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Technical challenges for High Luminosity LHC alignment and associated solutions

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The High Luminosity LHC (HL-LHC) is an upgrade of the LHC to achieve instantaneous luminosities of a factor five larger than the nominal LHC values. The project will comprise the replacement of 1.2 km of accelerator components such as magnets, collimators and radiofrequency cavities in 2024. The upgrade relies on a number of key innovative technologies. The alignment solutions chosen to answer the requirements of the project are challenging as well. They consist of alignment systems including Wire Positioning Sensors (WPS), Hydrostatic Levelling Sensors (HLS), and Frequency Scanning Interferometry (FSI) to determine the position of components, combined with motorized jacks and adjustable platforms. This paper introduces first these concepts. It then details the R&D undertaken to develop low cost alternatives of HLS and WPS, to improve the acquisition chain of the WPS, to make easier and quicker the installation and maintenance of the WPS and to propose innovative solutions of adjustment. It presents the direction of studies followed and the first results achieved.

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