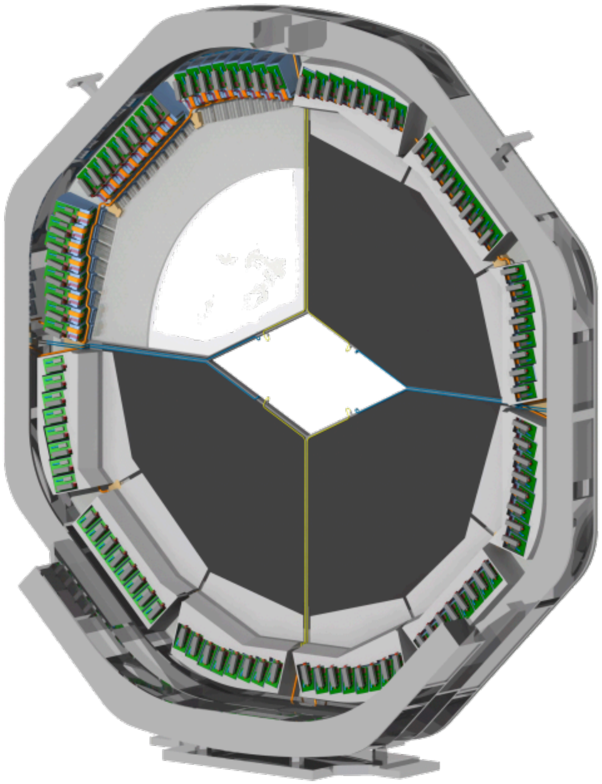
Status of the PANDA Endcap Disc DIRC Project



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PANDA CM 20/2- 2020/06/22

Bundesministerium für Bildung und Forschung

JUSTUS-LIEBIG-UNIVERSITÄT GIESSEN

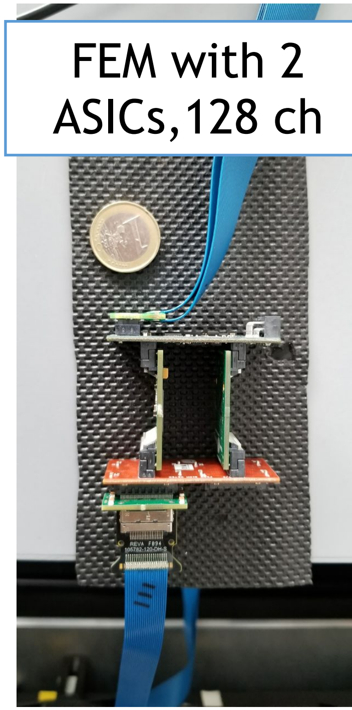
HGS-HIRe for FAIR Helmholtz Graduate School for Hadron and Ion Research

GSI Helmholtzzentrum für Schwerionenforschung GmbH

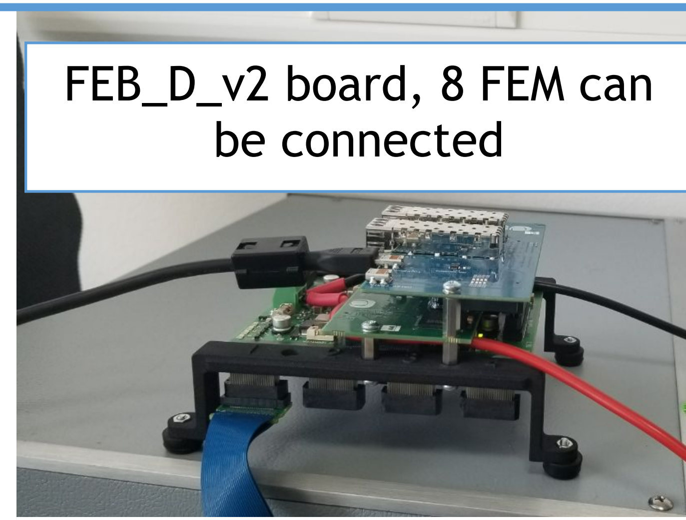
HIC for FAIR Helmholtz International Center

Frontend electronics

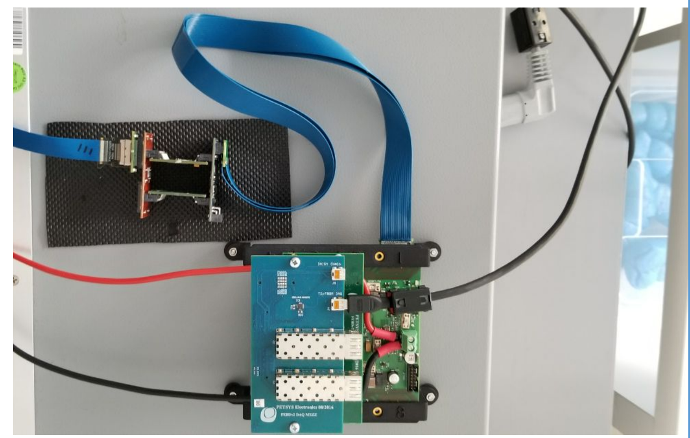
- New ASICs-FEM were arrived in Giessen few months ago.
- According to tests by PETsys and Giessen, the new version of the ASICs is compatible with positive and negative signal polarity.
- We started the tests with MCP-PMTs (negative signal polarity).
- Custom-designed (Flex-rigid) boards are planned to be sent around Summer.



FEM with 2 ASICs,128 ch



FEB_D_v2 board, 8 FEM can be connected

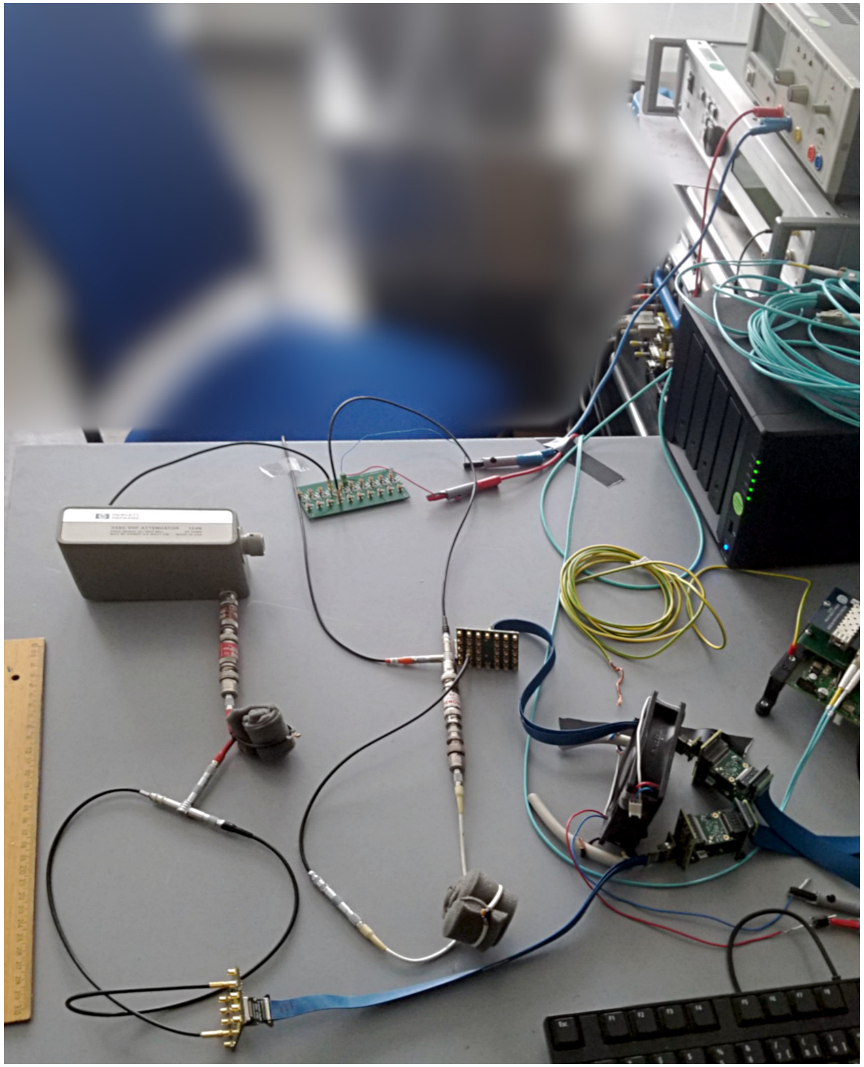


Frontend electronics

- The pulser provided negative signal ~ 200 mV. It was split into two cables and attenuated till ~ 20 mV. One signal was converted as a positive signal and given to ASIC, other negative signal was given to other ASIC.

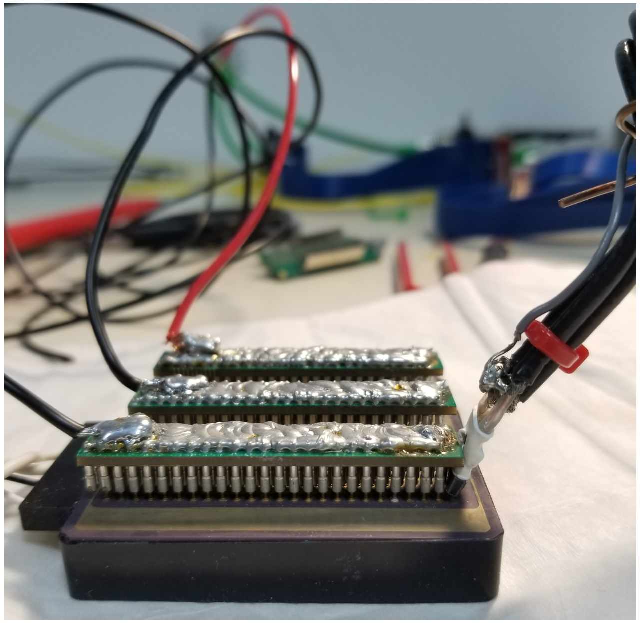
- The expected number of events was obtained with new ASICs.

- The recent ASIC version is compatible with negative and positive signals.



MCP-PMT signal measurements

- The 296 channels of the sensor are grounded to reduce the noise, only 4 channels are connected for scope measurements.
- The laser was pointing only 4 channels at the side.
- First measurements were done with Photonis Aqua sensor. The results were not reliable and the sensor was sent to Erlangen.
- Currently, Photonis 2mm is in the light-tight box.



MCP-PMT signal measurements

- We started measurements with Photonis 2 mm two weeks ago.
- We are triggering the laser externally with pulser to check the number of events to corresponding frequency.
- Preliminary results: we can say that we are able to measure the MCP-PMT signals, but we have to set the threshold settings and the parameters to make the calibration properly. We will work on finding the best settings in the following weeks.

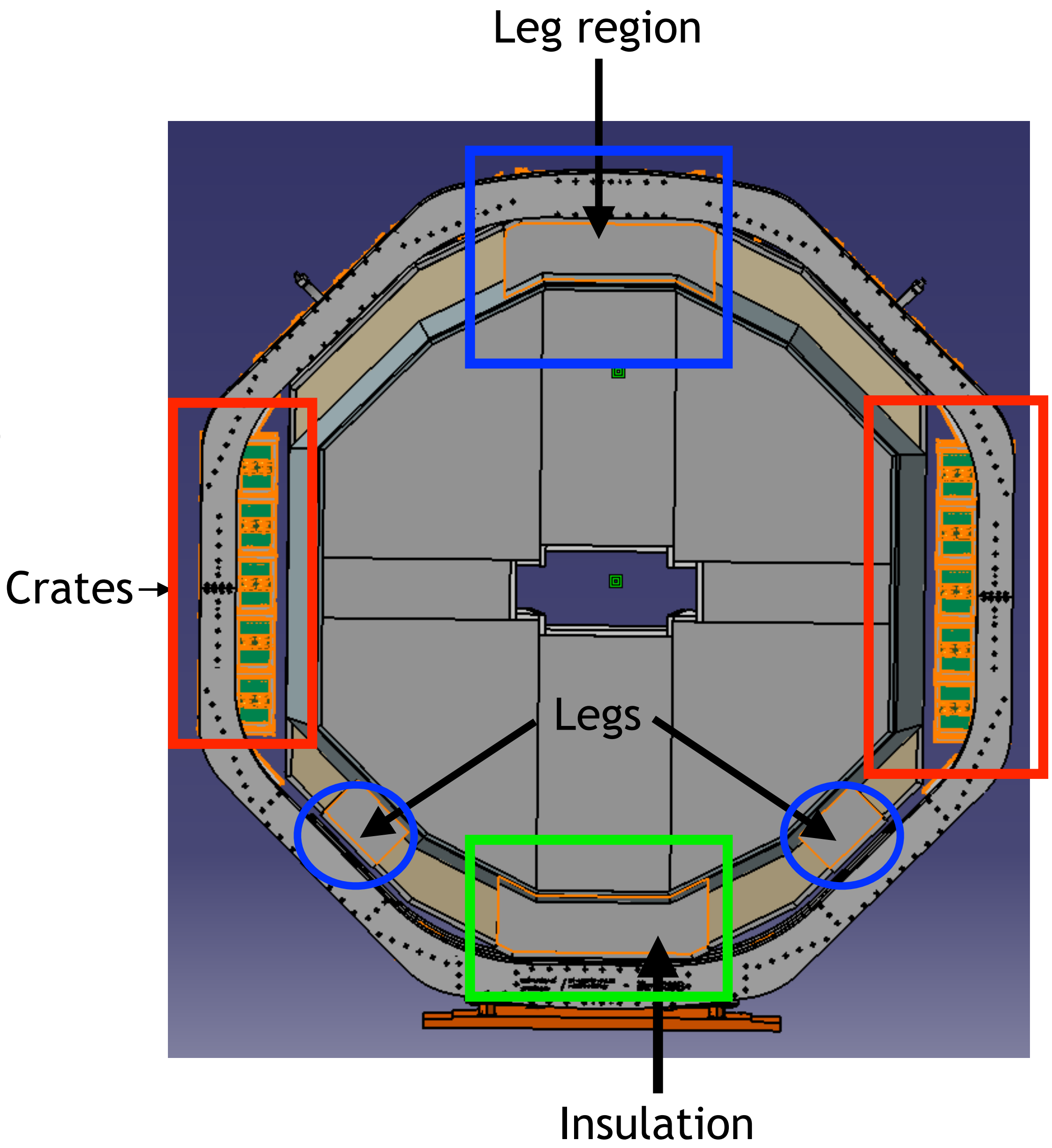
Observations

- Exchanging cable: lemo → BNC cable reduces the noise
- Power cable plugged into switched-off device (Oscilloscope, pulser)
- Changing the socket from one to another in the same room creates noise
- Putting some copper wire reduces noise

Mechanics - Limited regions

- Lightened areas are critical regions

- Spatial constraints change depending on phi-angle.
  - EMC-Crate region at two sides
  - Leg regions
  - Insulation at bottom



Mechanics problems -> Presented in previous CMs

- There are limits both z-direction and radial direction.
- No space for
  - HV cables, LV cables, Optical link, HV divider, FEE
  - Cooling system has not been implemented yet
    - Cooling system design is started to be worked on by B.Sc. Lisa Brück.
      (Required space for the cooling system will be determined.)

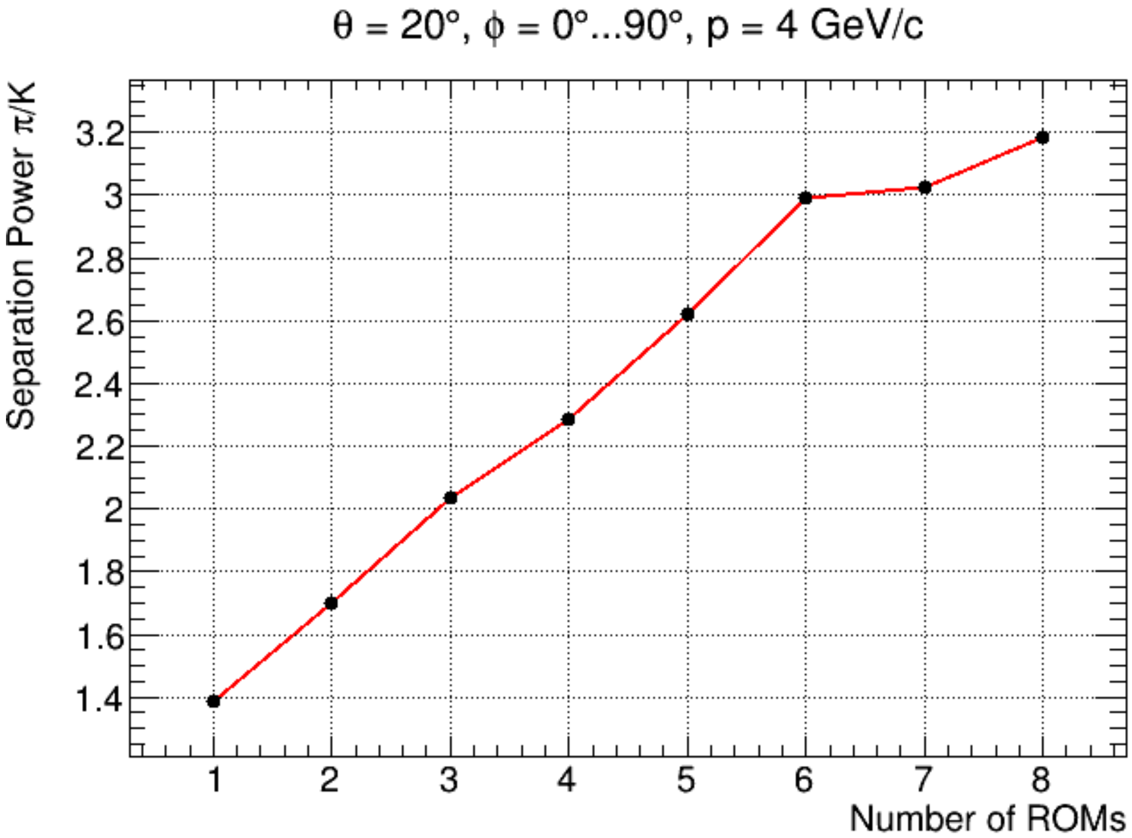
Proposed Solutions from previous CM

1. Reduce number of ROMs in each quadrant, not preferable. (Efficiency loss!)
2. Moving EDD through the upstream direction ~ 23 mm. EDD is in-between GEM detectors and forward EMC. -> GEM group tried to find a solution but as a result this is not possible either.
3. EMC group has already produced insulation part. From neighbors, we could not get extra space.

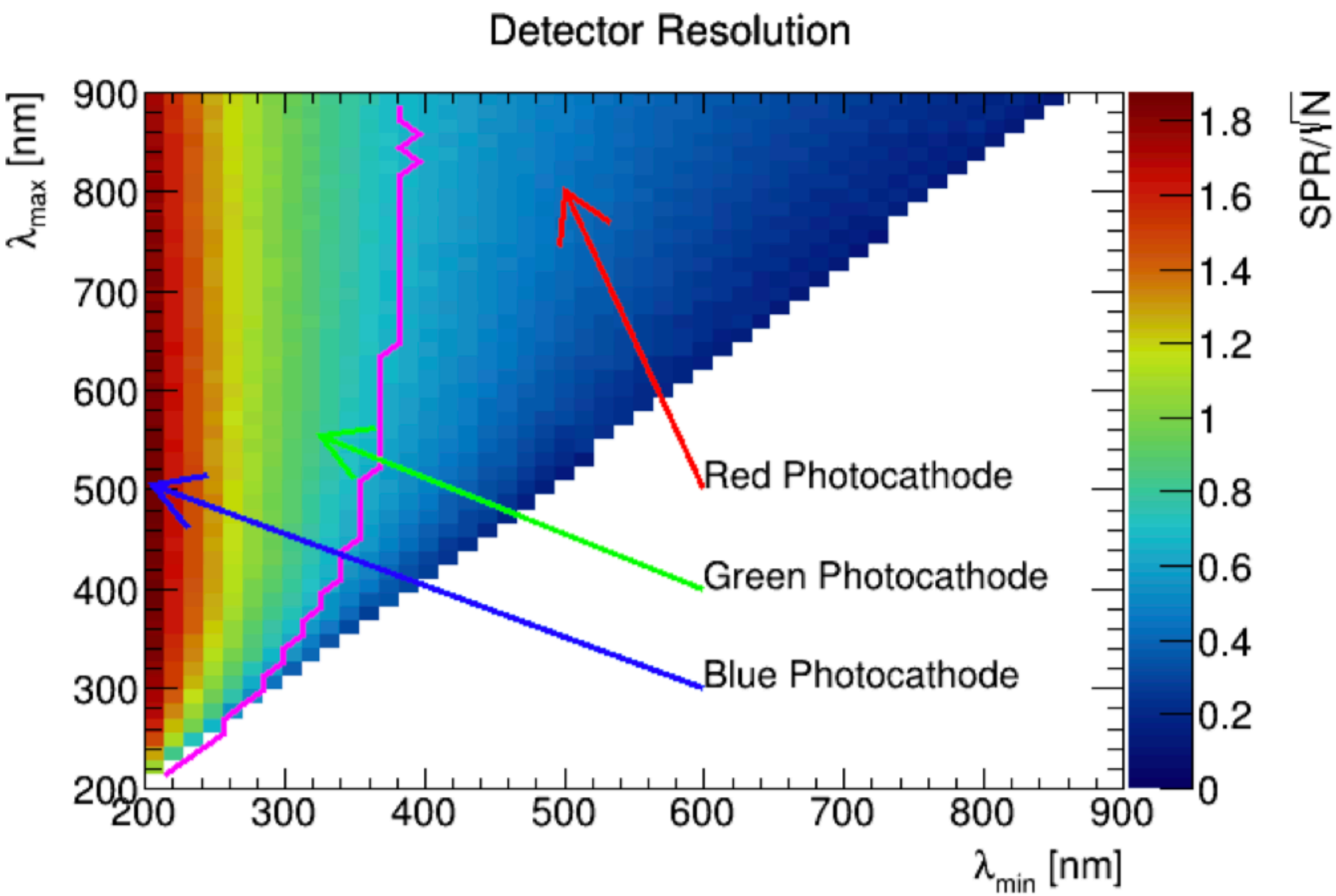
Not enough space for the EDD! → System optimization

- Optimization means reducing number of ROMs per row.
- We can keep the separation power with 6 or 7 ROMs.

Simulation results



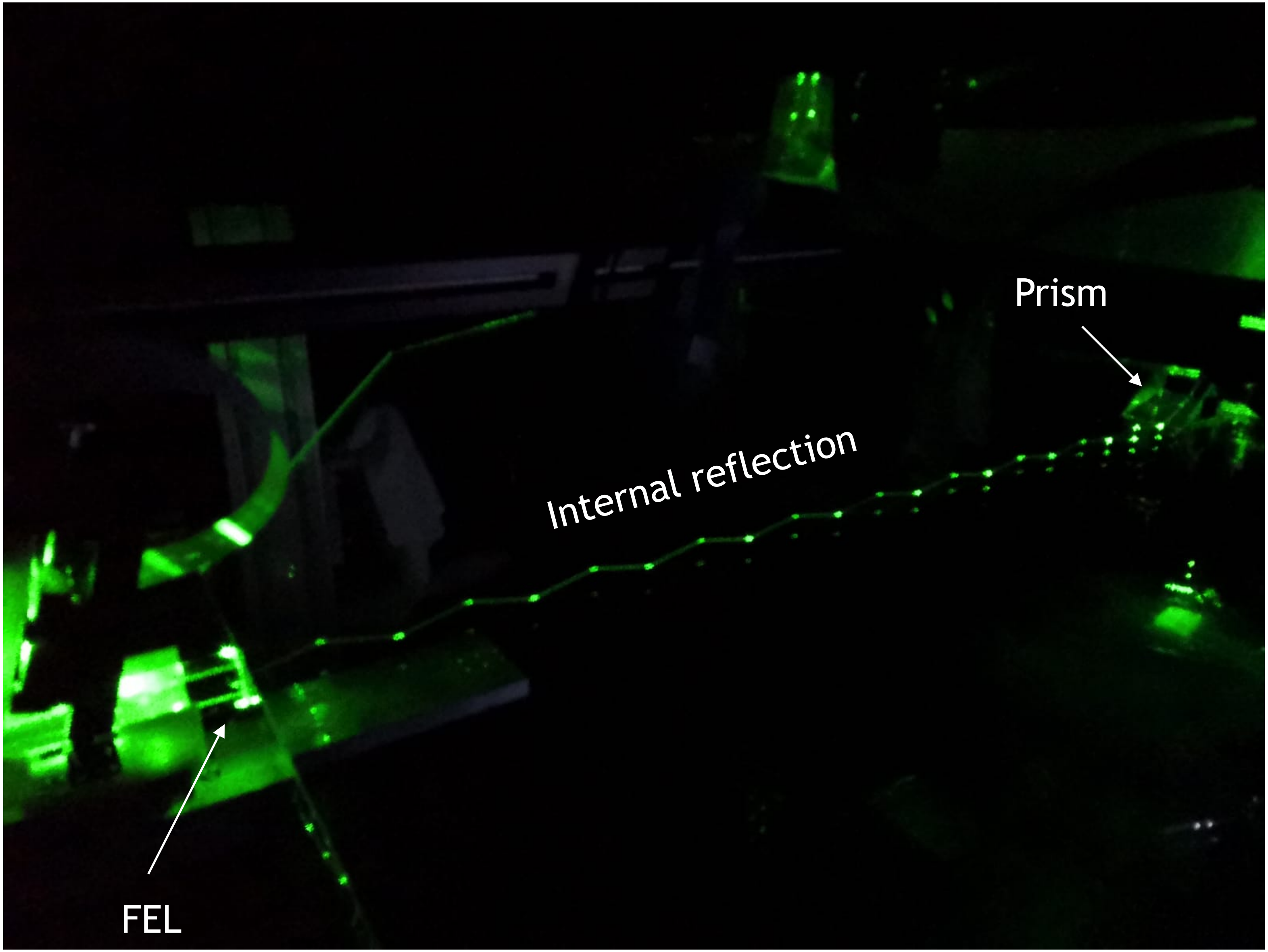
Detector Resolution (Dispersion)



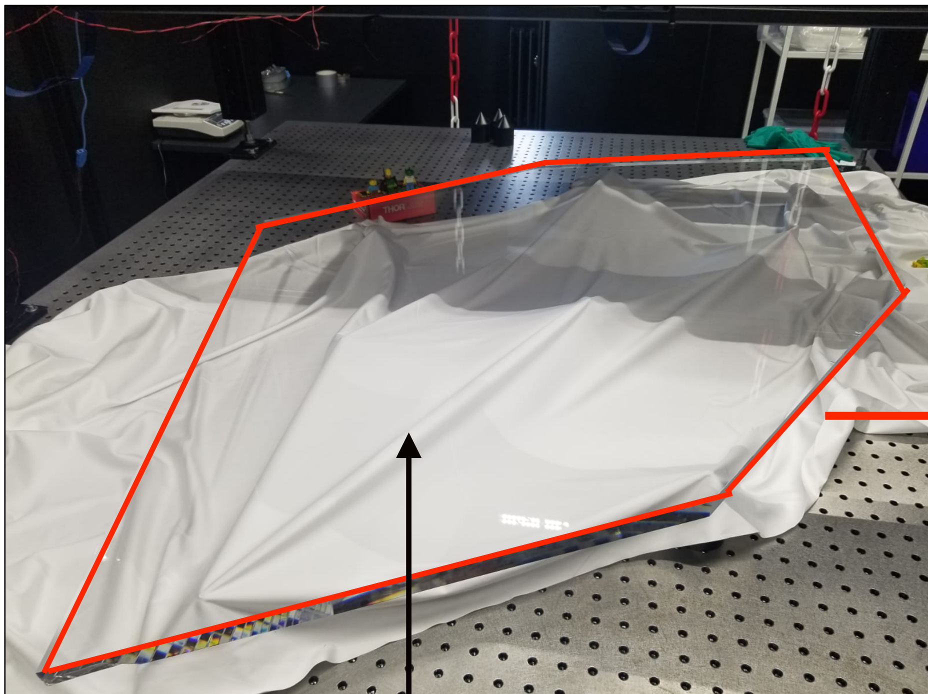
Detector Resolution for fused silica for pions with p = 1 GeV/c as a function of the minimum and maximum wavelength. The purple line represents the limit of 0.7 mrad.

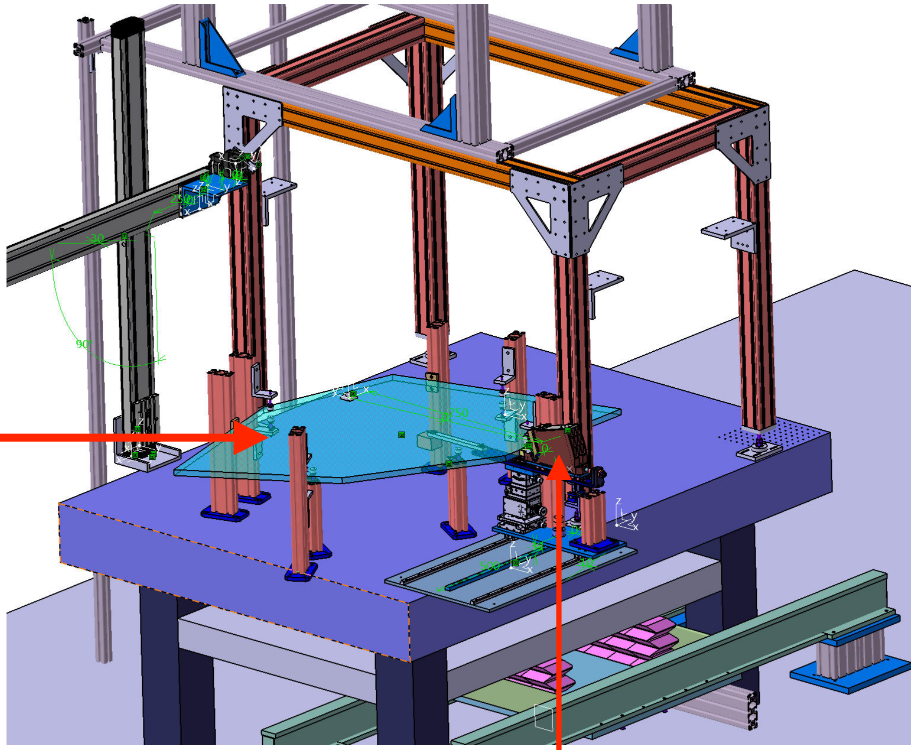
Conclusion

- The recent ASIC version is compatible with negative and positive signals.
- The MCP-PMT signals are started to be measured with recent version of the ASICs. Threshold settings and some parameters should be set properly.
- Regarding mechanics, system optimization (reducing the number of ROMs) will be necessary. We can keep the separation power with 6 or 7 ROMs according to simulations. We should work on required space for cooling system, electronics and then decide the number of ROMS that can fit.
- The cooling system design has been started to be worked by Master student Lisa Brueck.


Prism
Internal reflection
FEL

Quality measurements with final geometry - Sophie Kegel

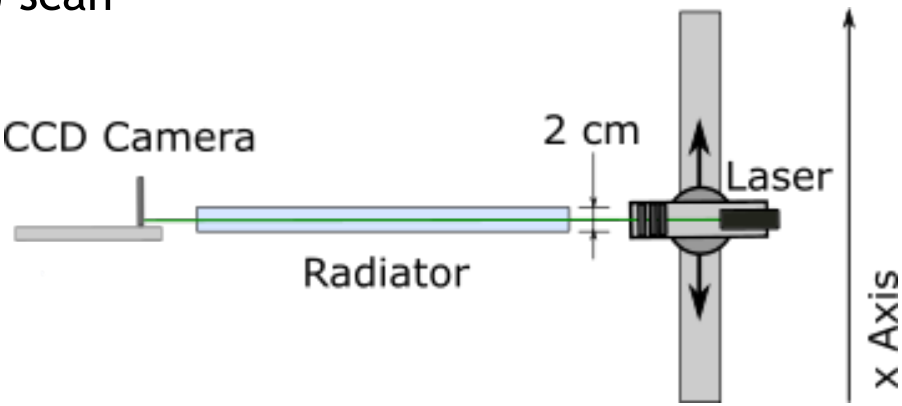


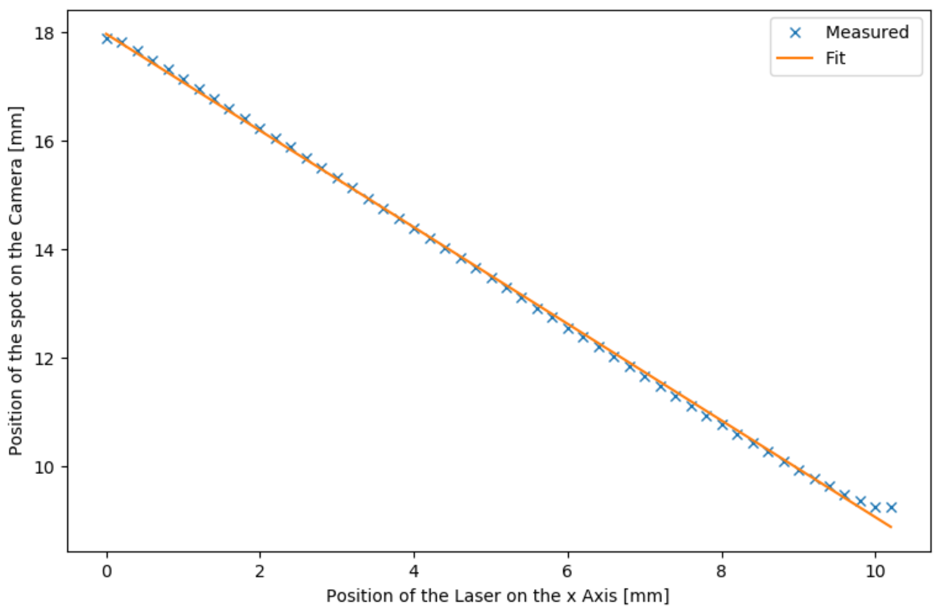


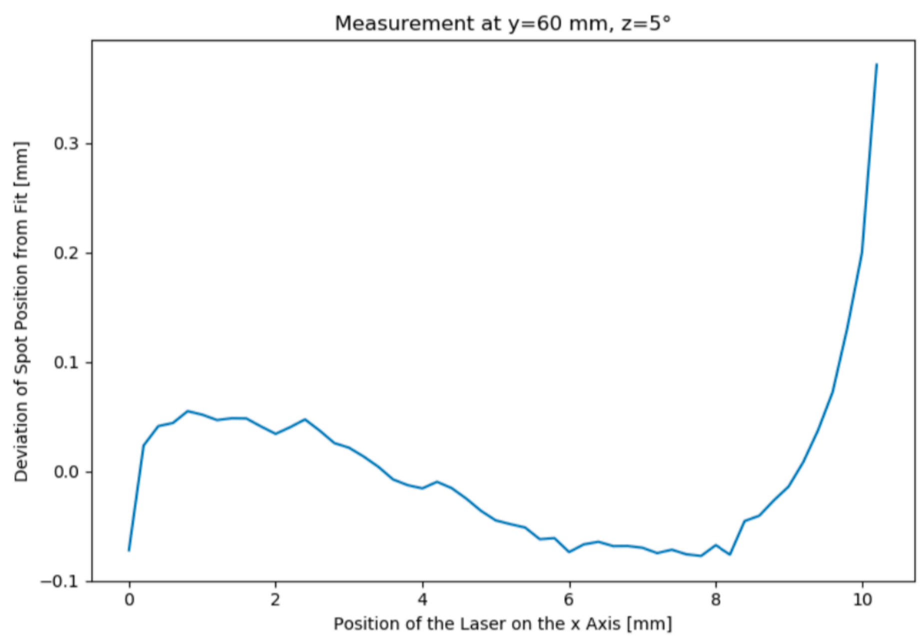
Fused silica quadrant with final geometry

ROM

Vertical (x-axis scan) scan

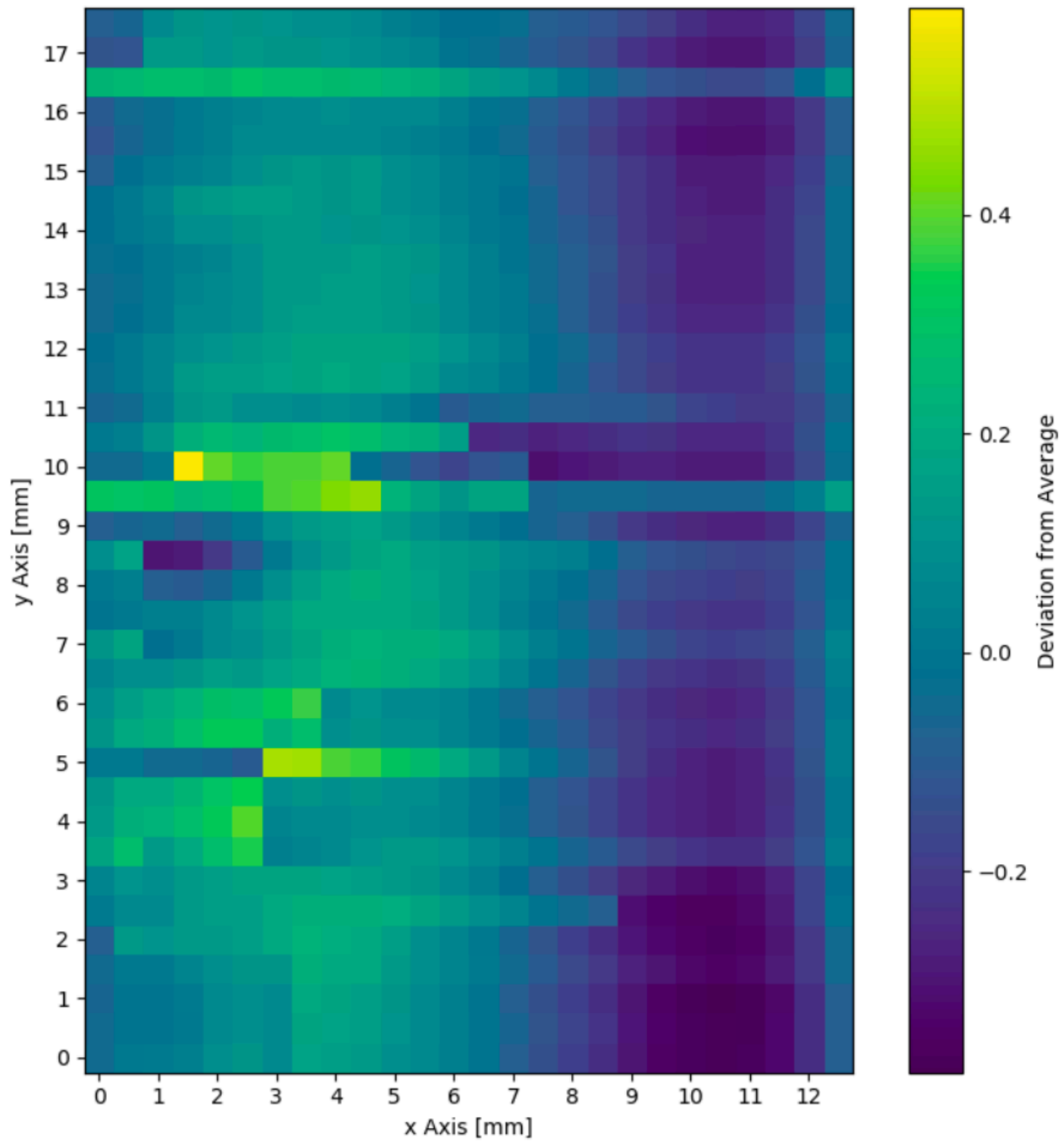




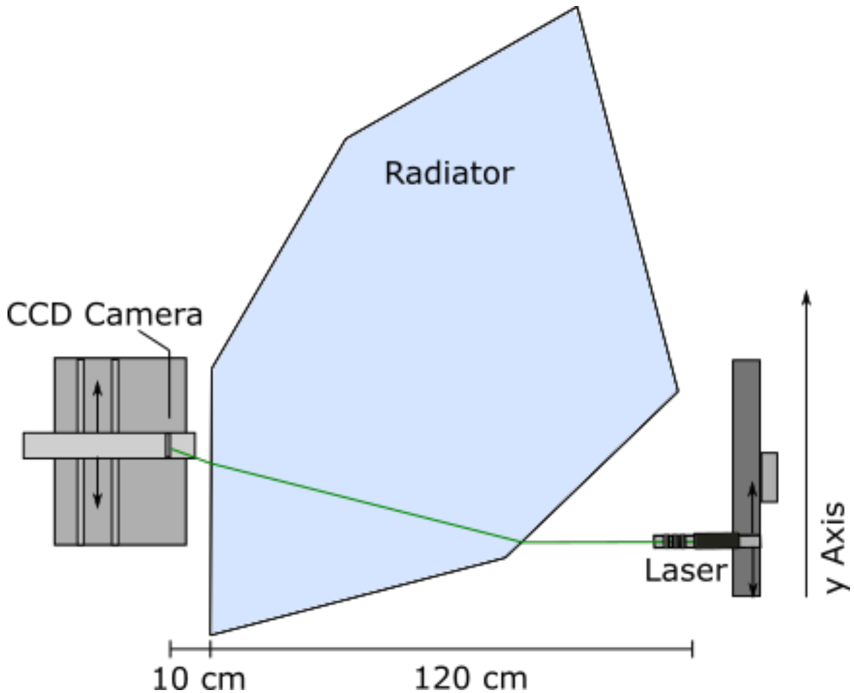


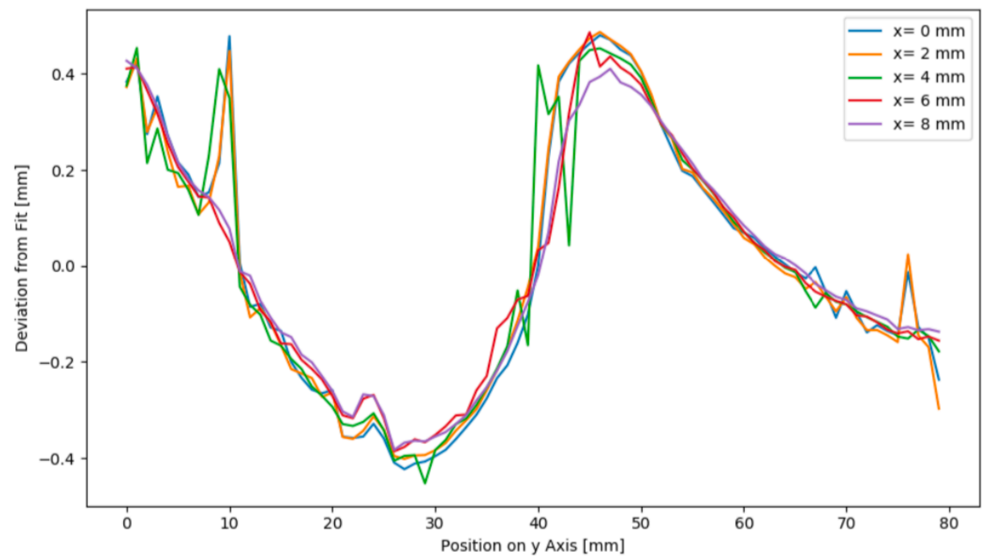
Heatmap: A series of vertical scans was taken to create a heatmap.

- After each vertical scan the laser is moved 0.5 mm on the y axis and another vertical scan is started.
- Heatmap showing the deviation of the spot from a linear movement.

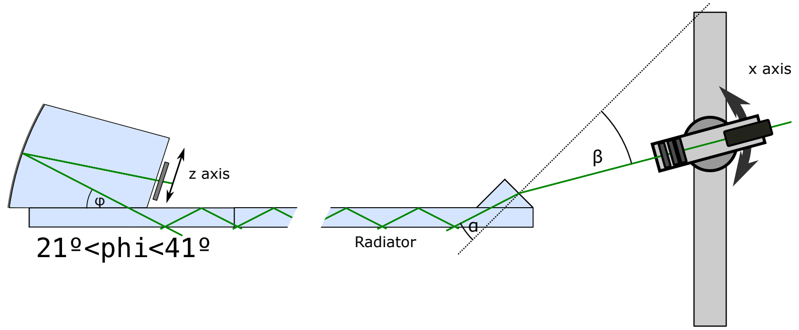


Horizontal (y-axis scan) scan: Deviation of the spot position on the y axis from a linear Fit



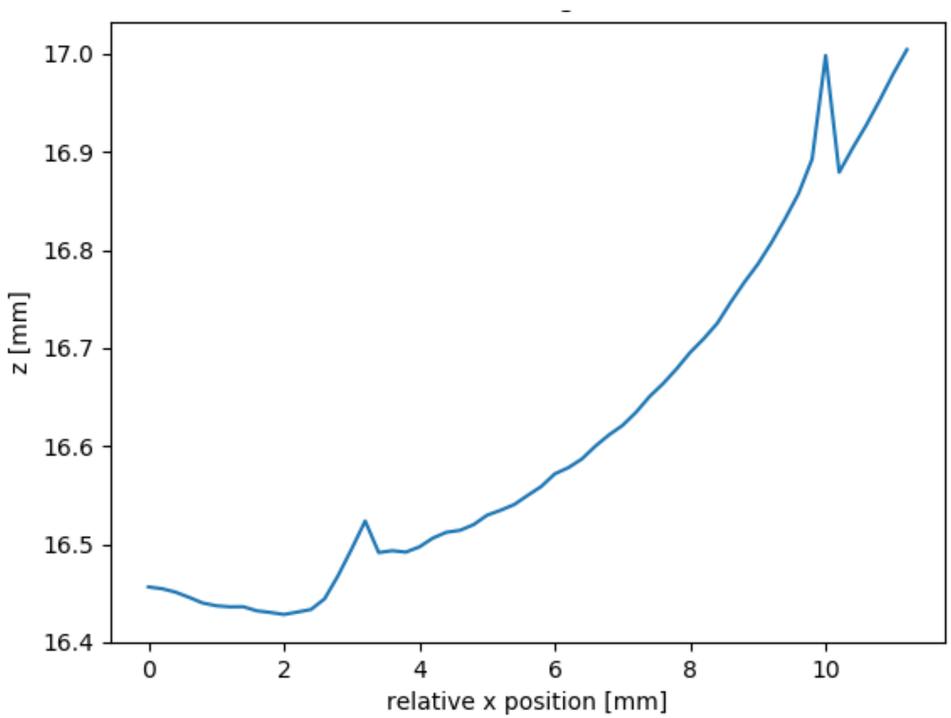


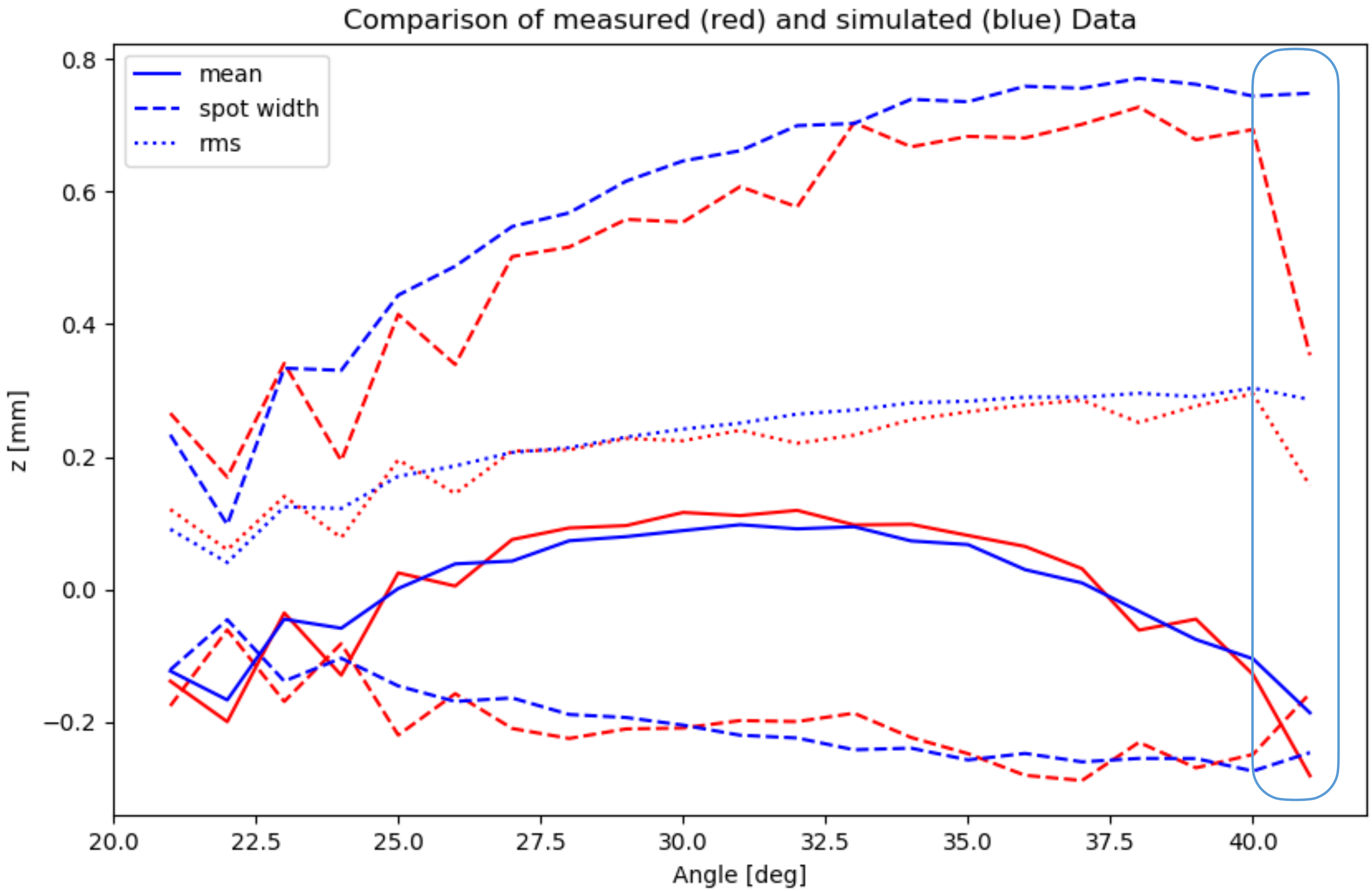
Vertical (x-axis scan) scan phi = 26º



- The spikes appear because there are additional refractions when the laser crosses the edge of the bar (at the top/ bottom of the radiator.

- For each angle, x-position scan was done. Spot width and rms are calculated.





There is a drop at 41° due to the spatial constraints

Conclusion - Sophie Kegel

- There is a deviation of the spot position when the laser is going through the radiator from the side. The reason may be the effects inside the radiator.
- Separate measurements have to be done to determine the surface quality.
- The measurements with the FEL indicate that the angle preservation inside of the radiator is good.
- Future plans: More quality measurements are planned.

Thanks for your time…