

Results of system qualification and quality control strategies for the production of the ITk Pixel Outer Barrel of the ATLAS experiment

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The new Inner Tracker of the ATLAS experiment will be installed during LHC Long Shutdown 3 and will consist of a pixel and strip detector. The Outer Barrel, comprising three central outer pixel layers, will be constructed using a combination of flat sections called longerons and inclined half-rings. Silicon modules will be mounted on these structures with good thermal contact and powered in series, forming chains with multiple modules. The evaluation of not only the radiation-hard silicon detector modules but also the concept of powering and readout is underway, along with the preparation for production. Quality control and safe testing and operation are crucial for early system testing and subsequent efficient production.

The Outer Barrel will be composed of 4472 pixel modules. Quality control steps are planned at the module level and at three successive stages: upon loading the modules onto designated “cells,” assembling them on longerons and half-rings, and finally integrating them into detector layers.

These quality control steps involve the operation of multiple modules within these substructures, necessitating a dedicated detector control system (DCS) and interlocking instrumentation to ensure their safe operation at all times. This presentation will focus on the results of system qualification for silicon modules in multi-module operation, with a particular emphasis on the DCS and interlocking infrastructure for quality control. The developed hardware, boards, their application, and the strategy employed during the integration stages of the cells and loaded local supports will also be discussed.

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