$\pi^{\pm}$ TRACKING EFFICIENCIES FROM ω PRODUCTION

GlueX Tracking Meeting – 02/07/2019

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Previously…

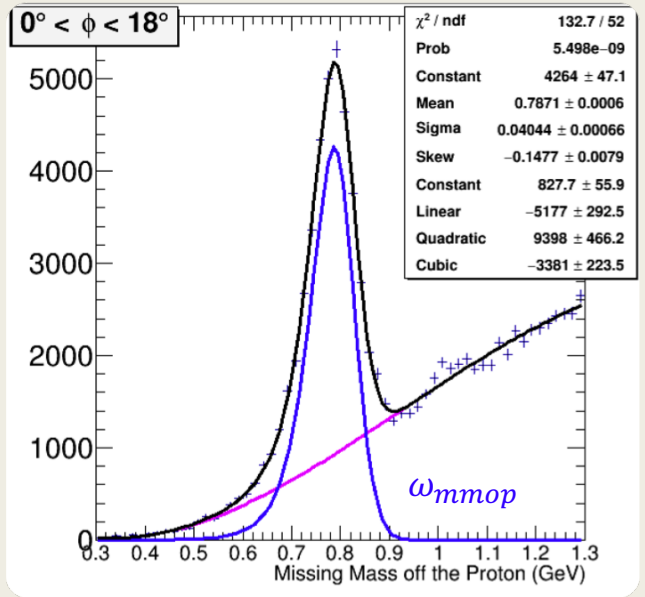
- Calculated $\pi^{\pm}$ efficiency as functions of ϕ, θ, p from analysis of exclusive $\omega \rightarrow (\pi^{\pm})\pi^{\mp}\pi^{0}$ events
- Summaries can be found at
  - https://halldweb.jlab.org/doc-private/DocDB/ShowDocument?docid=3801
  - https://halldweb.jlab.org/wiki/index.php/Meeting-1-24-2019

Now…

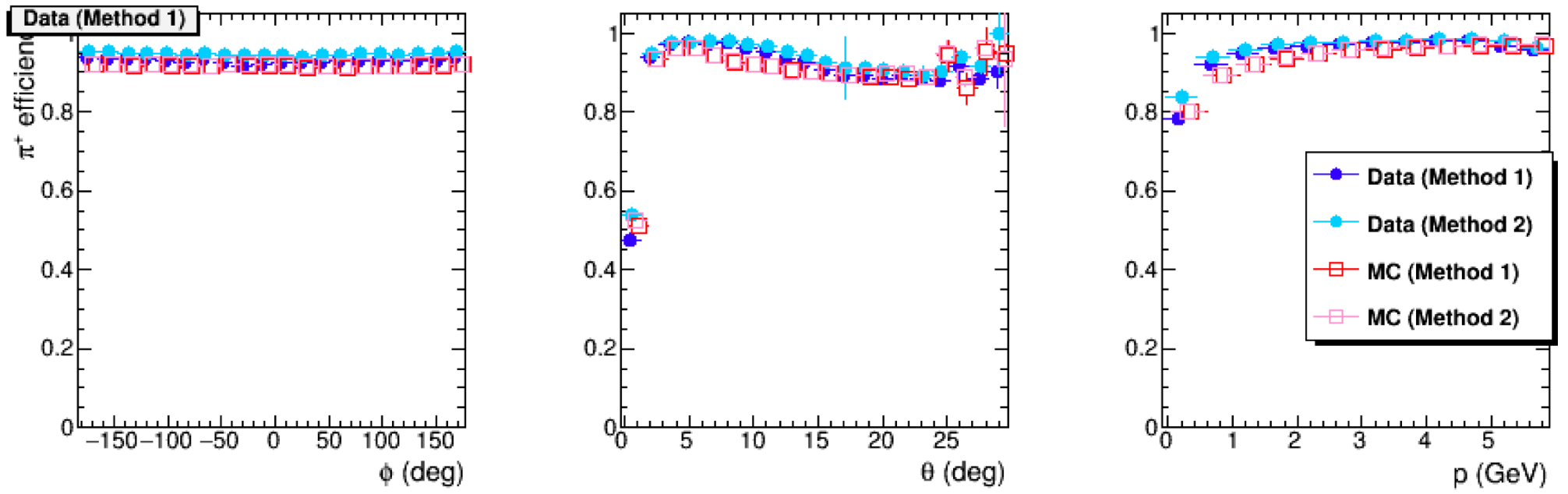
- Added series of cuts on MM^2, $P(\chi^2)$ and $|\Delta p|/p_{reco}$
  - *MM^2 cuts are useless, but $P(\chi^2)$ and $|\Delta p|/p_{reco}$ cuts show some promise*
- Still working with:
  - *TTree files from ReactionFilter plugin pi0pimmisspip__B1_T1_U1_M7*
  - *Data: REST ver03, analysis launch ver23, runs 30274-30499 (~2B entries (before cuts))*
  - *MC: OSG generated: REQUESTED_MC/jz_omega_3pi_geant3_20181012035719pm (~70M entries (before cuts))*

Procedure

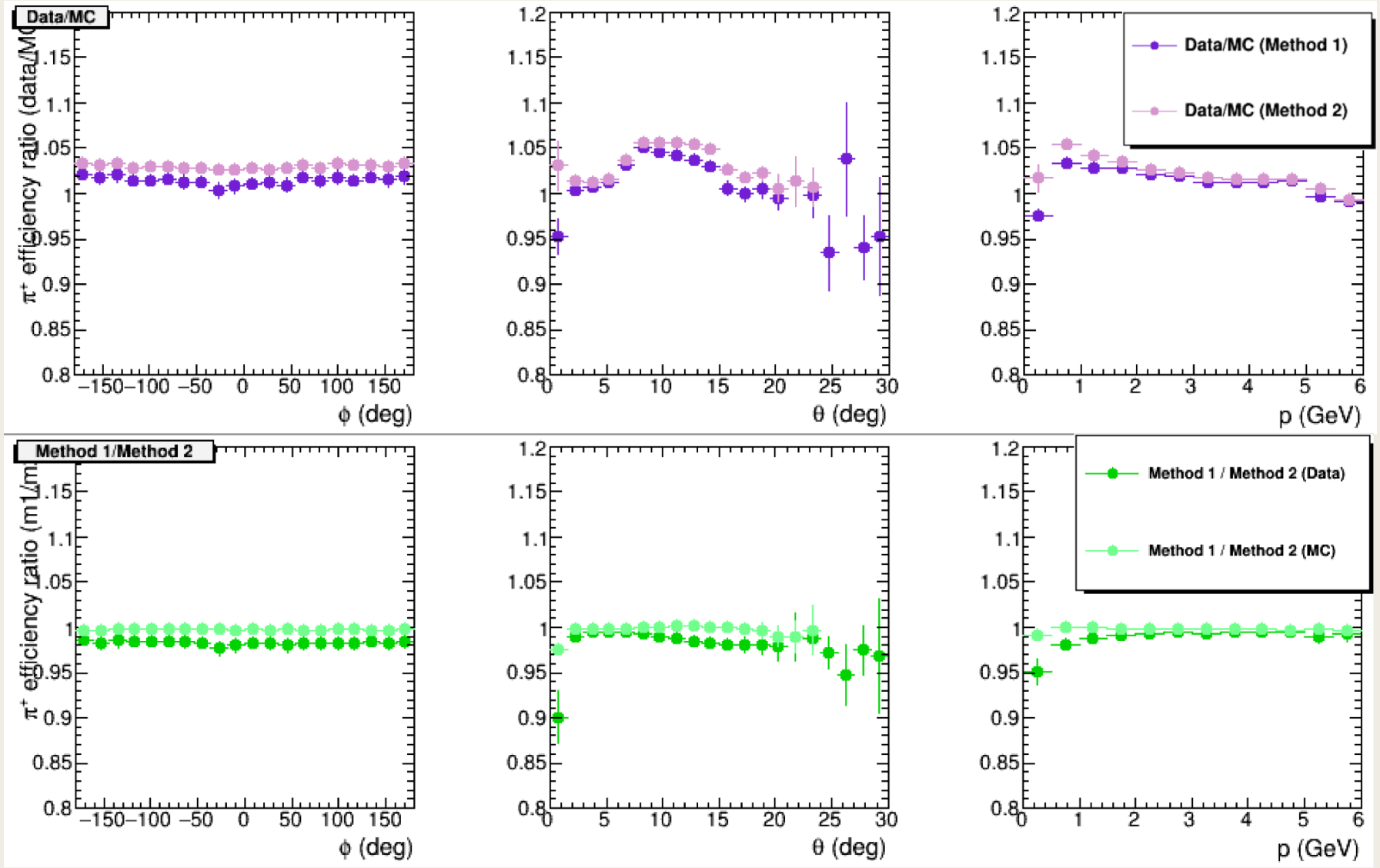
- After applying a series of cuts to data and MC, found ω_{mmop} and ω_{inv} yields by fitting mass distributions with Gaussian peaks and cubic polynomial background
  - *Reminder: mmop stands for missing mass off the proton, aka recoil mass, and is defined in the DSelector as:*
    - `TLorentzVector locOmegaP4_mmop = locBeamP4_Measured + dTargetP4 - locProtonP4_Measured;`
- Used two methods to determine efficiency from ω yields
  - $\varepsilon_1 = \dfrac{\omega_{mmop}|1\ \text{“}good\text{”}\ track\ candidate}{\omega_{mmop}|1\ candidate + \omega_{mmop}|0\ candidates}$
  - $\varepsilon_2 = \dfrac{\omega_{inv}}{\omega_{inv} + \omega_{mmop}|0\ candidates}$
- Both methods show good agreement in the data and MC



Efficiencies Before Analysis-Level Cuts

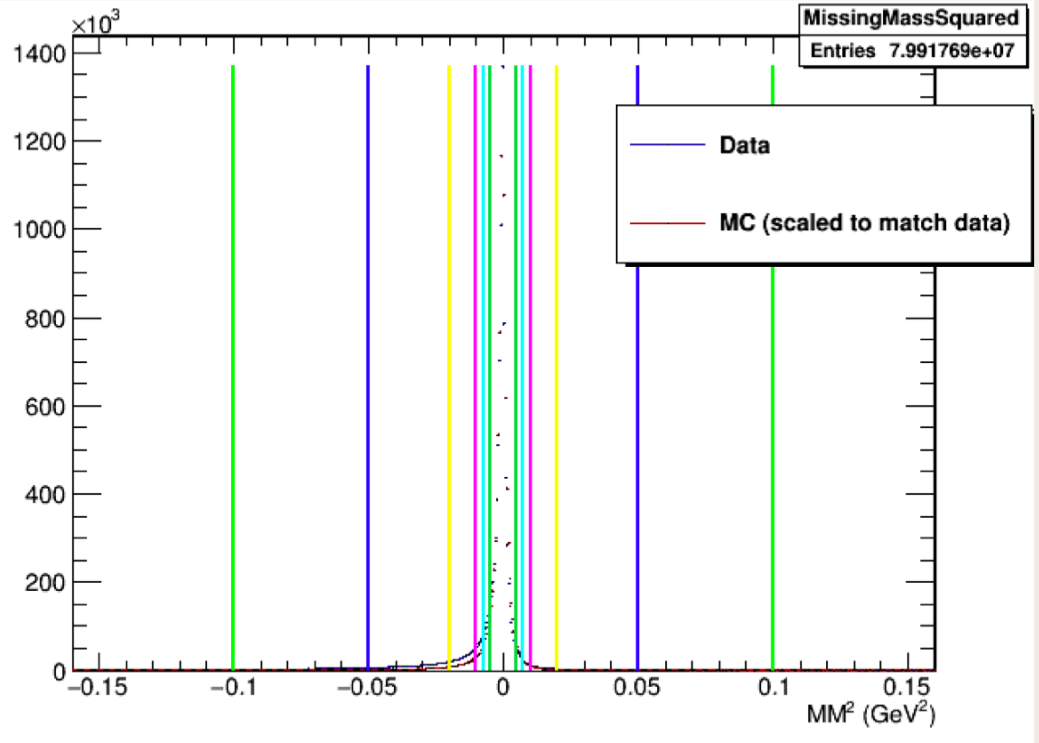


Efficiency Ratios Before Analysis-Level Cuts



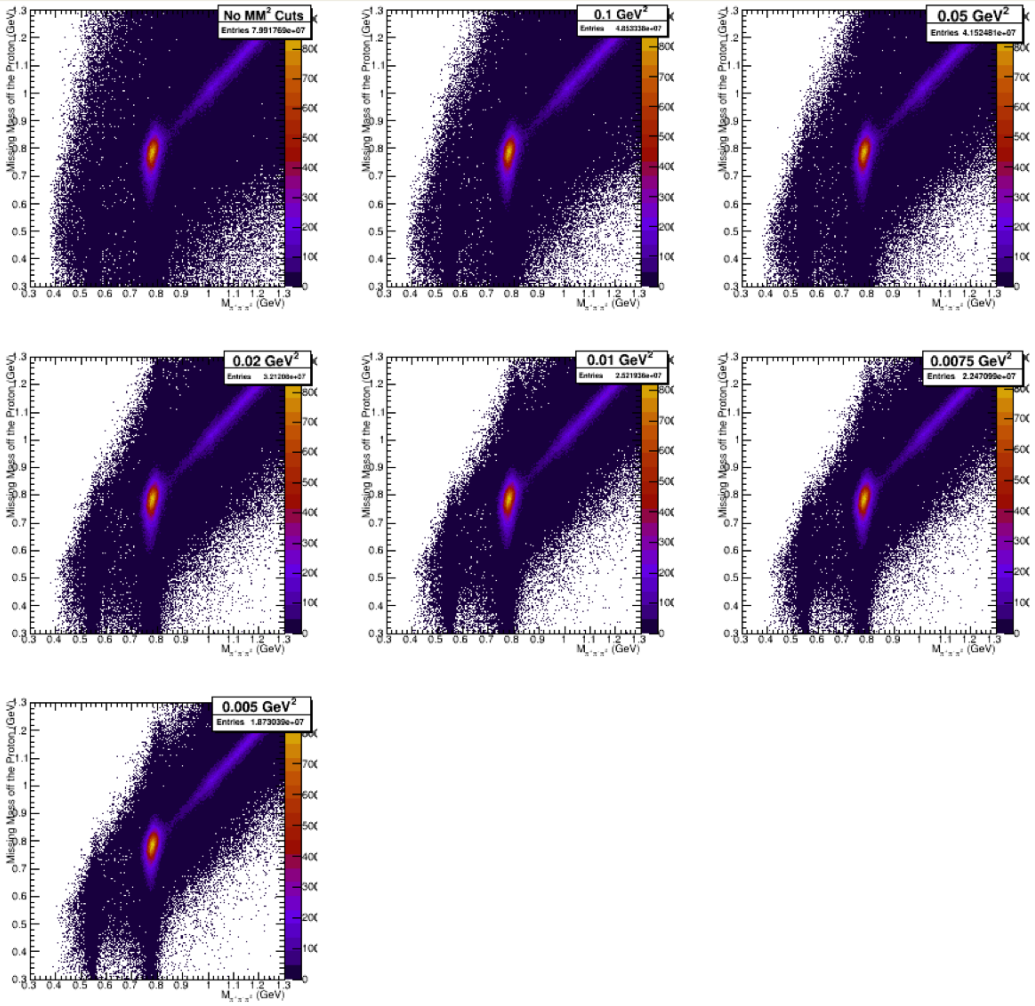
Missing Mass^2 Cuts

We initially tried placing cuts at $\pm$ 0.1 GeV^2. When this had almost no effect, we placed further cuts at $\pm$0.05, 0.02, 0.01, 0.0075, and 0.005 GeV^2.
The goal was to look for a visible change in the efficiency vs θ distribution around $10–20°$ associated with the FDC/CDC transition, which should indicate that our cuts are reducing efficiency for poorly reconstructed tracks.

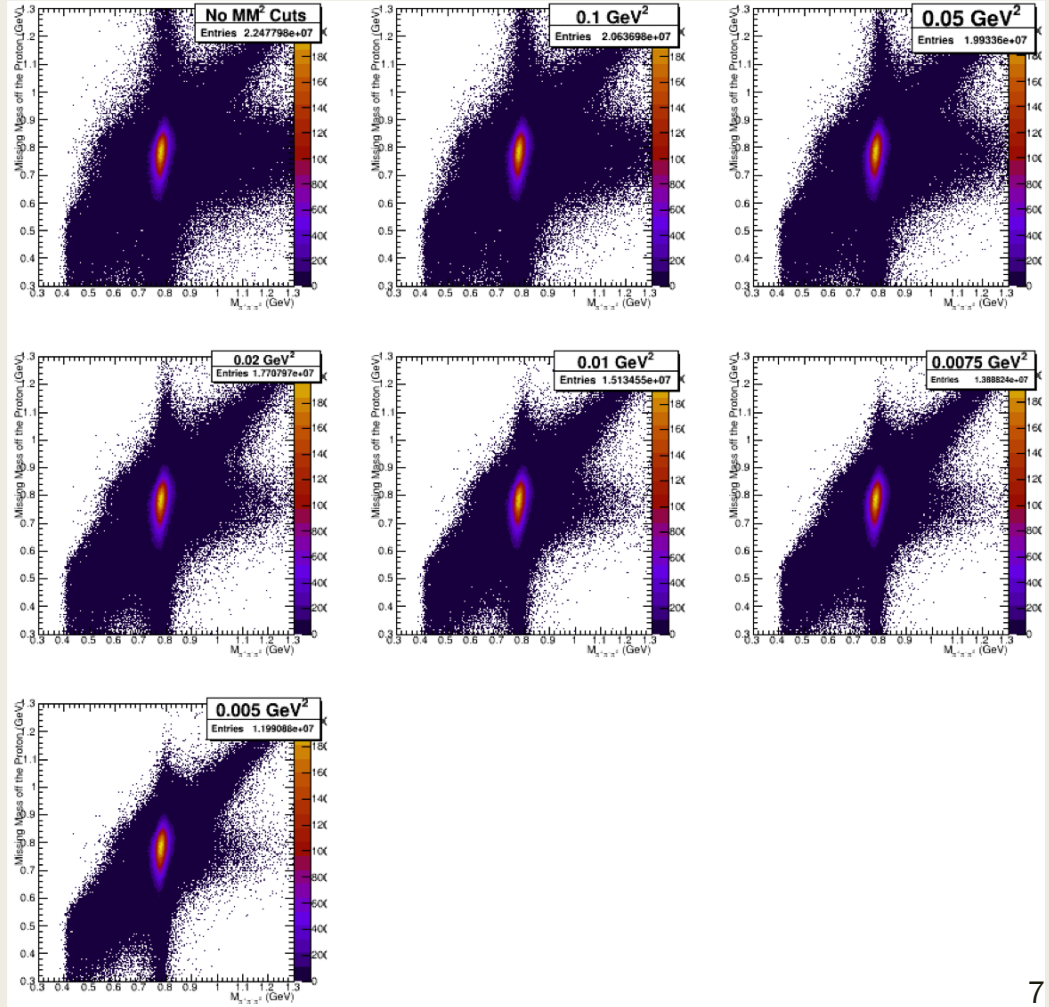


Mass Correlation Plots with MM^2 Cuts

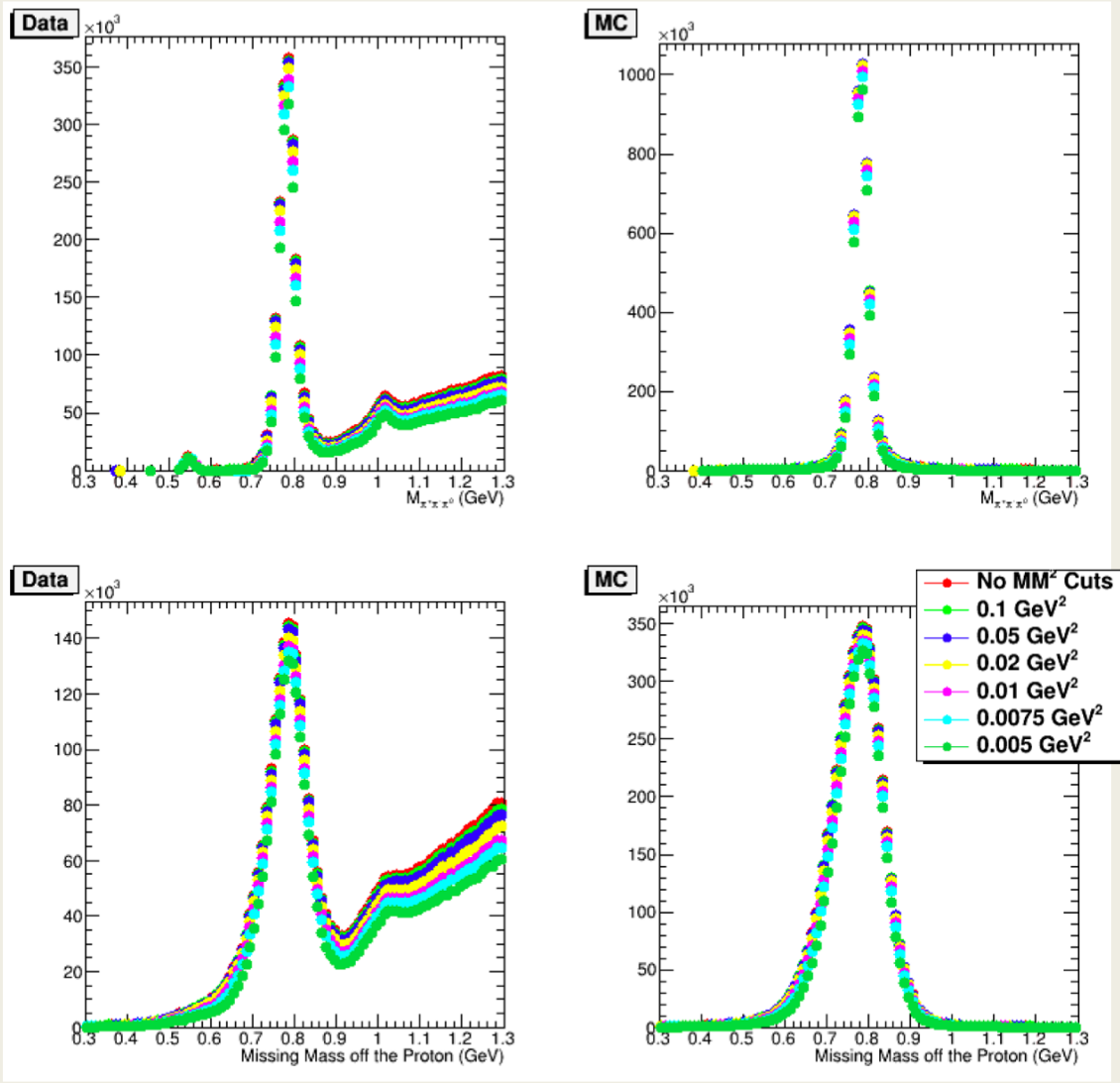
Data



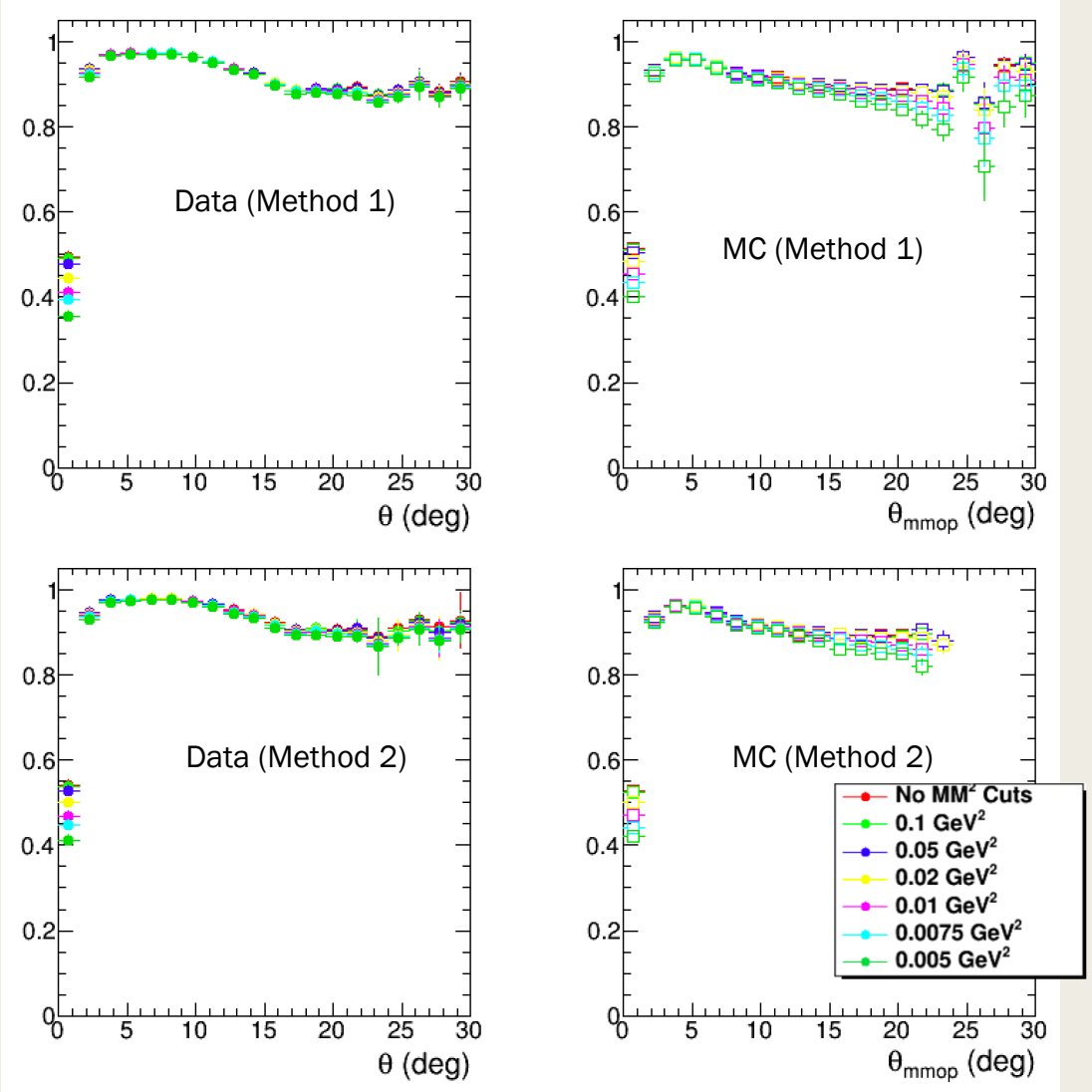
MC



1D Mass Plots with MM^2 Cuts



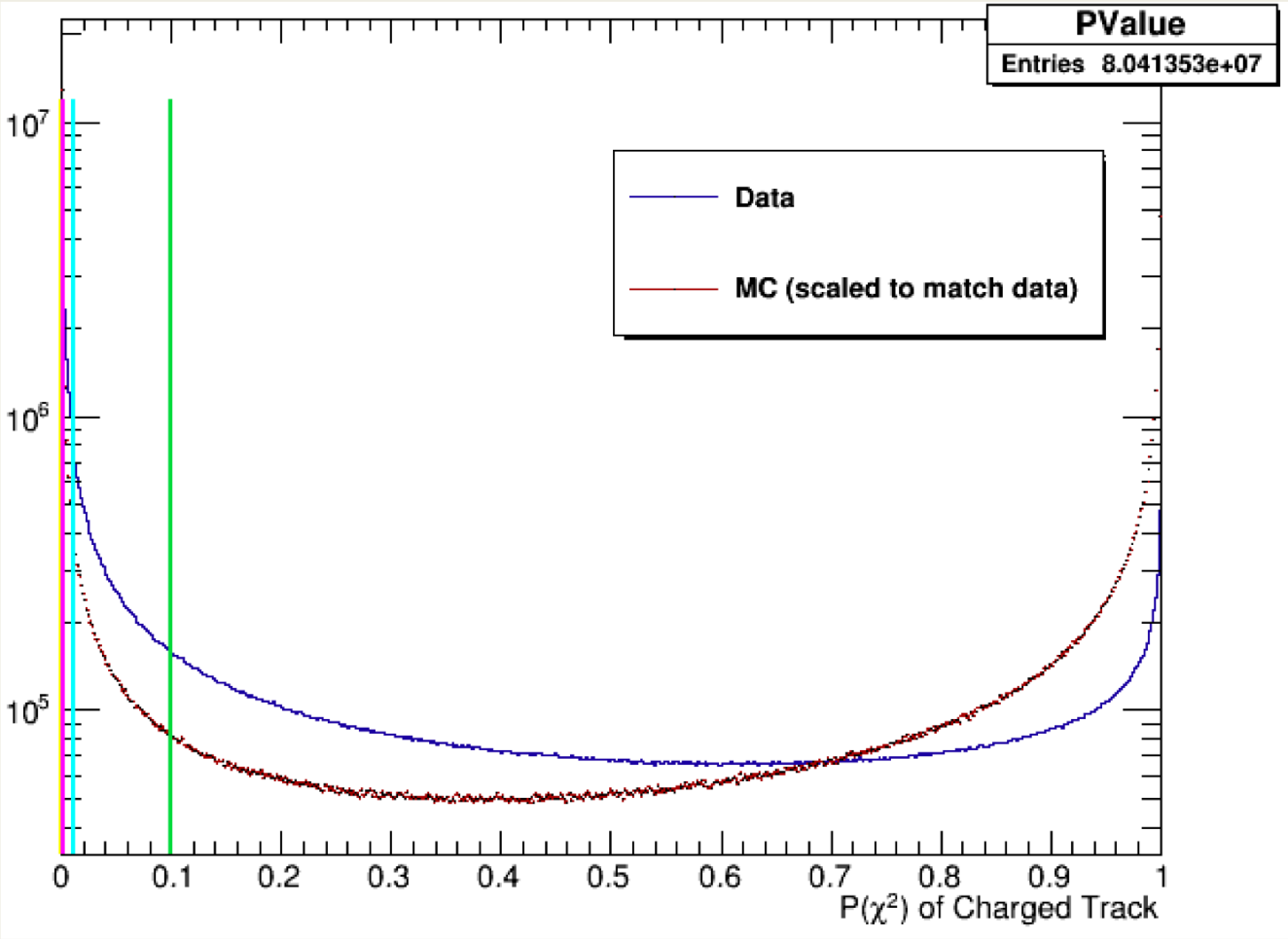
Efficiencies with MM^2 Cuts



$P(\chi^2)$ Cuts

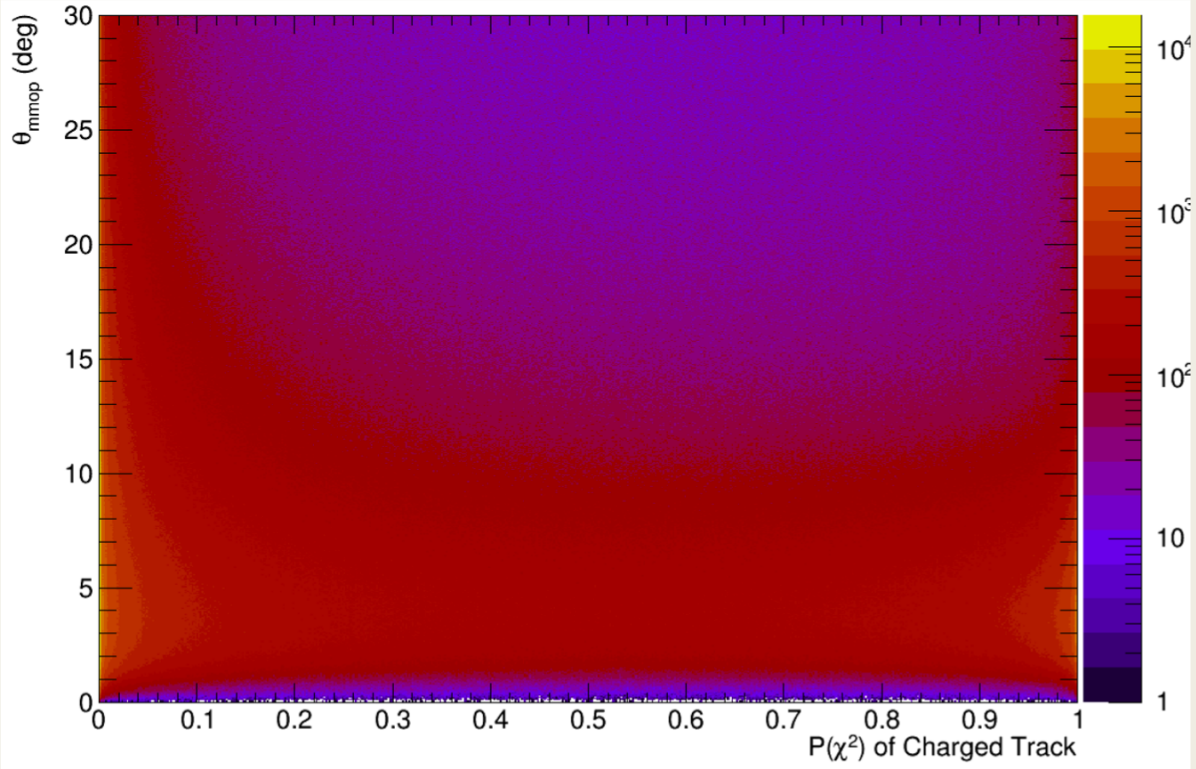
We placed a series of cuts on $P(\chi^2)$ > 0.000001, 0.00001, 0.0001, 0.001, 0.01, and 0.1.

These cuts turn out to have more of an effect than the MM^2 cuts.

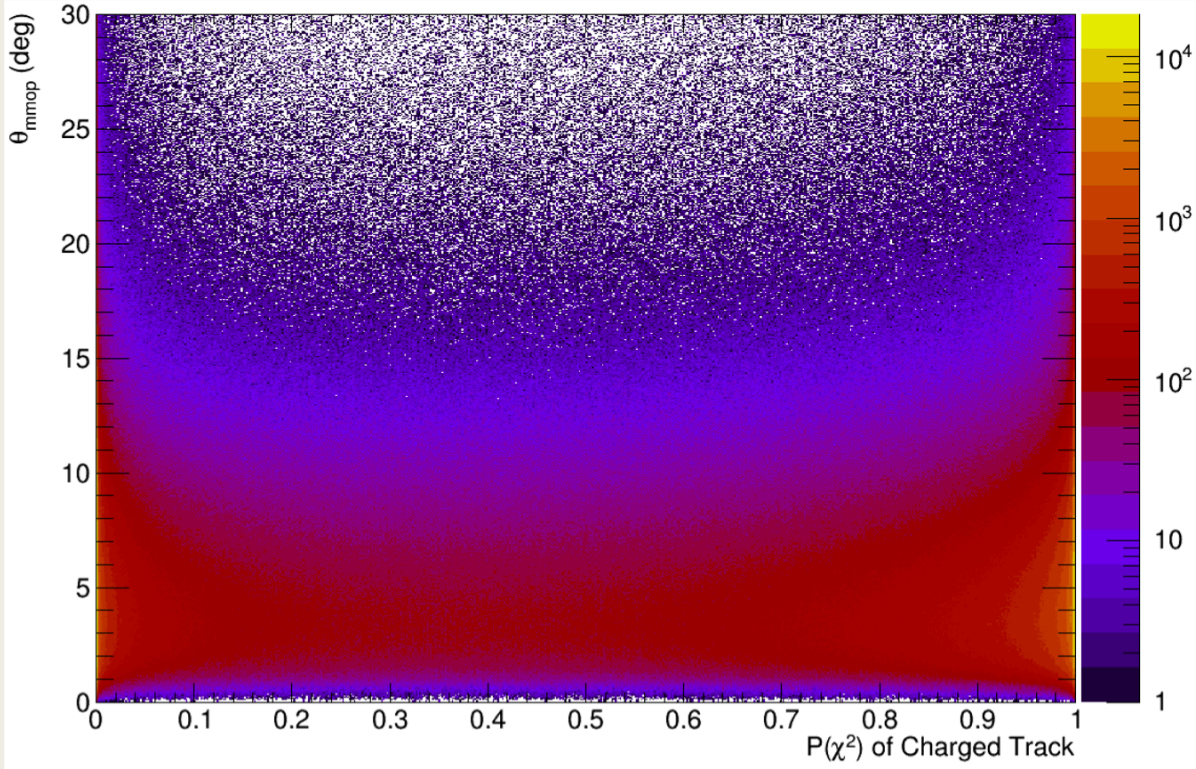


$P(\chi^2)$ vs θ

Data

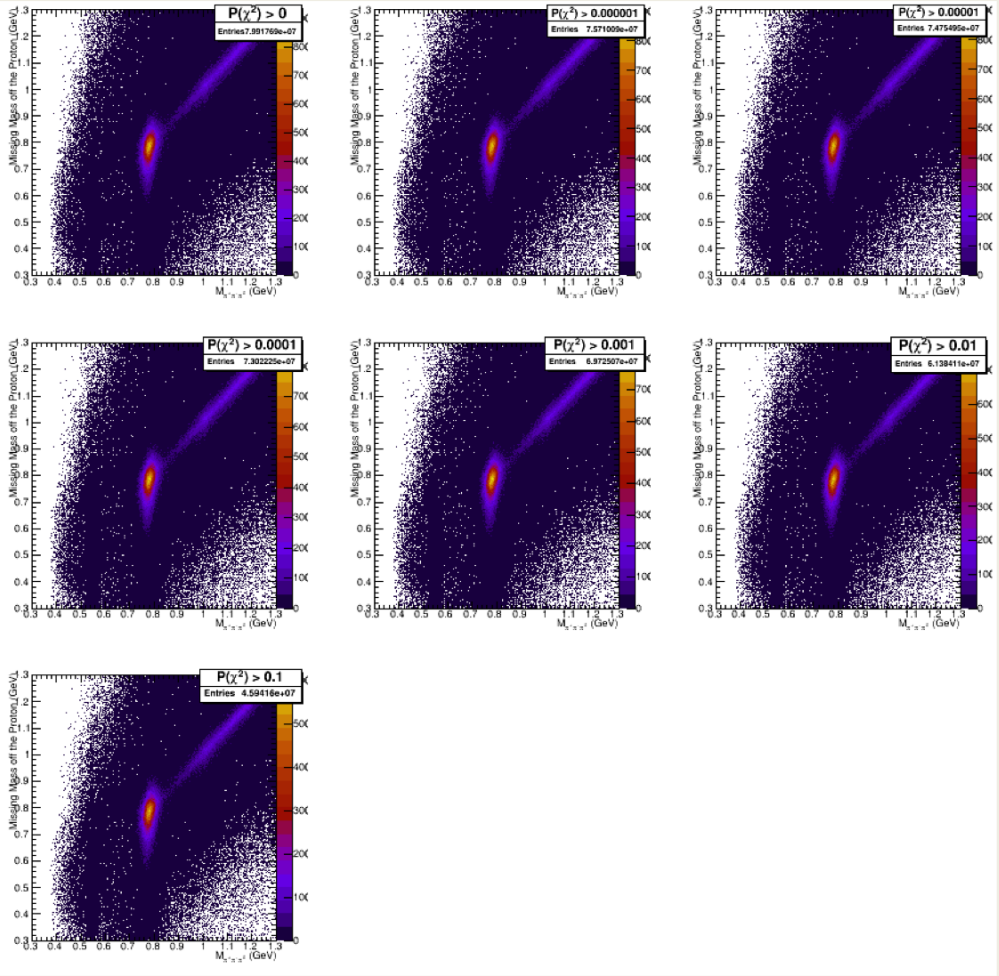


MC

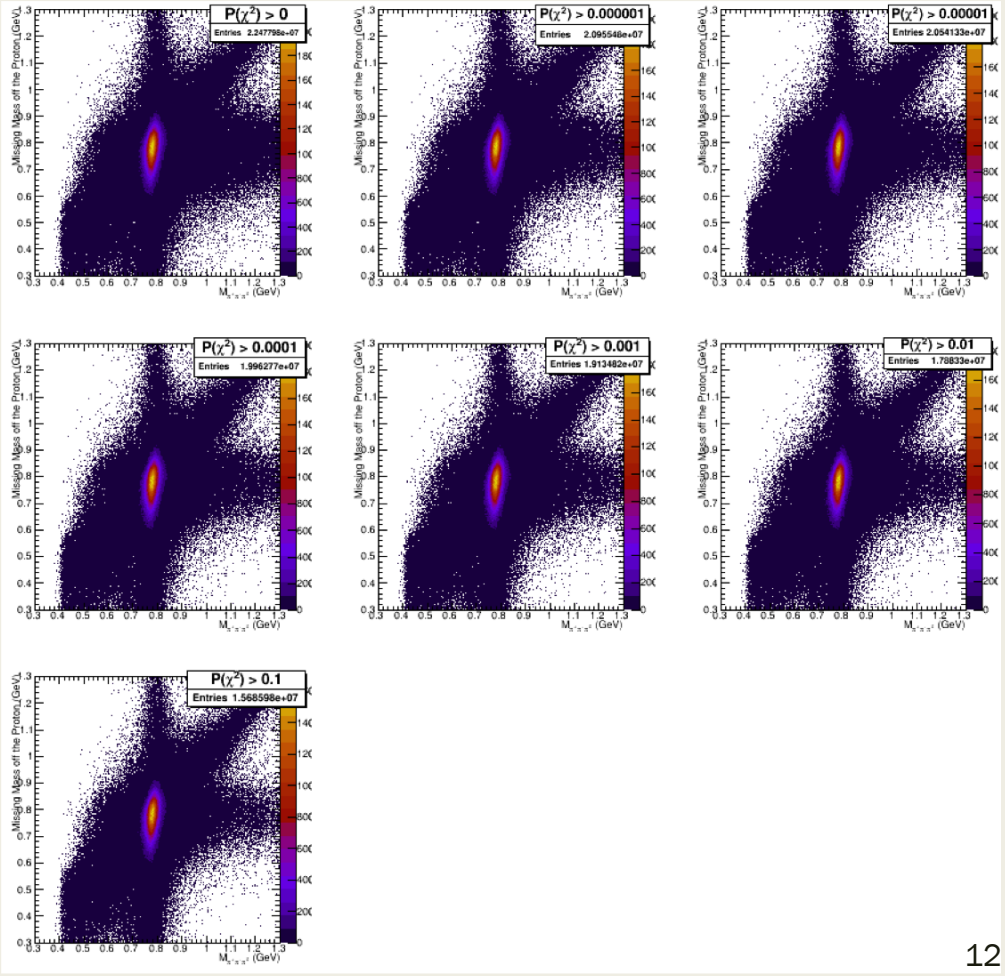


Mass Correlation Plots with $P(\chi^2)$ Cuts

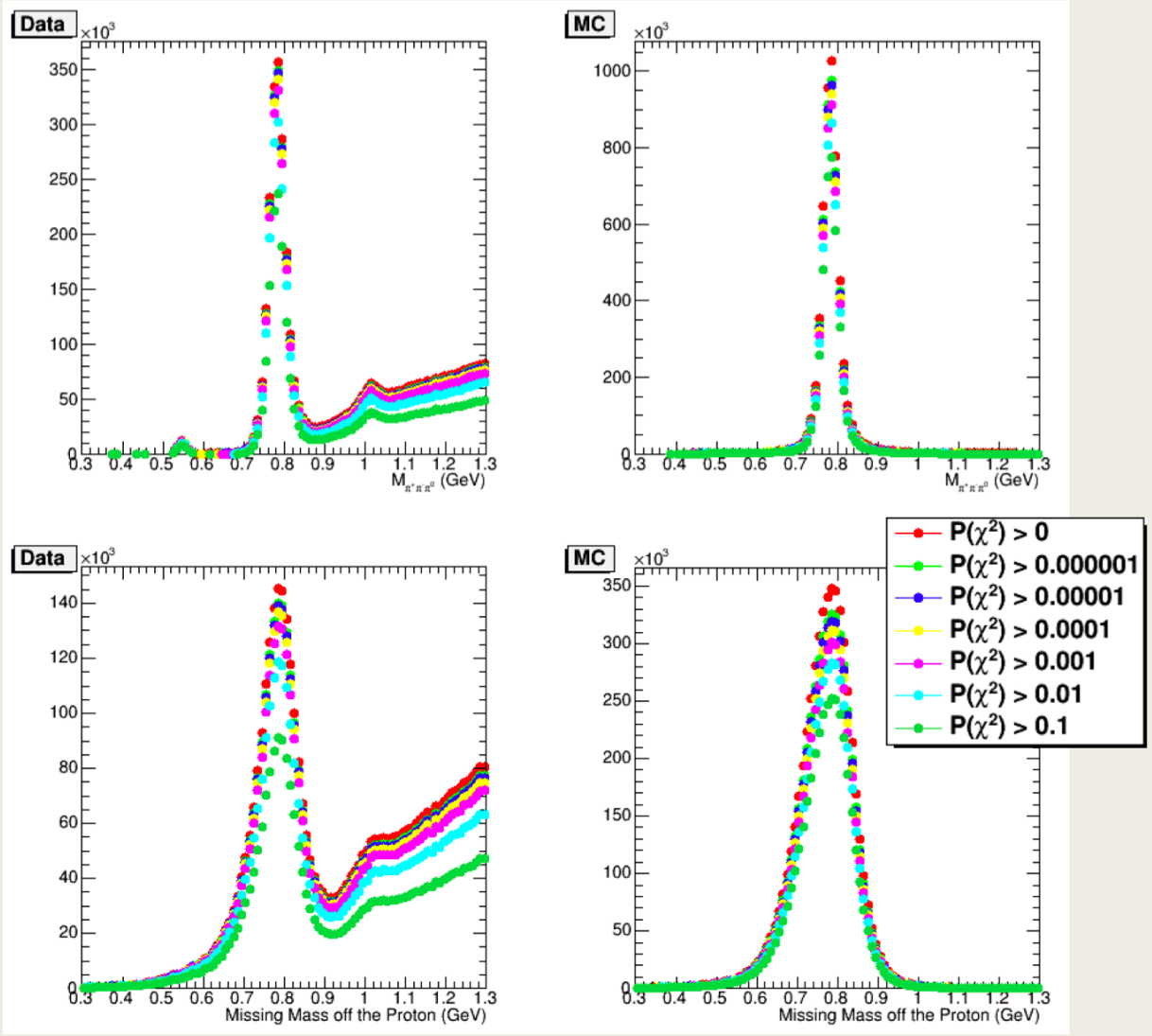
Data



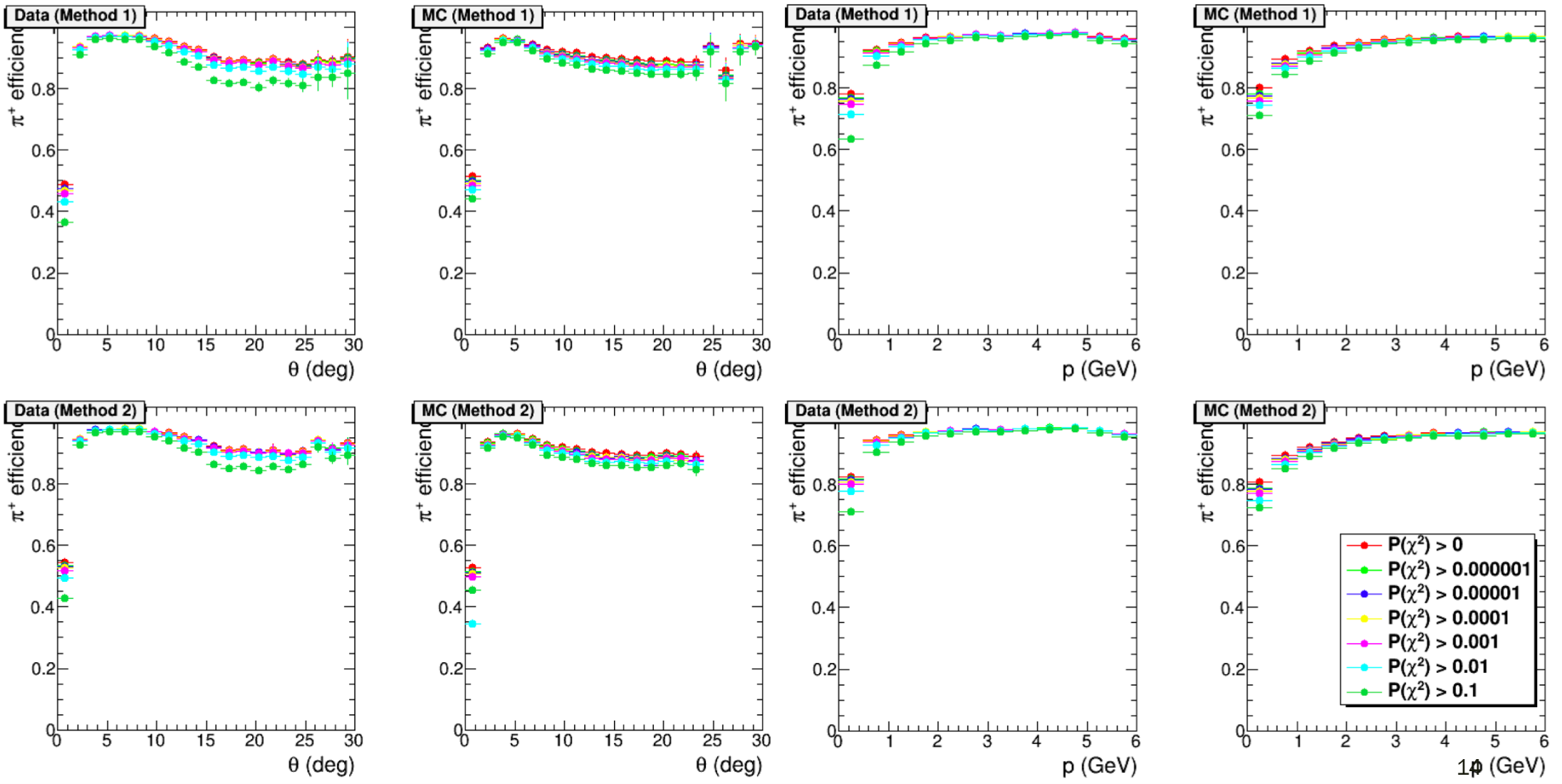
MC



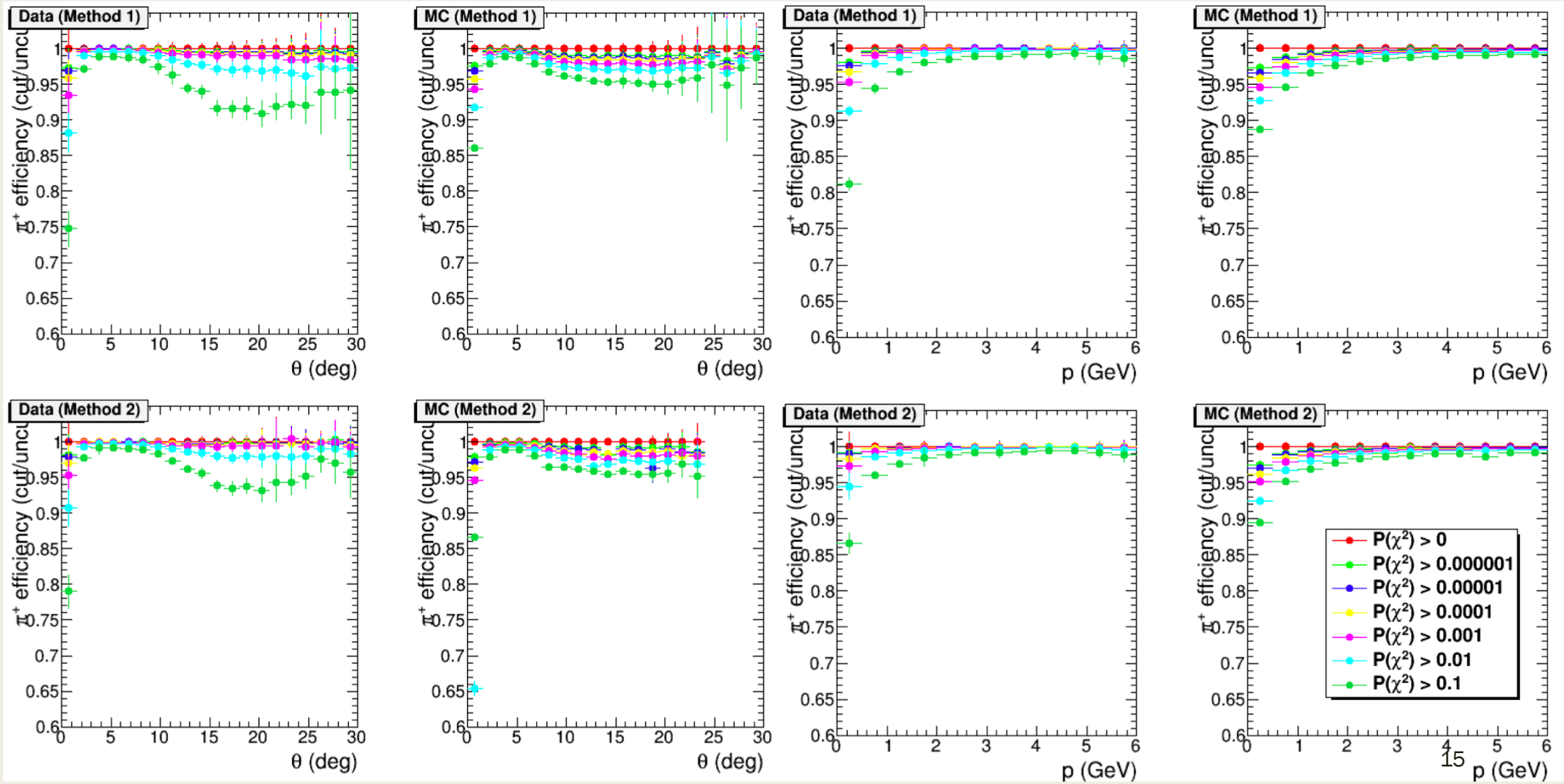
1D Mass Plots with $P(\chi^2)$ Cuts



Efficiencies with $P(\chi^2)$ Cuts



Efficiency Ratios (cut/uncut) for $P(\chi^2)$ Cuts



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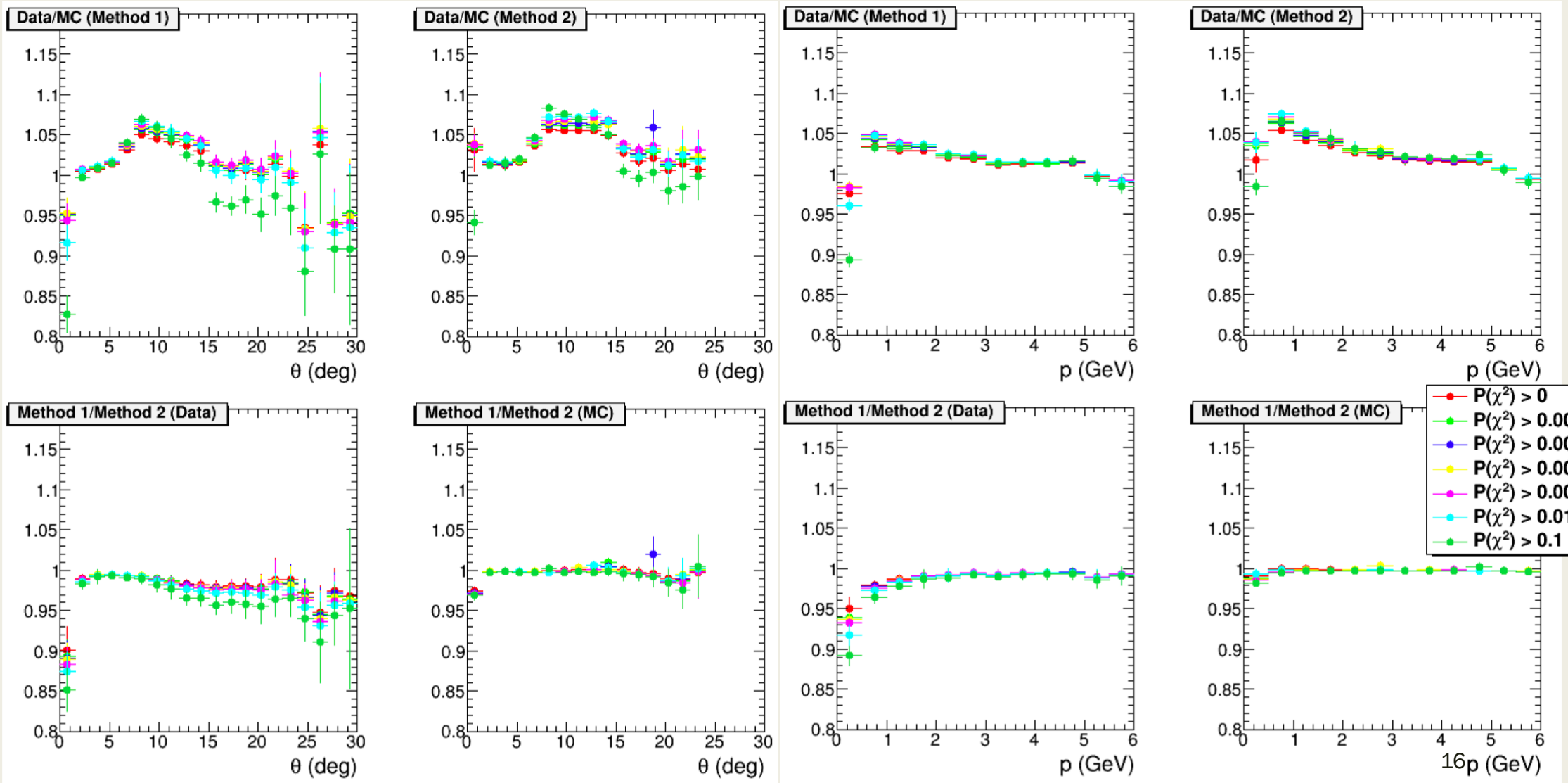
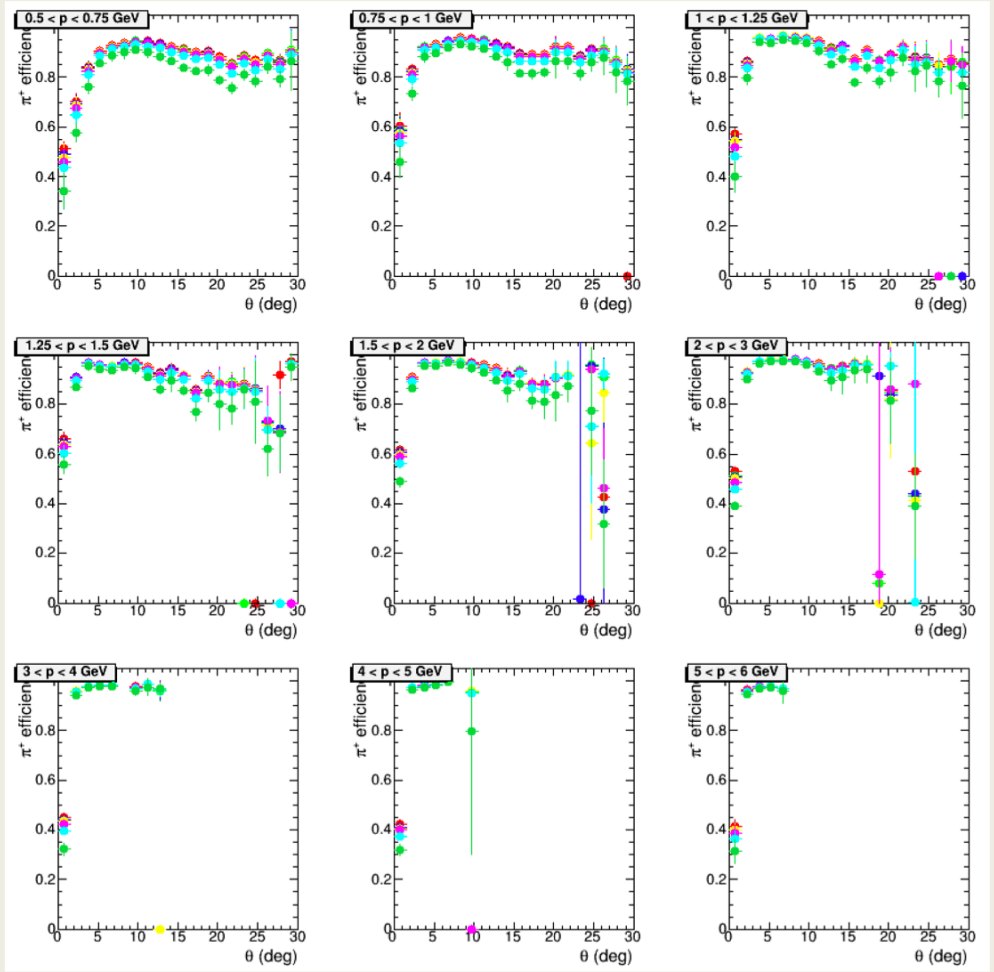
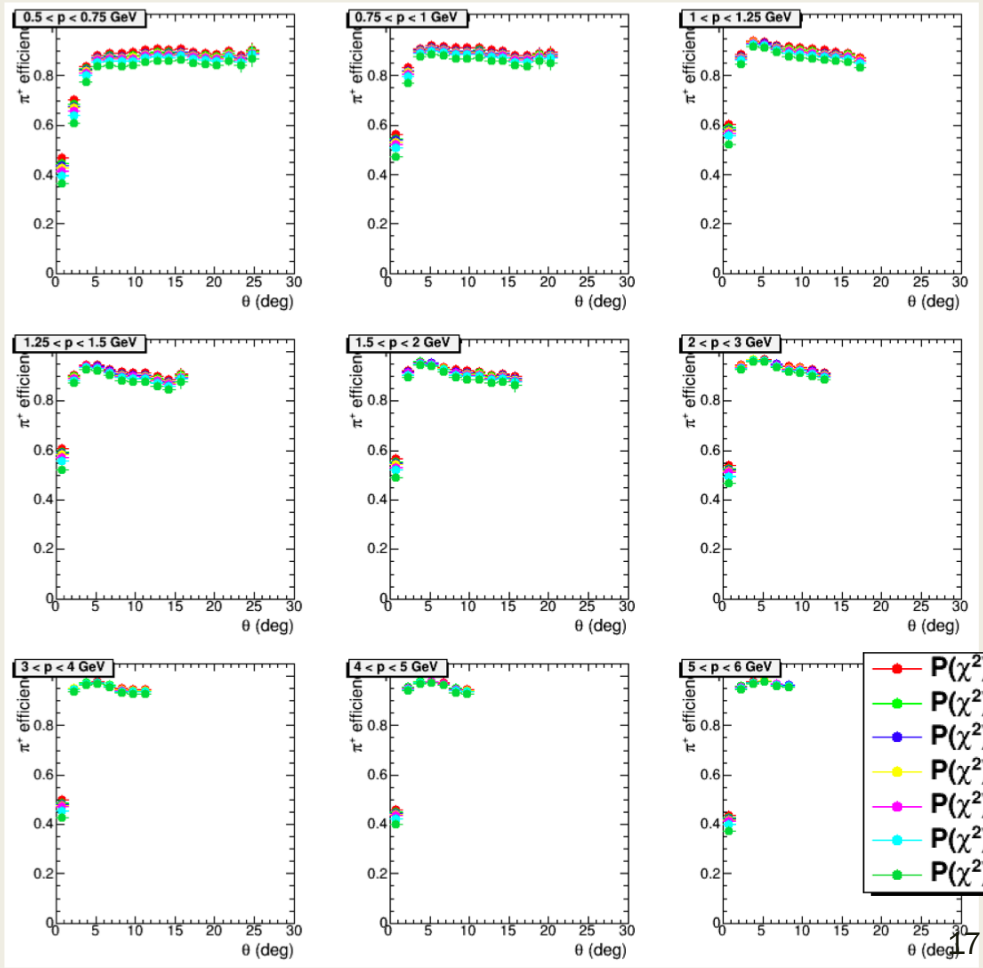


Efficiencies in theta, p (Method 1)

Data

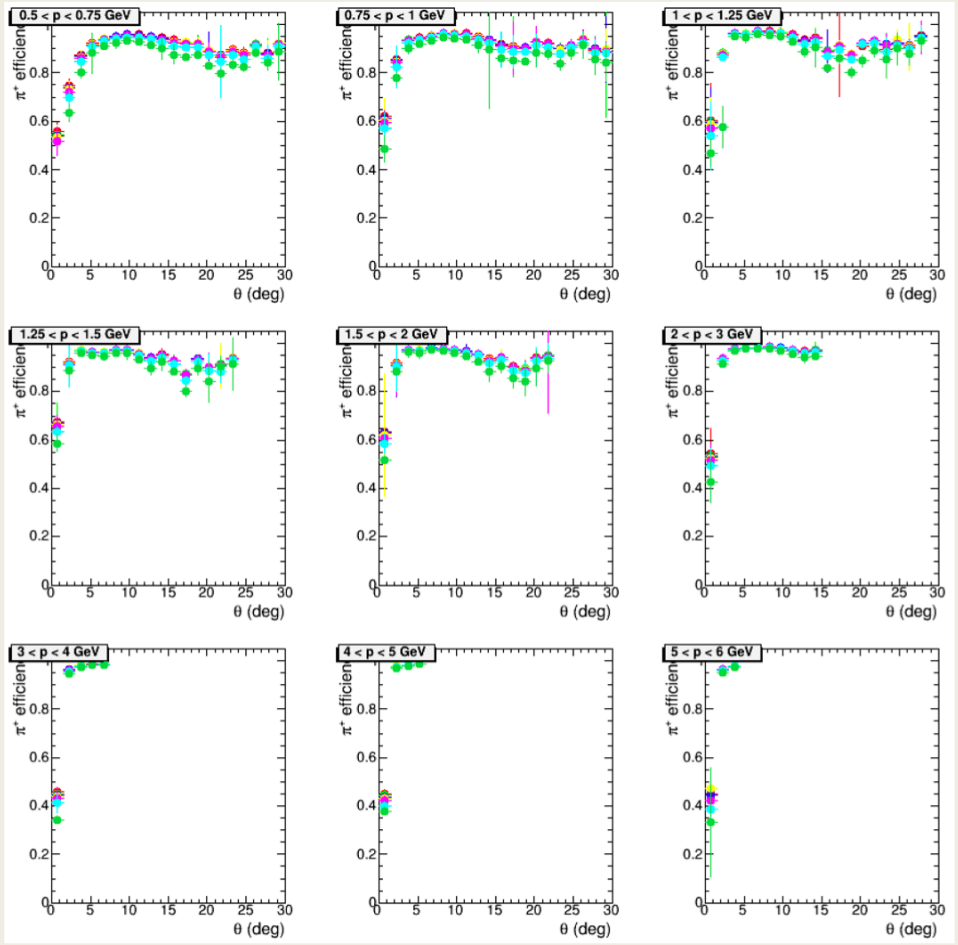


MC

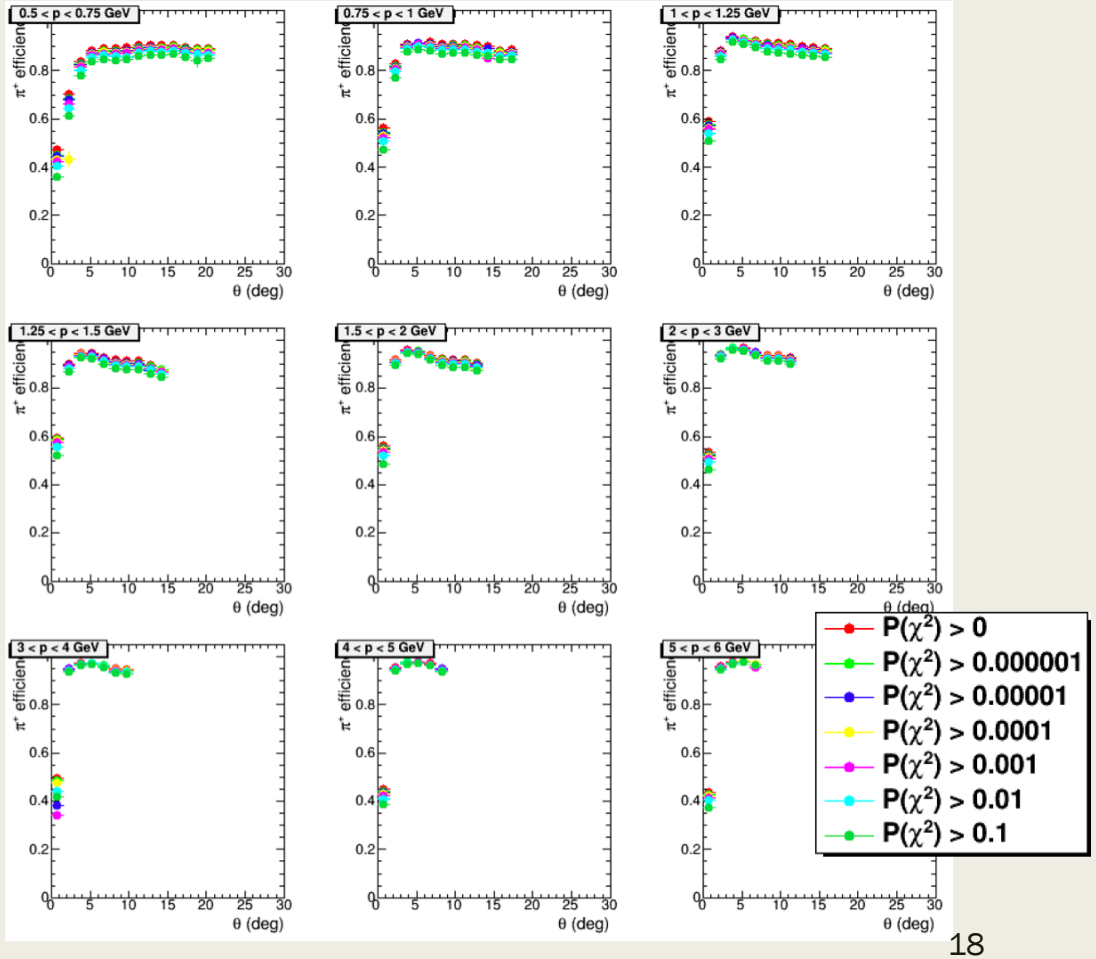


Efficiencies in theta, p (Method 2)

Data

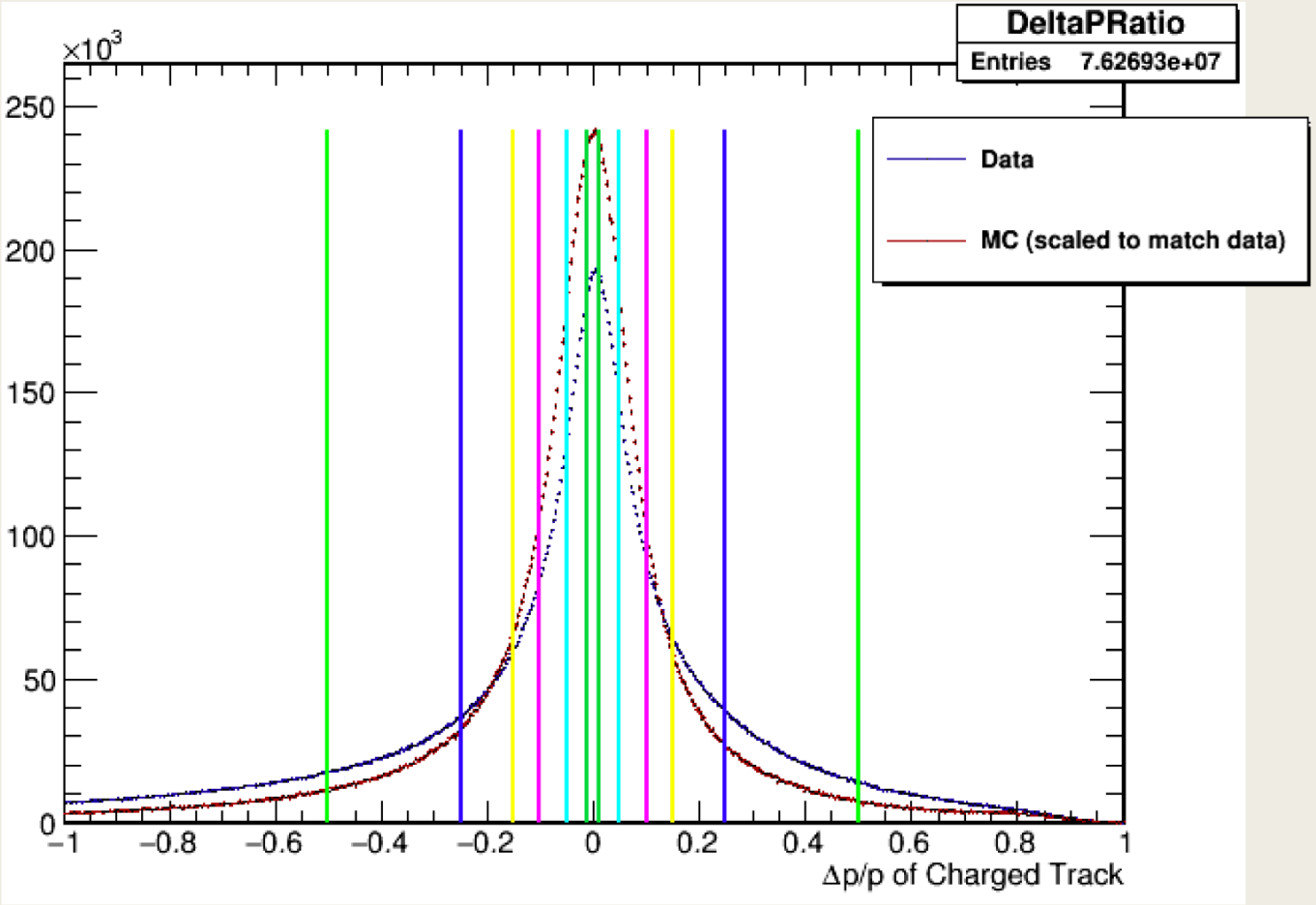


MC



$\Delta p/p_{reco}$ Cuts

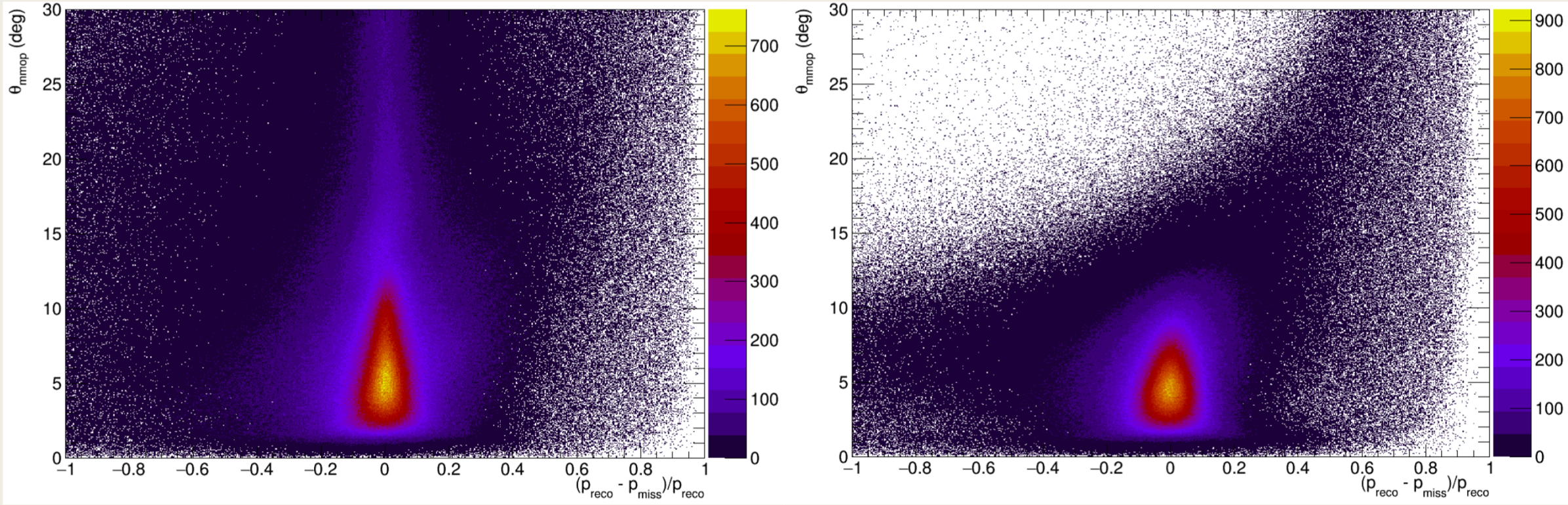
We placed a series of cuts at $|\Delta p|/p_{reco}$ < 0.5, 0.25, 0.15, 0.1, 0.05, and 0.01.



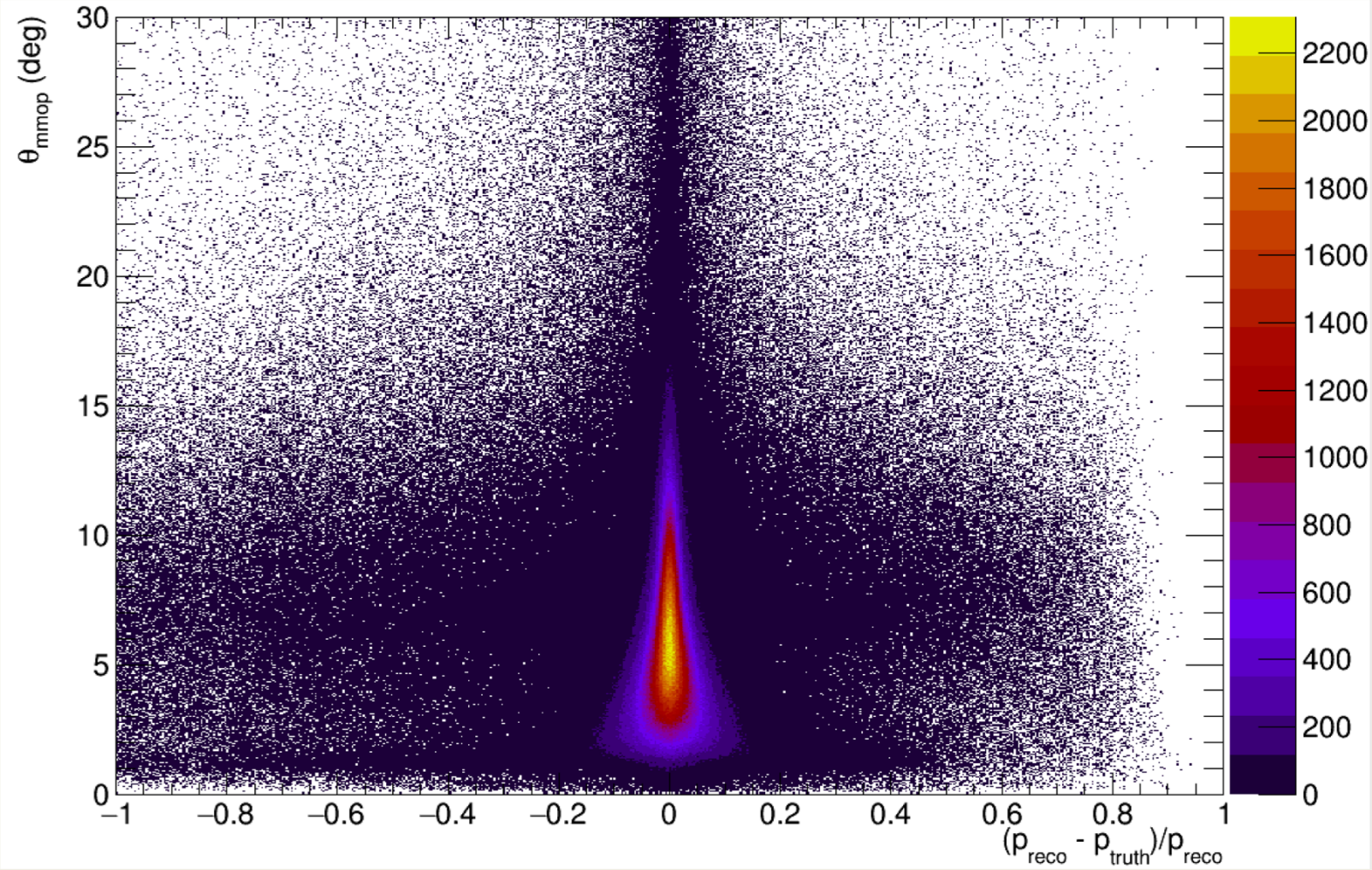
$\Delta p/p_{reco}$ (reco – missing) vs θ

Data

MC

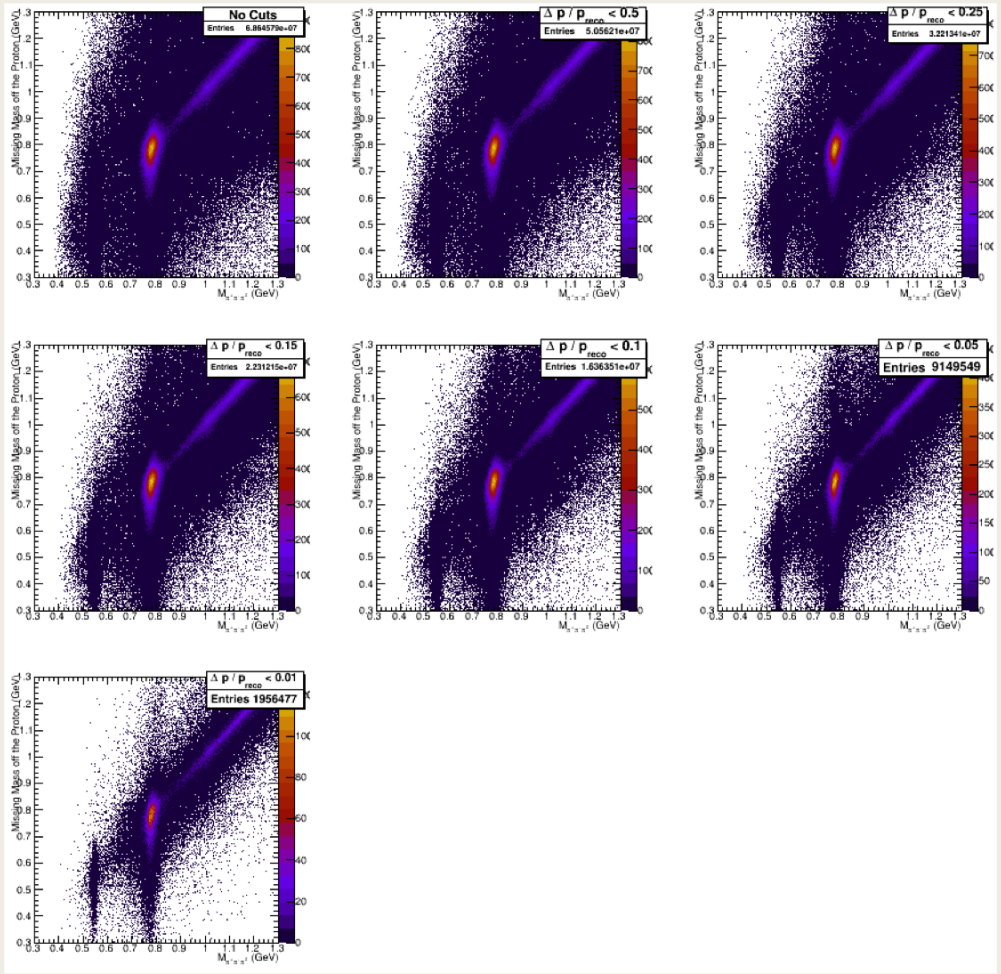


$\Delta p/p_{reco}$(reco – truth) vs θ (MC only)

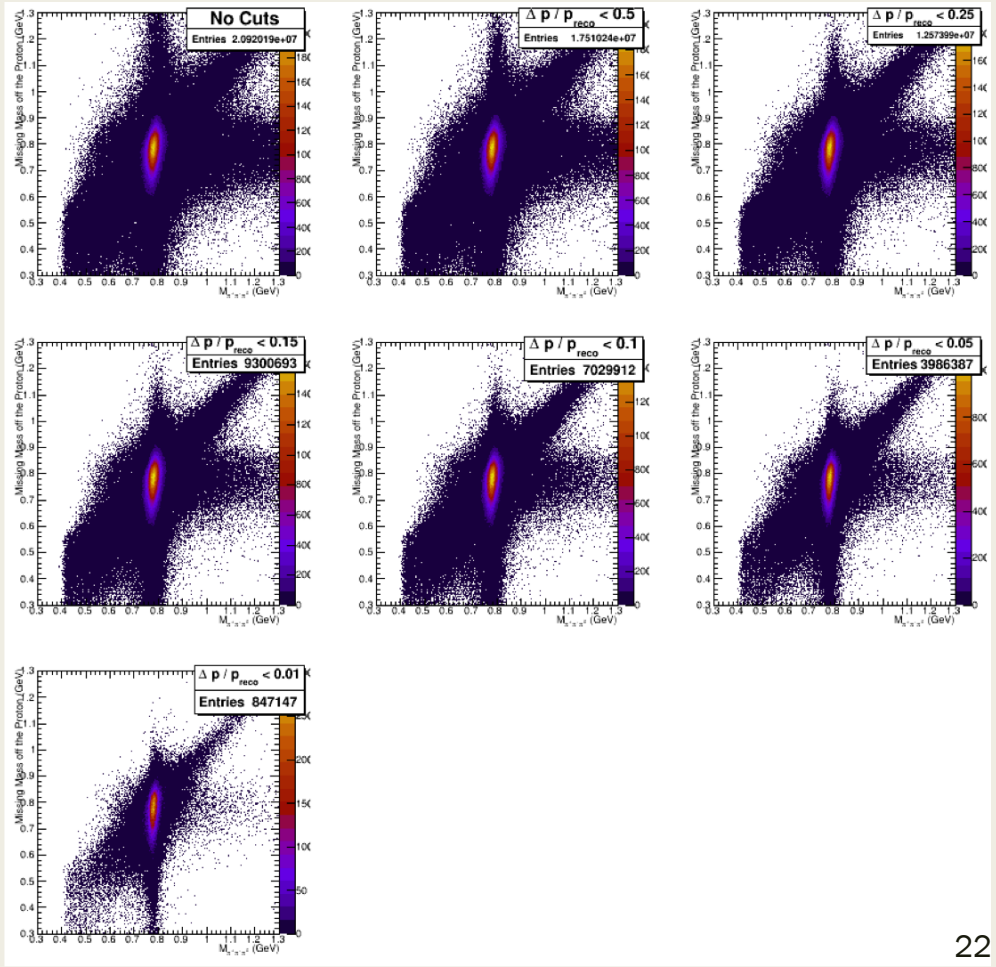


Mass Correlation Plots with $\Delta p/p_{reco}$ Cuts

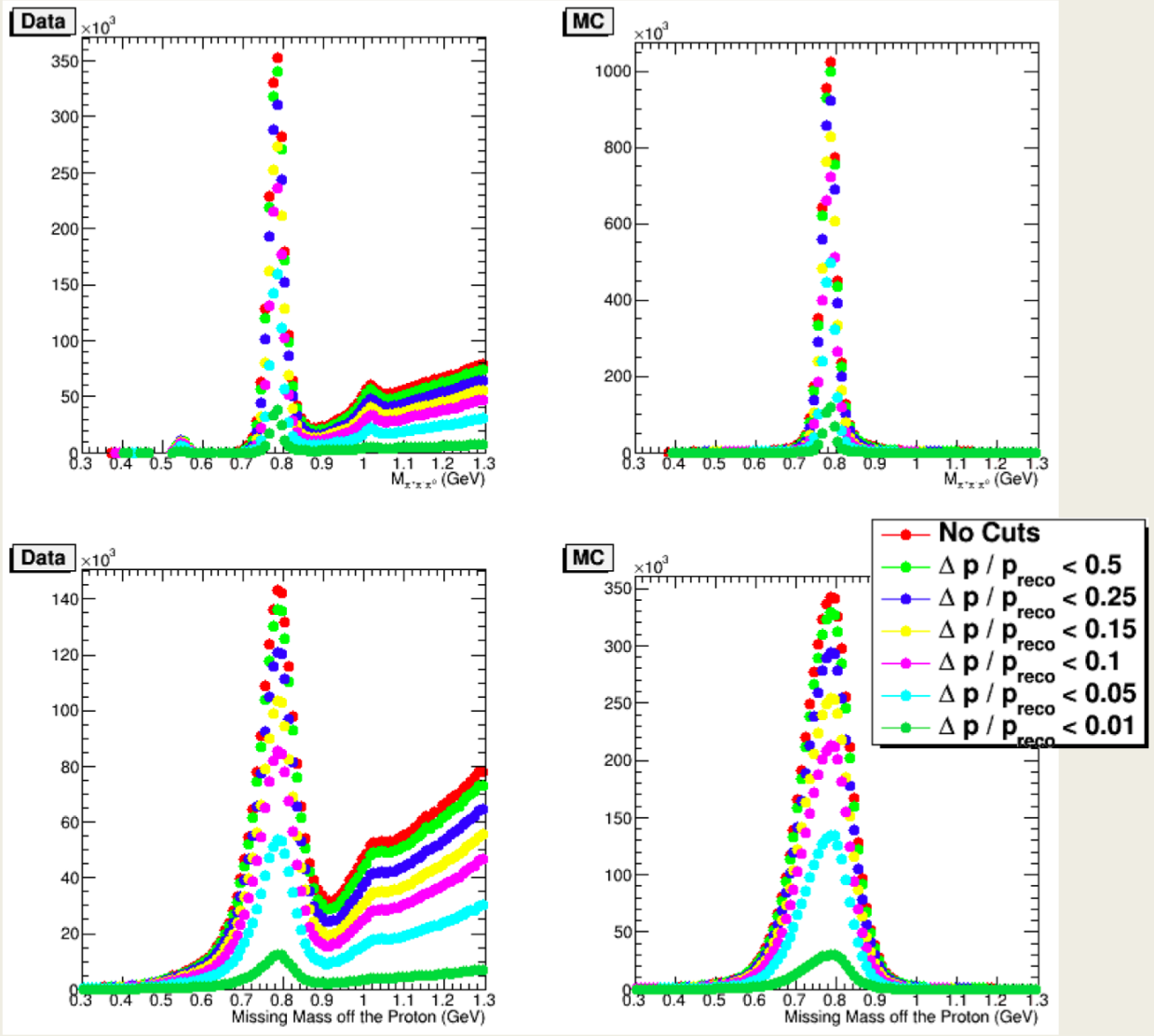
Data



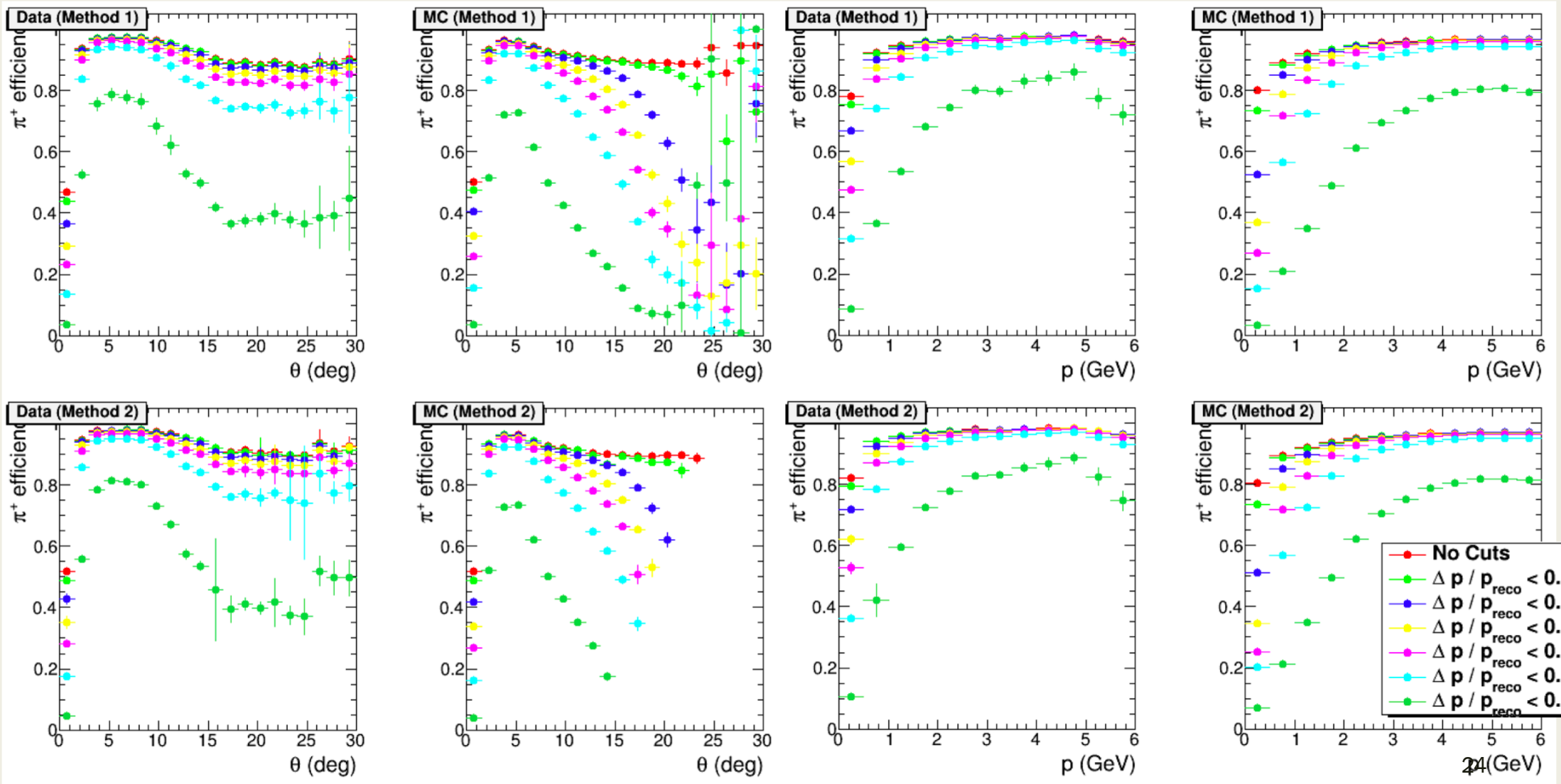
MC



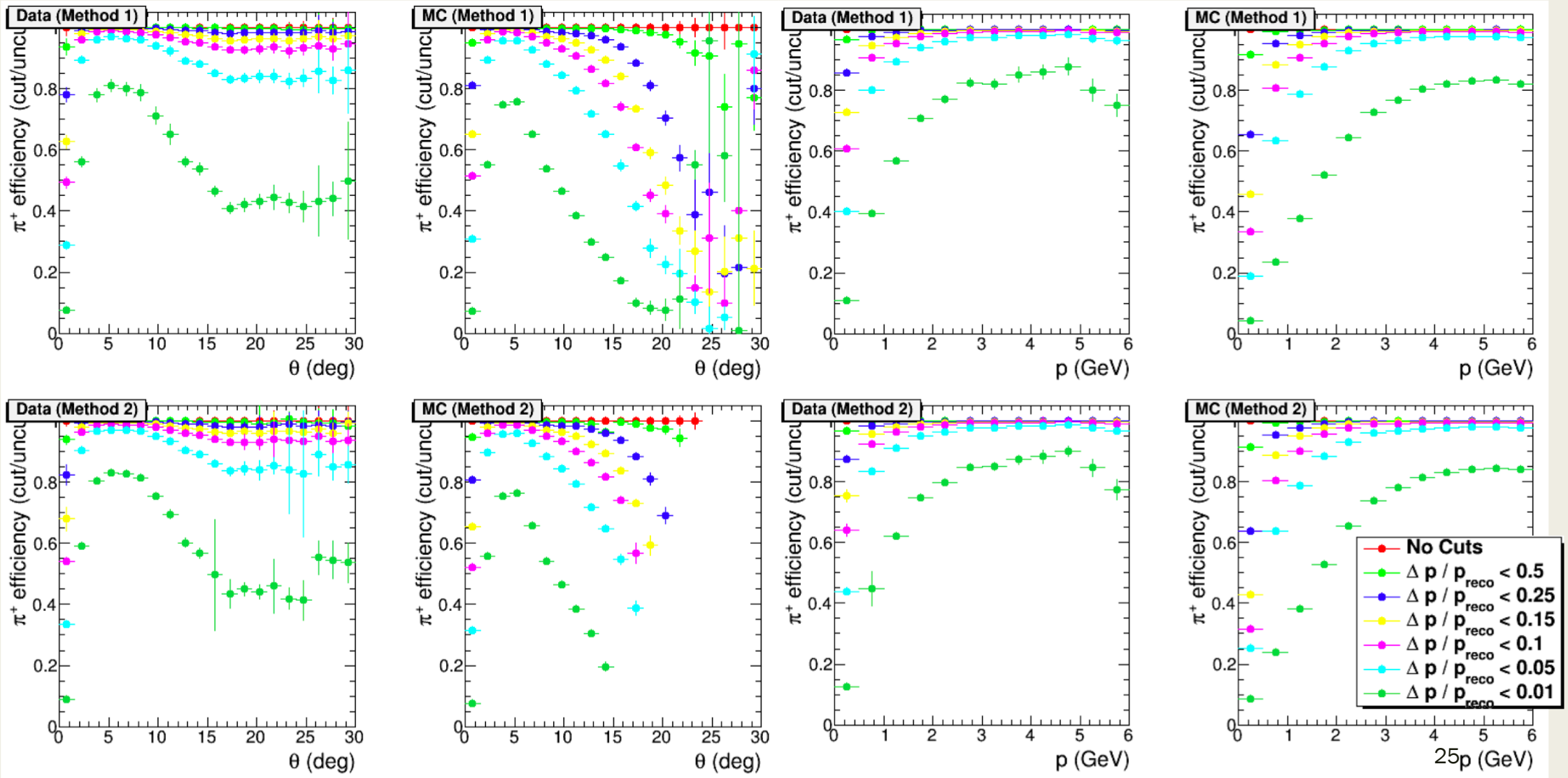
1D Mass Plots with $\Delta p/p_{reco}$ Cuts



Efficiencies with $\Delta p/p_{reco}$ Cuts

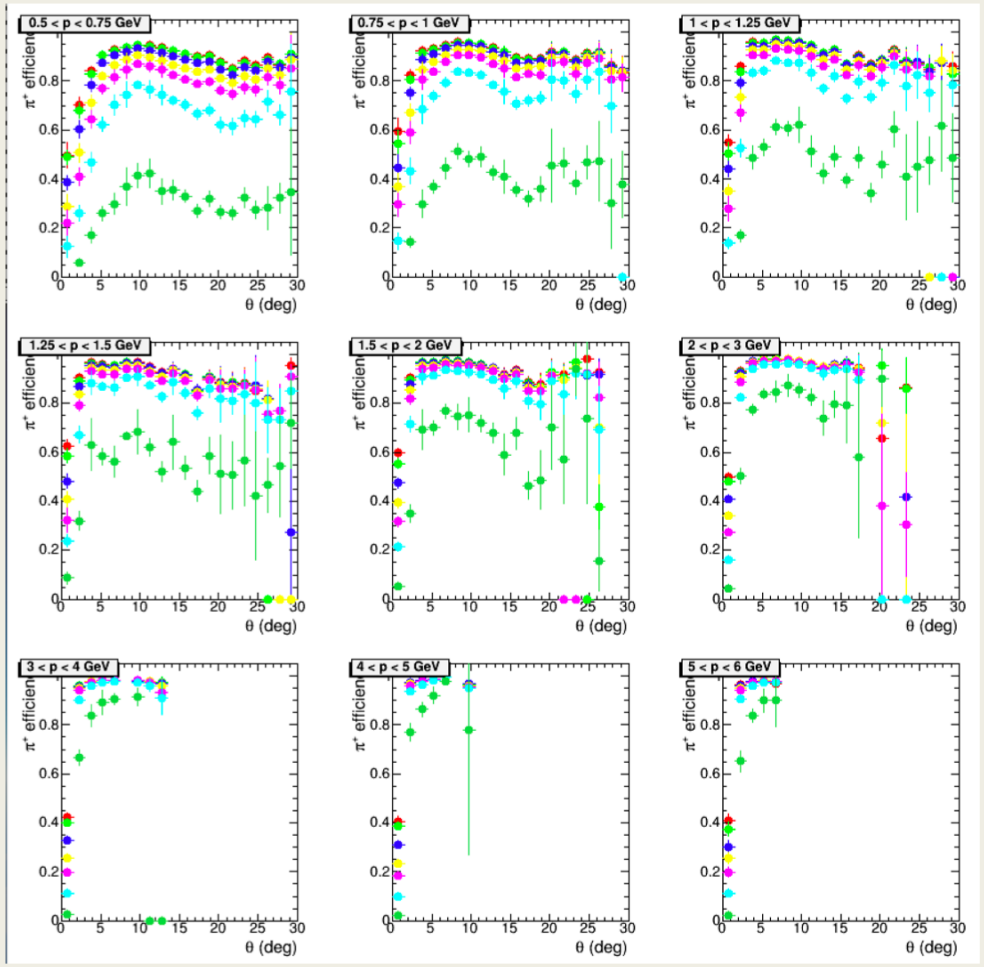


Efficiency Ratios (cut/uncut) for $\Delta p/p_{reco}$ Cuts

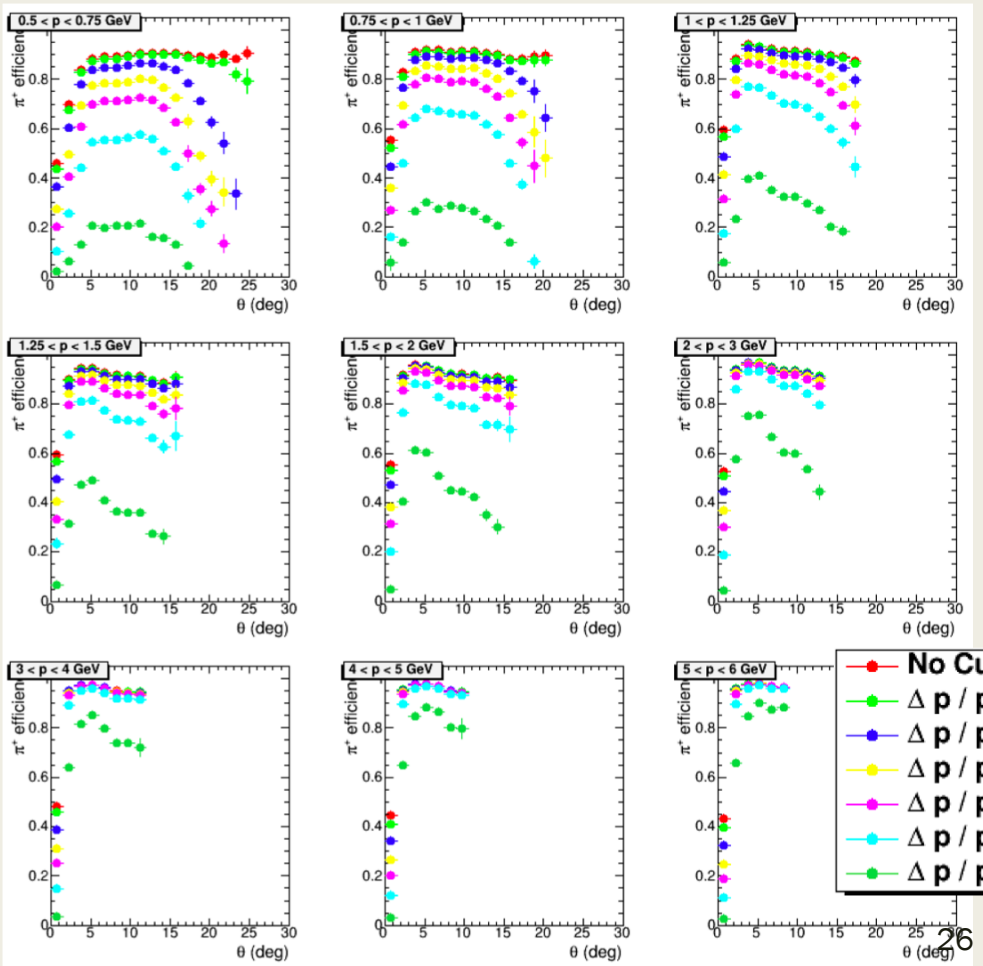


Efficiencies in theta, p (Method 1)

Data

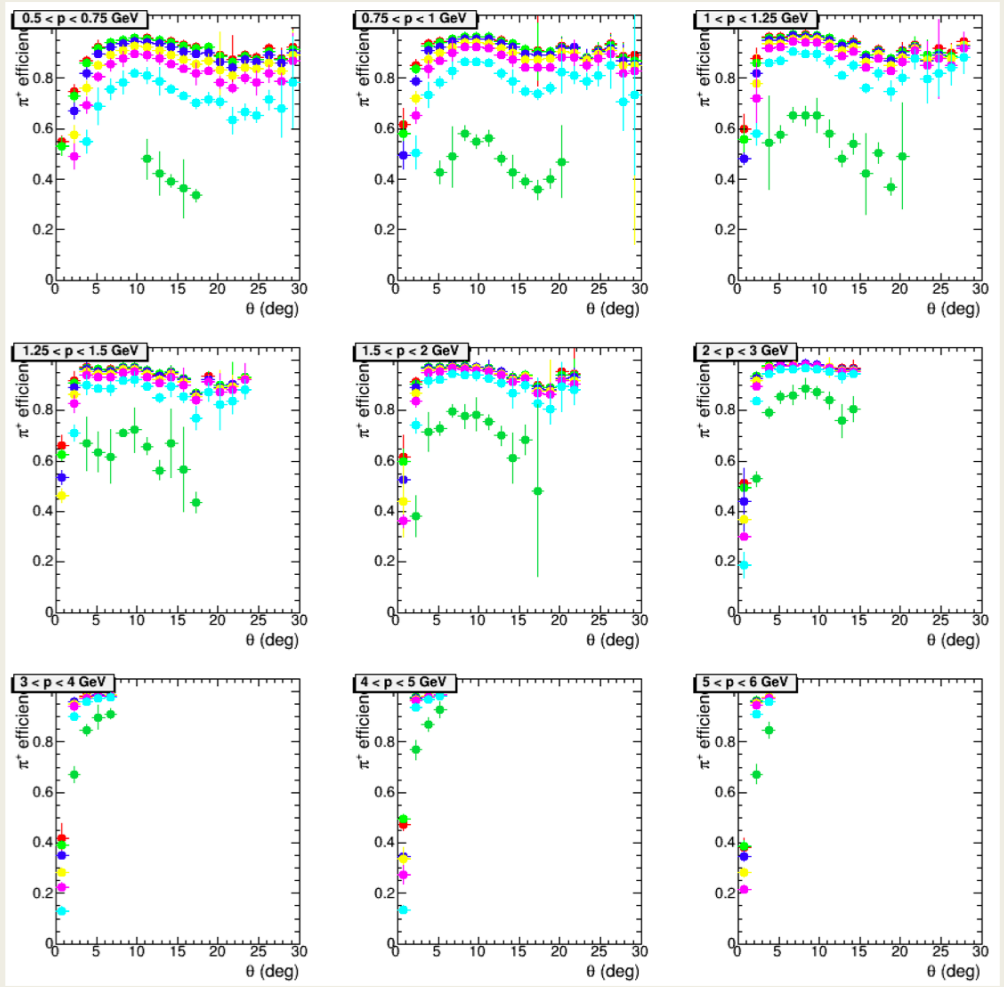


MC

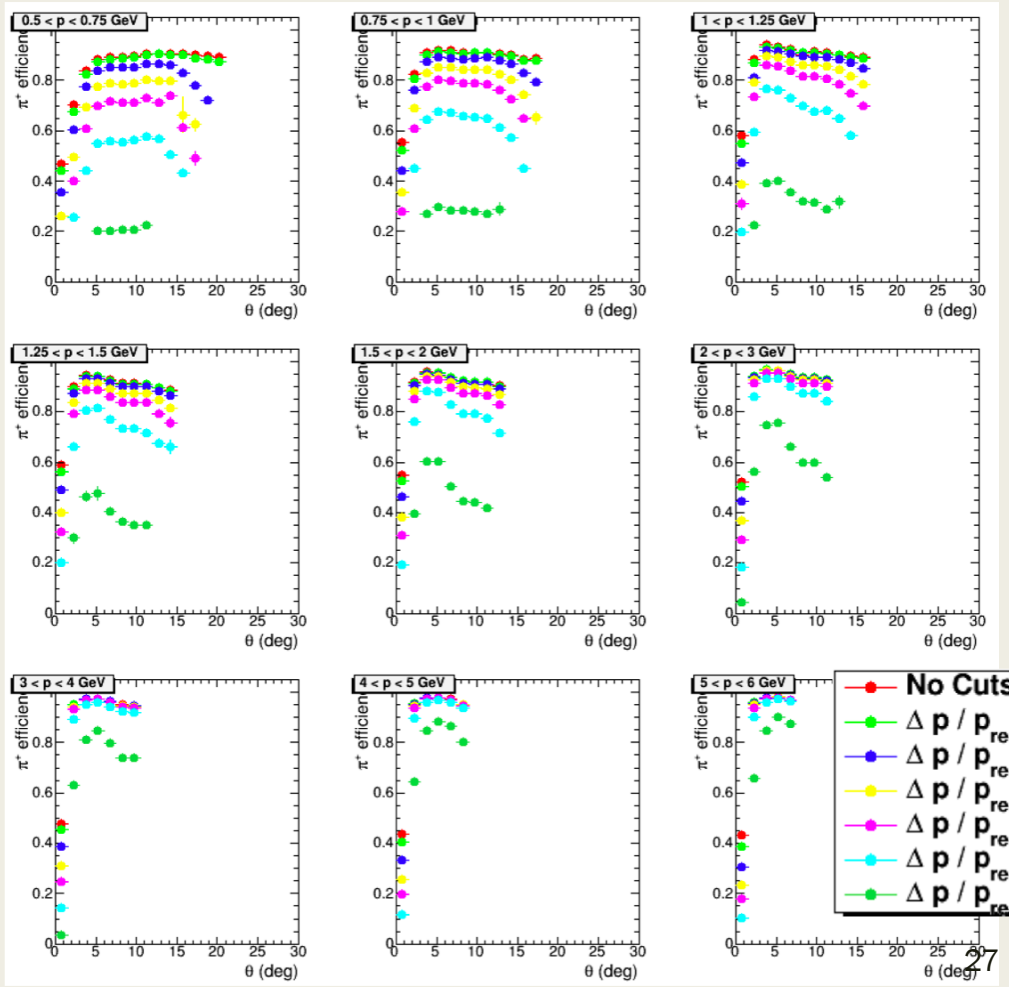


Efficiencies in theta, p (Method 2)

Data



MC



Future Plans

- Repeat for π^-
- Investigate other analysis-level cuts similar to J/ψ analysis
- Write summary analysis note with event selection, procedure, and p, θ dependent efficiencies
- Other suggestions?