

A strategy for the Limadou HEPD event reconstruction

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The Limadou HEPD detector

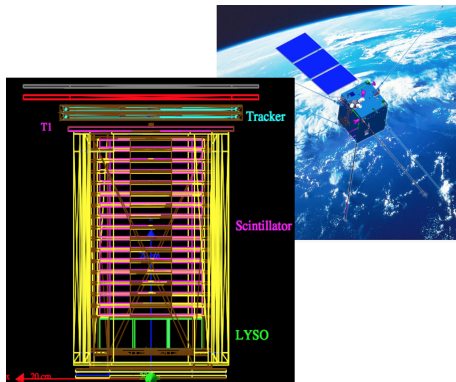
The Limadou HEPD is the **high energy particle detector** of the CSES and has been designed to maximize the sensitivity in the energy range 3 MeV - 100 MeV for the **electrons** and 30 MeV - 200 MeV for **protons**. The information is provided by several subsystems:

From the top:

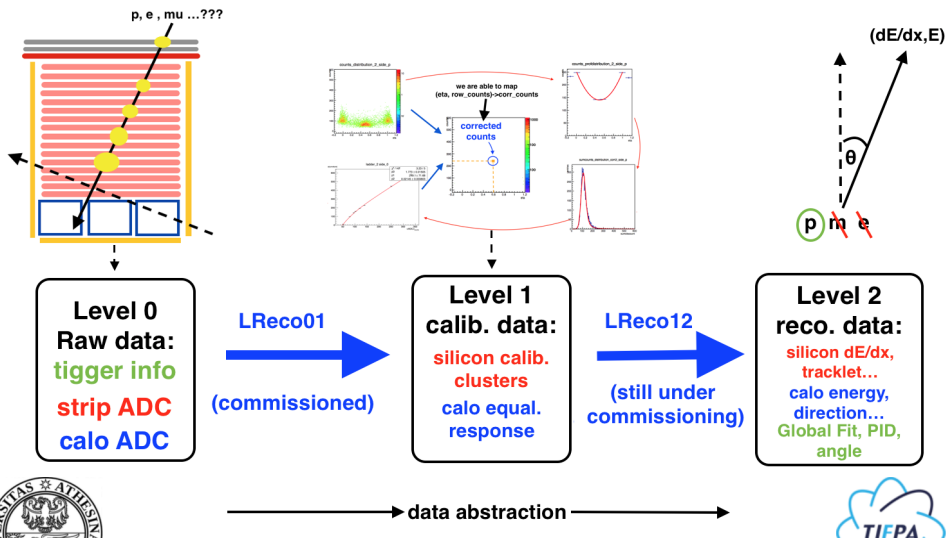
- **Tracker**: two planes of double-sided silicon microstrip (0.3 mm thick);
- **Trigger**: one plastic scintillator (0.5 cm thick);
- **Calo**: 16 scintillator planes (1 cm thick) and an array of LYSO crystals.

Around:

- **Veto**: 5 scintillator planes.



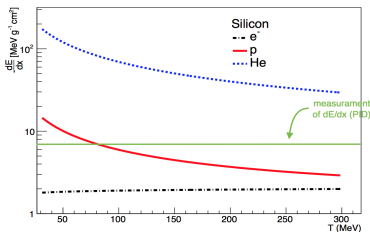
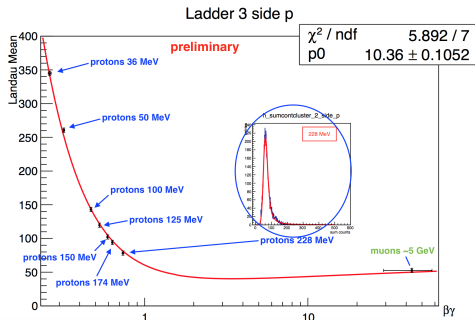
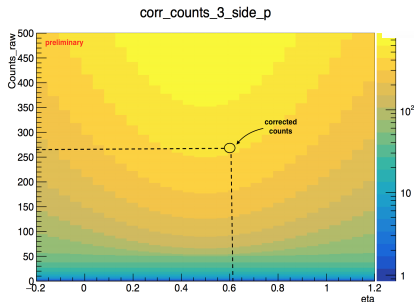
Limadou event reconstruction architecture



Tracker reconstruction of $\frac{dE}{dx}$, θ and PID

The reconstruction of the silicon tracker information provides:

- the energy loss ($\frac{dE}{dx}$);
 - a standalone PID;
 - the angle θ (see next talk);
- each event.

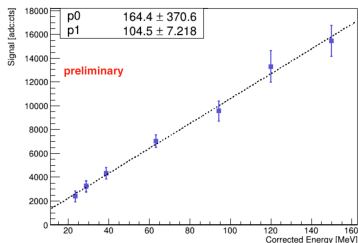


Calorimeter energy reconstruction

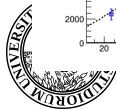
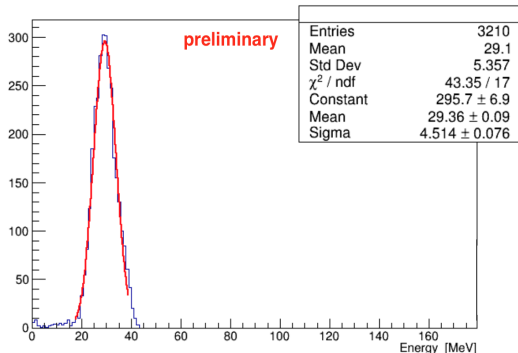
The information reconstructed by the plastic scintillator calorimeter provides:

- an estimation of the energy E released by the particle;
- topological information (i.e. penetration of the particle).

each event.



Credits: V.Vitale



Conclusion and Outlooks

The Limadou HEPD event reconstruction team is working hard in preparation for the launch (16th August). To summarize:

Done:

- 1 passage from L0 to L1;
- 2 reconstruction of $\frac{dE}{dx}$ (*preliminary*);
- 3 reconstruction of the energy E (*preliminary*);
- 4 reconstruction of the angle (*preliminary*).

Under commissioning:

- 1 more and more reliable procedure for E , $\frac{dE}{dx}$ and θ estimation;
- 2 mixed tracking algorithm between calorimeter and tracker;
- 3 passage from L1 to L2 (*almost done*).



Backup slides



Level0 → Level1 - What changes?

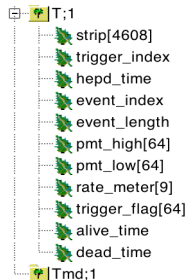
At **Level0** of data elaboration we have

- information on raw count;
- metadata, flags and index.

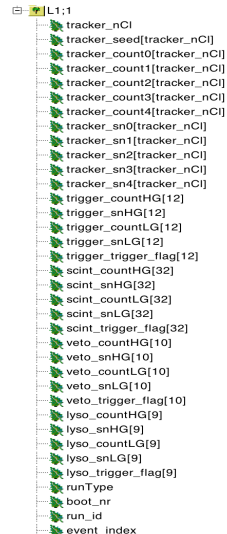
At **Level1** the information is more digested and classified :

- cluster formed by group of activated strips;
- calibrated counts for scintillator;
- S/N ratios for all the subdetectors;
- more metadata and flags.

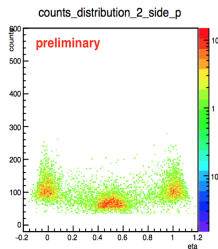
Lvl0



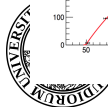
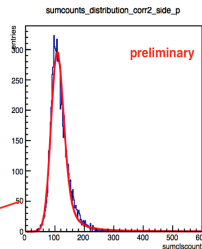
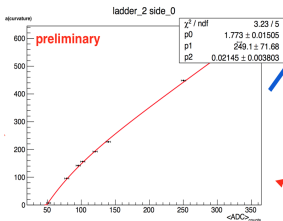
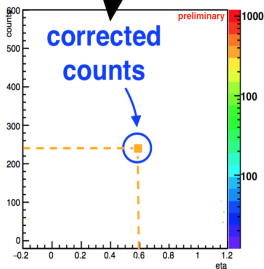
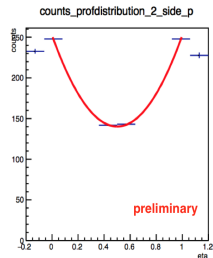
Lvl1



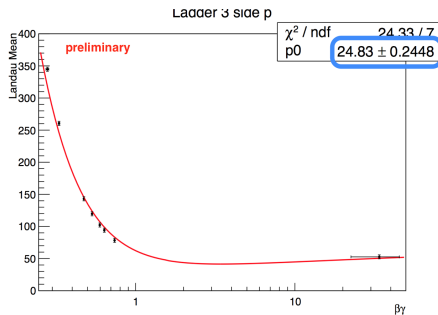
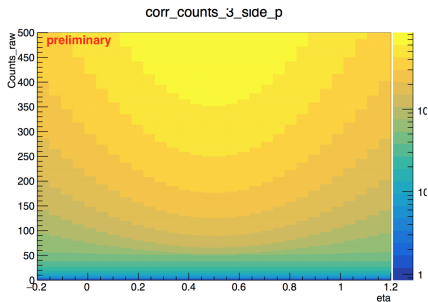
Backup - Tracker $\frac{dE}{dx}$ reconstruction



we are able to map
(eta, row_counts) \rightarrow corr_counts



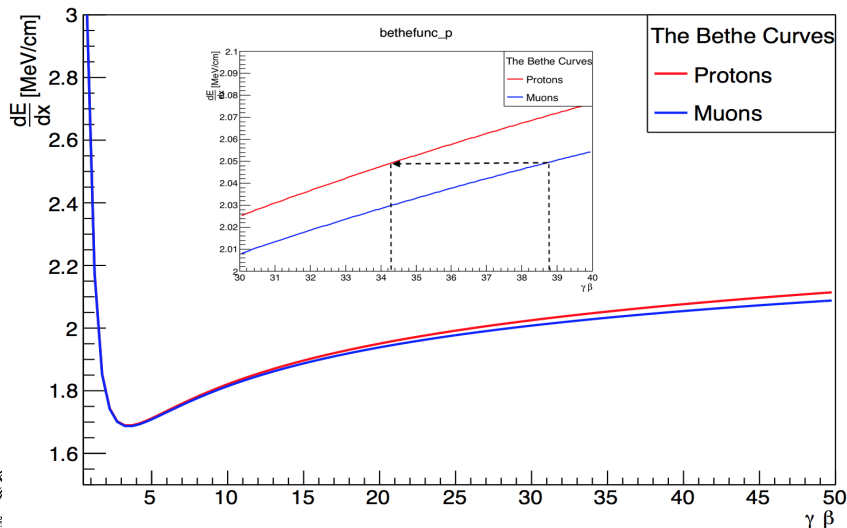
Backup - Tracker $\frac{dE}{dx}$ LUT



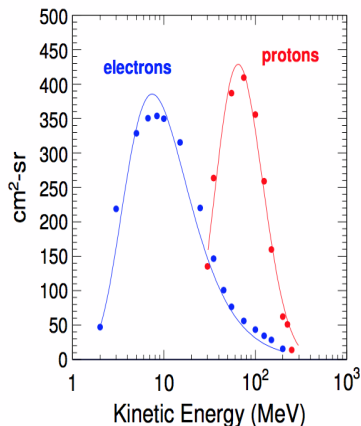
dE/dx Look Up Table



Backup - Muon point



Backup - Limadou main characteristics



Parameter	Value
Energy range	Electron: 3-100 MeV Proton: 30-200 MeV
Angular resolution	<8° @ 5 MeV
Energy resolution	<10% @ 5 MeV
Particle Identification	>90%
Maximum Omni-directional Flux	10 ⁷ cm ⁻² s ⁻¹ sr ⁻¹ (accepted by trigger before pre-scaling)
Operating temperature	-10 °C - +35 °C
Mass (including electronics)	< 43 kg
Power Consumption	< 43 W
Scientific Data Bus	RS-422
Data Handling Bus	CAN 2.0
Operation mode	Event by Event
Life span	> 5 Years

