
QUICK REFERENCES
GPS – π M3 AREA
QUANTUM CRYO – 9512

μ SR FACILITY 2002

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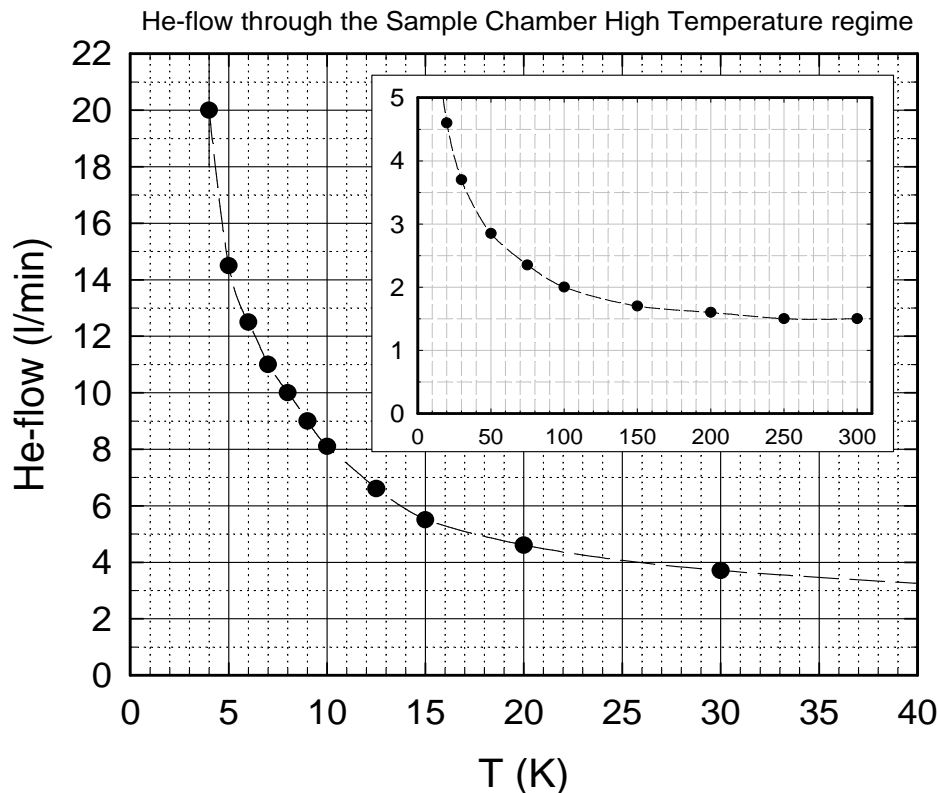
1 QUANTUM CRYOSTAT – QUICK REFERENCE

High temperature regime (5 K → 300 K):

1. Flow F1 (Transfer Line) at about 12-13 l/min to keep the Phase Separator temperature at about 4.1K (if necessary adjust yellow valve V1).
2. Manual valve V2 closed.
3. PUMP2_B switched OFF.
4. He-flow controlled by the electromagnetic valve V2 Controller and instruction in Counting Room.
5. Needle valve V4: 1/2-turn open.
6. 200 mA in Tube Heater.
7. The desired temperature is obtained by choosing the He-flow F2 according to the Figure and by sending the required setpoints to the temperature controller.

Note that if the needle valve V4 is not enough open, the necessary flow to reach 5 K cannot be reached → open slightly more the needle valve V4

On the other hand if the needle valve V4 is too much open, temperature oscillations may occur around 15-20 K → close slightly the needle valve V4



Low temperature regime ($\sim 2.15\text{ K} \rightarrow 10\text{ K}$):

1. Flow F1 (Transfer Line) at about 12-13 l/min to keep the Phase Separator temperature at about 4.1K (if necessary adjust yellow valve V1).
2. Manual valve V2 fully open.
3. PUMP2_B switched OFF.
4. No current in Tube Heater (do not switch *off* the power supply; just press the button *output*).
5. The lowest stable temperature is obtained by gradually closing the needle valve V4. As the valve is closed the pressure P2 will gradually decrease and the sample temperature will decrease correspondingly.
6. Higher temperatures (up to 10 K) are achieved by keeping the He-flow constant and solely changing the setpoints of the temperature controller.
Note that a temperature scan is only possible once the pressure and flow conditions necessary to reach the lowest temperature are obtained (i.e. $F2 \simeq 4.5\text{ l/min}$ and $P2 \simeq 30\text{ mbar}$)

Low temperature regime ($\sim 1.8\text{ K} \rightarrow 10\text{ K}$):

1. Flow F1 (Transfer Line) at about 12-13 l/min to keep the Phase Separator temperature at about 4.1K (if necessary adjust yellow valve V1).
2. Manual valve V2 fully open.
3. PUMP2_B switched ON.
4. No current in Tube Heater (do not switch *off* the power supply; just press the button *output*).
5. The lowest stable temperature is obtained by gradually closing the needle valve V4. As the valve is closed the pressure P2 will gradually decrease and the sample temperature will decrease correspondingly.
6. Higher temperatures (up to 10 K) are achieved by keeping the He-flow constant and solely changing the setpoints of the temperature controller.
Note that a temperature scan is only possible once the pressure and flow conditions necessary to reach the lowest temperature are obtained (i.e. $F2 \simeq 4.5\text{ l/min}$ and $P2 \simeq 5\text{ mbar}$)

2 CONDUCTUS TEMPERATURE CONTROLLER

The *Conductus* temperature controller connected to the *Quantum* cryostat is usually utilized in a REMOTE-mode and can be directly controlled from DELTAT.

The following steps describe how to initialize, configure and use the *Conductus* temperature controller from DELTAT.

- **Initialization:**

After a reboot or a cold-start of the computer, the driver controlling the temperature controller needs to be initialized.

In the menu

```
Modify ... \ Set Device ... \ Conductus
```

choose the option `initialize`. You will be asked about the serial number of your *Conductus* (this number is located on the back of the device).

- **Configuration:**

Each time that you change the configuration of the cryostat (new sample stick), you have to configure the driver controlling the temperature controller.

In the menu

```
Modify ... \ Set Device ... \ Conductus
```

choose the option `configure` and go first to the

```
Sample Holder & Control Loop Selection.
```

Choose your sample stick and your control loop mode.

Remember that the QUANTUM is presently controlled by the Conductus in a two-loop mode

At this point the software should automatically detect the PID tables needed and load them into the Conductus temperature controller.

If not, choose the Heater and Analog Output Settings (**Sensor Channels & PID Modes**) option and choose the PID mode for both channels:

- Channel 1: PID Mode Selection of Heater Output

- * Mode →TABLE

- * PID table →QUANTUM_DIFF_9512

- Channel 2: PID Mode Selection of Analog Output

- * Mode →TABLE

- * PID table →QUANTUM HOLDER

By quitting Configure, you have the option to put the controller in the CONTROL mode.

- **Setting a temperature:**

In the menu

Modify ... \ Set Device ... \ Conductus

choose the option **set**.

If you are in a two-loop mode you will have to give two temperatures with usually $T_2 = T_1$.

- **Autorun sequences:**

Before writing an autorun sequence, place first the driver of the *Conductus* in the desired mode (one or two-loop mode).

In the autorun file, do not forget to give all (6) the arguments in the two-loop mode (read carefully the header of the file...).

3 He-FLOW CONTROL

The He-flow through the “Sample Space” can only be controlled when only the Electromagnetic Valve V3b (Balzers RME 010) is used, the big bypass valve V2 is shut and the PUMP2_B is switch OFF.

The control is performed by the Valve Controller Balzers RVG 040. The actual He-flow is measured by a flowmeter (either BROOKS 5850 or HASTINGS HS-50KS). The actual flow is also indicated on the center display located at the top of the rack.

In order to allow a normal regulation, the amplifier located on the left hand side of the RVG 040 should be switched ON at all time.

The setpoint value of the He-flow can be indicated either manually or remotely (using either a Digital-Analog Converter–Camac module DA 503; or a KNICK voltage power supply) via the VAX station.

- *Manual setpoint:*

The switch located on the right hand side of the RVG 040 should be set on the appropriate position.

The setpoint is determined by the front potentiometer of the RVG 040

1 turn → 5 liters-gas/minute (HASTINGS flowmeter)

1 turn → 10 liters-gas/minute (BROOKS flowmeter)

- *Remote setpoint:*

The switch located on the right hand side of the RVG 040 should set on the appropriate position.

- *Setting a flow interactively:*

In the DELTAT menu (and only between runs) go in `Modify ... \Set Device ... \Helium Flow XXXX` (where XXXX represents a string indentifying the device used).

You will be asked to enter a new He-flow setpoint value.

In the present version, no readback of the present flow is possible, and therefore no check of the difference between setpoint and actual value of the He-flow is performed.

- *Setting a flow in an autorun sequence:*

A He-flow setpoint can also be included in a auto-run sequence by using the HE_FLOW device.

Example: 2000000 2 HE_FLOW 4.3

With this example, a run with 2000000 events in the scaler 2 will be started after that the remote He-flow setpoint has been set to 4.3 liter-gas/minute.

– *Software setup – usually done by the μ SR-Facility team:*

The software controlling the He-flow remote setpoint should be initialized according to the device utilized (DA503 or KNICK). In the DELTAT menu go in `Modify ... \Rig ... \Define` or `Check Rig Parameters` and choose the device accordingly. For the KNICK device, be sure to set the GPIB address of the KNICK_FLOW device (usually 4). You will have also to give a scaling factor (millivolts/deciliter) and an offset.

For the DA503 module, you will have to specify the Branch, Crate and Station number used by the module. An offset will also be asked.

The time needed for the actual He-flow to reach the setpoint value will depend on the PI parameters of the RVG 040 controller.

When changing temperature, the He-flow should be changed first, if necessary. The temperature controller setpoint, should be changed in a second step. If a large change of flow is required, big temperature overshoots can be observed. To minimize the overshoots, the He-flow setpoint should be changed in different steps prior to change the temperature controller setpoint.

Depending on the setting of the needle valve V4 between the “Phase Separator” and the “Sample Space”, it is possible that a desired He-flow cannot be reached eventhough the RVG 040 controller will fully open the Electromagnetic Valve V3b. To fix this problem, one should more open the needle valve.

During a sample-change or a He-dewar-change, the plug of the Electromagnetic Valve V3 RME 010 could possibly be disconnected. By reconnecting the plug, one observes that the light of the small voltmeter of the RVG 040 is ON, and that no control of the He-flow is possible. To fix this problem, the RVG 040 should be switched OFF for few seconds and switched ON again.

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.**
- Switch OFF the heaters by setting the Conductus (or Neocera) temperature controller in the *Monitor* Mode [by pressing the *Local* button (if necessary) and pressing the *Monitor* button].
- Switch OFF the Tube Heater (by pressing the *output* button).
- Disconnect the electrical plug from the sample holder.
- Dismount the rotation motor.
- Stop the He-flow through the pumps PUMP1 and PUMP2_A by closing:
 - the two valves V2 and V3a on the pumping line of the Sample Chamber (do not disconnect the electrical plug of the electrovalve V3b).
 - the yellow valve V1 on the transfer-line pump (use the closing-ring without changing the actual setting of the valve).
- Pressurize slightly the “Sample Chamber” with He-gas by opening the valve V6 until you reach a pressure P2 slightly above 1000 mbar (check that the He-gas cylinder is open).
- **Check carefully and frequently** the pressures P1 and P2 in the “Phase Separator” and 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 V6.
- Restart the He-flow through the He-pumps by opening the valves V1, V3a.

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

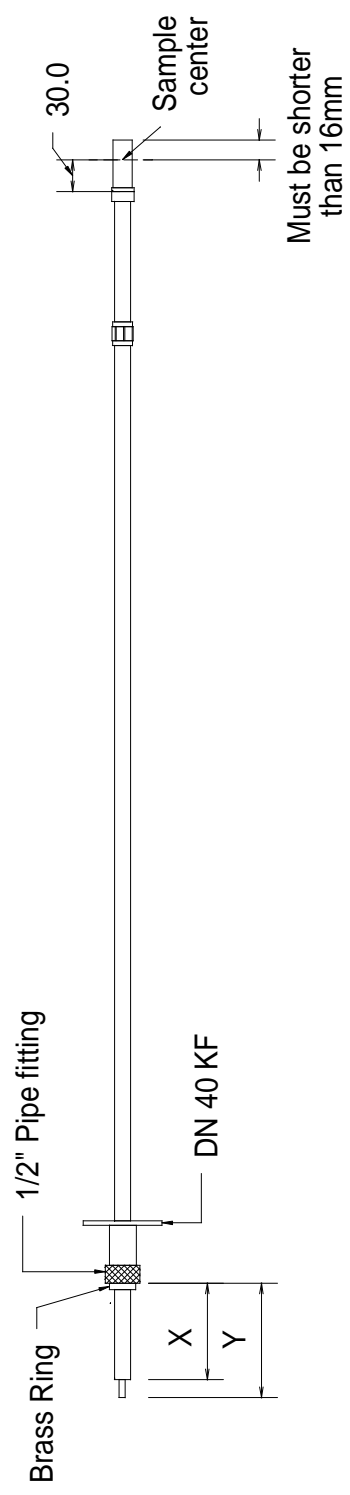
- Stop the He-flow through the pumps by closing:

- the two valves V2 and V3a on the pumping line of the Sample Chamber (do not disconnect the electrical plug of the electrovalve V3b).
 - the yellow valve V1 on the transfer-line pump (use the closing-ring without changing the actual setting of the valve).
- Pressurize slightly the “Sample Chamber” with He-gas by opening the valve V6 until you reach a pressure P2 slightly above 1000 mbar (check that the He-gas cylinder is open).
 - **Check carefully and frequently** the pressures P1 and P2 in the “Phase Separator” and 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 V6.
 - Restart the He-flow through the He-pumps by opening the valves V1, V3a (and V2 if the low temperature regime is needed).
 - Readjust the He-flows.
 - Check in the Counting Room whether a “RESET” of the electromagnetic valve controller is necessary.
 - When a sufficient He-flow is detectable in the Sample Chamber, set the temperature controller in the *Control* Mode [by pressing the *Local* button (if necessary) and pressing the *Control* button].
 - If you want to operate in the High Temperature regime, do not forget to switch ON the Tube Heater (by pressing the *output* button).

5 CHECK-LIST WHEN CHANGING THE SAMPLE

The following points should be checked after changing a sample.

- The nominal distance between the center of the sample and the 1/2" pipe fitting should be 1250 mm (see drawing).
- If your sample is not at the nominal position (30 mm from the back of the sample holder), the brass ring should be displaced accordingly.
- **Using the standard sample holder, the stick can be inserted only 1.5 mm more than its nominal value.**
- Check that flat brass part located on the external part of the stick corresponds to the sample holder orientation.
- Check that you have exactly **one** O-ring before introducing the target stick into the cryostat.
- The positioning of the sample can also be done by checking the external dimensions of the stick (see drawing).
- Check (if needed) that the sample holder is perpendicular to the beam (use the flat brass part located on the external part of the stick).
- The cryostat should be at the nominal X-position 10.6.



| Holder | X (mm) | Y (mm) |
|--------|--------|--------|
| 8 | 60.6 | 77.8 |
| 9 | 61.2 | 78.4 |
| 10 | 60.6 | 77.7 |
| 11 | 60.7 | 77.7 |

6 He-DEWAR CHANGE

Should the He-Dewar levelmeter read below $\sim 15\%$ (in the case of a 100-liters dewar) or below 100 mm (in the case of a 250-liters dewar), the He-Dewar needs to be changed.

- **For safety reasons, a He-dewar change should only be performed in the “High Temperature regime” with a sample temperature $T > 30\text{ K}$.**
- Stop the He-flow through the pumps PUMP1 and PUMP2_A by closing:
 - the two valves V2 and V3a on the pumping line of the “Sample Chamber” (do not disconnect the electrical plug of the electrovalve V3b).
 - the yellow valve V1 on the transfer-line pump (use the closing-ring).
- Switch OFF the heaters by setting the Conductus (or Neocera) temperature controller in the *Monitor* Mode [by pressing the *Local* button (if necessary) and pressing the *Monitor* button].
- Switch OFF the Tube Heater (by pressing the *output* button).
- Lift up slightly ($\sim 50\text{ cm}$) the transfer line on the He-dewar side (the bottom part of the transfer line in the He-dewar should now be above the liquid-He level).
- Pressurize slightly the “Phase separator” with He-gas by opening the valve V5 until you reach a pressure P1 of about 1000 mbar (check that the He-gas cylinder is open).
- **Check carefully and frequently** the pressures P1 and P2 in the “Phase Separator” and 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 V5.
- Open the valves on both He-pumps (do not forget, if necessary, to reconnect the electrical plug of the electromagnetic valve V3b).
Open the valve V1 completely.
- 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 centimeters 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.
- After a few minutes, the temperature of the “Phase Separator” should drop to the nominal value.
- Readjust the He-flows.
(For this last point, experience shows that the “Transfer Line” flow F2 should be maintained for few minutes to a high value and gradually decreased)
- Check in the Counting Room whether a “RESET” of the electromagnetic-valve controller is necessary.
- When a sufficient He-flow is detectable in the Sample Chamber, set the temperature controller in the *Control* Mode [by pressing the *Local* button (if necessary) and pressing the *Control* button].
- If you want to operate in the High Temperature regime, do not forget to switch ON the Tube Heater (by pressing the *output* button).
- Do not forget to tightly close the empty He-dewar and to connect it to the He-recovery line

7 IN-SITU MAGN. FIELD MEASUREMENT USING METROLAB NMR PROBE

- Select the probe according to the desired **field range** and connect it to the Model 1030 amplifier “black” box (Probe 3: 1.7 to 5.2 kG, Probe 4: 3.5 to 10.5 kG as indicated on the PT 2025 teslameter).
- Move the NMR-probe in position by moving out the cryostat on the linear feedthrough to the position **x = 155 mm**.
- In MAN mode, use the potentiometer to display a field value close to your actual field value.
- Press once **SEARCH** (in MAN mode) and wait till NMR LOCK is on and TOO HI and TOO LO switch OFF
- When you are finished, put back the cryostat at the nominal X-position 10.6.

8 SAMPLE ROTATION

- **Switch to computer control:**

- Set 8-bit code switch on control unit box:
switch #**3** **up**, all others **down**.
- Press **RESET**.
- In DELTAT, the application HSCM20 should be initialized:
 - * Go in the menu
Extras \ GPIB & RS232 Setup \ RS232 Setup
and configure the application HSCM20. The actual angle is also displayed on a display in the electronic cabin.
 - * The option HSMC20 should now appear in the menu
Modify \ Set Device....

- **Switch to manual control:**

- Set 8-bit code switch on control unit box:
switch #**2** **up**, all others **down**.
- Press **RESET**.
- Press once \uparrow or \downarrow to start forward or backward rotation, respectively.
- Press once **STOP** to stop the rotation.

9 COMBI-CONTROLLED POWER SUPPLIES

All the power supplies for the beam magnets are now “combi”-controlled.

All power supplies can now be controlled via the PC (PC125) or the VAX Workstation.

Both computers are clients of a server (PC231) which controls the CAMAC crate containing the interfaces to the power supplies. The server is located on the platform above the GPS cabin, in the first left-hand side row of power supplies, near the CAMAC crate.

The advantages of the use of “combi”-controlled power supplies for the users, is that the switching ON and OFF of these power supplies can occur remotely via the PC located in the GPS cabin.

For example, by loading a “set” file, the needed power supplies will be automatically switched ON. Note that this does not concern WED, WEDL, WEP which are switched ON by the Workstation.

Moreover a PC-application called *TCP/IP Combi-Control* allows one to directly control these power supplies.

By double-clicking the icon *TCP/IP Combi-Control*, after few seconds, a list of power supplies will appear on a menu. At this point one can switch ON and OFF the power supplies, and read their status.

If a problem is detected on a “combi”-controlled power supply and that the switching ON is no more possible via PC, one should have locally a closer look to the power supply...

The magnets WED, WEDL and WEP are normally set via the Workstation (giving a set value in Gauss). The other magnets are normally set via the PC giving a DAC value.

On the Workstation, the action of setting the power supplies WED or WEDL automatically switches the current cables to the appropriate power supply, switches it ON and switches OFF the unused power supply.

In addition, by setting WEP, WEDL or WED to zero the corresponding power supply will be switched OFF.

Examples:

- To switch the main coils between WED and WEDL: just set the desired value on the Workstation for the appropriate power supply.
- To switch between the main coils and the small transversal coils (WEP): set the last used power supply to zero; set the WEP power supply to the desired value.
- To switch between the small transversal coils (WEP) and the main coils: set WEP to zero; set the WED (or WEDL) power supply to the desired value.
- To switch in zero field: set the last used power supply (WEP, WEDL or WED) to zero. Be sure that the other power supply are set to zero.

10 BEAM-LINE SETTINGS

Which settings ?

Some standard settings are normally provided (transverse or longitudinal mode; shared or not shared...). The user will find the name of these settings by looking in the general logbook, where a list of the best settings is regularly reported.

The standard name of these settings is *pNNN_YY.set* ; where *NNN* corresponds to the page number and *YY* to the present year. Look at the page *NNN* to obtain more details about these settings.

How to set the beam-line ?

Load the set-file using the *Setpoint* application on the PC.

Be sure that the spin rotator is working properly (the π M3.1 area should be closed and the green LED of the reset box should be ON)

Due to hysteresis effects, cycle the steering magnets SSK31, SSK32 and SSK33: set their minimum values (either -2000 or -4000); wait few seconds and put back the proper initial values of the file.

By going from transverse to longitudinal mode, it is sometimes necessary to re-tune the spin rotator value. Note that this retune could be necessary over a long time scale (hours...).

If better settings are found, it is strongly requested to save them (with the standard notation and by doing a proper entry in the logbook) to the benefit of the following users.

NEVER OVERWRITE EXISTING SETTINGS !!

11 TRUE ZERO-FIELD MEASUREMENTS

Zero-field compensation is regularly performed by the Instrument Scientist. Since this operation is quite delicate and requires that the cryostat is at room temperature, **the users are in principle not allowed to performed it themselves.**

Extensive tests performed in June 1998 have shown that a weak remanent field is present at the sample region after that the main field (WED) has been set to high values.

This field has a value of few hundreds of milliGauss and is directed approximatly along the beam direction (angle of about 20 degrees).

High statistic runs have demonstrated that this field can be **completely** suppressed by applying, for a very short time, a small field of 50 Gauss with the auxilliary coils (WEP).

The users should also bear in mind that the zero-field compensation is strongly dependent on the position of the 60 tons crane in the hall and some variations (± 20 mG) can occur.

12 SWITCHING ON THE “FORWARD” VETO

In the normal mode, solely the “active collimator” (Backward veto) is utilized as a veto for the muons and positrons.

If measurements on small samples (and holders) are mandatory, the center part of the Forward detector can be used as an additional veto (Forward veto).

To switch on the Forward veto:

1. Locate the FAN IN – FAN OUT FO103A (center of the upper NIM Crate).
In the normal mode, only the sectors C and D of the FO103A should be coupled and the LED “C·D” between sectors C and D should be ON.
2. To switch ON the Forward veto, one should couple also the sectors A and B (leaving the sectors C and D coupled). This is performed by turning the yellow switch of the FO103A on the position “A·B+C·D”.
At this point, the LEDs between sectors A and B (“A·B”) as well as between sectors C and D (“C·D”) should be ON.
3. Locate the Coincidence Unit FC103 where the sum between $F_l + F_r$ and F_V is performed (right-hand side of the middle NIM crate).
4. Switch OFF the F_V coincidence (previously on OR).
5. You are now ready to perform measurements with both vetos.

To come back to the Normal mode, the inverse procedures described above should be performed.

Note that on the coincidence units determining the positron stops, the coincidence with the Veto signals should ALWAYS be active, and should NOT be touched.