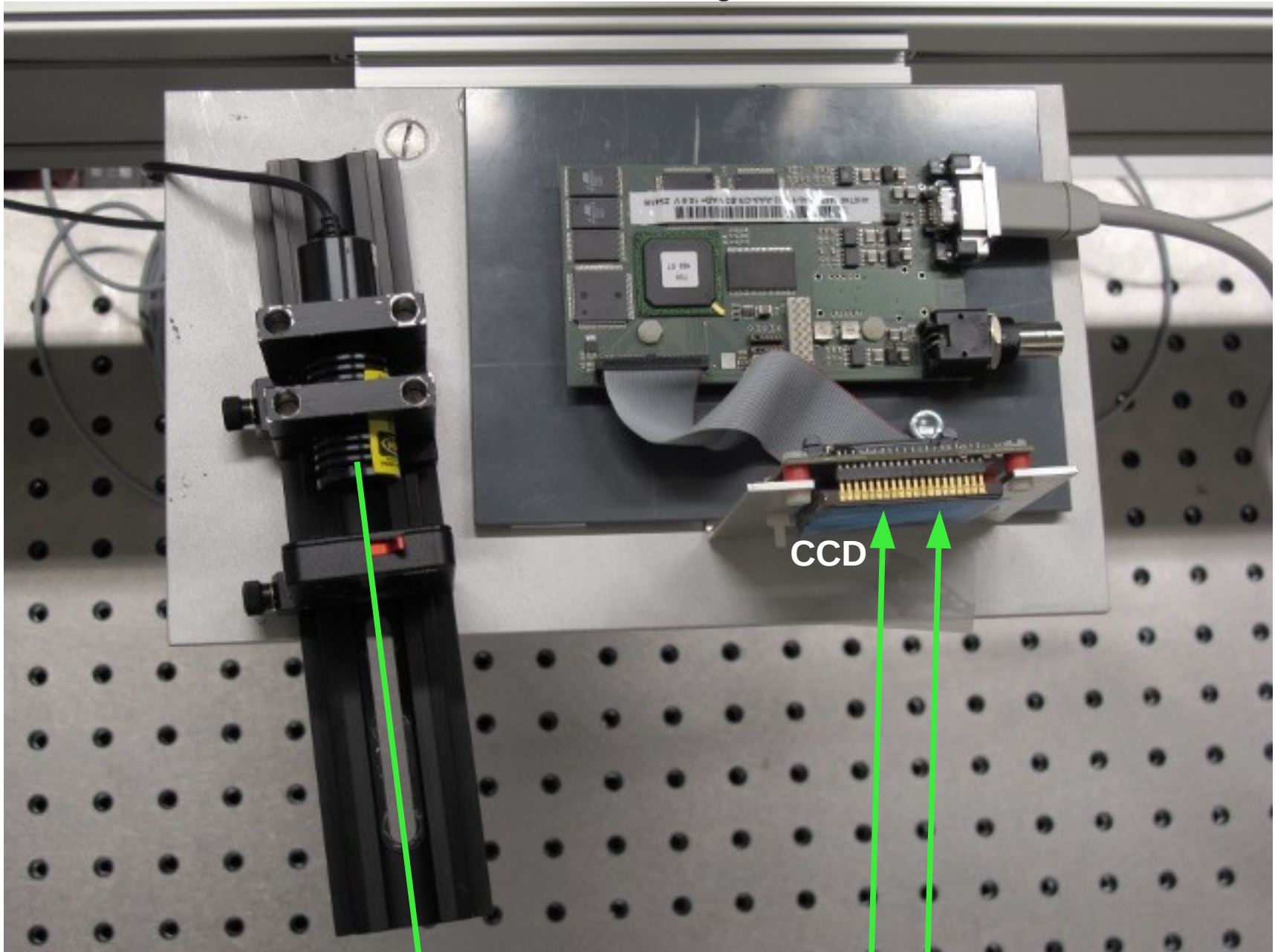


Measurement of radiator thickness profiles  
and  
FLG overview measurements

Klaus Föhl for AG Düren  
Gießen University

PANDA-PID-meeting 11-March-2014  
at GSI

X-Y-linear stage

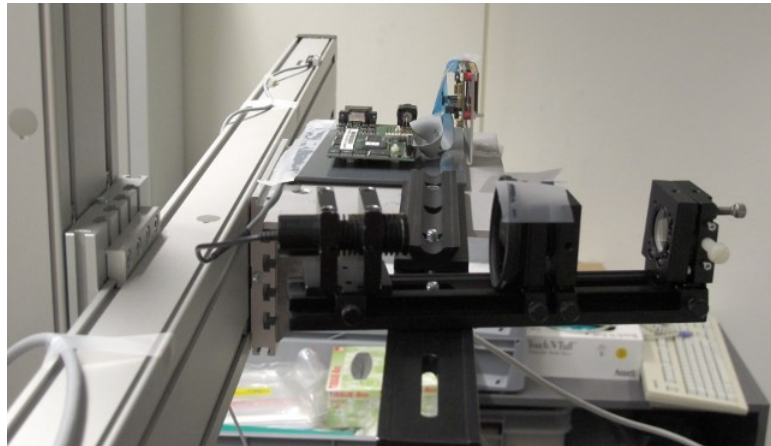
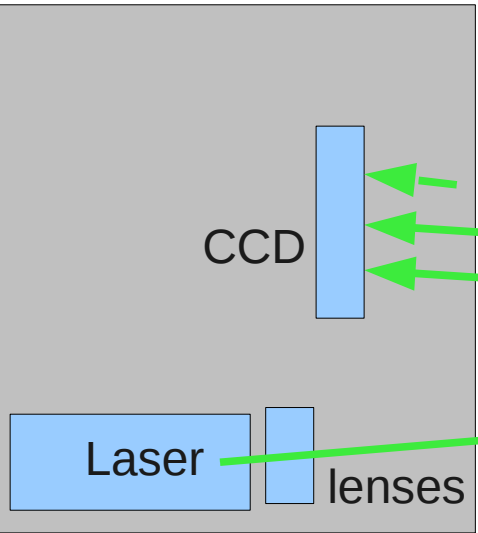
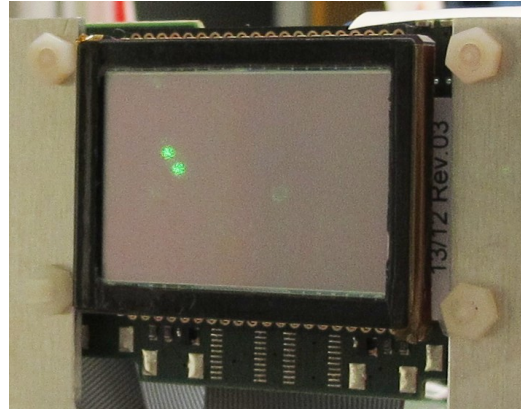


laser beam

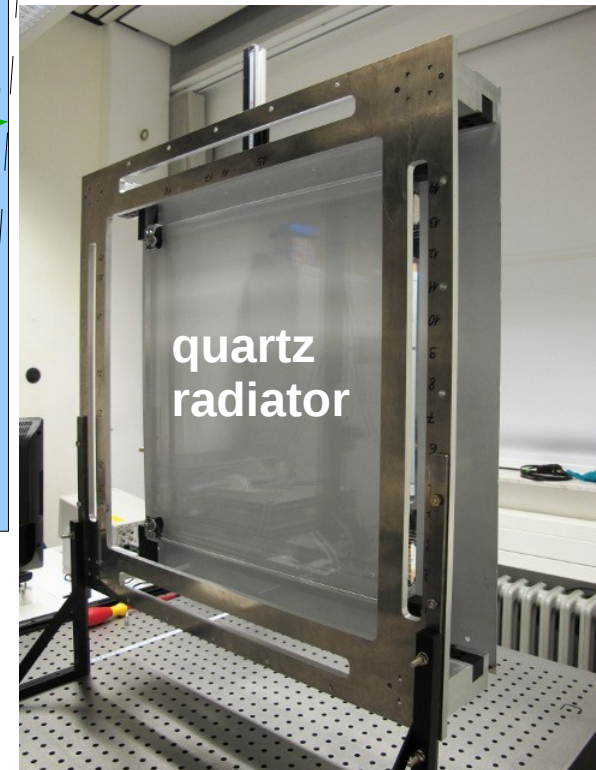
CCD

reflections

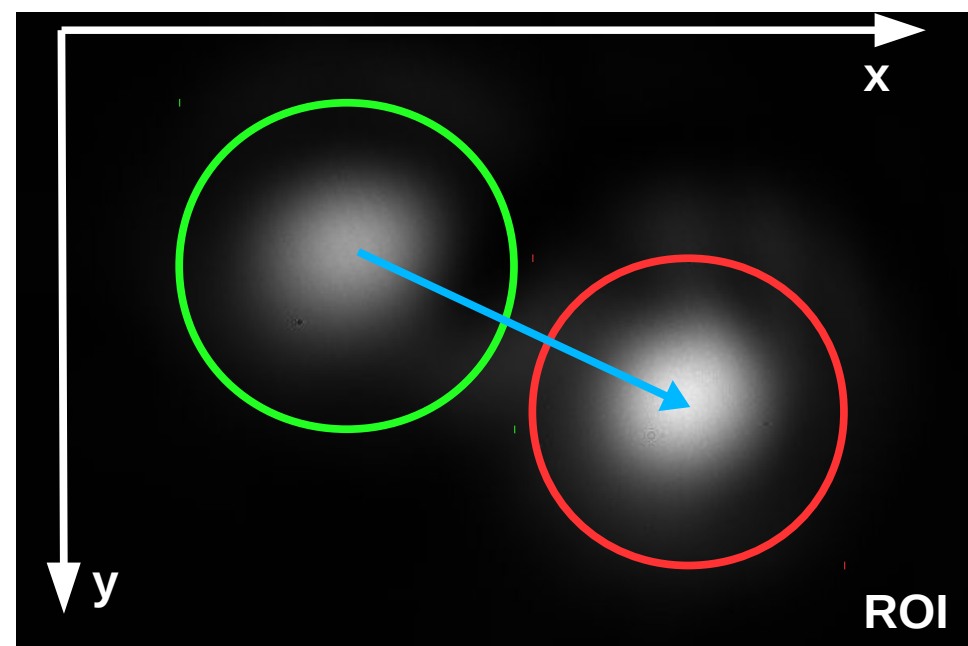
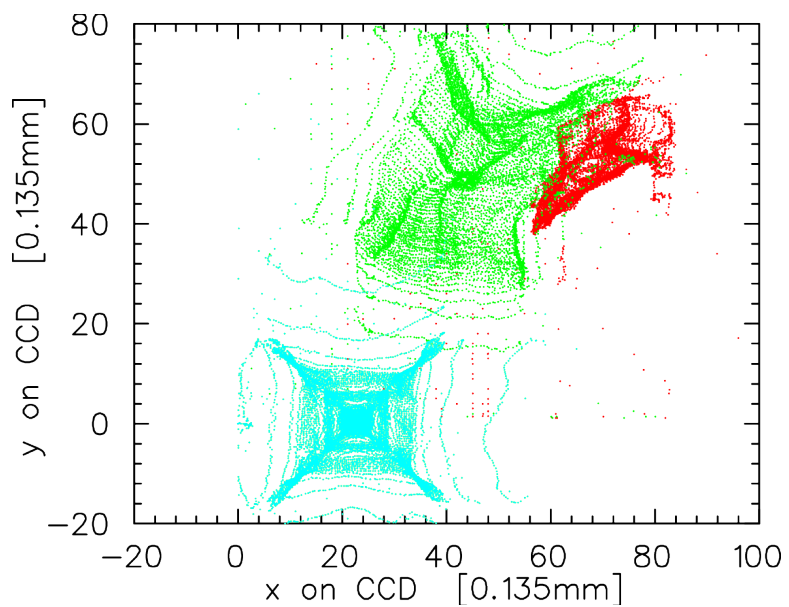
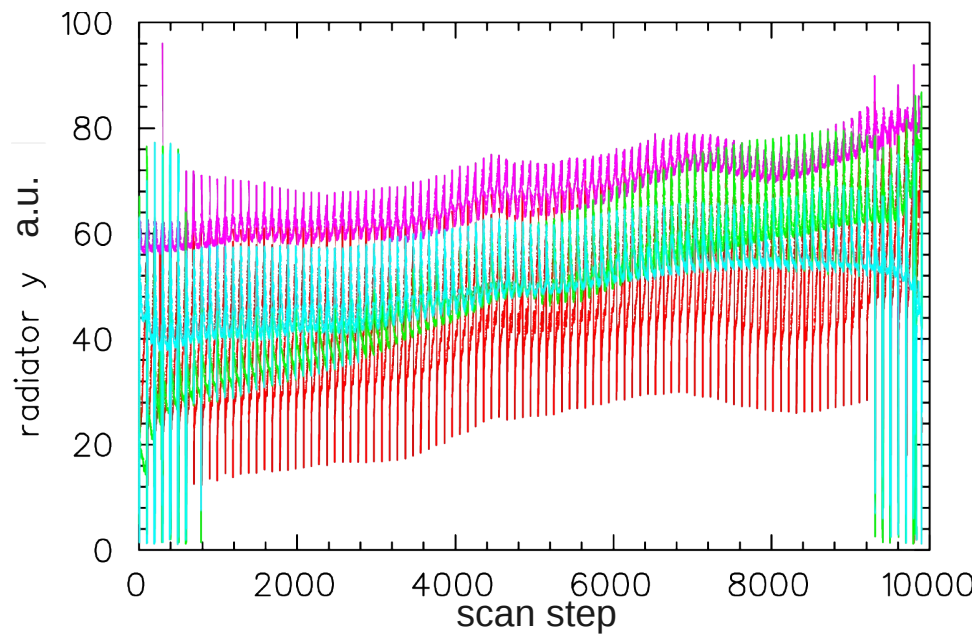
# Measurement principle



measurement stage on movable platform



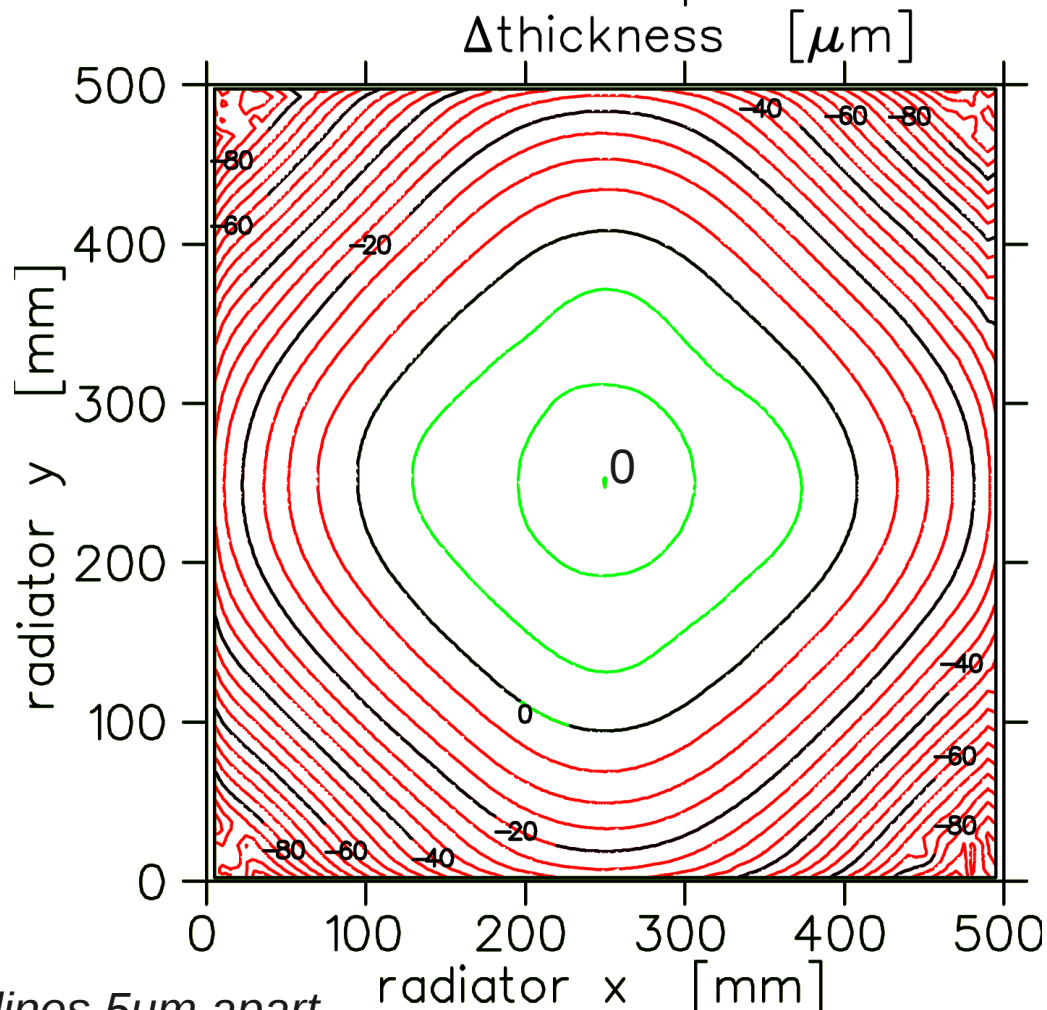
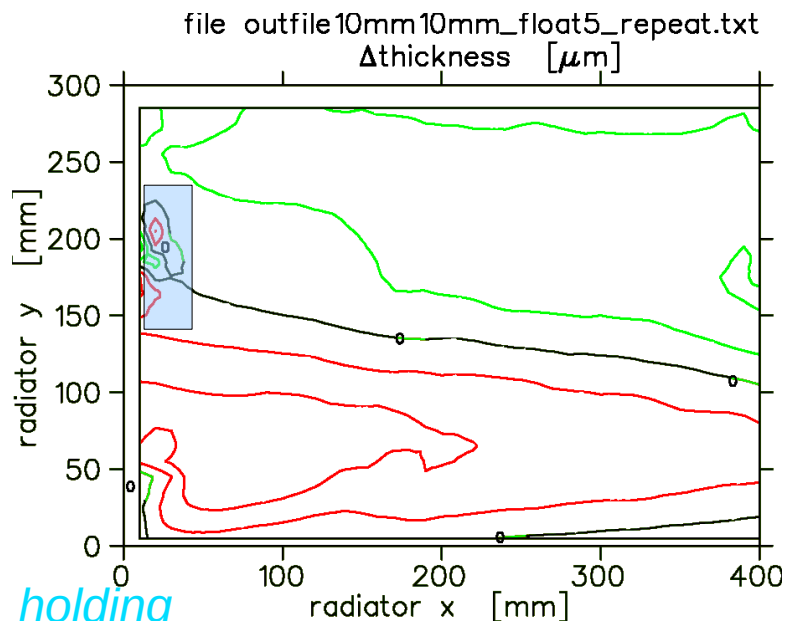
# Sample raw measurements



# Executive Summary

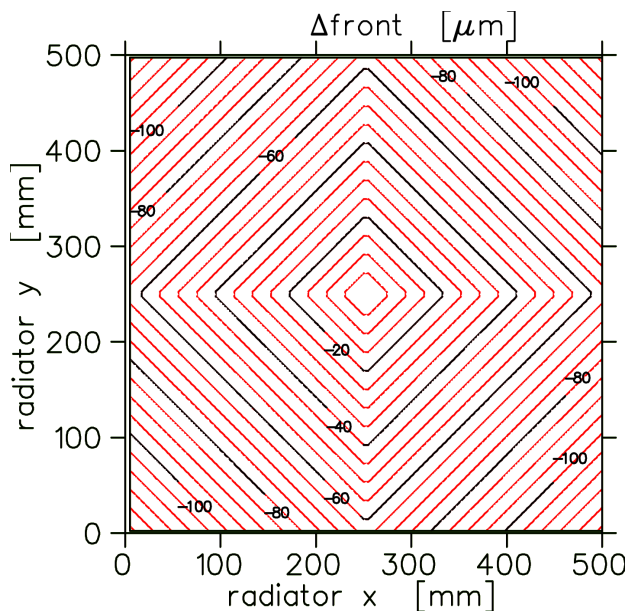
*quartz radiator plate DESY2013 polished by Heraeus;  
Heraeus gave typical RMS of 20 Ångström, provision  
no detailed specs possible file outfile5mm5mmqua.txt*

*measured for comparison:  
float glass plate*

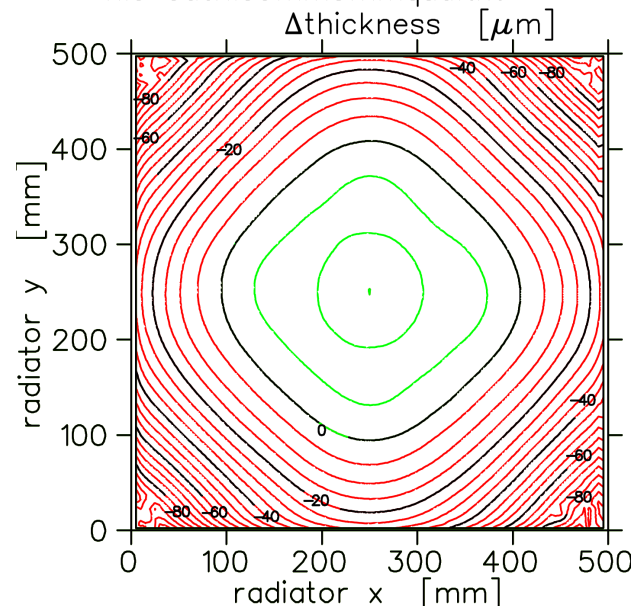


holding  
bracket

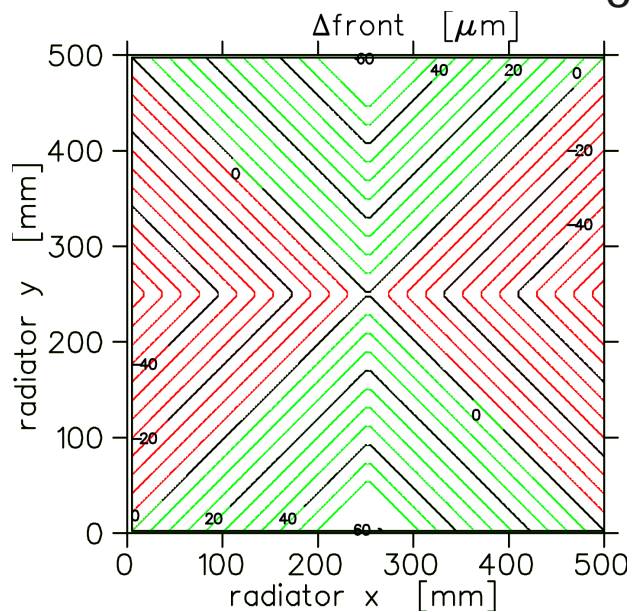
# Calibration & Reproducibility



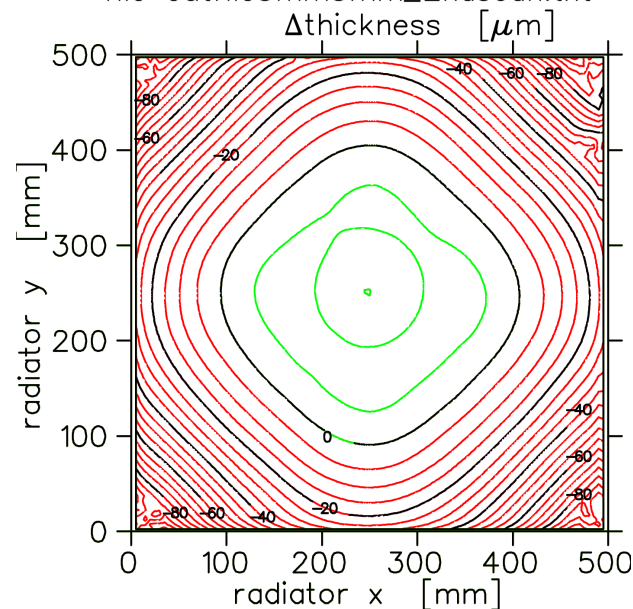
file outfile5mm5mmqua.txt



ok



file outfile5mm5mm\_2ndscan.txt

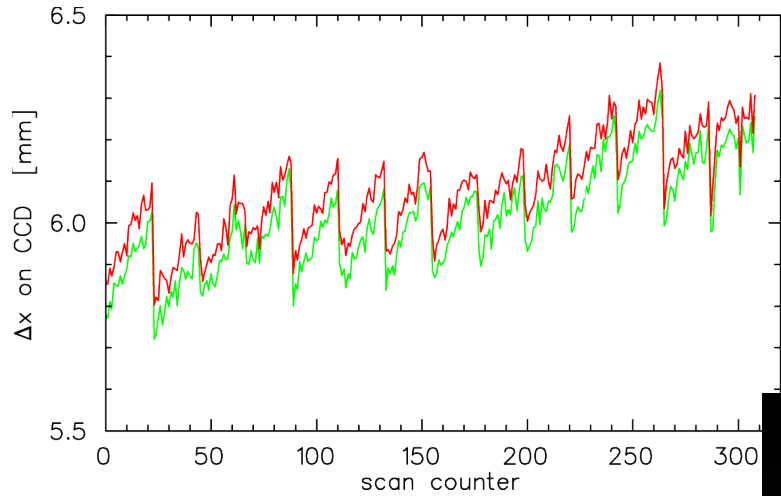


different  
cable routing  
causing  
different load  
on measuring  
table

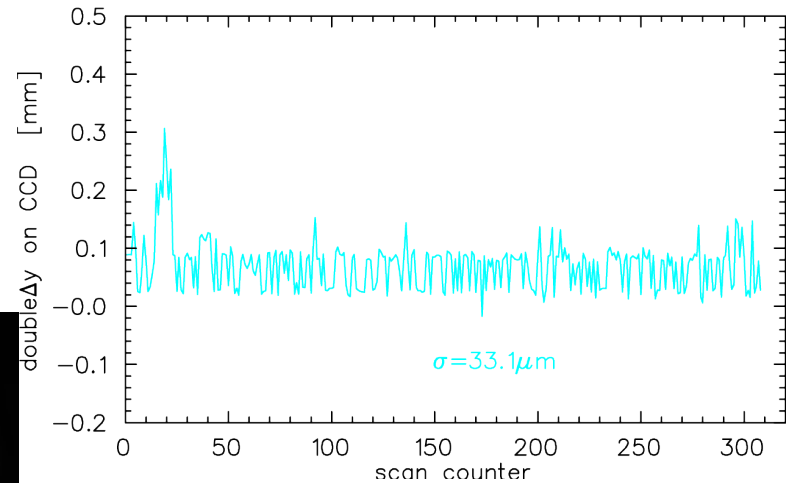
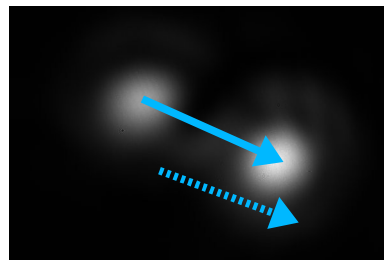
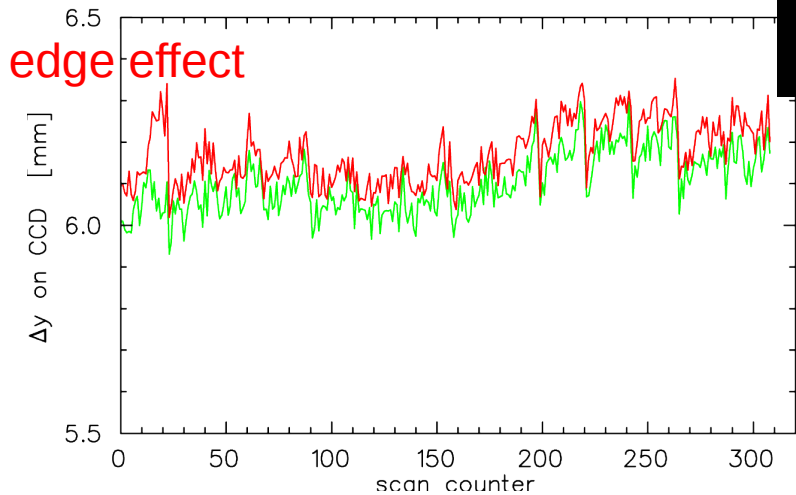
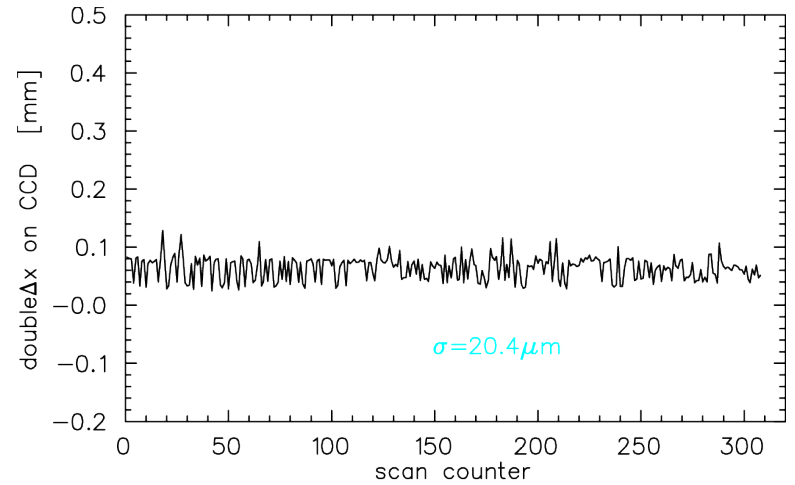
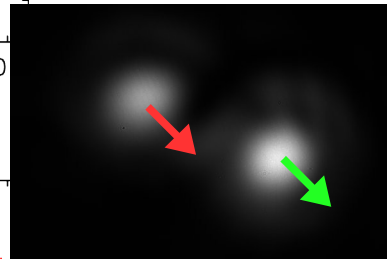
# strain change in radiator support

(order of magnitude: per torque of  $T=1Tm$  saggitta change of  $1.25\mu m$ )

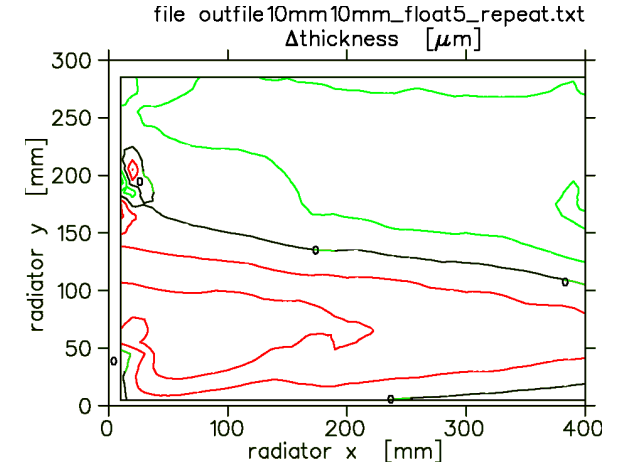
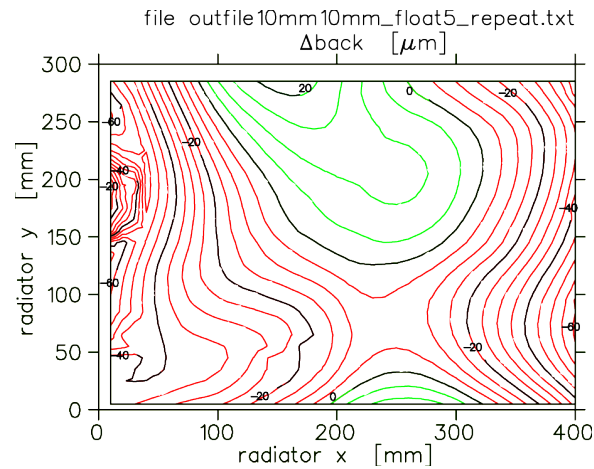
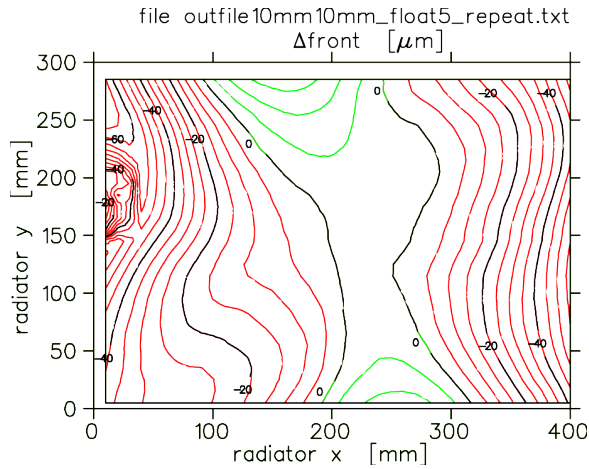
if radiator reorientation  $\rightarrow$  horizontal line only



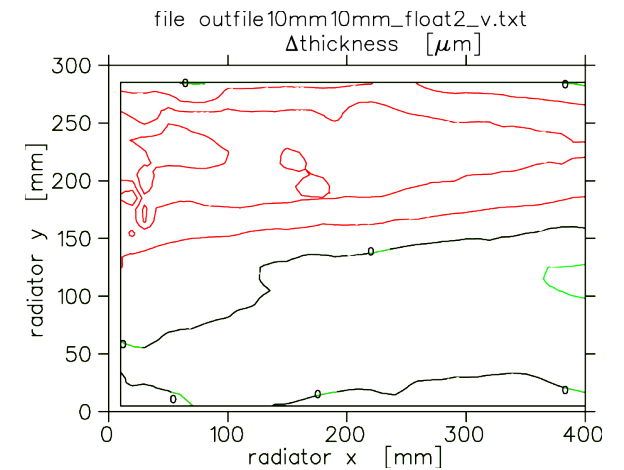
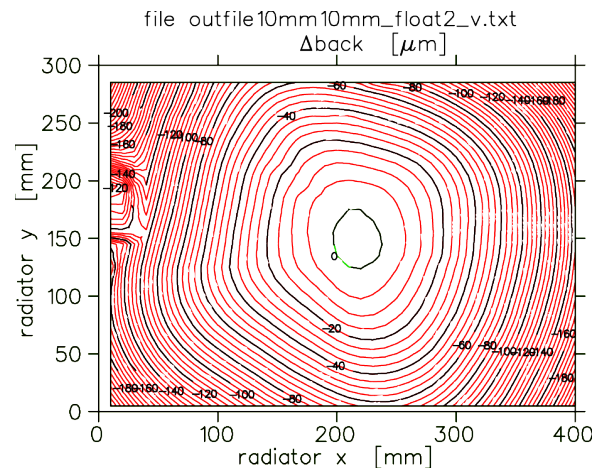
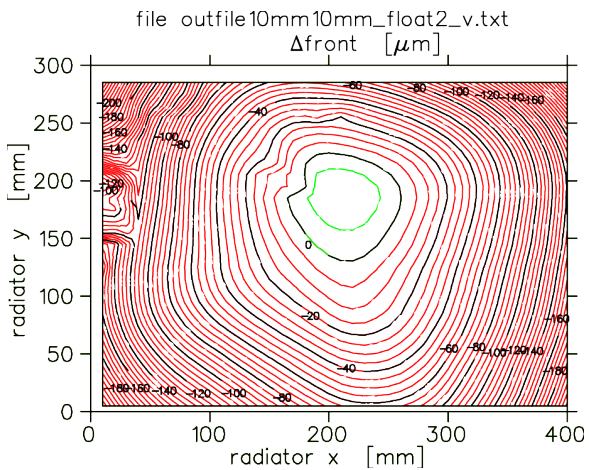
*difference:  
full fastening  
versus  
one leg  
unscrewed*



# parallelity of linear stages?



contour lines: bottom plots should be mirror images of top plots

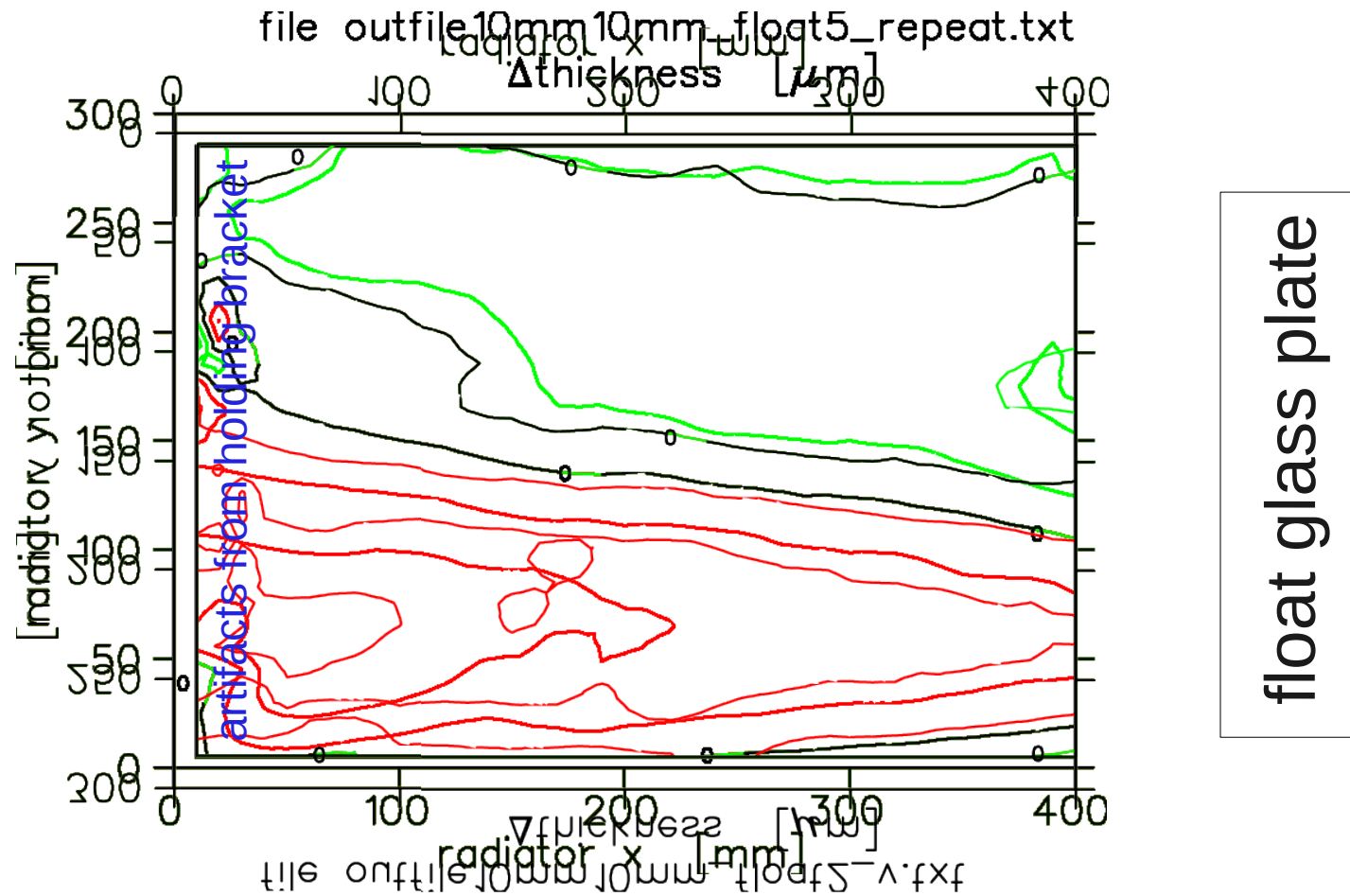


not the case for individual surfaces

reasonably well for surface differences

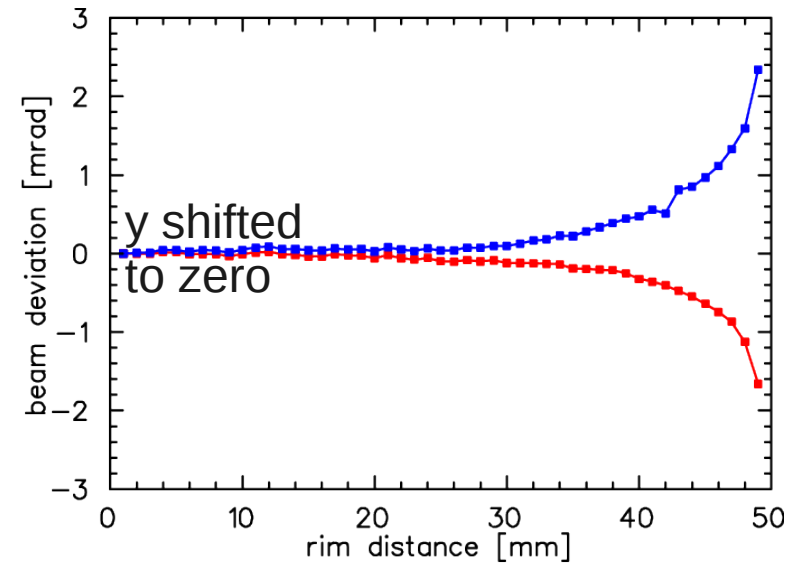
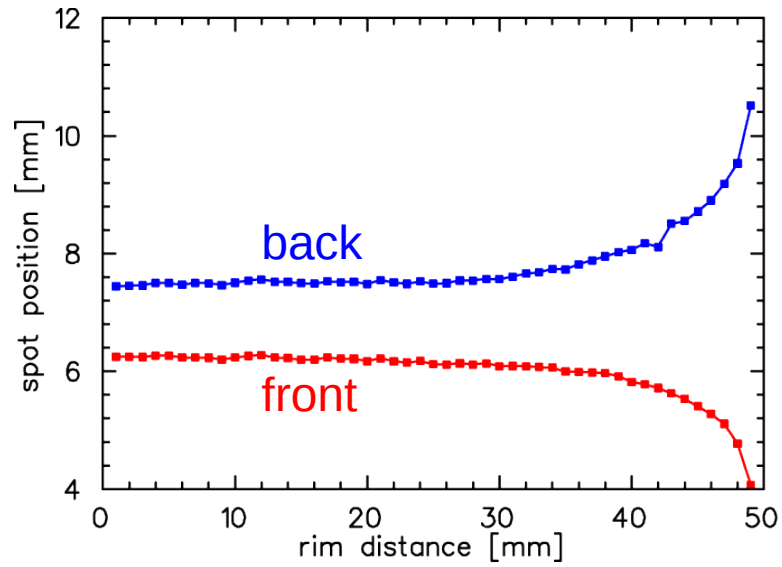
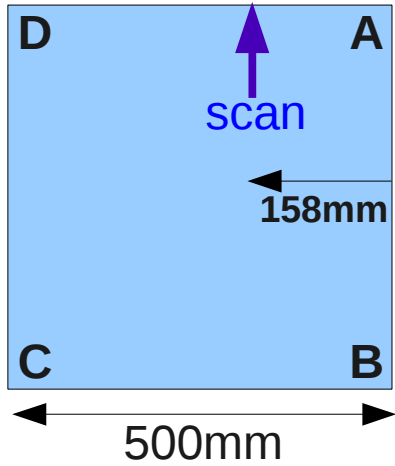


# Overlay of thickness measurements

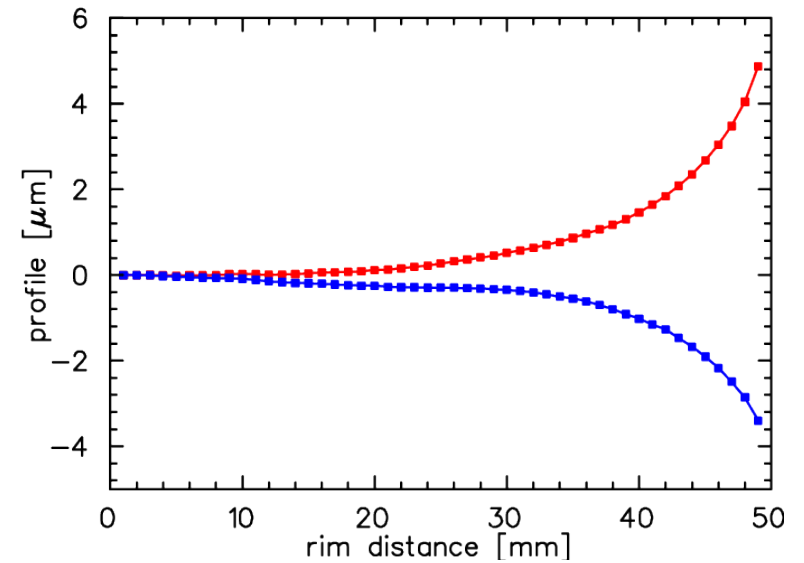
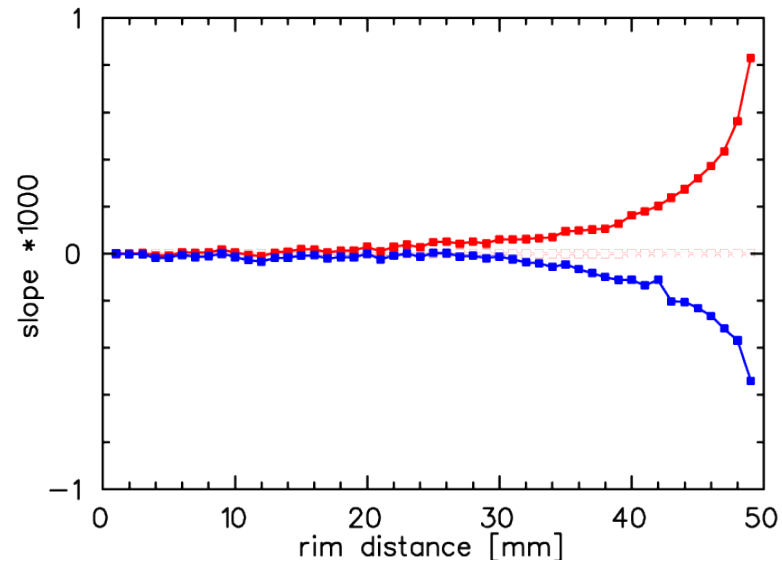


two measurements: plate vertically flipped in between  
(and analysis image also mirrored)  
N.B. zero points of the two analyses offset

# Scan at radiator rim



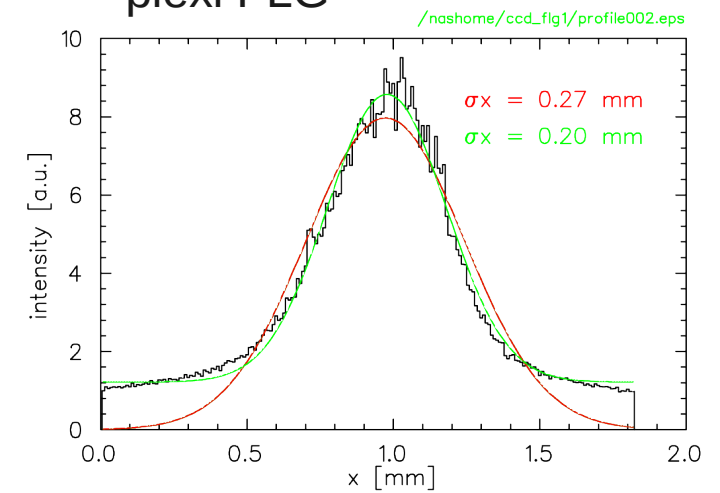
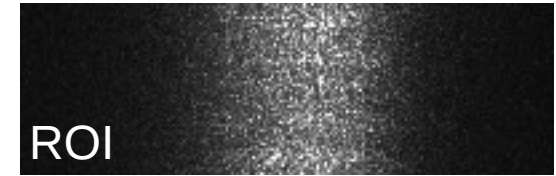
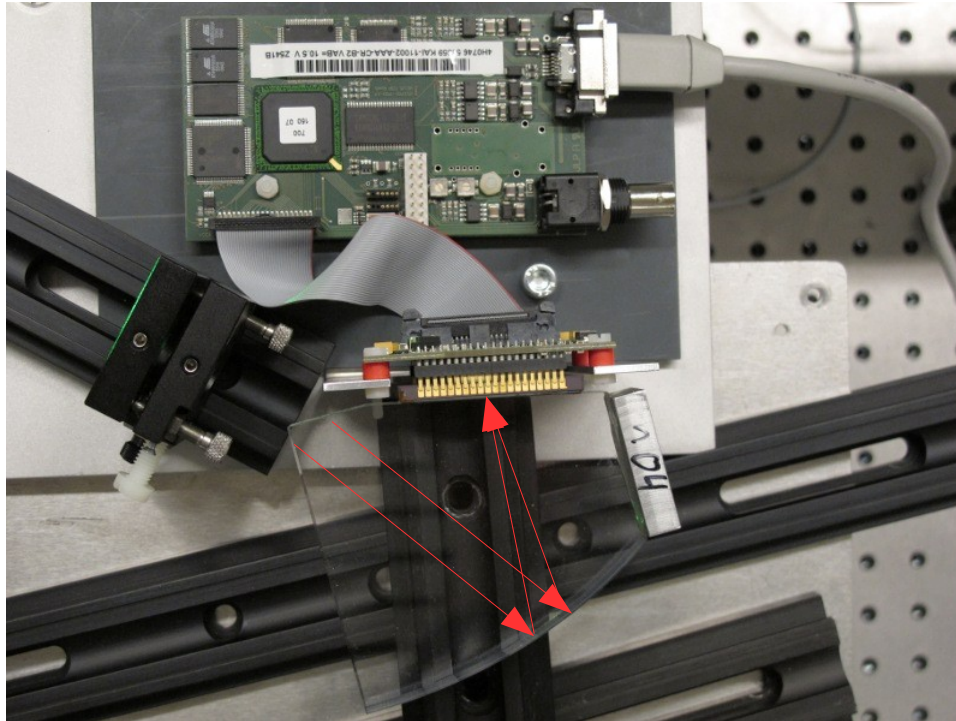
fused silica radiator is thinning out towards the edge



# Summary radiator

- thickness profiles at about 1 $\mu$ m accuracy
- surface profiles unreliable
  - smaller forces and torques cause plate to warp
  - large linear stages do not move exactly parallel
  - (could be calibrated – extra effort)
  -
- as  $b \cos \theta = c$  conserved quantity, adiabatic change of measured angle in 1-4 mrad range
- edge effect, angle offset  $\pm 2$ mrad (some photon)

# FLG overview measurement



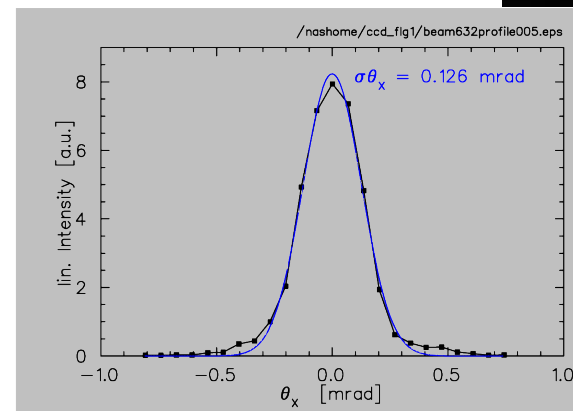
*very preliminary*

diode laser Galilei telescope



grey filter

camera  
with tele  
lense  
set at  $\infty$



1 mrad