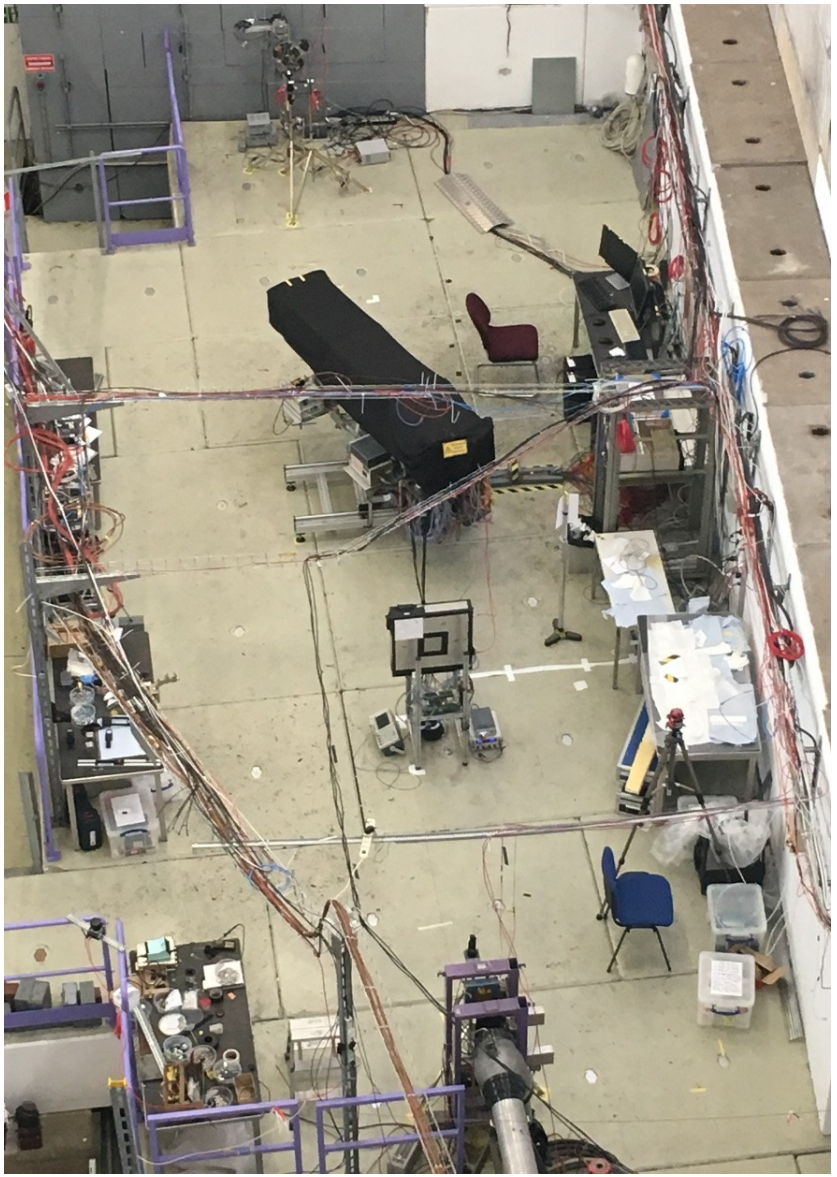
First Impression from CERN 2016 Beam Test

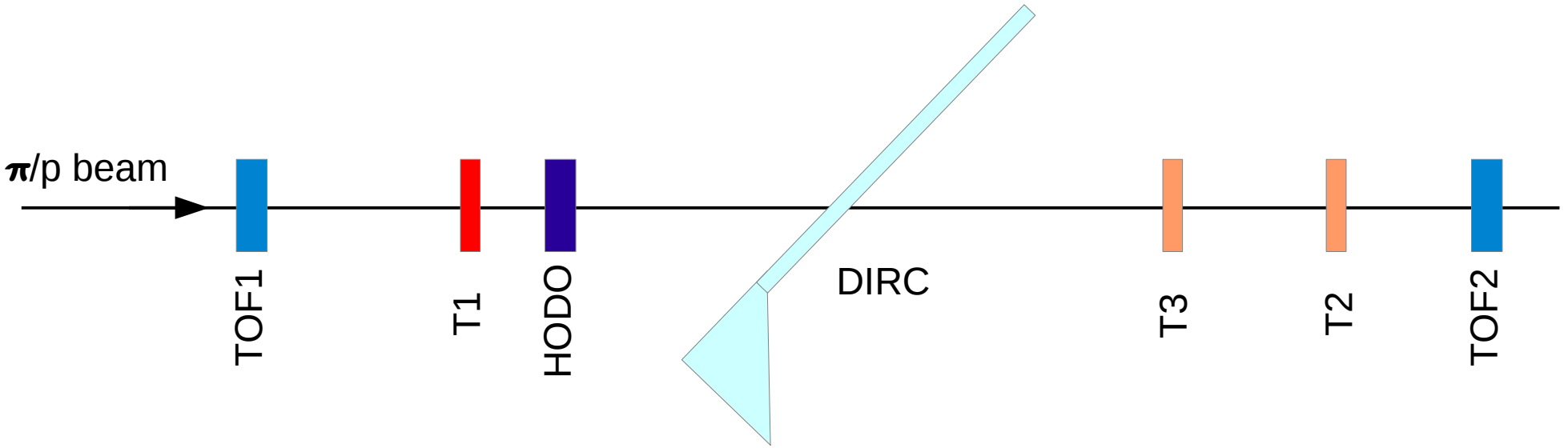


Roman Dzhygadlo,
Panda Cherenkov Group

- prototype test at CERN 2016
- data selection and calibration
- examples of the PID
- summary & outlook

PANDA meeting
06.12.16

Cern 2016 Prototype Test



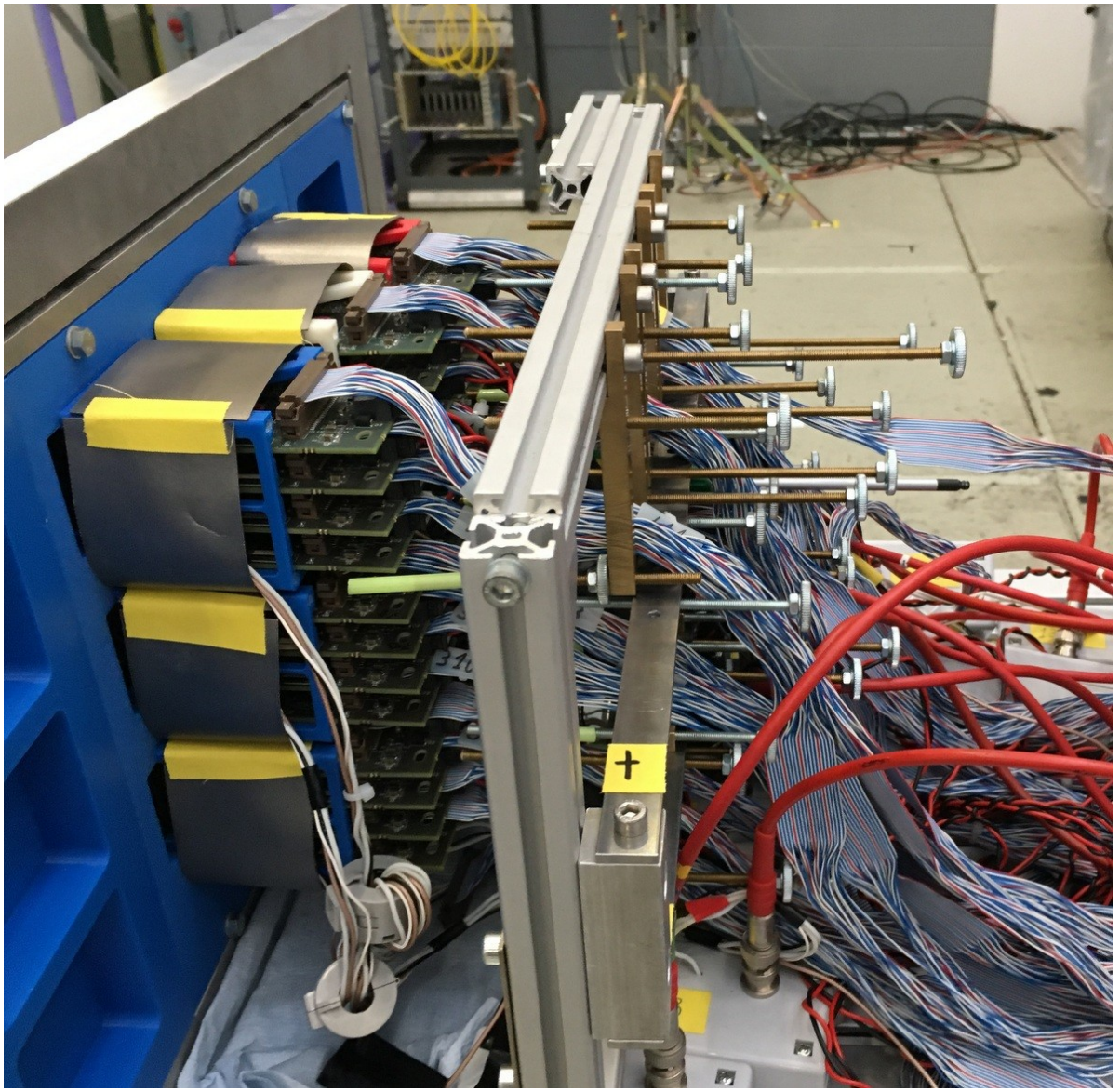
- main goal: validate the PID performance of the plate design

- CERN T9 area
- beam type: protons and pions
- beam momentum: 8, **7**, 6, 5, 4, 3 GeV/c
- TOF PID

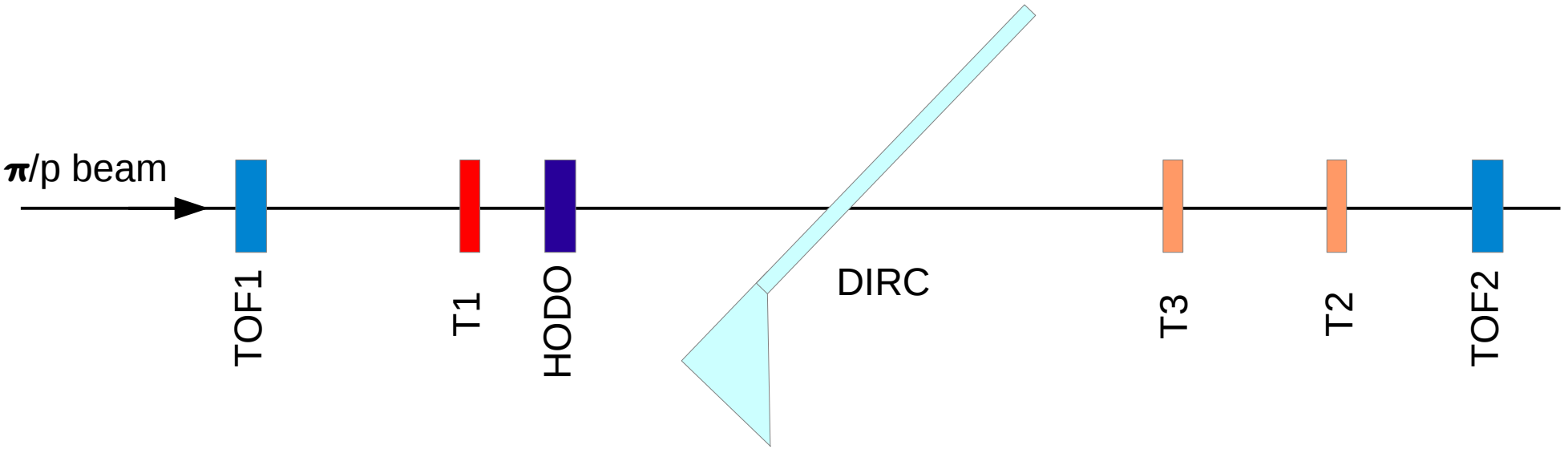
- 30 degree prism as expansion volume => 9 MCP-PMTs (vs 15 last year)
- different configurations of the DIRC prototype (most of the data are with plate)
- different DIRC prototype angles

Cern 2016 DIRC Prototype Photo

Cern 2016 DIRC Prototype Photo



Event Selection

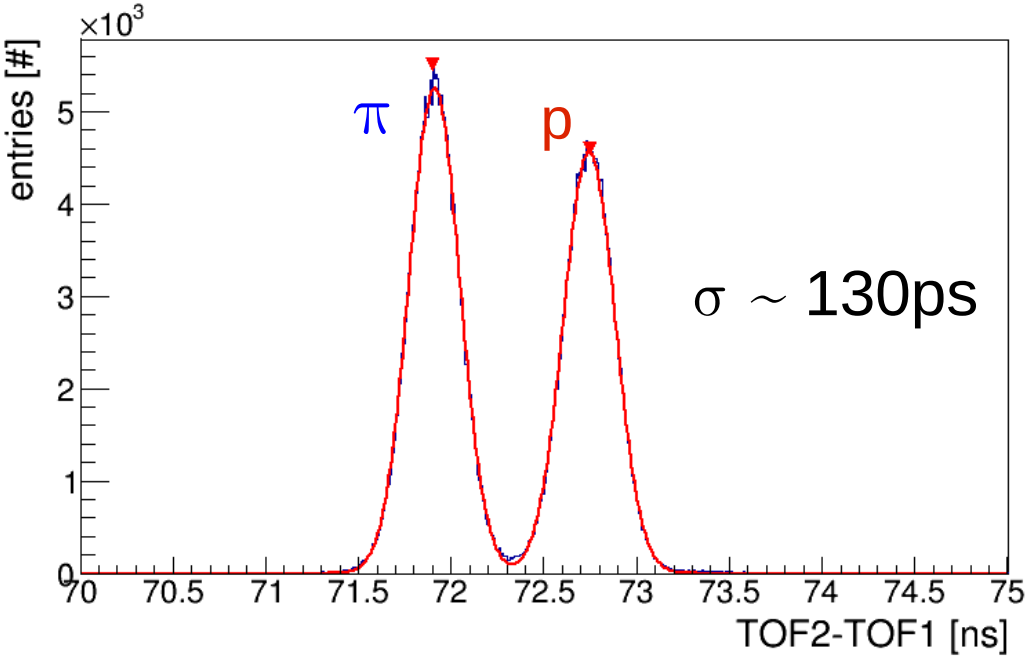


Event selection:

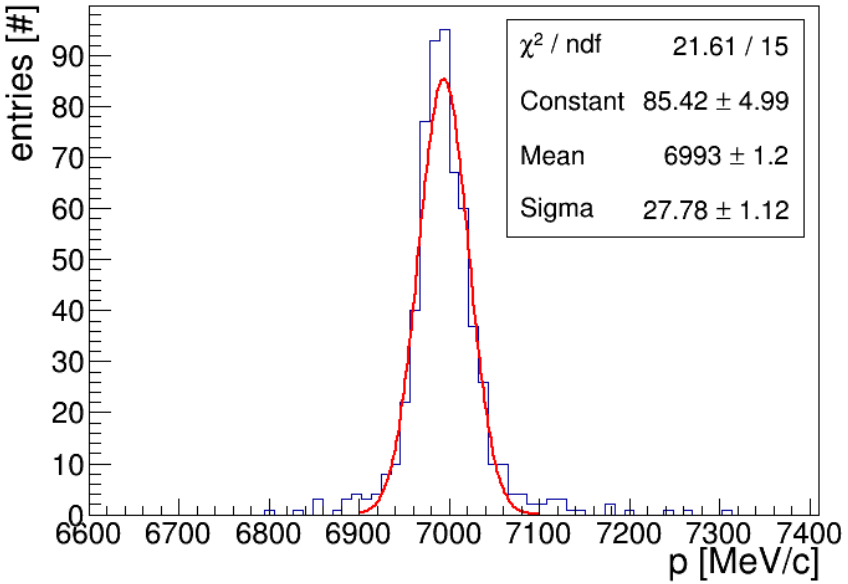
T1	100%
+ TOF1,TOF2	30%
+ T2,T3	10%
+ HODO	<1%

> 0.5B event on T1 level

TOF PID



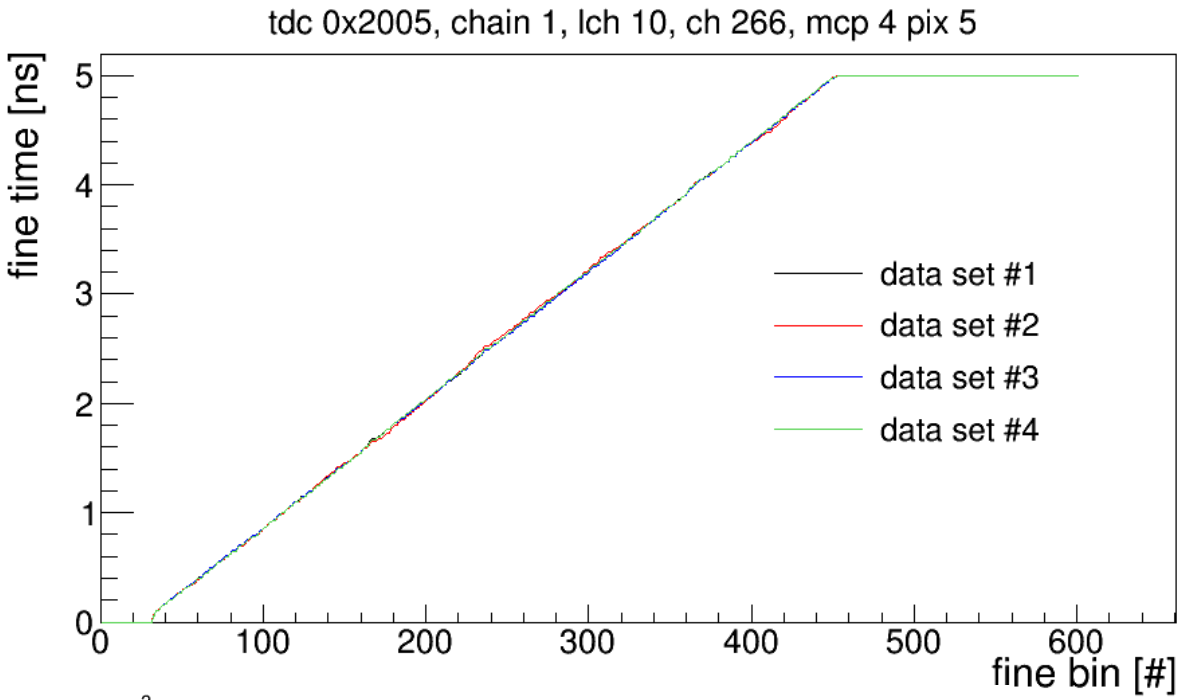
Difference of the MCP-OUT signal of TOF2 and TOF1 counters after walk correction @ 7 GeV/c



Beam momenta from each run

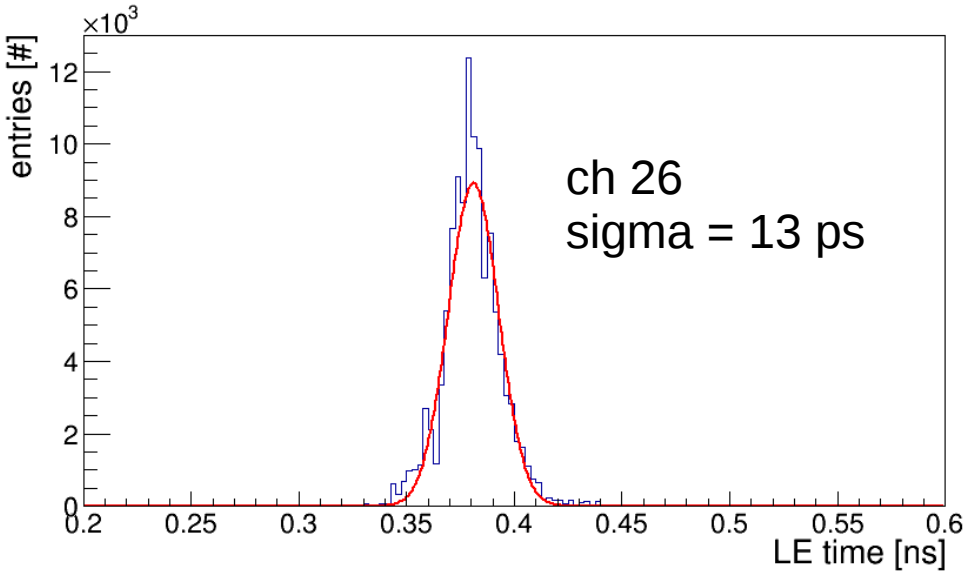
- stable with time
- p = 6990 +/- 20 MeV/c

Fine Time Calibration



Time = epoch time
+ coarse time
+ fine time

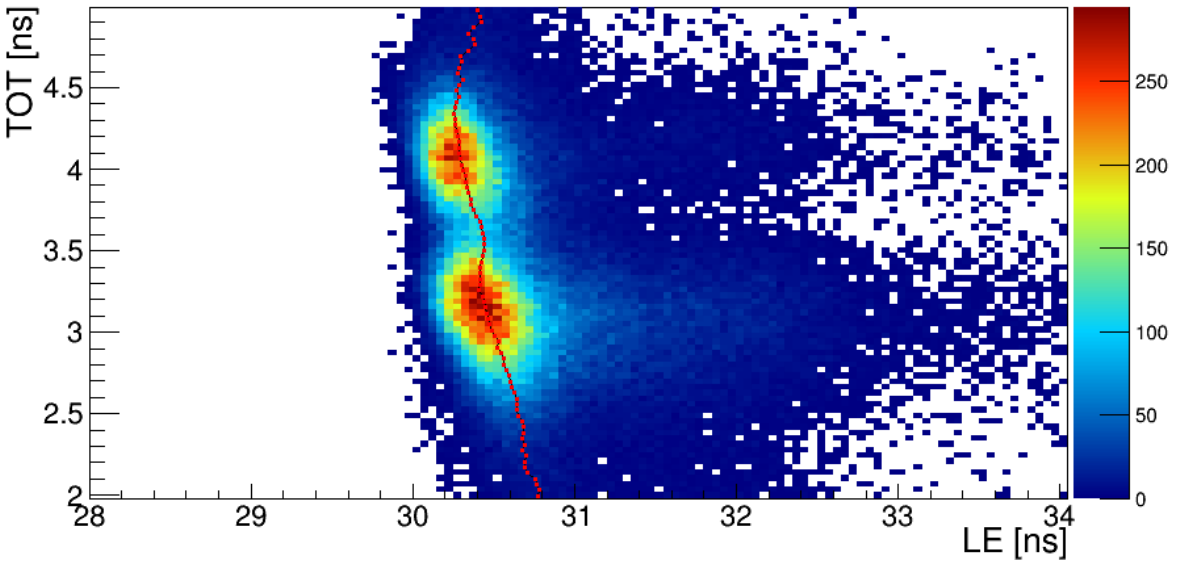
stable with time

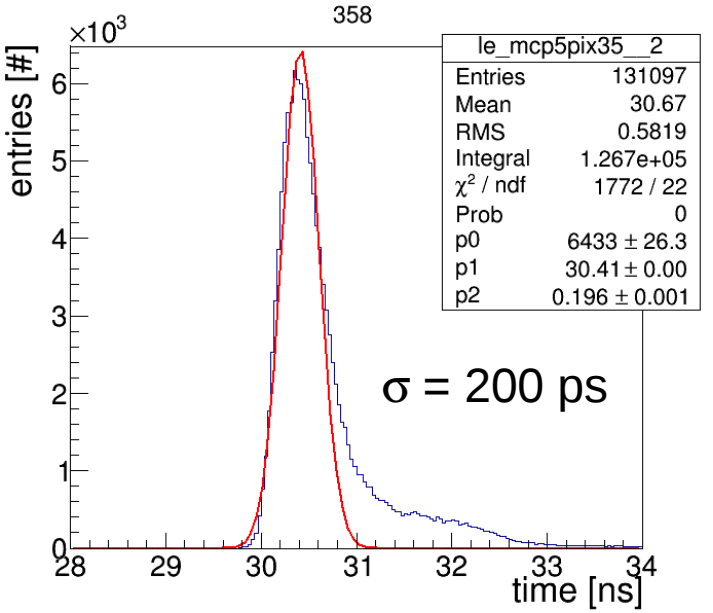


Example of the electronic time resolution

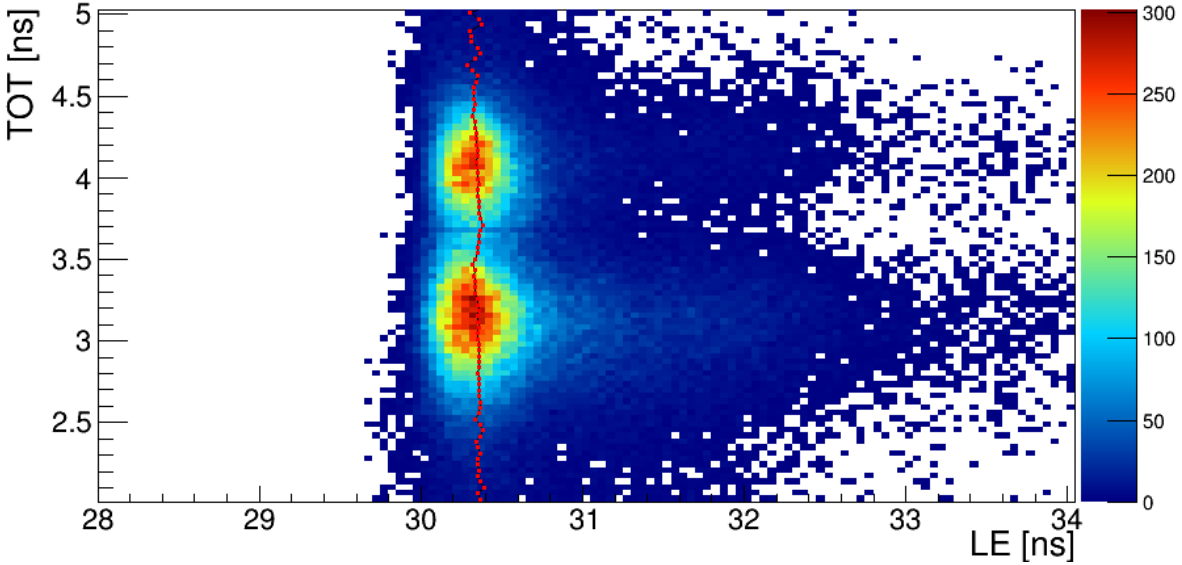
Time Walk Correction of the DIRC ch.

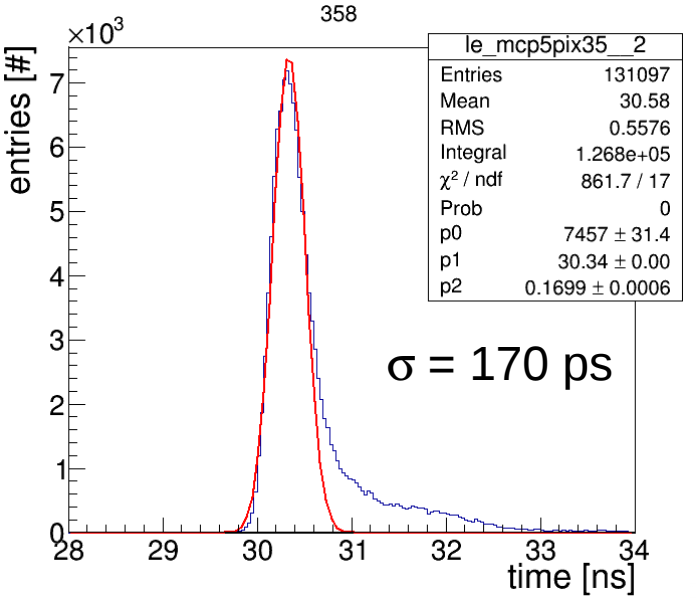
ch 358 before correction:



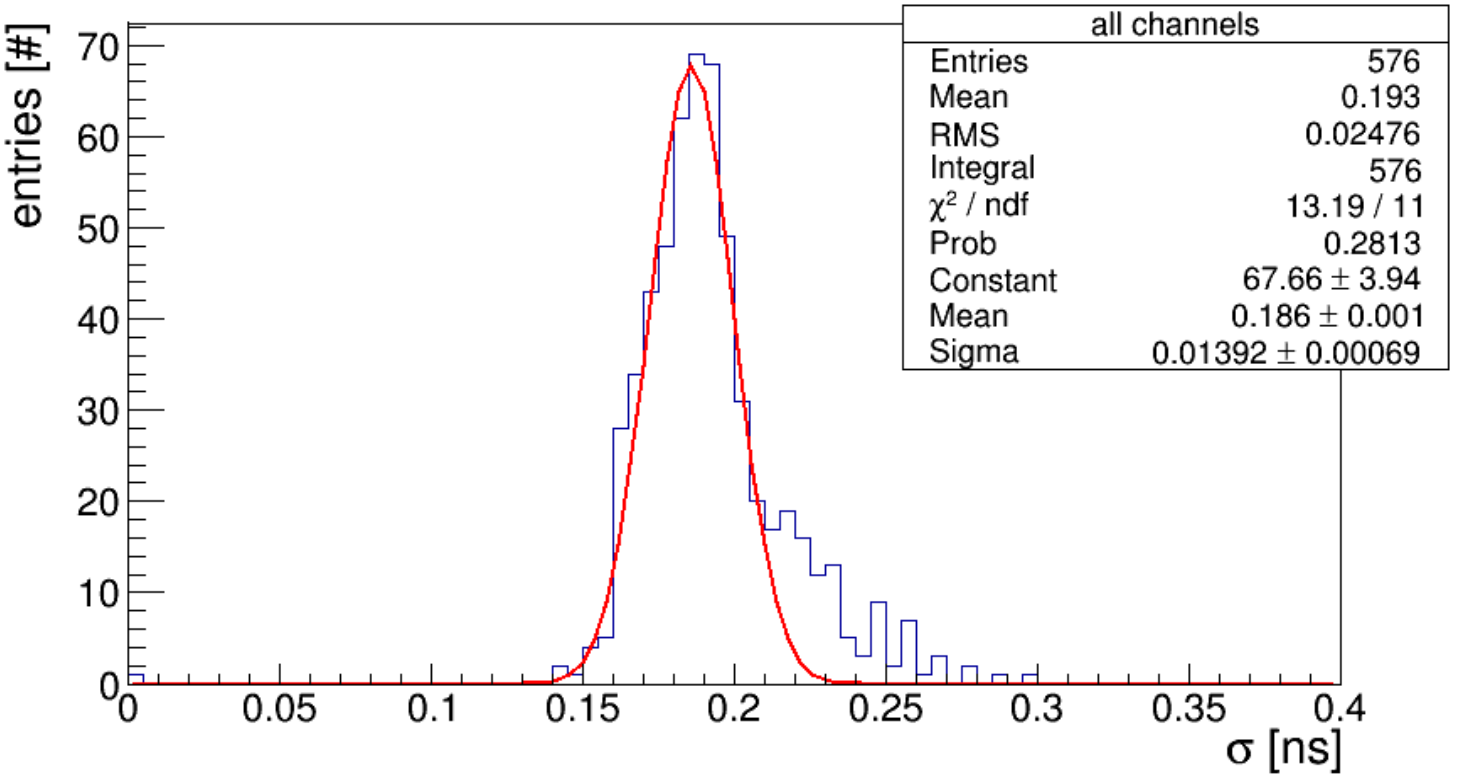


ch 358 after correction:



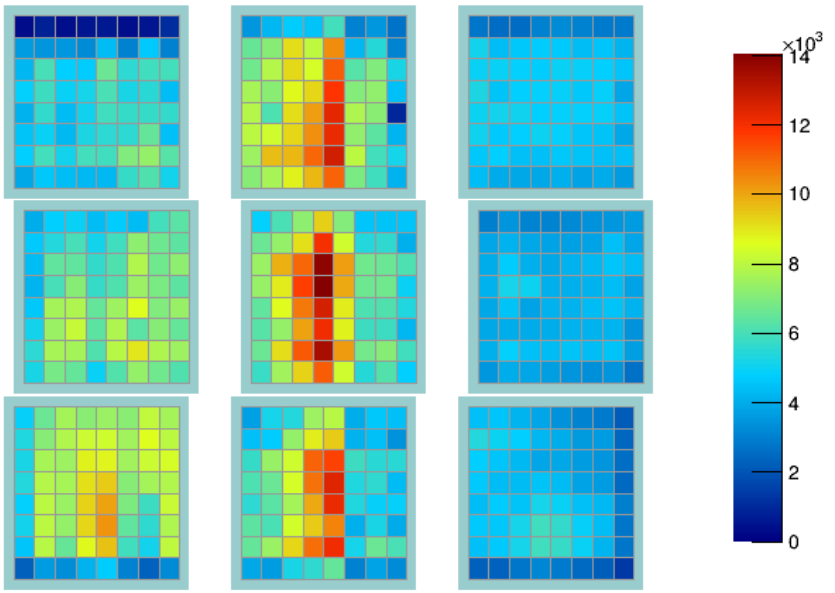


Time Resolution of the PILAS Runs



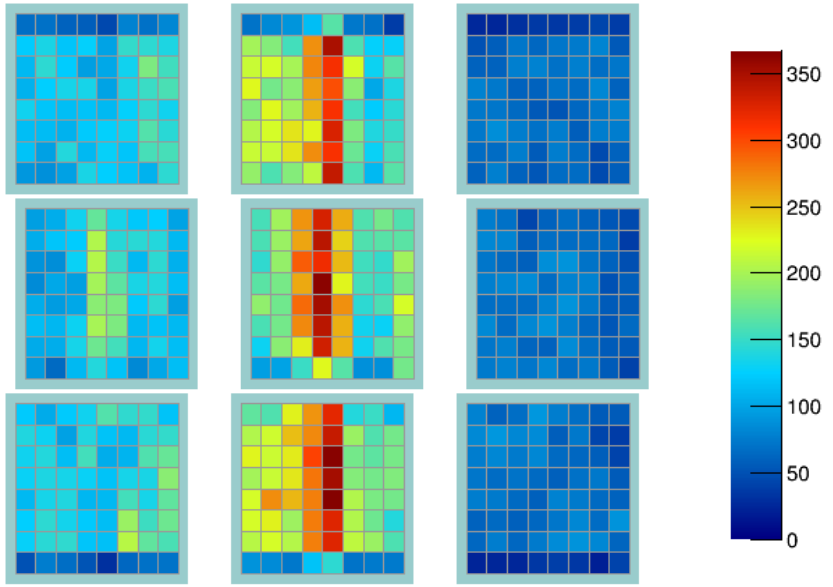
mean = 186 ps

Hit Patterns: Plate with Cyl. Lens



25 degree polar angle
7 GeV/c

Beam data for pion tag

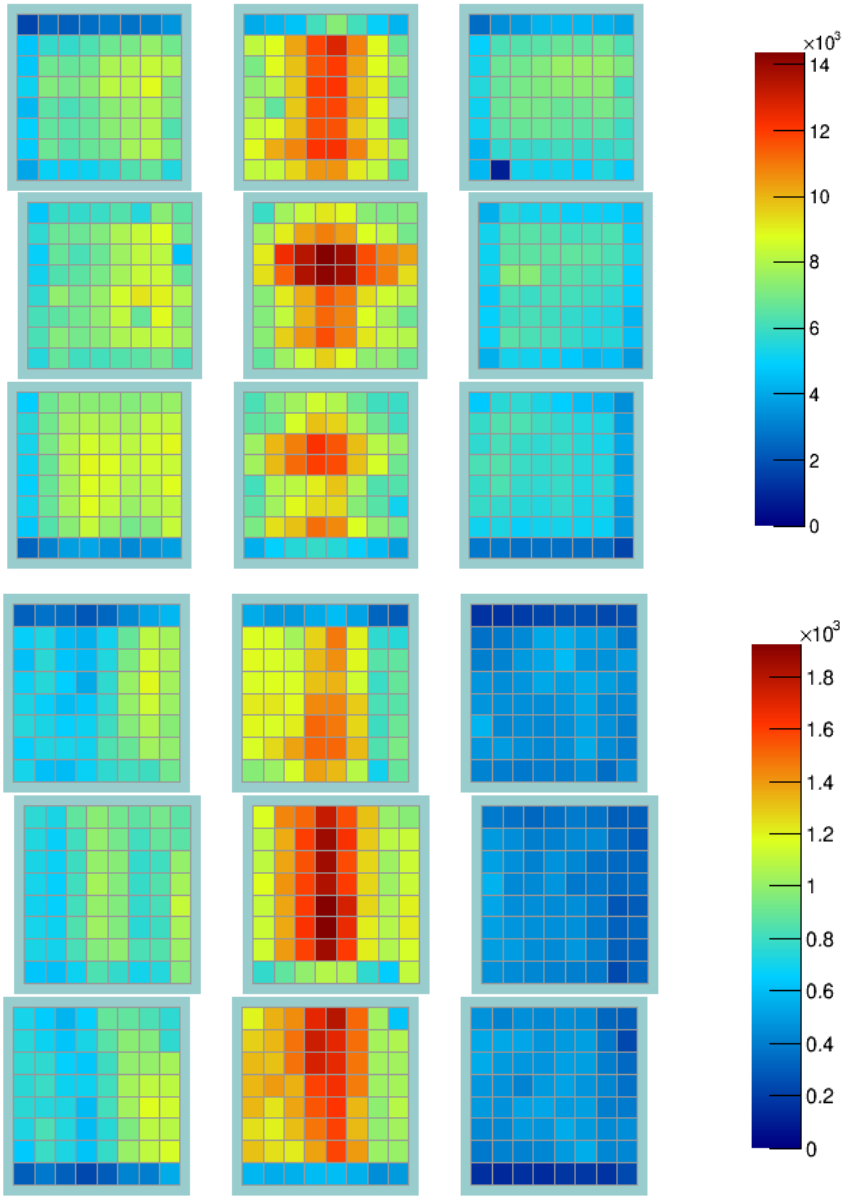


Simulation for pions

Standalone geant4 simulation includes:

- dead channels
- quantum/collection efficiency
- charge sharing
- 190 ps time resolution

Hit Patterns: Plate w/o Focusing

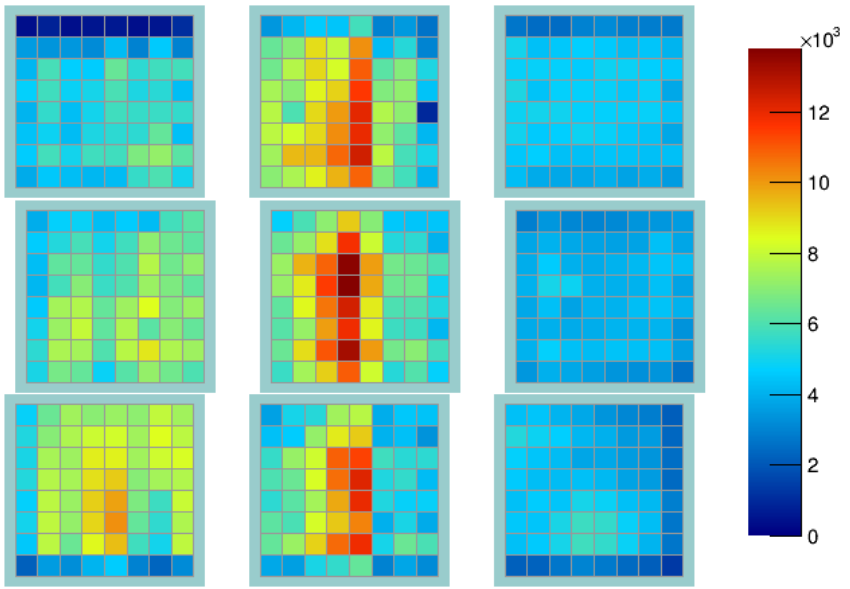


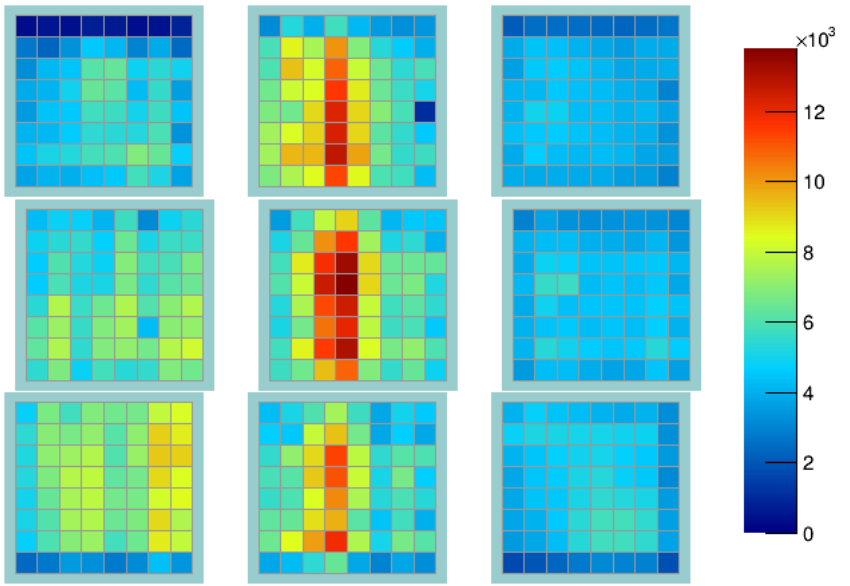
25 degree polar angle
7 GeV/c

Beam data for pion tag

Simulation for pions

Pions vs Protons



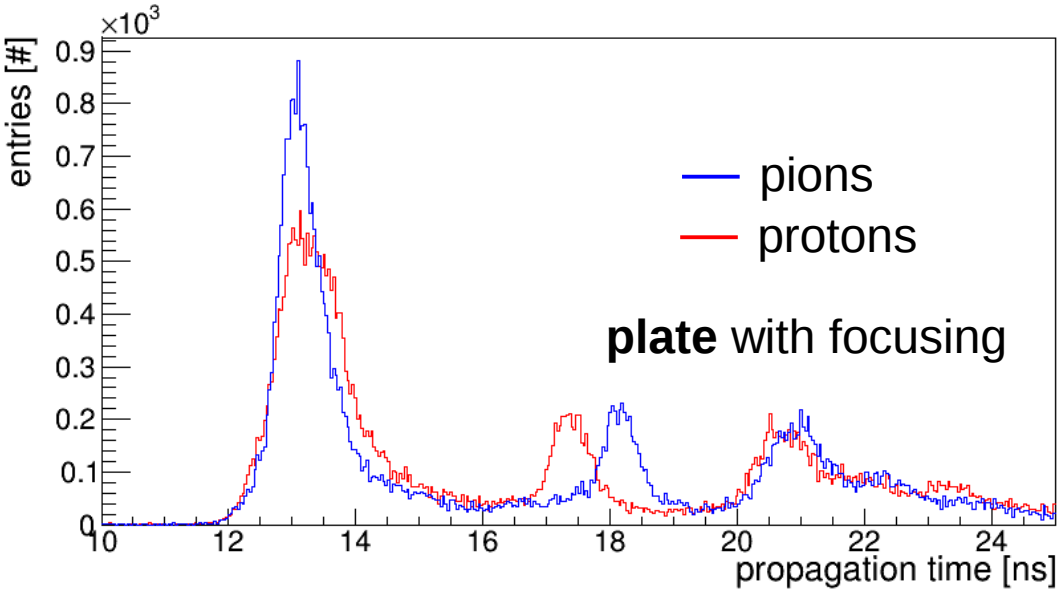


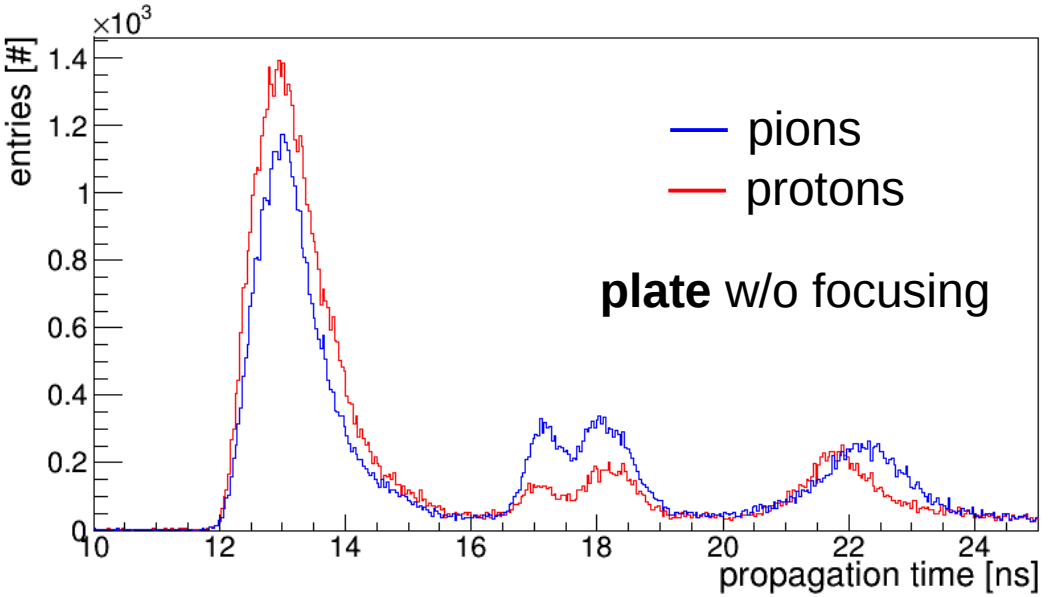
25 degree polar angle
7 GeV/c
plate with cylindrical lens

pions (beam data)

protons (beam data)

Propagation Time of the Cherenkov Ph.

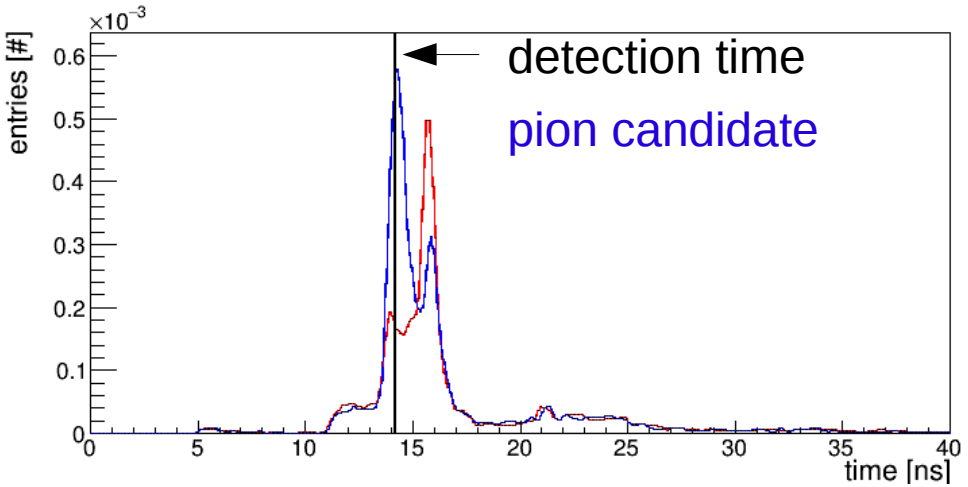


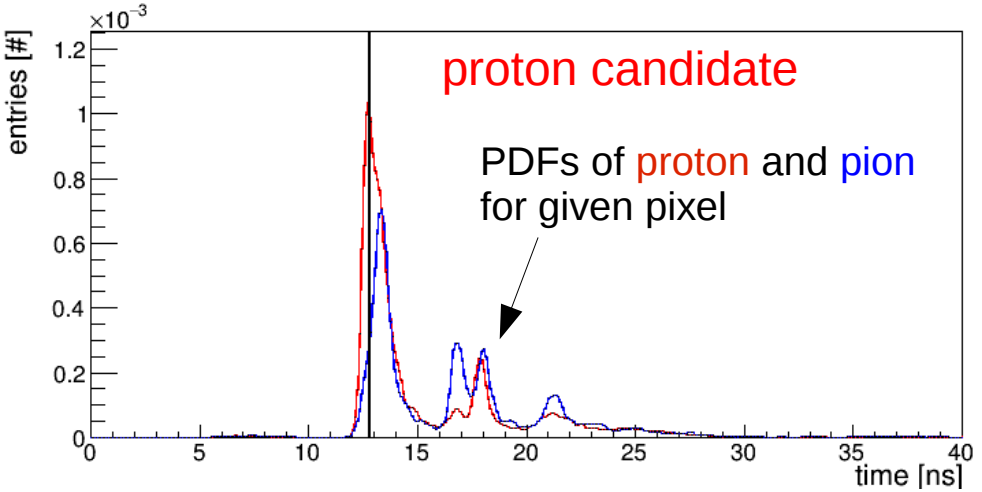


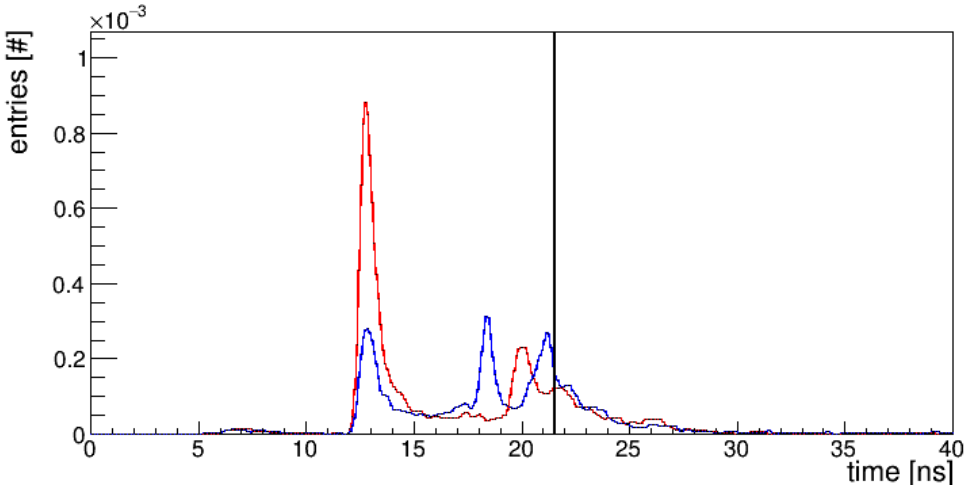
beam data
@ 7 GeV/c
@ 25 degree
ch 363

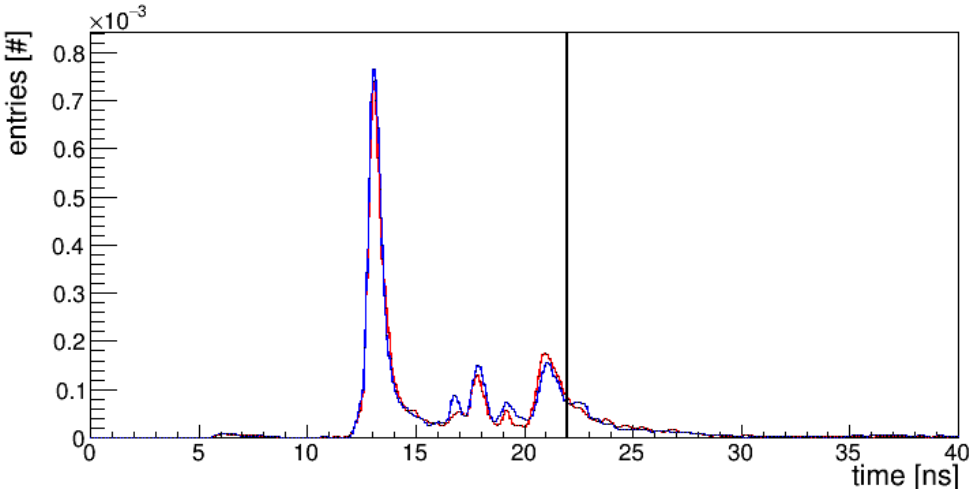
Time Imaging Reconstruction. PDFs

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





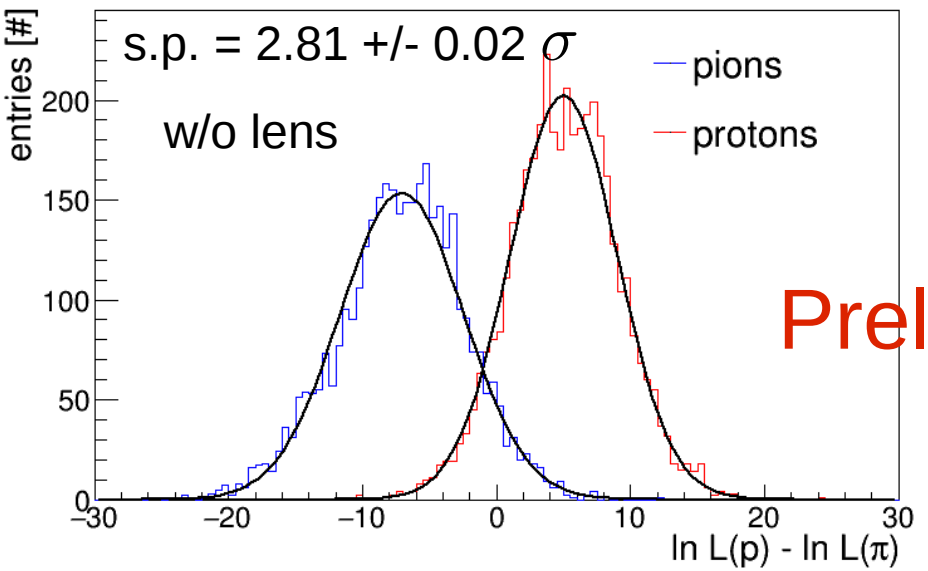


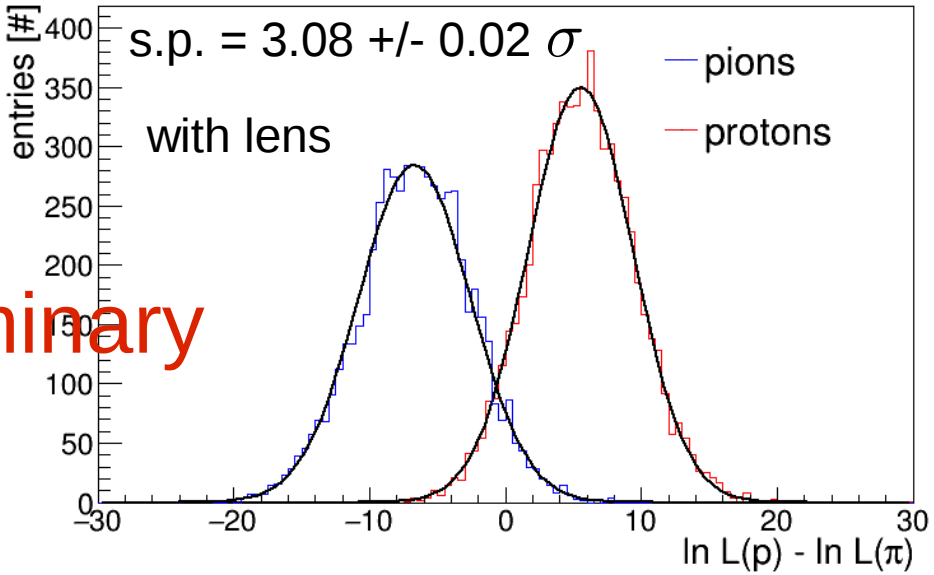


Time Imaging Reconstruction

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

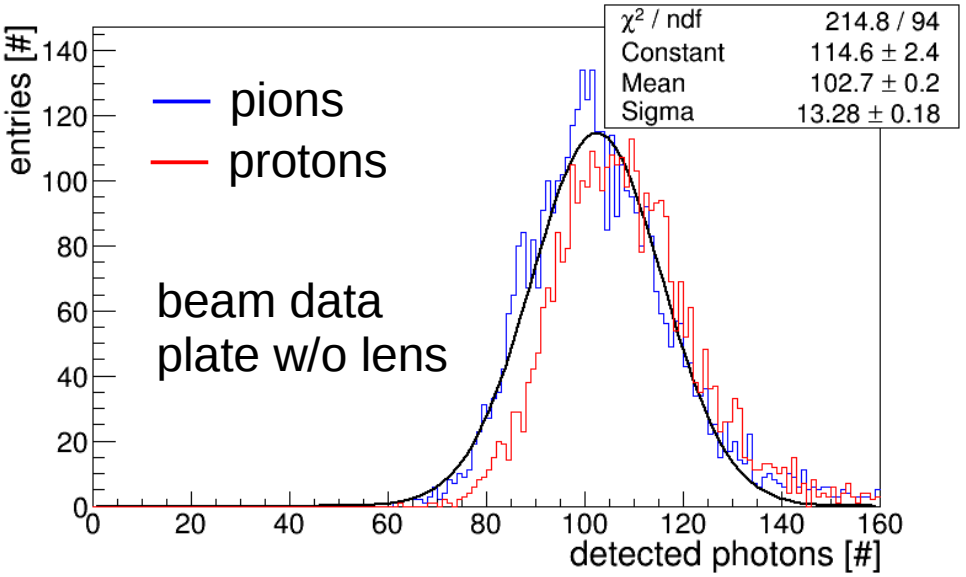
$$N_{\mathrm{sep}} = \frac{|\mu_1 - \mu_2|}{0.5(\sigma_1 + \sigma_2)}$$

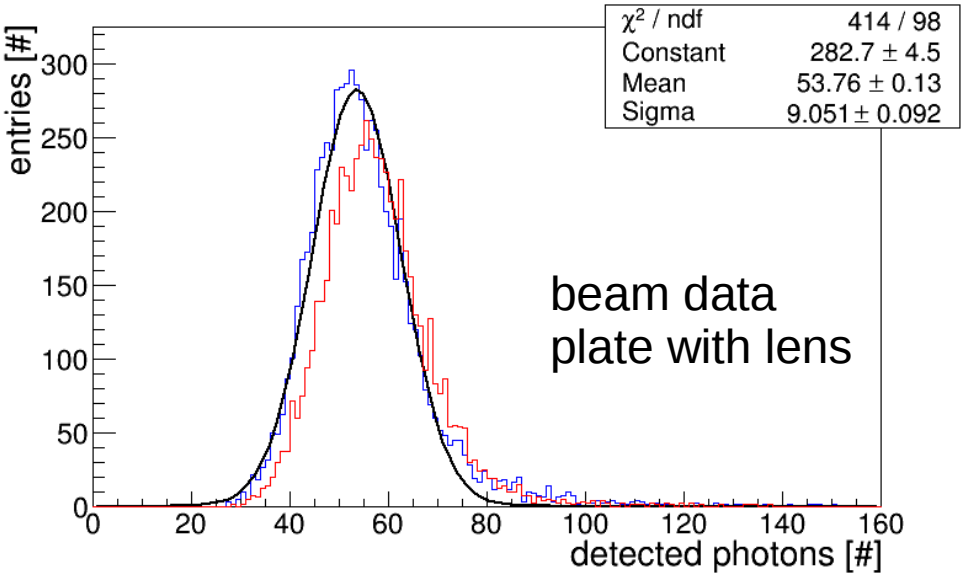


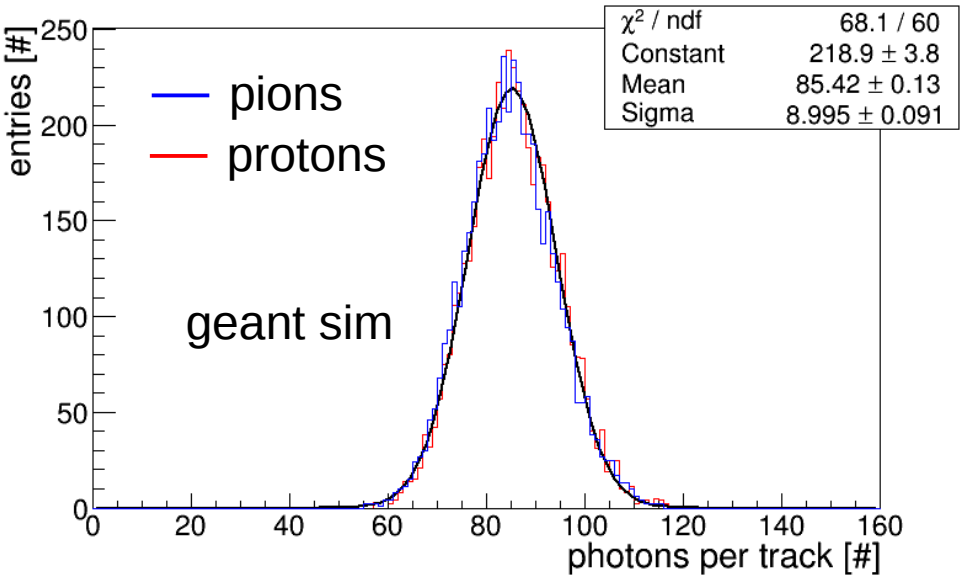


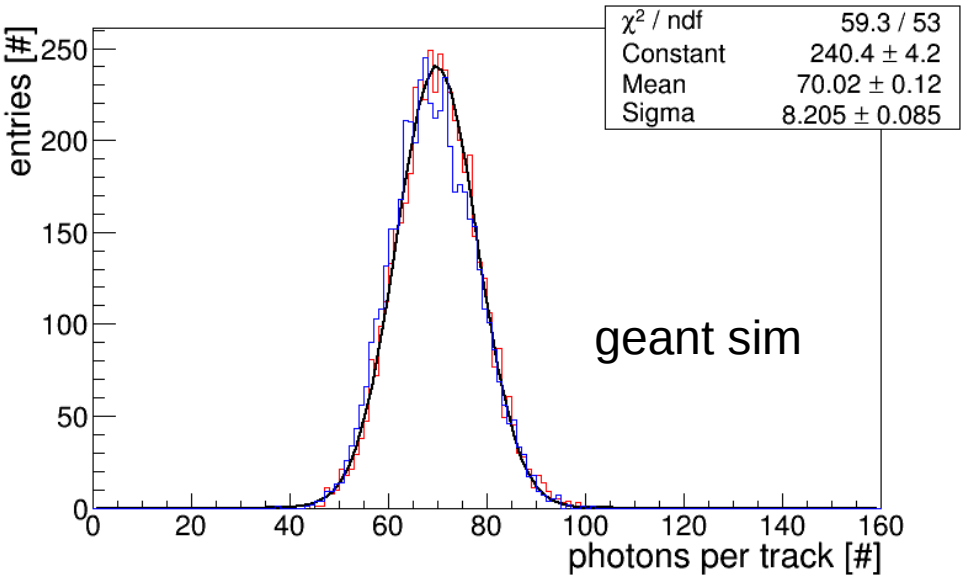
Preliminary

Detected Photon Yield



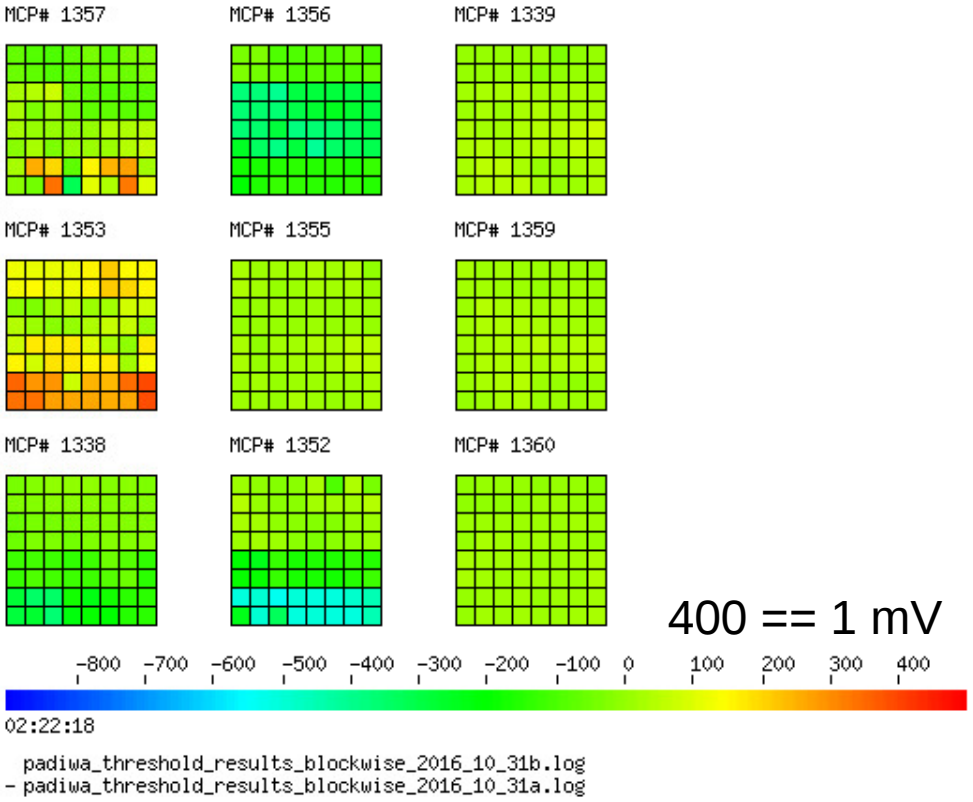


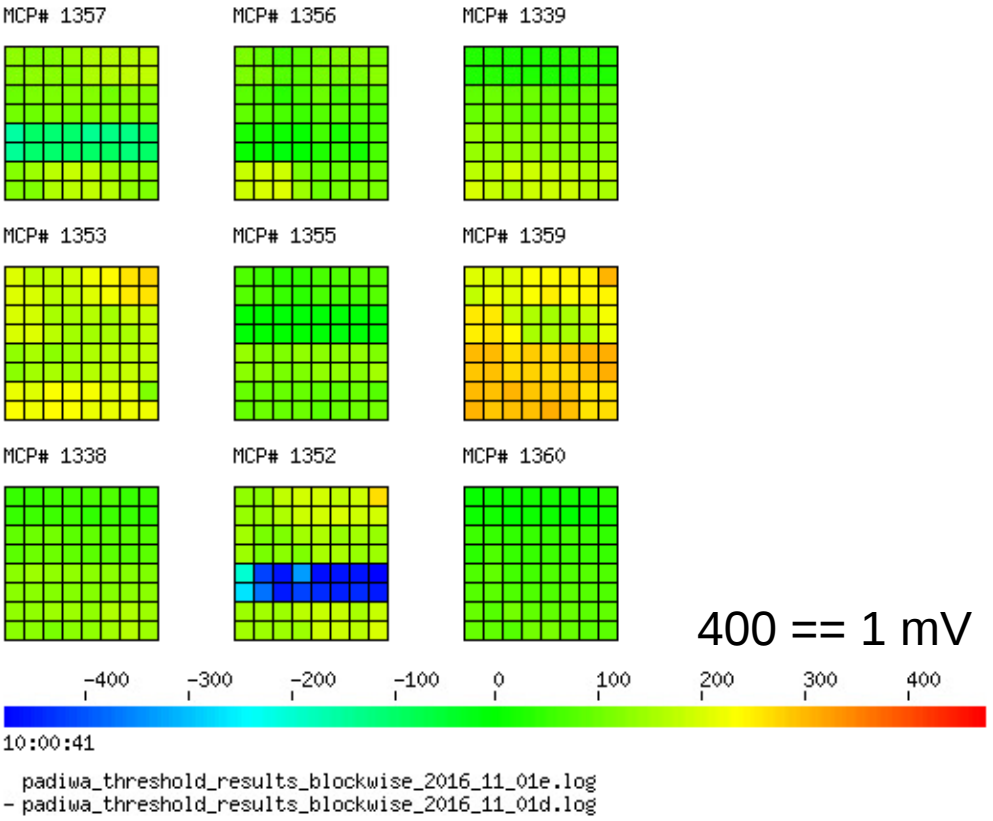




Threshold Floating

Threshold difference after few hours of data taking:





- floating in the range of [-1,+1] mV
- the data were taken with 1-2 mV offset to the threshold value due to low amplitude signals

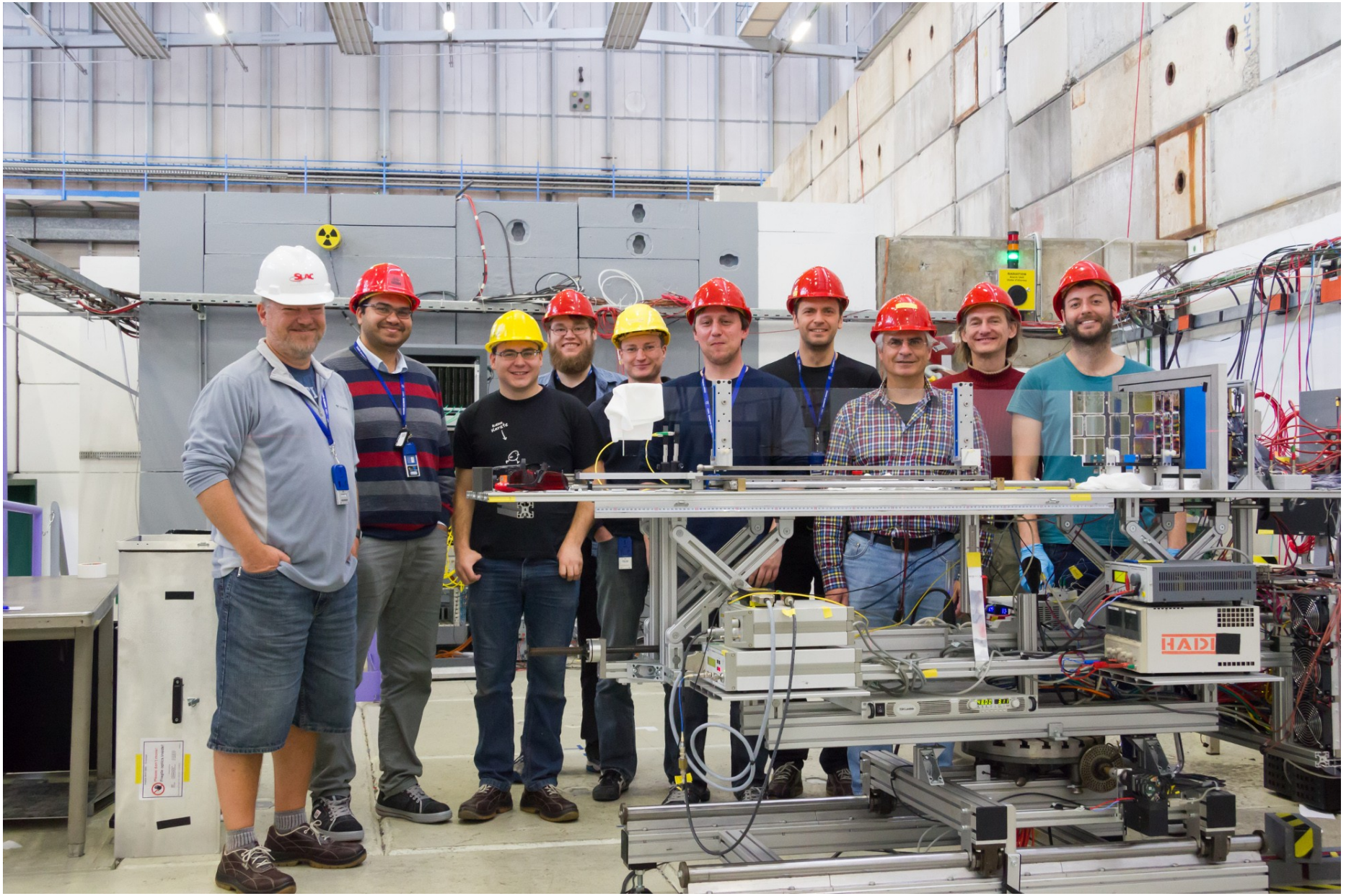
Significant impact on recorded hit multiplicity

Summary and Outlook

- Test beam was successful (recorded >0.5B triggers for different prototype config.)
- Achieved time resolution better than last year but still significantly worse than 100ps goal
- Preliminary analysis shows slightly improved pi/p separation compared to 2015
- The design with cylindrical lens performs better
- Detailed analysis needed to decide if plate meets PID goal for full phase space
- Floating thresholds and photon yield are under investigation

Next steps:

- Systematic data analysis for all configurations
- Write addendum to the DIRC TDR



Thank you for the attention