

Cryogenic Debugging of the prototype cryomodule and test valve box of the MYRRHA superconducting linear accelerator

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The first phase of the MYRRHA project, called MINERVA and led by SCK-CEN in Belgium, comprises a superconducting linear accelerator producing a continuous 100 MeV energy and 4 mA intensity proton beam that will be operational in 2026.

To achieve such performance, it is necessary to develop on the one hand a cryogenic system able to supply liquid helium at 2K to 60 SPOKE cavities, on the other hand, radiofrequency (RF) control systems for the accelerating gradient (amplitude and phase) and for the cavity resonance frequency. The robustness of those systems is crucial to satisfy the high reliability target of the final machine.

A period of R&D started in July 2017, to validate the components and freeze the specifications for the serial construction. Besides, this period would also allow to study the “Fault Tolerance” strategies. To this end, the tests in “Nominal Conditions” of a fully equipped low-energy ($\beta=0.37$) prototype cryomodule, supplied by its test valve box, are expected mid-2022.

In view of those final tests, an intermediate stage called “Cryogenic Debugging” was run end of 2021. The preparation of this step started in early 2021 with the prototype cryomodule and test valve box reception, inspection and assembly, together with the test site preparation. The prototype cryomodule was equipped with two mock-up cavities and couplers. Despite of the liquid helium supply limited to only two mobile Dewar (2x 400L), an extensive characterization was run. The collected data were processed and gave the green light to move ahead.