A new (2nd Generation) cryostat for superconducting undulators (SCU’s) was installed at APS in 2018.

- Cooling of SCU is provided by natural circulation of liquid helium (LHe)
- Reducing the cryostat via conductive cooling of the LHe reservoir wall (auto-bid-off operation)

The thermal resistance of the cooling circuits limits cryocooling capacity

- Cryocooler 2 stages operating at 3.1K
- Steady-state cooling power / cryocooler of 0.3W

**Conductive cooling systems:**

1. Braided copper links with soldered bimetallic plate
2. Rolled copper on 3/16” AISI 316 steel substrate
3. Copper layer RRR*

**Thermal Links:**

- RRR: 213
- Resistance: 0.272
- Cross section: 0.28
- Thickness: 0.70 K/W

- T (K)
- Voltage (µV)
- Current (A)
- Resistance (Ω)
- Conductivity (Ω−1cm−1)

**LHe off:**

- ∆V
- ∆I
- Contacts*

**Background:**

- Supports planar, helically wound bare copper, with Apiezon L-bracket/wall joint
- All thermal unit (all thermal specs)
- Supports planar, helically wound bare copper, with Apiezon L-bracket/wall joint
- All thermal unit (all thermal specs)

**Electrical Resistivity Test Results (Beam Specimen only)**

- Beam (above) and Ring (below) specimens thermal/conductance measurement setups

**Thermal Links:**

- Copper/Gap-Cu
- Copper/Gap-K
- Copper/Gap-CuAg
- Copper/Gap-CuAl
- Copper/Gap-CuAg

**Contact Resistance: Thermal Links:**

- Cu Foil Link
- 4K Doubler Link
- 4K Main Link

**Top and Bottom tank wall:**

- Supports planar, helically wound bare copper, with Apiezon L-bracket/wall joint
- All thermal unit (all thermal specs)

**Links 1st: 2nd tank LHe cryostat**

- Supports planar, helically wound bare copper, with Apiezon L-bracket/wall joint
- All thermal unit (all thermal specs)

**Bottom Circuit: 0.275 K/W 0.5W**

**Top Circuit: 0.190 K/W 1.0W**

**Analysis and Conclusions:**

- Braided copper thermal links are large resistances in both circuits
- Replacement with copper foil links may be advisable
- Copper l-foss in bottom circuit should be redesigned/replaced
- Higher RRR copper or reduced length
- Thermal contacts between links should be inspected