

THERMAL PERFORMANCE OF LIGHTWEIGHT COOLING SYSTEMS FOR THE ALICE ITS UPGRADE

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Manuel Gómez Marzoa (1)(2), Corrado Gargiulo (1)

on behalf of ALICE Collaboration

(1) European Centre for Nuclear Research (CERN), Geneva CH-1211

(2) Laboratoire de Transfert de Chaleur et de Masse (LTCM), École Polytechnique Fédérale de Lausanne (EPFL), Lausanne, CH-1015

ABSTRACT

The thermal performance of lightweight cooling systems proposed as baseline for the Inner and Outer Barrel modules of the ITS upgrade of the ALICE Experiment at CERN is reported. In order to provide minimum negative impact over the detector resolution, the cooling systems consist of a minimal amount of specific materials and refrigerants. Experimental heat transfer tests with water in single phase and boiling per-fluorocarbon (C4F10) refrigerant were carried out with the goal of thermally characterizing the prototypes. Maximum temperature, temperature uniformity and refrigerant pressure drop are the main parameters of interest in this study. The prototypes are capable to keep the detector temperature within its operational limits (below 30°C) for power densities as high as 0.3 W cm⁻², meeting the requirements of material budget at the same time. This is possible thanks to the use of lightweight, high-conductive materials for the structure and innovative thin wall plastic tubes for the refrigerant flow.

Primary author: GOMEZ MARZOA, Manuel (Ecole Polytechnique Federale de Lausanne (CH))

Co-author: GARGIULO, Corrado (CERN)

Presenter: GOMEZ MARZOA, Manuel (Ecole Polytechnique Federale de Lausanne (CH))