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Results from ATLAS-ITk Strip Sensors Quality Assurance Testchip

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The pre-production of the strip sensors for the Inner Tracker (ITk) of the ATLAS Upgrade detector at CERN has finished, comprising about 5% of the total number of sensors to be fabricated during the 4-year production period (approximately 22000). All sensors are tested by the collaboration according to the Quality Control procedures. For Quality Assurance, a number of test structures, designed by the collaboration and put together in a full testchip, are produced in every wafer together with the main sensors and the other QA test structures like mini sensors and large diodes by the foundry (HPK). Samples of these testchips are tested for every batch of sensors. One testchip is tested before irradiation for every batch fabricated in order to monitor the stability of the key technological and device parameters. Also for every batch, one test chip is irradiated either with gammas or protons in order to account for ionization damage. Additionally, one mini per batch is irradiated either with neutrons or protons to account for displacement damage effects. All this effort is carried out by 7 irradiation and test sites.

The results from about 100 testchips tested during the pre-production period will be shown and analyzed. The results of the pre-production batches show that all parameters remain under specifications before irradiation. After irradiation, all parameters remain under specifications except for some structures damaged by handling, for which replacement chips have been irradiated. Some of the newly designed structures show testing limitations for a few of the parameters.

These results help to accumulate enough statistics in order to establish what we call "soft"thresholds for those parameters that are not directly related to specifications. These soft thresholds will be used as Upper and Lower Control Limits (UCL and LCL) in the production control of the technological parameters for QA.

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