COMPASS

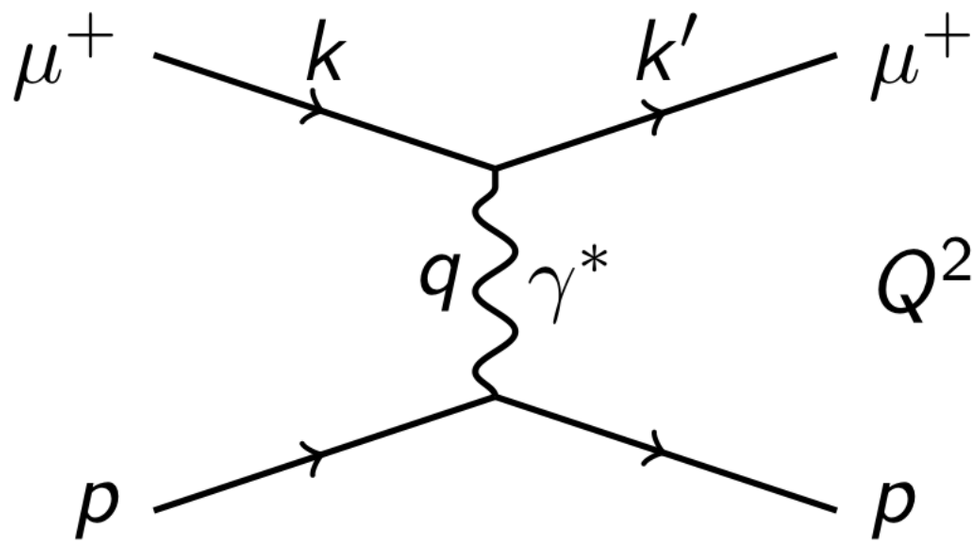
Weekly Meeting

Proton Radius Measurement
Test Beam 2018

Friday, 20. April 2018

Christian Dreisbach

Proton Radius Measurement



$$Q^2 = -q^2$$

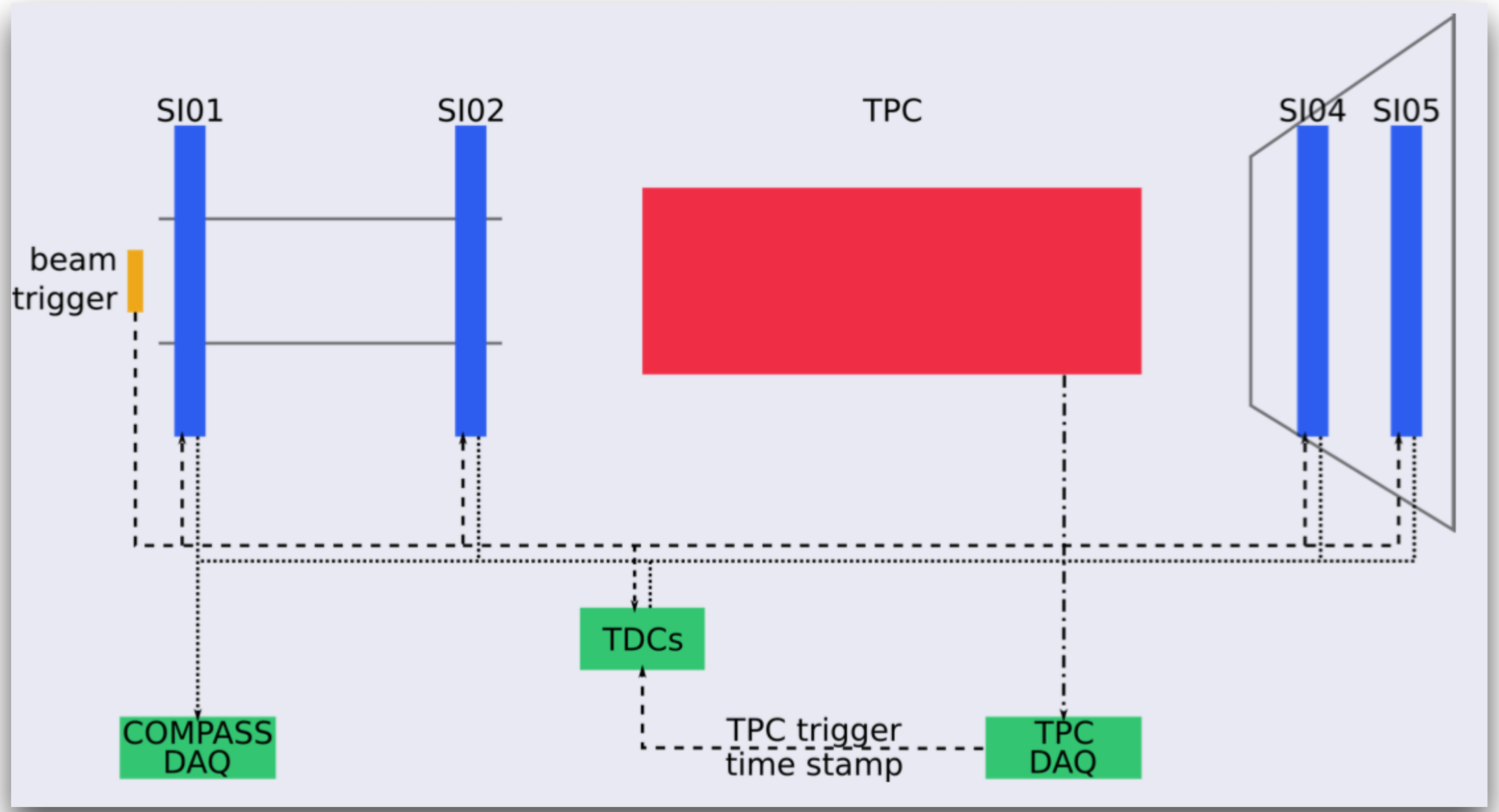
- elastic scattering of muons off a proton target
- measure Q^2 spectrum over wide range: 10^{-4} to 10^0 GeV^2/c^2
  - extract Radius from its shape
- muon scattering angle between 100 μrad and 10 mrad
- proton recoil energy between 100 keV and 500 MeV

➡ <u>challenge</u>: identify elastic reactions

Test Beam Goals

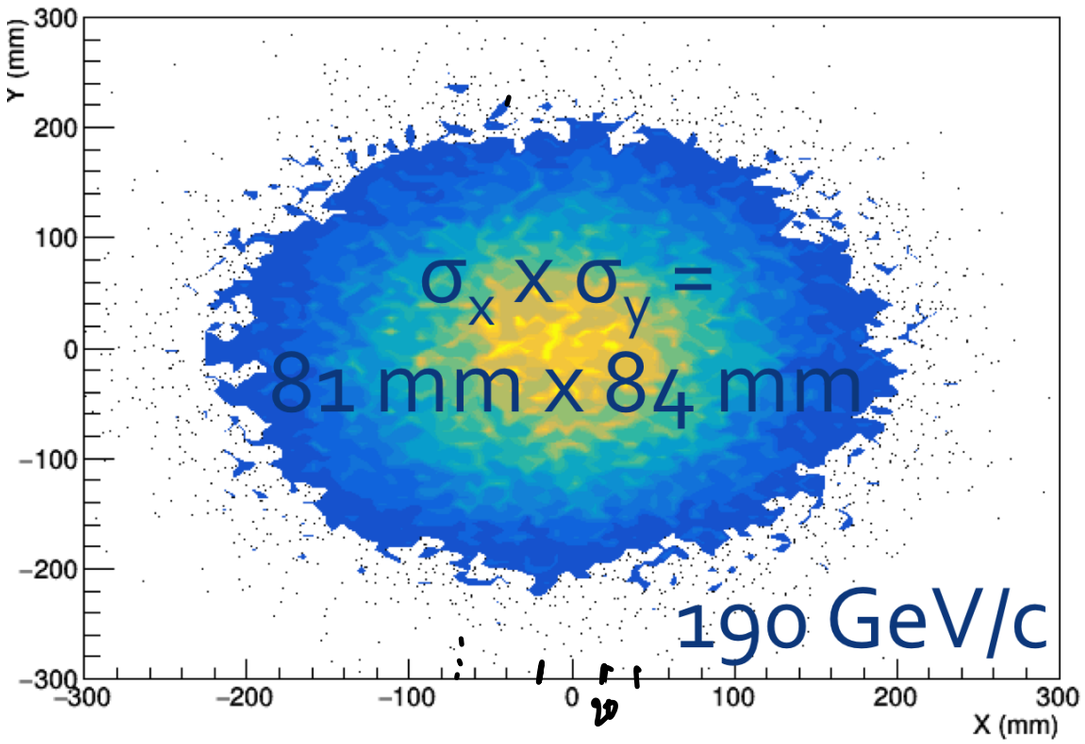
- performance of TPC as active target in muon beam
  - beam rate studies - background and readout
  - possibility to identify candidates for recoil protons
- correlate events in silicon detectors with TPC events
  - possibility of using time stamps and tracking
- collect experience for the future measurement

Test Beam Setup

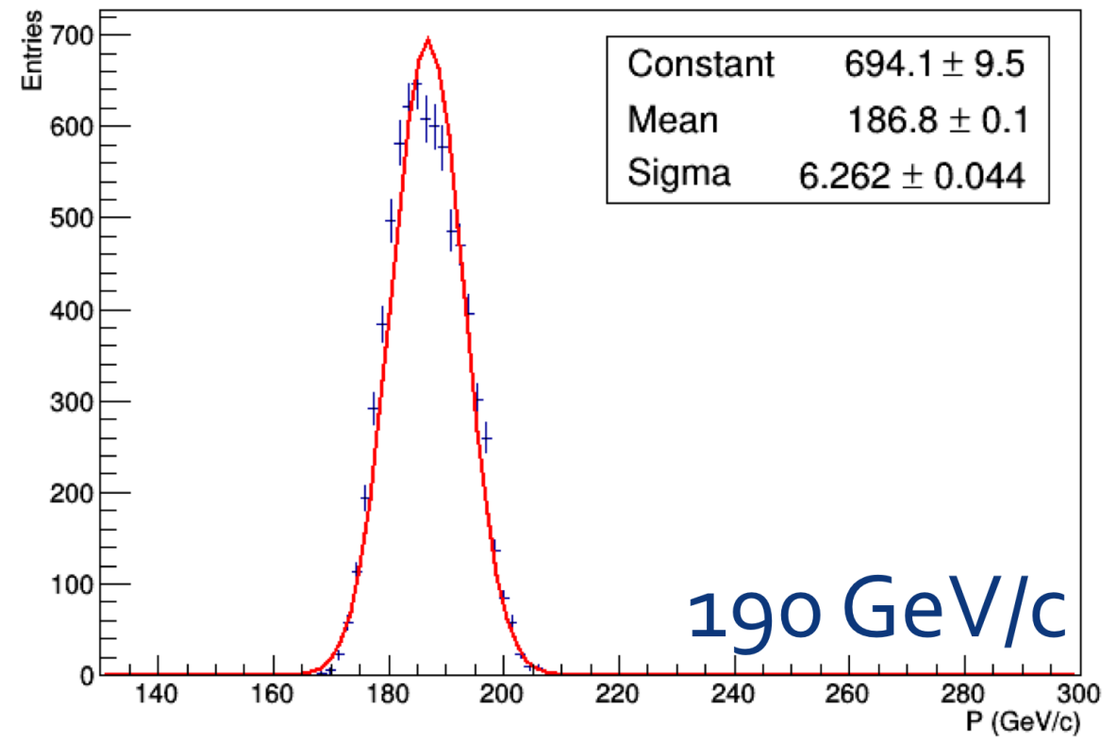


Test Beam Properties

Simulations of beam at the test experiment position (J. Bernhard)



muon beam distribution



muon beam momentum

- beam distribution at 190 GeV/c: $\sigma_x \times \sigma_y = 81$ mm $\times$ 84 mm
- beam momentum at 190 GeV/c: $p = 186.8$ GeV/c with $\sigma = 6.2$ GeV/c

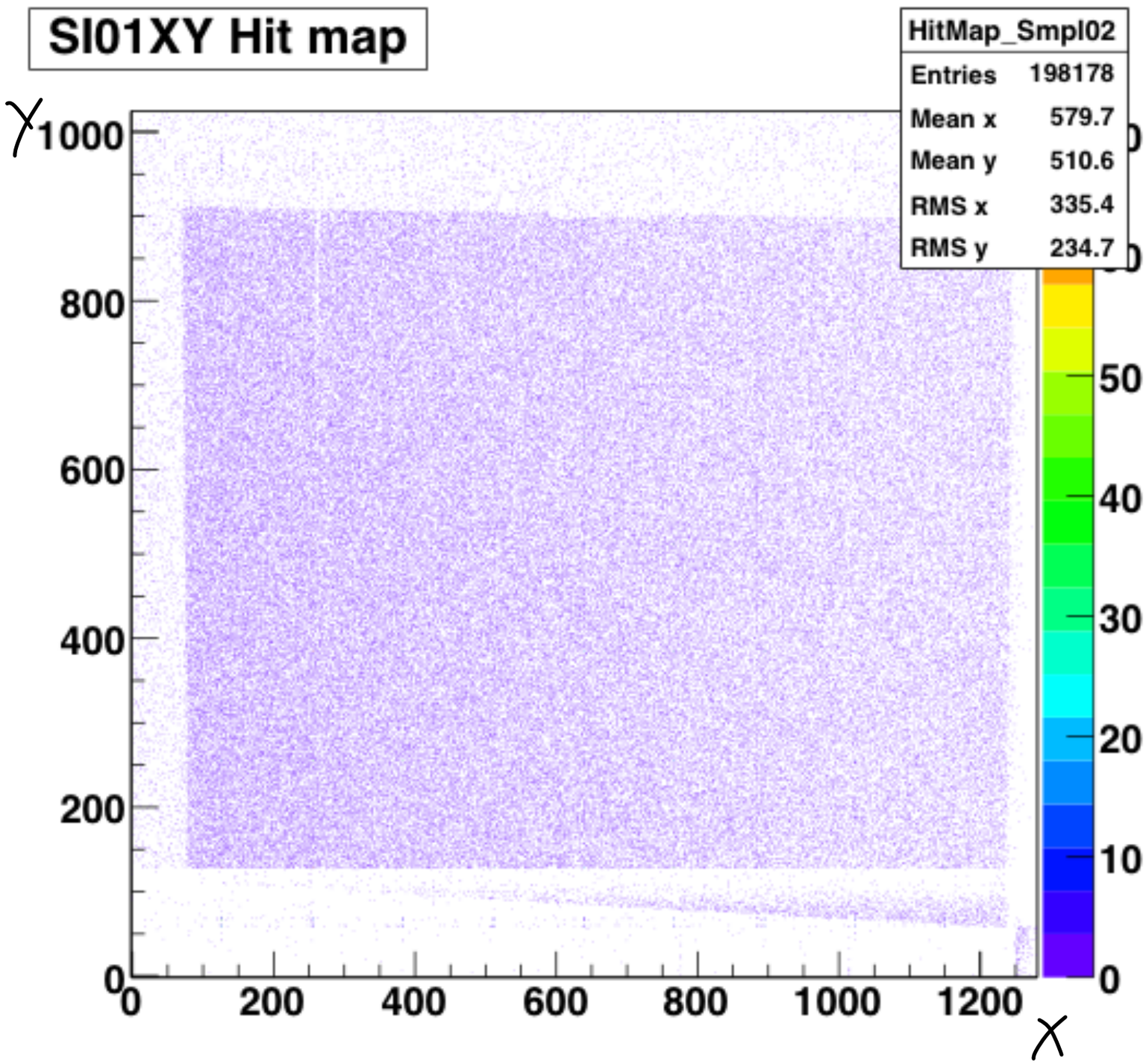
Test Beam Setup

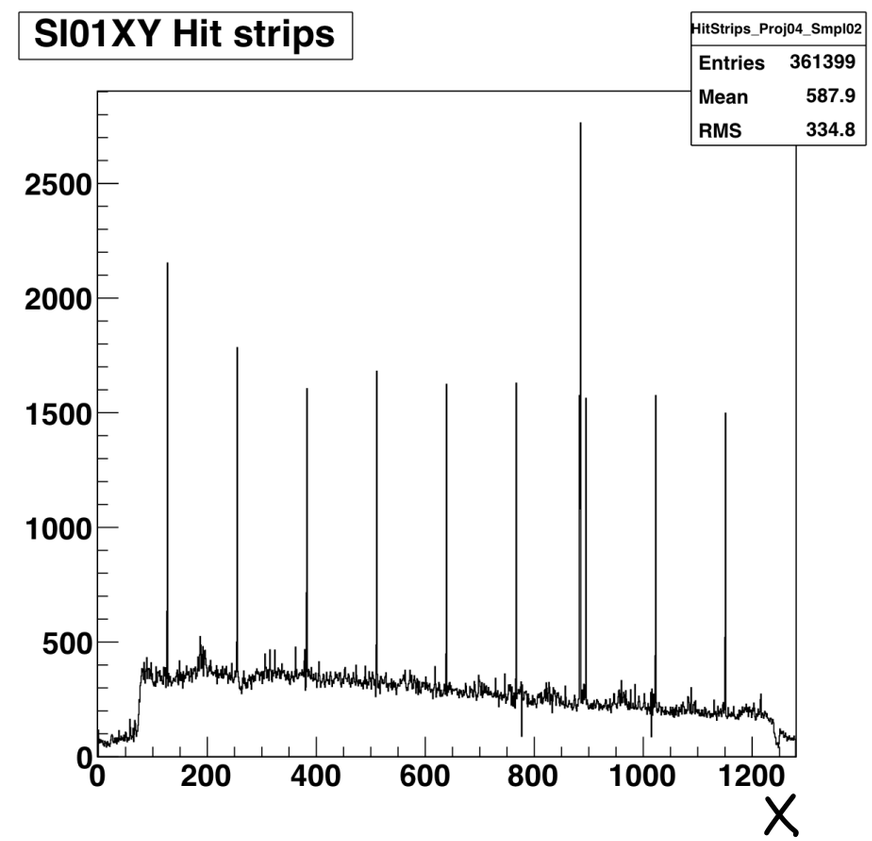
Test Beam Trigger

- active area: 6.4 cm x *4.8* cm (~Silicon)
- three trigger elements:
  - one segmented trigger elements (movable)
  - two normal scintillator elements (fixed)

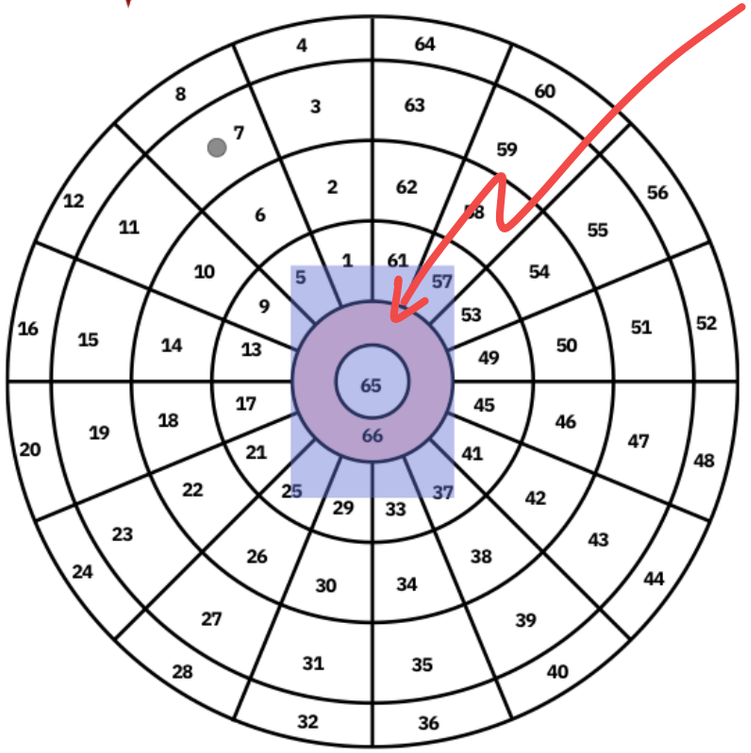
➡ estimate for beam rate

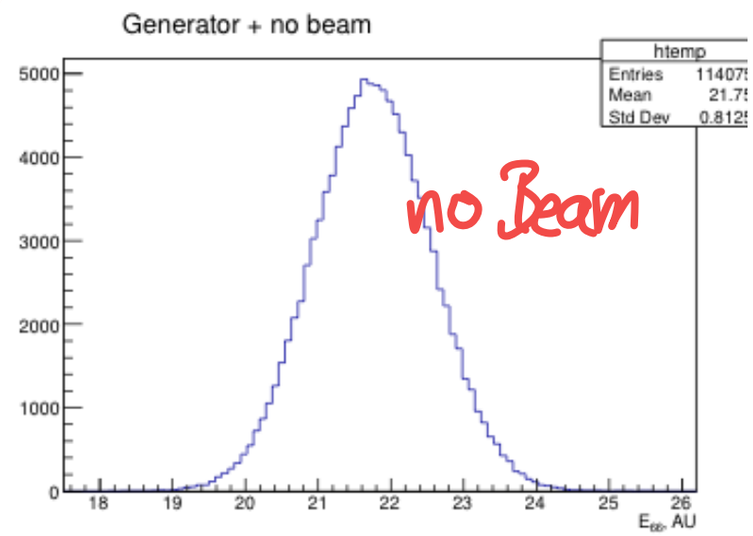
Trigger and Silicons

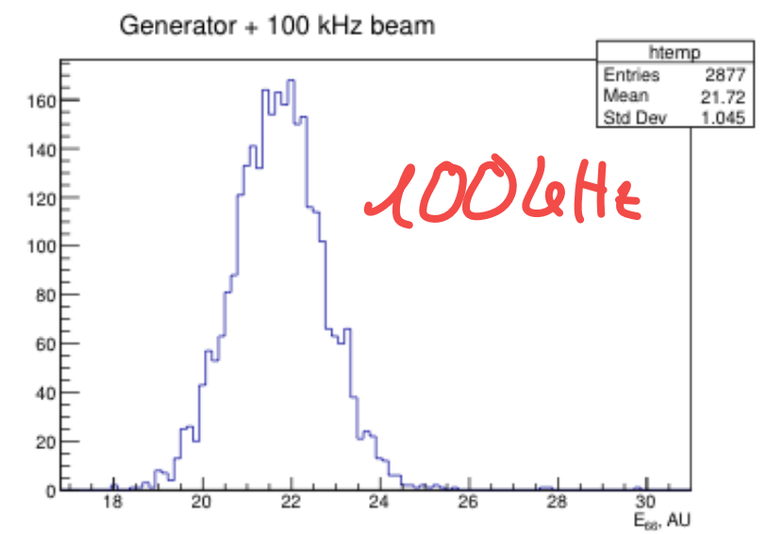


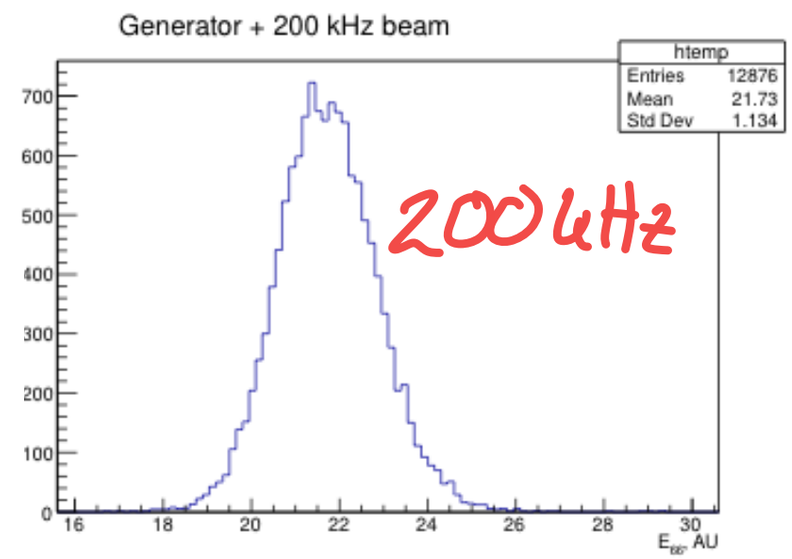


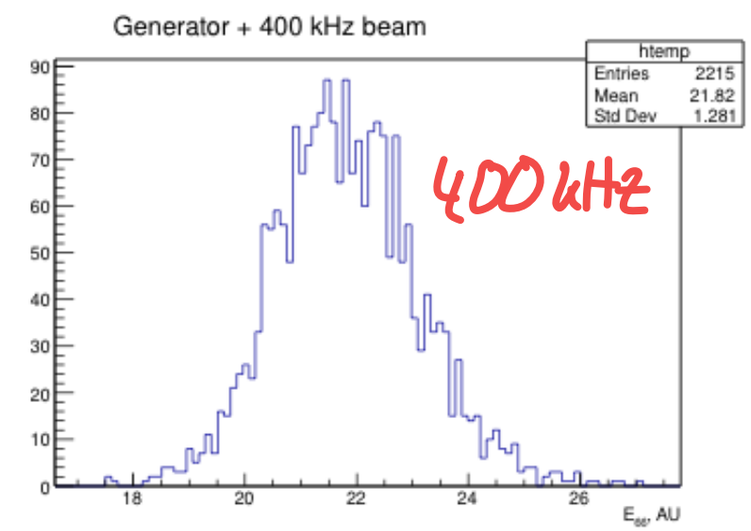
Trigger and Silicons



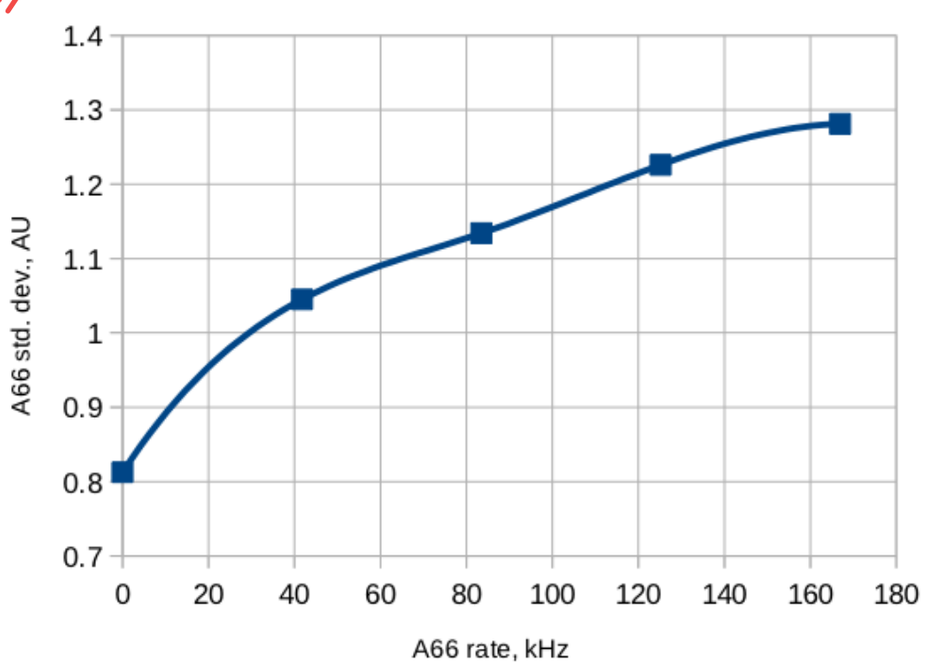








≈20keV



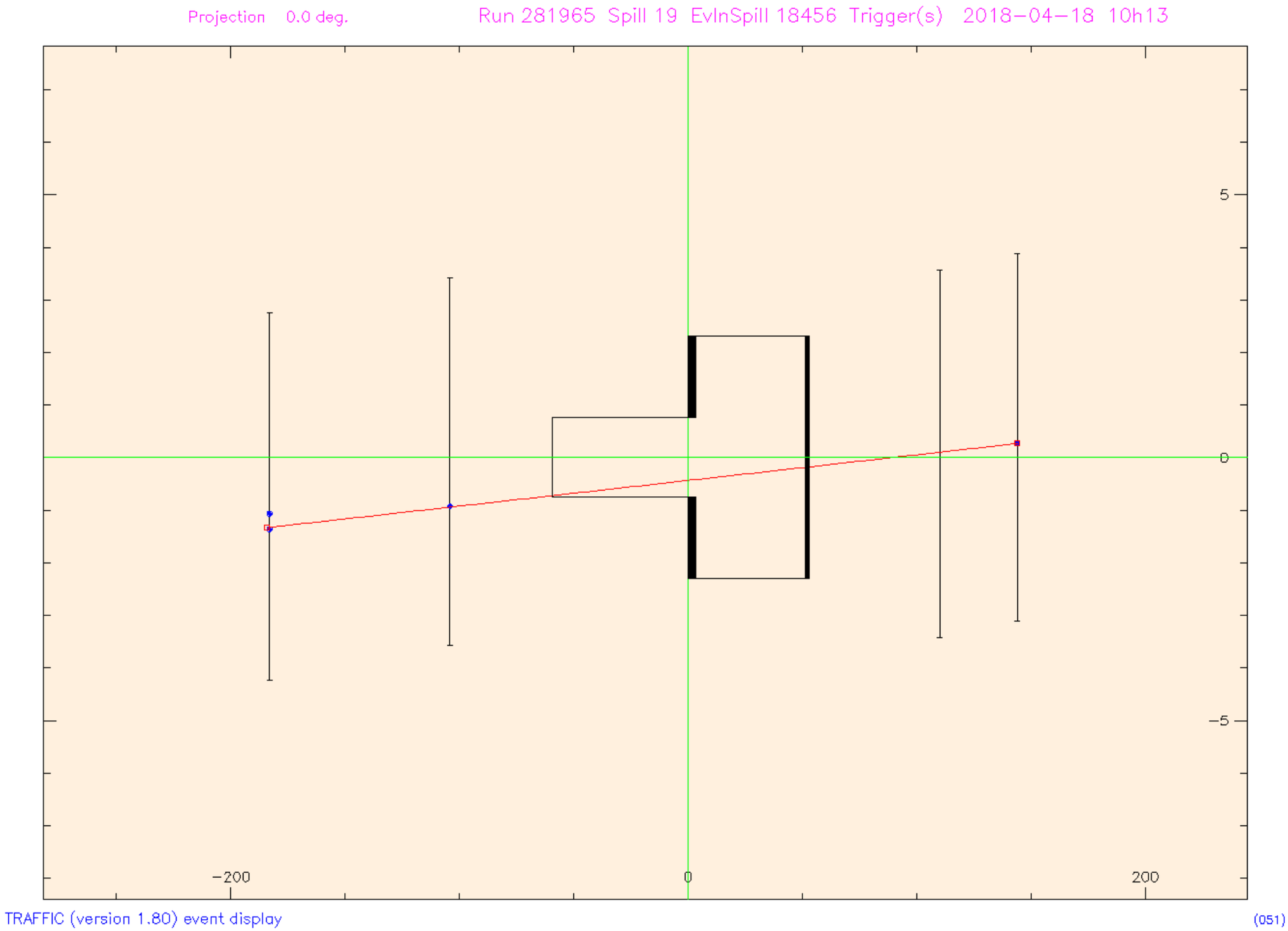
Data Taken

Since Monday Evening:

5000 Spills - 750 Million Events

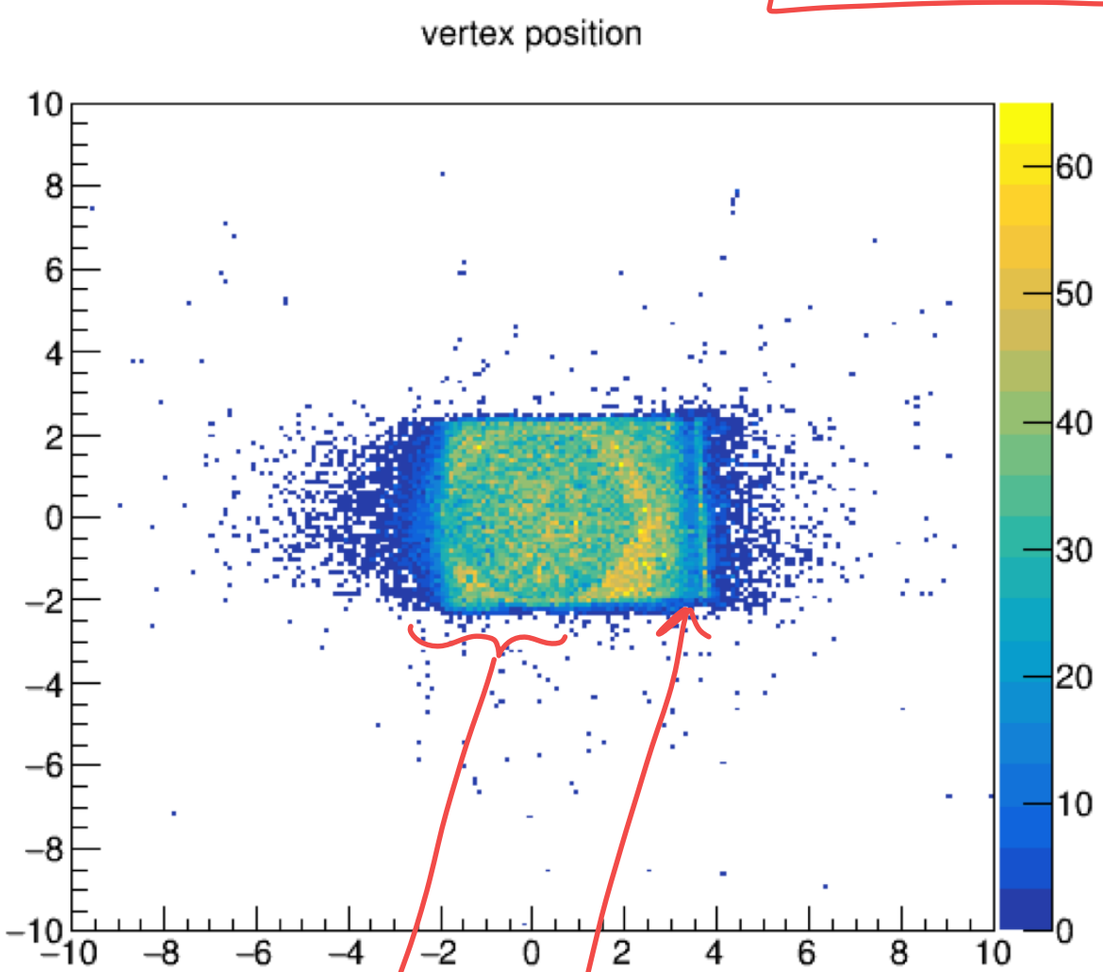
(Combined data taking)

First Tracking Results



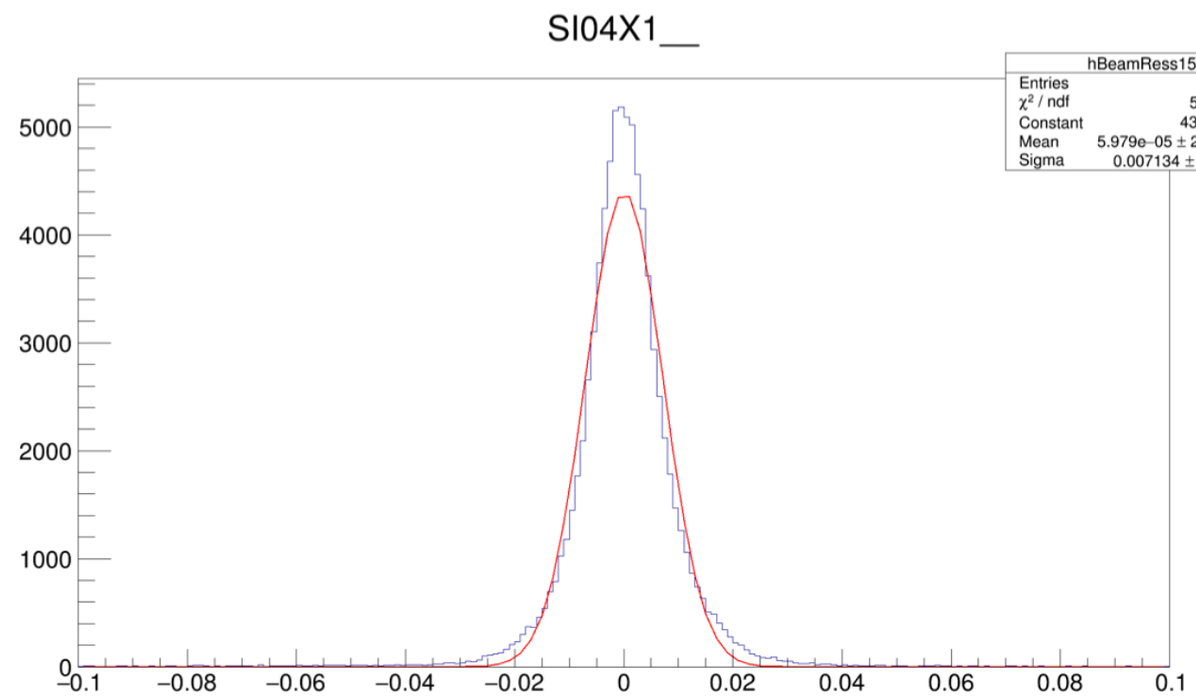
First Tracking Results

Preliminary



Window

cable / tube ?



↳ unbiased Residuum

- 5x better in general (Alignment + Reconstruction)

< 150k Events

Thank you all for your work!

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Thank you for your attention!