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Fast tracking for the ATLAS LVL2 Trigger

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We present a set of algorithms for fast pattern recognition and track reconstruction using 3D space points aimed for the High Level Triggers (HLT) of multi-collision hadron collider environments. At the LHC there are several interactions per bunch crossing separated along the beam direction, z. The strategy we follow is to (a) identify the z-position of the interesting interaction prior to any track reconstruction; (b) select groups of space points pointing back to this z-position, using a histogramming technique which avoids performing any combinatorics; and (c) proceed to the combinatorial tracking only within the individual groups of space points. The validity of this strategy will be demonstrated with results in terms of timing and physics performance for the LVL2 trigger of ATLAS at the LHC, although the strategy is generic and can be applied to any multi-collision hadron collider experiment.

In addition, the algorithms are conceptually simple, flexible and robust and hence appropriate for use in demanding, online environments. We will also make qualitative comparisons with an alternative, complimentary strategy, based on the use of look-up tables for handling combinatorics, that has been developed for the ATLAS LVL2 trigger. These algorithms have been used for the results that appear in the ATLAS HLT, DAQ and Controls Technical Design Report, which was recently approved by the LHC Committee.

Authors: Dr EMELIYANOV, D. (RAL); PARODI, F. (INFN Genova, Italy); Dr DREVERMANN, H. (CERN); Dr BAINES, J. (RAL); Dr SUTTON, M. (UCL); Dr KONSTANTINIDIS, N. (UNIVERSITY COLLEGE LONDON)

Presenter: Dr KONSTANTINIDIS, N. (UNIVERSITY COLLEGE LONDON)

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