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SLC Control Program

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FB69 Timeslot Control

May 28, 1992

Author: *Allison, Shoaee, Hendrickson* **Subsystem:** *IP* **User Impact:** *Small*
Panel Changes: *Few* **Documents:** *No* **Help File:** *No*

Fast feedback and beam scan software for collisions at the IP has been upgraded recently to provide independent control of collisions for each timeslot. The fast feedback measures the beam on timeslot 1 and determines the settings for the timeslot 1 dithers. Separate PAU channels are used for the electron dithers for timeslot 4, and the timeslot 4 settings are given a fixed offset from the timeslot 1 values. These fixed offsets are enforced by fast feedback and by beam scan software.

The timeslot offsets are automatically recalculated and implemented by the Auto Beam Collide and by the Fit Beam Position software whenever the **Auto Tslot Update** is toggled **ON** on the Scan Options panel. To measure the timeslot offsets, the beam rate must be 120 Hz and the IP_2BEAM BPM definition must have timeslot ANY selected. A MONITOR beam scan of 80 consecutive pulses is taken and the average deflection angle calculated separately for each timeslot. This is then converted into a timeslot difference in microns. In order to damp out fluctuations, only 10 percent of the calculated change is made to the timeslot corrections for each autocollide.

The following procedure is recommended for checking that the timeslot correction is working properly. On the BPM calibration panel, make sure that the IP2BEAM measurement definition has timeslot ANY selected. On the Scan Options Panel, Enter 1 for the BSCN average option ("NO AVERG"). On the correlation plot display panel, toggle the PLOT MODE to LINE. On the beam scan panel, do a MONITOR SCAN. Look at deflections both X and Y from the correlation plot display panel. The displays should show no noticeable timeslot separation. A button macro CHECK_IP_TS_DIFF has been created to implement this procedure.

History buffer plots of the timeslot corrections are available on the IPBM History Plots panel, as "TSlot Diff Plots". The values shown are the differences in control for timeslot 4 minus timeslot 1, for X and Y in microns. These represent the negative of the measured timeslot separation.

A button has been added to the beam scan options panel to allow disabling or enabling the automatic timeslot update. In addition, another button on the scan options panel shows the currently implemented timeslot corrections for X and Y, and the user may modify these values. This should not be necessary.

In order to accomplish the timeslot control, the dither units have been changed to pulsed channels which are run in pipeline mode on the precursor beam codes 2 and 3. The electron dithers are used to enforce the timeslot difference: XCOR 5101 and YCOR 5091 control timeslot 1, while XCOR 5104 and YCOR 5094 control timeslot 4. The positron beam is controlled on both timeslots by XCOR 5901 and YCOR 5911. The FB69 Magnet panel has been updated to reflect this change, and the previously used dither units (channel 0) have been moved to the Pulsed Dither Control panel.

Due to the separate electron dither timeslot control, doing beam scans using the electron beam on timeslot ANY is not recommended. It is recommended to use the positron beam instead and this has been made the default. It should be noted that electron beam scans on a single timeslot will have a different behavior than previously. During such a scan, the timeslot which is not scanned will remain in collision.

Since the first release of the new feedback software, some problems were encountered with the interaction of beam scans and fast feedback. In particular, beam scans had an incorrect scan range when the initial dither BACT value was non-zero. These problems have been fixed.

In addition, fast feedback has been modified to add measurements of beamstrahlung and luminosity monitor data. This data is provided for control room scope displays.

New Luminosity History Plots

June 3, 1992

Author: *Nan Phinney* **Subsystem:** *FF* **User Impact:** *Small*
Panel Changes: *Many* **Documents:** *No* **Help File:** *Yes*

A number of new history plots have been added for tracking luminosity. They are available on the **LUMM History Plots** panel off of **Special Displays** which replaces the **IPBM History Plots** button. The full complement of IPBM history data may still be selected on **IPBM History Plots** from the **LUMM History Plots** or Final Focus **Beam Tuneup** panels. Since the individual secondary names where the data is stored are not very intuitive, text labels have been added to clarify what is in the display. For user convenience, some other commonly accessed displays such as the Pulse Accounting Summary and LI02 and LI28 Emittance Summaries have also been added to this panel.

The Polarization plot shows the polarization measured by the Compton Polarimeter which is updated from the Compton MicroVax through the SLD Vax to the MCC database. All of the Luminosity counters are maintained by the IP Watchdog which updates approximately once a minute. Note that these counters have been implemented at different times so the total Z count since implementation will be different depending on when the counter started. Only the incremental number of Z's in a given period can be compared. The individual displays are described below.

1. **DEFL Lumm Plots** - This is a four plot display summarizing the electron and positron beam intensities at the IP and the Z rate. The Z rate is calculated using the measured beam sizes from the most recent Auto-Collide and the current beam intensities and rate for Beam code 10. The intensities are derived from the average TMIT value of the incoming two IP BPMs for each beam. The Beam rate used is the current rate reported by the Master Pattern Generator and does not include Single Beam Dumper Rate Limiting. The Normalized Z rate is a measure of the IP spot size. It is the measured Z rate per 10 E10 particles in each beam at 120 Hz.

where INTZ_BSM is the Z count weighted by pulses with BSM over threshold and INTZ_SLC is the unweighted Z count. When both counts are zero, the ratio is zero. This value updates every 6 minutes with the INTZ BSM counter, starting June 10 (prior data has a bug).

9. **SLD POLR Plot** - The SLD Polarization plot records the fractional polarization measured by the Compton Polarimeter. For the present gun and cathode, the polarization is about +/- 0.20 or 20 %. This value is updated with each new measurement, typically every 2 to 5 minutes.

10. **SLD L*P2 Plot** - The Luminosity times Polarization squared plot reflects the "Quality" of the data for the SLD ALR physics measurement. It is updated every six minutes along with the Beam Pulse Accounting integrators using the average luminosity and the average of the measured polarization during that interval. The average polarization calculation is weighted by the measurement error to reduce the sensitivity to bad measurements. If no new polarization measurement is available and beams are colliding, the last measured average polarization value is used. This calculation was implemented on May 31.

11. **Integ L*P2 Plot** - The Integrated Luminosity times Polarization squared counter measures the number of units of effective polarized luminosity delivered for the SLD ALR measurement. The counter updates every six minutes using the L*P2 value calculated as above multiplied by the elapsed time weighted by the fraction of pulses with both beams at the IP. The counter was implemented on May 31 and SLD estimates that about 40 units of L*P2 were accumulated before that date. First ALR physics results will require about 400 integrated L*P2 units on tape for SLD.

Display of Sampled Variables During a Correlation Plots Scan

May 18, 1992

Author: *Greg Sherwin* **Subsystem:** *Correlation Plots* **User Impact:** *Small*
Panel Changes: *Few* **Documents:** *No* **Help File:** *None*

An option to display sampled variables occasionally during a scan has been added to the correlation plots. This option is enabled or disabled through the selection of the $\boxed{\text{DISPLAY SAMPLE VAR.}}$ button on the correlation plots DATA ACQUISITION panels.

To successfully enable the displays, the user is first queried for a display frequency. This frequency is expressed as the number of samples between displays of the sampled variables. The user is presented a default value in square brackets which is updated after each successful entry. Entry of a carriage return selects the default value.

Secondly, the user is queried for the button numbers of the sample variables that the user wishes to display. Up to 10 button numbers may be entered on a single separated by either blanks or commas. The sample variables are uniquely identified by their corresponding button numbers which, if not known, can be obtained by selecting the HELP button followed by the button representing the sample variable of interest. In the resulting display, the three digits following " CRRSV" identify the button number. Default values are also presented to the user in square brackets and are similarly updated after each successful entry.

2. **SLC INTZ Plot** - The SLC Integrated Z count is incremented whenever both beams are present at the IP using the Z rate as calculated above. When the Z count is incremented, a time stamp is stored in IPBM FB69 2 LTIM and this time is used to calculate the elapsed time on the next update. Some logic is included to stop integrating if the measured spot size data is too old.
3. **SLD INTZ Plot** - The SLD Integrated Z count is incremented whenever SLD is SENSITIVE and LOGGING and the machine is in IP_BEAMS mode. The Luminosity is calculated as for SLC integrated Zs. The LOGGING bit has been used since April 19. Note that this counter was first implemented on July 22,1991 so data is not available for the beginning of the SLD Engineering Run.
4. **SLD INTZ CDC ON** - The SLD Integrated Z count with the Central Drift Chamber High Voltage ON is incremented whenever the SLD count is incremented and the CDC HV ON bit is set. This counter was added on May 27, 1992.
5. **SLC INTZ Pulses** - The SLC Integrated Z count weighted by counting pulses with both beams present at the IP uses the Beam Pulse Accounting system which updates counters every six minutes. Between six minute updates, the watchdog maintains a running average of the luminosity using only non-zero values (the zeros should be reflected in the pulse count). When the Pulse Counter time stamp changes, the Z count is incremented by the average luminosity over the time since the last counter update weighted by the fraction of 120 Hz pulses with both beams at the IP. Comparison with the SLC INTZ count shows the fraction of pulses missing due to wire scans or Single Beam dumpers. This counter was implemented in early May but was reset on May 21 and missed data from about May 26 to 27 due to a hardware problem.
6. **SLC Frac Pulses** - The SLC Fraction of Pulses plot shows the most recent calculation of the fraction of luminosity lost due to both beams not being at the IP. It is

   PULSE_FRACTION = (INTZ_SLC - INTZ_PULSES) / INTZ_SLC

   where INTZ_PULSES is the Z count weighted by pulses with both beams at the IP and INTZ_SLC is the unweighted Z count. When both counts are zero, the ratio is zero. This value updates every 6 minutes with the INTZ Pulses counter, starting June 10 (prior data has a bug).
7. **SLC INTZ BSM** - The SLC Integrated Z count weighted by counting pulses with the signal from the South Beamstrahlung monitor over threshold also uses the Beam Pulse Accounting system and the average luminosity between updates as above. Comparison with the SLC INTZ Pulses counter indicates the fraction of luminosity lost due to beam scan optimization or the beams being out of collision. A note of caution: the BSM counter signal is still being commissioned and may be contaminated by backgrounds or by a misadjusted threshold. As with the INTZ Pulses, this counter was reset on May 21 and missed data from May 29 to June 1 due to an unrelated hardware problem. On June 10, the counter was switched from the North BSM signal to the South BSM signal which appears to be more reliable.
8. **SLC Frac BSM** - The SLC Fraction of BSM plot shows the most recent calculation of the fraction of luminosity lost due to the South Beamstrahlung monitor signal being under threshold. It is

   BSM_FRACTION = (INTZ_SLC - INTZ_BSM) / INTZ_SLC

Following a successful enabling of the sampled variable displays, the sample number, a timestamp, the step variables and their values, and the selected sample variables and their values will be displayed at appropriate sample numbers during data acquisition. These displays will occur at sample numbers that are multiples of the display frequency.

To disable the display option, the user again selects the DISPLAY SAMPLE VAR. button.

Status Displays for Feedback Loops in Wrong States

June 3, 1992

Author: *Johnson,Miller,Grossberg* **Subsystem:** *SDS* **User Impact:** *Small*
Panel Changes: *None* **Documents:** *No* **Help File:** *No*

SDS displays have been modified for both slow and fast feedbacks to indicate when loops are in the wrong state. In particular, when a feedback loop is normally running and has been turned off, the SDS display will indicate the problem. For loops with current HSTA states which are less than their "normal" states, the severity is CYAN, and the text is NOTXXXX, where XXXX indicates the normal state. For example, a loop which is intended to be in FEEDBACK, but is currently in COMPUTE, will show a status of NOTFEED. For loops which are part of cascaded fast feedback the status would be NOTCASC.

Note that this NOT NORMAL severity takes precedence over an otherwise YELLOW or GREEN severity. But if the loop has a RED condition then the SDS display shows RED with the associated text. In addition to the SDS displays, this change also affects the Fast Feedback Loop Status and Scavenger Energy displays.

Extra BPM Readout during Beam scans

April 24, 1992

Author: *Nan Phinney* **Subsystem:** *FF* **User Impact:** *Small*
Panel Changes: *One* **Documents:** *No* **Help File:** *No*

The beam scan software has been extended to allow readout of the last four BPMs in each Arc and the Final Focus energy measuring BPMs along with a deflection scan. This is intended for diagnosis of position and energy jitter problems. The extra BPM data is loaded into additional Correlation Plot variables and can be viewed or dumped to a file for offline analysis. The **Toggle Extra BPMacq** button on the **Scan Options Panel** determines whether the Arc and FF BPMs are included in the scan data.

PNET/VETO System Diagnostic

April 15, 1992

Author: *Tony Gromme* **Subsystem:** *SLC* **User Impact:** *Small*
Panel Changes: *Few* **Documents:** *None* **Help File:** *None*

Three buttons have been added to the first-level Network control panel to help in diagnosing any problems with the Klystron VETO communication hardware or the new PNET pattern broadcast hardware. The "PNET display 1 micro" button will prompt for micro name, and then will display one full second's worth of PNET/VETO broadcast information as received by that micro (or sent, in the case of MP00 or MP01). The "PNET read all micros" button will acquire the same data from all on-line micro's simultaneously, and display any differences among the micro's. The "VETO read all micros" button will do the same, comparing VETO data as opposed to PNET data.

Summary Display Device Logging

April 20, 1992

Author: *Ralph Johnson* **Subsystem:** *All* **User Impact:** *Small*
Panel Changes: *One* **Documents:** *No* **Help File:** *No*

When the status of a device on the Summary Displays is changed from acknowledged or deferred to normal (*i.e.* cleared), an informational message is now written to Errorlog. The same also applies to enabling devices which have been disabled by an access routine.