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ABSTRACT

Data on the properties of leptons, mesons, and baryons are listed, referenced, averaged, and summarized in tables and wallet cards. This is an updating of the Reviews of Modern Physics article of Oct. 1965.

Data on Particles and Resonant States: Table S, Stable Particles. Rev. Mod. Phys., January 1967

A. H. Rosenfeld, A. Barbaro-Galtieri, W. J. Podolsky, L. R. Price, Matts Roos, Paul Soding, W. J. Willis, C. G. Wohl

	$I^G(J^P)C_n$	Mass (MeV)	Mass difference (MeV)	Mean life (sec) $c\tau$ (cm)	Mass² (GeV)²	Partial mode	Decays Fraction	Q (MeV)	p or p_{max} (MeV/c)‡
γ	0,1(1⁻)⁻	0		stable	0	stable			
ν_e, ν_μ	J = ½	0(<0.2 keV) 0(<2.1 MeV)		stable	0	stable			
e∓	J = ½	0.511006 ±.000002		stable (> 2×10²¹y)	0.000	stable	μ_e = 1.001159622 ±.000000027 $\frac{e\hbar}{2m_ec}$		
μ∓	J = ½	105.659 ±.002	-33.920 ±.014 (μ–π)	2.199×10⁻⁶ ±.001, S=1.3* cτ = 6.592×10⁴	0.011	$e\nu\bar\nu$	100 %	105	53
μ_μ = 1.001164 ±.000003 $\frac{e\hbar}{2m_\mu c}$						eγγ	(< 1.6)10⁻⁵	105	53
						3e	(< 1.3)10⁻⁷	104	53
						eγ	(< 6)10⁻⁹	105	53
π±	1⁻(0⁻)⁺	139.579 ±.014	4.6041 ±.0037 (π±–π⁰)	2.608×10⁻⁸ ±.015, S=3.5* cτ = 782 ($\tau^+-\tau^-)/\bar\tau$ = (.4±.2)% (test of CPT)	0.019	μν	100 %	34	30
						eν	(1.24±0.03)10⁻⁴	139	70
						μνγ	(1.24±0.25)10⁻⁴	34	30
						π⁰eν	(1.01±0.09)10⁻⁸	4	5
						eνγ	(3.0 ±0.5)10⁻⁸	139	70
π⁰	1⁻(0⁻)⁺	134.975 ±.014		b 0.89×10⁻¹⁶ ±.18, S=1.6* cτ = 2.67×10⁻⁶	0.018	γγ	c(98.8)%	135	67
						γe⁺e⁻	(1.169)%	134	67
						γγγ	c(< 5)10⁻⁶	135	67
						e⁺e⁻e⁺e⁻	c(3.47)10⁻⁵	133	67
K±	½(0⁻)	493.82 ±.11	-4.05 ±.12 (K±–K⁰)	1.235×10⁻⁸ ±.006, S=2.4* cτ = 3.70 ($\tau^+-\tau^-)/\bar\tau$ = (.09±.08)% (test of CPT)	0.244	μν	b(63.4 ±0.5)% S=1.5*	388	236
						ππ⁰	(21.0 ±0.3)%	219	205
						ππ⁻π⁺	(5.6 ±0.1)%	75	126
						ππ⁰π⁰	(1.71±0.08)%, S=1.5*	84	133
						μπ⁰ν	(3.41±0.22)%, S=1.9*	253	215
						eπ⁰ν	(4.79±0.18)%, S=2.1*	358	229
						ππ∓e±ν	(3.8 ±0.8)10⁻⁵	214	204
						ππ±e∓ν	(< 2)10⁻⁶	214	204
						ππ∓μ±ν	(≤ 1.4)10⁻⁵	109	151
						ππ±μ∓ν	(< 3)10⁻⁶	109	151
						eν	(1.9 ±1.2)10⁻⁵	493	247
						ππ⁰γ	(2.2 ±0.7)10⁻⁴	219	205
						ππ⁺π⁻γ	(10 ±4)10⁻⁵	75	126
						πe⁺e⁻	(< 1.1)10⁻⁶	353	227
						πμ⁺μ⁻	(< 3)10⁻⁶	143	172
K⁰	½(0⁻)	497.87 ±0.16		50% K_{Short}, 50% K_{Long}					
K_{Short}	½(0⁻)		-0.48×$\frac{1}{\tau_S}$ ±.02 (K_L–K_S)	0.87×10⁻¹⁰ ±.009, S=1.3* cτ = 2.61	0.248	π⁺π⁻	(69.3 ±1.2)% S=1.25*	219	206
						π⁰π⁰	(30.7 ±1.2)%	228	209
K_{Long}	½(0⁻)			5.68×10⁻⁸ ±.26 cτ = 1703	0.248	π⁰π⁰π⁰	(23.5 ±2.1)%	93	139
						π⁺π⁻π⁰	(11.5 ± .4)%	84	133
						πμν	(27.5 ±1.8)%	253	216
						πeν	(37.4 ±1.8)%	358	229
						π⁺π⁻	(.153 ±.007)%	219	206
						π⁺π⁻γ	(< 0.3)%	219	206
						π⁰π⁰	(< 2.7)10⁻³	228	209
						eμ	(< 4)10⁻⁵	392	238
						γγ	(1.3 ±0.6)10⁻⁴	498	249
						μ⁺μ⁻	(< 4)10⁻⁶	287	225
						e⁺e⁻	(< 4)10⁻⁵	497	249
η	0⁺(0⁻)⁺	548.6 ±0.4		1<Γ<10 keV (2<cτ<20)10⁻¹⁰		Neutral decays 72.9%: γγ	(31.4 ±2.2)%	549	274
						π⁰γγ	(20.5 ±3.5)% S=1.3*	414	258
						3π⁰	(21.0 ±3.2)% S=1.5*	144	179
						Charged decays 27.1%: π⁺π⁻π⁰	(22.4 ±1.8)%	135	174
						π⁺π⁻γ	(4.6 ±0.8)% S=1.1*	269	236
						π⁰e⁺e⁻	(< 0.2)%	413	258
						π⁺π⁻e⁺e⁻	(0.1 ±0.1)%	268	236
p	½(½⁺)	938.256 ±0.005	-1.2933 ±.0001 (p–n)	stable (> 6×10²⁷y)	0.880				
n	½(½⁺)	939.550 ±0.005		(1.01±.03)10³ cτ = 3.03×10¹³	0.882	pe⁻ν	100 %	1	1
Λ	0(½⁺)	1115.58 ±0.10		2.51×10⁻¹⁰ ±.04, S=1.4* cτ = 7.52	1.245	pπ⁻	(66.4 ±1.1)% S=1.1*	38	100
						nπ⁰	(33.6 ±1.1)%	41	104
						peν	(0.88±0.15)10⁻³	177	163
						pμν	(1.35±0.60)10⁻⁴	72	131
Σ⁺	1(½⁺)	1189.47 ±0.08	-7.97 ±.11 (Σ⁺–Σ⁻)	0.810×10⁻¹⁰ ±.013 cτ = 2.43	1.412	pπ⁰	(52.8 ±1.5)%	116	189
						nπ⁺	(47.2 ±1.5)%	110	185
						pγ	(1.9 ±0.4)10⁻³	251	225
						nπ⁺γ	(≈ 0.2)10⁻⁴	110	185
						Λe⁺ν	(1.5 ±0.9)10⁻⁵	73	72
						nμ⁺ν	(< 1.1)10⁻⁴	144	202
						ne⁺ν	(< 5)10⁻⁵	249	224
Σ⁰	1(½⁺)	1192.56 ±0.11	-4.88 ±.06 (Σ⁰–Σ⁻)	<1.0×10⁻¹⁴ cτ<3×10⁻⁴	1.422	Λγ	100 %	77	75
						Λe⁺e⁻	c(5.45)10⁻³		
Σ⁻	1(½⁺)	1197.44 ±0.09		1.65×10⁻¹⁰ ±.03, S=1.4* cτ = 4.95	1.434	nπ⁻	100 %	118	193
						ne⁻ν	(1.25±0.17)10⁻³	257	230
						nμ⁻ν	(0.62±0.12)10⁻³	152	210
						Λe⁻ν	(0.61±0.16)10⁻⁴	81	79
						nπ⁻γ	(≈ 1)10⁻⁵	118	193
Ξ⁰	½(½⁺)?	1314.7 ±1.0	-6.5 ±.2 (Ξ⁰–Ξ⁻)	3.0×10⁻¹⁰ ±.5, S=1.3* cτ = 8.99	1.728	Λπ⁰	100 %	64	135
						pπ⁻	(< .5)%	237	299
						pe⁻ν	(< .6)%	376	323
						Σ⁺e⁻ν	(< .7)%	125	119
						Σ⁻e⁺ν	(< .6)%	117	112
						Σ⁺μ⁻ν	(< .7)%	20	64
						Σ⁻μ⁺ν	(< .6)%	12	49
						pμ⁻ν	(< .6)%	271	309
Ξ⁻	½(½⁺)?	1321.2 ±0.2		1.74×10⁻¹⁰ ±.05 cτ = 5.22	1.746	Λπ⁻	100 %	66	139
						Λe⁻ν	(2.5 ±1.8)10⁻³	205	190
						nπ⁻	(< 5)10⁻³	242	303
						Λμ⁻ν	(< 1.2)%	100	163
						Σ⁰e⁻ν	(< 0.3)%	128	122
						Σ⁰μ⁻ν	(< 0.5)%	23	70
						ne⁻ν	(< 1)%	381	327
Ω⁻	0(3/2⁺) ? ?	1674 ±3		1.5×10⁻¹⁰ ±.5, cτ = 4.5	2.802	Ξπ	(~50)%	221	296
						ΛK̄	(~50)%	66	216

General Atomic and Nuclear Constants[a]

N	= 6.02252 × 10²³ mole⁻¹	(based on A_{C12} = 12)
c	= 2.997925 × 10¹⁰ cm sec⁻¹	
e	= 4.80298 × 10⁻¹⁰ esu	= 1.60210×10⁻¹⁹ coulomb
1 MeV	= 1.60210 × 10⁻⁶ erg	
ℏ	= 6.5819 × 10⁻²² MeV sec	
	= 1.05449 × 10⁻²⁷ erg sec	
ℏc	= 1.9732 × 10⁻¹¹ MeV cm	= 197.32 MeV fermi
k	= 8.6171 × 10⁻¹¹ MeV deg⁻¹	(Boltzmann const.)
α	= e²/ℏc = 1/137.0388	
m_e	= 0.511006 MeV/c² = 1/1836.10 m_p	
m_p	= 938.256 MeV/c² = 1836.10 m_e = 6.721 $m_{\pi\pm}$	
	= 1.00727663 m_1 (where m_1 = 1 amu = $\frac{1}{12}$ m_{C12} = 931.478 MeV/c²)	

$r_e = e^2/m_ec^2$ = 2.81777 fermi (1 fermi = 10⁻¹³ cm)

$\lambda\!\!\!^-_e = \hbar/m_ec = r_e\alpha^{-1}$ = 3.86144 × 10⁻¹¹ cm

a_∞ Bohr $= \hbar^2/m_ee^2 = r_e\alpha^{-2}$ = 0.529167 A (1 A = 10⁻⁸ cm)

$\sigma_{Thompson} = \frac{8}{3}\pi r_e^2$ = 0.66516 × 10⁻²⁴ cm² = 0.66516 barn

$R_\infty = m_ee^4/2\hbar^2 = m_ec^2\alpha^2/2$ = 13.60535 eV (Rydberg)

Hydrogen-like atom (non-rel., μ = reduced mass)

$$E_n = \frac{\mu z^2e^4}{2(n\hbar)^2};\quad a_{n=1} = \frac{\hbar^2}{\mu ze^2};\quad \left(\frac{v}{c}\right)_{rms} = \frac{ze^2}{n\hbar c}$$

$\mu_{Bohr} = e\hbar/2m_ec$ = 0.578817 × 10⁻¹⁴ MeV gauss⁻¹

$\mu_{nucl} = e\hbar/2m_pc$ = 3.1524 × 10⁻¹⁸ MeV gauss⁻¹

$\frac{1}{2}\omega_{cyclotron}$ $\{= e/2m_ec$ = 8.79404 × 10⁶ rad sec⁻¹ gauss⁻¹; $= e/2m_pc$ = 4.7895 × 10³ rad sec⁻¹ gauss⁻¹

$\sigma_{natural} = \pi(\hbar/m_{\pi\pm}c)^2$ = 62.768 mb

Other Physical Constants

1 year	= 3.1536 × 10⁷ sec (≈ π×10⁷ sec)
density of air	= 1.205 mg cm⁻³ (at 20°C)
acceleration by gravity	= 980.67 cm sec⁻²
gravitational constant	= 6.670×10⁻⁸ cm³g⁻¹ sec⁻²
1 calorie	= 4.184 joules
1 atmosphere	= 1033.2 g cm⁻²
1 eV per particle	= 11604.9°K (from E = kT)

Numerical Constants

1 rad	= 57.29578 deg	e	= 2.71828
C	= 0.577216	1/e	= 0.367879
ln 2	= 0.69315	$\log_{10}e$	= 0.43429
ln 10	= 2.30259	$\log_{10}2$	= 0.30103

[a] Based mainly on E. R. Cohen and J. W. M. DuMond, Rev. Mod. Phys. 37, 537 (1965).

Magnetic moment and Decay Parameters†

	Magnetic moment (eℏ/2m_pc)	Measured α	Measured Φ(degree)	Derived γ	Derived Δ(degree)
p	2.792763 ±.000030				
n	-1.913148 ±.000066				
Λ	-0.73 ±.16	.663±.022 .73 ±.18 .06 ±.19	(- 7±7)°	.74	(8±8)°
Σ⁺	2.3 ±.6	-.960±.067 +.008±.037	(180±30)°	-1.0	(0±85)°
Σ⁻		-.010±.043			
Ξ⁰		-.33 ±.10			
Ξ⁻		-.391±.032	(6±8)°	.92	(14±15)°

Sign of ϕ and Δ changed after RPM printing to correct for wrong sign in listed data card.

† The definition of these quantities is as follows

$$\alpha = \frac{2\,\mathrm{Re}(S^*P)}{|S|^2+|P|^2};\quad \beta = \frac{2\,\mathrm{Im}(S^*P)}{|S|^2+|P|^2};\quad \gamma = \frac{|S|^2-|P|^2}{|S|^2+|P|^2}$$

$$\tan\Phi = \frac{\beta}{\gamma},\quad \tan\Delta = \frac{-\beta}{\alpha}.$$

* S = Scale factor = $\sqrt{\chi^2/(N-1)}$ where N ≈ number of experiments. S should be ≈ 1. If S > 1, we have enlarged the error of the mean, δx, i.e., δx → S δx. This new convention, is still inadequate, since if S > 1, the real uncertainty is probably even greater than Sδx. See text.

a. See notes on Stable Particles in text. b. See notes in data card listings. c. Theoretical value. See also data card listings.

‡ In decays with more than two bodies, p_{max} is the maximum momentum that any particle can have.

MUB-13977

MESONS, November 1966

Name	Symbol(J^P)	$I^G(J^P)C_n$ (⊢⊣ = estab.)	Mass M (MeV)	Width Γ (MeV)	$M^2 \pm \Gamma M^{(a)}$ (GeV)^2	Partial Decay Modes: Mode	Fraction (%)	Q (MeV)	p or $p_{max}^{(b)}$ (MeV/c)	Nonet
η(549)	η(0⁻)	$0^+(0^-)+$	548.6 ±0.4	<0.01	0.301 <.000005	all neutral $\pi^+\pi^-\pi^0+\pi^+\pi^-\gamma$	73 27	See Table S		η (CP=−1, 0⁻)
σ, ε§										
ω(783)	φ'(1⁻)	$0^-(1^-)-$	783.4 ±0.7* S=1.8*	11.9 ±1.5	0.614 ±.009	$\pi^+\pi^-\pi^0$ $\pi^+\pi^-$ $\pi^0\gamma$ η+ neutral $\pi^+\pi^-\gamma$ e^+e^- $\mu^+\mu^-$	≈ 90 seen (c) 9.7±0.8 < 1.5 < 5 0.012±.003 < 0.10	369 504 648 234 504 782 572	328 366 380 199 366 392 377	ω (1⁻)
η'(958) or X⁰	η'(0⁻)	$0^+(0^-)+$	958.3 ±0.8	<4	0.918 <.004	ηππ $\pi^+\pi^-\gamma$(incl. $\rho^0\gamma$) for upper limits see footnote (f)	75 ± 3 S=1.8* 25 ± 3	131 679	232 458	η' (0⁻)
H§										
φ(1019)	φ(1⁻)	$0^-(1^-)-$	1018.6 ±0.5	4.0 ±1.0 S=1.2*	1.039 ±.004	K^+K^- K_LK_S $\pi^+\pi^-\pi^0$(incl. ρπ) for upper limits see footnote (g)	48 ± 3 40 ± 3 12 ± 4	31 23 604	125 107 461	φ (1⁻)
η_V(1050) → K_SK_S	η(0⁺)	$0^+(0^+)+$	1050	50	1.10 ±.05	ππ K$\bar{K}$	< 70 > 30	780 54	507 167	η_V (0⁺)
	Some data still favor large scattering length									
f(1250)	η'(2⁺)	$0^+(2^+)+$	1254 ±12	117 ±15	1.57 ±.15	ππ $2\pi^+2\pi^-$ K$\bar{K}$	large < 4 2.3±0.6	975 696 258	611 547 381	f (2⁺)
D(1285)	η'(A)	$0^+(1^+)+$	1285 ±4	32 ±8	1.65 ±.04	K$\bar{K}$π (mainly π_V(1003)π) only mode seen $K^*\bar{K}+\bar{K}^*K$ ππρ	 not seen	154 -100 256	304 356	D (1⁺)
E(1420)	η(A)	$0^+(0^-)+$	1424 ±7	76 ±9	2.03 ±.11	$K^*\bar{K}+\bar{K}^*K$ π_V(1003)π ππρ	50 ±10 50 ±10 not seen	38 284 395	157 338 462	? (0⁻); E? (1⁺)
K_sK_s§, ρρ§										
f'(1500)	η(2⁺)	$0^+(2^+)+$	1514 ±16	86 ±23	2.29 ±.13	ππ K$\bar{K}$ $K^*\bar{K}+\bar{K}^*K$ ηη	< 14 > 60 < 40 not seen	1235 518 128 417	744 570 294 522	f' (2⁺)
$\pi^\pm$(140) π^0(135)	π(0⁻)	$1^-(0^-)+$	139.58 134.98		0.019 0.018	See Table S				π (0⁻)
$\rho^\pm$(760)	ρ(1⁻)	$1^+(1^-)-$	778 (h)	160 (h)	0.605 ±.124	ππ $\pi^\pm\pi^+\pi^-\pi^0$ $\pi^+\pi^-\pi^+\pi^-$ $\pi^0\gamma$	≈100 < 0.2 < 0.6 < 0.4	480 206 199 619	353 243 238 367	ρ (1⁻)
ρ^0(760)			770 (h)	140 (h)	0.593 ±.108	$\eta\pi^\pm$ e^+e^- $\mu^+\mu^-$	< 0.8 .0065 +.011 −.005 .0033 +.0016 −.0007	71 759 549	135 380 365	
δ(965)	?( )	1( )	963.1 ±4.2	<5	0.927 <.005	$\delta^\pm$ → 1 charged+neutral(s) ≈ 60 $\delta^\pm$ → ≥3 charged+neutral(s) ≈ 40				
π_V(1003) → K$\bar{K}$	π(0⁺)	$1^-(0^+)+$	1003	70 ±15	1.006 ±.057	$K^\pm K^0$ ηπ	large see note in data listings	11 315	75 333	π_V (0⁺)
	may also be interpreted as due to large scattering length									
A1(1080)	π(1⁺)	$1^-(1^+)+$	1079 ±8	130 ±40	1.16 ±.14	ρπ K$\bar{K}$ ηπ η'π	≈100 < 0.25, $G=(-1)^{\ell+I}$ forbids this (Eq. 5) < 1.5 < 1.5	181 391 -19	245 385	A_1 (1⁺)
	unresolved mixture of resonance and "Deck effect"									
B(1210)	ρ(A) ?	$1^+(1^+)-$??	1208 ±12	119 ±24 S=1.6*	1.46 ±.14	ωπ ππ K$\bar{K}$ 4π φπ	≈100 < 30 < 2 < 50 < 1.5	297 941 232 662 66	339 594 358 528 137	
A2(1300)	π(2⁺)	$1^-(2^+)+$ (d)	1306 ±8 S=2.6*	81 ±8 S=1.4*	1.70 ±.11	ρπ K$\bar{K}$ ηπ η'π $\pi^+\pi^-\pi^0$(excl. ρπ)	93 ±3 3.8±1.3 2.9±2.4 S=1.5* < 1.5 < 17	408 314 618 208 892	417 425 527 276 616	A_2 (2⁺)
π(1640) → 3π	π(A) ?	$\geq 1^-(A)+$?	1640 ±20	100 ±20	2.69 ±.16	3π ρπ fπ K$\bar{K}$	appears dominant < 40 ? < 40	1235 746 251 644	792 636 319 652	
ρ(1650) g→2π	ρ(V)	$1^+(V)-$ S=1.4*	1637 ±23	150 ±50	2.68 ±.24	2π 4π ρππ	observed probably observed	1358 1079 599	807 758 605	
	$R_1R_2R_3$ bumps suggest more structure in this peak									
$R_1R_2R_3$§										
S(1930) X^-	?(V) ?(e)	≥ 1⁺( ) ?	1929 ±14	≤35	3.72 ≤.07	1 charged 3 charged >3 charged } +neutral(s)	6(+15/-6) 92(+ 8/-20) 2(+13/-2)			
T(2200) X^-		≥ 1	2195 ±15	≤13	4.82 ≤.03	1 charged 3 charged >3 charged } +neutral(s)	4(+11/-4) 94(+ 6/-19) 2(+13/-2)			
U(2380) X^-	?( )	≥ 1	2382 ±24	≤30	5.67 ≤.07	1 charged 3 charged >3 charged } +neutral(s)	30 ±10 45 ±15 25 ±10			
K^+(494) K^0(498)	K(0⁻)	1/2(0⁻)	493.78 497.7		0.244 0.248	See Table S				K (0⁻)
K^*(890)	K(1⁻)	1/2(1⁻)	892.4 ±0.8	49.8 ±1.7* S=1.1*	0.796 ±.044	Kπ Kππ	≈100 < 0.2	259 119	288 216	K^* (1⁻)
κ(725)§, K_V(1080)§, K_c(1215)§	$m_0-m_\pm$ = 3.5±1.8 S=1.2*									
K_A(1320)	K(A) ?	1/2(A) ?	1320 ±10	80 ±20	1.742 ±.106	$K^*\pi$ } overlap Kρ Kω probably seen Kπ Kη	large < 10 < 30 < 10	288 63 39 687 278	338 198 155 558 405	K_A (1⁺)
	m and Γ values taken from Shen+. Appreciable discrepancies with other experiments. See note in data listings.									
K_V(1420)	K(2⁺)	1/2(2⁺)	1411 ±5 S=1.8*	92 ±7 S=1.2*	1.991 ±.130	Kπ $K^*\pi$ Kρ Kω Kη	52 ± 5 36 ± 6 9 ± 5 } S=2.2*! 1.0±1.7 2.1±3.0	778 379 158 134 368	610 407 319 293 475	K_V (2⁺)
K_A(1800)	K(A)	1/2(A)	1789 ±10	80 ±20	3.20 ±.14	Kπ $K^*\pi$ K_V(1420)π Kρ Remaining Kππ Kω	< 10 35 ±12 8 ± 5 7 ± 5 40 ±15 10 ± 3	1156 762 243 532 1021 508	819 664 315 630 801 616	
$K^*_{3/2}$(1175)§, $K^*_?$(1270)§										

Nonets (CP=−1: 0⁻; CP=+1: 0⁺, 1⁻, 1⁺, 2⁺); "tentative" for 0⁺ and 1⁺ nonets:

	(0⁻)	(0⁺)	(1⁻)	(1⁺)	(2⁺)
$m_8 = \sqrt{K^2 + \frac{K^2-\pi^2}{3}}$ =	566.8 ±0.2		928.4 (i)±3.0	1391. ±13.	1444.3 ±6.9
$\sin^2\theta = \frac{\eta - m_8}{\eta - \eta'}$ =	0.033 ±0.001		0.414 (i)±0.013	0.25 ±0.10	0.29 ±0.06
θ =	10.4°		40.1°	29.7°	32.4°

§ The following bumps, excluded above, are listed among the data cards: σ (410), ε (700), H (975), K_SK_S (1440) and ρρ (1410), R_1, R_2, R_3 (≈1700), κ (725) K_V(1080), K_c(1215), $K^*_{3/2}$(1175), $K^*_?$(1270).

* Quoted error includes scale factor $S = \sqrt{\chi^2/(N-1)}$. See footnote to Table S.
Footnotes continued in right margin.

(a) ΓM is the half-width of the resonance when plotted against M^2.
(b) For decay modes into ≥ 3 particles p_{max} is the maximum momentum that any of the particles in the final state can have. The momenta have been calculated using the averaged central mass values, without taking into account the widths of the resonances.
(c) Reported values range between 1% and 10%, and depend on assumptions on ρ-ω interference.
(d) If A2 → both ρπ and K$\bar{K}$, then $J^P = 2^+$.
(e) S is ρ(V) if identified with $\pi^+\pi^-$ bump at 1910 MeV. See note on mesons.
(f) Empirical limits on fractions for other decay modes of η' (958): $\pi^+\pi^-$ < 7%, 3π < 7%, 4π < 1%, 6π < 1%, $\pi^+\pi^-e^+e^-$ < 0.6%, $\pi^0e^+e^-$ < 1.3%, ηe^+e^- < 1.1%, $\pi^0\rho^0$ < 4%, $\pi^0\omega$ < 8%.
(g) Empirical limits on fractions for other decay modes of φ(1019): $\pi^+\pi^-$ < 20%, ηγ < 8%, η + neutrals < 13%, $\pi^+\pi^-\gamma$ < 4%, e^+e^- < 0.2%, $\mu^+\mu^-$ < 0.5%, ωγ < 5%, ργ < 2%.
(h) m_ρ, Γ_ρ from p-wave fit to compiled spectrum of 2-4 GeV/c $\pi^+p \to \Delta^{++}\rho^0$, |t| < 10 m_π^2, and comparison of $\rho^\pm - \rho^0$ in similar reactions. Results depend on background and t-cut, hence real errors unknown, but larger than statistical errors ~ 5 MeV. (See Matts Roos, Phys. Letters, to be publ.) Note contrast between Roos' p-wave fit vs. weighted average of published results (see listings). m(±) 778 vs. 757; m(0) 770 vs. 760, Γ(±) 160 vs. 132, Γ(0) 140 vs. 116. This demonstrates present uncertainty.
(i) Error on m_ρ taken to be 10 MeV.

MUB 13978

BARYONS - January 1967

	Particle or resonance	$I(J^P)$ ⊢⊣ = estab.	Beam π,K (BeV) (BeV/c)	Mass (MeV)	Γ (MeV)	$M^2 \pm \Gamma M$ (BeV^2)	Partial decay modes: Mode	Fraction (%)	Q (MeV)	p or p_{max}‡ (MeV/c)	$4\pi\lambda^2$ (mb)
$N^*_{1/2}$	p	1/2(1/2+)		938.3		0.880	See Table S				
	n			939.6		0.883					
	N'(1400)	1/2(1/2+) P_{11}	T=0.43πp p=0.55	~1400[a]	~200	1.96 ±0.28	Nπ	70	322	367	36.3
	N(1525)	1/2(3/2−) D_{13}	T=0.62 p=0.75	1525[a]	105	2.33 ±0.16	Nπ	65	447	460	23.2
							Nππ	35	308	414	
							[Δ(1236)π][e]	[~ 20]	149	229	
	N(1570)	1/2(1/2−) S_{11}	T=0.69 p=0.82	1570[a]	130	2.46 ±0.20	Nπ	~ 30	492	491	20.3
							Nη	~ 70	82	242	
	N(1670)	1/2(5/2−) D_{15}	T=0.87 p=1.00	1670[a]	140	2.79 ±0.23	Nπ	40	592	560	15.6
							Nππ	dominant[a]	453	526	
							[Δ(1236)π][e]	[?]	294	357	
							ΛK	small	57	200	
							Nη	small	182	368	
	N(1688)	1/2(5/2+) F_{15}	T=0.90 p=1.03	1688[a]	110	2.85 ±0.19	Nπ	65	610	572	14.9
							Nππ	dominant[a]	471	538	
							[Δ(1236)π][e]	[?]	312	372	
							ΛK	small	75	231	
							Nη	small	200	388	
	N'(1700)[c]	1/2(1/2−) S_{11}	T=0.92 p=1.05	1700[a]	240	2.89 ±0.41	Nπ	100	622	580	14.5
	N(2190)	1/2(7/2−)	T=1.94 p=2.07	2190	200	4.80 ±0.44	Nπ	30	1112	888	6.21
							ΛK	?	577	710	
	N(2650)	1/2(11/2−)[b]	T=3.12 p=3.26	2650 ± 10	~300	7.02 ±0.80	Nπ	7	1572	1154	3.67
							ΛK	?	1037	1022	
	N(3030)[c]	1/2(15/2−)[b]	T=4.26 p=4.40	3030	400	9.18 ±1.21	Nπ	0.7	1972	1377	2.62
$N^*_{3/2}$	Δ(1236)	3/2(3/2+) P_{33}	T=0.195 p=0.304	(++) 1236.0 ±0.6	120 ±2	1.53 ±0.15	Nπ	100	158	231	91.9
							$N\pi^+\pi^-$	0	18	89	
		$m_0 - m_{++} = 0.45 \pm 0.85$		$m_- - m_{++} = 7.9 \pm 6.8$							
	Δ(1670)	3/2(1/2−) S_{31}	T=0.87 p=1.00	1670[a]	~180	2.79 ±0.30	Nπ	40	592	560	15.6
							Nππ	?	453	526	
	Δ(1920)	3/2(7/2+)	T=1.35 p=1.48	1920	200	3.69 ±0.38	Nπ	50	842	722	9.37
							ΣK	seen	229	423	
	Δ(2420)	3/2(11/2+)[b]	T=2.51 p=2.65	2423 ±10	~275	5.87 ±0.67	Nπ	10	1345	1024	4.66
							ΣK	?	732	830	
	Δ(2850)	3/2(15/2+)[b]	T=3.71 p=3.85	2850 ±12	~300	8.12 ±0.86	Nπ	3	1772	1266	3.05
	Δ(3230)[c]	3/2(19/2+)[b]	T=4.94 p=5.08	3230	440	10.4 ±1.4	Nπ	0.6	2152	1475	2.24
Z^*_0	Z_0(1865)[c]	0(?)	p=1.15 K^+p	1863	150	3.47 ±0.28	NK	55 (if J = 1/2)	432	579	14.6
Y^*_0	Λ	0(1/2+)		1115.6		1.24	See Table S				
	Λ(1405)[d]	0(1/2−)	p<0 K^-p	1405	35	1.97 ±0.05	Σπ	100	68	142	
	Λ(1520)	0(3/2−)	p=0.392	1518.8 ±1.5	16 ±2	2.31 ±0.02	$N\bar{K}$	39±5	81	235	83.6
							Σπ	S=1.7* → 51±6	182	258	
							Λππ	10±2	124	251	
	Λ'(1670)[a]	0(1/2−)	p=0.74	1670	18	2.79 ±0.03	Λη	$K^-p \to \Lambda\eta$ seen	6	66	
							$N\bar{K}$		233	410	28.5
	Λ'(1700)	0(3/2−)	p=0.80	1700 ±10	40 ±10	2.89 ±0.07	$N\bar{K}$	20	263	438	25.0
							Σπ	seen	363	411	
	Λ(1820)	0(5/2+)	p=1.06	1819.5 ±3.5	83 ± 8	3.31 ±0.15	$N\bar{K}$	70	382	541	16.5
							Σπ	11	482	502	
							Σ(1385)π	18	295	362	
							Λη	~ 1	155	349	
	Λ(2100)	0(7/2−)	p=1.68	2100	160	4.41 ±0.34	$N\bar{K}$	29	663	748	8.68
							Σπ	seen.	763	699	
	Λ(2340)	0(?)	p=2.27	2340 ±20	105	5.48 ±0.25	$N\bar{K}$	10	903	907	5.92
							seen in σ(total)	↳ if J = 9/2			
Y^*_1	Σ	1(1/2+)		(+)1189.5 (0)1192.6 (−)1197.4		1.41 1.42 1.43	See Table S				
	Σ(1385)	1(3/2+)	p<0 K^-p	(+)1382.2±0.9 S=1.6* ; S=4.8* (−)1388.0±3.0	(+)37±3 S=2.1* ; (−)38±8, S=3.7*	1.92 ±0.05	Λπ	91±3	130	208	
							Σπ	9±3 S=1.4*	48	117	
	Σ(1660)[a]	1(3/2−)	p=0.72	1660	50	2.76 ±0.08	Λ(1405)π	large	115	197	
							Σπ	?	323	379	
							Λπ	?	405	439	
							$N\bar{K}$	small	223	400	29.9
		Large contradictions among measured branching ratios.									
	Σ(1770)	1(5/2−)	p=0.95	1768 ±4 S=1.5*	89 ±12 S=2.0*	3.13 ±0.16	$N\bar{K}$	49	331	498	19.4
							Λπ	17	517	520	
							Λ(1520)π	19	110	192	
							Σ(1385)π	12	243	318	
							Ση	2	27	143	
							Σπ	< 1	431	463	
	Σ(1910)[c]	1(5/2+)	p=1.25	1910 ±10	60	3.65 ±0.11	$N\bar{K}$	8	473	612	12.9
							Λπ	10	655	619	
							Σπ	3	573	568	
	Σ(2035)	1(7/2+)	p=1.53	2035 ±15	160	4.14 ±0.33	$N\bar{K}$	16	598	703	9.83
							Λπ	25	784	703	
							Σπ	seen	698	655	
	Σ(2260)[c]	1(?)	p=2.06	2260 ±20	180	5.11 ±0.41	$N\bar{K}$	14	823	855	6.66
							seen in σ(total)	↳ if J = 9/2			
$\Xi^*_{1/2}$	Ξ	1/2(1/2+)		(0)1314.7 (−)1321.2		1.73 1.75	See Table S				
	Ξ(1530)	1/2(3/2+) p-wave		(0)1528.9±1.1 (−)1533.8±1.9	7.3 ±1.7	2.34 ±0.01	Ξπ	100	69	145	
	Ξ(1815)	1/2(?)		1815 ±3	16 ±8 S=2.2*	3.29 ±0.03	$\Lambda\bar{K}$	~ 65	202	391	
							Ξπ	~ 10	354	409	
							Ξππ	~ 25	215	351	
							[Ξ(1530)π][e]	[~ 20]	145	229	
		Branching ratios poorly known									
	Ξ(1930)	1/2(?)		1933 ±16	140 ±35	3.74 ±0.27	Ξπ	seen	472	501	
							$\Lambda\bar{K}$	seen	320	504	
Ω^-	Ω^-	0(3/2+)		1674		2.80	See Table S				

a. See note in data listings.
b. J^P assignment based on straight-line Regge-trajectory-recurrence hypothesis and supported by fits to πp elastic scattering at 180°. See note following data listings.
c. Evidence for the existence of the effect and/or for its interpretation as a resonance is open to some question.
d. A virtual bound state of the $\bar{K}N$ system with negative scattering length [$a_0 = (-1.6 + 0.6i)F$]; i.e., a pole in the S matrix below the elastic threshold. See notes in main text and data listings.
e. Square brackets indicate a sub-reaction of the previous unbracketed decay mode.

→ at left of Table indicates a candidate that has been omitted because the evidence for the existence of the effect and/or for its interpretation as a resonance is open to considerable question. See listings for information on the following: $N_?(3245)$, N(3695), $N^*_{5/2}(1560)$, $Z^*_1(1910)$, Σ(1780), Σ(3000), Ξ(1705), and $\Xi_?(2270)$.

* Quoted error includes an S (scale) factor. See footnote to Table S.

‡ For decay modes into ≥3 particles p_{max} is the maximum momentum that any of the particles in the final state can have. The momenta have been calculated using the averaged central mass values, without taking into account the widths of the resonances.

MUB 13979

This data survey is an updating of that of Oct. 1965.[1] An intermediate version was distributed at the XIII International Conference on High Energy Physics held at Berkeley in Aug. 1966. This time a large number of early data and references have been deleted from the listings; these pioneer works can be found in any earlier edition.[1]

As always, we make two requests of our readers:

1) Please inform us of mistakes and omissions. We cannot do an adequate job without this help.

2) We wish to emphasize that it is not appropriate to refer to this compilation instead of the original published work; nor is it necessary, since we provide complete listings of references!

Our procedures are as follows. We read journals and preprints and from information so obtained we punch data cards and reference cards for each relevant experiment. These cards are listed following the main text.

Computer programs make weighted averages of these data, and the results are summarized in three tables.

1. Table S covers all stable particles (leptons, mesons, and baryons), i.e., those states which are immune to decay via the strong interaction;

2. Meson Resonances, and 3. Baryon Resonances. For convenience, these tables include basic information on stable mesons and baryons.

Each table is of slightly different form; thus Table S includes magnetic moments and weak-decay asymmetry parameters, the meson table has two columns of names, one familiar, another more orderly, and the baryon table includes information on what momentum pion and K-meson beams will form certain resonances.

Of course most of our work involves deciding how to handle data. Often it is best not to average a result either because it is already incorporated in a later paper or because we have some reservations about the experiment. (We then punch any character in Col. 8 of our data cards, thereby instructing the averaging programs to ignore the result.) When the data for an individual particle received special treatment, this is noted either in the listings or in a special note following them.

NOTES ON THE TABLES

Quoted errors represent standard deviations. Inequalities are also standard deviations or 1/e confidence levels.

The quantum number C stands for the eigenvalue of the charge-conjugation operator applied to a neutral particle. The notation C_n (n for neutral) means the eigenvalue of C applied to the neutral member of a nonstrange triplet, like the pion. Thus for all members of the SU(3) 0^- nonet, $C_n = +1$.

Well-established quantum numbers are underlined (except in Table S, where most of the quantum numbers are established). We have used flimsy evidence to guess many of the remaining ones, and we have indicated with ? the ones for which there is almost no evidence.

We define antiparticles as the result of operating with CPT on particles; then both should share the same spins, masses, and mean lives.[2-4]

For resonances, Γ represents the full width at half maximum.

For broad resonances there is an inconsistency in the way the central value M_R is usually stated. For a well-studied resonance like

$N^*_{3/2}(1236)$ or $Y^*_0(1520)$, it is conventional to call M_R or E_R the energy at which the resonant amplitude would (in the absence of background) become pure imaginary. (For $N^*_{3/2}(1236)$ this corresponds to 1236 MeV, but for further discussion of this point see the note following the baryon listings.) But this does not mean that the peak in an observed cross section occurs at M_R, because kinematic factors enter into the relation between amplitude and cross section. Thus the peak in the πp cross section near 1236 MeV actually occurs at 1223 MeV. Nevertheless, it is conventional simply to report the energy of the peak in the observed cross section. For well-studied resonances, we have protected the averaging programs (by putting a star in the eighth column of the data cards) from masses and widths obtained without the proper kinematical factors or the proper background treatment. For the others, we have used whatever data was available.

Notes on Table S

The quantum numbers of all the stable particles seem well established, with the exceptions of Ξ and Ω^-. Of course if we accept the normal SU(3) assignments, then Ξ becomes $1/2^+$ and Ω^- must be $3/2^+$.

Hyperon Decay Asymmetries

We adopt the following conventions for the decay asymmetries:

$$\alpha = \frac{2\,\mathrm{Re}(s^*p)}{|s|^2 + |p|^2}$$

$$\beta = \frac{2\,\mathrm{Im}(s^*p)}{|s|^2 + |p|^2}$$

$$\gamma = \frac{|s|^2 - |p|^2}{|s|^2 + |p|^2}$$

where s is the parity-changing amplitude and p is minus the parity-conserving amplitude. (Here we use the Condon-Shortley conventions for spherical harmonics and Clebsch-Gordan coefficients. They are repeated in more detail on our wallet cards.) Then α is equal to the helicity of the decay baryon from unpolarized hyperon decay, and the polarization $\boldsymbol{P}_N$ of the decay baryon from hyperons with polarization $\boldsymbol{P}_Y$ is[5] (in the Y rest frame)

$$\boldsymbol{P}_N = \frac{1}{1+\alpha P_Y \cos\theta} \left\{ [\alpha + P_Y \cos\theta (1-\gamma)]\hat{N} + \gamma \boldsymbol{P}_Y + \beta(\hat{P}_Y \times \hat{N}) \right\} ,$$

where $\hat{N}$ is a unit vector along the direction of emission of the decay baryon, and θ is the angle between $\boldsymbol{P}_Y$ and $\hat{N}$. This convention for α and γ is the same as that of Cronin and Overseth,[6] except that they defined β with the opposite sign in its relation to s and p; nevertheless, the experimental value of β that they quote is in agreement with the convention used here.

In practice, the value of α is usually known much more accurately than those of β and γ. Since

$$\alpha^2 + \beta^2 + \gamma^2 = 1,$$

there is really only one other parameter to be determined. A quantity, ϕ, which has a more nearly Gaussian distribution than β or γ, is defined by

$$\left.\begin{aligned} \beta &= \sqrt{1-\alpha^2}\,\sin\phi \\ \gamma &= \sqrt{1-\alpha^2}\,\cos\phi \end{aligned}\right\} \quad \tan\phi = \frac{\beta}{\gamma}$$

On the other hand, in discussing time-reversal invariance, the quantity of interest is Δ, defined by

$$\tan\Delta = -\frac{\beta}{\alpha} \quad .$$

Under time-reversal invariance, one should have

$$\Delta = \delta_s - \delta_p ,$$

the difference between pion-nucleon scattering phase shifts at the correct energy and in the appropriate isospin state. For Λ decay, if we assume the $\Delta|I| = 1/2$ rule,

$$\delta_s - \delta_p \approx 7^\circ .$$ [7]

On the data cards, we list α and ϕ for each decay, since these are the most closely related to the experiment, and are essentially uncorrelated. In Table S we give α, ϕ, and Δ, with errors; and for convenience we also give the central value of γ, without an error.

Notes on the Meson Table

The Symbol-Minded Approach

In addition to the colloquial names for particles, we have used the names suggested by Chew, Gell-Mann, and Rosenfeld:[8, 9] atomic mass number A, hypercharge Y, and isospin I have been grouped into a single symbol. For mesons, A = 0, Matts Roos has suggested that the name should also reflect G, and sometimes J^P, so we now use

$Y = 0$, $I = 0$, η for $G = +1$, ϕ for $G = -1$,

$Y = 0$, $I = 1$, ρ for $G = +1$, π for $G = -1$,

$Y = 1$, $I = 1/2$, K (called K_V if $K \to K\pi$, K_A if $\not\to K\pi$),

$Y = 1$, $I = 3/2$ (if ever firmly established), L.

Hence a nonet with charge-conjugation quantum number $C_n = +1$ will have members η, π, K, $\bar{K}$, and η'. If C = -1, the members will be ϕ, ρ,

K^*, $\bar{K}^*$, and ϕ'.

In older editions, we used subscripts α, β, γ, and δ for J^P:

α for 0^+, 2^+, $\cdots$ mesons or $1/2^+$, $5/2^+$, $\cdots$ baryons.

β for 0^-, 2^-, $\cdots$ mesons or $1/2^-$, $5/2^-$, $\cdots$ baryons.

γ for 1^-, 3^-, $\cdots$ mesons or $3/2^-$, $7/2^-$, $\cdots$ baryons.

δ for 1^+, 3^+, $\cdots$ mesons or $3/2^+$, $7/2^+$, $\cdots$ baryons.

This has been accepted by many authors for baryons, but has not been popular for mesons, for which no Regge recurrences are yet known. Hence we now just give J^P, unless it is unknown. In that case, depending on whether 2π, $\bar{K}K$, or $K\pi$ decays are seen, we guess whether J^P belongs to the normal (0^+, 1^- $\cdots$) or to the abnormal series (0^-, 1^+, $\cdots$). In the former case, we write J^P = V (for Vacuum, Vector, etc.) or A for (Abnormal, Axial, etc.)

When two states have identical quantum numbers, we call one of them "prime," e.g., η, η', f, f', N, N' (1400, $1/2^+$). Note that $\eta(0^-)$ and $\eta(2^+)$ = f' are both the "mainly octet" members of their respective nonets. Then for our meson symbol for $I^G = 0^-$, we must choose either ω or ϕ. We chose ϕ, since it is the $\phi(1019)$, not the $\omega(783)$, which is mainly octet.

We were tempted to go further and use names that also reflect the J^P series, A vs V, but that would require four more names and there are not four more mesons with simple names and really established quantum numbers. We would rather leave open the later possibility of doubling the names via the use of capital vs lower case letters, subscripts, $\cdots$.

Quantum Numbers and the Symbol C_n

For nonstrange mesons we list the eigenvalue of the G parity operator[10, 11]

$$G = Ce^{\pi i I_y}. \tag{1}$$

For neutral mesons, C has the eigenvalue ±1, and it turns out that we can write[7]

$$G = C(-1)^I. \tag{2}$$

Now G and I have eigenvalues, of course, for all members of a charge multiplet, but C only for the neutral member. So to generalize Eq. (2) we define C_n as the eigenvalue of C for the neutral member of the multiplet, and then write for any member of the multiplet

$$G = C_n(-1)^I. \tag{3}$$

Meson Decays into 2π or $\bar{K}K$

In this discussion we use $\bar{K}K$ as an example. If the $\bar{K}K$ system is in a state with orbital angular momentum ℓ, Bose statistics require that for a neutral pair

$$C = (-1)^\ell; \tag{4}$$

for a charged pair C has no eigenvalue, but G does,[12] namely,

$$G = (-1)^{\ell+I}. \tag{5}$$

Thus consider the A2 meson π(1310). Its main decay mode is πρ, hence G = -1. It is also seen to go to $K^-K_S^0$, so I = 1. Then, by (5), observation of this mode establishes that ℓ is even.

Next consider the isospin=1 A1 meson π(1090). Its main decay is again πρ, so again G = -1, then again $\ell(\bar{K}K)$ must be even. Of course, if A1 has $J^P = 0^-$, 1^+, or 2^-, we never expect to see KK.

Finally consider the B meson $\pi(1220)$. Its main decay mode is $\pi\omega$, so G = +1, I = 1. This time (5) forces $\ell(\bar{K}K)$ to be odd. Hence non-observation of $\bar{K}K$ is evidence against a 1^- interpretation of B.

Whenever ℓ is even, neutral $\bar{K}K$ must appear as K_SK_S, K_LK_L, and K^+K^- in the ratio 1:1:2. If ℓ is odd, we can find only K_SK_L and K^+K^-, in equal numbers.[13]

<u>s-Wave Bumps Near Threshold</u> -- $\eta_V(1050) \rightarrow \bar{K}K$, $\pi_V(1003) \rightarrow \bar{K}K$, N(1560), $\Lambda(1405)$, $\Lambda(1670)$, $\Sigma(1780)$.

Peaks in cross sections near threshold pose special difficulties in interpretation, particularly for s-wave states. It is often uncertain which of the following causes the peak.

1. A Breit-Wigner resonance occurring just above or below threshold. In the complex energy plane, this is represented by a pole adjacent to the physical region but with a small negative imaginary displacement. See Fig. 1.

2. A pole near threshold but on or adjacent to the real axis of an <u>unphysical</u> sheet of the energy surface. See Fig. 2. This is often called an "anti-bound state."

3. Finally, the effect of non-threshold branch points in the energy plane often can be parameterized by a single pole whose position depends on the range of the nuclear force. With data of finite accuracy, such a parameterization may yield an adequate fit even though no pole really exists at the position indicated, but a "fake pole" cannot produce a scattering length larger than the dominant force range.

Clearly we do not want to list in this compilation threshold bumps which are most probably effects of type 3. We do intend to list those in

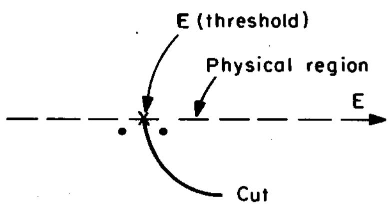

Fig. 1. The complex energy plane near threshold, showing possible poles (dots) corresponding to two ordinary Breit-Wigner resonances. The cut attached to the threshold branch point has been drawn so as to expose both the pole positions and the physical region.

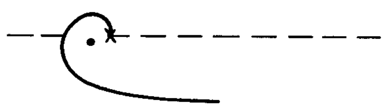

Fig. 2. The complex energy plane near threshold, showing the possible position of a pole corresponding to an "antibound state." Notice that in order to expose the pole in the figure the physical region just below threshold has been obscured from view.

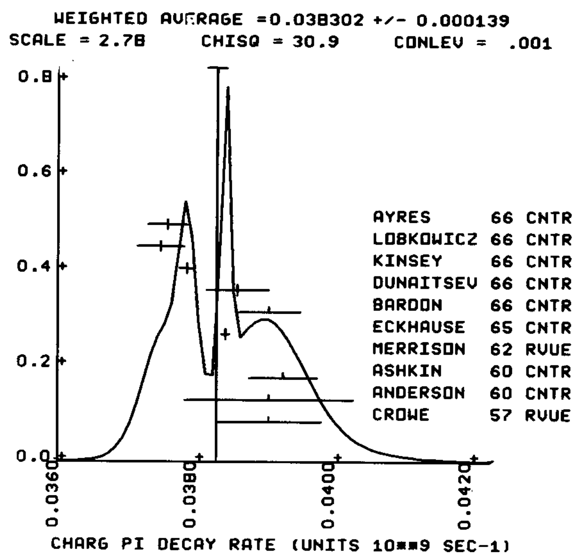

Fig. 3. Typical ideogram: $\pi^{\pm}$ decay rates. Results are usually published as mean lives τ, but we average rates, $\Gamma = 1/\tau$ because rates are more normally distributed. The rms average $\bar{\Gamma} = (38.33 \pm 0.05) 10^{6}\ \text{sec}^{-1}$ is drawn as a vertical line, with an error flag at the top scaled up by a scale factor S = 3.5. (It is easily seen that even after scaling, this final result is not a satisfactory statement of the situation.) Only five experiments, indicated by + error flags, were precise enough to satisfy Eq. 6 and be accepted in the calculation of the scale factor. The less precise experiments were included in the calculation of $\bar{\Gamma}$ but not of scale, they have ⊥ flags.

MUB 14095

which some kind of pole seems to be present, though it may not be clear whether it is of types 1 or 2. Roughly speaking, a true pole is indicated whenever the measured scattering length has a real part of the order of 1 Fermi or more.

Careful experimental analysis can distinguish between poles of type 1 and type 2, but in most of the cases we are considering, the data is not yet sufficient for us to make this distinction with certainty. Even when type 2 is firmly indicated, as in the singlet deuteron, we still wish to list the state. Arguments have been given by Chew[14] to support calling such states "particles."

Of the cases listed at the head of this note, the $Y_0^*(1405)$ is well established as a type 1 pole, as is also the $N_{1/2}^*(1560\ ,\ 1/2^-)$. The status of the other cases is less clear.

Notes on the Baryon Table

S-Wave Bumps Near Threshold

This matter was discussed under Mesons.

Symbol-Minded Approach for Baryons (cf. Mesons)

Again we use familiar symbols to denote baryons with various values of hypercharge and isospin: namely, N for $N_{1/2}^*$, Λ for Y_0^*, Σ for Y_1^*, Ξ for $\Xi_{1/2}^*$, and Ω^-. For $N_{3/2}^*$ we have invented Δ, and for hypercharge Y = +2 we have recently added Z.

PROCEDURES FOR TREATING THE DATA

Except for trivial cases, all branching ratios and rate measurements are analyzed by computer program AHR. This program makes a simultaneous, least-squares fit to all the data, and outputs the partial decay fractions, $\overline{f}_i$, and their errors, $\delta(\overline{f}_i)$. It is these values which we report in our tables (except that some errors have been "scaled" — see the following section on χ^2 Scale Factor).

Program AHR uses the contraints that the sum of all of the partial decay fractions must total 100%, and that the sum of the partial rates must equal the total decay rate. AHR was written by this project's perennial friend, J. Peter Berge, and is documented in the 8030 Programming Memo.

When inequalities are reported from a particular experiment, we have on the first iteration ignored that experiment; we then checked to see if the weighted average of the others violates the inequality. If so, we change the input data: $< x \rightarrow 0 \pm x$, or $> x \rightarrow 2x \pm x$, and iterate once more. If there are cases of small statistics, we weight them according to the prescription of maximum likelihood. When no errors are reported, we merely list the data for inspection.

χ^2 Scale Factor

When we calculate the weighted average $\bar{x}$, we also calculate the χ^2 that all the measurements of x agree. If there are N experiments, each with properly estimated errors normally distributed, the average value of χ^2 should be N-1. If χ^2 is much larger than N-1, we average the data even though this may not be warranted. But we plot an ideogram (Fig. 3, pg. 12) to help the reader decide which data to reject, and make his own selected average. However, if χ^2 is not too much greater than N-1, and we cannot select a single bad experiment, we can still be conservative by the following approach: Instead of rejecting one culprit, we can assume that all experimentalists underestimated their errors by the same factor (which is, of course, ($\sqrt{\chi^2/(N-1)} \equiv$ SCALE). If this were true, then we could correct the calculated error of the mean simply by multiplying each of the reported errors by SCALE, and then recalculating the error of $\bar{x}$. Multiplying the original $\delta(\bar{x})$ by SCALE would obviously also give the same final result.

In fact, this is exactly what we have done. (This is a NEW CONVENTION, started August 1966. In the older editions we listed the SCALE factor but did not enlarge the errors. We made this change because we discovered that few people paid any attention to SCALE.) This scaling approach is already common practice in bubble chamber experiments, where track distortion is not fully understood. For bubble chamber data it can be justified. For this compilation, it has all of the disadvantages of penalizing a whole class of students because of one naughty child, but (like the schoolmaster) we sometimes know of no other simple solution.

If all the experiments have errors of about the same size, the above (straightforward) procedure for calculating SCALE is carried out. If, however, we are to combine experiments with widely varying errors, we must modify the procedure slightly. This is because it is the more precise experiments which most influence not only the average value $\bar{x}$, but also the error $\delta(\bar{x})$. Now on the average the low-precision experiments each contribute about unity to both the numerator and the denominator of SCALE, hence the χ^2 contribution of the sensitive experiments is diluted, i. e., reduced. Therefore, we evaluate SCALE by using only experiments for which the errors are not much greater than those of the more precise experiments. Explicitly, to calculate SCALE we use only the most sensitive experiments, i. e., those with errors less than δ_0, where the ceiling δ_0 is (arbitrarily) chosen to be

$$\delta_0 = 3\sqrt{N}\ \delta(\bar{x}). \qquad (6)$$

Here $\delta(\bar{x})$ is the unscaled error of the mean of all the experiments. Note that if each experiment had the same error, δ_i, then $\delta(\bar{x})$ would be $\delta_i/\sqrt{N}$, so each individual experiment would be well under the ceiling on SCALE.

This scaling approach has the property that if there are two values with comparable errors separated by much more than their stated errors (with or without a number of other experiments of lower accuracy) the error on the mean value, $\delta(\bar{x})$, is increased so that it is approximately half the interval between the two discrepant values.

We wish to emphasize the fact that our scaling procedures in no way affect the value of $\bar{x}$. In addition, if one wishes to recover the unscaled errors, $\delta(\bar{x})$, he need only divide the given errors by the SCALE factor given for that error.

A slightly different approach must be taken when a number of different (but related) quantities enter the constrained averaging program AHR. Program AHR calculates not only the best simultaneous fit to all of the partial decay fractions, f_i, but also the contribution to χ^2 for each of the input ratios. If any of these individual contributions to χ^2 is considerably greater than the average expected χ^2 (a "ceiling" of $\chi^2 = 2.0$ is used at present), all of the measurements of that particular ratio have their errors increased by SCALE, with SCALE defined as before. (N and χ^2 are now, of course, the number, and the total contribution to χ^2, of only those experiments measuring that particular ratio.) Now, because of the many correlations induced by the constraint, it is not possible merely to multiply the output $\delta(\bar{f}_i)$'s by SCALE. Instead, one must actually rerun the program AHR on all of the data — those with errors unchanged as well as those with errors increased. We then get new values for $\delta(\bar{f}_i)$, i.e., the errors of the partial decay modes. These errors are the values given in our tables. (We list only the largest SCALE factor used for a particular particle. Thus it is not possible to recover the unscaled $\delta(\bar{f}_i)$'s from our reported values for particles which have constrained fits.) However, in line with our policy of not letting SCALE affect the central values, we give the values of $\bar{f}_i$ obtained from the original (unscaled) fits. (In all data processed so far, the differences between the $\bar{f}_i$'s calculated with either the scaled or the unscaled errors have been within the scaled errors, $\delta\bar{f}_i$).

Conversion of Mean Lives to Rates

An experimenter has a choice of reporting a mean life or a rate. Suppose he has an infinitely large bubble chamber; then he can report

$$\tau = \Sigma t_i/N,$$

where N is the total number of decays observed, and t_i is the elapsed proper time for each decay.

Alternatively he can report a rate

$$\Gamma = N/\Sigma t_i\ .$$

If his errors are large it is probably because N is small. In that case one can see that the distribution of rate Γ, with N in the numerator, should be fairly Poisson. But the distribution on mean life τ, with N in the denominator, will be badly skewed. Accordingly, we have inverted all mean lives before averaging data or making ideograms.

NOTES ON THE DATA CARDS

Some of the data on the mass of the ρ, for example, are followed at the far right by the entries +, -, or 0, with the sign depending on whether the experiment involved ρ^+, ρ^-, or ρ^0.

If skewed errors are reported, as is often the case for mean-life experiments, both the fields "Error +" and "Error -" are used. If there is no entry in "Error -", then the errors are symmetric.

Partial Decay Modes: For two-body decays our computer program calculates the Q value, and the momentum of decay. For three-body decays, it calculates Q, and then calculates the maximum momentum that any of the three particles can have. The reader may wonder about the numbers S-- or U-- in the far right-hand fields; they are simply the mass codes of the decay products for this program.

Cross-Sections Cards (Coded CS)

Starting in September 1966, we decided to punch cross-section information on some rare mesons, providing the information is new and easily available in papers we are processing anyway. We do not check or average these cross sections as carefully as our other input. This is an experiment, pursued randomly by some of us; absence of cross-section cards for a given paper does not imply absence of information in that paper.

EXPLANATION OF SYMBOLS USED ON DATA CARDS

The following abbreviations have been used:

1. Measurement Technique (TECH)

CC	Cloud chamber
CNTR	Counters, electronics
EMUL	Emulsions
HBC	Hydrogen bubble chambers
HEBC	Helium bubble chambers
DBC	Deuterium bubble chambers
PBC	Propane bubble chambers
XBC	Heavy liquid bubble chambers
SPRK	Spark chambers
MMS	Missing Mass Spectrometer
RVUE	Review of previous experimental data

2. Journals

ADVP	Advances in Physics
ANP	Annals of Physics
ARNS	Annual Reviews of Nuclear Science
BAPS	Bulletin of the American Physical Society
JETP	English Translation of Soviet Physics JETP

NC	Nuovo Cimento
NP	Nuclear Physics
PL	Physics Letters
PPSL	Proceedings of the Physical Society of London
PR	Physical Review
PRL	Physical Review Letters
PRSL	Proceedings of the Royal Society of London
RMP	Reviews of Modern Physics

The following abbreviations refer to proceedings of Conferences

AIX	International Conference on Elementary Particles, Aix-en-Provence, 1961
ARGONNE	International Conference on Weak Interactions, Argonne National Laboratory, 1965
ATHENS	Athens Topical Conference on Recently Discovered Resonant Particles, Ohio University, 1963
BALATON	Symposium on Weak Interactions, Balatonvilaeos, Hungary, 1966
BERKELEY	International Conference on High Energy Physics, 1966
BNL	International Conference on Fundamental Aspects of Weak Interactions, Brookhaven National Laboratory, 1963
BOULDER	Symposium on Strong Interactions 1965
CERN	International Conference on High Energy Physics, 1958 and 1962
CORAL GABLES	Conference on Symmetry Principles at High Energy, 1964 and 1965
DESY	International Symposium on Electron and Photon Interactions at High Energies, Hamburg, 1965
DUBNA	International Conference on High Energy Physics, 1964
KIEV	Ninth Annual International Conference on High Energy Physics, 1959
OXFORD	International Conference on Elementary Particles, 1965
ROCH	Fifth (Sixth, Seventh) Annual Rochester Conference on High Energy Nuclear Physics, 1955 (1956, 1957). Annual International Conference on High Energy Physics, Rochester, 1960
SIENA	International Conference on Elementary Particles, 1963
STANFORD	International Conference on Nucleon Structure, 1963

Finally

BNL	Brookhaven National Laboratory
CU	Columbia University, includes Nevis Reports
NYO	New York Operations Office, AEC
UCRL	Lawrence Radiation Laboratory (University of California)
etc.	refer to unpublished reports of the Author's Institution.

Acknowledgments

Alan Rittenberg has generously provided us with the nice routines which plot histograms and ideograms, and J. Peter Berge has as always been more than helpful with our fitting programs. Professor Gaurang Yodh helped us with the baryon table and the summary Chew-Frautschi plot for the baryons. This whole work is probably still littered with mistakes and omissions, but it would be far worse were it not for the help of many friends who have carefully read our listings and tables and tried to set us right.

FOOTNOTES AND REFERENCES

*Work performed under the auspices of the U. S. Atomic Energy Commission.

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DATA FOR TABLES ON STABLE PARTICLES

STABLE MEANING IMMUNE TO STRONG DECAY

```
CODE EVENTS QUANTITY  ERROR+  ERROR-  REFERENCE YR TECN SIGN COMMENTS     DATE PUNCHED
      ABOVE
   BACKGROUND

   N  ANY SYMBOL IN COLUMN 8 INDICATES DATA IGNORED BY AVERAGING PROGRAMS

         1         2         3         4         5         6         7         8
'4567890123456789012345678901234567890123456789012345678901234567890123456789012345678
```

γ

```
                    0 GAMMA (0,J=1)

****** ********* ********* ********* ********* ********* ********* *********
```

ν_e

```
                    1  E-NEUTRINO  (0,J=1/2)

                    1  E-NEUTRINO  MASS (KEV)

M    *  LESS THAN              0.25    LANGER    52 CNTR
M    *  LESS THAN              0.15    HAMILTON  53 CNTR
M    *  LESS THAN     0.55 +OR- 0.28   FRIEDMAN  58 CNTR

****** ********* ********* ********* ********* ********* ********* *********


                          REFERENCES

                          1  E-NEUTRINO  (0,J=1/2)

LANGER   52 PR  88  689       L M LANGER,R J D MOFFAT ////////  INDIANA
HAMILTON 53 PR  92  1521      D HAMILTON,W P ALFORD,L GROSS // PRINCETON
FRIEDMAN 58 PR 109  2214      LEWIS FRIEDMAN,LINCOLN G SMITH /////  BNL

****** ********* ********* ********* ********* ********* ********* *********
****** ********* ********* ********* ********* ********* ********* *********
```

ν_μ

```
                    2  MU-NEUTRINO  (0,J=1/2)

                    2  MU-NEUTRINO  MASS (MEV)

M    *          3.5    OR LESS           BARKAS    56 EMUL
M    *          4.0    OR LESS           DUDZIAK   59 CNTR
M    *          3.6    OR LESS           FEINBERG  63 RVUE                      7/66
M    *          3.0    OR LESS           ALLCOCK   65 RVUE                      7/66
M    *          2.5    OR LESS           BARDON    65 SPRK
M    *          2.1    OR LESS           SHAFER    65 CNTR  CONF LEV = 68PCT    7/66

****** ********* ********* ********* ********* ********* ********* *********


                          REFERENCES
                          2  MU-NEUTRINO  (0,J=1/2)

BARKAS   56 PR 101  778       W H BARKAS,W BIRNBAUM,F M SMITH ////  LRL
DUDZIAK  59 PR 114  336       W F DUDZIAK,R SAGANE,J VEDDER //////  LRL
FEINBERG 63 ARNS 13 431       G FEINBERG, L M LEDERMAN //////// COLUMBIA
ALLCOCK  65 PPSL  85  875     G R ALLCOCK /////////////////// LIVERPOOL
BARDON   65 PRL  14 449       BARDON,NORTON,PEOPLES +//COLUM+STONY BROOK
SHAFER   65 PRL  14 923       R E SHAFER,CROWE,JENKINS //////////  LRL

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****** ********* ********* ********* ********* ********* ********* *********
```

e

```
                    3  ELECTRON  (0.5,J=1/2)

                    3  ELECTRON  MASS (MEV)

M          0.511006 0.000002          COHEN     65 RVUE

------ --------- --------- --------- --------- --------- --------- ---------

               3  ELECTRON LIFETIME (UNITS 10**21 YR)

T    *     OVER                 2.0   MOE       65 CNTR                        6/66

------ --------- --------- --------- --------- --------- --------- ---------

                    3  ELECTRON MAGNETIC MOMENT(E/2ME)

MM   *     1.0011609 .0000024         SCHUPP    61 CNTR  -
MM         1.001159622  +-(27)*10**-9 WILKINSON 63 CNTR -                      8/66
MM   *     1.001168 0.000011          RICH      66 CNTR +  POSITRON            8/66

****** ********* ********* ********* ********* ********* ********* *********


                          REFERENCES
                          3  ELECTRON  (0.5,J=1/2)

SCHUPP   61 PR  121   1       A A SCHUPP,R W PIDD,H R CRANE //  MICHIGAN
WILKINSO 63 PR 130 852        D T WILKINSON,H R CRANE ///////// MICHIGAN
COHEN    65 RMP 37 537        E R COHEN, J W M DUMOND //// NAASC+CALTECH
MOE      65 PR 140 B 992      M K MOE,F REINES //// CASE INST TECHNOLOGY
RICH     66 PRL  17  271      A RICH, H R CRANE                 // MICHIGAN

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μ

```
                    4  MUON  (106,J=1/2)

                    4  MUON  MASS (MEV)

M            105.659    0.002          FEINBERG  63 RVUE

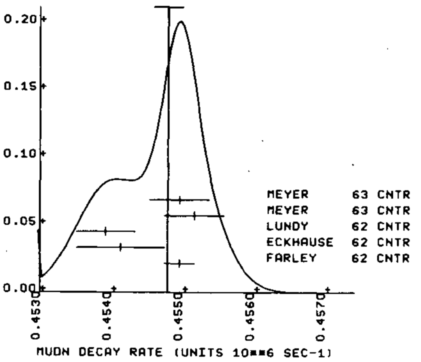
------ --------- --------- --------- --------- --------- --------- ---------

                    4  MUON LIFETIME (UNITS 10**-6)

T    N        2.200     0.015     0.015 FISHER    59 CNTR
T    N        2.225     0.006     0.006 ASTBURY   60 CNTR
T    N        2.211     0.003     0.003 REITER    60 CNTR
T    N        2.208     0.004     0.004 TELEGDI   60 CNTR
T    N  OLD DATA NEGLECTED FOLLOWING SUGGESTION OF V.TELEGDI

T             2.198     0.001     0.C01 FARLEY    62 CNTR
T             2.202     0.003     0.003 ECKHAUSF  62 CNTR
T             2.203     0.002           LUNDY     62 CNTR CONV. FROM CL=.98    9/66
T             2.197     0.002     0.002 MEYER     63 CNTR +
T             2.198     0.002     0.002 MEYER     63 CNTR -                    7/66
                         (Ideogram below)
------ --------- --------- --------- --------- --------- --------- ---------
```

WEIGHTED AVERAGE =0.454797 +/- 0.000203
SCALE = 1.34   CHISQ = 7.2   CONLEV = 0.127




```
                    4  RATIO OF LIFETIME OF MU+ TO MU-

LR           1.000     0.001              MEYER     63 CNTR  LIFETIME MU+/MJ-    7/66

------ --------- --------- --------- --------- --------- --------- ---------

                    4  MUON PARTIAL DECAY MODES

P1       MUON INTO E (E-NEU) (MU-NEU)                          S 3S 1S 2
P2       MUON INTO E 2GAMMA                                    S 3S 0S 0
P3       MUON INTO 3ELECTRONS                                  S 3S 3S 3
P4       MUON INTO E GAMMA                                     S 3S 0

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                    4  MUON  BRANCHING RATIOS

R1   *  MUON INTO  E+2GAMMA  (IN UNITS OF 10**-5)          (P2)/(P1)
R1   *  LESS THAN               1.6     FRANKEL 1 63 SPRK

R2   *  MUON INTO 3E (IN UNITS OF 10**-7)                  (P3)/(P1)
R2   *  LESS THAN               5.0     PARKER 1  62 CNTR
R2   *  LESS THAN               1.3     ALIKHANOV 62 SPRK
R2   *  LESS THAN               1.5     FRANKEL 2 63 CNTR
R2   *  LESS THAN               1.45    BABAEV    63 SPRK

R3   *  MUON INTO  E+GAMMA  (IN UNITS OF 10**-8)           (P4)/(P1)
R3   *  LESS THAN               1.2     FRANKEL 1 63 SPRK
R3   *  LESS THAN               0.6     PARKER 2  64 SPRK

------ --------- --------- --------- --------- --------- --------- ---------

                    4  MUON  MAGNETIC MOMENT (IN E/(2*MUON MASS)

MM           1.001162 0.000005          CHARPAK   62 CNTR +
MM           1.001165 0.000003          FARLEY    66      - STORAGE RINGS    11/66

****** ********* ********* ********* ********* ********* ********* *********


                          REFERENCES
                          4  MUON  (106,J=1/2)

FISHEP   59 PRL  3  349        FISHER,LEONTIC,LUNDBY,MEUNIER,STROOT//CERN
ASTBURY  60 ROCH CONF 60 542   ASTBURY,HATTERSLEY,HUSSAIN + //  LIVERPOOL
DEVONS   60 PRL  5  330        DEVONS,GIDAL,LEDERMAN,SHAPIRO  // COLUMBIA
LATHROP  60 NC    17 109       J LATHROP,R A LUNDY,V L TELEGDI + // EFINS
LATHROP  60 NC    17 114       J LATHROP,R A LUNDY,S PENMAN + ////  EFINS
REITER   60 PRL    5  22       REITER,ROMANOWSKI,SUTTON +  ///// CARNEGIE
TELEGDI  60 ROCH CONF 60 713   V L TELEGDI  //////////////////////  CERN

CHARPAK  61 PRL    6 128       CHARPAK,FARLEY,GARWIN,MULLER,SENS + //CERN
HUTCHINS 61 PRL    7 129       D P HUTCHINSON,J MENES +  //////  COLUMBIA
ALIKHANO 62 CERN CONF 423      A I ALIKHANOV,A BABAEV +  ///  ITEP MOSCOW
CHARPAK  62 PL     1  16       G CHARPAK,F J M FARLEY,R L GARWIN + //CERN
FARLEY   62 CERN CONF 415      FARLEY,MASSAM,MULLER,ZICHICHI  /////  CERN
LUNDY    62 PR 125 1686        RICHARD A LUNDY /////////////////// EFINS
PARKER   62 NC  23  485        S PARKER,S PENMAN ///////////////// EFINS
SHAPIRO  62 PR 125 1022        G SHAPIRO,L M LEDERMAN ////////// COLUMBIA

BABAEV   63 JETP 16 1397       BABAEV,BALATS,KAFTANOV,LANDSBERG + // ITEP
ECKHAUSE 63 PR 132  422        M ECKHAUSE,T A FILIPPAS + /////// CARNEGIE
FEINBERG 63 ARNS 13 431        GERALD FEINBERG, L M LEDERMAN /// COLUMBIA
FRANKEL  63 NC  27  894        S FRANKEL,W FRATI,J HALPERN + ////// PENNA
FRANKEL  63 PR 130  351        S FRANKEL,W FRATI,J HALPERN + ////// PENNA
MEYER    63 PR  132  2693      S L MEYER,ANDERSON,BLESER,LEDERMAN+//COLUM
PARKER   64 PR 133B 768        S PARKER,H L ANDERSON,C REY //////// EFINS
FARLEY   66  BERKELEY CONF.    FARLEY,BAILEY,BROWN,GIESCH +        // CERN

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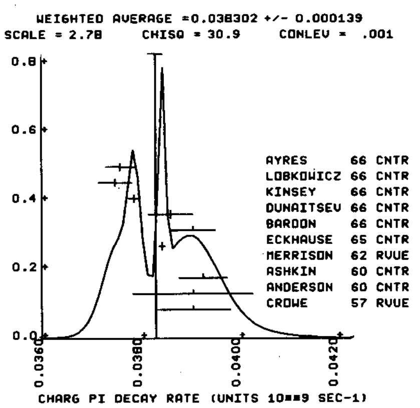
$\pi^\pm$

```
                    8  CHARGED PION  (140,JPG=0--)  I=1

                    8  CHARGED PI  MASS (MEV)

M            139.37     0.20              CROWE     54 CNTR  -
M            139.68     0.15              BARKAS    56 EMUL +
M            139.577    0.014             SHAFER    65 CNTR                    6/66

------ --------- --------- --------- --------- --------- --------- ---------

                    8  PI+ MU+ MASS DIFFERENCE (MEV)

D             34.00     0.076             BARKAS    56 EMUL
D             33.89     0.076             BARKAS    56 EMUL

------ --------- --------- --------- --------- --------- --------- ---------
```

8 CHAR.PI LIFETIME (UNITS 10**-9)

T		25.6	0.5	0.5	CROWE 57 RVUE	
T		25.6	0.8	0.8	ANDERSON 60 CNTR	
T	8000	25.46	0.32	0.32	ASHKIN 60 CNTR +	
T					MERRISON 62 RVUE	
T		26.02	0.04		ECKHAUSE 65 CNTR +	9/ 6/66
T		25.6	0.3		BARDON 66 CNTR	6/66
T		25.9	0.3		DUNAITSEV 66 CNTR	9/66
T		26.40	0.08		KINSEY 66 CNTR +	6/66
T		26.67	0.24		LOBKOWICZ 66 CNTR	9/66
T		26.6	0.2		AYRES 66 CNTR	10/66

(Ideogram below)



8 MEANLIFE DIFFERENCE,(+)-(-)/AVGE. (PERCENT)

LR	N	THIS QUANTITY IS A MEASURE OF CPT INVARIANCE IN W.I.				
LR		0.56	0.28	AYRES 66 CNTR		10/66
LR		0.23	0.40	LOBKOWICZ 66 CNTR	SEE NOTE L	9/66
LR	L	ABOVE IS THE MOST CONSERVATIVE VALUE QUOTED BY AUTHORS				9/66
LR		0.4	0.7	BARDON 66 CNTR		7/66

8 CHARGED PION PARTIAL DECAY MODES

P1	CHAR.PION INTO MU (MU-NEU)	S 4S 2
P2	CHAR.PION INTO E (E-NEU)	S 3S 1
P3	CHAR.PION INTO MU (MU-NEU) GAMMA	S 4S 2S 0
P4	CHAR.PION INTO PIO E (E-NEU)	S 9S 3S 1
P5	CHAR.PION INTO E NEU GAMMA	S 3S 1S 0

8 CHARGED PION BRANCHING RATIOS

R1	*	CHAR.PION INTO MU NEU GAMMA (UNITS 10**-4)				(P3)/(P1)	
R1	26	1.24	0.25		CASTAGNOL 58 EMUL		
R2	*	CHAR.PION INTO E NEU (UNITS 10**-4)				(P2)/(P1)	
R2		1.21	0.07		ANDERSON 60 CNTR		
R2		1.247	0.028		DI CAPUA 64 CNTR		
R3	*	CHAR.PION INTO PIO E NEU (UNITS 10**-8)				(P4)/(P1)	
R3	36	0.97	0.20		BARTLETT 64 SPRK		
R3	38	1.07	0.21		BACASTOW 65 SPRK +		
R3		1.10	0.26		BERTRAM 65 SPRK		6/66
R3	43	1.1	0.2		DUNAITSEV 65 CNTR		7/66
R3		1.01	0.08	0.10	DEPOMMIER 66 CNTR		6/66
R4	*	CHAR.PION INTO E NEU GAMMA (UNITS 10**-8)				(P5)/(P1)	
R4	143	3.0	0.5		DEPOMMIER 63 CNTR		6/66

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REFERENCES
8 CHARGED PION (140,JPG=0--)I=1

CROWE 54 PR 96 470 — K M CROWE,R H PHILLIPS /////////////// LRL
BARKAS 56 PR 101 778 — W H BARKAS,W BIRNBAUM,F M SMITH ////// LRL
CROWE 57 NC 5 541 — K M CROWE ////////////////// STANFORD HEPL
CASTAGNO 58 PR 112 1779 — C CASTAGNOLI,M MUCHNIK ////////// ROME I F

ANDERSON 60 PR 119 2050 — H L ANDERSON,T FUJII,R H MILLER + // EFINS
ASHKIN 60 NC 16 490 — ASHKIN,FAZZINI,FIDECARO,LIPMAN + //// CERN
MERRISON 62 ADVP 11 1 — A W MERRISON /////////////////// LIVERPOOL
SHAPIRO 62 PR 125 1022 — G SHAPIRO,L M LEDERMAN ////////// COLUMBIA

CZIRR 63 PR 130 341 — JOHN B CZIRR ///////////////////////// LRL
DEPOMMIE 63 PL 7 285 — P DEPOMMIER,HEINTZE,RUBBIA,SOERGEL // CERN
BARTLETT 64 PR 136B 1432 — BARTLETT,DEVONS,MEYER,ROSEN ///// COLUMBIA
DI CAPUA 64 PR 133B 1333 — DI CAPUA,GARLAND,PONDROM,STRELZOFF //COLUM

BACASTOW 65 PR 139 B407 — +GHESQUIERE,WIEGAND,LARSEN //LRL+SLAC
BERTRAM 65 PR 139 B 617 — BERTRAM,MEYER,CARRIGAN+ //// MICH+CARNEGIE
CLINE 65 PL 15 293 — A CLINE,W F FRY //////////////// WISCONSIN
DUNAITSE 65 JETP 20 58 — DUNAITSEV,PETRUKHIN,PROKOSHKIN + /// DUBNA
ECKHAUSE 65 PL 19 348 — ECKHAUSE,HARRIS,SHULER+// WILLIAM AND MARY
SHAFER 65 UCRL 16365 THESIS ROBERT E SHAFER ////////////////////// LRL
REPLACES 65 PRL 14 923 — R E SHAFER,K M CROWE,D A JENKINS ///// LRL

AYRES 66 PREPRINT — D.S.AYRES,CALDWELL,GREENBERG,KURZ+ // LRL
BARDON 66 PRL 16 775 — BARDON,DORE,DORFAN,KRIEGER + //// COLUMBIA
DEPOMMIE 66 PRIV COMM — DEPOMMIER,SOERGEL ////////////////// CERN
DUNAITSE 66 PL 23 283 — DUNAITSEV,KUTYIN,PROKOSHKIN + // SERPUKHOV
KINSEY 66 PR 144 1132 — KINSEY,LOBKOWICZ,NORDBERG //ROCHESTER UNIV
LOBKOWIC 66 PRL 17 548 — LOBKOWICZ,MELISSINOS,NAGASHIMA+ //ROCH+BNL

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9 NEUTRAL PION (135,JPG=0--) I=1

9 PI MASS DIFFERENCE (PI+-)-(PIO)(MEV)

D	*	5.37	1.0	PANOFSKY 51 CNTR -	
D		4.50	0.31	CHINOWSKY 54 CNTR -	
D		4.62	0.05	HADDOCK 59 CNTR -	
D		4.60	0.04	HILLMAN 59 CNTR	
D		4.55	0.07	CASSELS 59 CNTR	
D		4.6056	0.0055	CZIRR 63 CNTR	
D		4.59	0.03	PETRUKHIN 63 CNTR -	
D		4.6034	0.0052	VASILEVSK 66 CNTR -	9/66

9 PIO LIFETIME (UNITS 10**-16)

T	N	76	1.9	0.5	0.5	GLASSER 61 EMUL	
T	N	45	2.3	1.1	1.0	TIETGE 62 EMUL	
T	N	88	2.8	0.9	0.9	KOLLER 63 EMUL	
T			1.05	0.18	0.18	VON DARDE 63 CNTR	
T	N	75	1.7	0.5		SHWE 64 EMUL	
T			0.730	0.105		BELLETTIN 65 CNTR	6/66
T	N	67	1.6	0.6	0.5	EVANS 65 EMUL	6/66
T	N	EMULSION MEASUREMENTS NOT USED BECAUSE OF POSSIBLE SYSTEMATIC					
T	N	SHIFT TO LARGER LIFETIME VALUES					

9 NEUTRAL PION PARTIAL DECAY MODES

P1	PIO INTO 2GAMMA	S 0S 0
P2	PIO INTO E+ E- GAMMA	S 3S 3S 0
P3	PIO INTO 4ELECTRONS	S 3S 3S 3S 3
P4	PIO INTO 3 GAMMA	S 0S 0S 0

9 NEUTRAL PION BRANCHING RATIOS

R1	*	PIO INTO (GAMMA E+ E-)/(2GAMMA)			(P2)/(P1)		
R1	*		0.01196	THEORETICAL CALC.JOSEPH 61		QUANTUM ELECT.	9/66
R1	27	0.0117	0.0015	BUDAGOV 60 HBC			
R1	3071	0.01166	0.00047	SAMIOS 61 HBC		PI-P TO PIO N	
R1	S	SAMIOS VALUE USES PANOFSKY RATIO = 1.62					
R2	*	PIO INTO (3 GAMMA)/(2 GAMMA) (UNITS 10**-6)			(P4)/(P1)		
R2	*	0	5.0 OR LESS	DUCLOS 65 CNTR		CL=90 PERCENT	6/66
R3	*	PIO INTO (E+E+E-E-)/(2 GAMMA) (UNITS 10**-5)			(P3)/(P1)		
R3	*		3.47	THEORETICAL CAL. KROLL 55		QUANTUM ELECT.	9/66
R3	146	3.18	0.30	SAMIOS 62 HBC			6/66
R3	N	ABOVE VALUE USES PANOFSKY RATIO=1.62					

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REFERENCES
9 NEUTRAL PION (135,JPG=0--)I=1

PANOFSKY 51 PR 81 565 — W K H PANOFSKY,R L AAMODT,J HADLEY /// LRL
CHINOWSK 54 PR 93 586 — W CHINOWSKY,J STEINBERGER /////// COLUMBIA
KROLL 55 PR 98 1355 — N KROLL ,W WADA // COLUMBIA+NRL#
CASSELS 59 PPS 74 92 — CASSELS,JONES,MURPHY,O NEILL /// LIVERPOOL
HADDOCK 59 PRL 3 478 — HADDOCK,ABASHIAN,CROWE,CZIRR ///////// LRL
HILLMAN 59 NC 14 887 — HILLMAN,MIDDELKOOP,YAMAGATA,ZAVATTINI/CERN

BUDAGOV 60 JETP 11 755 — BUDAGOV,VIKTOR,DZHELEPOV,ERMOLOV + //JINR
JOSEPH 60 NC 16 997 — D W JOSEPH // EFI
GLASSER 61 PR 123 1014 — R G GLASSER,N SEEMAN,B STILLER /////// NRL
SAMIOS 61 PR 121 275 — N P SAMIOS ////////////////// COLUMBIA+BNL
SAMIOS 62 PR 126 1844 — SAMIOS,PLANO,PRODELL + ////// COLUMBIA+BNL
TIETGE 62 PR 127 1324 — J TIETGE,W PUESCHEL ////// MAX PLANCK INST

CZIRR 63 PR 130 341 — JOHN B CZIRR ////////////////////////// LRL
KOLLER 63 NC 27 1405 — E L KOLLER,S TAYLOR,T HUETTER //// STEVENS
PETRUKHI 63 SIENA CONF 208 — V I PETRUKHIN,YU D PROKOSHKIN /////// JINR
VONCARDE 63 PL 4 51 — VON DARDEL,DEKKERS,MERMOD,VAN PUTTEN+/CERN

SHWE 64 PR 136B 1839 — H SHWE,F M SMITH,W H BARKAS ////////// LRL
BELLETTI 65 NC 40 A 1139 — BELLETTINI,BEMPORAD,BRACCINI+/PISA+FIRENZE
DUCLOS 65 PL 19 253 — DUCLOS,FREYTAG,HEINTZE + //CERN+HEIDELBERG
EVANS 65 PR 139 B 982 — D A EVANS ///////////////////////// OXFORD

VASILEVS 66 PL 23 281 — VASILEVSKY,VISHNYAKOV,DUNAITSEV + // DUBNA

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$K^{\pm}$

10 CHARGED K (494,JP=0-) I=1/2

10 CHARGED K MASS (MEV)

M	493.9	0.2	COHEN 57 RVUE +		
M	493.7	0.3	BARKAS 63 EMUL -		
M	493.78	0.17	GREINER 65 EMUL +	VIA TAU DECAY	7/66

10 CHAR.K LIFETIME (UNITS 10**-8)

T			0.95	0.36	0.25	ILOFF 56 EMUL	
T		52	1.60	0.3	0.3	EISENBERG 58 EMUL	
T			1.21	0.06	0.06	BURROWES 59 CNTR	
T		33	1.38	0.24	0.24	FREDEN 60 EMUL	
T			1.25	0.22	0.17	BARKAS 61 EMUL	
T		51	1.27	0.36	0.23	BHOWMIK 61 EMUL	
T		293	1.31	0.08	0.08	NORDIN 61 HBC -	
T	*		1.24	0.07		NORDIN 61 RVUE -	
T			1.231	0.011	0.011	BOYARSKY 62 CNTR +	
T			1.2443	0.0038		FITCH 65 CNTR +	6/66
T			1.2265	0.0036		LOBKOWICZ 66 CNTR +	9/66

(Ideograms on next page)

10 LIFETIME DIFFERENCE,(+)-(-)/AVGE. (PERCENT)

LR	N	THIS QUANTITY IS A MEASURE OF CPT INVARIANCE IN W.I.				
LR		0.049	0.097	LOBKOWICZ 66 CNRT	SEE NOTE L	9/66
LR	L	ABOVE IS THE MOST CONSERVATIVE VALUE QUOTED BY AUTHORS				9/66

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                    10  CHARGED K PARTIAL DECAY MODES

P1      CHAR. K INTO MU (NEU)              K MU            S 4S 2
P2      CHAR. K INTO PI PIO                K PI            S 8S 9
P3      CHAR. K INTO PI PI+ PI-            TAU             S 8S 8S 8
P4      CHAR. K INTO PI 2PIO               TAU PRIME       S 8S 9S 9
P5      CHAR. K INTO MU PIO NEU            K MU            S 4S 9S 2
P6      CHAR. K INTO E PIO NEU             K E             S 3S 9S 1
P7      POSIT.K INTO PI+ PI- E+NEU         K E+            S 8S 8S 3S 1
P8      POSIT.K INTO PI+ PI+ E-NEU         K E-            S 8S 8S 3S 1
P9       POSIT.K INTO PI+ PI- MU+ NEU      K+MU+ 4         S 8S 8S 4S 2
P10      POSIT.K INTO PI+ PI+ MU- NEU      K+MU- 4         S 8S 8S 4S 2
P11      CHAR. K INTO E NEU                K E 2           S 3S 1
P12      CHAR. K INTO MU NEU GAMMA         K MU RAD        S 4S 2S 0
P13      CHAR. K INTO PI PIO GAMMA         K PI RAD        S 8S 9S 0
P14      CHAR. K INTO PI PI+ PI- GAMMA     TAU RAD         S 8S 8S 8S 0
P15      CHAR. K INTO PI E+ E-             PI E E          S 8S 3S 3
P16      CHAR. K INTO PI MU+ MU-           PI MU MU        S 8S 4S 4

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                    10  CHARGED K BRANCHING RATIOS

R   O      OLD DATA EXCLUDED

R1  *  CHAR. K INTO MU NEU (MU2)        (UNITS 10**-2)      (P1)/TOTAL
R1  O        58.5       3.0             BIRGE      56 EMUL +
R1  O        56.9       2.6             ALEXANDER 57 EMUL +

R2  *  CHAR. K INTO PI PIO (PI2)        (UNITS 10**-2)      (P2)/TOTAL
R2  O        27.7       2.7             BIRGE      56 EMUL +
R2  O        23.2       2.2             ALEXANDER 57 EMUL +
R2           21.0       0.6             CALLAHAN  65 PBC
R2  *        21.6       0.6             TRILLING  65 RVUE                        6/66

R3  *  CHAR. K INTO PI PI+ PI-(TAU)     (UNITS 10**-2)      (P3)/TOTAL
R3  O         5.6       0.4             BIRGE      56 EMUL +
R3  O         6.8       0.4             ALEXANDER 57 EMUL +
R3  O         5.2       0.3             TAYLOR     59 EMUL +
R3            5.7       0.3             ROE        61 XBC  +                     9/66
R3     2332   5.54      0.12            CALLAHAN   64 XBC  +
R3            5.1       0.2             SHAKLEE    64 XBC  +                     9/66
R3            5.71      0.15            DE MARCO   65 HBC                        6/66
R3            6.0       0.4             YOUNG      65 EMUL +                     6/66
                           (Ideogram on next page)
R4  *  CHAR. K INTO PI 2PIO (TAU PRIME)(UNITS 10**-2)      (P4)/TOTAL
R4  O         2.1       0.5             BIRGE      56 EMUL +
R4  O         2.2       0.4             ALEXANDER 57 EMUL +
R4  O         1.5       0.2             TAYLOR     59 EMUL +

R5  *  CHAR. K INTO MU PIO NEU (MU3)    (UNITS 10**-2)      (P5)/TOTAL
R5  O         2.8       1.0             BIRGE      56 EMUL +
R5  O         5.9       1.3             ALEXANDER 57 EMUL +
R5  O         2.8       0.4             TAYLOR     59 EMUL +

R6  *  CHAR. K INTO E PIO NEU (E3)      (UNITS 10**-2)      (P6)/TOTAL
R6  O         3.2       1.3             BIRGE      56 EMUL +
R6  O         5.1       1.3             ALEXANDER 57 EMUL +

R7  *  POSIT.K INTO PI+ PI- E+ NEU      (UNITS 10**-5)      (P7)/TOTAL

R8  *  POSIT.K INTO PI+ PI+ E- NEU      (UNITS 10**-5)      (P8)/TOTAL
R8            0.2     OR LESS           BIRGE      65 FBC  +  95 PER CT CONF     8/66
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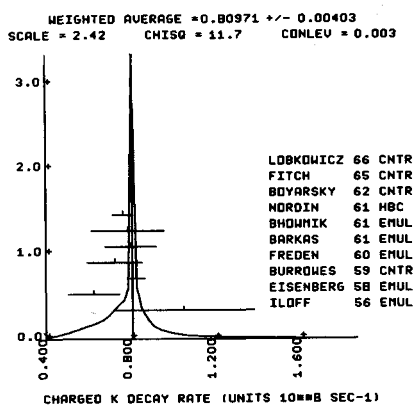
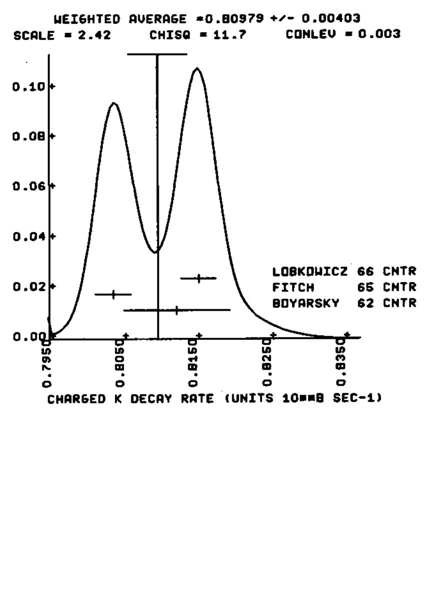


NOTE: Ideogram above contains all the data. Ideogram below contains only those in the central peak.

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R9  *  POSIT.K INTO PI+ PI- MU+ NEU (UNITS 10**-5)      (P9)/TOTAL
R9       1    0.77      0.54     0.50  CLINE      65 FBC  +                      8/66

R10 *  POSIT.K INTO PI+ PI+ MU- NEU (UNITS 10**-6)      (P10)/TOTAL
R10      0    3.0 OR LESS              BIRGE      65 FBC  +  95 PER CT CONF      8/66

R11 *  CHAR. K INTO E NEU             (UNITS 10**-5)      (P11)/TOTAL
R11 *        16.0    OR LESS           BORREANI   64 HBC  +                      8/66
R11 *    4    1.9       1.2            BOWEN      66 SPRK +                      8/66

R12 *  CHAR. K INTO MU NEU GAMMA      (UNITS 10**-5)      (P12)/TOTAL

R13 *  CHAR. K INTO PI PIO GAMMA      (UNITS 10**-4)      (P13)/TOTAL
R13 *   18    2.2       0.7            CLINE      64 FBC  +  PI+ KE 55-90 MEV    8/66

R14 *  CHAR. K INTO PI PI+ PI- GAMMA(UNITS 10**-4)      (P14)/TOTAL
R14           1.0       0.4            STAMER     65 EMUL +                      8/66

R15 *  CHAR. K INTO PI E+ E-          (UNITS 10**-6)      (P15)/TOTAL
R15      1    1.1    OR LESS           CAMERINI   64 FBC  +                      8/66

R16 *  CHAR. K INTO PI MU+ MU-        (UNITS 10**-6)      (P16)/TOTAL
R16           3.0    OR LESS           CAMERINI   65 FBC  +  90 PER CT CONF      8/66

R17 *  CHAR. K INTO (PI PIO)/TAU                          (P2)/(P3)
R17 N         3.26      0.23           ROE        61 XBC  +                      8/66
R17 N  KMU RAD VS KMU3 SORTING DIFFICULTIES SUSPECTED BY AUTHORS                 9/66
R17           4.40      0.23           SHAKLEE    64 XBC  +                      8/66
R17    134    3.24      0.34           YOUNG      65 EMUL +                      8/66
R17   1045    3.96      0.15           CALLAHAN   66 FBC                         9/66
                           (Ideogram on next page)
R18 *  CHAR. K INTO (PI 2PIO)/TAU                         (P4)/(P3)
R18           0.30      0.04           ROE        61 XBC  +                      8/66
R18           0.35      0.04           SHAKLEE    64 XBC  +
R18   2027    0.303     0.009          BISI       65 H+HL +                      8/66
R18     17    0.393     0.099          YOUNG      65 EMUL +                      8/66

R19 *  CHAR. K INTO (MU PIO NEU)/TAU                      (P5)/(P3)
R19 N         0.84      0.14           ROE        61 XBC  +                      8/66
R19 N  KMU RAD VS KMU3 SORTING DIFFICULTIES SUSPECTED BY AUTHORS                 9/66
R19           0.59      0.10           SHAKLEE    64 XBC  +                      8/66
R19   2175    0.632     0.035          BISI       65 H+HL +                      8/66
R19     38    0.90      0.16           YOUNG      65 EMUL +                      8/66
R19    650    0.525     0.032          CALLAHAN   66 FBC                         9/66
                           (Ideogram on next page)
R20 *  CHAR. K INTO (E PIO NEU)/TAU                       (P6)/(P3)
R20           0.88      0.11           ROE        61 XBC  +                      8/66
R20    230    0.90      0.06           BORREANI   64 HBC  +                      8/66
R20           0.92      0.08           SHAKLEE    64 XBC  +
R20     37    0.90      0.16           YOUNG      65 EMUL +                      8/66
R20    864    0.727     0.028          CALLAHAN   66 FBC                         9/66
                           (Ideogram on next page)
R21 *  POSIT.K INTO (PI+ PI- E+ NEU)/TAU(UNITS 10**-4)(P7)/(P3)
R21     69    6.7       1.5            BIRGE      65 FBC  +                      8/66

R22 *  POSIT.K INTO (PI+ PI- MU+ NEU)/TAU(UNITS 10**-4)(P9)/(P3)
R22      1    2.5    APPROX            GREINER    64 EMUL +                      8/66

R23 *  CHAR. K INTO (E PIO NEU)/(M2 + P2)(UNITS 10**-2)(P6)/(P1+P2)
R23   1679    5.89      0.16           CESTER     66 SPRK +                      8/66

R24 *  CHAR. K INTO (PI PIO)/(MU NEU)                     (P2)/(P1)
R24           0.3253    0.0062         AUERBACH   66 SPRK +                      8/66

R25 *  CHAR. K INTO (E PIO NEU)/(MU NEU)                  (P6)/(P1)
R25           0.0796    0.0054         AUERBACH   66 SPRK +                      8/66

R26 *  CHAR. K INTO (MU PIO NEU)/(MU NEU)                 (P5)/(P1)
R26           0.0602    0.0043         AUERBACH   66 SPRK +                      8/66
R26           0.059     0.004          TSIPIS     66 SPRK +                      9/66

R27 *  CHAR. K INTO (MU NEU)/(TAU)                        (P1)/(P3)
R27 R  427   10.38      0.82           YOUNG      65 EMUL +                      9/66
R27 R ONLY YOUNG MEASURED MU2 DIRECTLY. SEE NOTE PRECEDING THE K+ BRANCHING
      RATIOS LISTINGS

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1. In a number of experiments, the $K\mu 2$ branching ratio is not determined from kinematically identified events, but essentially by subtracting the sum of other branching ratios from one. Since our averaging program applies this constraint, we omit those unmeasured branching ratios from the input.

2. The tau branching ratios are not all in agreement within the stated errors. Since one would expect the number of taus to be reliably determined in each case, we take this to indicate a systematic error in the total number of K-decays, which would be reflected in errors in the other branching ratios.

Since there are some recent and precise measurements of the tau branching ratio, the following method has been devised. The ratio of the other modes to the number of taus is taken whenever appropriate (of course, in a number of experiments this is the quantity actually measured, with some value of the tau branching ratio being used to convert this measurement to an absolute branching ratio). All the recent measurements of the tau branching ratio are used, and together with the ratios of other modes to taus, are entered in the averaging program.

If there is, as suspected, a large correlation between the tau branching ratio and the other branching ratios, in the presence of certain kinds of systematic errors, this method takes advantage of it, with an unimportant increase in the quoted errors.

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                              REFERENCES
                              10 CHARGED K (494,JP=0-)I=1/2

BIRGE    56 NC    4    834    BIRGE,PERKINS,PETERSON,STORK,WHITEHEA//LRL
ILOFF    56 PR 102    927     ILOFF,GOLDHABER,LANNUTTI,GILBERT + /// LRL
ALEXANDE 57 NC    6    478    ALEXANDER,JOHNSTON,OCEALLAIGH//DUBLIN INST
COHEN    57 FUND.CONS.PHYS.   E R COHEN,K M CROWE,J DUMOND // AI+LRL+CIT
EISENBER 58 NC.   8   663     EISENBERG,KOCH,LOHRMANN,NIKOLIC + /// BERN
BURROWES 59 PRL   2   117     BURROWES,CALDWELL,FRISCH,HILL + ////// MIT
TAYLOR   59 PR 114   359      S TAYLOR,HARRIS,OREAR,LEE,BAUMEL//COLUMBIA

FREDEN   60 PR 118   564      S C FREDEN,F C GILBERT,R S WHITE ///// LRL
BARKAS   61 PR 124 1209       BARKAS,DYER,MASON,NORRIS,NICKOLS,SMIT//LRL
BHOWMIK  61 NC  20   857      B BHOWMIK,P C JAIN,P C MATHUR //DELHI UNIV
NORDIN   61 PR 123 2166       PAUL NORDIN JR ///////////////////////// LRL
ROE      61 PRL   7   346     ROE,SINCLAIR,BROWN,GLASER + ///// MICH+LRL
BOYARSKI 62 PR 128 2398       BOYARSKI,LOH,NIEMELA,RITSON ////////// MIT

BARKAS   63 PRL 11    26      W H BARKAS,J N DYER,H H HECKMAN ////// LRL
BIRGE    63 PRL  11   35      BIRGE,ELY,GIDAL,CAMERINI + // LRL+WIS+BARI
BORREANI 64 PL    12 123      G BORREANI,G RINAUDO,A WERBROUCK /// TURIN
CALLAHAN 64 PR   136 B 1463   A CALLAHAN,R MARCH,R STARK ///// WISCONSIN
CAMERINI 64 PRL   13 318      CAMERINI,CLINE,FRY,POWELL // WISCONSIN+LRL
CLINE    64 PRL   13 101      D CLINE, W F FRY //////////////// WISCONSIN
GREINER  64 PRL   13 284      D GREINER, W OSBORNE, W BARKAS /////// LRL
SHAKLEE  64 PR   136 B 1423   SHAKLEE,JENSEN,ROE,SINCLAIR ///// MICHIGAN

BIRGE    65 PR 139 B 1600     BIRGE,ELY,GIDAL,CAMERINI,CLINE + //LRL+WIS
BISI     65 NC    35  768     BISI,BORREANI,CESTER,FERRARO + ///// TURIN
BISI     65 PR 139 B 1068     BISI,MARZARI-CHIESA,RINAUDO // TURINO,INFN
CALLAHAN 65 PRL   15  129     A CALLAHAN,D CLINE ////////////// WISCONSIN
CAMERINI 65 NC    37 1795     CAMERINI,CLINE,GIDAL,KALMUS,KERNAN/WIS+LRL
CLINE    65 PL    15  293     A CLINE,W F FRY //////////////// WISCONSIN
DE MARCO 65 PR 140 B 1430     DE MARCO,GROSSO,RINAUDO ////// TURINO+CERN
FITCH    65 PR 140 B 1088     FITCH,QUARLES,WILKINS //PRINCETON+MT HOLYK
GREINER  65 ARNS  15   67     QUOTED BY BARKAS                      // LRL
STAMER   65 PR  138 B 440     STAMER,HUETTER,KOLLER,TAYLOR,GRAUMAN//STEV
TRILLING 65 UCRL 16473        GEORGE H TRILLING ///////////////////// LRL
   (TRILLING 65 IS AN UPDATE OF HIS REPORT AT THE 1965 ARGONNE CONF, P 115)
YOUNG    65 UCRL 16362        POH-SHIEN YOUNG (THESIS,BERKELEY) //// LRL

AUERBACH 66  BERKELEY 2B      AUERBACH,MANN,WHITE,YOUNT+//PENN-PRINCETON
BOWEN    66  BERKELEY 2B      BOWEN,MANN,MCFARLANE,HUGHES+/PENN-PRINCETO
CALLAHAN 66 NC 44A 90         A C CALLAHAN                    // WISCONSIN
CESTER   66 PL 21 343         CESTER,ESCHSTRUTH,ONEILL+ //PRINCETON-PENN
LOBKOWIC 66 PRL  17  548      LOBKOWICZ,MELISSINOS,NAGASHIMA+ //ROCH+BNL
TSIPIS   66  BERKELEY CONF    +MEYER,ROSEN+ //COLUMBIA+RUTGERS+ROCH+WISC

        QUANTUM NUMBER DETERMINATIONS NOT REFERRED TO IN THE DATA CARDS

BLOCK    62 CERN CONF 371     BLOCK,LENDINARA,MONARI /////// NWU+BOLOGNA
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K^0

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             11  NEUTRAL K  (JP=0-)  I=1/2

             11  KO MASS  (MEV)

M           498.1    0.4         CHRISTENS 64 SPRK
M     2223  497.44   0.33        KIM       65 HBC    KO FROM PBAR P   6/66
M     4500  498.9    0.5         BALTAY    66 HBC    KO FROM PBAR P   6/66
                          (Ideogram below)
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             11  KO-K CH. MASS DIFFERENCE (MEV)

D          3.9     0.6          ROSENFELD 59 HBC   -
D          5.4     1.1          CRAWFORD  59 HBC   +
D     9    3.90    0.25         BURNSTEIN 65 HBC   -
D    17    4.18    0.18         ENGELMANN 65 HBC                      6/66
D    25    3.71    0.35         KIM       65 HBC   -  K- P TO KO N    6/66

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                              REFERENCES
                              11 NEUTRAL K (JP=0-)I=1/2

CRAWFORD 59 PRL    2  112     CRAWFORD,CRESTI,GOOD,STEVENSON,TICHO //LRL
ROSENFEL 59 PRL    2  110     A H ROSENFELD,F SOLMITZ,R D TRIPP //// LRL
CHRISTEN 64 PRL 13 138        CHRISTENSON,CRONIN,FITCH,TURLAY//PRINCETON
BURNSTEI 65 PR   138 B 895    R A BURNSTEIN,H A RUBIN ///////// MARYLAND
ENGELMAN 65    PRI COMM       ENGLEMAN,FILTHUTH ///////////// HEIDELBERG
KIM      65 PR 140 B 1334     J K KIM,L KIRSCH,D MILLER /////// COLUMBIA
BALTAY   66 PR 142    932     BALTAY,SANDWEISS,STONEHILL +    //YALE+BNL
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K$^0_1$

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             12  SHORT-LIVED NEUTRAL K (498, JP=0-)  I=1/2

             12  KO1 LIFETIME (UNITS 10**-10)

T        90   1.07    0.13    0.13  BOLDT     58 CC
T    U   62   0.81    0.23    0.15  BROWN     58 PBC
T    U   29   0.84    0.35    0.19  COOPER    58 CC
T    U   39   1.15    0.40    0.25  BLUMENFEL 58 CC
T    U  259   1.06    0.08    0.06  EISLER    58 PBC
T    U   UNPUBLISHED DATA EXCLUDED

T       512   0.94    0.05    0.05  CRAWFORD  59 HBC
T        63   1.09    0.18    0.15  BOWEN     60 CC
T       378   0.94    0.05    0.05  BERTANZA  62 HBC
T       503   0.87    0.05          CHRETIEN  63 PBC
T       545   0.86    0.04          KREISLER  64 SPRK

T       572   0.91    0.04          AUERBACH  65 SPRK                 6/66
T             0.866   0.016         ALFF-STEI 66 SPRK                 9/66
T      4500   0.92    0.04          BALTAY    66 HBC                  6/66
T             0.904   0.024         BOTT-BODE 66 SPRK                 9/66
T             0.858   0.014         HILL      66 DBC                  9/66
T      5000   0.843   0.013         KIRSCH    66 HBC                  6/66
----------------------------(Ideogram below)----------------------------

             12  KO1 PARTIAL DECAY MODES

P1      KO1 INTO PI+ PI-                                S 8S 8
P2      KO1 INTO PIO PIO                                S 9S 9

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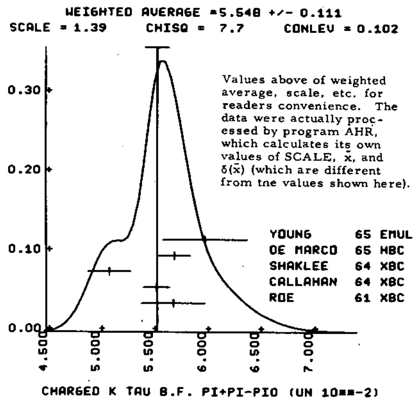

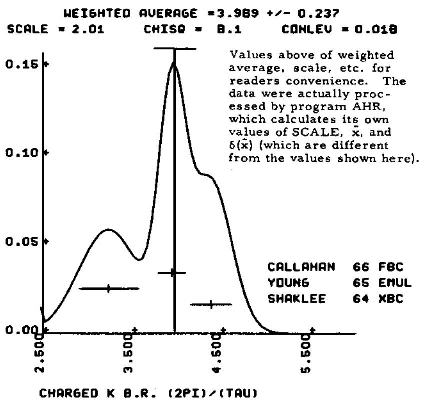

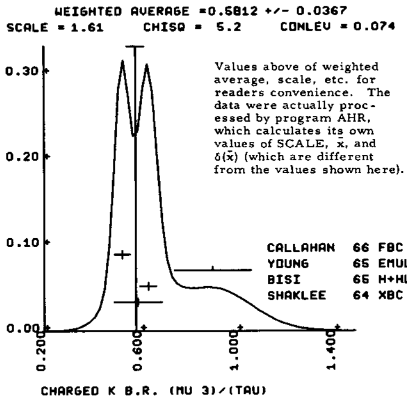

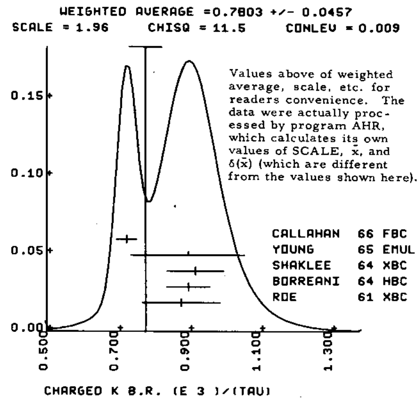

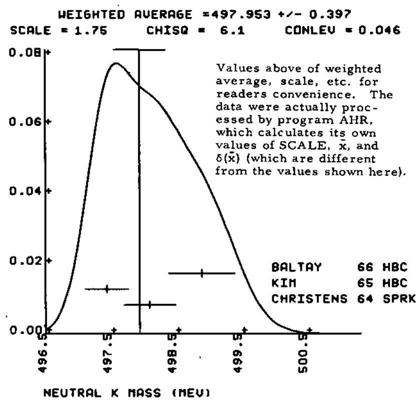

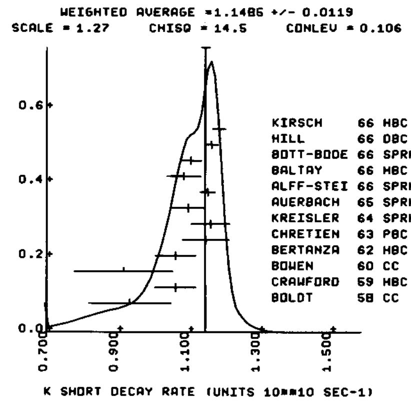

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                        12  K01  BRANCHING RATIOS

R1   *  K01 INTO (PI+ PI-)/TOTAL                              (P1)/TOTAL
R1            0.68      0.04          CRAWFORD  59 HBC
R1            0.70      0.08          COLUMBIA  60 HBC
R1            0.740     0.024         ANDERSON  62 HBC

R2   *  K01 INTO (PI0 PI0)/TOTAL                              (P2)/TOTAL
R2            0.27      0.11          CRAWFORD  59 HBC
R2            0.26      0.06          BAGLIN    60 PBC
R2            0.30      0.035         BROWN     61 XBC
R2     1066   0.335     0.014         BROWN     63 XBC
R2      198   0.288     0.021         CHRETIEN  63 PBC
                            (Ideogram below)
R3   *   (K01 INTO PI+ PI- PI0)/(K02 INTO PI+ PI- PI0)
R3            0.45   OR LESS          BEHR      66 HLBC    90 PER CT CONF    8/66

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REFERENCES
12 SHORT-LIVED NEUTRAL K (498, JP=0-) I=1/2


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BLUMENFE 58 CERN CONF 272      H BLUMENFELD,W CHINCNSKY,L LEDERMAN//COLUM
BOLDT    58 PRL    1  150      E BOLDT,D O CALDWELL,Y PAL //////////// MIT
BROWN    58 CERN CONF 272      J BROWN,D GLASER + /////////////// MICHIGAN
COOPER   58 CERN CONF 272      W A COOPER,H FILTHUTH + ///// JUNGFRAUJUCH
EISLER   58 CERN CONF 272      F EISLER,R PLANO + // BNL+COL+BOLOGNA+PISA
CRAWFORD 59 PRL    2  266      CRAWFORD,CRESTI,DOUGLASS,GOOD,TICHO +//LRL

BAGLIN   60 NC    18 1043      BAGLIN,BLOCH,BRISSON,HENNESSY + //PARIS EP
BIRGE    60 ROCH CONF 601      R W BIRGE,P P ELY + //////// LRL+WISCONSIN
BOWEN    60 PR   119 2030      BOWEN,HARDY,REYNOLDS,SUN,MCORE+/PRINCE+BNL
COLUMBIA 60 ROCH CONF 727      M SCHWARTZ + ///////////////////// CCLUMBIA
MULLER   60 PRL    4  418      MULLER,BIRGE,FOWLER,GOOD,PICCIOMI+/LRL+BNL

BROWN    61 NC    19 1155      BROWN,BRYANT,BURNSTEIN,GLASER,KADYK+//MICH
FITCH    61 NC    22 1160      V FITCH,P PIROUE,R PERKINS /// PRINCE+LASL
GOOD     61 PR   124 1223      GOOD,MATSEN,MULLER,PICCIONI + //////// LRL
ANDERSON 62 CERN CONF 836      J A ANDERSON,F S CRAWFORD + ////////// LRL
BERTANZA 62 PREPRINT D105      BERTANZA,CONNOLLY,CULWICK,EISLER + /// BNL
        (BERTANZA UNPUBLISHED,BUT RECERTIFIED BY AUTHORS,AUGUST 66)
CRAWFORD 62 CERN CONF 827      F S CRAWFORD ///////////////////////// LRL

BROWN    63 PR   130  769      BROWN,KADYK,TRILLING,ROE + ///LRL+MICHIGAN
CHRETIEN 63 PR   131 2208      CHRETIEN+ //// BRANDEIS+BROWN+HARVARD+ MIT
KREISLER 64 PR   136 B 1074    M KREISLER,O OVERSETH,J CRONIN / PRINCETON
AUERBACH 65 PRL 14 192         AUERBACH,LANDE,MANN,SCIULLI,UTO + /// PENN
TRILLING 65 UCRL 16473         GEORGE H TRILLING ///////////////////// LRL
   (THIS IS AN UPDATED VERSION OF REPORT AT 1965 ARGONNE CONF, PAGE 115)

ALFF-STE 66 PL 21 595          ALFF-STEINBERGER,HEUER,KLEINKNECHT +//CERN
BALTAY   66 PR 142   932       BALTAY,SANDWEISS,STONEHILL +  /// YALE+BNL
BOTT-BOD 66    BERKELEY CONF.  BOTT-BODENHAUSEN,DE BOUARD +       // CERN
HILL     66    BERKELEY CONF.  HILL,ROBINSON, SAKITT +     // BNL+CARNEGIE
KIRSCH   66 PR   147  939      L KIRSCH,P SCHMIDT /////////////// COLUMBIA
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K_2^0

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                 13   LONG-LIVED NEUTRAL K (498, JP=0-)  I=1/2

                 13   K02-K01  MASS DIFFERENCE (UNITS OF INVERSE K01 LIFE)

D    *        1.9       0.3            FITCH     61 CNTR
D             0.84      0.29      0.21 GOOD      61 PBC
D    *        1.5       0.2            CAMERINI  62 PBC
D             0.5       0.1            CHRISTENS 63 SPRK

D             0.47      0.21           AUBERT    65 PBC                     6/66
D             0.26      0.36      0.26 BALDO-CEO 65 PBC    ASS.CP CONS.
D    *        0.60   OR LESS           FITCH     65 SPRK   CF. MEISNER 56   7/66

D             0.445     0.034          ALFF-STEI 66 SPRK                    6/66
D             0.52      0.15      0.16 BALATZ    66 SPRK                    9/66
D             0.480     0.024          BOTT-BODE 66 SPRK                    9/66
D          72 + 0.64    0.18           CANTER    66 DBC    K0 SCATTER IN D2 11/66
D             0.55      0.1            CHRISTENS 66 SPRK                    6/66
D             0.72      0.15           FUJII     66 SPRK   IRON REGENERATOR  9/66

D           + 0.62      0.16           HILL      66 DBC    K0+D INTO HYPER.  9/66
D            +0.35      0.15           JOVANOVIC 66 SPRK   C+URANIUM REGEN. 11/66
D           + 0.44      0.06           MEHLHOP   66 SPRK                    9/66
D          59 0.65      0.30           MEISNER 1 66 HBC    SEE NOTE A       6/66
D    M    + SIGN FAVORED               MEISNER 2 66 HBC                     9/66
D             0.59      0.07           MISCHKE   66 SPRK                    9/66
                        (Ideogram below)
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                 13   K02 LIFETIME (NANOSEC)        (MICROSEC)

T    *   ASSUMED DS=DQ AND DELTA I=1/2 CRAWFORD  59 HBC
T       34    0.081     0.032    0.024 BARDON    58 CC
T       15    0.051     0.024    0.013 DARMON    62 FBC
T             0.054     0.06           FUJI      64 SPRK
T     1700    0.061     0.015    6.0   ASTBURY 3 65 CC

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                        13  K02 PARTIAL DECAY MODES

P1       K02 INTO 3PI0                                   S 9S 9S 9
P2       K02 INTO PI+ PI- PI0                            S 8S 8S 9
P3       K02 INTO PI MU NEUTRINO                         S 8S 4S 2
P4       K02 INTO PI E NEUTRINO                          S 9S 3S 1
P5       K02 INTO PI+ PI-                                S 8S 8
P6       K02 INTO MU+ MU-                                S 4S 4
P7        K02 INTO E+ E-                                 S 3S 3
P8        K02 INTO E MU                                  S 3S 4
P9        K02 INTO TWO GAMMAS                            S 0S 0
P10       K02 INTO PI+ PI- GAMMA                         S 8S 8S 0
P11       K02 INTO PI0 PI0                               S 9S 9

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                        13  K02 DECAY RATES

W1   *  K02 INTO PI0 PI0 PI0        (UNITS 10**6 SEC-1)  (P1)
W1       54   5.22   1.03      C.84  BEHR      66 HLBC    ASSUMES CP      8/66

W2   *  K02 INTO PI+ PI- P0         (UNITS 10**6 SEC-1)  (P2)
W2       18   3.26     0.77          ANDERSON  65 HBC                     8/66
W2       14   1.4      0.4           FRANZINI  65 HBC                     6/66
W2      136   2.62     0.28    0.27  BEHR      66 HLBC    ASSUMES CP      8/66
W2            2.54     0.43          HILL      66 DBC                     9/66
                       (Ideogram below)
W3   *  K02 INTO PI E NEUTRINO      (UNITS 10**6 SEC-1)  (P4)
W3            8.1      1.0           AUBERT    65 HLBC                    8/66

W4   *  K02 INTO CHARGED (3-BODY)   (UNITS 10**6 SEC-1)  (P2+P3+P4)
W4      107  14.7      1.8           AUERBACH  65 SPRK USING NEW K1 LIFE  6/66

W5   *  K02 INTO LEPTONIC (KMU3+KE3) (UNITS 10**6 SEC-1) (P3+P4)
W5      109   9.4      1.3           FRANZINI  65 HBC                     6/66
W5      204  10.3      0.8           CHO       66 DBC                     9/66
W5       54  11.3      1.9           GOLDEN    66 HBC                     9/66

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                        13  K02 BRANCHING RATIOS

R1   *  K02 INTO (PI0 PI0 PI0)/CHARGED                   (P1)/(P2+P3+P4)
R1       24   0.24     0.08          ANIKINA   64 CC                      6/66
R1            0.31     0.06          KULYUKINA 66 CC                      9/66

R2   *  K02 INTO (PI+ PI- PI0)/CHARGED                   (P2)/(P2+P3+P4)

R2       59   0.185    0.038         ASTIER    61 CC                      8/66
R2       79   0.151    0.020         ADAIR     64 HBC                     8/66
R2       75   0.157    0.03    0.04  LUERS     64 HBC                     8/66
R2       66   0.15     0.03    0.C4  ASTBURY 1 65 CC                      8/66
R2      326   0.159    0.015         ASTBURY 2 65 CC                      6/66
R2      566   0.178    0.017         GUIDONI   65 HBC                     6/66
R2     1729   0.144    0.004         HOPKINS   65 HBC                     6/66
R2      126   0.162    0.015         HAWKINS   66 HBC                     6/66
R2      180   0.17     0.03          KULYUKINA 66 CC                      9/66

R3   *  K02 INTO (PI MU NEUTRINO)/CHARGED                (P3)/(P2+P3+P4)
R3      479   0.356    0.07          LUERS     64 HBC
R3            0.39     0.08    0.10  ASTBURY 1 65 CC                      7/66
R3      330   0.32     0.07          KULYUKINA 66 CC                      9/66

R4   *  K02 INTO (PI E NEUTRINO)/CHARGED                 (P4)/(P2+P3+P4)
R4      479   0.487    0.05          LUERS     64 HBC
R4            0.46     0.08    0.10  ASTBURY 1 65 CC                      7/66
R4      500   0.51     0.06          KULYUKINA 66 CC                      9/66

R5   *  K02 INTO (PI E NEU)/((PI E NEU)+(PI MU NEU))     (P4)/(P3+P4)
R5      320   0.415    0.120         ASTIER    61 CC

R6   *  K02 INTO(PI+ PI- PI0)/TOTAL                      (P2)/TOTAL
R6       16   0.18     0.05          STERN     64 HBC

R7   *  K02 INTO(LEPTON PI NEUTRINO)/TOTAL               (P3+P4)/TOTAL
R7       14   0.58     0.17          ALEXANDER 62 HBC

R8   *    K02 INTO (2 GAMMA)/TOTAL    (UN. 10**-4)       (P9)/TOTAL
R8            1.3      0.6           CRIEGEE   66 SPRK                    8/66

R9   *  K02 INTO (PI+ PI-)/CHARGED    (UNIT 10**-3)      (P5)/(P2+P3+P4)
R9       45   2.0      0.4           CHRISTENS 64 SPRK
R9       54   2.08     0.35          GALBRAITH 65 SPRK
R9            1.97     0.18          CRONIN    65 SPRK                    6/66
R9            1.93     0.26          BASILE    66 SPRK                    9/66
R9            1.993    0.080         BOTT-BODE 66 SPRK                    9/66
R9            2.22     0.27          DEKKERS   66 CNTR                    6/66

R10 *  K02 INTO (PI MU NEU)/(PI E NEU)                   (P3)/(P4)
R10           0.81     0.19          ADAIR     64 HBC                     6/66
R10           0.78     0.15          DE BOUARD 65 CNTR

R11 *  K02 INTO (MU+MU-)/CHARGED   (UNITS 10**-4)        (P6)/(P2+P3+P4)
R11 *         1.0 OR LESS            ANIKINA   65 CC                      6/66
R11 *         2.     OR LESS         DE BOUARD 65 SPRK                    8/66
R11 *         0.5     OR LESS        ABASHIAN  66 SPRK    90 PER CT CONF  8/66
R11 *         2.5    OR LESS         ALFF      66 SPRK   0.90 CONF. LEVEL 9/66
R11 *         0.05   OR LESS         BOTT-BODE 66 SPRK   0.70 CONF.LIMIT  9/66
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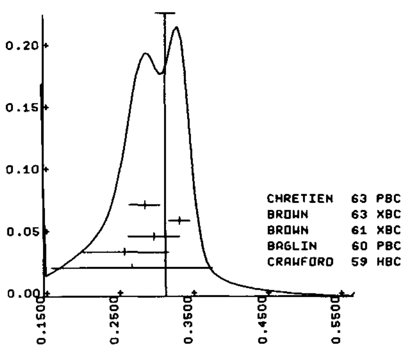
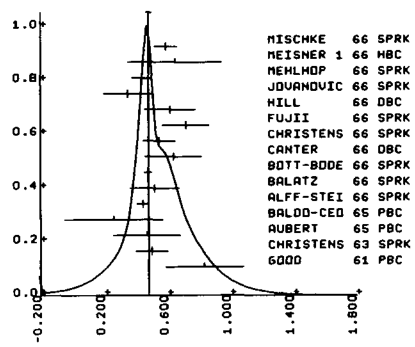
WEIGHTED AVERAGE =0.3161 +/- 0.0135
SCALE = 1.25   CHISQ = 4.7   CONLEV = 0.195



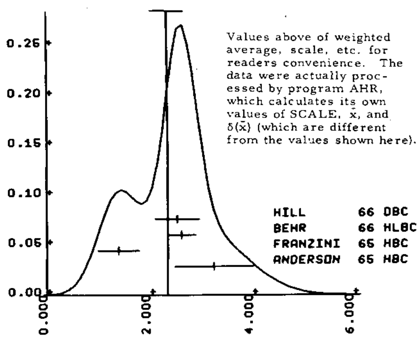
K SHORT B.F. INTO 2 PI0

WEIGHTED AVERAGE =0.4834 +/- 0.0168
SCALE = 0.97   CHISQ = 9.4   CONLEV = 0.492



K LONG - K SHORT MASS DIF (K01 LIFE -1)

WEIGHTED AVERAGE =2.357 +/- 0.321
SCALE = 1.66   CHISQ = 8.2   CONLEV = 0.042



K LONG RATE INTO PI+PI-PI0 (10**6 SEC-1)

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R12 *    K02 INTO (PI+ PI- GAMMA)/TOTAL (UNITS 10**-3)   (P10)/TOTAL
R12 *        15.0 OR LESS                ANIKINA   65 CC                  6/66
R12 *         3.0 OR LESS                NEFKENS   66 SPRK                6/66

R13 *    K02 INTO (E+ E-)/CHARGED     (UNITS 10**-4)     (P7)/(P2+P3+P4)
R13 *        10.0 OR LESS                ANIKINA   65 CC                  6/66
R13 *         1.      OR LESS            DE BOUARD 65 SPRK                8/66
R13 *         0.5     OR LESS            ABASHIAN  66 SPRK   90 PER CT CONF    8/66
R13 *         2.0    OR LESS             ALFF      66 SPRK   0.90 CONF. LEVEL  9/66
R13 *         0.3    OR LESS             BOTT-BODE 66 SPRK   0.70 CONF.LIMIT   9/66

R14 *    K02 INTO (E MU)/CHARGED      (UNITS 10**-4)     (P8)/(P2+P3+P4)
R14 *        10.0 OR LESS                ANIKINA   65 CC                  6/66
R14 *         0.5     OR LESS            ABASHIAN  66 SPRK   90 PER CT CONF    8/66

R15 *   K02 INTO(E+ PI- NEU)/(E- PI+ NEU)
R15     97     0.90      0.18            NEAGU     61 CC
R15            1.01      0.16            LUERS     64 HBC                 8/66
R15   2500     1.06      0.05            ABASHIAN  66 SPRK                8/66
R15    894     0.97      0.023           KULYUKINA 66 CC                  9/66

R16 *   K02 INTO(MU+ PI- NEU)/(MU- PI+ NEU)
R16   3200     1.02   0.04               ABASHIAN  66 SPRK                8/66

R17 *     K02 INTO (PI0 PI0)/TOTAL  (UNITS 10**-3)      (P11)/TOTAL
R17      7    1.2       1.5      1.2   CRIEGEE   66 SPRK                  7/66

R18 *    K02 INTO (3PI0)/(PI+PI-PI0)                      (P1)/(P2)
R18    188    2.0       0.6              ALEKSANYA 64 FBC                 9/66

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REFERENCES
13 LONG-LIVED NEUTRAL K (498, JP=0-) I=1/2


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BARDON   58 ANP 5 156              M BARDON,K LANDE,L LEDERMAN //COLUMBIA+BNL
CRAWFORD 59 PRL 2 361              CRAWFORD,CRESTI,DOUGLASS,GOOD + ////// LRL
ASTIER   61 AIX CONF 1 227         ASTIER,BLASKOVIC,RIVET,SIAUD +/// PARIS+EP
FITCH    61 NC  22 1160            V FITCH,P PIROUE,R PERKINS ///// PRINCETON
GOOD     61 PR 124 1223            GOOD,MATSEN,MULLER,PICCIONI,POWELL +// LRL

ALEXANDE 62 PRL 9 69               G ALEXANDER,S ALMEIDA,F CRAWFORD ///// LRL
CAMERINI 62 PR 128 362             CAMERINI,FRY,GAIDOS,BIRGE,ELY +///WISC+LRL
DARMON   62 PL 3 57                J DARMON,A ROUSSET,J SIX /////////PARIS+EP
JOVANOVI 63 BNL CONF 42            JOVANOVIC,FISCHER,BURRIS + // BNL+MARYLAND

ADAIR    64 PL 12 67               R K ADAIR,L B LEIPUNER ////////// YALE+BNL
ALEKSANY 64 DUBNA 2 102            ALEKSANYAN,ALIKHANYAN,VARTAZARYAN+//EREVAN
  SEE ALSO  JETP 19 1019           ALEKSANYAN+/// LEBEDEV+MOS ENG PHYS+EREVAN
ANIKINA  64 JETP 19 42             ANIKINA,ZHURAVLEVA+//GEORG ACAD SCI+ DUBNA
CHRISTEN 64 PRL 13 138             CHRISTENSON,CRONIN,FITCH,TURLAY //PRINCETN
FUJII    64 PRL 13 253             FUJII,JOVANOVICH,TURKOT,ZORN //BNL+MARYLND
LUERS    64 PR 133 B 1276          LUERS,MITTRA,WILLIS,YAMAMOTO ///////// BNL
STERN    64 PRL 12 459             STERN,BINFORD,LIND,ANDERSON + /// WISC+LRL

ANIKINA  65 JINR P 2488            ANIKINA,VARDENGA,ZHURAVLEVA,KOTLYA+//DUBNA
ANDERSON 65 PRL 14 475             ANDERSON,CRAWFORD,GOLDEN,STERN +//LRL+WISC
ASTBURY1 65 PL 16 80               ASTBURY,FINOCCHIARO,BEUSCH + / CERN+ZURICH
ASTBURY2 65 PL 18 175              ASTBURY,MICHELINI,BEUSCH + /// CERN+ZURICH
ASTBURY3 65 PL 18 178              ASTBURY,MICHELINI,BEUSCH + /// CERN+ZURICH

AUBERT   65 PL 17 59               AUBERT,BEHR,CANAVAN,CHOUNET+///PARIS+ORSAY
AUERBACH 65 PRL 14 192             AUERBACH,LANDE,MANN,SCIULLI + ////// PENNA
BALDO-CE 65 NC 38 684              BALDO-CEOLIN,CALIMANI,CIAMPOLILLO + /PADVA
BEHR     65 ARGONNE CONF 59        BEHR,BRISSON,BELLOTTI+ // EP+MILANO+PADOVA
CHRISTEN 65 PR 140 B 74            CHRISTENSON,CRONIN,FITCH,TURLAY//PRINCETON
  (CHRISTENSON 65 HAS BEEN CORRECTED FOR INTERFERENCE BY FITCH 65, FOOTNOTE)

CRONIN   65   ARGONNE CONF 17 FITCH,ROTH,RUSS,VERNON-TO BE PUB/PRINCETON
DE BOUAR 65 PL  15  58             DE BOUARD,DEKKERS,SCHARFF+//CERN+ORSAY+MPI
FITCH    65 PRL 15 73              FITCH,ROTH,RUSS,VERNON ///////// PRINCETON
FRANZINI 65 PR 140 B 127           FRANZINI,KIRSCH,PLANO + / COLUMBIA+RUTGERS
GALBRAIT 65 PRL 14 383             GALBRAITH,MANNING,JONES +//AERE+BRIST+RHEL

GUIDONI  65 ARGONNE CONF 49        +BARNES,FOELSCHE,FERBEL,FIRESTO+//BNL+YALE
HOPKINS  65 ARGONNE CONF 67        H W K HOPKINS,BACON,EISLER // VAND+RUTGERS
MESTVIRI 65 JINR P 2449            MESTVIRISHVILI,NYAGU,PETROV,RUSAKOV+//JINR
TRILLING 65 UCRL 16473             GEORGE H TRILLING //////////////////// LRL
   (THIS IS AN UPDATED VERSION OF REPORT AT 1965 ARGONNE CONF, PAGE 115)

ALFF     66 PL 21 595              ALFF-STEINBERGER,HEUER,RUBBIA +     // CERN
BALATZ   66     BERKELEY CONF. BALATZ,BEREZIN +                   // ITEP
BASILE   66  BALATON CONF          BASILE,CRONIN,THEVENET +        // SACLAY
BEHR     66  BERKELEY 28           BEHR,BRISSON,BALDO CEOLIN,AUBERT+/PADUA,EP
BOTT-BOD 66 PL  23  277            BOTT-BODENHAUSEN,DE BOUARD,CASSEL+ // CERN

CANTER   66 PRL 17 942             +CHO,ENGLER,FISK,HILL +    // CARNEGIE+BNL
CHO      66  BERKELEY CONF         CHO,CANTER,DRALLE,ENGLER,FISK+ // CARN+BNL
CRIEGEE  66 PRL 17 150             +FOX,FRAUENFELDER,HANSON,MOSCAT+//ILLINOIS
DEKKERS  66 THESIS BRUSSELS        D DEKKERS + ////////////////////////// CERN
FUJII    66 PRL 13 253             FUJII,JOVANOVICH,TURKOT,ZORN//BNL+MARYLAND
  (FUJII 66 IS THE CORRECTED VALUE GIVEN BY JOVANOVICH+ 66)

GOLDEN   66  BERKELEY 28           R.GOLDEN,F.CRAWFORD,D.STERN          // LRL
HAWKINS  66 PL 21 238              C J B HAWKINS ////////////////////// YALE
HILL     66     BERKELEY CONF. HILL,ROBINSON,SAKITT +      // BNL+CARNEGIE
JOVANOVI 66 PRL 17 1075            JOVANOVICH,FUJII,TURKOT,ZORN +//BNL+MD+MIT
KULYUKIN 66  BERKELEY 28           KULYUKINA,MESTVIRISHVILI,NEAGU,PETR+//JINR
MEISNER1 66 PRL 16 278             G W MEISNER,B B CRAWFORD,F CRAWFORD // LRL
MEISNER2 66 PRL  17  492           G MEISNER,B CRAWFORD,F CRAWFORD ////// LRL
MEHLHOP  66     BERKELEY CONF. MEHLHOP,GOOD,PICCIONI +             // LA JOLLA
MISCHKE  66     BERKELEY CONF. + ABASHIAN,ABRAMS,CARPENTER +  // ILLINOIS
NEFKENS  66 PL 19 706              NEFKENS,ABASHIAN,ABRAMS,CARPENTER+ /// ILL

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14 ETA (549,JPG=0-+) I=0

14 ETA MASS (MEV)

```
M        53  549.0      1.2              BASTIEN   62 HBC
M        35  546.0      4.0              PICKUP    62 HBC
M        91  548.0      1.0              ALFF      62 HBC
M            549.3      2.9              DELCOURT  63 CNTR
M       148  549.0      0.7              FOELSCHE  64 HBC
M       325  552.0      3.0              KRAEMER   64 DBC
M            548.2      0.65             FOSTER3   65 HBC                 7/66
M       250  552.0      4.0              JAMES     66 HBC                 6/66

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14 ETA WIDTH (MEV)

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W    *   91   10.0   OR LESS             ALFF      62 HBC
W    *  325   16.0   OR LESS             KRAMER    64 DBC
W    *  148   10.0   OR LESS             FOELSCHE  64 HBC
W    *   31   12.0   OR LESS             JAMES     66 HBC                 6/66
W    *         4.0   OR LESS             BALTAY    66 DBC                 7/66

W1   *  ETA INTO TWO GAMMAS, PARTIAL WIDTH
W1   *      BETWEEN 0.3 AND 3.0 KEV    LUEBBELSM 66 SPRK                  9/66

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14 ETA PARTIAL DECAY MODES

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P1      ETA INTO 2GAMMA                                      S 0S 0
P2      ETA INTO 3PI0                                        S 9S 9S 9
P3      ETA INTO PI+ PI- PI0                                 S 8S 8S 9
P4      ETA INTO PI+ PI- GAMMA                               S 8S 8S 0
P5      ETA INTO   E+E-PI0         VIOLATES C IN E.M.I.      S 9S 3S 3
P6      ETA INTO E+E-PI+PI-                                  S 8S 8S 3S 3
P7      ETA INTO PI0 2GAMMA                                  S 9S 0S 0
P8      ETA INTO E+E-GAMMA                                   S 3S 3S 0
P9      ETA INTO 2PI0 GAMMA        VIOLATES C                S 9S 9S 0

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14 ETA BRANCHING RATIOS

(P9) IS ASSUMED = 0 IN ALL RATIOS

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R1   *    ETA INTO NEUTRALS/CHARGED                     (P1+P2+P7)/(P3+P4)
R1   N   10     2.5       1.0            PICKUP    62 HBC
R1   N   53     3.20      1.26           BASTIEN   62 HBC
R1   N          2.7       0.8            SHAFER    62 HBC
R1              2.6        .9            BUSCHBECK 63 HBC                 7/66
R1   N  280     4.5       1.0            JAMES     66 HBC                 6/66
     N    THIS EXPERIMENT HAS NOT BEEN USED IN COMPUTING THE AVERAGES
     N  AS IT WAS UNABLE TO CLEARLY SEPARATE PARTIAL MODES (3) AND (4)
     N  FROM EACH OTHER.  THE REPORTED VALUE THUS PROBABLY CONTAINS
     N  SOME (UNKNOWN) FRACTION OF MODE (4), AS POINTED OUT BY E.C. FOWLER

R2   *  ETA INTO 2GAMMA/CHARGED                         (P1)/(P3+P4)
R2              0.99      0.48           CRAWFORD  63 HBC

R3   *    ETA INTO PI0 2GAMMA/NEUTRALS                  (P7)/(P1+P2+P7)
R3              0.375     0.072          DI GIUGNO 66 CNTR    ERROR DOUBLED    6/66
     *    THE ERRORS OF DIGIUGNO+ 66 HAVE BEEN INCREASED BY A FACTOR
     *  OF TWO, TO TAKE INTO ACCOUNT POSSIBLE SYSTEMATIC ERRORS, AS
     *  SUGGESTED BY THE AUTHORS.
R3               .19       .08           GRUNHAUS  66 SPRK                7/66

R4   *  ETA INTO (PI+ PI- GAMMA)/(PI+ PI- PI0)          (P4)/(P3)
R4              0.14      0.08           FOELSCHE  64 HBC
R4   M   24     0.73      0.25           PAULI     64 DBC
     M    THIS EXPERIMENT HAS NOT BEEN INCLUDED IN THE AVERAGES SINCE
     M  IT IS NOT CLEAR THAT THEIR CLASS B EVENTS ARE ACTUALLY FROM ETAS.
R4              0.30      0.06           CRAWFORD1 66 HBC                 6/66
R4   N    9     0.27      0.10           PAULI     64 DBC                 6/66
R4   N THE PAULI VALUE BASED ON ONLY 9 EVENTS IS DUE TO CRAWFORD1 66
R4               .10       .10           KRAEMER   64 DBC                 7/66
R4               .196      .041          FOSTER3   65 HBC                 7/66

R5   *  ETA INTO 3PI0/(PI+ PI- PI0)                     (P2)/(P3)
     S  FOR THIS RATIO, SEE NOTES ON TABLE S FOLLOWING THIS LISTING
R5   S          0.83      0.32           CRAWFORD  63 HBC     ASSUM.P7/P2 = 0    7/66
R5   S          2.0       1.0            FOELSCHE  64 HBC     ASSUM.P7/P2 = 0    7/66
R5   S          0.90      0.24           FOSTER1   65 HBC     ASSUM.P7/P2 = 0    7/66
R5   N          0.38      0.15           CRAWFORD2 66 HBC  ASSUM.(P7)/(P2)=1.8  6/66
R5   N          0.41      0.11           FOSTER1   65 HBC  ASSUM.(P7)/(P2)=1.8  6/66
     N      GIVEN BY CRAWFORD2 66

R6   *  ETA INTO 2GAMMA/3PI0                            (P1)/(P2)
R6   *          1.1       0.3 OR LESS    CHRETIEN  62 PBC
R6   S          1.10      0.5            MULLER    63 DBC     ASSUM.P7/P2 = 0    7/66
     S      FOR PRECEDING CARD, SEE NOTES ON TABEL S FOLLOWING THIS LISTING.
R6   *          2.38 OR MORE            STRUGALSKI 66 HLBC                9/66

R7   *  ETA INTO 2GAMMA/(PI+ PI- P0)                    (P1)/(P3)
R7              1.61      0.39           FOSTER    64 HBC

R8   *    ETA INTO NEUTRAL/(PI+ PI- PI0)                (P1+P2+P7)/(P3)
R8      280     3.6       0.8            KRAEMER   64 DBC
R8              3.8       1.1            PAULI     64 DBC                 7/66
R8              2.89      0.56           ALFF-STEI 66 HBC                 9/66

R9   *  ETA INTO  (E+E-PI0)/(PI+PI-PI0)  (UNITS 10**-2) (P5)/(P3)
R9   *  LESS THAN     1.1        1.1     PRICE     65 HBC
R9   *    0     0.77  OR LESS            FOSTER2   65 HBC
R9   *          0.45  OR LESS            BAGLIN    66 HLBC    0.9 CONF LEVEL   9/66

R10 *    ETA INTO (E+E-PI+PI-)/TOTAL  (UNITS 10**-2)    (P6)/TOTAL
R10 *         0.7 OR LESS                RITTENBER 65 HBC                 6/66

R11 *    ETA INTO (E+E-PI+PI-)/(PI+PI-GAMMA)            (P6)/(P4)
R11      1     0.026     0.026           GROSSMAN  66 HBC                 6/66

R12 *    ETA INTO 2 GAMMA/NEUTRALS                      (P1)/(P1+P2+P7)
R12             0.416     0.044          DI GIUGNO 66 CNTR    ERROR DOUBLED    6/66
R12              .47       .06           GRUNHAUS  66 SPRK                7/66

R13 *    ETA INTO 3PI0/NEUTRALS                         (P2)/(P1+P2+P7)
R13             0.209     0.054          DI GIUGNO 66 CNTR    ERROR DOUBLED    6/66
R13              .34       .04           GRUNHAUS  66 SPRK                7/66

R14 *      ETA INTO PI0 2GAMMA/2GAMMA                   (P7)/(P1)         7/66
R14 *            .5    OR LESS           WAHLIG    66 SPRK    .9 CONF LEVL     7/66
R14             0.86      0.47           STRUGALSK 66 HLBC                9/66

R15 *      ETA INTO (E+E-PI0)/TOTAL                     (P5)/TOTAL        7/66
R15 *         0.7 OR LESS                RITTENBER 65 HBC                 6/66

R16 *    ETA INTO 2GAMMA/(3PI0 + PI0 2GAMMA)            (P1)/(P2+P7)
R16             0.80       .25           BACCI     63 CNTR                7/66

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14 ETA C-NONCONSERVING DECAY PARAMETER

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A    DECAY ASYMMETRY PARAMETER FOR PI+ PI- PI0
A      1351    7.2       2.8             BALTAY    66 DBC                 8/66
A       565    4.1       4.1             FOWLER    66 HBC                 8/66
A       705   -6.0       4.0             RUTH-SACL 66 HBC                 8/66
A     10665    0.3       1.0             FINOCCHIA 66 SPRK                8/66
A      1300    5.8       3.4             OTHERS    66 HBC                 8/66
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(Ideogram on next page)

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B    DECAY ASYMMETRY PARAMETER FOR PI+ PI- GAMMA
B        33   -0.02      0.17            CRAWFORD1 66 HBC                11/66

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            WEIGHTED AVERAGE =1.19 +/- 1.43
      SCALE = 1.66      CHISQ = 11.0      CONLEV = 0.027
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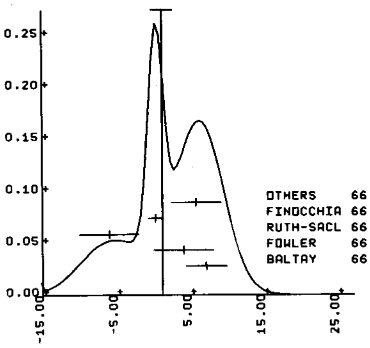

ETA C-NONCONSERVING DECAY PARAM. PERCENT


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                              REFERENCES
                              14 ETA(549,JPG=0-+)I=0

PEVSNER   61 PRL 7 421          PEVSNER,KRAEMER,NUSSBAUM,RICHARDSON +//JHU
ALFF      62 PRL 9 322          ALFF,BERLEY,COLLEY,BRUGGER +///COL+RUTGERS
BASTIEN   62 PRL 8 114          BASTIEN,BERGE,DAHL,FERRO-LUZZI + ///// LRL
CHRETIEN  62 PRL 9 127          CHRETIEN+ //BRAND+BROWN+HARVARD+MIT+PADOVA
PICKUP    62 PRL 8 329          E PICKUP,ROBINSON,SALANT ///// NRC+CAN+BNL
SHAFER    62 CERN CONF 307      J SHAFER,FERRO-LUZZI,MURRAY + ///// UC+LRL

BACCI     63 PRL 11 37          BACCI,PENSO,SALVINI + //ROME U+CNEN FRASCA
BUSCHBEC  63 SIENA CONF 1 166   BUSCHBECK-CZAPP,COOPER + //VIENNA+CERN+AMS
CRAWFORD  63 PRL 10 546         F S CRAWFORD,LLOYD,FOWLER /////// LRL+DUKE
DELCOURT  63 PL 7 215           DELCOURT,LEFRANCOIS,PEREZ Y JORBA+// ORSAY
MULLER    63 SIENA CONF 99      MULLER,PAULI + //LPCHE+SACLAY IF+ROME+INFN

FOELSCHE  64 PR 134 B 1138      H W FOELSCHE,H L KRAYBILL /////////// YALE
KRAEMER   64 PR 136 B 496       KRAEMER,MADANSKY,FIELDS + // JHU+NW U+WOOD
PAULI     64 PL 13 351          E PAULI,A MULLER //////////// LPCHE+SACLAY

PRICE     65 PRL  15  123       L.R.PRICE,F.S.CRAWFORD                //LRL
FOSTER1   65 PR 138 B 652       FOSTER,PETERS,MEER,LOEFFLER +//WISC+PURDUE
FOSTER2   65 ATHENS             FOSTER,GOOD,MEER                //WISCONSIN
FOSTER3   65 THESIS             M.C.FOSTER                      //WISCONSIN
RITTENBE  65 PRL 15 556         RITTENBERG,KALBFLEISCH /////////// LRL+BNL

ALFF-STE  66 PR 145 1072        ALFF-STEINBERGER,BERLEY+//COLUMBIA+RUTGERS
BAGLIN    66  BERKELEY CONF     BAGLIN,BEZAGUET,DEGRANGE+  // EC.POLYT+LRL
  ALSO    66 PL 22 219          BAGLIN,BEZAGUET,DEGRANGE+  // EC.POLYT+LRL
BALTAY    66 PRL 16 1224        +FRANZINI,KIM,KIRSCH+/COLUMBIA+STONY BROOK
CRAWFRD1  66 PRL  16  333       F.S.CRAWFORD,L.R.PRICE                //LRL
CRAWFRD2  66 PRL 16 907         F S CRAWFORD,L LLOYD,E FOWLER   //LRL+DUKE

DIGIUGNO  66 PRL 16 767         DIGIUGNO,GIORGI,SILVESTRI+//NAP+TRST+FRASC
JAMES     66 PR 142   896       F E JAMES,H L KRAYBILL ////////// YALE+BNL
GROSSMAN  66 PR 146   993       R GROSSMAN,L PRICE,F CRAWFORD //////// LRL
GRUNHAUS  66 THESIS             J.GRUNHAUS                       //COLUMBIA
LUEBBELS  66  BERKELEY 8A       LUEBBELSMEYER+                       // BONN+
STRUGALS  66 BERK CONF          STRUGALSKI,CHUVILE,IVANOVSKAJA,+   //DUBNA
WAHLIG    66 PRL  17  221       WAHLIG,SHIBATA,MANNELLI            //MIT+PISA

        QUANTUM NUMBER DETERMINATIONS NOT REFERRED TO IN THE DATA CARDS

BASTIEN   62 PRL 8 114          BASTIEN,BERGE,DAHL,FERRO-LUZZI,MILLER+/LRL
CARMONY   62 PRL 8 117          D CARMONY,A ROSENFELD,VAN DE WALLE /// LRL
ROSENFEL  62 PRL 8 293          A ROSENFELD,D CARMONY,VAN DE WALLE /// LRL

             REFERENCES ON ETA ASYMMETRY PARAMETERS

BALTAY    66 PRL  16  1224      BALTAY,FRANZINI,KIM,KIRSCH+/COLUM+STONY BK
CRAWFRD1  66 PRL  16  333       F.S.CRAWFORD,L.R.PRICE                //LRL
OTHERS    66 PR 149  1044       COLUMBIA,LRL,PURDUE,WISCONSIN,YALE
FOWLER    66 BAPS 11  380       E.C.FOWLER                           //DUKE
FINOCCHI  66  BERKELEY CONF     FINOCCHIARO,CNOPS,MULLER+//CERN+ZUR+SACLAY
RUTH-SAC  66  BERKELEY CONF     RUTHEFORD-SACLAY COLLABORATION

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p

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                   16  PROTON  (938,J=1/2)  I=1/2

                   16  PROTON  MASS (MEV)

M          938.256    0.005            COHEN      65 RVUE                    7/66

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                   16  PROTON LIFETIME  (UNITS 10**26 YR)

T   *  OVER                 1.5     BACKENSTO 60 CNTR
T   *  OVER                60.0     KROPP     65 CNTR                        6/66

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                   16 PROTON MAGNET. MOMENT(E/2MP)

MM         2.792763 0.000030           COHEN      65 RVUE                    7/66

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                              REFERENCES
                              16 PROTON (938,J=1/2) I=1/2

BACKENST 60 NC   16  749        BACKENSTOSS,FRAUENFELDER,HYAMS + //// CERN
COHEN    65 RMP 37 537          E R COHEN, J W M DUMOND //// NAASC+CALTECH
KROPP    65 PR 137 B 740        W R KROPP,F REINES ///CASE INST TECHNOLOGY

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n

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                   17  NEUTRON (939,J=1/2)  I=1/2

                   17  NEUTRON-PROTON MASS DIF.(MEV)

D          1.2939   0.0004          BONDELID  60 CNTR
D          1.2933   0.0001          SALGO     64 CNTR

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                   17  NEUTRON LIFETIME (UNITS 10**3 SEC)

T          1.01       0.03      0.03  SOSNOVSKI 59 PILE

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                   17  NEUTRON MAGNETIC MOMENT (MAGNETONS,938.2 MEV)

MM        -1.913148 0.000066          COHEN     56 SPECIAL                   7/66

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                              REFERENCES
                              17 NEUTRON (939,J=1/2) I=1/2

COHEN    56 PR 104 283          V W COHEN, CORNGOLD, RAMSEY // BNL+HARVARD
SOSNOVSK 59 JETP  9  717        SOSNOVSKII,SPIVAK,PROKOFEV + // IAE MOSCOW
BONDELID 60 PR  120  887        BONDELID,BUTLER,KENNEDY +//USNRL+CATH UNIV
SALGO    64 NP   53  457        R SALGO, STAUB, WINKLER, ZAMBONI // ZURICH
COHEN    65 RMP 37 537          E R COHEN,DUMOND ///// NAASC+CAL INST TECH

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Λ

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                   18  LAMBDA (1115,JP=1/2+)  I=0
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Hyperon Masses

For the Λ mass, there is a large discrepancy between the measurement of SCHMIDT 65 and the emulsion measurements reviewed by BHOWMIK 63. The former determination used range measurements in a hydrogen bubble chamber.

The Σ^- mass of SCHMIDT 65 (1196.53 ± 0.24 MeV) also obtained using HBC range measurements, is also in disagreement with previous emulsion determinations and with the one, by the same author, which does not use range measurements. Therefore, as a temporary procedure, we do not include any determinations of absolute masses which use range measurements in HBC. BURNSTEIN 64 has two sorts of measurements: absolute masses which again depend on HBC ranges, and mass differences; we have used only the latter. Both authors, P. Schmidt and G. Snow (representing Burnstein et al.) agree with this procedure.

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                   18  LAMBDA  MASS (MEV)

M    *    25 1115.06     0.41            ARMENTERO 62 HBC     ERROR IS STATIS.
M    *       1115.27     0.36            BALTAY    62 HBC     ERROR IS STATIS.
M            1115.44     0.12            BHOWMIK   63 RVUE +  SEE NOTE L BELOW
M    L  ABOVE LAMBDA MASS HAS BEEN RAISED 35 KEV TO ACCOUNT FOR 46 KEV
     L  INCREASE IN PROTON MASS AND 11 KEV DECREASE IN CHARGED PION MASS.
M    *       1115.4      0.2             BADIER    64 HBC     ERROR IS STATIS.   6/66
M    *   635 1115.86     0.09            BALTAY    65 HBC     ERROR IS STATIS.   6/66
M    N       1115.61     0.07            SCHMIDT   65 HBC                        9/66
M    N SEE NOTE PRECEDING LAMBDA MASS LISTINGS
M            1115.6      0.4             LONDON    66 HBC                        6/66

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                   18  LAMBDA LIFETIME (UNITS 10**-10)

T    U   74     2.75      0.45      0.38  BLUMENFEL 58 CC
T       188     2.63      0.21      0.21  BOLDT     58 CC
T    U   61     2.08      0.46      0.31  BROWN     58 PBC
T    U   40     3.04      0.78      0.51  COOPER    58 CC
T    U  454     2.29      0.15      0.13  EISLER    58 HBC
T       825     2.72      0.16      0.16  CRAWFORD  59 HBC
T       140     2.72      0.29      0.27  BOWEN     60 CC

T    U  748     2.58      0.11      0.11  BERTANZA  62 HBC
T       186     2.60      0.28      0.20  C-C CHANG 62 HBC
T    U 3447     2.52      0.08            FUNG      62 PBC                       6/66
T       799     2.69      0.11      0.11  HUMPHREY  62 HBC

T      2239     2.36      0.06      0.06  BLOCK     63 HEBC
T       706     2.76      0.20            CHRETIEN  63 PBC
T       794     2.59      0.09            HUBBARD   64 HBC
T      2260     2.31      0.10            KREISLER  64 SPRK
T      1378     2.59      0.07            SCHWARTZ  64 HBC

T       635     2.51      0.16            BALTAY    65 HBC                       6/66
T      2534     2.6       0.1             HILL      65 SPRK
T       916     2.35      0.09            BURAN     66 HLBC                      6/66
T      2213     2.452     0.056     0.054 ENGELMANN 66 HBC                       9/66

T    U  UNPUBLISHED MEASUREMENTS (EXCEPT THESES) NOT INCLUDED IN AVERAGE         7/66
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(Ideogram on next page)

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                   18  LAMBDA MAGNETIC MOMENT (MAGNETONS,938.26 MEV)

MM            -1.5      0.5             COOL      62 SPRK
MM             0.0      0.6             KERNAN    63 CC
MM     8553   -1.37     0.72            ANDERSON  64 HBC
MM      151   -0.5      0.28            CHARRIERE 65 EMUL
MM            -0.75     0.19            HILL      66 SPRK                        9/66

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                   18  LAMBDA PARTIAL DECAY MODES

P1     LAMBDA  INTO PROTON PI-                              S16S 8
P2     LAMBDA  INTO NEUTRON PI0                             S17S 9
P3     LAMBDA  INTO PROTON MU- NEUTRINO                     S16S 4S 2
P4     LAMBDA  INTO PROTON E- NEUTRINO                      S16S 3S 1

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                    18  LAMBDA BRANCHING RATIOS

R1  *  LAMBDA INTO (P PI-)/((P PI-)+(N PIO))                  (P1)/(P1+P2)
R1            0.627     0.031            CRAWFORD  59 HBC
R1            0.65      0.05             COLUMBIA  60 HBC
R1      903   0.643     0.016            HUMPHREY  62 HBC
R1            0.685     0.017            ANDERSON  62 HBC
                                (Ideogram below)
R2  *  LAMBDA INTO (N PIO)/((P PI-)+(N PIO))                  (P2)/(P1+P2)
R2            0.23      0.09             EISLER    57 PBC
R2            0.43      0.14             CRAWFORD  59 HBC
R2            0.28      0.08             BAGLIN    60 PBC
R2            0.35      0.05             BROWN     63 XBC
R2       75   0.291     0.034            CHRETIEN  63 PBC

R3  *  LAMBDA INTO (P E- NEU)/TOTAL   (UNITS  10**-3)        (P4)/(P1+P2)
R3       15   2.0       0.5              HUMPHREY  61 RVUE
R3        8   2.9       1.5       1.2    AUBERT    62 FBC
R3      150   0.82      0.12      0.13   ELY       63 FBC
R3       20   1.55      0.34             LIND      64 HBC
R3      102   0.78      0.12             BAGLIN    64 FBC
                               (Ideogram below)
R4  *  LAMBDA INTO (P MU- NEU)/TOTAL  (UNITS  10**-4)        (P3)/(P1+P2)
R4  *     1   0.2     OR GREATER         GOOD      62 HBC
R4  *     1   1.0     OR LESS            ALSTON    63 HBC
R4  *     2   1.0     OR LESS            KERNAN    64 FBC
R4  *    BETWEEN 1.3 AND 6.0             LIND      64 HBC
R4        3   1.3       0.7              LIND      64 RVUE                      7/66
R4        2   1.5       1.2              RONNE     64 FBC

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                    18  LAMBDA DECAY PARAMETERS

A-  *  ALPHA LAMBDA- (LAMBDA INTO PI- PROTON)
A-            0.62      0.05             CRONIN    63 CNTR                      6/66
A-     2529   0.747     0.096            MERRILL   66 HBC    FROM XI- DECAY     6/69
A-     4660   0.655     0.025            OVERSETH  66 SPRK   LAMBDA FROM PI-P   9/66
A-  *         0.663     0.022            BERGE     66 RVUE INCLUDES ALL ABOVE   9/66

A0  *  ALPHA0 /ALPHA- FOR LAMBDA (L INTO PIO N/L INTO PI- P)
A0            1.10      0.27             CORK      60 CNTR

AE        ALPHA LAMBDA E- (LAMBDA INTO PROTON E- NEUTRINO)
AE            0.06      0.19             BARLOW    65 SPRK                      7/66

F-  *   PHI ANGLE (TAN(PHI)=BETA/GAMMA)   (DEGREE)
F-           13.0      17.0              CRONIN    63 SPRK   LAMBDA FROM PI-P
F-     4660   6.0       7.5              OVERSETH  66 SPRK   LAMBDA FROM PI-P   9/66

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REFERENCES
18 LAMBDA (1115,JP=1/2+) I=0


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EISLER    57 NC     5 1700       EISLER,PLANO,SAMIOS,SCHWARTZ + //COLUM+BNL
BLUMENFE 58 CERN CONF 270       H BLUMENFELD,W CHINOWSKY,L LEDERMAN//COLUM
BOLDT     58 PRL    1  148       E BOLDT,D O CALDWELL,Y PAL /////////// MIT
BROWN     58 CERN CONF 270       BROWN,GLASER,GRAVES,PERL,CRONIN + //  MICH
COOPER    58 CERN CONF 270       W A COOPER,H FILTHUTH + ///// JUNGFRAUJOCH
EISLER    58 CERN CONF 270       F EISLER,PLANO,BASSI + // BNL+COLUM+BOL+PI
CRAWFORD 59 PRL     2  266       CRAWFORD,CRESTI,DOUGLASS,GOOD + /////  LRL

BAGLIN    60 NC    18 1043       BAGLIN,BLOCH,BRISSON,HENNESSY + //PARIS-EP
BOWEN     60 PR   119 2030       BOWEN,HARDY,REYNOLDS,SUN + ///// PRINCETON
CORK      60 PR   120 1000       CORK,KERTH,WENZEL,CRONIN,COOL //LRL+PR+BNL
COLUMBIA 60 ROCH CONF 726       M SCHWARTZ + //////////////////// COLUMBIA
HUMPHREY 61 PRL     6  478       HUMPHREY,KIRZ,ROSENFELD,RHEE + //LRL+SYRAC

ANDERSON 62 CERN CONF 832       ANDERSON,CRAWFORD,GOLDEN,LLOYD + ///// LRL
ARMENTER 62 CERN CONF 236       ARMENTEROS+/CERN+EP+LONDON+BIRM+CEN-SACLAY
AUBERT    62 NC    25  479       AUBERT,BRISSON,HENNESSY,SIX + /// PARIS-EP
BALTAY    62 CERN CONF 233       BALTAY,FOWLER,SANDWEISS,CULWICK+//YALE+BNL
BERTANZA 62 PREPRINT D105       BERTANZA,CONNOLLY,CULWICK,EISLER + /// BNL
CHANG     62 THESIS DUKE         CHUEN CHUEN CHANG //////////////////// DUKE
COOL      62 PR   127 2223       COOL,HILL,MARSHALL + ///// BNL+MIT+NYU+ANL
FUNG      62 BAPS   7  619       SUN YIU FUNG ///////////////////////// LRL
GOOD      62 PRL    9  518       M L GOOD,V G LIND /////////////// WISCONSIN
HUMPHREY 62 PR   127 1305       W E HUMPHREY,R R ROSS ///////////////// LRL

ALSTON    63 UCRL 10926          ALSTON,KIRZ,NEUFELD,SOLMITZ,WOHLMUT // LRL
BERGE     63 THESIS (BERKELEY)  J PETER BERGE ///////////////////////// LRL
BHOWMIK   63 NC    28 1494       B BHOWMIK,D P GOYAL ////////////////// DELHI
BLOCK     63 PR   130  766       BLOCK,GESSAROLI,RATTI,KIKUCHI + //NW+BLGNA
BROWN     63 PR   130  769       BROWN,KADYK,TRILLING,ROE + ///LRL+MICHIGAN
CHRETIEN 63 PR   131 2208       CHRETIEN,CROUCH+///BRAND+BROWN+HARVARD+MIT
CRONIN    63 PR   129 1795       J W CRONIN,O E OVERSETH //////// PRINCETON
ELY       63 PR   131  868       ELY,GIDAL,KALMUS,OSWALD,POWELL + ///// LRL
KERNAN    63 PR   129  870       KERNAN,NOVEY,WARSHAW,WATTENBERG // ANL+ILL

ANDERSON 64 PRL   13  167       J A ANDERSON,F S CRAWFORD /////////// LRL
BADIER    64 DUBNA CONF 1 593   BADIER,BARLOUTAUD + //////EP+SACLAY+AMSTDM
BAGLIN    64 NC    35  977       BAGLIN,BINGHAM+//EP+CERN+UC LOND+RHEL+BERG
HUBBARD   64 PR   135 B 183      HUBBARD,BERGE,KALBFLEISCH,SHAFER + /// LRL
KERNAN    64 PR   133 B 1271     KERNAN,POWELL,SANDLER + //LRL+UN-COLL-LOND
KREISLER 64 PR   136 B 1074     M N KREISLER,O OVERSETH,J CRONIN ///PRINCE
LIND      64 PR   135 B 1483     LIND,BINFORD,GOOD,STERN /////// WISCONSIN
RONNE     64 PL    11  357       RONNE+ /// CERN+EP+UCOL-LONDON+UNIV.BERGEN
SCHWARTZ 64 UCRL 11360 THESIS JOSEPH ADAM SCHWARTZ //////////////// LRL

BALTAY    65 PR   140 B 1027     BALTAY,SANDWEISS,CULWICK,KOPP + //YALE+BNL
BARLOW    65 PL    18   64       J BARLOW,BLAIR,DUKE,MANN+//CERN+RUTH+PENNA
CHARRIER 65 PL    15   66       CHARRIERE,GIBSON+ //// EPUL+BRIST+CERN+MPI
HILL      65 PRL   15   85       D A HILL,K K LI ////////////////////// MIT
SCHMIDT   65 PR   140 B 1328     P SCHMIDT ///////////////////////// COLUMBIA

BERGE     66    BERKELEY CONF.   BERGE,CABIBBO                        // RVUE
BURAN     66 PL 20 318           BURAN,EIVINDSON,SKJEGGESTAD,TOFTE + //OSLO
ENGELMAN 66     BERKELEY CONF.   ENGELMANN,FILTHUTH,ALEXANDER+/HEIDBG+WEIZM
HILL      66  BERKELEY CONF      HILL,LI,JENKINS,KYCIA,RUDERMAN       // BNL
LONDON    66 PR 143 1034         LONDON,RAU,GOLDBERG,LICHTMAN+//BNL+SYRACUS
MERRILL   66  BERKELEY CONF      MERRILL,SHAFER,BERGE                 // LRL
    CF.   66 UCRL 16455          DEANE MERRILL (THESIS, BERKELEY) ///// LRL
OVERSETH 66  BERKELEY CONF      O.E OVERSETH, R F ROTH//MICHIGAN+PRINCETON
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                19  SIGMA+   (1189,JP=1/2+)  I=1

                19  SIGMA+ MASS (MEV)

M    N SEE NOTE PRECEDING LAMBDA MASS LISTINGS

M         144 1189.38       0.15            BARKAS     63 EMUL +  SEE NOTE S BELOW
M          58 1189.48       0.22            BHOWMIK    64 EMUL +  SEE NOTE S BELOW
M    S  ABOVE SIGMA+ MASSES HAVE BEEN RAISED 30  KEV TO ACCOUNT FOR 46 KEV
     S  INCREASE IN PROTON MASS AND 21 KEV DECREASE IN PION MASS
M             1189.59       0.11            SCHMIDT    65 HBC                      9/66

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                19  SIGMA+ LIFETIME (UNITS 10**-10)

T    *                                      GLASER      58 RVUE
T         127     0.98      0.16     0.12   PUSCHEL     60 EMUL
T          41     0.82      0.34     0.20   EVANS       60 EMUL
T         117     0.85      0.14     0.11   FREDEN      60 EMUL
T          54     0.80      0.10     0.067  KAPLON      60 EMUL

T          23     0.76      0.22     0.14   CHIESA      61 EMUL
T          49     0.75      0.13     0.09   BERTHELOT   61 PBC
T         140     0.82      0.10     0.08   BARKAS      61 EMUL
T         192     0.749     0.056    0.052  GRARD       62 HBC
T         456     0.765     0.04     0.04   HUMPHREY    62 HBC

T         203     0.84      0.12     0.08   BHOWMIK     64 EMUL
T         181     0.84      0.09            BALTAY      65 HBC                     6/66
T         900     0.76      0.03            CARAYANNO   65 HBC                     6/66
T                 0.83      0.018           CHANG       65 HBC                     6/66
T         381     0.80      0.07            COOK        66 SPRK                    7/66

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                19  SIGMA+ MAGNETIC MOMENT (MAGNETONS,938.26 MEV)

MM         43     1.2       1.5             BRISTOL     66 EMUL                    9/66
MM        381     1.5       1.1             COOK        66 SPRK                    7/66
MM                3.2       1.1             GOZA        66 EMUL      K- P          9/66
MM         44     3.1       1.4             SULLIVAN    66 EMUL    PHOTOPROD       9/66

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                19  SIGMA+ PARTIAL DECAY MODES

P1      SIGMA + INTO PROTON PIO                          S16S 9
P2      SIGMA + INTO NEUTRON PI+                         S17S 8
P3      SIGMA + INTO NEUTRON PI+ GAMMA                   S17S 8S 0
P4      SIGMA + INTO LAMBDA E+ NEU                       S18S 3S 0
P5      SIGMA + INTO PROTON GAMMA                        S16S 0
P6      SIGMA + INTO NEUTRON MU+ NEUTRINO                S17S 4S 2
P7      SIGMA + INTO NEUTRON E+ NEUTRINO                 S17S 3S 1

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                19  SIGMA+  BRANCHING RATIOS

R1  *  SIGMA+  INTO (NEUTRON PI+)/(NUCLEON PI)              (P2)/(P1+P2)
R1      308     0.490     0.024             HUMPHREY  62 HBC
R1              0.46      0.02              CHANG     65 HBC                       6/66

R2  *  SIGMA+ INTO (NEUT PI+ GAM)/(PI+N)  (UNITS 10**-4)  (P3)/(P2)
R2      ABOUT             0.4               COURANT   63 HBC

R3  *    SIGMA+ INTO (LAMBDA E+ NEU)/TOTAL (UNIT 10**-5)  (P4)/TOTAL
R3  *     4     3.3       1.7               WILLIS    64 HBC      STOP. K-         9/66
R3        3     1.5       0.9               BAGGETT   66 RVUE     SEE NOTE B BELOW 9/66
R3  B  ABOVE EXP. CONTAINS 1 EVENT OF WILLIS + ASSUMES  S20R3=.00006               9/66

R4  *  SIGMA+  INTO (N MU+ NEU)/(PI+N)   (UNITS 10**-4) (P6)/(P2)
R4  *    1 EVENT SEEN,NO RATIO GIVEN. GALTIERI 62 EMUL
R4  *    0  LESS THAN              2.3  BURNSTEIN 63 HBC
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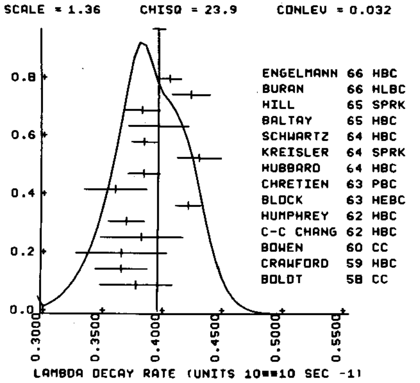
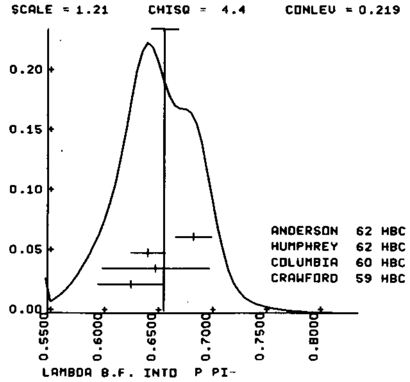
WEIGHTED AVERAGE =0.39844 +/- 0.00561
SCALE = 1.36   CHISQ = 23.9   CONLEV = 0.032



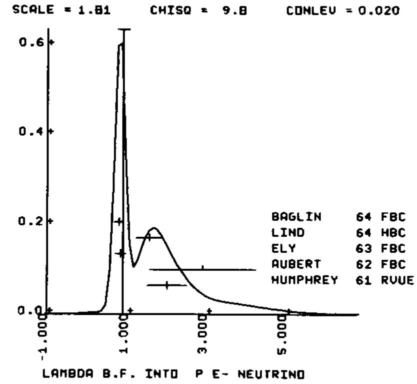
LAMBDA DECAY RATE (UNITS 10**10 SEC -1)

WEIGHTED AVERAGE =0.6579 +/- 0.0129
SCALE = 1.21   CHISQ = 4.4   CONLEV = 0.219



LAMBDA B.F. INTO P PI-

WEIGHTED AVERAGE =0.884 +/- 0.149
SCALE = 1.81   CHISQ = 9.8   CONLEV = 0.020



LAMBDA B.F. INTO P E- NEUTRINO

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R5   *   SIGMA+  INTO (N E+ NEU)/(N PI+)  (UNITS 10**-4)   (P7)/(P2)
R5   *     0  LESS THAN              2.6  BURNSTEIN 63 HBC
R5   *        LESS THAN          4.0      MURPHY    64 PBC
R5   *     1  LESS THAN             1.03  NAUENBERG 64 HBC

R6   *   SIGMA+  INTO (P GAMMA)/(P PIO)  (UNITS 10**-2)   (P5)/(P1)
R6   *     1    0.68  OR LESS              CARRARA   64 HBC
R6        24    0.37     0.08              BAZIN     65 HBC
R6         4    0.17                       QUARENI   65 EMUL                  6/66

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19 SIGMA+ DECAY PARAMETERS

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A+   *    ALPHA+/ALPHAO FOR SIGMA+ (SIG+ TO PI+ N)/(SIG+ TO PIO P)
A+              +0.04     0.11           CORK      60 CNTR    SIG+ FROM PI+P
A+   *          +0.20     0.24           TRIPP     62 HBC  +  REPLAC.BY BANGER
A+     3500    -.014     0.052           BANGERTER 66 HBC  +  SIG+ FROM K-P      9/66
A+     2600    -.047      .07            BERLEY    66 HBC  +  SIG+ FROM K-P      9/66

AO   *   ALPHA SIGMAO (SIG+ INTO PIO PROTON)
AO              -0.80     0.16           BEALL     62 CNTR
AO   *          -0.90     0.25           TRIPP     62 HBC     REPLAC. BY BANGER
AO     5200    -0.986     0.072          BANGERTER 66 HBC     K-P TO SIG+ PI-    7/66

F    *        PHI ANGLE (TAN(PHI)=BETA/GAMMA)   (DEGREE)
F       370  180.       30.              BERLEY    66 HBC  +  NEUTRON RESCATT.   9/66

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REFERENCES
19 SIGMA + (1189,JP=1/2+) I=1


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GLASER    58 CERN CONF 270       GLASER,GOOD,MORRISON //////////// MICH+LRL
EVANS     60 NC 15 873           BRIST+BRUSS+IAS-U.COL-DUBLIN+LON+MILAN+PAD
FREDEN    60 NC 16 611           S FREDEN,H KORNBLUM,P WHITE ////////// LRL
KAPLON    60 ANP 9 139           M KAPLON,A MELISSINOS,YAMANOUCHI // ROCHES
CORK      60 PR 120 1000         CORK,KERTH,WENZEL,CRONIN,COOL /LRL+PRI+BNL
PUSCHELL  60 NP 20 254           W PUSCHEL //////////////// MAX PLANCK INST

BARKAS    61 PR 124 1209         BARKAS,DYER,MASON,NICHOLS,SMITH ////// LRL
BERTHELO  61 NC 21 693           BERTHELOT,DAUDIN,GOUSSU + /// SACLAY+ORSAY
CHIESA    61 NC 19 1171          CHIESA,QUASSIATI,RINAUDO ////// INFN-TURIN

BEALL     62 PRL 8 75            BEALL,CORK,KEEFE,MURPHY,WENZEL /////// LRL
GRARD     62 PR 127 607          F GRARD,G A SMITH /////////////////// LRL
GALTIERI  62 PRL 9 26            GALTIERI,BARKAS,HECKMAN,PATRICK,SMITH//LRL
HUMPHREY  62 PR 127 1305         W E HUMPHREY,R R ROSS //////////////// LRL
TRIPP     62 PRL 9 66            R D TRIPP,M B WATSON,M FERRO-LUZZI /// LRL

BARKAS    63 PRL 11 26           W H BARKAS,J N DYER,H H HECKMANN ///// LRL
    ALSO  61 UCRL 9450           JOHN DYER (THESIS, BERKELEY) /////// LRL
COURANT   63 SIENA CONF  1 15    COURANT,FILTHUTH,BURNSTEIN+ // CERN+MD+NRL

BHOWMIK   64 NP 53 22            B BHOWMIK,P JAIN,P MATHUR,LAKSHMI // DELHI
BURNSTEI  64 PRL 13 66           BURNSTEIN,DAY,KEHOE,SECHI ZORN,SNOW /MARYL
CARRARA   64 PL 12 72            CARRARA,CRESTI,GRIGOLETTO,PERUZZO+//PADOVA
COURANT   64 PR 136 B 1791       COURANT,FILTHUTH+//CERN+HEIDLB+MD+NRL +BNL
MURPHY    64 PR 134 B 188        C THORNTON MURPHY ////////////// WISCONSIN
NAUENBER  64 PRL 12 679          NAUENBERG,MARATECK,BLUMENFELD+ /COL+RUT+PR
WILLIS    64 PRL 13 291          WILLIS,COURANT,ENGELMAN+//BNL+CERN+HEID+MD

BALTAY    65 PR 140 B 1027       BALTAY,SANDWEISS,CULWICK,KOPP + //YALE+BNL
BAZIN     65 PRL 14 154          BAZIN,BLUMENFELD,NAUENBERG +//PRINCE+COLUM
CARAYAN   65 PR 138 B 433        CARAYANNOPOULOS,TAUTFEST,WILLMANN// PURDUE
CHANG     65 NEVIS 145  THESIS CHUNG YUN CHANG ///////////////// COLUMBIA
QUARENI   65 NC 40 A 928         QUARENI,CARTACCI + //////BOL+FIR+GEN+PARMA
SCHMIDT   65 PR 140 B 1328       P SCHMIDT ////////////////////// COLUMBIA

BAGGETT   66          (PREPRINT) BAGGETT,DAY,GLASSER +           // MARYLAND
BANGERTE  66 PRL  17  495        BANGERTER,GALTIERI,BERGE,MURRAY+   // LRL
BERLEY    66 PRL 17 1071         +HERZBACH,KOFLER,YAMAMOTO +//BNL+MASS+YALE
BRISTOL   66  BERKELEY CONF      BRISTOL-CERN-LAUSANNE-MUNICH-ROME COLLABOR
COOK      66 PRL  17  223        V COOK,EWART,MASEK,ORR,PLATNER//WASHINGTON
GOZA      66  BERKELEY CONF      GOZA,KOTELCHUCK,ROOS,SULLIVAN //VANDERBILT
SULLIVAN  66  BERKELEY CONF      SULLIVAN,KOTELCHUCH,MCINTURFF,ROOS//VANDER
    ALSO  64 PRL 13 246          A D MCINTURFF,C E ROOS          // VANDERBILT

        QUANTUM NUMBER DETERMINATIONS NOT REFERRED TO IN THE DATA CARDS

TRIPP     62 PRL 8 175           R TRIPP,M WATSON,M FERRO-LUZZI /////// LRL
ALFF      63 SIENA CONF 1 205    ALFF,NAUFNBERG,KIRSCH,BERLEY+/COLU+RUT+BNL
    ALSO  65 PR 137 B 1105       ALFF,GELFAND,BRUGGER,BERLEY+/COLUM+RUT+BNL
COURANT   63 SIENA CONF 1 73     COURANT,FILTHUTH,BURNSTEIN,DAY+//CERN+MARY
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20 SIGMA- (1198,JP=1/2+) I=1

20 SIGMA- MASS (MEV)

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M    N SEE NOTE PRECEDING LAMBDA MASS LISTINGS

M    *        1197.47      0.11              SCHMIDT   65 HBC                    9/66

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20 SIGMA- MASS DIFFER.(-)-(+)(MEV)

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D        87    8.25      0.40              BARKAS    63 EMUL  -
D      2500    8.25      0.25              DOSCH     65 HBC

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20 (SIGMA-) - (LAMBDA) MASS DIFFERENCE (MEV)

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M    N SEE NOTE PRECEDING LAMBDA MASS LISTINGS

DL              81.70      0.19              BURNSTEIN 64 HBC                    9/66

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20 SIGMA- LIFETIME (UNITS 10**-10)

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T               1.67      0.40      0.28  BROWN     58 PBC
T               1.89      0.33      0.25  EISLER    58 PBC
T               1.45      0.12      0.12  CRAWFORD  59 HBC
T        45     1.35      0.32      0.17  CHIESA    61 EMUL
T        41     1.75      0.39      0.30  BARKAS    61 EMUL

T      1208     1.58      0.06      0.06  HUMPHREY  62 HBC
T               1.666     0.026           CHANG     65 HBC                     6/66
                          (Ideogram below)
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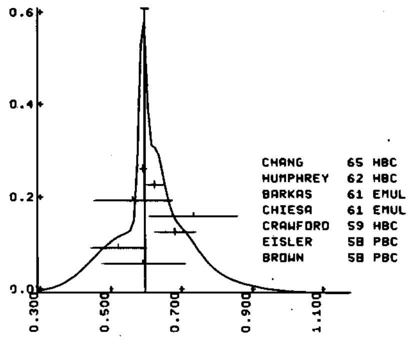
WEIGHTED AVERAGE =0.6060 +/- 0.0117
SCALE = 1.37   CHISQ = 3.7   CONLEV = 0.154



SIGMA - DECAY RATE (UNITS 10**10 SEC -1)

20 SIGMA- PARTIAL DECAY MODES

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P1     SIGMA - INTO  NEUTRON PI-                               S17S 8
P2     SIGMA - INTO  NEUTRON PI- GAMMA                         S17S 8S 0
P3     SIGMA - INTO  NEUTRON MU- NEUTRINO                      S17S 4S 2
P4     SIGMA - INTO  NEUTRON E- NEUTRINO                       S17S 3S 1
P5     SIGMA - INTO  LAMBDA E- NEUTRINO                        S18S 3S 1

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20 SIGMA- BRANCHING RATIOS

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R1   *   SIGMA - INTO (N MU- NEU)/(N PI-) (UNITS 10**-3)   (P3)/(P1)
R1        22    0.66      0.15               COURANT   64 HBC
R1        11    0.56      0.20               BAZIN     65 HBC      FROM STOP. K-     6/66

R2   *   SIGMA - INTO (N E- NEU)/(N PI-)   (UNITS 10**-3)   (P4)/(P1)
R2         9    1.0       0.4        0.3  MURPHY    64 PBC
R2        16    1.37      0.34            NAUENBERG 64 HBC
R2        16    1.15      0.4             MILLER    64 FBC
R2        31    1.4       0.3             COURANT   64 HBC

R3   *   SIGMA - INTO (LAMBDA E- NEU)/(N PI-) (UNITS 10**-4)(P5)/(P1)
R3        11    0.75      0.28            COURANT   64 HBC     STOP. K-
R3        12    0.50                      BAGGETT   66 HBC   - STOP. K-            9/66
R3   *    23    0.61      0.16            BAGGETT   66 RVUE  - AVER. ABOVE 2 EX  9/66

R4   *   SIGMA - INTO (N PI- GAMMA)/(N PI-) (UNITS 10**-4)(P2)/(P1)
R4   *   ABOUT                    0.1     COURANT   63 HBC

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20 SIGMA- DECAY PARAMETERS

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A-   *   ALPHA SIGMA-
A-   *          -0.16     0.21            TRIPP     62 HBC     REPL.BY BANGERTER
A-     6500    -0.010     0.043           BANGERTER 66 HBC     K-P TO SIG- PI+   7/66

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REFERENCES

20 SIGMA-(1198,JP=1/2+)I=1


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BROWN     58 CERN CONF 270       BROWN,GLASER,GRAVES,PERL,CRONIN + /// MICH
EISLER    58 NC SER10 10 150     EISLER,BASSI,CONVERSI + / COL+BNL+BOL+PISA
BROWN     57 PR 108 1036         J BROWN, D GLASER, M PERL / MICHIGAN + BNL

BARKAS    61 PR 124 1209         BARKAS,DYER,MASON,NICKOLS,SMITH ////// LRL
CHIESA    61 NC 19 1171          A M CHIESA,B QUASSIATI,G RINAUDO /// TURIN
HUMPHREY  62 PR 127 1305         W E HUMPHREY,R R ROSS ///////////////  LRL
TRIPP     62 PRL 9 66            R D TRIPP,M WATSON,M FERRO-LUZZI ///// LRL

BARKAS    63 PRL 11 26           W H BARKAS,J N DYER,H H HECKMAN ////// LRL
COURANT   63 SIENA 1 15          COURANT,FILTHUTH,BURNSTEIN+/// CERN+MD+NRL
BURNSTEI  64 PRL 13 66           BURNSTEIN,DAY,KEHOE,SECHI ZORN,SNOW// MARY
COURANT   64 PR 136 B 1791       COURANT,FILTHUTH+///CERN+HEIDLB+MD+NRL+BNL
MILLER    64 PL 11 262           MILLER,STANNARD,BEZAGUET+ /LOND+PARIS+BERG
MURPHY    64 PR 134 B 188        C THORNTON MURPHY ////////////// WISCONSIN
NAUENBER  64 PRL 12 679          NAUENBERG,SCHMIDT,MARATECK+ /COL+RUT+PRINC

BAZIN     65 PR 140 B 1358       BAZIN,PLANO,SCHMIDT +    //PRINC+RUTG+COLUM
CHANG     65 NEVIS 145  THESIS CHUNG YUN CHANG ////////////////  COLUMBIA
DOSCH     65 PL 14 239           DOSCH,ENGELMANN,FILTHUTH,HEPP,KLUGE+ /HEID
SCHMIDT   65 PR 140 B 1328       P SCHMIDT ////////////////////// COLUMBIA
BAGGETT   66          (PREPRINT) BAGGETT,DAY,GLASSER +           // MARYLAND
BANGERTE  66 PRL  17  495        BANGERTER,GALTIERI,BERGE,MURRAY+   // LRL
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21 SIGMA 0 (1193,JP=1/2+) I=1

21 (SIGMA-) - (SIGMAO) MASS DIFFERENCE (MEV)

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D1        18    4.75      0.1                BURNSTEIN 64 HBC     SEE NOTE IN TEXT
D1        37    4.87      0.12               DOSCH     65 HBC
D1              4.99      0.12               SCHMIDT   65 HBC     SEE NOTE IN TEXT  6/66

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21 (SIGMA 0) - (LAMBDA) MASS DIFFERENCE (MEV)

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M    N SEE NOTE PRECEDING LAMBDA MASS LISTINGS

DL              76.61      0.28              SCHMIDT   65             SEE NOTE IN TEXT  9/66

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21 SIGMAO LIFETIME (UNITS 10**-14)

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T    *      1.0 OR LESS                      DAVIS     62 EMUL

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             21  SIGMA 0 PARTIAL DECAY MODES

P1      SIGMA 0 INTO LAMBDA GAMMA                          S18S 0
P2      SIGMA 0 INTO LAMBDA E+ E-                          S18S 3S 3

R1  *   SIGMA 0 INTO(LAMBDA E+ E-)/TOTAL                 (P2)/(P1+P2)

R1  *        0.00545   THEORET. CAL. FEINBERG  58        QUANTUM ELECT.    9/66

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REFERENCES

21 SIGMA 0(1193,JP=1/2+)I=1

```
FEINBERG 58 PR 109 1019      G.FEINBERG                          // BNL
DAVIS    62 PR 127 605       D DAVIS,R SETTI,M RAYMOND,G TOMASIN ///CHI
COURANT  63 PRL 10 409       COURANT,FILTHUTH,FRANZINI+//CERN+UMD+USNRL
BURNSTEI 64 PRL 13 66        BURNSTEIN,DAY,KEHOE,SECHI ZORN,SNOW //MARY
DOSCH    65 PL 14 239        DOSCH,ENGELMANN,FILTHUTH,HEPP,KLUGE+ /HEID
SCHMIDT  65 PR 140 B 1328    P SCHMIDT ////////////////////// COLUMBIA

       QUANTUM NUMBER DETERMINATIONS NOT REFERRED TO IN THE DATA CARDS

ALFF     65 PR 137 B1105     ALFF,GELFAND,NAUENBERG+//COLUMBIA+RUTG+BNL  P

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             22  XI-  (1321,JP=1/2 ) I=1/2

             22  XI-  MASS (MEV)

M    H   11 1317.0      2.2            WANG       61 PBC
M    H   18 1317.9      1.9            FOWLER     61 PBC
M    H (OLD DATA AND LOW STATISTICS DROPPED ON SUGGESTION OF J R HUBBARD)
M    *    1 1322.0      1.3            BROWN      62 HBC      ANTI-XI-         7/66

M        62 1321.1      0.65           SCHNEIDER 63 HBC
M       517 1321.4      0.4            JANEAU     63 FBC
M       241 1321.1      0.3            BADIER     64 HBC
M    *  ALL MASSES ABOVE MUST BE RAISED 0.09 MEV BECAUSE LAMBDA MASS RAISED
M       299 1321.4      1.1            LONDON     66 HBC                       6/66

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             22  XI-  LIFETIME (UNITS 10**-10)

T    H   11     3.5      3.4      1.23 WANG       61 PBC
T    H   18     1.28     0.41     0.25 FOWLER     61 PBC
T    H (OLD DATA AND LOW STATISTICS DROPPED ON SUGGESTION OF J R HUBBARD)
T       517     1.86     0.15     0.14 JAUNEAU    63 FBC
T        62     1.55     0.31     0.31 SCHNEIDER 63 HBC
T       356     1.77     0.12          CARMONY    64 HBC
T       794     1.69     0.07          HUBBARD    64 HBC
T       299     1.80     0.16          LONDON     66 HBC                       6/66

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             22  XI- PARTIAL DECAY MODES

P1      XI- INTO LAMBDA PI-                                S18S 8
P2      XI- INTO LAMBDA E- NEUTRINO                        S18S 3S 1
P3      XI- INTO NEUTRON PI-                               S17S 8
P4          XI- INTO LAMBDA MU- NEUTRINO                   S18S 4S 2
P5          XI- INTO SIGMAO E- NEUTRINO                    S21S 3S 1
P6          XI- INTO SIGMAO MU- NEUTRINO                   S21S 4S 2
P7          XI- INTO NEUTRON E- NEUTRINO                   S17S 3S 1

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             22  XI- BRANCHING RATIOS

R1  * XI- INTO (LAMBDA E- NEU)/(LAMBDA PI-)          (P2)/(P1)
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We have arrived at a new world average using the following input:

Leptonic events	Efficiency	Nonleptonic events	Effective denominator	Reference
1	0.8	194	155	CARMONY 63
1	0.5	310	155	LONDON 66
0	0.4	551	220	BERGE 66
0	0.8	326	260	H. Bingham, priv. comm. EP + CERN
2			790	Total

The resulting branching ratio is $(2.5 \pm 1.8)10^{-3}$.

```
R2  *  XI- INTO (NEUTRON PI-)/(LAMBDA PI-)           (P3)/(P1)
R2  *        0.005    OR LESS        FERRO-LUZ 63 HBC

R3  *      XI- INTO (LAMBDA MU- NEUTRINO)/TOTAL         (P4)/TOTAL
R3  *        0.012    OR LESS           BERGE      66 HBC                      7/66

R4  *      XI- INTO (SIGMAO E- NEUTRINO)/TOTAL       (P5)/TOTAL
R4  *        0.003    OR LESS           BERGE      66 HBC                      7/66

R5  *      XI- INTO (SIGMAO MU- NEUTRINO)/TOTAL         (P6)/TOTAL
R5  *        0.005    OR LESS           BERGE      66 HBC                      7/66

R6  *      XI- INTO (N E- NEUTRINO) / (LAMBDA PI-)     (P7)/(P1)
R6  *        0.01  OR LESS              BINGHAM    65 RVUE     CONF.LIMIT 0.9  9/66

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             22  XI- DECAY PARAMETERS

A    *  ALPHA XI-
A             -0.44      0.11           JAUNEAU    63 FBC
A       240   -0.5       0.35           BADIER     64 HBC                      7/66
A       356   -0.62      0.12           CARMONY    64 HBC
A        62   -0.73      0.21           SCHNEIDER 64 HBC
A    * 1004   -0.368     0.057          BERGE      66 HBC    - REPL. BY MERRILL 7/66
A      2529   -0.342     0.044          MERRILL    66 HBC      USED ALPHAL=.747 9/66
A       364   -0.47      0.12           LONDON     66 HBC  USING A-LAMB =0.62  6/66
A    *        -0.391     0.032          BERGE 2    66 RVUE  INCLUDES ALL ABOVE 9/66
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```
F    *  PHI ANGLE (TAN(PHI)=BETA/GAMMA)  (DEGREE)
F        .     -16.      37.            JAUNEAU    63 FBC
F       356    54.0      25.0           CARMONY    64 HBC
F        62    45.0      30.0           SCHNEIDER 64 HBC
F    * 1004     0.45     10.7           BERGE      66 HBC    - REPL. BY MERRILL  7/66
F       364     0.0      17.0           LONDON     66 HBC      USED ALPHAL=.62   9/66
F      2529     1.2       7.5           MERRILL    66 HBC      USED ALPHAL=.747  9/66

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REFERENCES

22 XI - (1321,JP=1/2) I=1/2

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FOWLER   61 PRL 6 134          FOWLER,BIRGE,EBERHARD,ELY,GOOD,POWELL+/LRL
WANG     61 JETP 13 512        K WANG,T WANG,VIRYASOV,TING,SOLOVEV+//JINR
BERTANZA 62 PRL 9 229          BERTANZA,BRISSON,GOLDBERG,GRAY+/BNL+SYRACU
BROWN    62 PRL 8 255          BROWN,CULWICK,FOWLER,GAILLOUD +///BNL+YALE

CARMONY  63 PRL  10  381       CARMONY,P JERROU                    // UCLA
FERROLUZ 63 PR 130 1568        FERRO-LUZZI,ALSTON,ROSENFELD,WOJCICKI//LRL
JAUNEAU  63 SIENA CONF 4       JAUNEAU+ ///// PARIS+CERN+LOND+RUTH+BERGEN
    ALSO 63 PL 4 49            JAUNEAU+ ///// PARIS+CERN+LOND+RUTH+BERGEN
SCHNEIDE 63 PL 4 360           H SCHNEIDER ////////////////////////// CERN

CARMONY  64 PRL 12 482         CARMONY,P JERROU,SCHLEIN,SLATER,STORK+/UCLA
BADIER   64 DUBNA CONF         BADIER,DEMOULIN,BARLOUTAUD+ /PARIS+SAC+ZEE
HUBBARD  64 PR 135 B 183       HUBBARD,BERGE,KALBFLEISCH,SHAFER +/////LRL
BINGHAM  65 PRSL  285  202     H H BINGHAM                         // CERN
PJERROU  65 PRL 14 275         + SCHLEIN,SLATER,SMITH,STORK,TICHO // UCLA

BERGE    66 PR   147  945      BERGE,EBERHARD,HUBBARD,MERRILL + ///// LRL
BERGE 2  66     BERKELEY CONF. BERGE,CABIBBO                       // RVUE
LONDON   66 PR 143 1034        LONDON,RAU,GOLDBERG,LICHTMAN+//BNL+SYRACUS
MERRILL  66  BERKELEY CONF     MERRILL,SHAFER,BERGE                 // LRL
     CF. 66 UCRL 16455         DEANE MERRILL (THESIS, BERKELEY) ///// LRL

       QUANTUM NUMBER DETERMINATIONS NOT REFERRED TO IN THE DATA CARDS

CARMONY  64 PRL 12 482         CARMONY,P JERROU,SCHLEIN,SLATER,STORK+/UCLA  J
SHAFER   65 UCRL 11884         J BUTTON SHAFER, DEANE MERRILL  /////  LRL  J
MERRILL  66 UCRL 16455         DEANE MERRILL (THESIS, BERKELEY)  ///  LRL  J

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             23  XI 0  (1314,JP=1/2 ) I=1/2

             23  XI       MASS DIFFERENCE (-)-(0)(MEV)

D        23    6.8      1.6               JAUNEAU    63 FBC
D        45    6.1      1.6               CARMONY    64 HBC
D        29    6.9      2.2               LONDON     66 HBC                    6/66

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             23  XI 0 LIFETIME (UNITS 10**-10)

T        24    3.9      1.4      0.80  JAUNEAU    63 FBC
T        45    3.5      1.0       0.8  CARMONY    63 HBC
T       101    2.5      0.4       0.3  HUBBARD    63 HBC
                              (Ideogram below)
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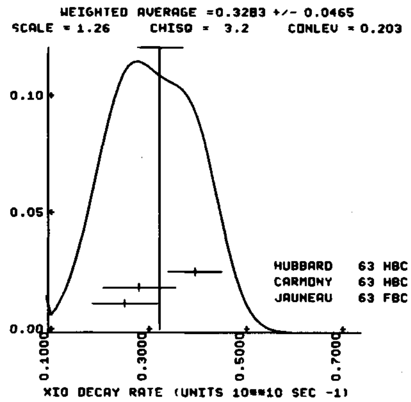


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             23  XI 0  PARTIAL DECAY MODES

P1      XI 0 INTO LAMBDA PIO                                  S18S 9
P2      XI 0 INTO PROTON PI-                                  S16S 8
P3      XI 0 INTO PROTON E- NEU                               S16S 3S 1
P4      XI 0 INTO SIGMA+ E- NEU                               S19S 3S 1
P5      XI 0 INTO SIGMA- E+ NEU                               S20S 3S 1
P6          XI 0 INTO SIGMA+ MU- NEUTRINO                     S19S 4S 2
P7          XI 0 INTO SIGMA- MU+ NEUTRINO                     S20S 4S 2
P8          XI 0 INTO PROTON MU- NEUTRINO                     S16S 4S 2

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             23  XI 0  BRANCHING RATIOS

R1  *  XI 0 INTO(PROTON PI-)/(LAMBDA PIO)                 (P2)/(P1)
R1  *   0     0.027  OR LESS          TICHO      63 HBC
R1  *   0     0.005  OR LESS          HUBBARD    66 HBC                        7/66

R2  *  XI 0 INTO(PROTON E- NEU)/(LAMBDA PIO)              (P3)/(P1)
R2  *   0     0.027  OR LESS          TICHO      63 HBC
R2      0     0.006 OR LESS           HUBBARD    66 HBC                        7/66

R3  *  XI 0 INTO(SIGMA+ E- NEU)/(LAMBDA PIO)              (P4)/(P1)
R3  *   0     0.013  OR LESS          TICHO      63 HBC
R3      0     0.007 OR LESS           HUBBARD    66 HBC                        7/66

R4  *       XI 0 INTO (SIGMA- E+ NEUTRINO)/TOTAL          (P5)/TOTAL
R4  *   0     0.006  OR LESS          HUBBARD    66 HBC                        7/66
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R5  *      XI 0 INTO (SIGMA+ MU- NEUTRINO)/TOTAL            (P6)/TOTAL
R5  *   0    0.007  OR LESS            HUBBARD   66 HBC                     7/66

R6  *      XI 0 INTO (SIGMA- MU+ NEUTRINO)/TOTAL            (P7)/TOTAL
R6  *   0    0.006  OR LESS            HUBBARD   66 HBC                     7/66

R7  *      XI 0 INTO (PROTON MU- NEUTRINO)/TOTAL            (P8)/TOTAL
R7  *   0    0.006  OR LESS            HUBBARD   66 HBC                     7/66

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                  23  XI 0 DECAY PARAMETER

A   *  ALPHA XI 0
A            -0.09      0.42           PJERROU   65 HBC
A   *        -0.149     0.154          BERGE     66 HBC                     7/66
A       46   -0.2       0.4            LONDON    66 HBC  USING A-LAMB=0.62  6/66
A      490   -0.33      0.10           MERRILL   66 HBC  A-LAM=0.690+-.048  8/66

F   *  PHI ANGLE XI0   (TAN(PHI)=BETA/GAMMA)   (DEGREE)
F   N  146   -2.9       23.5           BERGE     66 HBC                     7/66
F   N  490  107.0       38.0           MERRILL   66 HBC  USING A-LAMB=0.642 8/66
F   N  THE LIKELIHOOD FUNCTION FOR COMBINED DATA IS VERY NON-GAUSSIAN. THE  7/66
F   N    DATA ARE CONSISTENT (2.2 S.D.) WITH PHI BETWEEN -25 AND +225 DEG.  7/66

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                          REFERENCES

                          23 XI 0(1314,JP=1/2)I=1/2

ALVAREZ  59 PRL 2 215         ALVAREZ,EBERHARD,GOOD,GRAZIANO,TICHO+//LRL
JAUNEAU  63 SIENA CONF 1 1    JAUNEAU+ ///// PARIS+CERN+LOND+RUTH+BERGEN
    ALSO 63 PL 4 49           JAUNEAU+ ///// PARIS+CERN+LOND+RUTH+BERGEN
TICHO    63 BNL CONF 410      HAROLD K TICHO ////////////////////////UCLA

CARMONY  64 PRL 12 482        CARMONY,PJERROU,SCHLEIN,SLATER,STORK+/UCLA
HUBBARD  64 PR 135 B 183      HUBBARD,BERGE,KALBFLEISCH,SHAFER +/////LRL
PJERROU  65 PRL 14 275        + SCHLEIN,SLATER,SMITH,STORK,TICHO // UCLA

BERGE    66 PR  147  945      BERGE,EBERHARD,HUBBARD,MERRILL + ///// LRL
HUBBARD  66 UCRL 11510        J RICHARD HUBBARD (THESIS,BERKELEY) // LRL
LONDON   66 PR 143 1034       LONDON,RAU,GOLDBERG,LICHTMAN+//BNL+SYRACUS
MERRILL  66  BERKELEY CONF    MERRILL,SHAFER,BERGE                 // LRL
     CF. 66 UCRL 16455        DEANE MERRILL (THESIS, BERKELEY) ///// LRL

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                  24  OMEGA- (1675,JP=3/2+)   I=0
    *             QUANTUM NUMBERS ASSIGNED FROM SU3

                  24  OMEGA-  MASS (MEV)

M   *    1 1620.0     25.0      10.0 EISENBERG 54 EMUL
M   S    1 1673.0      8.0           ABRAMS    64 HBC     INTO XI- PI0     7/66
M   S    1 1686.0     12.0           BARNES 1  64 HBC     INTO XI0 PI-     7/66
M   S    1 1674.0      3.0           BARNES 2  64 HBC     INTO LAMBDA K-   7/66
M   S    1 1666.0      8.0           COLLEY    65 HBC     INTO XI0 PI-     6/66
M   S    1 1671.0      5.0           RICHARDSO 65 HBC     INTC LAMBDA K-   7/66
M   S      ABOVE EVENTS INCLUDED IN SAMIOS RVUE                            7/66
M        6 1674.0      3.0           SAMIOS    65 RVUE                     6/66

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                  24  OMEGA- LIFETIME   (UNITS 10**-10 SEC)

T   S    1    1.63                   ABRAMS    64 HBC                      7/66
T   S    1    0.7                    BARNES 1  64 HBC                      7/66
T   S    1    1.4                    BARNES 2  64 HBC                      7/66
T   S    1    1.85                   COLLEY    65 HBC                      7/66
T   S    1    1.5                    RICHARDSO 65 HBC                      7/66
T   S      ABOVE EVENTS INCLUDED IN SAMIOS RVUE                            7/66
T        6    1.5      0.5           SAMIOS    65 RVUE                     6/66

                  24 OMEGA- PARTIAL DECAY MODES

P1  OMEGA- INTO LAMBDA K-                                S18S10
P2  OMEGA- INTO XI 0 PI-                                 S23S 8

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                           REFERENCES
                           24 OMEGA-(1675,JP=3/2+)  I=0

EISENBER 54 PR 96 541         Y EISENBERG ////////////////////////CORNELL
ABRAMS   64 PRL 13 670        + BURNSTEIN,GLASSER + ///// MARYLAND+USNRL
BARNES 1 64 PRL  12  204      V E BARNES,CONNOLLY,CRENNELL,CULWICK+//BNL
BARNES 2 64 PL 12 134         V E BARNES,CONNOLLY,CRENNELL,CULWICK+//BNL
COLLEY   65 PL 19 152         COLLEY,DODD +  //  BIR+GLA+IC+MUN+OXF+RHEL
RICHARDS 65 BAPS 10 115       RICHARDSON,BARNES,CRENNEL+ // BNL+SYRACUSE
SAMIOS   65 ARGONNE CONF 189  N P SAMIOS //////////////////// (RVUE) BNL

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DATA ON MESON RESONANCES

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CODE EVENTS QUANTITY  ERROR+  ERROR-  REFERENCE YR TECN SIGN COMMENTS    DATE PUNCHED
     ABOVE
   BACKGROUND

   N  ANY SYMBOL IN COLUMN 8 INDICATES DATA IGNORED BY AVERAGING PROGRAMS

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σ (410)

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              7  SIGMA MESON (410, JPG=0++)  I = 0

   *          NO COMPELLING EVIDENCE FOR NARROW RESONANCE.
   *          OMITTED FROM TABLE.
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There are four kinds of information concerning a ππ, T = 0, $J^P = 0^+$ interaction at about 400 MeV invariant mass, called σ in each case:

I) direct evidence of a narrow peak (50-140 MeV) in experiments of limited statistics (SAMIOS 62, DEL FABRO 64, KOPELMANN 66);
II) indirect model-dependent evidence (width 90-100 MeV, but consistent with larger width) from η and K^+ decay (CRAWFORD 64, KALMUS 64, BROWN 65);
III) indirect evidence for a broad resonance (about 400 MeV) via πN (and NN) dispersion relations (LOVELACE 66); and
IV) indirect evidence for a broad resonance from the existence of a peak near the upper limit of phase space in the reaction

$$\pi^- p \to \pi^+ \pi^- n$$

at low energies (KIRZ 63, BLOKINTSEVA 63, BARISH 64, and perhaps others).

It is almost certain that the σ of types I and III cannot be the same object, unless the broad type III turns out to be in fact two narrower resonances, one of which is seen as type I. More experiments of better statistics and smaller background would be needed, in particular to exhibit the broad type III σ more directly.

There is good evidence from numerous peripheral experiments for a large S-wave at the ρ mass, which could be the tail of type III. Some such experiments have claimed to see a narrow resonance at about 720 MeV, but this is still controversial.


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                          REFERENCES FOR SIGMA

SAMIOS   62 PRL 9 139          +BACHMAN,LEA+ ///////////// BNL+CCNY+CU+KY
BLOKHINT 63 JETP 17 80         BLOKHINTSEVA,GREIBINNIK,ZHUKOV +  // DUBNA
BOOTH    63 PR 132 2314        + ABASHIAN ////////////////////////// LRL
KIRZ     63 PR 130 2481        +SCHWARTZ + TRIPP  //////////////////// LRL
BARISH   64 PR 135 B 416       BARISH,KURZ,PEREZ-MENDEZ,SOLOMON     // LRL
CRAWFORD 64 PRL 13 421         +GROSSMAN,LLOYD,PRICE,FOWLER ///////// LRL
DEL FABR 64 PRL 12 674         DEL FABRO,DE PRETIS,JONES+        FRASCATI
KALMUS   64 PRL 13  99         +KERNAN,PU,POWELL,DOWD ///// LRL+WISCONSIN
BROWN    65 CORAL GABLES 219   BROWN+FAIER ////////////////// NORTHWESTERN
ANDERSON 66  BERKELEY CONF.    +FUKUI,KESSLER+ // CHIC+ARG+OTT+MCGILL+QMC
KOPELMAN 66 PL   22  118       +ALLEN,GOODEN,MARSHALL +  // COLORADO+IOWA
LOVELACE 66 PL   22  332       LOVELACE,HEINZ,DONNACHIE             // CERN

    FOR NEGATIVE EVIDENCE FROM PI PI PHASE SHIFT DETERMINATIONS, SEE
BIRGE    65 PR 139 B 1600      +ELY+GIDAL+KALMUS+CAMERINI+ ///// LRL+WISC
WOLF     65 PL 19 328          WOLF /////////////////////////////// DESY
BIRGE    66  BERKELEY CONF     +ELY+GIDAL+HAGOPIAN+ / LRL+LONDON(UC)+WISC
JACOBS   66 PRL 16 669         +SELOVE //////////////////////////////// LRL
JONES    66 BERKELEY CONF      +CALDWELL+ZACHAROV+HARTING+BLEULER+ / CERN

    SEE ALSO DISCUSSION BY G. GOLDHABER, BERKELEY CONF. 1966, MESON REVIEW

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ϵ (700)

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              14      EPSILON (700,JPG=0++)  I=0

   *                  EVIDENCE NOT YET COMPELLING, OMITTED FROM TABLE.
   *                  FOR NEGATIVE EVIDENCE AND COMPILATION
   *                  SEE REVIEW BY G. GOLDHABER, 1966 BERKELEY CONFERENCE.

              14      EPSILON (700)  MASS (MEV)

M           700.0                        FELDMAN   65 SPRK
M        20 710.                         FORINO    65 DBC     4.5 PI+ D    10/66
M           720.0                        HAGOPIAN  65 HBC
M   *       740.0                        WOLF      65 RVUE                  6/66
M         SEE GOLDHABER MESON REVIEW, 1966 BERKELEY CONF

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              14      EPSILON (700)  WIDTH (MEV)

W.           50.0                        FELDMAN   65 SPRK
W            50.0                        HAGOPIAN  65 HBC
W   *        90.0                        WOLF      65 RVUE                  6/66

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                          REFERENCES FOR EPSILON

COHN     65 PRL 15 906         H O COHN,BUGG+//ORNL+TENN+UNCAR+COLU+EFINS
CORBETT  65 NC 39 979          CORBETT,DAMERELL,MIDDLEMAS,CLEG+//OXF+RHEL
DURAND   65 PRL 14 329         L. DURAND AND Y.T. CHIU ///////////// YALE
FELDMAN  65 PRL 14 869         FELDMAN,FRATI,HALPERN,CHOLDRY+/PENNA+COLUM
FORINO   65 PL 19 65           +GESSAROLI,LENDINARA+ /// BOL+ORSAY+SACLAY
HAGOPIAN 65 PRL 14 1077        HAGOPIAN,SELOVE,ALIT+/PENNA+SACLAY+BOLOGNA
WOLF     65 PL 19 328          G WOLF /////////////////////////////// DESY
GOLDHABE 66  BERKELEY CONF     G.GOLDHABER,SAMIOS,ASTIER,SHEN,LAI.MESON REVIEW
GUTAY    66  PURDUE COO-1428   L.J.GUTAY,JOHNSON,CSONKA+ //// PURDUE+UCRL
OLSSON   66  PREPRINT          MARTIN G. OLSSON /////////////// WISCONSIN

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ω (783)

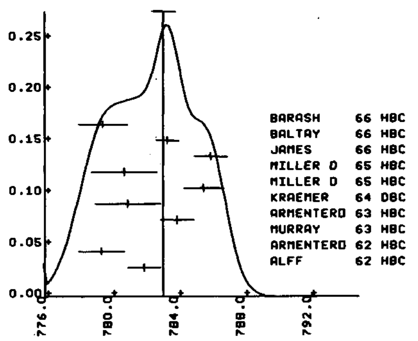
1 OMEGA (783,JPG=1--) I=C

1 OMEGA MASS (MEV)

M	400	782.0	1.0	ALFF	62	HBC		
M	64	779.4	1.4	ARMENTERU	62	HBC		
M	650	782.0		MURRAY	63	HBC		
M	34	784.0	1.0	ARMENTERU	63	HBC		
M	220	781.0	2.0	KRAEMER	64	DBC		
M		785.6	1.2	MILLER D	65	HBC	SEEN WITH K+K-	
M		780.8	2.0	MILLER D	65	HBC	SEEN WITH K1 K2	8/66
M	333	786.0	1.0	JAMES	66	HBC		6/66
M	2198	783.4	0.7	BALTAY	66	HBC	0.0 PBAR P	9/66
M	155	779.5	1.5	BARASH	66	HBC	C PBAR P TO K1K2 CM	11/66

(Ideogram below)

WEIGHTED AVERAGE =783.164 +/- 0.723
SCALE = 1.94 CHISQ = 30.1 CONLEV = .001



OMEGA MESON MASS (MEV)

1 OMEGA FULL WIDTH (MEV)

W		34	9.0	3.0	ARMENTERU	63	HBC		
W			13.4	2.0	MILLER D	65	HBC	SEEN WITH K+ K-	
W			11.6	3.0	MILLER D	65	HBC	SEEN WITH K1 K2	8/66
W		155	12.3	2.0	BARASH	66	HBC		
W	*	333	20.0	OR LESS	JAMES	66	HBC		6/66

1 OMEGA PARTIAL DECAY MODES

P1	CMEGA INTO PI+ PI- PIO	S 8S 8S 9
P2	CMEGA INTC PI+ PI- (VIOLATES G)	
P3	CMEGA INTC PI+ PI- GAMMA	S 8S 8S 0
P4	CMEGA INTO PIO GAMMA	S 9S 0
P5	CMEGA INTO 2PIO GAMMA	S 9S 9S 0
P6	CMEGA INTC MU+ MU-	S 4S 4
P7	CMEGA INTC E+ E-	S 3S 3
P8	CMEGA INTO ETA GAMMA	S14S 0
P9	CMEGA INTO ETA PIO (VIOLATES C)	

1 OMEGA BRANCHING RATIOS

R1	*	CMEGA INTC NEUTRAL/(PI+ PI- PIO)							(P4+P5)/(P1)	
R1			0.17	0.04		ARMENTERO	63	HBC		
R1		20	0.11	0.02		BUSCHBECK	63	HBC		
R1		35	0.08	0.03		KRAEMER	64	DBC		
R1	*		0.13	0.035		MILLER D	65	HBC		
R1		65	0.10	0.04		ALFF-STEI	66	HBC	CORR.BY SCHULTZ(COL)	9/66
R1		19	0.10	0.03		BARASH	66	HBC		11/66
R1		850	0.134	0.026		DI GIUGNO	66	CNTR		9/66
R1		348	0.097	0.016		FLATTE	66	HBC		9/66
R1			0.06	0.05	0.02	JAMES	66	HBC		6/66
R2	*	CMEGA INTC (PI+ PI-)/(PI+ PI- PIO)							(P2)/(P1)	
R2	*		0.010 OR LESS			BUTTON	61	HBC		
R2	*		0.07			ALITTI	63	HBC		
R2	*		0.05 OR LESS			ARMENTERO	63	HBC		
R2	*	100	0.05 OR GREATER			FICKINGER	63	HBC		
R2	*		0.02			JAMES	63	HBC		
R2	*		0.05 OR LESS			KRAEMER	64	DBC		
R2	*		0.005 OR LESS			LUTJENS	64	RVUE	NC INTERFERENCE	
R2	*		0.018	0.012	0.006	WALKER	64	RVUE		
R2	*		0.04 OR GREATER			PATON	65	HBC		
R2	*		0.010 OR LESS			CLARK	65	SPRK		6/66
R2	*		0.035 OR LESS			MILLER D	65	HBC		
R2	*		0.02 OR LESS			ALFF-STEI	66	HBC		11/66
R2	*		0.029	0.011	0.009	FLATTE	66	HBC	INTERFERENCE	9/66
R2	*		0.082	0.020		FLATTE	66	HBC	NO INTERFERENCE	9/66
R3	*	CMEGA INTC (PIO GAMMA) / (PI+ PI- PIO)							(P4)/(P1)	
R3	*		0.125	0.025		BARMIN	64	PXBC		
R3			0.10	0.03		BELYAKOV	64	PXBC		
R3		13	0.15	0.06		BAGLIN	66	HLBC		9/66
R4	*	CMEGA INTO (PI+ PI- GAMMA)/(PI+ PI- PIC)							(P3)/(P1)	
R4	*		0.05 OR LESS			FLATTE	66	HBC		9/66
R5	*	CMEGA INTC(E+ E-)/(PI+ PI- PIO) (UNITS 10**-3)							(P7)/(P1)	
R5	*		3.9	1.5	OR LESS	BARMIN	63	PBC		
R5	*	1	2.8 OR LESS			BEZAGUET	64	FBC		
R5		3	0.20	0.12		BINNIE	65	SPRK		6/66
R5	*		1.4 OR LESS			GALTIERI	65	HBC		
R5		20	0.11	0.03		AZIMOV	66	SPRK	MAY CONTAIN RHOS	9/66
R5			0.3 OR LESS			FLATTE	66	HBC		9/66
R5			0.11	0.19	0.08	HERTZBACH	66	SPRK	ASSUME SU(3)+MIXING	10/66
R6	*	CMEGA INTO (MU+ MU-)/(PI+ PI- PIO)(UNITS 10**-3)							(P6)/(P1)	
R6	*		1.2 OR LESS			GALTIERI	65	HBC		
R6			1.7 OR LESS			FLATTE	66	HBC		9/66
R7	*	CMEGA INTC (2PIO GAMM)/(PIO GAMMA)							(P5)/(P4)	
R7	*		0.1 OR LESS			BARMIN	64	PXBC		
R8	*	CMEGA INTO(ETA PIO +ETA GAM)/(PI+PI-PIO)							(P8+P9)/(P1)	
R8	*		0.017 OR LESS			FLATTE	66	HBC		9/66

REFERENCES FOR OMEGA

MAGLIC	61 PRL 7 178	B MAGLIC,ALVAREZ,ROSENFELD,STEVENSON //LRL
PEVSNER	61 PRL 7 421	PEVSNER,KRAEMER,NUSSBAUM,RICHARD+///JHU+NW
XUCNG	61 PRL 7 327	NGUYEN HUU XUONG,GERALD R LYNCH ///// LRL
ALFF	62 PRL 9 325	ALFF,BERLEY,COLLEY,GELFAND +//COLU+RUTGERS
ARMENTER	62 CERN CONF 90	R ARMENTEROS,R BUDDE + // CERN+COLL+FRANCE
BUTTON	62 PR 126 1858	BUTTON,KALBFLEISCH,LYNCH,MAGLIC + /// LRL
STEVENSC	62 PR 125 687	STEVENSON,ALVAREZ,MAGLIC,ROSENFELD /// LRL
ALITTI	63 NC 29 515	ALITTI,BATON,BERTHELOT+//LPCHE+PAR+BARI+BO
ARMENTER	63 SIENA CCNF 1 296	ARMENTEROS,EDWARDS,JACOBSEN+ // CERN+PARIS
BARMIN	63 SIENA CCNF 1 207	BARMIN,DOLGOLENKO,KRESTNIKOV+ ////// ITEP
BERTHELC	63 SIENA CONF 2 60	A BERTHELOT /////////////////// CEN-SACLAY
BUSCHBEC	63 SIENA CONF 1 166	BUSCHBECK,CZAPP+ /// VIENNA+CERN+AMSTERDAM
FICKINGE	63 PRL 10 457	W J FICKINGER,D K ROBINSON,E SALANT // BNL
GELFAND	63 PRL 11 436	GELFAND,MILLER,NUSSBAUM,RATAL+ /COLUM+RUTG
JAMES	63 PREPR. TID-19082	F E JAMES, H L KRAYBILL ///////////// YALE
MURRAY	63 PL 7 358	MURRAY,FERROLUZZI,HUWE,SHAFER,SOLMITZ+/LRL
BARMIN	64 JETP 18 1289	BARMIN,DOLGOLENKO,KRESTNIKOV + ///// ITEP
BELYAKOV	64 DUBNA CONF	BELYAKOV + /////////////// DUBNA+BUCHAREST
BEZAGUET	64 PL 12 70	BEZAGUET,NGUYEN KHAC,ROUSSET+//PAR+BERG+LO
KRAEMER	64 PR 136 B 496	KRAEMER,MADANSKY,MEER,FIELDS+//JHU+NW+WOOD
LUTJENS	64 PRL 12 517	G LUTJENS,J STEINBERGER /////// COLUMBIA
WALKER	64 PL 8 208	WALKER,BOYD,ERWIN,SATTERBLOM +// WISCONSIN
BATCN	65 NC 35 713	BATON,BERTHELOT,DELER,BENEDETTI+/SAC+BOLOG
BINNIE	65 PL 18 348	BINNIE,DUANE,JANE,W JONES+//IC-LOND+MANCHS
CLARK	65 PR 139 B 1556	CLARK,CHRISTENSON,CRONIN,TURLAY//PRINCETON
GALTIERI	65 PRL 14 279	A BARBARO GALTIERI,R D TRIPP ///////// LRL
MILLER	65 CU-237 (NEVIS 131)	DAVID C MILLER (THESIS) //////// COLUMBIA
	MILLER 65 INCLUDES DATA OF GELFAND 63 ABOVE	
ZDANIS	65 PRL 14 721	ZDANIS,MADANSKY,KRAEMER,HERTZBACH+/JHU+BNL
ALFF-STE	66 PR 145 1072	ALFF-STEINBERGER,BERLEY,BRUGGER+//COL+RUTG
AZIMCV	66 BERKELEY CONF.	AZIMOV,BALDIN,BELOUSOV,CHUVILO + // DUBNA
BAGLIN	66 PL 23 286	+BEZAGUET,DEGRANGE,HAATUFT + // EP+BERGEN
BALTAY C	66 BERKELEY CONF	+FRANZINI,SEVERIENS,YEH,ZANELLO //BNL,CCNY
BARASH	66 CU258(NEVIS 154)	BARASH,KIRSCH,MILLER,TAN //////// COLUMBIA
DIGIUGNC	66 NC 44A 1272	DI GIUGNO,PERUZZI,TROISE+ //NAPL+FRAS+TRST
FLATTE	66 PR 145 1050	+HUWE,MURRAY,BUTTON-SHAFER,SOLMITZ+ // LRL
HERTZBAC	66 PREPRINT	HERTZBACH,KRAEMER,MADANSKI,ZDANIS+/JHU+BNL
	(SEE ALSC ZDANIS 65)	
JAMES	66 PR 142 896	F E JAMES,KRAYBILL ////// YALE+BROOKHAVEN

η′(958)

2 ETA PRIME (958,JPG=0-+) I=C
KNOWN EARLIER AS XO OR ETA*

2 ETA PRIME MASS (MEV)

M	85	957.0		DAUBER	64	HBC		
M		958.0	1.0	KALBFLEIS	64	HBC		6/66
M		957.0	3.0	BADIER	65	HBC		
M	8	960.0	2.0	TRILLING	65	HBC	3.65 PI+ P	9/66
M	7	955.0	10.0	COHN	66	DBC		6/66
M		959.0	3.0	LONDON	66	HBC		6/66

2 ETA PRIME WIDTH (MEV)

W	*	85	4.0 OR LESS	DAUBER	64	HBC	
W	*		7.0 OR LESS	KALBFLEIS	64	HBC	6/66
W	*		30.0 OR LESS	BADIER	65	HBC	
W	*		15.0 OR LESS	LONDON	66	HBC	6/66

2 ETA PRIME PARTIAL DECAY MODES

P1	ETA PRIME INTO	PI+ PI- ETA(NEUTRAL DECAY)	S 8S 8S14
P2	ETA PRIME INTO	PI+ PI- ETA(CHARGED DECAY)	S 8S 8S14
P3	ETA PRIME INTO	PI+ PI- NEUTRALS (EXCLUDING PI+ PI- ETA(NEUTRAL DECAY))	
P4	ETA PRIME INTO	NEUTRALS	
P5	ETA PRIME INTO	PI+ PI- GAMMA (INCL. RHO GAM)	S 8S 8S 0
P6	ETA PRIME INTO	PIO E+ E- (VIOLATES C IN BORN APPROX.)	S 9S 3S 3
P7	ETA PRIME INTO	ETA E+ E- (VIOLATES C IN BORN APPROX.)	S14S 3S 3
P8	ETA PRIME INTO	PIO RHO 0 (VIOLATES C)	S 9U 9
P9	ETA PRIME INTO	PIO OMEGA (VIOLATES C)	S 9U 1
P10	ETA PRIME INTO	PI+ PI- E+ E-	S 8S 8S 3S 3
P11	ETA PRIME INTO	2 PI	S 8S 8
P12	ETA PRIME INTO	3 PI	S 8S 8S 9
P13	ETA PRIME INTO	4 PI	S 8S 8S 8S 8
P14	ETA PRIME INTO	6 PI	S 8S 8S 8S 8S 8S 8

2 ETA PRIME BRANCHING RATIOS

PARTIAL MODES ADJUSTED BY PROGRAM AHR=12345

R1	*	ETA PRIME INTO (PI+ PI- ETA (NEUTRAL DEC.)) / TOTAL						NUM 1 DEN 12345	
R1		68	0.36	0.05	KALBFLEIS	64	HBC		10/66
R2	*	ETA PRIME INTO (PI+ PI- NEUTRALS) / TOTAL						NUM 1 3 DEN 12345	
R2		39	0.4	0.1	LONDON	66	HBC		10/66
R2		33	0.35	0.06	BADIER	65	HBC		10/66
R3	*	ETA PRIME INTO (PI+ PI- ETA (CHRGD.DECAY)) / TOTAL						NUM 2 DEN 12345	
R3		10	0.1	0.04	LONDON	66	HBC		10/66
R3		7	0.07	0.04	BADIER	65	HBC		10/66
R3		44	0.12	0.02	KALBFLEIS	64	HBC		10/66
R4	*	ETA PRIME INTO (PI+ PI- NEUTRALS (EXCLUDING PI+ PI- ETA (NEUTR.DEC.))) / TOTAL						NUM 3 DEN 12345	
R4		10	0.05	0.04	KALBFLEIS	64	HBC		10/66
R5	*	ETA PRIME INTO (NEUTRALS) / TOTAL						NUM 4 DEN 12345	
R5		32	0.3	0.1	LONDON	66	HBC		10/66
R5		16	0.24	0.17	BADIER	65	HBC		10/66
R5		54	0.25	0.05	KALBFLEIS	64	HBC		10/66
R6	*	ETA PRIME INTO (PI+ PI- GAMMA (INCLUDING RHO GAMMA)) / TOTAL						NUM 5 DEN 12345	
R6	*	THIS MODE SEEMS TO BE CONSISTENT WITH BEING ENTIRELY RHO GAMMA							
R6		20	0.2	0.1	LONDON	66	HBC		10/66
R6		42	0.22	0.04	KALBFLEIS	64	HBC		10/66
R6	B	35	0.34	0.09	BADIER	65	HBC		10/66
R6	B	CONTROVERSIAL BACKGROUND SUBTRACTION							

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R7   *      ETA PRIME INTO (PI+ PI- GAMMA (INCLUDING       NLM      5
R7   *                     RHC GAMMA)) /(PI PI ETA)        DEN 1234
R7             0.25     0.14          DAURER    64 HBC                         10/66

R8   *      ETA PRIME INTO (PIO E+ E-)/TOTAL               NLM       6
R8   *         0.013   OR LESS        RITTENBER 65 HBC     DEN 12345           10/66

R9   *      ETA PRIME INTO (ETA E+ E-)/TOTAL               NLM        7
R9   *         0.011   OR LESS        RITTENBER 65 HBC     DEN 12345           10/66

R10  *      ETA PRIME INTO (PIO RHOO)/TOTAL                NLM         8
R10  *         0.04    OR LESS        RITTENBER 65 HBC     DEN 12345           10/66

R11  *      ETA PRIME INTO (PIO OMEGA) /TOTAL              NLM          9
R11  *         0.08    OR LESS        RITTENBER 65 HBC     DEN 12345           10/66

R12  *      ETA PRIME INTO (PI+ PI- E+ E-)/TOTAL           NLM           0
R12  *         0.006   OR LESS        RITTENBER 65 HBC     DEN 12345           10/66

R13  *      ETA PRIME INTO (2 PI)/TOTAL                    NLM            1
R13  *         0.07    OR LESS  COMP.BY LONDON    66 HBC   DEN 12345           10/66

R14  *      ETA PRIME INTO (3 PI)/TOTAL                    NLM             2
R14  *         0.07    OR LESS  COMP.BY LONDON    66 HBC   DEN 12345           10/66

R15  *    . ETA PRIME INTO (4 PI)/TOTAL                    NLM              3
R15  *         0.01    OR LESS  COMP.BY LONDON    66 HBC   DEN 12345           10/66

R16  *      ETA PRIME INTO (6 PI)/TOTAL                    NLM               4
R16  *         0.01    OR LESS  COMP.BY LONDON    66 HBC   DEN 12345           10/66

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η' Branching Ratios

There is evidence for only two η' partial modes, $\eta 2\pi$ and $\pi^+\pi^-\gamma$. (This electromagnetic mode may be mainly $\rho^0\gamma$.) In the $\eta 2\pi$ mode, the two pions, in an I = 0 state, will appear as 2/3 $\pi^+\pi^-$, 1/3 $\pi^0\pi^0$. The η then decays into 27% visible decay products, 73% invisible, yielding the following four distinguishable configurations:

$$\eta' \to \pi\pi\eta = \begin{cases} \frac{2}{3}(\pi^+\pi^-\eta) \to \begin{cases} \frac{2}{3}\times 0.27\ \pi^+\pi^-\pi^+\pi^- \begin{cases}\gamma \\ \pi^0\end{cases} \\ \frac{2}{3}\times 0.73\ \pi^+\pi^- + (\eta \text{ decaying into neutrals}) \end{cases} \\ \frac{1}{3}(\pi^0\pi^0\eta) \to \begin{cases} \frac{1}{3}\times 0.27\ \pi^0\pi^0\pi^+\pi^- \begin{cases}\gamma \\ \pi^0\end{cases} \\ \frac{1}{3}\times 0.73 \text{ all neutrals} \end{cases} \end{cases}$$

A measurement of the rate of any of these final states is therefore equivalent to a measurement of the rate of $\eta' \to \pi\pi\eta$ (provided the decay is I-conserving). Of course for the final states arising from $\eta' \to \pi^0\pi^0\eta$, the presence of an η as an intermediate particle cannot be proved experimentally, at least in a bubble chamber. Our branching ratios for the η' have been calculated using the additional assumption that the only strong decay mode of the η' is $\eta' \to \pi\pi\eta$. This is based on the experimental result that the observed decay $\eta' \to \pi^+\pi^-\pi^+\pi^-\pi^0$ always proceeds via an intermediate $\pi^+\pi^-\eta$ state, and further on the fact that η' decay into $\pi^+\pi^-$, $\pi^+\pi^-\pi^0$, or $\pi^+\pi^-\pi^+\pi^-$ has not been observed.

(Since the strong decay and the $\pi^+\pi^-\gamma$ decay of the η' have comparable rates, one might worry about a possible I-nonconserving admixture in the $\eta' \to \pi\pi\eta$ decay amplitude. One may, however, expect such an amplitude to be considerably smaller than the amplitude for $\eta' \to \rho^0\gamma$, (a) because of the much smaller phase space, and (b) because such an amplitude would be either of the order e^2, or would represent an I-nonconserving part of the strong interaction, which is known to be very small.)


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                         REFERENCES FOR ETA PRIME

DAUBER    64 DUBNA CCNF 1 418  DAUBER,SLATER,L T SMITH,STORK,TICHO //UCLA
DAUBER 2  64 PRL 13 449        CAUBER,SLATER,SMITH,STORK,TICHO ///// UCLA
KALBFLEI  64 PRL 13 349        G.R.KALBFLEISCH,O.DAHL,A.RITTENBERG // LRL

BADIER    65 PL 17 337         BADIER,CEMOULIN,BARLOUTAUD +/PAR+SAC+ZEEMA
KIENZLE   65 PL 19 438         KIENZLE,MAGLIC,LEVRAT,LEFEBVRES + /// CERN
RITTENBE  65 PRL 15 556        RITTENBERG,KALBFLEISCH //////////  LRL+BNL
TRILLING  65 PL 19 427         +BROWN,GOLDHABERS,KADYK,SCANIO       // LRL

COHN      66 PL 21 347         COHN,MCCULLUCH,BUGG,CONDO//ORNL+TENN+UNCAR
LONDCN    66 PR 143 1034       LONDON,RAU,SAMIOS,GOLDBERG +//BNL+SYRACUSE

        CUANTUM NUMBER DETERMINATICNS NOT REFERRED TO IN THE DATA CARDS

GALTIERI  65 OXF.VCL.2,P.10    + RITTENBERG,IN ROSENFELD MESON REVIEW/LRL I=0
GALTIERI  66  BERKELEY CONF    +RITTENBERG, IN GOLDHABER MESON REVIEW/LRL I=0
MARTIN    66 PL 22,352         MARTIN,CRITTENDEN,SCHROEDER    // INDIANA U I

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H(975)

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                  35  H (975, JPG=  -)  I=0
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     *            EVICENCE NOT YET COMPELLING, OMITTED FROM TABLE
     *            FOR COMPILATION SEE GOLDHABER MESON REVIEW
     *            1966 BERKELEY CONFERENCE
                  ALSO COMPILED IN APPENDIX A.

                  35  H (975)  MASS  (MEV)

M   C   50  975.0    15.0           BARTSCH   64 HBC      4.0 PI+ P        8/66
M   C   30  975.0  APPROX           GOLDHABER 65 HBC      3.65 PI+P        9/66
M   C   30  998.     10.            BENSON    66 DBC      3.65 PI+D        9/66
M   C  EXPERIMENTS ABOVE COMPILED IN GOLDHABER 66 MESON REVIEW
M       50 1000.   APPROX.   COMP.BY GOLDHABER 66 RVUE  C  SEE ABOVE     P  9/66
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                  35  H (975) WIDTH  (MEV)

W   C   90  120.0                   BARTSCH   64 HBC      4.0 PI+ P        8/66
W   C   30   45.0    30.0           BENSUN    66 DBC      3.65 PI+ D      10/66
W       50   80.0  COMPILED BY      GOLDHABER 66 RVUE  C ONLY 3.65,4 PI P  9/66
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                  H MESON CROSS SECTION (MICROBARNS)

CS  *        75.0    15.0           BENSON    66 DBC  3.65 PI+D TC HPP     9/66
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                        REFERENCES FOR H MESON

BARTSCH  64 PL  11  167      AACHEN-ZEUTHEN-BIRM-BONN-HAMB-MUNCHEN CULL
GOLDHABE 65 CORAL GABLES P 76 G. GOLDHABER                        // LRL
BENSCN H 66  BERK.CONF - PRL  +MARQUIT,ROE,SINCLAIR,VANDER VELDE// MICH.
GOLDHABE 66  BERKELEY CONF    G.GOLDHABER,SAMIOS,ASTIER,SHEN,LAI.MESON REVIEW

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φ(1019)

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                  4   PHI (1019,JPC=1-- ) I=C

                  4   PHI  MASS (MEV)

M          1017.0     2.0           ARMENTERO 63 HBC
M          1019.0     2.0           SCHLEIN   63 HBC    2.0 K- P
M          1018.6     0.5           MILLER    65 HBC                        8/66
M          1019.      3.            BARLOW    66 HBC     1.2 PBAR P        11/66
M          1021.0     4.0           HESS      66 HBC     1-4 PI- P          9/66
M          1020.0     2.0           LONDON    66 HBC                        6/66
------ --------- --------- --------- --------- --------- --------- ---------

                  4   PHI  WICTH (MEV)

W             3.4     1.7           ARMENTERO 63 HBC
W    *   34   5.0  OR LESS          SCHLEIN   63 HBC
W             3.5     1.0           MILLER D  65 HBC                        8/66
W            10.      3.            BARLOW    66 HBC     1.2 PBAR P        11/66
W            10.0     3.0           HESS      66 HBC     1-4 PI- P          9/66
W             6.0     4.0           LONDON    66 HBC                        6/66
                       (Ideogram below)
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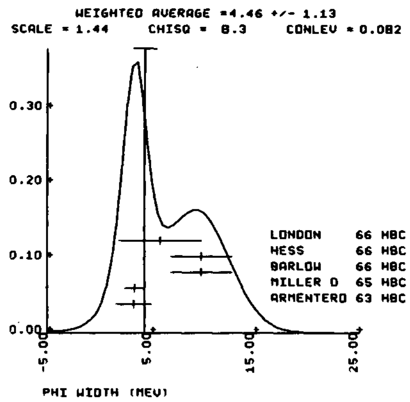


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                  4   PHI PARTIAL CECAY MODES

P1      PHI INTO K+ K-                                     S1CS10
P2      PHI INTO K01 K02                                   S11S11
P3      PHI INTO PI+ PI- PIO (INCLUDINC RHO PI)            S 8S 8S 9
P4      PHI INTO PI+ PI- (VIOLATES G)                      S 8S 8
P5      PHI INTO E+  E-                                    S 3S 3
P6      PHI INTO MU+ MU-                                   S 4S 4
P7      PHI INTO PIO GAMMA                                 S 9S 0
P8      PHI INTO ETA GAMMA                                 S14S 0
P9      PHI INTO PI+PI-GAMMA                               S 8S 8S 0
P10     PHI INTO OMEGA GAMMA (VIOLATES C)                  L 1S 0
P11     PHI INTO ETA PIO (VIOLATES C)                      S14S 9
P12     PHI INTO RHO GAMMA (VIOLATES C)                    L 9S 0
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                  4   PHI  BRANCHING RATIOS

                  PARTIAL MODES ACJUSTED BY PROGRAM   AHR=123

R1   *        PHI INTO (K+ K-)/TOTAL                       NLM 1
R1   *                                                     DEN 123
R1   B   27     0.26     0.06          BADIER    65 HBC                    10/66
R1   B        CCNTROVERSIAL BACKGROUNC SUBTRACTION
R1      252     0.48     0.04          LINDSEY   66 HBC                    10/66

R2   *        PHI INTO (K1 K2)/TOTAL                       NLM  2
R2   *                                                     DEN 123
R2   B   25     0.23     0.06          BADIER    65 HBC                    10/66
R2   B        CCNTROVERSIAL BACKGROUND SUBTRACTION
R2      167     0.40     0.04          LINDSEY   66 HBC                    10/66
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R3   *      PHI INTO (PI+ PI- PIO (INCL.RHO PI))/TOTAL    NLM   3
R3   *                                                     DEN 123
R3   B   57    0.51     0.09           BADIER    65 HBC                     10/66
R3   B       CONTROVERSIAL BACKGROUND SUBTRACTION
R3       30    0.12     0.08           LINDSEY   66 HBC                     10/66

R4   *      PHI INTO (K+ K-)/(K KBAR)                      NLM 1
R4   *                                                     DEN 12

R5   *      PHI INTO (K1 K2)/(K KBAR)                      NLM  2
R5   *                                                     DEN 12
R5             0.44     0.07           LONDON    66 HBC                     10/66
R5       10    0.40     0.10           SCHLEIN   63 HBC                     10/66

R6   *      PHI INTO (PI+ PI- PIO (INCL.RHO PI))/(K KBAR)NLM   3
R6   *                                                     DEN 12
R6             0.30     0.15           LONDON    66 HBC                     10/66

R7   *      PHI INTO (PI+ PI- PIO (INCL.RHO PI))/(K1 K2) NLM   3
R7   *                                                     DEN  2
R7   *         0.3    OR LESS          BERLEY    65 HBC                     10/66

R8   *      PHI INTO (PI+ PI-)/(K KBAR)                    NLM    4
R8   *                                                     DEN 12
R8   *         0.2    OR LESS          LONDON    66 HBC                     10/66

R9   *      PHI INTO (L+ E-)/(K KBAR)                      NLM     5
R9   *                                                     DEN 12
R9   *         0.0036 OR LESS          GALTIERI  65 HBC                     10/66
R9   *         0.002  OR LESS          AZIMOV    66 SPRK                    10/66

R10 *       PHI INTO (MU+ MU-)/(K KBAR)                    NLM      6
R10 *                                                      DEN 12
R10 *          0.0053 OR LESS          GALTIERI  65 HBC                     10/66

R11 *       PHI INTO (ETA GAMMA)/TOTAL                     NLM       8
R11 *                                                      DEN 123
R11 *          0.2    OR LESS          BADIER    65 HBC                     10/66
R11 *          0.08   OR LESS          LINDSEY   66 HBC                     10/66

R12 *       PHI INTO (PI+ PI- GAMMA)/(K KBAR)              NLM        9
R12 *                                                      DEN 12
R12 *          0.05   OR LESS          LINDSEY   65 HBC                     10/66

R13 *       PHI INTO (ETA NEUTRALS)/(K KBAR)               NLM       8  1
R13 *                                                      DEN 12
R13 *          0.15   OR LESS          LINDSEY   66 HBC                     10/66

R14 *       PHI INTO (OMEGA GAMMA) / TOTAL                 NLM        0
R14 *                                                      DEN 123
R14 *          0.05   OR LESS          LINDSEY   66 HBC                     10/66

R15 *       PHI INTO (RHO GAMMA) / TOTAL                   NLM          2
R15 *                                                      DEN 123
R15 *          0.02   OR LESS          LINDSEY   66 HBC                     10/66

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                          REFERENCES FOR PHI

BERTANZA 62 PRL 9 180          BERTANZA,BRISSON,CONNOLLY,HART + //BNL+SYR
ARMENTER 63 SIENA CONF 2 70    ARMENTEROS,EDWARDS,ASTIER+//CERN+CDF-PARIS
SCHLEIN  63 PRL 10 368         SCHLEIN,SLATER,SMITH,STORK,TICHO //// UCLA

BADIER   65 PL 17 337          BADIER,DEMOULIN,BARLOUTAUD+//PAR+LPCHE+ZEE
BERLEY   65 PR 139 B 1097      D BERLEY,N GELFAND ////////// BNL+COLUMBIA
GALTIERI 65 PRL 14 279         A BARBARO GALTIERI,R D TRIPP ///////// LRL
MILLER   65 CU-237 (NEVIS 131)DAVID C MILLER  (THESIS) //////// COLUMBIA
   MILLER 65 INCLUDES DATA OF GELFAND 63 BELOW
GELFAND  63 PRL 11 438         GELFAND,MILLER,NUSSBAUM,KIRSCH+//COLU+RUTG

AZIMOV   66  BERKELEY CONF.    AZIMOV,BALDIN,BELOUSOV,CHUVILO +  // DUBNA
BARLOW   66  CERN-TC66-22 -NC BARLOW,D.ANDLAU+ //// CERN+PARIS+LIVERPOOL
HESS     66  BERKELEY CONF.    +DAHL,HARDY,KIRZ,D.H.MILLER          // LRL
LINDSEY  66 PR  147  913       JAMES S LINDSEY, GERALD A SMITH  ////  LRL
   LINDSEY 66 INCLUDES DATA OF LINDSEY 65 AND 66 BELOW
LINDSEY  65 PRL 15 221         JAMES S LINDSEY,GERALD A SMITH /////// LRL
LINDSEY  66 PL 20 93           J S LINDSEY,G A SMITH //////////////// LRL
LONDON   66 PR 143 1034        LONDON,RAU,SAMIOS,GOLDBERG +//BNL+SYRACUSE

        QUANTUM NUMBER DETERMINATIONS NOT REFERRED TO IN THE DATA CARDS

GRAY, L  66 PRL  17  501       +HAGERTY,BIZZARRI,CIAPETTI +   // SYR+ROME JPG

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η_V (1050) $\to K_S K_S$

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            3 ETA (1050,JPG=0++)I=0

            NAMED S* BY CRENNELL ET AL.
            MAY BE JUST LARGE S-WAVE SCATTERING LENGTH

            3 ETA (1050) MASS (MEV)

M    *      1000.0     APPROX           BINGHAM   62 PBC
M    *      1000.0     APPROX           BIGI      62 HBC
M    *      1000.0                      ERWIN     62 HBC                    10/66
M    *   30 1030.0     APPROX.          BALTAY    64 HBC
M    *      1025.0     APPROX.          BARMIN    64 HLBC                    6/66
M        35 1045.        9.             BARLOW    66 HBC      1.2 PBAR P    11/66
M       135 1056.0                      BEUSCH    66 SPRK                    9/66
M        20 1068.0      10.0            CRENNELL  66 HBC        6.0 PI- P    6/66
M    H  120  SCATT.LENGTH FITS BETTER.  HESS      66 HBC      1.6-4.2 PI- P 10/66

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            3 ETA (1050) WIDTH (MEV)

W        35   50.       24.             BARLOW    66 HBC      1.2 PBAR P    11/66
W             50.0                      BEUSCH    66 SPRK                    9/66
W        20   80.0      15.0            CRENNELL  66 HBC                     6/66

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            3 ETA (1050) PARTIAL DECAY MODES

P1          ETA (1050) INTO KKBAR
P2          ETA (1050) INTO PIPI

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            3 ETA (1050) BRANCHING RATIOS

R1   *      ETA (1050) INTO (PI PI)/(K KBAR)            (P1)/(P2)
R1   *         2.5    OR LESS           CRENNELL  66 HBC      90 PCT CONF LEV  7/66

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                          REFERENCES FOR ETA(1050)

BIGI     62 CERN CONF 247      A BIGI,S BRANDT, R CARRARA + ///////  CERN
BINGHAM  62 CERN CONF 240      H H BINGHAM,M BLOCH + //PARIS+EC POLY+CERN
ERWIN    62 PRL 9 34           ERWIN,HOYER,MARCH,WALKER,WANGLER //WIS+BNL

BALTAY   64 DUBNA CONF 1 409  BALTAY,LACH,CRENNELL,OREN,STUMP +/YALE+BNL
BARMIN   64 DUBNA CONF 1 433  BARMIN,DOLGOLENKO,YEROFEEV,KRESTNI+// ITEP
BARLOW   66  CERN-TC66-22 -NC BARLOW,C.ANDLAU+ //// CERN+PARIS+LIVERPOOL
BEUSCH   66  BERKELEY CONF     BEUSCH,FISCHER,ASTBURY,MICHELINI+/ETH+CERN
CRENNELL 66 PRL 16 1025        CRENNELL,KALBFLEISCH,LAI,SCARR,SCHU+ //BNL
CRENNEL2 66  BERKELEY CONF     +KALBFLEISCH,LAI,SCARR,SCHUMANN+////// BNL I,JP
   CRENNELL 2 HAS MORE DATA THAN CRENNELL  BUT SAME CONCLUSIONS
HESS     66 UCRL-16832         R I HESS (THESIS, BERKELEY)          // LRL
  HESS REPLACES  PRL 9 460     ALEXANDER,DAHL,JACOBS,KALBFLEISCH + // LRL

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f (1250)

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            5  F  (1250,JPG=2++)  I=0

            5  F   MASS (MEV)

M             1250.0    25.0            SELOVE    62 HBC
M             1260.0    35.0            VEILLET   63 FBC
M           5 1250.0                    GUIRAGOSS 63 HBC
M           5 1260.0                    BONDAR    63 HBC
M             1250.0                    LEE       64 HBC
M             1240.0    20.0            ACCENSI   66 HBC                     6/66
M    *        1255.     13.             BARLOW    66 HBC    (K01 K01 MODE)  11/66
M             1275.0    25.0            WAHLIG    66 SPRK                    6/66

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            5  F   WIDTH (MEV)

W              100.0    25.0            SELOVE    62 HBC
W    *         200.0   OR LESS          VEILLET   63 FBC
W          85  160.0                    BONDAR    63 HBC
W              130.0    20.0            LEE       64 HBC
W              102.0    46.0            ACCENSI   66 HBC                     6/66
W    *          82.     34.             BARLOW    66 HBC    (K01 K01 MODE)  11/66
W              100.                     WAHLIG    66 SPRK                   11/66

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            5  F  PARTIAL DECAY MODES

P1       F  INTO PI+ PI-                                  S 8S 8
P2       F  INTO 2PI+ 2PI-                                S 8S 8S 8S 8
P3       F  INTO K KBAR                                   S12S12

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            5  F   BRANCHING RATIOS

R1   *  F  INTO (4PI)/(2PI)                               (P2)/(P1)
R1             0.08     0.06            BONDAR    63 HBC
R1   *         0.04   OR LESS           CHUNG     65 HBC

R2   *  F INTO (K KBAR)/(PI PI)                           (P3)/(P1)
R2             0.09   OR LESS           BARMIN    65                        10/66
R2   *         0.16   OR LESS           WANGLER   65 HBC
R2   *         0.06   OR LESS           BRANDT    66 HBC     CONF.LIMIT 0.95  9/66
R2   *         0.05 OR LESS             DEUTSCHMA 66 HBC                     6/66
R2             0.023     0.006          FISCHER   66 SPRK                    9/66
R2   *         0.025 OR LESS            HESS      66 HBC   -  1.6-4.2 PI- P 10/66

R    *FOR 2+ NONET SU3 RATES SEE E.G. GLASHOW,SOCOLOW, PRL 15,329(65)

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                          REFERENCES FOR F

SELOVE   62 PRL 9 272          SELOVE,HAGOPIAN,BRODY,BAKER,LEBOY // PENNA
BONDAR   63 PL 5 153           BONDAR+//AACHEN+BIRM+BONN+DESY+IC-LOND+MPI
VEILLET  63 PRL 10 29          VEILLET,HENNESSY,BINGHAM,BLOCH+//PAR+MILAN
LEE      64 PRL 12 342         LEE,ROE,SINCLAIR,VANDERVELDE //// MICHIGAN

BARMIN   65 SJNP 1 870         +DOLGOLENKO+EROFEEV+KRESTNIKOV+/ ITEP MOSC
CHUNG    65 PRL 15 325         CHUNG,DAHL,HARDY,HESS,JACOBS,KIRZ //// LRL
GUIRAGOS 65 PRL 11 85          Z G T GUIRAGOSSIAN  ////////////////// LRL
WANGLER  65 PR  137 B 414      T P WANGLER,A R ERWIN,W WALKER //WISCONSIN

ACCENSI  66 PL 20 557          ACCENSI,ALLES-BORELLI,FRENCH,FRISK+ //CERN
BARLOW   66  CERN-TC66-22 -NC BARLOW,C.ANDLAU+ //// CERN+PARIS+LIVERPOOL
BEUSCH   66   (PREPRINT)       BEUSCH,FISCHER,ASTBURY,MICHELINI+/ETH+CERN
BRANDT   66  BERKELEY CONF.    BRANDT,COCCONI,CZYZEWSKI+ //CERN+CRAC+WARS
DEUTSCHM 66 PL 20 82           DEUTSCHMANN,STEINBERG + //AACH+BERLIN+CERN
FISCHER  66  PRIVATE COMMUN.   W E FISCHER (BASED ON BEUSCH 66)//ETH+CERN
HESS     66 UCRL-16832         R I HESS (THESIS, BERKELEY)          // LRL
WAHLIG   66 PR  147  941       +SHIBATA,GORDON,FRISCH,MANNELLI //MIT+PISA  J

        QUANTUM NUMBER DETERMINATIONS NOT REFERRED TO IN DATA CARDS

HAGOPIAN 63 PRL 10 533         V HAGOPIAN,W SELOVE //////////////// PENNA
ADERHOLZ 64 PL 10 240          AACHEN+BERLIN+BIRM+BONN+HAMBUR+IC-LOND+MPI  IJ
BRUYANT  64 PL 10 232          BRUYANT,GOLDBERG,HOLDER,FLEURY,HUC/CERN+PA  I
SODICKSO 64 PRL 12 485         SODICKSON,WAHLIG,MANNELLI,FRISCH+ //// MIT  I
BARMIN   65 SJNP 1 230         +DOLGOLENKO,ELENSKY,EROFEEV+ / ITEP MOSCOW   JP

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D (1285)

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            8  D MESON (1285,JPG=  +) I=0

            JPG DISCUSSED AT OXFORD, SEE ROSENFELD 65

            8  D MESON  MASS (MEV)

M            1290.0      8.0            D.ANDLAU  65 HBC
M            1283.0      5.0            HESS      66 HBC      1.6-4.2 PI- P 10/66

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            8  D MESON WIDTH (MEV)

W              25.0     15.0            D.ANDLAU  65 HBC                     9/66
W              35.0     10.0            HESS      66 HBC      1.6-4.2 PI- P 10/66

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            8   D MESON PARTIAL DECAY MODES

P1          D MESON INTO K KBAR PI                        S11S11S 9
P2          D MESON INTO PI PI RHO                        S 9S 9U 9

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                    8  D MESON BRANCHING RATIOS

R1   *      D MESCN INTO (PI PI RHO) / (K KBAR PI)        NLM  2
R1   *                                                    DEN 1
R1   *        2.0   OR LESS            HESS      66 HBC    C CHARGED PI ONLY 10/66

R    *FOR 1+ NONET SU3 RATES SEE E.G. GOLDHABER, REVIEW BERKELEY CONF.1966

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REFERENCES FOR D MESON


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D.ANDLAU 65 PL 17 347          D.ANDLAU,ASTIER,BARLOW +//CDF+CERN+RAD+LIV
HESS     66 UCRL-16832         R I HESS (THESIS, BERKELEY)          // LRL
SEE ALSO 65 PRL 14 1074        MILLER,CHUNG,DAHL,HESS,HARDY,KIRZ+//LRL+UC
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E (1420)

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6  E MESON  (1420,JPG=  +)  I=C

                    6  E MESON MASS (MEV)

M          1425.       7.              BAILLON    66 HBC     C. PBAR P        11/66
M          1420.0     20.0             HESS       66 HBC      1.6-4.2 PI- P   10/66

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                    6  E MESCN WIDTH (MEV)

W            80.      10.              BAILLON    66 HBC     C. PBAR P        11/66
W            60.0     20.0             HESS       66 HBC      1.6-4.2 PI- P   10/66

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                    6  E MESON PARTIAL DECAY MODES

P1          E INTO K K*(890)                                 S10U18
P2          E INTC K KBAR PI                                 S12S12S 8
P3          E MESON INTO PI PI RHO                           S 9S 9U 9
P4          E INTO PI(1003) PI                               U16S 8

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                    6   E MESON BRANCHING RATIOS

R1   *      E INTO K K*(890)/((K K*)+(PI(1003) PI))      NLM 1
R1   *                                                   DEN 1  4
R1   *        .50      .10             BAILLON    66 HBC                      11/66

R2   *      E MESCN INTO (PI PI RHO) / (K KBAR PI)       NLM   3
R2   *                                                   DEN  2
R2   *        2.0   OR LESS            HESS       66 HBC    C CHARGED PI CNLY 10/66

R    *FOR 1+ NONET SU3 RATES SEE E.G. GOLDHABER, REVIEW BERKELEY CONF.1966

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REFERENCES FOR E MESON


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ARMENTER 64 DUBNA CCNF 1 467   ARMENTEROS,EDWARDS,JACOBSEN,ASTIER+ //CERN
ROSENFEL 65 OXFCRD CONF 58     A H ROSENFELD ////////////////// LRL--RVUE
BAILLON  66   PREPRINT - NC    +EDWARDS+D.ANDLAU+ASTIER+ //// CERN+CDF+IR
BARASH   66  CU258(NEVIS 154)  BARASH,KIRSCH,MILLER,TAN //////// COLUMBIA
HESS     66 UCRL-16832         R I HESS (THESIS, BERKELEY)          // LRL
SEE ALSO 65 PRL 14 1074        MILLER,CHUNG,DAHL,HESS,HARDY,KIRZ+ /LRL+UC
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$K_s K_s$(1440) $\rho\rho$ (1410)

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29  KSKS(1440) AND RHORHO(1410) (JPG=  +) I GTE 0

EVIDENCE NOT YET COMPELLING, OMITTED FROM TABLE

                    29  KSKS AND RHORHO MASS  (MEV)

M          1410.0                      BETTINI    66 DBC   C  0. PBARP TO 5PR  9/66
M          1439.0   SHOULDER ON A2     BEUSCH     66 SPRK    5-12 PI- P        9/66

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                    29  KSKS AND RHORHO WIDTH (MEV)

W            90.0                      BETTINI    66 DBC   C 0. PBAR P TO 5PR  9/66
W            43.0       40.0           BEUSCH     66 SPRK    5-12 PI- P        9/66

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REFERENCES FOR KSKS(1440) AND RHO RHO(1410)


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BETTINI  66 NC 42A 695         +CRESTI,LIMENTANI,LORIA,PERUZZO+//PAD+PISA
BEUSCH W 66  BERKELEY CONF     +ASTBURY,FINOCCHIARO,MICHELIN//CERN,ZURICH
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f′(1500)

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13  F PRIME (1500,JPG=2++)  I=C

                    13  F PRIME(1500) MASS (MEV)

M    *    14 1480.0                    CRENNELL  66 HBC       6.0 PI- P        8/66
M         35 1514.0     16.0           BARNES    66 HBC  K1 K1 ONLY 5.0 K-P    9/66

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                    13  F PRIME(1500) WIDTH (MEV)

W         35   86.      23.            BARNES    66 HBC  K1 K1 ONLY 5.0 K-P   10/66

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                    13  F PRIME PARTIAL DECAY MODES

P1          F PRIME INTO PI+ PI-                             S08S08
P2          F PRIME INTO K KBAR                              S12S12
P3          F PRIME INTO K K*(890)                           S10U18
P4          F PRIME INTO ETA ETA                             S14S14

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                    13  F PRIME BRANCHING RATIOS

R1   *      F PRIME INTO (PI+ PI-)/(K KBAR)              (P1)/(P2)
R1   *         0.14  OR LESS           BARNES    66 HBC     CONF.LIMIT 0.95  10/66
R1   N  SU3     .03  ESTIMATE FROM SU3 GLASHOW   65  SU3

R2   *      F PRIME INTO (K KBAR) / TOTAL                (P2)/TOTAL
R2   X         0.64     0.31           GOLDBERG  66, WITHDRAWN                 8/66
R2   X   BARNES 66 POINT OUT THAT F PRIME UNRESOLVABLE FROM E MESON

R3   *      F PRIME INTO (ETA ETA)/(K KBAR)              (P4)/(P2)
R3   *         1.0   OR LESS           BARNES    66 HBC     CONF.LIMIT 0.95  10/66

R    *FOR 2+ NONET SU3 RATES SEE E.G. GLASHOW,SOCOLOW, PRL 15,329(65)

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REFERENCES FOR F PRIME


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GLASHOW  65 PRL 15 329         S L GLASHOW, R H SOCOLOW      //SU3 BERKELEY
BARNES   66  BERKELEY CONF.    +CORNAN,GUIDONI,KALBFLEISCH,LONDON/BNL,SYR I=0
BARNES   65 PRL 15 322         REPLACED BY REFERENCE ABOVE
CRENNELL 66 PRL  16  1025      + KALBFLEISCH,LAI,SCARR,SCHUMANN +  // BNL I
GOLDBERG 66  SUBMITTED TO NC   + LEITNER,MUSTO,O RAIFEARTAIGH  //SYRACUSE
CRENNEL2 66  BERKELEY CONF     +KALBFLEISCH,LAI,SCARR,SCHUMANN+////// BNL I=0
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ρ (760)

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9 RHO (760,JPG=1-+)  I=1

             9 RHO  MASS (MEV)

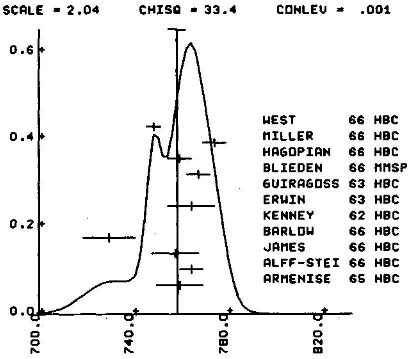
M+  C       760.0     9.0          CARMONY   64 HBC  +
M+  C   CARMONY  MASS CALCULATED FOR MOMENTUM TRANSFER LESS THAN 4 (MPI**2)
M+          760.      10.          ARMENISE  65 HBC  +
M+          765.0      5.0         ALFF-STEI 66 HBC  +   2-3 PI+ P         6/66
M+  *       783.0      6.0         JAMES     66 HBC    + 2.1 PI+ P         6/66
M+          758.0     10.0         JAMES     66 HBC  SEE NOTE J BELOW      8/66
M+  J   FROM JAMES WE USE MASS CALC FOR MOMENTUM TRANSFER LESS THAN 2.5 MPI**2

M+          750.0      3.0         BALTAY    66 HBC  +-  0.0 PBARP         6/66
M+          730.      11.          BARLOW    66 HBC  +- 1.2 PBAR P        11/66

M-  *       748.0                  KENNEY    62 HBC  -
M-          765.0     10.0         ERWIN     63 HBC  -
M-  * 130   775.0                  GUIRAGOSS 63 HBC  -
M-          768.0      5.0         BLIEDEN   65 MMSP -  3-5 PI- P          6/66
M-          772.0     19.0         FIDECARO  66 SPRK -  2.5 PI-,T CJT18  11/66
M-          760.0      5.0         HAGOPIAN  66 HBC  -  3.0 PI- P          6/66
M-  *       777.0      6.0         MILLER    66 HBC  -  2.7 PI-,T CJT 5    9/66
M-          775.0      5.0         MILLER    66 HBC  -  2.7 PI-,T CJT10    9/66
M-  *       768.0      5.0         MILLER    66 HBC  -  2.7 PI-,T CJT20    9/66
M-          749.0      3.0         WEST      66 HBC  -  2.1 PI- P         10/66
```

(Ideogram below)

WEIGHTED AVERAGE =758.97 +/- 3.67
SCALE = 2.04   CHISQ = 33.4   CONLEV = .001



RHO +- MASS (MEV)

```
MO  *  190  750.0     20.0         SAMIOS    62 HBC   0
MO     300  760.0     10.0         ABOLINS   63 HBC   0
MO          763.0     10.0         ERWIN     63 HBC   0
MO  *  160  775.0                  GUIRAGOSS 63 HBC   0
MO     500  770.0     10.0         GOLDHABER 64 HBC   0
MO  *       735.0     10.0         ALYEA     65 DBC   0 2.2 K- P            6/66
MO          750.0                  CLARK     65 SPRK  0
MO          763.0                  DERADO    65 DBC   0 4.0 PI- P           6/66
MO          750.0     15.0         GUTAY     65 HBC   0 2.0 PI- P           6/66
MO  N       736.0                  CLARK     65 SPRK  0 1.5 PI- P          10/66
MO  N  AT PI PI SCATT.ANGLE OF 90 DEG.WITHOUT INTERFERENCE WITH NONRES.BACKGD
MO  M       753.0                  CLARK     65 SPRK  0 1.5 PI- P          10/66
MO  M  AT PI PI SCATT.ANGLE OF 90 DEG. ALLOWING FOR INTERF.WITH NONRES.BACKGD
MO          768.0     14.0         ACCENSI   66 HBC   0 5.7 PBARP           6/66
MO          750.0      5.0         ALFF-STEI 66 HBC   0 2-3 PI+ P           6/66
MO          749.4      3.3         BALTAY    66 HBC   0 0.0 PBARP           6/66
MO          745.       9.          BARLOW    66 HBC   0 1.2 PBAR P         11/66
MO          773.0     12.0         CASON     66 HBC   0 7.0 PI- P           9/66
MO          775.0      5.0         HAGOPIAN  66 HBC   0 3.0 PI- P           6/66
MO          765.0      8.0         JAMES     66 HBC   0 2.1 PI+ P           6/66
MO          770.0      4.0         MILLER    66 HBC   0 2.7 PI-,T CJT20     9/66
MO          760.0      3.0         WEST      66 HBC   0 2.1 PI- P          10/66

MO  P  IN PHOTOPRODUCTION EXPERIMENTS THE RHOO MASS VALUE APPEARS SHIFTED
MO  P       740.0     10.0         LANZEROTT 65 CNTR  0 GAMMA P            10/66
MO  P       728.0      8.0         CAMBRIDGE 66 HBC   0 1.0-6.0 GAMMA P    10/66
MO  P       728.0      6.0         GERMAN CO 66 HBC   0 3.5-5.8 GAMMA P    10/66
```

(Ideogram on next page)

```
M      290  755.0                  CHADWICK  63 HBC  +-0

M           740.0                  WALKER    62 HBC  -0
M      240  752.0                  ALITTI    63 HBC  -0
M           765.0                  LEE       65 HBC  -0

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             9  RHO  WIDTH (MEV)

W+  C        77.0     20.0         CARMONY   64 HBC  +
W+  C   CARMONY WIDTH CALCULATED FOR MOMENTUM TRANSFER LESS THAN 4 (MPI**2)
W+           90.0     10.0         SACLAY    63 HBC  +
W+          160.      10.          ARMENISE  65 HBC  +
W+          100.0                  ALFF-STEI 66 HBC  +   2-3 PI+ P         6/66
W+  *       177.0     15.0         JAMES     66 HBC    + 2.1 PI+ P         7/66
W+          147.0     19.0         JAMES     66 HBC  SEE NOTE J BELOW      8/66
W+  J  FROM JAMES WE USE WIDTH CALC FOR MOMENTUM TRANSFER LESS THAN 2.5 MPI**2

W+          150.0     30.0         BALTAY    66 HBC  +-  0.0 PBARP         6/66
W+          130.      25.          BARLOW    66 HBC  +- 1.2 PBAR P        11/66
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W-	*		65.0	20.0		ERWIN	63	HBC	-		
W-	*	130	125.0			GUIRAGOSS	63	HBC	-		
W-		98	180.0			BONDAR	64	HBC	-		
W-			127.0	5.0		BLIEDEN	66	MMSP	-	3-5 PI- P	6/66
W-			150.0	20.0		HAGOPIAN	66	HBC	-	3.0 PI- P	6/66
W-	*		137.0	17.0		MILLER	66	HBC	-	2.7 PI-,T CJT 5	9/66
W-			145.0	12.0		MILLER	66	HBC	-	2.7 PI-,T CJT10	9/66
W-	*		153.0	13.0		MILLER	66	HBC	-	2.7 PI-,T CJT20	9/66
W-			149.0	13.0		WEST	66	HBC	-	2.1 PI- P	10/66
W0	*	190	150.0	20.0		SAMIOS	62	HBC	0		
W0	*	160	175.0			GUIRAGOSS	6	H			
W0		300	90.0	10.0		ABOLINS	63	HBC	0		
W0			165.0	20.0		ERWIN	63	HBC	0		
W0		96	210.0			BONDAR	64	HBC	0		
W0		500	130.0			GOLDHABER	64	HBC	0		
W0			110.0	20.0		ALYEA	65	DBC	0	2.2 K- P	6/66
W0			130.0			CLARK	65	SPRK	0		
W0			150.0			DERADO	65	HBC	0	4.0 PI- P	6/66
W0			80.0	15.0		GUTAY	65	HBC	0	2.0 PI- P	6/66
W0	*		150.0	10.0		LANZEROTT	65	CNTR	0		
W0			72.0	30.0		ACCENSI	66	HBC	0	5.7 PBARP	6/66
W0			100.0			ALFF-STEI	66	HBC	0	2-3 PI+ P	6/66
W0			146.0	17.0		BALTAY	66	HBC	0	0.0 PBARP	6/66
W0			92.	42.		BARLOW	66	HBC	0	1.2 PBAR P	11/66
W0	*		175.0			CAMBRIDGE	66	HBC	0	5-6 GAM P	9/66
W0			57.0	25.0	15.0	CASON	66	HBC	0	7.0 PI- P	9/66
W0			120.0	10.0		HAGOPIAN	66	HBC	0	3.0 PI- P	6/66
W0			103.0	13.0		JAMES	66	HBC	0	2.1 PI+ P	6/66
W0			160.0	15.0		MILLER	66	HBC	0	2.7 PI-,T CJT20	9/66
W0			173.0	13.0		WEST	66	HBC	0	2.1 PI- P	10/66

(Ideograms below)

W		290	110.0			CHADWICK	63	HBC	+-0		
W			120.0			WALKER	62	HBC	-0		
W			125.0	15.		LEE	65	HBC	-0		
W	*		170.0			WOLF	65	RVUE			6/66

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9 RHO PARTIAL DECAY MODES

P1	RHO INTO 2PI	S 8S 8
P2	RHO INTO 4PI	S 8S 8S 8S 8
P3	RHO INTO PI GAMMA	S 8S 0
P4	RHO INTO E+ E-	S 3S 3
P5	RHO INTO PI ETA	S 8S14
P6	RHO INTO MU+ MU-	S 4S 4

9 RHO BRANCHING RATIOS

R1 * RHO INTO 4PI/2PI (P2)/(P1)

R1 * RHO+- INTO (PI+- PI+ PI- PI0) / (PI+- PI0)
R1 * 0.026 OR LESS BLIEDEN 66 MMSP - 3-5 PI- P 6/66
R1 * 0.01 OR LESS DEUTSCHMA 66 HBC + 8.0 PI+ P 6/66
R1 * 0.002 OR LESS FERBEL 66 HBC +- PI+- P ABOVE 2.5 10/66
R1 * 0.0035 0.004 JAMES 66 HBC 11/66

R1 * RHO 0 INTO (PI+ PI- PI+ PI-) / (PI+ PI-)
R1 * 0.008 OR LESS JAMES 66 HBC + 6/66
R1 * 8 0.006 OR LESS GERMAN CO 66 HBC 0 3.5-5.5 GAMMA P 10/66

R2 * RHO INTO PI GAMMA/2PI (P3/P1)
R2 * 0.02 OR LESS DAUDIN 64 HBC +
R2 N 0.02 OR LESS LANZEROTT 65 CNTR 11/66
R2 N ONE PION EXCHANGE MODEL USED IN THIS ESTIMATION
R2 * 0.005 OR LESS FIDECARO 66 SPRK - 0.97 CONF LEV 10/66
R2 M 0.004 OR LESS GERMAN CO 66 HBC 0 3.5-5.5 GAMMA P 10/66
R2 M ONE PION EXCHANGE MODEL USED IN THIS ESTIMATION
R2 * 0.007 OR LESS HUSON 66 HLBC - 6/66

R3 * RHO INTO(E+ E-)/(PI+PI-) (UNITS 10**-4) (P4)/(P1)
R3 0.65 1.1 0.5 HERTZBACH 66 SPRK ASSUME SU(3)+MIXING 10/66

R4 * RHO INTO (PI ETA)/(2PI) (P5)/(P1)
R4 * 0.03 OR LESS DEUTSCHMA 66 HBC + 8.0 PI+ P 6/66

R5 * RHO INTO (MU+ MU-)/(PI+ PI-) (UN 10**-4) (P6)/(P1)
R5 0.33 0.16 0.07 DE PAGTER 66 CNTR 0 5.2 GAM P 6/66
R5 * 14. OR LESS HERTZBACH 66 SPRK 10/66

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REFERENCES FOR RHO

ANDERSON 61 PRL 6 365 ANDERSON,BANG,BURKE,CARMONY,SCHMITZ // LRL
KENNEY 62 PR 126 736 V P KENNEY,W D SHEPHARD,C D GALL /KENTUCKY
SAMIOS 62 PRL 9 139 SAMIOS,BACHMAN,LEA+ // BNL+CCNY+COLUM+KENT
WALKER 62 CERN CONF 42 W D WALKER,E WEST A R ERWIN + // WISCONSIN
XUONG 62 PR 128 1849 NGUYEN HUU XUONG,GERALD R LYNCH ////// LRL

ABOLINS 63 PRL 11 381 ABOLINS,LANDER,MEHLHOP,NGUYEN,YAGER / UCSD
ALITTI 63 NC 29 515 ALITTI,BATON,ARMENISE+/SAC+ORSAY+BARI+BOLO
CHADWICK 63 PRL 10 62 CHADWICK,DAVIES,DERRICK,CRESTI + / OXF+PAD
GUIRAGOS 63 PRL 11 85 ZAVEN GUIRAGOSSIAN ////////////////////// LRL
ERWIN 63 SIENA CONF 1 112 ERWIN,SATTERBLOM,WALKER,WEST /// WISCONSIN
SACLAY 63 SIENA CONF 1 239 SACLAY+ORSAY+BARI + BOLOGNA(COLLABORATION)

BATON 64 NC 35 713 BATON,BERTHELOT,ALLES,BORELLI + /CEN+BOLOG
BONDAR 64 NC 31 729 BONDAR+//AACHEN+BIRM+BONN+DESY+IMP-COL+MPI
CARMONY 64 DUBNA CONF 1 486 CARMONY,HOA,LANDER,NG H XUONG,YAGER //UCSD
DAUDIN 64 REPORT CEA-R-2525 DAUDIN,JABIOL,MONGELLI + ///// SACLAY+BARI
GOLDHABE 64 PRL 12 336 GOLDHABER,BROWN,KADYK,SHEN,TRILLING/LRL+UC

ALYEA 65 PL 15 82 ALYEA,CRITTENDEN,MARTIN,RHODE + // INDIANA
ARMENISE 65 NC 37 361 SACLAY+ORSAY+BARI+BOLOGNA (COLLABORATION)
BLIEDEN 65 PL 19 444 BLIEDEN,FREYTAG,GEIBEL,HASSAN + ///// CERN
CLARK 65 PR 139 B 1556 A CLARK,CHRISTENSON,CRONIN,TURLAY/PRINCETO
DERADO 65 PRL 14 872 DERADO,KENNEY,POIRIER,SHEPHARD//NOTRE DAME
GUTAY 65 NC 39 381 GUTAY,LANNUTTI,TULI ////////////// FLORIDA
LANZEROT 65 PRL 15 210 LANZEROTTI,BLUMENTHAL,EHN,FAISSLER +/HARVD
LEE 65 MICH 04938 YONG-YUNG LEE ////////////////// MICHIGAN
WOLF 65 PL 19 328 G WOLF //////////////////////////// DESY
ZDANIS 65 PRL 14 721 ZDANIS,MADANSKY,KRAEMER + //////// JHU+BNL

ACCENSI 66 PL 20 557 ACCENSI,ALLES-BORELLI,FRENCH,FRISK+// CERN
ALFF-STE 66 PR 145 1072 ALFF-STEINBERGER,BERLEY,BRUGGER+//COL+RUTG
BALTAY 66 PR 145 1103 +FRANZINI,LUTJENS,SEVERINS,TYCKO+/COLUMBIA
BARLOW 66 CERN-TC66-22 -NC BARLOW,D.ANDLAU+ //// CERN+PARIS+LIVERPOOL
BLIEDEN 66 NC 43 71 +FREYTAG,GEIBEL,HASSAN,KIENZLE+ ///// CERN
CAMBRIDG 66 PR 146 994 CAMBRIDGE BUBBLE CHAMBER GROUP //MIT+HARV+
CASON 66 PR 148 1282 N M CASON // WISCONSIN
DE PAGTE 66 PRL 16 35 DE PAGTER+//CAM EL ACC+MIT+NORTHEAST+ SLAC
DEUTSCHM 66 PL 20 82 DEUTSCHMANN,STEINBERG +//AACH+BERLIN+ CERN
FERBEL 66 PL 21 111 FERBEL ////////////////////////// ROCHESTER
FIDECARO 66 PL 23 163 G+M FIDECARO,J POIRIER,P SCHIAVON // CERN
GERMAN C 66 BERKELEY CONF GERMAN COLL./ AACH+BERL+BONN+HAMB+HEID+MUN
HAGOPIAN 66 PR 145 1128 HAGOPIAN,SELOVE,ALITTI,BATON+//PENN+SACLAY
HERTZBAC 66 PREPRINT HERTZBACH,KRAEMER,MADANSKI,ZDANIS+/JHU+BNL
(SEE ALSO ZDANIS 65)
HUSON 66 PL 20 91 HUSON,ALLARD,DRIJARD,HENNESSY + //ORSAY+EP
JAMES 66 PR 142 896 F E JAMES,KRAYBILL /////// YALE+BROOKHAVEN
MILLER 66 BERKELEY CONF. MILLER,GUTAY,JOHNSON,LOEFFLER + // PURDUE
WEST 66 PR 149 1089 WEST,BOYD,ERWIN,WALKER ///////// WISCONSIN

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δ (965) 36 DELTA MESON (963,JPG=) I = 1

COMPILATION AVAILABLE SEPARATELY IN UCRL-8030-SPECTRA

36 DELTA (963) MASS (MEV)

M SEE GOLDHABER MESON REVIEW, 1966 BERKELEY CONF

M			910.		TURKOT	63	MMS	+	3.3 PP TO D + MM	10/66
M		262	962.0	5.0	KIENZLE	65	MMS	-	3-5 PI- P	9/66
M	*	36	965.0		ALLEN	66	HBC	-	1.7 PI- P	9/66
M		106	965.0	COMPILATION BY	ALLEN	66	HBC	+-0	1-8 PI P	9/66
M			966.0	8.0	OOSTENS	66	MMS	+	3. P P TO D + MM	9/66

FOR RESULTS WHICH DO NOT SUPPORT ALLEN 66, SEE JACOBS 66 AND WEST 66

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36 DELTA (963) WIDTH (MEV)

W	262	50.		TURKOT	63	MMS	+	3.3 PP TO D + MM	10/66
W	262	5.0	OR LESS	KIENZLE	65	MMS	-	3-5 PI- P	9/66
W	36	25.	OR LESS	ALLEN	66	HBC	-	1.7 PI- P	9/66
W		10.0	OR LESS	OOSTENS	66	MMS	+	3. P P TO D + MM	9/66

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36 DELTA MESON PARTIAL DECAY MODES

P1		DELTA MESON INTO 2 PI	S 8S 8
P2		DELTA MESON INTO 3 PI	S 9S 9S 9
P3		DELTA MESON INTO 4 PI	S 9S 9S 9S 9
P4	*	DELTA MESON INTO 5 PI	
P5		DELTA MESON INTO ETA PI	S14S 9
P6		DELTA MESON INTO RHO PI	L 9S 9

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36 DELTA MESON BRANCHING RATIOS

R1 CHARGED DELTA INTO (1 CHARGED) / (3 OR MORE CHARGED)
R1 1.3 0.9 0.7 KIENZLE 66 MMS - 3-5 PI- P 9/66

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REFERENCES FOR DELTA(963)

TURKOT 63 SIENNA CONF 1 661 +COLLINS,FUJII,KEMP+ ////// BNL+PITTSBURGH
KIENZLE 65 PL 19 438 + MAGLIC,LEVRAT,LEFEBVRES + // CERN
ALLEN D 66 PL 22 543 +GP FISHER,G GODDEN,L MARSHALL,SEARS//COLO G=+
JACOBS 66 DISS. BERKELEY L.D.JACOBS //////////////////////////// LRL
OOSTENS 66 PL 22 708 +CHAVANON,CROZON,TOCQUEVILLE // SACLAY,CF I=1
WEST 66 PR 149 1089 WEST,BOYD,ERWIN,WALKER ///////// WISCONSIN

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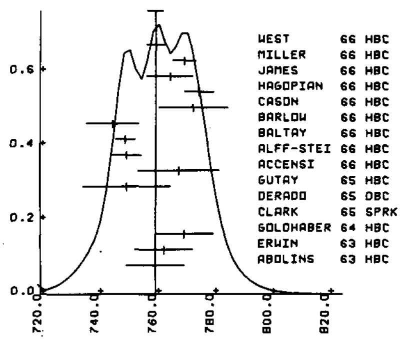
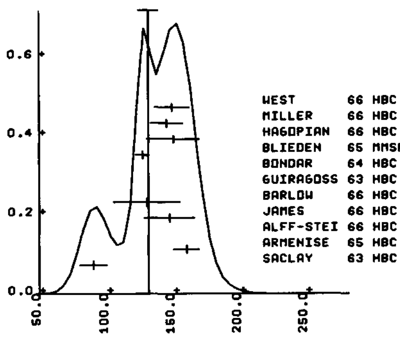
WEIGHTED AVERAGE =759.91 +/- 2.66
SCALE = 1.73 CHISQ = 35.8 CONLEV = .001



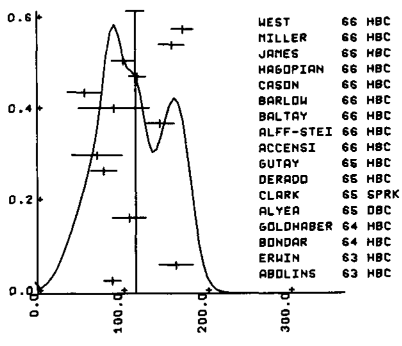
RHO O MASS (MEV)

WEIGHTED AVERAGE =131.17 +/- 7.42
SCALE = 2.10 CHISQ = 30.7 CONLEV = .001



RHO +- WIDTH (MEV)

WEIGHTED AVERAGE =117.4 +/- 10.3
SCALE = 2.37 CHISQ = 61.8 CONLEV = .001



RHO O WIDTH (MEV)

π_V (1003) $\rightarrow K\bar{K}$

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16 PI(1003,JPG=    ) I=1

16 PI(1003) MASS  (MEV)

M   *       1060.0                     BELYAKOV  64 PBC       7.5 PI- P        6/66
M   *    50 1025.0   APPROX.           ARMENTERO 65 HBC  +-  0.0 PBAR P
M       143 1003.3      7.0+SYSTEMATIC ROSENFELD 65 RVUE +-                    8/66
M   *       SCAT. LENGTH 2 TO 6 FERMIS.BALTAY    66 HBC      3.7 PBAR P        8/66
M   *       SCAT. LENGTH 2.4+-.5 FERMI BARLOW    66 HBC  +- 1.2 PBAR P        11/66

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16 PI(1003) WIDTH (MEV)

W   *         60.0                     BELYAKOV  64 PBC                        6/66
W   *    50   40.0   APPROX.           ARMENTERU 65 HBC  +-
W   *   143   57.0     13.0+SYSTEMATIC ROSENFELD 65 RVUE +-                    8/66
W             70.      15.             MONTANET  66 HBC                       11/66

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16 PI(1003) PARTIAL CECAY MODES

P1          PI(1003) INTO K KBAR                          S10S11
P2          PI(1003) INTO ETA PI                          S14S 8

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The I = 1$\bar{K}$K enhancement has been seen only in $\bar{p}p$ annihilations, where no $\eta\pi$ mass spectra are known to us. There are $\eta\pi$ spectra in π^-p interactions [see Alitti et al., Phys. Letters 15, 69 (1965)], but there the total production of KK_1 is ≤ 3 μb at 3.2 GeV/c [see Richard I. Hess et al., Phys Rev. Letters 17, 1109 (1966)].

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REFERENCES FOR PI(1CC3)


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BELYAKOV 64 JINR P-1586         BELYAKOV,VIRYASUV,KLADNITSKAYA + /// DUBNA
ARMENTER 65 PL 17 344           ARMENTERUS,EDWARDS,JACOBSEN +///CERN+PARIS
ASTIER   65 OXFORC ABSTRACT 143 AND SUPPLEMENT P 13  // CERN+CULL DE FR.
BARASH   65 PR  139 B  1659     +FRANZINI,KIRSCH,MILLER,STEINBERGER+/COLUM
ROSENFEL 65 OXFORC CCNF 58      A H ROSENFELD ////////////////// LRL--RVUE
BALTAY   66 PR  142 B  932      +LACH,SANDWEISS,TAFT,YEH,STONEHILL+ //YALE
BARLCW   66  CERN-TC66-22 -NC BARLUW,D.ANDLAU+ //// CERN+PARIS+LIVERPOOL
MONTANET 66  PRIVATE COMM.      L.MUNTANET ////////////////////////////// CERN
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A1 (1080)

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10  A1 MESON (1C79, JPG=  -)  1=1

SEE COMPILATION AND DISCUSSION IN G.GOLDHAVERS REVIEW
1966 BERKELEY CONFERENCE.

10  A1 MESON  MASS (MEV)

M          1080.0                      ADERHOLZ  64 HBC
M          1080.0    20.0              ALLARD    64 FBC  -
M          1080.0    10.0              HESS      64 HBC  -
M          1076.0    14.0              DEUTSCH 2 66 HBC  +                     9/66

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10  A1 MESON  WIDTH (MEV)

W            80.0                      ADERHOLZ  64 HBC
W   *       150.0  APPROX              ALLARD    64 FBC  -
W   *       100.0  APPROX              HESS      64 HBC  -
W           130.0    50.0     40.0     DEUTSCH 2 66 HBC  +                     9/66

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10  A1 PARTIAL CECAY MODES

P1       A1 INTO RHO PI                                   L 9S 8
P2       A1 INTO KBAR K                                   S1CS11
P3       A1 INTO ETA PI                                   S14S 8
P4       A1 INTO ETA PRIME PI                             L 2S 8

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10  A1 BRANCHING RATIOS

R1  *    A1 INTO (KBAR K)/(RHO PI)                       (P2)/(P1)
R1  *          0.01 OR LESS          DEUTSCH 1 66 HBC  +                       6/66
R1  *          0.0025 CR LESS        HESS       66 HBC  -   4.0 PI- P         10/66

R2  *     A1 INTO (ETA PI)/(RHO PI)                      (P3)/(P1)
R2  *          0.015 CR LESS         DEUTSCH 1 66 HBC  +                       6/66

R3  *     A1 INTC (ETA PRIME PI)/(RHO PI)                (P4)/(P1)
R3  *          0.015 OR LESS         DEUTSCH 1 66 HBC  +                       6/66

R   *FOR 1+ NCNET SU3 RATES SEE E.G. GOLDHABER, REVIEW BERKELEY CONF.1966

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REFERENCES FOR A1


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BELLINI  63 NC 29 896           BELLINI,FIORINI,HERZ,NEGRI,RATTI /// MILAN
ADERHOLZ 64 PL 10 226           AACH+BERL+BIRM+BONN+DESY+HAMB+IMP.COL+ MPI
ALLARD   64 PL 12 143           ALLARD+ // PARIS+CERN+MILAN+CEA-SAC+UC-BKY
GOLDHABE 64 PRL 12 336          GOLDHABER,BROWN,KADYK,SHEN,TRILLING/LRL+UC
HESS     64 DUBNA CONF  1 422 HESS,CHUNG,DAHL,HARDY,KIRZ,MILLER //// LRL
LANDER   64 PRL 13 346 A        LANDER,ABOLINS,CARMONY,HENDRICKS +/// UCSD  JP

ABOLINS  65  ATHENS(OHIO)CONF +CARMONY,LANDER,XUONG,YAGER ///// LA JOLLA I=1
ALITTI   65 PL 15 69            ALITTI,BATON,DELER,CRUSSARD+ ///// SAC+BOL
DEUTSCH1 66 PL 20 82            DEUTSCHMANN,STEINBERG + //AACH+BERLIN+CERN
DEUTSCH2 66 PL 22 112           DEUTSCHMANN,STEINBERG + //AACH+BERLIN+CERN
GOLDHABE 66  BERKELEY CONF      G.GOLCHABER,SAMIOS,ASTIER,SHEN,LAI.MESON REVIEW
HESS     66 UCRL-16832          R I HESS (THESIS, BERKELEY)          // LRL
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B (1210)

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11  B MESON (1210,JPG=  +) I=1
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The B meson was first seen in πp collisions, where its analysis was complicated by Deck Effect (see CHUNG + 64). However, in 1966 Baltay et al. reported a significant B peak in $\bar{p}p$ annihilations. This seems to confirm the existence of the B.

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11  B MESON  MASS (MEV)

M        60 1220.0                     ABOLINS   63 HBC  +
M           1220.0                     HESS      64 HBC  -
M           1220.0                     GOLDHABER 65 HBC
M       344 1200.0     15.0            BALTAY    66 HBC     0.0 PBAR P         9/66
M   *       FOR EVIDENCE THAT THE B IS JUST DECK EFFECT, SEE CHUNG 66

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11  B MESON  WIDTH (MEV)

W        60  100.0     20.0            ABOLINS   63 HBC  +
W            180.0     30.0            HESS      64 HBC  -
W             80.0                     GOLDHABER 65 HBC
W       344  100.0     30.0            BALTAY    66 HBC     0.0 PBAR P         9/66

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11  B MESON PARTIAL DECAY MODES

P1      B MESCN INTO OMEGA+PI                             L 1S 8
P2      B MESON INTO 2PI+ 2PI-                            S 8S 8S 8S 8
P3      B MESON INTO K KBAR                               S10S10
P4      B MESON INTO PI PI                                S 8S 8
P5      B MESCN INTO PI PHI                               S 9U 4

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11  B MESON  BRANCHING RATIOS

R1  *  B INTO  4PI/(OMEGA PI)                          (P2)/(P1)
R1  *         0.5   OR LESS          ABOLINS   63 HBC  +

R2  *  B MESCN INTO (K KBAR)/(OMEGA PI)                (P3)/(P1)
R2  *         0.02  OR LESS          HESS      66 HBC  -  1.6-4.2 PI- P      10/66

R3  *  B MESCN INTO (PI PI)/(PI OMEGA)                (P4)/(P1)
R3  *         0.3   OR LESS          ADERHOLZ  64 HBC                         7/66

R4  *  B MESON INTO (PI PHI) / (PI OMEGA)              (P5)/(P1)
R4  *         0.015 OR LESS          HESS      66 HBC     1.6-4.2 PI- P      10/66

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REFERENCES FOR B MESON


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ABOLINS  63 PRL 11 381          ABOLINS,LANDER,MEHLHOP,XLONG,YAGER // UCSD
BONDAR   63 PL 5 209            BONDAR,DODD+//AACHEN+BIRM+HAMB+IC-LOND+MPI
ADERHOLZ 64 PL 10 240           AACHEN+BERLIN+BIRM+BONN+HAMBUR+IC-LOND+MPI
HESS     64 DUBNA CCNF 1 422  HESS,CHUNG,DAHL,HARDY,KIRZ,MILLER //// LRL
   SEE ALSC CHUNG 66
GOLDHABE 65 PRL 15 118          G GOLCHABER,S GOLDHABER,KADYK,SHEN /// LRL
BALTAY C 66  BERKELEY CONF      +FRANZINI,SEVERIENS,YEH,ZANELLO //BNL,CCNY
CHUNG S  66 PRL 16 481          +NEVEU,DAHL,KIRZ,MILLER,GUIRAGOSIAN // LRL
HESS     66 UCRL-16832          R I HESS (THESIS, BERKELEY)          // LRL

        QUANTUM NUMBER DETERMINATIONS NOT REFERRED TU IN THE DATA CARDS

CARMCNY  64 PRL 12 254          CARMONY,LANDER,RINDFLEISCH,XUONG,YAGER//UC  JP
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A2 (1300)

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12  A2 MESON (1300,JPG=2+-)  1=1

SEE COMPIL. AND DISC. IN G.GOLDHABERS REVIEW 1966
BERKELEY CONF.

12  A2 MESON  MASS (MEV)

M             1320.0                     ADERHOLZ  64 HBC
M             1335.0     10.0            GOLDHABER 64 HBC  +-  3.7 PI+- P
M             1285.0                     ARMENTERO 65 HBC     K1K1 DECAY       6/66
M             1270.0                     DERADO    65 HBC                      6/66
M         130 1310.0                     FORINO    65 DBC  + C 4.5 PI+ D      10/66
M        1425 1290.0      5.0            LEFEBVRES 65 MMSP -                   6/66
M             1300.0                     SEIDLITZ  65 DBC  -                   6/66

M             1325.0                     BARI      66 DBC     C 5.1 PI+ D     10/66
M             1317.       3.             BARLOW    66 HBC  +- (K KBAR MODE)   11/66
M             1333.      13.             BARLOW    66 HBC  +- (K KBAR MODE)   11/66
M             1290.0     10.0            BARNES    66 HBC  -                   6/66
M             1310.0     10.0            BENSON    66 DBC                      6/66
M             1325.0                     BEUSCH    66 SPRK ' 0 5-12 PI- P     10/66
M             1317.0      5.0            CHUNG     66 HBC  -0 3-4 PI- P       10/66
M             1280.0                     DEUTSCHMA 66 HBC  +   8.0 PI+ P       6/66
M    * 1800 1310.0     10.0     COMP.BY FERBEL    66       +-  PI+- P        10/66
M    S        1260.0     10.0            LEVRAT    66 MMS  -   7-12 PI- P     10/66
M    S        1312.0     10.0            LEVRAT    66 MMS  -   7-12 PI- P     10/66
M    S   LEVRAT ET AL SEE SLIGHT EVICENCE FOR TWO NARROW A2 PEAKS.
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(Ideogram below)

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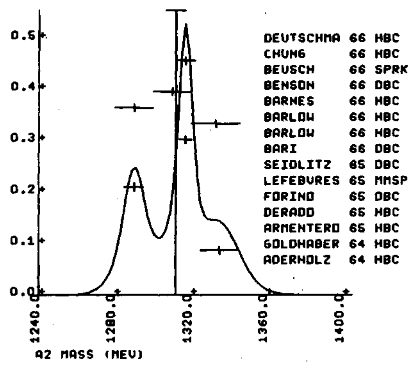
WEIGHTED AVERAGE =1311.96 +/- 5.13
SCALE = 2.45   CHISQ = 35.9   CONLEV = .001



12 A2 MESON WIDTH (MEV)

W		100.0			ADERHOLZ	64 HBC		
W		90.0	10.0		GOLDHABER	64 HBC	+- 3.7 PI+- P	
W		150.0			DERADO	65 HBC		6/66
W	1425	99.0	15.0		LEFEBVRES	65 MMSP	-	6/66
W		140.0			SEIDLITZ	65 DBC	-	6/66
W		70.0	10.0		BARNES	66 HBC	-	6/66
W		120.0			BARI	66 DBC	0 5.1 PI+ D	10/66
W		56.	28.		BARLOW	66 HBC	+- (K KBAR MODE)	11/66
W		56.	15.		BARLOW	66 HBC	+- (K KBAR MODE)	11/66
W		110.0	45.0		BENSON	66 DBC		6/66
W		90.0			BEUSCH	66 SPRK	0 5-12 PI- P	10/66
W		50.0	20.0		CHUNG	66 HBC	-0 3-4 PI- P	10/66
W	* 1800	80.0	10.0	COMP.BY	FERBEL	66	+- PI+- P	10/66
W	S	26.0	OR LESS		LEVRAT	66 MMS	- FOR BOTH PEAKS	10/66

(Ideogram below)

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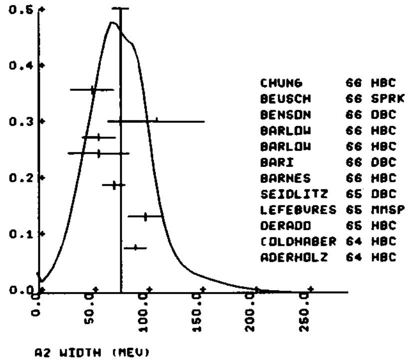
WEIGHTED AVERAGE =76.59 +/- 7.23
SCALE = 1.32   CHISQ = 8.7   CONLEV = 0.124



12 A2 MESON PARTIAL DECAY MODES

P1	A2 MESON INTO RHO PI	L 9S 8
P2	A2 MESON INTO KBAR K	S10S12
P3	A2 MESON INTO ETA PI	S14S 8
P4	A2 MESON INTO ETA PRIME PI	L 2S 8
P5	A2 MESON INTO PI+ PI- PIO	S 8S 8S 9

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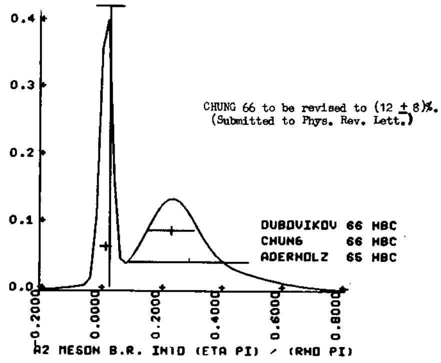
12 A2 MESON BRANCHING RATIOS

R1	*	A2 MESON INTO (K KBAR) / (RHO PI)				(P2)/(P1)	
R1	*	0.08	OR LESS	LANDER	64 HBC	+	10/66
R1	*	0.04	OR LESS	ARMENTERO	65 HBC	-	
R1		0.053	0.021	CHUNG	66 HBC	-0	10/66
R1		0.03	0.02	DEUTSCHMA	66 HBC	+	6/66
R2	*	A2 MESON INTO (ETA PI)/TOTAL				(P3)/TOTAL	
R2	*	0.03 OR LESS		DEUTSCHMA	66 HBC	+	6/66
R3	*	A2 MESON INTO (ETA PI) / (RHO PI)				(P3)/(P1)	
R3		0.3	0.2	ADERHOLZ	65 HBC		
R3		0.022	0.018	CHUNG	66 HBC	-0	10/66
R3		0.24	0.08	DUBOVIKOV	66 HBC	-	11/66

(Ideogram below)

WEIGHTED AVERAGE =0.0346 +/- 0.0466
SCALE = 2.66   CHISQ = 7.1   CONLEV = 0.008



R4	*	A2 MESON INTO (ETA PRIME PI) / TOTAL				(P4)/TOTAL	
R4	*	0.1	OR LESS	CHUNG	65 HBC	-	
R4	*	0.015	OR LESS	DEUTSCHMA	66 HBC	+	6/66
R5	*	A2 MESON INTO (PI+ PI- PI0) / (RHO PI)				(P5)/(P1)	
R5	*	0.17	OR LESS	BENSON	66 DBC	0	

R *FOR 2+ NONET SU3 RATES SEE E.G. GLASHOW,SOCOLOW, PRL 15,329(65)

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REFERENCES FOR A2

ADERHOLZ 64 PL 10 248 — AACHEN+BERLIN+BIRM+BONN+HAMB+IC-LONDON+MPI
GOLDHABE 64 DUBNA CONF 1 480 — G GOLDHABER,S GOLDHABER,OHALLORAN,SHEN/LRL
LANDER 64 PRL 13 346 — +ABOLINS,CARMONY,HENDRIKS,XUONG+/ LA JOLLA

ABOLINS 65 ATHENS(OHIO)CONF — +CARMONY,LANDER,XUONG,YAGER ///// LA JOLLA I=1
ARMENTER 65 PL 17 344 — ARMENTEROS,EDWARDS,JACOBSEN + //CERN+CDEF
CHUNG 65 PRL 15 325 — +DAHL,HARDY,HESS,JACOBS,KIRZ,MILLER // LRL
DERADO 65 PRL 14 872 — DERADO,KENNEY,POIRIER,SHEPHARD//NOTRE DAME
FORINO 65 PL 19 68 — +GESSAROLI+LENDINARA+/BOL+BARI+FIR+ORS+SAC
LEFEBVRE 65 PL 19 434 — LEFEBVRES,LEVRAT,BLIEDEN,DUBAL + //CERN
SEIDLITZ 65 PRL 15 217 — L SEIDLITZ,O I DAHL,D H MILLER /////// LRL

BARI 66 BERKELEY CONF 7A — BARI-BOLOGNA-FIRENZE-ORSAY COLLABORATION
BARLOW 66 CERN-TC66-22 -NC — BARLOW,D.ANDLAU+ //// CERN+PARIS+LIVERPOOL
BARNES 66 PRL 16 41 — BARNES,FOWLER,LAI,ORENSTEIN + /// BNL+CCNY
BENSON 66 PRL 16 1177 — G BENSON,LOVELL,MARQUIT,ROES + // MICHIGAN
BEUSCH 66 BERKELEY CONF 7A — +FISCHER,GOBBI,PEPIN,ASTBURY + // ETH+CERN
CHUNG 66 BERKELEY CONF 7A — S CHUNG,DAHL,HARDY,HESS,KIRZ,MILLER // LRL JP
SEE ALSO 66 UCRL-15832 — RICHARD I HESS--THESIS,BERKELEY // LRL
DEUTSCHM 66 PL 20 82 — DEUTSCHMANN,STEINBERG + //AACH+BERLIN+CERN
DUBOVIKO 66 BERKELEY+PRIV.C. — DUBOVIKOV,GRIGORIEV,VLADIMIRSKY + // ITEP
FERBEL 66 PL 21 111 — FERBEL // ROCHESTER
GOLDHABE 66 BERKELEY CONF — G.GOLDHABER,SAMIOS,ASTIER,SHEN,LAI.MESON REVIEW
LEVRAT 66 PL 22 714 — +TOLSTRUP,SCHUBELEIN,NEF,MAGLIC + // CERN

QUANTUM NUMBER DETERMINATIONS NOT REFERRED TO IN THE DATA CARDS

LANDER 64 PRL 13 346 A — LANDER,ABOLINS,CARMONY,HENDRICKS +/// UCSD JP
ADERHOLZ 65 PR 138 B 897 — AACHEN+BERLIN+BIRM+BONN+HAMB+LOND+MUENCHEN
ALITTI 65 PL 15 69 — ALITTI,BATON,DELER,CRUSSARD+/ SACLAY+BOLOG JP
FOR QUANTUM NUMBERS OF NEUTRAL A2, SEE BENSON ABOVE

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π (1640) → 3π

34 PI (1640, JPG= -) I GTE 1

* FOR COMPILATION BY T. FERBEL, SEE REVIEW ON MESONS,
* 1966 BERKELEY CONFERENCE

34 3 PI (1640) MASS (MEV)

M	C 30	1600.0		FORINO	65 DBC	0 4.5 PI+ D	10/66
M	C 1700 EVENTS,COMPILED BY FERBEL.			ABC COLL.	66 HBC	+ 8.0 PI+ P	10/66
M	C 4000 EVENTS,COMPILED BY FERBEL.			BALTAY	66 HBC	+ 8.4 PI+ P	10/66
M	C 2000 EVENTS,COMPILED BY FERBEL.			SLATTERY	66 HBC	+ 7.0 PI+ P	10/66
M	C THESE ARE MOST OF THE AVAILABLE DATA ABOVE 6 GEV/C PI+ P						10/66
M	110	1640.	20.	FERBEL	66 RVUE	+ 7-8 PI P	11/66
M	* 20	1630.0	30.0	VETLITSKY	66 HBC	- 4.7 PI- P	

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34 3 PI (1640) WIDTH (MEV)

W	110	100.	20.	FERBEL	66 RVUE	+ 7-8 PI P	11/66
W	* 20	100.		VETLITSKY	66 HBC	-	6/66

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34 PI (1640) PARTIAL DECAY MODES

P1		PI(1640) INTO 3 PI	S 9S 9S 9
P2		PI(1640) INTO RHO PI	S 90 9
P3		PI(1640) INTO ETA PI	S 9S14
P4	*	PI(1640) INTO 5 PI	
P5		PI(1640) INTO K K*(890)	S11U18
P6		PI(1640) INTO K KBAR PI	S11S11S 9
P7		PI(1640) INTO K KBAR	S11S11
P8		PI(1640) INTO F PI	U 5S 9

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34 PI (1640) BRANCHING RATIOS

R1	*	PI(1640) INTO (K KBAR) / (3 PI)	NUM 7	
R1	*		DEN 1	
R1	*	.40 OR LESS (ESTIMATED FROM DATA OF DEUTSCHMANN 66)		11/66

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REFERENCES FOR PI(1640)

ABC COLL 66 COMM.TO T. FERBEL — FOR AUTHORS SEE PL 19 608(65)AACHEN,BERLIN,CERN
BALTAY C 66 COMM.TO T. FERBEL — +YEH,FRANZINI,KUNG,PLANO,RAVIN//COL.RUTGER
DEUTSCHM 66 PL 20 82 — DEUTSCHMANN,STEINBERG + / AACH+BERLIN+CERN
FERBEL 66 BERKELEY CONF. — SEE G. GOLDHABER, REVIEW ON MESONS /// LRL
FORINO 65 PL 19 68 — +GESSAROLI+LENDINARA+/BOL+BARI+FIR+ORS+SAC
LUBATTI 66 THESIS BERKELEY — H.J.LUBATTI ////////////////////////// LRL 1-2-
SLATTERY 66 U.ROCH.875153--NC — +H.KRAYBILL, B.FORMAN, T.FERBEL//ROCH.YALE
VETLITSK 66 PL 21 579 — VETLITSKY,GUSZAVIN,KLIGER,ZOLGANOV+ //ITEP

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ρ (1650) → 2π

15 RHO (1650, JPG= +) I=

* FOR COMPILATION SEE GOLDHABER MESON REVIEW
1966 BERKELEY CONFERENCE.

15 RHO (1650) MASS (MEV)

M			1700.0	100.0	BELLINI	65 HLBC	0	6/66
M			1620.0	20.0	DEUTSCHMA	65 HBC	+	6/66
M			1640.0		FORINO	65 DBC	0	6/66
M			1670.0	30.0	GOLDBERG	65 HBC	0	
M		70	1700.		CRENNELLI	66 HBC	0 6.0 PI-P	10/66
M		25	1625.		CRENNELLI	66 HBC	- 6.0 PI-P	10/66
M	C		MOST OF DATA ABOVE COMPILED BY GOLDHABER					9/66
M	C	300	1650.0		COMP. BY GOLDHABER	66 RVUE	0 5-8 PI P, PI D	9/66
M	C	50	1650.0		COMP. BY GOLDHABER	66 RVUE	+- 5-8 PI P, PI D	9/66
			------ DECAY INTO FOUR PIONS ------					
M	*	23	1610.0	40.	KERNAN	65 HBC	0 2.7 PBAR P	10/66
M	*		1680.0	APPROX.	CONTE	66 HBC	- 11 PI- P	10/66

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15 RHO (1650) WIDTH (MEV)

W		13	80.0	40.0	DEUTSCHMA	65 HBC	+	6/66
W			40.0		FORINO	65 DBC	0	6/66
W			160.0	40.0	GOLDBERG	65 HBC	0	
W		70	200.		CRENNELLI	66 HBC	0 6.0 PI-P	10/66
W		25	60.		CRENNELLI	66 HBC	- 6.0 PI-P	10/66
W	C	350	150.0	50.0	COMP. BY GOLDHABER	66 RVUE	+-0 5-8 PI P, PI D	9/66
			------ DECAY INTO FOUR PIONS ------					
W	*		155.	85.	KERNAN	65 HBC	0 2.7 PBAR P	10/66
W	*		160.0	APPROX.	CONTE	66 HBC	- 11 PI- P	10/66

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15 RHO (1650) PARTIAL DECAY MODES

P1 RHO (1650) INTO PI PI S 8S 8
P2 RHO (1650) INTO PI PI PI PI S 8S 8S 8S 8
P3 RHO (1650) INTO PI PI RHO S 8S 8U 9
P4 RHO (1650) INTO RHO RHO U 9U 9

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15 RHO (1650) BRANCHING RATIOS

R1 * RHO(1650) INTO (4 PI) / TOTAL NUM 2
R1 * DEN 1234
R1 * KERNAN+ PROBABLY SEE THIS MODE 10/66
R1 * CONTE+ PROBABLY SEE THIS MODE 10/66

R2 * RHO(1650) INTO (PI PI RHO) / (4 PI) NUM 3
R2 * DEN 2
R2 * 0.25 OR LESS KERNAN 65 HBC 10/66
R2 * SEEN PROBABLY CONTE 66 HBC 10/66

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REFERENCES FOR RHO(1650)

BELLINI 65 NC 40 A 948 BELLINI,DI CORATO,DUIMINO,FIORINI //MILANO
DEUTSCHM 65 PL 18 351 DEUTSCHMANN,SCHULTE + //// AACH+ZEUTH+CERN
FORINO 65 PL 19 65 FORINO,GESSAROLI + //BOLOGNA+ORSAY+SACLAY
GOLDBERG 65 PL 17 354 GOLDBERG+/CERN+PARIS+ORSAY+MILANO+CEA-SACL
CONTE 66 PL 22 702 +TOMASINI+DITTMANN+/GENOVA+HAMB+MIL+SACLAY
CRENNEL1 66 BERKELEY CONF +HOUGH,KALBFLEISCH,LAI,BACHMAN+// BNL,CCNY
GOLDHABE 66 BERKELEY CONF G.GOLDHABER,SAMIOS,ASTIER,SHEN,LAI.MESON REVIEW
KERNAN 65 PRL 15 803 +LYON+CRAWLEY ////////////////////////// IOWA
KERNAN+ SEE DECAY ONLY INTO NEUTRAL 4 PION STATE

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R (1700)

30 R (1700, JPG=) I GTE 1, MAY BE 3 PEAKS

* OMITTED FROM TABLE. SEE NOTES
* ON MESONS FOLLOWING THIS LISTING.

30 R (1700) MASS (MEV)

M * 360 1632.0 15.0 R1 LEVRAT 66 MMS - 7-12 PI P 9/66
M * 485 1700.0 15.0 R2 LEVRAT 66 MMS - 7-12 PI P 9/66
M * 425 1748.0 15.0 R3 LEVRAT 66 MMS - 7-12 PI P 9/66
M 75 1675. CRENNELL1 66 HBC - 6.0 PI-P 10/66

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30 R (1700) WIDTH (MEV)

W * 21.0 OR LESS R1 LEVRAT 66 MMS - 7-12 PI P 9/66
W * 30.0 OR LESS R2 LEVRAT 66 MMS - 7-12 PI P 9/66
W * 38.0 OR LESS R3 LEVRAT 66 MMS - 7-12 PI P 9/66
W 75 150. CRENNELL1 66 HBC - 6.0 PI-P 10/66

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30 D(SIGMA)/D(T) (MICROBARNS/(GEV/C)**2)

CS * 125.0 30.0 FOCACCI 66 MMS .23 LTE T LTE .28 9/66

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30 R1,R2,R3 BRANCHING RATIOS

R1 * R1 MESON FRACTION INTO ONE / THREE / FIVE OR MORE CHARGED TRACKS
R1 * 0.37 / 0.59 / 0.04 FOCACCI 66 MMS - 10/66

R2 * R2 MESON FRACTION INTO ONE / THREE / FIVE OR MORE CHARGED TRACKS
R2 * 0.42 / 0.56 / 0.01 FOCACCI 66 MMS - 10/66

R3 * R3 MESON FRACTION INTO ONE / THREE / FIVE OR MORE CHARGED TRACKS
R3 * 0.14 / 0.80 / 0.05 FOCACCI 66 MMS - 10/66

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REFERENCES FOR R(1700)

FOCACCI 66 PRL 17 890 + KIENZLE,LEVRAT,MAGLIC,MARTIN // CERN
LEVRAT 66 PL 22 714 + TOLSTRUP,MAGLIC,FOCACCI,DUBAL + // CERN
CRENNEL1 66 BERKELEY CONF +HOUGH,KALBFLEISCH,LAI,BACHMAN+// BNL,CCNY

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S (1930)

31 S(1930, JP= , I GTE 1) 3 CHARGED DECAY TRACKS

31 S (1930) MASS (MEV)

M 1929.0 14.0 CHIKOVANI 66 MMSP - 8/66
M 15 1910.0 20.0 DEUTSCHMA 66 HBC + 6/66

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31 S (1930) WIDTH (MEV)

W 35.0 OR LESS CHIKOVANI 66 MMSP - 8/66
W 15 90.0 40.0 DEUTSCHMA 66 HBC + 6/66

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31 D(SIGMA)/D(T) (MICROBARNS/(GEV/C)**2)
CS * 35.0 12.0 FOCACCI 66 MMS .22 LTE T LTE .36 9/66

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REFERENCES FOR S(1930)

CHIKOVAN 66 PL 22 233 +DUBAL,FOCACCI,KIENZLE,LEVRAT,MAGLI+/CERN+
FOCACCI 66 PRL 17 890 + KIENZLE,LEVRAT,MAGLIC,MARTIN // CERN
DEUTSCHM 66 BERK.CONF.--PL +SCHULTE+STEINBERG+ ///// AACH+BERLIN+CERN

POSSIBLE CONTRADICTION SINCE MMS HAS LESS THAN 20 PERCENT OF DECAYS
WITH 1 CHARGED TRACK, WHEREAS HBC SEES DECAY INTO PI+ PIO.

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T (2195)

32 T(2200, JP= , I GTE 1) 3 CHARGED DECAY TRACKS

32 T(2200) MASS (MEV)

M 2195.0 15.0 CHIKOVANI 66 MMSP - 8/66

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32 T(2200) WIDTH (MEV)

W * 13.0 OR LESS CHIKOVANI 66 MMSP - 8/66

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32 D(SIGMA)/D(T) (MICROBARNS/(GEV/C)**2)

CS * 29.0 10.0 FOCACCI 66 MMS .22 LTE T LTE .36 9/66

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REFERENCES FOR T(2200)

CHIKOVAN 66 PL 22 233 +DUBAL,FOCACCI,KIENZLE,LEVRAT,MAGLI+/CERN+
FOCACCI 66 PRL 17 890 + KIENZLE,LEVRAT,MAGLIC,MARTIN // CERN

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U (2382)

33 U(2380, JP= , I GTE 1) 1,3,5 CHARGED TRACKS

33 U(2380) MASS (MEV)

M 2382.0 24.0 CHIKOVANI 66 MMSP - 8/66

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33 U(2380) WIDTH (MEV)

W * 30.0 OR LESS CHIKOVANI 66 MMSP - 8/66

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33 D(SIGMA)/D(T) (MICROBARNS/(GEV/C)**2)

CS * 42.0 14.0 FOCACCI 66 MMS .28 LTE T LTE .36 9/66

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33 U MESON BRANCHING RATIOS

R1 * U- MESON FRACTION INTO ONE / THREE / FIVE OR MORE CHARGED TRACKS
R1 * 0.30 / 0.45 / 0.25 FOCACCI 66 MMS - 10/66

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REFERENCES FOR U(2380)

CHIKOVAN 66 PL 22 233 +DUBAL,FOCACCI,KIENZLE,LEVRAT,MAGLI+/CERN+
FOCACCI 66 PRL 17 890 + KIENZLE,LEVRAT,MAGLIC,MARTIN // CERN

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κ (725)

17 KAPPA (725,JP=) I=1/2

* COMPILED IN APPENDIX A.

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K* (892)

18 K* (890,JP =1-) I=1/2

18 K* (890) MASS (MEV)

M 898.0 5.0 CHADWICK 63 HBC +
M 891.0 3.0 FERRO-LUZ 65 HBC +

M 890.5 ARMENTERO 65 HBC +-
M 890. 2. BARLOW 66 HBC +- 1.2 PBAR P 11/66
M 889. 3. BARLOW 66 HBC +- 1.2 PBAR P 11/66

M 3870 891.0 1.0 WOJCICKI 63 HBC -
M 895.0 3.0 GELSEMA 65 HBC -

M 200 880.0 ALEXANDER 62 HBC + 0
M 895.0 2.0 FERROLUZZ 65 HBC + 0 6/66
M 895.0 WANGLER 65 HBC + 0 6/66

M 885.0 ARMENTERO 62 HBC +-0

M 70 897.0 10.0 COLLEY 62 HBC 0
M 200 892.0 2.0 KRAEMER 63 HBC 0
M 150 885.0 SMITH 63 HBC C
M 889.5 2.5 ADELMAN 65 HBC 6/66
M 899. 4. BARLOW 66 HBC 0 1.2 PBAR P 11/66
M 897. 4. BARLOW 66 HBC 0 1.2 PBAR P 11/66
M 160 891. 5. CRENNELL3 66 HBC 0 6.0 PI-P 10/66

(Ideogram below)

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18 K*(0) - K*(+) MASS DIFF. (MEV)

D 6.5 3.8 BARASH 66 HBC 0 PBAR P 11/66

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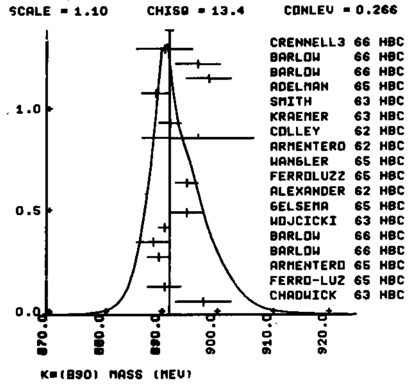
WEIGHTED AVERAGE =891.894 +/- 0.706
SCALE = 1.10 CHISQ = 13.4 CONLEV = 0.266



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                   18  K* (890) WIDTH (MEV)

W             46.0      8.0              CHADWICK  63 HBC  +
W             47.0      4.0              FERRO-LUZ 65 HBC  +

W      3870   46.0      3.0              WOJCICKI  63 HBC   -
W             50.0     15.0              GELSEMA   65 HBC   -

W             31.0                       ARMENTERO 65 HBC  +-
W             44.       7.               BARLOW    66 HBC  +-  1.2 PBAR P       11/66
W             43.       9.               BARLOW    66 HBC  +- 1.2 PBAR P        11/66
W             53.       7.               BARLOW    66 HBC  +-  1.2 PBAR P       11/66

W       200   60.0      5.0              ALEXANDER 62 HBC  + 0
W             51.8      3.5              FERROLUZZ 65 HBC  + 0                   6/66
W             40.0                       WANGLER   65 HBC  + 0                   6/66

W             55.0                       ARMENTERO 62 HBC  +-0

W        70   60.0     10.0              COLLEY    62 HBC   0
W       200   50.0      5.0              KRAEMER   63 HBC   0
W       150   50.0                       SMITH     63 HBC   0
W             51.0      3.0              ADELMAN   65 HBC                        6/66
W             53.      13.               BARLOW    66 HBC   0 1.2 PBAR P        11/66
W             34.       8.               BARLOW    66 HBC   0 1.2 PBAR P        11/66
W       160   49.       6.               CRENNELL3 66 HBC   0 6.0 PI-P          10/66
```

(Ideogram below)

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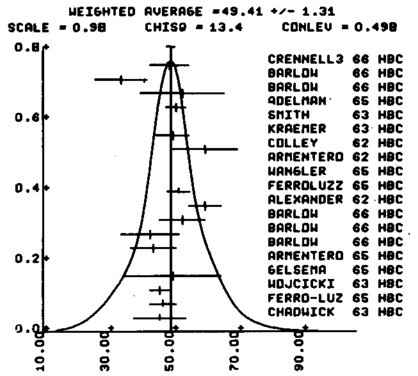

K*(890) WIDTH (MEV)

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                   18  K* (890) PARTIAL DECAY MODES

P1      K* INTO K PI                                         S10S 8
P2      K*(890) INTO (K PI PI)                               S10S 8S 8

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                   18  K* (890) BRANCHING RATIOS

R1   *  K*(890) INTO (K PI PI)/(K PI)                       (P2)/(P1)
R1   *    0     0.002 OR LESS         WOJCICKI+ 63 HBC   -

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REFERENCES FOR K*


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ALSTON   61 PRL 6 300            ALSTON,ALVAREZ,EBERHARD,GOOD,GRAZIANO+/LRL
ALEXANDE 62 PRL 8 447            ALEXANDER,KALBFLEISCH,MILLER,G SMITH //LRL
ARMENTER 62 CERN CONF 295        ARMENTEROS,MONTANET,D ANDLAU + ///CERN+CDF
COLLEY   62 CERN CONF 315        D COLLEY,N GELFAND + //// COLUMBIA+RUTGERS

CHADWICK 63 PL 6 309             CHADWICK,CRENNELL,DAVIES,BETTINI+/OXF+PADU
GOLDHABE 63 ATHENS CONF 92       SULAMITH GOLDHABER ////////////////// LRL
KRAEMER  63 ATHENS CONF 130      R KRAEMER L MADANSKY + ////  JOHNS HOPKINS
SMITH    63 PRL 10 138           SMITH,SCHWARTZ,MILLER,KALBFLEISCH,HUF+/LRL

FERROLUZ 64 PL 12 255            FERRO-LUZZI,GEORGE,HENRI,JONGEJANS+ //CERN
WOJCICKI 64 PR 135 B 495         S WOJCICKI,M ALSTON,G KALBFLEISCH //// LRL
WOJCICKI 64 PR 135 B 484         STANLEY G WOJCICKI /////////////////// LRL

ADELMAN  65 ATHENS 527           STUART LEE ADELMAN             // CAVENDISH
ARMENTER 65 PL 17 170            ARMENTEROS,EDWARDS,JACOBSEN + //CERN+PARIS
FERROLUZ 65 NC 36 1101           FERRO-LUZZI,GEORGE,HENRI,JONGEJANS // CERN
FERROLUZ 65 NC 39 417            FERRO-LUZZI,GEORGE,GOLDSCHMIDT-CLER+//CERN
GELSEMA  65  DISS. AMSTERDAM     E.S.GELSEMA (SEE ALSO PL 10 341) / AMSTERD
WANGLER  65 PR 137 B 414         WANGLER,ERWIN,WALKER /////////// WISCONSIN

BARLOW   66  CERN-TC66-22 -NC    BARLOW,D.ANDLAU+ //// CERN+PARIS+LIVERPOOL
CRENNEL3 66  BERKELEY CONF       +KALBFLEISCH,LAI,SCARR,SCHUMANN+////// BNL

       QUANTUM NUMBER DETERMINATIONS NOT REFERRED TO IN THE DATA CARDS

CHINOWSK 62 PRL 9 330            CHINOWSKY,GOLDHABER,LEE,OHALLORAN //// LRL  J
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K_V (1080)

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19  KV (1080)

    VERY TENTATIVE EVIDENCE HAS BEEN FOUND BY
    DE BAERE+ (BRUXELLES+CERN), 1966 BERKELEY CONF.
    OMITTED FROM TABLE.

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K_C (1215)

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20 KC MESON (1215,JP=  ) I=1/2

*                  SEEN ONLY IN ANNIHILATIONS AT REST.
*                  NO COMPELLING EVIDENCE FOR RESONANCE
*                  OMITTED FROM TABLE.

                   20  KC MASS  (MEV)

M          1215.0      15.0          ARMENTERO 64 HBC

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                   20  KC WIDTH (MEV)

W          60.0      15.0           ARMENTERO 64 HBC

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                   20  KC PARTIAL DECAY MODES

P1      KC INTO K RHO                                      S10U 9
P2      KC INTO K* PI                                      U18S 8
P3      KC INTO K PI PI                                    S11S 8S 8

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                   20  KC BRANCHING RATIOS

R1   *   KC INTO (K RHO)/TOTAL          (UNITS OF 10**-2)  (P1)/TOTAL
R1          75.0      10.0               ARMENTERO 64 HBC                  6/66

R2   *   KC INTO (K* PI)/TOTAL          (UNITS OF 10**-2)  (P2)/TOTAL
R2          25.0      10.0               ARMENTERO 64 HBC                  6/66

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REFERENCES FOR KC(1215)


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ARMENTER 64 DUBNA CONF 1 577  ARMENTEROS,EDWARDS,D ANDLAU +//// CERN+CDF
    ALSO    DUBNA CONF 1 617  R ARMENTEROS (RAPPURTEUR)
SEE ALSO 66 PR  145  1095     BARASH,KIRSCH,MILLER,TAN       // COLUMBIA
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K_A (1320)

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21  KA (1320,JP=  ) I=1/2

*                    THIS BUMP PARTLY DECK EFFECT BUT BISHOP+,
*                    SHEN+ SEE EVIDENCE FOR RESONANCE

                     21  KA (1320) MASS (MEV)

M        12 1320.0     25.0          ALMEIDA   65  HBC  +  3-5 K+  P         8/66
M   B       1310.0   SEE NOTE BELOW  BRITISH   65 HBC   -  6. K-P TO K 2PI 10/66
M   B       WIDTH ABOUT 300 MEV, MIXED REAL + DECK + TRIANGLE SINGULARITY  10/66
M        50 1320.0                   DE BAERE  65  HBC  +  3-5 K+  P         8/66
M   *       1330.    APPROX.         BARTSCH   66 HBC   - 10.0 K- P         11/66
M        20 1305.0     10.0          BISHOP    66 HBC  + 0 2.6 K+ P          8/66
M        40 1310.0                   BISHOP    66 HBC K PI MODE-SURPRISE     8/66
M        70 1320.0     10.0          SHEN      66  HBC  +  4.6 K+  P         8/66

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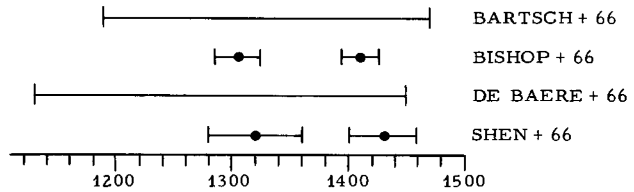
Mass of K_A(1320)

There are appreciable discrepancies between the $K\pi\pi$ mass spectra measured in different experiments, as indicated below.



$M(K^*\pi)$ (MeV)

The bars show position and widths of bumps.

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                   21  KA (1320) WIDTH (MEV)

W        12   60.0      20.0         ALMEIDA   65  HBC  +                    8/66
W   *         250.    APPROX.        BARTSCH   66 HBC   -                   11/66
W        60   40.0      15.0         BISHOP    66  HBC  +                    8/66
W        70   80.0      20.0         SHEN      66  HBC  +                    8/66

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                   21  KA (1320) PARTIAL DECAY MODES

P1          KA INTO K*(890) PI                           U18S08
P2          KA INTO K RHO                                S11U09
P3          KA INTO K OMEGA                              S11U01
P4          KA INTO K PI                                 S10S 8
P5          KA INTO K ETA                                S10S14

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                   21  KA (1320) BRANCHING RATIOS

R1   *      KA INTO K*(890) PI AND K RHO (OVERLAPPING BANDS)
R1       70    1.0                   SHEN      66  HBC  +                    8/66

R2   *      KA INTO(K OMEGA)/(K*(890) PI)                (P3)/(P1)
R2   *         0.1    OR LESS        SHEN      66 HBC   +                   10/66

R3   *      KA (1320) INTO (K*(890) PI)/ TOTAL           (P1)/TOTAL
R3   C         0.24      0.09        BISHOP    66 HBC                        6/66

R4   *      KA(1320) INTO (K PI) / TOTAL                 (P4)/TOTAL
R4   C         0.68      0.12        BISHOP    66 HBC                        6/66

R5   *      KA (1350) INTO (K RHO) / TOTAL               (P2)/TOTAL
R5   C         0.06      0.06        BISHOP    66 HBC                        6/66

R6   *      KA (1320) INTO (K ETA) / TOTAL               (P5)/TOTAL
R6   C         0.0       0.030       BISHOP    66 HBC                        6/66

R7   *      KA (1320) INTO ( K OMEGA ) / TOTAL           (P3)/TOTAL
R7   C         0.020     0.020       BISHOP    66 HBC                        6/66

R8   *      KA (1320) INTO (K PI) / (K*(890) PI)          (P4)/(P1)
R8   *         0.30   OR LESS        SHEN      66 HBC   +                   10/66
R8   *         0.21   OR LESS        DE BAERE  66 HBC                       11/66

R    C      ADDITIONAL DATA ARE FORTHCOMING. SEE GOLDHABER MESON REV.BERK.CONF
R    *FOR 1+ NONET SU3 RATES SEE E.G. GOLDHABER, REVIEW BERKELEY CONF.1966
```

NOTE ON K OMEGA MODE

BESIDES A WIDE PEAK IN THE (K* PI) MASS DISTRIBUTION, BARTSCH+ SEE A SIMILAR PEAK IN THE (K OMEGA) MASS. SINCE THE (K OMEGA) DECAY OF THE KV(1420) APPEARS TO BE VERY WEAK, IT IS REASONABLE TO ASSOCIATE AT LEAST PART OF THE (K OMEGA) PEAK OBSERVED BY BARTSCH+ WITH A (K OMEGA) MODE OF THE KA(1320).

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REFERENCES FOR KA(1320)

ALMEIDA 65 PL 16 184 — ALMEIDA,ATHERTON,BYER,DURNAN,FURSON+/CAMBR
BRITISH 65 OXFORD CONF — BIRM,GLASGOW,IC--LONDON,MUNICH,OXFORD,RUTH
DE BAERE 65 OXFORD SUPPL. 53 — +DEBAISIEUX,DUFOUR,JUNGEJANS+ // CERN+BRUX
BARTSCH 66 PL 22 357 — +DEUTSCHMANN,GROTE,MORRISON,+ // ABCL(IC)V
BISHOP 66 PRL 16 1069 — +GOSHAW,ERWIN,THOMPSON,WALKER,WEINBL//WISC
DE BAERE 66 BERK.CONF. - NC — DE BAERE,DEBAISIEUX,FILIPPAS+ // BRUX+CERN
AND PRIVATE COMMUNICATION BY B. JUNGEJANS
SHEN 66 PRL 17 726 — +BUTTERWORTH,FU,GOLDHABERS,TRILLING // LRL
ALSO SHEN BERKELEY CONF — +BUTTERWORTH,FU,GOLDHABERS,TRILLING // LRL

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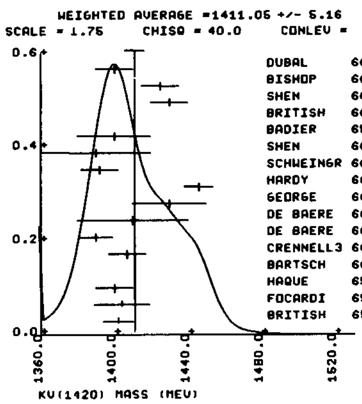
K_V (1420)

22 KV (1420,JP=) I=1/2

22 KV(1420) MASS (MEV)

M	*		1480.0	20.0		BRITISH	65 HBC	- 6. K-P (K PI)	10/66
M			1402.0	8.0		BRITISH	65 HBC	-0 3.5 K- P (K PI)	10/66
M			1404.0	15.0		FOCARDI	65 HBC	-C 3. K- P (K PI)	10/66
M		21	1400.0	10.0		HAQUE	65 HBC	- 3.5 K- P (K PI)	10/66
M		40	1440.0			BARTSCH	66 HBC	- 10. K- P (K PI)	
M		35	1407.0	10.0		CRENNELL3	66 HBC	C 6. PI- P (K PI)	10/66
M			1390.	9.0		DE BAERE	66 HBC	+ 3.5 K+P (K0 PI+)	10/66
M			1410.	20.0	40.	DE BAERE	66 HBC	+ 3.5 K+P (K+ PI0)	10/66
M			1430.0	20.0		GEORGE	66 HBC	C 5. K+ P (K PI)	10/66
M			1446.0	7.9		HARDY	66 HBC	C 4. PI- P (K PI)	10/66
M			1392.0	10.0		SCHWEINGR	66 HBC	0 4.1+5.5 K- P (K PI)	10/66
M			1390.0	30.0		SHEN	66 HBC	+ C 4.6 K+ P (K PI)	10/66
M			1400.0	20.0		BADIER	65 HBC	- 3. K- P (K*PI)	10/66
M	*		1450.0	20.0		BRITISH	65 HBC	- 6. K-P (K*PI)	10/66
M			1430.0			BRITISH	66 HBC	C 6. K- P (K*PI)	10/66
M	*		1450.0	APPROX.		SCHWEINGR	66 HBC	0 4.1+5.5 K- P (K*PI)	10/66
M			1430.0	10.0		SHEN	66 HBC	+ C 4.6 K+ P (K*PI)	10/66
M			1425.0	10.0		BISHOP	66 HBC	+ 3.5 K+ P	10/66
M			1400.0	10.0		DUBAL	66 MMS	- 7-12 K- P	10/66

(Ideogram below)



22 KV(1420) WIDTH (MEV)

W			140.0	20.0		BRITISH	65 HBC	-C 3.5 K-P (K PI)	10/66
W	*		150.0	50.0		BRITISH	65 HBC	- 6. K-P (K PI)	10/66
W			92.0	14.0		FOCARDI	65 HBC		
W	*	21	160.0			HAQUE	65 HBC		
W		35	70.	30.	15.	CRENNELL3	66 HBC	0 6.0 PI-P	10/66
W			100.0	25.0		DE BAERE	66 HBC	+ 3.5 K+ P	10/66
W			110.0	40.0		GEORGE	66 HBC	0 5.0 K+ P	10/66
W			61.0	24.0		HARDY	66 HBC	0 3.8-4.2 PI- P	9/66
W			124.0	25.0		SCHWEINGR	66 HBC	C 4.1+5.5 K- P	9/66
W			75.0	25.0		SHEN	66 HBC	4.6 K+ P	8/66
W			105.0	30.0		BADIER	65 HBC		6/66
W	*		160.0	50.0		BRITISH	65 HBC	- 6. K-P TO K* PI	10/66
W			96.0	10.0		BISHOP	66 HBC		6/66
W			62.0	16.0		DUBAL	66 MMS	- 7-12 K- P	9/66

(Ideogram at right)

22 KV (1420) PARTIAL DECAY MODES

P1	KV(1420) INTO K PI	S10S 8
P2	KV(1420) INTO K*(890) PI	U18S 8
P3	KV(1420) INTO K RHO	S10U 9
P4	KV(1420) INTO K OMEGA	S10U 1
P5	KV(1420) INTO K ETA	S10S14

U22 KV(1420) BRANCHING RATIOS

R1	*	KV(1420) INTO (K PI)/TOTAL				(P1)/TOTAL	
R1		0.37	0.19	BADIER	65 HBC		6/66
R1		0.33	0.07	BISHOP	66 HBC		6/66
R2	*	KV(1420) INTO (K*(890) PI) / TOTAL				(P2)/TOTAL	
R2		0.41	0.14	BADIER	65 HBC		6/66
R2		0.56	0.10	BISHOP	66 HBC		6/66
R3	*	KV(1420) INTO (K RHO)/TOTAL				(P3)/TOTAL	
R3		0.14	0.05	BADIER	65 HBC		6/66
R3		0.10	0.05	BISHOP	66 HBC		6/66
R4	*	KV(1420) INTO (K OMEGA)/TOTAL				(P4)/TOTAL	
R4		0.07	0.04	BADIER	65 HBC		6/66
R4		0.007	0.008	BISHOP	66 HBC		6/66
R5	*	KV(1420) INTO (K ETA)/TOTAL				(P5)/TOTAL	
R5		0.02	0.02	BADIER	65 HBC		6/66
R5		0.017	0.020	BISHOP	66 HBC		6/66
R6	*	KV(1420) INTO (K*(890) PI) / (K PI)				(P2)/(P1)	
R6		6 0.33	0.33	CHUNG	65 HBC	+ 0 3.9-4.2 PI- P	8/66
R6		0.56	0.11	SCHWEINGR	66 HBC	C 4.1+5.5 K- P	9/66
R6		0.65	0.20	SHEN	66 HBC	C N* PRODUCED	10/66
R6		0.63	0.20	SHEN	66 HBC	+ NO N* PRODUCED	10/66
R7	*	KV(1420) INTO (K OMEGA) / K PI				(P4)/(P1)	
R7		0.08 OR LESS		SHEN	66 HBC		8/66
R8	*	KV(1420) INTO (K RHO) / (K PI)				(P3)/(P1)	
R8	*	0.09 OR LESS		CHUNG	65 HBC	+ C 3.9-4.2 PI- P	8/66
R8		0.35	0.20	SCHWEINGR	66 HBC	0 4.1+5.5 K- P	9/66

R *FOR 2+ NONET SU3 RATES SEE E.G. GLASHOW,SOCOLOW, PRL 15,329(65)

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REFERENCES FOR KV(1420)

BADIER 65 PL 19 612 — BADIER,DEMOULIN,GOLDBERG+//EP+SACLY+ZEEMAN
BRITISH 65 OXFORD CONF — BIRM,GLASGOW,IC--LONDON,MUNICH,OXFORD,RUTH
CHUNG 65 PRL 15 325 — +DAHL,HARDY,HESS,JACOBS,KIRZ,MILLER // LRL
FOCARDI 65 PL 16 351 — FOCARDI,MINGUZZI RANZI,SERRA+ /BOLOGNA+CEN
HAQUE 65 PL 14 338 — HAQUE,SCOTTER + /////BIRM,IMP COL+OXF+RUTH

BARTSCH 66 PL 22 357 — +DEUTSCHMANN+GROTE+MORRISON+ /// ABCL(IC)V
BISHOP 66 PRL 16 1069 — BISHOP,GOSHAW,ERWIN,THOMPSON+ // WISCONSIN
BRITISH 66 BERKELEY CONF. — BIRM+GLASGOW+LONDON(IC)+MUNICH+OXFORD+RUTH
CRENNEL3 66 BERKELEY CONF — +KALBFLEISCH,LAI,SCARR,SCHUMANN+////// BNL I,JP
DE BAERE 66 BERK.CONF. - NC — DE BAERE,DEBAISIEUX,FILIPPAS+ // BRUX+CERN
DUBAL 66 BERKELEY CONF — +BAPEYRE,BRICMAN,CHIKOVANI,MAGLIC+ // CERN
GEORGE 66 BERK.CONF. - NC — +GOLDSCHMIDT-CLERMONT+HENRI+ /// CERN+BRUX
HARDY L 66 UCRL 16788 — LYNDON M HARDY (THESIS, BERKELEY) // LRL
SEE ALSO 65 PRL 14 401 — HARDY,CHUNG,DAHL,HESS,KIRZ,MILLER //// LRL
SCHWEING 66 (PREPRINT) — SCHWEINGRUBER,SIMPSON,AMMAR+ // ARGONNE+NW
SHEN 66 BERKELEY CONF — +BUTTERWORTH,FU,GOLDHABERS,TRILLING // LRL
ALSO SHEN66 PRL 17 726 — +BUTTERWORTH,FU,GOLDHABERS,TRILLING // LRL
ALSO 66 (PRIVATE COMMUN)GERSON GOLDHABER /// LRL

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K_A (1800)

23 KA (1800, JP=) I = 1/2
NAMED L BY BARTSCH+

U23 KA (1800) MASS (MEV)

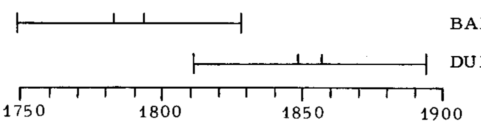
M		80	1789.0	10.0		BARTSCH	66 HBC	- 10.0 K- P	8/66
M	*	35	1852.0	8.0		DUBAL	66 MMS	- 12.0 K- P	8/66

U23 KA (1800) WIDTH (MEV)

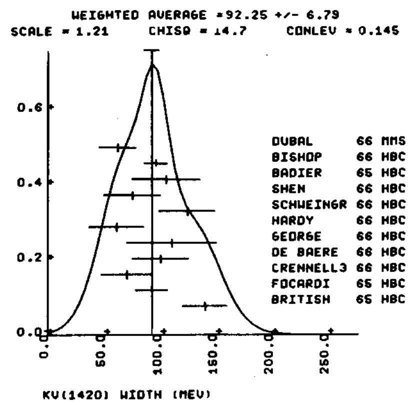
W		80.0	20.0	40.0	BARTSCH	66 HBC	8/66
W	*	84.0	14.0		DUBAL	66 MMS	8/66

Mass and Width of K_A(1800)

The results of the two experiments can be sketched as follows:



The total length of the bars is Γ; the smaller hatch marks show the uncertainty in mass reported by the two groups. It can be seen that the central values, with the errors reported, are inconsistent ($\chi^2 = 4.9^2$), and accordingly the result of Dubal et al. has been suppressed with an * until more data are obtained, at the suggestion of Bogdan Maglic. However the sketch shows that the results are not really as inconsistent as suggested by the large value of χ^2.



U23 KA (1800) PARTIAL DECAY MODES

P1	KA	INTO K PI	S11S 9
P2	KA	INTO K RHO	S11U 9
P3	KA	INTO K*(890) PI	S 9U18
P4	KA	INTO K OMEGA	S11U 1
P5	KA	INTO K PI PI	S11S 9S 9
P6	KA	INTO K*(1420) PI	S 9U22

U23 KA (1800) BRANCHING RATIOS

R1	*	KA	INTO (K PI)/TOTAL		BARTSCH+ SEE NONE(LESS THAN .05).		8/66
R2	*	KA	INTO (K RHO)/TOTAL				
R2			0.075	0.05	BARTSCH 2 66 HBC	-	10/66
R3	*	KA	INTO (K*(890) PI)/TOTAL				
R3			0.35	0.12	BARTSCH 2 66 HBC	-	10/66
R4	*	KA	INTO (K OMEGA)/TOTAL		BARTSCH+ PROBABLY SEE THIS MODE		8/66
R4			0.10	0.03	BARTSCH 2 66 HBC	-	10/66
R5	*	KA	INTO 1 CHARGED/(3 CH.+ 5 CH.) DUBAL 66 GIVE ABOUT 0.4.				8/66
R6	*	KA	INTO (K PI PI)/(TOTAL)			(P5)/TOTAL	
R6			0.40	0.15	BARTSCH 2 66 HBC	-	10/66
R7	*	KA	INTO (K*(1420) PI) / TOTAL			(P6)/TOTAL	
R7			0.085	0.05	BARTSCH 2 66 HBC		10/66

NOTE ON KA (1800) - NEGATIVE EVIDENCE

NUMBER OF ACCEPTED 4C EVENTS / NUMBER OF KA (1800)

REACTION		P K-PI+PI-	P KO PI-PIO	N KO PI+PI-	P K-OMEGA
BARTSCH 66	10 K- P	999 / 35	425 / 35	-	40 / 10
BGLMOR 66	6 K- P	-	1150 / 0	740 / 0	-

REFERENCES FOR KA(1800)

BARTSCH 66 PL 22 357 — DEUTSCHMANN,GROTE,MORRISON,+ //ABCL(IC)V
BARTSCH2 66 BERKELEY CONF. — BARTSCH ET AL, QUOTED BY GOLDHABER,MESON REVIEW
BGLMOR 66 BERKELEY CONF. — BIRM+GLASGOW+LONDON( ),+MUNICH+OXFORD+RUTH
DUBAL 66 BERKELEY CONF — +BAREYRE,BRICMAN,CHIKOVANI,MAGLIC+ // CERN

$K^*_{3/2}$ (1175)

24 K* 3/2 (1175,JP=) I = 3/2

EVIDENCE NOT YET COMPELLING, OMITTED FROM TABLE.
* FOR COMPILATIONS + NEG. EVIDENCE, SEE ROSENFELD, OXFORD
* 1965 SUPPL..
* BISHOP 66 SEES SLIGHT EVIDENCE FOR I=3/2.

24 K* 3/2 (1175) MASS (MEV)

M	*	23	1175.0		WANGLER	64	HBC		
M	*	15	1160.0	10.0	MILLER	65	HBC	PURDUE	
M	*		1180.0		BISHOP	66	HBC	SUGGEST I=3/2	6/66

24 K* 3/2 (1175) WIDTH (MEV)

W	*	23	25.0	OR LESS	WANGLER	64	HBC		
W	*	15	35.0	10.0	MILLER	65	HBC	PURDUE	
W	*		50.0		BISHOP	66	HBC		6/66

REFERENCES FOR K*3/2(1175)

WANGLER 64 PL 9 71 — T P WANGLER,A R ERWIN,W D WALKER //WISCONS
MILLER 65 PL 15 74 — MILLER,KOVACS,MCILWAIN,PALFREY +/// PURDUE
ROSENFEL 65 OXFORD CONF 58 — A H ROSENFELD ////////////////// LRL--RVUE
FOR SLIGHT EVID. FOR K*PI(1175) WITH I = 3/2 SEE BISHOP 66
BISHOP 66 PRL 16 1069 — +GOSHAW,ERWIN,THOMPSON,WALKER,WEINBE//WISC I

$K^*_?$ (1270)

25 K* /2(1270,JP=) I=

EVIDENCE NOT YET COMPELLING, OMITTED FROM TABLE.
* FOR COMPILATIONS + NEG. EVIDENCE, SEE ROSENFELD, OXFORD
* 1965 SUPPL., AND G. GOLDHABER, BERKELEY CONF. 1966.

25 K*(1270) MASS (MEV)

M	*	1270.0	20.0	I=3/2	BOCK	64	HBC		
M	*	1270.0	I = 1/2		DE BAERE	66	HBC	3.5-5 K+ P	10/66
M	*	1280.0	I = 1/2		SHEN	66	HBC	+0 4.6 K+P TO 3PI	10/66

25 K*(1270) WIDTH (MEV)

W	*	60.0	30.0	I=3/2	BOCK	64	HBC		
W	*	200.0	I = 1/2		DE BAERE	66	HBC	3.5-5 K+ P	10/66
W	*	100.0	20.0	I = 1/2	SHEN	66	HBC	+0 4.6 K+P TO 3PI	10/66

25 K*(1270) PARTIAL DECAY MODES

P1	K*(1270) INTO K PI	S11S 9
P2	K*(1270) INTO K*(890) PI	U18S 9
P3	K*(1270) INTO K RHO	S11U 9

25 K*(1270) BRANCHING RATIOS

R1	*	K*(1270) INTO (K PI) / (K*(890) PI)				(P1)/(P2)	
R1	*	0.8 OR LESS	SHEN	66	HBC		10/66

REFERENCES FOR K*(1270)

BOCK 64 PL 12 65 — BOCK,FRENCH,KINSON,BADIER+//CERN+PAR+ LOND
ROSENFEL 65 OXFORD CONF 58 — A H ROSENFELD ////////////////// LRL--RVUE
GOLDHABE 66 BERKELEY CONF — G.GOLDHABER,SAMIOS,ASTIER,SHEN,LAI.MESON REVIEW
DE BAERE 66 BERKELEY CONF — DE BAERE,DEBAISIEUX,DUFOUR+/BRUXELLES+CERN
SHEN 66 BERKELEY CONF — +BUTTERWORTH,FU,GOLDHABERS,TRILLING // LRL

DATA ON BARYON RESONANCES

CODE EVENTS ABOVE BACKGROUND, QUANTITY, ERROR+, ERROR-, REFERENCE, YR, TECN, SIGN, COMMENTS, DATE PUNCHED

N ANY SYMBOL IN COLUMN 8 INDICATES DATA IGNORED BY AVERAGING PROGRAMS

N (1400)

61 N*1/2(1400, JP=1/2+) I=1/2 P11

WHETHER THE BUMP NEAR 1400 MEV SEEN IN INELASTIC PP SCATTERING IS A RESONANCE OR A KINEMATIC EFFECT IS A SUBJECT OF DEBATE. SEE GELLERT 66 FOR THE VIEW THAT IT IS A KINEMATIC EFFECT -- SEE ALMEIDA 66 FOR THE OPPOSITE VIEW. WE LIST BUT STAR RESULTS OF PP SCATTERING EXPERIMENTS. PHASE-SHIFT ANALYSES APPEAR TO GIVE BETTER EVIDENCE FOR A RESONANCE IN THIS REGION. HOWEVER THAT DOESNT END THE PROBLEM. THE RESONANT ENERGY IS PROBABLY NOT WHERE THE P11 AMPLITUDE BECOMES PURE IMAGINARY BUT RATHER SOMEWHAT LOWER WHERE THE AMPLITUDE VARIES MOST RAPIDLY. SEE THE NOTE ON THE N*1/2(1400) FOLLOWING THE LISTINGS. (THE AUTHORS OF THE PHASE-SHIFT ANALYSES ARE NOT RESPONSIBLE FOR THE NUMBERS WE DEDUCE FROM THEIR WORK.)

61 N*1/2(1400) MASS (MEV)

CODE		QUANTITY	ERROR+	ERROR-	REFERENCE	YR	TECN	SIGN	COMMENTS	DATE PUNCHED
M	*	1400.0		APPROX	COCCONI	64	CNTR	+	PP 3.6-12 BEV/C	
M	*	1425.0		APPROX	ADELMAN	64	HBC	+	K-P 1.45 BEV/C	7/66
M	*	1430.0		APPROX	ANKENBRAN	65	CNTR	+	PP 7.1 BEV/C	7/66
M	*	1400.0		APPROX	BELLETTIN	65	SPRK	+	PP,D 10-26 BEV/C	7/66
M	*	1405.0	15.0		ANDERSON	66	SPRK	+	PP 6-30 BEV/C	9/66
M	*	1410.0	15.0		BLAIR	66	CNTR	+	PP 2.8-7.9 BEV/C	9/66
M	*	1450.0			ALMEIDA	66	HBC	+	PP 2PI 10 BEV/C	9/66
M	*	1380.0			ROPER	65	RVUE		PHASE-SHIFT ANAL	9/66
M		1400.0			BAREYRE	65	RVUE		PHASE-SHIFT ANAL	7/66
M	*	1370.0			BRANDSEN	65	RVUE		PHASE-SHIFT ANAL	9/66
M	N	1471.0			LOVELACE	66	RVUE		PHASE-SHIFT ANAL	9/66
	N	WHERE THE AMPLITUDE IS PURE IMAGINARY. DONT HAVE ARGAND DIAGRAM TO GET POINT OF FASTEST VARIATION.								

61 N*1/2(1400) WIDTH (MEV)

CODE		QUANTITY	ERROR+	ERROR-	REFERENCE	YR	TECN	SIGN	COMMENTS	DATE PUNCHED
W	*	200.0		APPROX	BELLETTIN	65	SPRK	+		7/66
W	*	180.0	50.0		ANDERSON	66	SPRK	+		9/66
W	*	125.0	20.0		BLAIR	66	CNTR	+		9/66
W		210.0			BAREYRE	65	RVUE			7/66
W	N	204.0			LOVELACE	66	RVUE		SEE NOTE ON MASS	9/66

61 N*1/2(1400) PARTIAL DECAY MODES

P1	N*1/2(1400) INTO PI N	S 8S16
P2	N*1/2(1400) INTO N SIGMA (SIGMA MESON)	S16U 7
P3	N*1/2(1400) INTO N*3/2(1236) PI	U8IS 8

61 N*1/2(1400) BRANCHING RATIOS

R1		N*1/2(1400) INTO (PI N)/TOTAL				(P1)/TOTAL	
R1		0.7	BAREYRE	65	RVUE		7/66
R1	N	0.60	LOVELACE	66	RVUE	SEE NOTE ON MASS	9/66
R2		N*1/2(1400) INTO (N SIGMA)/TOTAL				(P2)/TOTAL	
R2		DOMINANT INEL DECAY	LOVELACE	66	RVUE		9/66

REFERENCES -- N*1/2(1400)

COCCONI 64 PL 8 134 — +LILLETHUN,SCANLON,STAHLBRANDT, + //CERN
ADELMAN 64 PRL 13 555 — S L ADELMAN //CAMBRIDGE(CERN)
ANKENBRA 65 NC 35 1052 — ANKENBRANDT,CLYDE,CORK,KEEFE,KERTH,+ //LRL
BELLETTI 65 PL 18 167 — BELLETTINI,COCCONI,DIDDENS, + //CERN
ANDERSON 66 PRL 16 855 — +BLESER,COLLINS,FUJII, + //BNL,CARNEGIE
BLAIR 66 PRL 17 789 — +TAYLOR,CHAPMAN,+//HARWELL,QUEENMARY,RTHFD
GELLERT 66 PRL 17 884 — +SMITH,WOJCICKI,COLTON,SCHLEIN,+//LRL,UCLA
ALMEIDA 66 BERKELEY CONF — +RUSHBROOKE, + //CAVNDSH,HAMBURG
ROPER 65 PR 138 B190 — LD ROPER,RM WRIGHT,BT FELD //LRL-LVMR,MIT IJP
BAREYRE 65 PL 18 342 — +BRICMAN, STIRLING, VILLET //SACLAY IJP
BRANDSEN 65 PR 139 B1566 — +ODONNELL, MOORHOUSE //DURHAM,RTHFD IJP
LOVELACE 66 BERKELEY CONF — C LOVELACE //CERN IJP

PAPERS NOT REFERRED TO IN DATA CARDS.

BAREYRE 64 PL 8 137 — +BRICMAN,VALLADAS,VILLET, + //SACLAY,CAEN IJ
ADELMAN 65 PRL 14 1043 — S L ADELMAN //CAMBRIDGE(CERN)
DALITZ 65 PL 14 159 — R H DALITZ, R G MOORHOUSE //OXF,RTHFD
-- DALITZ 65 REVIEWS EARLY PHASE-SHIFT-ANALYSIS RESULTS (AND DISCUSSES WHETHER THEY IN FACT REQUIRE THE EXISTENCE OF A RESONANCE).
FRIDMAN 66 PL 23 386 — +MAURER,MICHALON, + //STRASBOURG,HEIDEL
DONNACHI 66 BERKELEY CONF — DONNACHIE, KIRSOPP, LEA, LOVELACE //CERN IJP
-- NUMBERS OF LOVELACE 66 ARE BASED ON THIS PHASE-SHIFT ANALYSIS.

N (1518) 62 N*1/2(1518, JP=3/2-) I=1/2 D13

WE LIST MASS, WIDTH, AND ELASTICITY FROM PHASE-SHIFT ANALYSES ALONE. THE PROXIMITY OF THE P11 AND S11 STATES MAKES THE DETERMINATION OF THE D13 PARAMETERS FROM LESS SOPHISTICATED METHODS (SUCH AS BUMPS IN TOTAL CROSS SECTIONS OR INVARIANT MASSES) SUBJECT TO ERROR. FOR REFERENCE TO SUCH EARLIER DETERMINATIONS, SEE THE LAST EDITION (RMP 37, 633, 1965).

---------------- 62 N*1/2(1518) MASS (MEV) ----------------

M	*	1536.0	RUPER	65	RVUE	PHASE-SHIFT ANAL	9/66
M		1535.0	BAREYRE	65	RVUE	PHASE-SHIFT ANAL	9/66
M	*	1530.0	BRANDSEN	65	RVUE	PHASE-SHIFT ANAL	9/66
M		1519.0	LOVELACE	66	RVUE	PHASE-SHIFT ANAL	9/66

---------------- 62 N*1/2(1518) WIDTH (MEV) ----------------

W		110.0	BAREYRE	65	RVUE	9/66
W	*	111.0	BRANDSEN	65	RVUE	9/66
W		102.0	LOVELACE	66	RVUE	9/66

---------------- 62 N*1/2(1518) PARTIAL DECAY MODES ----------------

P1	N*1/2(1518) INTO PI N	S 8S16
P2	N*1/2(1518) INTO N*3/2(1236) PI	L81S 8
P3	N*1/2(1518) INTO N PI PI	S16S 8S 8
P4	N*1/2(1518)+ INTO NEUTRON PI+	S17S 8
P5	N*1/2(1518)+ INTO PROTON PI+ PI-	S16S 8S 8

---------------- 62 N*1/2(1518) BRANCHING RATIOS ----------------

R1		N*1/2(1518) INTO (PI N)/TOTAL			(P1)/TOTAL	
R1		0.60	BAREYRE	65 RVUE		9/66
R1	*	0.6	BRANDSEN	65 RVUE		9/66
R1		0.72	LOVELACE	66 RVUE		9/66

EXPERIMENTS DISAGREE ABOUT WHETHER THE N PI PI MODE IS MAINLY N*3/2(1236) PI. IN ANY CASE THE MEASUREMENTS OF THE INELASTIC BRANCHING RATIOS ARE MODEL DEPENDENT AND OUGHT NOT BE TAKEN AS MORE THAN QUALITATIVE INDICATIONS OF TRUTH. ONLY OLSSON 66 AND KIRZ 66 DEFINITELY ASSOCIATED THE OBSERVED EFFECT WITH THE D13 WAVE.

R2	N*1/2(1518) INTO (N*3/2(1236) PI)/TOTAL					(P4)/TOTAL	
R2	DOMINANT INEL DECAY		OLSSON	66 RVUE		PI P TO PI PI N	9/66
R2	0.20	0.05	KIRZ	66 HBC	C	ASSUMING R1=0.72	9/66
R3	N*1/2(1518) INTO (N PI)/(N PI PI)					(P1)/(P3)	
R3	1.25	0.44 0.71	A-BORELLI	66 HBC	C	PBAR P 5.7 BEV/C	9/66
R4	N*1/2(1518) INTO (N*3/2(1236) PI)/(N PI PI)					(P2)/(P3)	
R4	0.00	0.09	A-BORELLI	66 HBC			9/66
R5	N*1/2(1518) INTO (NEUTRON PI+)/(P PI+ PI-)					(P4)/(P5)	
R5	0.77	0.45	ALEXANDER	66 HBC	+	PP 5.5 BEV/C	9/66

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REFERENCES -- N*1/2(1518)

RUPER 65 PR 138 B190 LC ROPER,RM WRIGHT,BT FELD //LRL-LVMR,MIT IJP
BAREYRE 65 PL 18 342 + BRICMAN, STIRLING, VILLET //SACLAY IJP
BRANDSEN 65 PR 139 B1566 +ODONNELL, MOORHOUSE //DURHAM,RTHFD IJP
OLSSON 66 PR 145 1309 M G OLSSON, G B YODH //WISC,MD
ALLES-BO 66 NC (SUBMITTED) ALLES-BORELLI,FRENCH,FRISK,MICHEJDA //CERN
LOVELACE 66 BERKELEY CONF C LOVELACE //CERN IJP
ALEXANDE 66 BERKELEY CONF ALEXANDER,BENARY,CZAPEK,+ //WEIZMANN(CERN)
KIRZ 66 PRIVATE COMM J KIRZ //LRL
-- NUMBER EXTRACTED FROM DATA DISCUSSED IN KIRZ 63.

PAPERS NOT REFERRED TO IN DATA CARDS.
SEE LAST EDITION (RMP 37, 633, 1965) FOR EARLY REFERENCES.

KIRZ 63 PR 130 2481 J KIRZ, J SCHWARTZ, R D TRIPP //LRL
CROUCH 65 DESY CONF II 21 + //BROWN,CEA,HARVARD,MIT,PADOVA,WEIZMANN
DERADO 65 ATHENS CONF 244 +KENNEY,LAMSA, + //NOTRE DAME,KENTUCKY
MERLO 66 P ROY SOC 289 489 J P MERLO, G VALLADAS //SACLAY
-- THE ABOVE PAPERS DISCUSS INELASTIC CHANNELS NEAR THE RESONANCE.
DONNACHI 66 BERKELEY CONF DONNACHIE, KIRSOPP, LEA, LOVELACE //CERN IJP
-- NUMBERS OF LOVELACE 66 ARE BASED ON THIS PHASE-SHIFT ANALYSIS.

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N (1570) 63 N*1/2(1570, JP=1/2-) I=1/2 S11

SEE NOTE IN MAIN TEXT ON S-WAVE BUMPS NEAR THRESHOLD.

63 N*1/2(1570) MASS (MEV) ----------------

M	*	1519.0	HENDRY	65	RVUE	ETA N + S11 PI N	9/66
M		1570.0	MICHAEL	66	RVUE	FITS BAREYRE S11	7/66
M	N	1557.0 OR 1565.0	UCHIYAMA-	66	RVUE	FITS N ETA DATA	9/66
	N	FITTING GIVES TWO SOLUTIONS. PROBLEMS MATCHING PI P PHASE SHIFTS.					
M	K	1561.0	LOVELACE	66	RVUE	PHASE-SHIFT ANAL	9/66
	K	AS GIVEN. WITHOUT ARGAND DIAGRAM WE DONT KNOW HOW DETERMINED.					

---------------- 63 N*1/2(1570) WIDTH (MEV) ----------------

W	*	130.0	HENDRY	65	RVUE		9/66
W		130.0	MICHAEL	66	RVUE		7/66
W	N	156.0 OR 144.0	UCHIYAMA-	66	RVUE	SEE NOTE ON MASS	9/66
W	K	180.0	LOVELACE	66	RVUE	SEE NOTE ON MASS	9/66

---------------- 63 N*1/2(1570) PARTIAL DECAY MODES ----------------

P1	N*1/2(1570) INTO PI N	S 8S16
P2	N*1/2(1570) INTO N ETA	S17S14
P3	N*1/2(1570) INTO N PI PI	S16S 8S 8

---------------- 63 N*1/2(1570) BRANCHING RATIOS ----------------

R1		N*1/2(1570) INTO (PI N)/TOTAL			(P1)/TOTAL	
R1	*	0.69	HENDRY	65 RVUE		9/66
R1		0.32	MICHAEL	66 RVUE		9/66
R1	N	0.71 OR 0.28	UCHIYAMA-	66 RVUE	SEE NOTE ON MASS	9/66
R1	K	0.40	LOVELACE	66 RVUE	SEE NOTE ON MASS	9/66
R2		N*1/2(1570) INTO (N ETA)/TOTAL			(P2)/TOTAL	
R2		DOMINANT INEL DECAY	HENDRY	65 RVUE		9/66
R2		0.68	MICHAEL	66 RVUE		9/66
R2	N	0.29 OR 0.71	UCHIYAMA-	66 RVUE	SEE NOTE ON MASS	9/66
R3		N*1/2(1570) INTO (N PI PI)/TOTAL			(P3)/TOTAL	
R3		SMALL TRACE	LOVELACE	66 RVUE		9/66

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REFERENCES -- N*1/2(1570)

HENDRY 65 PL 18 171 A W HENDRY, R G MOORHOUSE //RTHFD
-- REVIEWS EARLY PHASE-SHIFT-ANALYSIS RESULTS AND PI- P TO ETA N EXPERIMENTS. WE TAKE NUMBERS FROM THE SOLUTION USING BRANDSEN 65.
BAREYRE 65 PL 18 342 + BRICMAN, STIRLING, VILLET //SACLAY IJP
MICHAEL 66 PL 21 93 C MICHAEL //OXF
UCHIYAMA 66 PR 149 1220 F UCHIYAMA-CAMPBELL, R K LOGAN //ILL IJP
LOVELACE 66 BERKELEY CONF C LOVELACE //CERN IJP

PAPERS NOT REFERRED TO IN DATA CARDS.

BULOS 64 PRL 13 486 + //BROWN,BRANDEIS,HARVARD,MIT,PADOVA I
RICHARDS 66 PRL 16 1221 +CHIU,EANDI,HELMHOLZ,KENNEY,+ //LRL,HAWAII IJ
-- BULOS 64 AND RICHARDS 66 ARE EXPERIMENTS ON PI- P TO ETA N NEAR THRESHOLD. THEY ARE IN SOME DISAGREEMENT.
BRANDSEN 65 PR 139 B1566 +ODONNELL, MOORHOUSE //DURHAM,RTHFD IJP
-- BASIS OF NUMBERS WE QUOTE FROM HENDRY 65.
PREPOST 65 DESY CONF II 152 R PREPOST, D LUNDQUIST, D QUINN //STANFORD
BACCI 66 PRL 16 157 +PENSO,SALVINI,MENCUCCINI,+//ROME,FRASCATI
-- PREPOST 65 AND BACCI 66 ARE EXPERIMENTS ON ETA PHOTOPRODUCTION NEAR THRESHOLD.
THE FOLLOWING THREE ARE ANALYSES OF ETA PRODUCTION NEAR THRESHOLD --
DOBSON 66 PR 146 1022 P N DOBSON //HAWAII
MINAMI 66 PR 147 1123 S MINAMI //OSAKA
BALL 66 PR 149 1191 J S BALL //UCLA
DONNACHI 66 BERKELEY CONF DONNACHIE, KIRSOPP, LEA, LOVELACE //CERN IJP
-- NUMBERS OF LOVELACE 66 ARE BASED ON THIS PHASE-SHIFT ANALYSIS.

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N (1670) 64 N*1/2(1670, JP=5/2-) I=1/2 D15

UNTANGLED FROM THE 1688 MEV BUMP BY DUKE 65 AND PHASE-SHIFT ANALYSES. SEE THE NOTE ON THE N*1/2(1688).

---------------- 64 N*1/2(1670) MASS (MEV) ----------------

M	*	1674.0		DUKE	65	CNTR	PI+- P EL DSIG,P	7/66
M		1690.0		BAREYRE	65	RVUE	PHASE-SHIFT ANAL	7/66
M	*	1650.0	APPROX	BRANDSEN	65	RVUE	PHASE-SHIFT ANAL	7/66
M		1652.0		LOVELACE	66	RVUE	PHASE-SHIFT ANAL	9/66

---------------- 64 N*1/2(1670) WIDTH (MEV) ----------------

W	*	100.0	DUKE	65	CNTR	7/66
W		150.0	BAREYRE	65	RVUE	9/66
W		134.0	LOVELACE	66	RVUE	9/66

---------------- 64 N*1/2(1670) PARTIAL DECAY MODES ----------------

P1	N*1/2(1670) INTO PI N	S 8S16
P2	N*1/2(1670) INTO N ETA	S17S14
P3	N*1/2(1670) INTO LAMBDA K	S18S11
P4	N*1/2(1670) INTO N*3/2(1236) PI	L81S 8

---------------- 64 N*1/2(1670) BRANCHING RATIOS ----------------

R1		N*1/2(1670) INTO (PI N)/TOTAL			(P1)/TOTAL	
R1	*	0.42	DUKE	65 CNTR		7/66
R1		0.41	BAREYRE	65 RVUE		9/66
R1	*	0.52	BRANDSEN	65 RVUE		9/66
R1		0.40	LOVELACE	66 RVUE		9/66

SEE NOTE PRECEDING THE N*1/2(1688) INELASTIC DECAY MODE MEASUREMENTS.

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REFERENCES -- N*1/2(1670)

DUKE 65 PRL 15 468 +JONES,KEMP,MURPHY,PRENTICE, + //RTHFD,OXF IJP
BAREYRE 65 PL 18 342 + BRICMAN, STIRLING, VILLET //SACLAY IJP
BRANDSEN 65 PL 19 420 +ODONNELL, MOORHOUSE //DURHAM,RTHFD IJP
LOVELACE 66 BERKELEY CONF C LOVELACE //CERN IJP

PAPER NOT REFERRED TO IN DATA CARDS.

DONNACHI 66 BERKELEY CONF DONNACHIE, KIRSOPP, LEA, LOVELACE //CERN IJP
-- NUMBERS OF LOVELACE 66 ARE BASED ON THIS PHASE-SHIFT ANALYSIS.

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N (1688) 65 N*1/2(1688, JP=5/2+) I=1/2 F15

WE LIST MASS, WIDTH, AND ELASTICITY FROM PHASE-SHIFT ANALYSES ALONE. THE PROXIMITY OF THE D15 AND S11 STATES MAKES THE DETERMINATION OF THE F15 PARAMETERS FROM LESS SOPHISTICATED METHODS (SUCH AS BUMPS IN TOTAL CROSS SECTIONS) SUBJECT TO SERIOUS ERROR. FOR REFERENCE TO SUCH EARLY DETERMINATIONS, SEE THE LAST EDITION (RMP 37, 633, 1965).

---------------- 65 N*1/2(1688) MASS (MEV) ----------------

M	*	1688.0	APPROX	DUKE	65	CNTR	PI+- P EL DSIG,P	7/66
M		1695.0		BAREYRE	65	RVUE	PHASE-SHIFT ANAL	7/66
M	*	1680.0		BRANDSEN	65	RVUE	PHASE SHIFT ANAL	7/66
M		1672.0		LOVELACE	66	RVUE	PHASE-SHIFT ANAL	9/66

---------------- 65 N*1/2(1688) WIDTH (MEV) ----------------

W	*	100.0	DUKE	65	CNTR	VERY ENERGY DEP	7/66
W		120.0	BAREYRE	65	RVUE		9/66
W		104.0	LOVELACE	66	RVUE		9/66

---------------- 65 N*1/2(1688) PARTIAL DECAY MODES ----------------

P1	N*1/2(1688) INTO PI N	S 8S16
P2	N*1/2(1688) INTO N ETA	S17S14
P3	N*1/2(1688) INTO LAMBDA K	S18S11
P4	N*1/2(1688) INTO N*3/2(1236) PI	L81S 8
P5	N*1/2(1688) INTO N PIPI	S16S 8S 8
P6	N*1/2(1688)+ INTO NEUTRON PI+	S17S 8
P7	N*1/2(1688)+ INTO PROTON PI+ PI-	S16S 8S 8
P8	N*1/2(1688)+ INTO N*3/2(1236)++ PI-	L81S 8

---------------- 65 N*1/2(1688) BRANCHING RATIOS ----------------

R1		N*1/2(1688) INTO (PI N)/TOTAL			(P1)/TOTAL	
R1	*	0.80	DUKE	65 CNTR		7/66
R1		0.62	BAREYRE	65 RVUE		9/66
R1	*	0.61	BRANDSEN	65 RVUE		9/66
R1		0.66	LOVELACE	66 RVUE		9/66

WE LIST MEASUREMENTS OF THE INELASTIC DECAY MODES OF THE 1688 MEV BUMP. SUCH MEASUREMENTS HAVE NOT UNTANGLED THE D15 AND F15 (AND POSSIBLE S11) COMPONENTS. IT IS CLEAR THAT BOTH D15 AND F15 DECAY ALOT INTO N PI PI. THERE IS SOME DISAGREEMENT ABOUT WHETHER THIS IS DOMINATED BY N*3/2(1236) PI. IN ANY CASE THE MEASUREMENTS OF THE BRANCHING RATIO TO THIS FINAL STATE ARE MODEL DEPENDENT AND OUGHT NOT BE TAKEN AS MORE THAN QUALITATIVE INDICATIONS OF TRUTH.

R2 N*1/2(1688) INTO (N ETA)/TOTAL (P2)/TOTAL
R2 0.025 OR LESS KRAEMER 64 DBC + PI+D 1.23 BEV/C 9/66
R2 0.042 OR LESS (95PC CL) A-BORELLI 66 HBC + PBAR P 5.7 BEV/C 9/66

R3 N*1/2(1688) INTO (N ETA)/(PI N) (P2)/(P1)
R3 0.027 OR LESS HEUSCH 66 RVUE + PIC, ETA PHOTO 9/66

R4 N*1/2(1688) INTO (LAMBDA K)/TOTAL (P3)/TOTAL
R4 0.013 OR LESS (95PC CL) A-BORELLI 66 HBC + 9/66

R5 N*1/2(1688) INTO (N PI)/(N PI PI) (P1)/(P5)
R5 1.25 OR LESS (95PC CL) A-BORELLI 66 HBC + 9/66

R6 N*1/2(1688) INTO (N*3/2(1236) PI)/(N PI PI) (P4)/(P5)
R6 NO EVIDENCE A-BORELLI 66 HBC + 9/66

R7 N*1/2(1688) INTO (NEUTRON PI+)/(P PI+ PI-) (P6)/(P7)
R7 0.67 0.04 ALEXANDER 66 HBC + PP 5.5 BEV/C 9/66

R8 N*1/2(1688) INTO (N*(1236)++ PI-)/(P PI+ PI-) (P8)/(P7)
R8 0.7 0.3 ALEXANDER 66 HBC + 9/66
R8 1.0 0.3 ALMEIDA 66 HBC + PP 10 BEV/C 9/66

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REFERENCES -- N*1/2(1688)

KRAEMER 64 PR 136 B496 +MACANSKY,+ //J HOPKINS,NWESTERN,WOODSTOCK I
DUKE 65 PRL 15 468 +JONES,KEMP,MURPHY,PRENTICE, + //RTHFD,OXF IJP
BAREYRE 65 PL 18 342 + BRICMAN, STIRLING, VILLET //SACLAY IJP
BRANDSEN 65 PL 19 420 +ODONNELL, MOORHOUSE //DURHAM,RTHFD IJP
LOVELACE 66 BERKELEY CONF C LOVELACE //CERN IJP
HEUSCH 66 PRL 17 1019 C A HEUSCH, C Y PRESCOTT, R F DASHEN //CIT
ALLES-BC 66 NC (SUBMITTED) ALLES-BORELLI,FRENCH,FRISK,MICHEJDA //CERN
ALMEIDA 66 BERKELEY CONF +RUSHBROOKE, + //CAVNDSH,DESY(CERN)
ALEXANDE 66 BERKELEY CONF ALEXANDER,BENARY,CZAPEK,+ //WEIZMANN(CERN)

PAPERS NOT REFERRED TO IN DATA CARDS.
SEE LAST EDITION (RMP 37, 633, 1965) FOR EARLY REFERENCES.

CROUCH 65 DESY CONF II 21 + //BROWN,CEA,HARVARD,MIT,PADOVA,WEIZMANN
DERADO 65 ATHENS CONF 244 +KENNEY,LAMSA, + //NOTRE DAME,KENTUCKY
MERLO 66 P ROY SOC 289 489 J P MERLO, G VALLADAS //SACLAY
-- THE ABOVE PAPERS DISCUSS INELASTIC CHANNELS NEAR THE BUMP.
DONNACHI 66 BERKELEY CONF DONNACHIE, KIRSOPP, LEA, LOVELACE //CERN IJP
-- NUMBERS OF LOVELACE 66 ARE BASED ON THIS PHASE-SHIFT ANALYSIS.

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N(1700)

66 N*1/2(1700, JP=1/2-) I=1/2 S11

EXISTENCE NOT CONCLUSIVE. SEE LOVELACE 66.

66 N*1/2(1700) MASS (MEV) --------------------------

M * 1695.0 BRANDSEN 65 RVUE PHASE-SHIFT ANAL 9/66
M 1700.0 MICHAEL 66 RVUE FITS BAREYRE S11 7/66

---------------- 66 N*1/2(1700) WIDTH (MEV) -------------------------

W 240.0 MICHAEL 66 RVUE 7/66

---------------- 66 N*1/2(1700) PARTIAL DECAY MODES ------------------

P1 N*1/2(1700) INTO PI N S 8S16
P2 N*1/2(1700) INTO N ETA S17S14
P3 N*1/2(1700) INTO LAMBDA K S18S11

---------------- 66 N*1/2(1700) BRANCHING RATIOS --------------------

R1 N*1/2(1700) INTO (PI N)/TOTAL (P1)/TOTAL
R1 1.0 APPROX MICHAEL 66 RVUE 7/66

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REFERENCES -- N*1/2(1700)

BAREYRE 65 PL 18 342 + BRICMAN, STIRLING, VILLET //SACLAY IJP
BRANDSEN 65 PL 19 420 +ODONNELL, MOORHOUSE //DURHAM,RTHFD IJP
MICHAEL 66 PL 21 93 C MICHAEL //OXF
LOVELACE 66 BERKELEY CONF C LOVELACE //CERN
-- LOVELACE 66 QUESTIONS THE EXISTENCE OF THIS SECOND S11 RESONANCE.

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N (2190)

71 N*1/2(2190, JP=7/2-) I=1/2

71 N*1/2(2190) MASS (MEV) --------------------------

M 2190.0 DIDDENS 63 CNTR PI+- P TOTAL
M 2210.0 HOHLER 64 RVUE DATA + DISP REL
M 2190.0 APPROX YOKOSAWA 66 CNTR PI- P DSIG + POL 7/66

---------------- 71 N*1/2(2190) WIDTH (MEV) -------------------------

W 200.0 DIDDENS 63 CNTR
W 200.0 HOHLER 64 RVUE 7/66
W 220.0 APPROX YOKOSAWA 66 CNTR 7/66

---------------- 71 N*1/2(2190) PARTIAL DECAY MODES ------------------

P1 N*1/2(2190) INTO PI N S 8S16
P2 N*1/2(2190) INTO LAMBDA K S18S11

---------------- 71 N*1/2(2190) BRANCHING RATIOS --------------------

R1 N*1/2(2190) INTO (PI N)/TOTAL (P1)/TOTAL
R1 0.3 APPROX DIDDENS 63 CNTR 7/66
R1 0.3 APPROX YOKOSAWA 66 CNTR 7/66

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REFERENCES -- N*1/2(2190)

DIDDENS 63 PRL 10 262 +JENKINS, KYCIA, RILEY //BNL I
HOHLER 64 PL 12 149 G HOHLER, J GIESECKE //KARLSRUHE I
YOKOSAWA 66 PRL 16 714 +SUWA,HILL,ESTERLING,BOOTH //ARG,CHI JP

QUANTUM NUMBER DETERMINATIONS NOT REFERRED TO IN DATA CARDS.

CARROLL 66 PRL 16 288 +CORBETT,DAMERELL,MIDDLEMAS, + //RTHFD,OXF J-L
KORMANYO 66 PRL 16 709 KORMANYOS,KRISCH,OFALLON, + //MICH,ARG P
BARGER 66 PRL 16 913 V BARGER, D CLINE //WISC P

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N (2650)

72 N*1/2(2650, JP=11/2-) I=1/2

FOR JP ASSIGNMENT SEE BARGER 66 AND NOTE AFTER LISTINGS.

72 N*1/2(2650) MASS (MEV) --------------------------

M * 2700.0 ALVAREZ 64 CNTR PI PHOTOPROD
M * 2600.0 APPROX WAHLIG 64 SPRK C PI-P CH EX
M 2660.0 HOHLER 64 RVUE DATA + DISP REL
M 2649.0 10.0 CITRON 66 CNTR PI+- P TOTAL 7/66

---------------- 72 N*1/2(2650) WIDTH (MEV) -------------------------

W * 100.0 ALVAREZ 64 CNTR
W 200.0 HOHLER 64 RVUE 7/66
W 360.0 20.0 CITRON 66 CNTR 7/66

---------------- 72 N*1/2(2650) PARTIAL DECAY MODES ------------------

P1 N*1/2(2650) INTO PI N S 8S16
P2 N*1/2(2650) INTO LAMBDA K S18S11

---------------- 72 N*1/2(2650) BRANCHING RATIOS --------------------

R1 N*1/2(2650) INTO (PI N)/TOTAL (P1)/TOTAL
R1 0.0703 0.0045 CITRON 66 CNTR ASSUMING J=11/2 7/66

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REFERENCES -- N*1/2(2650)

ALVAREZ 64 PRL 12 710 +BAR-YAM,KERN,LUCKEY,OSBORNE, + //MIT,CEA
WAHLIG 64 PRL 13 103 +MANNELLI,SODICKSON,FACKLER,WARD, + //MIT
HOHLER 64 PL 12 149 G HOHLER, J GIESECKE //KARLSRUHE I
CITRON 66 PR 144 1101 +GALBRAITH,KYCIA,LEONTIC,PHILLIPS, + //BNL I
BARGER 66 PRL 16 913 V BARGER, D CLINE //WISC P

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N (3030)

73 N*1/2(3030, JP=15/2-) I=1/2

EVIDENCE FOR EXISTENCE NOT COMPLETELY CONCLUSIVE. FOR
JP ASSIGNMENT SEE BARGER 66 AND NOTE FOLLOWING LISTINGS.

---------------- 73 N*1/2(3030) MASS (MEV) --------------------------

M 3080.0 HOHLER 64 RVUE DATA + DISP REL 7/66
M 3030.0 CITRON 66 CNTR PI+- P TOTAL 7/66

---------------- 73 N*1/2(3030) WIDTH (MEV) -------------------------

W 400.0 CITRON 66 CNTR 7/66

---------------- 73 N*1/2(3030) PARTIAL DECAY MODES ------------------

P1 N*1/2(3030) INTO PI N S 8S16

---------------- 73 N*1/2(3030) BRANCHING RATIOS --------------------

R1 N*1/2(3030) INTO (PI N)/TOTAL (P1)/TOTAL
R1 0.0070 CITRON 66 CNTR ASSUMING J=15/2 7/66

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REFERENCES -- N*1/2(3030)

HOHLER 64 PL 12 149 G HOHLER, J GIESECKE //KARLSRUHE I
CITRON 66 PR 144 1101 +GALBRAITH,KYCIA,LEONTIC,PHILLIPS, + //BNL I
BARGER 66 PRL 16 913 V BARGER, D CLINE //WISC P

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$N_?$(3245)

74 N* /2(3245, JP=)

EXISTENCE ONLY TENTATIVE. I-SPIN NOT DETERMINED BUT
NARROW WIDTH PRECLUDES IDENTIFICATION WITH N*3/2(3230).
OMITTED FROM TABLE.

---------------- 74 N* /2(3245) MASS (MEV) --------------------------

M 3245.0 10.0 KORMANYOS 66 CNTR PI-P EL AT 180 D 7/66

---------------- 74 N* /2(3245) WIDTH (MEV) -------------------------

W 35.0 OR LESS KORMANYOS 66 CNTR 7/66

---------------- 74 N* /2(3245) PARTIAL DECAY MODES ------------------

P1 N* /2(3245) INTO PI N S 8S16

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REFERENCES -- N* /2(3245)

KORMANYO 66 PRL 16 709 KORMANYOS,KRISCH,OFALLON, + //MICH,ARG

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N (3695)

75 N*1/2(3695, JP=) I=1/2

EVIDENCE PRELIMINARY AND NOT COMPELLING. OMITTED FROM
TABLE.

---------------- 75 N*1/2(3695) MASS (MEV) --------------------------

M 3694.0 7.0 BARTKE 66 HBC + PI+P 8 PRONGS 9/66

---------------- 75 N*1/2(3695) WIDTH (MEV) -------------------------

W 46.0 23.0 BARTKE 66 HBC + 9/66

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REFERENCES -- N*1/2(3695)

BARTKE 66 BERKELEY CONF +CZYZEWSKI,DANYSZ,ESKREYS,+ //KRAKOW(CERN) I

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Δ (1236) 81 N*3/2(1236, JP=3/2+) I=3/2 P33

81 N*3/2(1236) MASS (MEV) ----------------------------

M * 1234.0 ROPER 65 RVUE C++PHASE-SHIFT ANAL
M++ 1236.0 0.55 OLSSON 65 RVUE ++ TOTAL-SIGMA DATA
M++ * 1232.0 6.0 FERRO-LUZ 65 HBC ++ K+P TO KC P PI+
M++ * 1233.4 4.4 GIDAL 66 DBC ++ D D TO NN(NN) PI 7/66
M++ 1236.0 DEANS 66 RVUE ++ PI+P TOTAL 7/66
MO 1236.45 0.65 OLSSON 65 RVUE C
M- * 1241.3 5.1 GIDAL 66 DBC - 7/66

---------------- 81 N*(0) - N*(++) MASS DIFFERENCE (MEV) ------------

D R 0.45 0.85 OLSSON 65 RVUE
R REDUNDANT WITH DATA IN MASS LISTING.

---------------- 81 N*(-) - N*(++) MASS DIFFERENCE (MEV) ------------

D 7.9 6.8 GIDAL 66 DBC

---------------- 81 N*3/2(1236) WIDTH (MEV) --------------------------

W++ 120.0 2.0 OLSSON 65 RVUE ++
W++ * 125.0 30.0 FERRO-LUZ 65 HBC ++
W++ * 124.0 14.0 GIDAL 66 DBC ++ 7/66
W++ 121.0 DEANS 66 RVUE ++ 7/66
WO 119.6 2.4 OLSSON 65 RVUE C
W- * 149.0 18.0 GIDAL 66 DBC - 7/66

---------------- 81 N*3/2(1236) PARTIAL DECAY MODES ------------------

P1 N*3/2(1236) INTO PI N S 8S16

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REFERENCES -- N*3/2(1236)

OLSSON 65 PRL 14 118 M G OLSSON //WISC
FERRO-LU 65 NC 36 1101 FERRO-LUZZI,GEORGE, + //CERN
ROPER 65 PR 138 B190 L D ROPER, R M WRIGHT, B T FELD //LRL,MIT JP
GIDAL 66 PR 141 1261 G GIDAL, A KERNAN, S KIM //LRL
DEANS 66 PREPRINT S R DEANS, W G HOLLADAY //VANDERBILT

FOR EXTENSIVE REFERENCES TO DATA AND PHASE-SHIFT ANALYSES TILL 1965, SEE ROPER 65, ESPECIALLY APPENDIX II.

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Δ (1670) 82 N*3/2(1670, JP=1/2-) I=3/2 S31

82 N*3/2(1670) MASS (MEV) ----------------------------

M * 1648.0 12.0 DEVLIN 65 CNTR PI+- P TOTAL
M 1665.0 BAREYRE 65 RVUE PHASE SHIFT ANAL 7/66
M 1692.0 LOVELACE 66 RVUE PHASE-SHIFT ANAL 9/66

---------------- 82 N*3/2(1670) WIDTH (MEV) ----------------------------

W * 201.0 74.0 DEVLIN 65 CNTR VERY ASYMMETRIC
W 130.0 BAREYRE 65 RVUE 7/66
W 230.0 LOVELACE 66 RVUE 9/66

---------------- 82 N*3/2(1670) PARTIAL DECAY MODES ------------------

P1 N*3/2(1670) INTO PI N S 8S16

---------------- 82 N*3/2(1670) BRANCHING RATIOS --------------------

R1 N*3/2(1670) INTO (PI N)/TOTAL (P1)/TOTAL
R1 * 0.56 DEVLIN 65 CNTR
R1 0.33 BAREYRE 65 RVUE 7/66
R1 0.44 LOVELACE 66 RVUE 9/66

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REFERENCES -- N*3/2(1670)

DEVLIN 65 PRL 14 1031 T J DEVLIN,J SOLOMON,G BERTSCH //PRINCETON I
BAREYRE 65 PL 18 342 + BRICMAN, STIRLING, VILLET //SACLAY IJP
LOVELACE 66 BERKELEY CONF C LOVELACE //CERN IJP

PAPERS NOT REFERRED TO IN DATA CARDS.

CARRUTHE 60 PRL 4 303 P CARRUTHERS //CORNELL I
DEVLIN 62 PR 125 690 T J DEVLIN, B J MOYER, V PEREZ-MENDEZ//LRL I
HELLAND 64 PR 134 B1062 +DEVLIN,HAGGE,LONGO,MOYER,WOOD //LRL I
DONNACHI 66 BERKELEY CONF DONNACHIE, KIRSOPP, LEA, LOVELACE //CERN IJP
-- NUMBERS OF LOVELACE 66 ARE BASED ON THIS PHASE-SHIFT ANALYSIS.

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Δ (1920) 83 N*3/2(1920, JP=7/2+) I=3/2

83 N*3/2(1920) MASS (MEV) ----------------------------

M 1922.0 APPROX COOL 56 CNTR PI+ P TOTAL 7/66
M 1912.0 15.0 BRISSON 61 CNTR PI+ P TOTAL 7/66
M N 1956.0 LAYSON 63 RVUE PI P TOTAL, EL 7/66
N ASSUMES AN N*3/2(1855).
M 1920.0 HOHLER 64 RVUE DATA + DISP REL 7/66
M 1900.0 9.0 DEVLIN 65 CNTR PI+ P TOTAL
M 1920.0 APPROX DUKE 65 CNTR PI+- P EL, POLAR 7/66
M 1950.0 APPROX YOKOSAWA 66 CNTR PI- P DSIG + PCL 7/66
M 1950.0 LOVELACE 66 RVUE PHASE-SHIFT ANAL 9/66

---------------- 83 N*3/2(1920) WIDTH (MEV) ----------------------------

W 170.0 HOHLER 64 RVUE 7/66
W 256.0 39.0 DEVLIN 65 CNTR
W 170.0 DUKE 65 CNTR 7/66
W 200.0 APPROX YOKOSAWA 66 CNTR 7/66
W 250.0 LOVELACE 66 RVUE 9/66

---------------- 83 N*3/2(1920) PARTIAL DECAY MODES ------------------

P1 N*3/2(1920) INTO PI N S 8S16
P2 N*3/2(1920) INTO SIGMA K S20S10
P3 N*3/2(1920) INTO N*3/2(1236) PI L8IS 8

---------------- 83 N*3/2(1920) BRANCHING RATIOS --------------------

R1 N*3/2(1920) INTO (PI N)/TOTAL (P1)/TOTAL
R1 N 0.33 LAYSON 63 RVUE 7/66
N ASSUMES AN N*3/2(1855).
R1 0.73 OR LESS HOHLER 63 RVUE DATA + DISP REL 7/66
R1 0.57 0.12 DEVLIN 65 CNTR
R1 0.41 DUKE 65 CNTR VERY ENERGY DEP 7/66
R1 0.4 APPROX YOKOSAWA 66 CNTR 7/66
R1 0.50 LOVELACE 66 RVUE 9/66

R2 N*3/2(1920) INTO (SIGMA K)/TOTAL (P2)/TOTAL
R2 SEEN HOLLADAY 65 RVUE PI+P DATA 11/66

R3 N*3/2(1920) INTO (N*3/2(1236) PI)/TOTAL (P3)/TOTAL
R3 DOMINANT INEL DECAY LOVELACE 66 RVUE 9/66

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REFERENCES -- N*3/2(1920)

COOL 56 PR 103 1082 R COOL, O PICCIONI, D CLARK //BNL I
BRISSON 61 NC 19 210 +CETOEUF,FALK-VAIRANT,VAN ROSSUM,+//SACLAY I
LAYSON 63 NC 27 724 W M LAYSON //CERN IJ
HOHLER 63 NP 48 470 G HOHLER, G EBEL //KARLSRUHE I
HOHLER 64 PL 12 149 G HOHLER, J GIESECKE //KARLSRUHE I
DEVLIN 65 PRL 14 1031 T J DEVLIN,J SOLOMON,G BERTSCH //PRINCETON I
DUKE 65 PRL 15 468 +JONES,KEMP,MURPHY,PRENTICE, + //RTHFD,OXF IJP
HOLLADAY 65 PR 139 B1348 W G HOLLADAY //VANDERBILT
YOKOSAWA 66 PRL 16 714 +SUWA, HILL, ESTERLING, BOOTH //ARG,CHI IJP
LOVELACE 66 BERKELEY CONF C LOVELACE //CERN IJP

PAPERS NOT REFERRED TO IN DATA CARDS.

HELLAND 64 PR 134 B1062 +DEVLIN,HAGGE,LONGO,MOYER,WOOD //LRL IJ
AUVIL 64 NC 33 473 P AUVIL, C LOVELACE //IMPCOL IJP
DONNACHI 66 BERKELEY CONF DONNACHIE, KIRSOPP, LEA, LOVELACE //CERN IJP
-- NUMBERS OF LOVELACE 66 ARE BASED ON THIS PHASE-SHIFT ANALYSIS.

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Δ (2420) 84 N*3/2(2420, JP=11/2+) I=3/2

FOR JP ASSIGNMENT SEE BARGER 66 AND NOTE AFTER LISTINGS.

84 N*3/2(2420) MASS (MEV) ----------------------------

M 2360.0 DIDDENS 63 CNTR PI+ P TOTAL
M * 2520.0 40.0 ALVAREZ 64 CNTR PI PHOTOPROD 7/66
M * 2400.0 APPROX WAHLIG 64 SPRK C PI-P CH EX
M 2440.0 HOHLER 64 RVUE DATA + DISP REL
M 2423.0 10.0 CITRON 66 CNTR PI+ P TOTAL 7/66

---------------- 84 N*3/2(2420) WIDTH (MEV) ----------------------------

W 200.0 DIDDENS 63 CNTR
W 245.0 HOHLER 64 RVUE 7/66
W 310.0 20.0 CITRON 66 CNTR 7/66

---------------- 84 N*3/2(2420) PARTIAL DECAY MODES ------------------

P1 N*3/2(2420) INTO PI N S 8S16
P2 N*3/2(2420) INTO SIGMA K S20S10

---------------- 84 N*3/2(2420) BRANCHING RATIOS --------------------

R1 N*3/2(2420) INTO (PI N)/TOTAL (P1)/TOTAL
R1 0.067 APPROX DIDDENS 63 CNTR ASSUMING J=11/2 7/66
R1 0.113 0.0036 CITRON 66 CNTR ASSUMING J=11/2 7/66

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REFERENCES -- N*3/2(2420)

DIDDENS 63 PRL 10 262 +JENKINS, KYCIA, RILEY //BNL I
ALVAREZ 64 PRL 12 710 +BAR-YAM,KERN,LUCKEY,OSBORNE, + //MIT,CEA
WAHLIG 64 PRL 13 103 +MANNELLI,SODICKSON,FACKLER,WARD, + //MIT
HOHLER 64 PL 12 149 G HOHLER, J GIESECKE //KARLSRUHE I
CITRON 66 PR 144 1101 +GALBRAITH,KYCIA,LEONTIC,PHILLIPS, + //BNL I
BARGER 66 PRL 16 913 V BARGER, D CLINE //WISC P

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Δ (2850) 85 N*3/2(2850, JP=15/2+) I=3/2

FOR JP ASSIGNMENT SEE BARGER 66 AND NOTE AFTER LISTINGS.

85 N*3/2(2850) MASS (MEV) ----------------------------

M * 2700.0 APPROX WAHLIG 64 SPRK C PI-P CH EX
M 2870.0 HOHLER 64 RVUE DATA + DISP REL
M 2850.0 12.0 CITRON 66 CNTR PI+ P TOTAL 7/66
M 2850.0 BARDADIN 66 HBC ++ N* TO P + 3 PIS 7/66

---------------- 85 N*3/2(2850) WIDTH (MEV) ----------------------------

W 400.0 40.0 CITRON 66 CNTR 7/66
W 150.0 BARDADIN 66 HBC ++ 7/66

---------------- 85 N*3/2(2850) PARTIAL DECAY MODES ------------------

P1 N*3/2(2850) INTO PI N S 8S16
P2 N*3/2(2850) INTO P PI PI PI S16S 8S 8S 8

---------------- 85 N*3/2(2850) BRANCHING RATIOS --------------------

R1 N*3/2(2850) INTO (PI N)/TOTAL (P1)/TOTAL
R1 0.0314 0.0025 CITRON 66 CNTR ASSUMING J=15/2 7/66

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REFERENCES -- N*3/2(2850)

WAHLIG 64 PRL 13 103 +MANNELLI,SODICKSON,FACKLER,WARD, + //MIT
HOHLER 64 PL 12 149 G HOHLER, J GIESECKE //KARLSRUHE I
CITRON 66 PR 144 1101 +GALBRAITH,KYCIA,LEONTIC,PHILLIPS, + //BNL I
BARDADIN 66 PL 21 357 BARDADIN-OTWINOWSKA,DANYSZ, + //WARSAW
BARGER 66 PRL 16 913 V BARGER, D CLINE //WISC P

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Δ (3230) 86 N*3/2(3230, JP=19/2+) I=3/2

EVIDENCE FOR EXISTENCE NOT COMPLETELY CONCLUSIVE. FOR JP ASSIGNMENT SEE BARGER 66 AND NOTE FOLLOWING LISTINGS.

---------------- 86 N*3/2(3230) MASS (MEV) ----------------------------

M 3230.0 CITRON 66 CNTR PI+ P TOTAL 7/66

---------------- 86 N*3/2(3230) WIDTH (MEV) ----------------------------

W 440.0 CITRON 66 CNTR 7/66

---------------- 86 N*3/2(3230) PARTIAL DECAY MODES ------------------

P1 N*3/2(3230) INTO PI N S 8S16

86 N*3/2(3230) BRANCHING RATIOS

R1	N*3/2(3230) INTO (PI N)/TOTAL			(P1)/TOTAL	
R1	0.0063	CITRON	66 CNTR	ASSUMING J=19/2	7/66

REFERENCES -- N*3/2(323C)

CITRCN 66 PR 144 1101 +GALBRAITH,KYCIA,LEONTIC,PHILLIPS, + //BNL I
BARGER 66 PRL 16 913 V BARGER, D CLINE //WISC P

$N^*_{5/2}$(1560) 91 N*5/2(1560, JP=) I=5/2

PROBABLE KINEMATIC EFFECT. SEE DASH 66, CONTE 66, AND ALEXANCER 66. OMITTED FROM TABLE.

91 N*5/2(1560) MASS (MEV)

M	1560.0	20.0	GOLDHABER 64 HBC	+++3.65 BEV/C PI+ P	7/66
M	1570.0		ALEXANDER 66 HBC	+++PP 4PI 5.5 BEV/C	9/66

91 N*5/2(1560) WIDTH (MEV)

W	220.0	20.0	GOLDHABER 64 HBC	+++	7/66
W	140.0		ALEXANDER 66 HBC	+++	9/66

91 N*5/2(156C) PARTIAL DECAY MODES

P1	N*5/2(1560) INTO N PI PI	S16S 8S 8
P2	N*5/2(1560) INTO N*3/2(1236) PI	L81S 8

REFERENCES -- N*5/2(156C)

GOLDHABE 64 DUBNA CONF I 480 G+S GOLDHABER,OHALLORAN,SHEN //LRL(BNL) I
DASH 65 LRL UCID-2752 J DASH, G GOLDHABER, J SWINHART //LRL
CONTE 66 BERKELEY CONF +CAMERI,RATTI,RUSSO, + //GENOVA,MILANO,UXF
ALEXANDE 66 BERKELEY CONF ALEXANDER,BENARY,CZAPEK,+ //WEIZMANN(CERN)

PAPER NOT REFERRED TO IN DATA CARDS.

ALEXANDE 65 PRL 15 207 ALEXANDER,BENARY,REUTER,+ //WEIZMANN(CERN) I
-- REPLACED BY ALEXANDER 66.

Z_0(1865) 96 Z*0(1865, JP=) I=C

IT IS NOT ESTABLISHED THAT THIS EFFECT IS A RESONANCE. HOWEVER IF SUCH A LARGE EFFECT APPEARED IN A PI N OR KBAR N CHANNEL IT WOULD IMMEDIATELY BE TAKEN AS A RESONANCE. WE INCLUDE IT IN THE TABLE UNTIL A PLAUSIBLE ALTERNATE INTERPRETATION IS PUT FORTH.

96 Z*0(1865) MASS (MEV)

M	1863.0	COOL	66 CNTR +	K+P, D TOTAL	7/66

96 Z*0(1865) WIDTH (MEV)

W	150.0	COOL	66 CNTR +	7/66

96 Z*0(1865) PARTIAL DECAY MODES

P1	Z*0(1865) INTO K N	S1CS17
P2	Z*0(1865) INTO K*(892) N	L18S16

96 Z*0(1865) BRANCHING RATIOS

R1	Z*0(1865) INTO (K N)/TOTAL			(P1)/TOTAL	
R1	0.55	COOL	66 CNTR +	IF J=1/2	7/66

REFERENCES -- Z*C(1865)

COOL 66 PRL 17 102 +GIACOMELLI,KYCIA,LEONTIC,LI,LUNDBY,+//BNL I

PAPER NOT REFERRED TO IN DATA CARDS.

BLAND 66 BERKELEY CONF +BOWLER,BROWN,G+S GOLDHABER,HIRATA,+ //LRL
-- PRELIMINARY RESULTS INDICATING THAT INELASTIC CHANNELS ARE NOT AS DOMINANT AS IN THE I=1 EFFECT (SEE THE Z*1(191C) BELOW).

Z_1(1910) 97 Z*1(1910, JP=) I=1

ESSENTIALLY ALL THE EFFECT IS DUE TO A BUMP IN THE KN* CHANNEL NEAR ITS THRESHOLD. ANGULAR DISTRIBUTIONS IN THIS CHANNEL INDICATE THE PREDOMINANCE OF THE P3/2 STATE IN THE K N* (AND THUS ALSO IN THE K N) SYSTEM. HOWEVER IT MAY BE POSSIBLE TO UNDERSTAND THIS CHANNEL WITHOUT INVOKING RESONANT BEHAVIOR -- SEE BLAND 66. OMITTED FROM TABLE.

97 Z*1(1910) MASS (MEV)

M	1910.0	20.0	COOL	66 CNTR ++	K+P TOTAL	7/66

97 Z*1(1910) WIDTH (MEV)

W	180.0	COOL	66 CNTR ++	7/66

97 Z*1(1910) PARTIAL DECAY MODES

P1	Z*1(1910) INTO K N	S1CS16
P2	Z*1(1910) INTO N*3/2(1236) K	L81S10

97 Z*1(1910) BRANCHING RATIOS

R1	Z*1(1910) INTO (K N)/TOTAL			(P1)/TOTAL	
R1	0.31	COOL	66 CNTR ++	IF J=1/2	7/66
R2	Z*1(1910) INTO (N*3/2(1236) K)/TOTAL			(P2)/TOTAL	
R2	DOMINANT DECAY	BLAND	66 HBC ++		9/66

REFERENCES -- Z*1(1910)

COOL 66 PRL 17 102 +GIACOMELLI,KYCIA,LEONTIC,LI,LUNDBY,+//BNL I
BLAND 66 BERKELEY CONF +BOWLER,BROWN,G+S GOLDHABER,KADYK, + //LRL I

PAPER NOT REFERRED TO IN DATA CARDS.

LEA 66 PL 23 380 LEA, MARTIN, OADES //COPENHAGEN,NORDITA
-- PRELIMINARY PHASE-SHIFT ANALYSIS. THE ONLY WAVE WITH POSITIVE AND INCREASING PHASE IS THE P1/2.

Λ(1405) 37 Y*0(1405, JP=1/2-) I=C

THIS RESONANCE CAN BE IDENTIFIED WITH THE VIRTUAL BOUND STATE IN THE KBAR-N SYSTEM DEDUCED FROM THE I=0 SCATTERING LENGTH DETERMINED FROM LOW ENERGY K-P INTERACTIONS. THE DIFFICULTIES IN EXTRAPOLATING FROM THE PHYSICAL REGION TO THE RESONANCE LOCATION ARE DISCUSSED BY DALITZ 66. THE PARAMETERS ARISING FROM ZERO-EFFECTIVE-RANGE FITS ARE MODEL DEPENDENT AND SHOULD NOT BE TAKEN AS SERIOUSLY AS THE SMALL QUOTED ERRORS SUGGEST. SEE THE NOTE IN THE MAIN TEXT ON S-WAVE BUMPS NEAR THRESHOLD.

37 Y*0(1405) MASS (MEV)

M		1405.0		ALSTON	61 HBC	K-P 1.15 BEV/C	
M		1410.0		ALEXANDER	62 HBC	PI-P 2.1 BEV/C	
M		1405.0		ALSTON	62 HBC	K-P 1.2-.5 BEV/C	
M		1400.0	24.0	MUSGRAVE	65 HBC	PBAR P 3-4 BEV/C	7/66
M	*	1382.0	8.0	ENGLER	65 HDBC	PI-P, PI+D 1.68	7/66
M		1410.7	1.0	KIM	65 HBC	0-EFF-RANGE FIT	7/66
M	N	1409.6	1.7	SAKITT	65 HBC	0-EFF-RANGE FIT	7/66
	N	DATA OF SAKITT ARE USED IN FIT BY KITTEL.					
M		1407.5	1.2	KITTEL	66 HBC	0-EFF-RANGE FIT	7/66

37 Y*0(1405) WIDTH (MEV)

W		20.0		ALSTON	61 HBC	7/66
W		35.0	5.0	ALEXANDER	62 HBC	
W		50.0		ALSTON	62 HBC	
W		60.0	20.0	MUSGRAVE	65 HBC	7/66
W	*	89.0	20.0	ENGLER	65 HDBC	7/66
W		37.0	3.2	KIM	65 HBC	7/66
W	N	28.2	4.1	SAKITT	65 HBC	7/66
	N	DATA OF SAKITT ARE USED IN FIT BY KITTEL.				
W		34.1	4.1	KITTEL	66 HBC	7/66

37 Y*0(1405) PARTIAL DECAY MODES

P1	Y*0(1405) INTO SIGMA PI	S2CS 8

REFERENCES -- Y*C(14C5)

ALSTCN 61 PRL 6 698 +ALVAREZ,EBERHARD,GOOD,GRAZIANO, + //LRL I
ALEXANDE 62 PRL 8 447 ALEXANDER,KALBFLEISCH,MILLER,SMITH //LRL I
ALSTCN 62 CERN CONF 311 +ALVAREZ,FERRO-LUZZI,ROSENFELD, + //LRL I
MUSGRAVE 65 NC 35 735 +PETMEZAS,+//BIRMGHM,CERN,EP,IMPCOL,SACLAY
ENGLER 65 PRL 15 224 +FISK,KRAEMER,MELTZER,WESTGARD,+//CRNG,BNL IJ
KIM 65 PRL 14 29 J K KIM //COLUMBIA IJP
SAKITT 65 PR 139 B719 +DAY,GLASSER,SEEMAN,FRIEDMAN, + //MD,LRL IJP
KITTEL 66 PL 21 349 W KITTEL, G OTTER, I WACEK //VIENNA IJP
DALITZ 66 PREPRINT DALITZ, WONG, RAJASEKARAN //OXFORD,BOMBAY

PAPERS NOT REFERRED TO IN DATA CARDS.

ABRAMS 65 PR 139 B454 G S ABRAMS, B SECHI-ZORN //MD IJP
KADYK 66 PRL 17 599 +OREN, G+S GOLDHABER, TRILLING //LRL IJP
DONALD 66 PL 22 711 + EDWARDS, LYS, NISAR, MOORE //LIVERPOOL
-- ABRAMS 65, KADYK 66, AND DONALD 66 SUPPORT THOSE EFFECTIVE-RANGE-FIT SOLUTIONS GIVING AN I=0 S1/2 RESONANCE.

Λ(1520) 38 Y*0(1520, JP=3/2-) I=C

38 Y*0(1520) MASS (MEV)

M		1519.4	2.0	WATSON	63 HBC	K-P ALL CHANNELS	
M	145	1517.2	3.0	GALTIERI	63 DBC	K-D 1.51 BEV/C	
M	29	1520.0	4.0	ALMEIDA	64 HBC	K-P 1.45 BEV/C	
M		1511.0	15.0	MUSGRAVE	65 HBC	PBAR P 3-4 BEV/C	7/66

38 Y*0(1520) WIDTH (MEV)

W	16.4	2.0	WATSON	63 HBC	
W	19.0	19.0	MUSGRAVE	65 HBC	7/66
W	18.0	OR LESS	HARDY	66 HBC	9/66

38 Y*0(1520) PARTIAL DECAY MODES

P1	Y*0(1520) INTO KBAR N	S11S17
P2	Y*0(1520) INTO SIGMA PI	S20S 8
P3	Y*0(1520) INTO LAMBDA PI PI	S18S 8S 6

38 Y*0(1520) PARTIAL WIDTHS (MEV)

W1	Y*0(1520) INTO KBAR N				(P1)
W1	4.8	0.5	WATSON	63 HBC	
W2	Y*0(1520) INTO SIGMA PI				(P2)
W2	9.0	1.0	WATSON	63 HBC	

38 Y*0(1520) BRANCHING RATIOS

R1	Y*0(1520) INTO (KBAR N)/TOTAL				(P1)/TOTAL	
R1	0.47	0.09	HESS	66 HBC	PI-P 1.6-4 BEV/C	9/66
R2	Y*0(1520) INTO (SIGMA PI)/TOTAL				(P2)/TOTAL	
R2	0.45	0.04	HARDY	66 HBC		9/66
R3	Y*0(1520) INTO (KBAR N)/(SIGMA PI)				(P1)/(P2)	
R3	0.58	0.26	MUSGRAVE	65 HBC		7/66
R4	Y*0(1520) INTO (SIGMA PI)/(LAMBDA PI PI)				(P2)/(P3)	
R4	4.5	1.0	ARMENTERO	65 HBC		7/66
R4	4.8	1.2	UHLIG	66 HBC	K-P .9-1.0 BEV/C	9/66

REFERENCES -- Y*C(1520)

WATSCN 63 PR 131 2248 M B WATSON, M FERRO-LUZZI, R D TRIPP //LRL IJP
GALTIERI 63 PL 6 296 A BARBARO-GALTIERI,A HUSSAIN,RD TRIPP//LRL
ALMEIDA 64 PL 9 204 S P ALMEIDA, G R LYNCH //CERN
MUSGRAVE 65 NC 35 735 +PETMEZAS,+//BIRMGHM,CERN,EP,IMPCOL,SACLAY
ARMENTER 65 PL 19 338 ARMENTEROS,F-LUZZI, + //CERN,HEIDEL,SACLAY
HARDY 66 UCRL-16788 THESIS L M HARDY //LRL
HESS 66 UCRL-16832 THESIS R I HESS //LRL
UHLIG 66 PR (ACCEPTED) +CHARLTON,CONDON,GLASSER,YODH,+ //MD,LSNRL

Λ (1670)

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40  Y*0(1670, JP=1/2-) I=0

        SEE NOTE IN MAIN TEXT ON S-WAVE BUMPS NEAR THRESHOLD.

                    40  Y*0(1670) MASS (MEV)    ----------------------------

M          1680.0                    Y-CHANG   64 PBC    PI-PRP 7-8 BEV/C  7/66
M          1670.0                    BERLEY    65 HBC    K-P TO LAM ETA    7/66

----------------    40  Y*0(1670) WIDTH (MEV)    ---------------------------

W            20.0       OR LESS      Y-CHANG   64 PBC                      7/66
W            18.0                    BERLEY    65 HBC                      7/66

----------------    40  Y*0(1670) PARTIAL DECAY MODES    -------------------

P1         Y*0(1670) INTO KBAR N                          S11S17
P2         Y*0(1670) INTO LAMBDA ETA                      S18S14
P3         Y*0(1670) INTO SIGMA PI                        S20S 8

----------------    40  Y*0(1670) BRANCHING RATIOS    ----------------------

R1   *     Y*0(1670) INTO ((KBAR N)(LAM ETA))/TOTAL**2   (P1*P2)/TOTAL**2
R1   *        0.046                  BERLEY    65 HBC                      7/66

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                       REFERENCES -- Y*C(1670)

Y-CHANG  64 DUBNA CCNF I 615  YUNG-CHANG, IN, KLADNITSKAYA, +    //DUBNA  I
BERLEY   65 PRL 15 641        +CONNOLLY,HART,RAHM,STONEHILL, +     //BNL IJP

                 PAPER NOT REFERRED TO IN DATA CARDS.

BANNIK   66 BERKELEY CONF     +BUBELEV,CHADRAA, + //DUBNA,BUCHAREST,CERN  I
     -- SUPPORTS RESULT OF YUNG-CHANG 64.

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Λ (1700)

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55  Y*0(1700, JP=3/2-) I=C

                    SPIN-PARITY DETERMINATION TENTATIVE.

                    55  Y*0(1700) MASS (MEV)    ----------------------------

M          1705.0     10.0           ARMENTERO 66 HBC    K-P EL, CH EX     9/66
M          1698.0      5.0           DAVIES    66 CNTR   K-P, D TOTAL     11/66

----------------    55  Y*0(1700) WIDTH (MEV)    ---------------------------

W            30.0        APPROX      ARMENTERO 66 HBC                      9/66
W            40.0     10.0           DAVIES    66 CNTR                    11/66

----------------    55  Y*0(1700) PARTIAL DECAY MODES    -------------------

P1         Y*0(1700) INTO KBAR N                          S11S17
P2         Y*0(1700) INTO SIGMA PI                        S20S 8

----------------    55  Y*0(1700) BRANCHING RATIOS    ----------------------

R1         Y*0(1700) INTO (KBAR N)/TOTAL                  (P1)/TOTAL
R1            0.18       APPROX      ARMENTERO 66 HBC                      9/66
R1            0.24                   DAVIES    66 CNTR   ASSUMING J=3/2   11/66

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                       REFERENCES -- Y*C(1700)

ARMENTER 66 BERKELEY CONF     ARMENTEROS,F-LUZZI, + //CERN,HEIDEL,SACLAY IJP
DAVIES   66 PRL (TO BE SUBM)  +COWELL,HATTERSLEY,+ //BIRMGHM,CAMBR,RTHFD  I

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Λ (1815)

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39  Y*0(1815, JP=5/2+) I=C

                    39  Y*0(1815) MASS (MEV)    ----------------------------

M    *     1815.0                    GALTIERI  63        K-P RVUE          7/66
M          1815.0                    BIRGE     65 HBC    KBAR N,LAM PI PI  7/66
M    N     1811.0      4.0           LEVI SETT 66 RVUE   SOME REAL BGD     9/66
M    N  OR 1814.0      3.0           LEVI SETT 66 RVUE   BGD PURE IMAG     9/66
     N     RES + DIFFRACTIVE BGD FOR K-P EL.  DATA ARE IN ARMENT 66 FITS TOO.
M          1820.0      5.0           ARMENTERO 66 HBC    2-BODY CHANNELS   9/66
M          1819.0      5.0           DAVIES    66 CNTR   K-P, D TOTAL     11/66

----------------    39  Y*0(1815) WIDTH (MEV)    ---------------------------

W    *       70.0                    GALTIERI  63
W            60.0                    BIRGE     65 HBC                      7/66
W    N       73.0     10.0           LEVI SETT 66 RVUE   SOME REAL BGD     9/66
W    N  OR   70.5      9.0           LEVI SETT 66 RVUE   BGD PURE IMAG     9/66
     N     RES + DIFFRACTIVE BGD FOR K-P EL.  DATA ARE IN ARMENT 66 FITS TOO.
W            80.0     10.0           ARMENTERO 66 HBC                      9/66
W            90.0     15.0           DAVIES    66 CNTR                    11/66

----------------    39  Y*0(1815) PARTIAL DECAY MODES    -------------------

P1         Y*0(1815) INTO KBAR N                          S11S17
P2         Y*0(1815) INTO SIGMA PI                        S20S 8
P3         Y*0(1815) INTO LAMBDA ETA                      S18S14
P4         Y*0(1815) INTO Y*1(1385) PI                    L43S 8

----------------    39  Y*0(1815) BRANCHING RATIOS    ----------------------

R1         Y*0(1815) INTO (KBAR N)/TOTAL                  (P1)/TOTAL
R1   *        0.8                    GALTIERI  63         K-P RVUE
R1   N        0.67     0.08          LEVI SETT 66 RVUE   SOME REAL BGD     9/66
R1   N  OR    0.61     0.07          LEVI SETT 66 RVUE   BGD PURE IMAG     9/66
     N     RES + DIFFRACTIVE BGD FOR K-P EL.  DATA ARE IN ARMENT 66 FITS TOO.
R1            0.60     0.05          ARMENTERO 66 HBC                      9/66
R1            0.74                   DAVIES    66 CNTR                    11/66

R2         Y*0(1815) INTO (SIGMA PI)/TOTAL                (P2)/TOTAL
R2            0.12     0.02          ARMENTERO 66 HBC                      9/66

R3         Y*0(1815) INTO (LAMBDA ETA)/TOTAL              (P3)/TOTAL
R3            0.01                   ARMENTERO 66 HBC                      9/66

R4         Y*0(1815) INTO (Y*1(1385) PI)/TOTAL            (P4)/TOTAL
R4            0.20     0.05          BIRGE     65 HBC                      7/66
R4            0.19     0.04          BARLOUTAU 66 HBC    ASSUMING R1=0.60  9/66

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                       REFERENCES -- Y*C(1815)

GALTIERI 63 PL 6 296          A BARBARO-GALTIERI,A HUSSAIN,RD TRIPP//LRL IJ
BIRGE    65 ATHENS CONF 296   +ELY,KALMUS,KERNAN,LOUIE,SAHOURIA,+ //LRL IJP
LEVI SET 66 BERKELEY CONF     R LEVI SETTI, E PREDAZZI              //CHI
ARMENTER 66 BERKELEY CONF     ARMENTEROS,F-LUZZI, + //CERN,HEIDEL,SACLAY IJP
BARLOUTA 66 BERKELEY CONF     BARLOUTAUD,GRANET, +  //SACLAY,HEIDEL,CERN IJP
DAVIES   66 PRL (TO BE SUBM)  +COWELL,HATTERSLEY,+ //BIRMGHM,CAMBR,RTHFD  I

                 PAPERS NOT REFERRED TO IN DATA CARDS.

CHAMBERL 62 PR 125 1696       CHAMBERLAIN,CROWE,KEEFE,KERTH, +      //LRL  I
     -- FIRST SEEN IN CHAMBERLAIN 62 TOTAL CROSS SECTION MEASUREMENTS.
SODICKSO 64 PR 133 B757       SODICKSON,MANNELLI,FRISCH,WAHLIG//MIT(BNL)  J
HOLLEY   65 UCRL-16274 THESIS W R HOLLEY                           //LRL  J
     -- SODICKSON 64 AND HOLLEY 65 ELASTIC SCATTERING WORK INDICATED J=5/2.
GELFAND  66 BERKELEY CONF     +HARMSEN,LEVI SETTI,RAYMUND, +    //CHI,ARG
     -- ELASTIC SCATTERING DATA FIT BY LEVI SETTI 66.

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Λ (2100)

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41  Y*0(2100, JP=7/2-) I=C

                    41  Y*0(2100) MASS (MEV)    ----------------------------

M    *     2097.0      6.0           BOCK      65 HBC    PBAR P 5.7 BEV/C  7/66
M          2100.0     20.0           COOL      66 CNTR   K-P, D TOTAL      7/66
M    *     2120.0                    WOHL      66 HBC    K-P CH EX         7/66

----------------    41  Y*0(2100) WIDTH (MEV)    ---------------------------

W    *       24.0     14.0     24.0  BOCK      65 HBC    INTO KBAR N (PI)  7/66
W           160.0                    COOL      66 CNTR                     7/66
W           145.0                    WOHL      66 HBC                      7/66

----------------    41  Y*0(2100) PARTIAL DECAY MODES    -------------------

P1         Y*0(2100) INTO KBAR N                          S11S17
P2         Y*0(2100) INTO SIGMA PI                        S20S 8
P3         Y*0(2100) INTO LAMBDA OMEGA                    S18S 1
P4         Y*0(2100) INTO KBAR N PI                       S11S17S 8

----------------    41  Y*0(2100) BRANCHING RATIOS    ----------------------

R1         Y*0(2100) INTO (KBAR N)/TOTAL                  (P1)/TOTAL
R1            0.29                   COOL      66 CNTR                     7/66
R1            0.25                   WOHL      66 HBC                      7/66

R2         Y*0(2100) INTO (LAMBDA OMEGA)/TOTAL            (P3)/TOTAL
R2            0.1        OR LESS     FLATTE    66 HBC                      9/66

R3         Y*0(2100) INTO (KBAR N PI)/TOTAL               (P4)/TOTAL
R3              SEEN                 BOCK      65 HBC                      9/66

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                       REFERENCES -- Y*C(2100)

BOCK     65 PL 17 166         +COOPER,FRENCH,KINSON, +      //CERN,SACLAY
COOL     66 PRL 16 1228       +GIACOMELLI,KYCIA,LEONTIC,LI,LUNDBY,+//BNL  I
WOHL     66 PRL 17 107        C G WOHL, F T SOLMITZ, M L STEVENSON //LRL IJP
FLATTE   66 PRIVATE COMM      S M FLATTE                            //LRL

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Λ (2340)

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42  Y*0(2340, JP=    ) I=0

                    42  Y*0(2340) MASS (MEV)    ----------------------------

M          2340.0     20.0           COOL      66 CNTR   K-P, D TOTAL      7/66

----------------    42  Y*0(2340) WIDTH (MEV)    ---------------------------

W           105.0                    COOL      66 CNTR                     7/66

----------------    42  Y*0(2340) PARTIAL DECAY MODES    -------------------

P1         Y*0(2340) INTO KBAR N                          S11S17

----------------    42  Y*0(2340) BRANCHING RATIOS    ----------------------

R1         Y*0(2340) INTO (KBAR N)/TOTAL                  (P1)/TOTAL
R1            0.102                  COOL      66 CNTR   ASSUMING J=9/2    7/66

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                       REFERENCES -- Y*C(2340)

COOL     66 PRL 16 1228       +GIACOMELLI,KYCIA,LEONTIC,LI,LUNDBY,+//BNL  I

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Σ (1385)

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43  Y*1(1385, JP=3/2+) I=1

              FOR THE TABLES WE USE ONLY THE UNSTARRED DATA, WHICH ARE
              ATTEMPTS TO OBTAIN THE SEPARATE CHARGE-STATE MASSES AND
              WIDTHS.  SEE HOWEVER THE IDEOGRAMS INSERTED IN LISTINGS.
   THESE INDICATE SERIOUS SYSTEMATICS, PERHAPS ARISING FROM INTERFERENCE EF-
   FECTS THAT CHANGE WITH PRODUCTION MECHANISM AND BEAM MOMENTUM.

----------------    43  Y*1(1385) MASS (MEV)    ----------------------------

M    *  141 1384.0                   ALSTON    60 HBC  +- K-P 1.15 BEV/C
M    *   38 1384.0                   MARTIN    61 HBC  C+ K20 P .98 BEV/C
M    *      1385.0                   BERGE     61 HBC  +- K-P .4-.85 BEV/C
M    *      1392.0     7.0           COLLEY    62 PBC  C- PI- PRP 2. BEV/C
MO   *  106 1381.0     4.0           CURTIS    63 SPRK C  PI-P 1.5 BEV/C
M    *      1392.0    10.0           MUSGRAVE  65 HBC  +-OPBAR P 3-4 BEV/C 7/66
M    *      1389.0     3.0           BALTAY    65 HBC  +- PBAR P 3.7 BEV/C 7/66

M+      154 1376.0     3.0           ELY       61 PBC  +  K-P 1.11 BEV/C
M+      170 1375.0     3.9           COOPER    64 HBC  +  K-P 1.45 BEV/C
M+      859 1381.0     1.6           HUWE      66 HBC  +  K-P 1.22 BEV/C
M+          1382.0     1.0           ARMENTERO 65 HBC  +  K-P .9-1.2 BEV/C
M+          1378.0     5.0           LONDON    66 HBC  +  K-P 2.24 BEV/C   7/66
M+          1384.3     1.1           COLTON    66 HBC  +  K-P 1.8 BEV/C    9/66
M+          1382.6     1.4           COLTON    66 HBC  +  K-P 1.95 BEV/C   9/66
M-       93 1382.0     3.0           DAHL      61 DBC  -  K-D 0.45 BEV/C
M-      224 1376.0     3.0           ELY       61 PBC  -
M-      200 1392.0     6.2           COOPER    64 HBC  -
M-     1086 1385.3     1.5           HUWE      64 HBC  -
M-          1384.0     1.0           ARMENTERO 65 HBC  -
M-          1389.0     9.0           LONDON    66 HBC  -                   7/66
M-          1391.5     1.8           COLTON    66 HBC  -  K-P 1.8 BEV/C    9/66
M-          1399.8     1.4           COLTON    66 HBC  -  K-P 1.95 BEV/C   9/66
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(Ideograms on next page)

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----------------    43  Y*(-) - Y*(+) MASS DIFFERENCE (MEV)    -------------

D    R         0.0     4.2           ELY       61 PBC  +- K-P 1.11 BEV/C   8/66
D    R         4.3     2.2           HUWE      64 HBC  +- K-P 1.22 BEV/C   8/66
D    R         2.0     1.5           ARMENTERO 65 HBC  +- K-P .9-1.2 BEV/C 8/66
D    R        11.0     9.0           LONDON    66 HBC  +- K-P 2.24 BEV/C   8/66
D    R         7.2     2.1           COLTON    66 HBC  +- K-P 1.8 BEV/C    9/66
D    R        17.2     2.0           COLTON    66 HBC  +- K-P 1.95 BEV/C   9/66
     R     REDUNDANT WITH DATA IN MASS LISTING.
D              9.0     6.0           LONDON    66 HBC  +- LAMBDA 3 PI EVTS 7/66
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43 Y*1(1385) WIDTH (MEV)

W	*	64.0		ALSTON	60 HBC	+-		
W	*	20.0	OR LESS	MARTIN	61 HBC	C+		
W	*	40.0		BERGE	61 HBC	+-		
W	*	80.0	10.0	COLLEY	62 PBC	C-		
W	*	30.0	9.0	CURTIS	63 SPRK	C		
W	*	38.0	9.0	MUSGRAVE	65 HBC	+-C		7/66
W	*	26.0	5.0	BALTAY	65 HBC	+-		7/66
W+		48.0	8.0	ELY	61 PBC	+		
W+		51.0	10.0	COOPER	64 HBC	+		
W+		46.5	3.0	HUWE	64 HBC	+		
W+		32.0	3.0	ARMENTERO	65 HBC	+		
W+		30.3	3.1	COLTON	66 HBC	+	K-P 1.8 BEV/C	9/66
W+		33.1	3.8	COLTON	66 HBC	+	K-P 1.95 BEV/C	9/66
W		40.0		DAHL	61 DBC	-		
W-		66.0	10.0	ELY	61 PBC	-		
W-		88.0	10.0	COOPER	64 HBC	-		
W-		62.0	7.0	HUWE	64 HBC	-		
W-		38.0	3.0	ARMENTERO	65 HBC	-		
W-		29.2	5.7	COLTON	66 HBC	-	K-P 1.80 BEV/C	9/66
W-		17.1	4.4	COLTON	66 HBC	-	K-P 1.95 BEV/C	9/66

(Ideograms below)

43 Y*1(1385) PARTIAL DECAY MODES

P1	Y*1(1385) INTO LAMBDA PI	S18S 8
P2	Y*1(1385) INTO SIGMA PI	S20S 8

43 Y*1(1385) BRANCHING RATIOS

R1	Y*1(1385) INTO (SIGMA PI)/(LAMBDA PI)				(P2)/(P1)	
R1	0.04	0.04	BASTIEN	61 HBC	+-	
R1	0.04	OR LESS	ALSTON	62 HBC	+-0	
R1	0.09	0.04	HUWE	64 HBC	+-	
R1	0.163	0.035	ARMENTERO	65 HBC	+-	7/66
R1	0.08	0.06	LONDON	66 HBC	+	7/66

(Ideogram below)

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REFERENCES -- Y*1(1385)

ALSTON	60 PRL 5 520	+ALVAREZ,EBERHARD,GOOD,GRAZIANO, + //LRL	I
DAHL	61 PRL 6 142	+HORWITZ,MILLER,MURRAY,WHITE //LRL	
MARTIN	61 PRL 6 283	+LEIPUNER,CHINOWSKY,SHIVELY, + //BNL,YALE	
BERGE	61 PRL 6 557	+BASTIEN,DAHL,FERRO-LUZZI,KIRZ, + //LRL	
BASTIEN	61 PRL 6 702	P BASTIEN,M FERRO-LUZZI,A H ROSENFELD//LRL	
ELY	61 PRL 7 461	+FUNG,GIDAL,PAN,POWELL,WHITE //LRL	J
ALSTON	62 CERN CONF 311	+ALVAREZ,FERRO-LUZZI,ROSENFELD, + //LRL	
COLLEY	62 PR 128 1930	+GELFAND,NAUENBERG, + //COLUMBIA,RUTGERS	JP
CURTIS	63 PR 132 1771	+COFFIN,MEYER,TERWILLIGER //MICH	J
COOPER	64 PL 8 365	+FILTHUTH,FRIDMAN,MALAMUD, + //CERN,AMSTR	
HUWE	64 UCRL-11291 THESIS	D O HUWE //LRL	JP
MUSGRAVE	65 NC 35 735	+PETMEZAS,+//BIRMGHM,CERN,EP,IMPCOL,SACLAY	
ARMENTER	65 PL 19 75	ARMENTEROS, + //CERN,HEIDEL,SACLAY	
BALTAY	65 PR 140 B1027	+SANDWEISS,TAFT,CULWICK,KOPP, + //YALE,BNL	
LONDON	66 PR 143 1034	+RAU,SAMIOS,YAMAMOTO,GOLDBERG,+ //BNL,SYCR	J
COLTON	66 H E P MEMC 27	+TICHO,DAUBER,SCHLEIN,SLATER,SMITH,+//UCLA	

QUANTUM NUMBER DETERMINATIONS NOT REFERRED TO IN DATA CARDS.

SHAFER	64 PR 134 B1372	J B SHAFER, D O HUWE //LRL	JP
MALAMUD	64 PL 10 145	E MALAMUD, P E SCHLEIN //CERN,UCLA	JP

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Σ (1660) 44 Y*1(1660, JP=3/2-) I=1

THE Y*1(1660) IS DIFFICULT TO STUDY IN FORMATION EXPERIMENTS BECAUSE (1) IT COUPLES ONLY SLIGHTLY TO THE KBAR N CHANNEL, AND (2) THERE ARE NEIGHBORING RESONANCES, THE Y*0(1670) AND Y*0(1700) AND PERHAPS OTHERS YET UNDETECTED, TO COMPLICATE THE ANALYSIS. THE LAMBDA PI CHANNEL HAS INDICATED THE PROBABLE JP=3/2- ASSIGNMENT. THERE IS NOT MUCH AGREEMENT BETWEEN FORMATION AND PRODUCTION EXPERIMENTS ON BRANCHING RATIOS.

THERE IS ALSO DISAGREEMENT AMONG EXPERIMENTS PRODUCING CHARGED Y*1(1660) AT DIFFERENT ENERGIES. THUS EVEN WHEN THE I=1 STATE IS LOOKED AT ALONE THERE ARE PROBLEMS. HOWEVER, EXCEPT FOR LEVEQUE 65 THE EXPERIMENTS DO AGREE THAT THE MOST PROBABLE JP ASSIGNMENT IS 3/2-.

44 Y*1(1660) MASS (MEV)

M	1685.0		ALEXANDER	62 HBC	C-	PI-P 2-2.2 BEV/C	
M	1660.0	10.0	ALVAREZ	63 HBC	+	K-P 1.51 BEV/C	
M	1660.0		BERLEY	64 HBC	0	K-P TO LAM PI0	7/66
M	1645.0	7.0	LEVEQUE	65 HBC	+	K-P TO Y*1660 PI	7/66
M	1662.0	5.0	DAVIES	66 CNTR		K-P, D TOTAL	11/66

44 Y*1(1660) WIDTH (MEV)

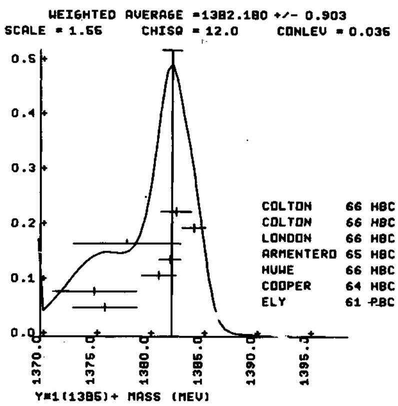
W	45.0		ALEXANDER	62 HBC	C-	
W	40.0	10.0	ALVAREZ	63 HBC	+	
W	60.0		BERLEY	64 HBC	C	7/66
W	55.0	10.0	LEVEQUE	65 HBC	+	7/66
W	45.0	15.0	DAVIES	66 CNTR		11/66

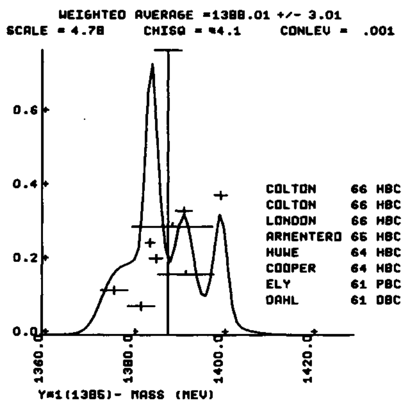
44 Y*1(1660) PARTIAL DECAY MODES

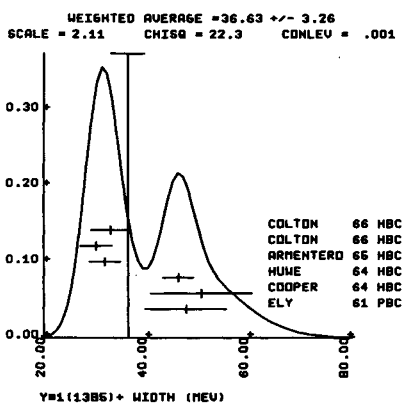
P1	Y*1(1660) INTO KBAR N	S11S1/
P2	Y*1(1660) INTO LAMBDA PI	S18S 8
P3	Y*1(1660) INTO SIGMA PI	S20S 8
P4	Y*1(1660) INTO LAMBDA PI PI	S18S 8S 8
P5	Y*1(1660) INTO SIGMA PI PI	S20S 8S 8
P6	Y*1(1660) INTO Y*1(1385) PI	U43S 8
P7	Y*1(1660) INTO Y*0(1405) PI	L37S 8

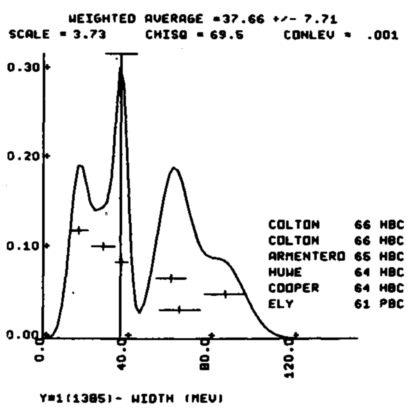
44 Y*1(1660) BRANCHING RATIOS

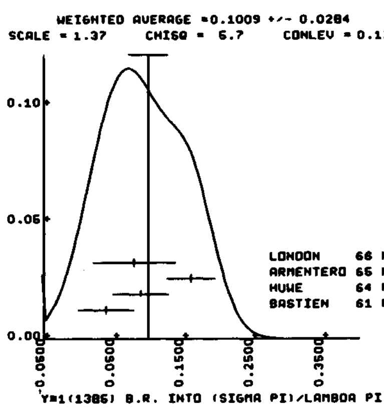
R1		Y*1(1660) INTO (KBAR N)/TOTAL					(P1)/TOTAL	
R1		0.05	OR LESS	ALVAREZ	63 HBC	+		
R1	*	0.16	OR MORE	BASTIEN 2	63 HBC	C		
R1		0.2	OR LESS	LONDON	66 HBC	+		7/66
R1		0.065		DAVIES	66 CNTR		ASSUMING J=3/2	11/66
R2		Y*1(1660) INTO (LAMBDA PI)/TOTAL					(P2)/TOTAL	
R2		0.32		ALVAREZ	63 HBC	+		
R2		0.09	OR LESS	BASTIEN 2	63 HBC	C		
R2		0.2	OR LESS	LONDON	66 HBC	+		7/66
R2		0.06	0.06	SMART	66 DBC	-	ASSUMING R1=0.15	7/66
R2		0.45		ARMENTERO	66 HBC	0	ASSUMING R1=0.15	9/66
R3		Y*1(1660) INTO (SIGMA PI)/TOTAL					(P3)/TOTAL	
R3		0.27		ALVAREZ	63 HBC	+		
R3	*	0.22	0.06	BASTIEN 2	63 HBC	C		
R3		0.25	0.15	LONDON	66 HBC	+		7/66
R3		0.15		ARMENTERO	66 HBC	C	ASSUMING R1=0.15	9/66
R4		Y*1(1660) INTO (LAMBDA PI PI)/TOTAL					(P4)/TOTAL	
R4		0.18		ALVAREZ	63 HBC	+		
R4	*	0.16	0.05	BASTIEN 2	63 HBC	C		
R4		0.2	OR LESS	LONDON	66 HBC	+		7/66











R5		Y*1(1660) INTO (SIGMA PI PI)/TOTAL				(P5)/TOTAL		
R5		0.18			ALVAREZ 63 HBC	+		
R5	*	0.25	0.06		BASTIEN 2 63 HBC	O		
R6		Y*1(1660) INTO (Y*0(1405) PI)/TOTAL				(P7)/TOTAL		
R6		0.75	0.25		LONDON 66 HBC	+		7/66
R7		Y*1(1660) INTO (KBAR N)/(LAMBDA PI)				(P1)/(P2)		
R7		0.43	OR MORE		SMITH 63 HBC	C-		
R8		Y*1(1660) INTO (SIGMA PI)/(LAMBDA PI)				(P3)/(P2)		
R8		0.86			SMITH 63 HBC	C-		
R8		6.8	3.0		HUWE 64 HBC	+		
R9		Y*1(1660) INTO (LAMBCA PI PI)/(LAMBDA PI)				(P4)/(P2)		
R9		0.14			SMITH 63 HBC	C-		
R10		Y*1(1660) INTO (Y*0(1405) PI)/(SIGMA PI PI)				(P7)/(P5)		
R10		0.90	0.10	0.16	EBERHARD 65	+		7/66
R11		Y*1(1660) INTO (Y*0(1405) PI)/(Y*1(1385) PI)				(P7)/(P6)		
R11		0.8	OR MORE		EBERHARD 65	+		7/66

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REFERENCES -- Y*1(1660)

ALEXANDE 62 CERN CONF 320 ALEXANDER,JACOBS,KALBFLEISCH,MILLER,+//LRL I
ALVAREZ 63 PRL 10 184 +ALSTON,FERRO-LUZZI,HUWE, + //LRL I
BASTIEN2 63 UCRL-10779 THESIS P L BASTIEN //LRL IJ
SMITH 63 ATHENS CCNF 67 G A SMITH //LRL
HUWE 64 UCRL-11291 THESIS D O HUWE //LRL
BERLEY 64 DUBNA CONF I 565 +CONNOLLY,HART,RAHM,STONEHILL, + //BNL IJP
EBERHARD 65 PRL 14 466 +SHIVELY,ROSS,SIEGAL,FICENEC, + //LRL,ILL I
LEVEQUE 65 PL 18 69 + //SACLAY,EP,GLASGOW,IMPCOL,OXF,RTHFD JP
LONDON 66 PR 143 1034 +RAU,SAMIOS,YAMAMOTO,GOLDBERG,+ //BNL,SYCR IJ
SMART 66 PRL 17 556 W M SMART,A KERNAN,G E KALMUS,R P ELY//LRL IJP
ARMENTER 66 BERKELEY CONF ARMENTEROS,F-LUZZI, + //CERN,HEIDEL,SACLAY IJP
DAVIES 66 PRL (TO BE SUBM) +COWELL,HATTERSLEY,+ //BIRMGHM,CAMBR,RTHFD I

PAPERS NOT REFERRED TO IN DATA CARDS.

BASTIEN1 63 PRL 10 188 P L BASTIEN, J P BERGE //LRL IJ
-- REPLACED BY BASTIEN 2, BUT SIMILAR AND MORE READILY AVAILABLE.
T-ZADEH 63 PRL 11 470 TAHER-ZADEH,PROWSE,SCHLEIN,SLATER,+ //UCLA JP
-- SEE NOTE FOLLOWING SCHLEIN 66.
EBERHARD 65 BAPS 10 478 P EBERHARD //LRL IJP
SLATER 65 BAPS 10 1196 +CAUBER, SCHLEIN, STORK, TICHO //UCLA JP
LEE 66 PRL 17 45 Y Y LEE, D D REEDER, R W HARTUNG //WISC JP
SCHLEIN 66 UCLA-1016 P E SCHLEIN, T G TRIPPE //UCLA JP
-- REANALYZES DATA OF TAHER-ZADEH 63 AND BASTIEN 63 AND ALL PUBLISHED LAMBDA PI CROSS SECTION DATA IN THE LIGHT OF THE NOW KNOWN Y*1(1765) AND REVERSES THE MODEL-DEPENDENT CONCLUSION OF TAHER-ZADEH ON THE PREFERRED JP ASSIGNMENT (FROM 3/2+ TO 3/2-).

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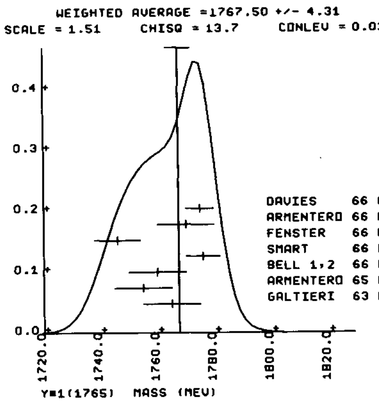
Σ (1765) 45 Y*1(1765, JP=5/2-) I=1

45 Y*1(1765) MASS (MEV) ------------------------------

M			1765.0	10.0	GALTIERI 63 DBC	C	K-D 1.51 BEV/C		
M			1755.0	10.0	ARMENTERO 65 HBC	C	K-P TO Y*1520 PI		7/66
M			1760.0	10.0	BELL 1,2 66 DBC	-	K-N TO Y*1520 PI		7/66
M			1776.0	6.0	SMART 66 DBC	-	K-N TO LAM PI-		7/66
M			1746.0	8.0	FENSTER 66 HBC	C	K-P TO Y*1520 PI		9/66
M	N		1758.0	11.0	LEVI SETT 66 RVUE		SOME REAL BGD		9/66
M	N	OR	1770.0	11.0	LEVI SETT 66 RVUE		BGD PURE IMAG		9/66
	N		RES + DIFFRACTIVE BGD FOR K-P EL. DATA ARE IN ARMENT 66 FITS TCC.						
M			1770.0	10.0	ARMENTERO 66 HBC	C	2-BODY CHANNELS		9/66
M			1775.0	5.0	DAVIES 66 CNTR		K-P, D TOTAL		11/66

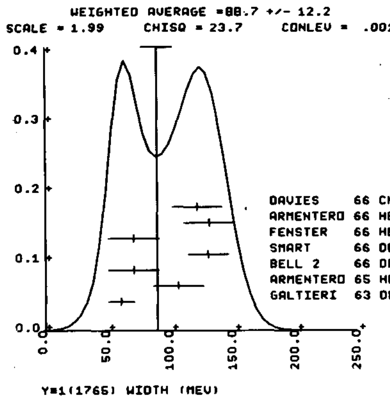
(Ideogram below)



----------------- 45 Y*1(1765) WIDTH (MEV) ------------------------------

W			60.0	10.0	GALTIERI 63 DBC	C		
W			105.0	20.0	ARMENTERO 65 HBC	C		7/66
W			70.0	20.0	BELL 2 66 DBC	-		7/66
W			129.0	16.0	SMART 66 DBC	-		7/66
W			70.0	20.0	FENSTER 66 HBC	C		9/66
W	N		113.0	25.0	LEVI SETT 66 RVUE		SOME REAL BGD	9/66
W	N	OR	158.0	38.0	LEVI SETT 66 RVUE		BGD PURE IMAG	9/66
	N		RES + DIFFRACTIVE BGD FOR K-P EL. DATA ARE IN ARMENT 66 FITS TCC.					
W			130.0	20.0	ARMENTERO 66 HBC	C		9/66
W			120.0	20.0	DAVIES 66 CNTR			11/66

(Ideogram below)



----------------- 45 Y*1(1765) PARTIAL DECAY MODES ---------------------

P1	Y*1(1765) INTO KBAR N	S11S17
P2	Y*1(1765) INTO LAMBDA PI	S18S 9
P3	Y*1(1765) INTO SIGMA PI	S20S 8
P4	Y*1(1765) INTO SIGMA ETA	S21S14
P5	Y*1(1765) INTO Y*1(1385) PI	L43S 8
P6	Y*1(1765) INTO Y*0(1520) PI	L38S 8

----------------- 45 Y*1(1765) BRANCHING RATIOS ---------------------

R1			Y*1(1765) INTO (KBAR N)/TOTAL			(P1)/TOTAL		
R1	*		0.6		GALTIERI 63 HBC	C	K-P RVUE	
R1			0.53	0.09	UHLIG 66 HBC	C		9/66
R1	N		0.46	0.05	LEVI SETT 66 RVUE		SOME REAL BGD	9/66
R1	N	OR	0.46	0.04	LEVI SETT 66 RVUE		BGD PURE IMAG	9/66
	N		RES + DIFFRACTIVE BGD FOR K-P EL. DATA ARE IN ARMENT 66 FITS TCC.					
R1			0.45	0.05	ARMENTERO 66 HBC	C		9/66
R1			0.43		DAVIES 66 CNTR			11/66
R2			Y*1(1765) INTO (LAMBCA PI)/TOTAL			(P2)/TOTAL		
R2			0.14	0.02	SMART 66 DBC	-	ASSUMING R1=0.5	7/66
R2			0.17	0.02	UHLIG 66 HBC	C		9/66
R2			0.20	0.05	ARMENTERO 66 HBC	C	ASSUMING R1=0.44	9/66
R3			Y*1(1765) INTO (SIGMA PI)/TOTAL			(P3)/TOTAL		
R3			0.01	0.01	UHLIG 66 HBC	C		9/66
R3			0.01	OR LESS	ARMENTERO 66 HBC	C		9/66
R4			Y*1(1765) INTO (SIGMA ETA)/TOTAL			(P4)/TOTAL		
R4			0.02	APPROX	ARMENTERO 66 HDBC	C-		9/66
R5			Y*1(1765) INTO (Y*1(1385) PI)/TOTAL			(P5)/TOTAL		
R5			0.14	0.05	UHLIG 66 HBC	C		9/66
R5			0.12	0.02	BARLOUTAU 66 HBC	C	ASSUMING R1=0.44	9/66
R6			Y*1(1765) INTO (Y*1(1520) PI)/TOTAL			(P6)/TOTAL		
R6			0.15	0.03	ARMENTERO 65 HBC	C	R1=0.5, HYPERONS	7/66
R6			0.24	0.06	FENSTER 66 HBC	O	R1=0.5, KBAR N	9/66
R6			0.15	0.02	UHLIG 66 HBC	C		9/66

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REFERENCES -- Y*1(1765)

GALTIERI 63 PL 6 296 A BARBARO-GALTIERI,A HUSSAIN,RD TRIPP//LRL IJ
ARMENTER 65 PL 19 338 ARMENTEROS, + //CERN,HEIDELBERG,SACLAY IJP
BELL 1 66 PRL 16 203 R B BELL, R W BIRGE, Y-L PAN, R T PU //LRL IJP
BELL 2 66 UCRL-16936 THESIS R B BELL //LRL IJP
SMART 66 PRL 17 556 W M SMART,A KERNAN,G E KALMUS,R P ELY//LRL IJP
FENSTER 66 PRL 17 841 +GELFAND,HARMSEN,L-SETTI,+ //CHI,ARG(CERN) IJP
UHLIG 66 PR (ACCEPTED) +CHARLTON,CONDON,GLASSER,YODH,+ //MD,USNRL IJ
LEVI SET 66 BERKELEY CONF R LEVI SETTI, E PREDAZZI //CHI
ARMENTER 66 BERKELEY CONF ARMENTEROS,F-LUZZI, + //CERN,HEIDEL,SACLAY IJP
BARLOUTA 66 BERKELEY CONF BARLOUTAUD,GRANET, + //SACLAY,HEIDEL,CERN IJP
DAVIES 66 PRL (TO BE SUBM) +COWELL,HATTERSLEY,+ //BIRMGHM,CAMBR,RTHFD I

PAPERS NOT REFERRED TO IN DATA CARDS.

YODH 65 ATHENS CONF 269. G B YODH //MARYLAND IJ
BIRGE 65 ATHENS CONF 296 +ELY,KALMUS,KERNAN,LOUIE,SAHOURIA, + //LRL IJP
-- YODH 65 AND BIRGE 65 ARE PRECURSORS OF UHLIG 66 AND BELL 66.
GELFAND 66 BERKELEY CONF +HARMSEN,LEVI SETTI,RAYMUND, + //CHI,ARG
-- ELASTIC SCATTERING DATA FIT BY LEVI SETTI 66.

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Σ (1780) 57 Y*1(1780, JP=) I=1

SIGMA ETA THRESHOLD EFFECT. INTERPRETATION AS RESONANCE NOT CONCLUSIVE. SEE FERRO-LUZZI 66. OMITTED FROM TABLE

----------------- 57 Y*1(1780) MASS (MEV) ------------------------------

M	1780.0	CLINE 66 DBC	-	K-N TO SIG- ETA	9/66

----------------- 57 Y*1(1780) WIDTH (MEV) ------------------------------

W	100.0	CLINE 66 DBC	-		9/66

----------------- 57 Y*1(1780) PARTIAL DECAY MODES ---------------------

P1	Y*1(1780) INTO KBAR N	S11S17
P2	Y*1(1780) INTO SIGMA ETA	S20S14

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REFERENCES -- Y*1(1780)

CLINE 66 BERKELEY CONF D CLINE, M OLSSON //WISC(LRL) I
F-LUZZI 66 BERKELEY CONF M FERRO-LUZZI //CERN

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Σ (1915)

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46  Y*1(1915, JP=5/2+) I=1

              PERHAPS SOME SLIGHT RESERVATION SHOULD BE HELD AGAINST
              COMPLETE ACCEPTANCE OF THE INTERPRETATION OF THIS EFFECT
              AS (1) BEING A RESONANCE (2) HAVING JP = 5/2+.

----------------  46  Y*1(1915) MASS (MEV)   ----------------------------

M   *    1942.0     9.0             BOCK      65 HBC    PBAR P 5.7 BEV/C
M        1915.0    20.0             COOL      66 CNTR C- K-P, D TOTAL     7/66
M        1905.0     5.0             DAVIES    66 CNTR   K-P, D TOTAL     11/66

----------------  46  Y*1(1915) WIDTH (MEV)  ----------------------------

W   *      36.0    20.0     36.0    BOCK      65 HBC
W          65.0                     COOL      66 CNTR C-                  7/66
W          60.0    20.0             DAVIES    66 CNTR                    11/66

----------------  46  Y*1(1915) PARTIAL DECAY MODES   --------------------

P1       Y*1(1915) INTO KBAR N                          S11S17
P2       Y*1(1915) INTO LAMBDA PI                       S18S 8
P3       Y*1(1915) INTO SIGMA PI                        S20S 8

----------------  46  Y*1(1915) BRANCHING RATIOS   ----------------------

R1       Y*1(1915) INTO (KBAR N)/TOTAL                  (P1)/TOTAL
R1          0.103                   COOL      66 CNTR   ASSUMING J=5/2    7/66
R1          0.06     0.02           ARMENTERO 66 HBC  C K-P EL, CH EX     9/66
R1          0.1                     DAVIES    66 CNTR   ASSUMING J=5/2   11/66

R2       Y*1(1915) INTO (LAMBDA PI)/TOTAL               (P2)/TOTAL
R2          0.12     0.08           SMART     66 DBC  - ASSUMING R1=0.10  7/66
R2          0.10                    ARMENTERO 66 HBC  C ASSUMING R1=0.06  9/66

R3       Y*1(1915) INTO (SIGMA PI)/TOTAL                (P3)/TOTAL
R3          0.03     0.02           ARMENTERO 66 HBC  C ASSUMING R1=0.06  9/66

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                        REFERENCES -- Y*1(1915)

BOCK     65 PL 17 166          +COOPER,FRENCH,KINSON, +     //CERN,SACLAY  I
COOL     66 PRL 16 1228        +GIACOMELLI,KYCIA,LEONTIC,LI,LUNDBY,+//BNL  I
SMART    66 PRL 17 556         W M SMART,A KERNAN,G E KALMUS,R P ELY//LRL IJP
ARMENTER 66 BERKELEY CONF      ARMENTEROS,F-LUZZI, + //CERN,HEIDEL,SACLAY IJP
DAVIES   66 PRL (TO BE SUBM)   +COWELL,HATTERSLEY,+ //BIRMGHM,CAMBR,RTHFD  I

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Σ (2035)

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47  Y*1(2035, JP=7/2+) I=1

                  47  Y*1(2035) MASS (MEV)   ----------------------------

M   *    2022.0    20.0             BLANPIED  65 CNTR C  GAMMA P TO K+ Y*
M        2040.0    20.0             COOL      66 CNTR C- K-P, D TOTAL     7/66
M        2030.0    20.0             WOHL      66 HBC  C  K-P TO LAM PIO   7/66

----------------  47  Y*1(2035) WIDTH (MEV)  ----------------------------

W   *     120.0    20.0             BLANPIED  65 CNTR C
W         150.0                     COOL      66 CNTR C                   7/66
W         170.0                     WOHL      66 HBC  C                   7/66

----------------  47  Y*1(2035) PARTIAL DECAY MODES   --------------------

P1       Y*1(2035) INTO KBAR N                          S11S17
P2       Y*1(2035) INTO LAMBDA PI                       S18S 9
P3       Y*1(2035) INTO SIGMA PI                        S20S 8

----------------  47  Y*1(2035) BRANCHING RATIOS   ----------------------

R1       Y*1(2035) INTO (KBAR N)/TOTAL                  (P1)/TOTAL
R1          0.155                   COOL      66 CNTR C  K-P TOTAL        7/66
R1          0.25                    WOHL      66 HBC  C  K-P CH EX        7/66

R2       Y*1(2035) INTO (LAMBDA PI)/TOTAL               (P2)/TOTAL
R2          0.16                    WOHL      66 HBC  C  ASSUMING R1=0.25 7/66

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                        REFERENCES -- Y*1(2035)

BLANPIED 65 PRL 14 741         +GREENBERG,HUGHES,KITCHING,LU,+//YALE(CEA)
COOL     66 PRL 16 1228        +GIACOMELLI,KYCIA,LEONTIC,LI,LUNDBY,+//BNL  I
WOHL     66 PRL 17 107         C G WOHL, F T SOLMITZ, M L STEVENSON //LRL IJP

                 PAPERS NOT REFERRED TO IN DATA CARDS.

SMART    66 PRL 17 556         W M SMART,A KERNAN,G E KALMUS,R P ELY//LRL IJP
ARMENTER 66 BERKELEY CONF      ARMENTEROS,F-LUZZI, + //CERN,HEIDEL,SACLAY IJP
      -- SMART 66 AND ARMENTEROS 66 TEND TO CONFIRM THE JP ASSIGNMENT.

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Σ (2260)

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48  Y*1(2260, JP=     ) I=1

              EVIDENCE NOT COMPLETELY CONCLUSIVE.  THE BUMP IS SMALL
              AND SENSITIVE TO DETAILS OF THE UNFOLDING OF THE EFFECTS
              OF INTERNAL MOMENTA OF THE NUCLEONS IN THE DEUTERON.

----------------  48  Y*1(2260) MASS (MEV)   ----------------------------

M   *    2245.0                     BLANPIED  65 CNTR    GAMMA P TO K+ Y*
M   *    2299.0     6.0             BOCK      65 HBC     PBAR P 5.7 BEV/C
M        2260.0    20.0             COOL      66 CNTR    K-P, D TOTAL     7/66

----------------  48  Y*1(2260) WIDTH (MEV)  ----------------------------

W   *     150.0                     BLANPIED  65 CNTR
W   *      21.0    17.0     21.0    BOCK      65 HBC
W         180.0                     COOL      66 CNTR                     7/66

----------------  48  Y*1(2260) PARTIAL DECAY MODES   --------------------

P1       Y*1(2260) INTO KBAR N                          S11S17
P2       Y*1(2260) INTO KBAR N PI                       S11S17S 8

----------------  48  Y*1(2260) BRANCHING RATIOS   ----------------------

R1       Y*1(2260) INTO (KBAR N)/TOTAL                  (P1)/TOTAL
R1          0.14                    COOL      66 CNTR    ASSUMING J=9/2   7/66

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                        REFERENCES -- Y*1(2260)

BLANPIED 65 PRL 14 741         +GREENBERG,HUGHES,KITCHING, +  //YALE(CEA)
BOCK     65 PL 17 166          +COOPER,FRENCH,KINSON, +     //CERN,SACLAY
COOL     66 PRL 16 1228        +GIACOMELLI,KYCIA,LEONTIC,LI,LUNDBY,+//BNL  I

                 PAPER NOT REFERRED TO IN DATA CARDS.

DAUBER   66 PL 23 154          +SCHLEIN, SLATER, STORK, TICHO //UCLA(LRL)  J
      -- SUGGESTS J=9/2 RESONANT BEHAVIOR IN SIGMA- PI+, BUT APPEARS
         INCONSISTENT WITH COOL 66 PARAMETERS.

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Σ (3000)

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59  Y*1(3000, JP=     ) I=1

              ENHANCEMENT IN LAMBDA PI AND KBAR N INVARIANT MASS
              SPECTRA AND IN MISSING MASS OF NEUTRALS RECOILING
              AGAINST KO.  EVIDENCE NOT CONCLUSIVE.  OMITTED FROM
              TABLE.

----------------  59  Y*1(3000) MASS (MEV)   ----------------------------

M        3000.0                     EHRLICH   66 HBC  C PI-P 7.91 BEV/C   9/66

----------------  59  Y*1(3000) PARTIAL DECAY MODES   --------------------

P1       Y*1(3000) INTO KBAR N                          S11S17
P2       Y*1(3000) INTO LAMBDA PI                       S18S 8

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                        REFERENCES -- Y*1(3000)

EHRLICH  66 PR (SUBMITTED)    R EHRLICH, W SELOVE, H YUTA    //PENN(BNL)  I

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Ξ (1530)

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49  XI*1/2(1530, JP=3/2+) I=1/2

                  49  XI*1/2(1530) MASS (MEV)   --------------------------

M   *    1529.0     5.0             PJERROU   62 HBC  C- K-P 1.8 BEV/C
M   *    1532.0     2.0             BADIER    64 HBC  C- K-P 3 BEV/C
M-       1535.7     3.2             LONDON    66 HBC  -  K-P 2.24 BEV/C   7/66
MO       1528.7     1.1             LONDON    66 HBC  C                   7/66

----------------  49  XI*(-)-XI*(0) MASS DIFFERENCE (MEV)   -------------

D           5.7     3.0             PJERROU   65 HBC  0- K-P 1.8-1.95 B/C 7/66
D   R       7.0     4.0             LONDON    66 HBC  0                   7/66
    R    REDUNDANT WITH DATA IN MASS LISTING.
D           2.0     3.2             MERRILL   66 HBC  C- K-P 1.7-2.7 BE/C 7/66

----------------  49  XI*1/2(1530) WIDTH (MEV)   ------------------------

W           7.0     2.0             SCHLEIN   63 HBC  C  K-P 1.8-1.95 B/C
W           8.5     3.5             LONDON    66 HBC  C                   7/66
W           7.0     7.0             BERGE     66 HBC  C  K-P 1.5-1.7 BE/C 7/66

----------------  49  XI*1/2(1530) PARTIAL DECAY MODES   -----------------

P1       XI*1/2(1530) INTO XI PI                        S22S 8

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                        REFERENCES -- XI*1/2(1530)

PJERROU  62 PRL 9 114          +PROWSE,SCHLEIN,SLATER,STORK,TICHO  //UCLA  I
SCHLEIN  63 PRL 11 167         +CARMONY,PJERROU,SLATER,STORK,TICHO //UCLA IJP
BADIER   64 DUBNA I 593        +DEMOULIN,GOLDBERG, +     //EP,SACLAY,AMSTR  I
PJERROU  65 PRL 14 275         +SCHLEIN,SLATER,SMITH,STORK,TICHO    //UCLA
LONDON   66 PR 143 1034        +RAU,SAMIOS,YAMAMOTO,GOLDBERG,+ //BNL,SYCR  IJ
BERGE    66 PR 147 945         +EBERHARD,HUBBARD,MERRILL,B-SHAFER,+ //LRL  I
MERRILL  66 UCRL-16455 THESIS D W MERRILL                        //LRL  JP

          QUANTUM NUMBER DETERMINATION NOT REFERRED TO IN DATA CARDS.

SHAFER   66 PR 142 883         BUTTON-SHAFER,LINDSEY,MURRAY,SMITH   //LRL  JP

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Ξ (1705)

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51  XI*1/2(1705, JP=     ) I=1/2

              EVIDENCE NOT COMPELLING.  OMITTED FROM TABLE.

                  51  XI*1/2(1705) MASS (MEV)   --------------------------

M        1705.0        APPROX       SMITH     65 HBC  C- K-P 2.1-.7 BEV/C

----------------  51  XI*1/2(1705) WIDTH (MEV)   ------------------------

W          20.0        APPROX       SMITH     65 HBC  C-

----------------  51  XI*1/2(1705) PARTIAL DECAY MODES   -----------------

P1       XI*1/2(1705) INTO XI PI                        S22S 8
P2       XI*1/2(1705) INTO LAMBDA KBAR                  S18S11

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                        REFERENCES -- XI*1/2(1705)

SMITH    65 ATHENS CONF 251   G A SMITH, J S LINDSEY                //LRL  I

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Ξ (1815)

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50  XI*1/2(1815, JP=     ) I=1/2

                  50  XI*1/2(1815) MASS (MEV)   --------------------------

M   *    1770.0                     HALSTEINS 63 FBC  C- K-FR 3.5 BEV/C
M        1817.0     7.0             SMITH 1   65 HBC  C- K-P 2.4-.7 BEV/C
M        1814.0     4.0             BADIER    65 HBC  C  K-P 3 BEV/C

----------------  50  XI*1/2(1815) WIDTH (MEV)   ------------------------

W   *      80.0        OR LESS      HALSTEINS 63 FBC  C-
W          12.0     4.0             BADIER    65 HBC  C
W          30.0     7.0             SMITH 2   65 HBC  C-
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-----------------   50  XI*1/2(1815) PARTIAL DECAY MODES   ------------------

P1        XI*1/2(1815) INTO LAMBDA KBAR                      S18S11
P2        XI*1/2(1815) INTO XI PI                            S22S 8
P3        XI*1/2(1815) INTO XI*1/2(1530) PI                  U49S 8
P4        XI*(1815) INTO XI PI PI (XI PI NOT XI*(1530)) S22S 8S 8

-----------------   50  XI*1/2(1815) BRANCHING RATIOS   --------------------

R1        XI*1/2(1815) INTO (LAMBDA KBAR)/TOTAL            (P1)/TOTAL
R1   *      LARGE                      BADIER    65 HBC                       7/66
R1   *      LARGE                      SMITH 2   65 HBC                       7/66

R2        XI*1/2(1815) INTO (XI PI)/(LAMBDA KBAR)          (P2)/(P1)
R2          0.20      0.20             BADIER    65 HBC                       7/66
R2   *      SMALL                      SMITH 2   65 HBC     IF XI*1933 EXIST  7/66

R3        XI*1/2(1815) INTO (XI*(1530) PI)/(LAM KBAR)      (P3)/(P1)
R3          0.26      0.13             SMITH 1   65 HBC
R3   *      SMALL                      BADIER    65 HBC                       7/66

R4        XI*1/2(1815) INTO (XI PI PI)/(LAMBDA KBAR)       (P4)/(P1)
R4          0.1          OR MORE       SMITH 1   65 HBC
R4   *      SMALL                      BADIER    65 HBC                       7/66

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                      REFERENCES -- XI*1/2(1815)

HALSTEIN 63 SIENA CCNF 173    HALSTEINSLID,+//BERGEN,CERN,EP,RTHF,UNICOL  I
SMITH 1  65 PRL 14 25         +LINDSEY,BUTTON-SHAFER,MURRAY         //LRL IJP
BADIER   65 PL 16 171         +CEMOULIN,GOLDBERG, +    //CP,SACLAY,AMSTR  I
SMITH 2  65 ATHENS CONF 251   G A SMITH, J S LINDSEY                //LRL

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Ξ (1935) 52  XI*1/2(1935, JP=    ) I=1/2

                  52  XI*1/2(1935) MASS (MEV)   --------------------------

M            1933.0      16.0              BADIER    65 HBC  C  K-P 3 BEV/C

-----------------   52  XI*1/2(1935) WIDTH (MEV)   --------------------------

W             140.0      35.0              BADIER    65 HBC  C

-----------------   52  XI*1/2(1935) PARTIAL DECAY MODES   ------------------

P1        XI*1/2(1935) INTO XI PI                            S22S 8
P2        XI*1/2(1935) INTO LAMBDA KBAR                      S18S11

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                      REFERENCES -- XI*1/2(1935)

BADIER   65 PL 16 171         +CEMOULIN,GOLDBERG, +    //CP,SACLAY,AMST  I

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Ξ? (2270) 53  XI* /2(2270, JP=    ) I= /2

              EVIDENCE PRELIMINARY.  OMITTED FROM TABLE.

                  53  XI* /2(2270) MASS (MEV)   --------------------------

M            2270.0                        ABRAMS    66 HBC     K-P 4.25 BEV/C    9/66

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                      REFERENCES -- XI* /2(2270)

ABRAMS   66 BERKELEY CONF     +CAY,GLASSER,KEHOE,SECHI-ZORN, + //MD(BNL)

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Eta Decay Into Neutrals (Price, Nov. '66)

Certain HBC and DBC experiments report the mode "$\eta \to 3\pi^0$", but actually they detect both $\eta \to 3\pi^0$ plus $\eta \to \pi^0 2\gamma$, and they cannot distinguish them (we ignore the mode $\eta \to 2\pi^0\gamma$). Since the detection efficiencies are different for the various modes, one may not merely substitute the combined rate $(3\pi^0 + \pi^0 2\gamma)$ for the reported $3\pi^0$ rate in these experiments. MULLER+ 63 (DBC) state that their detection efficiency per γ ray is about the same regardless of the mode of decay ($3\pi^0$ or $\pi^0 2\gamma$). CRAWFORD2 66 (HBC) has shown that the same is true for the HBC experiments listed. Thus for all these experiments (assuming $\eta \to 2\pi^0\gamma$ to be equal to zero)

$$3\pi^0{}_{\text{true}} = 3\pi^0{}_{\text{reported}} \times \frac{1}{1+\frac{4}{6}r} \qquad (1)$$

and

$$\pi^0 2\gamma_{\text{true}} = 3\pi^0{}_{\text{reported}} \times \frac{r}{1+\frac{4}{6}r}, \qquad (2)$$

where

$$r \equiv \frac{\pi^0 2\gamma}{3\pi^0} \qquad (3)$$

CRAWFORD2 gives values for $3\pi^0/\pi^+\pi^-\pi^0$, using (1) and assuming $r = 1.79\pm0.58$, from DIGIUGNO+ 66 (CNTR).

Now in principle it would be possible for us to include "r" in our least-squares fitting, recalculating it at every step. In reality, however, this would require a major programming change in program AHR. Thus we have not included these particular HBC and DBC experiments in our present constrained fitting. For the purposes of comparison, we note that our over-all best fits to all data (excluding the particular HBC and DBC experiments) gives

$$R \equiv \frac{3\pi^0}{\pi^+\pi^-\pi^0} = 0.94\pm0.16.$$

If we now use the experimental results from the BC experiments along with our best-fit values for the partial modes $\pi^0 2\gamma$ and $3\pi^0$, we have [Eqs. (1) and (3)]:

$$R = 0.50\pm0.12.$$

The agreement is not good (it is about 2 standard deviations). If such a discrepancy persists, we will recode program AHR to accept all of the data next time.

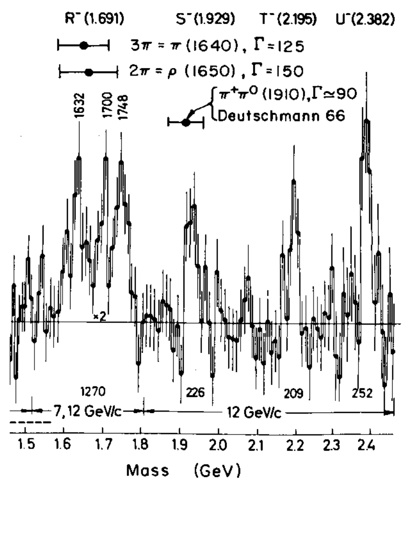
Relationship between peaks seen in missing mass spectrometer and in bubble chamber experiments

a) Relationship between:
   1. Narrow R^- peaks seen by MMS
   2. Broad 3π peak, $\pi(1640)$ seen by HBC
   3. Broad 2π peak, $\rho(1650)$ seen by HBC

The figure below shows the R^- data of the MMS group (LEVRAT + 66). We have added the average mass and width of the HBC bumps (GOLDHABER + 66RVUE). The observations must be related, but there is not yet enough information to apportion them.

b) Relationship between:
   1. Narrow S^- peak seen by MMS
   2. $\Gamma = 90\pm40$ MeV $\pi^+\pi^0$ peak seen in HBC

It is hard to relate these, since MMS bump has 3 charged tracks, HBC is $\pi^+\pi^0$. See fig. below.



Notes on Baryon Resonances

Parameters of the lower N^*'s (Rosenfeld, Wohl)

We take masses, widths, and elasticities of the lower N^*'s [except for the $\Delta(1236)$] from phase-shift analyses of BAREYRE 65 and LOVELACE 66. These are the latest of a number of such analyses and appear to be the most complete and comprehensive. However it should be kept in mind that even these are only in qualitative agreement with one another.

The Argand diagrams of BAREYRE 65 are shown in Fig. 4. Those of Donnachie et al. have not yet appeared; their best estimates of resonance parameters are given by LOVELACE 66. We would be happy to include their diagrams (as well as anyone else's) in future editions. Argand diagrams are clearly the most succinct form for presenting and comparing results of phase-shift analyses.

A resonating partial-wave elastic-scattering amplitude with no background has the simple Breit-Wigner form

$$T(E) = x/(\epsilon - i), \qquad (1)$$

where x is elasticity and ϵ is $(M-E)/(\Gamma/2)$. This amplitude traces a circle of diameter x and becomes entirely imaginary at E = M. The amplitude also has greatest velocity $|dT/dE|$ at E = M, for it is easy to show that

$$\left|\frac{dT}{dE}\right| = \frac{x}{\epsilon^2+1} = \text{Im } T, \qquad (2)$$

which is a maximum at E = M. The $P_{33}\,\Delta(1236)$ is a good example of a resonant partial wave with no background until E is well above M.

If the resonance is superimposed on a varying background, the resonant circle may be translated, rotated, and distorted. The S_{31} amplitude shows these effects well. Since this amplitude never becomes entirely imaginary, we must choose another criterion for the resonant energy. If the background varies only slowly, it is reasonable to choose the point at which the velocity of the amplitude is greatest.

The S_{11} amplitude is obviously quite complex. MICHAEL 66 has visually fitted the solution of BAREYRE 65 to two resonant circles plus no background. We use his results.

The influence of background on the P_{11} amplitude is less apparent. The clue is that the amplitude varies most rapidly somewhat below the energy at which it becomes entirely imaginary. This behavior suggests that the resonant circle is rotated, an interpretation supported by the fact that the phase shift starts off negative before commencing its counterclockwise rotation and recrossing the origin at 1175 MeV. Maximum velocity is reached at about 1400 MeV or slightly lower.

Let us consider the P_{11} amplitude to be the result of two opposite forces, a repulsive force responsible for a negative scattering length A, and an attractive resonant interaction. The scattering length will produce a phase shift $2i\delta'$ and a contribution to the T matrix

$$T' = \frac{e^{2i\,\delta'}-1}{2i}. \qquad (3)$$

The resonant term T will be given by (1). The total amplitude, obtained by multiplying the S-matrix elements[1] (S is related to T by S = 2iT + 1), will now start out negative, and then superimposed on its clockwise motion will be the counterclockwise circular resonant behavior.

How far around this resonant circle is 1400 MeV? To solve this simple problem, assume that the repulsive phase shift $2\delta'$ is related to a scattering length by

$$k^3 \cot \delta' = 1/A,$$

or more precisely, using McKinley's phase shifts,[2]

$$(k/m_\pi)^3 \cot \delta' = -(.015)^{-1}.$$

Then, at 1400 MeV, δ' has reached -15 deg. We have plotted the corresponding point on Fig. 4. It is encouraging that this point lies almost diametrically across the resonant circle from 1400 MeV.

The other resonating amplitudes, the D_{13}, the D_{15}, and the F_{15}, appear to have little background; the variation is most rapid approximately where the amplitude becomes imaginary. Therefore the resonant parameters may be chosen as follows: M is where T(E) is entirely imaginary; x is the length of T at this point; and $\Gamma/2$ is (M - E'), where E' is the energy at which Im T is x/2.

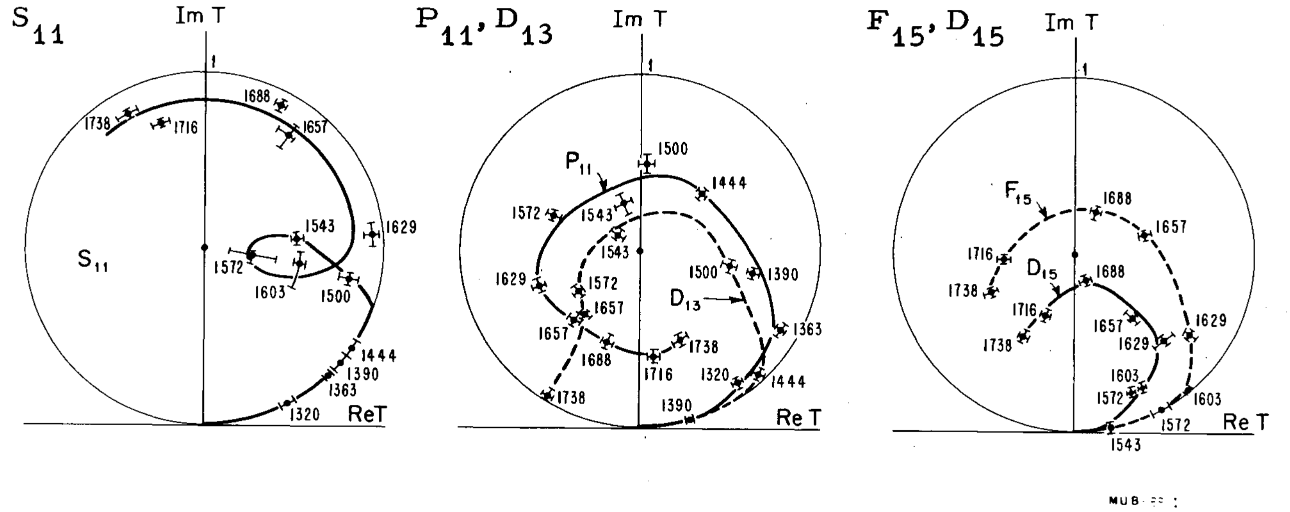
---

1. By multiplying S matrices we get

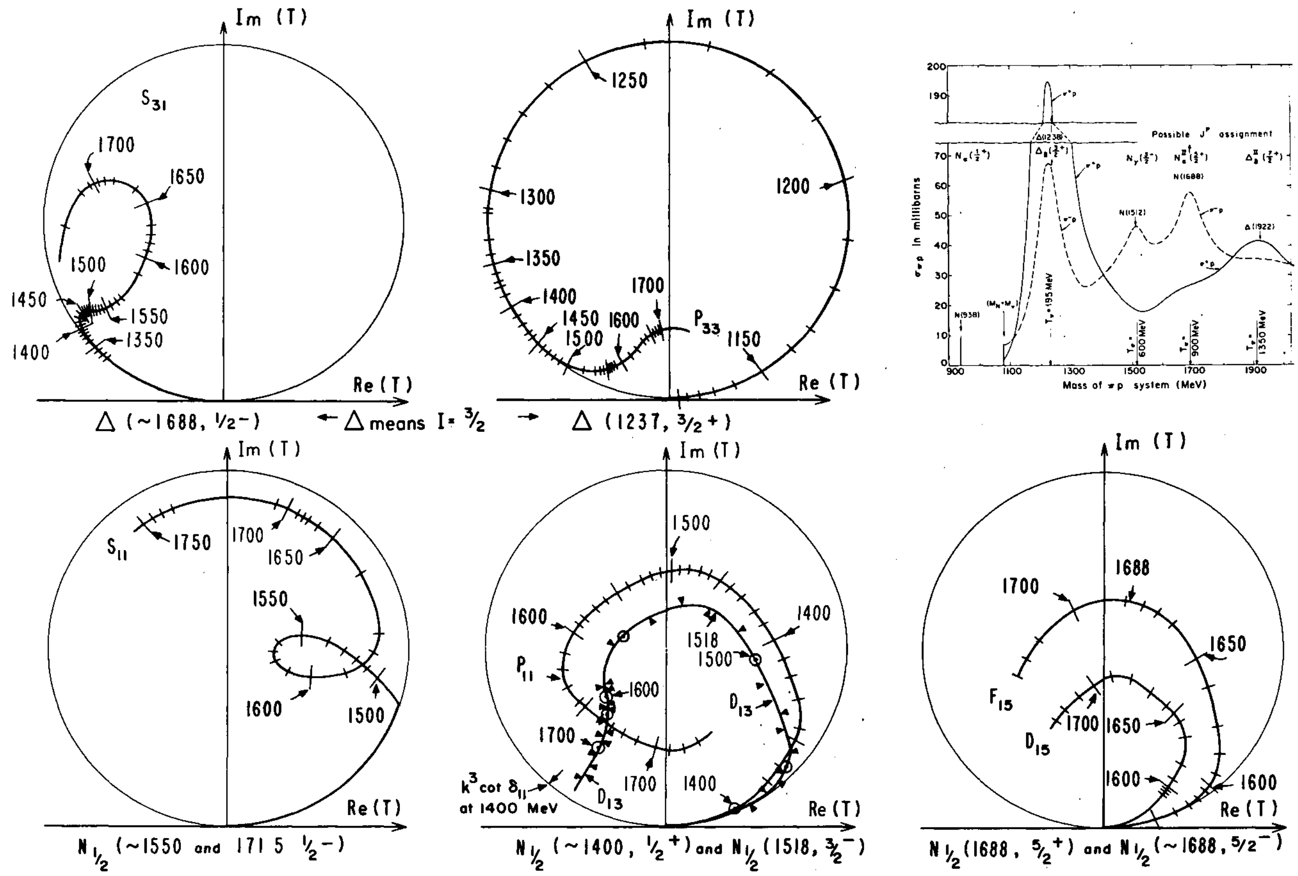
$$S'' = S'\,S = \eta' e^{2i\delta'}\,\eta e^{2i\delta} = 2iT'' + 1.$$

Hence $T'' = \dfrac{\eta'\eta\, e^{2i(\delta'+\delta)}-1}{2i}$ which rotates the clockwise resonant circle by $2i\delta'$, keeping it tangent to the unit circle.

2. J. M. McKinley, Rev. Mod. Phys. 35, 788 (1963).



Solutions of Bareyre et al. to I-spin 1/2 resonant partial waves. The crosses show the amplitudes and errors computed from the data at various energies. The smooth connecting lines are guesses.



The smooth guessed curves above are replotted with the actual calculated amplitudes replaced by hatch marks interpolated every 10 MeV. For a resonance they should be spaced proportionally to $\mathrm{Im}(T) = (1+\epsilon^2)^{-1}$. The I-spin 3/2 resonant partial waves have been added at the top, along with a summary of the total cross section for π^+p and π^-p.

Fig. 4

MUB-14051

Spin-parity assignments of the higher mass N^*'s

Spins and parities of the higher mass N^*'s are taken from Barger and Cline (BARGER 66). They classify all the N^*'s as Regge recurrences on three straight-line trajectories [namely, recurrences of N(938), N(1525), and Δ(1236)] in a Chew-Frautchi plot. In addition they construct a model for π^-p elastic scattering, near and at 180°, based on interference of the resonance amplitude with an amplitude due to Regge exchange of Δ(1236) in the crossed channel. The predictions compare well with the existing experimental data on the energy dependence of the π^-p differential cross section at 180° and the general shape of the π^-p angular distribution near 180°.[1] This result confirms the consistency of the Regge recurrence parity assignments with the scattering data. In addition to the N^* reported in the Table on Baryons, they predict two more states: one at ≈ 2200 MeV ($J^P = 9/2+$) and another one at ≈2630 MeV ($J^P = 13/2+$) which they can accomodate in the prediction of the backward πp scattering by changing the elasticities of the neighboring resonances. We do not list these two resonances since they have not yet been experimentally observed.

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1. V. Barger and D. Cline, Regge Recurrence Parity Assignments for the S = 0 Recurrences, paper submitted to the XIII International Conference on High Energy Physics, August 31 through September 7, 1966, Berkeley (proceedings to be published by the Univ. of Calif. Press).

Appendix A. Compiled Spectra Relevant to H and κ Mesons

In an attempt to confirm or deny the existence of certain tentative bumps, we have started compiling the relevant published spectra. It would be better to compile events, rather than spectra, but the former entails collecting data summary tapes, whereas the latter involves only key-punching published data. Perhaps this simpler procedure will stimulate experimental groups to combine their data more effectively.

The compiling is done with a Fortran program SCHISM, written by Alan Rittenberg. SCHISM rebins the input data into common intervals, then outputs the combined histograms. An alphameric character is assigned to each input histogram and is displayed on output, permitting the reader to identify the source of the data. To facilitate reading of the histograms, certain rows and columns of letters have been changed to dots.

Our latest compilations will be continuously available from the Lawrence Radiation Laboratory as UCRL-8030 Spectra. However, we present here two examples, partly as an advertisement for help; we hope readers will call to our attention omitted data and send us new relevant data. The two mesons investigated are H and κ. The results for both are inconclusive. The H spectra show that there is not enough data for us to rely on histograms alone (we will have to go to combined events): the κ spectra discredit but do not kill the κ. In any case, we try to present enough spectra that the reader can form his own opinion on these bumps.

1. The κ(725) (Lynch, Rittenberg, Rosenfeld, Söding, Dec. 1966)

We are beginning to think that κ should be classified along with flying saucers, the Loch Ness Monster, and the Abominable Snowman. We have heard of several experiments which were supposed to confirm it, and each one has either failed completely or failed to find it in the sought-for channel, but found instead a small Kπ peak near 725 MeV in some other channel.

We present here a collection of 19 histograms, some of which represent the results of particular experiments in which the experimenters have claimed to have found the κ; the rest summarize experiments relevant for confirmation or rejection of the κ as a resonance. In Table A-I we list the various reactions and experiments which are discussed and compiled in this appendix, and give numbers of events, incident momenta, and references.

a. $\pi^-p \to (K\pi)\,Y$

The κ was first reported by ALEXANDER+ 62 and MILLER+ 63 in the reaction $\pi^-p \to \Sigma^{-,0}(\pi K)^{+,0}$ at 1.9 to 2.4 GeV/c. Figure A1, taken from MILLER+ 63 (which incorporates events from ALEXANDER+ 62), shows an enhancement of 55 "κ mesons" just at the peak of phase space. These data have now more than doubled, and appear in the thesis of HARDY 66, from which we have gathered two histograms to make Fig. A2. The enhancement has become considerably less impressive and, if present, corresponds to ≤ 40 events. The corresponding plot at higher primary energy, Fig. A3 (also from HARDY 66), also shows no evidence for κ.

The data of Fig. A2 included only Σ^- events, although the original paper of ALEXANDER+ 62 (see Fig. A4) included also Σ^0. Improved Σ^0 statistics have failed to produce any evidence for κ, either near the threshold range shown in Fig. A5 or at higher energy, as shown in Fig. A6.

Table A-I. Experiments on κ discussed in Appendix A.

Reaction	Beam momentum (GeV/c)	Decay products studied	Number of combinations	Published as evidence for κ	Reference	m_κ (MeV)	Γ_κ (MeV)	κ Prod. Cross Section (μb)	Plot symbol	Figure
$\pi^- p \to (K\pi)^{+,0}\Sigma^{-,0}$	1.9 -2.0	$(K^+\pi^0)+(K^0\pi^+)+(K^+\pi^-)$		+	Alexander 62[a] Fig. 3 (incl. in Hardy below)	≈730	≤ 20			A4
$\pi^- p \to (K\pi)^+\Sigma^-$	1.8 - 2.2	$K^+\pi^0$	736		Hardy 66[b] Fig. 12(g)				K	A2
	1.9 - 2.4	$K^+\pi^0$	520	+	Miller 63[c] Fig. 2(b) (incl. in Hardy above)	726±3§	≤ 20§	6-3§		A1
	1.8 - 2.2	$K^0\pi^+$	1602		Hardy 66[b] Fig. 13(g)				N	A2
	1.9 - 2.4	$K^0\pi^+$	1202	+	Miller 63[c] Fig. 2(c) (incl. in Hardy above)	726±3§	≤ 20§	6-3§		A1
	2.9 - 3.3	$K^+\pi^0$	299		Hardy 66[b] Fig. 12(h)				L	
	2.9 - 3.3	$K^0\pi^+$	732		Hardy 66[b] Fig. 13(h)				P	A3
	3.8 - 4.2	$K^+\pi^0$	123		Hardy 66[b] Fig. 12(i)				M	
	3.8 - 4.2	$K^0\pi^+$	223		Hardy 66[b] Fig. 13(i)				Q	
$\pi^- p \to (K\pi)^0\Sigma^0$	1.8 - 2.2	$K^+\pi^-$	670		Hardy 66[b] Fig. 11(g)				H	A5
	2.9 - 3.3	$K^+\pi^-$	314		Hardy 66[b] Fig. 11(h)				I	A6
	3.8 - 4.2	$K^+\pi^-$	104		Hardy 66[b] Fig. 11(i)				J	
$\pi^- p \to (K\pi)^0\Lambda$	1.5	$K^0\pi^0$	154	+	Kim 65[d] Fig. 3	735±5†	< 20		A	
	1.59	$K^0\pi^0+K^+\pi^-$	104		Sene [e] Fig. 2. 10				Z	A7
	1.8	$K^0\pi^0$	259	+	Kim 65[d] Fig. 4	735±5†	< 20		B	
	1.8 - 2.2	$K^0\pi^0$	522		Hardy 66[b] Fig. 15(g)				U	A8
	1.8 - 2.2	$K^+\pi^-$	1590		Hardy 66[b] Fig. 14(g)				R	
	2.9 - 3.3	$K^0\pi^0$	208		Hardy 66[b] Fig. 15(h)				V	
	2.9 - 3.3	$K^+\pi^-$	688		Hardy 66[b] Fig. 14(h)				S	A9
	3.8 - 4.2	$K^0\pi^0$	72		Hardy 66[b] Fig. 15(i)				W	
	3.8 - 4.2	$K^+\pi^-$	263		Hardy 66[b] Fig. 14(i)				T	
$\pi^+ p \to (K\pi)^+\pi^+\Lambda$ (4-body)	3.2	$K^+\pi^0+K^0\pi^+$	314	+	Cason 66[f] Fig. 1 (213 events)	731±2	≤ 12		C	A10
$K^- p \to (\bar{K}\pi)^- p$ (3-body)	0.78-0.99	$K^-\pi^0$	220		Gelfand 66[g] Fig. 10				C	
	0.8 -1.05	$K^-\pi^0$	203		Kalmus 66[h]				N	
	0.78-0.99	$\bar{K}^0\pi^-$	79		Gelfand 66[g] Fig. 10				G	
	0.8 -1.05	$\bar{K}^0\pi^-$	143		Kalmus 66[h]				L	
	1.02-1.18	$K^-\pi^0$	300		Gelfand 66[g] Fig. 10				D	A11
	1.05-1.2	$K^-\pi^0$	180		Kalmus 66[h]				K	
	1.02-1.18	$\bar{K}^0\pi^-$	270		Gelfand 66[g] Fig. 10				H	
	1.05-1.2	$\bar{K}^0\pi^-$	186		Kalmus 66[h]				I	
	1.2	$K^-\pi^0$	894		Lynch 66[i]				O	
	1.2	$\bar{K}^0\pi^-$	891		Lynch 66[i]				Q	
	1.0 -1.7	$\bar{K}^0\pi^-$	4296	+	Wojcicki 63[j] Fig. 1	723±3	< 12	30-0	B	A13
	1.4 -1.7	$K^-\pi^0$	2543		Lynch 66[i]				R	
	1.4 -1.7	$\bar{K}^0\pi^-$	2166		Lynch 66[i]				T	
	1.8 -2.1	$K^-\pi^0$	2925		Lynch 66[i]				U	
	1.8 -2.1	$\bar{K}^0\pi^-$	2584		Lynch 66[i]				W	A14
	2.4 -2.7	$K^-\pi^0$	1950		Lynch 66[i]				X	
	2.1 -2.7	$\bar{K}^0\pi^-$	5833		Friedman 66[k]				A	
	2.4 -2.7	$\bar{K}^0\pi^-$	1833		Lynch 66[i]				Z	
$K^- p \to (\bar{K}\pi)^0 n$	0.78-0.99		114		Gelfand 66[g] Fig. 10				E	
	0.8 -1.05		194		Kalmus 66[h]				M	
	1.02-1.18		314		Gelfand 66[g] Fig. 10				F	A12
	1.05-1.2	$K^-\pi^+$	215		Kalmus 66[h]				J	
	1.2		1068		Lynch 66[i]				P	
	1.4 -1.7		3732		Lynch 66[i]				S	
	1.8 -2.1		4554		Lynch 66[i]				V	A15
	2.4 -2.7		2834		Lynch 66[i]				Y	
$K^- p \to (K\pi)^{+,0}\Xi^{-,0}$	2.24	$K^+\pi^0+K^0\pi^++K^+\pi^-$	413	+	London 66[ℓ] Fig. 28	730	≤ 15		L	A16
$K^- p \to$ $(\bar{K}\pi)^0\pi^- p$, $(\bar{K}\pi)^-\pi^+ n$, $(\bar{K}\pi)^-\pi^0 p$	1.2 -1.7	$K^-\pi^++\bar{K}^0\pi^-$	1523	+	Wojcicki 64[m] Fig. 5	≈ 725	< 12		W	A17
$K^- p \to (\bar{K}\pi)^0\pi^- p$ (4-body)	1.45	$K^-\pi^+$	101		Almeida 64[n] Fig. 4			< 3±1.7	A	
	2.0	$K^-\pi^+$	4519		Dauber 66[o] Fig. 45(b)	≈ 690	≤ 30		D	
	2.1 -2.7	$\bar{K}^0\pi^0$	4367		Friedman 66[k]				F	
	2.68	$K^-\pi^+$	1857		Pripstein 66[p] Fig. 8				P	A18
$K^- p \to (\bar{K}\pi)^-\pi^0 p$	2.1 - 2.7	$\bar{K}^0\pi^-$	4338		Friedman 66[k]				G	
$K^- p \to (\bar{K}\pi)^-\pi^+ n$	2.1 - 2.7	$\bar{K}^0\pi^-$	3909		Friedman 66[k]				H	
$K^+ p \to (K\pi)^+\pi^+\pi^- p$ (5-body)	3.0	$K^+\pi^0$	312	+	Ferro-Luzzi 64[q] Fig. 2(a)				F	
	3.0	$K^0\pi^+$	226	+	Ferro-Luzzi 64[q] Fig. 2(c) (113 events)	725±5*	< 30*	85	F	A19
	3.52	$K^0\pi^+$	1144	-	Goshaw 66[r] Fig. 2 (572 events)			<3	G	
$K^+ p \to (K\pi)^0\pi^+\pi^0 p$	3.0	$K^+\pi^-$	312	+	Ferro-Luzzi 64[q] Fig. 2b	725±5*	< 30*	65	F	
		total number	≈ 60 000							

§Values obtained from the combined $(K^+\pi^0)$ and $(K^0\pi^+)$ mass distributions.

†Values obtained from the combined 1.5 and 1.8 GeV/c data.

*Values obtained from the combined $(K^+\pi^0)$, $(K^0\pi^+)$, and $(K^+\pi^-)$ mass distributions.

a. G. Alexander et al., Phys. Rev. Letters 8, 447 (1962).
b. L. Hardy, Analysis of Strange-Particle Resonant States from π^-p Interactions, (Ph. D. Thesis), Lawrence Radiation Laboratory Report UCRL-16788, July 1966 (unpublished).
c. D. Miller et al., Phys. Letters 5, 299 (1963).
d. Y. S. Kim et al., Phys. Letters 19, 350 (1965).
e. M. Sene (Univ. of Paris Thesis), unpublished.
f. N. M. Cason et al., Phys. Rev. Letters 17, 838 (1966).
g. N. Gelfand et al., Formation and Production of Resonant States in Two-Prong K^-p Interactions between 0.8 and 1.2 GeV/c, Enrico Fermi Institute for Nuclear Studies Report EFINS-66-81, August 1966 (unpublished).
h. G. Kalmus (LRL), private communication.
i. G. R. Lynch (LRL), private communication.
j. S. Wojcicki et al., Phys. Letters 5, 283 (1963); Phys. Rev. 135, B484 (1964).
k. J. Friedman (LRL), private communication.
ℓ. G. W. London et al., Phys. Rev. 143, 1034 (1966).
m. S. Wojcicki et al., Phys. Rev. 135, B495 (1964).
n. S. Almeida and G. R. Lynch, Phys. Letters 9, 204 (1964).
o. P. M. Dauber et al., Phys. Rev. (to be published).
p. M. Pripstein (LRL), private communication.
q. M. Ferro-Luzzi et al., Phys. Letters 12, 255 (1964).
r. A. T. Goshaw et al., Phys. Letters 22, 347 (1966).

MUB-13980

Miller, claim.

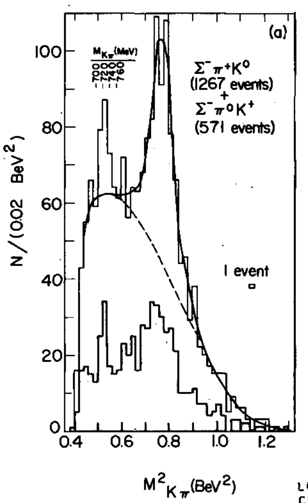

Fig. A1. $M^2(K\pi)$ from $\pi^-p\to(K\pi)^+\Sigma^-$, P_{inc} = 1.9 to 2.4 GeV/c. From MILLER+ 63.

Miller decreased

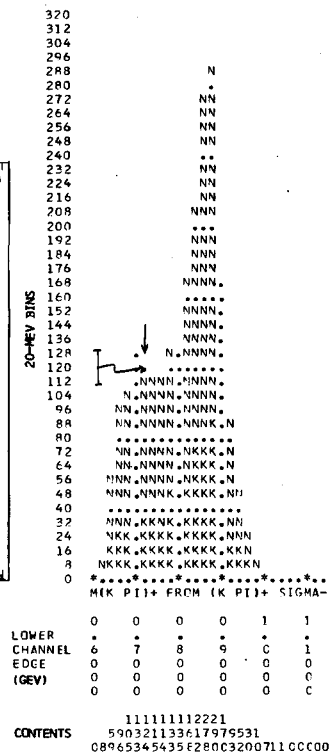

Fig. A2. $M(K\pi)$ from $\pi^-p\to(K\pi)^+\Sigma^-$, P_{inc} = 1.8 to 2.2 GeV/c.

Same channel, higher energy.

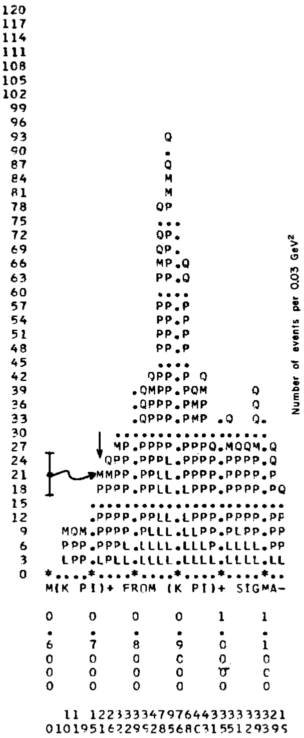

Fig. A3. $M(K\pi)$ from $\pi^-p\to(K\pi)^+\Sigma^-$, P_{inc} = 2.9 to 4.2 GeV/c.

Alexander $\Sigma^-,\Sigma^0,\Lambda$.

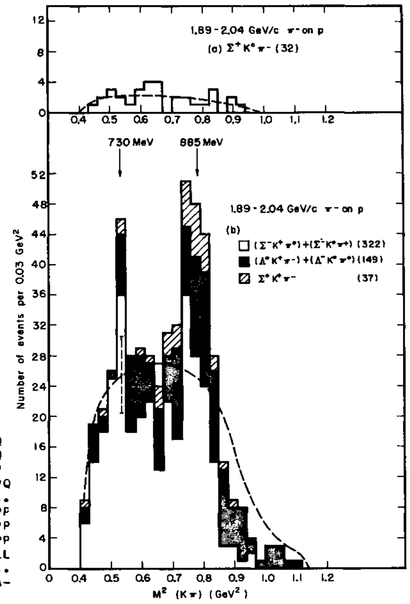

Fig. A4. $M^2(K\pi)$ from $\pi^-p\to(K\pi)^{+,0}\ \Sigma^{-,0}$, and $\pi^-p\to(K\pi)^0\Lambda$, P_{inc} = 1.9 to 2.0 GeV/c. From ALEXANDER+ 62.

Alexander Σ^0 disappeared.

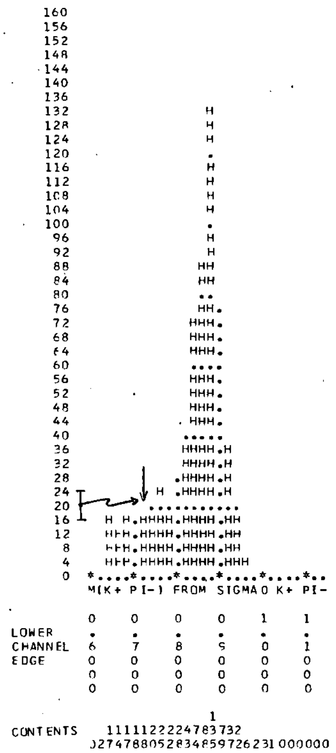

Fig. A5. $M(K\pi)$ from $\pi^-p\to(K\pi)^0\Sigma^0$, P_{inc} = 1.8 to 2.2 GeV/c.

Same channel, higher energy.

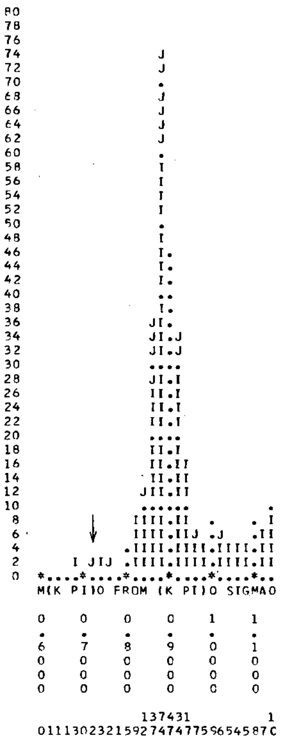

Fig. A6. $M(K\pi)$ from $\pi^-p\to(K\pi)^0\Sigma^0$, P_{inc} = 2.9 to 4.2 GeV/c.

Kim claim (A+B) + other (Z), strong uncorroborated peak.

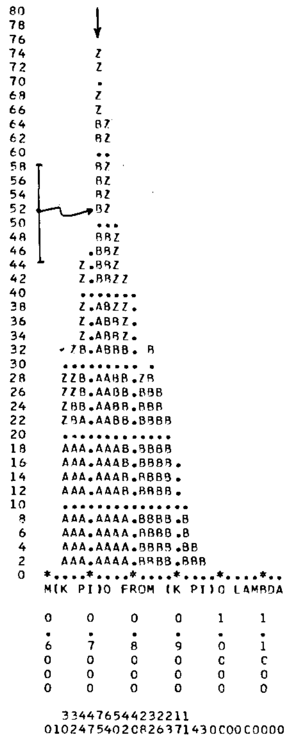

Fig. A7. $M(K\pi)$ from $\pi^-p\to(K\pi)^0\Lambda$, P_{inc} = 1.5 to 1.8 GeV/c.

Same channel, higher energy.

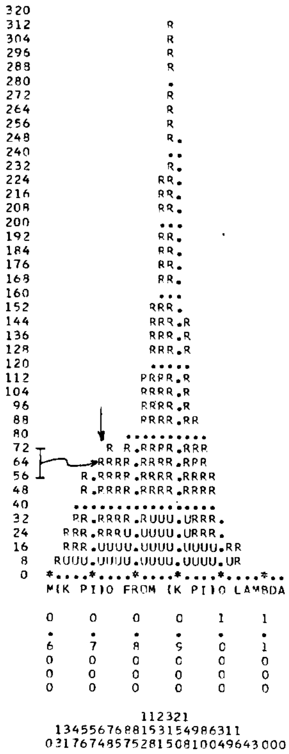

Fig. A8. $M(K\pi)$ from $\pi^-p\to(K\pi)^0\Lambda$, P_{inc} = 1.8 to 2.2 GeV/c.

MUB-13962

On the other hand, some positive evidence for an enhancement at 735 MeV comes from studies of $(K\pi)^0 \Lambda$ final states! This evidence is shown in Fig. A7, which is a compilation of 517 events from two experiments (KIM+ 65, SENE 66) with incident momenta of 1.5 to 1.8 GeV/c, partly below the K^* production threshold. In an experiment with 6× better statistics (3342 events), HARDY 66 has found no evidence for the κ (Figs. A8 and A9), but his experiment covers only the momentum range well above K^* threshold (1.66 MeV) and therefore does not invalidate the positive results of KIM+ 65 and SENE 66.

b. $\pi^+ p \rightarrow (K\pi)^+ \pi^+ \Lambda$

From a recent experiment involving 314 events of this type (Fig. A10), CASON+ 66 claim to have found evidence for the κ. To our knowledge, there is no similar experiment with comparable statistics to either support or weaken the conclusion of CASON+ 66.

c. $K^- p \rightarrow (K\pi)\ N$

Historically, the second experiment to report the κ was that of WOJCICKI+ 63, in which 4296 events of the reaction $K^- p \rightarrow \bar{K}^0 \pi^- p$ were studied. In agreement with the original κ evidence, their κ has a mass of 723±3 MeV and a width of < 12 MeV. Wojcicki's largest effect was at 1.08 GeV/c.

There are now several other experiments measuring $(\bar{K}\pi)^- p$ final states in this region of incident K^- momenta. Figure A11 is a compilation of 3367 events (not including Wojcicki's); it represents an independent confirmation of Wojcicki's observation of a peak in the $(\bar{K}\pi)^-$ mass at about 725 MeV. Moreover, a compilation of recent results from $(K\pi)^0 n$ final states in the same energy region (1882 events) also shows an enhancement (see Fig. A12), perhaps at a slightly higher mass value. Although the statistical significance of each of these peaks is not larger than 1 to 2 standard deviations, it is hard to deny that some peculiar effect seems to be present here.

Again, larger statistics is available at higher energies, but no peak is observed (see compilation in Figs. A13, A14, and A15).

d. $K^- p \rightarrow (K\pi)^{+,0}\ \Xi^{-,0}$

Evidence for the κ was reported by LONDON+ 66on the basis of 413 events of this type (see Fig. A16). This is still waiting for confirmation or disproval.

e. $K^- p \rightarrow (\bar{K}\pi)^{0,-}\ \pi N$

The κ was also reported, with m ≈ 725 MeV and Γ < 12 MeV, by WOJCICKI+ 64 in 1523 events with 4-body final states, for incident momenta between 1.2 and 1.7 GeV/c. A compilation of 6152 events presently available for this reaction (including the data of WOJCICKI+ 64) in the range of 1.2 to 2 GeV/c (Fig. A17) shows, instead, a broad maximum around 700 MeV. However 700 MeV is just the peak of phase space and we would not take such a broad maximum as evidence for an enhancement in the 725-MeV mass region. A compilation of 14467 events at 2.1 to 2.7 GeV/c similarly shows no κ (see Fig. A18).

f. $K^+ p \rightarrow (K\pi)^{0,+} \pi^{0,-} \pi^+ p$

Finally, the κ was reported from a CERN experiment by FERRO-LUZZI+ 64, who saw a peak in the reaction $K^+ p \rightarrow NK\pi\pi\pi$. This κ was at 725 MeV and had a width of < 30 MeV. The effect was found in the 3 GeV/c data, but was absent in the 3.5 GeV/c data. An experiment at Wisconsin at 3.6 GeV/c with three times as many events as the CERN experiment also indicated no evidence for a κ.

The combined distribution of the $(K\pi)^{+,0}$ mass from these experiments is shown in Fig. A19. There is no peak at ≈ 730 MeV; although a broad enhancement centered at about 750 MeV can be seen, this is where phase space also peaks.

The κ has also been looked for in other experiments--e.g., the CERN group (V. Henri, private communication) has looked for the κ_+ below K^* threshold in the reaction $K^+ p \rightarrow K^0 \pi^+ p$, but did not find it.

What can we conclude from this study? If the κ is real, then each claim for its existence should be strengthened when combined with later data. We now summarize the discussion above for each claim:

§. The MILLER 63 signal has decreased from 53 to < 40 events, and the signal of FERRO-LUZZI 64 has disappeared.

§. There are no new data to compare with the claims of KIM 65, CASON 66, or LONDON 66; they are of course still impressive.

§. The fate of the claim of WOJCICKI 63 is undecided. His data suggested a κ produced by K^- between 1 and 1.7 GeV/c. When combined with new data over this entire range, the signal has disappeared. On the other hand, with limited statistics, Wojcicki's best signal/noise ratio was at 1.08 GeV/c. We have compiled events produced by K^- between 0.78 and 1.2 GeV/c, and indeed see a 1 to 2-σ signal for both κ and κ^0.

Same channel, still higher energy.

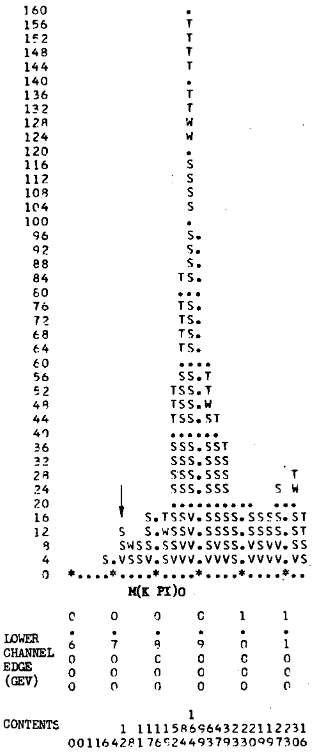

Fig. A9. $M(K\pi)$ from $\pi^- p \to (K\pi)^0 \Lambda$, P_{inc} = 2.9 to 4.2 GeV/c.

Cason claim, strong uncorroborated peak.

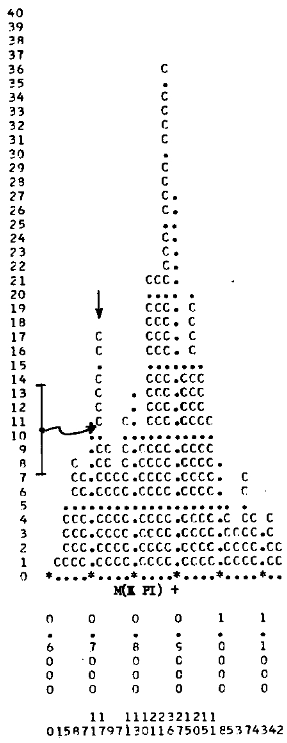

Fig. A10. $M(K\pi)$ from $\pi^- p \to (K\pi)^+ \pi^\mp \Lambda$, P_{inc} = 3.2 GeV/c.

No claim, but κ near threshold, supports Wojcicki.

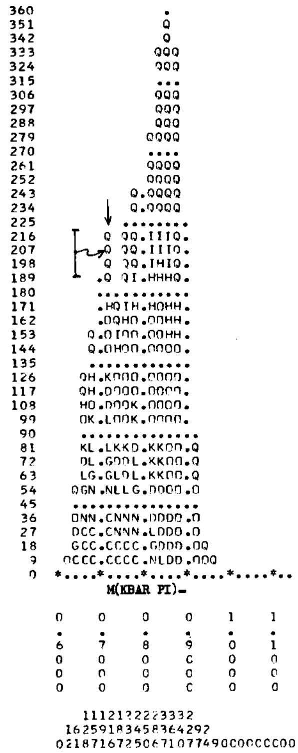

Fig. A11. $M(\bar{K}\pi)$ from $K^- p \to (\bar{K}\pi)^- p$, P_{inc} = 0.78 to 1.2 GeV/c.

Same reactions, different charge, supports Wojcicki.

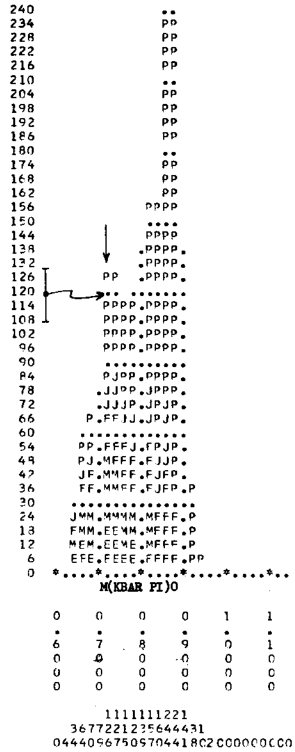

Fig. A12. $M(\bar{K}\pi)$ from $K^- p \to (\bar{K}\pi)^0 n$, P_{inc} = 0.78 to 1.2 GeV/c.

Wojcicki claim (B), + others, up to 1.7 GeV/c, Signal decreased.

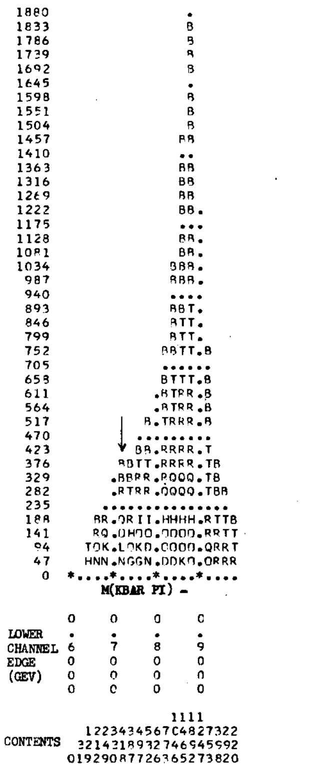

Fig. A13. $M(\bar{K}\pi)$ from $K^- p \to (\bar{K}\pi)^- p$, P_{inc} = 0.78 to 1.7 GeV/c.

Same channel, higher energy. No κ.

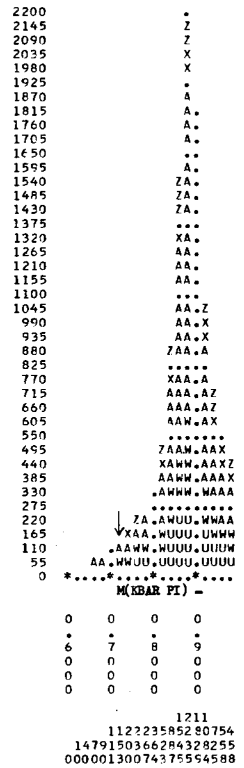

Fig. A14. $M(\bar{K}\pi)$ from $K^- p \to (\bar{K}\pi)^- p$, P_{inc} = 1.8 to 2.7 GeV/c.

Same reactions, different charge. No κ.

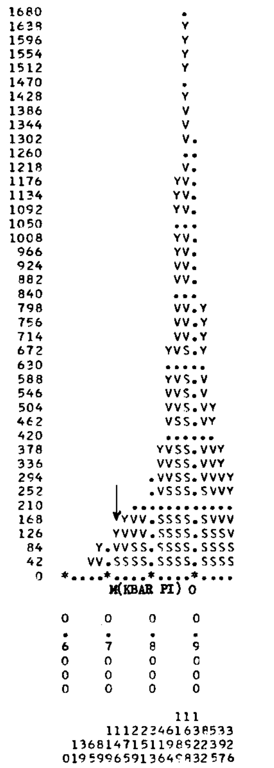

Fig. A15. $M(\bar{K}\pi)$ from $K^- p \to (\bar{K}\pi)^0 n$, P_{inc} = 1.4 to 2.7 GeV/c.

London claim, strong uncorroborated peak.

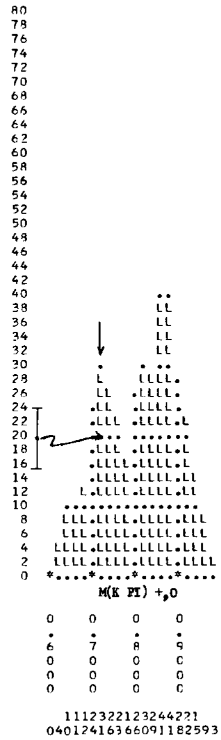

Fig. A16. $M(K\pi)$ from $K^- p \to (K\pi)^{+0} \Xi^{-,0}$, P_{inc} = 2.24 GeV/c.

MUB-13963

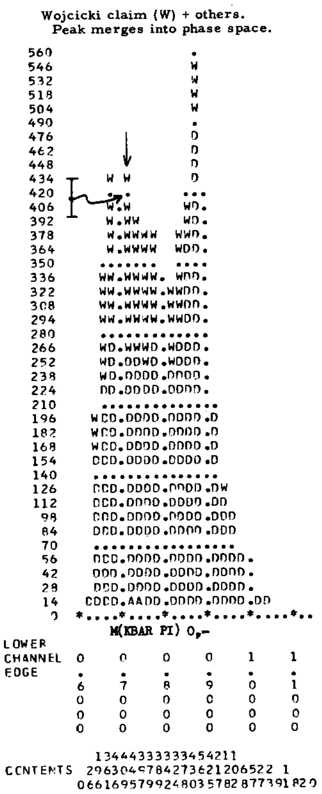

Fig. A17. $M(\bar{K}\pi)$ from $K^-p \to (\bar{K}\pi)^{0,-}\pi N$, P_{inc} = 1.2 to 2 GeV/c.

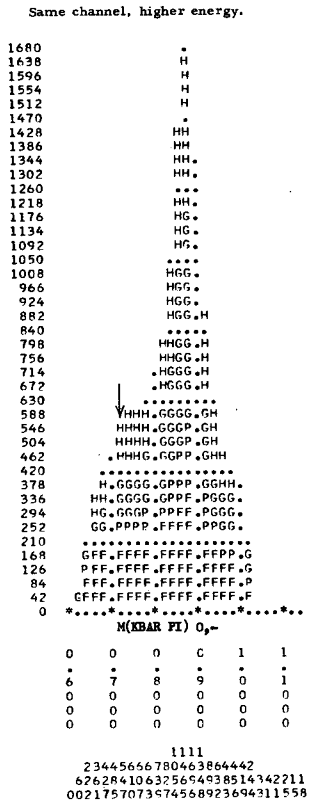

Fig. A18. $M(\bar{K}\pi)$ from $K^-p \to (\bar{K}\pi)^{0,-}\pi N$; P_{inc} = 2.1 to 2.7 GeV/c.

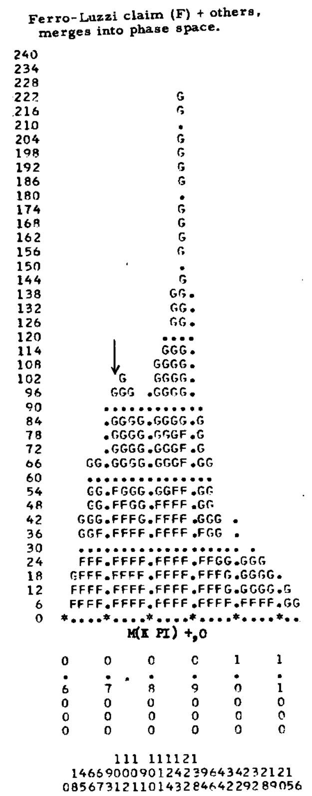

Fig. A19. $M(K\pi)$ from $K^+p \to (K\pi)^{+,0}\pi^{-,0}\pi^+p$, P_{inc} = 3 to 3.5 GeV/c.

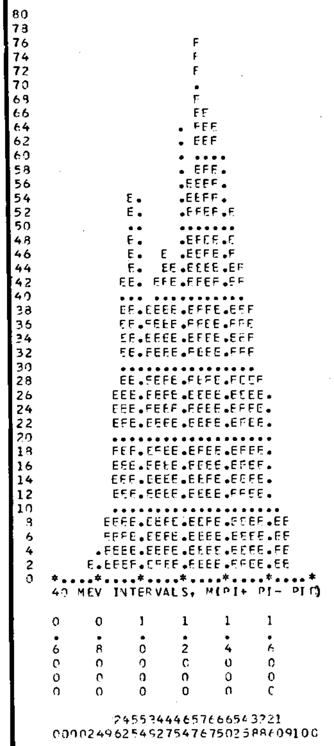

Fig. A20. $M(\rho\pi)^0$ from $\pi^+p \to (\rho\pi)^0\Delta^{++}$, P_{inc} = 4 GeV/c. From BARTSCH+64.

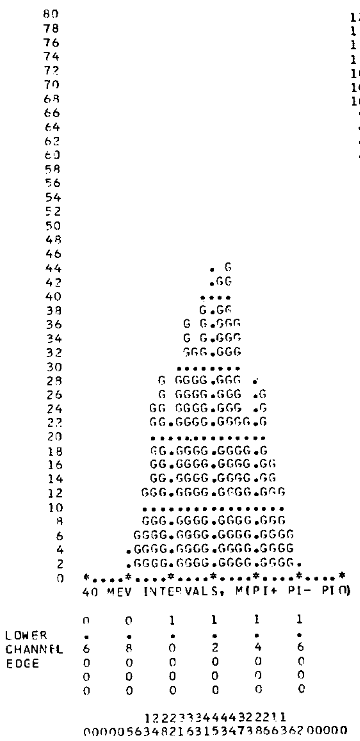

Fig. A21. $M(\rho\pi^0)$ from $\pi^+p \to (\rho\pi)^0\Delta^{++}$, P_{inc}=3.65 GeV/c. From G. GOLDHABER 65.

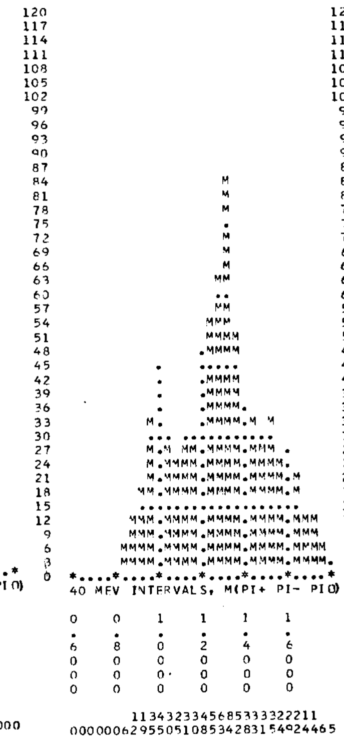

Fig. A22. $M(\rho\pi)^0$ from $\pi^+d \to (\rho\pi)^0pp$, P_{inc} = 3.65 GeV/c. From BENSON+ 66.

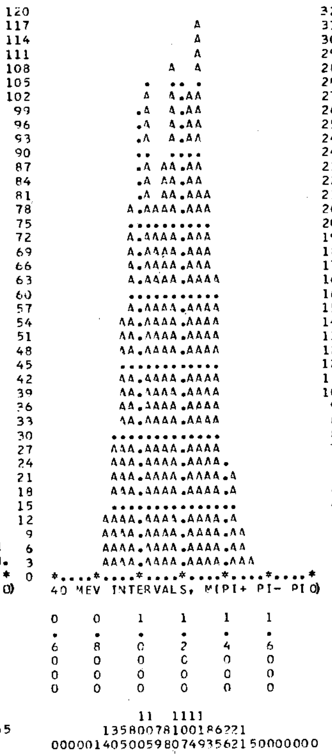

Fig. A23. $M(\rho\pi)^0$ from $\pi^+p \to (\rho\pi)^0\Delta^{++}$, P_{inc}=3.2 and 3.5 GeV/c. From ABOLINS+ 66.

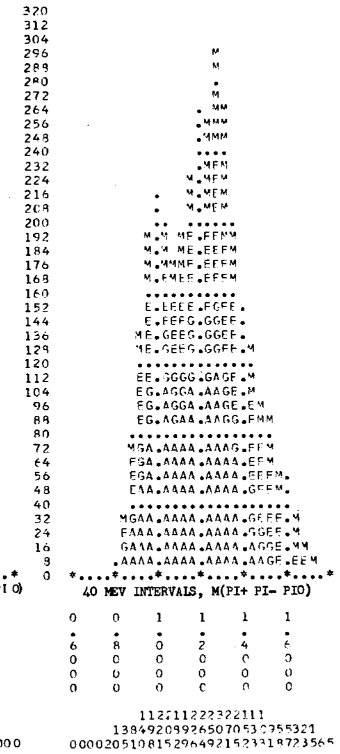

Fig. A24. $M(\rho\pi)^0$ from $\pi^+p \to (\rho\pi)^0\Delta^{++}$ and $\pi^+d \to (\rho\pi)^0pp$, 3.2 to 4 GeV/c.

MUB 13964

This behavior could be that of a real κ, but it is more what one would expect of statistical fluctuations.

The fact remains that we compiled 19 histograms (representing 60 000 events) and found 5 (6000 events) which show surprising peaks apparently not statistical fluctuations. We now try to explain it as a bias. We have keypunched any spectrum associated with a positive κ claim, but stopped at 60 000 total events simply because of the work involved. (We shall next automate the preparation of input data.) We estimate that 1.5 to 2 million events have been measured, each of which yields a Kπ mass value. Our reasoning is as follows:

Last year ≈ 2 million events were measured in the United States,[1] and we guess ≈ 3 million events for the world-wide annual rate. This rate has been roughly doubling every two years,[2] so the time integral of the number of bubble-chamber events measured must be ≈10 million. By comparing the number[3] of pictures exposed to $K^{\pm}$ with the number exposed to $\pi^{\pm}$ and p, we see that a quarter of these 10 million events were produced by $K^{\pm}$ with enough energy to produce Kπ events in the final state (with Kπ mass > 725 MeV).

So physicists have looked at Kπ spectra from ≈ 2.5 million events. We guess that 1.5 to 2 million events have been assembled in large collections and looked at carefully. If a κ peak is seen, it is published, and we keypunch. If nothing surprising is seen, one may not even publish the data, and we may not punch it. (But if readers will send us large relevant spectra, we will enter them from now on.) Then, at 1000 events/histogram, 2 million events yield 200 uninteresting histograms. Then the five surprising ones (only three from $K^{\pm}$ experiments) are perhaps to be expected.

So we restate our conclusion. We have not killed the κ but we do feel that we have further discredited it.

2. The H Meson (Ferbel, Rosenfeld, Soding)

The "H meson" is a supposed $I^G = 0^-$ state with a mass $m_H \approx 1000$ MeV, decaying into $(\rho\pi)^0$. Table A-II lists the experiments in which evidence was observed for a bump near 1000 MeV in the $(\rho\pi)^0$ mass spectrum. Figures A20 through A23 show the distributions of $M(\rho\pi)^0$ from these experiments. Goldhaber[4] discussed the H meson and compiled the data of Figs. A20 and A21, plus 1705 events from the reaction $\pi^+ d \to (\rho\pi)^0 pp$ from Benson et al.[5] After consultation with Benson et al., however, we have decided that it would be better to use only 790 events remaining in their sample after $p\pi^+$ combinations in the Δ band have been excluded. We have also added 1204 events that were contributed by the La Jolla group[6] but not used by Goldhaber because they were not yet available.

Table A-II. Experiments on H meson discussed in Appendix A.

Reaction	Beam momentum (GeV/c)	Number of events	Constraints	Reference	Plot symbol	Figure
$\pi^+ p \to (\rho\pi)^0 \Delta^{++}$	3.2 and 3.5	1204		Abolins 66[a]	A	A23
	3.65	519	no ω	Goldhaber 66[b]	G	A21
	4.0	975		Bartsch 64[c]	E	A20
$\pi^+ d \to (\rho\pi)^0 pp$	3.65	790	no Δ^{++}	Benson 66[d]	M	A22
	Total	3488				

a. See Ref. 6
b. Gerson Goldhaber, Experimental Study of Multiparticle Resonance Decays, in Proceedings of the 1965 Coral Gables Conference on Symmetry Principles at High Energies, University of Miami, Florida, 1965 (W. H. Freeman and Co., San Francisco, Calif., 1965), p. 34.
c. J. Bartsch et al., Phys. Letters 11, 167 (1964).
d. See Ref. 5.

The combined spectrum (Fig. A24) shows a peak extending from 960 to 1080 MeV, with an estimated significance of at least four standard deviations. Note, however, that its mean mass is about 1020 MeV, only about 50 MeV below that of the A1 meson. And its width, $\Gamma \approx$ 120 MeV, is the same as Γ(A1).

This peak is presently seen only in experiments in the beam momentum range 3.2 GeV/c $\leq p(\pi^+) \leq$ 4 GeV/c. It is not seen in similar experiments in the range 5.1 GeV/c $\leq p(\pi^+) \leq$ 8.5 GeV/c. This means that whatever the H phenomenon is, its production cross section drops rapidly at energies greater than $p(\pi^+)$ = 4 GeV/c. Note that 4 GeV/c is already high above the threshold, which is at $p(\pi^+)$ = 2.18 GeV/c for $\pi^+ p \rightarrow H\Delta^{++}$ and even lower for $\pi^+ d \rightarrow$ Hpp. Moreover, the data for $p(\pi^+) \leq 4$ GeV/c presented above are incomplete; we estimate that at least $\approx$ 1000 events from other experiments exist but are not yet accessible to us.

Let us accept the evidence for a neutral A1-like peak 50 MeV below the mass of A1. Is it a new meson, H, or is it the neutral A1, displaced to low energy by one half-width through interference with background? We know that the A1 is seen only when enhanced by the Deck effect, i.e., A1 seems to be produced weakly, and needs to interfere positively with background in order to be seen. But the interference could also displace its peak upwards by $\approx$ 25 MeV. The $A1^{\pm} (\rho\pi)^{\pm}$ is seen recoiling against a proton; the $H(\rho\pi)^0$ is seen recoiling against a Δ^{++}. Could the background phases differ enough between these two experiments that the $(\rho\pi)^0$ peak is displaced downwards by about 25 MeV? We do not know how to answer this question until more work is done.

The Michigan group [5] has suggested that as a next step one should look for an H peak in $\rho^0\pi^0$ only, where the A1, having isopin I = 1, cannot contribute. One can do this in two ways:

1) Compile $\rho^0\pi^0$ spectra, or 2) compile events from data-summary tapes. The latter procedure seems more likely to give us the information we want, for the following considerations. The $\pi^+\pi^-\pi^0$ Dalitz plot has three ρ bands (ρ^0, ρ^+, and ρ^-) which overlap partly at 1000 MeV, and overlap three deep at $\sqrt{3}m_\rho \approx$ 1300 MeV. As the Michigan group shows in Fig. 2 of their paper, $\rho^0\pi^0$ spectra are contaminated with overlapping $\rho^{\pm}\pi^{\mp}$, but if one selects out the overlapping, double-ρ events, one produces an artificial bump at 1000 MeV. One can get around this difficulty by compiling the actual events and doing a maximum-likelihood fit to the population of the ρ^0 band. We shall do this.

A final difficulty with the H bump is contamination from the radiative decay of another meson, $\eta' \rightarrow \rho^0\gamma$, which will often fit the interpretation $\rho^0\pi^0$. The Michigan group [5] estimates that 6 ± 3 of their events are such intruders; their spectrum, Fig. A22, seems to contain about 36 H mesons from all the ρ bands; about half might come from $\rho^0\pi^0$.

In summary, the compilation of spectra carried out so far shows a bump but seems inadequate to distinguish between H and a neutral A1 peak. We feel that a compilation of very carefully selected $\rho^0\pi^0$ events is the most promising next step.

APPENDIX REFERENCES

1. E. C. Fowler, R. Plano, and A. H. Rosenfeld, Survey and Analysis of Bubble Chamber Pictures, in Proceedings of the 1966 International Conference on Instrumentation for High-Energy Physics, SLAC, Stanford, California, Sept. 9, 10, 1966; also Lawrence Radiation Laboratory Report UCRL-17097 (in preparation).
2. We assume that the world growth rate is the same as that of the Alvarez group, which has been doubling its rate every 2 years for 6 to 8 years. See L. W. Alvarez, Round-Table Discussion on Bubble Chambers, in Proceedings of the 1966 International Conference on Instrumentation for High Energy Physics, SLAC, Stanford, California, Sept. 9, 10, 1966; also Lawrence Radiation Laboratory Report UCRL-17096 (Sept. 1966) (unpublished).
3. L. Piekenbrock, Annual Survey of Bubble Chamber Film, University of Colorado, Boulder, Colorado.
4. Gerson Goldhaber, Rapporteur's talk, Session 7, in Proceedings of the XIIIth Conference on High-Energy Physics, August 31 through September 7, 1966, Berkeley, California (proceedings to be published by the University of California Press, Berkeley).
5. G. Benson et al., Phys. Rev. Letters 16, 1177 (1966), and private communication from D. Sinclair (Univ. of Michigan).
6. M. Abolins, R. Lander, N. Xuong, and P. Yager (private communication), University of California, San Diego, at La Jolla.