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Module support structures and thermo-mechanical prototypes for the endcap of the ATLAS strips tracker

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The forward regions of the phase-II ATLAS strips tracker consist of 6 disks per side, constituted by low-mass wedge-shaped structures called petals. The active regions of the detector are constituted by the so-called silicon modules, constituted by silicon microstrip sensors and their associated readout and power electronics. The silicon modules are directly glued on top of carbon fiber-based structures, called 'cores'which provide precise mechanical support, integrated cooling, power rails and high-speed data links from and to the outside world. The petal cores consist of carbon-fiber structures with integrated titanium cooling pipes. The titanium pipes are surrounded by thermal carbon-based foam in order to enhance the cooling power along the structure. The structure is enclosed by carbon-fiber skins co-cured together with thin, flexible, polyimide-copper PCBs called 'bus tapes'. Power, data and control lines run along the bus tapes and reach the silicon modules along the structures, which are electrically connected to it via wire-bonds and electrically conductive glue. The first batch of those high precision core prototypes was manufactured. This was achieved with custom-made mechanical tools, providing an accurate build and tight tolerances. A full mechanical and thermal evaluation program of these structures and the tools to build them is currently ongoing and initial results will be presented. As a first step to produce fully functional electrical petals, thermo-mechanical modules and petals were manufactured, in order to validate the layout. The first thermo-mechanical petal has already been assembled and is currently under test. Initial results will be shown in this presentation. In addition, detailed thermal simulations of the petals are also ongoing in combination with the thermo-mechanical prototypes and will also be presented. A strong effort was recently put in place in order to define the interface between the petals and the endcap integration structures. Locking mechanisms are in design and being introduced as an integral part of the core design. The different designs for the locking mechanism will be also introduced in this contribution.

Summary

Presenter: DIEZ CORNELL, Sergio (Deutsches Elektronen-Synchrotron (DESY))