

SPIRE-RAL-NOT-001514

Electrical Isolation of the SPIRE Level-0 Thermal Straps

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Background:

The principal requirements of the Level-0 SPIRE thermal straps are:

1. Conductance of $\sim 100\text{mW/K}$ total between the Herschel Helium Two Tank (HTT) and the Sorption Cooler (SCO)
2. Electrical Isolation between the HTT and SPIRE.

Currently these conflicting requirements are proving to be nearly impossible to achieve. In particular, the joint impedance of the electrical isolation joint is problematic. This note is a proposal of an alternative design intended to assist SPIRE in meeting the thermal and electrical requirements.

Concept:

See Figure 1 overleaf.

1. The strap is fabricated from bar stock. (High purity Cu or Al)
2. An electrically isolating joint is formed with a Stycast Hole-Spigot joint.
3. A small volume is left at the end of the spigot. This volume is filled with Helium via the Helium fill port. The pressure at room temperature is potentially high (10 MPa ?) to get sufficient mass of Helium in the void. Once the volume is filled, the tube is permanently sealed off á la Lionel's Sorption Cooler.
4. A safety pin is used as insurance to prevent injury if the Stycast joint lets go.
5. When the strap is cooled, the Helium turns superfluid. The Helium would then be the main heat conduction path between the two sections of the strap.

If this concept were to be used on the Level-1 and Level-3 straps then the Helium would not be superfluid. In fact it would remain in the gaseous phase. A good thermal joint would then require a thin gap between the two sections of strap to have high conductivity.

Issues

- Obviously - testing and development.
- Would the joint work under one-g?
- Would the Helium-II turn to Helium-I during recycle? This would cause a step decrease in strap conductance just when you need high conductance.
- Would the thermal conductivity of the joint be strongly temperature dependant?
- If ^3He were used in the gap then the gas would not become superfluid.
- The optimal means for obtaining the electrical isolation and the sealing of the joint may be through a brazed ceramic spacer between the two sections of the joint. (if Helium leaks through the epoxy joint).

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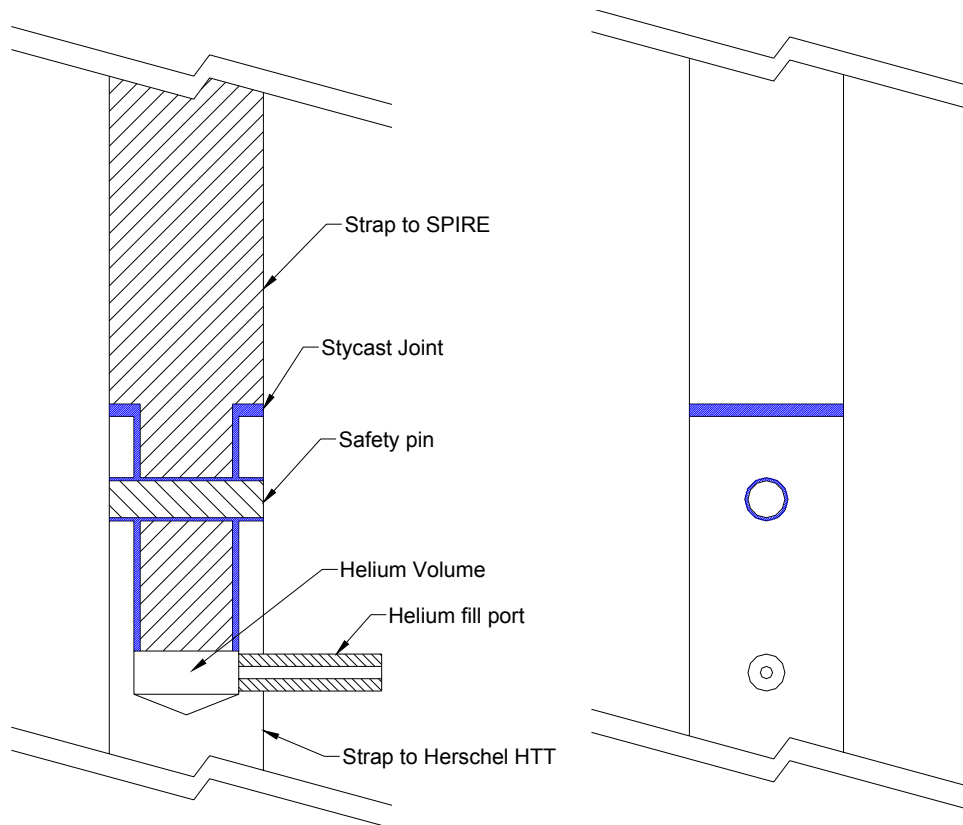


Figure 1 - Schematic representation of the isolation joint.