

The EUDET telescope in the ALFA test beam campaign 2010

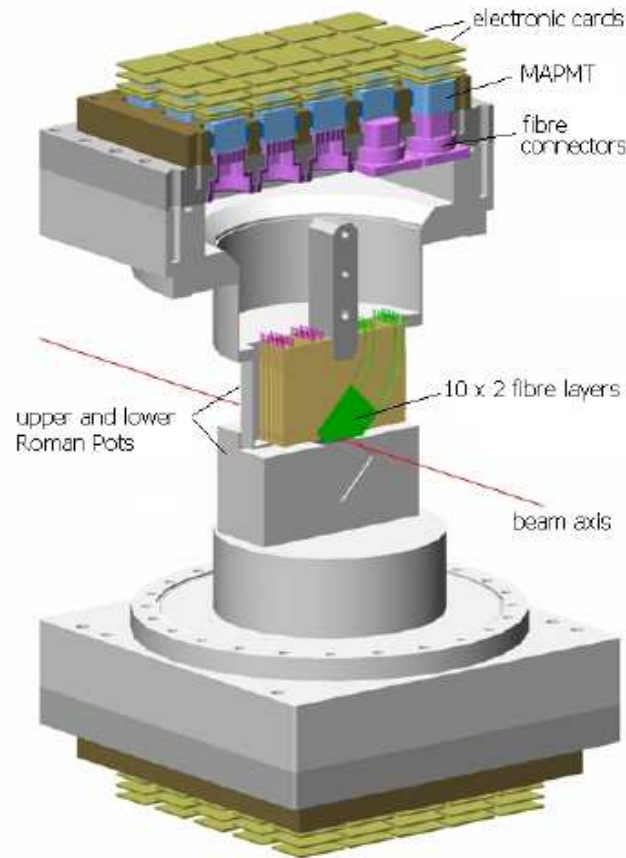
M.Viti, from the ALFA/ATLAS
group

Outline

- In the period **27 August – 19 September** we tested **7 ALFA** detectors.
- EUDET used as tracking detector and included in the trigger, synchronisation with ALFA by EUDET TLU.
 - Data were taken separately.
- **Intense program!!!**
- Large amount of data (81 millions of triggers ~ 87 Gb of data for ALFA).
- Some preliminary results will be presented.

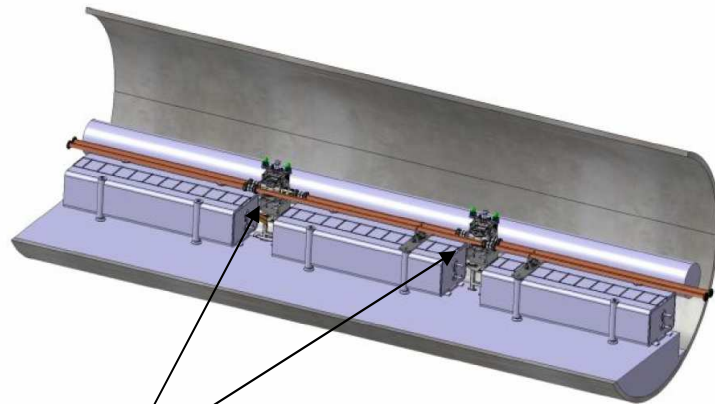
ALFA Detector

- 8 scintillating fiber detectors located in Roman Pots.
- $05 \times 05 \text{ mm}^2$ square fibers arranged in UV geometry.
- 2 Roman Pots (1 up and 1 down) form a station.
- Measurement of the angle (position) for elastic scattered protons.
- Resolution of 30-40 μ required.
- Determination of the absolute luminosity for ATLAS with an accuracy of $\sim 3\%$.



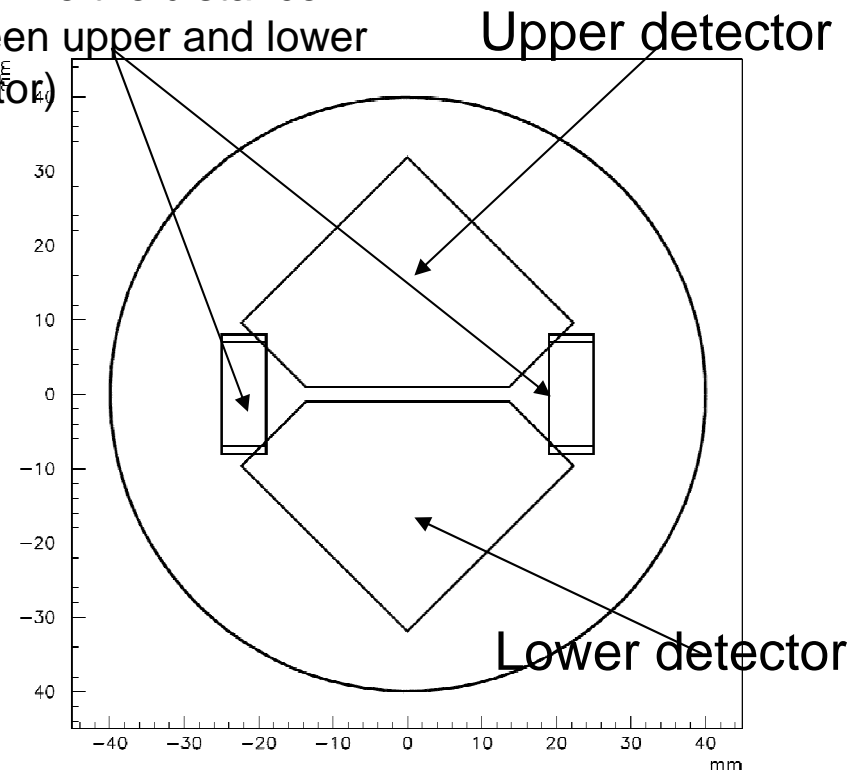
ALFA Detector

ALFA in the LHC tunnel. 2 stations are located each side of ATLAS detector at 240 m distance from the IP.



ALFA stations

Overlap detector (used to determine the distance between upper and lower detector)



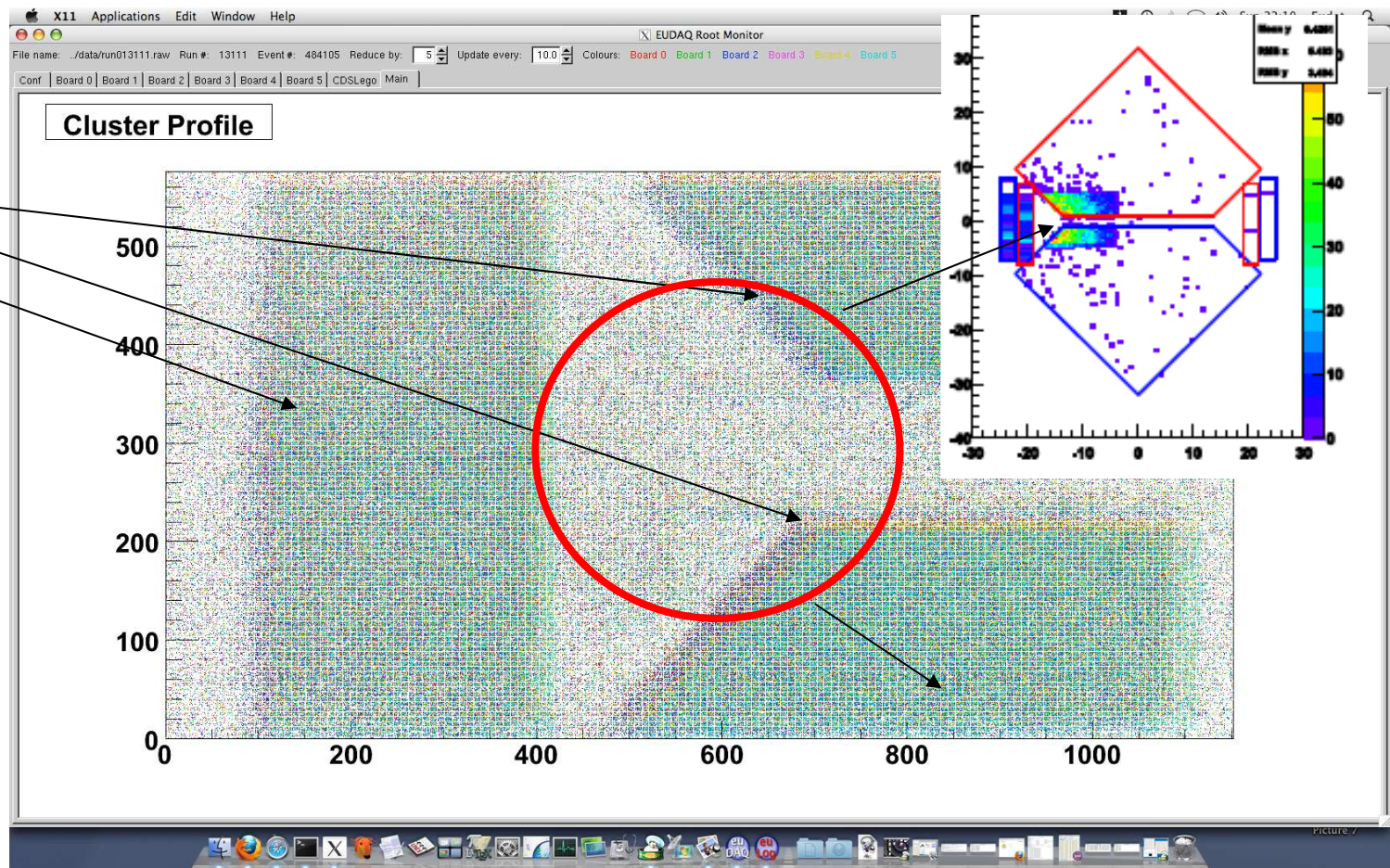
Schematic representation of an ALFA station.

EUDET Configuration

- 2 VME-Creates were implemented (data acquisition velocity twice than normal)
- EUDET threshold from 8+7.5 (sensor#3) ---> 10+9 (sensor#3), lower efficiency but also lower background, **data processing much faster!!!!**
- For the data process the Sparse Clustering 2 algorithm was used.

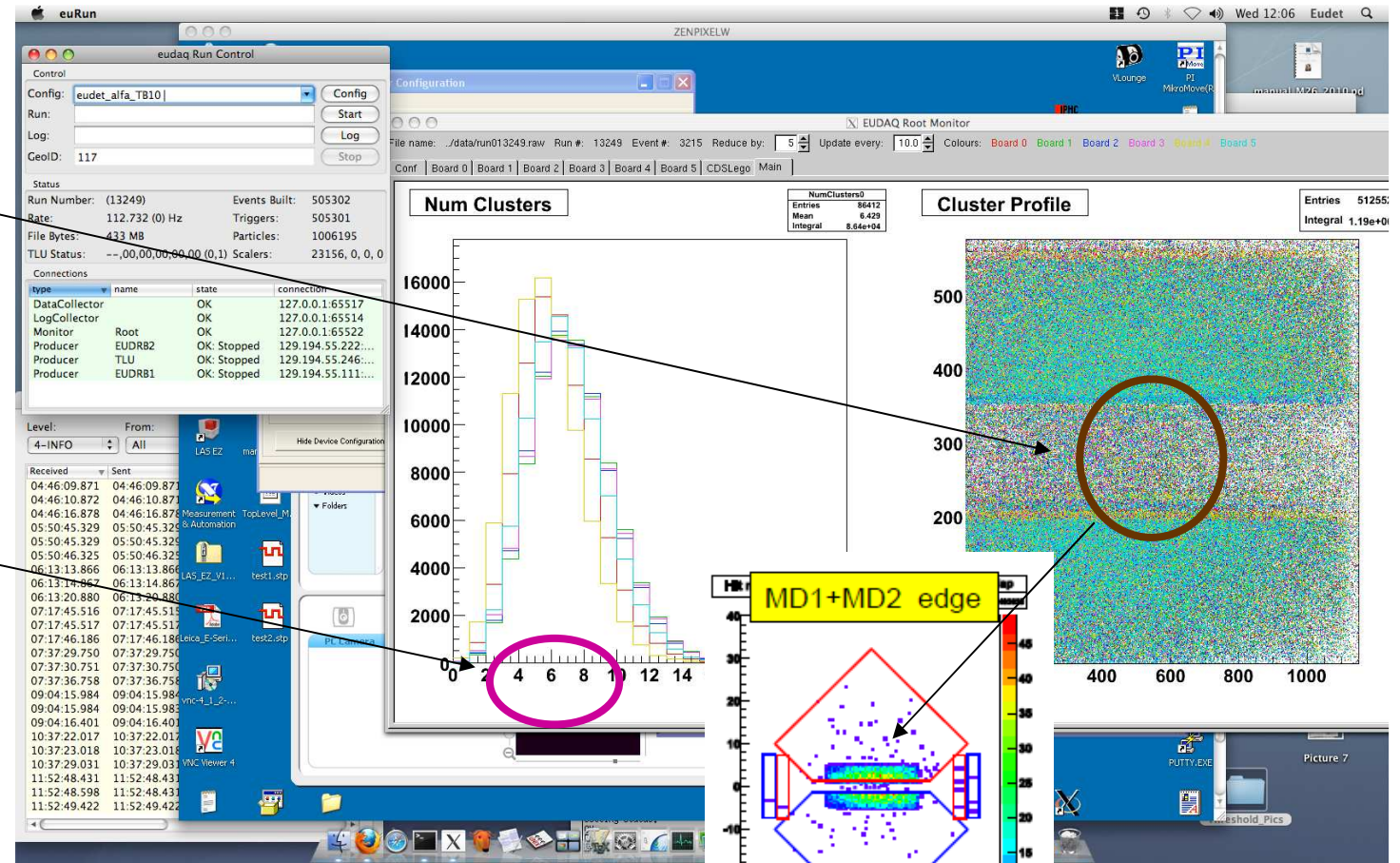
EUDAQ ROOT Monitor

- Beam centered on main detectors and overlap detector
- Shape of the our detector **clearly visible**.
- In the picture, the hitmap of all 6 sensors is shown. **Good overlap of the pictures -> good alignment!!!**



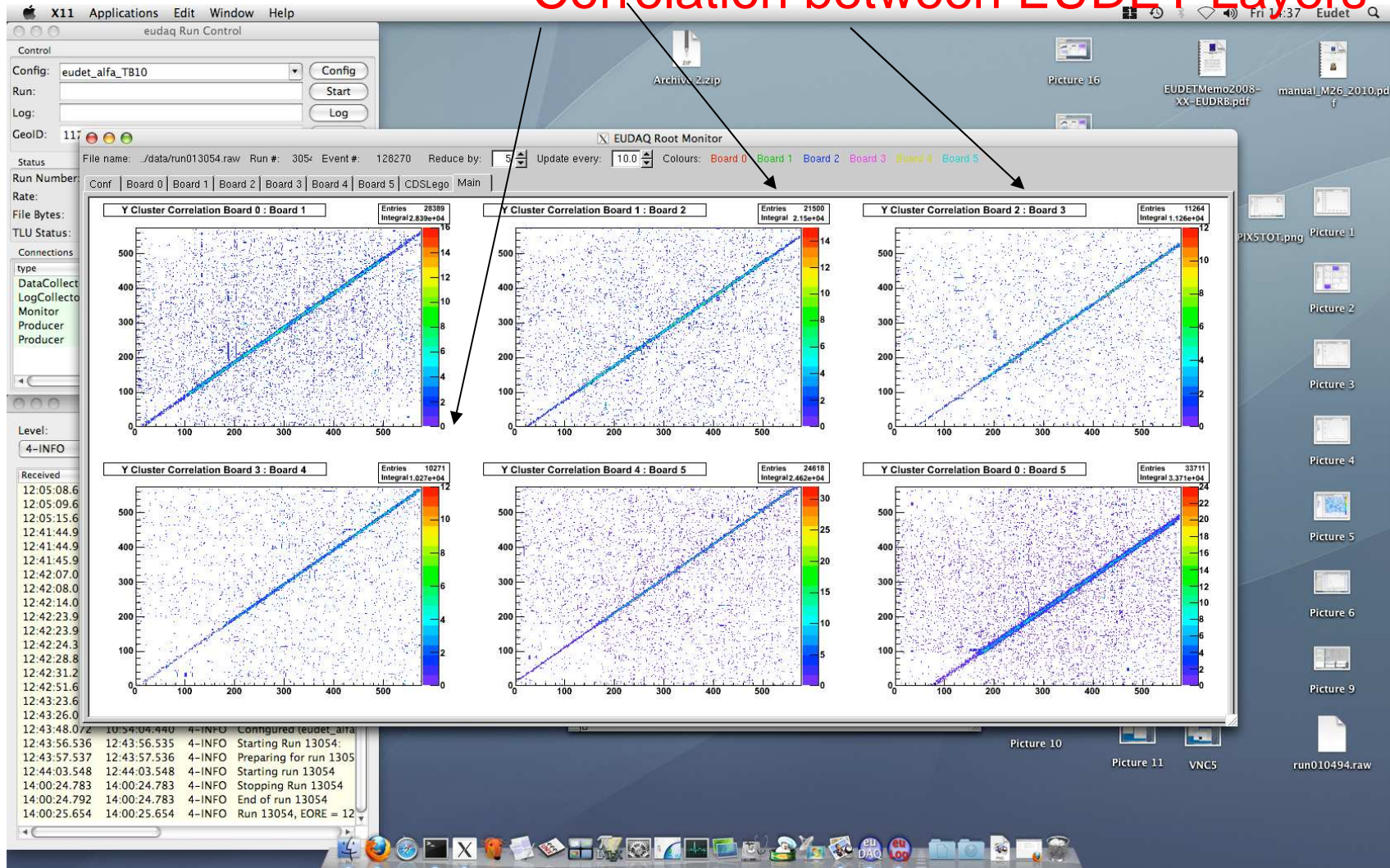
EUDAQ ROOT Monitor

- Beam centered on main detectors.
- Clusters distribution. The threshold was at a high value to avoid to have too much background.
- We had ~5-6 background clusters/event/layer.



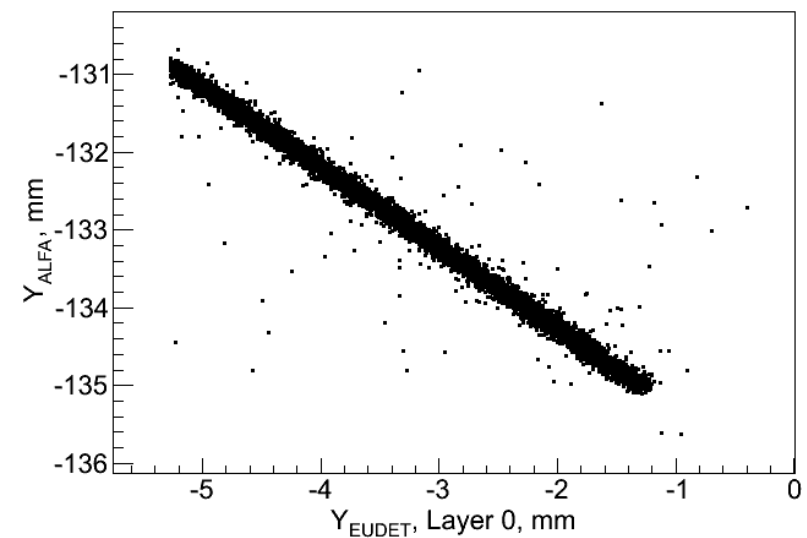
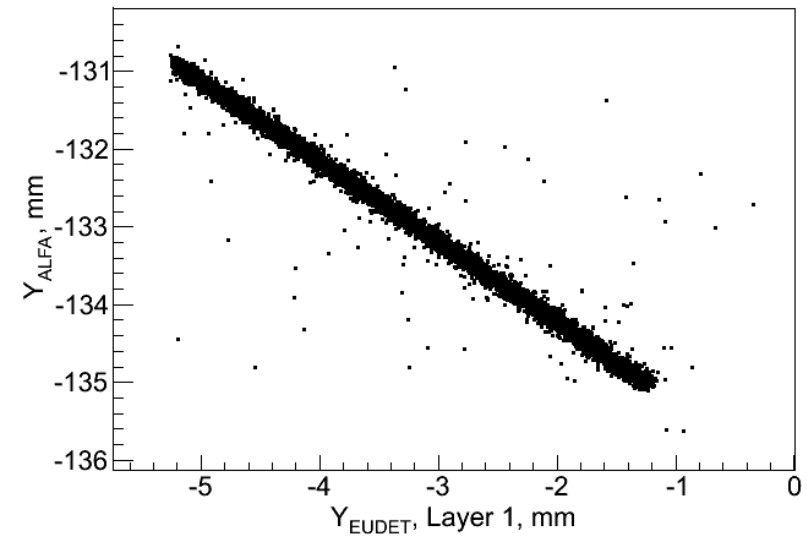
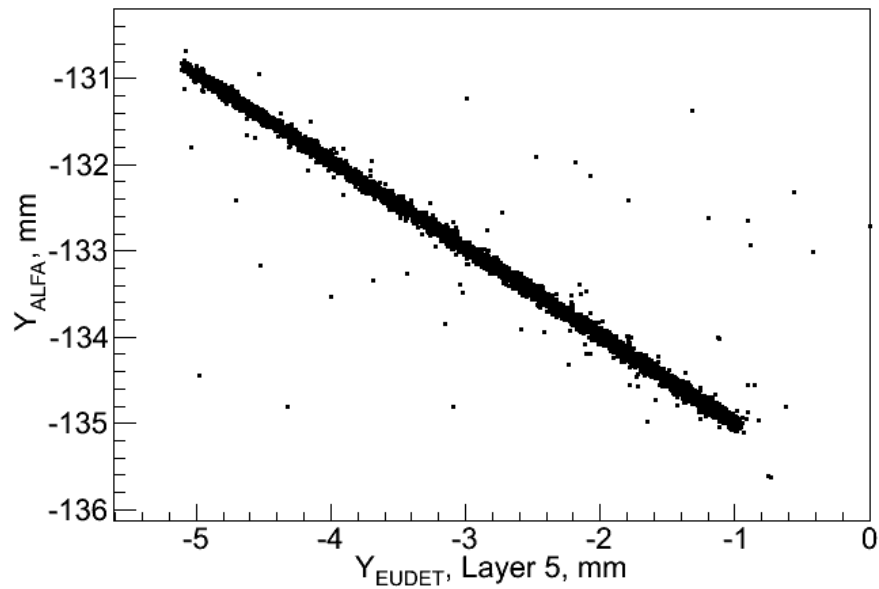
EUDET Layers Correlation

Correlation between EUDET Layers



EUDET – ALFA Correlation

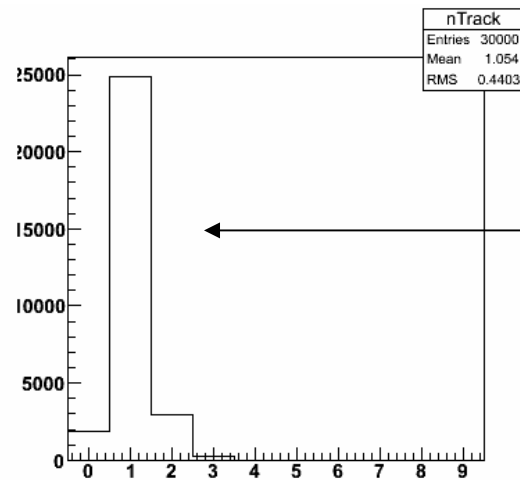
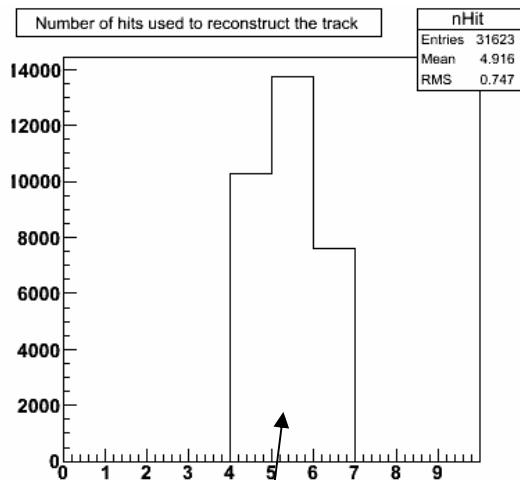
Very good correlation between
EUDET and ALFA!!!!



29/09/2010

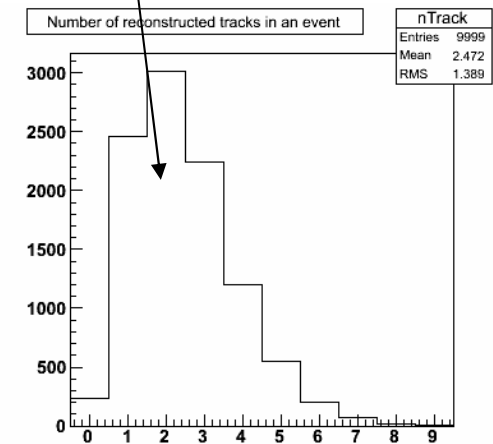
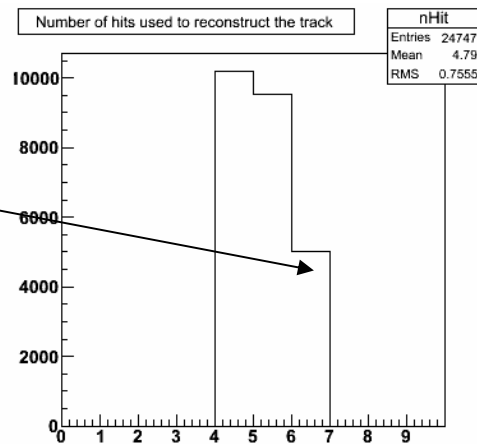
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Hit and Track Multiplicity

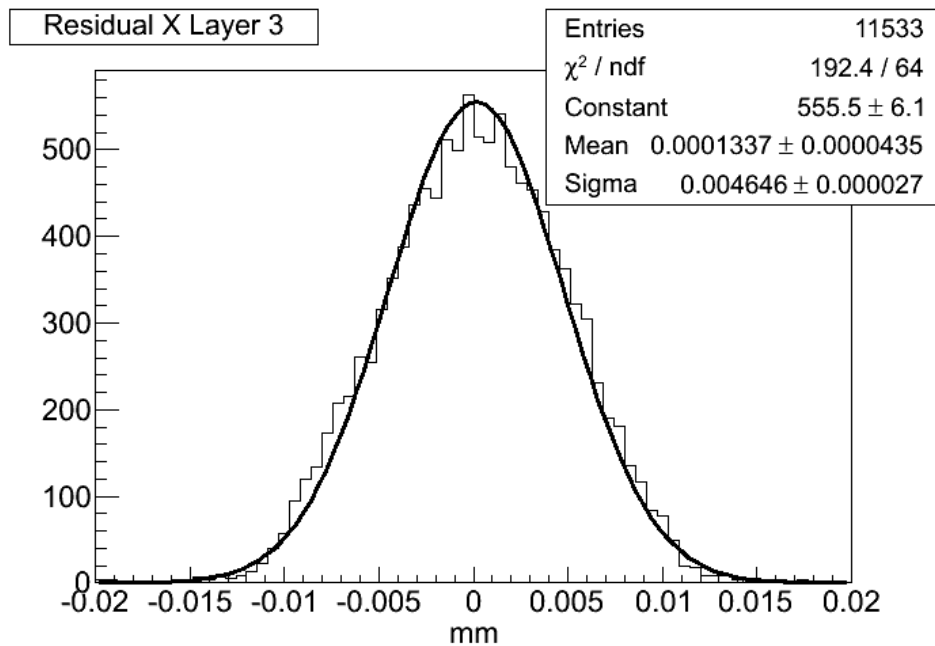


- Number of tracks per event.
- For ALFA we run with relative low intensity beam. Most of events had 1 track. Track efficiency ~ 93%
- We run sometimes with higher intensity. No problem with EUDET track reconstruction.

Number of hits per track. Most of tracks have 5 or 6 hits.

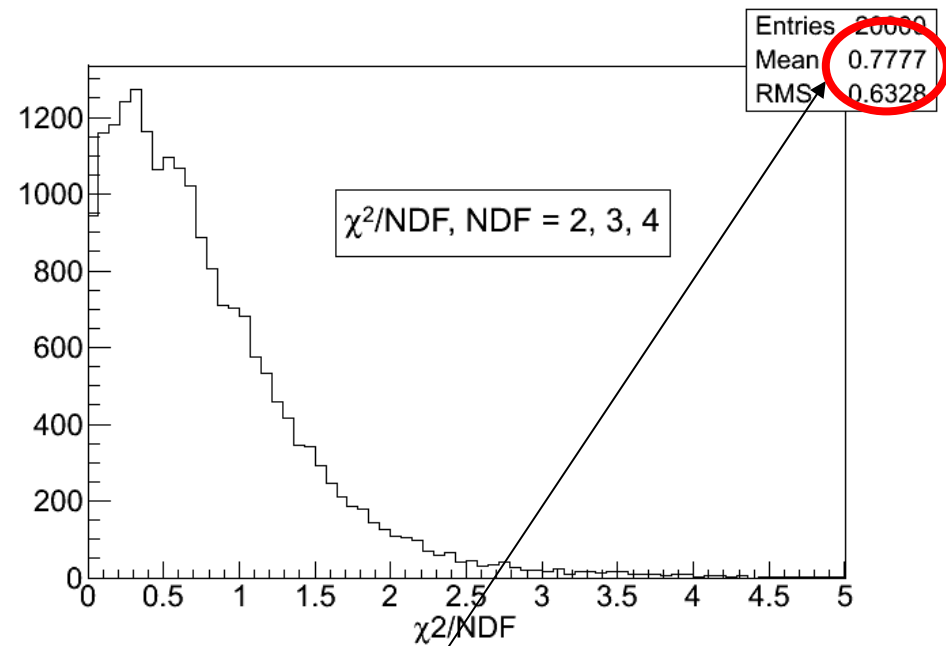


Residuals and Resolution



Residual in X for Layer 3. The Layer is not used for the fit and acts as DUT.

29/09/2019



Normalized Chi2. As error was used the intrinsic resolution 4.5 mu. **Scaling this error an effective resolution of ~4 mu was found.**

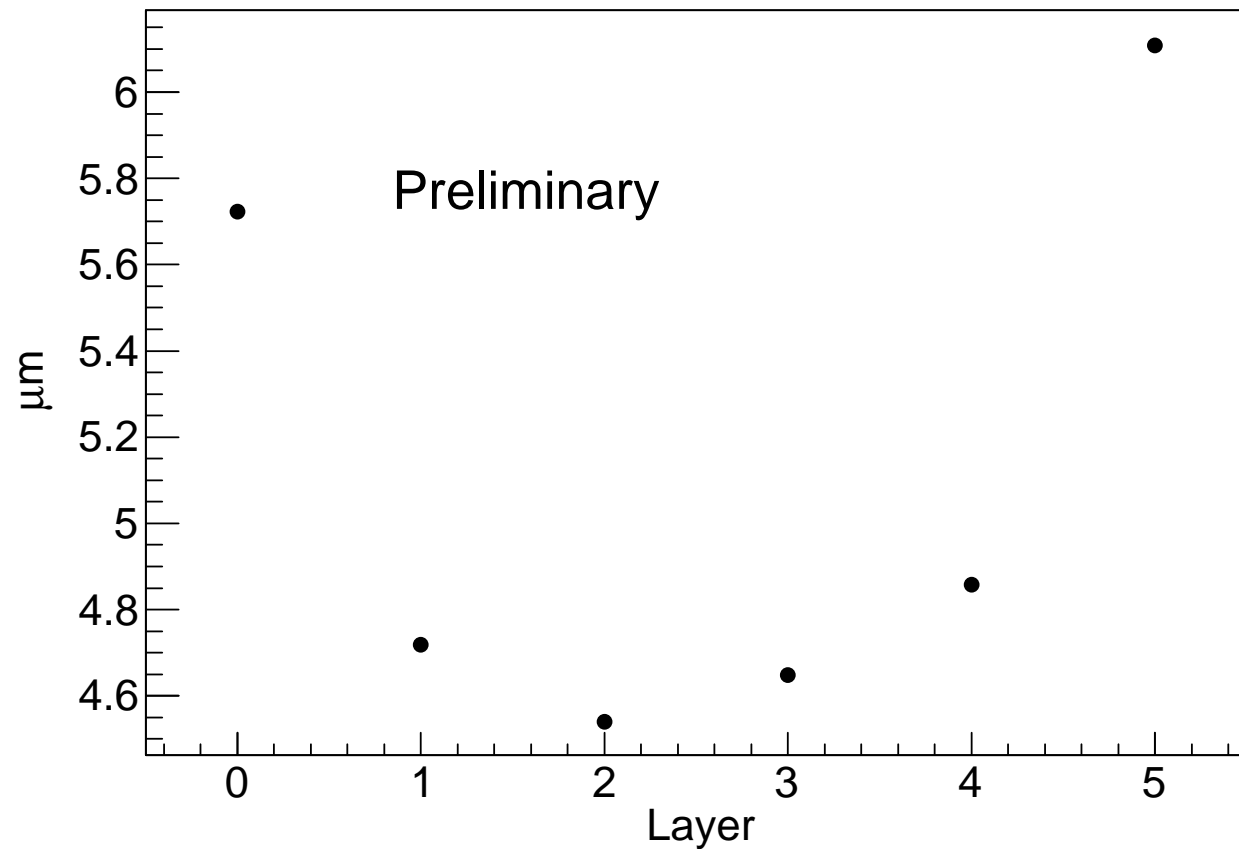
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Residuals

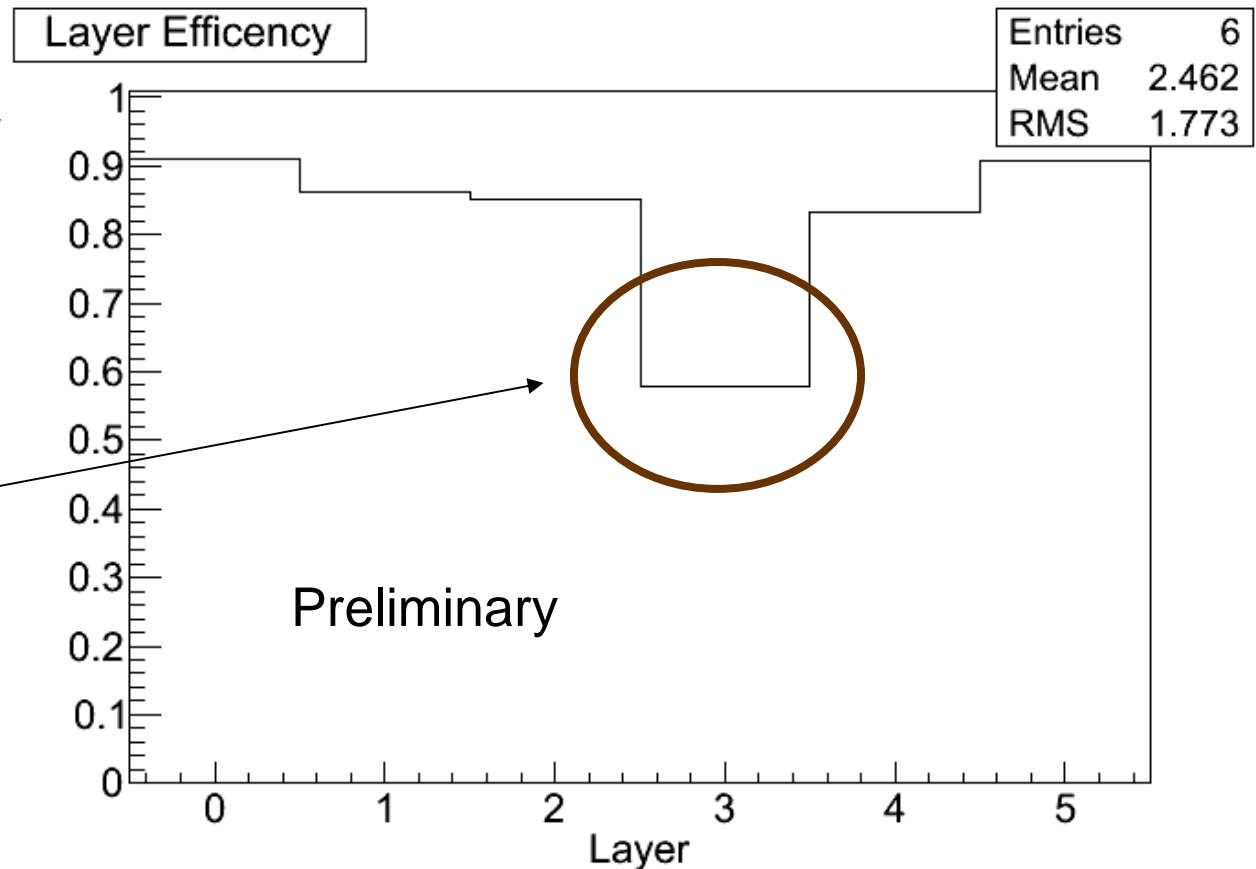
Residual values

- Residual values for the 6 layer where the layers act each time as DUT.
- Nice parabolic behavior.



Layer Efficiency

- Except layer 3, layer efficiency bigger than 80%.
- Efficiency for layer 3 much lower. **Not yet understood, must be checked** (the threshold was set even lower than other layers).



Conclusions

- EUDET worked very well. **The system was very stable** (the windows pc was restarted once and 2-3 time the EUDAQ/JTAG1 program) in 2,5-3 weeks of almost continuous data taking.
- **Using the Sparse Clustering 2** algorithm reduces the processing time (the fitter is still pretty slow, but I'm using not the latest version).
- To reconstruct 81 millions events needs a faster fitter.
- **High threshold set for low background.**
- **Excellent performance of the detector** also with higher intense beam. Good efficiency and a effective resolution of ~ 4 mu was found.