LAPP/Demokritos H4 setup Preliminary results and Plans

Sampling Calorimetry with Resistive Anode Micromegas

(SCREAM)

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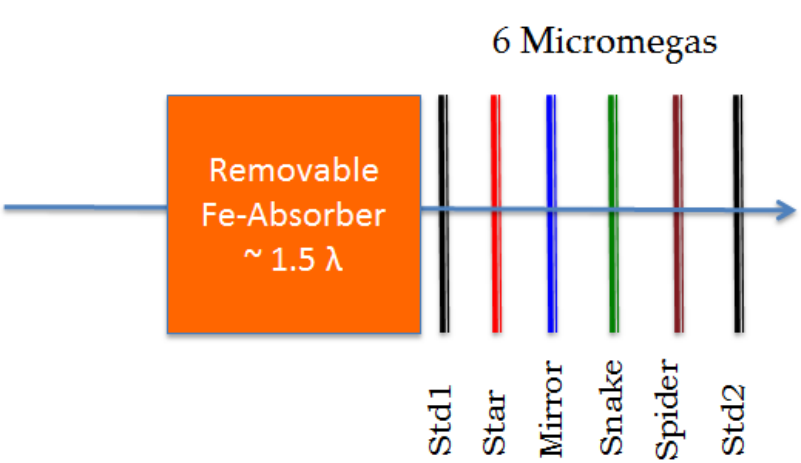
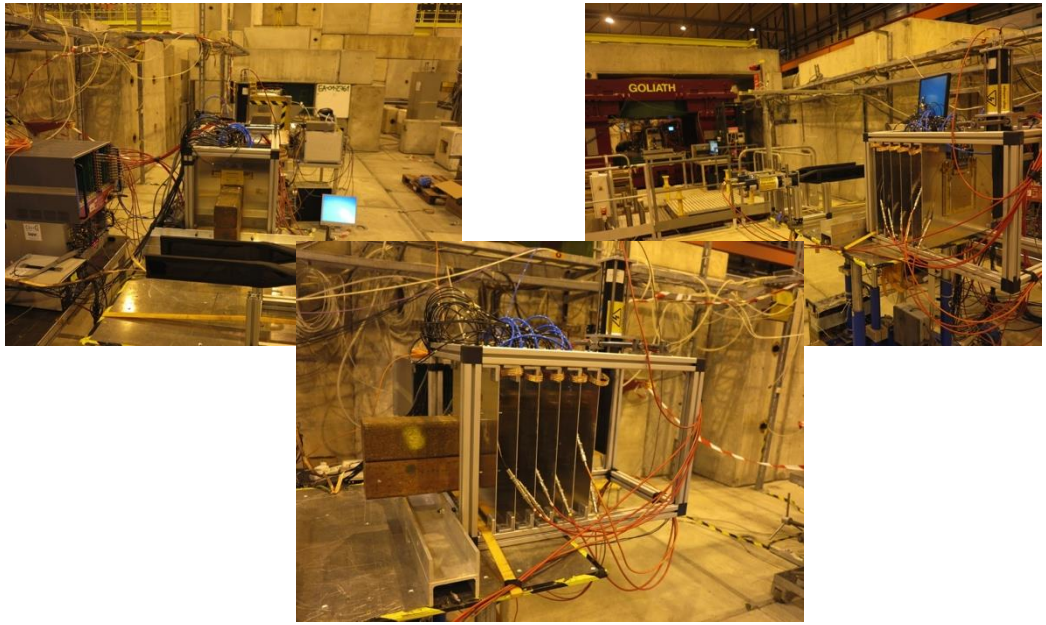
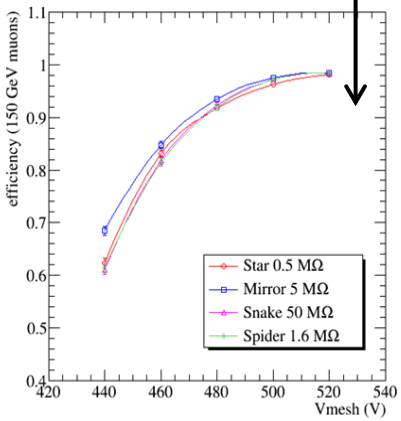
R&D ON RESISTIVE MICROMEGAS: LAPP / DEMOKRITOS H4 TEST-BEAM

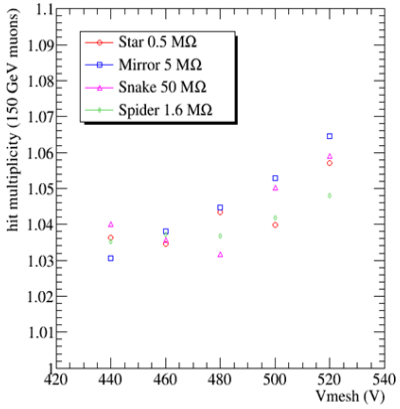


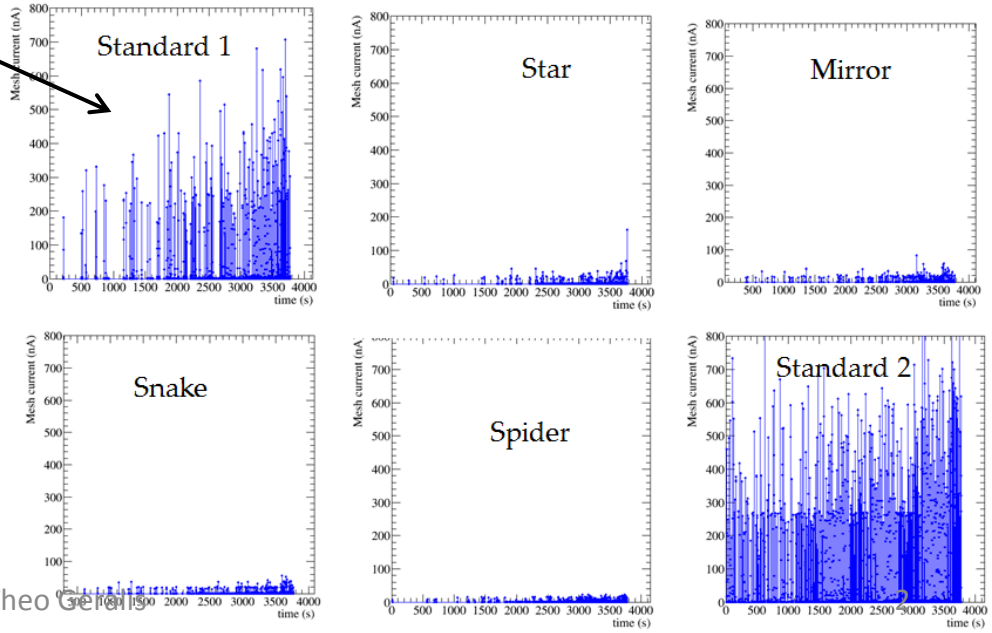


Resistivities: (0.5, 1.6, 5 and 50) MOhm

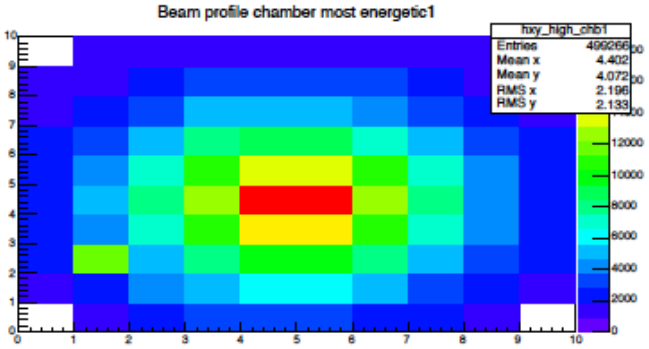
- Mesh current with pions (2-400 kHz)
- Efficiency and Hit multiplicity

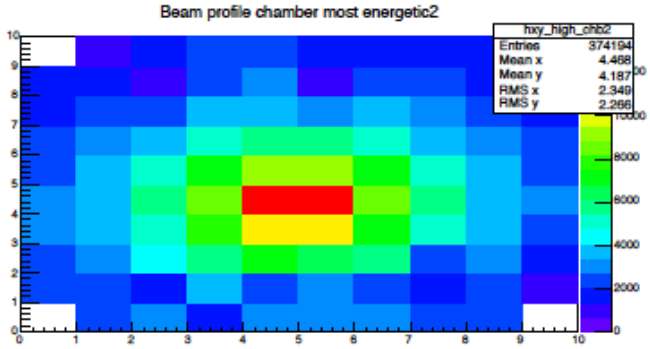


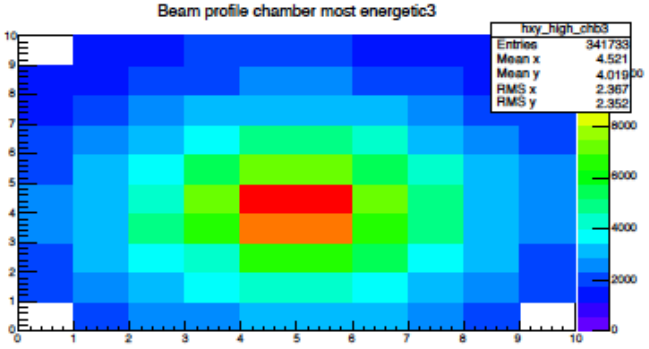


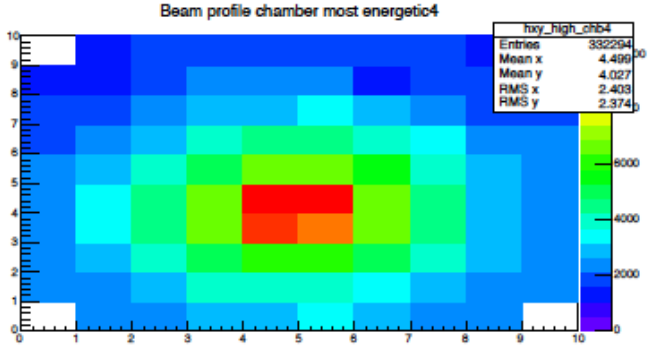


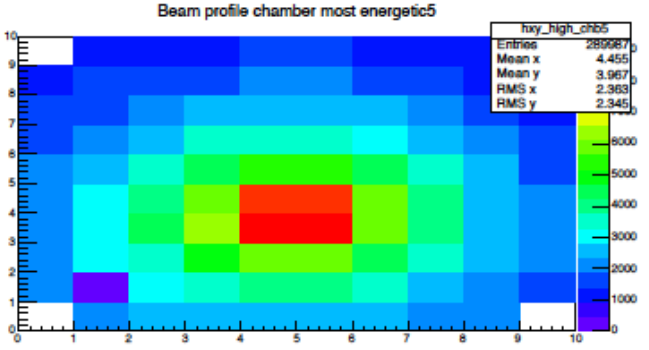
Beam spot in all detectors
Pion beam at 150 GeV with Fe absorber

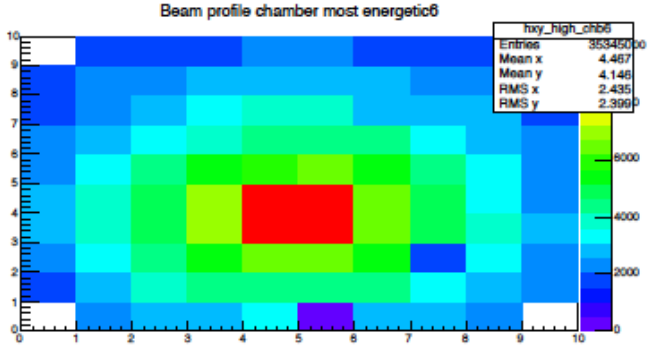




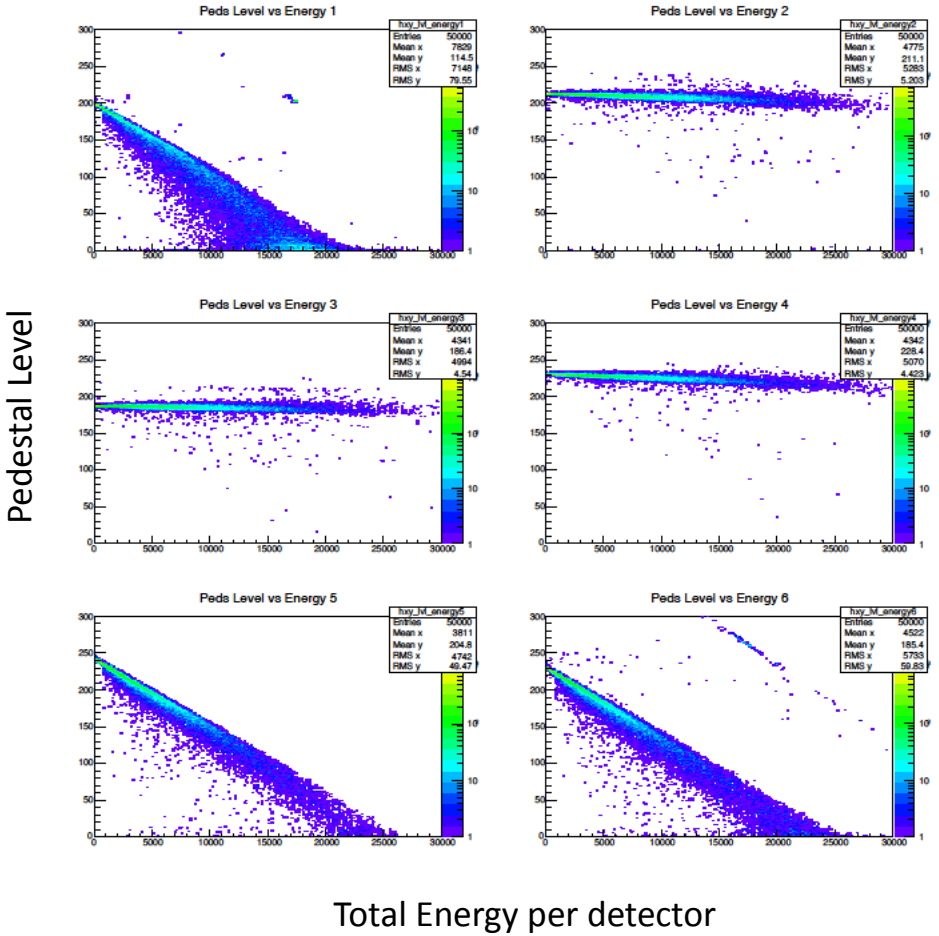








Pedestal Level variation - Energy response (corrected)



1) Get Pedestal Run before runs
2) Pedestal level shifts per event
3) Use pads without deposited energy to calculate level
4) Correct Energy for level shift per event

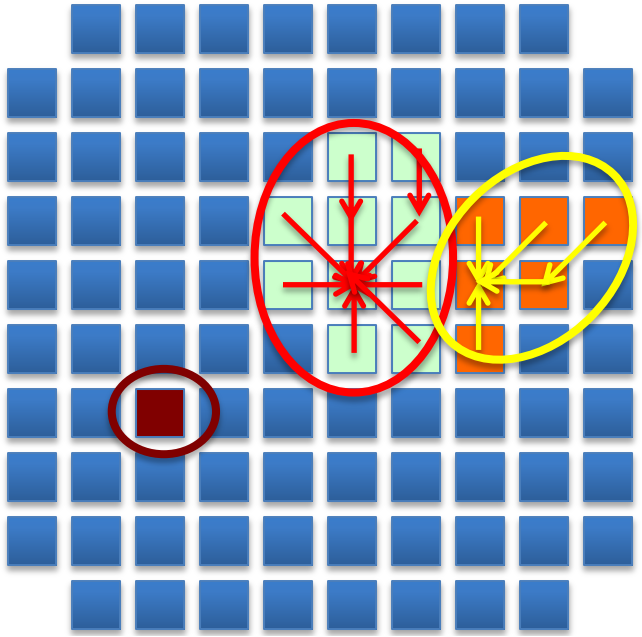
Standard Bulk and Spider (Patterned surface resistivity)

➔ Suffer Pedestal level shift Proportional to the Deposited Energy

Star, Mirror, Snake

➔ Not the case for flat Surface resistivity

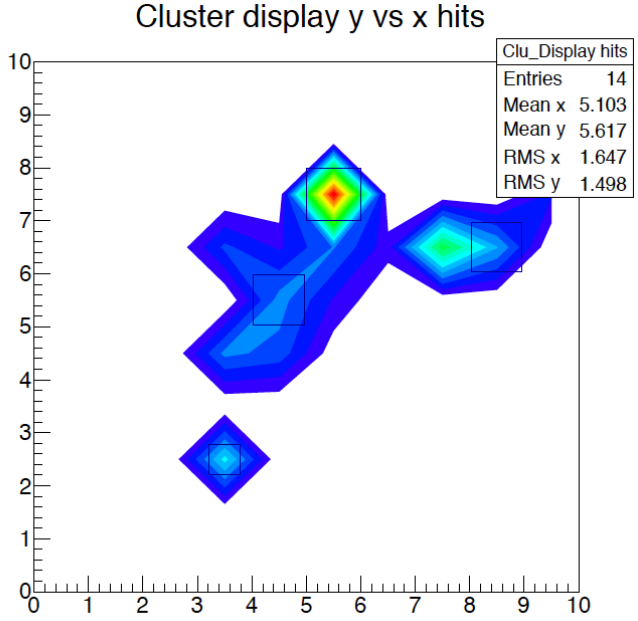
Energy Flow Clustering Algorithm

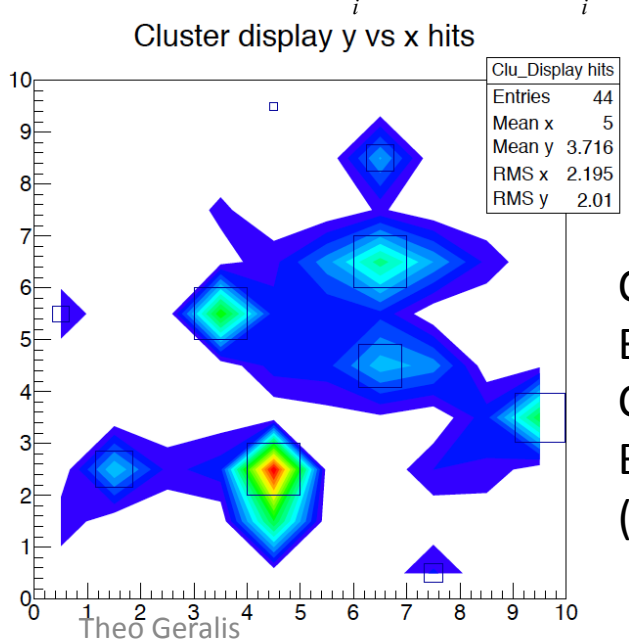


1) Define all neighbor pads for every pad
2) Connect pad A to neighbor pad B: Con(A,B) if B has higher deposited Energy than A
3) Pad A can connect to itself
4) If Con(A,B) and Con(B,C) ➔ Con(A,C)
5) Cluster Energy and position is defined as:

$$E = \sum_i E_{iPad}$$

$$x = \frac{\sum_i x_i \ln E_i}{\sum_i \ln E_i}, y = \frac{\sum_i y_i \ln E_i}{\sum_i \ln E_i}$$



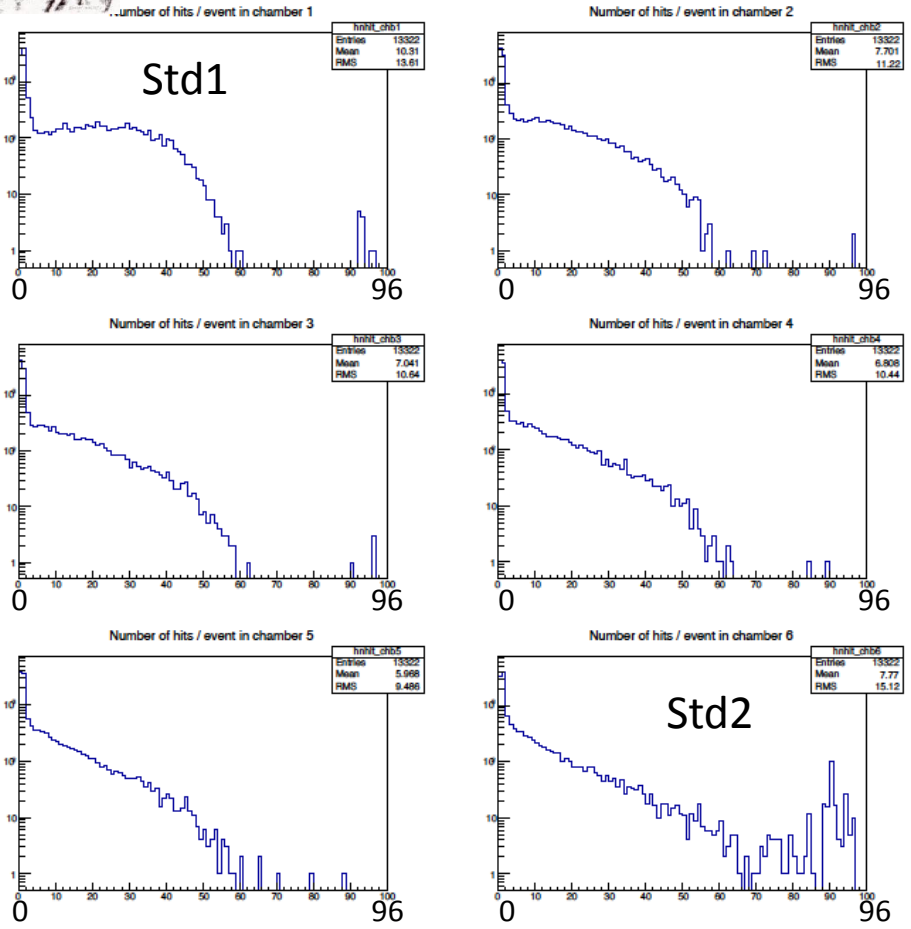


TEST BEAM EVENTS

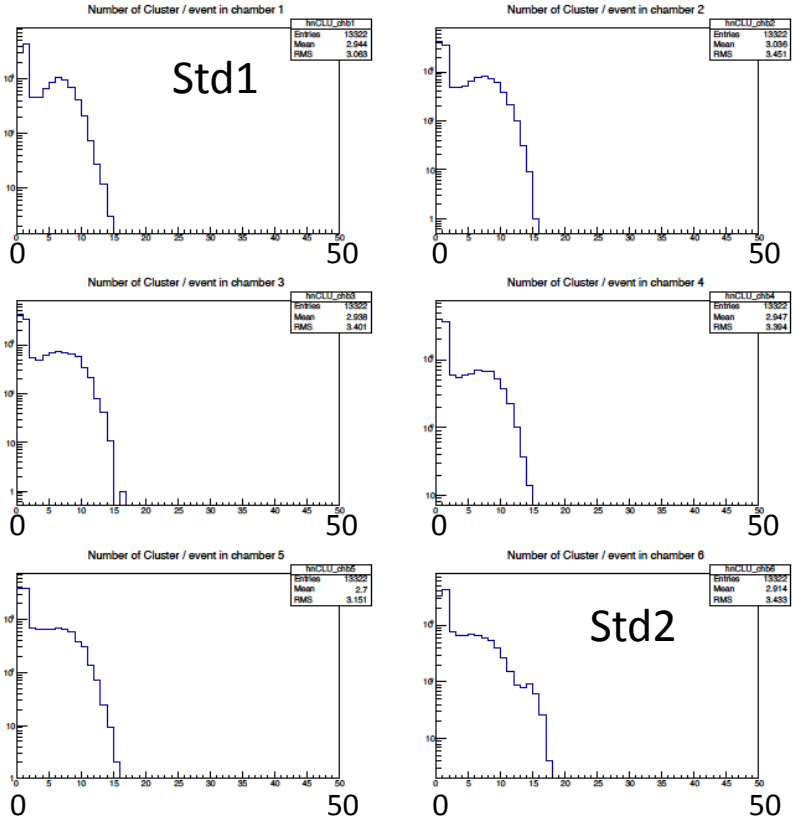
Clustering in test Beam data Events:
Color contour=hits
Boxes= clusters
(size of square = energy)

Hit and Cluster Multiplicity in all 6 Micromegas

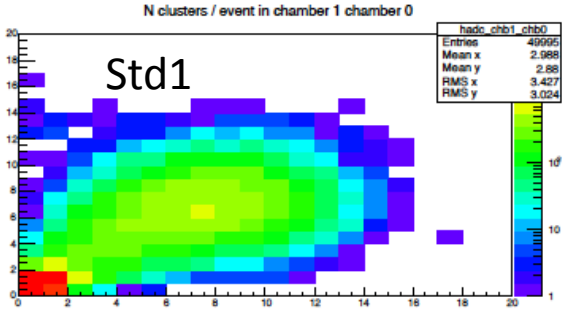
NHits distribution

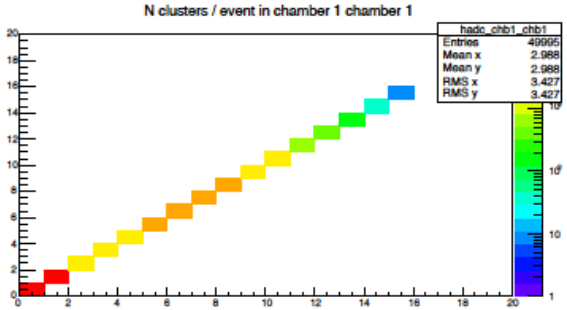


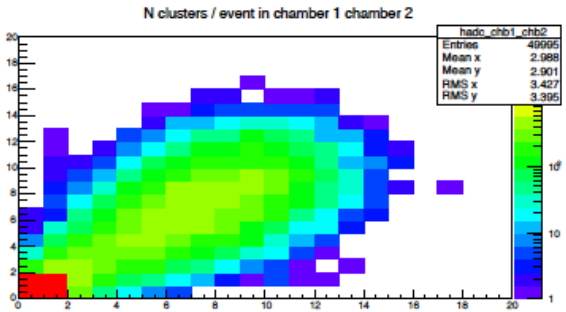
NClusters distribution

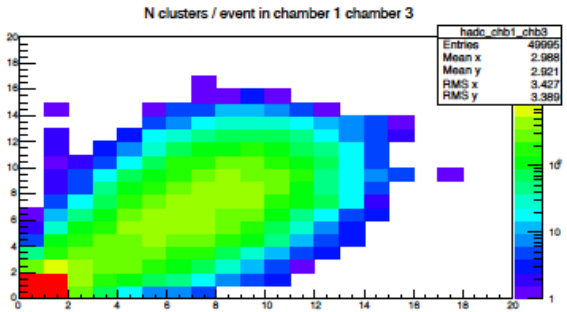


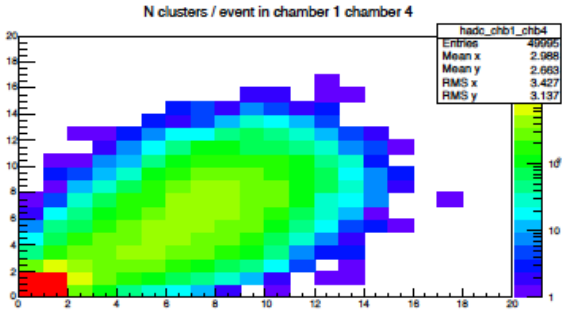
Number of Clusters in “Star” vs Nclusters in all other detectors

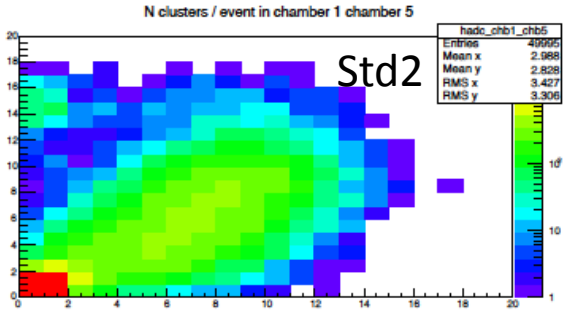








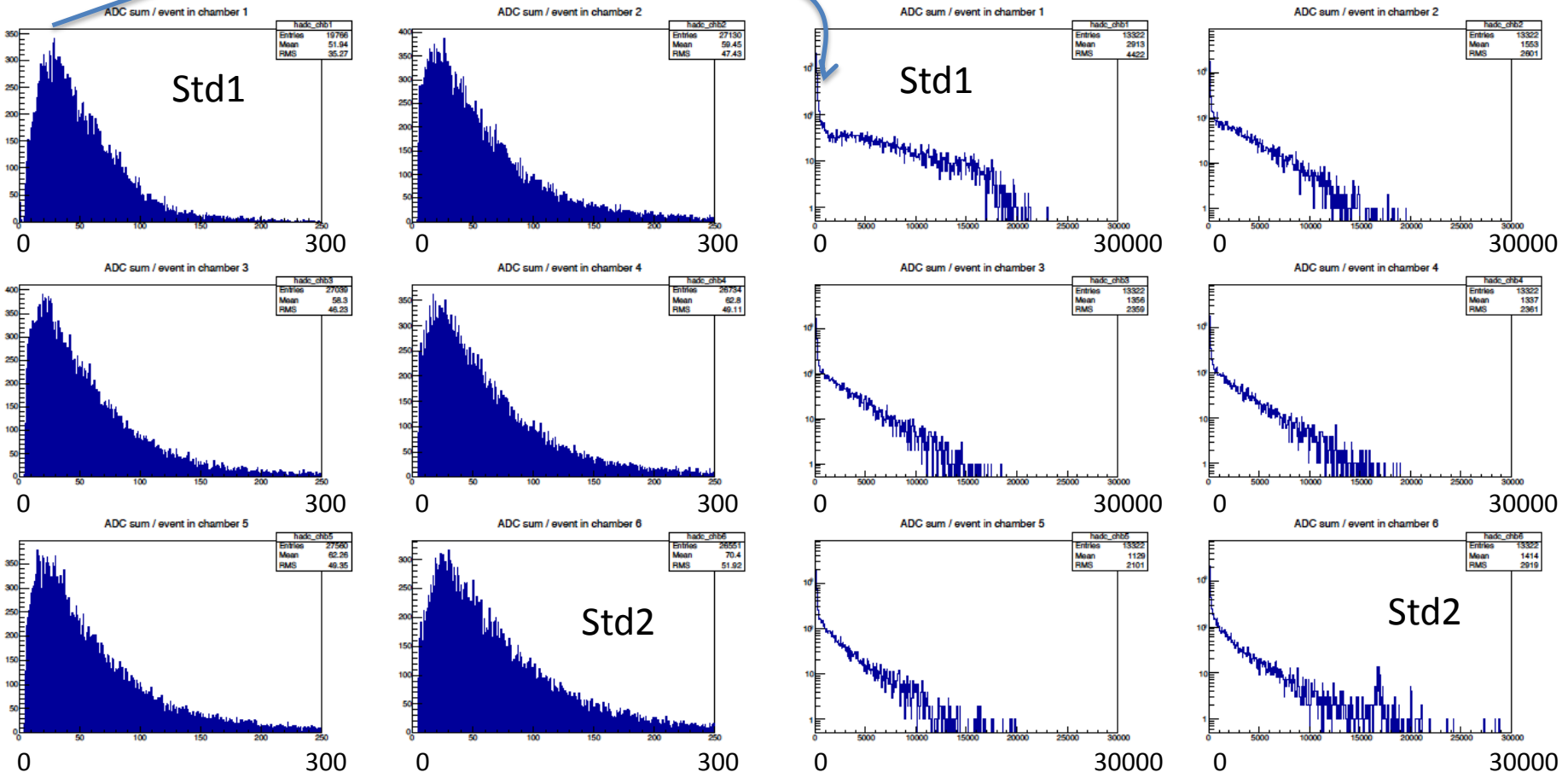




Energy distributions

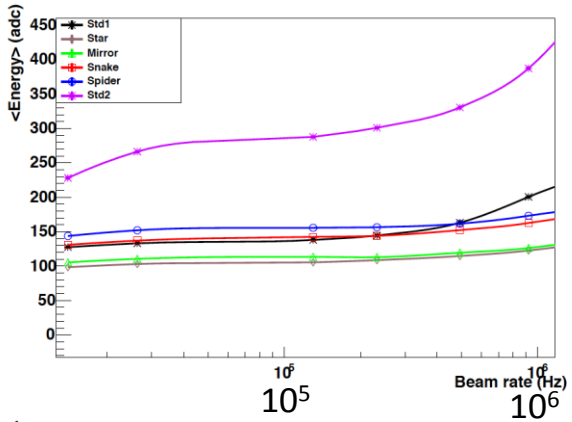
Landau distribution for mips
(muons at 150 GeV)

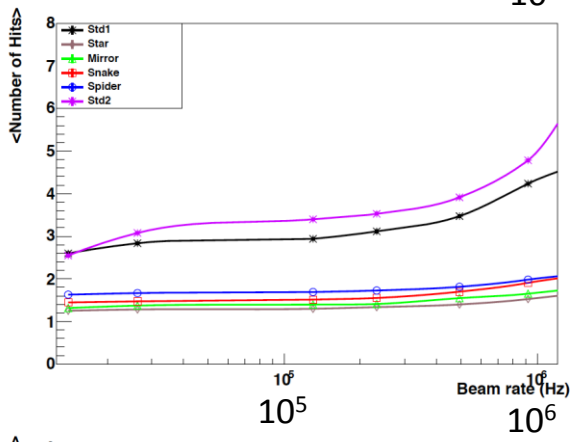
Energy distribution for pions
At 150 GeV with absorber

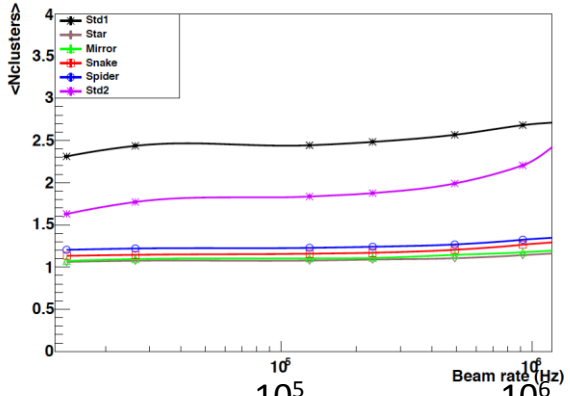


Energy, Nhits and Nclusters Vs Rate

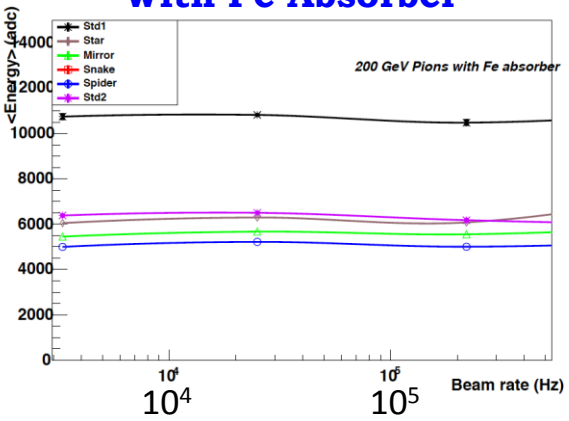
Pions at 150 GeV

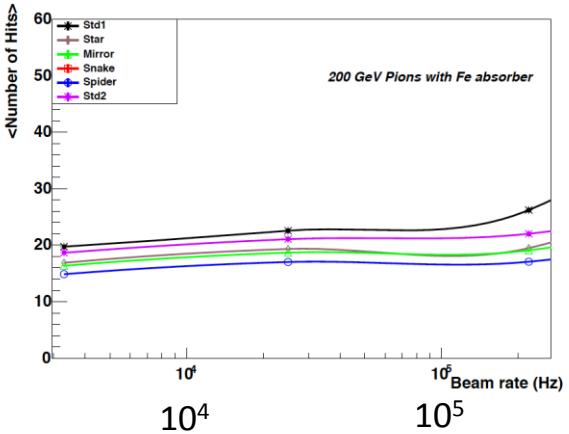


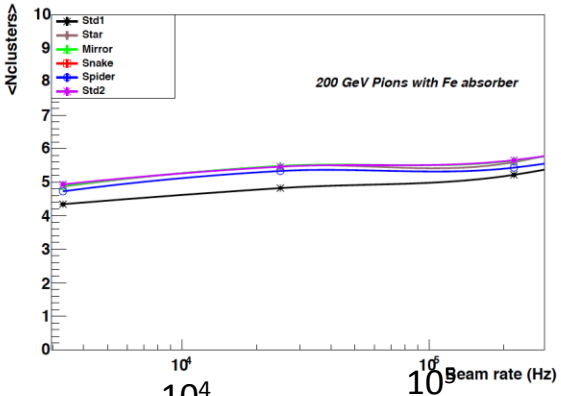




Pions at 150 GeV With Fe Absorber



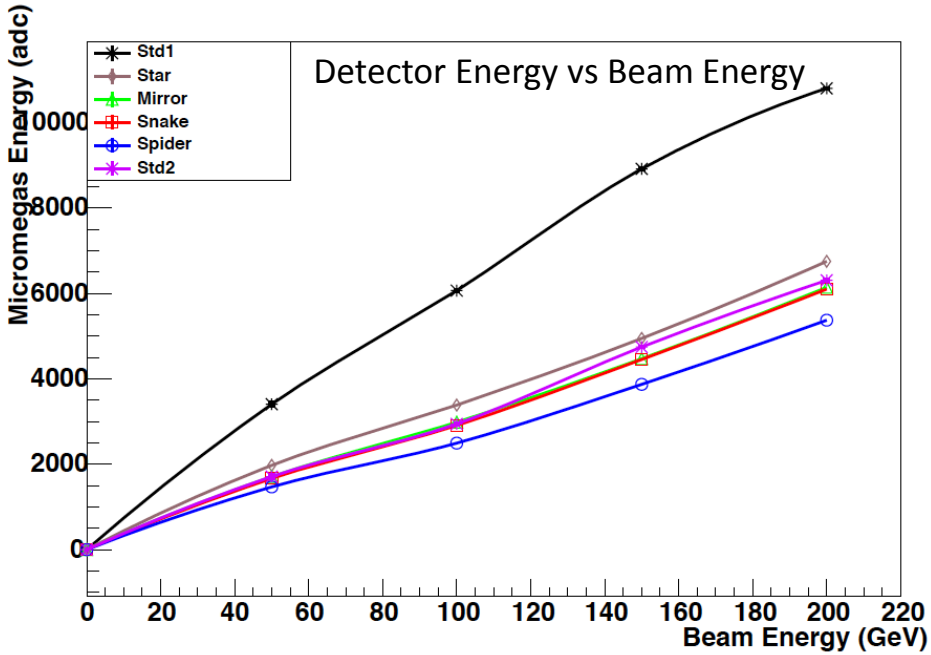


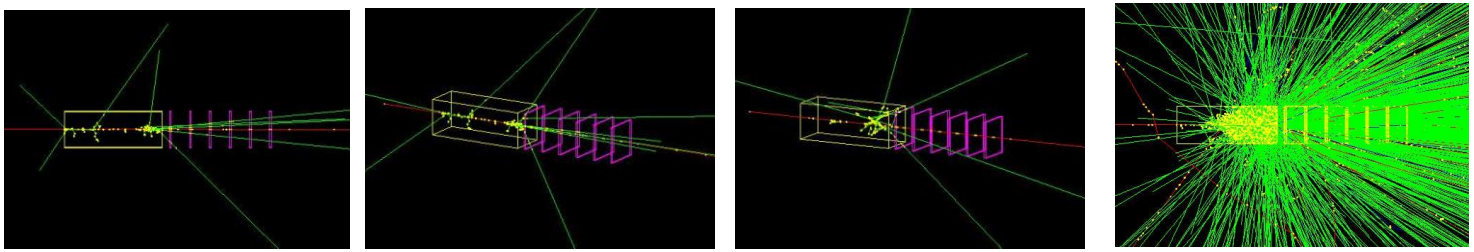


In the Absorber case the Landau distribution was subtracted.

At about 10^6 Hz we are close to the Gassiplex shaping time.

Corrected Energy Deposited on the Micromegas vs Energy





Detailed simulation of the layout is in progress (Thanos Kalamaris).
We should compare with the MC deposited energy that is the integral over all possible conversion depths in the Fe block.

During the Nov. – Dec. 2014 test beam period we have completed:

1) **Study of the detectors with mips (Landau)**
2) **Efficiency measurements**
3) **High rate scans at medium gain and Spark rate**
4) **High rate scans and Spark rate with Fe absorber**
5) **Pion energies scan at different gains**
6) **Rate scan at different gains**

Conclusions (so far)

1) **Achieve linearity better than $1/10^3$ up to 10MHz/cm^2 (CMS/HCAL rates ~ 1.5 MHz/cm^2)**
2) **Low spark rate with X-rays up to 11 MHz/cm^2**
3) **Low currents (<50nA) with hadrons up to ~ 5MHz/cm^2**
4) **Test beam favors flat covered resistive surface than patterned**

Plans for the Test beam in May-June 2015

- **Aim:** Test new Micromegas with lower resistivities(3 new ordered)
- **Beam:** **Electrons** – What energies, intensities, purity are available ? Advantage: Showers start immediately and the deposited energy doesn't fluctuate much
  muons (MIP response)
  pions (rate studies, energy scan)
  Pions beam energies: 50, 100, 150 and 200 GeV
- **NO Magnetic field**
- **Time:** 1/7 – 15/7 according to the number of users, equivalent master shifts. Electron beam poses problems since it cannot be shared
- **Allocated space:** ~9m^2 downstream (using absorbers)
- **X-Y table (LAPP)**
- **Telescope is NOT necessary**
- **Gas: Ar + 7% CO_2**
- One **optical fiber** for the DAQ (V2718 – a2818) from H4 to the control room
- **HV power supplies** will be available from our side
- **The RD51 HV and current Monitor** will be required