Work of Saclay - analyzing the FCC-ee TPC spatial resolution

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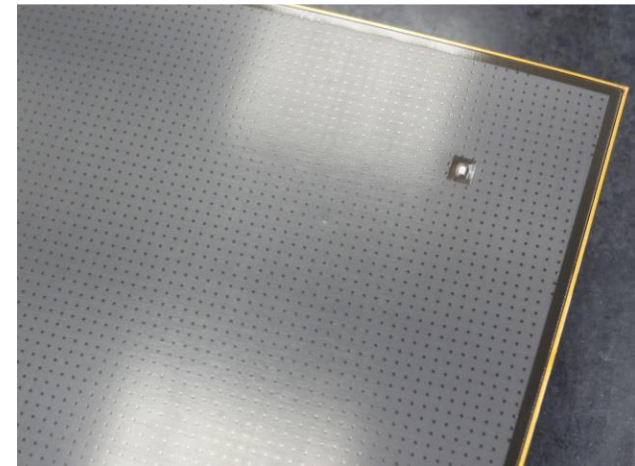
Jun. 6th 2018

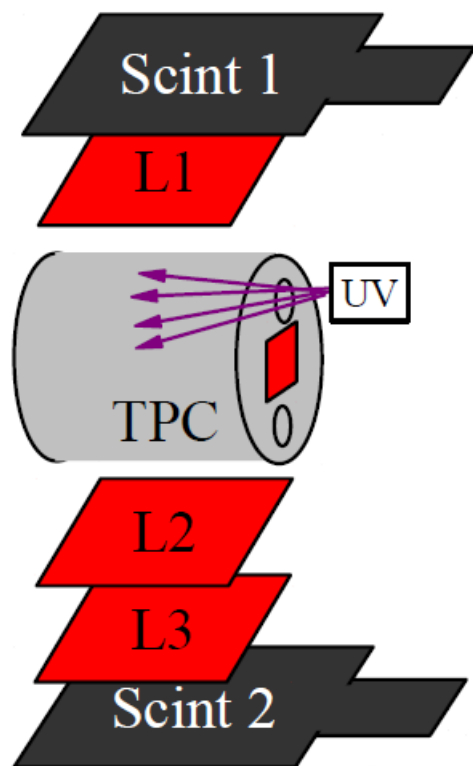# TPC Laboratory visiting & Micro-Megas Manufacturing lab

The TPC system

The Micromegas with resistive ink

FCCee-TPC Prototype sketch

TPC system devices:
2 scintillators S1, S2
3 micromegas Multigen (MG) (resistive)chambers L1, L2 , L3
1 TPC + micromegas (resistive) Pads

TPC cathode: -10kV
- Δz TPC =48cm, D=50cm, drift field=200V/cm

TPC pad:
- Mesh:-430V, readout pad(anode) is designed to 0V,
- Amplification gap=128um, field=30kV
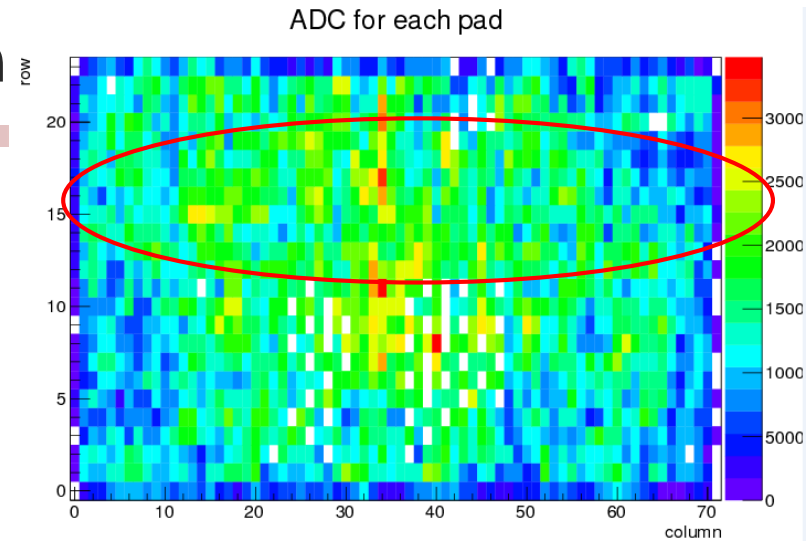- Readout pad:1728 channels

MG detectors
- MG Drift (common) ~ -300 V
- L1 L2 L3 (anods): +480 V
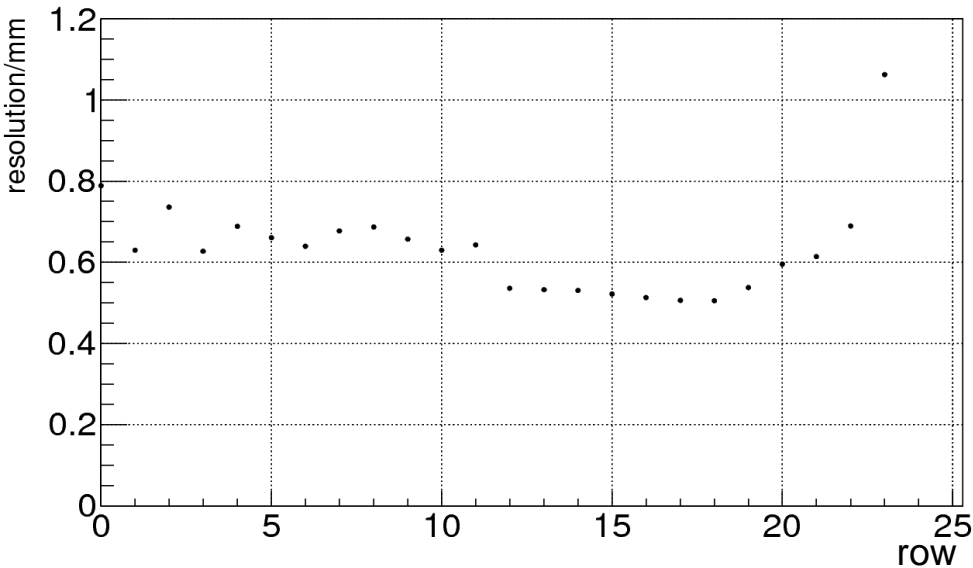- MG mesh is at 0 V by construction

Gas:
- Ar:iC4H10=95:5

New data(2018.03) analyzation

ADC for each pad

➢ Resolution of 24 rows
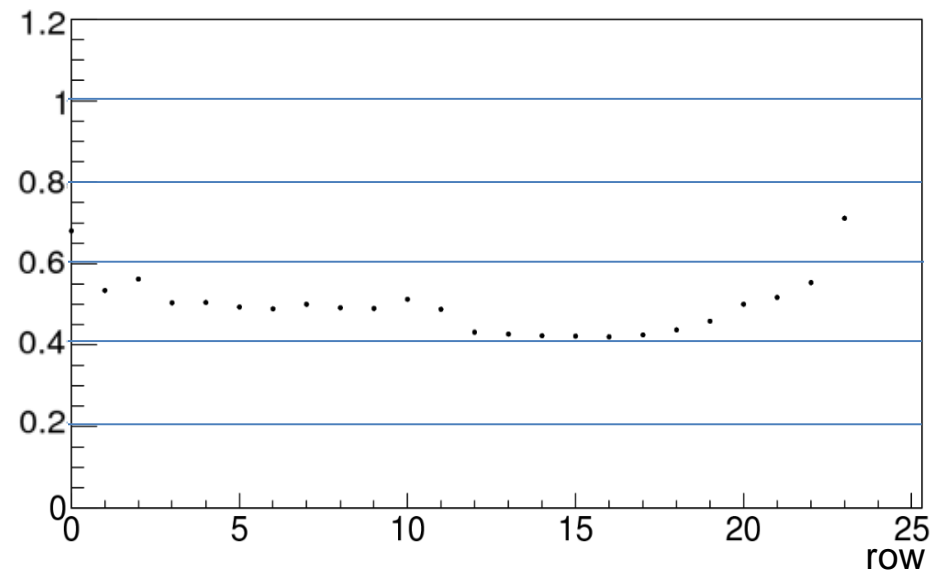➢ Data of 2018.03 v.s. data of 2017.10

2018.03

1sigma of resolution for 24 rows

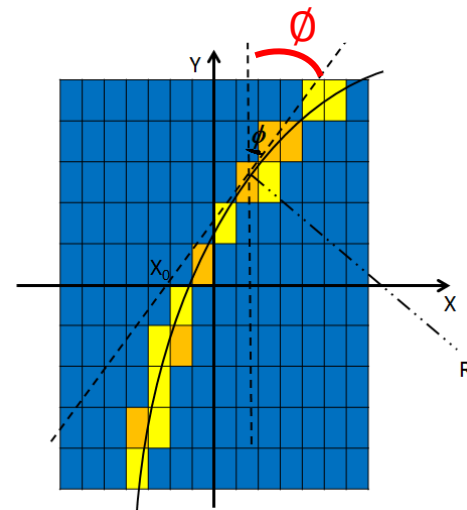**2017.10**
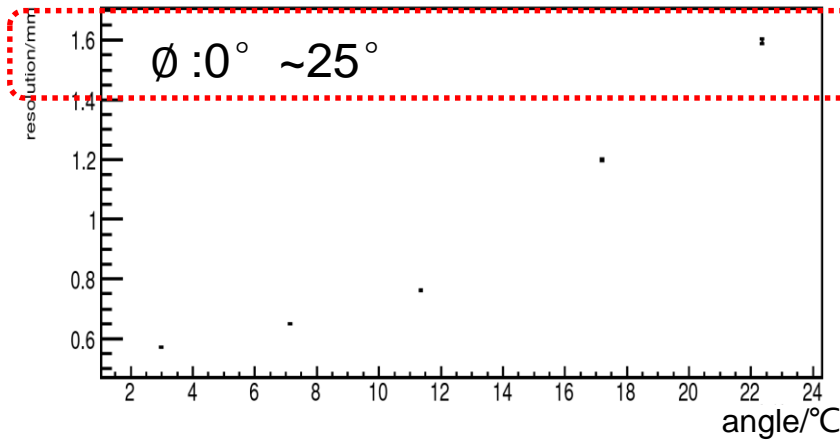
1sigma of resolution for 24 rows

New data(2018.03) analyzation

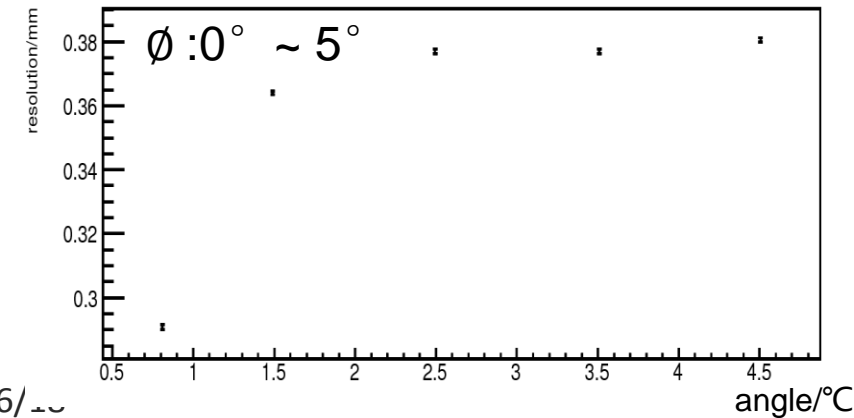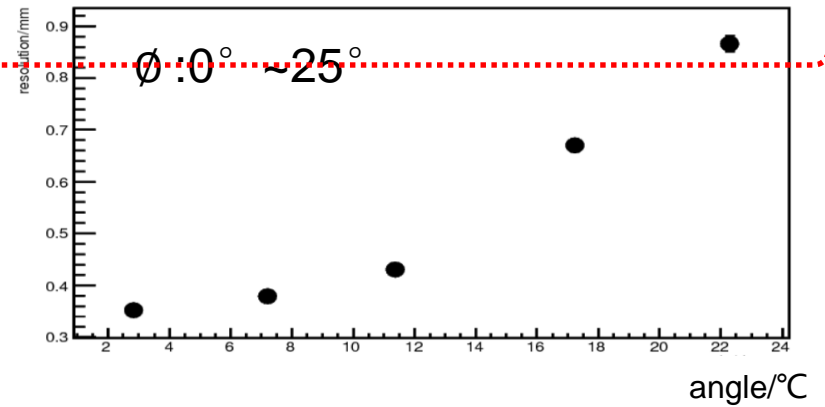➢ Resolution of angles(∅ :0°～25°)
➢ Data of 2018.03 v.s. data of 2017.10

2018.03

∅ :0°～25°

resolution/mm — angle/℃

2017.10

∅ :0°～25°

resolution/mm — angle/℃

∅ :0°～5°

resolution/mm — angle/℃

∅ :0°～5°

resolution/mm — angle/℃

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New data(2018.03) analyzation

Fit function:

$$\sigma = \sqrt{\sigma_0^2 + \frac{C_d^2 \cdot z}{N_{eff} \cdot \exp(\frac{z}{L})}}$$

C_D, transverse diffusion constant,
σ_0, spatial resolution at $Z = 0$,
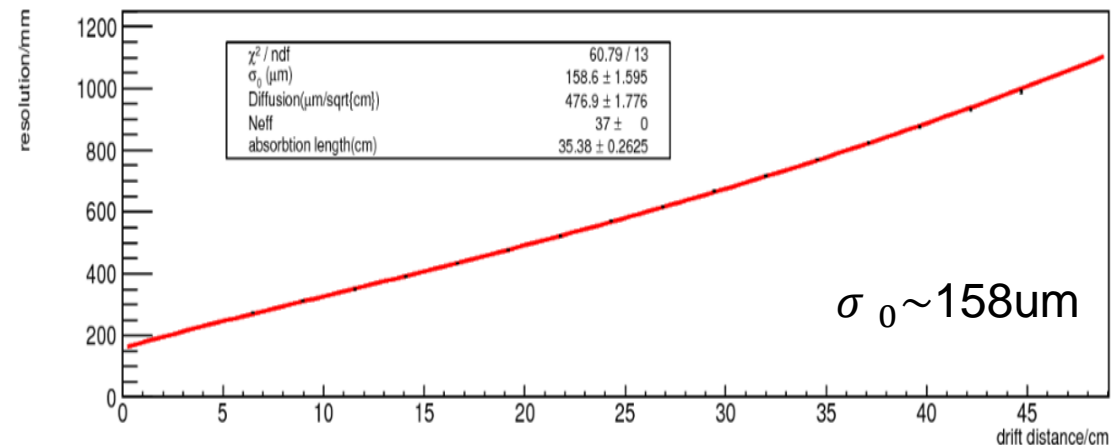L, absorbtion length
N_{eff}, number of effective elctrons over the length of a pad

➢ resolution along Z/drift time
• rows: 12,13,14,15,16,17,18
• angle: ≤±5
➢ Data of 2018.03 v.s. data of 2017.10

2018.03

resolution along drift distance

χ^2 / ndf	38.61 / 12
σ_0 (μm)	197.2 ± 1.921
Diffusion(μm/sqrt{cm})	540.8 ± 2.918
Neff	37 ± 0
absorbtion length(cm)	64.27 ± 1.286

$\sigma_0 \sim 197um$

2017.10

χ^2 / ndf	60.79 / 13
σ_0 (μm)	158.6 ± 1.595
Diffusion(μm/sqrt{cm})	476.9 ± 1.776
Neff	37 ± 0
absorbtion length(cm)	35.38 ± 0.2625

$\sigma_0 \sim 158um$

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New data(2018.03) analyzation

- ➤ "S" shape
- ➤ After selection:
- • rows: 12,13,14,15,16,17,18
- • time: 22~150
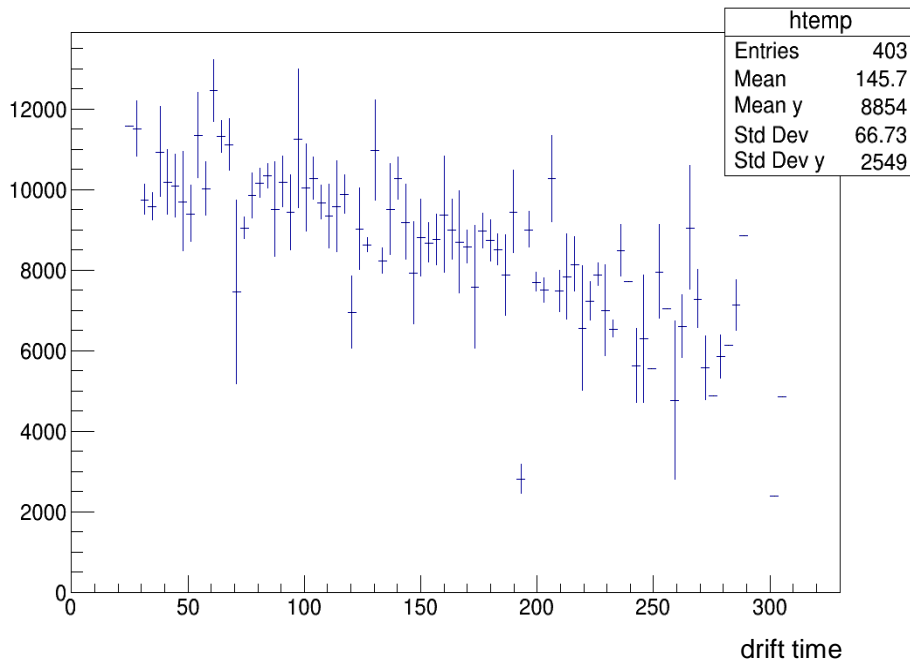- • angle: ≤±5°
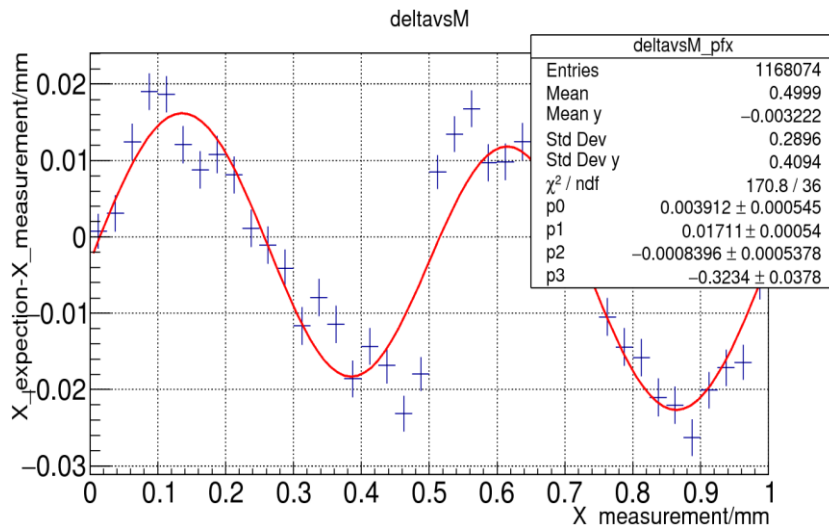
2018.03

2017.10
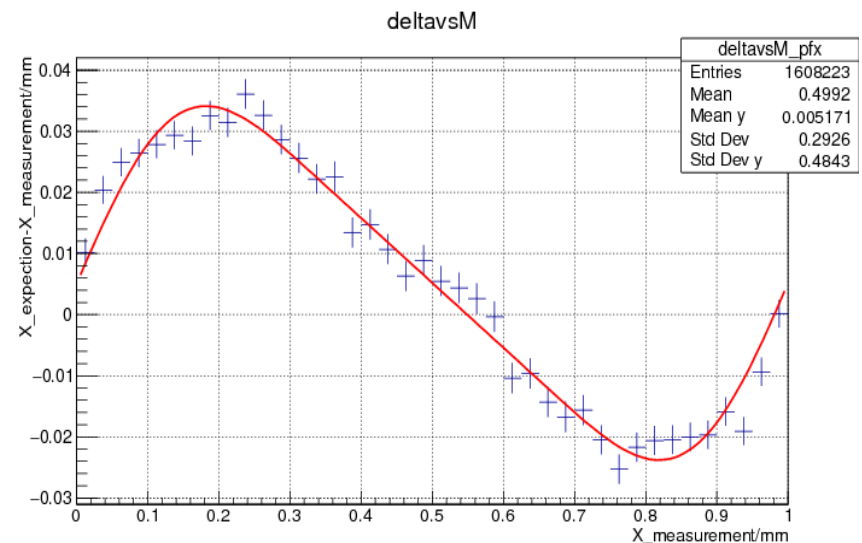
New data(2018.03) analyzation

- ➢ Gain along Z/drift time
- ➢ After selection:
- • rows: 12,13,14,15,16,17,18
- • time: 22~150
- • angle: ≤±5°
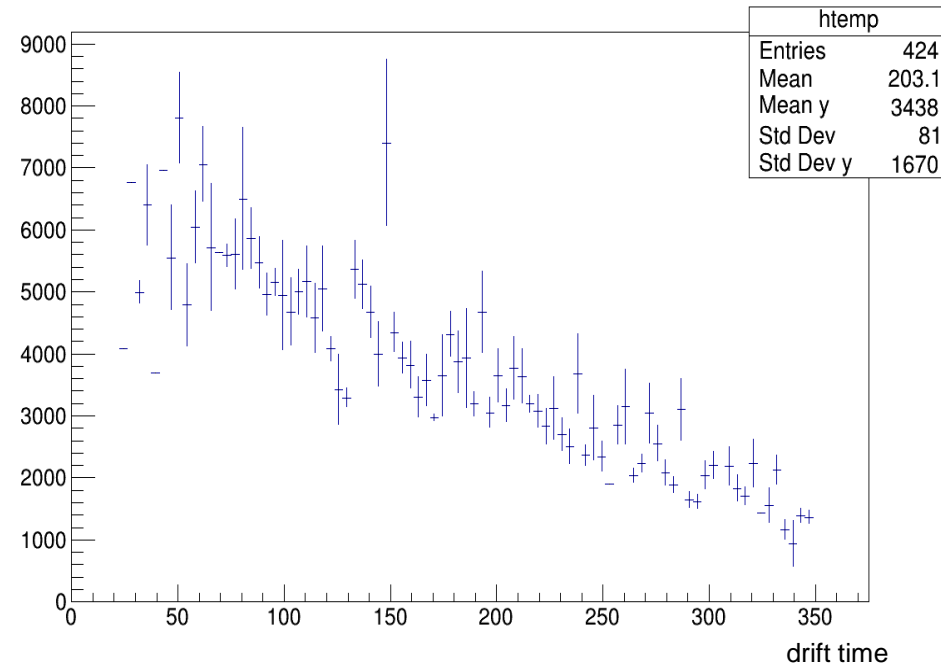
2018.03   Gain along Z/drift time

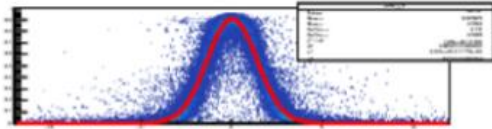

2017.10   Gain along Z/drift time

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New data(2018.03) analyzation

➢ Using PRF - resolution along Z/drift time
➢ After selection:
• rows: 12,13,14,15,16,17,18
• time: 22~150
• angle: ≤±5°

2018.03
After iteration of 2 times

$\sigma_0 \sim$171um

2017.10
After iteration of 2 times

$\sigma_0 \sim$123.3um

Thanks for your attention!
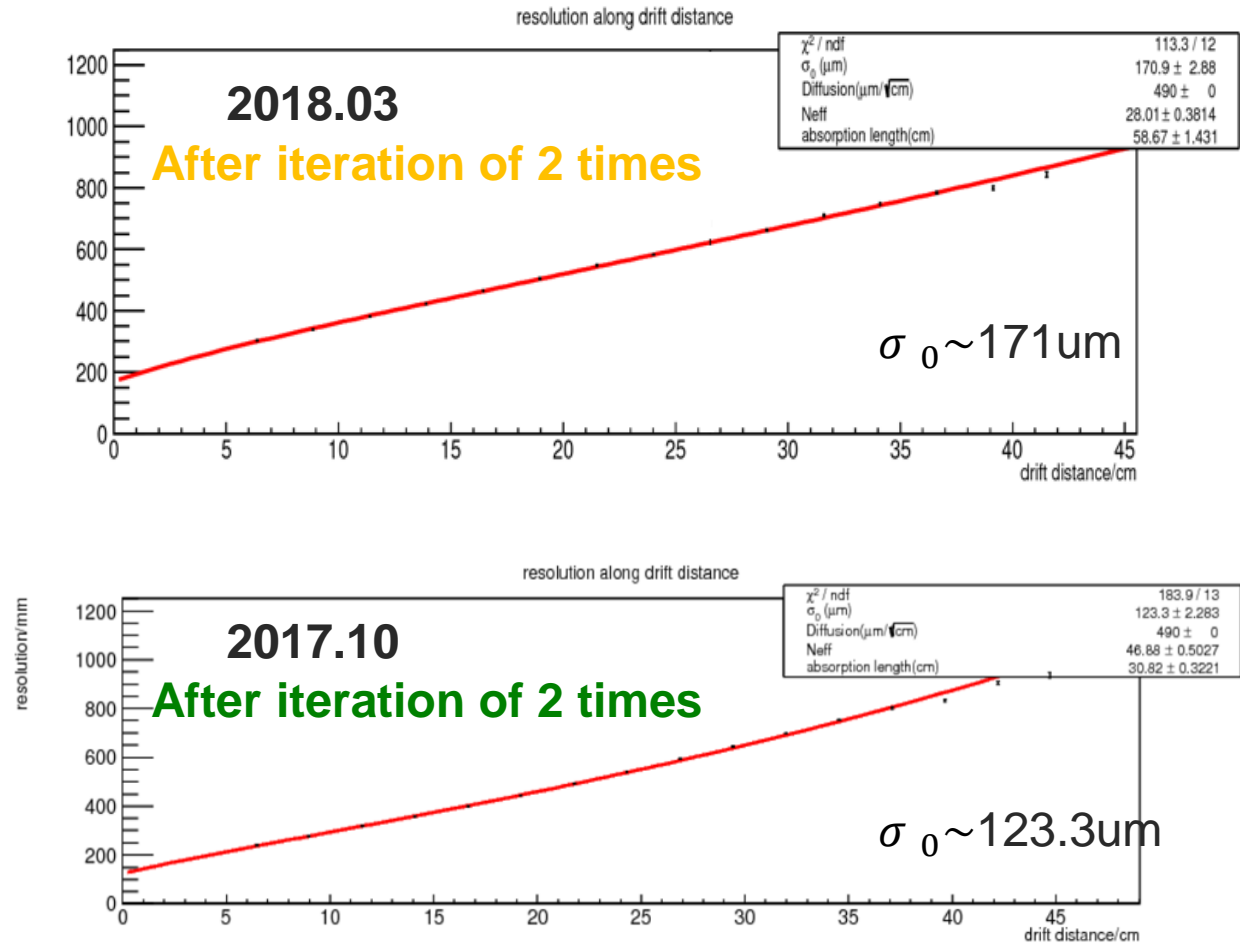
PRF v.s. drift time(before iteration)　**PRF v.s. drift time(after iteration of 1)**　**PRF v.s. drift time(after iteration of 2)**