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Neural network based cluster creation in the ATLAS silicon pixel detector

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The read-out from individual pixels on planar semi-conductor sensors are grouped into clusters to reconstruct the location where a charged particle passed through the sensor. The resolution given by individual pixel sizes is significantly improved by using the information from the charge sharing between pixels.
Such analog cluster creation techniques have been used by the ATLAS experiment for many years to obtain an excellent performance.
However, in dense environments, such as those inside high-energy jets, clusters have an increased probability of merging
the charge deposited by multiple particles.
Recently, a neural network based algorithm which estimates both the cluster position and whether a cluster should be split
into sub-cluster has been developed for the ATLAS pixel detector. The algorithm significantly reduces ambiguities
in the assignment of pixel detector measurement to tracks within jets and improves the position accuracy with respect
to standard interpolation techniques by taking into account the 2-dimensional charge distribution.
The implementation of the neural network, the training parameters and performance of the new clustering will be presented.
Significant improvements to the track and vertex resolution obtained using this new method will be presented based on Monte Carlo simulated data and the results will be compared to data recorded with the ATLAS detector.
Finally, the resulting improvements to the identification of jets containing b-quarks will be discussed.

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