Contribution ID: **479** Type: **oral**

ATLAS Upgrade Simulation with the Fast Track Simulation FATRAS

Tuesday 24 March 2009 15:00 (20 minutes)

With the completion of installation of the ATLAS detector in 2008 and the first days of data taking, the ATLAS collaboration is increasingly focusing on the future upgrade of the ATLAS tracking devices. Radiation damage will make it necessary to replace
the innermost silicon layer (b-layer) after about five years of operation. In addition, with future luminosity upgrades of the LHC machine the current combination of silicon pixel and strip detectors and a transition radiation tracker will surpass the maximum hit occupancy at which pattern recognition is feasible. Therefore the ATLAS collaboration is preparing a replacement with a higher-granularity all-silicon detector.
During the last years, a new fast track simulation (FATRAS) has been developed for the ATLAS tracking devices and successfully interfaced with a fast calorimeter simulation to be part of the standard full and fast simulation "cocktail" needed to comply with both, the high statistics of simulated Monte Carlo samples for various physics analyses and the computing budget of the experiment. FATRAS has undergone various validation steps against full the simulation chain to guarantee compatibility and to understand shortcomings that arise from necessary simplifications traded off for a reduction in CPU consumption. During the design phase of FATRAS dedicated emphasis has been put on a flexible way of integrating geometry and detector technologies, making it a useful tool to evaluate the impact of different layouts and technologies for the future ATLAS inner tracking devices on the expected detector performance.

Summary

The preparation of an experiment that is of a comparable size as the ATLAS experiment spans over a long period in time and includes many studies based on Monte Carlo simulation to optimise the detector setup and to estimate the detector performance. Already during the startup phase of the ATLAS experiment, first studies are carried out to simulate different detector setups foreseen to be integrated in a major upgrade phase that is scheduled to take place after about ten years of operation. Already after five years of operation radiation damage will make it necessary to replace the innermost pixel layer of the ATLAS tracking detector.
The detector upgrade of the ATLAS detector will be evoked and accomplished by an according upgrade of the LHC machine — to become the Super Large Hadron Collider (SLHC) — with an increased peak luminosity of $10^{35} cm^{-2} s^{-1}$. The increased collision rates, a direct consequence of the higher luminosity, require higher granulated detector devices, in particular for the TRT detector it will become almost impossible to resolve the high track density has shown, that with the use of new pattern recognition techniques, a significantly higher track multiplicity than in the ATLAS startup setup can be handled.). Several layout proposals exist in the meanwhile to exchange the existing ATLAS ID detector with a silicon-only detector structure. For a final decision, however, it is important to test these proposed layouts in both feasibility and performance.

The description of such detector setups is a first requirement for the establishment of a detector simulation. In FATRAS, since the offline reconstruction geometry is used as the simulation geometry, this can realised through a dedicated reconstruction geometry description based on generic input parameters. FATRAS provides for this purpose generic detector builders that allow a flexible choice of cylinder and disc detector layouts with both pixel and strip detector technologies.
Custom clusterisation algorithms — e.g. needed for newly established developments such as the 3D-pixel detector — can be included and since the ATLAS offline EDM has been extended with appropriate generic hit and cluster classes, track simulation and refit can be performed very similarly to the ATLAS offline setup.

Author: Dr SALZBURGER, Andreas (DESY & CERN)

Co-authors: Mr MECHNICH, Joerg (NIKHEF); Mr BEIMFORDE, Michael (Max-Planck-Istitut fuer Physik, Muenchen); Dr HUSEMANN, Ulrich (DESY)

Presenter: Dr SALZBURGER, Andreas (DESY & CERN)

Session Classification: Event Processing

Track Classification: Event Processing