# Z series Camera Calibration

Calibration Field

Place 30 5cm flat reflector targets 1 foot apart on three columns. Place 10 targets on each column vertically. The columns should be approximately 10 feet apart from each other in depth.


Each target needs to be angled properly. For each of the three columns the two top and bottom targets need to be angled 19.3 degrees. The top two will need to be facing down and the bottom two will need to be facing upwards.
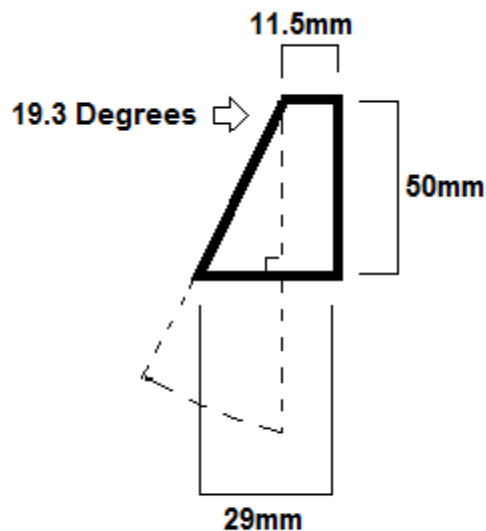
For each of the three columns every third target down from the top will need to be set at a specific angle facing downwards. Also every third target up from the bottom will need to be set at the same angle but facing upwards. These targets will need to be angled at 7.5 Degrees.
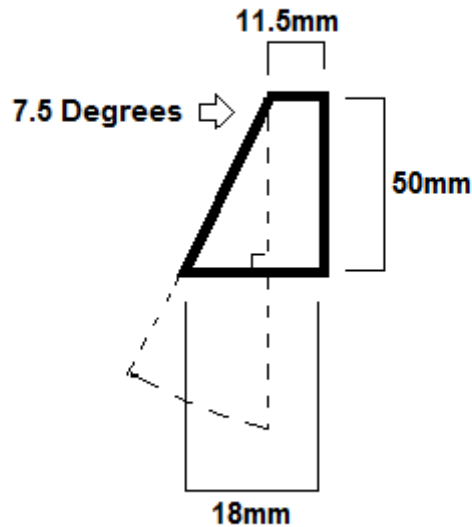
Every other target will need to be vertically placed on the column.

System Placement

Place the system at roughly 30 feet away from the center column and place the center axis of the instrument roughly 5 feet above the ground for calibrating a 20mm lens. Be sure all 30 flat reflector targets can be seen within the view finder of the camera and that they are equally distributed. The scanner may have to be tilted to achieve this. Use a sturdy tripod and a power source that will be efficient enough for one hour. We recommend using the AC power for the scanner and camera.
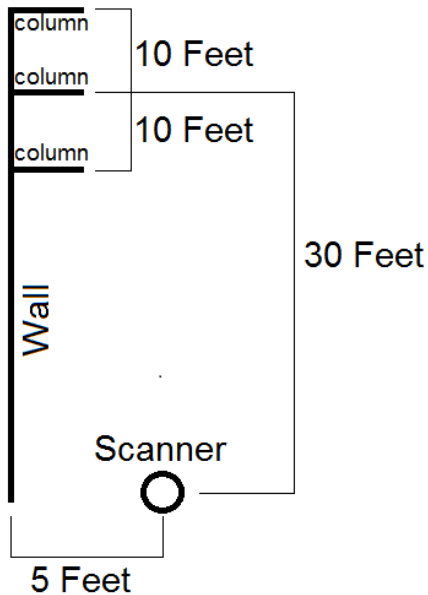
RiScanPro Setup

Step1) Create a new project in RiScanPro and name the project accordingly to the scanner's model, serial number, camera type, serial number, and lens type.
Example: Z420_s999000_nikonD700_1234567_20mm_A

Step 2) An original camera calibration file for the Z420i will be needed here. Right click CALIBRATIONS and select "Import Camera Calibration Wizard". A window will appear asking for the source of the calibration import. Import the original camera calibration file which originally came with the scanner.

Once done a camera calibration should show up under the file name CAMERA and a mounting calibration should show up under the file name MOUNTING. Rename both files to indicate that they are initial camera calibration files and not the finals.

Step 3) In RiScanPrO; right click on the "CAMERA" folder and select option "Calibrate camera (reflector column – RECOMMENDED)".
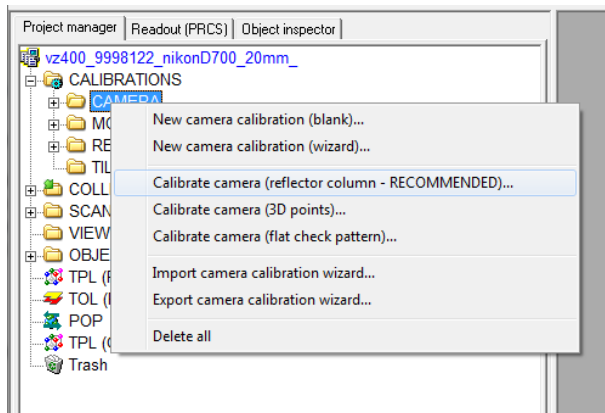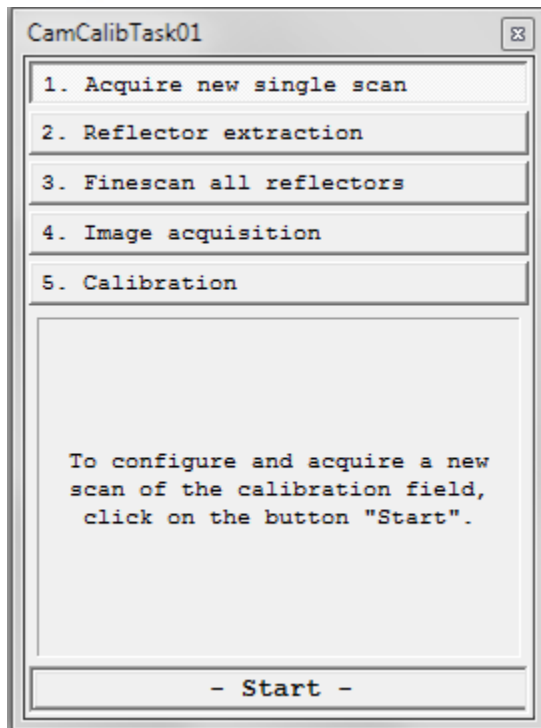
In the new pop-up window, under 'INITIAL CAMERA CALIBRATION" click on the drop down arrow and select the "calibration release" file and do the same for the "INITIAL CAMERA MOUNTING".

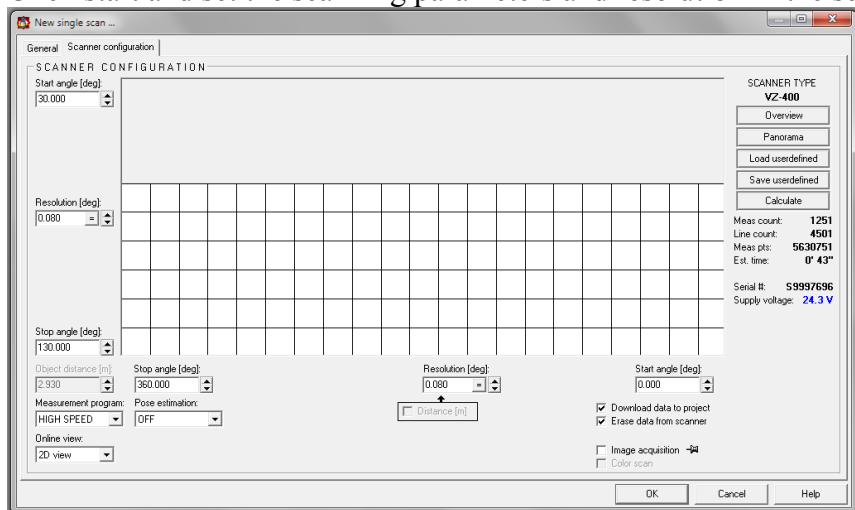After selecting the proper camera and mounting files click the "CREAT NEW" then click OK.
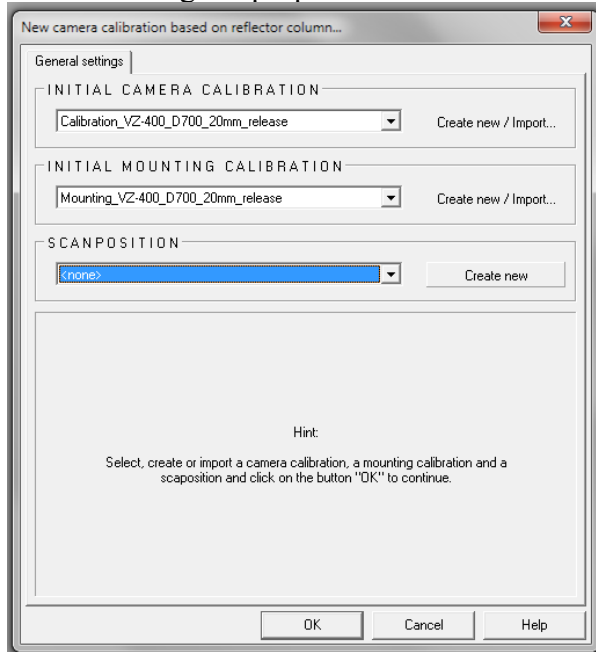
A new camera calibration wizard window should pop-up after clicking OK.

Camera Calibration Wizard

Step 1) Acquire new single scan.
Click start and set the scanning parameters and resolution in the scanner configuration window.

Only scan a window 10 degree to the left and right of the target field.

Leave the vertical at start angel 30 degrees and stop angle 130 degrees.
Set the resolution 0.080 degree then click OK.

Step 2) Reflector extraction
Click on option 2 (reflector extraction) from the wizard and click start then click OK on the following popup window.
This will automatically place a tiepoint on each reflector. Please note that the auto extraction algorithm will place a tipoint on most objects that are reflective so DELETE or ADD tiepoints as needed in the 2D view of the point cloud.
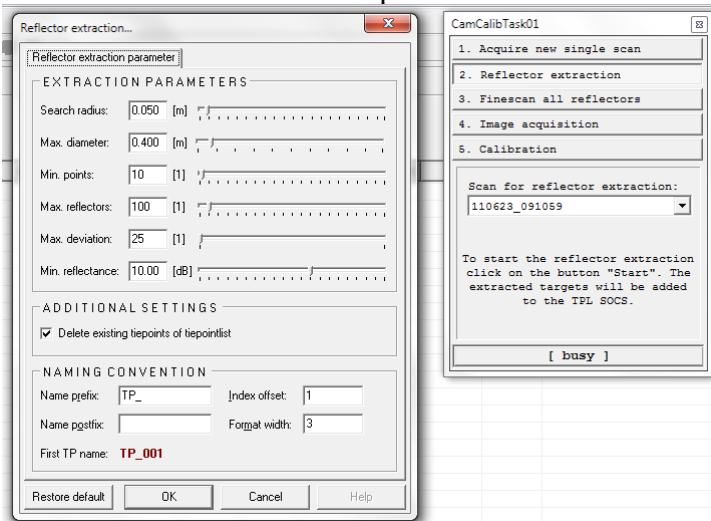

Step 3) Finescan all reflectors
Click start on step 3 from the camera calibration wizard and RiScanPro will move the tiepoint to the center of each target.

Step 4) Image Acquisition
From the camera, turn on the flash then set the aperture and shutter speed to its highest settings. Reason for such settings is to enhance the targets so that RiScanPro can better locate all reflective targets in the images. After all camera settings are set, click START on the camera calibration wizard. The camera will take approximately 11 photos at different angels. There will be one or two images that will not contain any targets and some photos will contain more targets than other. After the image acquisitions are done, open an image and turn on the TPL socs and TPL image (Ctrl 1 and Ctrl 2).

Step 5) Calibration
Click start on the camera calibration wizard then select "USE ALL" in the popup window and click START. The new camera calibration is now being processed.
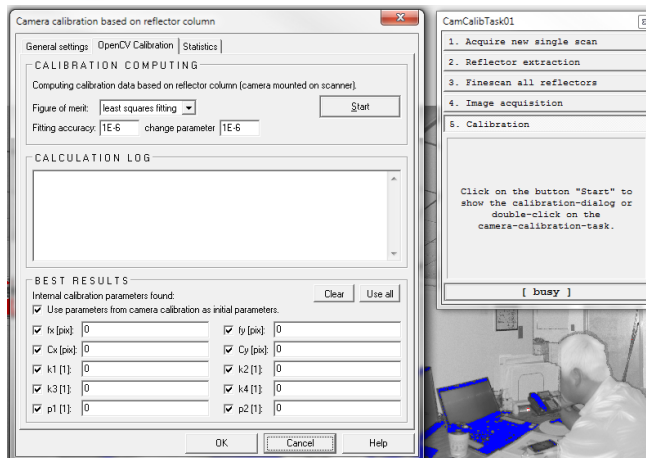
Once the processed is finished, click on the "STACTICES" fold to view the final results.
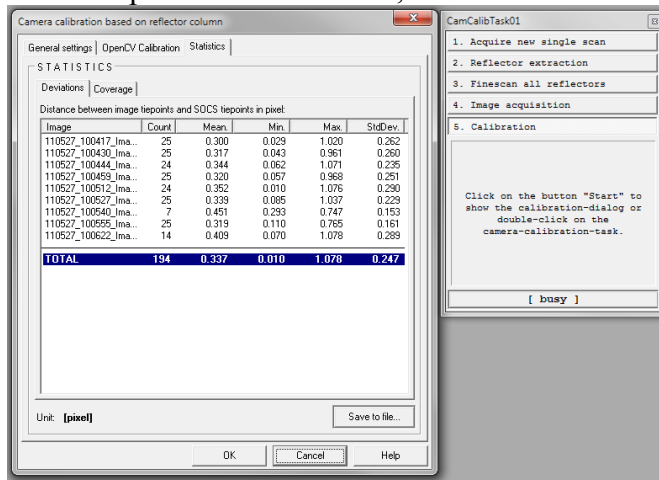
Acceptable values for lens variance 20mm:
Distance mean < 1.5 pixel
Distance mx   < 2.5 pixels

Acceptable values for lens variance 85mm:
Distance mean < 2.5 pixel
Distance mx   < 4 pixels

Acceptable values for lens variance 180mm:
Distance mean < 3 pixel
Distance mx   < 4 pixels

If the mean and max values are within the specified pixels then click OK.
To exit and save the new calibration files, click yes on the following promote.
If the mean and max does not meet the specified pixels, then click no and make adjustments in the images and reprocess step 5.

Once all steps are complete the new calibration file will be found here;
Calibrations/Camera/CamCalbTask01
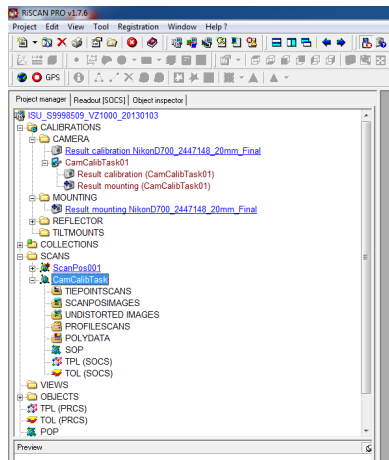
The files will be called Result calibration (CamCalbTask01) and Result mounting (CamCalbTask01). Rename these files accordingly for example: "Result calibration_ Z420_s999000_nikonD700_1234567_20mm_Final" and "Result mounting_ Z420_s999000_nikonD700_1234567_20mm_Final"

Right click on Camera and select "Export Camera Calibration Wizard"
A window will open asking to select a camera calibration and a mounting calibration. Select the two that have just been created and click next.
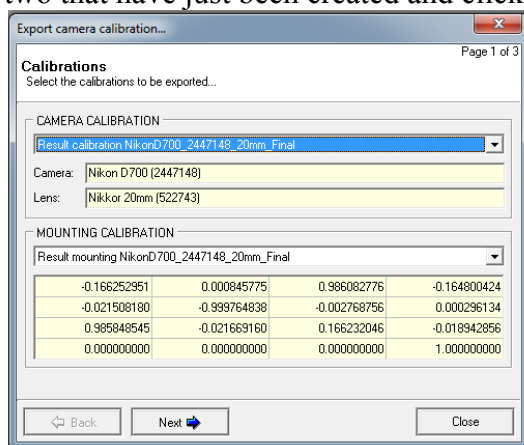
The next window will ask to store the calibration file to either the instrument or storage device. Since the Z series scanner doesn't have this feature the storage option will have to be used. The Calibration file can be stored on any media device for later use.
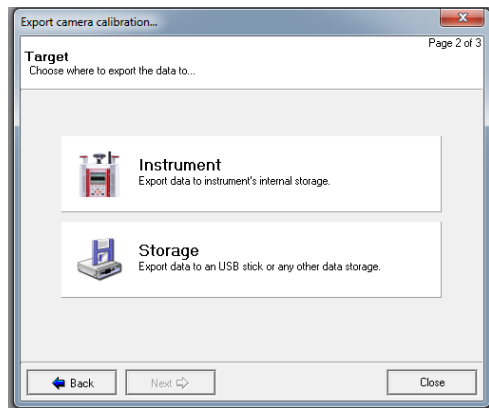
We recommend placing the Camera Calibration file on a CD for later use. The files will need to be burned to a CD to allow use of the calibration file on any computer or project.

How to import and use the calibration file

If the calibration file is on a CD place the CD in a computer's CD Drive. When in RiScan Pro create a new project or within the project that is open, right click on camera in the calibrations folder. Click on "Import Camera Calibration".

A window will appear. Select "file" and locate the CD drive. Double click on camera calibration file and the next window will be the "Import Camera Calibration Successful".

From here camera calibration can be applied to recently done scans and also create new ones.

And always be sure to perform a camera readjustment anytime the camera is placed back onto the scanner after being packed away.