Asian Module

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No news from the last meeting

except minor update of beam test result

typical performance meets ILD requirement 100um σrphi, 5% dE/dx

some behavior are still not explained well

such as

diffusion constant are not stable in each pad row

angular dependence is not understood well . . .

Module does has not been updated more than 10 years

(except minor modification of GEM)

It's almost time to renew , under common module design concept

how ?

Asian module

concept : minimize dead region with Gate device

Frame less @ module side -> effect is unclear

we may have dead area even without frame

due to gap btw module (1mm clearance in design)

GEM hole cannot be allocate the edge

local dead area @module boundary might be miner thing

comparing to “aligned” module EP design

would be proposed by Mech. session

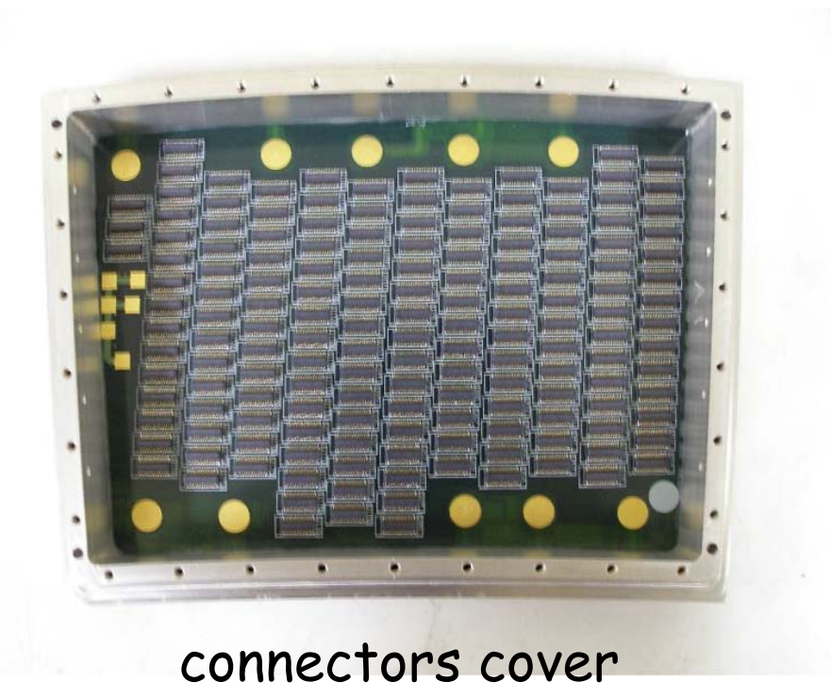
for deformation

Concept of Asian GEM module LP1

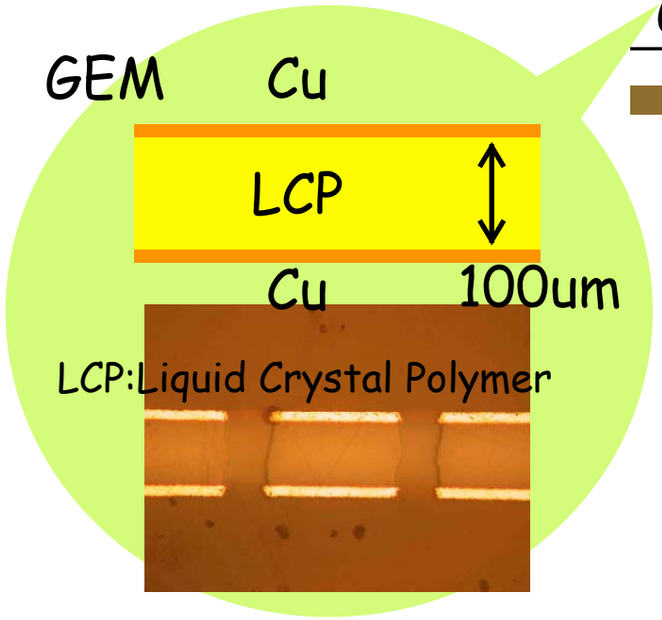
Pad plane (w/ Tsinghua U.)

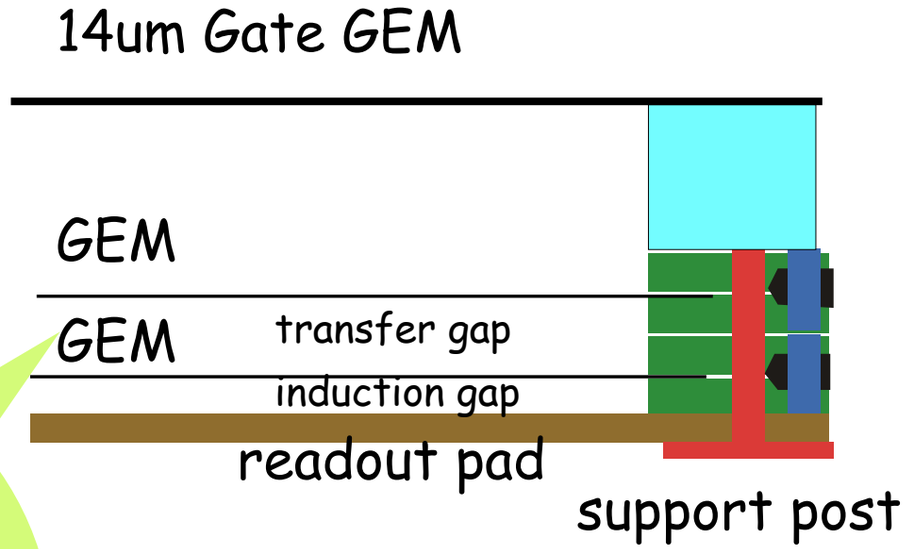
pad pitch ~1.1mm
pad height ~5.5mm
by ~300um diff.@amp.GEM

~5000 pads/module



connectors cover
most of the area in backside

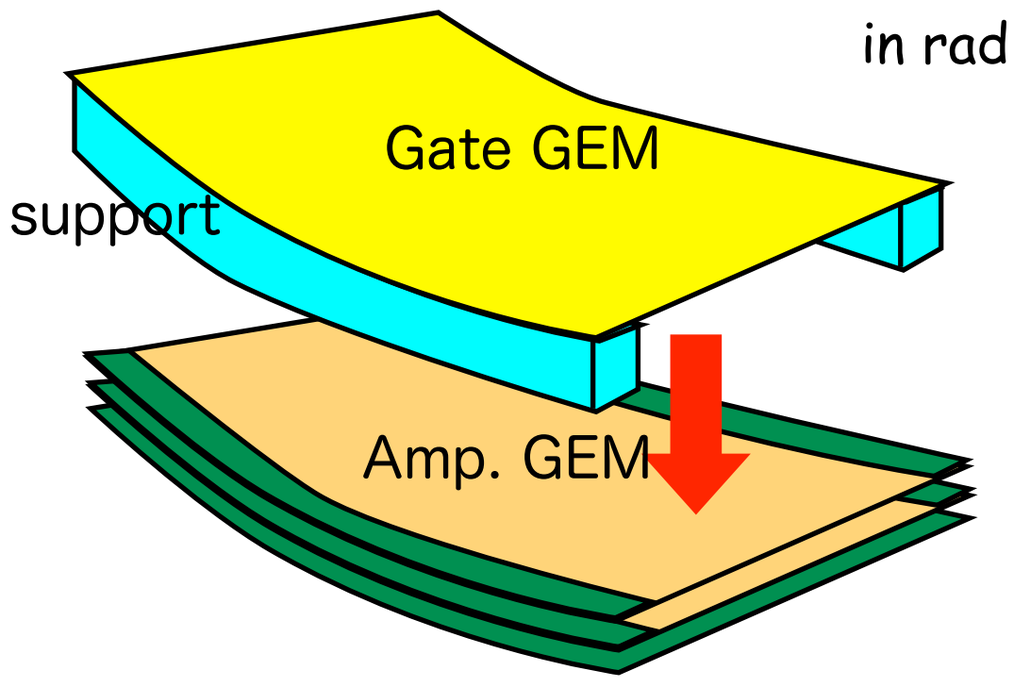




Amp. structure

Double 100um thick GEM

GEM stretched by support post
to minimize dead(support) area
in radial direction



GEM gate

14um thick GEM

Upper structure of module (Amp. GEM + Gate)

Which kind of GEM is the best for ILC ?

we have been waiting ideal GEM coming but ???????

std GEM, LCP GEM, teflon GEM, ...

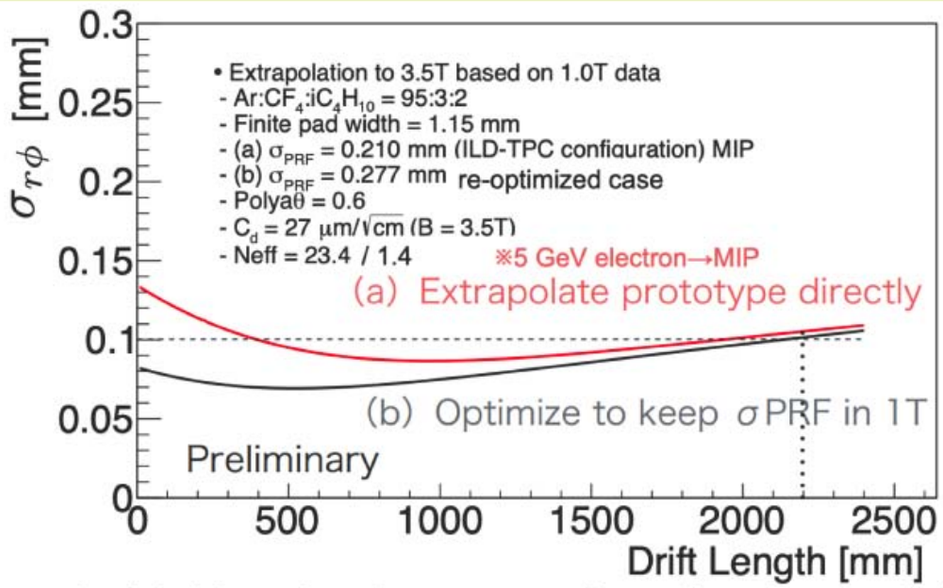
glass GEM

ceramic GEM

these are rigid, no frame is necessary (?)

but GATE must be thin, so frame is necessary

Extrapolation of spatial resolution

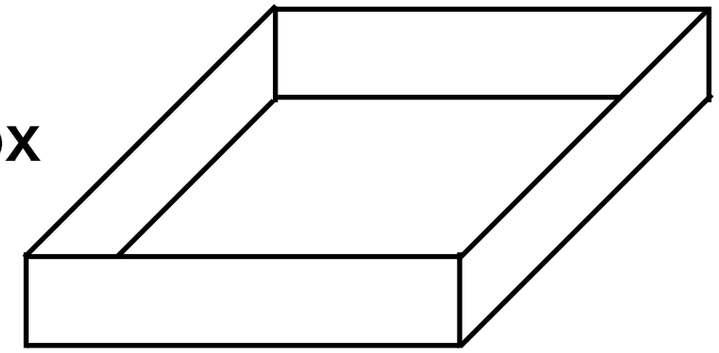


When we decide hit points by center of gravity, the graph is (a) because of bias.

When we optimize to keep σPRF in 1T, we get graph (b)

→The spatial resolution (100 μm) can be achieved

rigid box



How do we enlarge diffusion at amp. region

current 6mm(4mm trans. + 2mm indu.)

should be 8mm??

or other ? method

Middle structure of module (PCB)

front side
  Pad plane : 1mm width?

routing

rear side
  connectors

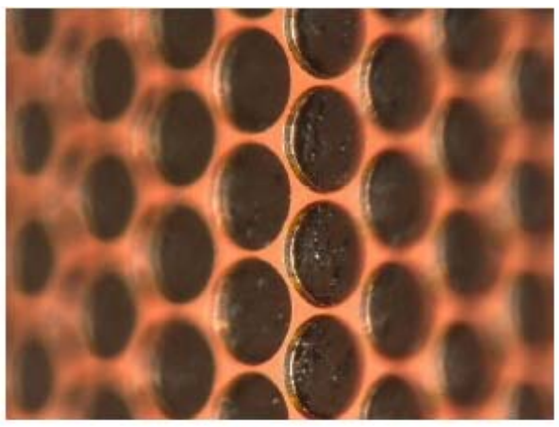
current connector
  X-talk btw neighbor channel >10%
  not necessary to be high pitch like we used at LP1
    -> Saclay's connector
      can we make it 3 times more dense ?
      RO chip can be mounted 5000ch on one side?
      how to cooperate w/ sAltro16 effort

Back structure of module (electronics+cooling) must be same

Gate:　this is not a specific issue of Asian module

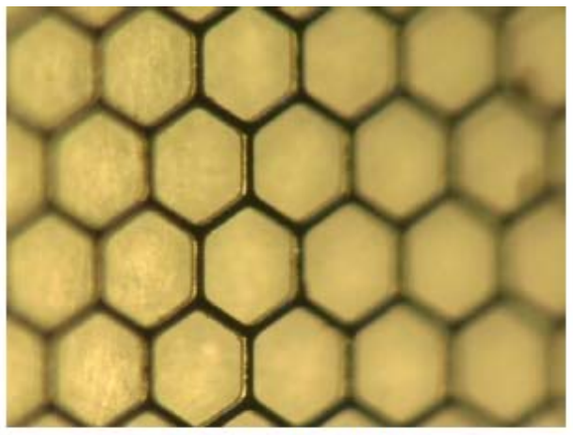
Gate R&D with FUJIKURA
　type0 -> type3 (current final model for 10x10cm size)
　　type4 is module size

type4 is produced @2015
　some production@2016 for beam test
　　but no further production is done.
we may need to make sure their technology still alive someday



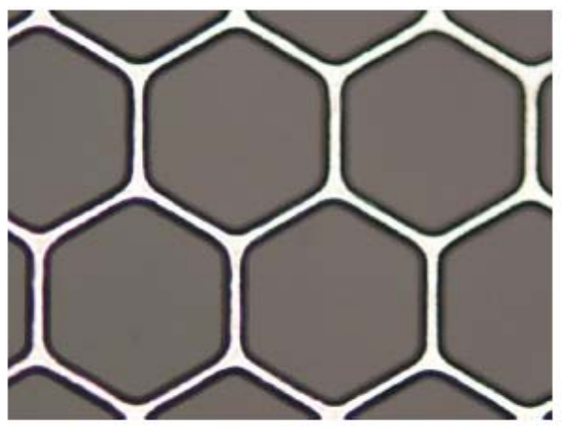
Gate GEM Type 0

形状：丸穴
穴径：300μm
リム幅：top 15μm, bottom 30μm
開口率：75%
size : 10 x10 mm
Process : Lazer direct



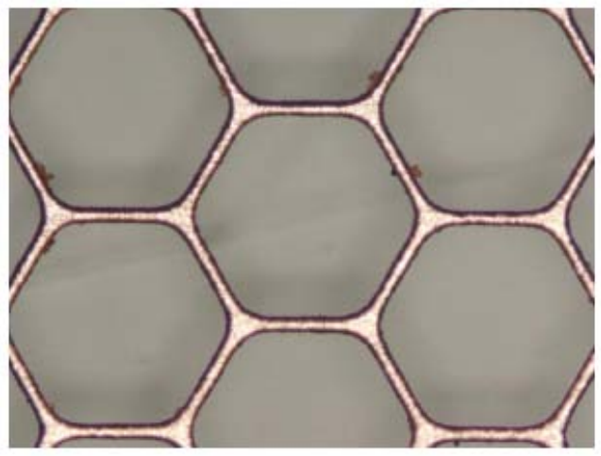
Gate GEM Type 1

形状：ハニカム
穴径：295μm
リム幅：top 25μm, bottom 35μm
開口率：80%
size : 30 x30 mm
Process : Ni -Plating



Gate GEM Type 2

形状：ハニカム
穴径：275μm
リム幅：top 35μm, bottom 40μm
開口率：76%
size : 90 x90 mm
Process : Ni-Plating



Gate GEM Type 3

穴径：295μm
リム幅：top 10μm, bottom25 μm
開口率：85%
size : 30 x30 mm
Process : Ni -less-Process

Electron transmission has been measured

by using test chamber with std 10x10cm GEM

with 3GEM, with 2GEM and ? with MM ? using Fe

by LP1 module w/ Asian module using 55Fe, Laser and Beam

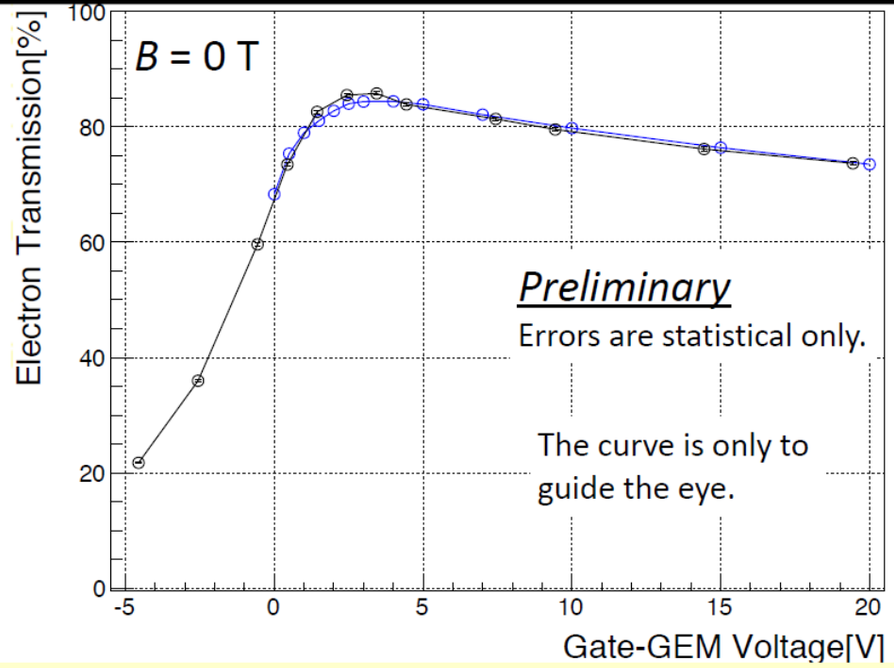
Transmission are obtained by different methods

but obtained results agree well each other (within error)

from charge ratio, position resolution and dE/dx

Quality Gate seem to be same for different sample

Electron transmission rate vs. ΔV measured with ^{55}F



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Data
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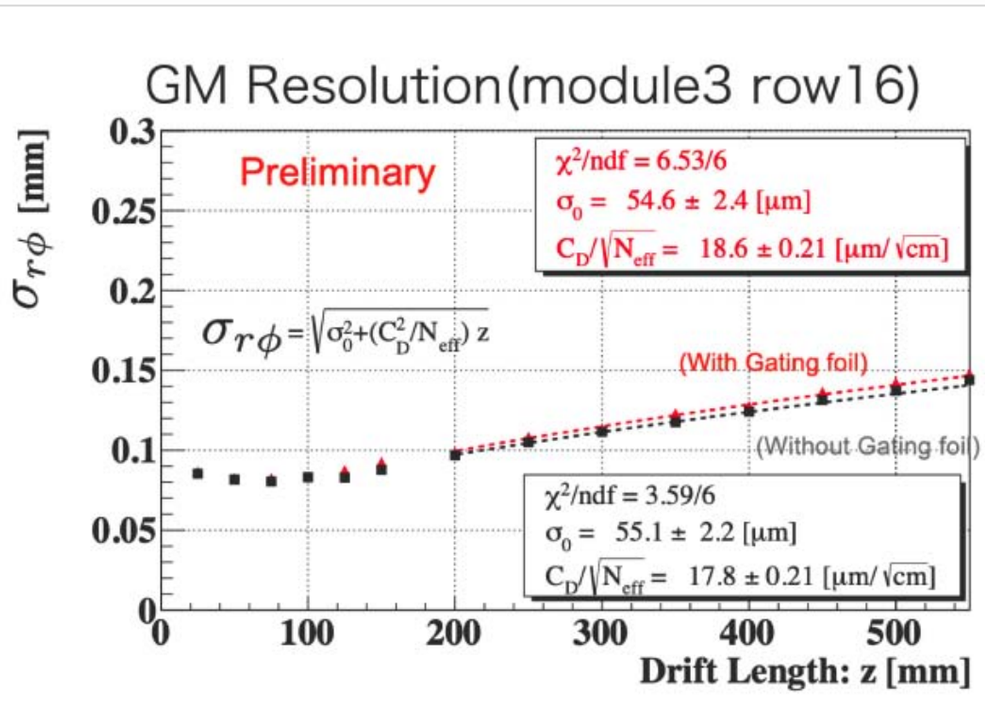
Confer
DOI: 10.1109/NS

- The maximum transmission rate is about 86% at around ΔV = +3.5 V.
- The transmission rate decreases slowly above +3.5 V.
- It decreases rapidly with increasing negative ΔV.
- The measurement is difficult below ΔV = -4.5 V because of small signals.

Spatial resolution



Track angle cut[deg
(With Gate)
-4.49< ϕ_{0loc} <0.
(Without Gate)
-6.78< ϕ_{0loc} <-2.7

Transmission is also measured by CERN with P. Colas
show similar results with different gas Ar/CO2 with 3GEM

they also measure ion back flow using 55Fe

we don’t see any problem yet

Basic performance of Fujikura Gate meets our requirements !
can be a primary candidate for Gate

WP5 mission is completed ?

What do we do next ?

a proof of 10^-4 reduction of ions at closed gate

real module design/fabrication/HV supply

Summary

We have to consider what will we do
after Green(?) light on

we should summarize
what would be integrated in common module
from past studies
what would be studied individually in each module