Analysis on Low Pt Muons

VERY PRELIMINARY

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1 First Results

1.1 Used Samples

I used single muon samples of negative charge, generated by A.DiMattia, stored in: /castor/cern.ch/atlas/transfer/dc1/roma1 with pt: 1, 3, 4, 5, 6, 8, 20 GeV and with $|\eta| < 3$. Using in RecExCommon the follow reconstruction packages:

- Moore, MUTRUTH informations included,
- Calo Block (Calorimeters EM + Tile),
- TileMuId (G.Usai).

Atlas_release = 7.0.1

The number of generated muons, obtained by KINE block, has been defined as the number of muons at the entrance of Muon Spectrometer, because the KINE informations in other parts of the detector were not available, and for $|\eta| < 1.3$, range defined by the Tile Muid algorithm. The number of simulated events are 5000 per pt, the real number is about 1/3 of this one for the limited range of eta in Tile MuId.

1.2 Analysis

In the first step, I studied the efficiency of selection for MOORE and TileMuId in the case of low pt muons, and the event topology in both packages, comparing then the values of eta and phi obtained by TileMuId and MOORE with those by MUTRUTH. The efficiency values obtained by TileMuId are equal to those reported in the G.Usai note (Feasibility study of a level two low pt di-muon trigger based on Tile calorimeter), i.e. about 60-70% of tagged muons.

The distributions of the deposited energy in Tile Cal are Landau distributions with a max at 2-3 GeV, according to the Bethe-Block formula in the case of a charged particle passing through a material of X_0 equal to Tile Cal X_0. The results are very interesting in the pt range 2-6 GeV, where the TileMuId efficiency are better than the MOORE one, see figure 1. The MOORE efficiency is obtained as the ratio of the number of reconstructed muons by MOORE (nmuonmo.eq.1) in $|\eta| < 1.3$ over the number of single muons generated at the entrance of the Spectrometer in the same eta range; for TileMuId the efficiency is calculated as the ratio of number of identified muons by TilelMuId (ntag.eq.1) over the number of single muons generated at the entrance of the Spectrometer in the same eta range.

Then I analyzed the differences between the angle variables phi and eta obtained by MOORE and TileMuId. The eta distribution seems to be centered in zero with a resolution depending on the Tile granularity, while the phi distribution is not centered in zero, shifted on the left or right according to the muon charge and depending on the magnetic field (the shift is greater for low pt muons $\Delta\phi \approx 1/pt$), see figure 2.

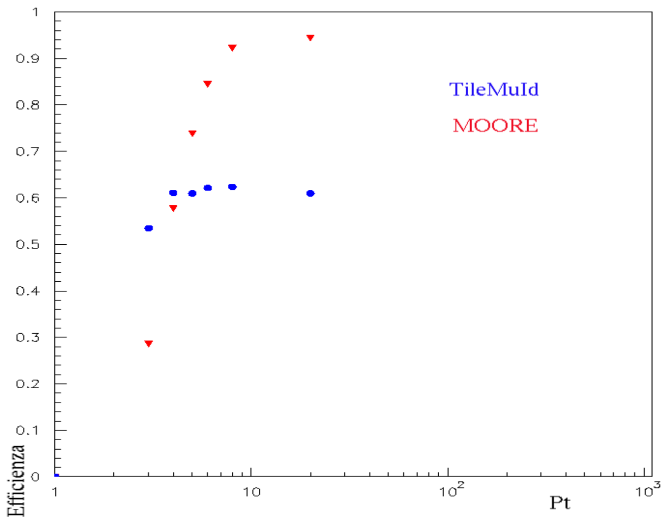
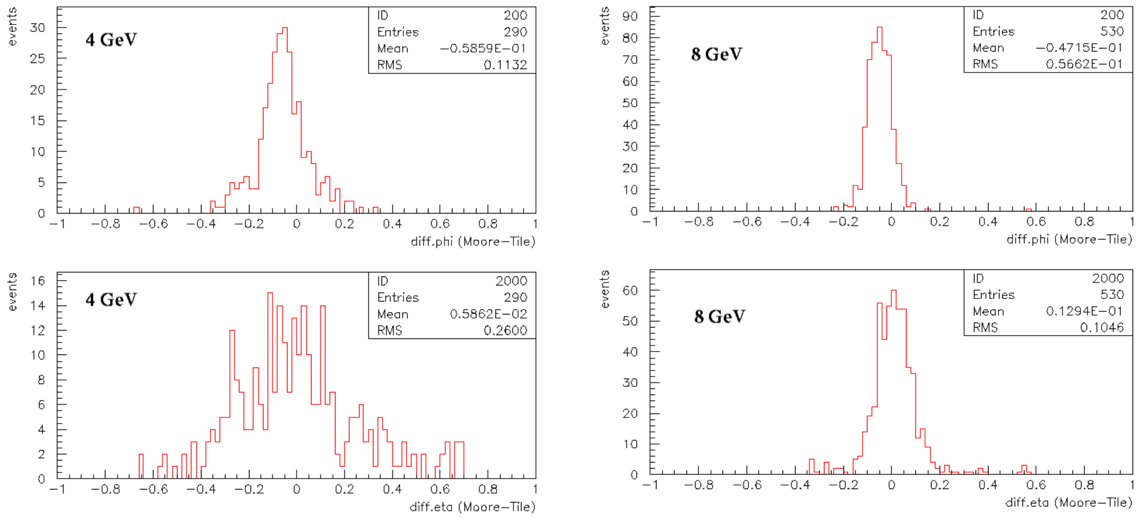


Figure 1: *Selection efficiencies for the Moore and TileMuId packages.*

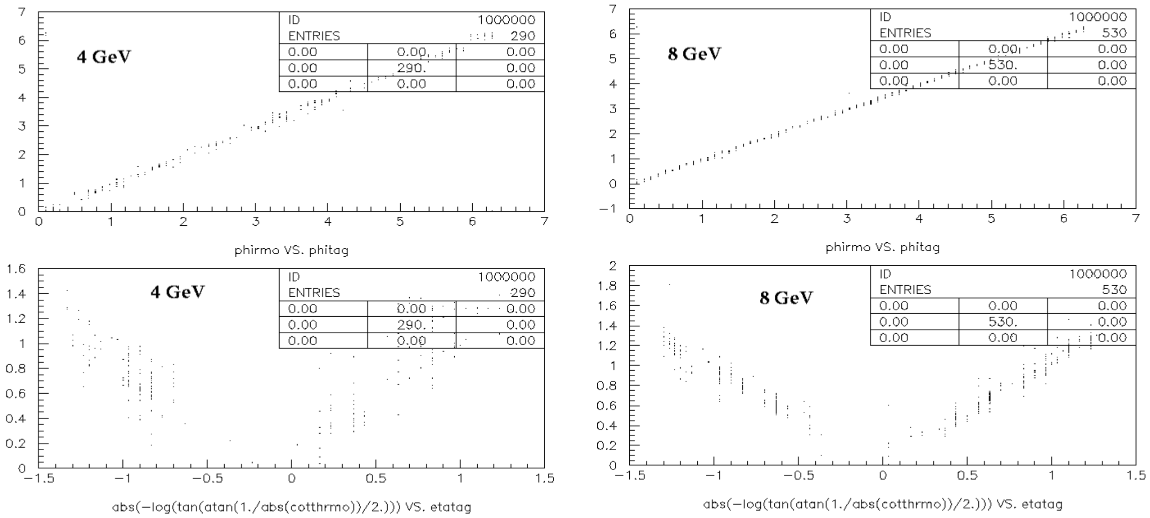


(a) (b)

Figure 2: *The figure (a) shows the distributions of the differences: phi(moore)-phi(calo) (top) eta(moore)-eta(calo) (down) for single muons of 4 GeV. The figure (b) shows the same distributions and in the same order but for single muons of 8 GeV.*

Looking to the scatter plots of eta and phi obtained in TileMuId and MOORE, see figure 3, is evident the linear relation between the phi quantities in the two packages, in eta I have to consider the granularity (± 0.2).

In the figure 4 are shown the number of hits in the MDT chamber by MOORE, depending on the



(a) (b)

Figure 3: *The figure (a) shows the distributions of the differences of phi in moore vs phi in the calo (top) eta in moore vs eta in the calo (down) for single muons of 4 GeV. The figure (b) shows the distributions of the same differences for single muons of 8 GeV.*

muon pt, these hits are for the only muons that are reconstructed in MOORE.

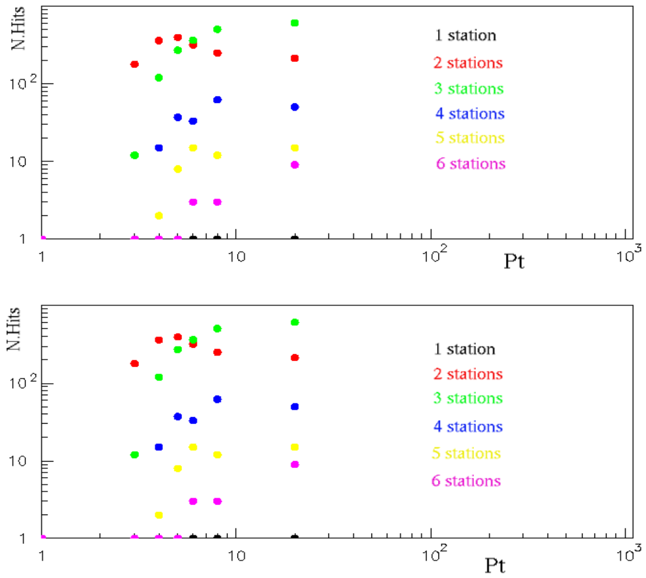


Figure 4: *Number of hits depending on the number of chambers, in the plots stations, fired. For example the red dots for the 2 stations means the number of hits when are fired two chambers.*

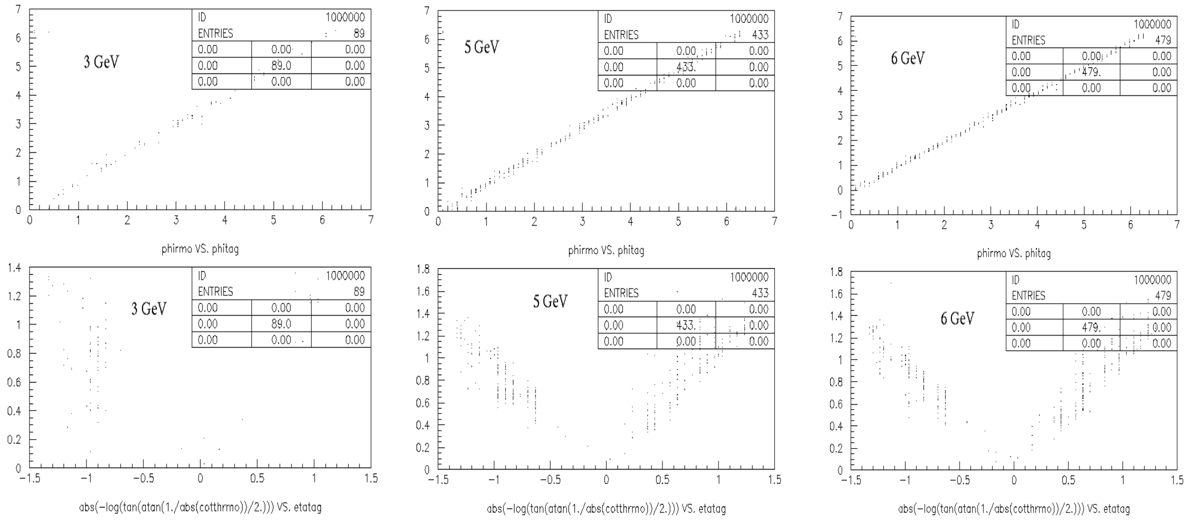
2 Future

Starting from the angular values of phi and eta obtained by Tile Calorimeter, I should recover the muons that are not reconstructed in MOORE, so low pt muons that are not passed through more than 2 chambers, in particular those muons that fired only the Inner Station.

Knowing that the relation between eta and phi for the two packages TileMuId and MOORE is linear, as shown in figure 3, it is possible to recover the hits of the Inner Station, asking for a linear matching between the variables in the two packages, with errors that are confident with algorithm resolutions, figure 2.

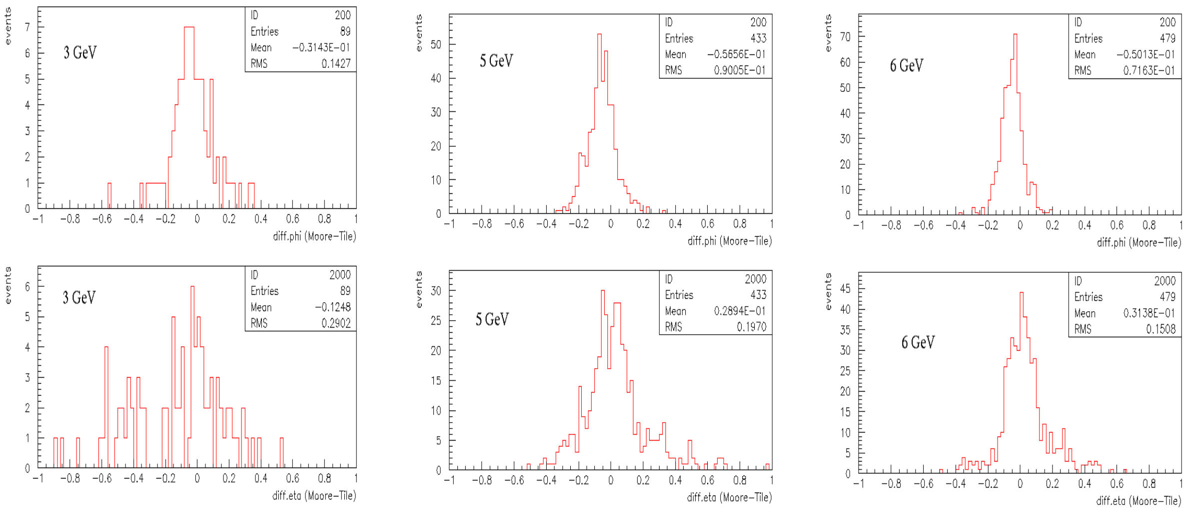
3 Appendix

In this appendix follow the plots obtained for pt: 3, 5, 6 GeV.



(a) (b) (c)

Figure 5: *The figure (a) shows the distributions of the differences of phi in moore vs phi in the calo (top) eta in moore vs eta in the calo (down) for single muons of 3 GeV. The figure (b) shows the distributions of the same differences for single muons of 5 GeV, while the figure (c) for a single muon of 6 GeV.*



(a) (b) (c)

Figure 6: *The figure (a) shows the distributions of the differences: phi(moore)-phi(calo) (top) eta(moore)-eta(calo) (down) for single muons of 3 GeV. The figure (b) shows the same distributions and in the same order but for single muons of 5 GeV, while the figure (c) for single muons of 6 GeV.*