IFR Fast Simulation Status

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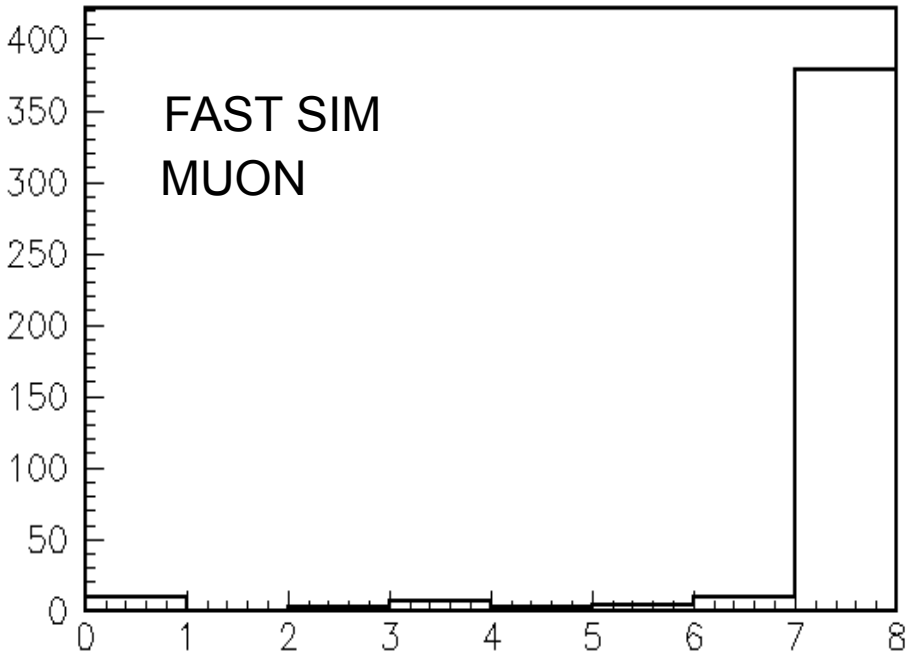
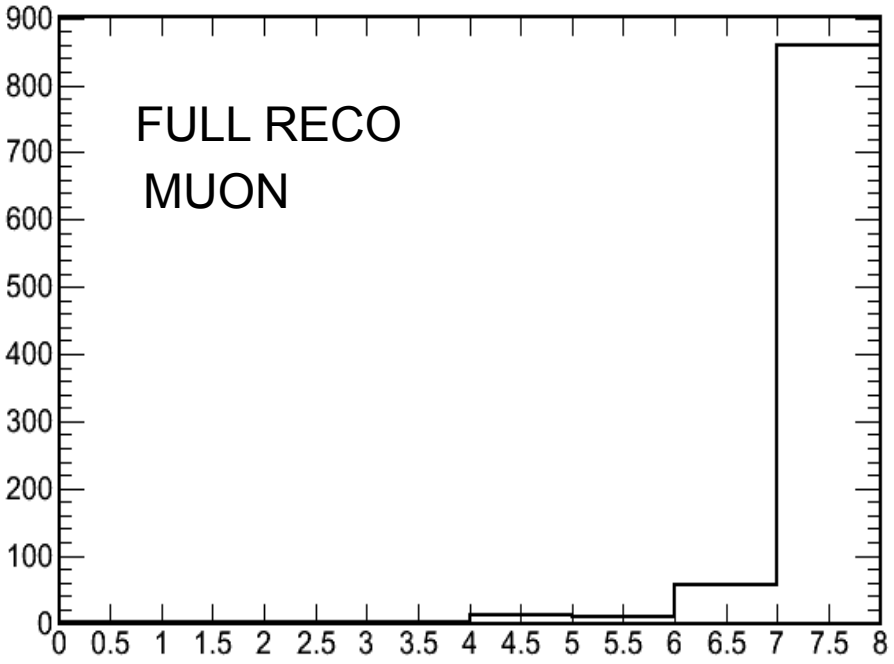
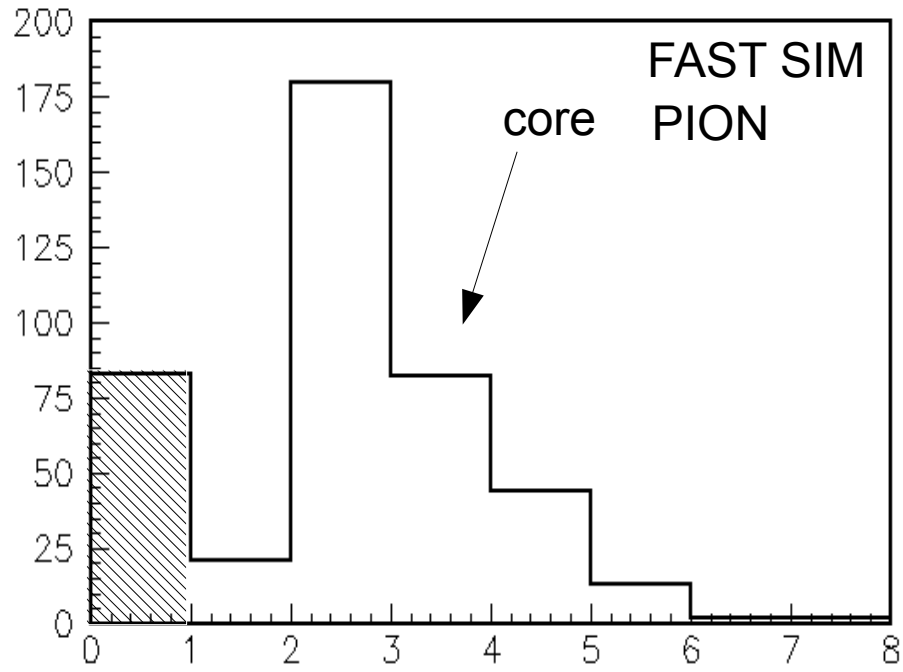
Fast .vs. Full simulation

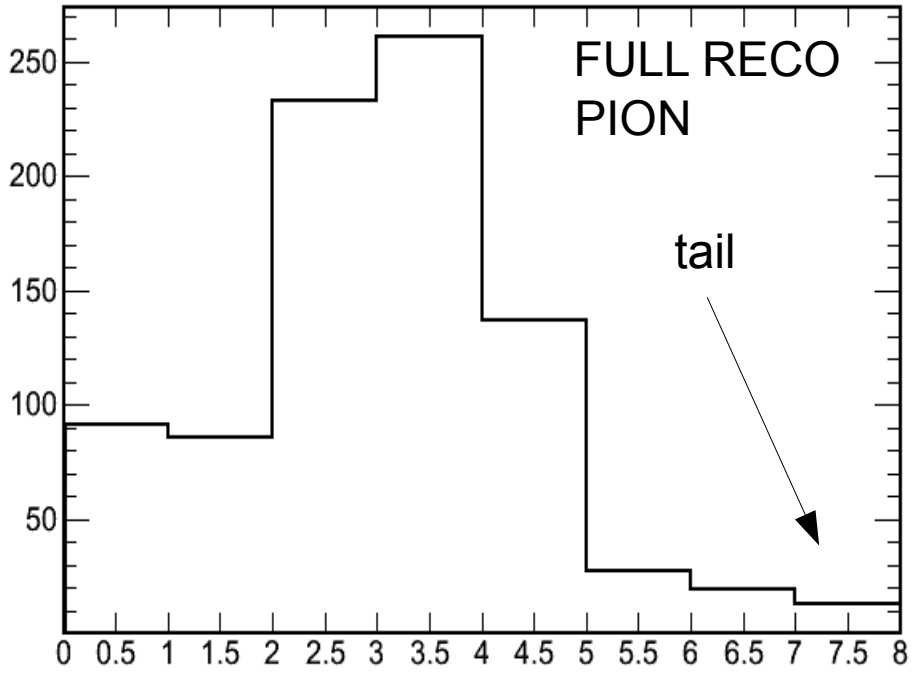
- *Full simulation reconstruction now working: start comparison/tuning of the Fast MC*
  - *Full: single particles*
    - *Configuration C2 (CDR)*
  - *Fast: muons/pions from B->4μ, 4π decays*
- *Caveats: in FastSim the reconstruction still not finished*
  - *Rough Ifr track fit of Ifr clusters implemented and available*
  - *next future use the code developed for IFR detector optimization*
- *Some preliminary comparisons in the next slides*

Fast .vs. Full simulation N Last Layer 1.8<p<2.2 GeV

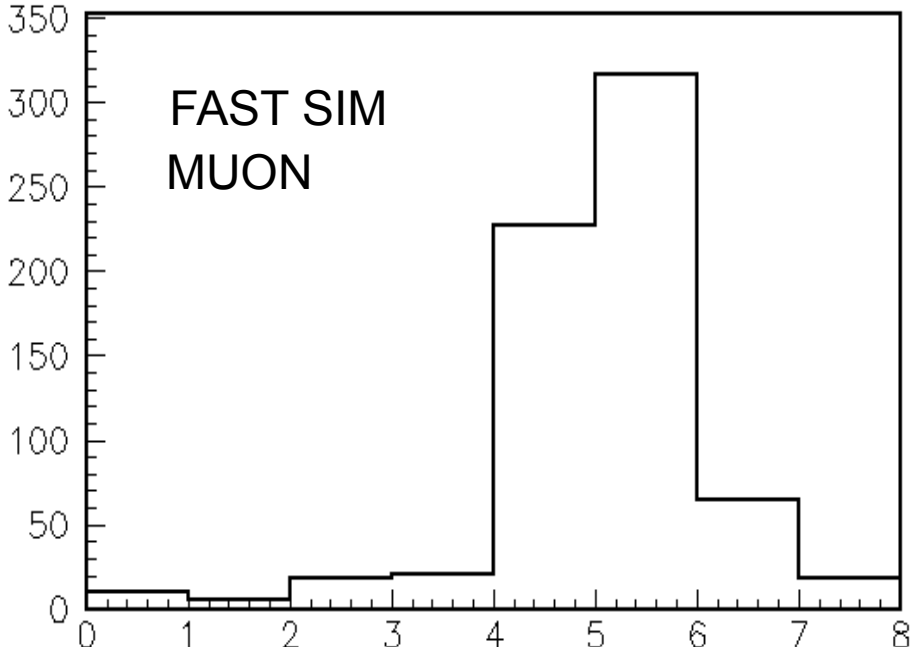


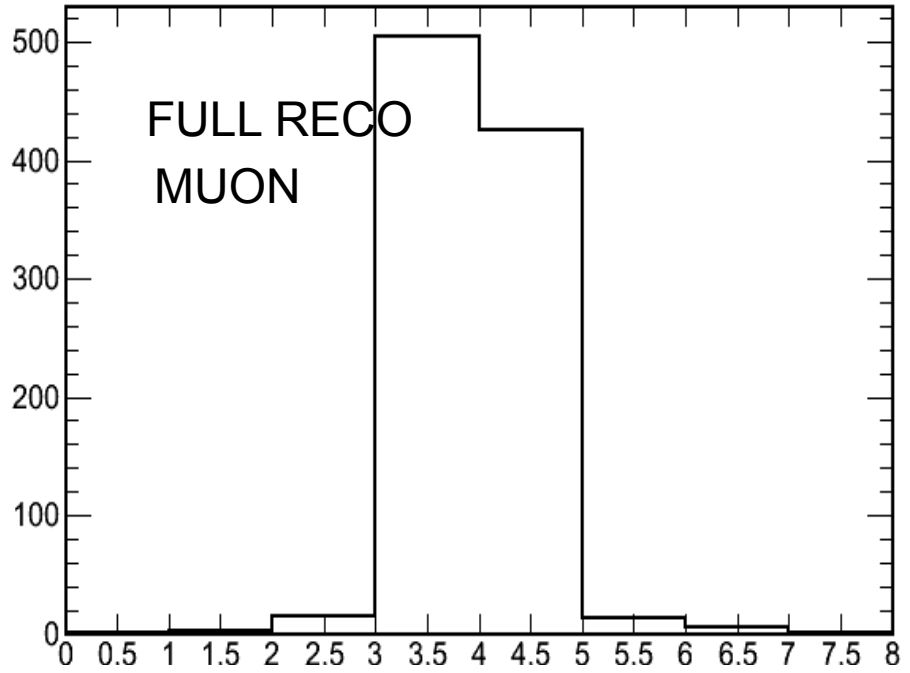


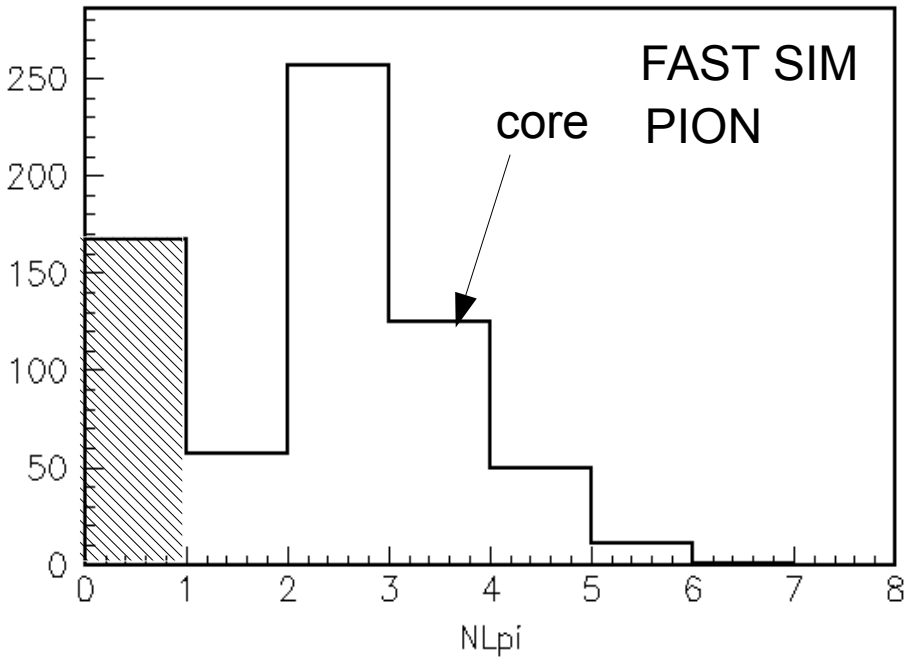


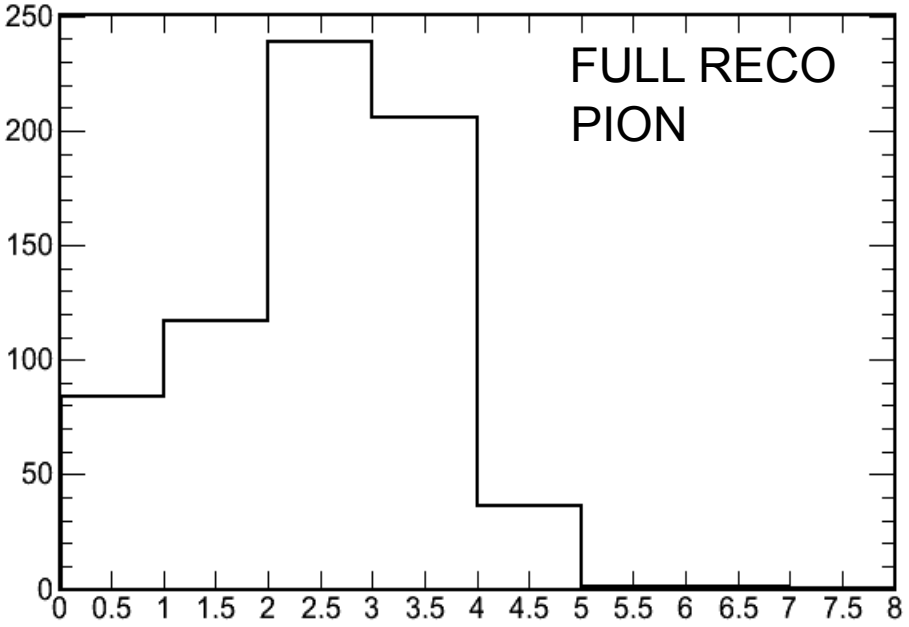


Fast .vs. Full simulation N Last Layer 0.8<p<1.2 GeV

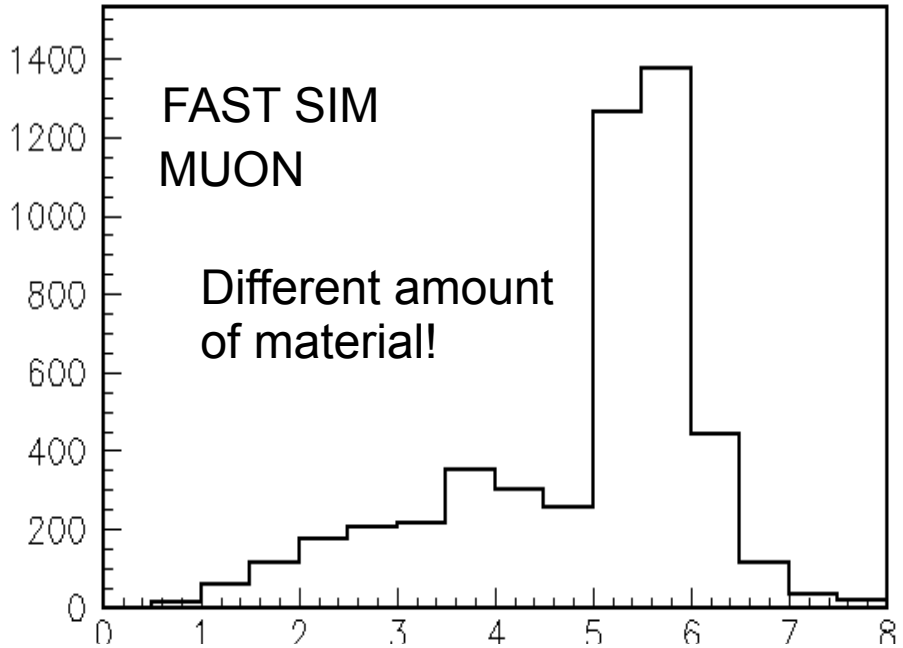


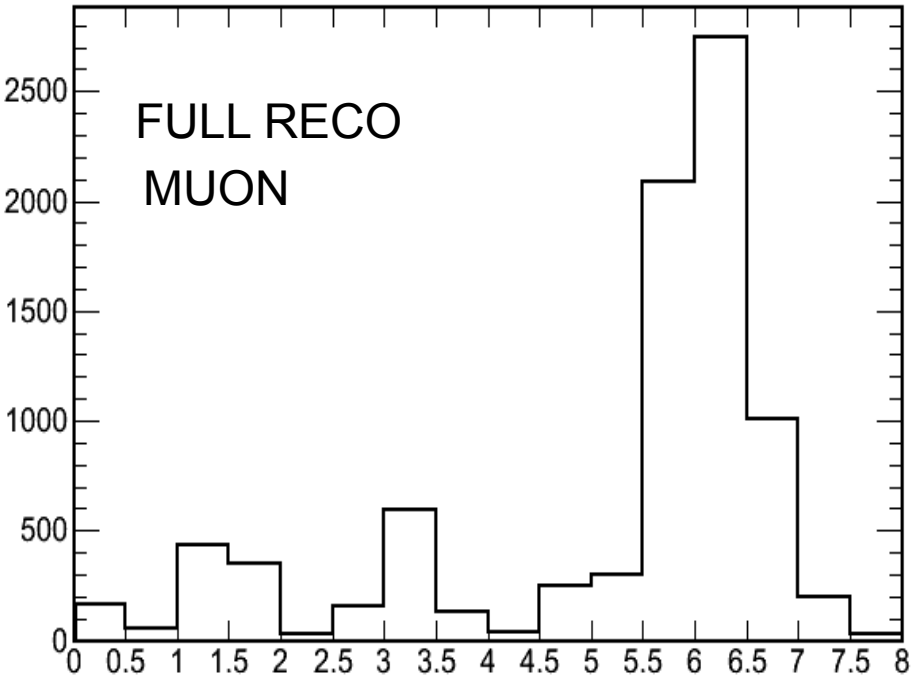


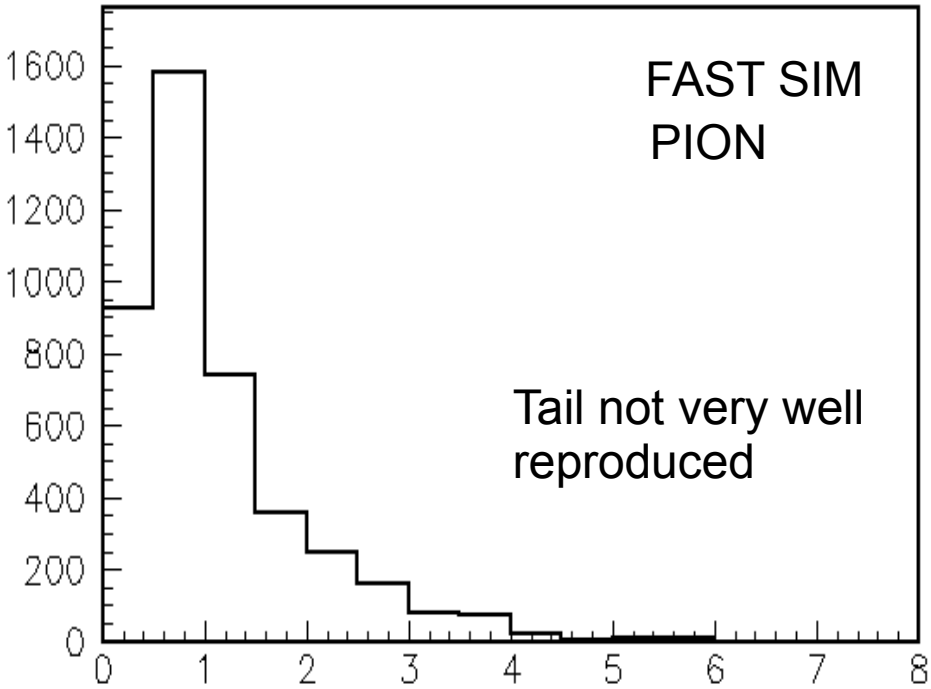


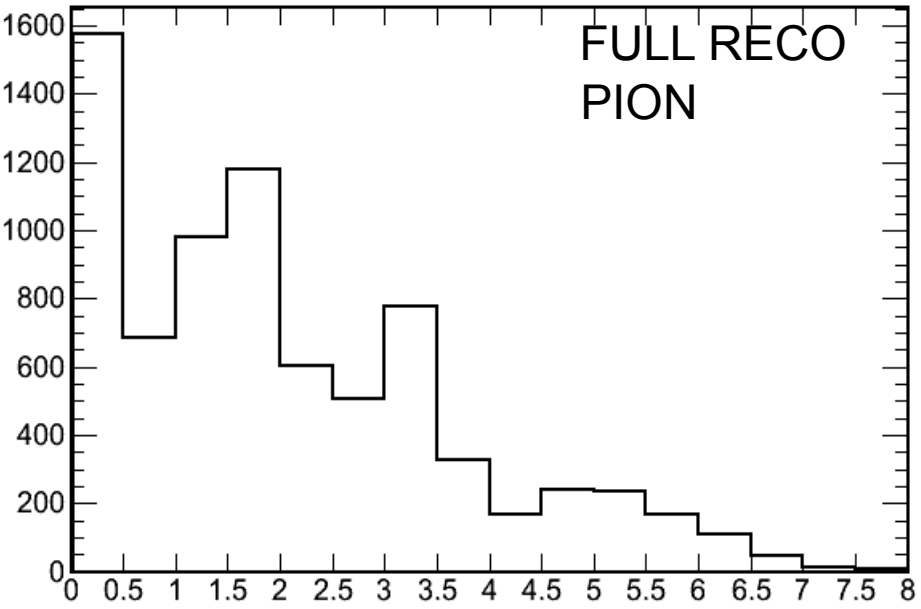


Fast .vs. Full simulation N Interaction Lenght

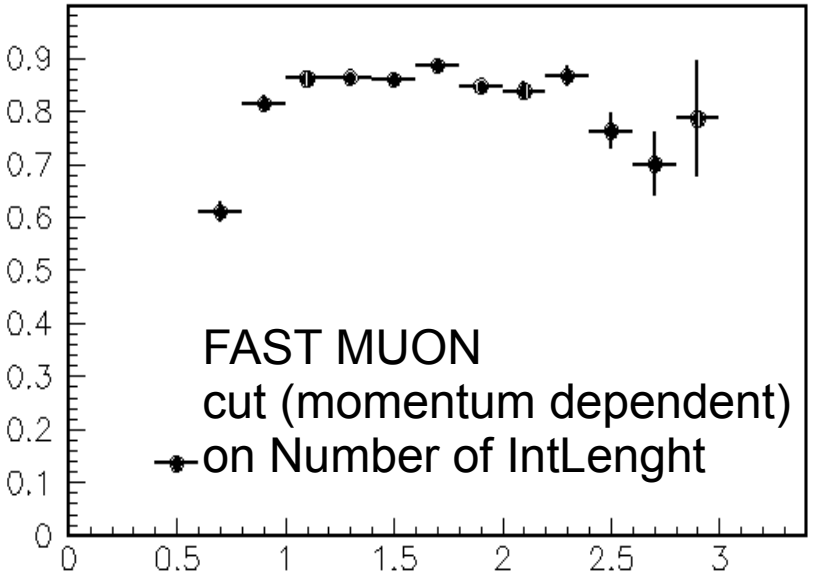


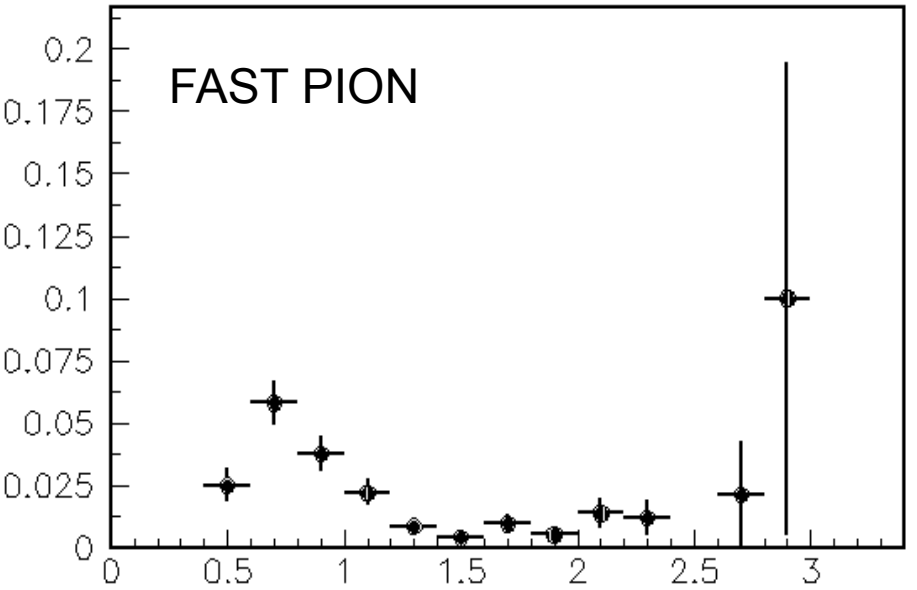


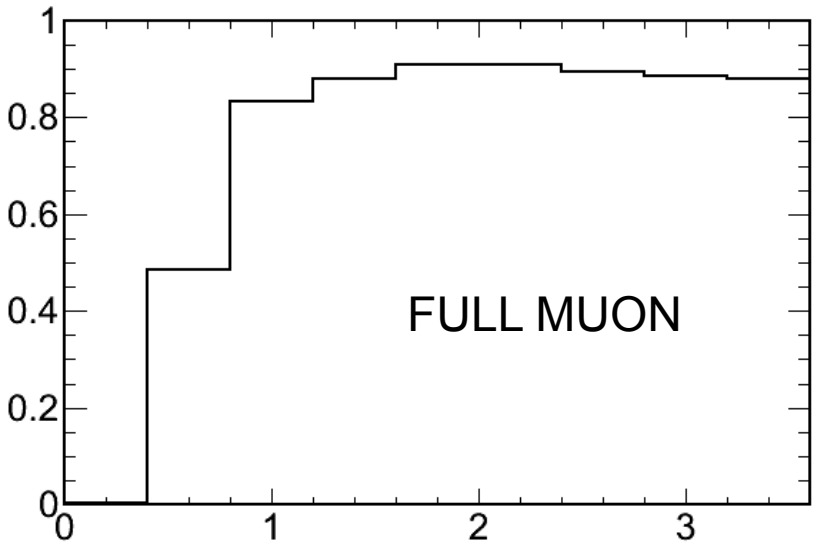


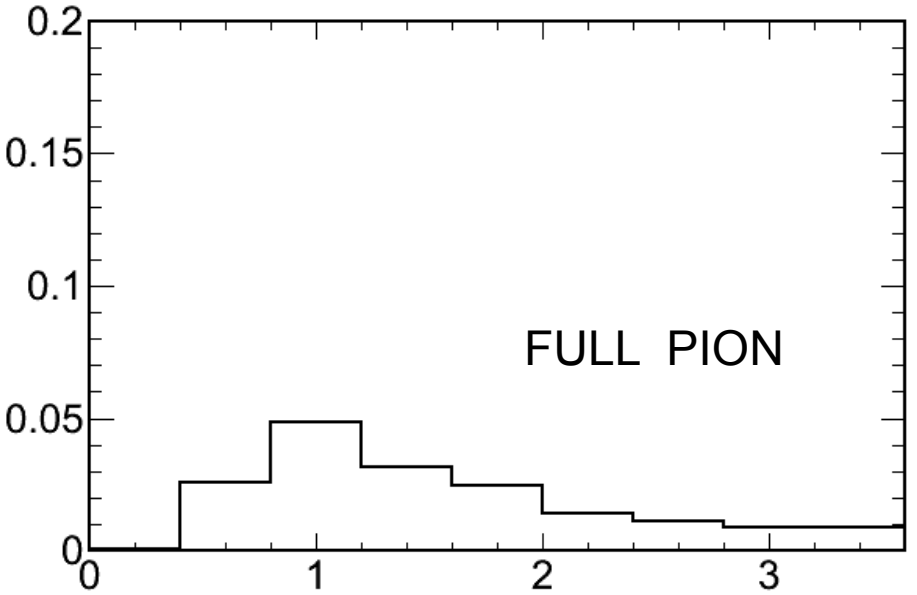


Efficiency


FAST MUON
cut (momentum dependent)
on Number of IntLenght


FAST PION


FULL MUON


FULL PION

To Do List

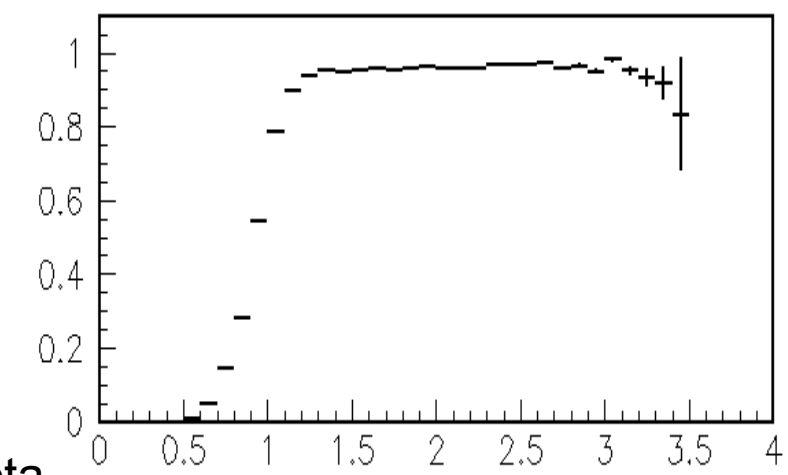
- *Tune the pion hadronic interactions according to FullSim*
  - *Hit multiplicity per layer still not implemented*
- *Finish to implement reconstruction in FastSim*
  - *Reuse code developed for the Ifr detector optimization*
- *Implement a muon PID selector: performace guided by the FullSim studies*
- *Implement the background superposition*

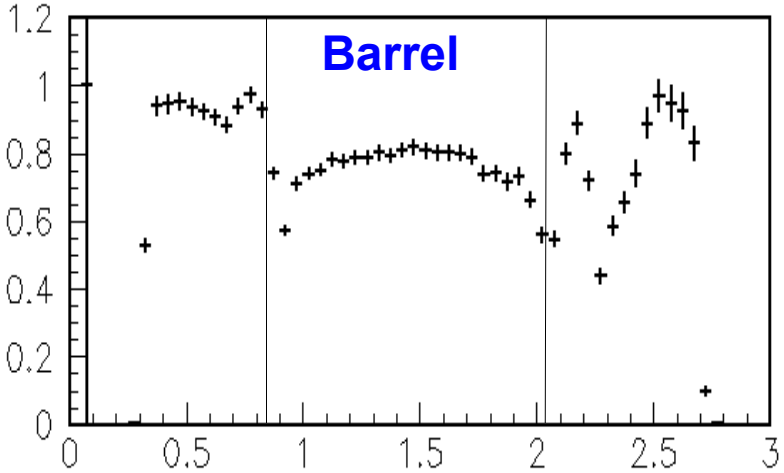
BACKUP SLIDES

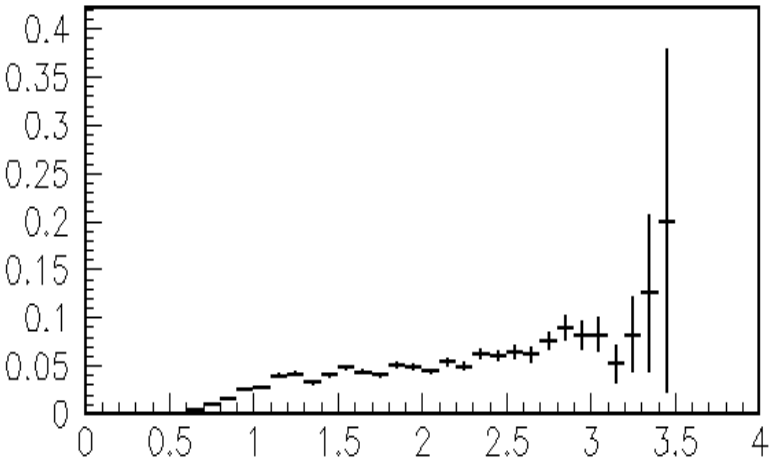
Performances

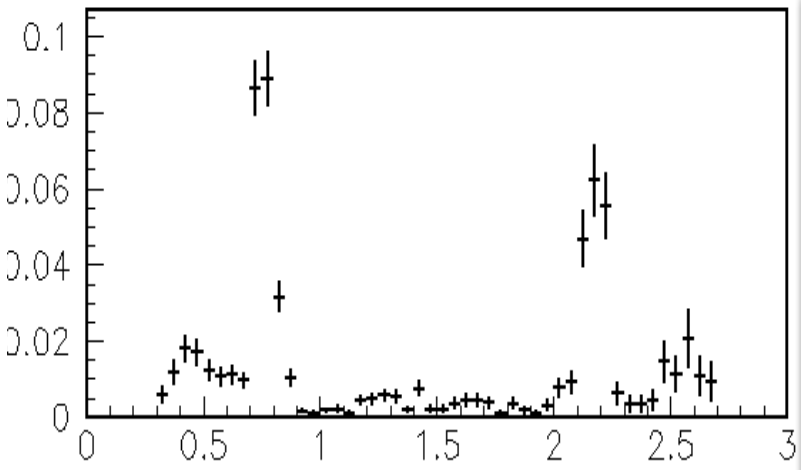
- *mu/pi separation based on the # of traversed layers in the Iron: N>5 Layers*

Muon efficiency too optimistic, but the general features (shape of the efficiency versus theta and p) are in reasonable good agreement with the expectation



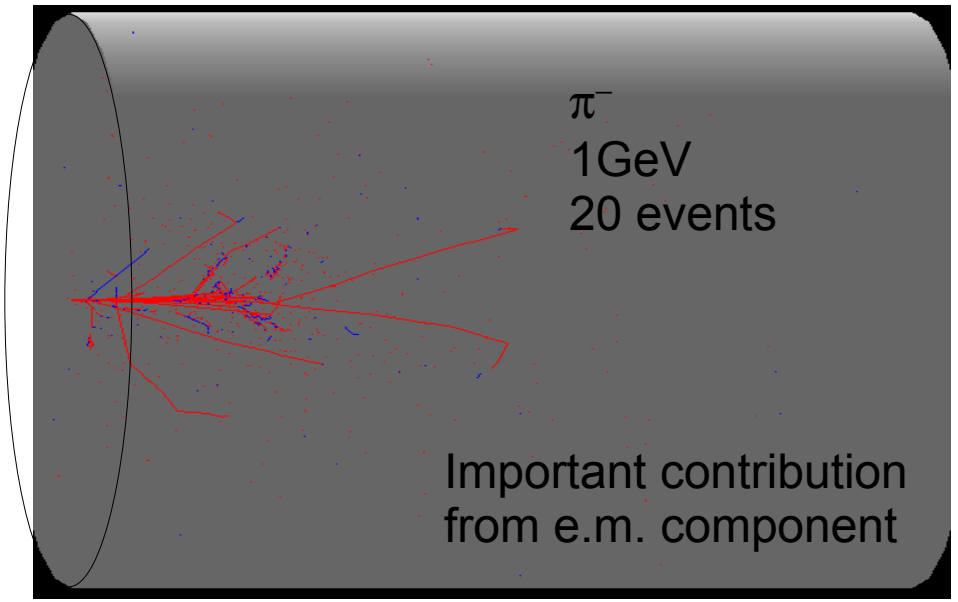


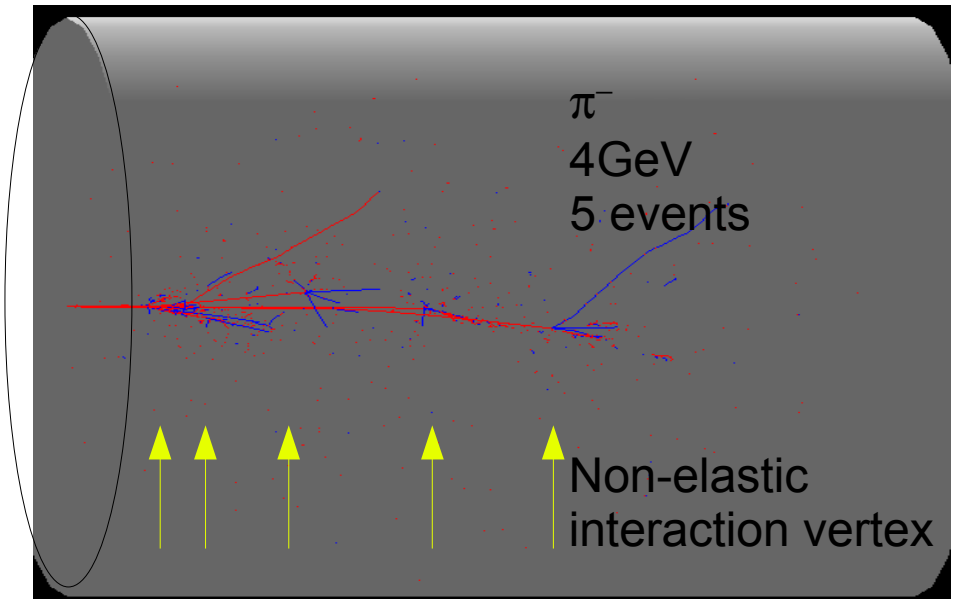




Studies of showers with Geant4

- *Cylinder of Iron (omogeneous material)*
  - *Use the QGSP_BERT physics list: more realistic hadronic interactions*
  - *Fire single pions with different energies and store the amount of energy released as a function of the longitudinal depth and radial distance*
  - *The vertex of the non elastic interaction need to be detected*

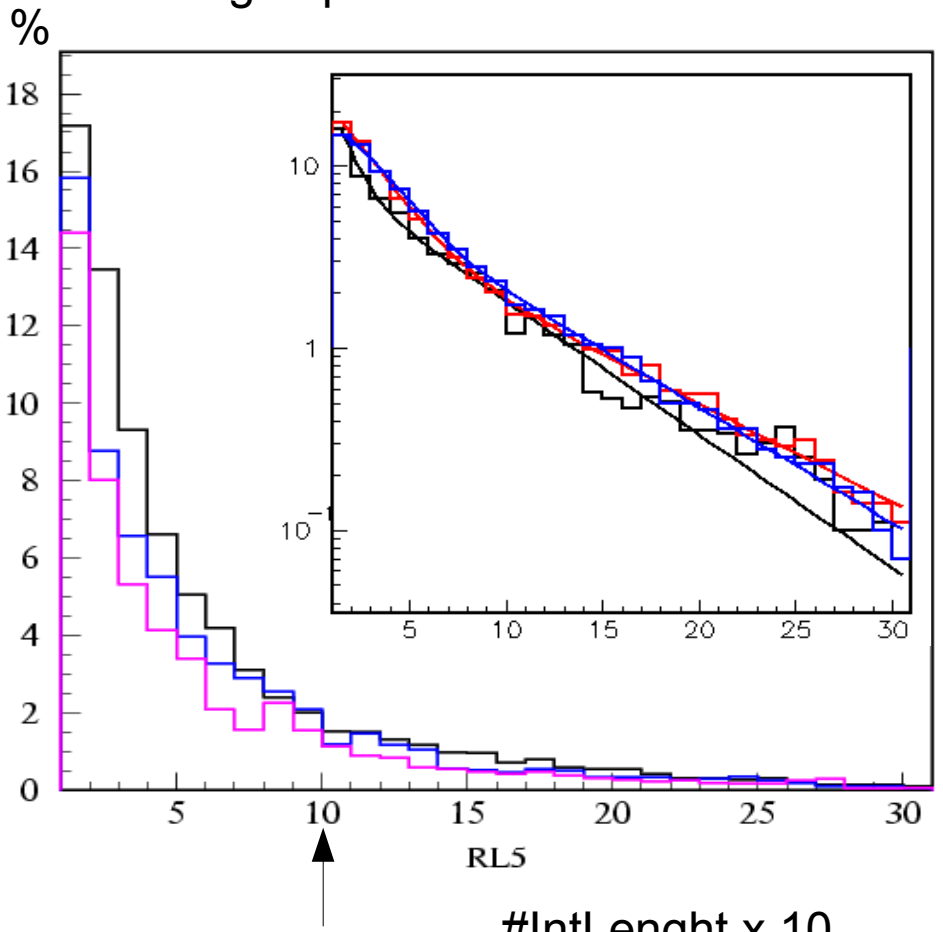




Only charged tracks contribute to the visible component of the shower

Study of the transverse development

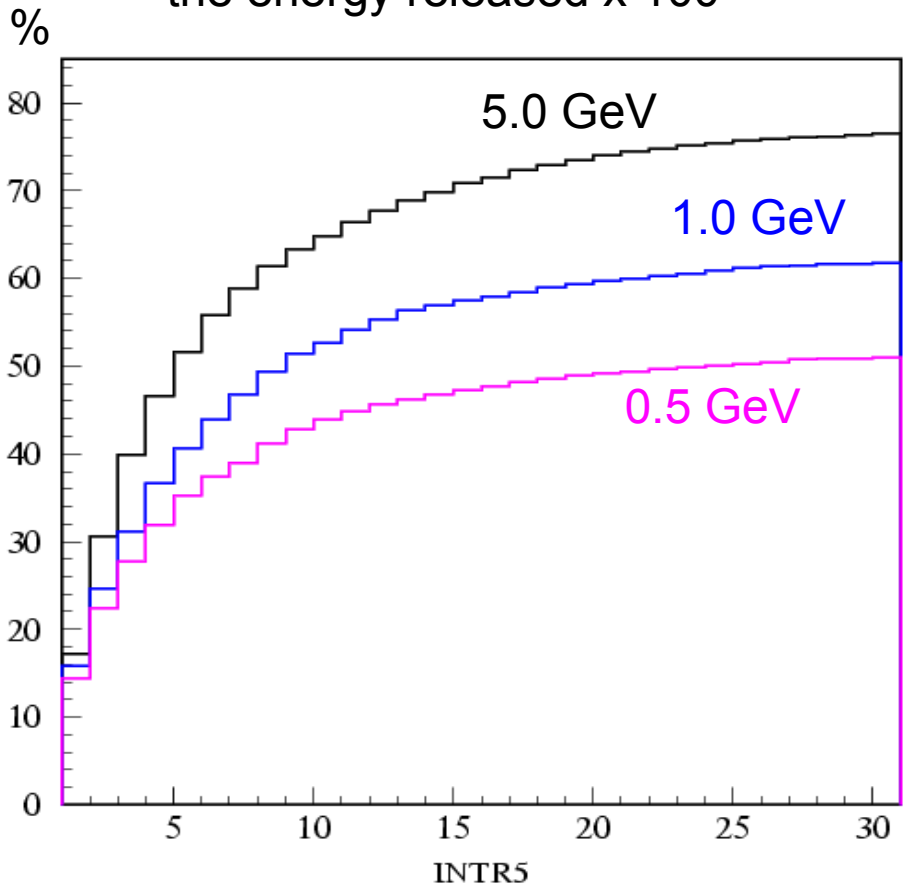
Fraction of energy released by charged particles x 100



#IntLenght x 10

1 int. length

Integral of the fraction of the energy released x 100

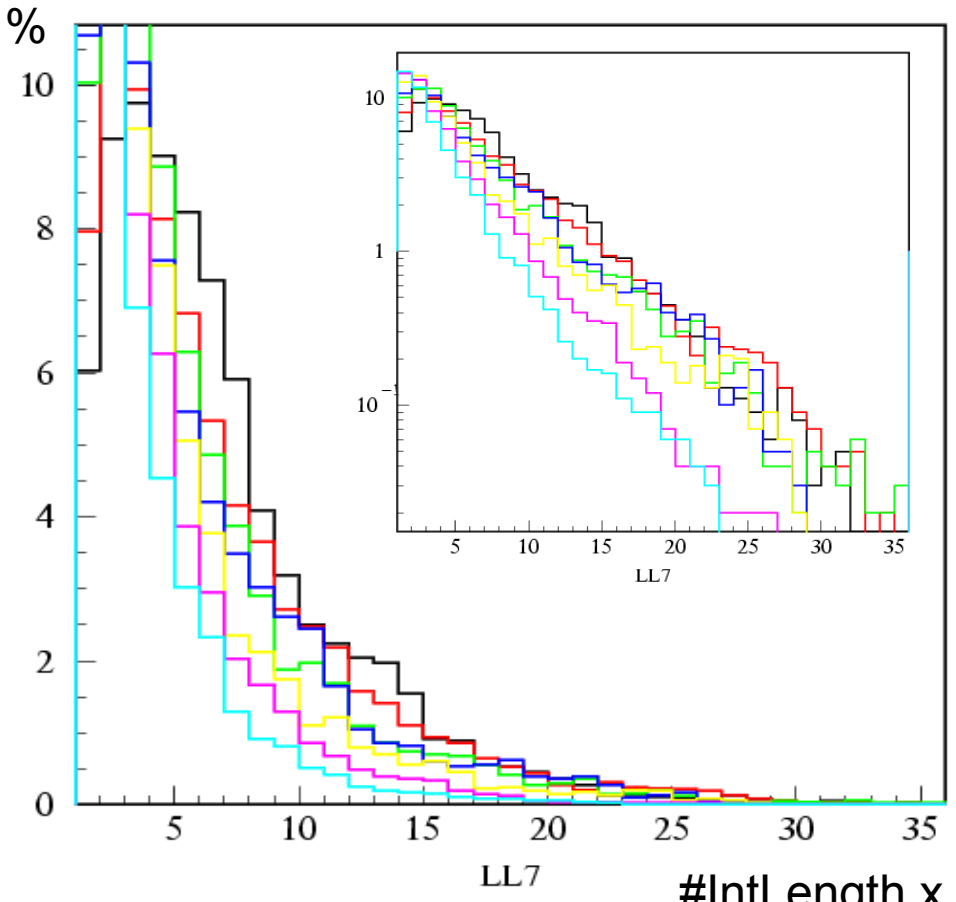


#IntLenght x10

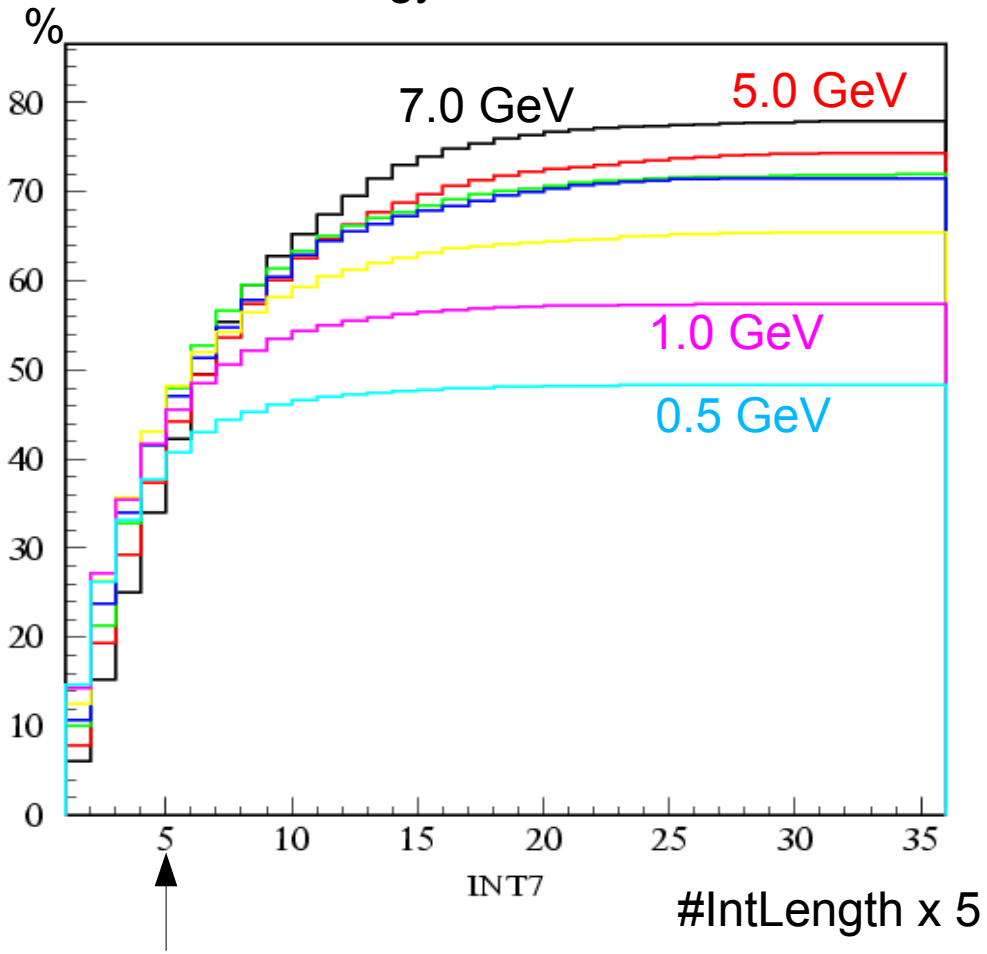
Parameterization: Exp+Gauss $\frac{dE}{dA} = \frac{B_1}{r} e^{-r/\lambda_1} + \frac{B_2}{r} e^{-r^2/\lambda_2^2}$

Study of the longitudinal development

Fraction of energy released by charged particles x 100



Integral of the fraction of the energy released x 100



Parameterization implemented by Dave Brown

Ongoing works

- *Better tuning of the Ifr response*
  - *Hadronic shower tuning*
- *IfrTrack implemented:*
  - *Now the track chi2 and the measured number of int lenght are accessible from the IfrQual object:* ***the code will be committed soon***
- *Some information still missing:*
  - *matching between the fitted helix of the track and the track in the IFR, at the coil*
  - *expected number of int lenght in the muon hypotesis*
- *Look at the K_L interactions*

Super B IFR geometry

- *SuperB IFR configuration available in PacSim*
  - *Simplified geometry: cylinders (barrel) + rings (endcaps)*
  - *Outside the coil the magnetic field is modelled with a 0-Field*
  - *Reduced number of active layers to 8*
  - *More # of Interaction lenghts*
- *Hadrons int in the EMC: large leakage*

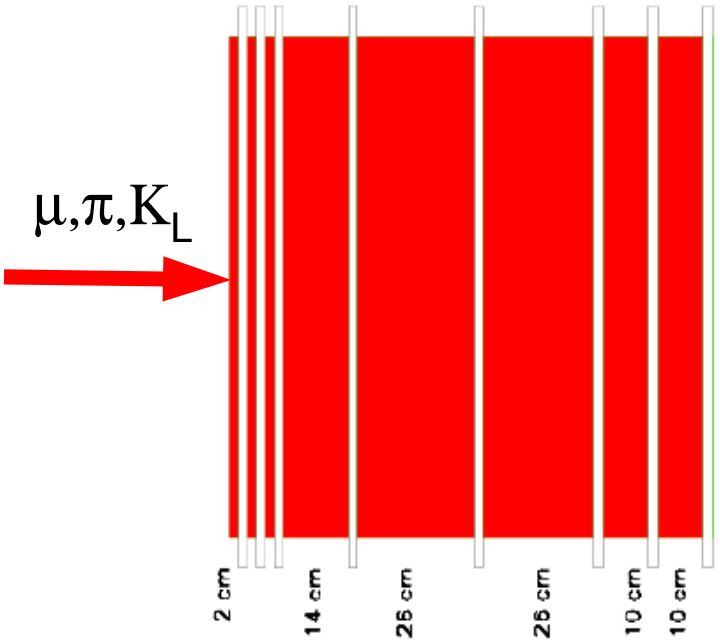
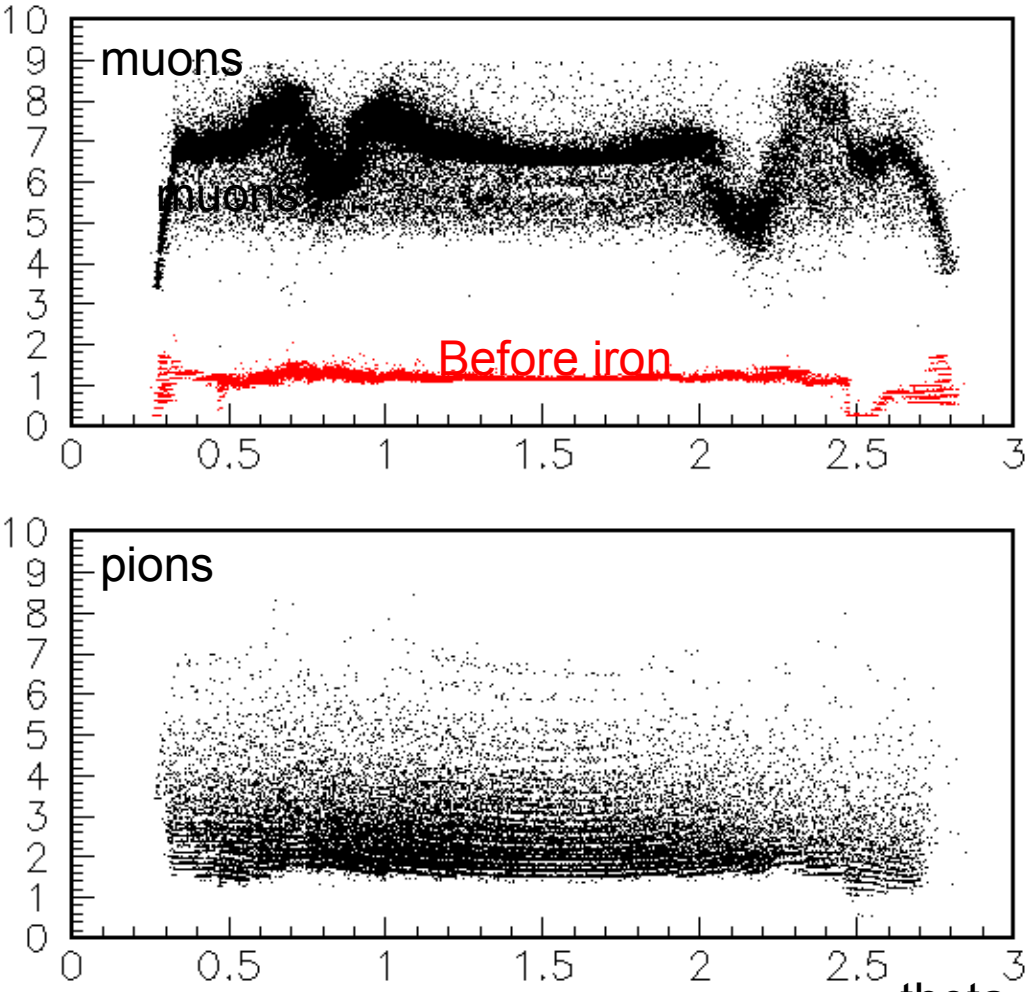
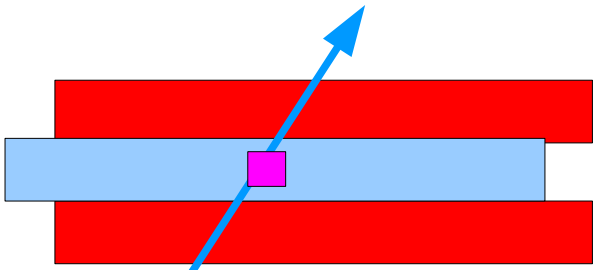


Figure 4-41. *Sketch of the longitudinal segmentation of the iron absorber (gray). Active detector positions are shown in white from the innermost (left) to the outermost (right) layers*



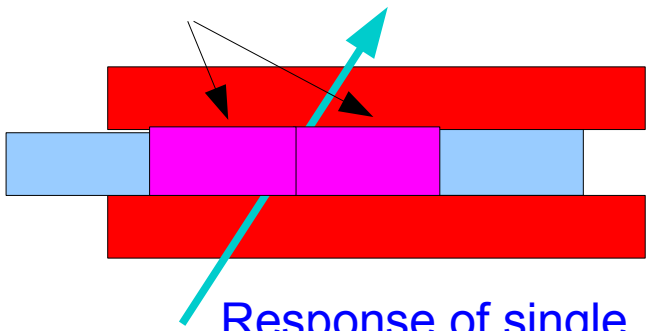
IFR Fast Simulation: design

PacSimHit



Digitization

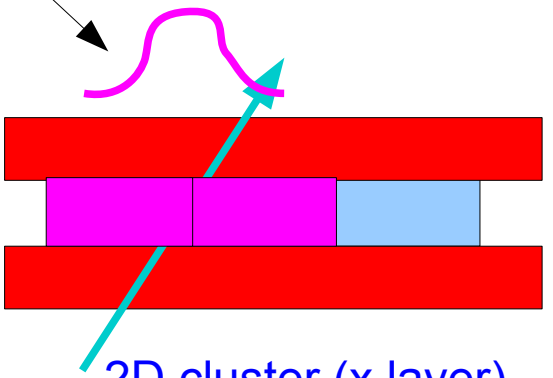
PacIfrHit



Response of single scintillator (x_o,y_o,z)

Reconstr clusters

PacIfrResponse

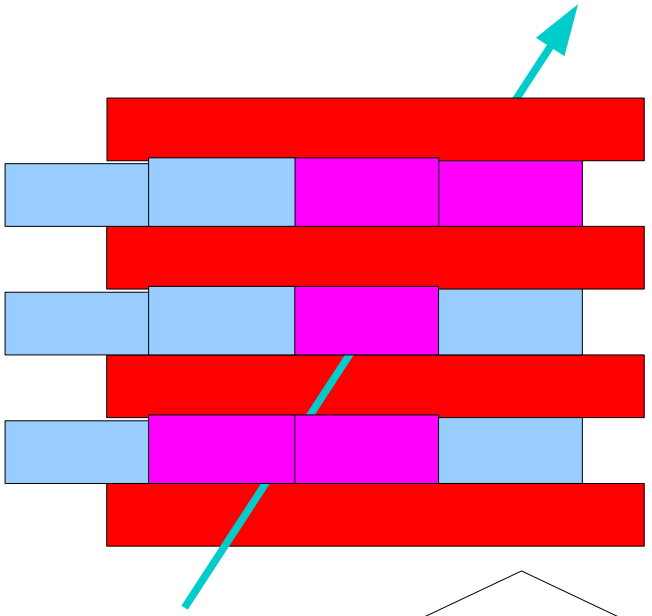


2D cluster (x layer) mades with the IfrHits

No patter recognition - we konw the PacIfrHits associated with a track

Reconstruct tracks

PacIfrTrack made from a list of **PacIfrResponse**



Final reco quantities associated to a track to fill IfrQual object:
- last layer
- layers active
- average number of hits per layer
- track chi2

IFR Simulation: hadronic shower

- *The hadronic interaction at low momentum, crucial to π–μ separation*
  - *in particular the later and the longitudinal development of the shower require detailed studies.*
  - *The same for Neutral Hadrons*
  - *No parameterization available in the literature for low momentum hadrons (<5 GeV)*
- *Use the Geant4 to study the shape of the hadronic shower*
  - *Parameterize the shower with a functional form in Fast Sim*