Contribution ID: **12** Type: **Upgrades and Future Projects**

Construction of the ATLAS ITk strip detector for the HL-LHC era

The inner detector of the present ATLAS experiment has been designed and developed to function in the environment of the present Large Hadron Collider (LHC). For the next LHC upgrade to High Luminosity, the particle densities and radiation levels will exceed the current levels by a factor of ten. The instantaneous luminosity is expected to reach unprecedented values, resulting in up to 200 proton-proton interactions in a typical bunch crossing, corresponding to an instantaneous luminosity of 7 × 10ˆ34 s−1 cm−2. For these reasons, the new detectors must be faster and more highly segmented. The sensors need to be far more resistant to radiation, and have a much greater power delivery to the front-end (FE) systems. At the same time, they cannot introduce excess material that could undermine the tracking performance. For this upgrade, the ATLAS detector will replace its existing inner detector with a full silicon and larger Inner Tracker (ITk). The new ITk detector consists of several layers of silicon particle detectors: the innermost parts are pixel detectors and a strip detector surrounds them. This poster focuses on the strip region.

The ITk-Strip detector contains four layers in the barrel and six in each of the two endcaps, covering pseudo-rapidity (⊠) range of |⊠| < 2.7. The silicon sensors along with application specific integrated circuits (ASICs) and the high and low voltage power controls for the sensors are integrated in a module. These modules are placed on staves in the barrel and petals in the end-caps, providing mechanical support for the modules and host the common electrical, optical and cooling services. The FE of the ITk-Strip detector, the ABCStar chip, is an ASIC with 256 channels that read outs the hit information collected on each silicon strip. To prepare for integration, the reception tests are the first step after the structures construction. They consist on shipping assembled barrel staves and endcap petals to assembling centres, like CERN, Nikhef and DESY, to be tested and inserted into the support structures. At the moment, the structural detector parts and the setups for reception tests are being finished. This poster gives a general overview of the future ITk strip detector, presenting its structures, final designs and detecting technologies. Current status, performance results and future plans are discussed.

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Session Classification: Poster session

Track Classification: Upgrades and Future Projects