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Testbeam studies on Cold Noise and Cracking in ITk Strips modules.

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The High Luminosity-Large Hadron Collider (HL-LHC) will reach an approximate pile-up of 200 collisions per bunch crossing, three times more than the current Large Hadron Collider. Beginning operation at the end of the decade, it will accumulate up to 4000 fbˆ-1, increasing the chances of observing new processes and allowing measurement of rare processes with higher precision. Moreover, the pile-up increase means more particle production, causing higher radiation damage and detector occupancy conditions. Therefore, the current tracking system in the ATLAS detector will be replaced by the new Inner Tracker (ITk), consisting of pixel and strip sub-systems. The ITk is based on silicon detectors called modules, composed of individual sensors and readout electronics. For the last two years, the ITk strip testbeam group has performed studies on two problems that have threatened the performance or operability of the detector: cold noise and cracking. Cold Noise is a phenomenon observed in certain types of modules that increases the noise read when the module is cooled down. Detailed studies of modules exhibiting cold noise have been performed at the DESY-II testbeam facility, providing insight into the potential impact on detector performance. Cracking is an issue that affects the module's sensor when the modules are glued onto the local structures, producing stress fractures on the sensors. The main solution for cracking is adding an extra kapton layer, known as interposer, between the sensor and the module's hybrids. Various types of interposed modules have been tested at the DESY-II and CERN SPS testbeam facilities, calculating the range of operational thresholds, and comparing the interposed modules' performance with non-interposed modules.

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