Contribution ID: **175** Type: **poster**

A new inclusive secondary vertex algorithm for b-jet tagging in ATLAS

Wednesday, September 5, 2007 8:00 AM (20 minutes)

A new inclusive secondary vertexing algorithm which exploits the topological structure of weak b- and c-hadron decays inside jets is presented. The primary goal is the application to b-jet tagging. The fragmentation of a b-quark results in a decay chain composed of a secondary vertex from the weakly decaying b-hadron and typically one or more tertiary vertices from c-hadron decays. The decay lengths and charged particle multiplicities involved in these decays, as well as the instrumental resolution, do not allow to separately reconstruct and resolve these vertices efficiently using conventional secondary vertexing algorithms based on the assumption of a common geometrical vertex. These difficulties are partially overcome in the algorithm presented in this paper, that is based on the hypothesis that the primary event vertex and the vertices of the weak b- and c-hadron decays lie on the same line, the flight direction of the b-hadron. The algorithm provides detailed information on the topology of the decay cascade, also allowing the reconstruction of topologies with only one charged particle from a b- and c-hadron decay, respectively, which are difficult to access for conventional algorithms.
The algorithm based on this hypothesis is implemented mathematically as an extension of the Kalman Filter formalism for vertex reconstruction and technically as a set of flexible software modules integrated in the ATLAS software framework Athena, which make use of the existing Event Data Model for vertexing and B-Tagging. The application of the algorithm to b-jet tagging and the impact on its performance is shown.

Submitted on behalf of Collaboration (ex, BaBar, ATLAS)

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Session Classification: Poster 2

Track Classification: Event Processing