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Safety at HL-LHC IT String during construction, commissioning, and operation

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The HL-LHC IT String, a test facility for the major components of the HL-LHC Inner Triplet, is currently in its construction and commissioning phases in a surface building at CERN. The primary motivation of the HL-LHC IT String is to study and validate the collective behavior of its different subsystems which include mainly: the inner triplet superconducting magnets and their correctors, a novel superconducting link, the cryogenics infrastructure for the cooling and quench recovery, the powering and quench protection systems, and the remote alignment system.
Over the past two years, the HL-LHC IT string project has made progress in the installation of general infrastructure and hardware components. It has initiated a series of individual system tests focused on the powering systems and the cryogenic supply infrastructure. By the year 2025, the following objectives are foreseen: gradually and securely finalize the hardware installation and perform the required individual system tests of the warm and cold powering systems in preparation of the HL-LHC IT String Validation Program due to start in the second half of 2025. This program aims at fully validating the collective behavior and performance of the HL-LHC IT region before installation in the LHC tunnel.
The HL-LHC IT String is a multi-disciplinary project that integrates novel superconducting technologies and requires the contribution of multiple stakeholders. Throughout the construction and commissioning It involves a significant number of co-activities that must be safely managed, considering the safety and operational requirements of neighboring testing facilities located in the same buiding. During its operation, multiple failure modes can occur for which a detailed risk assessment has been conducted to address and mitigate them. The safety aspects of the HL-LHC IT String are of key importance and have been duly addressed. In this paper we will first introduce the HL-LHC IT String facility. Subsequently we will then focus on methodologies employed for safety assessments and explore how safety measures are implemented during the different phases of design, construction, commissioning, and operation of the cryogenic and superconducting systems.

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