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The radiation tolerance of specific optical fibers for the LHC upgrades

Optical fibers in the readout system for the LHC upgrades will operate in a harsh radiation environment. The fibers within 12 meters from the front-end detectors are exposed up to 250 kGy(Si) total ionizing dose in 10 year operation life time. In some applications the nearest 2 meters from the front-end are kept in a cold environment near -25 ℃. The paper presents the identification of suitable optical fibers for the LHC detector upgrades.

Several optical fibers have been tested to 650 kGy(Si) at room temperature with various dose rates of 60Co gamma rays. Two MM fibers and one SM fiber have been qualified for use in the LHC upgrades for warm operations. Four optical fibers have been tested to 500 kGy(Si) at -25 ℃ with 27 kGy(Si)/hr 60Co gamma rays. Two SM fibers have been qualified for the LHC upgrades for cold operations. Several optical fibers, including two MM fibers, have been tested up to 11 kGy(Si) at -25 ℃ with 70 Gy(Si)/hr 60Co gamma rays and exhibited moderate RIA, indicating that all fibers under test are potential candidates for the LHC upgrades for cold operations.

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