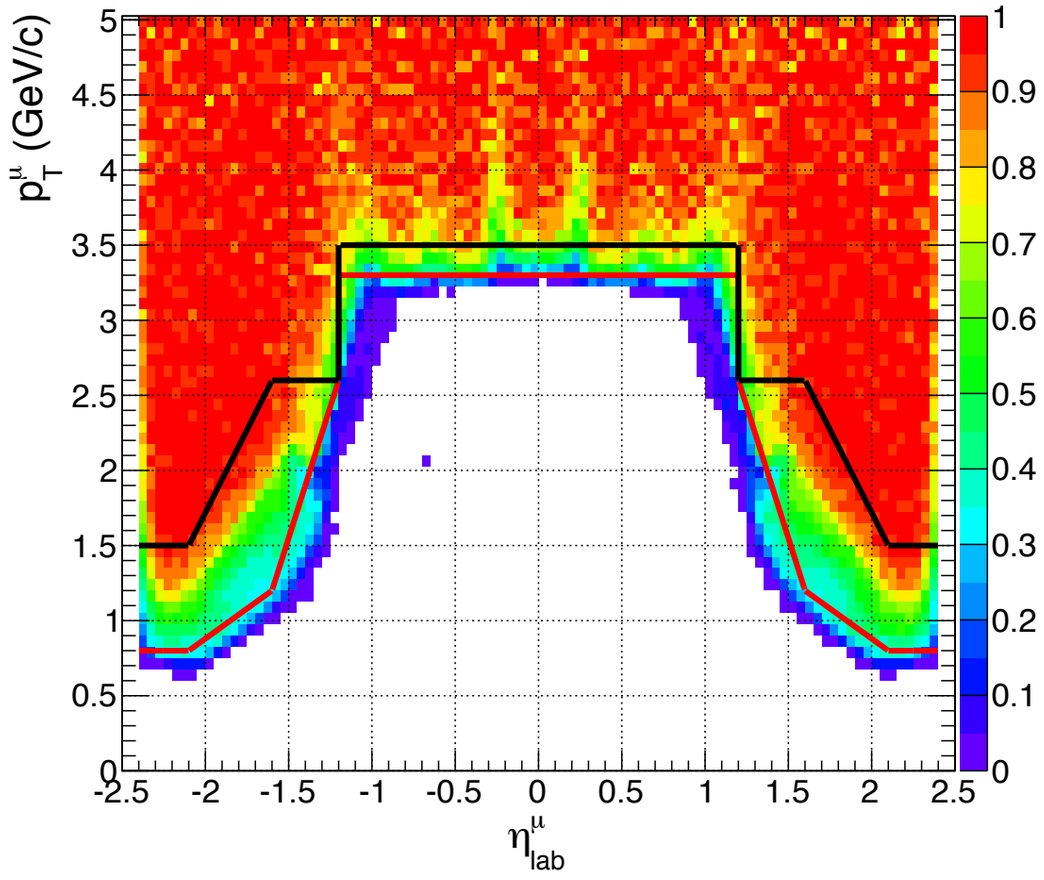
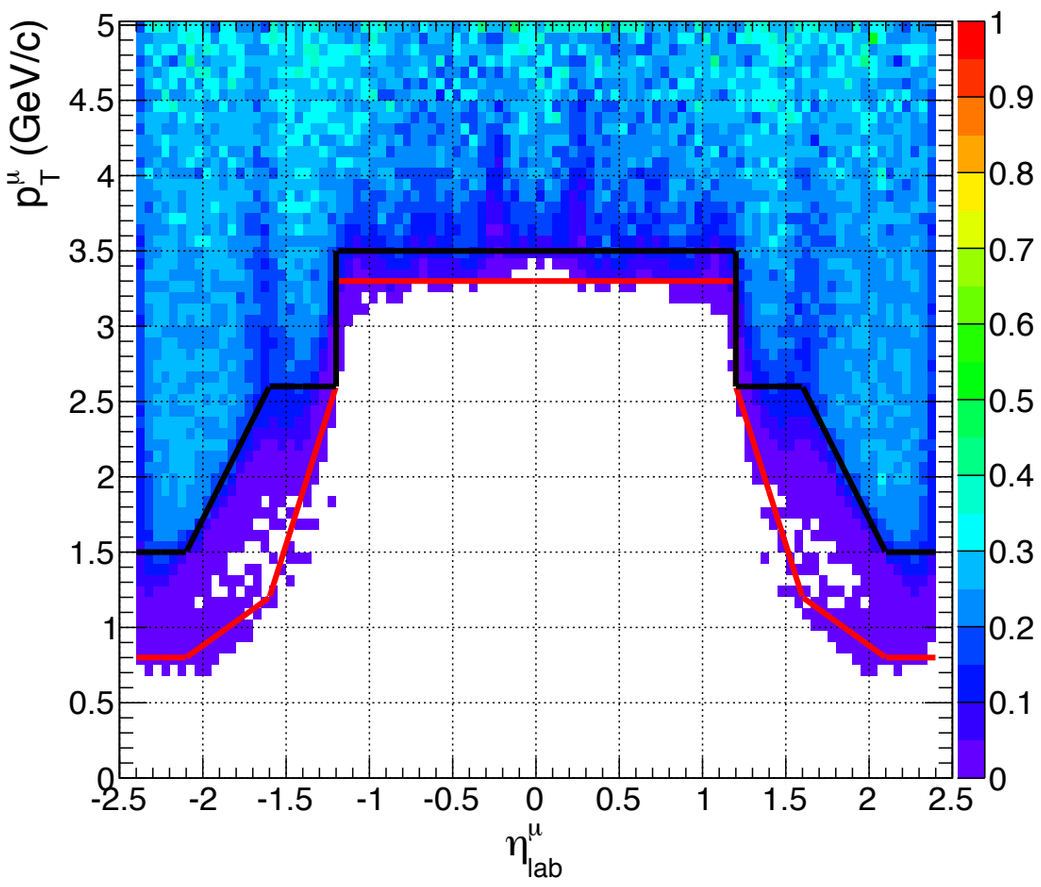
single muon efficiency

1) no muon quality cut, no trigger selection (as done in the BPH 10-002)



2) with muon quality cut and trigger selection



- **single muon acceptance cut to guarantee the efficiency > 10 %**

1) Loose cut (Red line) for the left plot

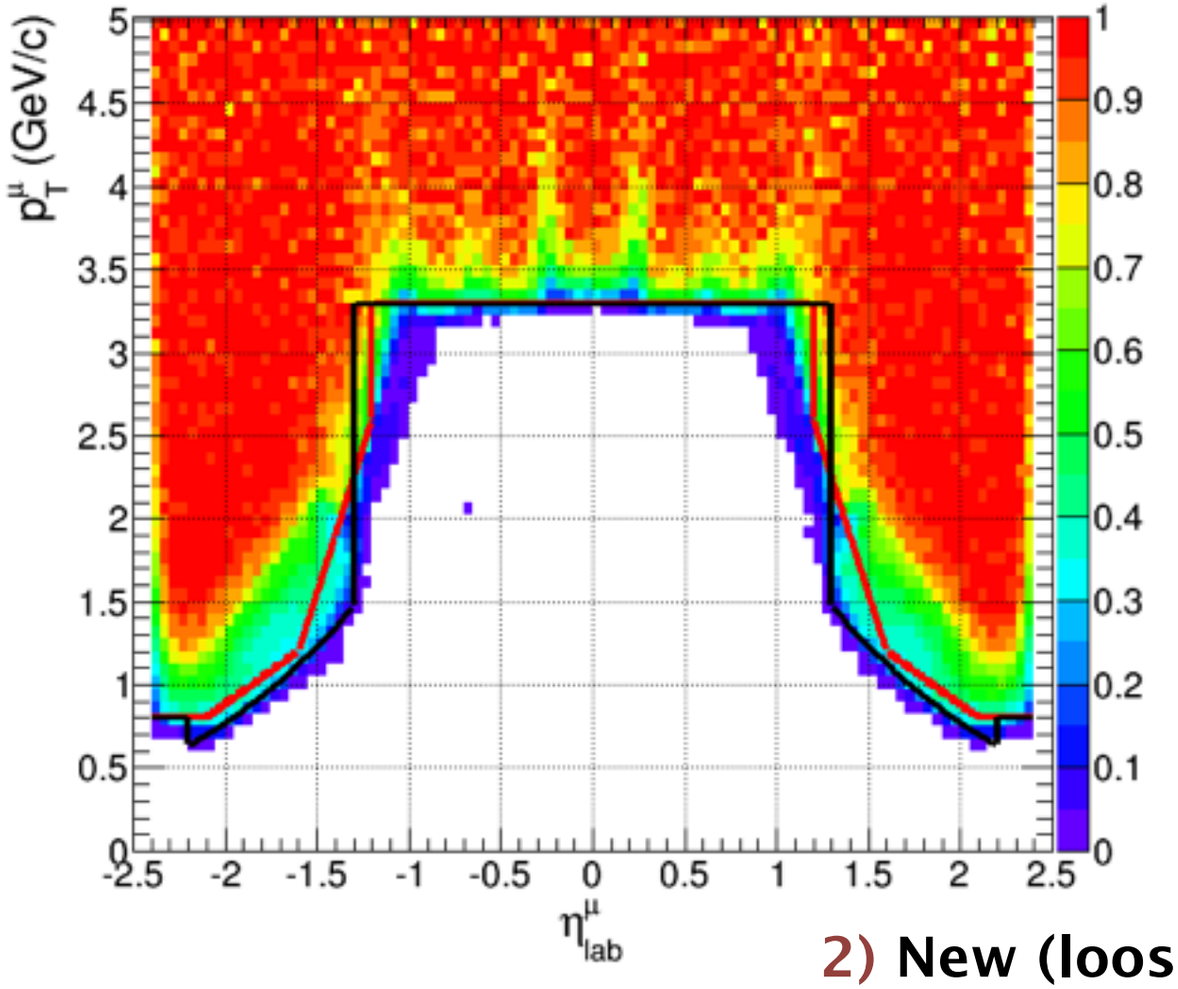
- $|\eta^\mu| < 1.2$ → $p_T > 3.3$ GeV/c
- $1.2 < |\eta^\mu| < 1.6$ → $p_T > -3.5 \times \text{abs}(\eta^\mu) + 6.79$
- $1.6 < |\eta^\mu| < 2.1$ → $p_T > -0.8 \times \text{abs}(\eta^\mu) + 2.48$
- $2.1 < |\eta^\mu| < 2.4$ → $p_T > 0.8$ GeV/c

2) Tight cut (Black line) for the right plot

- $|\eta^\mu| < 1.2$ → $p_T > 3.5$ GeV/c
- $1.2 < |\eta^\mu| < 1.6$ → $p_T > 2.6$ GeV/c
- $1.6 < |\eta^\mu| < 2.1$ → $p_T > -2.2 \times \text{abs}(\eta^\mu) + 6.12$
- $2.1 < |\eta^\mu| < 2.4$ → $p_T > 1.5$ GeV/c

single muon efficiency

- **Comparison of the "new loose cut (red)" and "old cut (black)"**



1) old cut (black)

$$
\begin{aligned}
|\eta^\mu| < 1.3 &\rightarrow p_{\mathrm{T}}^\mu > 3.3\ \mathrm{GeV}/c \\
1.3 < |\eta^\mu| < 2.2 &\rightarrow p^\mu > 2.9\ \mathrm{GeV}/c \\
2.2 < |\eta^\mu| < 2.4 &\rightarrow p_{\mathrm{T}}^\mu > 0.8\ \mathrm{GeV}/c
\end{aligned}
$$

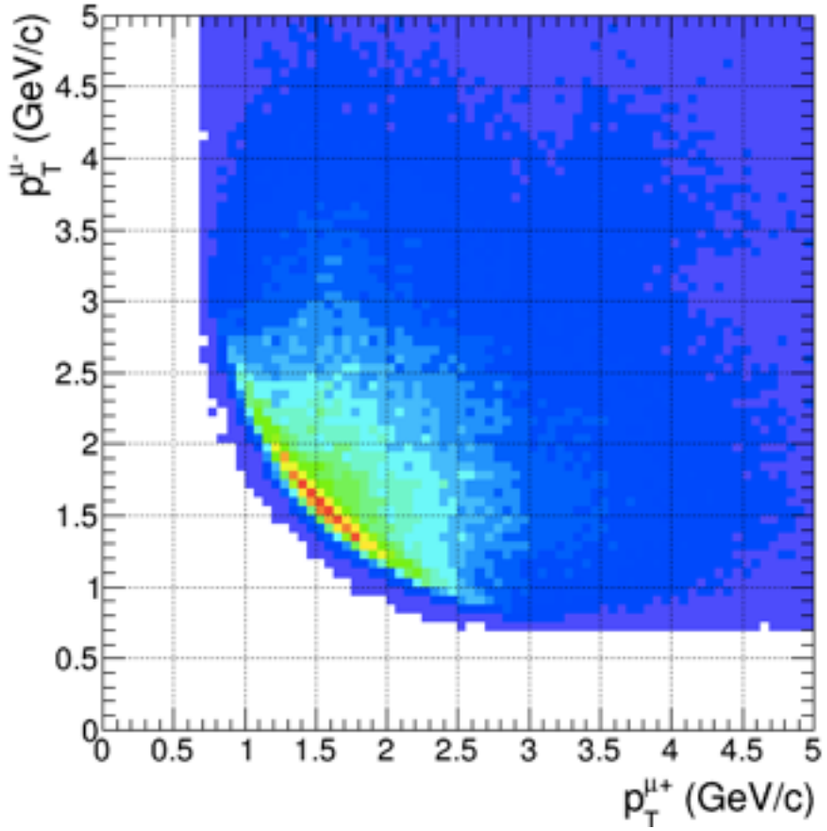
2) New (loose) cut (red)

- $|\eta^\mu| < 1.2$ → $p_T > 3.3$ GeV/c
- $1.2 < |\eta^\mu| < 1.6$ → $p_T > -3.5 \times \mathrm{abs}(\eta^\mu) + 6.79$
- $1.6 < |\eta^\mu| < 2.1$ → $p_T > -0.8 \times \mathrm{abs}(\eta^\mu) + 2.48$
- $2.1 < |\eta^\mu| < 2.4$ → $p_T > 0.8$ GeV/c

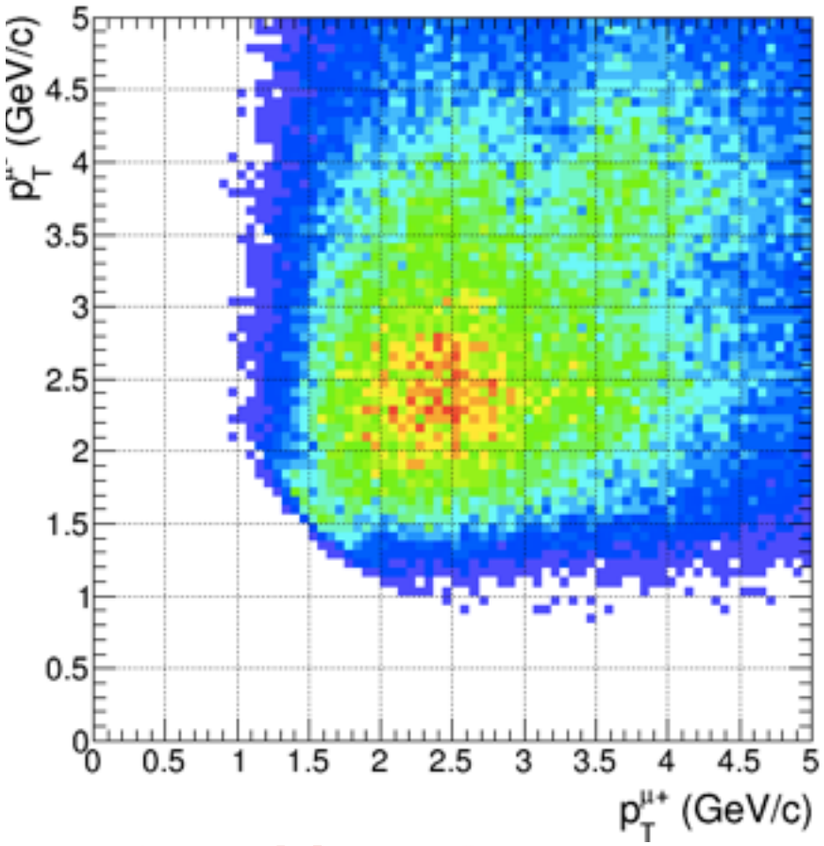
- **Almost similar except 1.2 < eta < 1.6 .. Is this enough?**

problems in the loose cut

- **pT distributions of mu$^+$ and mu$^-$ actually used in the dimuon efficiency estimation**
  - 2.6 < $m_{\mu\mu}$ < 3.5 GeV
    - J/psi p_T and rapidity in the analysis range
    - soft muon ID cut



No trigger

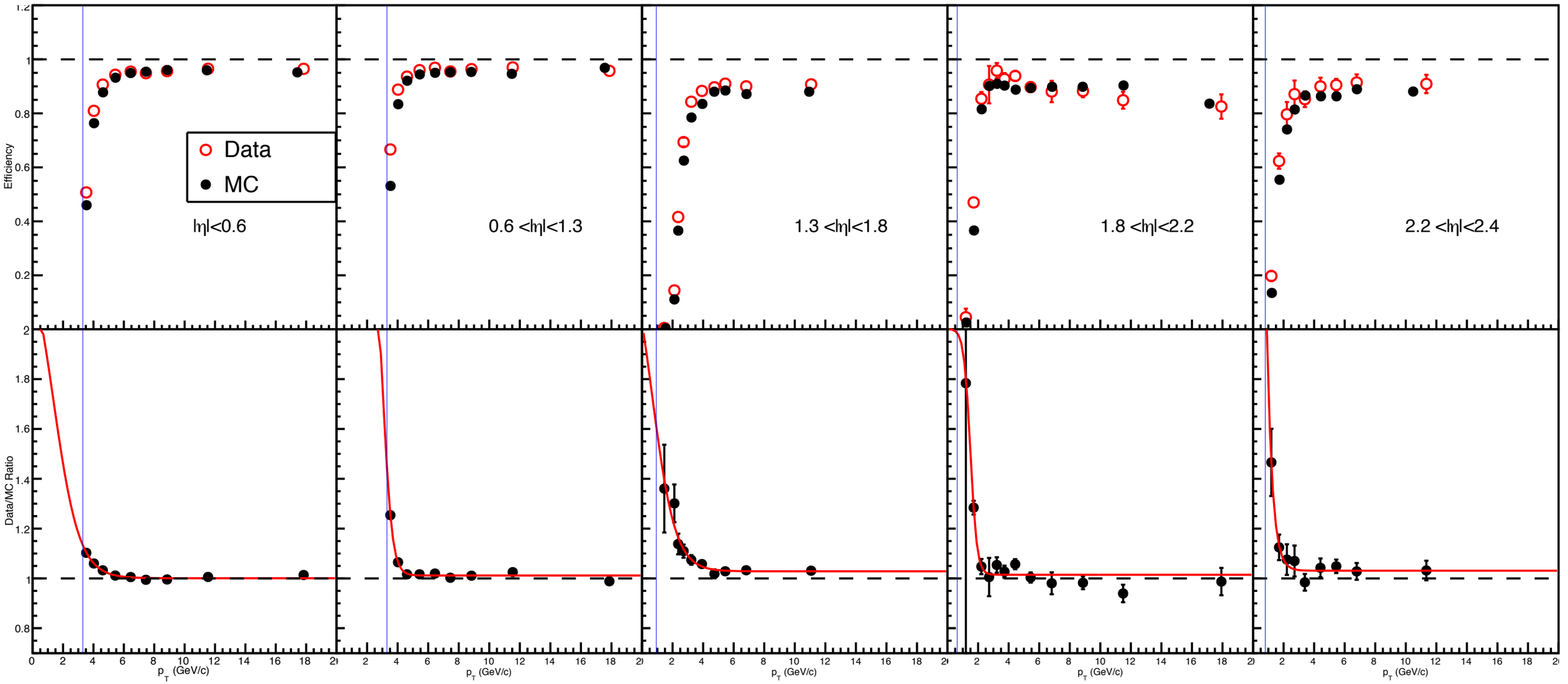


L1DoubleMuOpen trigger

- **problem 1)**
  we don't use reco muons down to p_T ~ 0.8 GeV/c

problems in the loose cut

- **TNP results (from the approval)**



- **Problem 2)**

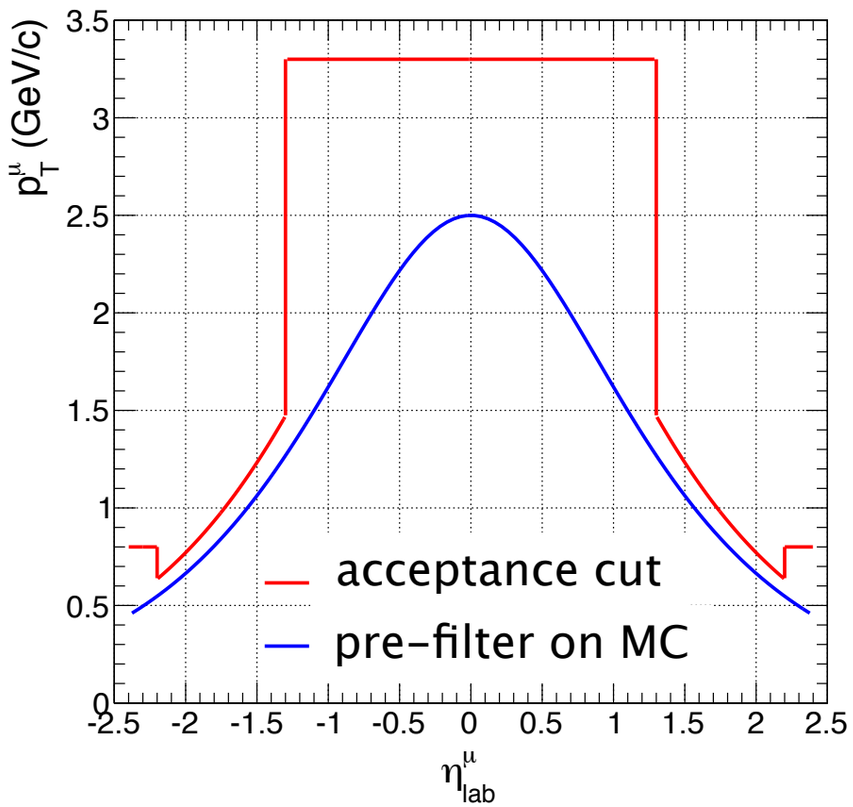
e.g.) For 1.3 < eta < 1.8 or 1.8 < eta < 2.2,

efficiencies too low below 2 GeV, while the loose cut is ~ 1 GeV

Back up

theory prediction

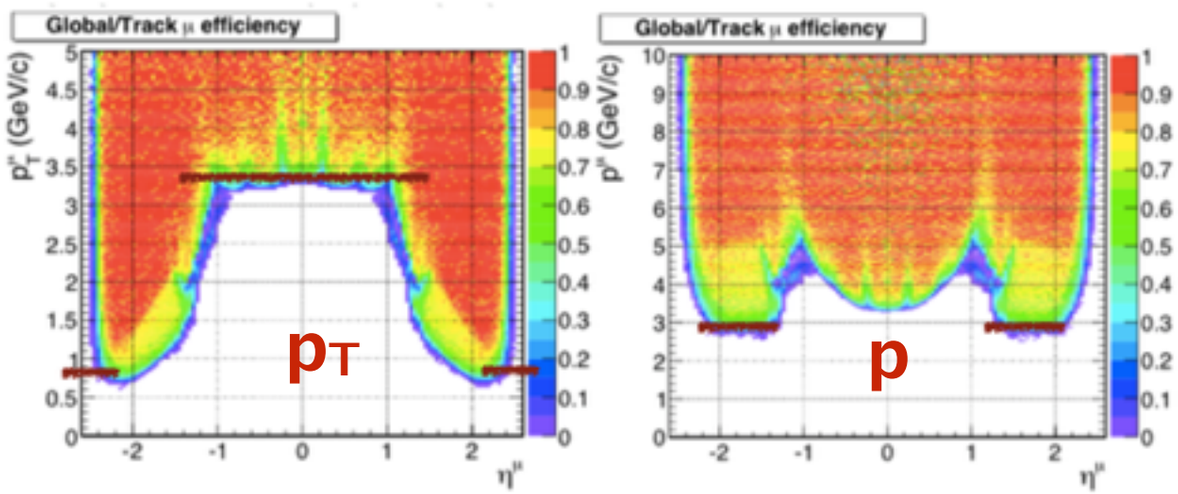
- **Old single muon acceptance cut**



$$
\begin{aligned}
|\eta^\mu| < 1.3 &\rightarrow p_T^\mu > 3.3\ \mathrm{GeV}/c \\
1.3 < |\eta^\mu| < 2.2 &\rightarrow p^\mu > 2.9\ \mathrm{GeV}/c \\
2.2 < |\eta^\mu| < 2.4 &\rightarrow p_T^\mu > 0.8\ \mathrm{GeV}/c
\end{aligned}
$$

: p based!

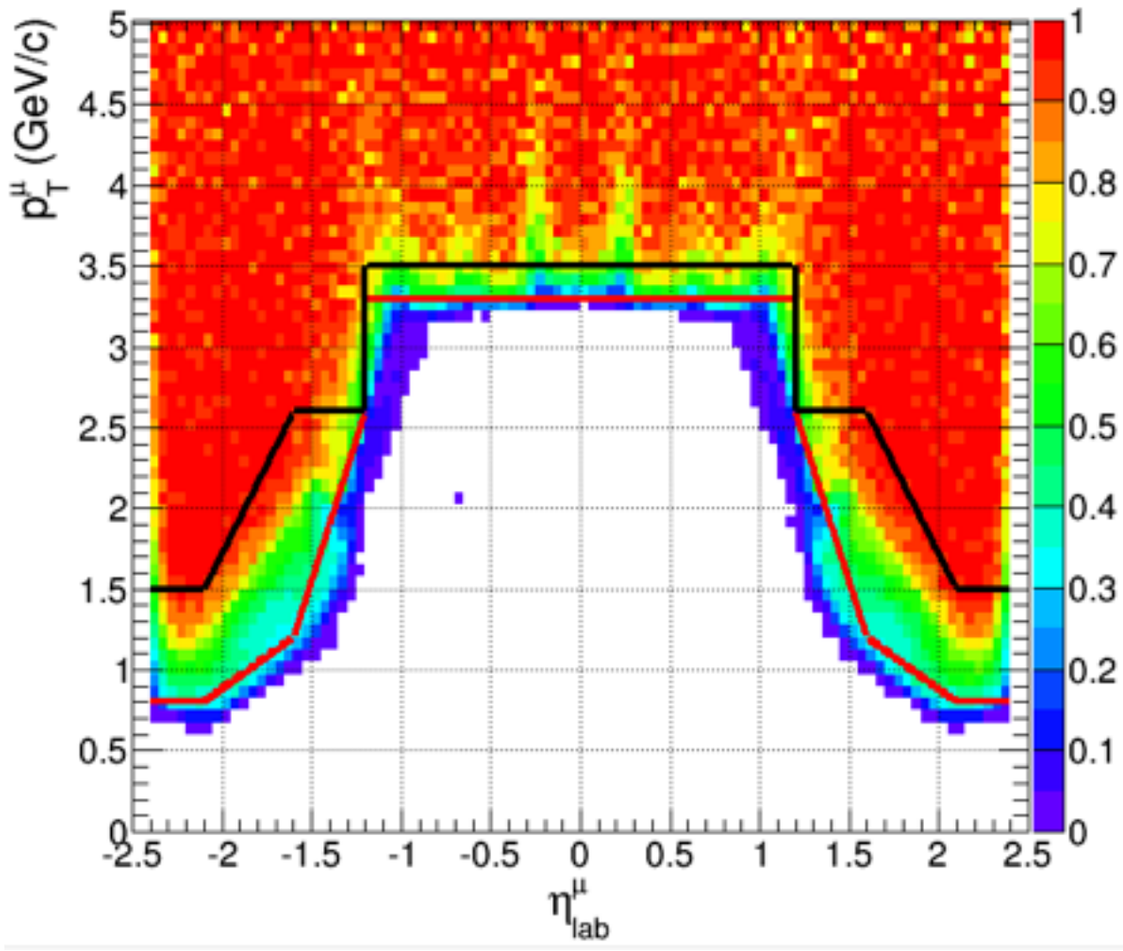
- **e.g.) BPH-10-002**



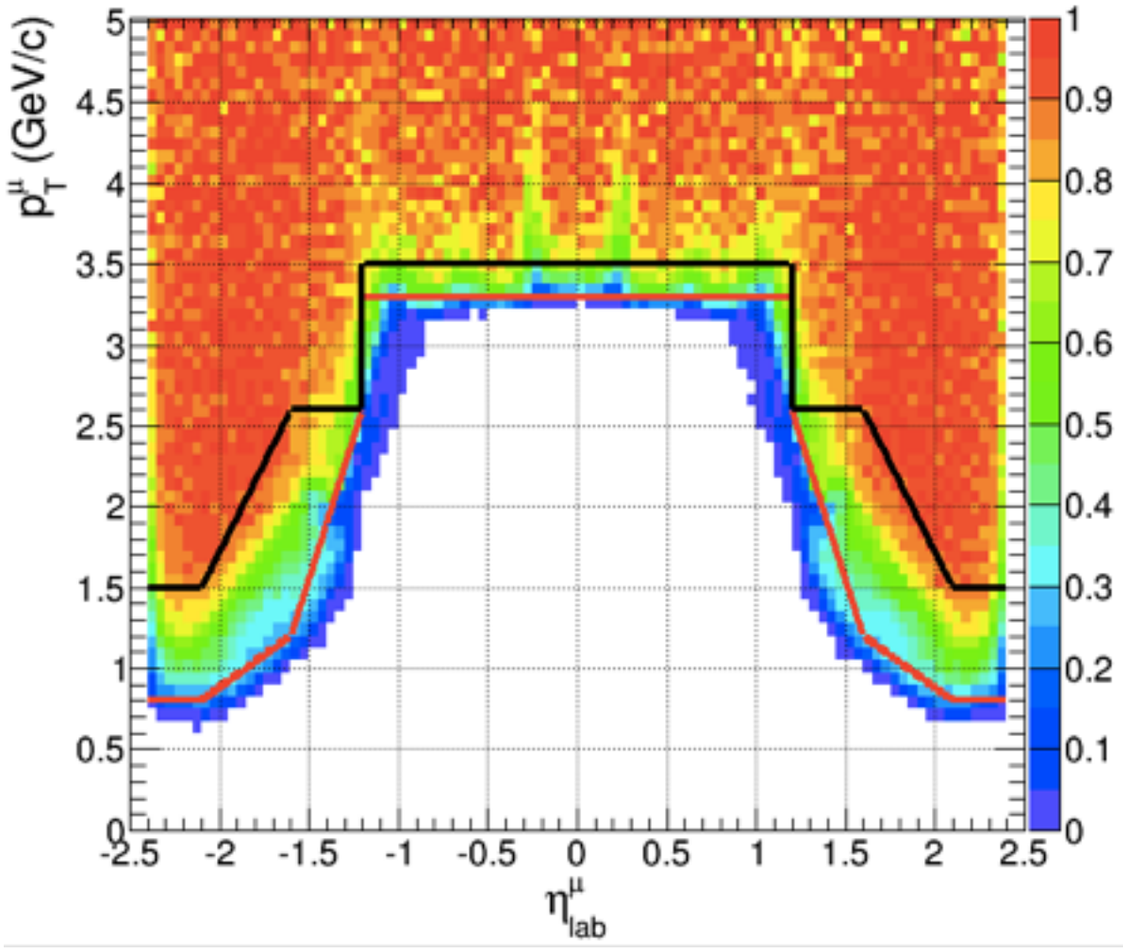
- **New single muon acceptance cut**
  - Ensure the single muon efficiency > 10 %
  - Withdraw “p” cut, and use “p_T” only, for the simplicity and the consistency with TNP (comments from muon POG)
  - Eta ranges considering the detector performance

single muon efficiency

1) no muon quality cut



2) with muon quality cut

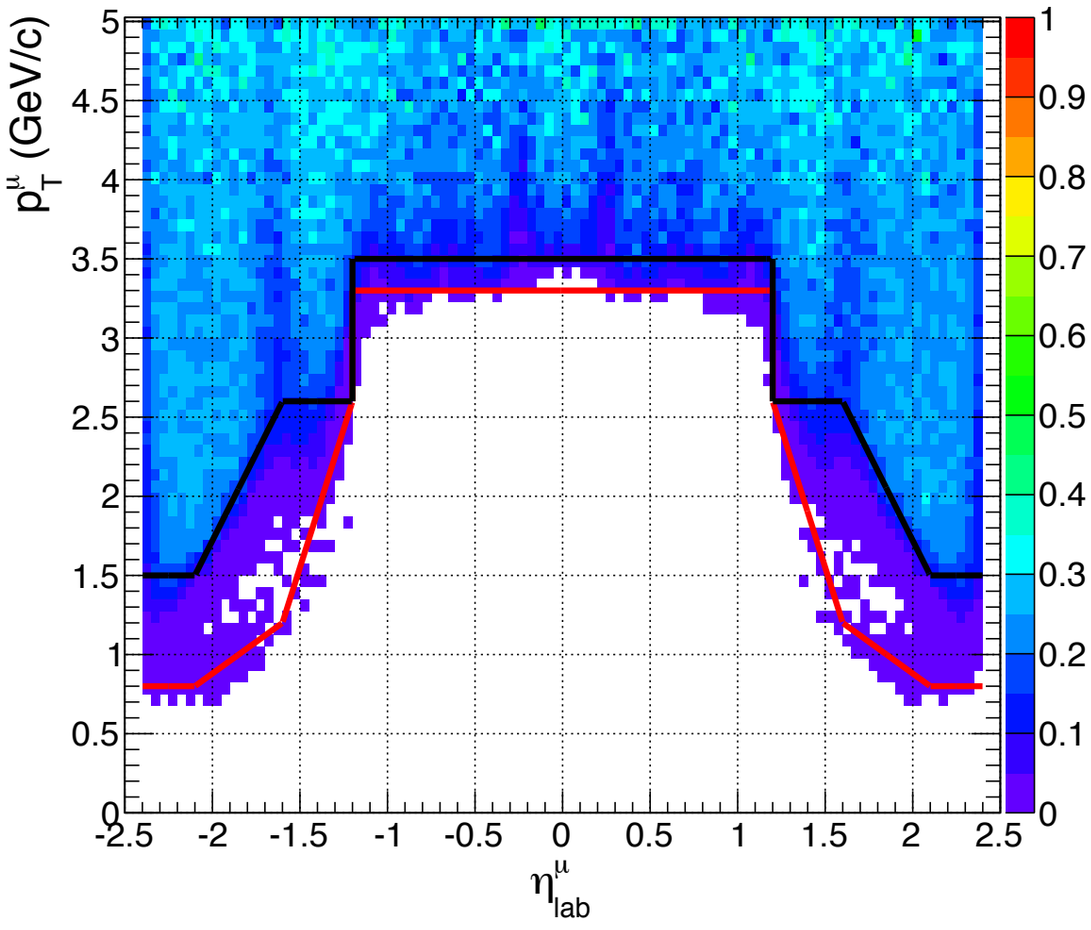


- **Almost no effects on the cut determination**

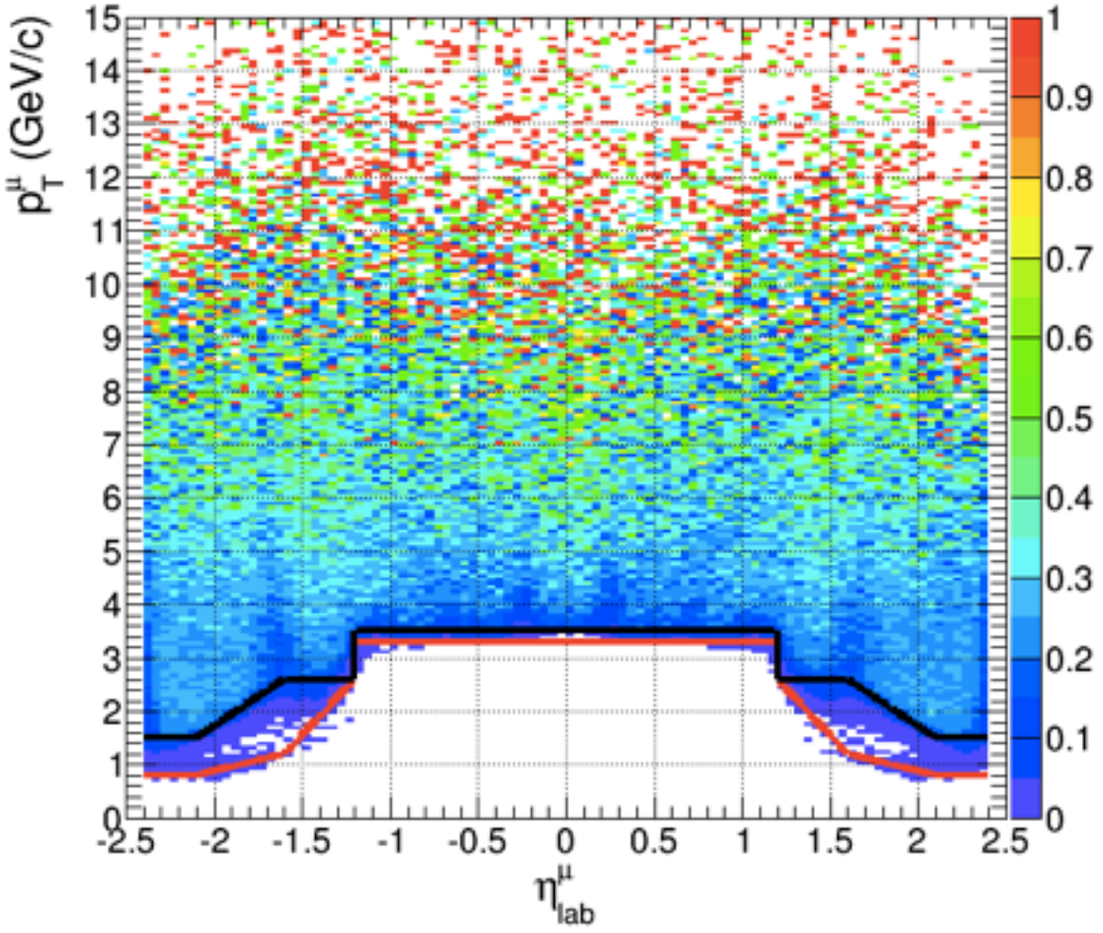
single muon efficiency

2) with muon quality cut and trigger selection

- **cf) Reco_mu efficiency with**
  (Reco_mu_trig&1)==1 [L1DoubleMuOpen]



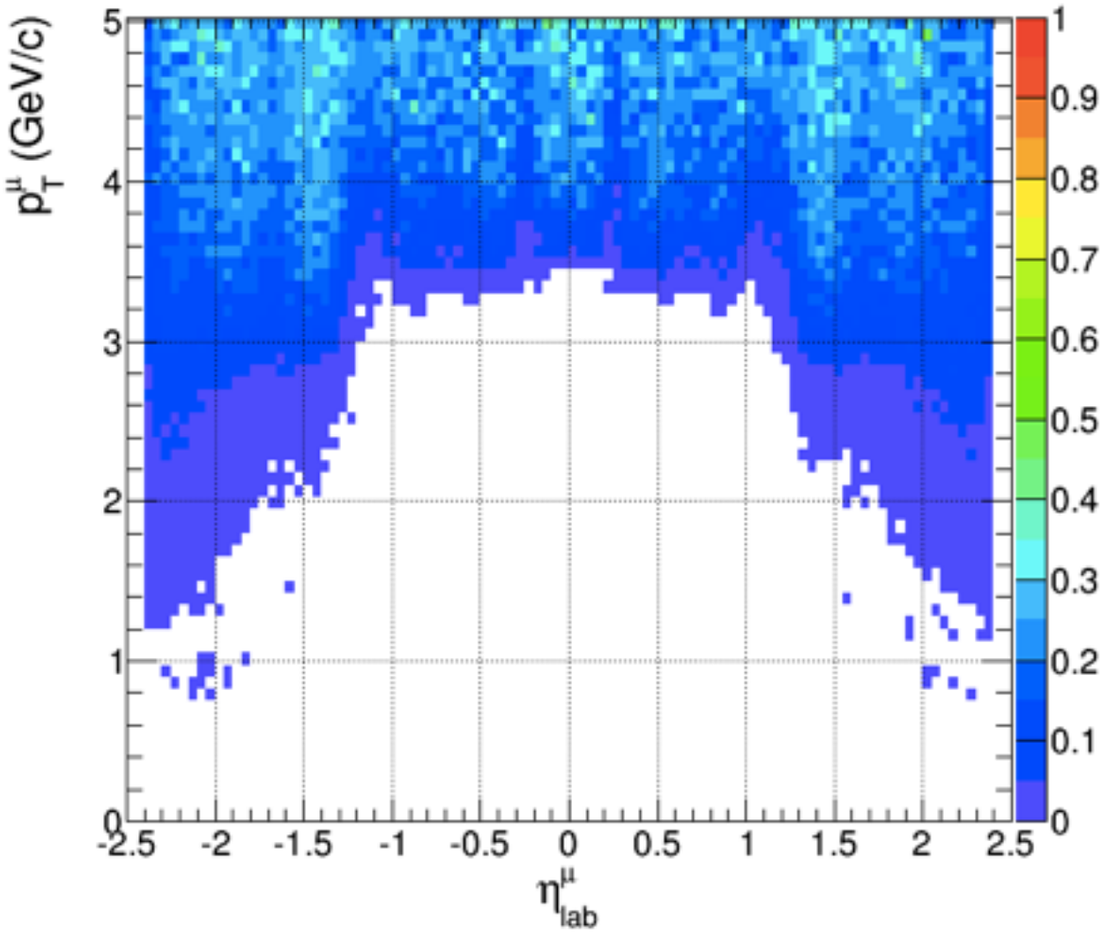
?



single muon efficiency

2) with muon quality cut and trigger selection

- **cf) Reco_mu efficiency with**
  (Reco_mu_trig&5)==5 [L3pAMu3]



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