



Contribution ID: 464

Type: **Oral Presentation**

Beam Conditions Monitoring in ATLAS

Thursday 9 June 2011 15:10 (20 minutes)

Beam conditions and the potential detector damage resulting from their anomalies have pushed the LHC experiments to build their own beam monitoring devices. The ATLAS Beam Conditions Monitor (BCM) consists of two stations (forward and backward) of detectors each with four modules. The sensors are required to tolerate doses up to 500 kGy and in excess of 10^{15} charged particles per cm^2 over the lifetime of the experiment. Each module includes two diamond sensors read out in parallel. The stations are located symmetrically around the interaction point, positioning the diamond sensors at $z = \pm 184$ cm and $r = 55$ mm (a pseudorapidity of about 4.2). Equipped with fast electronics (2 ns rise time) these stations measure time-of-flight and pulse height to distinguish events resulting from lost beam particles from those normally occurring in proton-proton interactions. The BCM also provides a measurement of bunch-by-bunch luminosities in ATLAS by counting in-time and out-of-time collisions. Eleven detector modules have been fully assembled and tested and the best eight installed in ATLAS. Testbeam results from the CERN SPS show a module median-signal to noise of 11:1 for minimum ionising particles incident at a 45-degree angle. The BCM has operated reliably in ATLAS for the last 18 months, has provided feedback on every beam dump during that time and is required to show a clean abort before ATLAS returns the LHC injection permit. In addition the BCM provides collision rate and background measurements that have been instrumental in ATLAS achieving a luminosity precision of better than 4%. The performance of the detector and their contributions to ATLAS physics will be presented.

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Session Classification: Machine Det. Interface and Beam Instr.

Track Classification: Machine Detector Interface and Beam Instrumentation