About tracking efficiency in SpdRoot

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SPD Physics Weekly Meeting
October 10, 2023

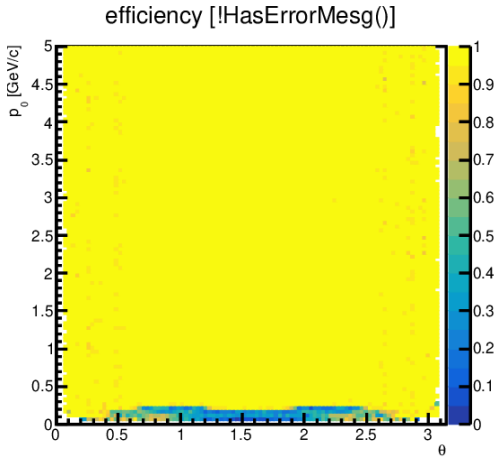
Generation of events

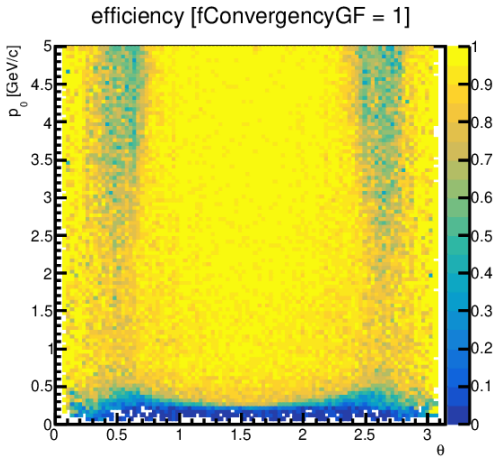
- SpdRoot: branch **`geometry-update-spring-2023`**
- Inner tracker: DSSD
- Two artificial samples were generated:
  - Pions: isotropical, p = 0 .. **5** GeV/c (with step 0.05 GeV/c), $Z_{\text{primary vertex}}$ = **0**.
  - Pions: isotropical, p = 0.1 .. **1** GeV/c (with step 0.01 GeV/c), $Z_{\text{primary vertex}}$ = **0**.

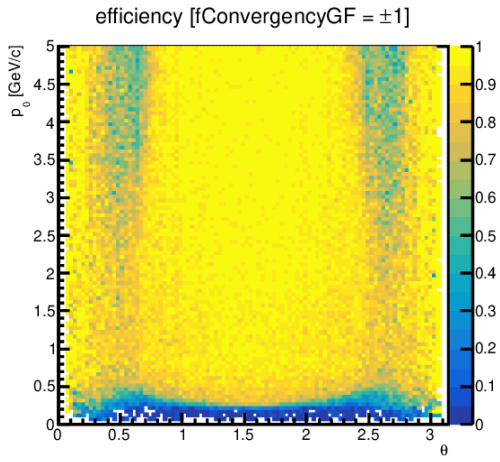
Reconstruction

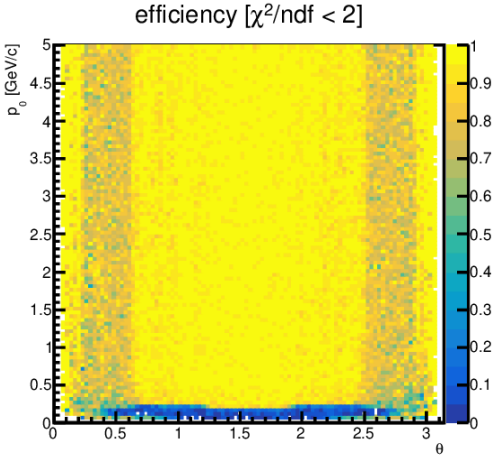
- Ideal track finding.
- The only requirement for a particle to be accepted as a track (in `SpdMCTracksFinder`) was total **N hits >= 3**.
- The corrected function for the drift radius calculation is used (see my talk at SPD Physics Weekly Meeting, Sep 19, 2023).

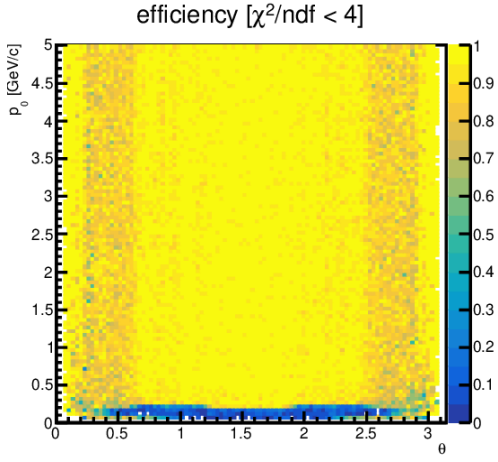
Efficiency of track quality cuts. Pions, $0 < p_0 < 5$ GeV/c, $Z_{\text{prim.vtx.}} = 0$.

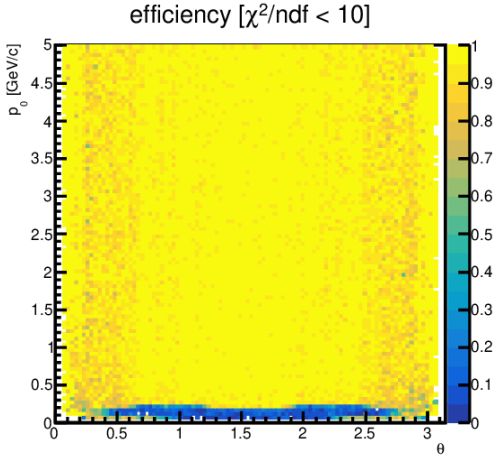


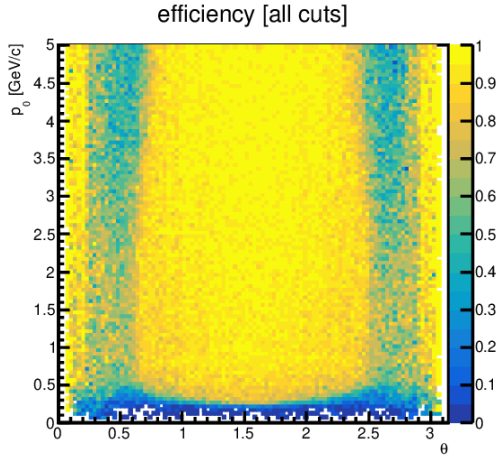




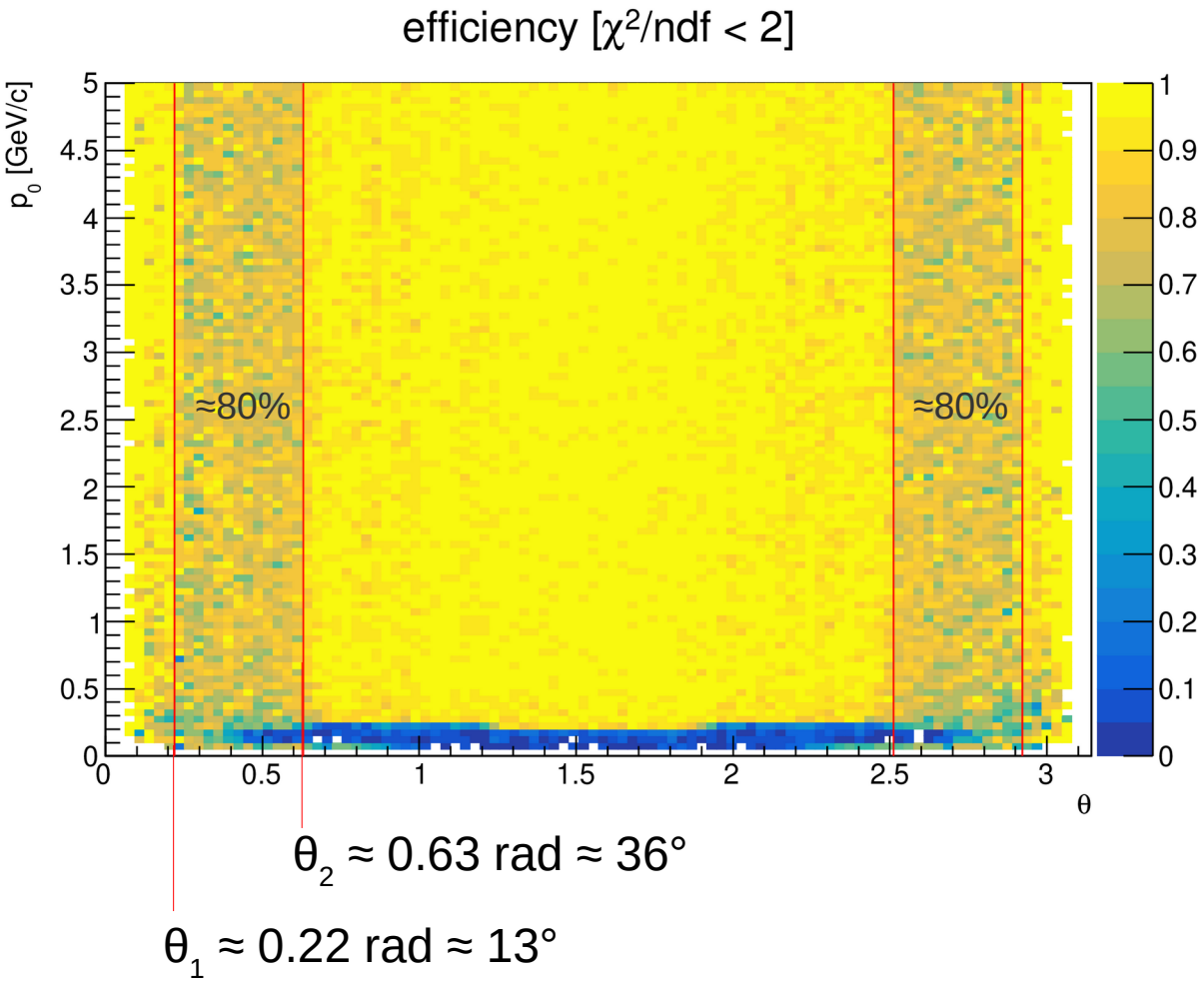


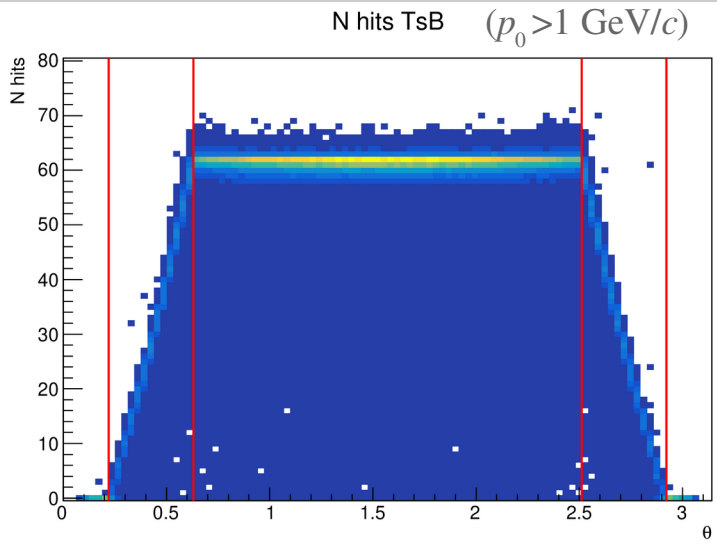


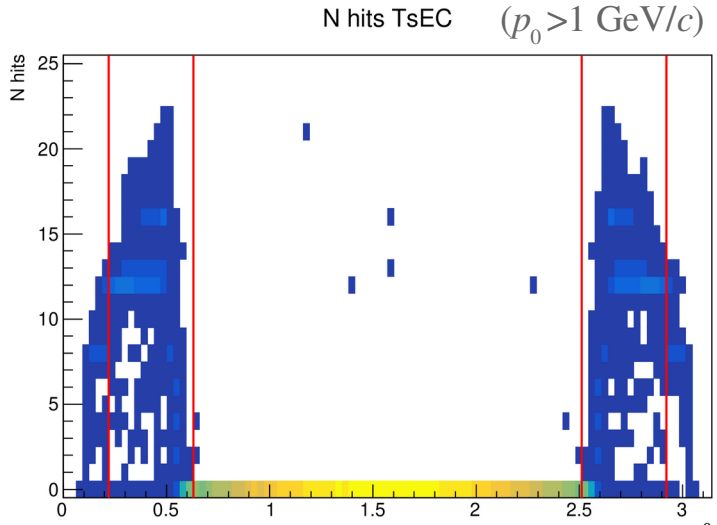




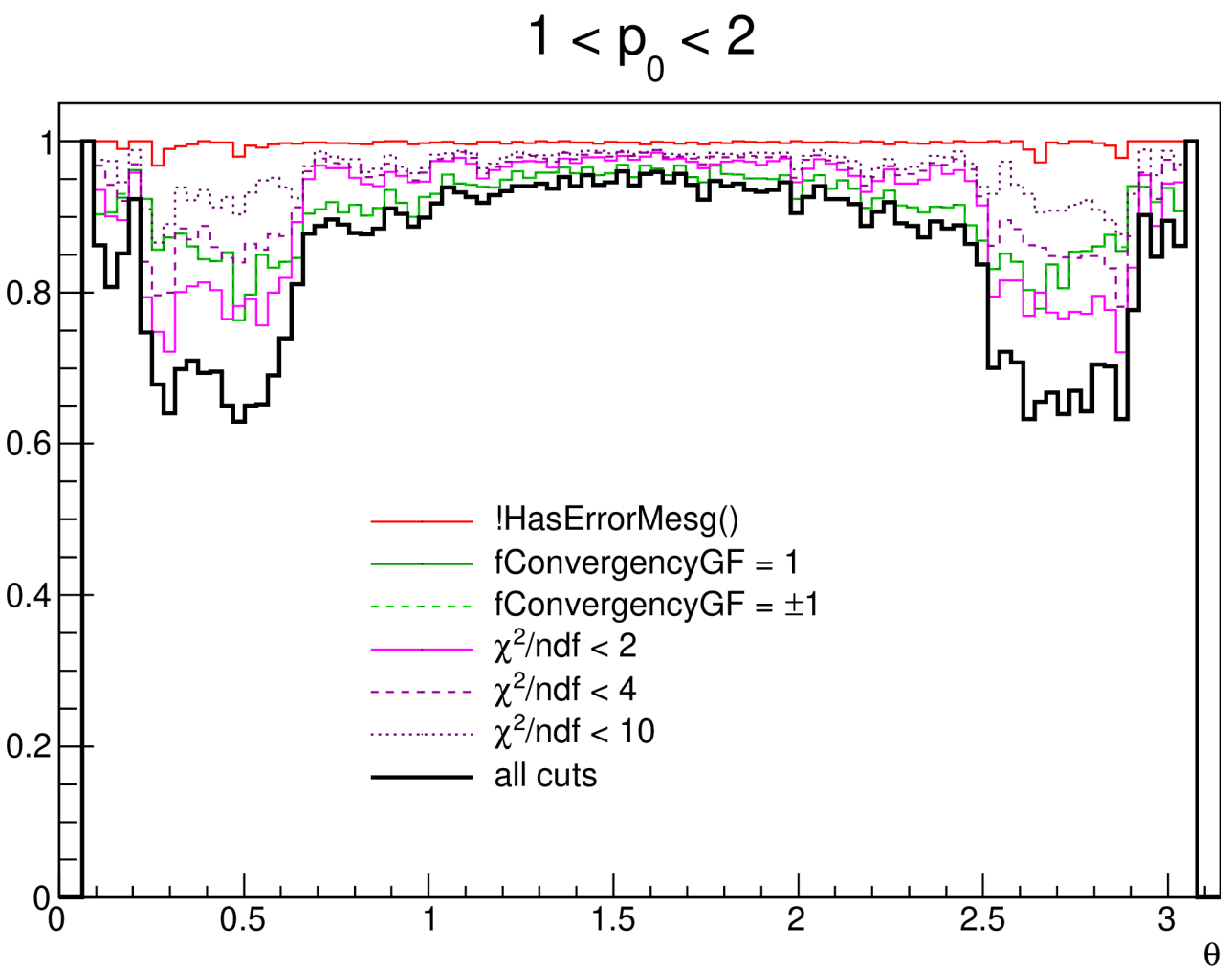
Number of hits. Pions, $0 < p_0 < 5$ GeV/c, $Z_{prim.vtx.} = 0$.







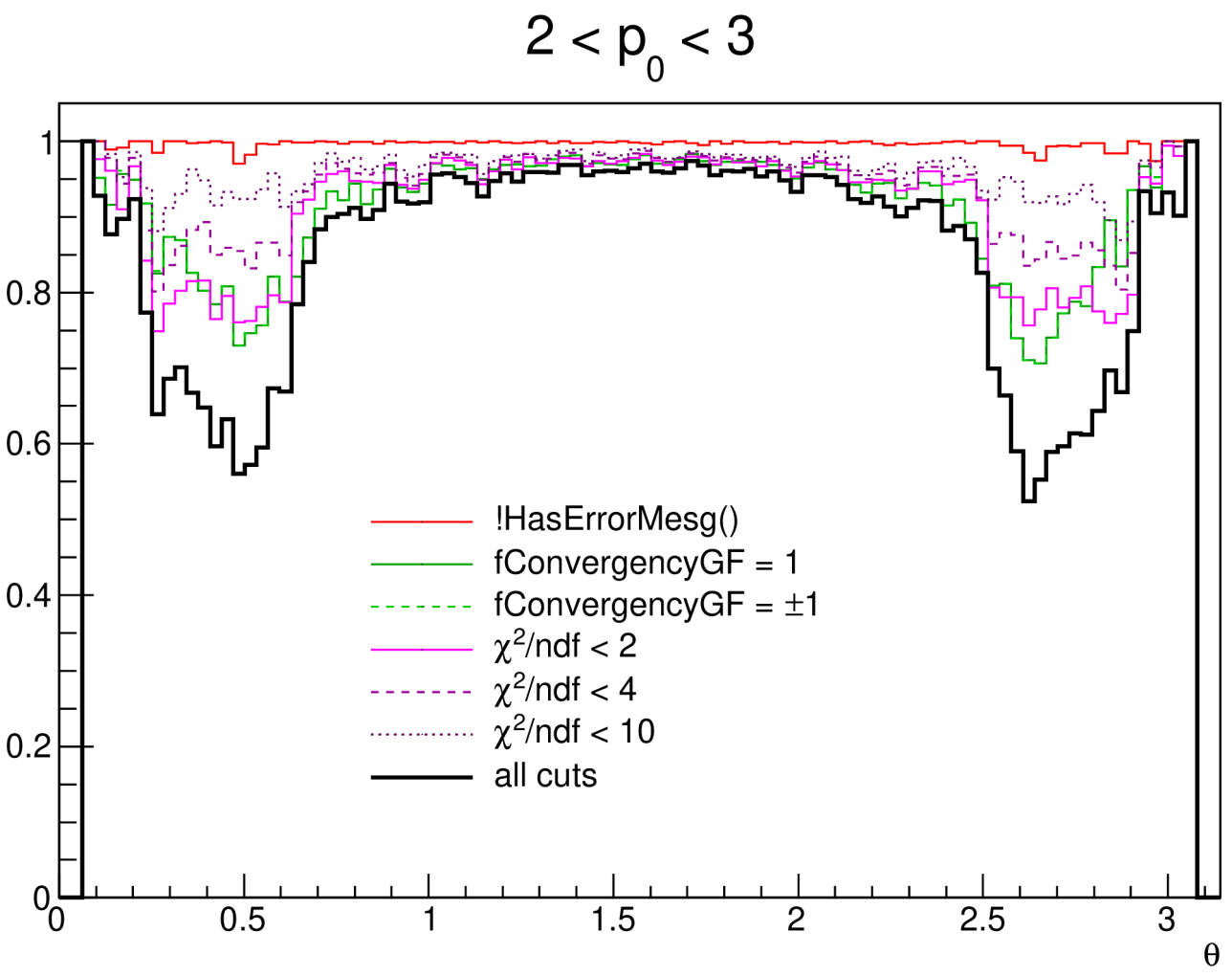
Efficiency of track quality cuts. Pions, $1 < p_0 < 2$ GeV/c, $Z_{\text{prim.vtx.}} = 0$.



At θ=π/2: 94%

Minimal: 63%

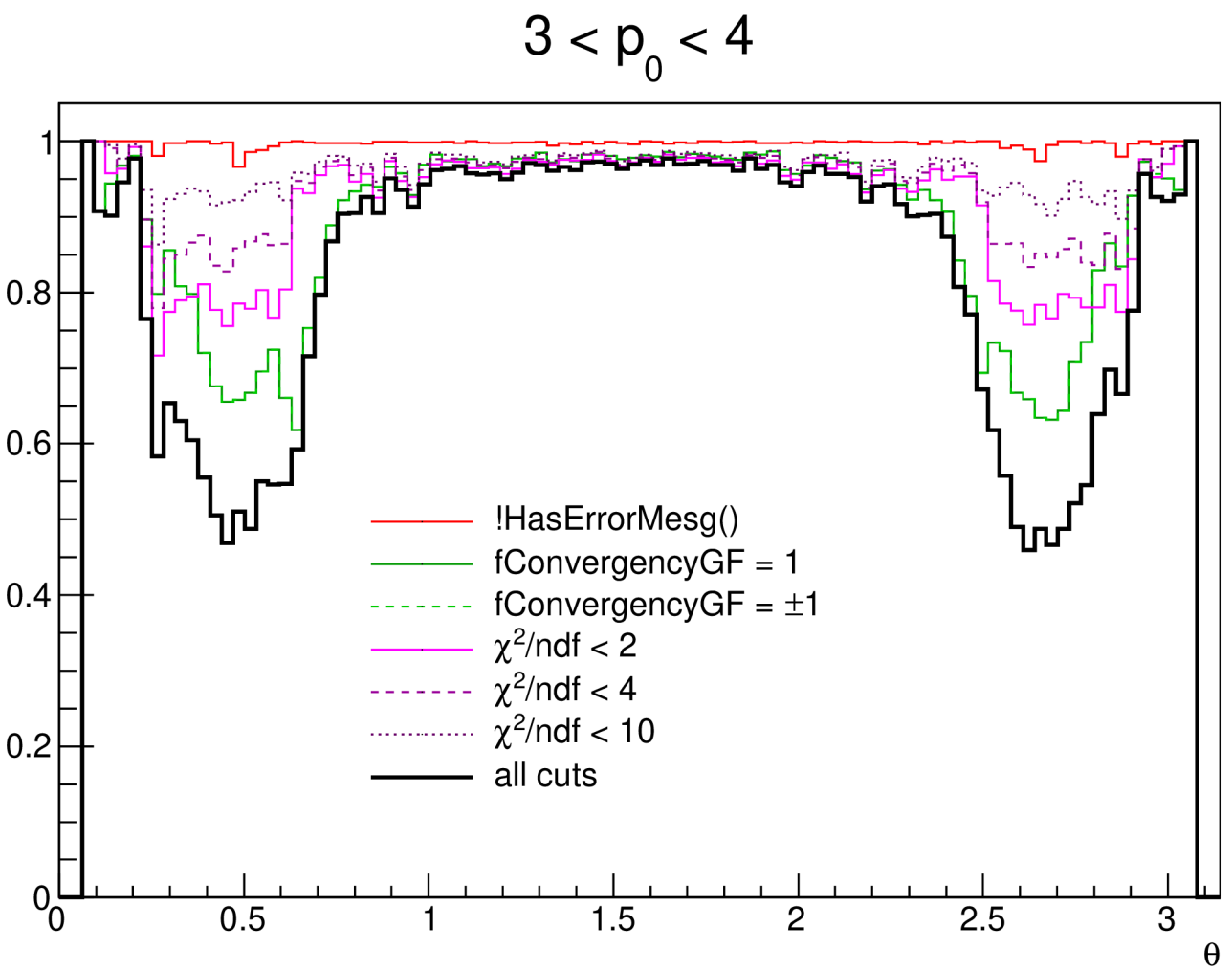
Efficiency of track quality cuts. Pions, $2 < p_0 < 3$ GeV/c, $Z_{\text{prim.vtx.}} = 0$.



At θ=π/2: 96%

Minimal: 52%

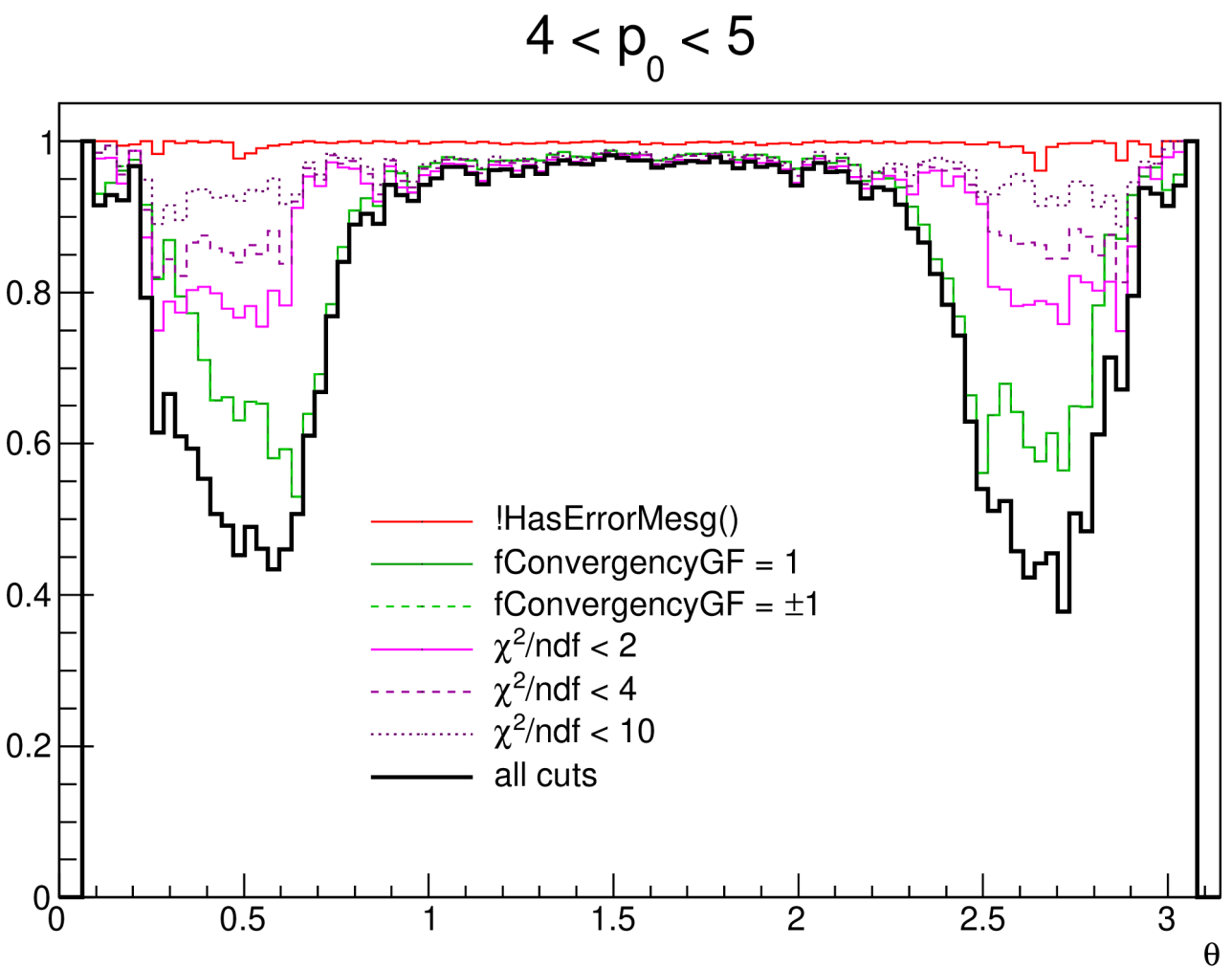
Efficiency of track quality cuts. Pions, $3 < p_0 < 4$ GeV/c, $Z_{\text{prim.vtx.}} = 0$.



At θ=π/2: 97%

Minimal: 46%

Efficiency of track quality cuts. Pions, $4 < p_0 < 5$ GeV/c, $Z_{\text{prim.vtx.}} = 0$.

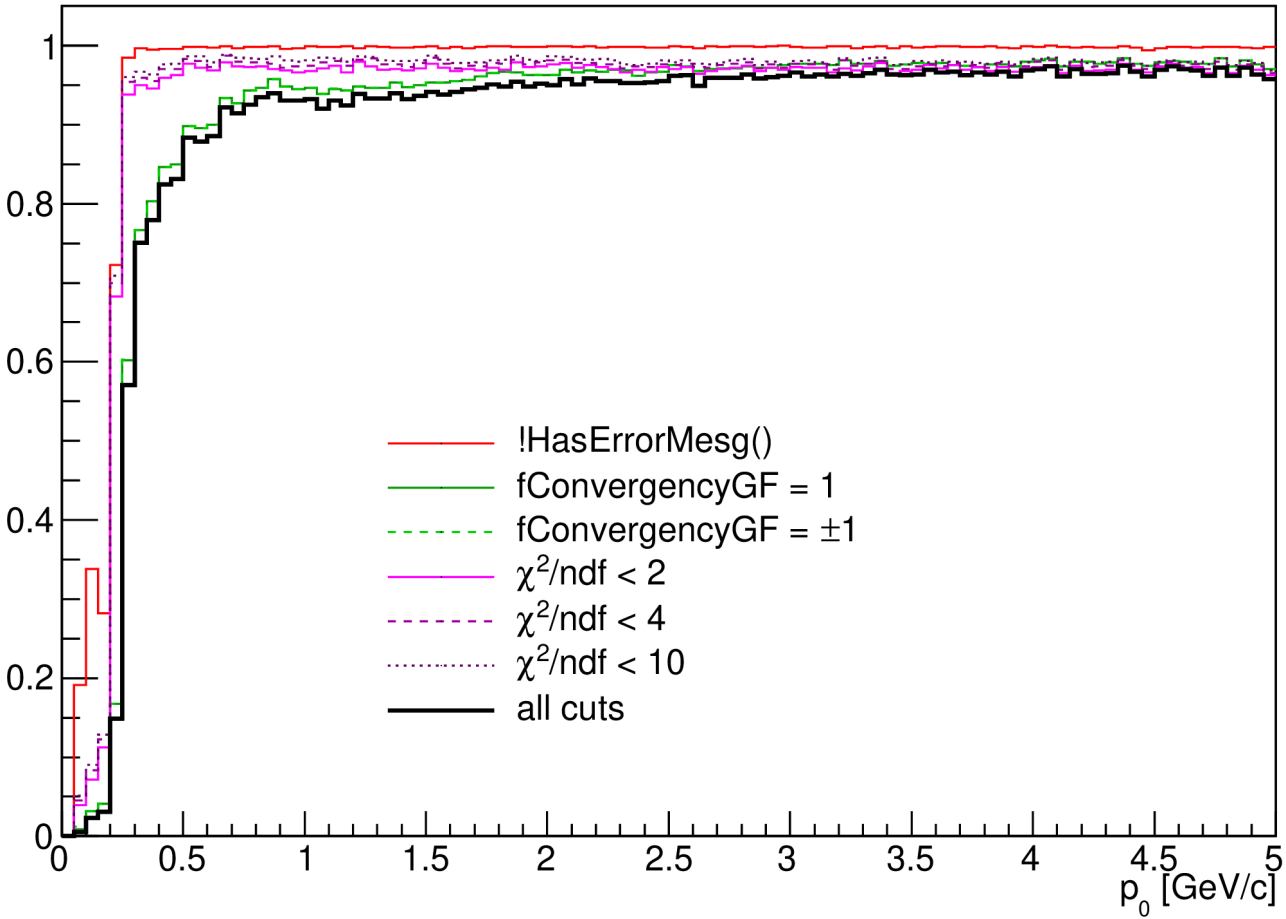


At θ=π/2: 97%

Minimal: 38%

Efficiency of track quality cuts. Pions, $0 < p_0 < 5$ GeV/c, $Z_{\text{prim.vtx.}} = 0$.

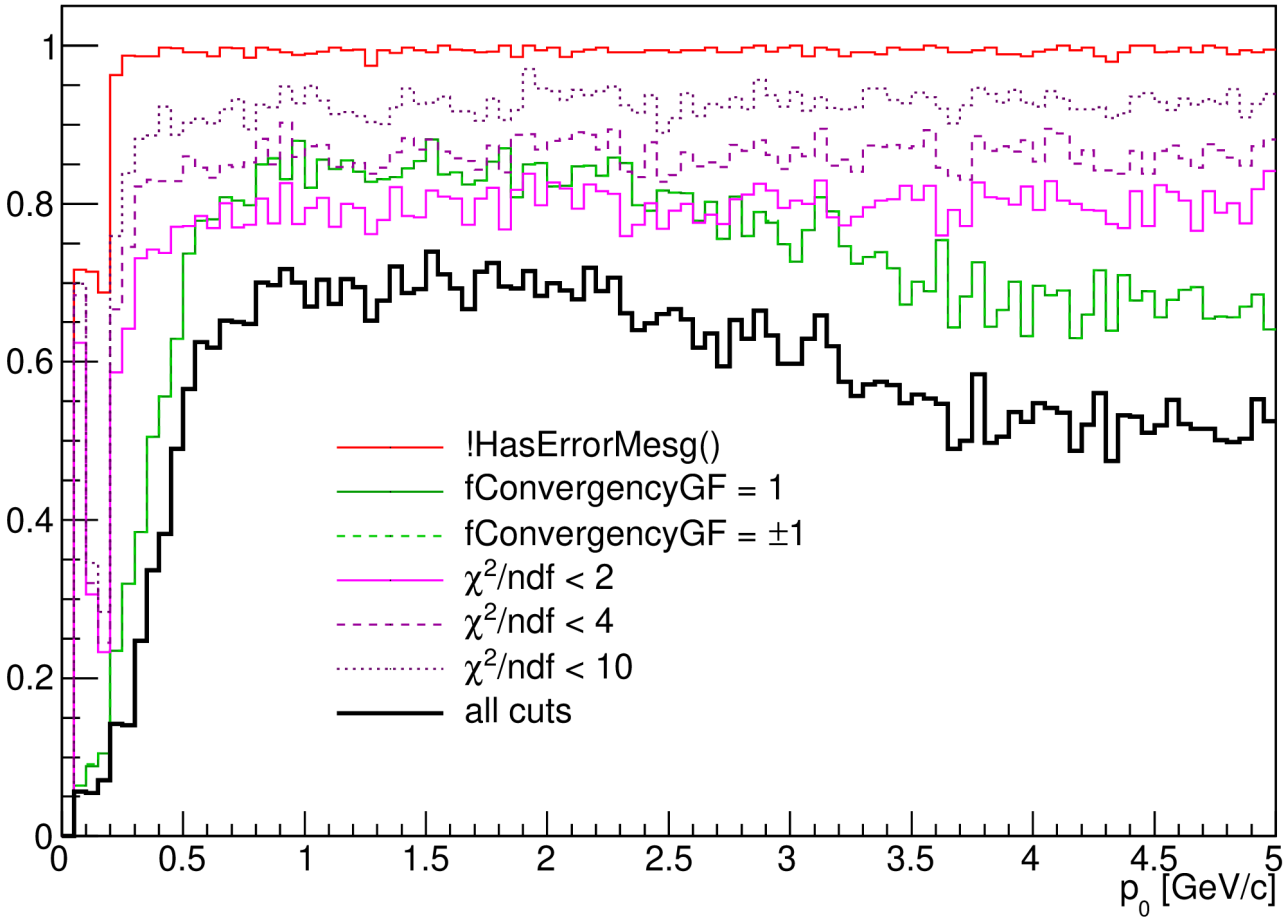
$60° < \theta < 120°$ (1.05 < θ < 2.09 rad)



≈ 97%

Efficiency of track quality cuts. Pions, $0 < p_0 < 5$ GeV/c, $Z_{\text{prim.vtx.}} = 0$.

$13° < \theta < 36°$ $(0.22 < \theta < 0.63$ rad)



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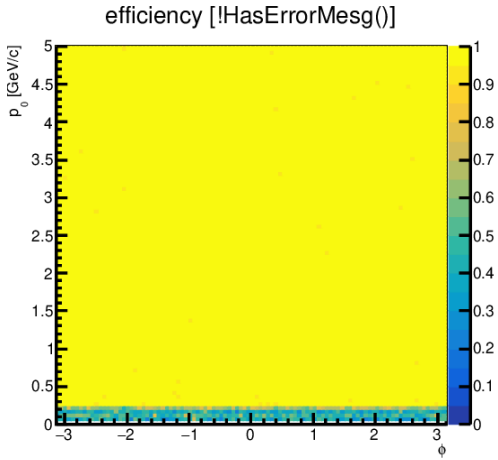
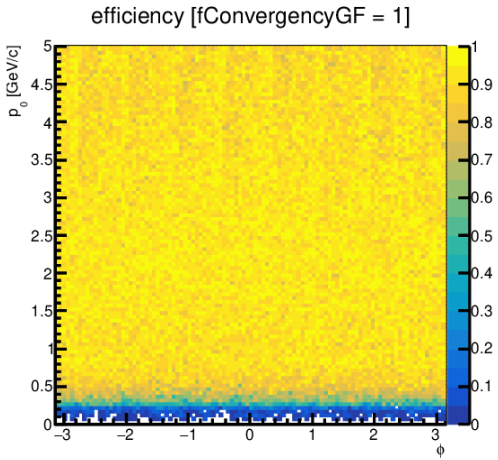
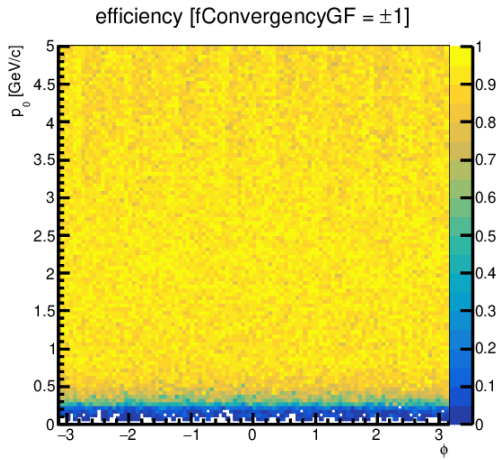
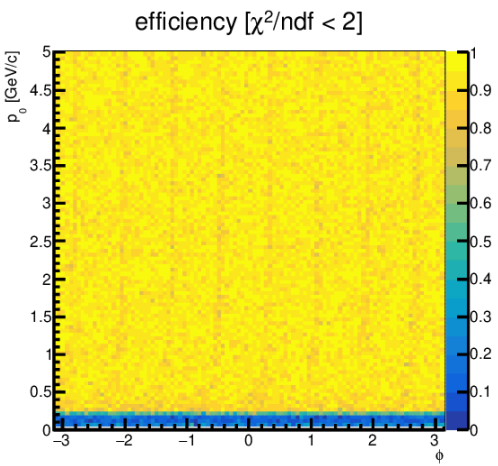
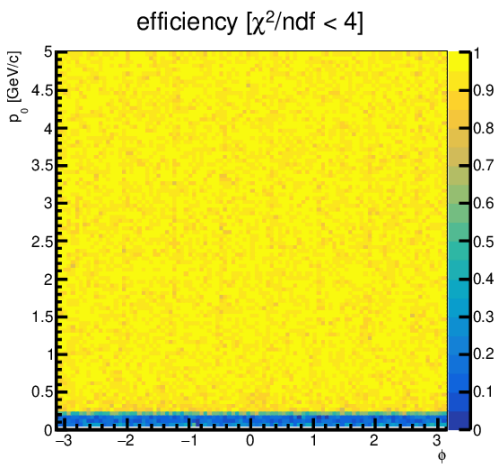
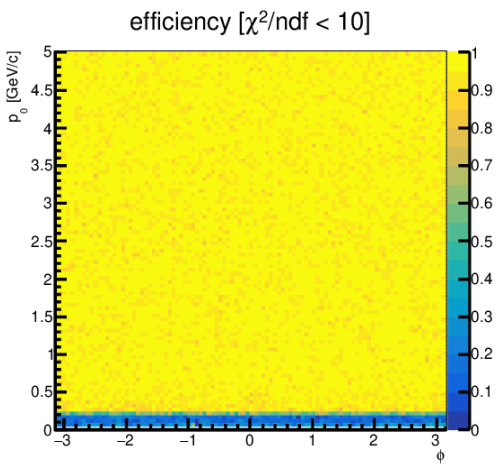


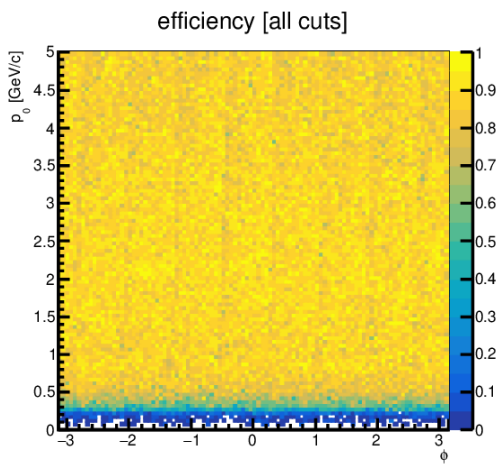




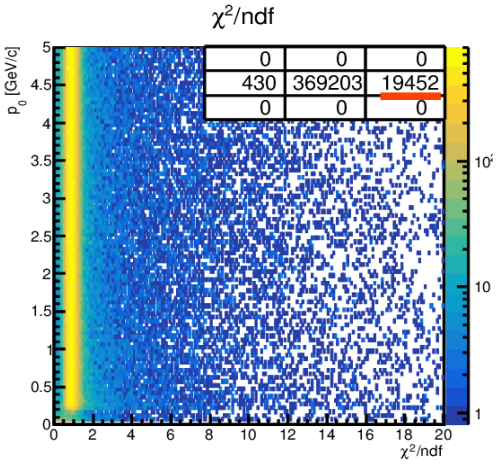


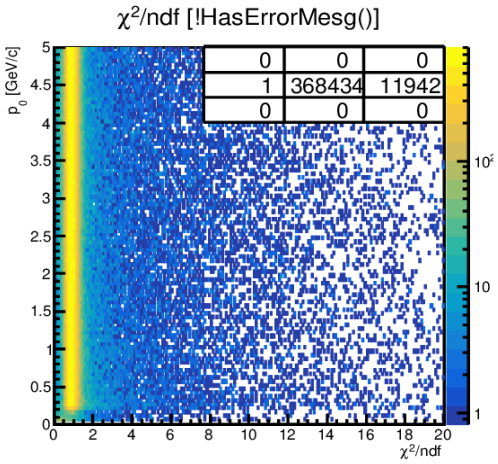


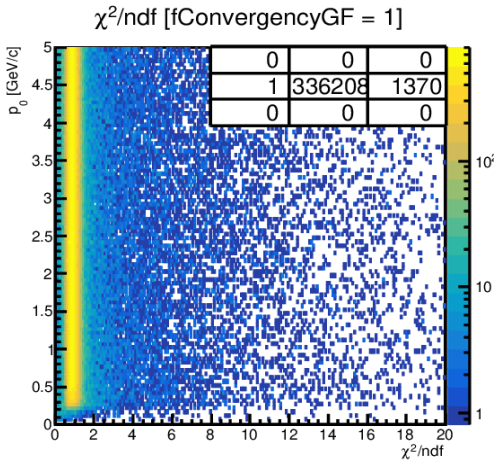


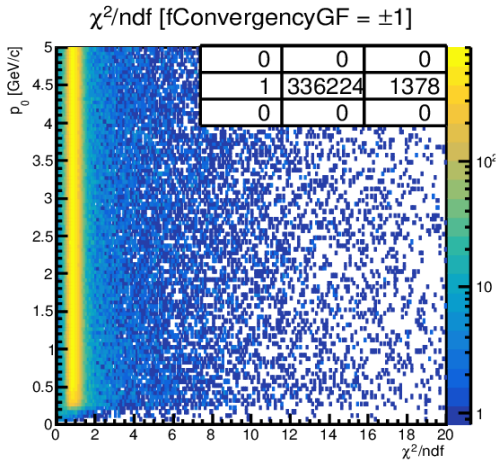


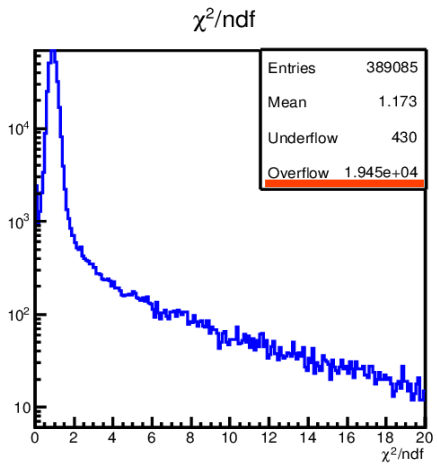
χ^2/ndf distribution. Pions, $0 < p_0 < 5$ GeV/c, $Z_{\text{prim.vtx.}} = 0$.

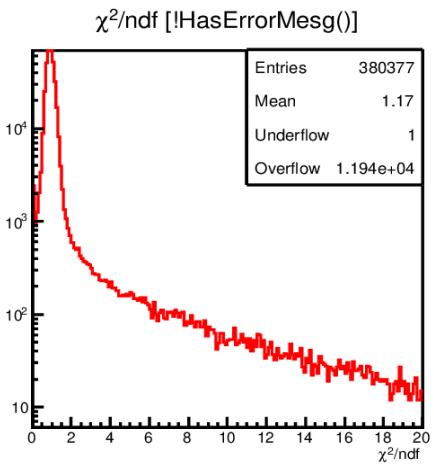


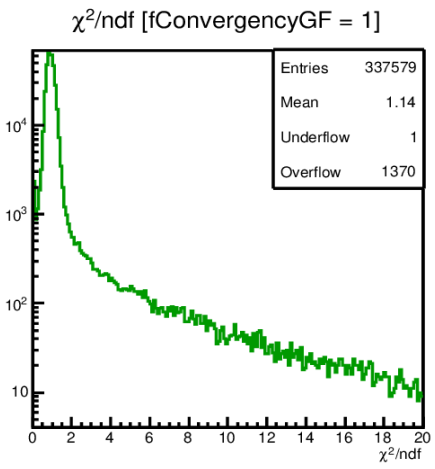


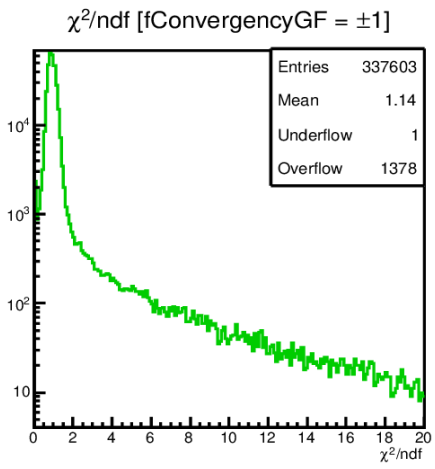




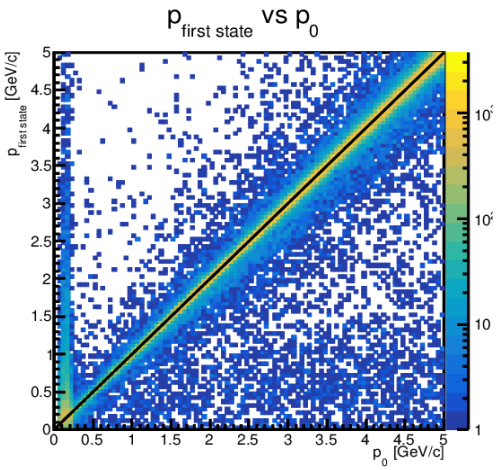


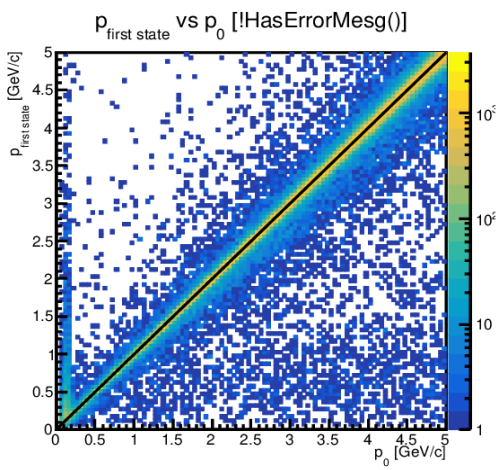


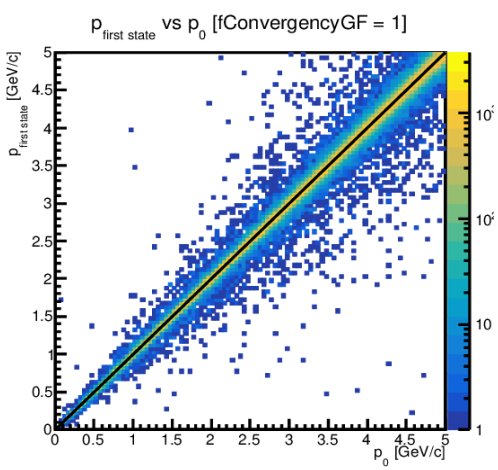


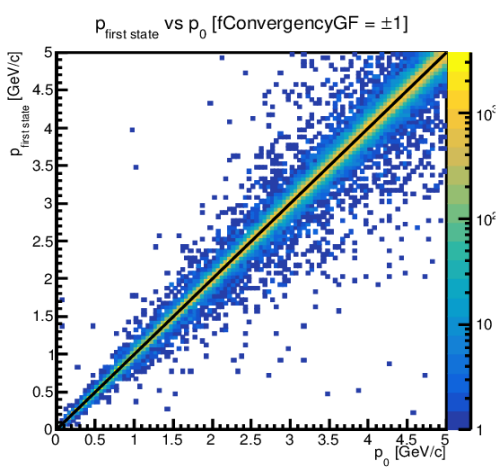


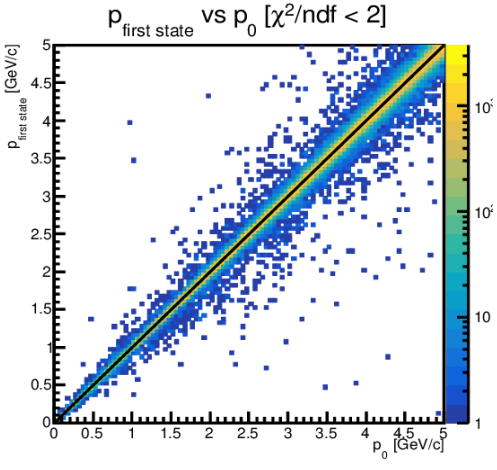
Reconstructed momentum vs true momentum. Pions, $0 < p_0 < 5$ GeV/c, $Z_{\text{prim.vtx.}} = 0$.

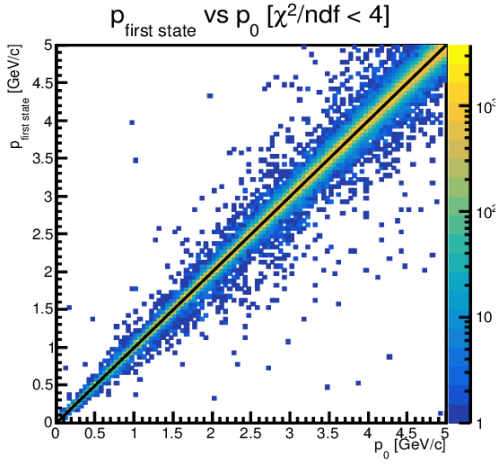


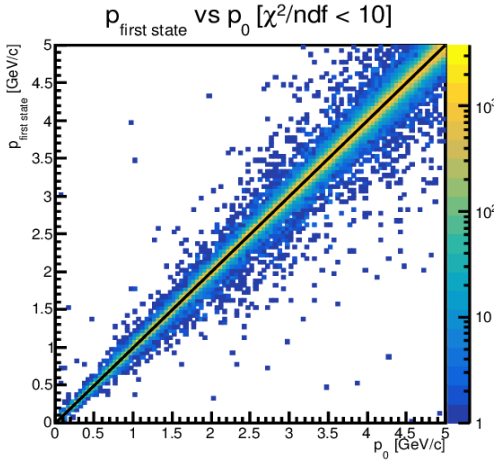


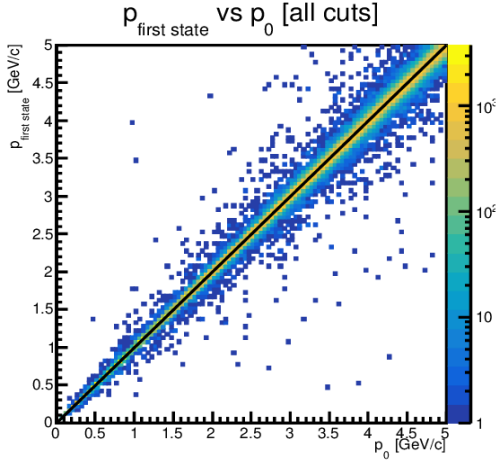










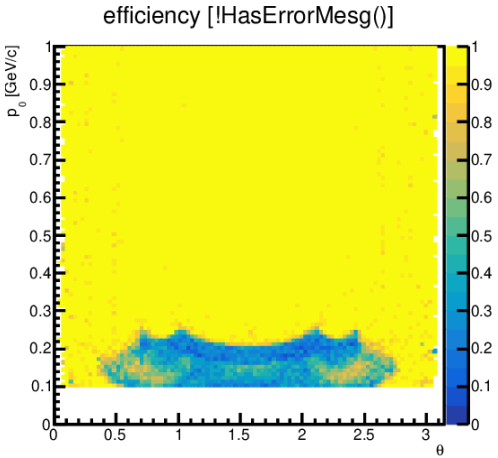


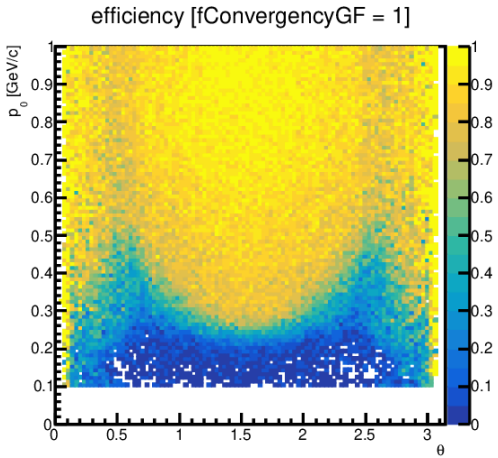
Pions

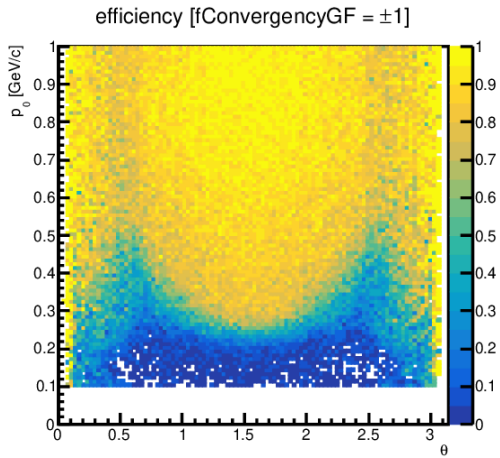
$0.1 < p_0 < 1$ GeV/c

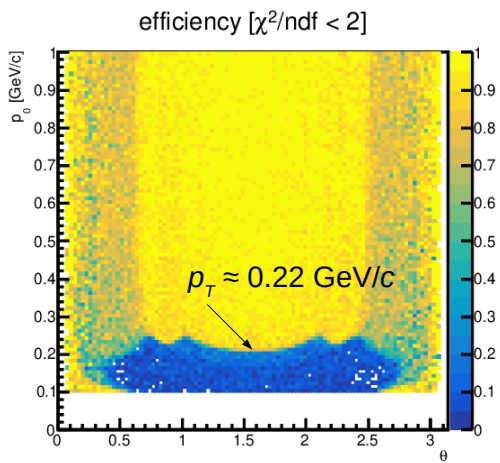
$Z_{\text{prim.vtx.}} = 0$

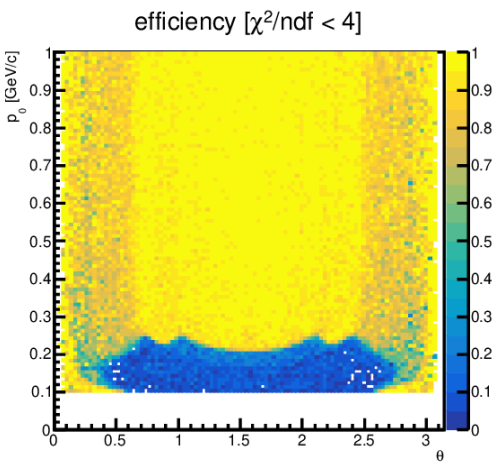
Efficiency of track quality cuts. Pions, $0.1 < p_0 < 1$ GeV/c, $Z_{\text{prim.vtx.}} = 0$.

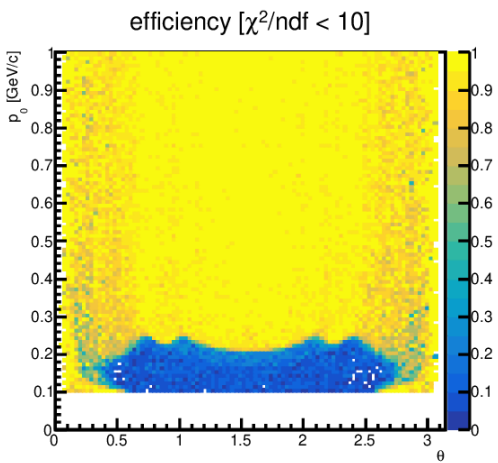


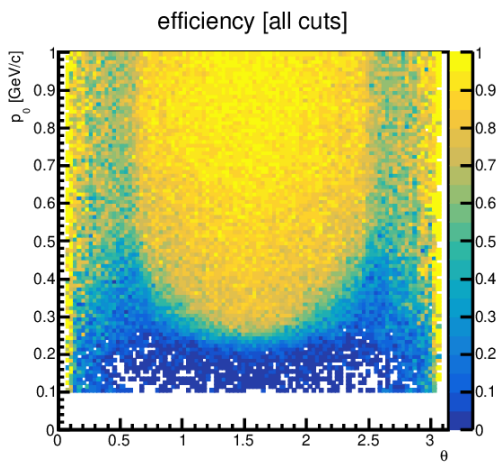




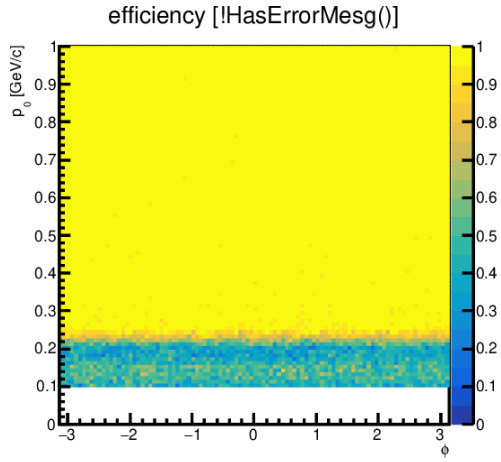


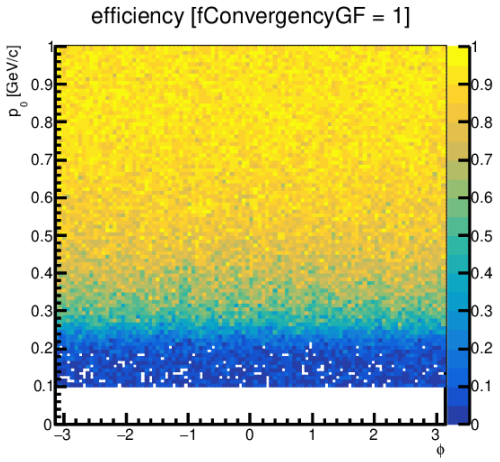


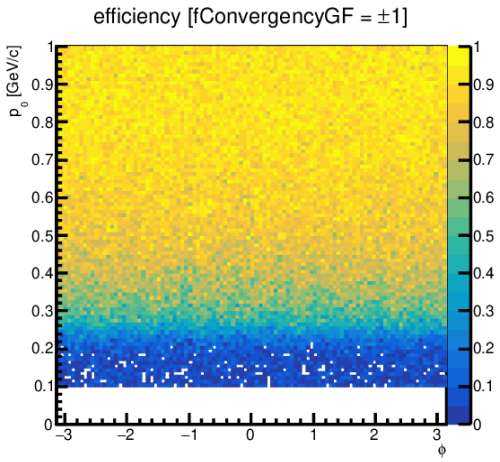


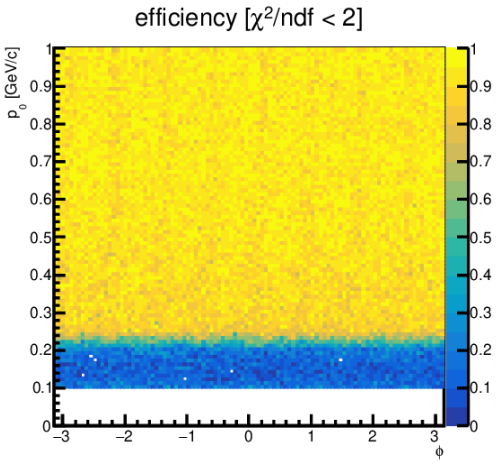


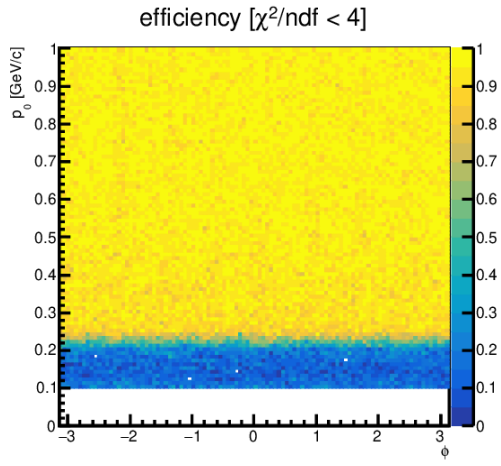
Efficiency of track quality cuts. Pions, $0.1 < p_0 < 1$ GeV/c, $Z_{\text{prim.vtx.}} = 0$.

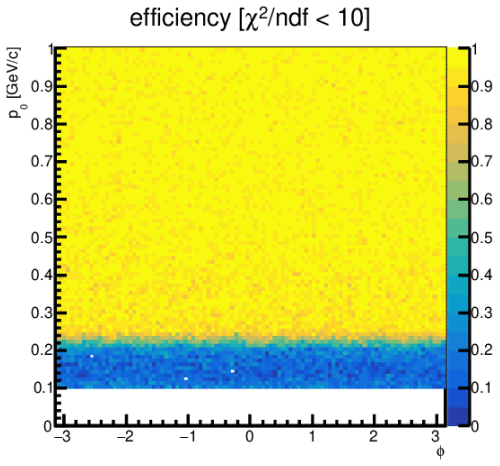


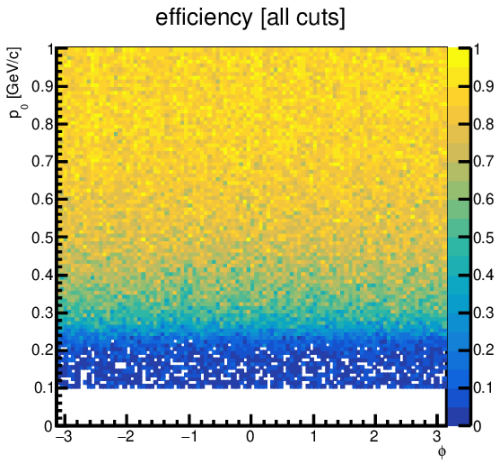




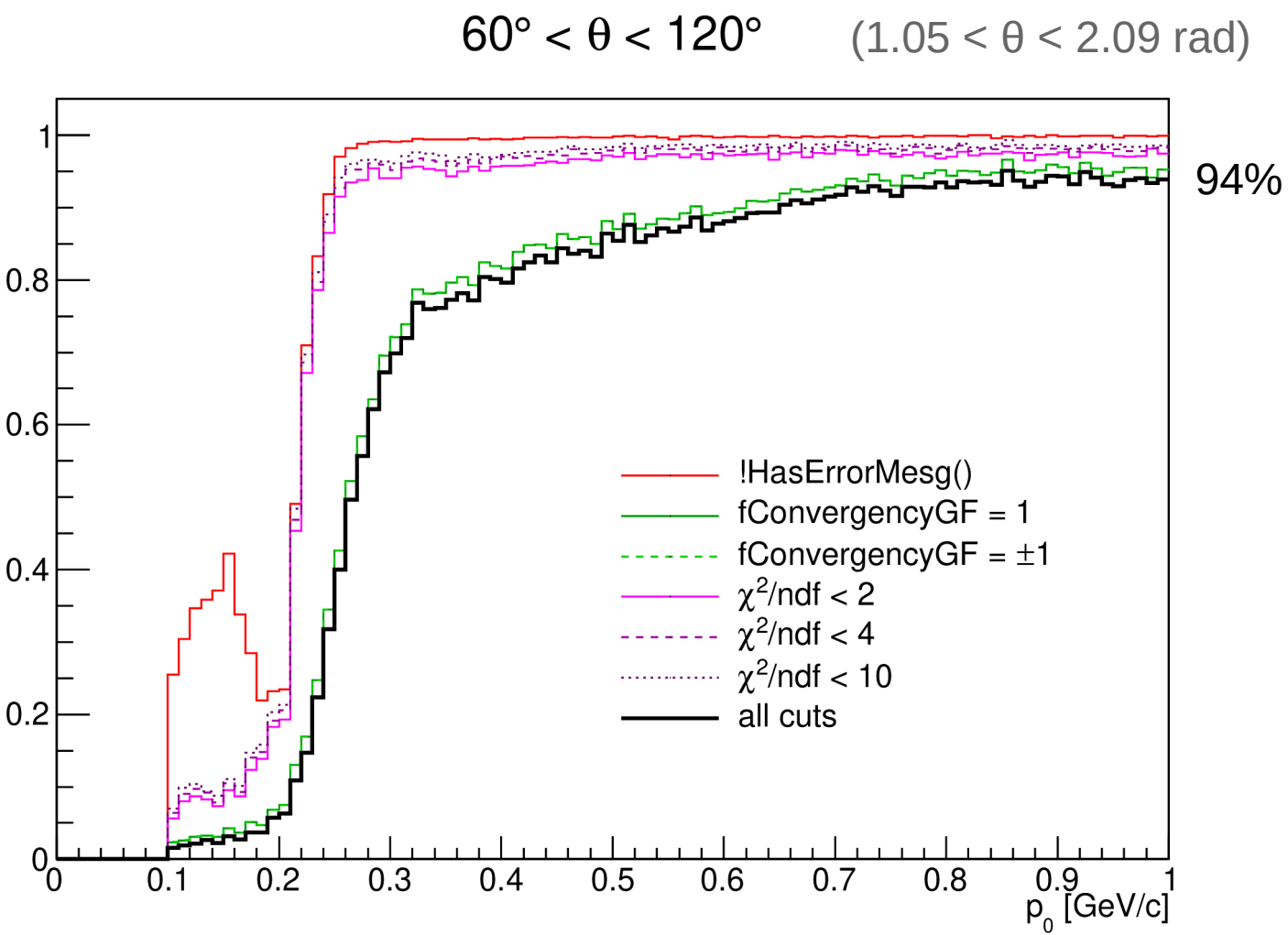








Efficiency of track quality cuts. Pions, $0.1 < p_0 < 1$ GeV/c, $Z_{\text{prim.vtx.}} = 0$.



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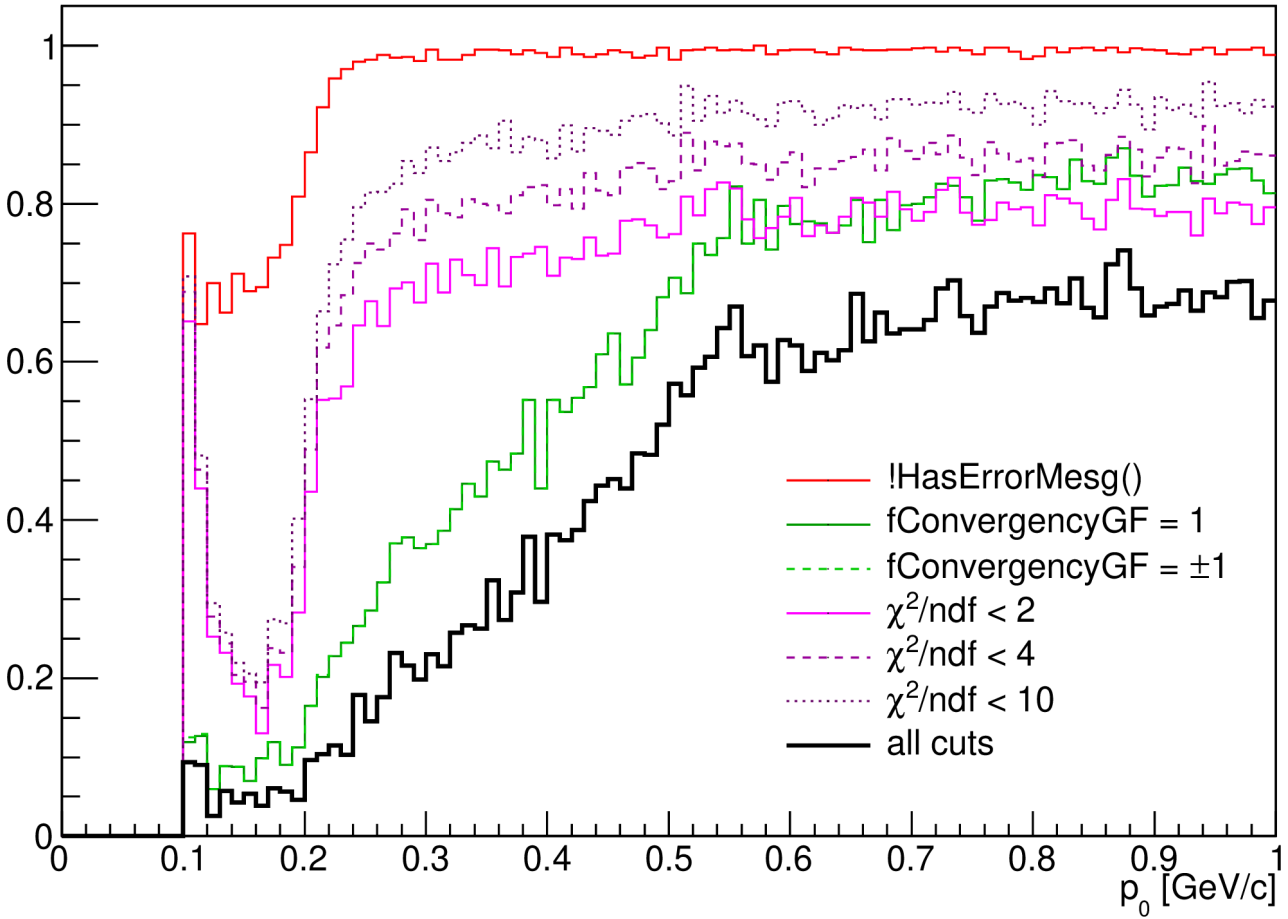
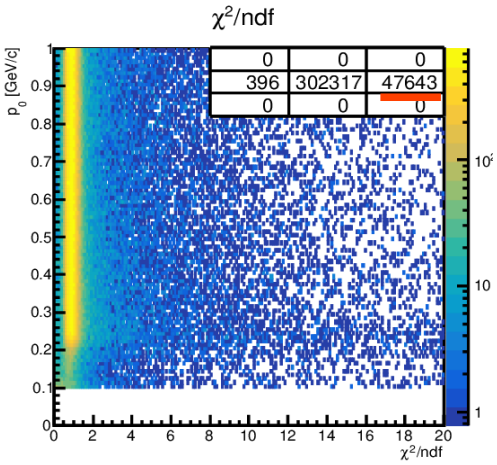
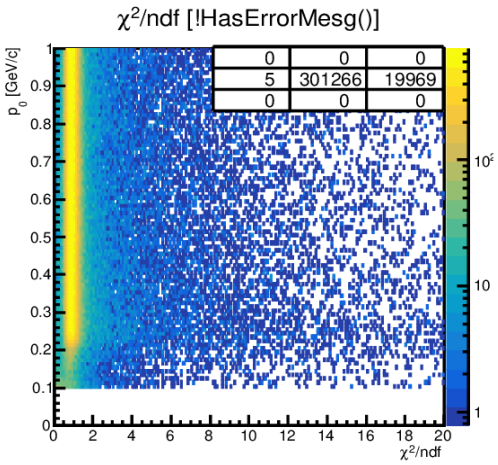
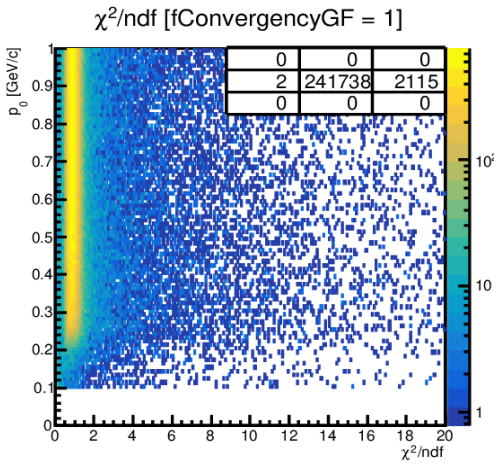
$13° < \theta < 36°$ $(0.22 < \theta < 0.63$ rad)

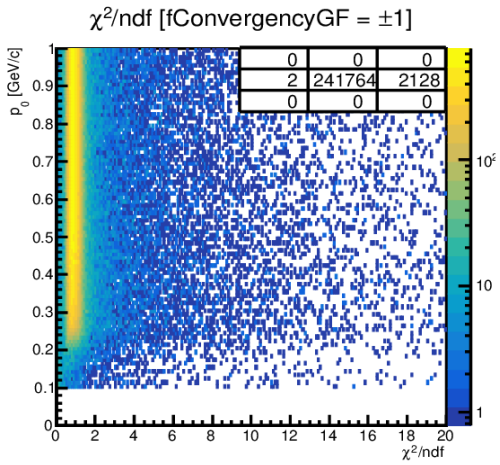


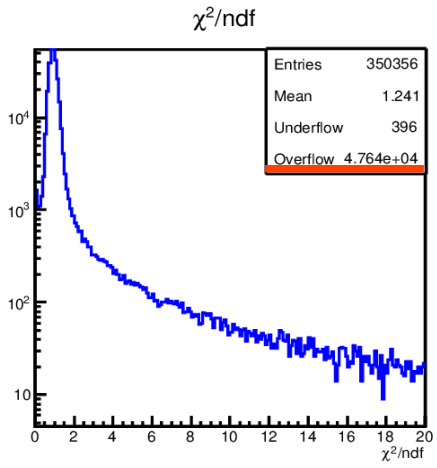
χ^2/ndf distribution. Pions, $0.1 < p_0 < 1$ GeV/c, $Z_{\text{prim.vtx.}} = 0$.

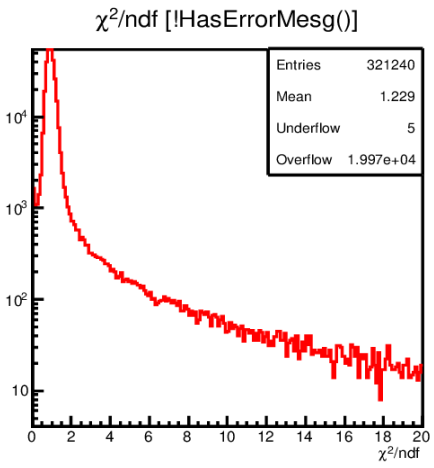


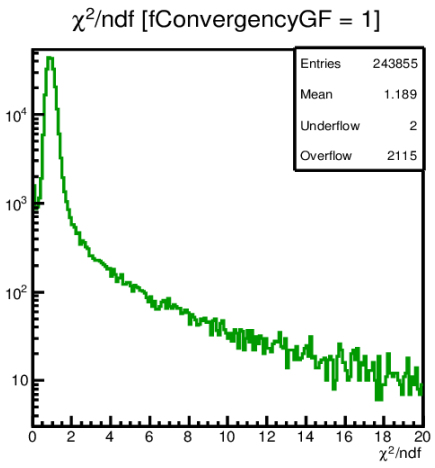


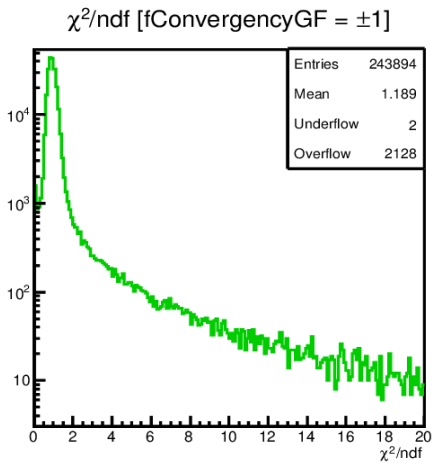




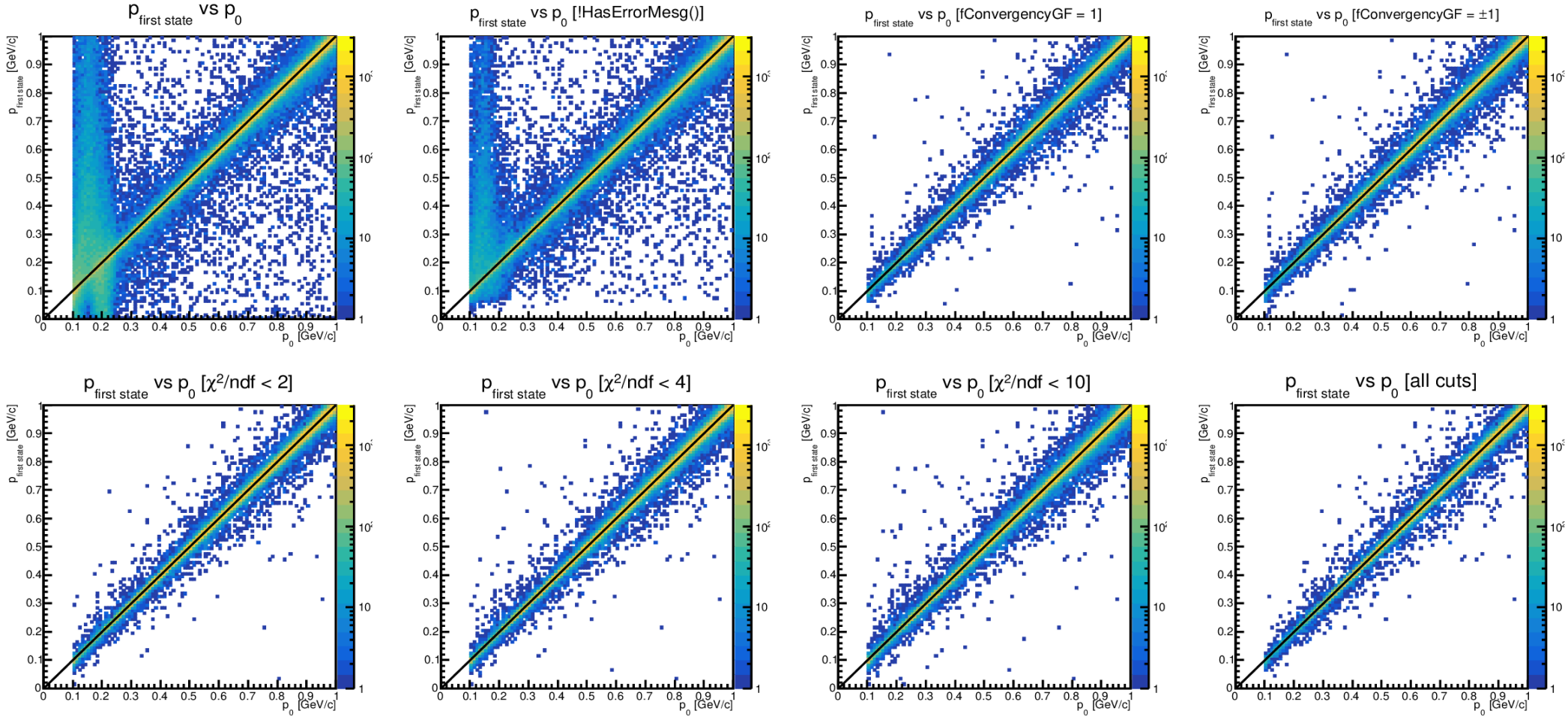








Reconstructed momentum vs true momentum. Pions, $0.1 < p_0 < 1$ GeV/c, $Z_{\text{prim.vtx.}} = 0$.



Summary

- Tracking works OK for tracks going through the barrel and with sufficiently large momenta ($p \gtrsim 1$ GeV/c).
- χ^2/ndf distribution becomes worse for $0.22 < \theta < 0.63$ rad, presumably range which corresponds to tracks with hits both in barrel and endcaps
- Cut on convergency significantly reduces statistics for similary (but not exactly the same) range of θ, more so for large momenta.
- For small momenta the cut on convergency is the most constraining.