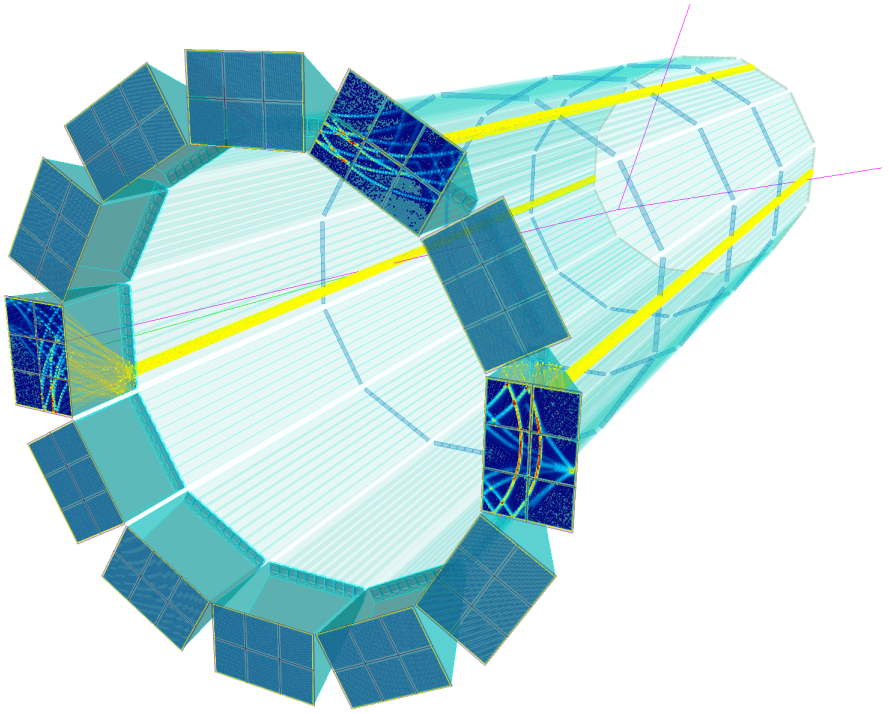
Generic R&D and DIRC@EIC Simulations



Status Update

DIRC Annual Meeting

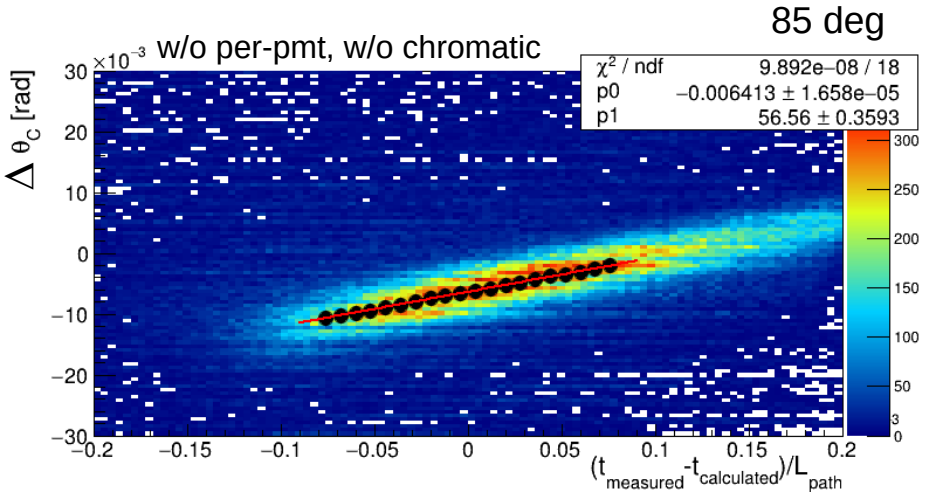
JLab, 26.06.25

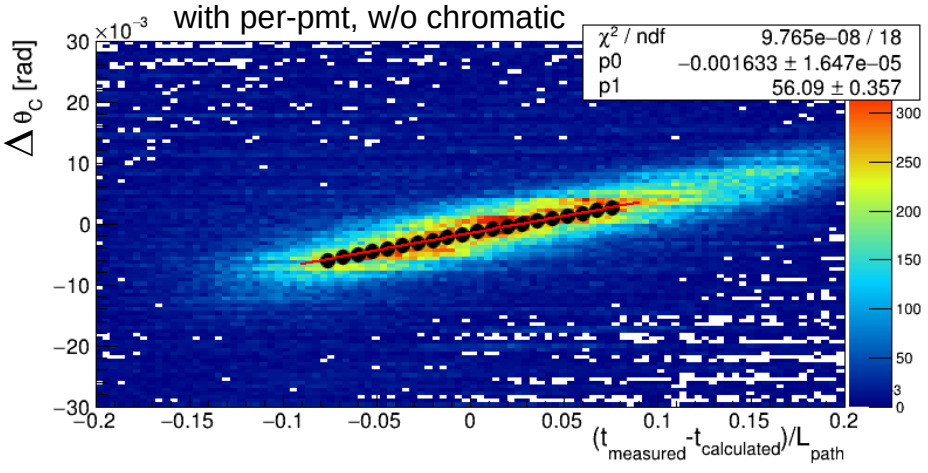
Roman Dzhygadlo GSI

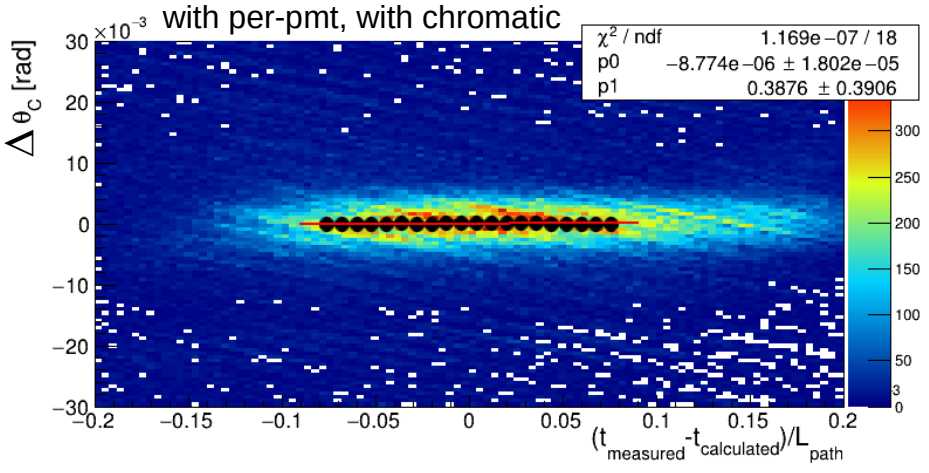
Reconstruction Corrections

- per-pmt correction
- chromatic correction
  (normalized by propagation length)

85 deg

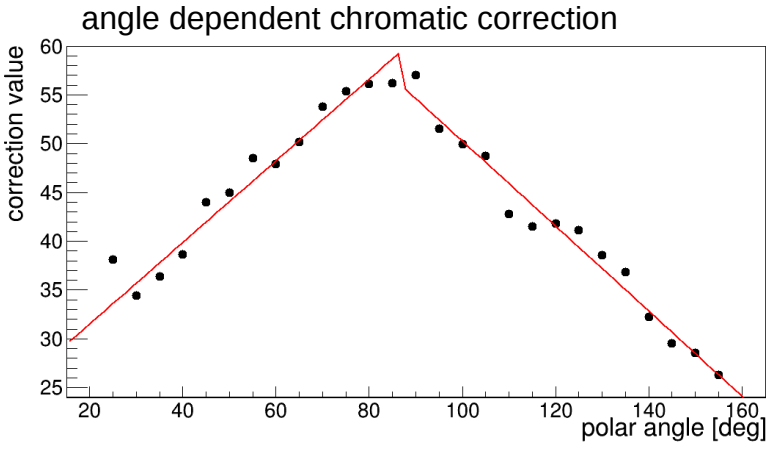


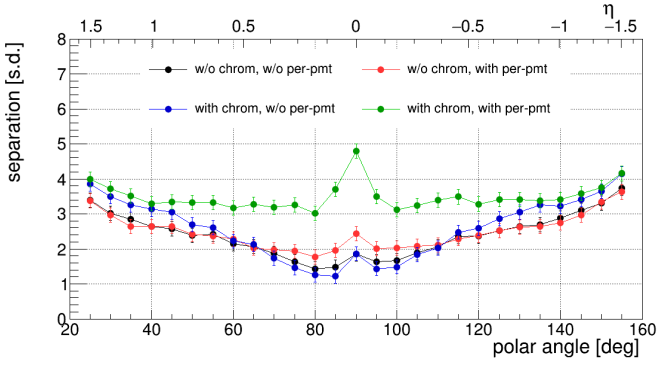


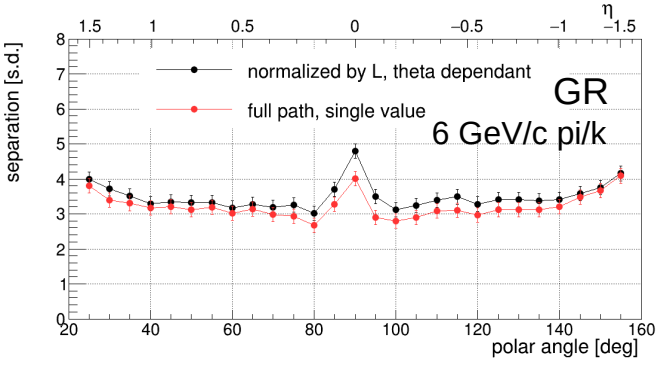


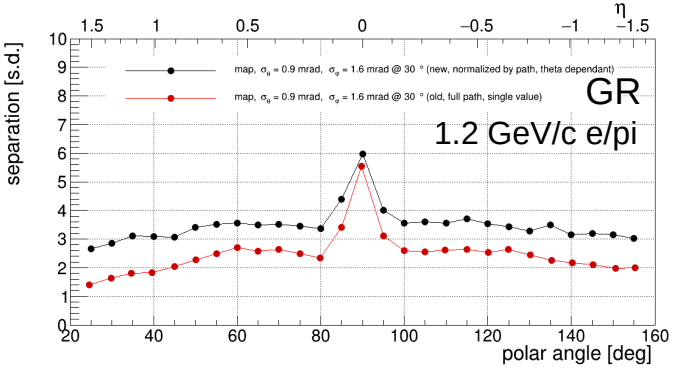
Reconstruction Corrections

- per-pmt correction
- chromatic correction
  (normalized by propagation length)





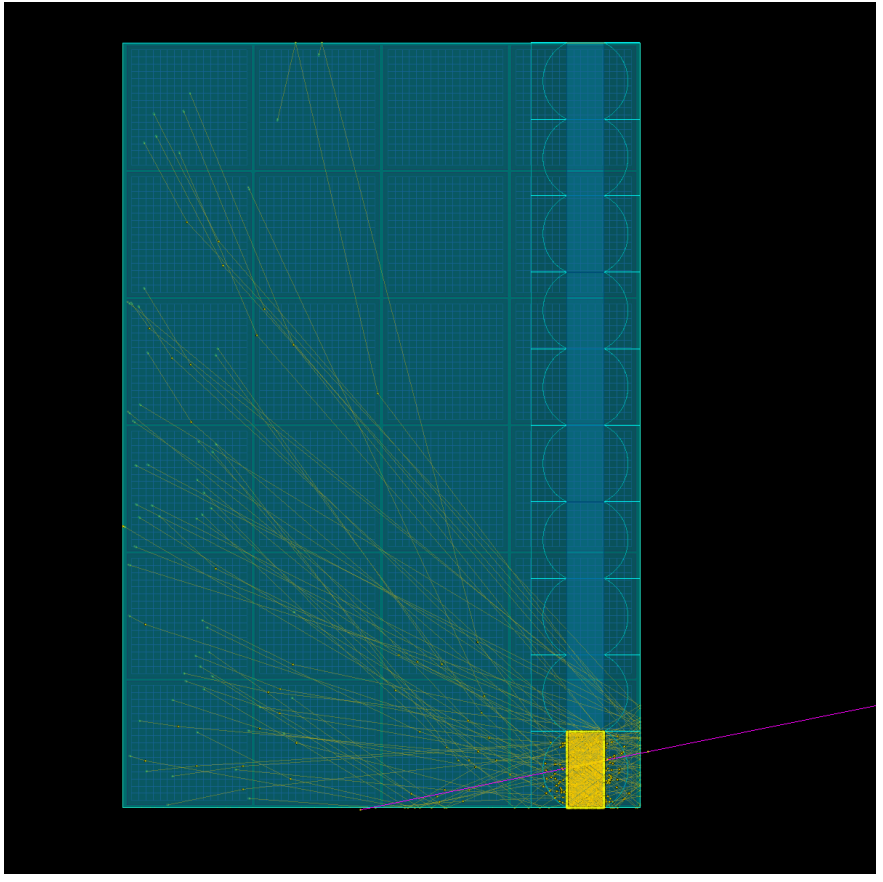




DIRC Performance

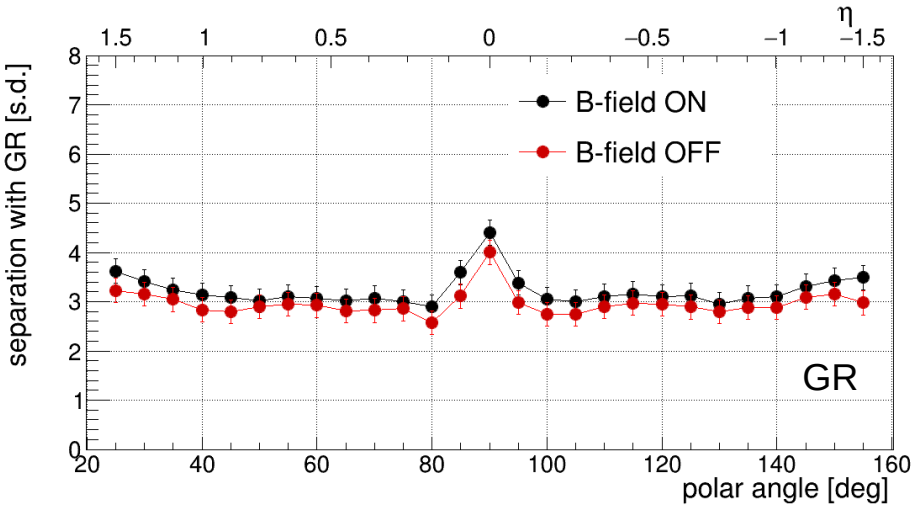
- new default track parameters (vertex at 0,0; hit middle of the bar; non-zero azimuth angle)

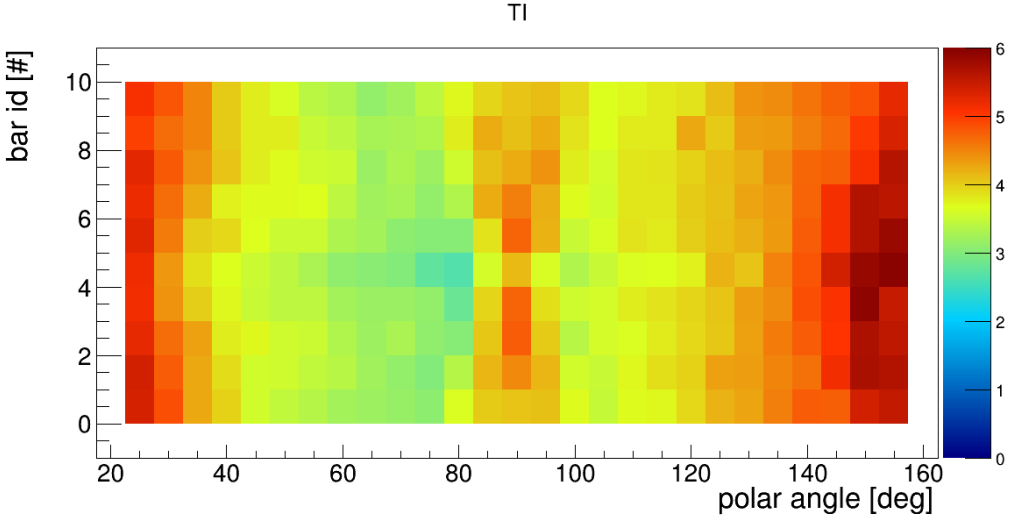
example of hitting middle of first bar

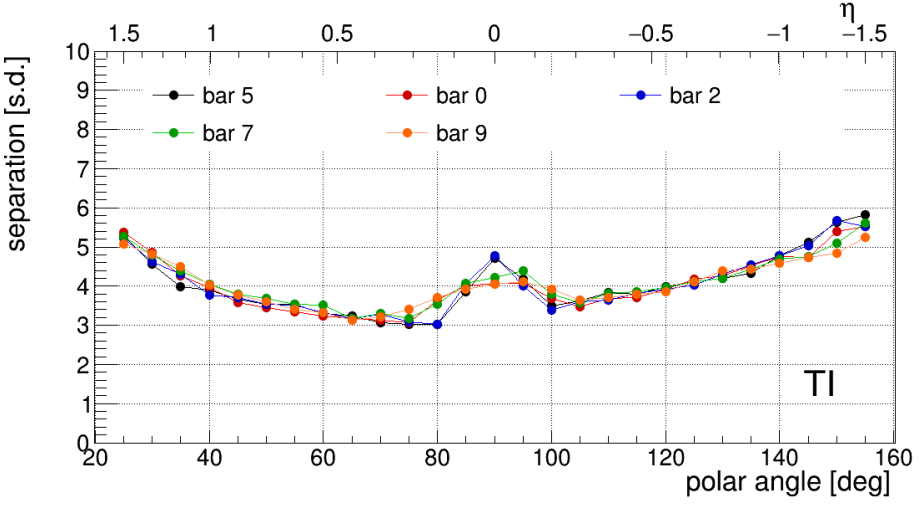


DIRC Performance

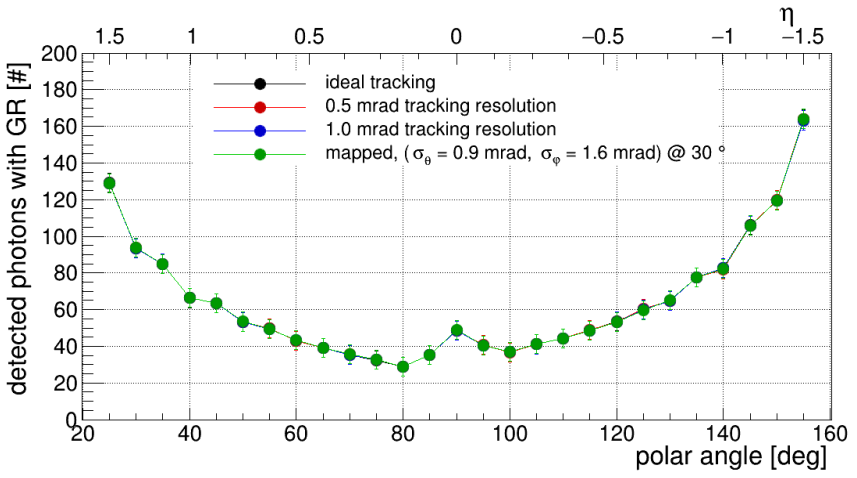
- new default track parameters (vertex at 0,0; hit middle of the bar; non-zero azimuth angle)
- evaluated for full phase space (across all radiator bars)
- with B-field
- Time Imaging for pi/K @ 6 GeV/c

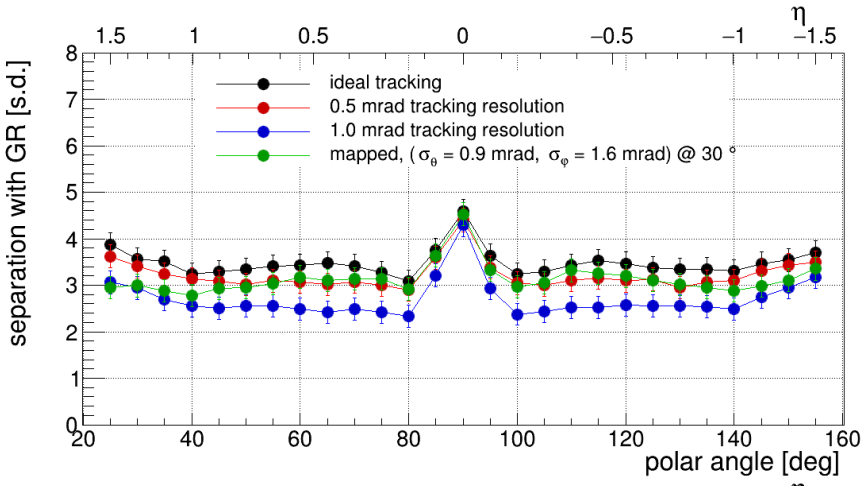


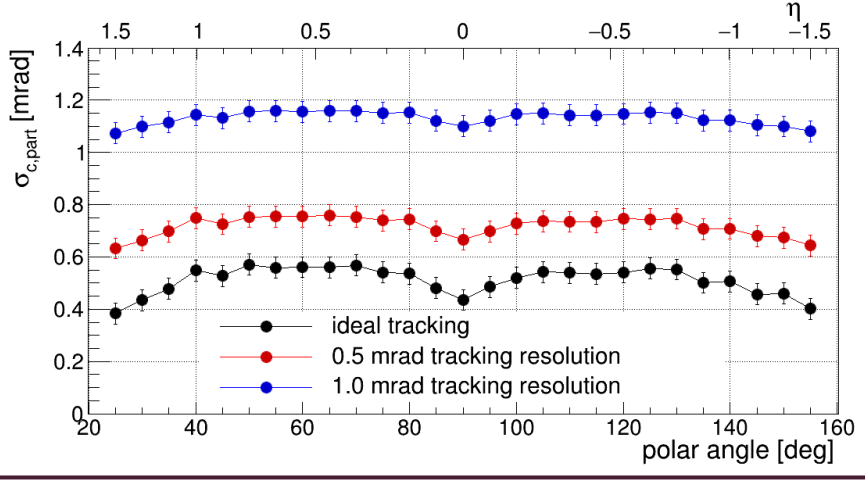


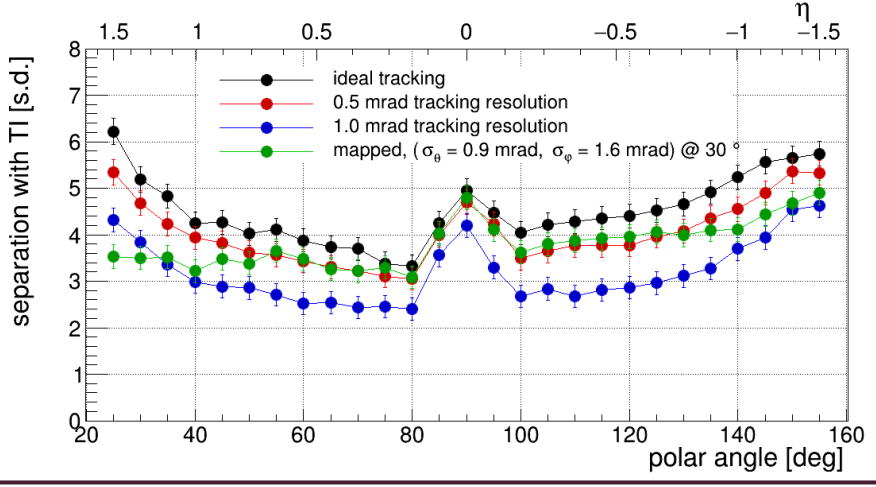


DIRC Performance



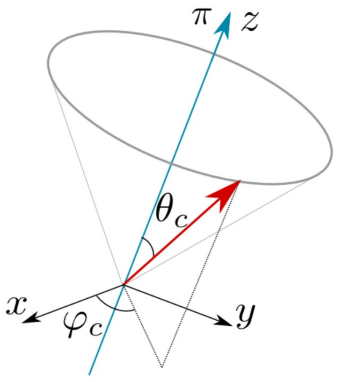




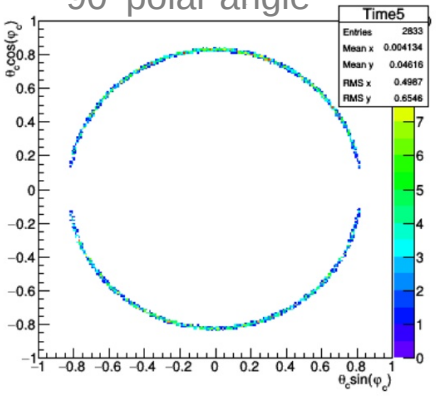


Cherenkov Ring Fit

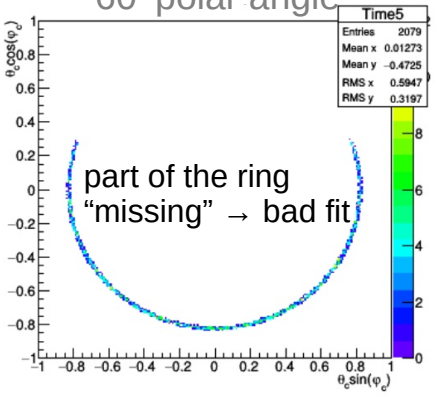
Cherenkov ring fit (corrects the direction of the charged track)



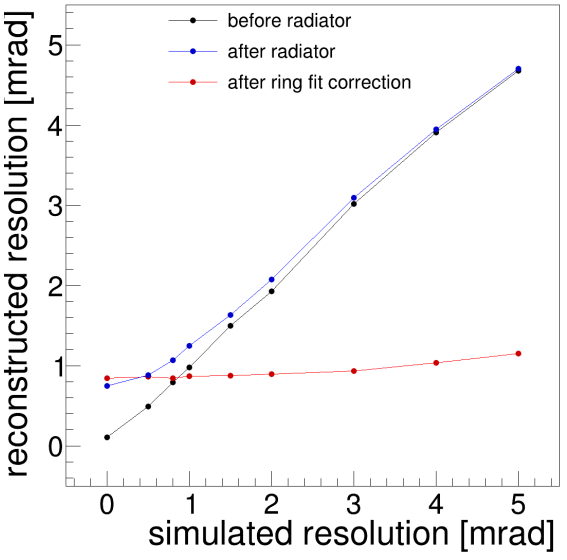
90° polar angle



60° polar angle

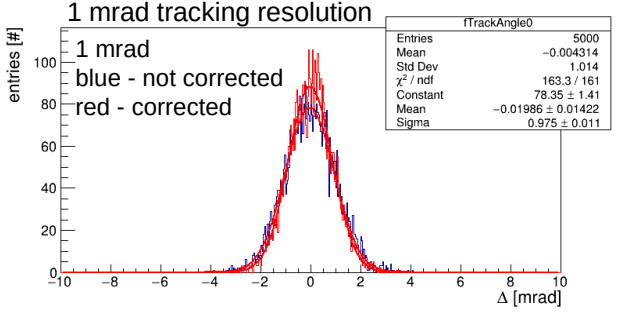


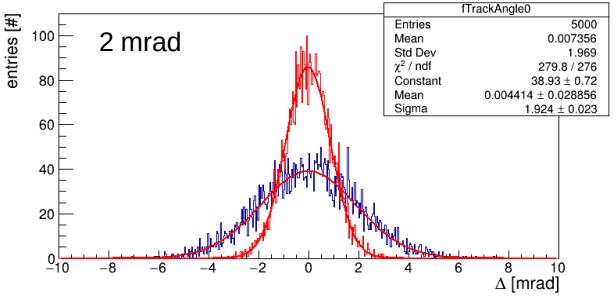
90° polar angle

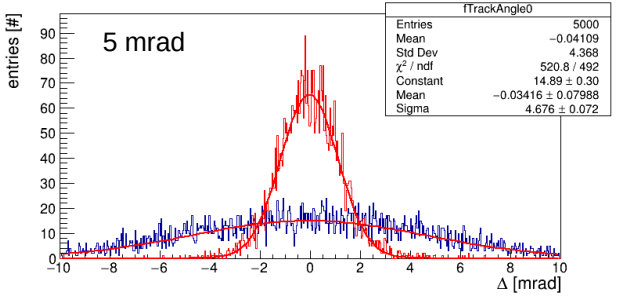


Examples of fit result @ 90° polar angle

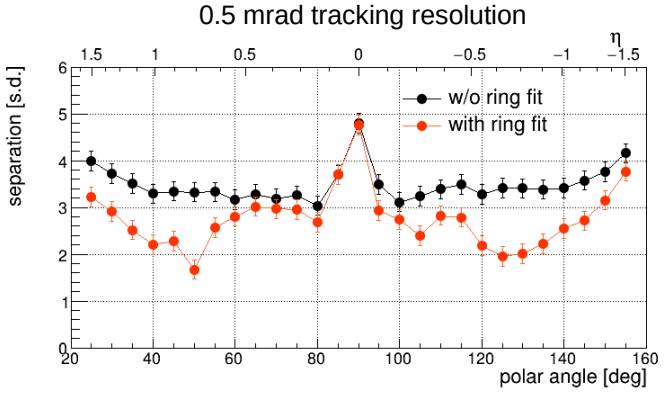
1 mrad tracking resolution

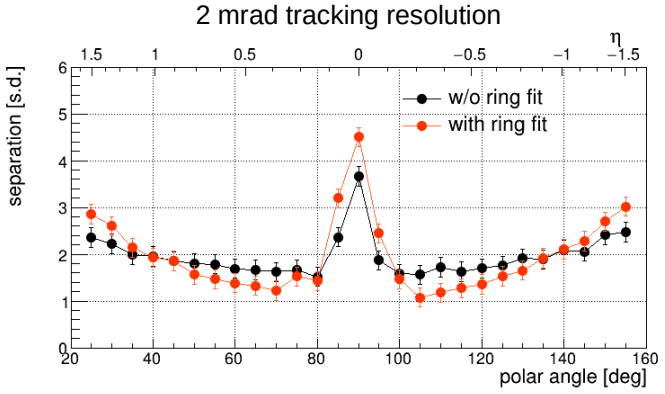


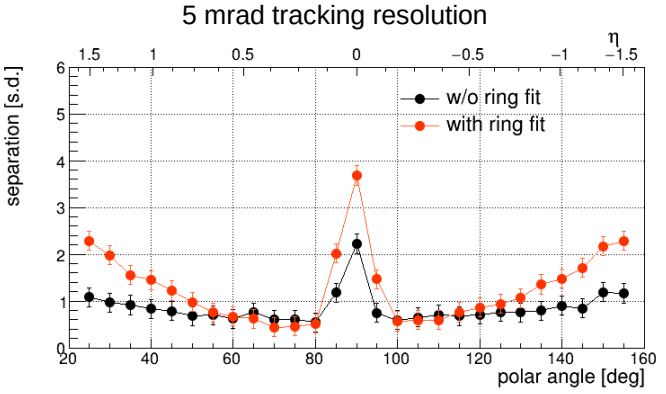




Cherenkov Ring Fit

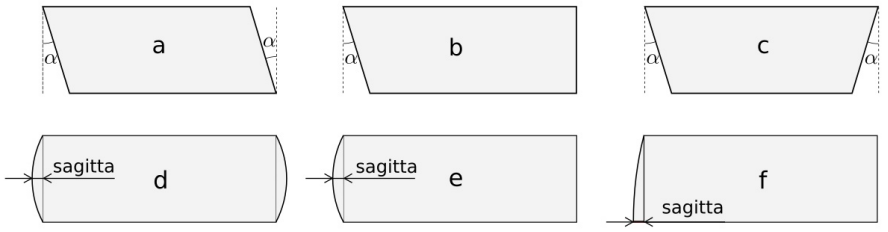


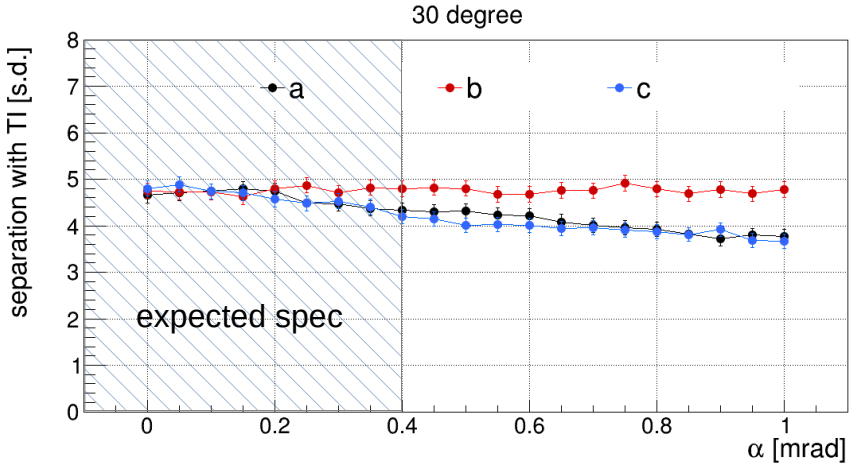


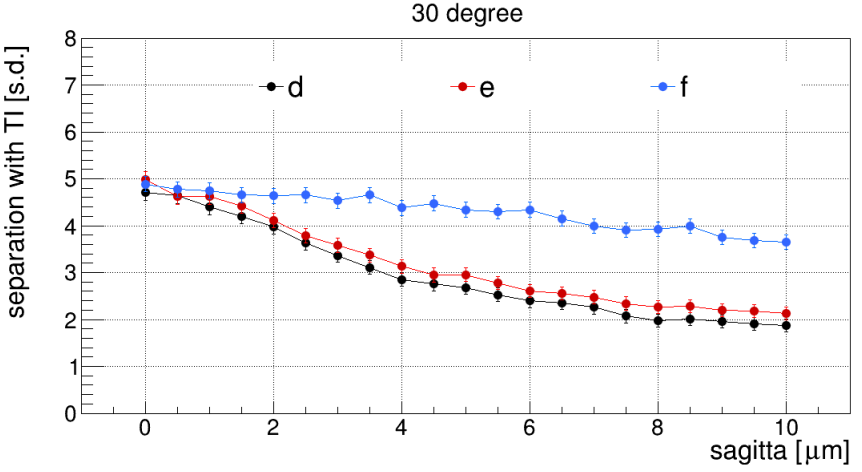


- tracking resolution < 1 mrad => no improvements
- tracking resolution > 1 mrad improvements around 90^{o} and in far backward / forward angles

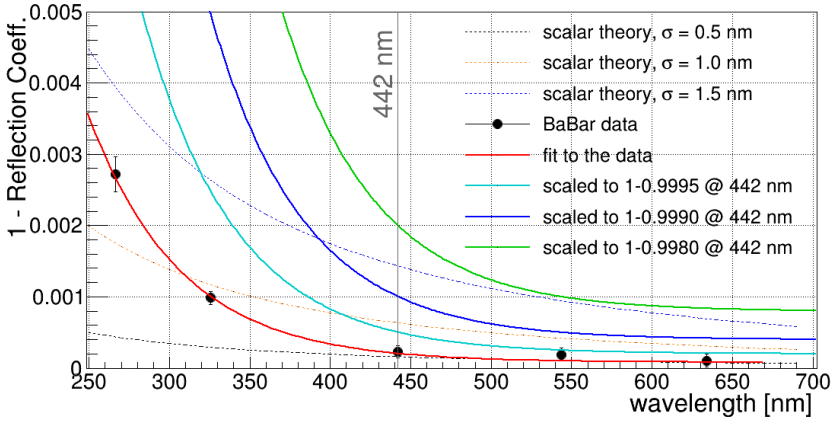
Bar Imperfections

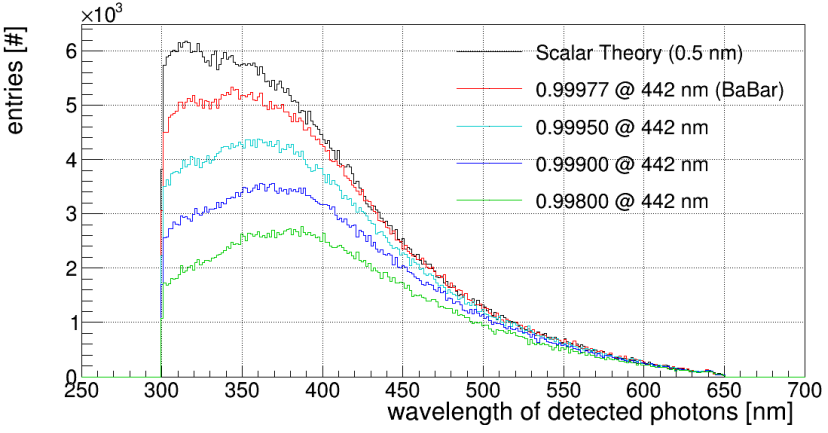


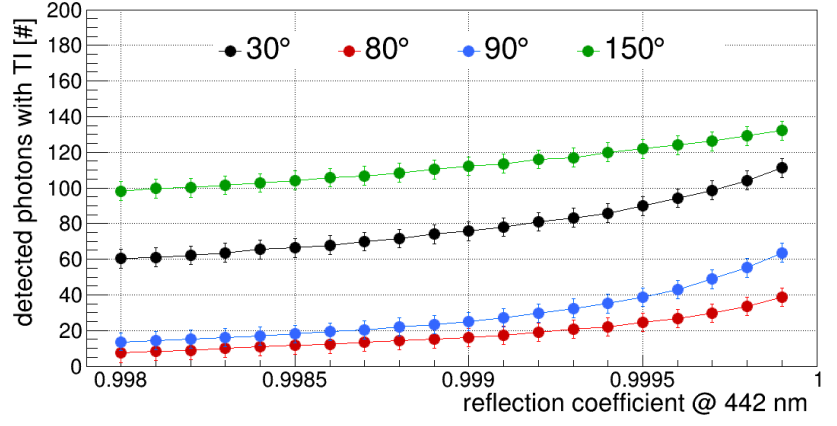


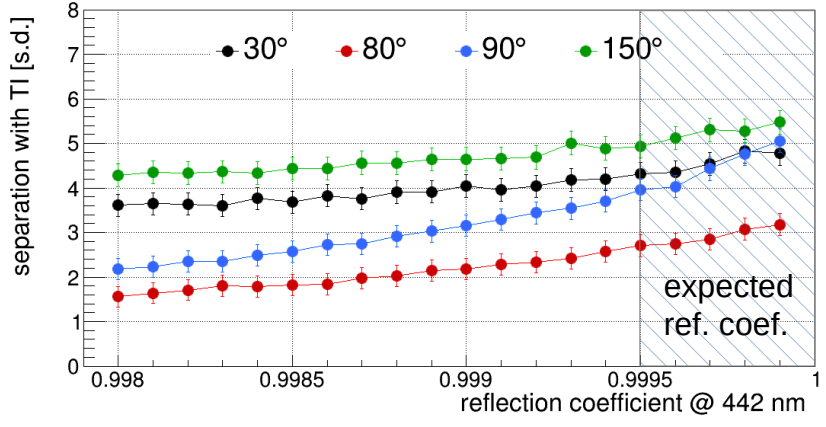


Transport Efficiency

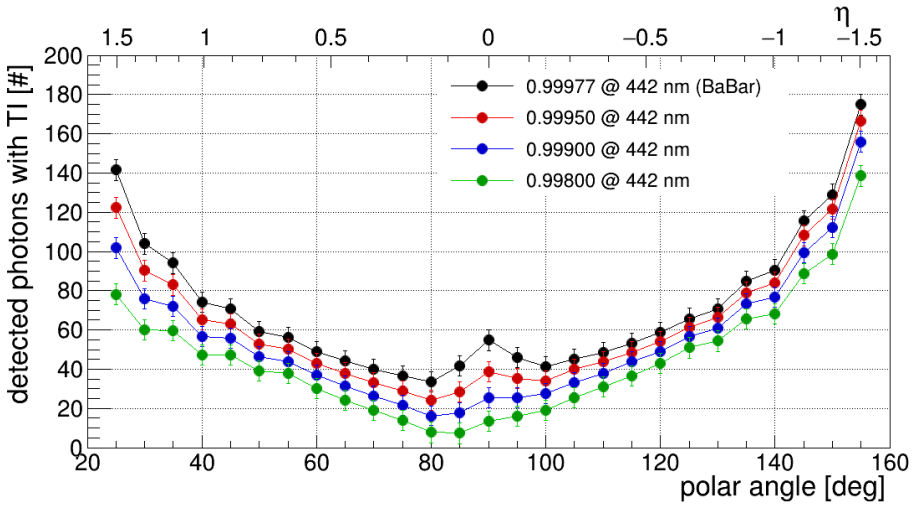


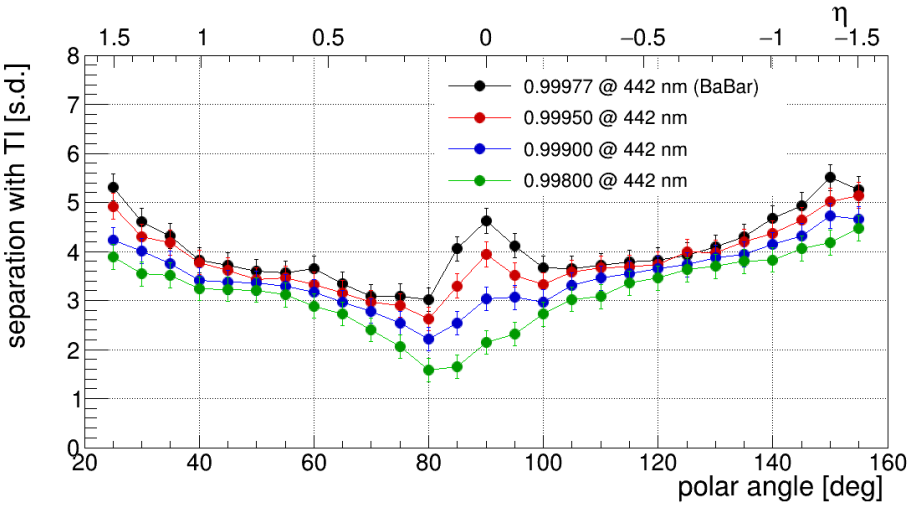




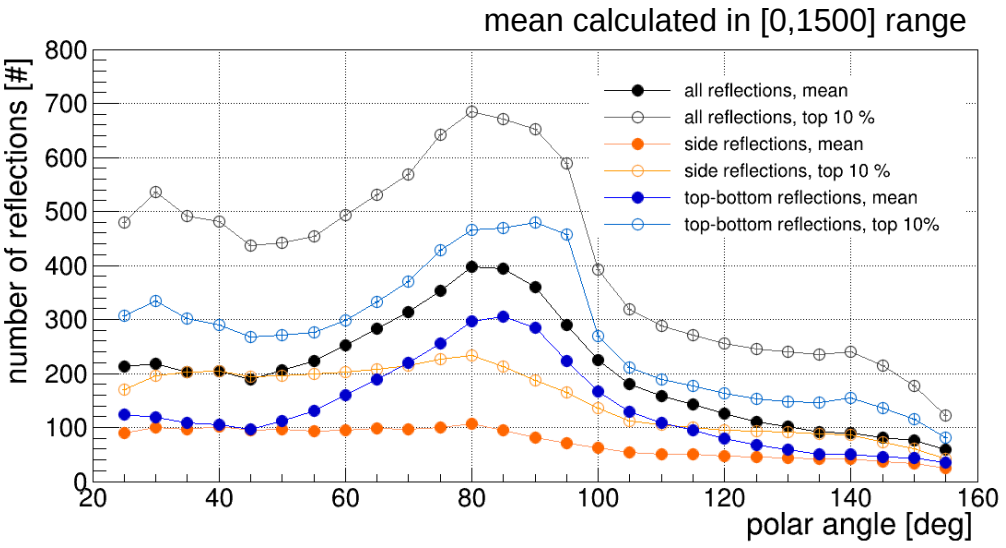


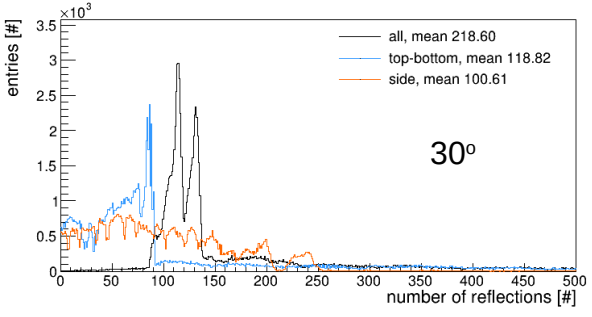
Transport Efficiency

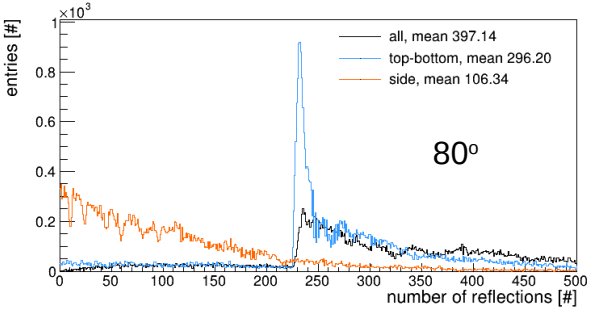


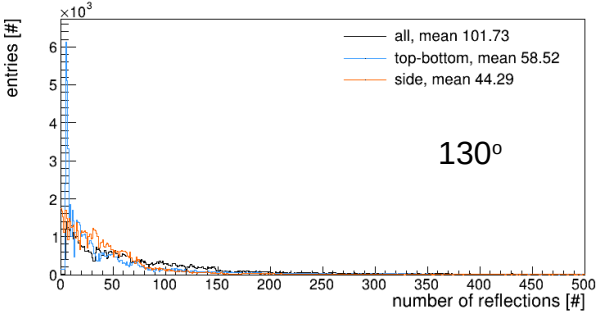


Number of Reflections inside Bar





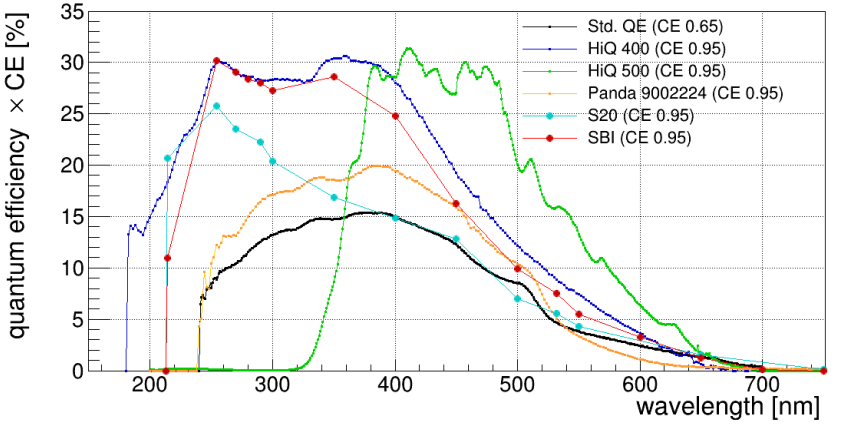


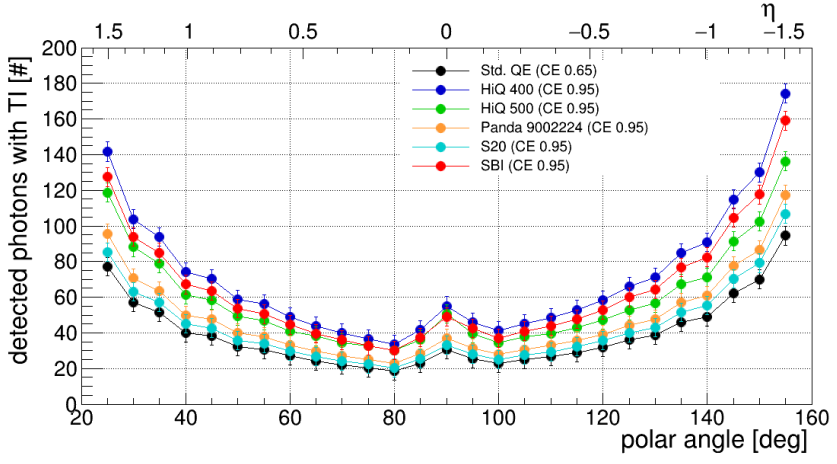


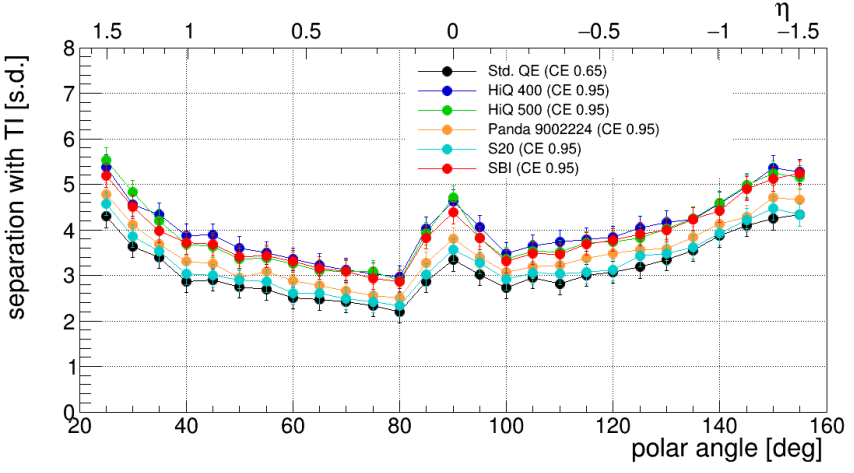
QE Comparison

New Photek PMTs

- S20 photocathode
- SBI, Super-Bialkali photocathode

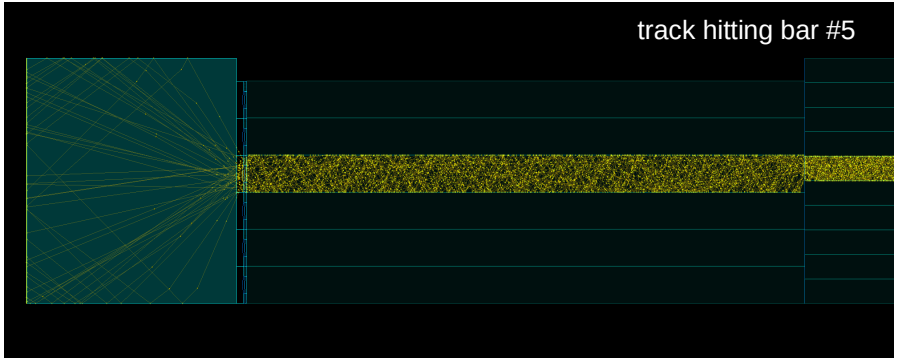


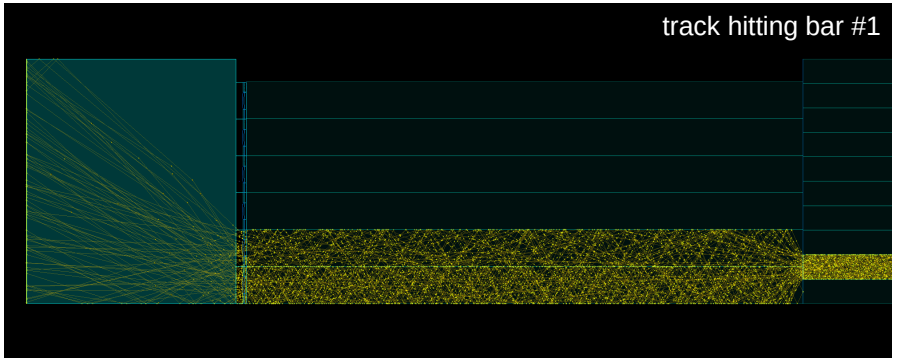


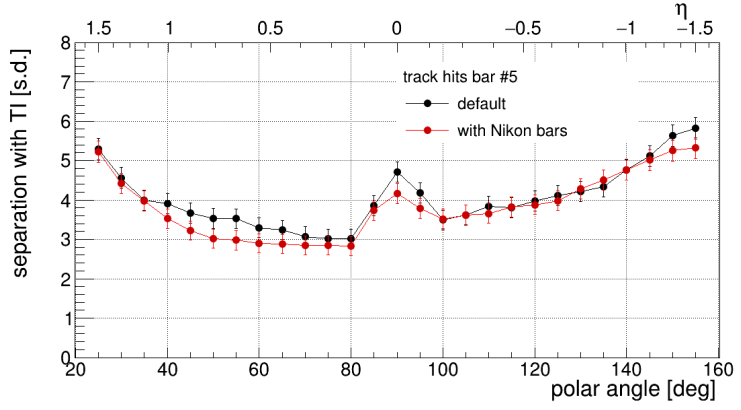


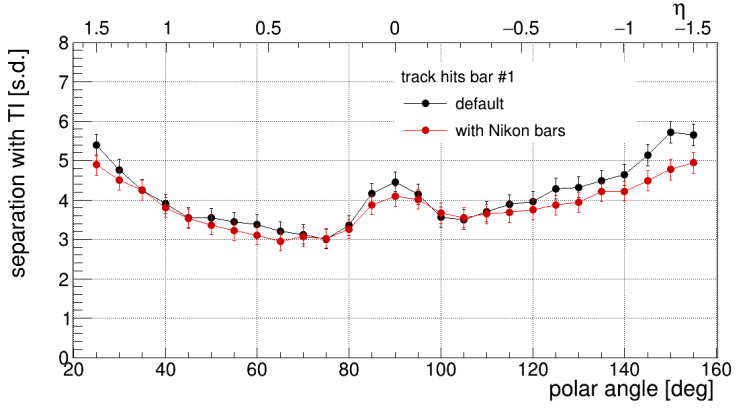
PANDA Bars with BaBar bars

- 800 mm Nikon bar + 3 x 1225 BaBar bars
- PANDA lens with r=[95,50]





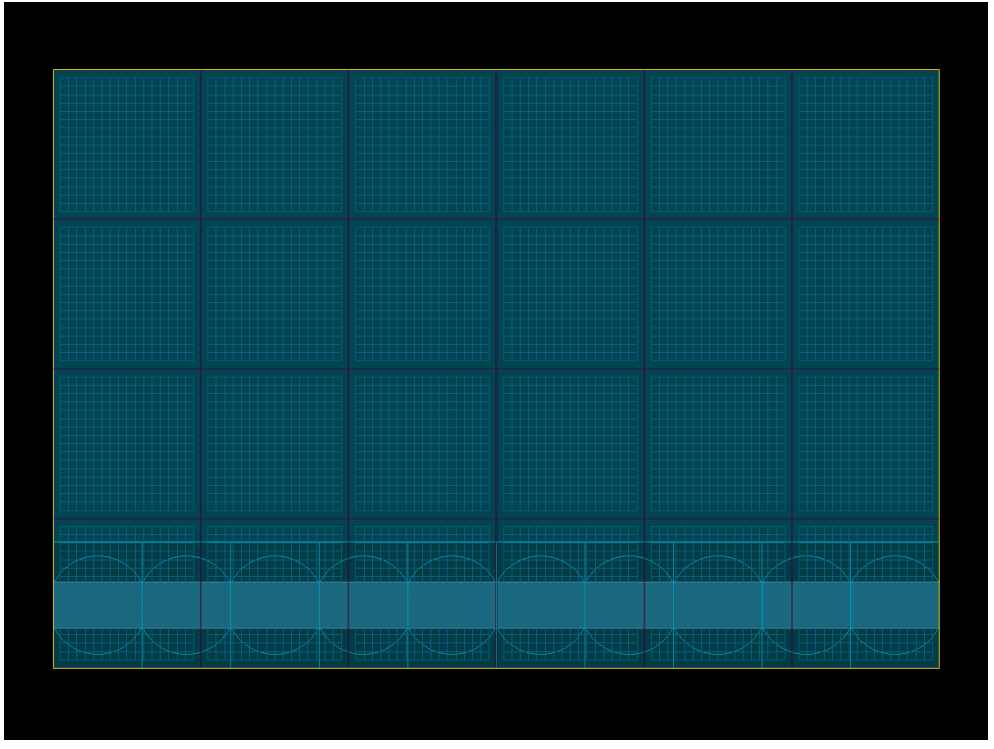




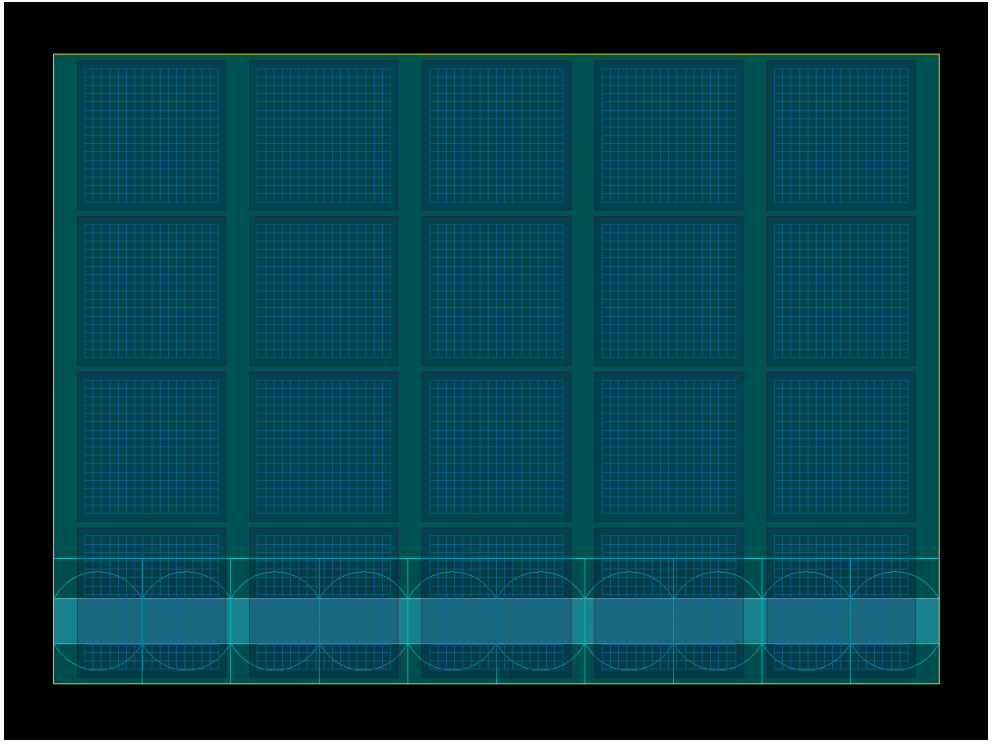
4x5 PMTs layout

opening angle of the prism (32° -> 33.7°)

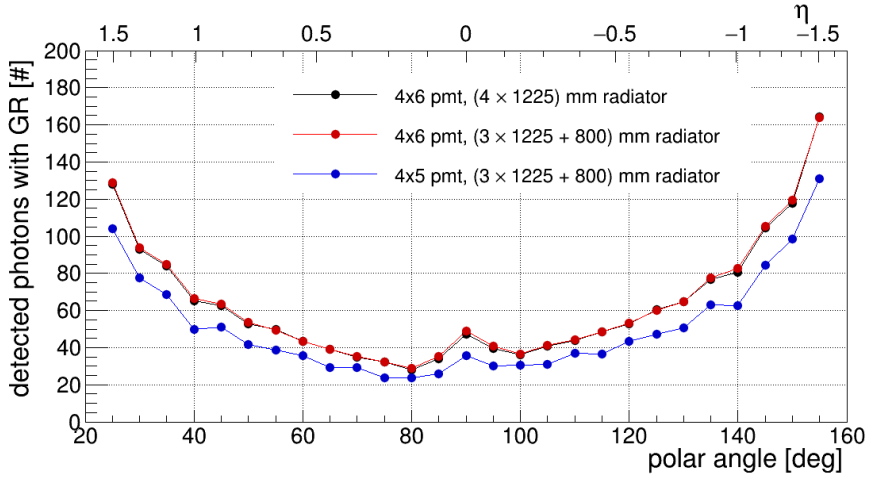
4x6 layout

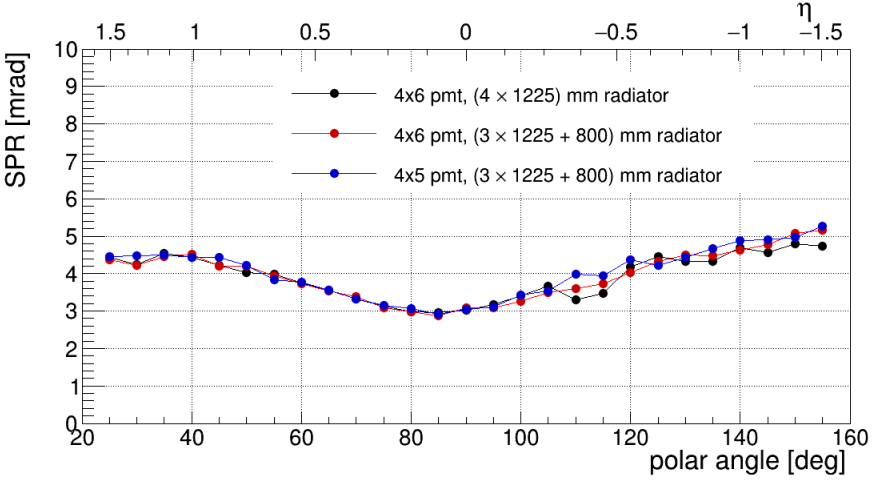


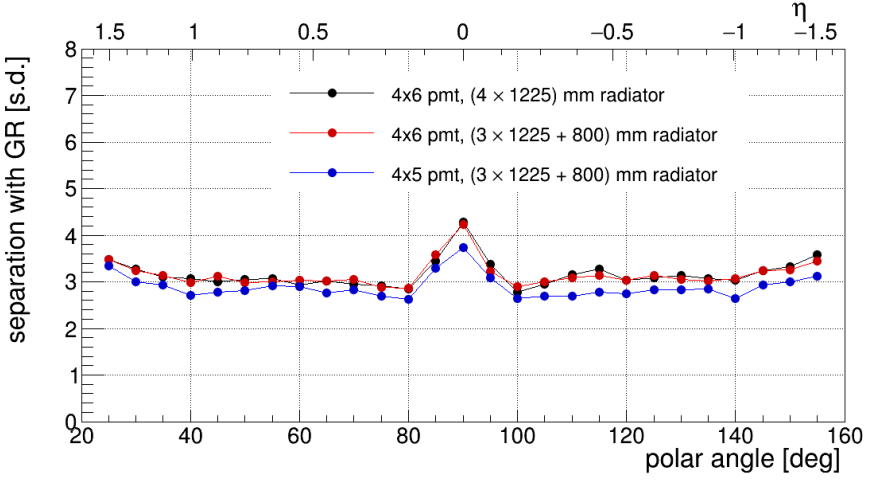
4x5 layout

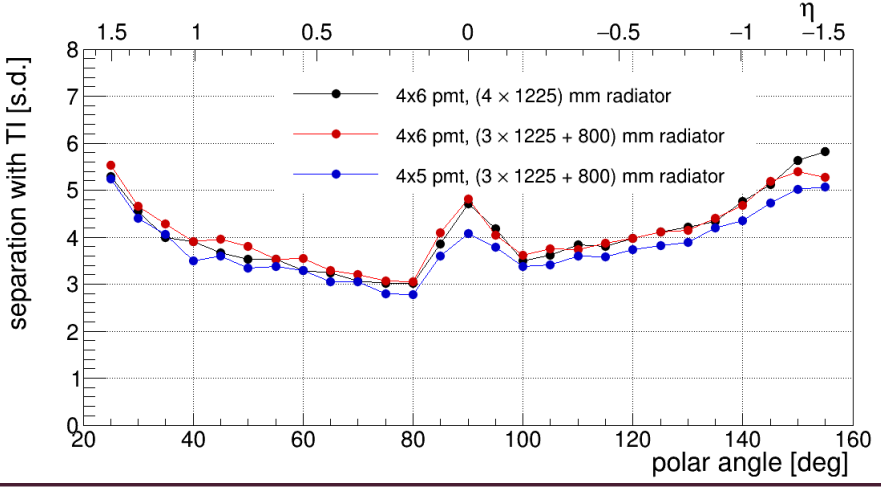


4x5 PMTs layout



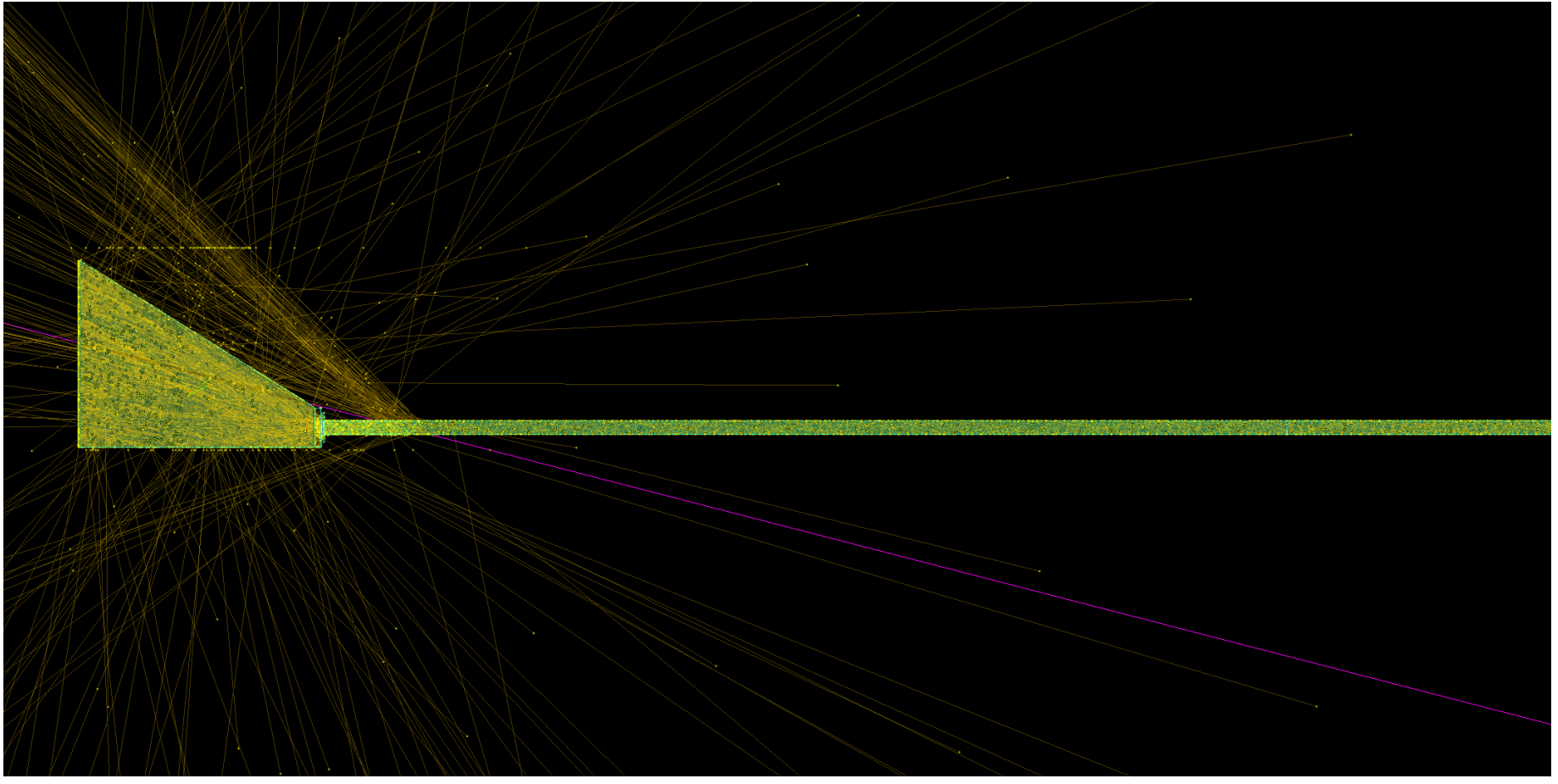






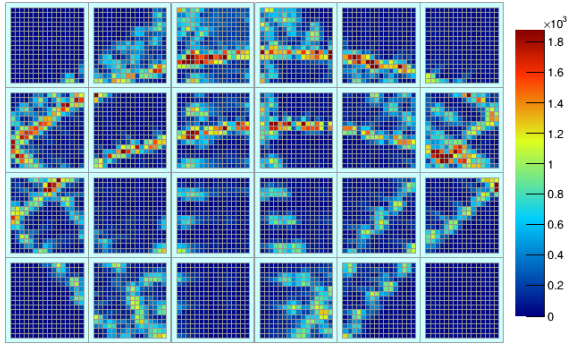
Track in Prism

Event Display for 165.4 degree polar angle pion @ 6 GeV/c

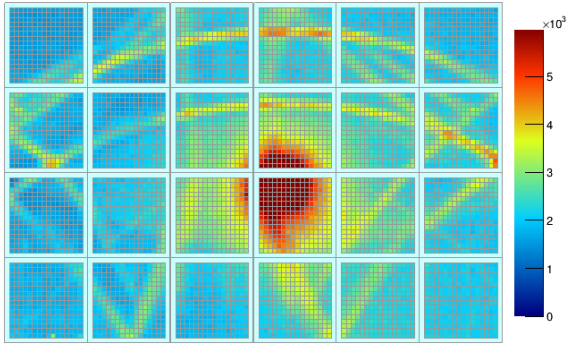


Track in Prism

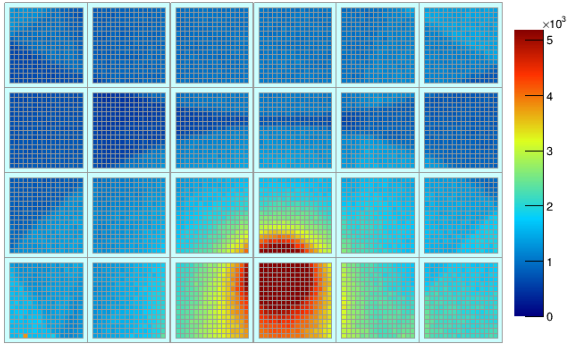
163.5 degree polar angle
(hitting only bar)



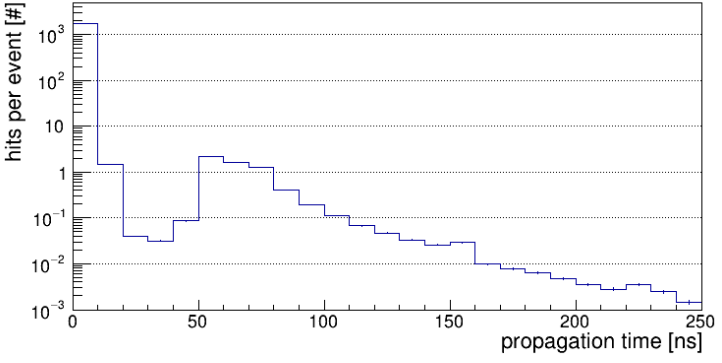
165.75 degree polar angle
(hitting both bar and prism)



166.75 degree polar angle
(hitting only prism)



propagation time distribution (averaged for all track hitting prism)



Alternative Designs for the Expansion Volume

Baseline design

3 x 1225 mm (bars) + 893 mm (bars)

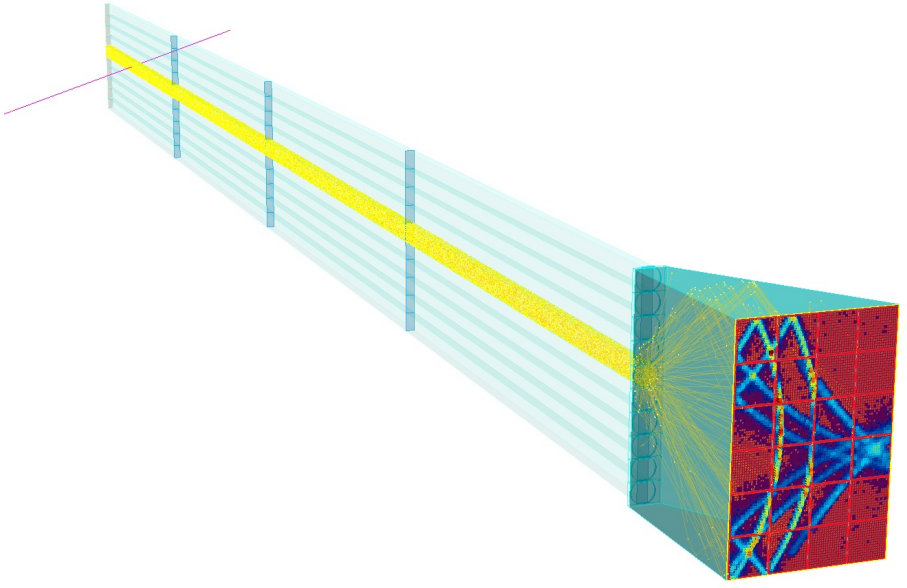
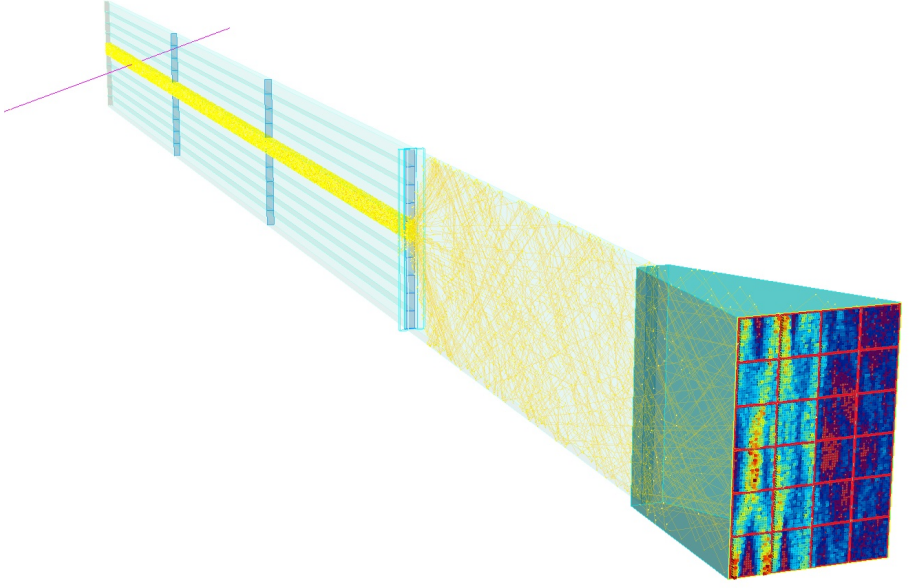


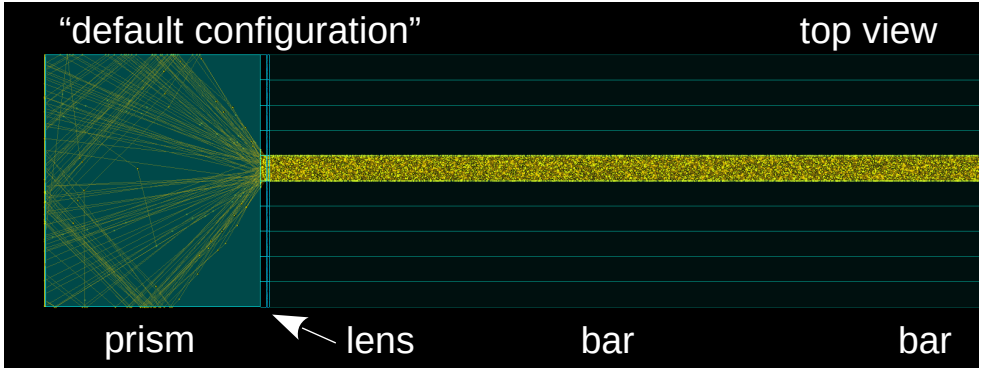
Plate as optical guide:

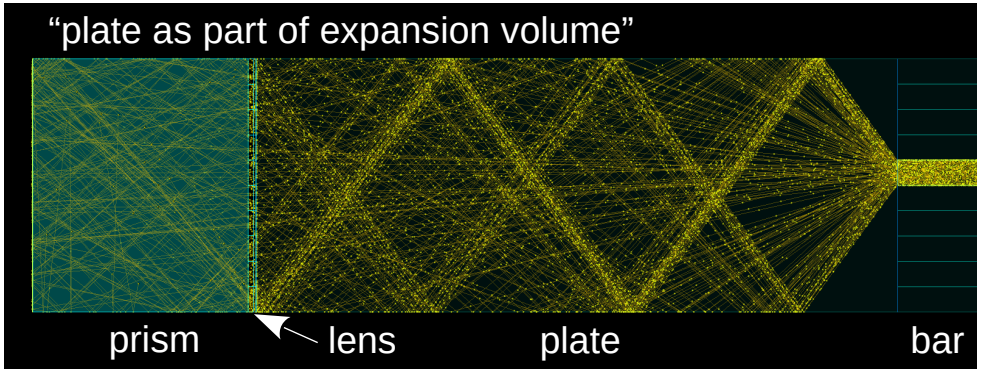
3 x 1225 mm (bars) + 893 mm (plate)

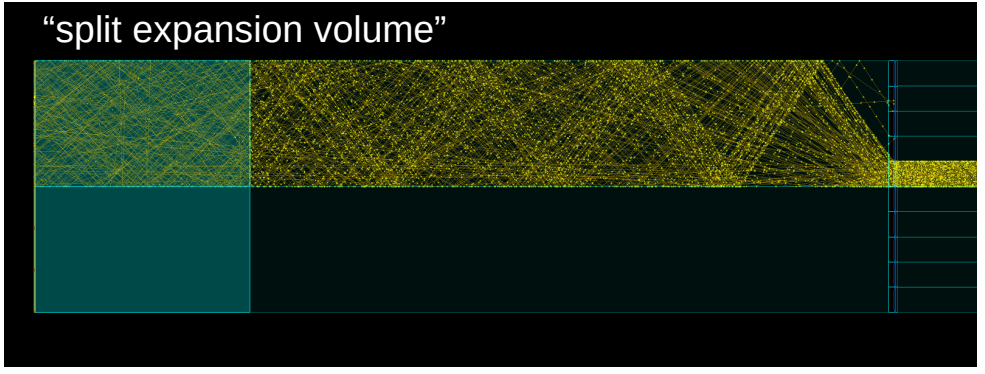


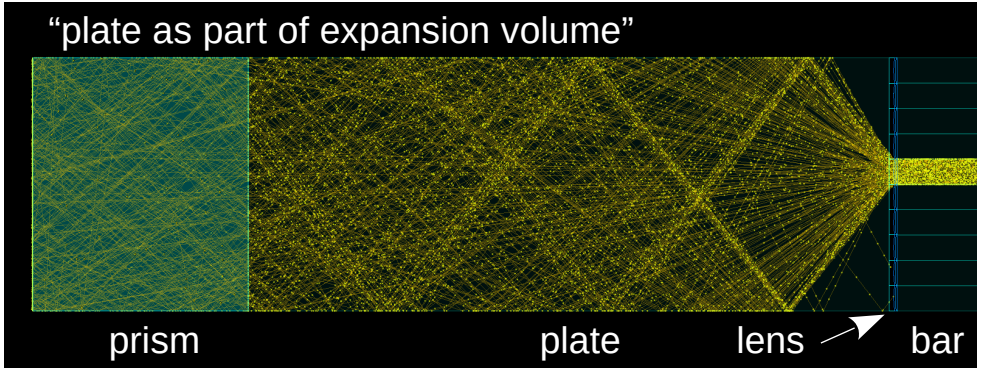
Alternative Designs for the Expansion Volume

event display witch Cherenkov photons from 1 pion @ 6 GeV/c



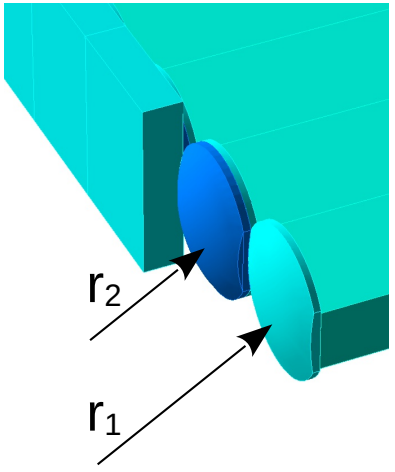




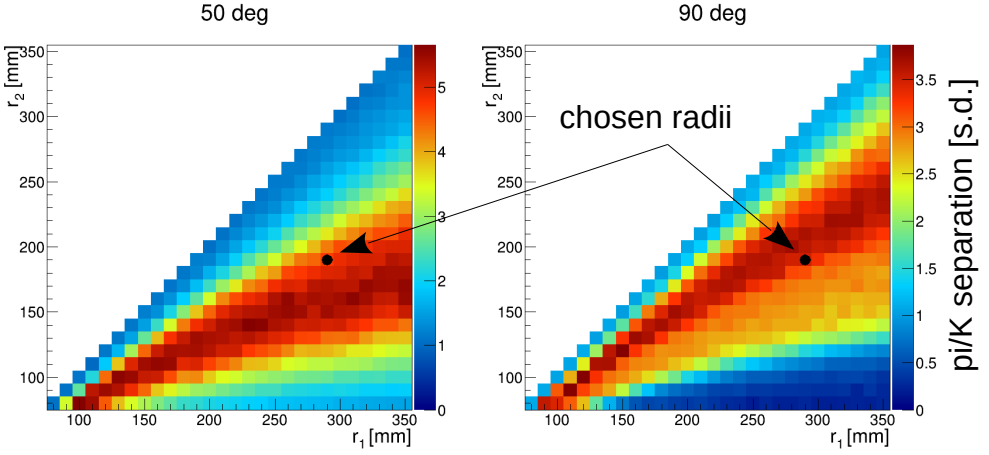


Focusing System

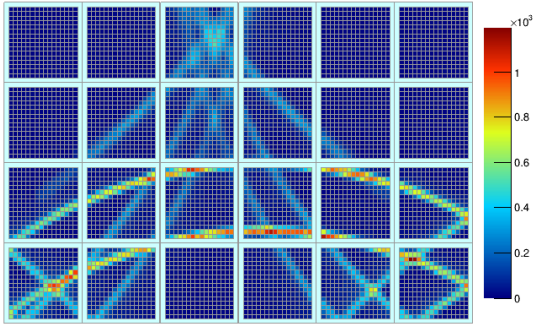
- 3-layer spherical lens
- optimized using radii scan with time imaging reconstruction
- Hit pattern is more complicated
  - kaleidoscopically effect
  - chromatic dispersion



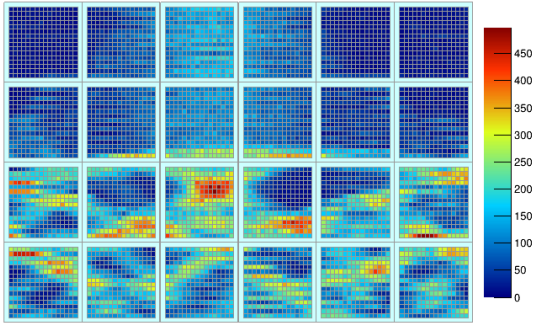
example of radii scan for EV-plate-SL-bars



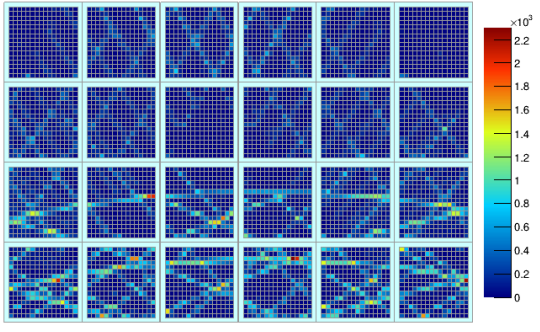
EV-SL-bars-bars



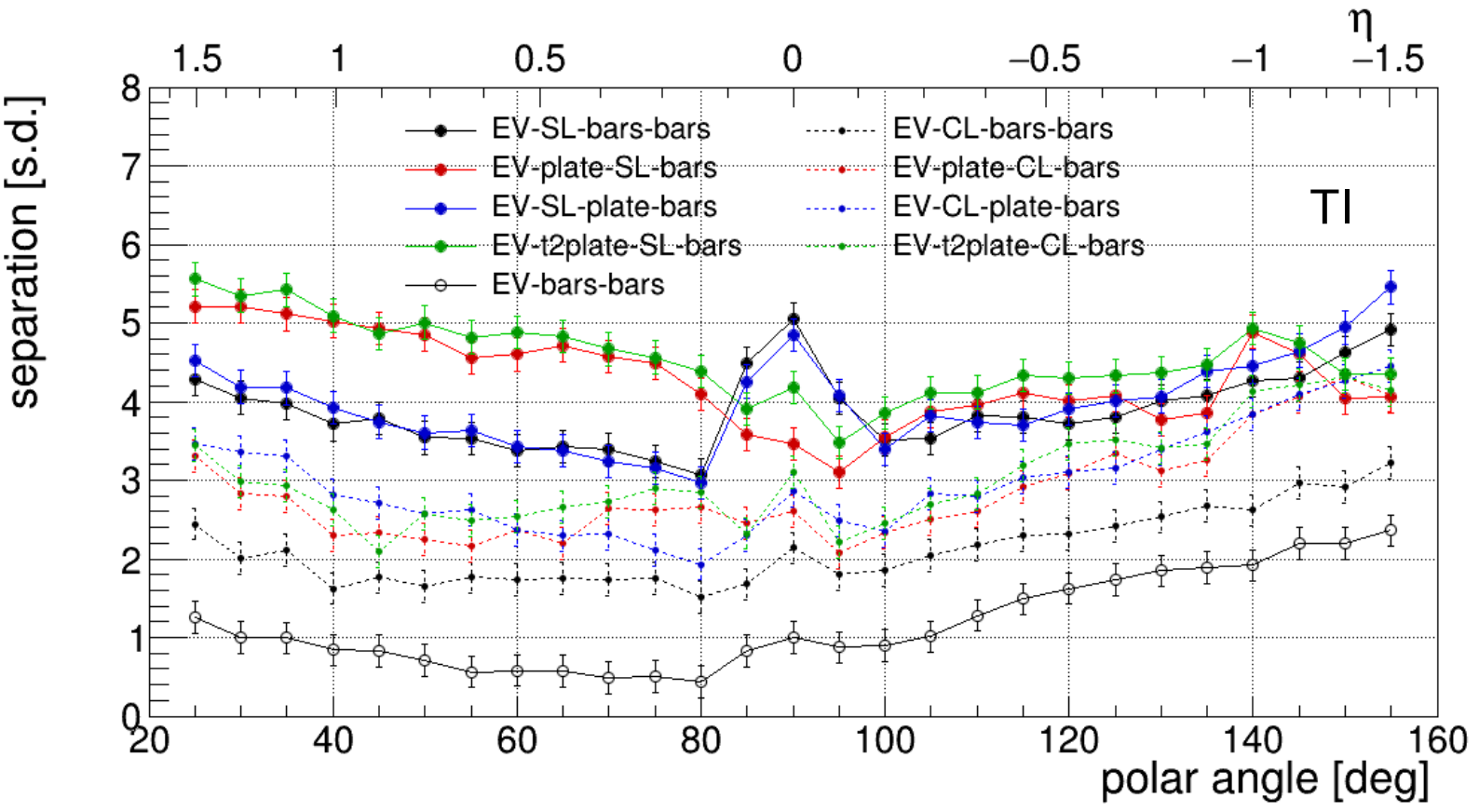
EV-plate-SL-bars



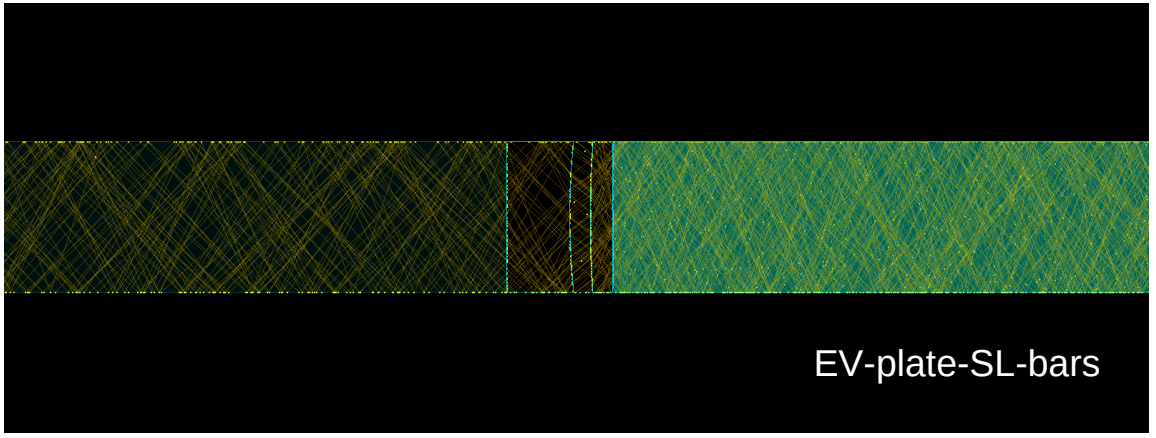
EV-plate-SL-bars with monochromatic Cherenkov light

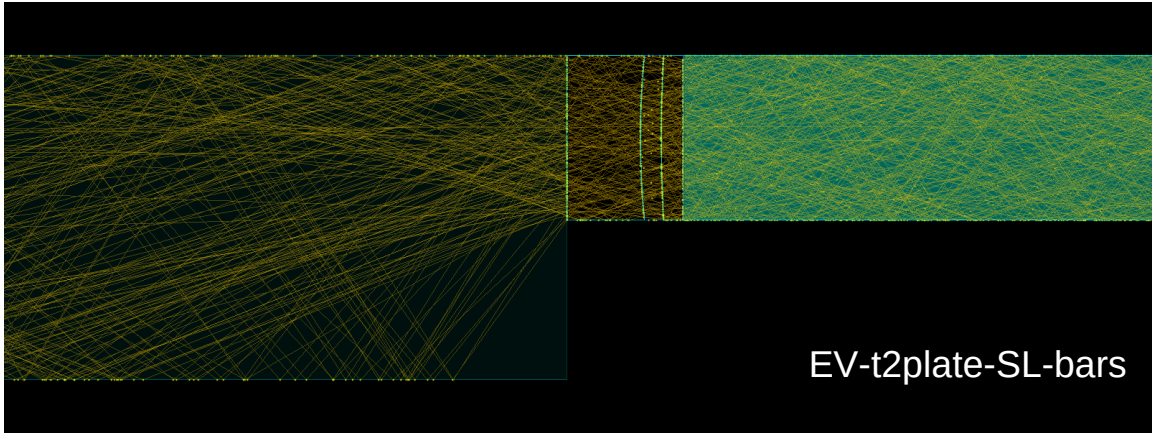


Alternative Designs for the Expansion Volume



Alternative Designs for the Expansion Volume





Alternative Designs for the Expansion Volume