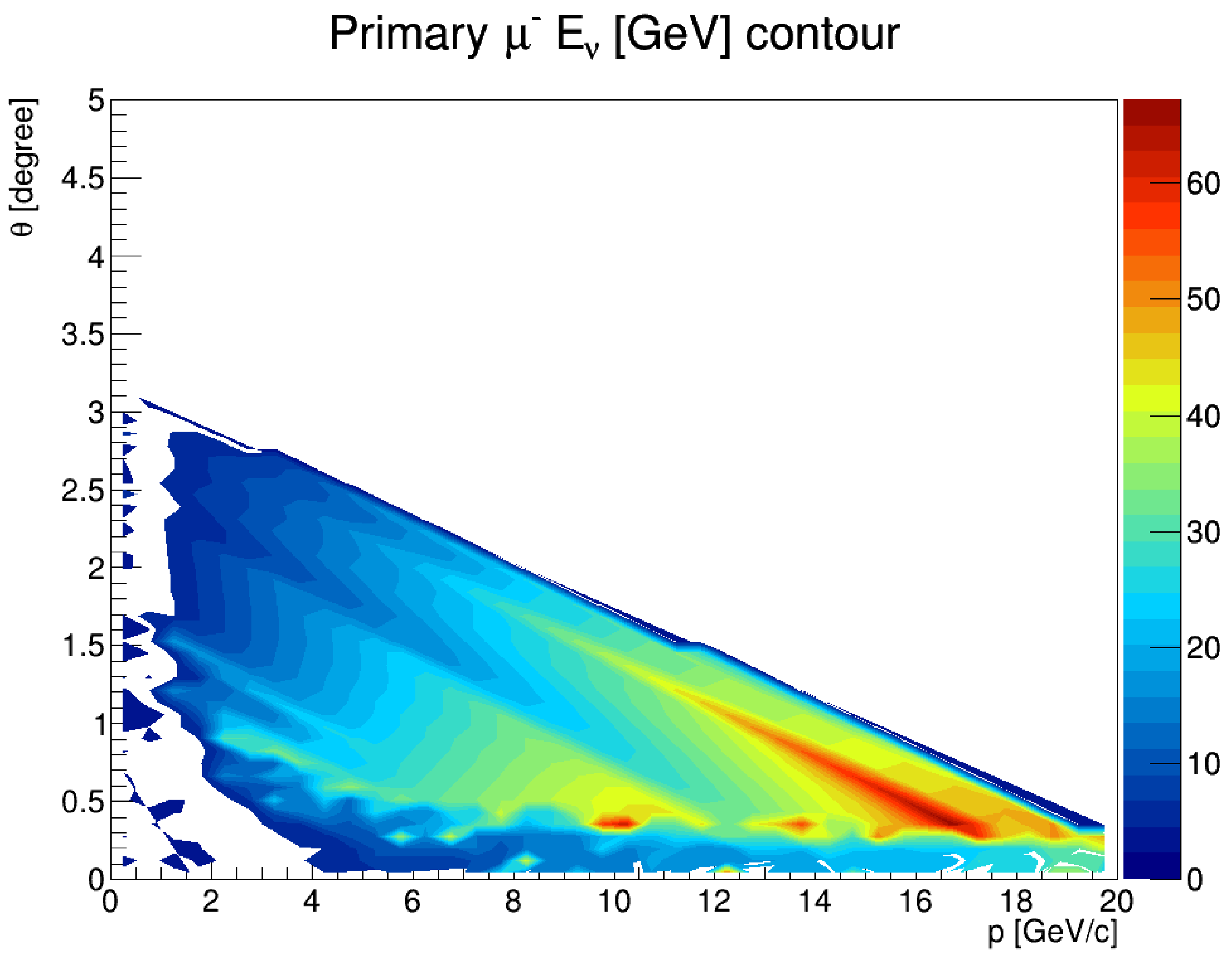
NEUTRINO ENERGY CONTOUR PLOT

- Contour plot of E_ν [GeV] as a function of p_{μ^-} [GeV/c] and θ [degree]

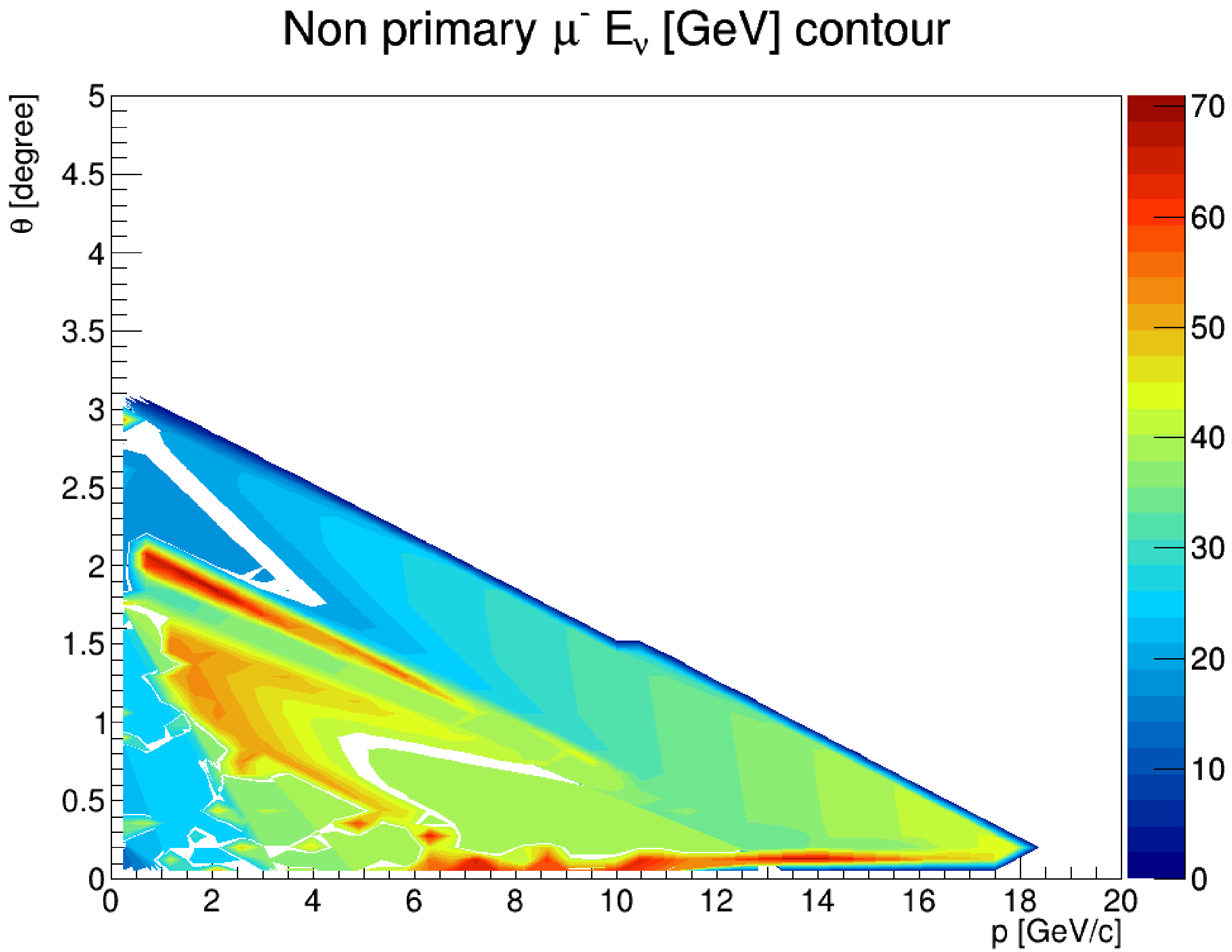
- Produced using TGrapg2D and the CONT4 drawing option

- Here I consider all primary muons



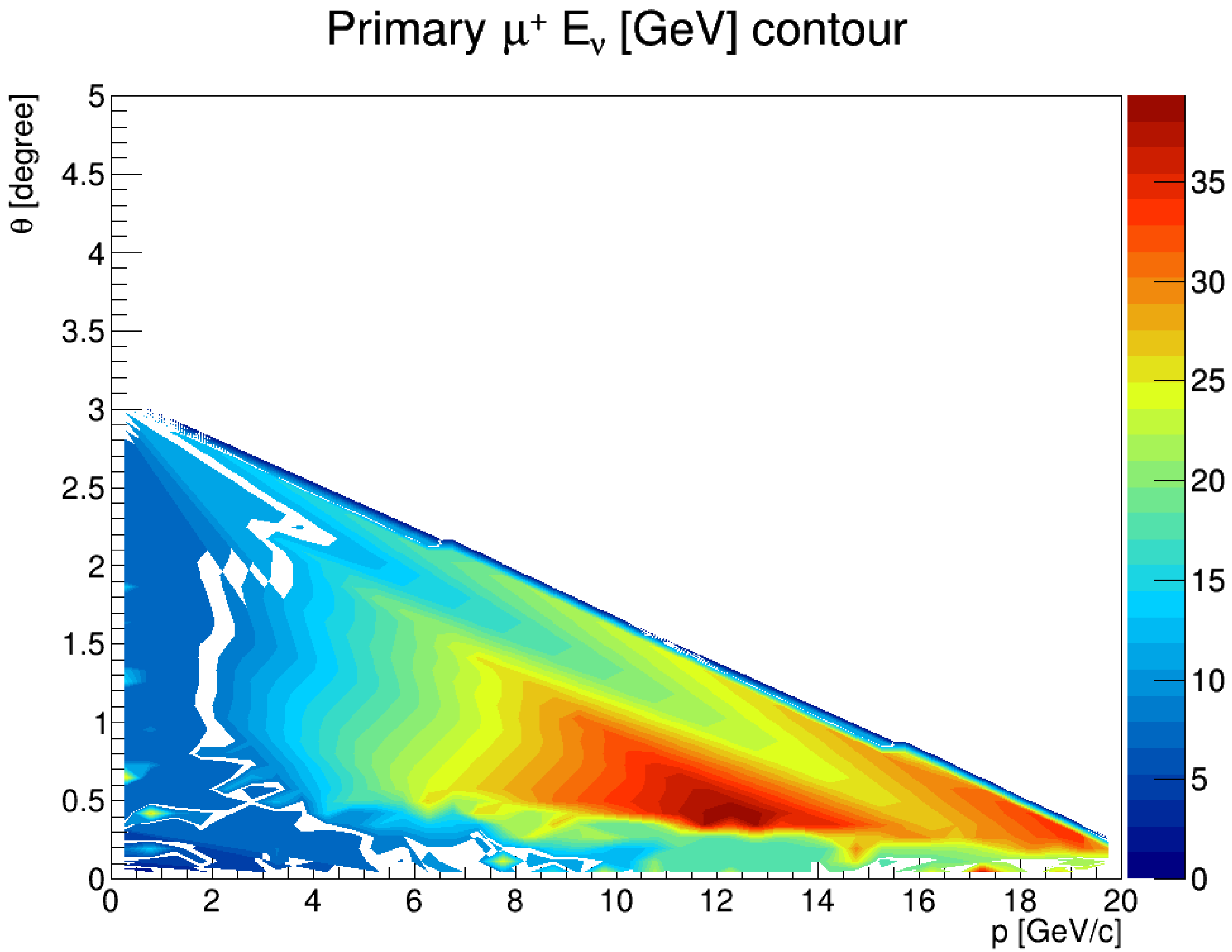
NEUTRINO ENERGY CONTOUR PLOT

- Contour plot of E_ν [GeV] as a function of p_{μ^-} [GeV/c] and θ [degree]
- Produced using TGrapg2D and the CONT4 drawing option
- Here I consider all non primary muons



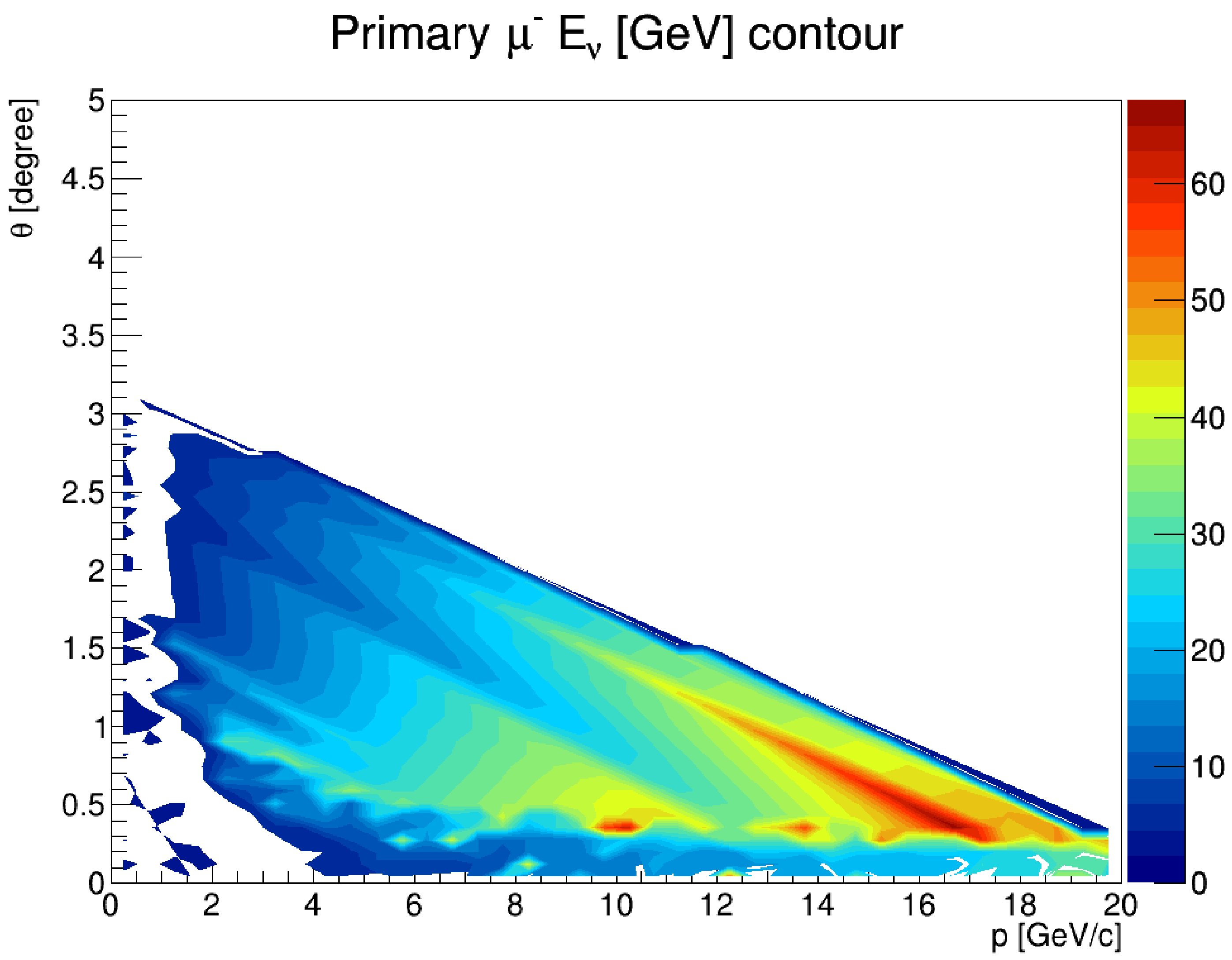
NEUTRINO ENERGY CONTOUR PLOT

- Contour plot of E_ν [GeV] as a function of p_{μ^+} [GeV/c] and θ [degree]
- Produced using TGrapg2D and the CONT4 drawing option
- Here I consider all primary anti-muons



NEUTRINO ENERGY CONTOUR PLOT

- Contour plot of E_ν [GeV] as a function of p_{μ^+} [GeV/c] and θ [degree]
- Produced using TGrapg2D and the CONT4 drawing option
- Here I consider all non-primary anti-muons

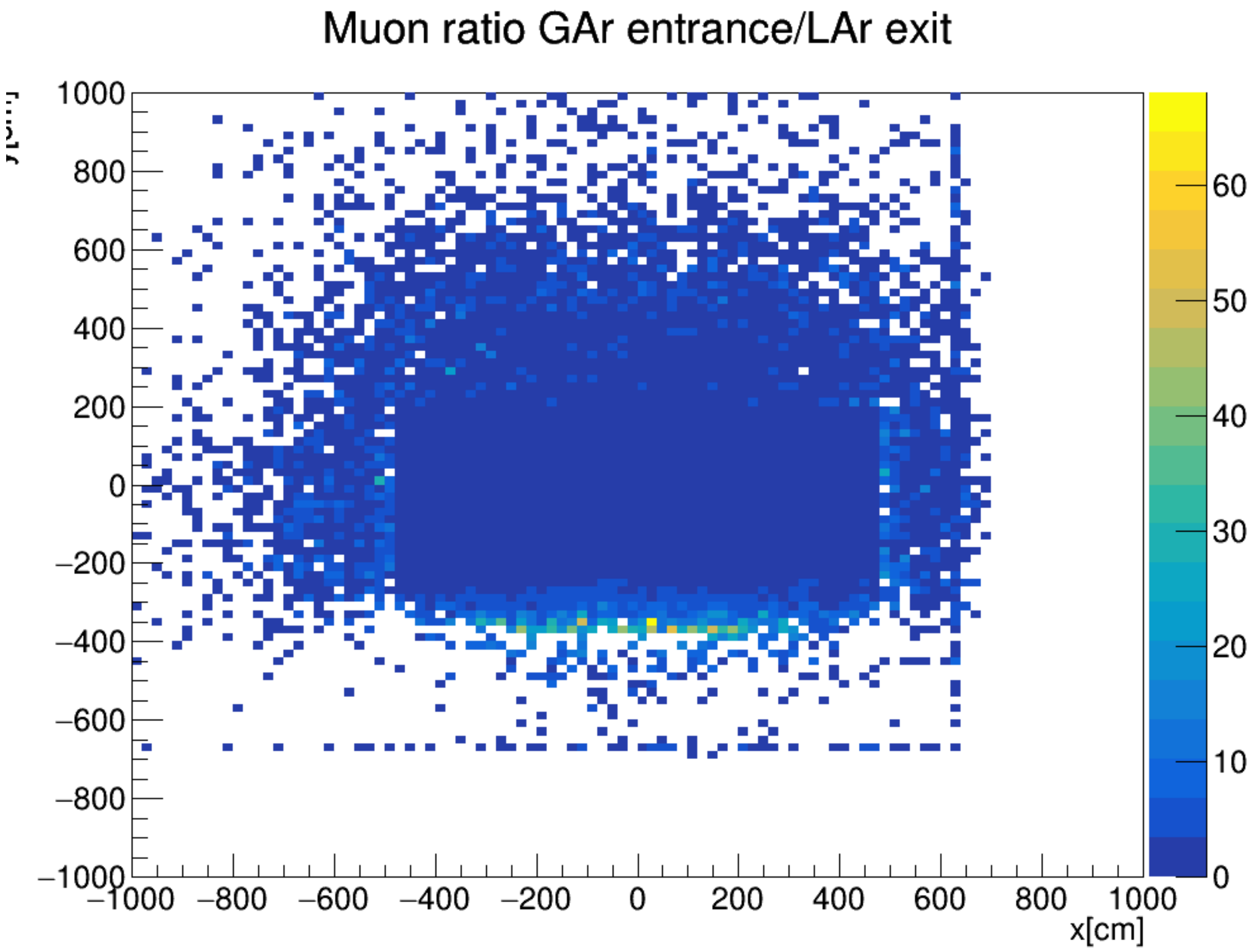


PROPAGATION PLOTS

- Tried producing propagation plots: for that I used Traj points that Eldwan made available

- Problem: the points in the trajectories seem to be saved in the TTrees at arbitrary steps, which makes it very difficult to produce a scatter-plot in XY at a given Z

- Tried to produce a propagation plot by making two XY histograms: one using muon trajectory points having $(850 < z < 950)\text{cm}$ and the other with $(1100 < z < 1200)\text{cm}$.
- The first represents roughly the XY distribution of muons exiting the active Lar volume and the second is the same for muons entering the GAr TPC
- Finally divided the second by the first to obtain the propagation plot



TRACK MATCHING FOR RESOLUTION PLOTS

- Tried producing charge resolution plots: in order to do so need to match reconstructed tracks to MC particles

- Tried using Leo's strategy:

1. Cycle over all MC muons in file
2. For each muon find the reconstructed track for which angle between the reco track momentum and the MC momentum θ_T is the smallest
3. Calculate the distance between these two in the plane transverse to the direction of the MC momentum $delX$
4. Apply the cut: $(\cos(\theta_T) > 0.996)$ && $(delX < 3\text{ cm})$
5. If a track that passes the cut is found the matching was successfull

- Problem: when I tried applying the method I got huge values for $delX$ so that no particle is ever successfully matched.
- Might be a mistake on my part or a problem with the reconstruction (need to check)

```
delX= 371.419 cm
delX= 466.861 cm
delX= 472.144 cm
delX= 285.584 cm
delX= 128.261 cm
delX= 73.3511 cm
delX= 975.339 cm
delX= 139.032 cm
delX= 225.849 cm
delX= 407.29 cm
delX= 300.747 cm
delX= 278.237 cm
delX= 460.953 cm
delX= 297.672 cm
delX= 178.04 cm
delX= 141.839 cm
delX= 386.398 cm
delX= 182.053 cm
delX= 182.017 cm
delX= 389.681 cm
delX= 37.5819 cm
delX= 257.064 cm
delX= 234.258 cm
delX= 188.609 cm
delX= 551.569 cm
delX= 523.813 cm
```

	No smear [cm]	1 Smeared [cm]			2 Smeared [cm]			3 Smeared [cm]
	$(\sigma_x, \sigma_y, \sigma_z) = (0,0,0)$	$\sigma_x = 0.1$	$\sigma_y = 3$	$\sigma_z = 3$	$(\sigma_x, \sigma_y) = (0.1,3)$	$(\sigma_y, \sigma_z) = (3,3)$	$(\sigma_x, \sigma_z) = (0.1,3)$	$(\sigma_x, \sigma_y, \sigma_z) = (0.1,3,3)$
Σ_y	Σ_y and Σ_z moving down together filter breaks at 0.0005cm Σ_y fixed at 3cm filter breaks at $\Sigma_z = 0.1cm$	Proceding downwards along with Σ_z filter breaks at $\Sigma_y = 1cm$, following measurement and loosing predictive power	With Σ_y fixed at 3cm, proceeding downwards with Σ_z the filter first improves then breaks at $\Sigma_z = 0.1cm$	With Σ_y fixed at 3cm, proceeding downwards with Σ_z the filter immediately breaks at $\Sigma_z = 1cm$	Σ_y and Σ_z moving down together filter breaks at 2cm. Σ_y fixed at 4cm filter breaks at $\Sigma_z = 1cm$	Σ_y and Σ_z moving down together filter breaks at 2cm. Σ_y fixed at 4cm filter breaks at $\Sigma_z = 2cm$	Σ_y and Σ_z moving down together filter breaks at 1cm Σ_y fixed at 3cm filter breaks at $\Sigma_z = 2cm$	Σ_y and Σ_z moving down together filter breaks at 4cm Σ_y fixed at 5cm filter breaks at $\Sigma_z = 2cm$
Σ_z	Σ_y and Σ_z moving down together filter breaks at 0.0005cm Σ_z fixed at 3cm filter never completely breaks	Proceding downwards along with Σ_y filter breaks at $\Sigma_z = 1$, following measurement and loosing predictive power	With Σ_z fixed at 3cm, proceeding downwards with Σ_y the filter immediately breaks at $\Sigma_y = 1cm$	With Σ_z fixed at 3cm, proceeding downwards with Σ_y the filter first improves then breaks at $\Sigma_y = 0.1cm$	Σ_y and Σ_z moving down together filter breaks at 2cm. Σ_z fixed at 4cm filter breaks at $\Sigma_y = 3cm$	Σ_y and Σ_z moving down together filter breaks at 2cm. Σ_z fixed at 4cm filter breaks at $\Sigma_y = 2cm$	Σ_y and Σ_z moving down together filter breaks at 1cm Σ_z fixed at 3cm filter breaks at $\Sigma_y = 0.1cm$	Σ_y and Σ_z moving down together filter breaks at 4cm Σ_z fixed at 5cm filter breaks at $\Sigma_y = 2cm$
Σ_{yz}								

SUMMARY TABLE