MEBT-BI-FC83-04

MEBT FC GUI Description

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Change History

Rev.	Date	Author(s)	Description
1.0	2017-06-26	I. Mazkiaran	First version.
2.0	2017-06-30	I. Bustinduy	Some comments.
3.0	2017-07-03	A.R. Páramo	Document Revision
4.0	2017-07-04	I. Mazkiaran	Document Revision

MEBT FC GUI Description

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1. Introduction

This document describes the development of the GUI for the FC.

This document describes the engineering GUI of the FC with the settings for configuring and controlling the FC, along with the monitoring tools.

This GUI design is based on the mock-up of the engineering screen provided in the FC specification document Faraday Cup Functionalities (FC_ICS_functionality.pdf) provided by Benjamin Cheymol (ESS). The software design document is described in “MEBT-BI-FC81 MEBT Faraday Cup Software Design Document” and the software development in “MEBT-BI-FC82 MEBT Faraday Cup Software Development Document”.

The FC GUI (see Figure 1) is implemented with the CSS BOY libraries as they are developed at the moment. Some changes would be done to adapt this GUI to the new standard CSS Display Builder that ICS has under development.

Figure 1. FC GUI screen.

2. FC Settings

In the FC GUI (see Figure 1) there are represented several groups of settings. Inside each group of settings, a FC functionality is configured.

The different **functionalities** of the Faraday Cup implemented in the GUI are: Acquisition Settings: position control, repeller voltage, data monitoring (plotting and show statistics). The functionalities can be configured by group of **settings (**In Figure 1, *AC420 control*, *Position*, etc.).

2.1. **Acquisition Settings**

In the case of acquisition settings (see Figure 2), the design provided in the ifcdaq module is presented.

In the left column of values, the application settings values to be configured are represented, and in the right column the active settings are shown.

Acq420 control:

Sample Count: Number of samples.
Sample Rate: 2 MSamples /sec maximum.
Clock Source: It will be set to internal source.
Clock Frequency: Depending on the oscillator, it will be 1E8 by default.
Clock Divisor: Correlated to sampling, it will be 200 by default.
Decimation: By default, will be set to 1; FC decimation will be implemented by configuring the Decimation setting of Data acquisition menu.
Averaging: Not used in this application, by default will be set to 1.
Trigger Source: It will be set to external by default.
Trigger Threshold: Minimum voltage of the pulse to trigger.
Trigger Edge: By default, will be set to Raising Edge.
Trigger Delay: Number of samples the trigger to be delayed.
Trigger Repeat: By default, will be set to -1: continuously trigger.
Trigger Counter: Readback of the trigger counts.

In the definitive solution of the FC, some of the particular settings of the ADC may differ, as the digitizer board will be different. The purpose of this versatile group of settings was suggested by ICS, in order to allow potential recycling of this GUI in other FCs along the ESS LINAC (with a different ADC).

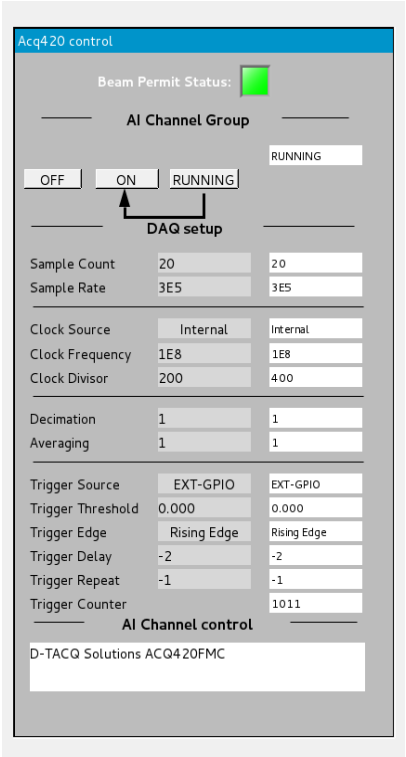

Figure 2. FC GUI Acquisition settings sub-screen.

2.2. **Position Settings**

In the Position control menu (see Figure 3) there are two buttons:
Insert: Insert the FC in the beam trajectory.
Retract: Remove the FC from the beam trajectory.

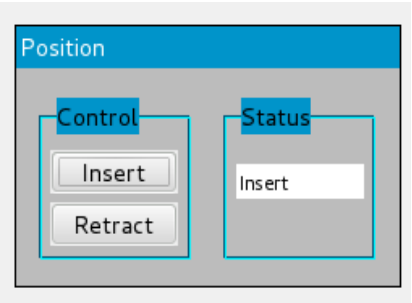

Figure 3. FC GUI Position settings sub-screen.

2.3. **High Voltage**

In the High Voltage Control (see Figure 4) there are different settings:
On: Activate the Voltage of the repeller.
Off: Deactivate the Voltage of the repeller.
Status: There is the Status value and a led to indicate if the repeller is On or Off.
Setpoint: Insert the value of the voltage of the repeller.
Actual: There is the readback to read the active value of that setting.

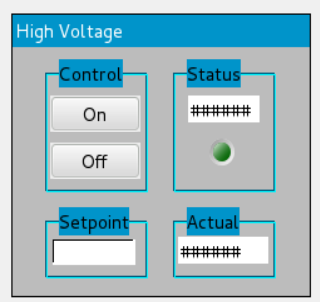

Figure 4. FC GUI High Voltage settings sub-screen.

2.4. **Data acquisition**

Apart from the basic acquisition settings implemented by the Ac420 control module (see Figure 2) we have implemented and additional group of settings for the Data Acquisition.

These extra settings for Data Acquisition are (see Figure 5):
Decimation: Decimation of the number of samples in the pulse.
#Acq Pulses: Number of pulses for statistical calculations. The #Acq. Pulses that will be used as refresh rate for the statistics.
#Bgnd Pulses: Number of pulses needed to calculate the background subtraction.
Trigger: Threshold of the samples to calculate the statistics.

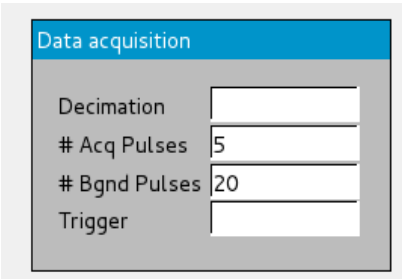

Figure 5. FC GUI Extra Data Acquisition settings sub-screen.

2.5. **Background Data Window settings**

The settings of the **Background Data Window** control the limits of the region of interest (ROI).

In Figure 6-b the text entry boxes for the Background Data Window are shown:

leftCursor: Start sample of the ROI interval.

rigthCursor: End sample of the ROI interval.

3. Monitoring the results.

There are two screens showing the pulsed signal, the raw data signal (see Figure 6-a) and the background subtraction signal (see Figure 6-b). In the screens, there are flags and graphs for displaying the ongoing of the application.

a)

b)

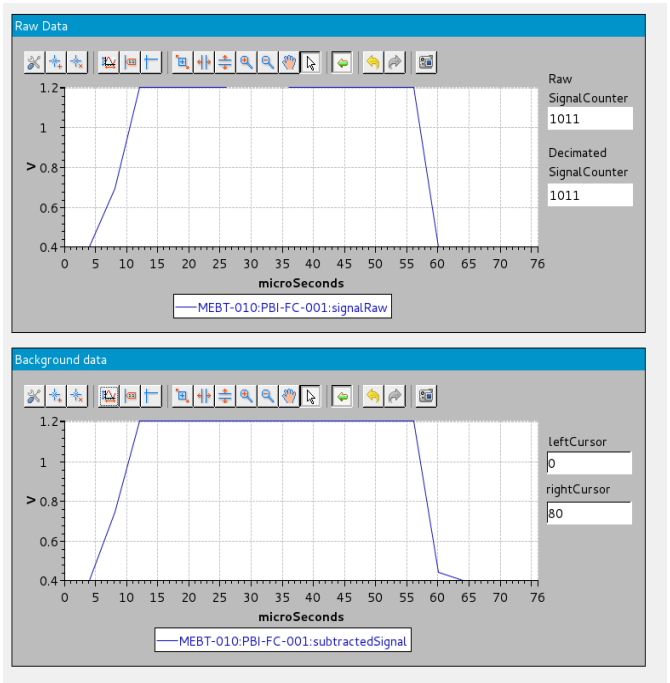

Figure 6. FC GUI Monitoring sub-screens.

3.1. **Raw data graphic**

This sub-screen (see Figure 6-a) represents the pulse raw data, as it comes from the analogue channel.

There are two menus that show:

Raw SignalCounter: Number of triggered pulses.

Decimated SignalCounter: Internal debugging.

3.2. **Background data**

We have implemented an additional function in the Faraday Cup EPICS module in order to perform a Background Subtraction of the raw signal. The method used for Background Subtraction is described in "MEBT-BI-FC82 MEBT Faraday Cup Software Development Document".

For the Background Subtraction, samples are acquired before and after the signal chosen for the analysis.

In the Background Subtraction sub-screen (see Figure 6-b) the leftCursor and rigthCursor are configured. They indicate the limits of the samples of the signal that is going to be considered for the statistic calculations.

3.3. **Statistics**

The statistics are calculated from the signal shown in the graphic of Background data.

These statistics are calculated each #Acq Pulses and are shown in the subscreen of Statistics (see Figure 7).

The statistical values shown in the GUI are:

- Peak current value.
- Minimum current value.
- Standard deviation.
- Average current value.

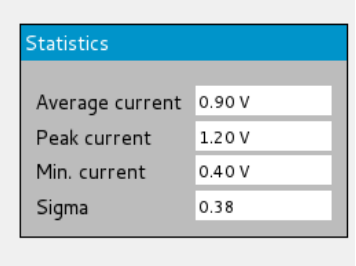

Figure 7. FC GUI Statistic sub-screen.

4. Application control flow

The Application Control Flow follows the next steps:

1.1. Settings configuration
1.2. Push Insert in the menu of Position
1.3. Application running: statistics calculation
1.4. Push Retract in the menu of Position

Before the start of the application, the convenient settings must be introduced. These settings can be changed when the FC is in retracted status. Also, in order to control the insertion of the FC, a Beam Permit signal that is written by MPS (Machine Protection System) is checked. When the Beam Permit is not allowed, then the button of insert is inactive and insertion of the FC is not possible. The status of Beam Permit is shown in the flag presented in the upper side of Figure 2.

In the menu of Position (see Figure 3), there are the two buttons for controlling the flow of the application.

Insert:

Once the button Insert is pushed, the FC is inserted into the beam trajectory. Then it begins reading in the analogue channel the generated voltage and starts the process of background calculation and calculation of the statistics at each interval defined in #Acq Pulses.

Retract:

The button Retract stops the application, and retracts the FC to the home position.