



# 2018 EMTF Emulator Study

EMTF Working Meeting

Wei Shi

# Basics

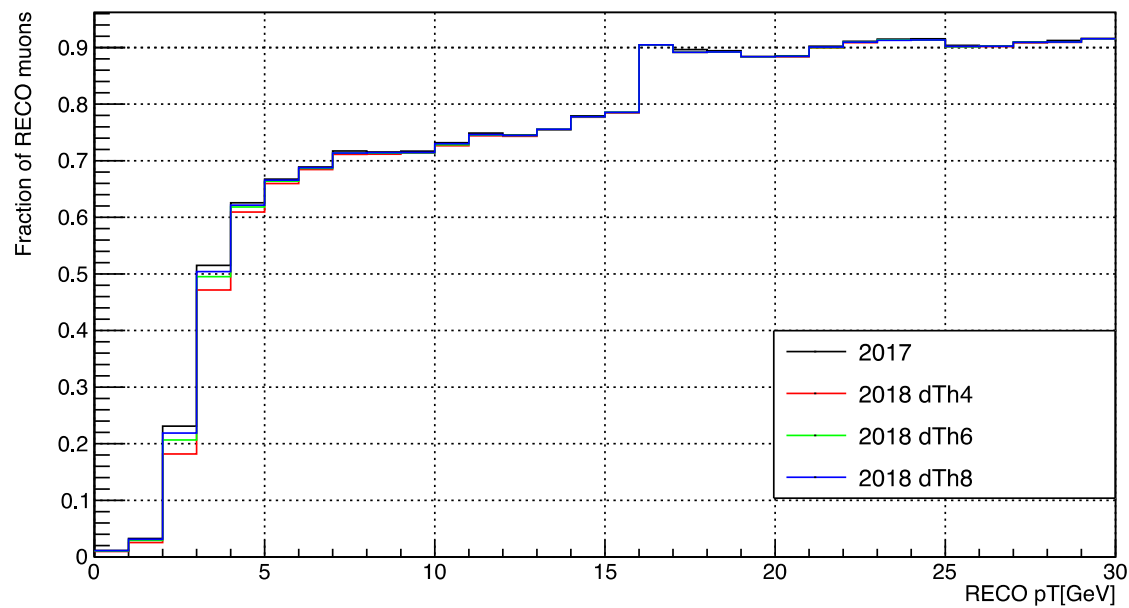
- 2018 Emulator Changes
  - BX window changed from 3→2
  - 2-station tracks with different hit BX removed
  - dTheta ambiguity when multiple LCTs are in the same chamber resolved
  - Mode 9 promoted to DoubleMu and mode 12 demote to MuOpen
  - Maximum dTheta for “Zone 0” (ring 1) changed from 8 to 4

# Basics

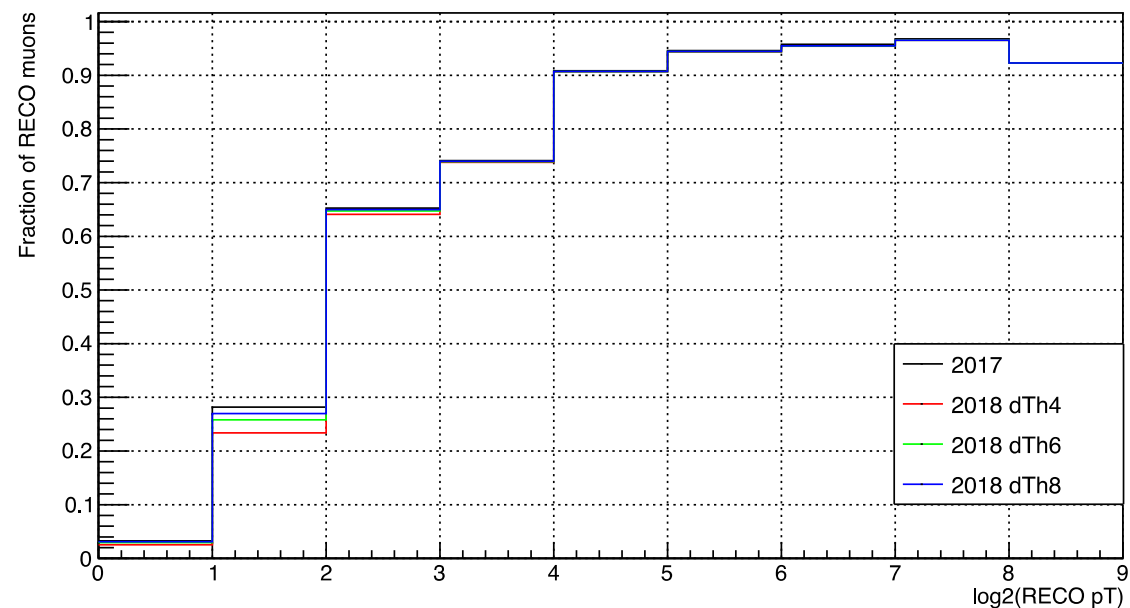
- Remove biased events
  - HLT\_IsoMu27 or HLT\_Mu50
  - Only use RECO muons in events
    - $n\text{RecoMuonsTrig} \geq 2$
    - $n\text{RecoMuonsTrig} == 1 \ \&\& \ n\text{RecoMuonsTrigCen} == 1 \ \&\& \ \text{reco\_trig\_ID} < 0$
- Selection on RECO muons
  - Eta and eta@station1 in (1.25, 2.4); loose ID; medium\_ID or  $pt < 16$ ; tight ID or  $pt < 64$
- Rate
  - $\text{Trk\_BX} = 0$ ;  $\text{trk\_mode} \neq \text{trk\_mode\_neighbour}$ ;  $\text{abs}(\text{eta}) > 1.25$
- 2018 Emulator
  - dTh4: 1487898 events, dTh6: 1475029 events, dTh8: 1487898 events
- 2017
  - 1487898 events

# SingleMu: Efficiency

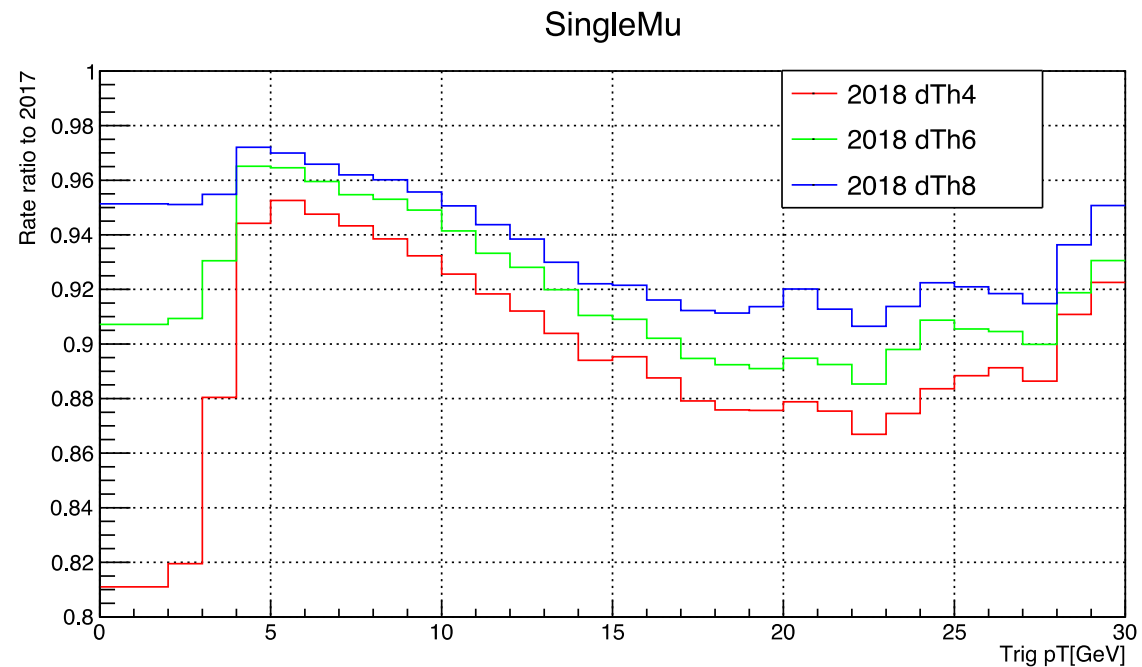
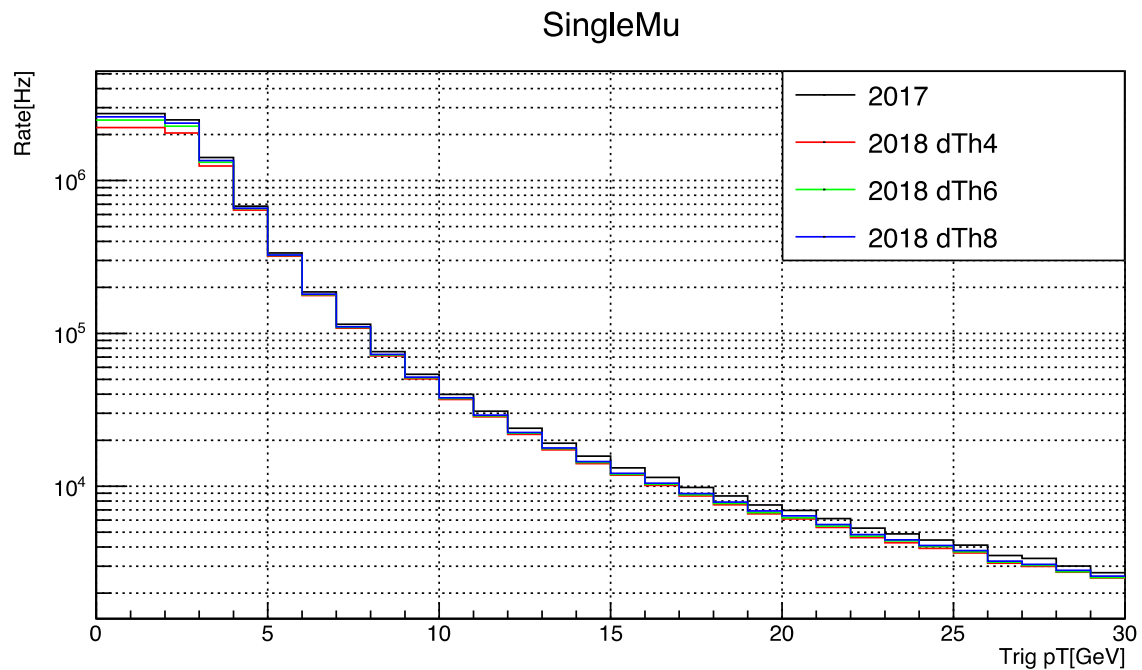
SingleMu: IsRecoMatch && BX0



SingleMu: IsRecoMatch && BX0

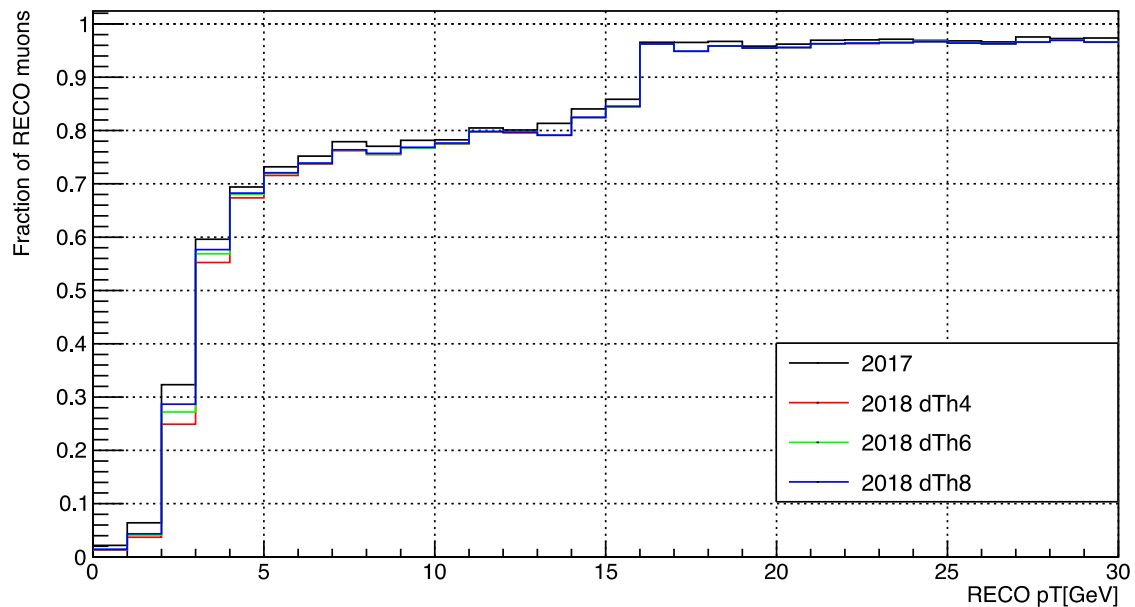


# SingleMu: Rate

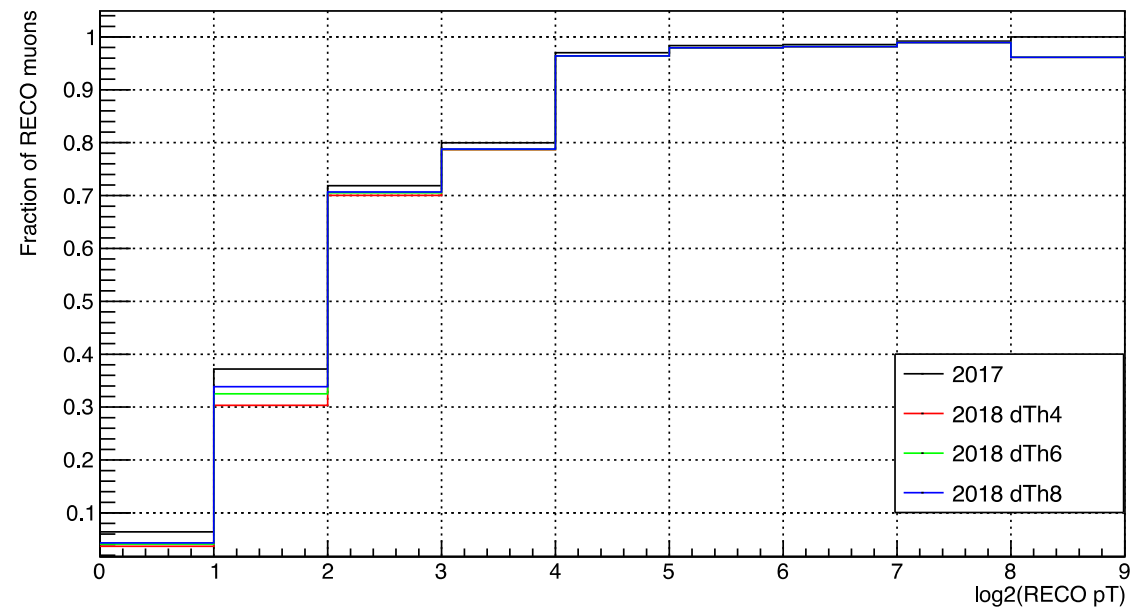


# DoubleMu Inclusive: Efficiency

DoubleMu Inclusive: IsRecoMatch && BX0

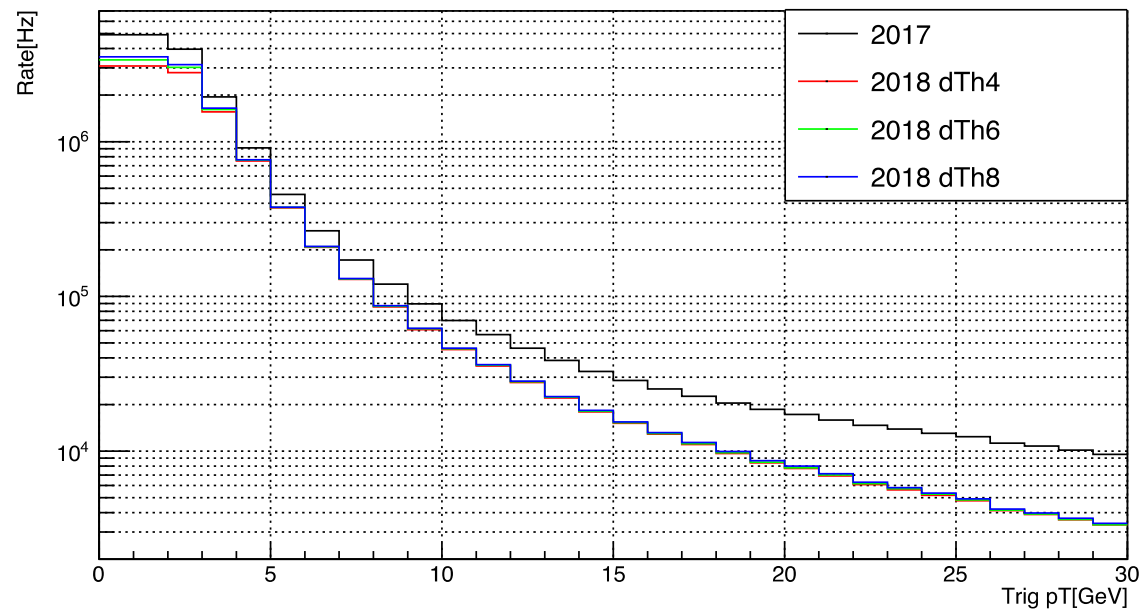


DoubleMu Inclusive: IsRecoMatch && BX0

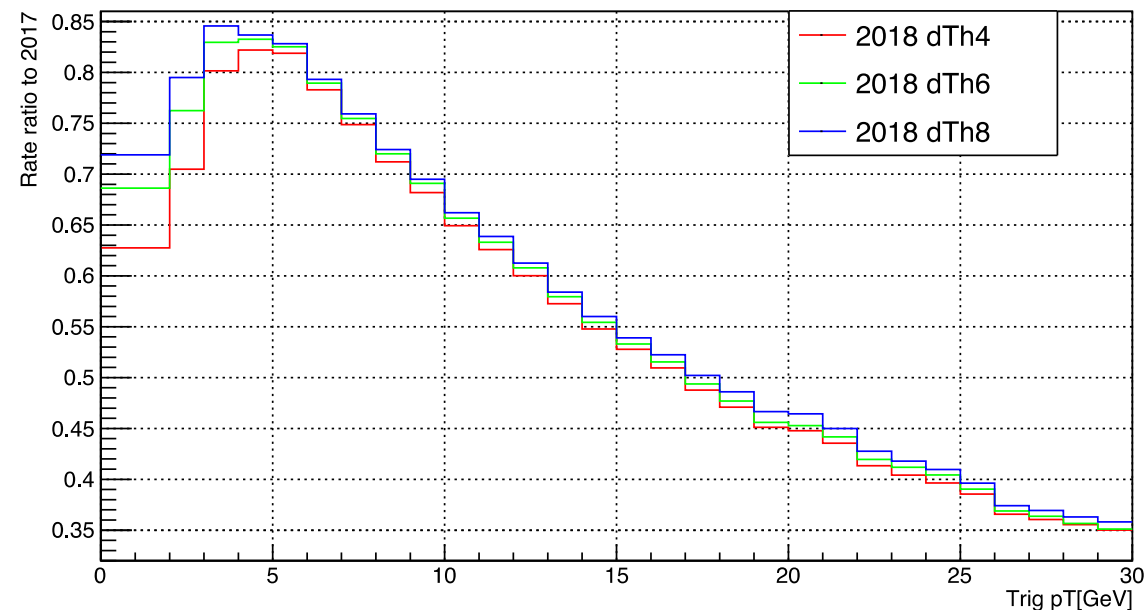


# DoubleMu Inclusive: Rate

DoubleMu Inclusive

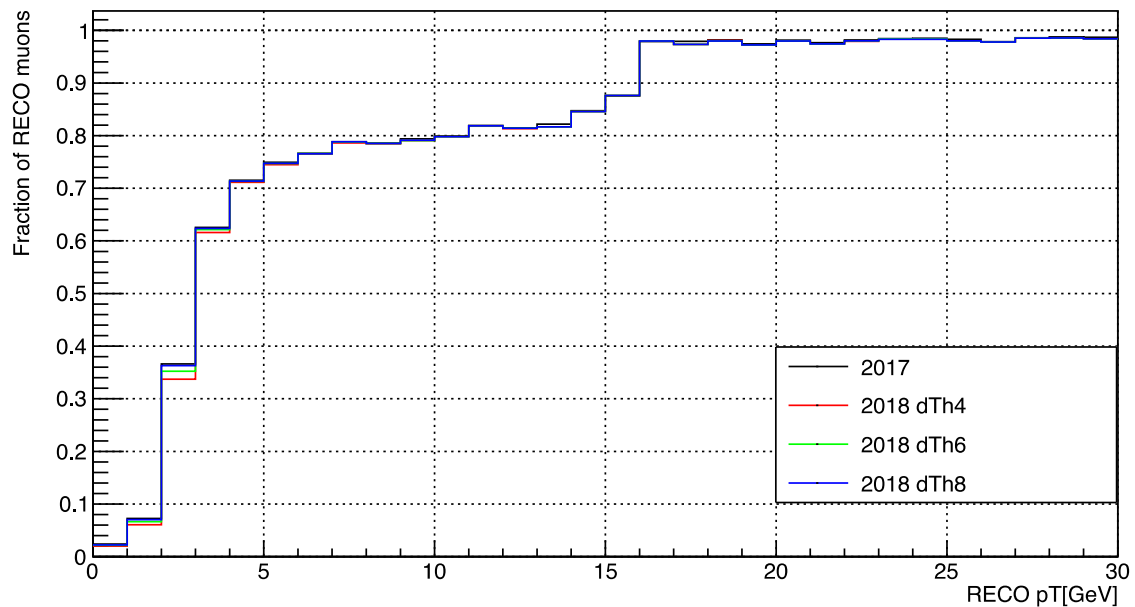


DoubleMu Inclusive

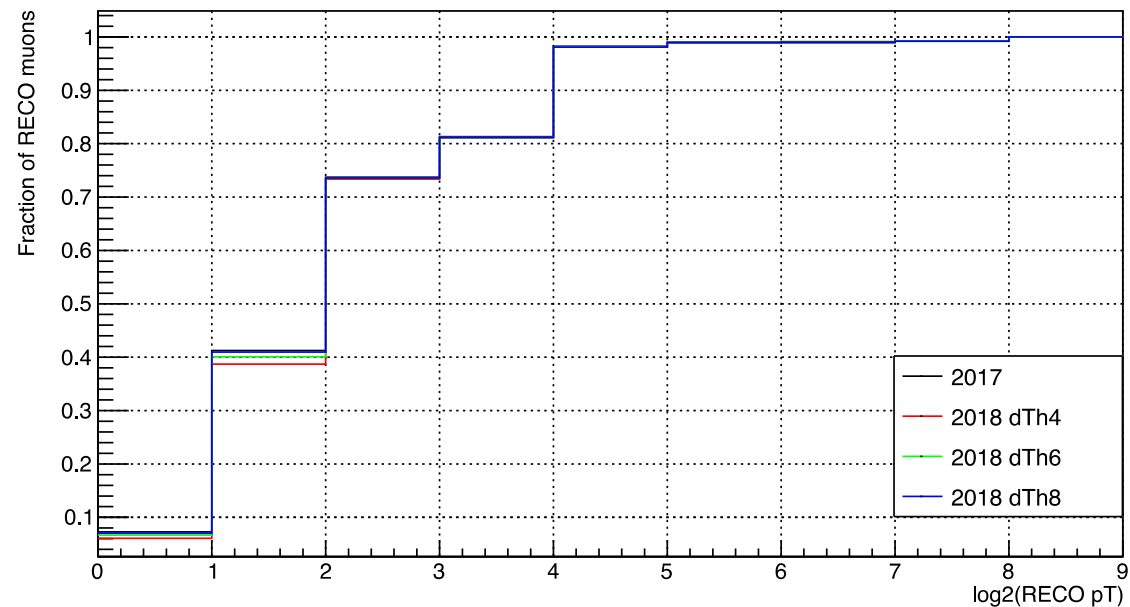


# MuOpen Inclusive: Efficiency

MuOpen Inclusive: IsRecoMatch && BX0



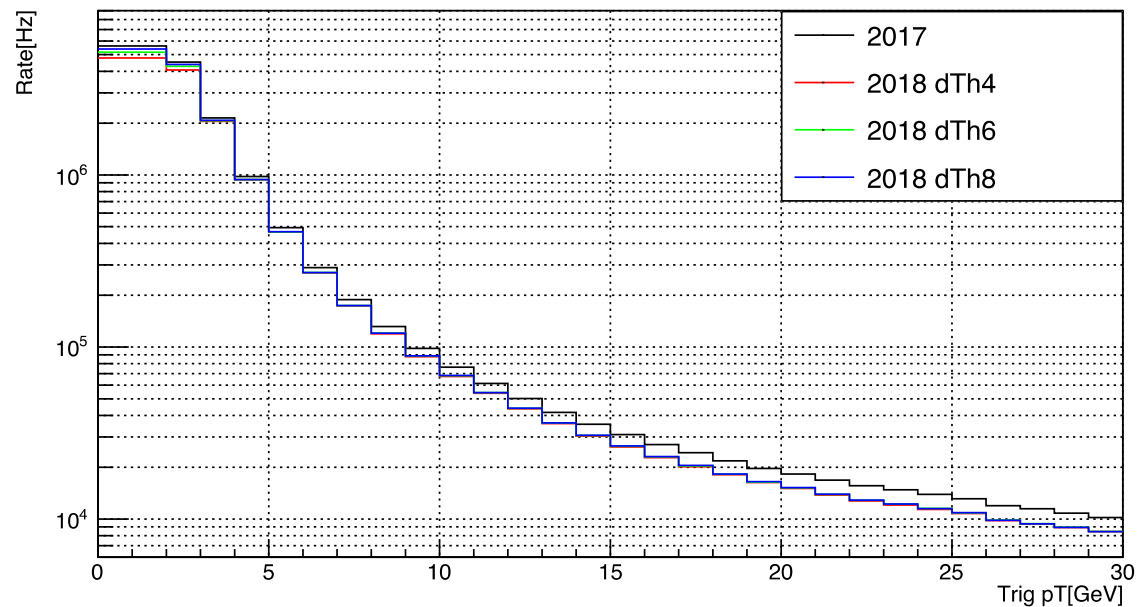
MuOpen Inclusive: IsRecoMatch && BX0



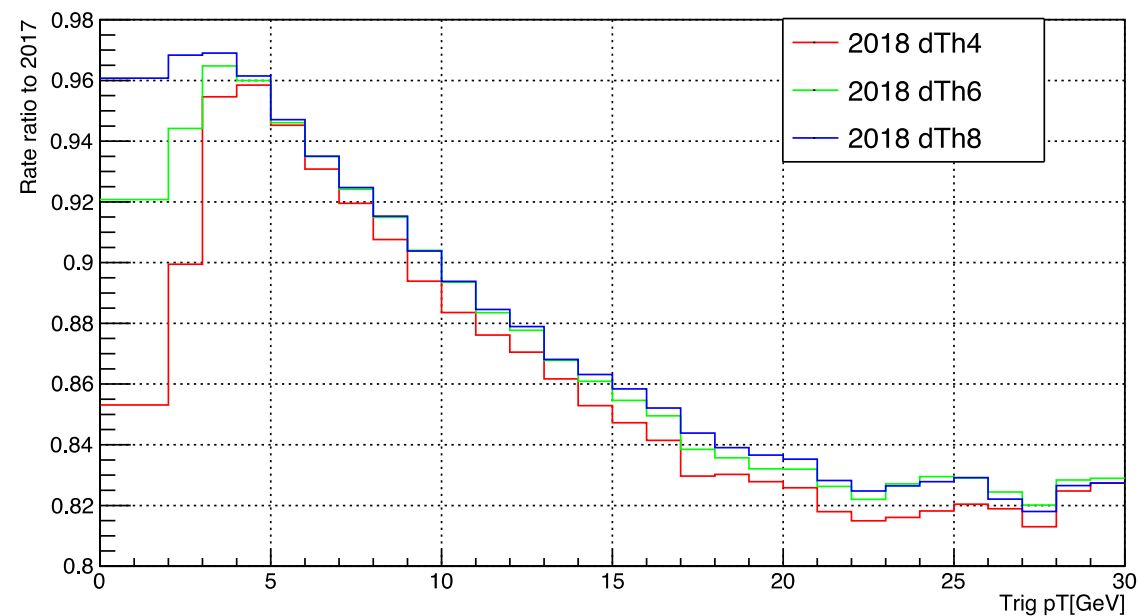


# MuOpen Inclusive: Rate

MuOpen Inclusive



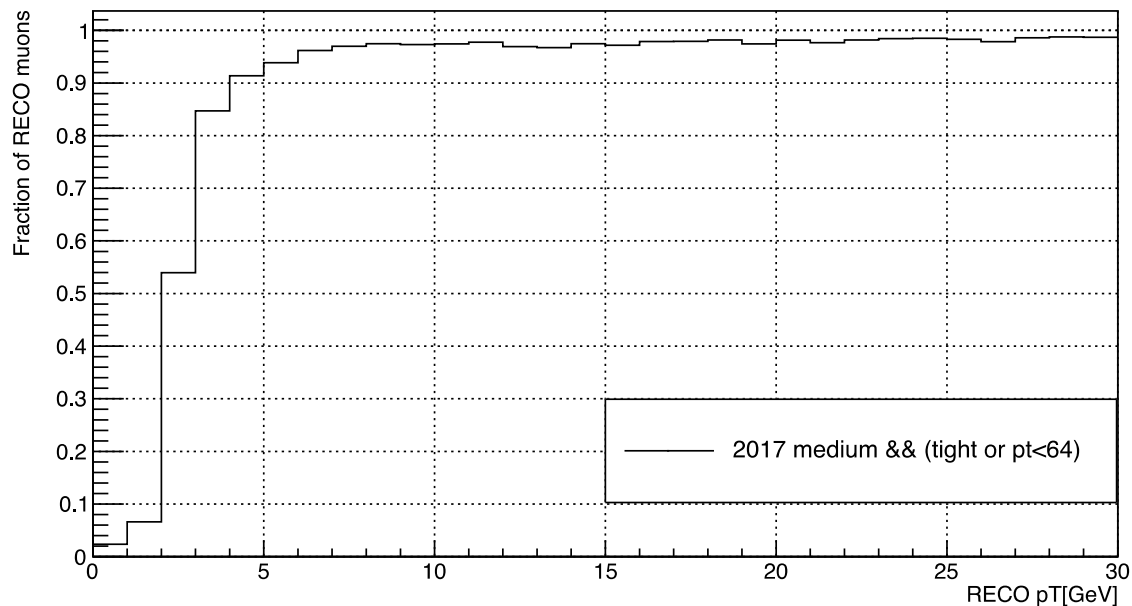
MuOpen Inclusive



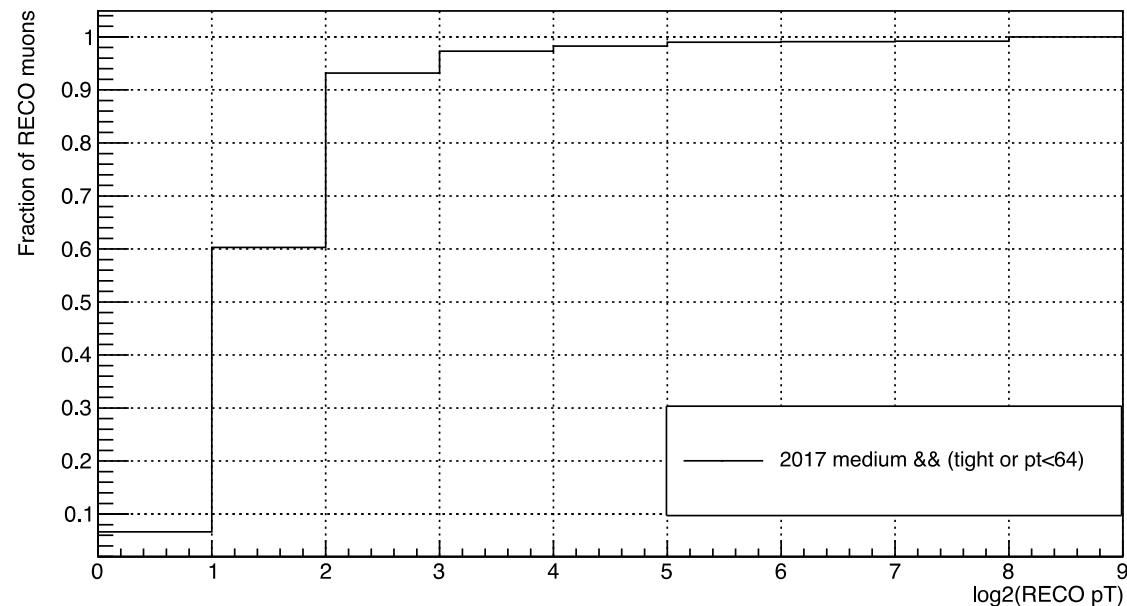
# Back Up

# MuOpen Inclusive: Efficiency

MuOpen Inclusive: IsRecoMatch && BX0



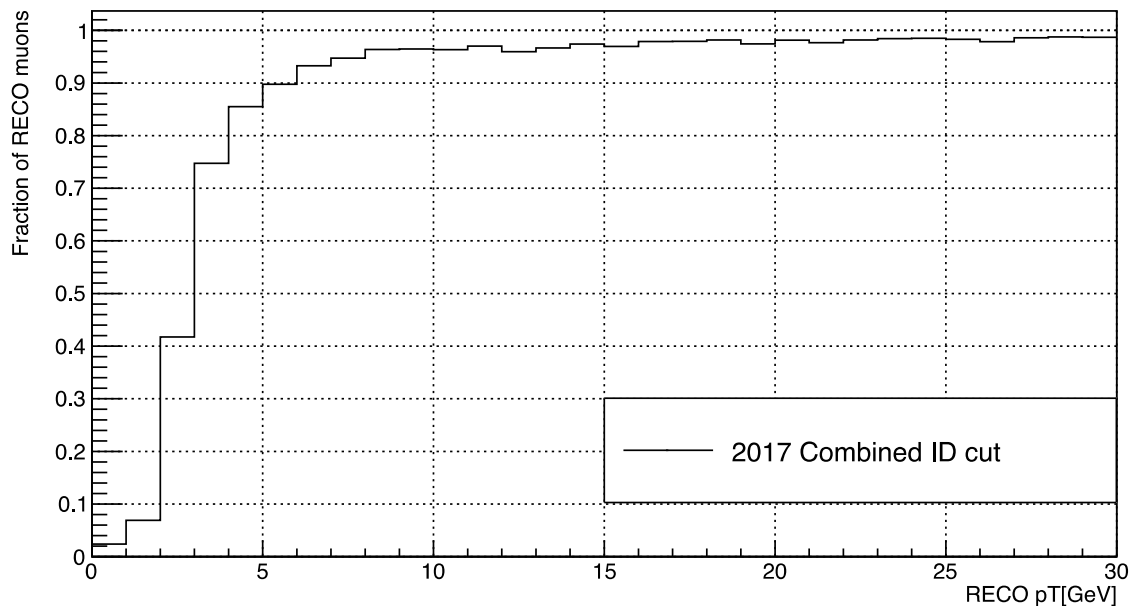
MuOpen Inclusive: IsRecoMatch && BX0



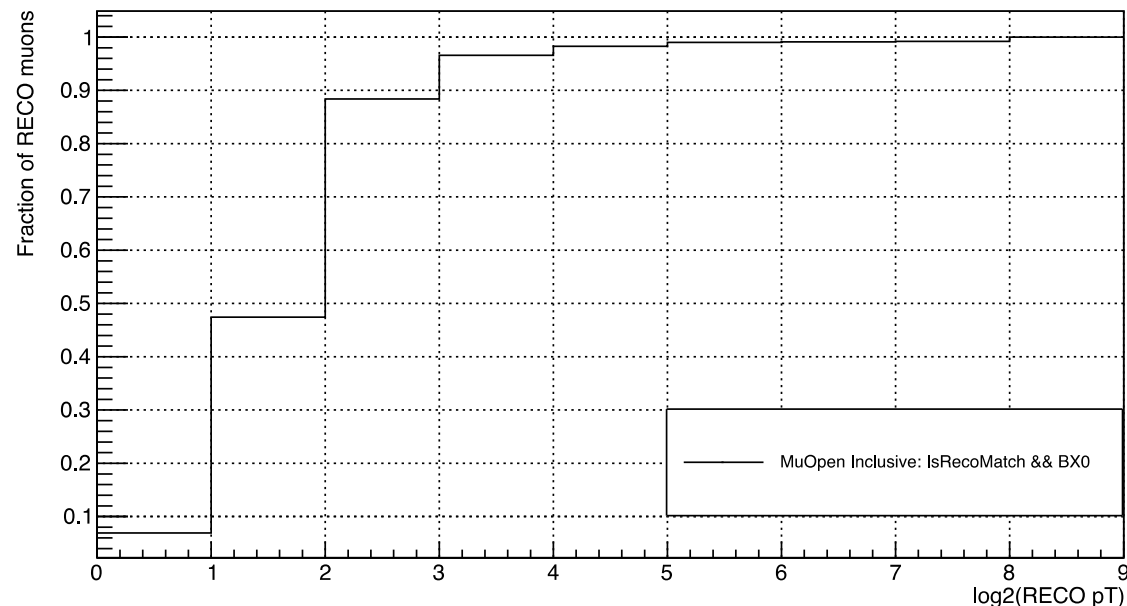
- Require
  - `reco_ID_medium == 1 && (reco_pt < 64 || reco_ID_tight == 1)`

# MuOpen Inclusive: Efficiency

MuOpen Inclusive: IsRecoMatch && BX0



MuOpen Inclusive: IsRecoMatch && BX0



- Require
  - $((\text{reco\_ID\_loose} == 1 \ \&\& \ \text{reco\_ID\_soft} == 1) \ || \ \text{reco\_ID\_medium} == 1) \ \&\& \ (\text{reco\_pt} < 16 \ || \ \text{reco\_ID\_medium} == 1) \ \&\& \ (\text{reco\_pt} < 64 \ || \ \text{reco\_ID\_tight} == 1)$

# Muon Quality

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

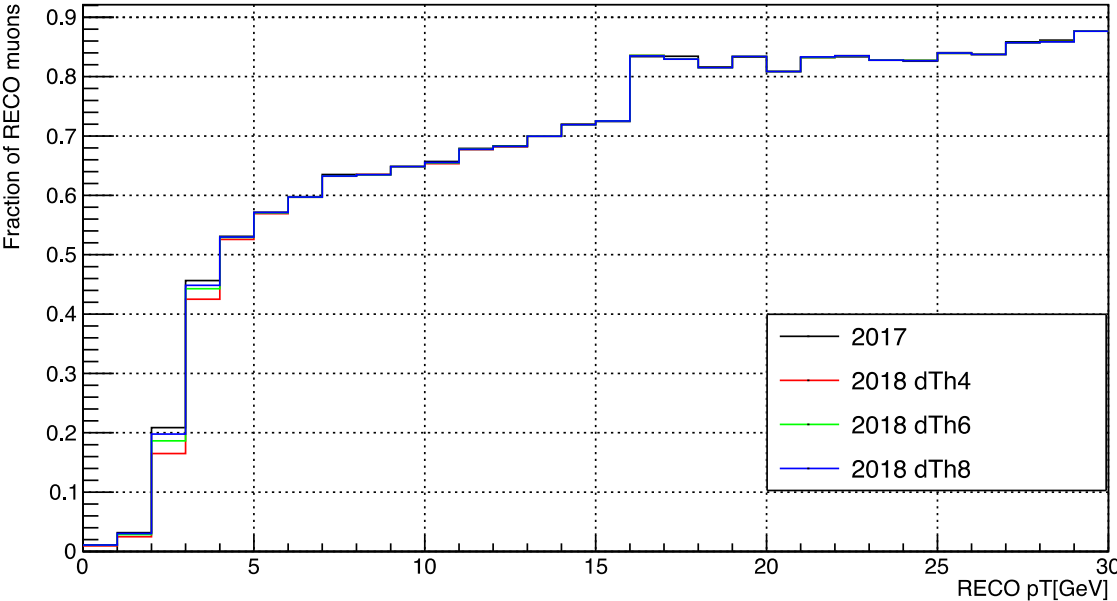
2017 Emulator

- SingleMu Quality ( $Q \geq 12$ )
  - EMTF mode 15, 14, 13, 11
- DoubleMu Quality ( $Q \geq 8$ )
  - EMTF mode **9**, 10, 7
  - EMTF mode 15, 14, 13, 11
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  - EMTF mode 9, 10, 7
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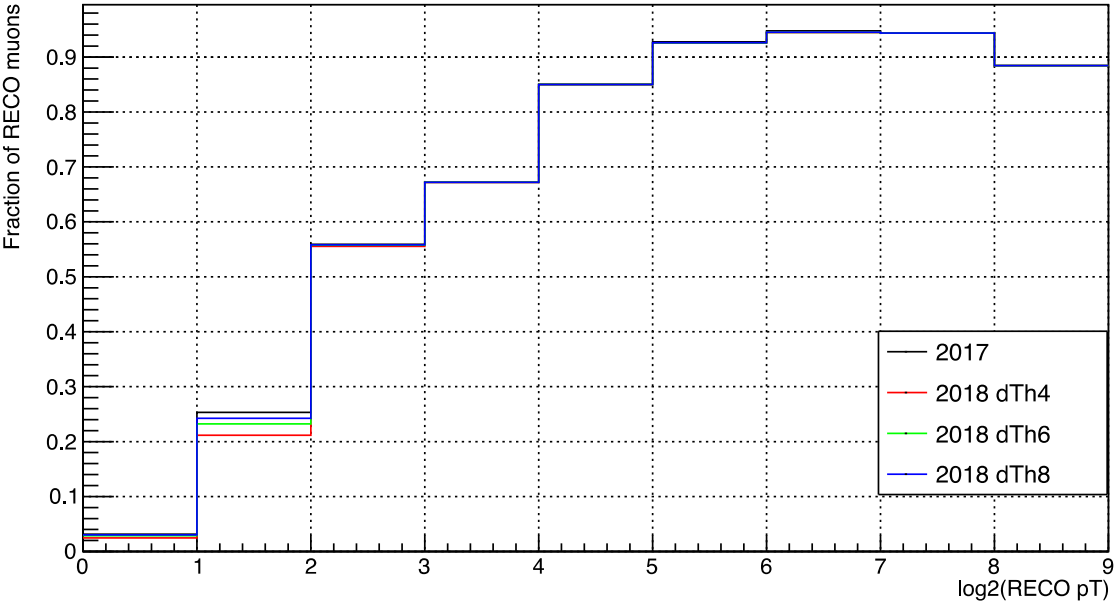
2018 Emulator

# SingleMu: Plateau Efficiency

SingleMu: IsRecoMatch && BX0 && Plateau

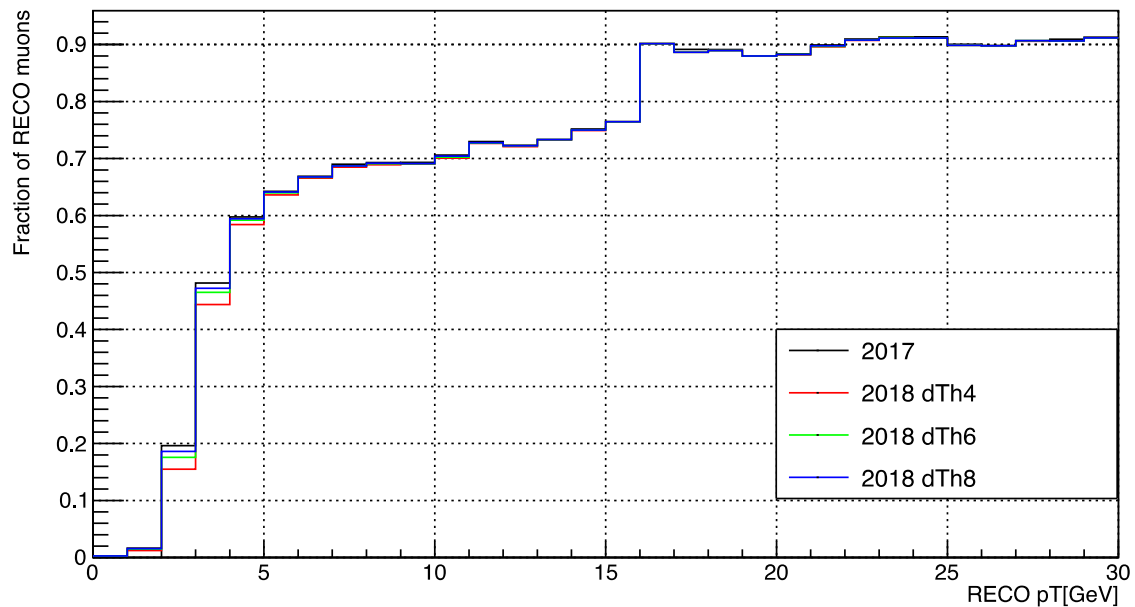


SingleMu: IsRecoMatch && BX0 && Plateau

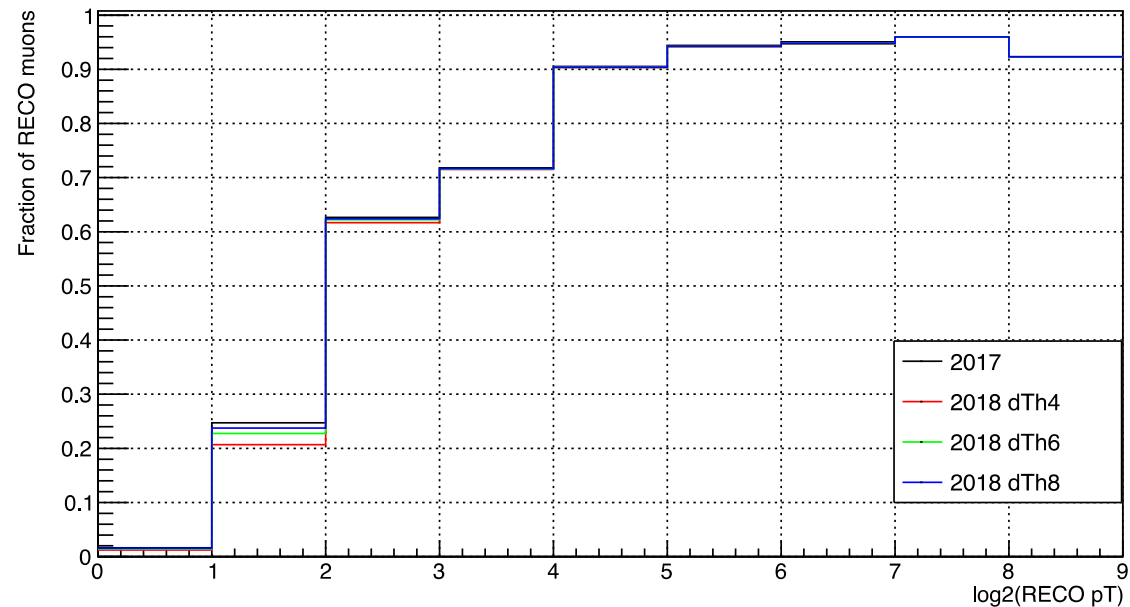


# SingleMu: Efficiency (match unique)

SingleMu: IsRecoMatch && BX0 && Unique

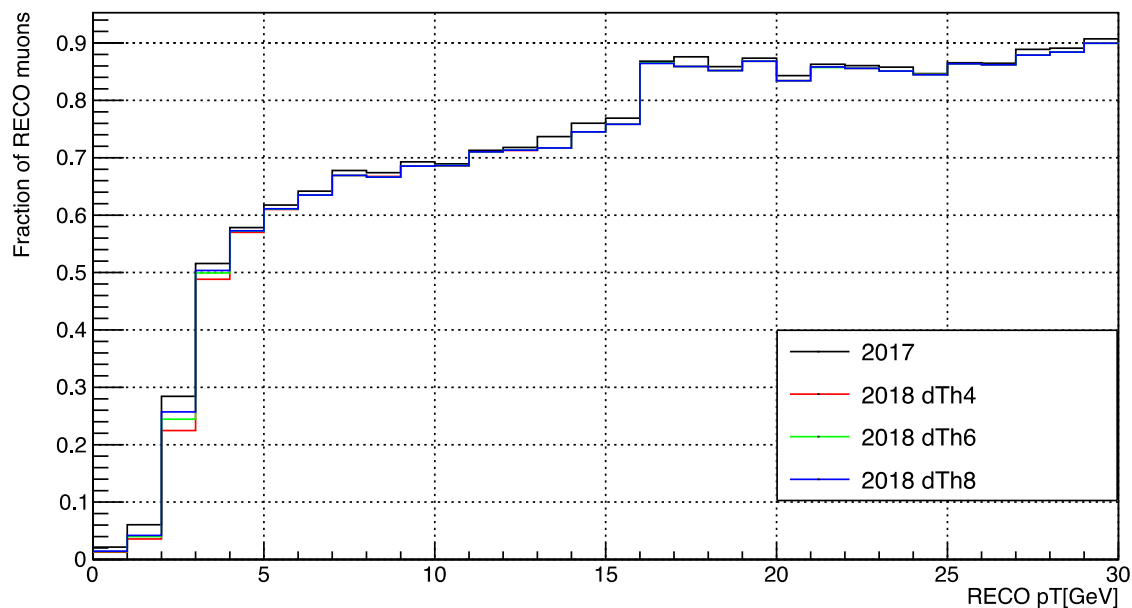


SingleMu: IsRecoMatch && BX0 && Unique

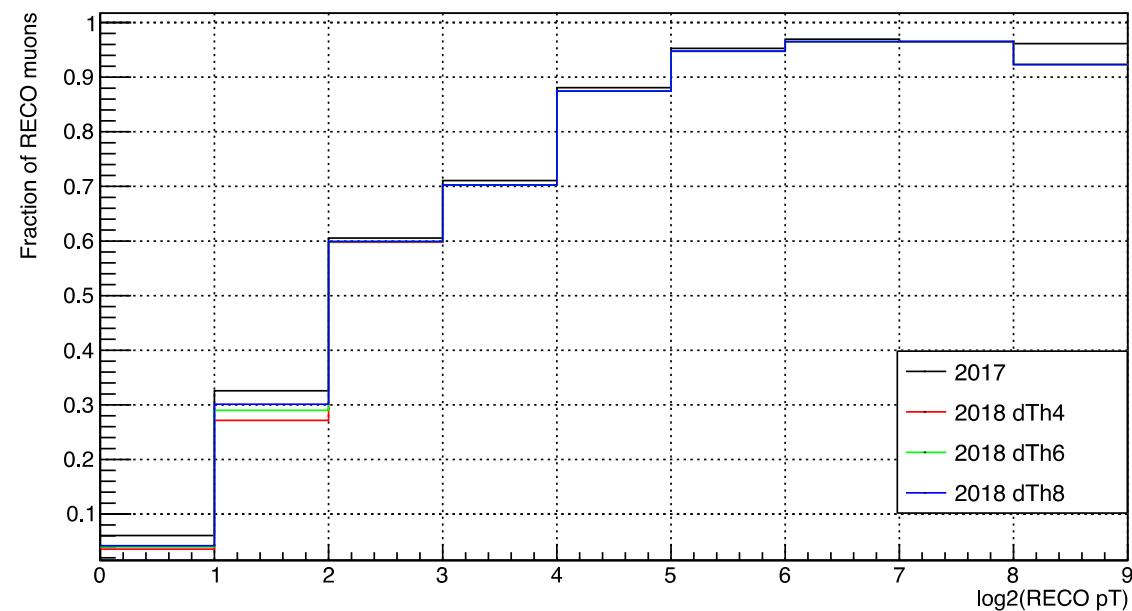


# DoubleMu Inclusive: Plateau Efficiency

DoubleMu Inclusive: IsRecoMatch && BX0 && Plateau



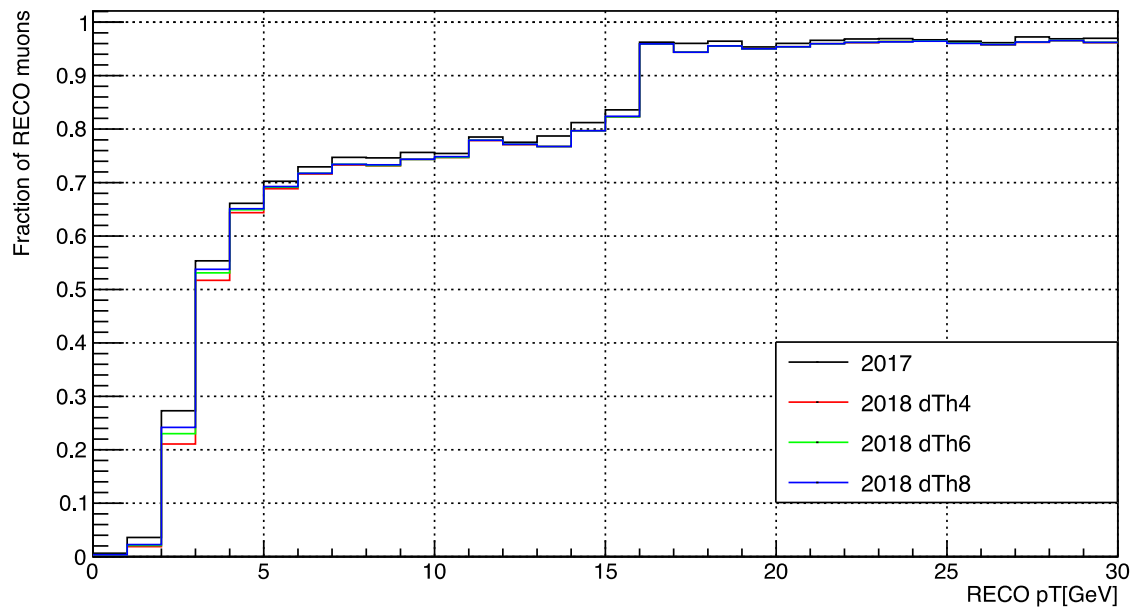
DoubleMu Inclusive: IsRecoMatch && BX0 && Plateau



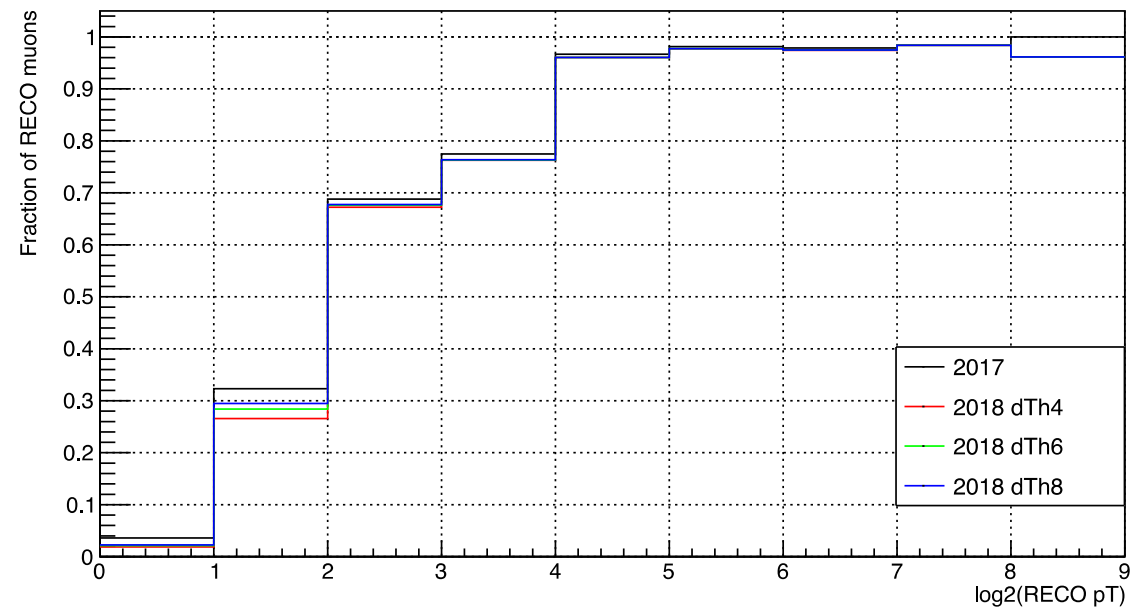


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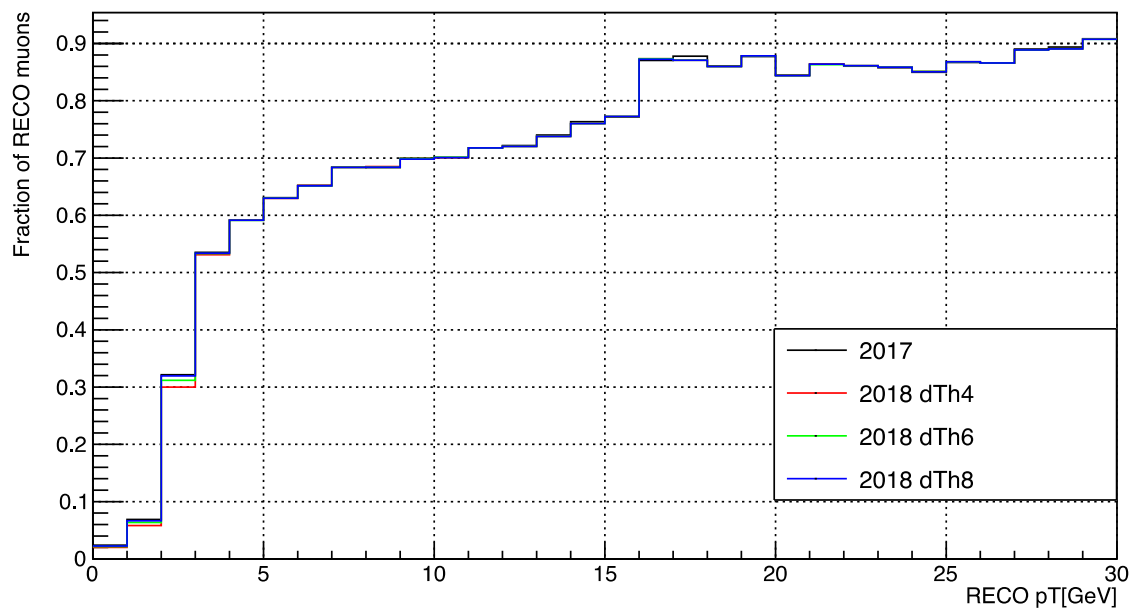


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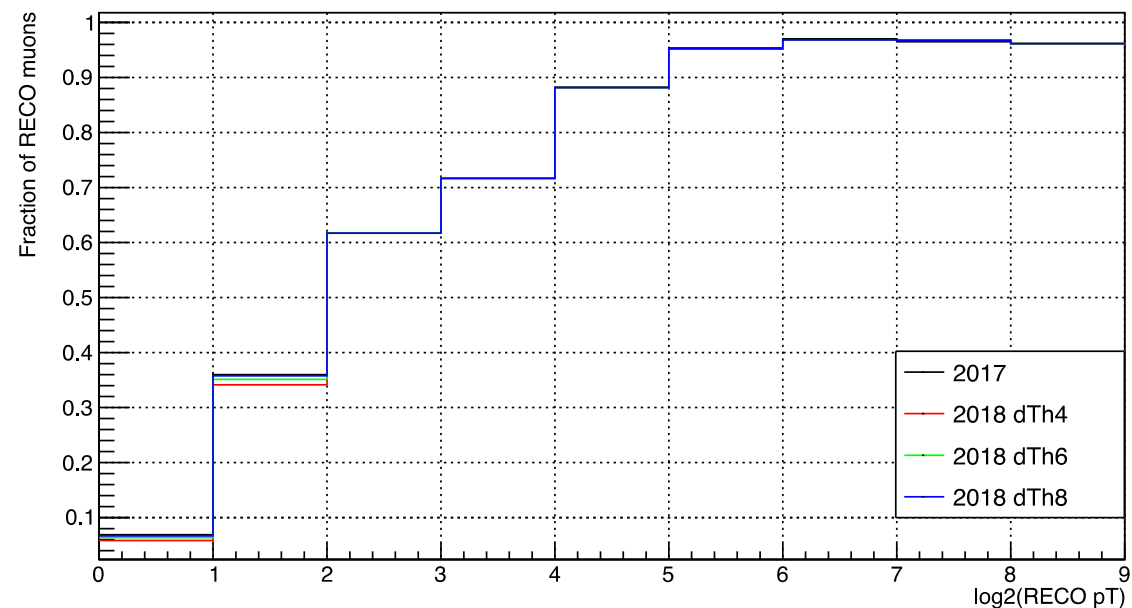


# MuOpen Inclusive: Plateau Efficiency

MuOpen Inclusive: IsRecoMatch && BX0 && Plateau

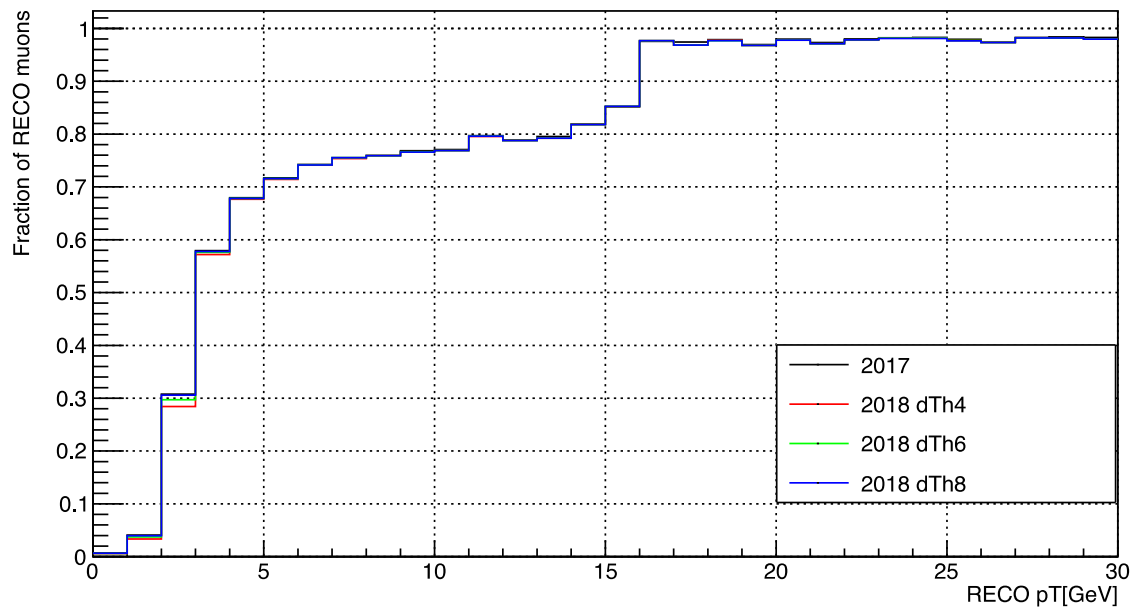


MuOpen Inclusive: IsRecoMatch && BX0 && Plateau

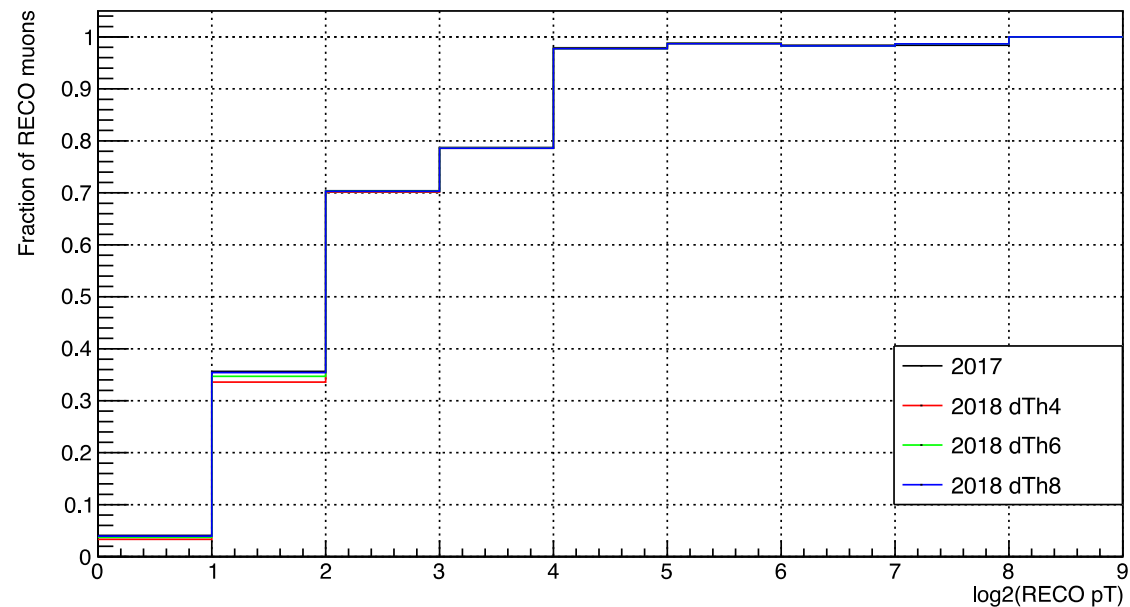


# MuOpen Inclusive: Efficiency (match unique)

MuOpen Inclusive: IsRecoMatch && BX0 && Unique



MuOpen Inclusive: IsRecoMatch && BX0 && Unique



# 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

- 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