CLAS12 Møller Operations Manual - v0.4

N. Baltzell, S. Stepanyan

(Dated: October 23, 2018)

I. Introduction

The CLAS12 Møller system measures the polarization of the electron beam delivered to Hall B, and this document details its operating procedures. The user interface for shift workers is shown in Fig. 1 and provides direct access to all controls and feedback that the normal operator should need, and its operating procedures are described in Section IV. Expert operations are described in Section V D.
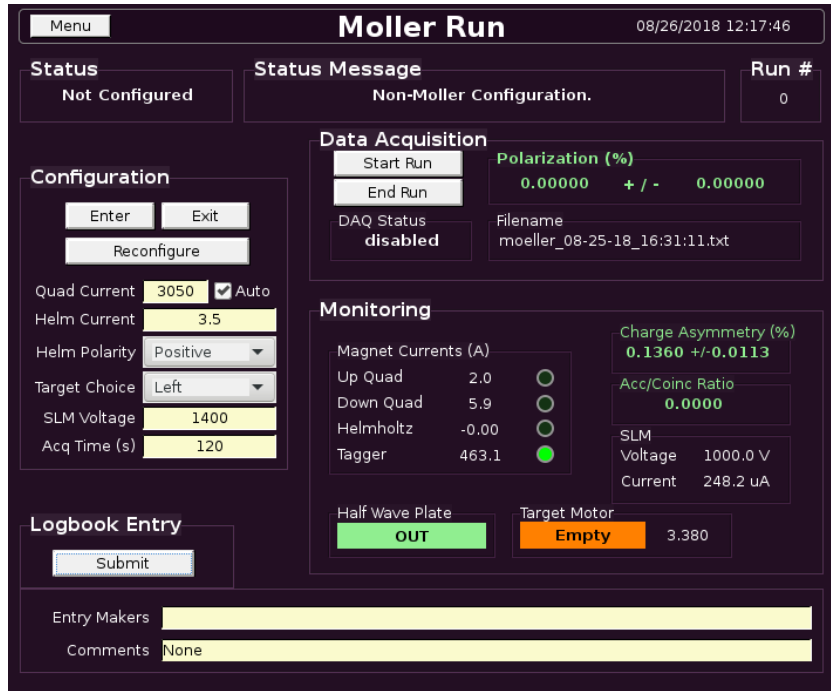

FIG. 1: The user interface for shift workers for operating a Møller run is divided into *Status*, *Configuration*, *Data Acquisition*, *Monitoring*, and *Logbook* sections. In this screenshot, the Møller system is not configured, according to the *Status* section, i.e. the setup is for non-Møller beam delivery.

II. Hardware Settings

The standard hardware settings for a Møller run are shown in Table I. These are displayed in the *Configuration* section of Figure 1 and will be used to automatically configure all hardware during the procedure in Section IV. It is the responsibility of the operator to ensure that the settings in the *Configuration* section are the desired ones before entering the Møller setup.

SLM Voltage	1400 V
Collimator Position	Blank
Target Position	Left
Helmholtz Current	±3.5 A
Quadrupole Current	
5-pass / 10.7 GeV	3145 A
3-pass / 6.4 GeV	1350 A

TABLE I: Standard hardware parameter values for the Møller setup. Live values are shown in the *Monitoring* section in Figure 1.

III. Quality Requirements

The requirements to be maintained during a Møller run, and the resulting desired error on the polarization measurement are shown in Table II. It is the responsibility of the operator to monitor these quantities to ensure a successful polarization measurement.

2C21 BPM Current	~4 nA
Beam Charge Asymmetry	< 0.1%
Accidental/Coincidence Ratio	< 0.05
Final Beam Polarization Error	< 1.5% (absolute)

TABLE II: Standard quality conditions required for a Møller run. Live values are shown in the *Monitoring* and *Data Acquisition* sections in Figure 1. Note, beam polarization error depends on statistics and should gradually decrease during the run.

IV. Standard Procedures

A. Summary

The procedure for the operator with the interface in Figure 1 can be summarized in the following steps, and more details are shown on the next section.

1. **Configure:** ensure the Configuration section is set as desired
2. **Enter:** click *Enter* in the Configuration section and wait for success status
3. **Start Run:** click *Start Run* in the DAQ section
4. **Monitor:** monitor the critical parameters
5. **End Run:** click *End Run* in the DAQ section
6. **Log Entry:** click *Submit* in the Logbook Entry section
7. **Reconfigure:** (Optional)
8. **Exit:** click *Exit* in the Configuration section and wait for success status

B. Details

1. **Configure:** ensure the Configuration section of Fig. 1 is set as desired

   See Table I for standard values. Contact the Run Coordinator if uncertain.

2. **Enter:** click *Enter* in the Configuration section and wait for success status

   This will configure the system for a Møller run by initiating a sequence of actions and provide corresponding feedback in the status portion of the screen. This includes turning off all appropriate detectors' high voltage, inserting the blank collimator, energizing the quadrupoles and Helmholtz magnets, and inserting the Møller target. Success will result in "Moller Configuration Ready" in the status message.

3. **Start:** click *Start Run* in the DAQ section

   This will initiate a new Møller run, including zeroing any accumulated data, opening a new data file, incrementing the run number, and starting data acquisition.

4. **Monitor:** monitor the critical quality parameters

   This is left to the operator and described in Table II. Of particular importance are beam charge asymmetry below 0.1% and accidental ratio of less than 0.05. *If you cannot achieve the quality requirements, contact the Run Coordinator.*

5. **End:** click *End Run* in the DAQ section

   At this point you should have achieved the desired polarization error of 1.5% (see Table II), or just need to stop the current run and start a new one.

6. **Log Entry**: click *Submit* in the Logbook Entry section if the run was successful.

   This will submit a log entry to HBLOG with a table summarizing the results and an attached data file, and requires filling the Entry Makers and Comments fields. *Note, if you want to log any screenshots associated with this Møller run, then you should navigate to this log entry and upload them as comments.*

7. **Reconfigure:** (Optional) At this point you may reconfigure the system (e.g. change the Helmholtz polarity or switch to a different target, and then click *Reconfigure*) and then start a second run (go to Step #3), or just start another run with the same configuration (go to Step #3).

8. **Exit**: click *Exit* in the Configuration section and wait for success status

   This will restore the non-Møller configuration by turning off the quadrupoles and Helmholtz and retracting the Møller target. *Note, this will not restore any detector high voltage (except the SLM) nor move the collimator.*

V. TODO

A. Status Values

Describe the possible values of the status variable in the top left of the screen.

B. Run Duration

Add something about expected run duration?

C. Tuning Parameters

What knobs to adjust if requirements are not being met?

1. Injector

2. Quadrupoles

3. Beam Current

4. SLM Voltage

D. Expert Procedures

The instructions for the old, manual procedure.

Appendices

Description of the hardware and software involved in the CLAS12 Møller system.

A. Quadrupoles

The quadrupoles use a Dyapower power supply with communications via classc3 hosting a vxWorks EPICS IOC and DVME628 and .

B. Helmholtz

The Helmholtz coils use a SCE410 power supply, located on the first level of the space frame in the electronics racks beam-right. EPICS controls are running on a clonioc linux server in the counting house, communicating with SCE410 via a MOXA serial-ethernet converter in the same rack.

C. Synchrotron Light Monitor

The SLM is located in the upstream beam tunnel near 2c21. Controls are located on space frame, level 1. Its high voltage power supply is beam-left in CND's CAEN SY527 mainframe, while its signal is routed to a Jorger scaler in classc1, beam-right.

D. Target

The target controls are running on classc1, with an OMS motor controller, both beam-right on space frame level 1.

E. Helicity Signal

The helicity signals are routed through NIM crates and into the Struck scaler in classc6, all on space frame beam-right.

F. Struck Multi-Channel Scaler

The Struck scaler is located in classc6, beam-right.

G. Sequencing

Automated sequencing of controls is via a softioc in the counting house.