



# SingleMu Modes $p_T$ Resolution

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EMTF Working Meeting

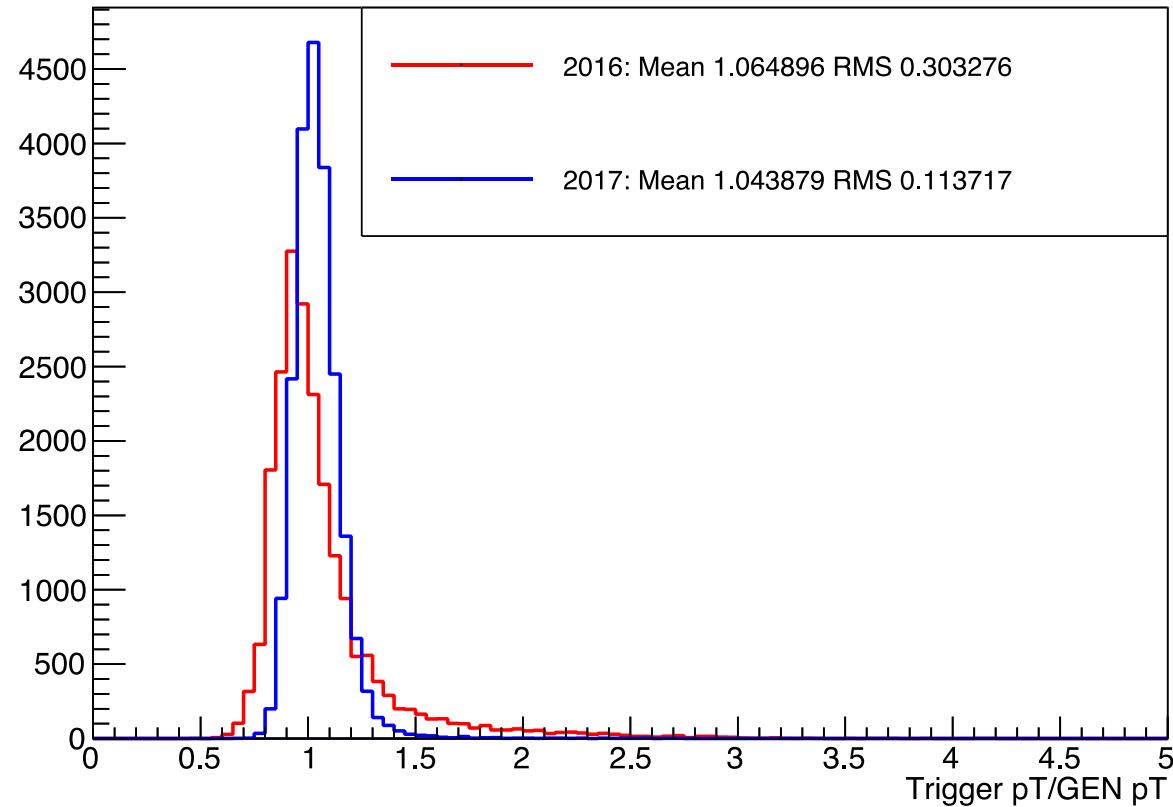


# Mode 15

- Four pT ranges
  - 1-4 GeV
  - 4-8 GeV
  - 8-16 GeV
  - 16-32 GeV
- Compare different eta ranges
  - $1.2 < |\eta| < 1.55$
  - $1.5 < |\eta| < 1.85$
  - $1.85 < |\eta| < 2.10$
  - $2.10 < |\eta| < 2.40$

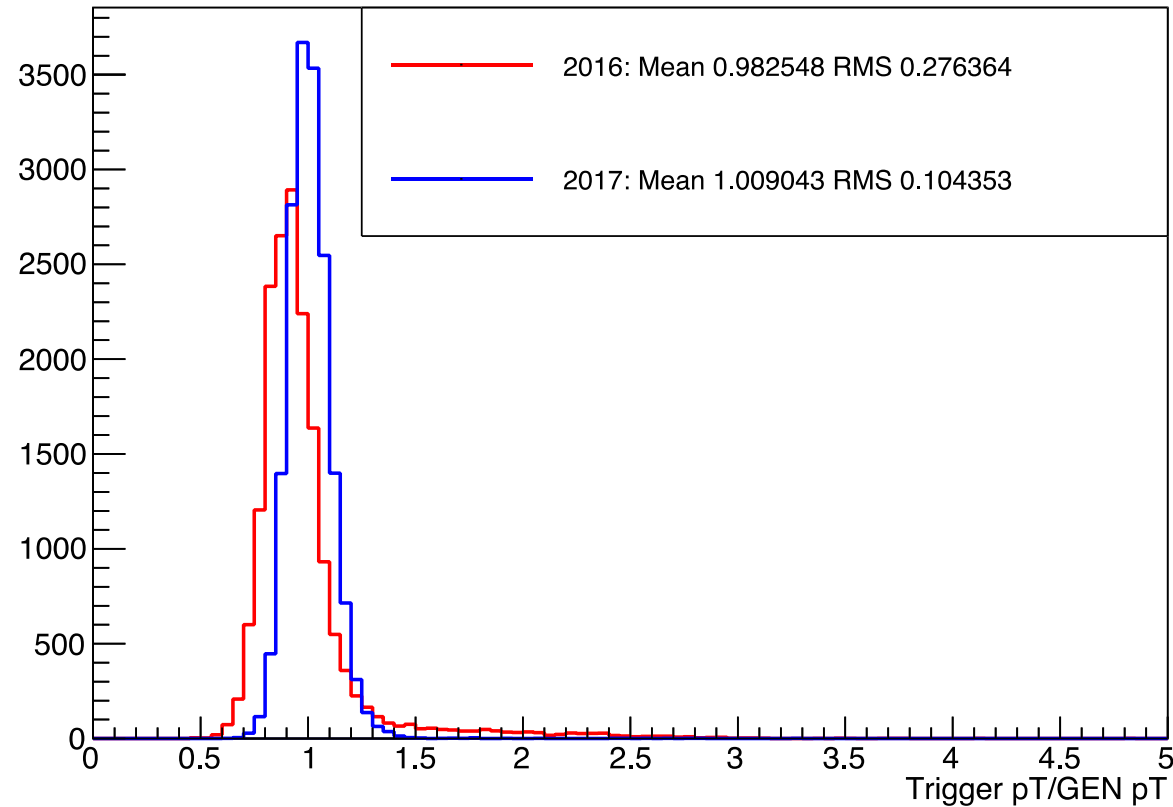
# Mode 15 1-4 GeV $1.2 < |\eta| < 1.55$

Mode 15 pT Resolution  $1 < \text{GEN pT} < 4 \text{ GeV}$   $1.2 < \text{GEN } \eta < 1.55$



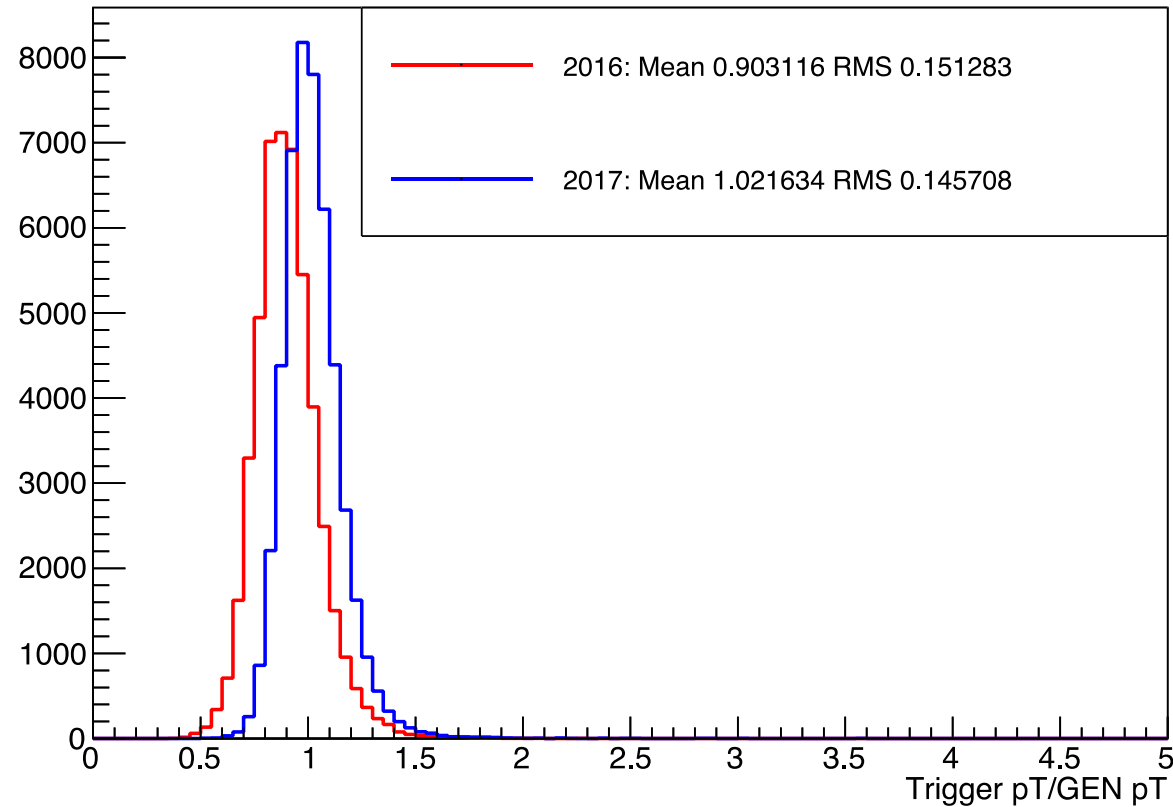
# Mode 15 1-4 GeV $1.55 < |\eta| < 1.85$

Mode 15 pT Resolution 1<GEN pT<4 GeV 1.55<GEN eta<1.85



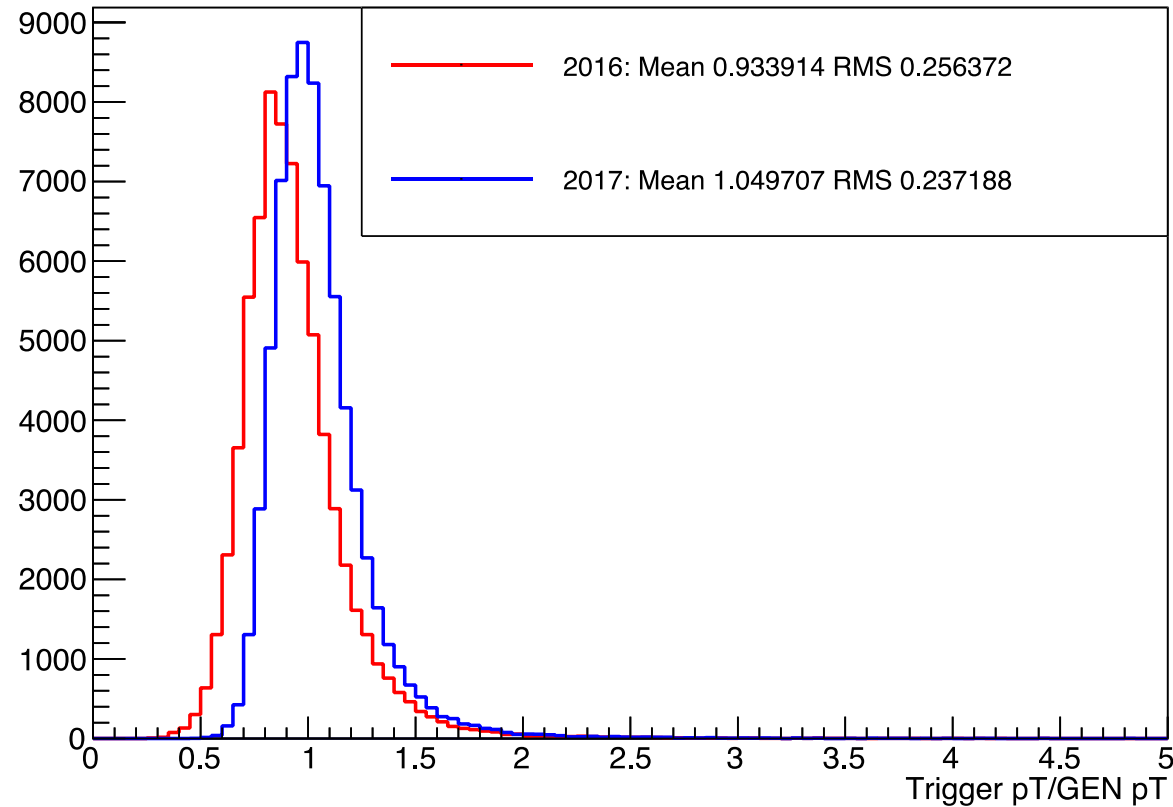
# Mode 15 1-4 GeV $1.85 < |\eta| < 2.1$

Mode 15 pT Resolution  $1 < \text{GEN pT} < 4 \text{ GeV}$   $1.85 < \text{GEN } \eta < 2.1$



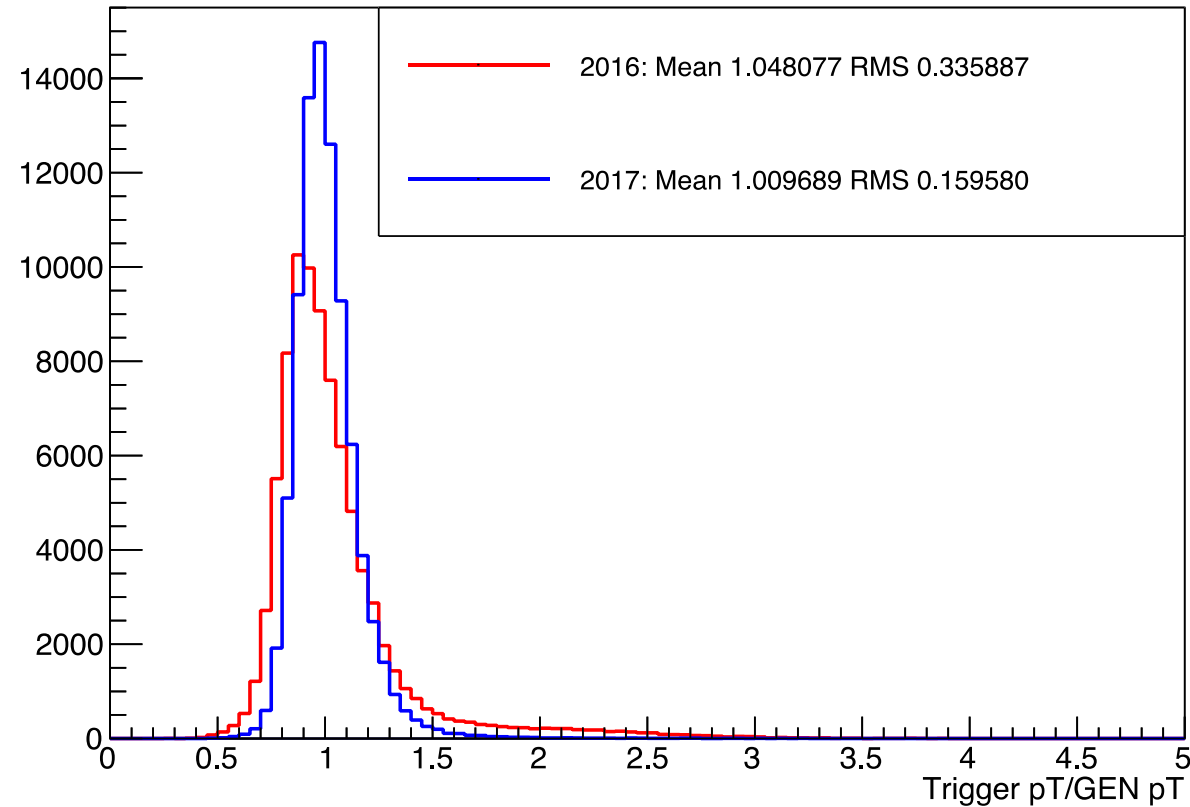
# Mode 15 1-4 GeV $2.1 < |\eta| < 2.4$

Mode 15 pT Resolution 1<GEN pT<4 GeV 2.1<GEN eta<2.4



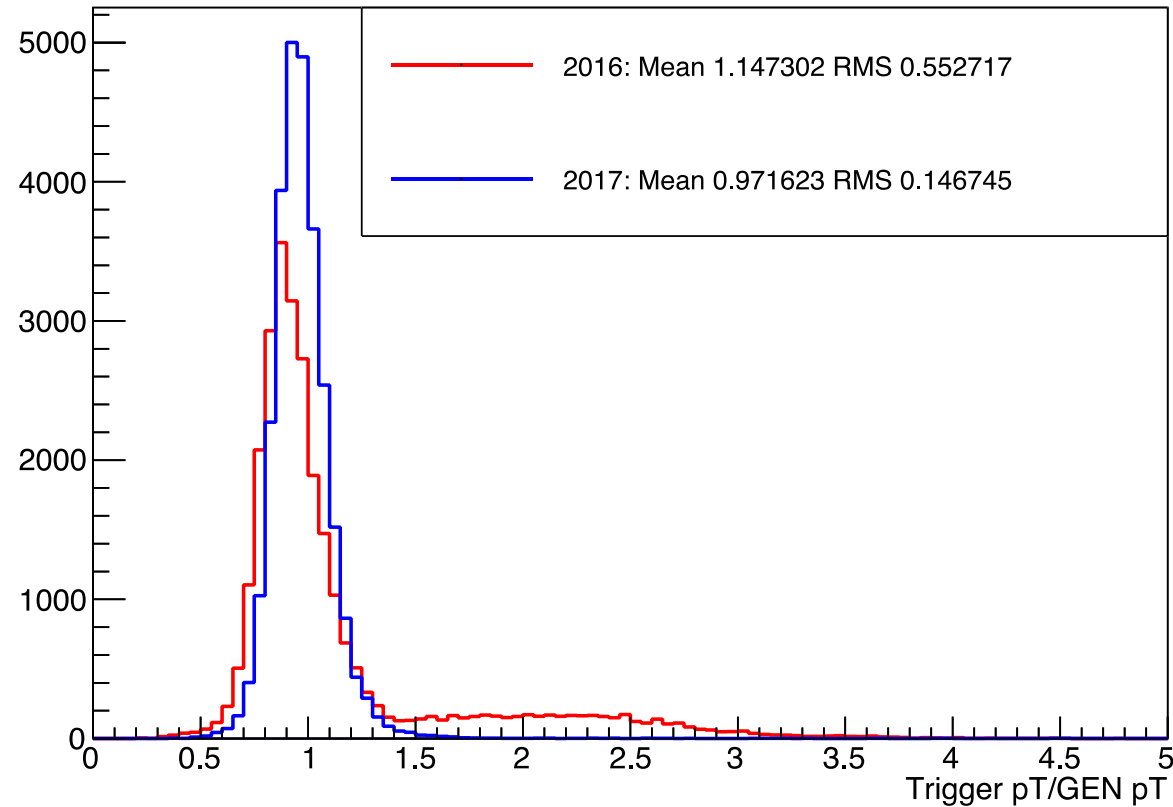
# Mode 15 4-8 GeV $1.2 < |\eta| < 1.55$

Mode 15 pT Resolution 4<GEN pT<8 GeV 1.2<GEN eta<1.55



# Mode 15 4-8 GeV $1.55 < |\eta| < 1.85$

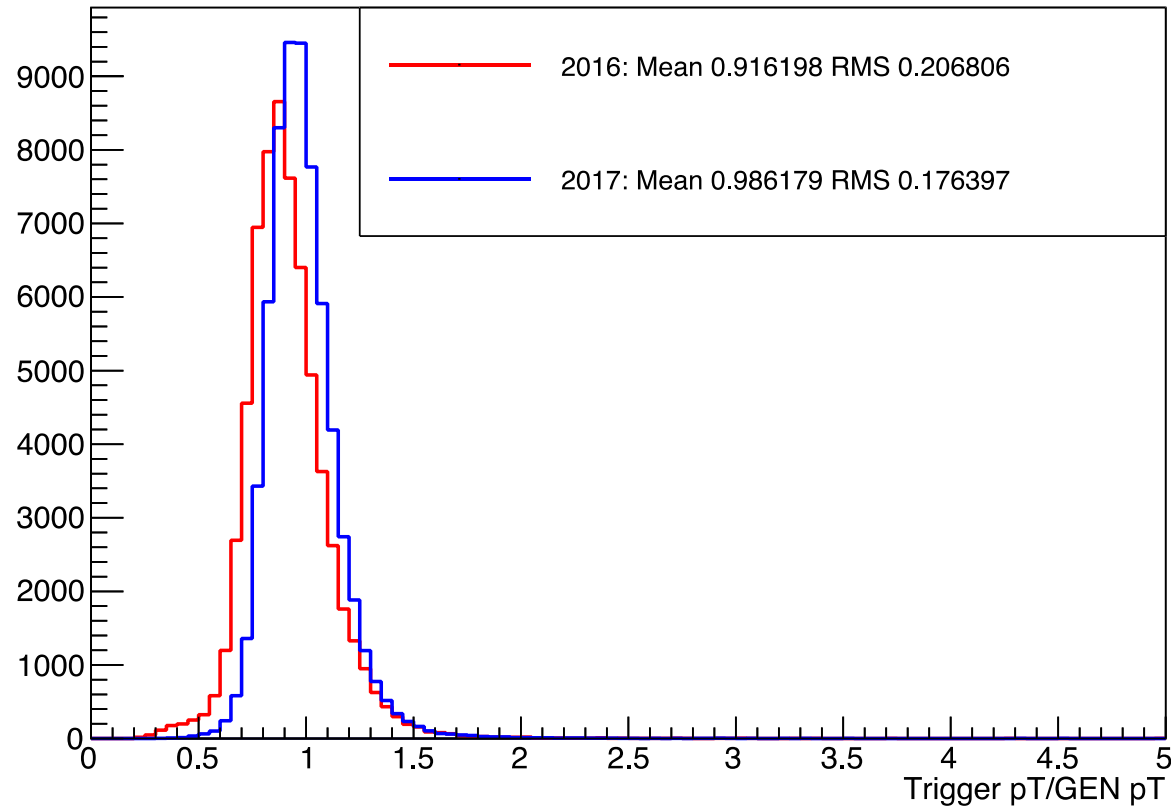
Mode 15 pT Resolution 4<GEN pT<8 GeV 1.55<GEN eta<1.85





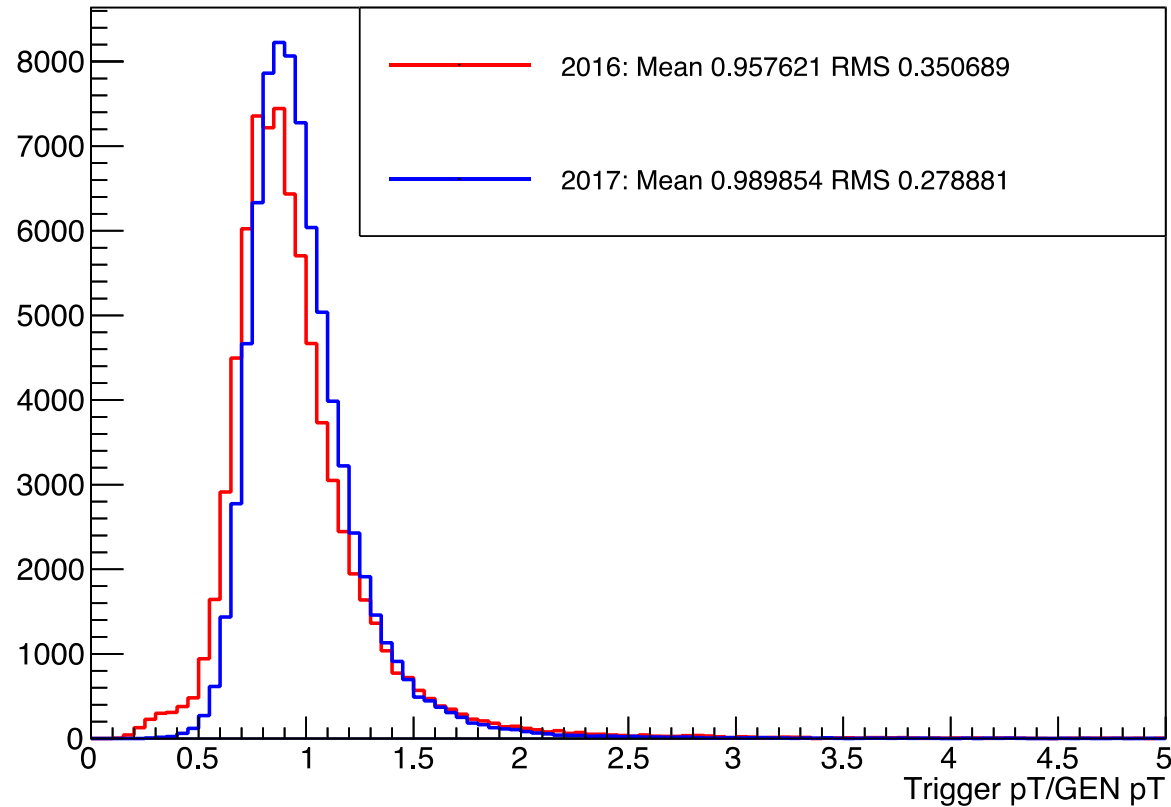
# Mode 15 4-8 GeV $1.85 < |\eta| < 2.1$

Mode 15 pT Resolution  $4 < \text{GEN pT} < 8 \text{ GeV}$   $1.85 < \text{GEN } \eta < 2.1$



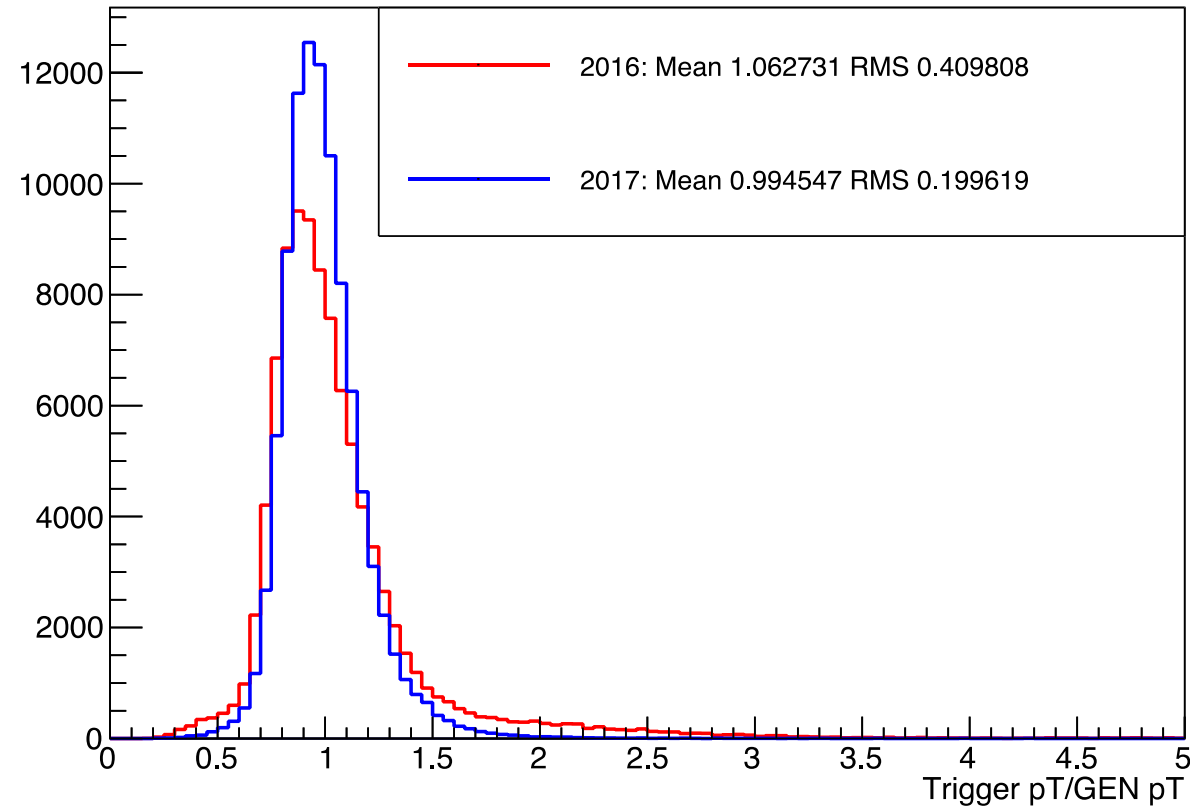
# Mode 15 4-8 GeV $2.1 < |\eta| < 2.4$

Mode 15 pT Resolution 4<GEN pT<8 GeV 2.1<GEN eta<2.4



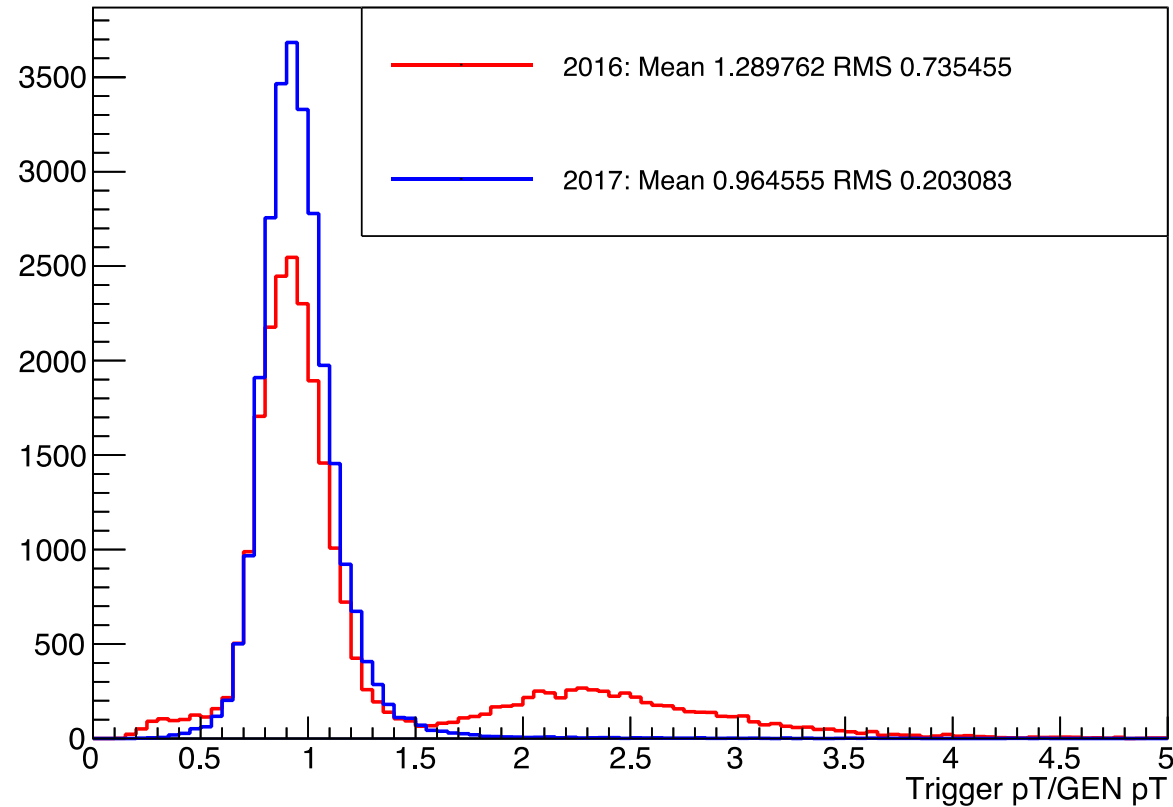
# Mode 15 8-16 GeV $1.2 < |\eta| < 1.55$

Mode 15 pT Resolution 8<GEN pT<16 GeV 1.2<GEN eta<1.55



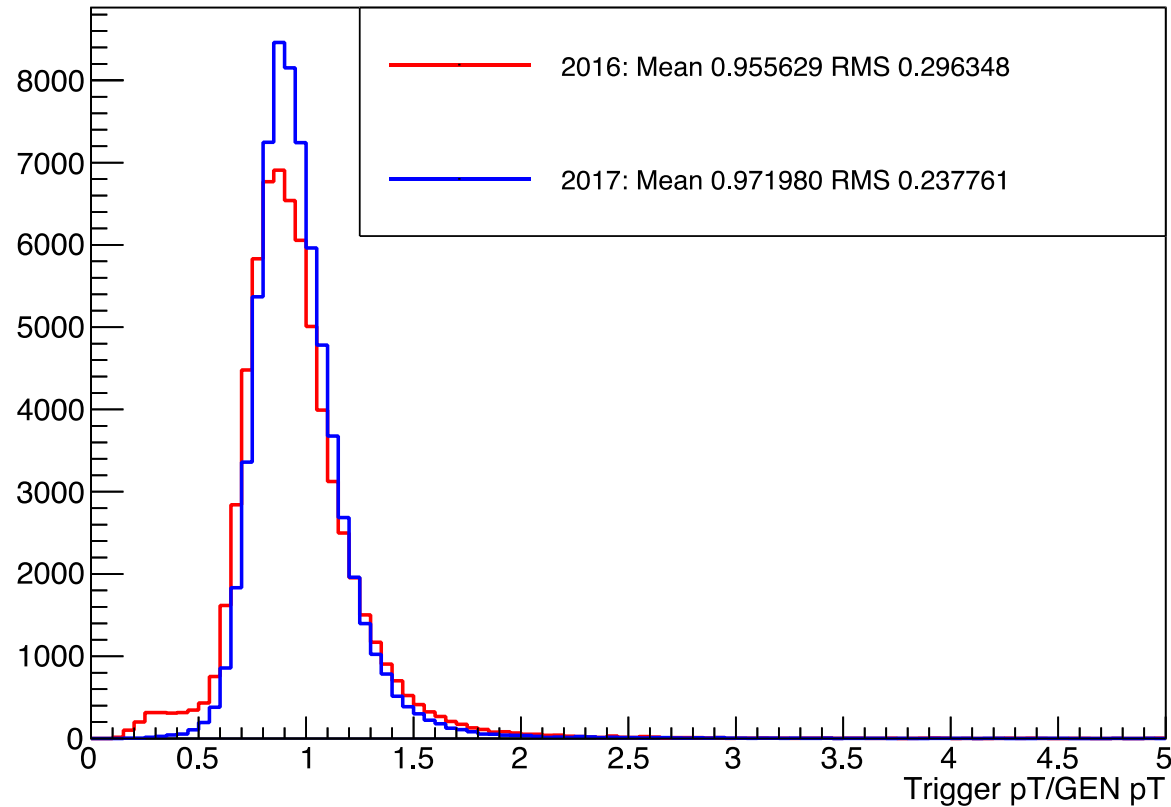
# Mode 15 8-16 GeV $1.55 < |\eta| < 1.85$

Mode 15 pT Resolution 8<GEN pT<16 GeV 1.55<GEN eta<1.85



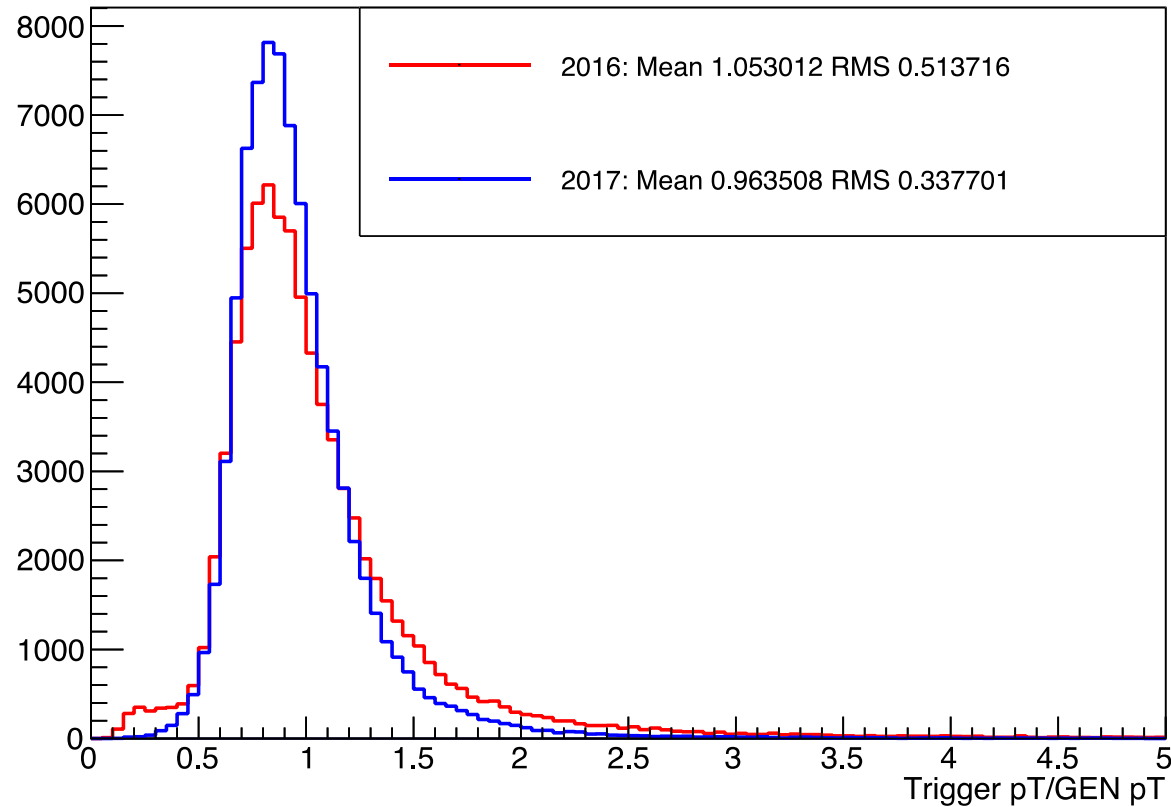
# Mode 15 8-16 GeV $1.85 < |\eta| < 2.1$

Mode 15 pT Resolution 8<GEN pT<16 GeV 1.85<GEN eta<2.1



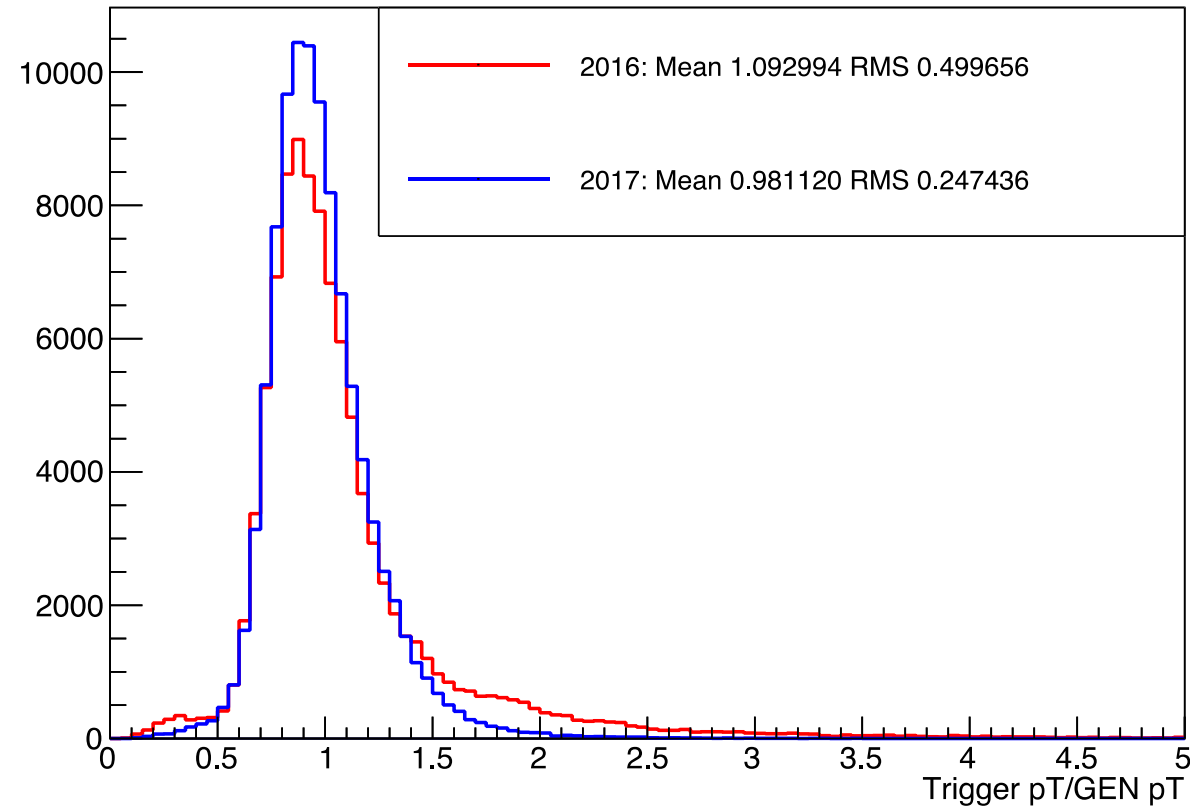
# Mode 15 8-16 GeV $2.1 < |\eta| < 2.4$

Mode 15 pT Resolution 8<GEN pT<16 GeV 2.1<GEN eta<2.4



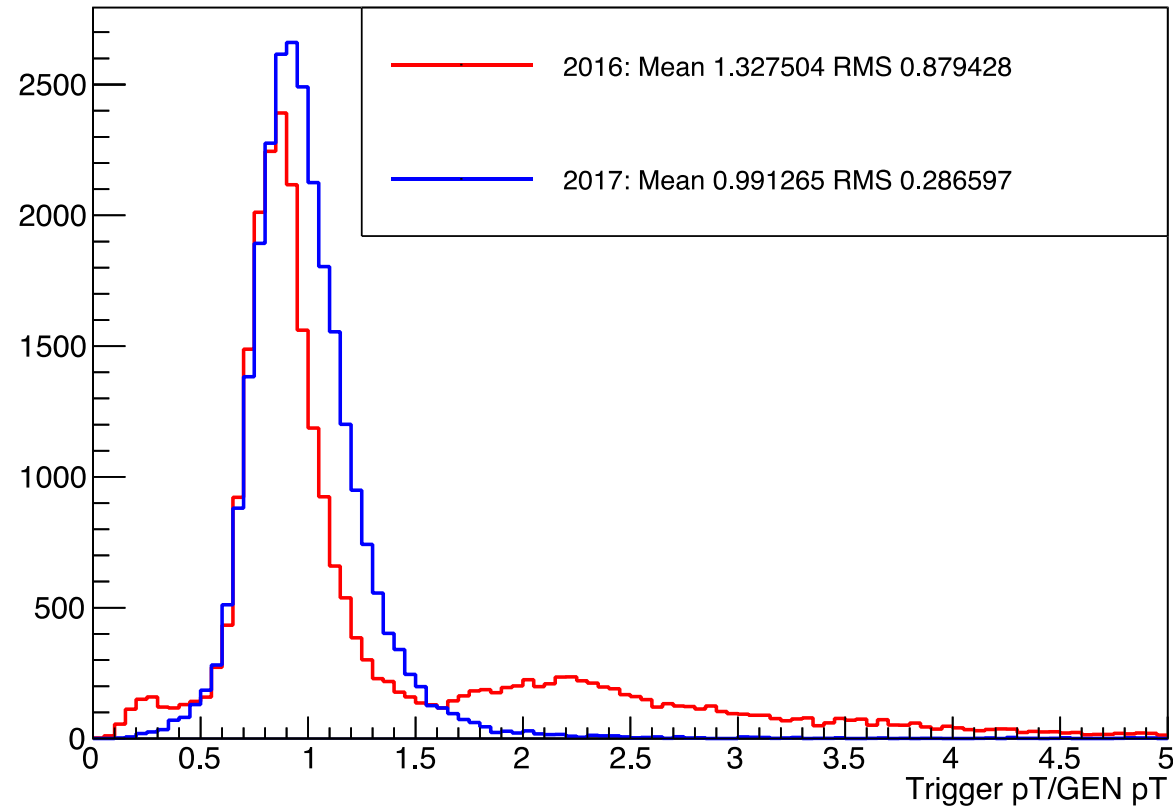
# Mode 15 16-32 GeV $1.2 < |\eta| < 1.55$

Mode 15 pT Resolution 16<GEN pT<32 GeV 1.2<GEN eta<1.55



# Mode 15 16-32 GeV $1.55 < |\eta| < 1.85$

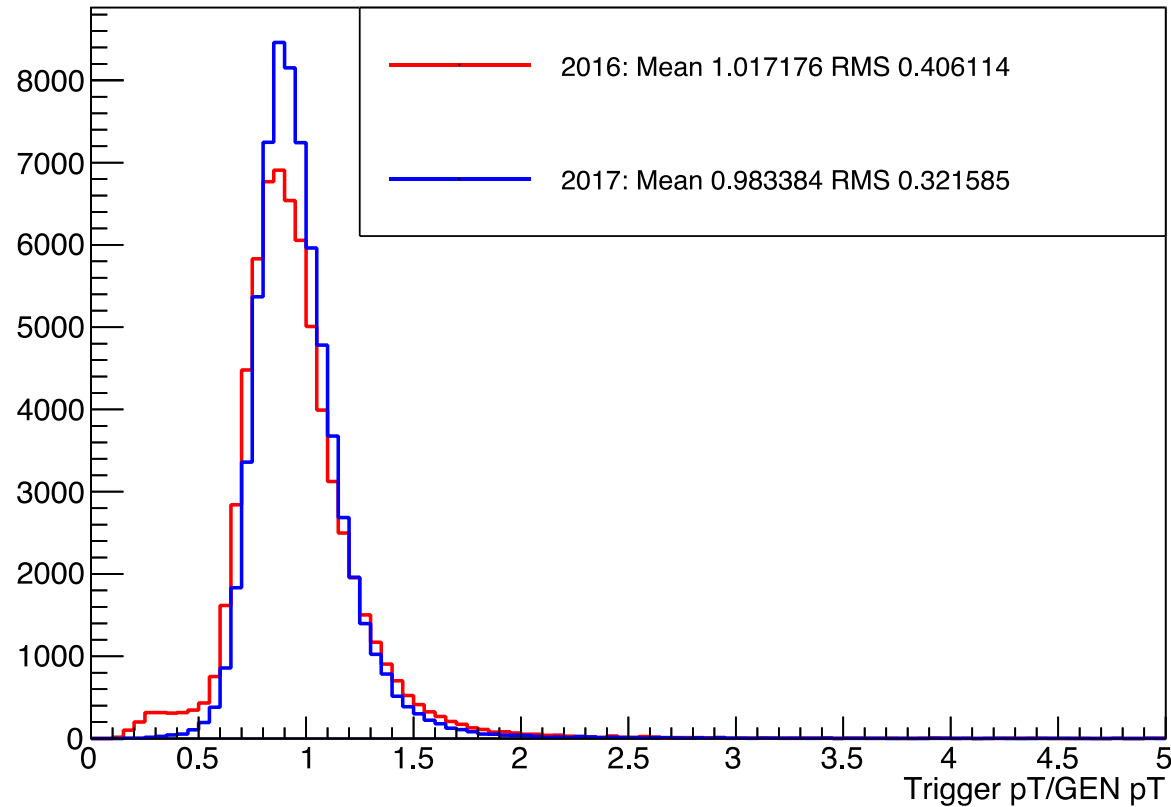
Mode 15 pT Resolution 16<GEN pT<32 GeV 1.55<GEN eta<1.85





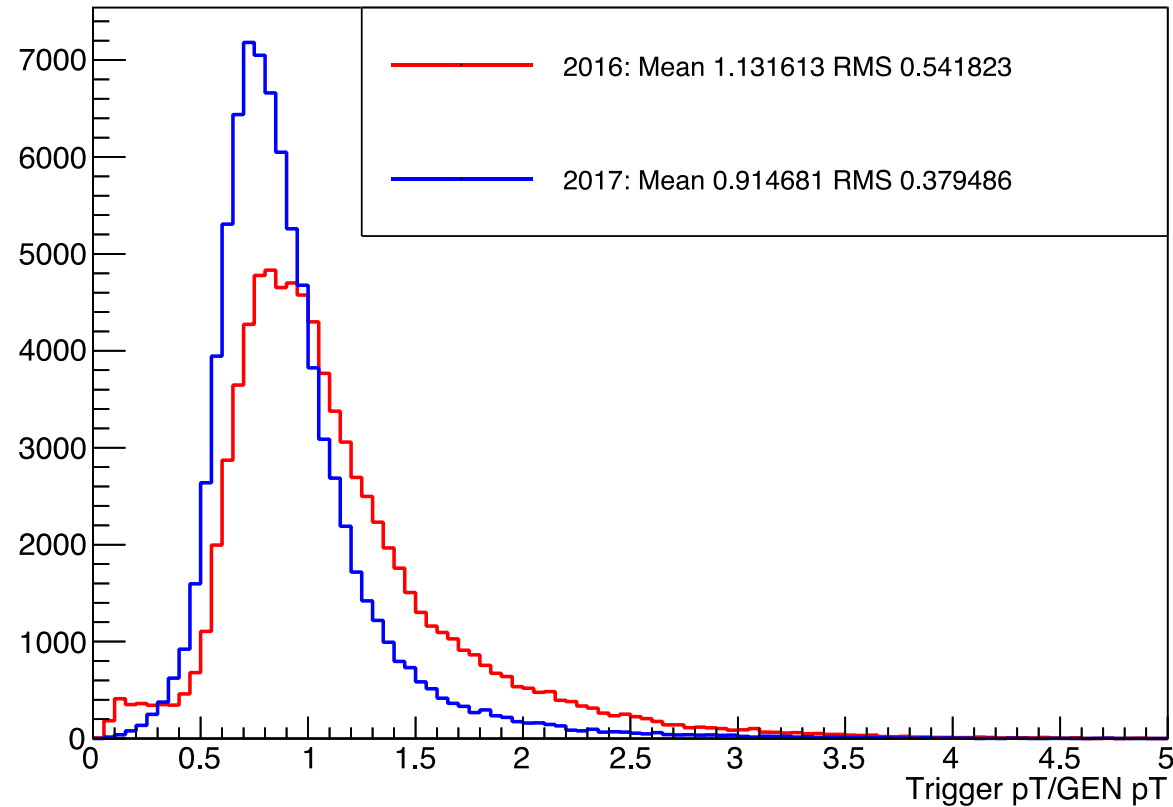
# Mode 15 16-32 GeV $1.85 < |\eta| < 2.1$

Mode 15 pT Resolution 16<GEN pT<32 GeV 1.85<GEN eta<2.1



# Mode 15 16-32 GeV $2.1 < |\eta| < 2.4$

Mode 15 pT Resolution 16<GEN pT<32 GeV 2.1<GEN eta<2.4



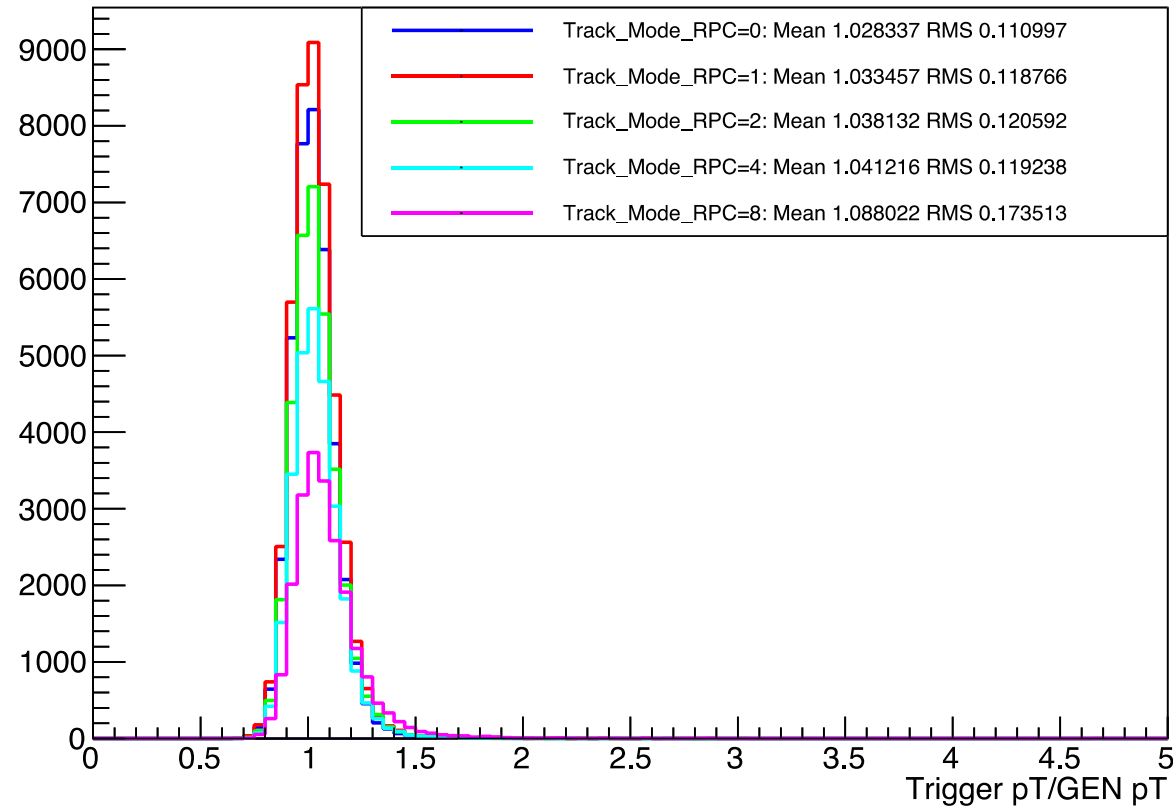


# Mode 15

- Four pT ranges in  $1.2 < |\eta| < 1.85$ 
  - 1-4 GeV
  - 4-8 GeV
  - 8-16 GeV
  - 16-32 GeV
- Compare RPC-only modes
  - 0: No RPC
  - 1: RPC @station 4
  - 2: RPC @station 3
  - 4: RPC @station 2
  - 8: RPC @station 1

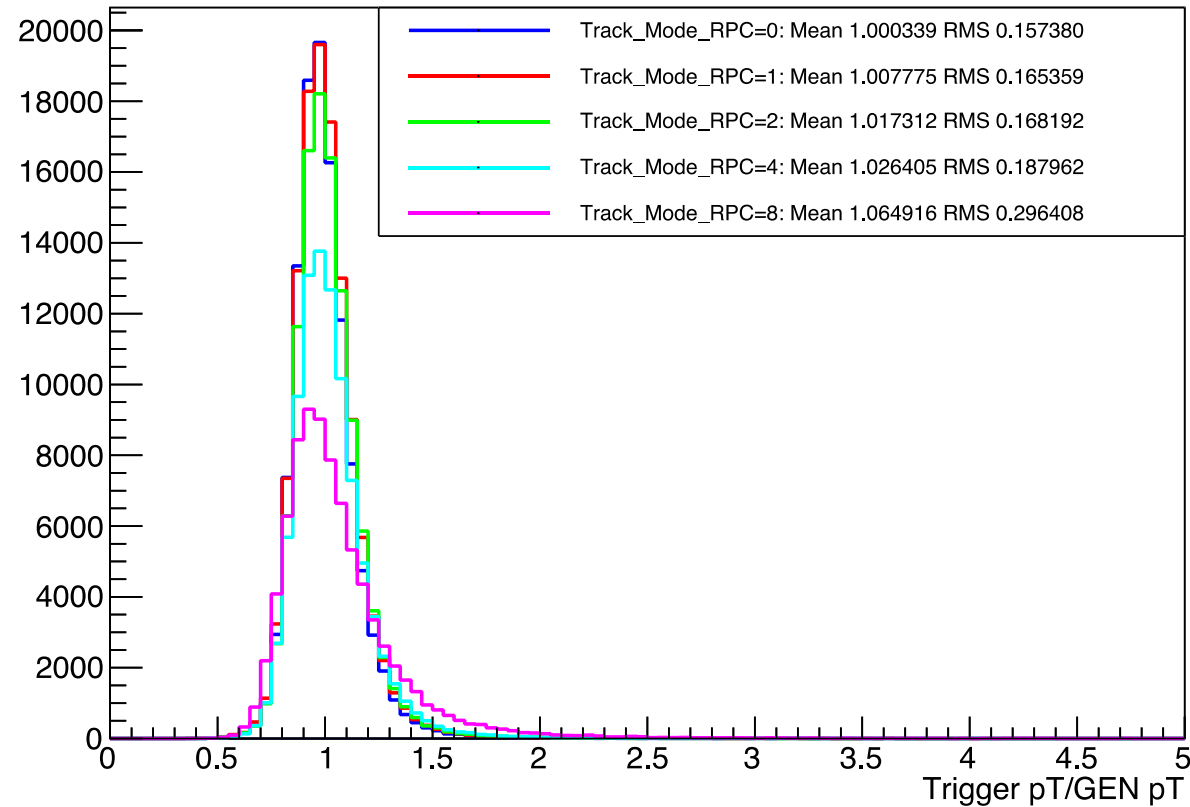
# Mode 15 1-4 GeV $1.2 < |\eta| < 1.85$

Mode 15 pT Resolution  $1 < \text{GEN pT} < 4 \text{ GeV}$   $1.2 < \text{GEN } \eta < 1.85$



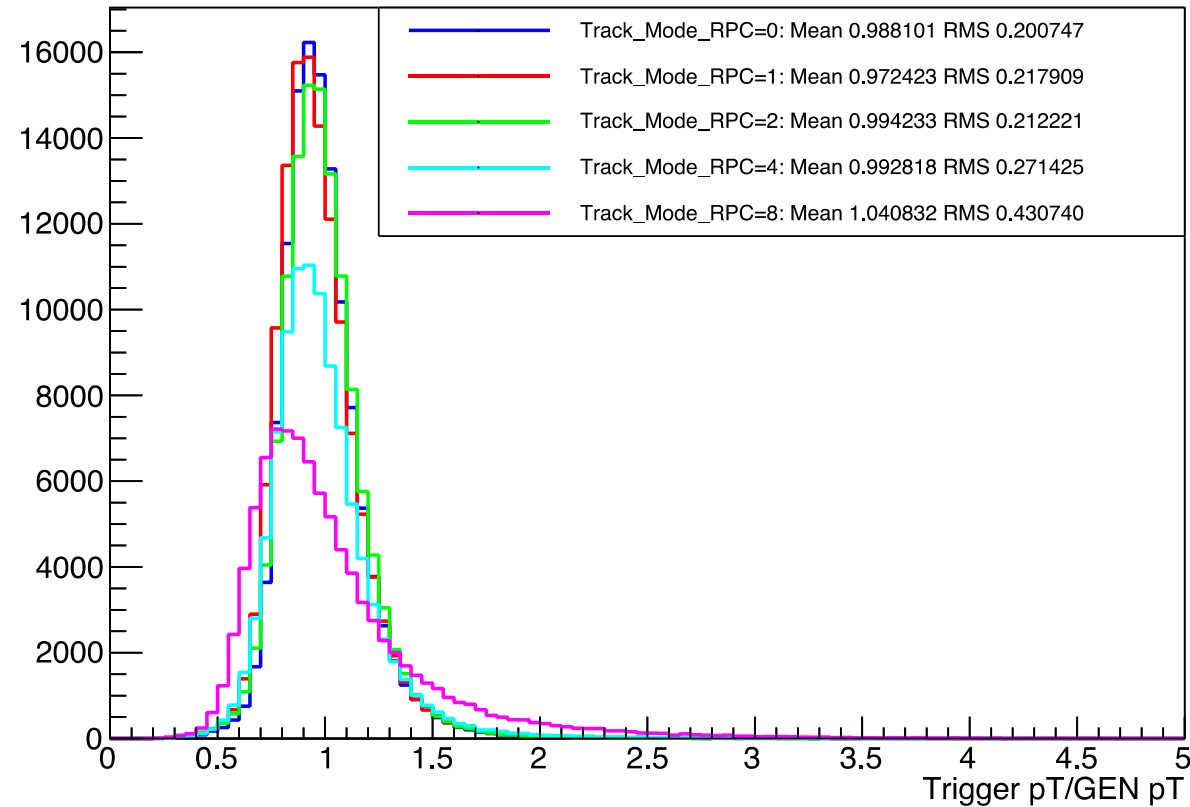
# Mode 15 4-8 GeV $1.2 < |\eta| < 1.85$

Mode 15 pT Resolution 4<GEN pT<8 GeV 1.2<GEN eta<1.85



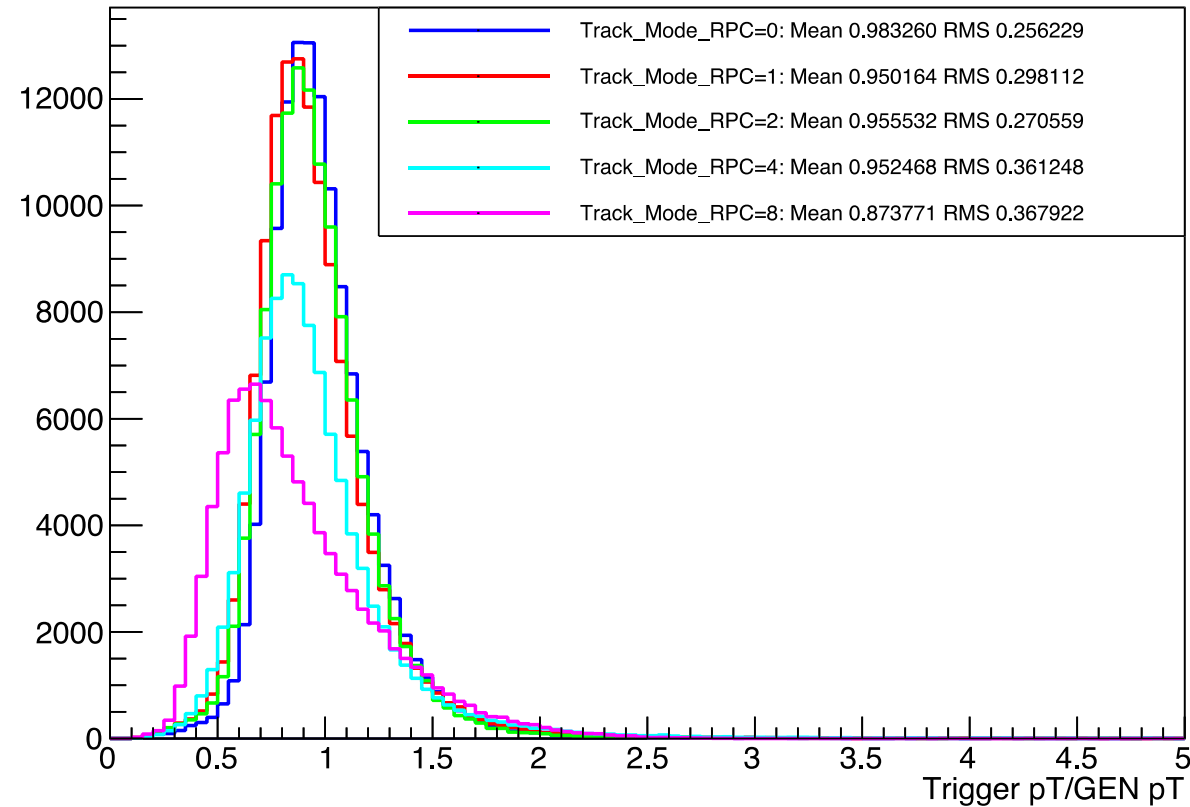
# Mode 15 8-16 GeV $1.2 < |\eta| < 1.85$

Mode 15 pT Resolution 8<GEN pT<16 GeV 1.2<GEN eta<1.85



# Mode 15 16-32 GeV $1.2 < |\eta| < 1.85$

Mode 15 pT Resolution 16<GEN pT<32 GeV 1.2<GEN eta<1.85





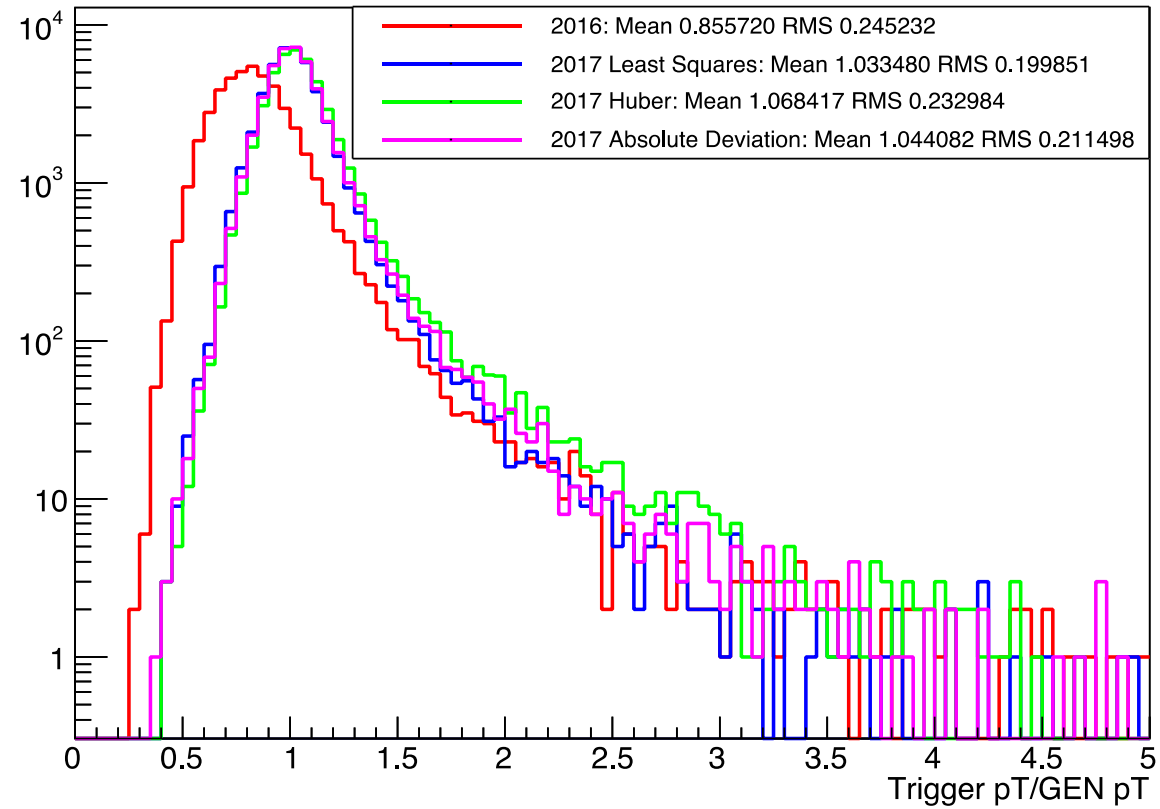
# Mode 14 & 7

- Four pT ranges
  - 1-4 GeV
  - 4-8 GeV
  - 8-16 GeV
  - 16-32 GeV
- Compare loss functions
  - 2016
  - 2017 Least Squares
  - 2017 Huber
  - 2017 Absolute Deviation



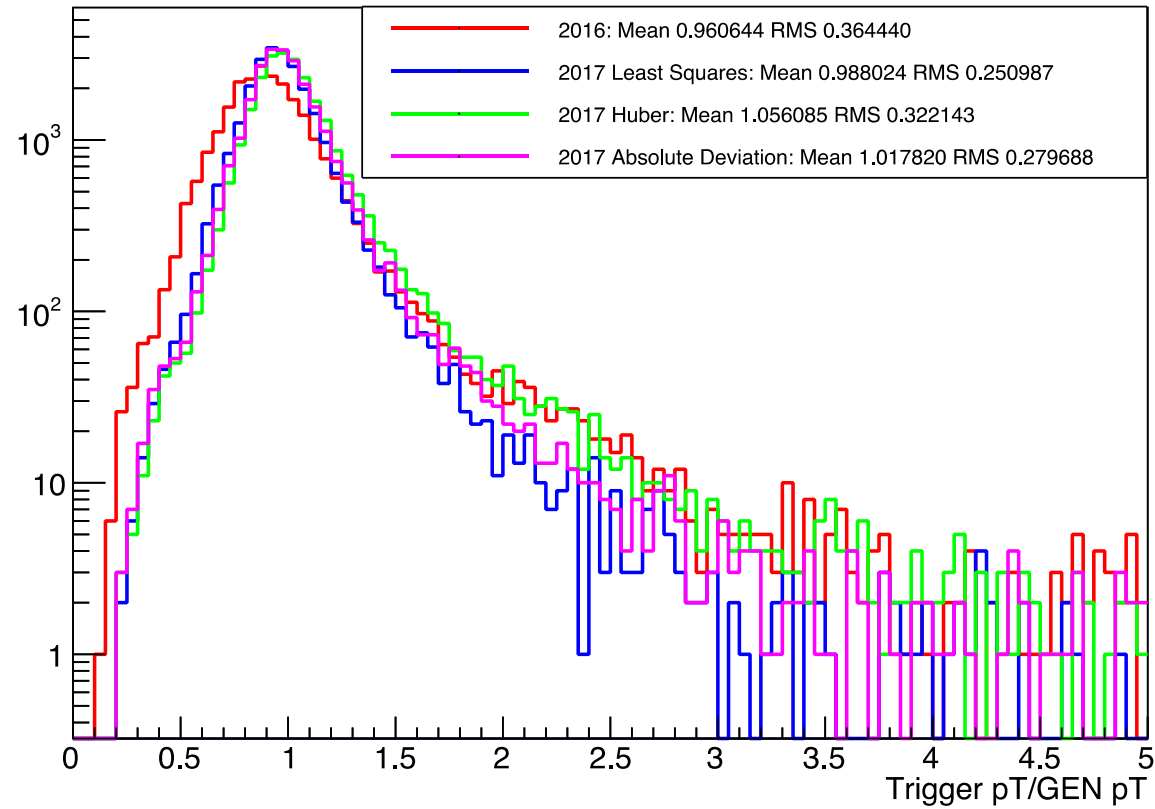
# Mode 14 1-4 GeV

Mode 14 pT Resolution  $1 < \text{GEN pT} < 4 \text{ GeV}$



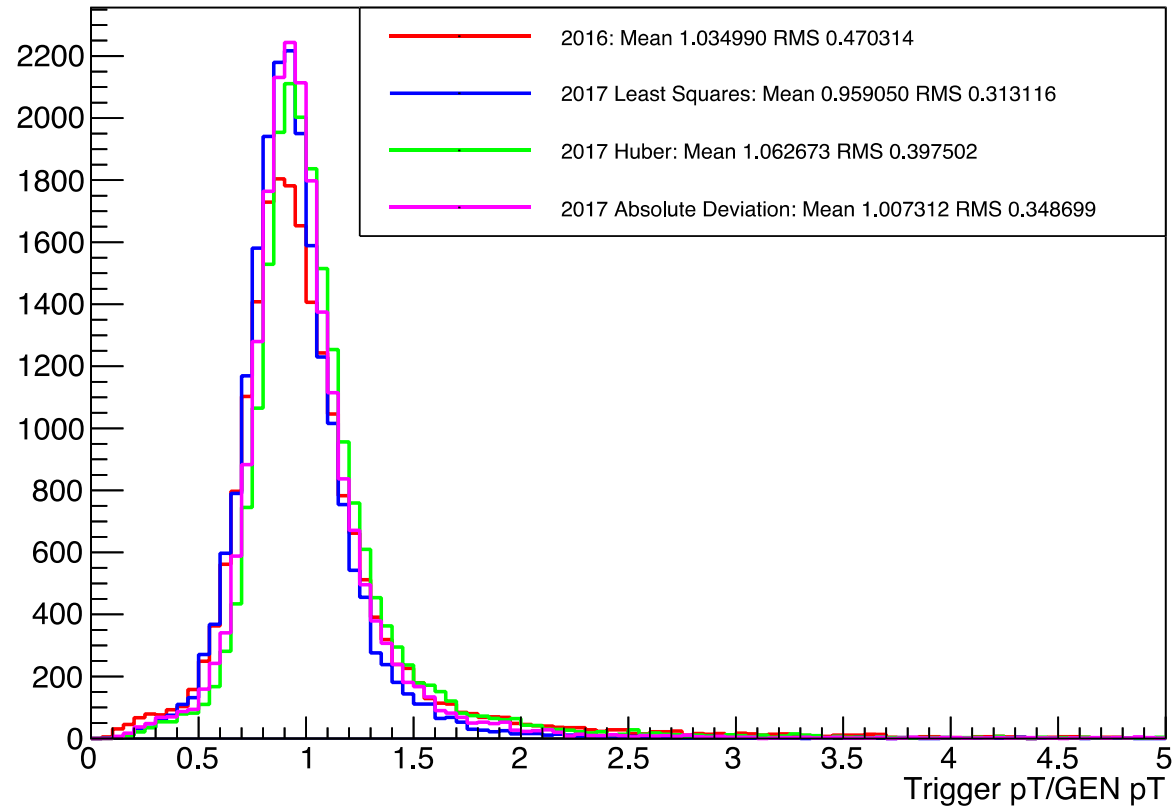
# Mode 14 4-8 GeV

Mode 14 pT Resolution  $4 < \text{GEN pT} < 8 \text{ GeV}$



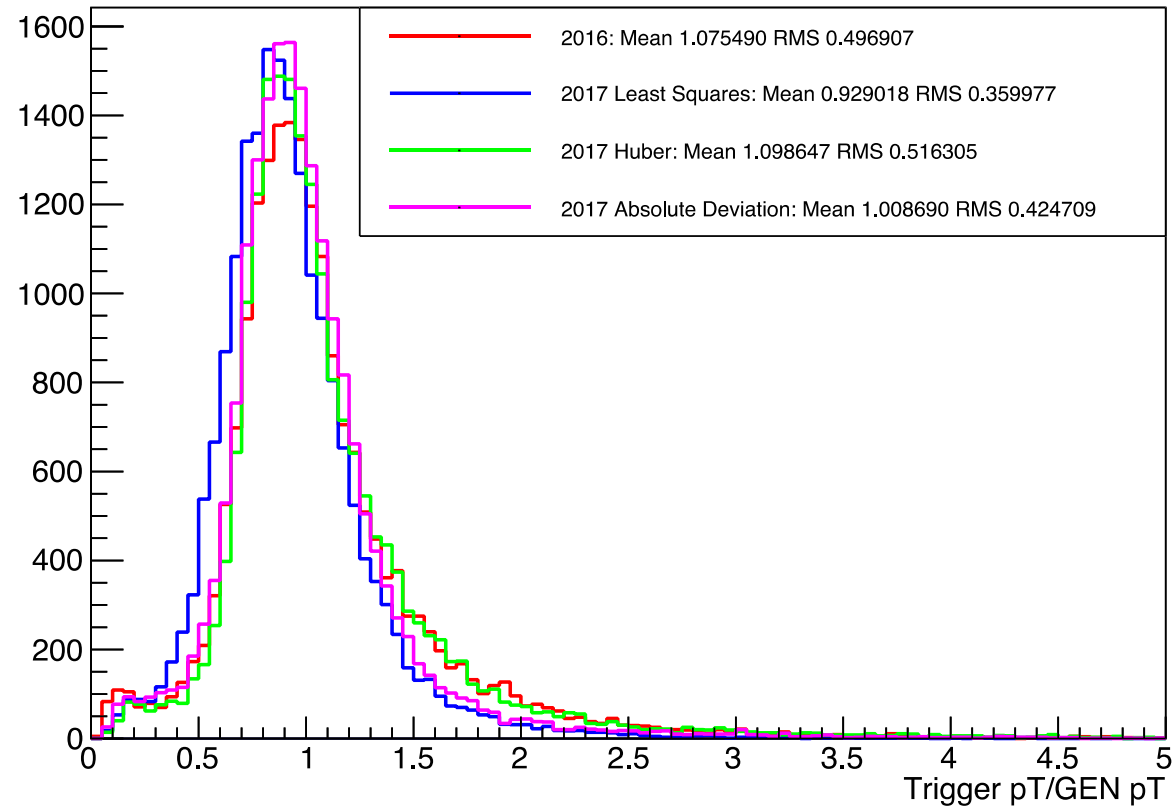
# Mode 14 8-16 GeV

Mode 14 pT Resolution  $8 < \text{GEN pT} < 16 \text{ GeV}$



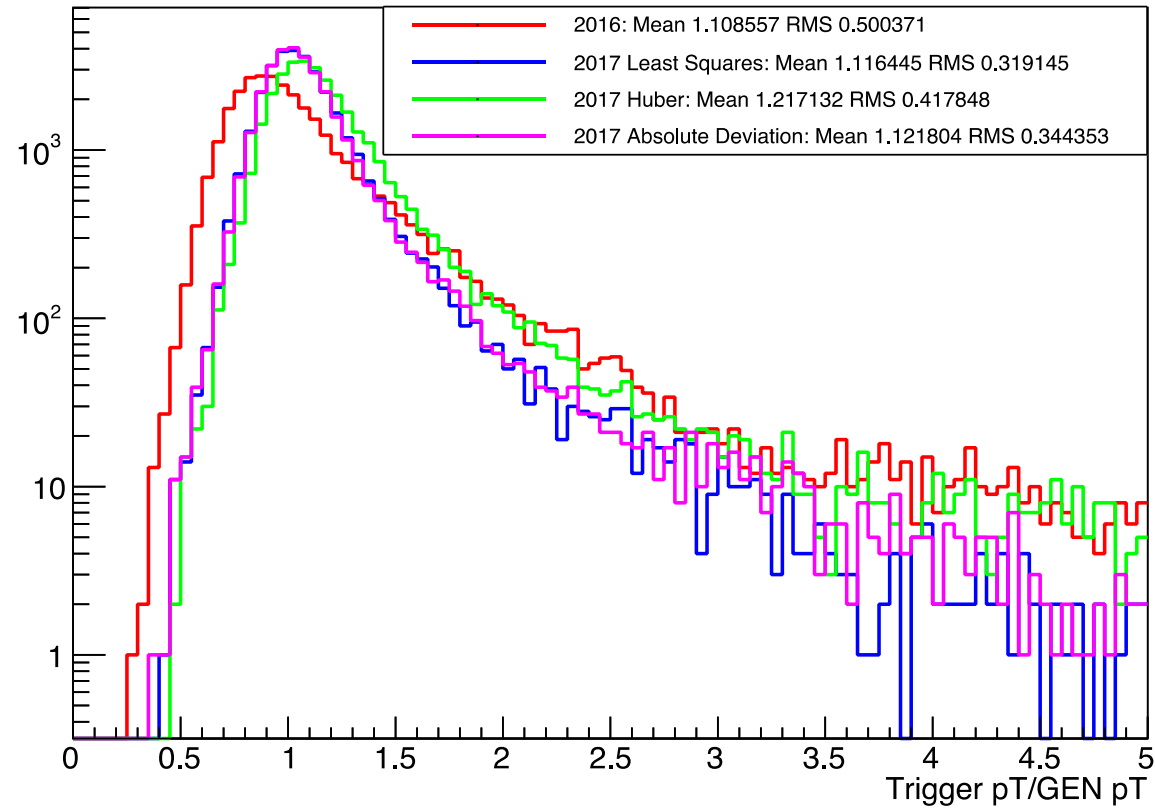
# Mode 14 16-32 GeV

Mode 14 pT Resolution 16<GEN pT<32 GeV



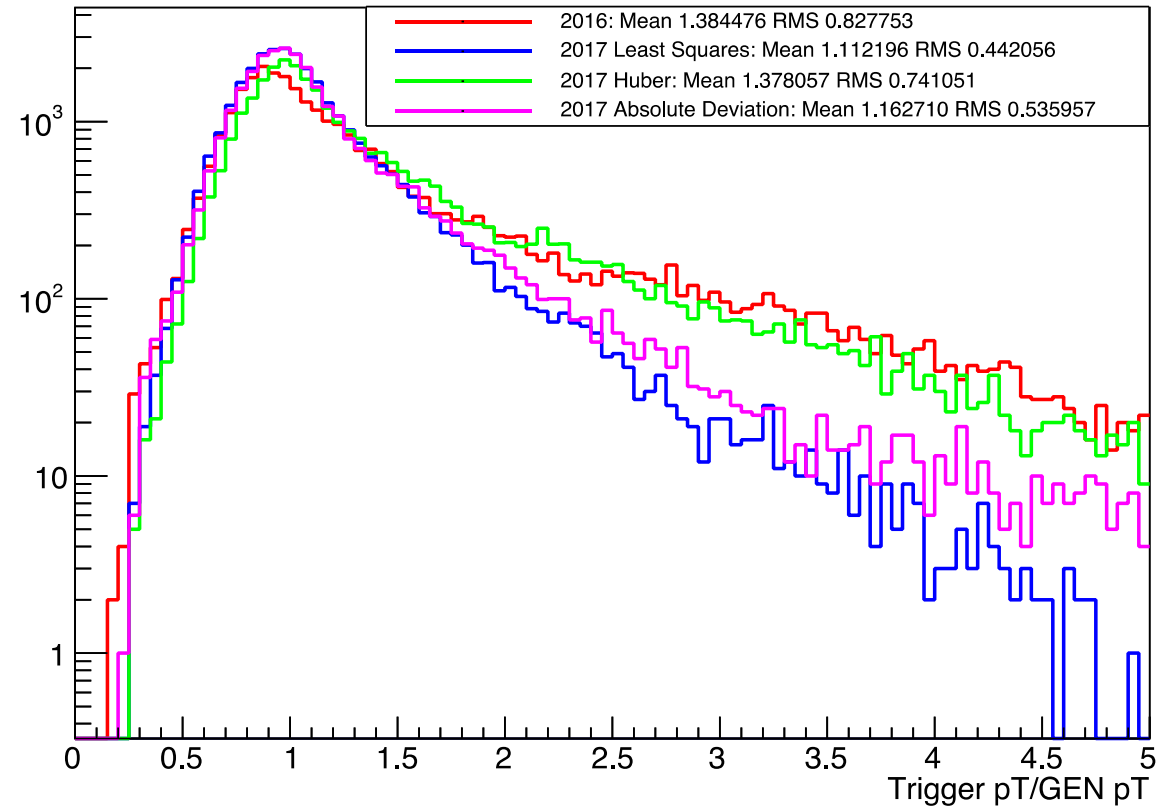
# Mode 7 1-4 GeV

Mode 7 pT Resolution  $1 < \text{GEN pT} < 4 \text{ GeV}$



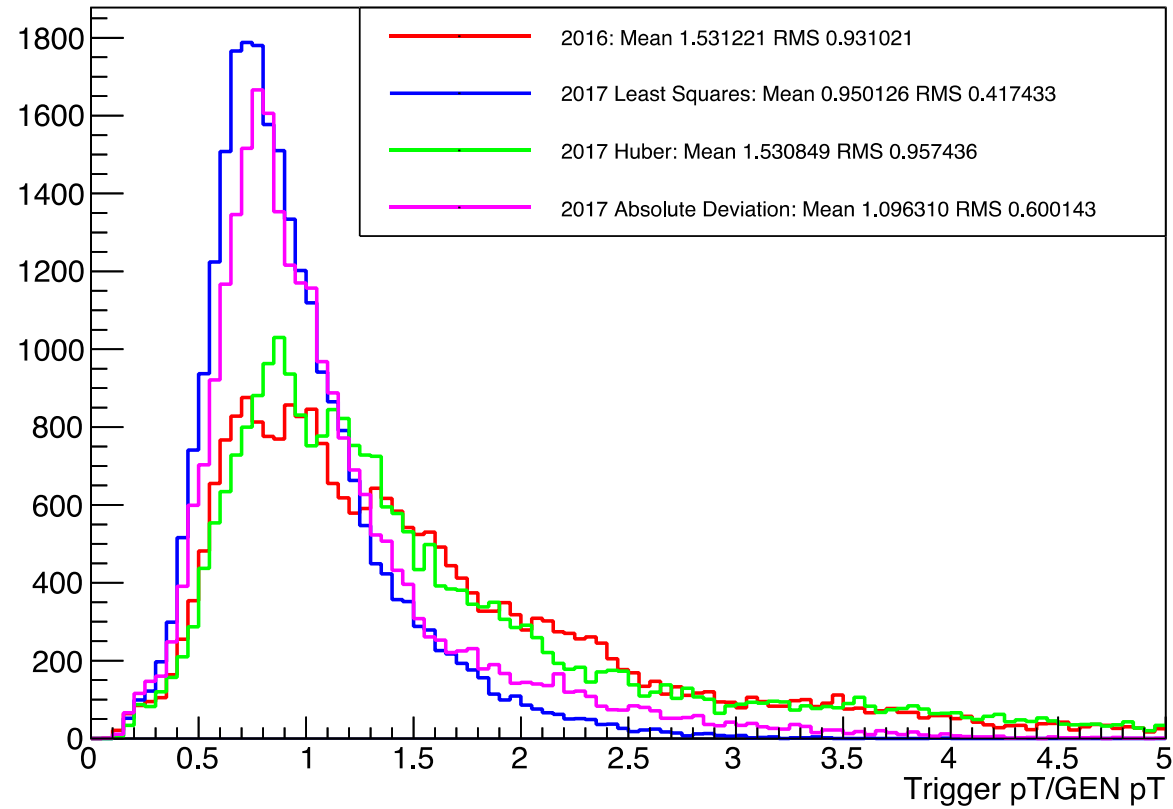
# Mode 7 4-8 GeV

Mode 7 pT Resolution  $4 < \text{GEN pT} < 8 \text{ GeV}$



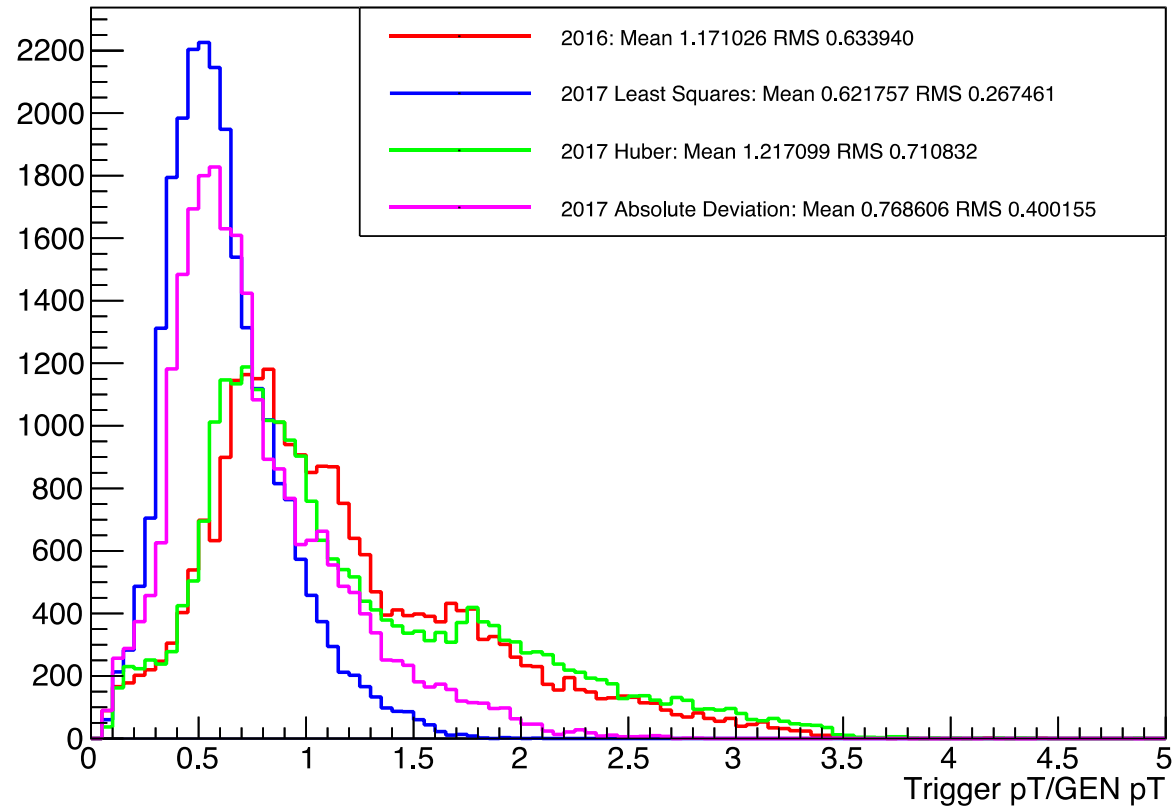
# Mode 7 8-16 GeV

Mode 7 pT Resolution  $8 < \text{GEN pT} < 16 \text{ GeV}$



# Mode 7 16-32 GeV

Mode 7 pT Resolution 16<GEN pT<32 GeV







# Conclusions

- Mode 15
  - 2017 trigger pT resolution significantly improves between ring 1 and ring 2 ( $1.55 < |\eta| < 1.85$ )
    - The 2016 bump at high trigger pT: slide 8, 12, 16
  - RPC hits in station 4 are more frequently used
  - RPC hits in station 1 are least frequently used
    - In this case, pT resolution degrades the most: slide 21-23
- Three station tracks (mode 14 & 7)
  - Least square loss function: good at suppressing high trigger pT assignment
  - Huber loss function: good at suppressing low trigger pT assignment