Variable plots

Process: pp→pX(→ττ)p;

Protons are tagged by PPS, while the decay products of the X system are detected by the CMS central detector.

Decay mode in study:

- Fully hadronic decay mode; Both τs decay hadronically

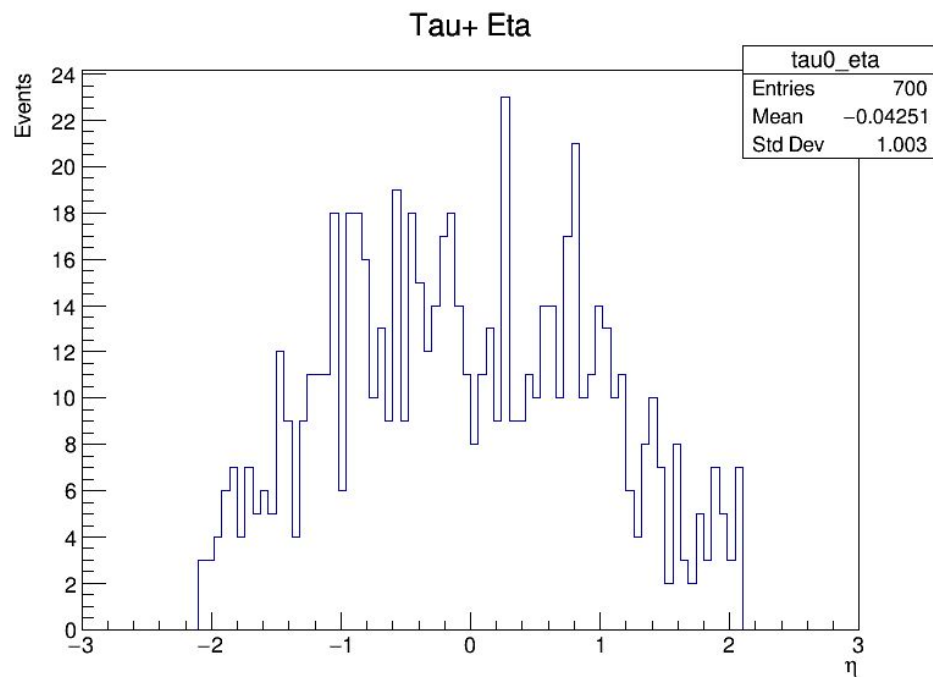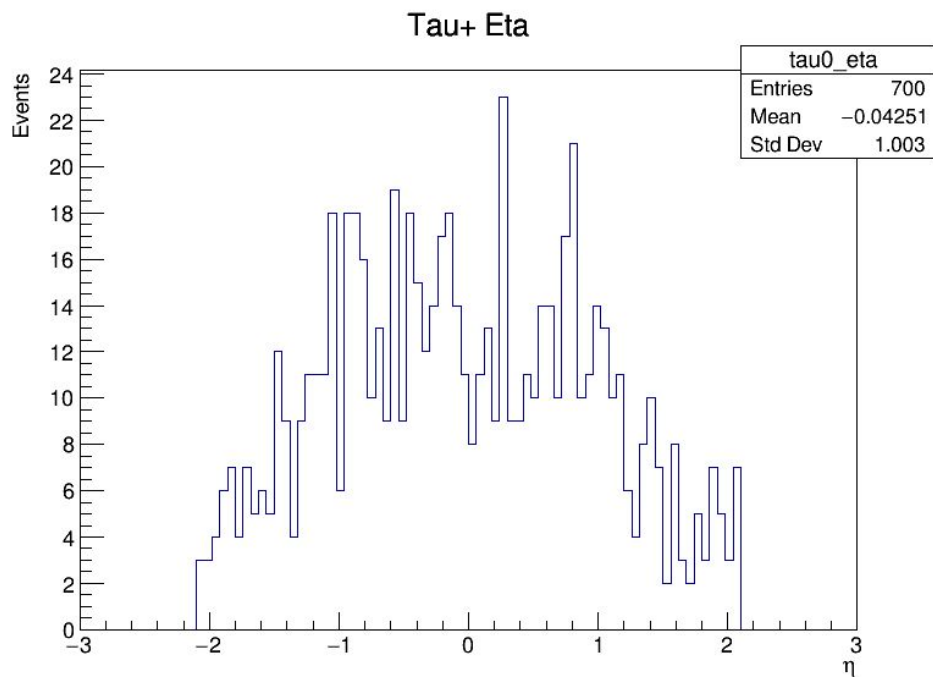# Fase0 code 23k -> 700 events
508 for no pileup protons

- Monte Carlo generated signal (23k events before processing);
- Events selected : Where trigger `HLT_DoubleMediumChargedIsoPFTauHPS40_Trk1_eta2p1_Reg` is applied
- Protons are selected by checking if there is one on each arm. If there is more than one, the one with largest ξ is selected.

Δφ
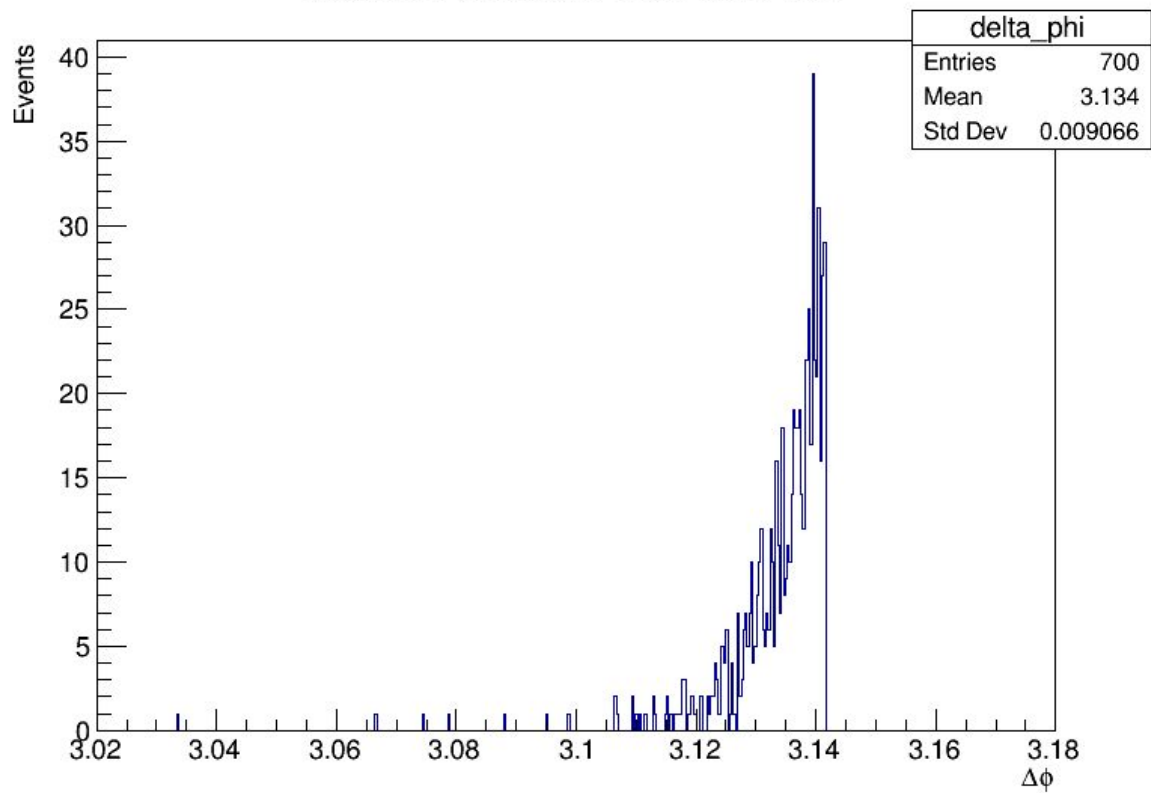
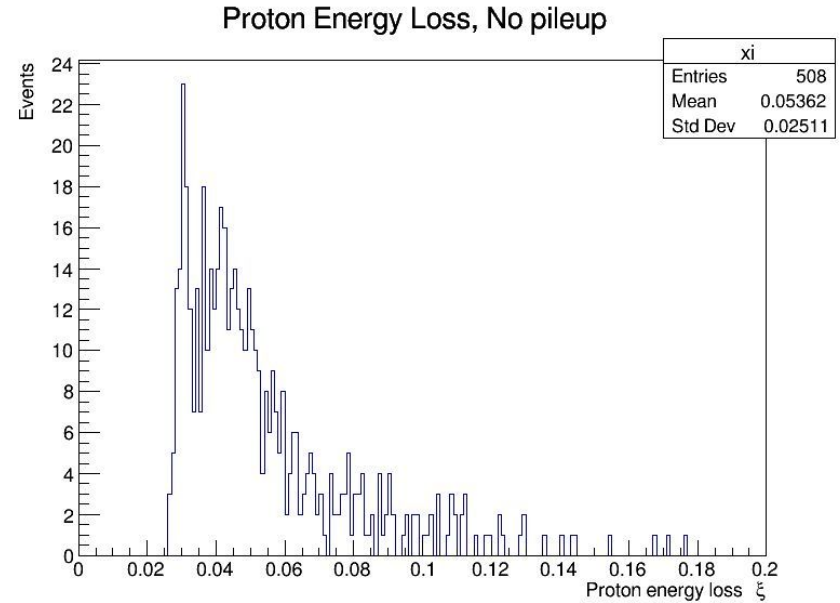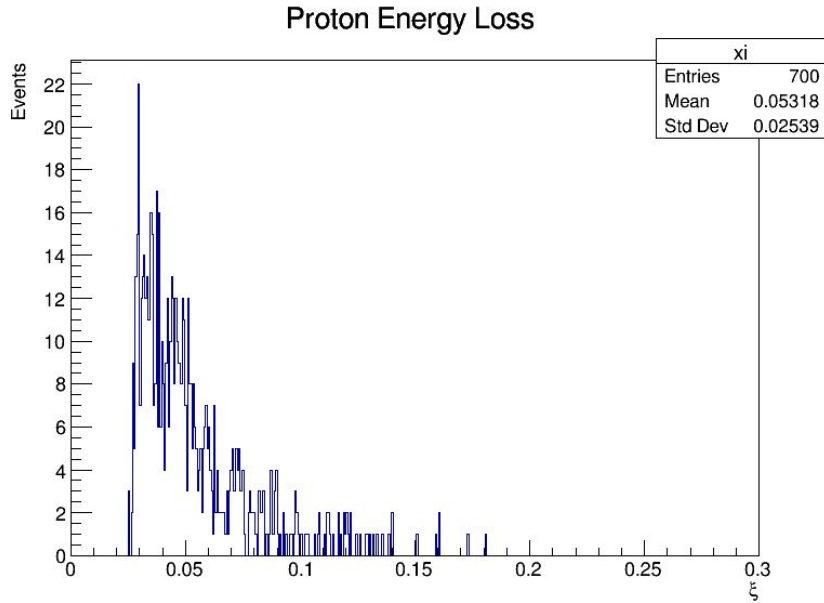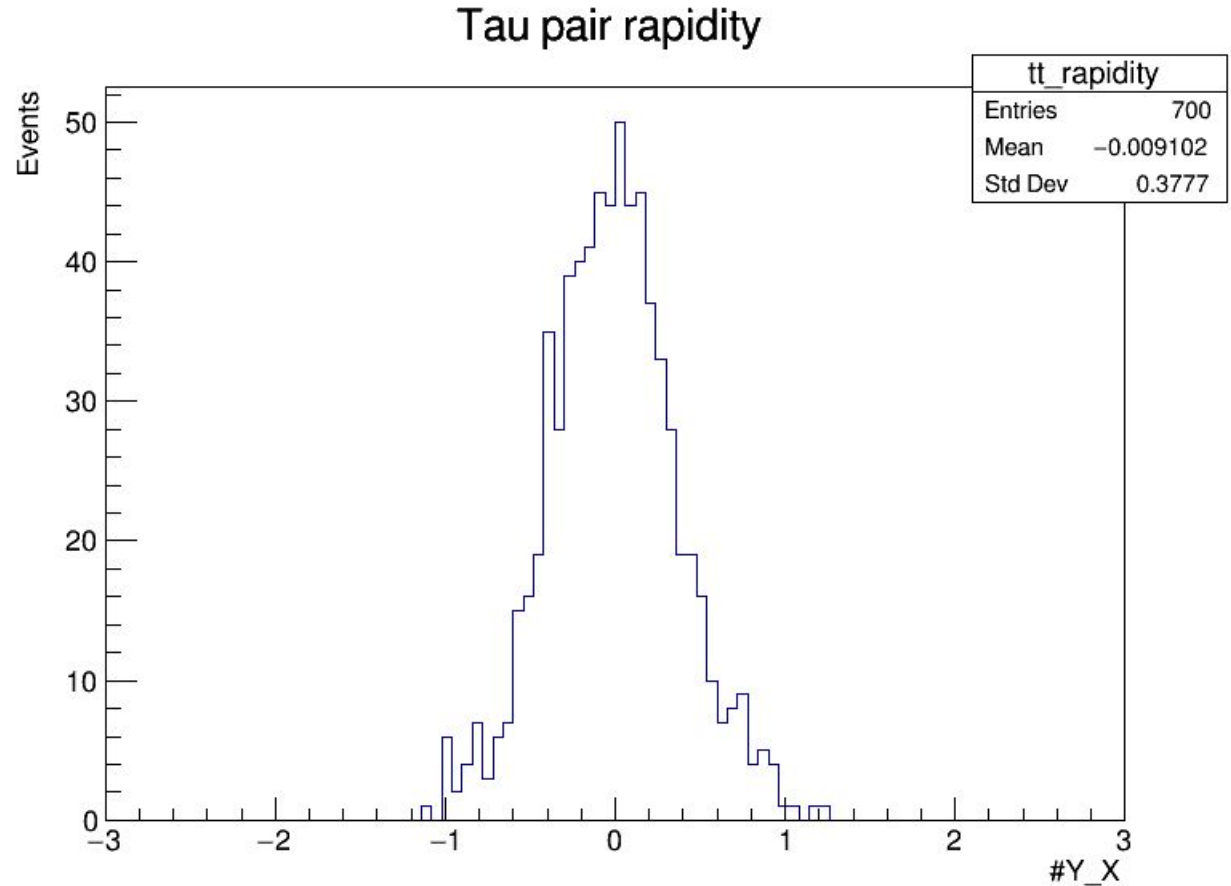# Pseudorapidity, η

Proton energy Loss, ξ
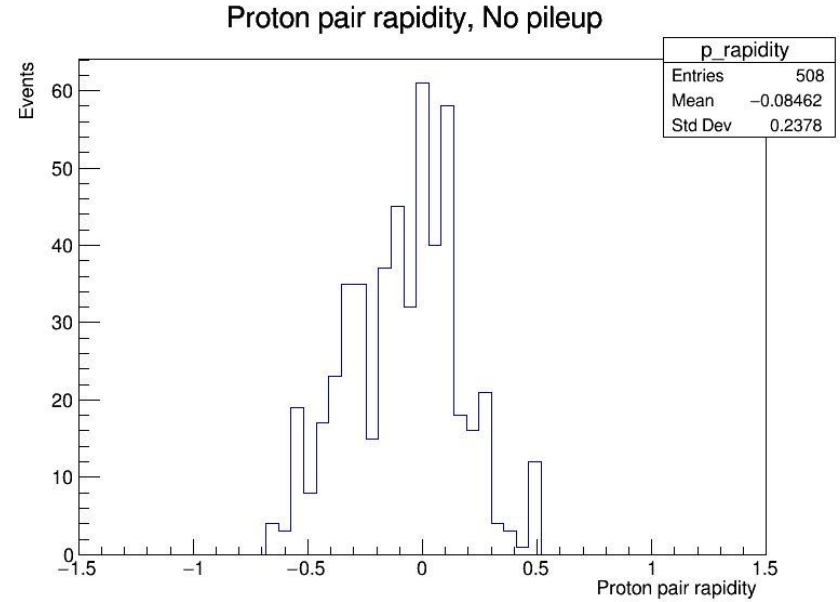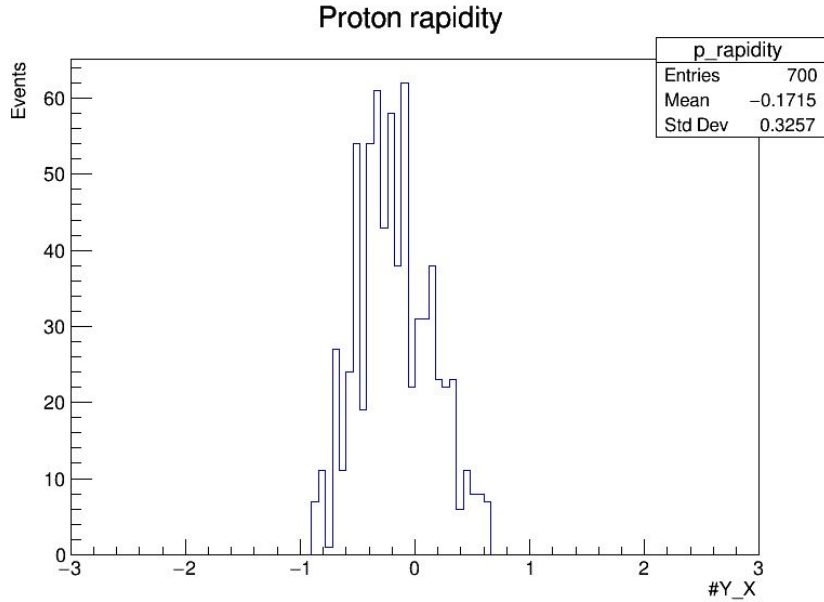
Tau pair rapidity

$$Y = \frac{1}{2} * \left(\frac{E + p_z}{E - p_z} \right)$$

- E is total energy of tau pair
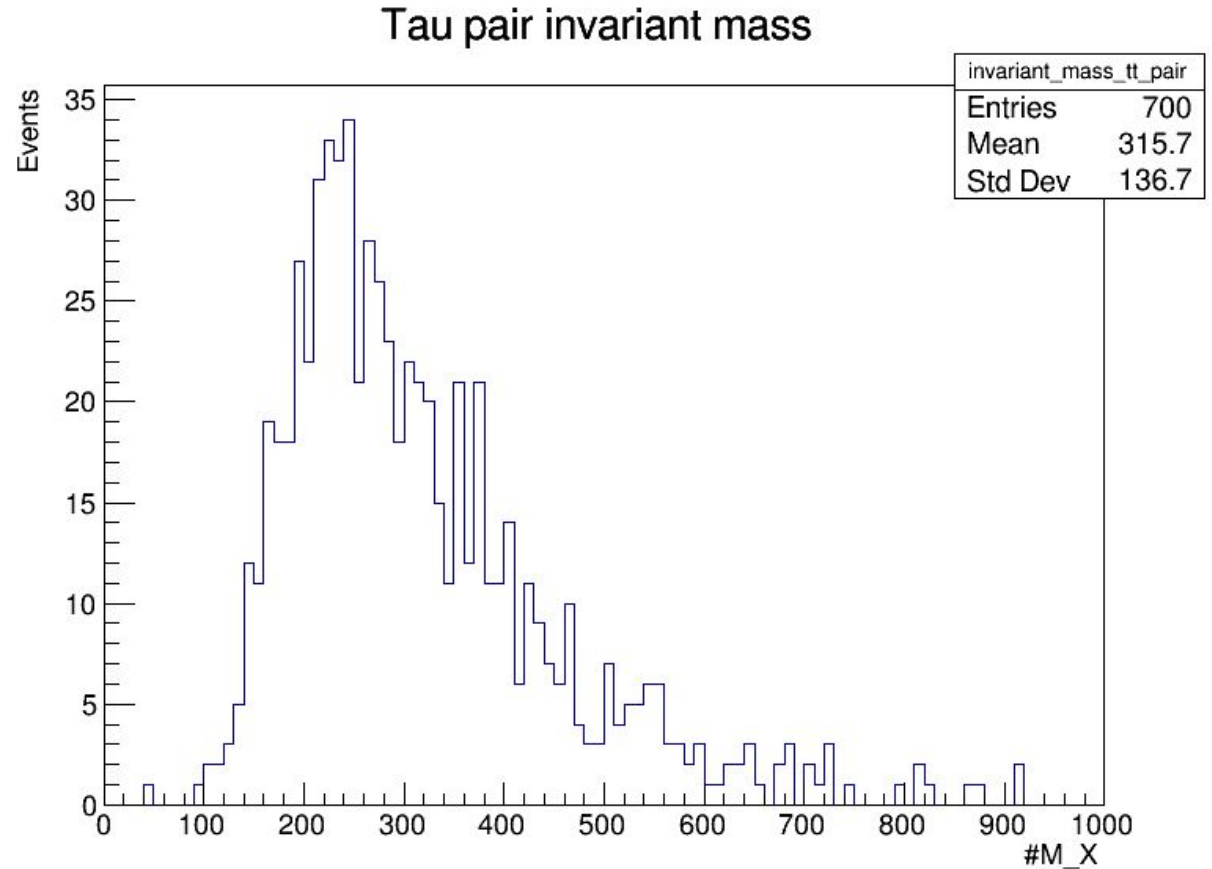- $P_{z;}$ is total longitudinal momentum of tau pair system

Tau pair rapidity

tt_rapidity	
Entries	700
Mean	−0.009102
Std Dev	0.3777

Proton Rapidity

$$Y_{x;} = \tfrac{1}{2} * \log(\xi_1 / \, \xi_2)$$

Proton rapidity

p_rapidity	
Entries	700
Mean	−0.1715
Std Dev	0.3257

Proton pair rapidity, No pileup

p_rapidity	
Entries	508
Mean	−0.08462
Std Dev	0.2378

Tau pair Invariant mass

$$M^2 = 2 \square pT_1 pT_2 \square (\cosh(\Delta\eta) - \cos(\Delta\phi))$$

Tau pair invariant mass

invariant_mass_tt_pair	
Entries	700
Mean	315.7
Std Dev	136.7

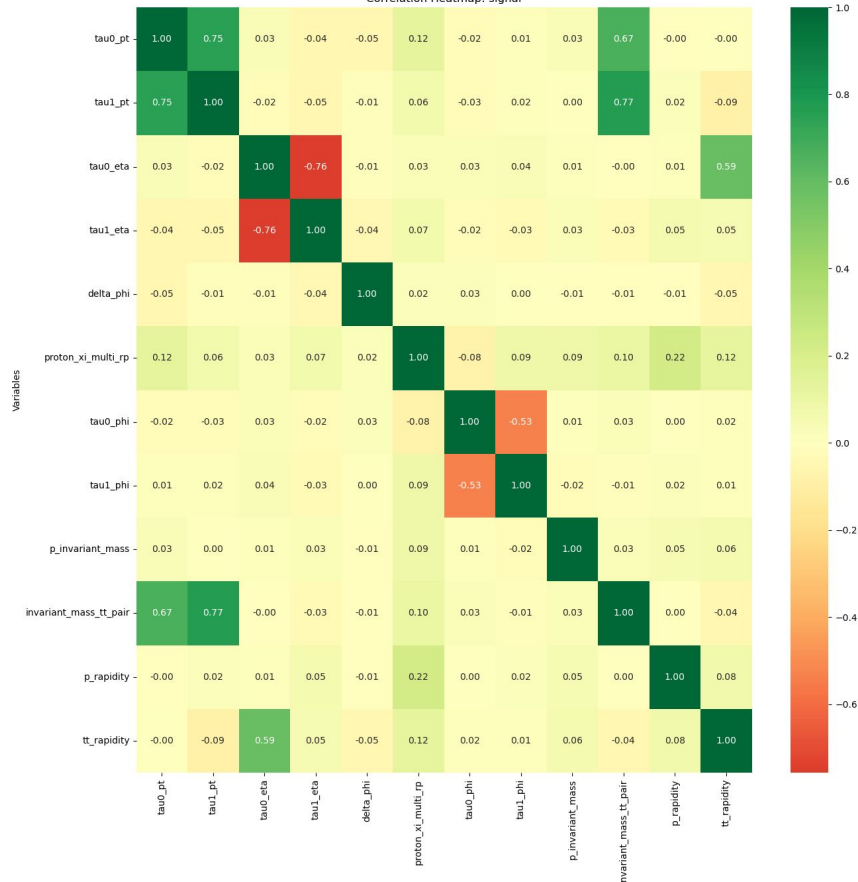# Proton Invariant mass

$$M_X{}^2 = s\xi_1\xi_2$$
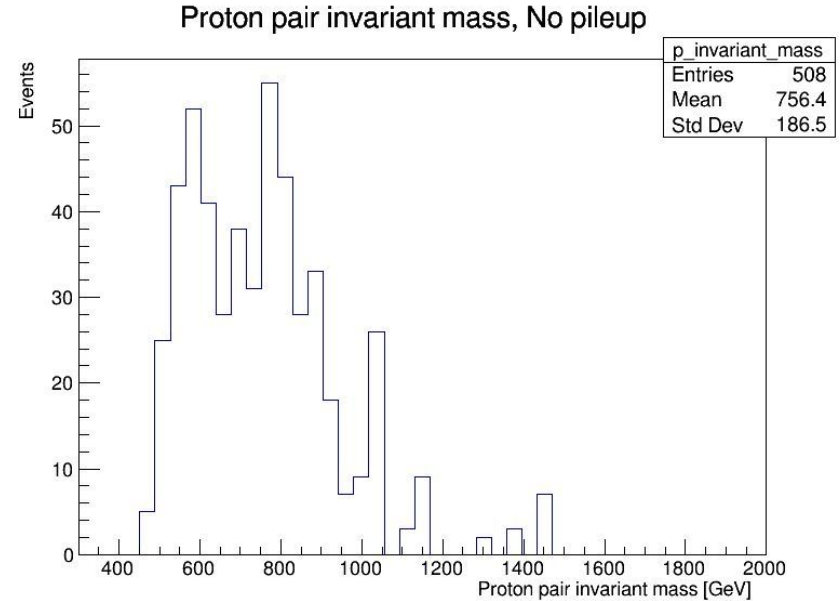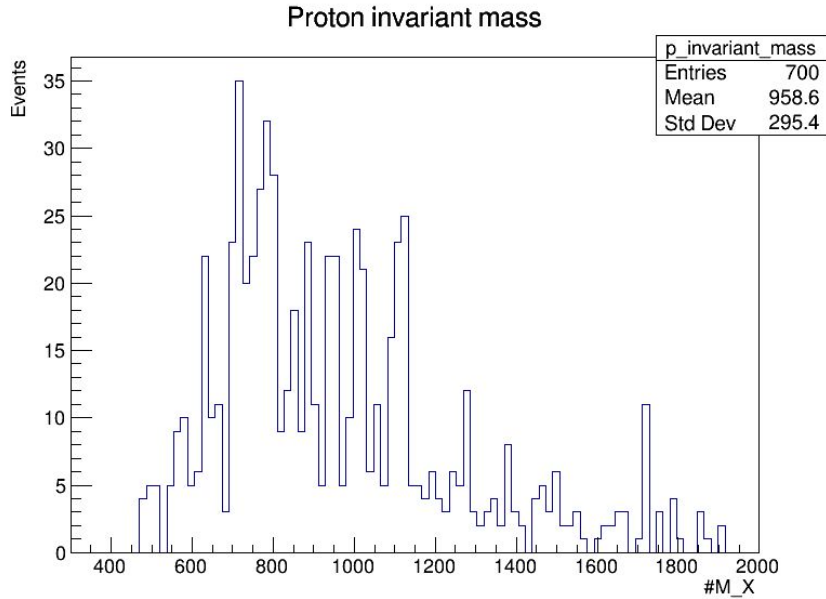
Correlation between variables

- tau0_phi,tau1_phi
- tau0_eta,tau1_eta
- tau0_pt,tau1_pt
- sist_mass,tau0_pt
- sist_mass,tau1_pt
- Sist_rap,tau0_eta
- Tt_rapidity,tau0_eta
- p_invariant_mass,invariant_mass_tt_pair
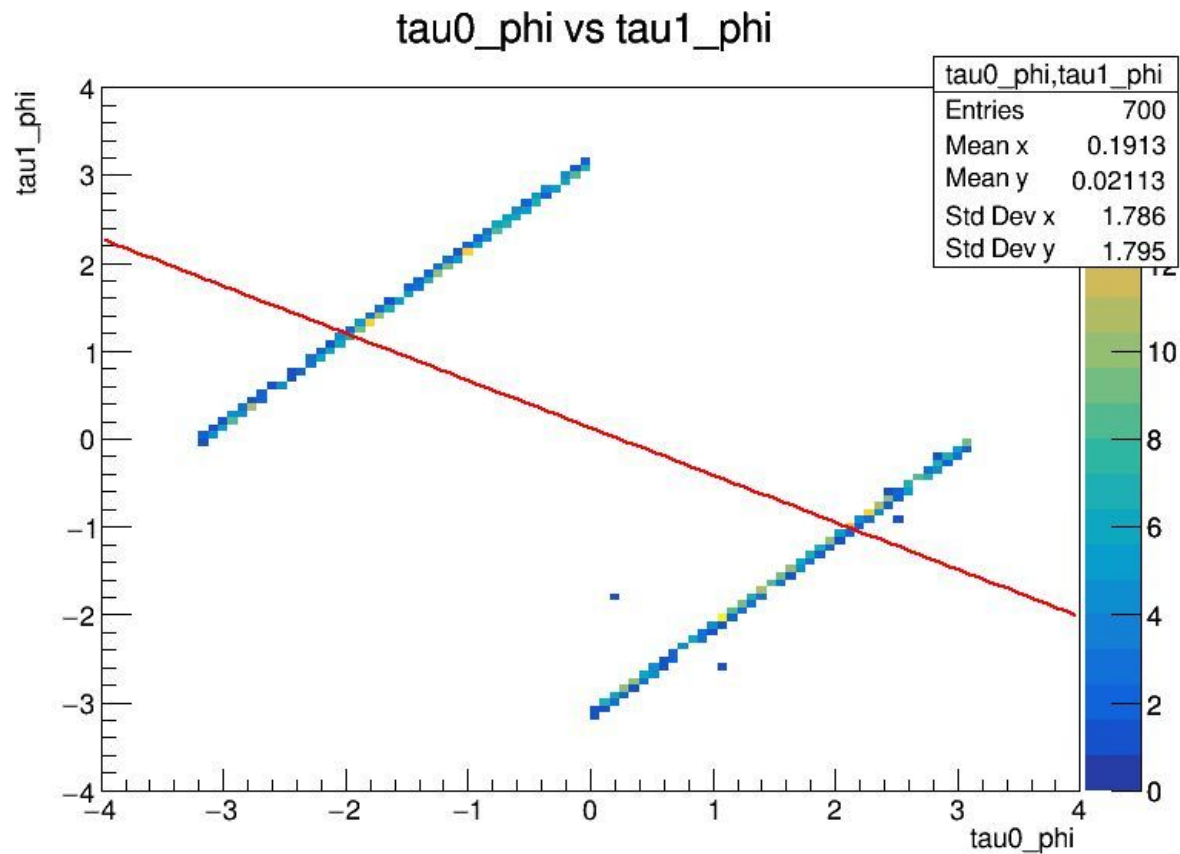- p_rapidity,tt_rapidity
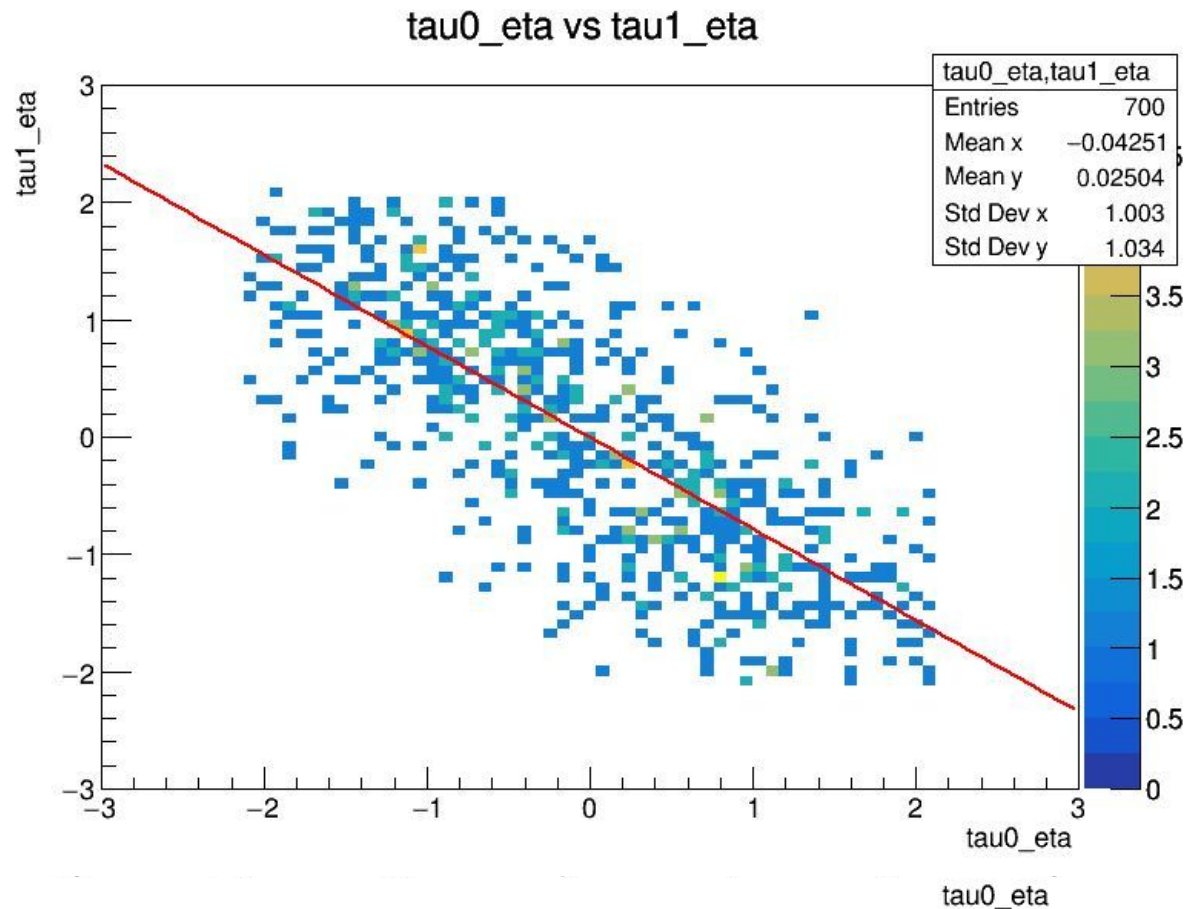
Correlation Heatmap: signal

Expected:

- Strong correlation between tau0 and tau1 phi
- Negative correlation between tau0 and tau1 eta
- Strong correlation between invariant mass of tau pair and tau0 and tau1 pt
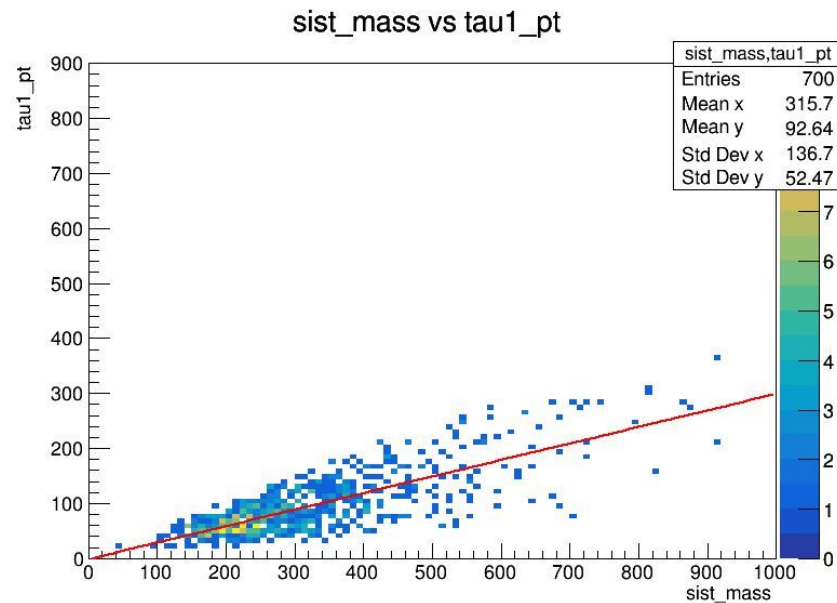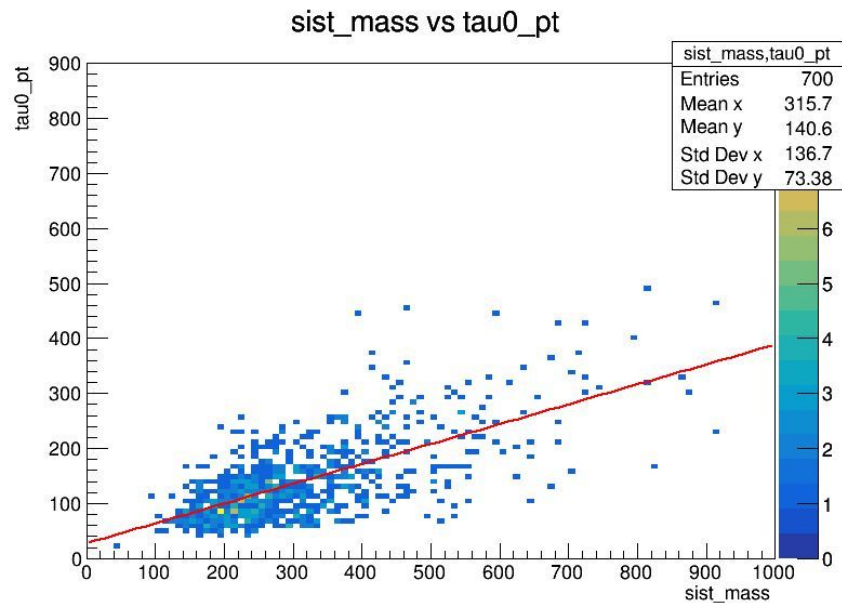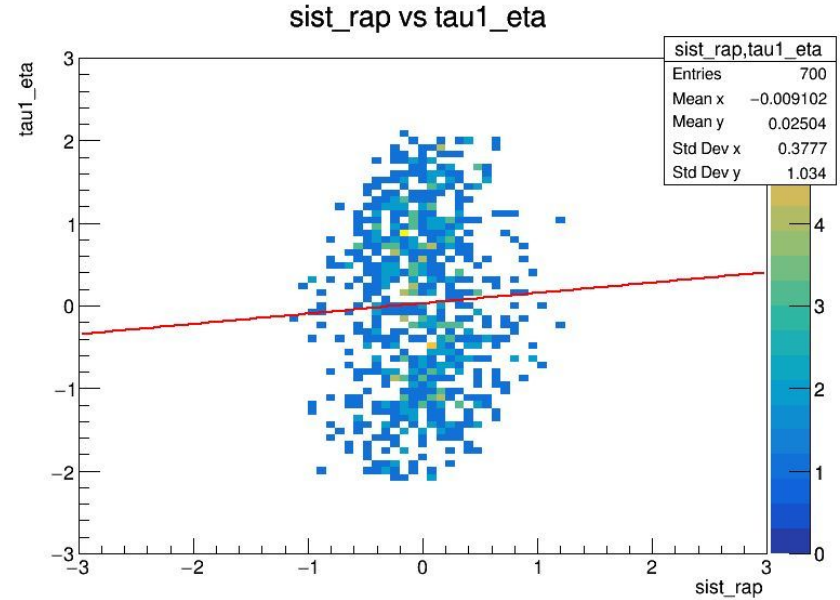- Some correlation between tau pair rapidity and tau0 eta
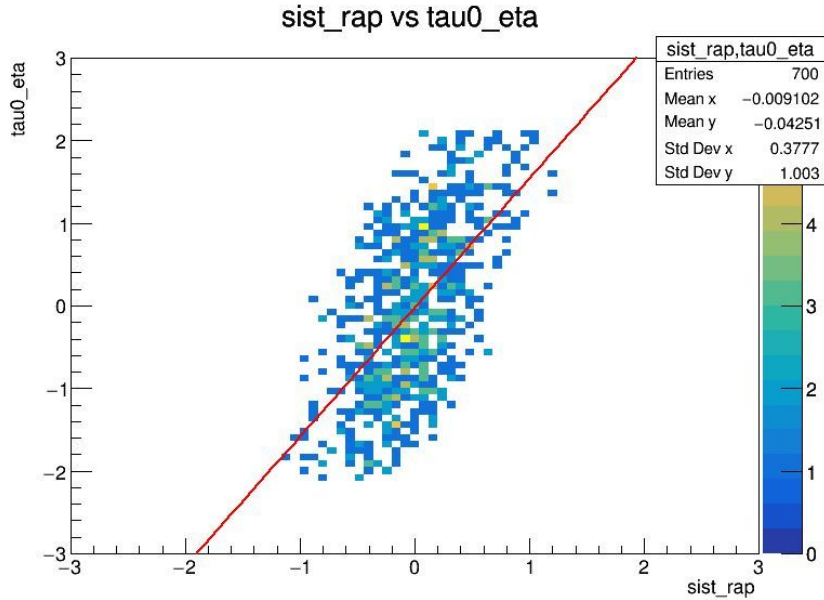
Tau0 and Tau1 phi

tau0_phi vs tau1_phi

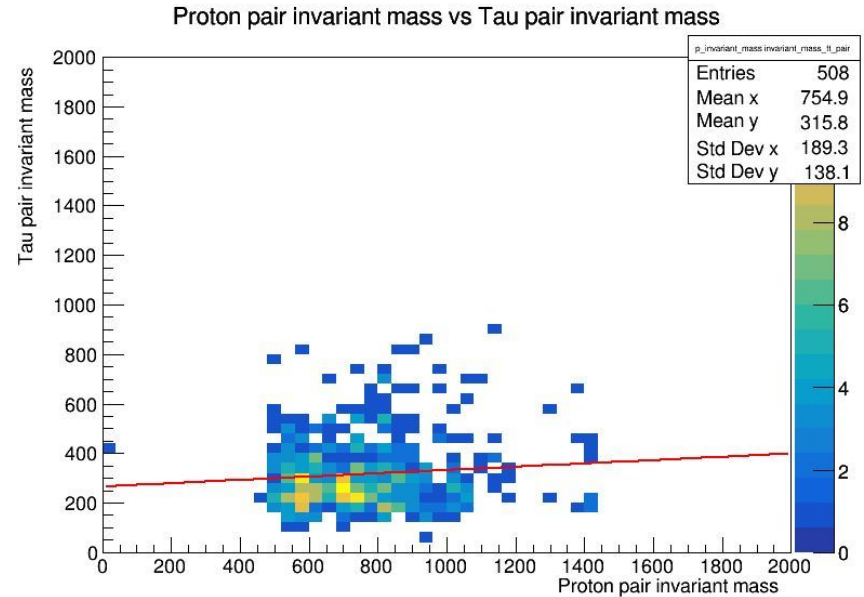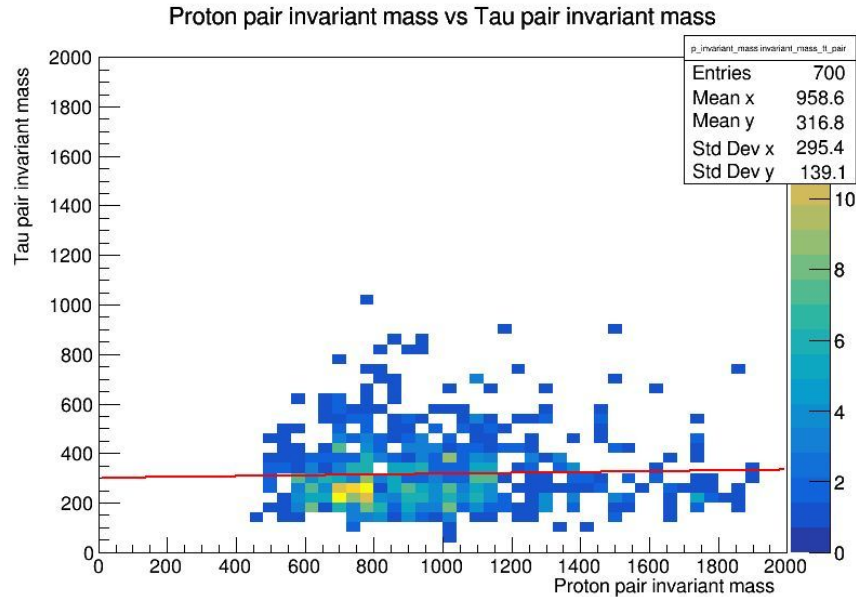| tau0_phi,tau1_phi	
Entries	700
Mean x	0.1913
Mean y	0.02113
Std Dev x	1.786
Std Dev y	1.795

Tau0 and Tau1 eta
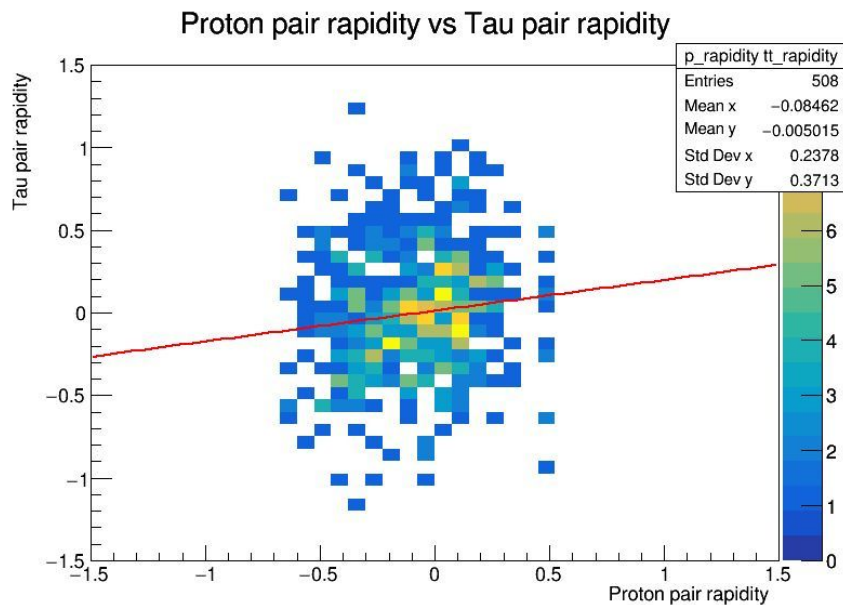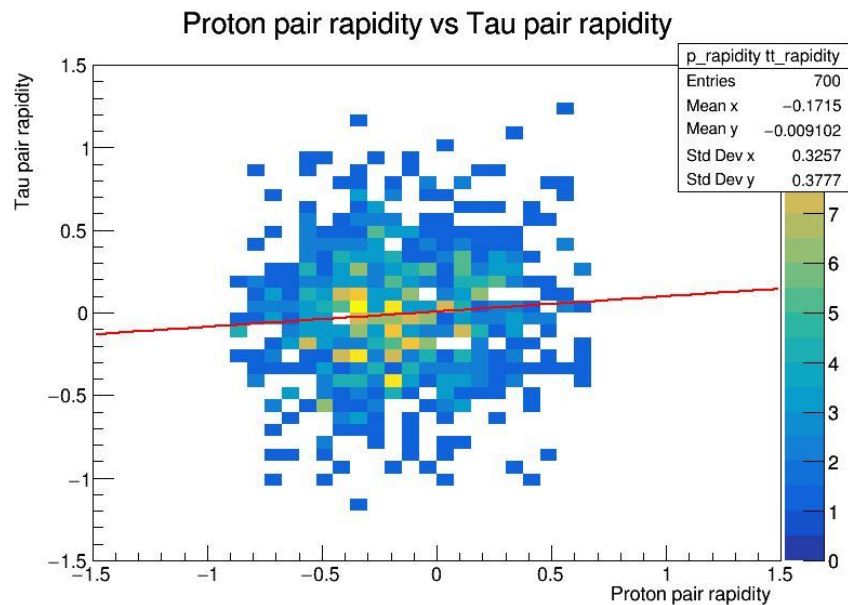
System mass, tau0 pT and tau1 pT

System rapidity, tau0 eta

Invariant mas of tau pair, protons: pileup vs no pileup

Proton rapidity, tau pair rapidity: pileup vs no pileup

Proton-Tau pair invariant mass, Rapidity: pileup vs no pileup

Proton inv mass - tau pair inv mass

Vs

Proton rapidity - tau rapidity