基于THGEM探测器的DHCAL初步实验研究

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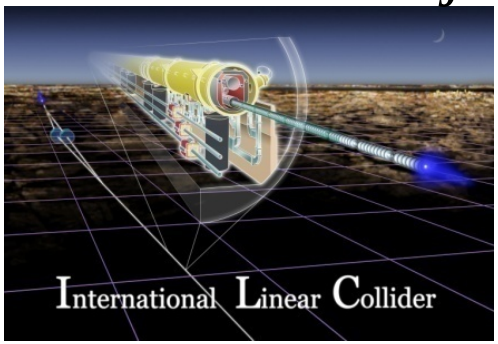
- DHCAL introduction
- THGEM detector performances
- Pion/proton study at beam-test facility
- Conclusion

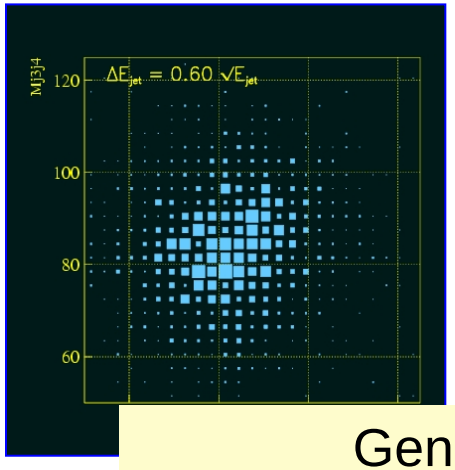
DHCAL

$e^+e^- \rightarrow ZH \rightarrow 4\,jets$



Precision studies of new physics

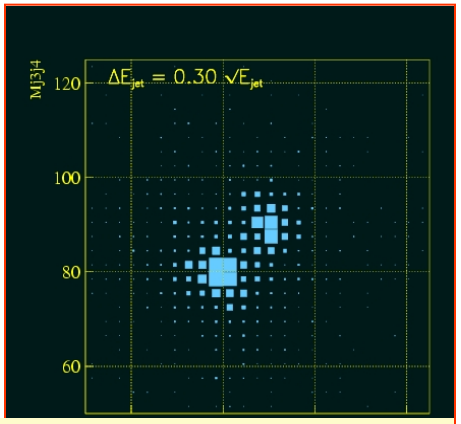
ILC: Separate W,Z boson masses on event-by event basis



60%/√E

Best JET resolution with **traditional calorimeter**

Need 30%/√E



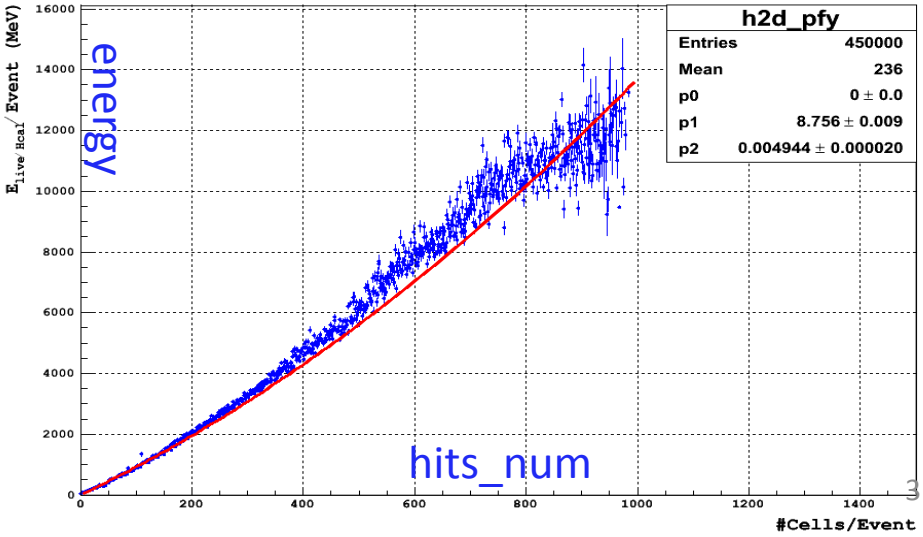
Generally need σ/E_{jet} ~3-4%

Digital calorimeter

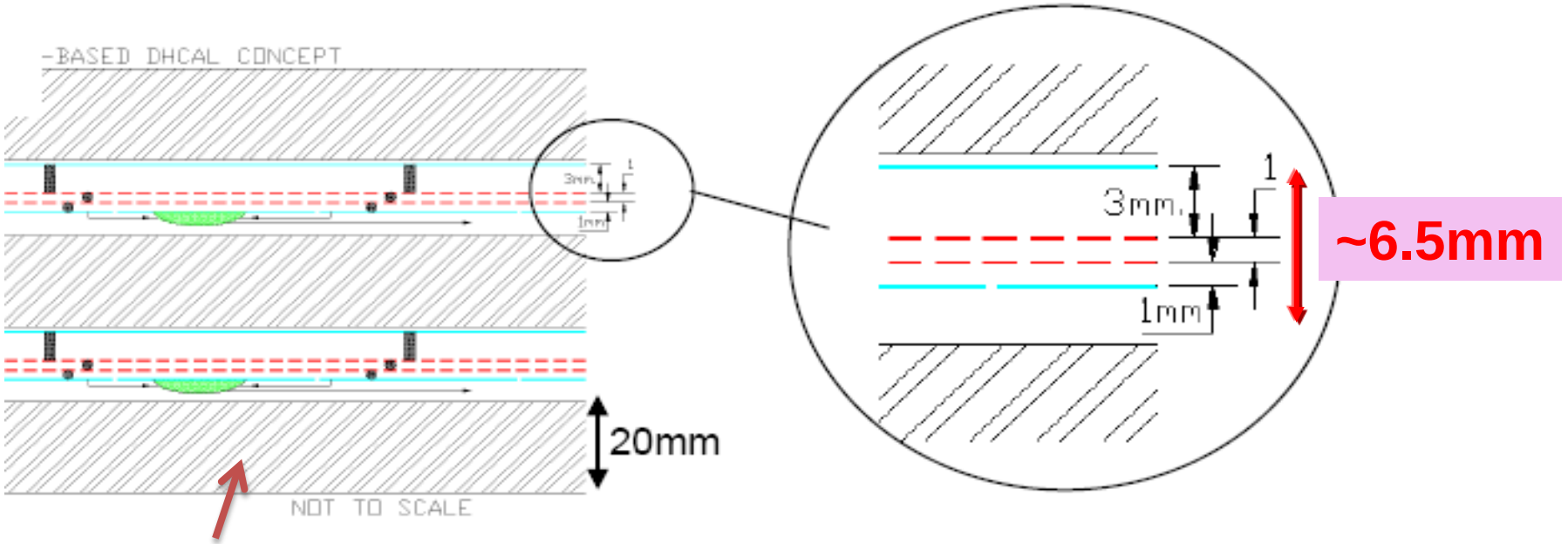
- hits vs. energy
- Particle Flow Algorithms

Requires thin, efficient, highly segmented, compact, robust medium,

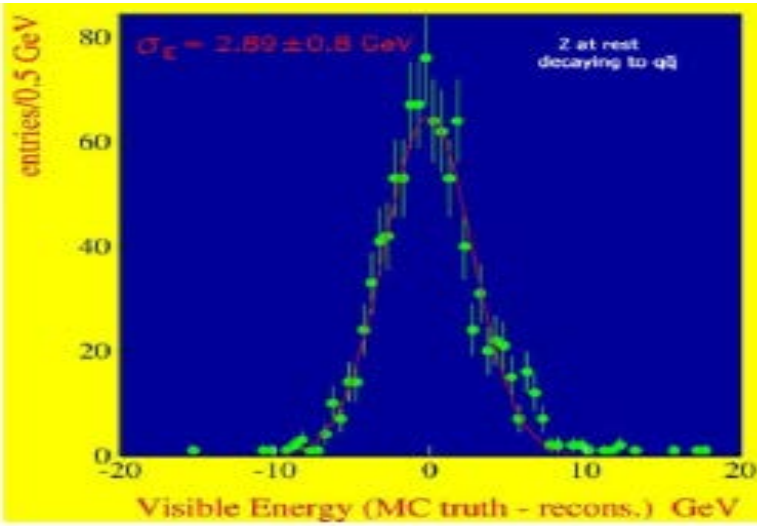
(**RPC, GEM, THGEM, etc.**)



DHCAL concept with THGEM

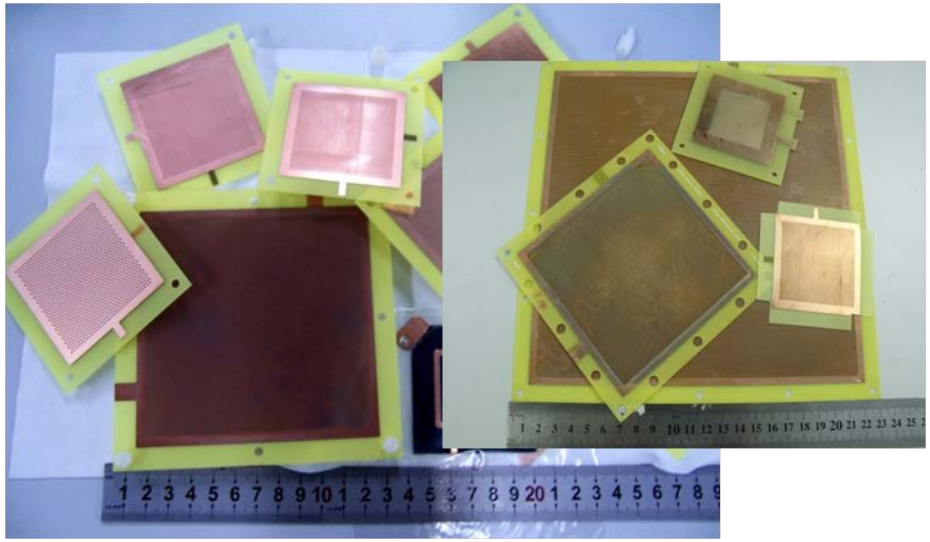


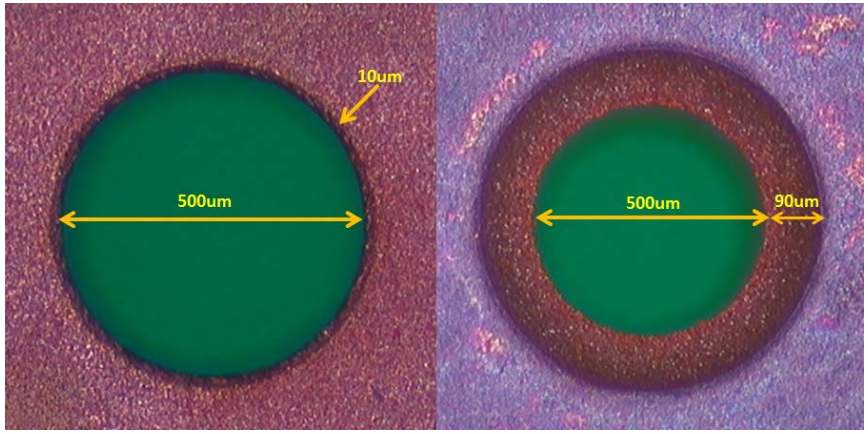
40 of double-THGEM sampling layers



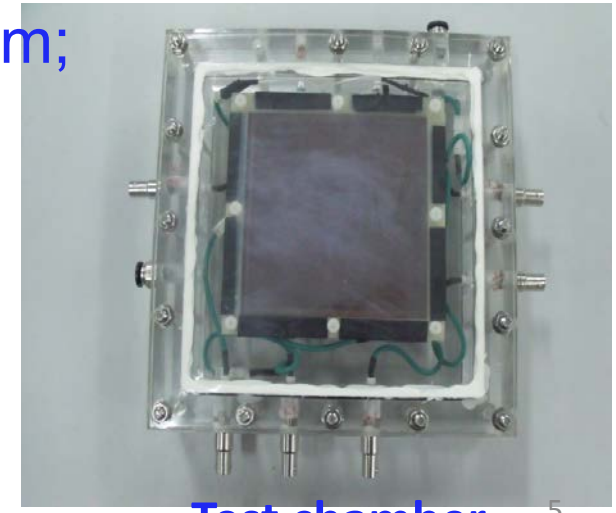
Reconstructed jet: Simulated energy resolution
σ/E_{jet} ~ 3%
(CALICE)

THGEM status at IHEP



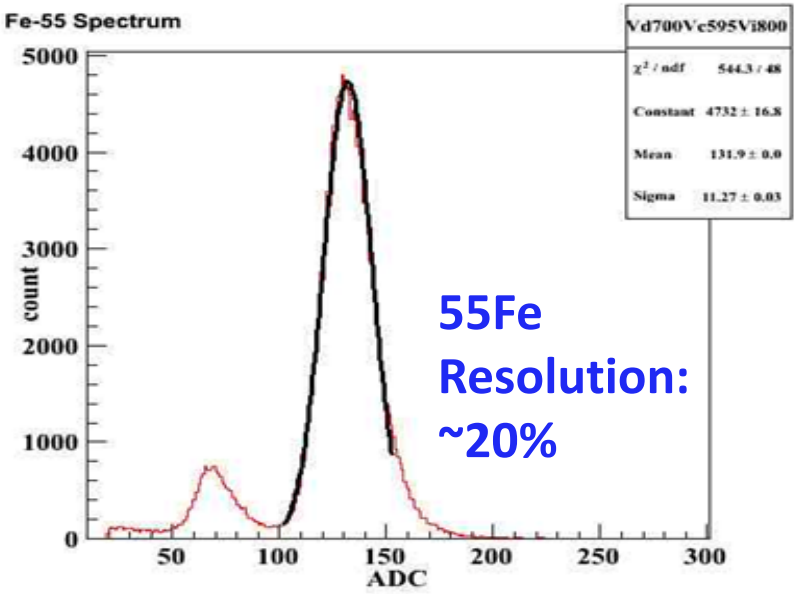


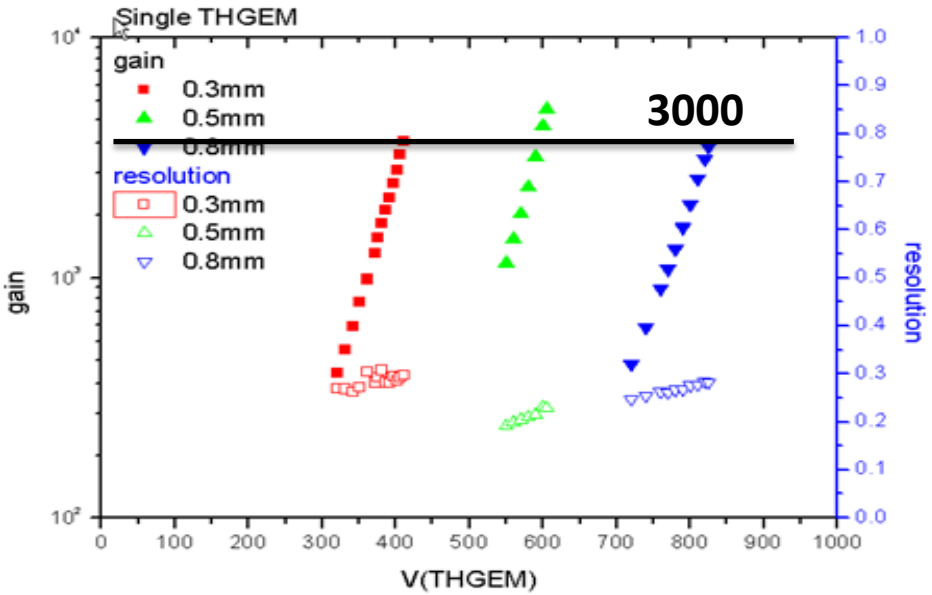
Area: 5cm*5cm, 10cm*10cm, 20cm*20cm;
Thickness: 0.2mm~1.6mm;
Hole size: 0.2mm~0.8mm;
Pitch: 0.4mm~1.6mm;
Rim: 10μm~100μm
Domestic, and very cheap!
High gain, stable, robust.



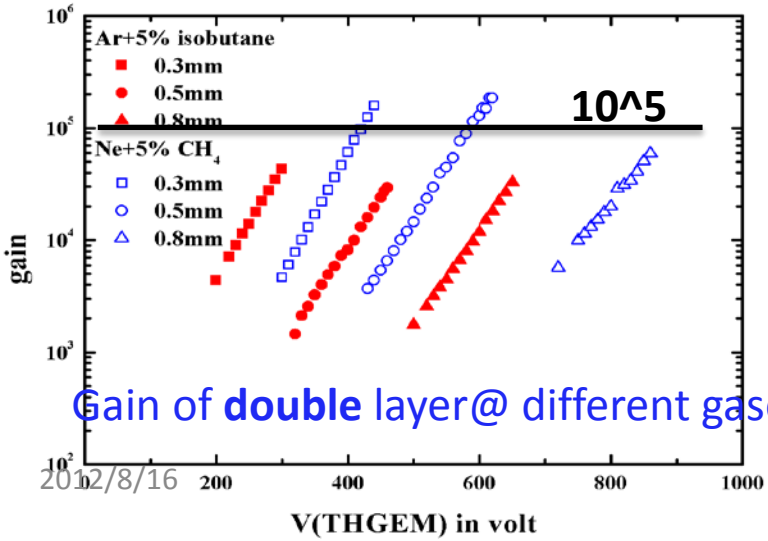
Test chamber

THGEM performance study





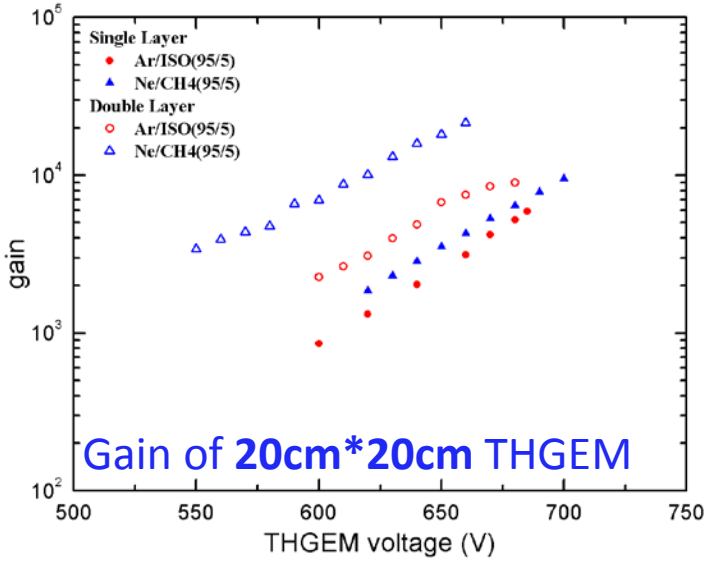
Gain of **single** layer@ **Ar/isobutane**(95/5)

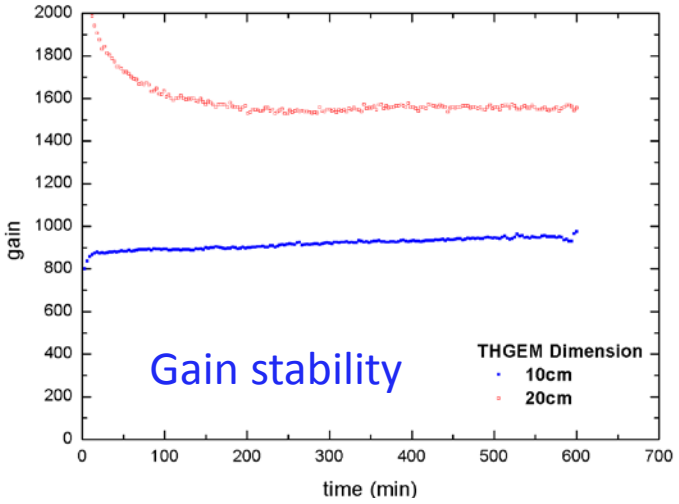


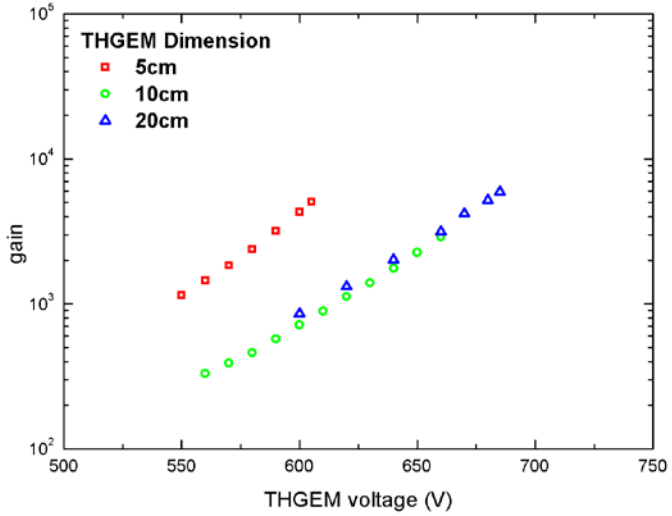
Gain of **double** layer@ different gaseous

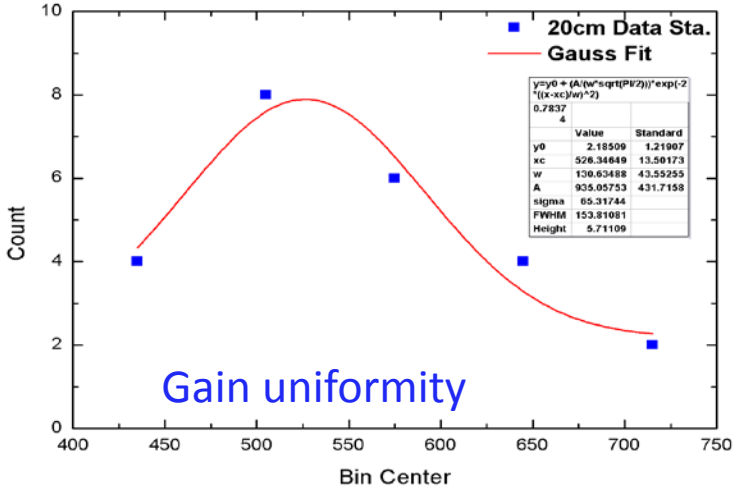
Results based on 5cm*5cm samples.

THGEM performance study (Cont.)



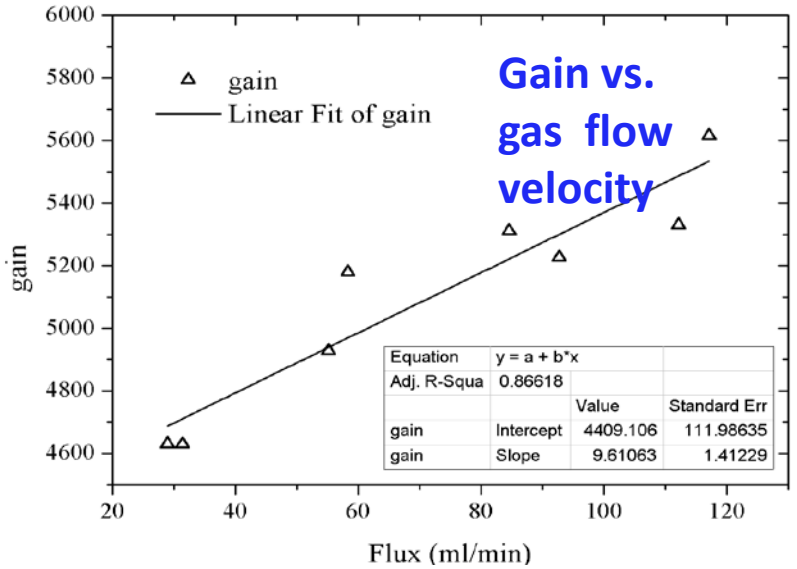


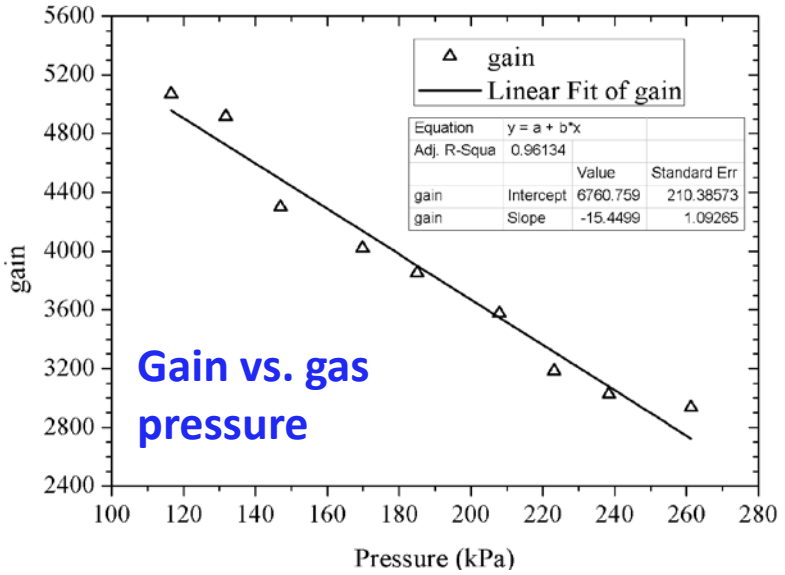


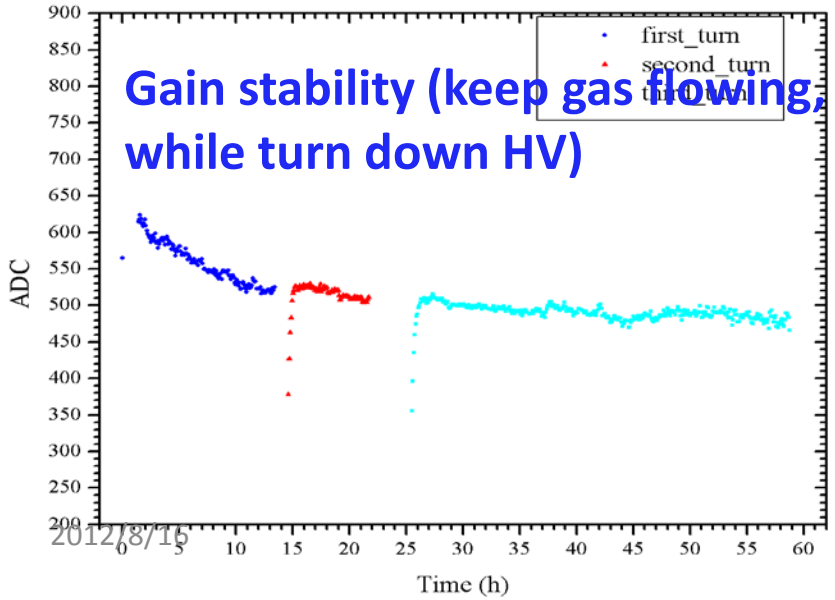


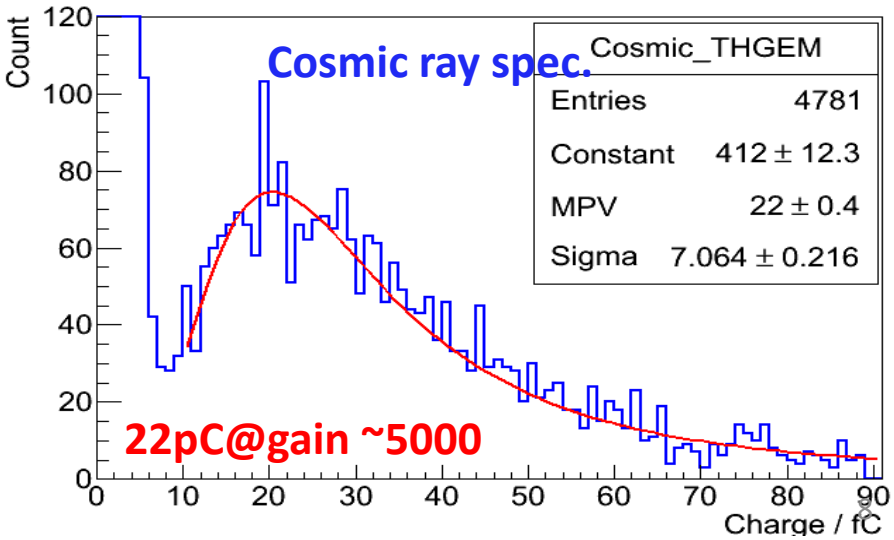
10cm*10cm, 20cm*20cm
have also been successfully tested.

THGEM performance study (Cont.)



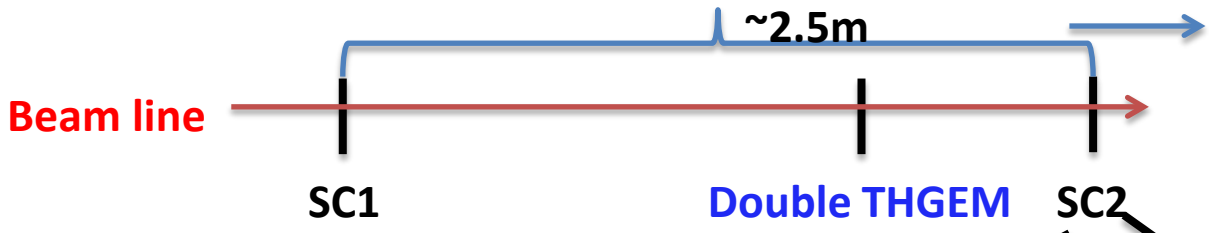






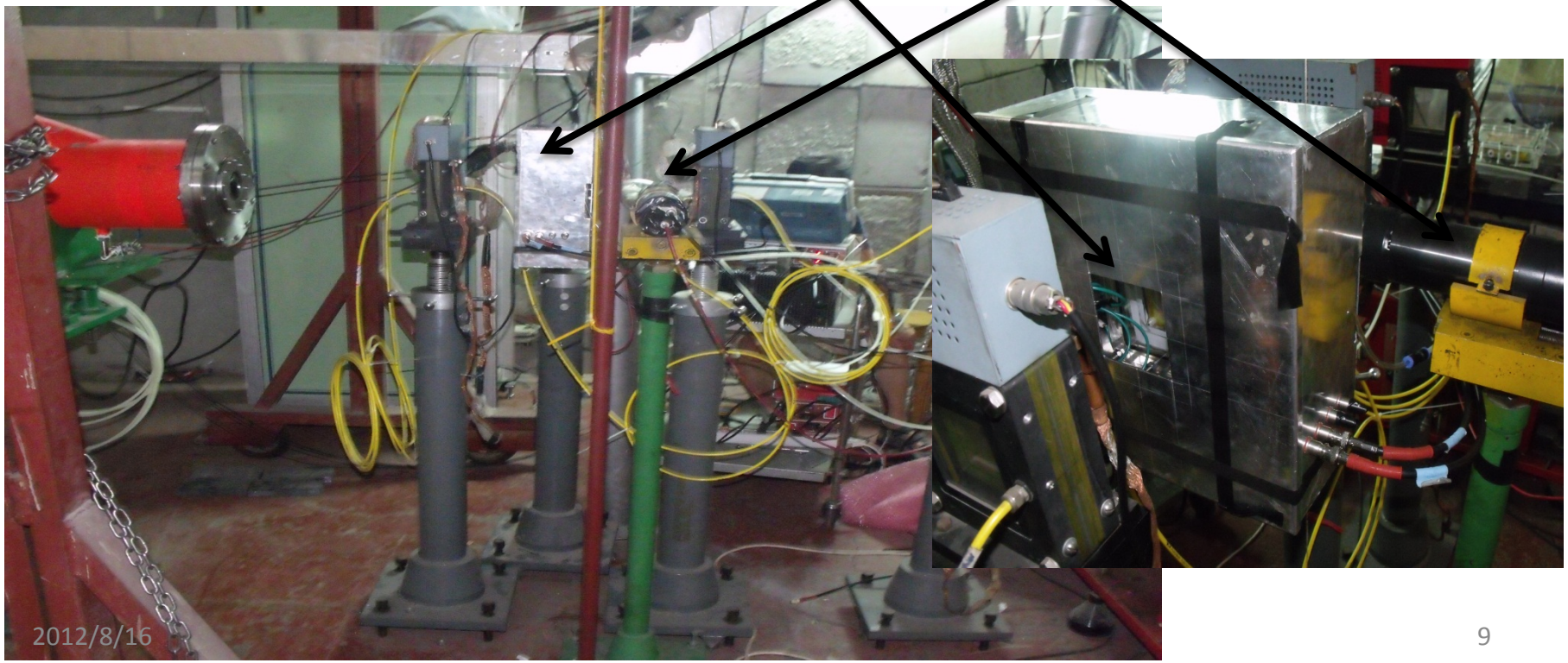
Pion/proton beam test

Pion/proton beam, 300~700MeV/c were tested

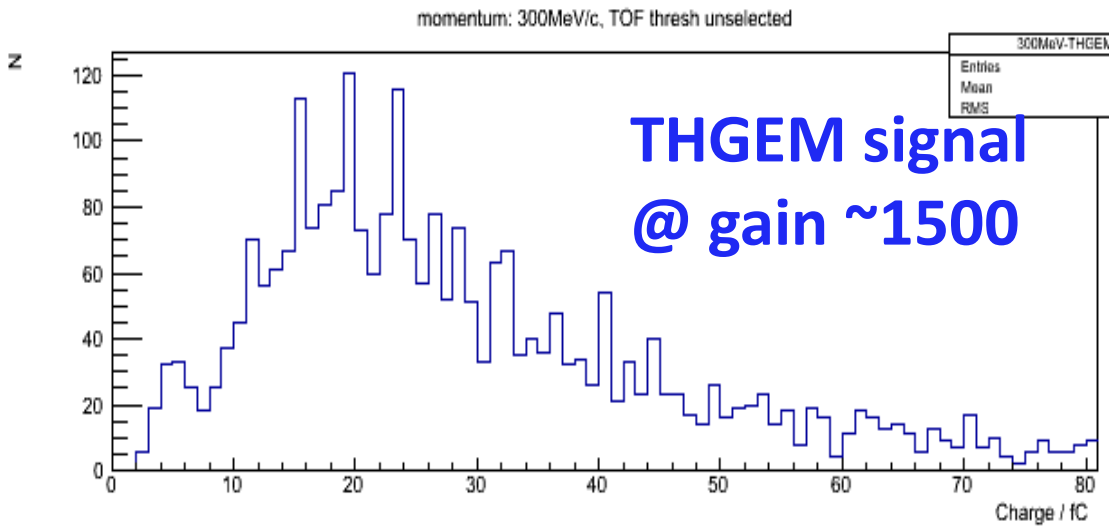


TOF

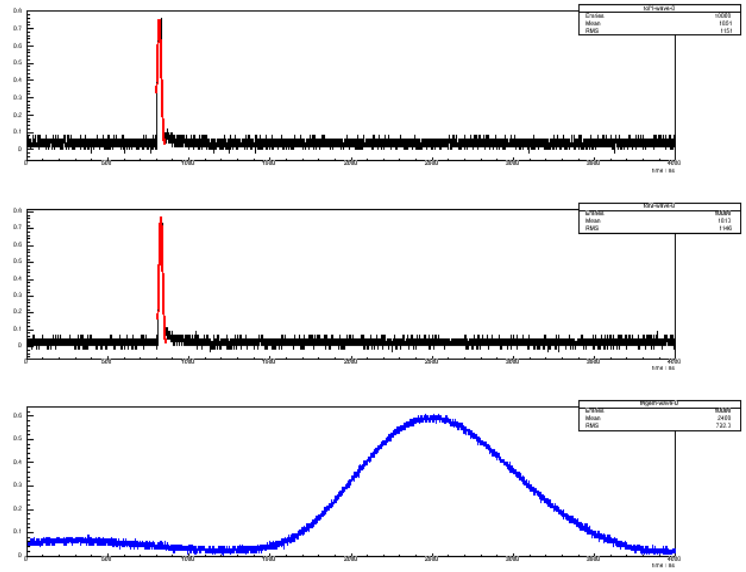
P(MeV/c)	pion	proton
300	9.2ns	27.3ns
600	8.5ns	15.5ns



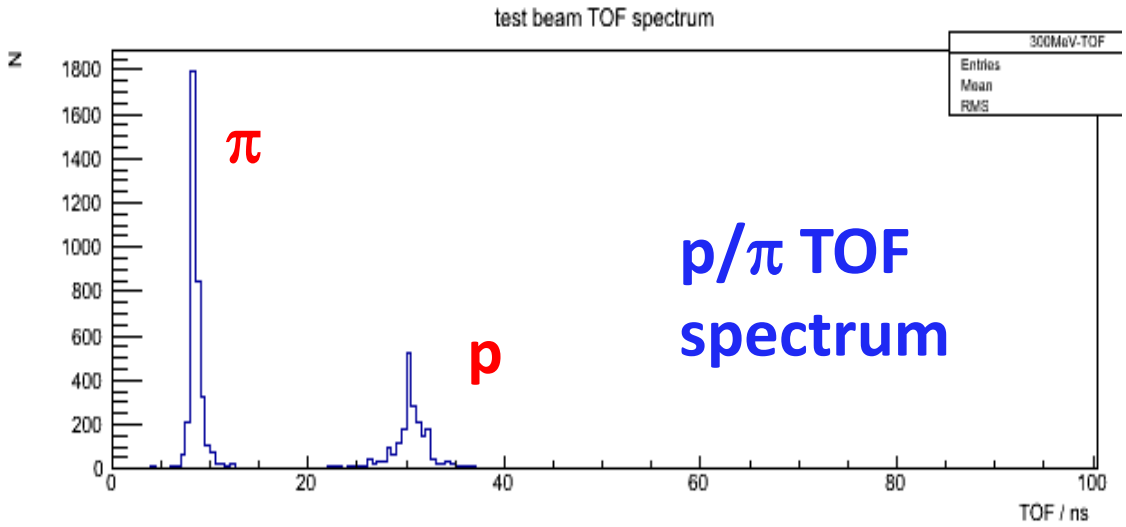
beam test result



THGEM signal @ gain ~1500



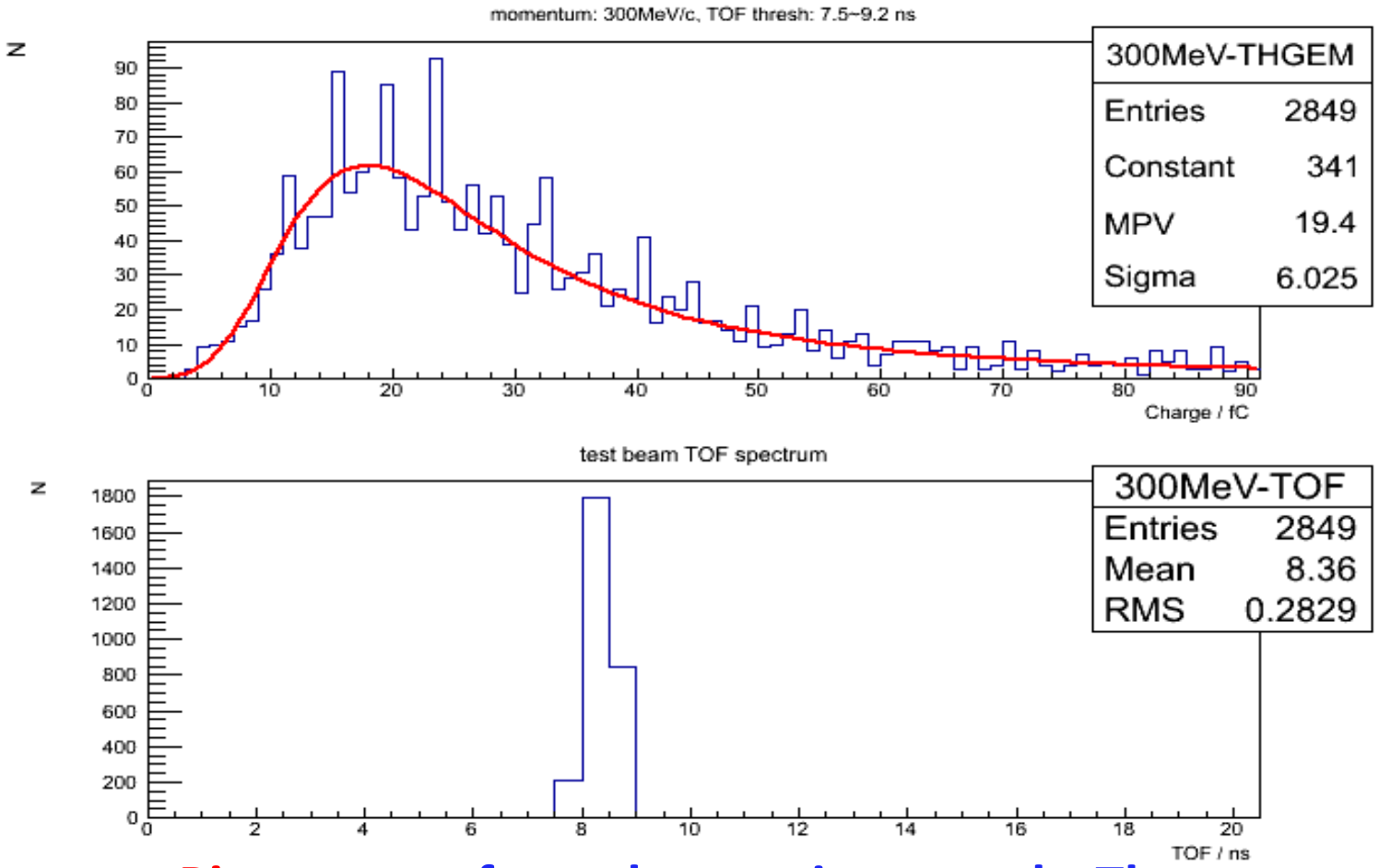
Signal waveform



p/π TOF spectrum

300MeV/c

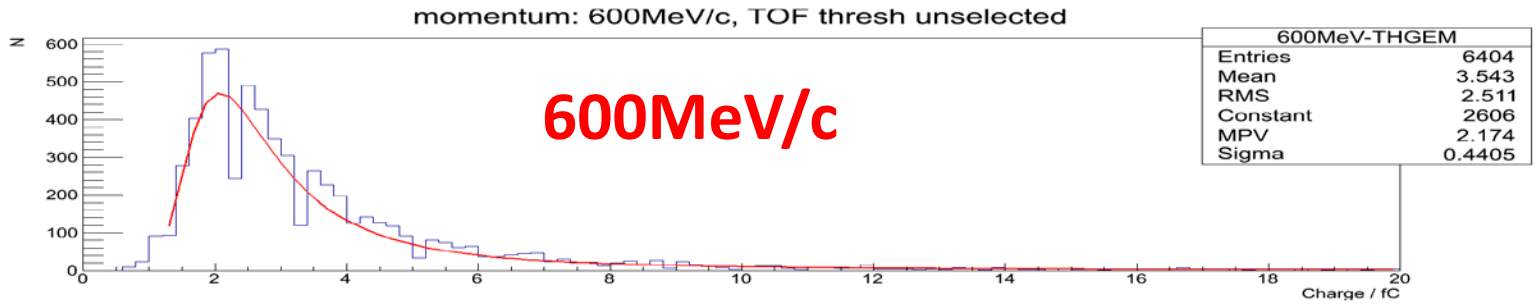
beam test result (Cont.)



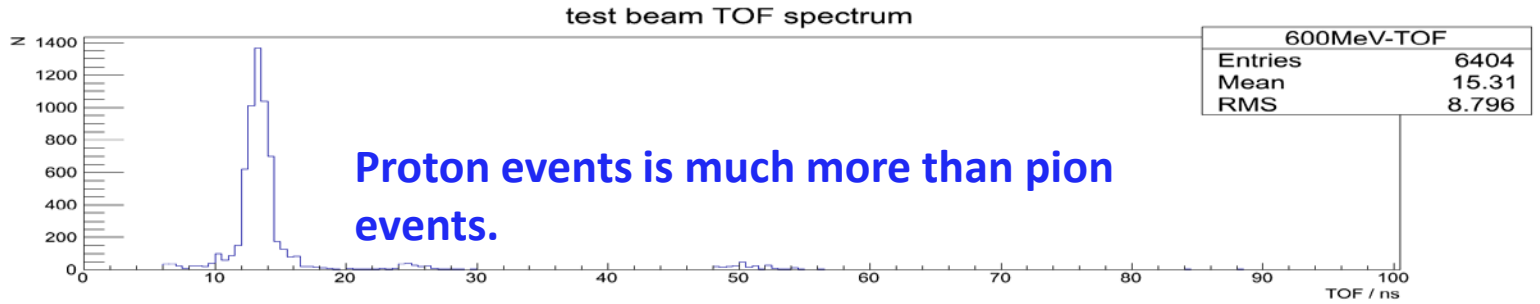
Pion events from the previous result. The detection efficiency is ~97%

300MeV/c

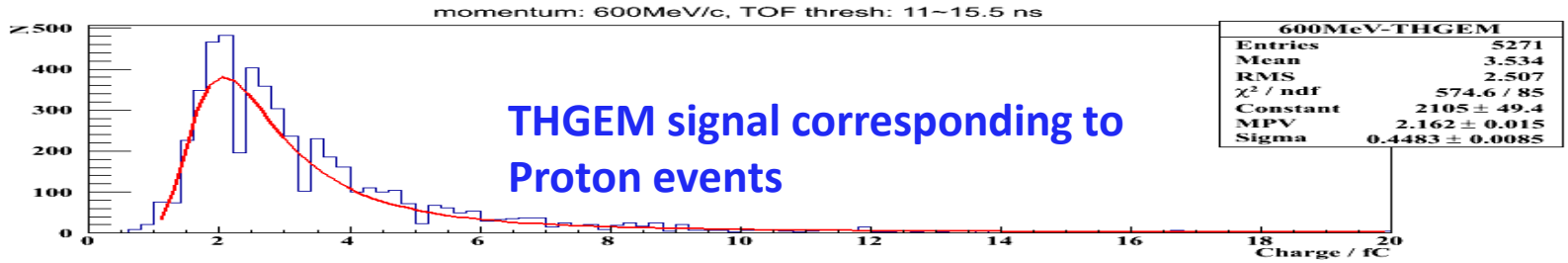
beam test result (Cont.)



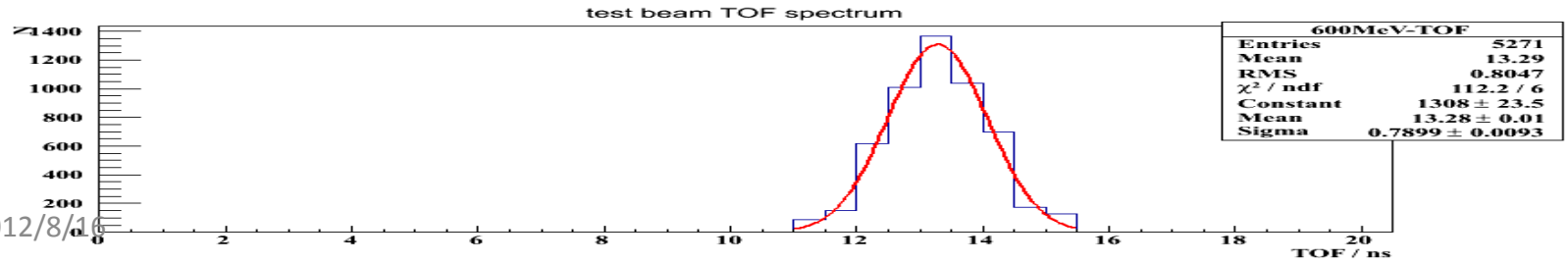
600MeV/c



Proton events is much more than pion events.



THGEM signal corresponding to Proton events



Conclusion

- THGEM detector has been studied in detail at IHEP. The detector has high gas gain, good gain stability and uniformity, robust to discharge, and easier to be produced.
- For the future ILC program, hadron calorimeter (HCAL) plays an important role. The THGEM detector is suitable for making a digital HCAL.
- More precise measurements, and other applications are in process.

Thanks!