



# **Beam Test at DESY on December 2012**

**Ryo Yonamine**  
on behalf of those concerned

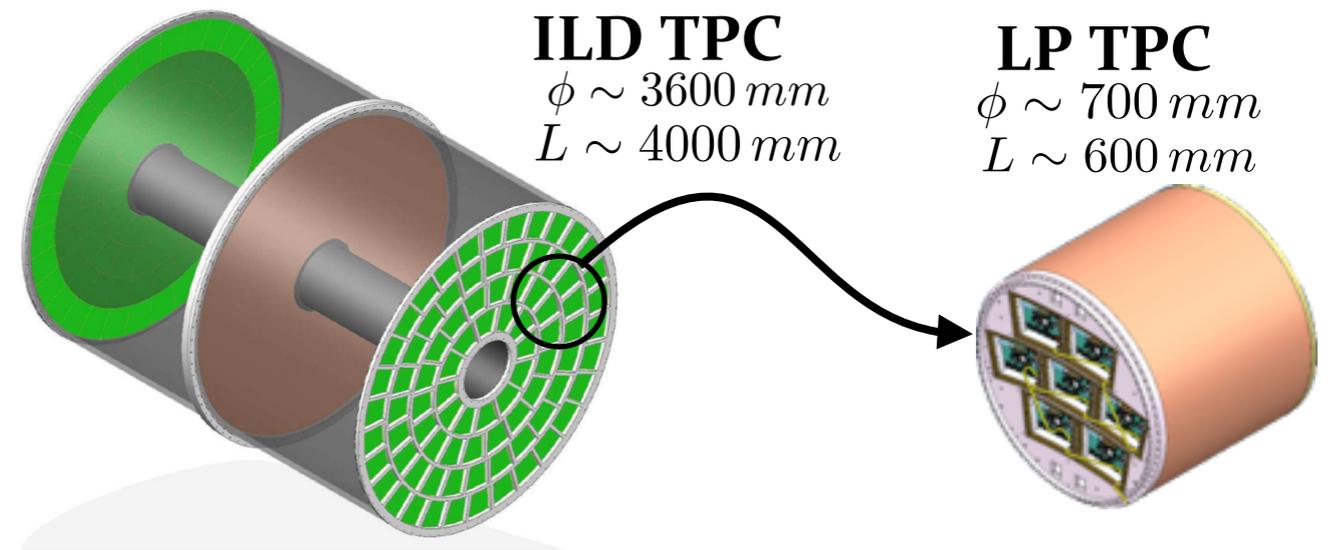
**20th Dec. 2012**

# Beam Test with LP-TPC

## ❖ Large Prototype TPC

Preliminary step for the ILD-TPC :

- Field correction,
- Alignment procedure,
- Study on the module boundaries,
- Field quality, stability, material budget of the field cage and endplate.



## ❖ Benefit of Beam Test

- High rate  $\sim 1\text{kHz}@5\text{GeV}$  (compared to cosmic rays)
- Possibility to specify drift length (=length between the beam and readout plane)
  - > Powerful tool for performance studies of a TPC

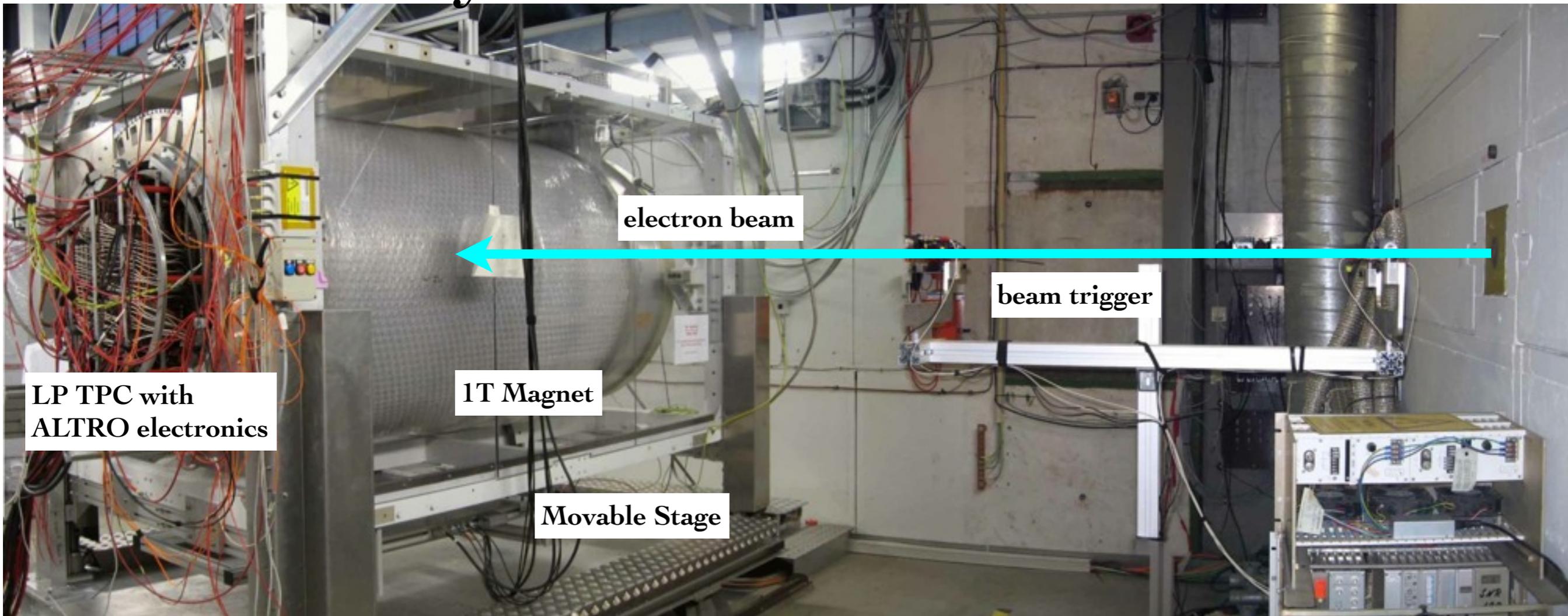
## ❖ Main Target of This Beam Test

- Experimental proof of improvement of the field distortion which existed in the last beam test,
- Experimental proof of our spatial resolution formula,
- Clear up questionable points of our modules, ... etc.

❖ 12/6 ~ 12/20 (11/19 ~ for preparation)

# Large Prototype TPC at DESY

## Test Beam Facility



gas monitor  
(pressure, temperature  
oxygen, water)



H.V. system  
(Field cage, GEM, etc.)

# Beam Test Crews

**More manpower than ever before!**

- ❖ Postdoc × 3
- ❖ Ph.D student × 1
- ❖ Master student × 3



# Improvements and New Points

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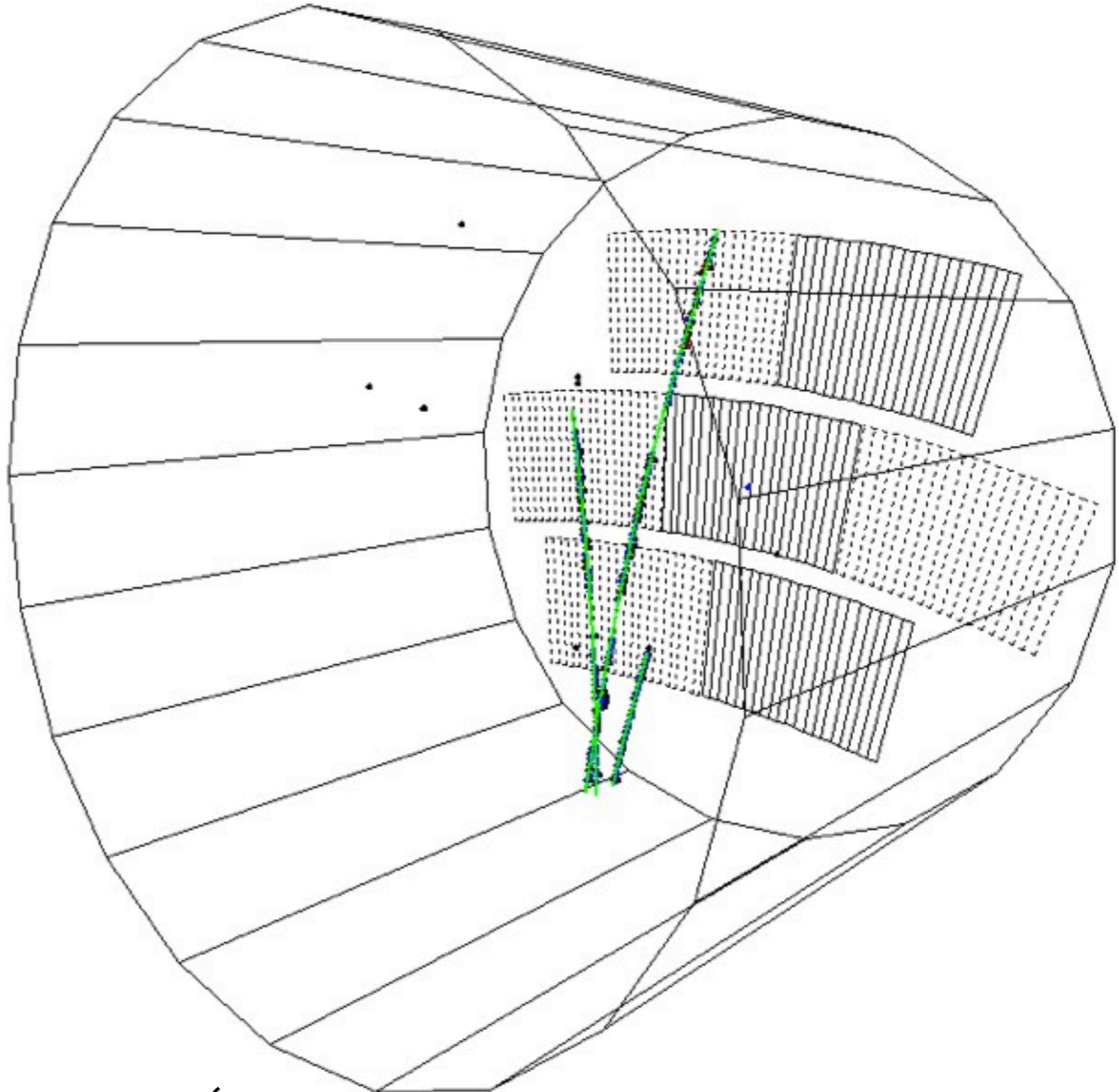
- Optimized the voltage for the field shapers
- Taking several condition data to understand behavior of the spatial resolution (short drift distance, angle track, etc.)
- Using a laser system set up at KEK, we found the changes for worse related to new GEMs.

# Data Taking

❖ Basically went well !

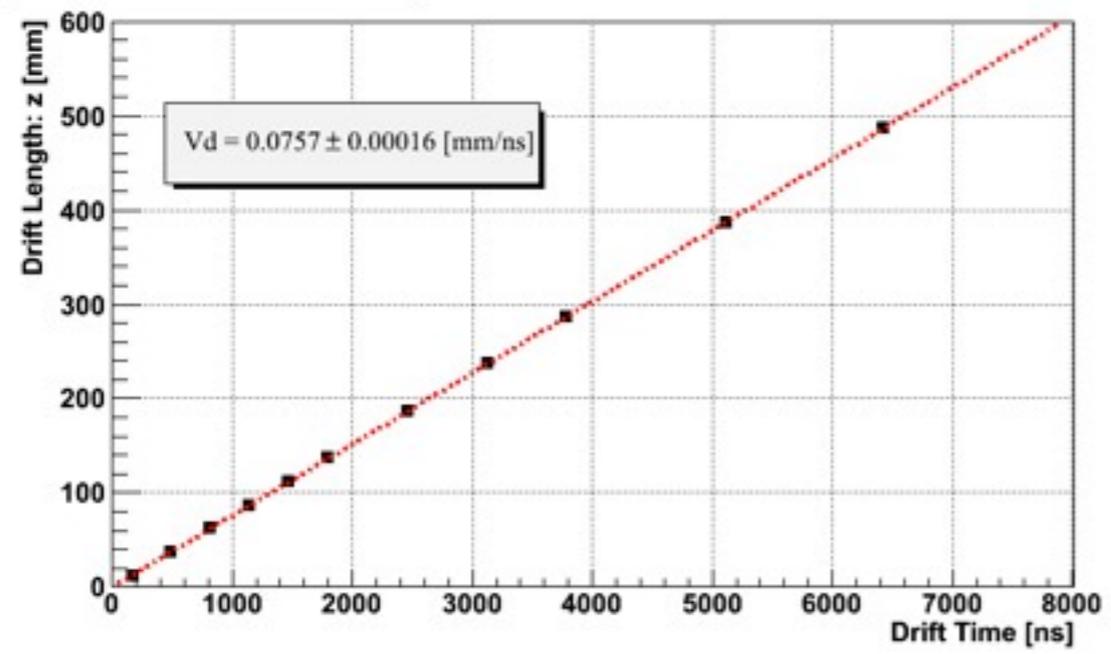
We have taken a lot of data to check the module performance.

- different GEM voltage setting
- drift length scan (z scan)
- beam position scan (x scan)
- beam energy scan (3,4,5GeV)
- track angle scan (theta, phi)
- w/, w/o magnetic field



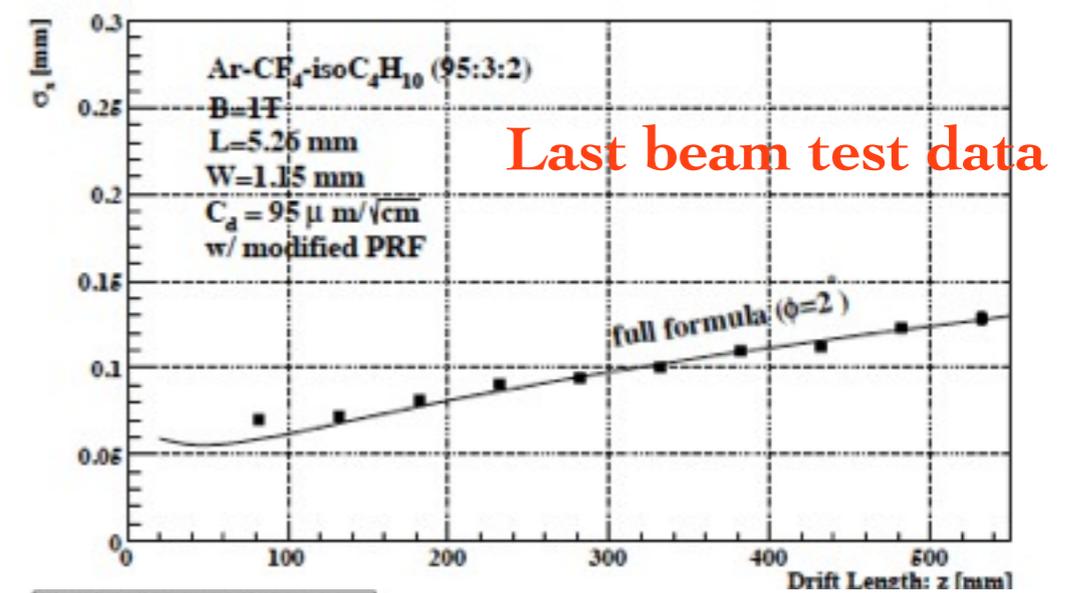
# Very Preliminary Results

Drift Length vs Drift Time

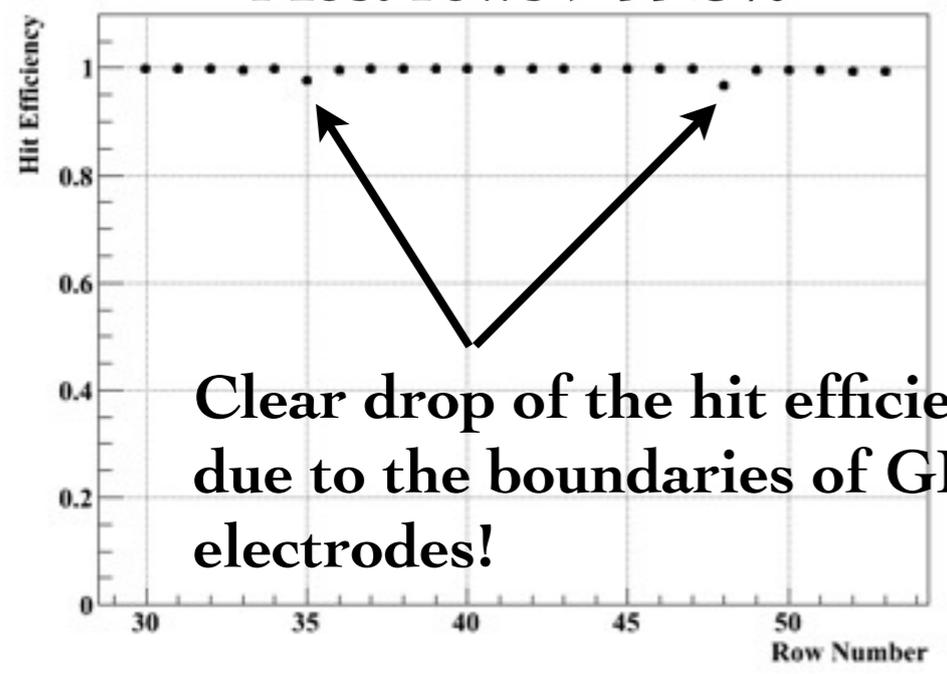


Drift Velocity  
 Measured :  $7.57 \pm 0.02$  [cm/ $\mu$ s]  
 Magboltz expectation :  $7.60 \pm 0.01$  [cm/ $\mu$ s]

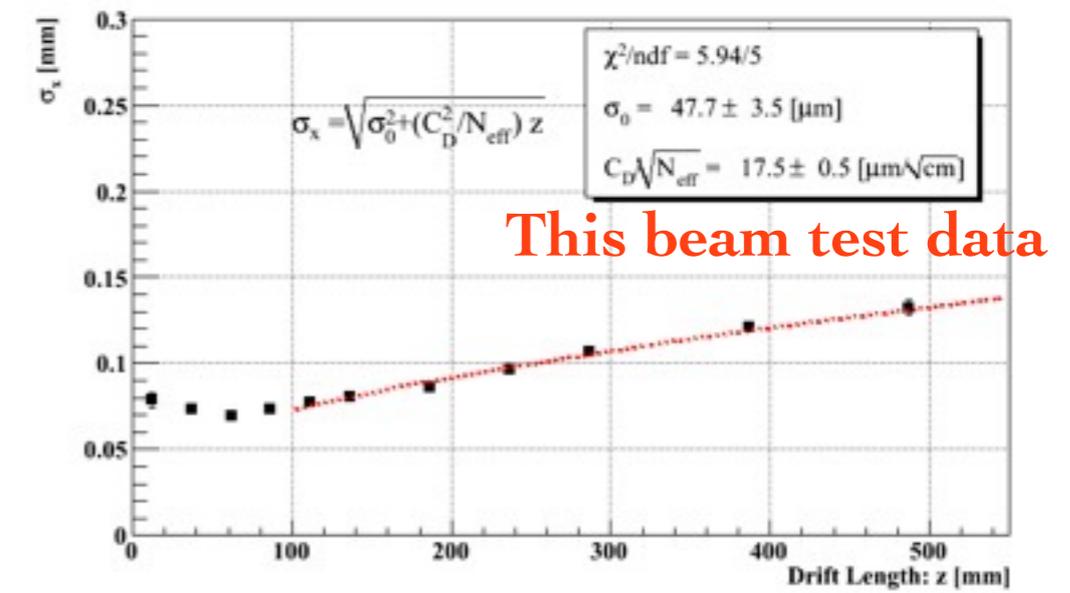
Point resolution



Most rows > 99.5%



GM Resolutin (row 44)



# Questionable Points

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## Technical Issues

- ❖ Should minimize insulator surface to minimize electric field distortion (GEM)
- ❖ Otherwise need any field shaping structure (module boundaries)
- ❖ Need strong grounding for H.V. cables for noise reduction
- ❖ Very careful design for H.V. lines not to discharge (GEM, PCB)
- ❖ most probably more ...

# Summary

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- We have just finished the beam test.
- Data taking went well.
- Detailed studies are on going.
- Questionable points found in this beam test should be overcome for next modules.

**Backup**

# Asian Modules

## Double GEMs

### Features

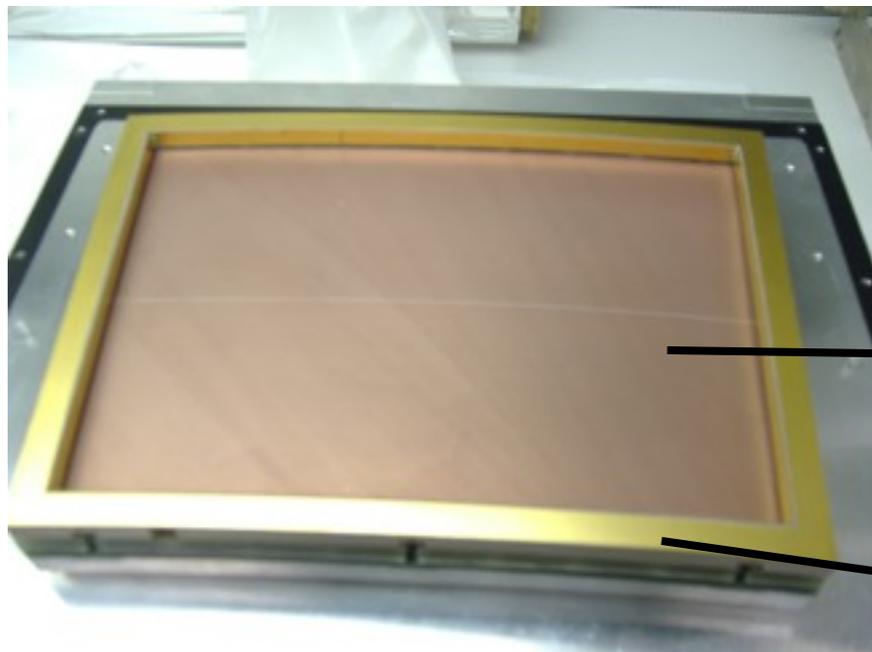
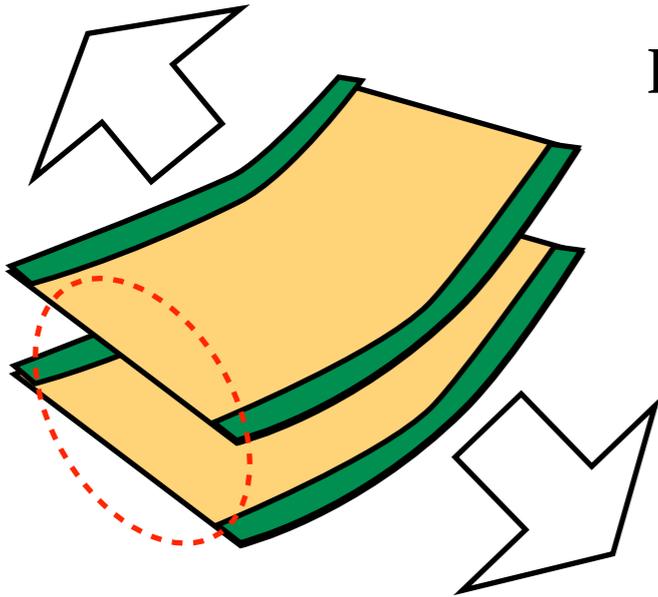
100 $\mu$ m thick GEMs (SciEnergy)

Stretching structure without side frames

### Segmentation

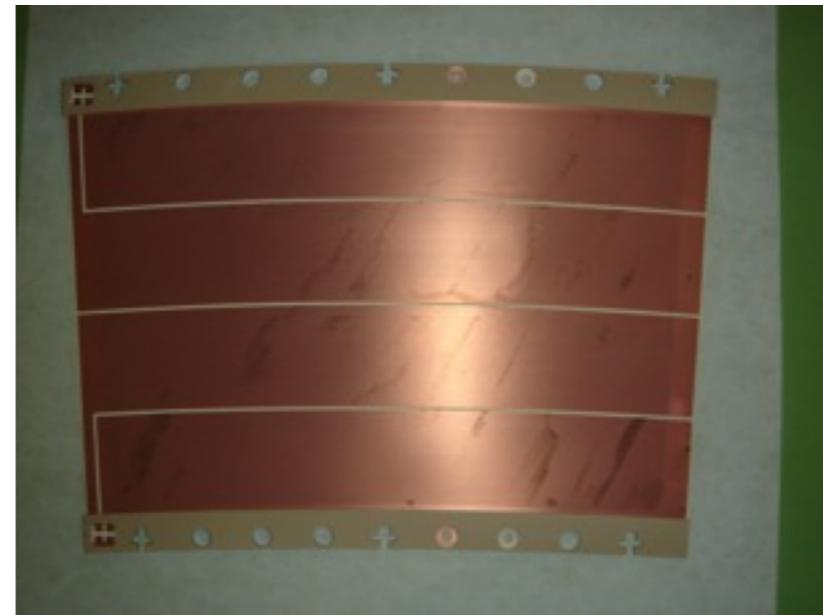
1<sup>st</sup> design 160cm<sup>2</sup>/seg.

--> New design 80cm<sup>2</sup>/seg.



**Previous version**  
of GEMs with  
a field shaper instead of  
gating device

field shaper



**New version**  
Electrode segments 2-->4  
for decrease the effect of  
discharges.

|| The gaps were increased to 1mm for safety.