Pre-prototype GEM panel for LP1

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What is Large Prototype

Why we need pre-prototype test

What we are going to make

GEM panel
100um GEM

Schedule

Large prototype TPC in LC TPC collab.

Mom. resolution
dead space
Large area MPGD
calibration

reconstruction efficeincy
under non-uniform field
low material TPC

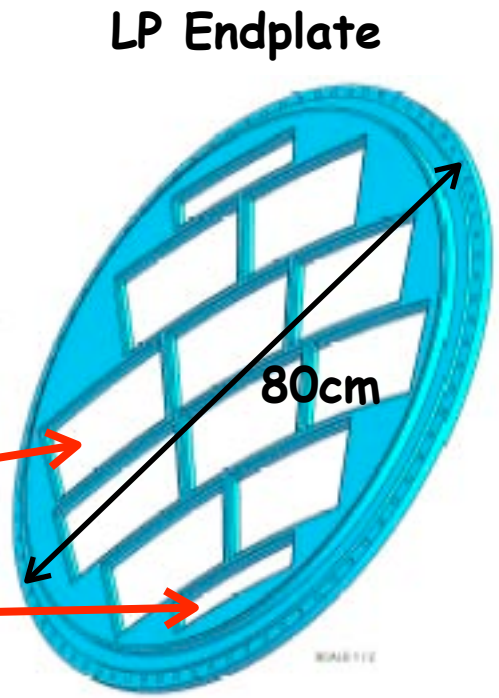
could be studied in LargePrototype in LC-TPC

Conceptual Design at moment

Endplate
+
small/medium size panel
1 MPGD/panel ??

Gas seal by endplate
stand for pressure
Size of panel ??

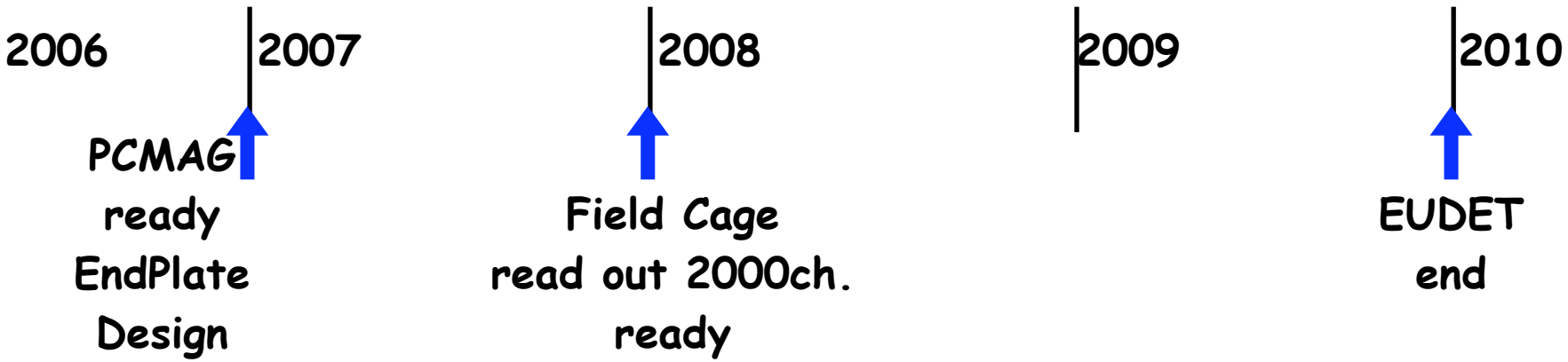
Readout electronics
——>std. RO @LP1



Alignment using tracks
Efficiency at boundary

LC-TPC prototype study schedule

EUDET



realistic electronics
realistic config.

Target date
of LP1
production

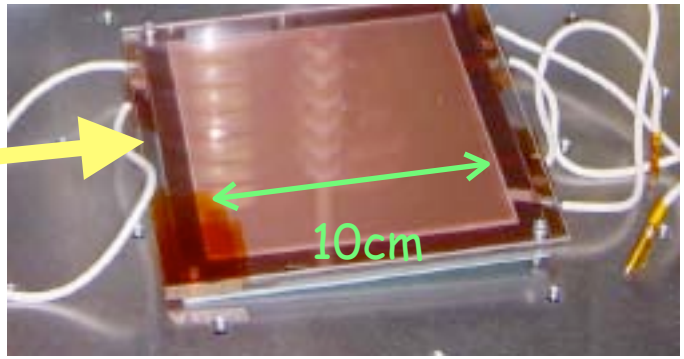
limited time for R&D !!

"Pre-PROTO"

though many issues are not fixed yet

What we want to do at Pre-proto

Production of GEM panel



minimize dead area due to GEM support frame

specially in radial direction

we hope to remove radial frame

to avoid loss of series of hit info.

can we mount GEM properly ?

how do we stretch GEM?

Pad plane

Proper Pad size

Analytic formula teach us max. pad width

in order to avoid hod-scope effect

diffusion in GEMs must be larger than

~0.3 of pad pitch

~300um w/ 5mm thick

for the most of gas

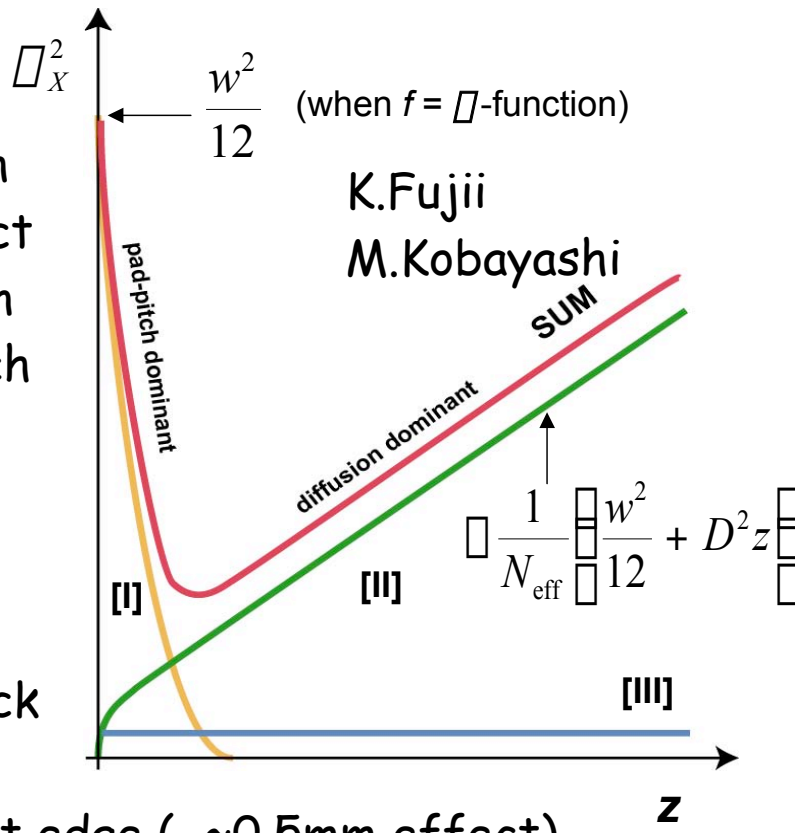
1mm pitch of pad width

length angular dep. of

σ_0 ~30um @6mm for 50GeV track

staggered pad layer by layer

forget about loss of a half pad at edge (~0.5mm effect)



SIZE of panel under discussion

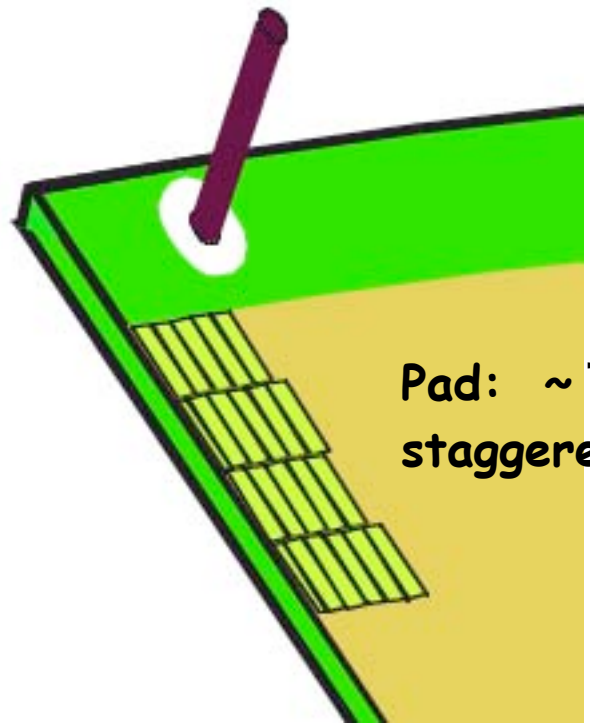
We choose Dan's early design

(Final panel size will be decided soon)

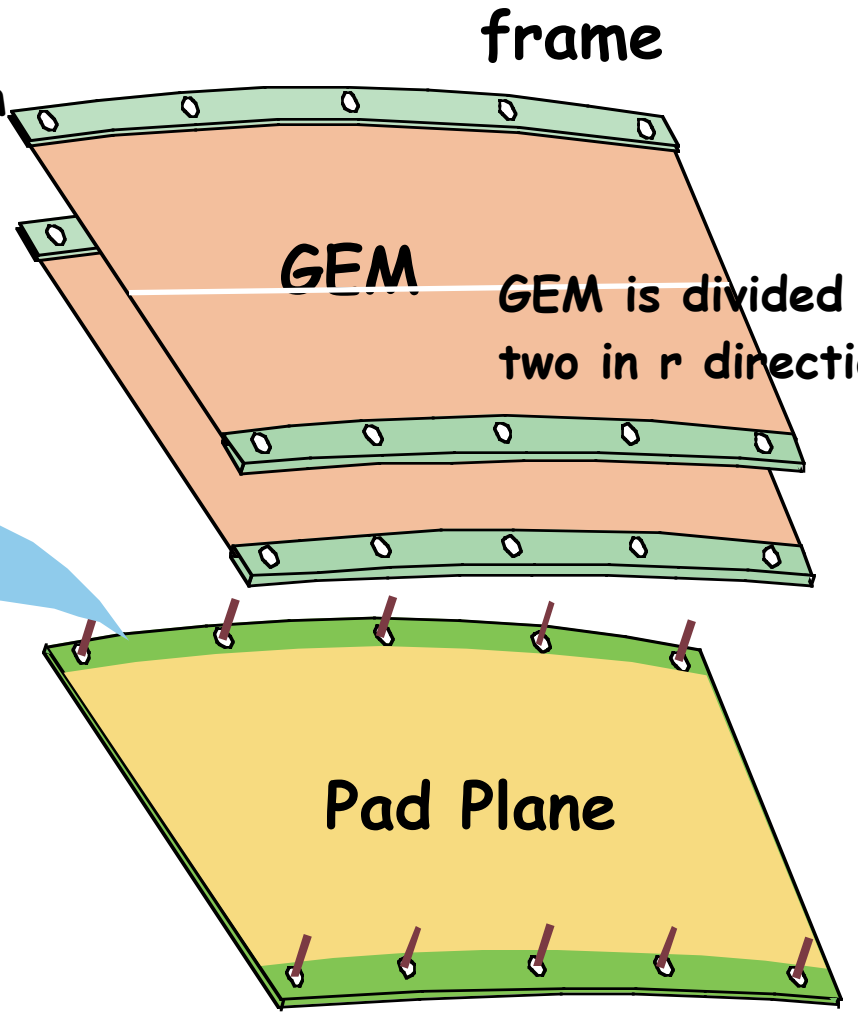
GEM structure

narrow frame (mount mechanism)
double GEM(100um thick) : high gain
simple strucuture
how to provide HV
low capacitance (100um + division)
F.Sauli suggested < 70cm2 @50um
field shaping at frame

GEM is stretched by the post



Pad: ~1 x 5.5 mm2
staggered a half pitch

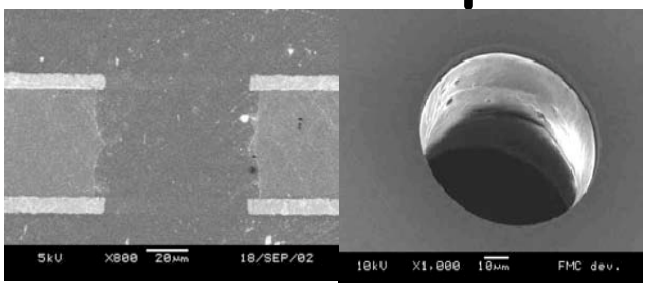


GEM

We are considering to use 100um GEM
in order to simplify the structure on the panel

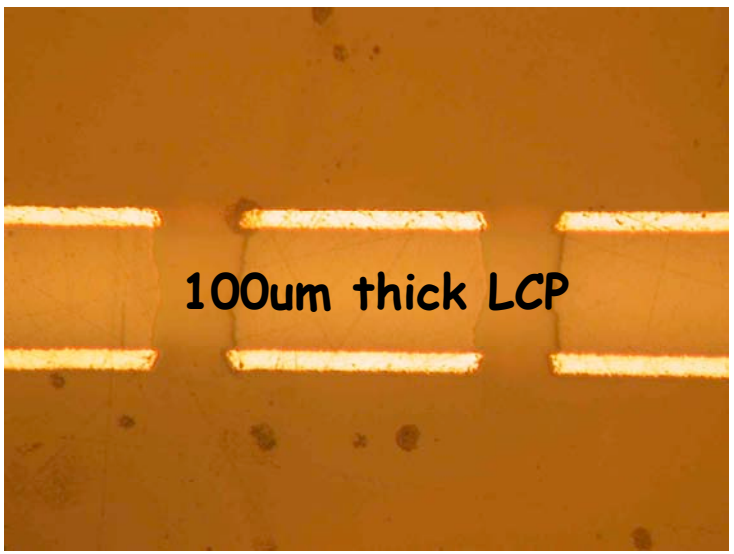
Double GEM is simpler than triple
100um GEM provides good enough gain

Scienergy CO.(Japanese GEM company)
produce 100um thick GEM



Laser etching
straight hall
instead of bi-conical in wet

material choice
LCP(liquid Crystal Polymer)
easier to be processed than PI



Property of 100um thick GEM

表1　ポリイミドと LPC の特性比較

特性	吸水率	吸湿率	湿度膨張係数	比誘電率 ε γ	誘電正接 t a n
単位	%	%	ppm/%RH	(a t 1GHz)	(a t 1GHz)
PI	3.1	1.6	30	3.51	0.0113
LPC	0.04	<0.04	1	3.20	0.0024

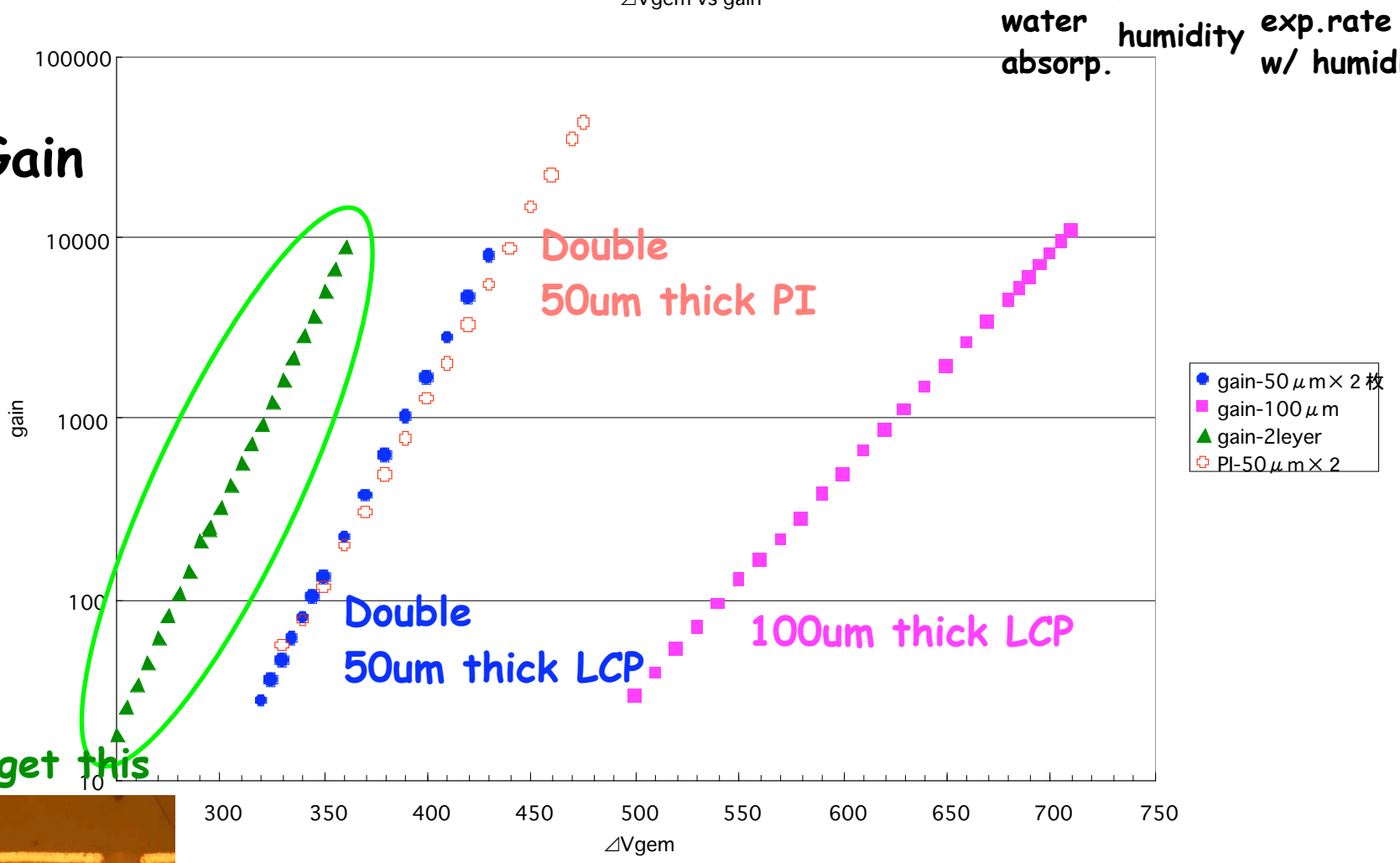
PolyImide

LCP

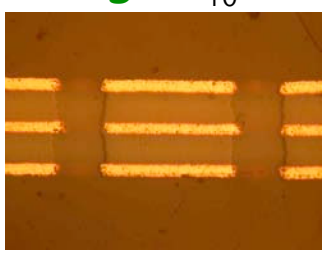
water absorp.

humidity

exp.rate w/ humidity

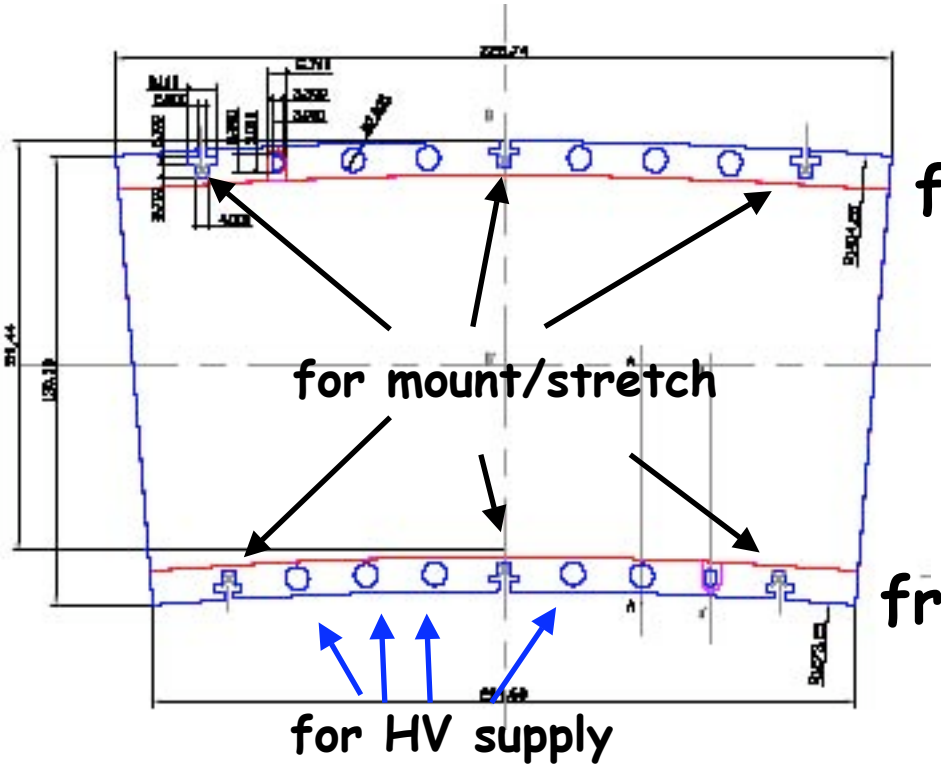


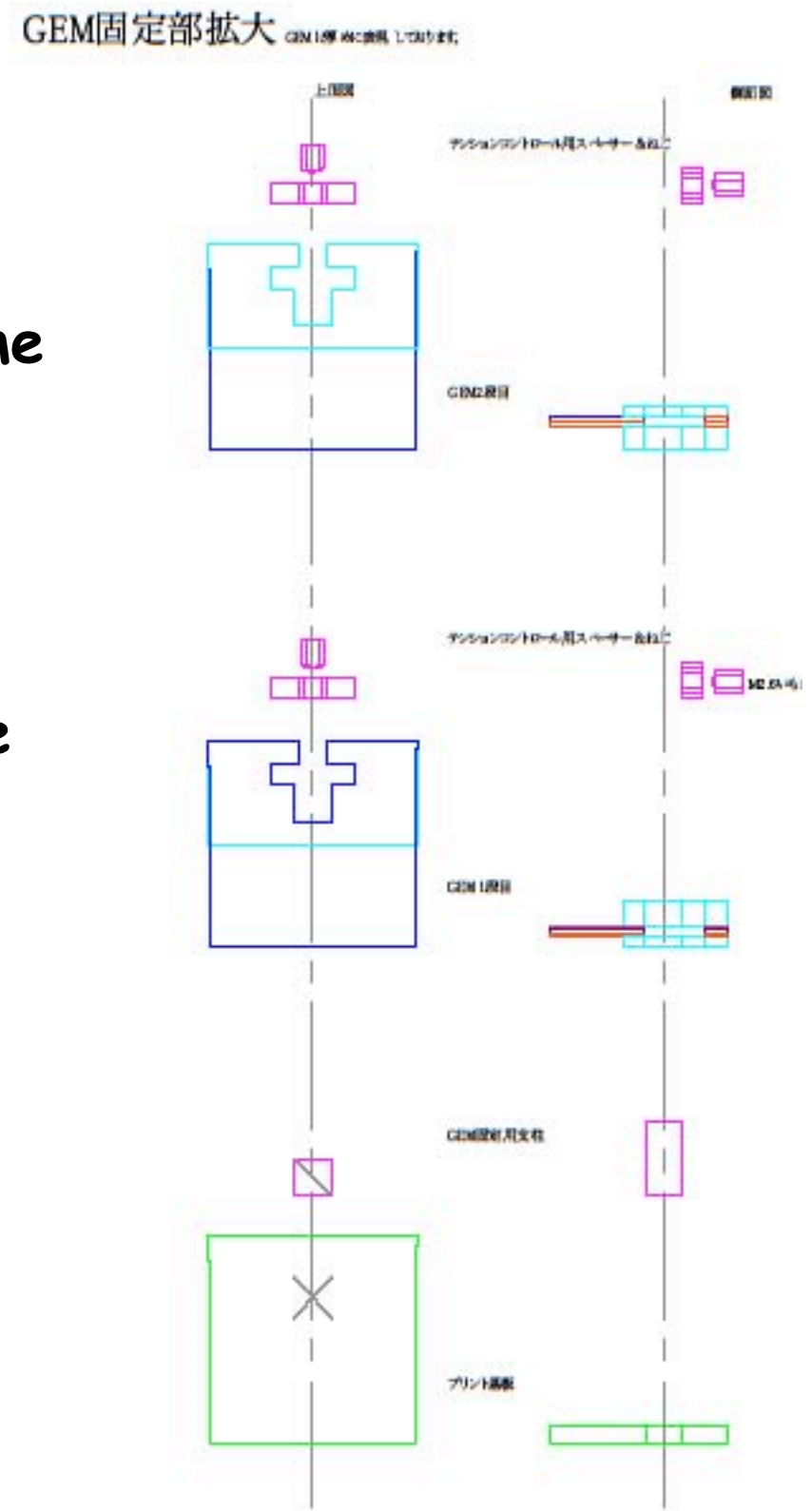
Forget this



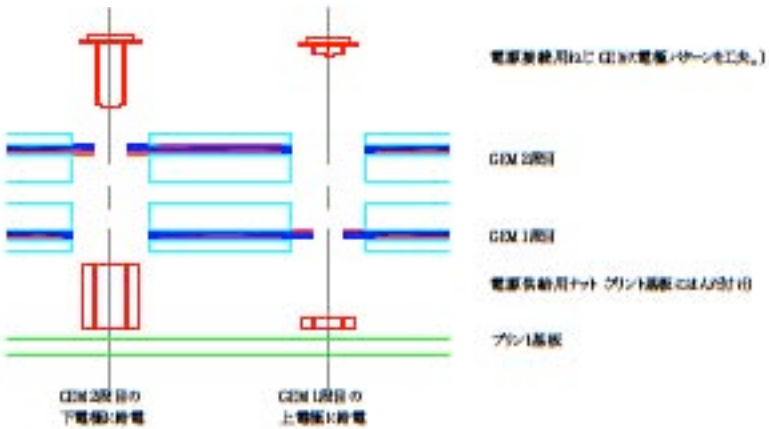
ΔVGEM

Mount mechanism





HV supply

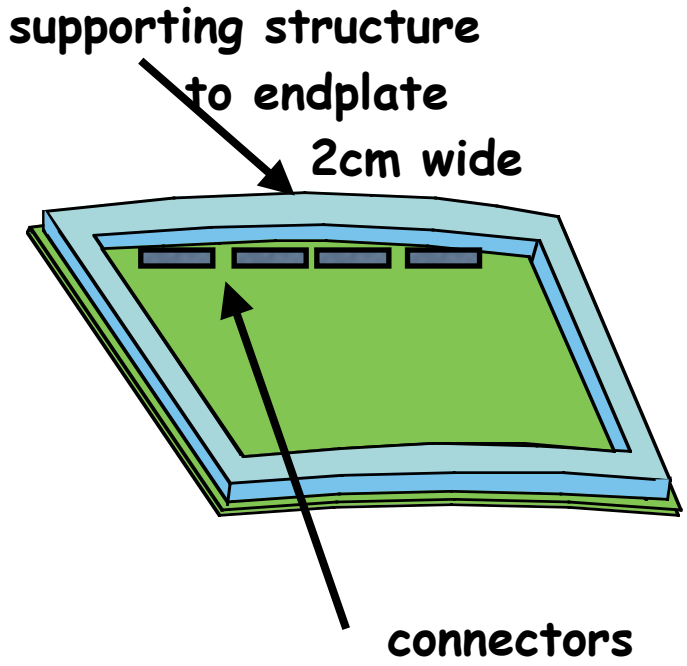


Pad size

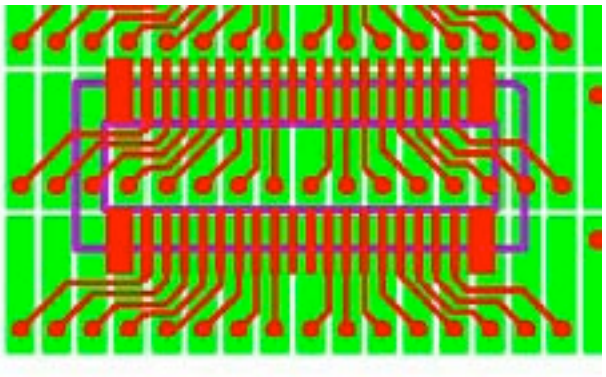
Actual Pad size is limited by arrangement of connectors

conn. size is 5mm x11.5 mm

but soldering / line design need more space ~ 8.5mm x 15mm



Leif's drawing



# of connectors

10 lyr x 12 con./lyr

20 layers

192 pads /layer

Length of pad pitch 5.55 mm

Width of pad pitch 1.08 mm @innermost

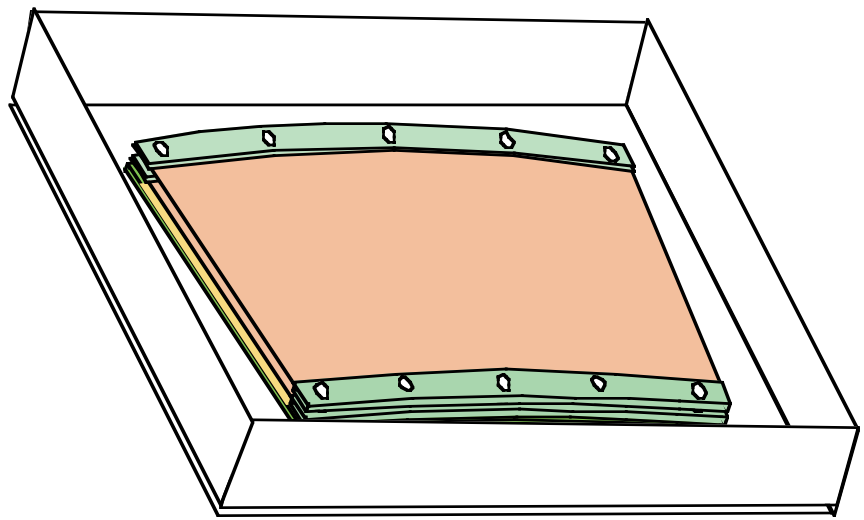
1.18 mm @outermost

Schedule

Nov. Dec. Jan. Feb. Mar.

test of Mount mechanism

now:We are facing to ...



GEM production

Pad Plane production

Assembly

TEST

Gain check

over the panel

Summary

We started to make pre-prototype
as R&D for LP1

how to minimize dead region due to GEM support

We will try to release every information about this study

please give us any suggestions/idea for pre-prototype study
AND be a collaborator

we want to work together !