Contribution ID: **406** Type: **talk**

The upgraded Pixel detector and the commissioning of the Inner Detector tracking of the ATLAS experiment for Run-2 at the Large Hadron collider

Friday 24 July 2015 14:45 (15 minutes)

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Run-2 of the LHC will provide new challenges to track and vertex reconstruction with higher energies, denser jets and higher rates. Therefore the ATLAS experiment has constructed the first 4-layer Pixel detector in HEP, installing a new Pixel layer, also called Insertable B-Layer (IBL). IBL is a fourth layer of pixel detectors, and has been installed in May 2014 at a radius of 3.3 cm between the existing Pixel Detector and a new smaller radius beam-pipe. The new detector, built to cope with the high radiation and expected occupancy, is the first large scale application of 3D detectors and CMOS 130nm technology. In addition the Pixel detector was refurbished with a new service quarter panel to recover about 3% of defective modules lost during run-1 and a new optical readout system to readout the data at higher speed while reducing the occupancy when running with increased luminosity.

In addition, many improvements to Inner Detector track and vertex reconstruction were developed during the two year shutdown of the LHC. These include novel techniques developed to improve the performance in the dense cores of jets, optimisation for the expected conditions, and a software campaign which lead to a factor of three decrease in the CPU time needed to process each recorded event.

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Session Classification: Detector R&D and Data Handling

Track Classification: Detector R&D and Data Handling