

Status of the Test Beam Analysis

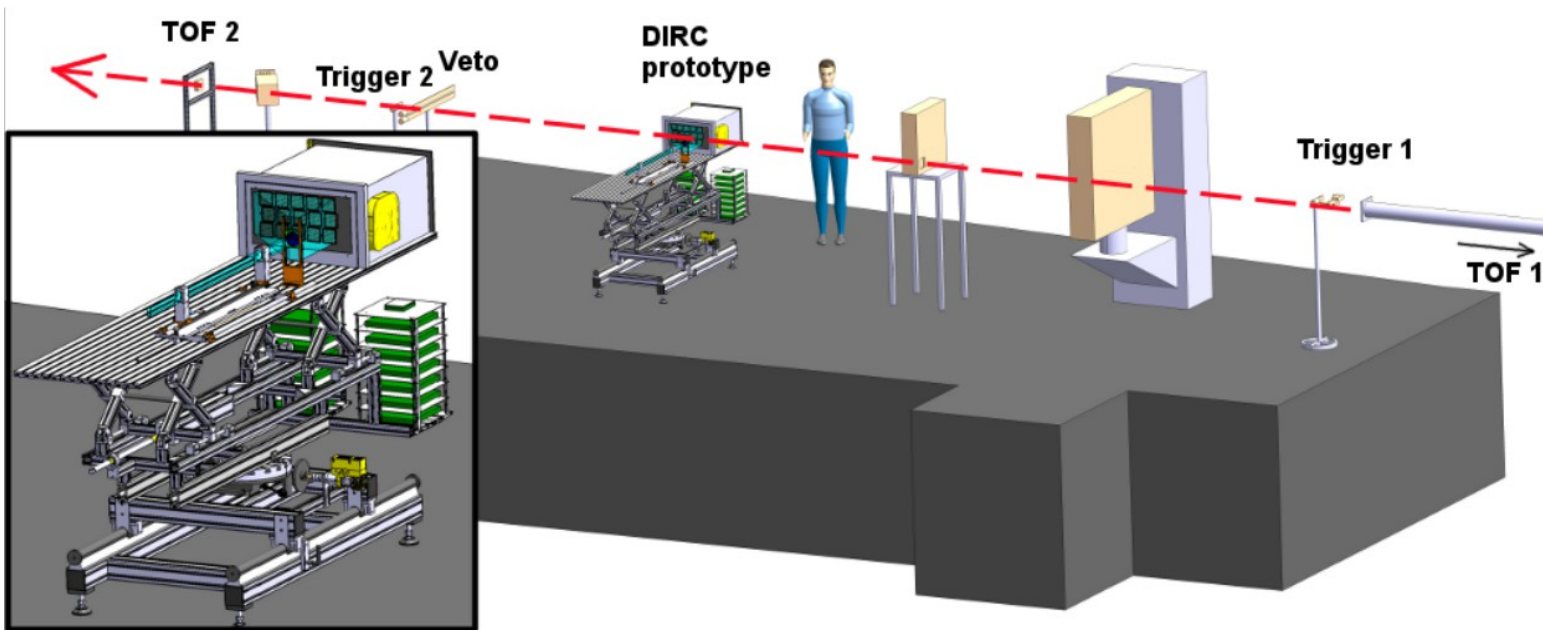
Roman Dzhygadlo,
Panda Cherenkov Group



- Prototype test at CERN 2015
- Example of observables
- Results of the geometrical reconstruction
- Results of the time imaging
- Summary & Outlook

PANDA meeting 06.16

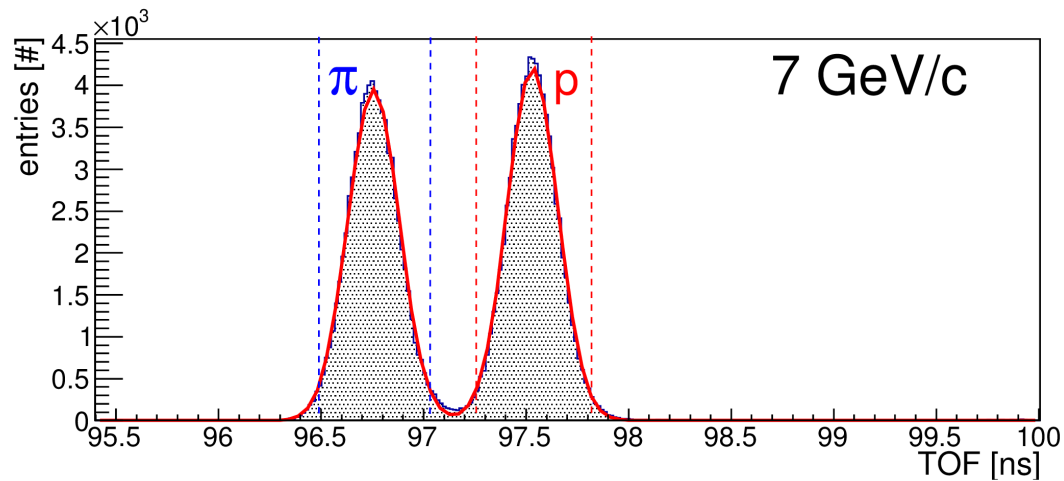
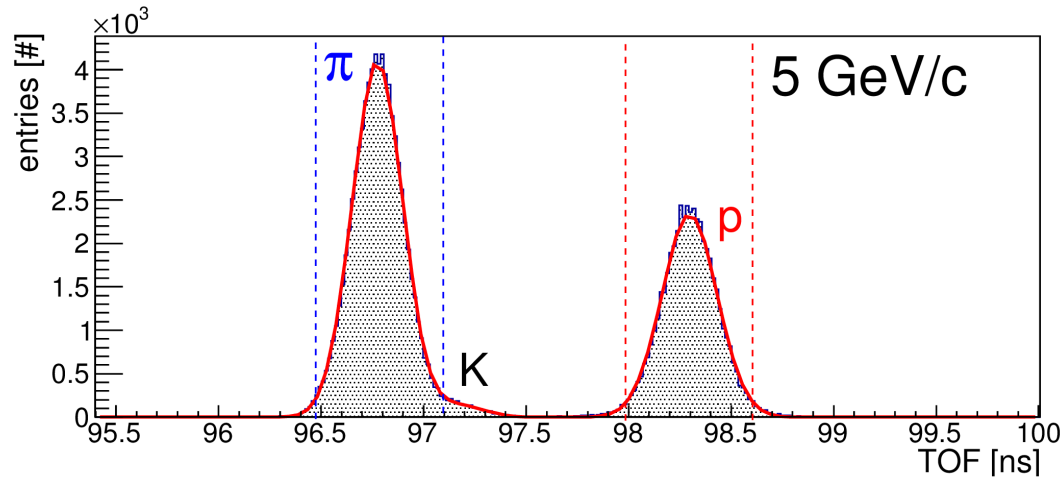
Cern 2015 Prototype Test



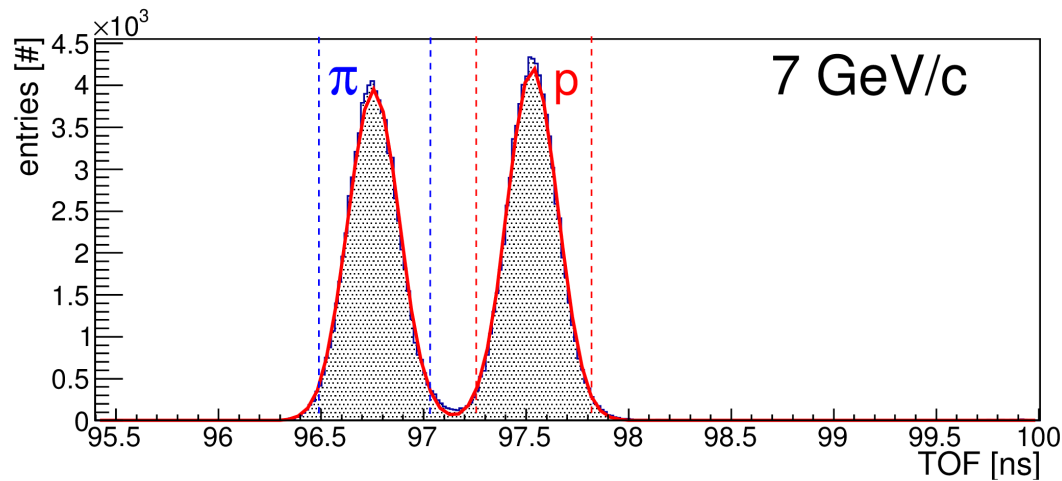
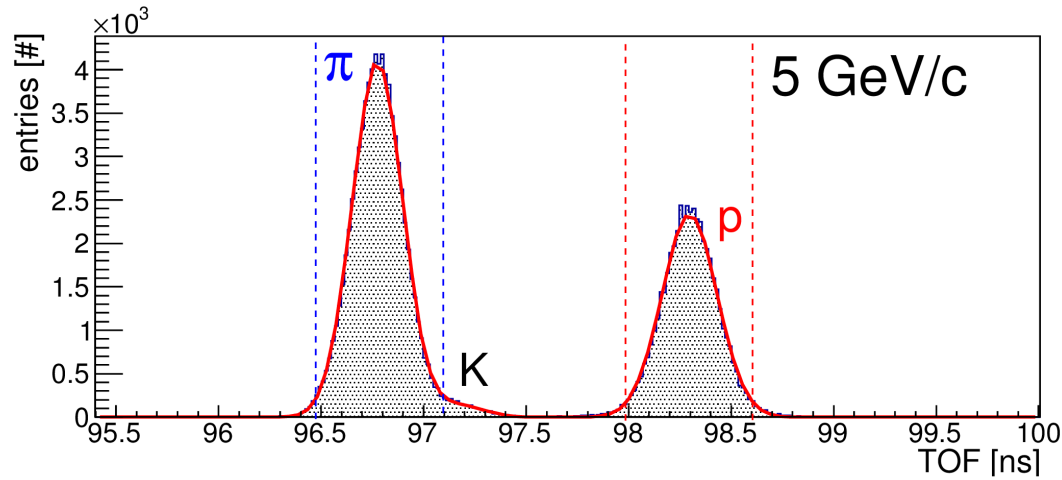
- beam type: protons and pions
- beam momentum: 10, 9, 8, 7, 6, 5, 4, 3, 2 GeV/c
- TOF PID
- different configurations of the DIRC prototype

TOF PID

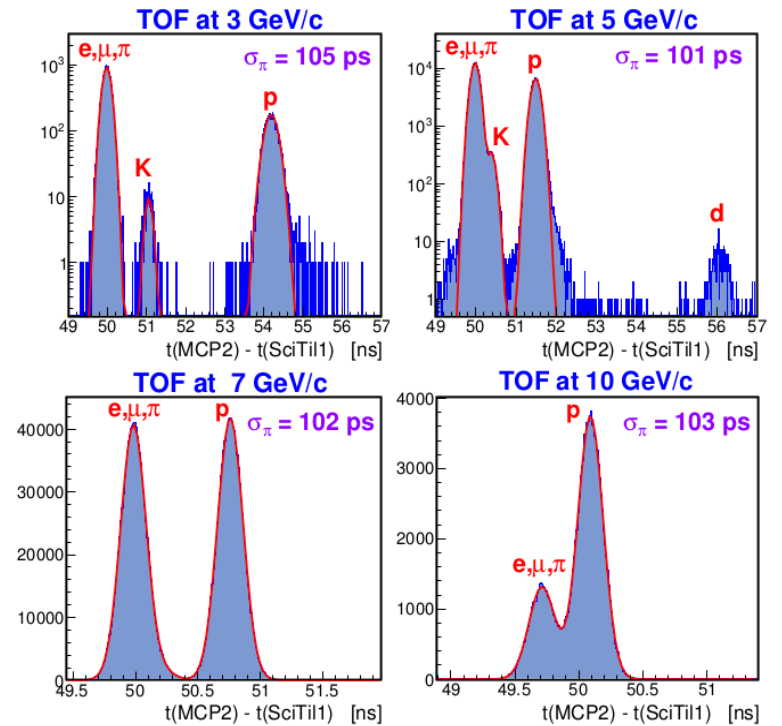
Difference of the MCP-OUT signal of TOF2 and TOF1 counters after walk correction



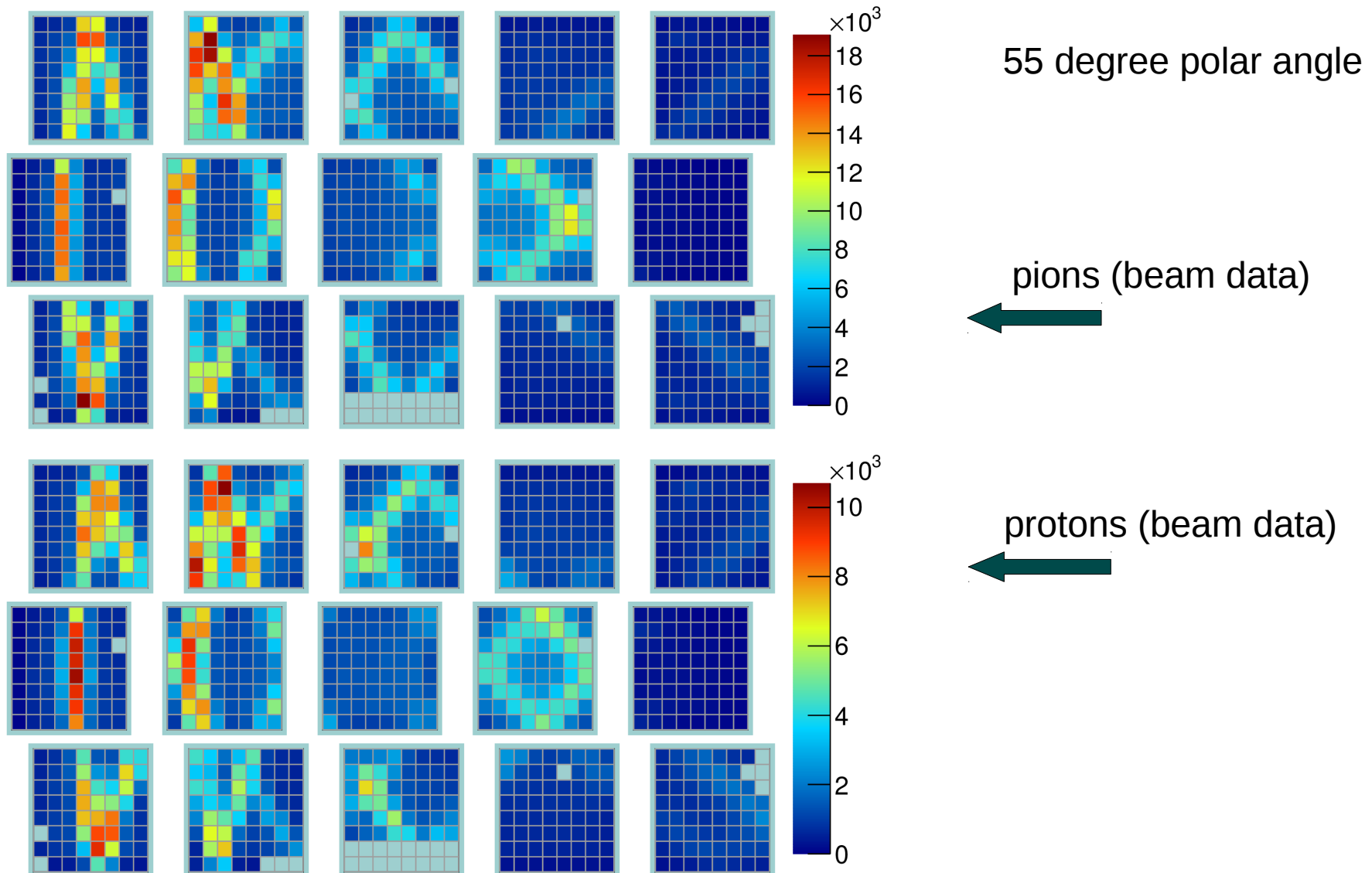
TOF PID



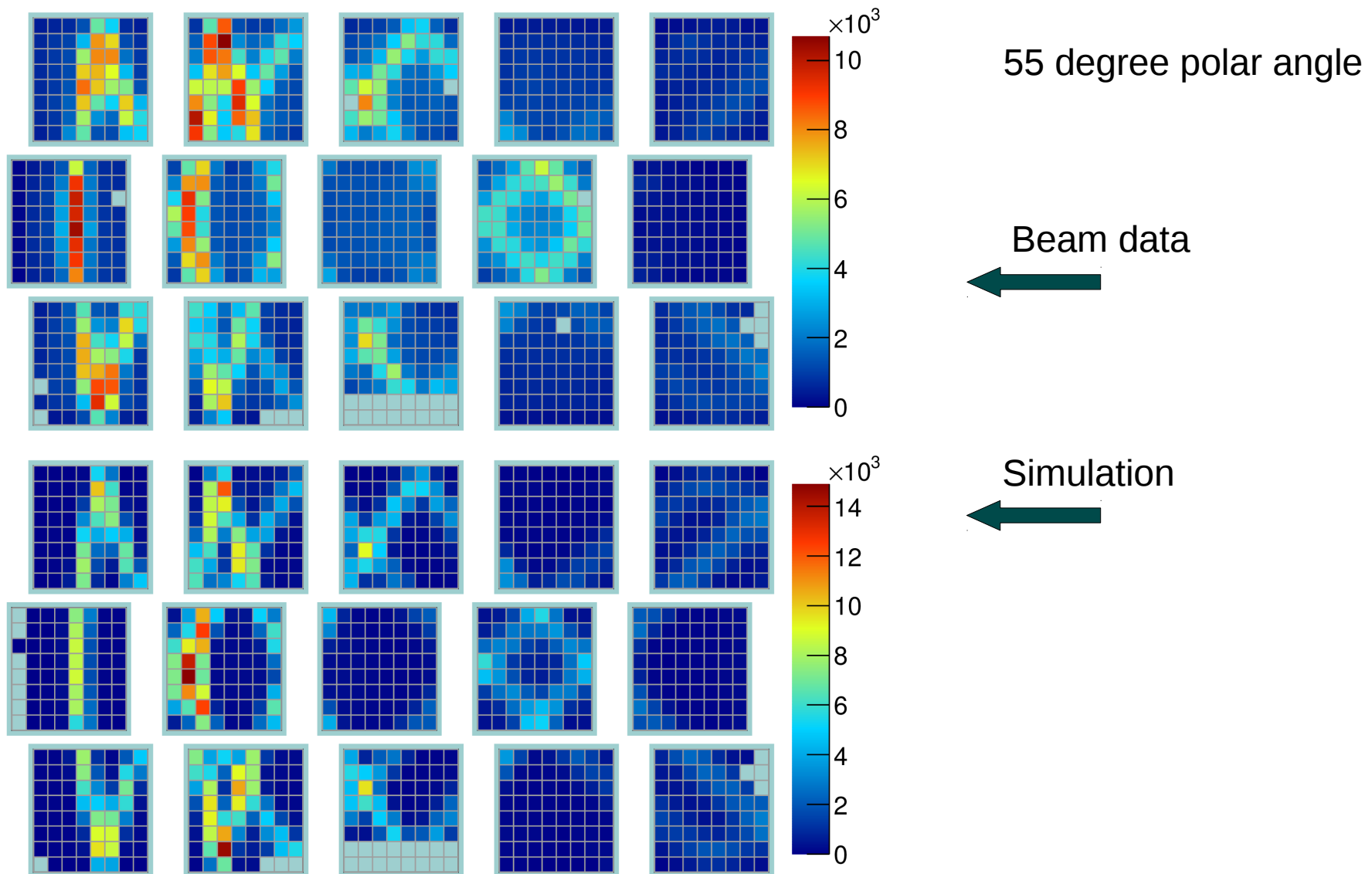
Difference of the MCP-OUT signal of TOF2 and TOF1 counters after walk correction



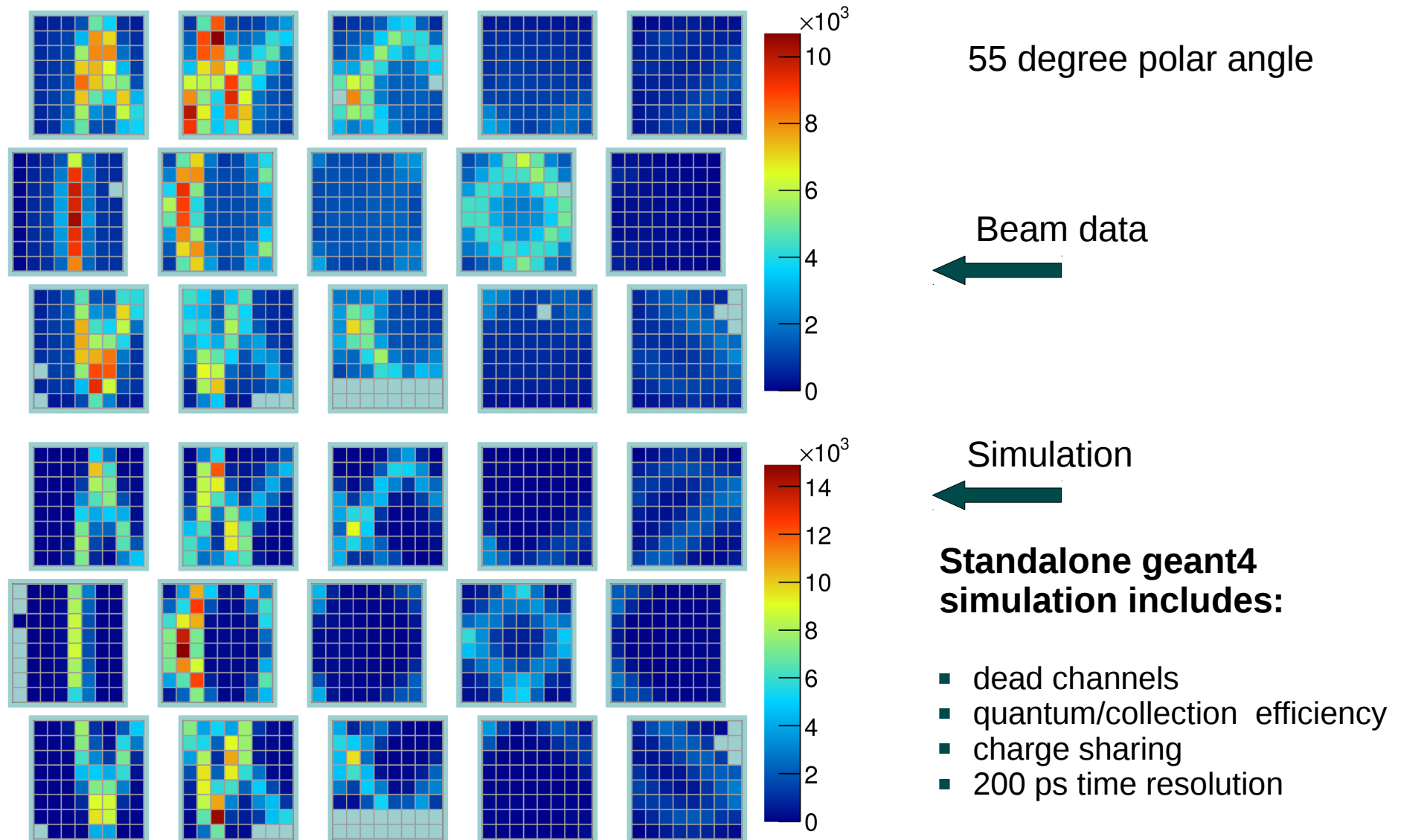
Hit Patterns: bar with focusing @ 5 GeV/c



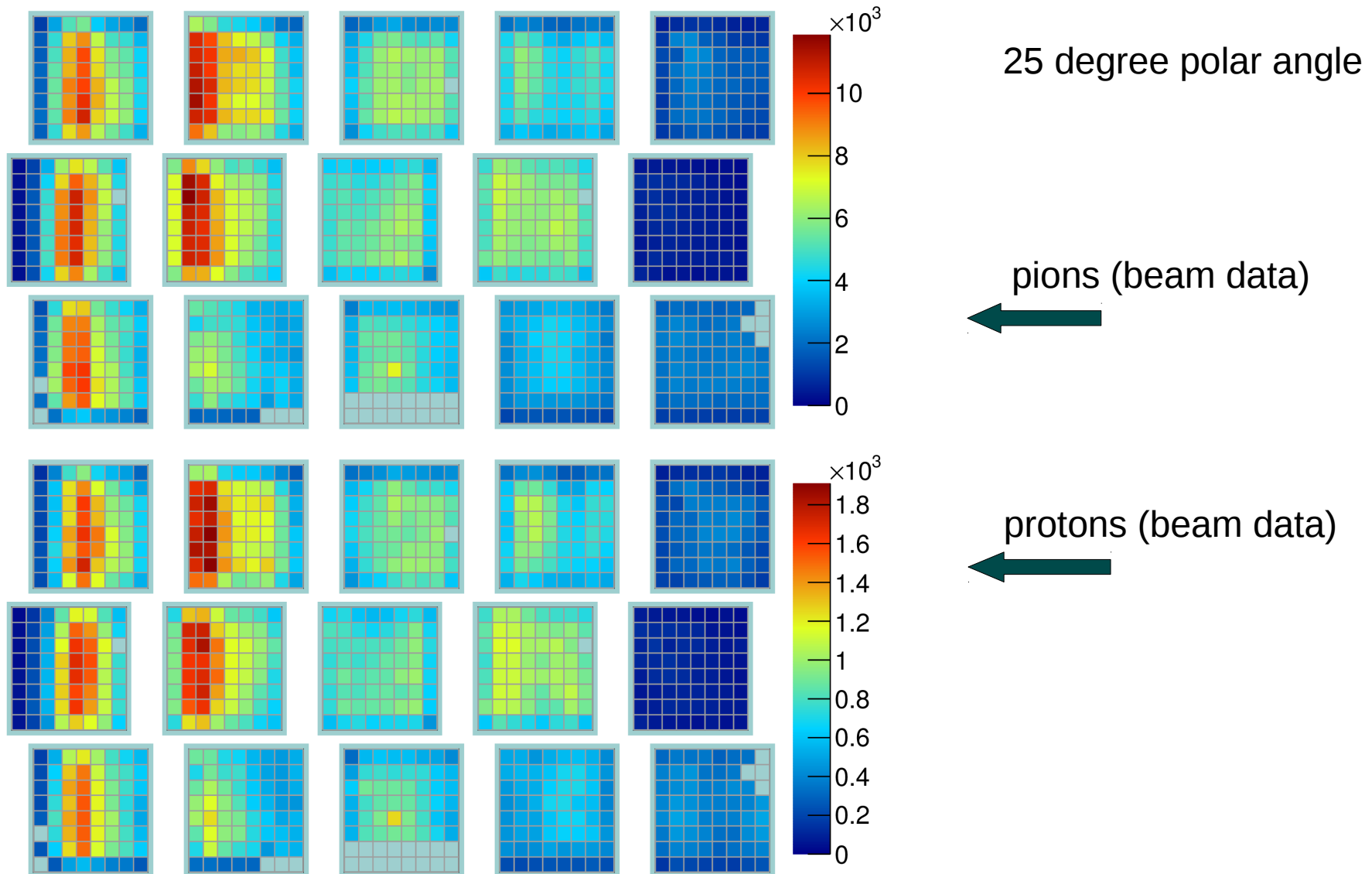
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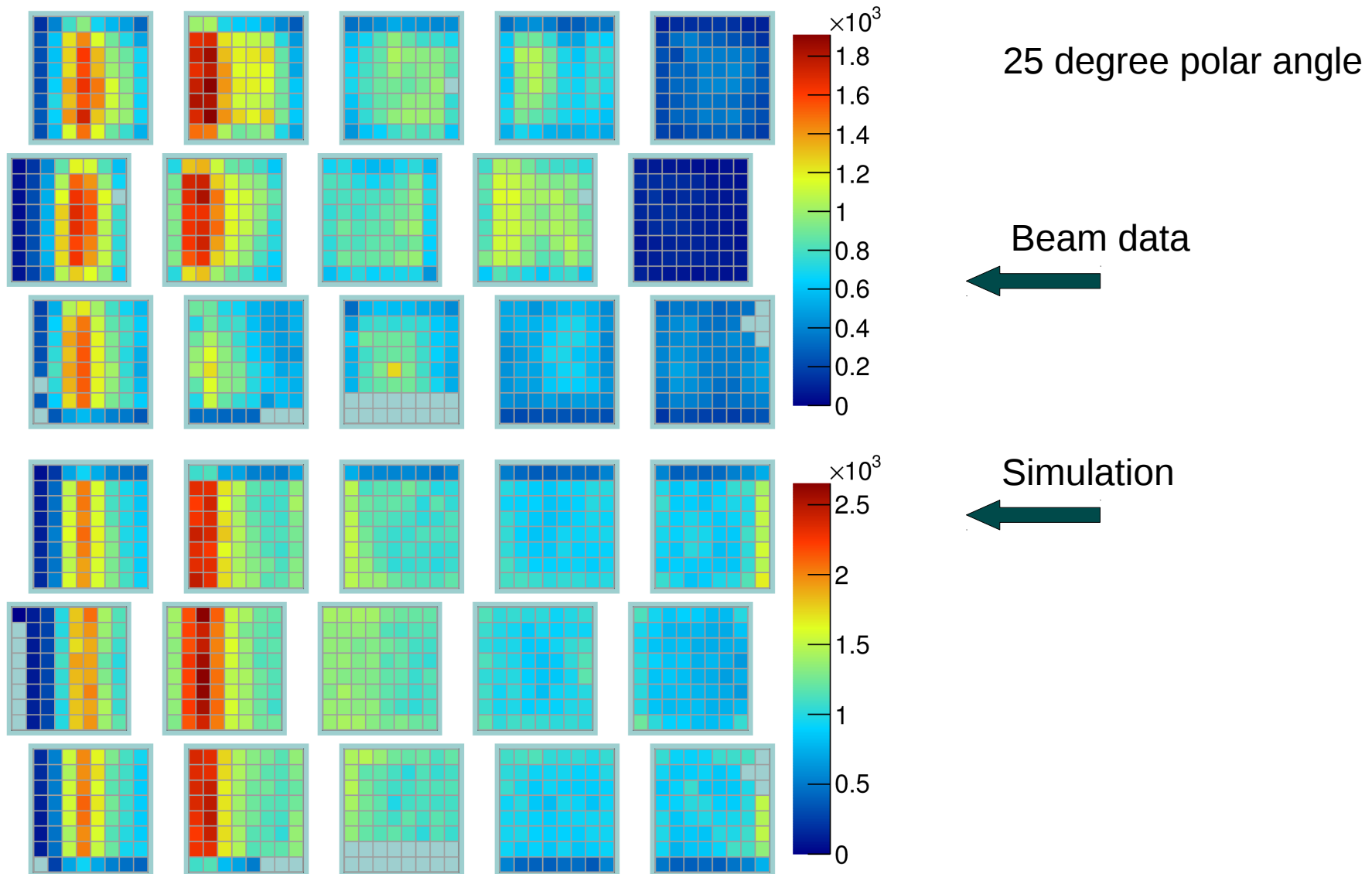
Hit Patterns: bar with focusing @ 5 GeV/c



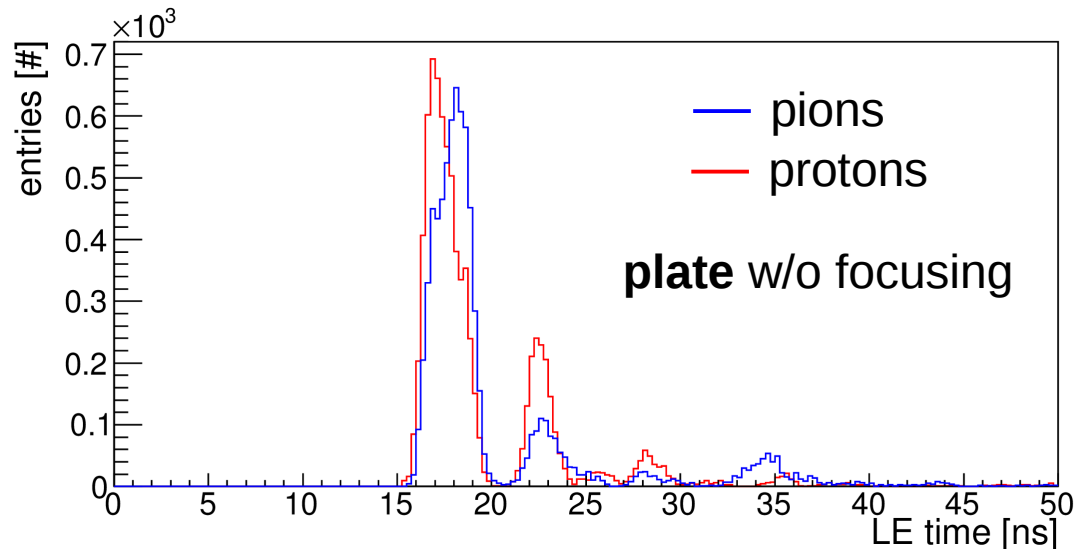
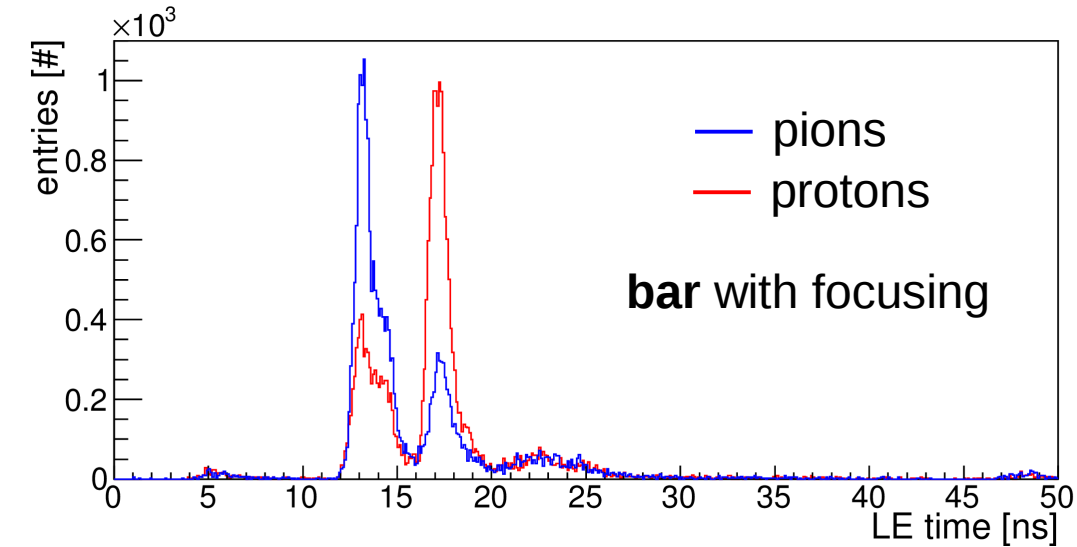
Hit Patterns: plate w/o focusing @ 7 GeV/c



Hit Patterns: plate w/o focusing @ 7 GeV/c



Propagation Time of the Cherenkov Ph.

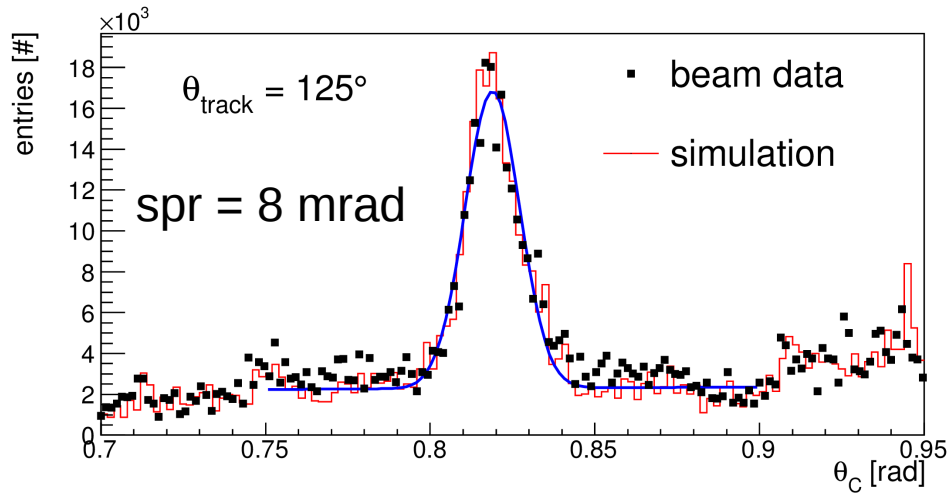


beam data
@ 7 GeV/c
@ 25 degree

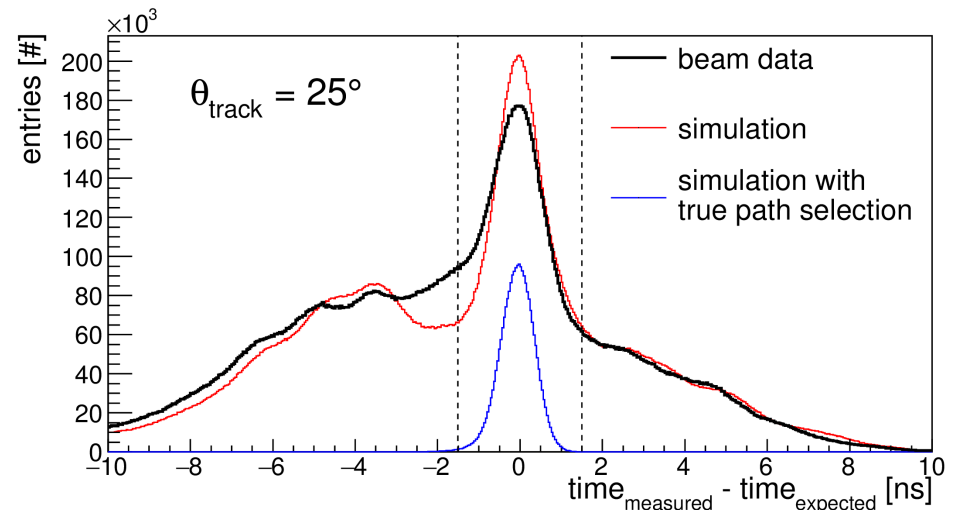
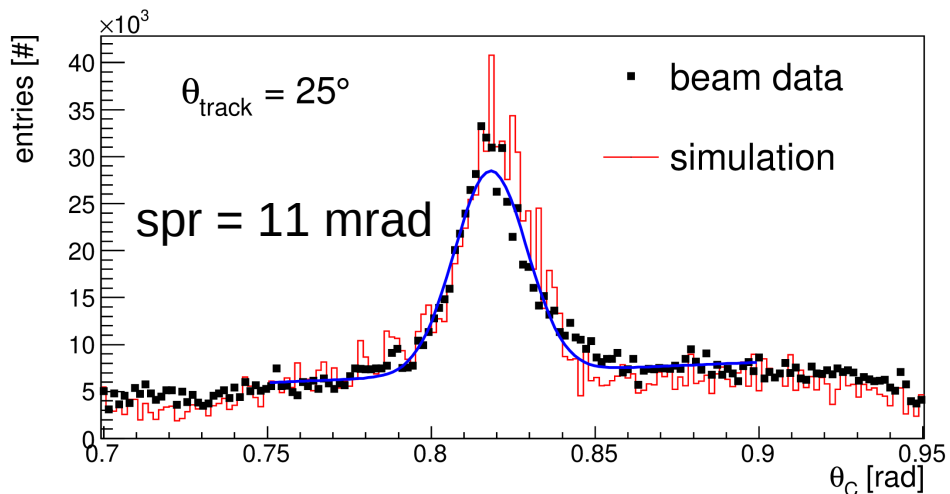
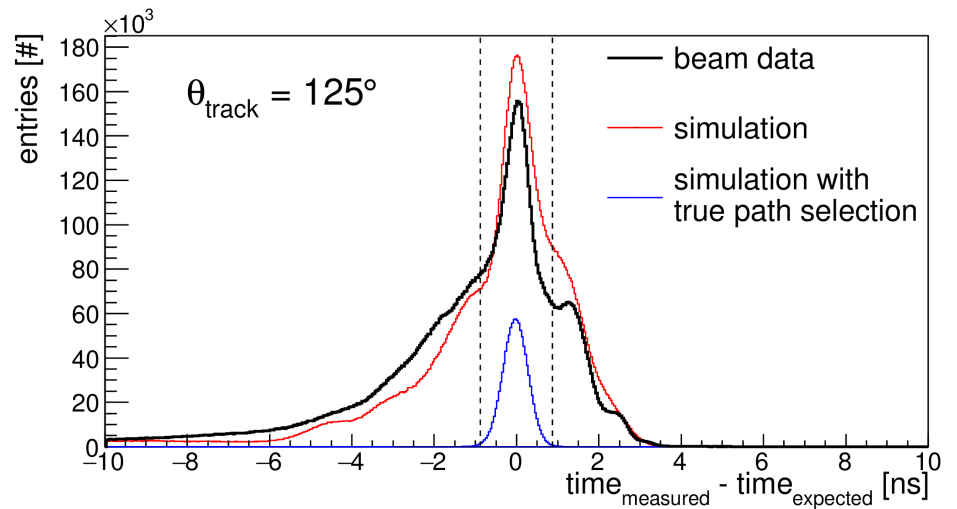
Results of Geometrical Reconstruction

Bar with 3-layer spherical lens @ 7 GeV/c @ 25 degree

Cherenkov angle distribution for 5k protons:

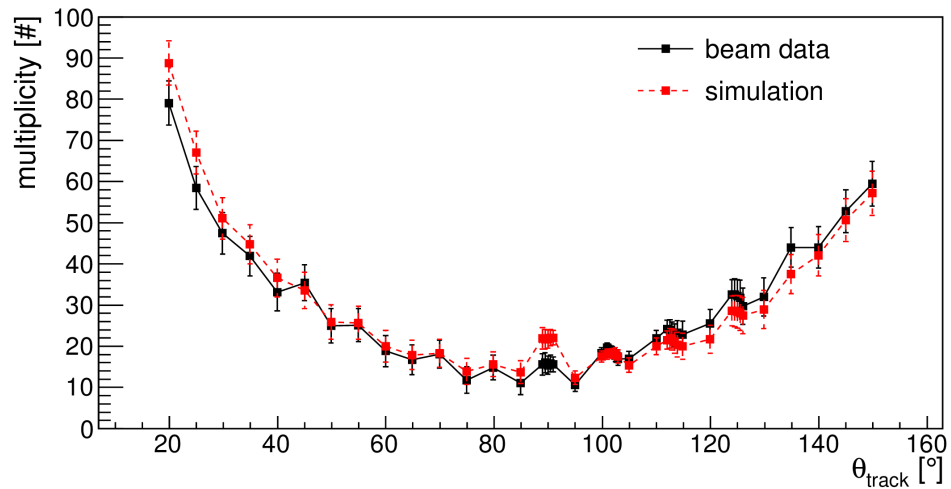


Selection:

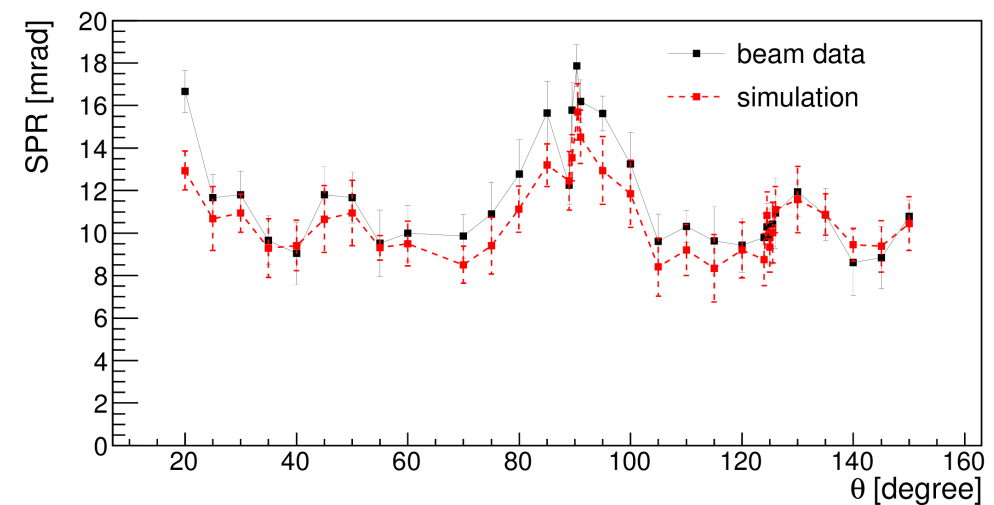
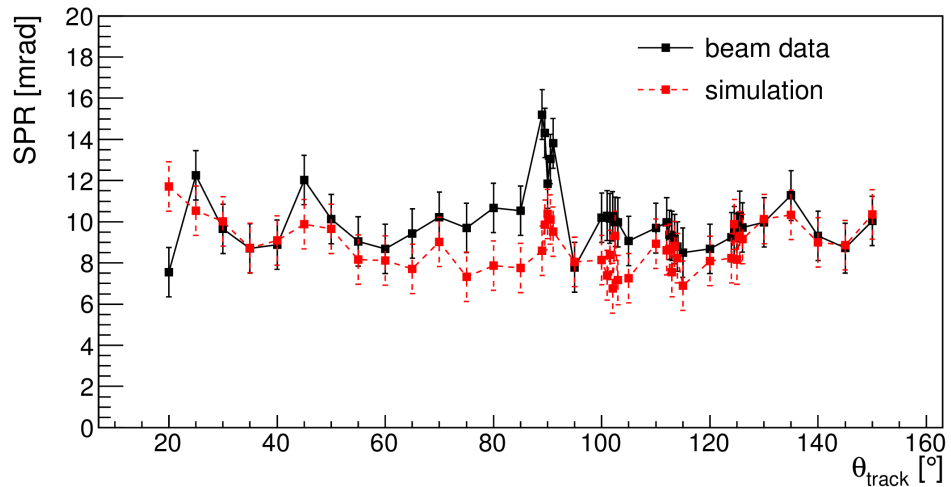
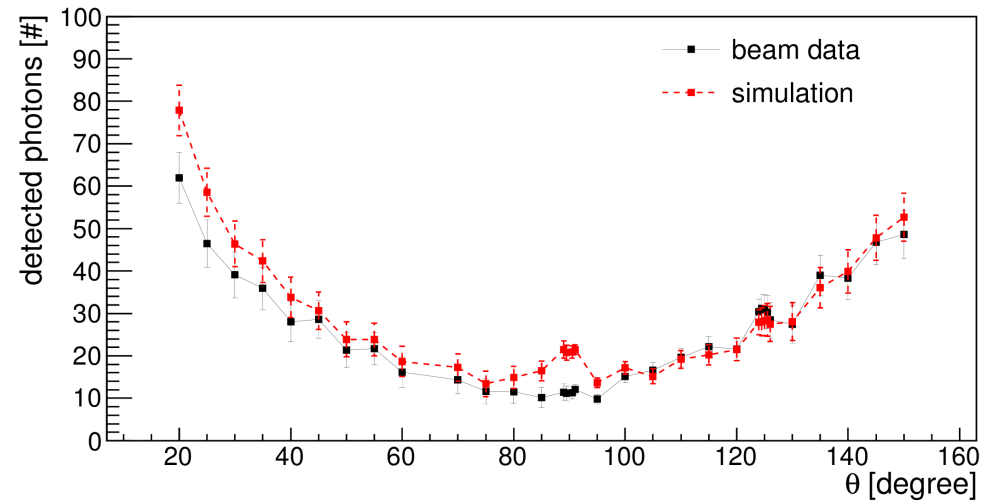


Results of Geometrical Reconstruction

bar with 3-layer spherical lens
@ 7 GeV/c

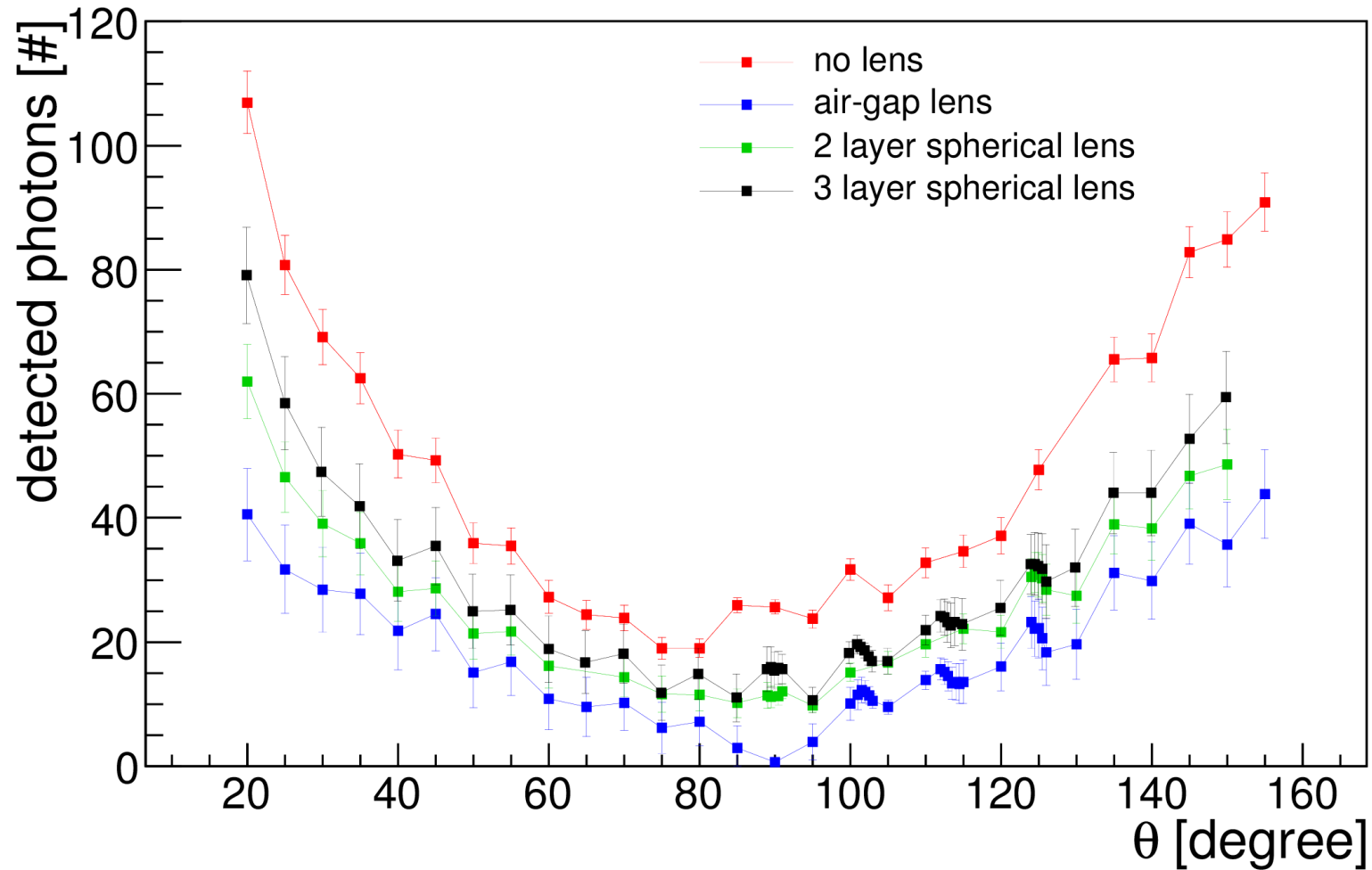


bar with 2-layer spherical lens
@ 7 GeV/c



Results of Geometrical Reconstruction

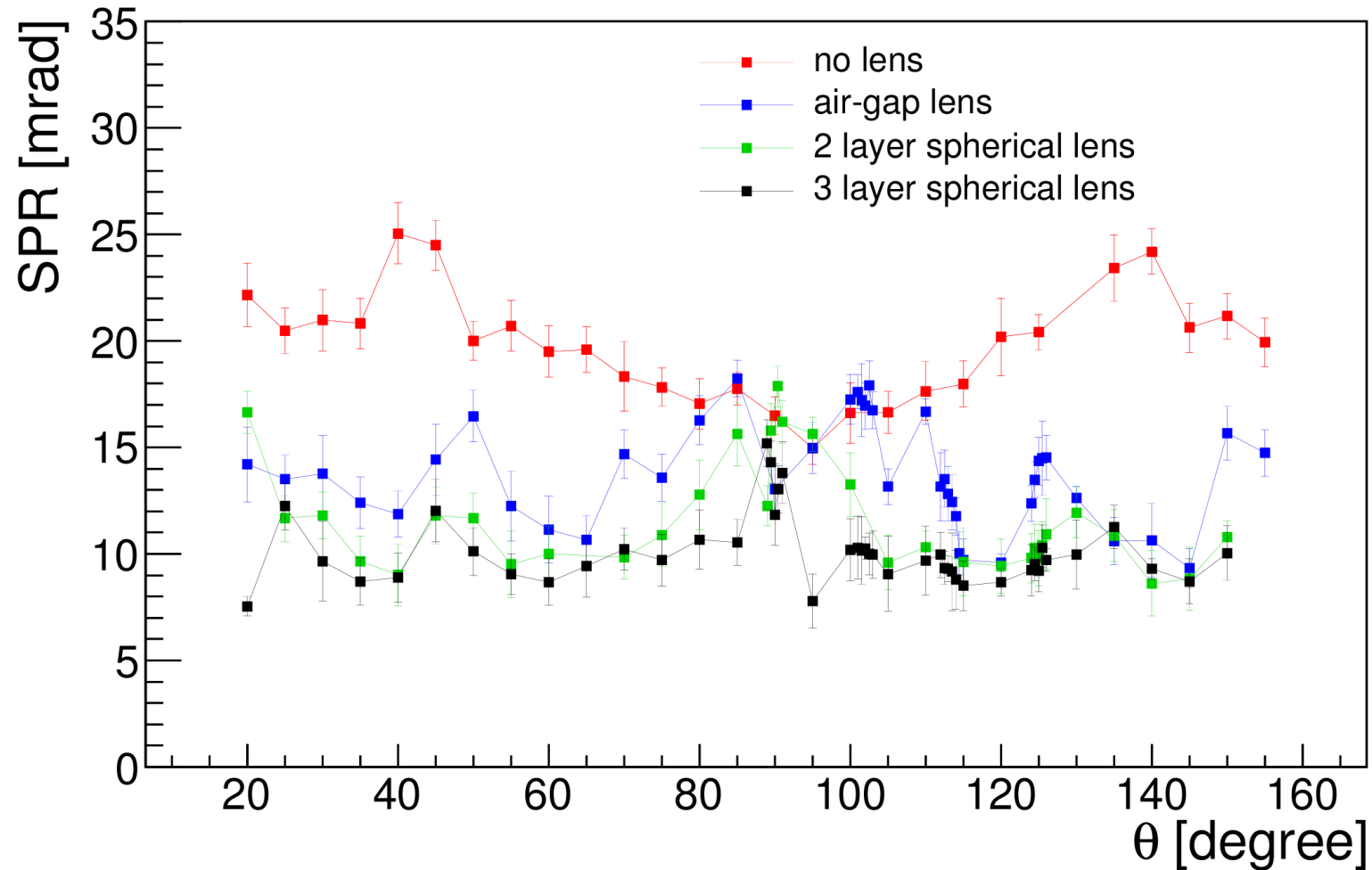
bar with 3-layer spherical lens
@ 7 GeV/c



requirement: > 15 photons

Results of Geometrical Reconstruction

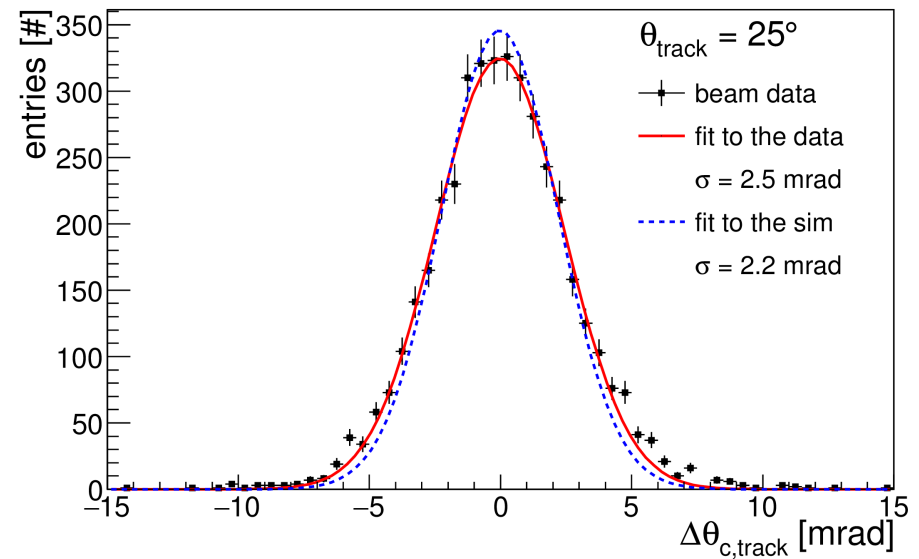
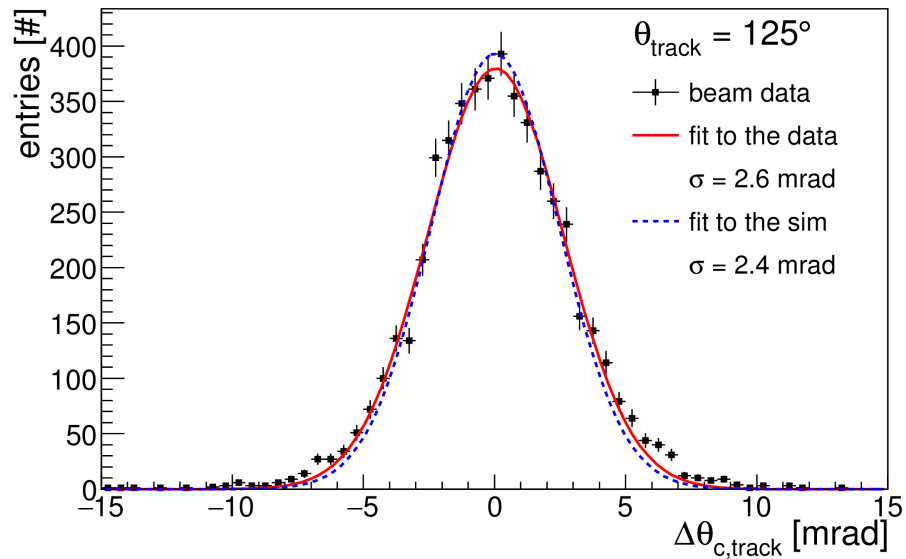
bar with 3-layer spherical lens
@ 7 GeV/c



requirement: spr < 10-12

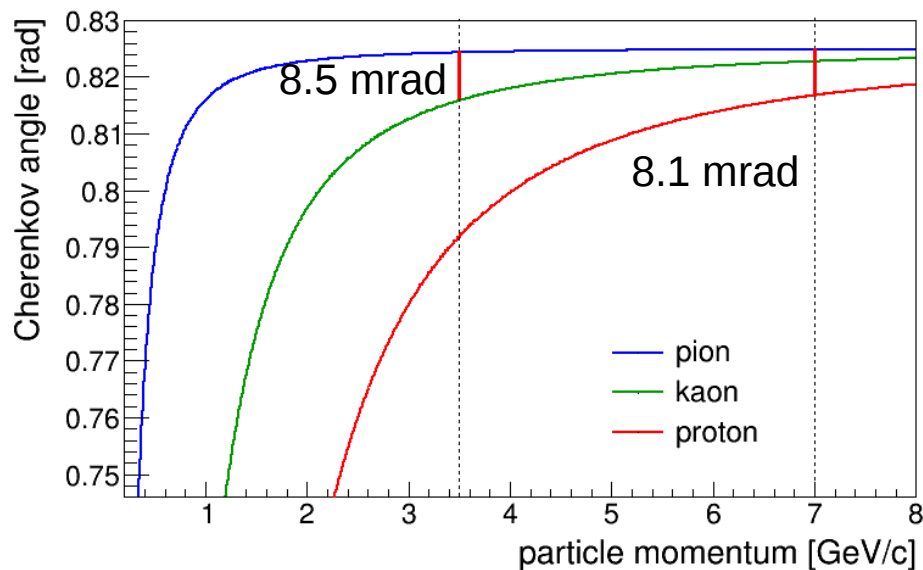
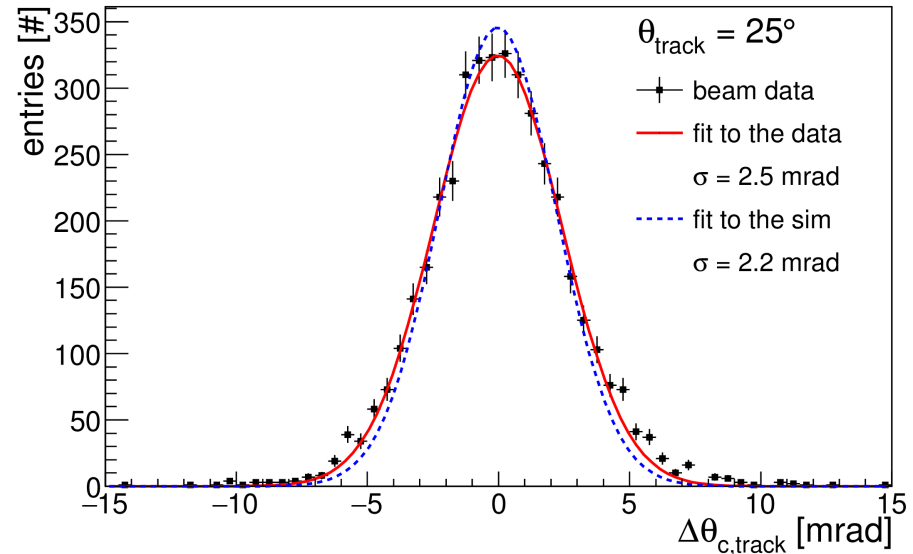
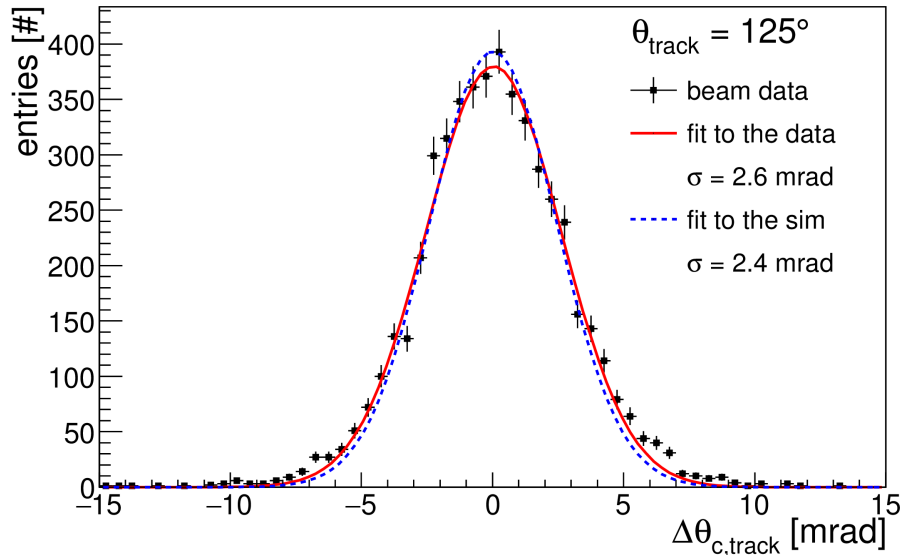
Results of Geometrical Reconstruction

Cherenkov track resolution for bar with 3-layer spherical lens @ 7 GeV/c



Results of Geometrical Reconstruction

Cherenkov track resolution for bar with 3-layer spherical lens @ 7 GeV/c

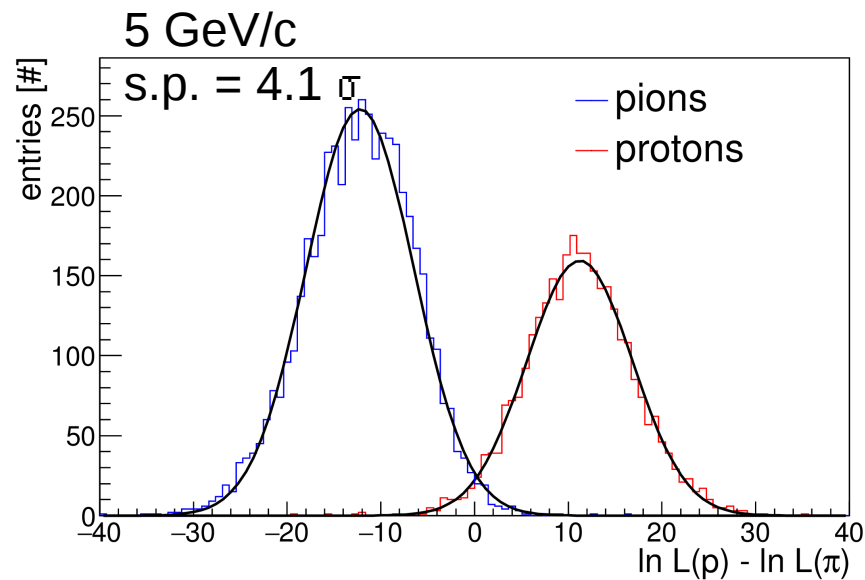
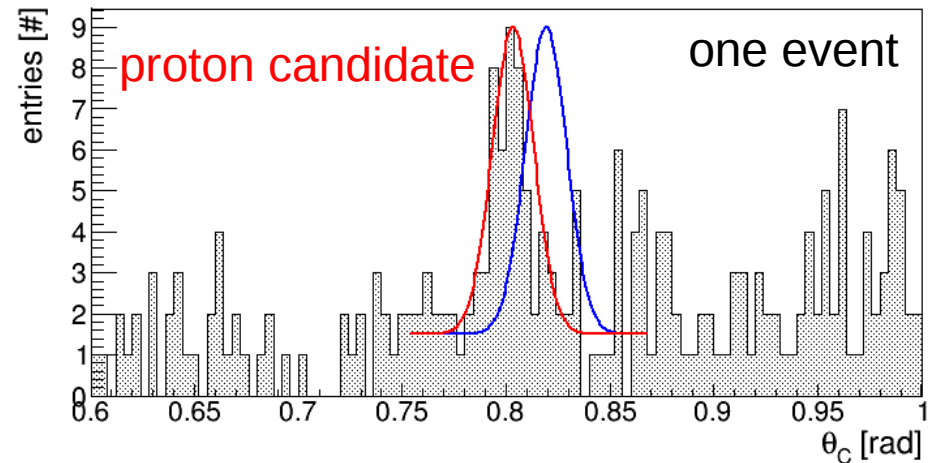
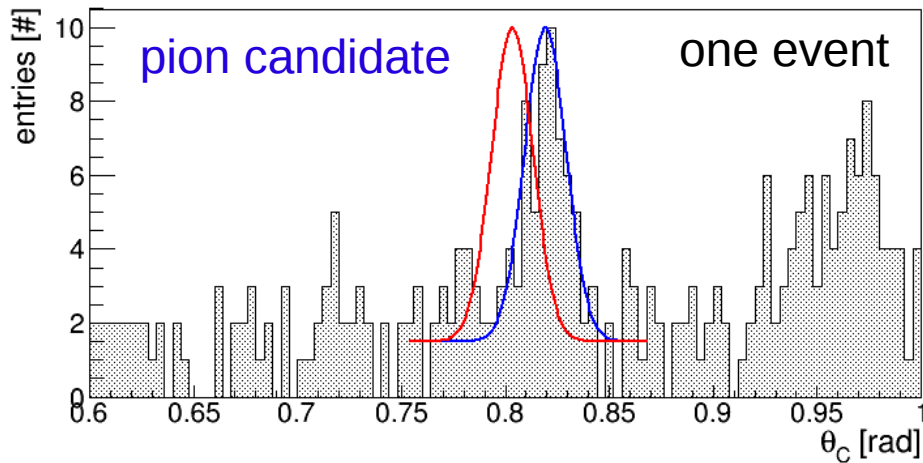


p/π @ 7 GeV/c (125 deg): $8.1/2.6 = 3.1$ s.d.
(25 deg): 3.2 s.d.

π/K @ 3.5 GeV/c (125 deg): $8.5/2.6 = 3.3$ s.d.
(25 deg): 3.4 s.d.

Geometrical reco.: likelihood calculation

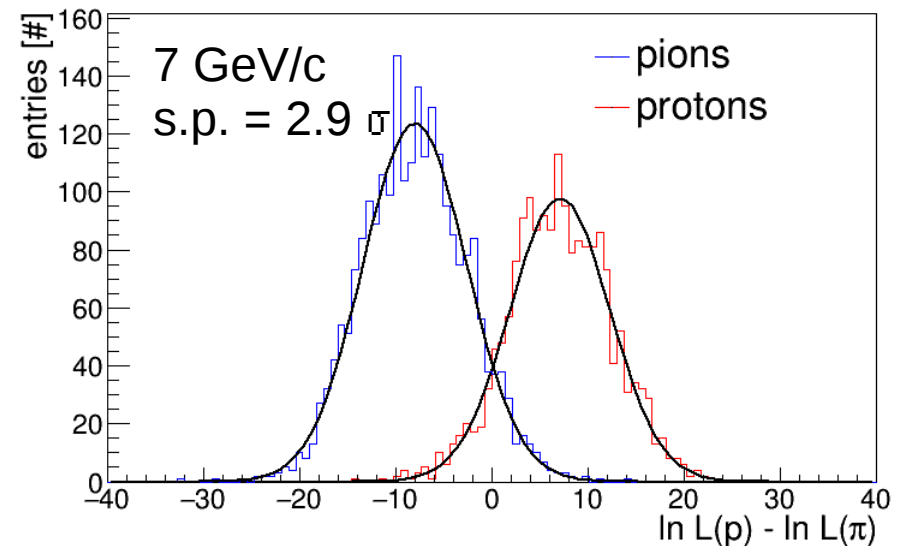
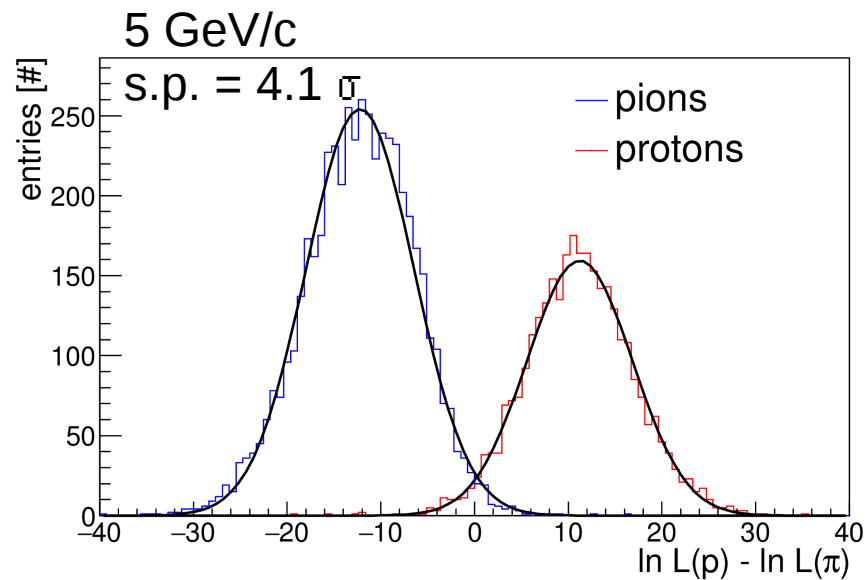
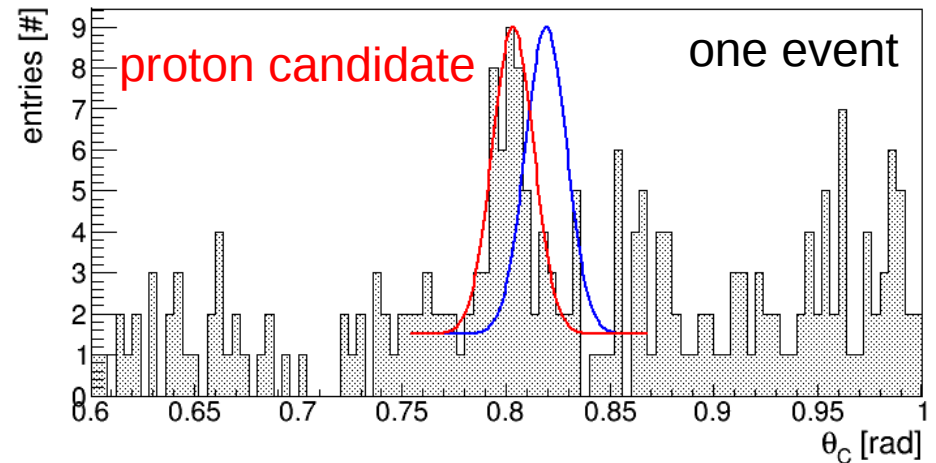
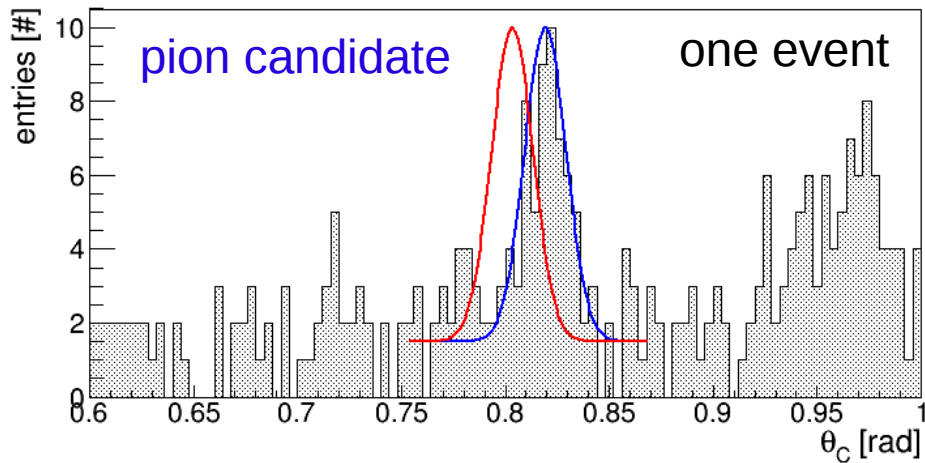
bar with focusing @ 5 GeV/c @ 25 degree:



$$N_{\text{sep}} = \frac{|\mu_1 - \mu_2|}{0.5(\sigma_1 + \sigma_2)}$$

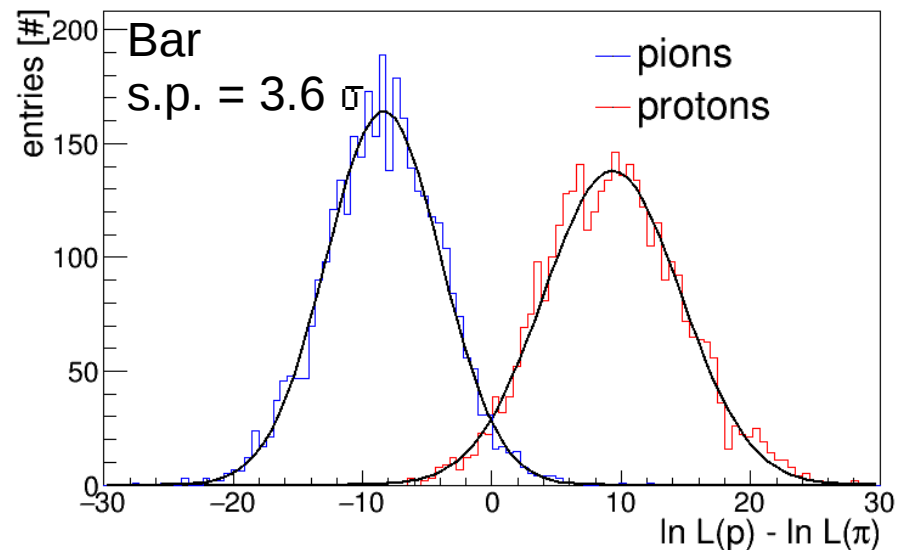
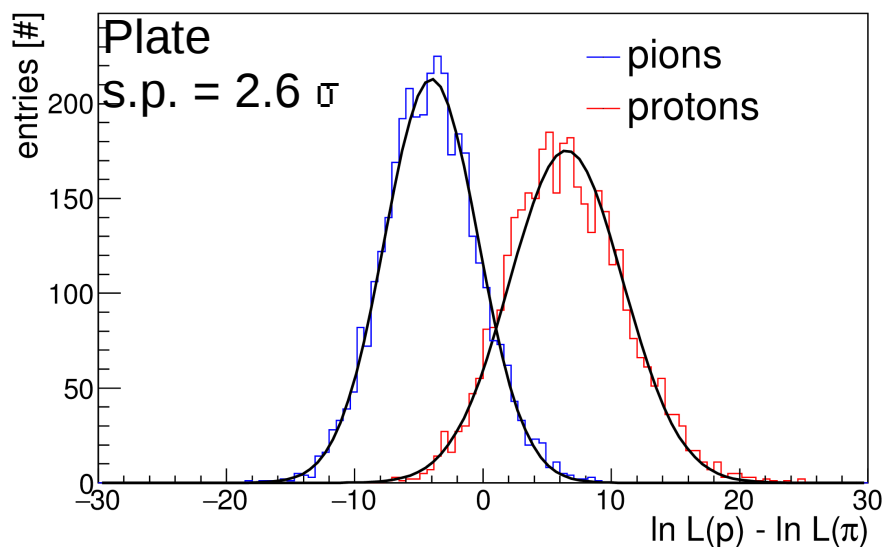
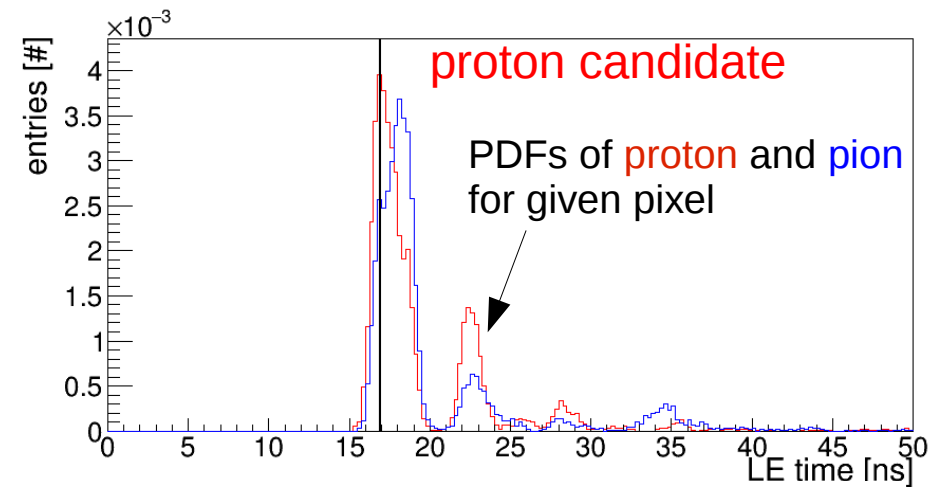
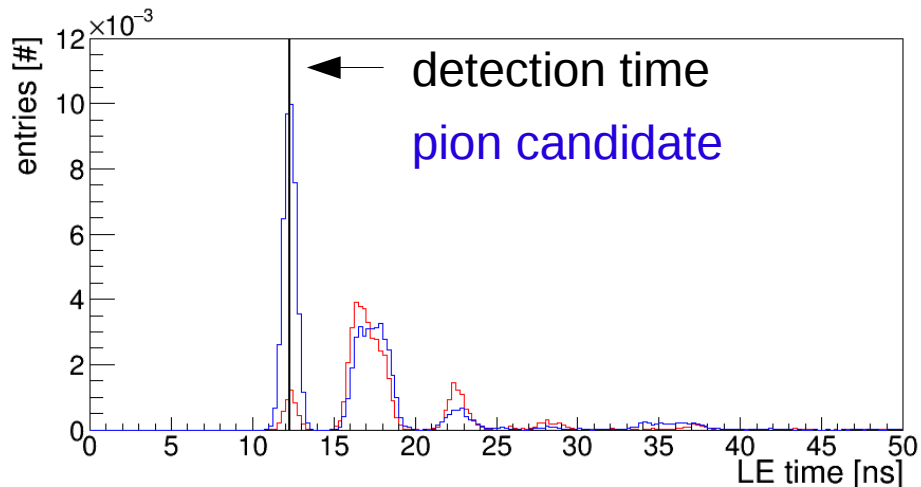
Geometrical reco.: likelihood calculation

bar with focusing @ 5 GeV/c @ 25 degree:

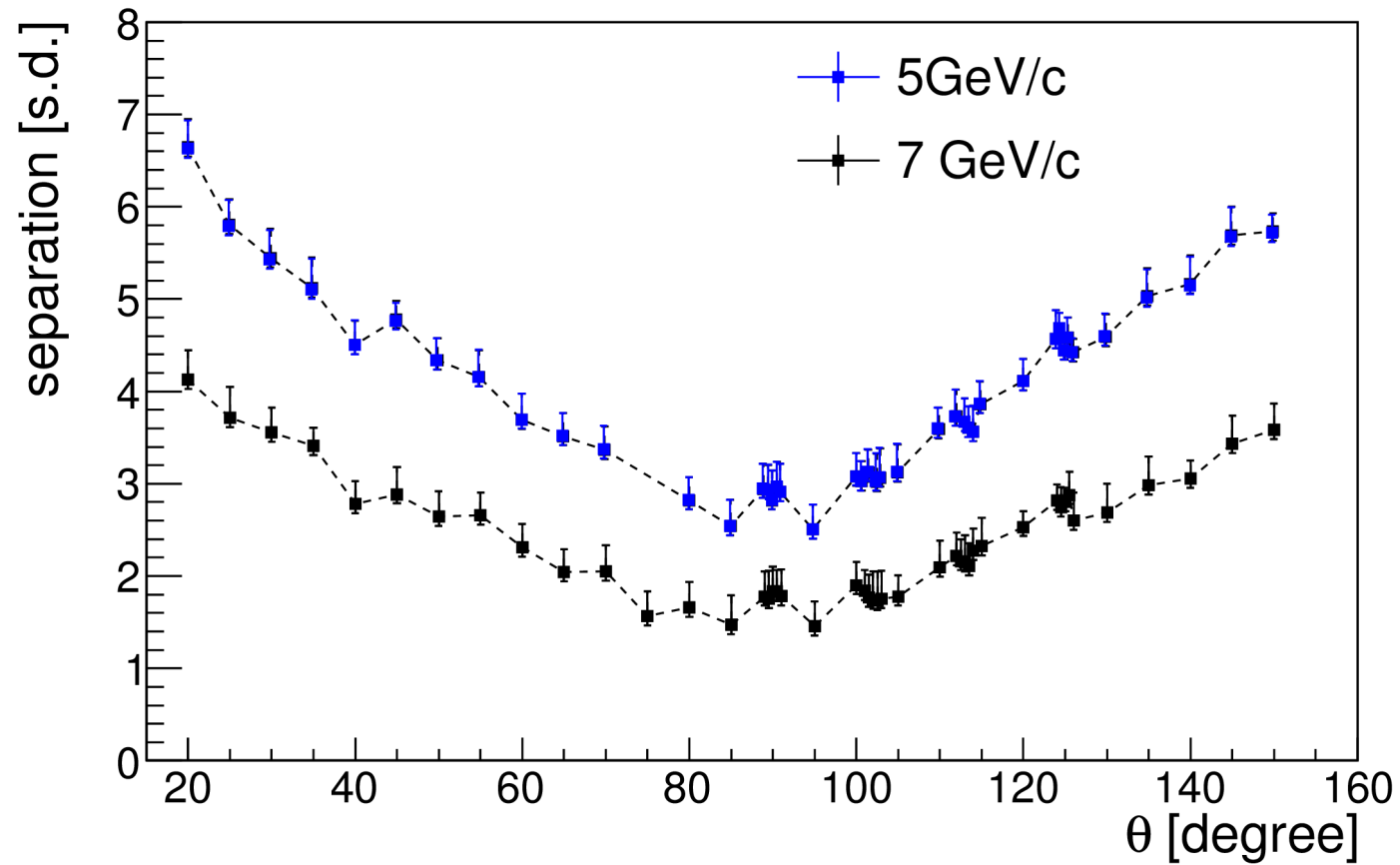


Time imaging reconstruction. Example

plate w/o focusing @ 7 GeV/c @ 25 degree:

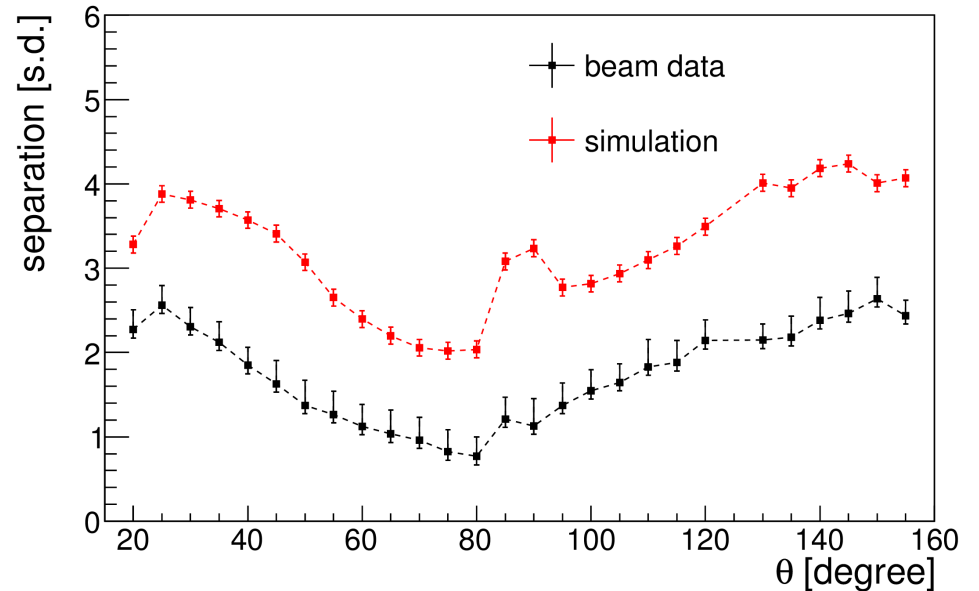
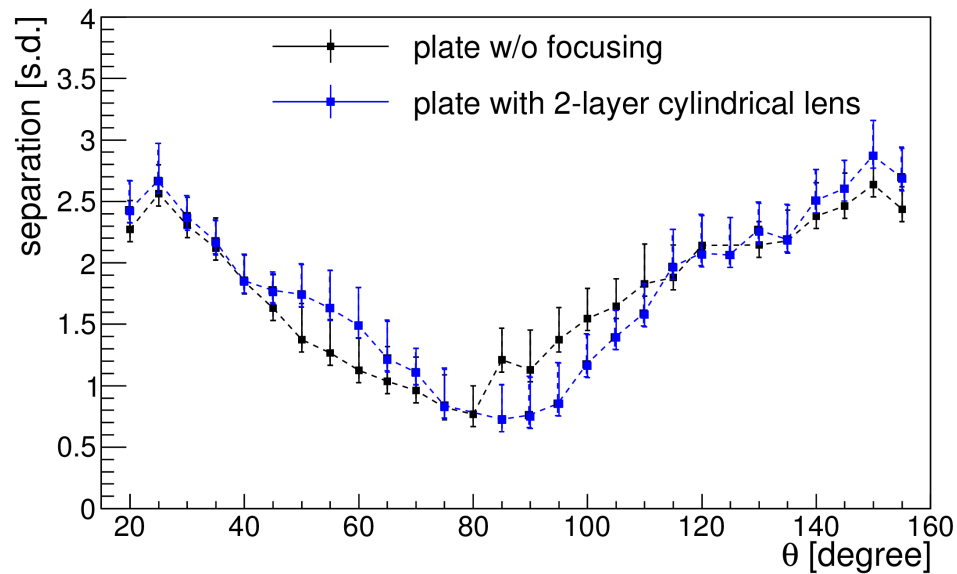


Time imaging reconstruction. Bar



Time imaging reconstruction. Plate

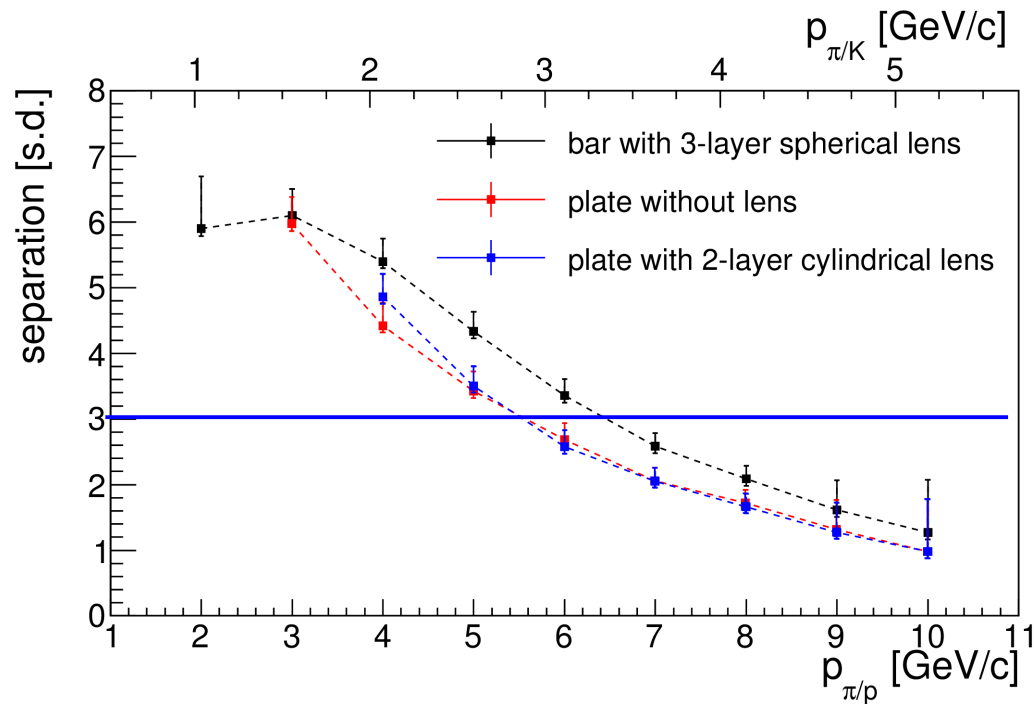
@ 7 GeV/c



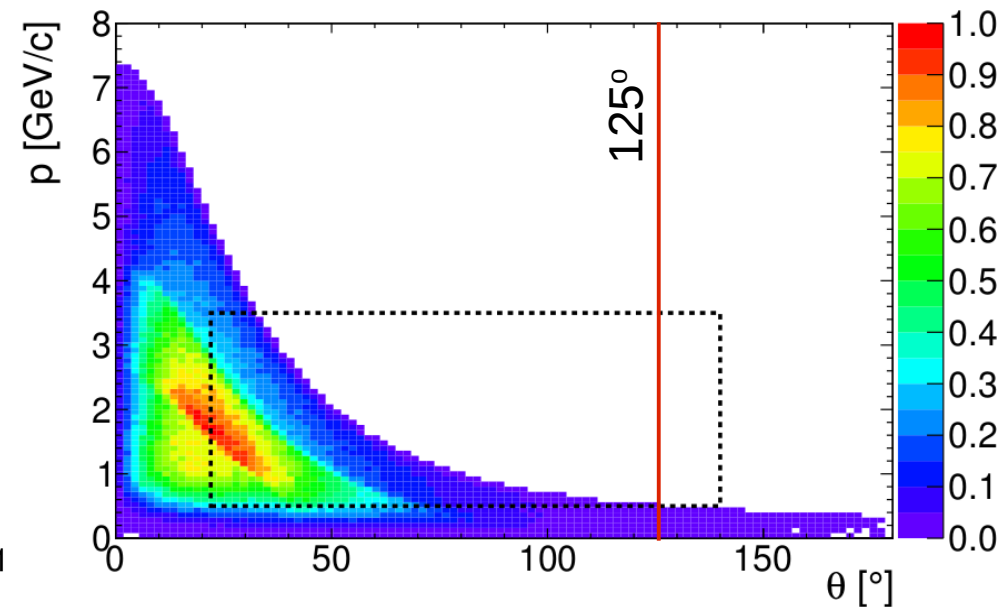
Simulation done with:
100 ps time resolution
3 mm RMS beam spot

Time imaging reconstruction

Momentum scan @ 125 degree



Panda's Phase Space of mixed benchmark channels:



Summary and Outlook

- Data from the CERN 2015 prototype test provide valuable results
- The hit patterns and time spectra are in good agreement with Geant4 simulation
- Both geometrical and time-imaging reconstructions give reasonable results
- The obtained photon yield and SPR of the configuration with bar radiator and 3-layer spherical lens support the baseline design of the Panda Barrel DIRC
- The best performance is reached by using bar radiator with focusing and time imaging reconstruction
- The designed performance of the plate radiator could not be verified due to worse time resolution (250-300 ps vs. planned 100 ps) and wider beam spread
- **Ongoing activities:**
 - improving detector alignment
 - chromatic corrections
 - errors evaluation

Thank you for the attention