

Polarimeter GEM tracker for
SuperBigbite
07/21/2015

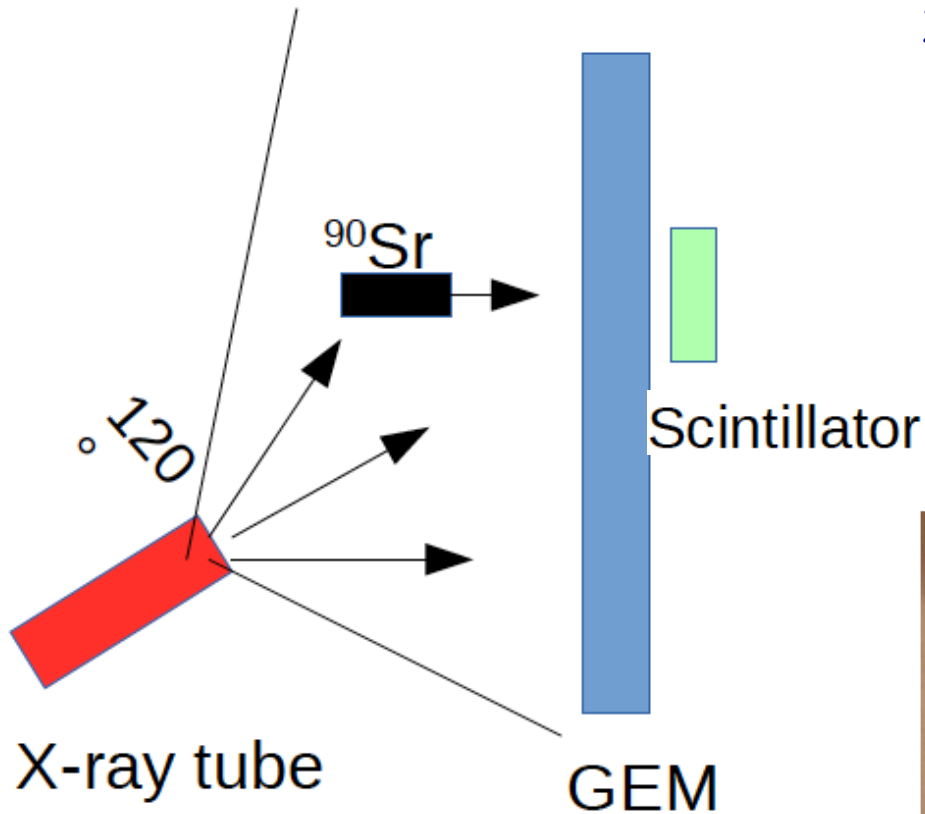
Production Status:

- 34 modules completed; 32 fully tested:
 - 30 modules 100% operational.
 - 2 modules have one bad sector each.97% of active area operational.
- Going at ~ 2 modules per month
- Construction on hold this month due to vacations, will resume mid August.
- Expect to complete ~42 by end of January and all 48 by end of April.
- Preparing a 5-layer tracker with 5 early modules, #12-#16, for parasitic beam tests in the fall.
- Storage is becoming a real problem: running out of shelf space and storage not in a clean area: Jlab is trying to provide clean room space by August/September



x 3

Testing the modules

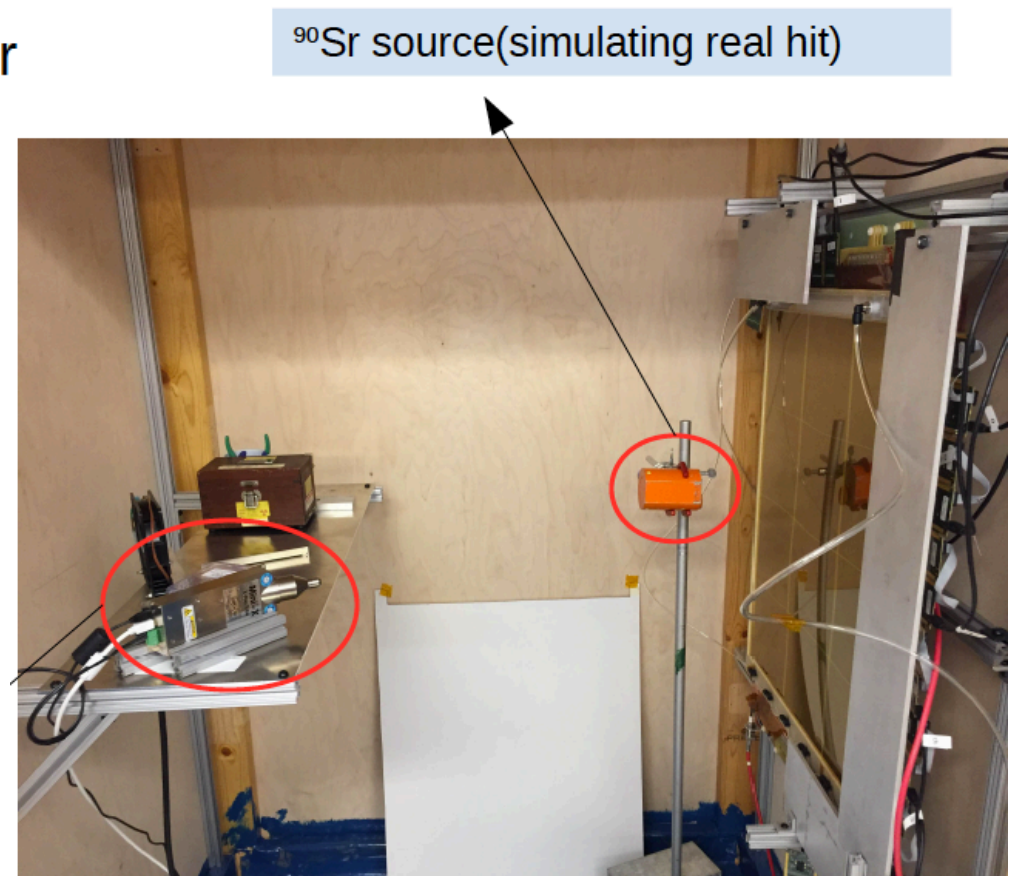


X-ray generator specification:

- Photon energy range: up to 50 keV
- Output flux: 100 MHz/cm² on the surface of GEM (conversion rate $\sim 0.5\%$ to electrons for ionization to happen)
- Angular distribution: uniform within 60°

This setup provides:

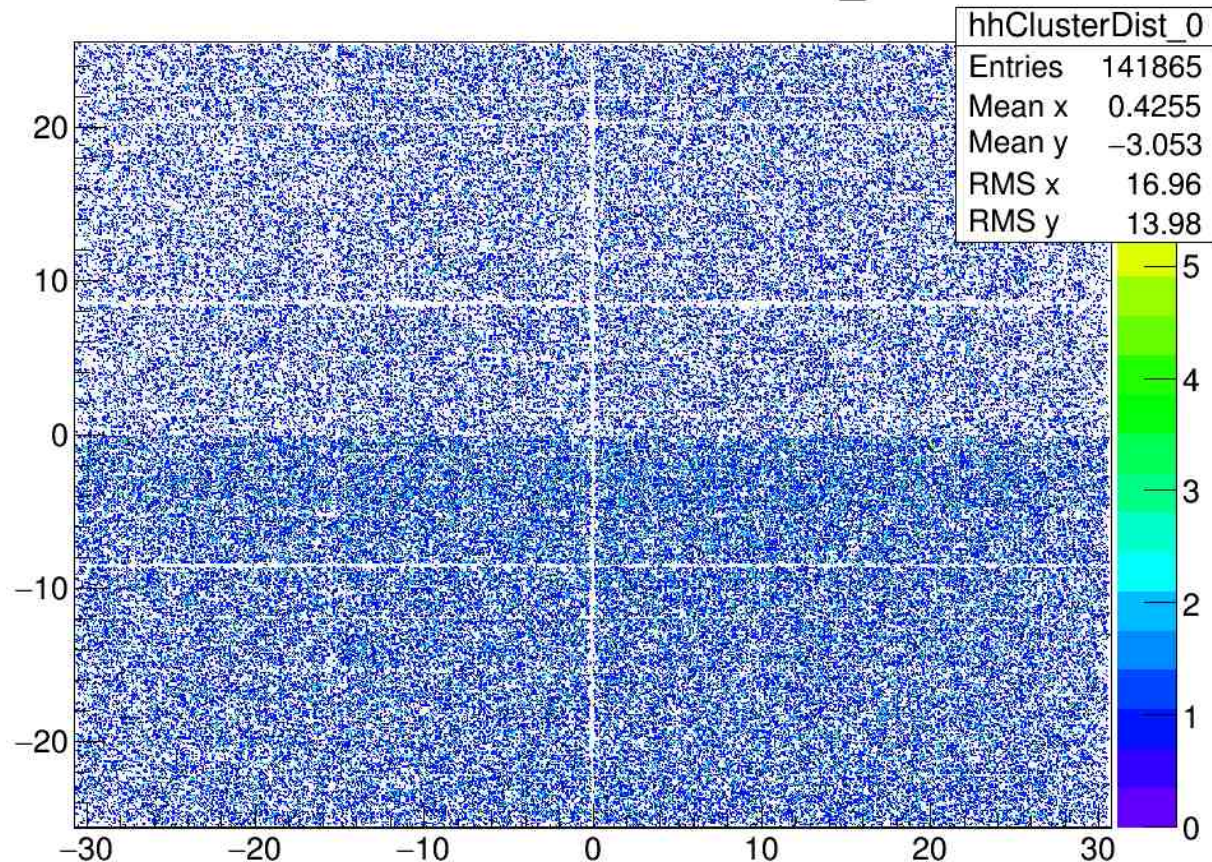
- Charge deposition in GEM: up to $3.4 \times 10^{11} \text{ e}^-/\text{cm}^2/\text{s}$, equivalent to $\sim 7 \text{ MHz}/\text{cm}^2$ MIP.



Production module Testing

- In May we switched from SRS electronics to MPD electronics for testing of SBS modules.
- Danning setup the prototype MPD system at UVa with 17 APV cards: can test $\frac{1}{2}$ the chamber in one go.
- So far used to test 8 SBS modules: results are roughly comparable to what we got with SRS.

Cluster Distributions module_0

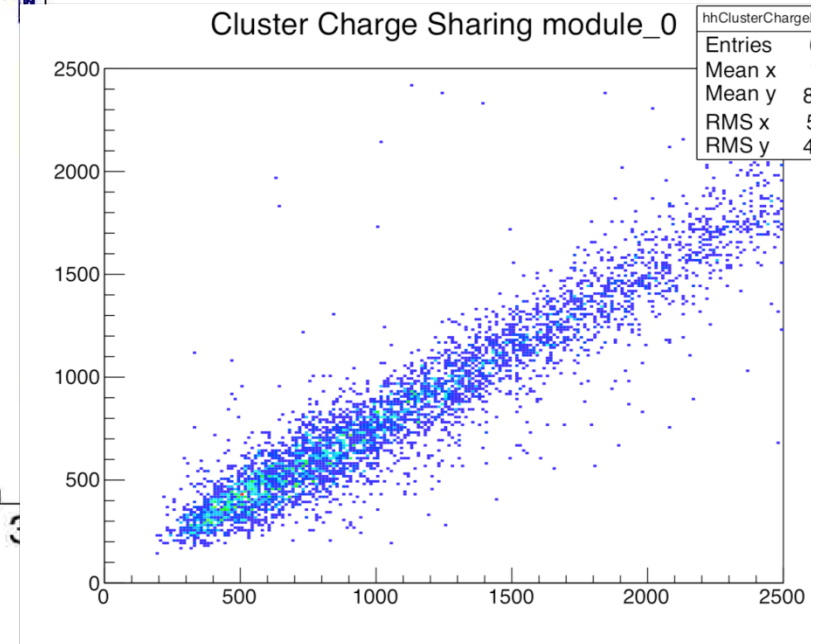
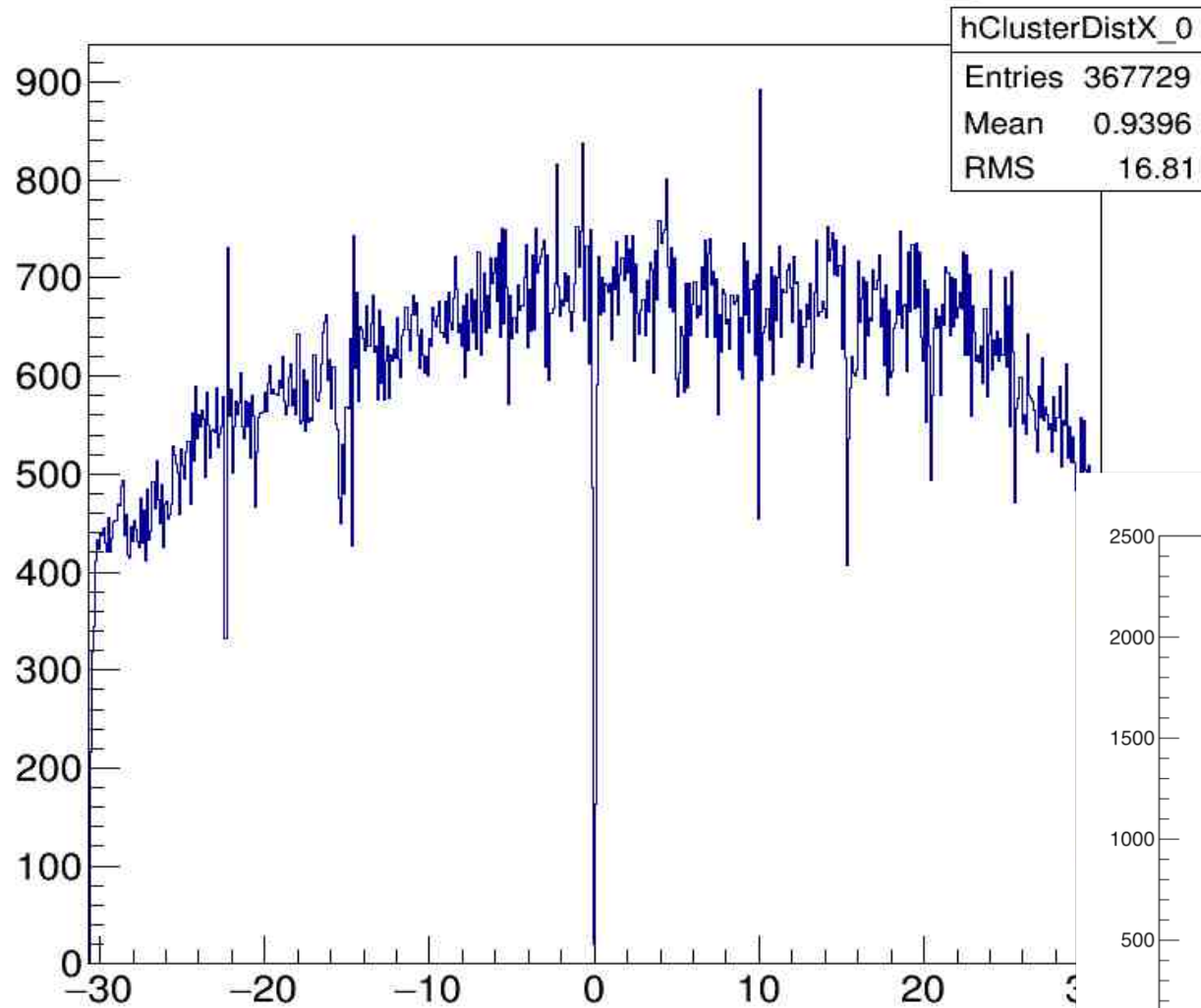


Module # 29

Production module Testing

Module # 29

X side Cluster Distributions module_0



Chamber Components

- A major delay in CERN GEM foil and readout plane production in the last few months: due to some thickness irregularities found in the raw material foil used for GEM production.
 - We had sufficient GEM foils in store to keep going; however have had to wait for the last few readout.
 - Just received the shipment of 3 readout.
 - Have GEM foils for 2 more modules: expect to get some more soon.
-
- GEM foils:
 - 138 ordered (need 144: will order a few more as needed)
 - 123 received and tested
 - 14 bad foils with minor issues (ie: one sector drawing a bit too much current etc.): sent back to CERN: Rui has agreed to either repair or replace.
 - 1 foils sent back for inspection (re: low gain issue): will be replaced.
 - Readout foils:
 - 45 ordered (need 48: will order more as needed)
 - 40 received
 - 37 tested so far
 - 3 unacceptable quality (too much Kapton as reported last year); CERN will replace these.

MPD for SBS-BT-GEMs: Large production of MPD electronics

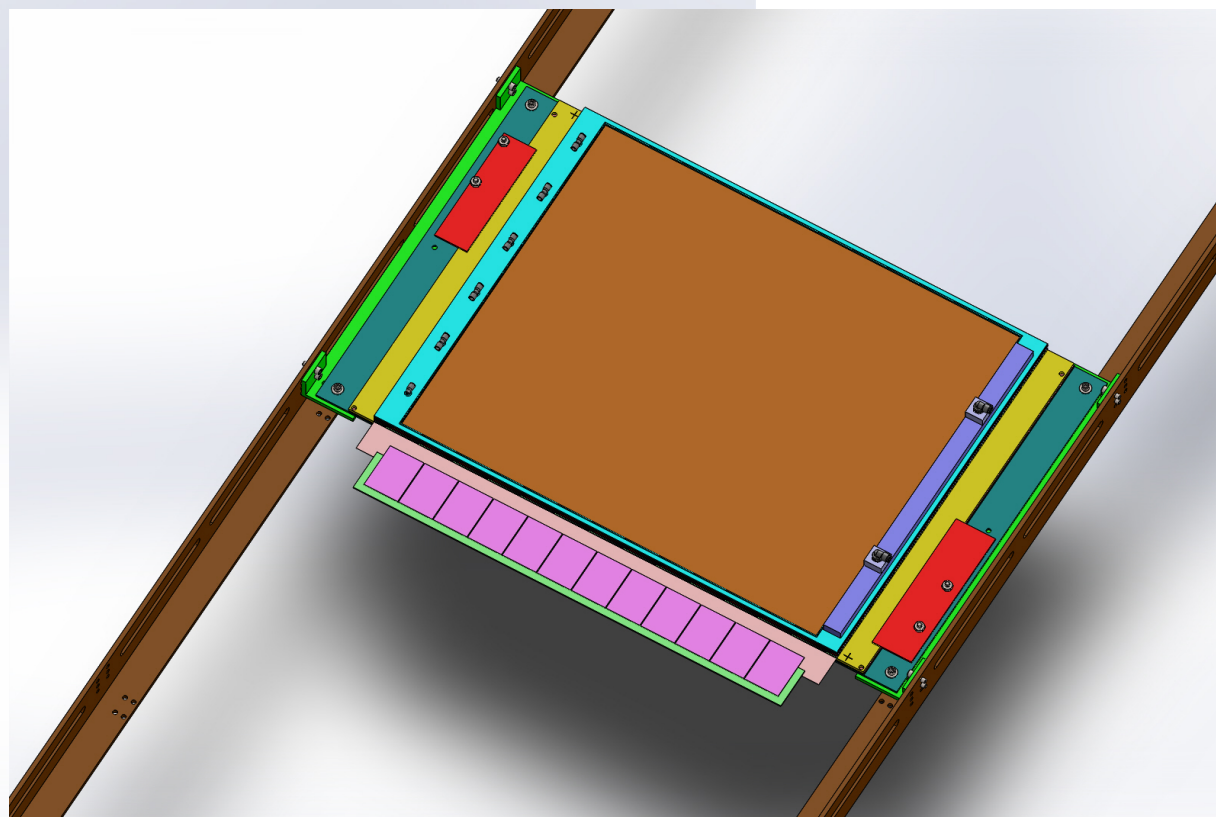
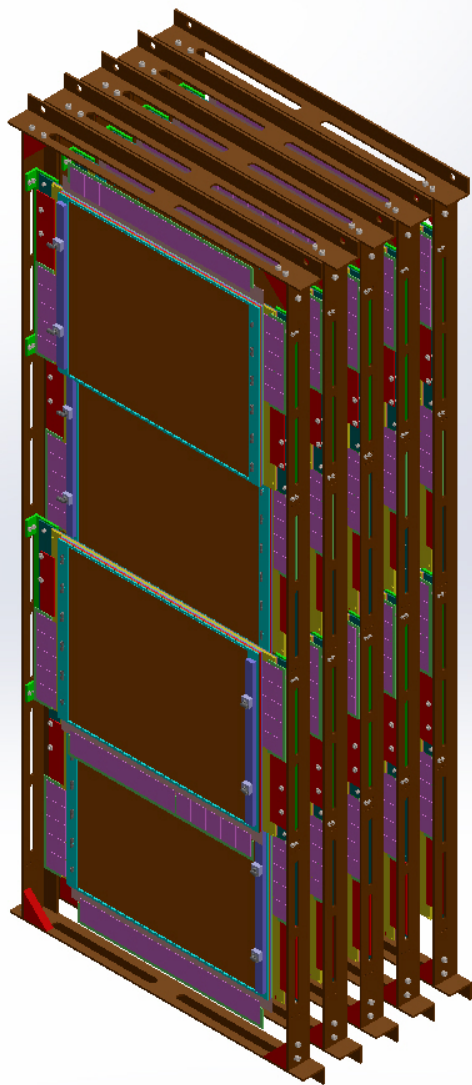
40 modules for the 2 Back Tracker stations (112,640) electronic channels to readout

- Original option: combine two detector readout strips into one electronic channels
- A lot of concerns for this option:
 - Additional items: Need adapter 2-1 strips in addition to the back planes
 - electronic noise level, APV25 saturation, detector performance ...
- Second option: Reading out all single detector strips
 - Safer option for performance and less development needed
- Economies of scale and strong \$ allow us to instrument all channels instead: big improvement.
- However: forcing us to really stretch the available resources.
- Including spares procuring 118 k MPD channels for the back tracker.

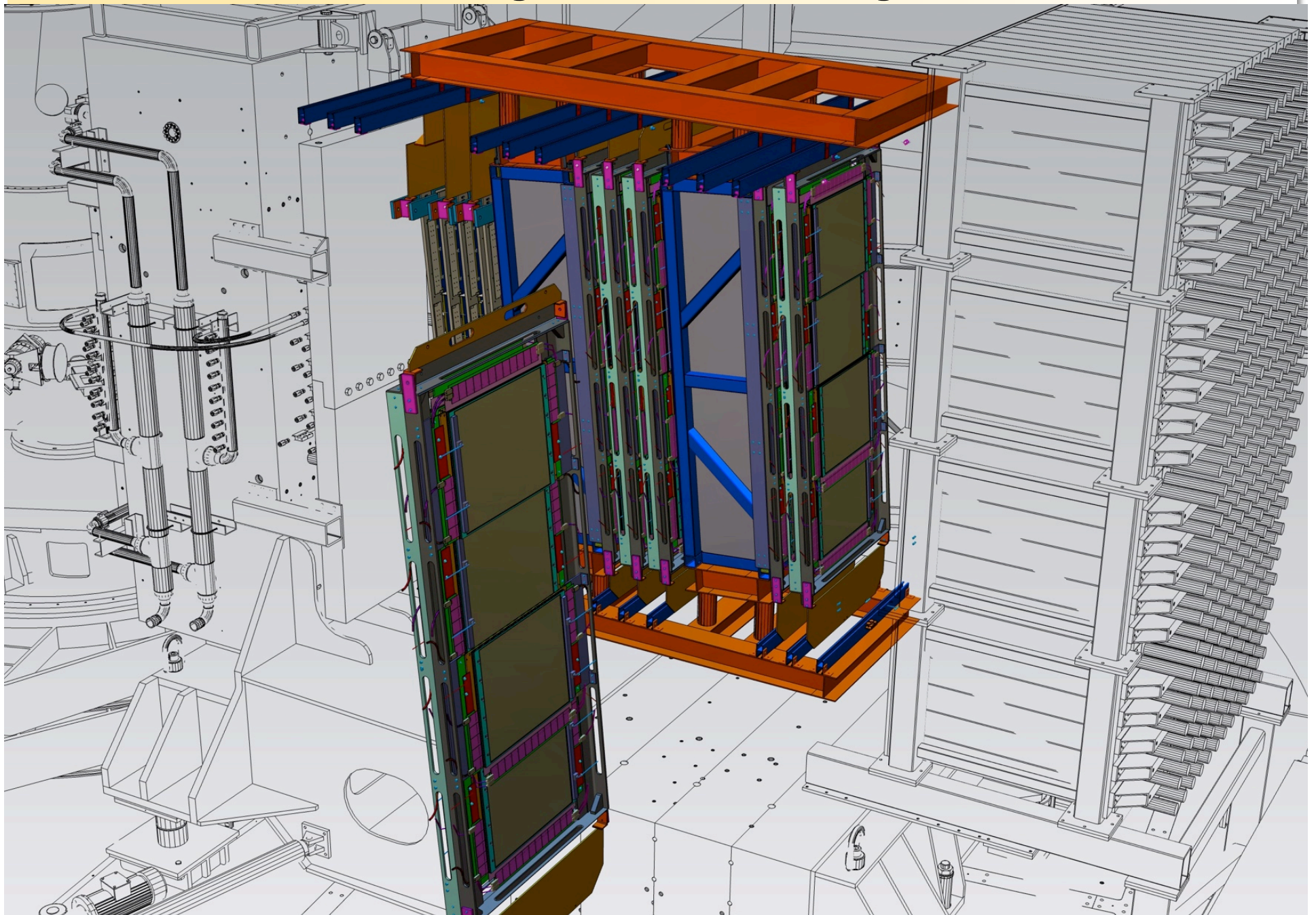
Status of MPD readout for Polarimeter tracker

- Order for (almost) all components placed.
 - All 57 MPD units received: will be tested soon.
 - 73/82 12-slot back planes received.
 - Expect other components in a month or two.
- More details from Danning and Paolo

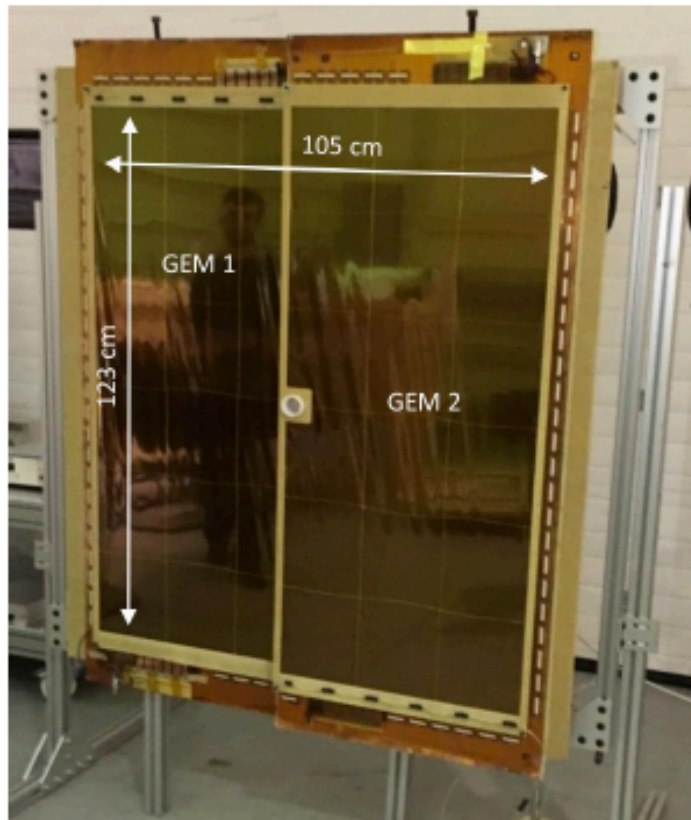
Work in Progress: GEM holding frame



Work in Progress: GEM holding frame



GEM Efficiency from calibration runs



GEM Setup Before mounted on HyCal

Analysis Status :

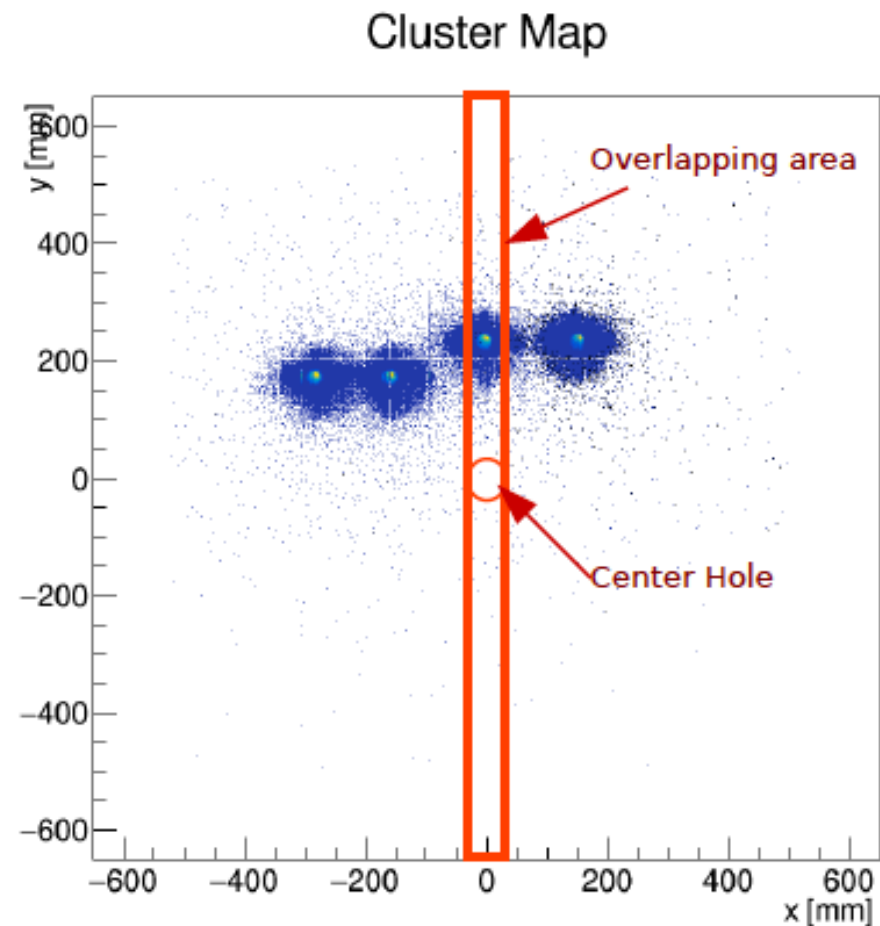
~50% percent data finished
analyzing...

4 spots

Results very preliminary.

PRad Coll

- 1), Two World largest GEM Detectors
- 2), 44mm overlapping area in the middle



GEM Efficiency From Production Run

Efficiency from ep(suspected) events:

Requirement:

- 1) HyCal one cluster (preliminary, will change to after match one cluster left)
- 2) cluster energy > beam_energy - 5 sigma
- 2) match with GEM

Efficiency = number of clusters after match / number of clusters before match

Efficiency from moller(suspected) events:

Requirement:

- 1) HyCal two cluster (preliminary)
- 2) two cluster total energy > beam_energy - 5 sigma
- 2) match with GEM

Efficiency = number of clusters after match / number of clusters before match

Using quantity of clusters, instead of number of events.

Relative to HyCal

Efficiency Results:

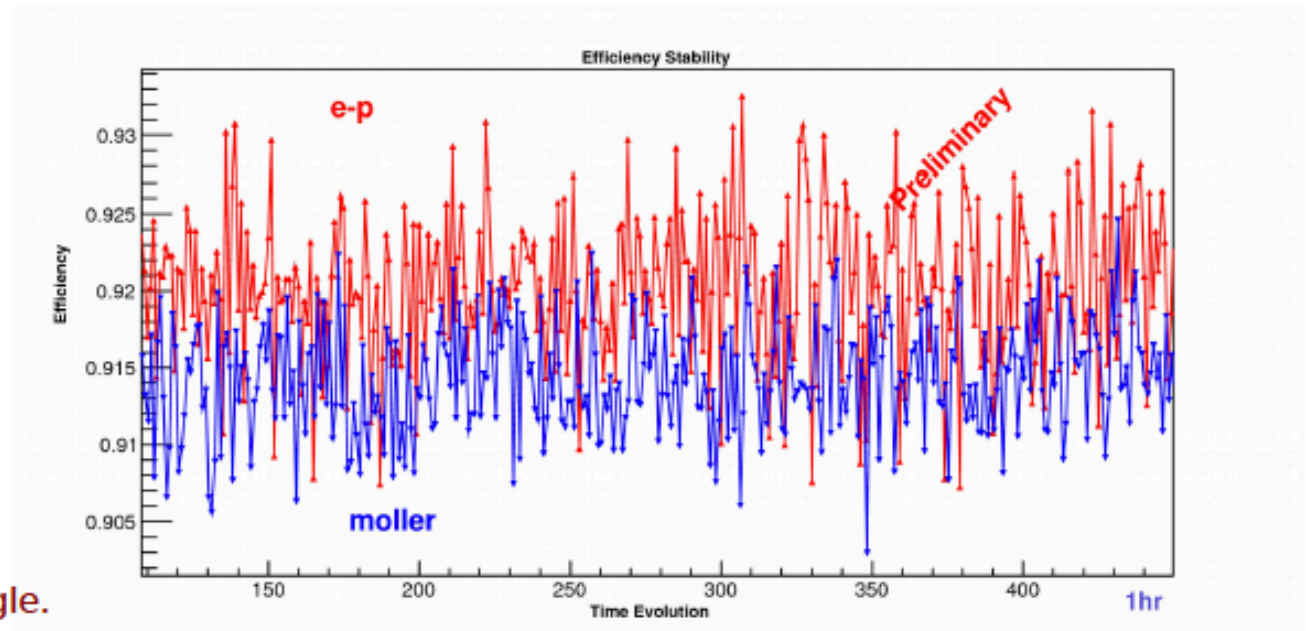
E-p: 92.0% +/- 0.03%

Moller: 91.4% +/- 0.03%

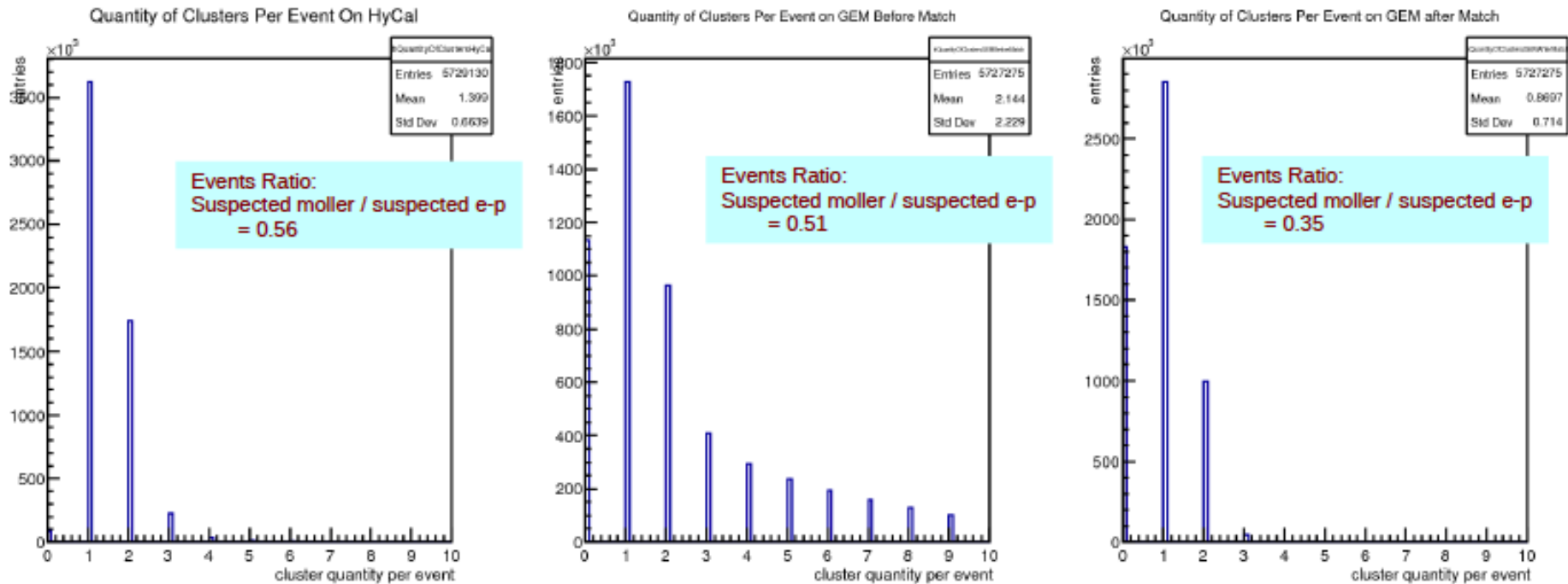
Covering nearly the whole
Active area of GEMs!!!
spacer, dead area,

Results Preliminary:

According to design, HyCal has a
Larger acceptance at smaller angle.

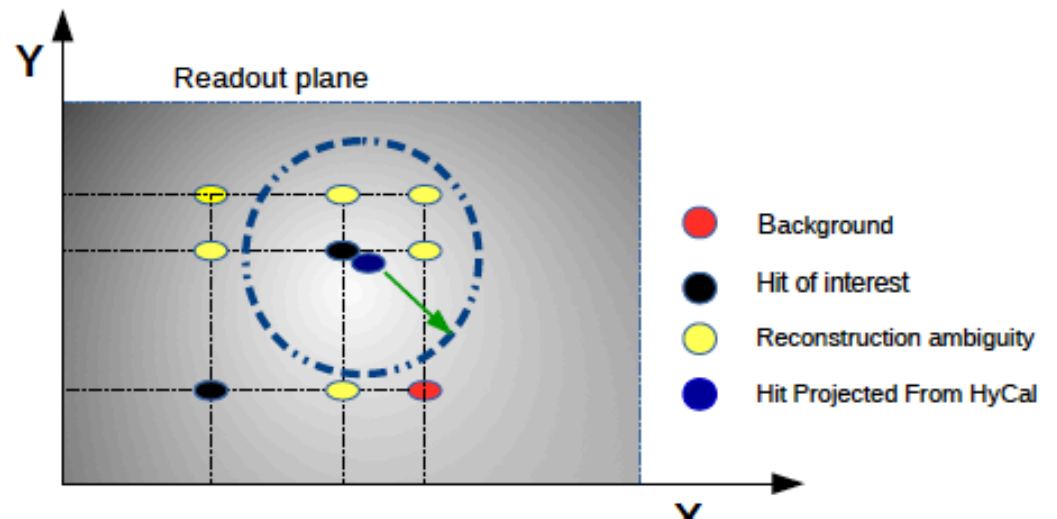


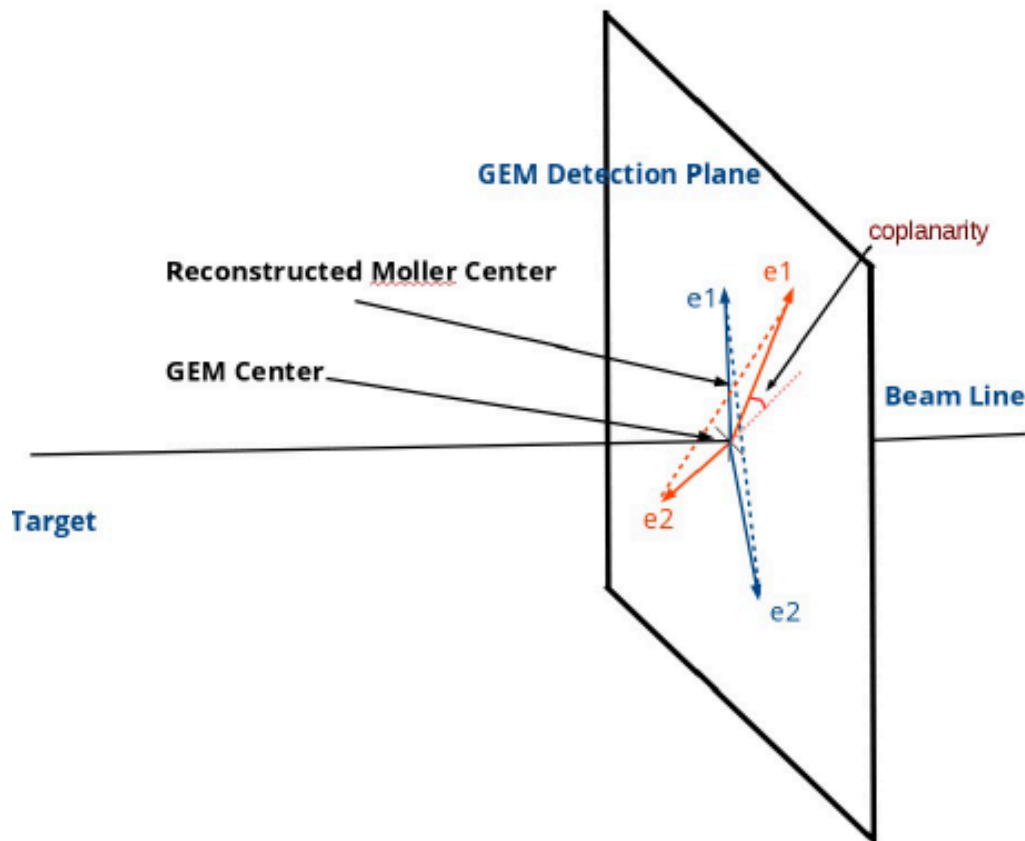
1.1 GeV Data



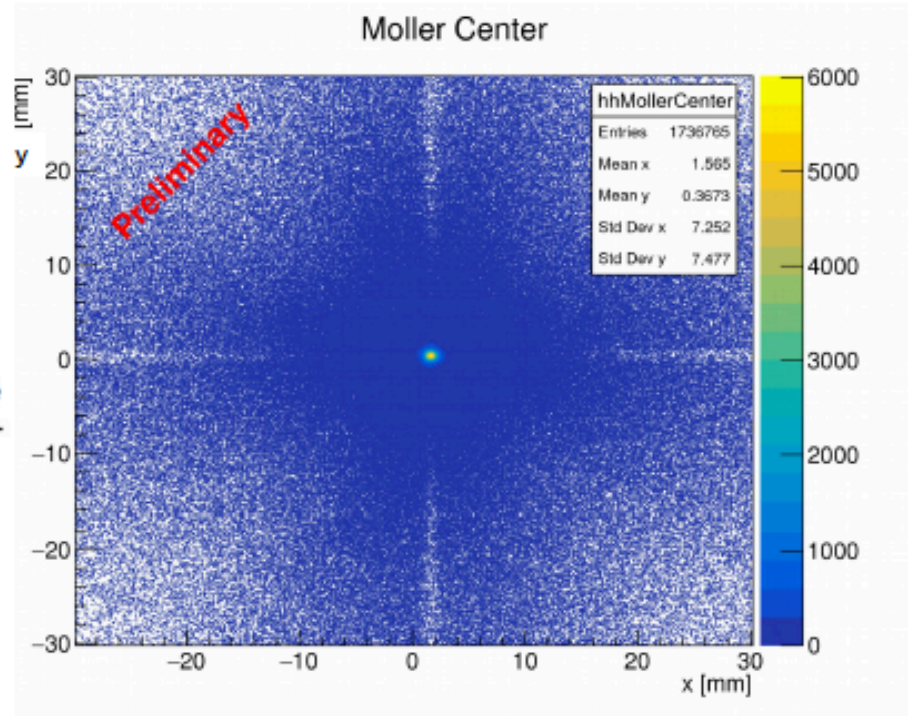
The matching method*:

For each cluster on hycal, search the closest one on GEM, within a certain area.





Moller Geometry



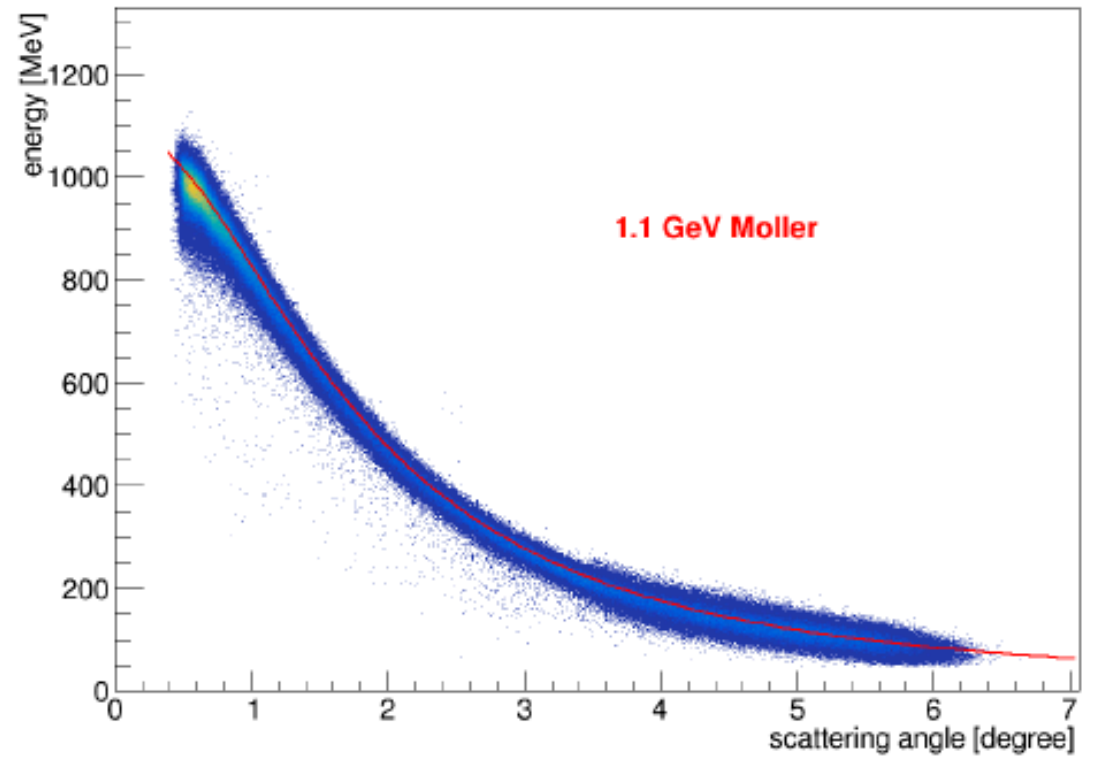
Reconstructed Moller Center

Energy angle distribution

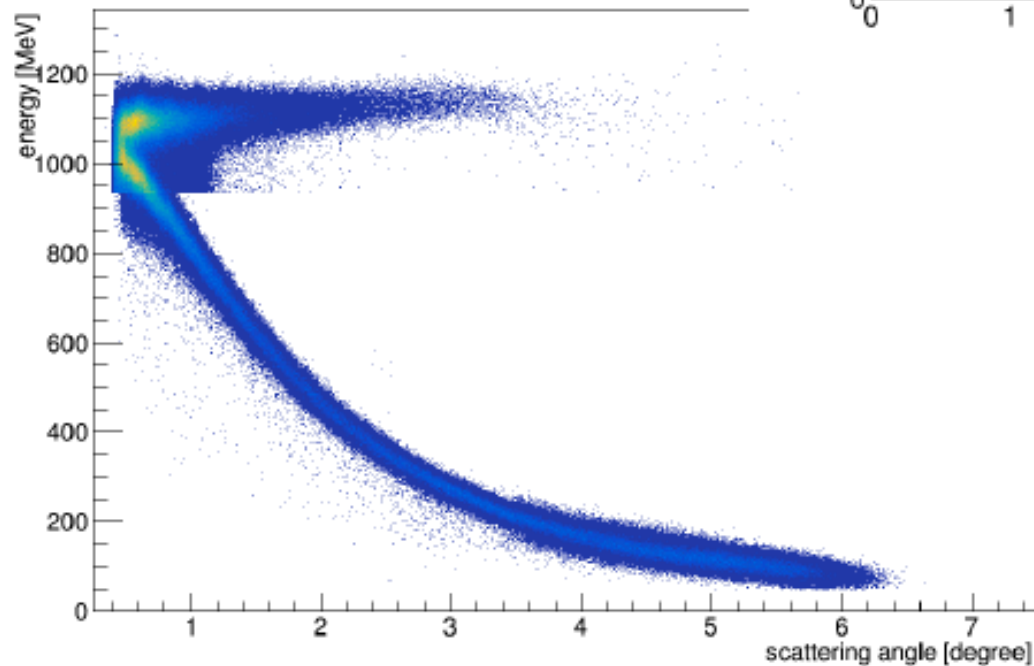
1.1 GeV

Red line: From Calculation

E [MeV] vs Scatt. θ [deg]



Energy Angle



Energy From HyCal

Coordinates from
GEM