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The ATLAS ITk strip local support structures

A new silicon tracker of the ATLAS detector is envisioned for the Phase-II upgrade of the Large Hadron Collider experiment (LHC), the so-called High Luminosity LHC (HL-LHC). The new inner tracker (ITk) will consist of a silicon pixel inner tracker and a silicon microstrips outer tracker. Both of these sub-detectors are initiating the production phase during the year 2023. This contribution focuses on the Strip ITk detector. In particular, the high precision, low-mass, high thermo-mechanical performance support structures equipped with the silicon microstrip sensors, the so-called "staves"for the barrel region and "petals"for the endcap regions.

This contribution aims to describe in detail the design of these peculiar structures, and how this design advanced over the years to accommodate the evolving requirements of the detector. Special emphasis will be dedicated to detail the flexible, poliymide-based circuits called "bus tapes", which are completely embedded in the structures, as they constitute an important structural and electrical component of the supports. The main aspects of the electrical behavior of the structure will be described in detail as well.

The prototyping efforts at the ATLAS institutes, both of the supports themselves but also for their subcomponents, will be also explained in depth. A strong collaboration effort was also motivated by the transfer of knowledge and assembly of the petal cores in industry, which was consolidated with the signing of a full production contract. This process will also be described.

Finally, the results of the recently completed petal pre-production, where 20 support structures were manufactured and characterized at multiple ATLAS institutes with an ambitious Quality Control (QC) program, covering the mechanical, electrical and thermal performance of the supports will be detailed. The progress of the pre-production of the stave structures will also be presented.

Submission declaration

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