Contribution ID: **761** Type: **Poster Presentation**

C1Po2D-01 [10]: Experimental and numerical investigation of 2 K heat exchanger for superfluid cryogenics system at KEK

Monday, 22 July 2019 14:00 (2 hours)

Superfluid cryogenics systems at KEK are constructed for research and development of cryomodules of the compact Energy Recovery Linac (cERL) and International Linear Collider (ILC). The niobium superconducting radio frequency (SRF) cavities in the cERL and ILC, operate at temperatures of 2.0 K or below. The SRF cavities are cooled with saturated superfluid helium, which is another phase of liquid helium (LHe) when it is cooled below 2.17 K, under saturation condition. To produce superfluid helium continuously, a Joule-Thomson (JT) valve is employed in the cryogenic system. Also, a 2 K heat exchanger (2K HX) is introduced in series with the JT valve, to recover the coldness from 2.0 K gaseous helium (GHe) evaporating from the helium tanks of the SRF cavities. This increases the production rate of superfluid helium, by reducing the incoming LHe temperature from 4.4 K to 2.2 K or above, before the JT valve. At KEK, we have a 2K HX consisting of a helical coil and laminated fins for thermal loads up to 100 W. Its performance needs to be determined and is characterized by a factor known as effectiveness, which is the ratio of actual heat transfer to the maximum possible heat transfer between the fluids. The performance of the 2K HX has been determined experimentally using the heat exchanger test stand and numerically by computational fluid dynamics (ANSYS CFX®), respectively. In the heat exchanger test stand, the mass flow rate of incoming LHe is kept identical to outgoing GHe through the 2K HX, using the level and pressure control of superfluid helium. A heater is immersed in the superfluid helium to vary the mass flow rate of evaporating superfluid helium. In the future, the results will be further analyzed to optimize the design of the 2K HX to improve its performance.

Primary author: Mr KUMAR, Ashish (The Graduate University for Advanced Studies (SOKENDAI))

Co-authors: Prof. NAKAI, Hirotaka (High Energy Accelerator Research Organization (KEK)); Dr NAKANISHI, Kota (High Energy Accelerator Research Organization (KEK)); Dr SHIMIZU, Hirotaka (High Energy Accelerator Research Organization (KEK)); Mr HARA, Kazufumi (High Energy Accelerator Research Organization (KEK)); Mr KOJIMA, Yuji (High Energy Accelerator Research Organization (KEK)); Mr HONMA, Teruya (High Energy Accelerator Research Organization (KEK))

Presenter: Mr KUMAR, Ashish (The Graduate University for Advanced Studies (SOKENDAI))

Session Classification: C1Po2D - Heat Exchangers