The remote positioning of the LHC low beta triplets

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Abstract

Because of tight alignment tolerances and severe environment (high radiation fluxes and magnetic fields), the LHC low beta quadrupoles are equipped with permanent instrumentation and are supported by motorized jacks, allowing their remote positioning thanks to the sensors’ readings.

This poster describes the alignment systems, the motorized jacks as well as the first results obtained.

Monitoring and Repositioning Systems

Hydrostatic Levelling System (HLS)
- based on the principle of communicating vessels
- reference surface is the water network
- a sensor is fitted to each vessel
- measurement of distance to the free surface of water

Resolution: 0.1 micron
Range: 5 mm
Repeatability: 1 micron
Bandwidth: up to 10 Hz

Wire Positioning System (WPS)
- reference frame is a stretched wire
- horizontal plane: wire is a straight line
- vertical plane: wire follows a catenary curve

Resolution: 0.2 micron
Range: 10 mm x 10 mm
Repeatability: 1 micron
Bandwidth: up to 10 Hz

Motorized Jacks
- modified LHC cryo-magnets jacks, with two mechanical interfaces (traverse and vertical adaptors)
- minimum effective movement 10 micron, range 2 mm
- motor mounting time less than 15 minutes

Configuration

Total number of sensors:
- 100 hydrostatic levelling sensors (HLS)
- 68 wire position sensors (WPS)
- 24 distance measurement sensors (DOMS)
- 128 temperature probes (PT-100)

80 motorized jacks with
- 48 traverse adaptors
- 80 vertical adaptors

Results

Monitoring of low beta magnets
displacement due to variation of magnet’s internal pressure
during accelerator operation (beam on)

PVSS data visualization