Summary of the 2011 SDHCAL TB data analysis

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Outline

- **SDHCAL m3 Prototype setup**

- **Aquisition & Data format**

- **Reconstruction**
  - **Event builder**
  - **Reconstruction**

- **Ongoing Analysis**
  - **Efficiency & multiplicity**
  - **Energy recontruction**

- **Summary**

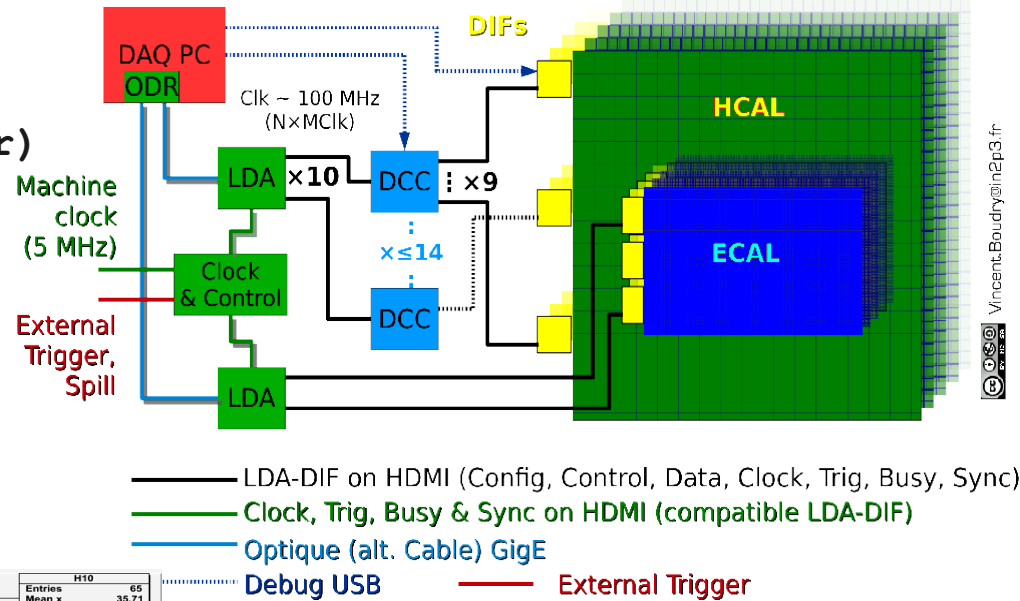# SDHCAL m3 Prototype setup

RPC Gaseous detector
- GRPC
  - Simple, robust rate ≤ 100 Hz/cm2
  - 1.2 mm gas gap
  - 2 glass resistive plates with 0.7mm (anode) & 1.1mm (cathode).
  - Graphite resistive coating.
  - Hv ~ 7.4 kV (Limited by leakage current due to high temperature)
  - 1x1 cm Pads
  - Each pad it's a channel with 3 threshold coded in 2 bits.
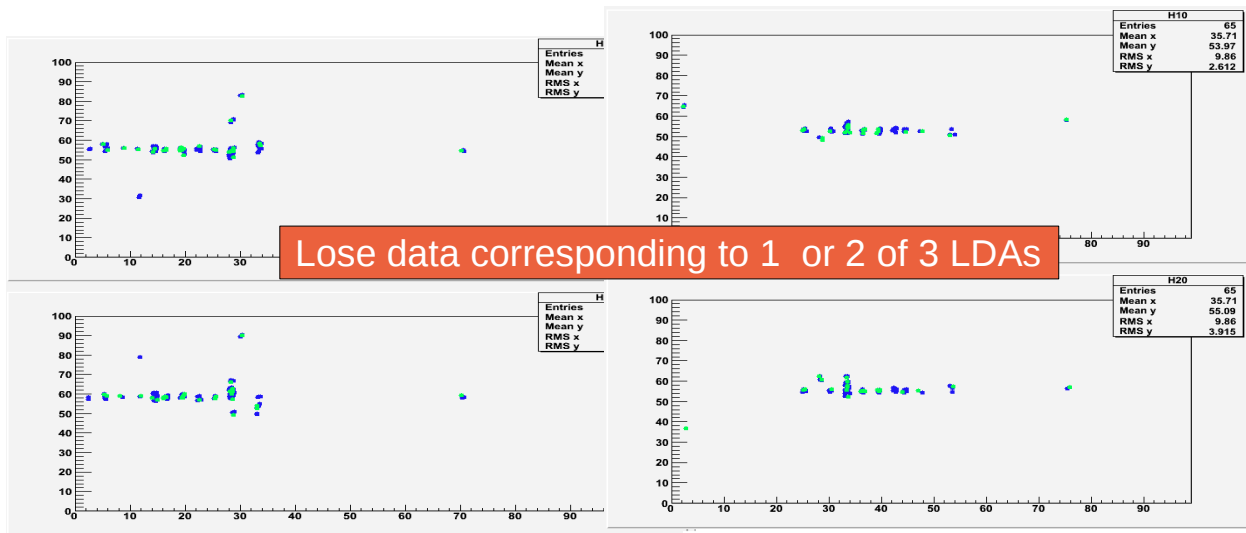- 48 Layer available (6 int lengths) but only 36 used (LDA availability problem).
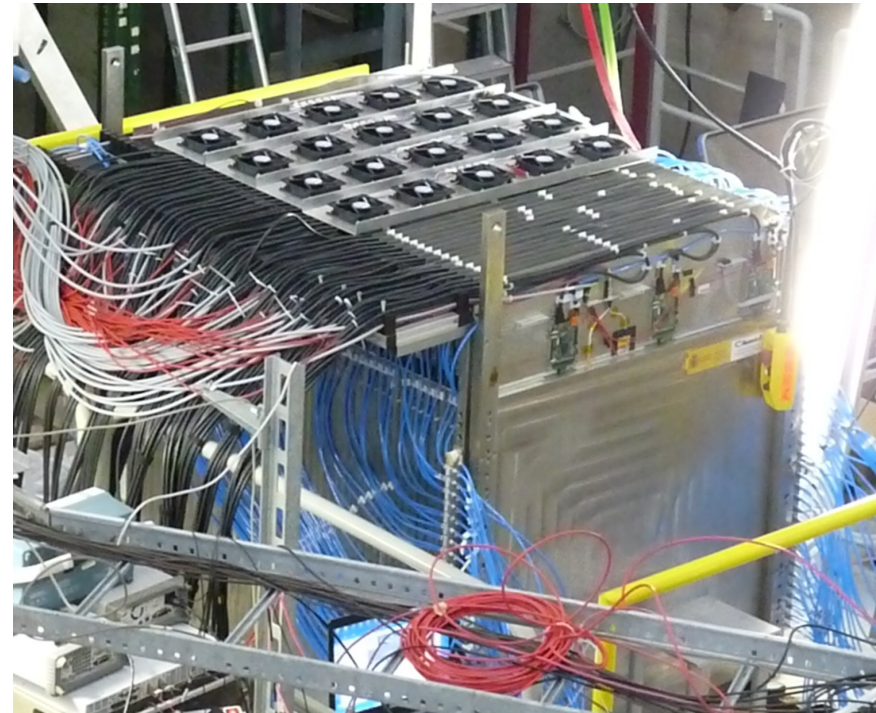
- Thresolds values:
  - Thr0 = 186fC
  - Thr1 = 1 pC
  - Thr2 = 5 pC

Aquisition system

- **2 readout systems have been used,**
  - **DAQv2 readout(September & October)**
  - **USB readout (June & July & November)**

- **During the TB@SPS test, we find some problem with DAQ system (Event information could be lost during the acquisition).**
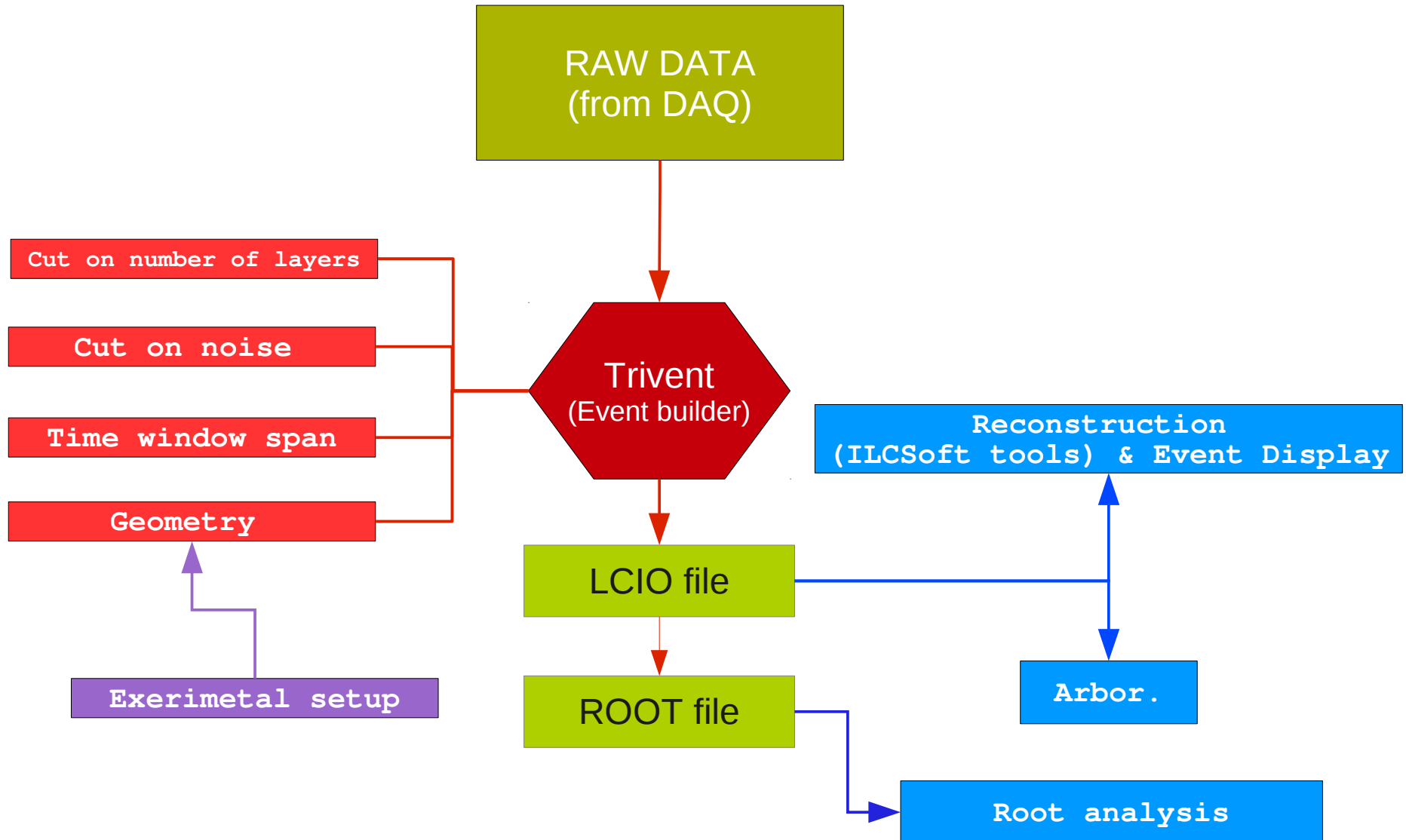

LDA-DIF on HDMI (Config, Control, Data, Clock, Trig, Busy, Sync)
Clock, Trig, Busy & Sync on HDMI (compatible LDA-DIF)
Optique (alt. Cable) GigE
Debug USB   External Trigger

Lose data corresponding to 1 or 2 of 3 LDAs

- **The hybrid solution between USB a DAQ are under study to solve this problem.**

Diagram of event finder

RAW DATA
(from DAQ)

Cut on number of layers

Cut on noise

Time window span

Geometry

Exerimetal setup

Trivent
(Event builder)

LCIO file

ROOT file

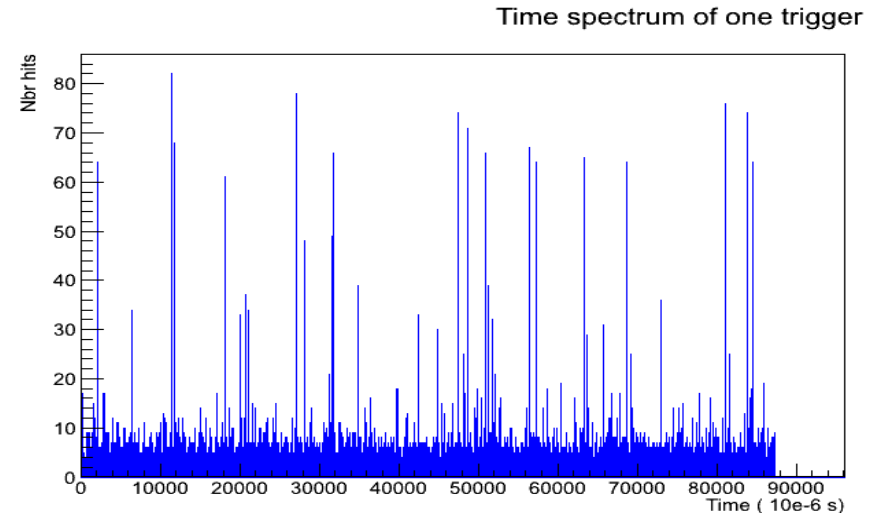Reconstruction
(ILCSoft tools) & Event Display

Arbor.

Root analysis

Data format

- When the acquisition started, all collected informations are saved during **one trigger** (~10ms).
- The physical event are merged in this time window. The acquisition are stopped when the memory of one ASIC is full.
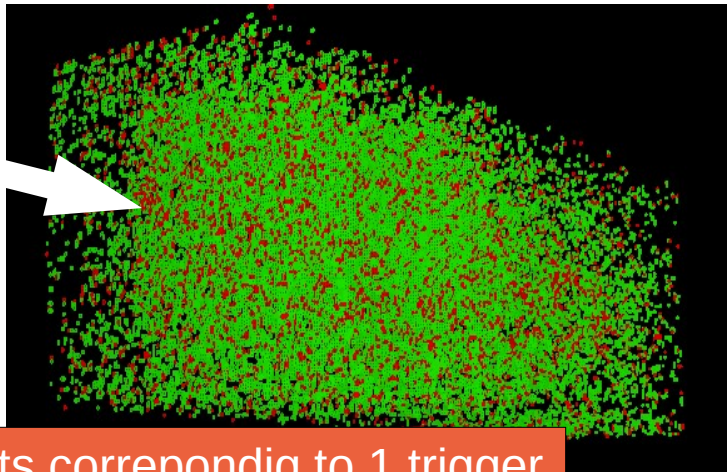
Hits correpondig to 1 trigger

Time spectrum of one trigger

To select the physics events ;
- Use time spectrum of one trigger to find the candidates events.
- Remove the events corresponding to noisy ASICs and DIFs.

Event Builder « Trivent »

Trivent is a Marlin processor used to build and select the physical events in triggers.
This tool is available @ lyosvn.in2p3.fr/repository/ilc/Analyse/Trivent/

- **In fisrt step (Event builder)**: Trivent build the events by slecting the peaks in time spectrum of triggers (with Nhit > Noise_cut) with defined time window –> save the corresponding hits (and other informations) as condidate events.

- **Second step :** Select the condidates with good proprities (remove the noisy events ...) and save the corresponding infomations in new LCIO file.
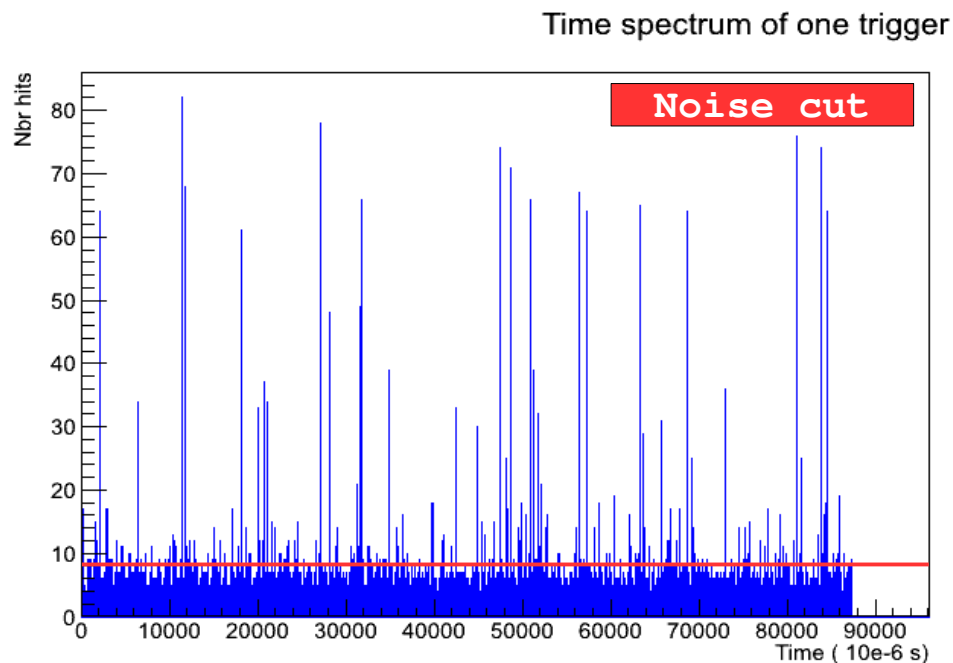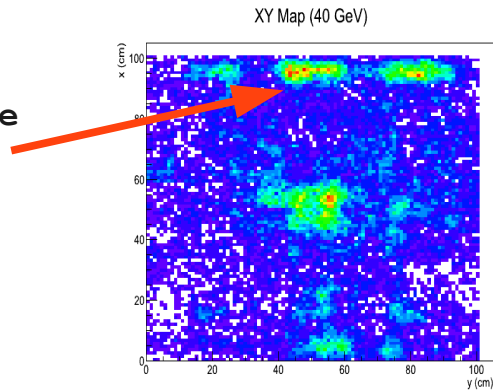

Find a peak with Nhit > Nhit_cut.
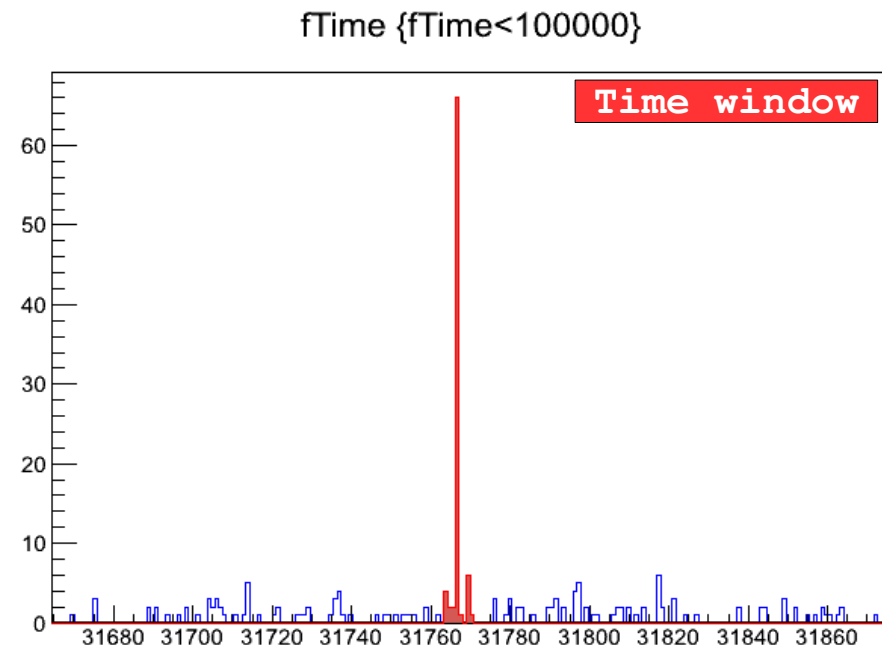
Get informations of corresponding time peaks with oppening window, as condidate events.

Event selection.

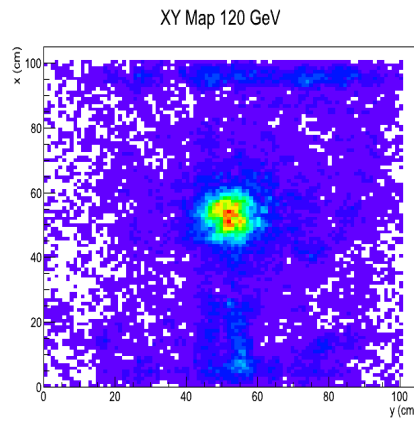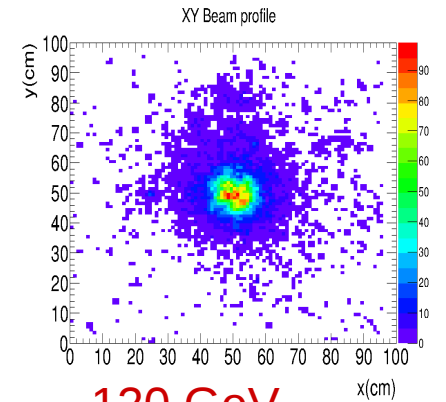- **Noise due to hight voltage and temperature (without cooling).**

XY Map (40 GeV)

40 GeV

XY Map 120 GeV

120 GeV

DRUID, RunNum = 21509, EventNum = 5

Bad event –> Crazy DIF
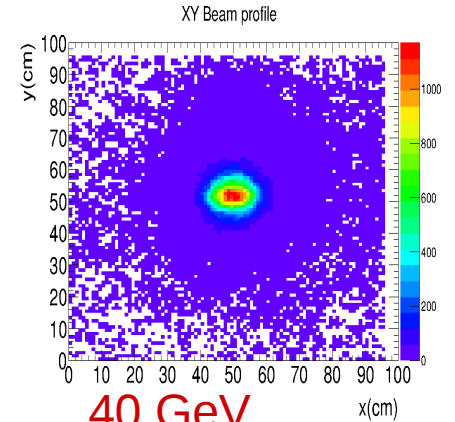
| More than few layers must be hited in time |

XY Beam profile

40 GeV

XY Beam profile

120 GeV

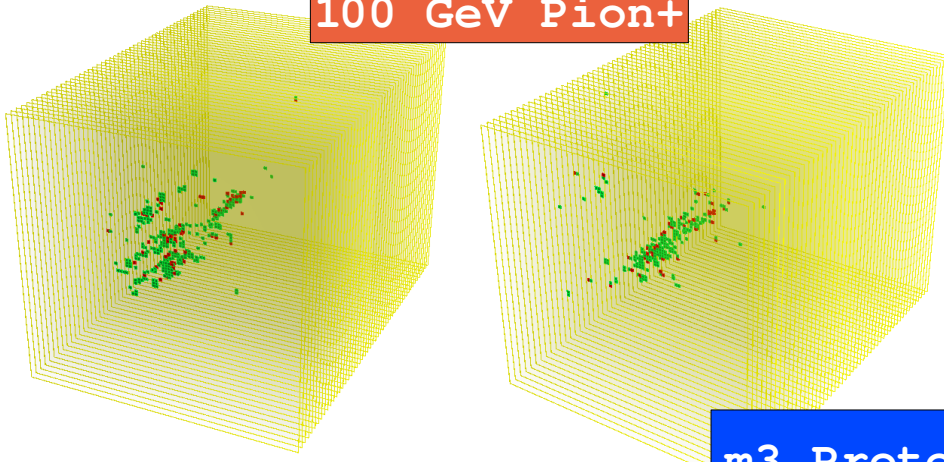- **This cut reduces significantly the noise due to the ASICs & DIFs.**
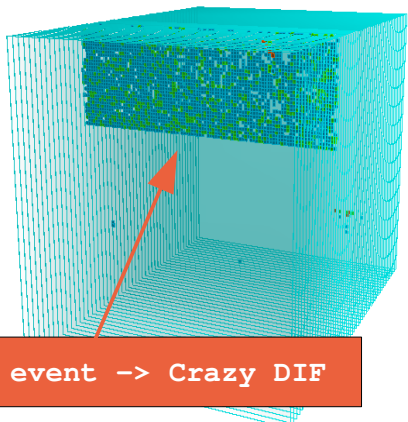
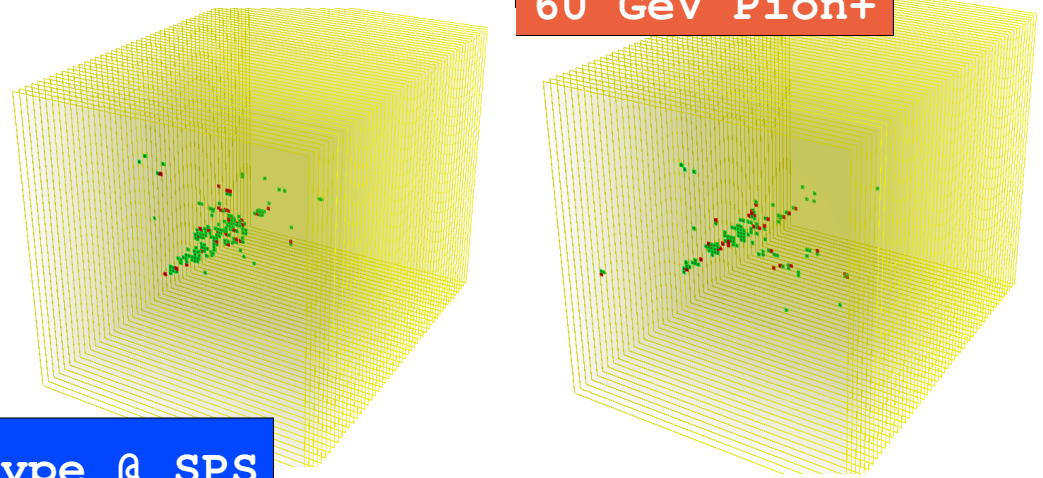- **Example of condidate event removed by the previous cut.**

SDHCAL Event display

Druid is the soft used to display the event here. This tool is included in ILCSoft (For more information contact Manqi Ruan **ruan@llr.in2p3.fr**).
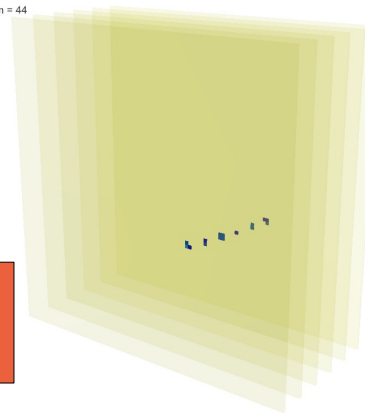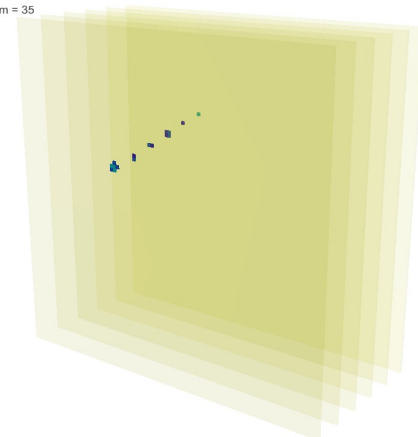

100 GeV Pion+

60 GeV Pion+

m3 Prototype @ SPS

- The color is correspondig to the different thresolds.

EventNum = 44

EventNum = 35

8 GeV Pion+ @ PS
(6 GRPC chambers without absorber)
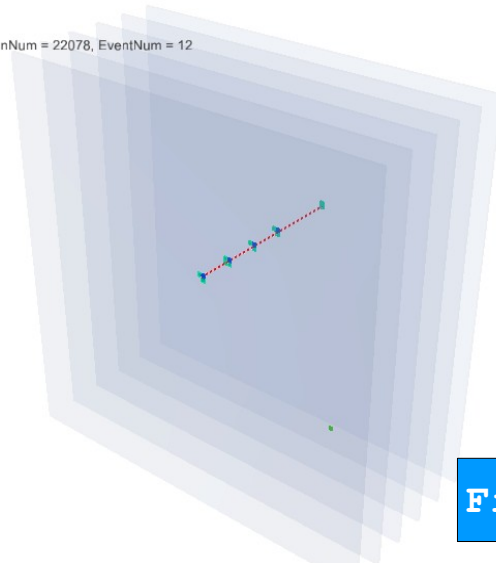
Track reconstruction

- The tracks are reconstructed using linear fit.
- The efficiency of one layer is the propability to find 1 hit at minimum around 5 cm of reconstructed track using other layers.

$$\varepsilon_i = \frac{\sum_{track\ i} (1_{Nhit>0})_i}{N\ track}$$

- Track i = reconstructed track excluding layer i
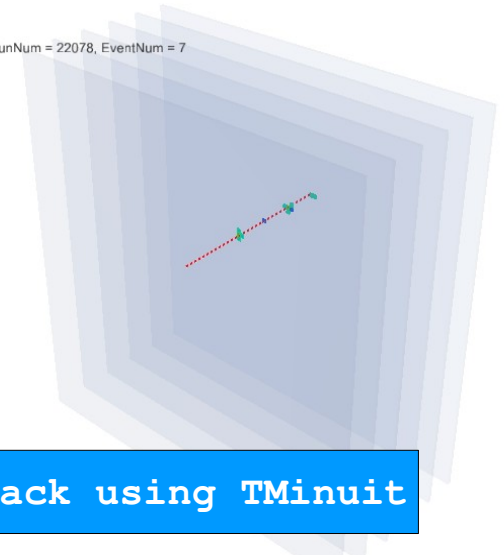- Multiplicity = number of fired pads in each layer.

DRUID, RunNum = 22078, EventNum = 12

, RunNum = 22078, EventNum = 7

Fited track using TMinuit

PRELIMINARY

PRELIMINARY
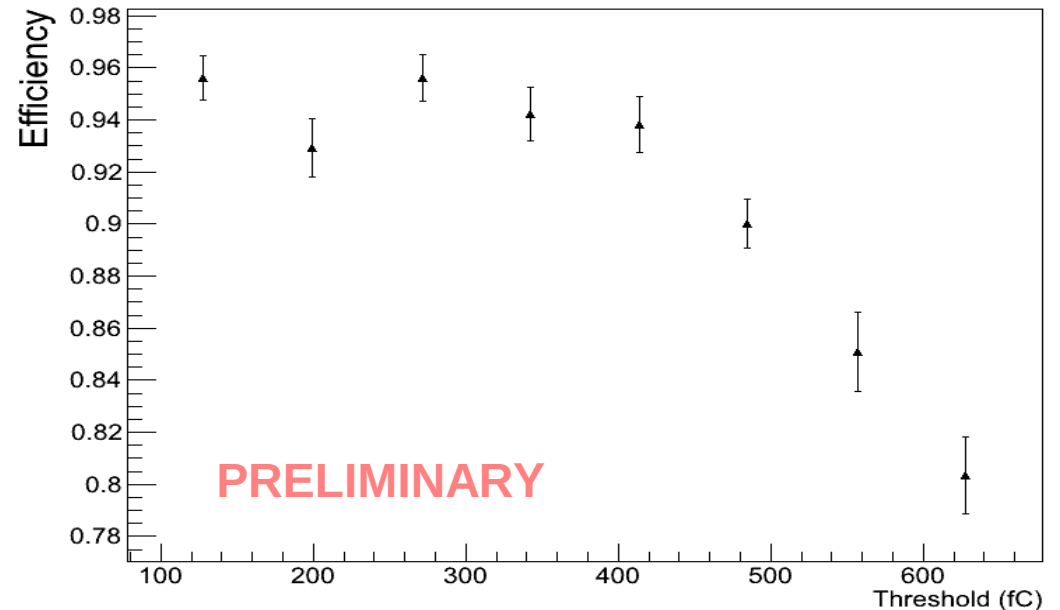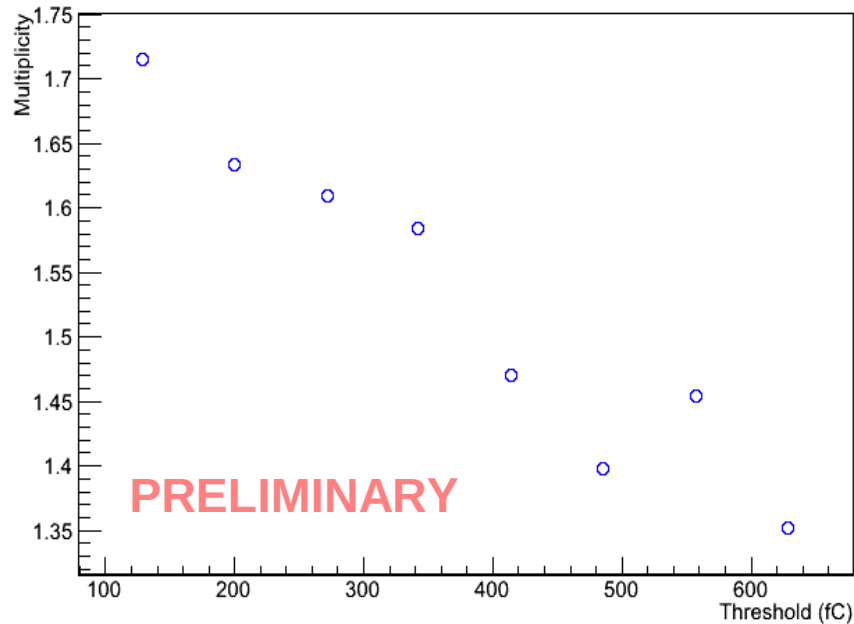
Energy resolution
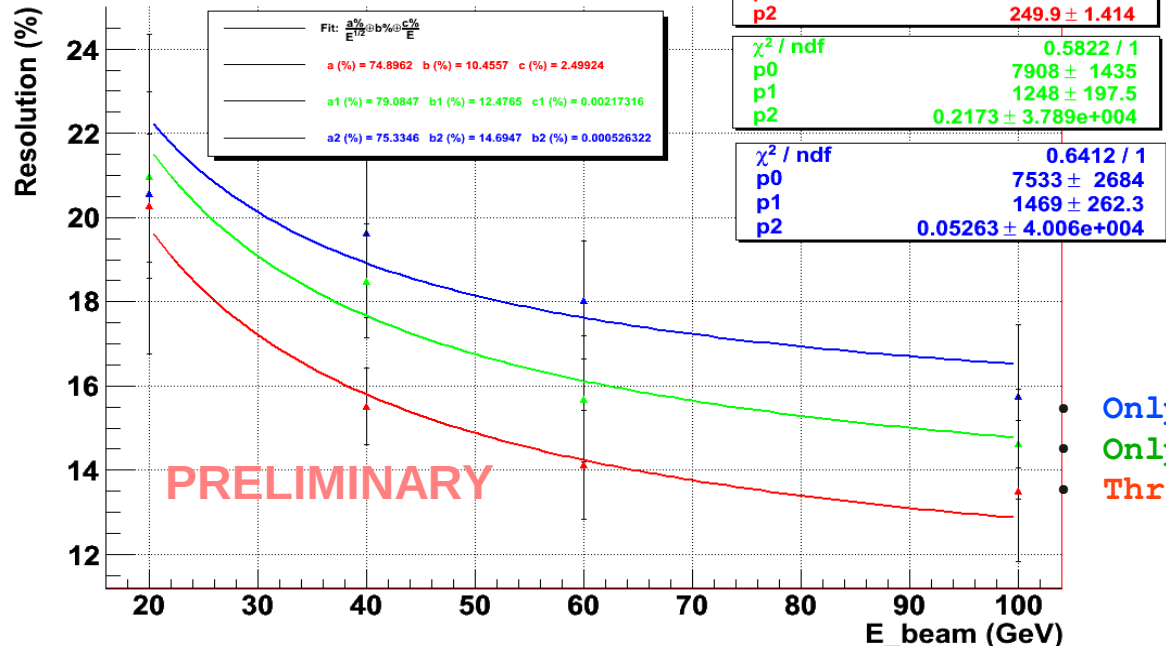
Resolution

- Reconstructed energy is defined by,

$$E_{reco} = A\ N_{thr0}\ +\ B\ N_{thr1}$$

- Energy Resolution ;

$$R = \frac{\sigma(E)}{E} = \frac{a}{\sqrt{E}} \oplus \frac{b}{E} \oplus c$$

- Only Thr1
- Only Thr0
- Thr0 and Thr1

PRELIMINARY

- **Thresolds values:**
  - **Thr0 = 186   fC**
  - **Thr1 = 1   pC**

E(GeV)	Nb events
20	94
40	299
60	194
100	179

01/10/12

CA

Linearity

Fit: Erec=a*Ebeam

Linearity : a=0.94+/-0.007
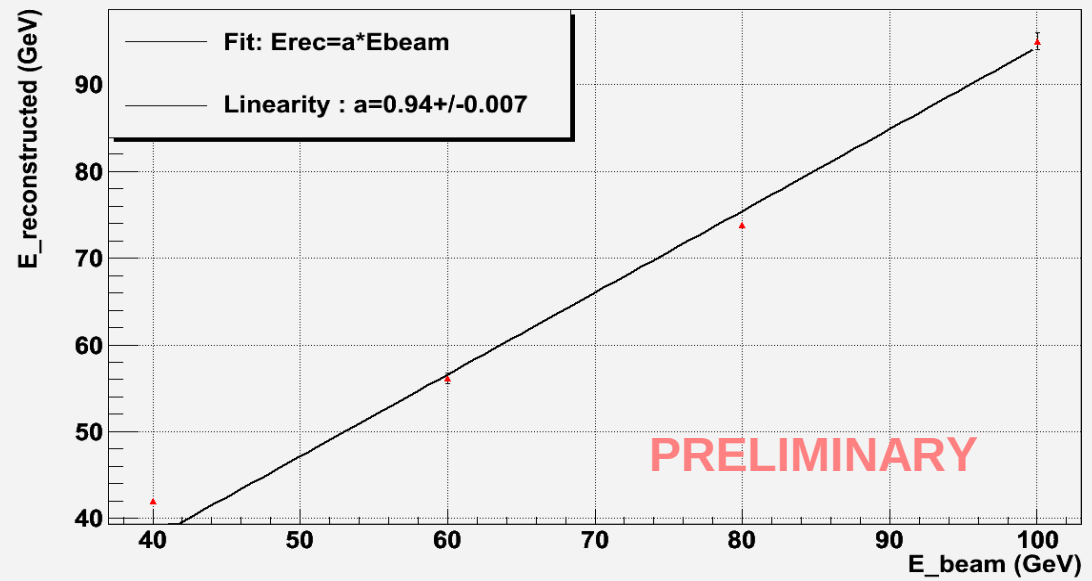
PRELIMINARY

Summary

- **Analysis of TB Data has begun.**
- **Preliminary results have been presented :**
  - Event selection & reconstruction
  - Efficiency and Multiplicity
  - Energy reconstruction & Energy resolution
- **The developement are based in ILCsoft (LCIO, Marlin..)**
  - -> can be adapted and tuned for other groups
- **The SDHCAL group are in tools developement phase and the results are very priliminary.**
  - -> Other studies coming soon.

Backup

USB readout @ SPS in June

- **TB @ SPS in June -> Using the USB readout system because the DAQv2 did't ready.**