
SESSION 16: Cryocooler Applications and Integration

Paper 16.6

Thursday ORAL Session

2:15 PM

10K Remote Helium Cooling Loop for C400 Carbon Ion Cyclotron Application

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To improve the precision and the efficiency of cancer treatment, a new kind of radiotherapy using carbon ions is under development in France. This project called C400, involved a 400 MeV/u cyclotron composed of a 15 tons superconducting magnet cooling by a 470 L liquid helium bath.

In order to cool down of the magnet from 300 K, Absolut System designed, manufactured and tested a high capacity 10 K Remote Helium Cooling Loop. This system is a forced Helium 4 cooling loop cryostat which is providing a progressive and controlled cooling for the application from 300 K to 10 K. The cryostat is equipped with two Gifford-MacMahon AL630 cold heads, two double stage Pulse Tube PT420 cold heads and a LN2 tank corresponding to seven cooling stages. Helium flow controlled by two cryogenic circulators has a range of 0.1 to 5 g/s. Pressure range from 1 to 4 bars, can be adjusted to optimize the efficiency depending on the Helium temperature. In C400 Project, our cryostat also provides LN2 to other equipment such as cryogenic transfer lines, magnet and quench tank thermal shields.

It will guarantee the best cooling for the superconducting magnet before the liquefaction phase takes place under 10 K. Moreover, when quench will occur, all the Helium gas will be recovered in tanks. Our 10 K Remote Helium Cooling Loop will cool once again Helium gas from the tanks permitting to recycle all Helium gas and restart quickly the cyclotron. Thus, the 10 K Remote Helium Cooling Loop is an innovative solution permitting to cool down the C400 cyclotron as many times as it will need, from a 300 K Helium gas storage in complete autonomy even if quench occurred.