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C3Or2B-03: Development of beyond state-of-the-art cryostat for the linear accelerator HELIAC of GSI

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GSI/FAIR is planning for a Helmholtz Linear Accelerator (HELIAC), a continuous-wave linear accelerator that will allow for new research opportunities with a continuous particle beam. The first cryogenic accelerator module of the HELIAC, the so-called advanced demonstrator, has been designed, manufactured and tested at 4 K. The cryostat of the advanced demonstrator has a length of about 5 m and a diameter of 1.7 m and will contain four superconducting accelerator RF cavities and two superconducting solenoids.

Cryoworld has designed and manufactured the cryostat in collaboration with GSI Darmstadt and Helmholtz Institute Mainz. The cryostat has unique features making it first of its kind. Four large doors in the vacuum jacket allow access to the internal components, and to assemble the RF-power couplers and the current leads. A dedicated suspension system of the cavities and solenoids is designed from scratch to align the components accurately and to ensure that the centre line stays within a cylinder of 0.2 mm during evacuation and cool down. Further, due to space restrictions, the cryogenic valves, safety relief devices and instrumentation required for process control are included in the cryostat.

The advanced demonstrator cryostat was cooled down to 4 K and tested with identical dummy cavities and with the original solenoids to demonstrate the mechanical behaviour under cryogenic conditions. By using special targets and a high-end optics camera, the actual displacement of the components during evacuation and cool down was observed. The solenoids have been successfully tested with a heavy ion beam. Further, instrumentation and heat loads were checked.

This contribution will present the design and manufacturing of the cryostat in detail. It will discuss the special design features, the suspension system, frame and FEM analysis and the first test results.

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