

Quality Assurance Methodology for the ATLAS ITk Strip Sensor Production

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The production of the strip sensors for the ATLAS Inner Tracker (ITk) will start in 2020. Nearly 22000 large area sensors will be produced over a period of roughly 4 years. The Institutes involved in the sensor development and production are committed to deliver and maintain the highest quality sensors for the experiment. A Quality Assurance (QA) strategy has been prepared to be carried out during the whole production period. Once the process has been characterized as providing the required pre-irradiation specifications and the proper radiation hardness, the onus is on the manufacturer to rigidly stick to that qualified process. Still, sample testing with specific device-element structures and irradiation of devices should be implemented by the ITk Groups.

The main devices that will be used by the collaboration for QA purposes are the miniature strip sensors, strip sensors with the same design as the MAIN sensor but with 1cm×1cm dimensions; the monitor diodes, 8mm×8mm pad diodes with contactable guard ring; and the ATLAS test chip. The ATLAS test chip contains several test structures to test specific device-element parameters. It includes a structure with bias resistors; a CBR (Cross-Bridge Resistor) structure, which allows a precise measurement of the sheet resistance; square coupling capacitances and field oxide capacitors for precise measurements of critical parameters for the device oxides such as capacitance, thickness, breakdown voltage, flat-band voltage, etc.; gated diodes, diodes with a gate implemented in order to evaluate the Si/SiO₂ interfaces; and specific structures to monitor the strip and inter-strip characteristics, such as strip-like structures or interdigitated structures.

The irradiations will be carried out on a sample basis. In order to have a practical methodology, samples from odd or even batches will be sent for different irradiations. A detailed description of the production flow, the periodic irradiations, and the different tests planned during production will be provided. Example measurements from the prototype batches will be shown and their results analyzed.

Submission declaration

Original and unpublished

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