
Some results of TPC prototype integrated with 266nm UV laser

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4th detector concept



Guideline of The Paper



- ❖ Introduction (2 p)
- ❖ Physics requirements (3 p)
 - Consistent with the current CDR with further understanding, e.g. flavor physics
- ❖ General detector description (4 p)
- ❖ MDI, mechanical and magnet system
 - Beam pipe, radiation background (3 p)
 - Mechanical and cooling (2p)
 - Magnet system (2 p)
- ❖ Tracking system
 - Silicon pixel vertex (6 p)
 - FST of HV-CMOS (5 p)
 - PIDs (4 p)
 - Tracking optimization (3 p)
- ❖ Calorimeter and LumiCal
 - ECAL: crystal bar ECAL (6 p)
 - HCAL: glass or scint (5 p)
 - Luminosity, beam energy (2 p)
- ❖ Muon: scintillator bar and other options (2 p)
- ❖ TDAQ and software
 - Trigger strategy (2 p)
 - Wireless readout (2 p)
 - Software: emphasize more on our own, but refer and acknowledge other packages (4 p)
- ❖ Physics performance: (10 p)
 - Especially those associated with the new sub-detectors in the 4th concept.
- ❖ Summary and roadmap (2 p)

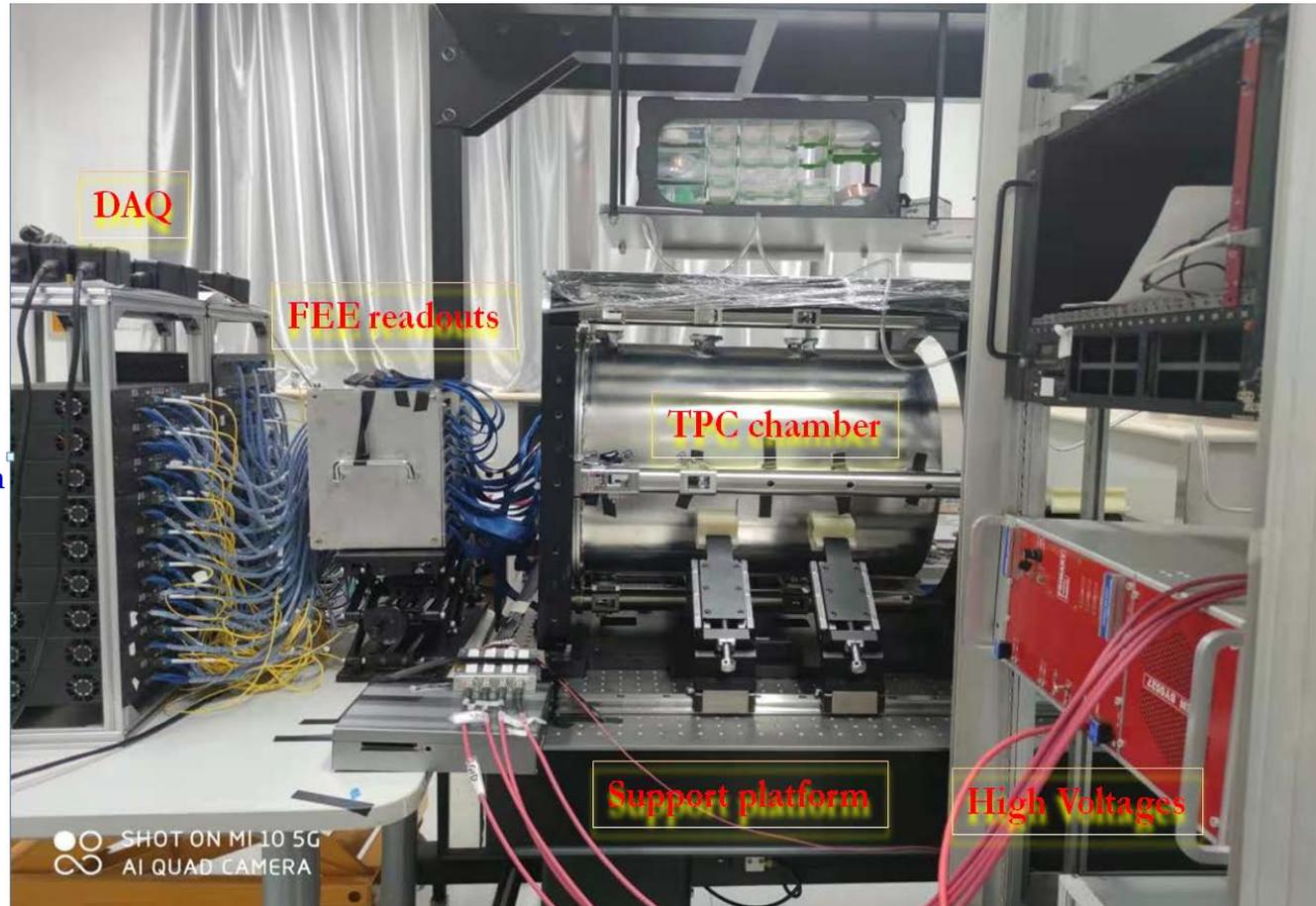
Current total ~ 69 pages

Outline

- TPC prototype
- Analysis and results
- Spatial resolution and N_{eff}

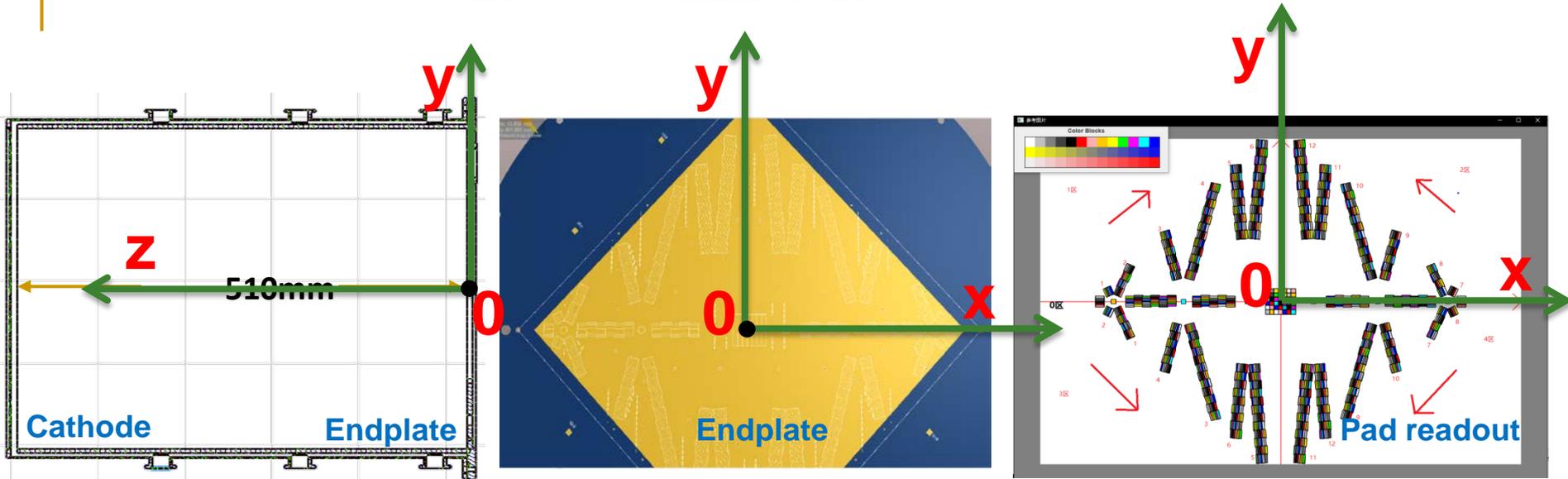
Status of TPC prototype

- Data taking and more analysis on going
- Commissioning: Huirong Qi, Zhiyang Yuan, Yiming Cai, Yue Chang, Jiang Zhang, Yulan Li, Zhi Deng
- Data taking: the same, plus: Hongyu Zhang, Ye Wu



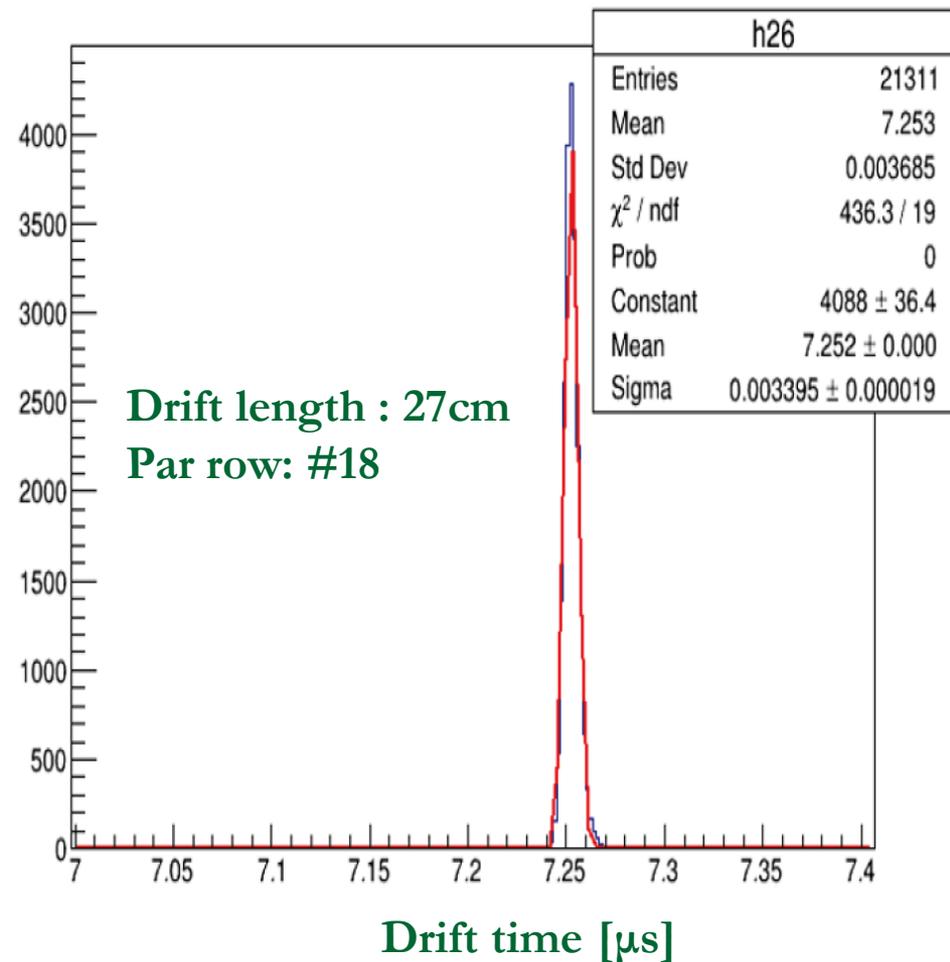
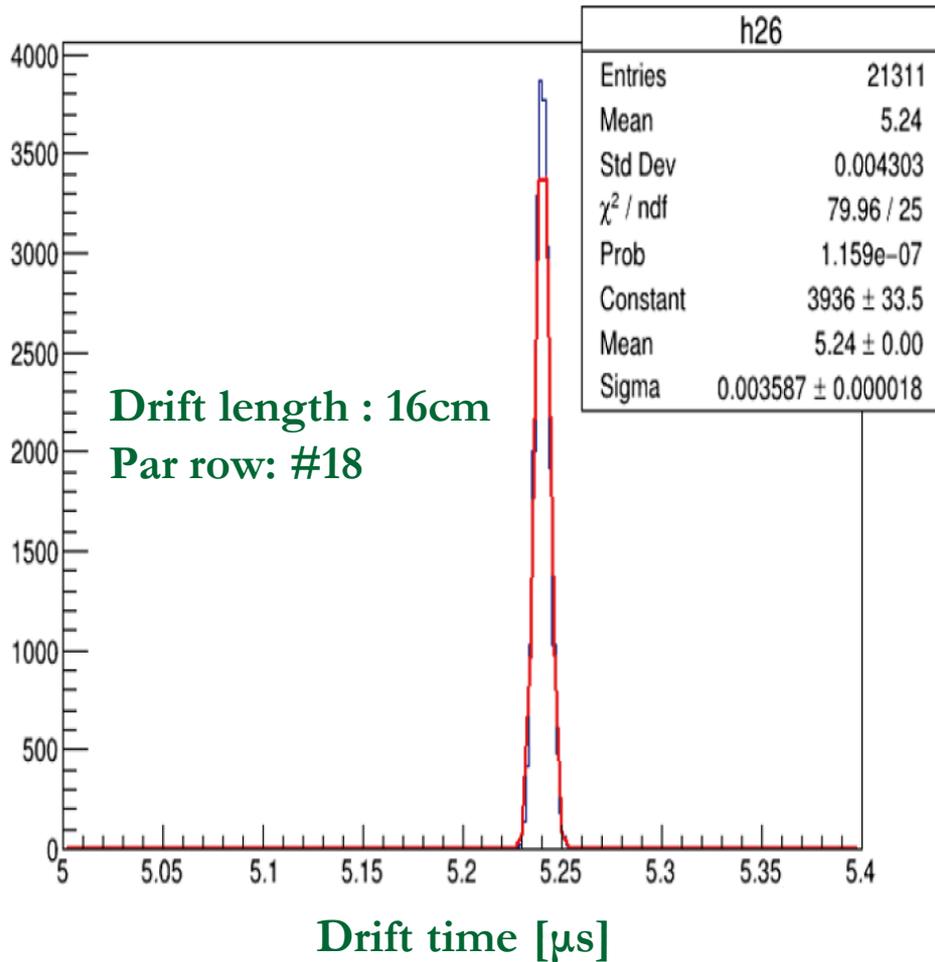
TPC prototype in the lab

Detector coordinate definition



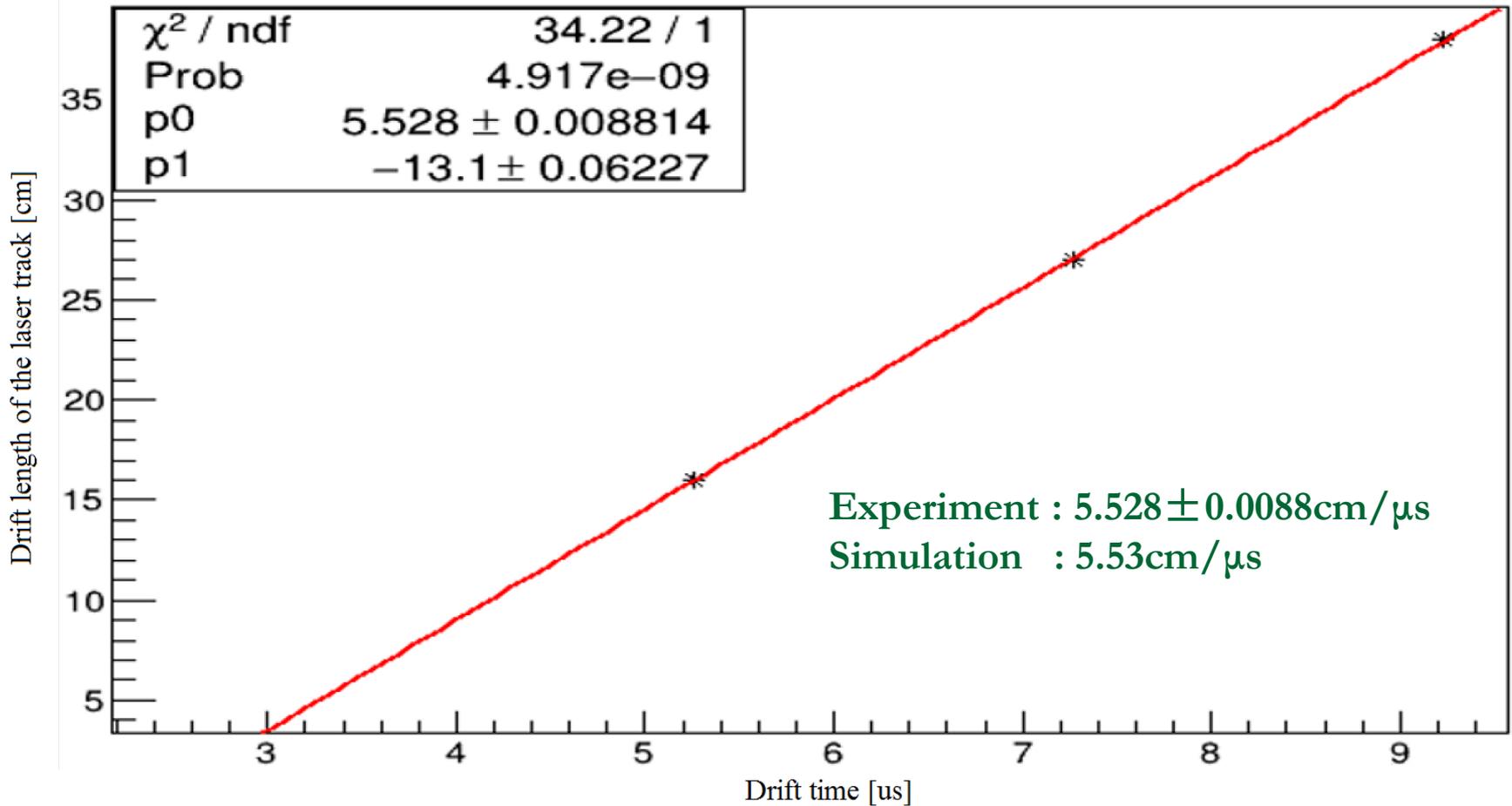
- ❑ The origin of the coordinate is set at the center of the endplate board.
- ❑ X and Y plan is set as the readout plane
- ❑ Z is set along the drift length from endplate to the cathode
- ❑ Z_0 plane is set at the first surface of the detector from cathode to endplate plane.
- ❑ The center of the pad is set as the pad's coordinate, and every pad has the specific x and y.

Drift time @400MHz



Drift time of the electron at 150V/cm in T2K

Drift velocity



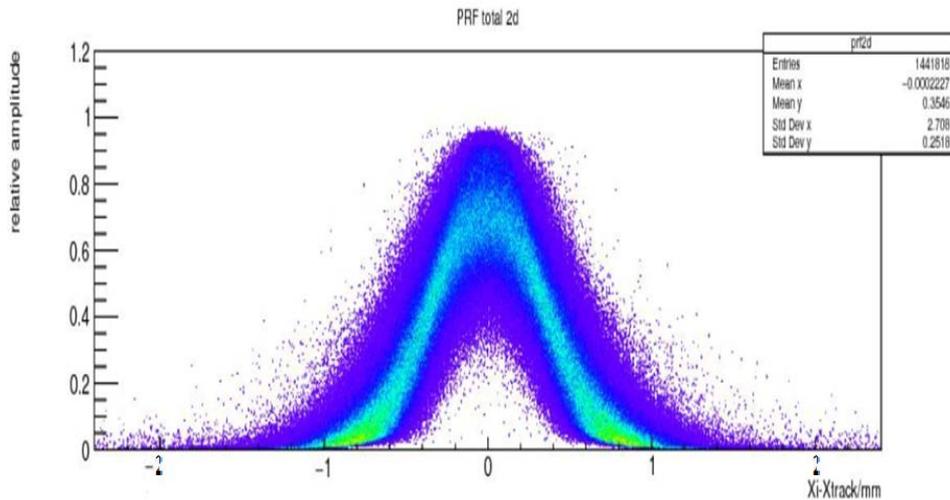
Drift velocity of the electron at 150V/cm in T2K

PRF analyzing of the spatial resolution (update)

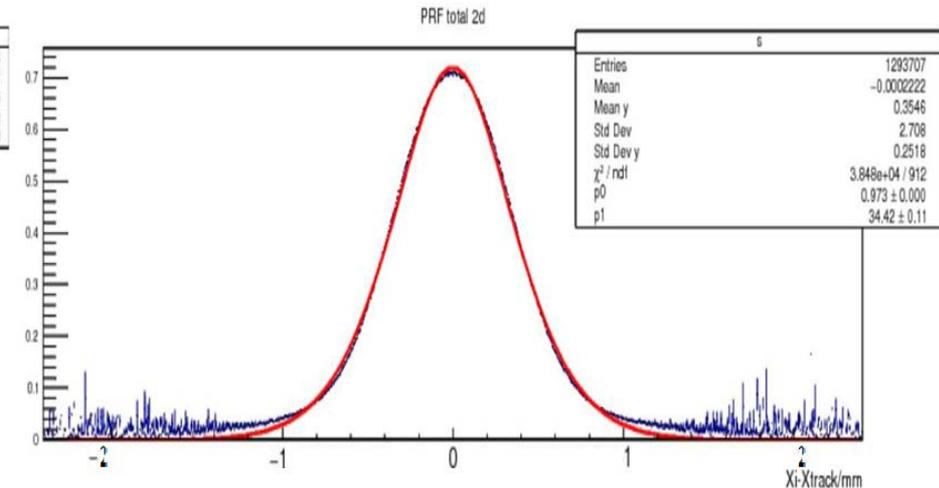
- **Pad Response Function (PRF):** a function used to describe the charge distribution and to determine the hit position via Pad

$$PRF(x, y, w) = \frac{e^{-4\ln 2(1-y)x^2/w^2}}{1 + 4y \cdot x^2/w^2}$$

- **x** is the Pad's coordinate of the center of the corresponding Pad in x-axis.
- **y** is a factor to describe Lorentzian and the Gaussian function
- **w** is the width of the Pad (in here, the Pad's width is 0.9 mm)



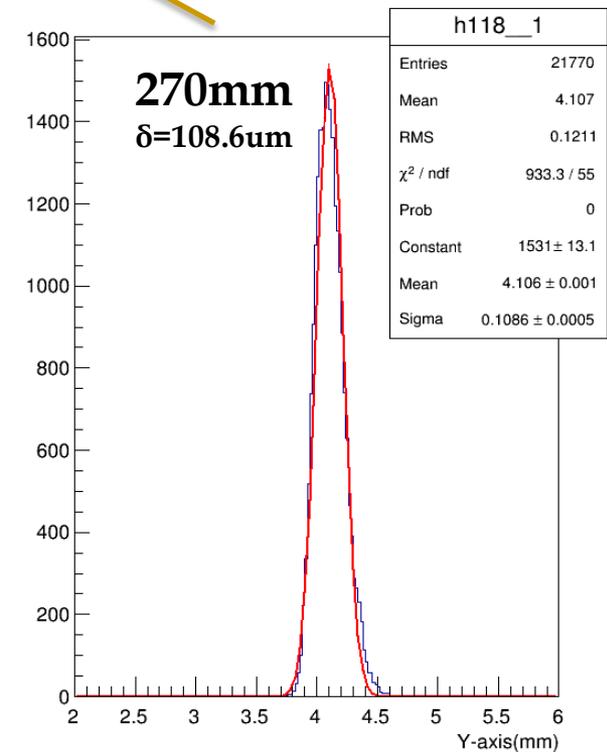
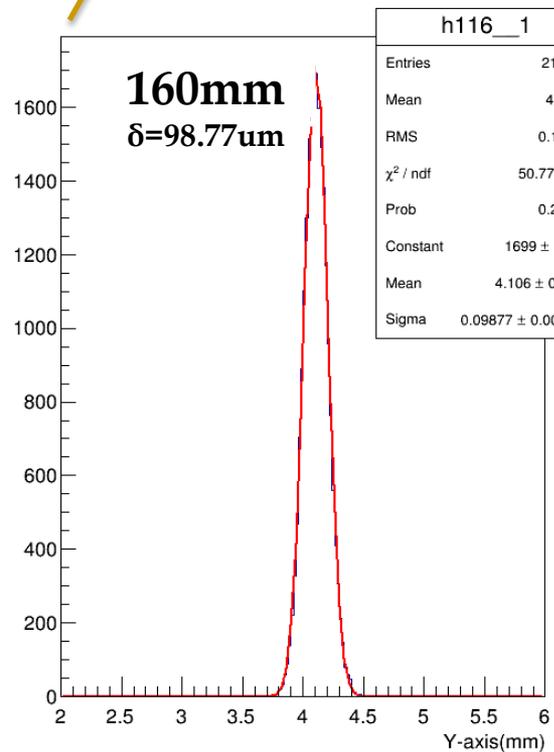
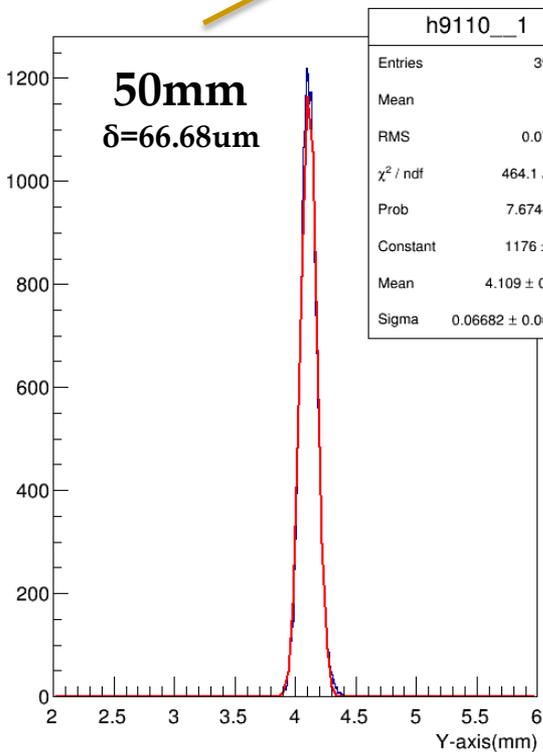
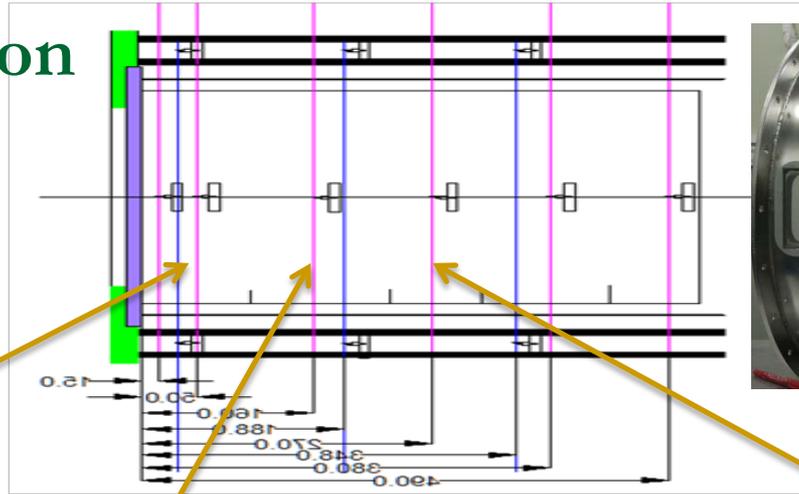
PRF total of all data



Profile of PRF from one pad row

Space resolution

N_{eff} of UV laser
in test: ~80



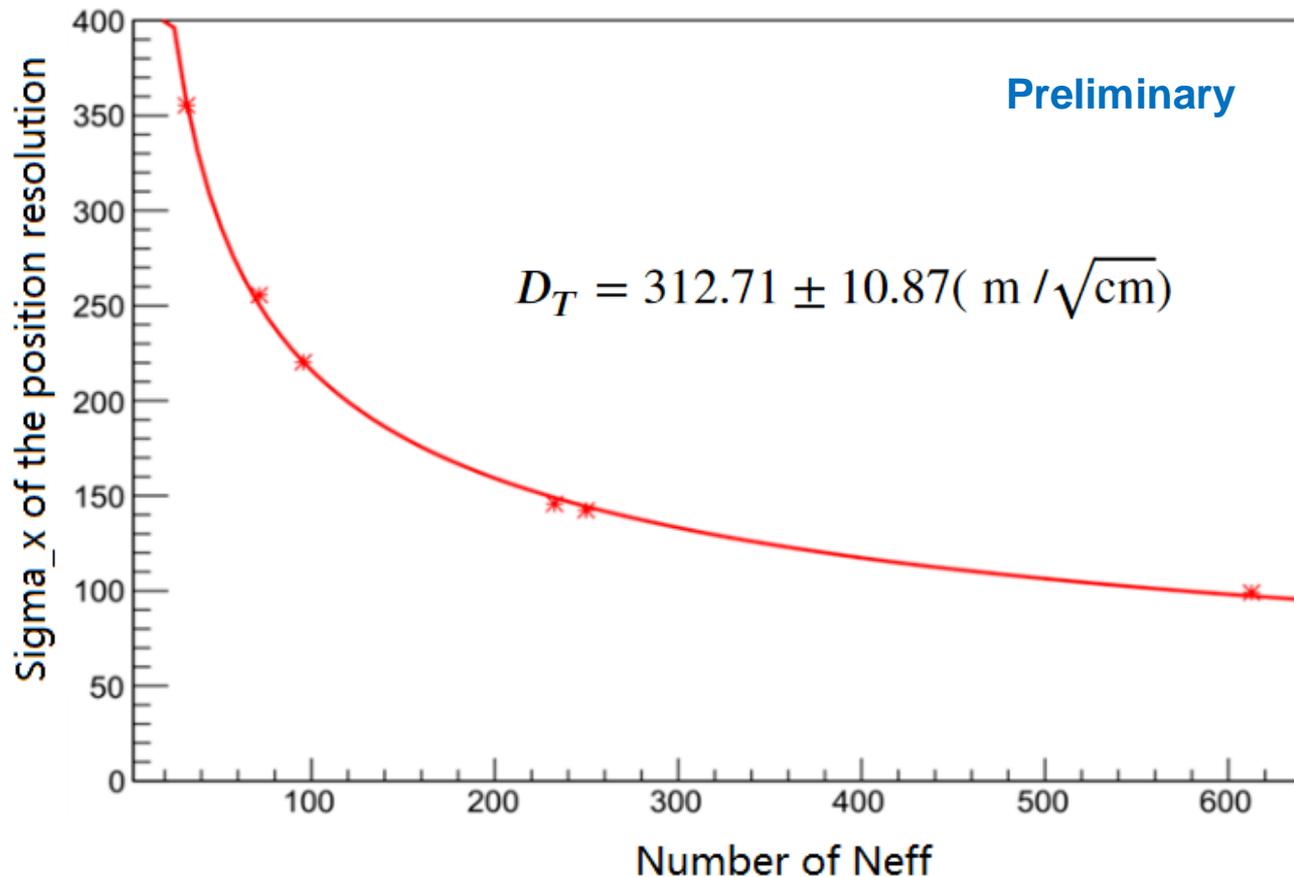
Space resolution at the different drift length

Spatial resolution VS Neff (simulation)

Testing parameters

- T2K operation gases and 0T of the magnetic field
- Drift field: 150V/cm-220V/cm
- Pad readout option (1mm×6mm)

$$\sigma_x^2 = \sigma_0^2 + \frac{D_T^2 \cdot z + \frac{w_{laser}^2}{12}}{N_{eff}}$$



Spatial resolution VS the number of Neff

Summary

- Some update results of TPC prototype have been studies, the prototype is working well, and the results indicated that 266nm UV laser beams system could used in the TPC prototype R&D.
- Spatial resolution and Neff simulated. (Comments?)
- More analysis on going
 - E_d : 230V/cm
 - Graduates: Yuan Zhiyang and Chang Yue

Thanks for your attention.