Reconstruction for Displaced Muons in MiniAODSIM

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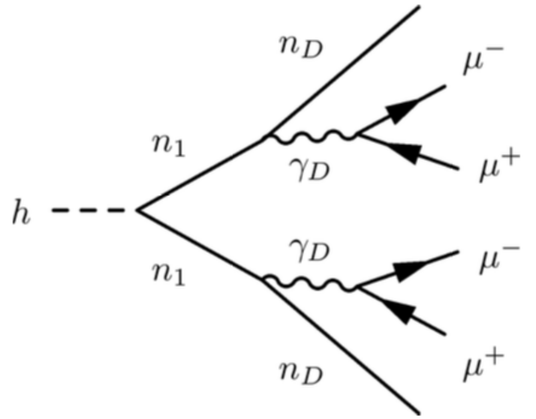
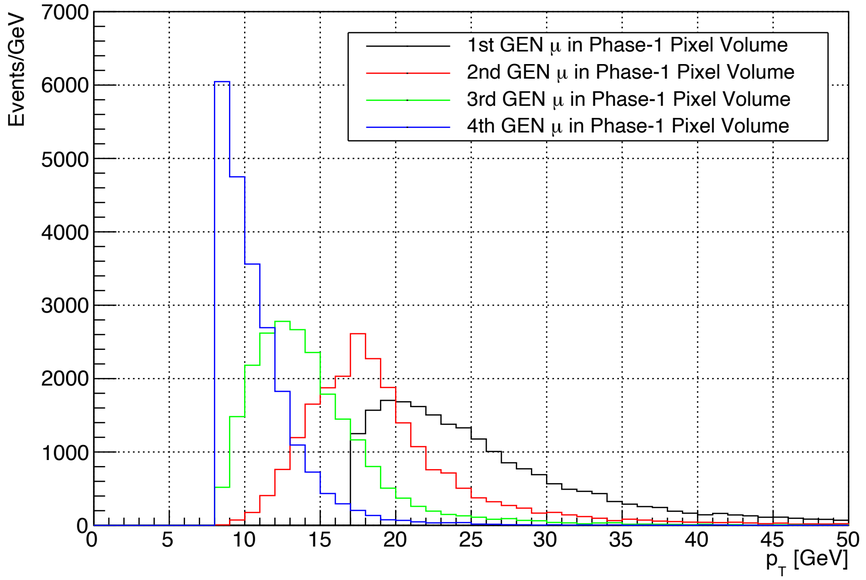
Rice U.

2017 MSSMD MC [m(h)=125GeV, m(n1)=60GeV, m(nD)=1GeV]: m_gammaD=25 GeV, cTau=100 mm

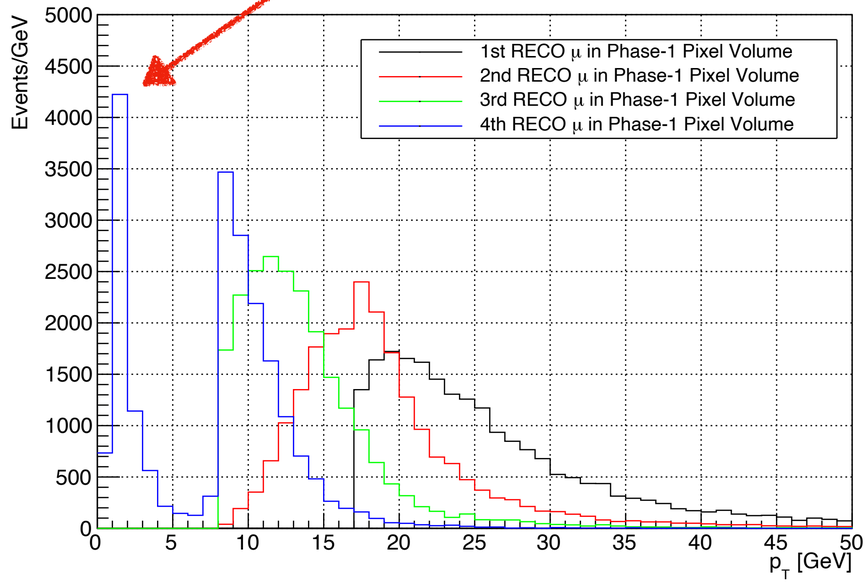
- Analysis requires four muons pT>8GeV passing PF LooseMuon ID





First four leading pT muons at GEN level

Unexpected peak



First four leading pT muons at RECO level

2017 MSSMD MC [m(h)=125GeV, m(n1)=60GeV, m(nD)=1GeV]: m_gammaD=25 GeV, cTau=100 mm

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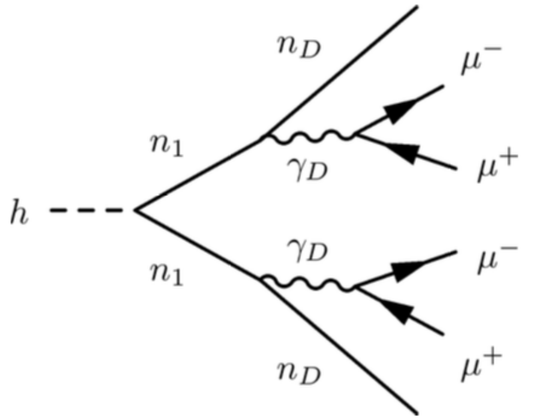
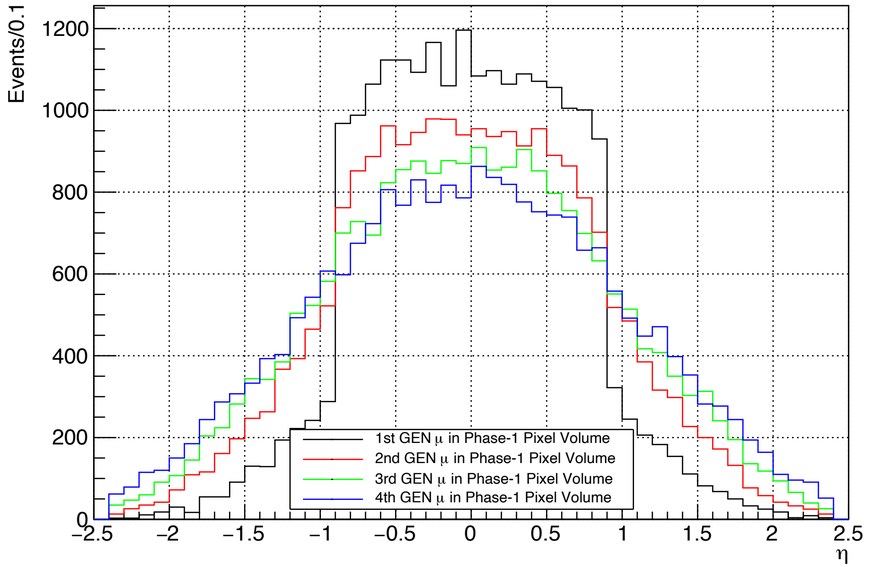
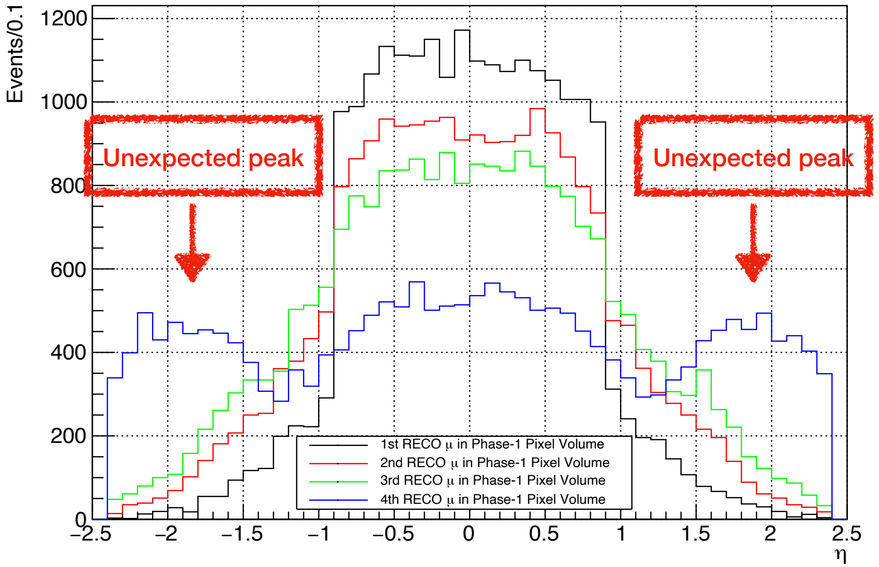




First four leading pT muons at GEN level



First four leading pT muons at RECO level

2017 MSSMD MC [m(h)=125GeV, m(n1)=60GeV, m(nD)=1GeV]: m_gammaD=25 GeV, cTau=100 mm

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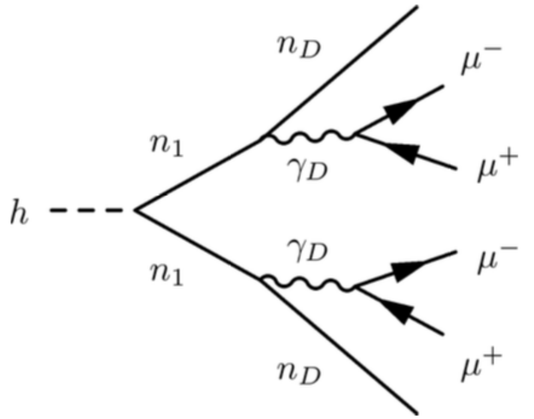
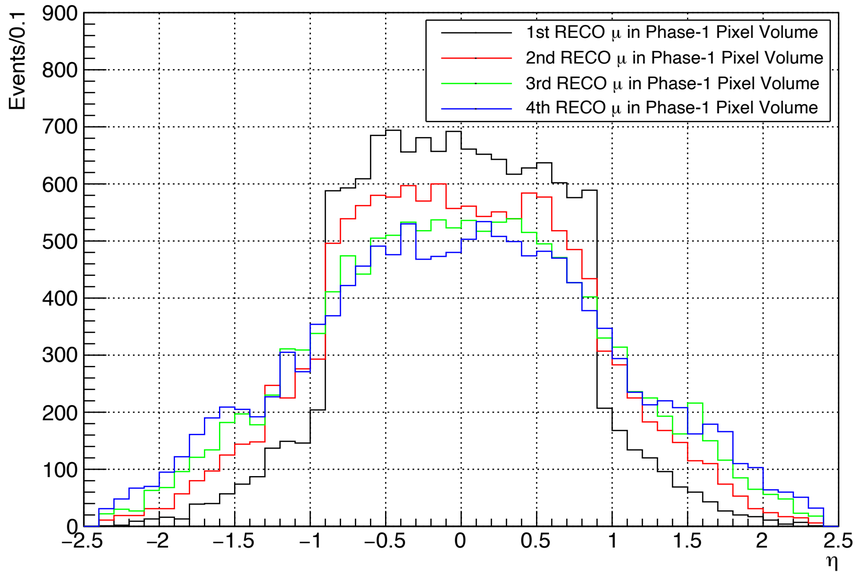
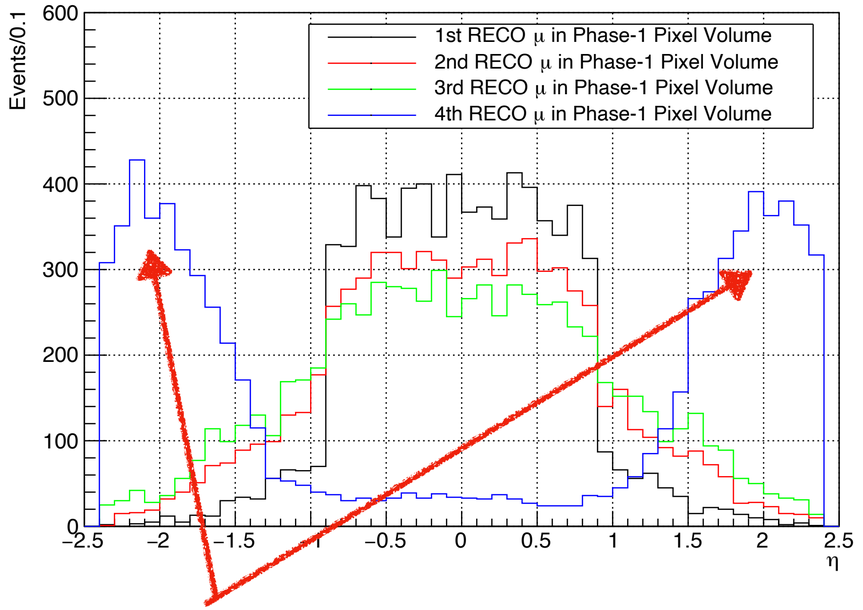


4th RECO mu pT>8GeV

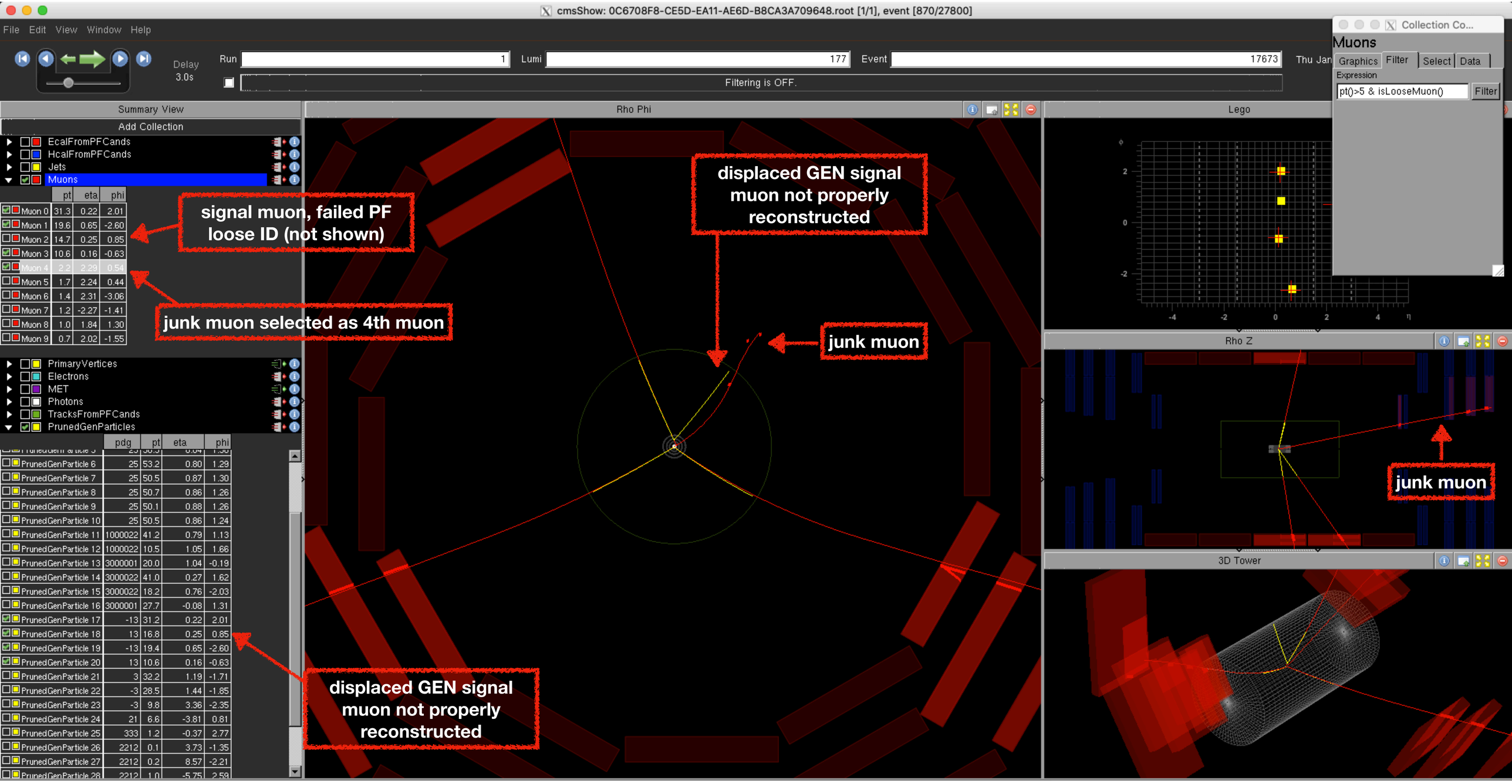


4th RECO mu pT<8GeV



Volunteer/junk RECO muons with low pT in the forward region: passed PF loose mu ID

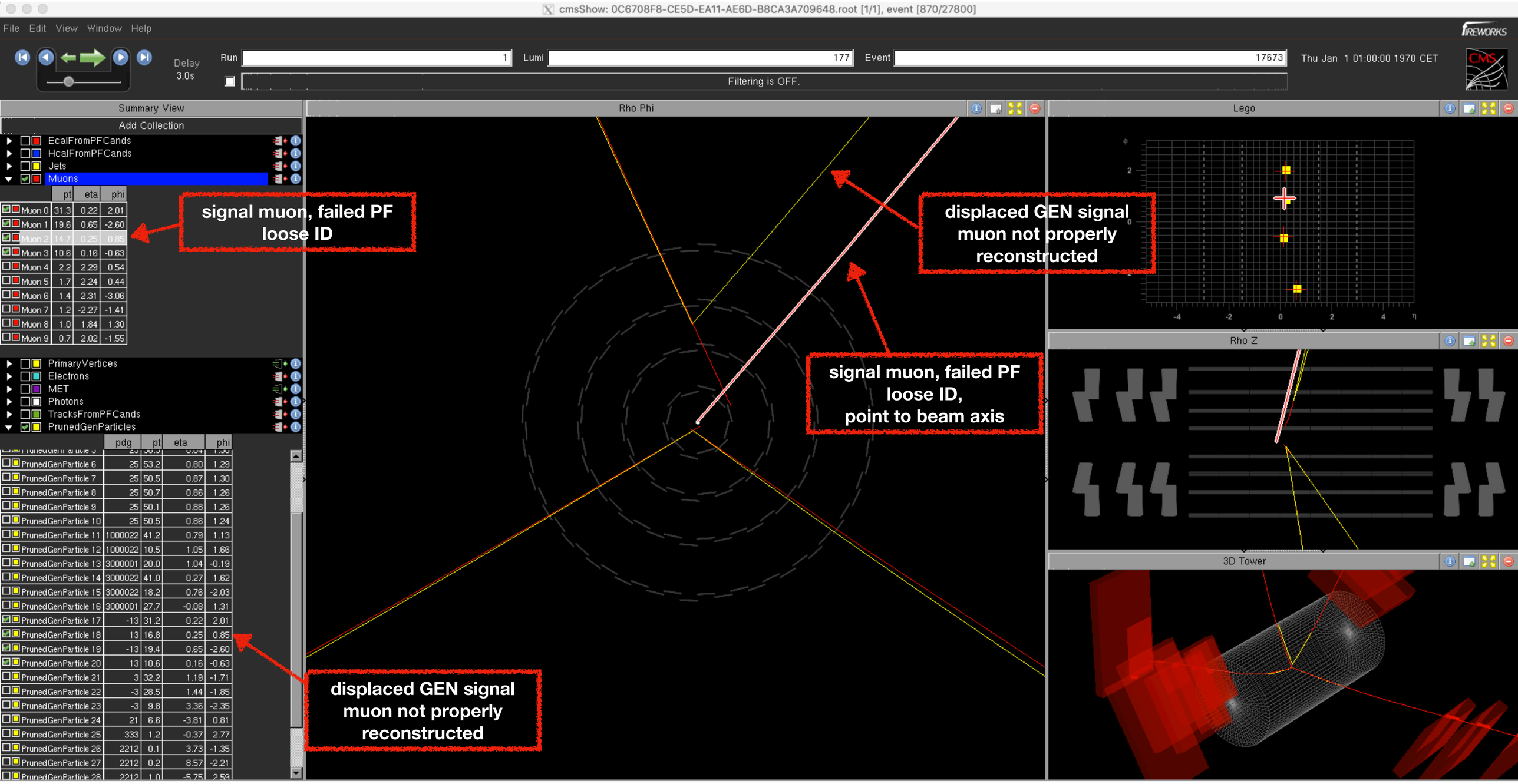
MSSMD: m=25 GeV, cT=100 mm (2017) Event #1



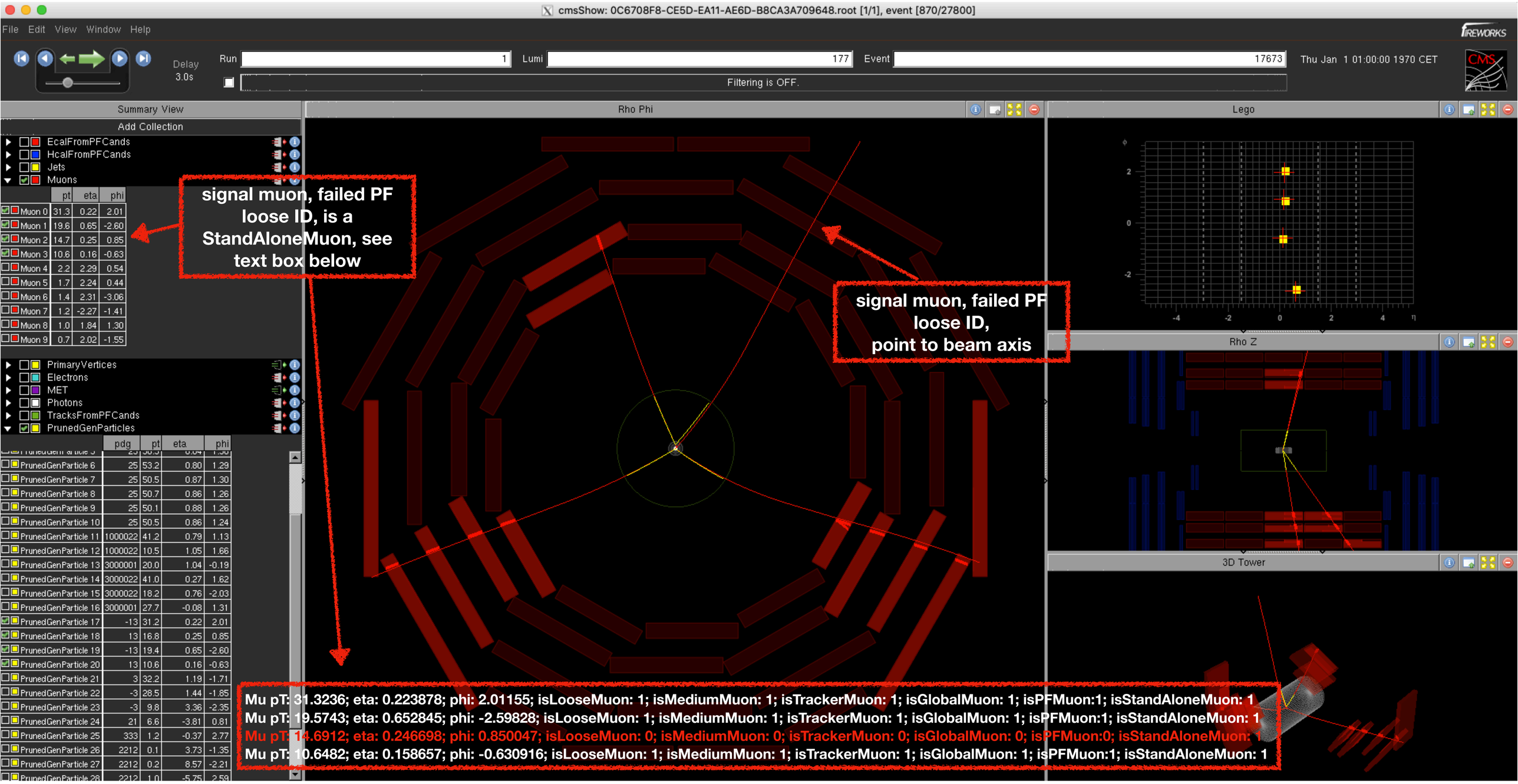
	pt	eta	phi
Muon 0	31.3	0.22	2.01
Muon 1	19.6	0.65	-2.60
Muon 2	14.7	0.25	0.85
Muon 3	10.6	0.16	-0.63
Muon 4	2.2	2.29	0.54
Muon 5	1.7	2.24	0.44
Muon 6	1.4	2.31	-3.06
Muon 7	1.2	-2.27	-1.41
Muon 8	1.0	1.84	1.30
Muon 9	0.7	2.02	-1.55

	pdg	pt	eta	phi
PrunedGenParticle 6	25	53.2	0.80	1.29
PrunedGenParticle 7	25	50.5	0.87	1.30
PrunedGenParticle 8	25	50.7	0.86	1.26
PrunedGenParticle 9	25	50.1	0.88	1.26
PrunedGenParticle 10	25	50.5	0.86	1.24
PrunedGenParticle 11	1000022	41.2	0.79	1.13
PrunedGenParticle 12	1000022	10.5	1.05	1.66
PrunedGenParticle 13	3000001	20.0	1.04	-0.19
PrunedGenParticle 14	3000022	41.0	0.27	1.62
PrunedGenParticle 15	3000022	18.2	0.76	-2.03
PrunedGenParticle 16	3000001	27.7	-0.08	1.31
PrunedGenParticle 17	-13	31.2	0.22	2.01
PrunedGenParticle 18	13	16.8	0.25	0.85
PrunedGenParticle 19	-13	19.4	0.65	-2.60
PrunedGenParticle 20	13	10.6	0.16	-0.63
PrunedGenParticle 21	3	32.2	1.19	-1.71
PrunedGenParticle 22	-3	28.5	1.44	-1.85
PrunedGenParticle 23	-3	9.8	3.36	-2.35
PrunedGenParticle 24	21	6.6	-3.81	0.81
PrunedGenParticle 25	333	1.2	-0.37	2.77
PrunedGenParticle 26	2212	0.1	3.73	-1.35
PrunedGenParticle 27	2212	0.2	8.57	-2.21
PrunedGenParticle 28	2212	1.0	-5.75	2.59

MSSMD: m=25 GeV, cT=100 mm (2017) Event #1



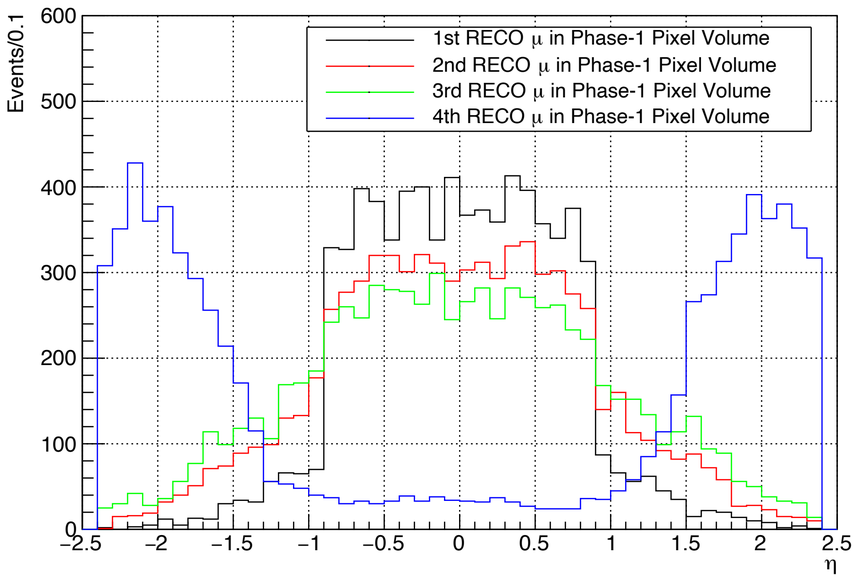
MSSMD: m=25 GeV, cT=100 mm (2017) Event #1



Summary & Questions

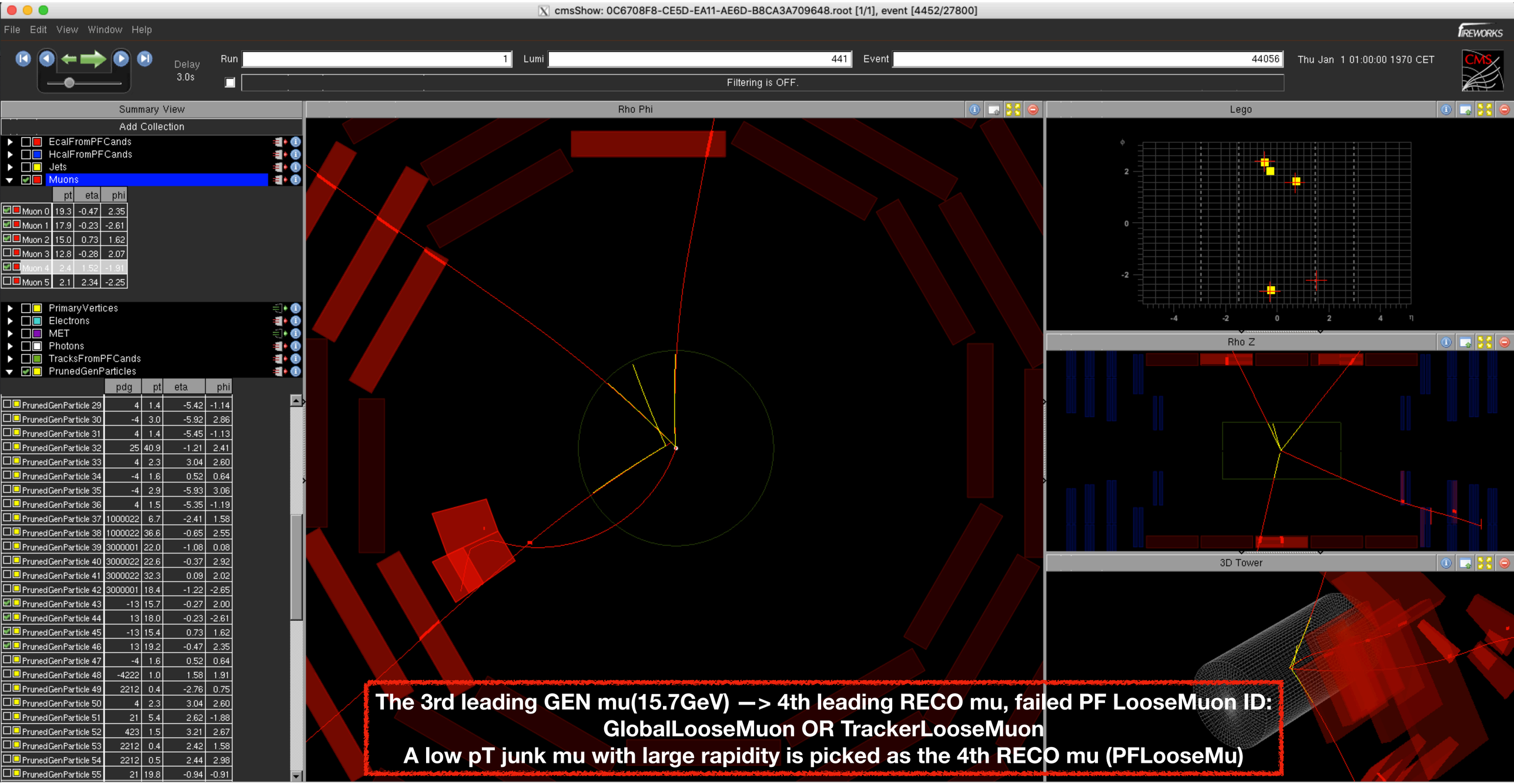
- Analysis has four muons in the final state
  - Use slimmedMuons collection in 2017-2018 MINIAODSIM
  - Ask four muons pass PF LooseMuon ID: pT>8GeV
- In many cases, a junk/volunteer muon with large pseudorapidity is picked up as the 4th RECO signal muon because one of the actual displaced signal muons is NOT properly reconstructed:
  - The signal muon is reconstructed pointing back to beam axis (usually smaller pT)
- The wrongly reconstructed muon shows up as a StandAlone muon
  - Something wrong when propagate outside-in to tracker or failed to find compatible tracker hit? Other possibilities?
- Why some displaced signal muons are reconstructed fine? Is this purely an inefficiency when reconstructing displaced muons? How can we mitigate this?

4th RECO mu pT<8GeV



Back Up

MSSMD: m=25 GeV, cT=100 mm (2017) Event #2



MSSMD: m=25 GeV, cT=100 mm (2017) Event #2

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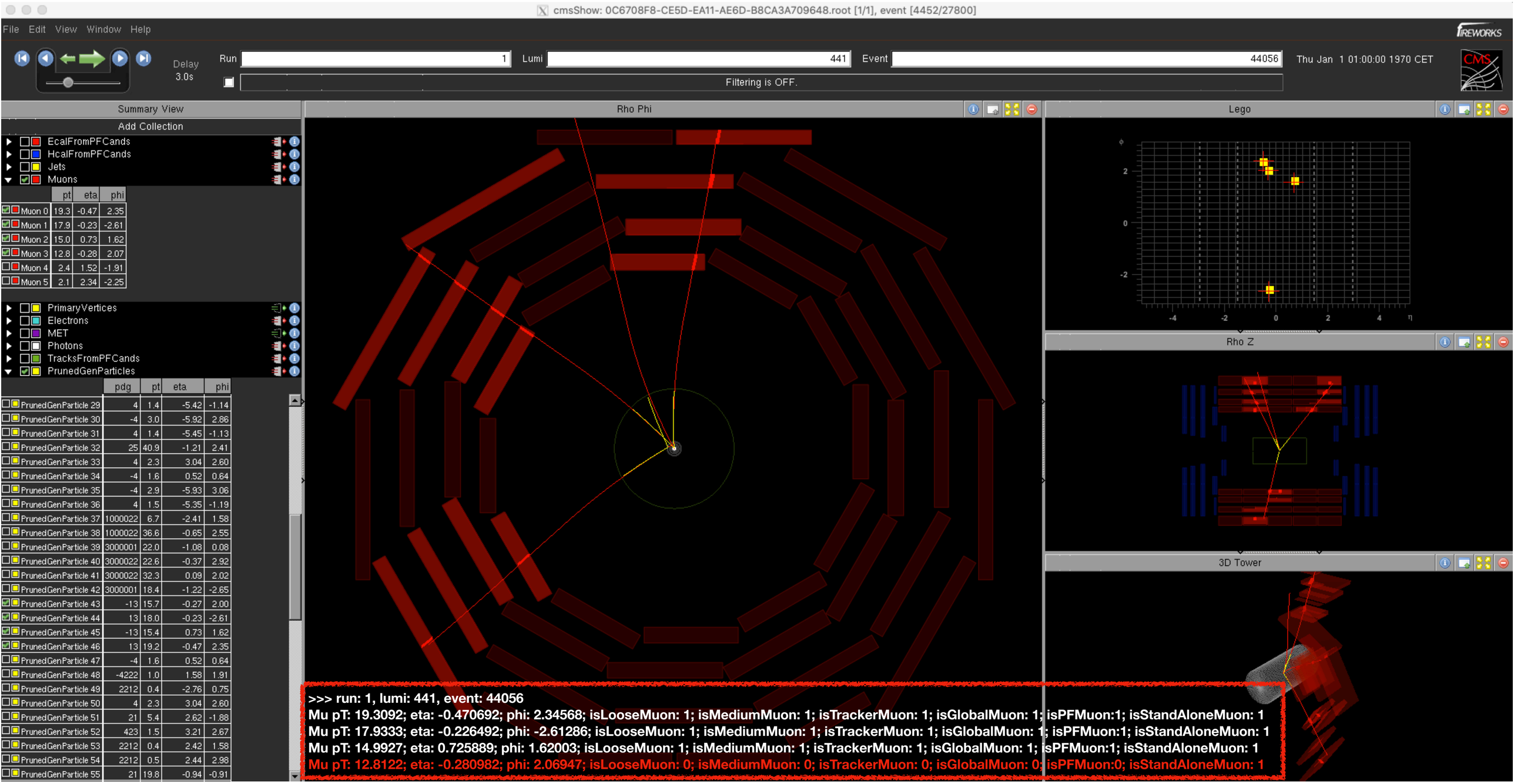
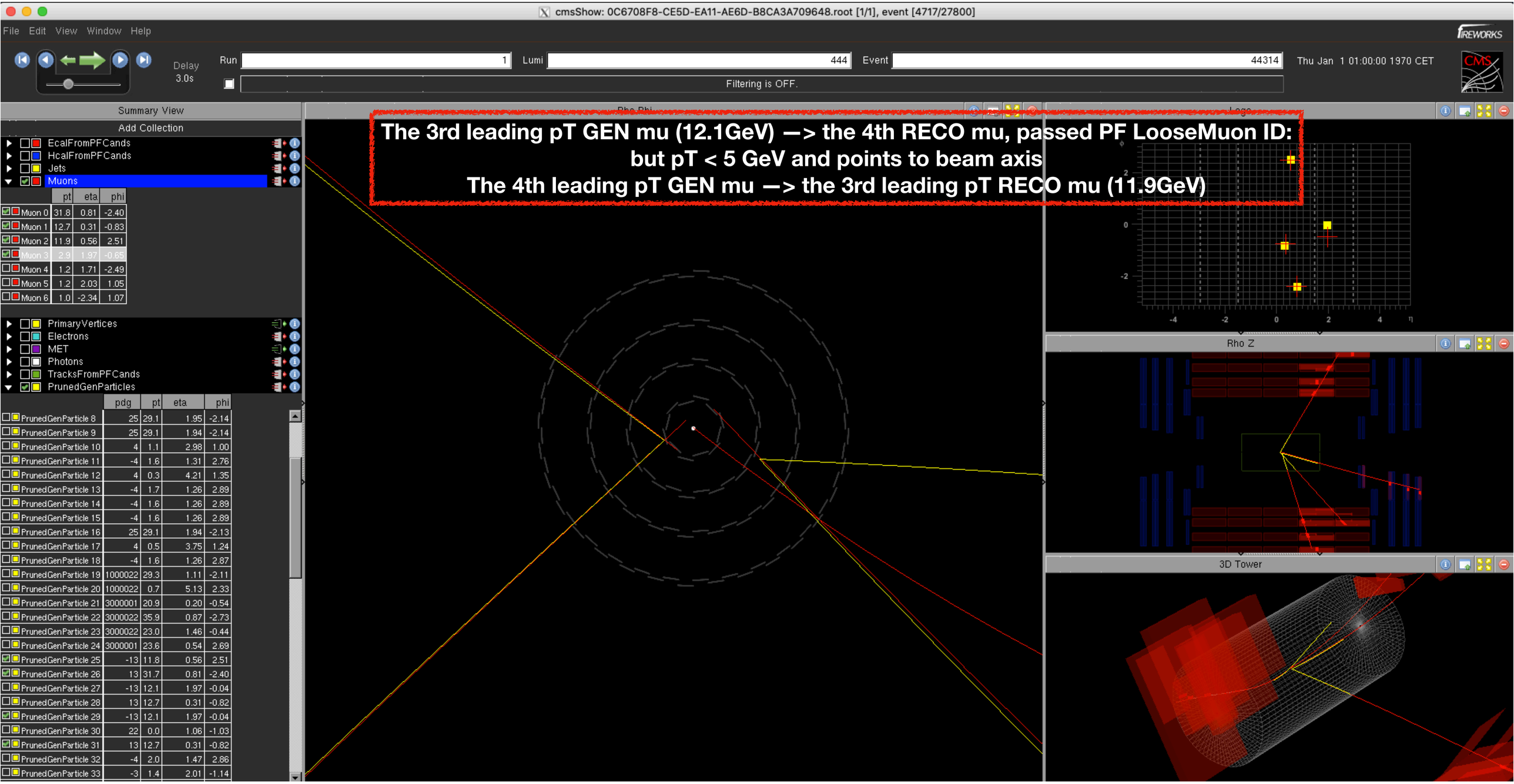
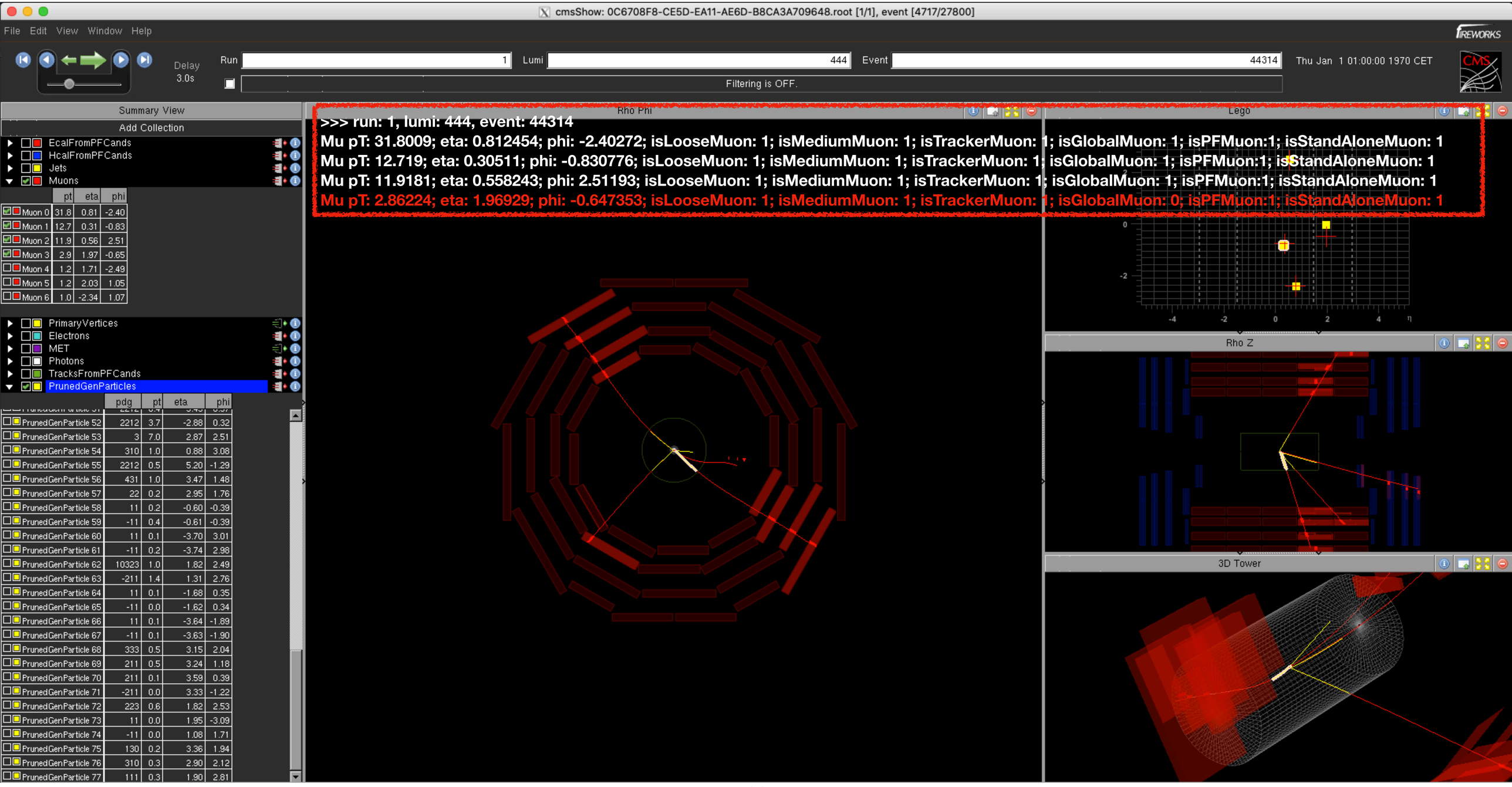


MSSMD: m=25 GeV, cT=100 mm (2017) Event #3



The 3rd leading pT GEN mu (12.1GeV) —> the 4th RECO mu, passed PF LooseMuon ID:
but pT < 5 GeV and points to beam axis
The 4th leading pT GEN mu —> the 3rd leading pT RECO mu (11.9GeV)

MSSMD: m=25 GeV, cT=100 mm (2017) Event #3

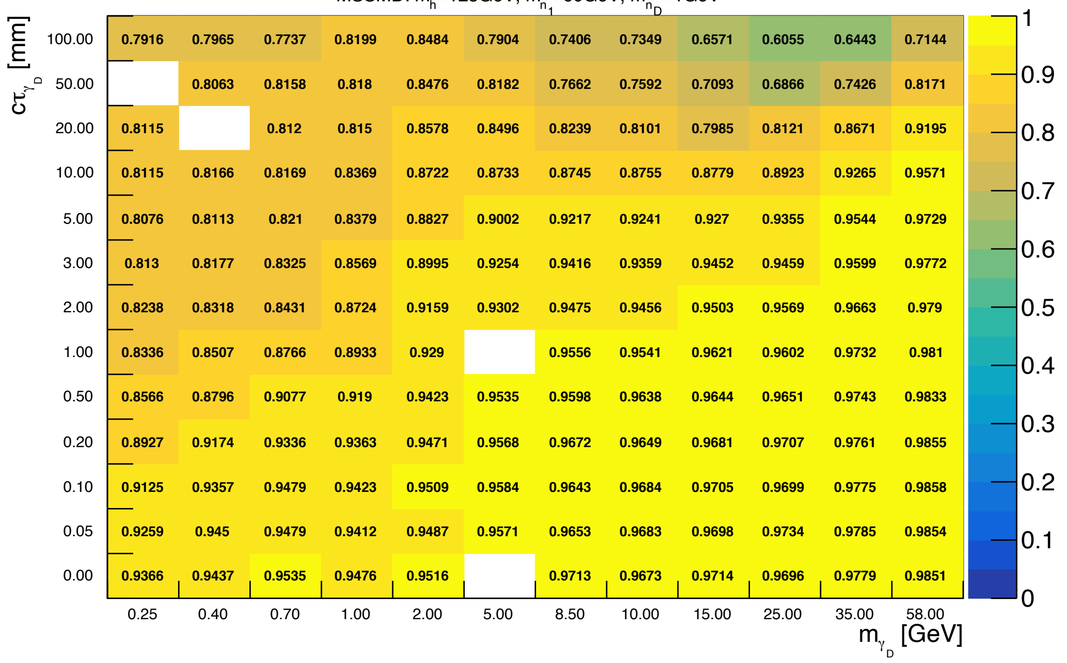


GEN Matched Sel. #9 / Sel. #5

MSSMD: m_h=125GeV, m_{n_1}=60GeV, m_{n_D}=1GeV

GEN Matched Sel. #9 / Sel. #8

MSSMD: m_h=125GeV, m_{n_1}=60GeV, m_{n_D}=1GeV



2017

#	Selection
#0	No cut
#1	is1GenMu17Barrel
#2	is2GenMu8
#3	is3GenMu8
#4	is4GenMu8
#5	Lxy<16.0cm && Lz<51.6cm
#6	is1SelMu17Barrel
#7	is2SelMu8
#8	is3SelMu8
#9	is4SelMu8
#10	isVertexOK
#11	is2Dimuons
#12	is2DiMuonsPixHitOk
#13	is2DiMuonsFittedDzOk
#14	isNotDYLLQEDRadiate
#15	is2MuonsIsolationOK
#16	isSignalHLTAccepted
#17	is2DiMuonsMassOK

2018

GEN Matched Sel. #9 / Sel. #5

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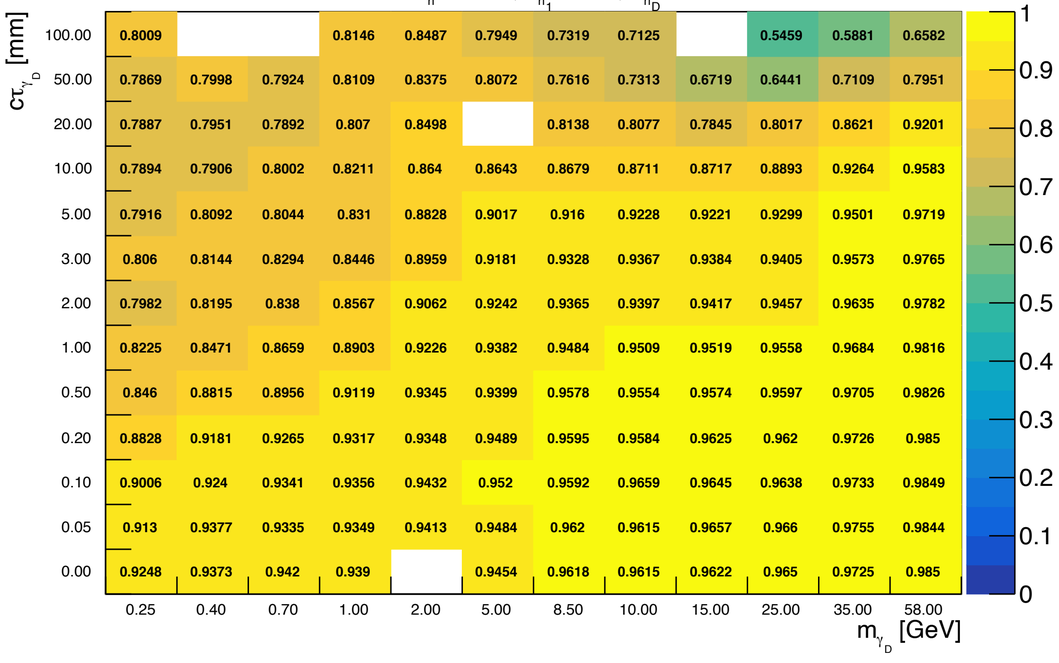

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