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First testbeam results of prototype modules for the upgrade of the ATLAS strip tracking detector (12' + 3')

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The planned HL-LHC (High Luminosity LHC) in 2025 is being designed to maximise the physics potential of the LHC through a sizeable increase in the luminosity, totalling $1 \times 10^{35} \text{ cm}^{-2} \text{ s}^{-1}$ after 10 years of operation. A consequence of this increased luminosity is the expected radiation damage at a integrated luminosity of 3000 fb^{-1} , requiring the tracking detectors to withstand hadron equivalences to over $1 \times 10^{16} > 1 \text{ MeV neutron equivalent per cm}^2$. With the addition of increased readout rates, a complete re-design of the current ATLAS Inner Detector (ID) is being developed as the Inner Tracker (ITk), which will consist of both strip and pixellated silicon detectors.

The silicon strip tracker exploits the concept of modularity. Fast readout electronics, deploying 130nm CMOS front-end electronics is glued on top of a silicon sensor. These so-called modules are glued on carbon structures and will span about 200 m^2 of active area. A broad R&D program is ongoing to develop and prototype many detector components. The modules are extensively tested electronically and recent tests of the prototype strip sensors and associated binary readout electronics have been performed at the DESY II testbeam. The DURANTA telescope was used to obtain a pointing resolution of $< 4 \mu\text{m}$, with an additional pixel layer installed to improve timing resolution to $\sim 25 \text{ ns}$.

Results will be shown on the tracking performance of both silicon sensors for the central and forward region of the future silicon strip tracker using the Generalized Broken Lines algorithm. Moreover, results of gain measurements of the CMOS 130nm binary readout chip (ABC130) will be presented and an outlook of their applicability be given.

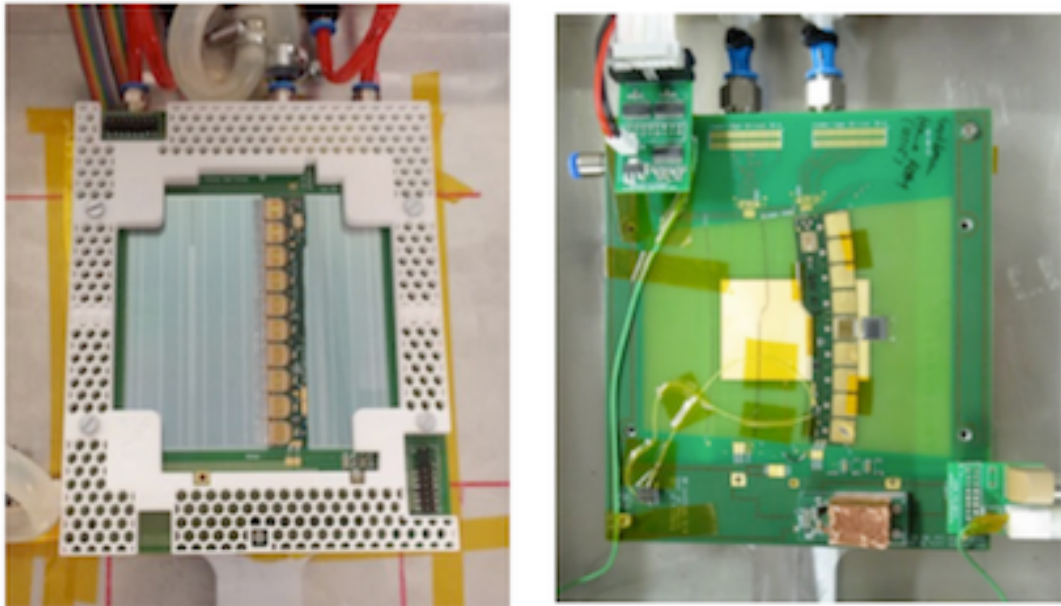


Figure 1: The ATLAS ITK prototype Strip (left) central and (right) forward modules under test at the DESY II testbeam

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