ICALEPCS 2025 - The 20th International Conference on Accelerator and Large Experimental Physics Control Systems

Contribution ID: **543** Contribution code: **WEPD009** Type: **Poster Presentation**

LCLS-II cavity heater controls: design, operation, and accuracy

Wednesday, 24 September 2025 16:30 (1h 30m)

The SLAC National Accelerator Laboratory's upgrade to the LCLS-II, featuring a 4 GeV superconducting linear accelerator with 37 cryomodules and two helium refrigeration systems supporting 4 kW at 2.0 K, represents a significant advancement in accelerator technology. Central to this upgrade is a 2K system with five stages of centrifugal cold compressors, operating across a pressure range from 26 mbar suction to 1.2 bara discharge*. These dynamic centrifugal compressors have a limited operational envelope hence maintaining stable pressure and flow is critical for its operation. This paper describes how SLAC achieved stable LINAC pressures in each of the 37 Cryomodule using electrical heaters compensating actively to the changes in RF power to maintain constant flow through the system. Additionally, this paper details the power accuracy of these heaters, which can be useful not only for control, but also when measuring cavity efficiency.

Funding Agency

Funding: This work was supported by Department of Energy, Office of Basic Energy Sciences, contract DE-AC02-76SF00515

Footnotes

*Shrishrimal, S., et al. (2024). LCLS-II 2K Pumpdown and Control Automation. ICEC29-ICMC-2024

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Session Classification: WEPD Posters

Track Classification: MC01: Project Status Report on New Facilities