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Application of Distributed Temperature Sensing for fire and cryogenic leak detection in accelerator tunnels

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High-energy accelerators like CERN's Large Hadron Collider (LHC) present hazards characterized by temperature variations such as cryogenics leak or fire. Considering that LHC tunnels are large, underground and radioactive areas, traditional systems to detect these hazards can't be used. CERN is exploring the feasibility of installing a large-scale temperature monitoring system in LHC tunnels using Distributed Temperature Sensing (DTS) technology. Based on optical fiber, such a system would be resistant to the LHC radioactive environment and could detect temperature changes induced by both fire and cryogenic leak events, over LHC large distances. This paper presents simulations, tests, studies and a foreseen prototype of DTS equipment in the LHC tunnel to be installed and tested at the beginning of 2025. This publication evaluates the DTS as a safety enhancement tool for accelerator facilities. The main advantages over traditional detection systems like early smoke detection (fire), and Oxygen Deficiency Hazard (ODH) detection systems will be also discussed.

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