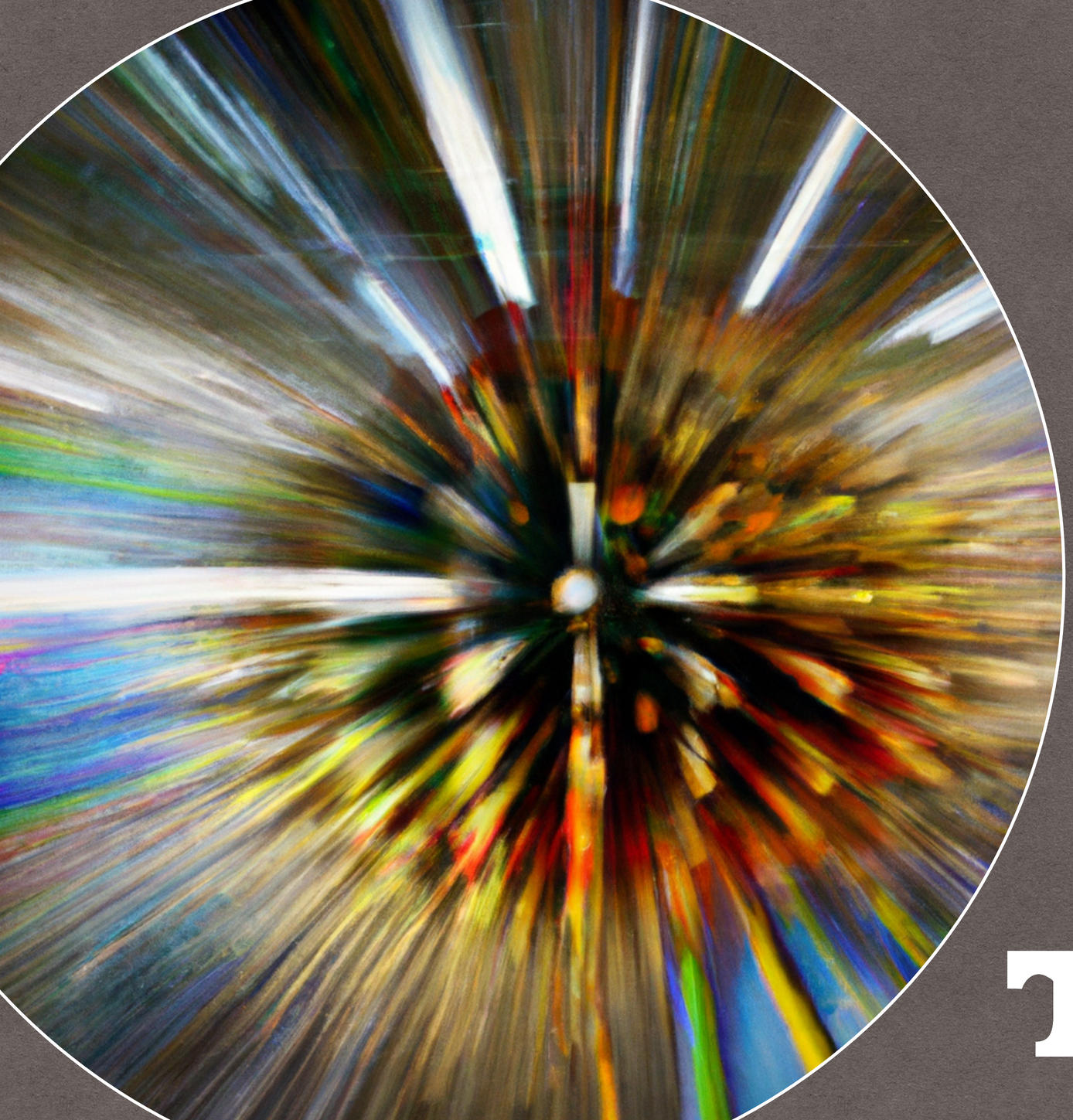


U.S. DEPARTMENT OF ENERGY | Office of Science

10 TeV MuCol

QUICK MUON STUDIES

TOVA HOLMES, U. OF TENNESSEE

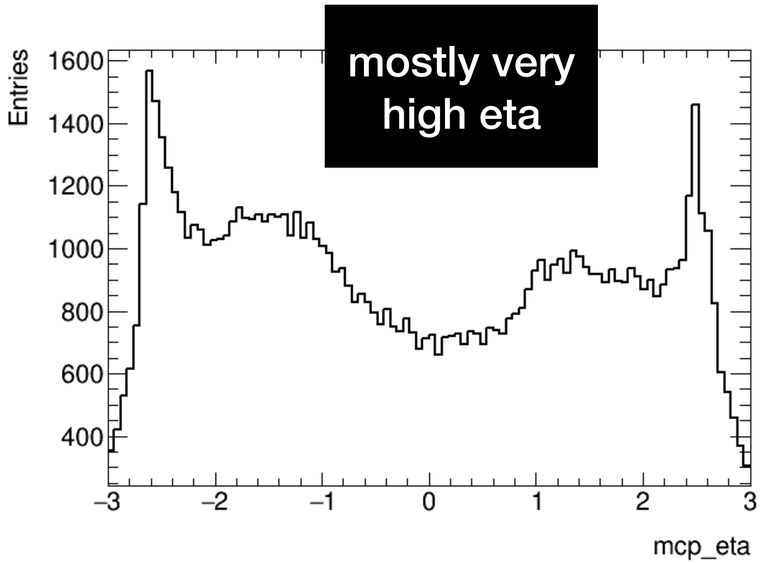
10 TEV MUCOL STUDIES

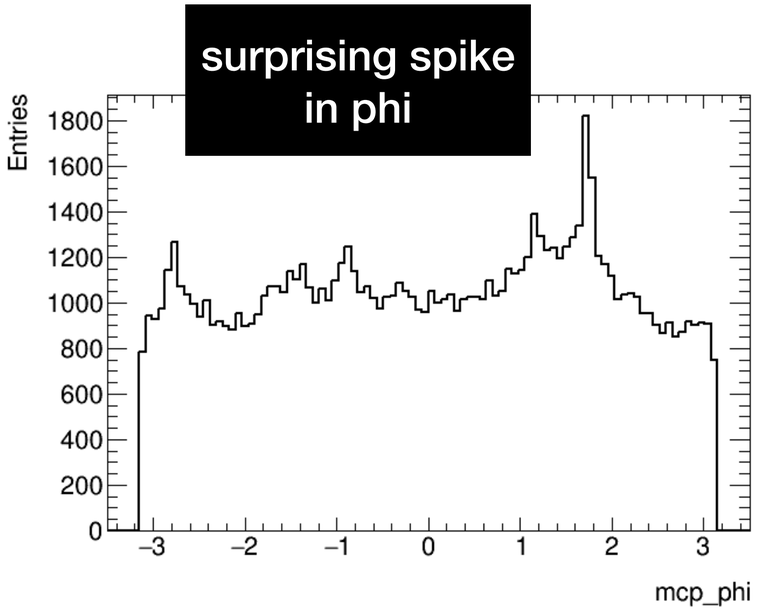
JULY 12, 2023

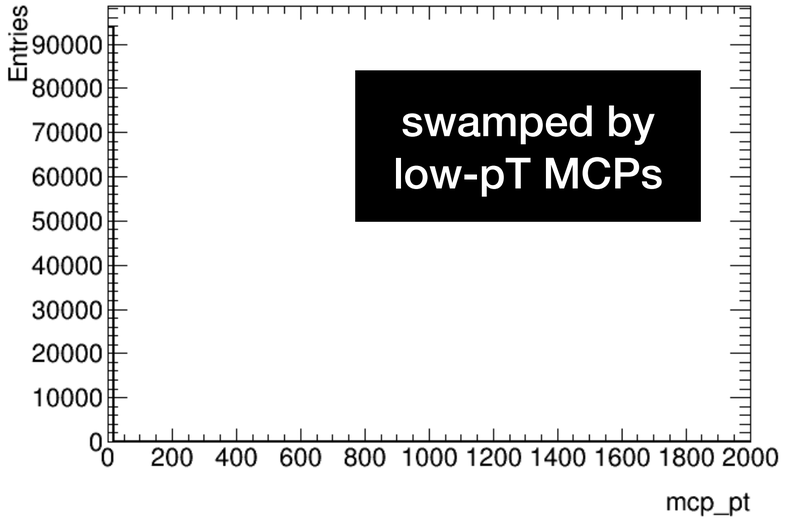
Technical details

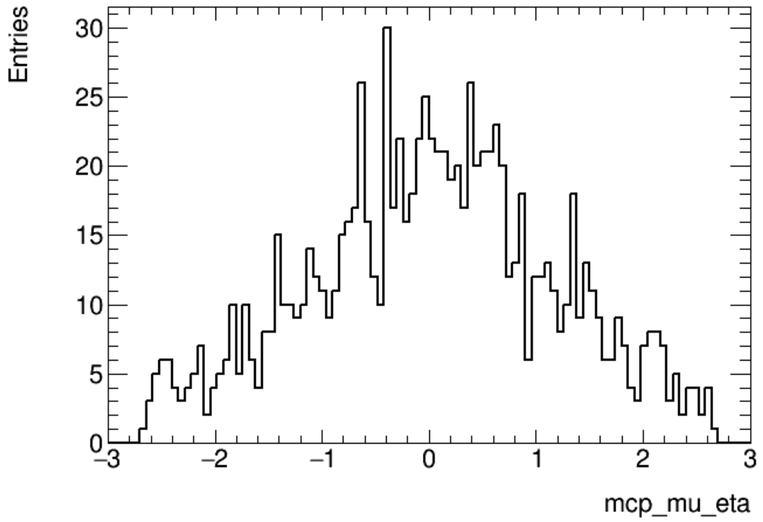
- Plotting code here:
  - https://github.com/trholmes/mucolstudies/blob/main/makeMuonPlots.py
- Running on input:
  - /data/fmeloni/DataMuC_MuColl_v1/muonGun/reco/*.slcio (3 TeV, no BIB; this is the only one available)
  - 1000 events total
    - 94858 MCPs
    - 1001 mu MCPs
    - 1318 PFOs
    - 671 mu PFOs
    - No filters yet on these quantities

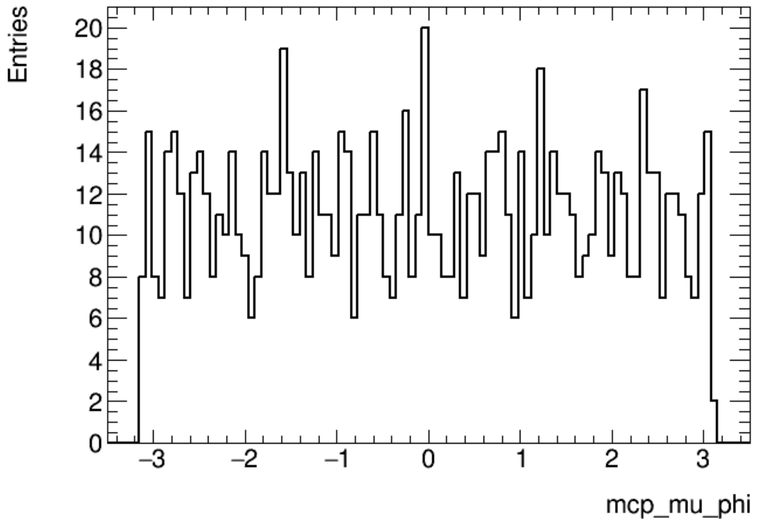
MCP plots

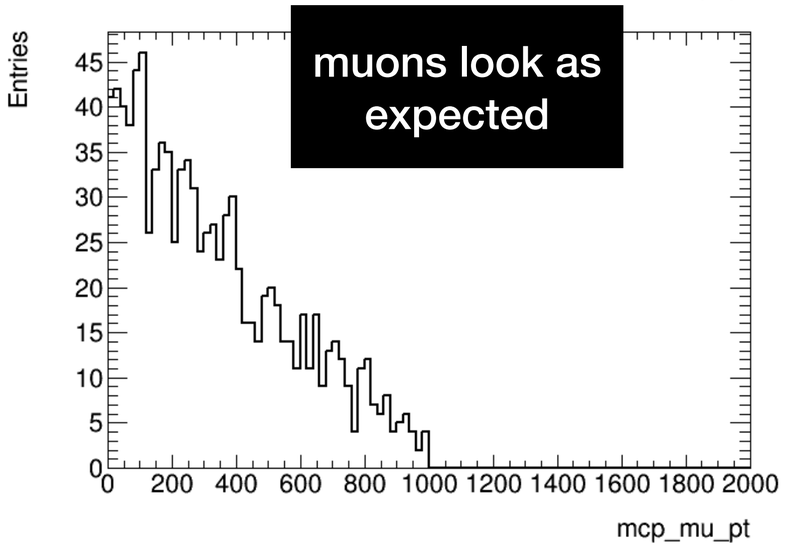

mostly very high eta
Entries
mcp_eta


surprising spike in phi
Entries
mcp_phi

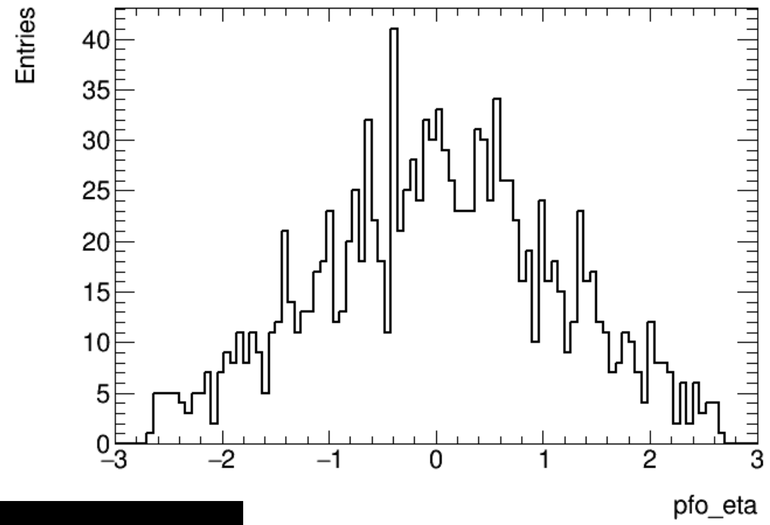

swamped by low-pT MCPs
Entries
mcp_pt

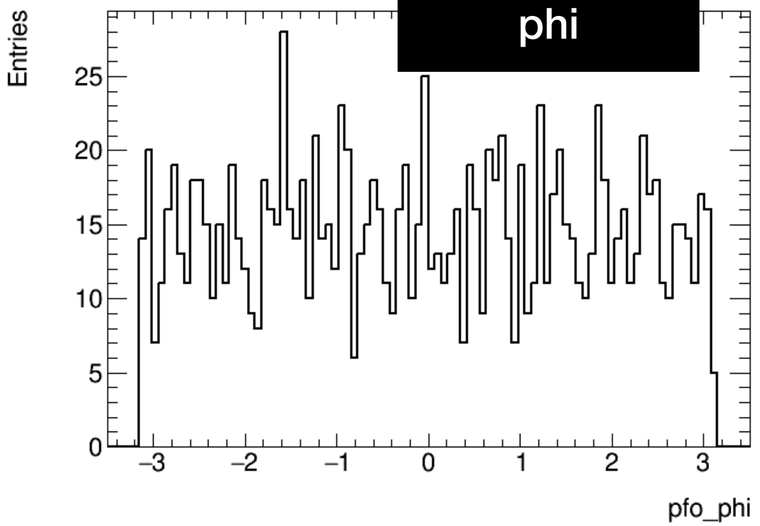

Entries
mcp_mu_eta


Entries
mcp_mu_phi

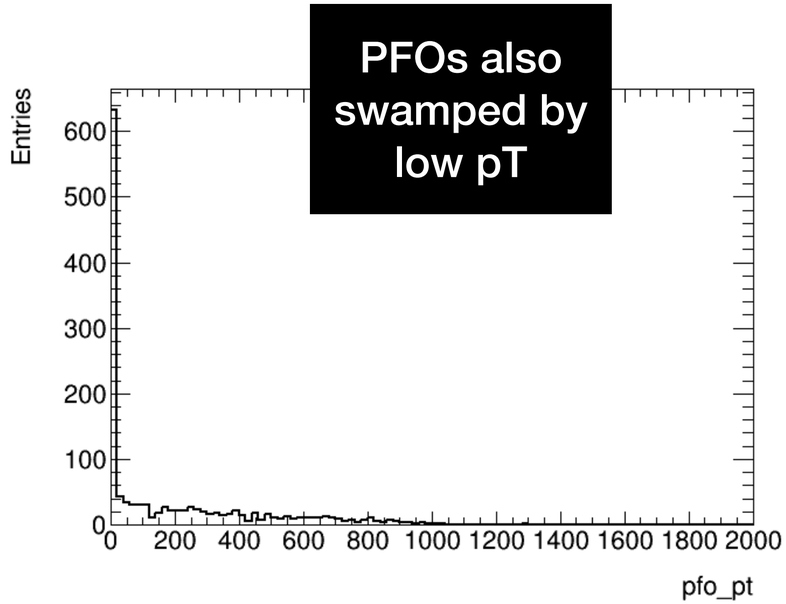

muons look as expected
Entries
mcp_mu_pt

PFO plots



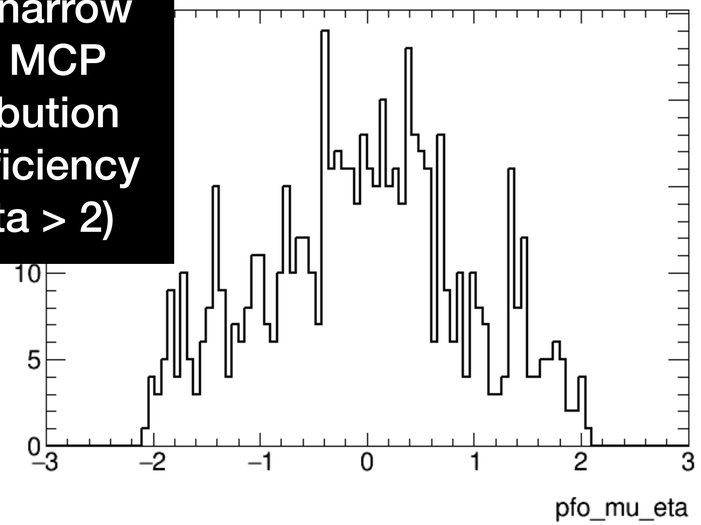


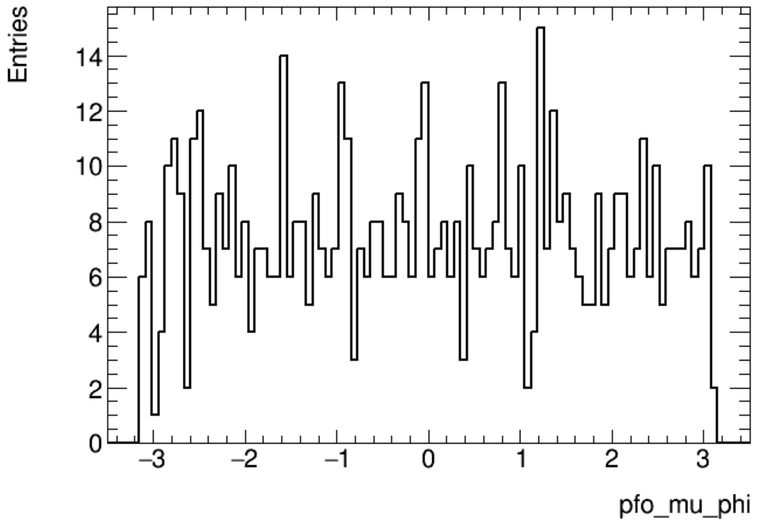
PFOs flat in phi

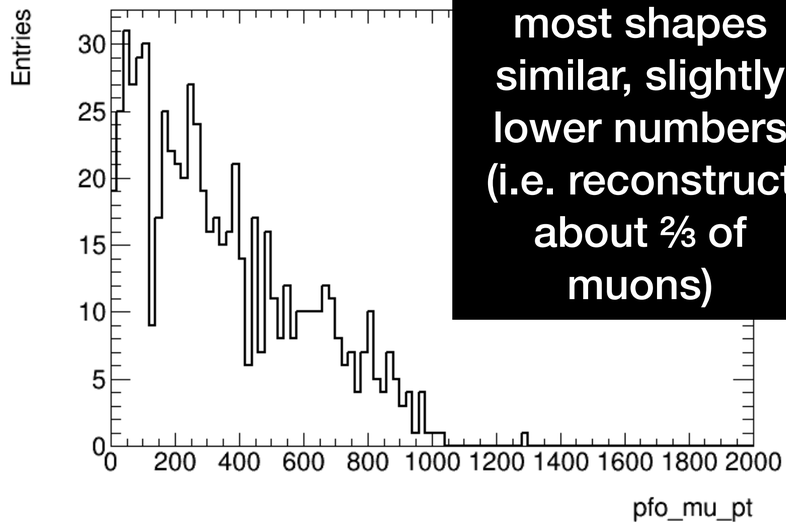


PFOs also swamped by low pT

more narrow than MCP distribution (no efficiency for eta > 2)





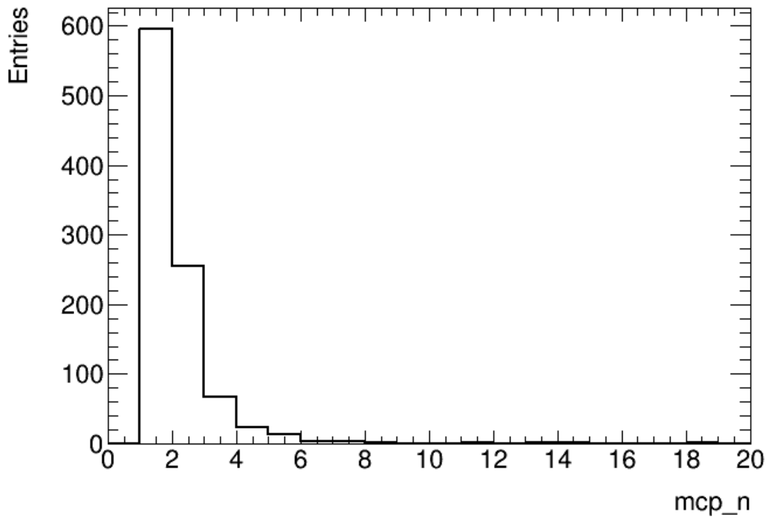


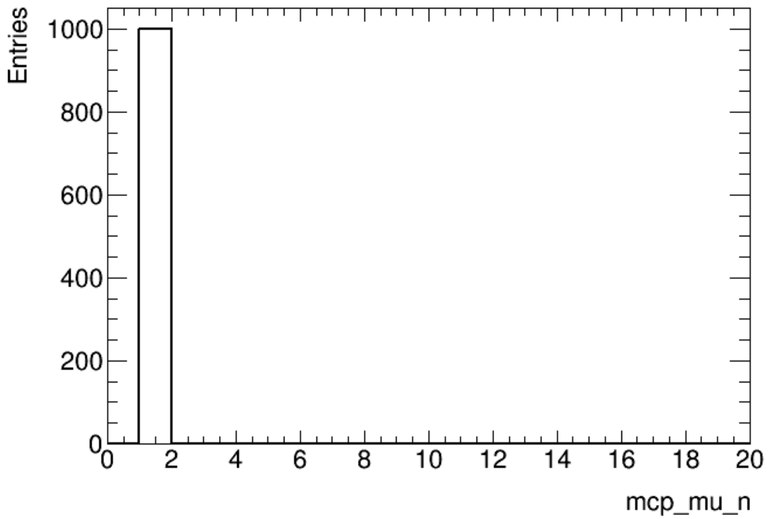
most shapes similar, slightly lower numbers (i.e. reconstruct about ⅔ of muons)

Technical details – Pt II

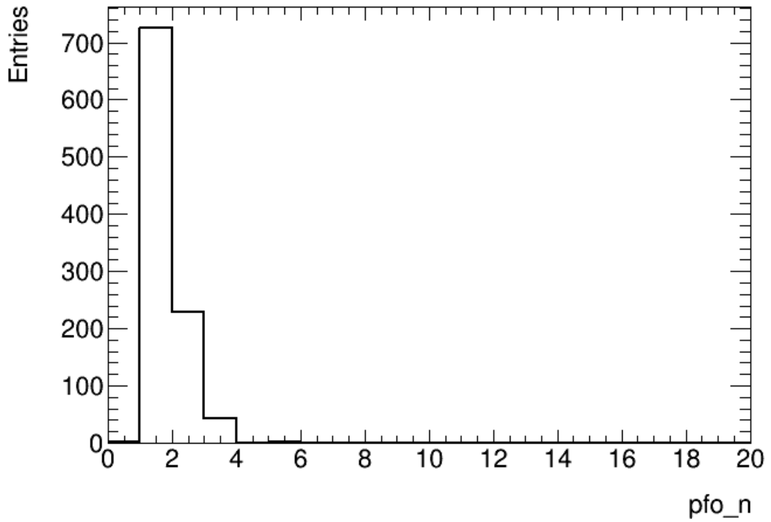
- Same sample, same code (updated in place)
- Added requirement that MCP muons be status code 1, now have exactly 1000
- **Checked that there is only at most one PFO muon per event**
  - Skipped any formal matching because this was true
  - Made efficiency and resolution plots from these

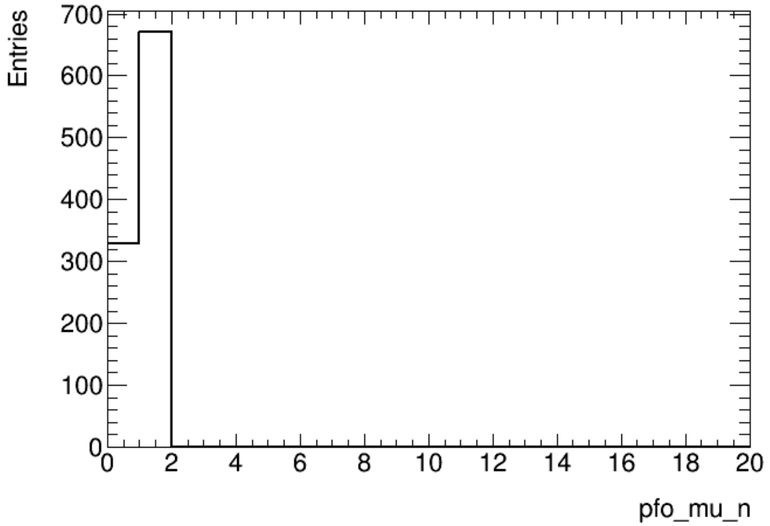
Numbers of objects





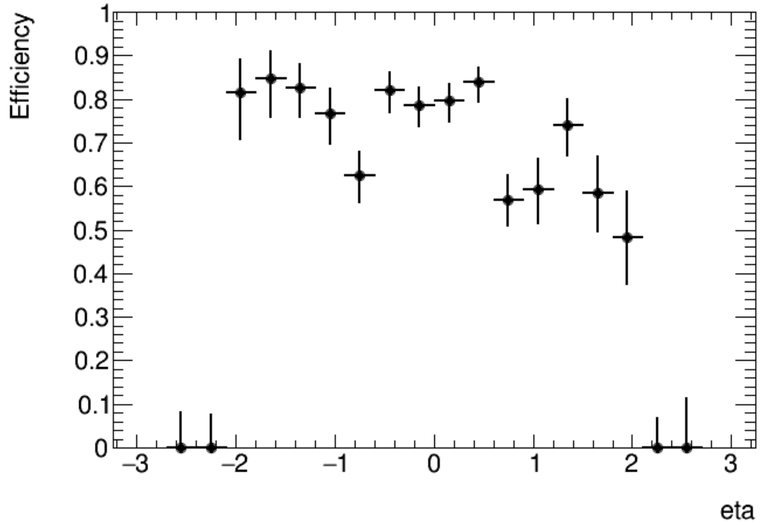
Now just showing statuscode = 1

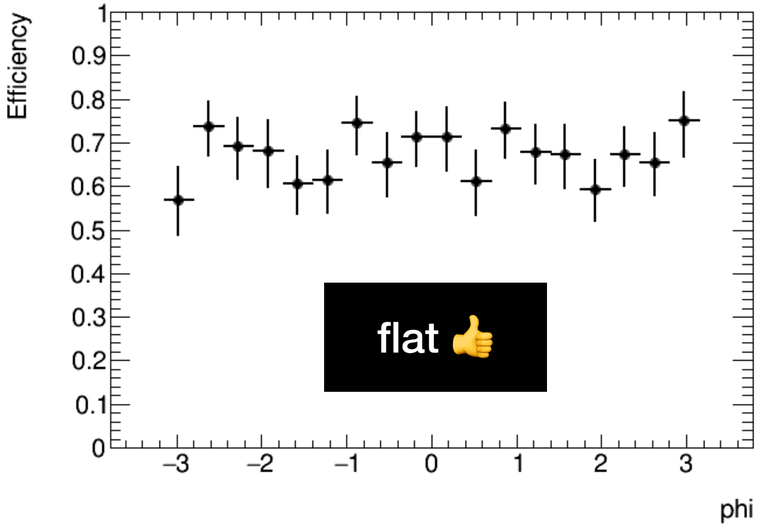


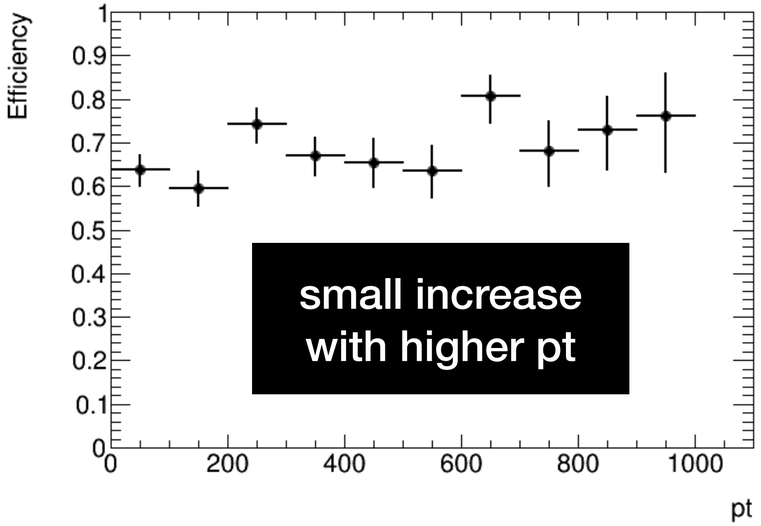


Sometimes get other PFOs (from S3 can see these are largely VERY low pT)

Efficiency plots



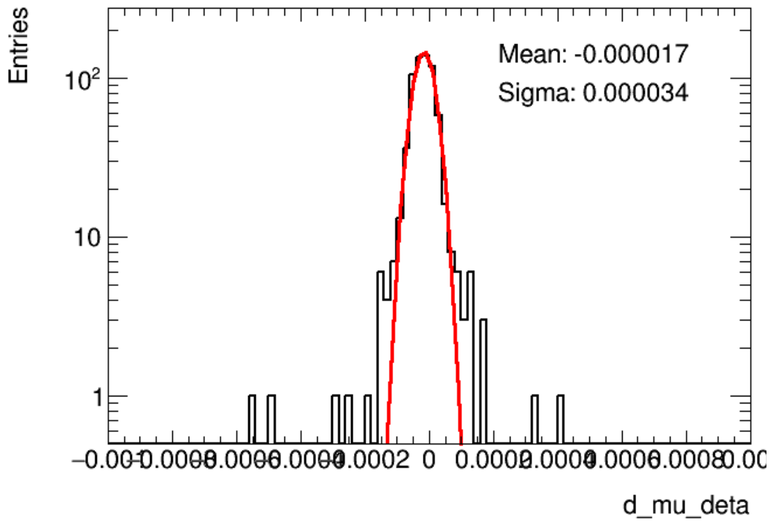


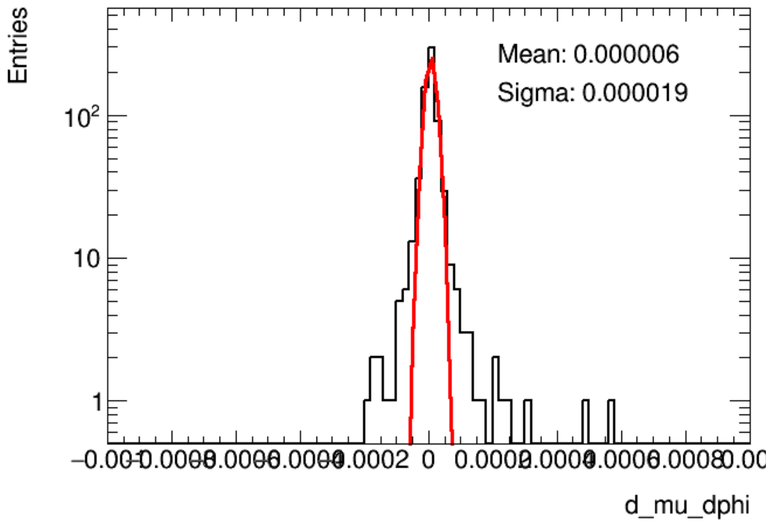


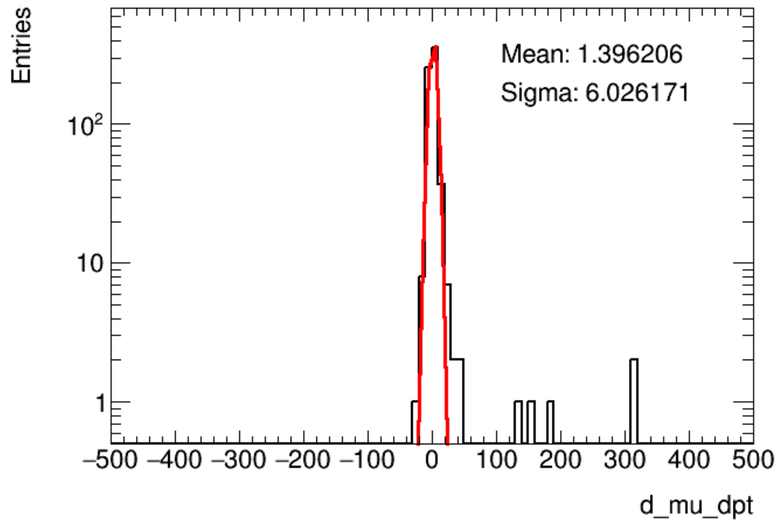
some “efficiency loss” just because I’m not making a fiducial eta selection

eta efficiency seems notably asymmetric

Resolution plots



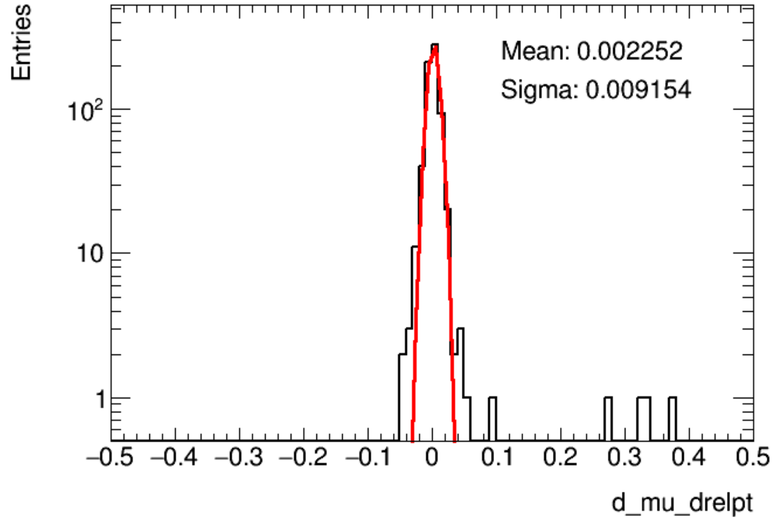




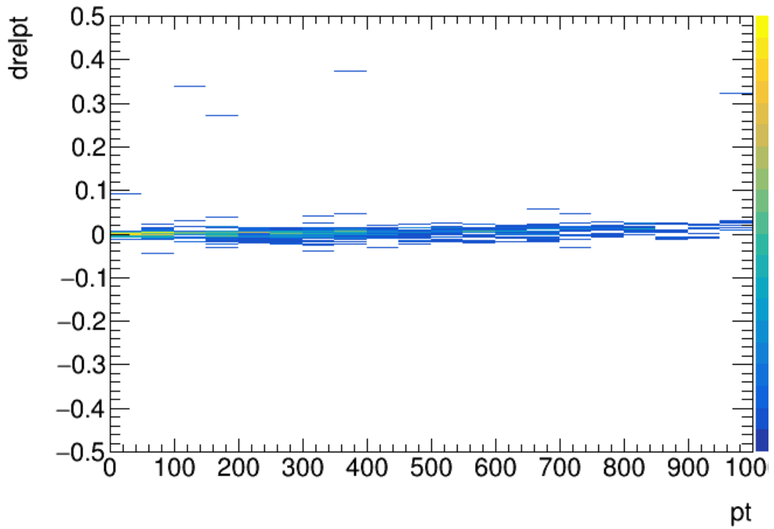
angular resolution very good (too good!)

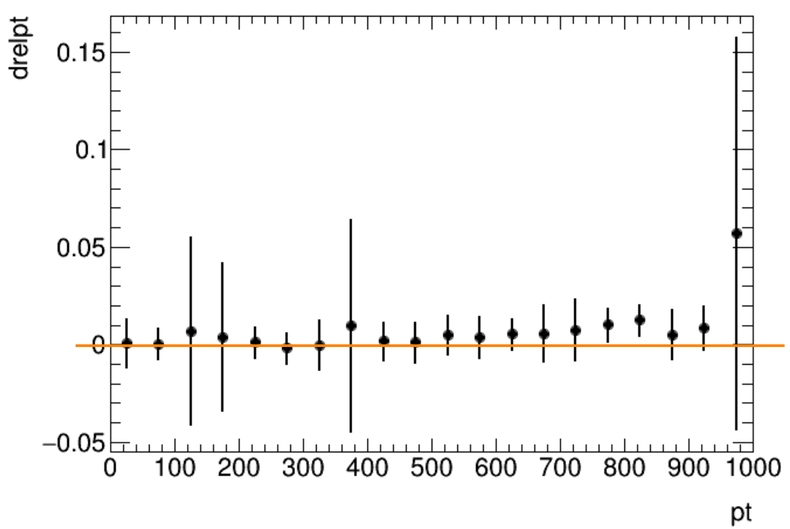
pT resolution also very good except for a few failures

pT is overestimated in these cases



Resolution v pT





start with a 2D plot of relative pT difference v. pT

Made a TProfile from that (with RMS errors)

Get a bias that increases with pT

Resolution suspiciously good at high pT

Very mis-measured muons are not just high pT

RMS spikes driven by a few very mis-measured muons

Next steps (if I ever have a plot-making day again)

- Investigate source of efficiency failures, especially eta asymmetry
- Run this on 10 TeV geometry instead of 3 TeV
- Look at what non-muon PFOs are showing up in the events
- Try to understand expected track pT resolutions based on geometry, compare to what's observed

- Right now just creating machinery to make plots; currently running on DataMuC_MuColl_v1 samples with no BIB
  - Tried to use :
    - /data/fmeloni/DataMuC_MuColl10_v0A/muonGun_1000/
    - /data/fmeloni/DataMuC_MuColl10_v0A/gen_muonGun/
    - For both, no files for reco/, recoBIB/ has files but no entries
  - Also no BIB files available for these 3 TeV v1 samples