Hall C User Howto

HALL C Møller Step-By-Step Guide - How to take a Møller Run (includes special instructions for Qweak)

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Abstract

A step-by-step guide for shift personnel to follow in order to take a Møller run. It is assumed that the polarimeter has already been set up and tuned for the present beam energy by an expert.

For a more detailed HOW–TO, see:
`http://hallcweb.jlab.org/document/howtos/moller_sbys/`

1 HOW TO TAKE A Møller RUN

This document describes the steps to be taken by a Hall-C experimenter performing a Møller beam polarization measurement during Qweak. There is a complimentary procedure[1] which the MCC operators will follow.

1. **Record Injector Parameters**: during some period of "normal" Qweak running, record the conditions of the polarized source and the state of the beam to the other halls. This will allow us to verify that we are taking Møller data in a state as close as possible to Qweak production data–taking conditions.

   (a) Login: ssh cdaq@cdaql1. Standard **cdaq** password.

[1] `http://opsntsrv.acc.jlab.org/ops_docs/online_document_files/MCC_online_files/HallC_moller_pol_m`

(b) `cd moller/anal/qweak/moller_fortran`

(c) `./GetEpics.pl`

(d) Capture this screen or transcribe its contents to the hclog

2. **Møller GUI**: if not displayed already, bring up the main Møller screen:

   (a) Login: ssh cvxwrks@cdaql1. Standard **cvxwrks** password.

   (b) `cd MEDM/moller`

   (c) `medm -x moller.adl`

   (d) You should now see the main Møller control screen.

3. **Møller HV**: make sure the Møller high voltages are on. If the HV GUI is not already up:

   (a) Login: ssh cvxwrks@cdaql5. Change directory (cd $EPSHV/tk).

   (b) `./hv.tcl`

   (c) You may need to wait a while (sometimes several minutes) before the GUI appears.

4. **Verify the Cryo status**: Check that the Møller cryostat is above 90% on the main Møller GUI screen. It is in the upper left corner.

5. **Møller BPMs**: if not displayed already, bring up the relevant BPM screen:

   (a) Log in and change directory (cd MEDM/moller) as above.

   (b) `medm -x BPMs_for_moller_qweak.adl`

   (c) You should now see the Møller BPM screen.

6. **Call MCC**: tell them that you are getting ready for a Møller run and need beam OFF to retract the Qweak target. Once the target is retracted, they will take a "zero pos" of the Hall C line.

7. **Setting Up**: At this point, MCC should start loading in the Møller optics. While they are doing that you can:

   (a) Ask MCC to load the appropriate Moller quad optics.

   (b) Ask MCC to turn off the fast raster.

(c) Turn off the Qweak detector high voltage

(d) Turn off the halo monitor high voltage

(e) Check BCM 2 Range: Carefully note the current status of the gain setting for BCM 2 and then change it to gain setting 5. The selector switch is on the left-hand side of a chassis in rack CH03B11 in the electronics room. Make sure to record in the hclog that you have done this carefully noting the original gain setting and the new one.

(f) Check BCM 17 range: BCM 17 should have 22 dB attenuation for a Møller measurement. It typically has 52 dB, so remove the 30 dB attenuator. If this process is unclear or you are unsure how to proceed, contact a Møller expert.

(g) If the halo target is in, have MCC take it out (0.0 on the halo target control)

8. **Ramp Up the Solenoid**: MCC will call when they are ready for this. It will take about 12 minutes to ramp the solenoid up to 3.5T. In the past, we have ramped directly to 3.5T. The new procedure is to ramp incrementally. Under `Solenoid Control` on the Møller GUI screen:

   (a) Press `SDBY` and wait until `HEATER` is `ON`.

   (b) Set Field to 2.0(Tesla) and Ramping Speed to 8.000 A/m.

   (c) Press `GO SET` and observe field ramping up.

   (d) After reaching 2T, call MCC and tell them. They will send tuned beam for a rough steer.

   (e) When MCC is done, ramp to 3.5T. Let MCC know when finished.

   (f) Later, to ramp field down, press `GO ZERO`, and, when field is down, press `OFF` to turn off heater.

9. **Beam Tune**: The beam requires tuning into and after the polarimeter.

   (a) The Møller expert should have made a log entry with a screen snapshot of the tuned settings for the system. Locate that log entry for reference.

   (b) Verify that the quad currents agree with those from the reference log entry.

(c) Inform MCC when the solenoid field stabilizes. They will then continue with the Møller setup procedure.

(d) MCC will establish beam and center it to within 0.5 mm of zero at 3C20 and 3C21, with the positions on these three BPMs within 0.5 mm of one-another. The beam at 3H02, 3H04, and 3H07A should be within 1 mm of center (a very loose requirement).

(e) MCC should contact you when this is completed.

(f) Verify the final BPM positions:
(3C20 ± 0.5 mm) = (3C21a ± 0.5)
$|3C20| \leq 0.5$ mm $|3C21| \leq 0.5$ mm
$|3H02|$, $|3H04|$, $|3H07a|$ all ≤ 1.0mm.

10. **Turn Beam OFF**: request MCC to turn off beam to Hall-C so that you may insert the Møller target. (NB: this is NOT the same as moving the experiment target, and does NOT require masking any FSDs.)

11. **Ready Møller Detector**: Referring to the tune snapshot, verify that the Møller collimators are within 0.05cm of their tune positions. Then turn on the Møller high voltage.

12. **Insert Møller Target**: from the Møller GUI, select target 3 (1 μm thick). Targets 2 (4 μm thick) or 1 (4 μm target) should not be used unless you have received specific instructions from the Møller expert.

13. **Beam current**: By default NEVER take more than 2μA beam on a Møller target.

14. **Turn Beam ON**: request MCC to turn beam ON to the Møller run current (0.2–1 μA).

15. **Check Møller Scalers**: observe the rates by running `ratemon` on cdaqs1 from the moller directory (`/home/cdaq/moller`). The left and right singles rates should be in the 100-1000 kHz range. The coincidence rate should be roughly 10% of the singles rate (at LEAST 5%), and the accidental rate should be no more than 5% of the coincidence rate.

    Also use `scalerwatch` to make sure all scaler banks are counting (`/home/cdaq/moller/scalerwatch`). Pay special attention to channels 7 and 39 - these are the real coincidence scalers and should be

roughly equal. If they are dramatically different, there is a problem with one or the other scaler bank - call the Møller expert.

16. **Take Data**: on the Møller DAQ screen, which is presently waiting for you to begin a new run, click `START`. 5 million coincidences yield about 0.7% statistical error (total number of coincidences can be found in channel 71 on `scalerwatch`).

    (a) Soon after the start of a run, run the analysis program (below) and look for helicity errors.

17. **Record Injector Parameters**: while taking data, record the conditions of the polarized source and the state of the beam to the other halls. Run the script
    `cdaql1> /home/cdaq/moller/anal/qweak/GetEpics.pl`
    to get a snapshot of the polarized source settings. Capture this screen or transcribe its contents to the hclog.

18. **Take More Data**: while you have the system running, you may wish to take at least two or three runs to verify that beam conditions are stable. You may also wish to request a change of state for the half-wave plate (speak to MCC) for yet another run in order to verify your systematics. (The half-wave plate change requires agreement from any other halls taking polarized beam.)

19. **Analyze Data**:

    (a) ssh cdaq@cdaql3. Standard **cdaq** password.

    (b) **cd moller/anal/qweak/moller_fortran**

    (c) **./replay_moller RRRRR**, where RRRRR is the run number for Møller data.

    (d) Answer any questions asked. Non-experts shoule answer `''n''` for ntuples. The software will display the measured polarization and a number of other results. It also generates a .hbook file which may be of interest if something seems wrong with the result.

    (e) `cd hbook` and use `paw` or `paw++` to view the histograms. Running the macro `mscan RRRRR` (where `RRRRR` is the run number) will present a slide show of the more interesting histograms. The critical one for non-experts is the color surface plot showing left/right

hodoscope correlation. It should show a ridge along the x=y diagonal. If this ridge is not present or is significantly off center, the polarimeter is not properly tuned.

(f) Make a log entry summarizing all of your Møller runs and the results. The value to record is the beam polarization with accidentals removed. If the polarized source setup was changed between runs be sure to make a clear note of the conditions in the hclog.

20. **Restore Conditions**: Undo whatever you did and go back to production running:

    (a) Request beam off.

    (b) Retract Møller target.

    (c) Restore BCM 2 gain setting to setting 2.

    (d) Restore the 30 dB attenuator to BCM 17.

    (e) Have MCC insert the halo target if it was in when you began.

    (f) Turn off the Møller solenoid if it was off when you began.

    (g) Have MCC re-tune the beamline to data-taking condtions. (especially quads)

    (h) Turn on the Qweak high voltages.

2 Troubleshooting

This section will help you deal with some common problems that pop–up from time to time.

- **One or both of the scaler banks is not counting.**

  This can usually be fixed by rebooting the VME crate. Currently, the crate that holds the Møller scalers is not hooked up to the reboot-panel so you need to reboot by hand. Walk into the electronics room and go to the lowest crate in the rack furthest to the left as you face the Møller electronics (rack 13). Push the "reset" button on the left-most module in that crate.

  You may need to do this more than once. You may also need to kill RunControl and start it again.

On very rare occasions, rebooting does not work, and we need to power cycle the whole crate. Please consult with the Møller expert before you do this though.

- **The solenoid field is not ramping.**

  This ocassionally happens and can often be fixed by trying the HOLD and GO SET buttons in the gui. If this doesn't work, contact the Møller expert.