Contribution ID: **269** Type: **Oral presentation (15min)**

40 K liquid Neon Energy Storage Unit

Tuesday, 8 July 2014 16:45 (15 minutes)

To attenuate temperature fluctuations, inherent to the cryocooler working or due to sudden heat bursts, a thermal Energy Storage Unit (ESU) could be used. The ESU directly coupled to the cold source actuates as a thermal buffer increasing temporarily its cooling capacity and providing a better thermal stability of the cold finger ("Power Booster mode"). The energy storage units presented here uses an enthalpy reservoir based on the high latent heat of the liquid to vapour transition of neon (38 K- 44 K) to store up to 900 J and a 6-liter expansion volume at RT in order to work as a closed system.

Experimental results in the power booster mode will be described: the low temperature cell was directly coupled to the cold finger, its volume (≈12 cm3 of liquid neon) allowing to store 450 J around 40 K. 10 W heat bursts were applied, leading to liquid evaporation, with reduced temperature changes.

The liquid neon reservoir can also provide a temporary cold source to be used after stopping the cryocooler allowing a vibration-free environment. In this case the enthalpy reservoir implemented (≈24 cm3) was linked to the cryocooler cold finger through a gas gap heat switch for thermal coupling/decoupling of the cold finger. We will show that, by controlling the enthalpy reservoir's pressure, 900 J is stored at a constant temperature of 40 K as in a triple-point ESU.

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Session Classification: Tue-Af-Orals Session 5

Track Classification: C-14: New devices and novel concepts