

Camera Calibration Design Parameters

Camera Data

Camera: Canon EOS 300D / Digital Rebel

Camera body: 123

Camera lens: 456

Owner:EnsoMOSAIC-generic

Focal length: 24.0000 mm

Effective focal length: 38.0875 mm

Frame size: 3072x2048 pixels

Instructions for Camera Calibration

Setting up the camera calibration target

The idea is to set up a calibration target that is planar and completely still at least during the time the images are captured. It needs to be planar in order to improve the calibration results. If the same target is to be used more than once it is worthwhile to fix it in a way that it cannot move or glide downwards so that it starts to deviate from a planar surface. Place the middle of the target at approximately eye-height or a bit lower.

In order to make the setup easier it is best to print out the camera calibration target on as big sheets as possible in order to have as few sheets as possible. Use matte paper or other matte canvas material. If possible print the calibration field on one sheet only and use some non-stretching and durable canvas that can be firmly suspended against a wall or in the air by its four corners. If normal paper is used then the sheets should be fastened to a one-coloured, smooth and texture free planar wall in a way that all the black dots remain in the same plane. This can, e.g., be done by putting double sided adhesive tape on the backside of the paper behind every big black dot and behind every fourth of the small ones. If the target is attached to the wall only in the corners or in a few places there is likely that the target will not be quite planar or it will not remain planar for a long time.

Please do NOT use, e.g. black or glossy pins that are visible from the front and can be confused with the 1-8 very small dots which are circled around the eight orientation dots in the corners of the inner and outer dot fields.

Capturing the images

In order to increase the quality of the images make sure that the calibration target gets enough and evenly distributed light. Two or more 300W halogen lamps normally give enough light. In too dark conditions the ISO-value might become high introducing noise into the images. If the shutter speed is too low and no tripod is used the camera might shake when pushing the trigger. Watch out for non-wanted shadows when moving between the light sources and the wall.

Focus the camera to infinity and make sure it remains constant for all images.

If the lighting conditions are OK and the camera is not shaken during the image capturing it is normally enough to capture the ten images as described on the following pages. The distances from the wall as described on the next pages are only approximate. When capturing the first five images the small dots (inner dot field) are of interest and for the other five the large dots (outer dot field). In order to get similar images to the templates shown on the following pages the important thing is that:

- On the two images that are captured from straight in front of the test field (stations 1 and 6) the orientation dots (including the very small label dots) should be completely visible just in the four corners of the image.
- On the other images captured from approximately the edge of the inner and outer dot field respectively the orientation dots (including the label dots) should be completely visible in the two corners of the upper or lower side of the image, depending on the station. The two orientation dots of interest should be aligned horizontally in the image. Move the camera position and rotate the camera so that the orientation dots get into the corners of the image but still inside the image. Normally the camera can always be at a constant altitude from the floor but in some cases it might help to raise or lower the camera a bit when trying to position the orientation dots into the corners of the image.

Measuring the distances between the labelled dots

The camera calibration needs both the images of the calibration target and some information of the target and actual field dimensions. For the latter then distances between the labelled dots 1-2, 1-3, 1-4, 2-3, 2-4, 3-4, and 5-6, 5-7, 5-8, 6-7, 6-8, 7-8 should be measured according to the figure below.

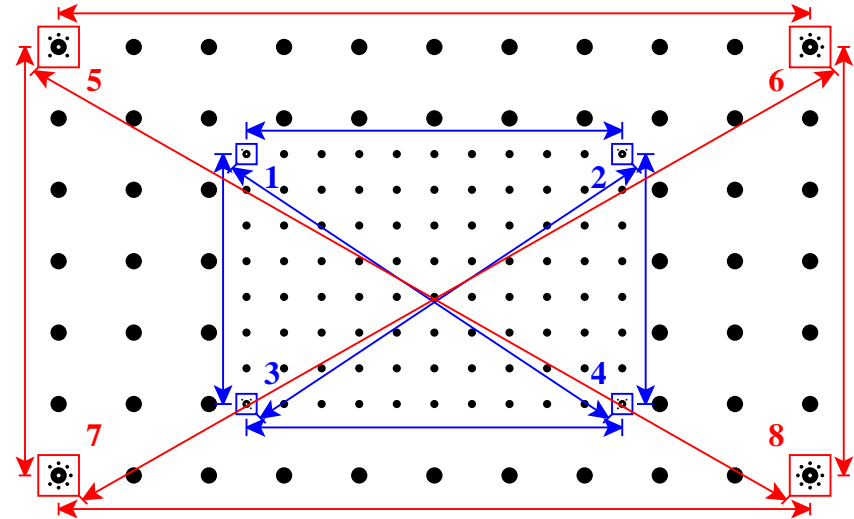
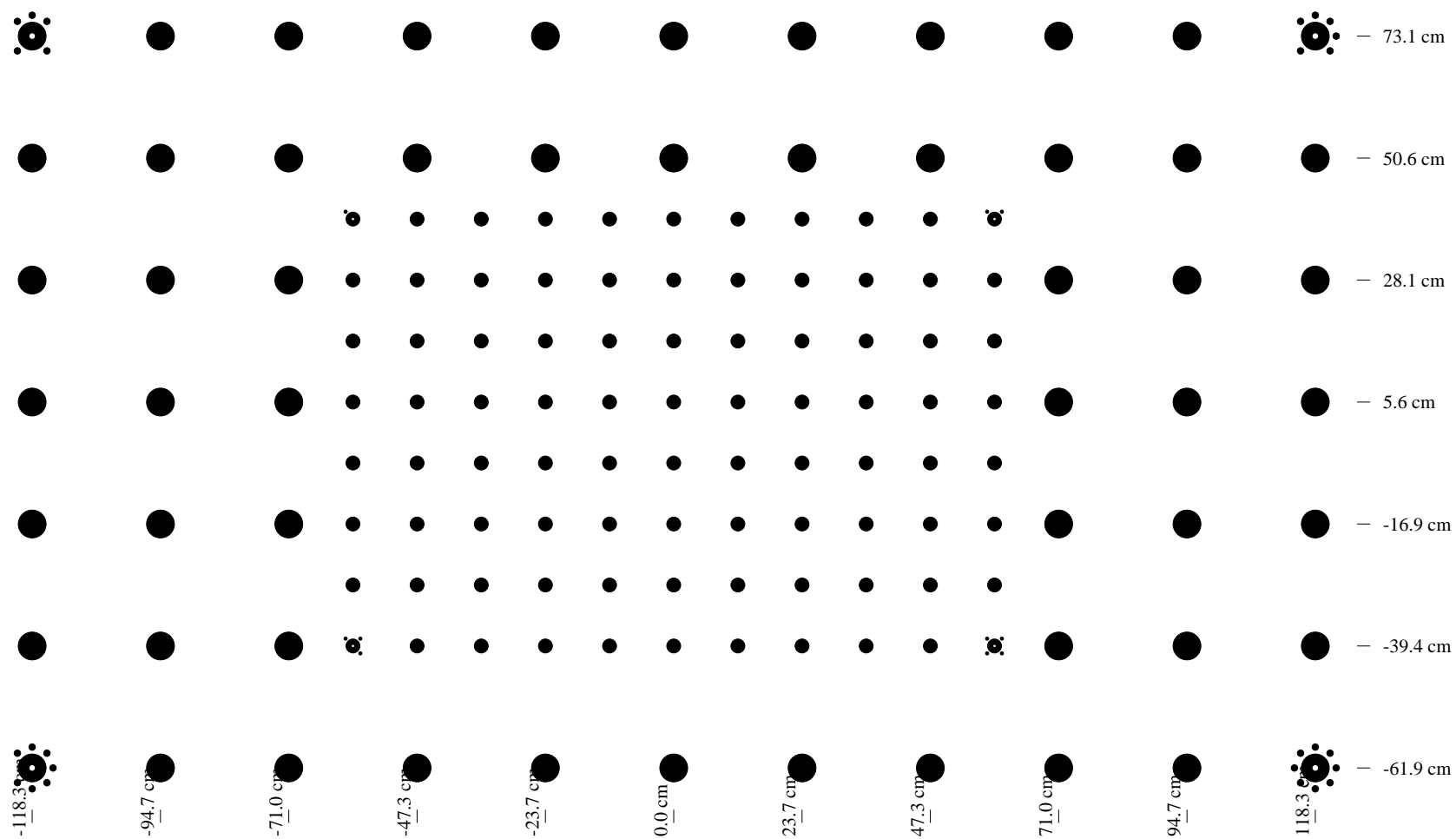


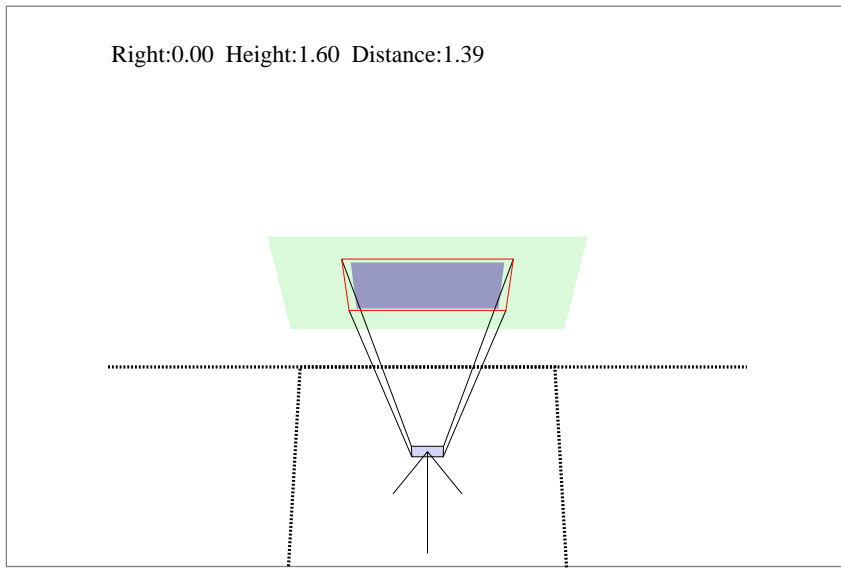
Figure. Distances to be measured from the established test-field. Distances of the inner field are in blue, and distances of the outer field are in red. Altogether 12 distances should be delivered. It is advised to make real measurements of all 12 distances (it may happen that the easiness of just copying the data of the symmetrical distance or copying the theoretical distance is favoured!). This way the measurement noise will better correspond to the true measurement noise of the distance measurement method used. If you do this, an ordinary measurement tape is precise enough for the most reliable calibration.

Testfield target locations

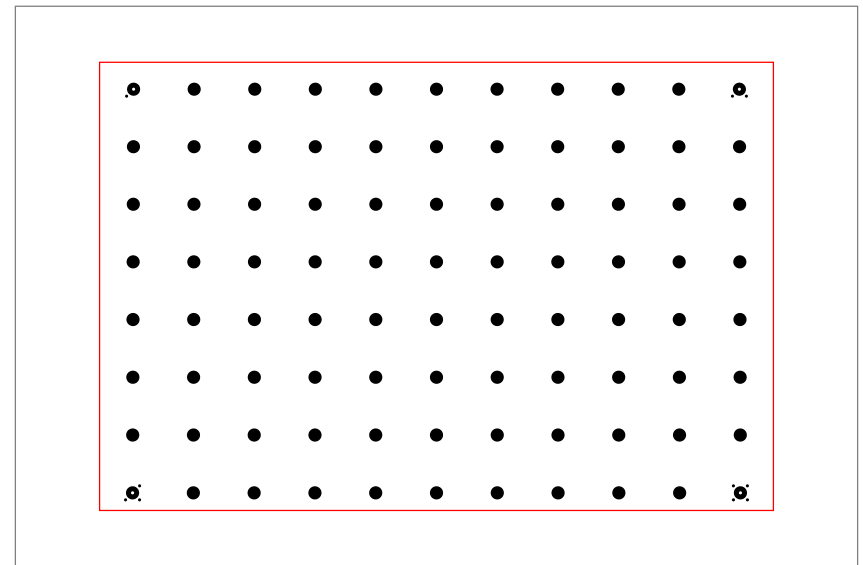


Target locations on individual images

EXPOSURE LOCATION OF STATION 1



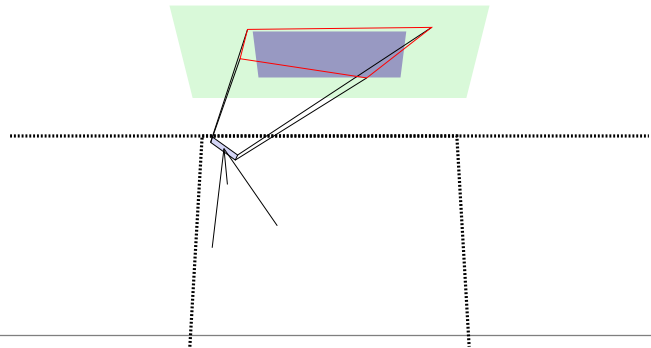
Exposure geometry



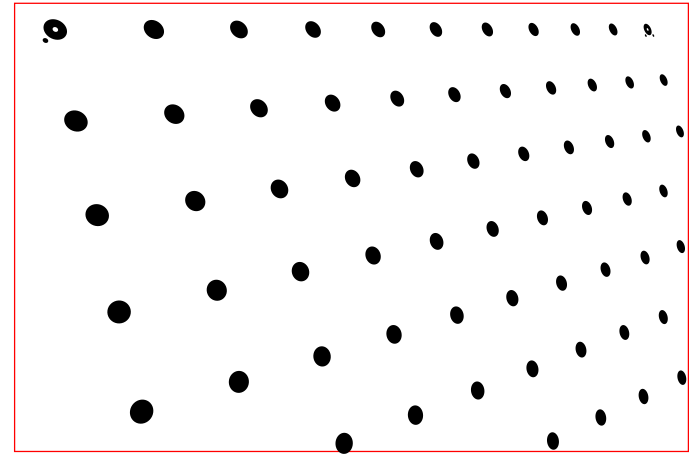
Targets seen on the focal plane

EXPOSURE LOCATION OF STATION 2

Left:0.81 Height:1.60 Distance:0.81



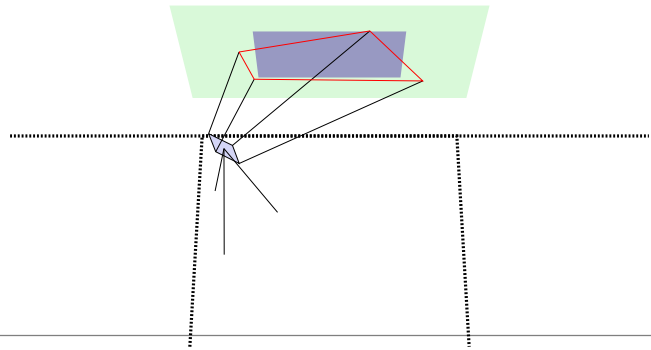
Exposure geometry



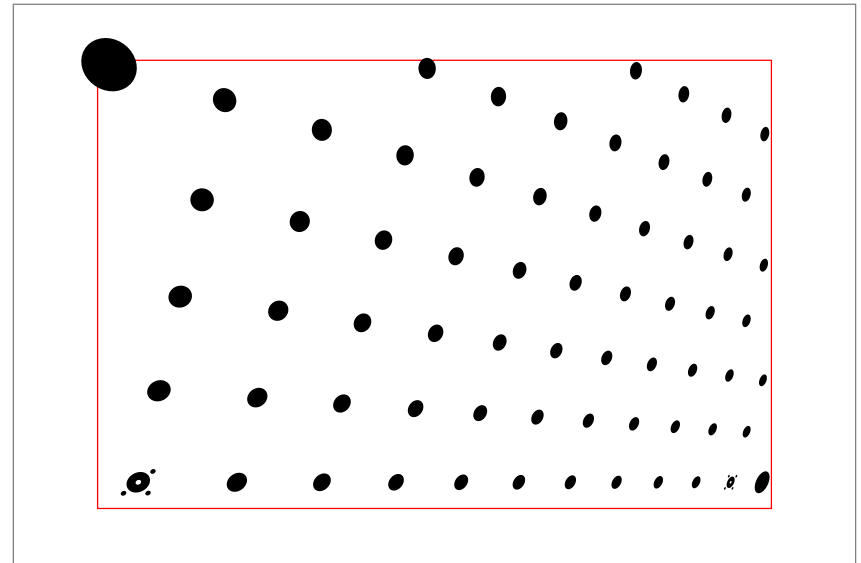
Targets seen on the focal plane

EXPOSURE LOCATION OF STATION 3

Left:0.81 Height:1.60 Distance:0.81



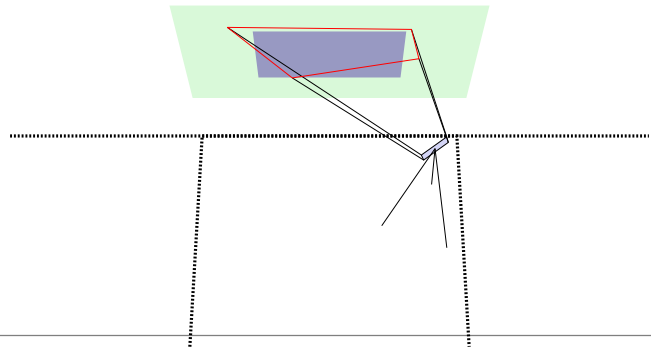
Exposure geometry



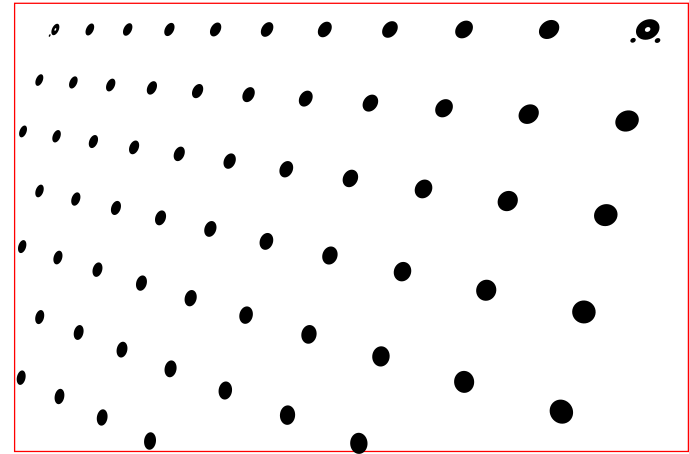
Targets seen on the focal plane

EXPOSURE LOCATION OF STATION 4

Right:0.81 Height:1.60 Distance:0.81



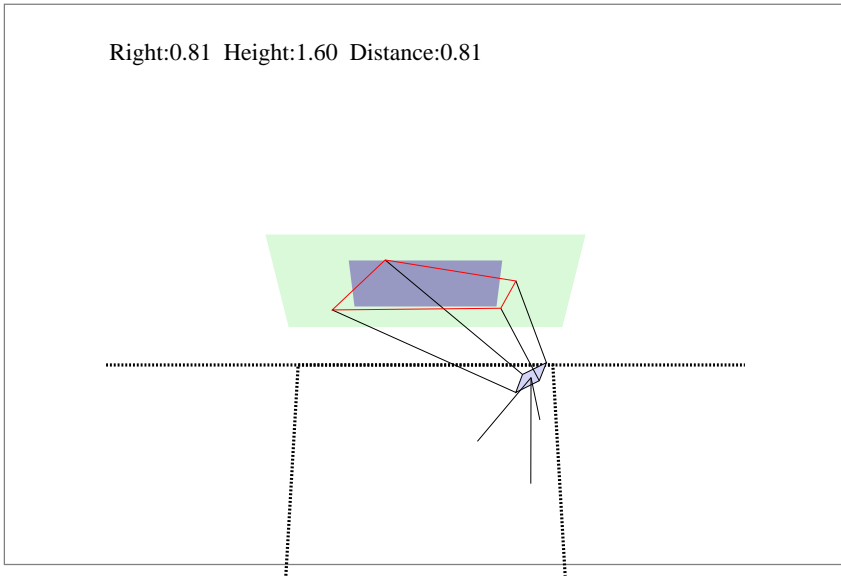
Exposure geometry



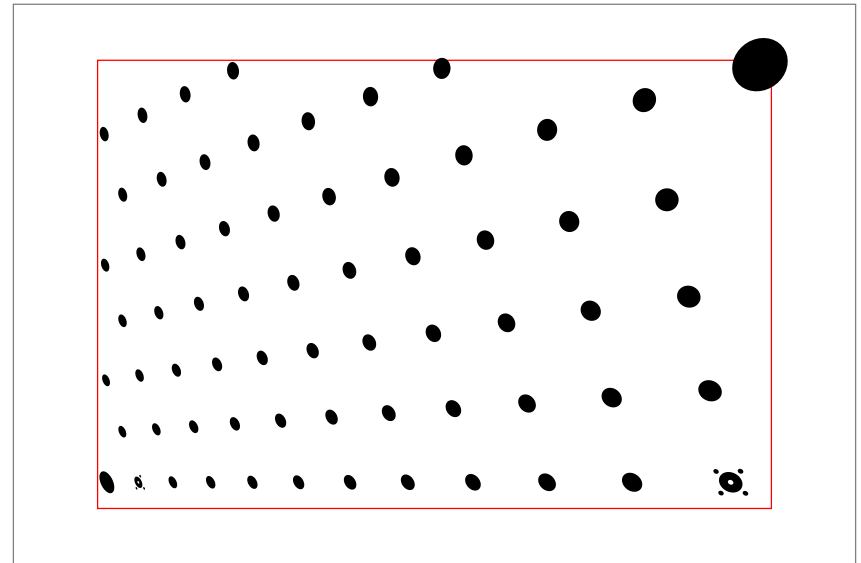
Targets seen on the focal plane

EXPOSURE LOCATION OF STATION 5

Right:0.81 Height:1.60 Distance:0.81



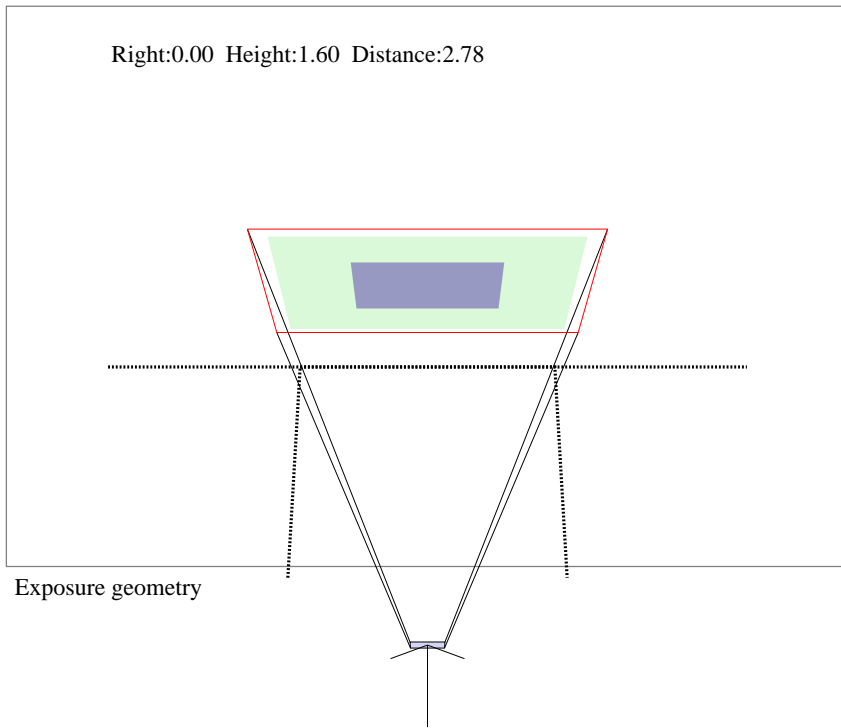
Exposure geometry



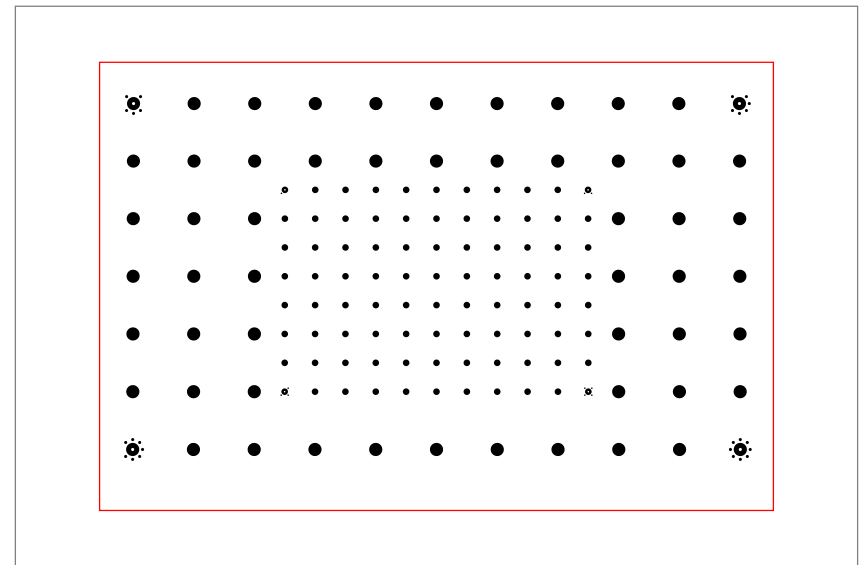
Targets seen on the focal plane

EXPOSURE LOCATION OF STATION 6

Right:0.00 Height:1.60 Distance:2.78



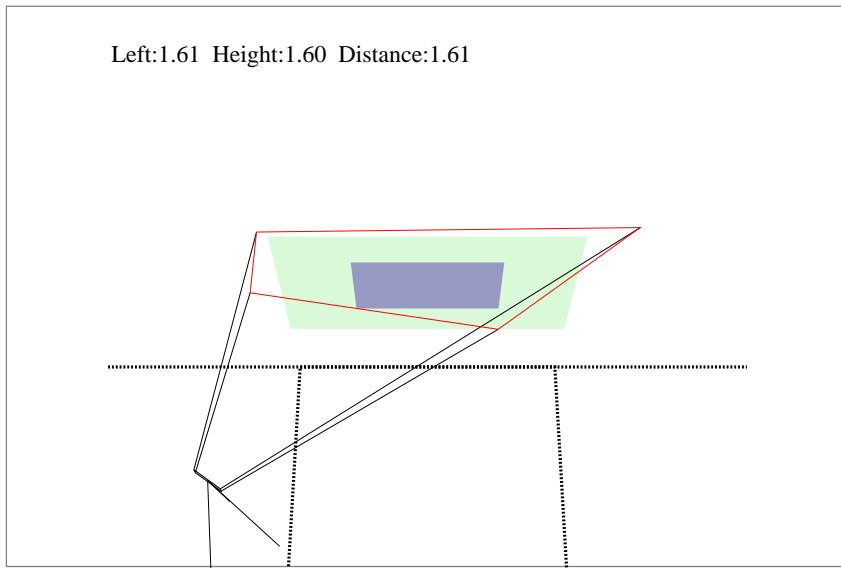
Exposure geometry



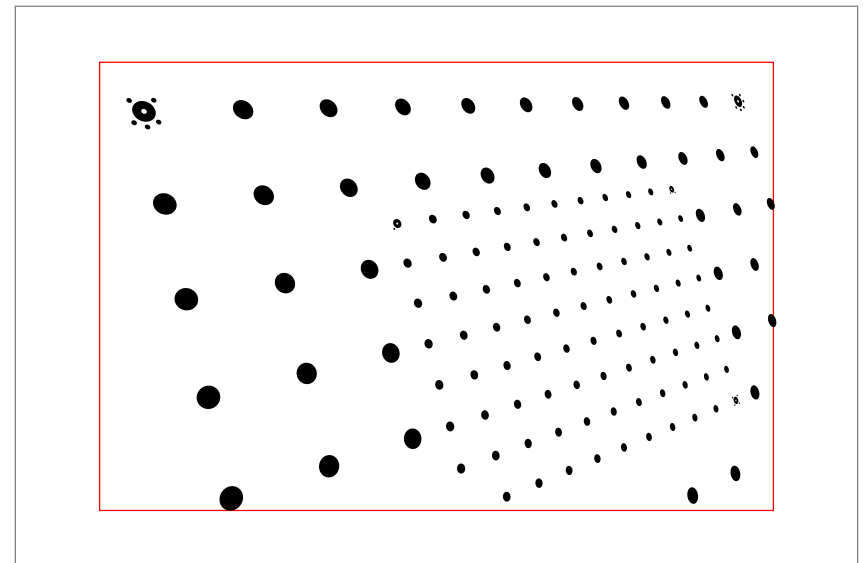
Targets seen on the focal plane

EXPOSURE LOCATION OF STATION 7

Left:1.61 Height:1.60 Distance:1.61



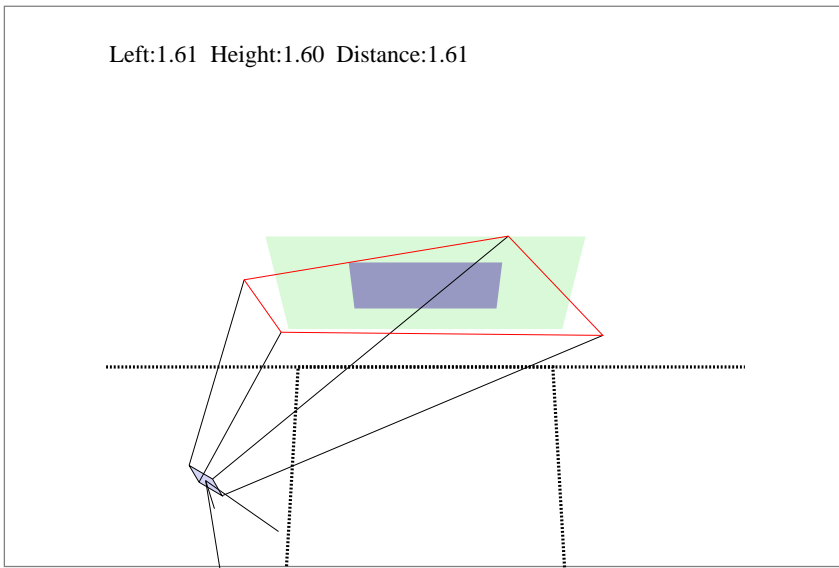
Exposure geometry



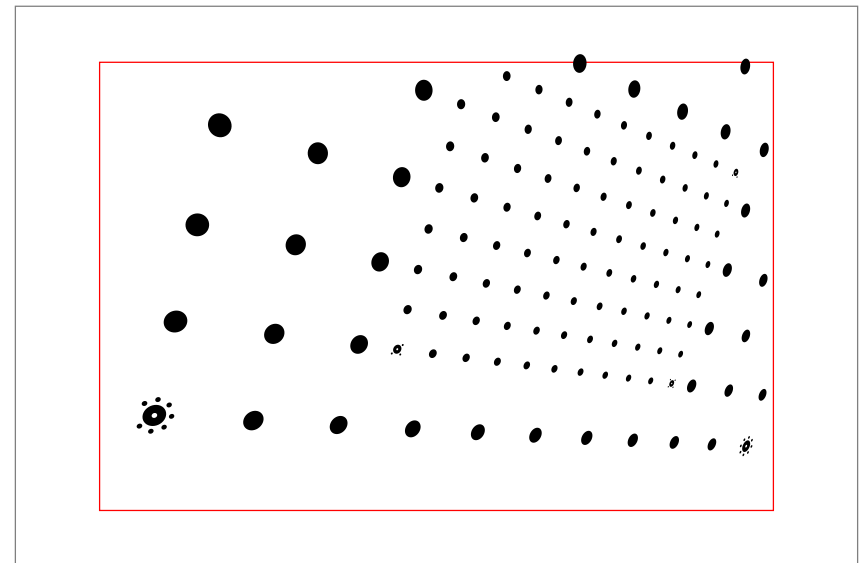
Targets seen on the focal plane

EXPOSURE LOCATION OF STATION 8

Left:1.61 Height:1.60 Distance:1.61

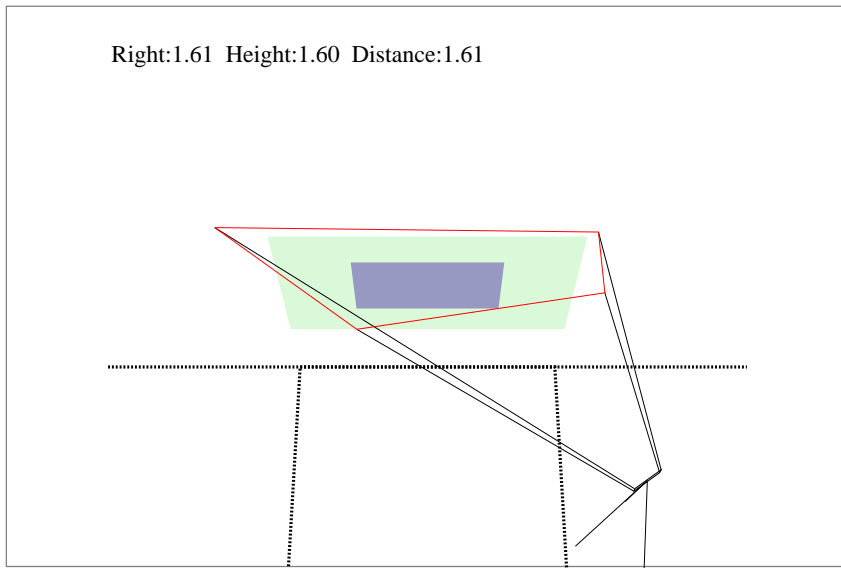


Exposure geometry

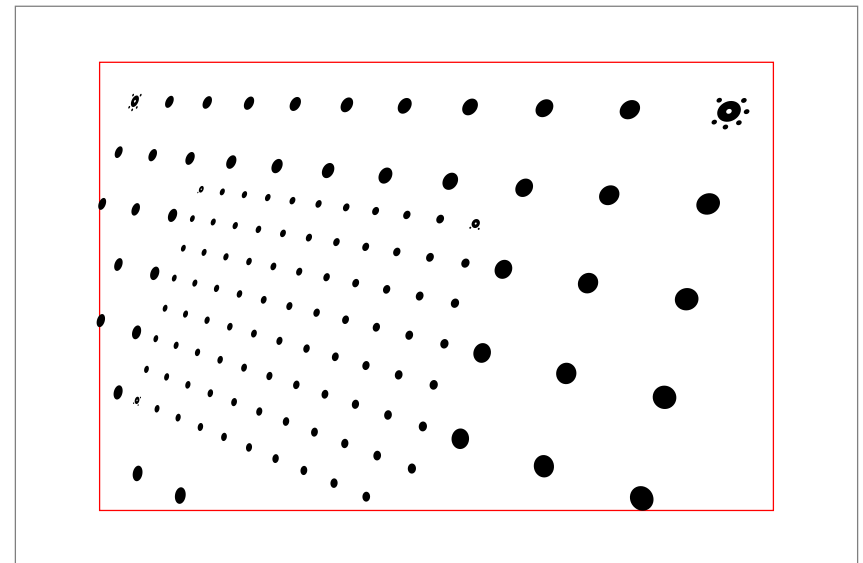


Targets seen on the focal plane

EXPOSURE LOCATION OF STATION 9



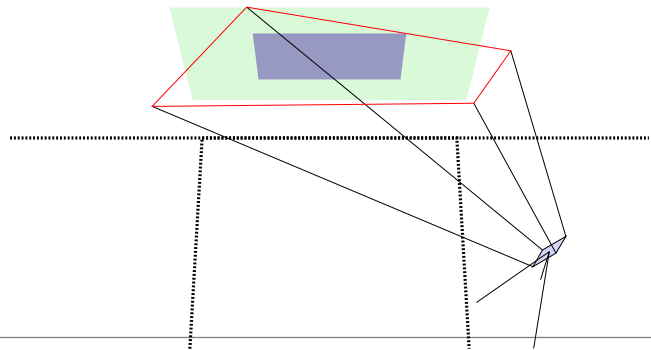
Exposure geometry



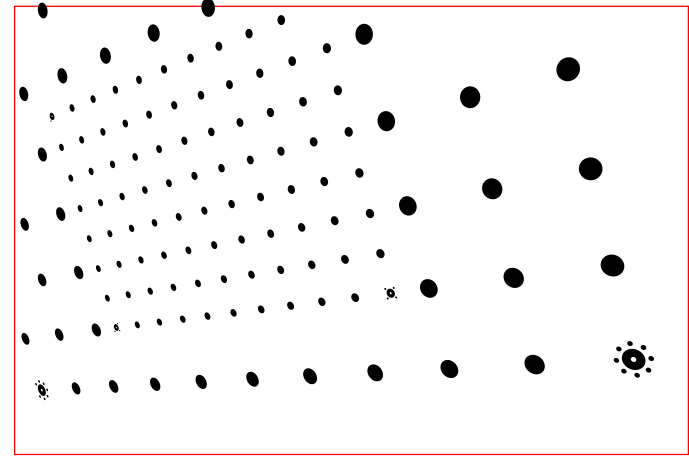
Targets seen on the focal plane

EXPOSURE LOCATION OF STATION 10

Right:1.61 Height:1.60 Distance:1.61



Exposure geometry



Targets seen on the focal plane