# UChicago Muon Collider Track Ambiguity & Efficiency

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# Track Ambiguity Resolution

- Initial goal: measure tracking efficiency and fake rates
  - Muon Gun Samples without BIB
  - SiTrack collection
  - New geo SLCIO Files

- Found ~2.5 % of truth muons result in multiple reconstructed tracks

- Propose to resolve ambiguity by selecting the track with greatest nhits - tends to be better reconstructed

**Truth muon pT versus matched Track pT (random muon sample w/o BIB)**

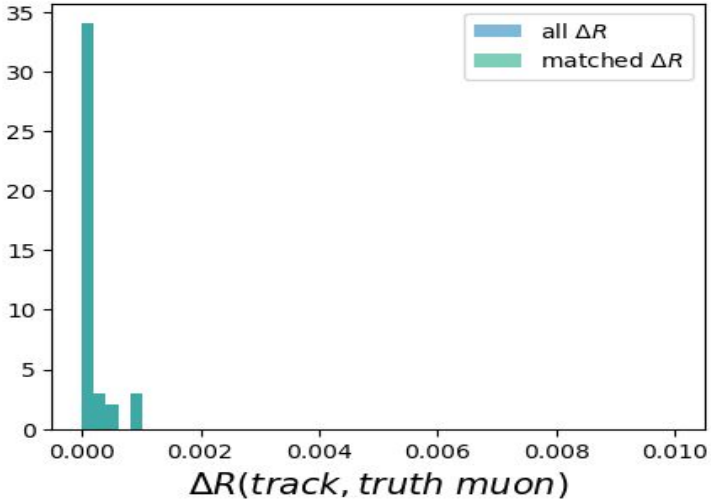
Evt 1
795.2050149804448 162.20599807823453
Evt 2
617.2353377187403 626.929771651157
617.2353377187403 382.24666223774346
Evt 3
625.6000554827832 621.1479154061415
Evt 4
536.8833128103413 536.7122743876484

# Truth Matching

- Then began looking at muon gun samples w/ and w/o BIB to optimize truth matching criteria
  - SiTrack collection
  - New geo SLCIO Files

- Found optimal truth matching
  - Tightened min ΔR < 0.005, to reduce the probability of picking up tracks from BIB
  - And if multiple tracks are still found, select the one w/ greater nhits

V1 Muon Sample w/o BIB, need to repeat for V0 to confirm the new ΔR min is not too tight



# Reconstruction Efficiency

Muon Gun BIB, ΔR<0.005
Truth/Reco: pt, eta, phi, nhits

- After choosing this Delta R cut, we started to investigate reconstruction efficiency in w/ Muon Gun sample (new geometry) with Pt was between 250 and 1000

- Immediately clear that the efficiency for reconstructing muons as tracks is reduced when BIB is included, compared to no BIB
  - Working on quantifying this

```
Apptainer> python makeMuonPlots.py
Loading LCIO ROOT dictionaries ...
Found 1 files.
Processing event 0.
Truth muon: 407.54956946610343 -1.214419574745779 -1.608064827259399
Reco: 0.5671258970978866 -1.222474058614802 -1.6990981101989746 5
Reco: 40.173100733414095 -1.2131042250160813 -1.6047368049621582 4
Truth muon: 514.3789763340791 0.8345370472059591 -2.002755375260535
Reco: 0.39855092424616695 0.7942454593600224 -2.037485122680664 4
Reco: 1089.2248071597157 0.8345220896272769 -2.00239634513855 4
Truth muon: 777.6528581310107 -2.140314199314627 2.5295660899894084
Truth muon: 957.7314087205208 -0.28931075396030337 -2.6063391386325656
Truth muon: 918.9177810926778 0.4701546394632165 -1.4590669381947754
Reco: 2.1157293711121024 0.3982721453875837 -1.425943374633789 4
Reco: 0.38877934991132085 0.40107832510057256 -1.455080509185791 4
Reco: 0.4839048995884993 0.40905300688980756 -1.4690443277359009 3
Reco: 0.5652624429315 29 0.414870644361261 -1.4008572101593018 3
Reco: 0.5039704209939287 0.42467227626546333 -1.512438416481018 4
Reco: 0.588586312625992 0.42878018164324716 -1.5494990348815918 3
Reco: 2.083001725824932 0.4520516338762735 -1.4099770784378052 3
Reco: 0.4593122821146392 0.4614059543527326 -1.471977949142456 4
Reco: 2403.2183064706614 0.4704751242504086 -1.4587817192077637 11
Reco: 0.9518318368861765 0.4770789752977135 -1.5333901643753052 3
Reco: 1.2808450806824228 0.4793733251608503 -1.379449725151062 3
Reco: 1.3594277095995528 0.4921799880650129 -1.3680893182754517 5
Reco: 0.5534991329521485 0.5158335638474975 -1.4246904850006104 5
Reco: 0.5523814138465348 0.5178914554740529 -1.520915150642395 3
Reco: 0.9786983848885085 0.5288997262652995 -1.3883730173110962 5
Reco: 0.4596139444615188 0.5334712633378909 -1.4656223058700562 4
Reco: 1.7329991972460637 0.545616256034672 -1.435499668121338 3
Truth muon: 811.474779906207 -0.6485486760909466 -0.6133852295667158
Truth muon: 607.8632619366048 -2.076308745665875 0.8357521799833177
Truth muon: 565.6297474513824 0.22216497069345434 -2.795445649504163
Truth muon: 747.6542630243886 0.03052180560558586 1.4250443901879137
Truth muon: 649.3887240605947 -0.3653090496095396 0.4430971990505933
Reco: 2.1752525596341967 -0.45388280650061963 0.41965365409851074 3
Reco: 1.0110000061201863 -0.4492099351648774 0.49339282512664795 4
Reco: 1.093085613560371 -0.44193142886717 06 0.38462644815444946 3
```

# Reconstruction Efficiency (v1)