Results from ATLAS Endcap Combined Testbeam

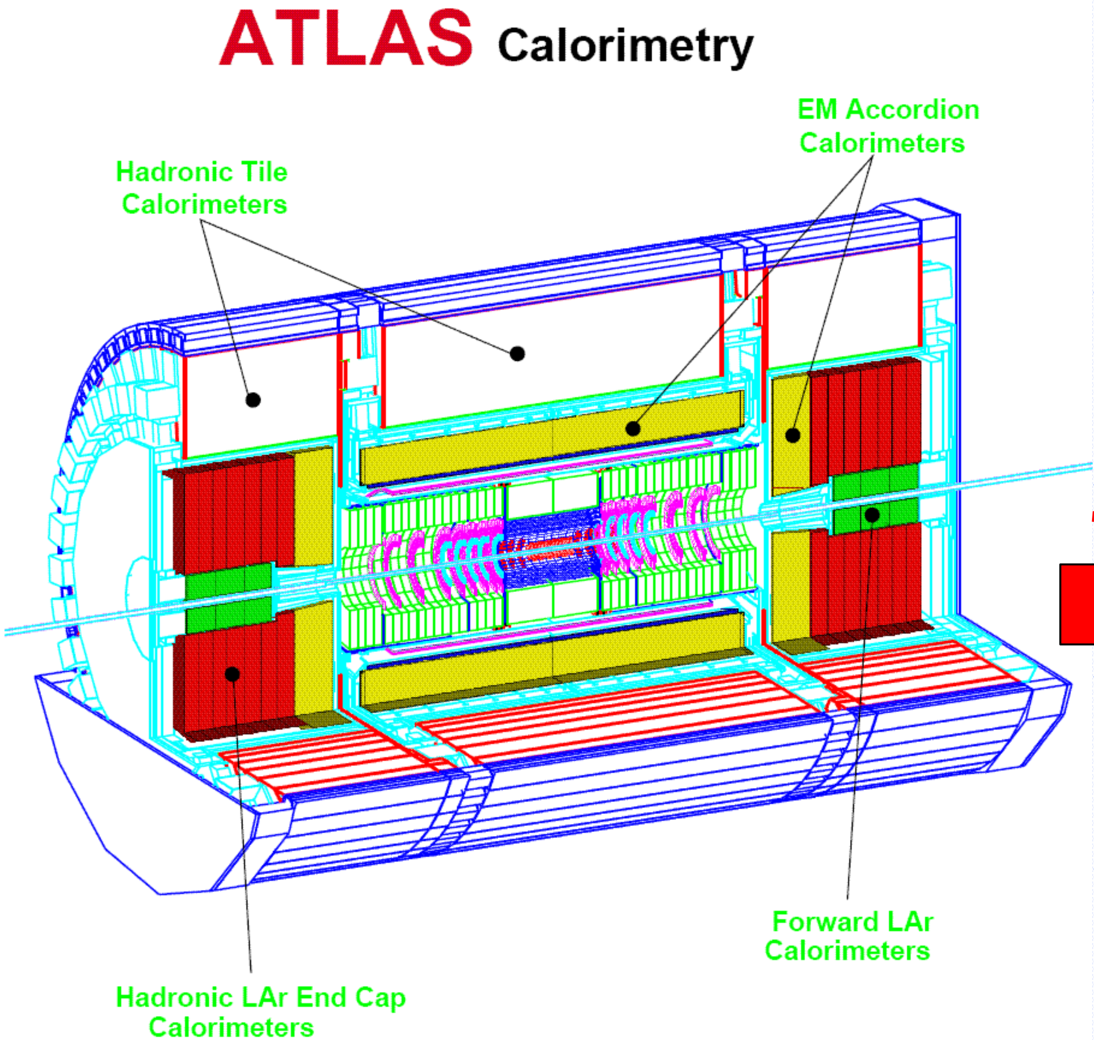
Goal:
Study response in particular difficult region with 3 calorimeters and additional support structures (‘dead material’)

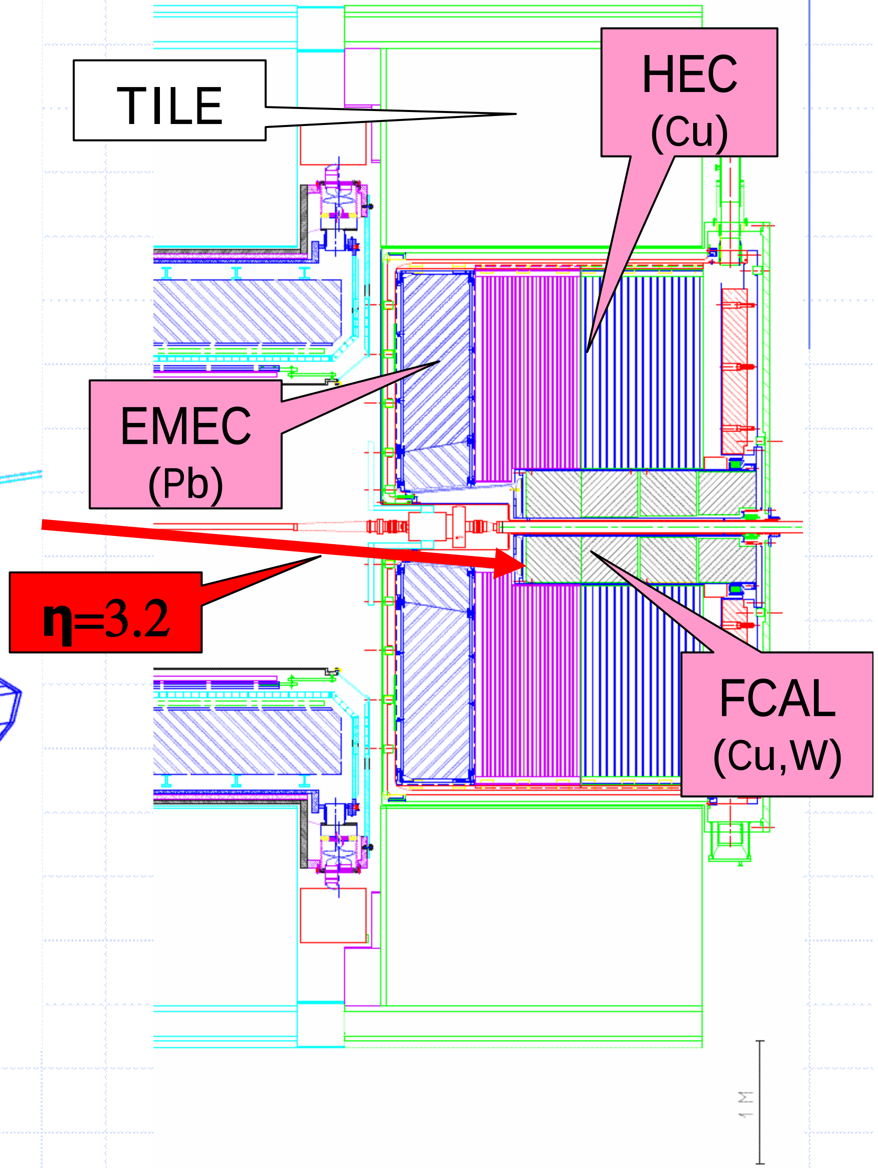
- Set-up, data
- Electrons in EMEC and FCAL: response, calibration
- Electrons: vertical (η) scans
- Pions in EMEC/HEC and FCAL: response on em scale
- Pions: vertical scans (em scale)
- Next steps

Caveat: all data are very preliminary ... analysis still in progress ...

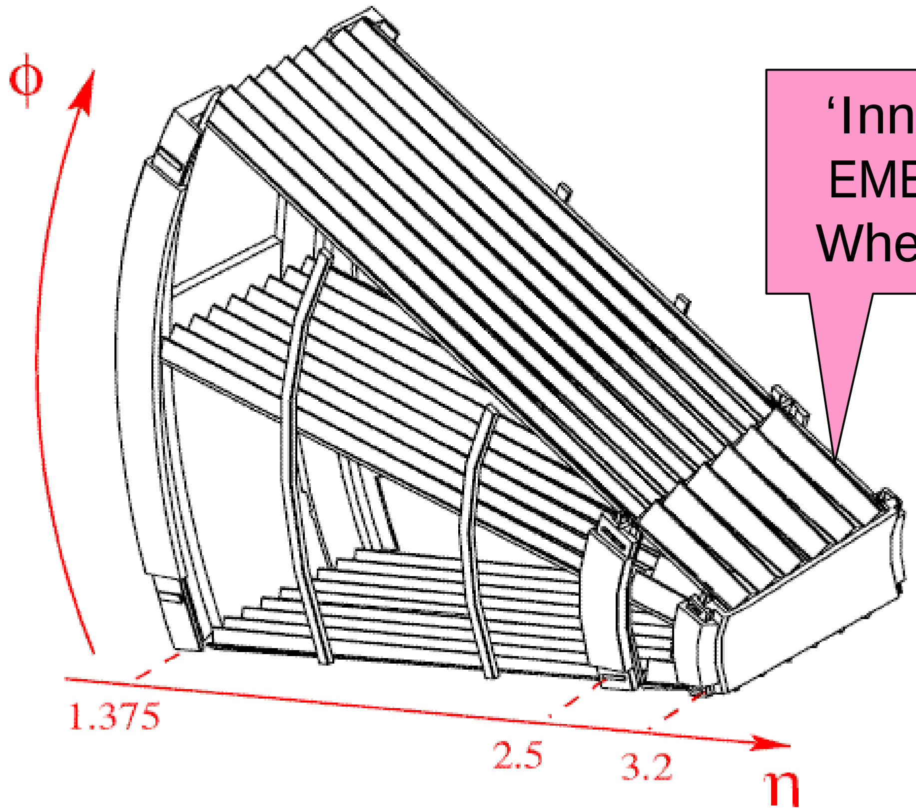
- Thanks to the ATLAS H6 CTB collaboration, in particular to M. Bieri, P. Cavalleri, A. Minaenko, W. Shaw, P. Strizenec !

ATLAS Calorimeter: Endcap Region around η=3.2

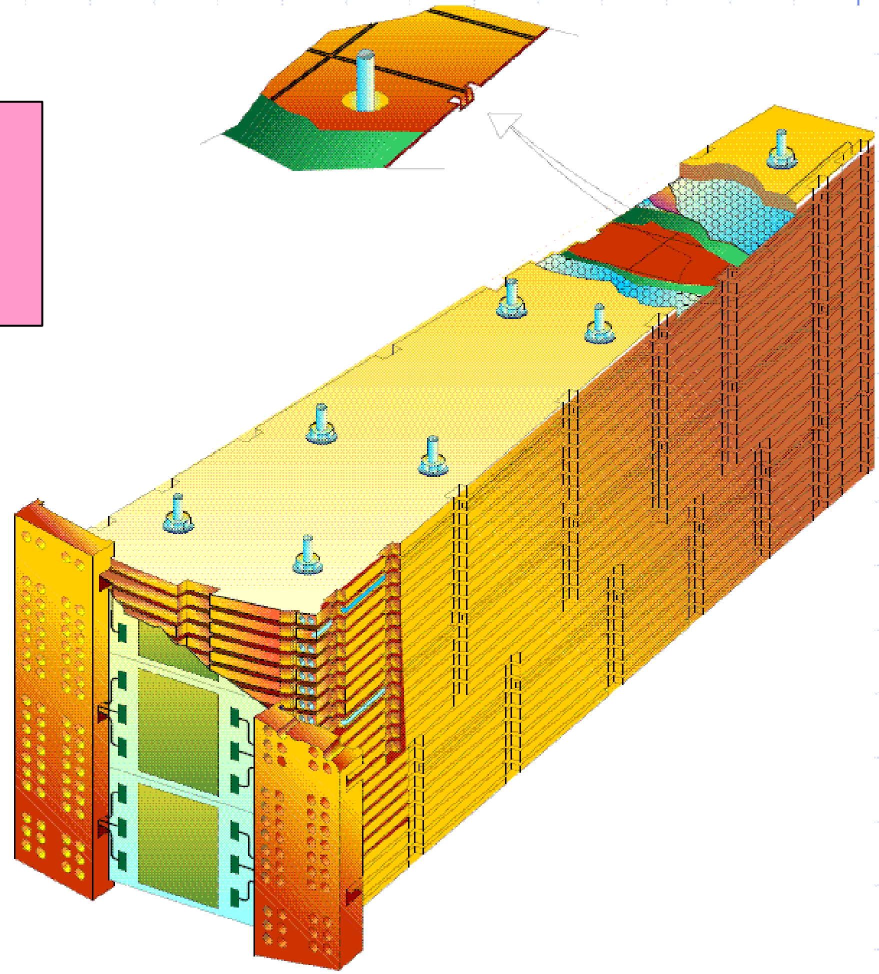




LAr Endcap Calorimeter



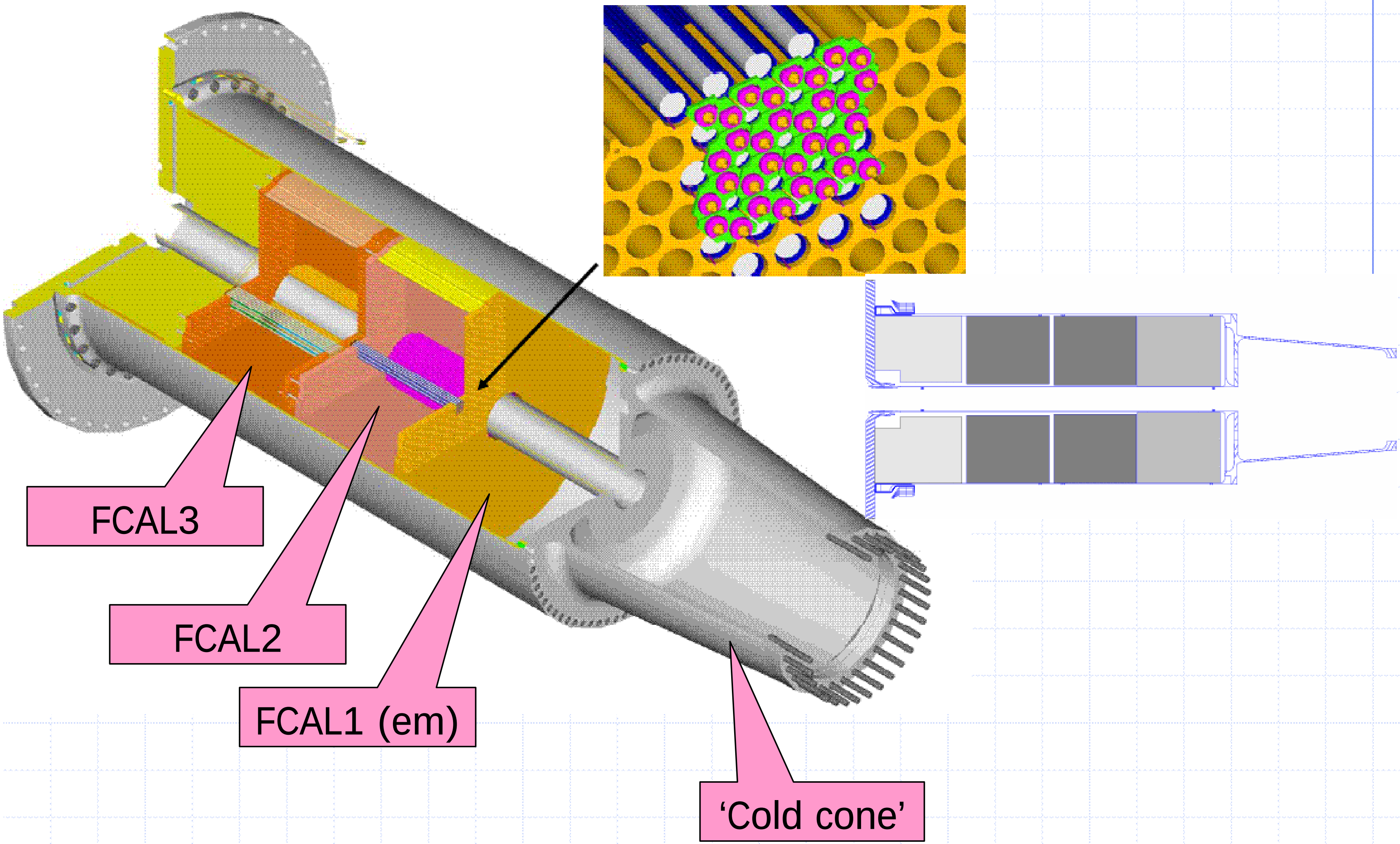
'Inner EMEC Wheel'



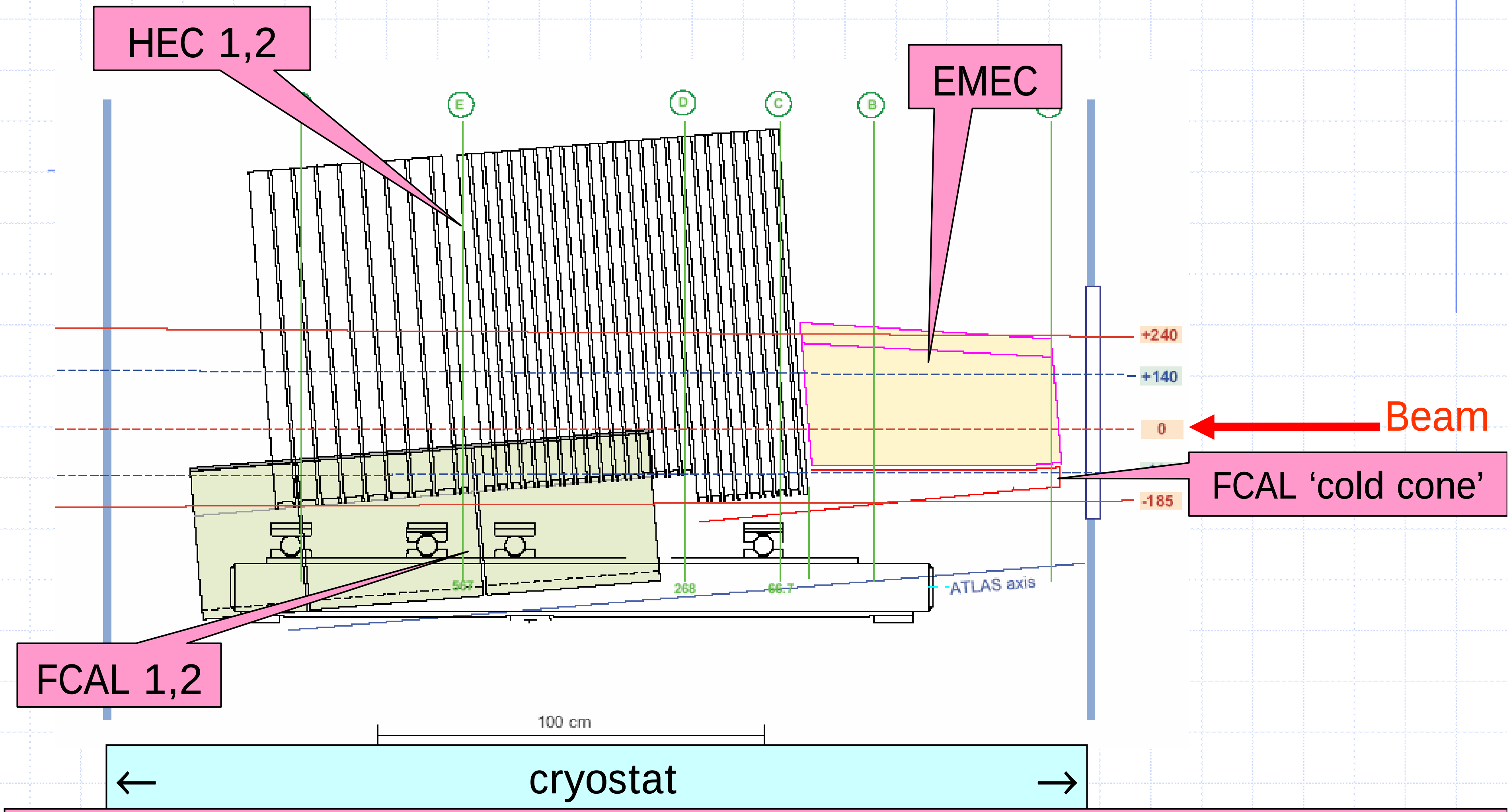
EMEC wheel has 8 modules ..

Each HEC (1and 2) wheel has 32 modules ..

LAr Forward Calorimeter

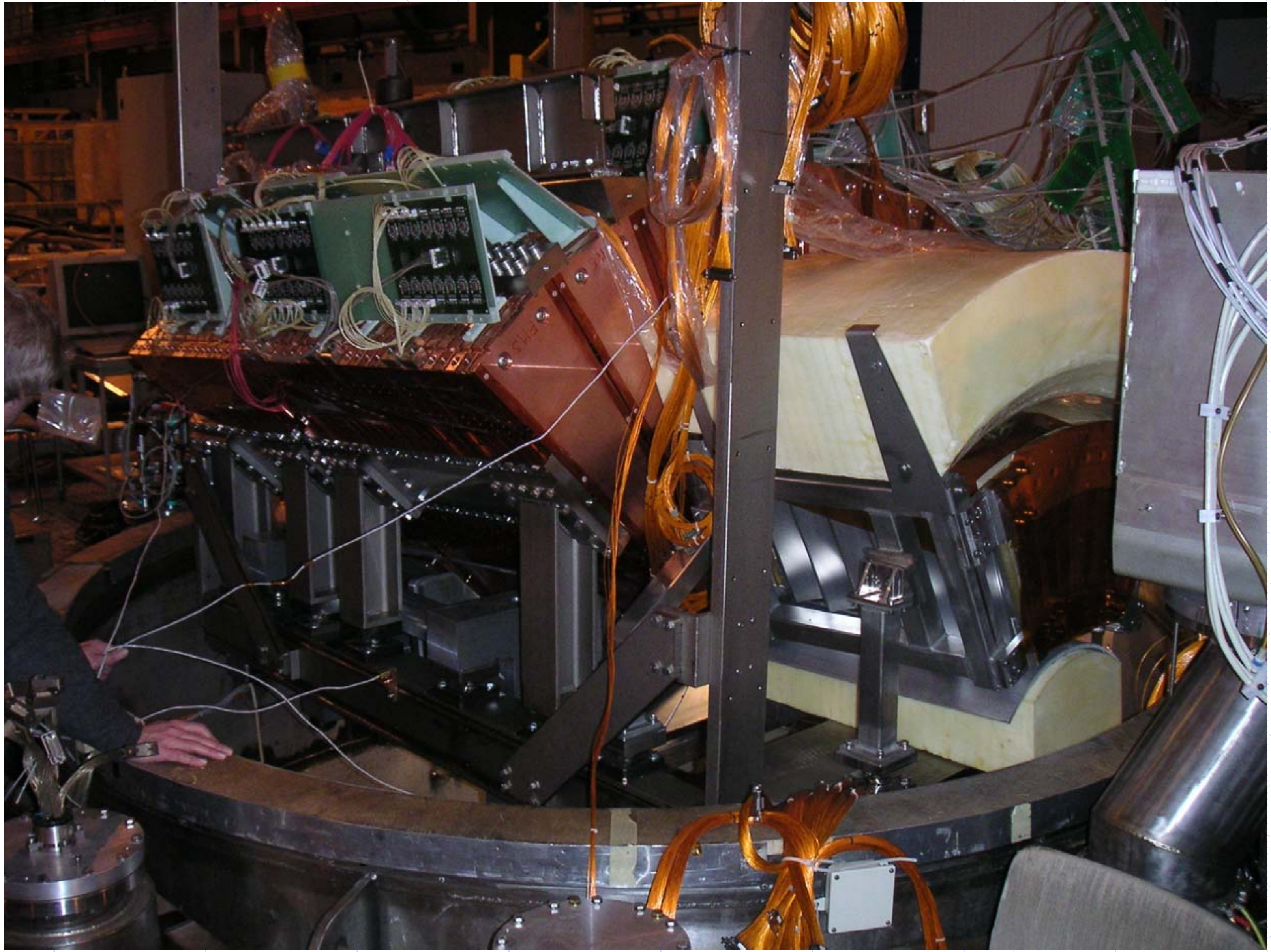


Testbeam Set-up: Side View (CERN, H6 Beam)



Goal: calibrate complicated region with various dead material zones and 3 different calorimeters

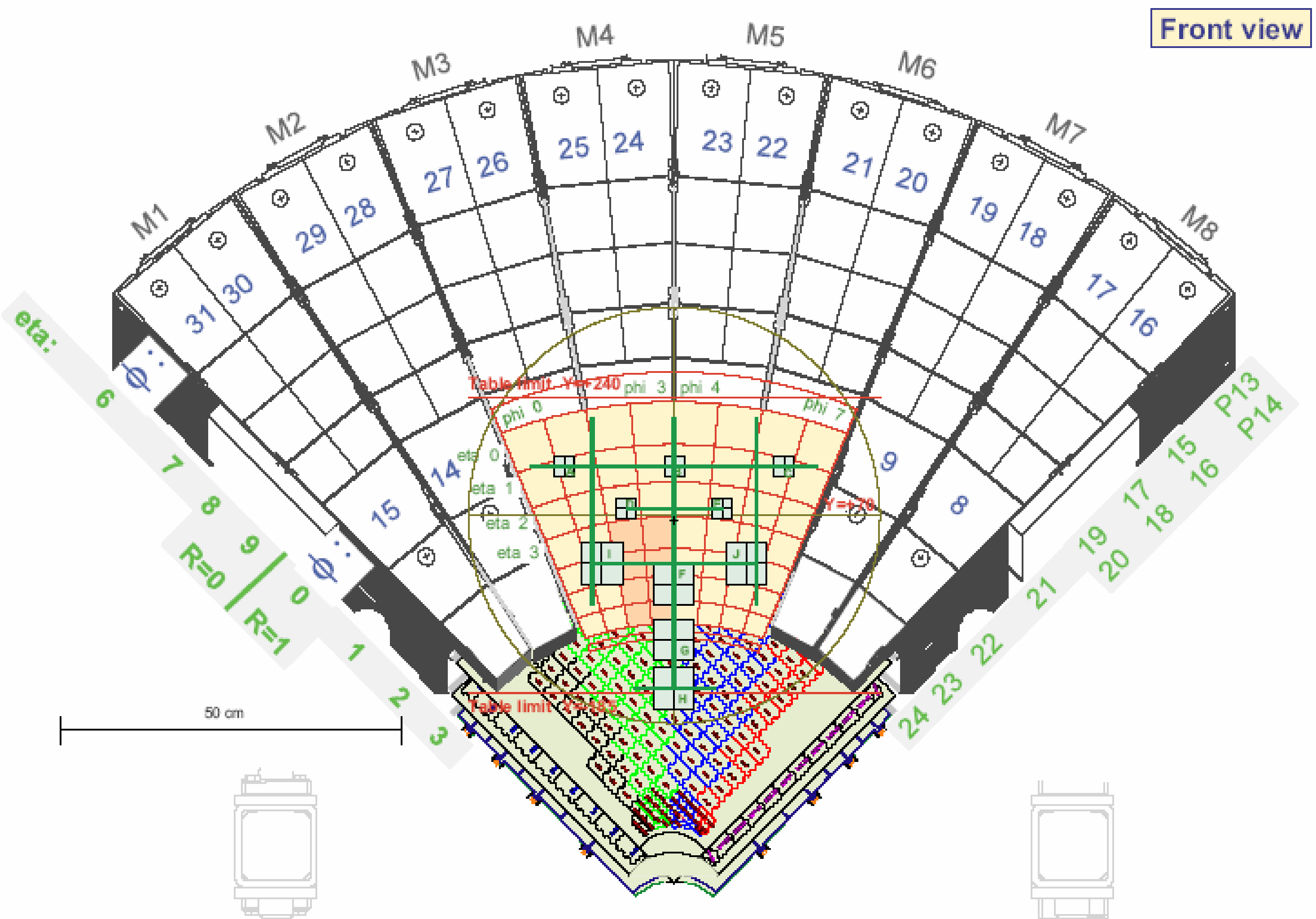
Testbeam Set-up … in reality…during insertion



Beam

Testbeam Set-up: Front View, Data

- Electrons, Pions
- Energy 6-200GeV
- Vertical scans
- Horizontal scans
- Fixed points for energy scans

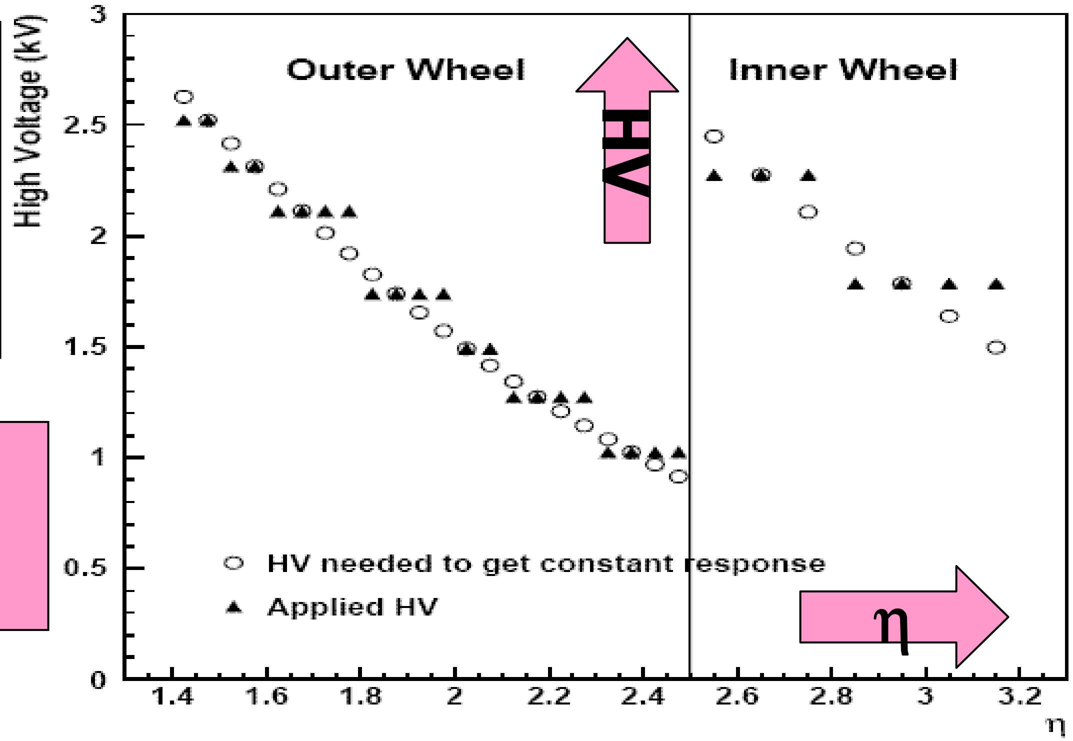


Electron response in EMEC

- Gap variation → HV variation in η! Try to compensate for response!
- η-dependent correction: $\mathbf{E_{corr}=E_{cell}*\beta/(1+\alpha(\eta_{cell}-\eta_0))}$
- In consequence: α and β determined for each HV section from electron data!

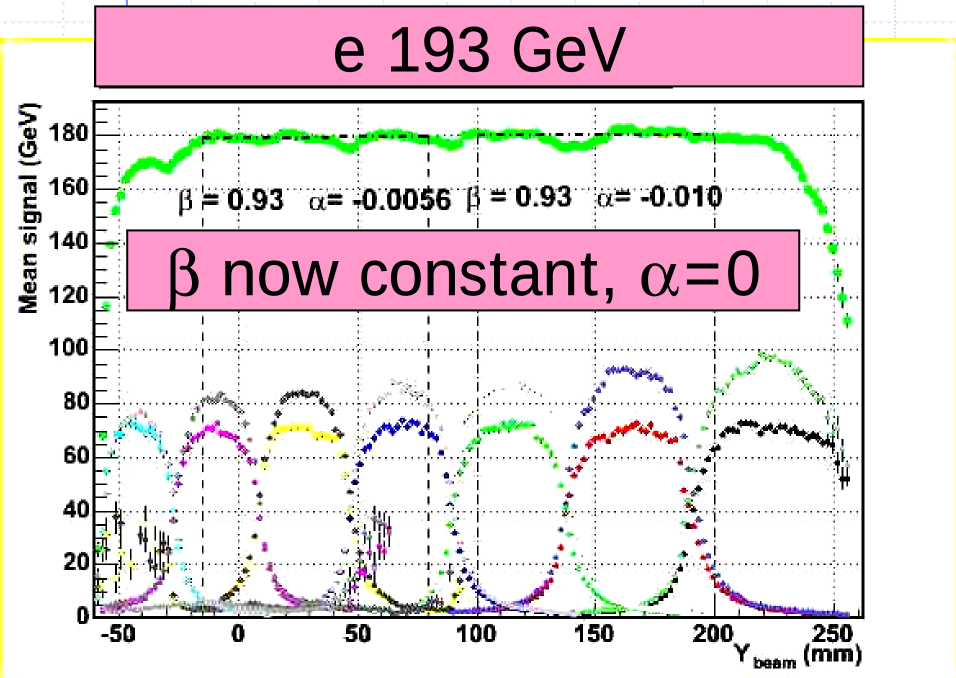
* α=**0.55** for high and low η
* β=**1.0** (high η)
* β=**1.04** (low η)

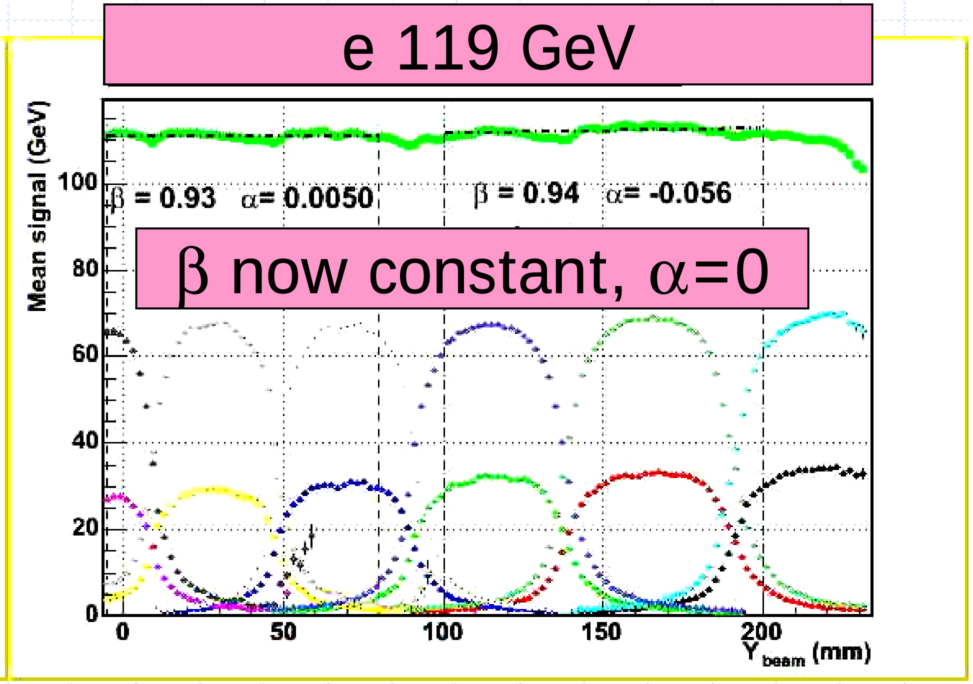
...very close to theoretically expected values....



Electron response in EMEC

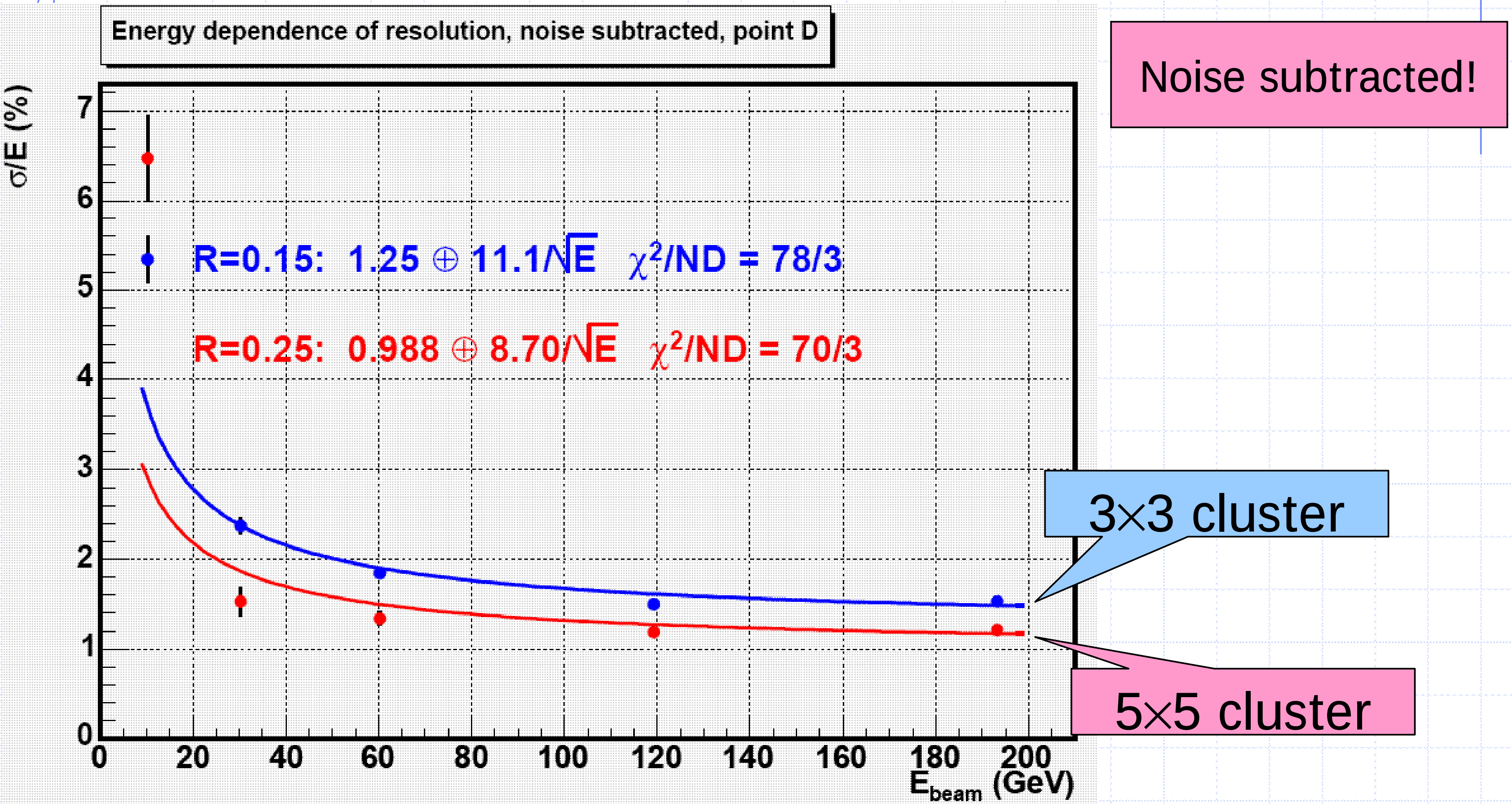
- Normalization done with electrons R_{max}=0.25 (5×5 cluster), almost no leakage outside cluster
- Check with electrons R_{max}=0.15 (3×3 cluster), few % out of cluster leakage .....
- Checks done with y (η) scans at different x (φ) positions and different energies .....





Electron resolution of Δη×Δφ cluster in EMEC

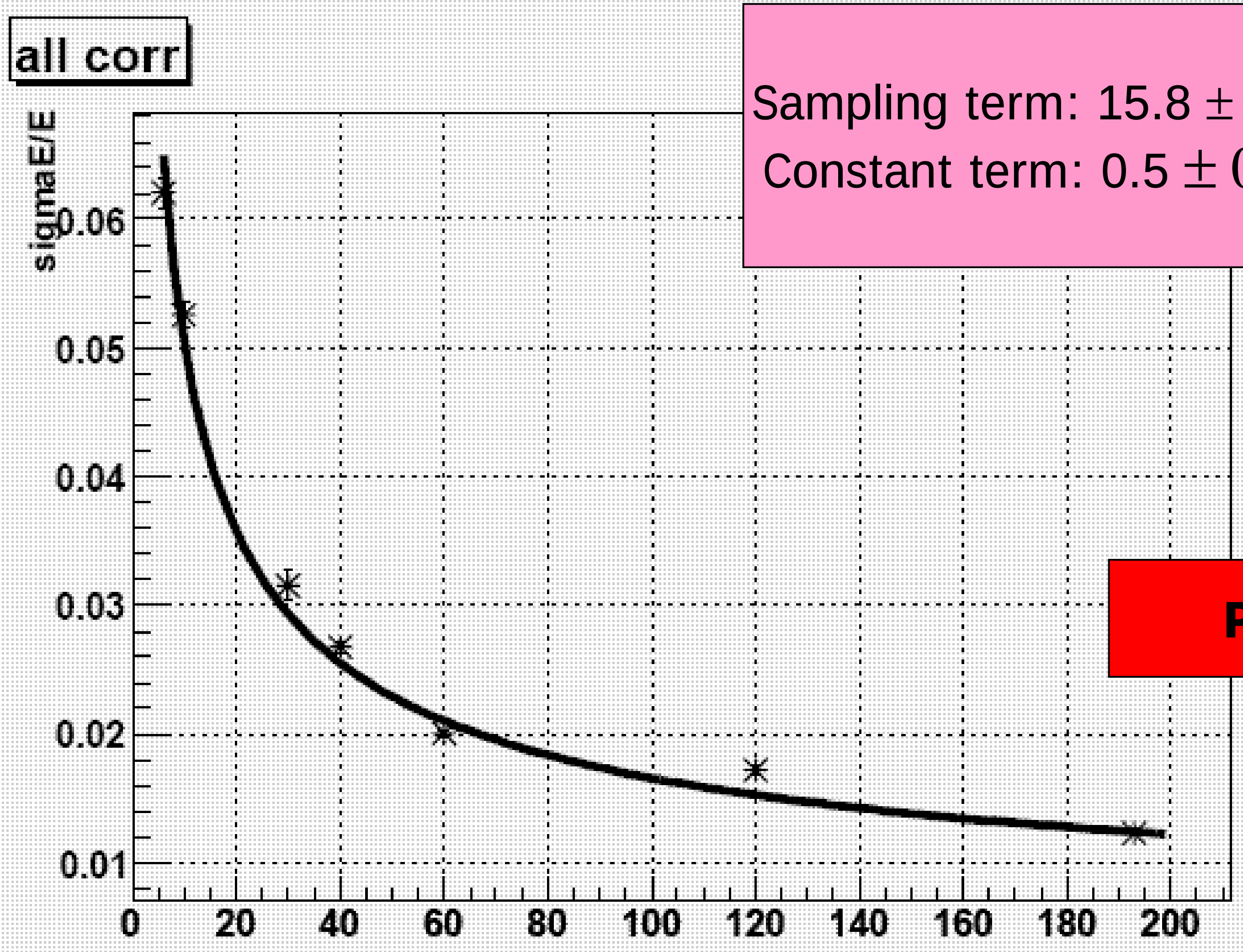
- No dead material corrections;
- No φ correction, no out of cluster leakage correction yet;



Electron resolution in EMEC (point B)

- Cluster (leakage) and φ correction;

Noise subtracted!

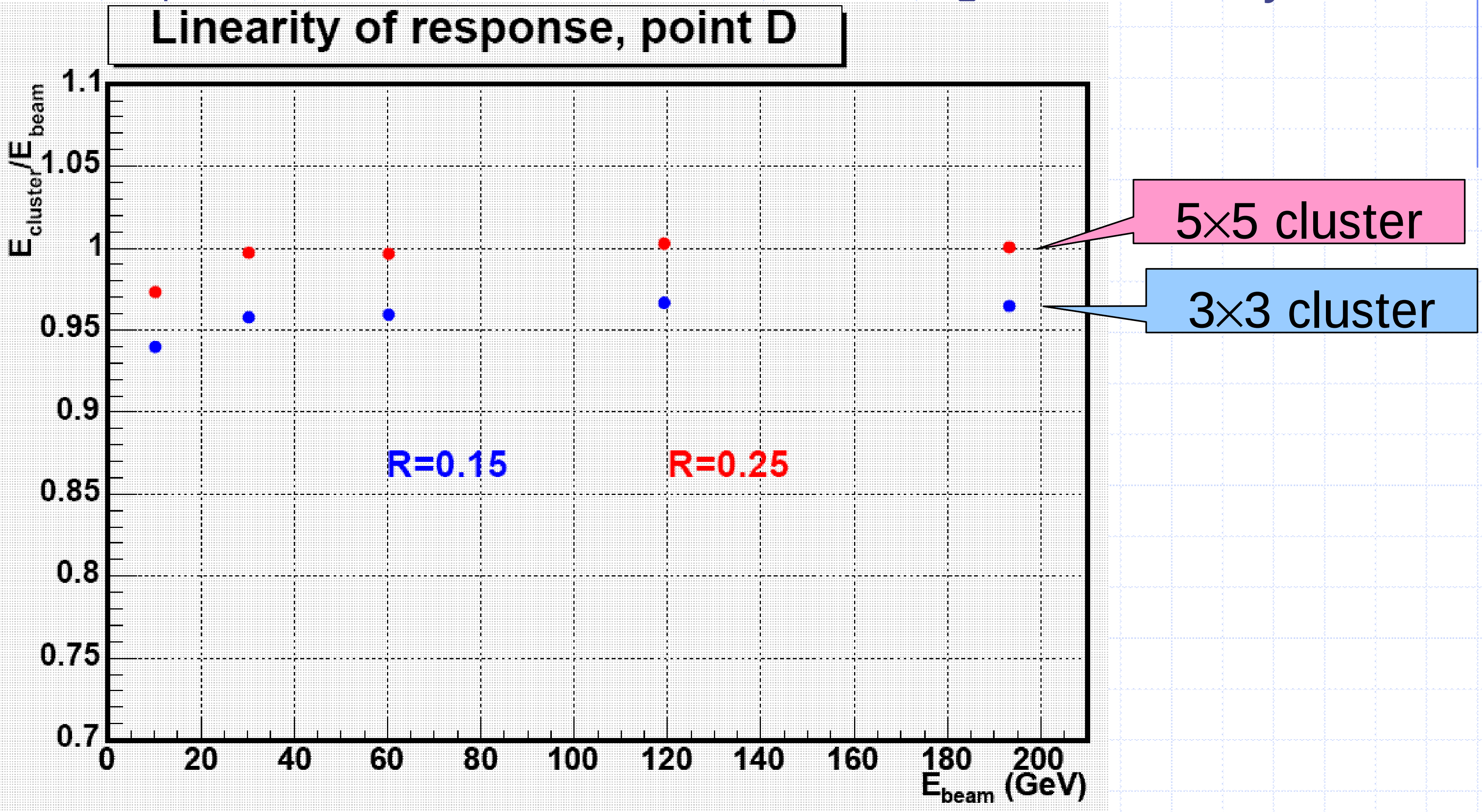


Sampling term: 15.8 ± 0.1 %
Constant term: 0.5 ± 0.1 %

Preliminary !

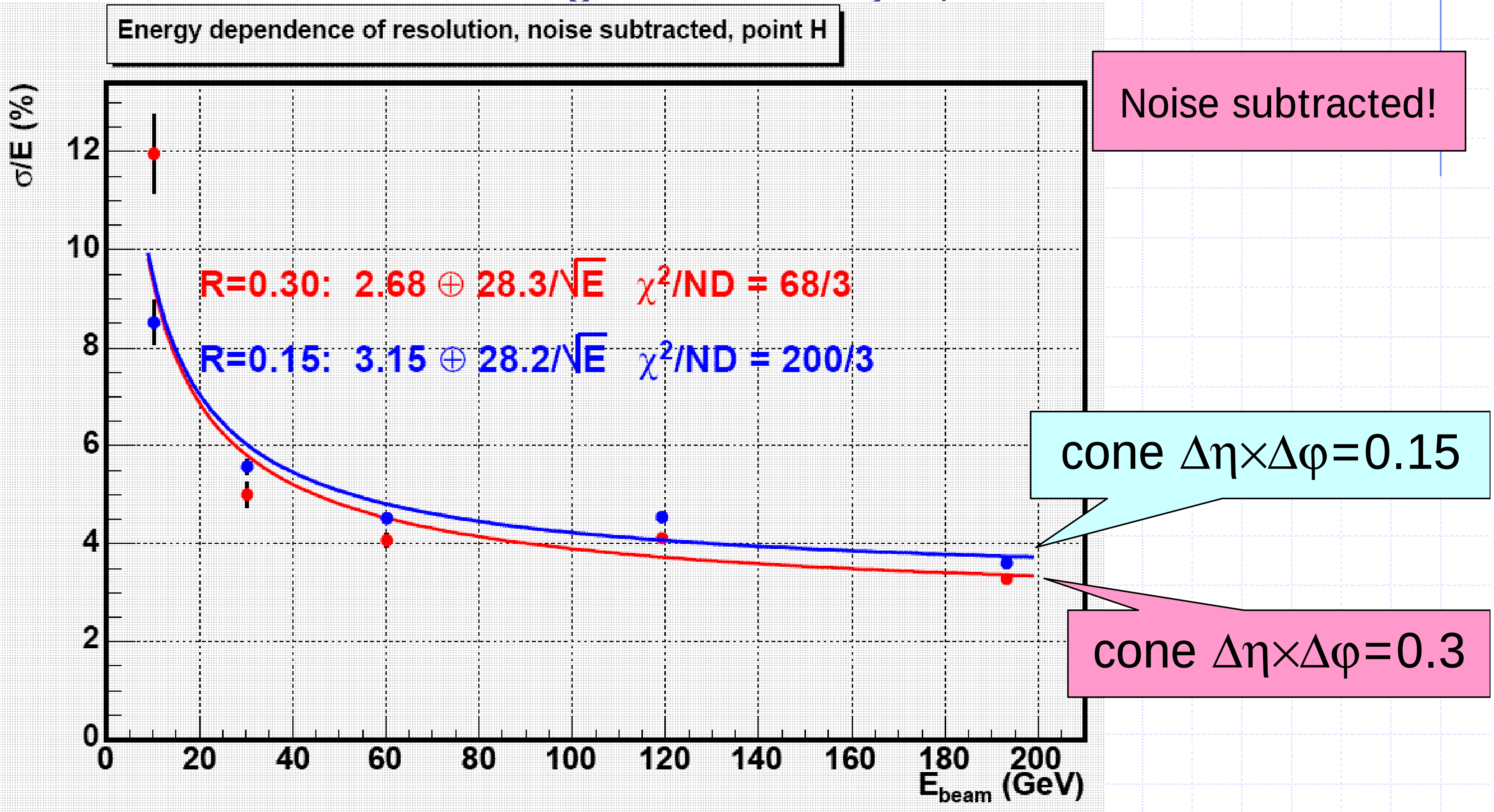
Electron linearity of $\Delta\eta\times\Delta\varphi$ cluster in EMEC

- No dead material corrections;
- No φ correction, no out of cluster leakage correction yet;



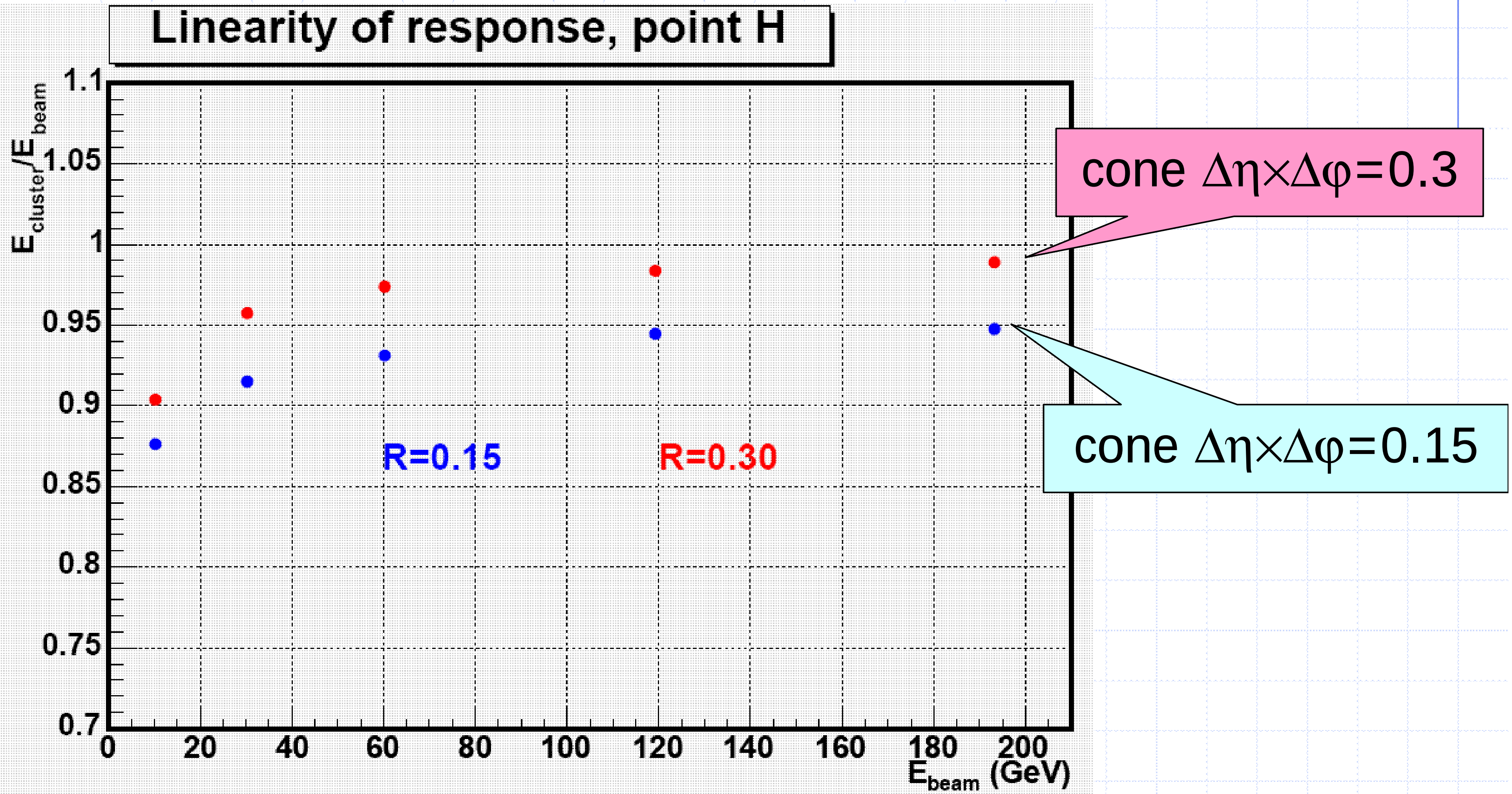
Electron resolution of Δη×Δφ cluster in FCAL

- No dead material corrections;
- No out of cluster leakage correction yet;



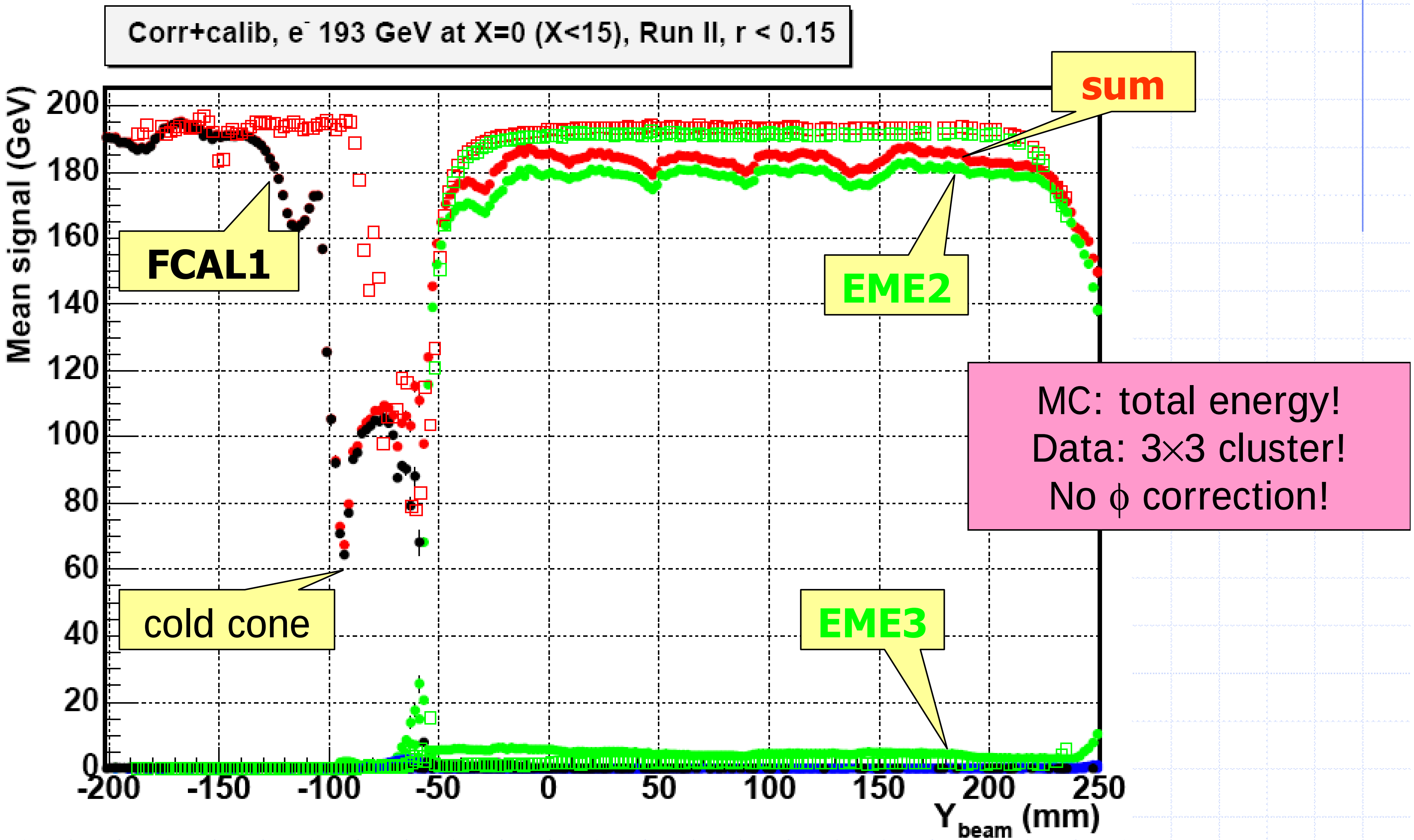
Electron linearity of $\Delta\eta\times\Delta\varphi$ cluster in FCAL

- No dead material corrections;
- No out of cluster leakage correction yet;



Electrons (193 GeV): vertical scan at x=0

- MC: Open squares; Data: solid points;

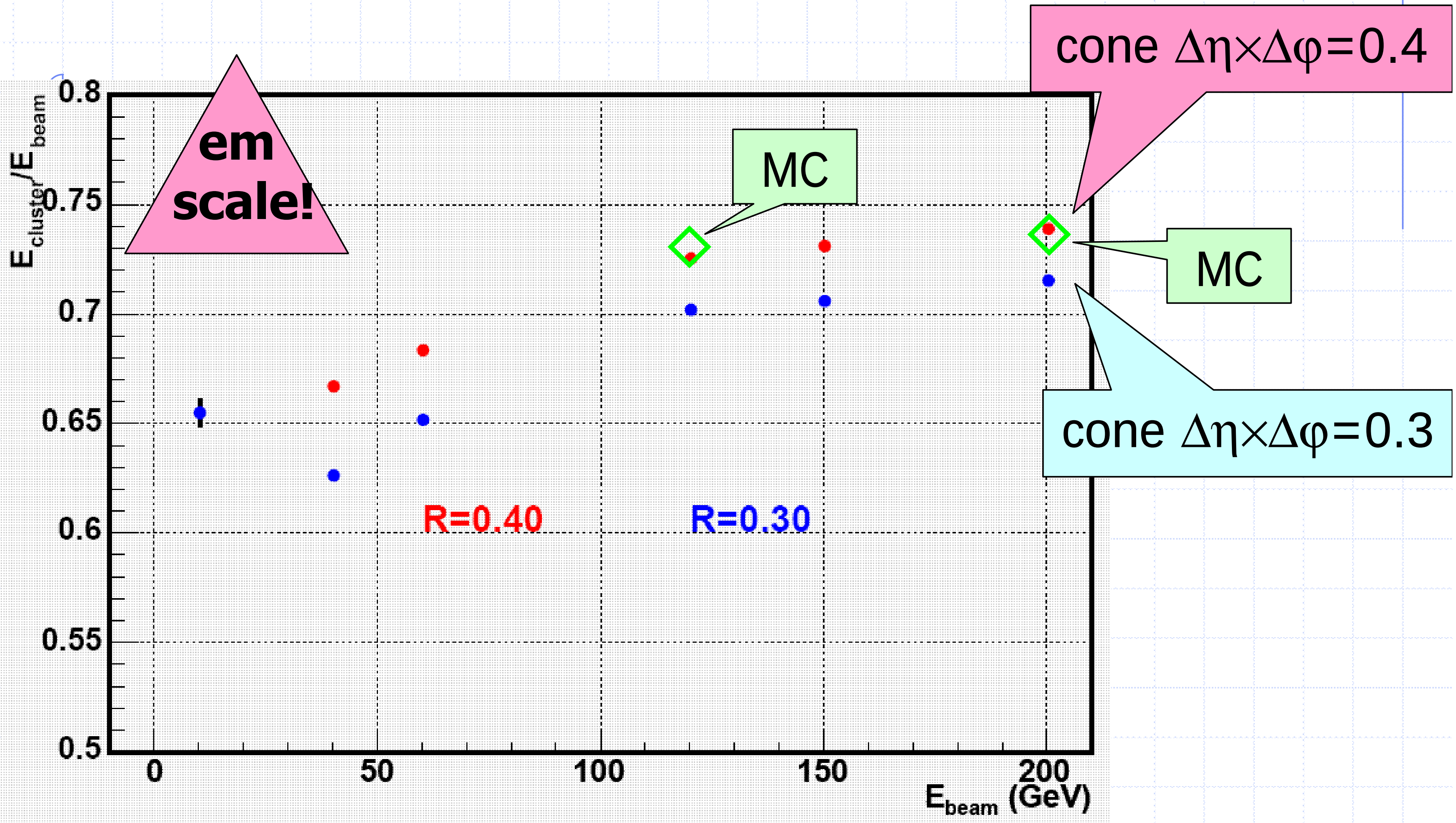


Electrons: vertical scan at x=0;

- Geometry: crack in data wider by ~ 15 mm;
- 'Double dip structure in crack': OK – EMEC-back-support-ring+LAr and cold cone;
- Cold cone shifted by ~ 35 mm;
- **Still in process of improving details of MC geometry and material structures**;

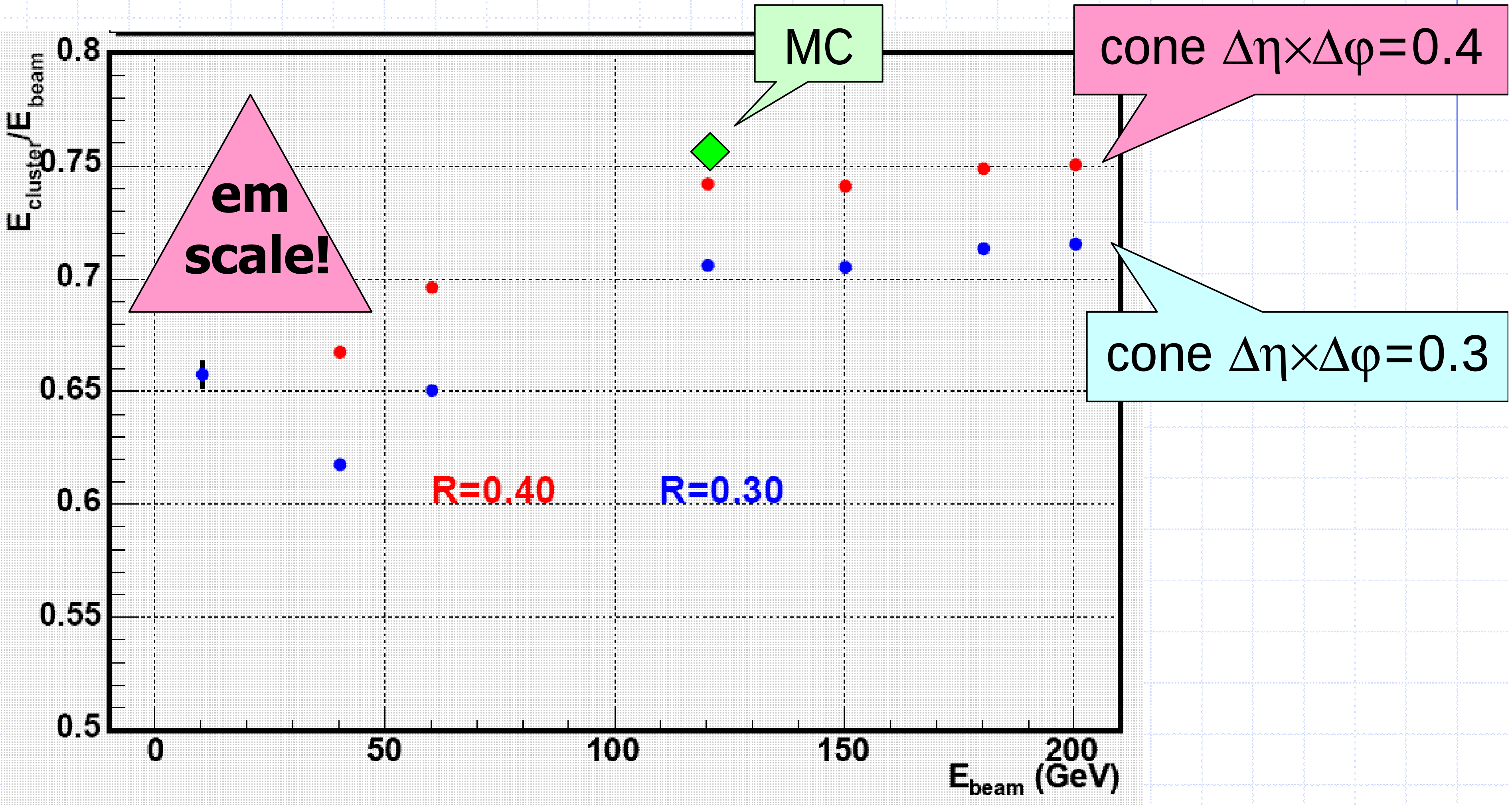
Pions in EMEC/HEC: em scale!!!

- Energy dependence of $\Delta\eta\times\Delta\varphi$ cluster;



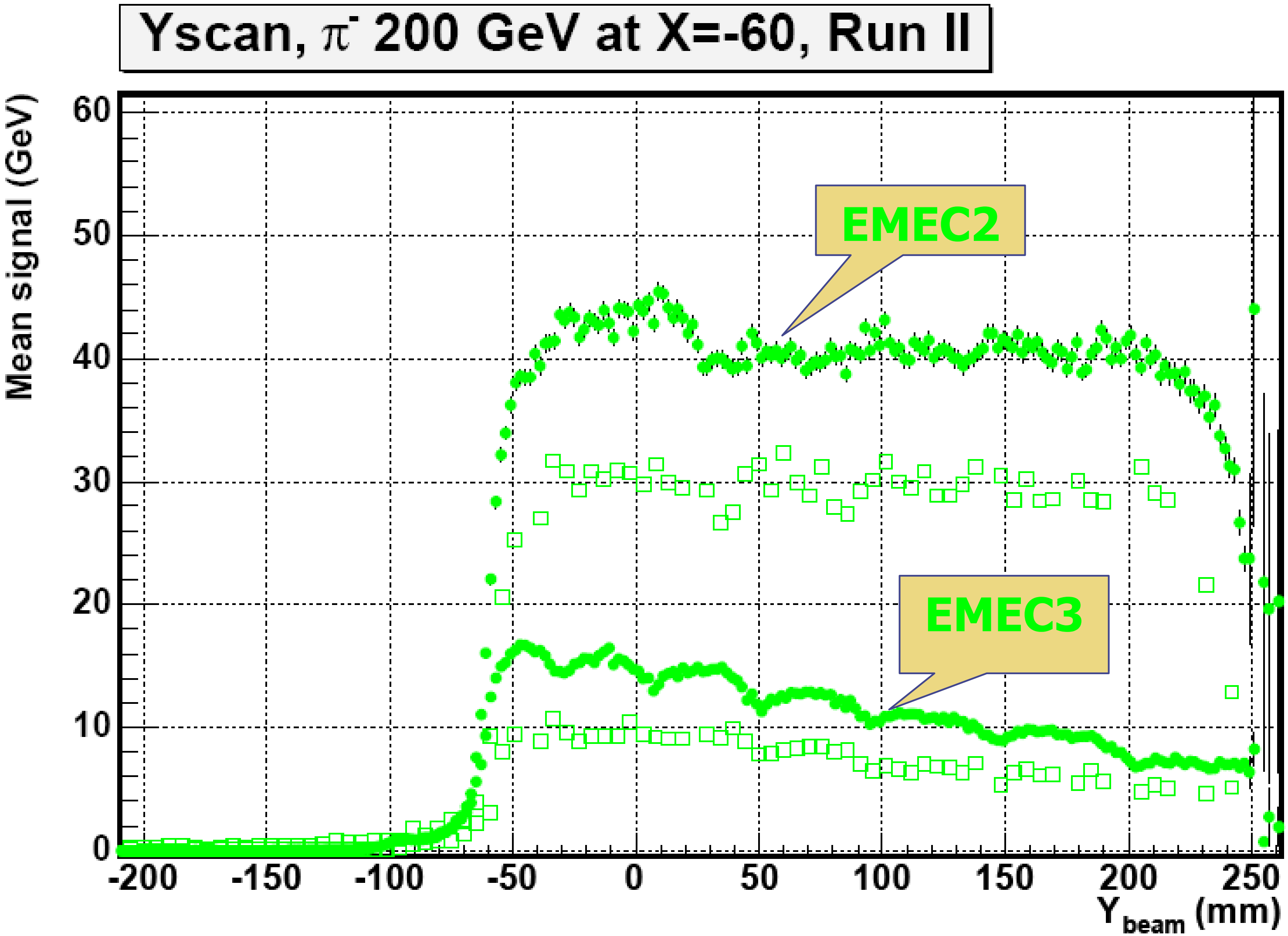
Pions in FCAL: em scale!!!

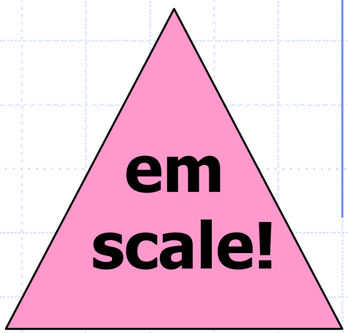
- Energy dependence of $\Delta\eta\times\Delta\varphi$ cluster;



EMEC: Pions (200 GeV): vertical scan at x=-60;

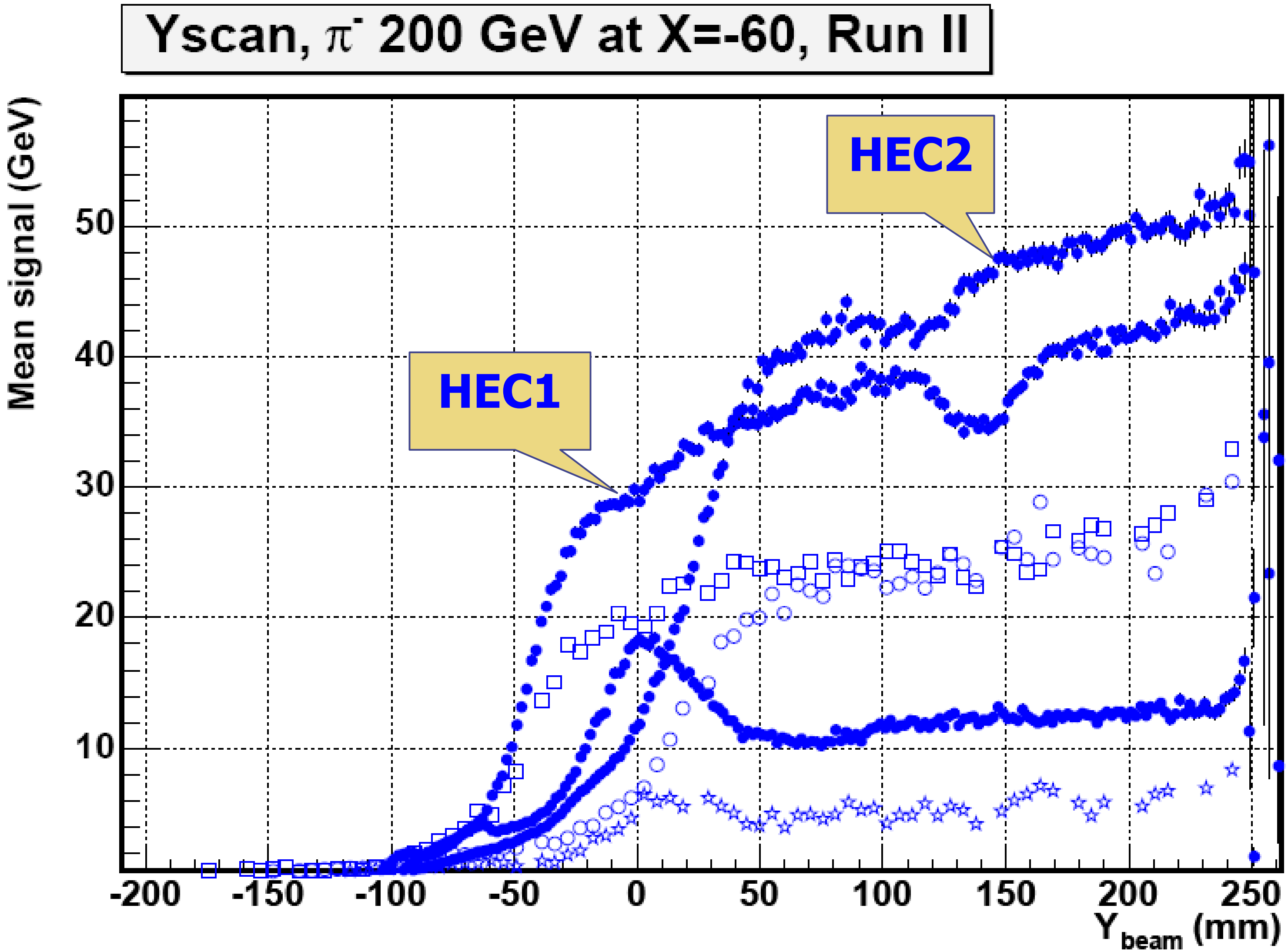
- Data (200 GeV) solid points; MC (120 GeV) open squares;

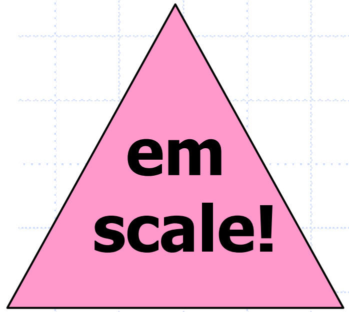




HEC: Pions (200 GeV): vertical scan at x=-60;

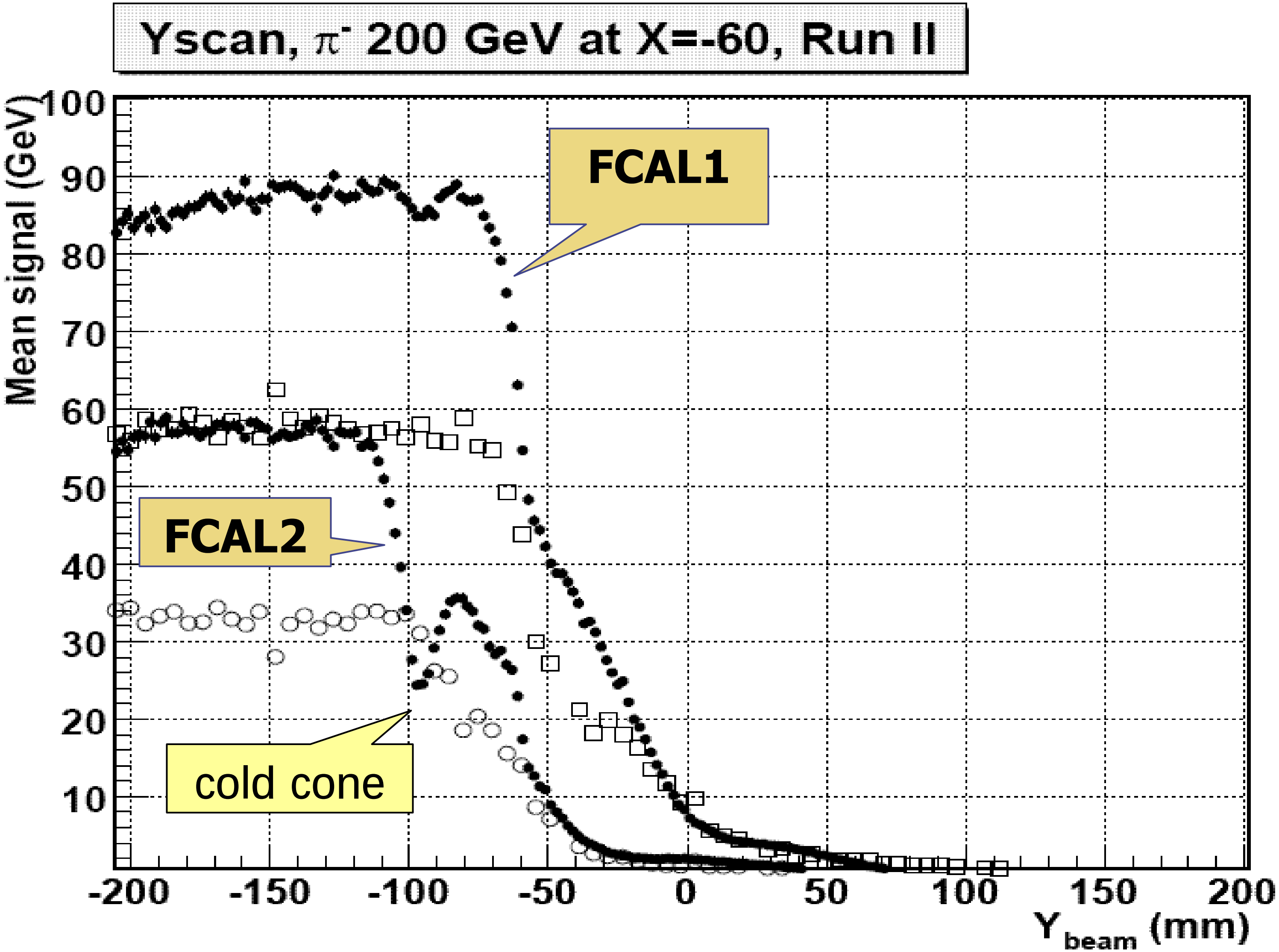
- Data (200 GeV) solid points; MC (120 GeV) open squares;

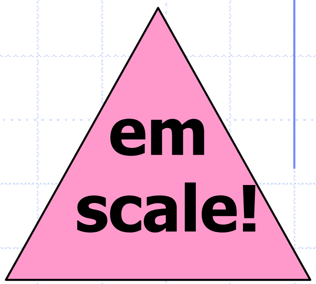




FCAL: Pions (200 GeV): vertical scan at x=-60;

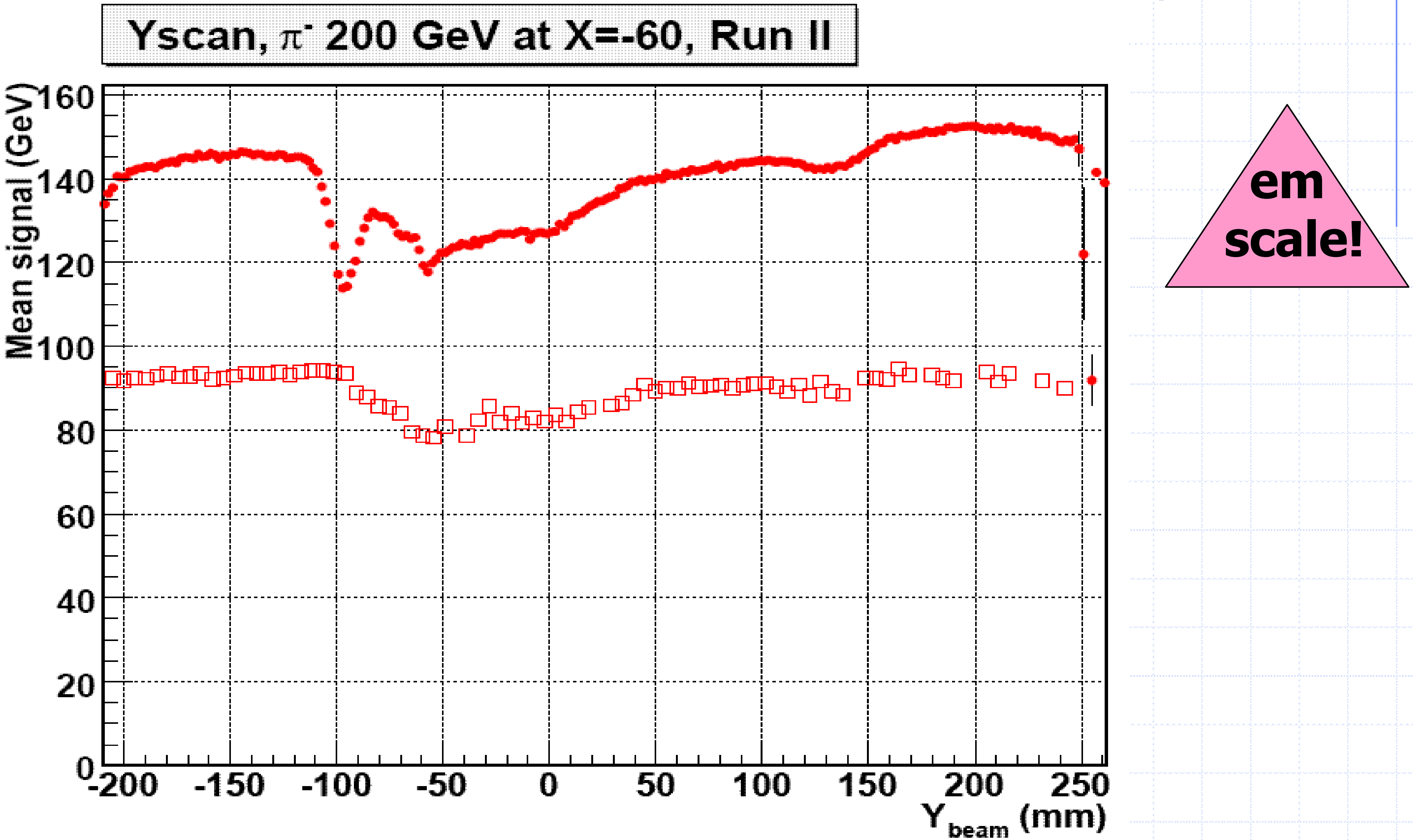
- Data (200 GeV) solid points; MC (120 GeV) open squares;





Total: Pions (200 GeV): vertical scan at x=-60;

- Data (200 GeV) solid points; MC (120 GeV) open squares;



Summary

- em scale for all calorimeter subdetectors established;
- electron results close to expectations!
- MC geometry: from electron position scans small adjustment for next iteration required;
- Pion response on em scale: close to MC
- pion position scans: MC seems to give reasonable description of data (general trend), details yet to be clarified;
- ... many more things to do: go from em scale to π-scale; do e/π weighting using data and MC weights; compare energy tails in dead material with MC; do dead material corrections and compare with MC; and more to come ....