

The Vienna Nuclear Demagnetization Refrigerator

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A new nuclear demagnetization system coupled to a powerful dilution refrigerator and a vector magnet was successfully built and operated. Our aim was to construct a versatile, modular cryostat, with a large experimental space providing an excellent platform for various types of ultralow temperature measurements. A powerful dilution unit allows us to cool the mixing chamber down to 3 mK and to precool a massive copper (~90 mol) nuclear stage in a field of 9 T to 8 mK in 100 h. After demagnetization the lowest temperature of the copper stage measured by a Pt thermometer was 50.9 μ K in a field of 20 mT. The cryostat is integrated with a 8 T - 4 T vector magnet system. Furthermore it is equipped with several semi-rigid coaxial lines (SC-219/50-C-TU-L) to the still plate extending to the mixing chamber with semi-rigid superconducting coaxial lines (SC-160/50-NbTi-NbTi) for microwave frequencies up to 65 GHz. The refrigerator is provided with a 50 mm central clear shot tube allowing the insertion of a top-loading probe to carry out measurements inside the vector magnet bore in a reasonably short time of about 4 hours. The system will be used to study the quantum critical behavior of heavy fermion compounds.

Acknowledgment

Financial support from the European Research Council under the European Community's Seventh Framework Programme (FP7/2007-2013)/ERC grant agreement no. 227378 and from Vienna University of Technology is gratefully acknowledged.