

How to find the focus?

The focus finding is essential before most of the Scanning-TCT measurements can be taken. In order to find the focus there should be a border between metalized and non-metalized (silicon) part on the detector surface and of course the silicon region should be sensitive. In most cases you will encounter one of the situations found in Fig. 1, pad, strip and strip detector in edge-tct configuration.

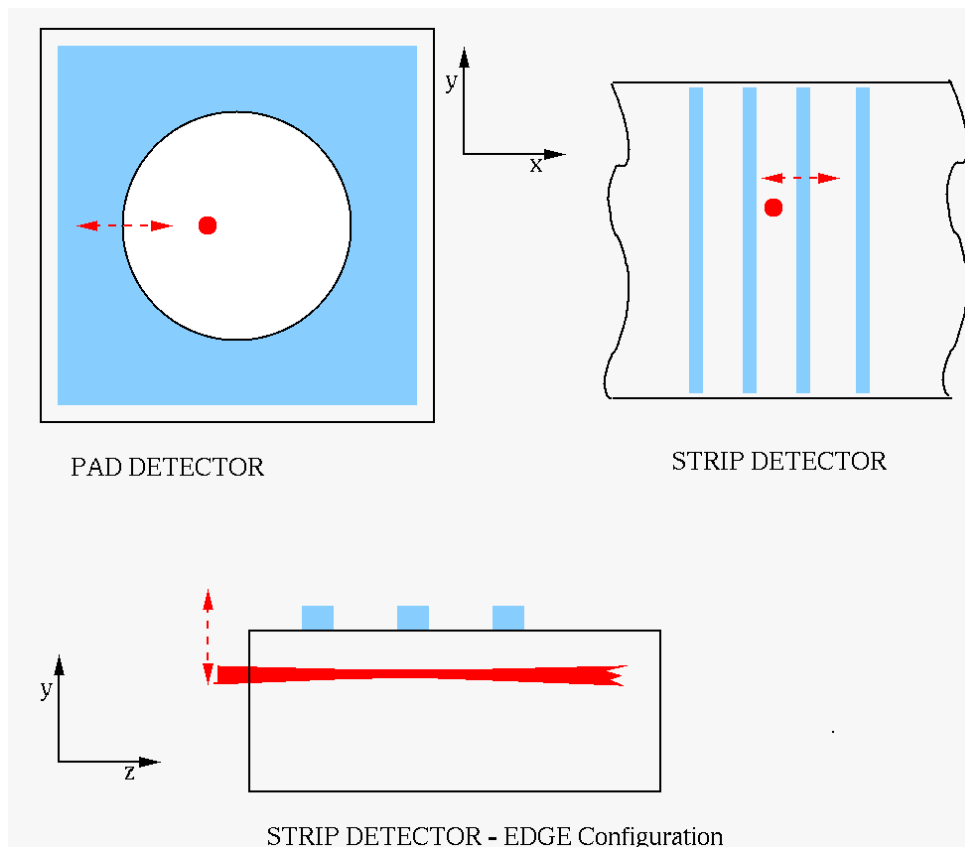


Figure 1: Typical cases of focus finding. Red dot/beam denotes the laser position, the dashed line the scanning axis with a typical range denoted by arrows.

The following steps should be done to find the focus:

1. If red laser is used switch to high frequency so that you are able to see the red spot on the sensor.
2. Set z coordinate (optical system) to approximately right distance from the sensor.
3. Select the search range in x or y to approximately cover the region denoted by dashed line in Fig. 1
4. Change x (or y) position at given z and see how the signal behaves. Change z if you don't see any dependence on x (or y)
5. Fix x (or y) to approximately position as indicated in Fig. 2. If the centre of spot hits the metal then moving in the direction of focus will reduce the signal as indicated. If the centre of the spot hits the silicon the curve will be reversed (max signal -> max. signal -> small signal). In general it is easier to observe disappearance of the signal.



- Once you approximately found the focus set the scanning range in x (or y) as indicated by the dashed line in the Fig. 1 and also in z (range of 1-2 mm in steps of 50 mm). Leave the detector biased fixed (no scanning of bias voltage).
- Make the scan and run a macro: GetFocus.C (www.particulars.si/TCTAnalyse/examples/GetFocus.C.html). As a result you will usually get two plots shown in Fig. 3. and Fig. 4. Each curve/graph shown in Fig. 3 represents a dependence of charge (induced current integral) on x/y (scanning axis) at given z (optical axis). An error function is fit to each individual graph and from the fit the FWHM is calculated for a given z. The z value with smallest FWHM is declared as the “correct focus distance”. Please have a look at GetFocus.C for details about the analysis.

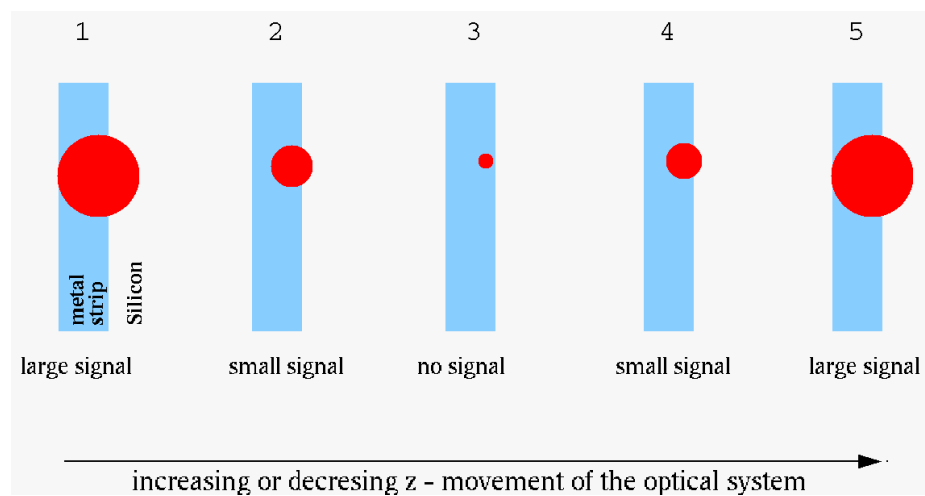


Figure 2: Focus finding procedure; movement of optical system causes changes of beam spot size (at fixed x/y position of the beam) and by that the signal.

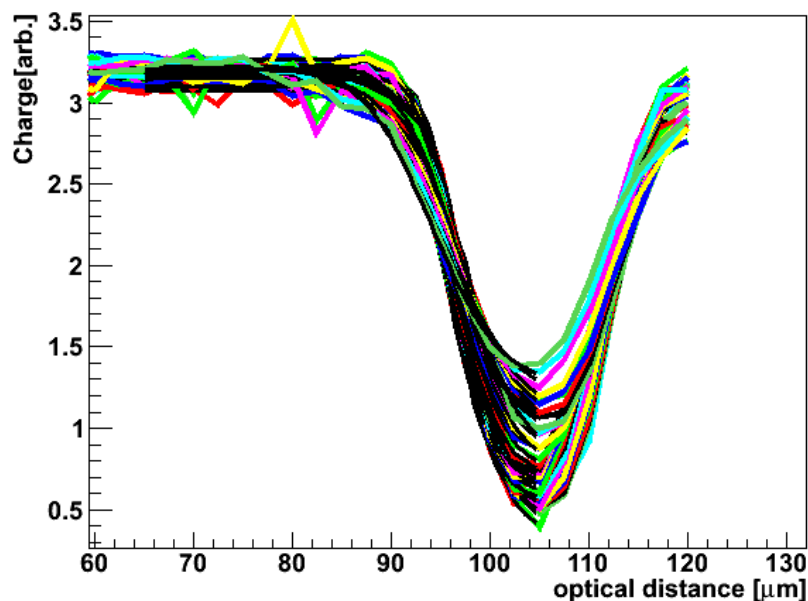


Figure 3: Dependence of collected charge on position along scanning axis (x or y) for different positions of optical system (z axis).

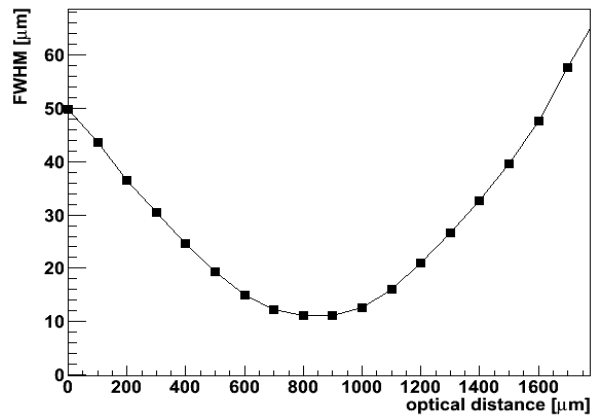
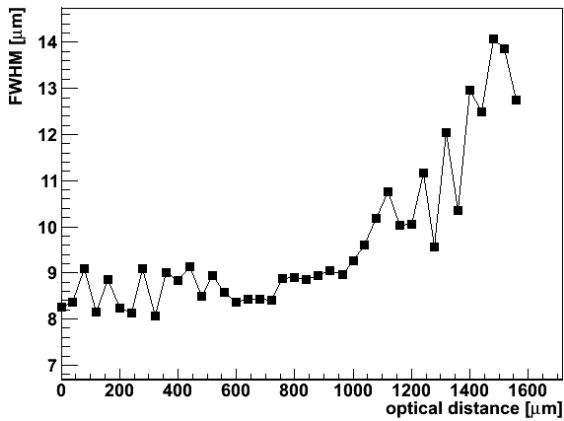


Figure 4: (left) FWHM of the red beam at different positions of the optical system (z axis) - refers to Figs. 2,3. Note that in this case the neck of the beam at this beam expander aperture (iris) is a few hundred microns. (right) An example of the FWHM of the IR beam measured on the pad detector.

Correcting the alignment

You may find that the transition between metallized and sensitive region depends on the position of the axis with mounted optical system (z-axis), which should not be case if z-axis and optical axis would be perfectly aligned (see Fig. 5). The angle between axis can be easily measured by measuring the position of the edge in x at different z (see GetFocus.C, 3rd Canvas). An example of finding the angle can be seen in Fig. 6. The slope of the curve gives $\tan(\theta) \sim \frac{1}{f}$. If large f are measured (depends on the application) and you need the correction, please unscrew slightly the screws which fix the optical system to the stage and reposition the optical system for adequate angle and fasten the screws.

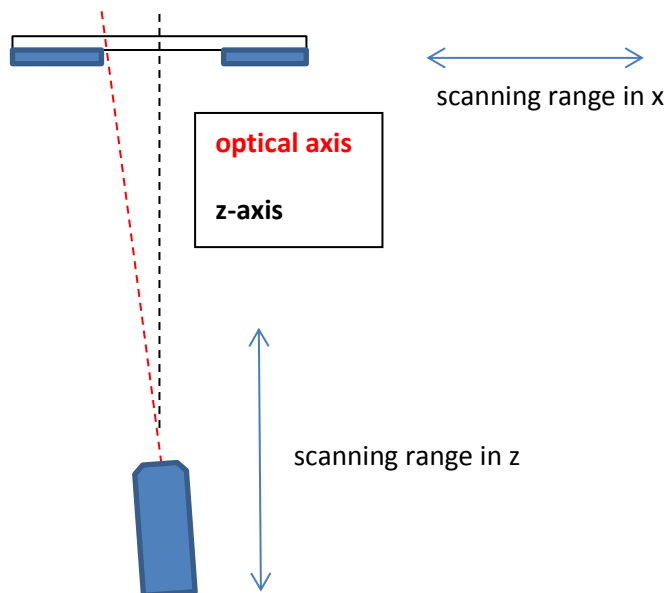


Figure 5: Misaligned optical and z-axis lead to dependence of transition point on position of the optical system (z- coordinate).

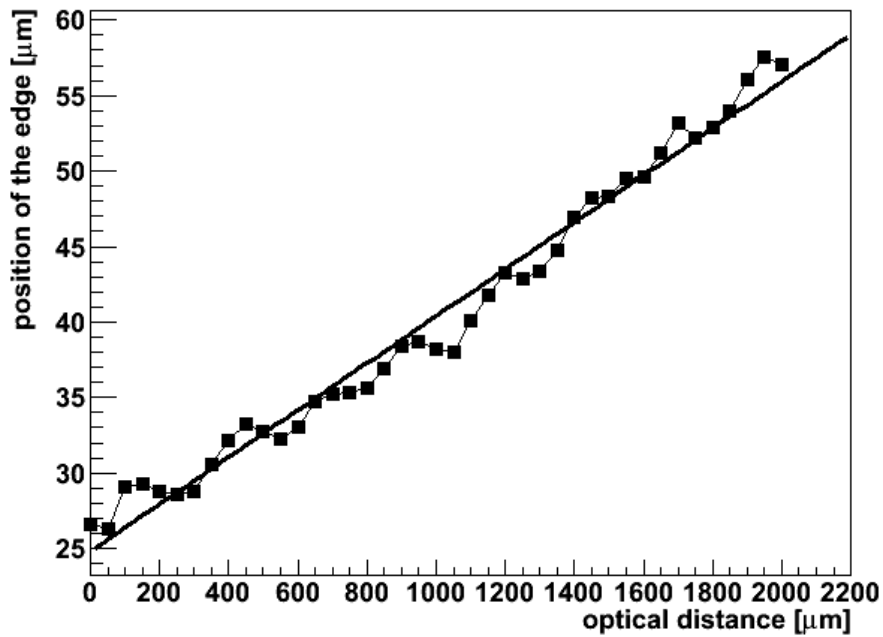


Figure 6: An example of transition point dependence (in x) on position of z axis. The linear fit is shown in the figure. Its slope is approximately equal to the angle between optical system and x axis.

Setting the iris opening

The iris opening plays a role in getting to the optimum focus and good contrast. In order to have narrowest beam the iris opening should be around 8-10 mm in diameter.