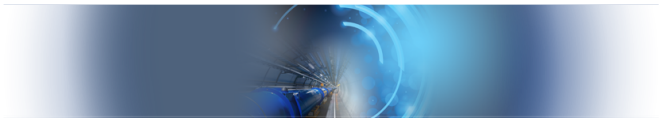

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Heat flux to the helium cryogenic system elements in the case of incidental vacuum vessel ventilation with atmospheric air

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The selection process for size in safety equipment for cold vessels or process pipes in cryogenic systems should take into consideration the incidental ventilation of the vacuum vessel with atmospheric air. In this case, a significant heat input toward the cold elements of the system can be expected. A number of experimental investigations have been done for the elements at liquid helium temperature which have been covered with 10 layers of MLI. The typical values of the heat flux were measured in a range of 3.7 to 5.0 kW/m2 of the element surface. The helium temperature parts are typically surrounded by thermal shields that are kept in a temperature range of 50-80K. On the external side, the thermal shields are covered with 30-40 layers of MLI while on the internal side, the shields are bare. The theoretical calculations of heat flux to the thermal shield, with respect to the possibility of air condensation and freezing on the bare side of the thermal shield, show that the heat flux to the thermal shield can be extremely large. A review of the available literature shows no experimental data in this area of interest.

Another issue can be found in the unknown ratio of inflowing air, which is deposited on the liquid helium temperature surface, to the air which is deposited on the thermal shield. This would be important if the ratio of the expected cross section area of a hole in the vacuum vessel to the surface area of the cold elements is found to be relatively small.

This talk will discuss the abovementioned problems. A WUST cryostat designed to allow the determination of heat flux to the bare surface of the thermal shield, as well as test methodology, will also be presented.

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