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## Validation of Wire Measurements in the LHC Tunnel

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The High Luminosity LHC (HL-LHC) is an upgrade of the LHC accelerator to achieve instantaneous luminosities a factor of five larger than the LHC nominal value. This challenging project requires the installation of new high-technology components along more than 200 m of the current machine on each side of Interaction Point 1 (ATLAS) and Interaction Point 5 (CMS).

The radiation level will increase during beam operation after Long Shutdown 3 (2024-2025). Therefore, in order to reduce dose to personnel during the alignment, all these new sections will be online monitored by Hydrostatic Levelling System and Wire Positioning System sensors and equipped with motorized jacks.

The HL-LHC component positions need to be taken into account for the alignment process during the LHC smoothing activities. The survey sections of the EN-SMM group (Engineering Department - Survey, Mechanics and Measurements) are studying various wire measurement solutions in order to be able to geometrically link the HL-LHC components, monitored by sensors, and the LHC components measured by standard methods.

While the design study and R&D are still in progress, a global comparison of different solutions, including all the constraints and working conditions, has been organized inside the LHC tunnel environment during the last winter technical stop. A common “wire measurement” campaign along 80m of LHC magnets has been performed with the following techniques : offset manual measuring device, oWPS associated with laser tracker (AT40x), photogrammetry (D3X, Aicon software) and micro-triangulation with a Leica TS60 total station.

The paper will give an overview of the methodologies used, the issues and the results.

**Primary author:** Mr FUCHS, Jean-Frederis (CERN)

**Co-authors:** Mr VENDEUVRE, Camille (CERN); Mr DUQUENNE, Mathieu (CERN); Mr VLACHAKIS, Vasileios (CERN); Mr RUDE, Vivien (CERN)

**Presenter:** Mr FUCHS, Jean-Frederis (CERN)

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