## Tutorial (Intermediate Level): Radiometric calibration using reflectance panels in PhotoScan Professional 1.4

*This tutorial describes common workflow related to the reflectance calibration of multispectral image data acquired using Parrot Sequoia or MicaSense RedEdge cameras.* 

### 1. Add Photos.

Images from Parrot Sequoia and MicaSense RedEdge can be loaded at once for all bands. Open Workflow menu and choose Add Photos option. Select all images including reflectance calibration images and click OK button.

In the Add Photos dialog choose "Create Multispectral Cameras" option:

E	Add Photos	×
Please se	elect data layout:	
	Create camera from each file add 550 cameras	
	Create multispectral cameras from files as bands add 110 cameras	
	OK Cancel	

If the images are stored in several folders, the same operation should be repeated for each folder. <u>Please remember to add reflectance calibration images!</u>

PhotoScan can automatically sort out those calibration images to the special camera folder in the Workspace pane if the image meta-data says that the images are for calibration. The images will be disabled automatically (not to be used in actual processing).



If there is no such information in the image meta-data, the calibration images will be detected automatically at the next step.

### 2. Locate reflectance panels.

Open Tools Menu and choose Calibrate Reflectance option. Press "Locate Panels" button:

E		C	alibrate Reflect	ance	e		×
	Images			Par	nel Calibration		
	Label	Panel			Band	Reflectance	
				1	Blue		
				2	Green		
				3	Red		
				4	Rededge		
				5	NIR		
			Locate panels			Select panel.	
	Parameters						
	Use reflectance p	anels	Use	sun s	sensor		
		Reset	ОК	(	Cancel		

As a result the images with the panel will be moved to the separate folder and the masks would be applied to cover everything on the images except the panel itself. If the panels are not located automatically, use manual approach described in the *Appendix A*.

If you are using the panel for the first time, and its calibration is not added to PhotoScan internal database yet, you will be prompted to load calibration from CSV file:

Η	Agisoft PhotoScan ×
?	Missing calibration for panel: RP02-1603068-SC. Do you want to load it now?
	<u>Y</u> es <u>N</u> o

If you don't have a CSV file with calibration information, you can enter calibration values manually at the next step.

### 3. Input reflectance (albedo) values of the calibration panel for the bands.

If reflectance calibration was loaded from CSV file or calibration database on the previous step, you can proceed to step 4.

After the panels are located, the reflectance values corresponding to each band should be input according to the panel certificate. It can be done manually in Calibrate Reflectance dialog or using "Select Panel..." button as described in the *Appendix B* of this instruction.

E		Ca	alibrate Reflect	ance	е		×
	Images			Par	nel Calibration		
	Label	Panel		Γ	Band	Reflectance	
	panel_1-B.tif panel_2-B.tif	RP02-1603068-SC RP02-1603068-SC		1	Blue	0.65952	
				2	Green	0.67788	
				3	Red	0.67718	
				4	Rededge	0.66653	
				5	NIR	0.622327	
			Locate panels			Select panel.	
	Parameters						
	Use reflectance p	panels	Use	sun s	sensor		
		Reset	ОК		Cancel		

#### 4. Run reflectance calibration

Check on "Use reflectance panels" and "Use sun sensor" options in the Calibrate Reflectance dialog to perform calibration based on panel data and/or image meta-information.

Click OK to start the calibration process.

### 5. Proceed to the data processing.

Now you can Align Photos, Build Dense Cloud, Build Mesh/DEM and Build Orthomosaic. Generally, the reflectance calibration can be performed anytime prior to the orthomosaic generation procedure.

# Appendix A. Manual calibration image marking.

If the panels cannot be detected automatically for some reason and the "Calibration images" folder is not created automatically, then create the camera group in the Workspace manually and name it "Calibration images", then put the calibration cameras there and disable them. To create a new folder in the Workspace pane select the images that contain the calibration panel, right-click on selection and choose "Move Cameras"  $\rightarrow$  "New Camera Group" option, then right-click on the newly created folder and name it "Calibration images" (without the quotes).

Also in case of manual approach, it is necessary to apply masks to the calibration images manually. To do that for every calibration image (every camera in the "Calibration images" folder of the active chunk) it is necessary to create the mask – mask out everything that is not related to the calibration plate:



IMG\_170529\_171806\_0001\_GRE.TIF 🔀

So only the part of the plate is unmasked and everything else is masked out.

*It is necessary to apply masks for each calibration image and for each band!* To switch between bands use "Set Primary Channel" in the context menu after right-clicking on the chunk's label in the Workspace pane.

After the masking procedure is finished, proceed to step 3 of this instruction and input the reflectance values for each band for the calibration panel and proceed to the calibration procedure.

# Appendix B. Reflectance panel database.

PhotoScan stores the information about the used reflectance panels. Thus, when calibration images of the same panel are detected, PhotoScan will automatically suggest the reflectance values from internal database.

The database of the reflectance panels may be edited via "Select Reflectance Panel" dialog accessible by clicking on "Select panel" button in the "Calibrate Reflectance" dialog.

In the "Select Reflectance Panel" dialog it is possible to

- load reflectance information from a CSV file;

- save current table (wavelength / reflectance factor);

- edit the name of a panel in the database (the name is used in "Calibrate Reflectance" dialog);

- remove the panel from the database.

B	Se	lect Reflectance	Panel	×
📂 🗐 🥒 🗙 Filter:				0
RP02-1603068-SC		Wavelength (nm)	Reflectance	^
	215	464	0.657	
	216	465	0.6566	
	217	466	0.6564	
	218	467	0.6568	
	219	468	0.6572	
	220	469	0.6565	
	221	470	0.6561	
	222	471	0.6566	
	223	472	0.6578	
	224	473	0.6596	
	225	474	0.6603	
	226	475	0.6601	
	227	476	0.6603	
	228	477	0.6611	
	229	478	0.662	
	230	479	0.6623	•
		OK Can	icel	

## Appendix C. Controlling reflectance calculation.

Reflectance calculation can be enabled/disabled separately for each sensor in the Camera Calibration dialog. If the reflectance calibration results should be taken into account during the orthomosaic generation process, open the Camera Calibration dialog and ensure that "Normalize band sensitivity" option is checked on:

453 images, 1280x960 pix	Callicia	type:		Frame				
	Pixel size	e (mm):		0.0037	0.00375 x 0.00375		00375	
🚌 RedEdge, Green (5.5mm)	Focal ler	igth (mm):		5.5				
453 images, 1280x960 pix	🗌 Enab	ole rolling shut	ter compensati	ation 🗌 Film	Film camera with fiducial marks			
RedEdge, Red (5.5mm)	Initial	Adjusted	Bands	GPS/INS Of	fset S	ave Offset	1	
453 images, 1280x900 pix		ormalize band	sensitivity					
RedEdge, Rededge (5.5mm) 453 images 1280x960 pix		Band	Bla	ck level		Sensitiv	ity	
PadEdas NIP (5 Sava)	1 B	ue	4984.25	5 1				
	1000000	in data la						
	Layer	index: 0						
	Layer	a label	Resolution	Camera mo	del Fo	cal length	Date & time	
	Layer Camer	index: 0 a Îabel G_0000_1	Resolution 1280x960	Camera mo RedEdge	del Fo 5.5	cal length	Date & time 2016:08:17 1	
	Layer Camer IM IM	index: 0 a Îabel G_0000_1 G_0001_1	Resolution 1280x960 1280x960	Camera mo RedEdge RedEdge	del Fo 5.5 5.5	cal length	Date & time 2016:08:17 1 2016:08:17 1	
	Layer Camer IM I IM	index: 0 a Îabel G_0000_1 G_0001_1 G_0002_1	Resolution 1280x960 1280x960 1280x960	Camera mo RedEdge RedEdge RedEdge	del Fo 5.5 5.5 5.5	cal length	Date & time 2016:08:17 1 2016:08:17 1 2016:08:17 1	
	Layer Camer IM IM IM IM	index: 0 a Îabel G_0000_1 G_0001_1 G_0002_1 G_0003_1	Resolution 1280x960 1280x960 1280x960 1280x960 1280x960	Camera mo RedEdge RedEdge RedEdge RedEdge RedEdge	del Fo 5.5 5.5 5.5 5.5	cal length	Date & time 2016:08:17 1 2016:08:17 1 2016:08:17 1 2016:08:17 1	
	Layer Camer	index: 0 a Îabel G_0000_1	Resolution 1280x960	Camera mo RedEdge	del Fo 5.5	cal length	Date & time 2016:08:17 1	

If "Normalize band sensitivity" option is unchecked, the orthomosaic will contain default color values without any update thanks to calibration with the reflectance panel or image meta-data information.