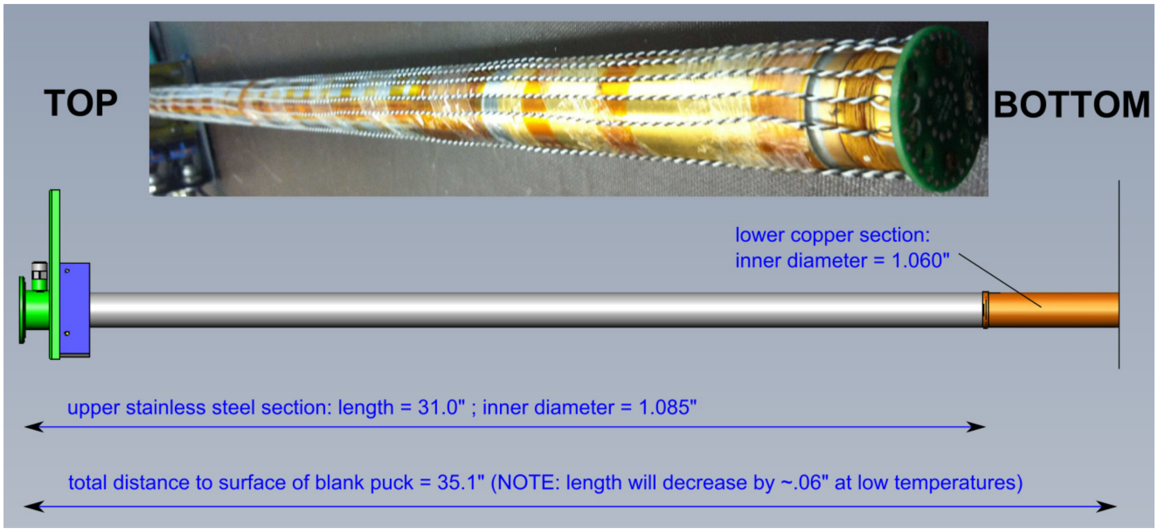
PPMS and DynaCool Sample Chamber Info for Users



Properties of Chamber Wiring

parameter	value	comments
wire type	copper alloy	similar resistivity to Cu at 300 K; typical RRR ~ 3 - 10
gauge	28 AWG (.0126" diam)	twisted pairs are taped down to outside of chamber – see photo above
length	~36"	twisted pairs along 34.2" length
calculated resistance	R = 0.40 Ω	at 300 K ; roundtrip along two wires, assuming perfect short at bottom of sample chamber
measured resistance	R ~ 1Ω	at 300 K ; roundtrip along two wires with shorted puck at bottom; additional ~0.6 ohms from contacts at grey Lemo connector, vacuum interface board, heater block, and blank puck (4084-100); there are a total of 16 joints (either solder or connectors) in the roundtrip circuit including the shorted puck.
capacitance to ground	~100 pF	for one wire to ground
max. voltage	50 V DC	this is a conservative limit; note that helium gas pressure in annulus around chamber is in the range of ~10-760 torr and minimum He breakdown voltage occurs near 1 torr
max. current	500 mA	continuous; up to 2 A used in short pulses in PPMS AC Transport

NOTES ON THE TABLE:

- all properties here refer only to the chamber wiring; user pucks impose further limits.
- Although DynaCool and PPMS sample chambers are identical regarding the properties discussed here, they are different assemblies and are not interchangeable.

NOTES FOR CUSTOM EXPERIMENTS:

WIRE PAIRING
Alignyour experiment pairs (e.g., V+/V-) with our pairs to minimize inductive crosstalk. These are pins 3/4, 5/6, etc., at the grey Lemo connector and the puck interface (see pin-out diagrams in PPMS or DynaCool Hardware manuals).

GROUNDING
Cryostat (including puck and chamber) is grounded through the vacuum pump so is NOT a good ground reference for sensitive measurements; all user experiments should be isolated from the puck/chamber. Furthermore, highly charge-sensitive measurements will be affected by capacitive coupling of the twisted pair wiring to chamber ground and should instead use a custom probe with user-shielded wiring. The user shield should be tied to a known quiet ground, and be isolated from the cryostat.

GROUND LOOPS
Due to cryostat grounding through vacuum pump, shielding on the external cable for experiment wiring should be connected only at the electronics and not at the cryostat. Otherwise, a “ground loop” is created which produces AC currents in shielding that interfere with measurements.

USE AT LOW TEMPERATURES
If designing a custom probe, consider starting with a P450 Multi Function Probe framework (see https://www.qdusa.com/pharos/browse.php?fFolderId=88 in Pharos Library) which uses a thin-walled stainless steel tube and radiation baffles to minimize heat leak. If running custom wiring for low current applications on this probe, consider alloys such as phosphor bronze, Constantan, or Manganin. For high current applications, the chamber wiring is recommended. Helium exchange gas (pressure of a few torr) in the chamber will intercept much of the heat coming down a custom probe. If thermal isolation vacuum (<10 millitorr) is required for the measurements, wiring and probe must be thermally anchored to the chamber walls along the way using contact fingers or similar. To calculate static heat leak in a vacuum for various materials, use the Thermal Conductance Calculator on our website:
http://www.qdusa.com/techsupport/thermalCalculator.html
Lastly, differential thermal expansion of the custom probe and sample chamber require a sliding piston seal at the top of the probe, as is shown in the Multi Function Probe documents in Pharos.