The H1 First Level Fast Track Trigger

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Abstract

The HERA collider has recently been upgraded to produce a factor of approximately 5 more luminosity. In parallel, upgrades to the H1 detector and trigger have been necessary. One of the projects was the design of an improved Fast Track Trigger (FTT) which should replace the old track trigger and is based on the central drift chambers of the H1 experiment. This work describes the design and expected performance of the FTT. Special emphasis is put on the design of a fast pipelined track segment finding algorithm which is the heart of the first level of the trigger. With the FTT having been designed to perform online particle identification for the first time at H1, the triggering on exclusive final state particles is possible. The expected performance for exclusive vector meson production is investigated here. It is shown that the FTT is able to reconstruct diffractive J/ψ events in photoproduction with an efficiency of 94% with acceptable trigger rates. Diffractive ρ^0 electroproduction events with a four-momentum transfer squared, $t = -15$ GeV^2, can be triggered with an efficiency of 72% with acceptable trigger rates. Finally, the expected trigger performance of charged current events is investigated here. It is shown that the use of additional FTT tracking information allows a rate reduction of a factor of 5 for the present charged current triggers if a minor acceptable loss in efficiency with respect to the HERA I efficiency is taken into account. It is further shown, that a re-designed trigger built specifically to select charged current events with a low missing transverse momentum between 12 and 15 GeV is possible at an acceptable trigger rate.