

Module and System test Development for the Phase-2 ATLAS ITk Pixel Upgrade

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In the high-luminosity era of the Large Hadron Collider, the instantaneous luminosity is expected to reach unprecedented values, resulting in about 200 proton-proton interactions in a typical bunch crossing. To cope with the resulting increase in occupancy, bandwidth and radiation damage, the ATLAS Inner Detector will be replaced by an all-silicon system, the Inner Tracker (ITk). The innermost part of ITk will consist of a pixel detector, with an active area of about 14 m². In order to cope with the changing requirements in terms of radiation hardness, power dissipation and production yield, several different silicon sensor technologies will be employed in the five barrel and endcap layers. With the arrival of the first readout chip prototype, the RD53A chip, the development of hybrid detector modules is starting to address numerous production issues, understanding of which will be crucial for the layout and production of the final ITk pixel detector modules. In addition, the new powering scheme is serial which gives further challenges. A large prototyping programme on system test level is ongoing. Components for larger structures with multiple modules based on the FE-I4 front-end chips were produced and are in assembly and evaluation. The paper will present latest results from the assembly and characterization of prototype modules as well as the latest evaluation and results of thermo-mechanical prototypes and fully electrical prototypes.

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