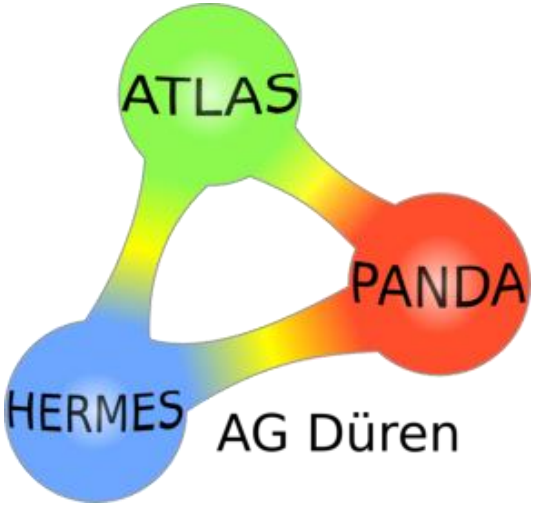
Results of the CERN Testbeam



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Justus Liebig Universität, Gießen

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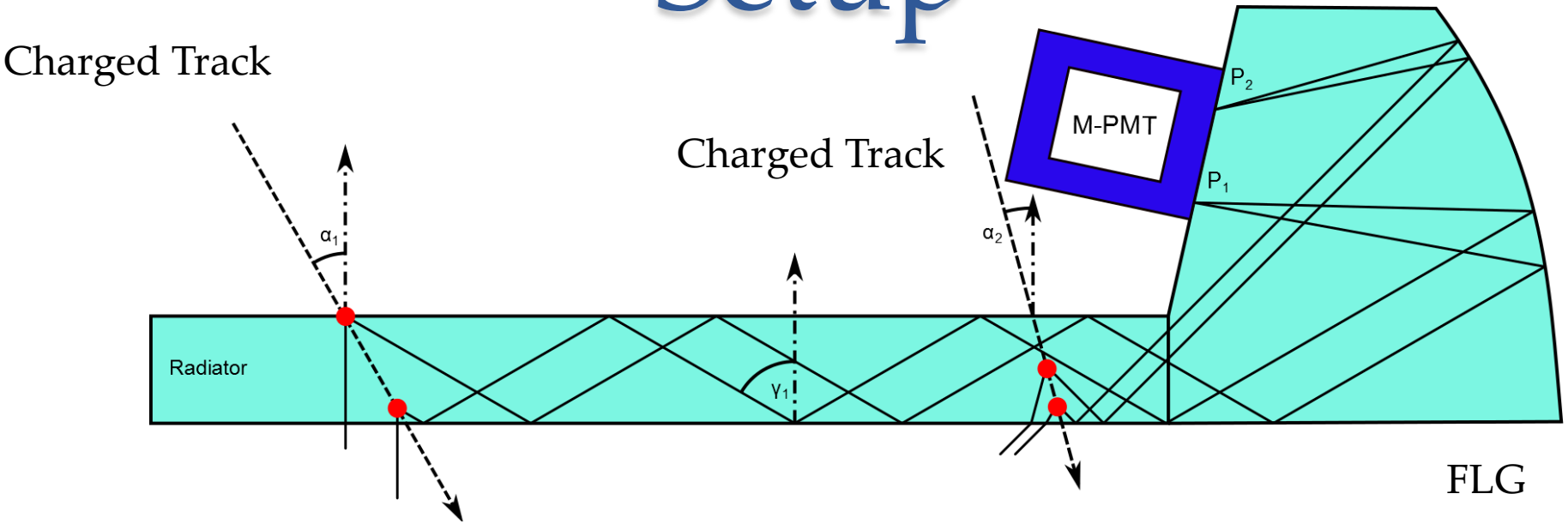
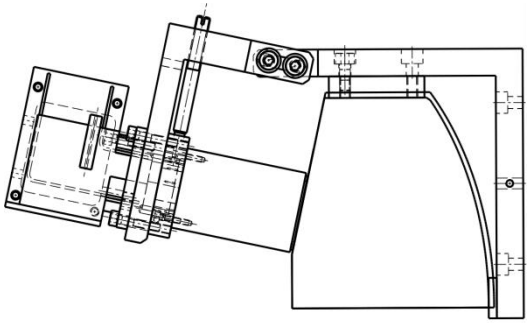
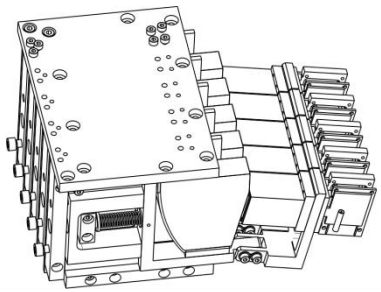
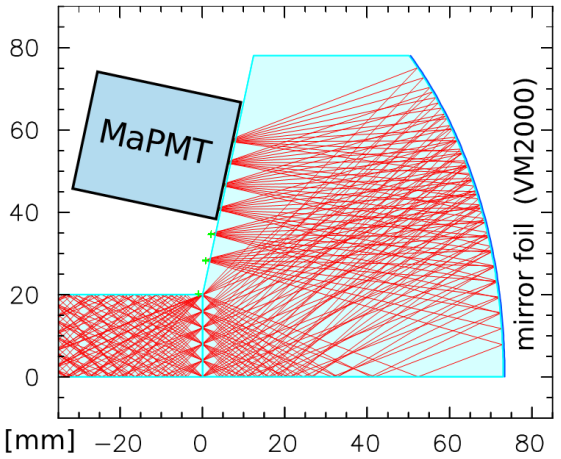
Setup







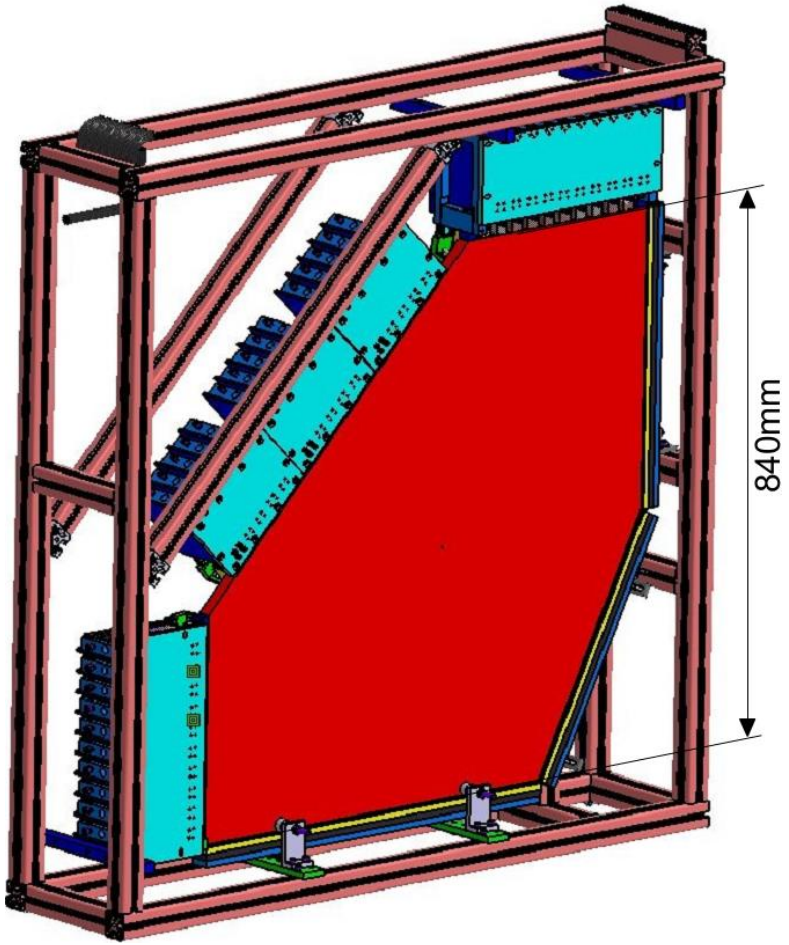


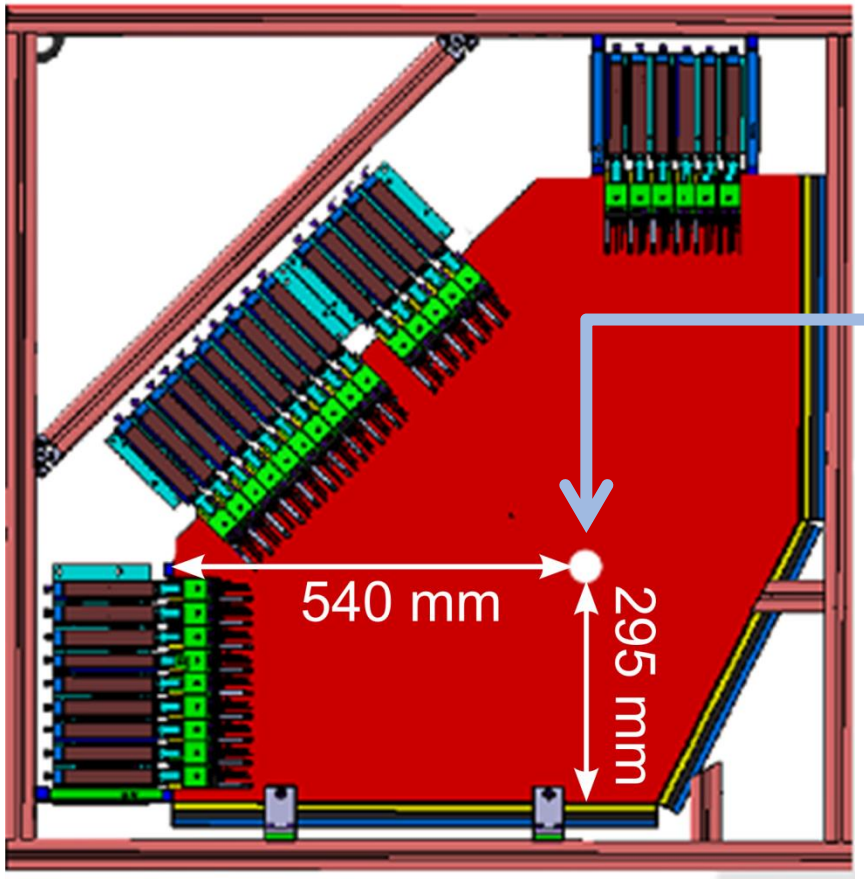
Acrylic Glas FLGs

Setup

30 Sensors with 16 Pixels each
Unfortunately 3 were broken
→ 432 active Pixels

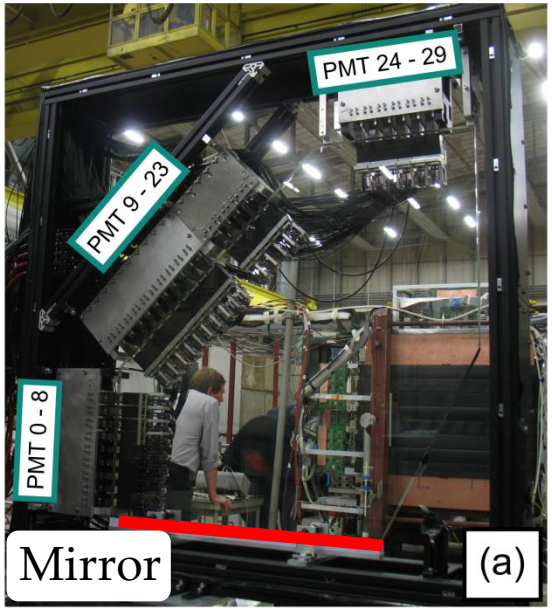
3.5 GeV/c Mixed Beam
Protons, Pions, Muons, Electrons

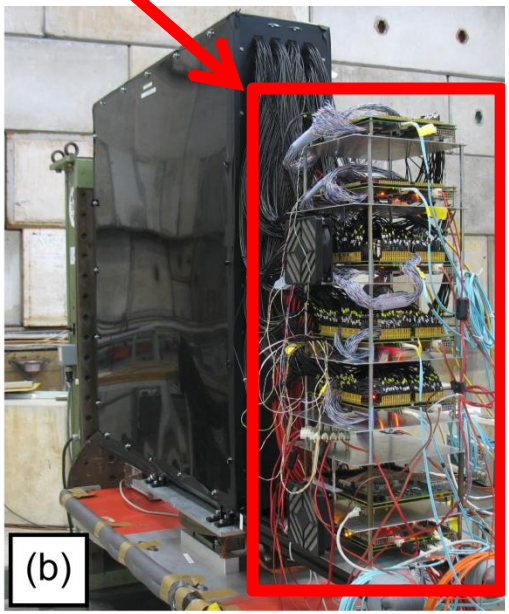


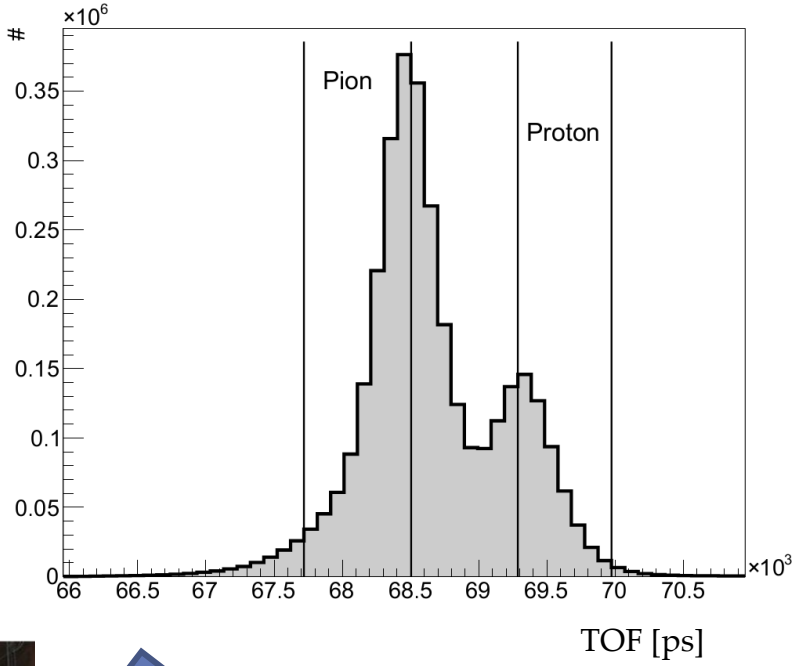


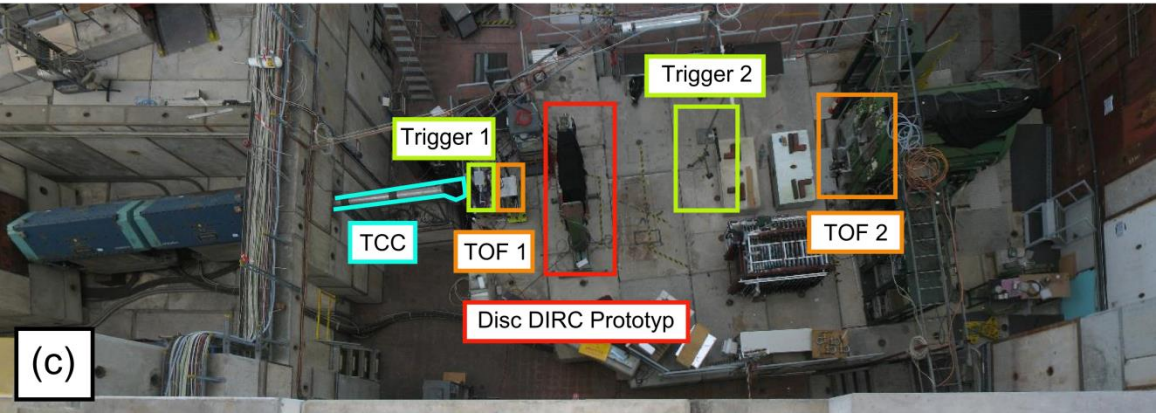
Setup

Tof-Addon-Boards and TRBv2 Boards were used for DAQ









Use TCC and TOF to Create Pion and Proton Sample

Sample Creation

5.307.265 Events originally recorded

TOF measurement available
&& Not more than 5 Hits per Sensor

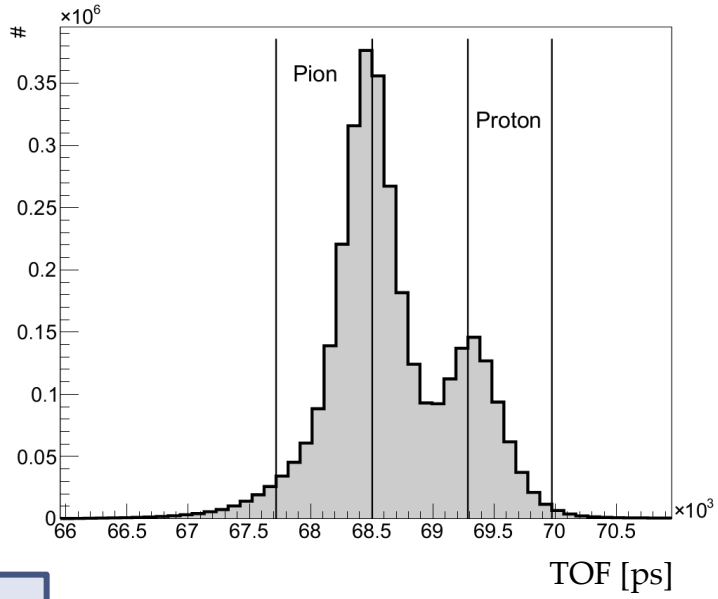
3.523.321 Events left

TOF → π
&& TCC on

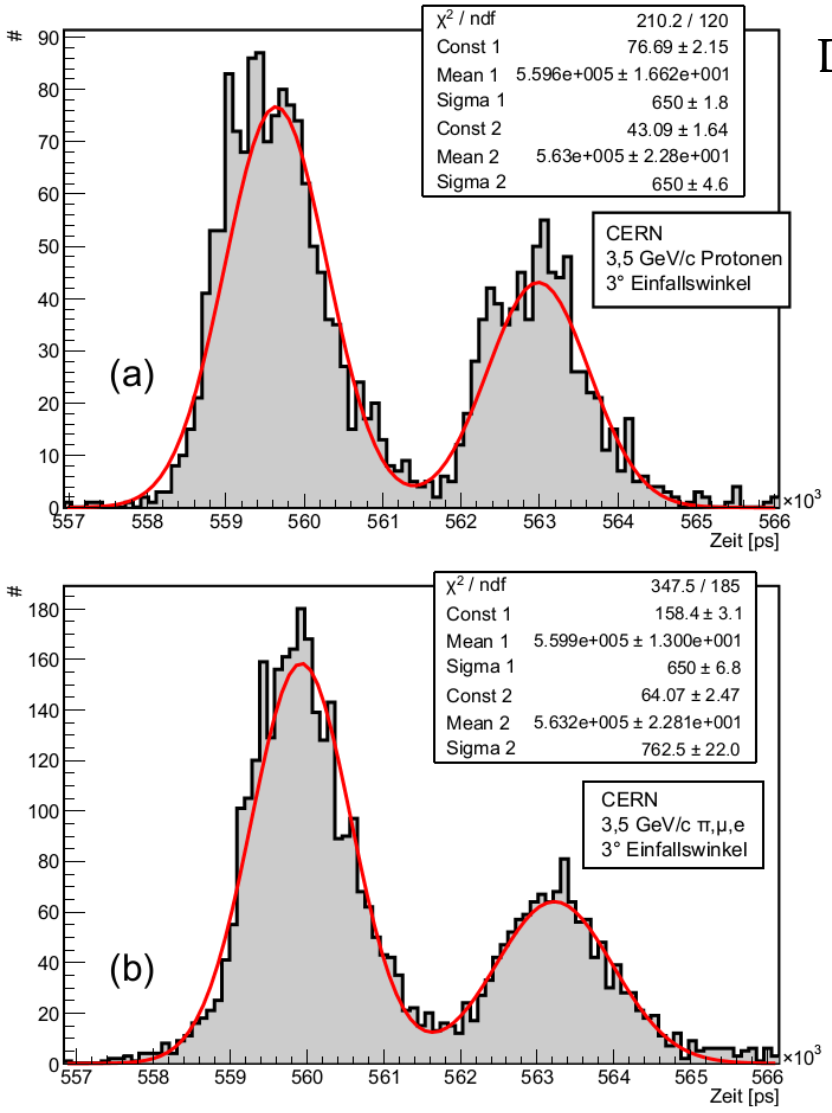
TOF → p
&& TCC off

1.093.368 Pion Events 403.828 Proton Events

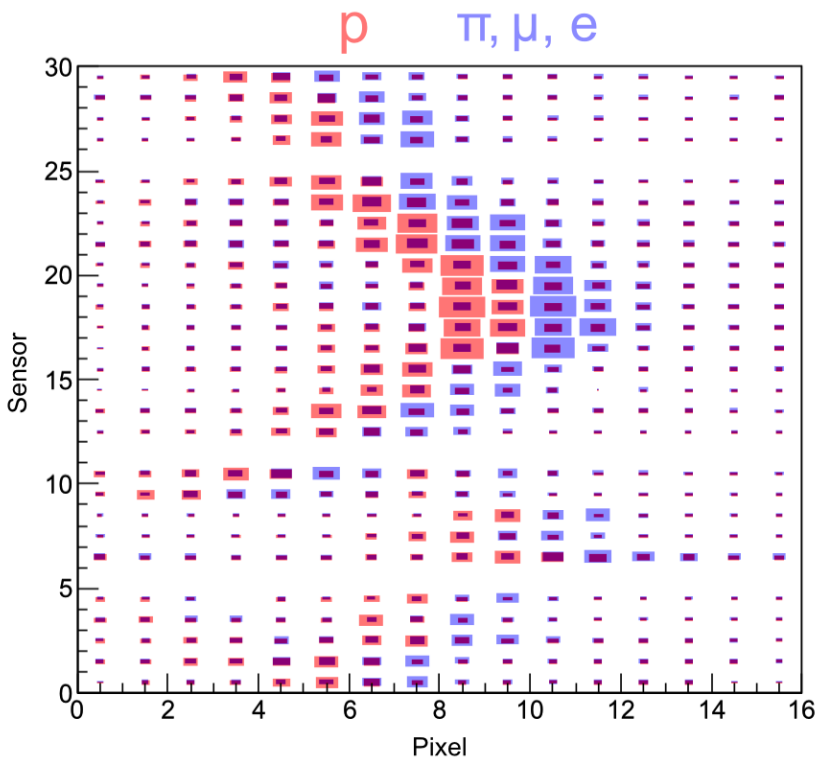
Basis of analysis



Calibration



Direct (stray) light and reflected light coming from the mirror



Pattern can be further decomposed into direct and reflected light using a time cut.

Calibration

The **first half** of each sample is used to calibrate the reconstruction algorithm (that is to say: obtain probabilities for photon detetections at certain spacetime points)

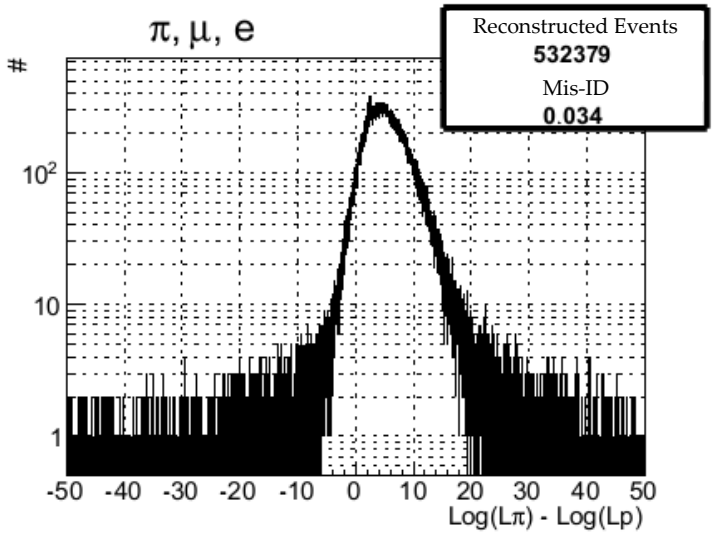
1. Accumulate times for each pixel
2. Fit the spectrum with a *Double Gaussing Function*
3. Save the fit parameters and the best fit function for all 480 pixels
4. Every time bin can be hit only once per event:
   → the probability that a time bin in a pixel is hit by a photon can be obtained from the fit function scaled down by the number of events contributing to the spectrum
5. Given the PID the probability for a hit at a certain spacetime point is known

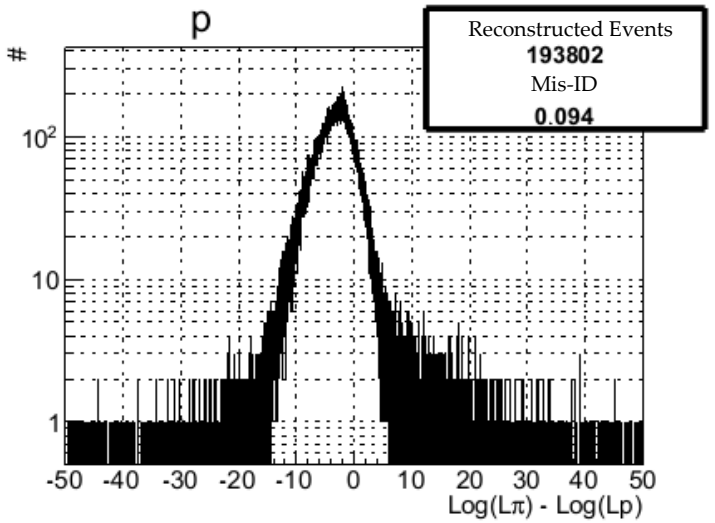
Reconstruction

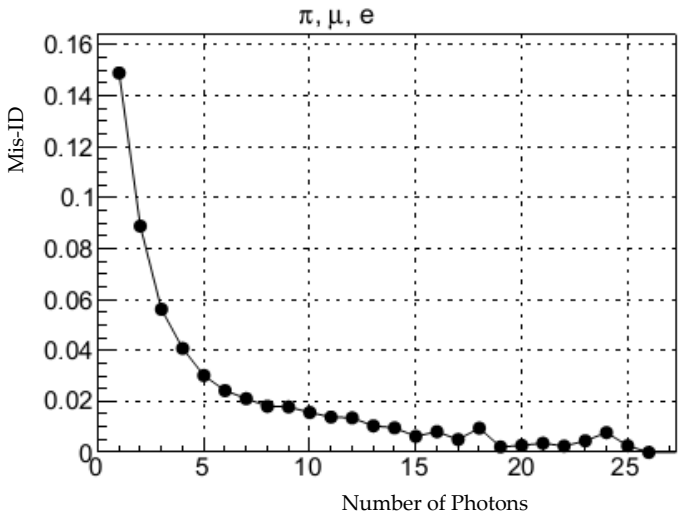
The **second half** of each sample is used for a *Likelihood-Ratio-Reconstruction*

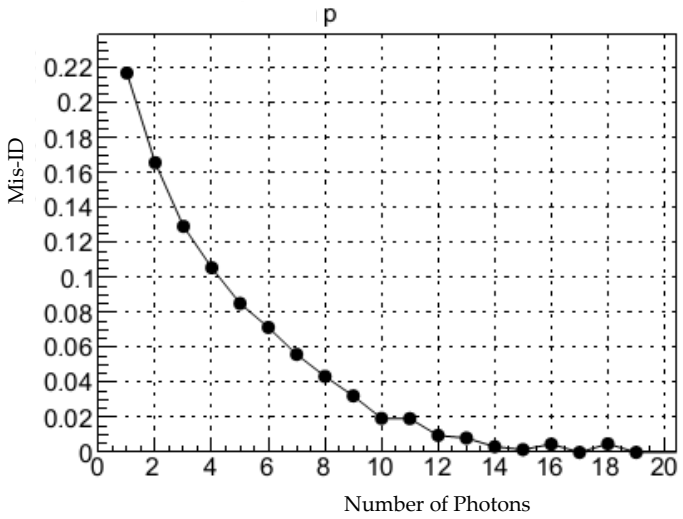
1. Events are reconstruced only if at least one hit in the event has a minimum Likelihood within at least one PID-hypothesis. → Noise rejection
2. Proton: 193.802 out of 201.914 reconstructed (96%)
3. Pion: 532.379 out of 546.684 reconstructed (97%)

Reconstruction







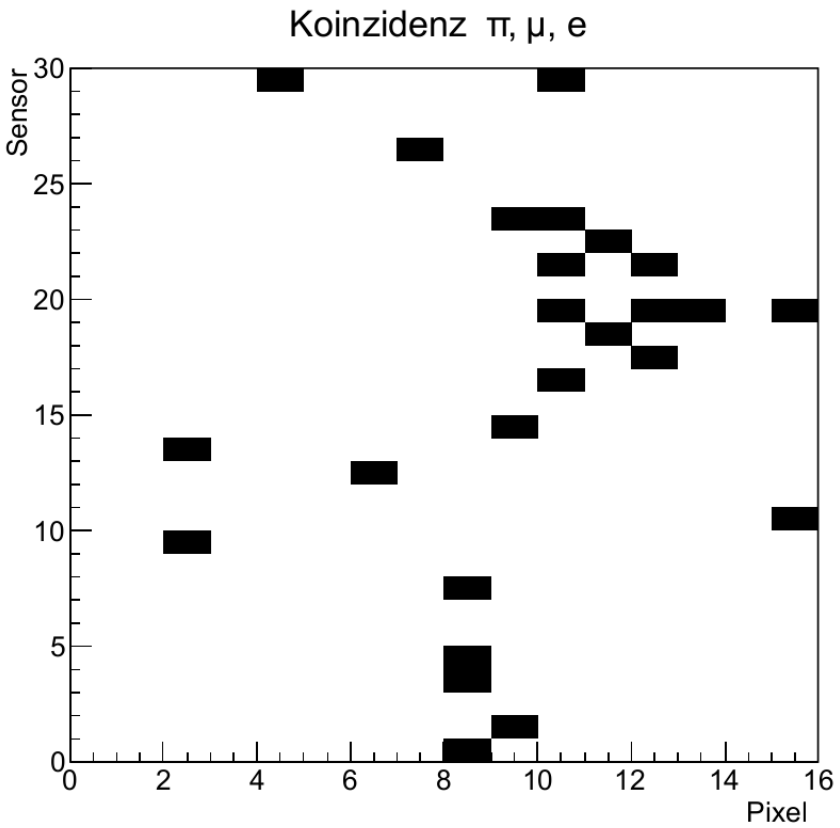


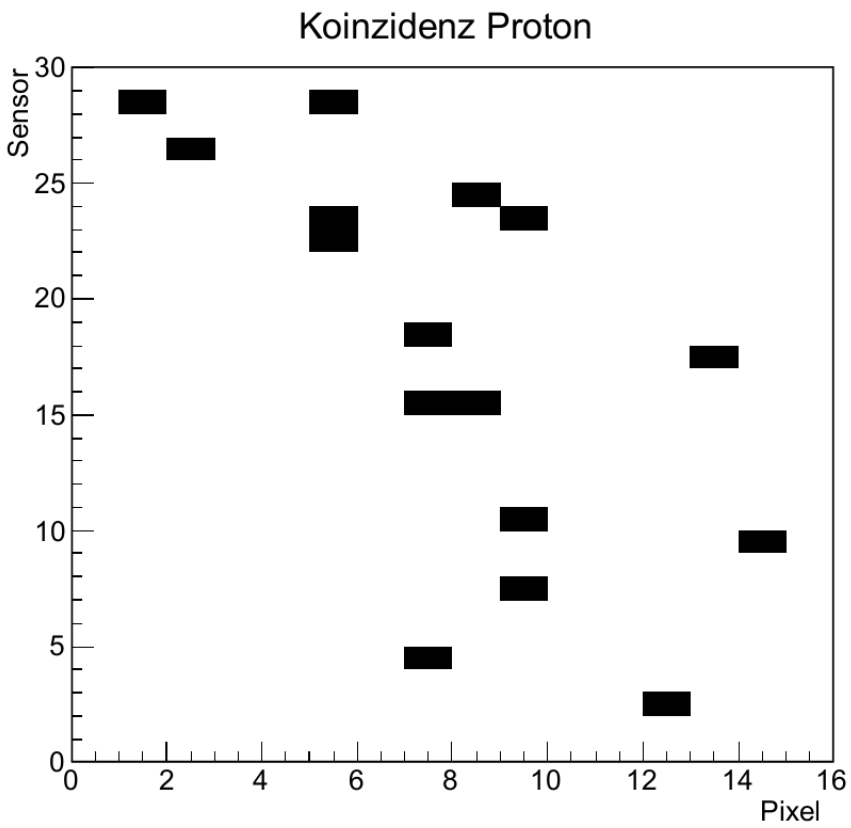
Summary & Outlook

- PID done with both space and time information used for reconstruction for the very first time.

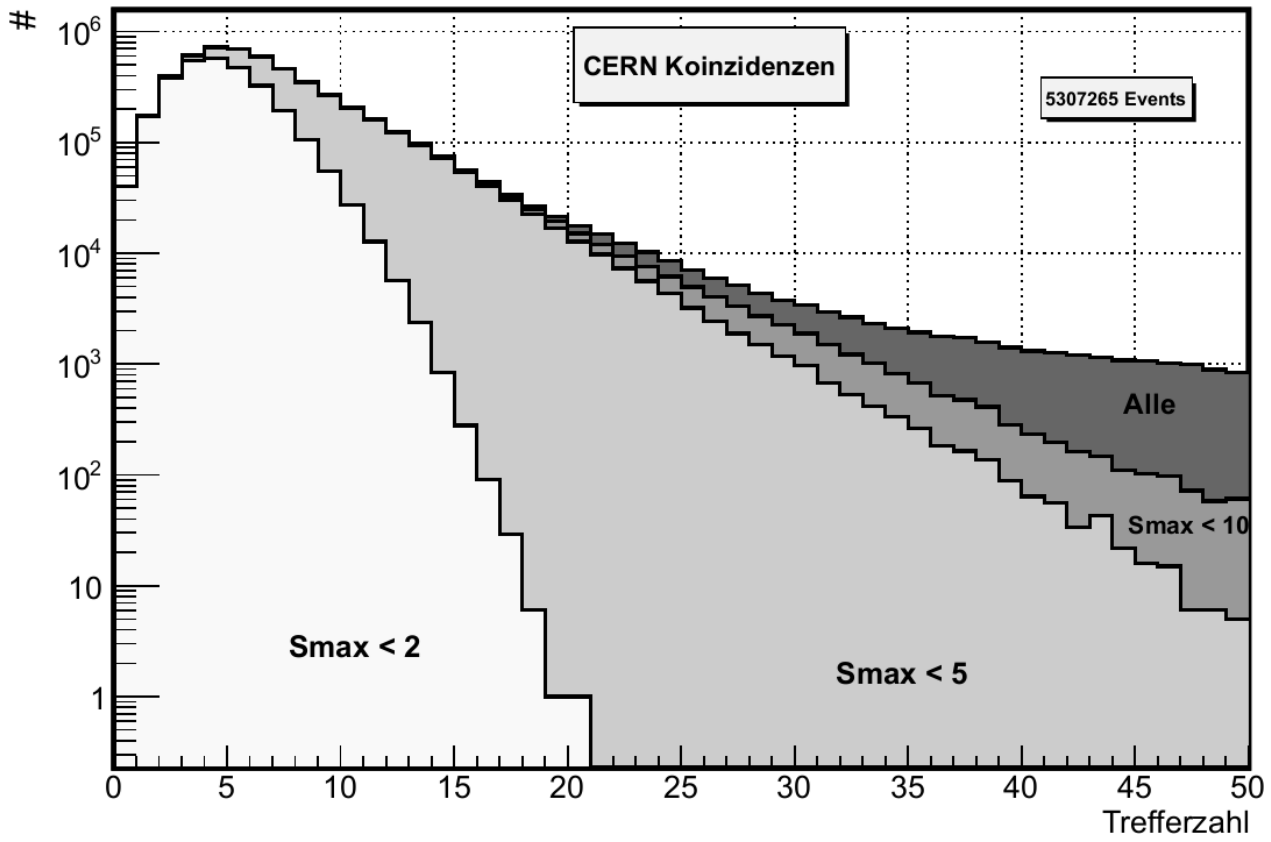
- Increase performance of front-end-electronic (TRBv3)
  - (current boards estimated to waste a factor of 4 in light yield)
- Build optics from fused silica
- Understand all details of light yield

Backup

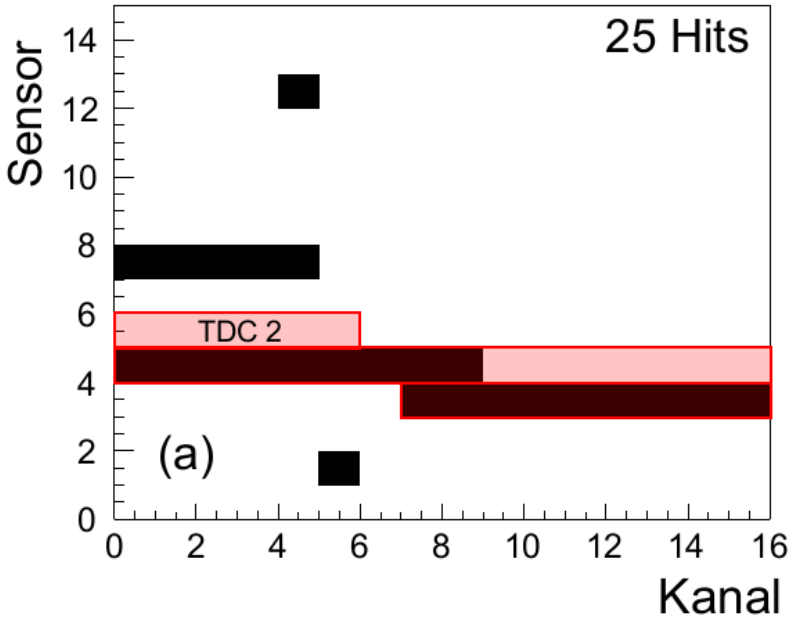

Koinzidenz π, μ, e
Sensor
Pixel
0
5
10
15
20
25
30
0
2
4
6
8
10
12
14
16

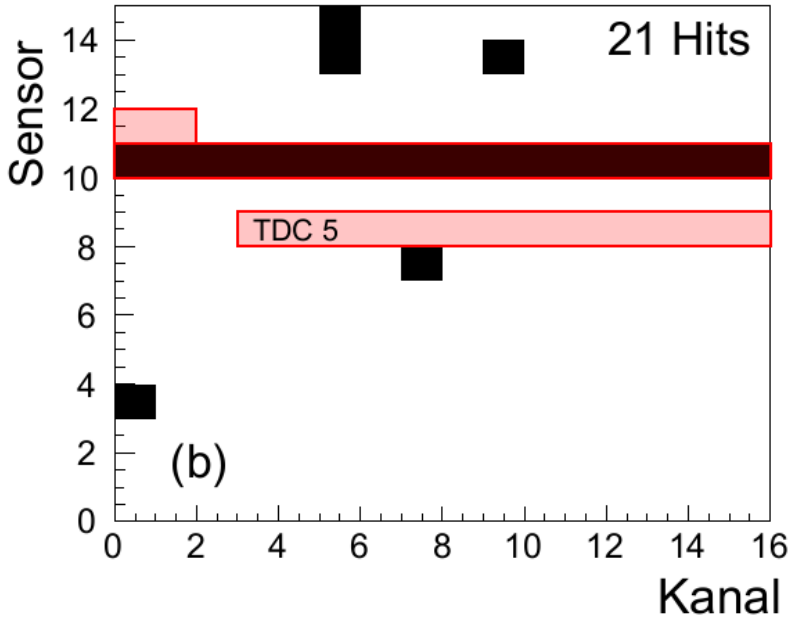

Koinzidenz Proton
Sensor
Pixel
0
5
10
15
20
25
30
0
2
4
6
8
10
12
14
16

Backup


CERN Koinzidenzen
5307265 Events
Alle
Smax < 10
Smax < 5
Smax < 2
#
10^6
10^5
10^4
10^3
10^2
10
1
0
5
10
15
20
25
30
35
40
45
50
Trefferzahl

Backup


25 Hits
TDC 2
(a)
Sensor
Kanal
0
2
4
6
8
10
12
14
16


21 Hits
TDC 5
(b)
Sensor
Kanal
0
2
4
6
8
10
12
14
16