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Thermal Design and Performance results of the first High Beta Cryomodule for HIE-ISOLDE at CERN

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The High Energy and Intensity HIE-ISOLDE is a facility under construction at CERN whose target is ultimately to produce radioactive ion beams at 10MeV/u maximum energy in order to significantly expand the nuclear physics programme carried out by REX-ISOLDE. In its final stage the new upgrade will be composed of two low-β and four high-β superconducting cryomodules. The first high-β cryomodule, currently being assembled at CERN, presents an optimum vacuum and cryogenics environment aimed at offering the highest beam quality output to the scientific community for a first physics run starting from 2015.
Since thermal control is essential to the performance of the whole cryomodule, a combination of a passive (materials, coatings, and surface finishes) and active (cryogenic loops, heaters) control has been implemented to keep the cryostat operating within the allowable thermal budget. Moreover in order to preserve the cavities from the risk of surface contamination, a thermal insulating system without multilayer insulation has been adopted with consequent effect on the global strategy of heat loads optimization.
A numerical model based on Finite Elements has been developed in order to generate a faithful global mapping of temperatures and heat fluxes inside the cryomodule. This simulation tool has as primary aim to reproduce as precisely as possible the most significant heat exchange phenomena, but it also represents a validation and diagnostic tool for interpreting the experimental data obtained from numerous temperature sensors located inside the cryostat. The numerical model, combined with the experimental results of the first test campaign, will serve as an optimization tool for the future cryomodules in terms of improvements in the global and specific heat loads management.

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