

Heat load measurements of XFEL cryomodules using the helium evaporation method

Wednesday 24 July 2024 12:45 (15 minutes)

The European XFEL Free Electron Laser (EuXFEL) at DESY is operated at 2K since January 2017. The first laser light was produced in May 2017 while the user operation began in September 2017. The electrons are accelerated in pulses with a repetition rate of 10 Hz. Each pulse is about 1.37 ms long; 650 μ s are used for beam acceleration.

An R&D program is ongoing at EuXFEL and DESY to investigate a future upgrade of the EuXFEL linac to allow operation in the continuous wave and long pulse mode (High Duty Cycle - HDC operation), which will allow more flexibility in the electron and photon beam time structure.

The upgrade will increase the number of cryomodules from 96 to 112 by adding 16 new, HDC-designed cryomodules. The already existing cryomodules will not be modified.

In the HDC operation, the beam acceleration will take place at lower accelerating gradients but with longer accelerating pulses. The related increase of the heat loads will have to be taken over by an additional refrigerating plant to be built and installed at DESY. Precise knowledge of the future heat loads is therefore essential for the design of the cryogenic system of the HDC-upgrade.

This paper describes a heat load measurement method based on the amount of helium evaporated from the LHe II bath during a certain time period. A distinctive feature of the method is its insensitivity to eventual leaks across the seats of JT-valves. Furthermore, possible errors in the LHe II level readings can be avoided using this method.

This paper summarizes the experience gained so far with this method at the EuXFEL linac and at the CryoModule Test Bench (CMTB). Issues that have arisen during the measurements are discussed and conclusions are drawn. Results of the heat load measurements for different RF duty factors are presented for a single cryomodule at the CMTB.

Submitters Country

Germany

Authors: ABASSI, Emna; PENNING, Joerg (Deutsches Elektronen-Synchrotron DESY); Dr ZAJAC, Juliusz (Linde Kryotechnik); JENSCH, Kay (Deutsches Elektronen-Synchrotron DESY); BARBANOTTI, Serena; SCHNAUTZ, Tobias; BOZHKO, Yury

Presenter: ABASSI, Emna

Session Classification: Wed-Or7

Track Classification: Tracks ICEC 29 Geneva 2024: ICEC 01: Large scale refrigeration and liquefaction