



Contribution ID: 288

Type: **Contributed Oral Presentation**

Commissioning and Operational Results of Helium Refrigeration System at JLab for the 12GeV Upgrade

Wednesday 1 July 2015 11:15 (15 minutes)

The new 4.5 K refrigerator system at the Jefferson Lab (JLab) Central Helium Liquefier (CHL-2) for the 12 GeV upgrade was commissioned in late spring of 2013, following the commissioning of the new compressor system, and has been supporting 12 GeV LINAC commissioning since that time. The six design modes were tested during commissioning, consisting of a maximum capacity condition, nominal capacity, maximum liquefaction, maximum refrigeration, maximum fill and a stand-by/reduced load condition. The maximum capacity was designed to support a 238 g/s 30 K 1.16 bar cold compressor return flow, a 15 g/s 4.5 K liquefaction load and a 12.6 kW 35-55 K shield load. The other modes were selected to ensure proper component sizing and selection to allow the cold box to operate over a wide range of conditions and capacities. The cold box system is comprised of a two cold box sections with a large interconnecting transfer-line. The outside (upper) 300-60 K vertical cold box has no turbines and incorporates a liquid nitrogen pre-cooler. The inside (lower) 60-4.5 K horizontal cold box houses seven turbines that are configured in four expansion stages including one Joule-Thompson expander. The helium compression system has five compressors to support three pressure levels in the cold box. This paper will summarize the analysis of the test data obtained over the wide range of conditions and capacities which were tested.

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Session Classification: C3OrA - Operating Experience I

Track Classification: CEC-01 - Large-Scale Refrigeration and Liquefaction