

Index Panel

SLAC's Software Engineering Newsletter

SLC Control

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Program

October 12, 1990

All that Fits is News to Print

Vol. 4, No. 29

BPM Gold Reference Orbits

October 8, 1990

Author: Daniel Van Olst

Subsystem: SLC

User Impact: Moderate

Panel Changes: Many

Documents: No

Help File: Yes

The gold configuration software has been significantly expanded to include BPM reference orbits. This provides for easier and more understandable use of BPM reference orbits, and extends its functionality to other software within the control system.

Different regions of the machine belonging to the same BPM measurement definition (such as the NRTL, LINAC, NARC and FF in the EXT_ELEC measurement definition) usually have different gold reference orbits. The new software allows for the separate regions comprising a single gold reference orbit to include BPM data taken at different times.

These gold reference orbits may be used for monitoring orbits throughout the accelerator. They are also used as the reference for the computation of RMS orbit deviations as shown on the new BPM RMS history plots and the SLC Orbit Summary Display (see related articles in this issue of Index Panel).

Basic Information

The BPM Gold reference orbit facility is reached via the

BPMO
GOLD
PANEL

button located off of the BPM

REF ORBITS panel. As with the existing Gold Configuration facility for magnets and timing, you are able to perform the following functions:

LOAD
GOLD
REF

CHOOSE
NEW
GOLD

DISPLY
GOLD
HISTORY

DISPLY
GOLD
INDEX

DISPLY
GOLD
CONFIG

Similar to the magnet gold configurations, the BPM gold configuration must be an existing NORMAL configuration (or 'NONE'). A reference orbit may be moved from SCRATCH to NORMAL on the BPMO REF ORBITS panel. No more than one gold is permitted for each reference orbit index.

A function has been provided to update just a portion of a BPM gold reference, to allow more specific tracking of various areas of the machine (see below for more information).

Additional Features and Warnings

The database contains a *default reference* for each BPM measurement definition. This default reference is the configuration that is loaded automatically if you select a BPM difference display and do not specifically load another reference orbit. This *default reference* is now set to the Gold reference when a new Gold is chosen, and the buttons MAKE CALIB PUBLIC, PARTL UPDATE PUBLIC, and UPDATE PUBLIC DEFLT on the BPM CAL Panel have no effect on the *default reference*.

A new function, available through the

UPDATE
GOLD
PARTL

button, takes the existing gold reference orbit,

makes a new reference orbit from it, and allows part of the new reference orbit to be over-written from the last BPM data measured. You are then prompted if you wish to make the new, *composite* reference orbit the gold reference orbit. This will allow just part of the Gold reference to be updated. For instance, if the NRTL orbit has been changed, you can make a new gold reference from the old gold and data just taken for DR13.

Caution should be exercised when updating partial gold orbits since any continuous range of micros may be updated in the gold configuration resulting in an inconsistent mix of different orbits taken at different times. Comments should be very detailed as to the region name and the reason it was updated. Good comments are also important as the title for the new gold is chosen by the SCP to indicate the old reference number and the region updated.

Currently partial updates may only occur from just-taken BPM data, not previously saved reference orbits. Partial updates from previously saved references orbits may be supported in the future if needed.

An important point to bear in mind with the Gold BPM references is that the designated gold for a machine region is used by the BPM Sampler to compute difference orbit RMS values for history plotting and the SLC Orbit Summary. If the gold reference orbit is changed, the values shown on these displays will change. Excessive changing of the gold orbits will make these displays difficult to interpret and less useful.

The buttons

DISPLY
GOLD
VS. Z

and

DISPLAY
GOLD
VALUES

on the BPM GOLD panel are similar to the BPM vs.

Z and BPM VALUES DISPLY buttons on the BPM MEASUREMENT panel. They do, however, require that the gold be loaded to be used. If the gold is not loaded when one of these buttons is pressed, the SCP will prompt the user if it is OK to load the gold reference.

Restrictions

Currently both the high and low intensity injected e- measurement definitions (SLC L INJECT E- and SLC H INJECT E-) use the same configuration index. This means that (for now at least) these two measurement definitions are only allowed one gold reference. A slightly stickier problem is gold references for the 9999 ring turns. Currently, there is no way to specify a gold for the NDR and SDR 9999 turns. In both cases, the user may select another reference as needed for difference displays. These problems will be resolved in the near future.

Redesigned BPMO Reference Orbit Panel

October 09, 1990

Author: *Daniel Van Olst*
Panel Changes: *Many*

Subsystem: *SLC*
Documents: *No*

User Impact: *Moderate*
Help File: *Yes*

The BPM reference orbit panel has been redesigned to streamline its operation. In particular, LOAD and SAVE functions should be easier to perform and less prone to causing confusion.

The primary change has been in the way the regions are selected. Each measurement definition implicitly has a BPM configuration *region* associated with it. Previously, the selected region would be changed automatically when a new measurement definition was chosen on the BPM measurement panel. However, the region could be changed on the BPM reference panel without changing the measurement definition. This has resulted in load and save operations taking place with unintended measurement definitions.

On the new BPM reference orbit panel the region selection buttons have been replaced with measurement definition buttons. These will work as region select buttons, since changing a measurement definition also selects the appropriate configuration region.

One may select a configuration region different from the implicit one for a measurement definition by going to the

SELECT NONDEF REGION

 panel, off of the BPM REFERENCE ORBIT panel. On this panel the configuration region may be changed without changing the measurement definition.

If you wish to select a region not represented on the BPM reference orbit panel (for instance, one of the PEP regions) go to the appropriate BPM startup panel and select the desired measurement definition. The desired region will then be selected automatically when you return to the BPM reference orbit panel.

There have also been some improvements in the DISPLY LOADED REF button. There are now two buttons,

DISPLY LOADED vs. Z

 and

DISPLY LOADED VALUES

 which equate to the BPM VS. Z and the BPM VALUES DISPLAY buttons on the BPM MEASUREMENT PANEL. A SELECT RANGE button has also been provided.

History of Orbit RMS Values

October 5, 1990

Author: *Lou Sanchez-Chopitea*
Panel Changes: *Few*

Subsystem: *SLC*
Documents: *No*

User Impact: *Small*
Help File: *No*

History plots are now available for tracking variations in the RMS of the orbits of the production electron and positron beams from the north and south RTLs through the Final Focus regions. The BPM Sampler has been upgraded to include a calculation of the orbit RMS values for selected regions as a part of the normal BPM sampling every 6 minutes. When the BPM data is read and stored in a file for further analysis, the Sampler has the option of computing the RMS of the X and Y readings and storing the RMS values in the database where they can be recorded by the history buffers.

RMS values are stored under the special Linac and Sources Beam database area, primary LSBM and micro VX00. Data for the production electron beam is in unit 1, for positrons in unit 2. Both absolute RMS (secondaries RMSX and RMSY) and RMS with respect to the Gold Reference Orbit (RMDX and RMDY) are computed. Separate values are kept for RTLs, LI02-LI04, LI05-LI10, LI11-LI19, LI20-LI27, LI28-LI30, ARCs, incoming FFs, IP, and outgoing FFs.

A new RMS History Panel, is available off of the Special Display Panel to facilitate access to this data. Special displays have been provided to plot e^+ and e^- X and Y RMS with respect to the Gold Reference Orbit. These plots are 4 to a page for rapid viewing. If needed, a similar panel could provide easy access to the history of absolute RMS.

SLC Orbit Summary Display

October 8, 1990

Author: *Dan Van Dlst*

Subsystem: *SLC*

User Impact: *Large*

Panel Changes: *Few*

Documents: *No*

Help File: *No*

A new summary display has been written to provide Operations with a quick overview of the orbit RMS values throughout the machine. This display is designed for the new Continuously Updating Display monitors being installed at MCC. It may also be brought up on any console from the SLC ORBIT SUMMARY button on the Special Display Panel.

The display has a diagram of the SLC showing color-coded paths of the three SLC bunches: positron (Cyan), production electron (Magenta) and scavenger electron (Yellow). Data for each bunch is also color-coded. Orbit RMS values are shown for the production electron and positron bunches in the RTLs, Linac, ARCs and Final Focus. These are the RMS values with respect to the Gold Reference orbits calculated by the BPM Sampler (see related article in this issue of Index Panel). They are updated every 6 minutes.

Also shown on the display are a few important machine parameters including the currents of the three bunches in the Linac, plus the currents at the IP and estimated Z's per hour. The production electron and positron currents in the Linac are the intensities measured by the North and South RTL feedback loops. The scavenger electron intensity is read from the last toroid before the target, PT01 376. The IP parameters are the same as the data in the familiar Luminosity history summary. They are updated by the deflection scans or by the IP feedback watchdog.

History Plots of Toroid Data

October 7, 1990

Author: *Nan Phinney*

Subsystem: *SLC*

User Impact: *Small*

Panel Changes: *Few*

Documents: *No*

Help File: *No*

A new Toroid History Panel is available from the Special Displays Panel to provide easy access to the History plots of Toroid data throughout the machine. Of particular interest are the Toroid readings throughout the Positron system which monitor the efficiency of positron production.

These toroids are read out by the BPM Sampler as part of the standard data acquisition and the values are stored in the database where they can be put in the history buffers. In the near future, the Sampler will be enhanced to add a calculation of critical toroid yield ratios which will also be available in the history buffers.

Beam Pulse History*October 10, 1990***Author:** *Ralph Johnson***Subsystem:** *SLC***User Impact:** *Some***Panel Changes:** *One***Documents:** *No***Help File:** *None*

A new button, COUNTS SUMMARY PLOT, on the beam pulse accounting panel selects a history plot of the hourly pulse count totals for four areas of SLC: CID e-, NRTL e-, NARC e-, and NFF e+/e-. These counts are all plotted on the same graph to make it apparent where beam losses have occurred.

Invariant Emittance at the IP*October 9, 1990***Author:** *Nan Phinney***Subsystem:** *Final Focus***User Impact:** *Small***Panel Changes:** *None***Documents:** *No***Help File:** *None*

The Emittance calculation at the IP now shows the invariant emittance for easier comparison with Linac emittance measurements. These values are displayed when the CALC WAIST FITS button is pushed. They are also stored in the history buffers and displayed with the WAIST EMIT PLOTS button on the IP History Plots panel.

Note that the old emittance history plots have units of 10^{-10} while the invariant emittance has units of 10^{-5} so users will have to either rescale the Y axis or select a time base which includes only the older calculation if they want to look at details of the old emittance history. With the new scale, all old values will appear to be zero.

Beam Sigma Plotting*October 10, 1990***Author:** *Helen Jarvis***Subsystem:** *SLC***User Impact:** *Small***Panel Changes:** *Few***Documents:** *No***Help File:** *Yes*

A new display from the OPTICS panel provides plots of beam sigmas for a selected region of the machine. On the OPTICS panel off of the MODEL APPLICATIONS panel toggle the

SELECT TWISS PARAM

button to SIGMA and then press the

PLOT TWISS PARAM

button. You will be prompted to enter X and Y

invariant emittances and a value for the energy spread. These values along with the beta and eta functions are used to calculate the beam size or SIGMA (in units of mm). Note that the emittance and energy spread values are assumed to remain constant throughout the selected region.

Improved Button Macros for Rate Changing*October 6, 1990***Author:** *Glenn A. Horton-Smith*
Panel Changes: *Few***Subsystem:** *Accelerator*
Documents: *No***User Impact:** *Small*
Help File: *No*

The six button macros for changing rate and time-slot have been combined and reorganized. The SLC 120 HZ MACRO now undoes the "long term 10 Hertz" modifications as well as establishing the correct beam code patterns. Any MPS rate limits will cause the "short term 10 Hertz" style rate limit, where electrons load the positrons in sector 1. The SLC 10HZ MACROs establish the "long term" mode, where electrons do not load the positrons in sector 1. This mode is preferable whenever 120 pps running is not anticipated in the next five minutes or so.

There are currently two SLC 10HZ MACROs: 10HZ TS1 and 10HZ TS4. They differ only in the time slot they send the beam to the BSY. You can switch from either mode to 120Hz and from 120Hz to either 10Hz mode without any problems. The public BPM definitions are often set to read on only time slot one, so you may not be able to read BPMs if you switch to TS4.

The 10HZ TS4 MACRO is where the SLC 120Hz MACRO used to be, so those who have memorized the Beam Rate Control Panel should be warned.

Rate Limit Status Panel*October 6, 1990***Author:** *Glenn A. Horton-Smith*
Panel Changes: *Few***Subsystem:** *Accelerator*
Documents: *No***User Impact:** *Small*
Help File: *No*

The beam rate throughout the machine may be limited by a number of devices and conditions such as the EP01 PICs, the FARC IN status, the operator rate limit button, and (coming shortly) the sector 30 collimator PICs. The Rate Limit Panel provides information about what is limiting the beam rate. It is available from the Linac Index and from the Beam Rate Control Panel.

The panel indicates the status on each rate limiting input to the MPG. It also has more detailed information about the inner workings of the Linac PLIC module, including the "PPYY RELAY", which stops all beam codes if it is opened. The relay will open if there are too many large PLIC pulses in a row. It can be closed again from this panel.