A Large Volume micro-TPC

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July 6 2006, IWORID8 PISA, ITALY

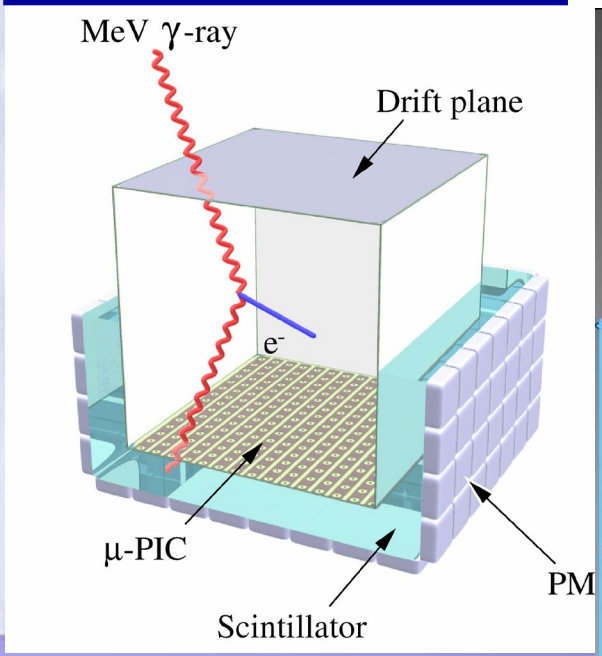
OUTLINE

1 : A Large Volume micro-TPC

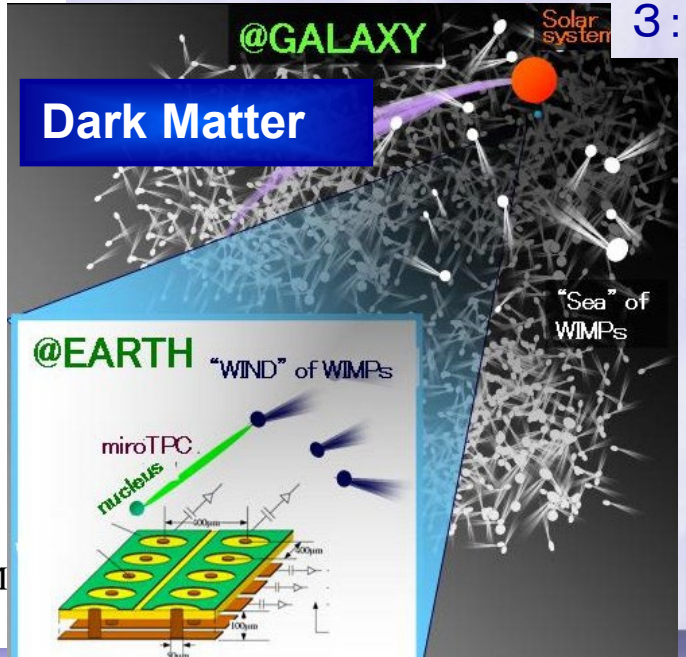
2 : Performance

3 : Summary

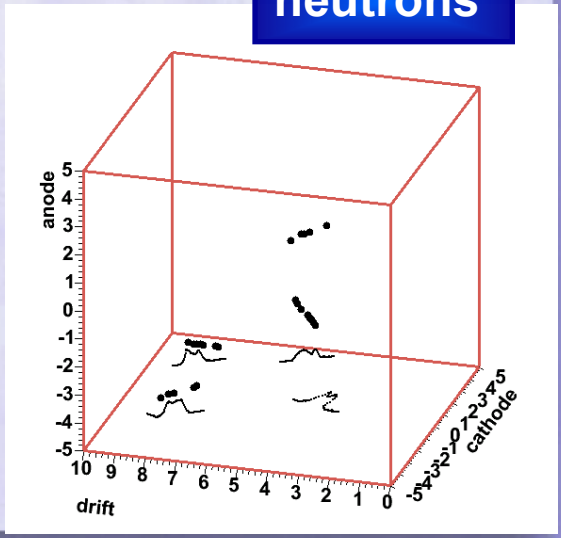
Compton gamma-ray



Dark Matter

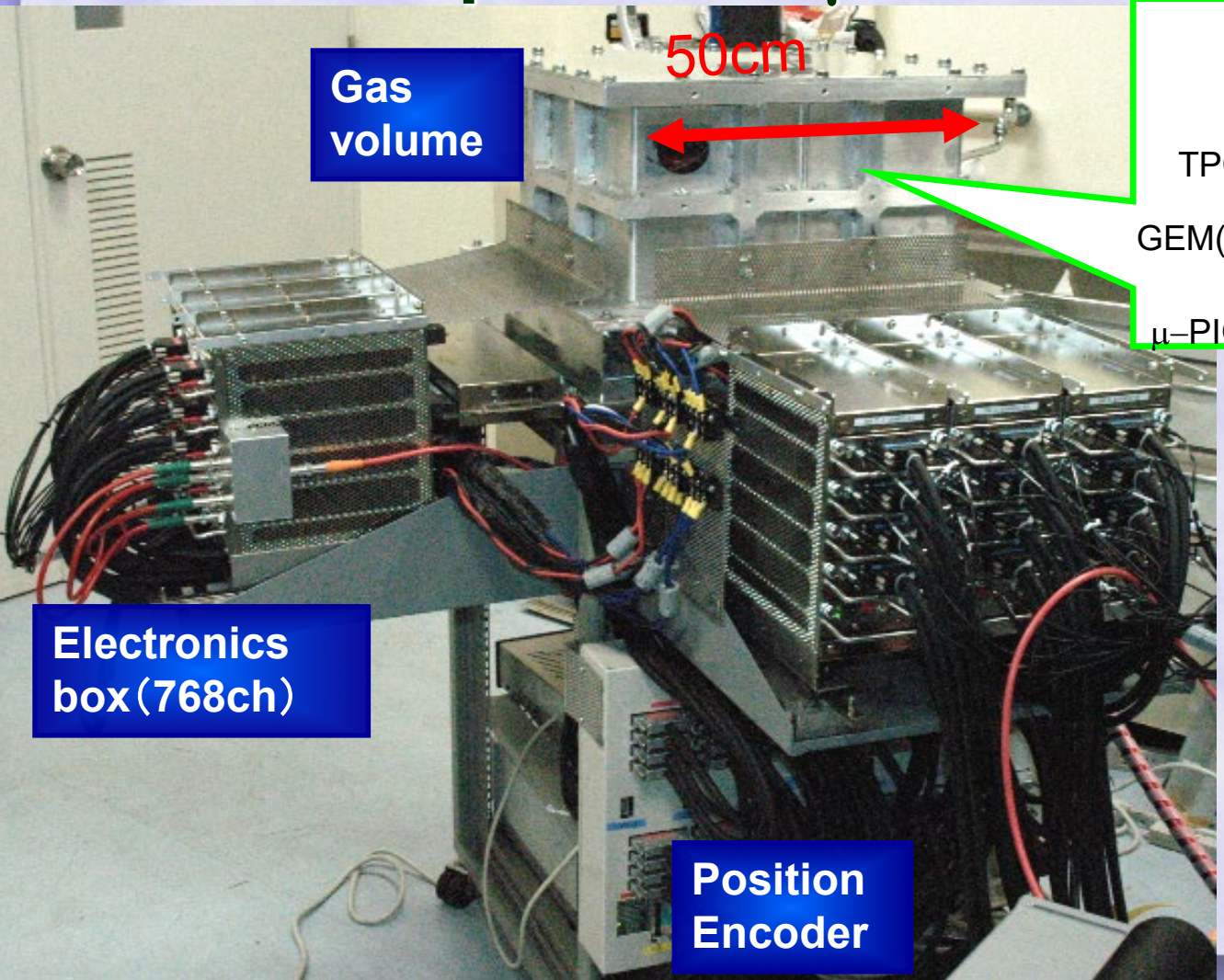


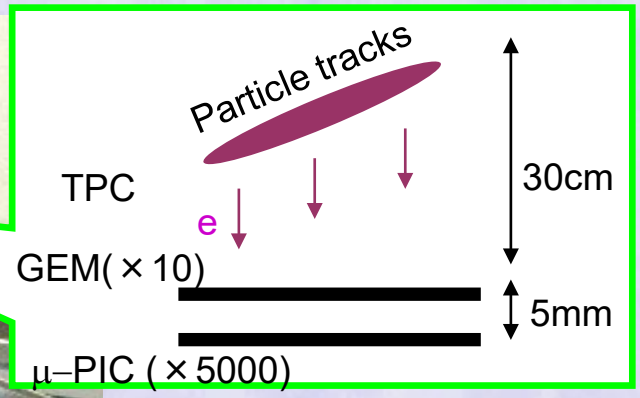
neutrons



1: A large volume micro-TPC

- Effective volume: 23 ×28 ×31cm^3
- Detector pitch: 400μm





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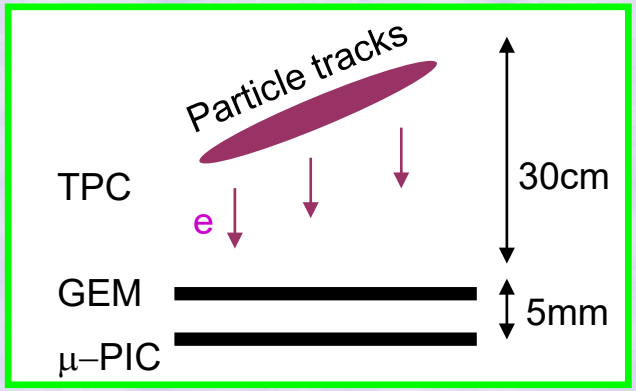
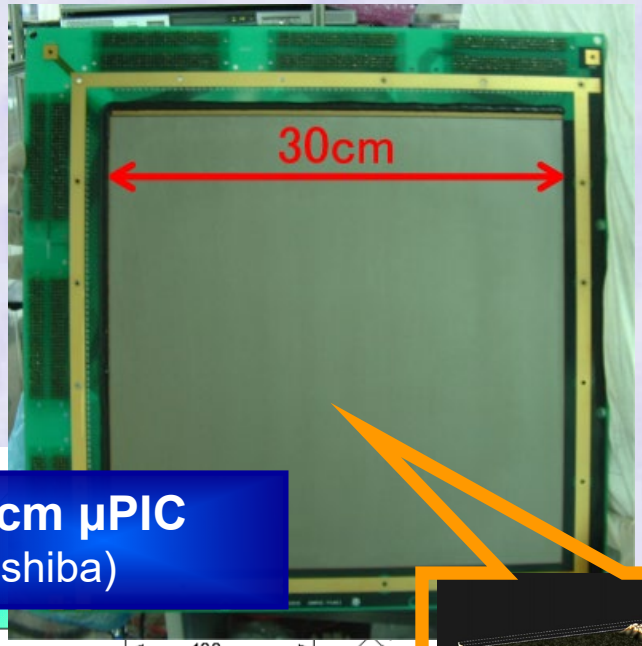
2D imaging device

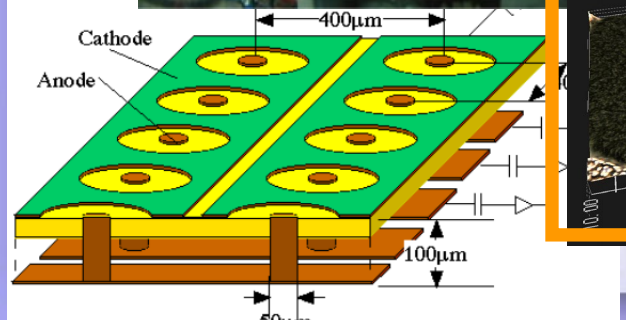
- μ-PIC (gas gain 5000)
  - 400μm pitch
  - 589824 pixels
  - 768+768 readout

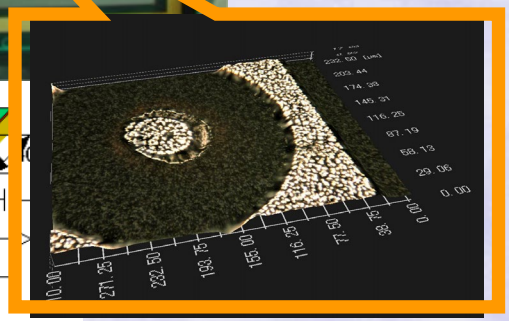
Takada et. Al.
PSD7



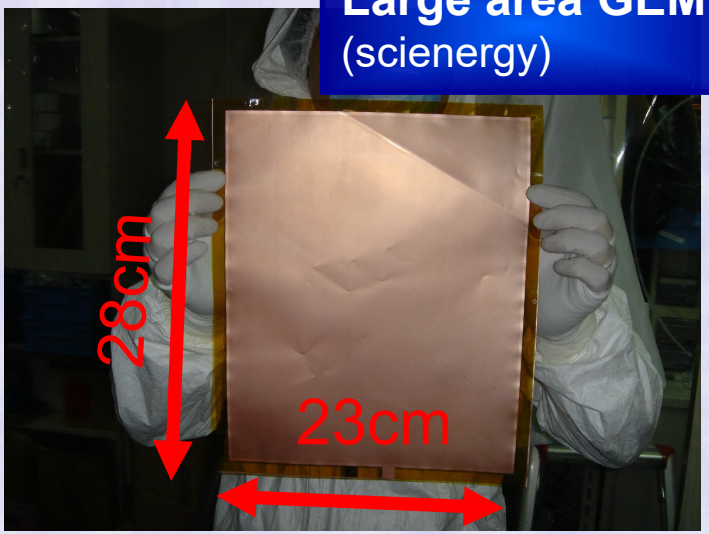


30cm μPIC
(Toshiba)





- GEM (gas gain 10)
  - 140μm pitch
  - 70μm diameter

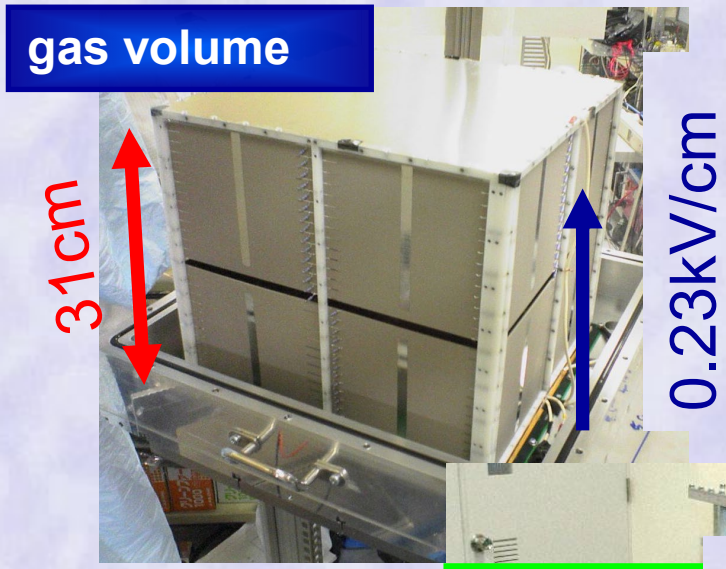


Large area GEM
(scienergy)

TPC system

Gas volume

- DRIFT length 31cm
- Ar + C2H6 (90:10) gas

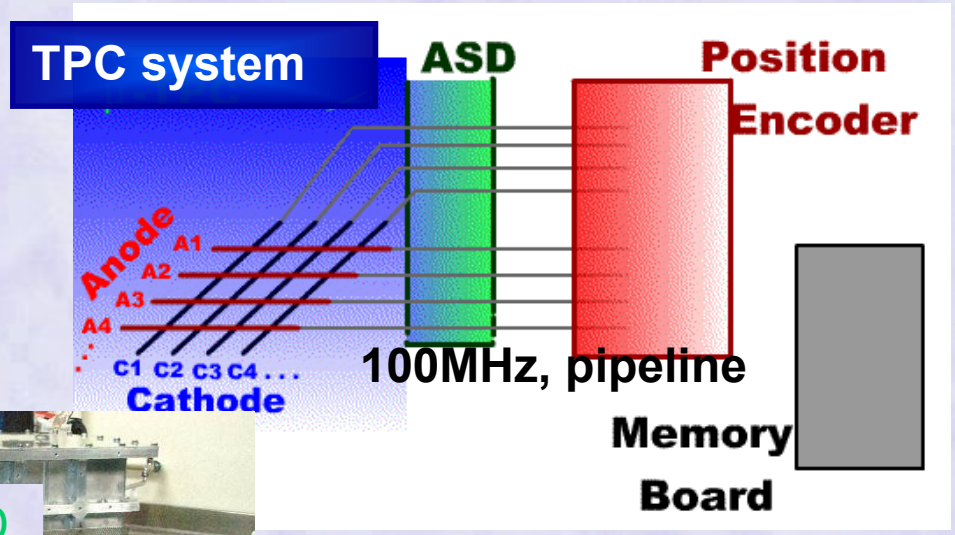


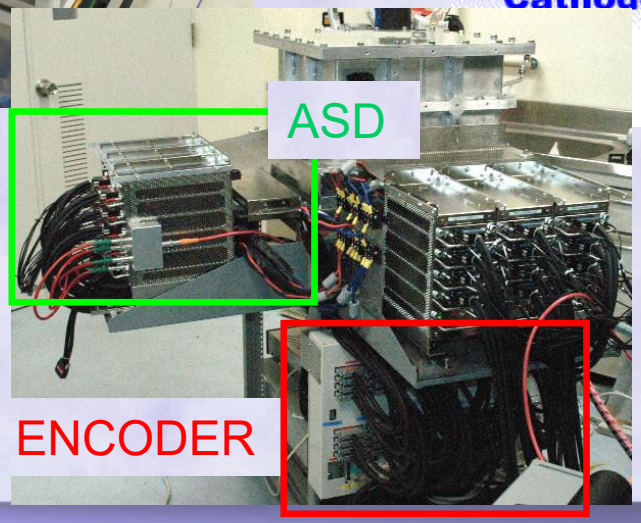
Readout electronics

Kubo et. al.
IEEE/NSS 2005

- 768 anode + 768 cathode
- Digital (LVDS) signals at ASD
- (X,Y,T) at the position encoder

for tracking





+

Summed analog signal for energy

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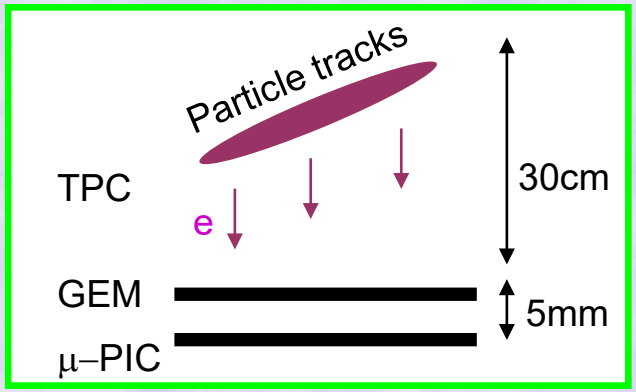
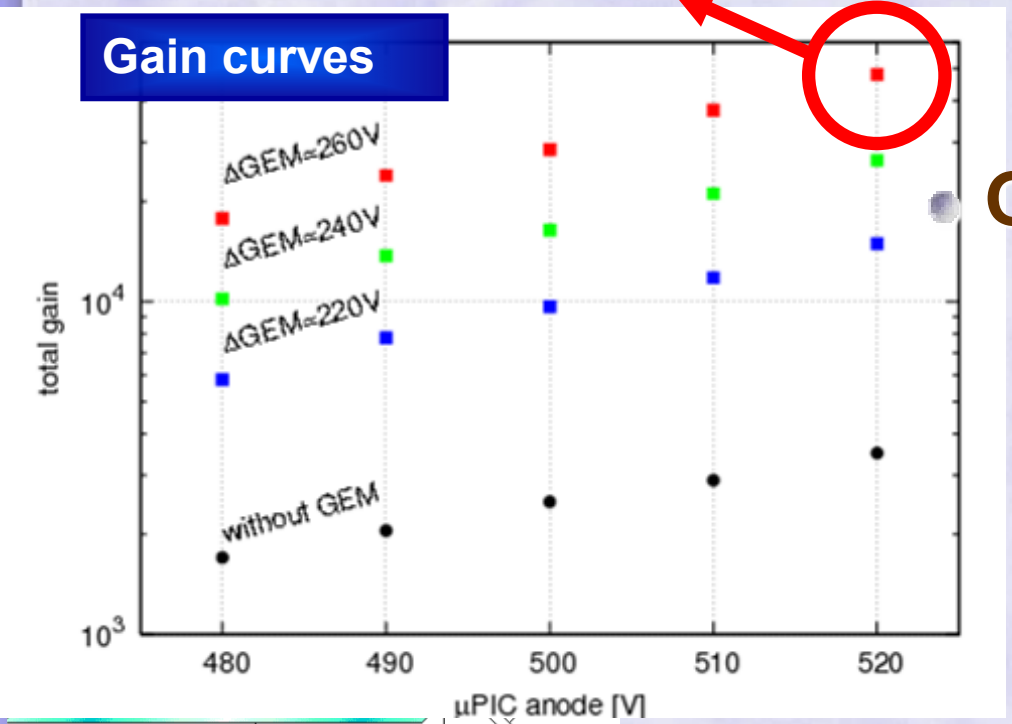
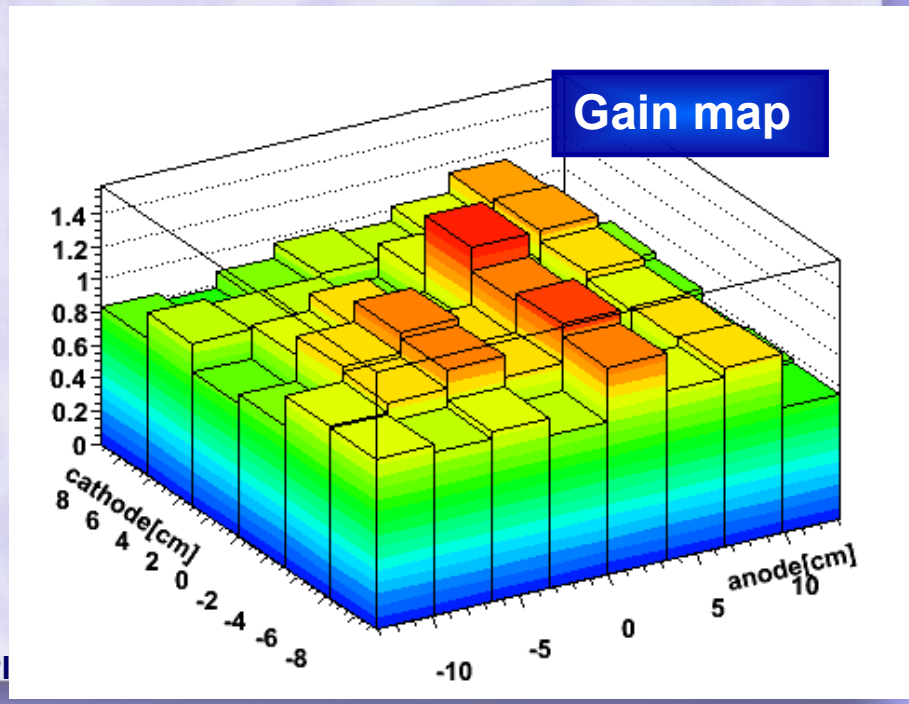
2: Performance

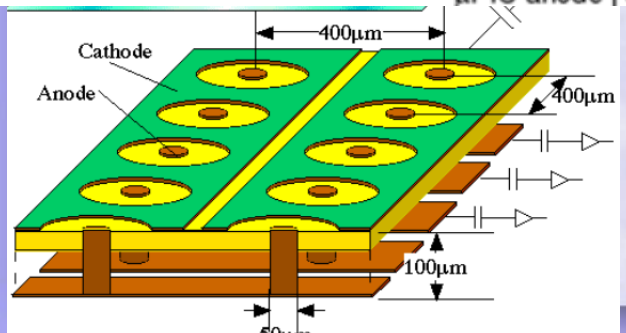
- **Gas gains**
  - **operation gain for MIPs ~50,000**





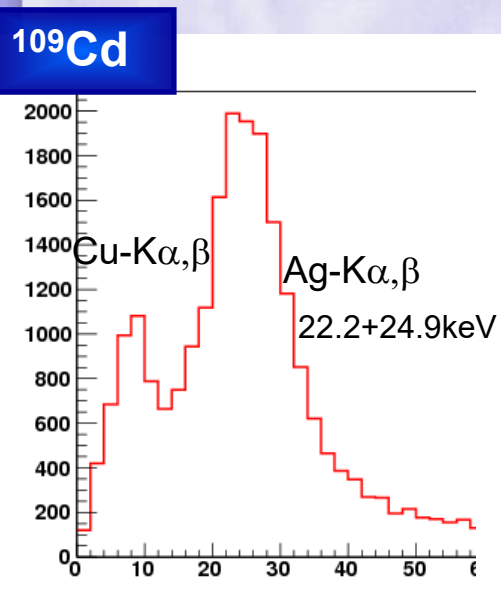
- **Gain uniformity**
  - **Maximum / minimum = 2.2**

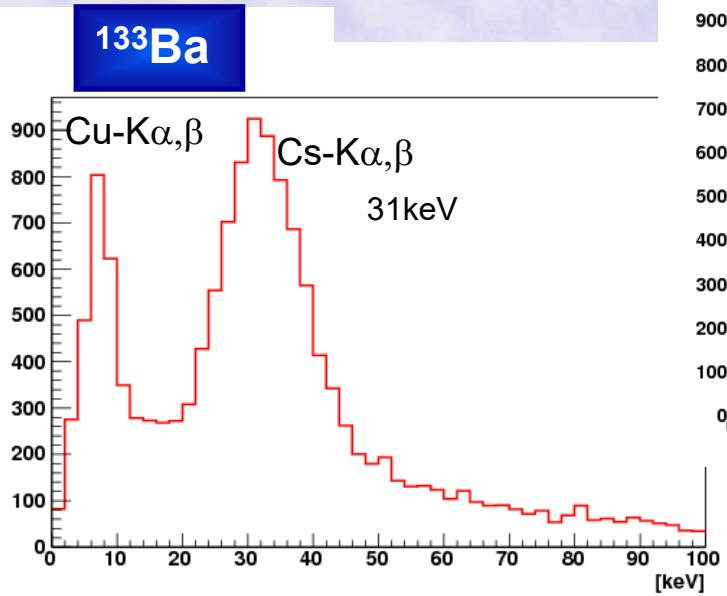


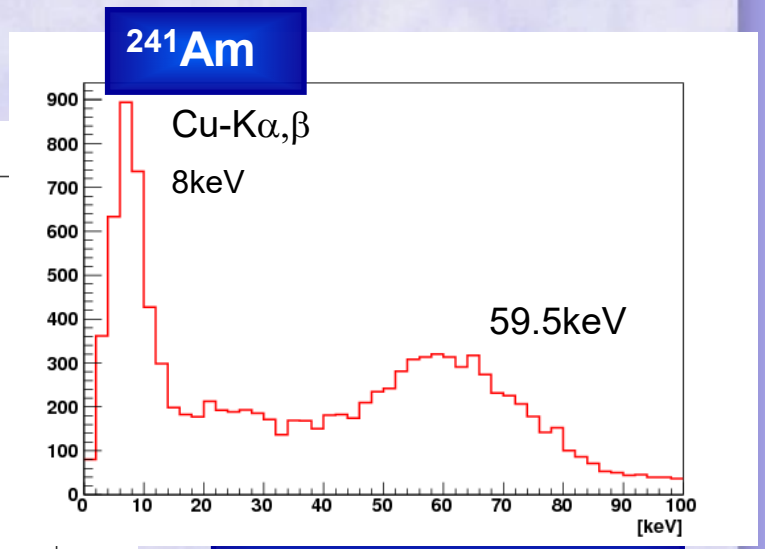


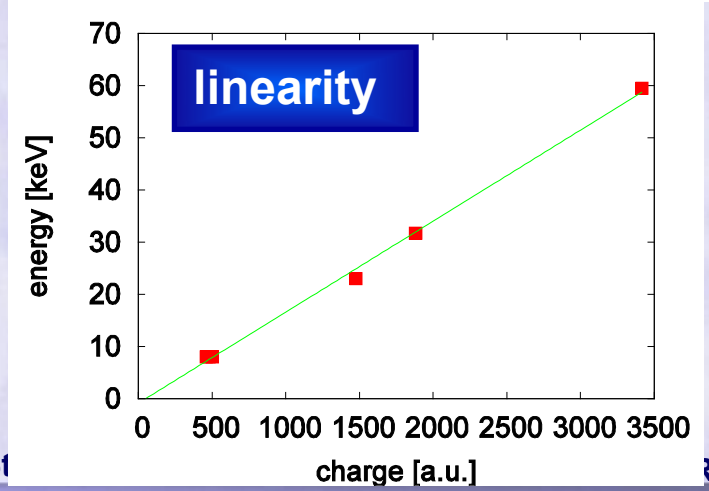
Spectrometry

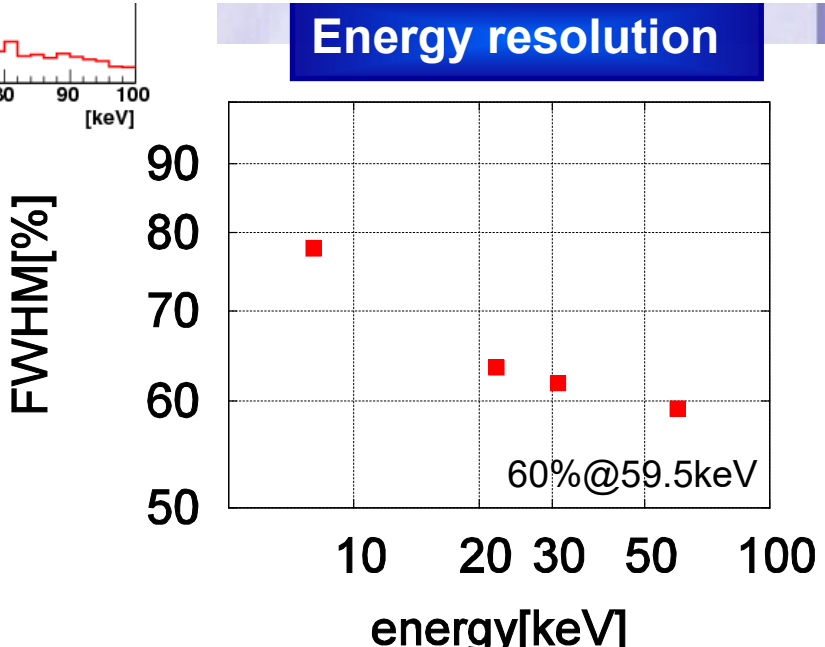
- **Energy spectra from the whole volume (with energy corrections)**





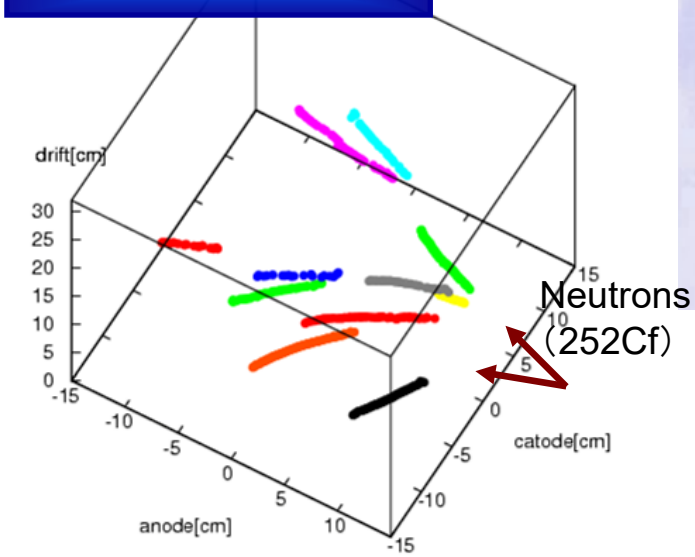


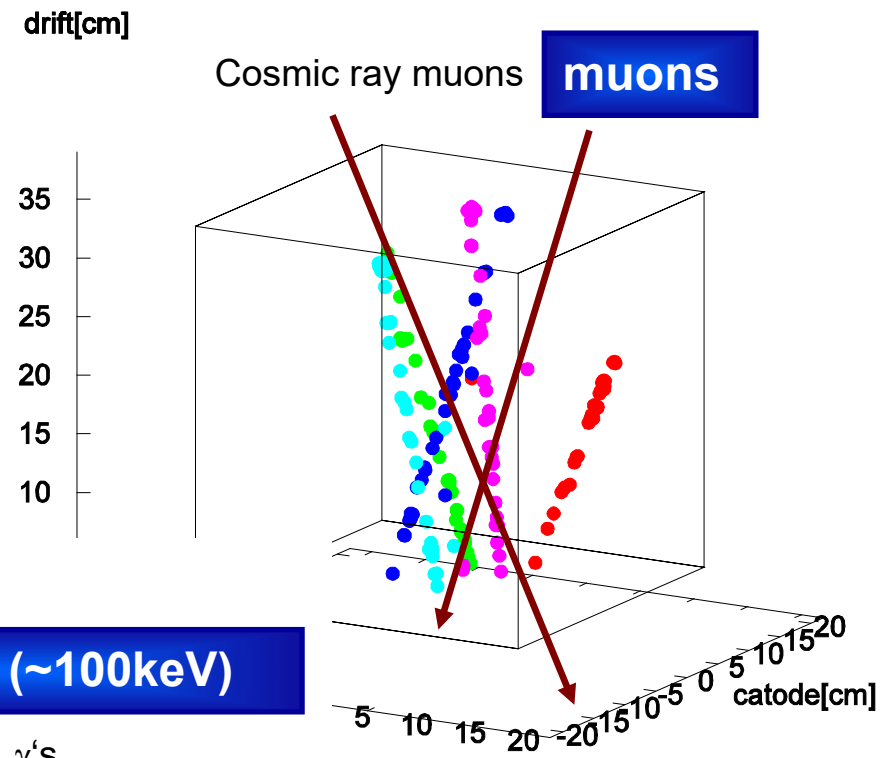




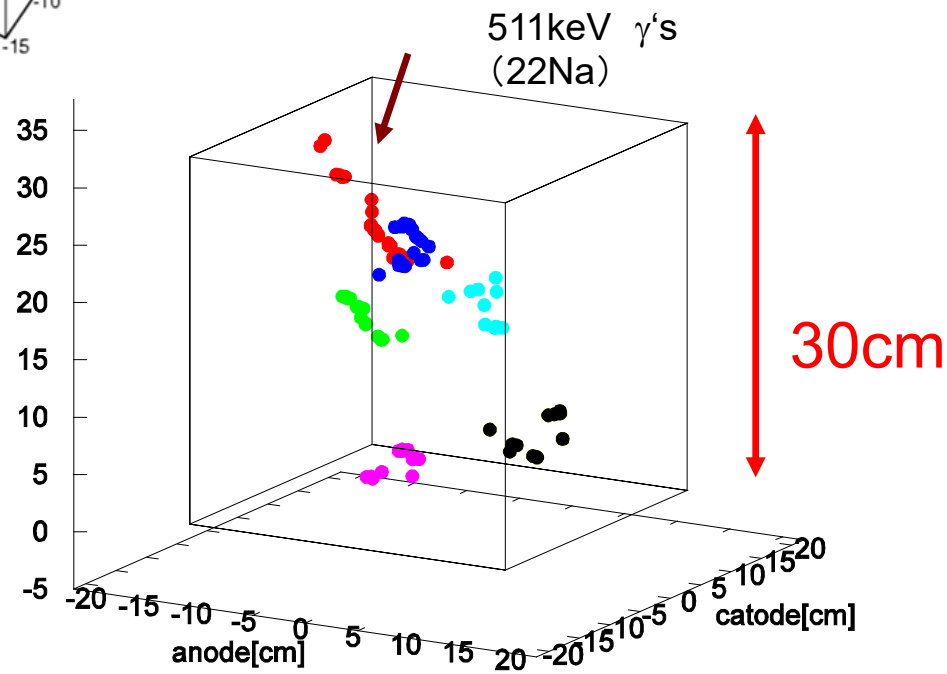
Particle Tracking

Protons (~2MeV)





Electrons (~100keV)



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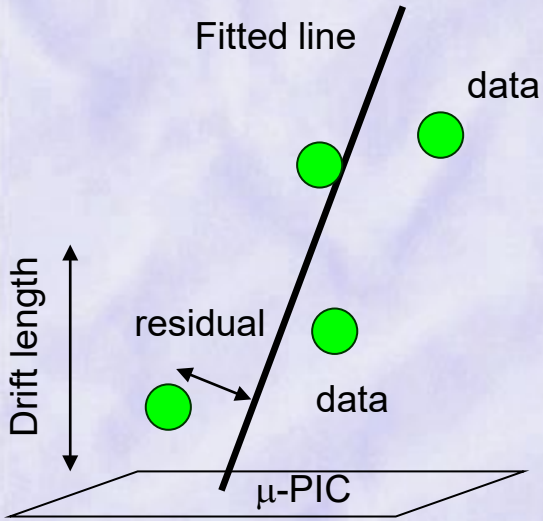
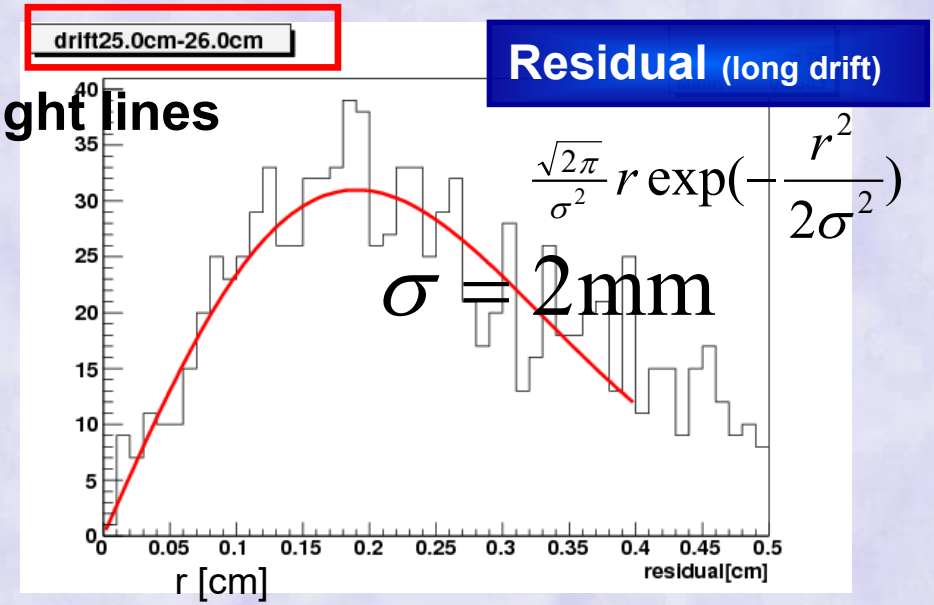
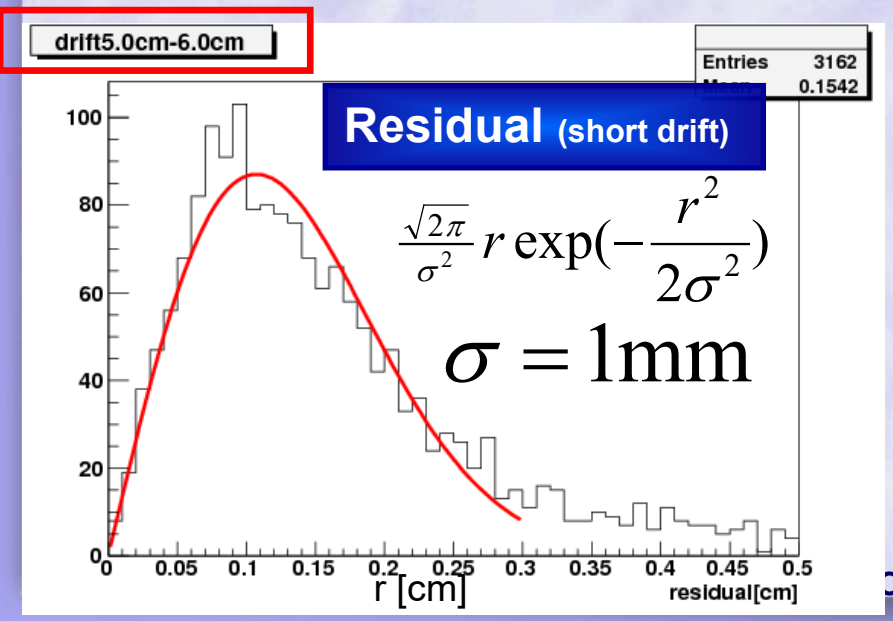
3D Spatial resolution

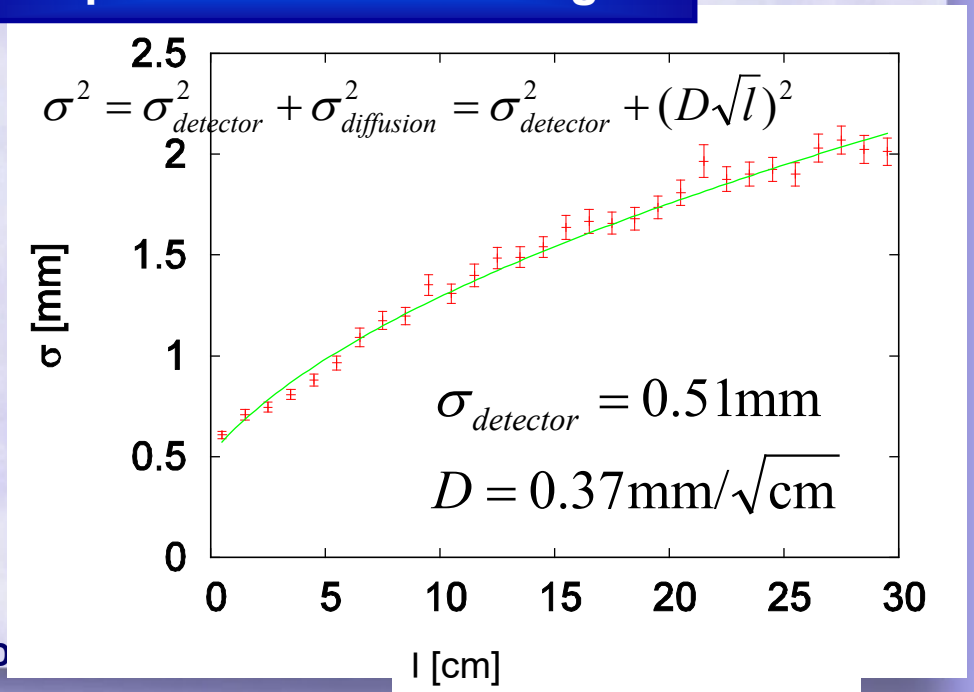
- Fit muon tracks with straight lines
- plot the residuals







σ dependence on drift length



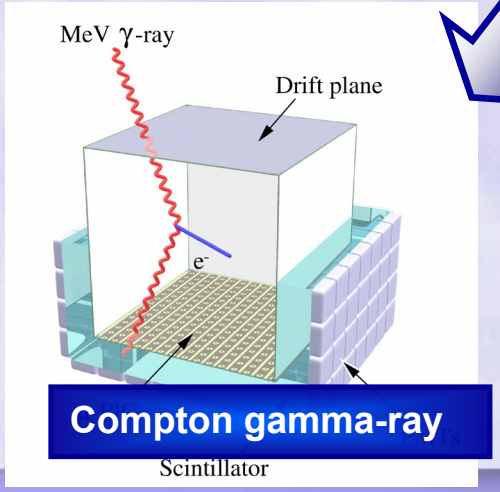
Summary & Future

- **Large volume Micro-TPC : 23 × 28 × 31cm^3**
  - μ-PIC +GEM
- **Fundamental performance was measured**
  - Operation gas gain 50000
  - Energy : 20~ 60keV peaks observed
  - 3D spatial resolution :
    0.5mm (drift 0cm) ~2(drift 30cm)mm

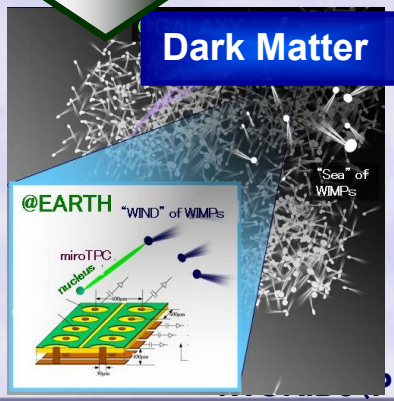
energy resolution,
energy range

Spatial
resolution

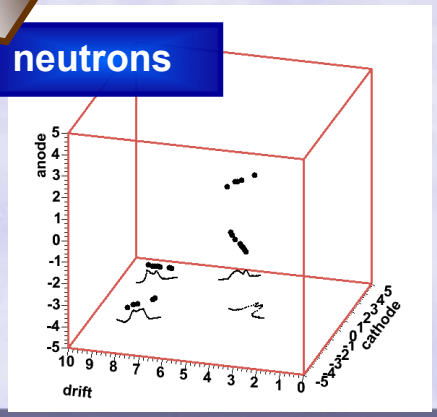
3He TPC gas



Compton gamma-ray



Dark Matter



neutrons

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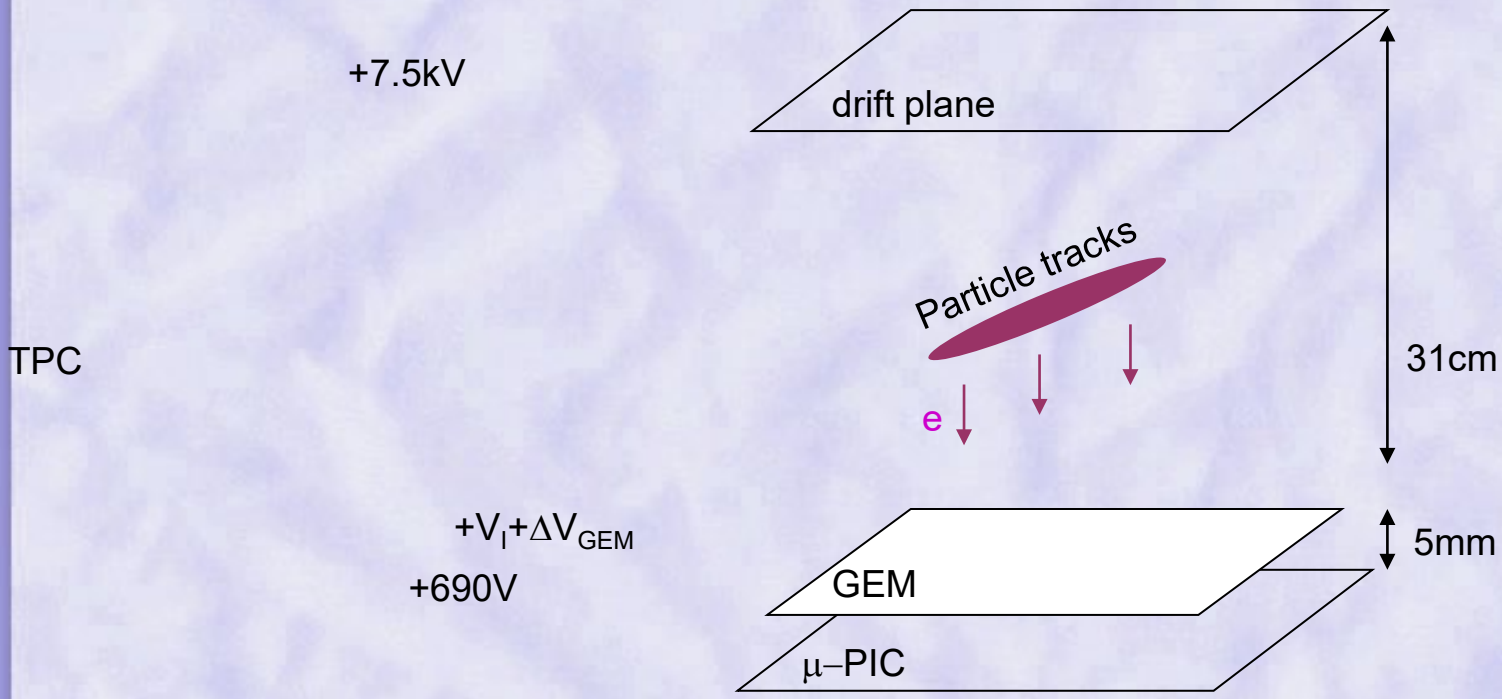
+7.5kV
drift plane
Particle tracks
TPC
31cm
e
$+V_I+\Delta V_{GEM}$
+690V
GEM
5mm
μ–PIC