

# Timing Measurements with the ATLAS High Granularity Timing Detector at the HL-LHC

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As the Large Hadron Collider enters the High-Luminosity era, several sub-detectors require major upgrades. The ATLAS High Granularity Timing Detector (HGTD), currently under development for the HL-LHC, is designed to mitigate pile-up levels of up to  $\sim 200$  simultaneous proton-proton interactions by providing precise timing information in the forward region (roughly  $2.4 < |\eta| < 4.0$ ). When vertex separation in  $z$  becomes insufficient, per-track timing (targeting  $\mathcal{O}(30\text{--}50\text{ ps})$ ) improves track-to-vertex association and thus enhances object reconstruction and background rejection. The HGTD will complement the upgraded all-silicon Inner Tracker (ITk) by adding a timing coordinate to spatial tracking. This talk presents simulation studies of the HGTD's timing performance, the effects on the time resolution, and the calibration strategies explored to date.

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