IFR-Prototype Data Analysis: Plans and Timeline

People involved in past and in the present
development of the IFR reconstruction code and simulation
of both the prototype and the superb IFR

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Detector Optimization

- Optimization will be performed with full simulation of the SuperB detector
  - Number of layers: 8-9 layer
  - Total amount of iron: 92cm + (10cm ?)
  - Scintillator size BIRO (TDC readout
  - Impact of the background on the performances (and design)
- Prototype data analysis crucial to tune the MC
  - Physics List
  - Digitization
    - Criteria to form a Digi starting from the GHits

Old MC study: as an example

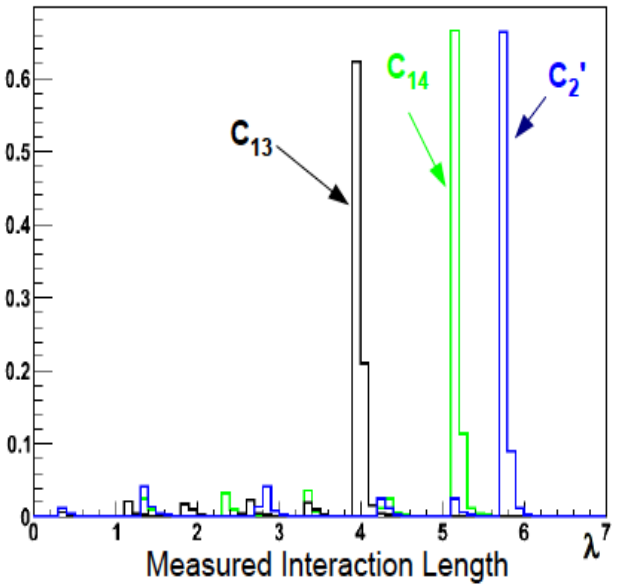
- Use Bruno to generate GHits
- Use IfrRootCode, developed to perform Digitization and Reconstruction
  - GHits → IFRHits → Clusters
  - Clusters → Track
  - Output: reconstructed quantity (track fit/number of hits, last layer...)
- Tested 3 configurations

```
|=|=|========|============|============|=======|=====|
|2|2|   16   |     24     |     24     |  14   |  10 |

|=|=|========|========|========|========|=======|
|2|2|   16   |   16   |   16   |   16   |  14   |

|=|=|======|======|======|======|=====|
|2|2|  12  |  12  |  12  |  12  |  10 |
```

C_2' Fe 920mm

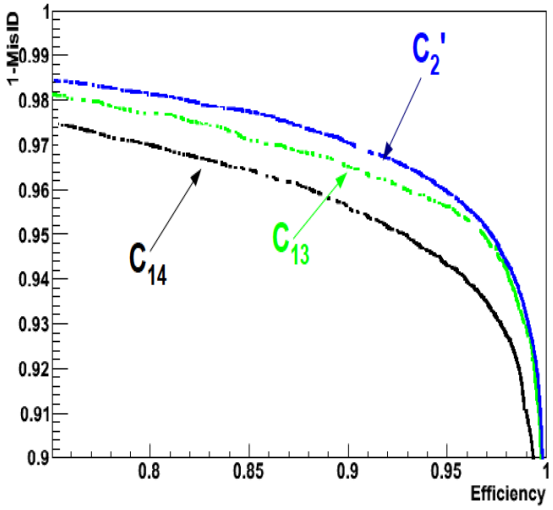
C_{13} Fe 820mm

C_{14} Fe 620mm

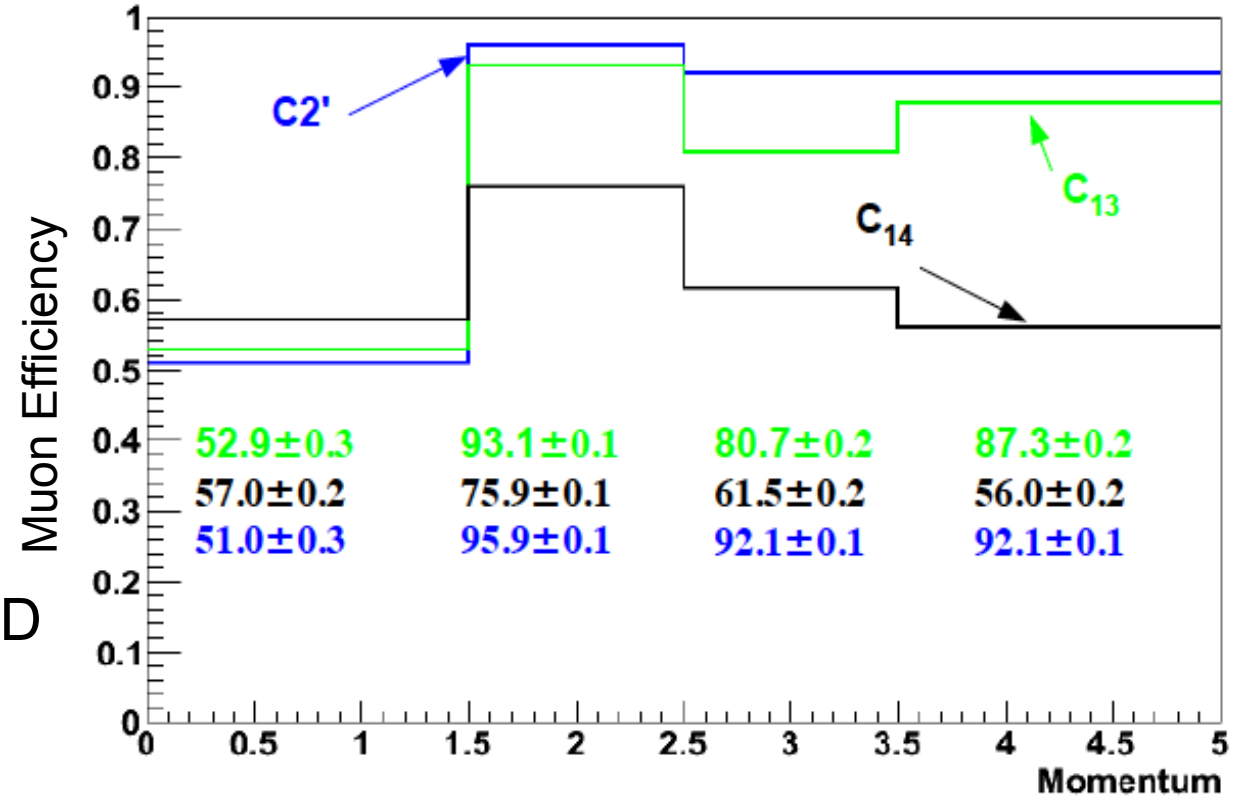


Config. Comparison Strategy

- Make a muon selector, based on BDT (trained using TMVA) with the reconstructed output coming from IfrRootCode
- BDT optimized in bins of particle momentum



Cut on BDT, requiring π mis-ID at 2 %



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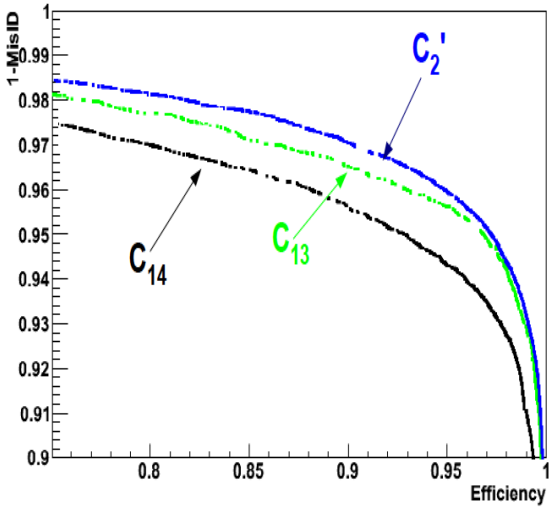

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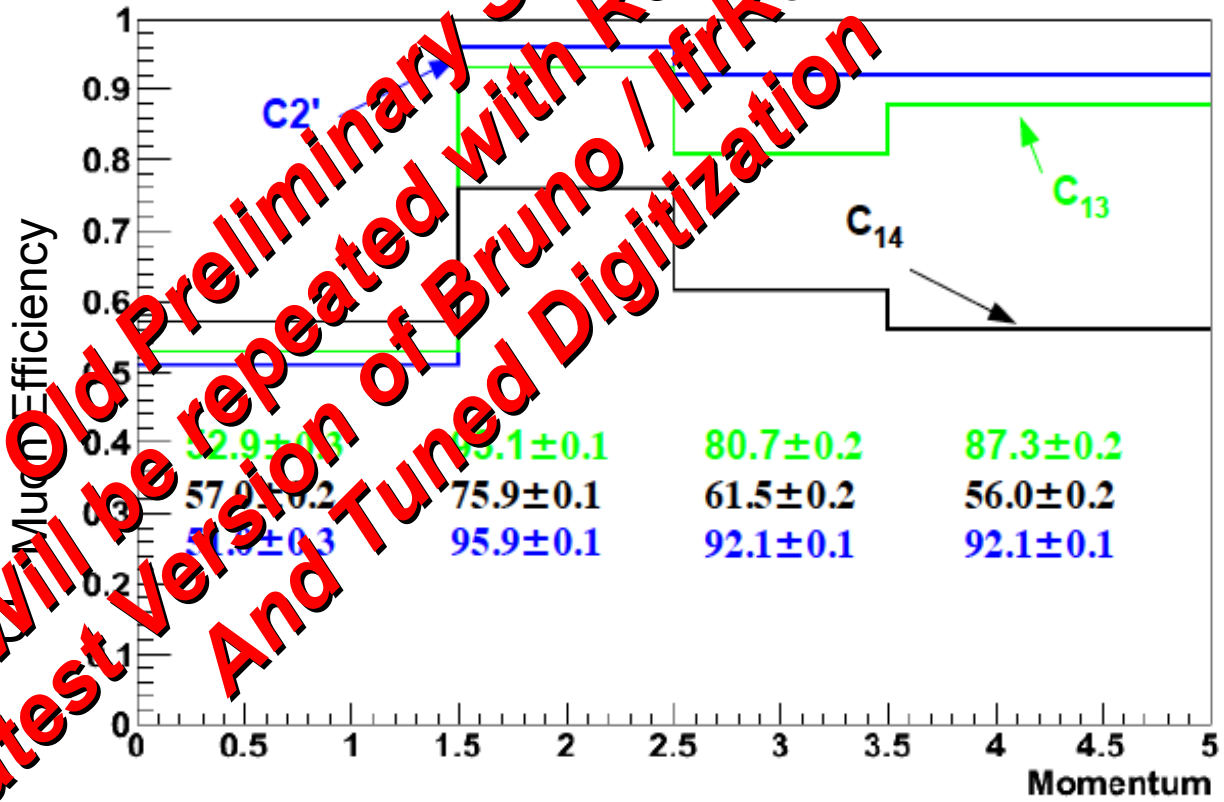
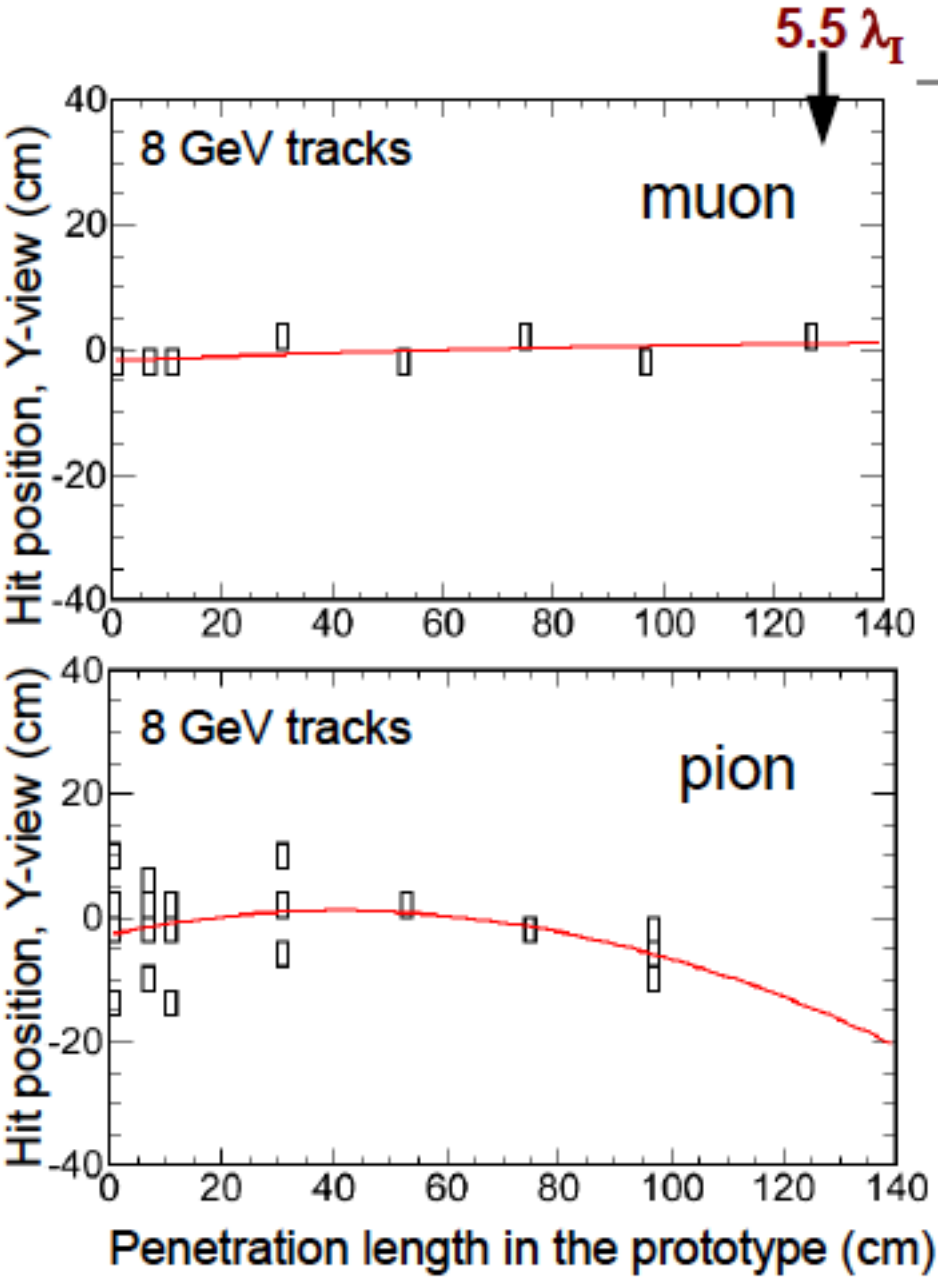


Old Preliminary Study
Will be repeated with Realistic
Latest Version of Bruno / IfrRootCode
And Tuned Digitization

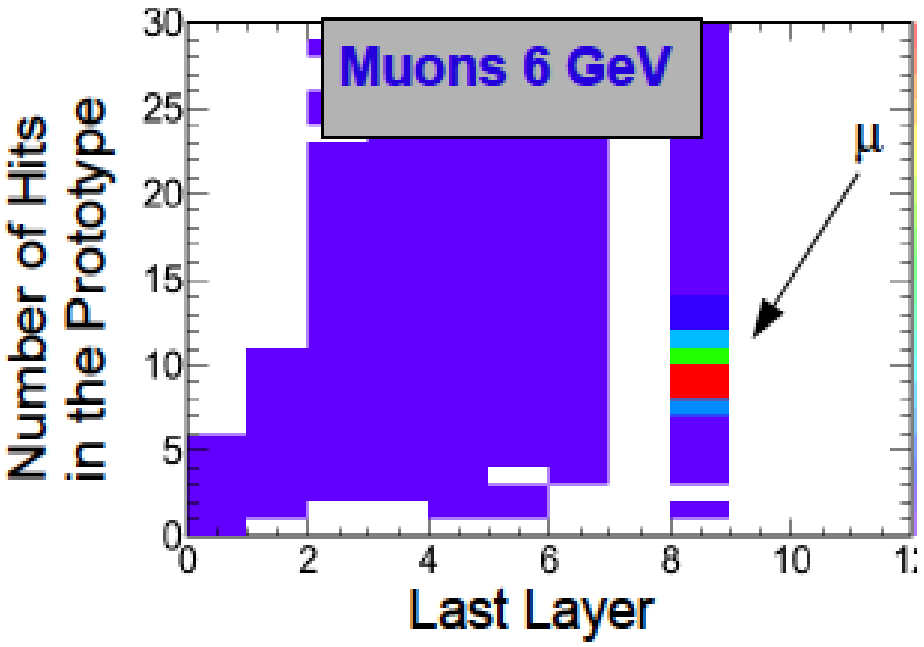
Information from Prototype Data

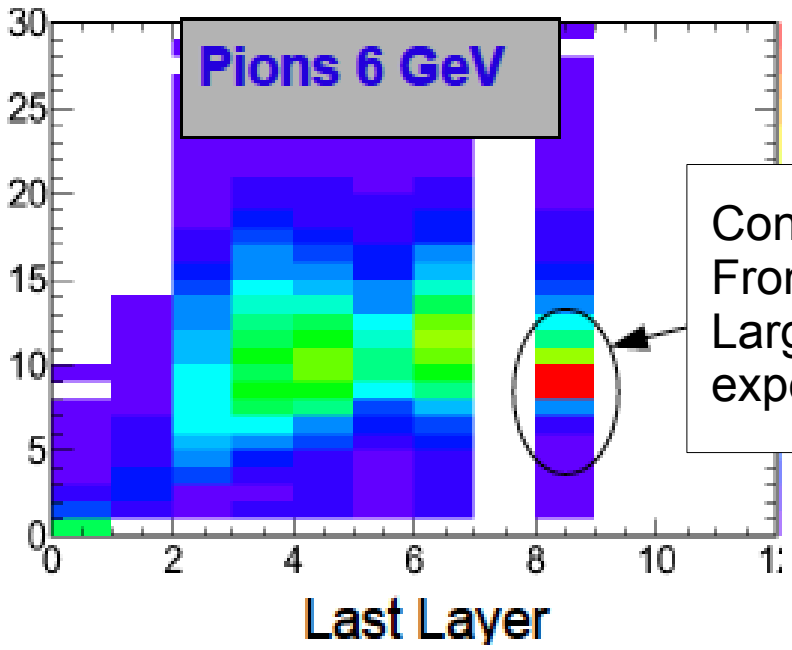
- Study on Data various quantities
  - Hit muliplicity
  - Shower shape: transverse activity
  - Track length
  - Tracking parameters



Sample Composition

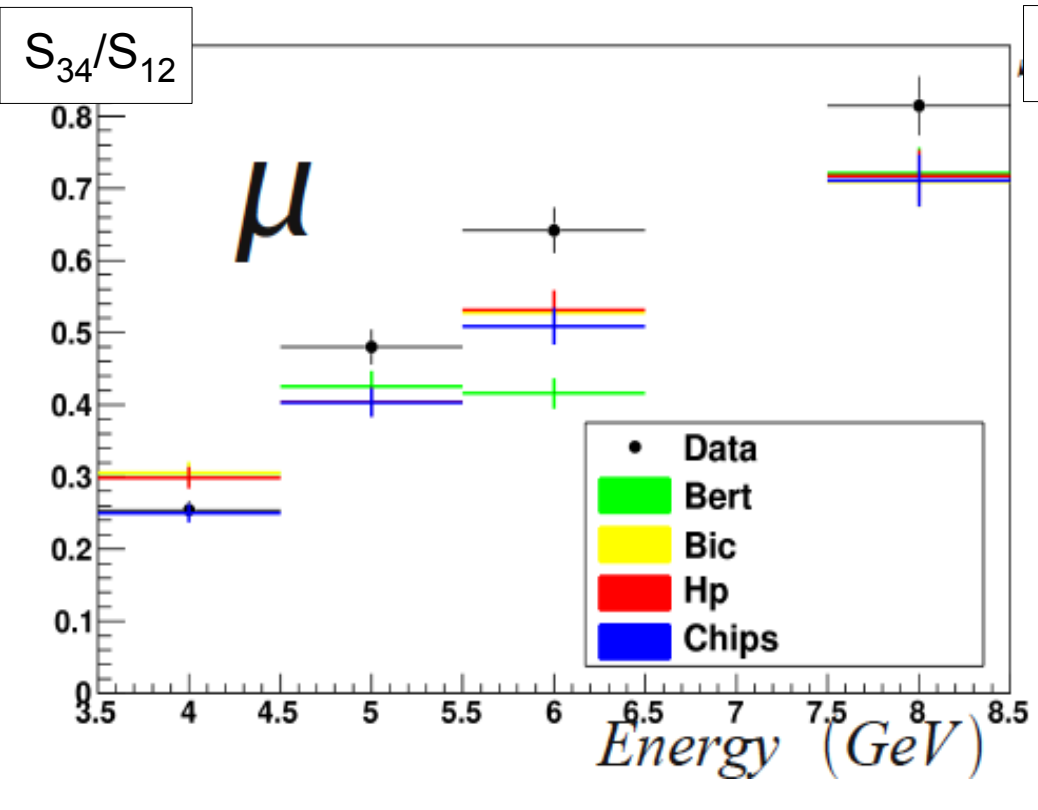
- Problems with July/October'11 data
  - Not very well know sample composition (at energy lower that 8 GeV):
    - large muon contamination in the pion sample (larger than expected from π decay in fly)

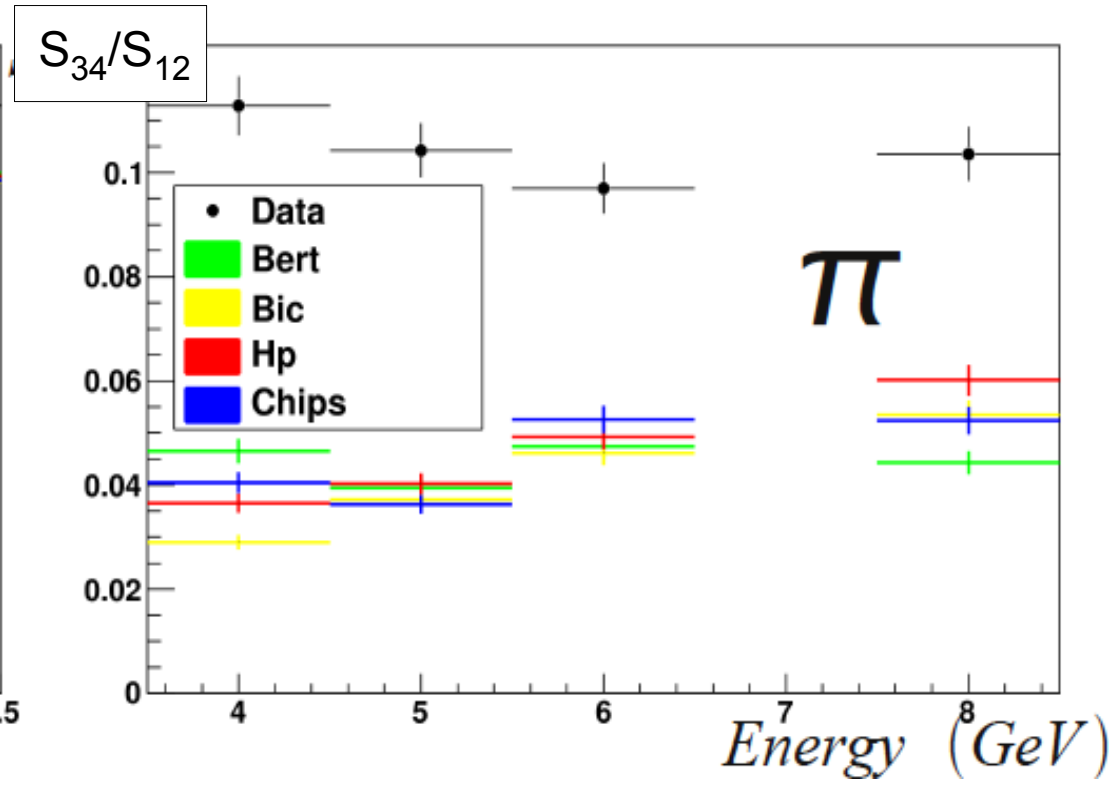




Problems with old data

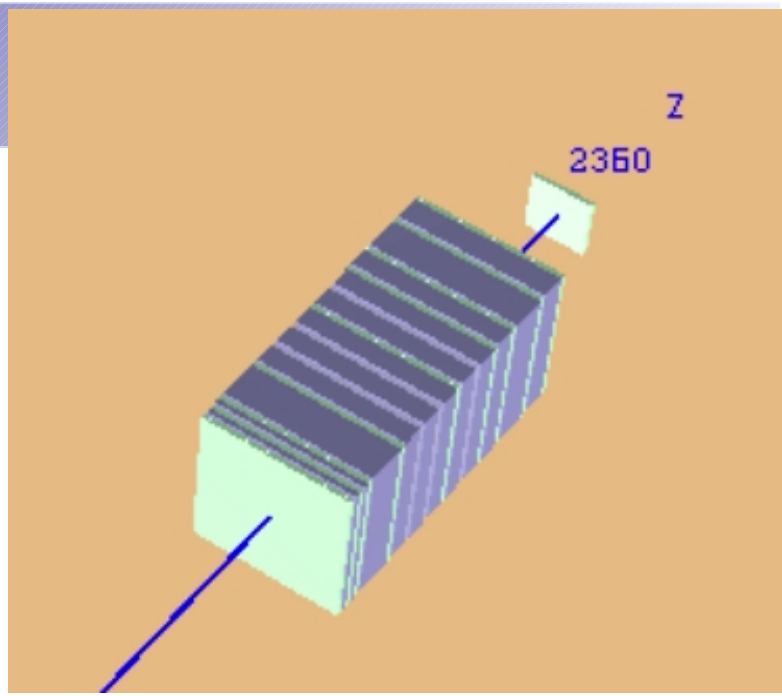
- With Dec2010 data: muons sample is well described, pions were identified vetoing on the Cerenkov





- New Data looks much better: primarily the Cerenkov performances looks much better! Now we select pions with the Cerenkov

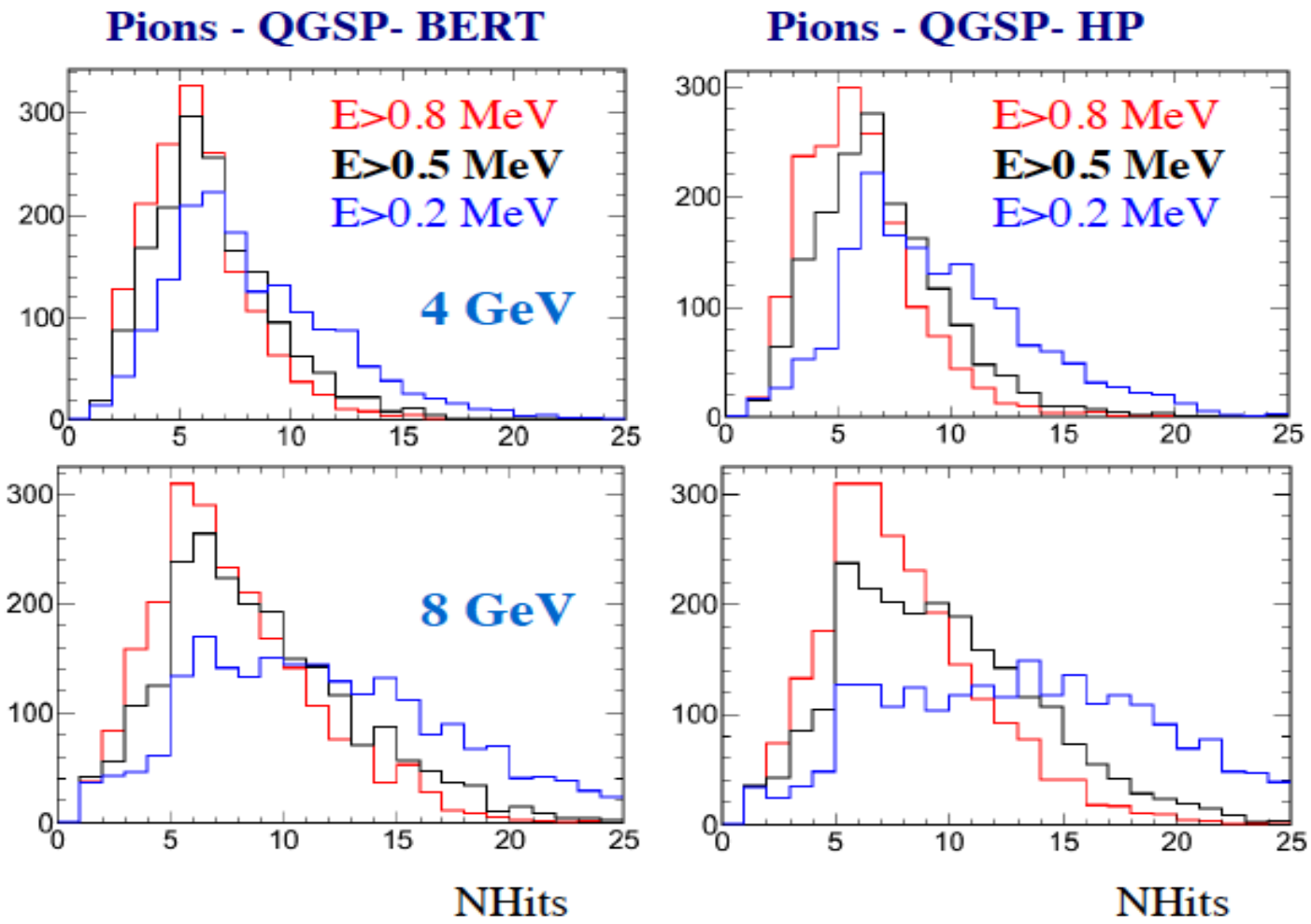
Monte Carlo Tuning



- Full simulation of the Prototype and experimental setup has already been implemented and used for preliminary studies
- Physics Lists available need to be tested
- Digitization
  - Criteria to form a Digi from the GHits need to be tuned
    - Cuts on total energy
    - Cuts on gtime
  - Tune properly the MC timing structure of the IFR hits (can be important to separate pions from muons)
- Criteria will be adjusted to match the data taken from the prototype: efficiency/timing

MC tuning (example)

- Different requirements on the total energy released in the scintillating bar
  - 0.5 MeV is equivalent to ¼ of a MIP (~3.5 p.e.)



Conclusions

- We already developed and tested machinery to answer the questions about the detector geometry optimization
- New big improvements:
  - New data with new experimental setup looks better than previous runs (the Cerenkov works better)
  - IfrRootCode has been improved (and bug fixed)
- We are ready to repeat the studies we did with old data with the present software/data
- Plans...

Plan for the next 6-7 weeks

- Understand the new data and process with the new reconstruction code
- Adjust the experimental setup in Bruno, generate and reconstruct MC simulations of the prototype

2 week

- Analyze the data and tune the MC (lists, digitization, etc etc) to match:
  - Scintillator bar efficiency
  - Lateral and longitudinal shape of the hadronic shower
  - Time structure of the hits

2-3 week

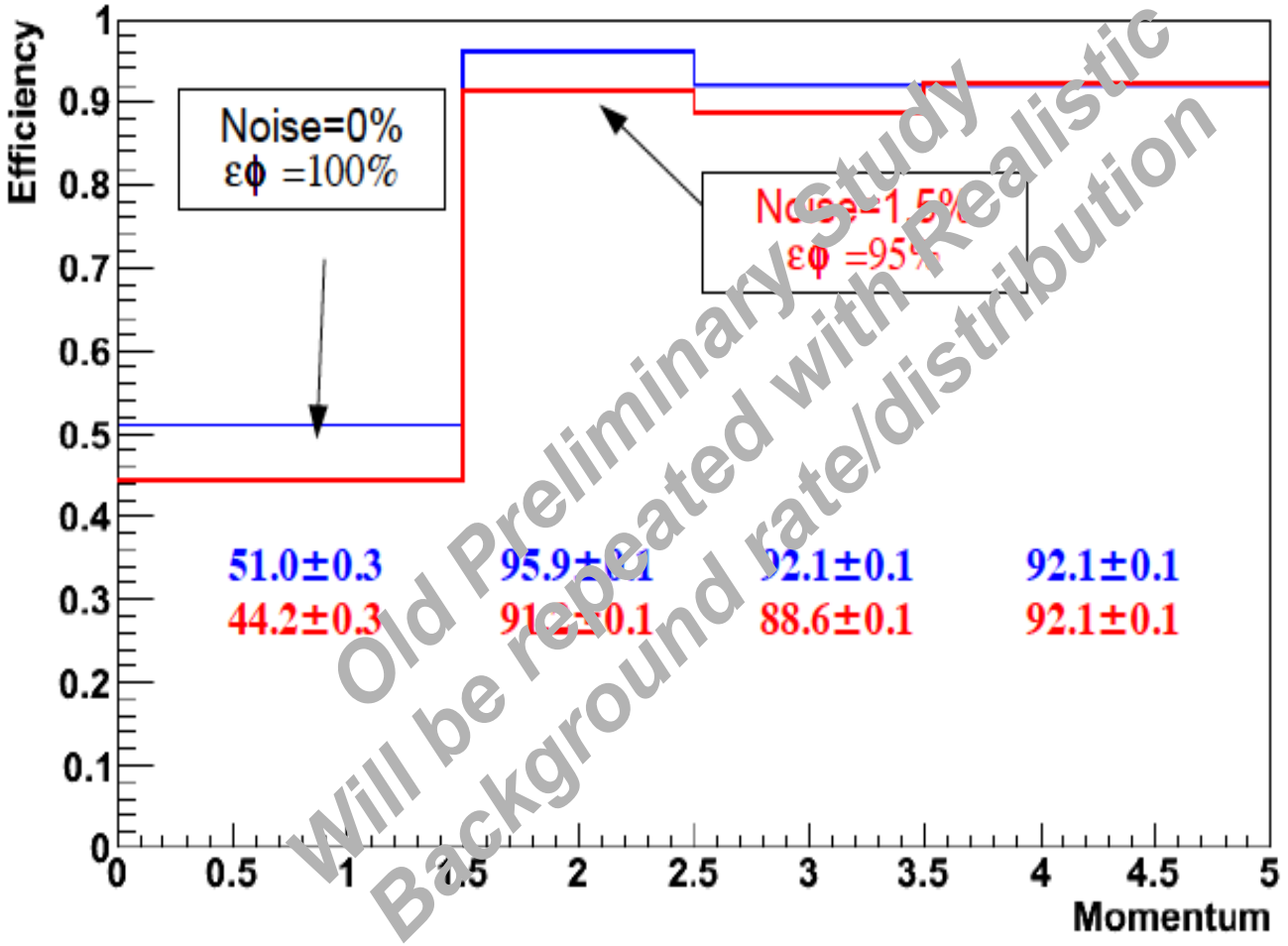
- Generate and reconstruct the MC of the Superb-IFR with different configurations
  - Train the BDT and compare the efficiency and mis-id rate for the various configurations

2 week

BACKUP

Further Example: impact of the background

- C2' configuration
- 95% bar efficiency + 1.5 % uniform noise



Another use of the Data-Prototype

- Use the prototype data to perform comparison studies
- Example: kill hits randomly with different rates: 5%,10%,15%
  - Optimize the BDT and compare the performances