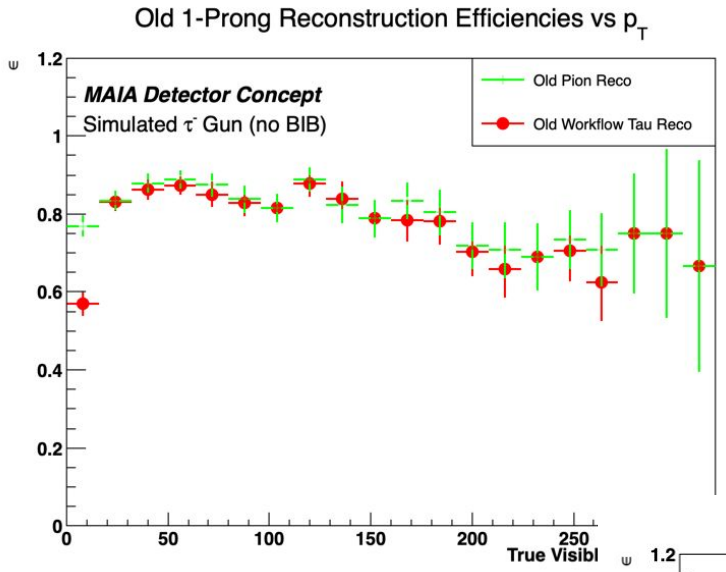
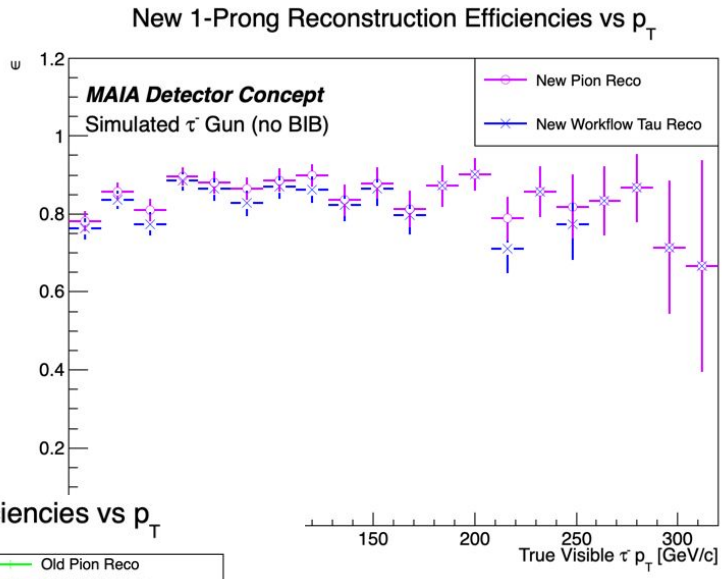
TauFinder 9/25/2025

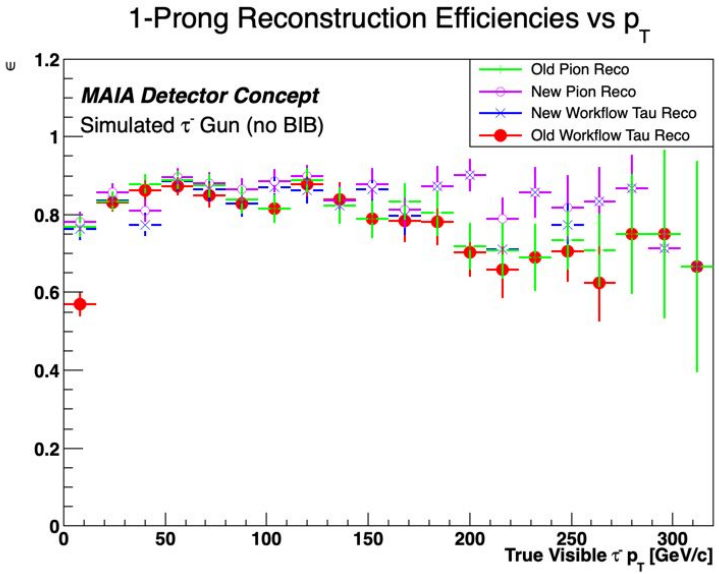
New workflow, same gen:

- 15k events with a τ^- each

MC τ^- Parameters
$0 \leq \phi \leq 2\pi$ [rad]
$8^\circ \leq \theta \leq 172^\circ$
$20 \leq p_T \leq 320$ [GeV/c]

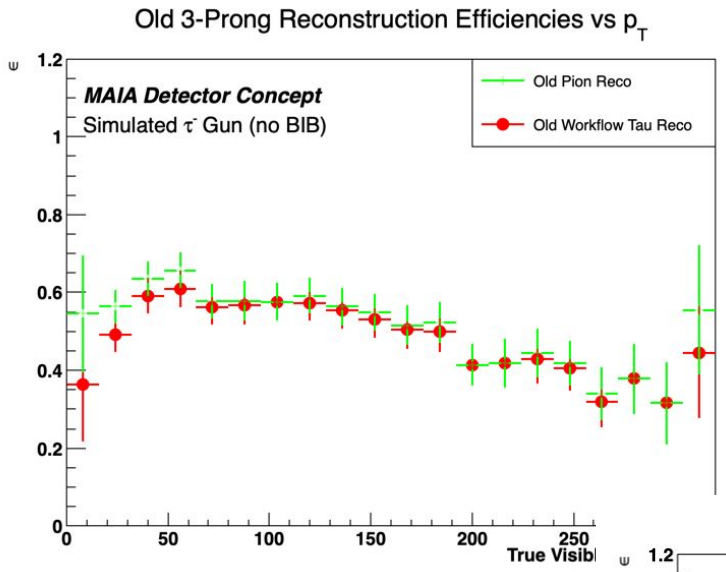


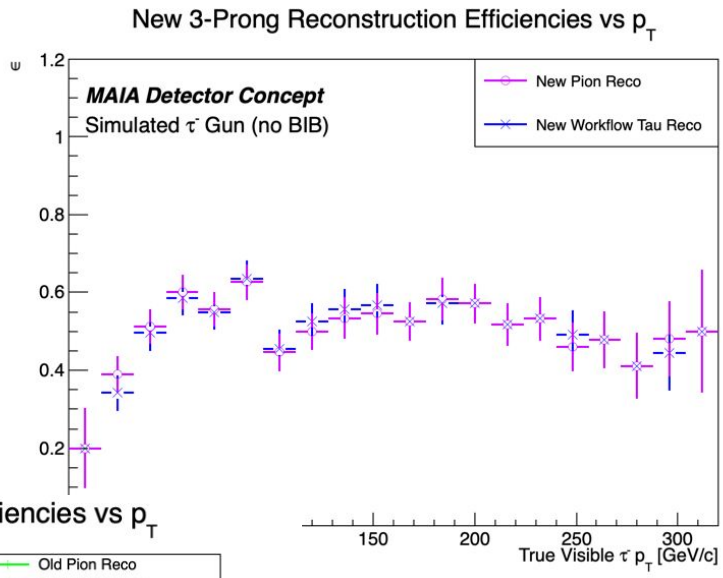


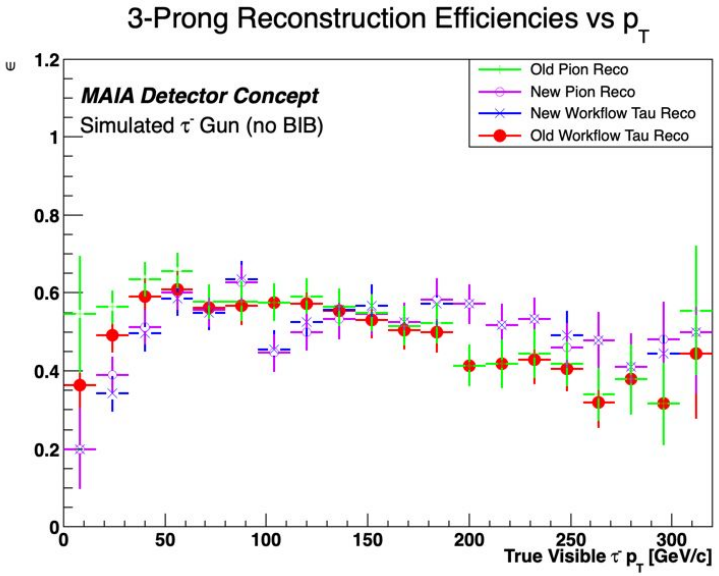


New to old comparison (1 prong)

$$\text{Signal Cone Angle} = \begin{cases} 0.6 & p_T \leq 10 \\ \frac{6}{p_T} & 10 < p_T < 120 \\ 0.05 & p_T \geq 120 \end{cases}$$

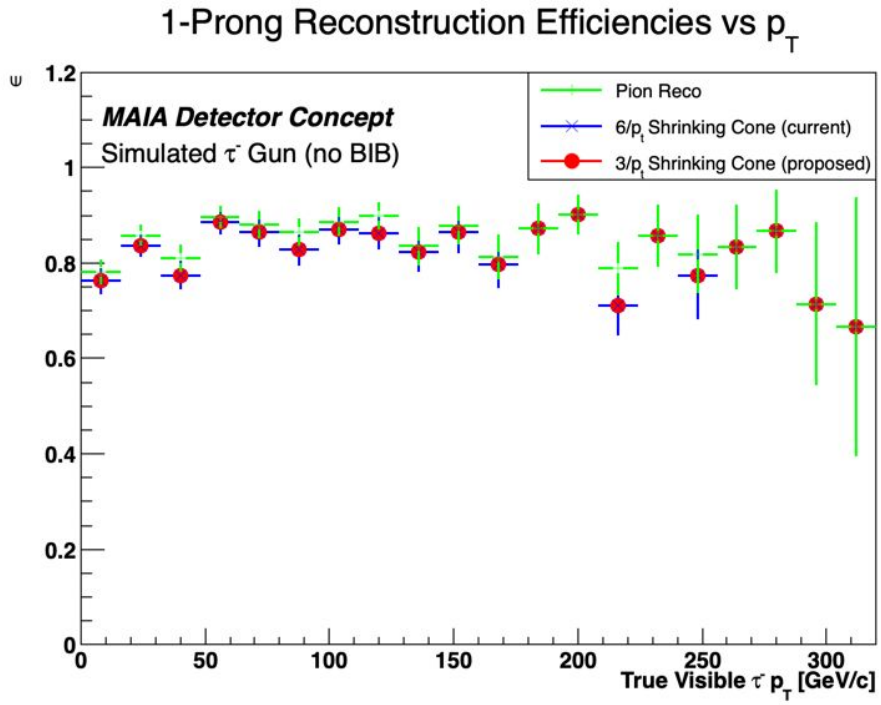






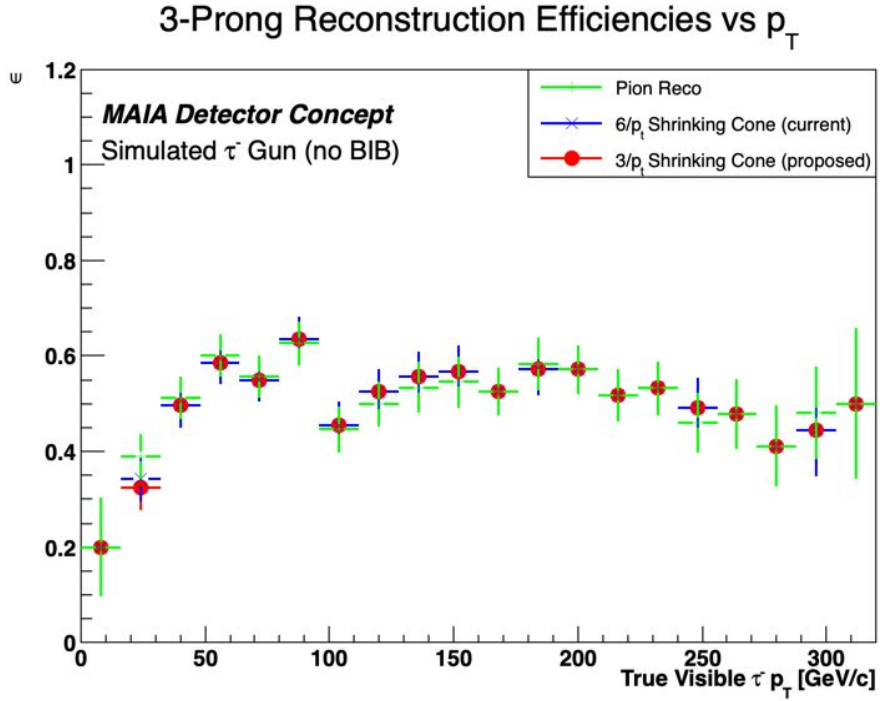
New to old comparison (3 prongs)

$$\text{Signal Cone Angle} = \begin{cases} 0.6 & p_T \leq 10 \\ \frac{6}{p_T} & 10 < p_T < 120 \\ 0.05 & p_T \geq 120 \end{cases}$$



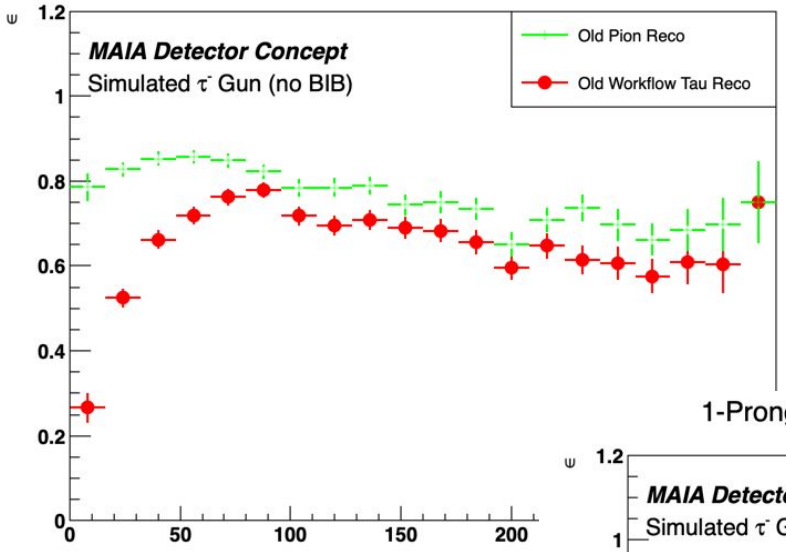
$$\text{Signal Cone Angle} = \begin{cases} 0.3 & p_T \leq 10 \\ \frac{3}{p_T} & 10 < p_T < 60 \\ 0.05 & p_T \geq 60 \end{cases}$$

$$\text{Signal Cone Angle} = \begin{cases} 0.6 & p_T \leq 10 \\ \frac{6}{p_T} & 10 < p_T < 120 \\ 0.05 & p_T \geq 120 \end{cases}$$

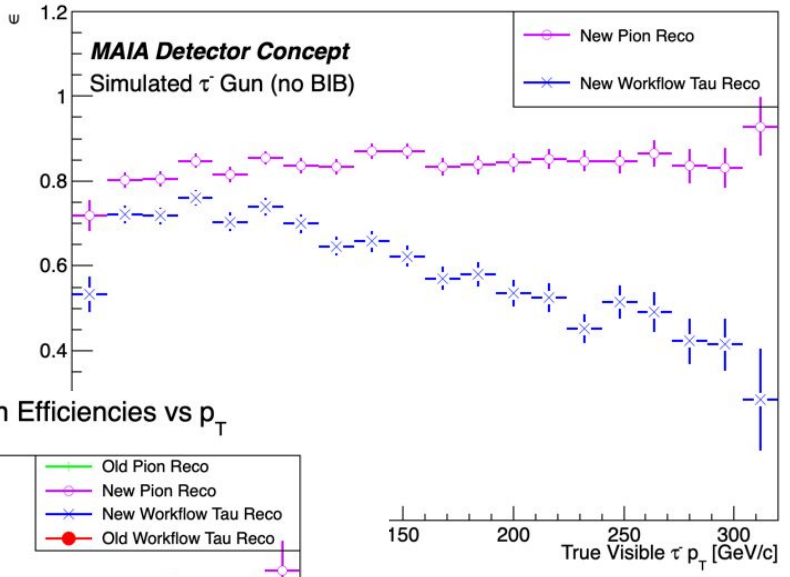


Dynamic cone definition

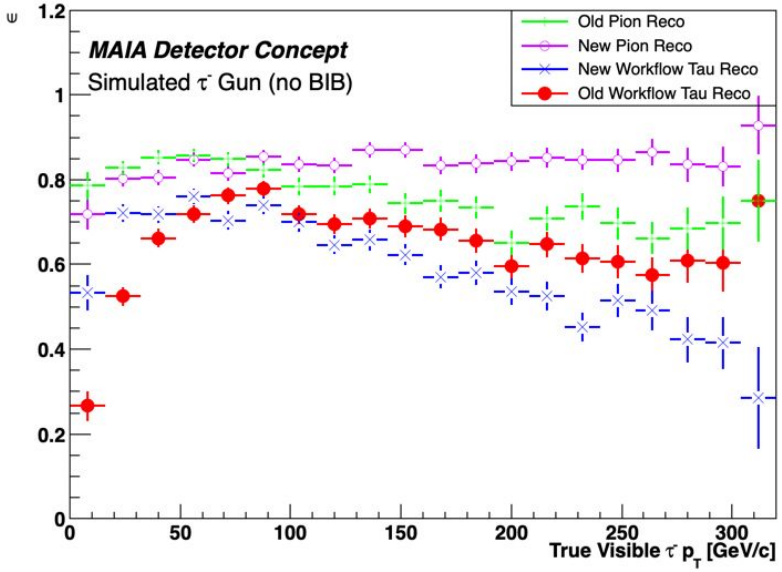
Old 1-Prong + N Reconstruction Efficiencies vs p_T



New 1-Prong + N Reconstruction Efficiencies vs p_T



1-Prong + N Reconstruction Efficiencies vs p_T

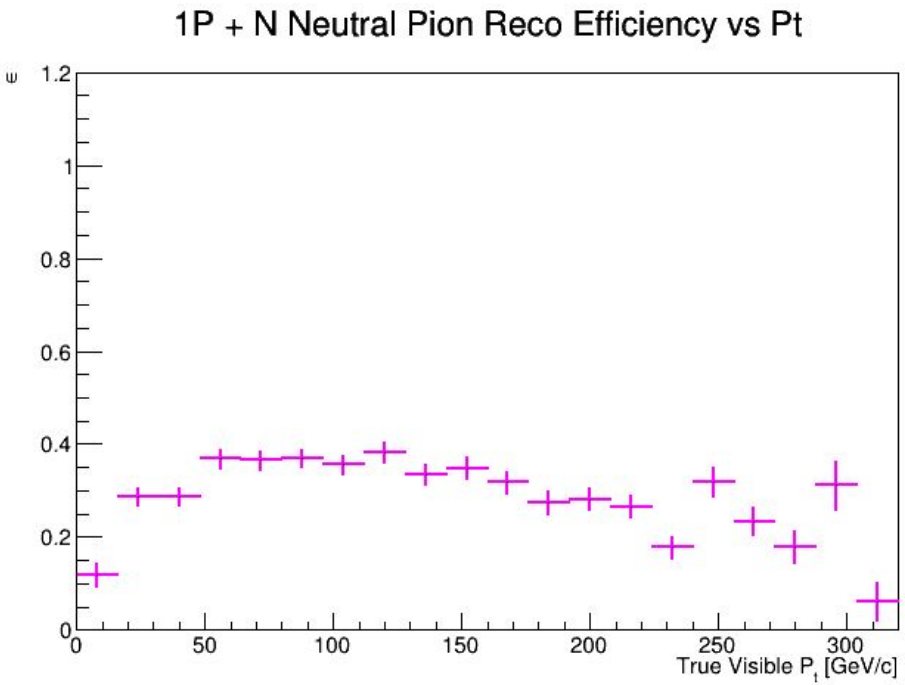


New to old comparison (1 prong + Ns)

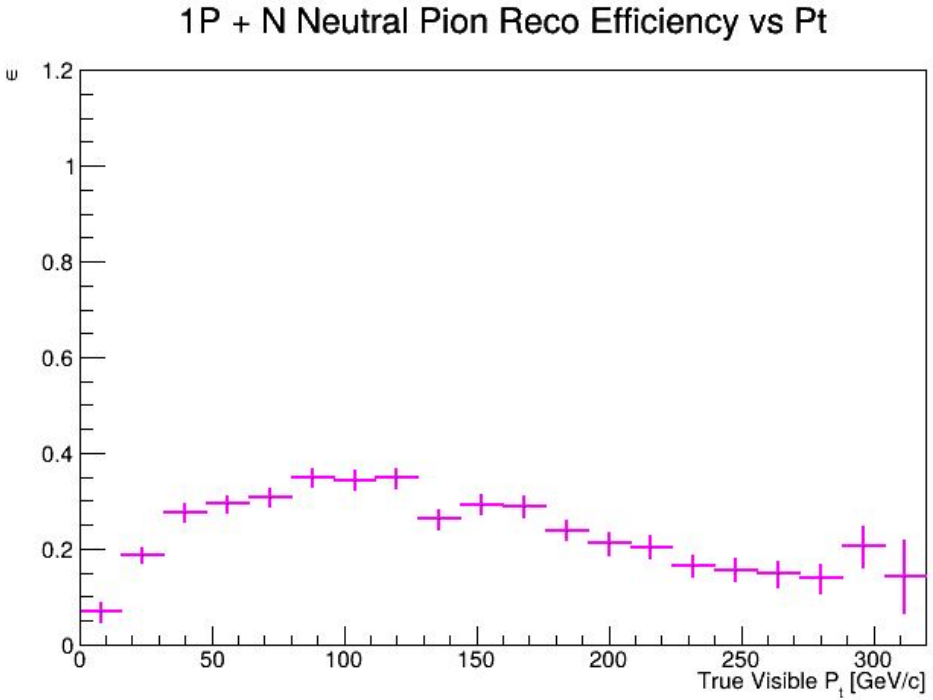
$$\text{Signal Cone Angle} = \begin{cases} 0.3 & p_T \leq 10 \\ \frac{3}{p_T} & 10 < p_T < 60 \\ 0.05 & p_T \geq 60 \end{cases}$$

Potential explanation for high pt drop off

Old:



New:



Recall: efficiency = # of reco photons matched to MC pi0 / # of MC pi0

Updating merging criteria and isolation cone placement

Both still using the static cone:

Merging:

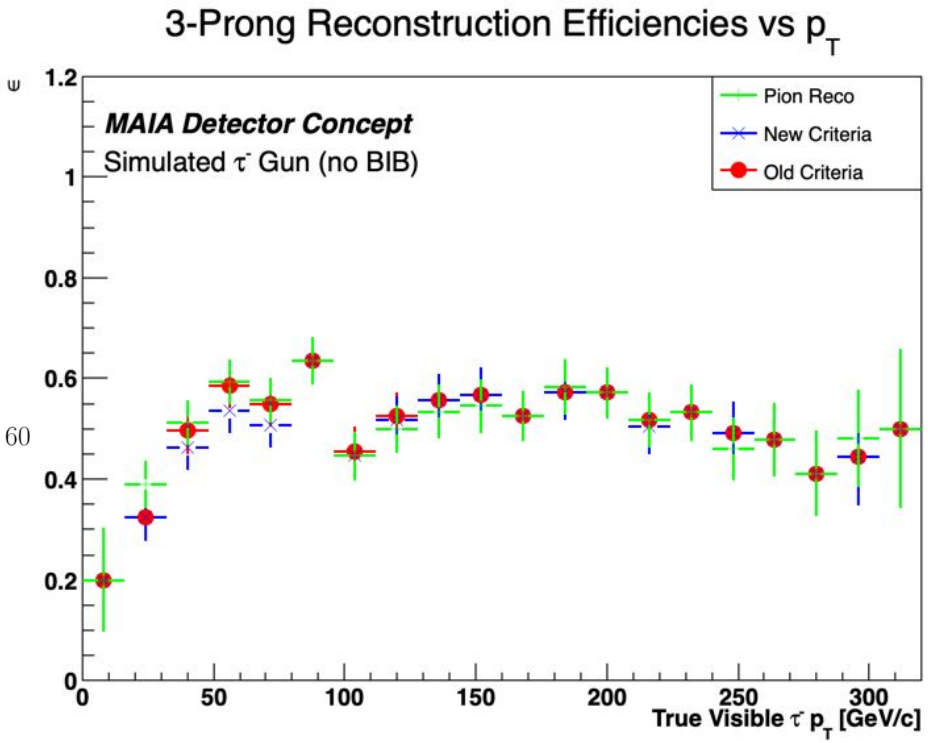
```
    // Merge if angle between two taus is less than search cone angle
    if(angle < _coneAngle)
{
```

Isolation cone placement:

```
if(angle > _coneAngle && angle < _isoAngle+_coneAngle)
  {
```

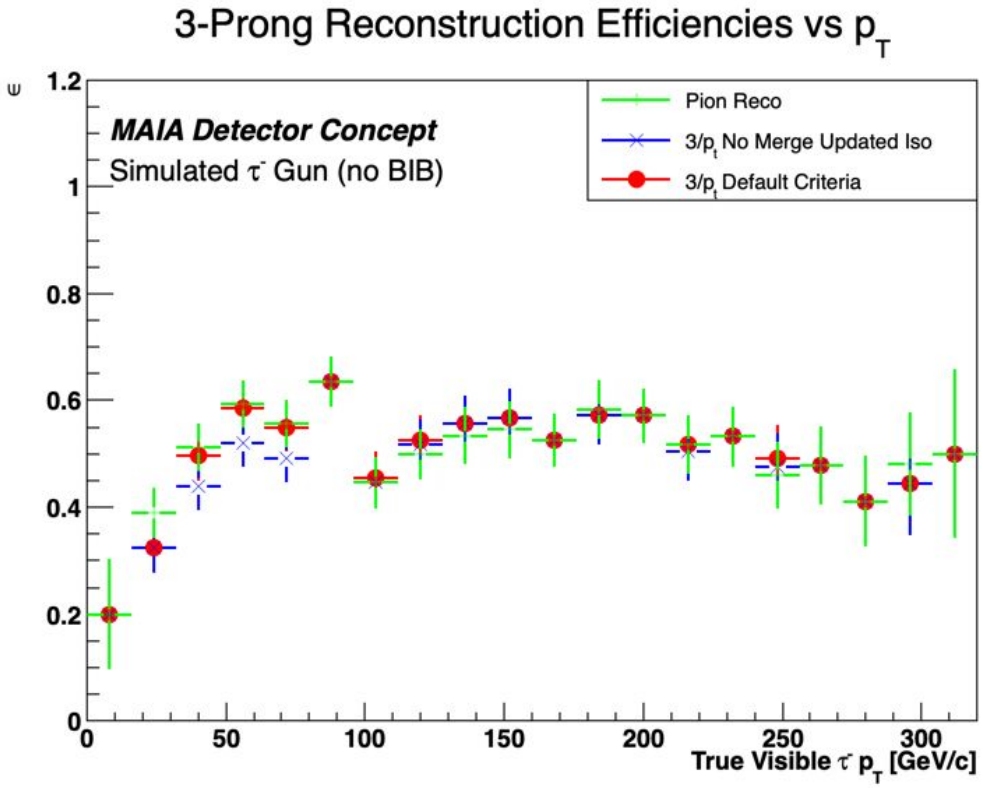
Updating merging criteria and isolation cone placement

$$\text{Signal Cone Angle} = \begin{cases} 0.3 & p_T \leq 10 \\ \frac{3}{p_T} & 10 < p_T < 60 \\ 0.05 & p_T \geq 60 \end{cases}$$



Still needs a couple more changes, the isolation cone is inconsistent

Updated Iso but no merging



Curious to see how much merging is helping efficiency

Next Steps

- Redefine the merge criteria and isolation cone
  - Change the check on charged tracks from maxQ = 4 to maxQ = 3

- Check for neutrons being reconstructed as Pi0 daughters

- Implement relative isolation (E iso / Pt) cut

- Look into multiple reco taus per event

Backups

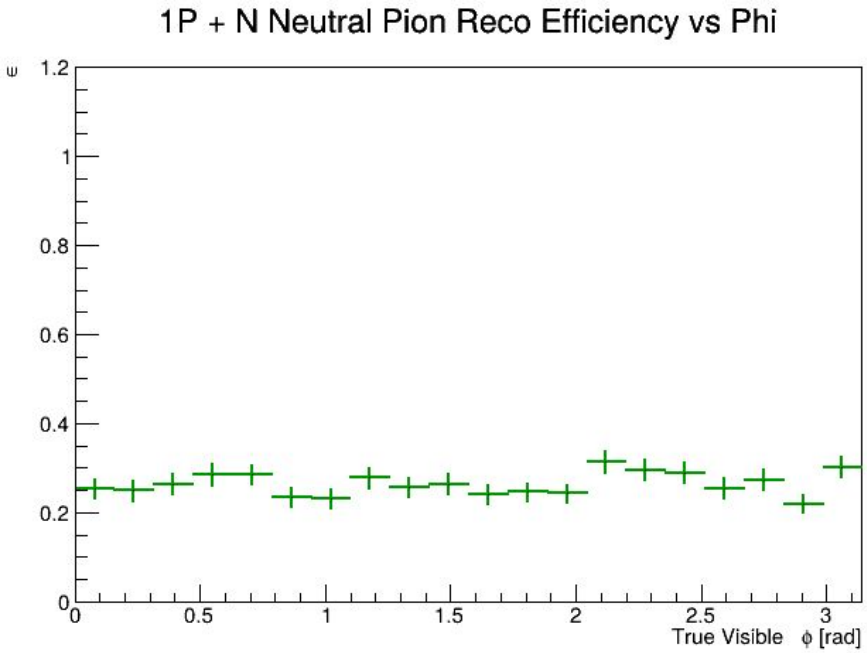
Changes made in workflow

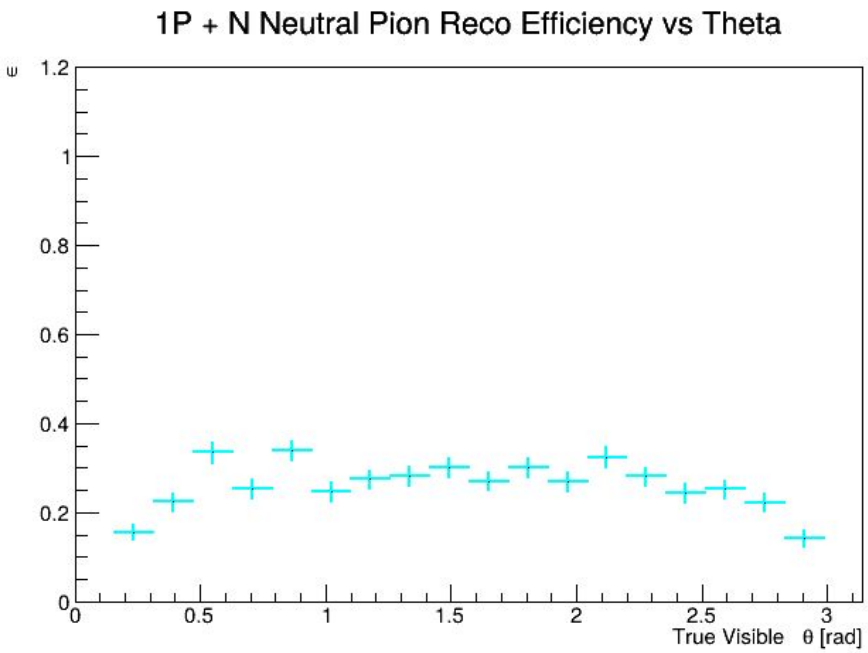
- New MAIA geometry

- Updated reco step with custom truth matching

MC τ^- Parameters
$0 \leq \phi \leq 2\pi$ [rad]
$10^\circ \leq \theta \leq 170^\circ$
$20 \leq p_T \leq 320$ [GeV/c]

Pi0 reco


1P + N Neutral Pion Reco Efficiency vs Phi
ε
1.2
1
0.8
0.6
0.4
0.2
0
0
0.5
1
1.5
2
2.5
3
True Visible ϕ [rad]


1P + N Neutral Pion Reco Efficiency vs Theta
ε
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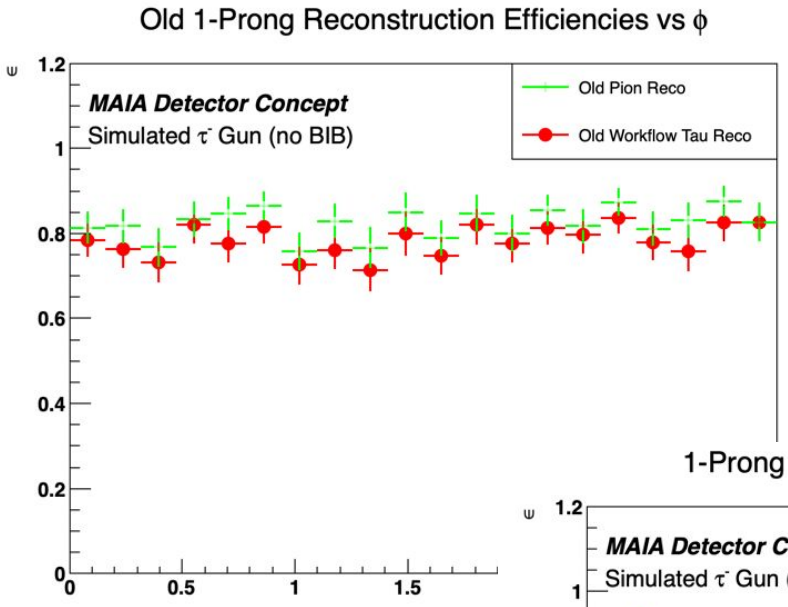
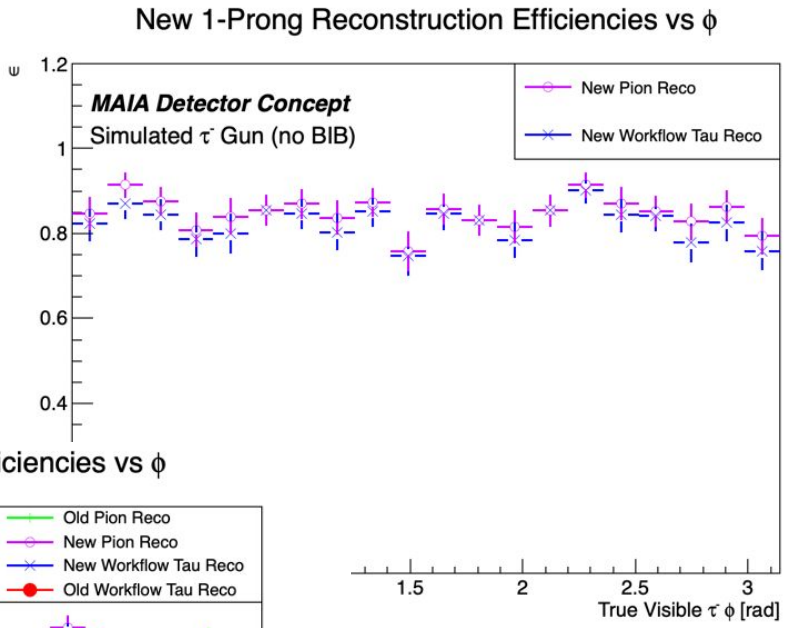
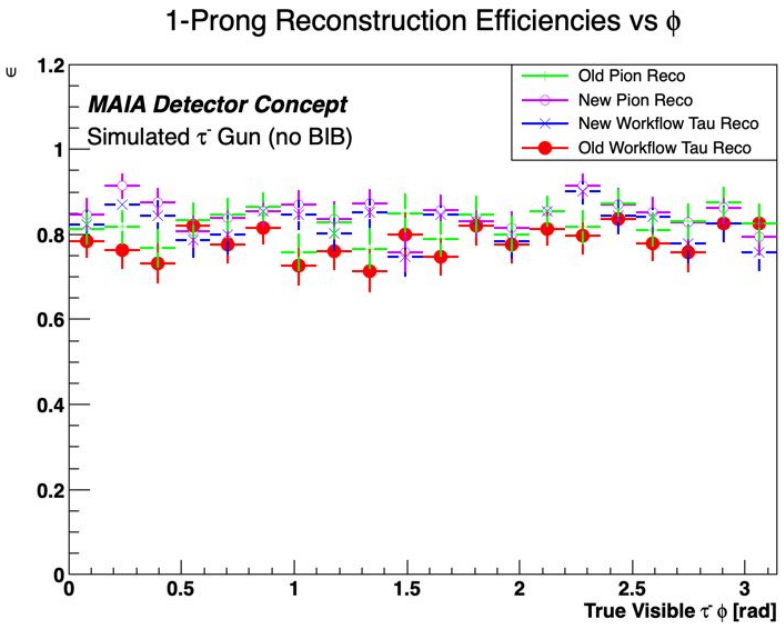
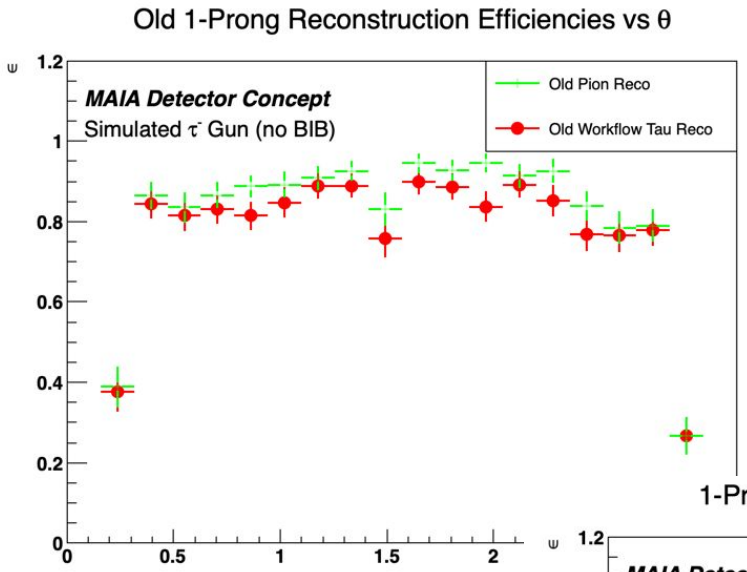
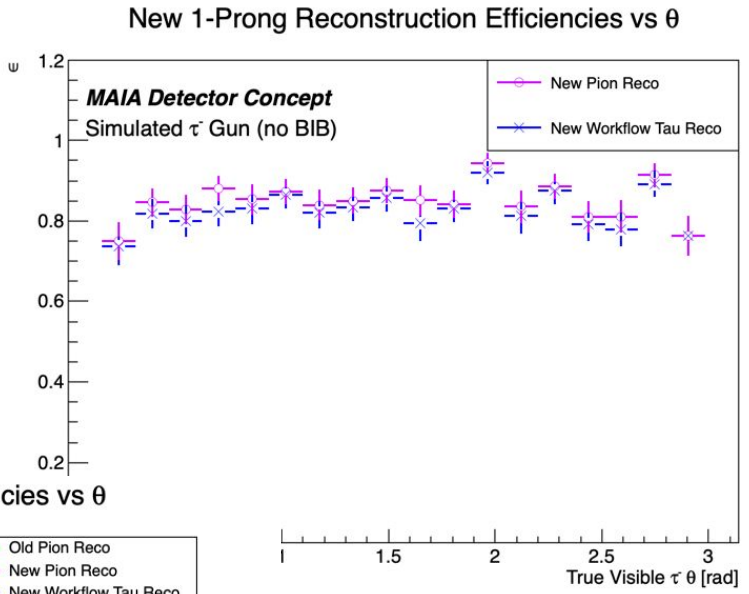


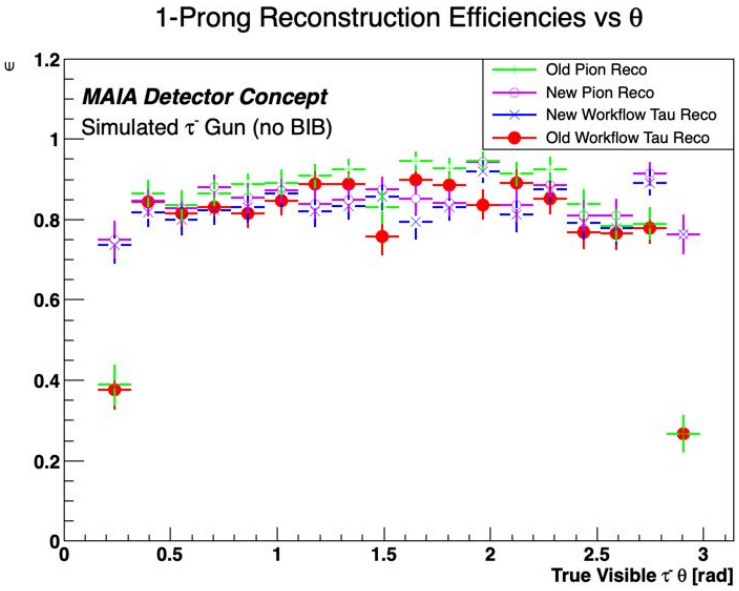




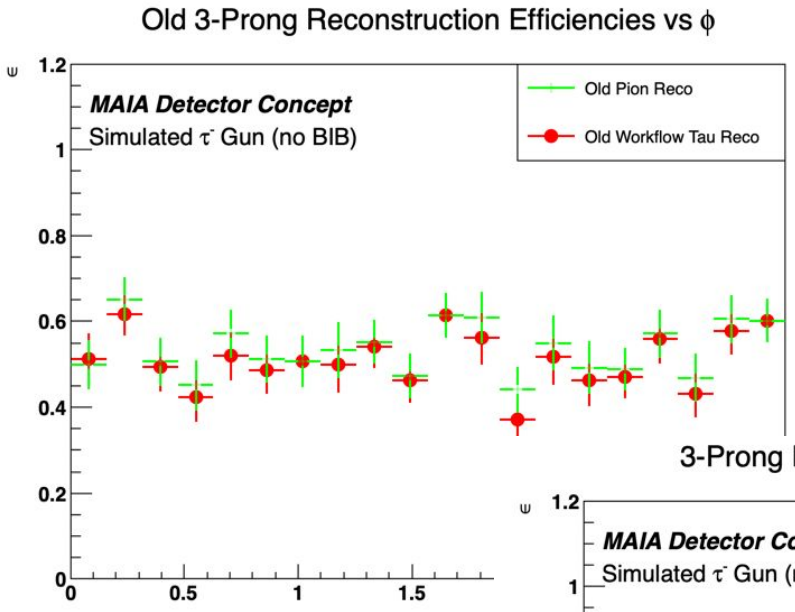
New to old comparison (1 prong)

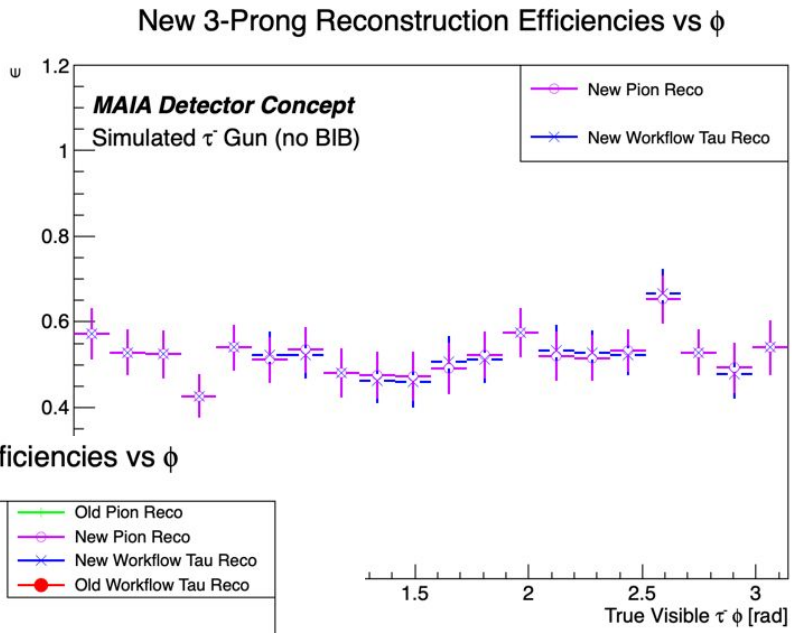


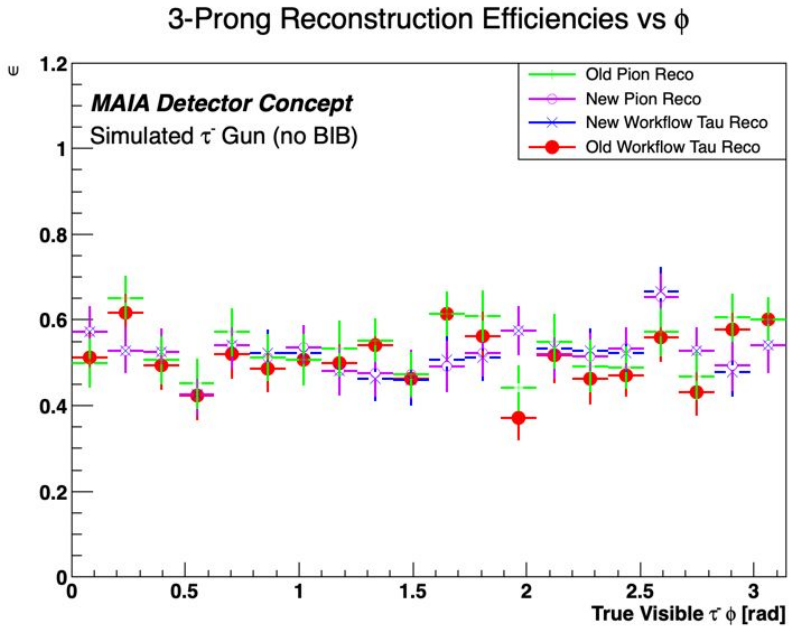




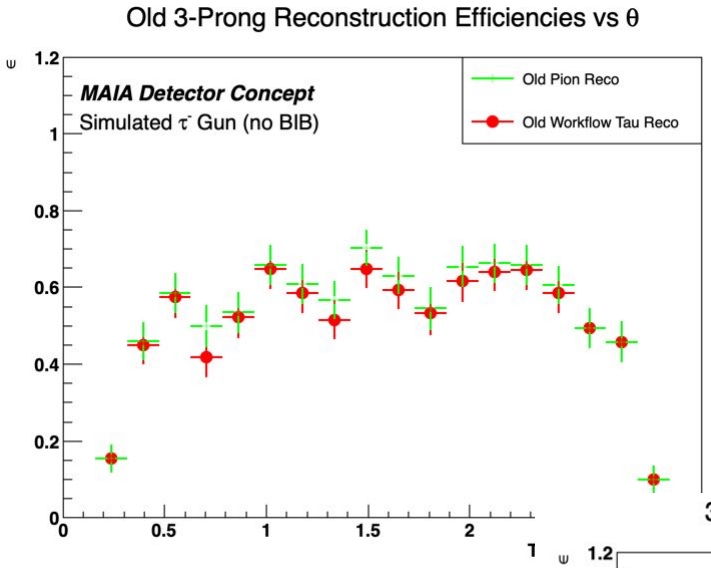
New to old comparison (1 prong)

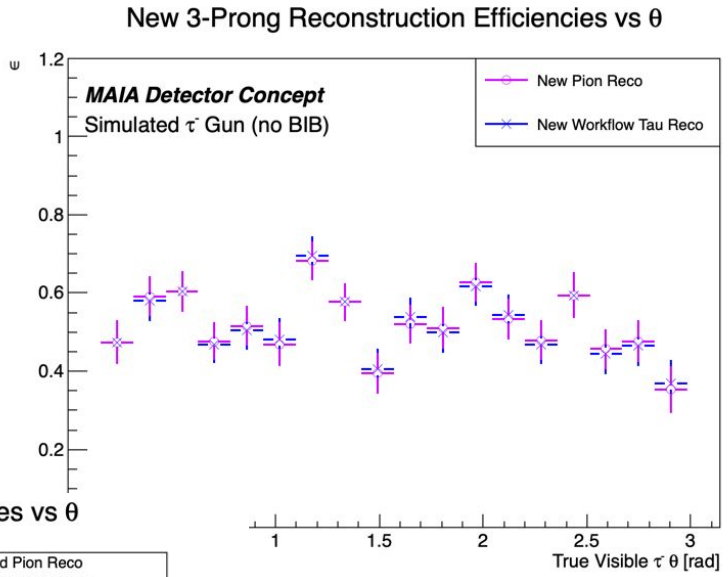


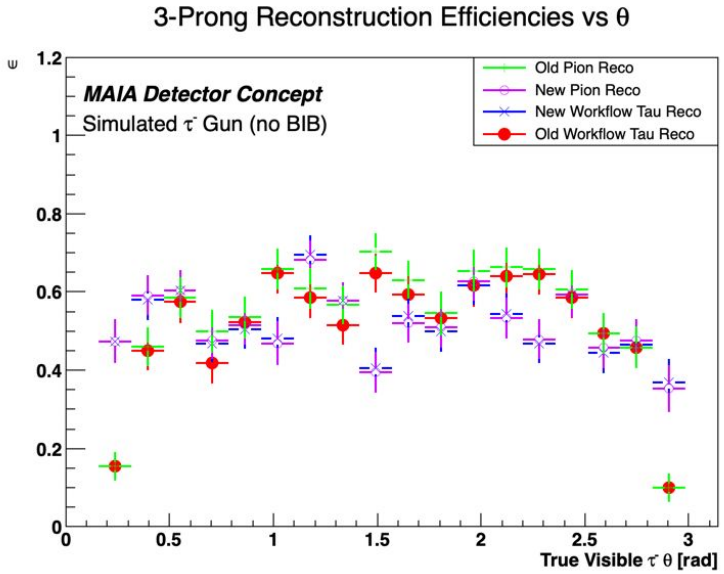




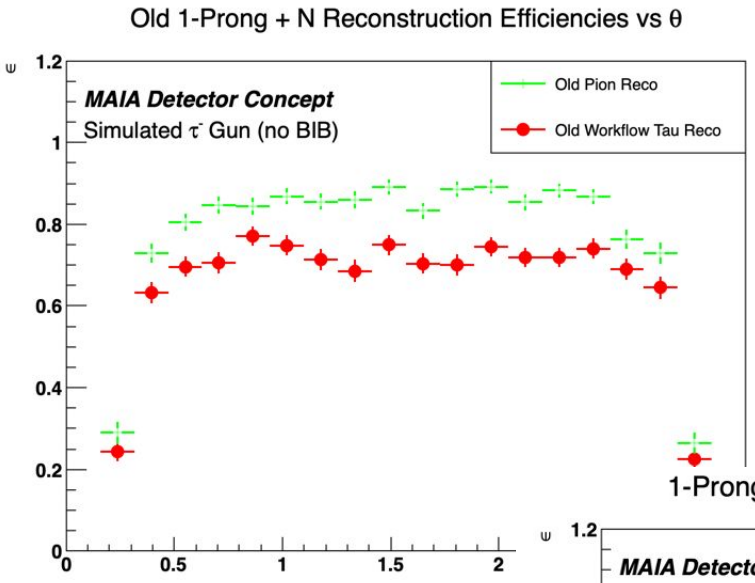
New to old comparison (3 prongs)

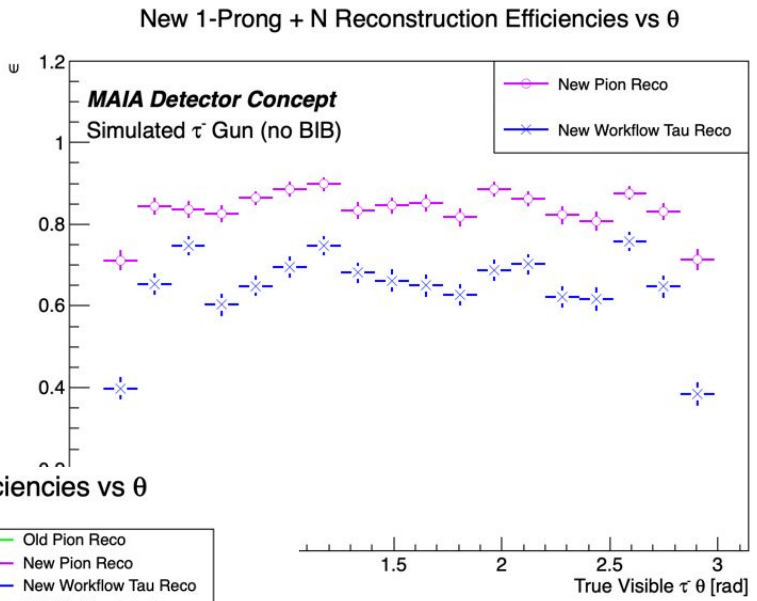


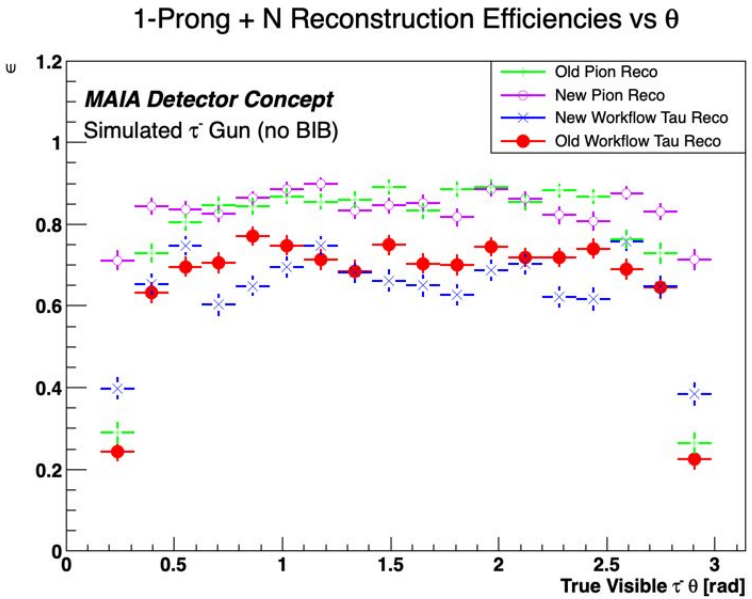




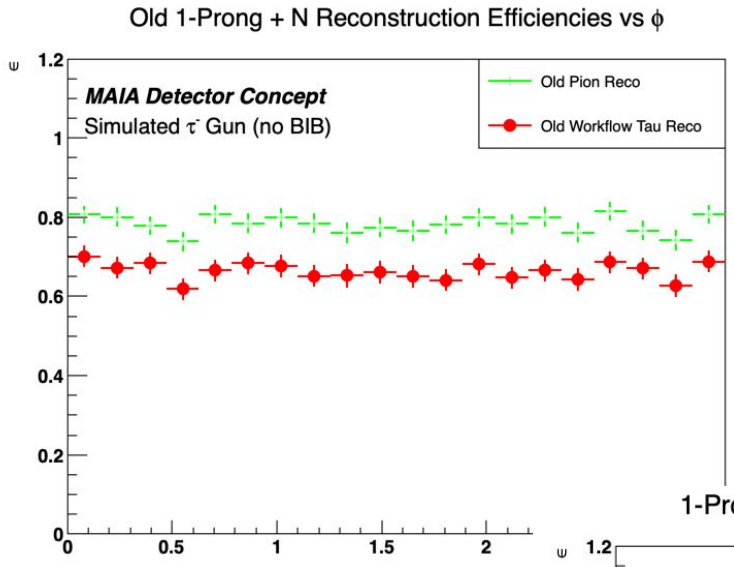
New to old comparison (3 prongs)

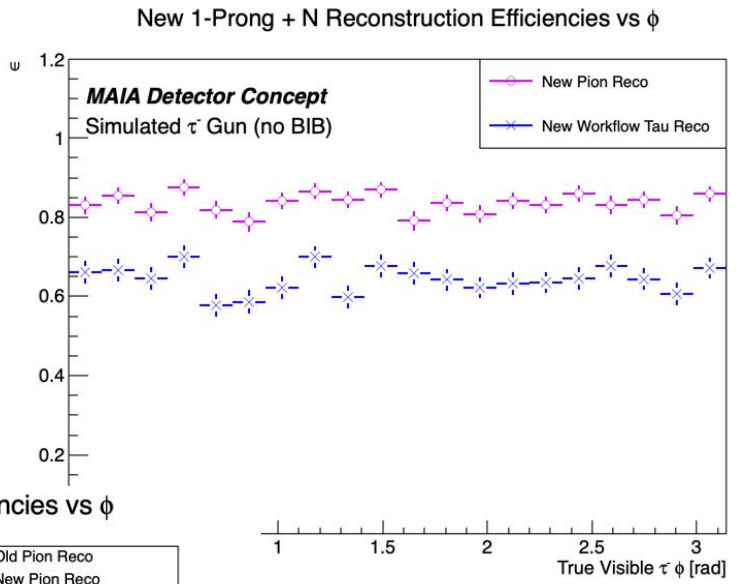


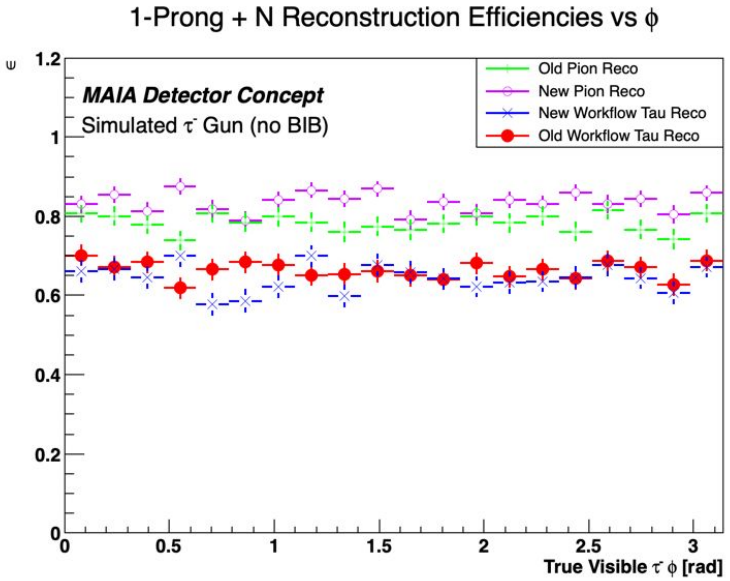




New to old comparison (1 prong + Ns)







New to old comparison (1 prong + Ns)