

Up-to-date test beam results of ATLAS ITk Pixel sensors and modules

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The ATLAS inner detector will be completely replaced with a new all-silicon tracking detector (ITk) in 2026-28 to cope with the challenging conditions of the High Luminosity LHC.

The pixel detector will be located in the innermost part of the ITk detector. It will be instrumented with 3D sensor technology in the innermost layer (L0), where a fluence up to 2×10^{16} neq/cm² is expected, and with n-in-p planar hybrid modules 150 μ m and 100 μ m thick in the three outer layers (L2-L4) and in the first layer (L1), respectively.

The study of sensors and modules with beam is an important test bench to assess their performance and operation, both before and after irradiation to the expected fluence. In the last few years different types of sensors produced by different vendors became gradually available to be studied with beam. In the latest 2024 test beam season new sensor types, or produced with improved techniques, and modules equipped with the latest version of the readout chip also became available. First thick planar sensors produced by Micron are being tested both before and after irradiation during several test beam campaigns carried out in 2024. Eventually, the final version of the readout chip (ITkPixV2) was submitted in March 2023 and first modules assembled with the ITkPixV2 chip became available to be tested with beam this summer. Hence, this year test beam data includes several novelties to progress with the complete picture of the qualification of ITk pixel sensors. Some of the new 2024 test beam data are being analyzed and some are going to be collected soon. This talk will provide an overview of the ITk pixel sensors and modules qualification with test beams up to date with the latest 2024 results.

Authors: Dr RUMMLER, Andre (CERN); KRAUSE, Christopher (Technische Universitaet Dortmund (DE)); RESSEGOTTI, Martina (INFN e Universita Genova (IT)); SAMY, Md Arif Abdulla (University of Glasgow (GB))

Presenter: KRAUSE, Christopher (Technische Universitaet Dortmund (DE))

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