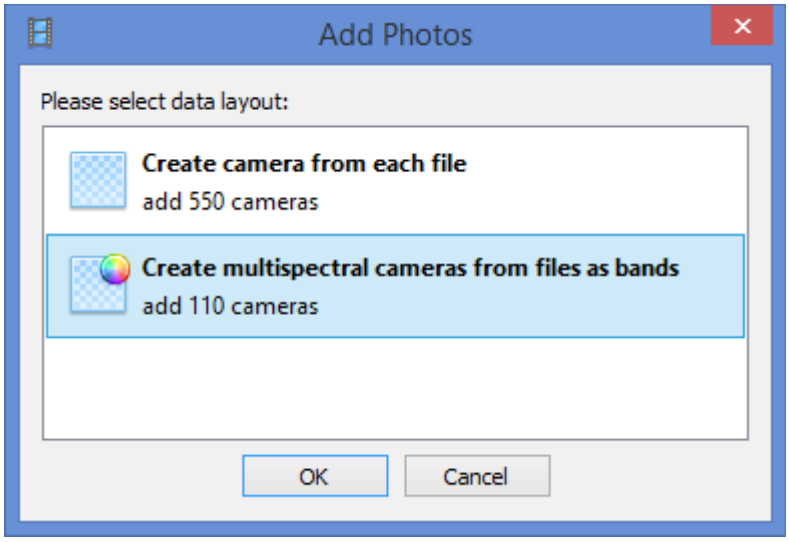
Tutorial (Intermediate Level):
Radiometric calibration using reflectance panels
in PhotoScan Professional 1.4

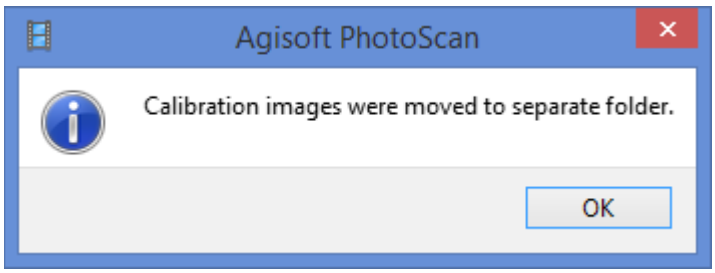
This tutorial describes common workflow related to the reflectance calibration of multispectral image data acquired using Parrot Sequoia or MicaSense RedEdge cameras.

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:



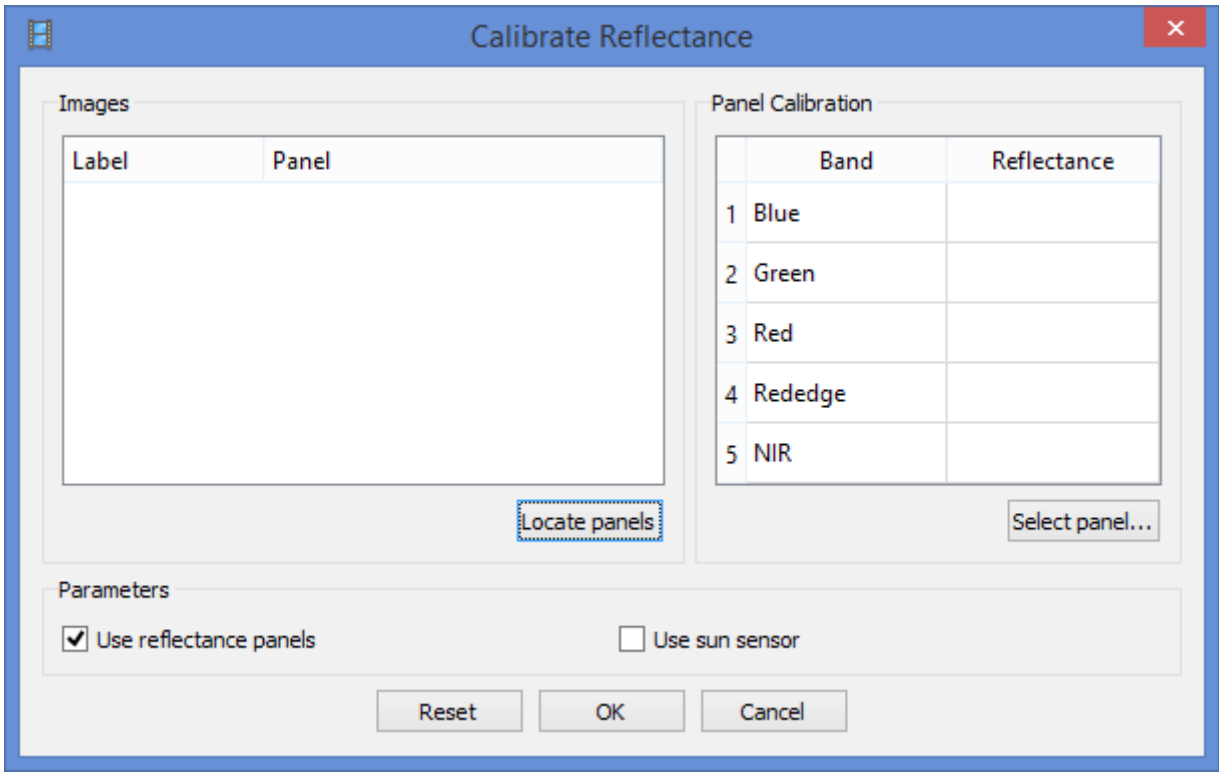
   If the images are stored in several folders, the same operation should be repeated for each folder. Please remember to add reflectance calibration images!

   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).



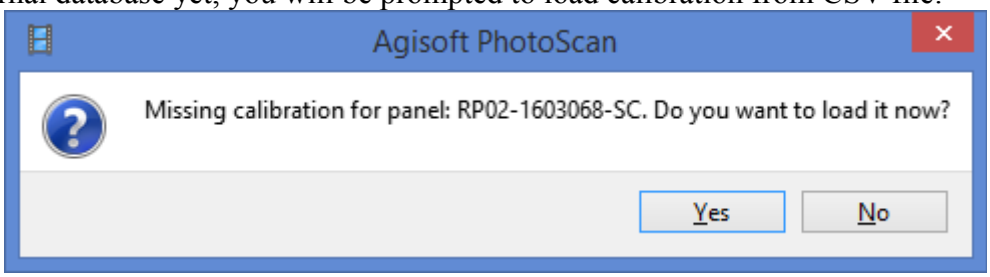
   If there is no such information in the image meta-data, the calibration images will be detected automatically at the next step.

2. **Locate reflectance panels.**
   Open Tools Menu and choose Calibrate Reflectance option. Press “Locate Panels” button:



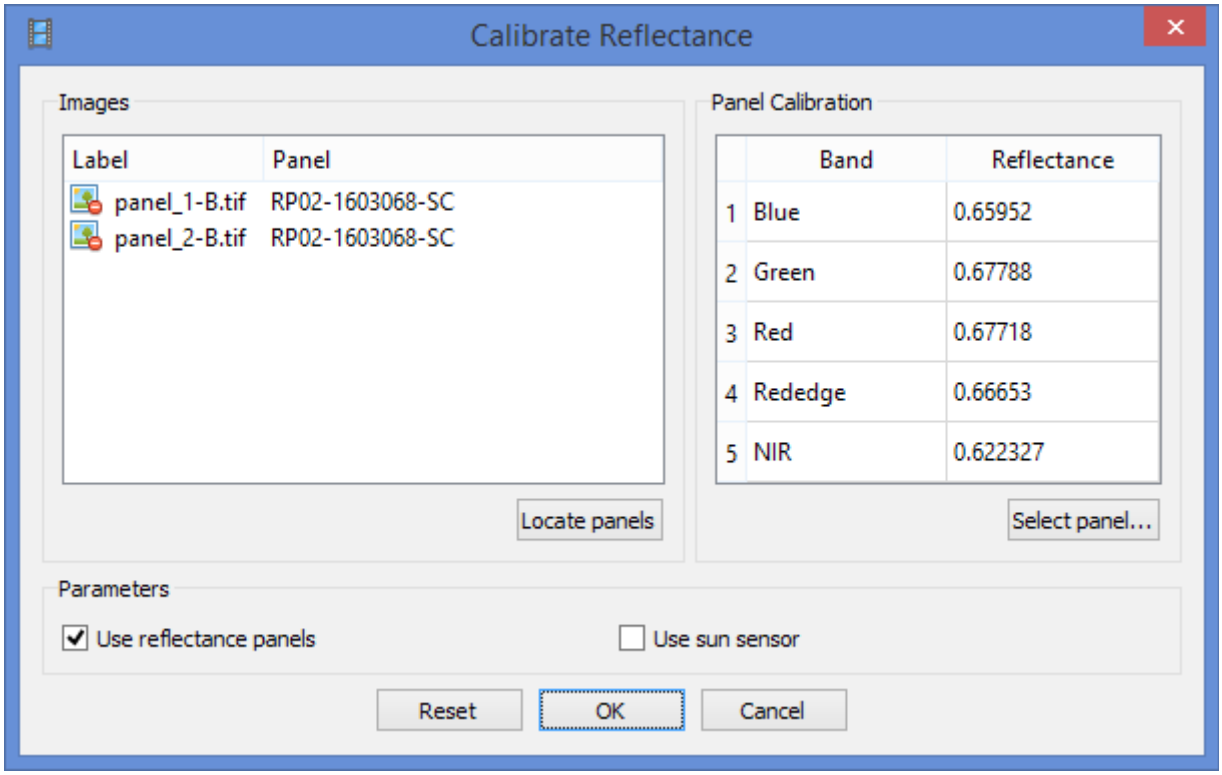
As a result the images with the panel will be moved to the separate folder and the masks would be applied to cover everything on the images except the panel itself. If the panels are not located automatically, use manual approach described in the *Appendix A*.

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:



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.



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” → “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:

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

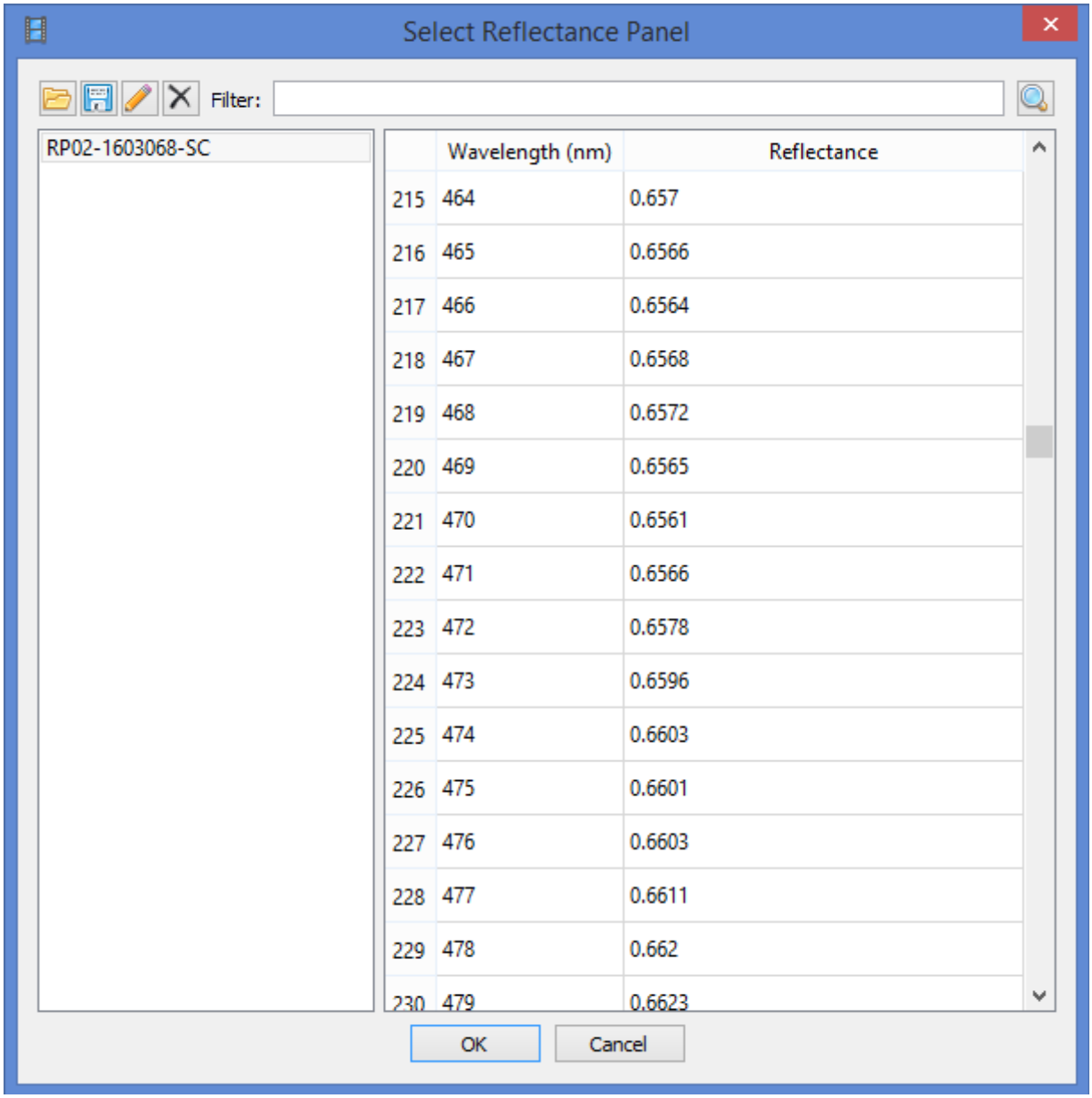
It is necessary to apply masks for each calibration image and for each band! To switch between bands use “Set Primary Channel” in the context menu after right-clicking on the chunk's label in the Workspace pane.

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.

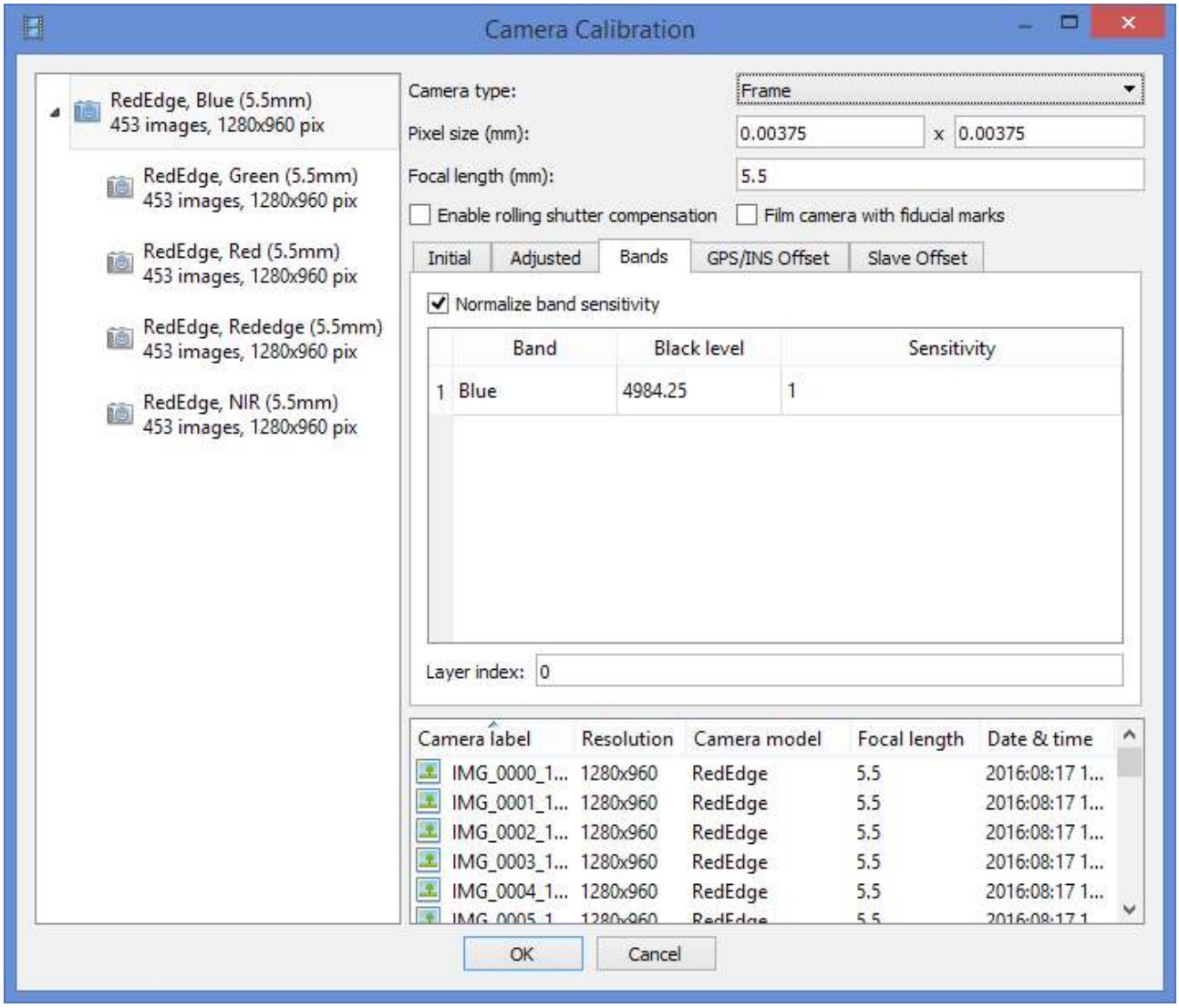
PhotoScan stores the information about the used reflectance panels. Thus, when calibration images of the same panel are detected, PhotoScan will automatically suggest the reflectance values from internal database.
The database of the reflectance panels may be edited via “Select Reflectance Panel” dialog 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.



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:



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.