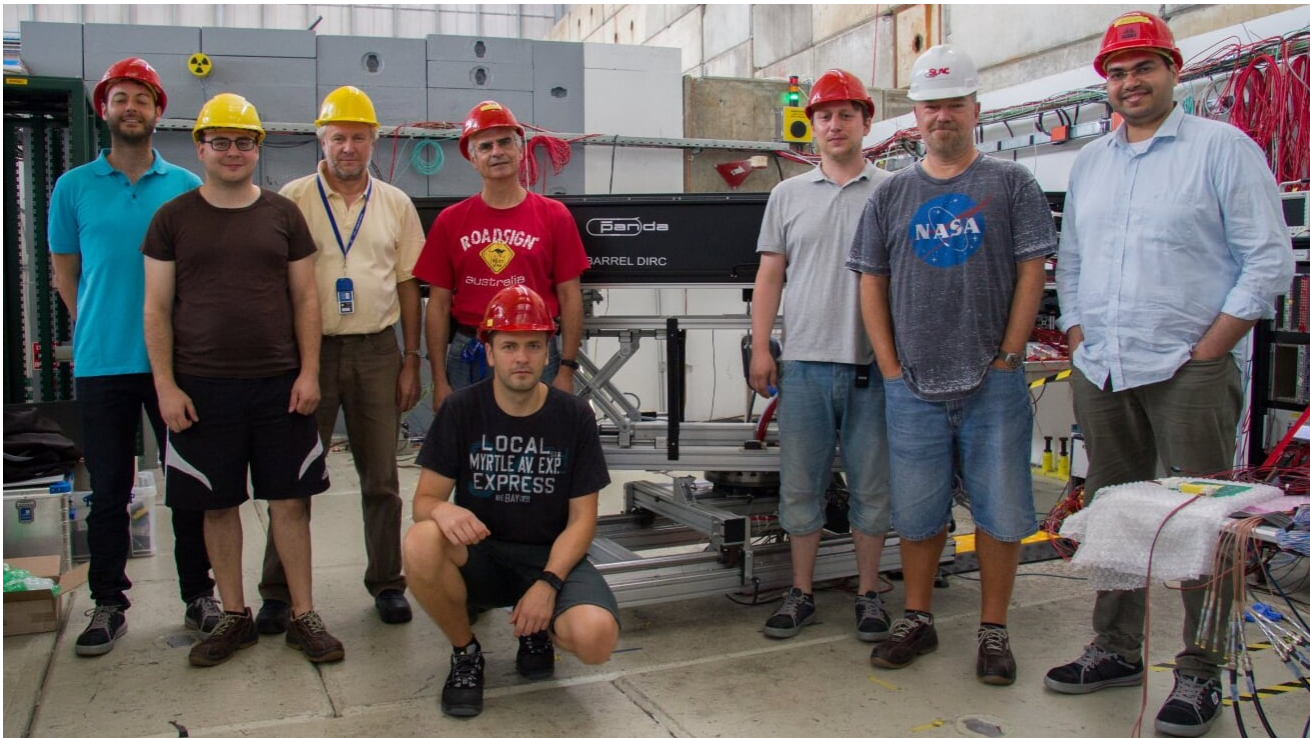


Update on the Barrel DIRC Prototype Test @ CERN Aug 23 – Sep 13, 2017



PANDA

FAIR

GSII

THE
CATHOLIC UNIVERSITY
of AMERICA

JGU
JOHANNES GUTENBERG
UNIVERSITÄT MAINZ

FAU
FRIEDRICH-ALEXANDER
UNIVERSITÄT
ERLANGEN-NÜRNBERG

- Prototype test at CERN
- Previous results
- Momentum scan
- Summary

PANDA meeting
06.18

Roman Dzhygadlo,
PANDA Cherenkov Group

DIRC Prototype Test 2017

Goal:

- evaluate performance of advanced/near-final configuration of the PANDA Barrel DIRC
- test aspects of the EIC DIRC design

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- 33 degree prism as expansion volume => 12 MCP-PMTs (vs 9 last year)
- new readout modules
- new 3-layer cylindrical lens (eRD14 funding)
- narrow bar and plate as the radiators (plate for the EIC DIRC)
- updated mechanics to study impact of azimuthal angle on hit pattern, PID performance

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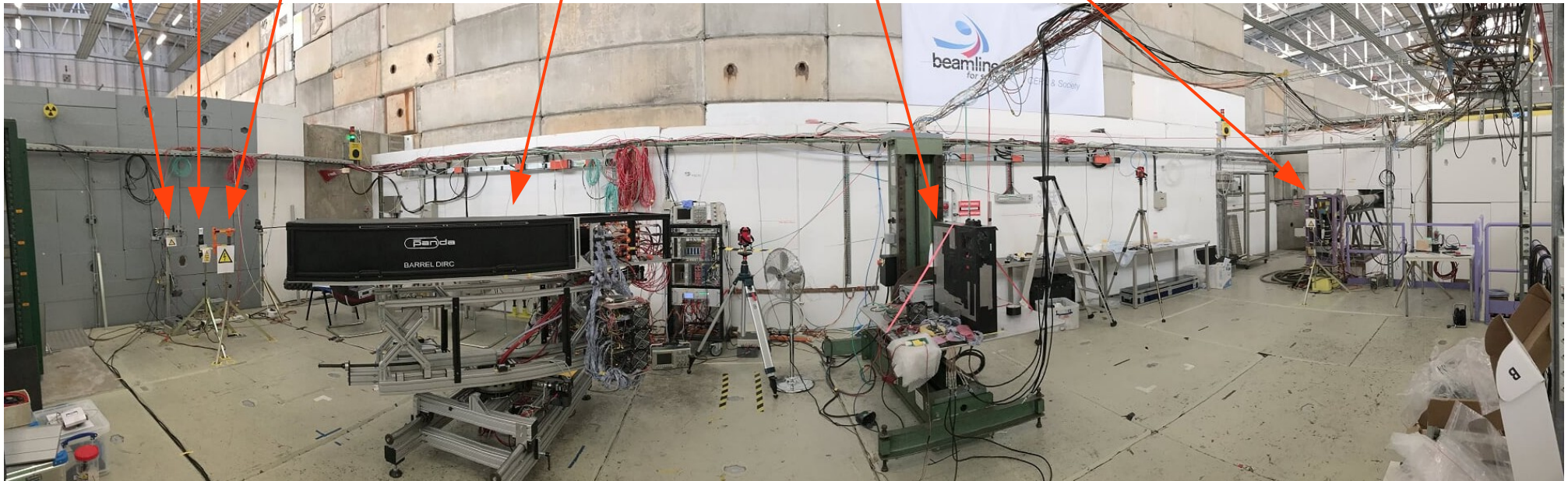
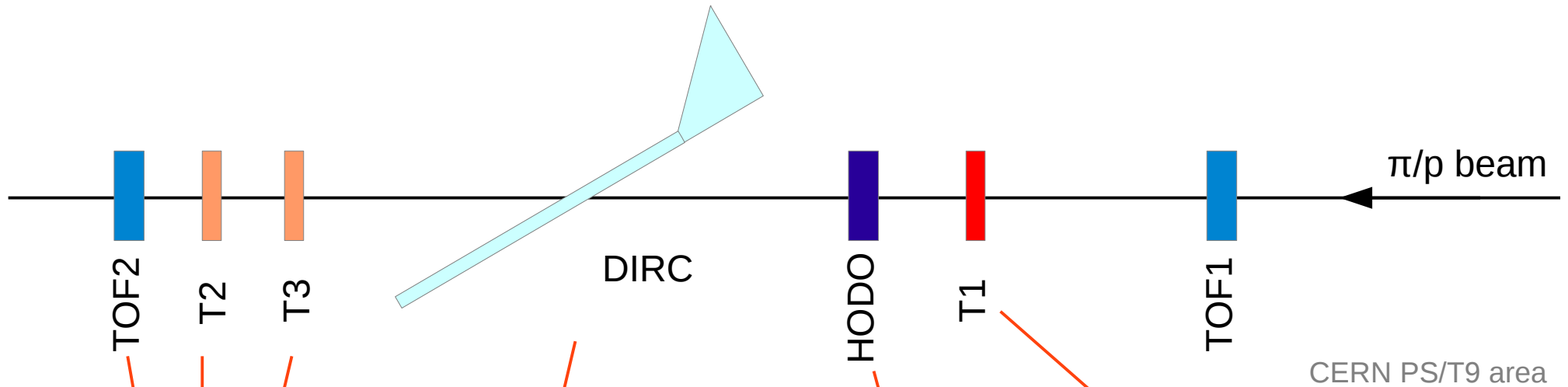
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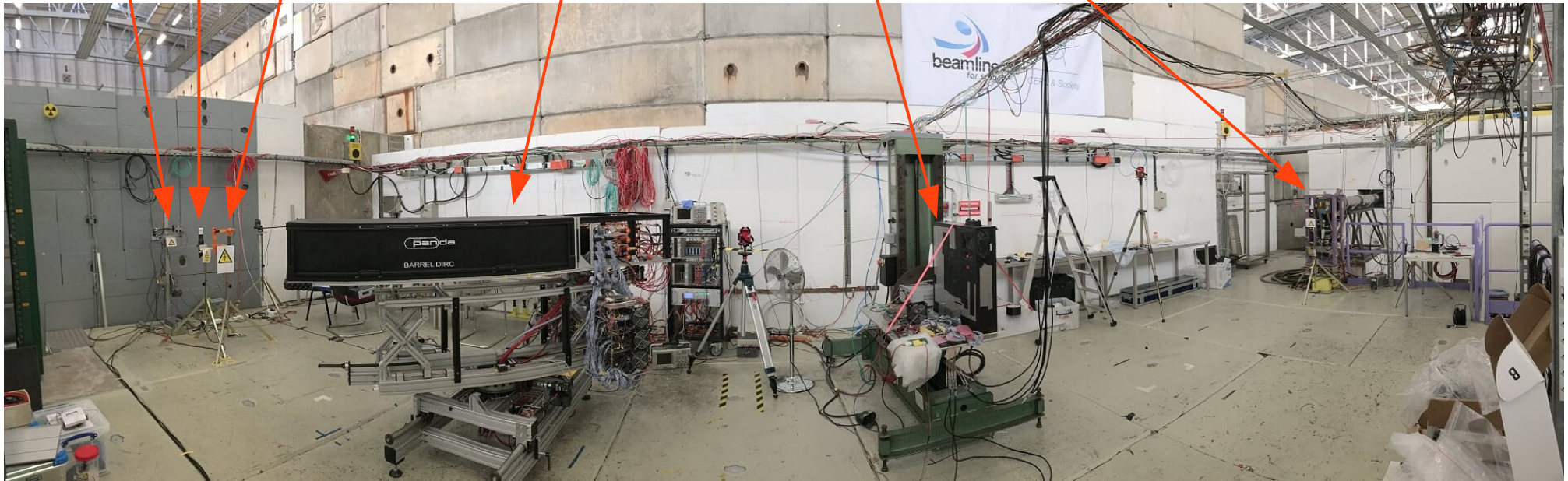
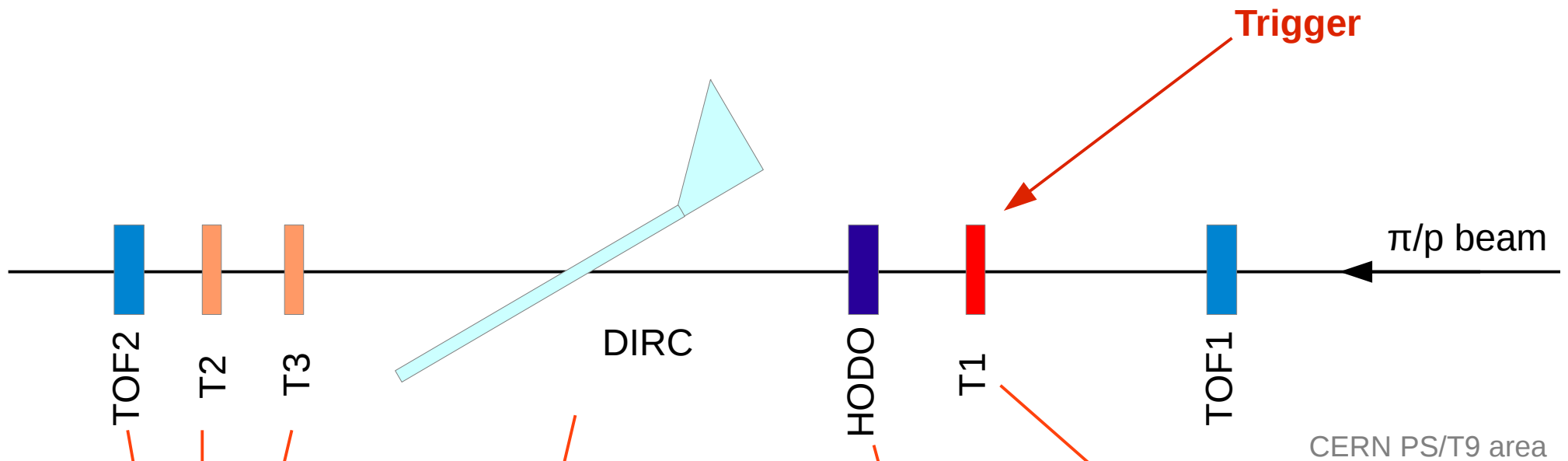
Test conditions:

- CERN PS/T9 area
- 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
- different DIRC prototype angles

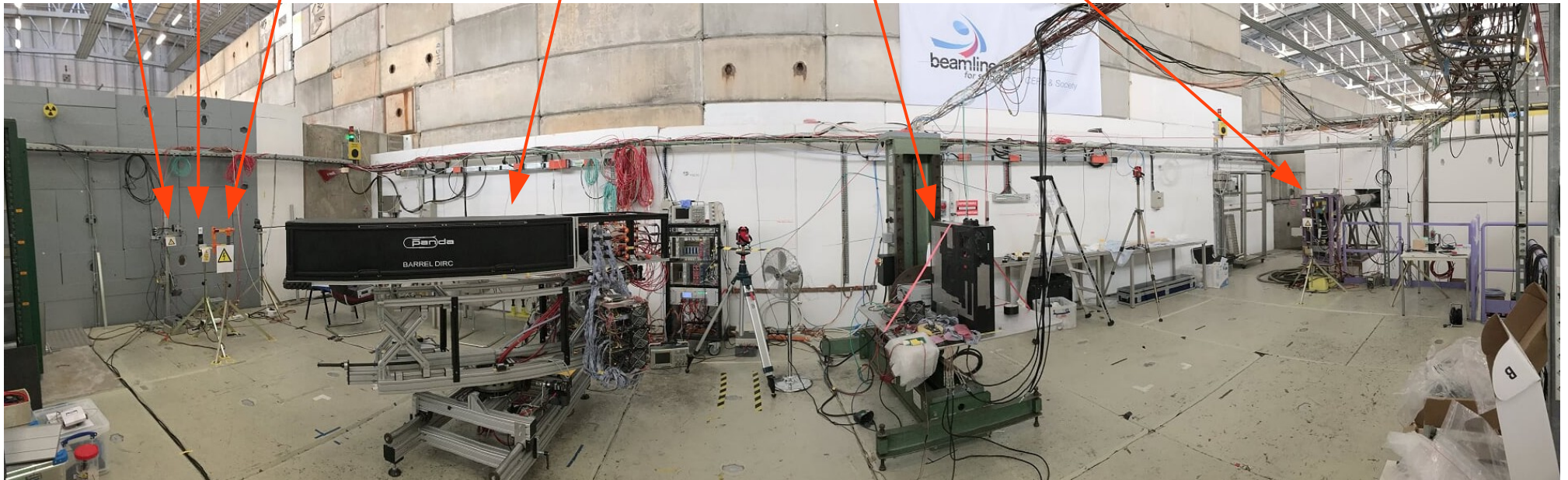
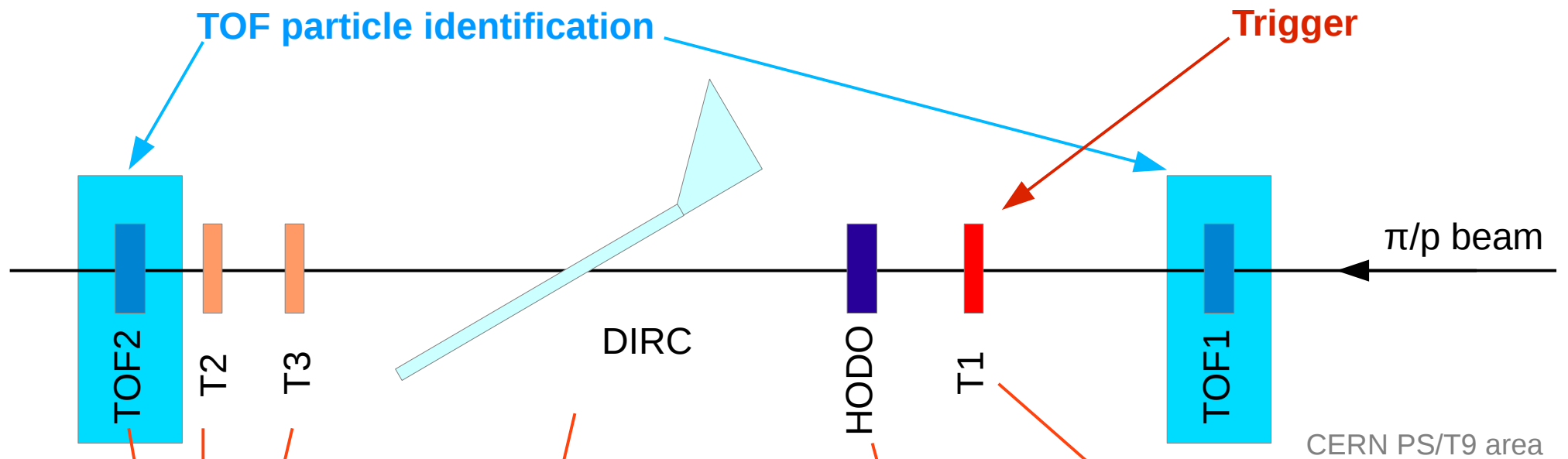
CERN 2017 Prototype Test



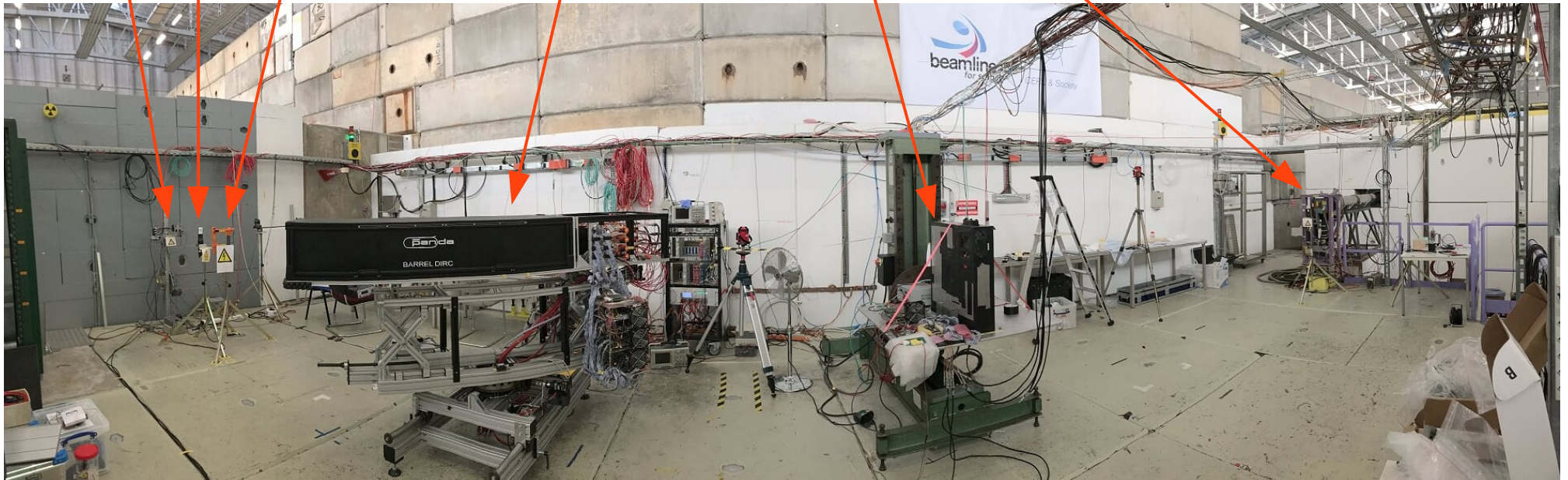
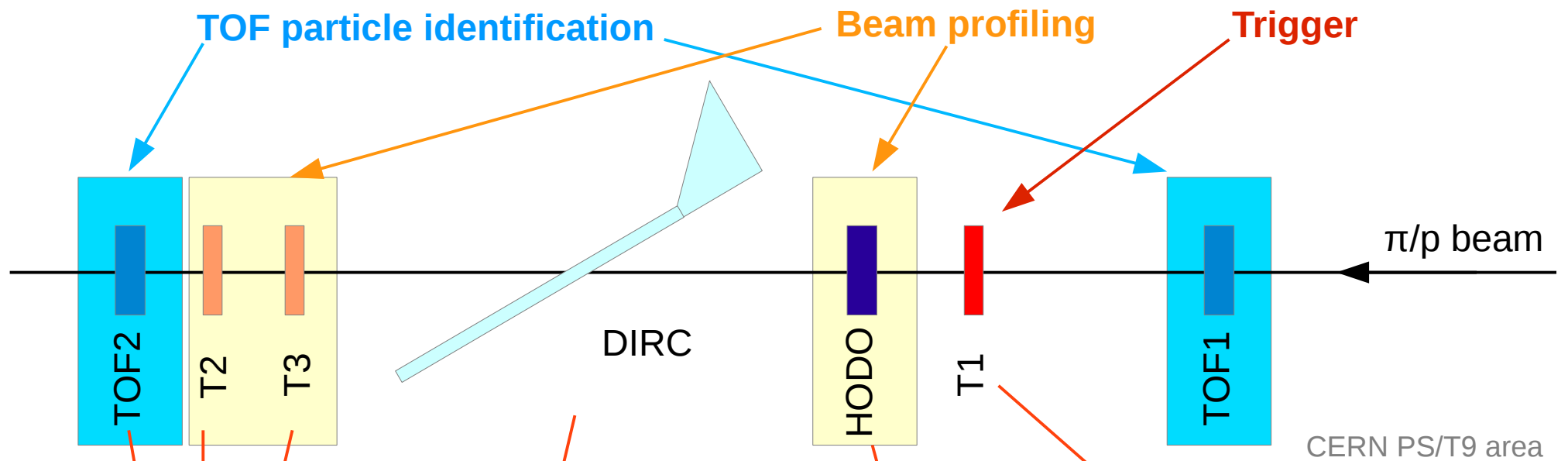
CERN 2017 Prototype Test



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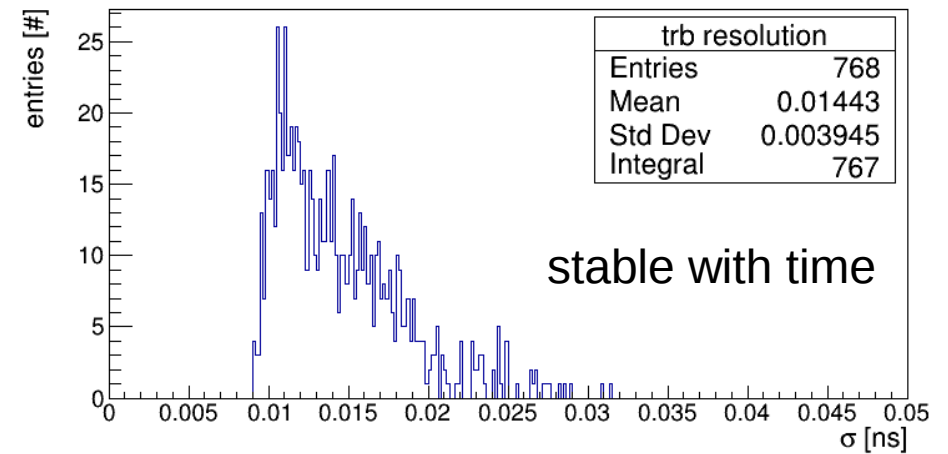
CERN 2017 Prototype Test



Time Resolution

TRB internal pulses:

- TRB time resolution ~14ps



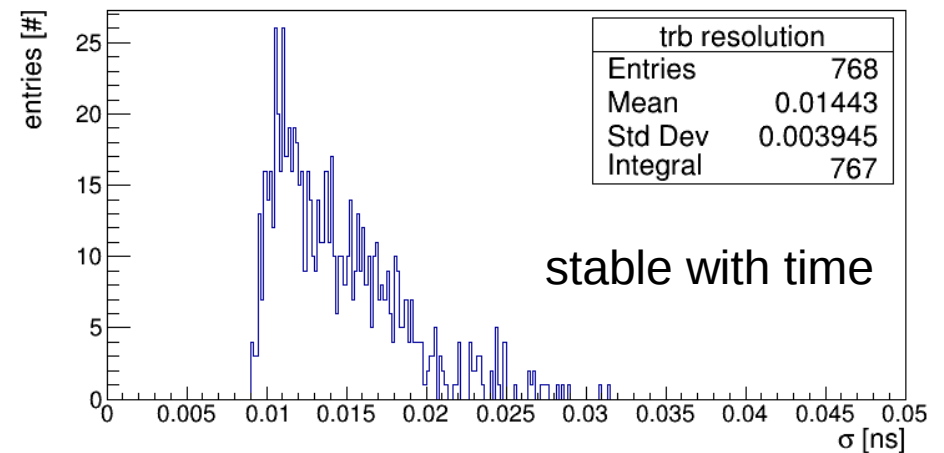
Time Resolution

TRB internal pulses:

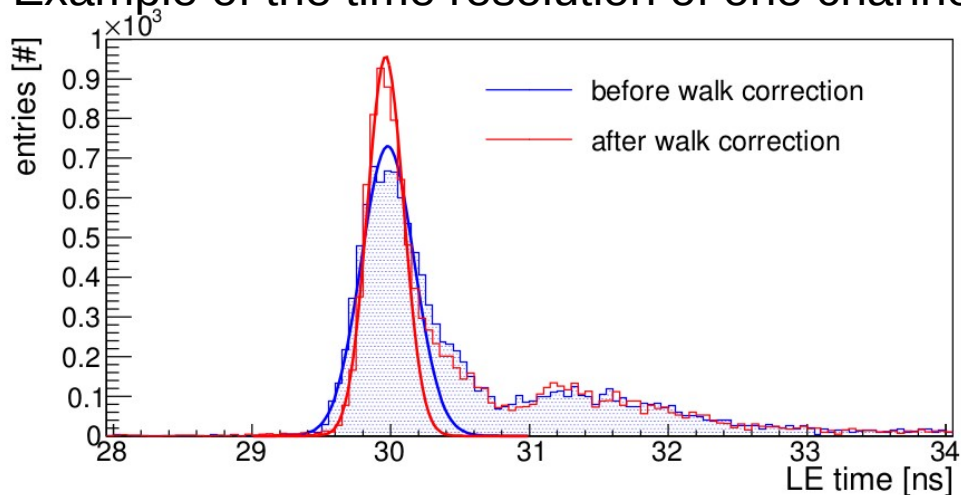
- TRB time resolution $\sim 14\text{ps}$

Pilas laser:

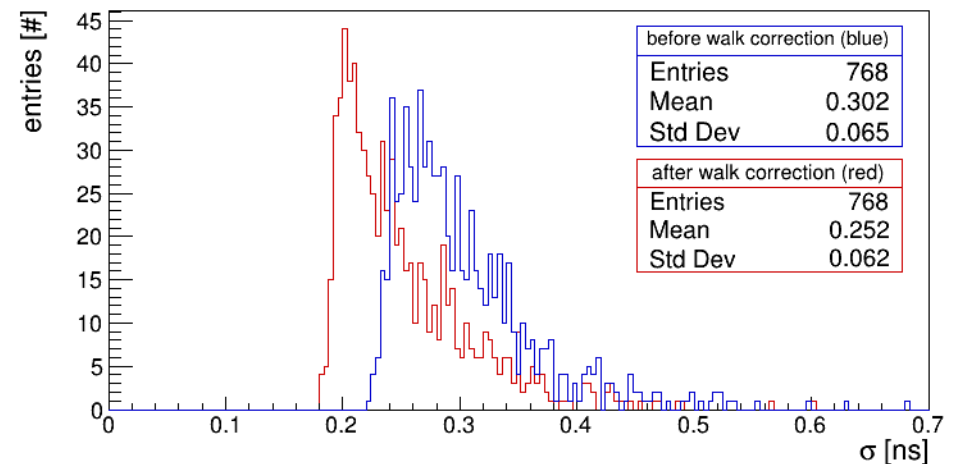
- Total time resolution $\sim 250\text{ps}$



Example of the time resolution of one channel:



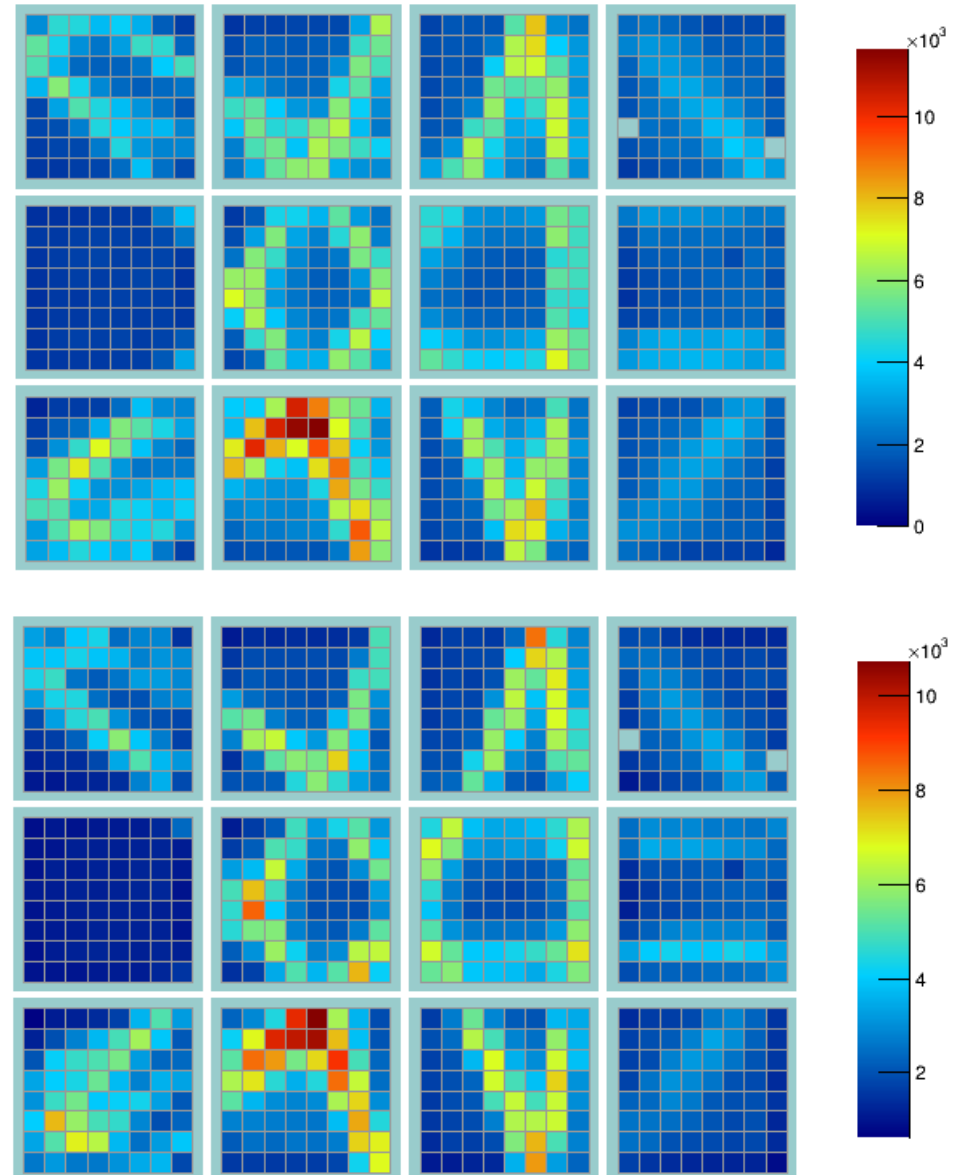
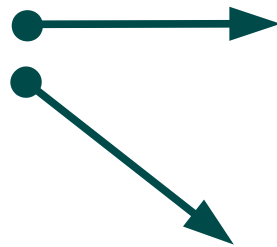
Time resolution of all 768 channels:



Examples of the Hit Pattern

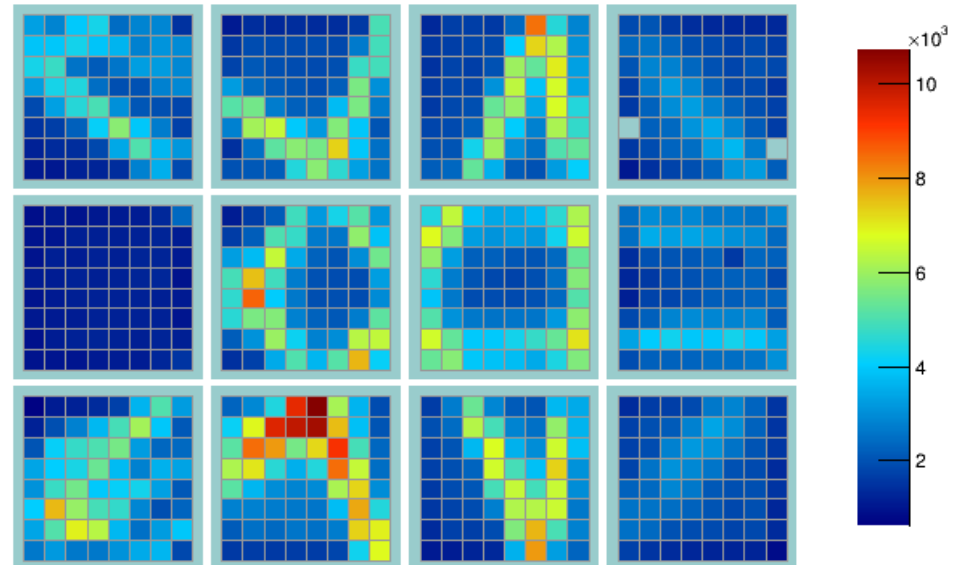
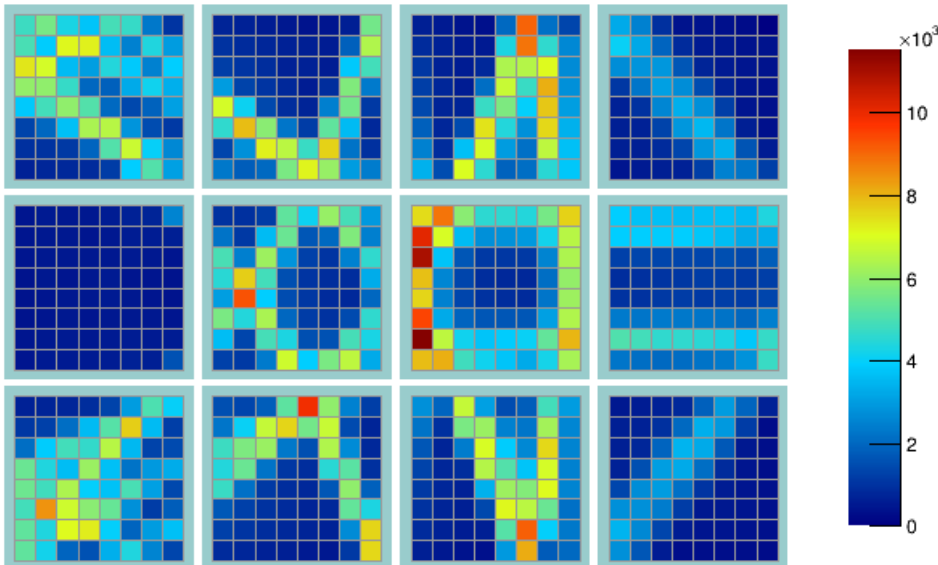
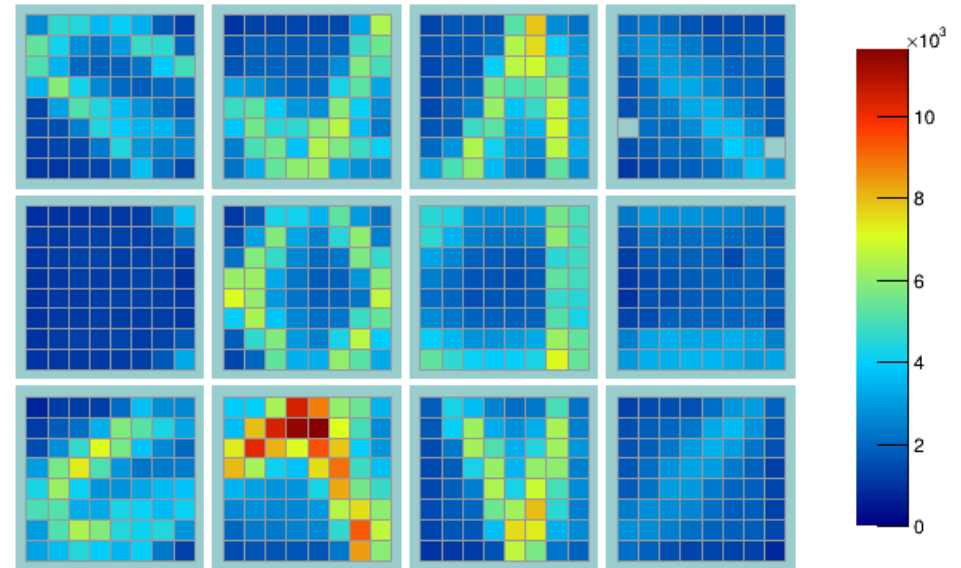
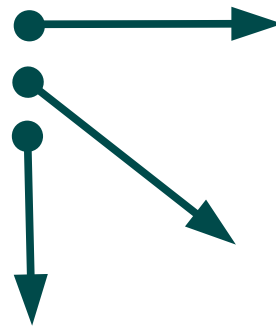
- 20 degree polar angle
- pions and protons @ 7 GeV/c
- bar + 3 layer spherical lens

- beam data with proton tag
- beam data with pion tag



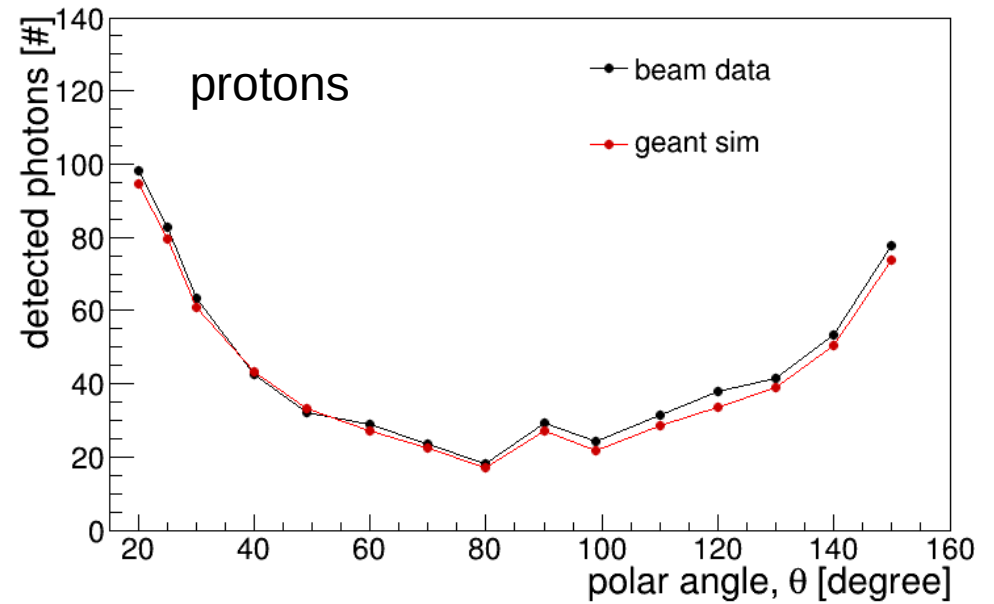
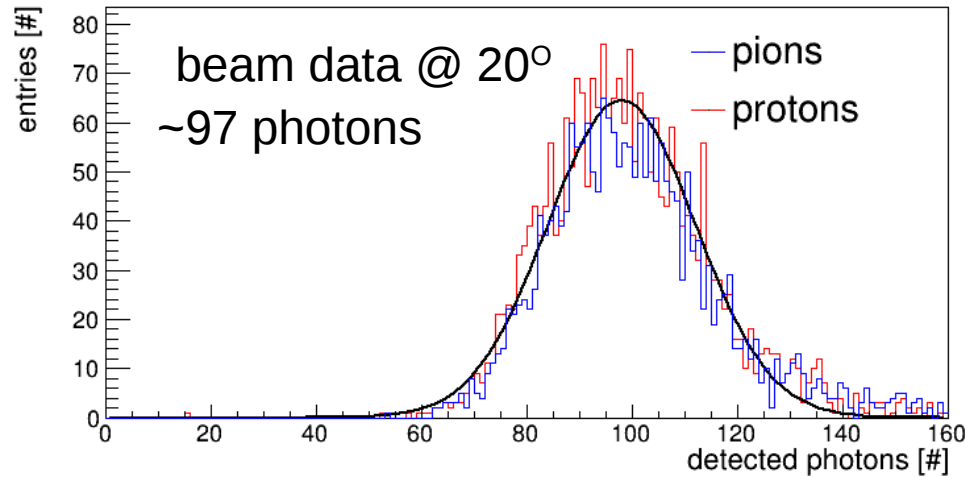
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- **geant** simulation for pions



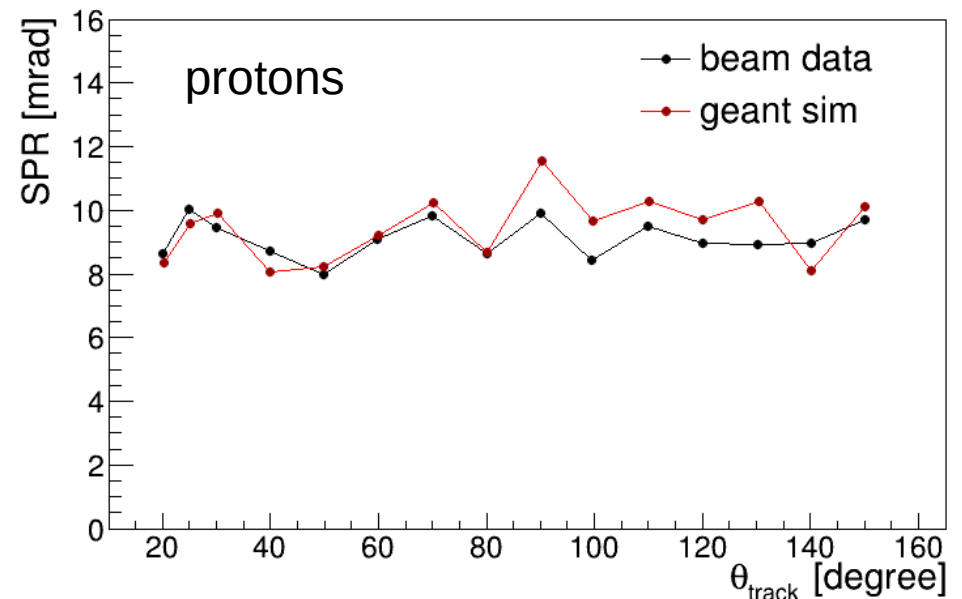
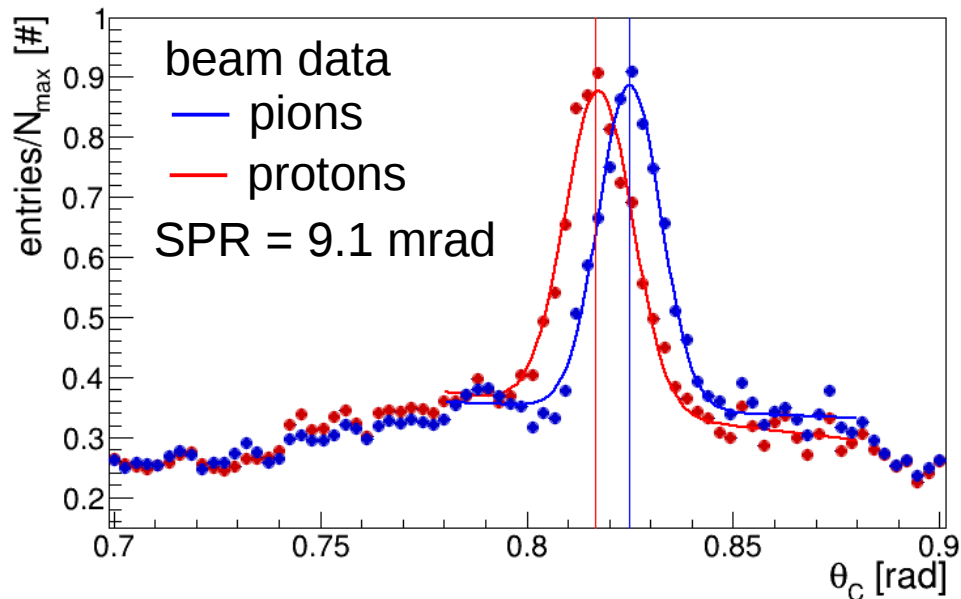
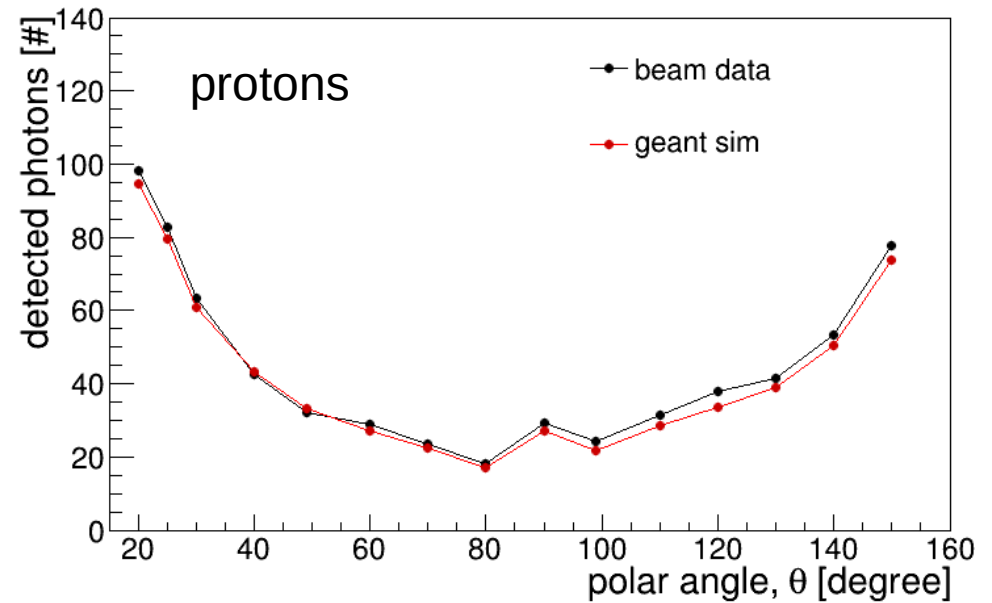
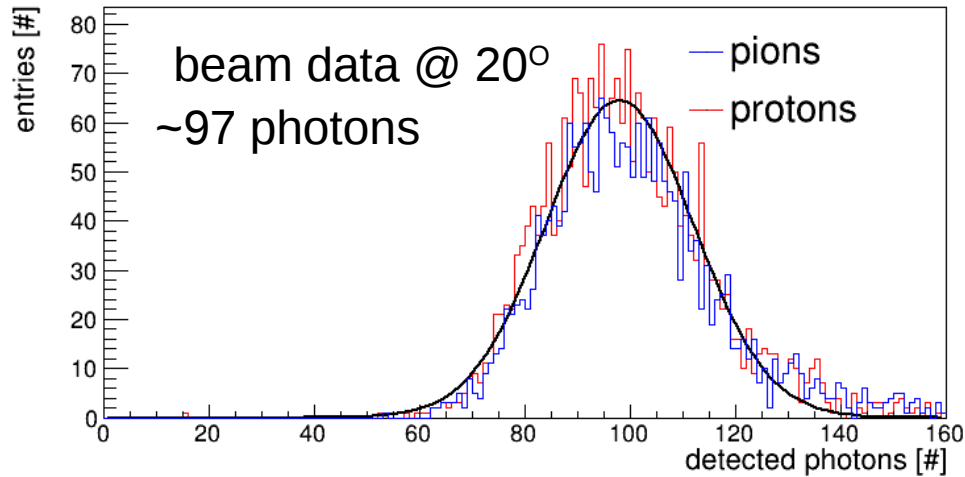
Geometrical Reconstruction

- bar + 3LS lens
- π/ρ @ 7 GeV/c



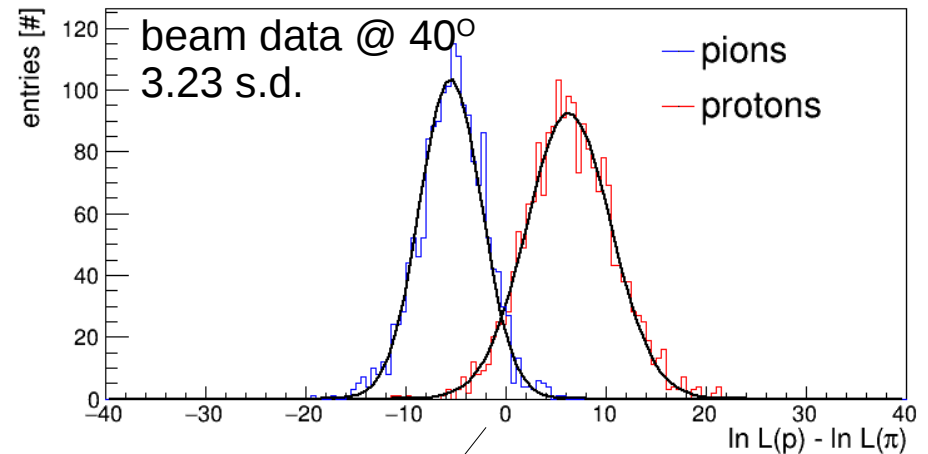
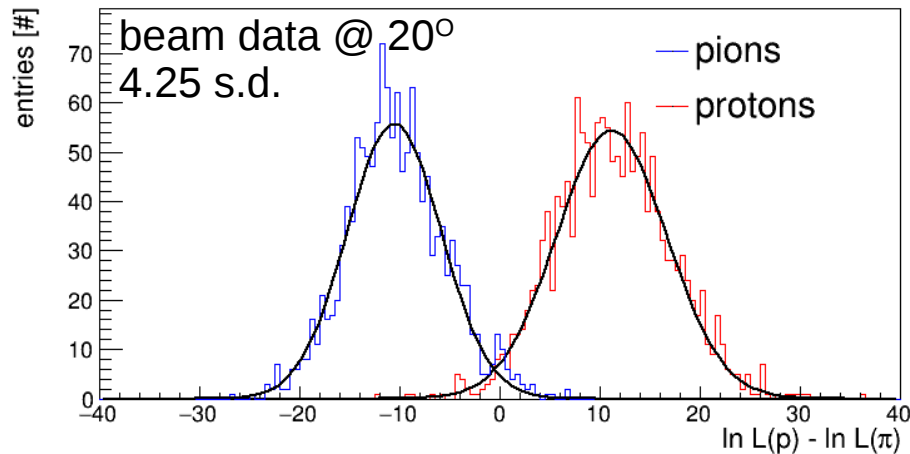
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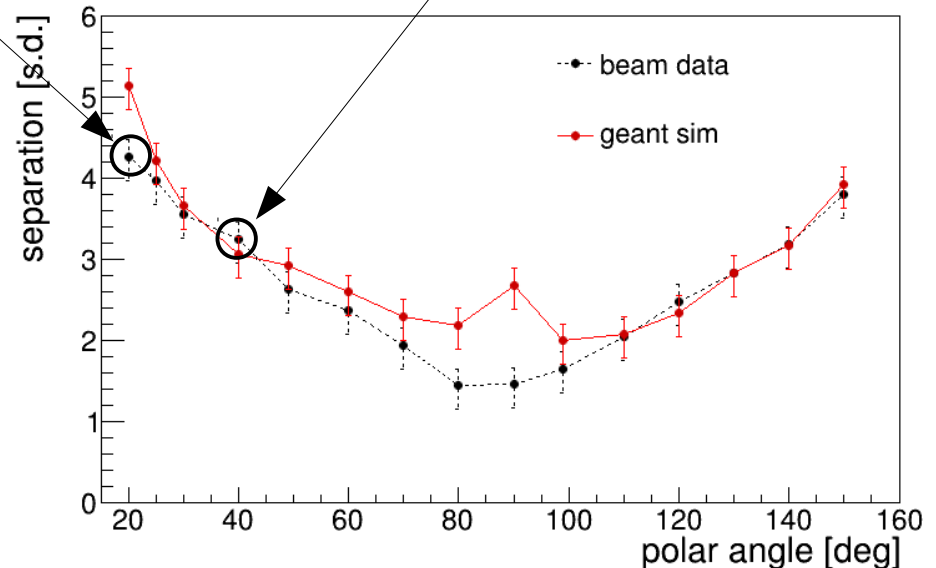


Bar with 3L Spherical Lens @ 7 GeV/c

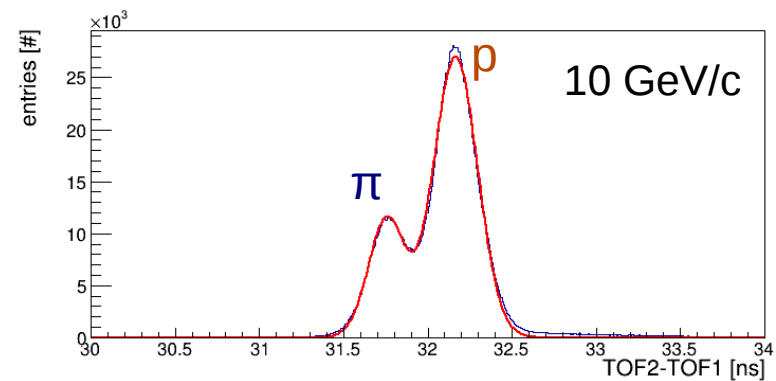
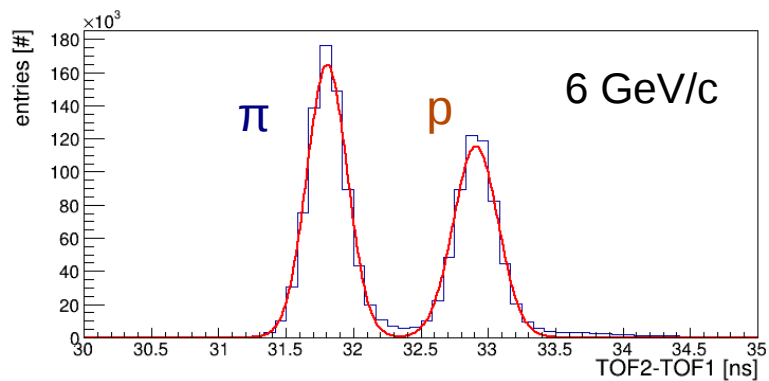
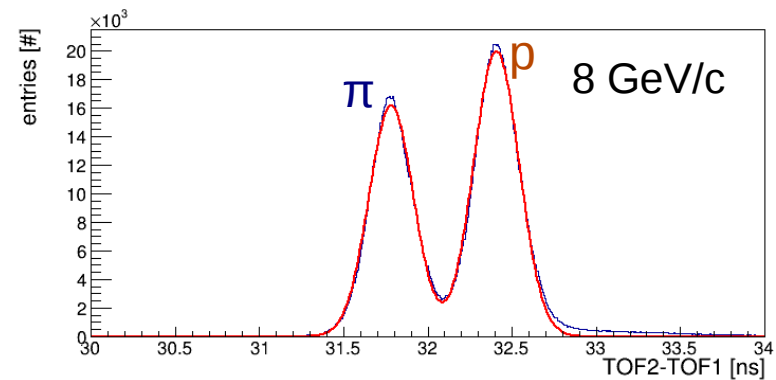
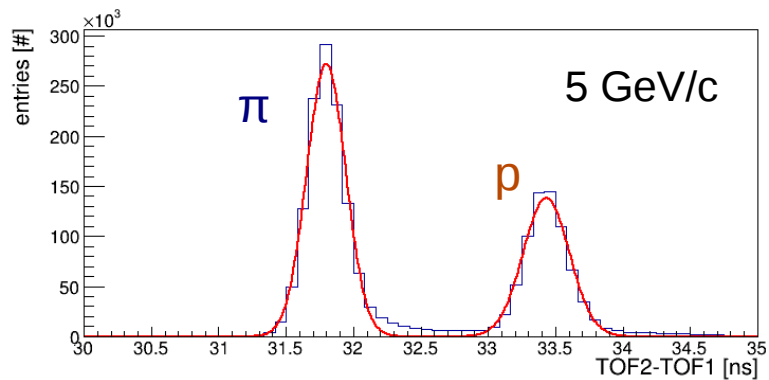
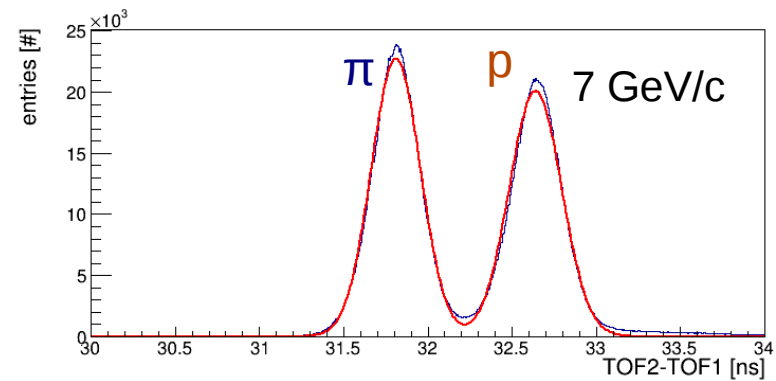
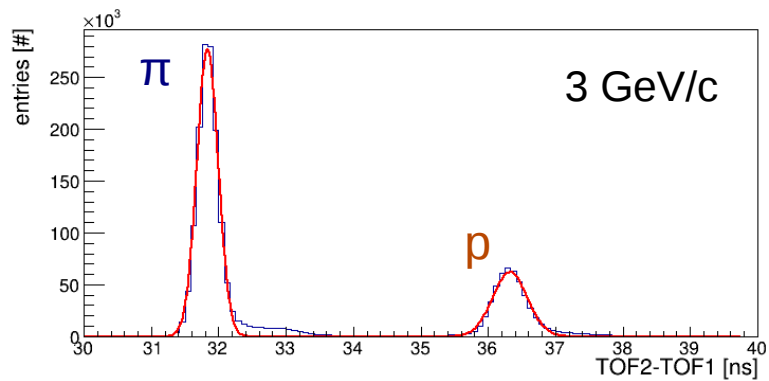
π/p separation power (using time imaging reconstruction):



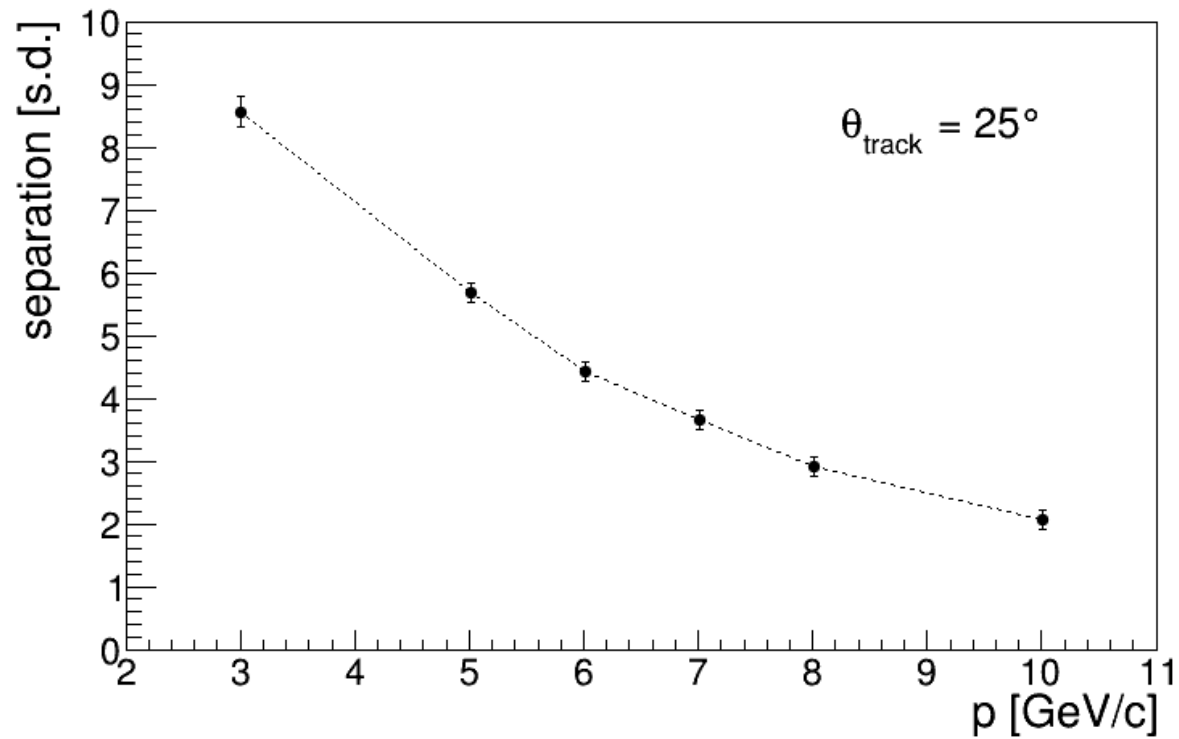
$$N_{\text{sep}} = \frac{|\mu_1 - \mu_2|}{0.5(\sigma_1 + \sigma_2)}$$



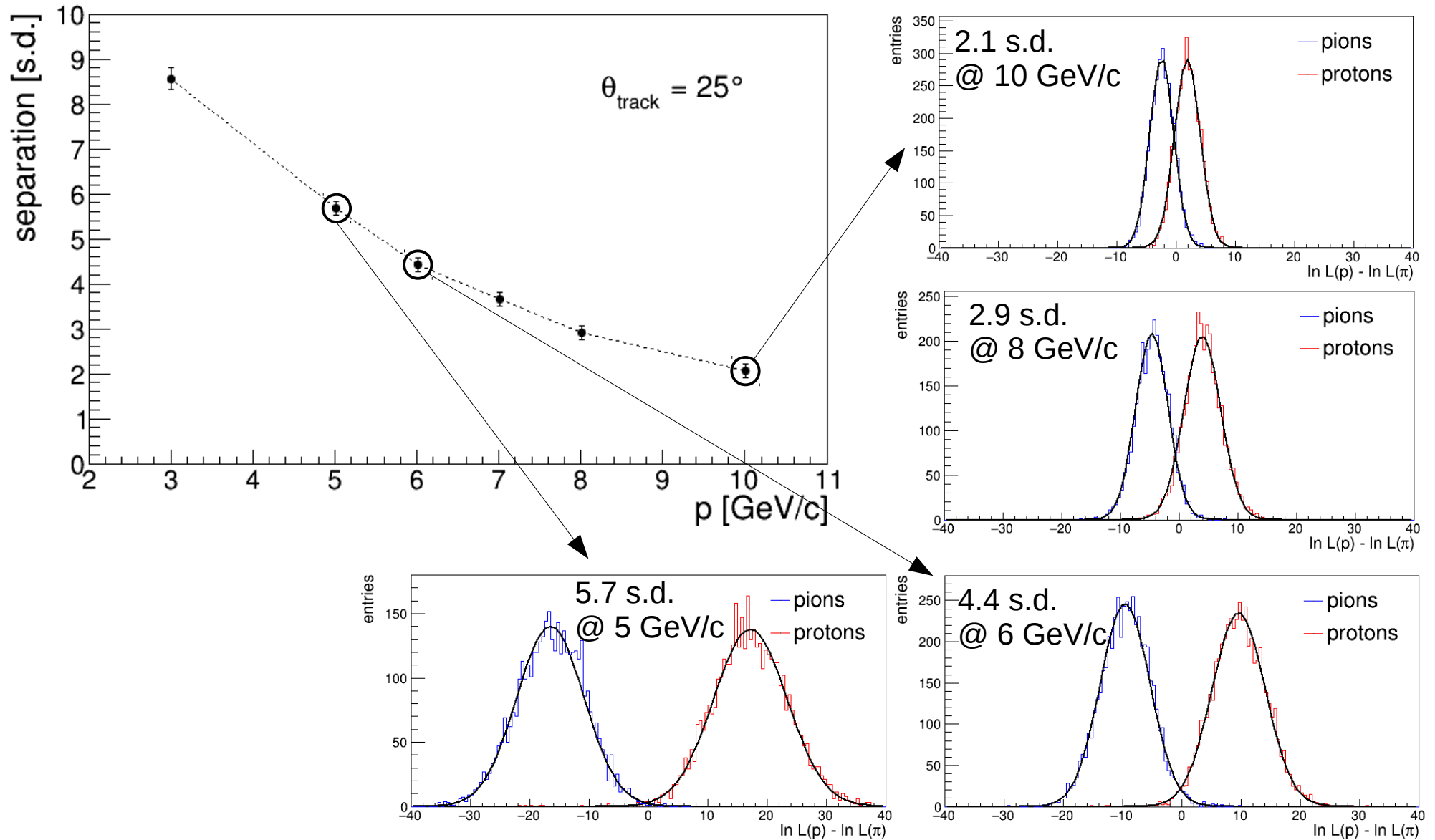
Time-of-Flight PID



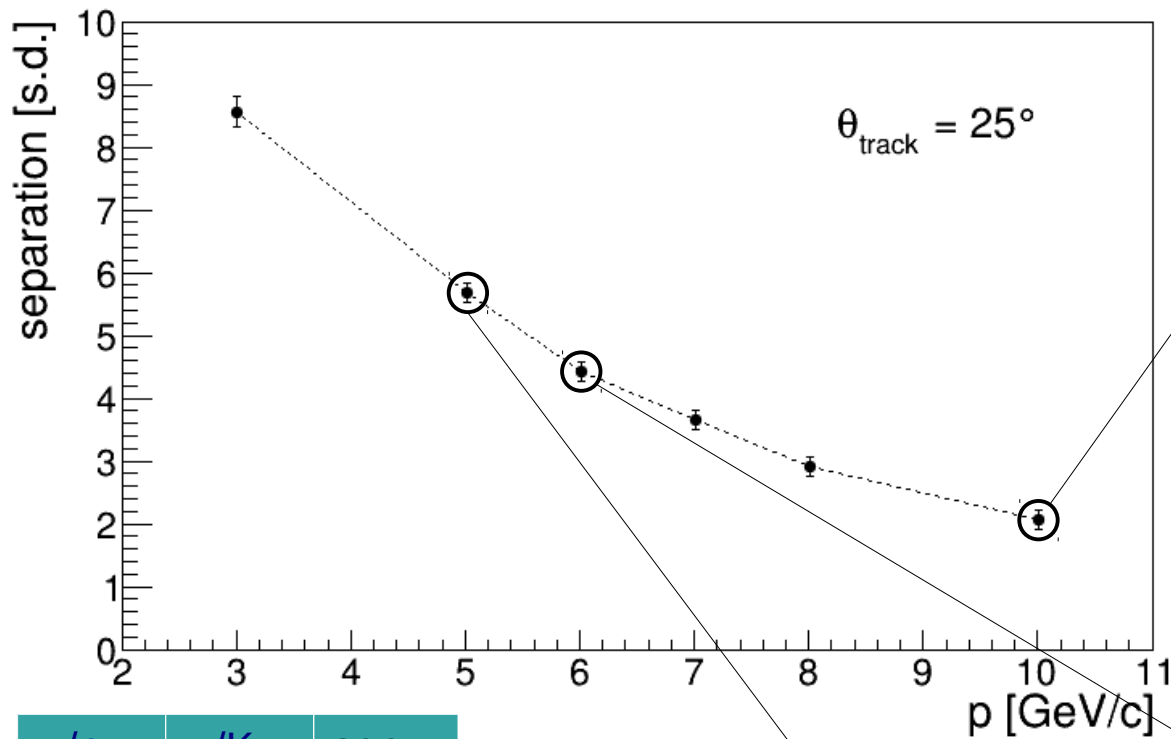
Momentum Scan for Bar with 3LS Lens



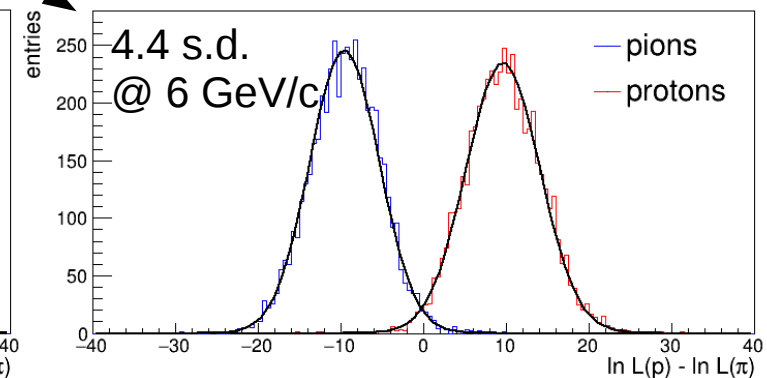
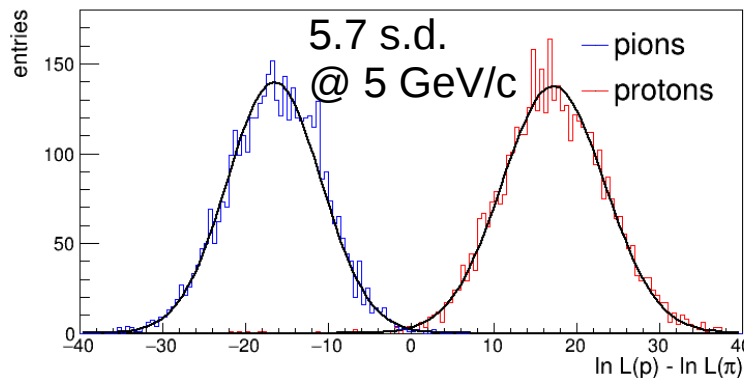
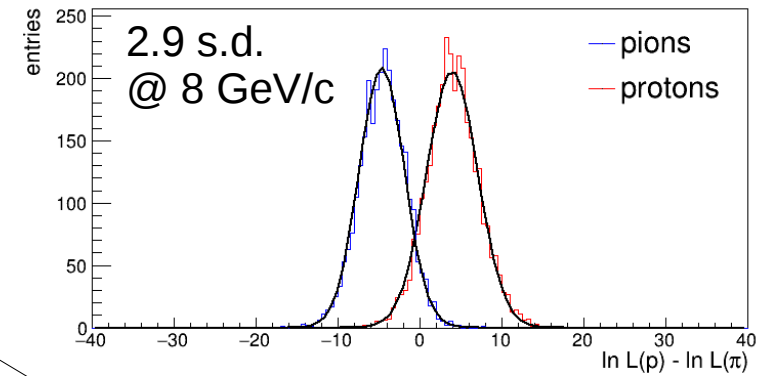
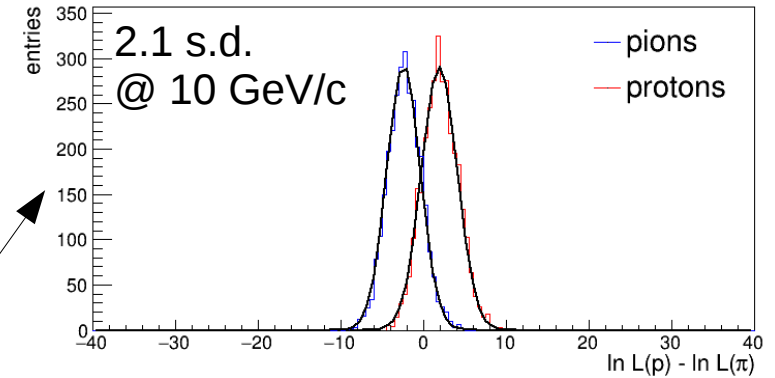
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π/p [GeV/c]	π/K [GeV/c]	sep [s.d.]
3	1.5	8.6
5	2.6	5.7
6	3.1	4.4
7	3.6	3.7
8	4.1	2.9
10	5.1	2.1



Summary and Outlook

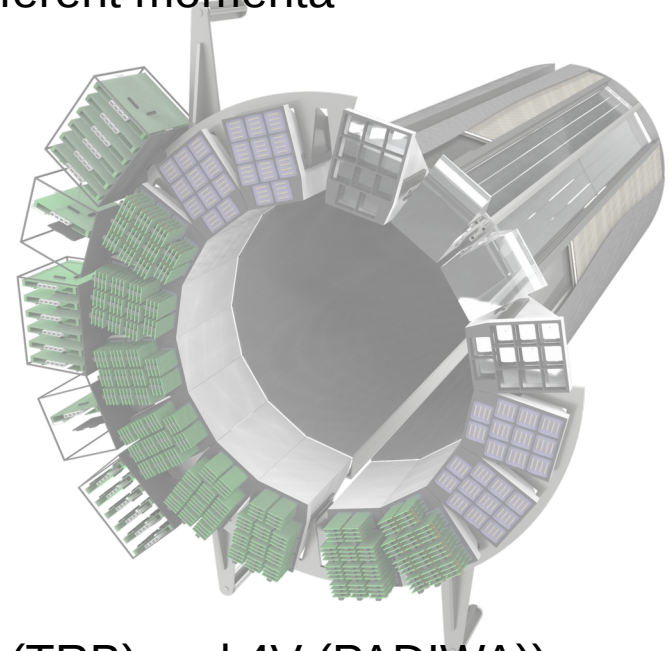
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Ongoing studies:

- air gap vs. optical grease vs. optical cookies
- z scans through the radiator
- analytical PDF

Outlook:

- prototype test at CERN 2018
 - new MCP-layout (4x2)
 - new power supply (WIENER PL-506 for the 48V (TRB) and 4V (PADIWA))



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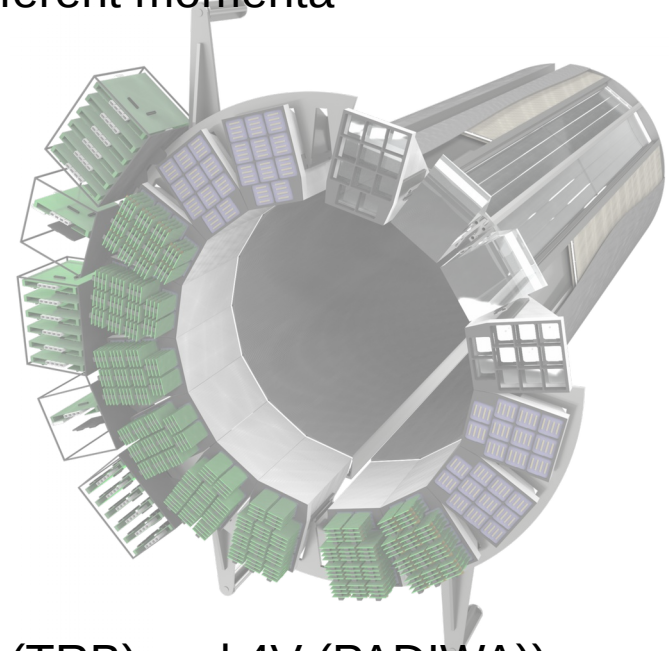
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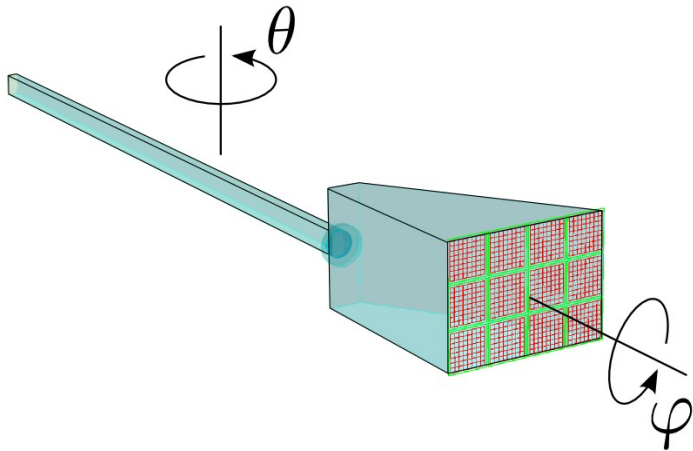
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Thank you for your attention

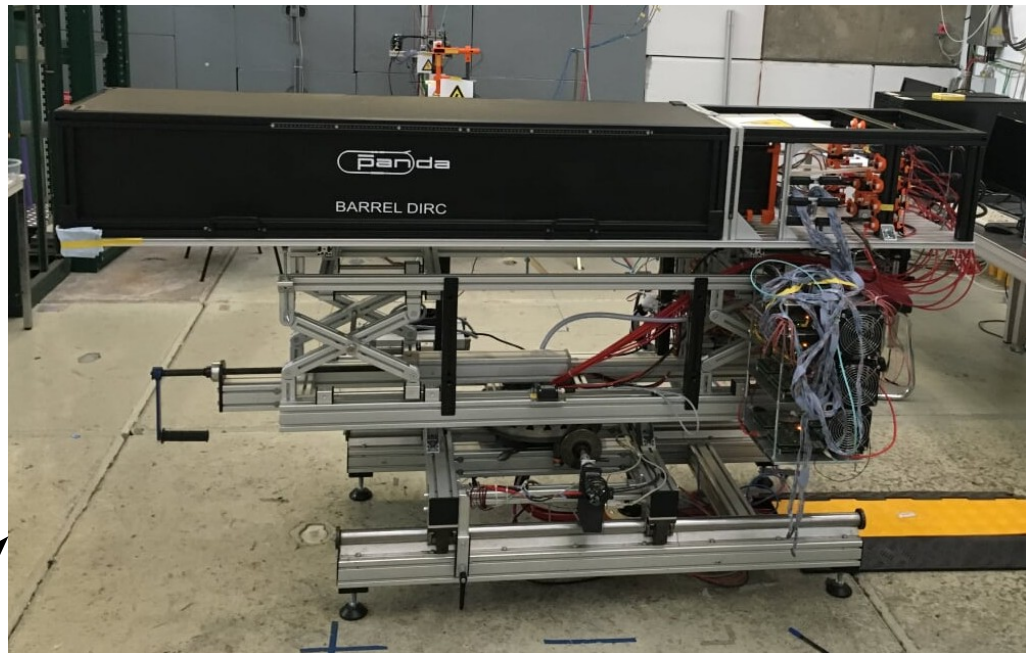
Backup

DIRC Prototype Photos

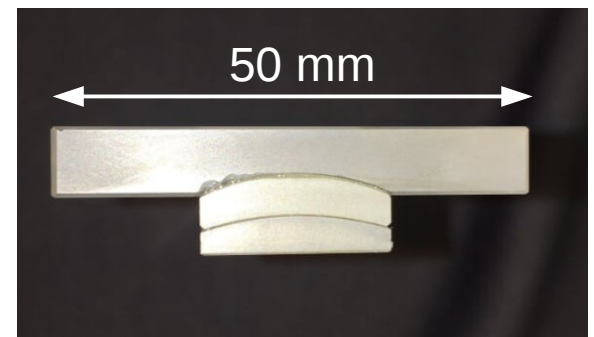
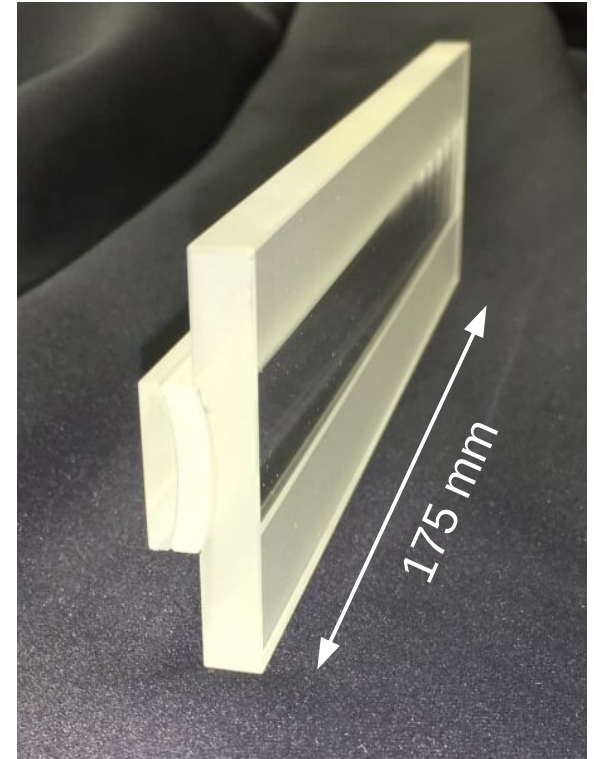


Polar angle 90°
Azimuthal angle 0°

Polar angle 25°
Azimuthal angle 10°

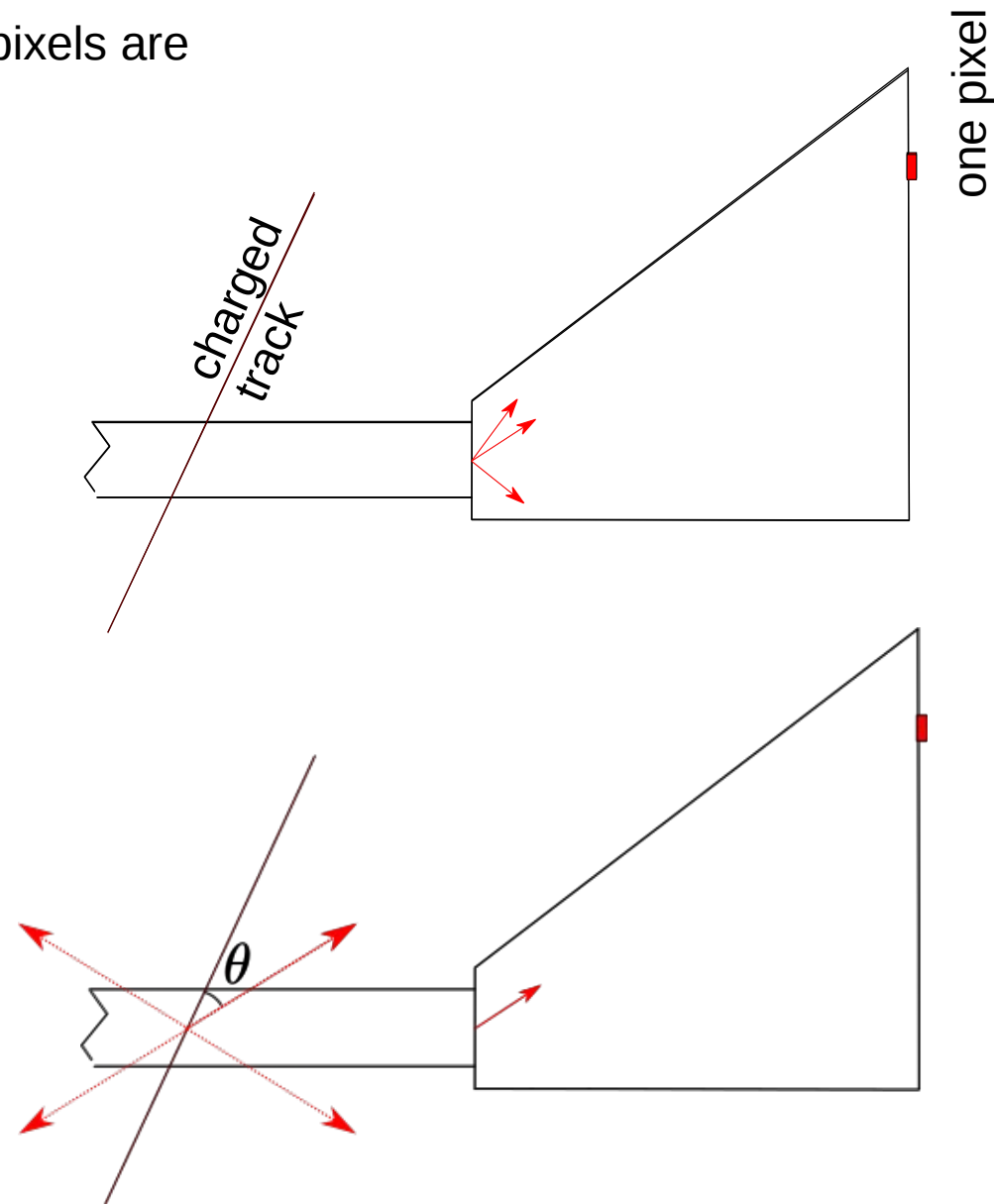
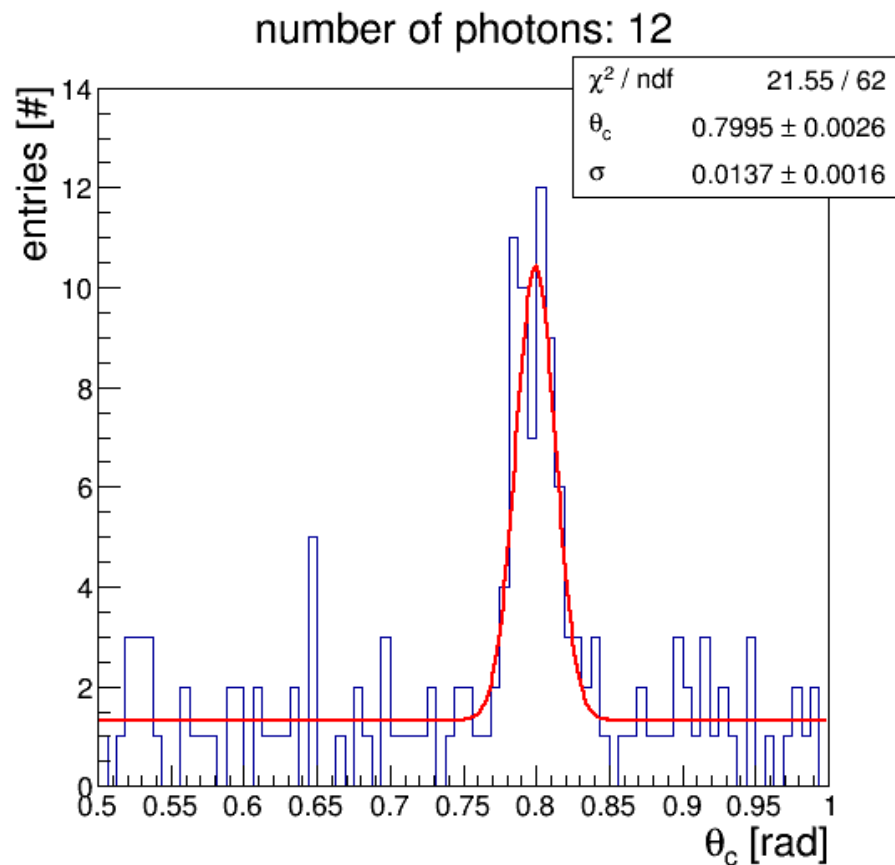


New 3 Layer Cylindrical Lens



Geometrical Reconstruction

- **Reconstruction:** direction from LUT for hit pixels are combined with charge track direction



Time Imaging Reconstruction. PDFs

beam data with plate @ 7 GeV/c @ 25 degree

