Aug/Sep 2015 preliminary analysis

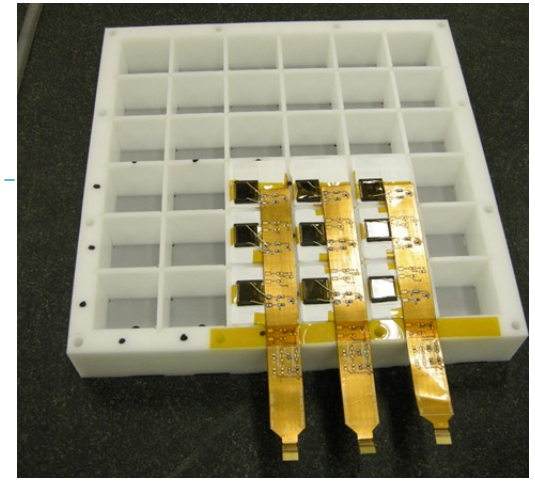
Miriam Olmi

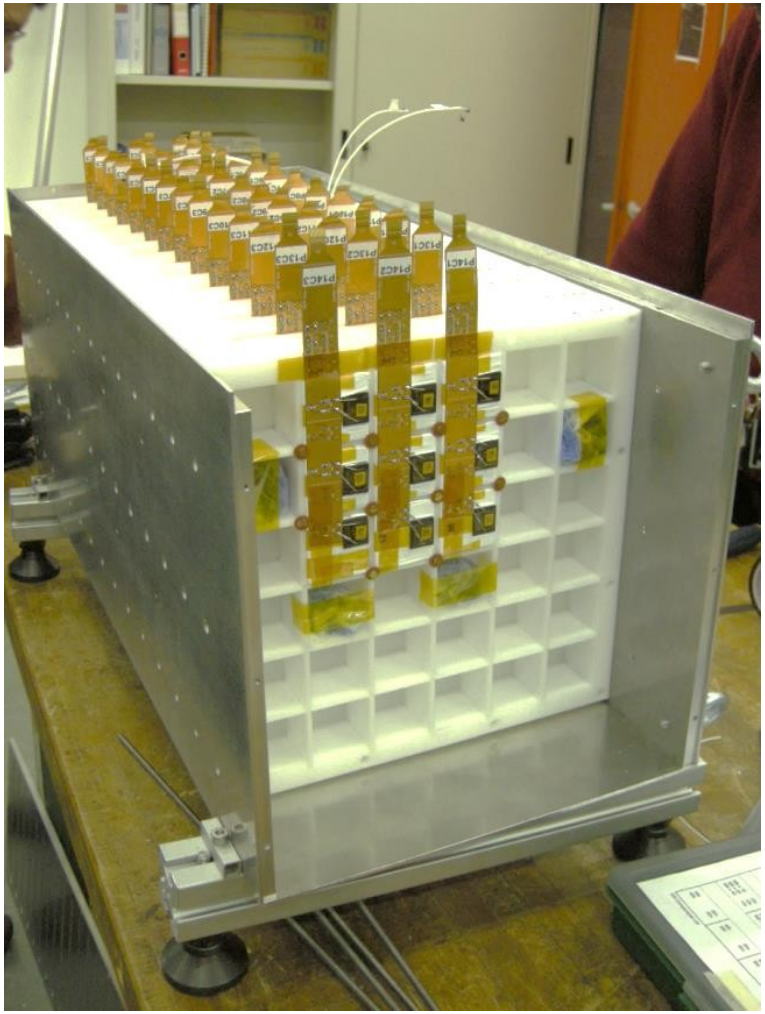
The Aug/Sep-2015 setup

- **Assembly**
  - CsI(Tl) cubes **3.6 cm** side
    - reflective (Vikuiti film) wrapping
  - 3×3×15 elements (**0.4 cm** gap)
    - ~1.5 RM containment
    - active depth **28 X_0 → 1.35 λ_I**
- **Sensors**
  - VTH2090H Pds
  - VTP9412H PDs (only 3 central cubes, 3rd, 4th and 5th layer)
- **FE electronics:** CASIS
- **Tracking system:** Adamo

NEW!!!

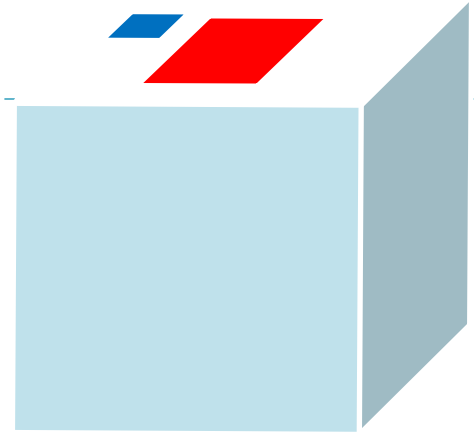
The calorimeter assembly





- **4mm** gap btw active elements
- 3×3 elements for each plane
  - **~1.5 RM** shower containment
- 15 layers
  - active depth
    28.4 X_0 → 1.35 λ_I

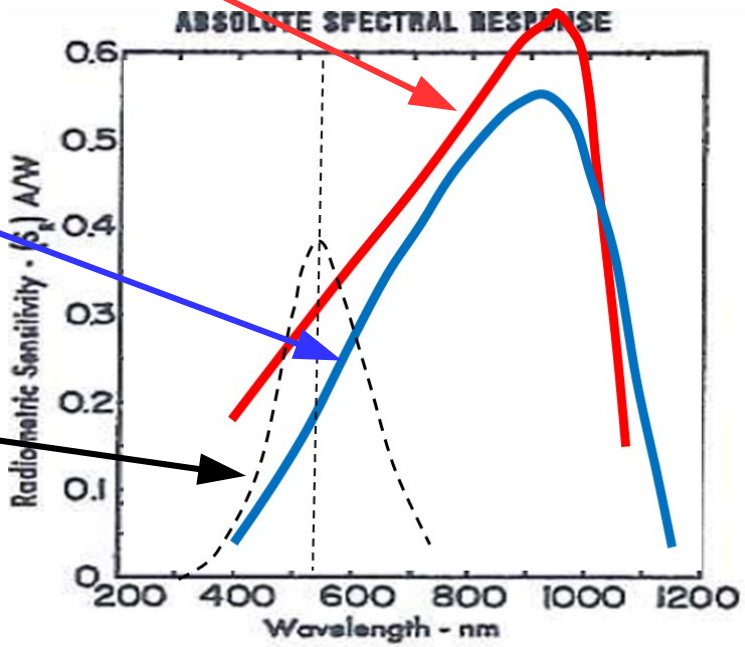
Large & small sensors



- **Large sensor**
  - VTH2090H Pds
    - Active area 84.6 mm2
    - 0.31 A/W @580 nm
- **Small sensor**
  - VTP9412H Pds
    - Active area 1.6 mm2
    - 0.19 A/W @580 nm

NEW!!!

Measured CsI(Tl) response

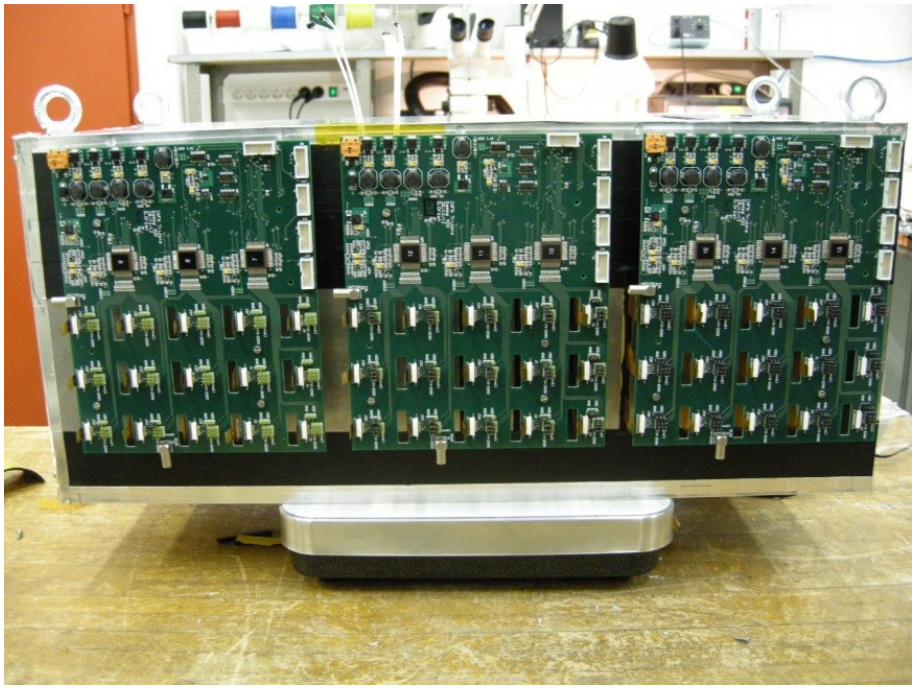


→ Gain ratio ~86@peak

Front-end electronics

- **9 CASIS chips** (developed by INFN-Trieste)

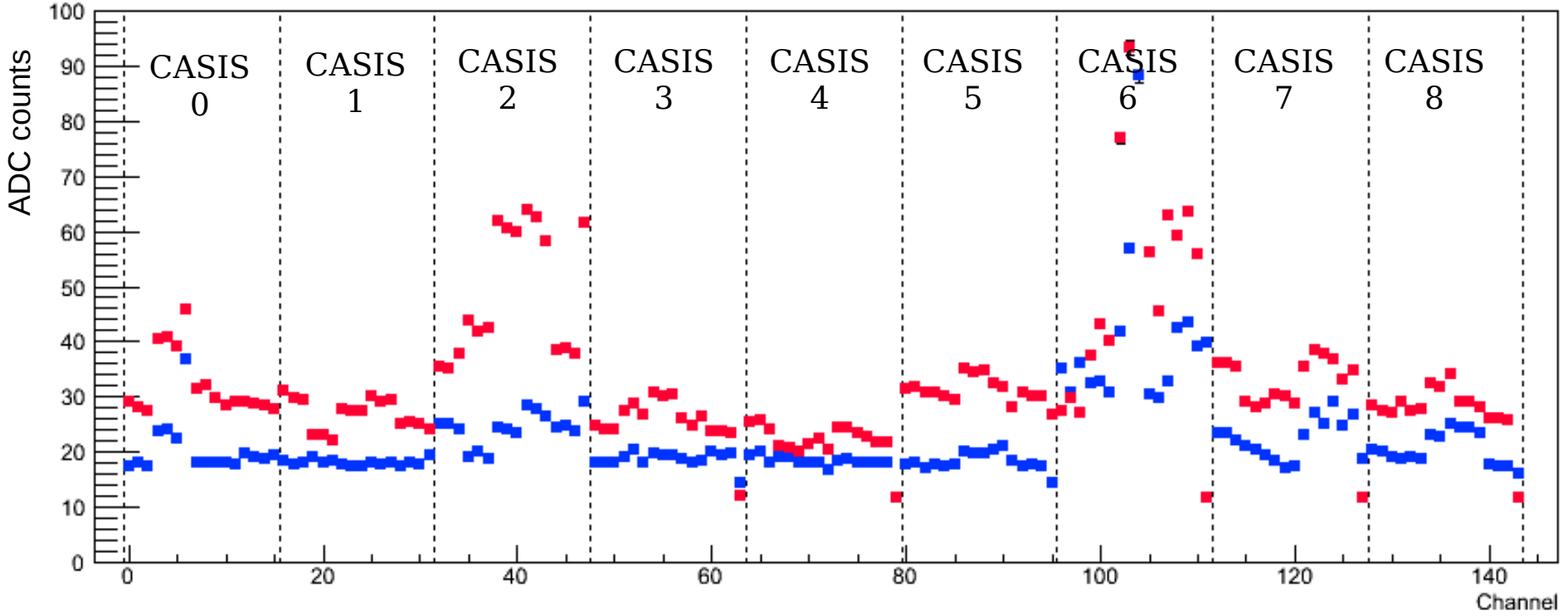
  - Very large dynamic range (0÷10000 MIP)
  - Automatic switching btw low and high (×20) gain mode
  - 16 channels (CSA+CDS shaper)



Single crystal performance

Channel Noise

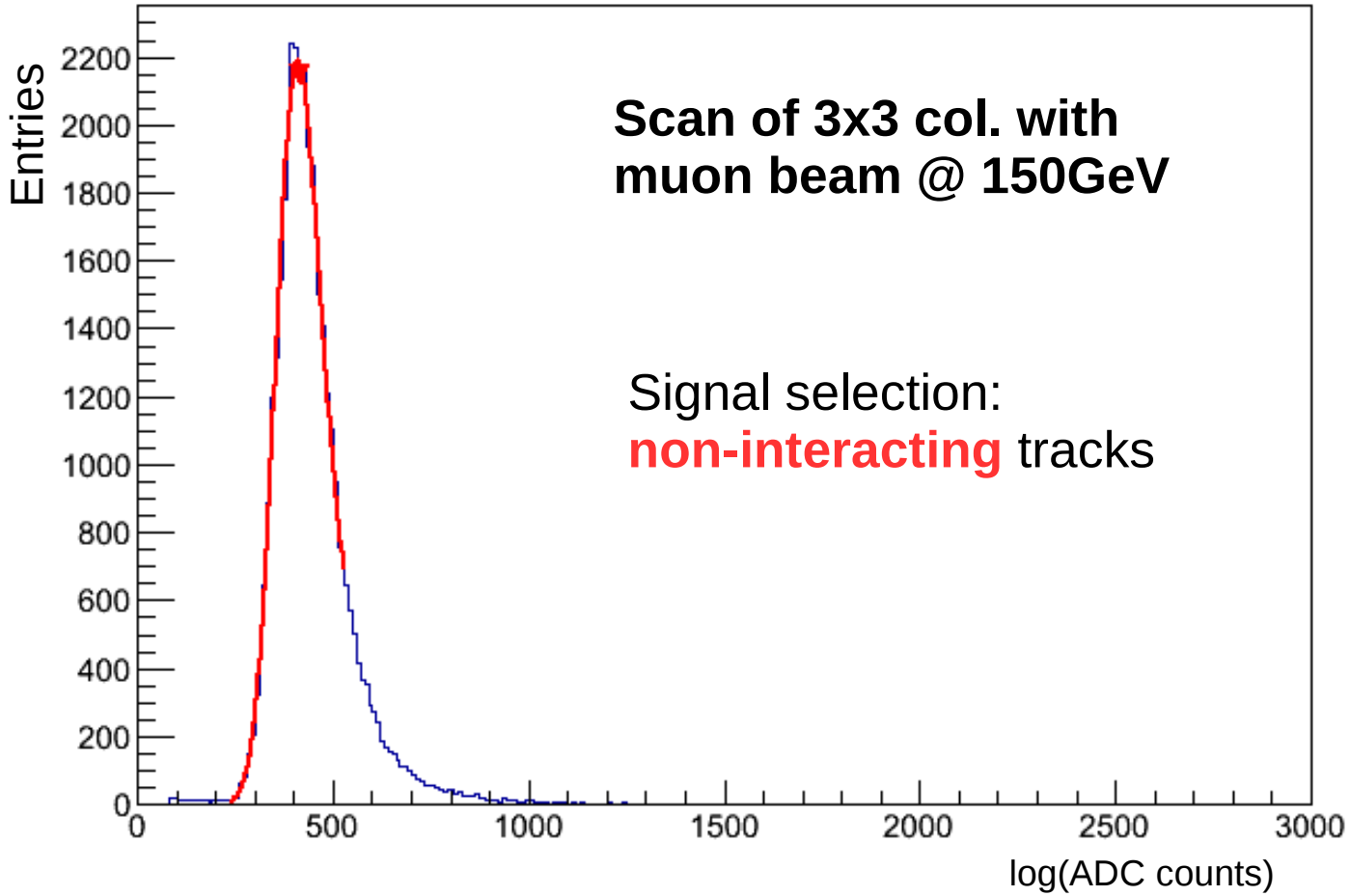
RMS(PED)
RMS(PED-CN)



- Channel pedestals (PED) evaluated by acquiring off-spill events
- Random noise (RN) ⊕ common noise (CN) ~ **20÷40 ADC counts**

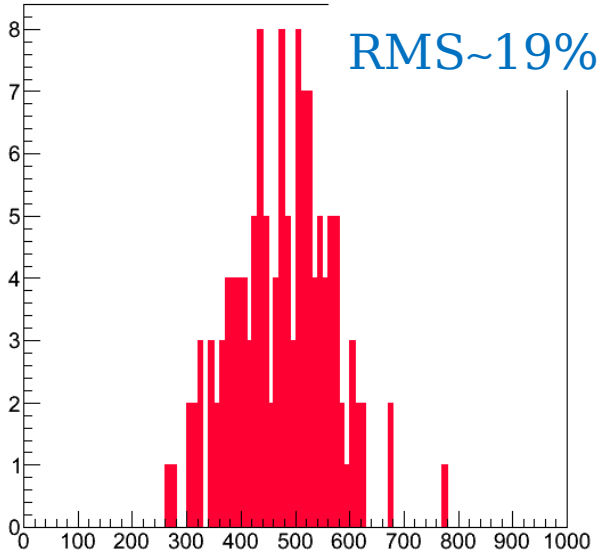
Cube calibration example

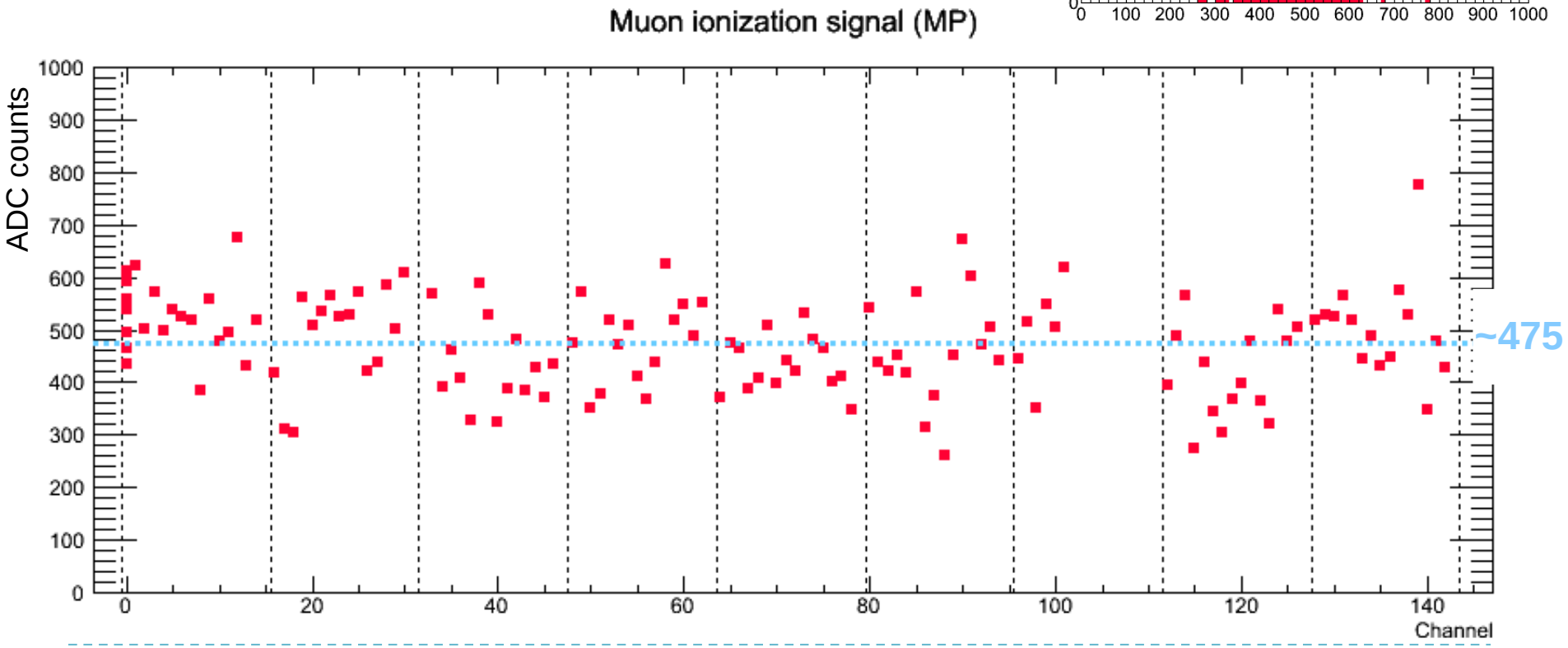
First crystal along the beam direction



Gain dispersion

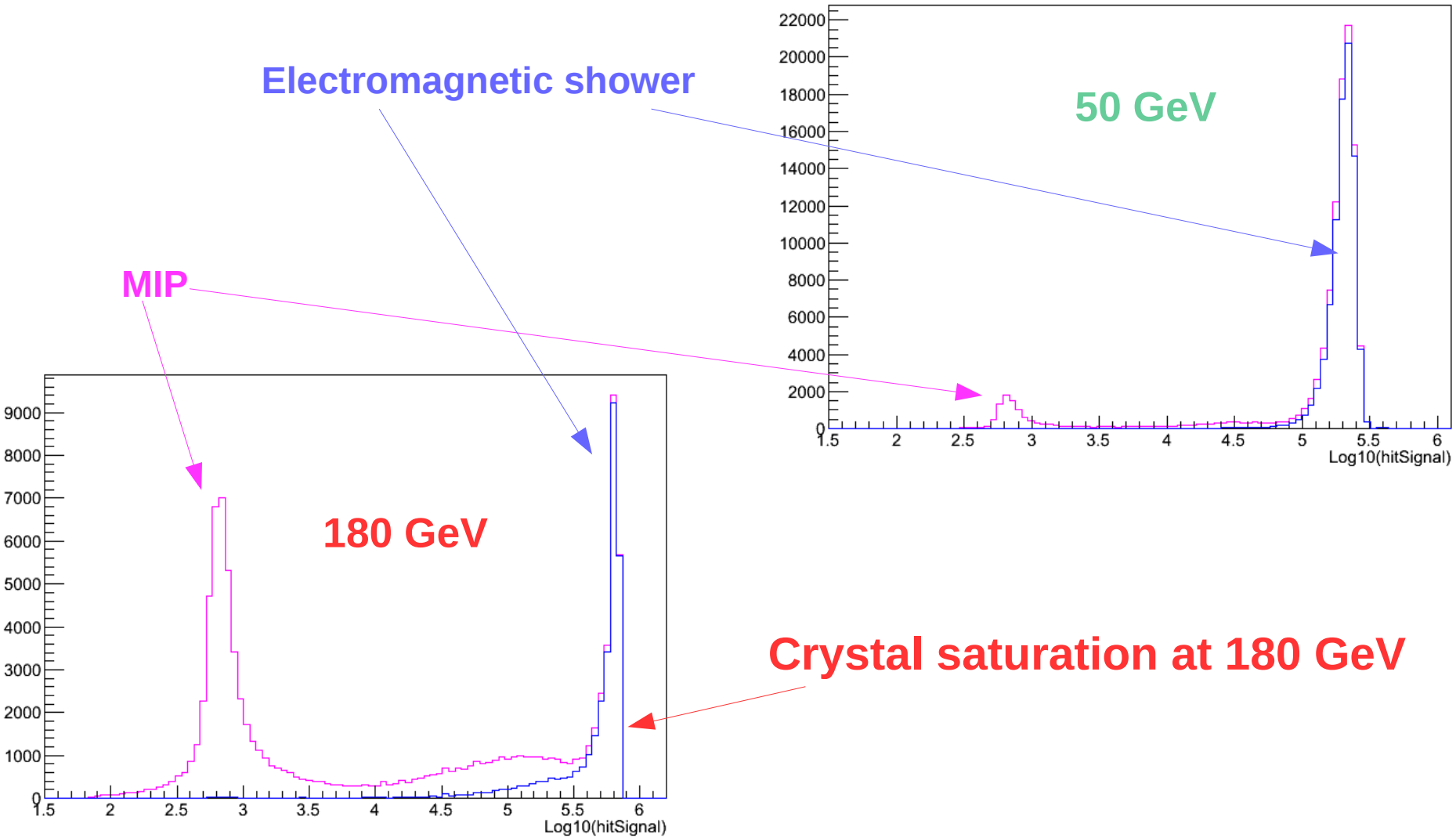
Crystal responses equalized by normalizing to 1MIP the ionization energy deposit of muons (@peak)





Electronic showers

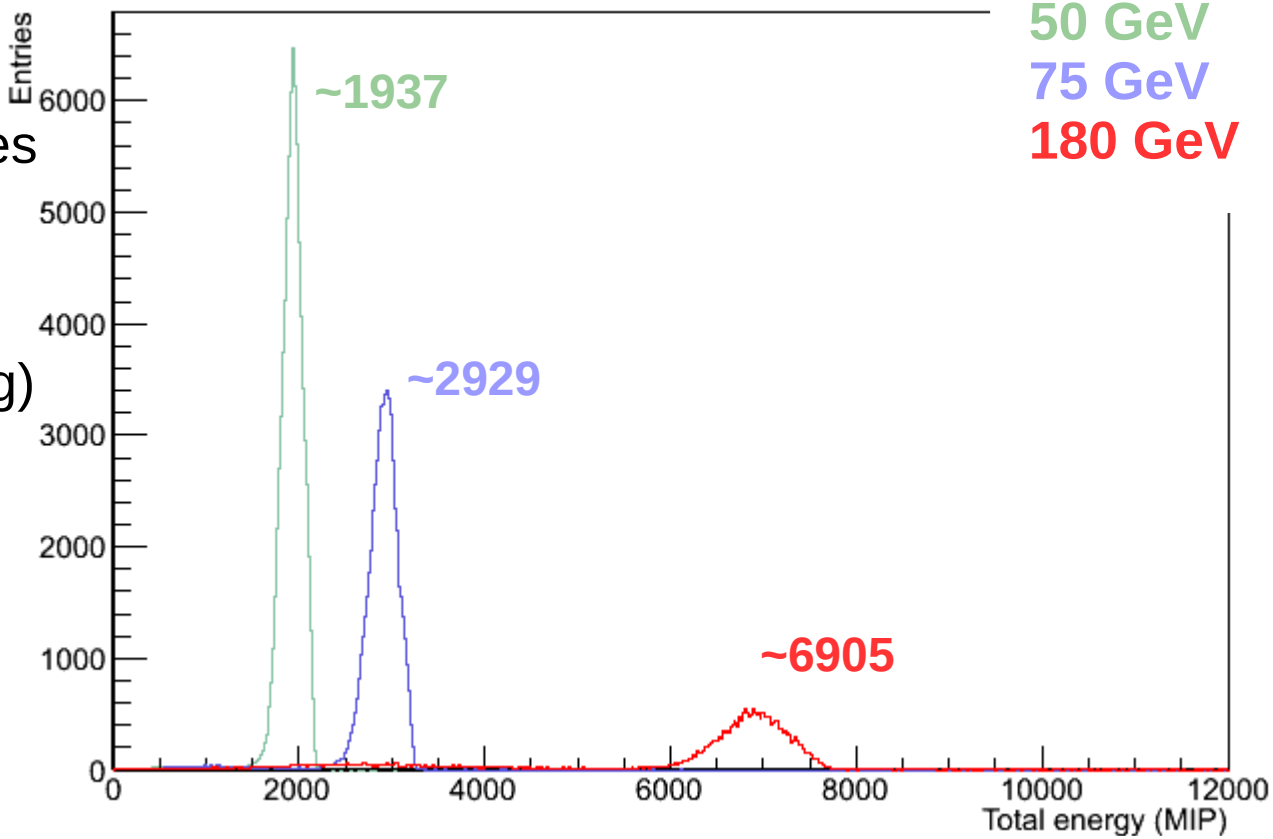
Signal distrbution



Electron selection

- Selection:
  - First layer interaction
  - Central shower

- Contamination:
  - Hadrons
  - Interacting particles
  - Instrumental negative pile-up ? (cit. L.Pacini @2nd CaloCube meeting)

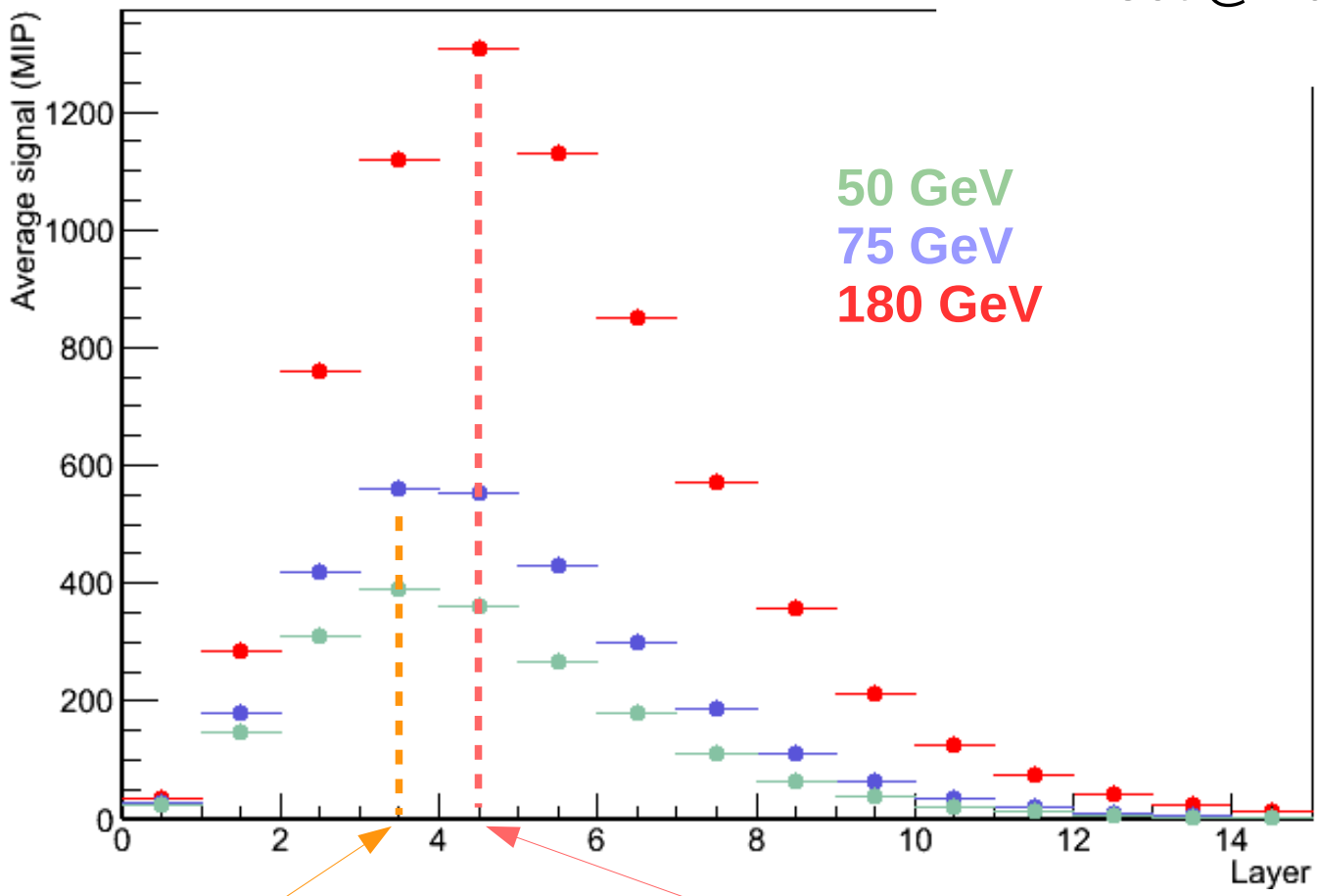


- Possible solutions:
  - Instrumental negative pile-up ? → Temporal analysis
  - Hadrons → Topological selection
  - Interacting particles → Adamo

Preliminary:
- **Linearity: Peak (MIP)/Energy (GeV) ~ 39**
- **Energy resolution: ~ 5%**

Longitudinal shower profile

- Selection:
  - First layer interaction
  - Central shower
  - Cut @ 20% peak

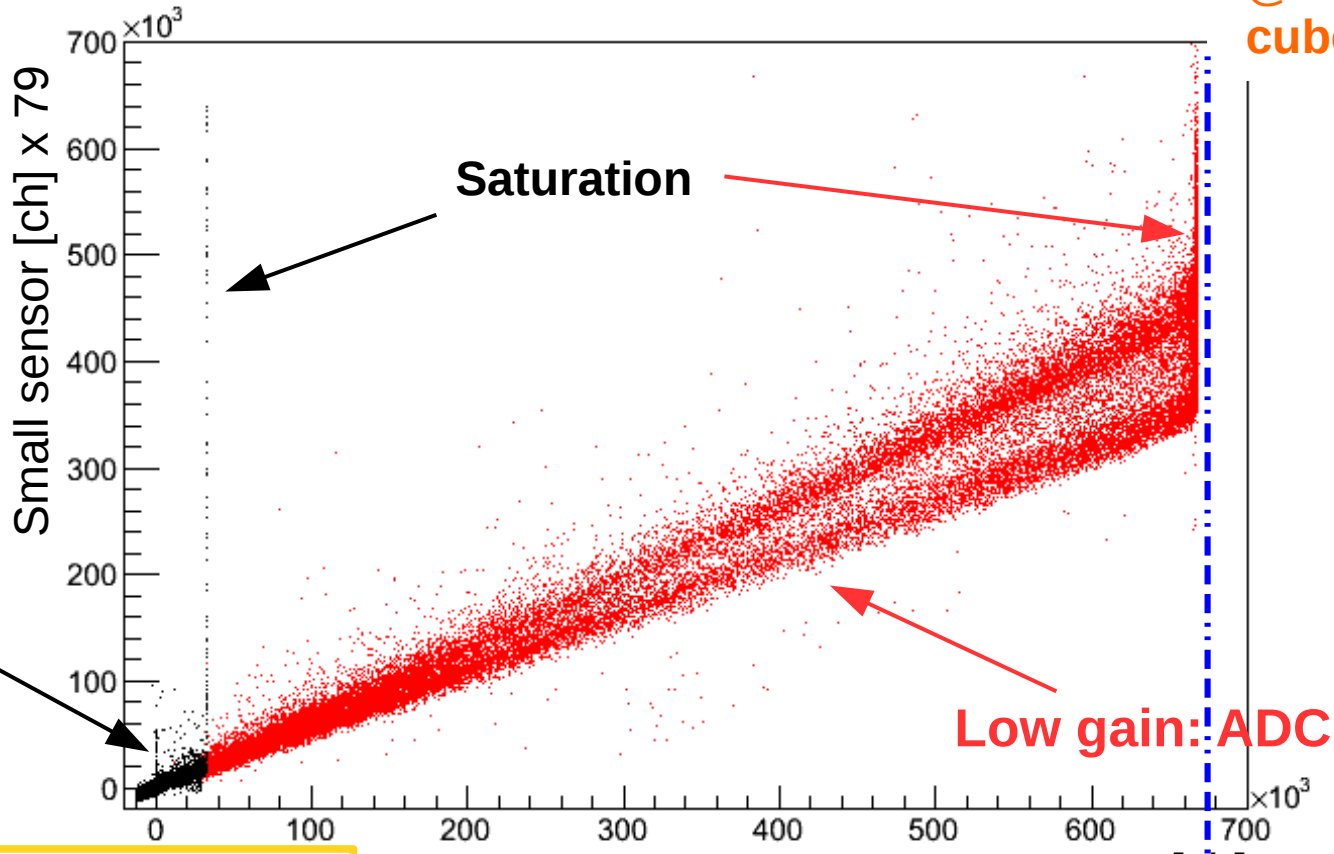


50 GeV & 75 GeV → 3 layer

180 GeV → 4 layer

Small & large sensors correlation

@ 180 GeV
cube 4 – layer 3



79 x ADC_{small} ~ 0.6 ADC_{large}

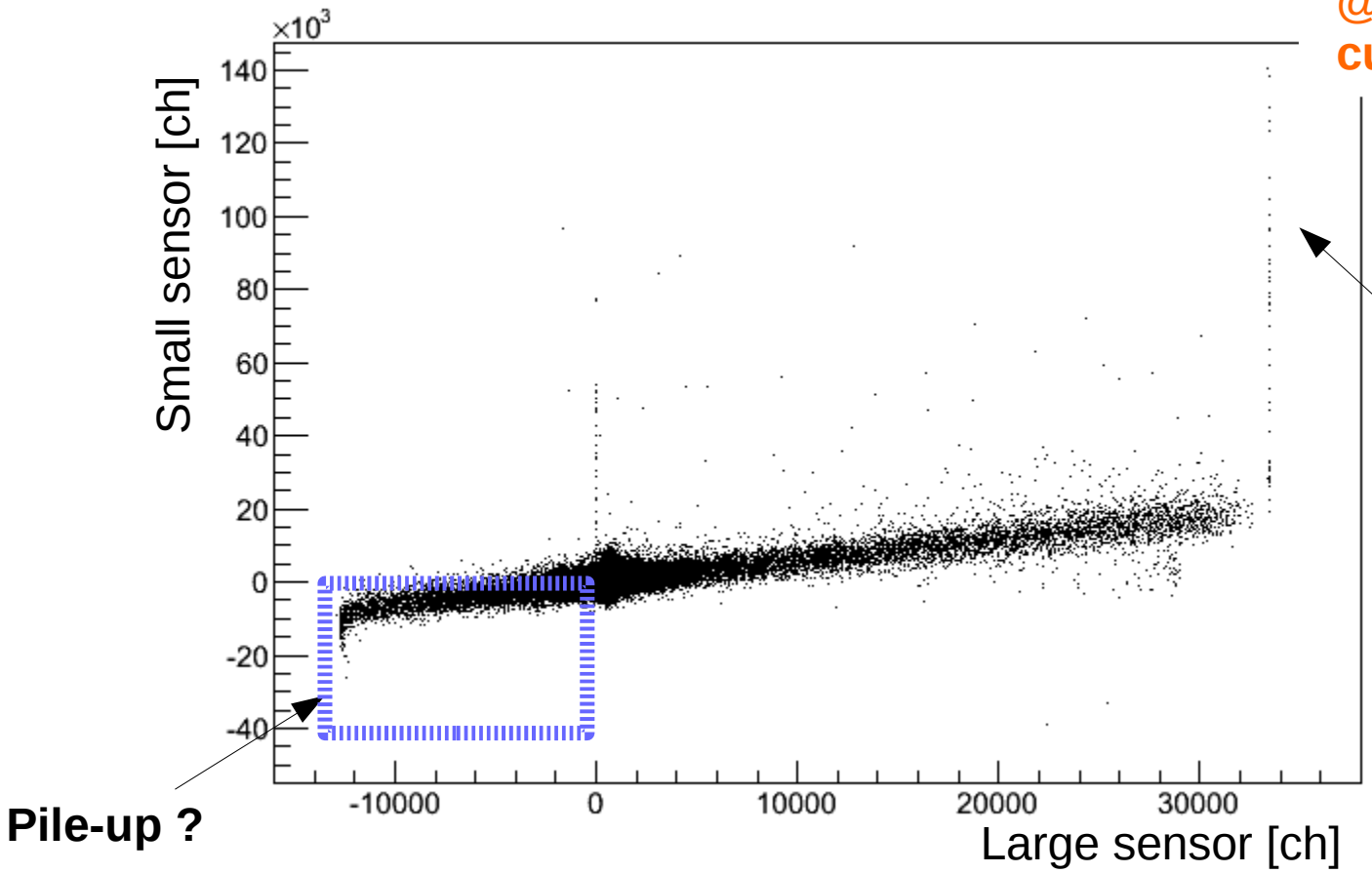
$$\frac{ADC_{large}}{ADC_{small}} \sim 132$$

(In agreement with Lorenzo estimation)

$$\sim \frac{660000 \text{ ch}}{500 \text{ ch/MIP}} \times 20 \text{ MeV/MIP} \sim 26 \text{ GeV}$$

(In agreement with Sasha estimation)

Small & large correlation: high gain



Next steps

- Add small sensor information
- Add Adamo information
- Extend analysis to all Sep 2015 TB data
- Extend analysis to all Aug 2015 TB data