Optimization of the Electron and Photon Selection in the ATLAS High Level Trigger

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Summary:

In this presentation an overview of the commissioning strategy of the ATLAS electron and photon triggers will be given. First physics collisions are expected towards the end of 2007. It will be essential to understand the e/gamma trigger performance as fast as possible and put in place a selection chain to reject efficiently the huge backgrounds while retaining a very high fraction of interesting e/gamma candidates.

The initial phase of LHC exploitation will be characterised by large uncertainties. At start-up the initial luminosity is expected to be around 10^{31} ramping up to 10^{32}. Initially the beam conditions might vary introducing unforeseen backgrounds. The trigger rates will be strongly influenced by unknown contributions from minimum bias events and detector noise making the prompt commissioning of the trigger an essential and complicated task.

LHC will be the highest centre of mass energy machine ever built, exploring new regions in parameter space. This means, for example, that the jet cross-sections are only known to a factor of around two in a large fraction of the available phase space. This constitutes a further background rate uncertainty to which the trigger must be able to react.

A good knowledge of the trigger selection is indispensable, so that selection thresholds can be quickly and correctly adapted to provide the best possible efficiency while keeping the trigger rate at a manageable level. The idea is to run with a pre-scaled LVL1 selection in the beginning, with the HLT running only in monitoring mode. When the HLT selection is understood with this data, the HLT will be switched on and the pre-scale factors for the various LVL1 e/g trigger menu items will be dropped. With time the selection cuts will be tightened and the triggers will span the whole pT range.

For efficiency calculations various methods will be deployed which allow cross calibration. For example, for electrons we will use a mixture of $Z \rightarrow e^+e^-$, $W \rightarrow e\nu$ and pre-scaled triggers in which part of the sequence is skipped. For the various data taking periods and luminosity conditions tools for measuring turn-on curves, extracting efficiencies and optimisation of the selections are developed.

Optimal strategies must also be used to continuously monitor the working of

the trigger: for example it will be necessary to have a set of overlapping triggers which allow cross calibration of efficiencies. This should include pre-scaled HLT signatures with loose cuts. It also includes calibration triggers in which, for example, cuts are not applied on tracking quantities. Such triggers would then be independent of tracking inefficiencies and would provide a valuable cross-check for the physics-signatures efficiency. Studies of the optimal selection thresholds, as well as the tools used to produce them will be shown.

Timing and performance studies using test-bed setups are essential to guarantee the readiness of the system for data taking. Results of such studies will be shown. Finally, the impact of a realistic trigger menu on a standard physics analysis in ATLAS will be shown.