Status of the R^{3}B GLAD magnet cryosystem*

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The superconducting GLAD (GSI Large acceptance Dipole) magnet will be one of the major components of the R³B experiment to be installed at FAIR at the experimental area. Within the year 2015 we expect the full magnet to arrive at GSI in Cave C for field measurements and first commissioning experiments. To install and run the magnet in Cave C it has to be provided with liquid Helium, and therefore, a new cryogenic system has to be installed at the GSI target hall.

Figure 1: R^{3}B Glad magnet during the welding of the cryostat at CEA/Saclay

The cold mass of the magnet has a weight of 21 tons and was fully manufactured in 2012.

The superconducting coil was tested successfully in December 2013 at the test facility of the CEA in Saclay in a huge cryostat with a diameter of 5.2 m. With its full current of 3584 Amps it was possible to reach the intended peak field of 6 Tesla.

The GLAD magnet will be provided with Helium at GSI by a used TCF 50 Helium liquefier (year of manufacture 1985) which was used before for cooling cavities at DESY. The cryoplant was moved to Darmstadt in June 2012.

The liquefier was refurbished and upgraded in collaboration with the Linde Kryotechnik Company within the last two years.

The new compressor, the gas management system and the oil removal was first tested successfully at the beginning of 2014. After these tests the bypass system, the oil removal system and the control system were optimized. The cooling water supply of the compressor was improved too to reduce the noise inside the target hall.

To build a completely new automation system for the cryo plant, a PLC control system, based on the UNICOS framework, developed at CERN, was used the first time at GSI.

The complete control and automation system is designed by the industrial controls group and the cryo department in coordination with the R3B experiment, according to specifications from CEA (France) and Linde Kryotechnik. The whole cryo plant is now constructed and documented following the European Pressure Equipment Directive and Machinery Directive as well as associated standards.

In the second half of 2014 preparations for the cool-down of the coldbox have begun. The needed automation functions for the cool down procedure were added to the code of the control system. Prior to installing the turbines in the coldbox, several simulations were done to test and verify the control system part, required for the turbines. The two expansion turbines can be seen as the heart of the coldbox, but they are very expensive as well as fragile while rotating with revolution frequencies up to 4700 1/s.

In December 2014 first cool down tests with built-in turbines started. Before Christmas 2014 the first liquid Helium after over 12 years of downtime was produced by the TCF50 cryoplant.

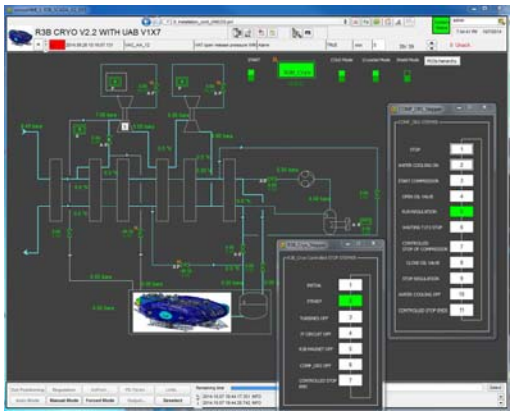

Figure 2: Operator interface of UNICOS for R^{3}B fridge

Right now, the area between the south entry door of the target hall and Cave C is prepared for the delivery of GLAD, the 60 ton magnet, to be transported by air cushions into its Cave.

Outlook

In 2015 power tests of the coldbox to estimate the maximum cooling power @ 4.5 K and improvements of the control system are planned. Furthermore the isolation vacuum system of the cryostate has to be mounted, its control system hast to be developed and the documentation has to be completed.

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