ELECTRON RECONSTRUCTION THROUGH OPEMUREC

F. BRUNET – LAPP Annecy – Collaboration meeting

- MC samples
- Reconstruction tool : OpEmuRec – Fedra
- Results
- Outlook

MC production

- Beamfiles from ccali (Lyon)
- MC Production through OpRelease 3.2 SL5 software
  - OpSim
  - OpDigit : 100% efficiency, no disalignment between plates
  - OpEmuIO : 100% & different other efficiencies
  - OpEmuRec : Fedra reconstruction & analysis
- Statistics : electron 1000 events
  gamma 1000 events

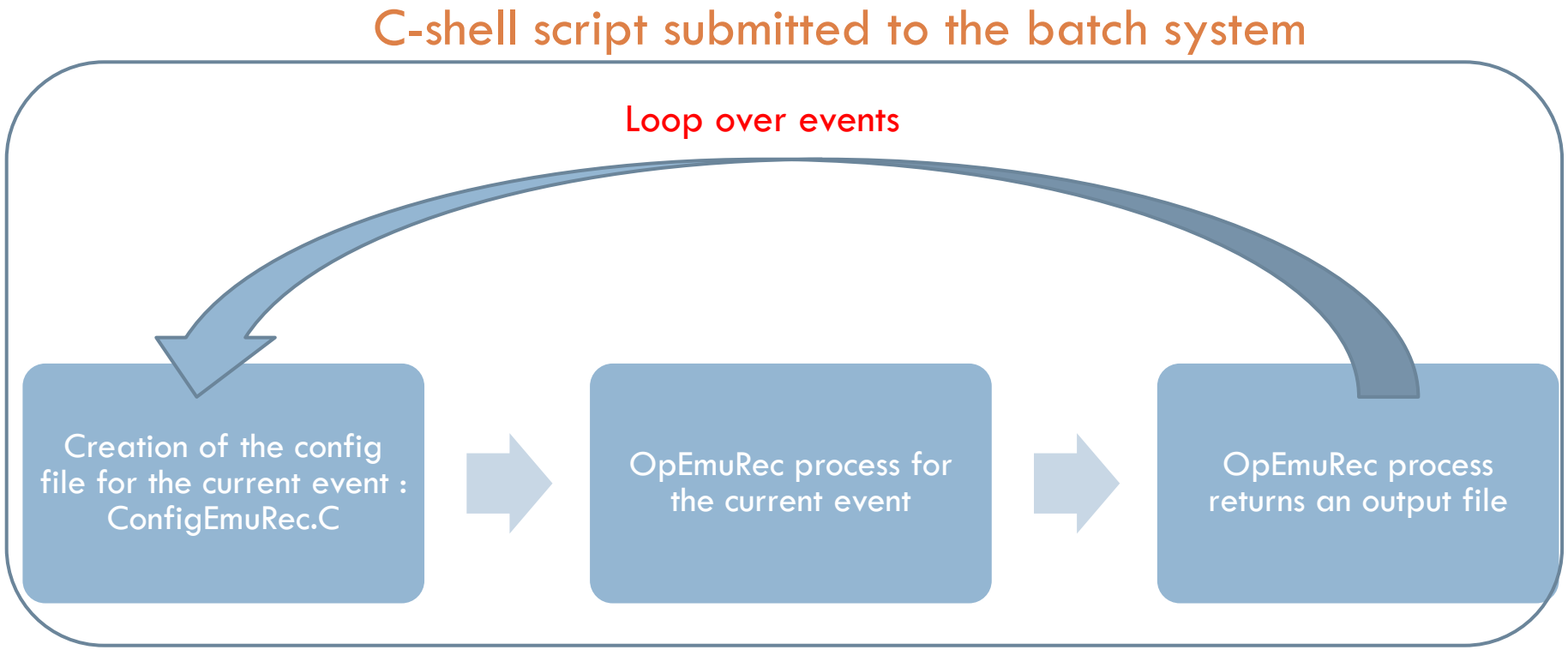
Reconstruction tool

- OpEmuRec :
  - Fedra linking
  - Fedra alignment : not necessary for MC but useful for software robustness
  - Fedra tracking : nsegmin=2, ngap=3
  - Fedra Vertexing : ProbMin=0.0001,dz=3000μm, IPmax=100μm
  - Fedra showering : nplatemin=4, ngap=3, cone 0.020 mrd & 800 μm

Use of OpEmuRec

- OpEmuRec v1 (SL5)
- OpEmuRec designed for event-per-event processing
- Need of « external » loop over events → C-shell script for instance

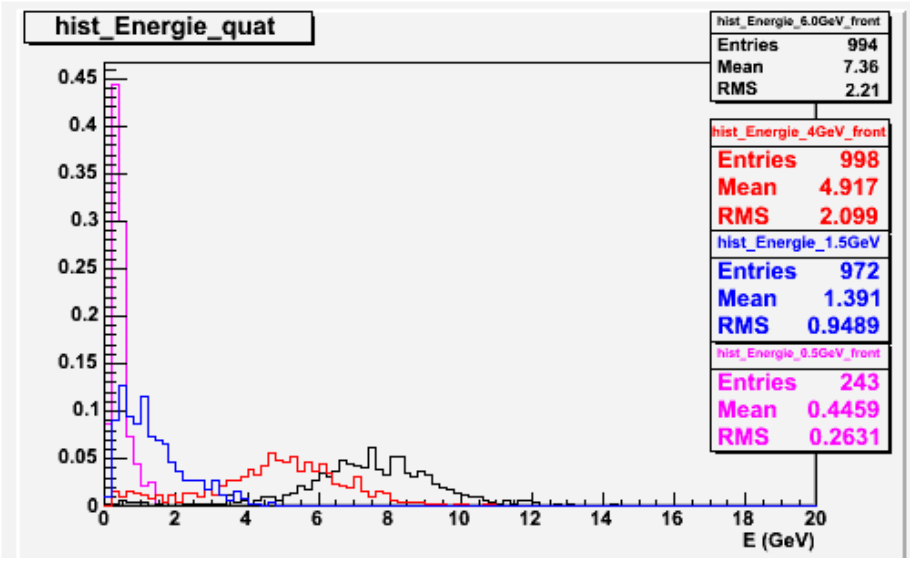
Fedra/SySal processes in OpEmuRec : Linking, Alignment, Tracking, Vertexing & Showering

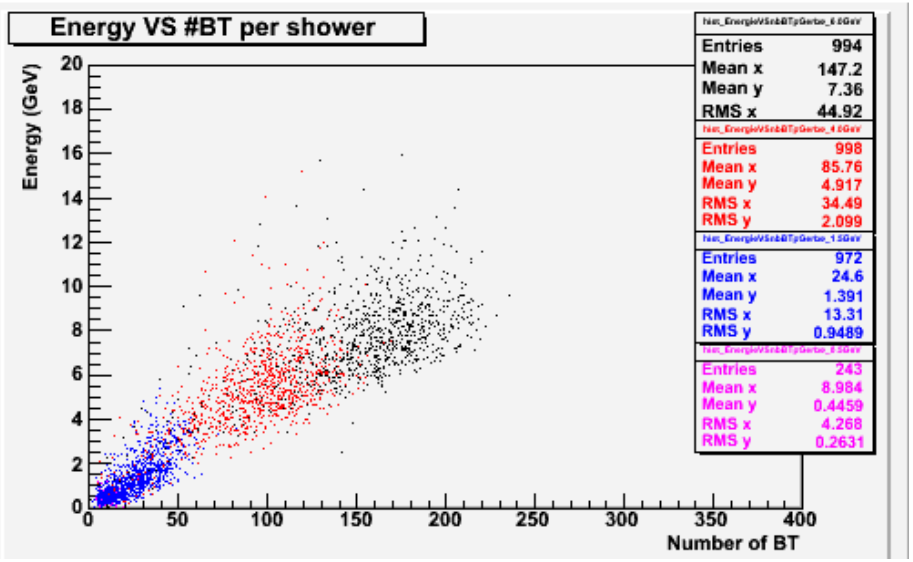


Simulation parameters

- 1000 electrons, gammas
- 10, 6, 4, 1.5 & 0.5 GeV Energy
- Interaction point «FRONT » : before the brick in the middle of the transverse plane
- Propagation through the whole brick : 57 plates
- No incident angle

Electron reconstructed





MC Energy	EnergyMean	EnergyRMS
10 GeV	11.7	2.4 (20%)
6 GeV	7.4	2.2 (30%)
4 GeV	4.9	2.1 (43%)
1.5 GeV	1.4	0.9 (65%)
0.5 GeV	0.44	0.26 (60%)

Electron reconstructed

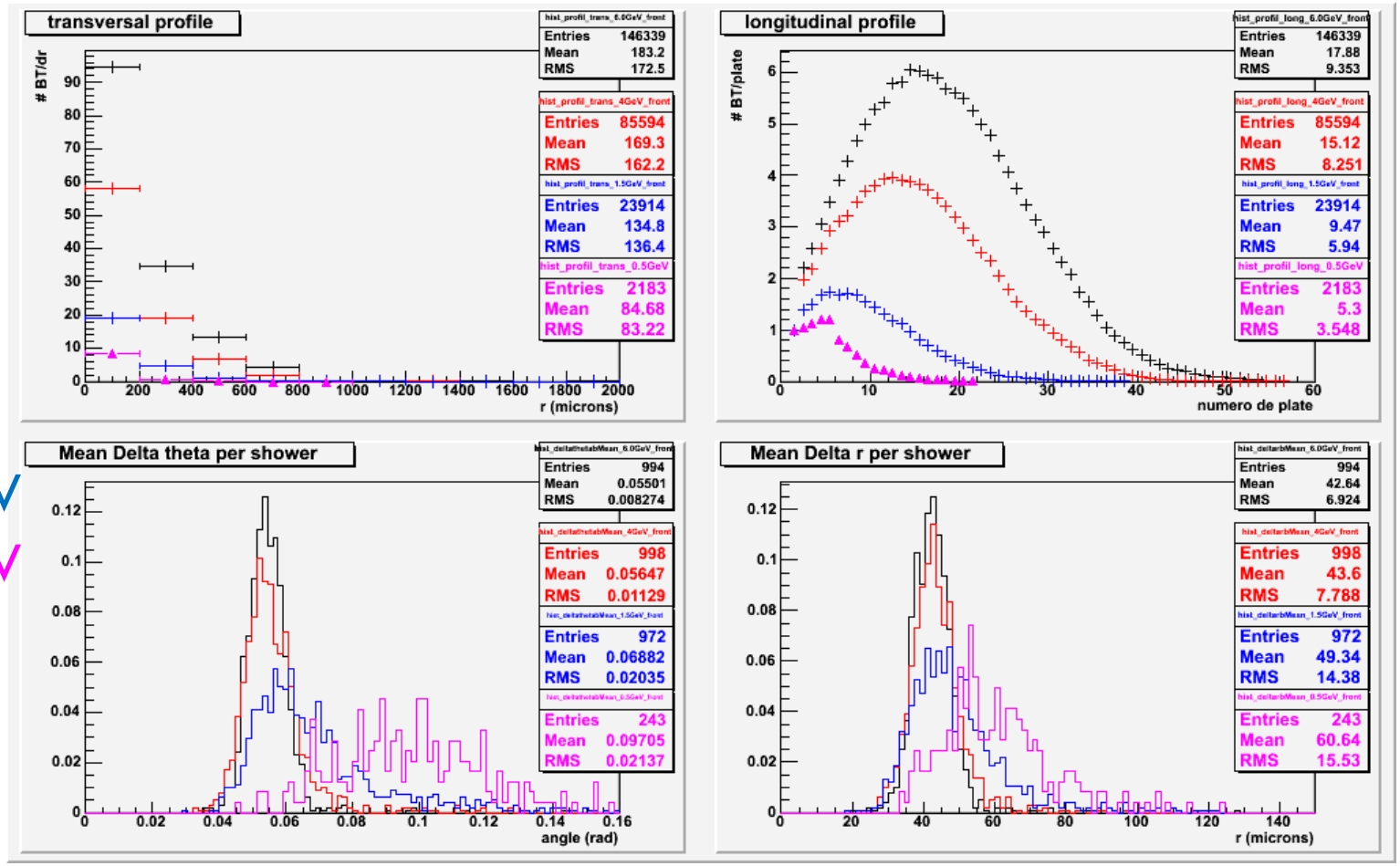
MC True :

E_{MC} = 6 GeV

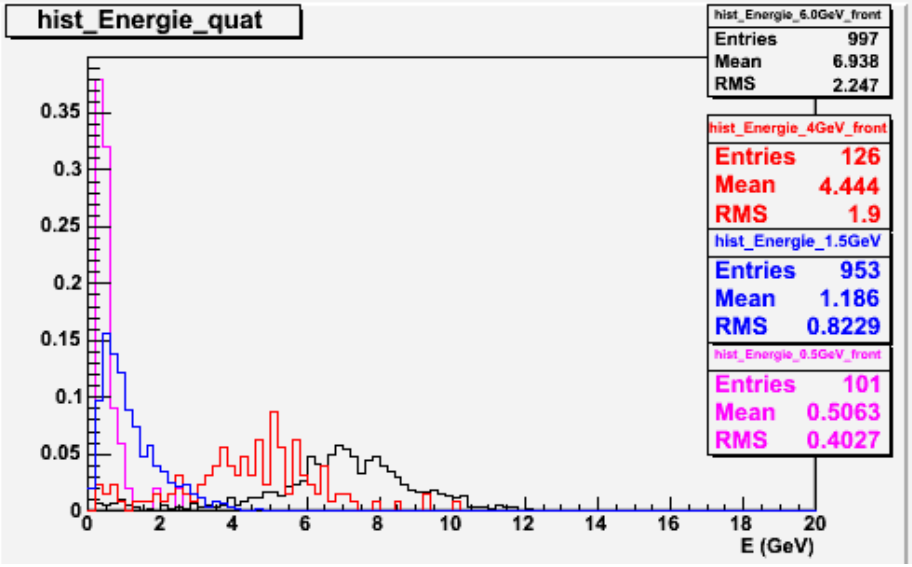
E_{MC} = 4 GeV

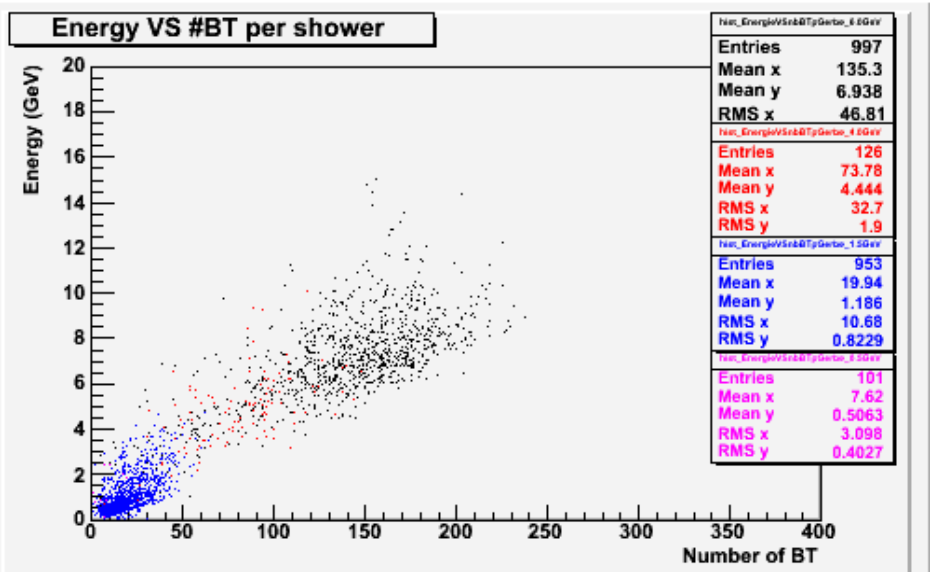
E_{MC} =1.5 GeV

E_{MC} =0.5 GeV



Gamma reconstructed





MC energy	Mean Energy	RMS Energy
6 GeV	6.9	2.2 (32%)
4 GeV	4.4	1.9 (43%)
1.5 GeV	1.2	0.8 (67%)
0.5 GeV	0.64	0.55 (85%)

Gamma reconstructed

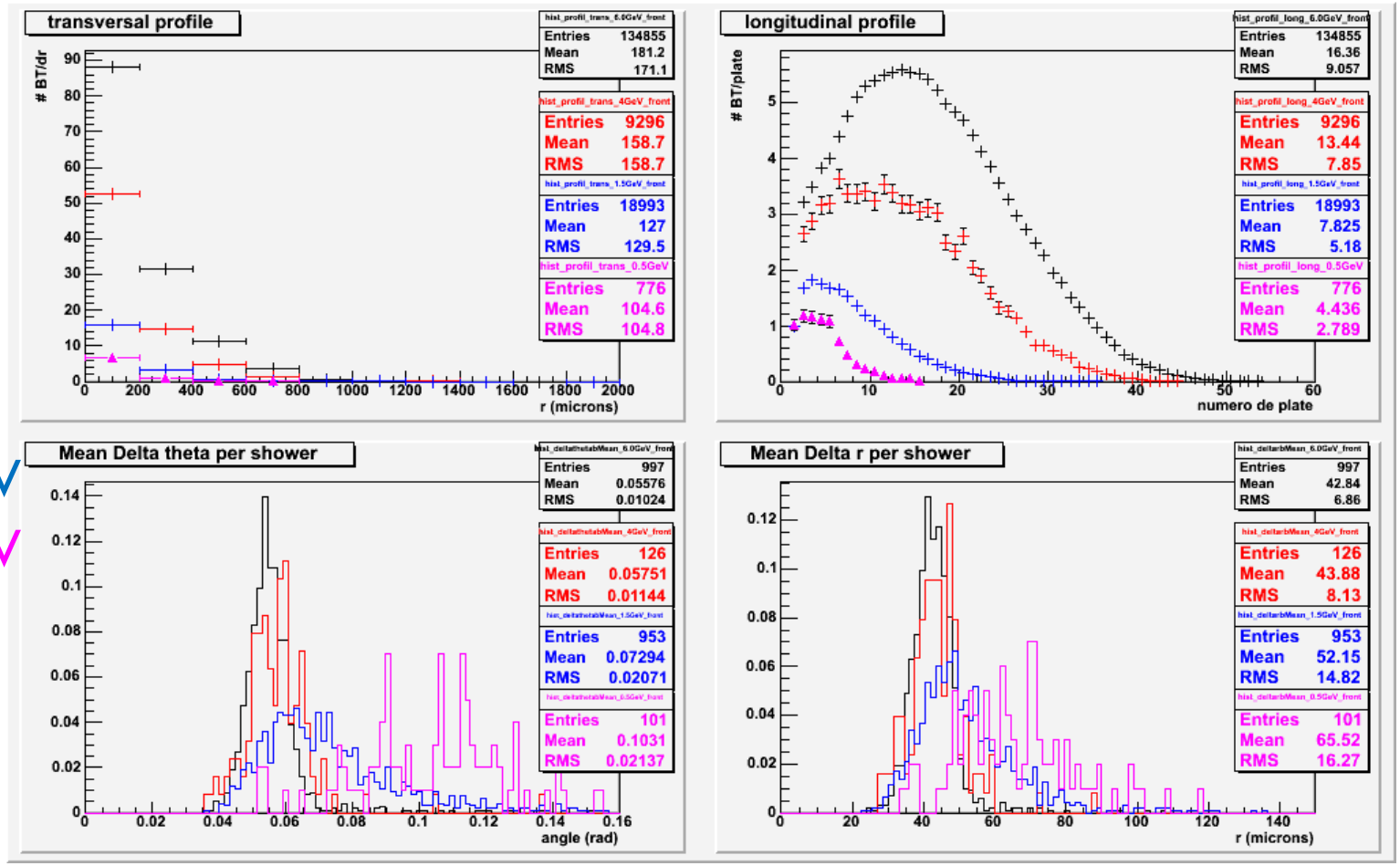
MC True :

E_{MC} = 6 GeV

E_{MC} = 4 GeV

E_{MC} =1.5 GeV

E_{MC} =0.5 GeV



Outlook : Electron analysis

- **Signal : $\nu_\mu \leftrightarrow \nu_\tau$: ν_τ^{CC} interaction → τ + hadronic shower & τ → e$\nu\nu$**
- Background : processes which mimick tau decay & give an electron
  - ν_μ interaction → charm particles which may decay into electron as kink-like event
  - ν_e^{CC} interaction → e which is going to scatter as a kink-like event
  - $\nu_{\mu,e}$ beam : $\nu_{e,\mu}^{NC}$ interaction → pion exchange process → π^0
- Signal $\nu_\mu \leftrightarrow \nu_e$: ν_e^{CC} interaction → **e** + hadronic shower
- Background : processes which contain electrons
  - ν_e beam: ν_e^{CC} interaction → e + hadronic shower
  - **ν_τ from ν_μ beam : ν_τ^{CC} interaction → τ + hadronic shower & τ → e$\nu\nu$**
  - $\nu_{\mu,e}$ beam : $\nu_{e,\mu}^{NC}$ interaction → ν + hadronic shower with π^0 & $\pi^0 \rightarrow \gamma\gamma$
  - ν_μ beam : ν_μ^{CC} interaction → μ missed → ν_μ^{NC} interaction

→ Analysis of $\tau \rightarrow e$ channel

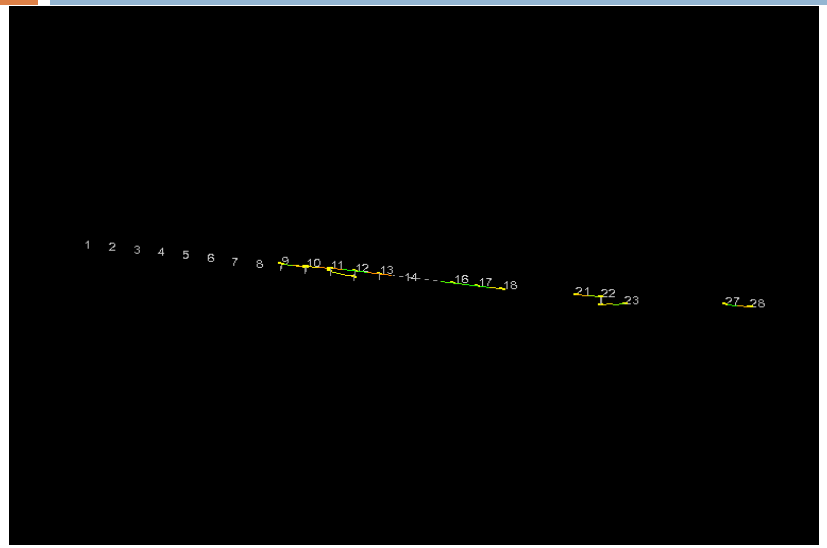
by reconstructing MC samples through OpEmuRec to take into account detector effects & to analyse MC samples as data

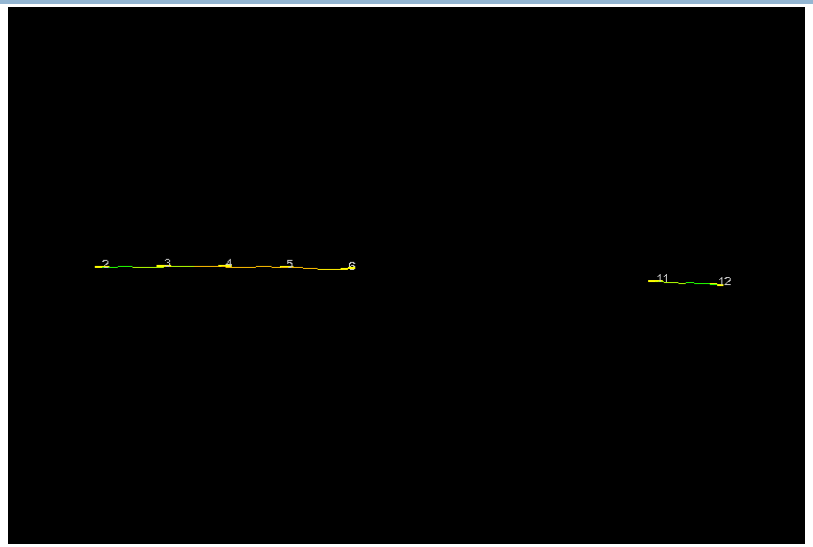
Outlook

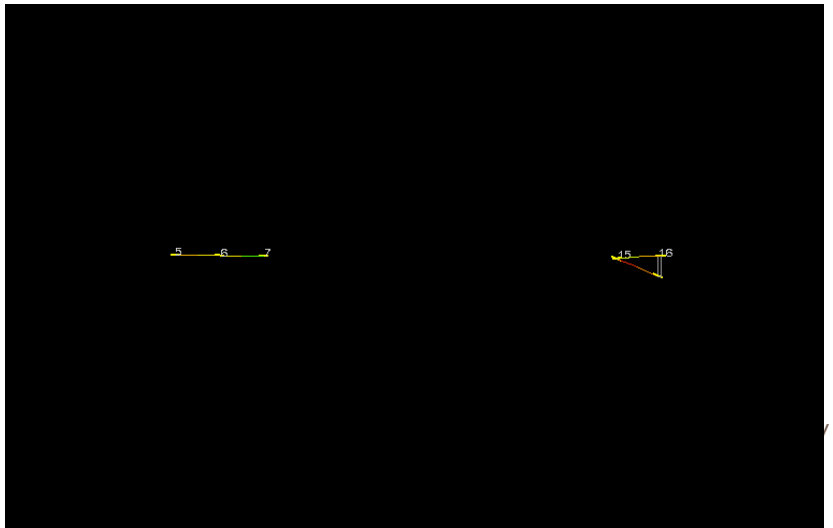
- Electron reconstruction is working through OpEmuRec on MC samples
- Work is in progress about reconstruction of data
- Analysis of electron detection
- In parallel electron/gamma reconstruction tool for low energy < 2 GeV → electron working group

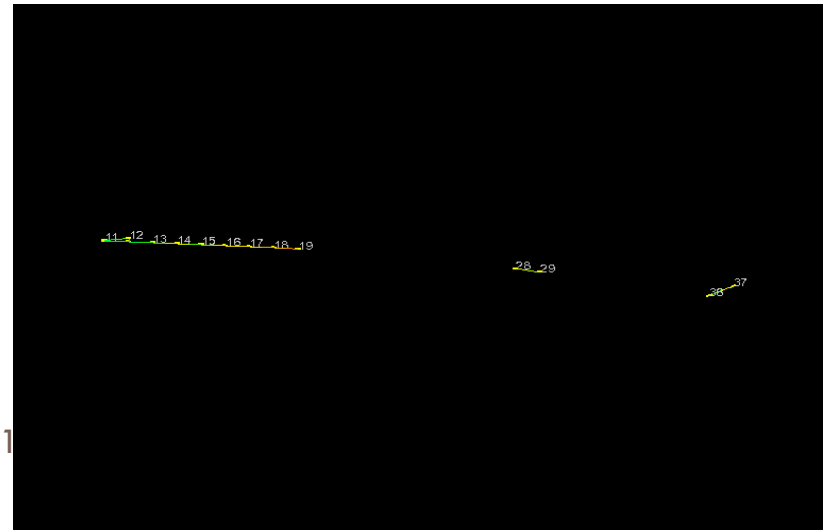
Back up slides

Gamma showers 0.5 GeV : Examples





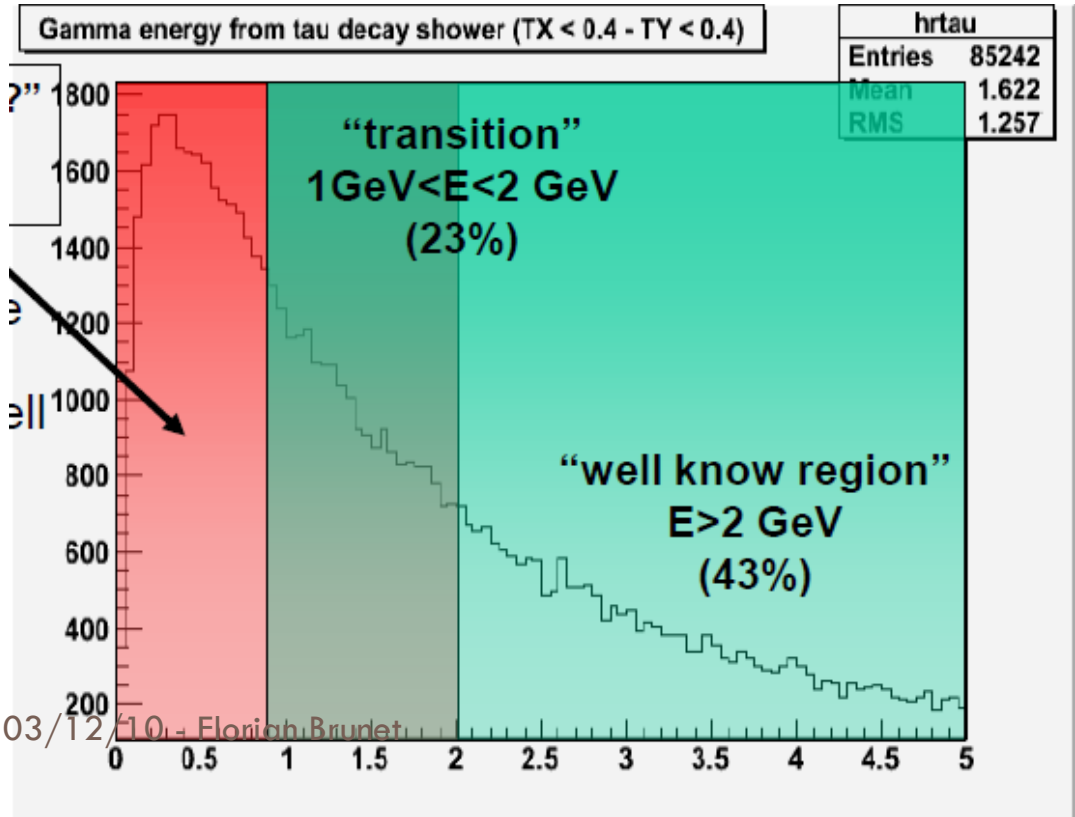




- Why do we need a good energy reconstruction of low energy gammas ?

$\tau \rightarrow h$: 43% of γ have E>2 GeV & 83% E>0.5 GeV

Idea : PMCS on the « main » track



Analysis variables

- **Angle** between neutrino and electron from CC interaction
- **Multiplicity**
- **Missing p_T**
- **p_T & energy** of primary electrons
- **Visible energy**