BEAM TEST in Nov. 2016.

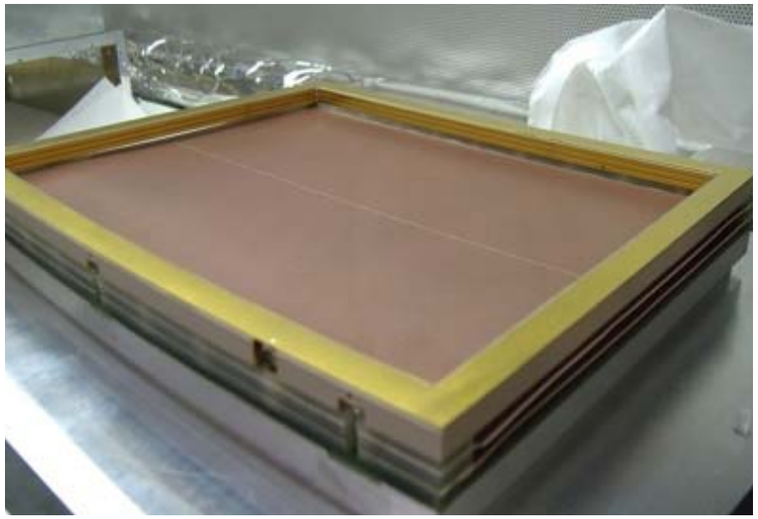
The Main Objective of Beam Test and Rough Schedule.

LCTPC-Asia/Japan group
Tomohisa Ogawa

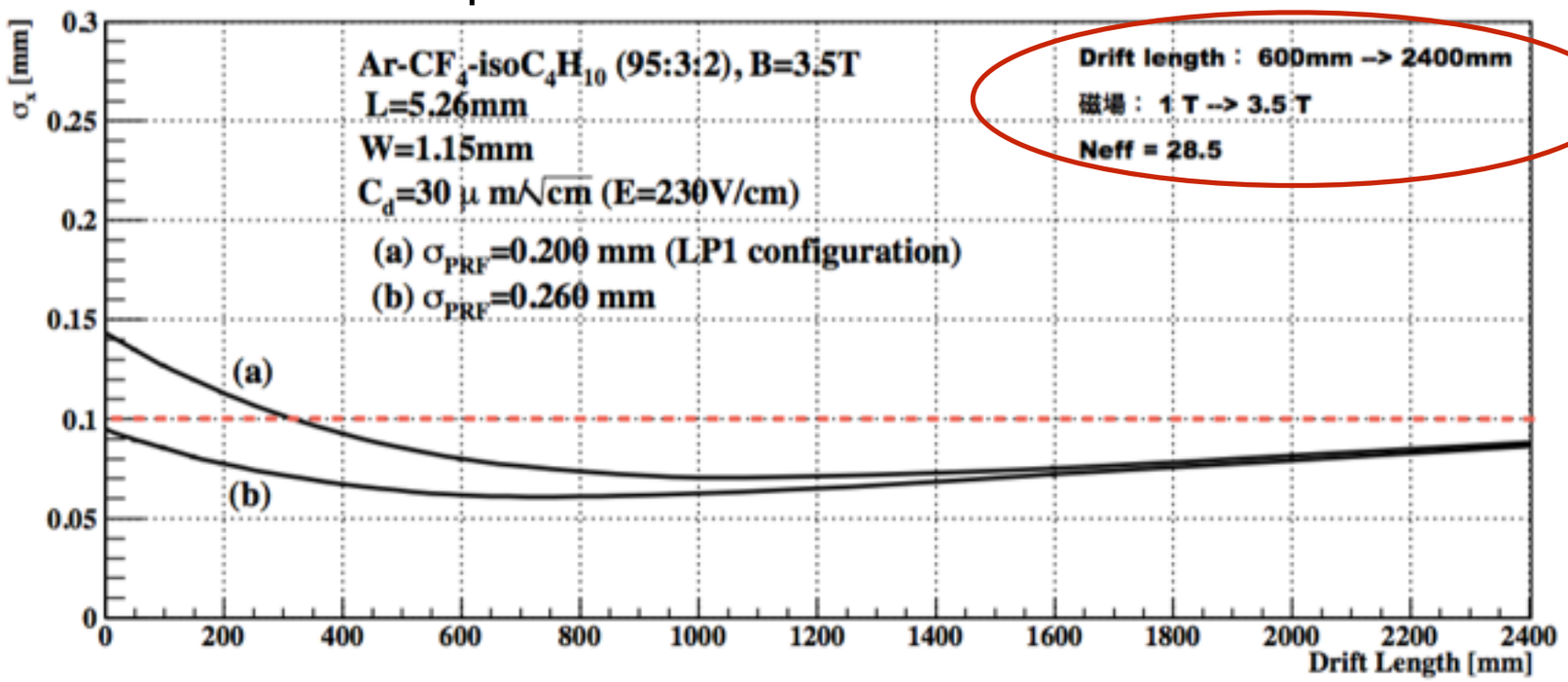
Look Throw The Activities: Asian-GEM.

>. In 2010 and 2012 Asia group carried out beam test in order to confirm that the Asian GEM design have good performance on position resolution "$\sigma_{r\varphi}$".

>. The extrapolated result based on beam test data satisfied the demand that "$\sigma_{r\varphi}$" should be less than 100um at 2.2m. ($\sigma_{r\varphi}$~85um).



The extrapolated result based on beam test



>. Ion back flow also needs to be stopped.

>. If the electron transmission rate is more than 80%,

"$\sigma_{r\varphi}$" will be still less than 100 um because $\sigma_{r\varphi}$ should be proportional to 1/sqrt(N_{eff}).

(85 * 1/sqrt(0.8) ~ 95)

Look Throw The Activities: Gating-GEM.

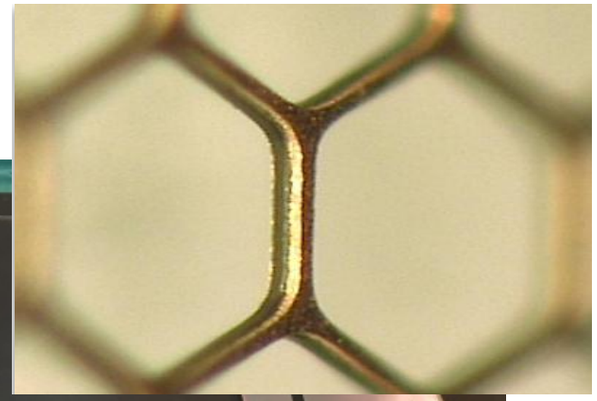
>. Asian group started to develop a high transparency gating GEM in cooperation with FIJIKURA company.

>. optical transparency: 82%.

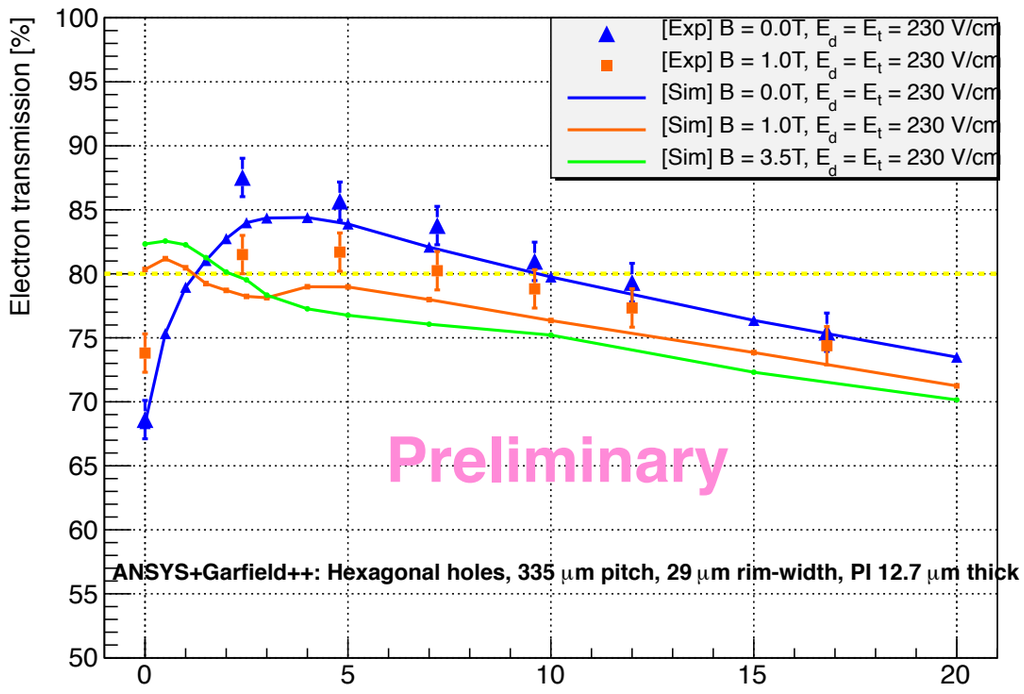
>. Saga group have also measured the elec. transmission rate with Sauli's way using small/large samples.

>. The transmission rate achieved the good value which was more than ~80% with 1 T.

>. Need precise simulation to estimate it with 3.5 T.



Under 1T Magnet.



The Main Objective Of Beam Test 2016.

>. Get a proof of position resolution "$\sigma_{r\varphi}$" with a gating-GEM.

>. Can we really achieve the required "$\sigma_{r\varphi}$" for ILD-TPC?

>. Comparison of "$\sigma_{r\varphi}$" using a module equipped with a field-shaper and a gating-GEM.

>. Confirm that the degradation of "$\sigma_{r\varphi}$" is proportional to 1/sqrt(transmission).

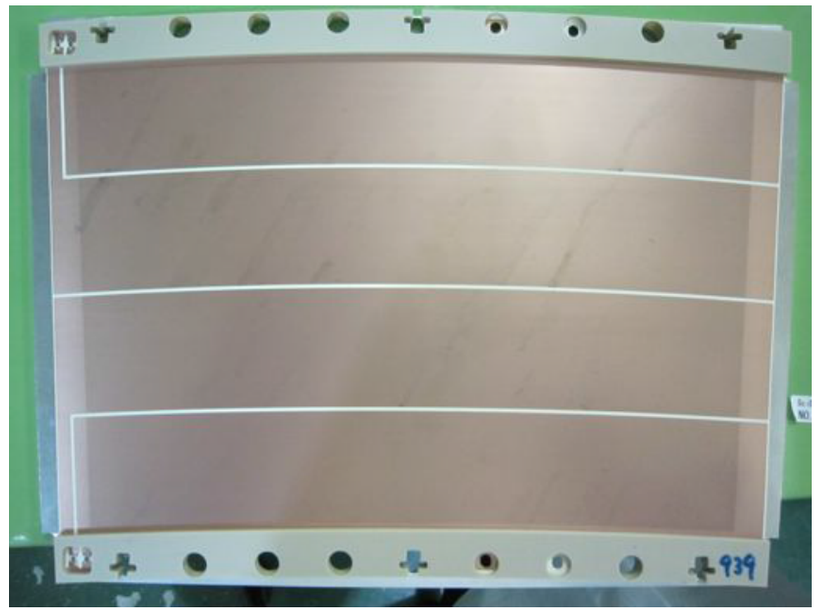
>. Check distortions of track with new Asian-GEMs.

One side is flat, another side is divided into 4 electrically.

>. Distortion may be less small than that of 2010/2012 data.

>. Try to construct Z resolution formula like Yonamine's position resolution formula.

>. Nobody knows.

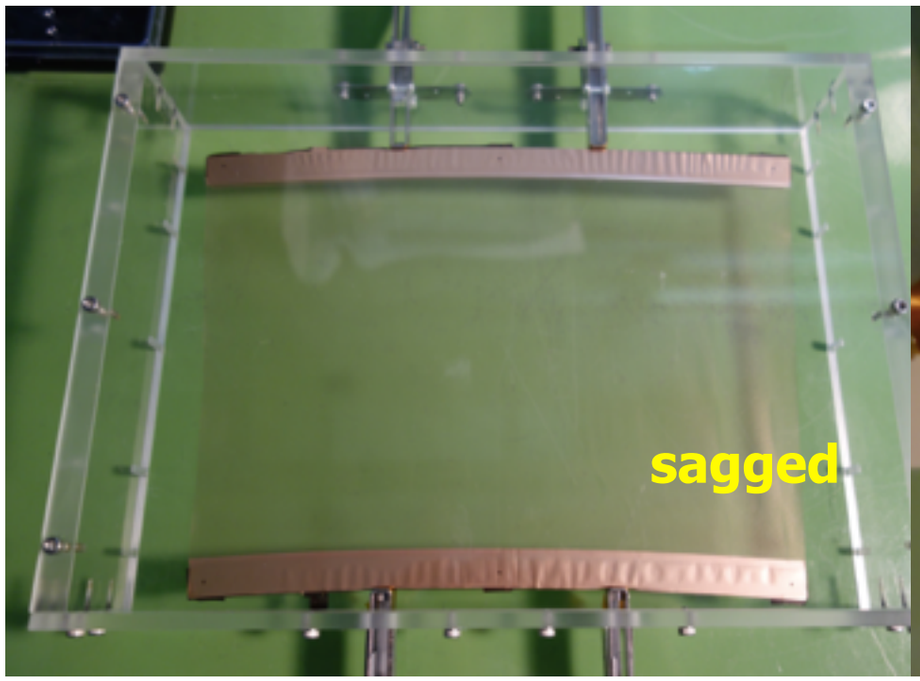


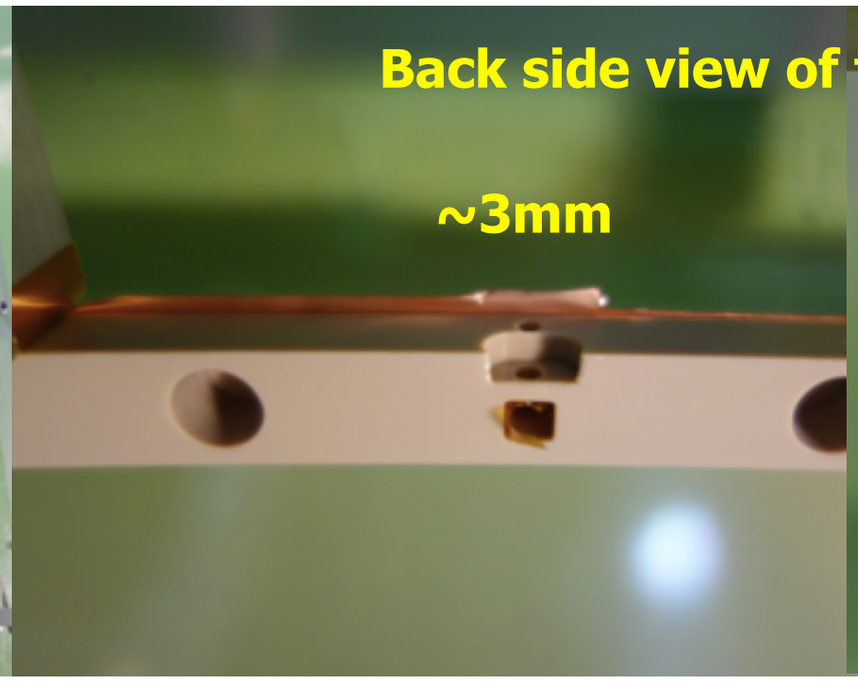
$$\sigma_x^2(z; w, L\tan\phi, C_d, N_{eff}, \hat{N}_{eff}, [f]) = [A] + \frac{1}{N_{eff}}[B] + [C] + \frac{1}{\hat{N}_{eff}}[D]$$

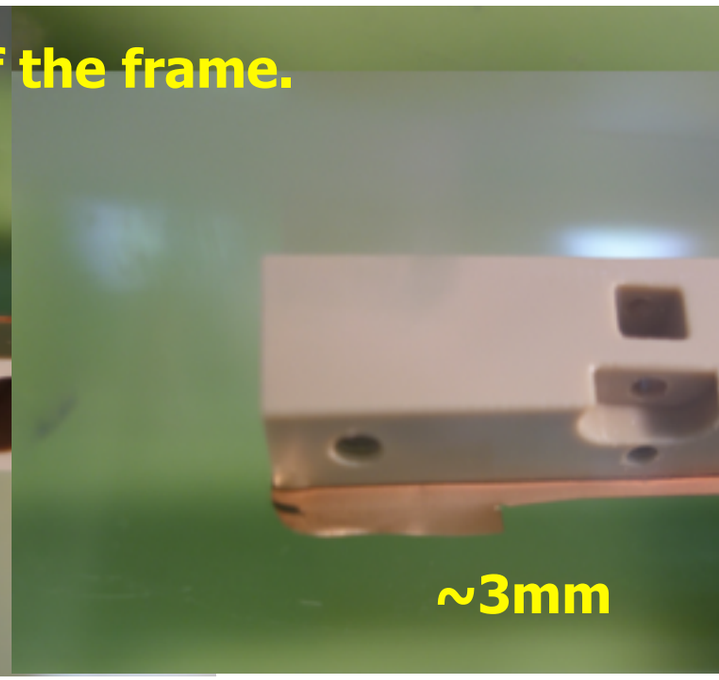
Full Frame Gating GEM.

>. A few problems on gating GEM (half frame gating GEM).
These problems are come from not precise framing.

>. A sag & protrusions.
>. After we bend protrusions and tape it, we plan to apply H.V. (Lab. test).







>. We want to use the best gating GEM! which has no sag and no protrusions.
>. Another gating GEM is ordered to the company.
>. This gating GEM has a square frame (full frame) to avoid a sag.
>. It will be delivered in early Sep.

Plan During Beam Time (1st Week).

Sunday	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday
10/30	10/31	11/ 1	2	3 文化の日	4	5
6	7	8	9	10	11	12

Move to the test area.

Tuning the system Noise reduction etc…

Start to Take Pede/Phys data with 1T.

Mini WS?

>. We need to operate electronics stably at least once in order to take data.

>. What we are worried about is the situation that electronics is broken during operation.

>. The possible process we might get troubles is the time that we Un/Mount the modules. Before this step (2_{nd} week to replace the modules), we should have minimal data set to compare "$\sigma_{r\varphi}$". So we plan to install 2 modules which have a field shaper & a gate.

>. If we start operation with 2 modules, We can get minimal data set with only one-time stable operation and compare "$\sigma_{r\varphi}$".

→ Of course same module should be used to compare performance. Above way is a kind of insurance.

→ This is minimal line for our objective of beam test in Nov.

Plan During Beam Time (1st Week).

>. During 1st week we plan to take enough data set for the objective.

Start with 1 [T].

>. A set of data points along Z. (9~12points)
[mm] 25, 50, 100, 150, 200, (250), 300, (350),
400, (450), 500, 550.

T = 0T, 1T(has priority),
φ = 0°,+20°,-20°,+10°,-10°
G = nominal (3000~3500)

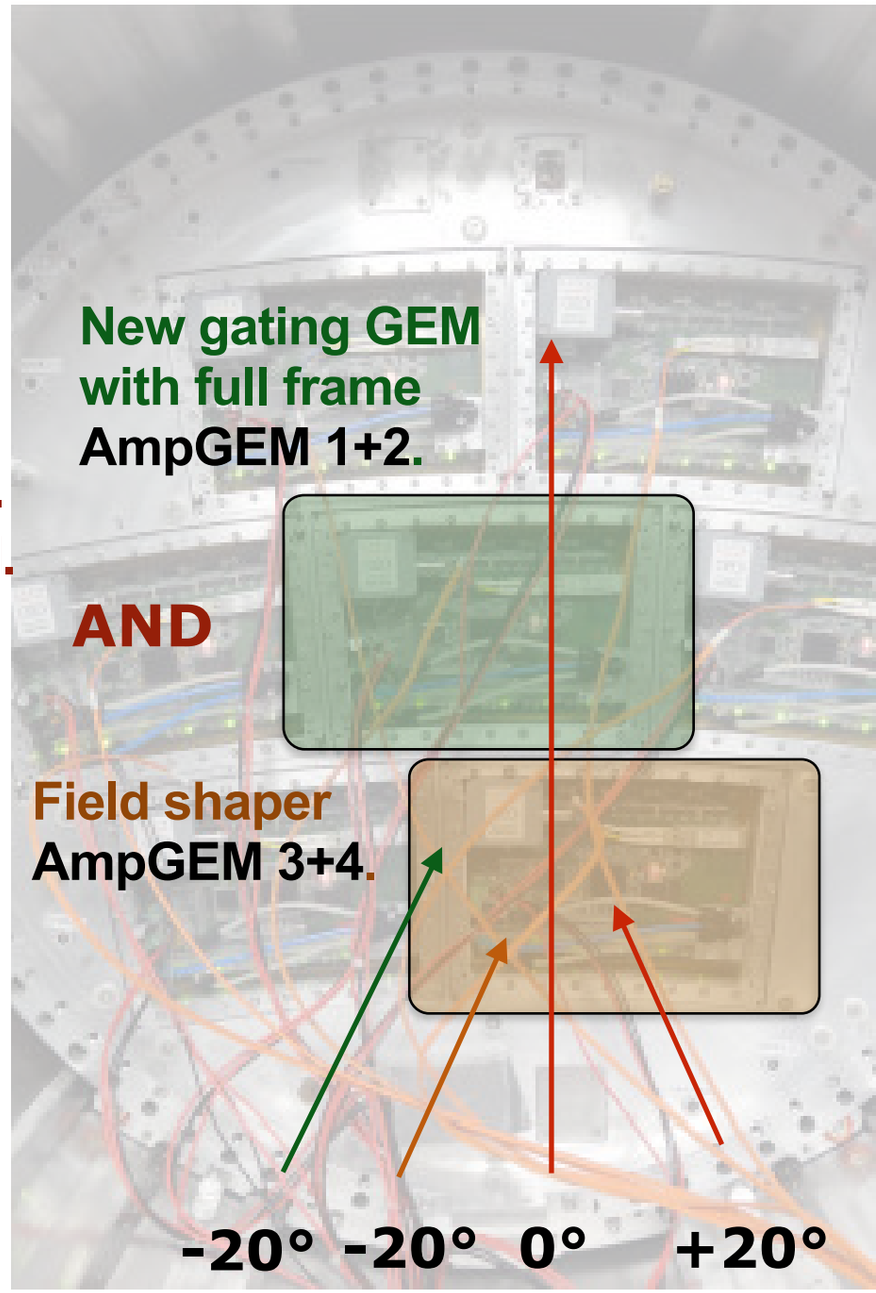
Even if we finish here,
minimal data set will be taken.
The objective will be achieved.

>. Additional data set.

>. For Z resolution: θ = +30°, -30°, …
(at φ = 0° G = nominal)
>. For Lower Gain: T=1T, φ=0°, θ=0°.
>. Ed ~ 110 V/cm.

→15min/run * 9~12points
* (10set + additional run)
~ 35~45hours (4days).

>. We should rethink replacement of modules before/after 11/8. (including a plan of data set)



Plan During Beam Time (2nd Week).

Sunday	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday
10/30	10/31	11/ 1	2	3 文化の日	4	5
Move to the test area.	Tuning the system Noise reduction etc…		Start to Take Pede/Phys data with 1T.			
6	7	8	9	10	11	12
		Mini WS?	Start 2nd operation with 1T.			

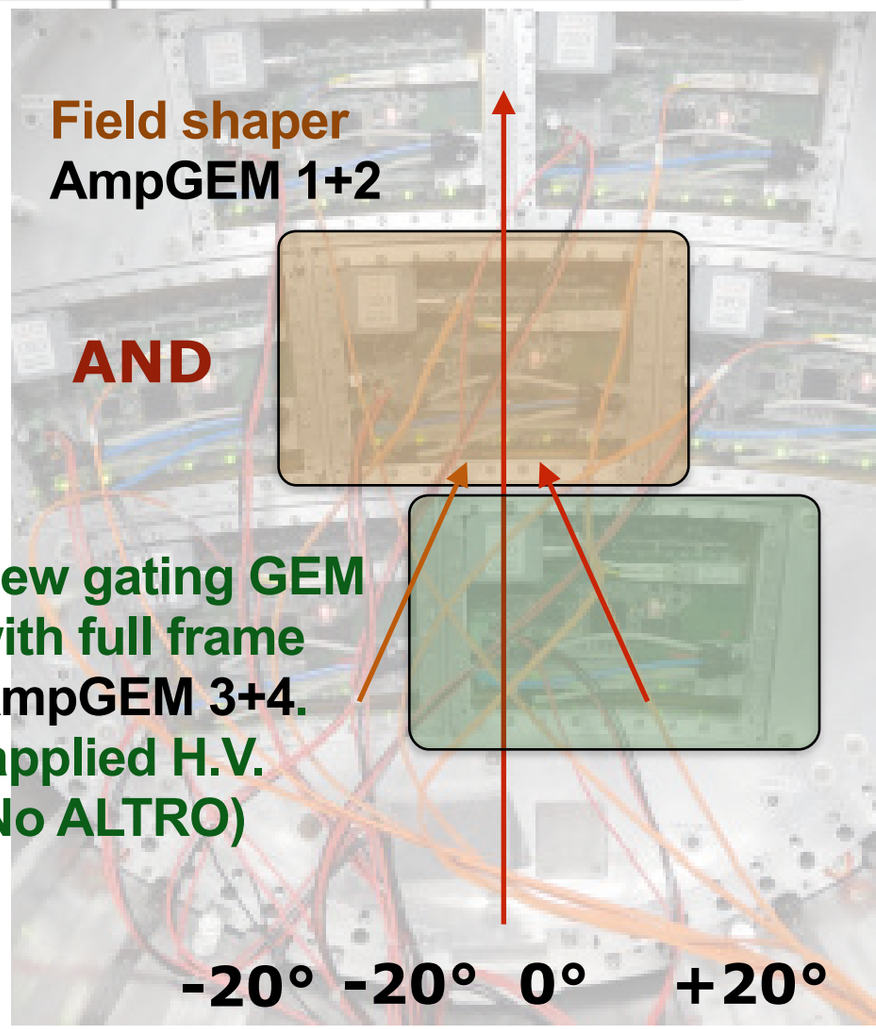
>. The purpose is to take data under the same conditions.
Just replace upper devices.
(Same AmpGEMs, position, electronics)

>. Another module is applied H.V but
no ALTRO connection?

>. A set of data points along Z. (9~12points)
[mm] 25, 50, 100, 150, 200, (250), 300, (350),
400, (450), 500, 550.

T = 0T, 1T(has priority),
φ = 0°,+20°,-20°,+10°,-10°
G = nominal (3000~3500)

>. Additional data set.



Summary.

>. We are planning to carry out beam test in this Nov.

>. The main objective is to take data with gating GEM in order to proof that it has still good performance on position resolution “$\sigma_{r\varphi}$”.

Memo

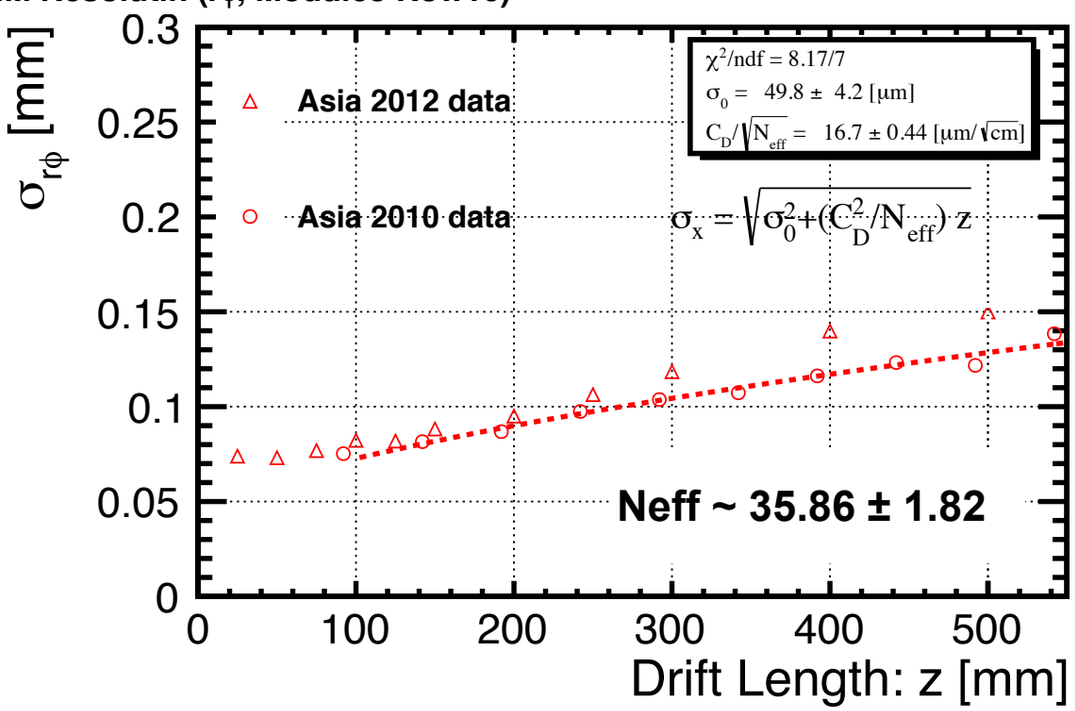
(0) It would be good if you can discuss the measurement errors of the effcetice numbers of electrons from the past beam tests and try to convert them into that of the electron transmission of the gate GEM to be measured this time.

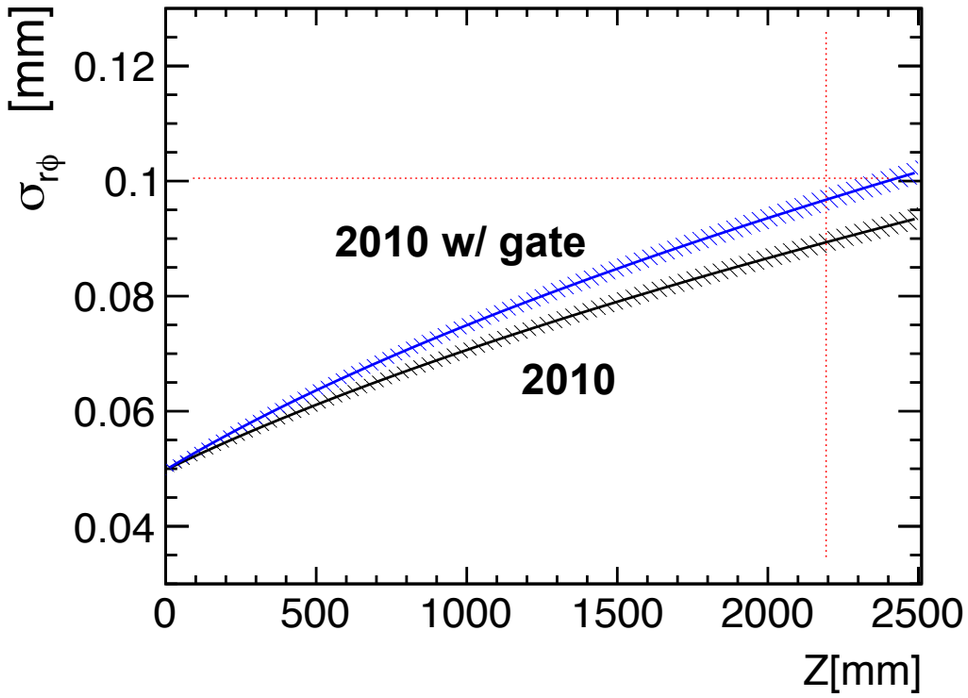
Neff ~ 35.86 ± 1.82 (2010 data)
Err 2.078 %
20% electron loss

resolution curve along Z with 3.5T.
No Use Yonamine formula.

Cd ~ 100 um/√cm @ 1.0T **Cd ~ 30 um/√cm @ 3.5T**

GM Resolutin (rϕ, Module3 Row16)





Memo

(0) It would be good if you can discuss the measurement errors of the effcetice numbers of electrons from the past beam tests and try to convert them into that of the electron transmission of the gate GEM to be measured this time.

Neff ~ 35.86 ± 1.82 (2010 data)
Err 2.078 %
20% electron loss

resolution curve along Z with 3.5T.
No Use Yonamine formula.

(2) It would be more clear if you could add some operation parameters of the Asian modules (amp. GEM voltages, the gain, etc) for the people who will join the test from other groups.

Gain 3000~4000 Electron loss ~ 20% due to a gating GEM.

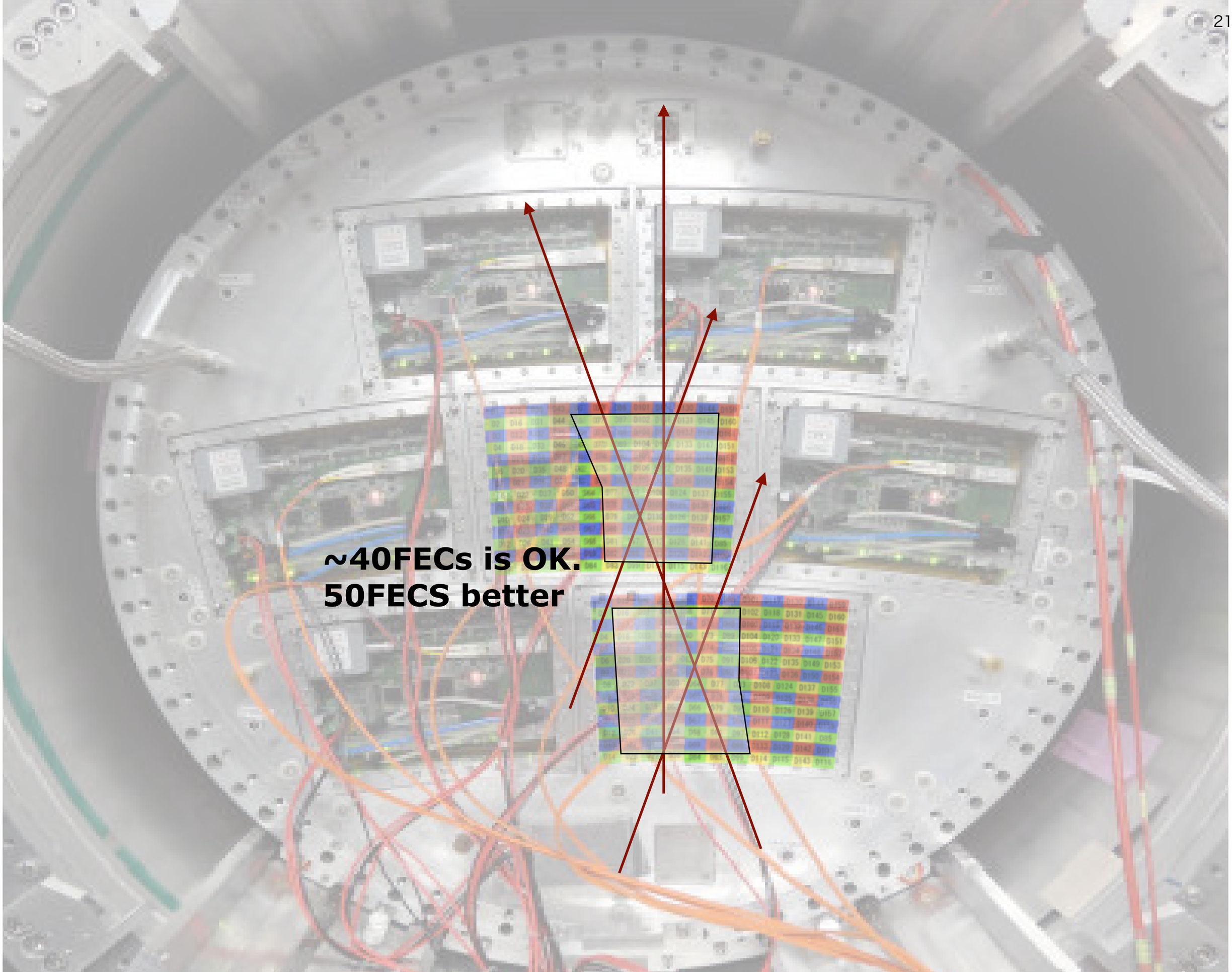
3000 is a bit small according to Yonamine's opinion.

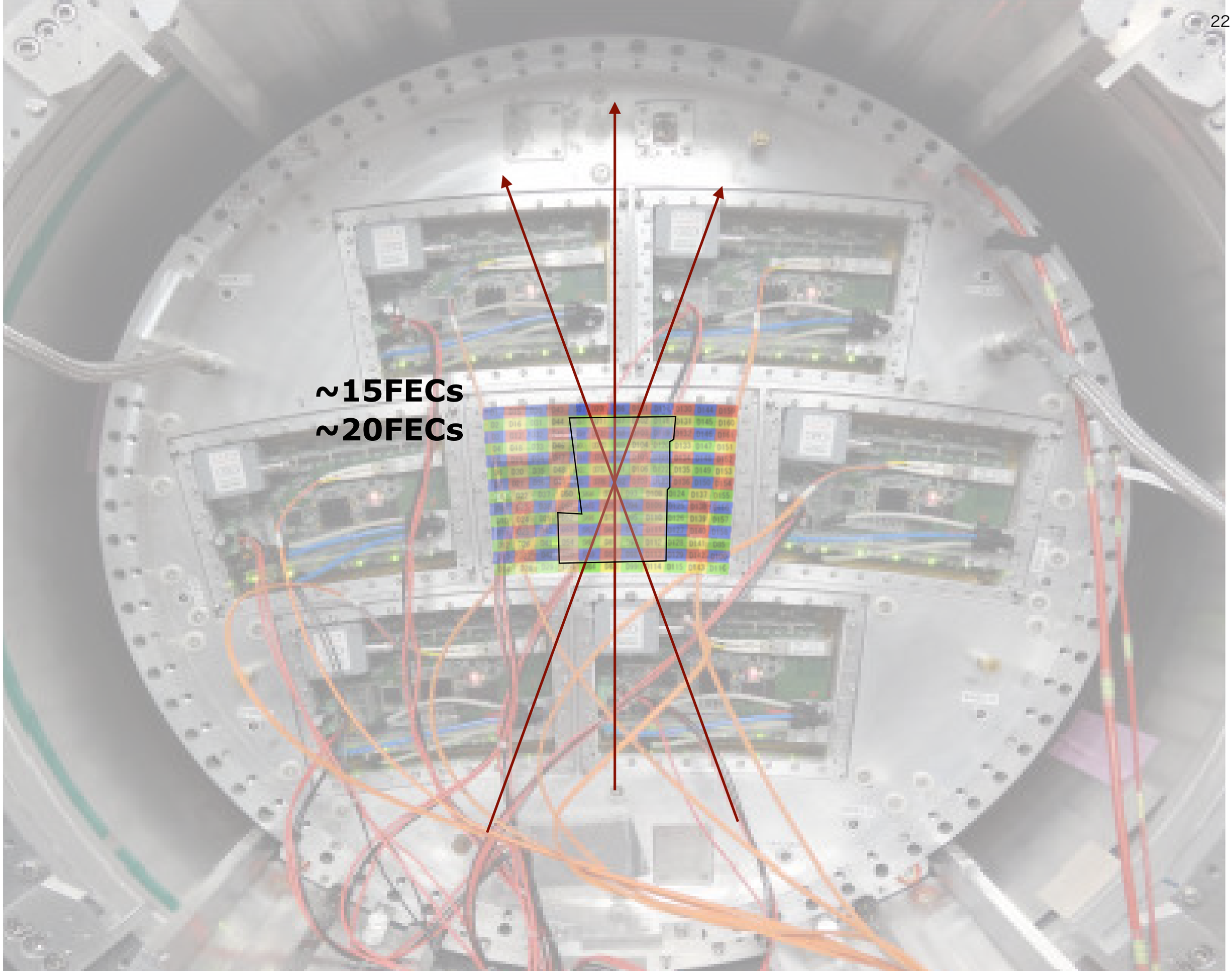
H.V for lower : 315 if 320 → discharge increase on the current GEM.
H.V for upper : 345 ~ 355

(4) In the LCTPC WP meeting tonight, it might be helpful to explain the gain non-uniformity and its possible cause of the Scienergy GEM (since they do not know about them), and ask about the gain uniformities of the other two modules, in particular the DESY module.

Another topic.

BACK UP.


~40FECs is OK.
50FECS better


~15FECs
~20FECs