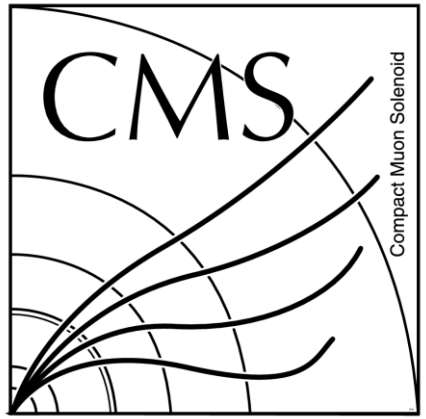
2018 EMTF Emulator Changes

EMTF Working Meeting
May 2018

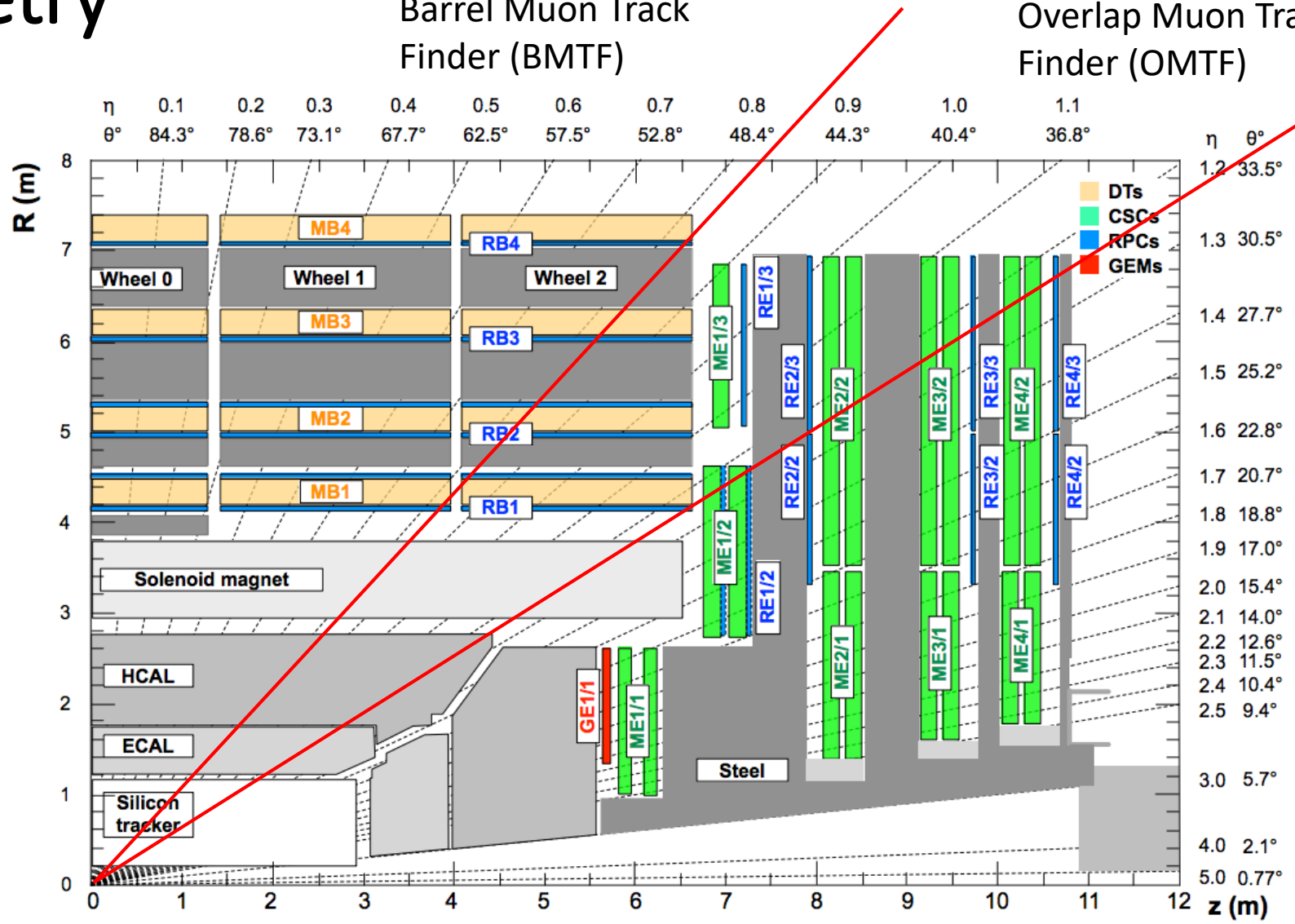
Wei Shi on behalf of the
EMTF working group



Geometry

Barrel Muon Track Finder (BMTF)

Overlap Muon Track Finder (OMTF)



Endcap Muon Track Finder (EMTF)

Emulator changes

- Track building BX window: 3→2
  - i.e. a track in BX = 0 can now include LCTs from BX = -1 and 0, or BX = 0 and +1, but not from BX = -2 or +2, and not both -1 and +1
- 2-station tracks with different hit BX removed [1]
- Δθ ambiguity when multiple LCTs are in the same chamber resolved
- Revised quality
  - Mode 9 promoted to DoubleMu, mode 12 demoted to MuOpen [1]
- Tuning maximum Δθ for "Zone 0" (ring 1) from 8 to 4
  - Roughly covers CSC ring 1 (|η| > 1.7), does not include RPC hits
  - Wide Δθ window (8 units, ~2°) not necessary

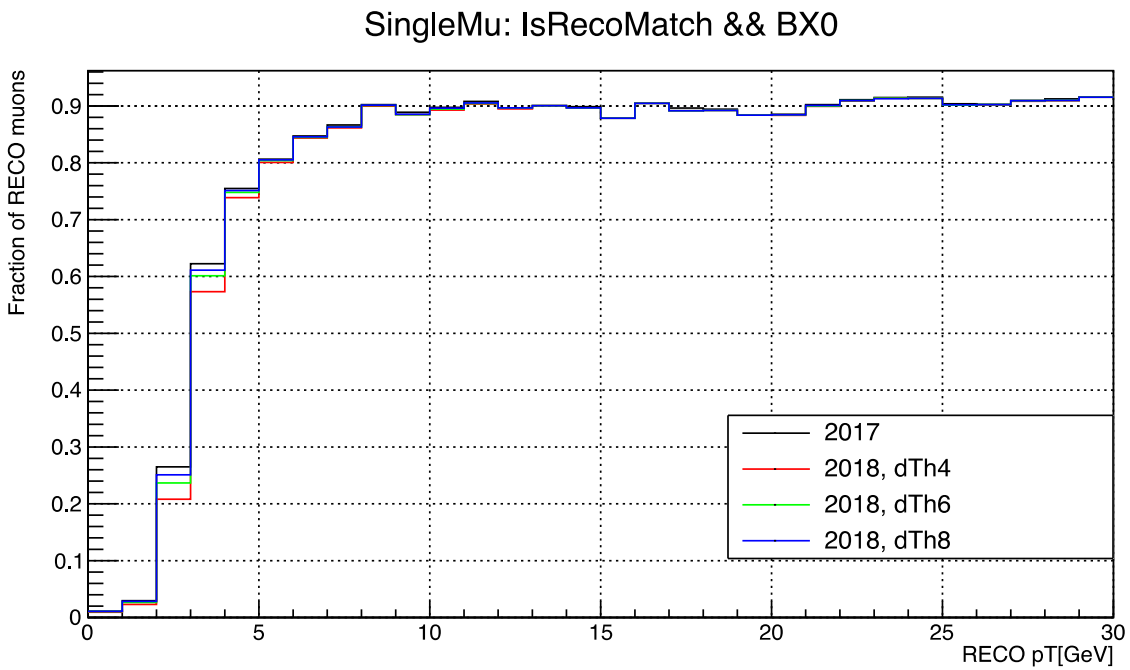
[1] https://indico.cern.ch/event/719916/contributions/2959195/attachments/1629473/2596583/EMTF_Studies_on_Reco_Muons.pdf

Selections

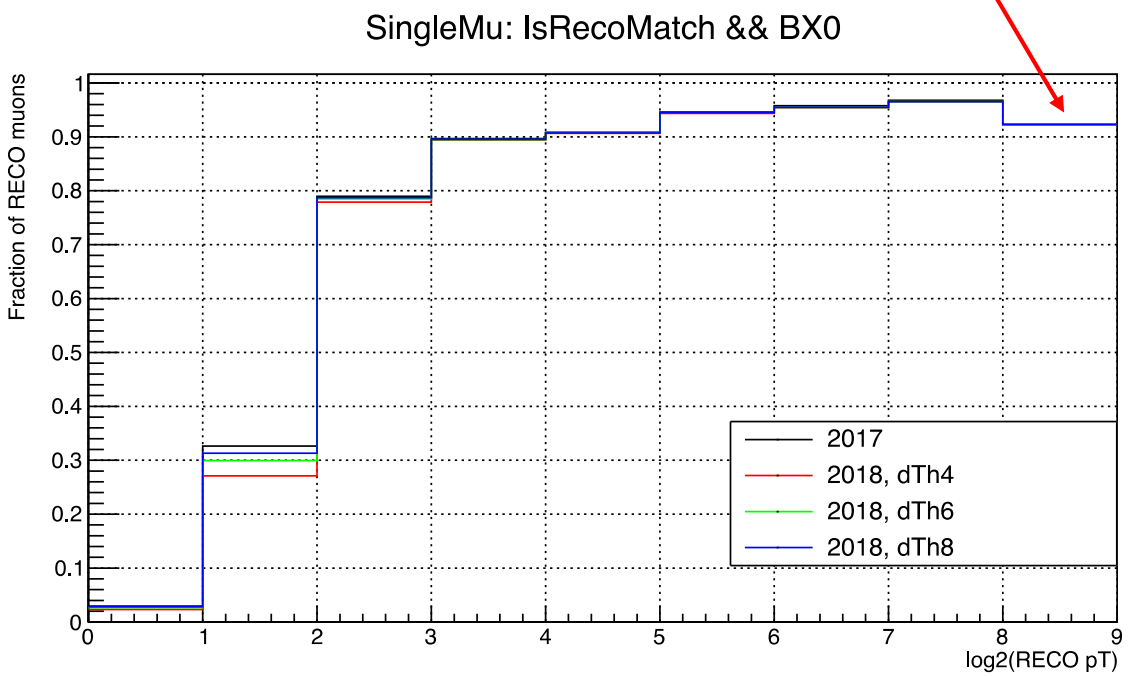
- Remove trigger bias
  - “HLT_IsoMu27” or “HLT_Mu50”
  - Use RECO muons
    - Events with more than 2 fired the trigger
    - From the endcap when only 1 barrel muon fired trigger
- Selection on RECO muons
  - $|\eta|$@vertex and$|\eta|$@ME1 $\in$ (1.25, 2.4);
  - ID
    - pT < 8 GeV: loose && soft or medium
    - 8 < pT < 64 GeV: medium [2]
    - pT > 64 GeV: tight
- Rate
  - Track BX=0, $|\eta|$>1.25
  - Track mode != track mode neighbor (avoid double counting)

[2] https://indico.cern.ch/event/357213/contributions/1769745/attachments/710701/975626/muonid-pog081214.pdf

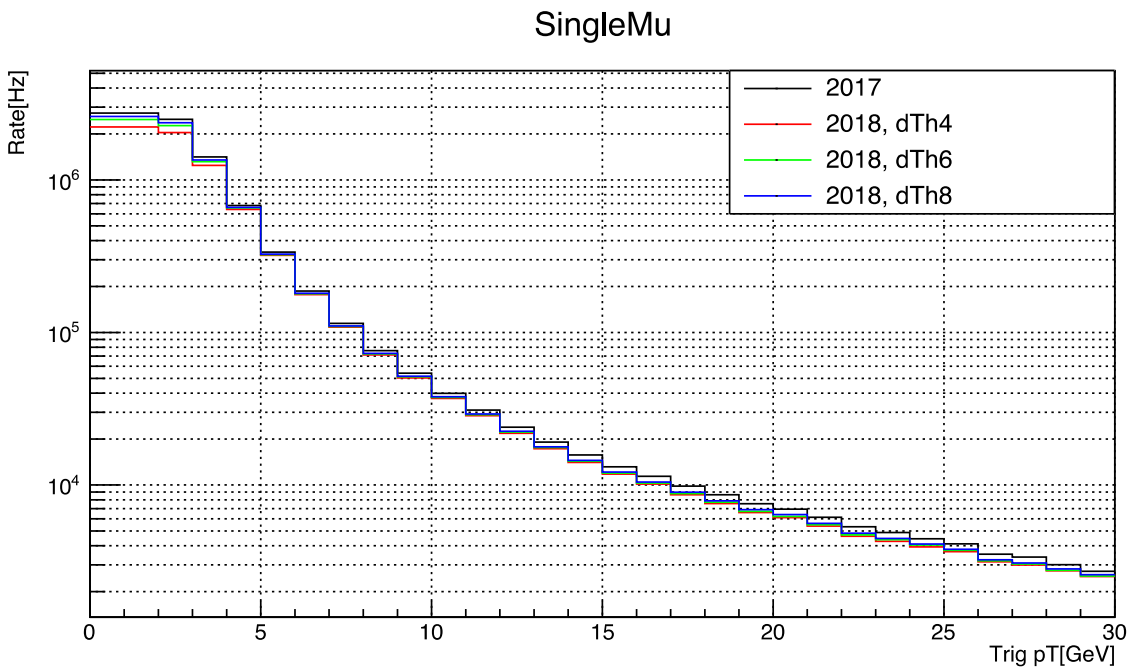
SingleMu: Efficiency

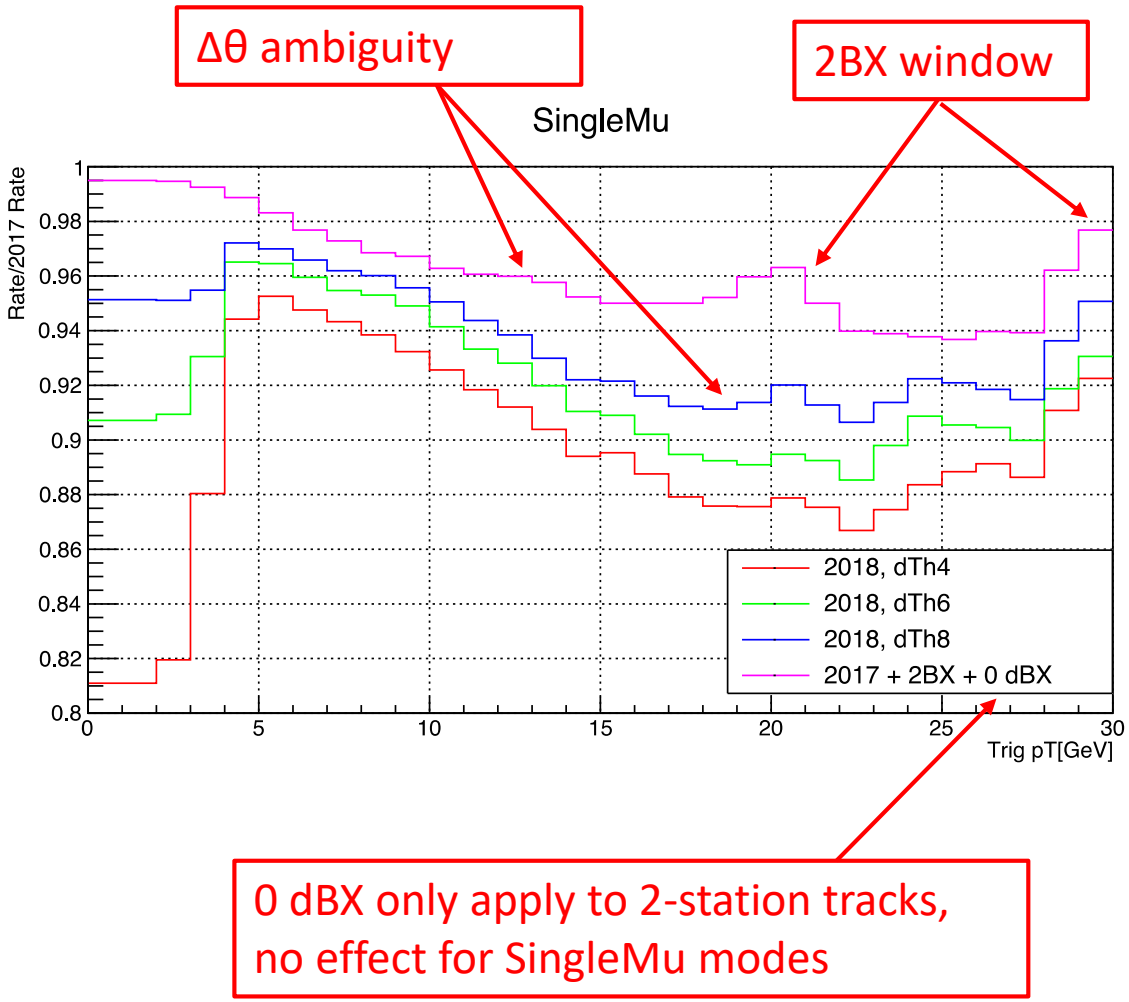


Include pT > 256 GeV

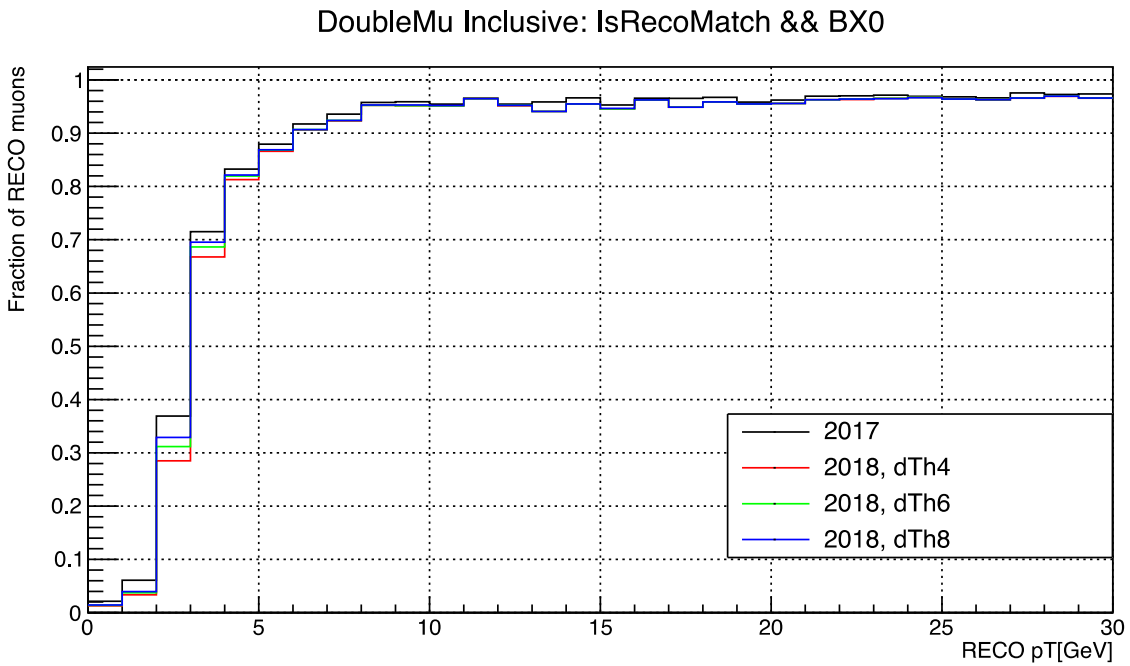


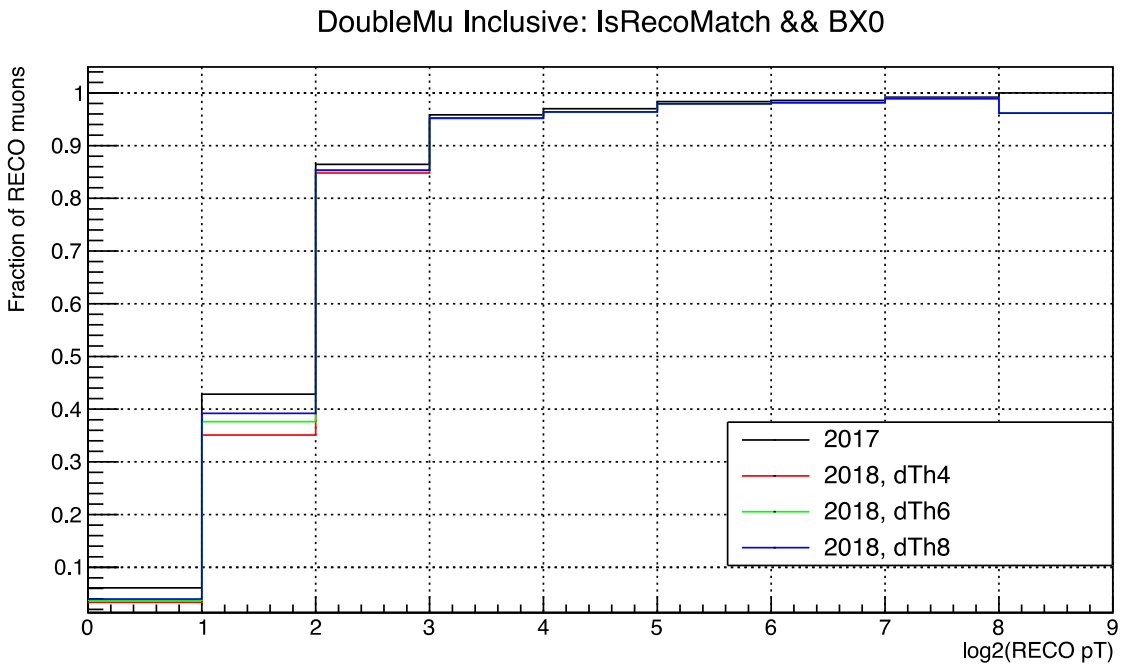
SingleMu: Rate



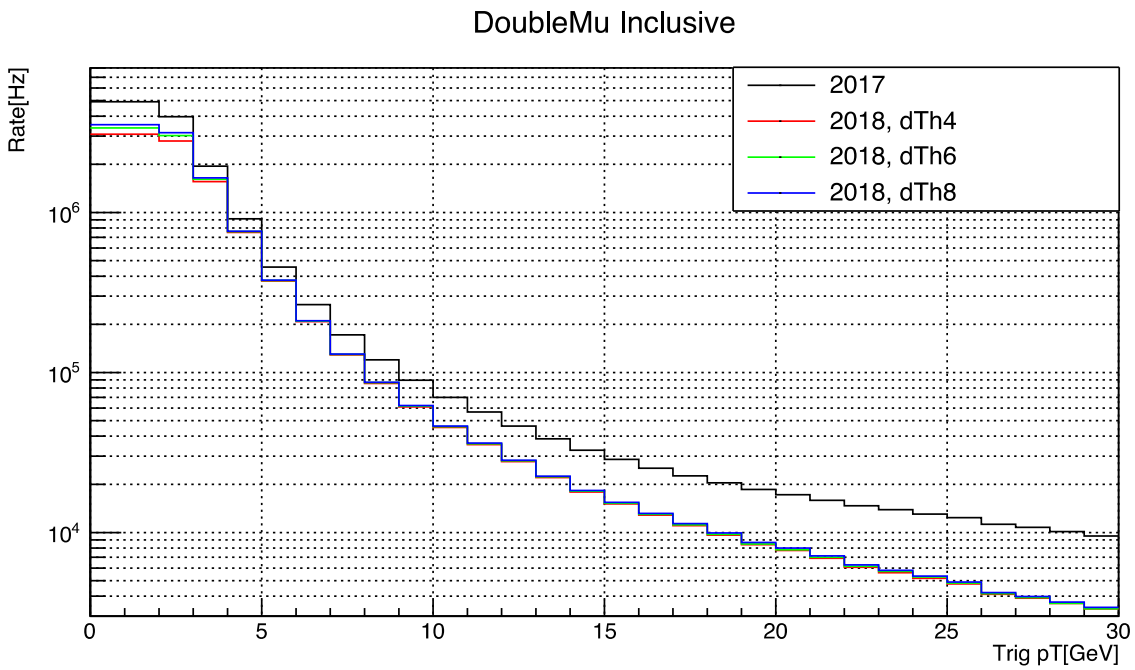


DoubleMu Inclusive: Efficiency





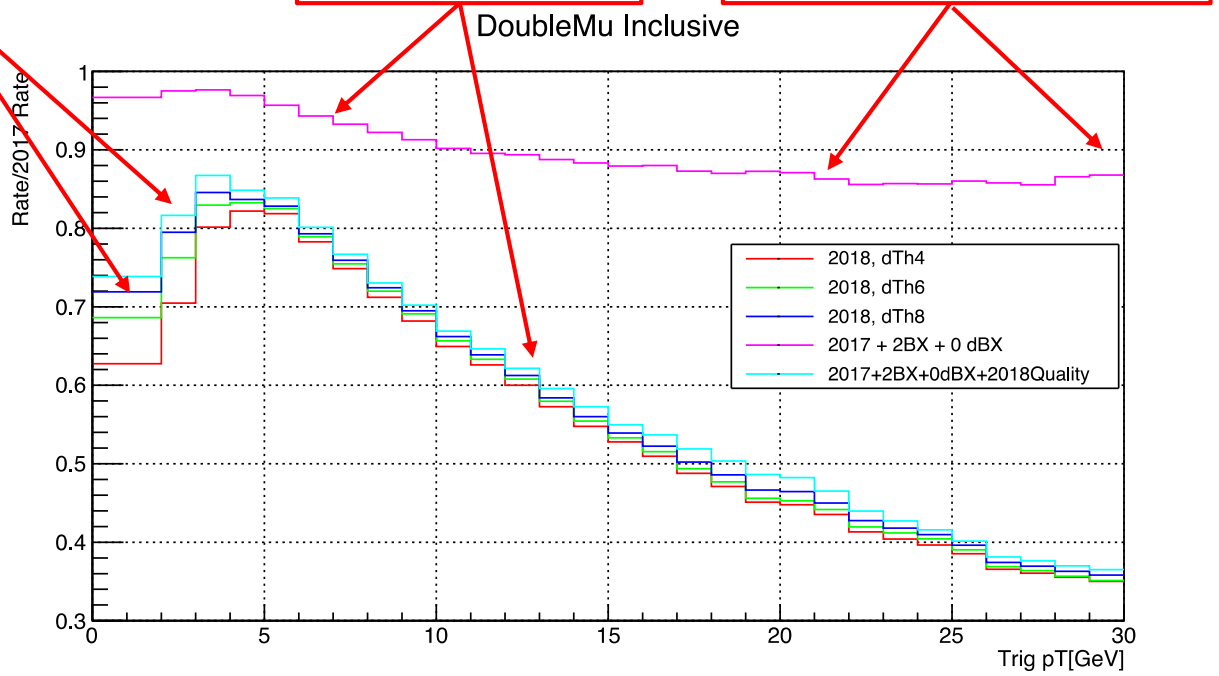
DoubleMu Inclusive: Rate



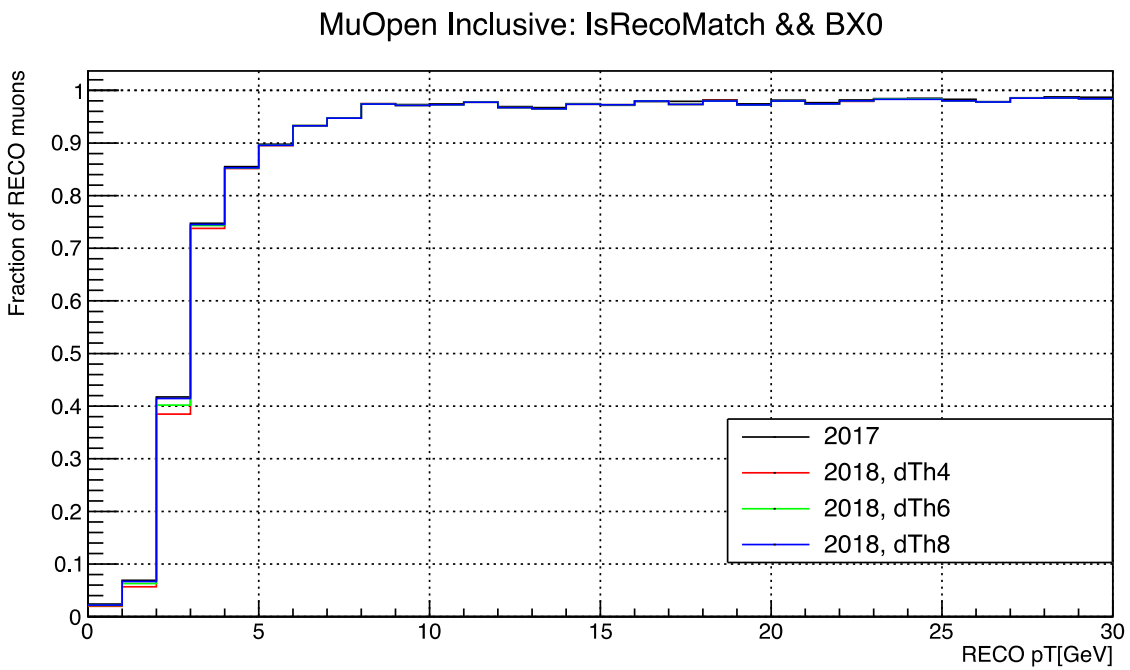
Δθ ambiguity

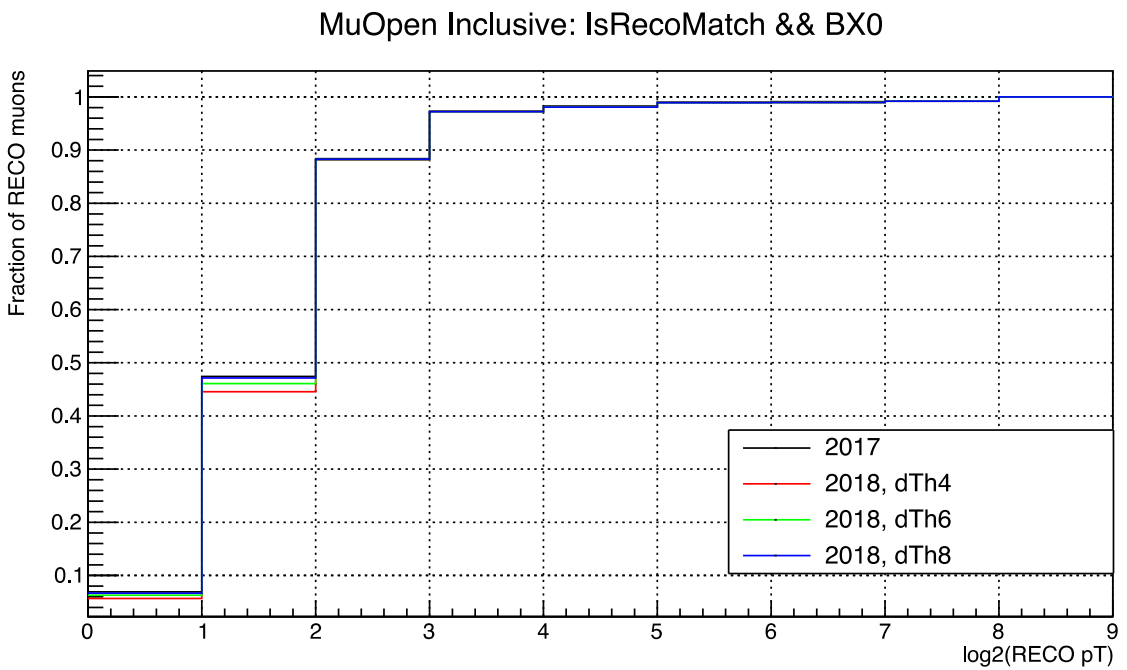
Revised quality

2BX window + 0dBX

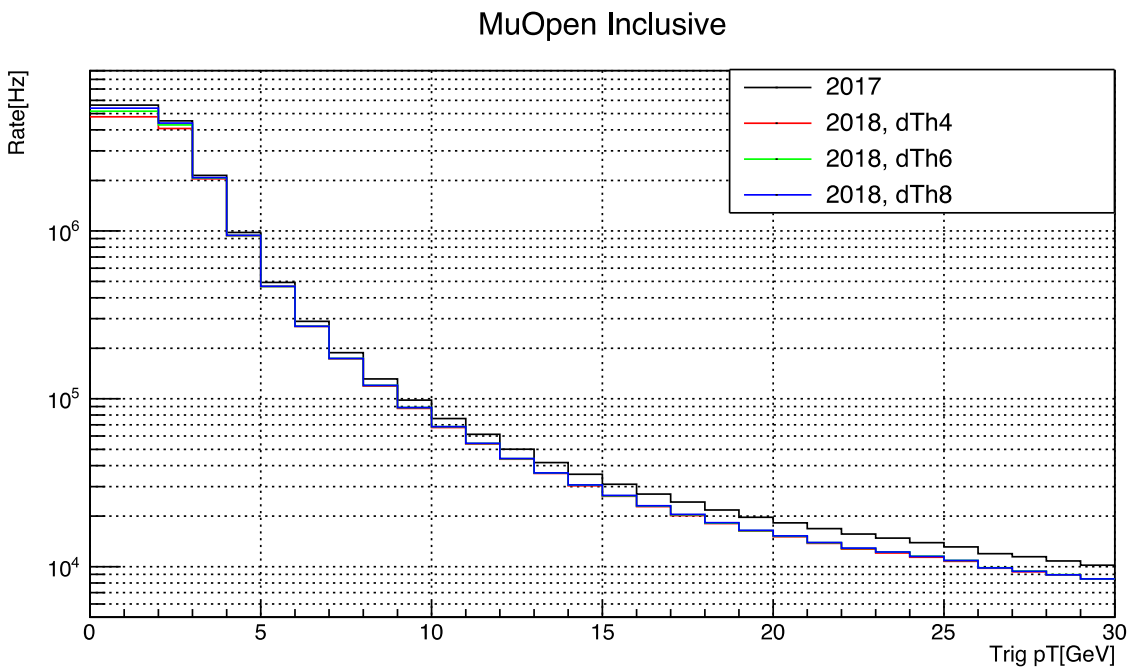


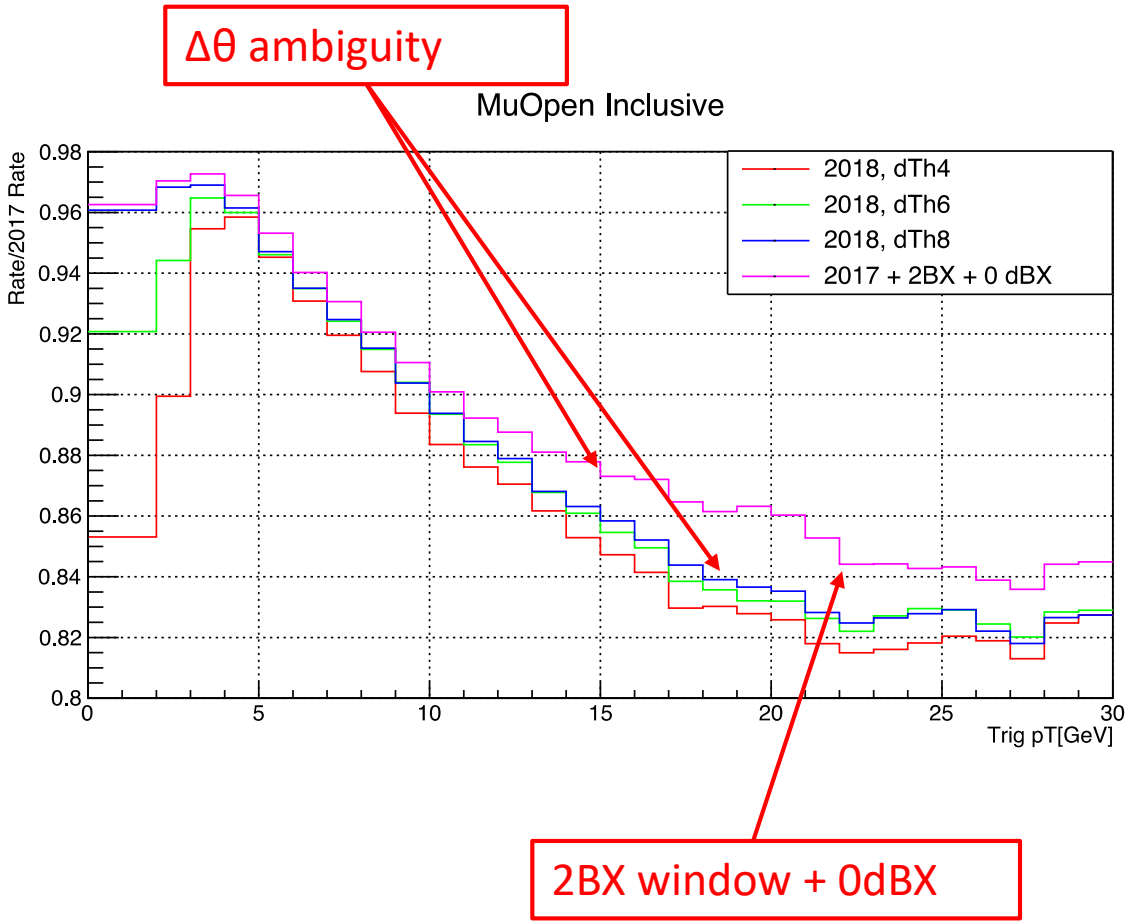
MuOpen Inclusive: Efficiency





MuOpen Inclusive: Rate



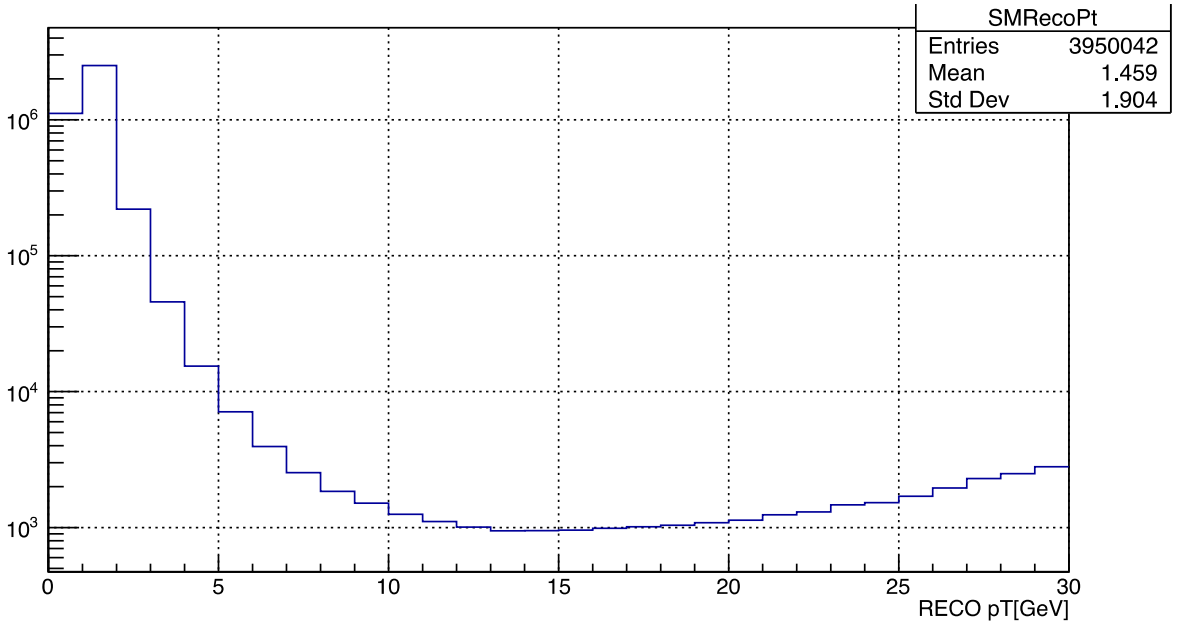


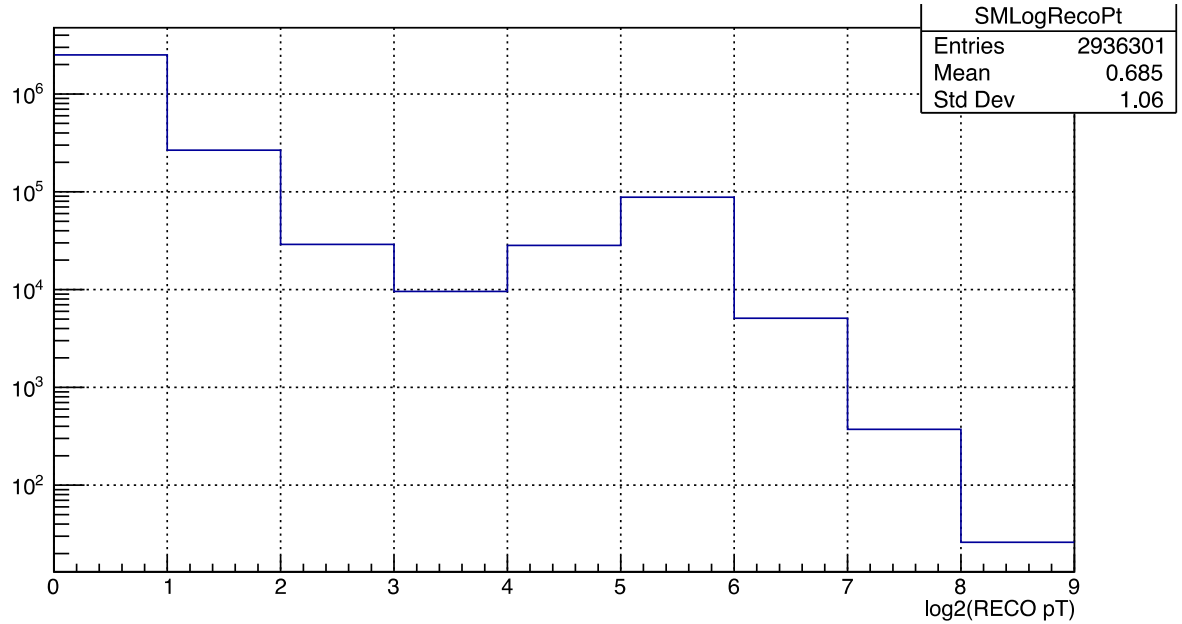
Summary

- 2018 EMTF emulator changes show rate reductions with similar efficiency performance to 2017 for all muon quality
- DoubleMu quality inclusive has the most reduction (>50% @22GeV) due to revised map b/t modes and quality (mode 9 ←→ mode 12)

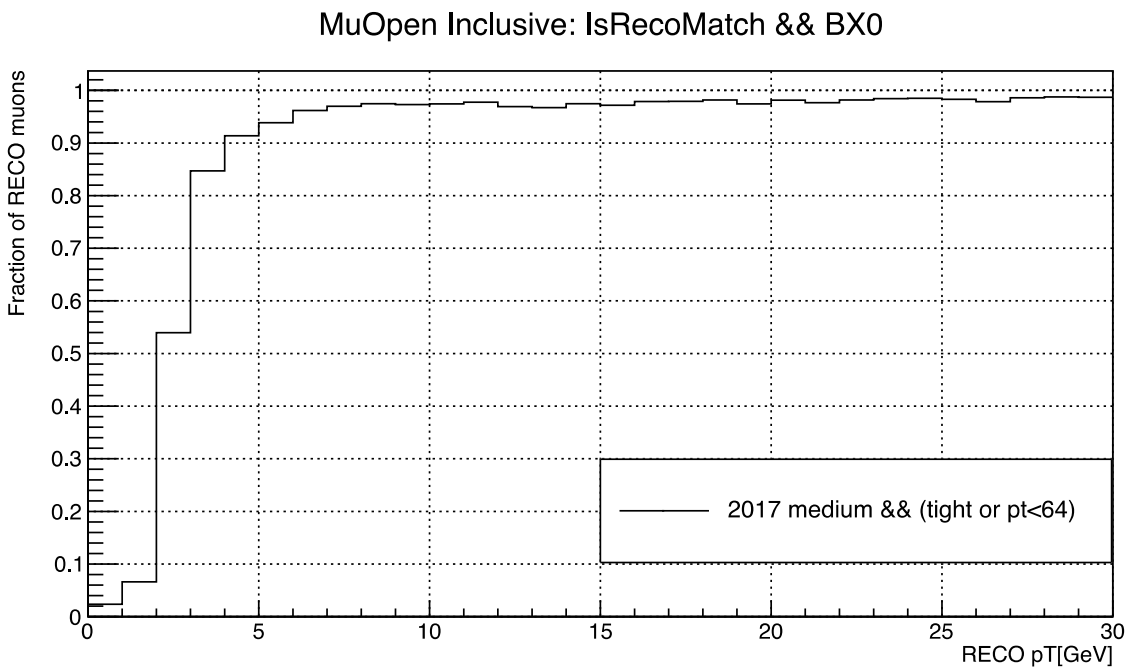
Back Up

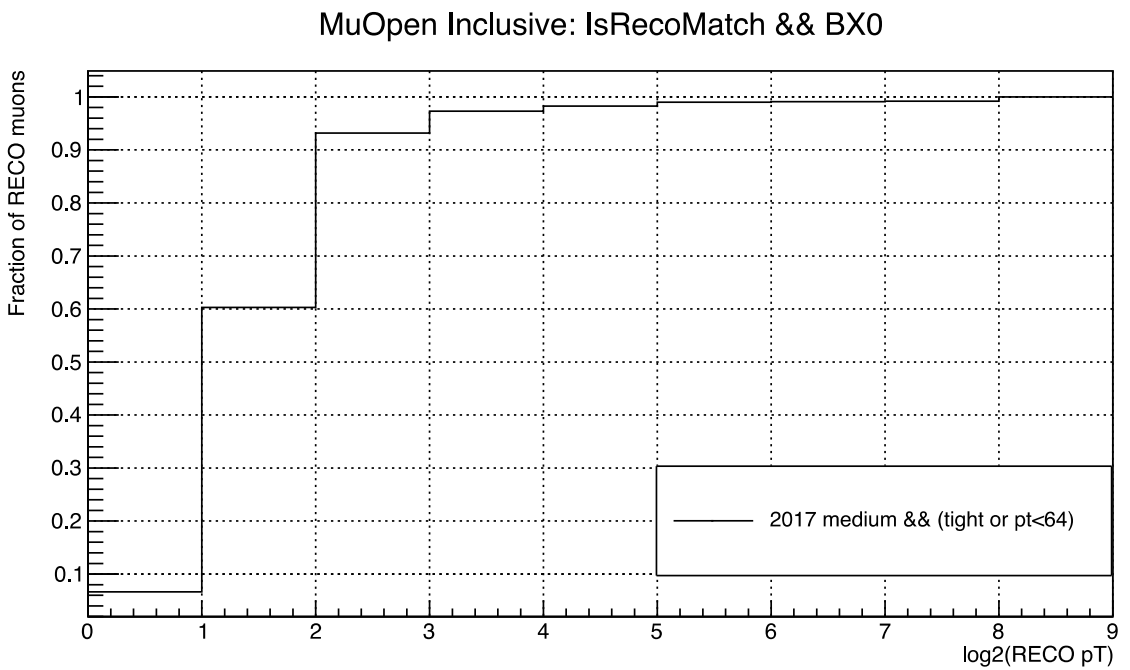
RECO pT


SMRecoPt
Entries 3950042
Mean 1.459
Std Dev 1.904
10^6
10^5
10^4
10^3
0 5 10 15 20 25 30
RECO pT[GeV]


SMLogRecoPt
Entries 2936301
Mean 0.685
Std Dev 1.06
10^6
10^5
10^4
10^3
10^2
0 1 2 3 4 5 6 7 8 9
log2(RECO pT)

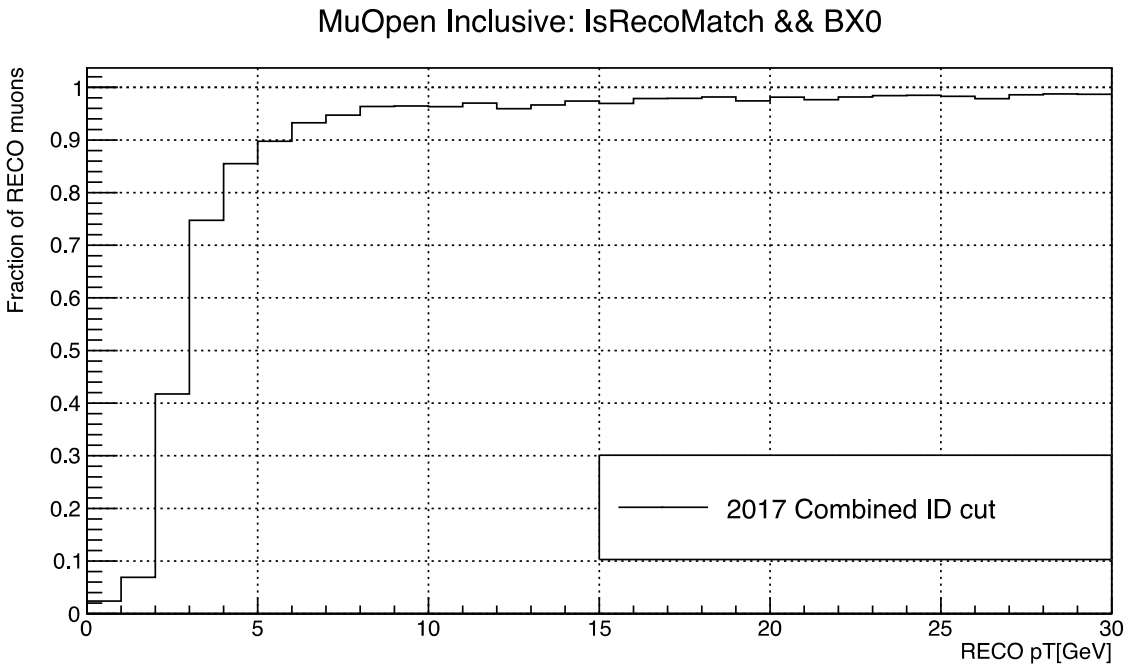
MuOpen Inclusive: Efficiency

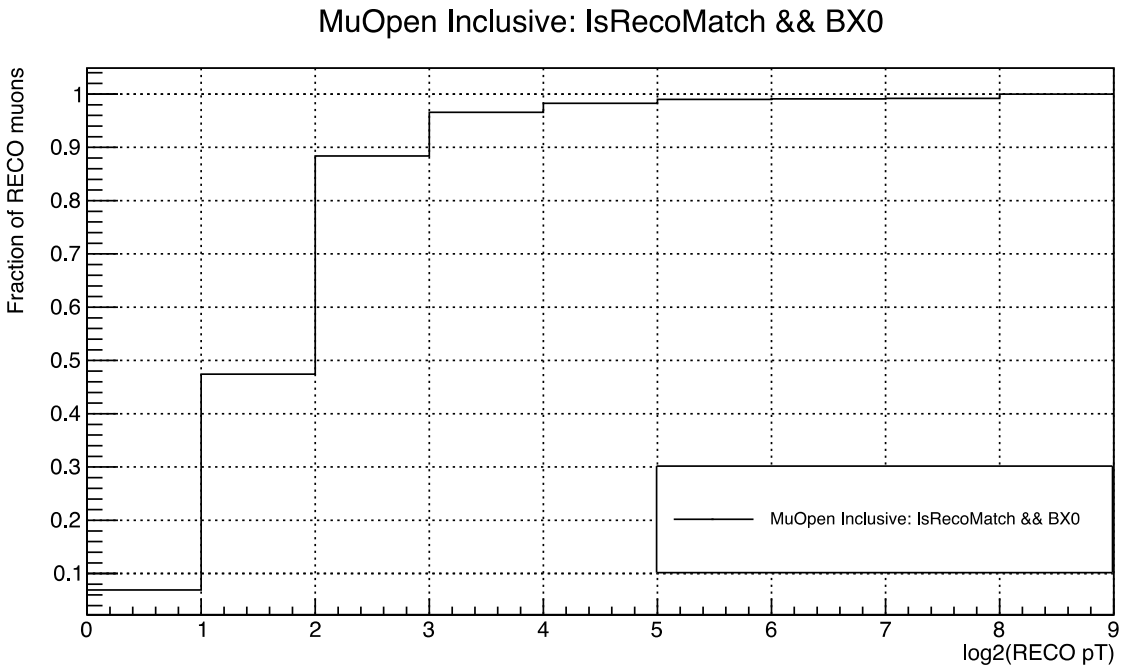




- Require ID
  - pT<64 GeV: medium; pT>64 GeV: tight

MuOpen Inclusive: Efficiency





- Require ID
  - pT < 16 GeV: loose && soft or medium
  - 16 < pT < 64 GeV: medium
  - pT > 64 GeV: tight

Muon Quality

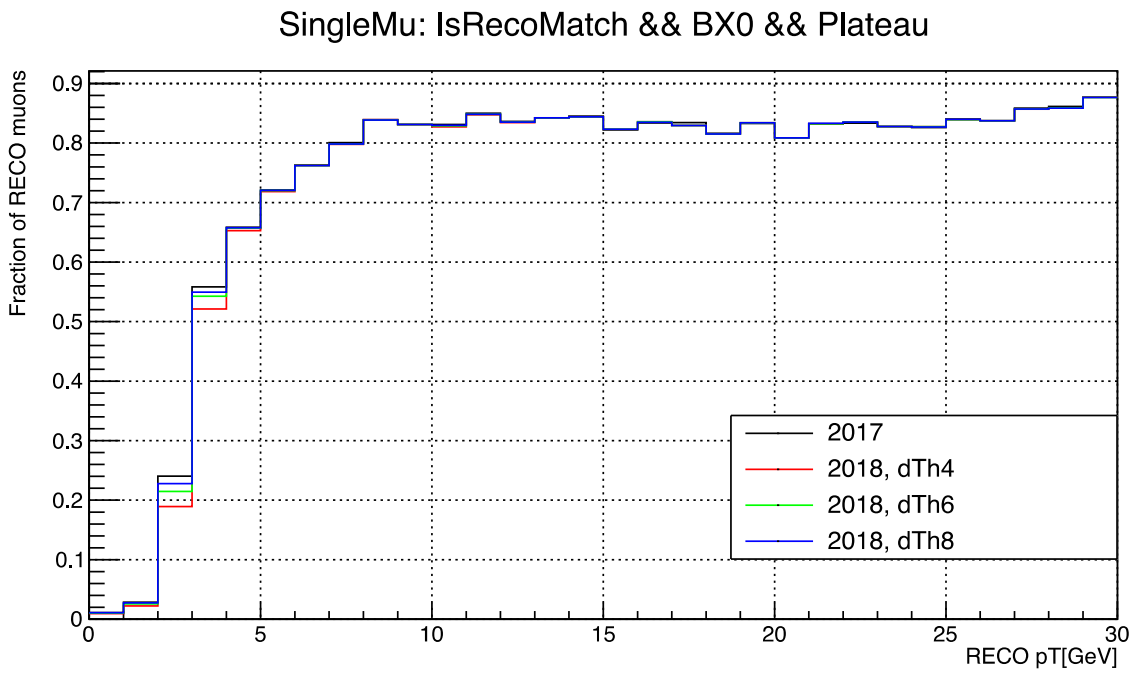
- SingleMu (Q>=12)
  - EMTF mode 15, 14, 13, 11
- DoubleMu (Q>=8)
  - EMTF mode 12, 10, 7
  - EMTF mode 15, 14, 13, 11
- MuOpen (Q>=4)
  - EMTF mode 9, 6, 5, 3
  - EMTF mode 9, 10, 7
  - EMTF mode 15, 14, 13, 11

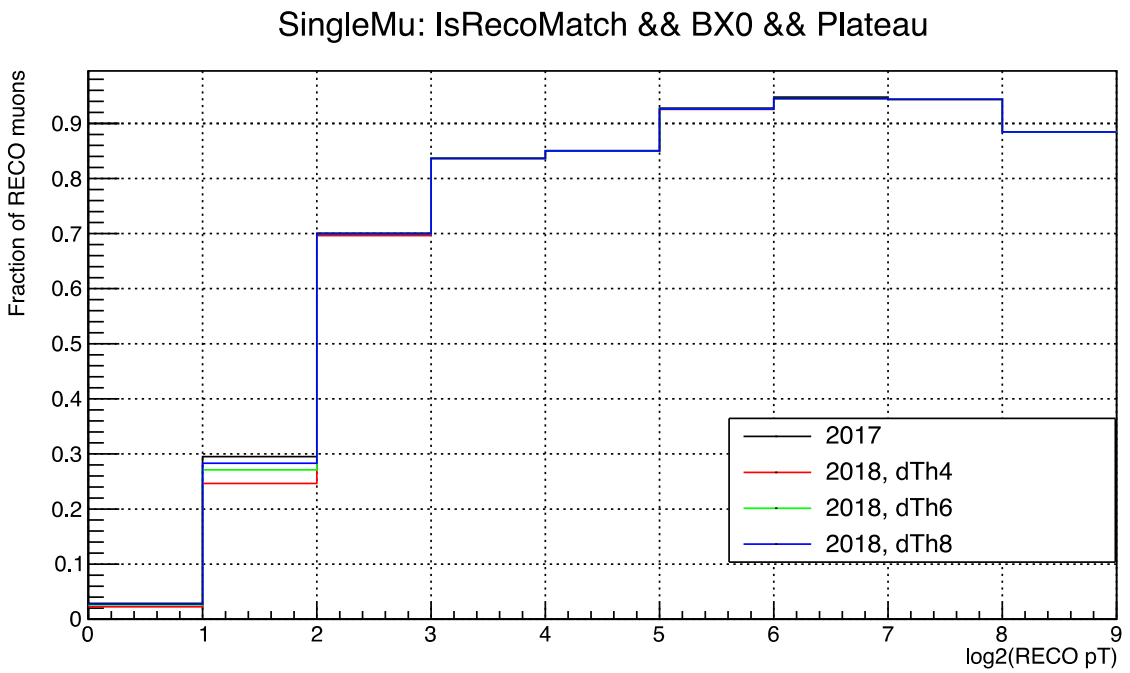
2017 Emulator

- SingleMu Quality (Q>=12)
  - EMTF mode 15, 14, 13, 11
- DoubleMu Quality (Q>=8)
  - EMTF mode 9, 10, 7
  - EMTF mode 15, 14, 13, 11
- MuOpen Quality (Q>=4)
  - EMTF mode 12, 6, 5, 3
  - EMTF mode 9, 10, 7
  - EMTF mode 15, 14, 13, 11

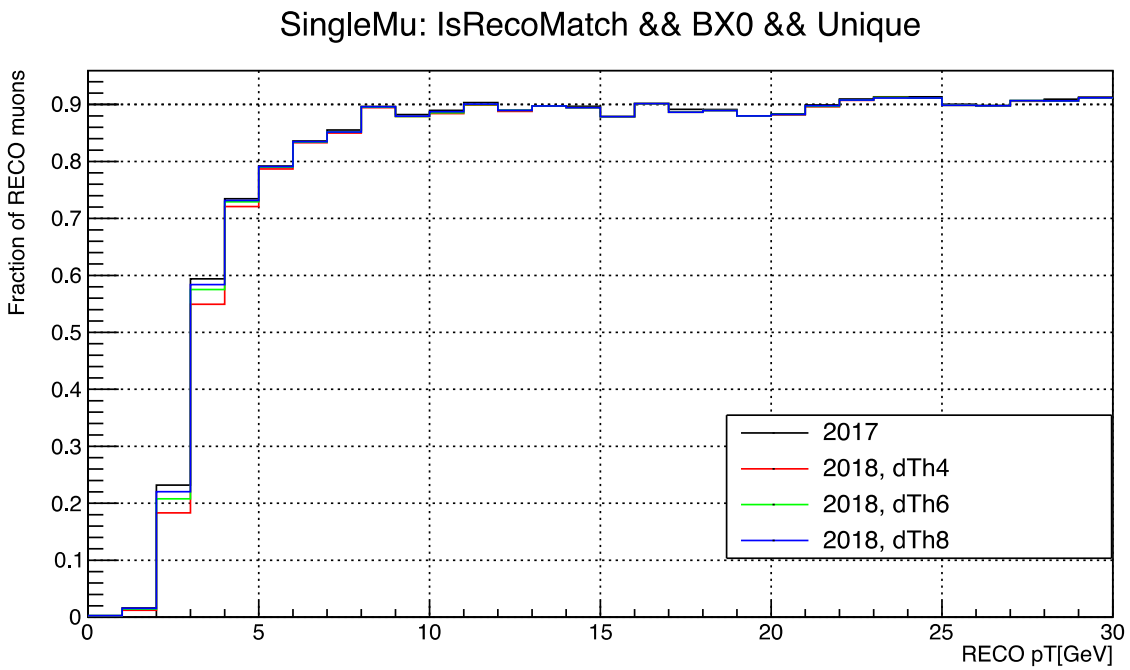
2018 Emulator

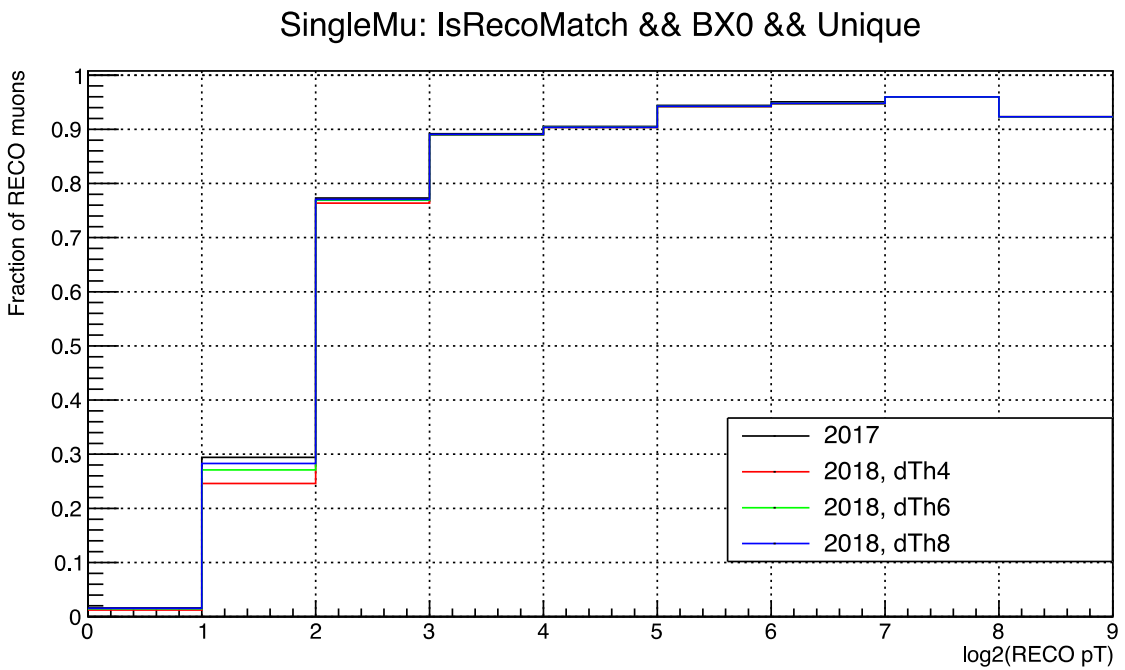
SingleMu: plateau efficiency



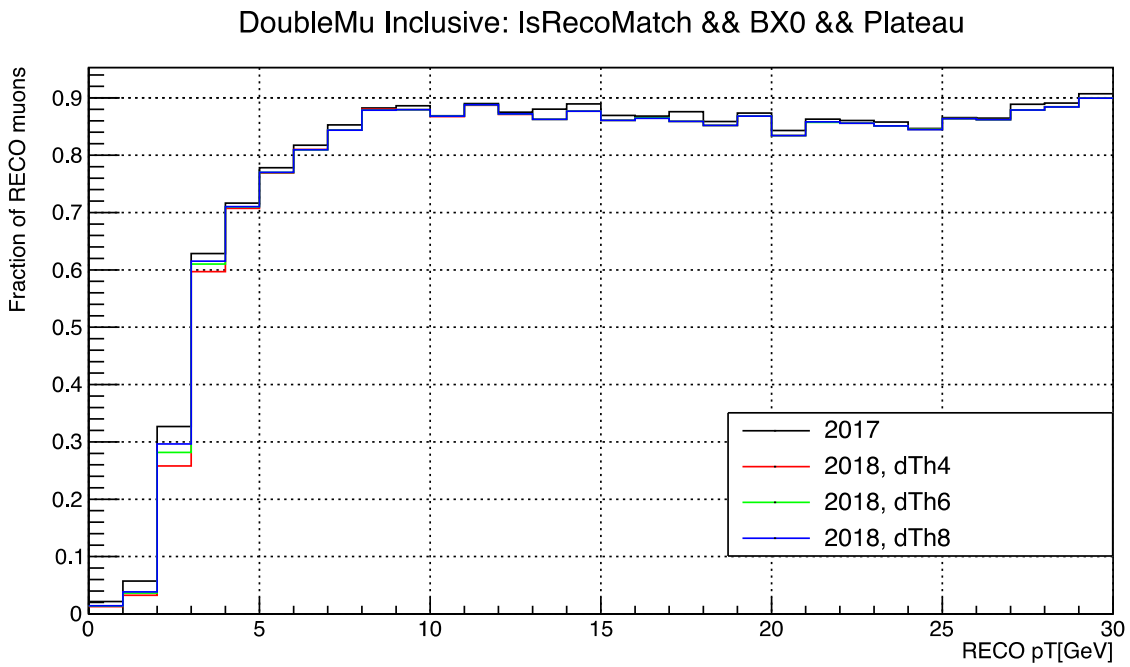


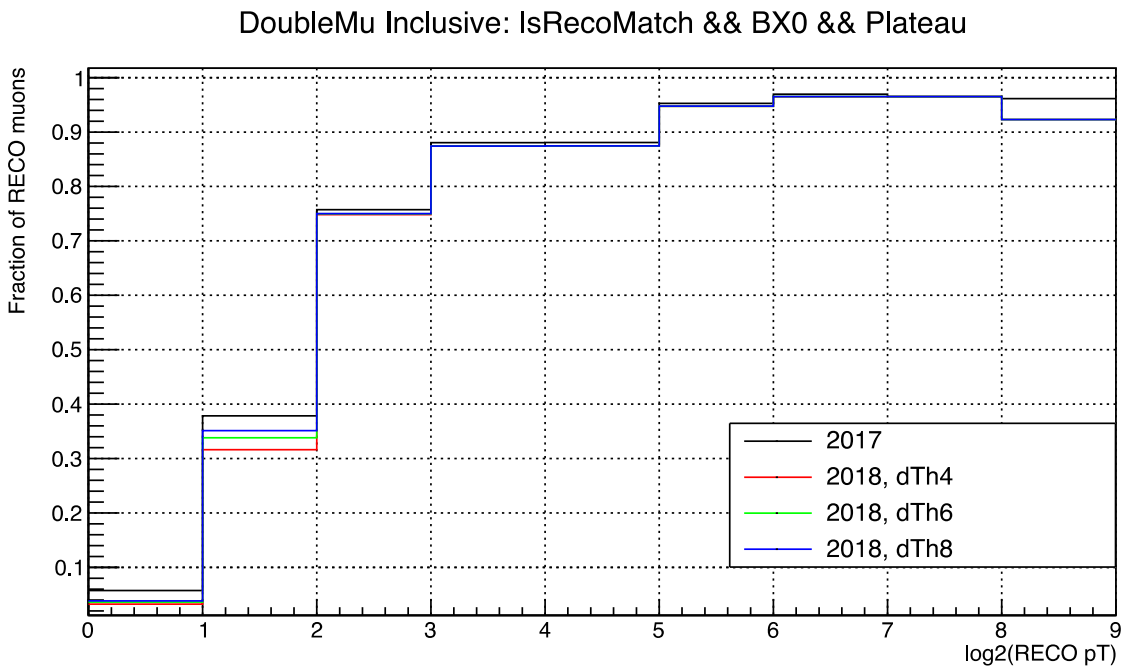
SingleMu: unique match efficiency



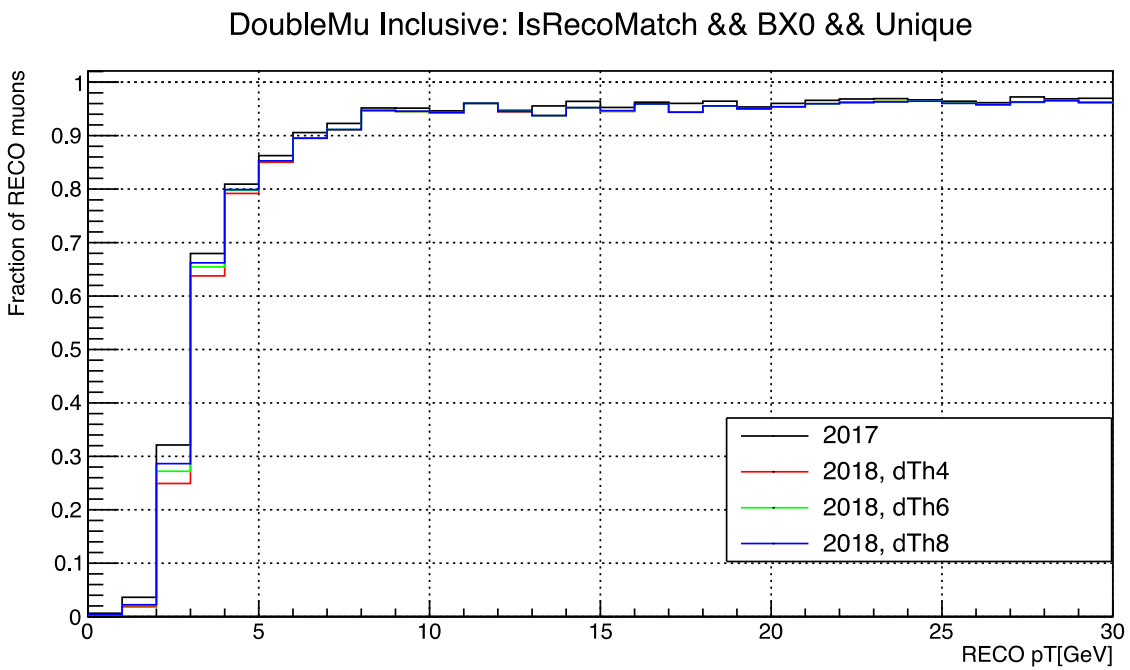


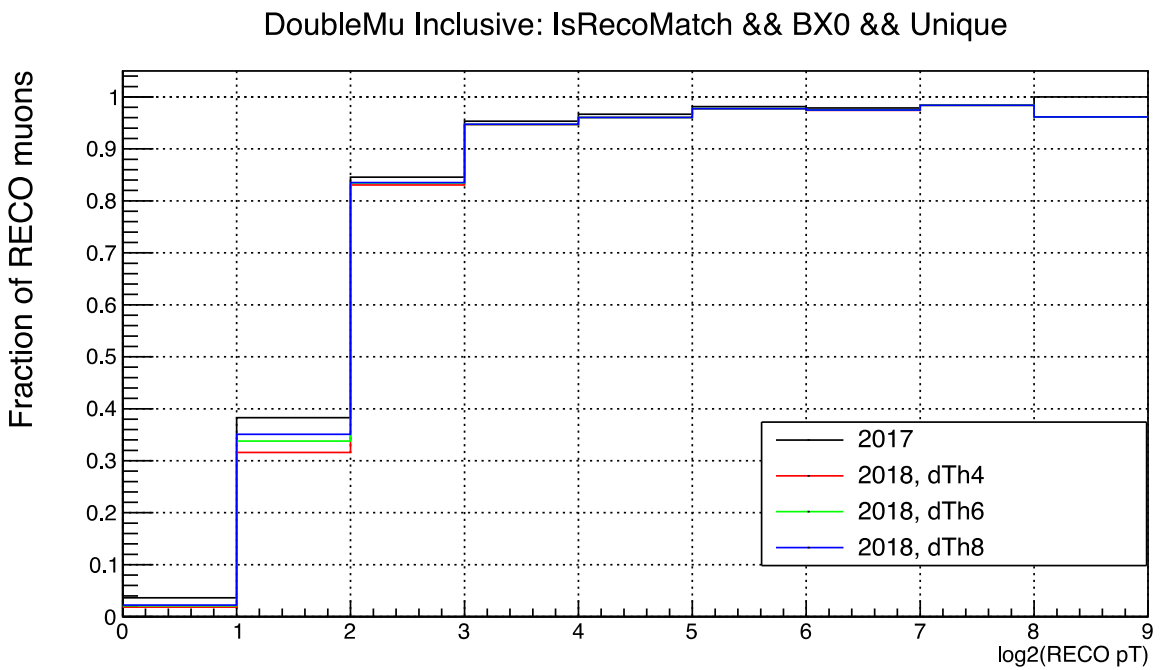
DoubleMu Inclusive: plateau efficiency



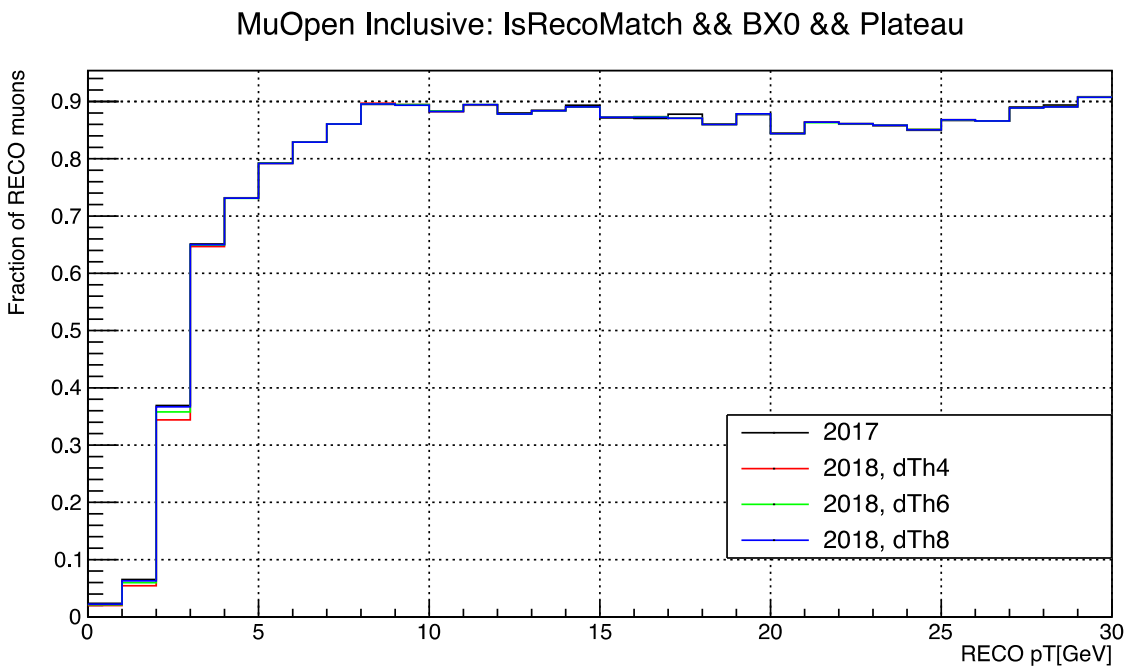


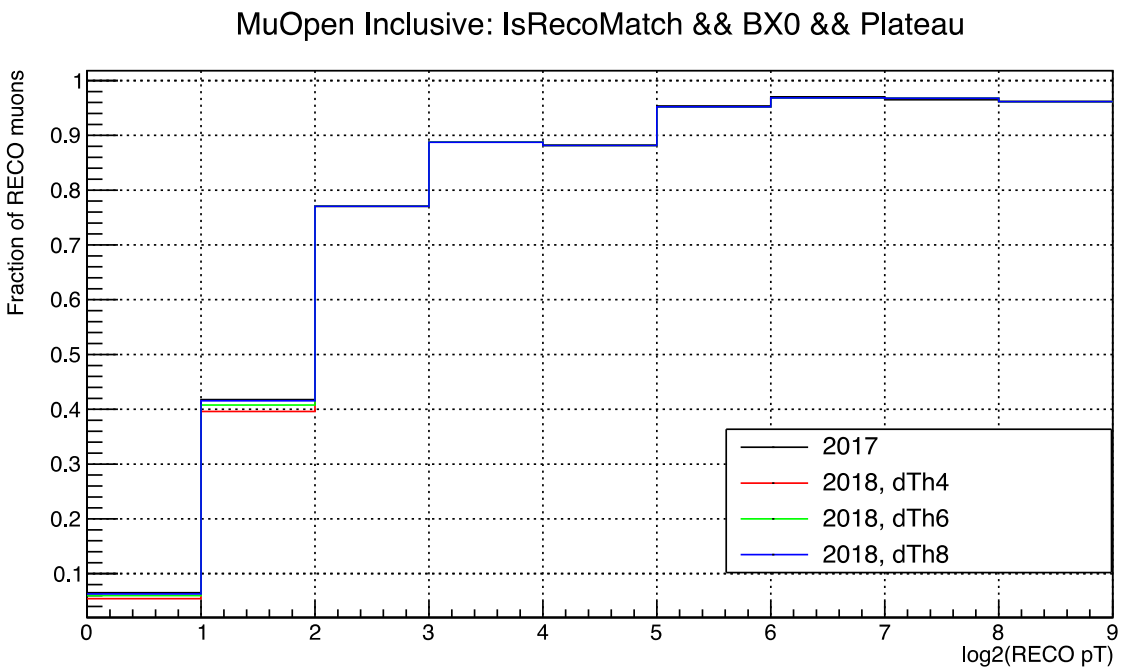
DoubleMu inclusive: unique match efficiency



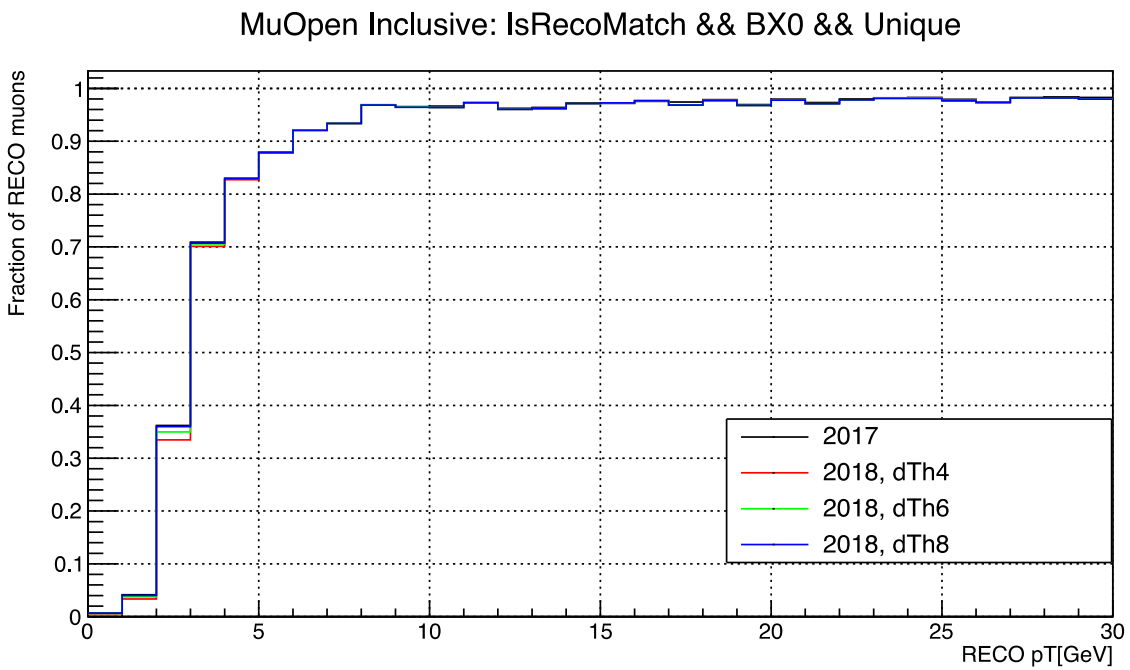


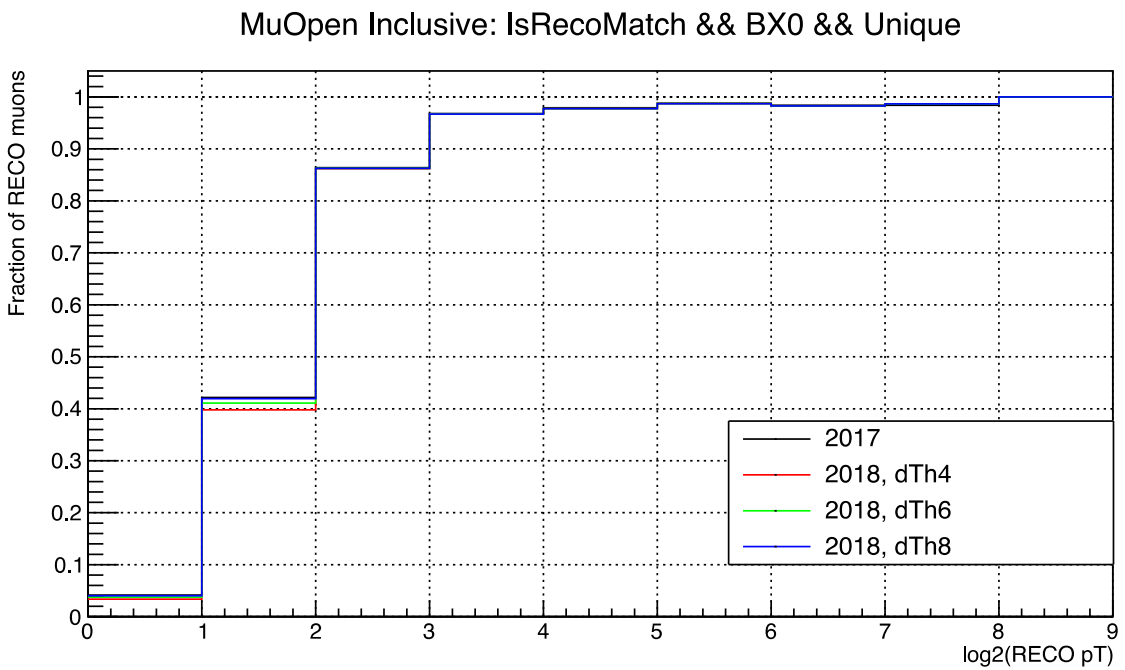
MuOpen Inclusive: plateau efficiency





MuOpen Inclusive: unique match efficiency





EMTF track modes vs Stations

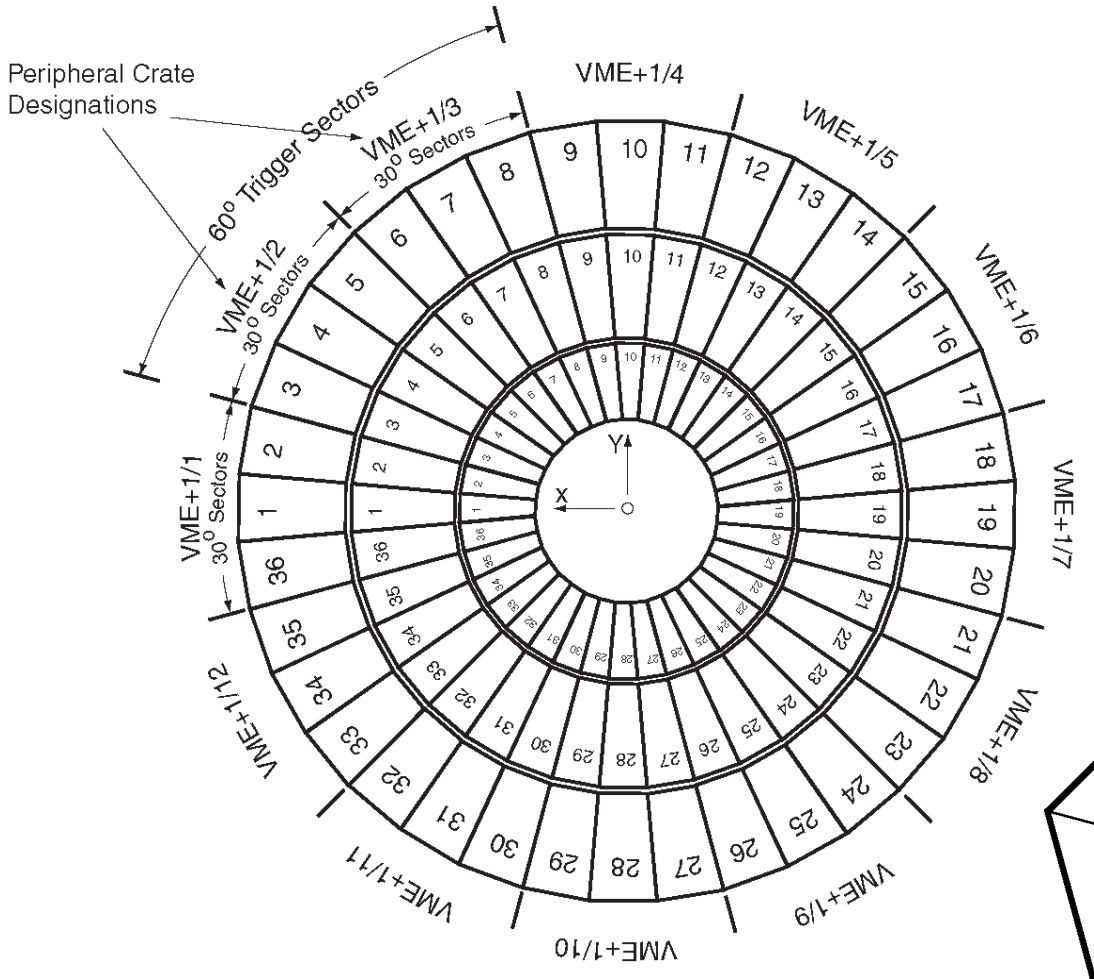
Mode #	Definition	Stations
15	1+2+4+8	1,2,3,4
14	2+4+8	1,2,3
13	1+4+8	1,2,4
12	4+8	1,2
11	1+2+8	1,3,4
10	2+8	1,3
9	1+8	1,4
7	1+2+4	2,3,4
6	2+4	2,3
5	1+4	2,4
3	1+2	3,4

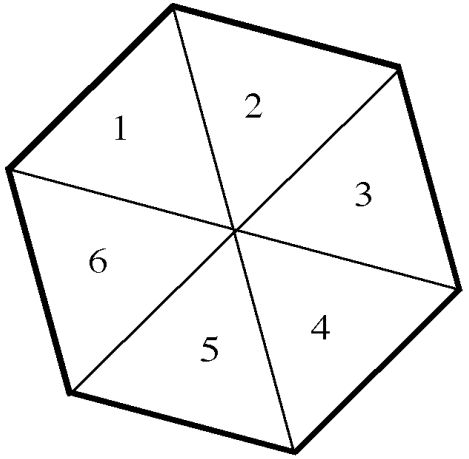
Data Files

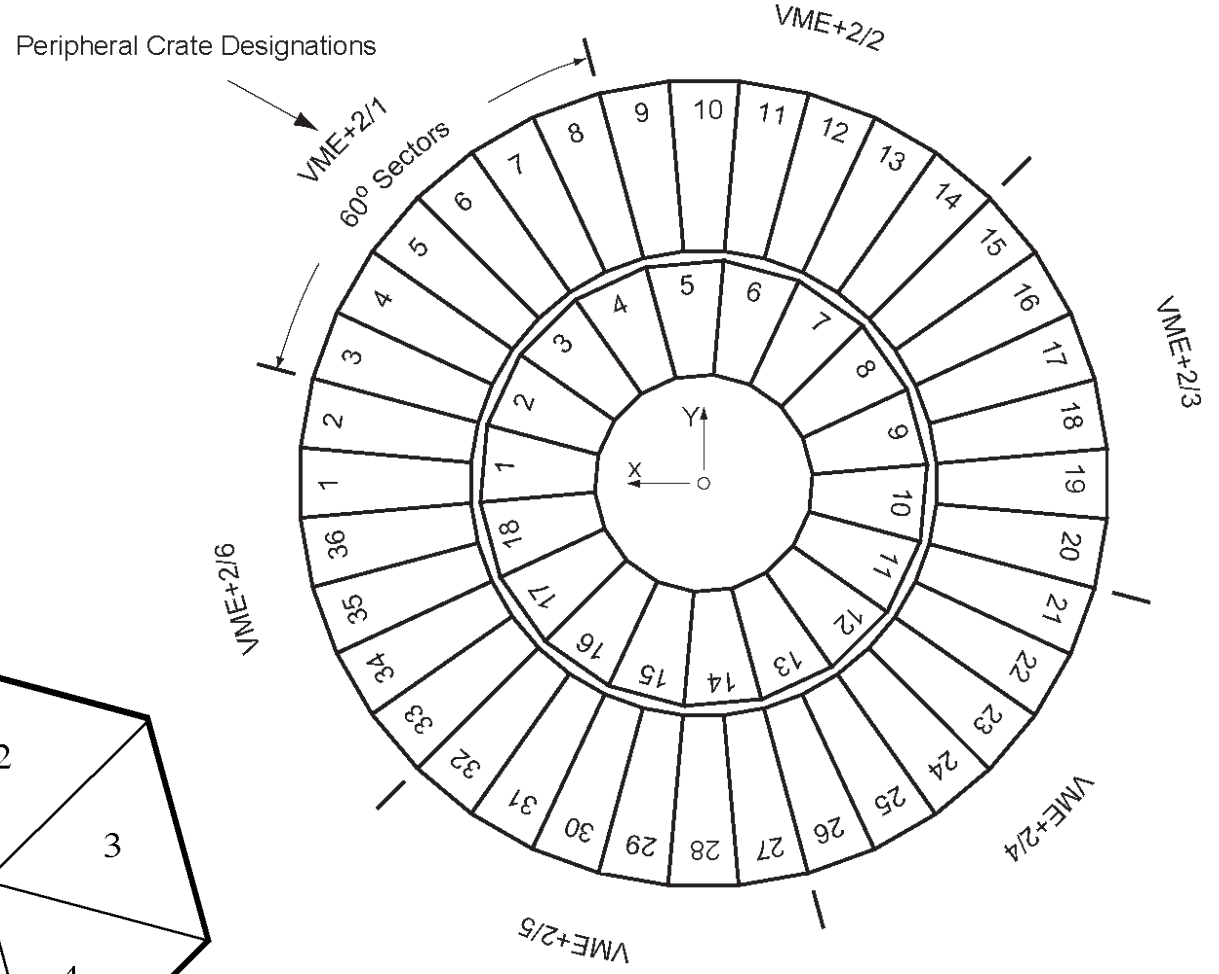
root://eoscms.cern.ch//store/user/abrinke1/EMTF/Emulator/ntuples/HADD/

- 2017
  - NTuple_SingleMuon_FlatNtuple_Run_306154_2018_05_07_SingleMu_2017_emul.root
  - NTuple_ZeroBias1_FlatNtuple_Run_306091_2018_05_07_ZB1_2017_emul.root
  - NTuple_ZeroBias1_FlatNtuple_Run_306091_2018_05_07_ZB1_2017_emul_dBX.root
- 2018
  - NTuple_SingleMuon_FlatNtuple_Run_306154_2018_05_07_SingleMu_2018_emul_dTh4.root
    NTuple_SingleMuon_FlatNtuple_Run_306154_2018_05_07_SingleMu_2018_emul_dTh6.root
    NTuple_SingleMuon_FlatNtuple_Run_306154_2018_05_07_SingleMu_2018_emul_dTh8.root
  - NTuple_ZeroBias1_FlatNtuple_Run_306091_2018_05_07_ZB1_2018_emul_dTh4.root
    NTuple_ZeroBias1_FlatNtuple_Run_306091_2018_05_07_ZB1_2018_emul_dTh6.root
    NTuple_ZeroBias1_FlatNtuple_Run_306091_2018_05_07_ZB1_2018_emul_dTh8.root

CSC Geometry



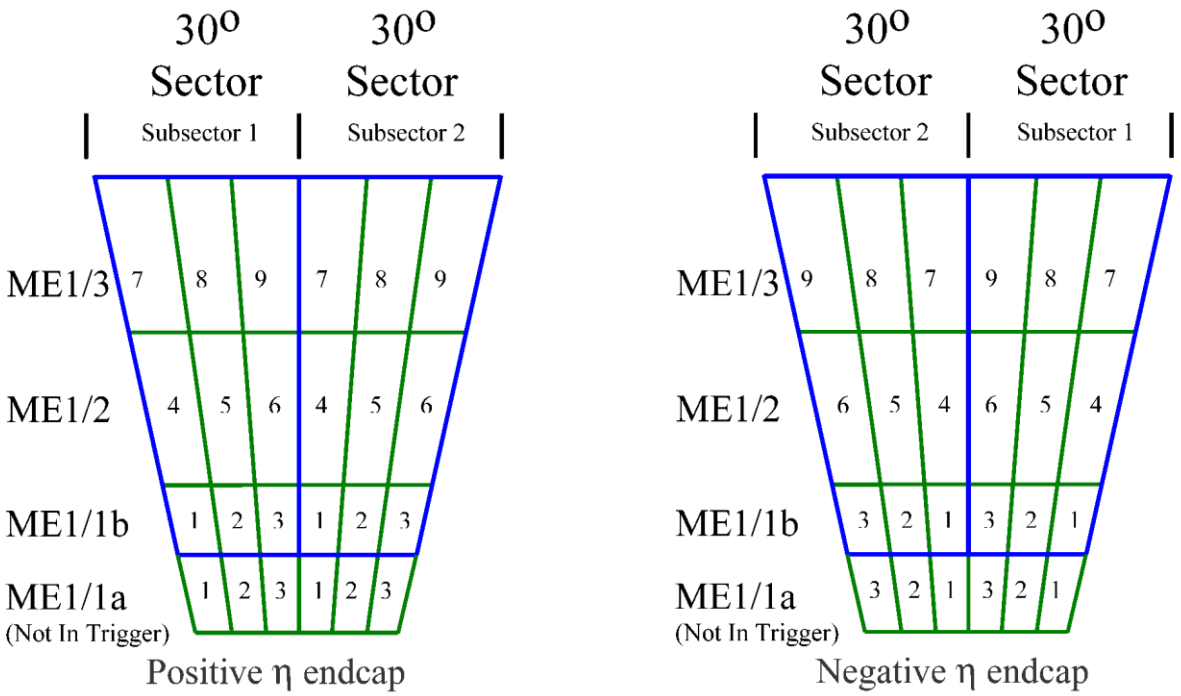




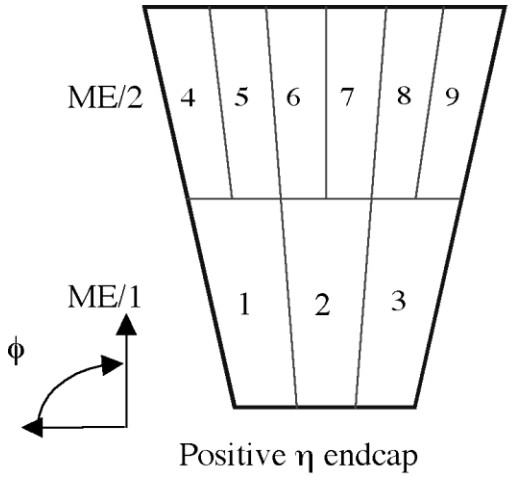
Station 1

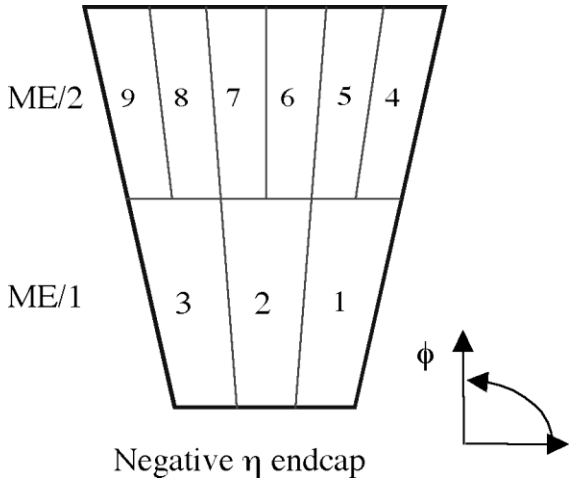
Station 2, 3, 4

CSCs in a trigger sector



Station 1





Station 2, 3, 4