QUICK REFERENCES
GPD – μE1 AREA
JANIS ^{4}He VAPORIZER CRYOSTAT

μSR Facility 2014

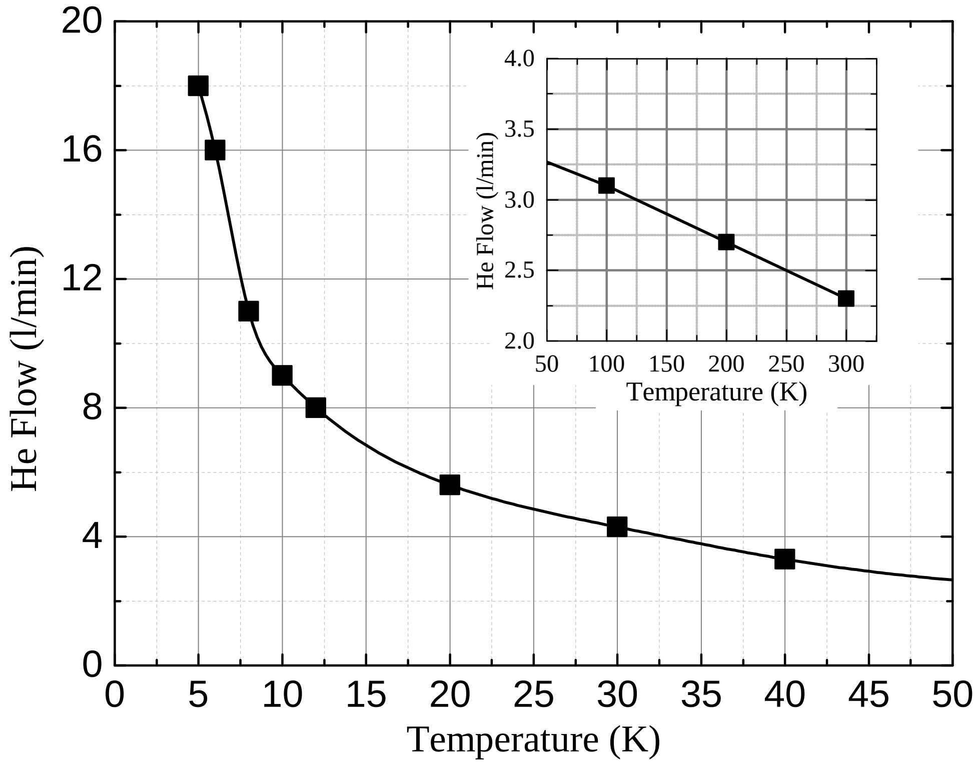
Contents

1 JANIS ^{4}He VAPORIZER CRYOSTAT – QUICK REFERENCE

Top loading type with continuous He-flow through sample chamber, mounted on vertical spectrometer axis, sample rotation about vertical axis, pneumatic retraction of the sample from beam axis. The top loading design of this cryostat allows sample interchange while the dewar is cold. This is accomplished by bringing the pressure in the sample chamber up to atmospheric, then quickly removing the sample mount and covering the top entrance of the sample chamber to prevent any air or moisture from entering it. It works on a continuous flow principle using an oil-free pump to draw liquid helium from a storage dewar, along a transfer tube, to the heat exchanger/vaporizer placed at the bottom of the sample tube. The cryogen is regulated by a needle valve on the transfer tube. The warm helium vapor flows up the sample tube and escapes out of a vent port at the top of the cryostat. Furthermore, the temperature of the helium vapor can also be reduced by reducing the pressure at the sample tube. Thus, flowing vapor at 2.5 K is easily obtained with a pump. The sample tube can also be quickly filled with liquid helium by opening fully the needle valve, and the pressure is reduced to reduce the temperature of the liquid helium to 1.5 K or less. Temperature control is achieved by a combination of helium flow control and power dissipated in an electrical heater, regulated using a temperature controller. The temperature is monitored on the heat exchanger by fitting the temperature sensor at it. To monitor the temperature at the sample position, an extra temperature sensor is fitted at the sample position.

High temperature regime (5 K → 300 K):

1. PUMP2_A and PUMP2_B switched ON.
2. Needle valve is open (1/4-turn open).
3. Bypass Valve V2 open.
4. Manual valve V1 closed.
5. He-flow controlled by the electromagnetic valve V2a.
6. The desired temperature is obtained by choosing the He-flow according to the Figure and by sending the required setpoints to the temperature controller.
   Note that if the needle valve is not enough open, the necessary flow to reach 5 K cannot be reached → open slightly more the needle valve
   On the other hand if the needle valve is too much open, temperature oscillations may occur around 10-20 K → close slightly the needle valve.



Low temperature regime 2.3 K → 5 K

1. PUMP2_A and PUMP2_B switched ON.
2. Bypass Valve V2 open.
3. Manual valve V1 fully open.
4. The lowest stable temperature is obtained with He-Flow of about 28 l/min and the pressure about 55 mbar.

2 NEOCERA TEMPERATURE CONTROLLER

The *Neocera* LTC-21 temperature controller connected to the the Janis cryostat is usually utilized in a REMOTE-mode and can be directly controlled from `deltat`. The Heater of this LTC is used to control the the Janis Cryostat in two-loop mode using the analog output and a Gossen/Konstanter DC-power supply in addition as the second loop.

The following steps describe how to use the *Neocera* temperature controller from `deltat`.

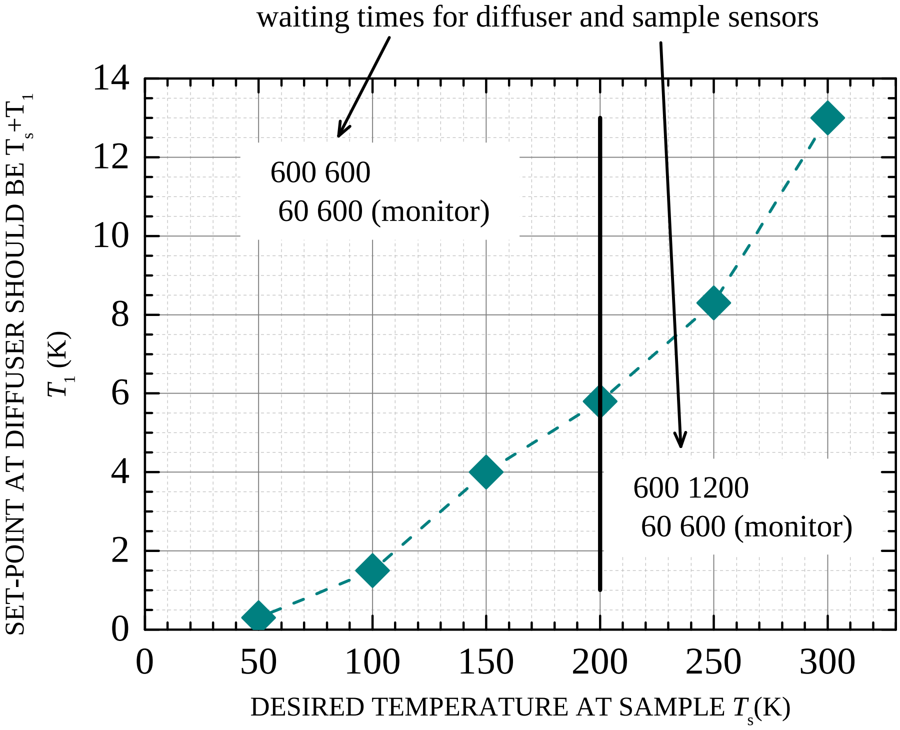
- **Setting a temperature:**
  In the tab `Modify Devices` Remember to put the controller in the CONTROL mode. choose the temperature controller entry and hit the buttons `Modify` and, on the pop-up window, `Modify Temperature`.
  On the pop-up window, change for both loops the setpoints and hit the button `Apply Changes`.

- **Autorun sequences:**
  Before writing an autorun sequence, be sure that the *Neocera* in the two-loop mode.
  In the autorun file, do not forget to give all (6) the arguments in the two-loop mode.
  To change the temperature, you will need an entry like:

  ```
  SET Temperature 101.5 2.0 600 101.5 2.5 600
  WAIT Temperature INRANGE
  SET Temperature 101.5 2 60 100.0 2.5 600
  WAIT Temperature INRANGE
  ```

  In this example the setpoints are 101.5 K for both loops, the tolerances 2 K for the first loop and 2.5 K for the second loop and the waiting times are 600 seconds

  Note that the temperature set-points for diffuser (Heater setpoint) at given desired sample temperature (Analog setpoint) should be chosen according to the following graph.


waiting times for diffuser and sample sensors
600 600
60 600 (monitor)
600 1200
60 600 (monitor)
SET-POINT AT DIFFUSER SHOULD BE T_s+T_1
T_1 (K)
DESIRED TEMPERATURE AT SAMPLE T_s(K)
14
12
10
8
6
4
2
0
0
50
100
150
200
250
300

3 He-FLOW CONTROL

The control is performed by the Valve Controller PFEIFFER RVC300. The actual He-flow is measured by a flowmeter (TELEDYNE HASTINGS).

- *Setting a flow from `deltat`:*
  In the tab `Modify Devices` choose the flow controller entry and hit the `Modify` button. Enter the new flow value in the pop-up window and close it.
- *Setting a flow in an autorun sequence:*
  A He-flow setpoint can also be included in a auto-run sequence by using the command `SET Flow FLOW XXX` command.

  Example: `SET Flow FLOW 5.5`

  With this example, an He-flow setpoint has been set to 5.5 liter-gas/minute.
- *Manual setpoint (only in case of emergency):*
  The RVC300 device is located in the area.
  Press the button locate below `PARAM`.
  Press the `edit` button to edit the `SOLL` value. Change it with arrow buttons (note that 100 mV correspond to 1 l/min).
  Presse the button locate below `SAVE`

The time needed for the actual He-flow to reach the setpoint value will depend on the PID parameters of the RVC300 controller.
If the desired He-flow cannot be reached, one should more open the needle valve.

4 SAMPLE CHANGE

The following points describe the process of changing a sample in the "Quantum Cooler" cryostat.

- **For safety reasons, a sample change should only be performed in the "High Temperature regime" with a sample temperature $T > 30$ K.**
- Disconnect the electrical plug from the sample holder.
- Dismount the rotation motor.
- Stop the He-flow through the pumps PUMP2A and PUMP2B by closing:
  - the two valves V1 and V2 on the pumping line of the Sample Chamber.
- Pressurize slightly the "Sample Chamber" with He-gas by opening the valve V3 and V3a until you reach a pressure (see the pressure value on Balzers Absolute Pressure Meter APG 010) slightly above 1000 mbar (check that the He-gas cylinder is open).
- **Check carefully and frequently** the pressure in the "Sample Chamber". (An overpressure in the sample chamber could damage the titanium windows).
- Remove the clamp of the sample holder.
- Remove the sample holder from the cryostat.
- **Immediately** mount a blind-flange on the cryostat opening.
- Stop blowing He-gas by closing the valve V3 and V3a.
- Restart the He-flow through the He-pumps by opening the valves V1 and V2 in case you need the low temperature regime.

When you are ready to insert the sample holder with the new sample, you should follow an analog procedure as above. Namely:

- Stop the He-flow through the pumps by closing:
  - the two valves V1 and V2 on the pumping line of the Sample Chamber.
- Pressurize slightly the "Sample Chamber" with He-gas by opening the valve V3 and V3a until you reach a pressure slightly above 1000 mbar (check that the He-gas cylinder is open).
- **Check carefully and frequently** the pressure in the "Sample Chamber".
- Dismount the blind-flange very shortly before inserting the sample holder.

- Insert the sample holder **carefully** (to insert a *warm* sample holder requires more force than to remove a *cold* holder).
- Replace the clamp.
- **Immediately** stop blowing He-gas by closing the valve V3 and V3a.
- Restart the He-flow through the He-pumps by opening the valve V1 and V2 in case you need the low temperature regime.
- Readjust the He-flows.
- Reconnect the electrical plug to the sample stick

5 He-DEWAR CHANGE

Should the He-Dewar levelmeter read below ~15 % (in the case of a 100-liters dewar) the He-Dewar needs to be changed.

- **For safety reasons, a He-dewar change should only be performed with a sample temperature $T > 30$ K.**
- Stop the He-flow through the pumps PUMP1 and PUMP2 by closing:
  * the two valves V1 and V2 on the pumping line of the "Sample Chamber".
- Lift up slightly the transfer line on the He-dewar side (the bottom part of the tranfer line in the He-dewar should now be above the liquid-He level).
- Pressurize slightly the sample chamber with He-gas by opening the valve V3 and V3a until you reach a pressure of about 1000 mbar (check that the He-gas cylinder is open).
- **Check carefully and frequently** the pressure in the "Sample Chamber". (An overpressure in the "Sample Chamber" could damage the titanium windows).
- Disengage the adaptor of the transfer line from the top of the dewar by releasing the O-rings.
- Slide the adaptor upward along the transfer line.
- Remove completely the transfer line on the He-dewar side.
  Replace the plug of the He-dewar to prevent freezing of the He-dewar.
- **Carefully** warm up the transfer line using the available heat-gun.
- Be sure that the sintered end-part is free of any ice.
- Change the He-dewar.
- **Check that the He-recovery line is connected to the dewar and that the corresponding valves are open. Be sure that the recovery line is not bent and that the He-gas can flow freely.**
- Insert slowly the transfer line in the new He-dewar.
- As soon as the sintered part is enough inserted in the dewar, lower the adaptor and connect it to the dewar.
  Make sure that the adaptor of the transfer line is well inserted in the dewar, and that all O-rings are tightened.
  Leave the transfer line above the liquid-He level.
- Stop blowing He-gas by closing the valve V3 and V3a.
- Open the valves on both He-pumps.
- Wait 30 seconds.

- Pull down slowly the transfer line in the He-dewar.

  Check carefully and frequently that the transfer line is well aligned with the dewar and that it does not bent; if necessary move slowly and carefully the He-dewar to align it with the transfer-line.

  Be also sure that the transfer line does not touch the bottom of the He-dewar (leave it few centimers above the bottom).
- The He-flow in the transfer line will first show a rapid increase, due to the sudden overpressure in the He-dewar, which will be followed by a decrease. After 1-2 minutes, the He-flow through the transfer line will again increase to its maximum value.
- Readjust the He-flows.

  (For this last point, experience shows that the needle valve opening should correspond one quarter of turn of the adaptor of the transfer line.
- Do not forget to tightly close the empty He-dewar and to connect it to the He-recovery line

6 HOW TO SET THE EXPERIMENT MAGNETS

The main magnetic field of 0-0.66T can be powered by two different power supplies:

- the GOSSEN power supply, recommended for low fields, 0-250G.
- or the HELMHOLTZ beam line power supply for high fields, 0-6660G.

  Only positive values in Gauss are allowed for both power supplies.
  The respective power supplies can be set from DELTAT by

- `SET Magnet HELM 150 30`
  `SET Magnet GOSSEN 150 30`

  Note:

- A 16-bit DAC is used to set the 6.6kG-Helmholtz power supply, i.e. the resolution is about 0.1G. An ADC with only 12-bit resolution (1.6G resolution) is used for read back. This causes a discrepancy between the values displayed in 'Demand' and 'Measured' in 'Deltat/Exp. Magnets/'). The value set by the power supply always corresponds to the 'Demand' value within the DAC-resolution of 0.1G. This value will also be stored in the header of the data file.
- Like all other magnet power supplies HELMH2 (650A/250V) is located on the second floor above the Studios but it is placed at the end of the front row above Studio E.
- Setting HELM to zero causes the Helmholtz power supply to switch off physically. You can also see the settings of the beam line power supply on the beam line PC in the windows for TCP/IP COMBI CONTROL or TCP/IP SETTINGS. Note: HELMH2 is the corresponding name in the device list on the beam line PC for the new GPD, HELMH was used for the old instrument.
- The GOSSEN can be switched off only manually. The GOSSEN power supply is located in the bottom part of rack No. 2.
- There is no auxiliary field available, i.e. the coils have to be rotated for calibration measurements when working in LF-mode.