NLCTA Transverse "Fast" Feedback User Guide

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First draft

Introduction

The purpose of the Fast Feedback is to automate control of the NLCTA transverse beam angle, position and energy dispersion. The Fast Feedback application encompasses EDM, EPICS, Matlab, AIDA and the labCA package and is based on code originally written by Diane Fairley for LCLS. Differences between the NLCTA and LCLS versions are largely due to the necessity of acquiring SCP data via AIDA calls for the NLCTA installation, while the LCLS version has hooks only for EPICS. The feedback application can be entered via EDM or directly from Matlab. The EDM code runs only on RHEL4, while the Matlab runs on RHEL5 as well, and possibly on Windows (untested) as well.

Opening the Feedback Application

Most users will want to initiate feedback control by opening the main EDM window (see Illustration 1). To do so:

a. Log-in to an RHEL 4 host. Any RHEL 4 host on any slac.stanford.edu subnet should work.

b. Make sure that you have a java.opts file in your current working directory. AIDA needs this.

c. From either bash or csh, execute

/afs/slac/g/testfac/rhel4/epics/R3.14.8.2-lcls2/iocTop/NLCTAff/prod/fbckNlctaApp/srcDisplay/startNLCTAffDisplay

You may not wish to type this command frequently, in which case you can put

alias startNLCTAffDisplay=/afs/slac/g/testfac/rhel4/epics/R3.14.8.2-lcls2/iocTop/NLCTAff/prod/fbckNlctaApp/srcDisplay/startNLCTAffDisplay

(all on one line) in your .bashrc file, or

alias startNLCTAffDisplay /afs/slac/g/testfac/rhel4/epics/R3.14.8.2-

lcls2/iocTop/NLCTAff/prod/fbckNlctaApp/srcDisplay/startNLCTAffDisplay

(all on one line) in your .cshrc or .tcshrc file.

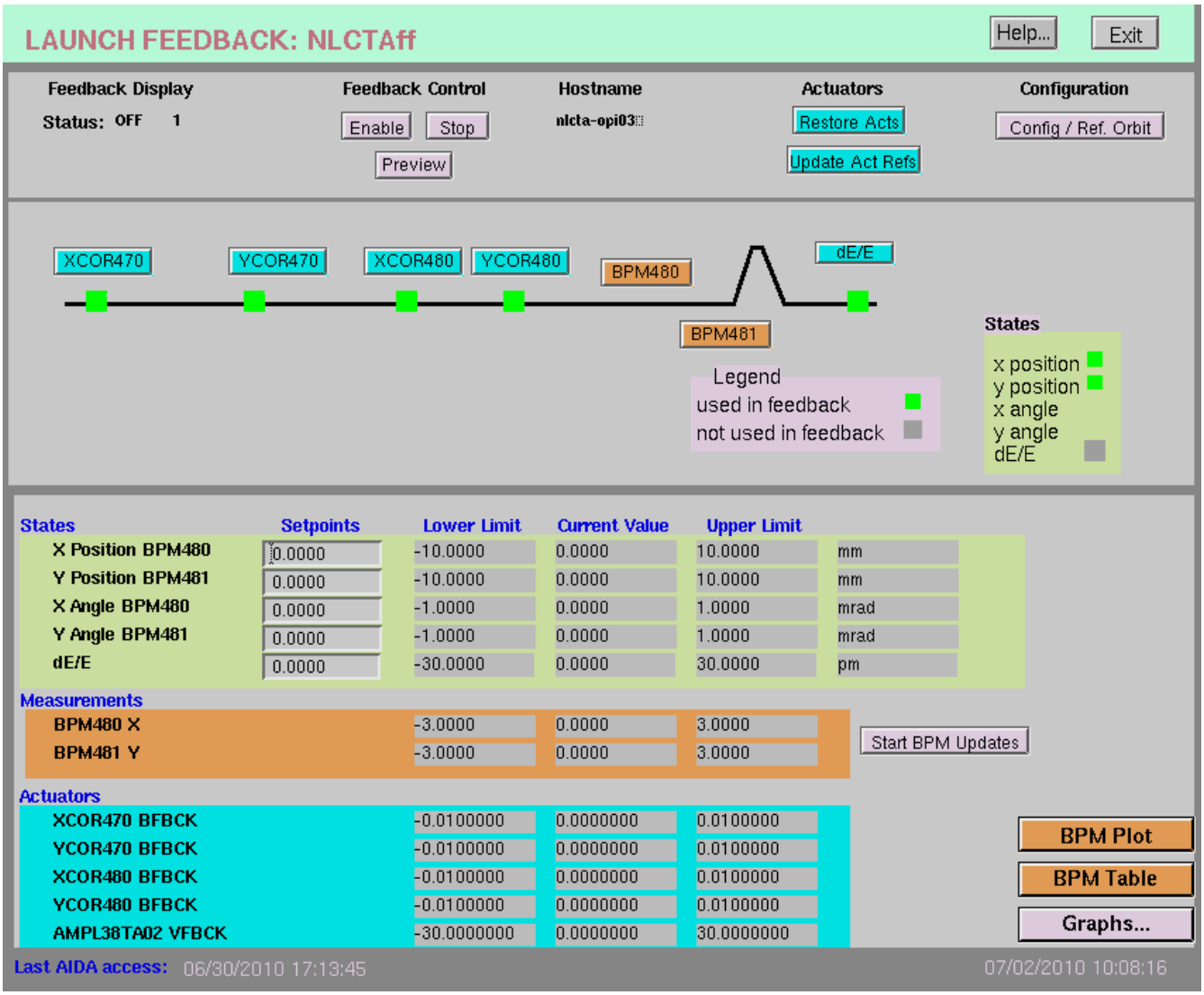


Illustration 1: The main EDM screen, used to configure, initiate and control the feedback. The layout of the display has been changed to accomodate more actuators, as shown in Illustration 3.

The EDM screen shown in Illustration 1 should appear.

Configuring the Feedback

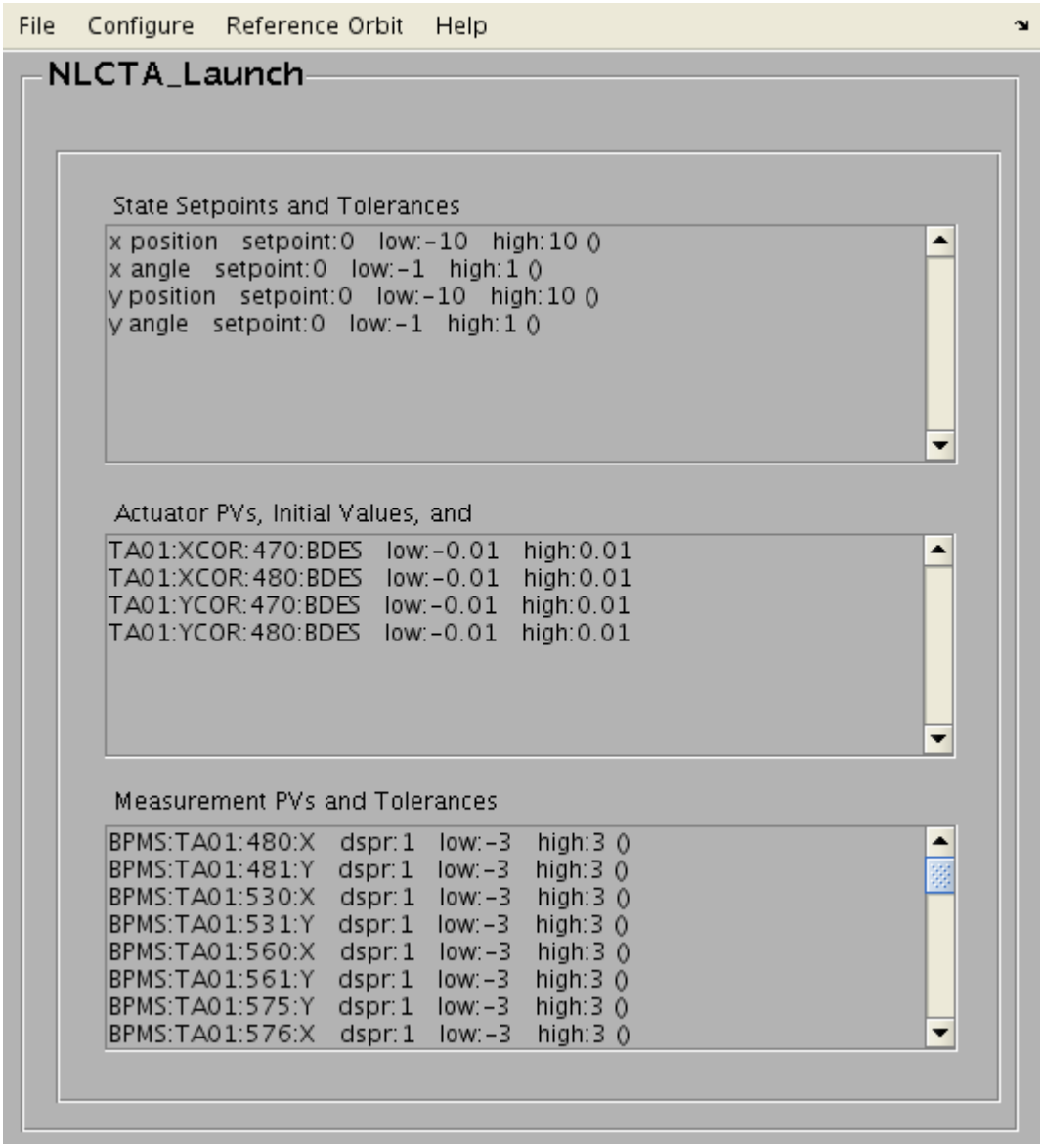


Illustration 2: The Configuration Window opened by clicking the pink "Config/Ref. Orbit" button in the upper right-hand corner of the main screen shown in Illustration 1. Use the menus at the top to modify the selections.

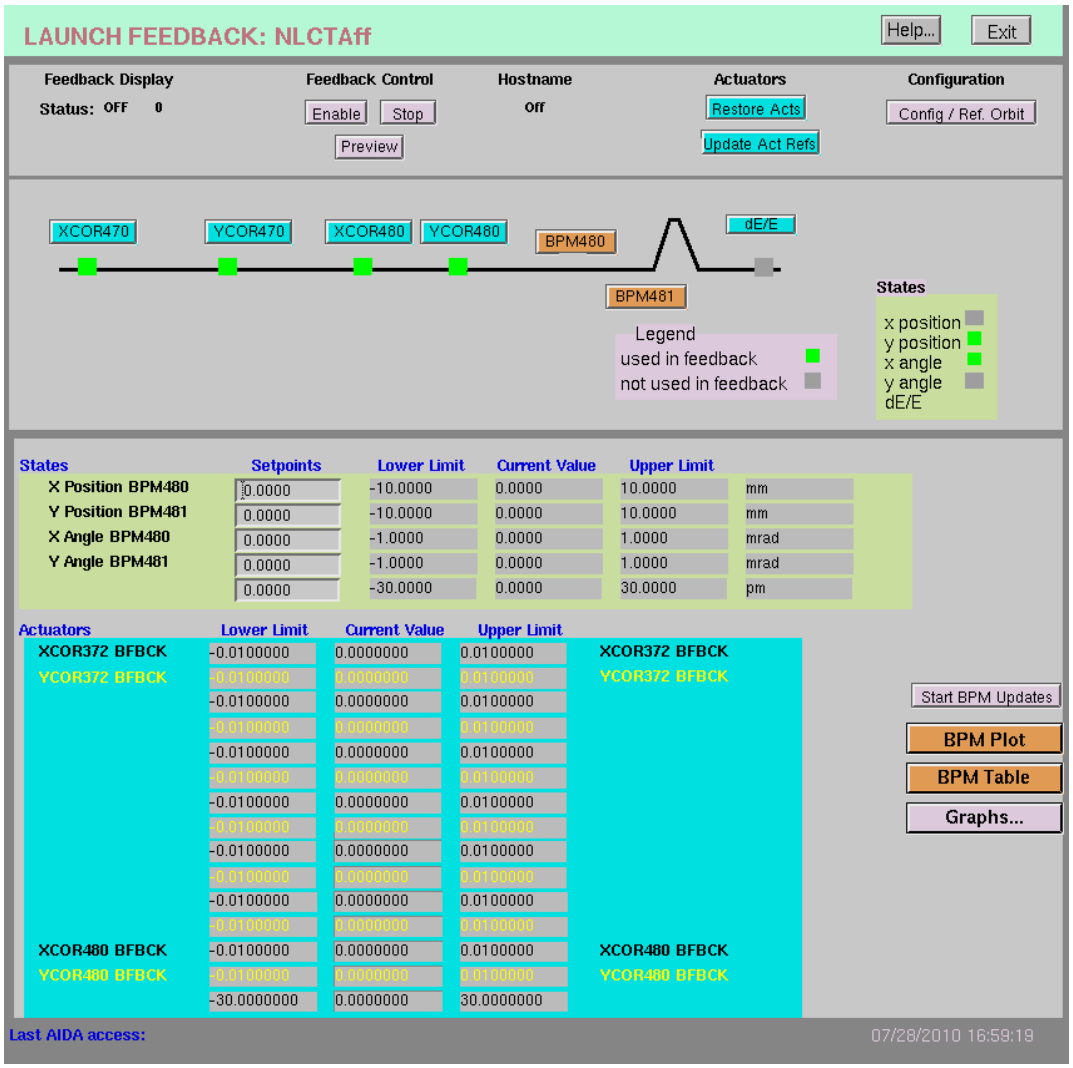


Illustration 3: When PVs are unselected using the menu shown in Illustration 2, their labels (but not their values) disappear from the main EDM display window, as shown in Illustration 3.

The default configuration of the Feedback is set by the file /nfs/slac/g/testfac/esb/NLCTAff/Feedback/config.xml . Saving multiple configuration files to allow a

choice of operation modes at start-up is possible and allows users to preserve sets of BPMs, actuators and gains.

The actual run-time configuration is changeable via menus accessible by clicking the pink “Config/Ref. Orbit” button in the upper right-hand corner of the main EDM screen. The main configuration window, which is displayed in Illustration 2, shows the current choices for State Setpoints and Tolerances, Actuator PVs, and Measurement PVs and Tolerances. From this window's pull-down menus, users can access further GUIs that permit changes to the settings, as exemplified by Illustration 4.

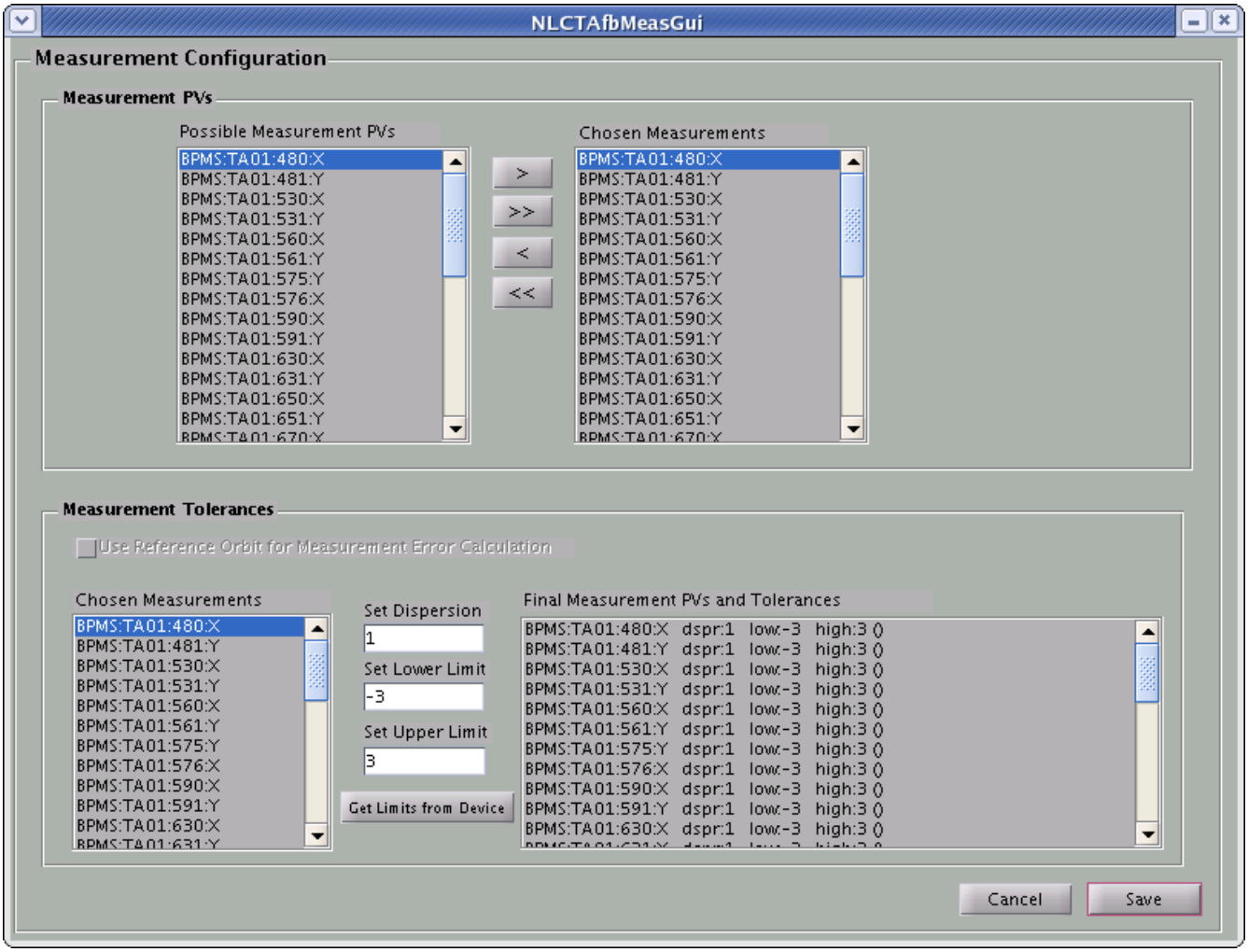


Illustration 4: Measurement selector for feedback loop. Choices here do not affect the plot or table display, nor do they modify the config.xml file. The GUI is accessible from the pull-down menu of the main configuration window shown in Illustration 2. Similar GUIs allow changes to the Actuator, State, Gain and Timer settings.

Running the Feedback

Once the Feedback has been configured, operators can start the automatic control by clicking the pink

“Enable” button in the top center of the main EDM screen. The feedback can be tuned by changing the selection of actuators, BPMS, or control states, or by modifying the gains on the State GUI page or Timer parameters on the Timer GUI page. All the control GUIs are accessible from the configuration GUI (see Illustration 2).

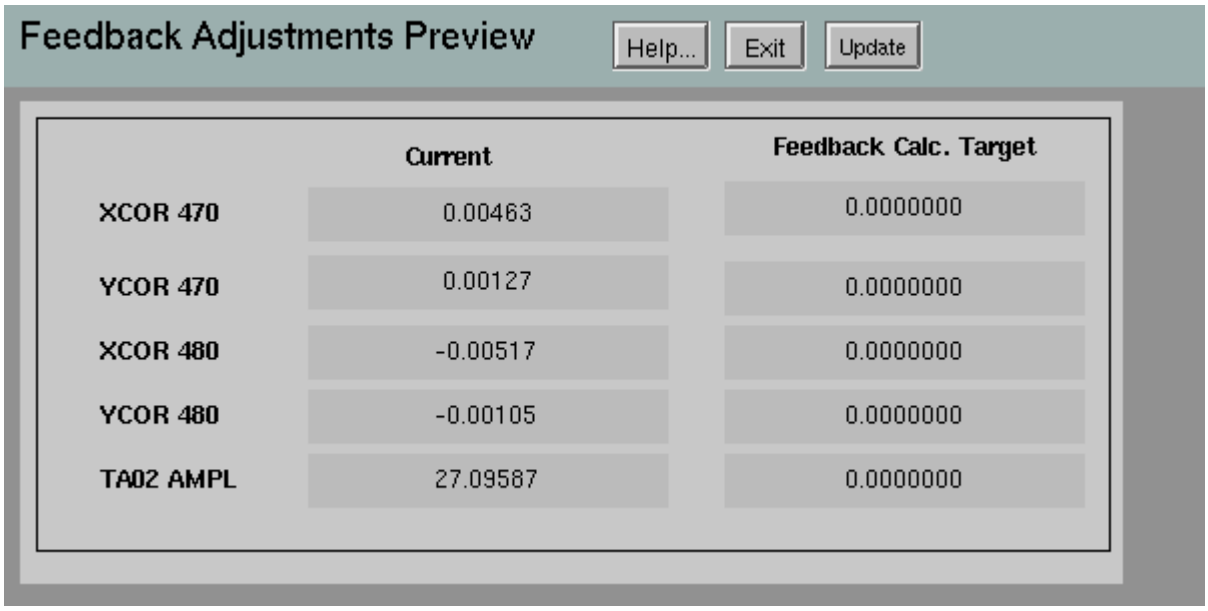


Illustration 5: The values that enablement of the Feedback control will send the actuators to can be previewed via a GUI that can be opened by pressing the pink "Preview" button near the "Enable" button near the top center of the main EDM screen.

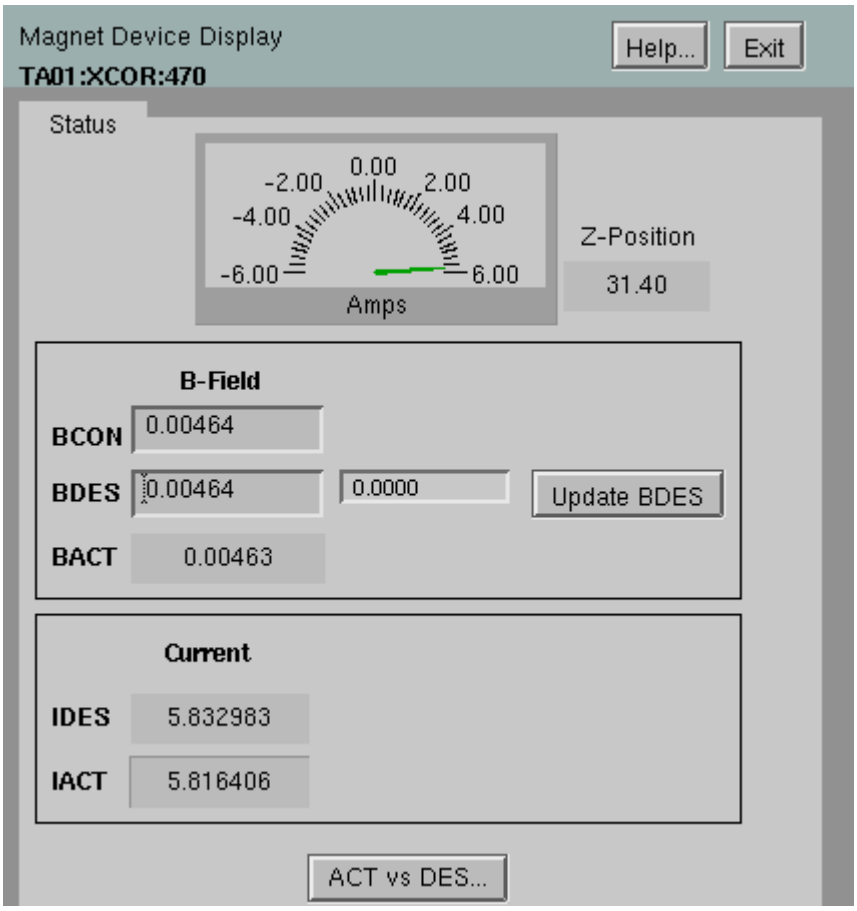


Illustration 6: Manual magnet control screen opened by clicking on the teal squares of the main diagram shown in Illustration 1.

Manual Control of Magnets

Opening these screens allows manual setting of magnetic fields.

BPM Status Displays

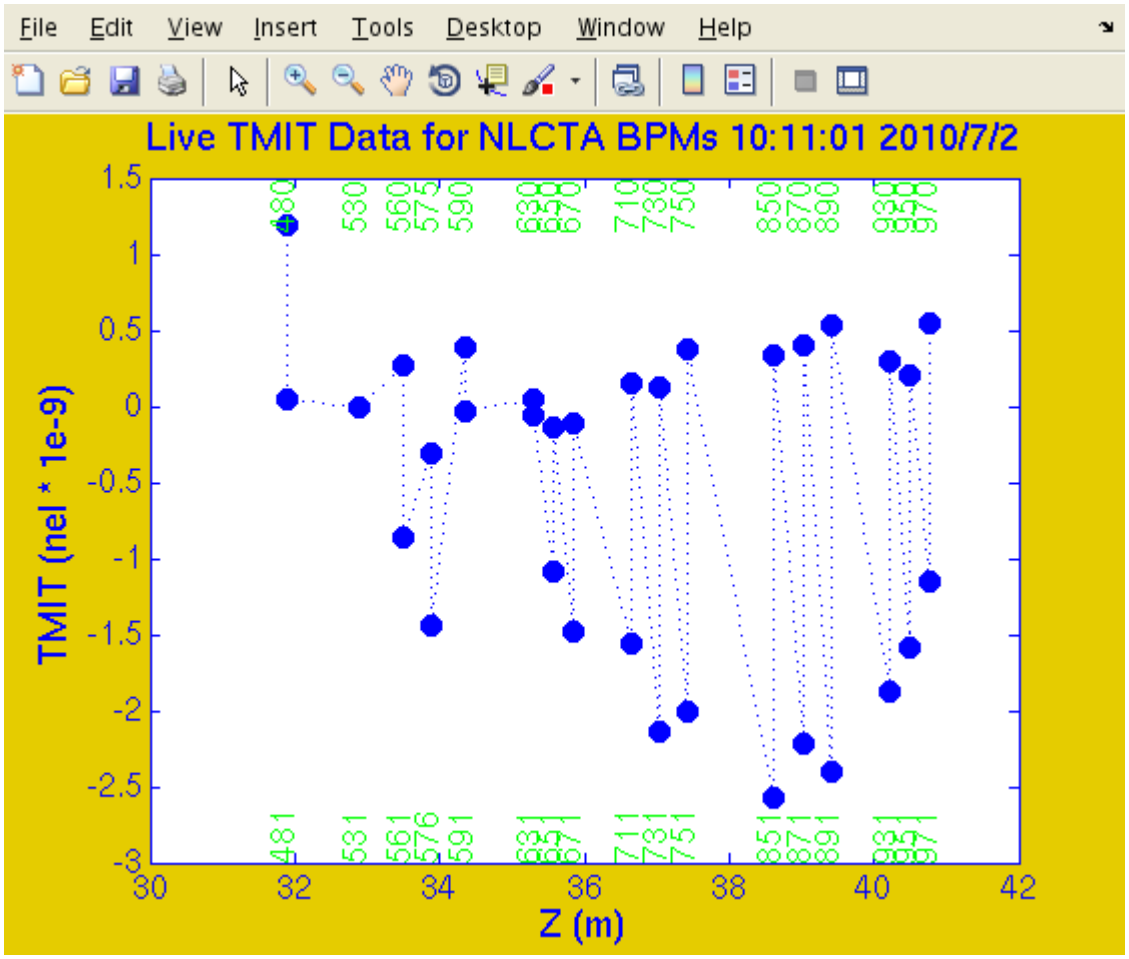
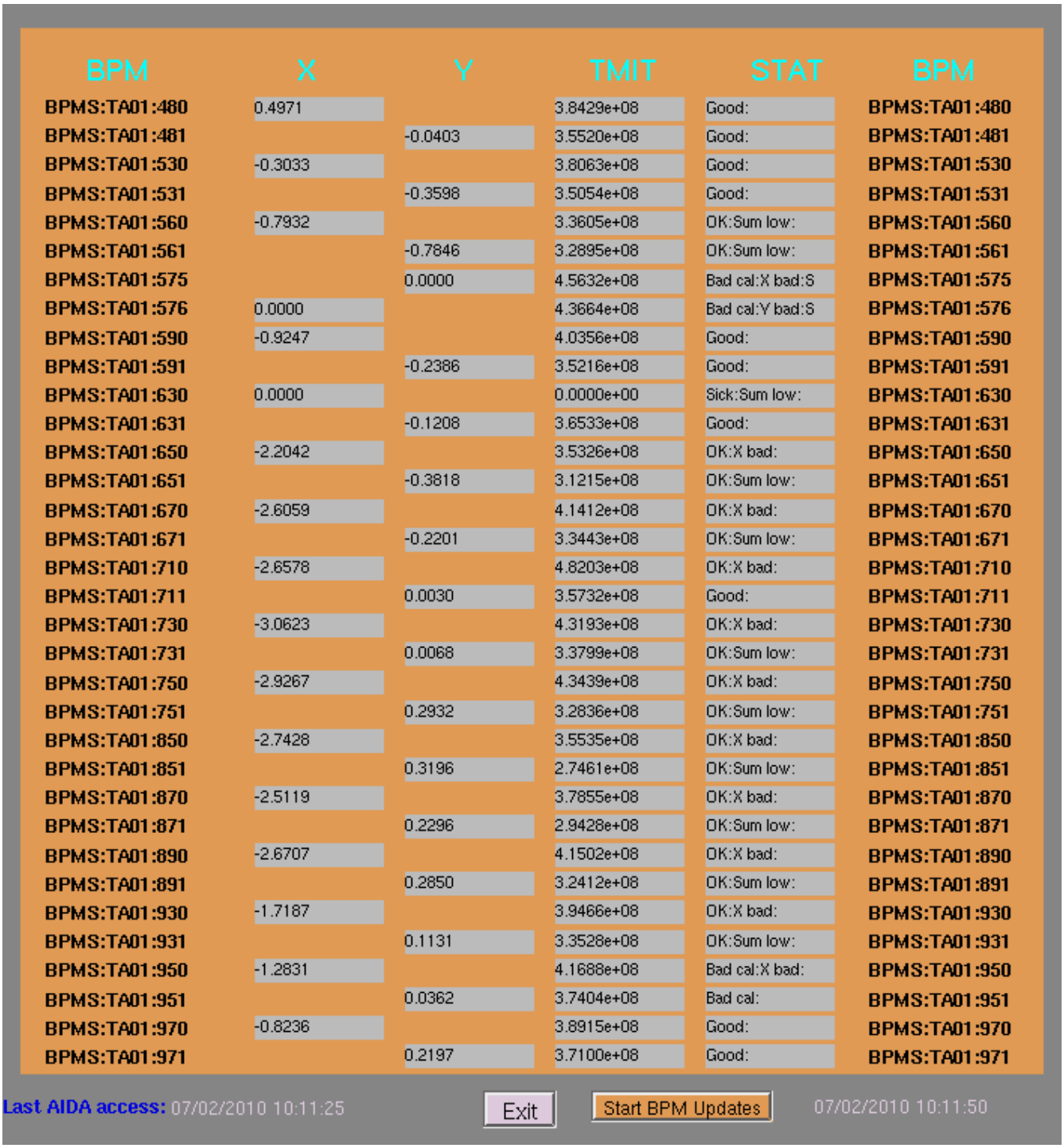


Illustration 7: TMIT data plot opened by clicking the orange "BPM plot" button on the lower right-hand corner of the main display shown in Illustration 1.



BPM	X	Y	TMIT	STAT	BPM
BPMS:TA01:480	0.4971		3.8429e+08	Good:	BPMS:TA01:480
BPMS:TA01:481		-0.0403	3.5520e+08	Good:	BPMS:TA01:481
BPMS:TA01:530	-0.3033		3.8063e+08	Good:	BPMS:TA01:530
BPMS:TA01:531		-0.3598	3.5054e+08	Good:	BPMS:TA01:531
BPMS:TA01:560	-0.7932		3.3605e+08	OK:Sum low:	BPMS:TA01:560
BPMS:TA01:561		-0.7846	3.2895e+08	OK:Sum low:	BPMS:TA01:561
BPMS:TA01:575		0.0000	4.5632e+08	Bad cal:X bad:S	BPMS:TA01:575
BPMS:TA01:576	0.0000		4.3664e+08	Bad cal:Y bad:S	BPMS:TA01:576
BPMS:TA01:590	-0.9247		4.0356e+08	Good:	BPMS:TA01:590
BPMS:TA01:591		-0.2386	3.5216e+08	Good:	BPMS:TA01:591
BPMS:TA01:630	0.0000		0.0000e+00	Sick:Sum low:	BPMS:TA01:630
BPMS:TA01:631		-0.1208	3.6533e+08	Good:	BPMS:TA01:631
BPMS:TA01:650	-2.2042		3.5326e+08	OK:X bad:	BPMS:TA01:650
BPMS:TA01:651		-0.3818	3.1215e+08	OK:Sum low:	BPMS:TA01:651
BPMS:TA01:670	-2.6059		4.1412e+08	OK:X bad:	BPMS:TA01:670
BPMS:TA01:671		-0.2201	3.3443e+08	OK:Sum low:	BPMS:TA01:671
BPMS:TA01:710	-2.6578		4.8203e+08	OK:X bad:	BPMS:TA01:710
BPMS:TA01:711		0.0030	3.5732e+08	Good:	BPMS:TA01:711
BPMS:TA01:730	-3.0623		4.3193e+08	OK:X bad:	BPMS:TA01:730
BPMS:TA01:731		0.0068	3.3799e+08	OK:Sum low:	BPMS:TA01:731
BPMS:TA01:750	-2.9267		4.3439e+08	OK:X bad:	BPMS:TA01:750
BPMS:TA01:751		0.2932	3.2836e+08	OK:Sum low:	BPMS:TA01:751
BPMS:TA01:850	-2.7428		3.5535e+08	OK:X bad:	BPMS:TA01:850
BPMS:TA01:851		0.3196	2.7461e+08	OK:Sum low:	BPMS:TA01:851
BPMS:TA01:870	-2.5119		3.7855e+08	OK:X bad:	BPMS:TA01:870
BPMS:TA01:871		0.2296	2.9428e+08	OK:Sum low:	BPMS:TA01:871
BPMS:TA01:890	-2.6707		4.1502e+08	OK:X bad:	BPMS:TA01:890
BPMS:TA01:891		0.2850	3.2412e+08	OK:Sum low:	BPMS:TA01:891
BPMS:TA01:930	-1.7187		3.9466e+08	OK:X bad:	BPMS:TA01:930
BPMS:TA01:931		0.1131	3.3528e+08	OK:Sum low:	BPMS:TA01:931
BPMS:TA01:950	-1.2831		4.1688e+08	Bad cal:X bad:	BPMS:TA01:950
BPMS:TA01:951		0.0362	3.7404e+08	Bad cal:	BPMS:TA01:951
BPMS:TA01:970	-0.8236		3.8915e+08	Good:	BPMS:TA01:970
BPMS:TA01:971		0.2197	3.7100e+08	Good:	BPMS:TA01:971

Illustration 8: Tabular display of BPM data opened by clicking the orange "BPM Table" button on the lower right-hand side of the main screen shown in Illustration 1.

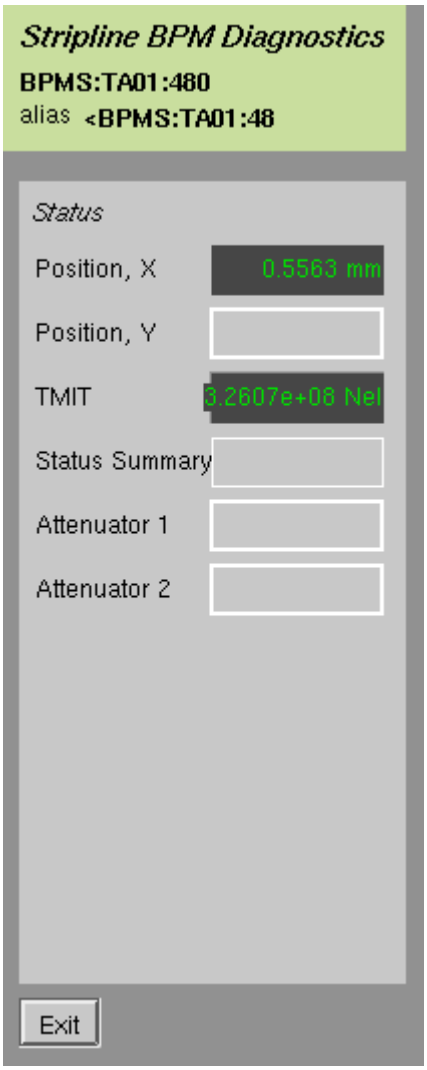


Illustration 9: Those operators who find the table or z-plot overwhelming can view information about just their favorite BPM by clicking the orange individual-BPM buttons on the central part of the main screen shown in Illustration 1.

View System Status from Matlab rather than EDM

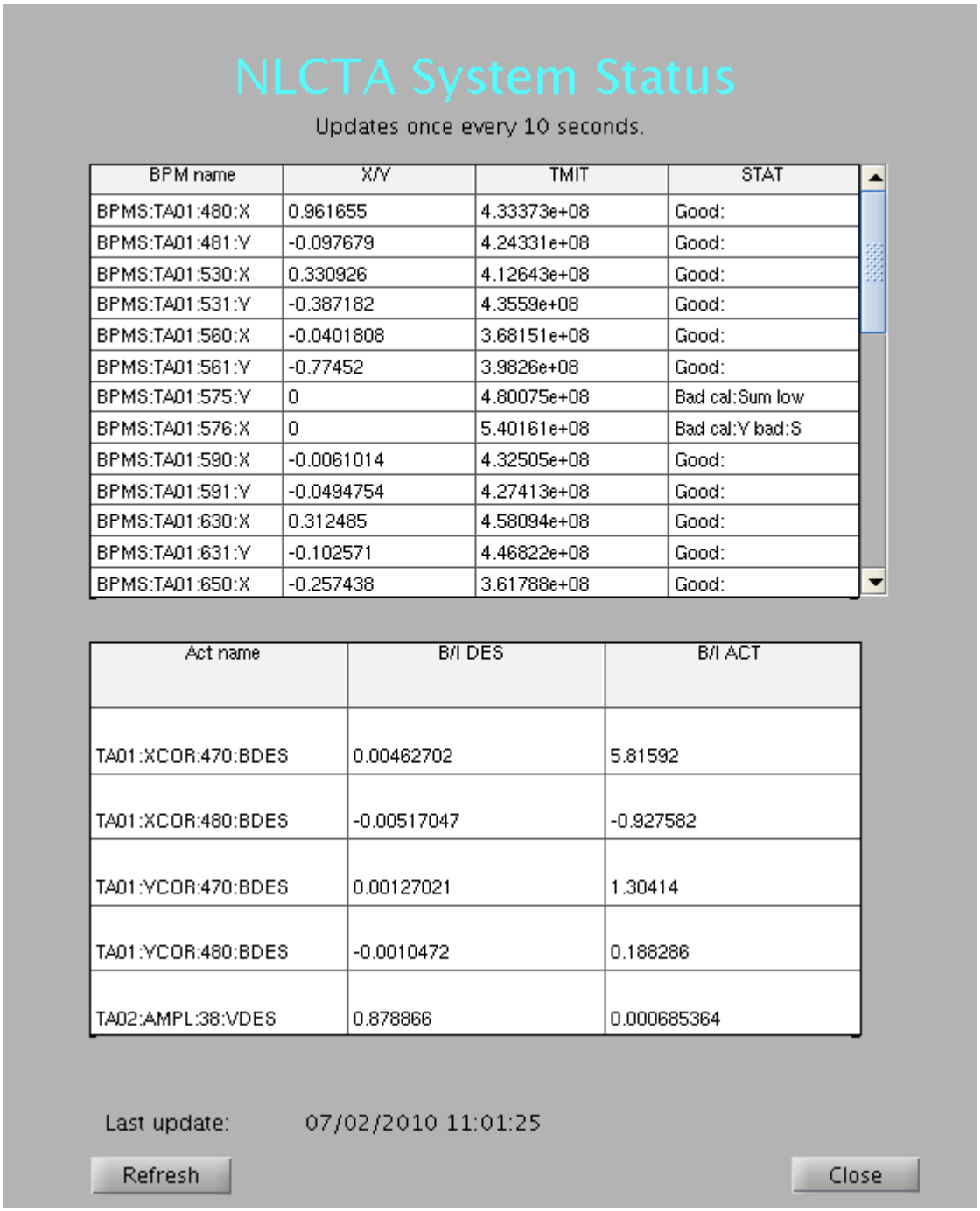


Illustration 10: A live, updating status display is available from Matlab via (one line) /afs/slac/g/testfac/rhel4/epics/R3.14.8.2-lcls2/iocTop/NLCTAff/test/NLCTAff_matlab/NLCTASystemStatusGui.m

Performance Limitations

The “soft IOC” sioc-esb-fb00 running on the host ilc-esb11 serves the calculated and derived PV values. SCP values are derived via AIDA calls to host MCC-LAVC. By far the slowest part of the control are the AIDA calls that read the magnets. The delay that is unavoidably inserted in the control loop by AIDA may limit the utility of the Feedback.

Running Feedback from Matlab

The guts of the Feedback are all written in Matlab. The Feedback can thus be run and controlled from Windows or RHEL5 by direct Matlab calls. I'll be happy to demonstrate to anyone who's interested how to use the Matlab scripts directly. Using Matlab's compiler to create EXE files for Windows is possible.

Known Bugs and Missing Features

1. The green-squares “used in feedback” feature of the main panel doesn't work properly.
2. There is no easy way to close the BPM plot on RHEL4, as clicking the “x” in the upper right-hand corner doesn't force a close. Instead, you must close the xterm that is opened along with the plot.
3. Every Matlab window that reads BPM values is running its own timer. Opening enough Matlab windows of this kind could load the system.
4. The individual BPM display needs to be improved or perhaps eliminated.
5. The system diagram on the main EDM window is completely meaningless. Image contributions or just suggestions are hereby solicited.
6. I haven't yet created manual control screens for all the corrector magnets (312-470).
7. The BPM values don't update unless the operator starts a timer.
8. Stephen requested that I bring the gain settings out to the main EDM screen.
9. I haven't put the text in the Matlab source files to take advantage of Matlab's help facility.

Acknowledgements

The NLCTA Feedback code is derived from Diane Fairley's program with advice and contributions from Mark Woodley, Stephen Weathersby, Janice Nelson and Doug McCormick. Kay Ganapathi and Nick Arias made the development possible by wrestling Mathworks' uncooperative license-dispensers and Zen Szalata answered many questions about EPICS.