Time over Threshold study for the ASIC +TRB FRONT- END

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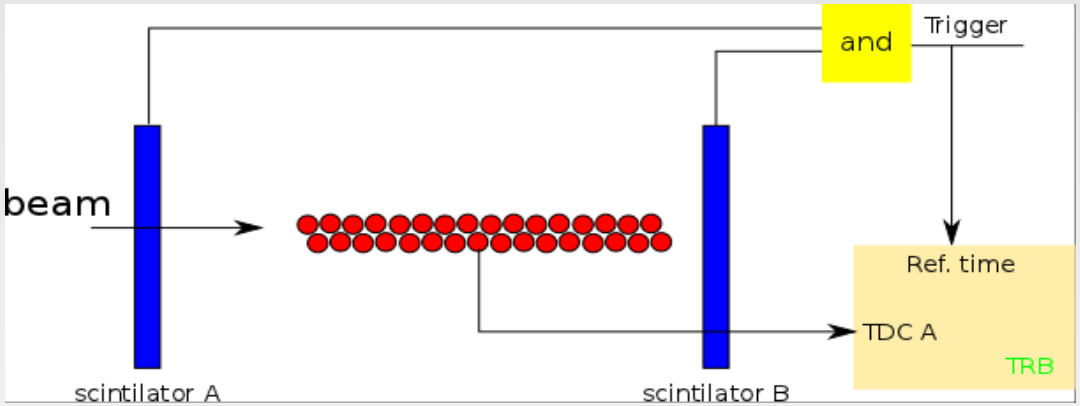
The Setup

September Juelich STT data

- Beam momentum 900 MeV/c protons
- Beam intensity ~30 kHz
- HV from 1700V to 1900V
- 32 Straws
- Cracow ASIC setup
- TRB readout

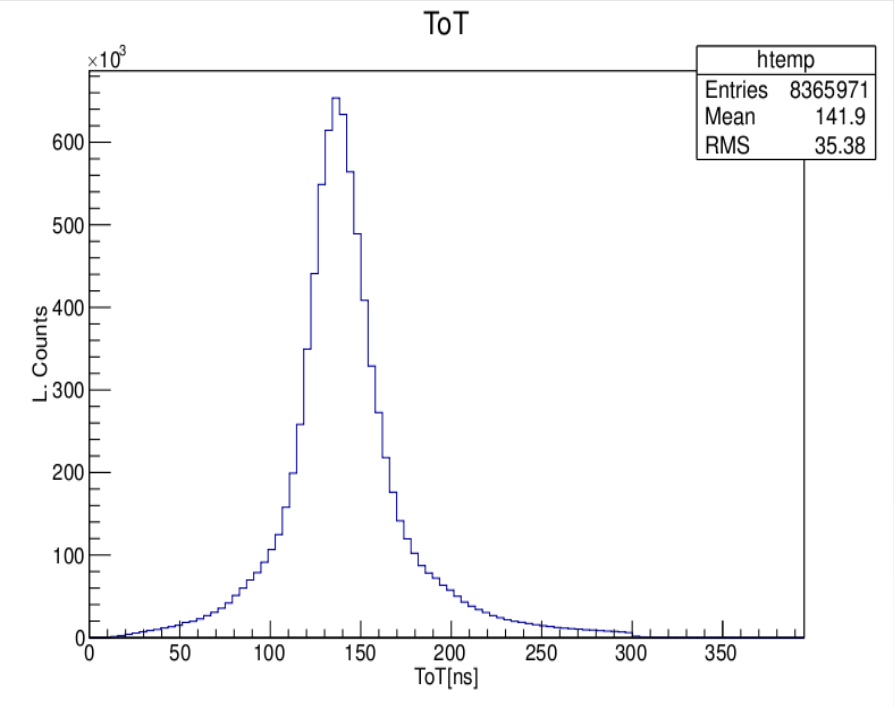


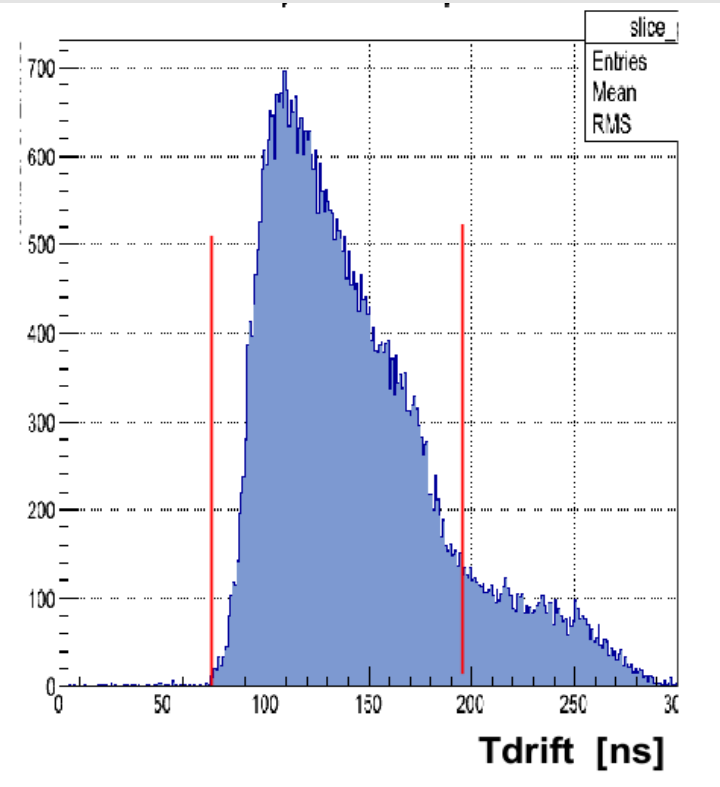
December Juelich STT data

- Same geometry and setup
- Beam momentum 600 MeV/c
- Beam intensity 1MHz
- HV from 1700 V to 1900 V

The data

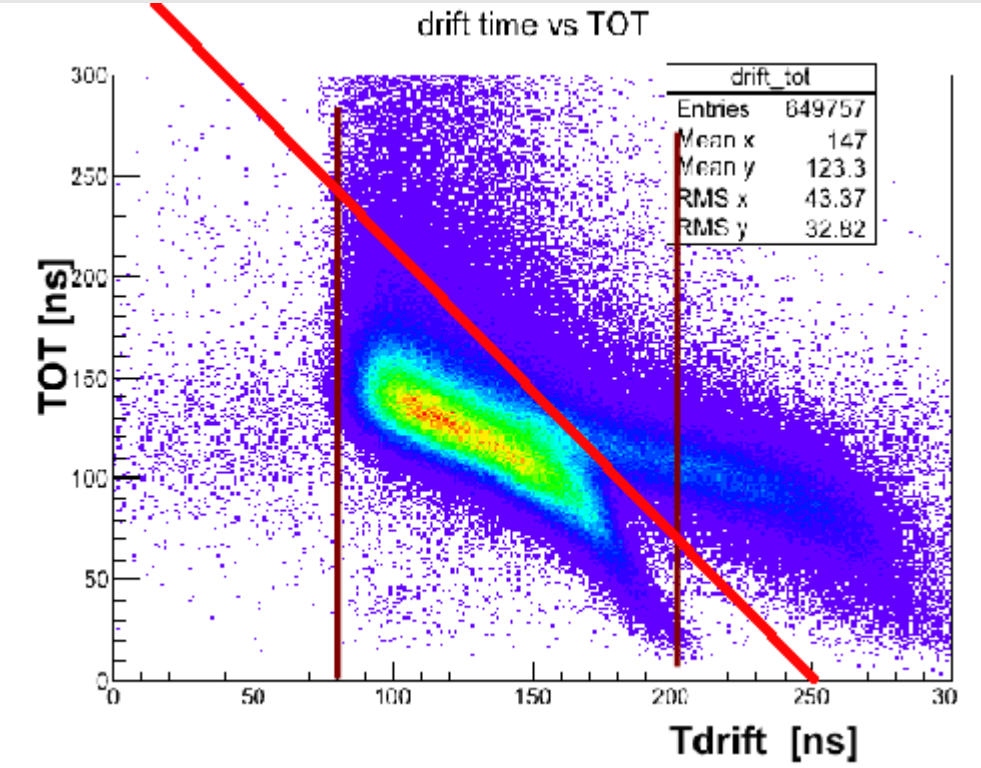
- ToT & electron drift spectra taken from raw data

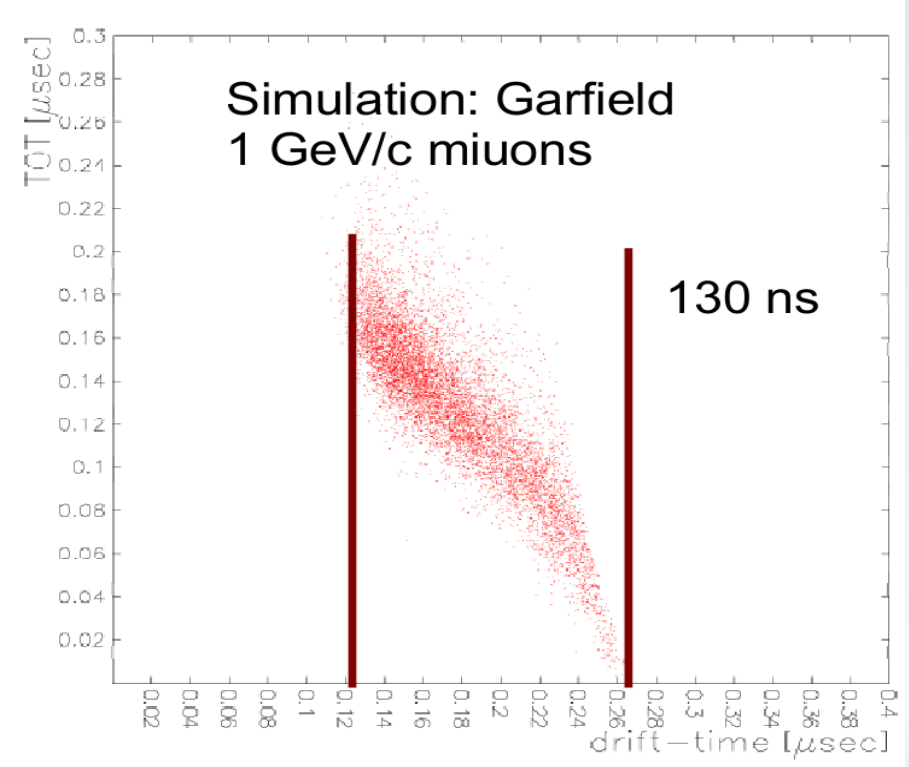




ToT vs tDrif

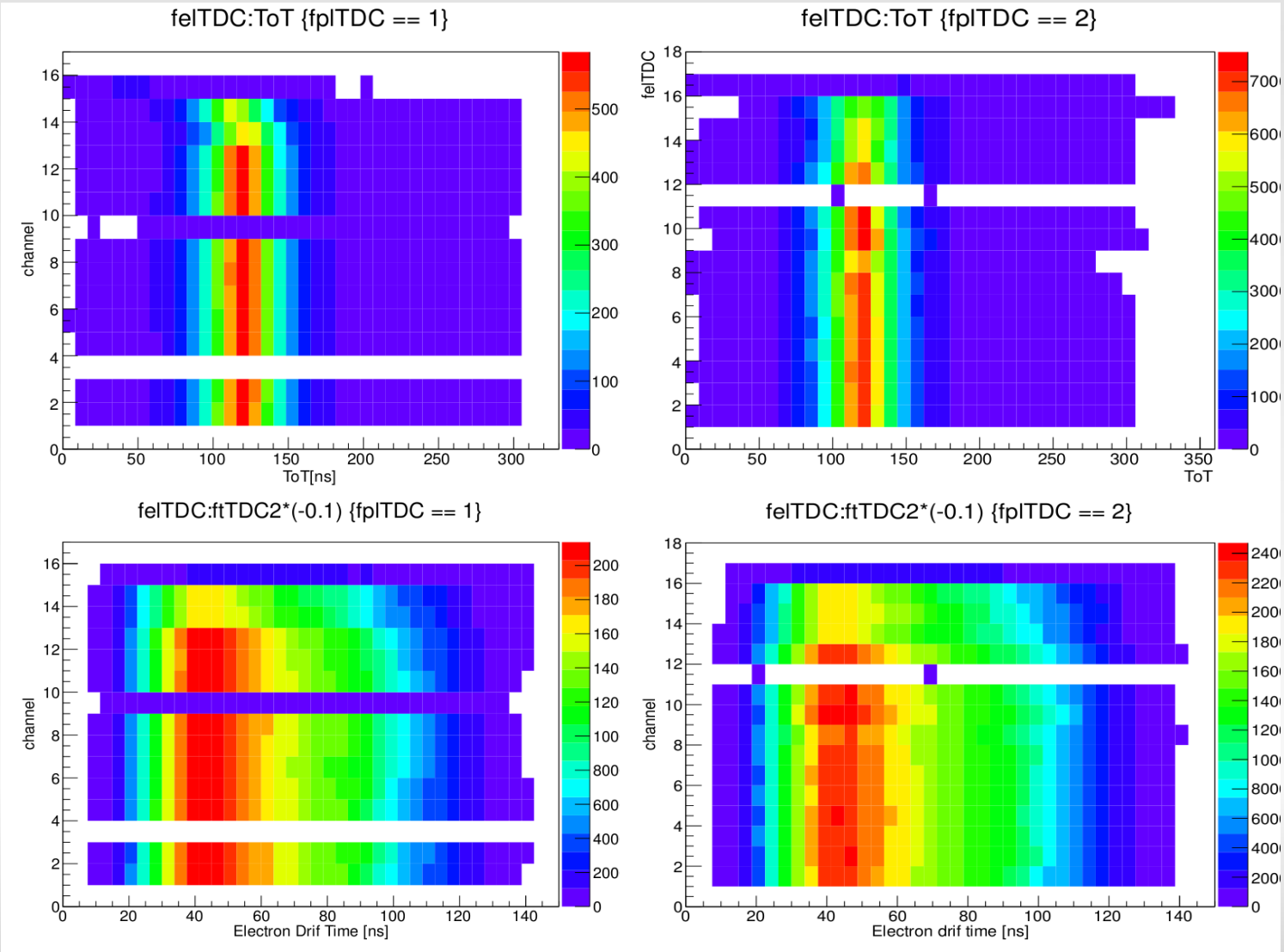
- Second background structure visible
- Simple graphical cut to reject background





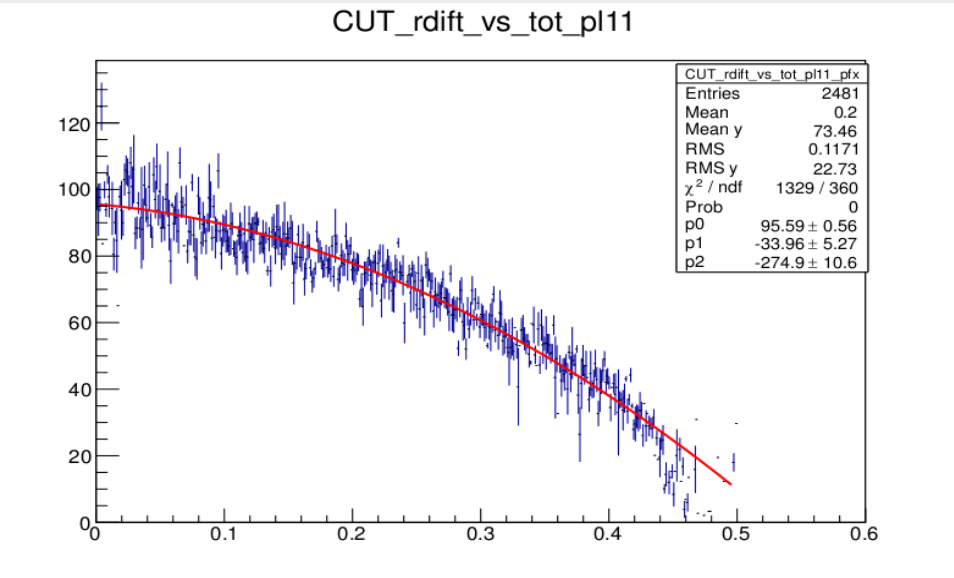
1st Step

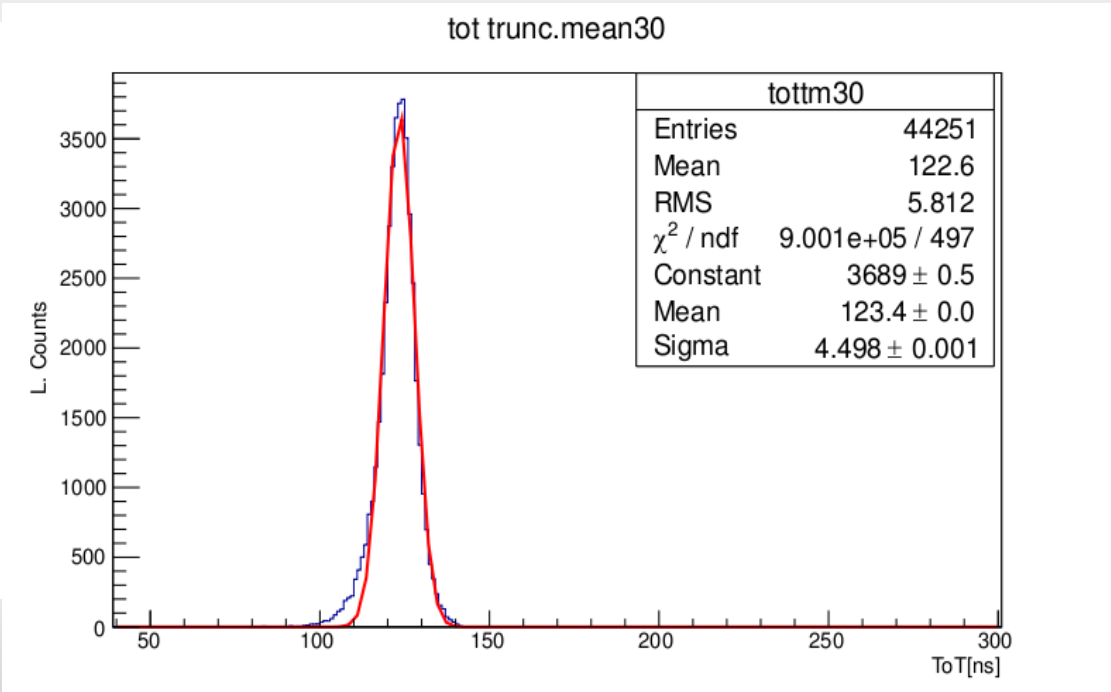
- ToT and tDrift aligned for all channels and HV settings



2nd Step

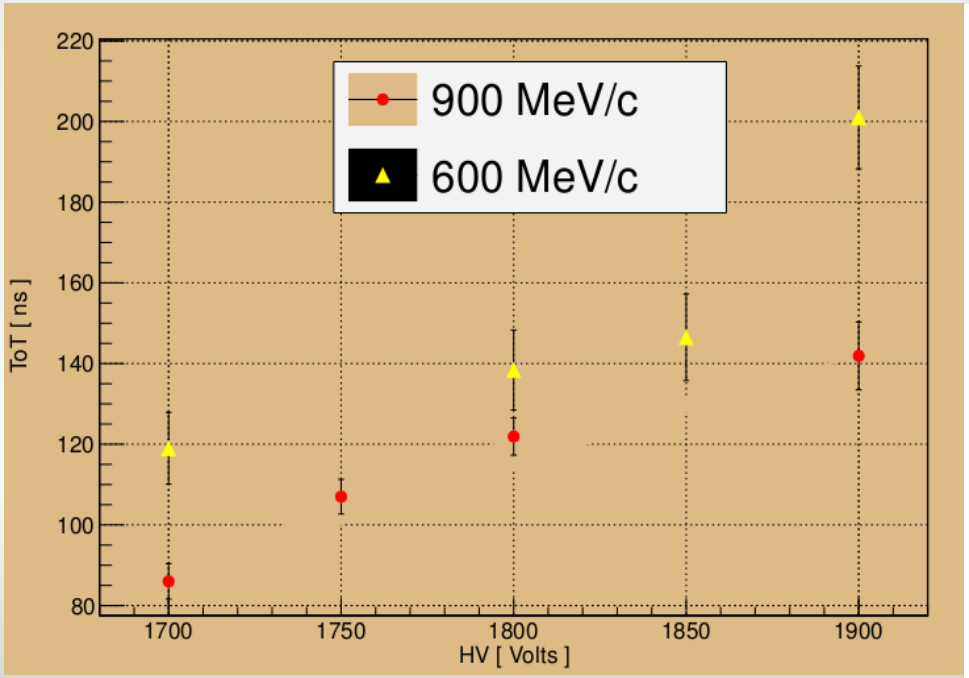
- Performing the ToT(rdrift) calibration
- Example ToT spectrum after calibration done for 1800V p = 900MeV/c (12 straws)
- σ(ToT)/ToT = 3.6%

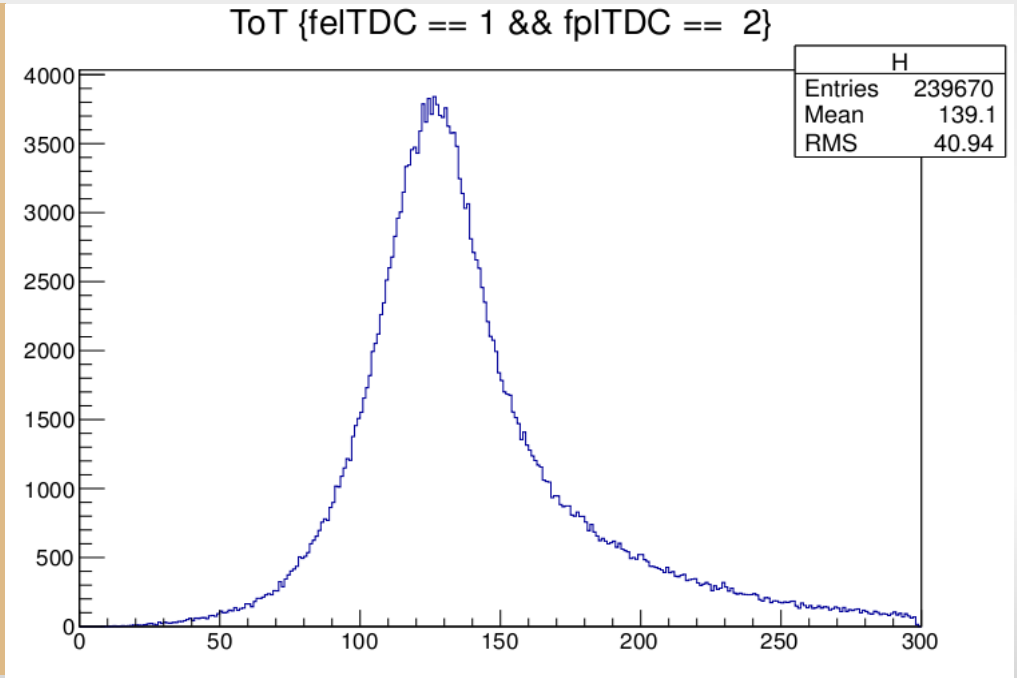




Data Analysis

- Mean value of the sum after 12 straws
- Trunckated mean was preformed by cutting off 30% the highest energy events
- ToT after calibration
- Mean & Sigma calculated using an Gaussian fit
- There is a difference of a 1.6 factor in dE/dx for 600 MeV/c and 900 MeV/c
- Only one layer was taken in to account





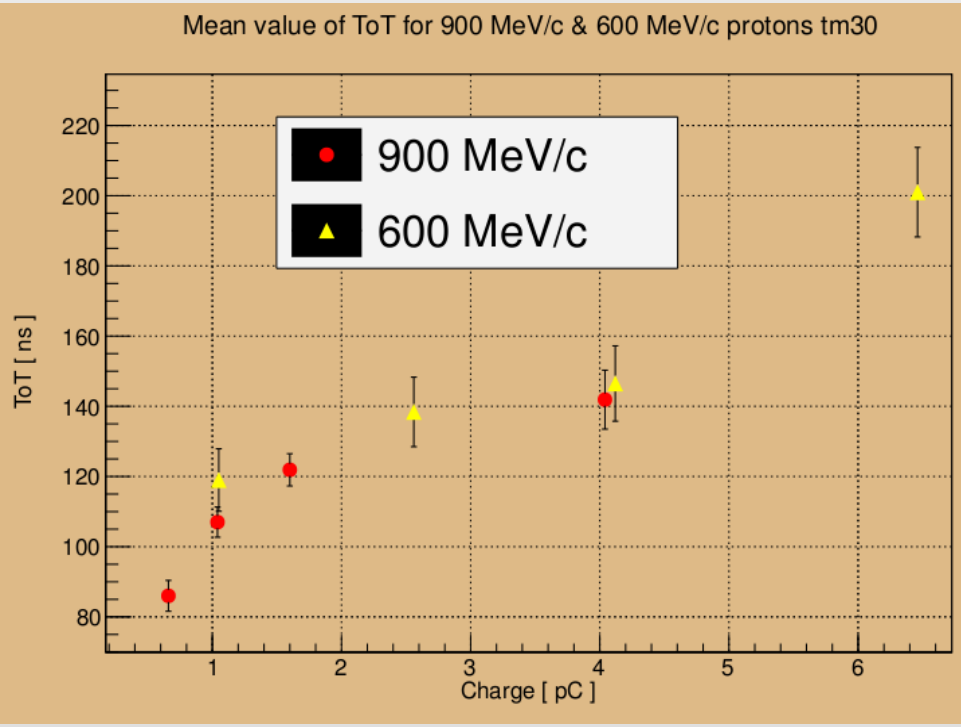
ToT vs charge

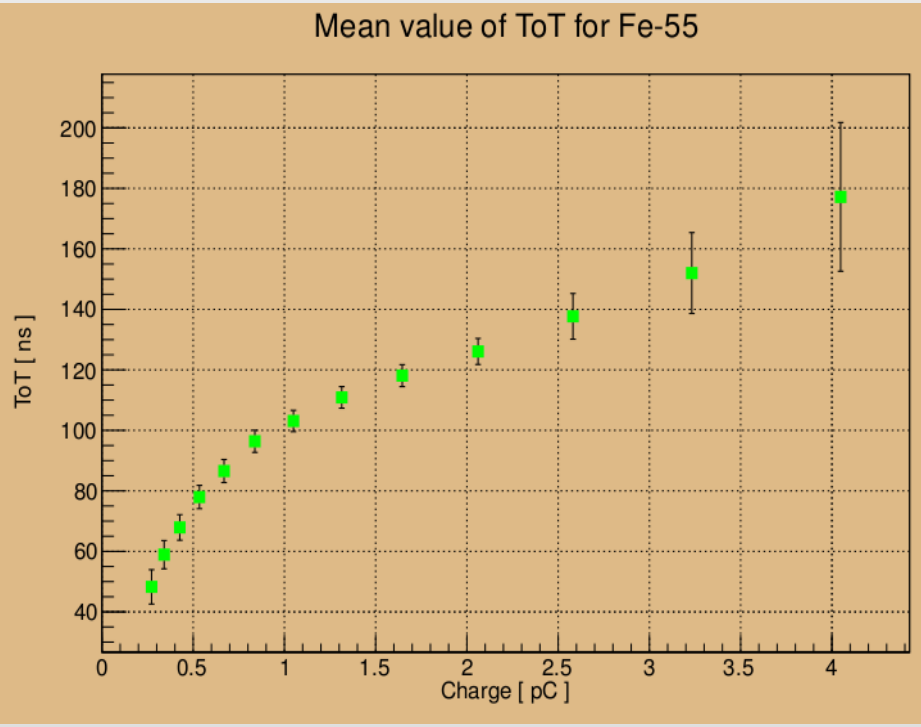
- Charge was calculated using:

  G=exp(0.009xU – 5.3525) ,G – gas amplification ,U- Voltage

  assuming 200 primary electrons for 900 MeV/c (multiplied by a factor o 1.6 for 600 MeV/c)

- ToT vs Charge done for Fe-55 (dE/E = 9.8% for Q=0.42 pC) ,(dE/E = 11% for Q = 1.64 pC)
- ToT vs Charge done for protons (dE/E = 10% for Q = 1.04 pC protons 900MeV/c), (dE/E = 28% Q = 2.6 pC protons 600 MeV/c & 900 MeV/c)
- Mean value taken for 12 straws

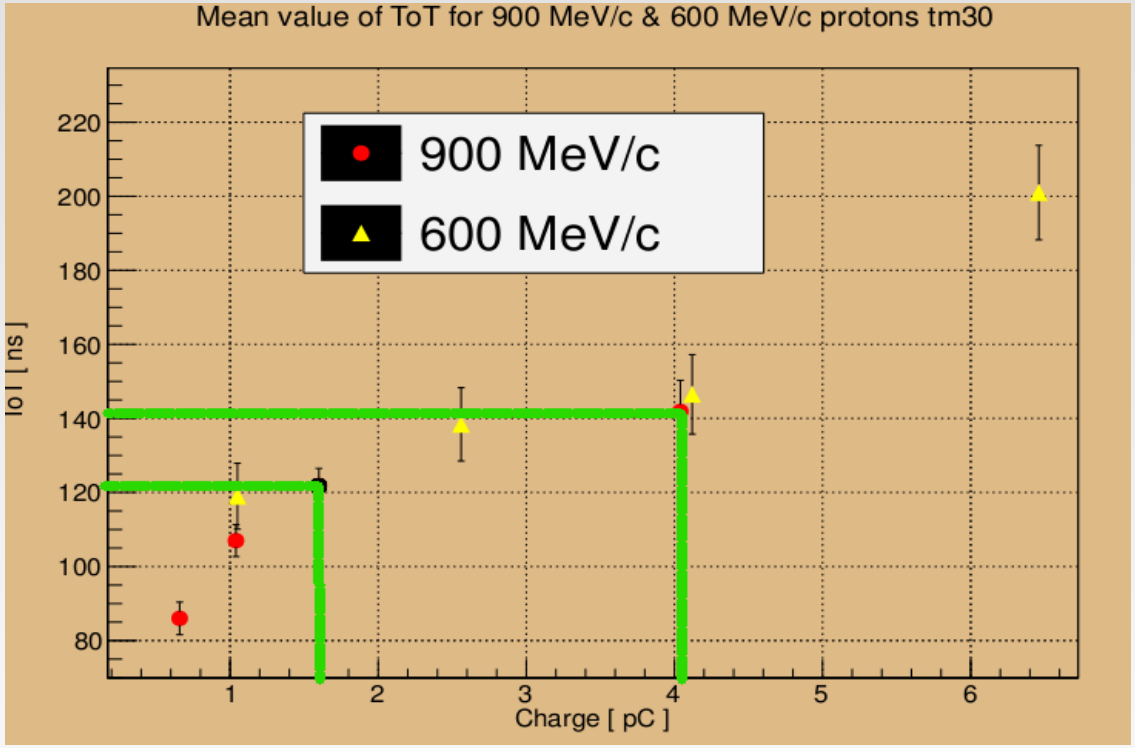




Energy resolution

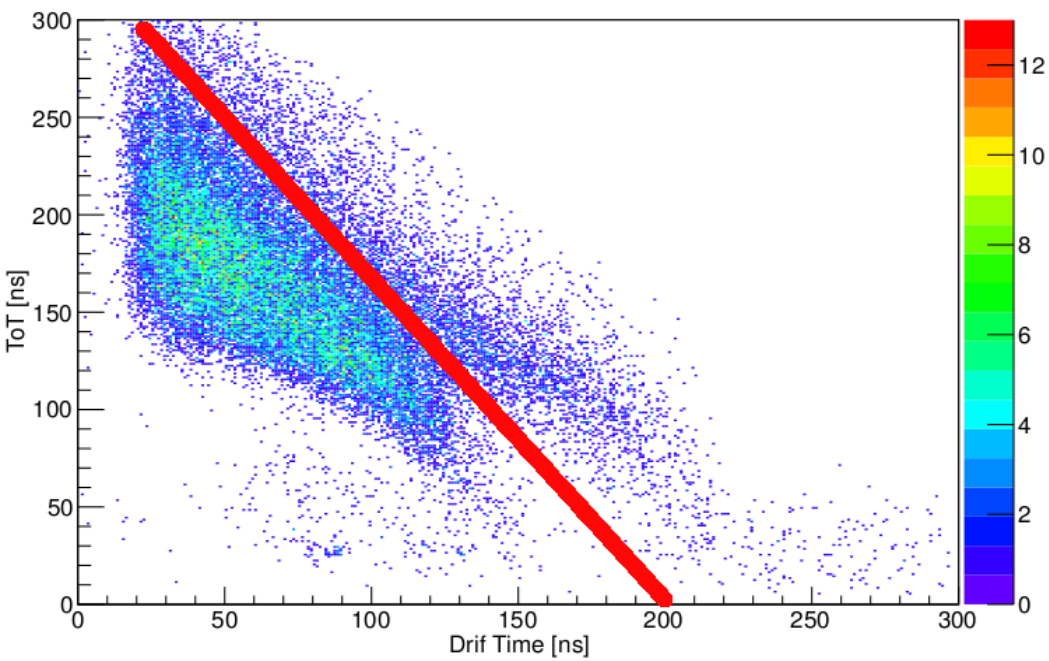
- The calculations were done by:

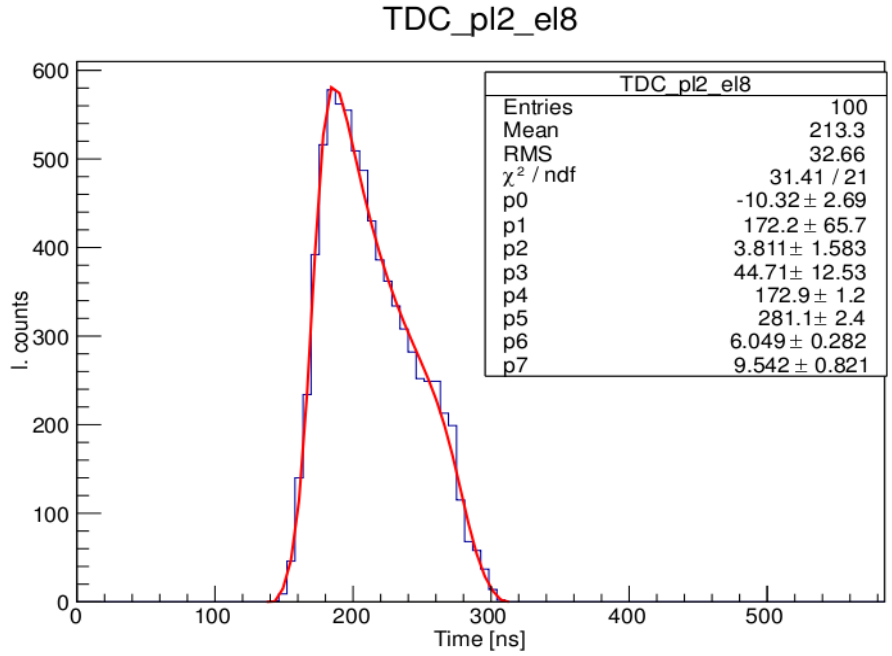
$$\frac{\delta E}{E} = \frac{\sigma ToT_1}{ToT_2 - ToT_1} * \left(\frac{Q_2 - Q_1}{Q_1}\right)$$



Spatial Resolution Study

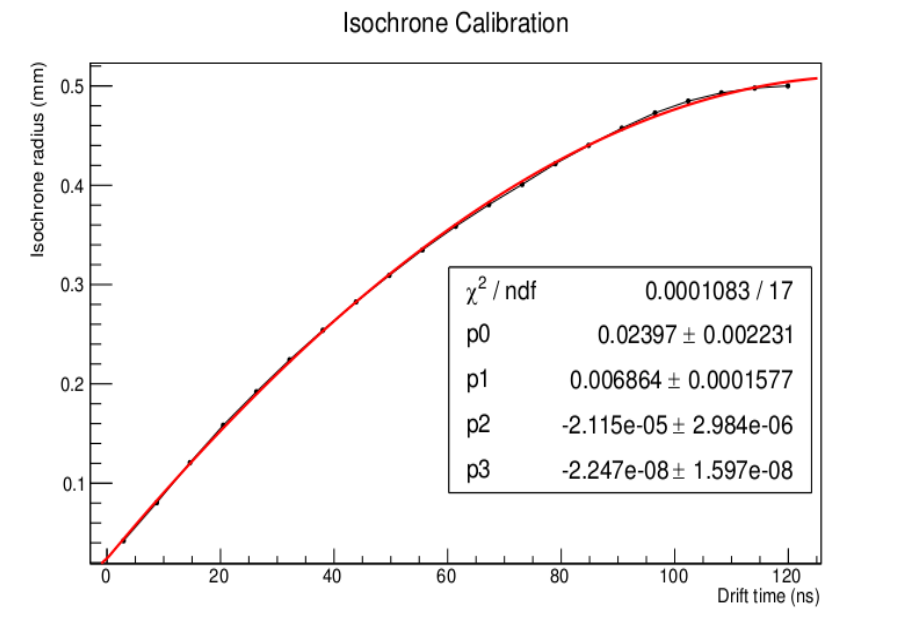
- A pattern was chosen: only 120ns/130ns events taken in to account
- Events related to second structure/background were removed as shown on fig below
- Tracking was preformed for all layers





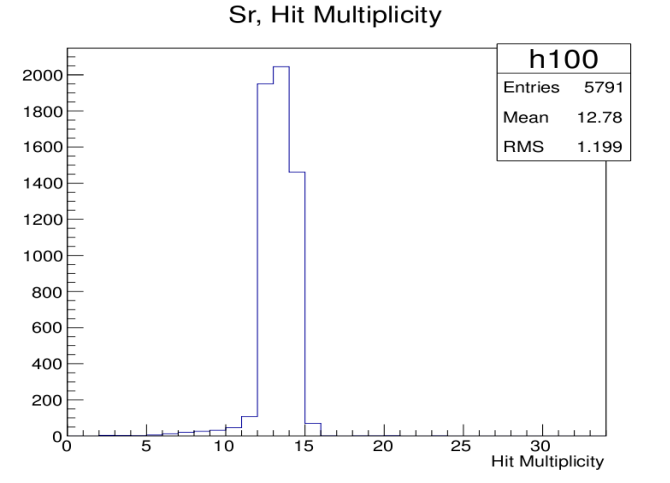
Calibration

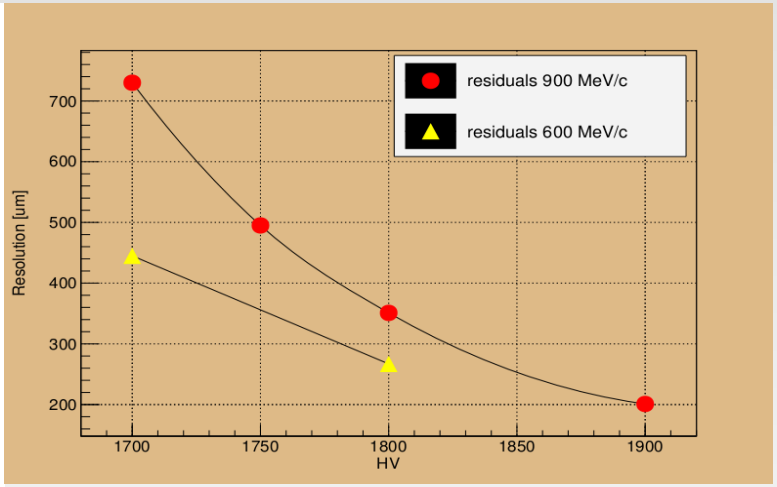
- Uniform irradiation methode was used
- A D(t) calibration was preformed



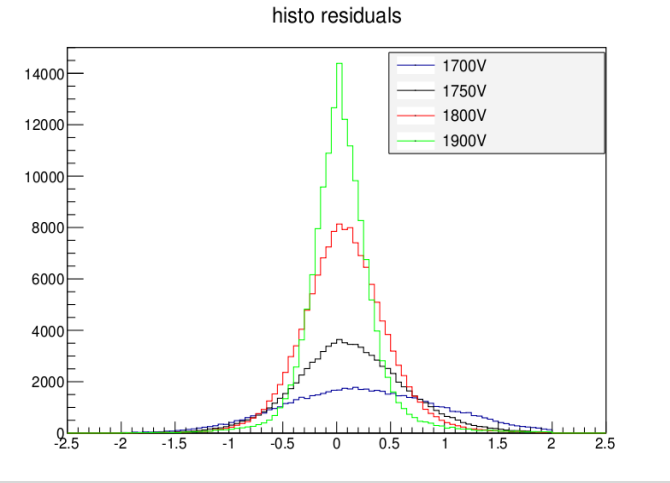
3rd Step, a track reconstruction procedure was done for each HV setting

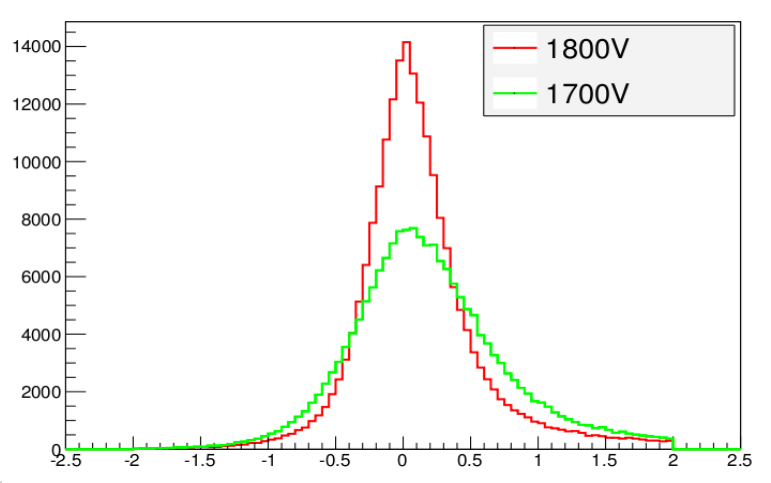
- Calculating the track multiplicity
- Residua distributions were made to calculate the spatial resolution (Gaus function was fitted and the calculated sigma is the valu of the spatial resolution [um])
- Only track with more then 11 hits were taken under consideration





Warnings: only 25% of tracks reconstructed





Backup Slides

Background

- Tdrif spectrum calculations for 1 layer
- 130 ns drift time, but background present