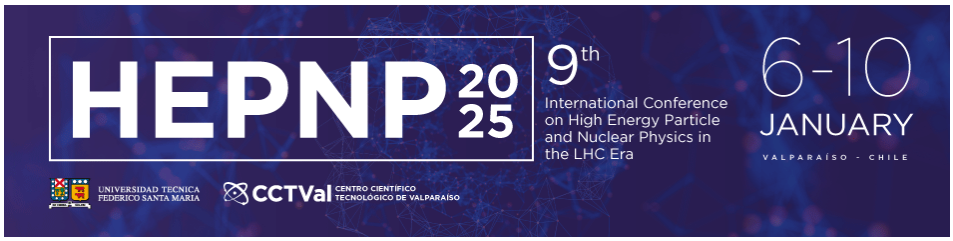

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BCM' system for beam abort and luminosity monitoring in ATLAS

Wednesday 8 January 2025 09:05 (35 minutes)

The High Luminosity upgrade of the Large Hadron Collider (HL-LHC) at CERN will significantly increase the collider's particle density, presenting new challenges for the ATLAS experiment's detectors. To address these challenges, a new radiation-hard beam monitoring system has been developed to protect the inner silicon detectors and accurately monitor the increased luminosity. This system employs polycrystalline Chemical Vapor Deposition (pCVD) diamond sensors, coupled with a newly designed radiation-hard front-end ASIC, to ensure high performance under the HL-LHC's extreme conditions.

The upgraded system, known as BCM', will replace the existing beam protection system and be integrated into the retractable part of the new all-silicon Inner Tracker (ITk) of the ATLAS experiment. BCM'will not only safeguard the ITk by monitoring background activity and aborting the LHC beam in case of hazardous particle showers but will also serve as a luminosity meter for ATLAS. In addition, a slower Beam Loss Monitoring (BLM) system, developed by the LHC machine, will act as a backup to the BCM'.

Given the HL-LHC's more intense radiation environment, the BCM'system must meet much stricter radiation tolerance requirements, including higher neutron equivalent fluence, total ionizing dose, and charged particle flux. Preliminary results from the prototype detectors using the new ASIC have shown promising performance in beam tests at CERN, indicating that the system is on track to meet the demanding specifications of the upgraded collider.

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