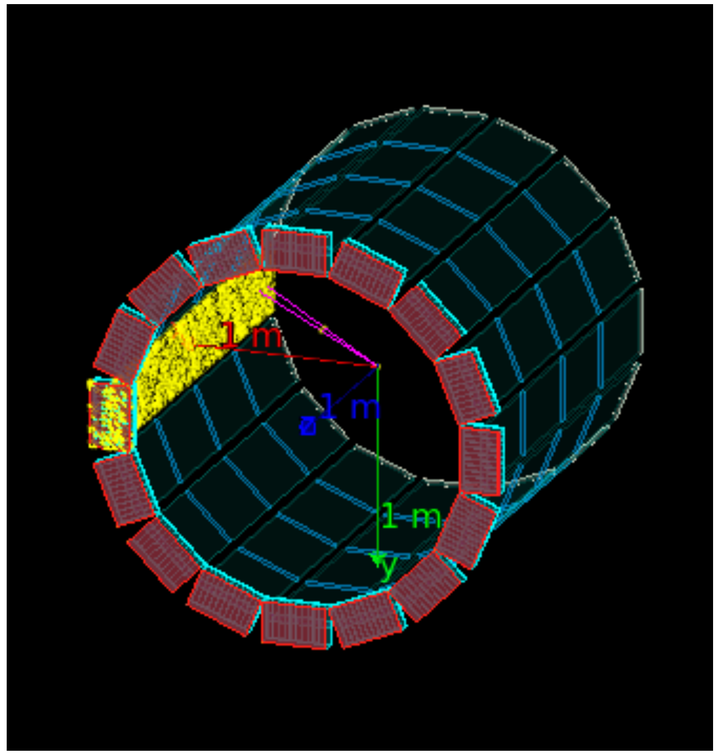
Giessen prototyping of fDIRC's for SCTF
Cremlin+ Task 5.6



Michael Dueren, Avetik Hayrapetyan, Mustafa Schmidt

WP 5.6

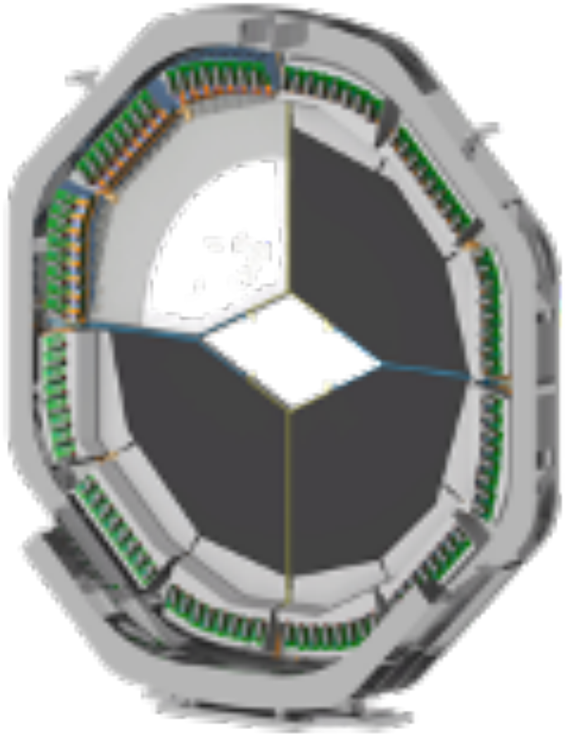
JUSTUS-LIEBIG-UNIVERSITÄT GIESSEN

and

Budker Institute of Nuclear Physics

for

CREMLIN PLUS
Connecting Russian and European Measures for Large-scale Research Infrastructures



JUSTUS-LIEBIG-UNIVERSITÄT GIESSEN

Bundesministerium für Bildung und Forschung

This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No. 871072

WP 5.6 Deliverables and Milestones

- Deliverables
- **D5.8 M24** Status report on R&D work on Particle Identification(PID) system for the SCT detector
- **D5.9 M44** Final report on R&D work on Particle Identification(PID) system for the SCT detector
- Milestone
- **6 M42** Prototype for PID system of the SCT Detector (Conference contribution)

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The SCTF detector volumes and PID part (here the FARICH version)

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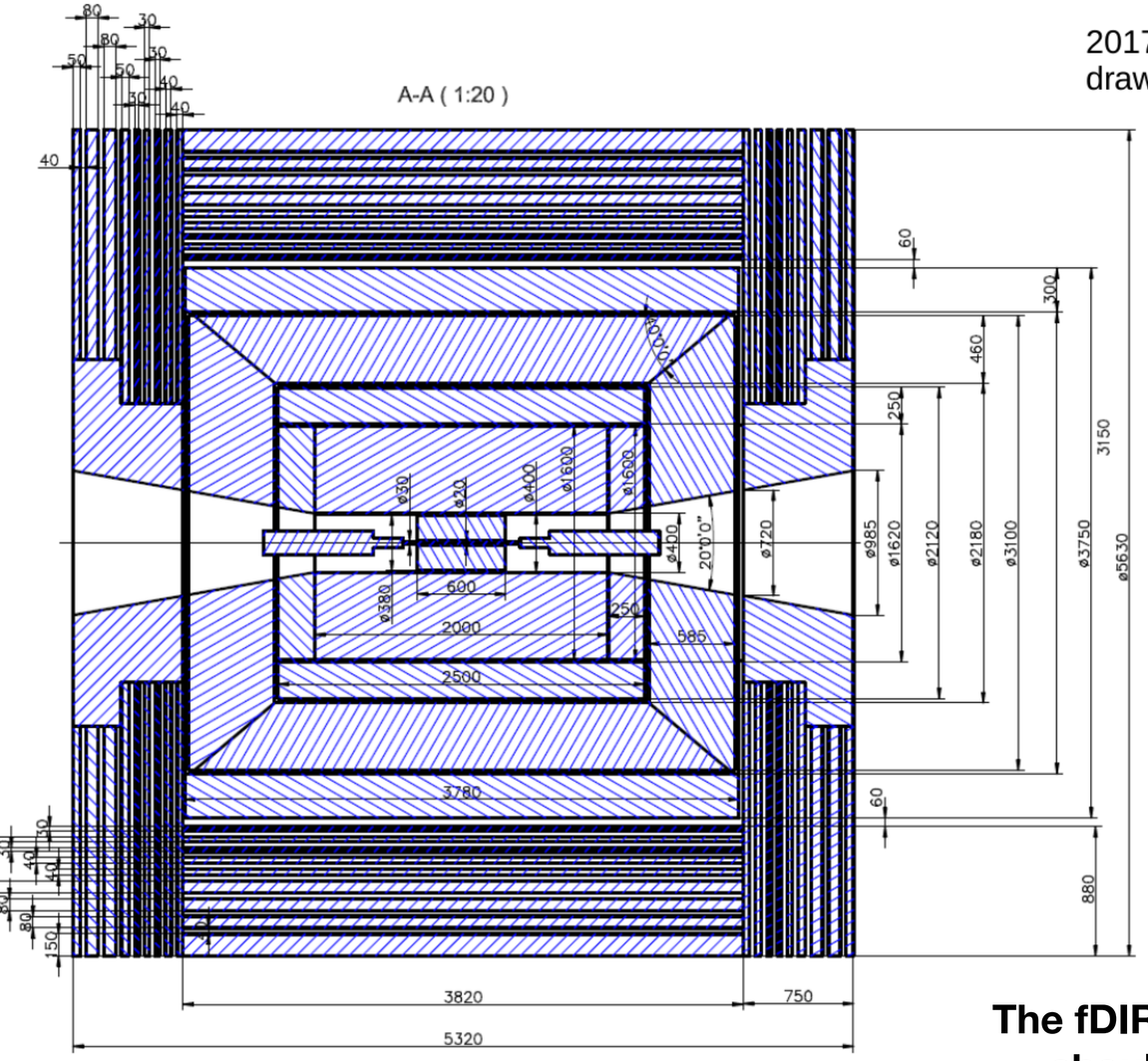
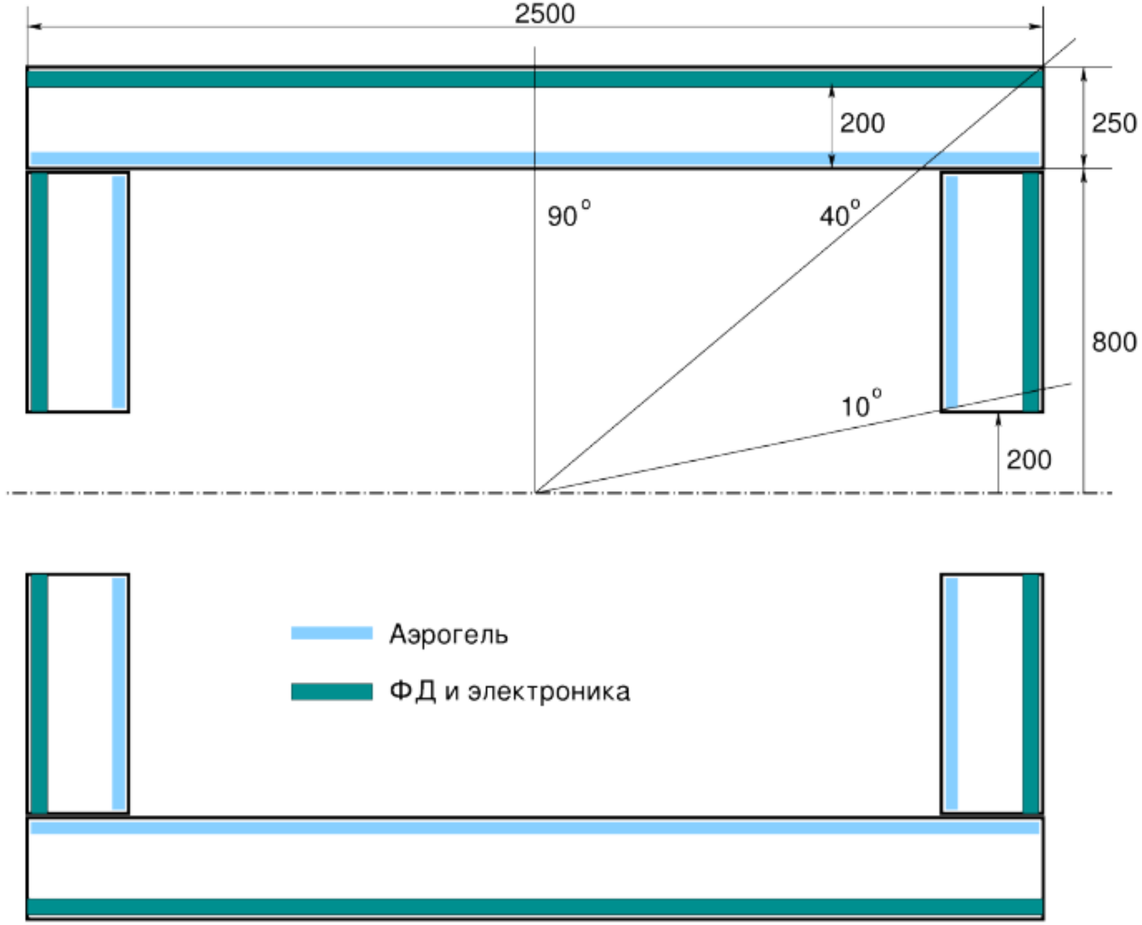
2017 size drawing





The fDIRC models we implement in MC should reside inside this volumes

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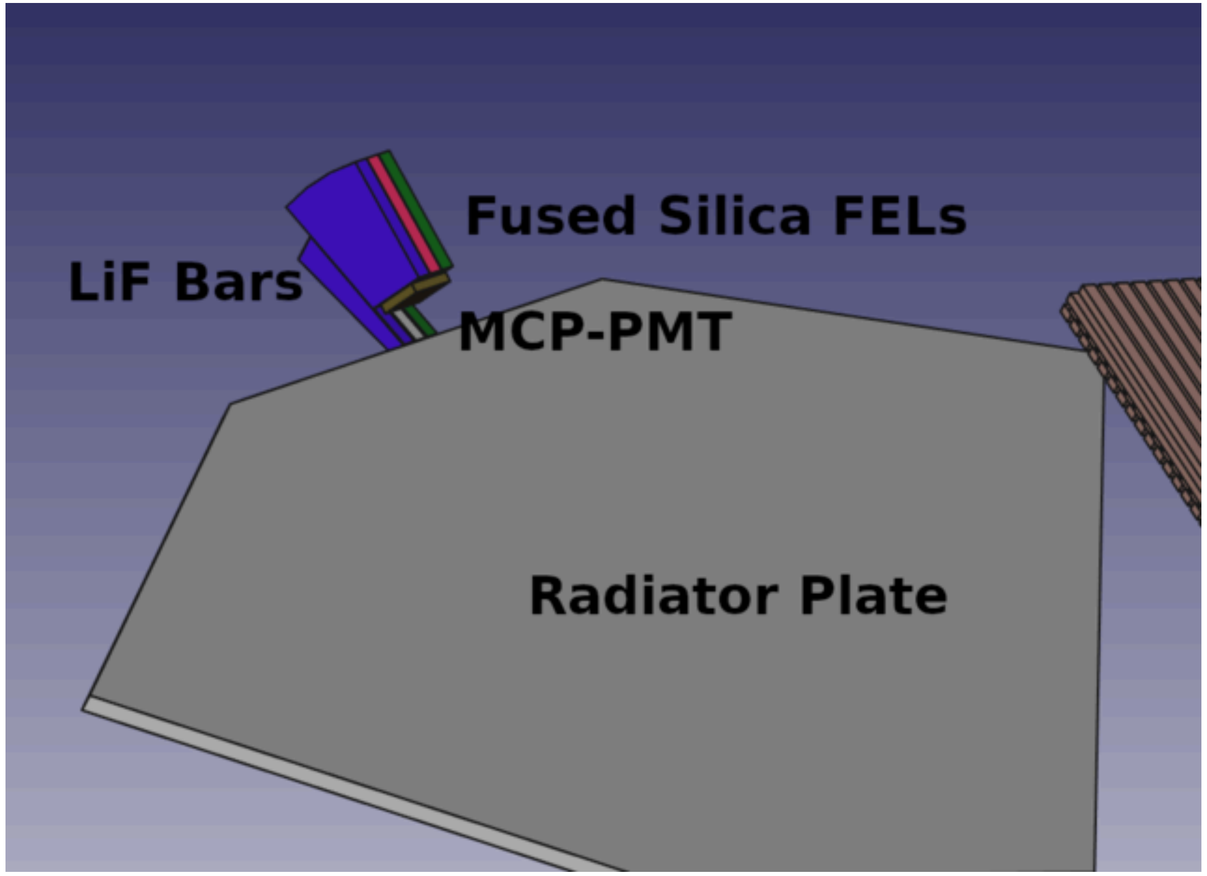
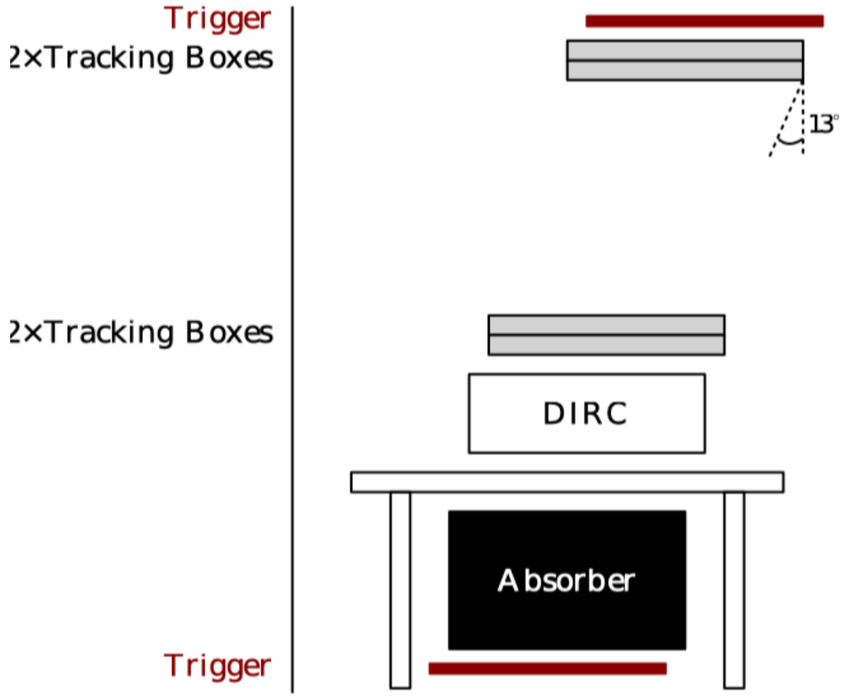
Disc fDIRC model is based on PANDA disc fDIRC and is in advanced stage



This prototype is now inside GCS and taking data using cosmic muons, the difference from SCTF desired prototype is that, instead of LiF bars, it equipped with SiO2 bars like the Plate and the Photon detector is 300 channel MCP-PMT instead of SiPM



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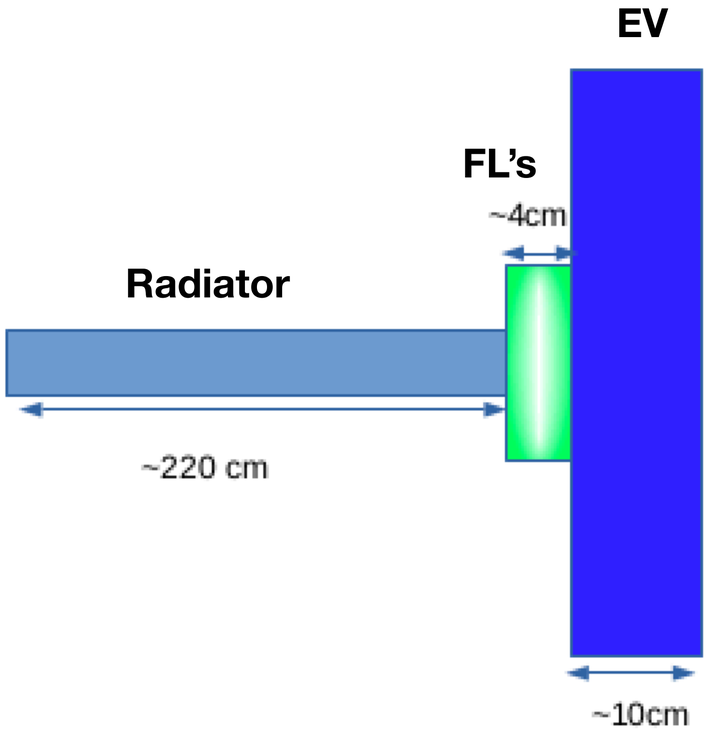
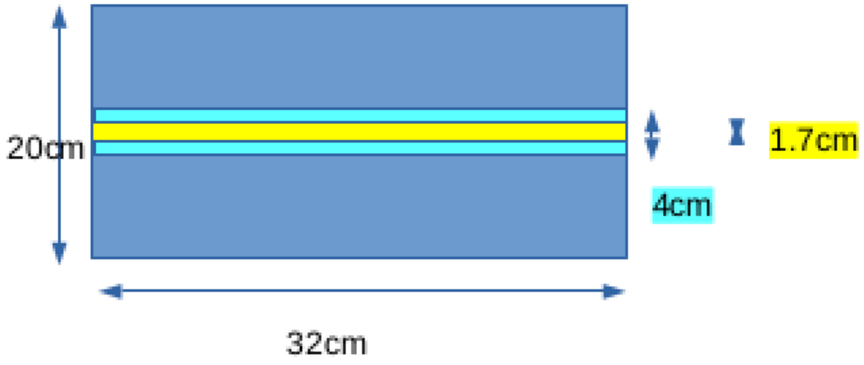
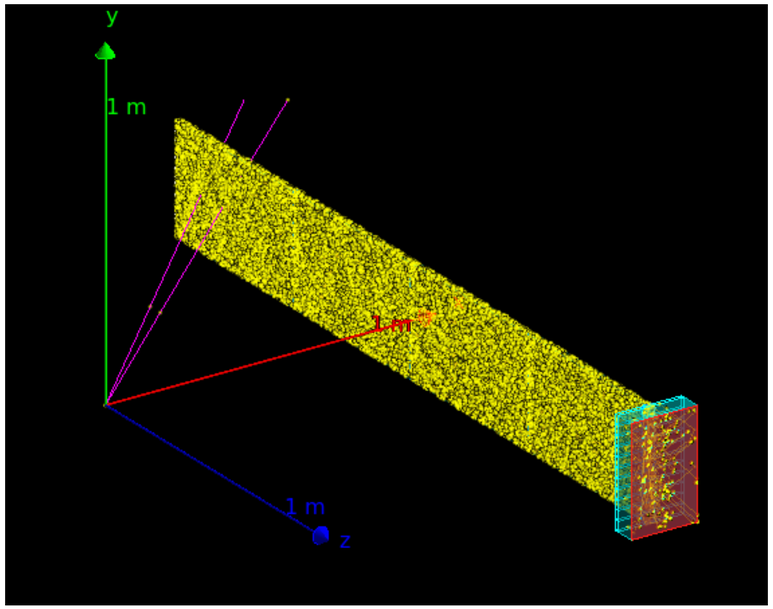
Possible Prototype for barrel fDIRC







The Geant model is based on R. Dzhygadlo(GSI) EIC fDIRC, with modification of focusing lens(FL) and expansion volume (EV)

For a complete prototype our resources might not be enough
But:
a short radiator, a few FL and half coverage of Photon detector area is feasible

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Radiator with less dispersion

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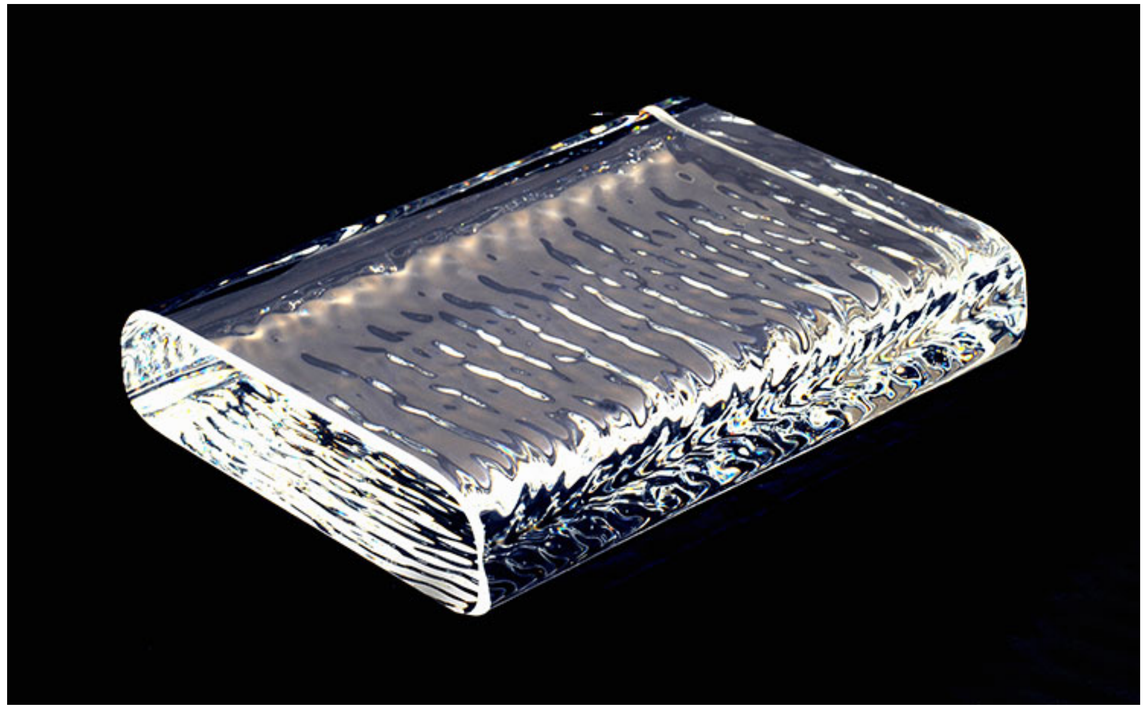
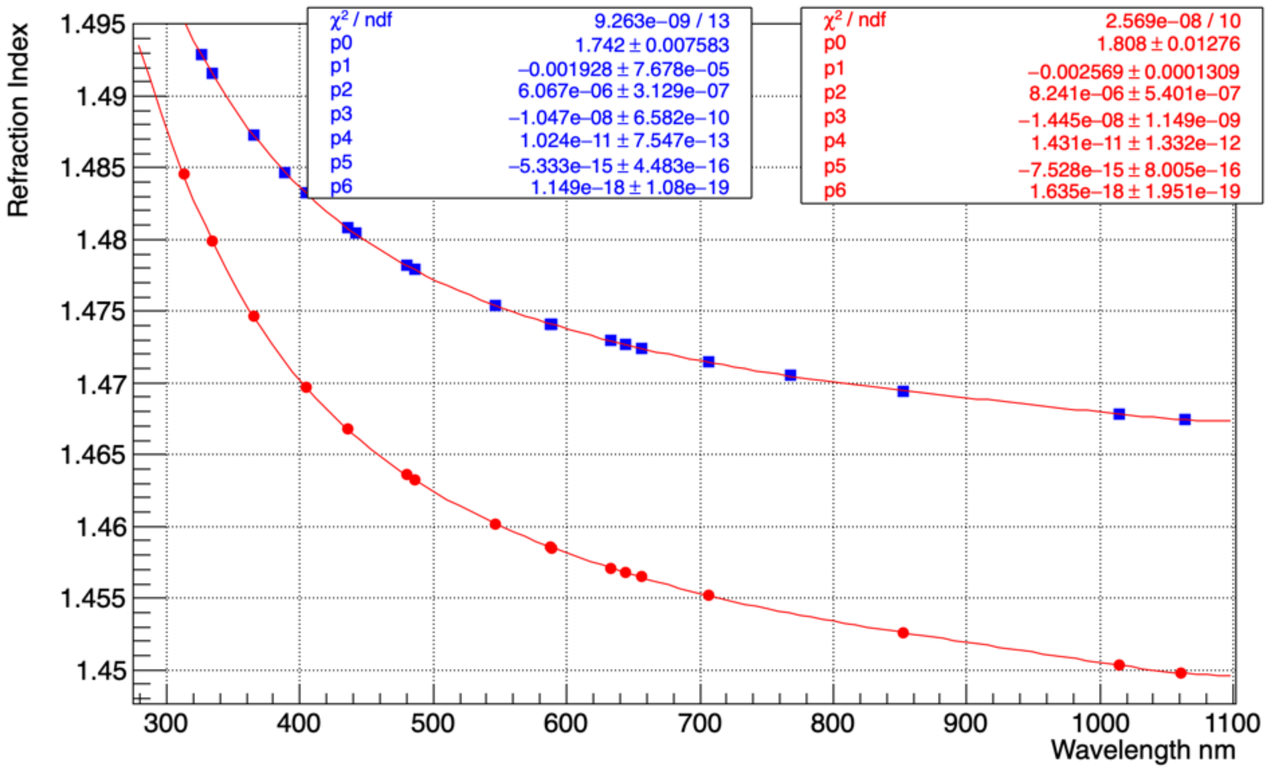
Nikon i-line Glass

https://www.nikon.com/



One of main components that restricts DIRC angular resolution is radiator dispersive medium while in case of disc DIRC one can go into LiF bars to correct the Cherenkov angle, here we might try to use a material with small dispersion

In both cases the radiation hardness could come in game



Nikon iGlass(blue points) and SiO2(red points) Refractive Index against photon wavelength

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The new Expansion Volume and 3 layer focusing Lens

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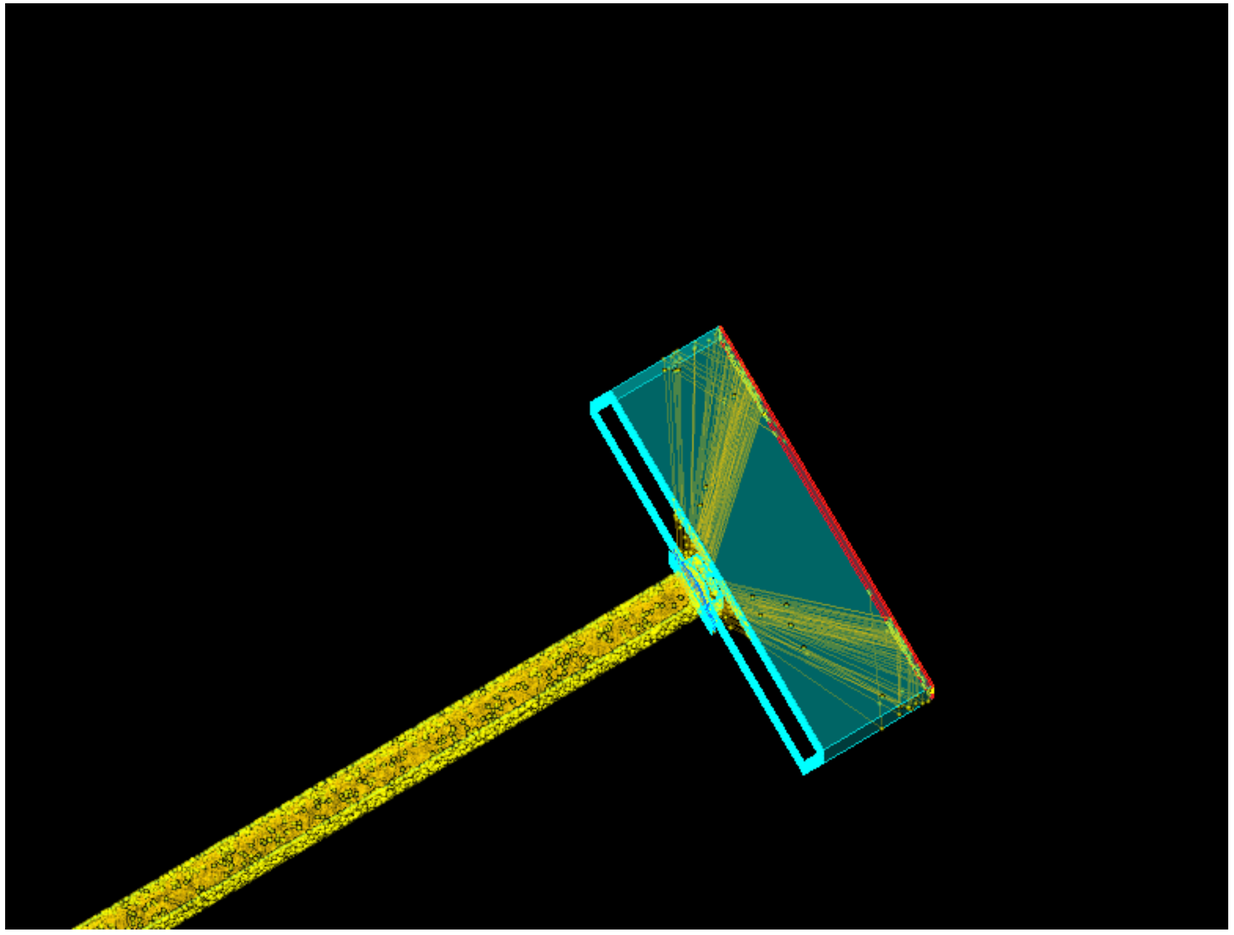
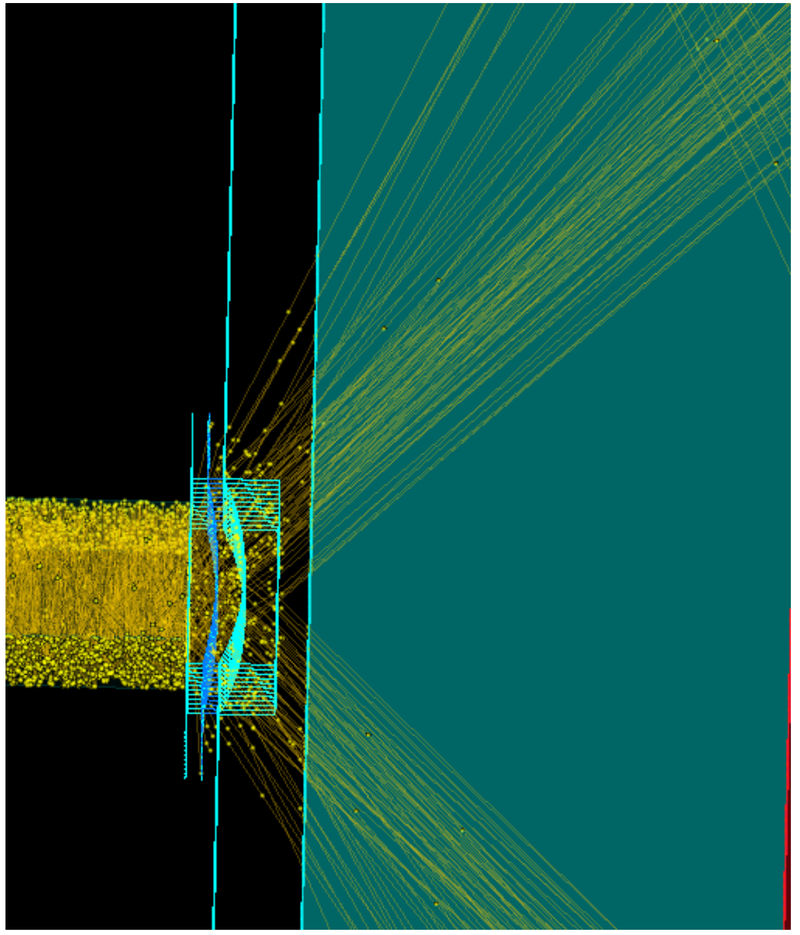


The new Expansion Volume is 320X200X100mm Quartz Module in MC, here zoomed with Cherenkov Photons produced by 1 GeV/C Muons



Here zoomed area shows the 3 Layer focusing Lens with circa 20mm thickness all together, again with MC photons

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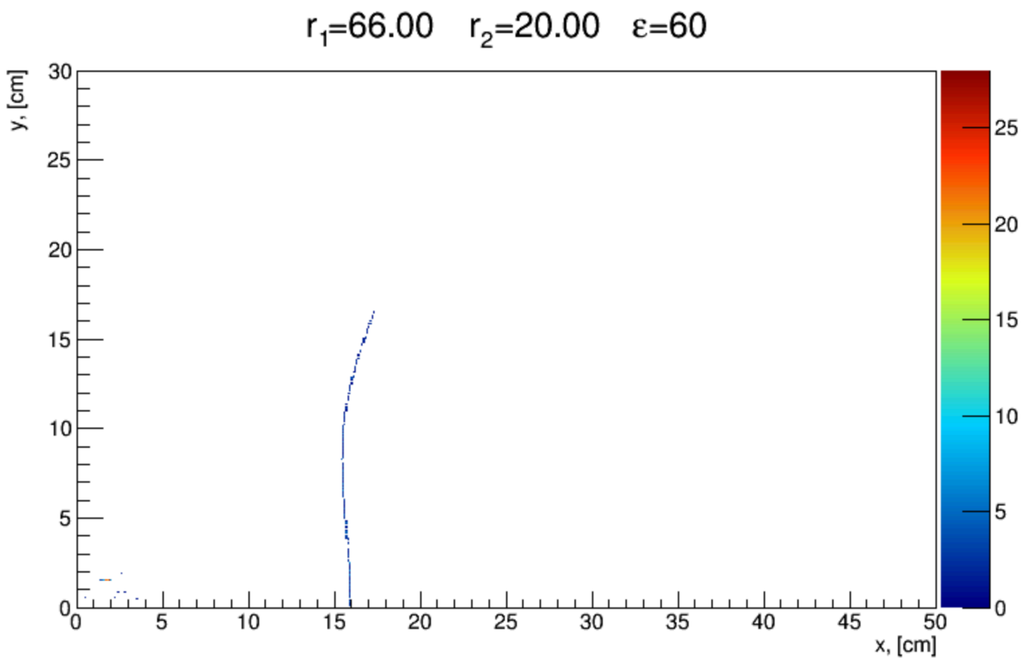
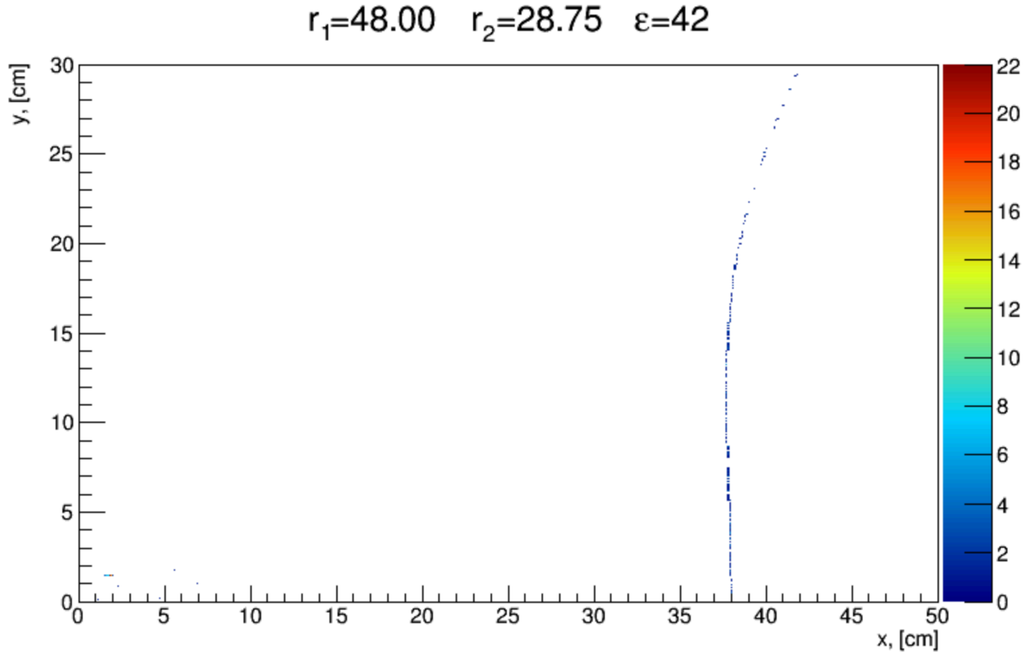
Possible 3 Layer Lens Configuration for SCTF fDIRC(left) based on PANDA Lens MC(right)

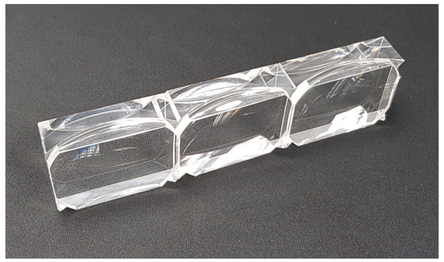
(ordered prototype has r1=47.8 r2=29.1)



(ordered prototype has r1=47.8 r2=29.1)



Possible focusing of 3 Layer Lens for SCTF Barrel DIRC



Courtesy of C. Schwarz (GSI)

PANDA Barrel DIRC Focusing
The Lens configuration is already fixed and
50 triplet Lens is supposed to be produced

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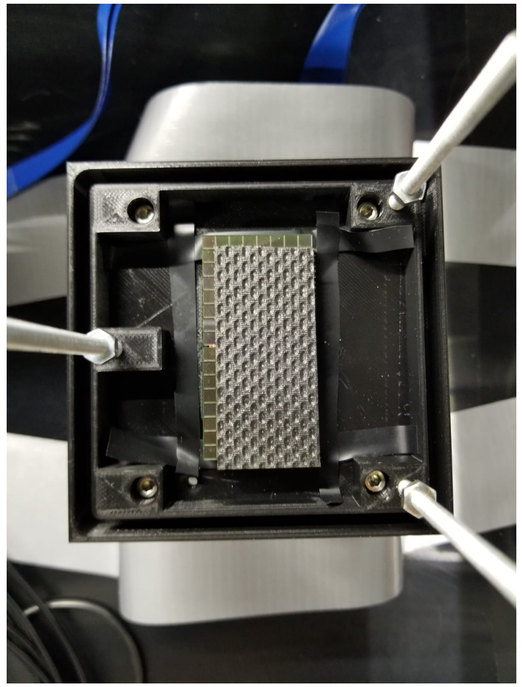
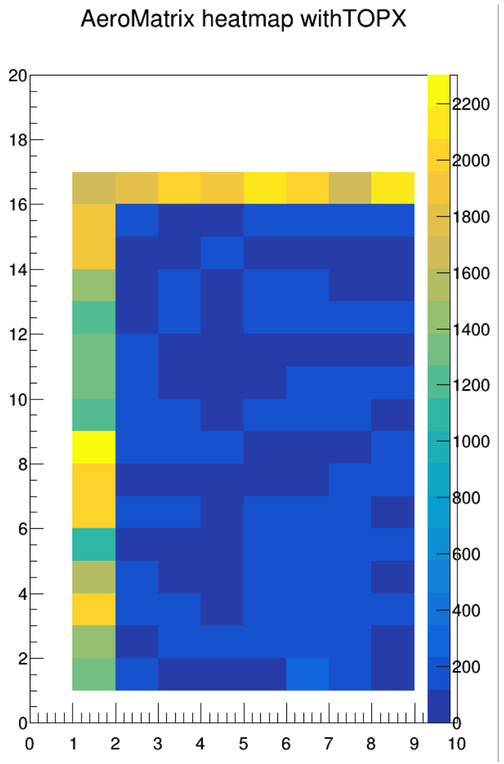
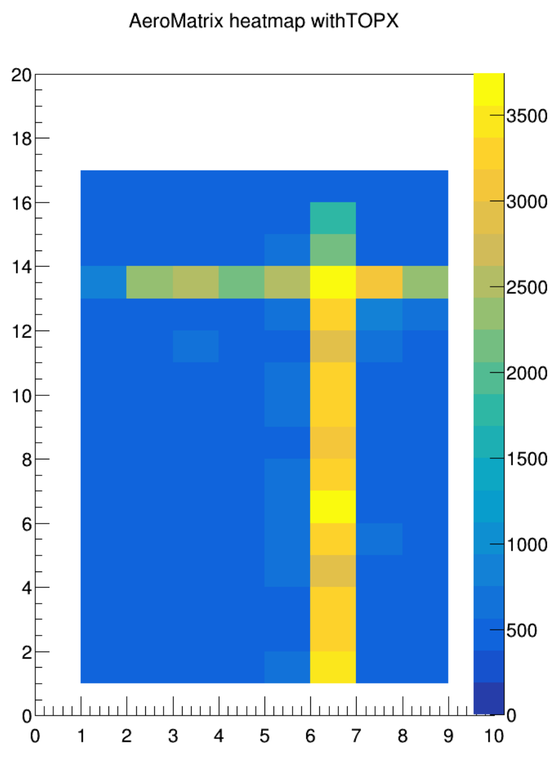
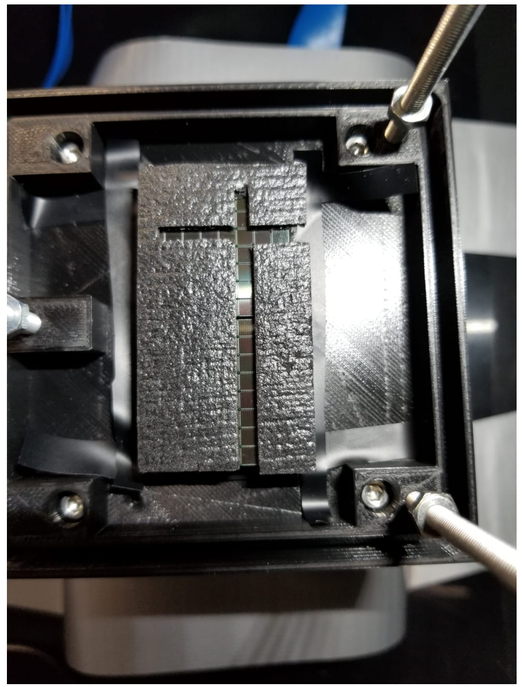
Photon detector candidate



KETEK 3X3 mm 8X8 two SiPM matrices are a good candidate for Photon detector
Already first checks was done to check their mapping







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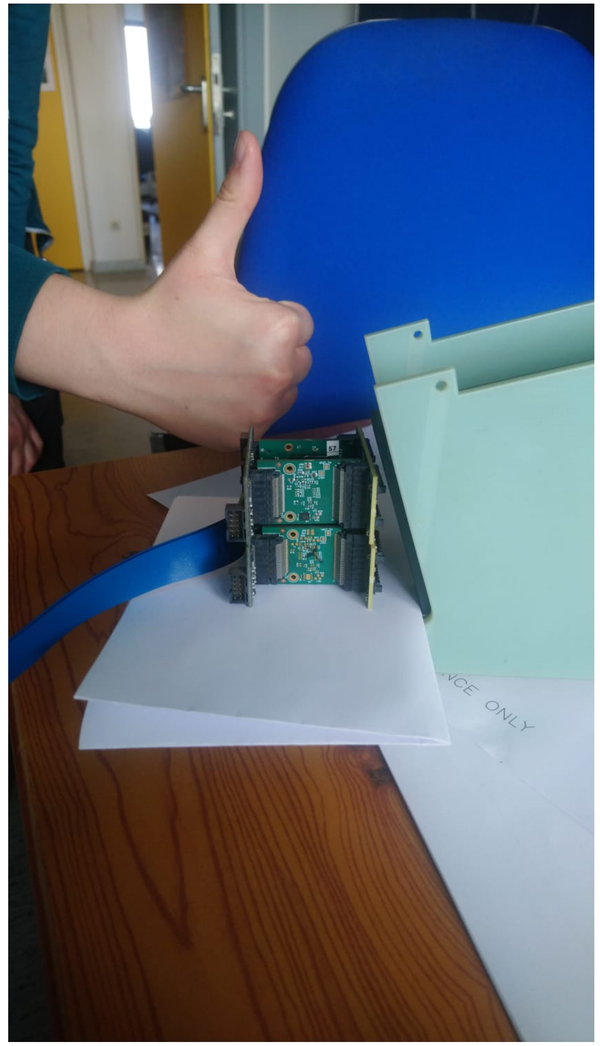
Possible Photon Detectors for DISC and Barrel Proto

CERN-Hamamatsu developed strip MPPC

Unfortunately for the Barrel part we don't have a candidate Focusing Lens (FL) and Expansion Volume (EV) yet
For the DISC part we need adapter PCB(in design)
and
In both cases more Photon detector needed to cover whole(or maximum possible range)

We can cover
18X11.5(8 active)mm hit area
With 16channel two side readout

We can cover 48X24mm hit area with one TOFPET ROM module



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Conclusions

- Although our Milestone and Deliverable deadline might be seen as in far future, but on view of possible delay in delivery and development time for a new products (FL,EV, new pixelation of Photon detector….) we have to keep our attentiveness high

- That the GCS is running now and some of new Prototype elements are already in(readout, photon detector….) allows us to be sure that we will meet the deadlines

- Stay healthy

MiniGCS inside GCS