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An excerpt of X-shooter operations at Paranal

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We report on the current performances and measurements done with X-shooter during its first year of operations at Paranal. We present the current instrumental problems, recent and future improvements, and give advice for the observations.

1 Brief X-shooter observation description

The X-shooter observing sequence is as follows: the Acquisition Flexure Compensation frames (AFC) are acquired during the pre-set of a target OB, and are used to measure and correct the instrument backbone flexures. Then the observation target is acquired by the night support astronomer. The acquisition target could be the science target or the target from which a blind offset (in arcseconds both in RA and DEC) is performed in case of very faint object (currently fainter than 21). The light is split by efficient dichroics and goes to the UVB, VIS, and NIR echelle spectrographs. In the light path there are 2 pairs of ADC (Atmospheric Dispersion Compensator) that are used in the UVB and VIS arms. For IFU (Integral Field Unit) observation they are set to zero correction. The IFU is composed by an image-slicer. For the different optical arms the slit and the read out mode can be specified. As the detector NIR arm has a fixed non destructive readout mode and minimum DIT fixed (0.66 s), only the slit setting can be chosen. For more details, have also a look at D'Odorico et al. (2006), Vernet et al. (2007, 2009, 2010).

2 X-shooter performances

X-shooter has been designed with several objectives, first for its large simultaneous spectral coverage that allows to study at the same time central objects and circumstellar disks for example. Second, it also allows contemporaneous optical and near infrared observations, avoiding the time variability of the object between optical and infrared observations. Third, its high efficiency also allows to observe very faint targets and get useful spectra. Fourth, its simplicity to operate allows the Rapid Response Mode to be activated. It was actually used for observing afterglows of long and short GRBs, or SNe few minutes after the explosion detection. X-shooter is also complementary of UVES about resolving power and efficiency.

For these reasons, after FORS2, X-shooter is the most demanded instrument at Paranal with 151 proposals in P86 and 1757 hours requested. Combined with the requests for the use of FLAMES and UVES, the pressure at UT2 is between 3.4 and 7.5 depending on the semester.

Among others, at Paranal were observed different categories of objects:

Galaxies at different redshifts including $z = 7.5$: Those galaxies are faint (V above 23–25), and often the PIs are looking for emission-lines but in one case a continuum was also observed.

Highly extinguished stars (Martayan et al. 2010): Ultra-massive stars from the Galactic center were observed. However, due to the dense nebulosities, these objects are highly extinguished. X-shooter is the perfect instrument for observing them with its high efficiency and large spectral coverage.

Stars in other galaxies: With its high efficiency, X-shooter is also used to observe individual stars in other galaxies, not only in the Magellanic Clouds but in very far galaxies (730 kpc) of the local group.

Fast variable objects: Time series are performed to follow accurately the behaviour of very close binaries.

Very bright objects (incl. the Moon): To create a useful spectroscopic library for galaxy modelling observations of bright stars are performed (see Trager's contribution).

Asteroids observations (Alvarez et al., in prep.): As for other fields of astronomy, the asteroids observations suffered from the lack of simultaneous observations in the different wavelength ranges.

For more science information, check the other contributions of this proceedings volume.

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3 Recommendations and instrument monitoring

Always check the last user manual version and the X-shooter public webpages[1] for more information. Ditto, use the last X-shooter ETC version for properly preparing the observations. Often the filter for the target acquisition is not really chosen with sufficient consideration to the requirements of the observation. It should be selected according to the quantum efficiency of the TCCD, the filter bandpass, and the flux distribution of the target. Due to thermal drifts in the piezos, the flexure measurement and correction should be refreshed after about 1 hour. This is necessary to guarantee proper centering of the object in the direction perpendicular to the slit (to minimize slit losses) and along the slit (for data extraction). Moreover for longer integration some distortions appear leading to possible problems during the data reduction (Bristow et al. 2010; Vernet's study). The ADC are used in slit and IFU mode (in UVB and VIS). The full correction by the ADC is possible only for zenith distances up to 60 degrees (airmass 2).

If the NIR observations are critical, we advice to use the nodding mode for better correct the sky emission lines and background. The telescope will do 2 offsets and the observations will take place in 2 positions along the slits in the three arms. For a more detailed explanation of the nodding, one should check the user manual (current Sect. 3.3.4). About the telluric lines correction we advice the users to provide their own telluric standard stars OBs. The pipeline[2] already generates results useful to scientifically analyse the data (Modigliani et al. 2010). However continuous improvements are being carried on to provide better results and add more functionalities. Moreover X-shooter health and science and calibration quality[3] is continuously monitored executing a well established calibration plan and monitoring the defined quality control parameters and trend plots. The number of those parameters is in continuous development (see also Moehler et al. 2010).

4 Main current problems

Even if X-shooter is efficient to provide new scientific results, currently it has few youth problems. This section provides some clues about them.

- The AFC is failing from time to time due to warmup problem of the lamps. It is under monitoring after the software modifications performed.
- The UVB ADC failure, possibly related to an high-risk earthquake in July 2010, was responsible of the largest X-shooter technical downtime (33 hours and 37 min) corresponding to observations performed with the ADC2 at a random rotational position, leading to large slit losses and/or wrong spectral format in the UVB arm. Since this date, the ADC2 is failing occasionally. However, a way was found to check it on-fly and it is verified several times the day, in order not to affect the observations or calibrations.
- The TCCD suffered different problems, among them the loss of communication is the most problematic one, leading to 15 hours and 35 min technical downtime. A potential software solution was implemented early January 2011 and is currently in monitoring phase.

5 Instrument improvements

The WCS on X-shooter was improved. The patterns in the VIS CCD were removed and the quality is better.

In July 2011, an intervention on X-shooter will take place. A cold filter will be included in the NIR slit wheel in order to allow studies that require a very low background, specially in J and H bands, for the given slit allowing these slits to filter-out the K-band spectrum. In addition to already available slits, two new slits of 0.6 and 0.9″ will be offered with K-band blocking filters. The 1.5″ slit will have to be sacrificed. At the same time we intend to investigate the problems with the ADC (sometimes incorrect position) and the TCCD (high level of pickup noise, gain variations).

6 Conclusion

X-shooter is already providing some interesting and amazing data to the community. In the near future, the limiting performance in the J and H bands will be improved. X-shooter is just waiting for you to test its limits.

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[3] http://www.eso.org/observing/dfo/quality/X-shooter/reports/HEALTH/trend_report_BIAS_UVB_med_master_HC.html