Tau trigger configuration for high luminosities

In order to demonstrate the performance of the ATLAS tau trigger, signal efficiencies for $Z \rightarrow \tau \tau$ are shown in the following. The plot to the right shows trigger efficiencies for Monte Carlo (MC) simulated $Z \rightarrow \tau \tau$ decays. The tauLoose HLT tau chain is seeded by the L1_TAU6 item. It is used as the tau trigger in combined lepton chains.

At L1, an efficiency of 100% is reached in the plateau region, while at L2 and EF the efficiency is above 90% starting from a calibrated tau energy of 30 GeV.

The histogram to the left shows a comparison of $Z \rightarrow \tau \tau$ signal MC to QCD di-jet background for the tauLoose HLT tau chain. After the application of loose di-jet event selection, the trigger efficiency for data taken in 2010 agrees very well with the QCD background sample after applying a tight offline tau selection. The uncertainties shown include statistics only.

For the signal, a plateau efficiency of about 90% is obtained while the efficiency for background from fake tau candidates does not exceed 50%.

### QCD jet rejection

In order to enrich the collected data with interesting signal signatures, it is necessary to reject as many background events as possible. Only then is the signal sufficiently clear for the trigger to be optimally exploited.

The L1 rates (before prescaling) are shown for the L1 tight and medium primary tau trigger HLT chains as a function of instantaneous luminosity. The rates scale linearly over a large luminosity range for data taken from several ATLAS runs in 2011. Each entry represents the rate for a given luminosity averaged over all selected data.

As a result, the HLT output rate is significantly lower than at L1. For the same selection, four primary HLT chains are shown to the right. A linear scaling of the rate as a function of instantaneous luminosity can be observed, also for combined HLT chains of tau with missing $E_t$ and lepton triggers.