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Study and realization of a High Granularity Timing Detector (HGTD) for the ATLAS detector at the High Luminosity phase of the LHC.

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The High-Luminosity upgrade of the Large Hadron Collider (HL-LHC) is scheduled to begin colliding protons in 2028. This increase of luminosity will induce a larger number of collisions per beam crossing (around 200). This phenomenon is called the pile-up (μ). A High Granularity Timing Detector (HGTD) has been proposed for the ATLAS experiment to address this new challenges. This new ATLAS sub-detector will improve track reconstruction and enhance pile-up rejection by providing a timing resolution better than 50 ps/track throughout the HL-LHC running period.

The HGTD will consist of around 8000 modules, each composed of LGAD sensors, new read-out chips (called ALTIROC), and module flexes.
For detector assembly and mechanical stability, the modules are glued onto Support Units (SU) to form the Detector Units (DU), a process referred to as loading. The LPNHE has been responsible for developing the loading procedure and will produce 20% of the DUs.

The operational functioning of the DU's is validated through electrical tests. To optimize the Production Phase, the automation of the electrical testing has been developed through the design and implementation of a Graphical User Interface that may be deployed across production sites. HGTD module performances are measured in test beam, where time resolution and sensor efficiency are characterized.

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