

# Asian Module

What is our concept

The status of LP1

What we propose ??

What can we do for coming year

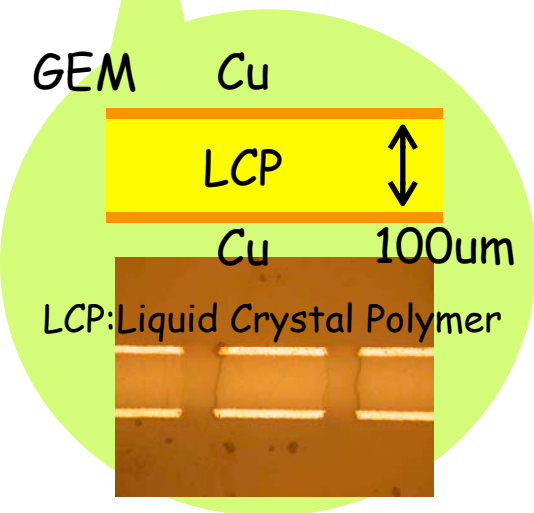
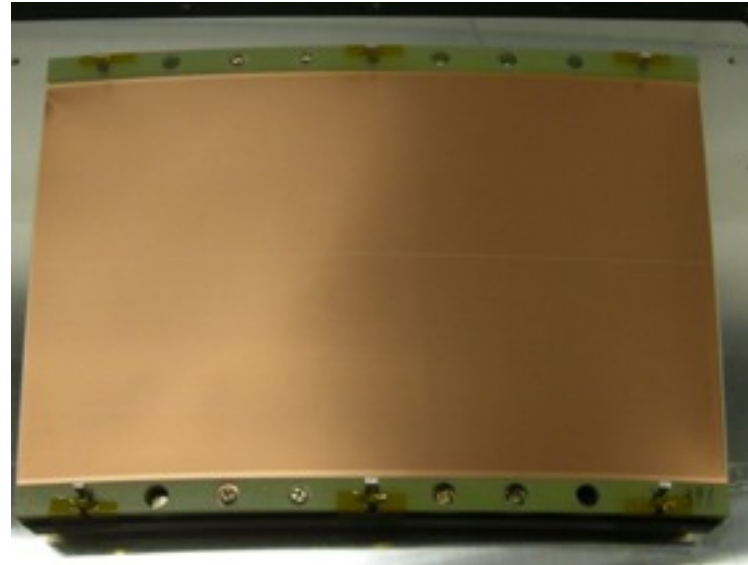
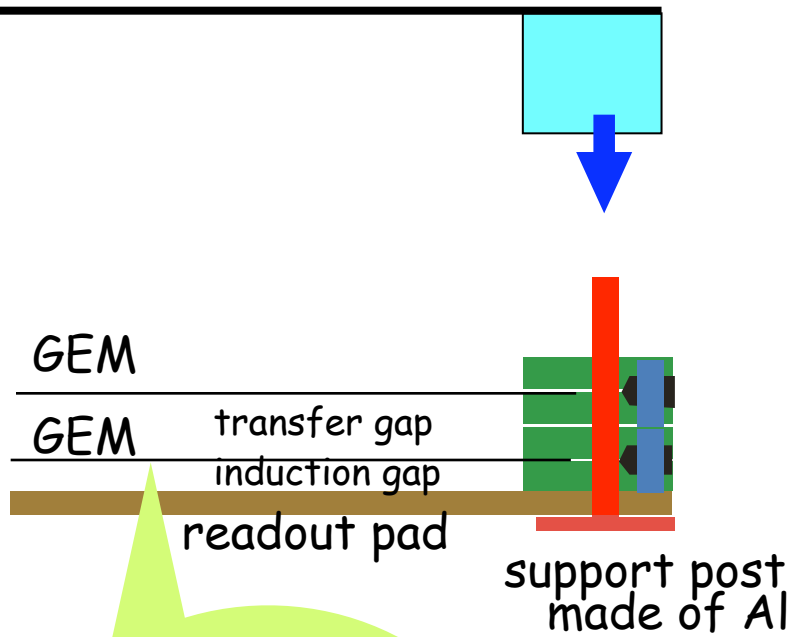
# Basic concept

To achieve good resolution and efficiency

- optimize pad size for GEM operation
  - $O(1\text{mm})$  pad pitch @ $\sim 300\mu\text{m}$  diff. at gas amp.
  - routing of signal/HV
- minimize dead region pointing IP
  - no frame in the side
  - GEM stretching
- simplify the structure
  - double GEM w/ Gate (separate function)
  - Gate is necessary

No frame on the side:  
 stretch only from inner/outer in r  
 -> introduction of "post"

Gate GEM



100um thick LCP GEM: to reduce #of GEM  
 -> double GEM w/ enough gain  
 giving up self reduction of ion b. flow

# What we have done

1st beam test @ 2009 Feb.

w/o Gate : we observe a big distortion

2nd beam test @ 2010 Mar.

w/ Gate : Gate oversize/ HV connection btw neighbor gates  
HV leak to pad plane -> damage to readout electronics  
and/or GEM discharge ->

we found thin GEM Gate cannot provide enough transmission

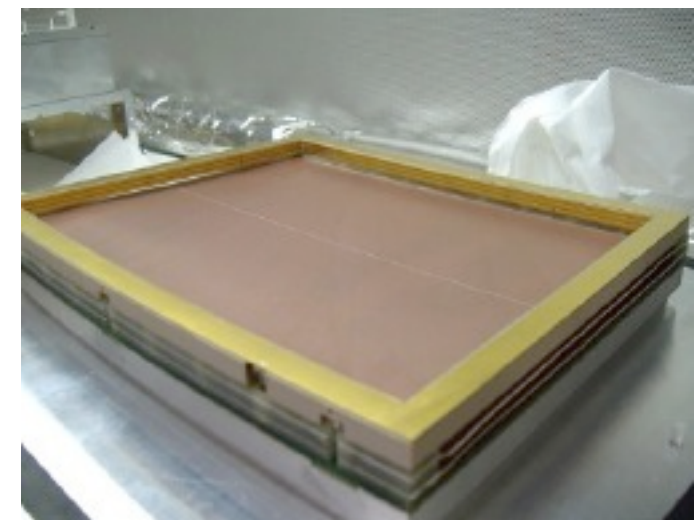
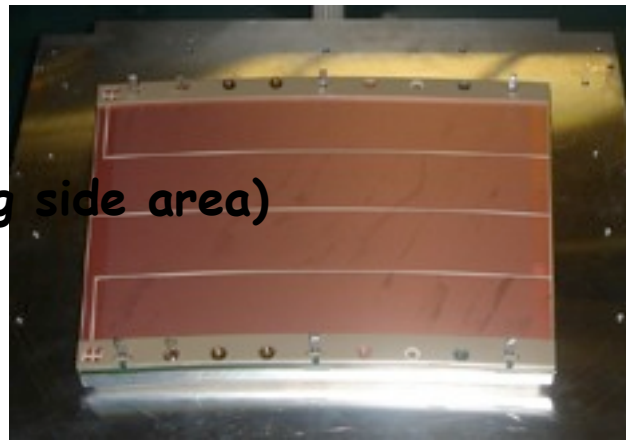
3rd @ 2010 Sept.

we need good data anyway to investigate mom. resolution

w/o Gate w/ field shaper  
but many GEM discharge

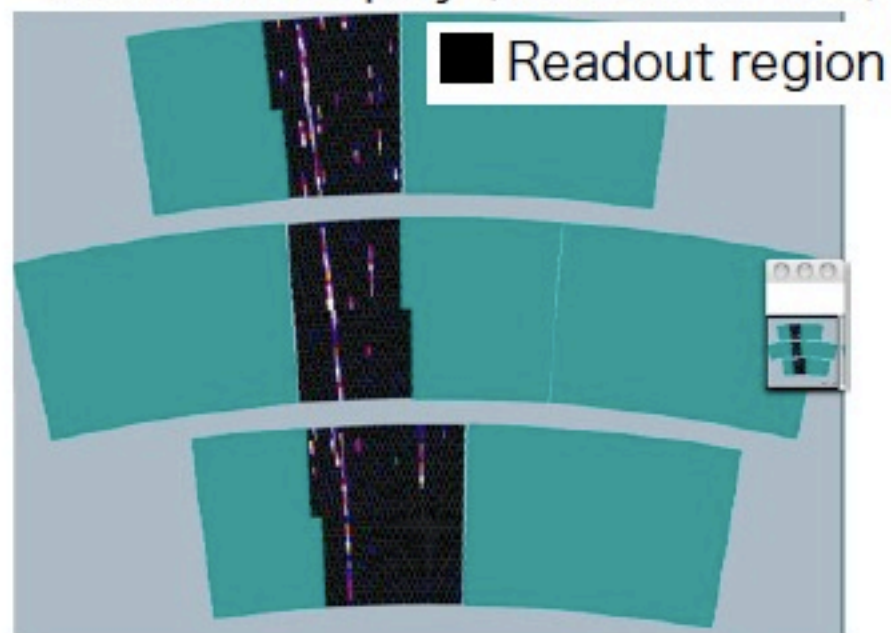
to Next

modify GEM 4 div. (sacrificing side area)  
not finished yet

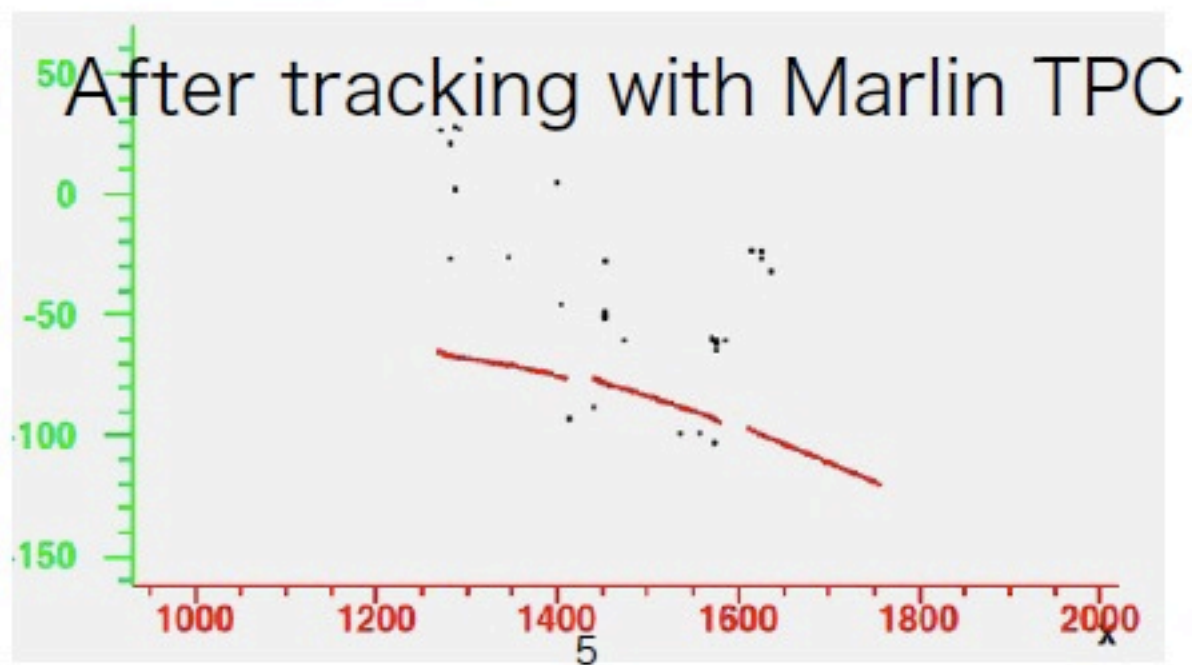
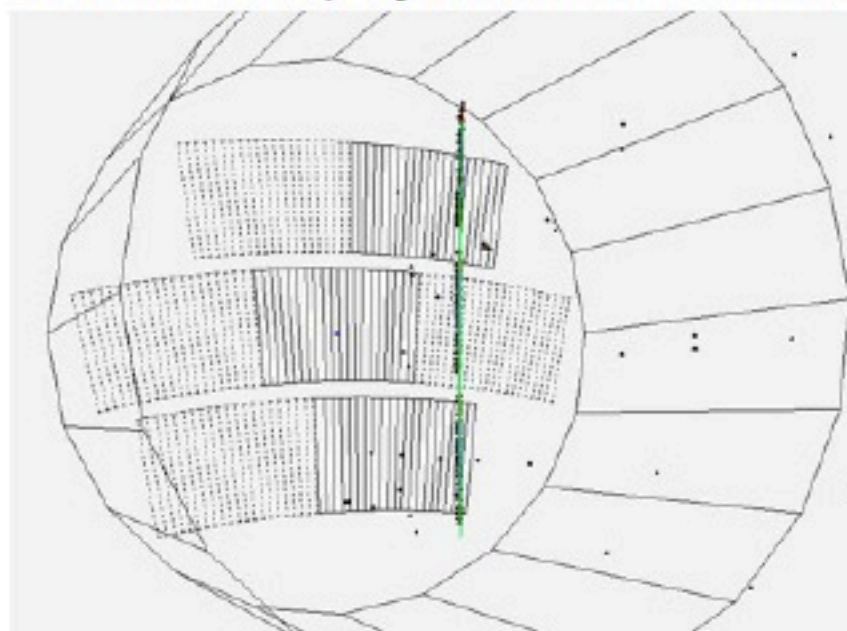


# Event display

2D event display (not Marlin TPC)

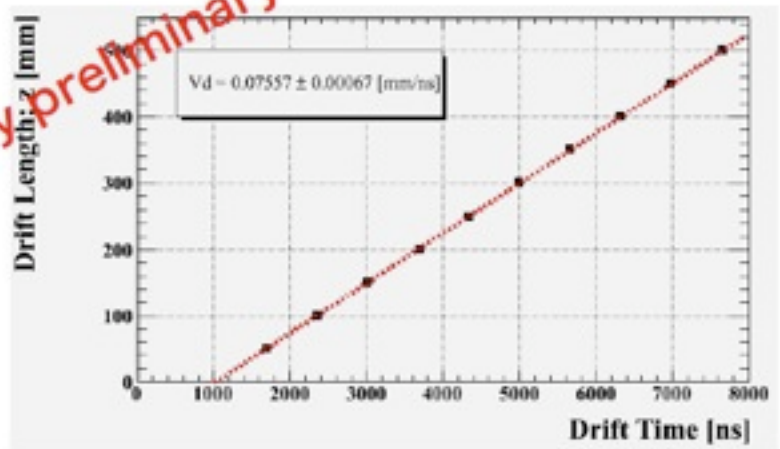


3D event display (not Marlin TPC)



# Drift velocity measurement

Very preliminary

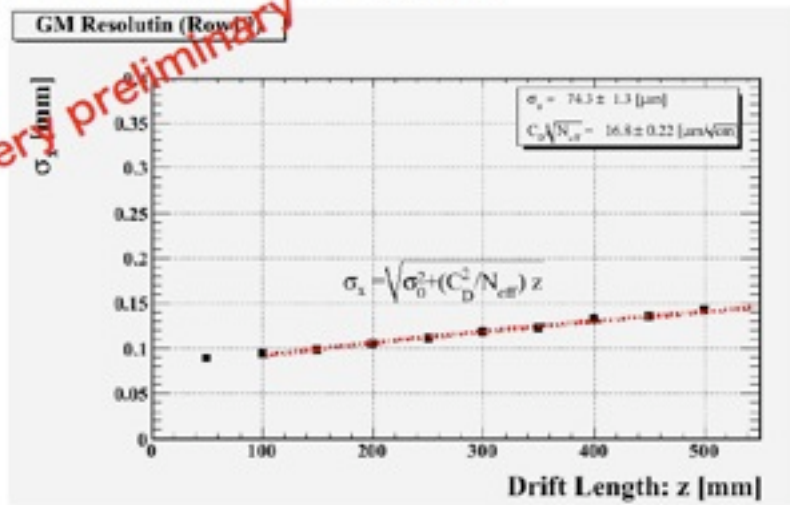


Measurement  $V_d = 7.557 \pm 0.001$  [cm/ $\mu$ s]

Magboltz (v8.5)  $V_d = 7.509 \pm 0.002$  [cm/ $\mu$ s]  
 (Temperature 290K, Pressure 1atm, with considering 200ppm H<sub>2</sub>O)

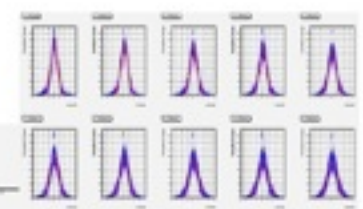
# Point resolution as a function of drift length

Very preliminary

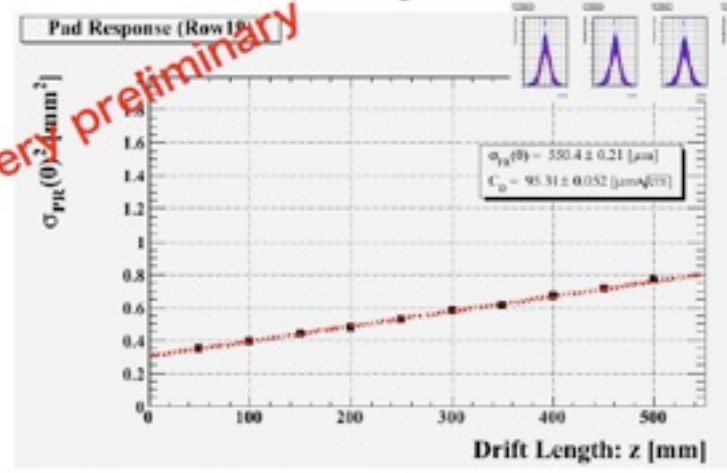


I'm trying to estimate Neff with fitting by analytic formula.

# Width of padresponse as a function of drift length



Very preliminary



Measurement  $C_D = 95.3 \pm 0.1$  [ $\mu$ m/ $\sqrt{\text{cm}}$ ]

Magboltz(v8.5)  $C_D = 94.3 \pm 1.9$  [ $\mu$ m/ $\sqrt{\text{cm}}$ ]  
 (Temperature 290K, Pressure 1atm, with considering 200ppm H<sub>2</sub>O)

# What happen to us

## GEM itself

we observe many discharge

the problem of 100um thick LCP GEM ?

itself ?

-> see gain and discharge test @KEK

the way to supply HV

## Stretch method

- too much tolerance

difficulty of precise fabrication

-> touching to neighbor module

HV mis-connection

- metal post

HV leak btw gates

distortion of field

-> need field shaping w/o Gate

- complication of HV connection

-> washer fall down

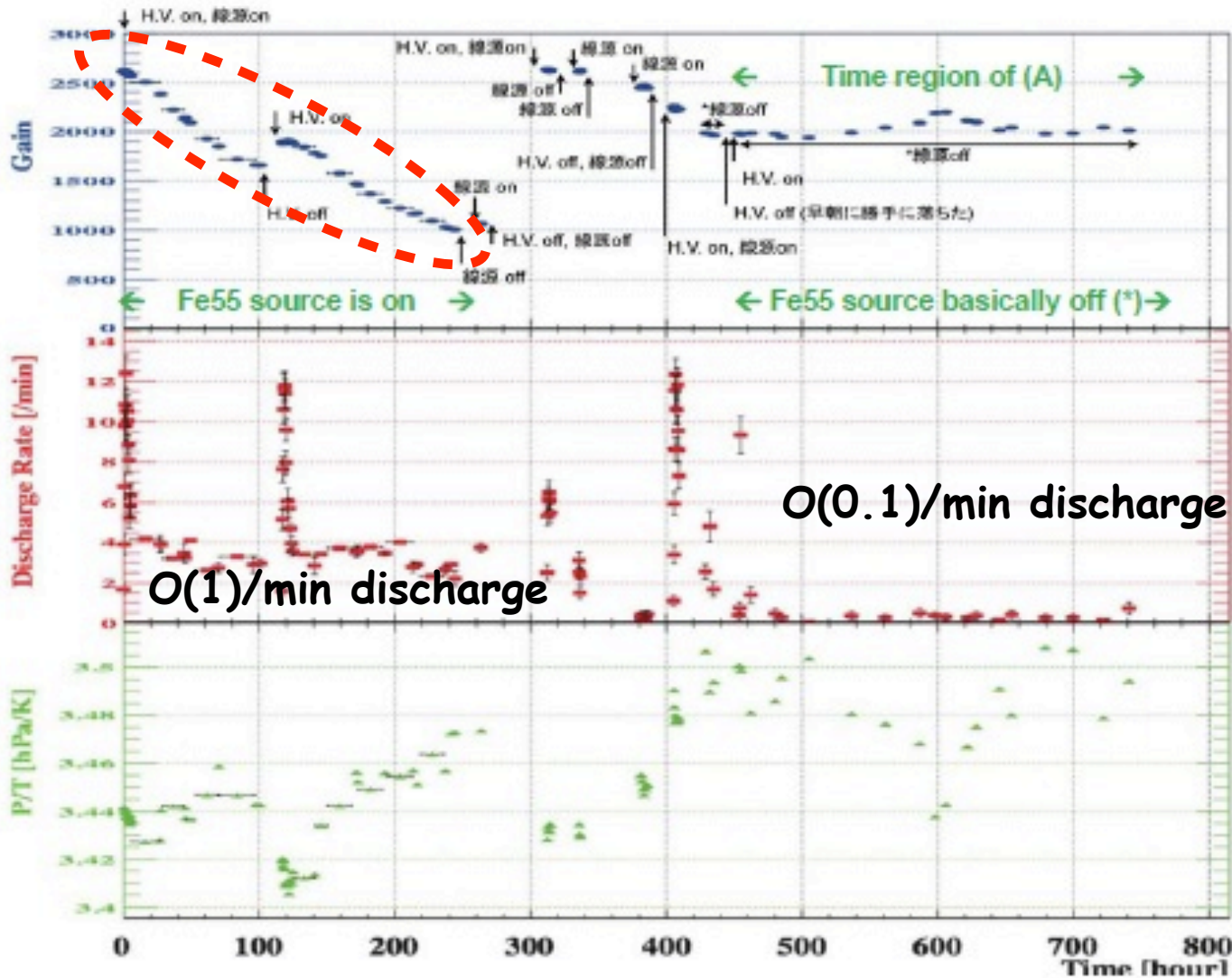
HV leak

# Gain & discharge test @KEK

## More Information by the end of Jan 2012

A summary plot of the discharge rate and the gain shift  
Measured for the module with the termination plate

constant gain decrease  
with source



ゲイン測定時のみ線源を当てる。1回の測定で約10分程度。



100um thick GEM discharge

~O(1)/min with Fe55 source

~O(0.1)/min w/o source

too much comparing to "good one"  
more discharge @HV on "RIKEN GEM"

Gain drop

constant gain drop last w/ source

but gain become stable w/o source

gain recover after HV shut off ; not damage

-> due to charge up ?? -- related to structure of hole

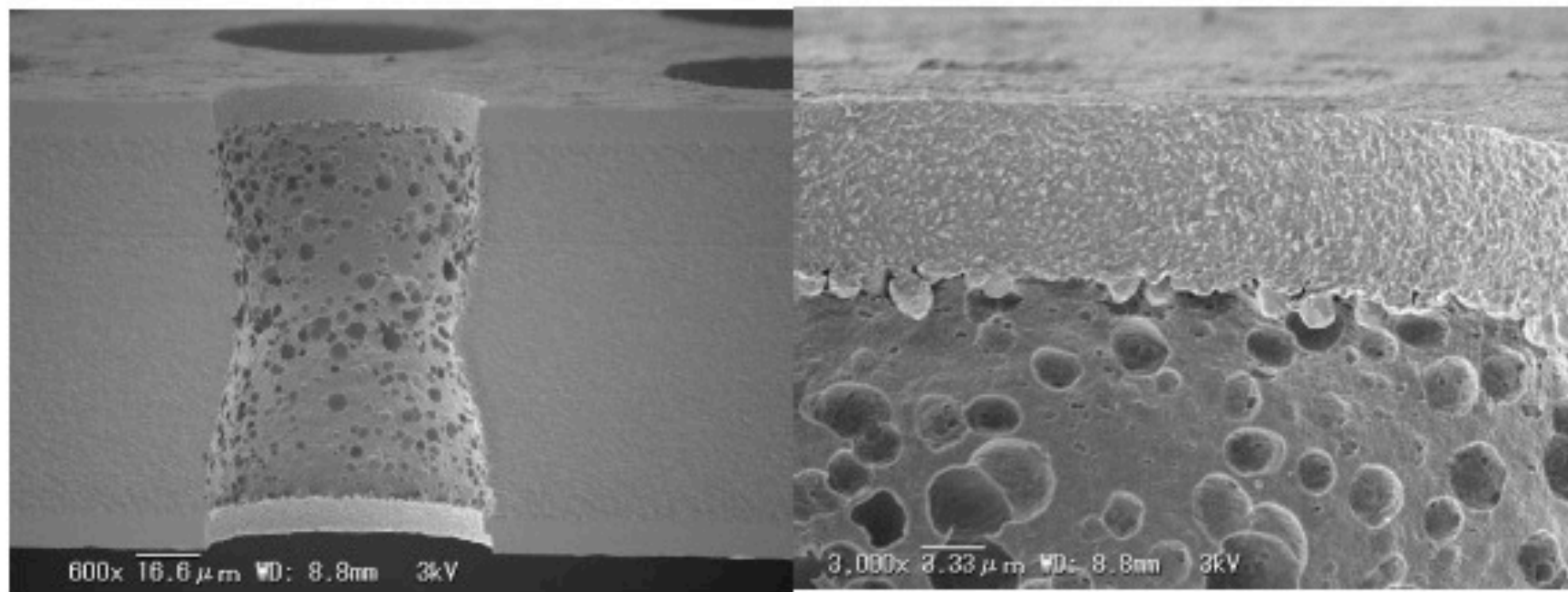
## Photography of GEM Holes

These photos are not of our GEM, but one of the SiEnergy GEMs.

The photos were provided by SciEnergy.

Dots on the surface of the hole are hollows due to the bubbling when the GEM holes are made by an irradiation by a laser.

It is said that carbons or other semi-conductive contaminations may be left on the surface of the hole when the clearing processes (etching process) are not sufficient.



**Good 100um thick GEM @RIKEN(Tamagawa)  
is processed**

**(1) CO2 Laser etching LCP holes**

**(2) de-smearing (cleaning) hole by dry etching (Plasma)**

**this is regular process but intensive care of (2) for RIKEN GEM**

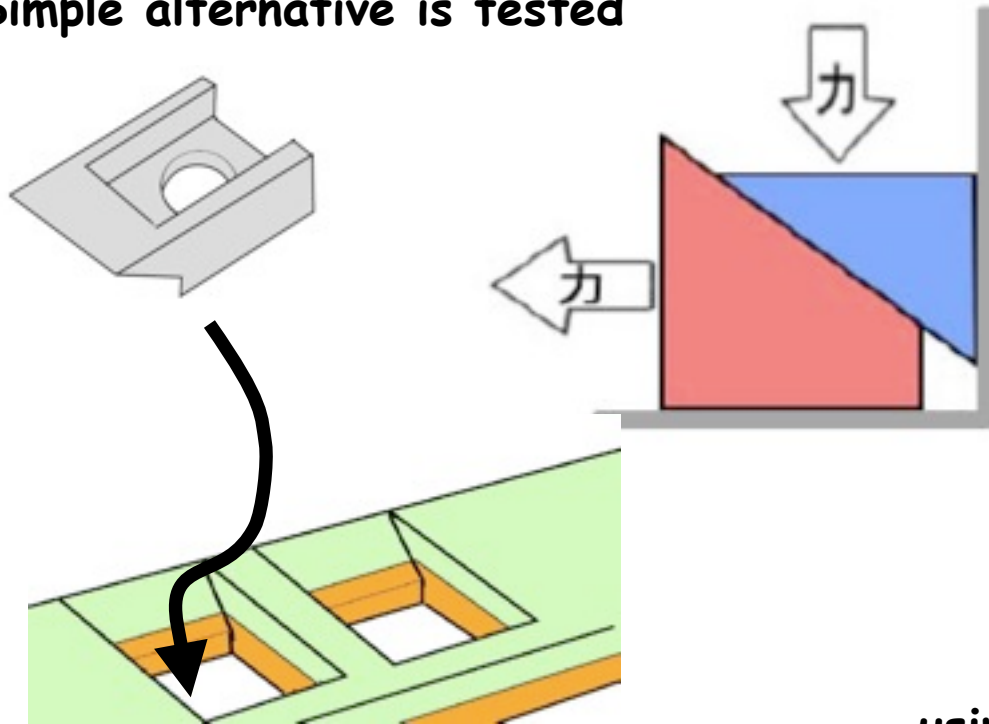
**We are asking same process for our GEMs**

**GEM is ready to be checked at KEK soon**

# Stretch method/HV supply

We don't have progress yet.

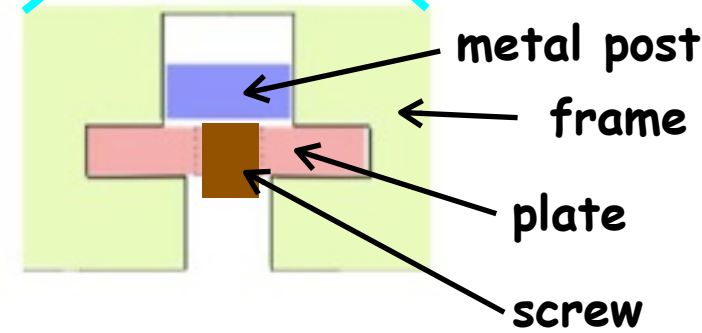
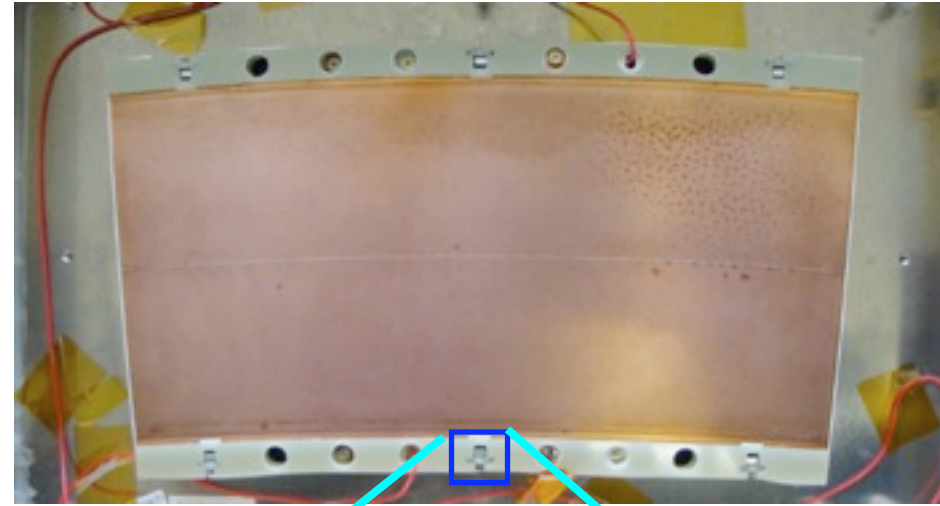
Simple alternative is tested



1/4

2/4

3/4



using metal frame/holder/screw  
std. M3 screw  
but Not simple enough

KEK try to find new way



We have to think about stretch method/HV supply more before start next module design.

Next module: common PCB design ?

with DESY module ?

with MM module ??

What we propose ?

# What can we do for coming year

Momentum resolution using 3 modules - > using current modules  
w/o Gate  
w/ field shaper -> like a test of field shaping

or cutting metal posts and putting spacer to backframe ?  
(treatment of FR4 frame is another issue)

==> within this year ( depending on situation of GEM )

Next module MCM will not be ready until the end of this year

Stretching ? GEM ?

Gate ???