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First beam test results for the flash ADC- readout

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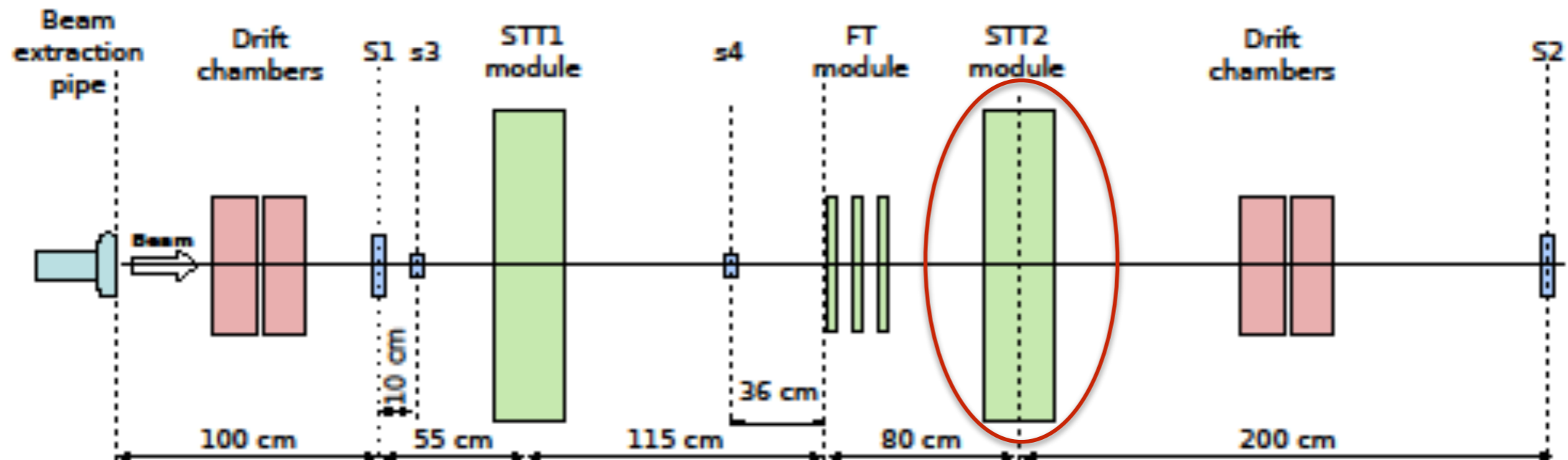
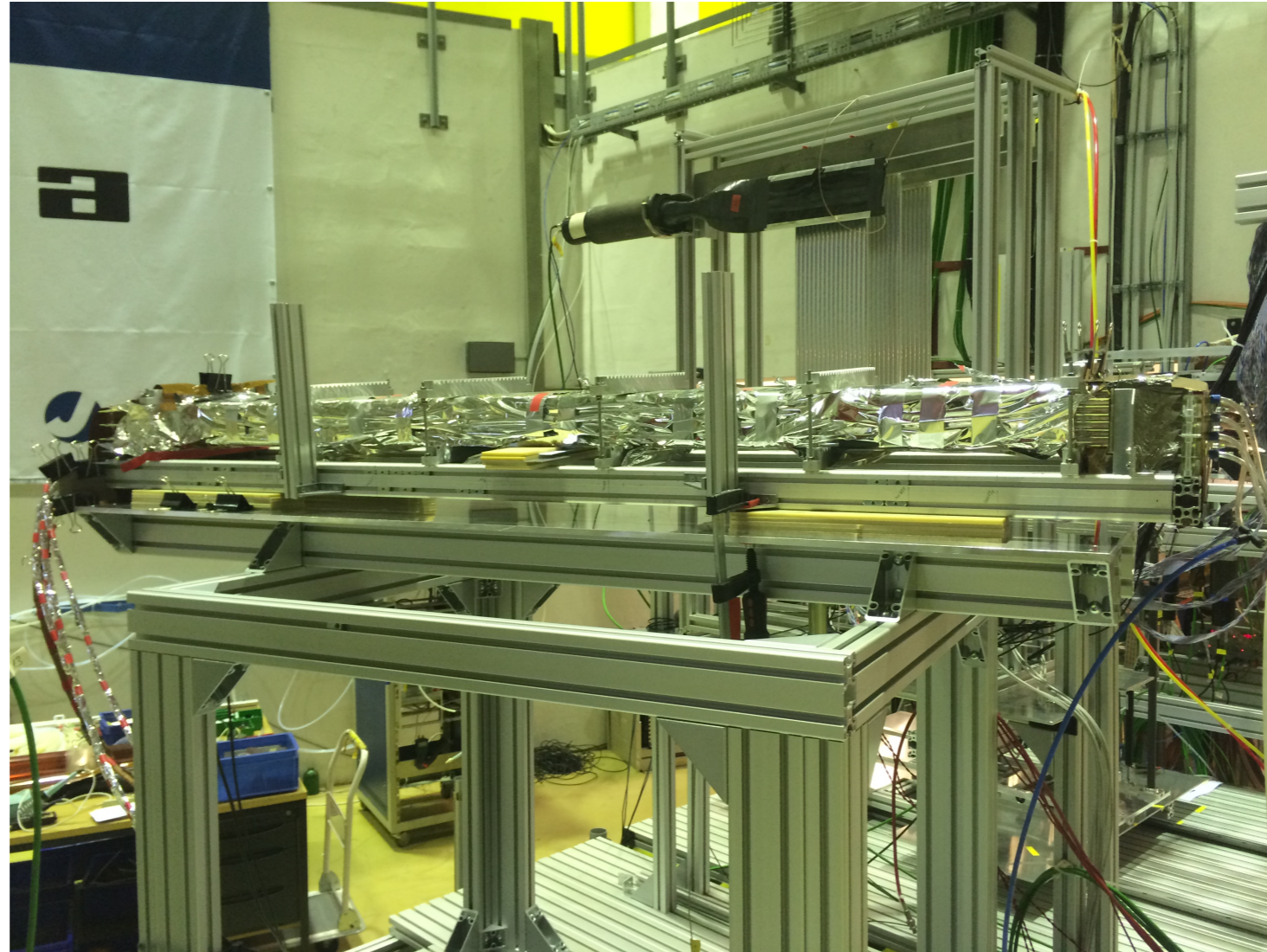
Outlines

- Beam Time setup April 2016
- Preliminary results of spatial and energy resolution
- Summary and outlook

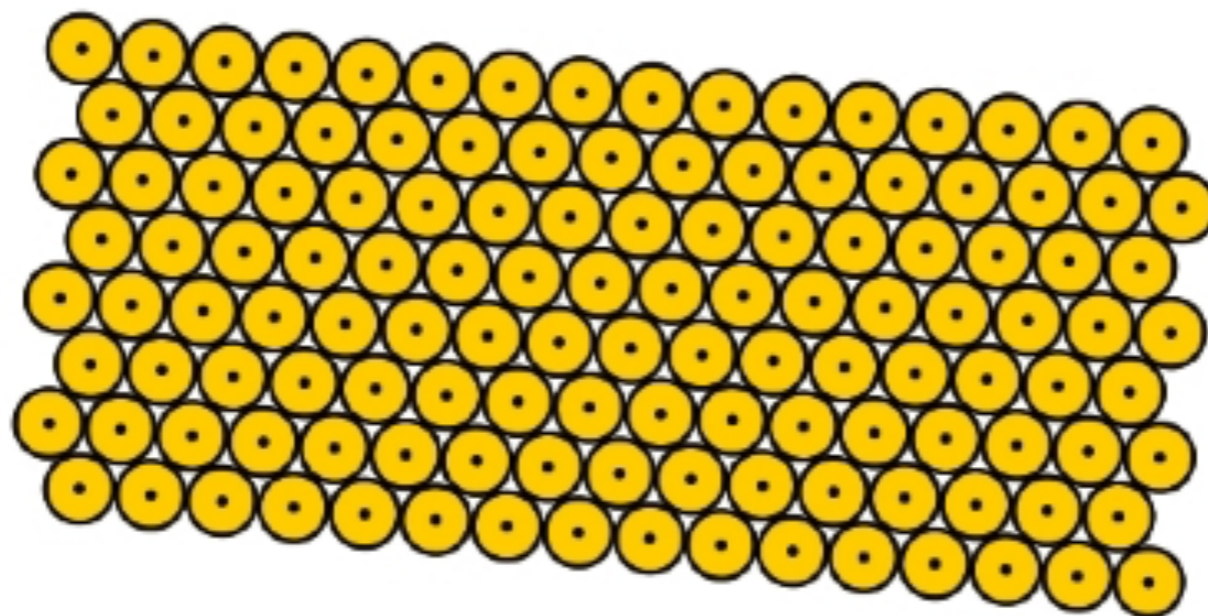


STT beam test in April 2016

- For the first time in **COSY-TOF** area , almost 10 days beam with time 3 prototype detectors
 1. STT with flash ADC read out
 2. STT with ASIC read out
 3. Forward tracker with ASIC readout
- Proton beam with 4 different momenta (0.55 GeV/c, 0.75 GeV/c, 1.00 GeV/c and 2.95 GeV/c)
- Different high voltages (1750V, 1800V & 1850V)




Proton beam



0.55 GeV/c
0.75 GeV/c
1.00 GeV/c
2.95 GeV/c

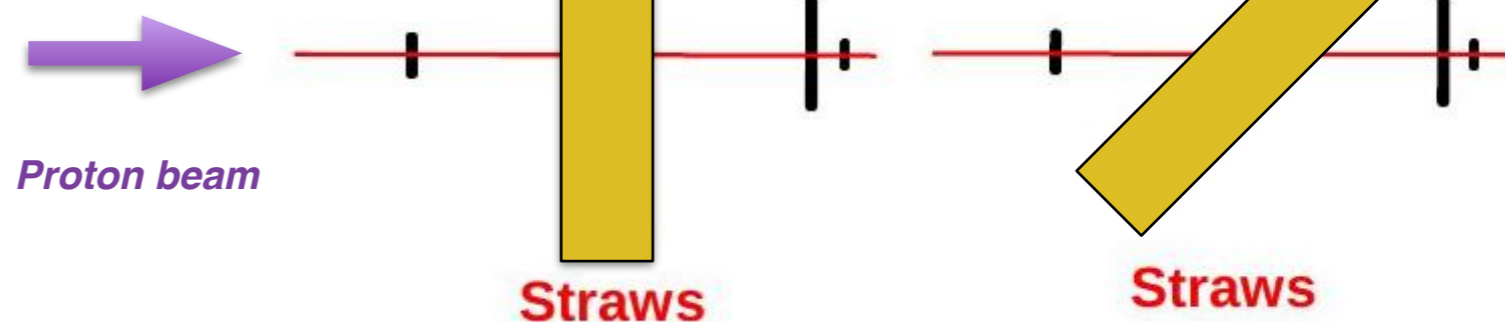
 Readout with TIA04 preamplifier

12 m
coax
Cable
Signal/HV
MK7501
75 Ω

Various beam
intensities



Different Proton impinging angle:
90deg, 23deg, 18deg

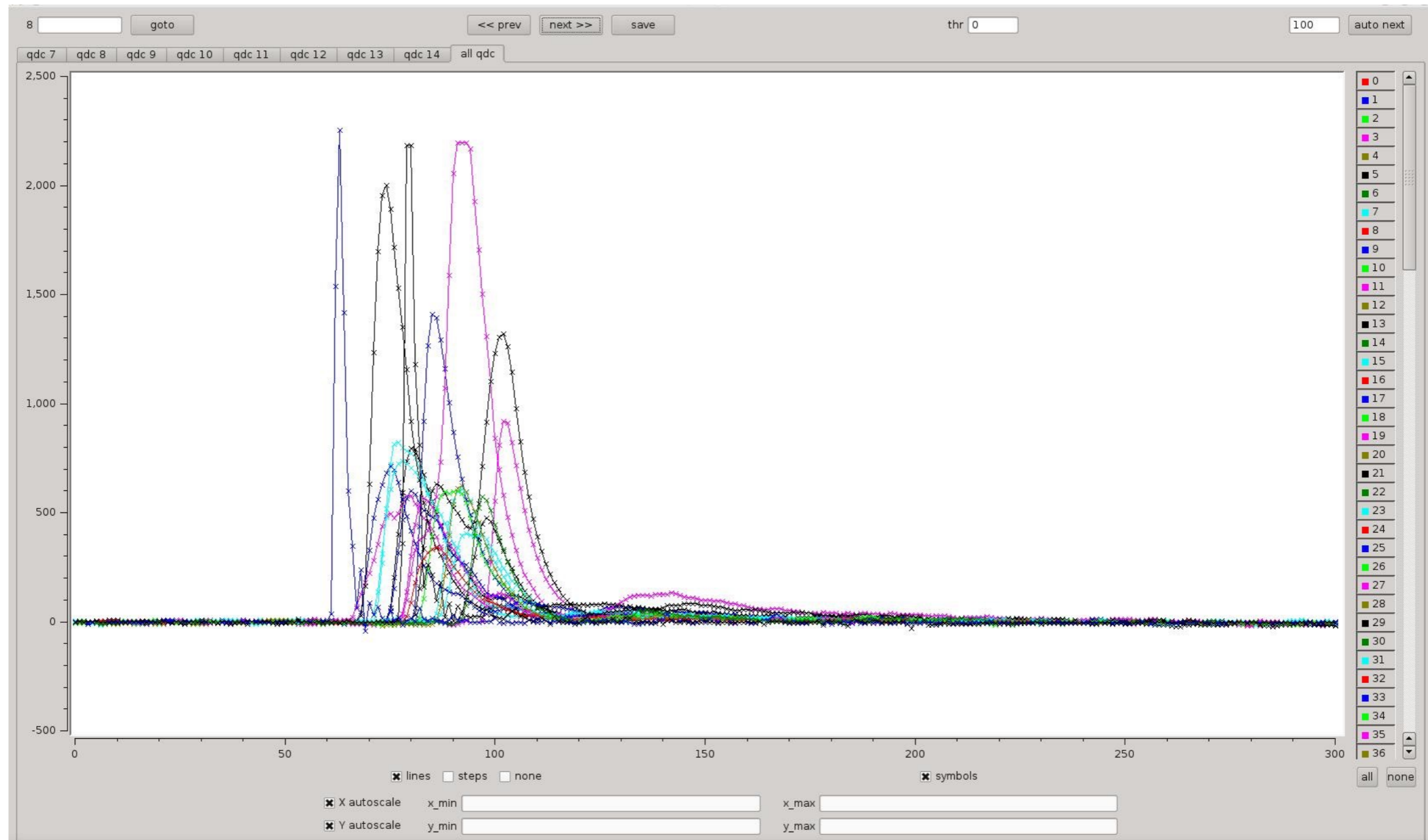




Analysis Method

1. Tracking

- Signal selection
- Drift time spectra
- Calculation of radius-drift time (calibration curve)
- Geometrical track reconstruction

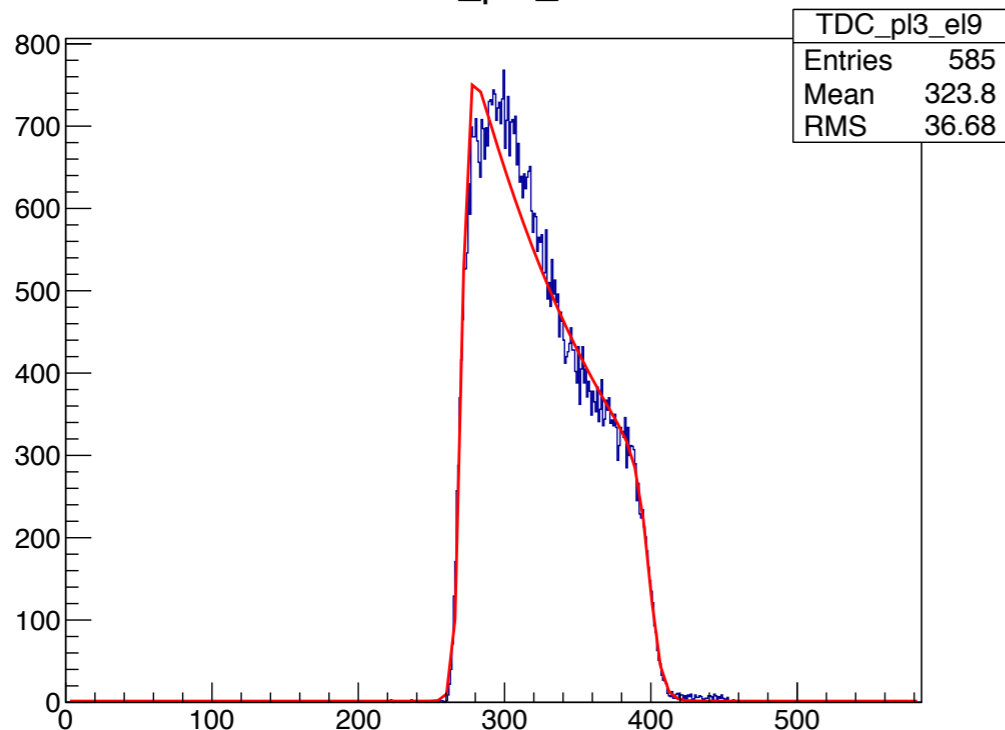


1. Tracking

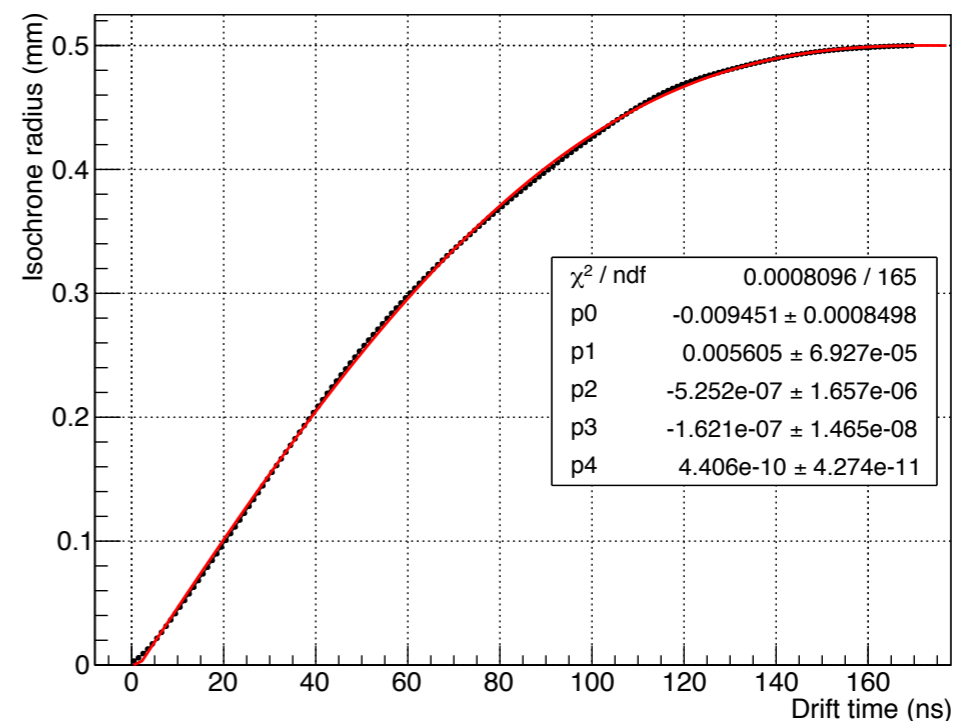
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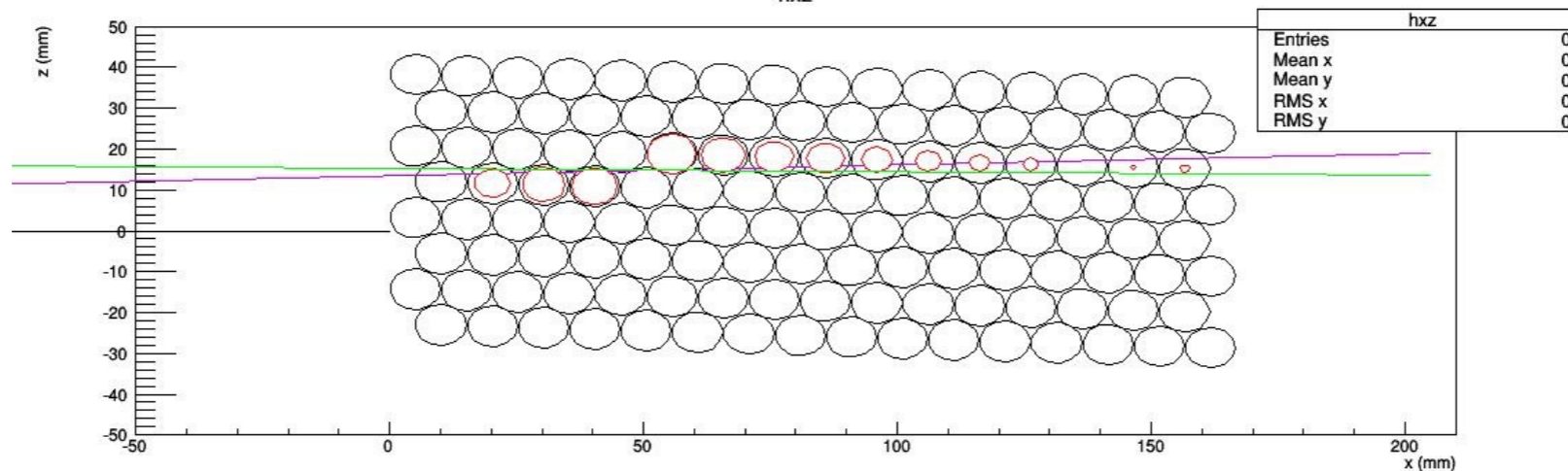
TDC_pl3_el9



Isochrone Calibration



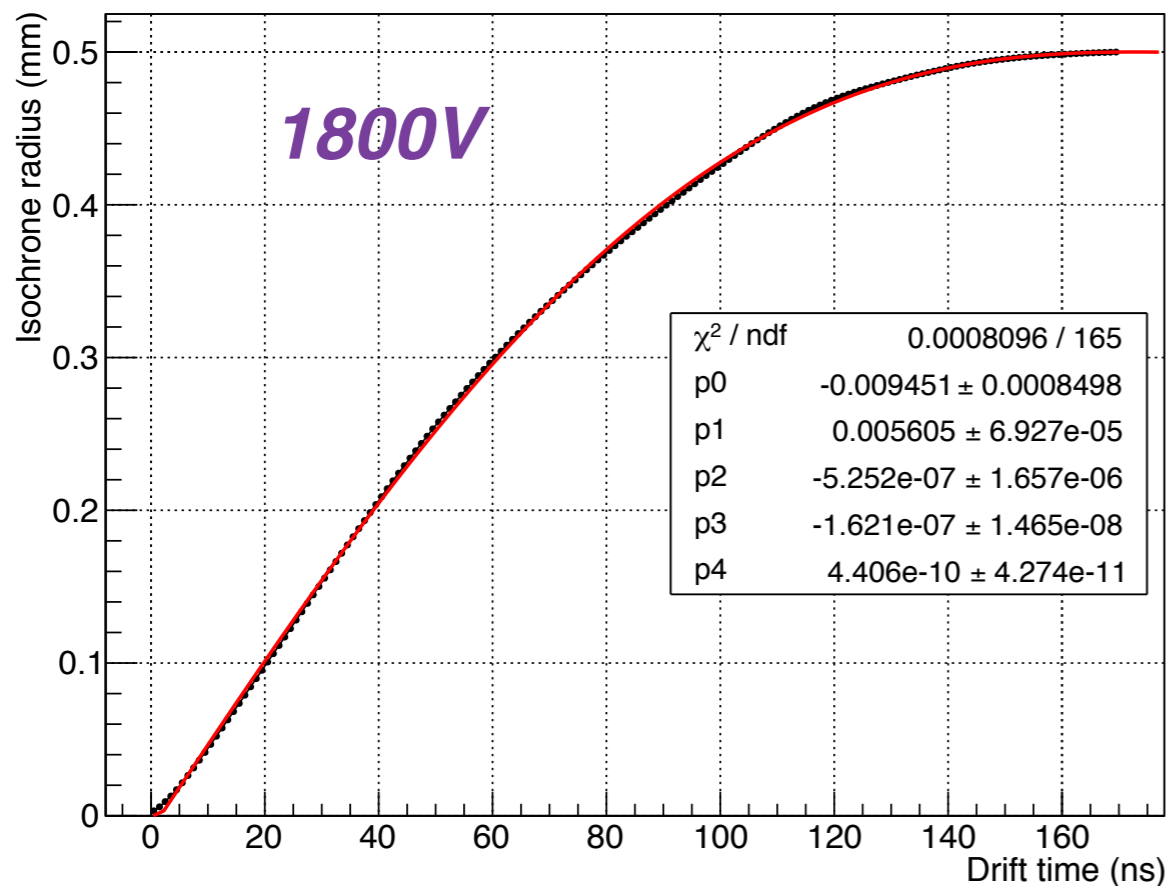
hxz



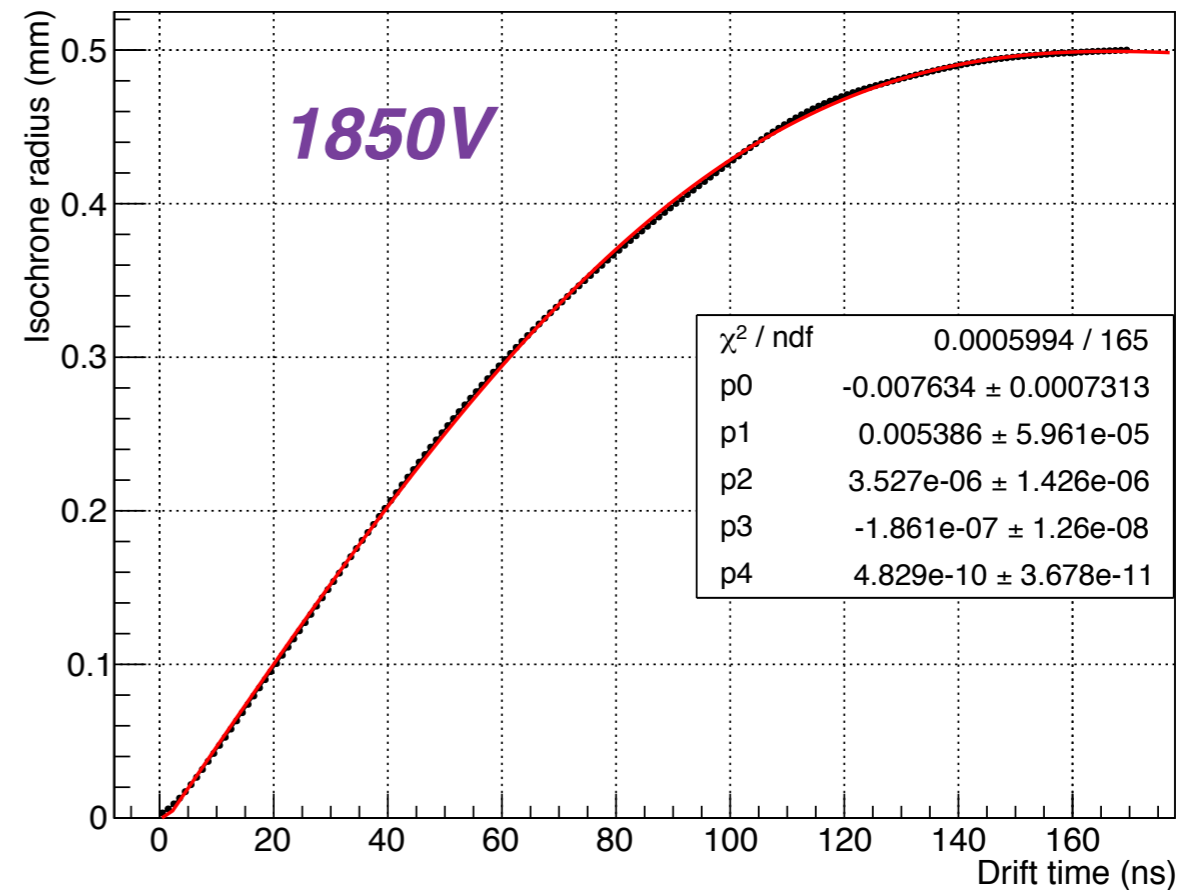
Data from April 2016, Isochrone calibration

- Clean beam condition, data taken for different intensities
- Equal samples of data collected at different momenta
- Obtained calibration curve used for the analysis of data

Isochrone Calibration

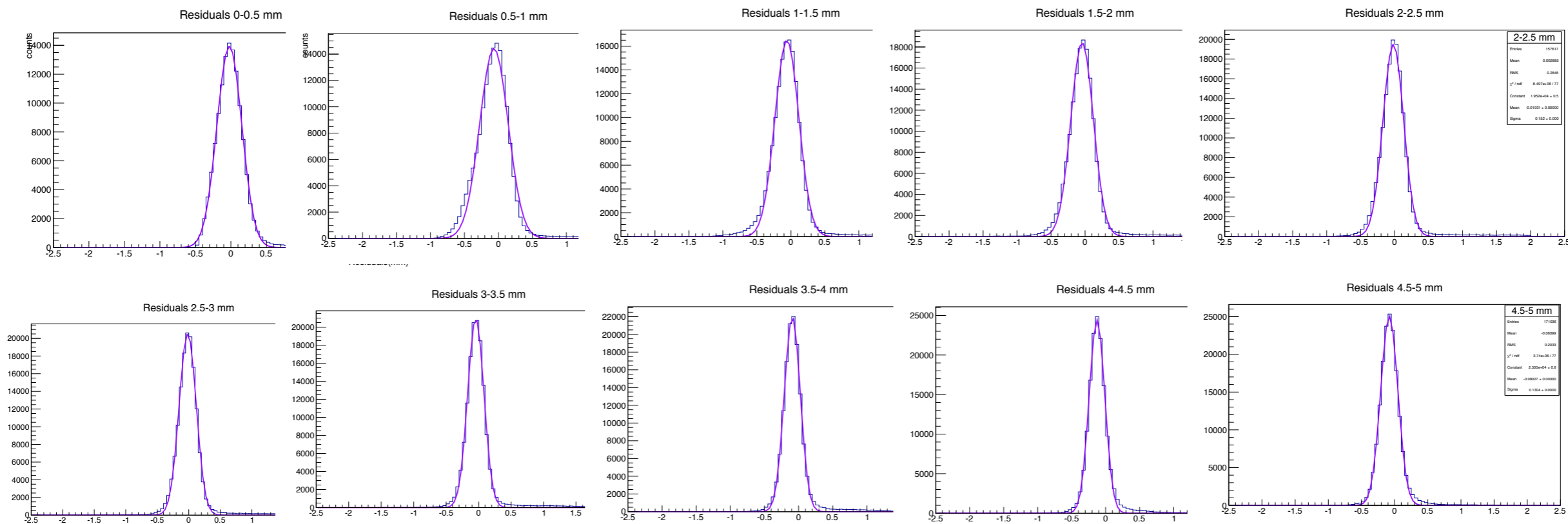


Isochrone Calibration

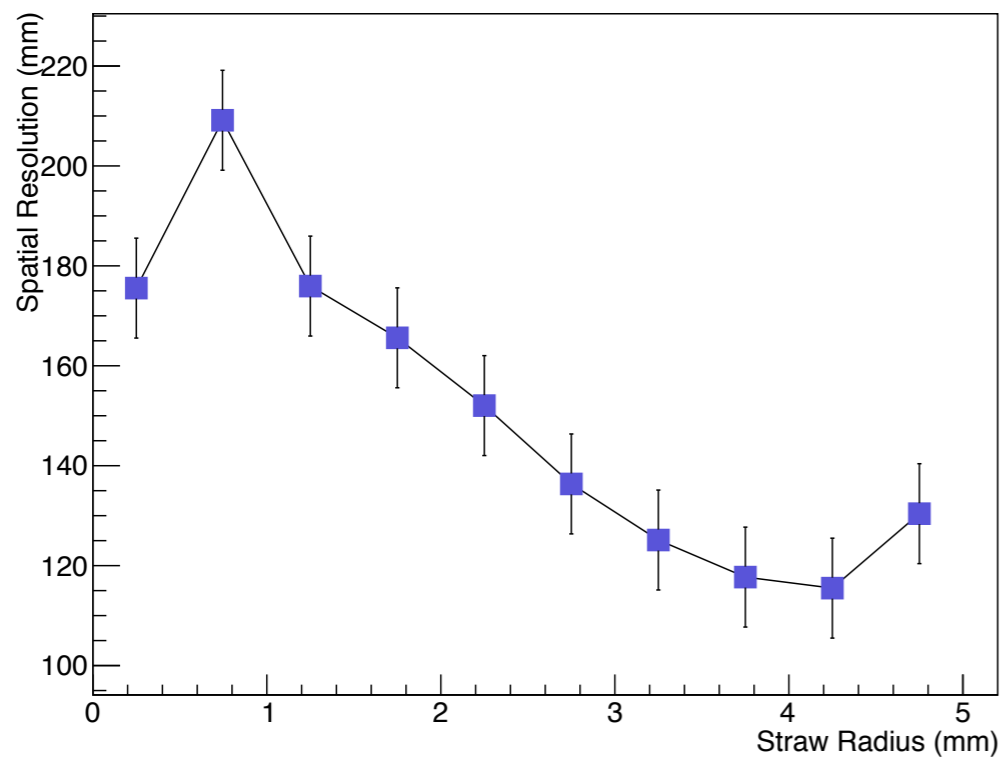




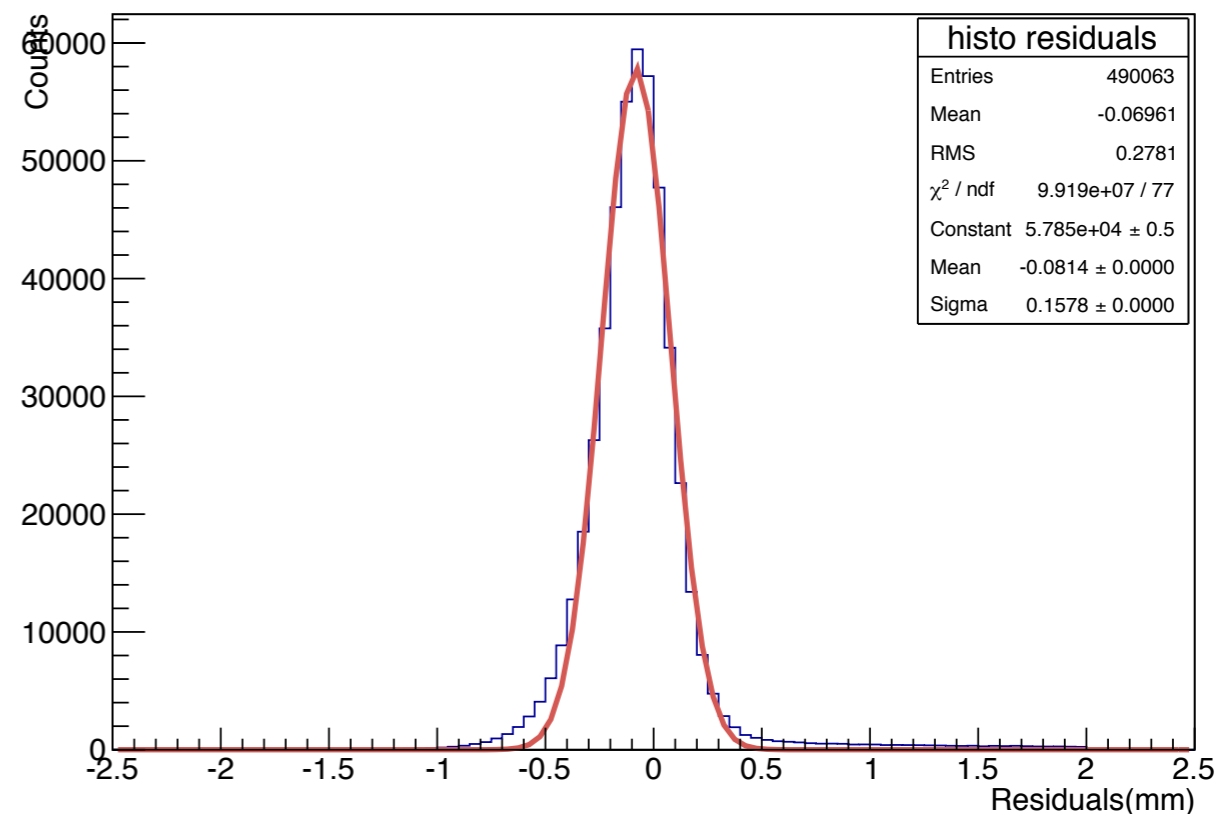
Residual distribution for 0.550 GeV/c, 1800V



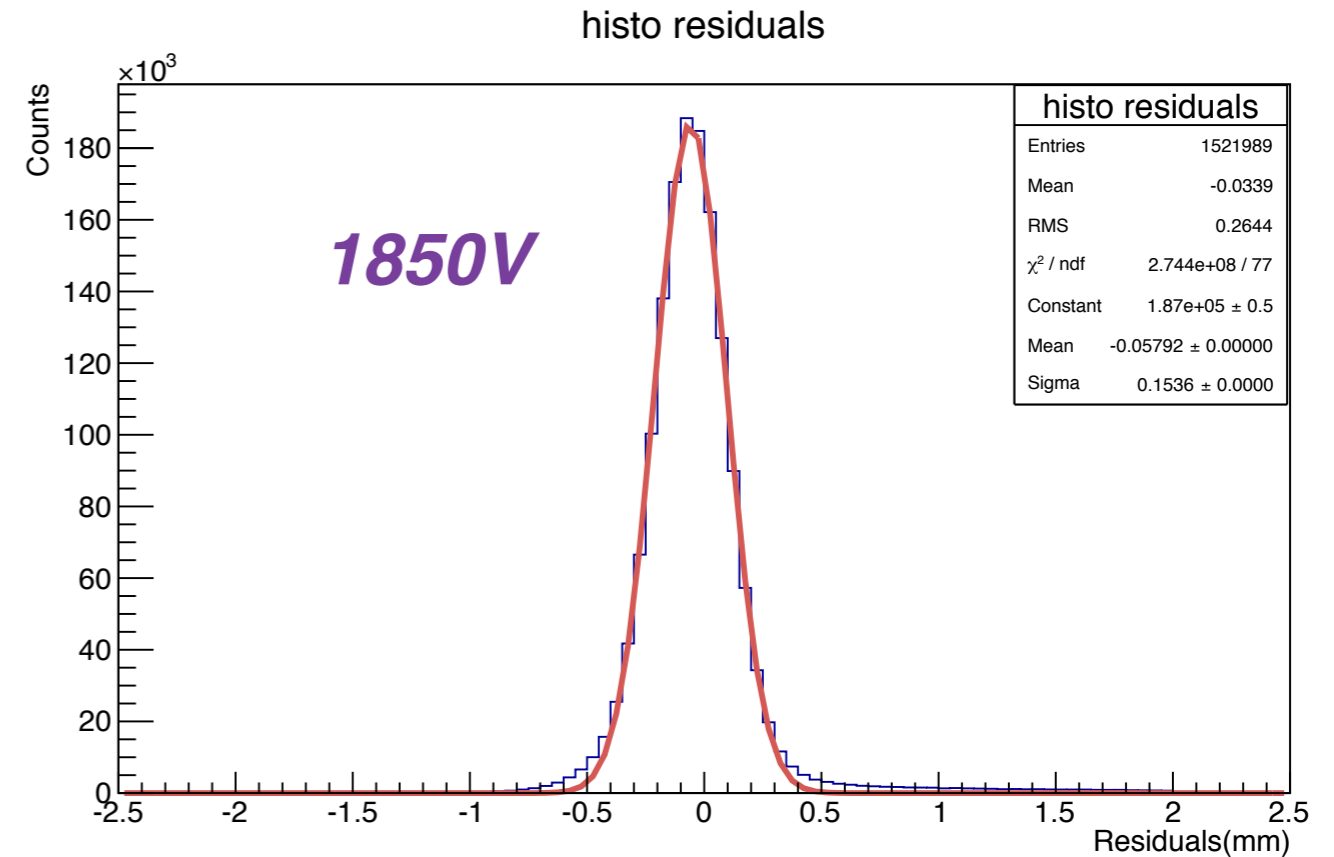
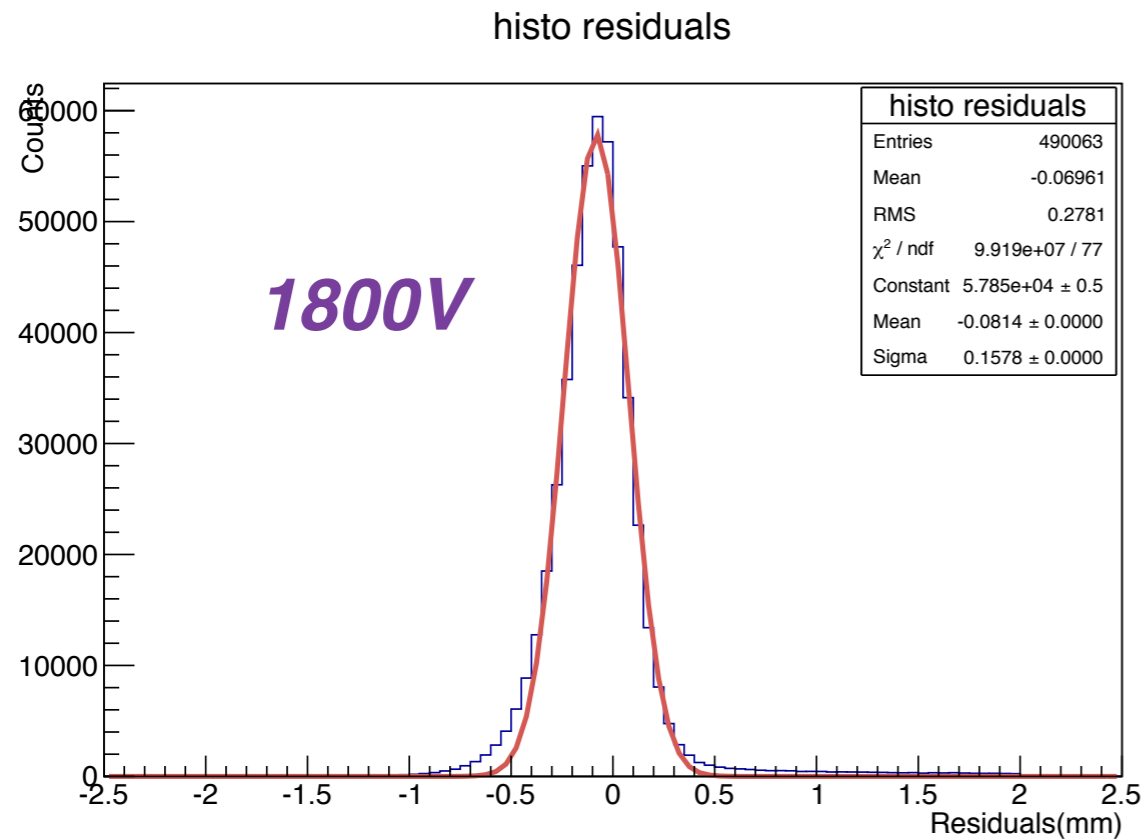
Position Resolution



histo residuals



Residual distribution for 0.550 GeV/c



The best preliminary achieved spatial resolution at 0.550 GeV/c proton momentum:

at 1800V is $\sigma_{(\text{spatial resolution})} = 157 \mu\text{m}$

at 1850V $\sigma_{(\text{spatial resolution})} = 153 \mu\text{m}$

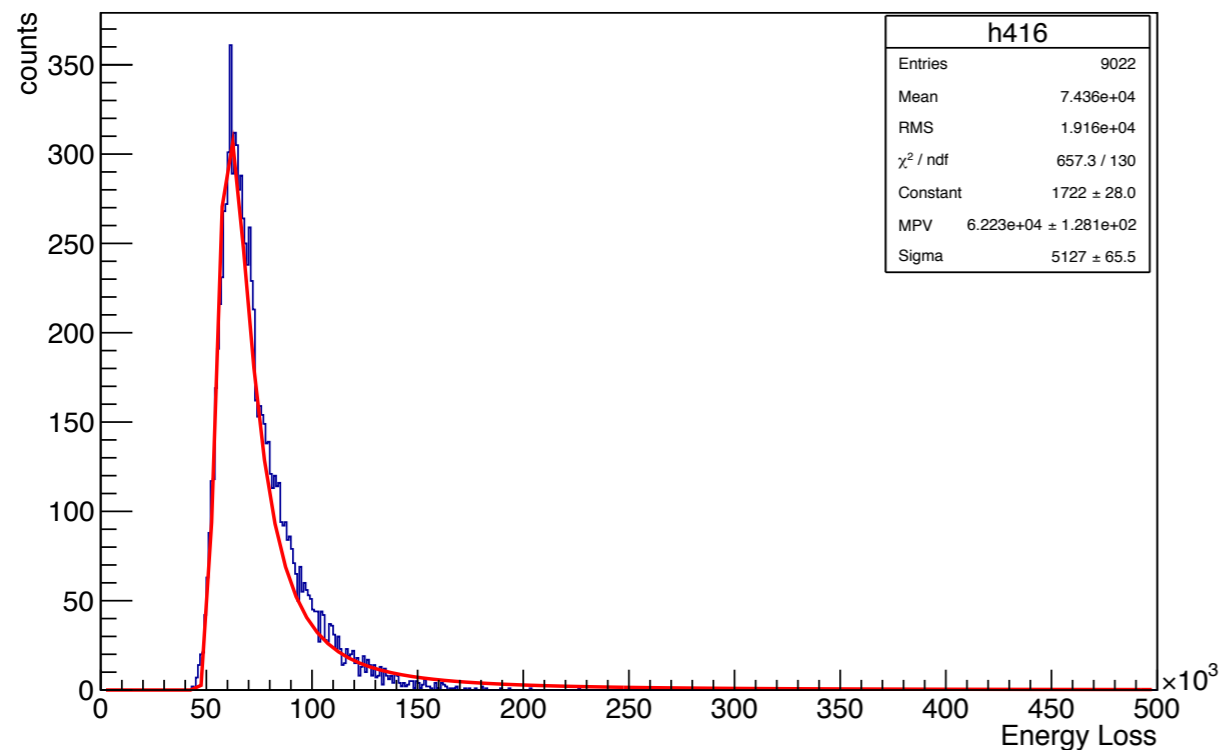
Data analysis for other momenta is in progress....

Analysis Method

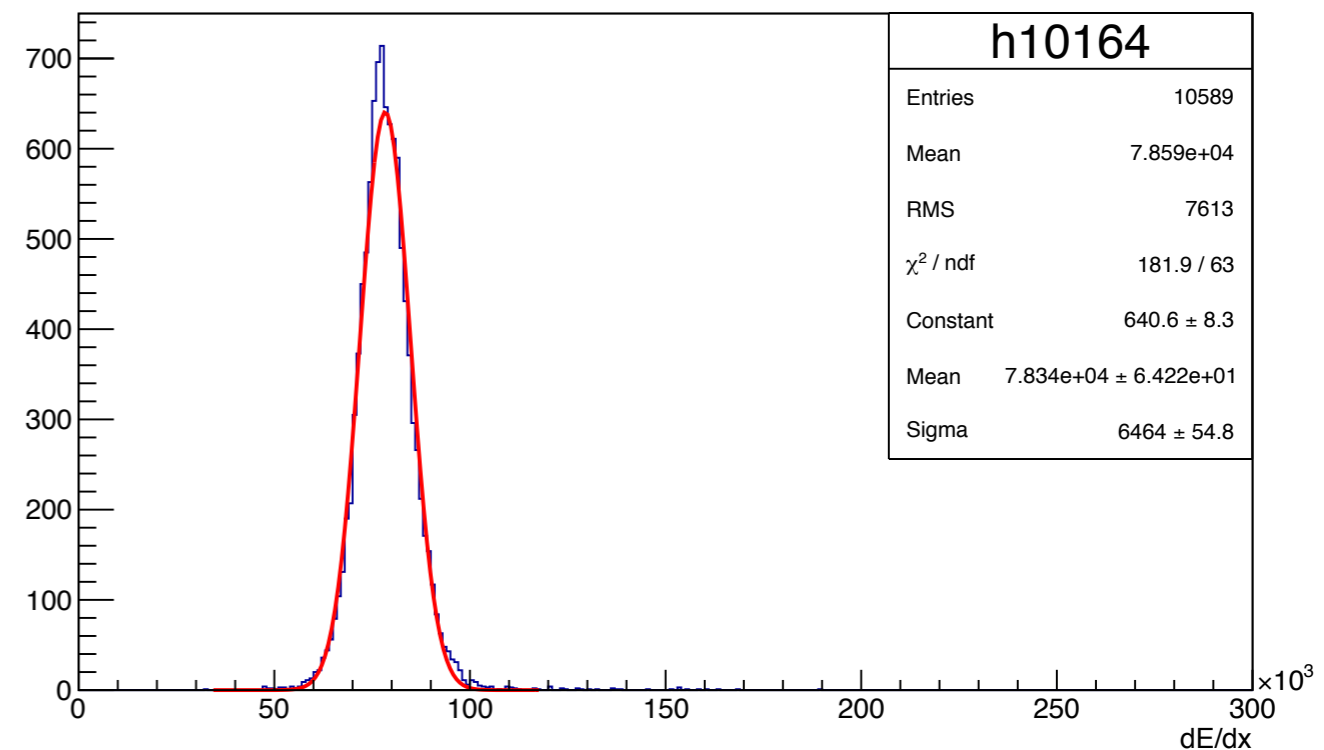
2. Energy loss measurement

- Energy loss spectra for reconstructed tracks
- Truncation mean - cut of largest energy losses per track
- Calculation of path length for truncated events
- Calculation of specific energy losses per path length

Energy Loss for 16 straws

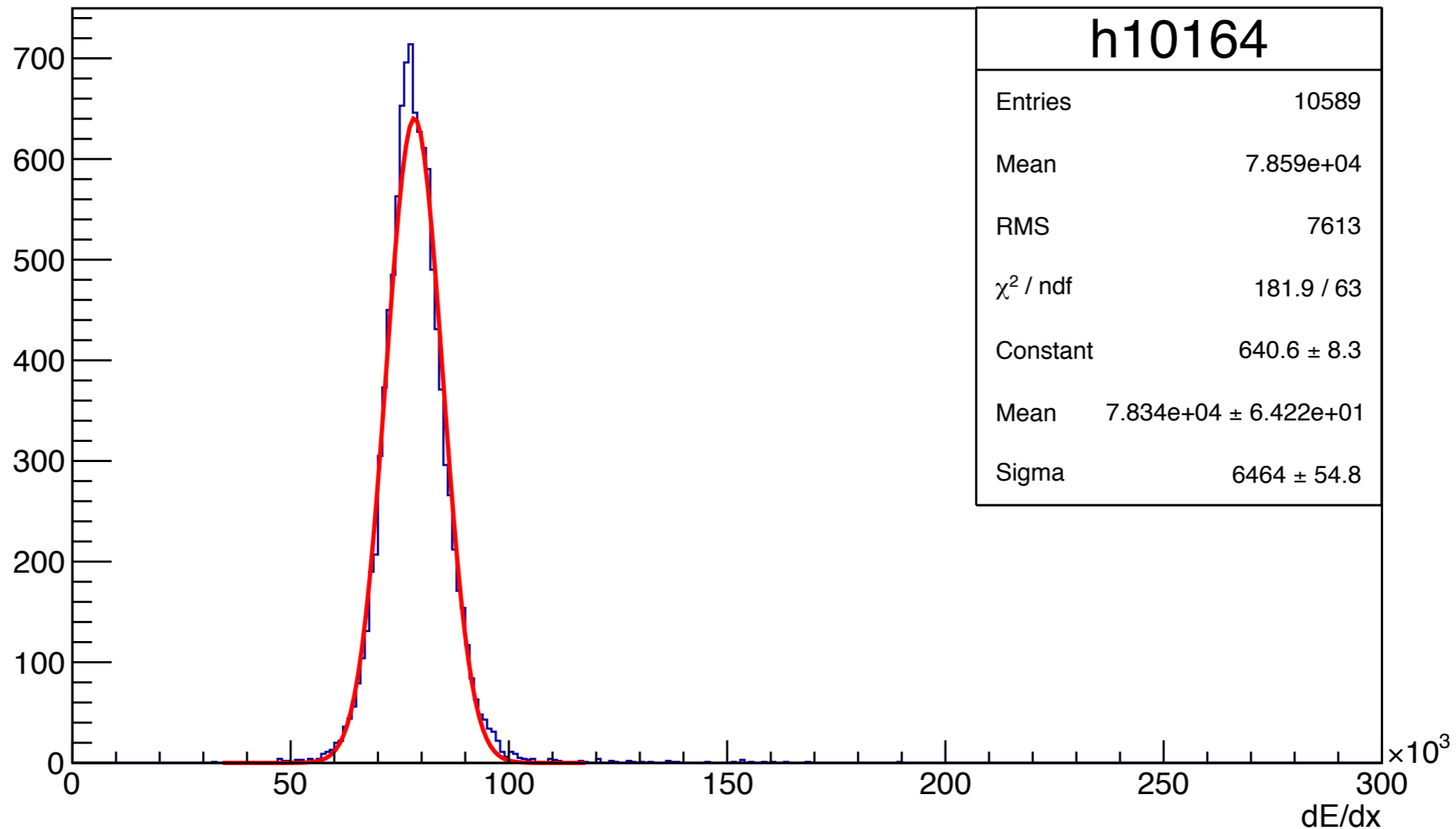


dE/dx 16 hit track, TM40



Preliminary results of Energy Resolution for example at 0.55 GeV/c

dE/dx 16 hit track, TM40



The best preliminary achieved energy resolution (with 16 straws and at 0.550 GeV/c proton momentum) : $\sigma_{(dE/dx)} \sim 8.2\%$

Data analysis for other momenta is in progress....



Summary & Outlook

- The first beam test in COSY- TOF area was successful
- Clean beam condition, data taken for different intensities, low noise level smaller than 6 mV
- The preliminary results of the spatial and energy resolutions look good and promising
- Data analysis for other momenta is still in progress

Thank You!





Back up



where Δr_i is the residual of the i^{th} tube, defined as:

$$\Delta r_i = r_{i,fit}(a, b) - r_{i,raw} = \frac{|y_i - (a + bx_i)|}{\sqrt{1 + b^2}} - r_{i,raw}.$$

In this equation, $r_{i,fit}$ is the distance of closest approach of the best fit line found in the center of tube i . $r_{i,raw}$ indicates the radius computed using the $r(t)$ relation