IFR Fast Simulation: status of QA module and μ-ID

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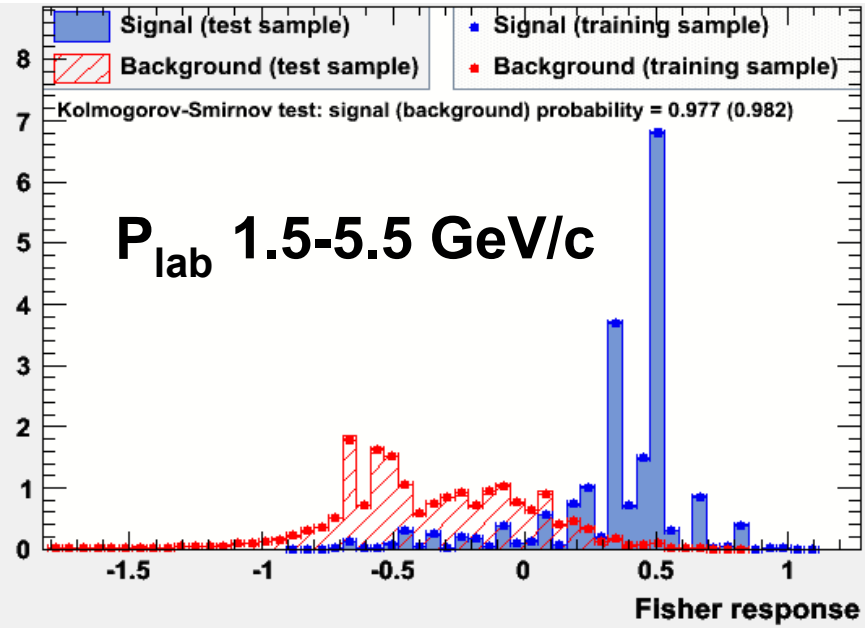
In December'12

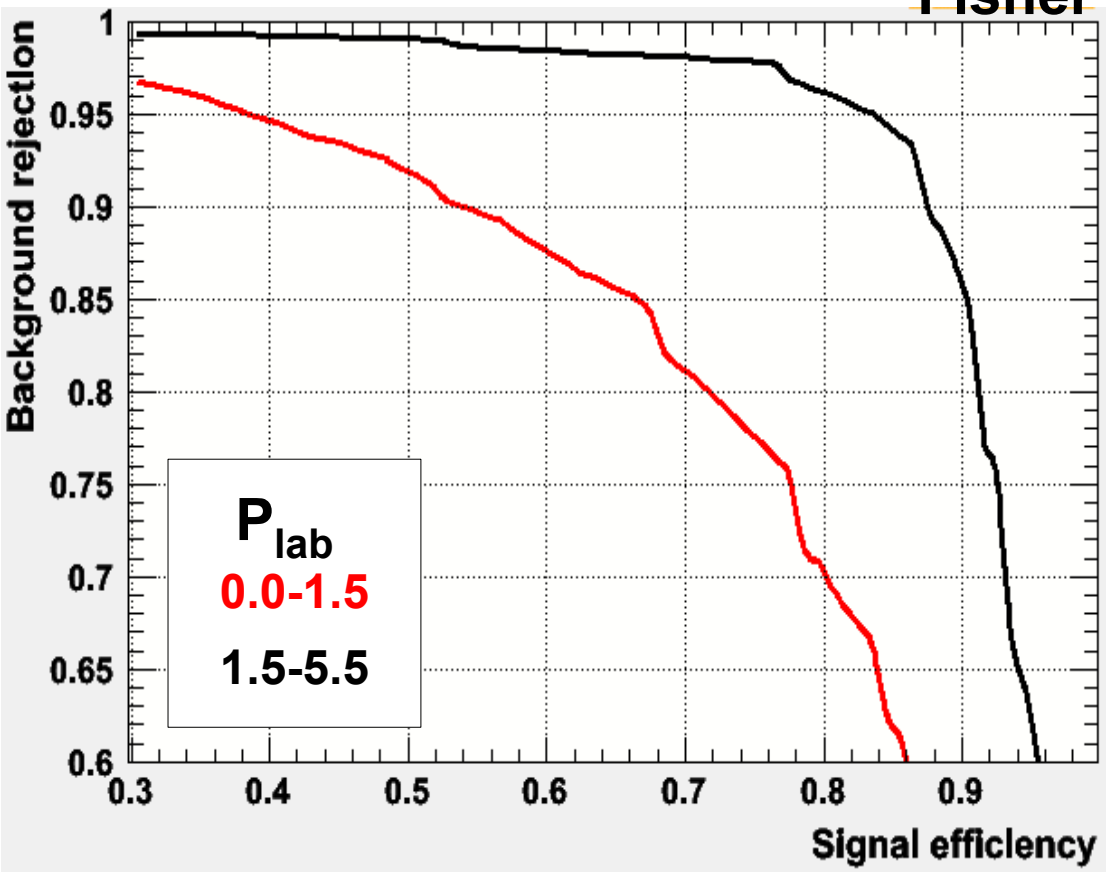
- Pion interaction length λ_π in material is about 20% longer than the nucleon Interaction length (different cross sections)
  - Affect the probability for a pion to have hadronic interaction in EMC/Coil/Iron: $P(\Delta L) = \exp(-\Delta L/\lambda_\pi)$
  - Affect the hadronic shower length: change in the scale
- Improve the simulation of the lateral hit production
  - Radial distribution
    - $P(r)=f_{narrow}\exp(-r/d_{narrow}) + (1-f_{narrow})\exp(-r/d_{wide})$, $d \propto \log(E+constant)$
  - Narrow and wide size are fixed (4cm and 12cm) in the code

Muon selector

- Based on a simple Fisher (optimized with TMVA), 2 bins in P_{lab}
  - Last Layer
  - Number_Hits/Active_Layer
  - Track fit chi2
  - Energy in the EMC
  - Number of EMC crystals

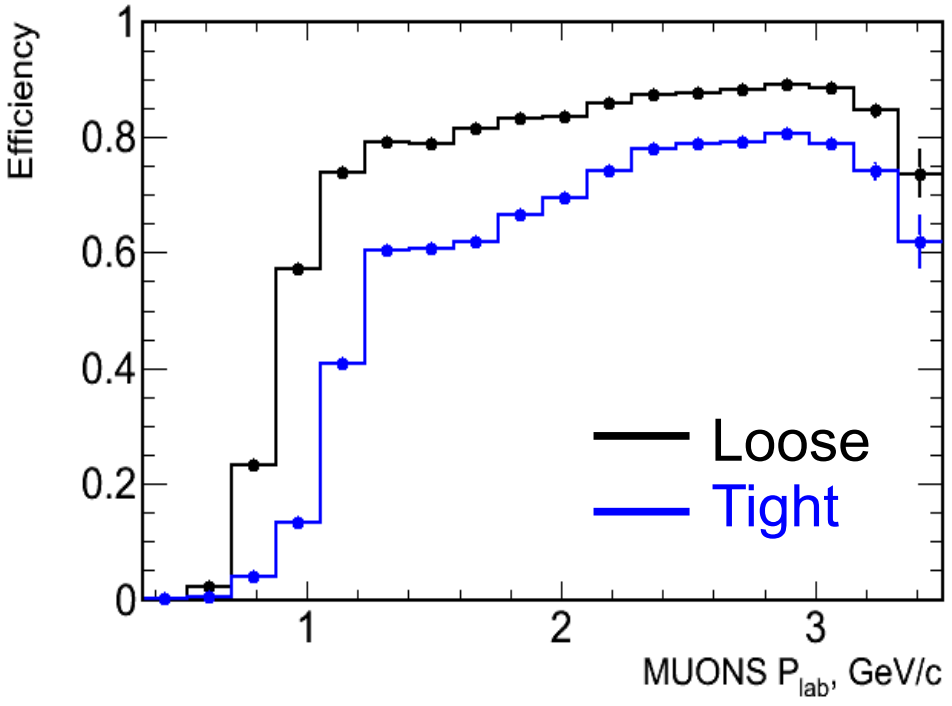
Fisher trained with a large sample of $B \to \gamma \mu \mu$ & $B \to \gamma \pi \pi$

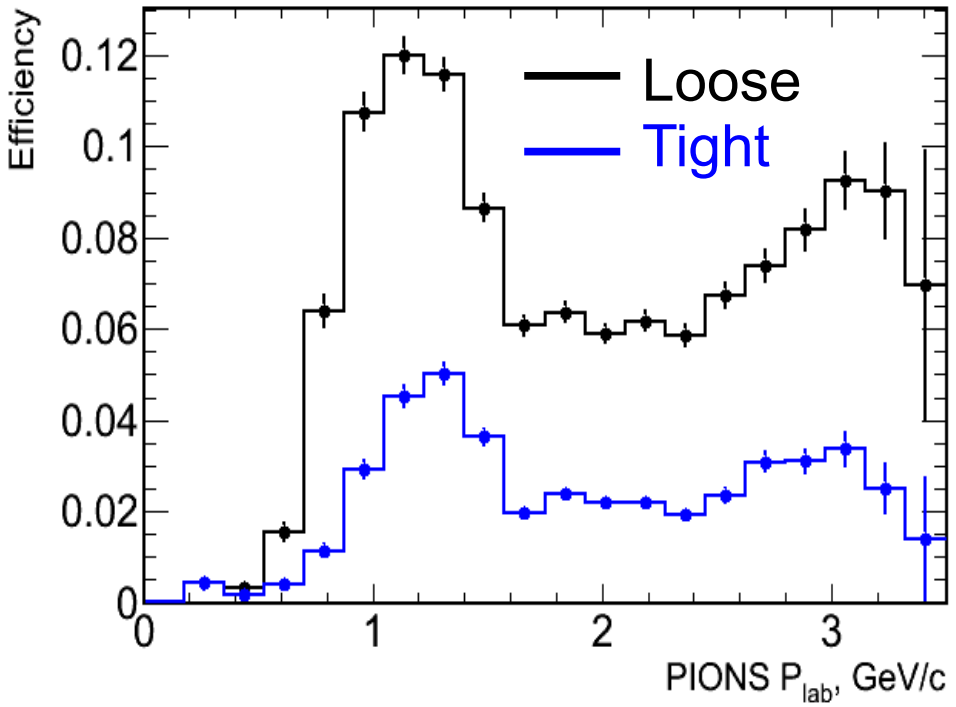




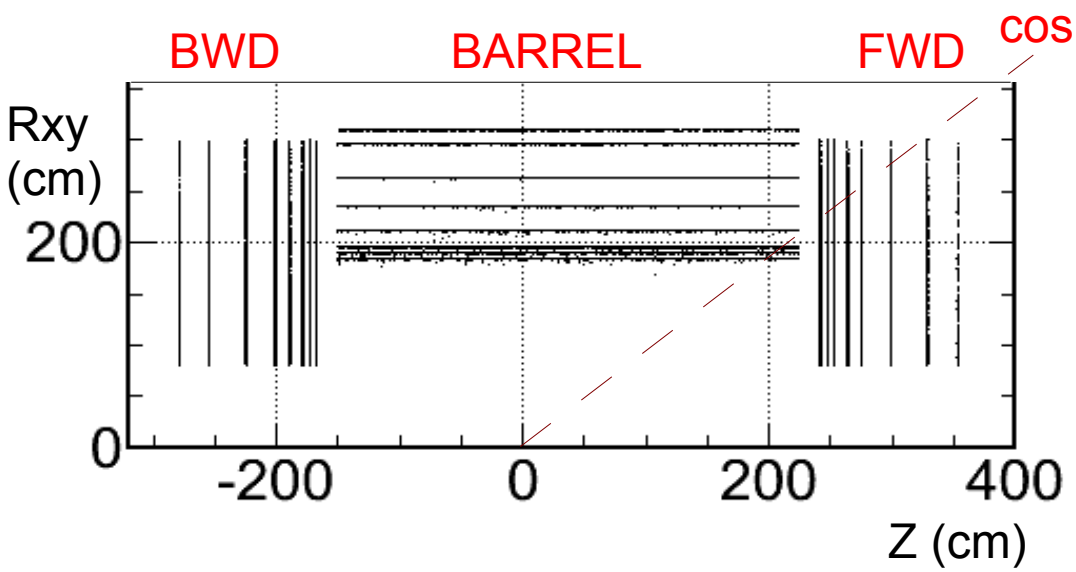
Muon Selectors

- Implemented a Fisher-based muon select in PacPid
- Two lists with different level of S/B
  - `PacPidFisherMuonLooseSelection`
    - P mis-id: is at 7% for p>1.5 GeV
  - `PacPidFisherMuonTightSelection`
    - P mis-id: is at 3% for p>1.5 GeV

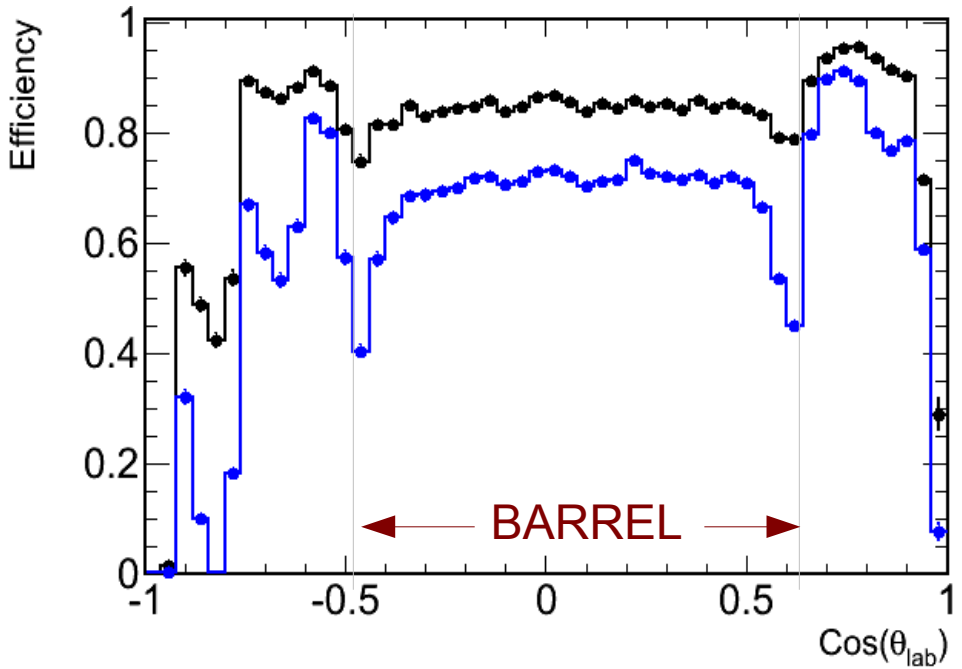


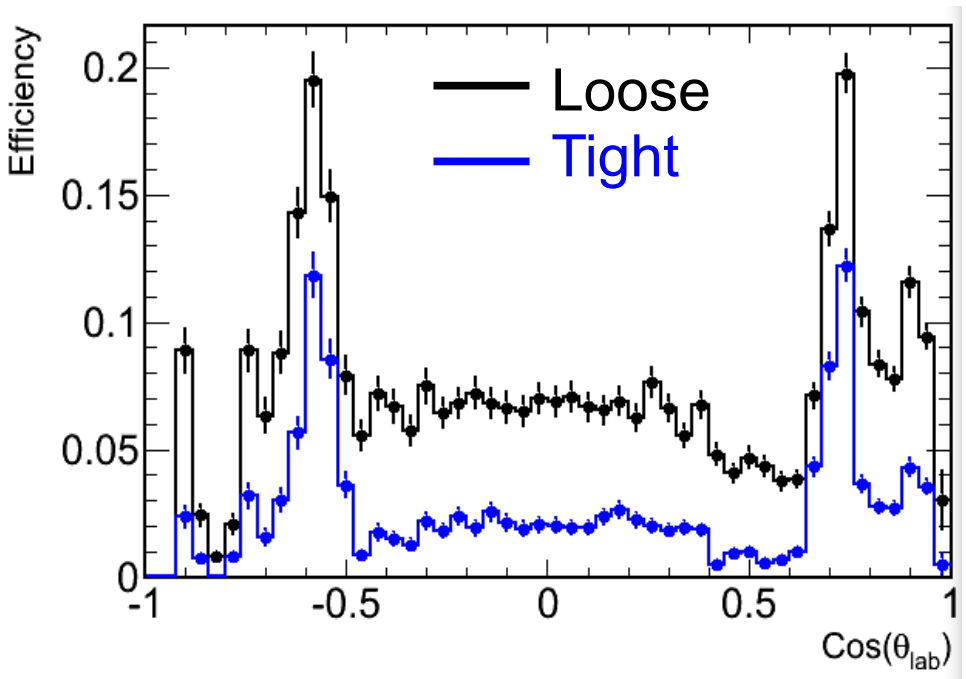


Muon Selector: overall performances I



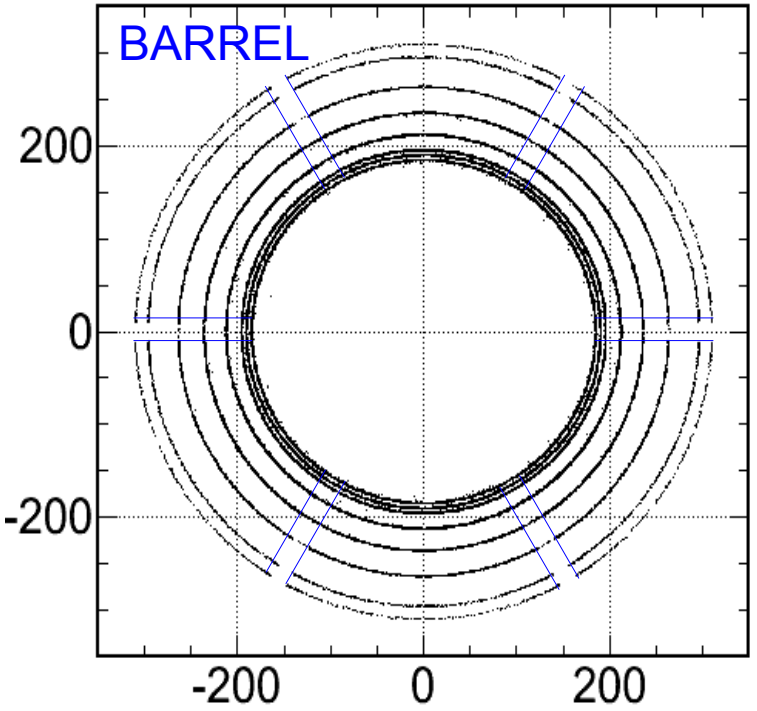
- Larger π contamination in the FWD and BWD
- The selector could be improved to provide a more uniform mis-ID rate as a function of polar angle

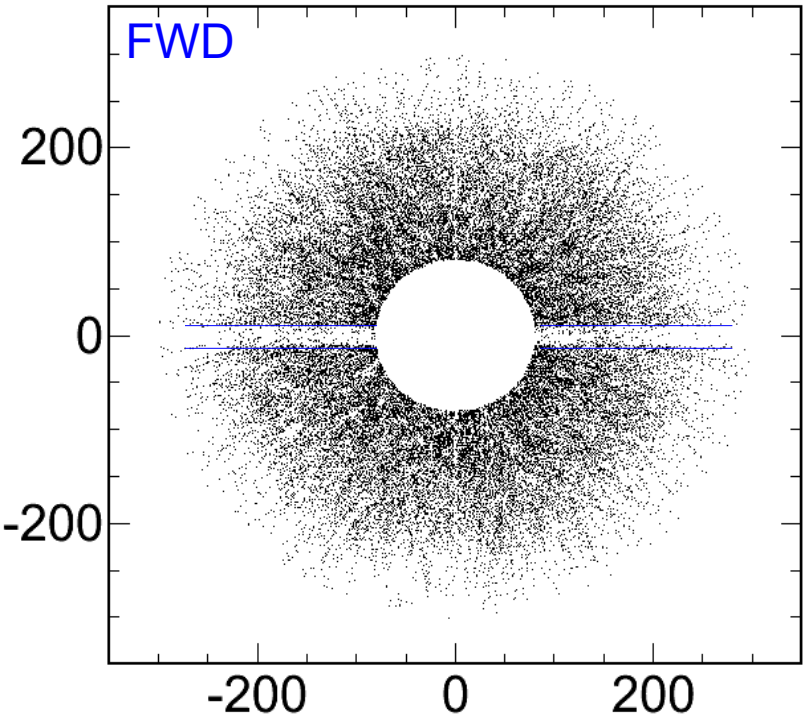


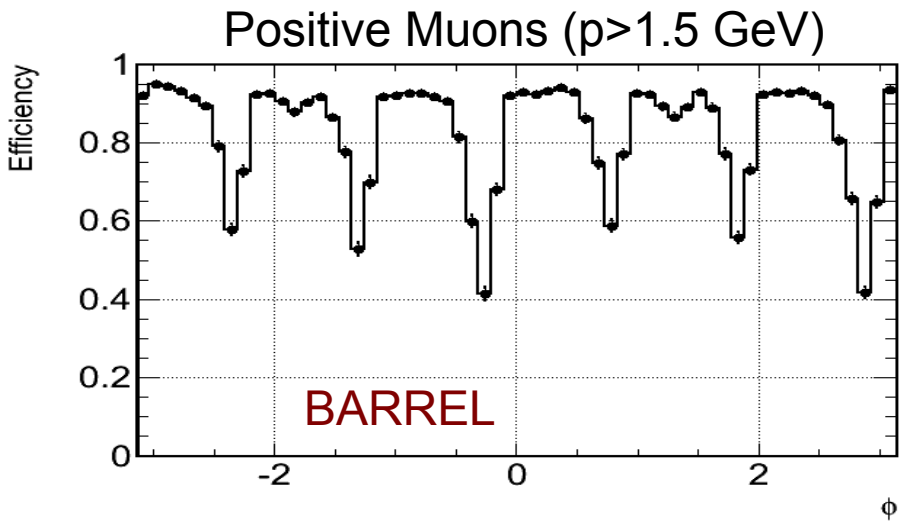


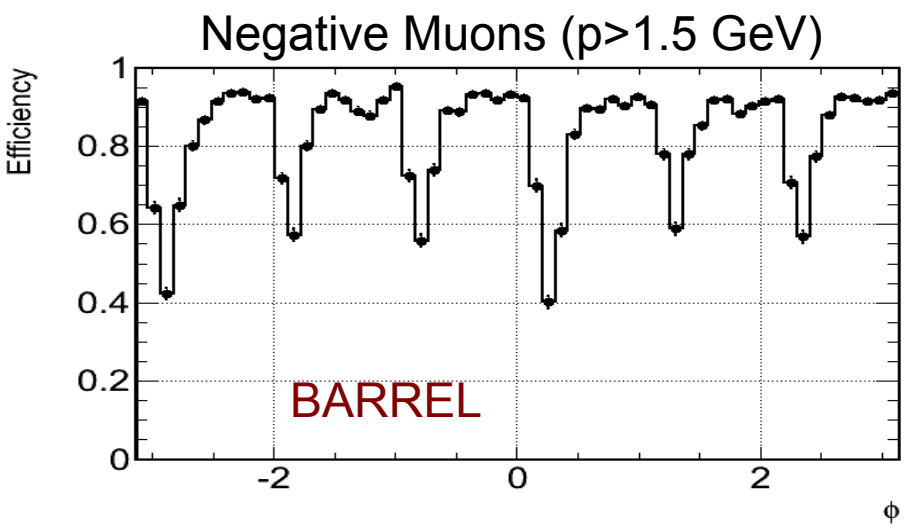
Muon Selector: overall performances II

- Muon efficiency as a funciton of phi, as expected
- Space between sextant and differencies between + and - particles







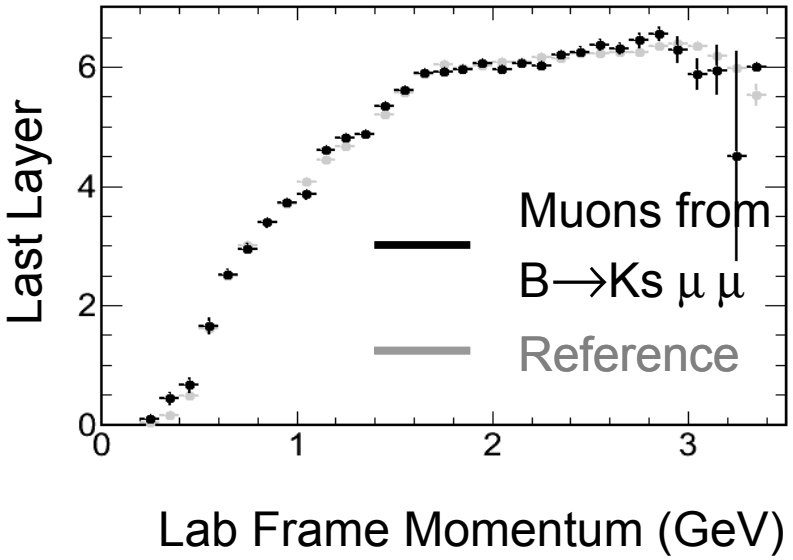


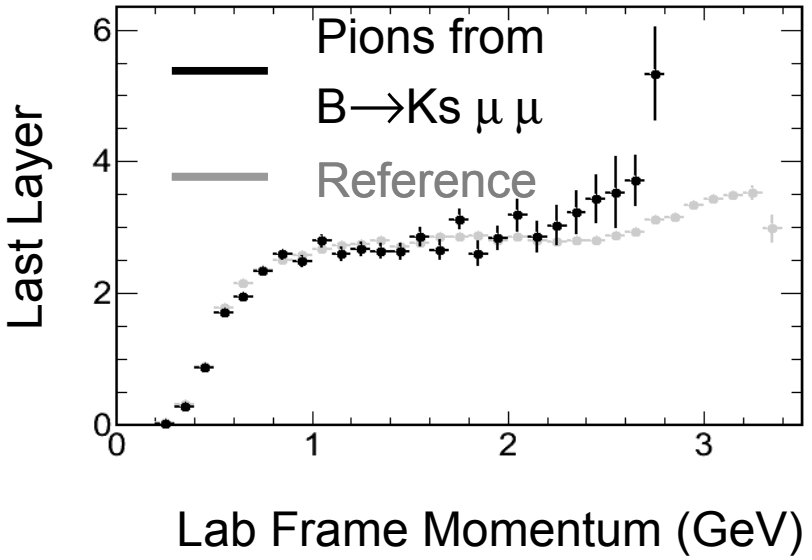
QA Module

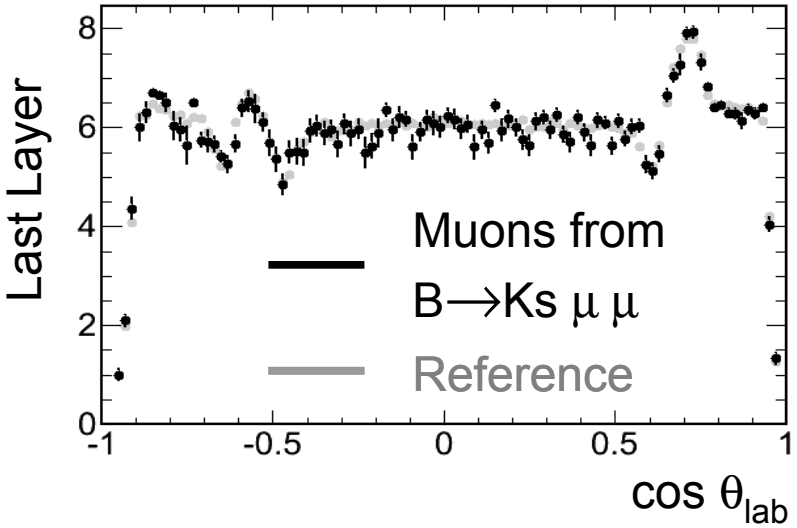
- Variable available TTree the QA root file:
  - For each track with non empty `getMicroAdapter()->getIfrQual();`
    - `p3, costh, phi, mclund`
    - `lastIFR, fitChi2IFR, intLInIFR, intLMeasIFR, nStripsIFR, nDigiIFR, EmcEnergy, nEmcCluster`
    - `isALooseMuon, isATightMuon`
  - Per 2D-cluster informations:
    - `xIfrHit, yIfrHit, zIfrHit`

QA Plots

- Reference with large sample of $B \to \gamma \mu \mu$ & $B \to \gamma \pi \pi$







- 5k tracks in Test Histograms

Conclusions

- A muon list is available for physics analysis
  - Performances are reasonably good
- Documentation is ongoing
  - IFR simulation
  - QA module
  - PID performance
- QA macro will be committed soon