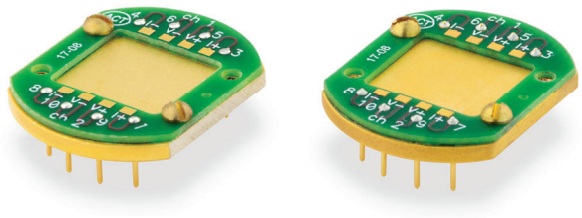
Quantum Design

Sub-Kelvin Measurements

Several existing PPMS® measurement options have been adapted to operate at sub-Kelvin temperatures in the various refrigerators offered. In some cases, additional hardware and/or electronics may be required for full compatibility, and the associated specifications are modified accordingly.

AC Resistance, DC Resistance [ADR, Helium-3, DR]



DR (left) and Helium-3 (right) Transport Pucks for use with either Resistivity or ETO

Sub-Kelvin Measurements Specifications (for Zero Field)

AC Resistance, DC Resistance [ADR, Helium-3, DR]

Identical to standard specifications except:

Current Amplitude Range:	Maximum available current may be further limited by sample resistance and available cooling power, or desired drift rate in the case of the ADR.
Operational Range:	0.1 to 2 K; 0 T (ADR) 0.4 to 350 K; 0 to 16 T (^{3}He) 0.05 to 4 K; 0 to 16 T (DR)

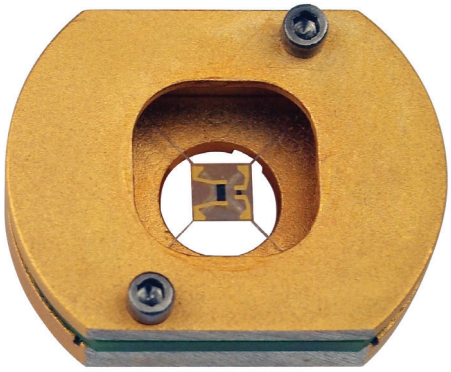
Heat Capacity [Helium-3, DR]

Identical to standard specifications except:

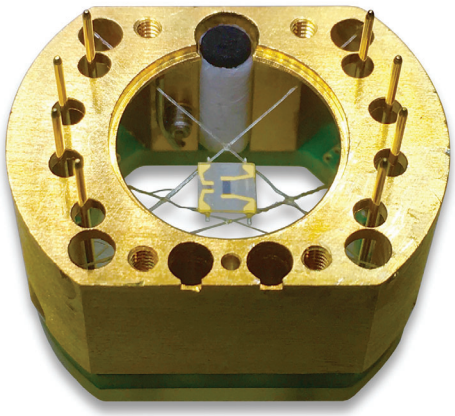
Typical Addenda Magnitude:	2.5 nJ/K @ 0.05 K, 225 nJ/K @ 2 K, 1.5 μJ/K @ 4 K; (DR) 10 nJ/K @ 0.4 K, 2.25 μJ/K @ 4 K, 340 μJ/K @ 35 K, 11 mJ/K @ 350 K; (^{3}He)
Operational Range:	0.4 to 350 K; 0 to 16 T (^{3}He) 0.05 to 4 K; 0 to 16 T (DR)

Specifications are subject to change without notice.

Heat Capacity [Helium-3, DR]



Dilution Refrigerator / Helium-3 2D Heat Capacity Puck



Dilution Refrigerator 3D Heat Capacity Puck (DynaCool only)

Quantum Design

Sub-Kelvin Measurements

AC Susceptibility [DR]

The AC Susceptibility Option for the Dilution Refrigerator (AC DR) brings the easy usability of the ACMS II option into the milli-Kelvin temperature range. Thermally anchoring the coil set to the puck interface rather than the DR sample stage, and using superconducting wires for the drive coils, lead to virtually no heat load on the DR. This allows for a mutual induction-based determination of the AC susceptibility of samples for frequencies between 10 Hz and 10 kHz down to 50 mK.

Sub-Kelvin Measurements Specifications (for Zero Field)

AC DR [DR]

AC Susceptibility [χ]

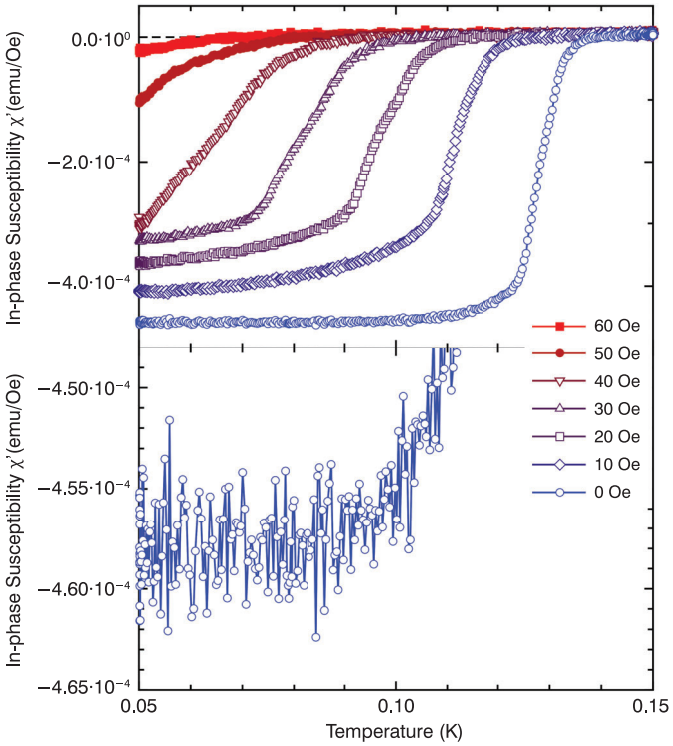
Sensitivity*:	$5 \cdot 10^{-7}$ emu @ 10 kHz
Phase Accuracy:	±2°

Drive Parameters

Drive Amplitude:	2 mOe to 3 Oe (peak)
Frequency Range:	10 Hz to 10 kHz
Operational Range:	0.05 to 4 K; 0 to 12 T

*Expect an order of magnitude decrease in sensitivity for every order of magnitude decrease in drive frequency.

Specifications are subject to change without notice.



In-phase susceptibility for the superconducting transition of an $Ir_{0.8}Ru_{0.2}$ sample measured using an AC excitation of 10 mOe and a frequency of 10 kHz for various DC background fields. The lower graph highlights the noise level for the zero field data. The peak to peak scatter of the data is about $5x10^{-6}$ emu/Oe, corresponding to $5x10^{-8}$ emu in absolute signal.

Sample provided by Milton S. Torikachvili of San Diego State University.

DR Probe with AC DR Saphire Sample Stage

AC DR Coil Set