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SLAC's Software Engineering Newsletter

October 26, 1994 **All that Fits is News to Print** Vol. 8, No. 9

Composite Wire Scans

October 25, 1994

Author: *Greg Sherwin* **Subsystem:** *Accelerator* **User Impact:** *Small*
Panel Changes: *Few* **Documents:** *You're looking at it* **Help File:** *None*

Introduction

To improve the dynamic range of wire scans, hardware has been installed and software has been developed to perform composite wire scans. These composite wire scans use data from a high-gain GADC channel (for an improved signal-to-noise level in the sidebands of a wire scan) and a low-gain GADC channel (for reading peak values where the high-gain GADC channel would otherwise be saturated). Both GADC channels read the same scan data but differ by a gain factor. The two sets of data are converted and/or passed through different cuts before finally being merged together for fitting and display. To the user making a scan, these wire scans will appear much like any other. However there are some additional features and considerations to be aware of.

Configuration

Like many other SCP functions, composite wire scans must be configured properly before they can work as designed. The appropriate hardware must be in place, and the wire unit's WIRE:HDSC must have its 200 (hex) bit set. Additional configuration issues are GADC channel and conversion constant selection.

The default GADC channel index for the scan readout (represented in the database as WIRE:GIND, or, sometimes, as WIRE:GOND) is retained in composite scans as the high-gain GADC channel index. An additional low-gain GADC channel index is represented in the database as the new secondary, WIRE:GILO. In the case of composite scans on secondary beams, the low-gain GADC index is stored in the new WIRE:GOLO (complement to WIRE:GOND). Whenever a composite scan wire is also configured for two-beam scans, the composite scan software works in parallel with the two-beam scan software. Therefore high- and low-gain GADCs must be selected for both the primary and secondary beams.

As before, GADC readout devices can be viewed, set, and saved to the database through use of the relevant buttons supported on the **Scan Options Panel**. To support composite wire scans, the software supporting these buttons has been modified to additionally query for high-gain or low-gain GADC channel readout indices if they apply to the wire in question.

Once a wire unit is selected on the wire panel, on the **Scan Options Panel** you will notice new buttons titled [LoGain GADC Scalar] and [LoGain GADC Cutoff]. Floating-point numbers displayed at the bottom of these buttons indicate what is currently set for the selected wire unit. A string of asteriks ("******") will appear if no wire is currently selected or if the selected wire is not configured for composite scans. If the selected unit is also configured for two-beam scans, the default values displayed will be for the primary beam. If a value is altered by selecting the respective button and entering a value, the values displayed will reflect those just entered whether they are for the primary or secondary beam.

If you select either button to enter a value and the currently selected wire is configured for two-beam scans, you will first be asked if you wish to change the value for the primary or secondary beam (i.e., for the primary beam or secondary beam set of GADCs). Once you enter "P" or "S", the software will present you with the current value which you can then overwrite. Overwriting the value automatically updates it in the database. The new database secondaries used are WIRE:LCUT for the cutoff and WIRE:LMUL for the scalar multiplier.

The low-gain GADC scalar is the value that the low-gain GADC data will be multiplied by before merging with the high-gain GADC data. If a value of zero or less is entered, following each scan the software will determine an appropriate multiplication factor to use from the data itself. After the low-gain GADC data is multiplied by this scalar, it is then checked against the low-gain GADC data cutoff, or threshold, which can be set through the selection of its respective button. As with the scalar multiplier, an entered value of zero or less will result in the software determining an appropriate value to use by examining the data. Any low-gain GADC data point which does not exceed this cutoff will be set to a bad status and will not be included in the fit.

Making A Composite Scan

Once properly configured, the user can perform a wire scan from the panel or from correlation plots as usual. Following a scan, the software groups the data from the separate GADC channels and prepares them for merging and fitting. Since saturated GADC data is neither represented uniformly nor identified by hardware status, the high-gain GADC channel data passes as many as three separate checks for saturated points using three separate algorithms. Although these algorithms have been tuned to detect nearly all saturated points, a rare saturated point may pass through. Some GADC channels may be more susceptible to this than others, and if it ever becomes an issue the algorithms can be refined by modifying one of several hard-coded parameters in the software.

The final goal of the composite scan is to have low-gain GADC data for the peak of the scan, high-gain GADC data for the sidebands, and a small amount of overlap between the two sets of data that, together, will be suitable for fitting.

Once a scan is made, be it a single scan or a scan as part of an emittance or skew measurement, the resulting scan data will be deposited into correlation plots. For single scans from the wire panels, the normal, single-GADC-channel-sized arrays of data points remain in their usual locations on the correlation plots displays. However the merged data (i.e., both position data and GADC data) are deposited at correlation plots button locations 49-56. The button labels are defined as follows:

Button#	*Label*	*Contents*
49	tPOScE-X	merged position from step counts (like "TPOS E-X")
50	ctUNFILT	unfiltered merged position from step counts (like "TUNFILTR")
51	c NOJITR	merged raw wire positions (like "NOJITRCR")
52	ctNOJITR	merged raw positions from wire position transducer (like "T NOJITR")
53	COMPE-_N	normalized merged e- (primary) beam data
54	COMPE-_R	raw merged e- (primary) beam data (or "COMPE-_F" if fake data)
55	COMPE+_N	normalized merged e+ (secondary) beam data
56	COMPE+_R	raw merged e+ (secondary) beam data (or "COMPE+_F" if fake data)

These button locations are normally used for BPM data, but only if there are seven or more BPMs included on the wire scan. If so, data from the seventh and latter BPMs are bumped up to the next block (button numbers 61-80 and greater) of correlation plots display buttons. Furthermore, for emittance and skew measurements the merged GADC data is deposited in correlation plot display buttons named "COMPOS_N" or "COMPOS_R" (for normalized or raw data).

An additional feature is that the vertical dimension (i.e., GADC counts) of the default plots for composite wire scans is in log-scale. Additional information on the new log-scaling feature of correlation plots is presented in an article below. Fake data and the $\boxed{\text{DISPLY LATEST SCAN}}$ functionality are also supported for the merged composite wire scan data.

Summary

Composite wire scan support now exists in the SCP. Once configured, scans made with wires configured for these composite scans should perform no differently than regular, single-GADC wire scans. Correlation plots displays for all data, wire position transducers, two-beam scans, latest scan displays, vertical log-scale plots, and asymmetric and gaussian fits are all supported for composite wire scans. The merged data from these scans is dynamically allocated and encapsulated in a file to have a minimum impact on SCP memory constraints.

Correlation Plots Log Scales

October 26, 1994

Author: *Greg White/Greg Sherwin* **Subsystem:** *SCP* **User Impact:** *Small*
Panel Changes: *Few* **Documents:** *No* **Help File:** *Yes*

A new button has been added to Correlation Plots display panels, $\boxed{\text{PLOT SCALE}}$, which can be used to select either "linear" or "log" scaling of the Y axis in plots.

BPM CAL display change

October 6, 1994

Author: *Alan Cheilek* **Subsystem:** *BPM* **User Impact:** *Small*
Panel Changes: *None* **Documents:** *No* **Help File:** *Yes*

A new error is being flagged on the BPM CALIBRATION Panel. This error, BADGVR, often indicates impending problems with the Acopian power supply associated with the BPMP, and only applies to ARC and Interaction Point BPMPs. The displays generated by [CAL DISPLAY] and [BAD CAL DISPLAY] will show the affected BPMPs in yellow, with a BADGVR label, but they will still carry a GOOD status and will still be used. There is also a separate line in the Summary Display which counts BADGVR BPMPs.

Fast Feedback Gain Factor

October 6, 1994

Author: *Joan Paz* **Subsystem:** *SLC* **User Impact:** *Small*
Panel Changes: *Few* **Documents:** *No* **Help File:** *None*

There's a new Fast Feedback Loop history plot, 'Gain Factor Plot'. To access it,

press the [FEEDBK SYSTEM INDEX] button from the main index panel,

select a feedback loop, press [STATE PANEL], then [FFBK HIST PANEL].

The "Gain Factor Plot" shows the gain factor data versus time for the selected feedback loop.

Fast Feedback Veto Disabling

October 7, 1994

Author: *Linda Hendrickson* **Subsystem:** *FBCK* **User Impact:** *Small*
Panel Changes: *None* **Documents:** *This is it* **Help File:** *None*

In response to operational concerns, the fast feedback system has been modified to allow disabling of VETO. Previously, when BPM measurements were VETOed, fast feedback would have bad measurements and be nonfunctional, even if the global VETO system was disabled. With the new software, when a feedback loop is COLD started, if the global veto is not enabled from the VETO panel, it is disabled for fast feedback also.

Please note that when the global veto toggle is changed, you need to cold start any loops for which the veto mode is important.

New PT01 Feedback

October 2, 1994

Author: *Chestnut/Grossberg* **Subsystem:** *Feedback* **User Impact:** *Small*
Panel Changes: *Few* **Documents:** *No* **Help File:** *Yes*

A new special purpose LINAC fast feedback loop, PT01FBCK, has been defined to compensate for steering effects caused by the rotation of the positron target. It is intended to fix a long-standing 2 Hz oscillation. This is really a feed-forward type of loop, since the measurement is not affected by the actuator setting.

The loop consists of one measurement, one state, and, at least for the time being, one actuator. The single measurement is the rotation position of the positron target, i.e., the gear tooth number. The current actuator used is EP02 XCOR 512. In the future, one or more actuators may be used from either EP01 or EP02.

Each time feedback receives a new measurement of the rotation position, the actuator is moved according to the following expression:

```
actuator setting = GAIN * AMPLITUDE * VALUE[tooth number + PHASE OFFSET]
```

where

GAIN is the loop gain enterable from the main Fast Feedback Panel.

AMPLITUDE and PHASE OFFSET are scalar values entered from the PT01 Positron Target Parameters Panel.

VALUES is an array with data for each positron target tooth. These values are also entered from the PT01 Positron Target Parameters Panel.

The first guess at the VALUE as a function of tooth number is a sine function. It is anticipated that optimal values for all parameters will be determined during commissioning of this loop.

The PT01 Positron Target Parameters Panel is reachable from the main Fast Feedback Panel via the FBCK Magnet Index Panel.