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The ATLAS ITk Strip Detector System for the Phase-II LHC Upgrade

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The ATLAS experiment at the Large Hadron Collider is currently preparing for a major upgrade of the Inner Tracking for the Phase-II LHC operation (known as HL-LHC), scheduled to start in 2026. In order to achieve the integrated luminosity of 4000 fb⁻¹, the instantaneous luminosity is expected to reach unprecedented values, resulting in about 200 proton-proton interactions in a typical bunch crossing. The radiation damage at the full integrated luminosity implies integrated hadron fluencies over 2×10^{16} neq/cm² requiring a complete replacement of the existing Inner Detector. An all-silicon Inner Tracker (ITk) is under development with a pixel detector surrounded by a strip detector, aiming to provide increased tracking coverage up to $|\eta|=4$.

The ITk Strip Detector system consisting of four barrel layers in the centre and forward regions composed of six disks at each end, is described in the ATLAS Inner Tracker Strip Detector Technical Design Report (TDR). With the recent completion of Final Design Reviews (FDRs) in a number of key areas, such as Sensors, modules, ASICs and front-end electronics, the prototyping phase has been completed successfully. The pre-production phase is about to start at the institutes involved.

In this contribution we present an overview of the ITk Strip Detector System, including the final layout of the ITk Strip Detector System, and highlight the final module designs and ASICs. We will give an extended summary of the R&D results achieved in the prototyping phase. Some of the modules were irradiated with a range of fluencies and reaching up to and in some cases exceeding HL-LHC doses, demonstrating the excellent radiation hardness achieved. In addition, we will outline the current status of pre-production on various detector components, with an emphasis on QA and QC procedures. We will also discuss the status of preparations and the plans for the forthcoming pre-production and production phase.

Primary author: VICKEY, Trevor (University of Sheffield (GB))

Presenter: SAWYER, Craig Anthony (Science and Technology Facilities Council STFC (GB))

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