The ATLAS silicon strip tracker upgrade

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The high luminosity LHC is anticipated to begin operation as of 2026 and is expected to accumulate a total integrated luminosity for proton-proton collisions of 3000 fb^{-1} over the ensuing decade of operation. As a consequence of the significant increase in instantaneous luminosity, the detectors comprising ATLAS will be subject to far harsher radiation conditions. The radiation exposure for the strip detector is estimated to exceed 50 MRad in the innermost regions of the end-caps, exceeding the designed radiation tolerance of the current strip semiconductor tracker (SCT) by a factor of 10. As such, a redesign of the strip detector was required. In addition to new radiation hardened electronics, further changes to the design were chosen to further optimise the physics reach in the HL-LHC environment. These include: a reduced material budget, increased segmentation of the detectors, and an optimised geometry of the detector.

The Inner Tracker (ITk) strip detector will consist of four layers of silicon modules which surround the beam (barrel), as well as six disks of silicon modules in the forwards/backwards regions (end-caps). In its entirety, the detector will comprise a total of 17,888 individual silicon modules. Each end cap disk is made of 32 segments (petals), the petals are further subdivided into six modules (R0 ... R5 ordered by increasing radius). The Melbourne group is focused on the construction of R1 and R4 modules for the end-caps.

In this talk an overview of the testing and optimisation of the assembly procedures in the lead up to module construction will be presented. In addition, results of the electrical characterisation of the pre-production modules will be discussed.