Tau Reconstruction in the MAIA Detector

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MAIA Detector and 10 TeV Studies

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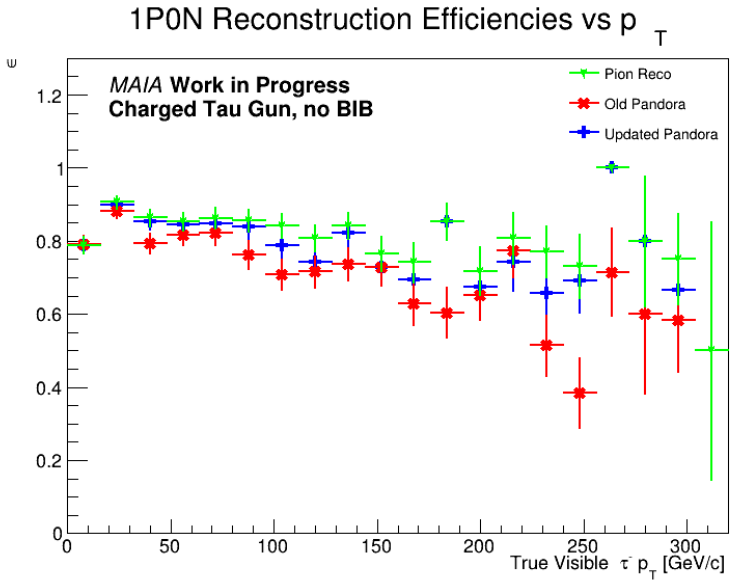
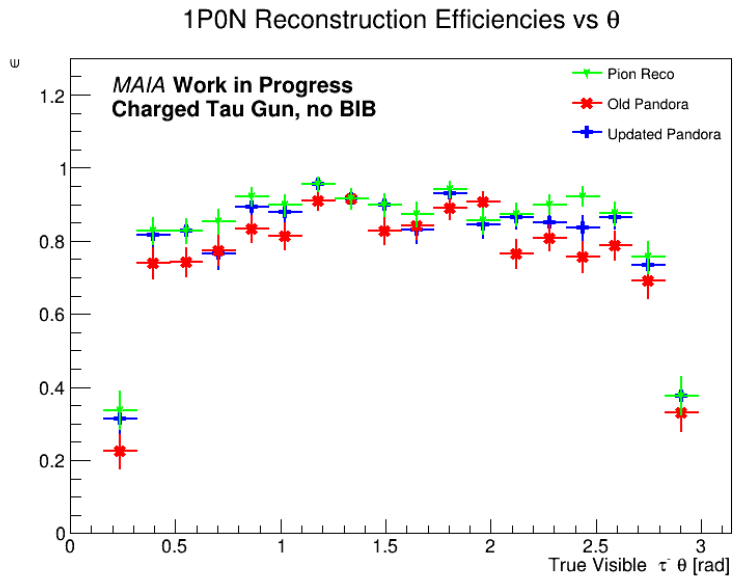
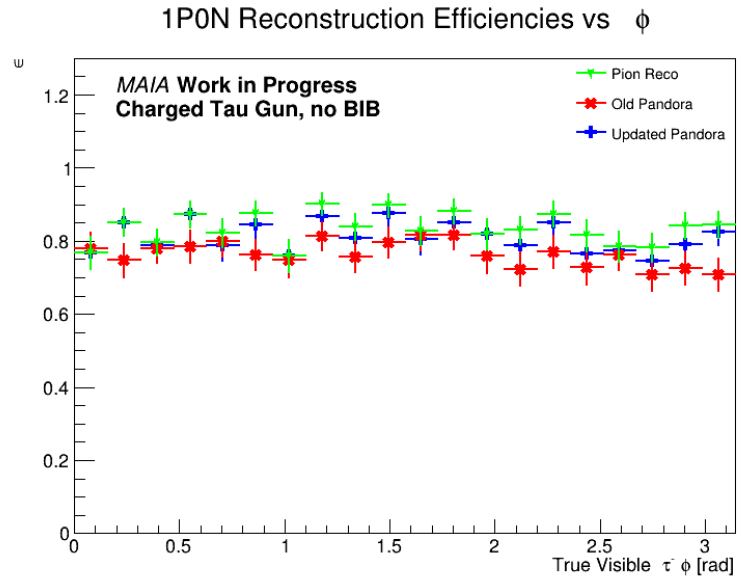
Updated 1P0N Efficiencies

$$\epsilon_\tau = \frac{\#\ of\ 1P\ Reco\ \tau\ Matched\ with\ 1P\ MC\ \tau}{Total\ \#\ of\ 1P\ MC\ \tau}$$

$$\epsilon_{\pi^\pm} = \frac{\#\ of\ Single\ Reco\ \pi^\pm\ Matched\ with\ Single\ MC\ \pi^\pm}{Total\ \#\ of\ Single\ MC\ \pi^\pm}$$





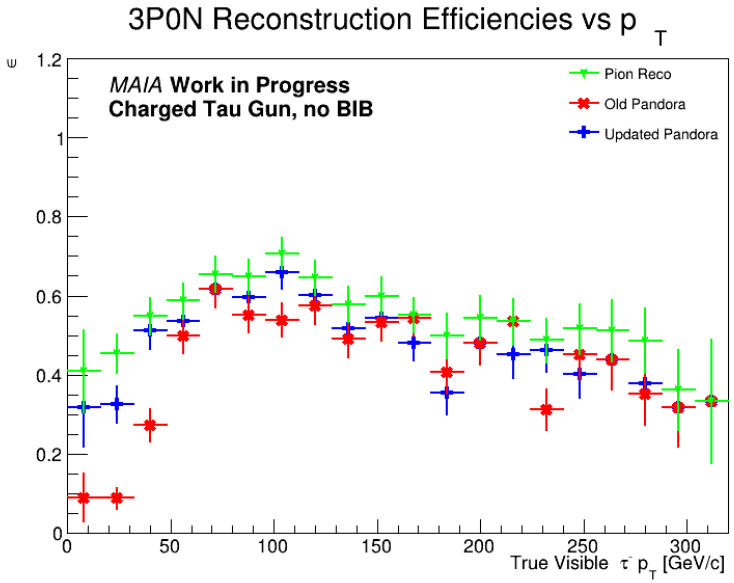


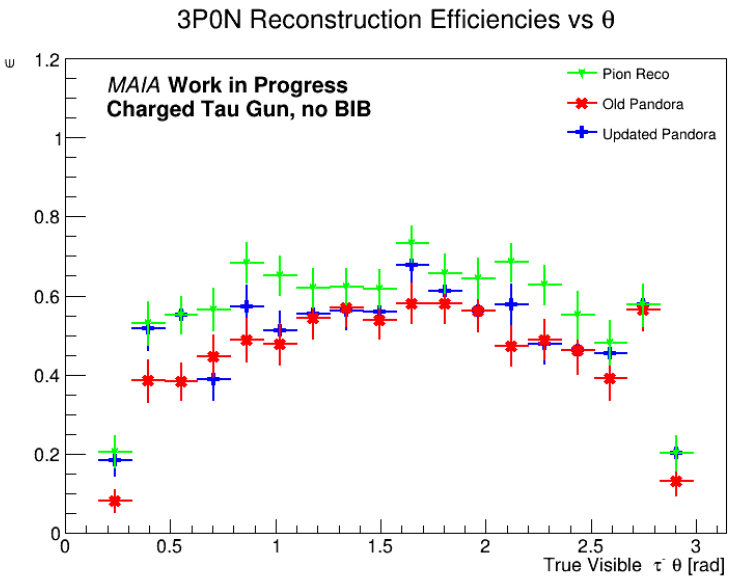
- Updated Pandora reconstruction with loosened “MaxTrackSigmaPOverP”
  - 0.15 -> 0.30
- Widened search cone opening angle from 0.05 to 0.10 rad
- Increased average 1P0N reconstruction efficiency from ~75% to ~80%
  - Can match charged pion efficiency if NParticles selection cut is loosened

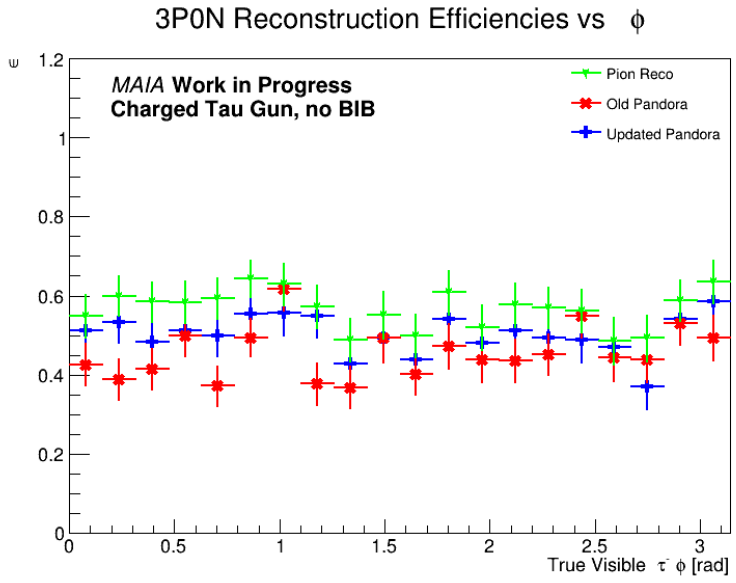
Updated 3P0N Efficiencies

$$\epsilon_\tau = \frac{\#\ of\ 3P\ Reco\ \tau\ Matched\ with\ 3P\ MC\ \tau}{Total\ \#\ of\ 3P\ MC\ \tau}$$

$$\epsilon_{\pi^\pm} = \frac{\#\ of\ Triple\ Reco\ \pi^\pm\ Matched\ with\ Triple\ MC\ \pi^\pm}{Total\ \#\ of\ Triple\ MC\ \pi^\pm}$$

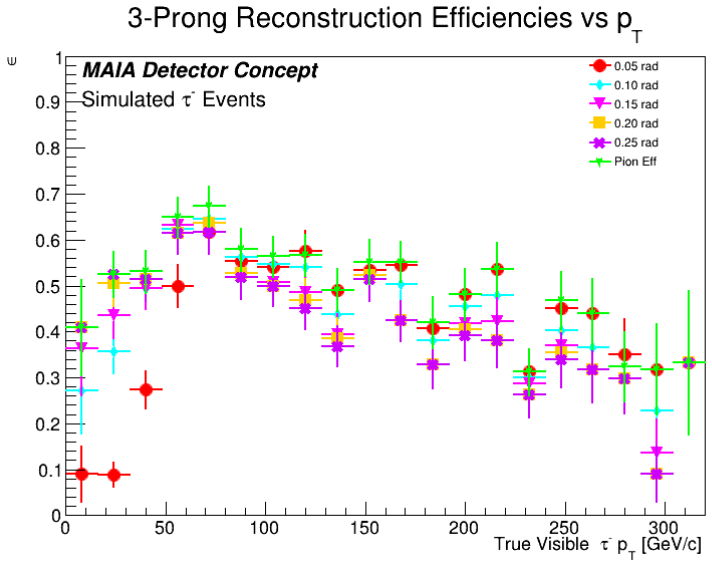


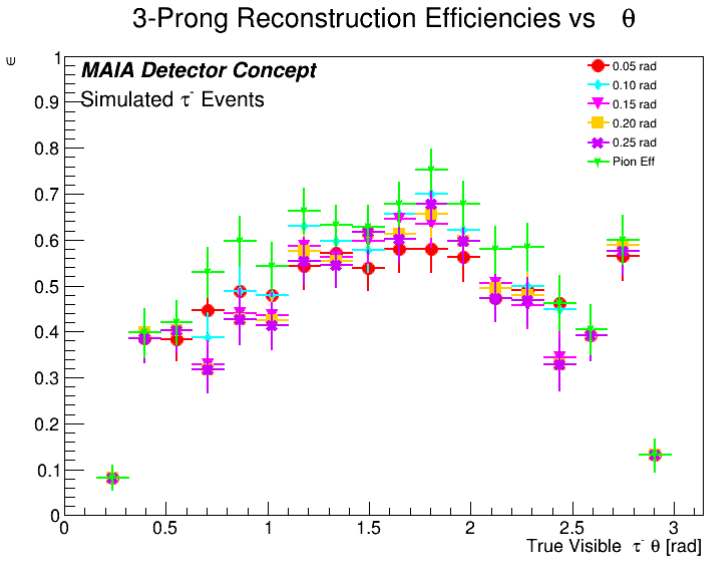


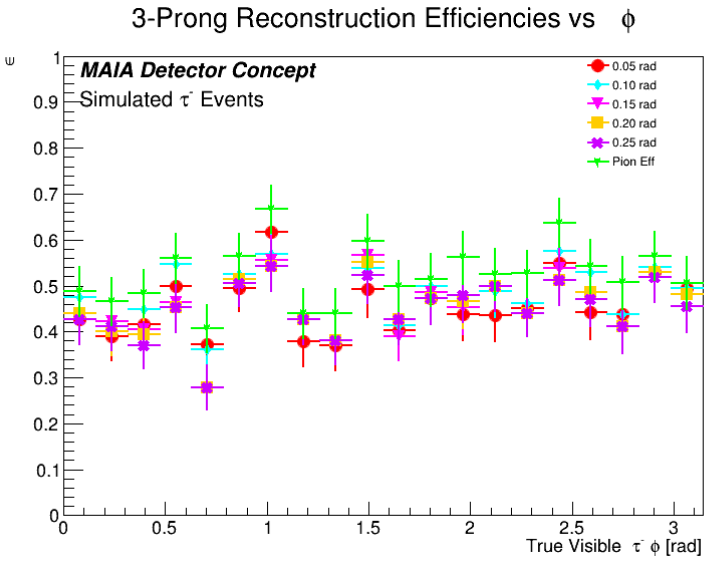


- Updated Pandora reconstruction with loosened “MaxTrackSigmaPOverP”
  - 0.15 -> 0.30
- Widened search cone opening angle from 0.05 to 0.10 rad
- Increased average 3P0N reconstruction efficiency from ~45% to ~50%
  - Can match charged pion efficiency if NParticles selection cut is loosened and cone is widened

Scan of Search Cone Opening Angle (3P0N)

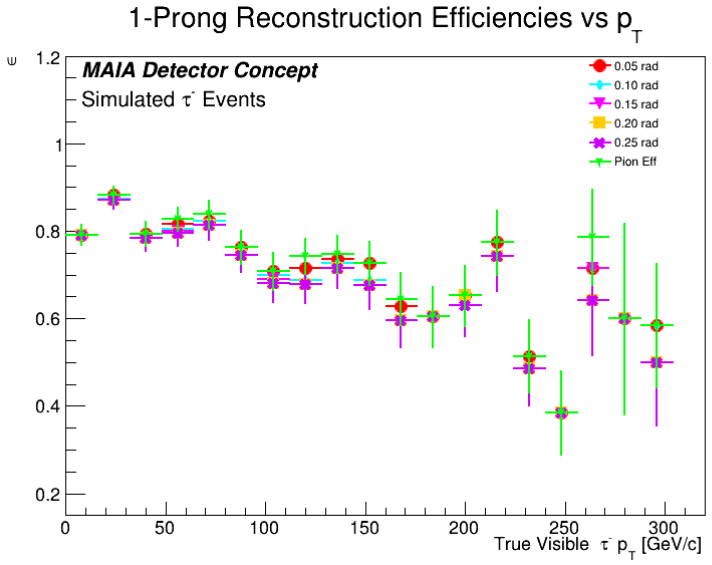


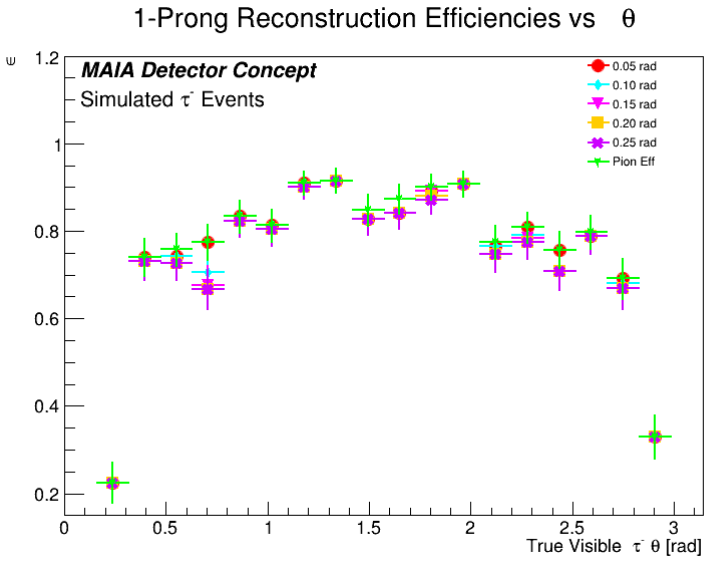


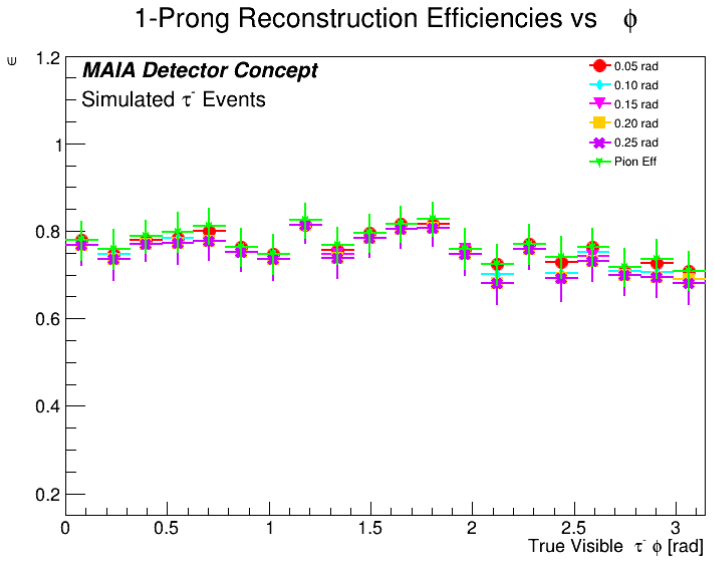


Opening Angle (rad)	Average Efficiency
0.05	0.455 ± 0.012
0.10	0.479 ± 0.012
0.15	0.456 ± 0.012
0.20	0.453 ± 0.012
0.25	0.449 ± 0.012

Scan of Search Cone Opening Angle (1P0N)

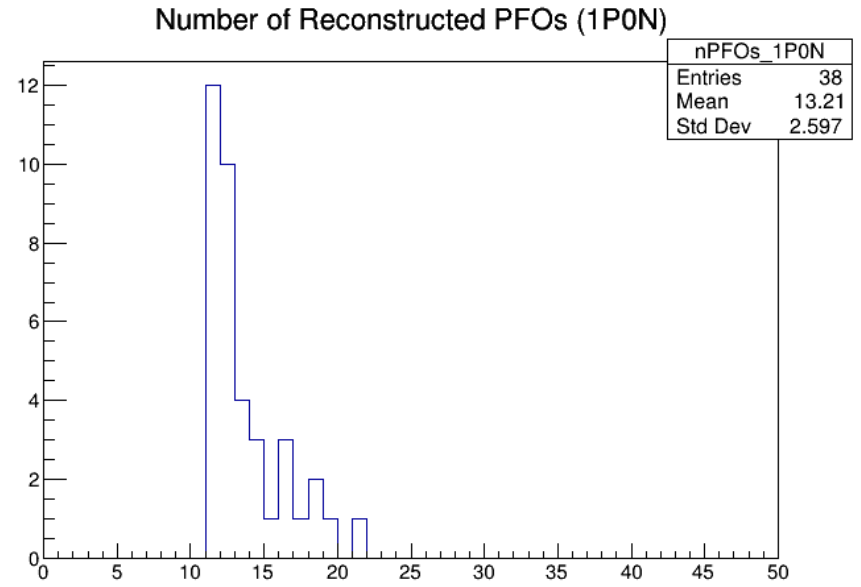




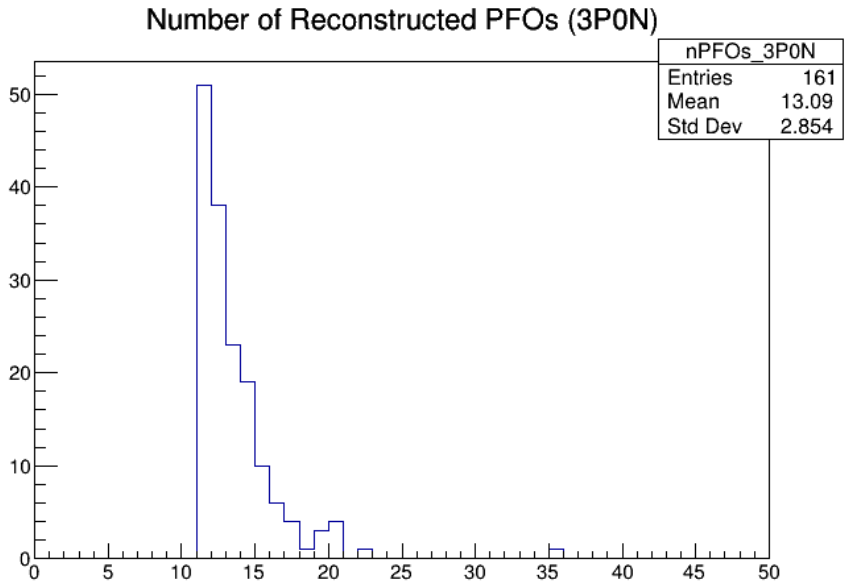


Opening Angle (rad)	Average Efficiency
0.05	0.763 ± 0.010
0.10	0.755 ± 0.010
0.15	0.748 ± 0.010
0.20	0.747 ± 0.010
0.25	0.746 ± 0.010

PFOs in Search Cone (0.10 rad) of Failed Taus



PFO Type	Fraction of Total PFOs	Average Number Reconstructed per Event
$\pi^{\pm}$	0.070	0.92
γ	0.687	9.08
$e^{\pm}$	0.008	0.11
n	0.235	3.12



PFO Type	Fraction of Total PFOs	Average Number Reconstructed per Event
$\pi^{\pm}$	0.200	2.62
γ	0.616	8.06
$e^{\pm}$	0.016	0.20
n	0.168	2.20

Next Steps

- Redo scan of search cone opening angle with updated Pandora reconstruction
  - Plot NPFOs as a function of the search cone opening angle
- Begin BIB studies