Ultra-low temperature high magnetic field quantum oscillation experimental station

The ultralow temperature high magnetic field quantum oscillation experimental station (QO station) could carry out measurements such as electrical transport and magnetic torque, in the aim to detect quantum oscillation signals in different physical quantities.

The QO station has a hybrid (LTS + HTS) magnet in operation, which has a cold bore diameter of 34 mm, by 2024 the highest field available is 30 T. This all superconducting magnet has certain advantage in regards of magnetic field holding time, field homogeneity, level of mechanical vibration, and power consumption, thus is a good choice for experiments that require long field-holding time, high signal-to-noise ratio, and high field homogeneity. At the same time, it is also a specialized project to accumulate operation parameters of the magnet constructed by high temperature superconductors, in order to develop next generation of high field magnets.

There are one top-loading dilution refrigerator and on top-loading He-4 refrigerator that could be mounted onto the hybrid, all superconducting magnet. Those two fridges could also fit into a conventional 18/20-52mm superconducting magnet at the QO station.

The QO station could provide multiple sets of stand-alone AC/DC current sources, nanovoltmeters, lock-in amplifiers, pre-amplifiers, temperature monitors/controllers, capacitance bridges, and function generators, as well as PXIe chassis based voltage multimeters and frequency counters, to set up a data acquisition system.

Currently the QO station is developing thermal expansion and magnetostriction measurements based on capacitive dilatometer, as well as ac susceptibility measurement. Thermal transport measurement is in the plan. The user are welcome to develop new techniques based on our available low temperature and magnetic field environment.

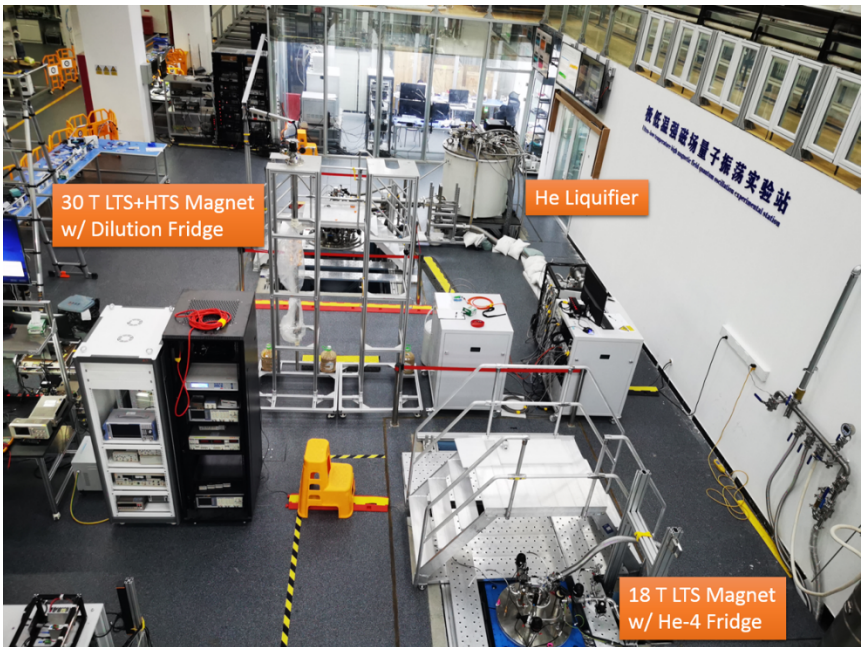

Photo of the experimental station

Parameters:

The all superconducting magnet	
Field range	0 - 30 T
Full field ramping time	6 Hours
Field Homogeneity	50 ppm@±10 mm z-axis
Top-loading dilution fridge	
Temperature range	30 mK - 1.2 K
Sample space dia.	22 mm
Rotation	Yes, about 135 degree
Signal lines	12 maganin twisted pairs, 6 ss flexible coax, expandable
Top-loading He-4 fridge	
Temperature range	1.5 K – 60 K
Sample space dia.	24 mm
Rotation	Yes, about 135 degree
Signal lines	8+4 phosphor-bronze twisted pairs, 4 ss flexible coax, expandable

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