

Preliminary STT results of December 2014 beamtime for FADC readout



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Outline

State of the art of the analysis of proton data collected in December 2014 with the FADC readout

- *Beamtime overview*
- *Analysis results*
 - *Residuals distributions*
 - *Spatial resolution*
 - *dE/dx distributions*
- *Summary & Outlook*

Outline

State of the art of the analysis of proton data collected in December 2014 with the FADC readout

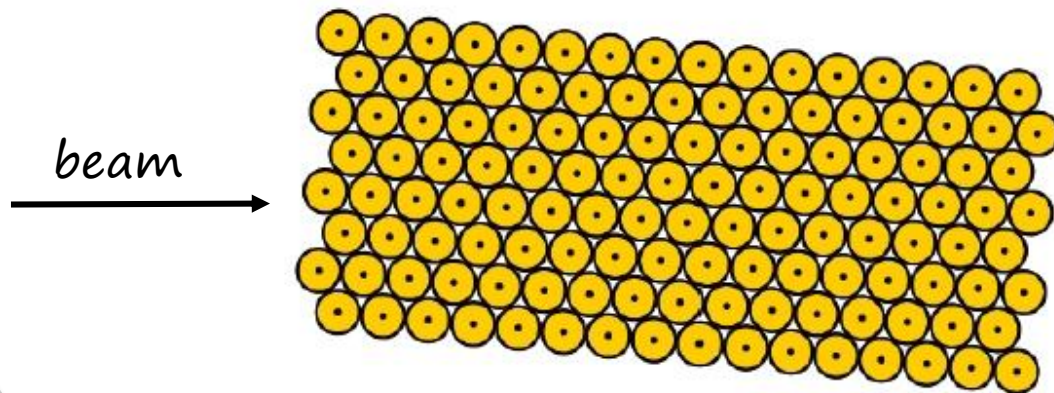
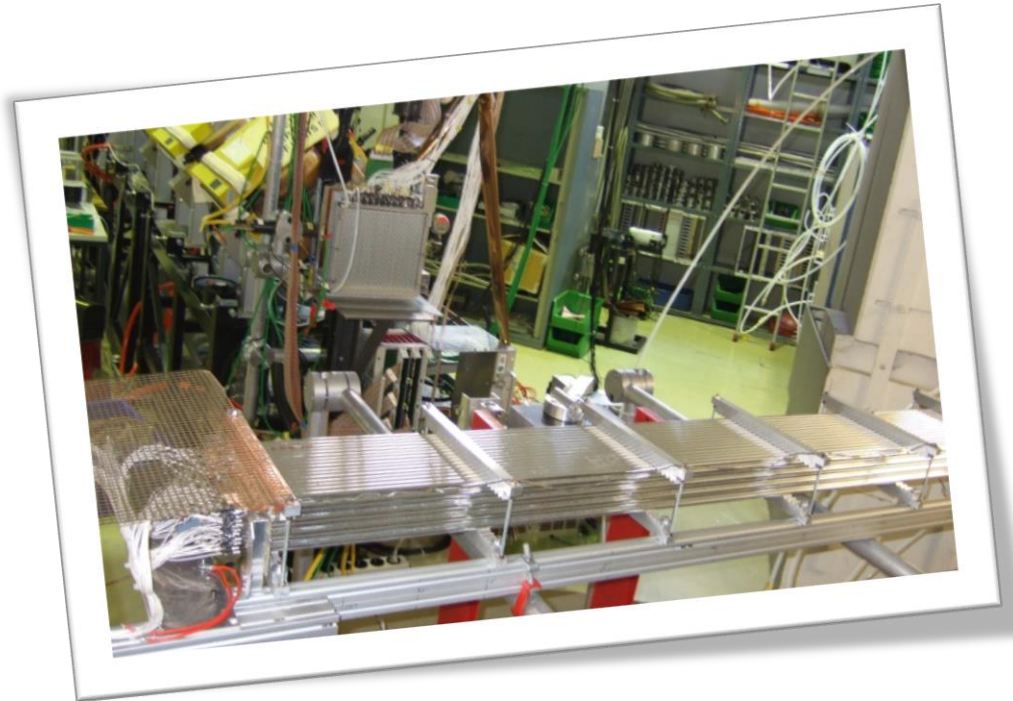
- Beamtime overview
- Analysis results
 - Residuals distributions
 - Spatial resolution
 - dE/dx distributions
- Summary & Outlook



Preliminary results!!!!

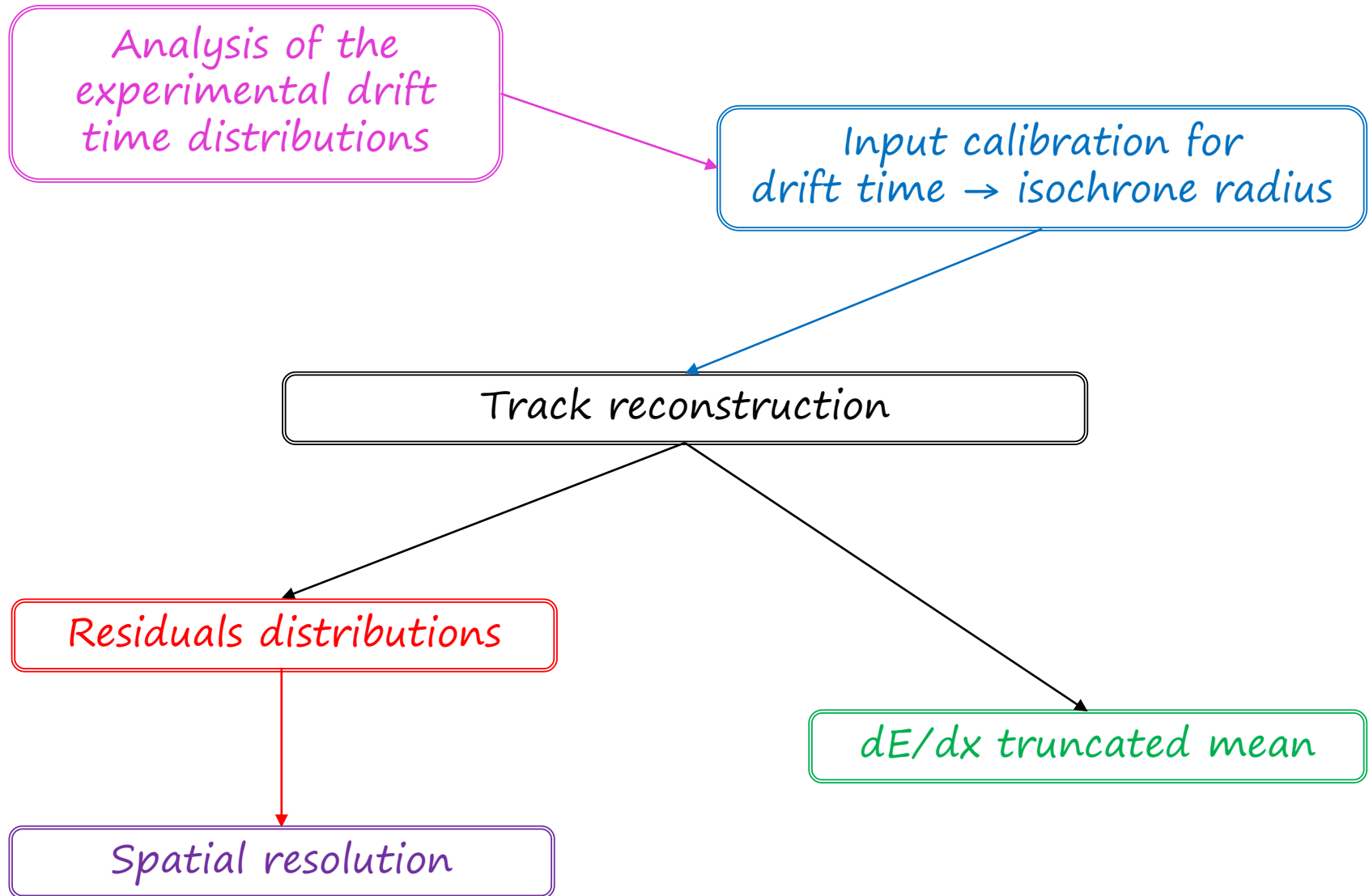
Beamtime overview

- Prototype with FADC readout
- Placed in the Big Karl area
- Proton beam provided by COSY (Dec 2014):
 - 1.0 GeV/c
 - 1.3 GeV/c
 - 2.0 GeV/c

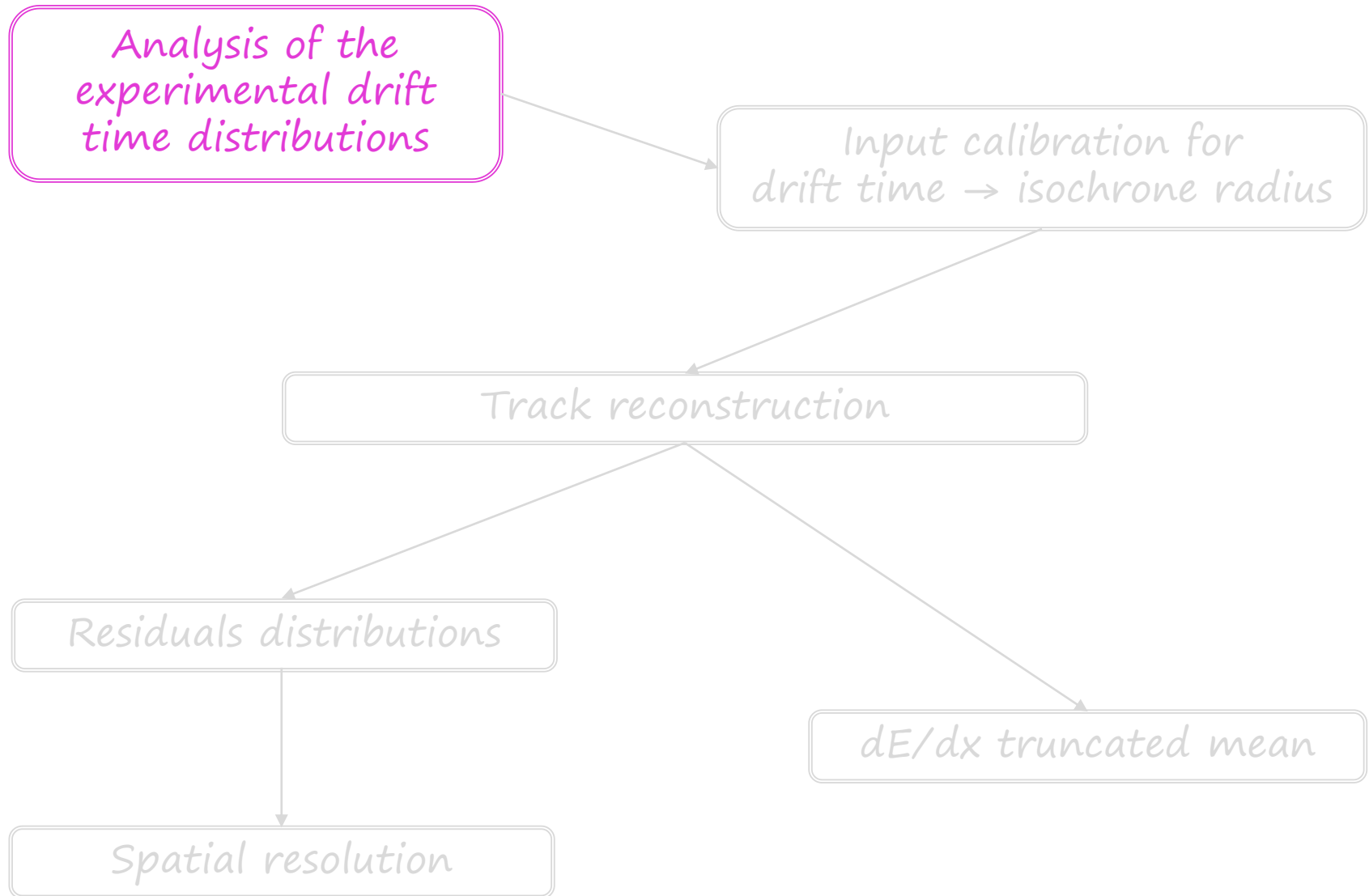


- ArCO₂ (90/10) mixture
- 2 bar absolute pressure
- HV = 1800 V, 1850 V

Analysis procedure

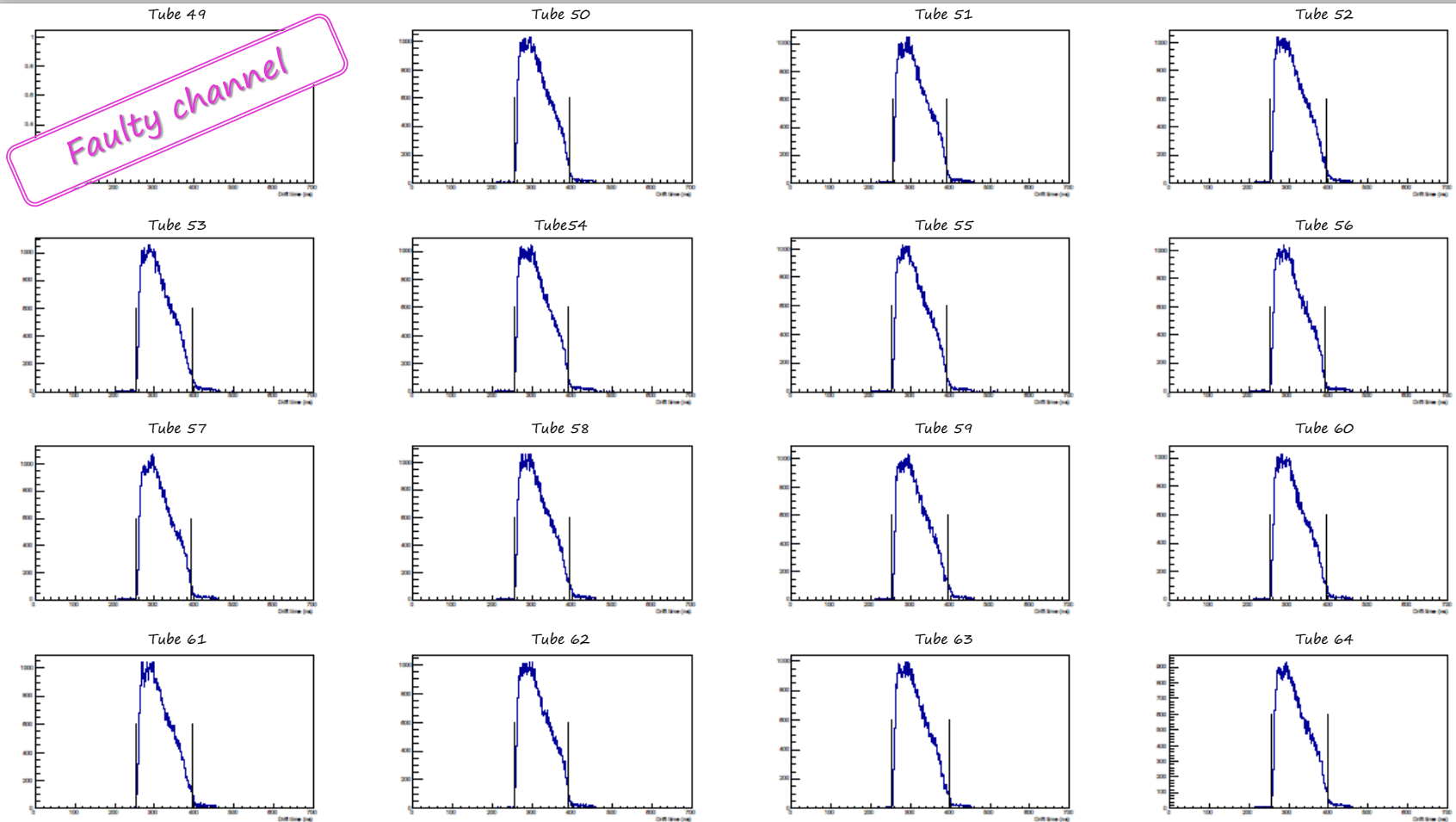


Analysis procedure



Drift time distributions

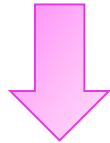
t_0 and t_{max} determination: 10% of the peak value



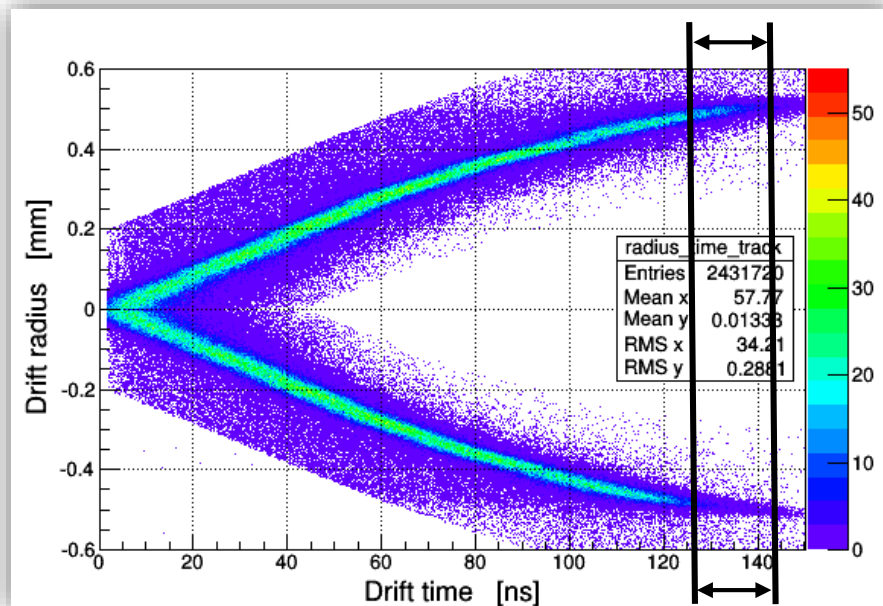
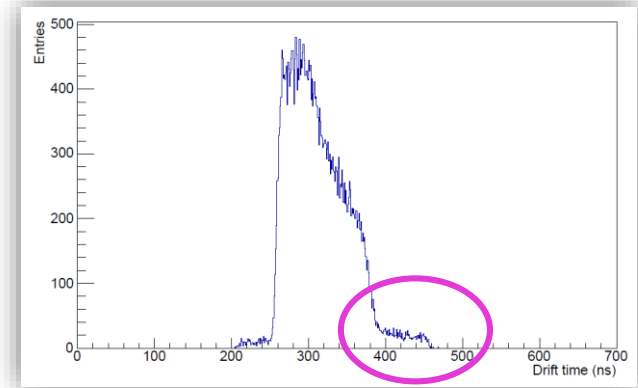
Protons @ 1 GeV/c, 1800 V, 1 run, layer 4

Still 2nd leg issue?

2nd leg \leftrightarrow track position wrt the tube wire

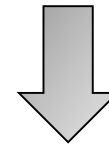


different drift time distributions for hits traversing the tubes above/below the wires



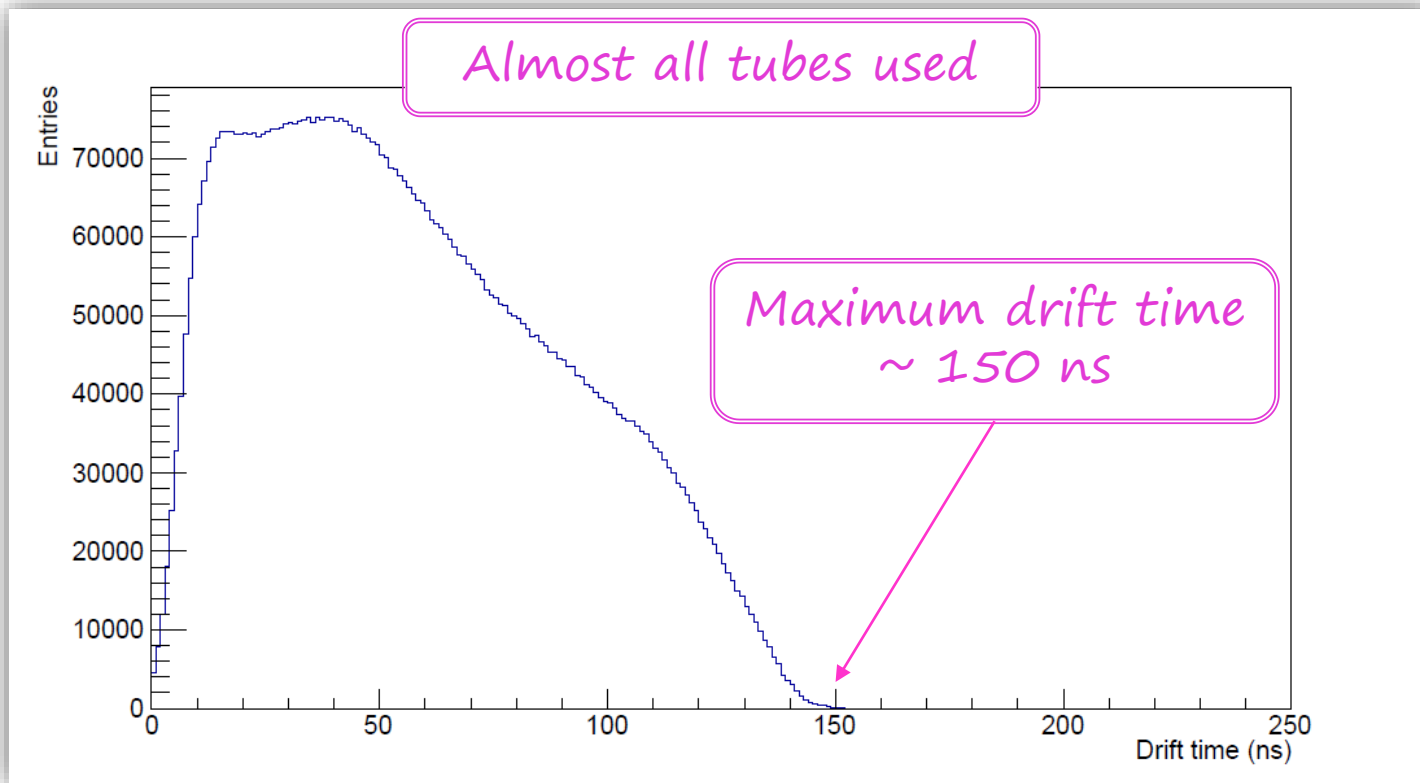
Plot from K. Pysz's talk at LI PANDA meeting

Slight above/below (wrt wire) time difference



- ❑ Ignored in this analysis ($<10\%$ $t_{peak} \rightarrow$ cut out by t_{max} determination)
- ❑ Needs to be further investigated

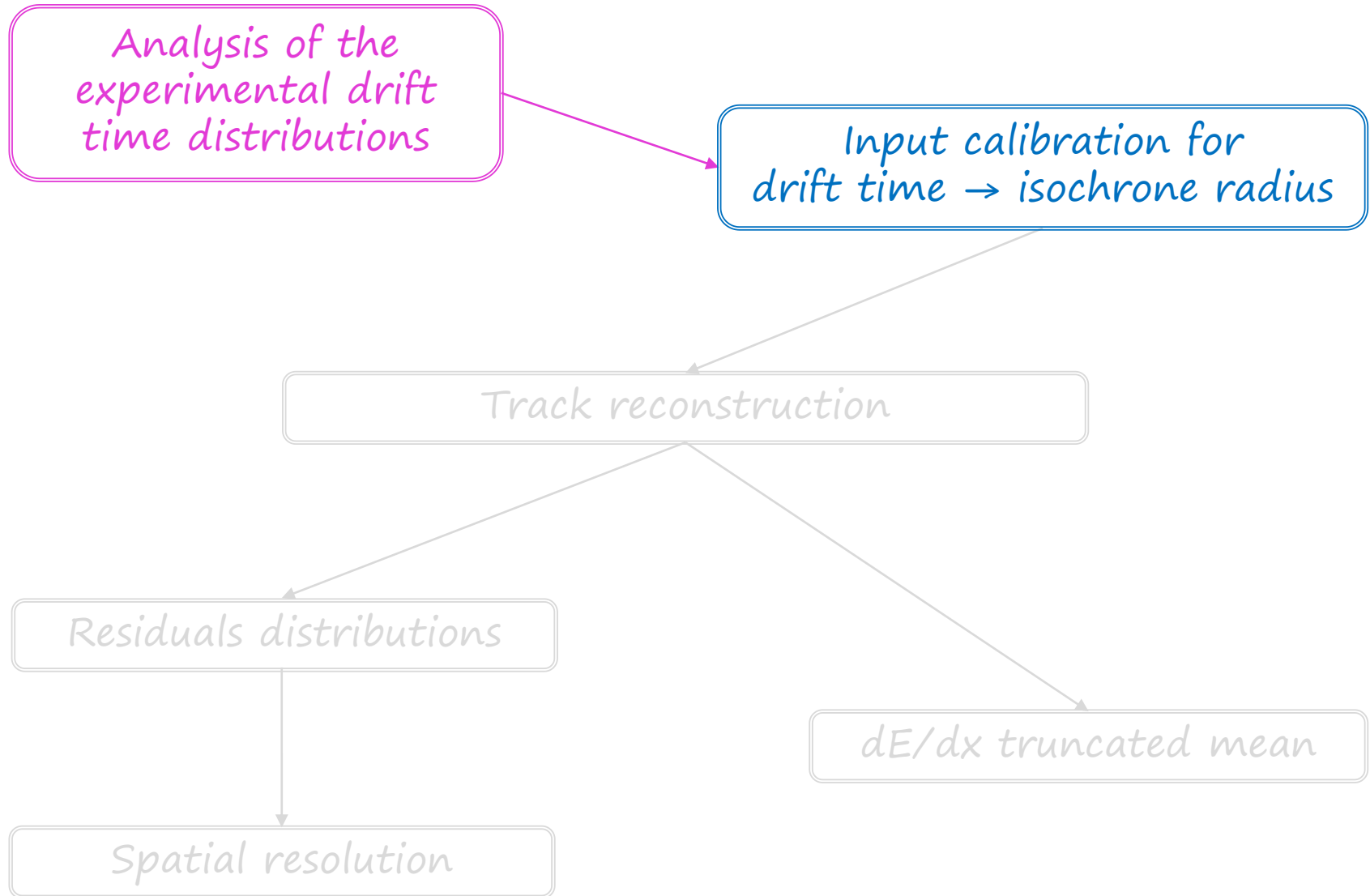
Total drift time distribution



By its integration, we get isochrone curve - drift time $r(t)$ relation:

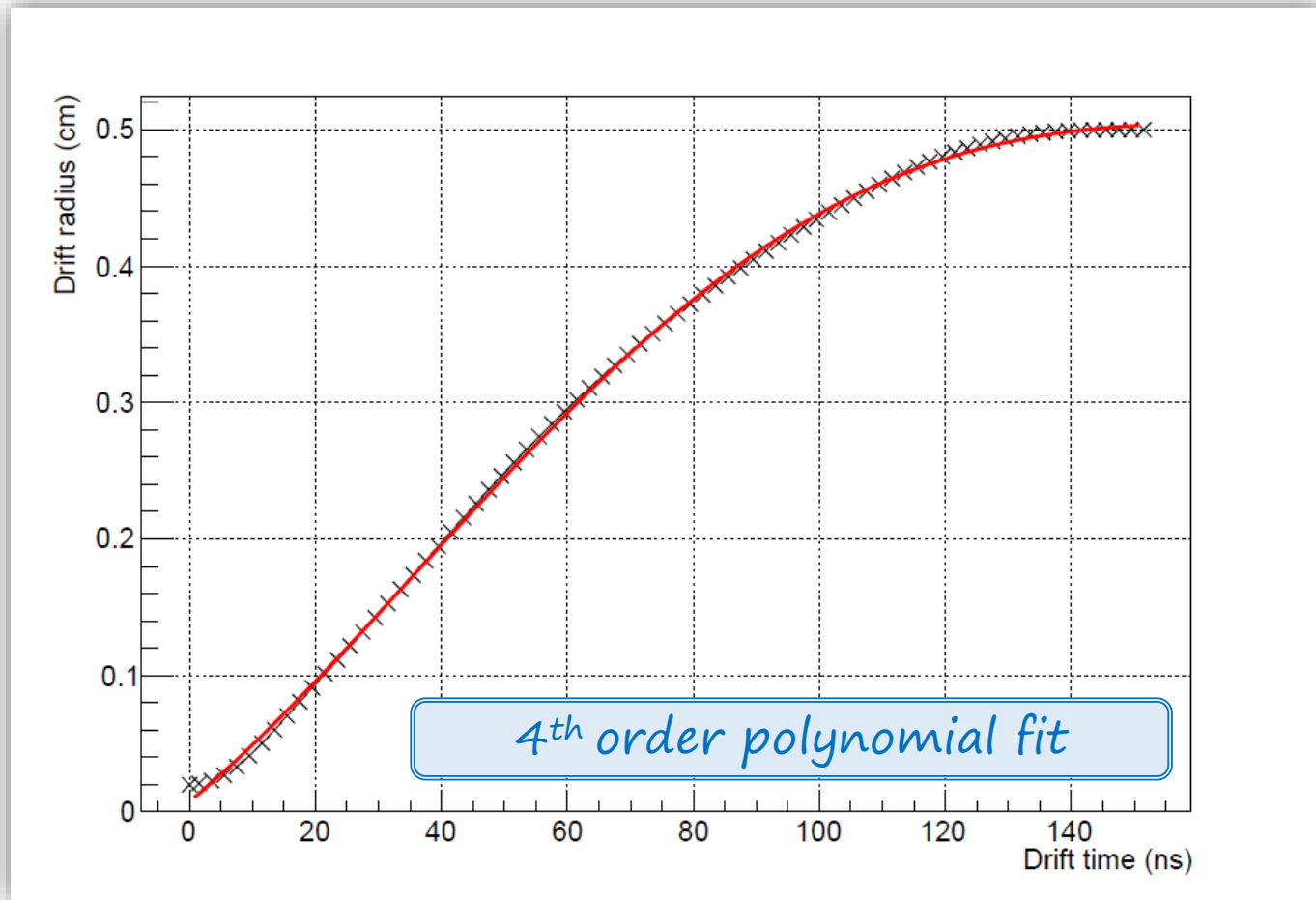
$$r(t_i) = \frac{\sum_{i=1}^{i_t} N_i}{N_{tot}} \cdot (R_{tube} - R_{wire}) + R_{wire}$$

Analysis procedure

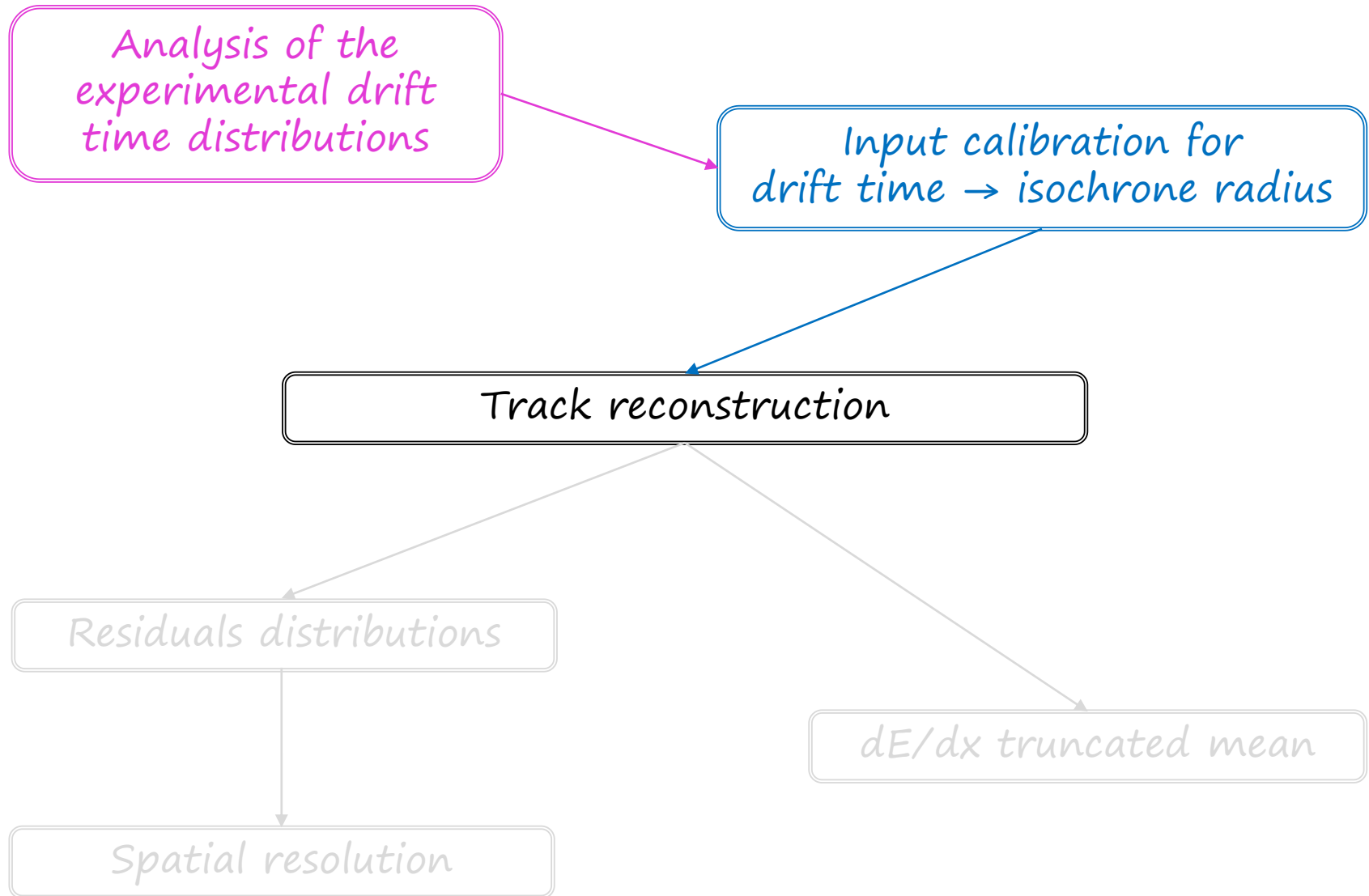


$r(t)$ calibration

Input calibration curve for track reconstruction



Analysis procedure



Track reconstruction

«Ad hoc» algorithm for track reconstruction and dE/dx determination (in PandaROOT)

Algorithm steps:

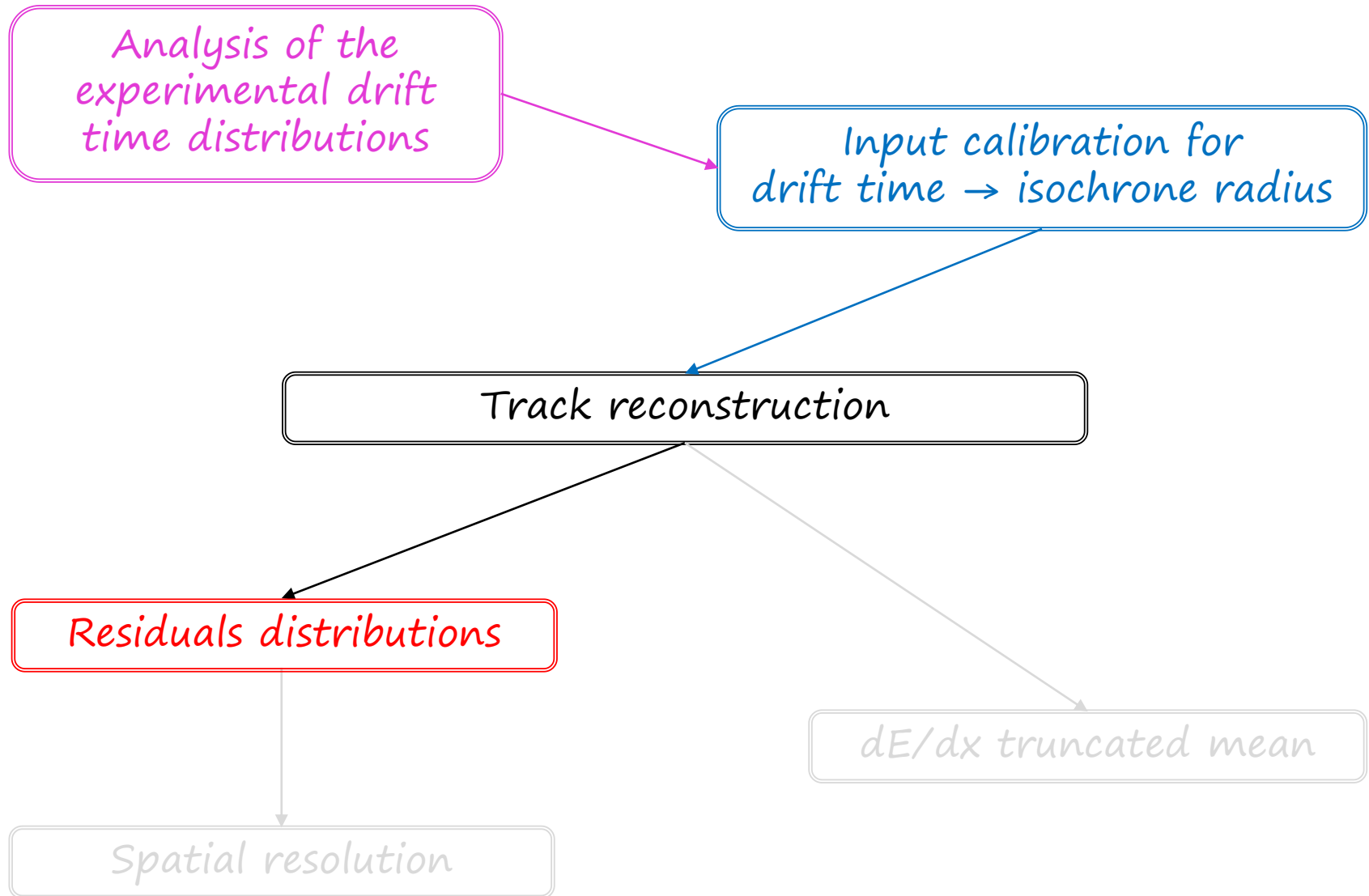
- «Hit producing»:
 - Drift time conversion into isochrone radius
- Track finding (pattern recognition)
 - Cluster formation
- Track fitting:
 - Prefit using points (centers of tubes)
 - Fit using isochrones
 - Fit using points (intersections on isochrones)
 - Refit

(see my talk @ June Tracking Session @ PANDA CM)

Cuts:

- Centre of the firing tube < 8 mm from prefit line
- Residuals from fit line < 1 mm

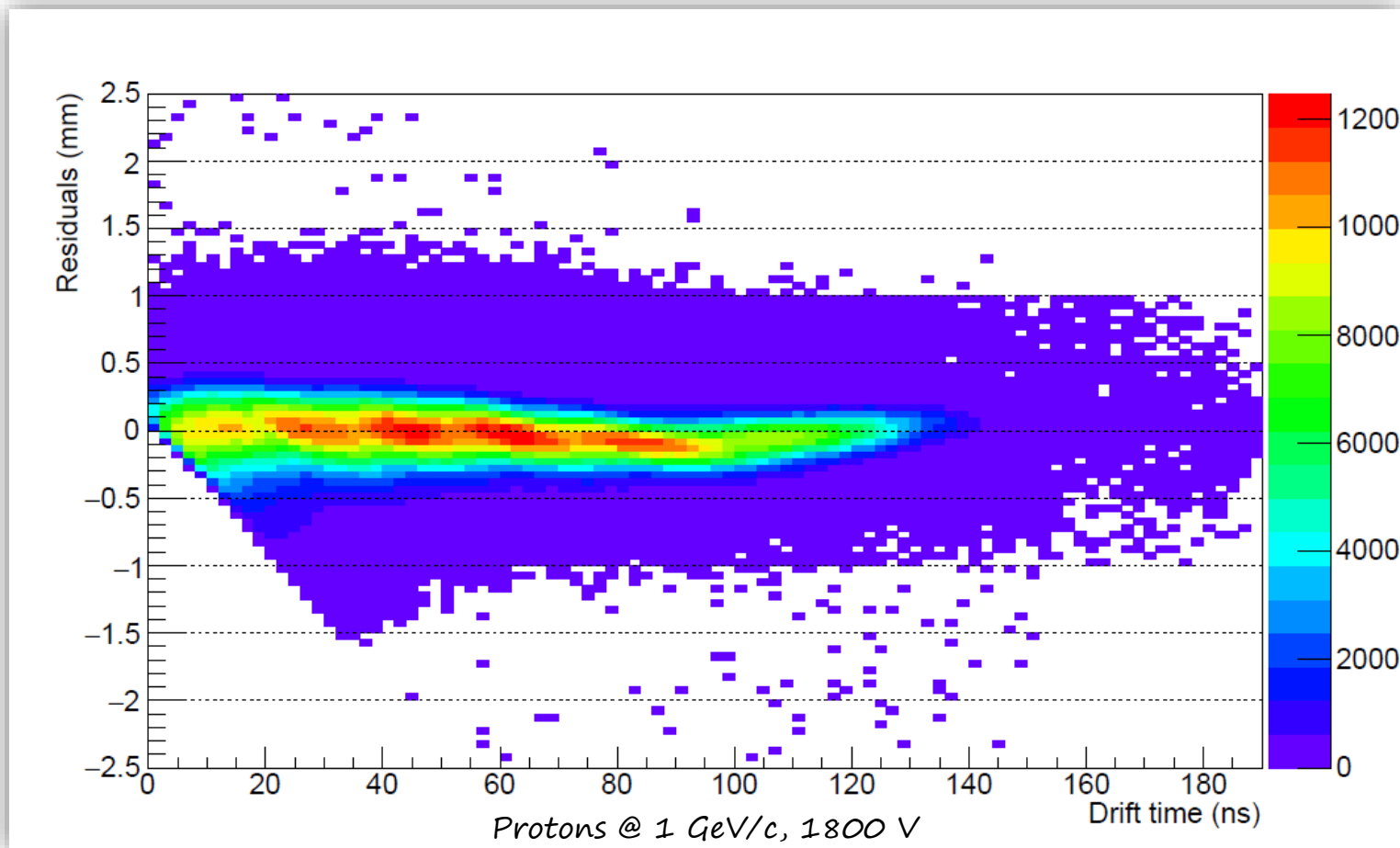
Analysis procedure



Residuals distributions

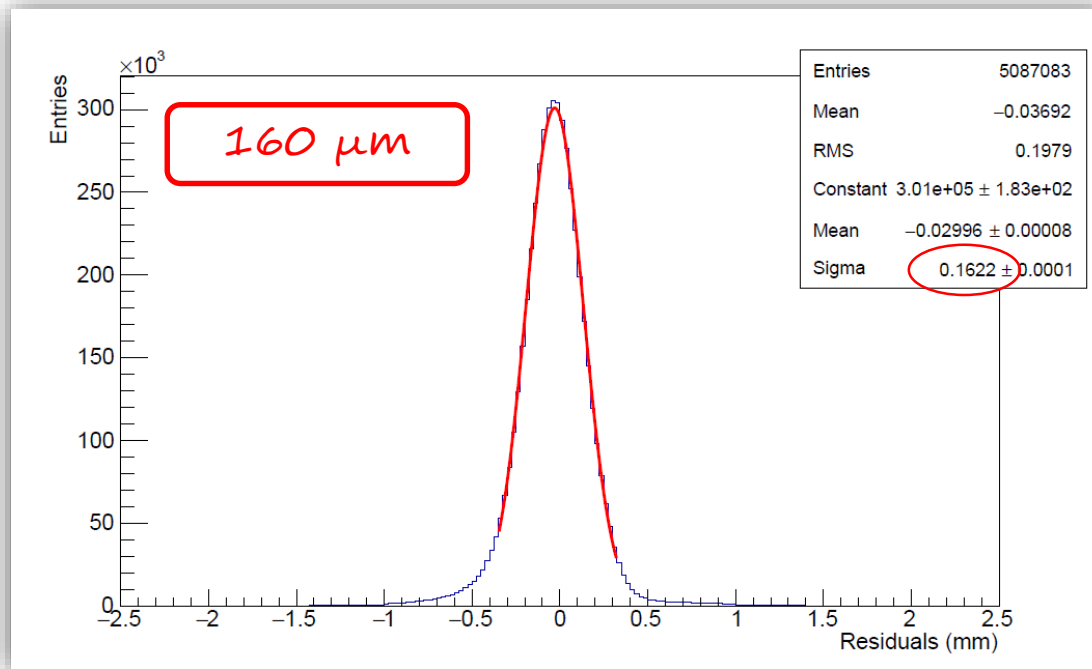
$$\Delta r = r_{\text{fit}}(a,b) - r_{\text{raw}}$$

as a function of drift time



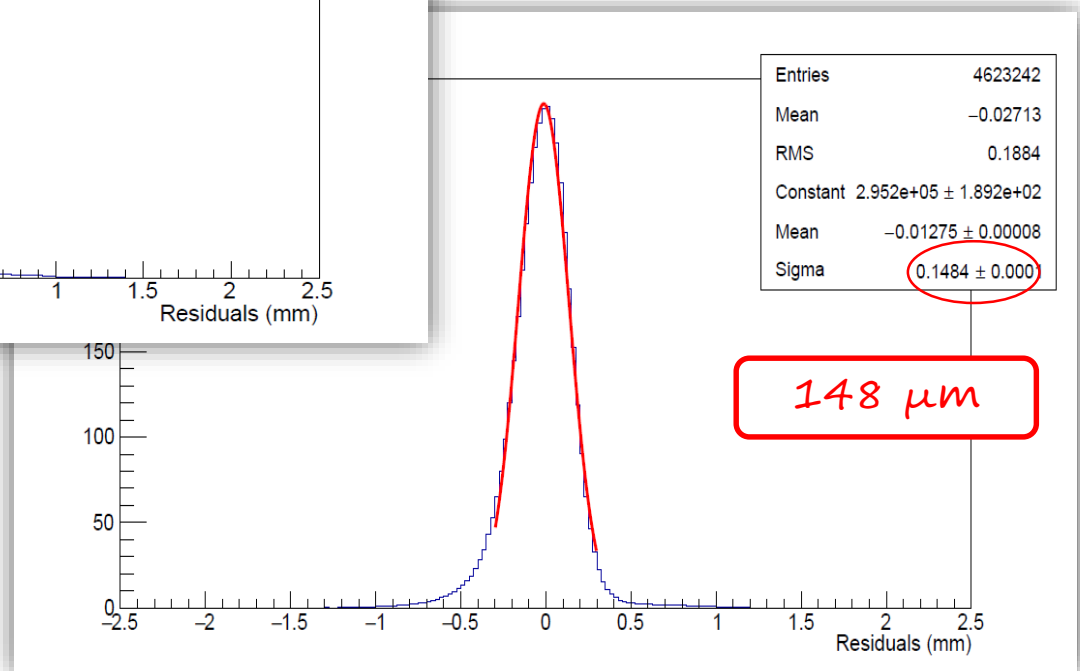
Residuals distributions (II)

$$\Delta r = r_{fit}(a,b) - r_{raw}$$



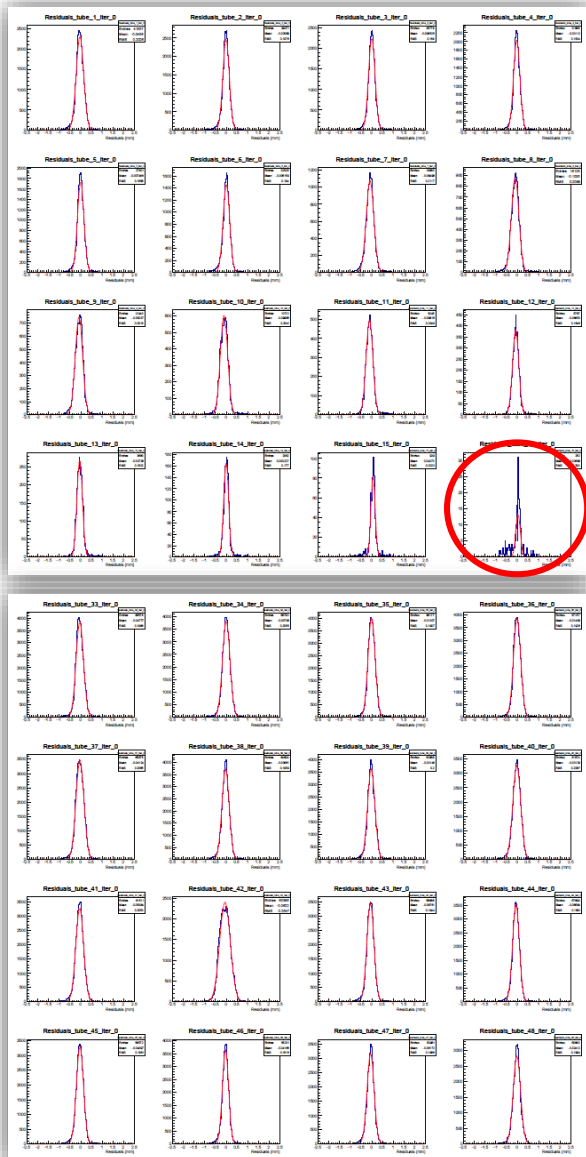
Protons @ 1 GeV/c, 1800 V

Protons @ 1 GeV/c, 1850 V



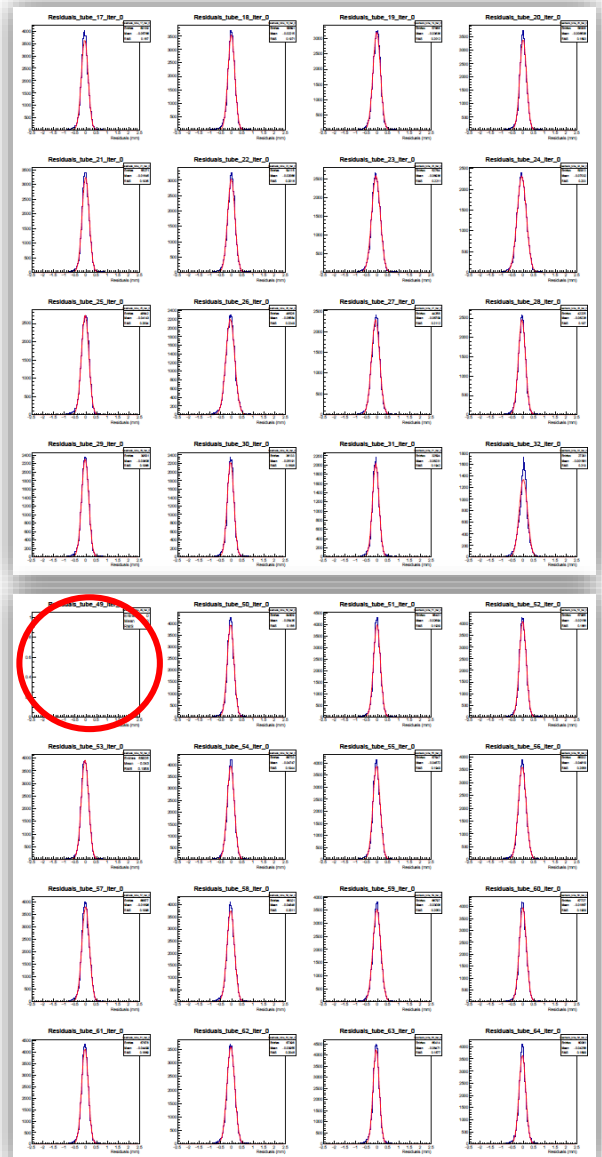
Residuals distributions (III)

for single tubes



Layer 1

Layer 3

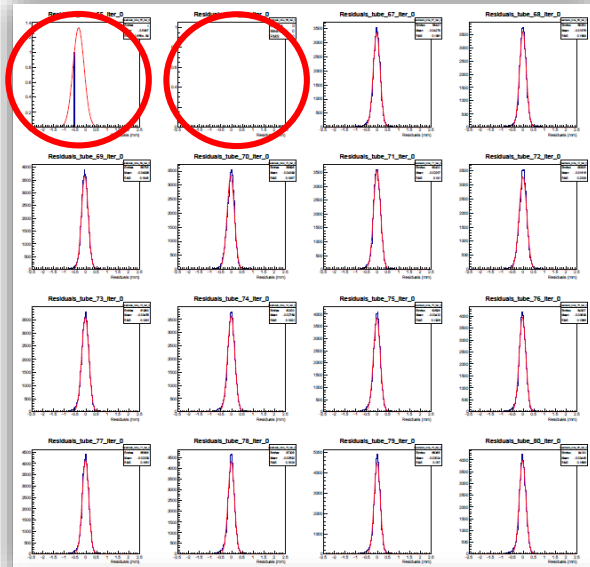


Layer 2

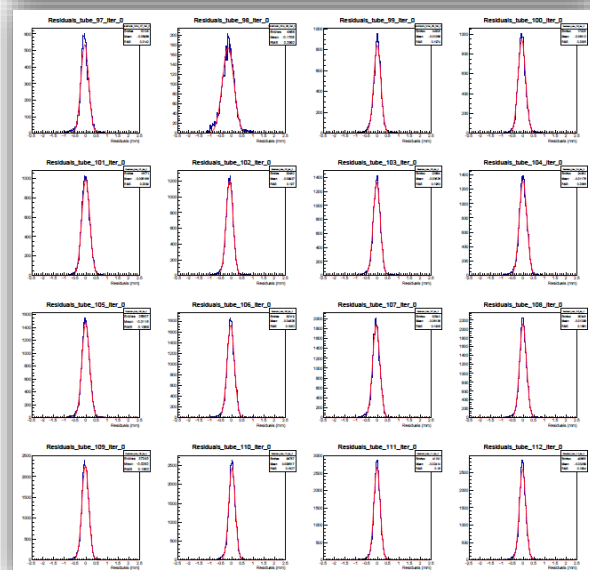
Layer 4

Residuals distributions (IV)

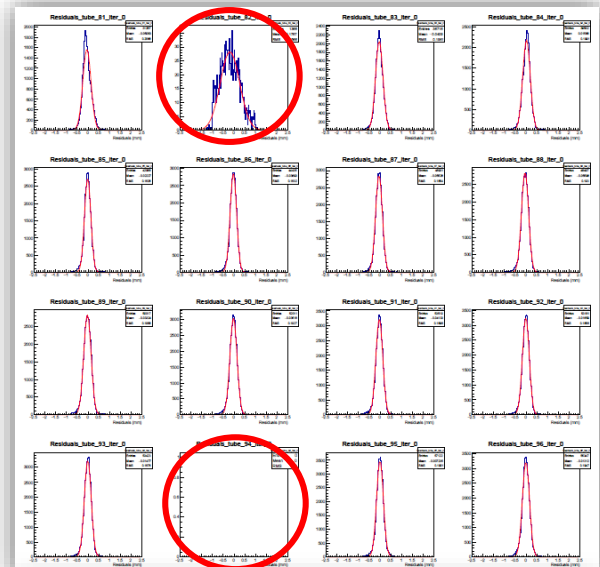
for single tubes



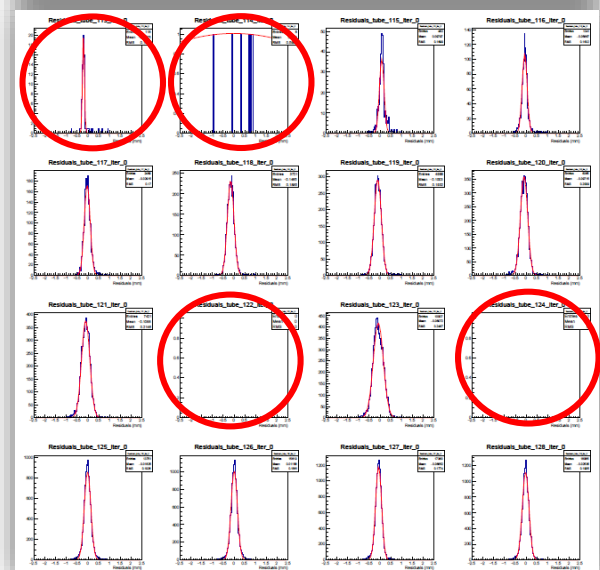
Layer 5



Layer 7



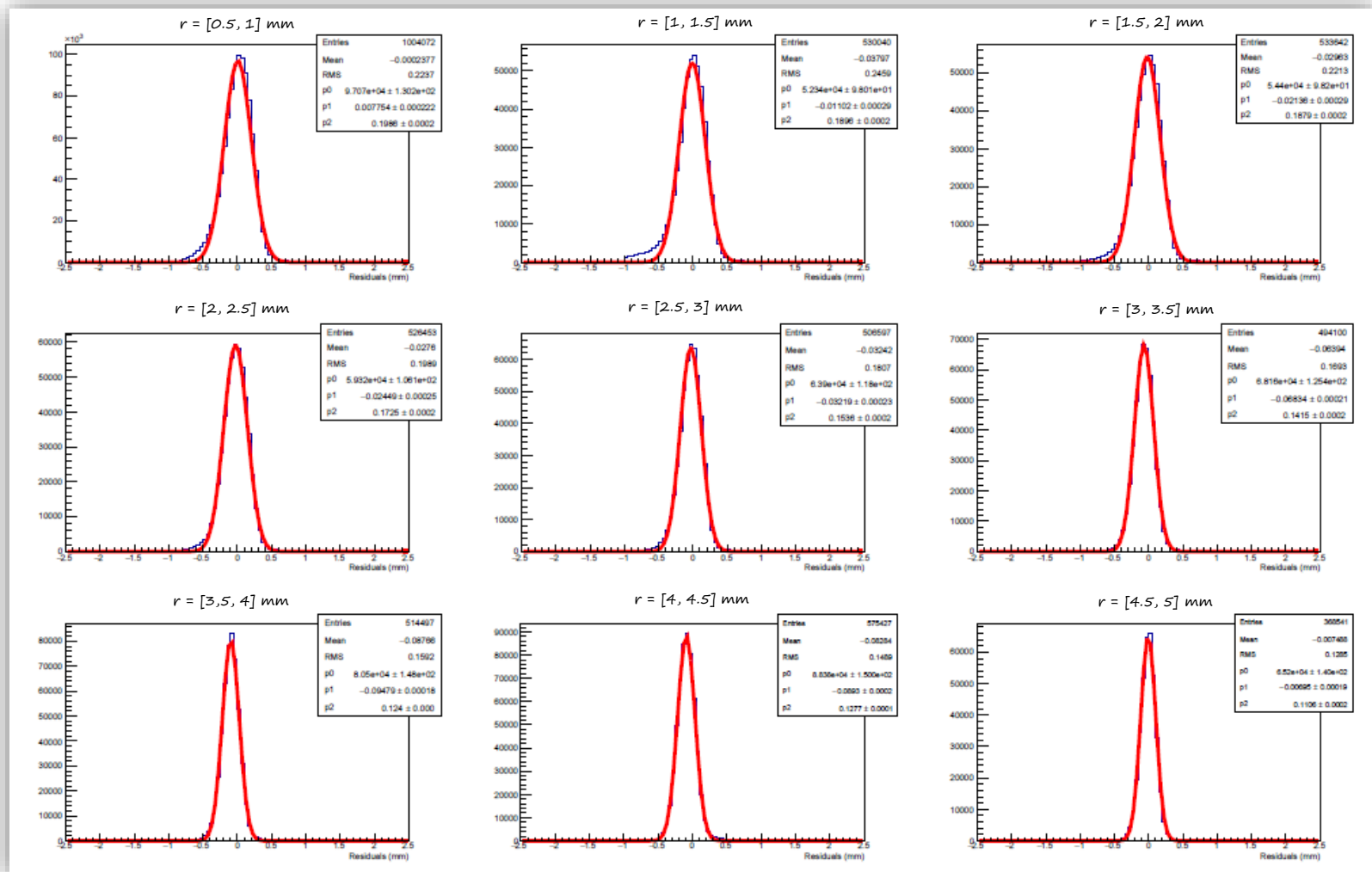
Layer 6



Layer 8

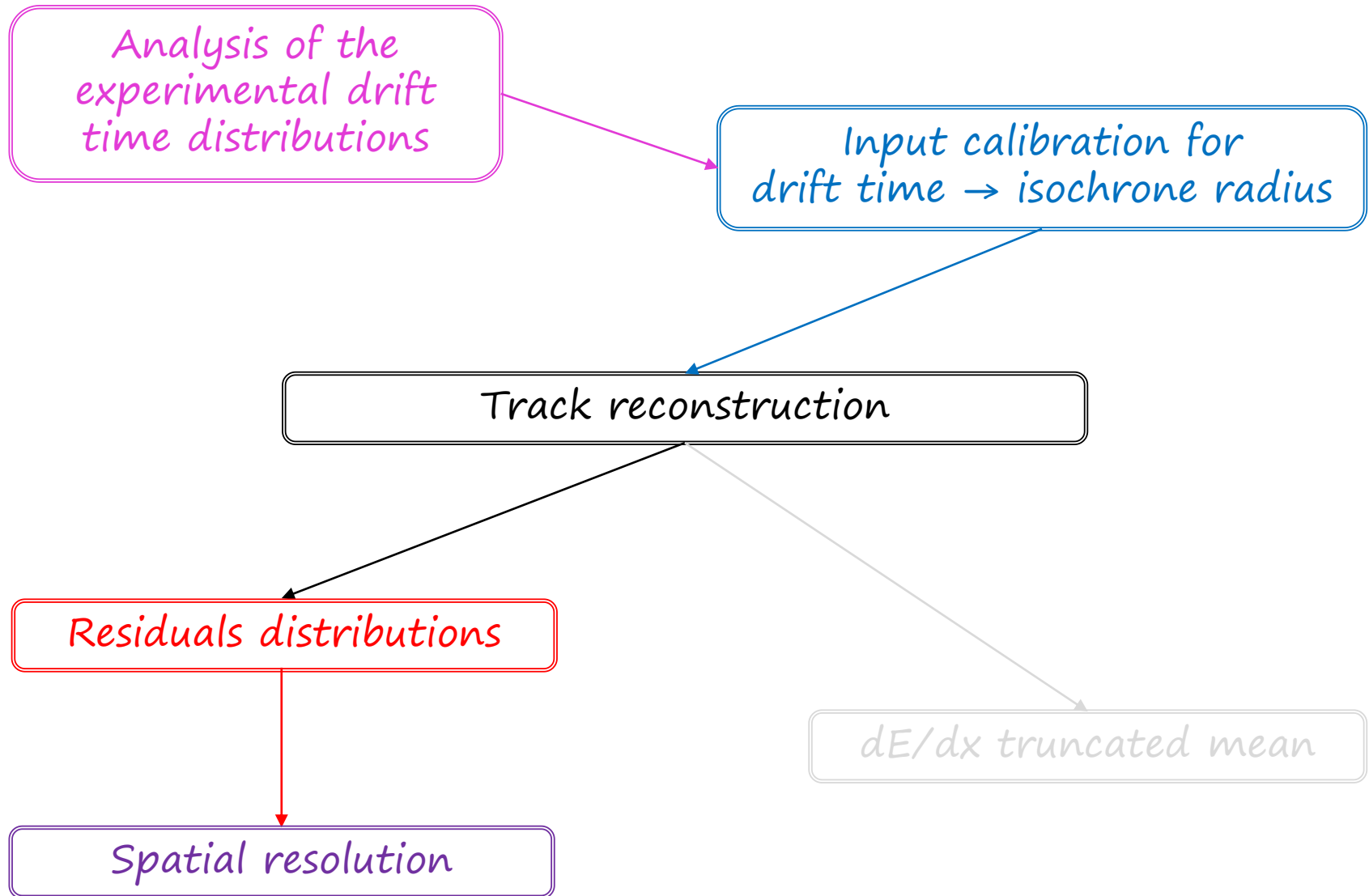
Residuals distributions (V)

for different isochrone radius ranges

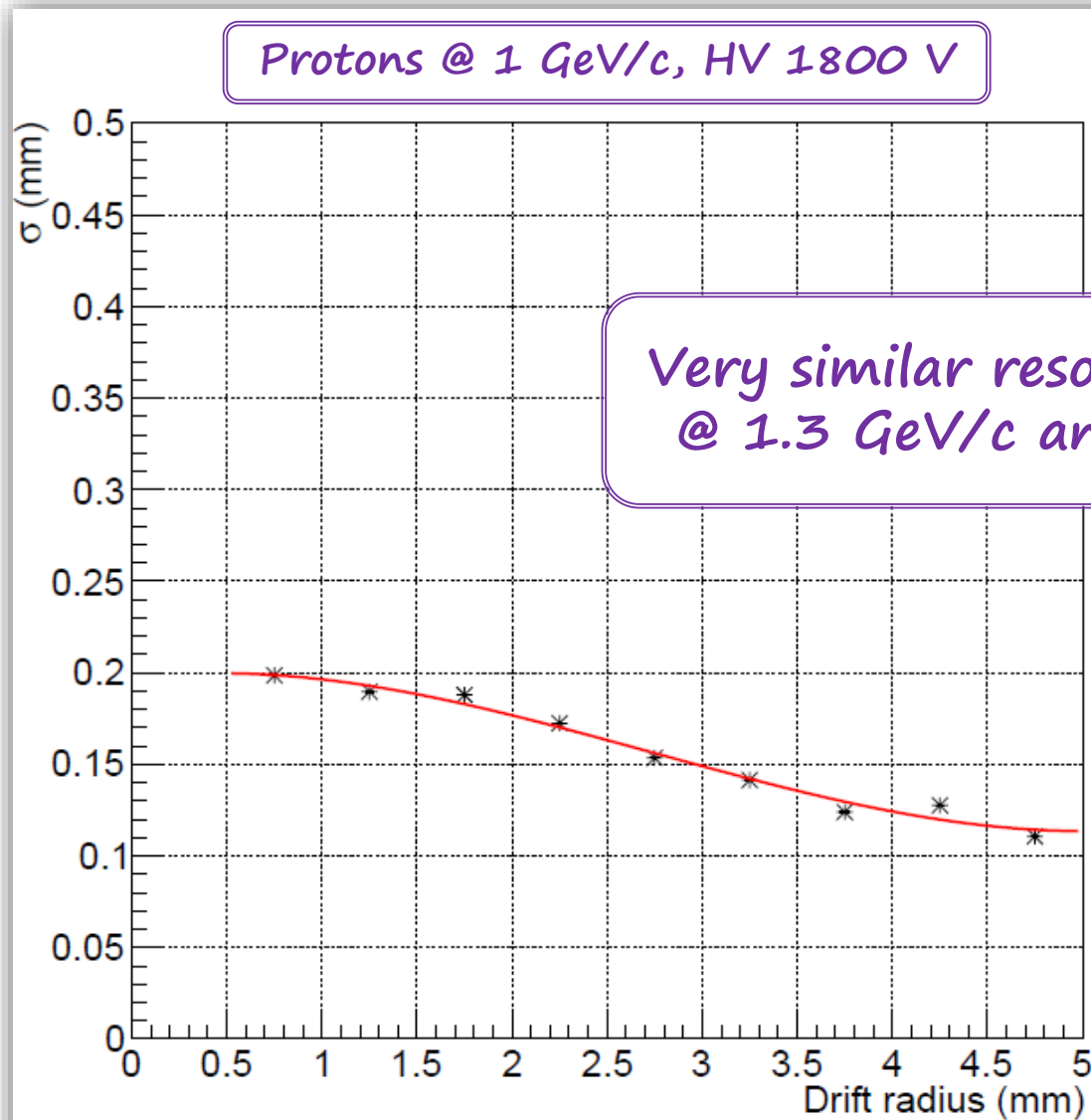


Protons @ 1 GeV/c, 1800 V

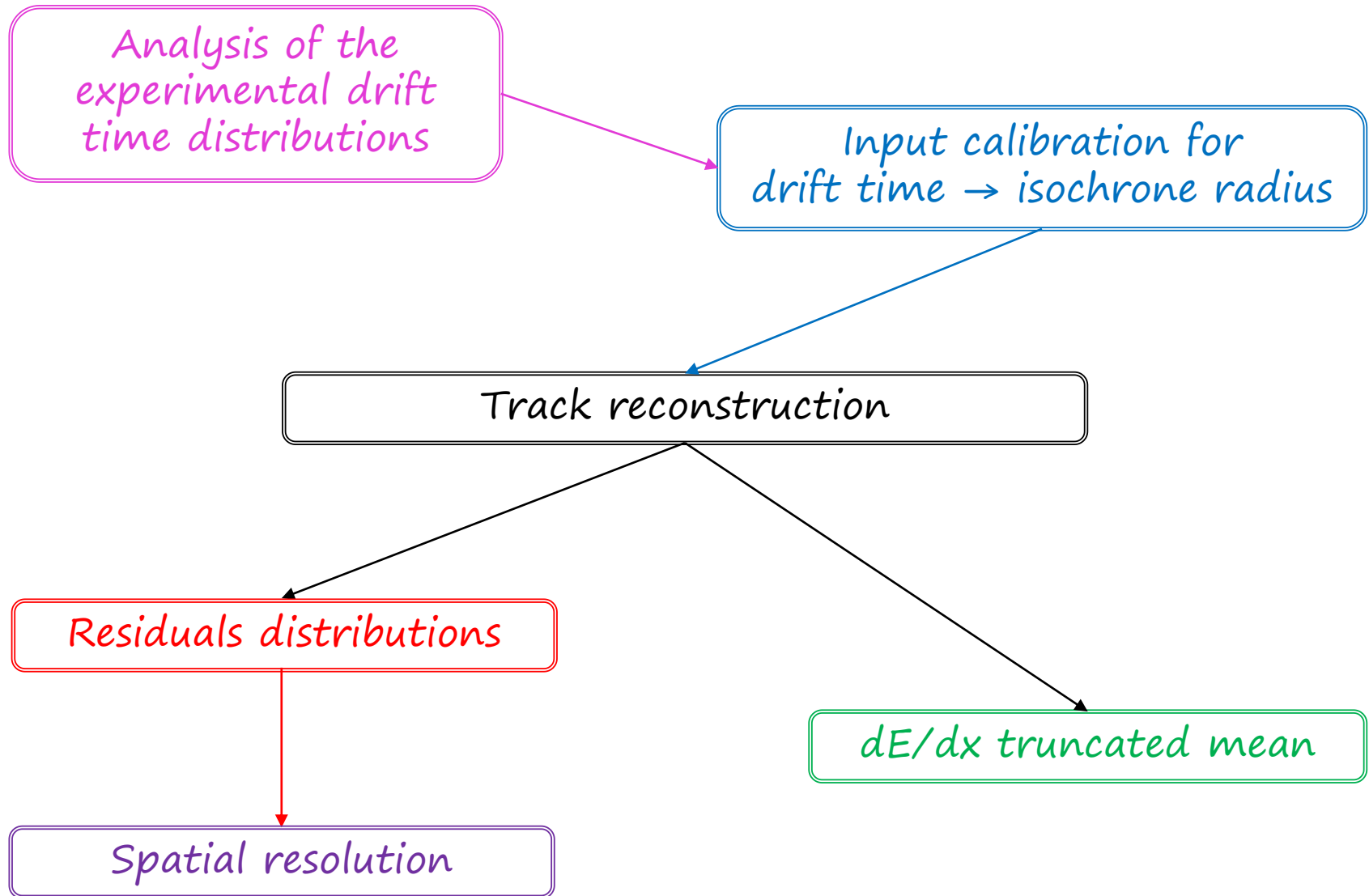
Analysis procedure



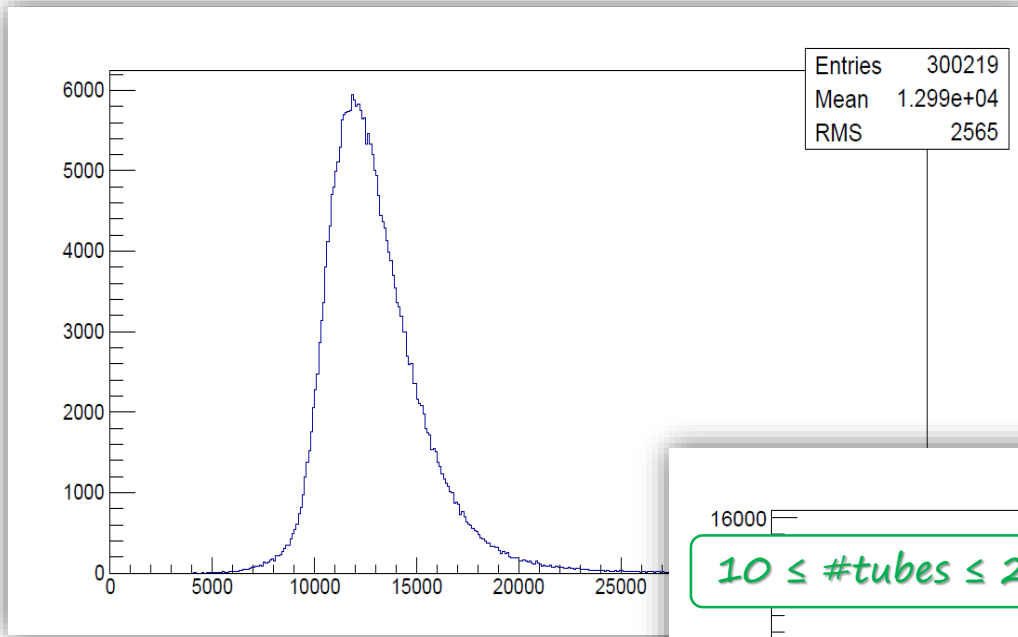
Spatial resolution



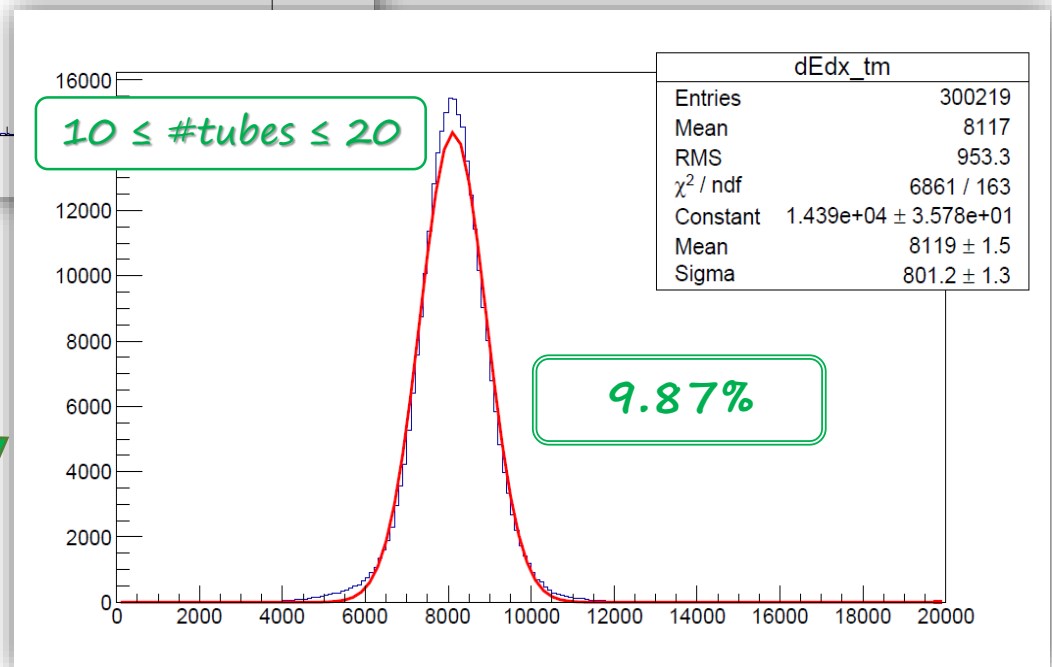
Analysis procedure



dE/dx distribution



Protons @ 1 GeV/c, 1850 V



Truncation
factor: 30%
applied to dE/dx

dE/dx distribution TM 30%

16 tubes

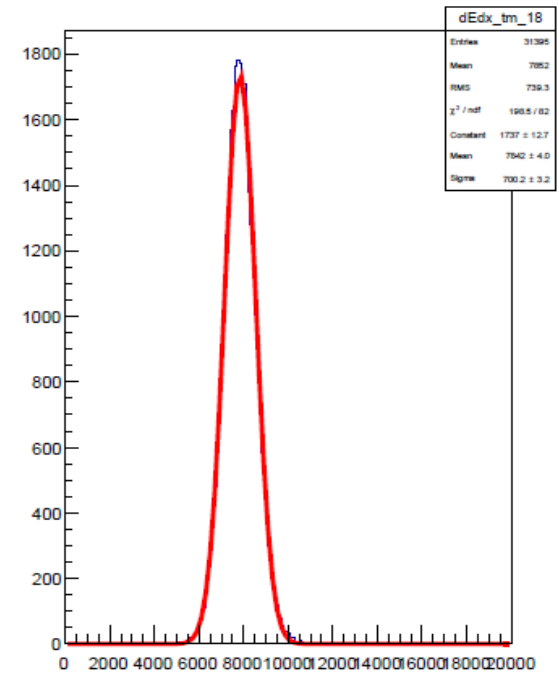
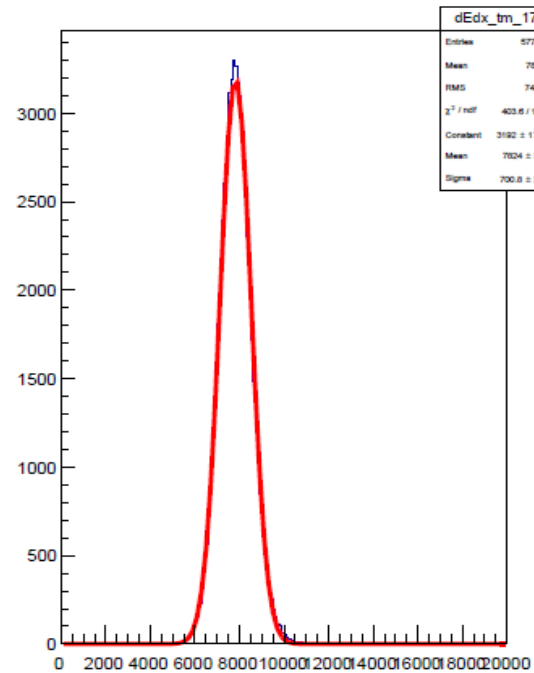
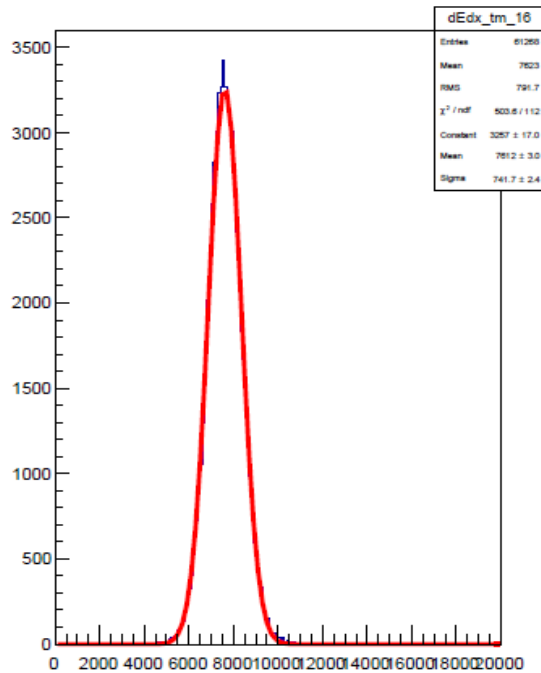
17 tubes

18 tubes

9.74 %

8.96 %

8.93 %



Protons @ 1 GeV/c, 1850 V

dE/dx distribution TM 20%

16 tubes

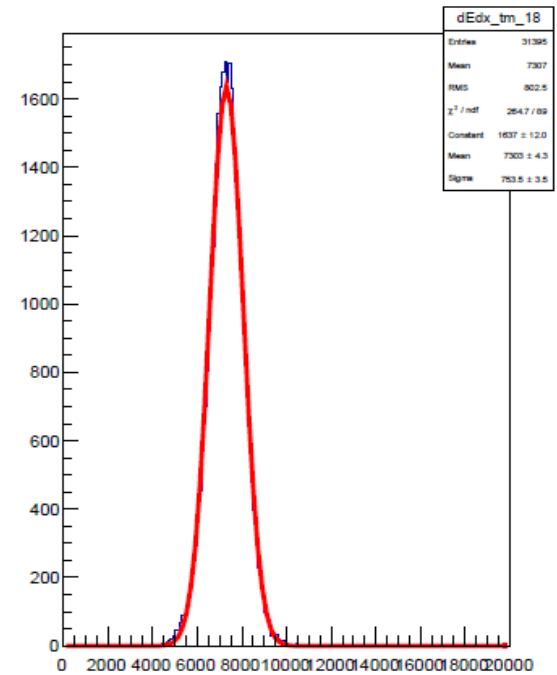
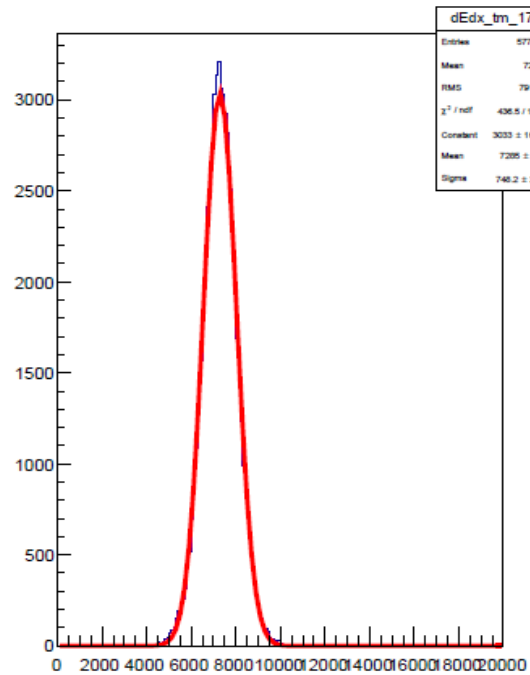
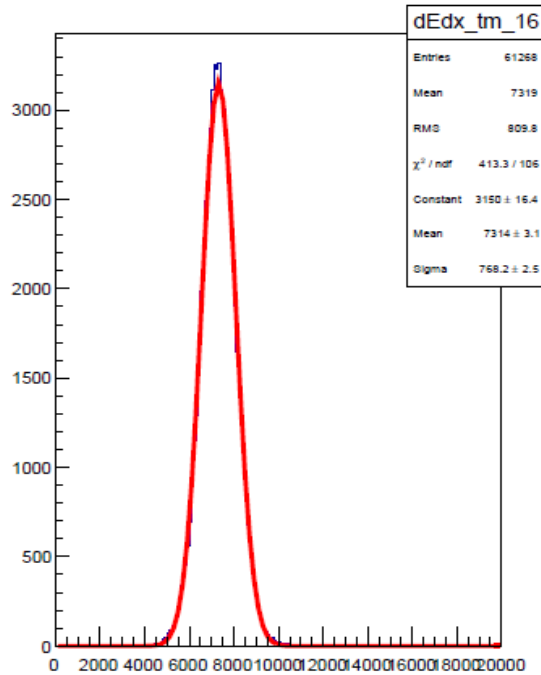
17 tubes

18 tubes

10.5 %

10.27%

10.31 %



Protons @ 1 GeV/c, 1850 V

dE/dx distribution TM 40%

16 tubes

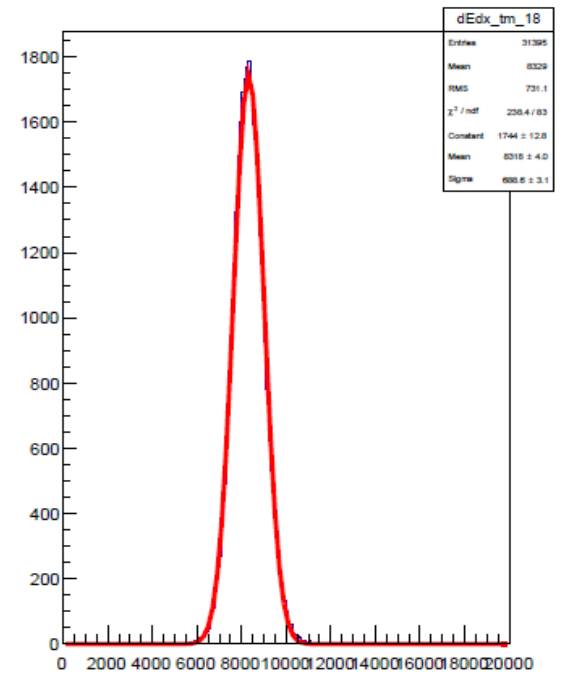
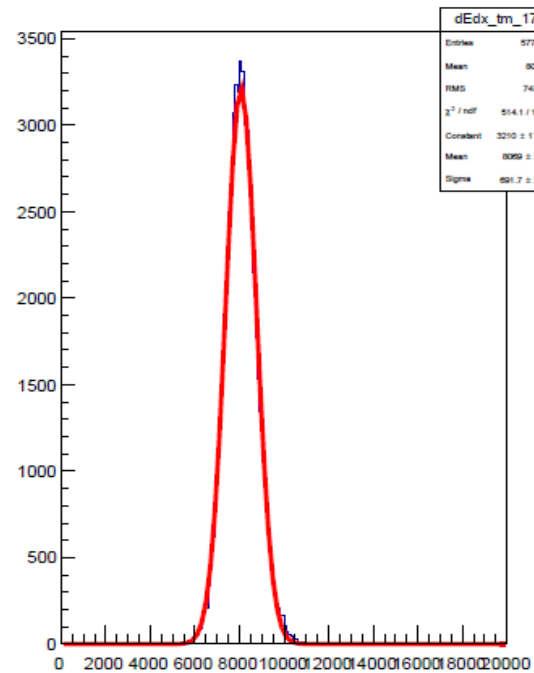
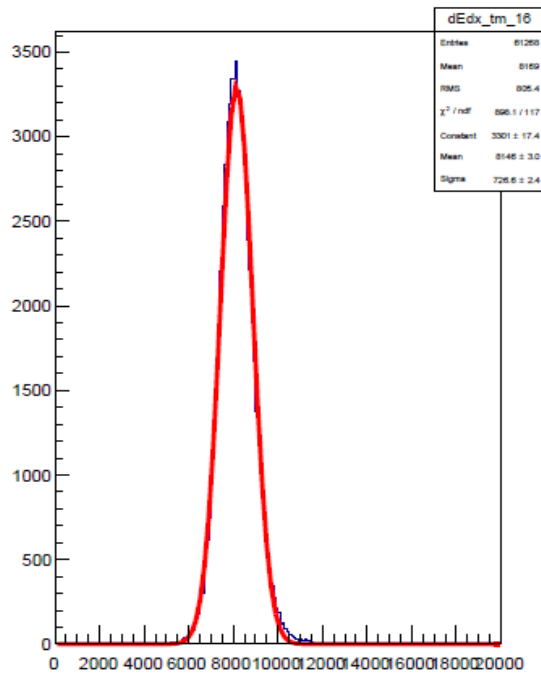
17 tubes

18 tubes

8.92 %

8.57 %

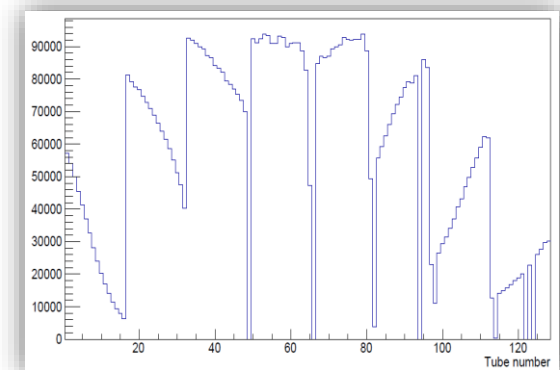
8.28 %



Protons @ 1 GeV/c, 1850 V

Summary & Outlook

- Preliminary analysis of the proton data collected in December 2014 has been shown
- Results are promising
 - Spatial resolution: $\sim 150 \mu\text{m}$ @ 1 GeV/c and 1850 V
 - dE/dx resolution: $\sim 9\%$ @ 1 GeV/c, 1850 V, 17-18 hits
- Starting point for further and more detailed analysis
 - Focus on t_0 determination and $r(t)$ calibration
 - Selection of a few «good» channels
 - Tracking with uniformly illuminated layers (layers 4-5)
 - Iteration of the $r(t)$ calibration
 - Tracking with the whole detector



Thank you!