mK Facility Frequently Asked Questions (FAQ)

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1. Personnel

Q. Who works in the mK Facility and what are their phone numbers?

A. Eric Palm 644-1325
Tim Murphy 644-0682
Glover Jones 644-5398

Q. Where are the office locations for mK personnel.

A. Eric Palm is located in office A118. Tim Murphy (OP-112) and Glover Jones (OP-108) are located in the mK facility

Q. In case of an emergency on the weekend who do I contact?

A. Eric Palm or Tim Murphy. They provide each user with emergency contact numbers as required. Lab wide emergency numbers are listed in the NHMFL telephone directory.

2. Safety

Q. Are first time users required to sign the mK facility safety guideline procedure?

A. Yes, if you are a first time user of the facility. If you have not used the mK facility within the past year you might want to read the safety guideline procedure to reacquaint yourself with proper safety procedure.

Q. What are the names and phone numbers for safety personnel at the National High Magnetic Field Laboratory Facility in Tallahassee?

A. Angela Sutton can be reached at 644-6955
Carl Green can be reached at 644-0233

3. Equipment

Q. What type of wire is used in the construction of the superconducting magnets in the mK facility?

A. The inner coil wire type is Nb3Sn.
The outer coil wire type is NbTi.

Q. What is the procedure for 20T operation?

A. First notify mK staff and then mK personnel will configure the magnet for this operation and after, receiving approval from mK personnel the user may ramp from 18 to 20 Tesla. The maximum ramp rate is reduced from 0.6 T/min to 0.23 T/min.

Q. I am using Model 6221 AC and DC Current and the OUTPUT indicator light is blinking?

A. When the OUTPUT indicator light blinks it indicates that there is a fault condition in the test circuit or the source and/or compliance levels are not properly set. First, make sure that the test circuit is correct. If you turn on the current source without connecting it a circuit (open) the indicator light will blink. In a diode application the indicator light will also blink if the leads are improperly connected. In that case you might reverse the leads. Secondly, the compliance limit serves to limit the current. To set the compliance level, press the EDIT/LOCAL twice, you should see the blinking cursor under one of the compliance digits. You can either use the Value Adjust Method or Numeric Entry Method to set the compliance value. Users can select the Help Icon at the bottom of the screen and choose >Manuals, >Keithley, >6221 AC Current Source Reference.pdf, page 3-9 for more information.

4. SCM1/Probes

Q. What are the degrees per turn for the SCM-1 rotator?

A. 4.925 degrees per turn for SCM-1

Q. When running the Lambda Fridge what is the maximum rate that will limit eddy current?

A. 1.5 amps/minute.

Q. What is the base operating temperature for SCM-1?

A. About 20 mK

Q. What is the available sample space for the SCM1 probes?

A. 25 mm

Q. How long does it take to reach base temperature once the probe is fully loaded?

A. After the probe is fully loaded and mK personnel have started circulation, base temperature should be achieved in four hours. It takes rough two hours to load a probe and any additional time users may want to slowly cool their sample.

Q. Is the user allowed to adjust the gas handling system?

A. No. Only mK personnel are allowed access to the gas handling system and the associated software.

Q. What is the temperature of my sample?

A. The mixing chamber temperature is a good indicator of the sample temperature. The mixing chamber thermometer is located within a half inch of the sample. However, local heating can occur from measurement techniques, i.e., passing excessive current through the sample contacts and sample.

Q. How do I control the mixing chamber heater?

A. First notify mK personnel before putting heat into the mixing chamber. The mixing chamber heater is controlled two ways. First, through the gray box labeled “IBM D.R.”, pins 17 and 18, using a current source. The maximum amount of current is 8.0 mA. Secondly, through the GPIB bus, using system software, the maximum temperature amount is 650 mK. There is a chart that reflects heat load verses mixing chamber temperature for reference in the mK facility.

T_{max} Main Heater = 650 mK
I_{max} Flow Diverter = 8.0 mA

Q. I have a powder sample. In my proposal (AC susceptibility experiment) I stated, “that we could get a sample of about 10g”, but I believe that much less is needed. What are the sample holders like, and how much sample do they hold?

A. You can find a drawing of our coils on the web page: http://www.magnet.fsu.edu/users/facilities/dcfield/magnetometry/acc/nontranscoils.html. You will get best sensitivity if you fill out the space inside one of the coils. This space is a cylinder with 0.1" in diameter and 0.25' in length. It is the volume estimation, please, do the mass estimation yourself. It is better to have extra material for a case of accident during a sample preparation. You should increase your final estimation to 3-5 times, if you do not have problems with the powder preparation. The powder has to be placed in a nonmagnetic container that will fit the coil.

The nonmagnetic container we use is a gelatin capsules. Information about the smallest gelatin capsules can be found on http://www.capsugel.com/products/pccaps.php. It has about 1 mm in diameter and 5 mm in length. You are welcome to use NHMFL capsules or make your own container, if you would like to do so. You have to be sure that the container will not open accidentally inside our cryostat.

Q. One of the things we would like to do is the specific heat of a sample exactly at the metamagnetic transition field (20 T) to extend some data we took at 3He temperatures earlier. Is there any chance of doing that, or is getting the magnet to 20 (Lambda Fridge) too big a deal?

A. We can start the lambda frig first thing in the morning and have it ready to get to field 2-3 hours later. Your maximum ramp rate will be reduced from 0.6 T/min to 0.23T /min. The magnet itself generates eddy current heat. We don't run the Lambda Fridge on the weekend because it takes extra helium and a little looking after while running.

5. SCM2/Probes

Q. What are the degrees per turn for the SCM-2 rotator?

A. 3.6 degrees per turn for SCM-2

Q. What is the operating temperature range for the SCM-2 ^{3}He insert?

A. 250 mK to 70 K.

Q. What is the operating temperature range for the SCM-2 VTI?

A. 1.4 K to 300 K.

Q. What is the largest sample that I can mount on the SCM2 probes?

A. 35 mm

Q. What is the resistance of the 3He Pot Heater, Sample Rod Heater and Sorb Heater?

A. All of the above heaters have a resistance of 25 ohms.

Q. How many coaxial wires are on the SCM2 Rotator Probe?

A. The SCM2 Rotator Probe has a total of six coaxial wires. Two of the wires are (Gore) used for high frequency. Normally the remaining S1 coaxial wires (four) are used for high capacitance, high resistance experiments.

Q. Where is the 25 ohm heater and calibrated Cernox resistor located on the VTI?

A. On the vaporizer assembly.

6. General Information

Q. Will I get a helium transfer over the weekend while running my experiment?

A. Yes, mK personnel will provide one helium transfer per day on Saturday and Sunday. Staff personnel provide this service on a rotating basis.

Q. What is the maximum sweep rate for the power supply?

A. 0.66 tesla/minute

Q. What type of thermometer works best at 1.5 K to 300 K?

A. Cernox

Q. What type of thermometer works best at 0.02 K to 1.5 K?

A. RuO

Q. When does my experiment time end?

A. Monday morning starts new magnet time for the next user. You should immediately pull your probe on Monday morning unless you have made arrangements with the next scheduled user and mK personnel. New magnet time typically starts at 9:00 a.m.

Q. What is that cracking sound around the magnets during a helium transfer?

A. During a helium transfer there is a tendency for ice to form on top of the magnets. The sound you hear is the ice cracking. It poses no danger to the user or lab worker.

7. Acronyms

mK	milliKelvin
SCM	Super Conducting Magnet
mm	millimeter
μw	microwatt
mw	milliwatt
K	Kelvin
VTI	Variable Temperature Insert
T	Tesla
PDF	Portable Dilution Refrigerator

8. Definitions

KELVIN
1. A unit of absolute temperature equal to 1/273.16 of the absolute temperature of the triple point of water. One Kelvin degree is equal to one Centigrade degree.
2. Kelvin A temperature scale in which zero occurs at absolute zero and each degree equals one kelvin. Water freezes at 273.15 K and boils at 373.15 K.

TESLA
The unit of magnetic flux density in the International System of Units, equal to the magnitude of the magnetic field vector necessary to produce a force of one newton on a charge of one coulomb moving perpendicular to the direction of the magnetic field vector with a velocity of one meter per second. It is equivalent to one weber per square meter. A typical refrigerator magnet has a flux density at its surface of 0.01 tesla.

MAGNET
An object that is surrounded by a magnetic field and that has the property, either natural or induced, of attracting iron or steel.

RESISTANCE
Electricity. The opposition of a body or substance to current passing through it, resulting in a change of electrical energy into heat or another form of energy.

PHYSICS
The science of matter and energy and of interactions between the two, grouped in traditional fields such as acoustics, optics, mechanics, thermodynamics, and electromagnetism, as well as in modern extensions including atomic and nuclear physics, cryogenics, condensed matter physics, particle physics, and plasma physics.

HELIUM
A colorless, odorless inert gaseous element occurring in natural gas and with radioactive ores. It is used as a component of artificial atmospheres and laser media, as a refrigerant, as a lifting gas for balloons, and as a superfluid in cryogenic research. Atomic number 2; atomic weight 4.0026; boiling point -268.9°C; density at 0°C 0.1785 gram per liter.

NITROGEN
A nonmetallic element that constitutes nearly four-fifths of the air by volume, occurring as a colorless, odorless, almost inert diatomic gas, N2, in various minerals and in all proteins and used in a wide variety of important manufactures,

including ammonia, nitric acid, TNT, and fertilizers. Atomic number 7; atomic weight 14.0067; melting point -209.86°C; boiling point -195.8°C; valence 3, 5.