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The Large Hadron Collider's beam wire scanner consolidation

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To serve the needs of the High Luminosity (HL) LHC, a consolidation of the beam wire scanner has been initiated. The instrument is a crucial tool for measuring the transverse beam profile by moving a thin carbon wire across the beam. It can only withstand a fraction of the LHC's nominal beam intensity but provides a reference to calibrate other instruments that operate non-invasively at higher beam intensities. Since the start of the LHC, the scanners have provided hundreds of thousands of measurements, but the design has technical limitations that need to be addressed to provide the required reliability and performance for the HL runs. The initial consolidation phase involved testing the injector's acquisition and control electronics in the LHC to assess its suitability for the specific beam conditions. As part of this process, we updated the mechatronic and motion controller. Beam test campaign has revealed higher performance w.r.t the existing system and a higher adaptability to varying beam conditions. Simultaneously, we are developing a novel actuator that uses a permanent magnets-based coupling replacing the standard bellows and long arm that limits the performance and induces vibrations. Before testing this new concept with beam, we have developed a calibration bench to evaluate the mechanism's precision and accuracy of the wire position determination. This contribution presents the 2023 beam and laboratory tests as well as the electromechanical developments.

Footnotes

Funding Agency

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Yes

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