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Modular sensor supports for precision alignment of HL-LHC components

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The High Luminosity Large Hadron Collider (HL-LHC) is an ambitious upgrade to increase the LHC's collision rate fivefold, significantly enhancing discovery potential beyond 2030. As part of this effort, new components must be aligned within an elliptical 1σ tolerance zone, with radii of 0.17 mm vertically and 0.33 mm radially over 420 meters. To meet these requirements, all components will be equipped with micrometric alignment sensors, including 276 Wire Positioning Sensors (WPS) and 148 Hydrostatic Levelling Sensors (HLS). These sensors must be rigidly attached to the component structures to enable precise position determination and must be accurately pre-adjusted relative to external reference networks. The large number of sensors, combined with the need for both stability and adjustability, led CERN's geodetic metrology team to develop a modular support system. This system ensures ergonomic sensor adjustment, long-term positional stability, and robustness against mechanical disturbances. This paper presents the design approach and the results of final testing and validation of the modular sensor support solution.

Footnotes

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Author: SOSIN, Mateusz (European Organization for Nuclear Research)

Co-author: NOIR, Michel (European Organization for Nuclear Research)

Presenter: SOSIN, Mateusz (European Organization for Nuclear Research)

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