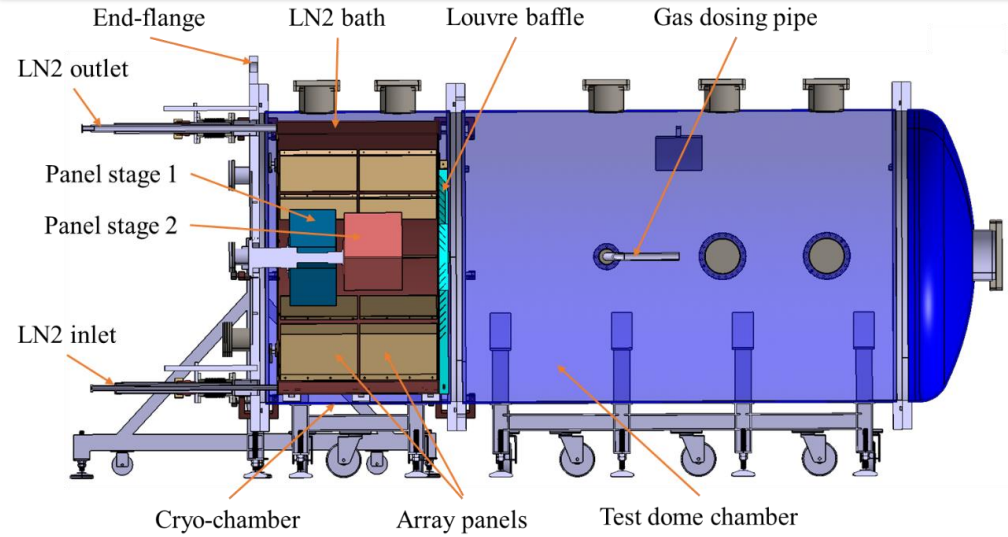
Thermostructural Analysis of Large Cryopumping Test Facility

Hemang S. Agravat, Samiran S. Mukherjee, Vishal Gupta, Paresh Panchal, Pratik Nayak, Jyoti Shankar Mishra & Ranjana Gangradey



Cross-sectional view of the Large Cryopumping Test Facility

The main three parts of the LCTF are the test dome chamber, the cryo-chamber, and the end flange. The system has two different cooling and pumping areas: one is a liquid nitrogen-filled bath, and the other is a cryocooler, which is mounted on the end flange. Cryopanels working at 80 K are mounted on the LN2 bath, known as array panels. Cryopanels working at 40 K and 20 K temperatures are mounted on the first and second stages of the cryocooler. These panels are used for the cryo-pumping of all gases, including noble gases. The Louvre baffle and array panels together can pump most of the water vapor, nitrogen, hydrocarbons, and oil vapors, whereas the panels on the cryocooler can pump hydrogen and other residuals.

To create a high and ultra-high vacuum environment in large chambers for the application in space research, nuclear fusion, accelerators, etc., vacuum pumps with large pumping speed are essentially required. To cater the need, the Institute for Plasma Research (IPR) is working on the development of large-size cryopumps. For their performance testing and design validation, a Large Cryopumping Test Facility (LCTF) is conceptualized. It houses a large cryopump designed to achieve a pumping speed of ~50000 l/s for nitrogen gas and ~150000 l/s for water vapor. In this paper, thermal-structural analysis and its optimization studies are discussed and reported.

FUSION SCIENCE AND TECHNOLOGY · VOLUME 79 · 683–702 · AUGUST 2023
DOI: https://doi.org/10.1080/15361055.2023.2178252