MEBT-BI-EM83-03

MEBT EMU GUI Description

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Change History

Rev.	Date	Author(s)	Description
0.1	2017-06-26	I. Mazkiaran	First version.
0.2	2017-06-27	Z. Izaola	Corrections
0.3	2017-06-29	Z. Izaola	Minor corrections

MEBT EMU GUI Description

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1. Introduction

This document describes the development of the engineering GUI for the MEBT EMU. In this description, some of the settings for configuring and controlling the EMU will be report. Also, the monitoring tools of this application is shown.

This GUI design is based on the picture provided in the EMU specification document ESS-0068700.docx; which shows the Linac4 Slit and Grid EMU engineering screen.

The GUI shown in Figure 1 is a prototype screen. It is implemented with the CSS BOY libraries as they are developed so far. The definitive screen should be implemented under CSS Display Builder; which ICS has under development.

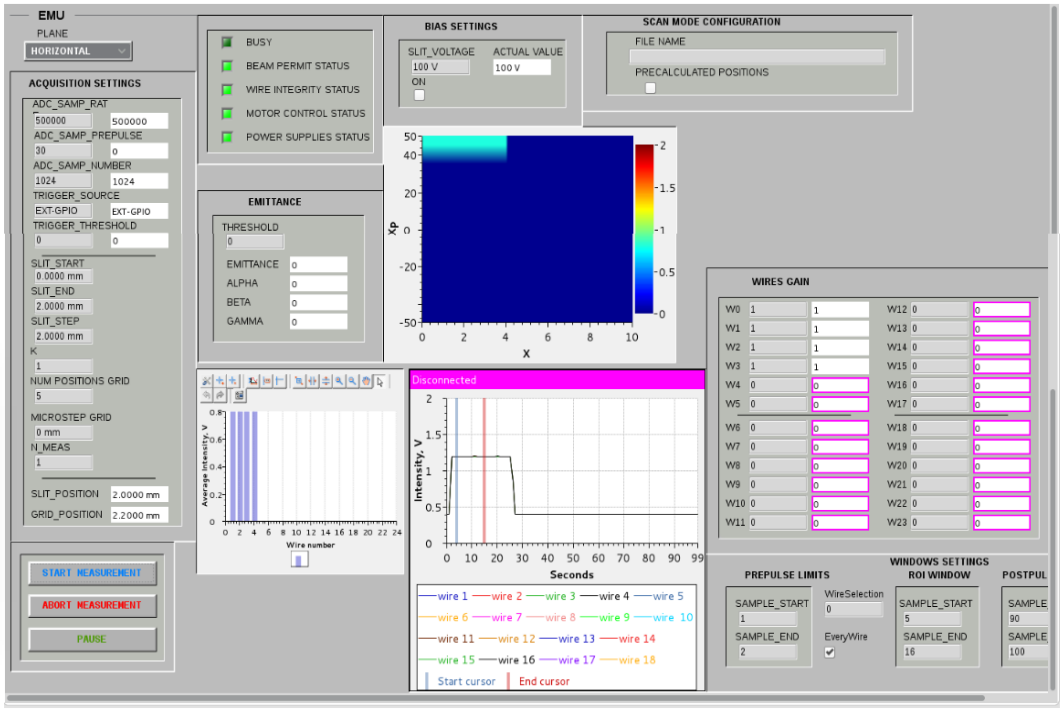

Figure 1. EMU GUI screen

The simulated data have been made inserting a pulse of 50 µs with 0.8 V of amplitude and 0.4 V of offset; in the 4 channels that are available in our digitizer board.

2. EMU Settings.

The GUI groups setting in different boxes. Before the start of the application, the necessary settings must be introduced in their text entry boxes. These settings can be changed when the application is not running.

2.1 Plane Settings:

PLANE: HORIZONTAL or VERTICAL.

The calculations can be made for the horizontal component (x, x'), corresponding to vertical slit aperture; and for the vertical component (y, y'), corresponding to horizontal slit aperture. The wires of the grid are parallel to the slit aperture.

Once the plane is changed in the GUI; the value of a digital output in the EMU system is changed to switch the 24 channels to be connected to the horizontal or to the vertical grid of wires. Internally, in the EPICS PVs, there are two macros, $(PLANEGRID) and $(PLANESLIT), that take their associated value to perform the calculations in the corresponding plane.

1.1.SCAN mode Settings:

Each motor is associated to each plane. In the Scan Mode menu, it can choose between moving the slit and grid to on line calculated positions; or moving them to pre-calculated positions.

In case of on line calculated steps, the movement stops at equidistant positions. There are five settings, set by the operator, to calculate those positions: start/end position, the step size of the slit and the desired resolution and amplification factor k.

For example, for the grid that has a wire pitch of 500 μm; and a desired resolution of 100 μm, 5 micro steps (steps of the grid for each slit position) are needed. The formula for calculating the grid movement, for each slit position, is the following:

$$x_{grid_1} = kx_{slit_0} - 200\mu m$$
$$x_{grid_2} = kx_{slit_0} - 100\mu m$$
$$x_{grid_3} = kx_{slit_0}$$
$$x_{grid_4} = kx_{slit_0} + 100\mu m$$
$$x_{grid_5} = kx_{slit_0} + 200\mu m$$

In the case of pre-calculated positions scan, the positions of the slit and the grid have to be stored in the "misc" directory of the associated EMU EPICS module

SCAN MODE CONFIGURATION:

FILE_NAME: Name of the file to load with the configuration of the pre-calculated positions.

PRECALCULATED_POSITIONS: When selected activates the pre-calculated position mode.

1.2.Acquisition Settings.

In this group, there is a subdivision of settings, the first one is related to the ADCs, and the second group is related to the motion system settings.

ADC Settings:

In the final implementation of the EMU, some of these settings can be different because the digitizer board may differ.

The Acquisition group in Figure 1, shows the setting values to be applied in the left column and the active values on the right.

ADC_SAMP_RAT: Sample rate, 2 MSamples /sec maximum.
ADC_SAMP_PREPULSE: Number of samples to delay the trigger.
ADC_SAMP_NUMBER: Number of samples.
TRIGGER_SOURCE: It will be set to external by default.
TRIGGER_THRESHOLD: Minimum voltage of the pulse for triggering.
N_MEAS: Number of pulses to do an average of each sample.

Motion Settings:

Those are the values applicable to equidistant steps mode:
SLIT_START: Start position of the slit in mm.
SLIT_END: End position of the slit in mm.
SLIT_STEP: Distance between slit steps.
K: Amplification factor.
NUM_POSITIONS_GRID: Number of movements of the grid on each slit position.
MICROSTEP_GRID: Step between grid positions.
SLIT_POSITION: Actual position of the slit.
GRID_POSITION: Actual position of the grid.

1.3. EMITTANCE Settings.

THRESHOLD: Percent of the maximum value of the received pulse averages. The points below this value are not included in the emittance calculations.
EMITTANCE: Calculated emittance value.
ALPHA: Calculated alpha Twiss parameter.
BETA: Calculated Beta Twiss parameter.
GAMMA: Calculated gamma Twiss parameter.

1.4. BIAS Settings:

GRID_VOLTAGE: Set-point voltage of the BIAS installed in the grid.
ON: Activates the BIAS voltage.
ACTUAL VALUE: Readback value of the BIAS voltage.

1.5. WIRES GAIN settings:

W0..W23: ADC gain for each of the 24 EMU analogue channels.

1.6. WINDOWS settings:

Settings for the representation of the pulses in the "per wire" intensities windows:
EveryWire: When selected, the intensity of all the wires is represented.
WireSelection: If EveryWire is not selected, then the number introduced in this menu corresponds with the wires to be displayed.

To calculate the RMS emittance, a background subtraction is applied to the samples in the ROI (region of interest). The operator will set two time intervals (pre-pulse and post-

pulse) for the background estimation. The background value is calculated as an average of samples in these intervals.

PREPULSE LIMITS:
SAMPLE_START: Start sample of the pre-pulse interval.
SAMPLE_END: End sample of the pre-pulse interval.

POSTPULSE LIMITS:
SAMPLE_START: Start sample of the post pulse interval.
SAMPLE_END: End sample of the post pulse interval.

ROI WINDOW
The region of interest is defined. Their values are represented with cursors in the intensity plot.
SAMPLE_START: Start sample of the ROI interval.
SAMPLE_END: End sample of the ROI interval.

3. Monitoring.

There are several flags and graphs for displaying the ongoing status of the application.

3.1. Status Flags:

There is a status panel in the GUI that shows the state of relevant flags.
BUSY: It turns on light green when the application starts running.
BEAM PERMIT STATUS: It is activated if the beam is not permitted.
WIRE INTEGRITY STATUS: It is activated if the wire integrity check falls. In that case there is a maintenance screen where the numbers of the broken wires can be found.

MOTOR CONTROL STATUS: If this flag is activated there are problems with the motors. In the maintenance screen, it is indicated the detailed problem and to which motor is associated.

POWER SUPPLIES STATUS: This flag shows if there is a problem with the BIAS power supply and the power supplies that feed the electronic front end.

3.2. Raw signal plot

The raw signal of each wire of the grid as function of time.
The pulse representation of each wire, to the screen of time intensity measurement per wire

3.3. Average intensity graph

In this graph, the average of the intensity read in each wire is displayed. Each bar corresponds to the value read in each wire.

3.4.Phase space surface graph.

This plot represents the intensity associated to each x-x’ (y-y’) coordinate.
1.1.

4. Application control flow

There are three buttons to control the application flow. When pushing those buttons first it is checked if beam is not permitted. If the beam is not permitted, the slit and the grid are moved to their home positions, the bias voltage is shutdown, and the GUI is disabled.

START MEASUREMENT:
After the beam permit is checked, there is a test of the power supplies. After that, there is a checking of the wires and then depending of the option, the bias voltage is set. Once all the needed settings are done, the measurement starts.

ABORT MEASUREMENT:
It aborts the process and the slit and the grid are sent to their home position.

PAUSE:
The EMU application is paused and the operator has the possibility to continue or to restart it.