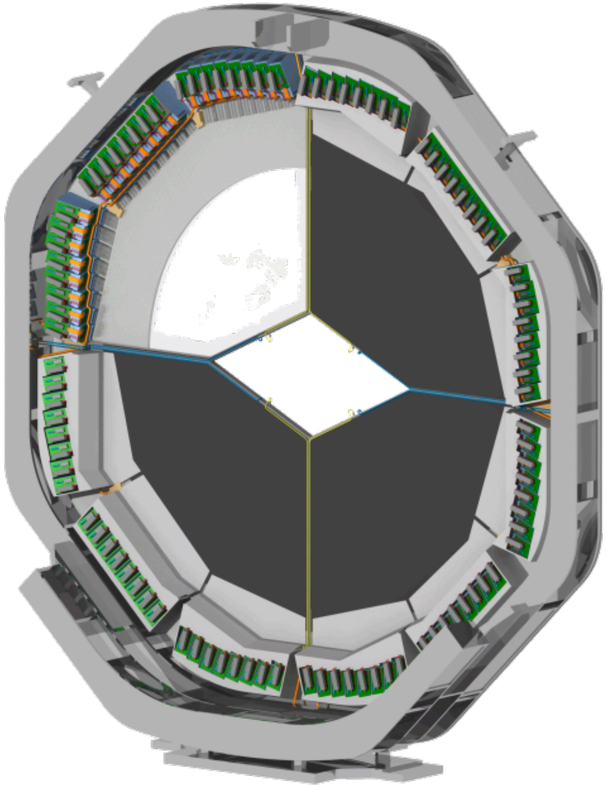
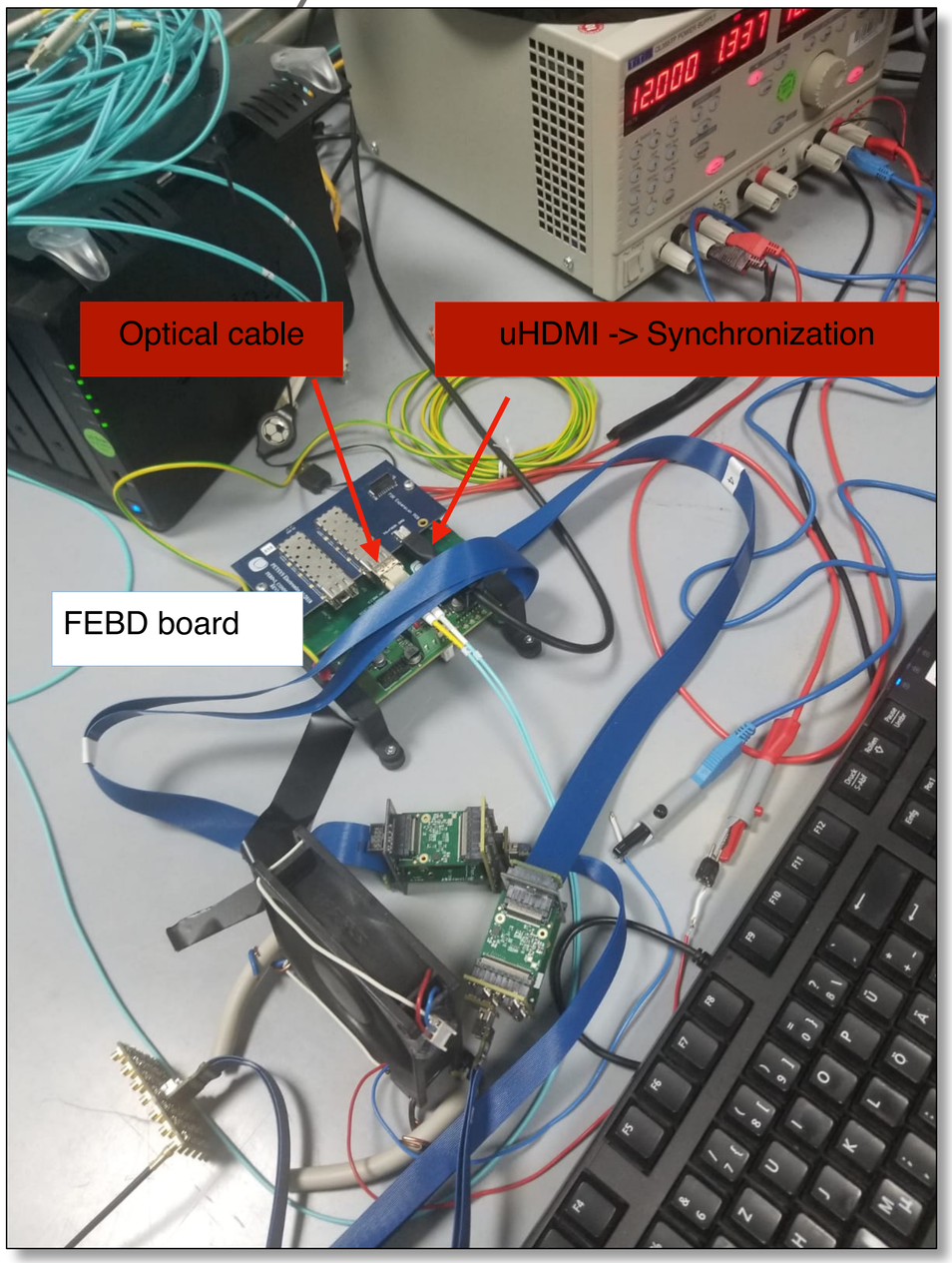
Status of the PANDA Endcap Disc DIRC Project



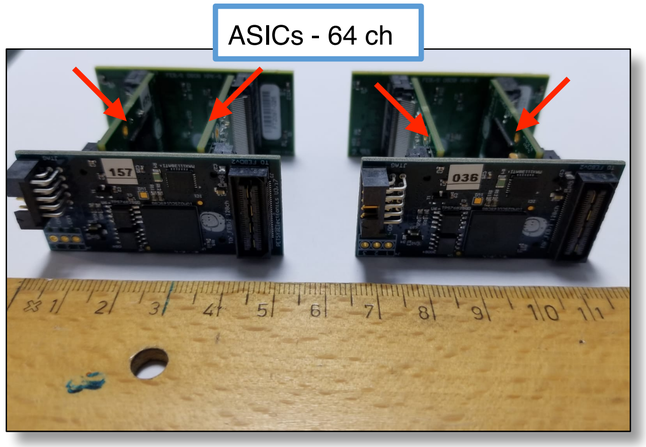
Simon Bodenschatz, **Lisa Brück**, Michael Düren, Avetik Hayrapetyan, Jan Hofmann, Sophie Kegel, **İlknur Köseoğlu-Sarı**, Jhonatan Pereira de Lira, Mustafa Schmidt, Marc Strickert

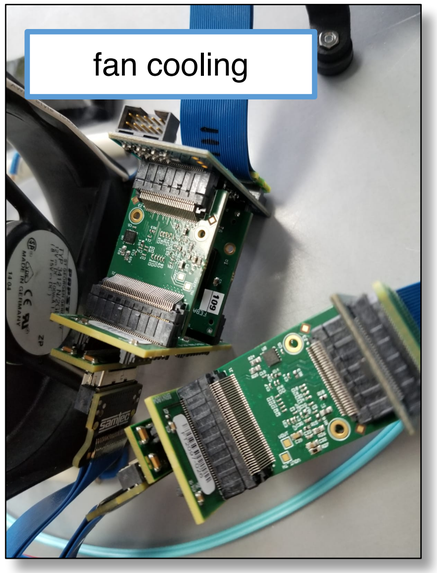
PANDA CM 21/1- 2021/03/09

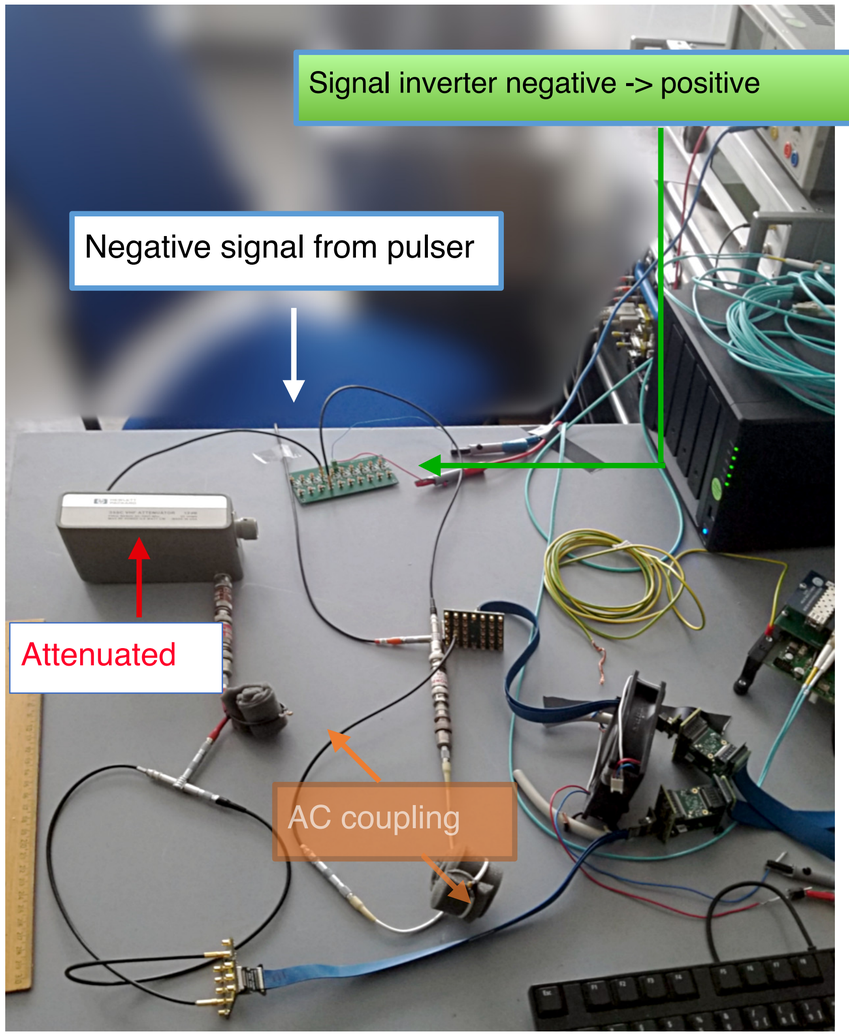
The recent batch of ASICs - test measurements



- Positive Signal ~ 40mV
- Negative Signal ~ 40mV, pW 3.5ns,

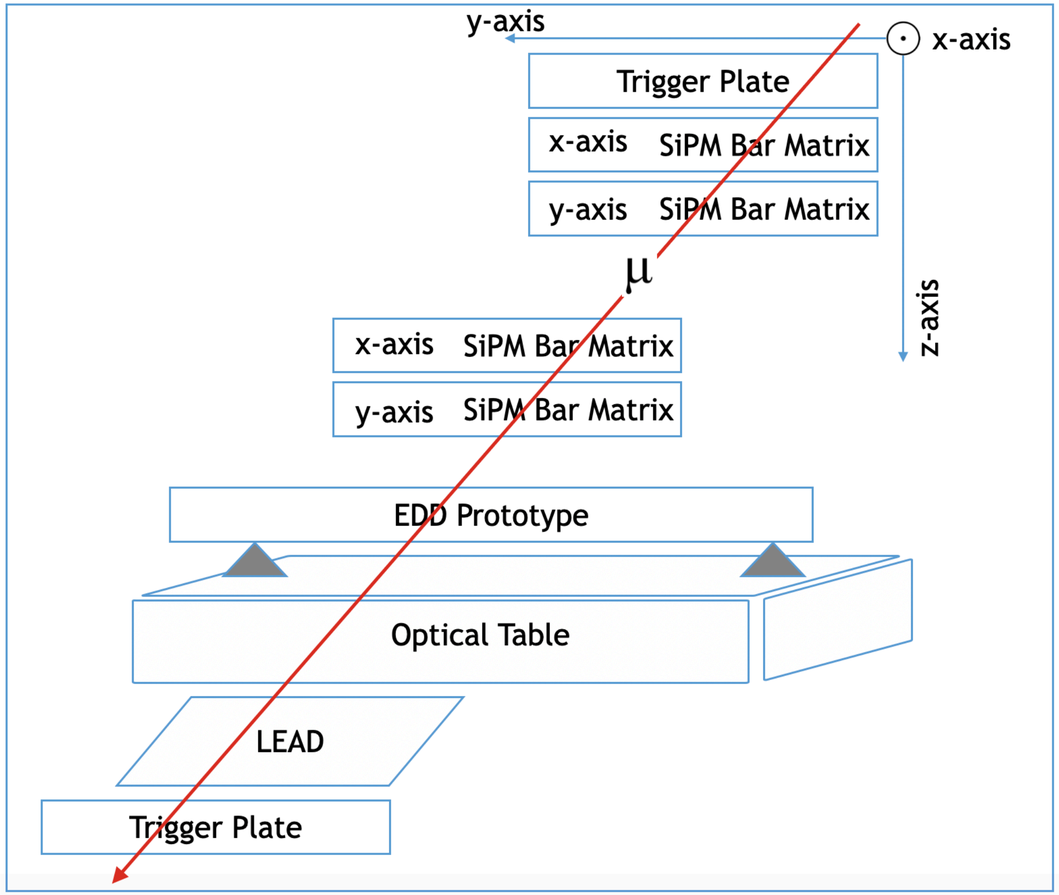


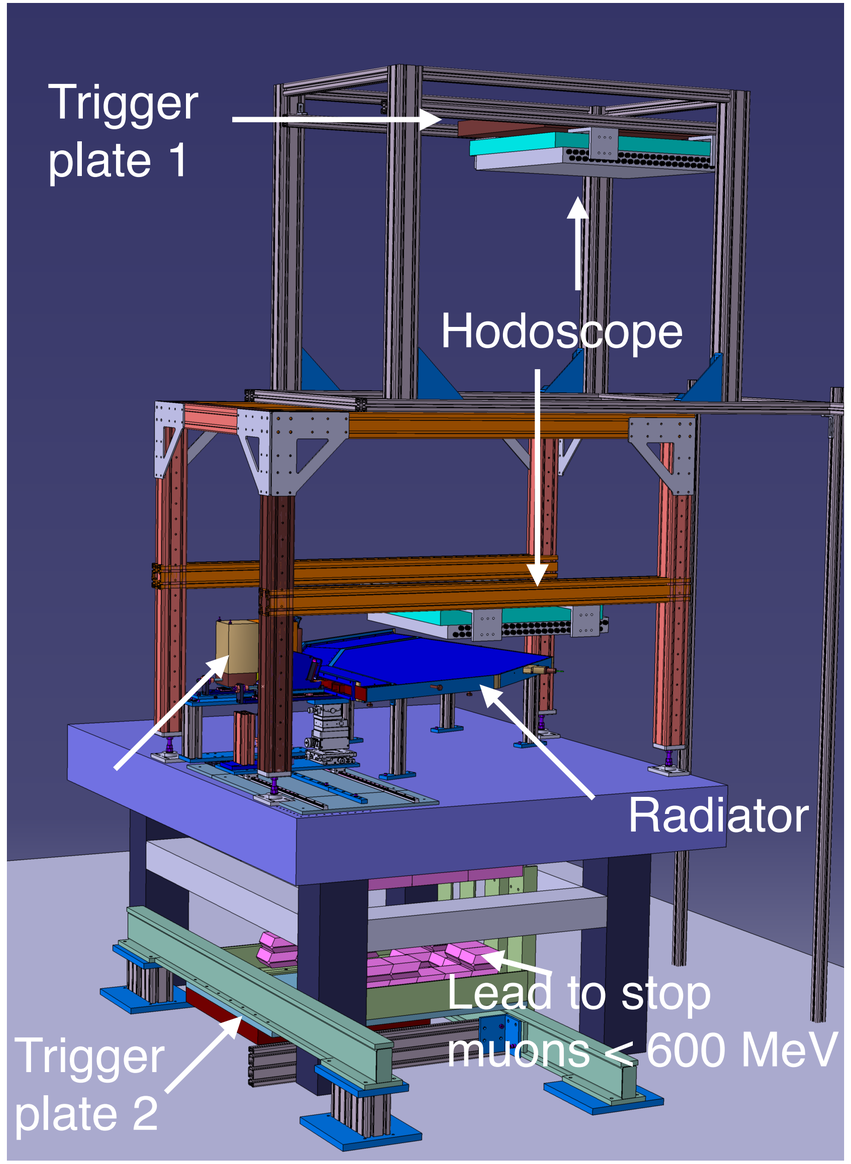


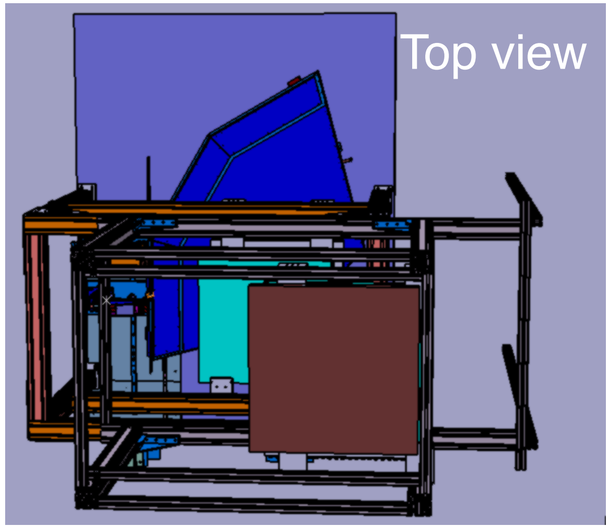


Giessen Cosmic Station (GCS) 3D Construction

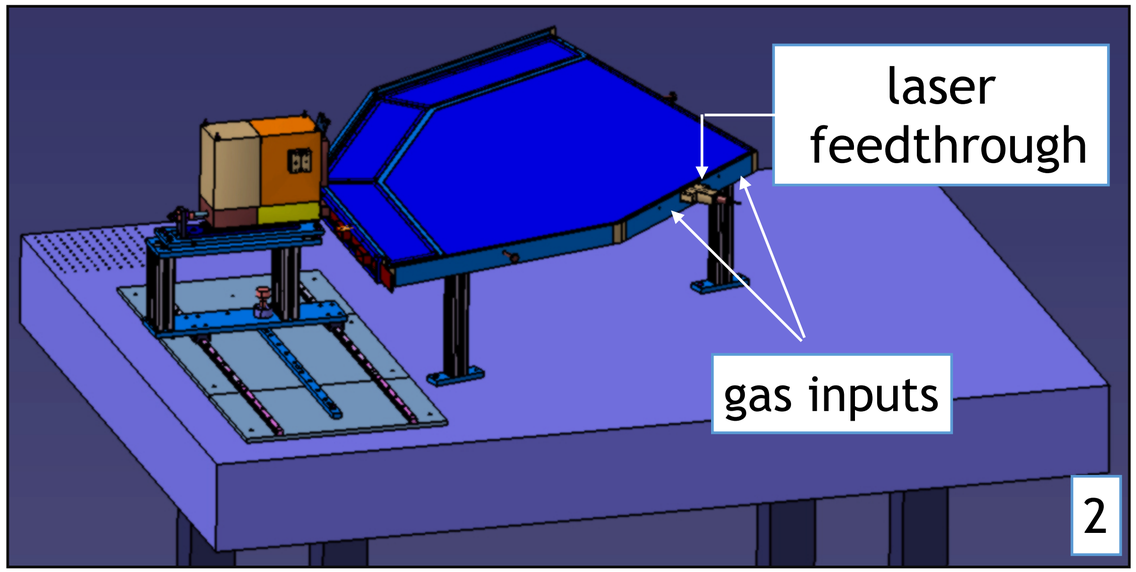
Confirm the performance of the readout system and the prototype

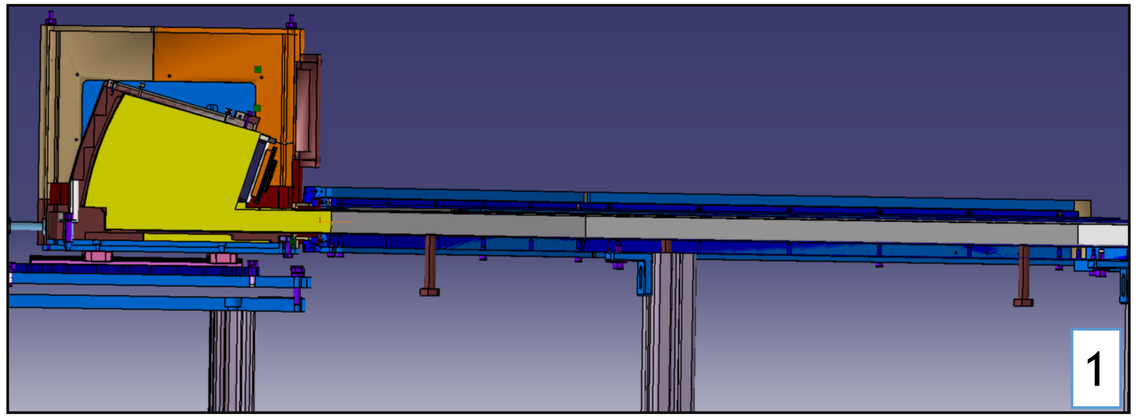


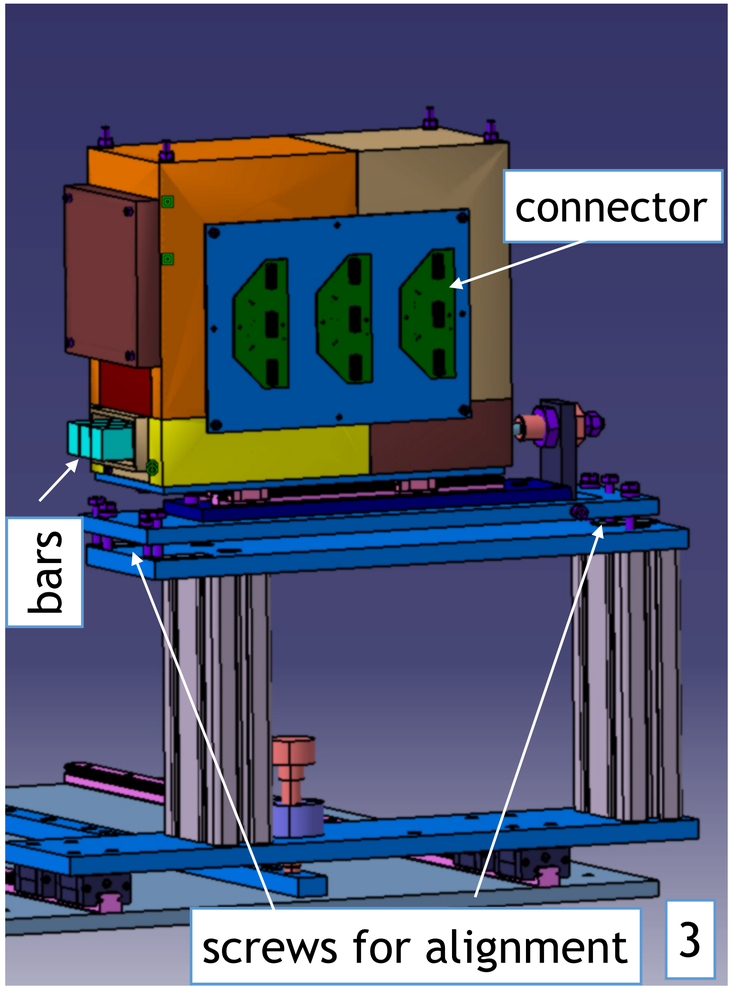




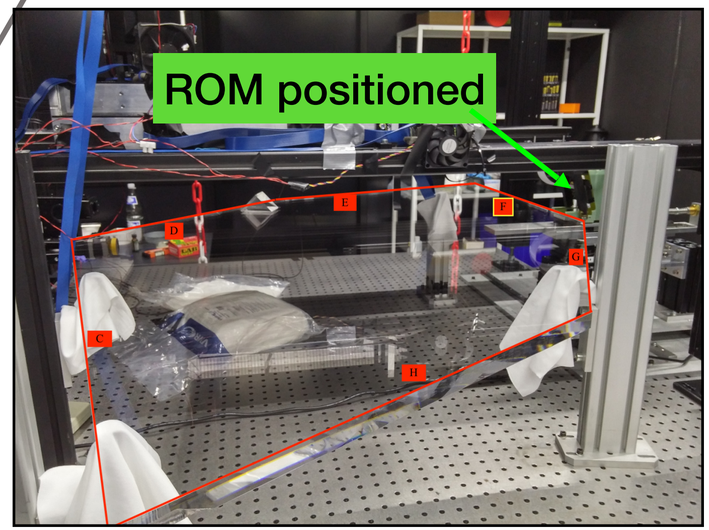
Light-tight cases for radiator and ROM



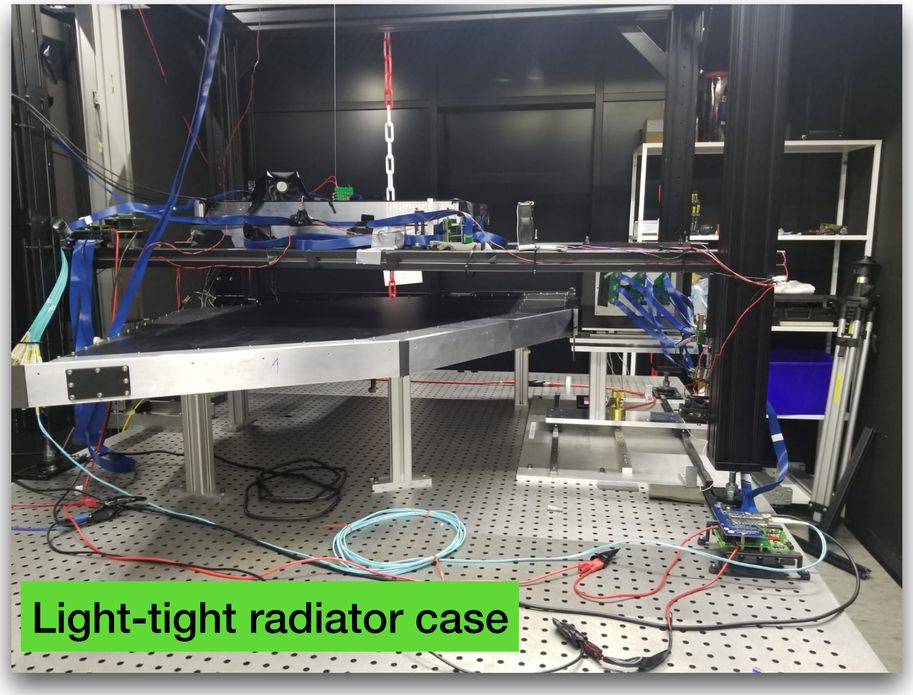


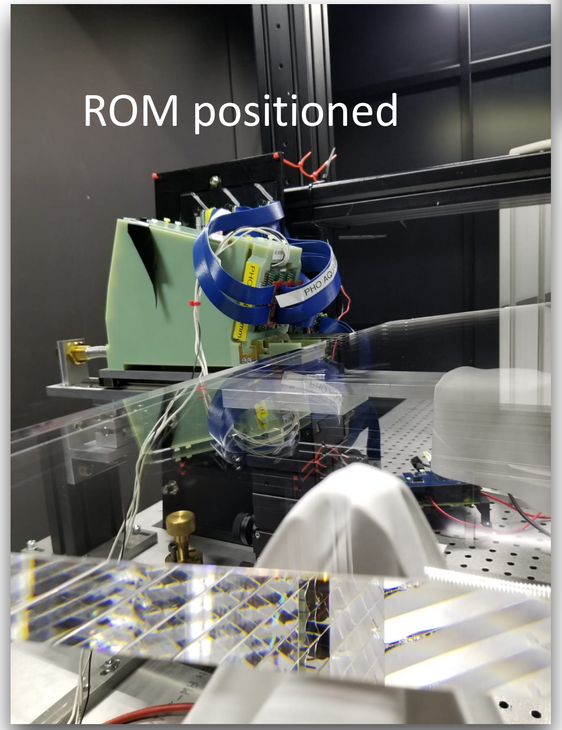


Preparation for the Giessen Cosmic Station



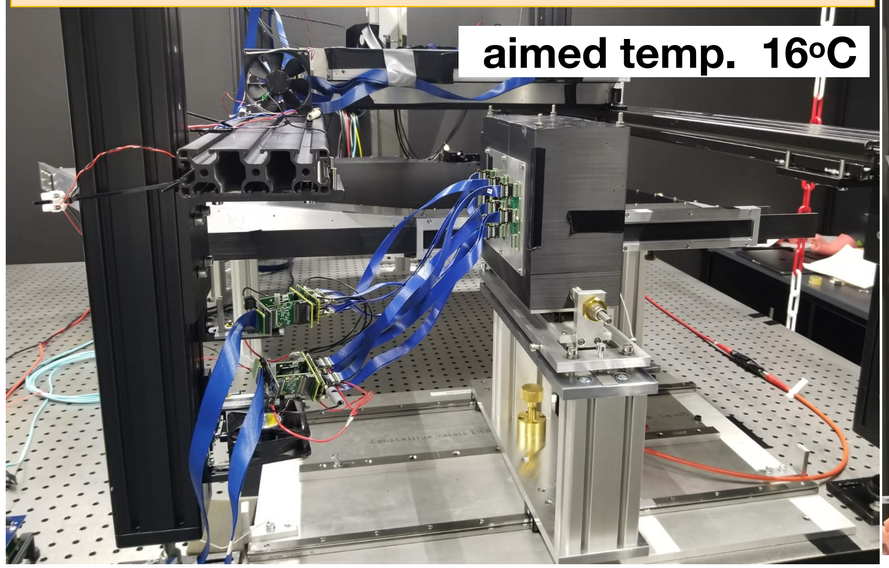
Radiator and ROM case are light-tight, radiator case is also gas-tight.

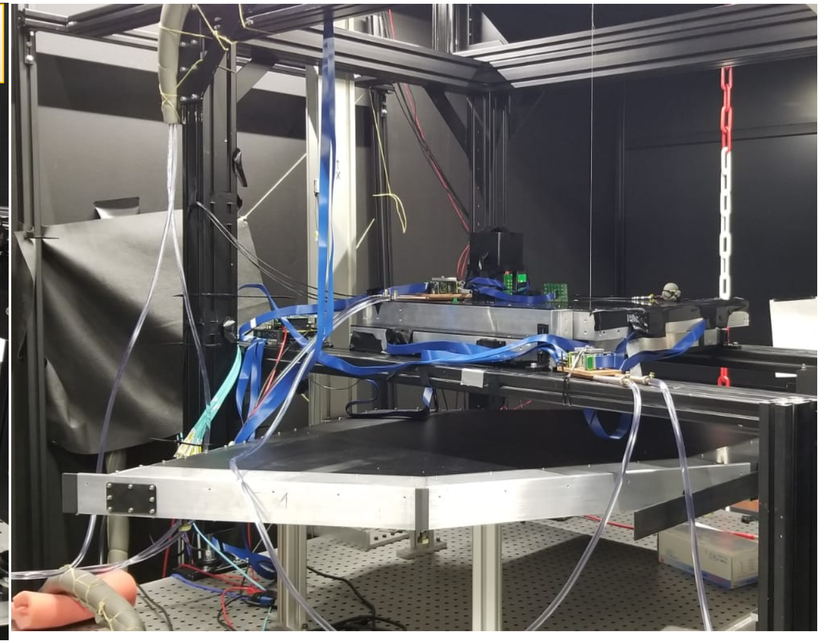




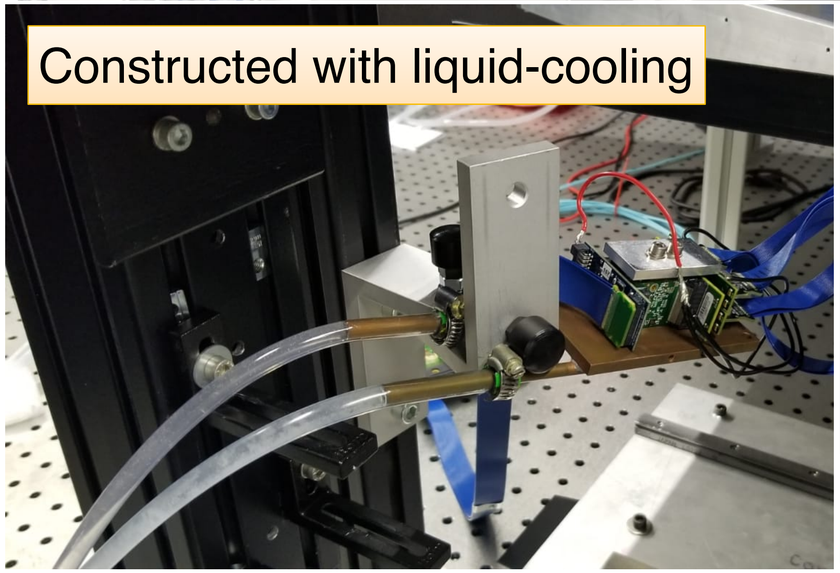
GCS Construction

Constructed with air-cooling $22^oC \pm 0.15$

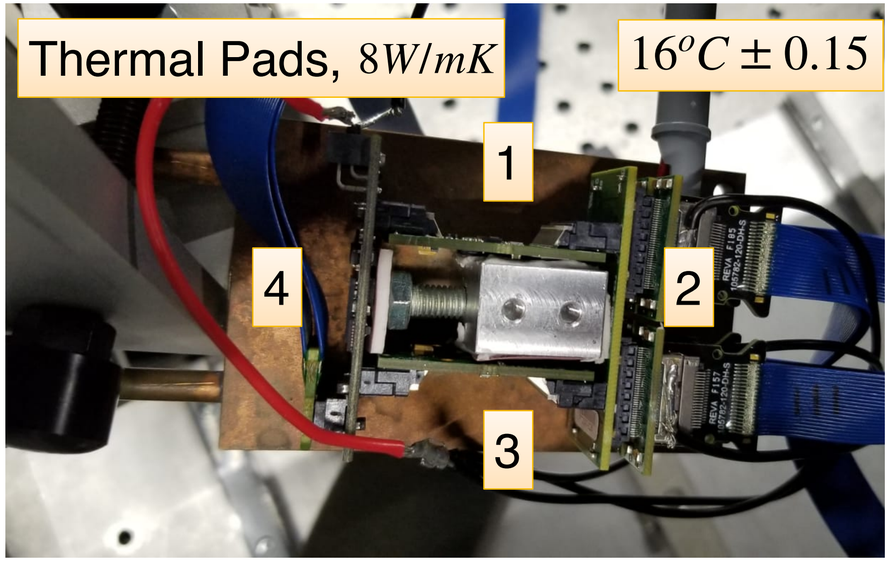




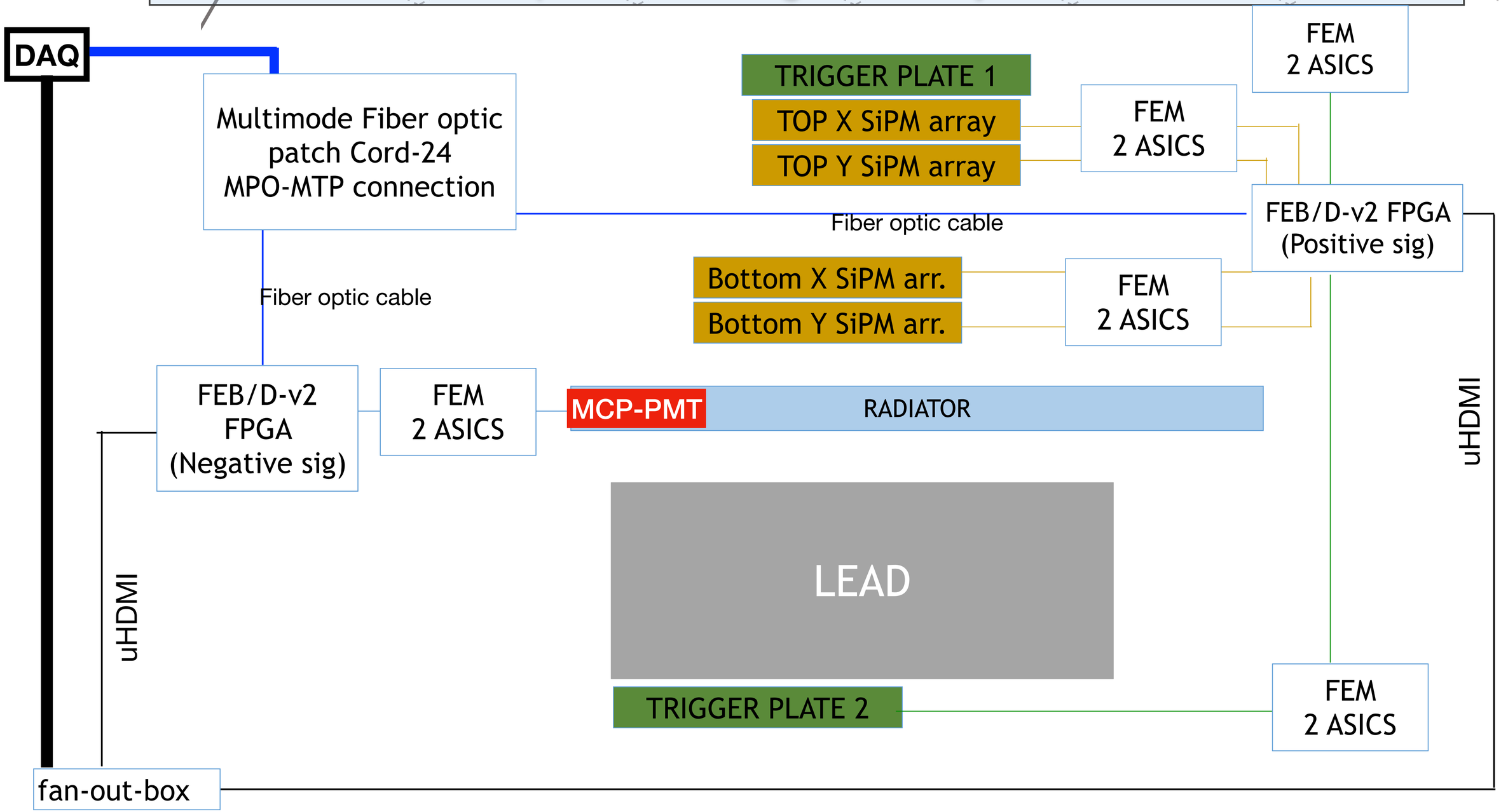
Constructed with liquid-cooling



Thermal Pads, $8W/mK$ $16^oC \pm 0.15$

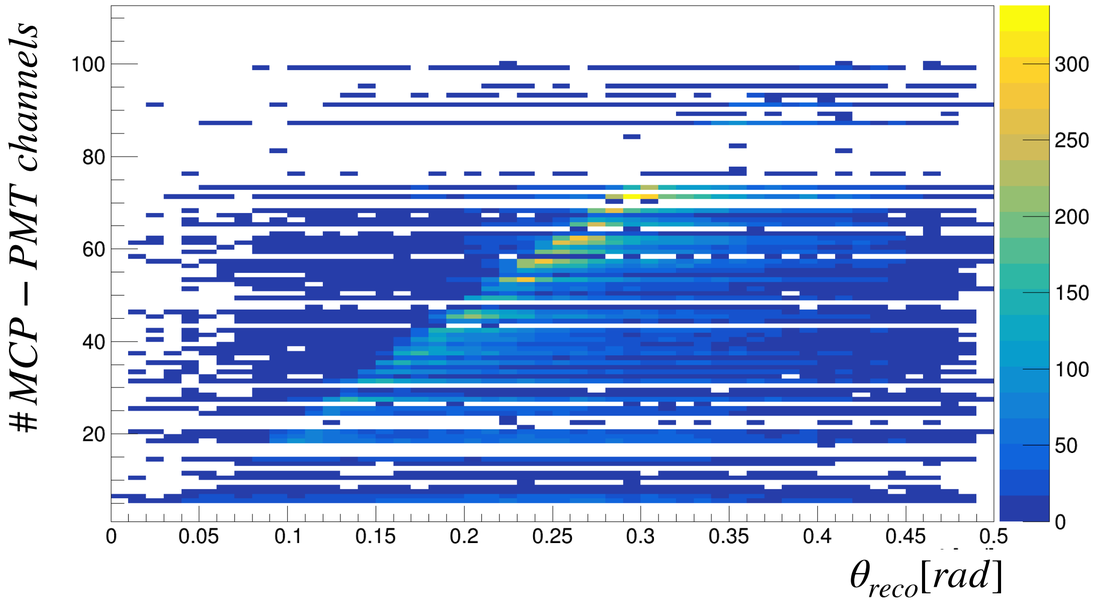


GCS - Data Acquisition existing readout system

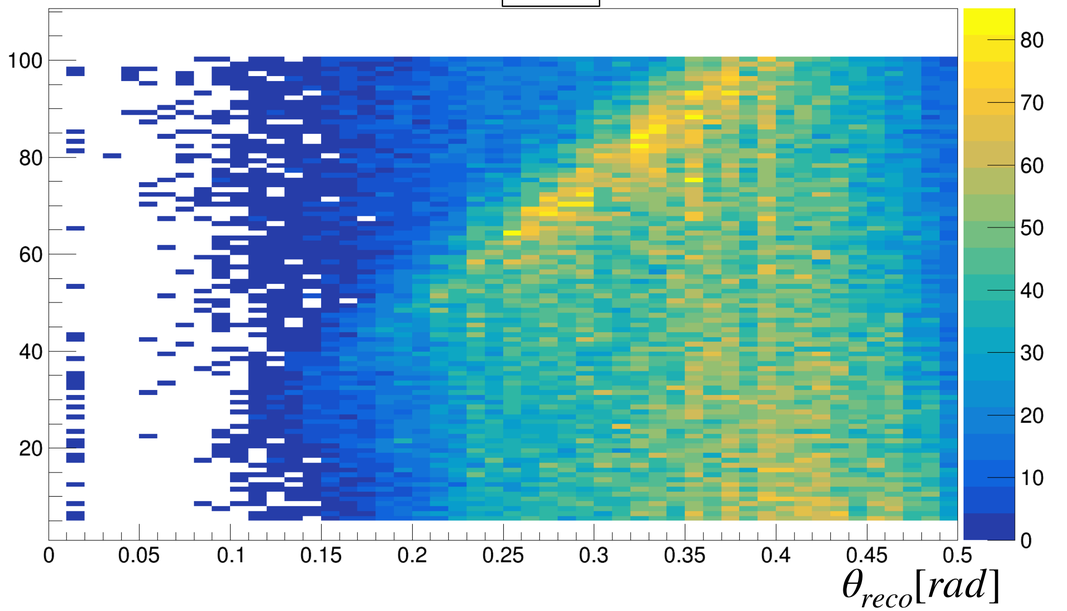


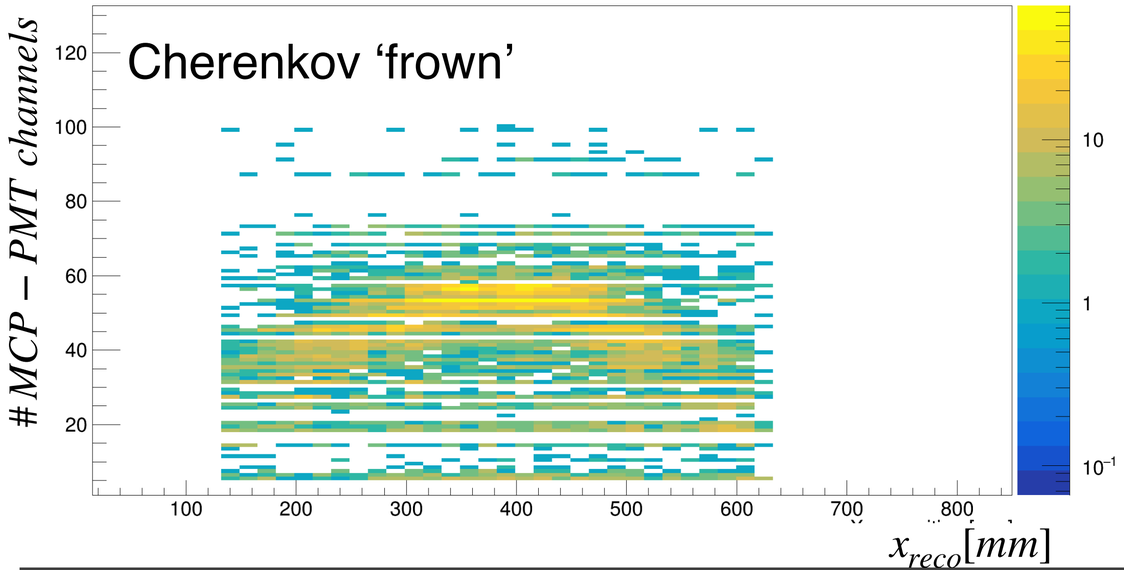
GCS - Data Analysis

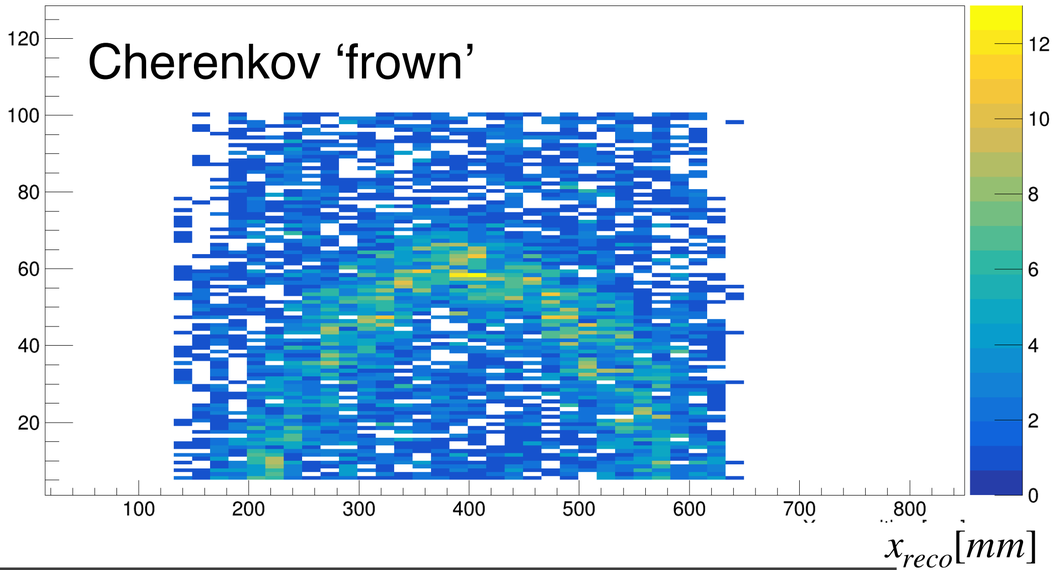
DATA



MC



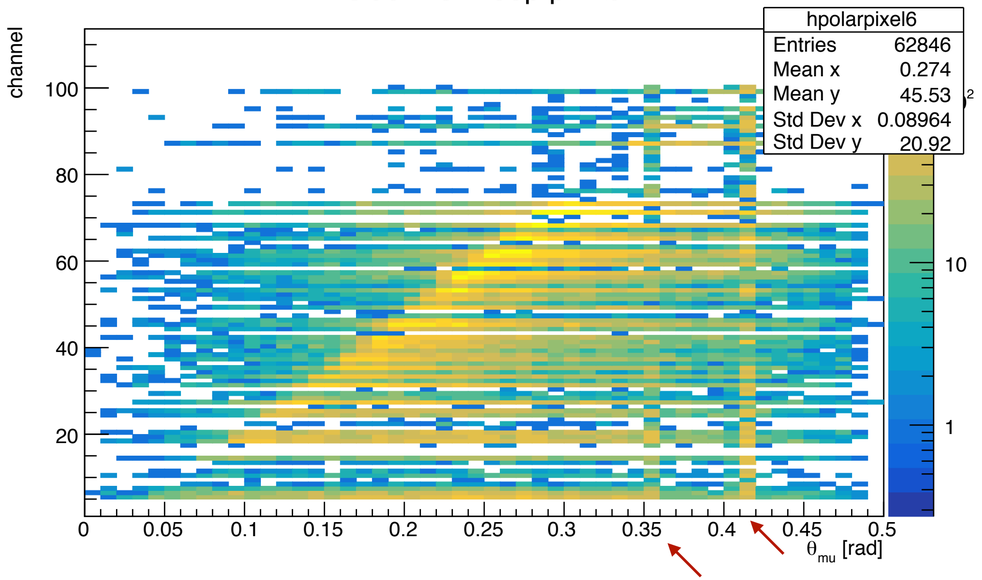




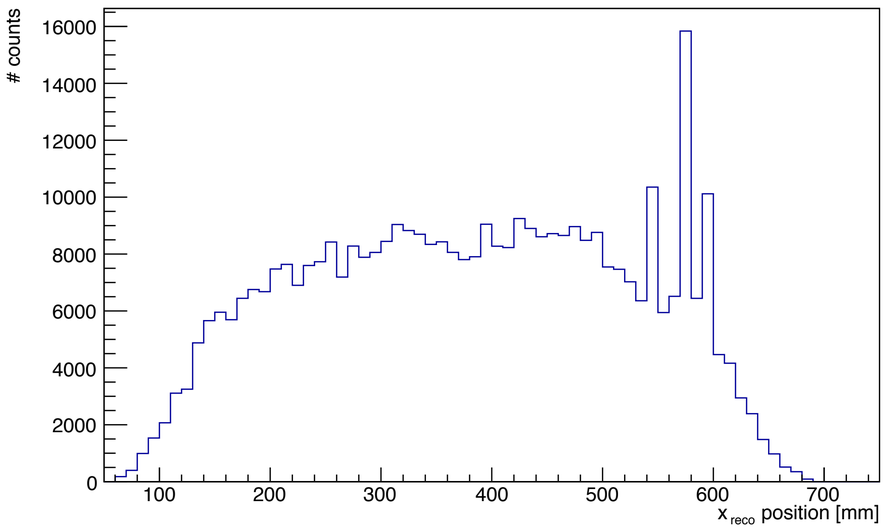
- Good agreement between data and MC.

Pattern investigation

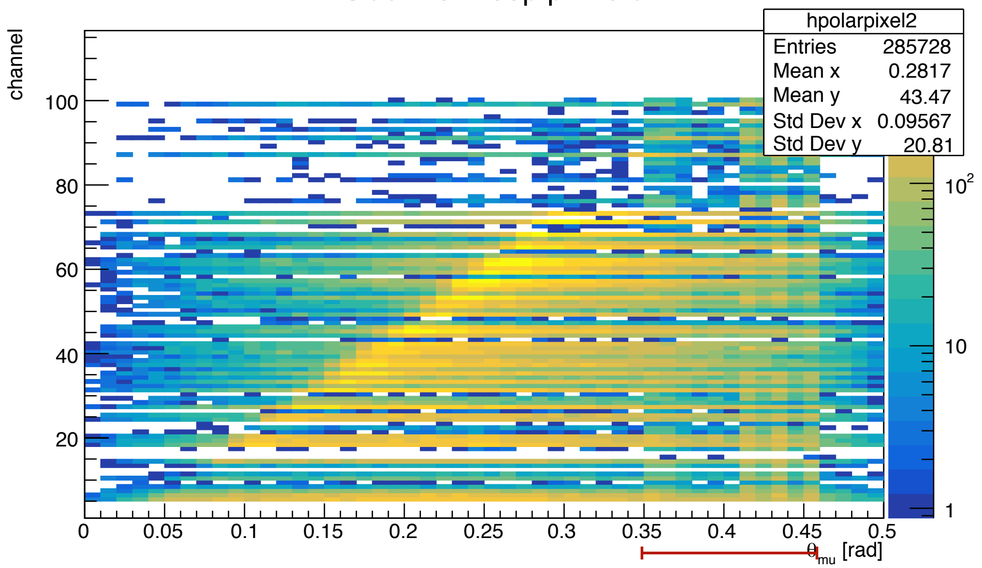
inside MCP loop phi<0.1



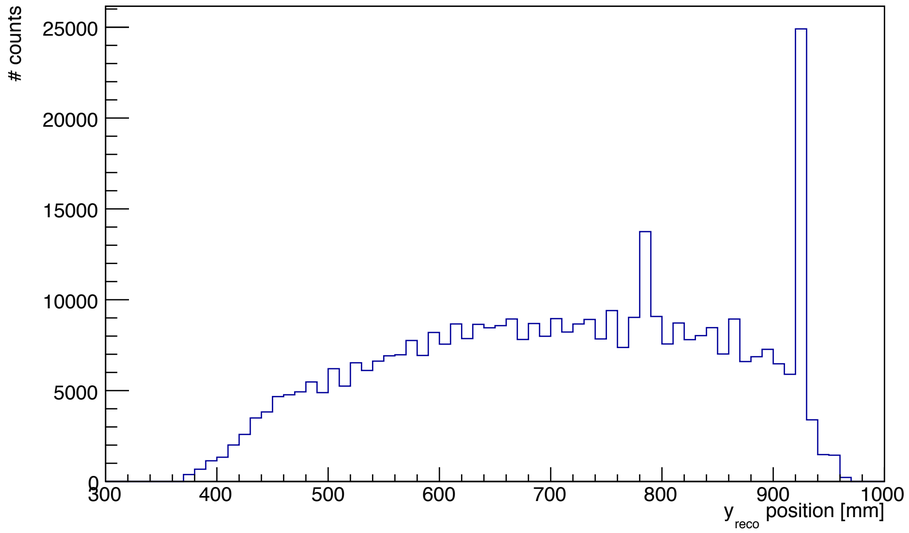
inside MCP loop

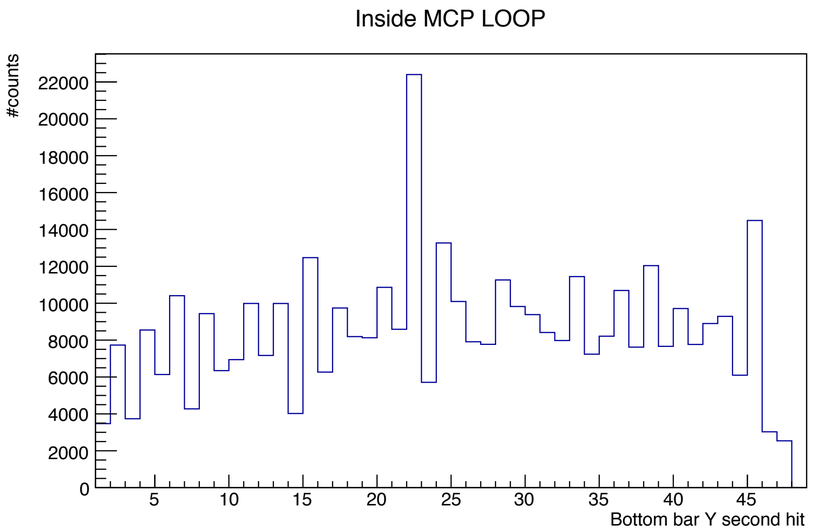


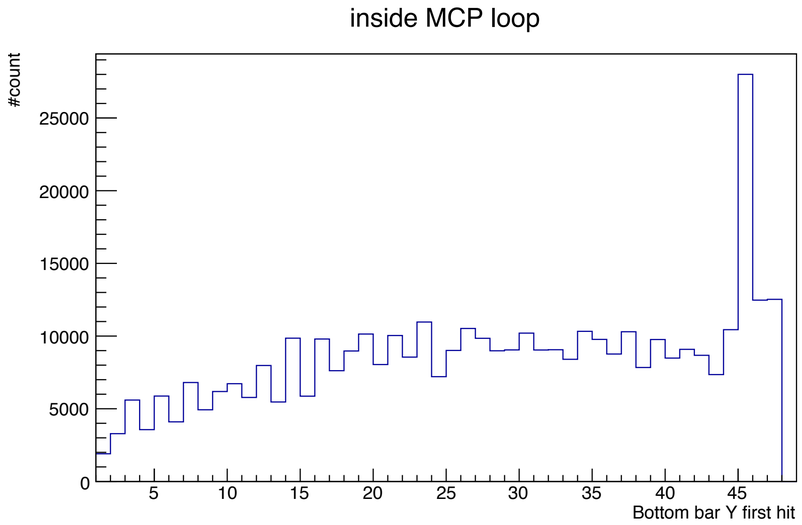
inside MCP loop phi<0.5

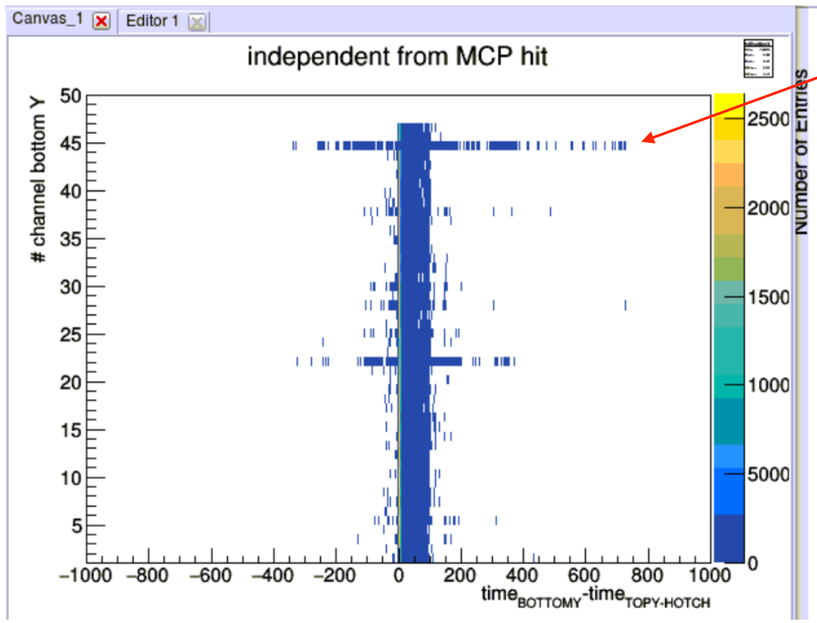


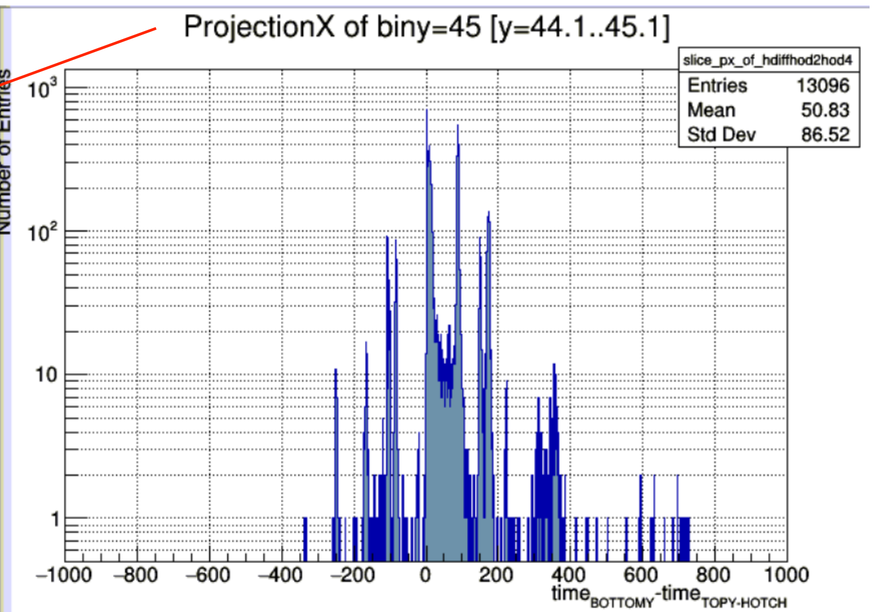
inside MCP Loop




Inside MCP LOOP
#counts
Bottom bar Y second hit

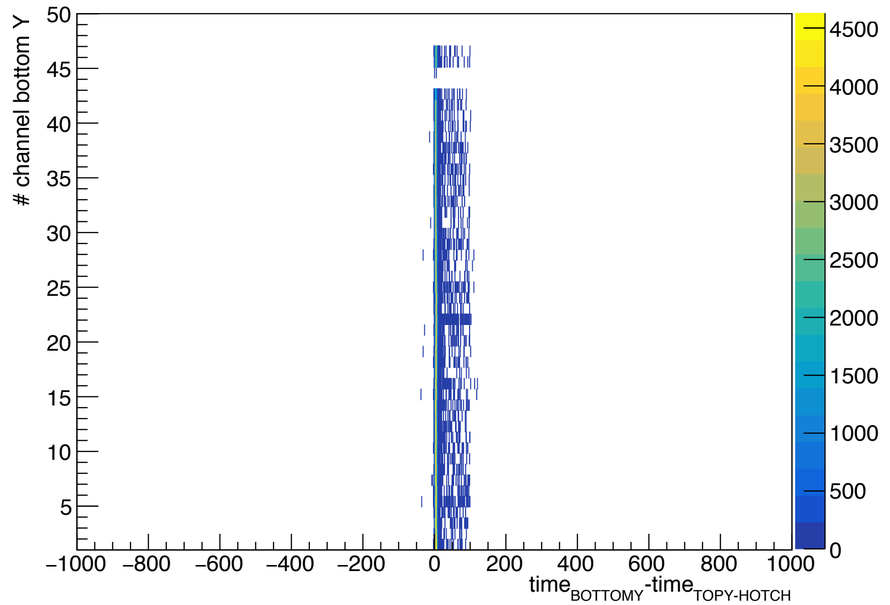

inside MCP loop
#count
Bottom bar Y first hit


Canvas_1
Editor 1
independent from MCP hit
channel bottom Y
time_BOTTOMY-time_TOPY-HOTCH

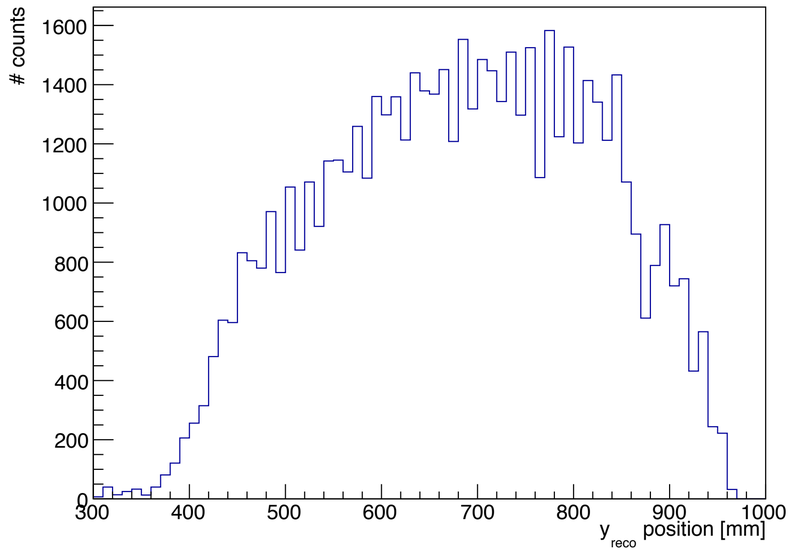

ProjectionX of biny=45 [y=44.1..45.1]
slice_px_of_hdiffhod2hod4
Entries 13096
Mean 50.83
Std Dev 86.52
Number of Entries
time_BOTTOMY-time_TOPY-HOTCH

Excluding specific SiPM bars

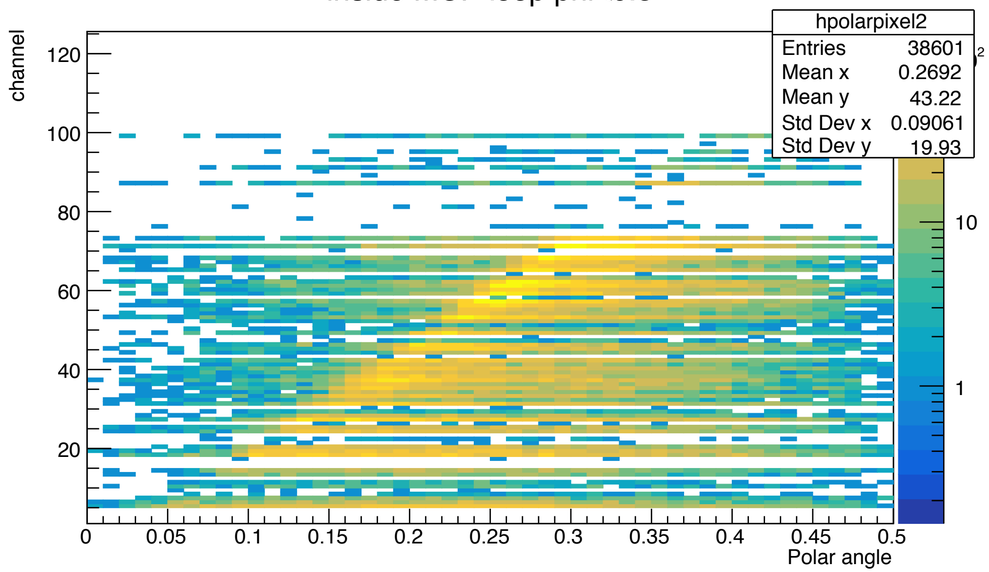
independent from MCP hit



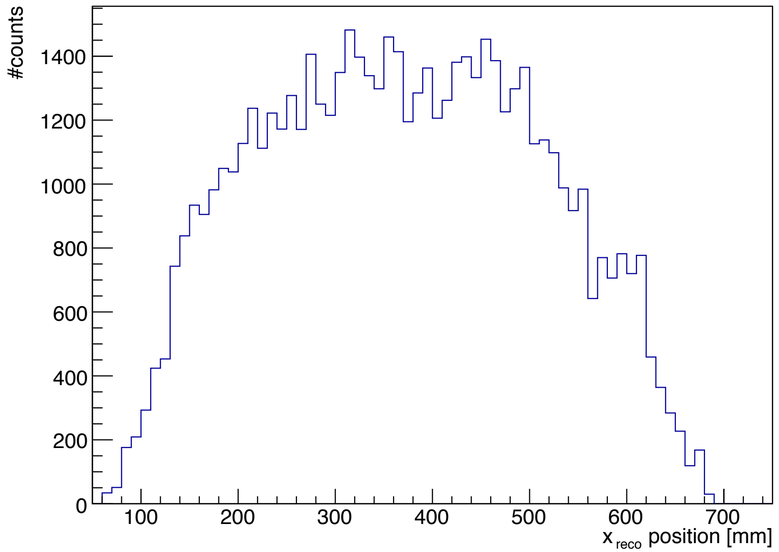
inside MCP Loop



inside MCP loop phi<0.5



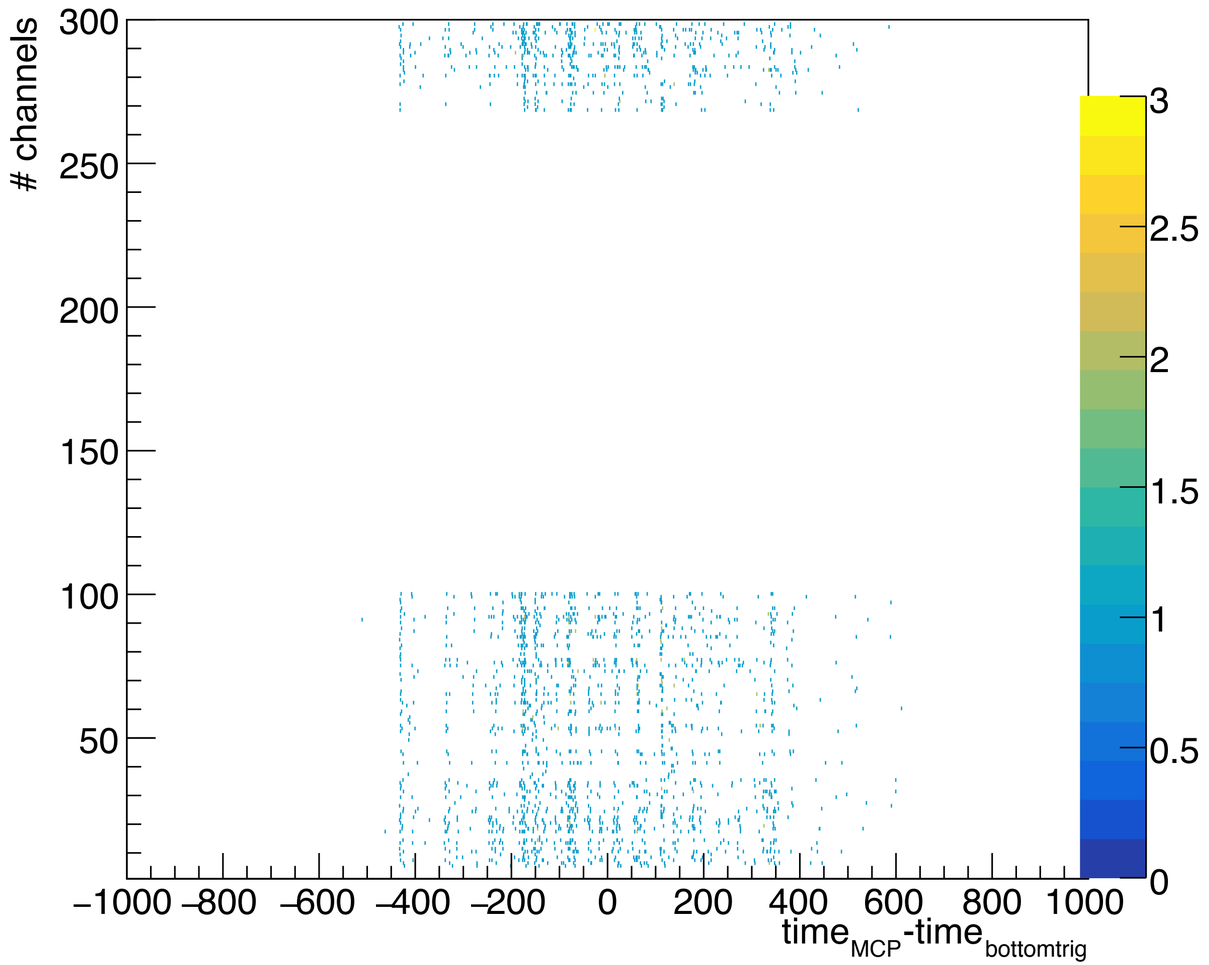
inside MCP loop



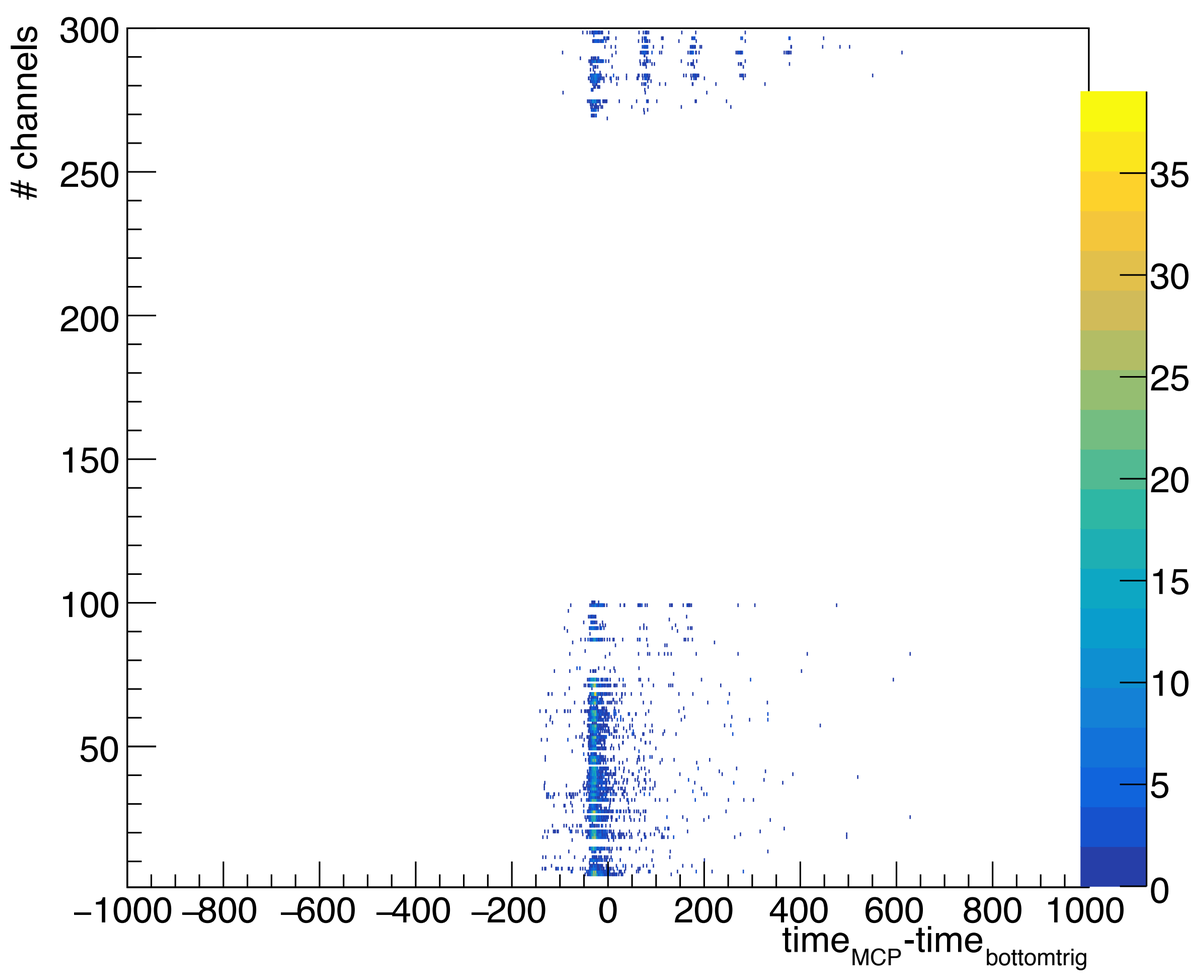
ONLY for hot SiPM bars

hot SiPM bars are EXCLUDED!

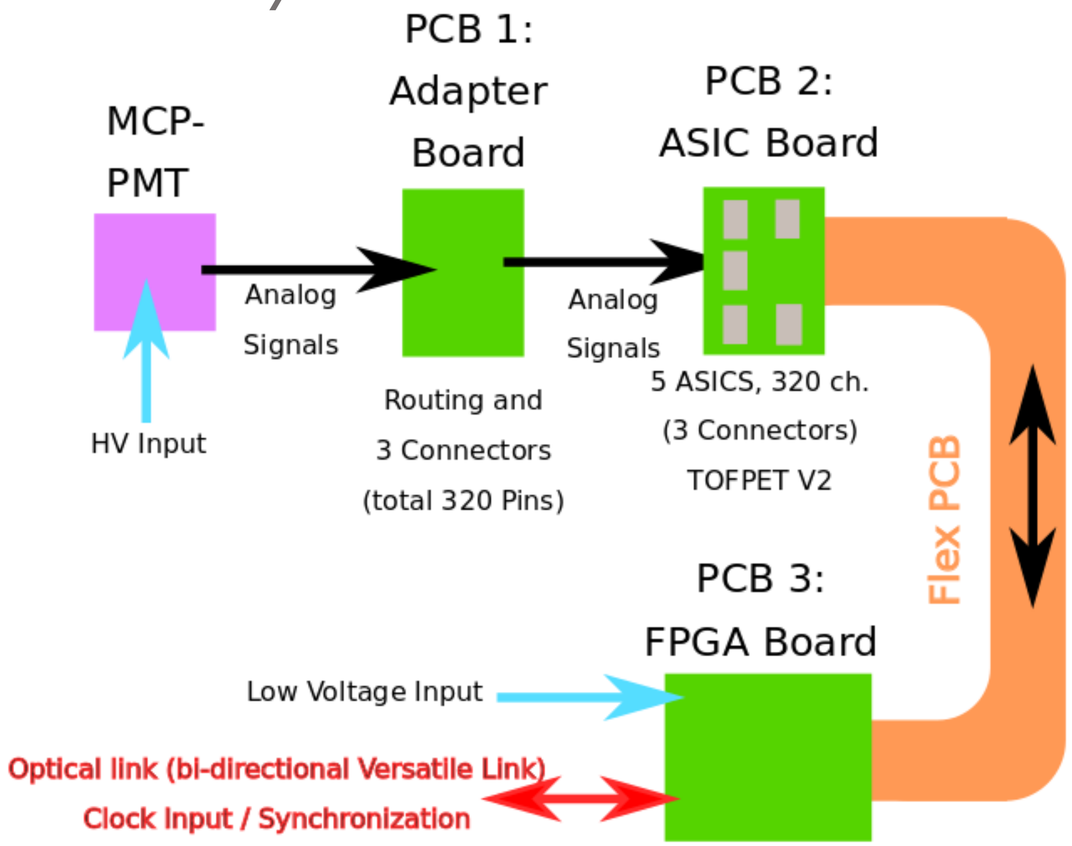
inside MCP loop

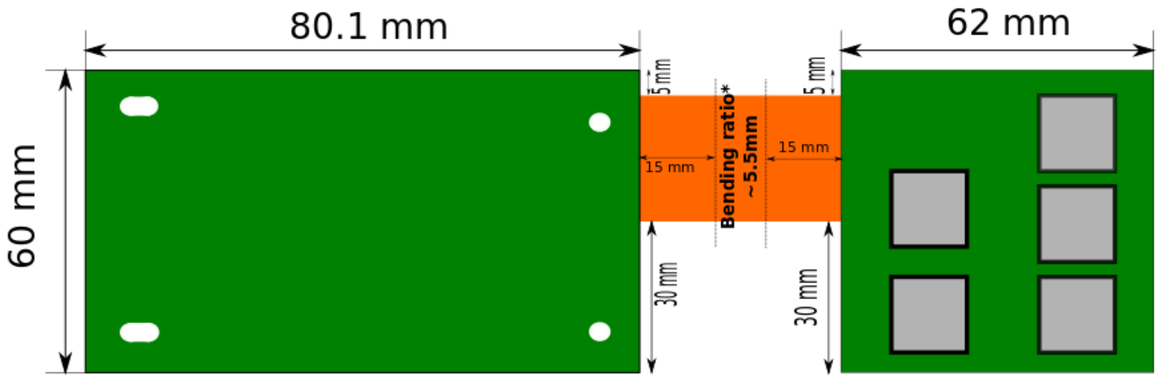


inside MCP loop

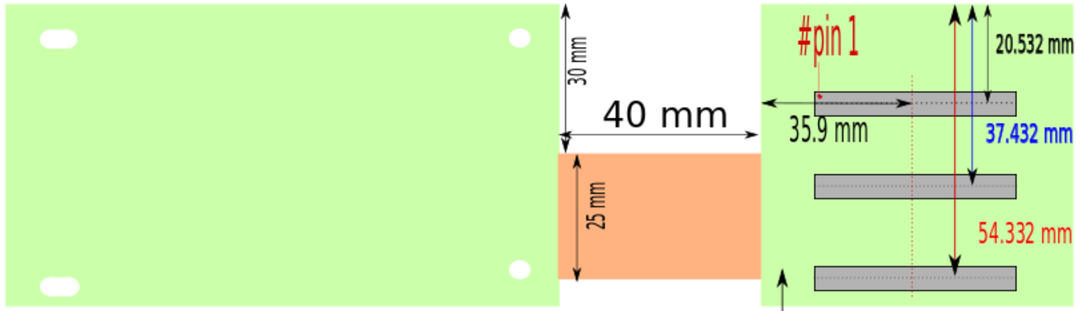


Custom PCB design for compact readout



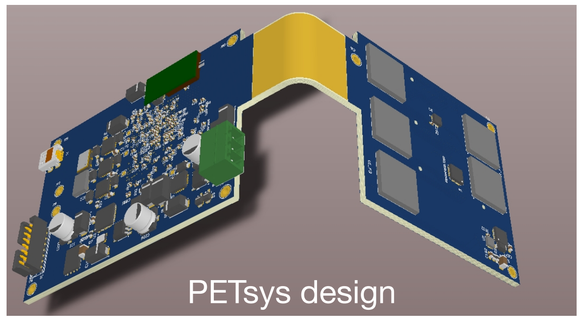


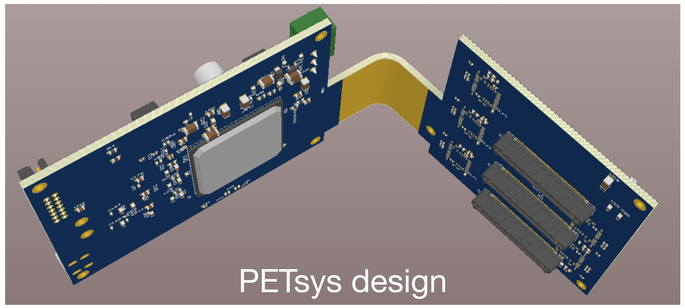
5 ASICs, 320 Channels



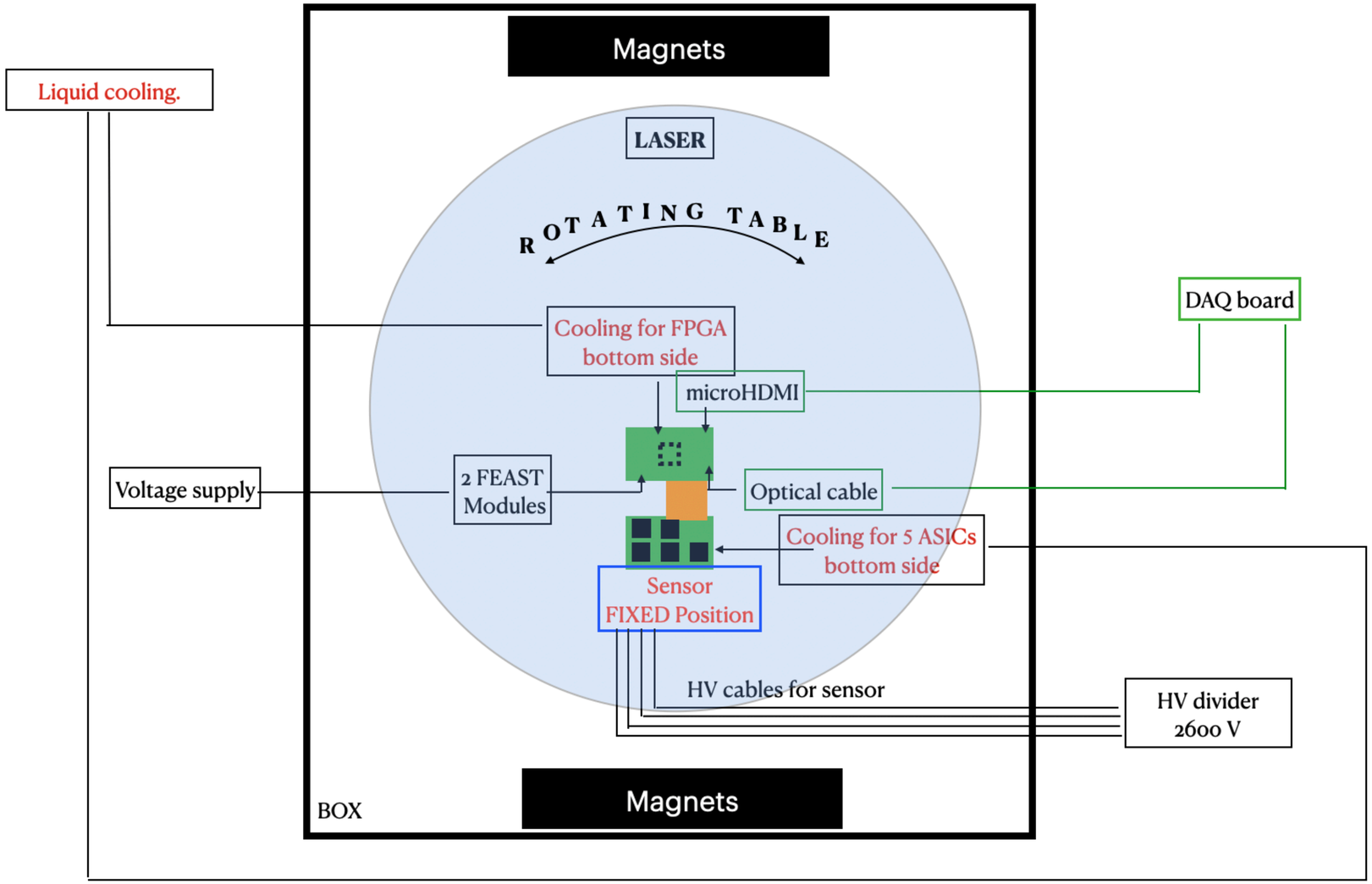
Connectors to adapter PCB

- Spatial constraints (Neighboring detector)
- Environmental factors (Magnetic field)
- FPGA choice to communicate central DAQ system
- Cooling system



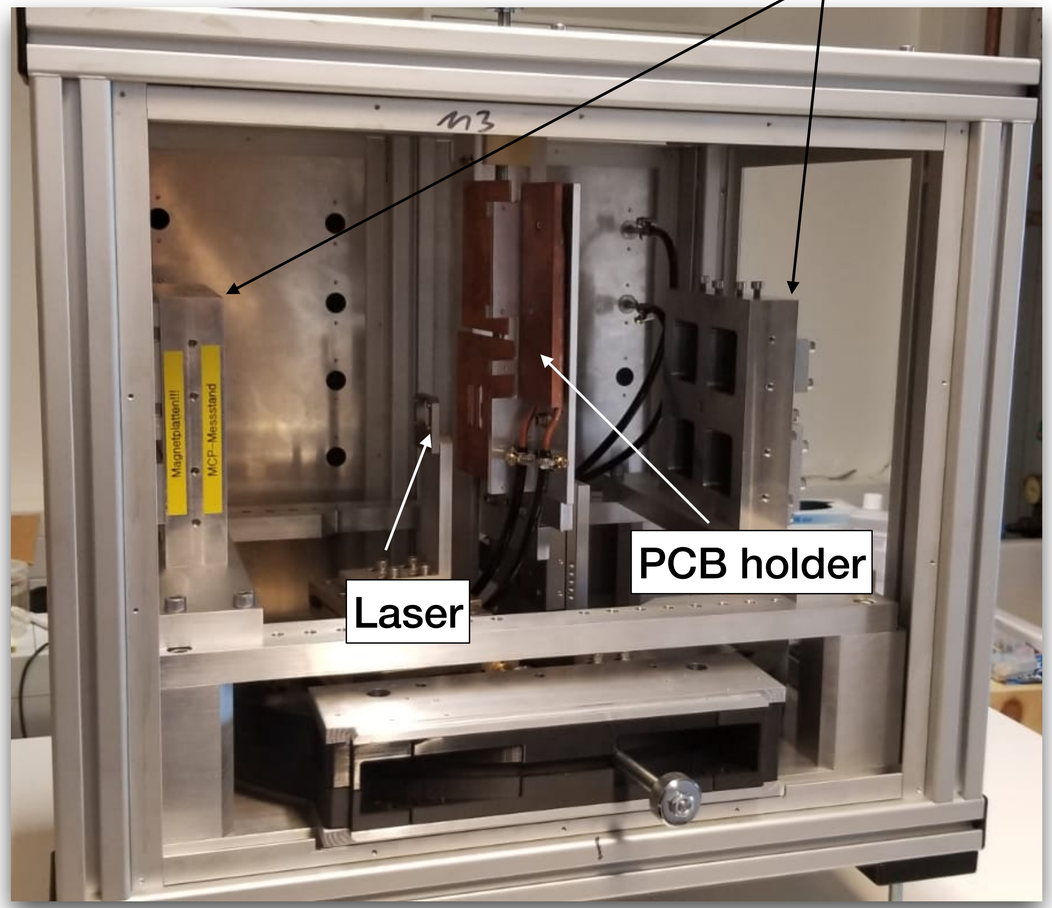


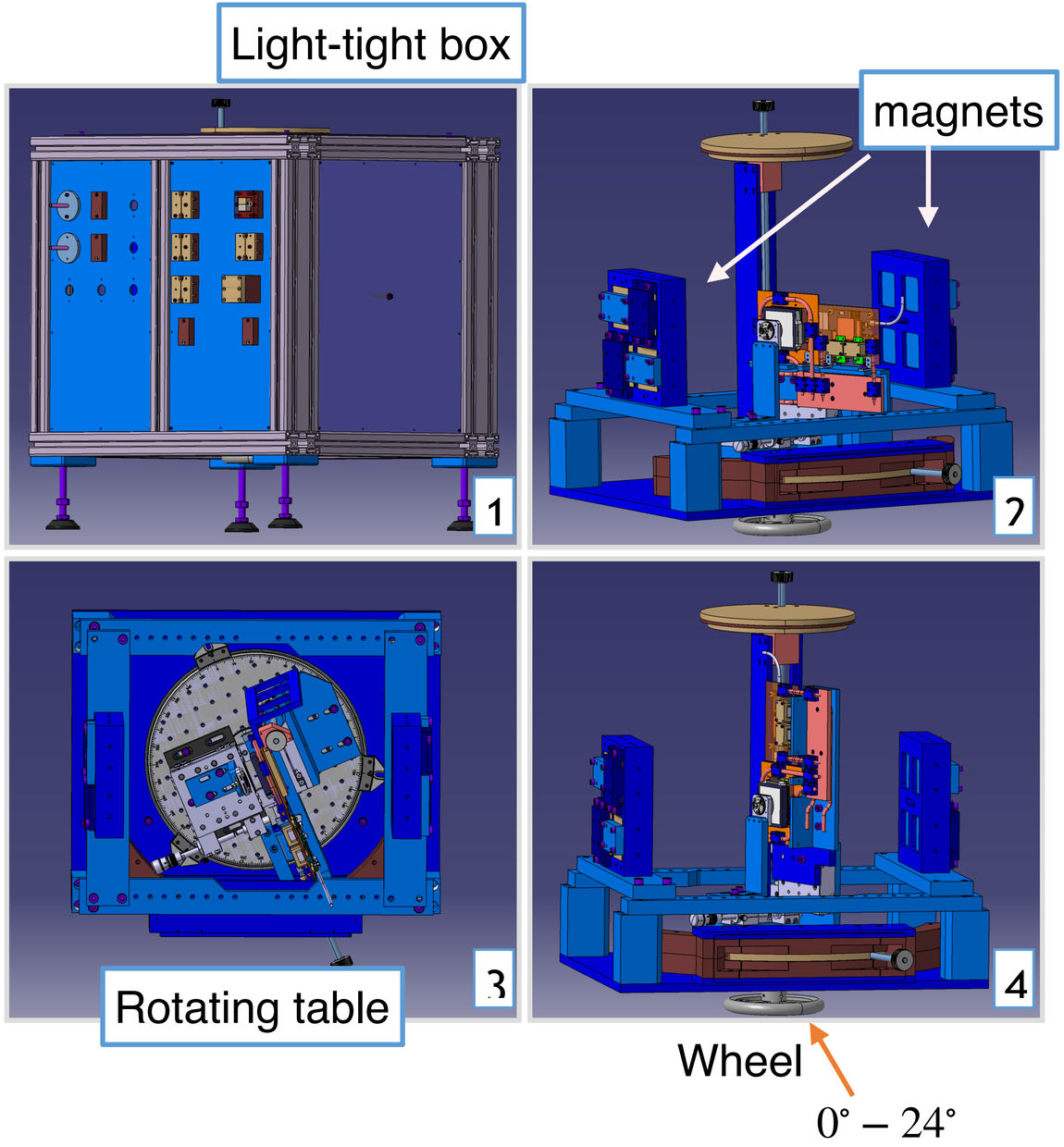
Development of a light-tight magnet box for testing custom PCB



Magnet Box design

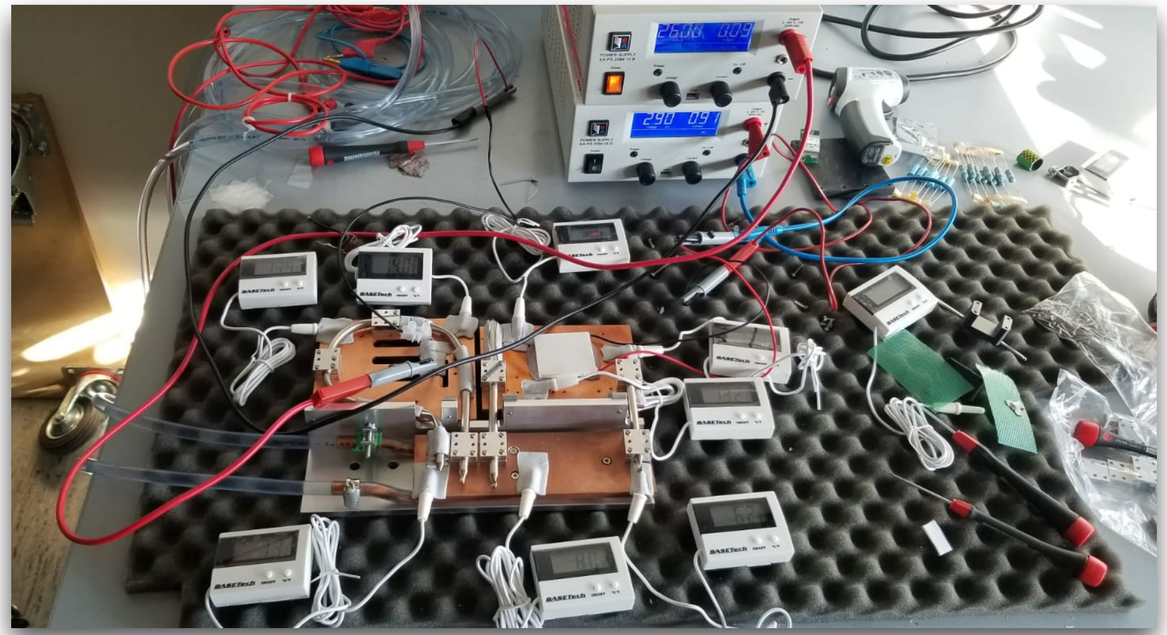
- Magnet box is designed to test the custom design PCB with(out) permanent magnets.

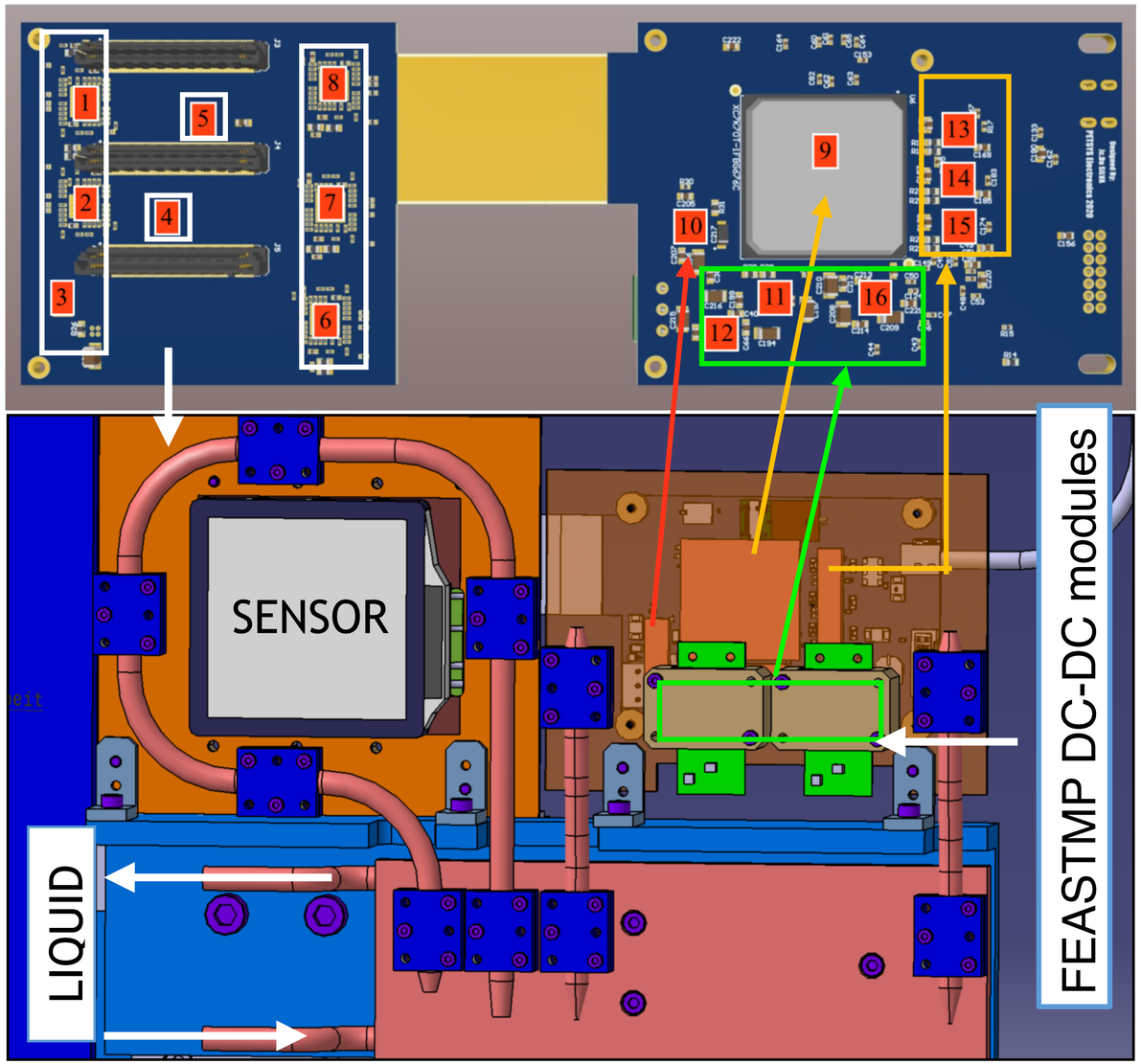




PCB cooling system

- There are 16 hot parts for the custom design PCB to be cooled down and 2 DC-DC modules.
- Cooling system includes 3 heat pipes clamped to the one main copper plate which has U-shaped pipe with liquid.
- The tests have been started.





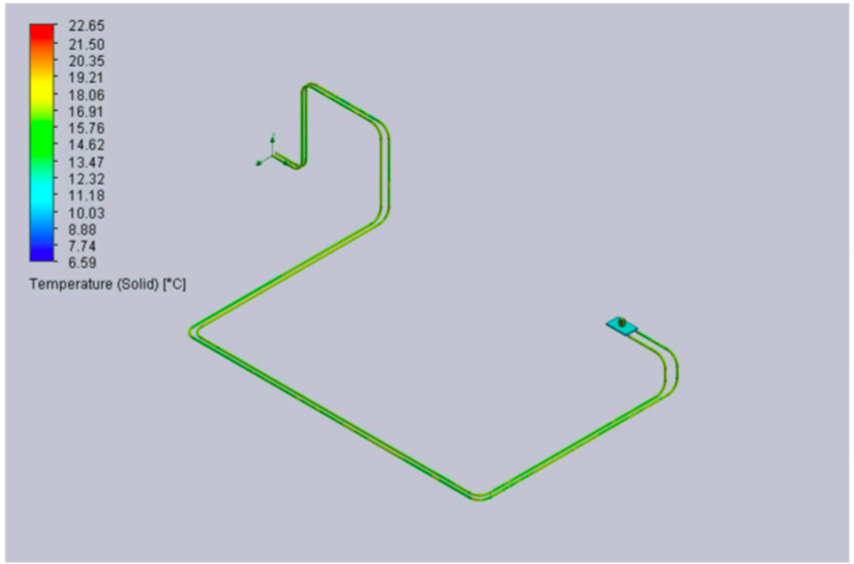
GCS Cooling

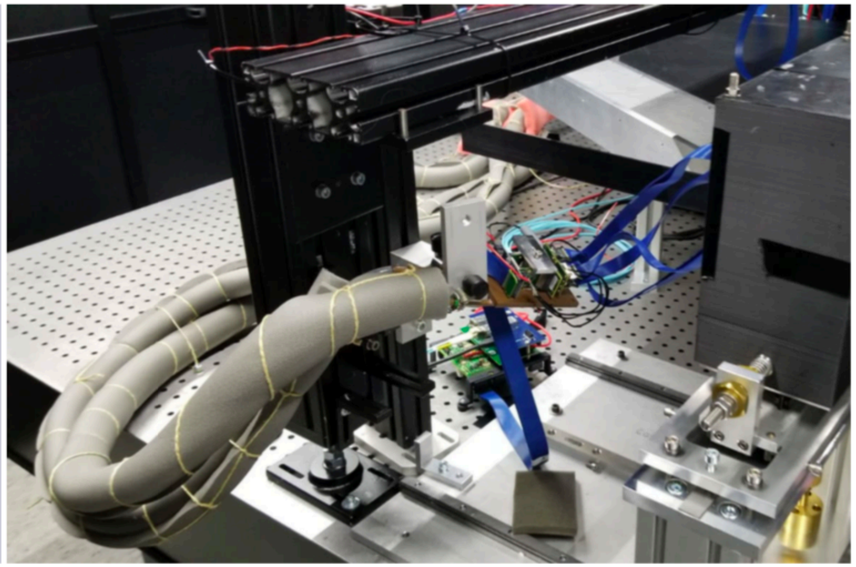
Until now:

- Simulation of one water cooled front-end module
  - Implementation of simulation setup at GCS
  - Validation of simulation results

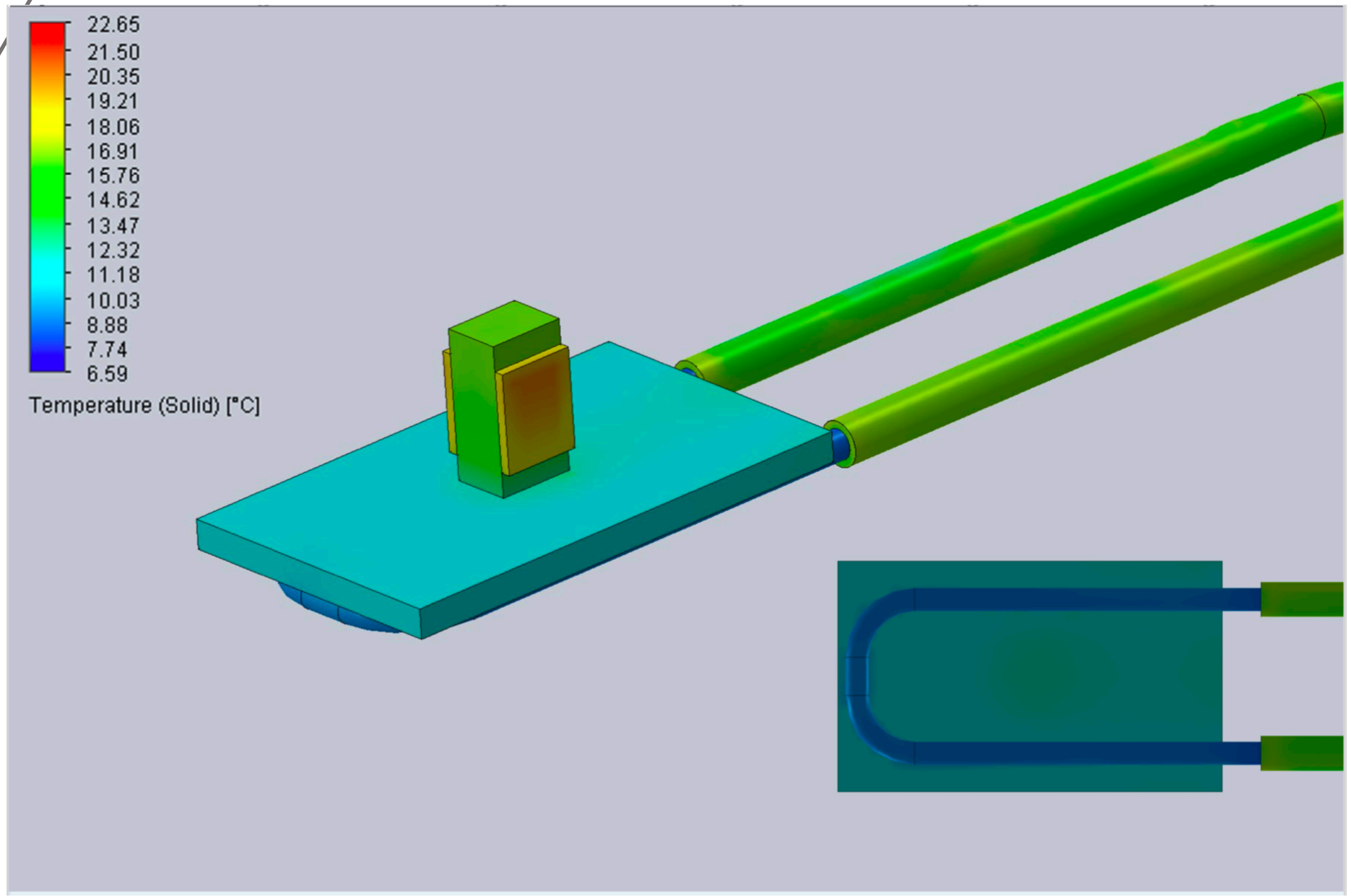
Now:

- Water cooling system applied to five front-end-modules at GCS
- Works sufficiently and without any further problems

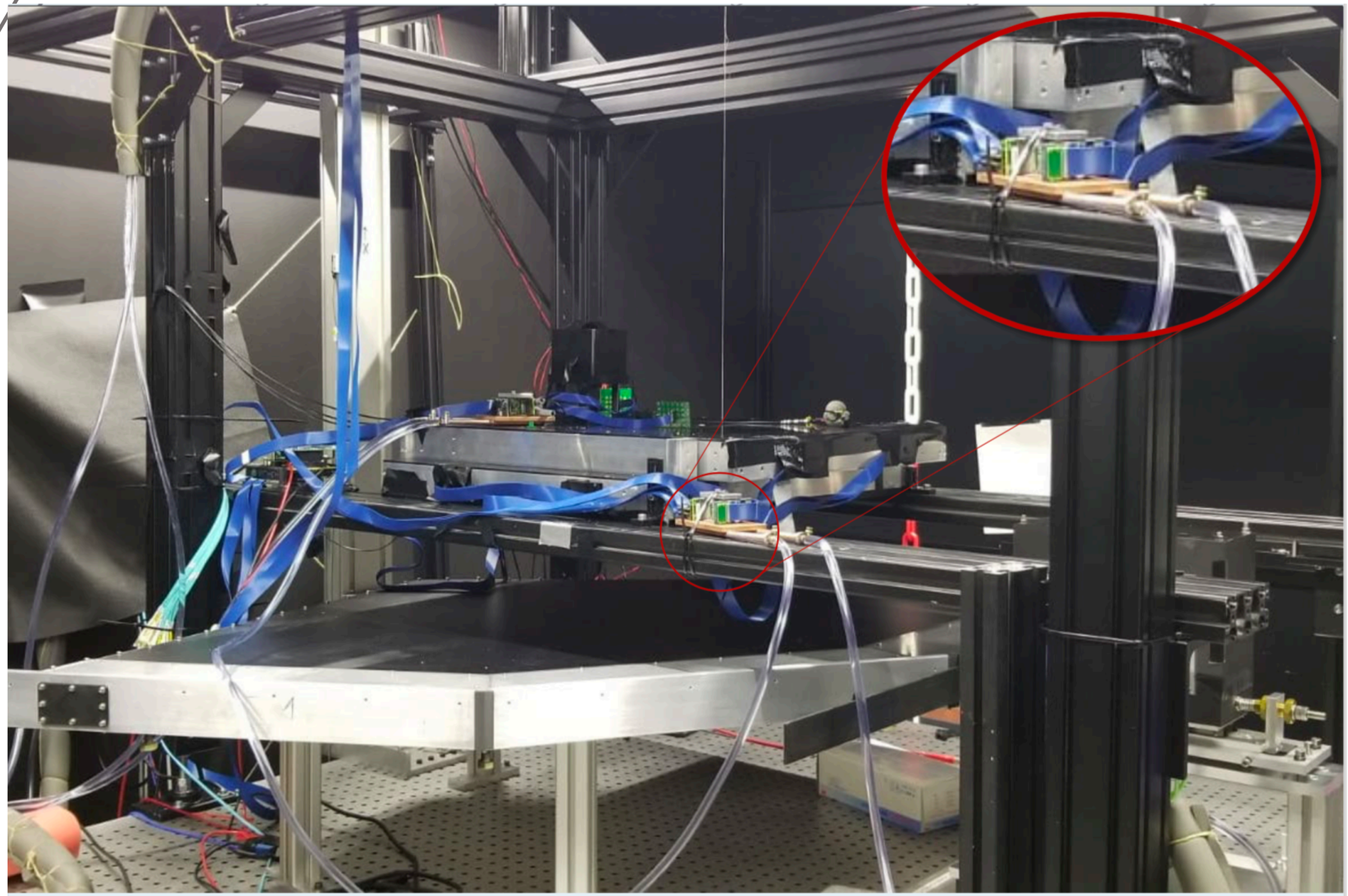




GCS Cooling

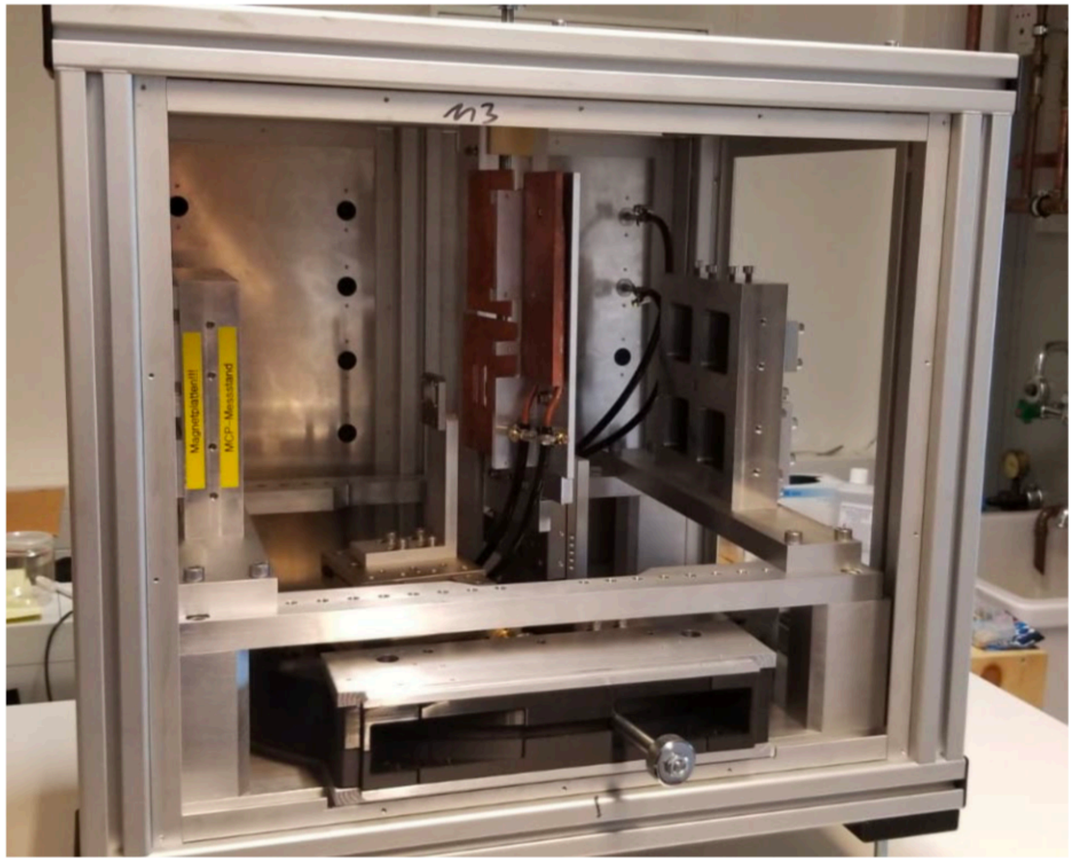

22.65
21.50
20.35
19.21
18.06
16.91
15.76
14.62
13.47
12.32
11.18
10.03
8.88
7.74
6.59
Temperature (Solid) [°C]

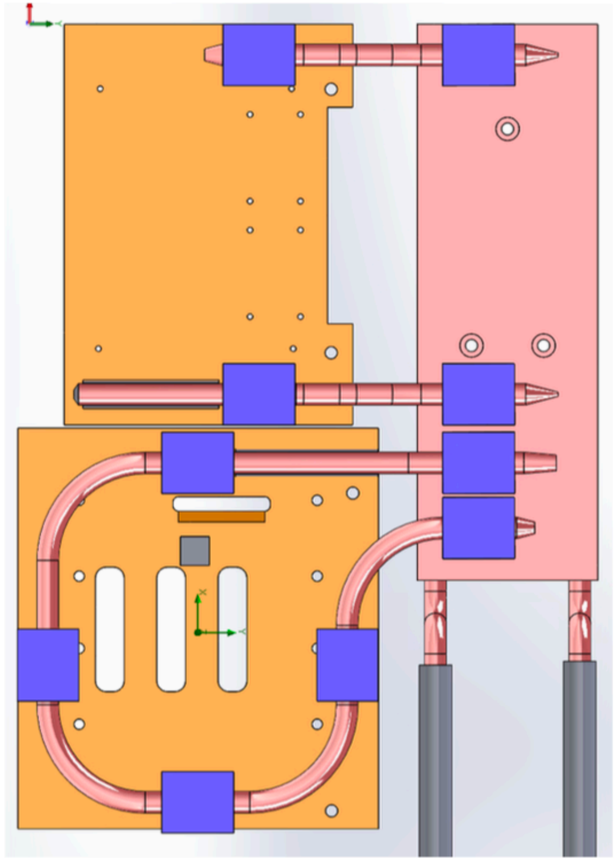
GCS Cooling



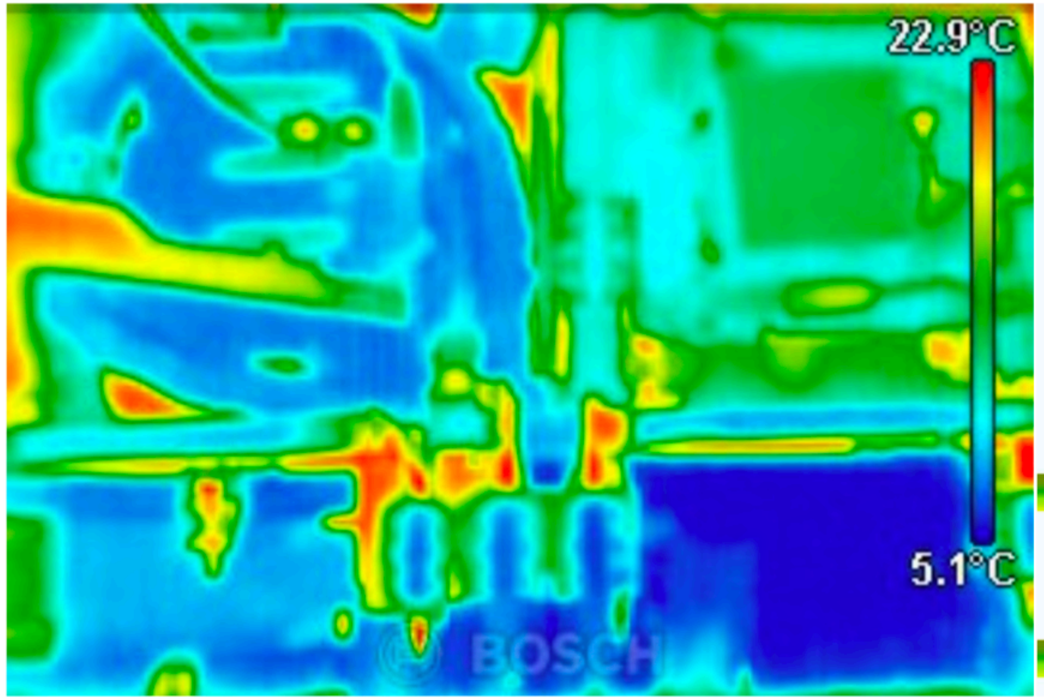
Magnet box cooling

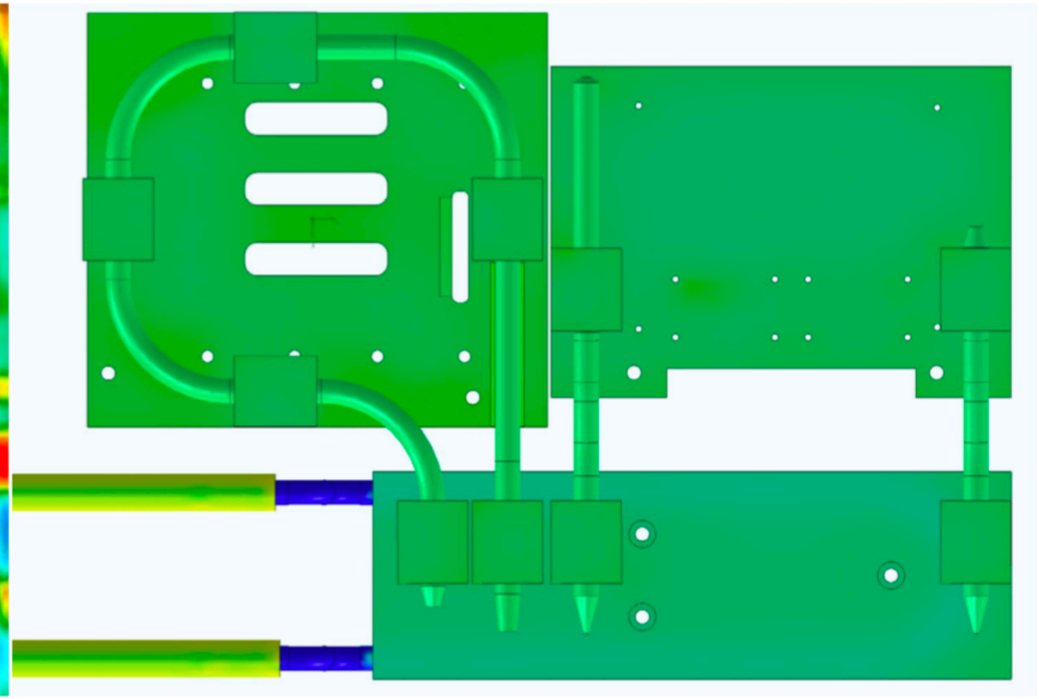
- Test stand for new custom PCB design
- Cooling construction with liquid cooling and heat pipes
- Comparison of experiment and simulation



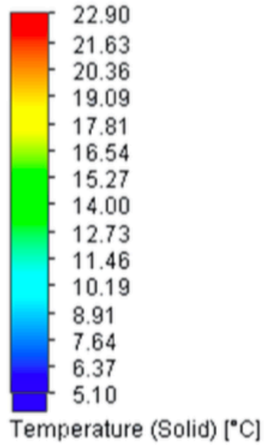


Magnet box cooling

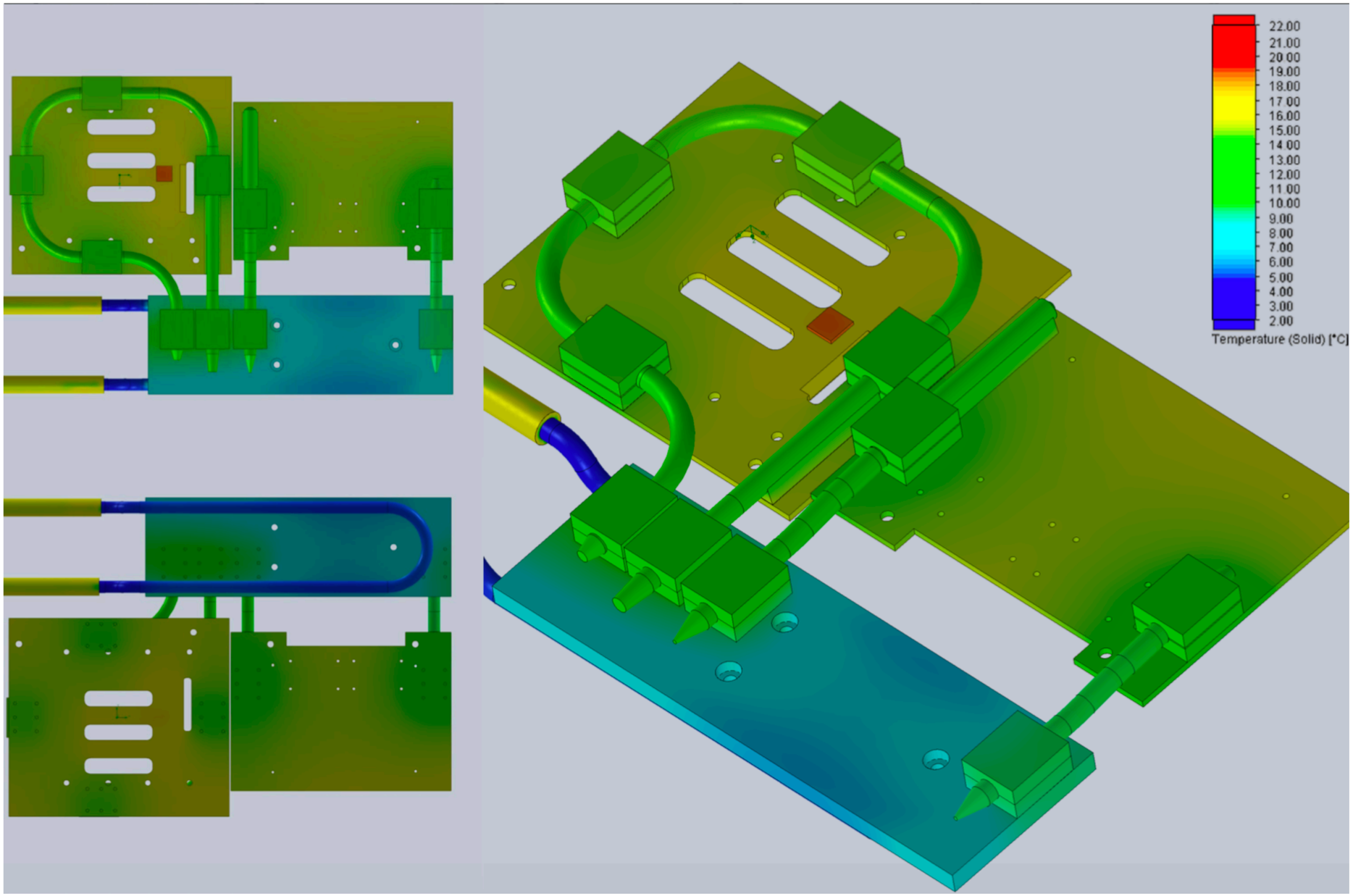




Heat camera picture of the experimental setup versus simulation result



Magnet box cooling

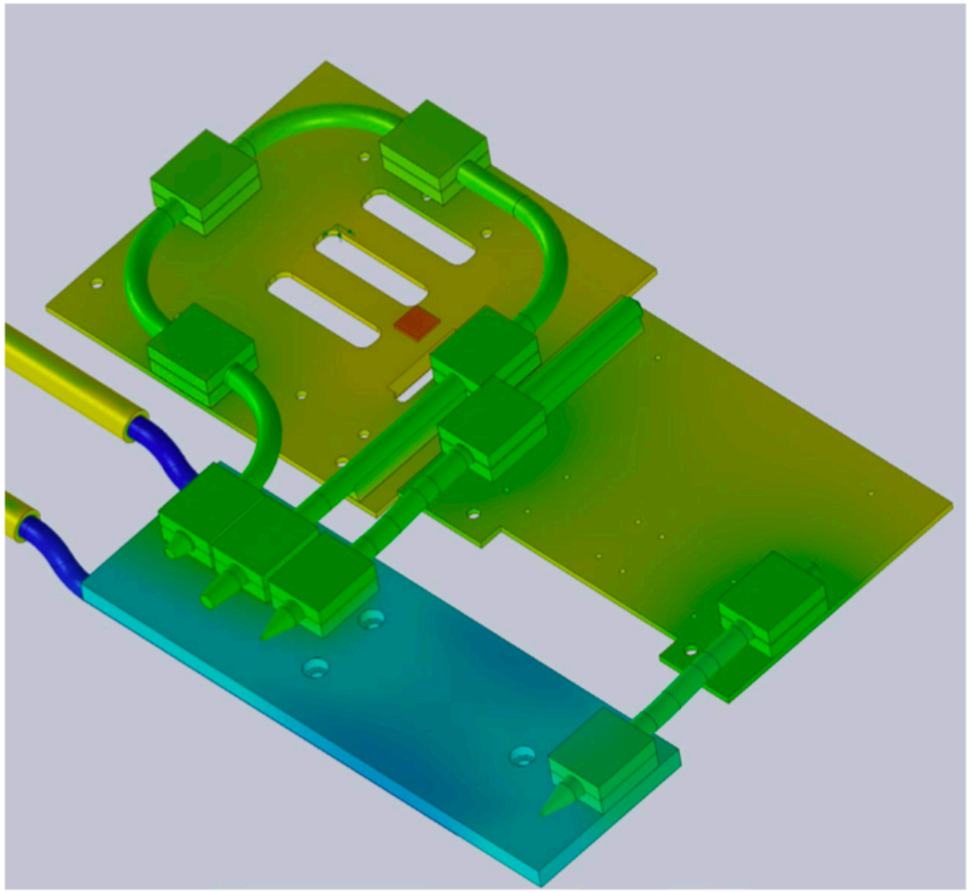


Conclusion

- Good progress on recreating cooling systems in Solidworks in general
- Validation of simulation with experiments

Future plans

- Simulation of current GCS cooling system with five Front End Modules
- Proceed on imitating new custom PCBs heat generation in experiment
- Simulation of Magnet Box Cooling system with more heat sources



Thank you for your attention!