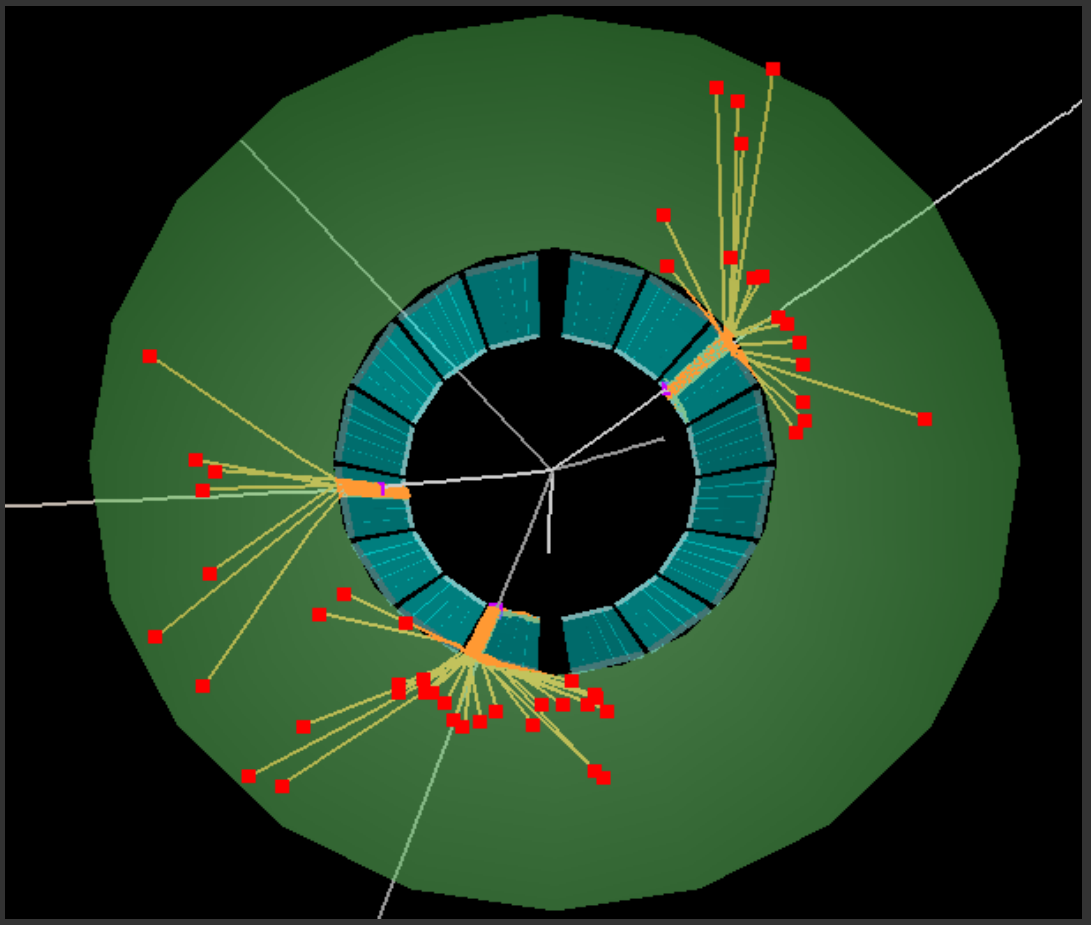
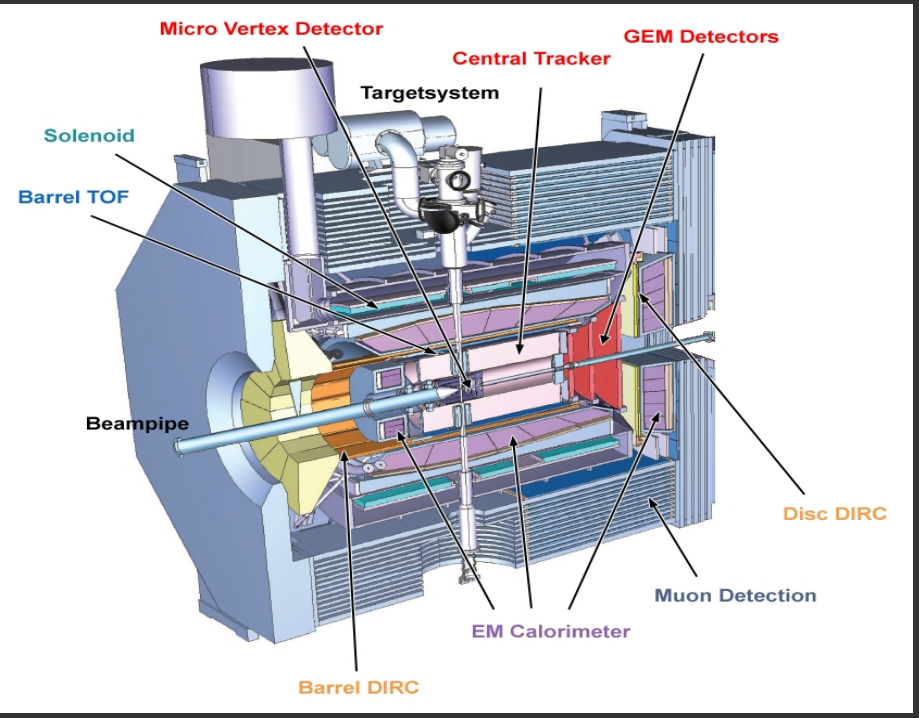


Simulation and Reconstruction of the PANDA Barrel DIRC

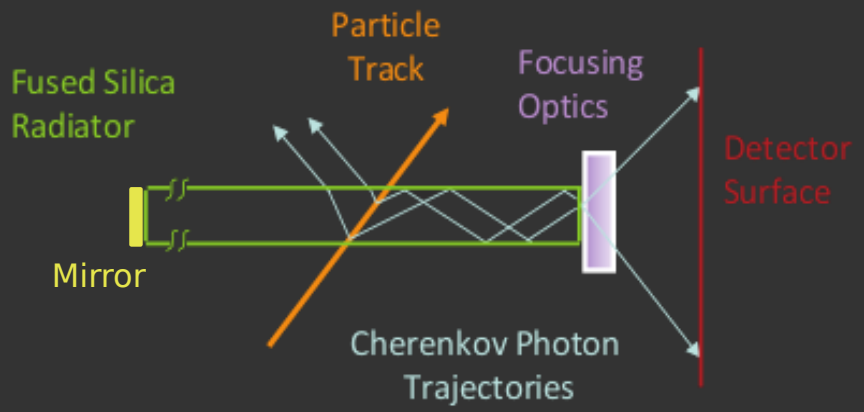
Maria Patsyuk

PANDA Barrel DIRC

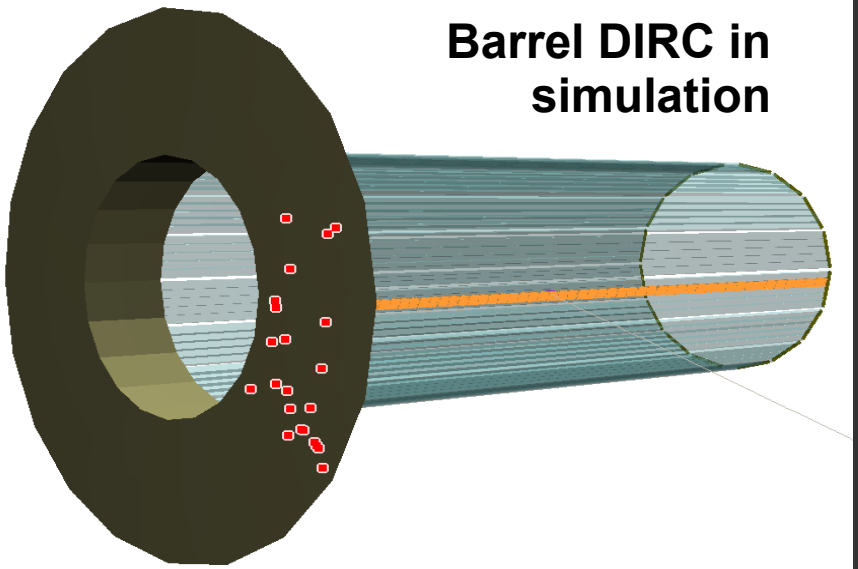


- PANDA DIRC is a PID detector

- Cherenkov light coming from the charged particle is trapped in the radiators and guided to the photo detector plane. Depending on the particle velocity the hit patterns are different:



Barrel DIRC in simulation



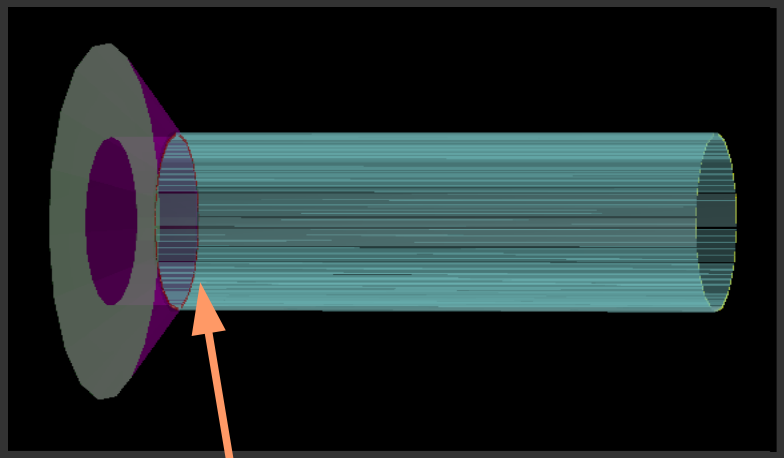
- PANDA PID requirement: π/K separation in the range of [0.5; 3.5] Gev/c

- Design goal: 3 mrad Cherenkov angle resolution, which means ~8-9 mrad single photon Cherenkov angle resolution and > 20 photons per track detected

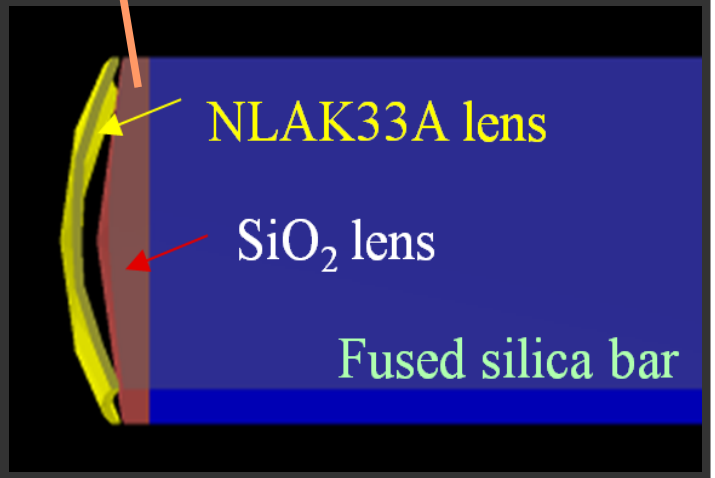
- Baseline design is based on the BABAR-DIRC, but many parameters should be optimized

Some design options

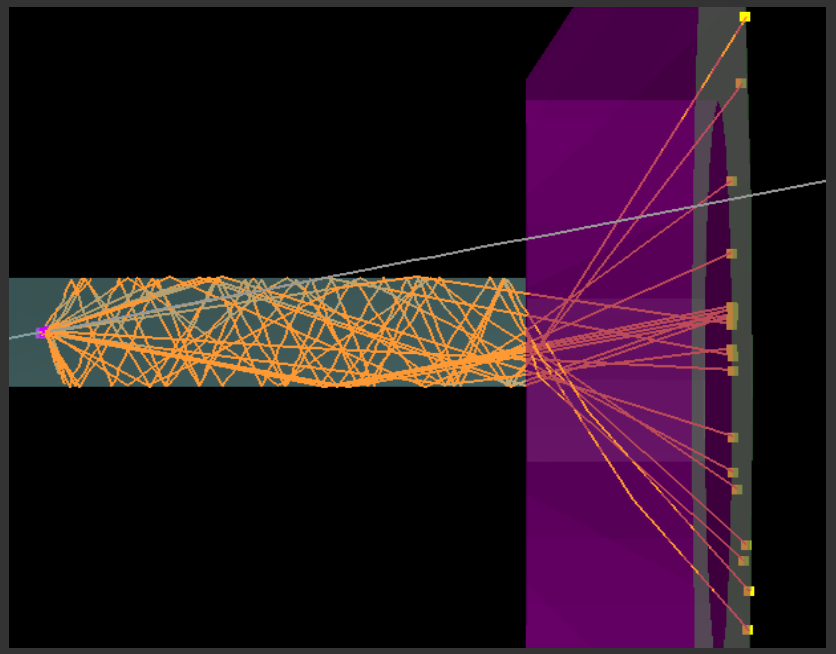
Radiator bars (5 bars per bar box)



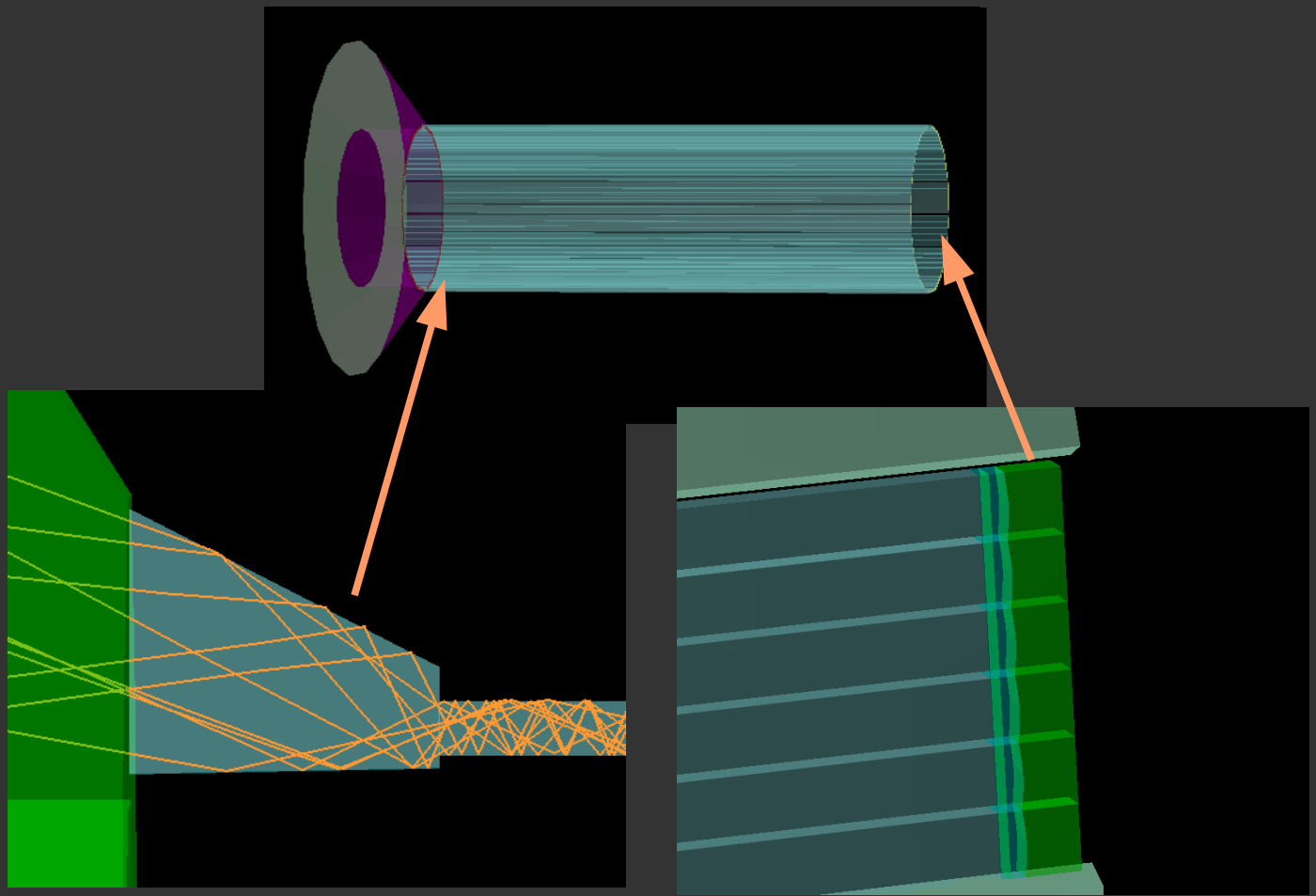
Baseline design, focusing system - coated doublet lens



Radiator plate



Some design options



- Prism compresses the phase space in radial direction and reduces the number of required pixels
- Forward mirror focuses forward-going photons
- Separated expansion volumes (one for each bar box) reduce weight, simplifiy detector design. They can be used with prisms

Reconstruction approach

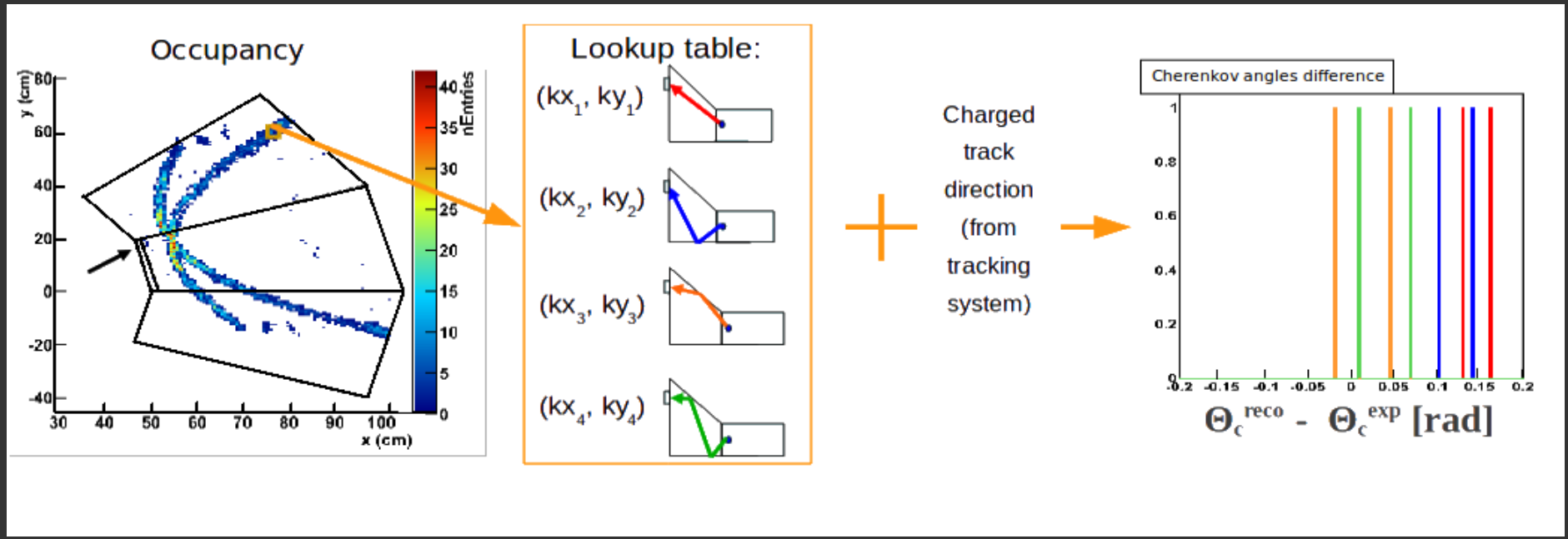
Photo detector plane is covered with PMT-MCPs, hit pixels are used as the detector raw data. Time information is planned to be used as well.

Procedure:

1. Before reconstruct track patterns create look-up tables where initial photon direction for each pixel is saved (taking into account 4 possible photon paths to the photo detector)

2. Get charged particle direction from tracking system (or from MC data)

3. For each pixel of the hit pattern combine information about the photon and the charged particle direction to reconstruct the Cherenkov angle and plot it (subtracting the expected Cherenkov angle)

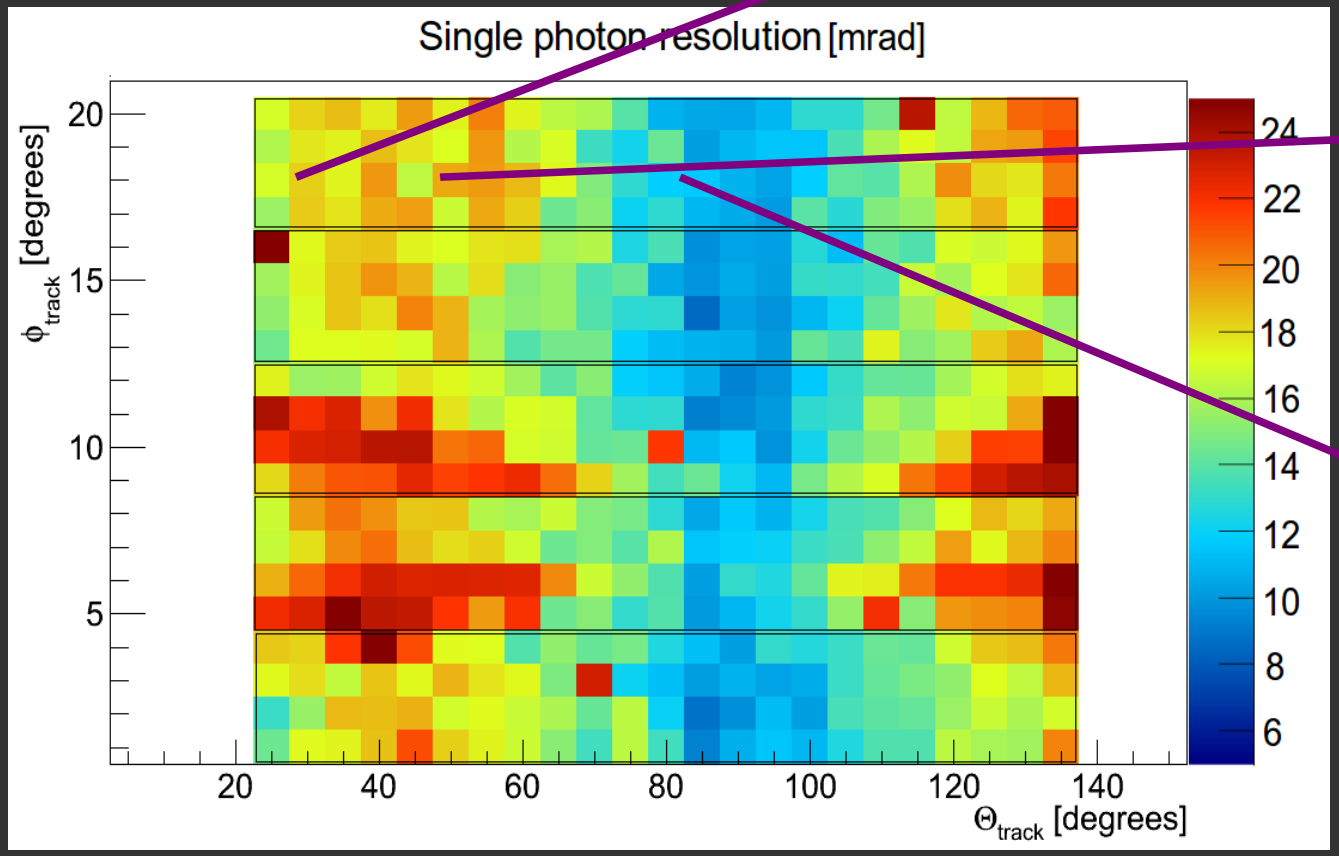


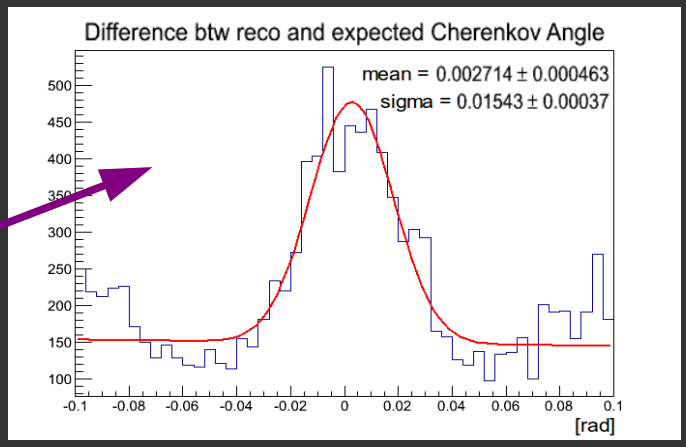
Performance of the simplest DIRC design

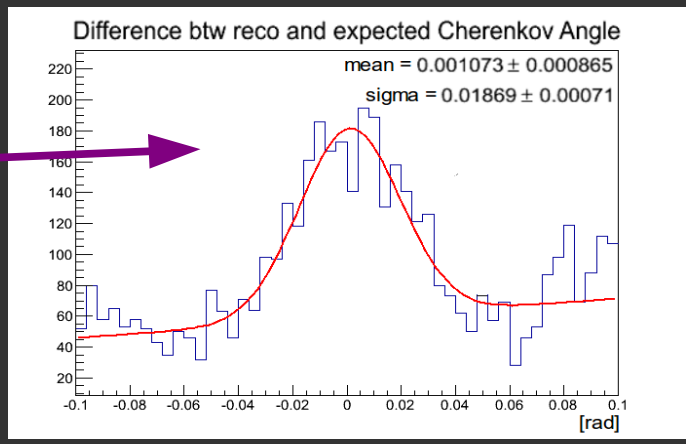
No focusing, fused silica bars are directly attached to the expansion volume (EV)

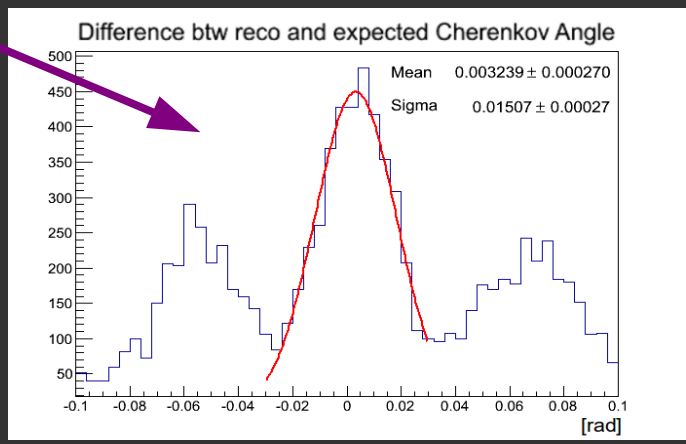
Simple estimation of Single photon Cherenkov angle resolution - 18-19 mrad

map of θ_c^{photon} for one bar box, 3 GeV muons

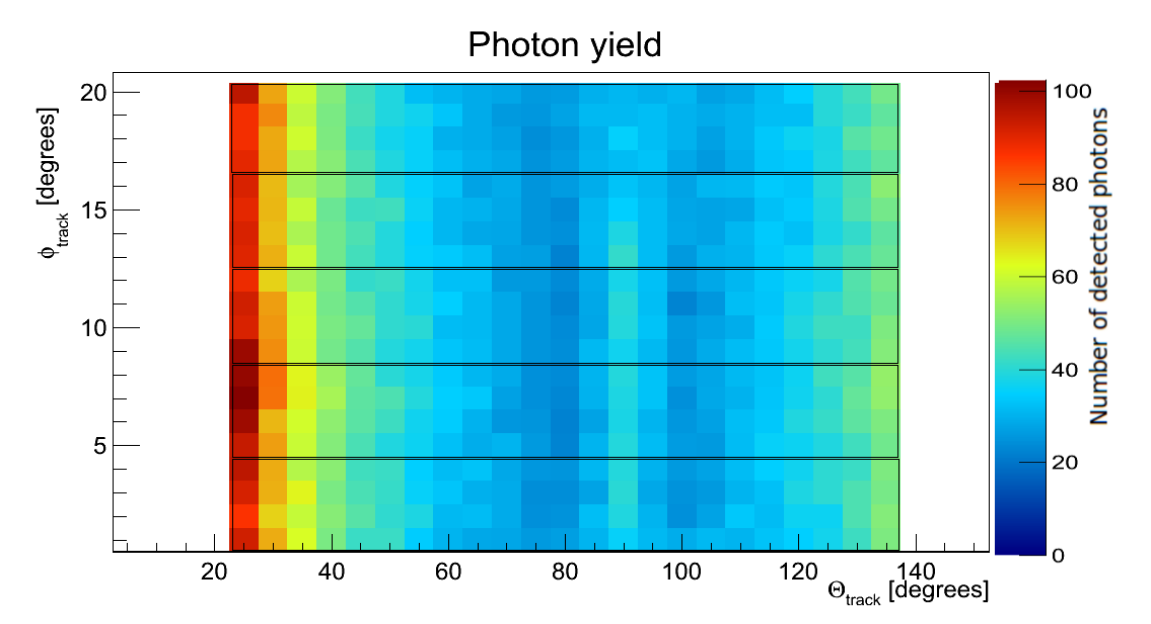




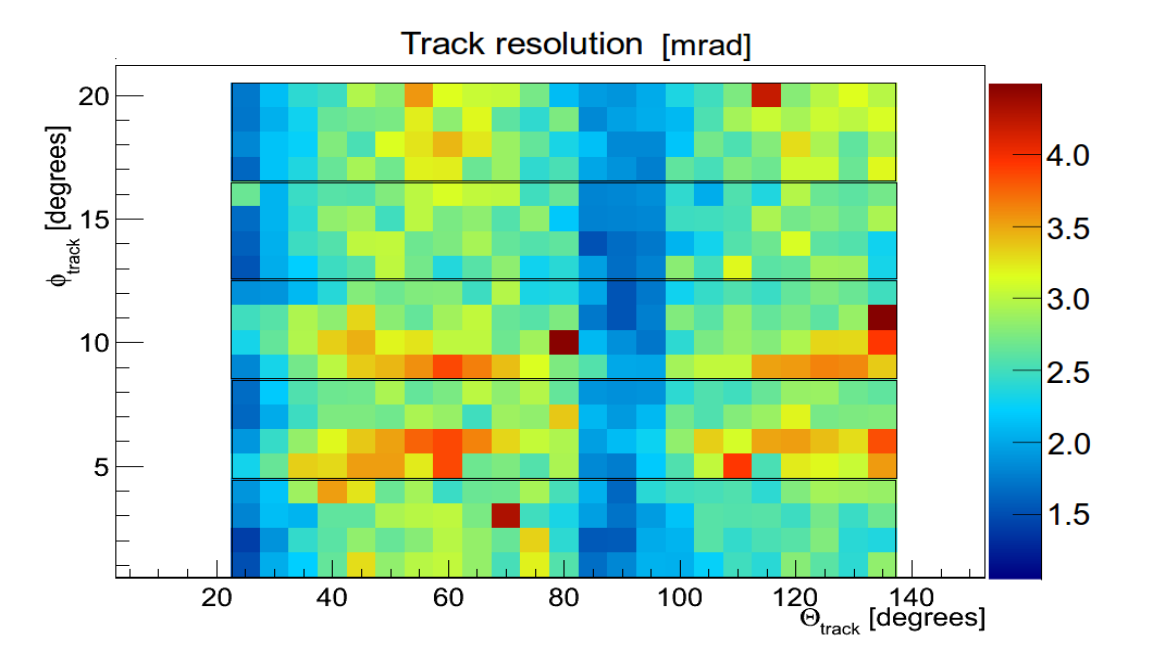




Performance of the simplest DIRC design



A map of number of detected photons per charged track



A map of Cherenkov angle resolution per track assuming ideal tracking and perfect bar shape

$$\sigma_{\theta_C^{track}} = \sigma_{\theta_C^{photon}} / \sqrt{N_{photons}}$$

Summary of Sim&Reco status

1. The final DIRC design has not been decided yet

2. The reconstruction procedure is dependent on the particular design features and is under development

3. Time information is not yet properly taken into account

→ no Digitization stage in the reconstruction yet: positions of hit pixels are taken as raw data

→ no time-based event mixing

→ DIRC is not yet available in the full PandaRoot reconstruction (but there are fast table-based algorithms of DIRC reconstruction)