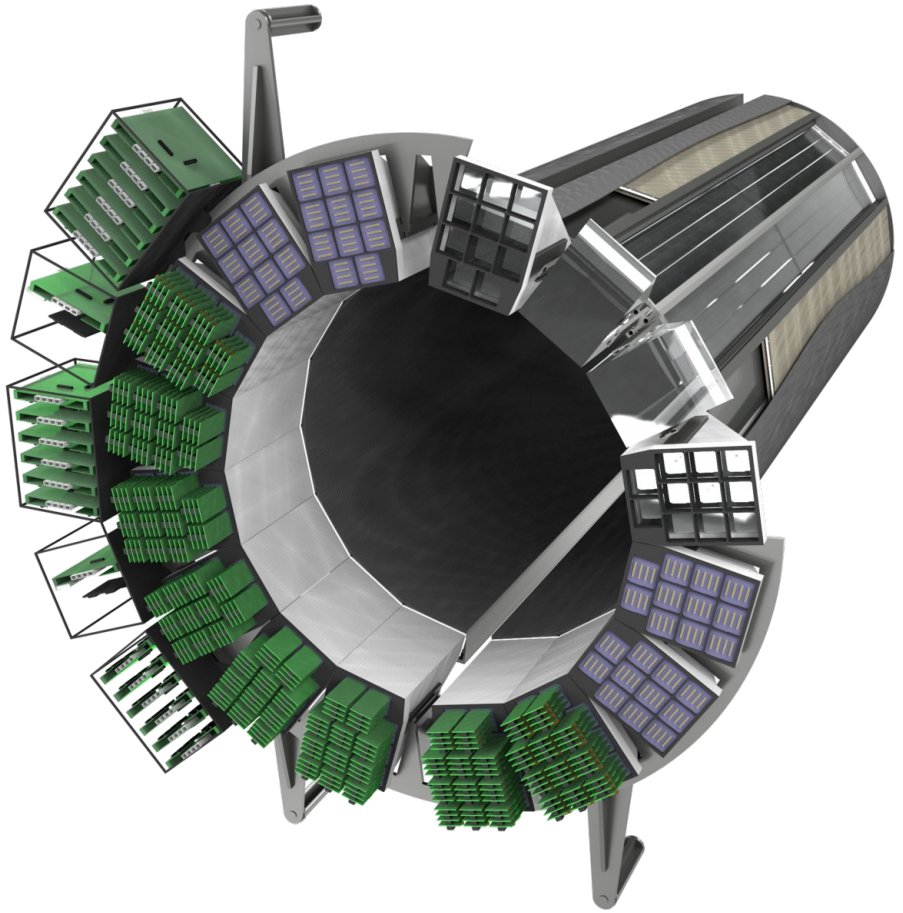
PANDA Barrel DIRC Status at GSI



Roman Dzhygadlo,
Panda Cherenkov Group

PANDA meeting 13.09.16

- TDR committee report
- Time Line
- Prototype test at CERN 2016
- Summary

TDR review committee report

Committee members:

- Nicolas Arnaud (LAL Orsay)
- Klaus Föhl (CERN)
- Matthias Steinke (Ruhr-Universität Bochm)
- Jerry Va'vra (SLAC)

July 11 – TDR presentation to the committee
Aug 19 – answers to the committee questions

Overall impression:

"The proponents are to be congratulated on a very good quality TDR, clear answers to the committee's questions and a clear plan how to address some still open questions by additional R&D studies. We were impressed by the level of detail, backed by very nice experimental results from the test beam at CERN. We were also impressed with ongoing MCP-PMT studies, detailed simulation and data analysis effort."

TDR review committee report

Committee decision:

"Because the presented bar design for the PANDA Barrel DIRC is well advanced and will fulfill the PANDA PID requirements, and because the group is on a good way concerning the development of the wide plate option, the committee recommends the TDR for approval."

Bars/plate statement:

"In case that in the upcoming CERN beam tests the plate design will be verified, we think that the bar design still is the more robust detector and promises a better PID for PANDA."

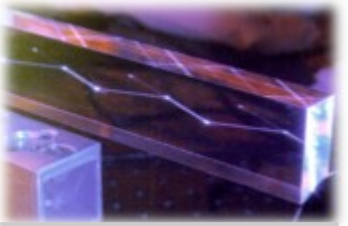
Suggested / ongoing studies

- Determining the lowest time resolution needed for the PID with time based imaging
- Radiation hardness of the lenses
- Laser calibration system
- MCP-PMT's operation in the B-field
- Study to find an optical coupling between the prism and MCP-PMTs

Time Line

Sep. 2016: Completed technical design, TDR in review, to be submitted to FAIR.
2017-2021: Component Fabrication, Assembly, Installation.

2017: TDR approval, finalize specifications, tender, contracts.



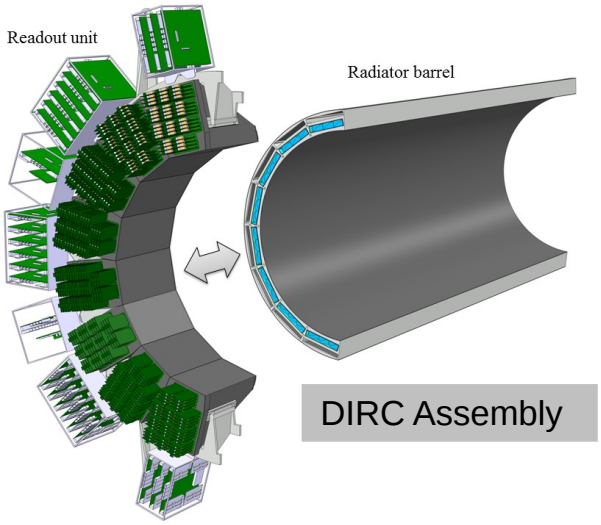
DIRC bar with laser

2018-2020: Industrial fabrication of fused silica bars/plates and prisms.
Industrial production of photon sensors.

2018-2019: Production and QA of readout electronics at GSI/Mainz.

2018-2021: Industrial fabrication of bar containers and mechanical support frame,
gluing of bars/plates, construction of complete bar boxes in Mainz.
Detailed scans of all sensors in Erlangen.
Assembly of readout units at GSI/Mainz.

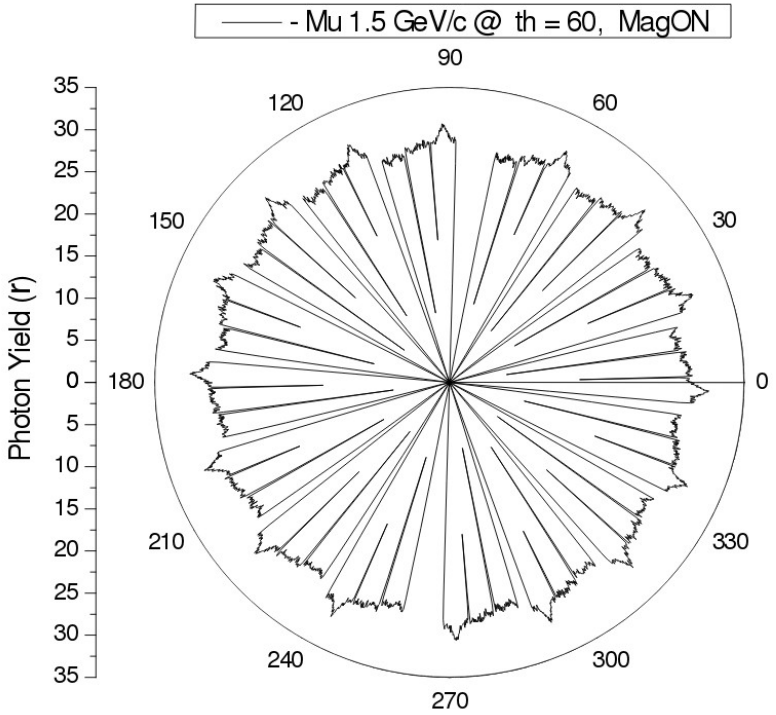
2021: Installation of mechanical support frame in PANDA,
insert bar boxes, mount readout modules.
Ready as “Start Setup / Day One” detector.

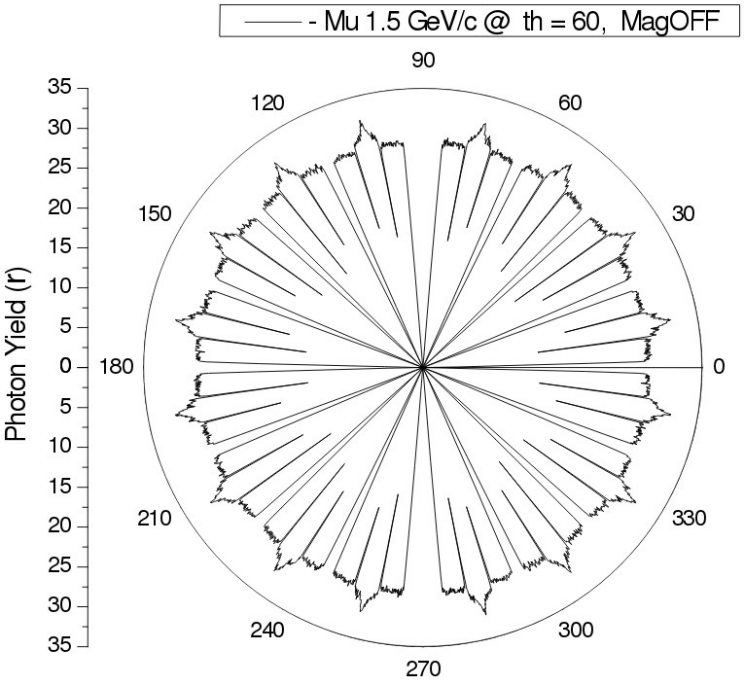


DIRC Assembly

DIRC azimuthal coverage

by Ahmed



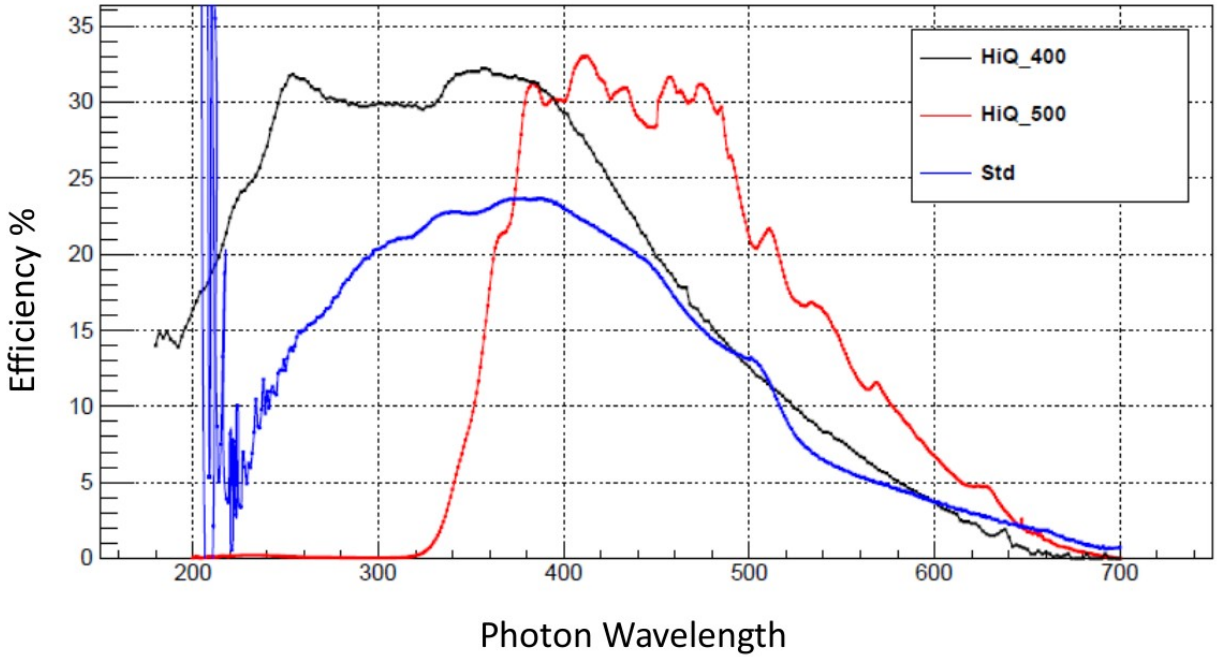


DIRC Coverage, Baseline Design (Magnet ON)

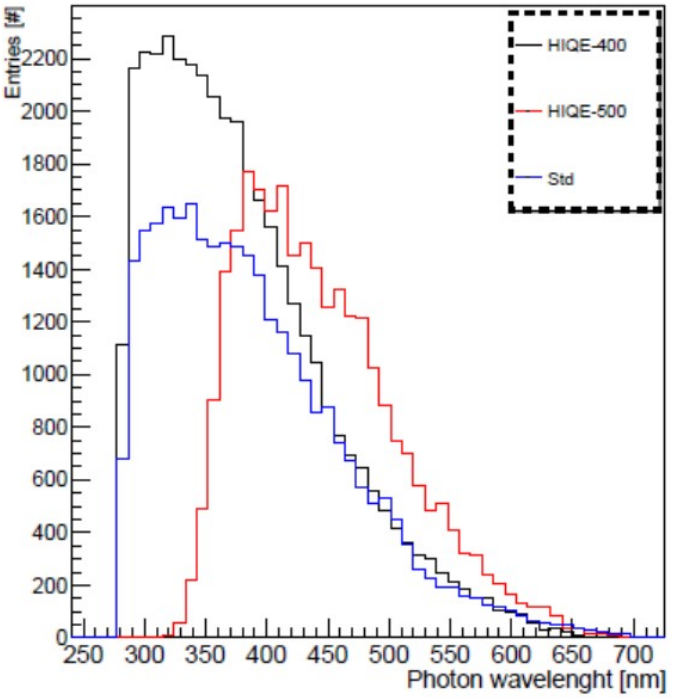
500 Event of (-) Mu , Ø step 0.1, using Kronos , MC seed 1 , PndVersion 29363

	(-) Mu at ploar angle = 60 °			(-) Mu at 3.5 GeV/c		
	0.5 GeV/c	1.5 GeV/c	3.5 GeV/c	Θ = 25°	Θ = 90°	Θ = 120°
coverage	84.25	84.64	84.64	85.78	84.94	84.89

Quantum efficiency study by Ahmed



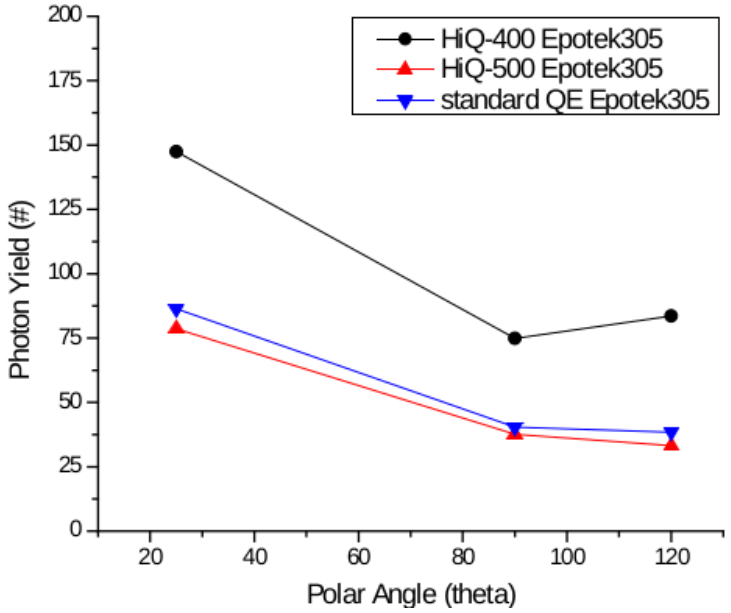
Detected photons spectrum:

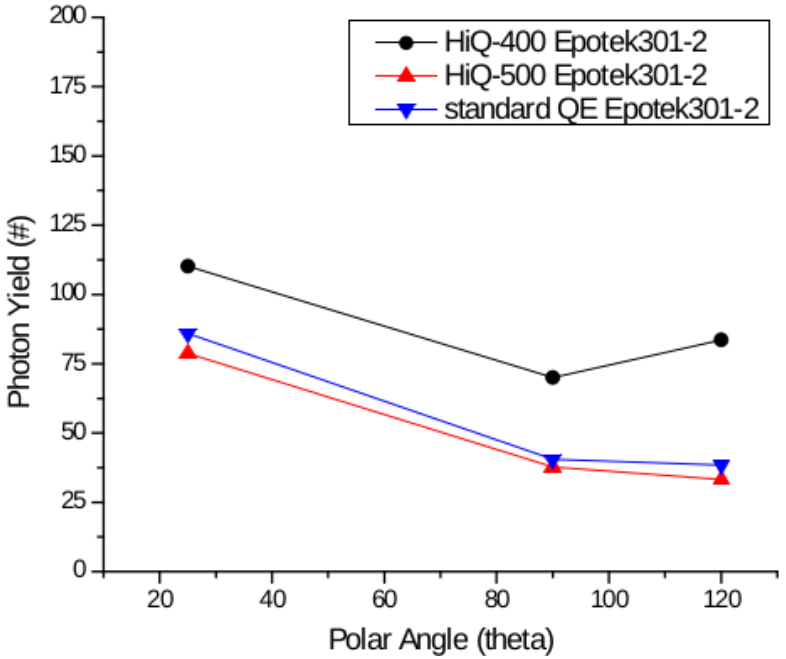


std – from Alex Britting (2011)

Quantum efficiency study

Epotek 305 vs. Epotek 301-2





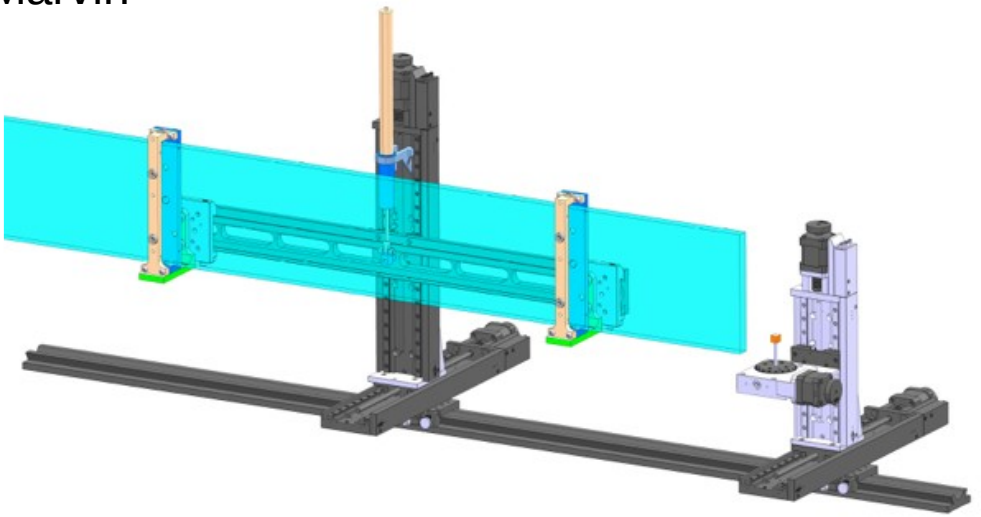
Best choice from the photon yield point of view is

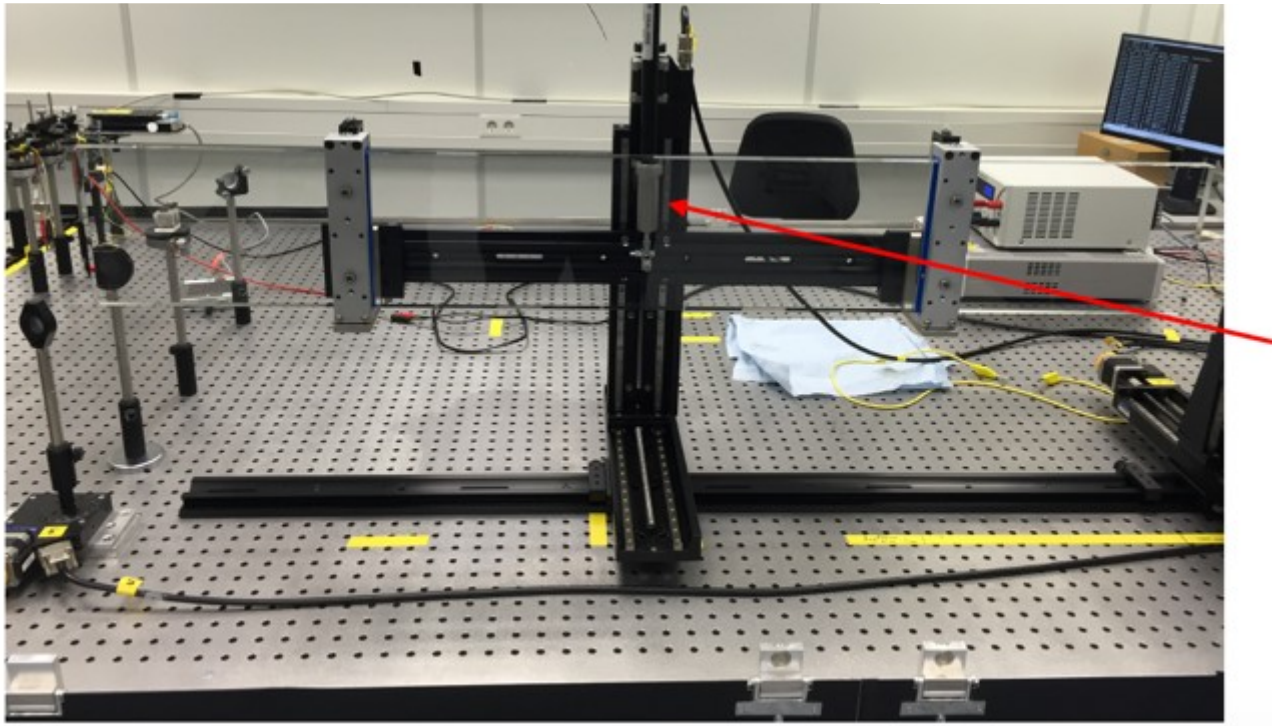
Epotek 305 with HiQ-400

Optics lab status

by Marvin

Setup is updated for accommodating plates



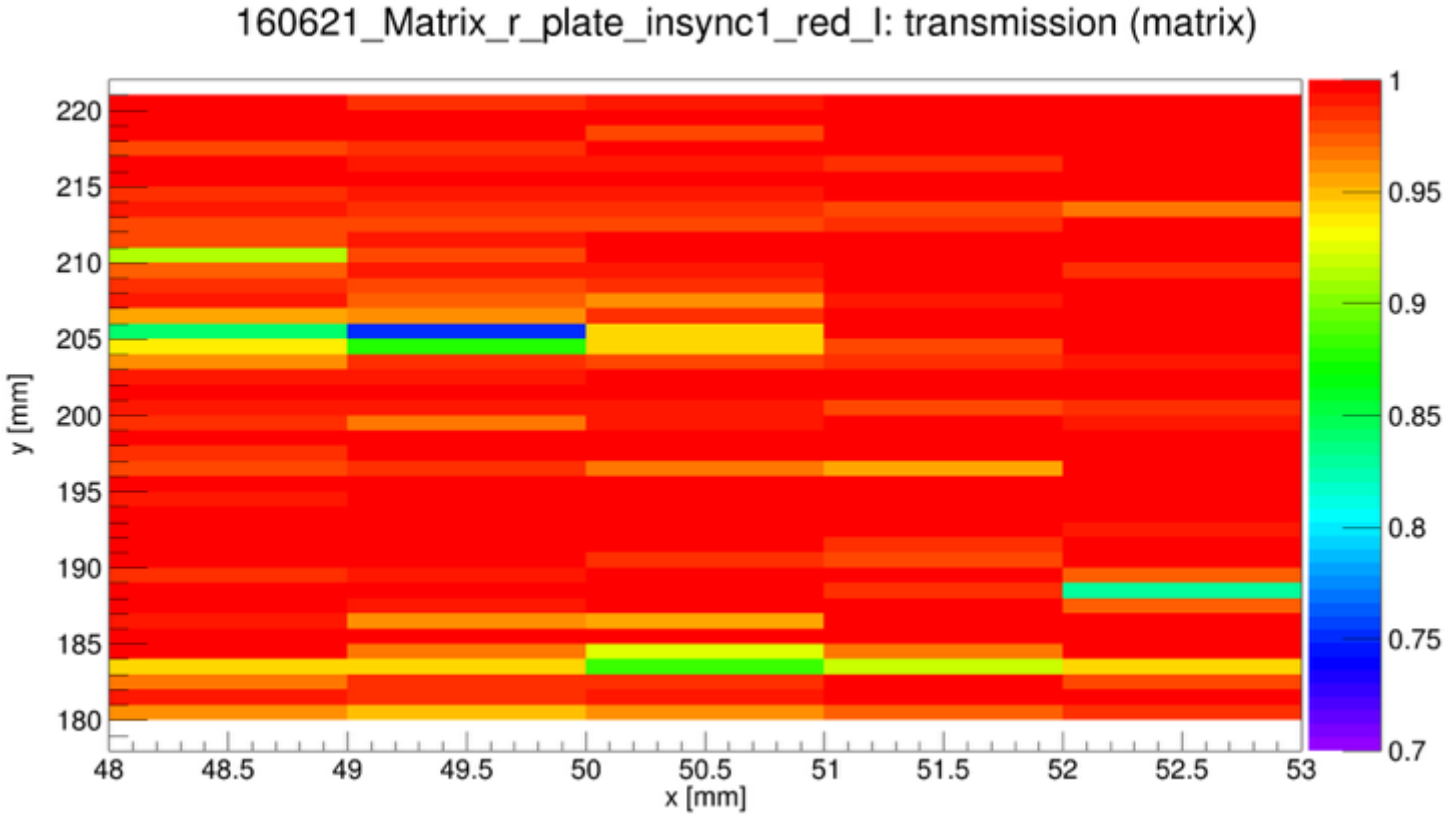


Prototype plate from InSync

Optics lab status

Test measurement for InSync prototype bar:

→ Minimized range for first tests ...

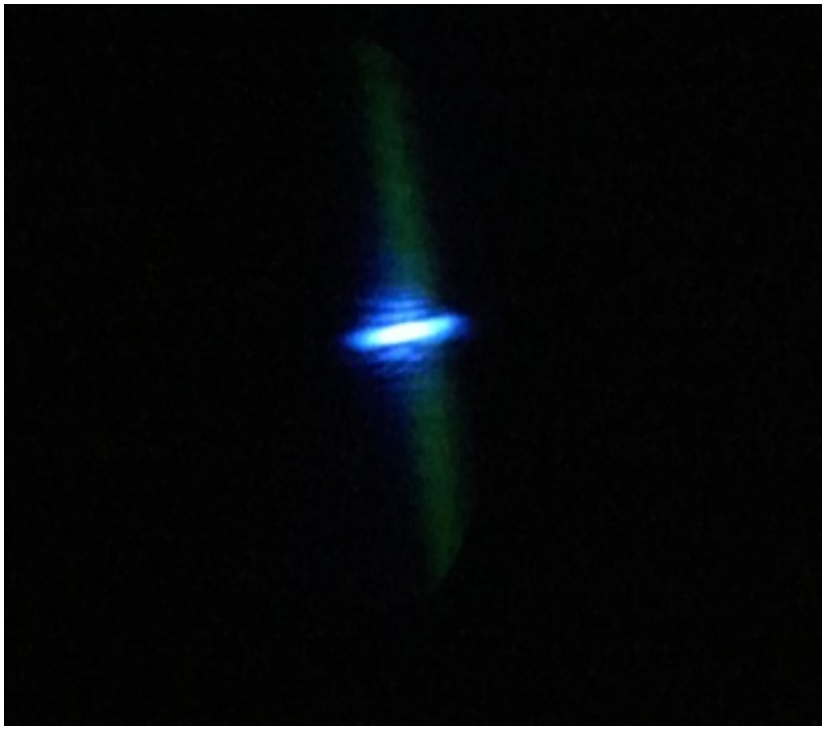


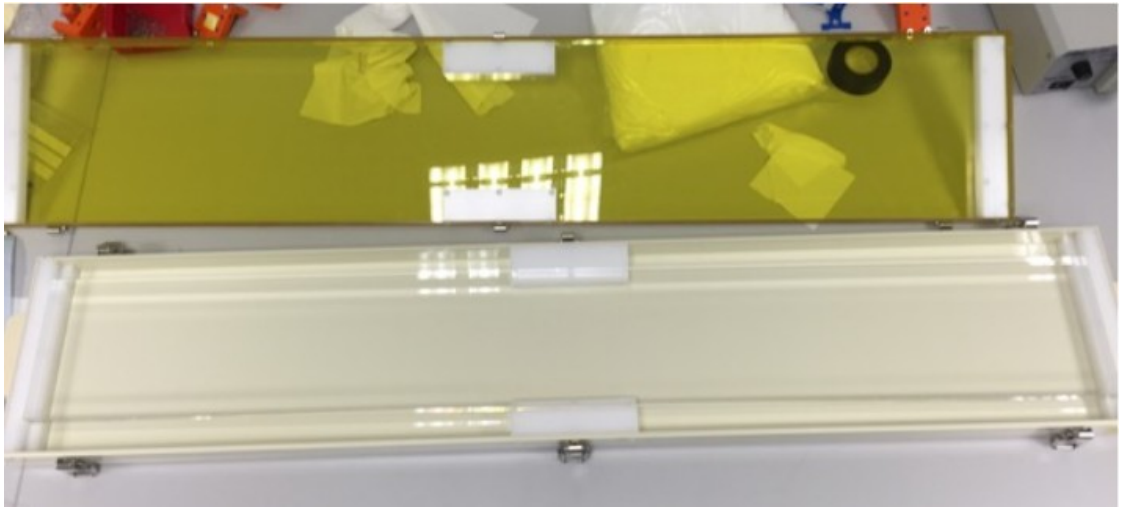
Red laser (635 nm)

→ R ~ 0.999933
→ approx. 4 A surf. Roughness (Spec-sheet: 3.7 A)

Optics lab status

Further upgrade:
-> Added UV (266 nm) laser to the setup





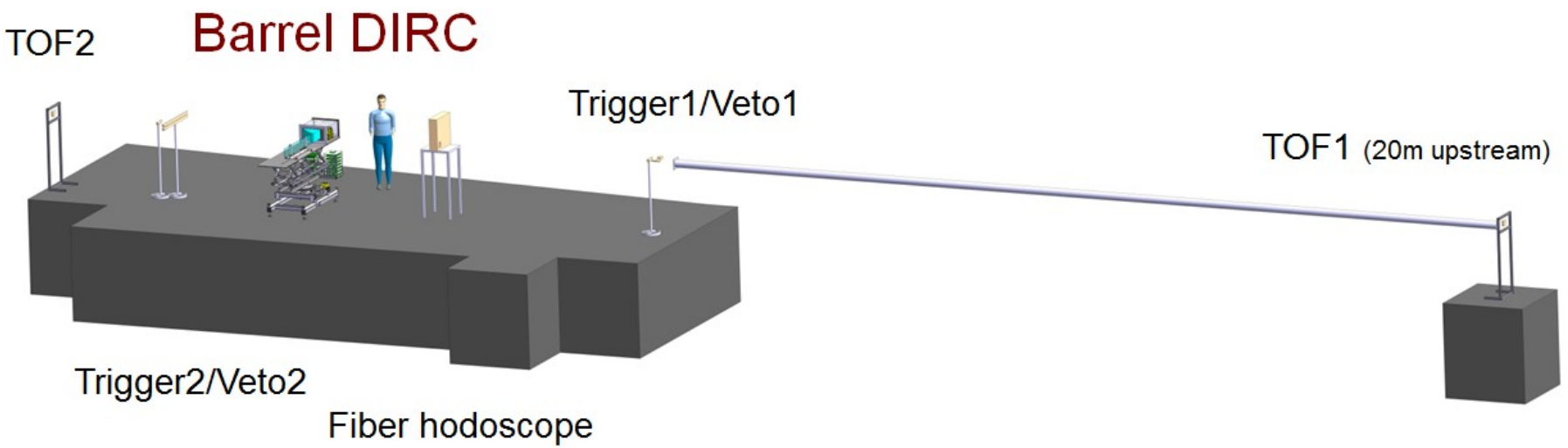
Prototype plate from Nikon
arrived at GSI

-> Will be measured soon

Prototype test at CERN 2016

CERN PS/T9 (Oct 14 – Nov 2, 2016)

- PID performance of plate with and without focusing will be the top priority.
- Smaller fused silica prism, 3 x 3 array of Planacon MCP-PMTs (large prism with 5 x 3 array in 2015).
- Modified PADIWAs, better discriminator threshold setting procedure, fewer number of channels.
- Hodoscope, MCP-TOF, trigger counters, new scintillator fingers. No veto, no Disc DIRC, no FLASH.
- Higher statistics for PDF creation, longer runs, fewer momentum/angle scan points.
- PID performance of bar without lens (with time-based imaging) as secondary goal.
- Probably share T9 area with PANDA Muon detector prototype for first days, details to be discussed.



Prototype test at CERN 2016

CERN PS/T9 (Oct 14 – Nov 2, 2016)

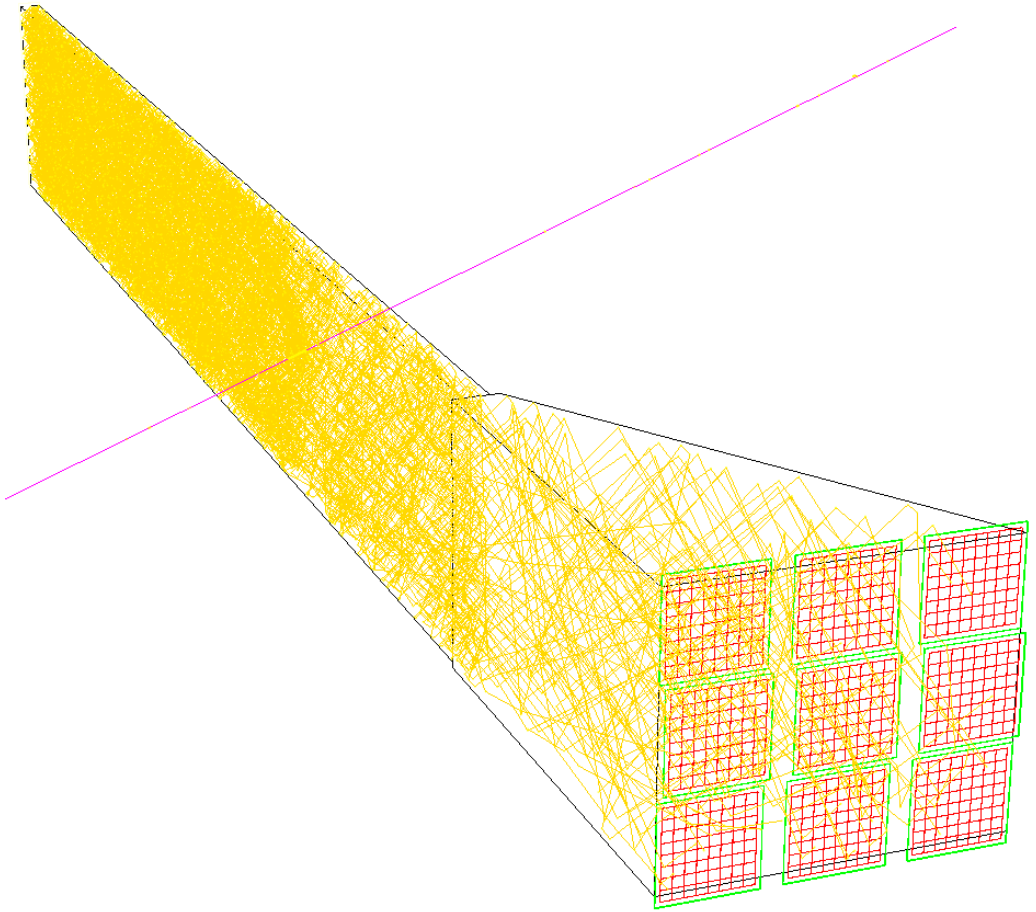
- PID performance of plate with and without focusing will be the top priority.
- Smaller fused silica prism, 3 x 3 array of Planacon MCP-PMTs (large prism with 5 x 3 array in 2015).
- Modified PADIWAs, better discriminator threshold setting procedure, fewer number of channels.
- Hodoscope, MCP-TOF, trigger counters, new scintillator fingers. No veto, no Disc DIRC, no FLASH.
- Higher statistics for PDF creation, longer runs, fewer momentum/angle scan points.
- PID performance of bar without lens (with time-based imaging) as secondary goal.
- Probably share T9 area with PANDA Muon detector prototype for first days, details to be discussed.

Participants:

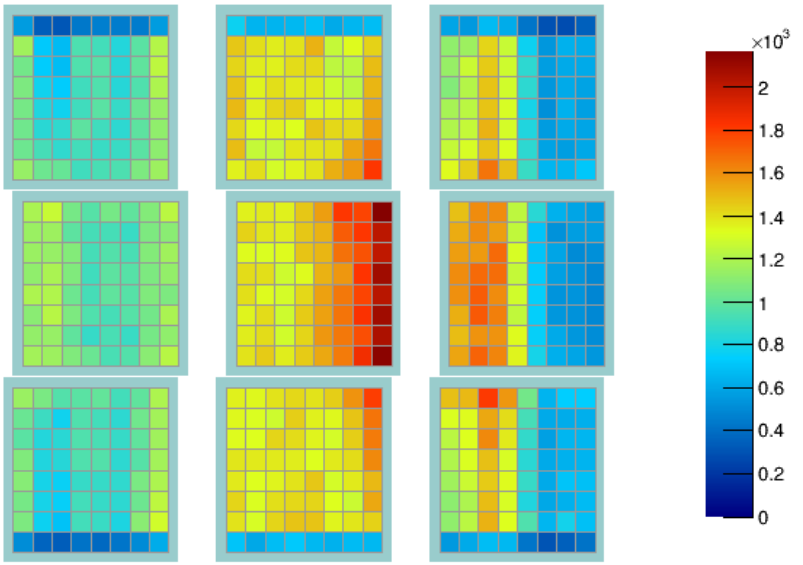
- GSI (Jochen, Carsten, Georg, Marvin, Ahmed, Tassos, Andreas, Doro and Roman)
- Erlangen University

Prototype test at CERN 2016

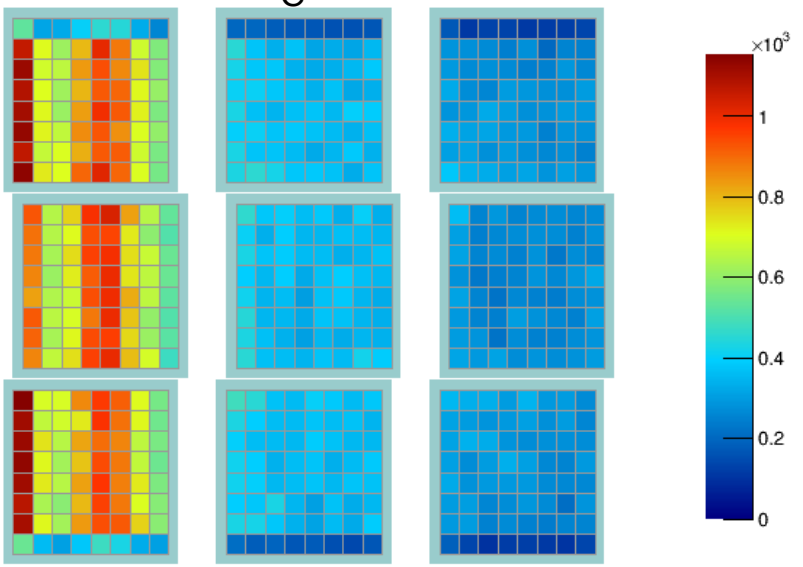
Geant simulation of the prototype



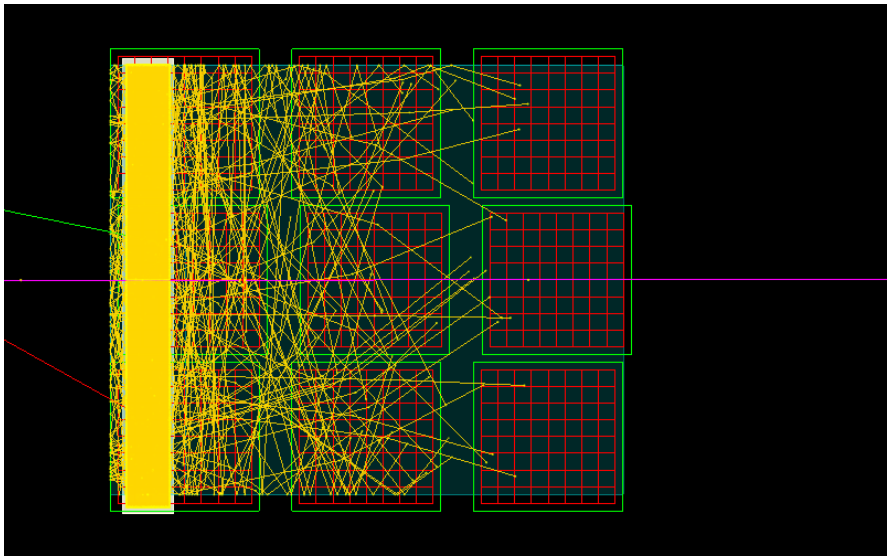
$\theta_C = 20^o$

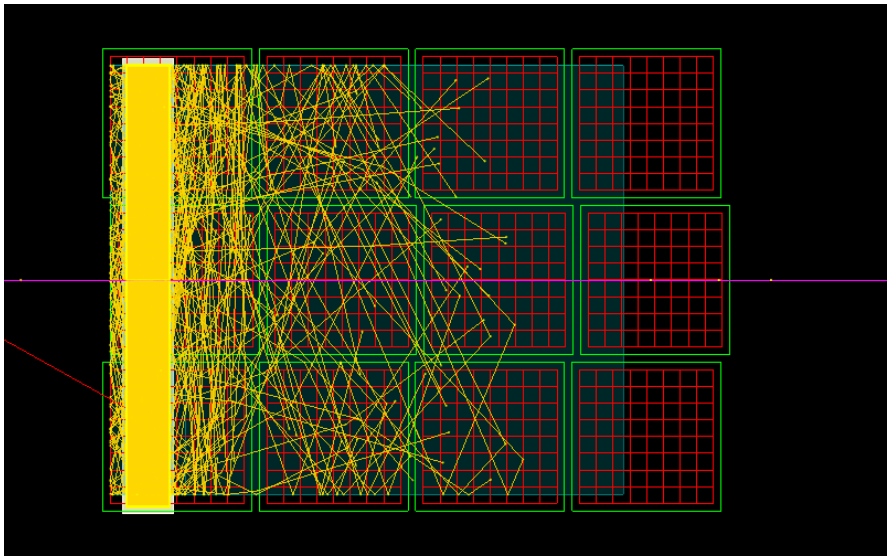


$\theta_C = 50^o$

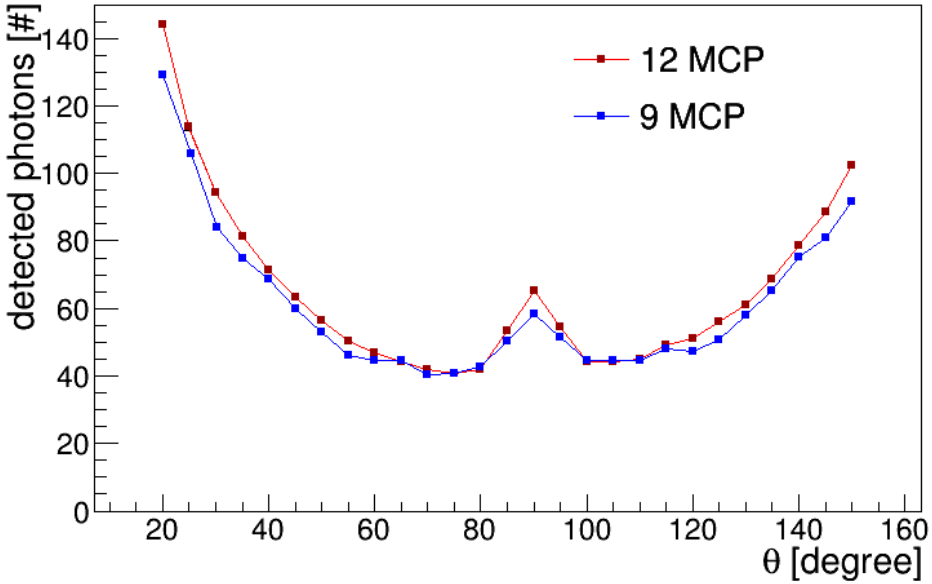


Prototype test: 9 vs. 12 MCP

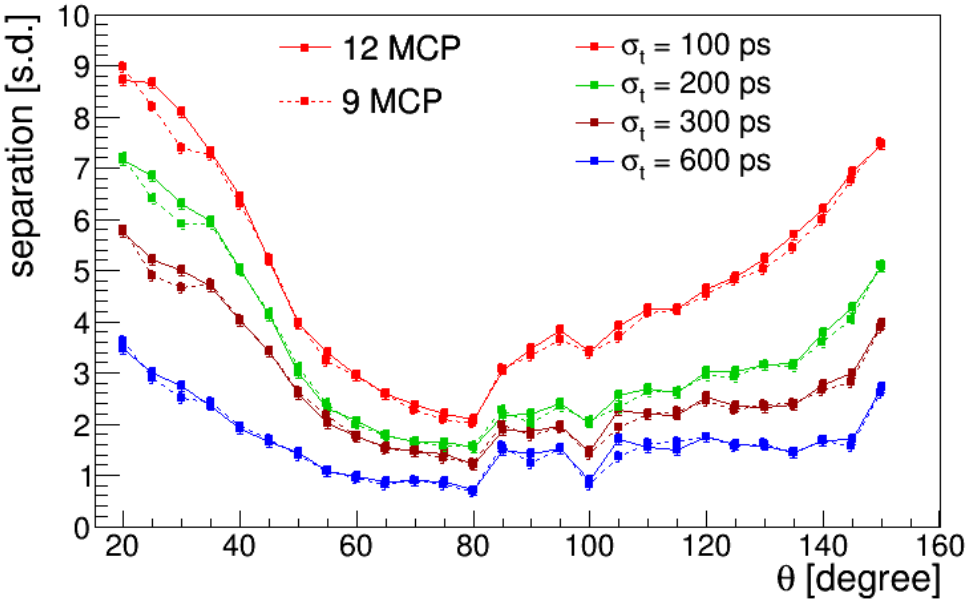




Expected photon yield:



Expected pi/K separation with different timing resol.:



Summary

- TDR review committee state “a very good quality TDR”
- TDR is recommended for approval by the TDR review committee.
- Preparation to the CERN beam test is ongoing
  - Improving time resolution
  - Performing Geant simulations

Summary

- TDR review committee state “a very good quality TDR”
- TDR is recommended for approval by the TDR review committee.
- Preparation to the CERN beam test is ongoing
  - Improving time resolution
  - Performing Geant simulations

Thank you for the attention