

Beam Position Monitor GUI

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Confidentiality

This document is classified as a **confidential document**. As such, it or parts thereof must not be made accessible to anyone not listed in the Audience section, neither in electronic nor in any other form.

Scope

This document lists the requirements for the graphical user interface (GUI) for the beam position monitoring (BPM) subsystem. The BPM GUI is an application that offers a comprehensive overview of present read-outs of BPMs in the system.

Audience

The audience of this document are:

- All members of the GSI-SD group.
- All members of the GSI-BEL group.
- All members of development team at Cosylab.

The document can be disclosed to all GSI staff and staff of all entities participating in the FAIR project.

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1. STYLE GUIDES



This is under construction.

2. GENERAL REQUIREMENTS

- All graphs should have possibility to save current display as figure on the disk. This is extremely handy for users to use such figures in presentations.
- Since it is possible to run BPM application from several clients there should be a special attention given to multi user approach. There are two main subjects to this matter:
 - Settings. When settings will be changed by one client the changes will reflect on all the clients.
 - Data representation (graphs). Graph manipulations (i.e. zooming, scale settings ...) will affect only the client in question. This will be accomplished by explicitly issuing get requests to CCCP.

3. GRAPHICAL USER INTERFACE



All figures in this document are given as example only. They do not show the actual intended implementation from look & feel point of view. They are used to better represent functionality of the screens.

Graphical user interface will be implemented in CERN application environment using Java Swing components.

Graphical user interface consists of four major panels:

- Global panel
- BPM mode panel
- Sub modes panel
- Message log panel

Example screen when bunch to bunch BPM mode is selected.

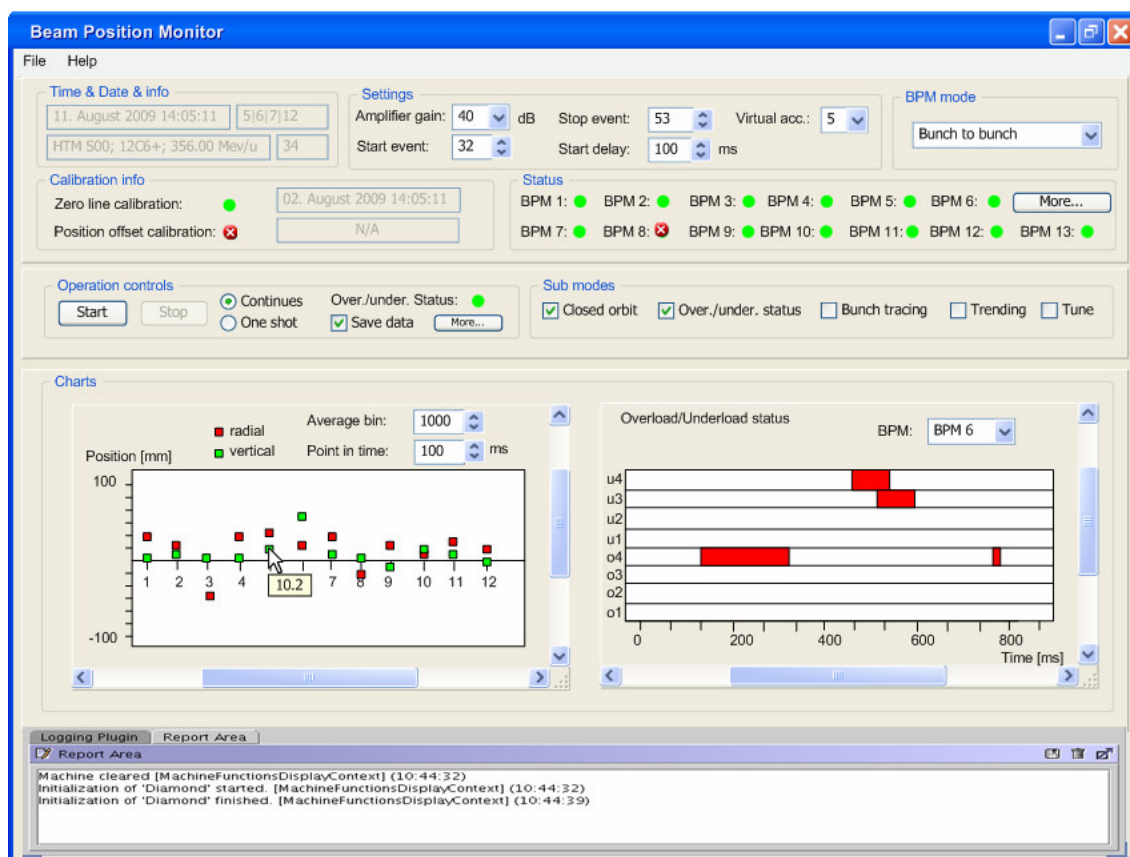


Figure 1: Beam position monitor screen.

3.1. GLOBAL PANEL

Global panel is used for controlling and monitoring properties that are common to all BPM modes. It is shown on the figure below:

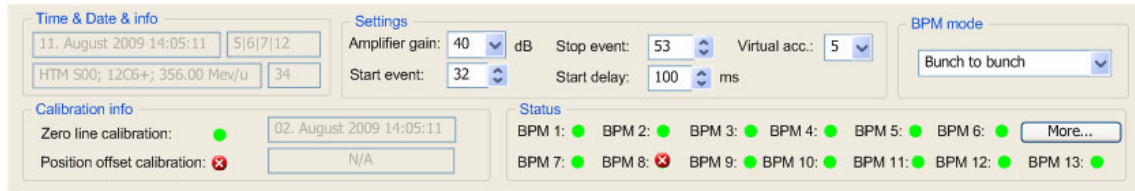


Figure 2: Global panel

It consists of:

- Time, Data and Info section. The following is displayed:
 - Date and time.
 - Super cycle description (displays which virtual accelerators are available).
 - Selected virtual accelerator description.
 - Missed cycle counter.
- Settings section. It consists of:
 - Amplifier gain selection drop down menu.
 - PTIF setup. It consists of the following settings:
 - Start event selection drop down menu. The items are filled from database with all available events.
 - Stop event selection drop down menu. The items are filled from database with all available events.
 - Start delay setup.



Amplifier gain and PTIF setup can be changed during acquisition but some restrictions exist. If current mode is set to e.g. bunch to bunch mode with continuous acquisition, changes will take effect only for the next cycle (not immediately if there is an ongoing acquisition present). This will be indicated on the screen in a way that new settings will be colored in red until they are actually set on the device (PTIF or amplifiers).

- Virtual accelerator selection drop down menu. The items are filled from the database with all available virtual accelerators in the current super cycle.
- BPM mode section. It consists of:
 - BPM mode drop down menu.
- Calibration information section. It shows whether BPMs were calibrated. It shows also the time and date of the last calibrations. It consists of:

- Zero line calibration LED. It is red if the calibration was not performed at all or if the time when it was last performed is longer than the time specified in configuration.
- Position offset calibration LED. It is red if the calibration was not performed at all or if the time when it was last performed is longer than time specified in configuration.
- Status section. It consists of:
 - Status LED for each BPM (real names will be used when known). If there is problem on BPM the LED is red otherwise it is green.
 - More button. This button is used to open screen with detailed BPM status.

3.2. BUNCH TO BUNCH BPM MODE

When bunch to bunch BPM mode is selected the BPM mode panel shall look like this.



Figure 3: Bunch to bunch BPM mode panel

This panel is composed of the following:

- Operation controls which comprises the following:
 - Start/stop buttons. When start is pressed some settings from global panels will be disabled (e.g. BPM mode drop down menu, virtual accelerator selection ...).
 - Continuous/one shot selection radio button. When continuous is selected, acquisition will be done cycle by cycle. When one shot is selected, only one acquisition will be performed.
 - Overload/underload status LED. This LED is red if any overload or underload bit set in any of 12 BPM. It is green otherwise.
 - Save data check box. If this check box is selected acquisition will be saved to the disk. Saving data to file can take longer than time between two cycles. In this case, if continuous operation is selected, not all cycles will be written to disk (some will be skipped).
 - More button. This button will open save data configuration screen. For detail see 3.2.1.
- Sub modes which comprises the following:
 - Check boxes to select individual sub mode.

3.2.1. Save data configuration screen

This screen is used for configuration of saved data. It consists of the following:

- Binary/ASCII file type radio button.
- File name.
- OK/Cancel buttons.

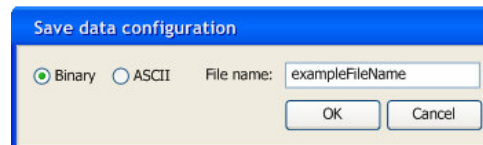


Figure 4: Save data configuration screen

3.2.2. Sub modes

Available sub modes in bunch to bunch BPM mode are:

- Closed orbit
- Overload and underload
- Trending
- Tune
- Bunch tracing
- Consistency check
- Signals from AUX BPM

Each of these sub modes is displayed on a separate panel and can be switched off with controls on BPM mode panel (see 3.2)

3.2.2.1. Closed orbit panel

This panel is used to display closed orbit and consists of the following

- Averaging enable check box.
- Bin size selector for averaging. Enabled only if averaging is selected.
- Point in time select box. User is able to select which point in time wants to display on graph. Step in time depends on the bin size (if higher also the step is higher). This point in time is at the beginning of each averaging.
- Graph of X and Y positions vs. BPM number (or name). The example graph is displayed on the figure below. The following settings for the graph will be possible:
 - Scale change on y (position) axis.

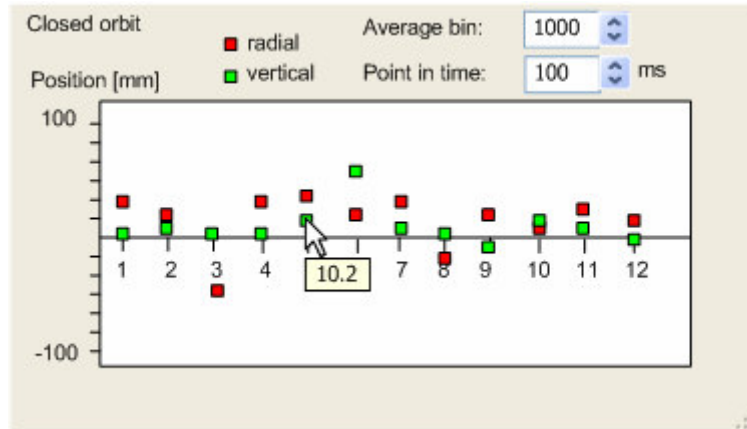


Figure 5: Closed orbit panel

3.2.2.2. Overload and underload panel

This panel is used to display overload and underload bits and consists of the following

- BPM selection drop down menu. User can select one BPM.
- Graph of overload and underload status vs. time or bunch number.

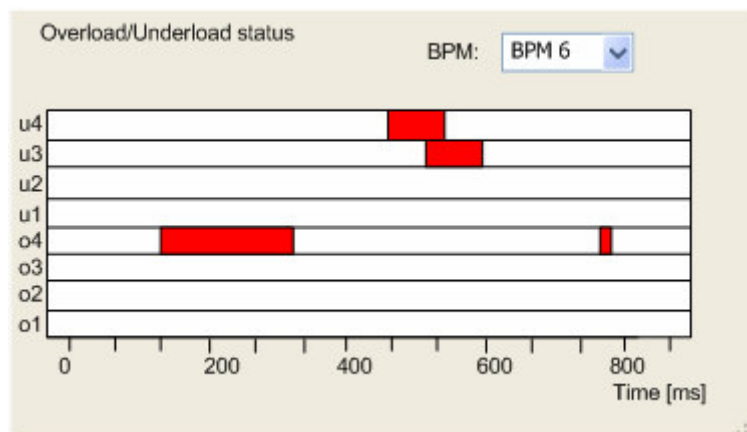


Figure 6: Overload / underload panel.

3.2.2.3. Trending panel

This panel is used to display position vs. bunch number (or time) and consists of the following

- BPM selector. It is possible to select up to six BPMs to display on graph. If more than one BPM is selected they are shown on separate graphs with common x axis.

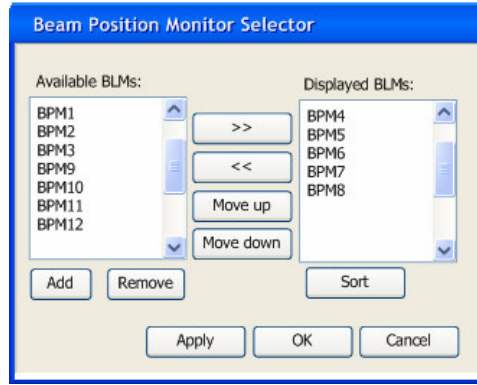


Figure 7: Beam Position Monitor selector

- Averaging enable check box.
- Bin size selector for averaging. Enabled only if averaging is selected.
- Graph of X and Y positions vs. time or bunch number. Example graph of X position vs. bunch number is shown below.



Figure 8: Trending panel

3.2.2.4. Trending mean value

This panel is used to display mean position value of selected BPMs vs. bunch number (or time) and consists of the following

- BPM selector. It is possible to select which BPMs will be used in calculation of mean value.

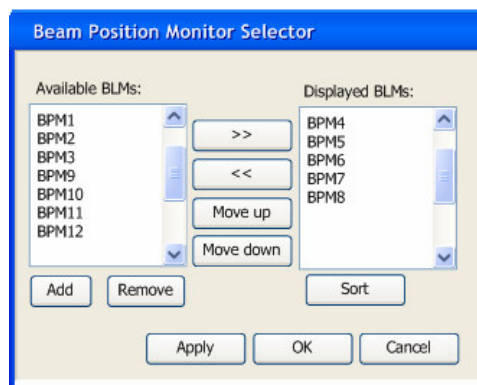


Figure 9: Beam Position Monitor selector

- Averaging enable check box.
- Bin size selector for averaging. Enabled only if averaging is selected.
- Graph of X and Y mean positions of selected BPMs vs. time or bunch number. Example graph of X position vs. bunch number is shown below.

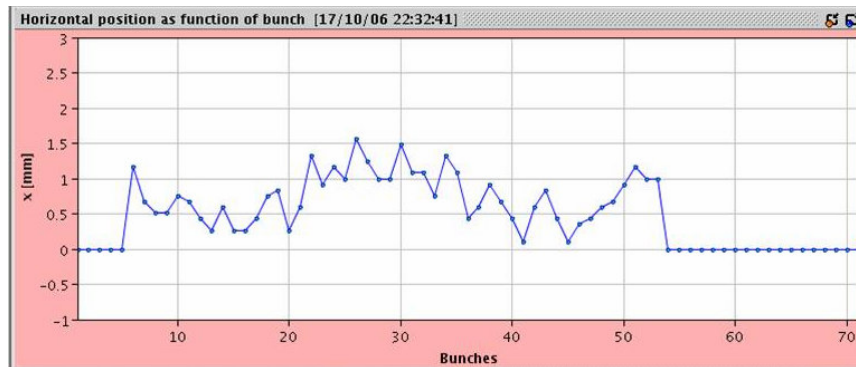


Figure 10: Mean value trend panel

3.2.2.5. Tune panel

This panel consists of the following:

- BPM selection drop down menu. User can select one BPM.
- Turn by turn/ bunch by bunch selector. If turn by turn is selected only data belonging to one bunch will be used.
- Number of samples for FFT calculation (default 1024).
- Graph of amplitude vs. frequency for both planes which is shown as an example on figure below (left graph) (on figure it is displayed for one plane only).
- Graph of positions vs. turn number (or time). Displayed on the figure below (right graph). There should be no averaging used to display this graph. Enveloping will be used to reduce the data displayed in GUI.
- Point in time select box. User is able to select which point in time wants to display on both graphs. Step in time depends on the bin factor (if higher also the step is higher).

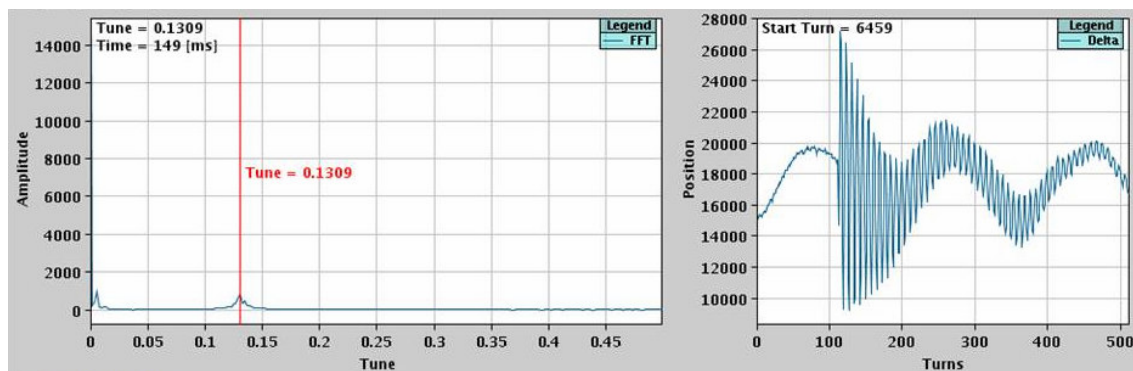


Figure 11: Amplitude vs. frequency (FFT) (left graph)

- Graph of tune y (Q_y) vs. tune x (Q_x) which is shown as an example on figure below. The following settings for the graph will be possible:
 - Scale change on x and y axis.

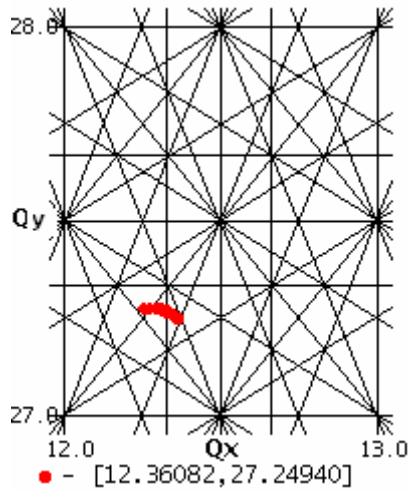


Figure 12: Graph of Q_y vs. Q_x

- Graph of tune vs. bunch number (or time or turn number) which is shown as an example on the figure below. The following settings for the graph will be possible:
 - Bin size selector.
 - Z axis scale factor (default is max value).
 - Linear or Logarithmic z axis scale.
 - Scale change on x (turns or time) axis.
 - Scale change on y (frequency) axis.

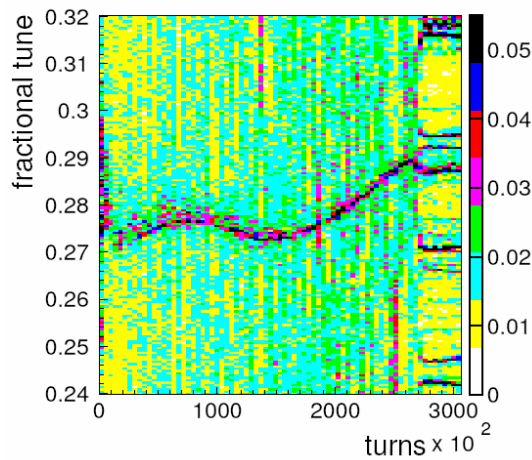


Figure 13: Graph of tune vs. turn number

3.2.2.6. Bunch tracing panel



This panel is under construction. Implementation of this panel is postponed.

This panel consists of the following:

- Graph of betatron phase advance vs. time.

3.2.2.7. Consistency check

This panel consists of the following:

- Graph of time window vs. bunch number (or time). This graph is shown on the figure below.



Figure 14: Graph of time window vs. bunch number

3.2.2.8. AUX signals

This panel consists of the following:

- Graph showing signals from AUX Libera. The signals will be plotted vs. bunch number (or time). Signal can be one of the:
 - Current transformer
 - RF amplitude
 - Dipole magnetic field
 - Quadrupole Magnetic field
 - Beam Loss

3.3. ZERO LINE CALIBRATION BPM MODE

When zero line calibration BPM mode is selected BPM mode panel shall look like this.

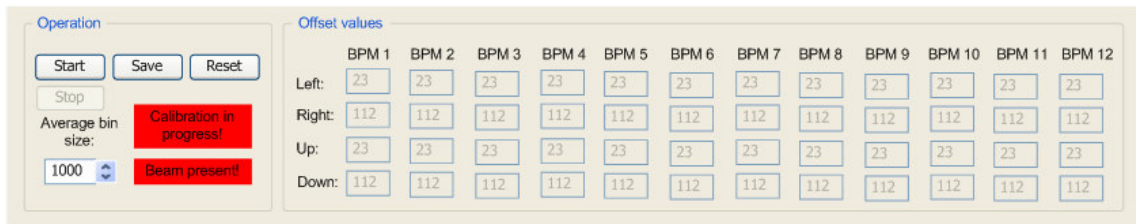


Figure 15: Zero line calibration BPM mode panel

This panel is composed of the following sections:

- Operation. It consists of:
 - Start/stop buttons. When start is pressed some settings from global panels will be disabled (e.g. BPM mode drop down menu, virtual accelerator selection ...).
 - Save button. When user presses this button current values are saved together with metadata (time, date ...).
 - Reset button. When this button is pressed, previously saved offset values are restored. This button can be used if new calibration was done when beam was pressed and new acquired values are incorrect.
 - Bin size selector for averaging. With this user selects the number of samples BPM should acquire during calibration.
 - Warning message showing that calibration is in progress. It is displayed only when calibration in progress.
 - Warning message showing if the beam is present.
- Offset values. Display of offset values acquired for each BPM.

3.4. POSITION OFFSET CALIBRATION BPM MODE

When position offset calibration BPM mode is selected BPM mode panel shall look like this.

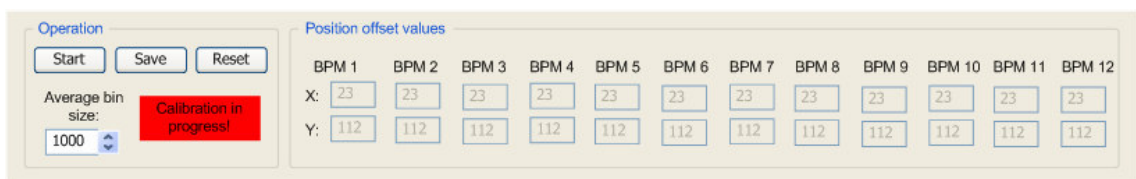


Figure 16: Position offset calibration BPM mode panel

This panel is composed of the following sections:

- Operation. It consists of:
 - Start/stop buttons. When start is pressed some settings from global panels will be disabled (e.g. BPM mode drop down menu, virtual accelerator selection ...).
 - Save button. When user presses this button current values are saved together with metadata (time, date ...).

- Reset button. When this button is pressed previously saved offset values are restored.
- Bin size edit box. User can select the number of samples over which the offset values will be averaged.
- Warning message showing that calibration is in progress. It is displayed only when calibration in progress.
- Position offset values. It displays x and y position offset for each BPM.

In addition to above position offset values will be also displayed in graph similar to one used in closed orbit sub mode. Example figure is shown below.

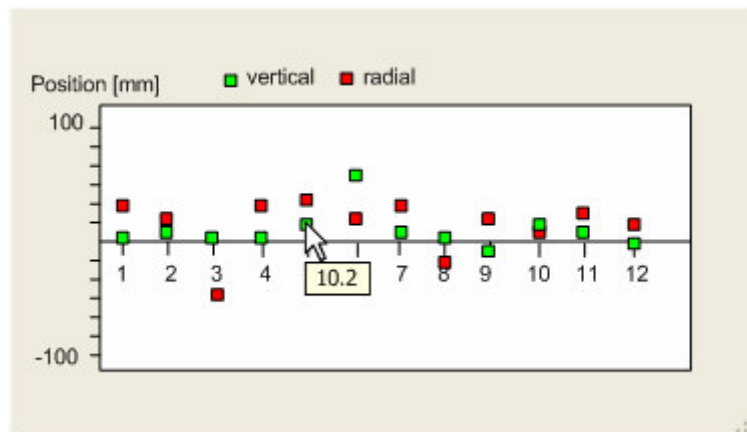


Figure 17: Position offset values graphical representation

3.5. RAW DATA BPM MODE



This panel is under construction.

When raw data BPM mode is selected BPM mode panel shall be composed of the following:

- Start button.
- Expert setup screen open button.
- Save data configuration screen (see 3.2.1) open button.

3.5.1. Expert setup

This screen is used to for expert setup. It consists of the following:

- Start delay setup for each BPM.
- OK/Cancel button.

- Reset button. When the user presses this button all delays are set to 0.

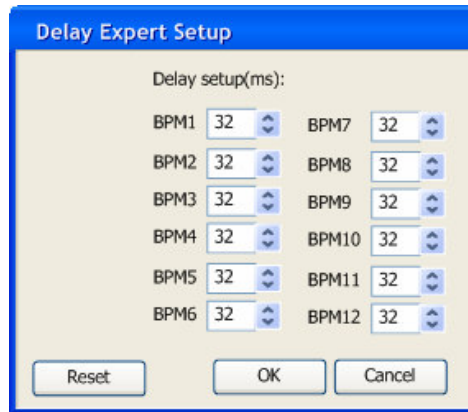


Figure 18: Expert setup

3.6. MESSAGE LOG PANEL

Important information and error messages are listed in this panel.

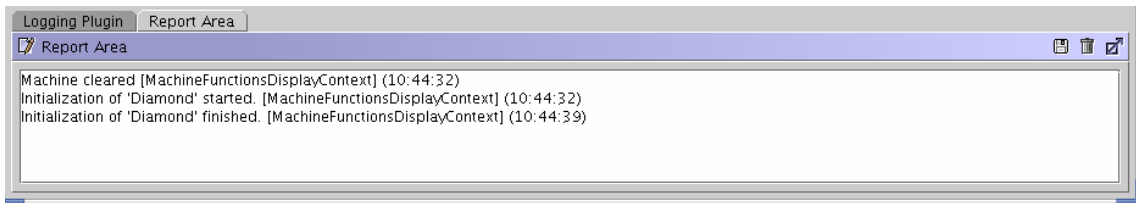


Figure 19: Message log panel