Studying the ATLAS Interaction Region with LHC Beam Instrumentation

The ATLAS High Level Trigger reconstructs the position and shape of the interaction region (the "beam spot") in real time using a dedicated algorithm that analyses the distribution of primary vertices in the Inner Detector. The characteristics of the interaction region and its time-evolution are of great interest to the LHC operators as they have a direct impact on the luminosity generated for the experiment.

Outside of the detector, there is a wealth of information available from the beam instrumentation of the LHC itself, including beam pickups, beam position monitors, synchrotron light monitors etc. These per-beam and per-bunch measurements can be directly related to the luminous region observed in ATLAS. Both LHC and ATLAS measurements are recorded in real-time in the so-called LHC Logging Database.

The goal of this project is to exploit the luminous region data from ATLAS and correlate it with what the LHC sees. For example, from measurements of the transverse emittances of both beams and the beta function at the interaction point one can predict the luminous widths seen in ATLAS. The task involves tapping into the LHC Logging Database and extracting the most relevant information. This will involve some programming in C++ and python and possibly scripting in Java. A web interface called Timber is available for making interactive plots that can help guide what to look for and how to make the data accessible in programmatic way. Ideally, the project would result in a new online monitoring display available to both ATLAS and the LHC, as well as in archived plots that can be used for more detailed studies.

Contact: Rainer Bartoldus