

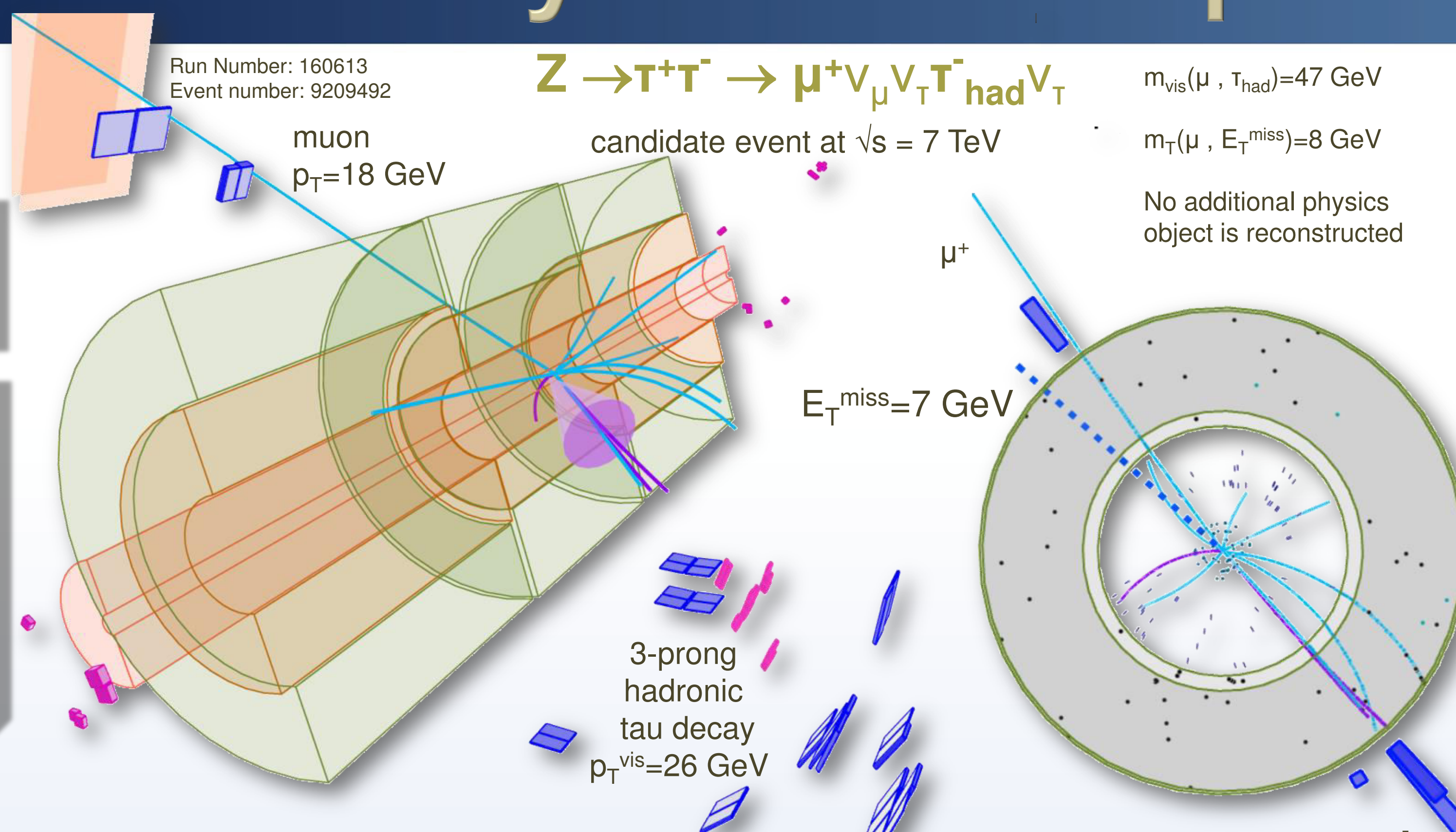
Reconstruction and Identification of Hadronic Decays of Tau Leptons in ATLAS

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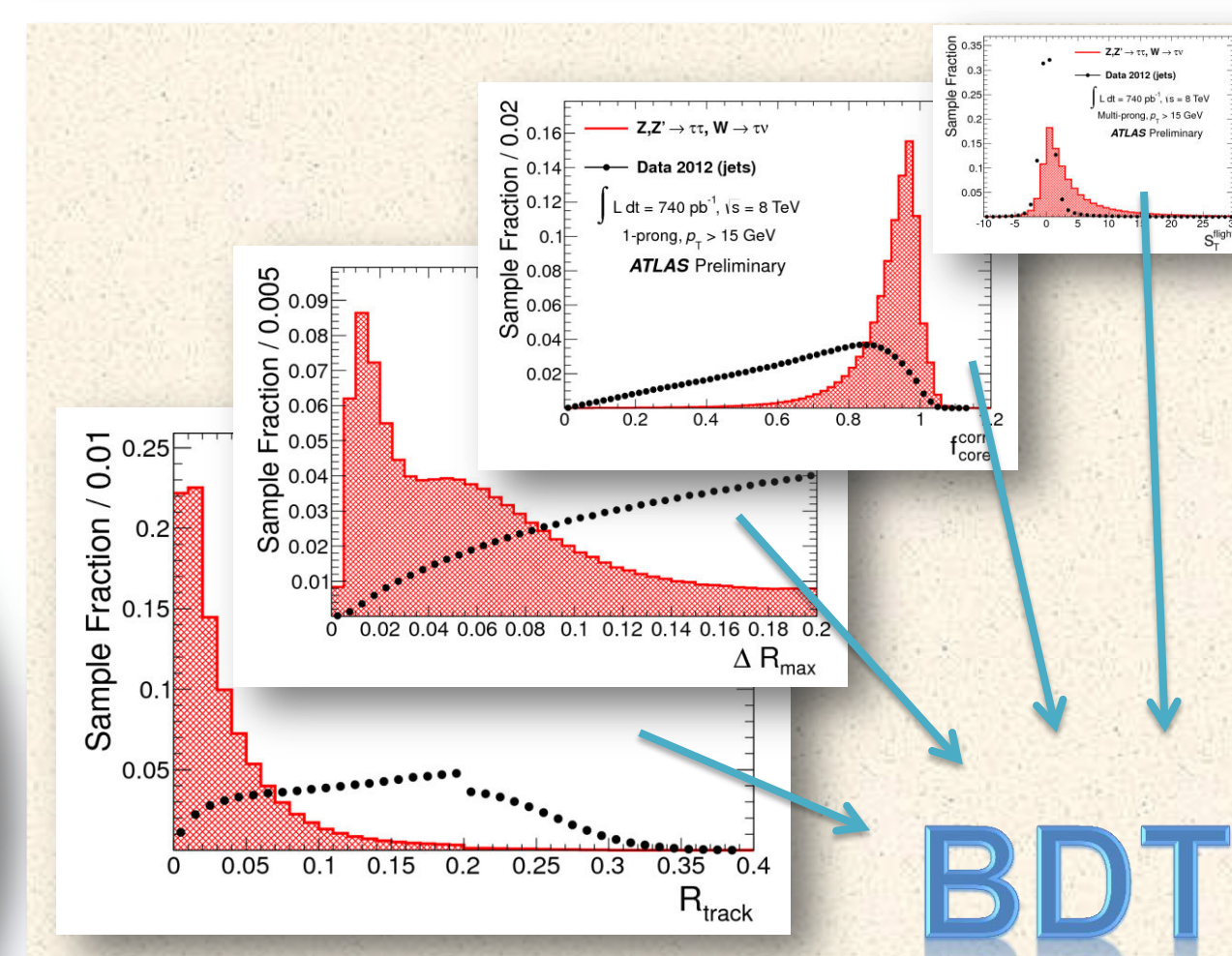
Tau Reconstruction

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

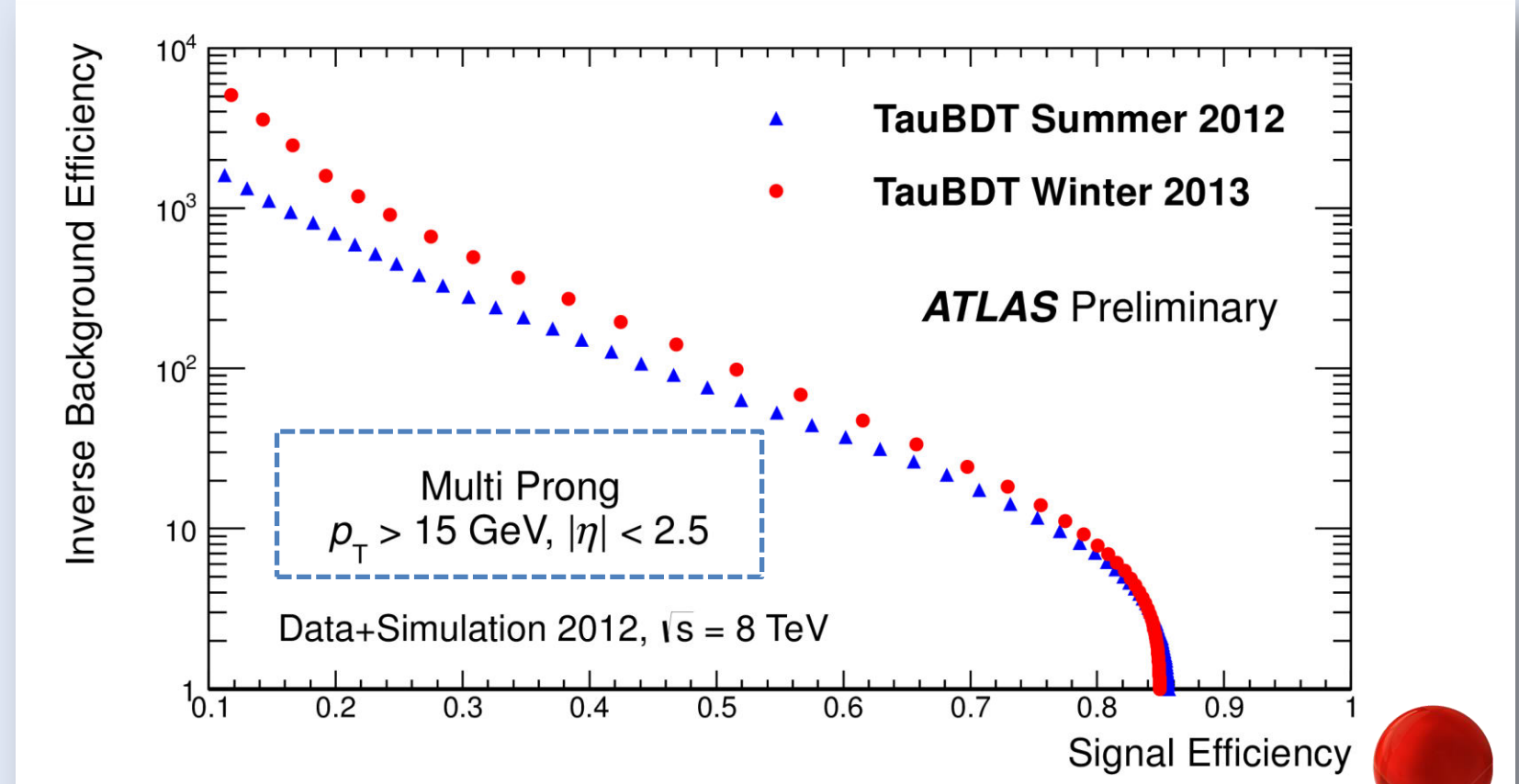
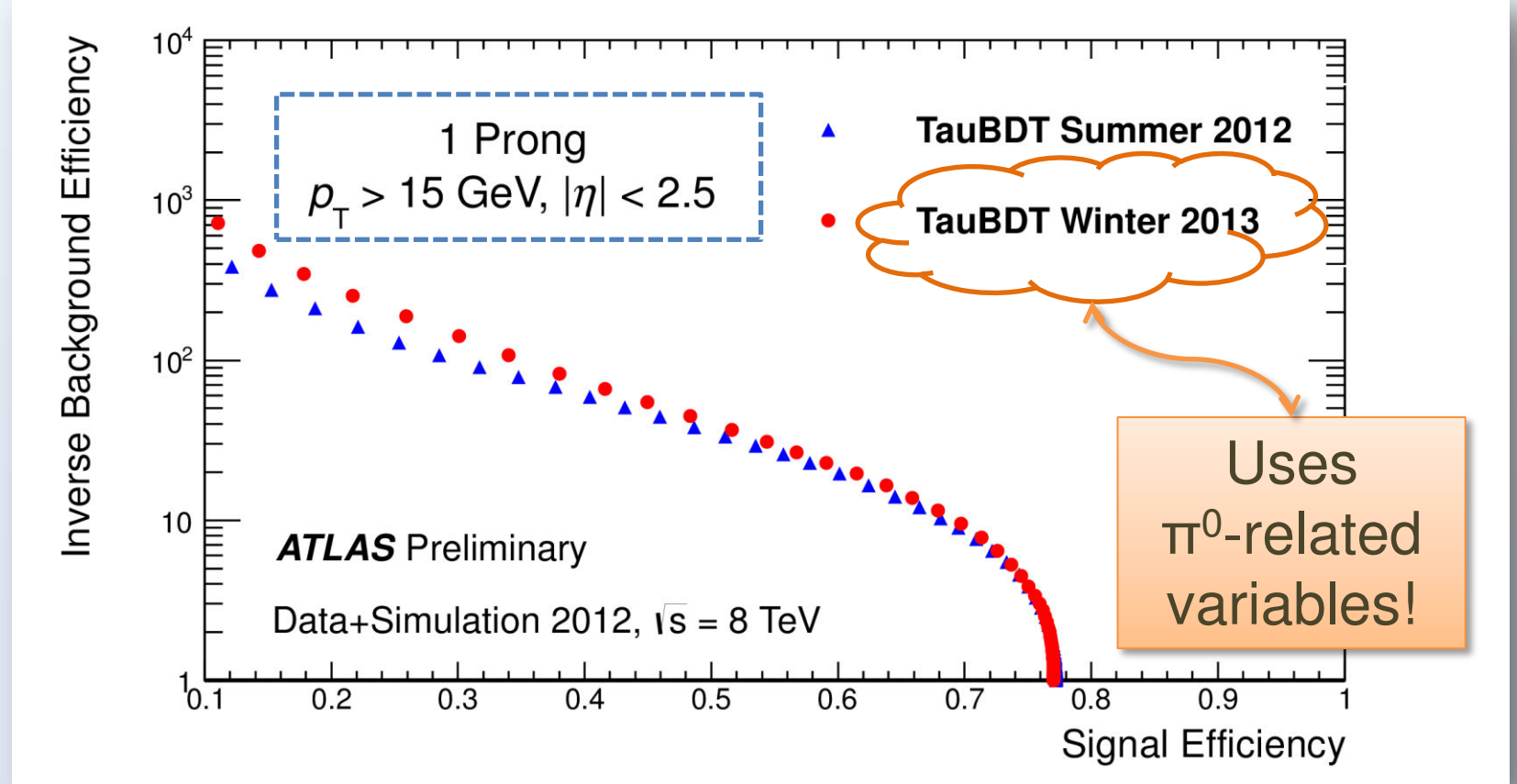
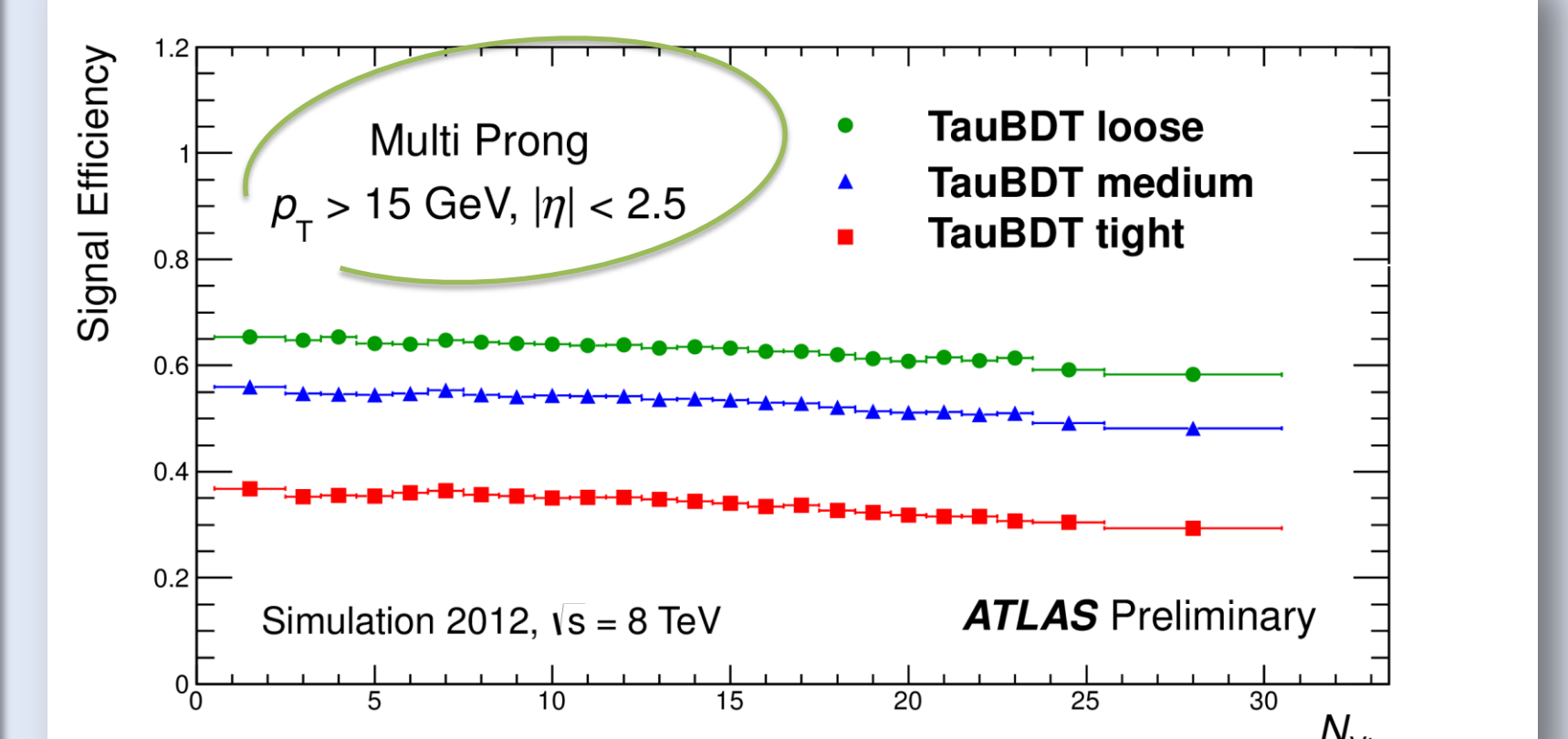
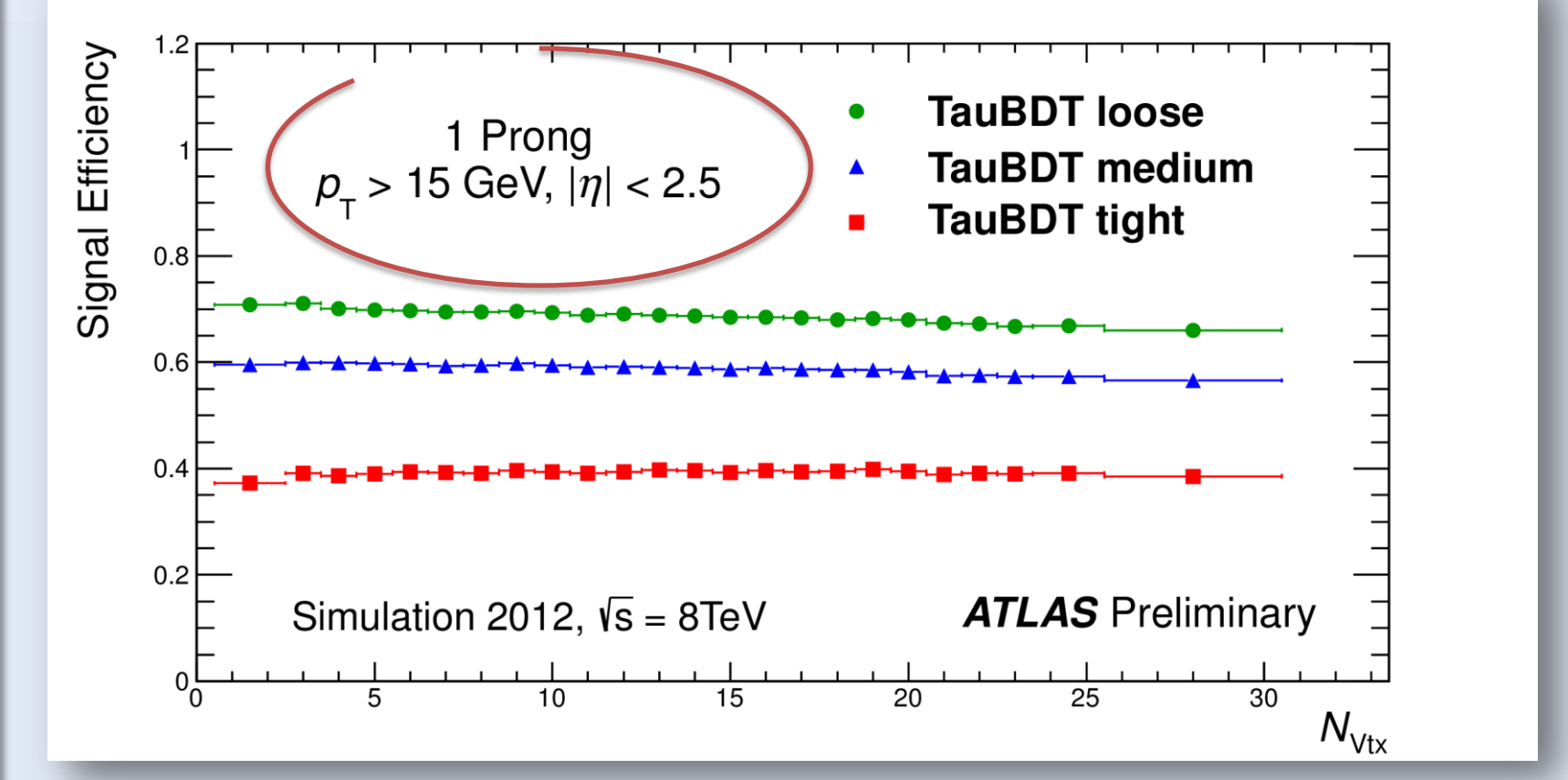
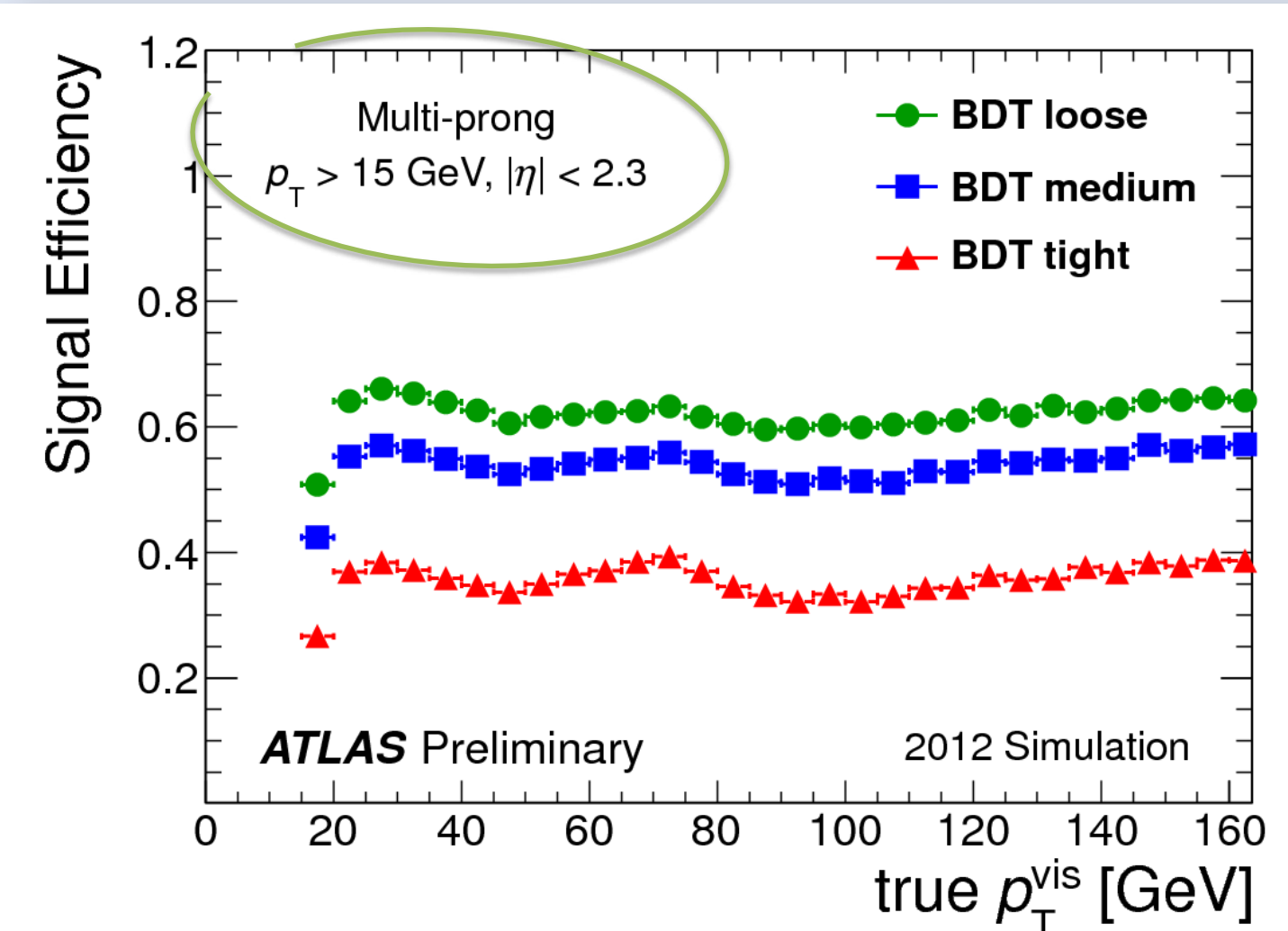
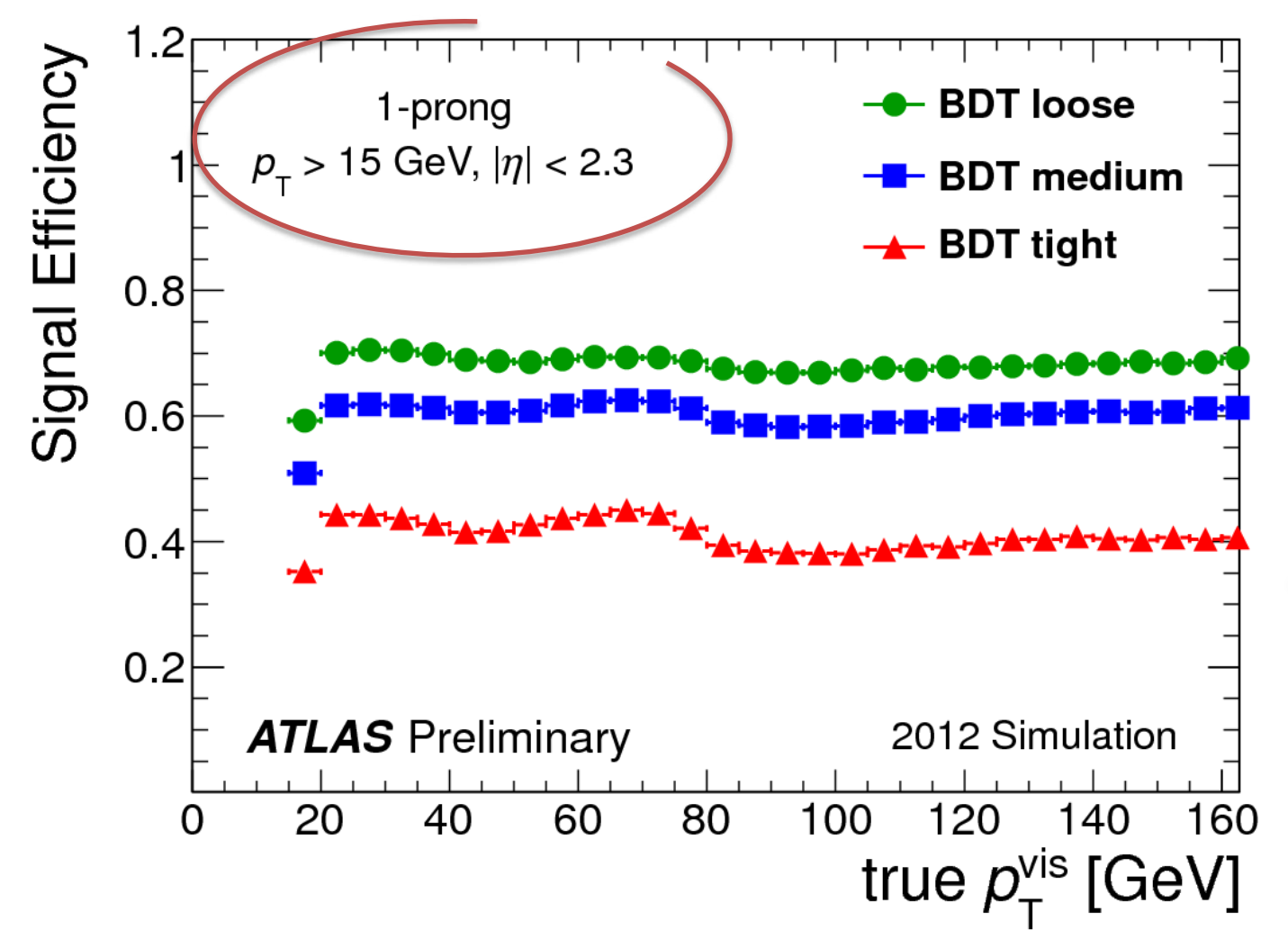
Tau Identification Performance

Tau ID Signal efficiency as a function of

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

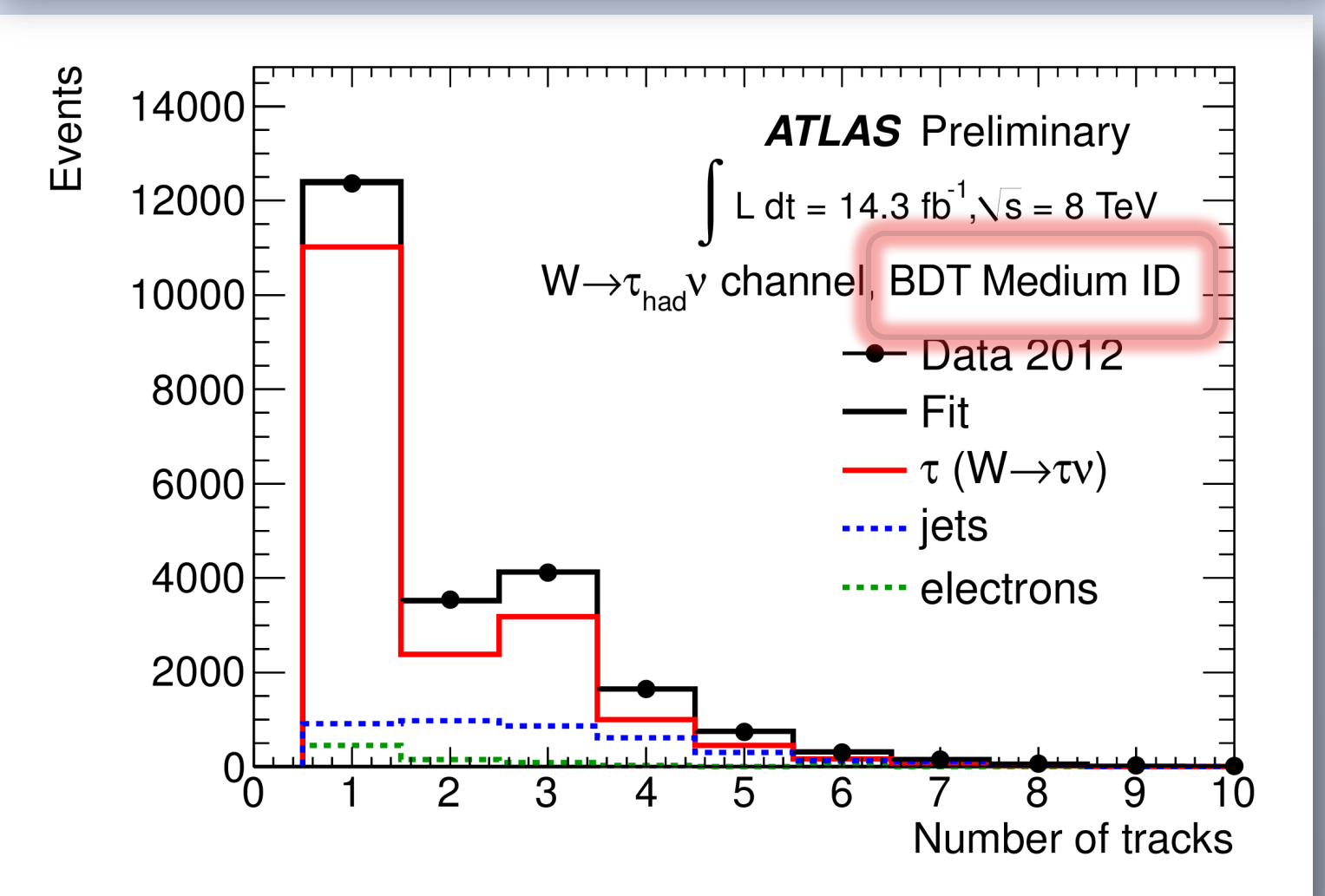
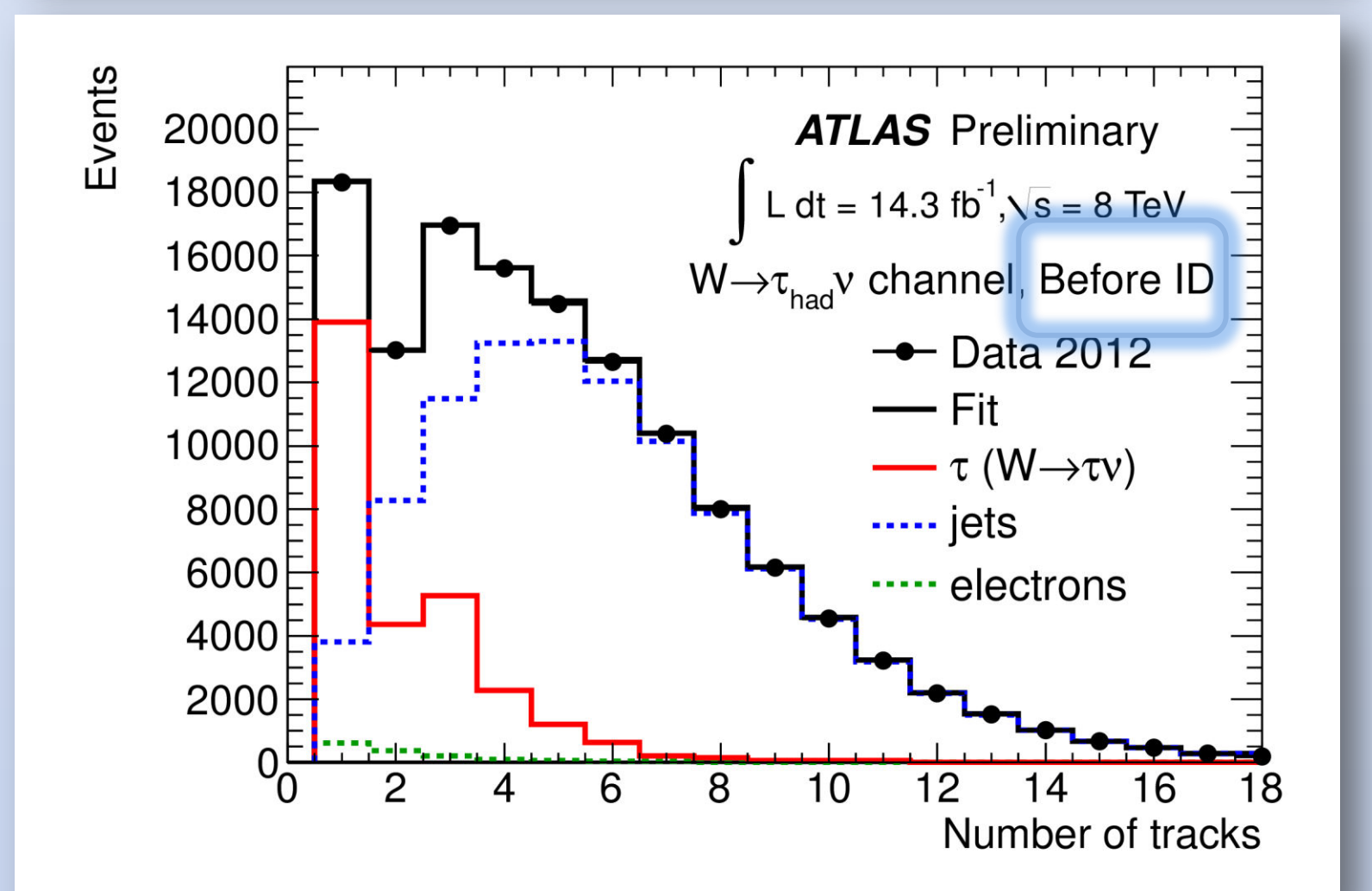
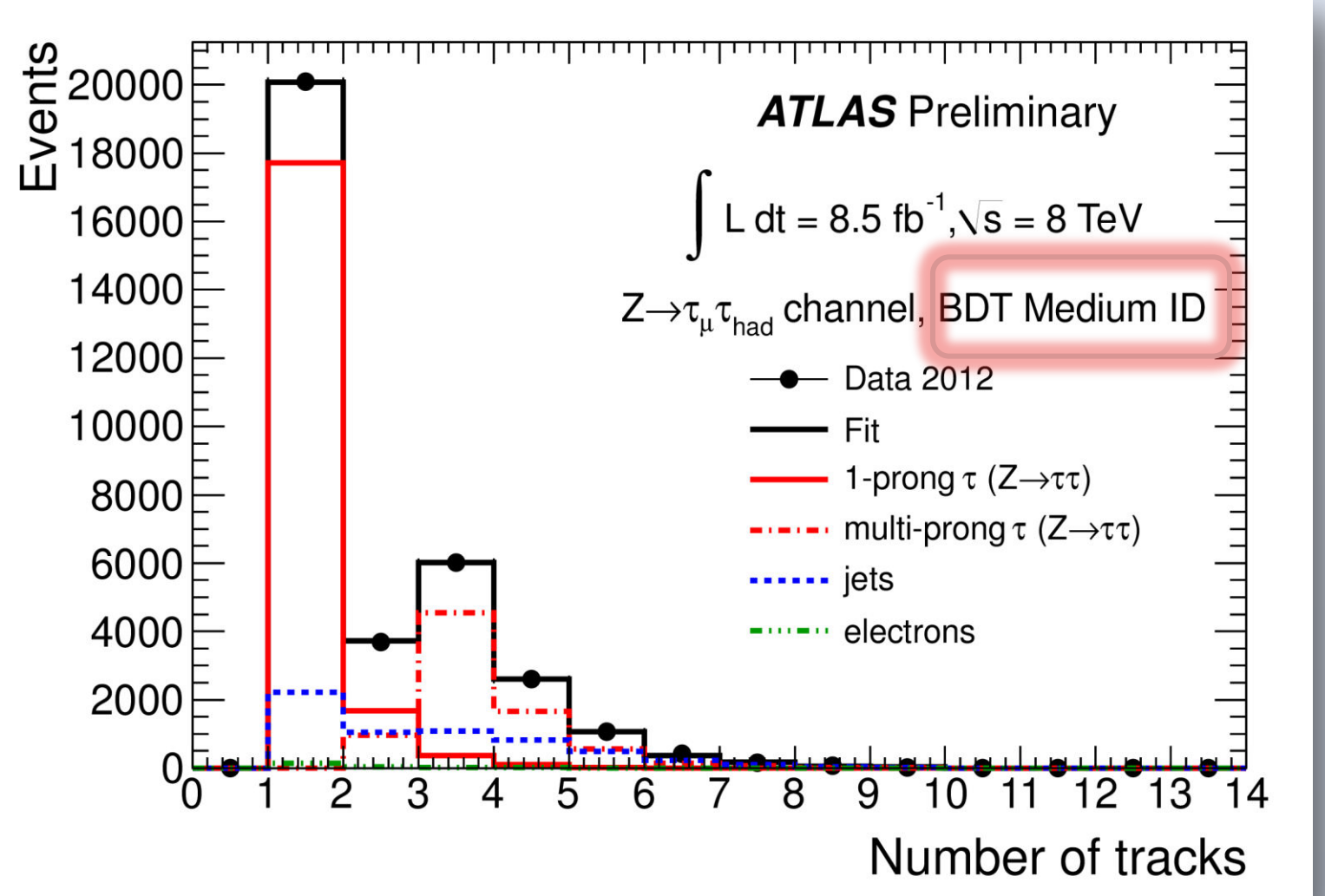
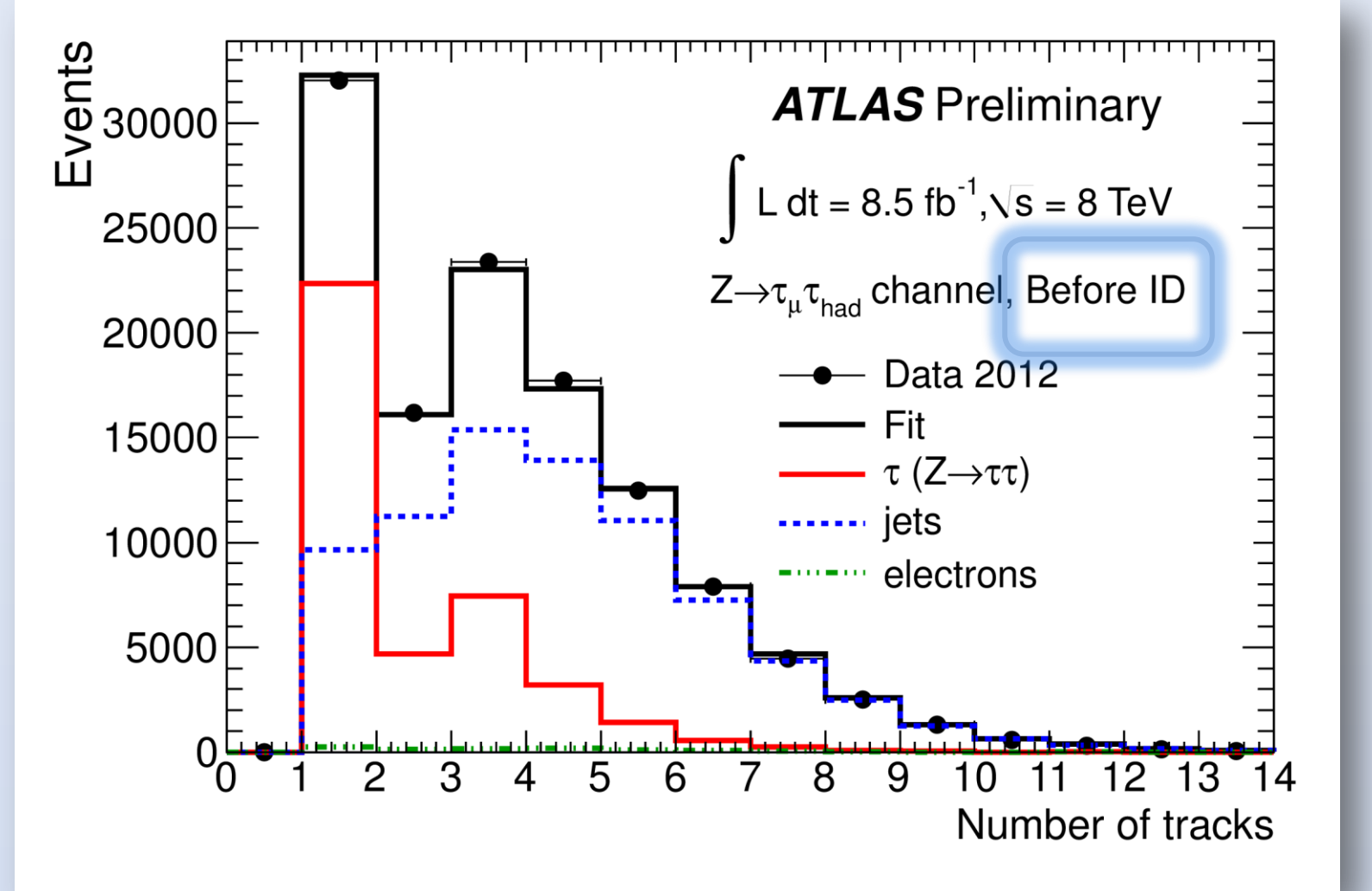
for 1-prong and multi-prong τ_{had} candidates for the three working points of the BDT tau ID

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



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

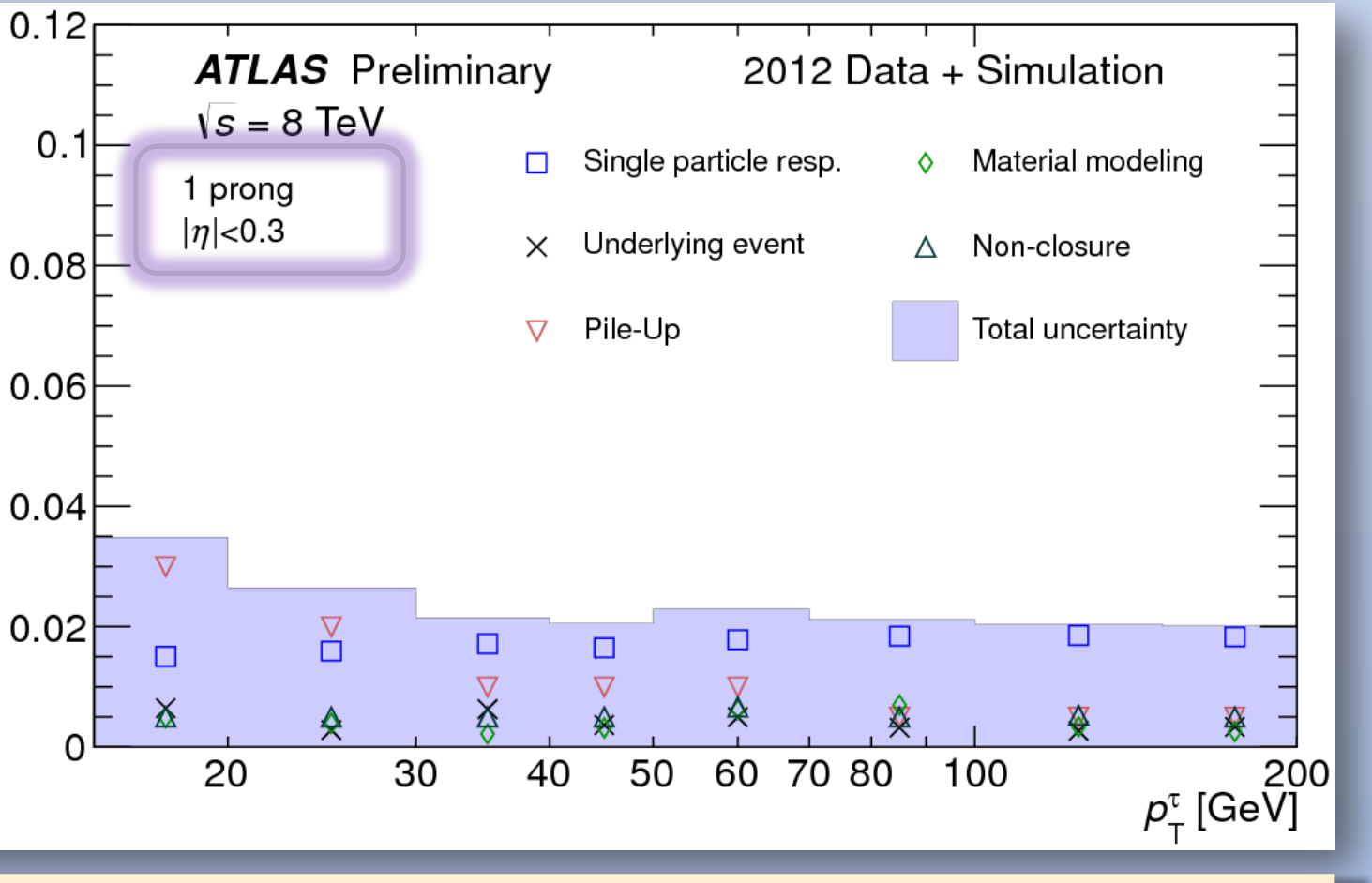
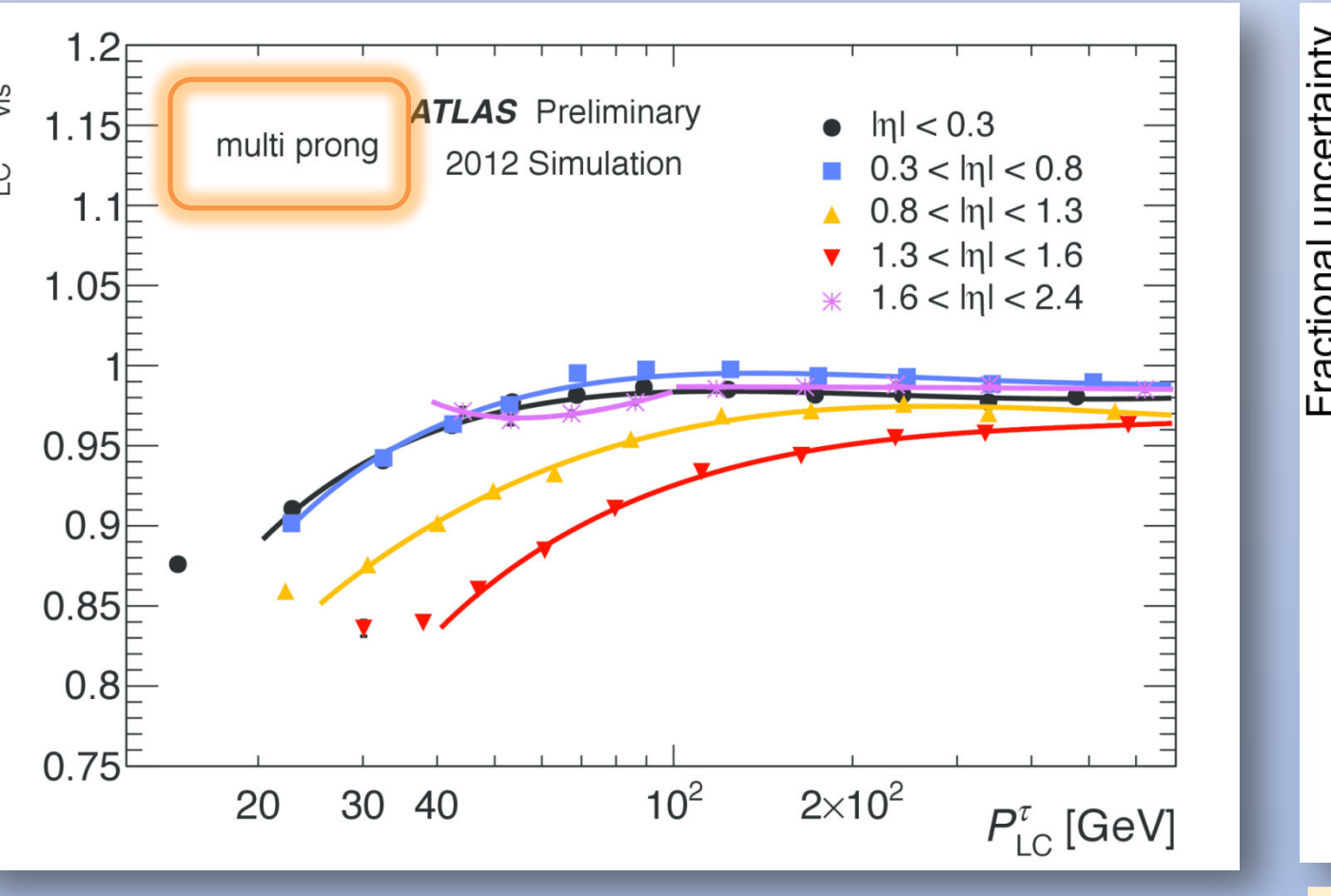
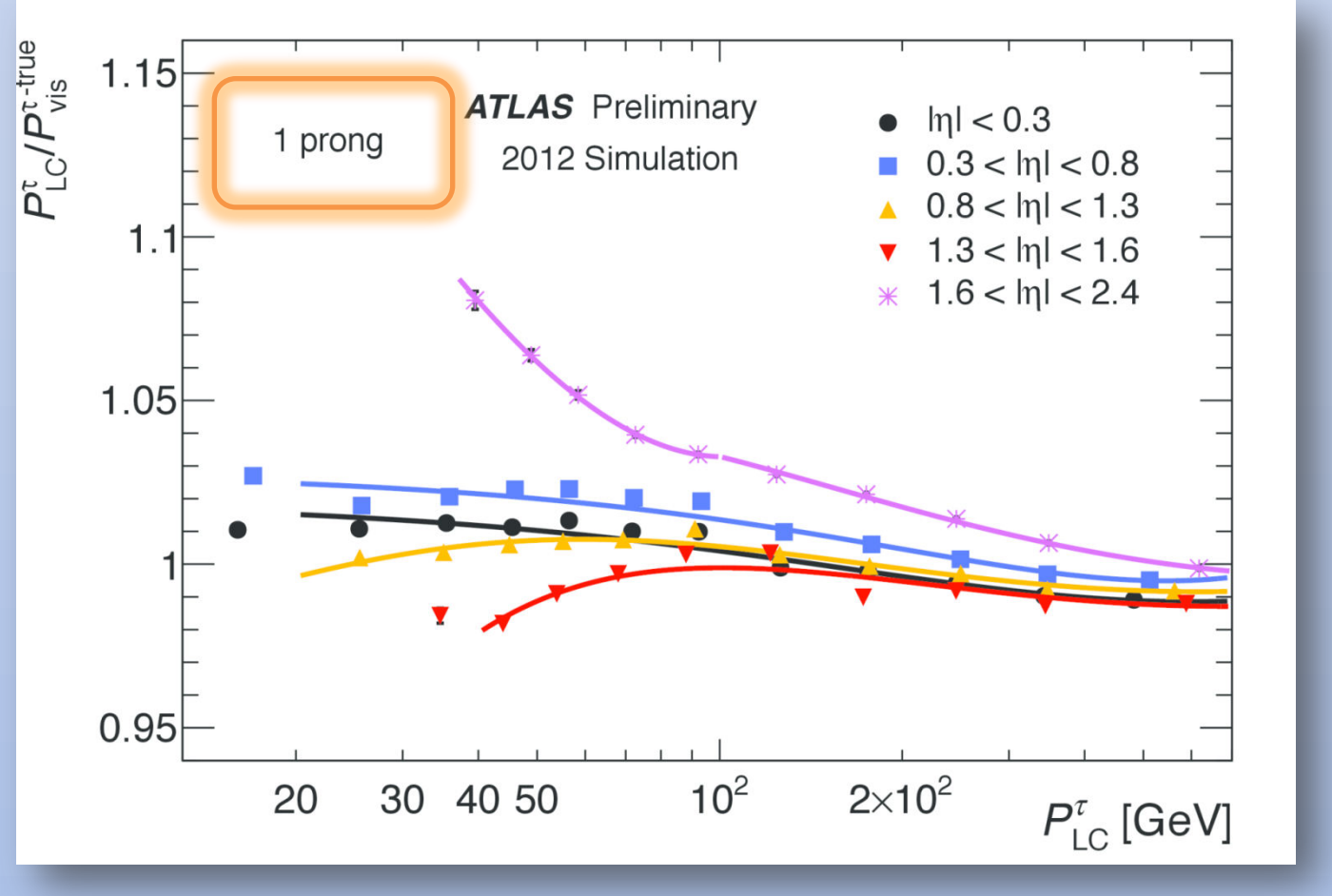
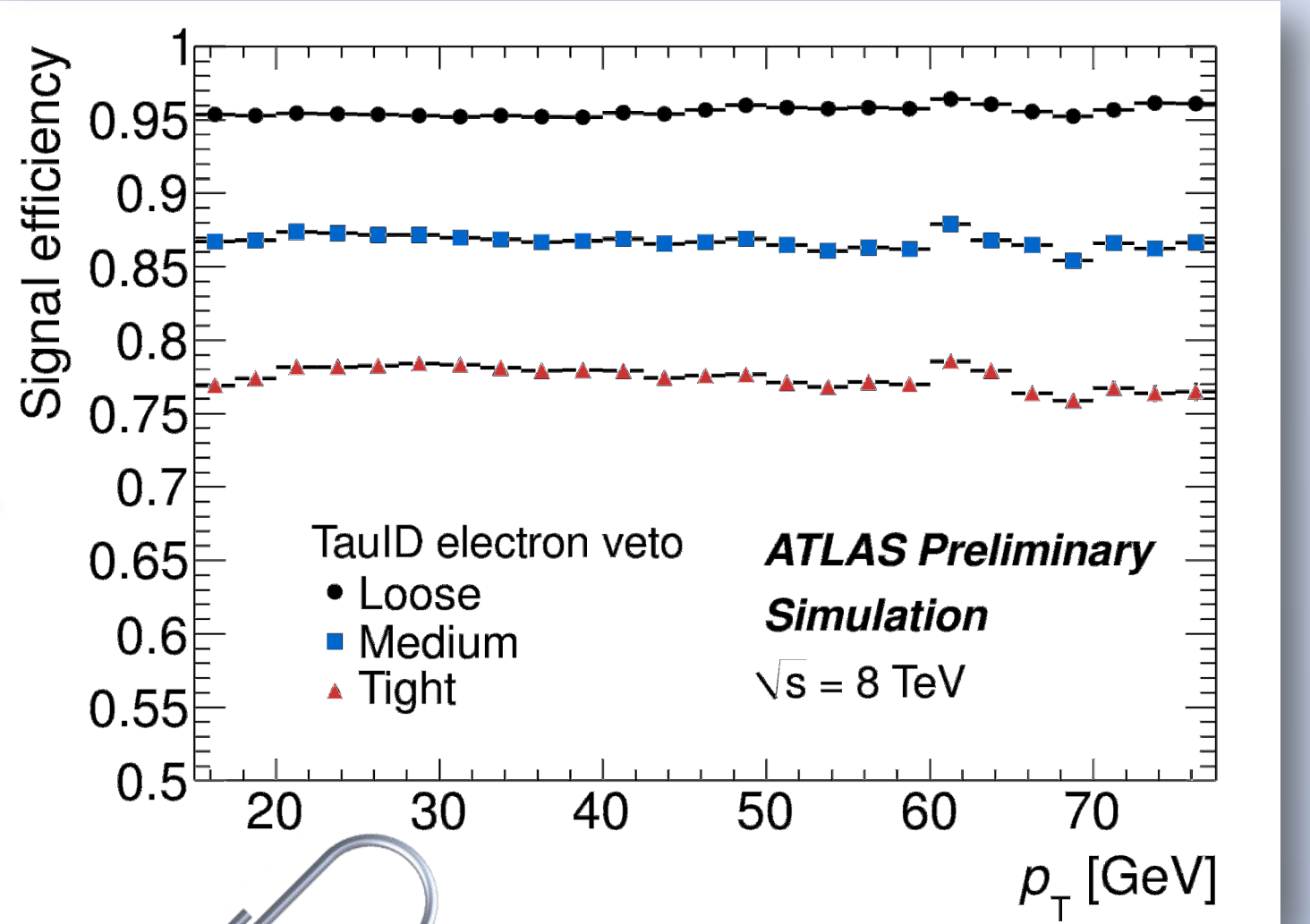
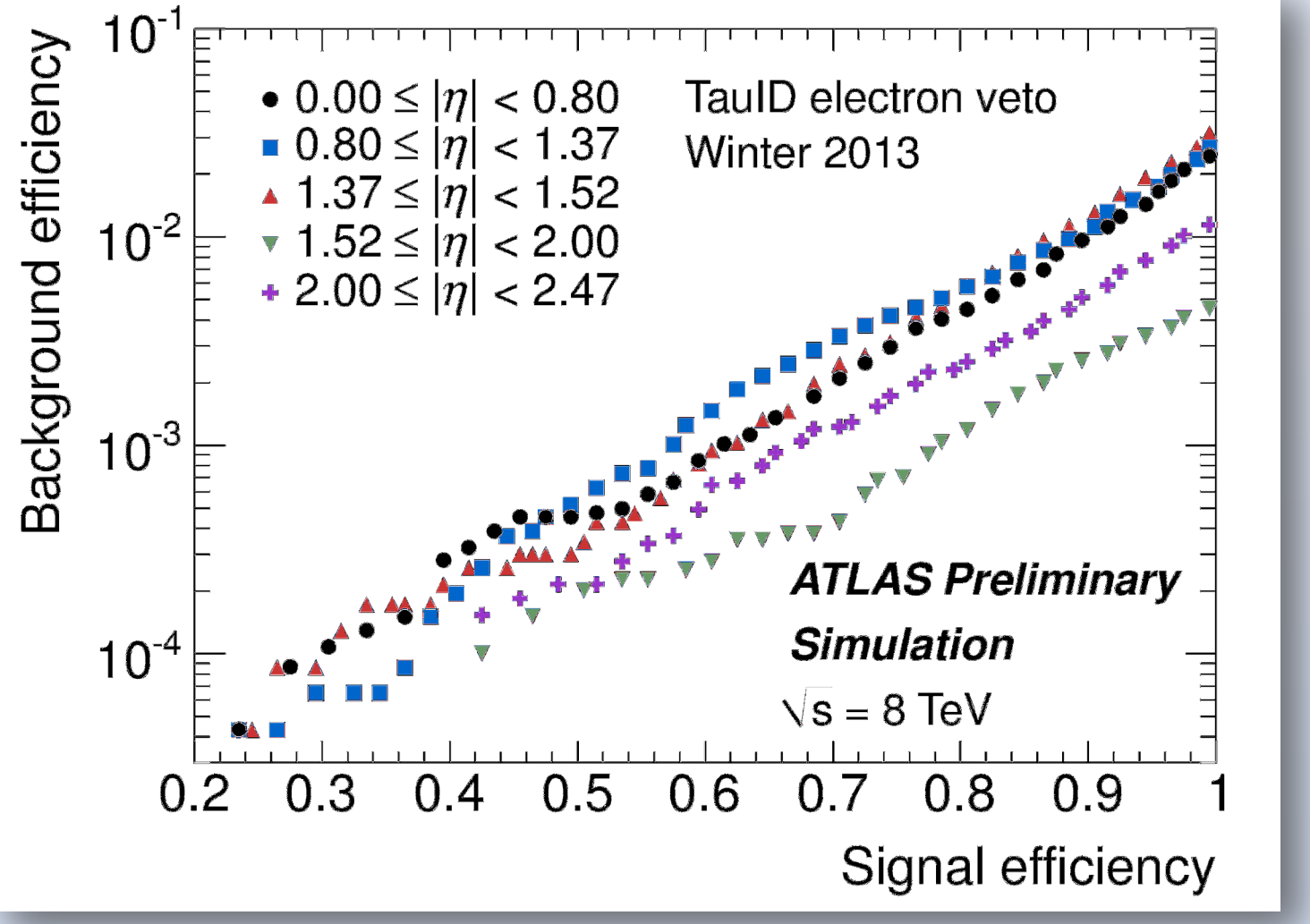


Tau ID Efficiency Measurement

- Data-driven techniques
- Different final states:
 - $Z \rightarrow \tau_{lep} \tau_{had}$ "tag-and-probe" method
 - $W \rightarrow \tau_{had} \nu \tau$
 - $t\bar{t} \rightarrow \tau_{had} + jets$
- 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

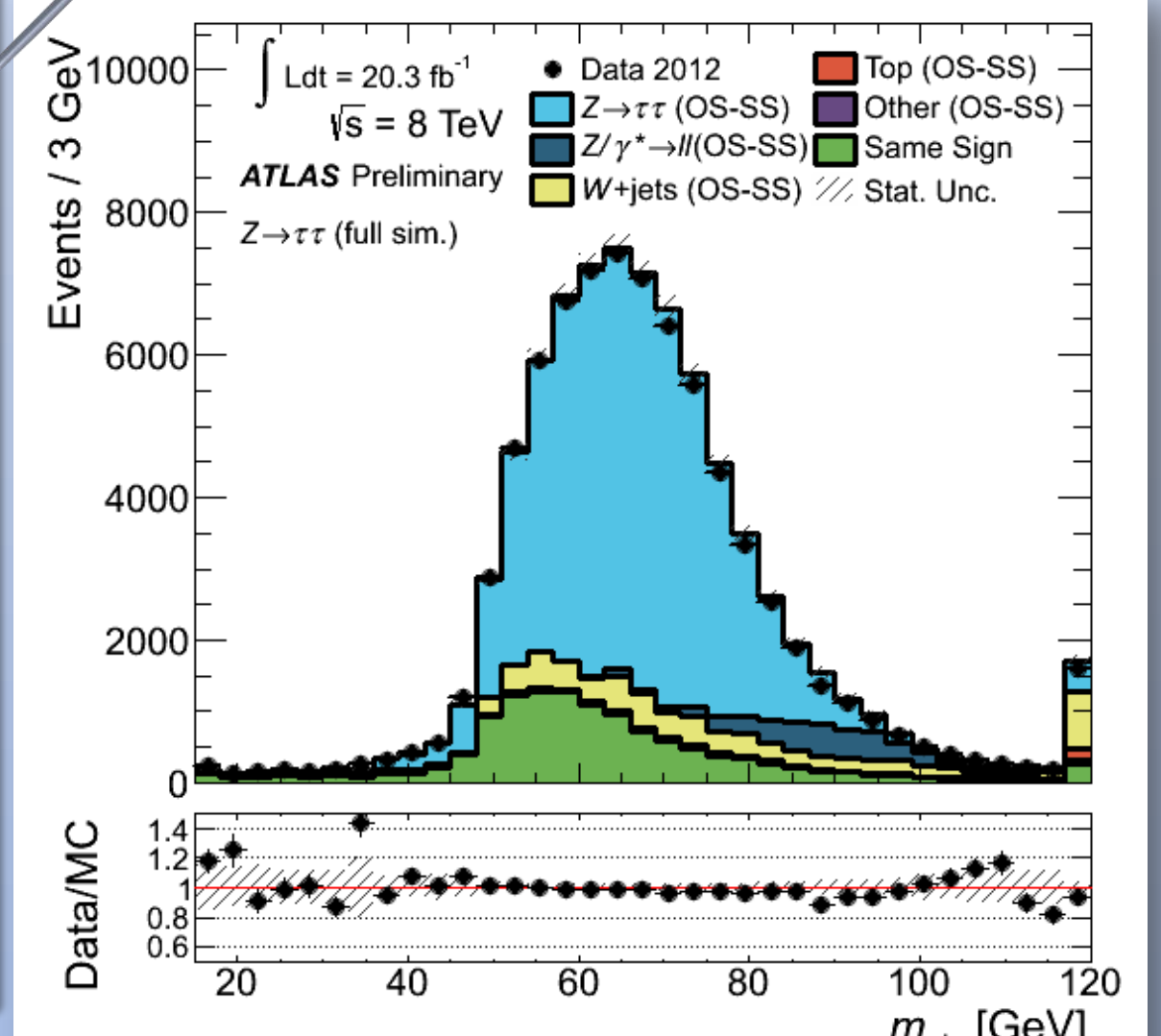
Electron Veto

- 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



Response curves as a function of the reconstructed τ_{had} at the LC scale

Individual and combined tau energy scale (TES) uncertainties in the central region

