

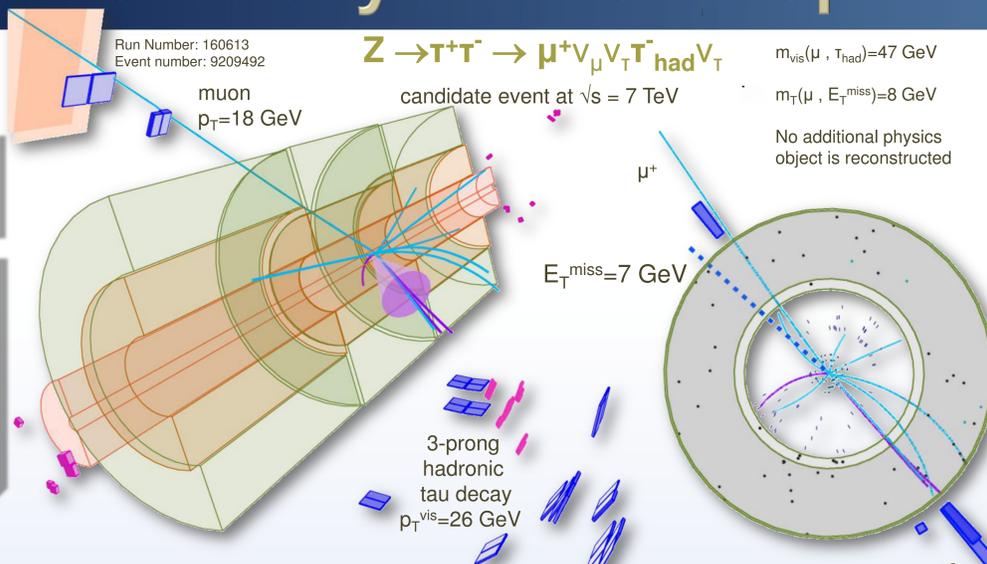
Reconstruction and Identification of Hadronic Decays of Tau Leptons in ATLAS

17

Tau Reconstruction

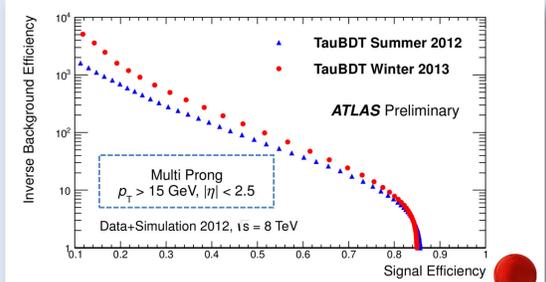
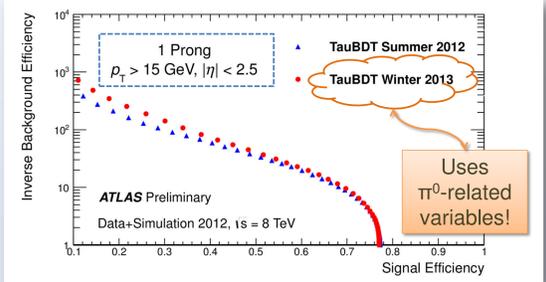
ATLAS-CONF-2013-064
ATLAS-CONF-2013-044

- ✓ topological clusters made of calorimeter cells & calibrated using the Local Hadron Calibration (LC) scheme
- ✓ anti-k_T R=0.4 jet finder
- ✓ associate tracks within the tau core cone $\Delta R \leq 0.2$
- ✓ identify the best vertex hypothesis for the τ_{had} candidate
- ✓ sum up clusters within $\Delta R \leq 0.2$ around the barycenter



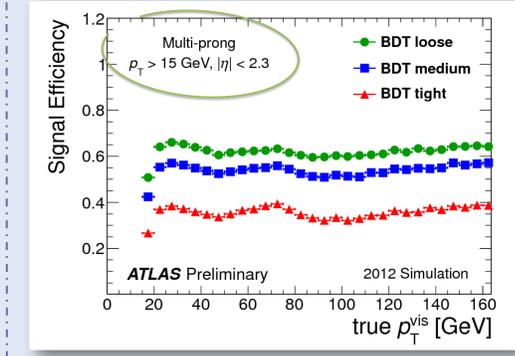
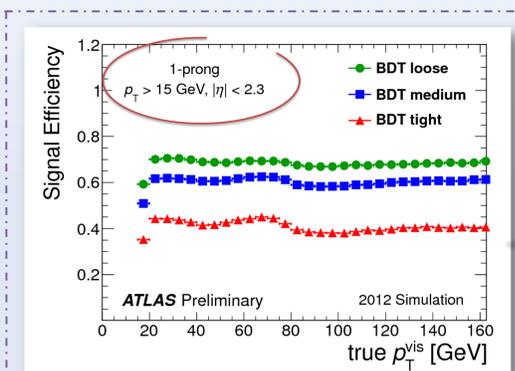
Tau Identification

- Multivariate technique (Boosted Decision Trees) to identify hadronic taus
- Calorimetric and tracking shower shapes to discriminate hadronic tau decays from QCD jets and electrons
- Cut-based muon-veto to reject muon track and associated calorimeter cluster



Inverse background efficiency as a function of the signal efficiency

- Signal efficiencies are obtained using $Z \rightarrow \tau\tau$, $Z' \rightarrow \tau\tau$ and $W \rightarrow \tau\nu$ simulation
- Background efficiencies are derived using QCD multi-jet events in 2012 data



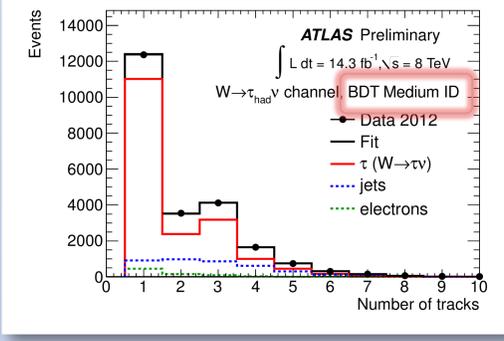
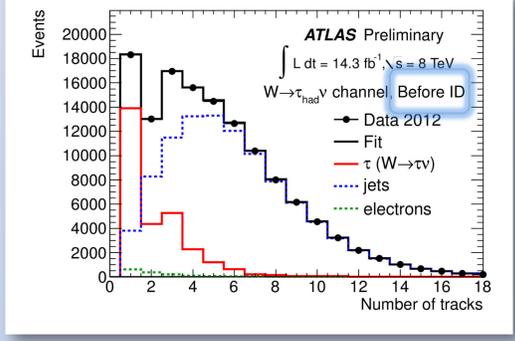
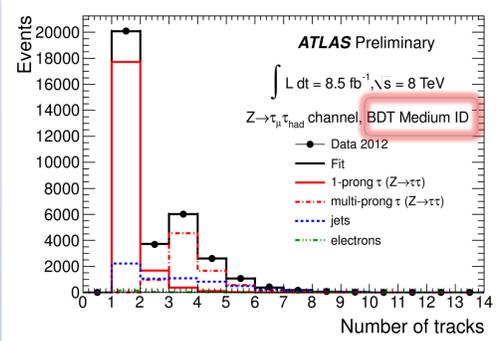
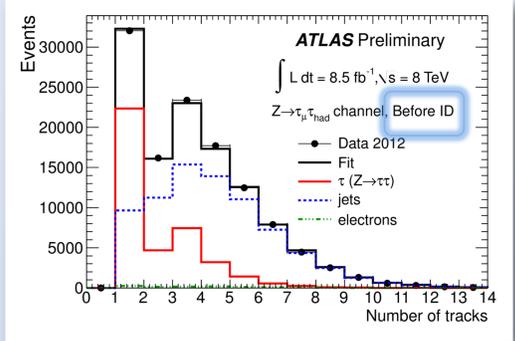
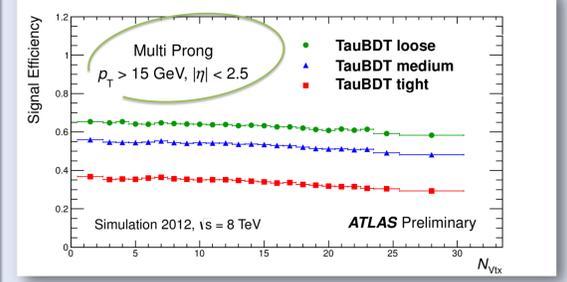
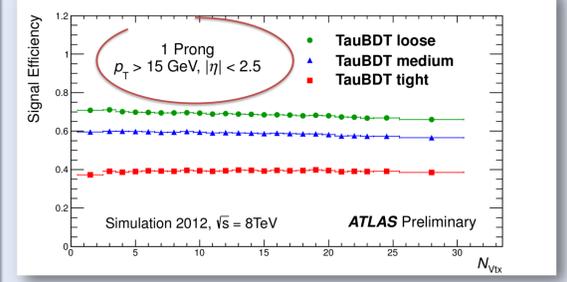
Tau Identification Performance

Tau ID Signal efficiency as a function of

- Number of interaction vertices (pile-up)
- visible tau p_T

for 1-prong and multi-prong τ_{had} candidates for the three working points of the BDT tau ID

Simulated samples:
 $Z \rightarrow \tau\tau$, $Z' \rightarrow \tau\tau$ & $W \rightarrow \tau\nu$

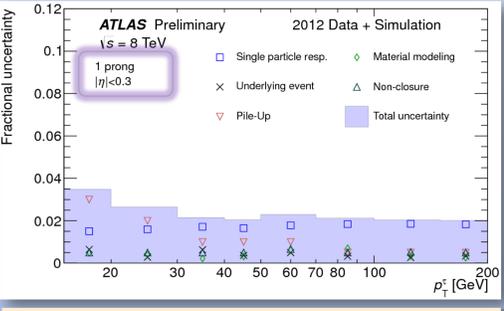
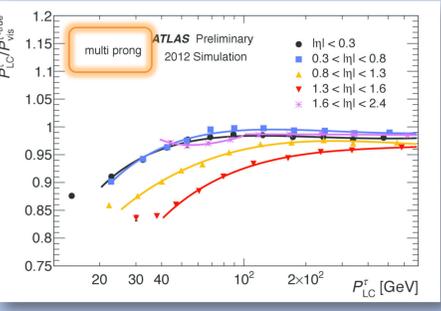
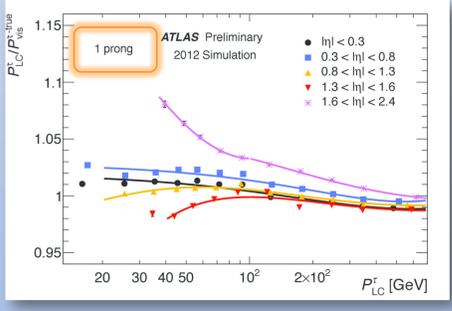
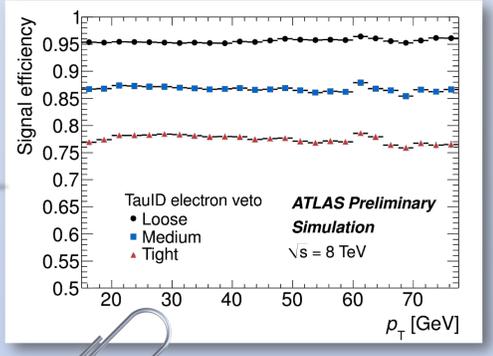
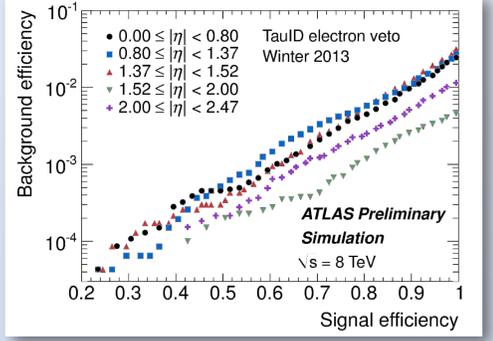


Tau ID Efficiency Measurement

- ✓ Data-driven techniques
- ✓ Different final states:
 - ✓ $Z \rightarrow T_{lep} T_{had}$ "tag-and-probe" method
 - ✓ $W \rightarrow T_{had} \nu T$
 - ✓ $t\bar{t} \rightarrow T_{had} + jets$
- ✓ Extended counting of p_T -correlated tracks in the annulus $0.2 \leq \Delta R \leq 0.6$
- ✓ Fit expected signal & background track templates to data
- extract tau ID efficiency

Electron Veto

- ✓ Optimized using simulated $Z \rightarrow \tau\tau$ events (signal) and $Z \rightarrow ee$ events (background)
- ✓ Signal efficiency for 1-prong τ_{had}



In-situ analysis

provides a data-driven TES measurement using the reconstructed $Z \rightarrow \tau\tau$ visible mass peak