

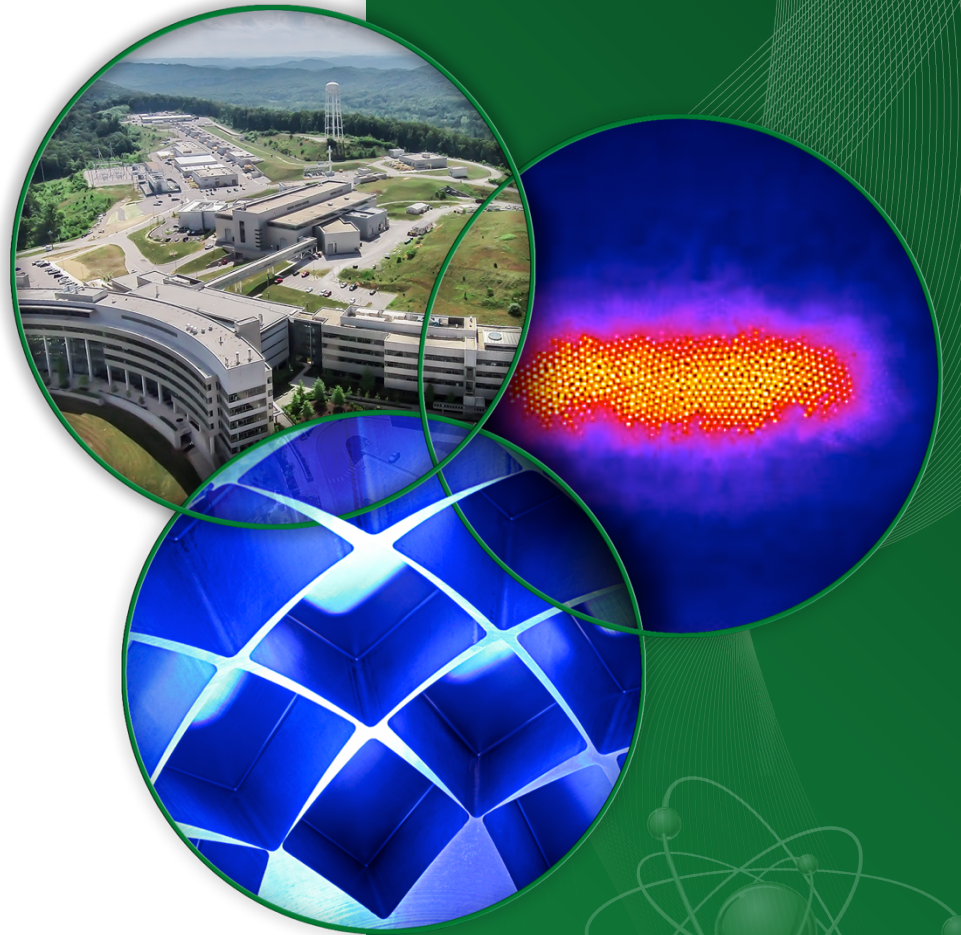
# SNS High Level Control Room and Physics Applications

Thomas Pelaia II, Ph.D.

ORNL

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# Control Room Software

<i>Software</i>	<i>Description</i>	<i>Examples</i>
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<i>Control System Studio (CSS)</i>	<i>Control System, EPICS PV Display and Control</i>	<i>Strip tool, PV plots, PV sliders, PV fields, archiving</i>

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# High Level Accelerator Physics Applications

**Open XAL** provides control room high level physics applications and services

# Open XAL

- Accelerator Physics Software Platform
- Open Source International Collaboration
- Applications, scripts and services
- Many packages
  - Online Model and Simulation
  - Application Framework and GUI building
  - EPICS Channel Access support
  - Math and Statistics
  - GUI components
  - Database connection



# Open XAL System Requirements

- Building
  - Java 8 JDK
  - Git 1.7.5
  - Ant 1.9
- Running
  - Java 8 Runtime
  - JRuby and Jython for scripts

# Open XAL Advantages over XAL

- Open Source International Collaboration
- Site specific extensions
- Simple, zero configuration build and launch
- All compiler warnings fixed
- Many bug fixes

# Open XAL Applications and Services

- Support for commissioning and operations
- Several Types
  - Accelerator Physics Analysis
  - Machine Measurement and Tuning
  - Utility
  - Controls and Diagnostics
- **Contributions from multiple physicists**

# Sampling of Applications

<b><i>Application</i></b>	<b><i>Description</i></b>
<b><i>Energy Manager</i></b>	<b><i>Energy change support</i></b>
<b><i>Energy Meter</i></b>	<b><i>Measure beam energy in linac</i></b>
<b><i>Knobs</i></b>	<b><i>Change multiple PVs in specific ratios</i></b>
<b><i>Launcher</i></b>	<b><i>Launch applications</i></b>
<b><i>Linac Tuning</i></b>	<b><i>Determine RF cavity phases</i></b>
<b><i>Loss Viewer</i></b>	<b><i>Display beam loss</i></b>
<b><i>Machine Simulator</i></b>	<b><i>Perform what-if scenarios</i></b>
<b><i>My Tuner Viewer</i></b>	<b><i>Change individual PVs</i></b>
<b><i>Orbit Correction</i></b>	<b><i>Measure and Correct beam orbit</i></b>
<b><i>Profile Tools and Analysis</i></b>	<b><i>Measure and analyze wire scans</i></b>
<b><i>Ring BPM Viewer</i></b>	<b><i>Measure and analyze BPM signals</i></b>
<b><i>Ring Injection</i></b>	<b><i>Measure and control ring injection coordinates</i></b>
<b><i>RTBT Wizard</i></b>	<b><i>Measure and analyze beam profile in RTBT</i></b>
<b><i>SCAN 1D/2D</i></b>	<b><i>Perform 1D and 2D scans over PVs</i></b>
<b><i>Save Compare Restore</i></b>	<b><i>Save, Compare and Restore machine state</i></b>
<b><i>Virtual Accelerator</i></b>	<b><i>Simulate a live machine and serve up PVs</i></b>

# Services

<i>Service</i>	<i>Description</i>
<i>Errant Beam Capture</i>	<i>Monitor and Log machine state due to certain trips</i>
<i>First Faults</i>	<i>Monitor and log machine protection system faults clustering them by time stamp and determining the first fault</i>
<i>PV Logger</i>	<i>Log groups of channel access process variables both on demand and periodically</i>
<i>Trip Monitor</i>	<i>Monitor and Log RF Trips</i>

# Energy Manager

- *Purpose*
  - Compensate for RF Cavity reduced field
- *Features*
  - ✓ Evaluation of machine functions with trial magnet fields and RF phases and amplitudes
  - ✓ Plots comparison of trial versus base machine functions
  - ✓ Optimize machine parameters to account for loss of RF cavities or reduced RF cavity performance
  - ✓ Compute and apply magnet field settings to account for beam energy changes

# Energy Manager

The screenshot displays the Energy Manager software interface, which is used for controlling the SNS High Level Control Room and Physics Applications. The interface is divided into several sections:

- Parameter Table:** A table listing various parameters such as SCL\_Mag:QH00, SCL\_Mag:DCV00, SCL\_RF:Cav01a, etc. The table includes columns for Node, Position, Variable, Parameter, Active Source, Design Value, Control Value, Initial Value, Lower Limit, and Upper Limit.
- Satisfaction Table:** A table showing the satisfaction level for various parameters. The columns are Parameter, Custom Value, and Satisfaction. The satisfaction levels range from 0.0000% to 100.0000%.
- Chart Controls:** A section with checkboxes for Design, Trial, Kinetic Energy, Beta, Beta Error, Eta, Alpha, Emittance, X, Y, Z, Legend, and Grid. The Beta Function chart is currently selected.
- Beta Function Chart:** A line graph showing the Beta Function (Parameter Value) versus Position from sequence start (m). The chart displays two data series: Trial: Beta X (blue line) and Trial: Beta Y (red line). The x-axis ranges from 0 to 300 meters, and the y-axis ranges from 0 to 50. The chart shows a complex, oscillatory pattern.
- Elapsed Time and Duration:** A section at the bottom right of the chart area showing the elapsed time and duration in seconds. The duration is currently set to 1,000 seconds.

# Energy Meter

- *Purpose*
  - Compute and display the live linac beam energy
- *Features*
  - ✓ Uses beam phase differences measured with beam position monitor (BPM) pairs
  - ✓ Performs live averaging over beam pulses
  - ✓ Displays results from multiple BPM pairs



# Energy Meter

Linac Avg Energy

Fri May 22 13:40:10 EDT 2015

BPM pair	E (MeV)	Mean (MeV)	Sigma (MeV)	N counts
SCL_Diag:BPM23, SCL_Diag:BPM24	946.995	947.053	0.495	24

**BPM Pair Selection**

**Preset BPM Pairs**

- SCL\_Diag:BPM23, SCL\_Diag:BPM24
- SCL\_Diag:BPM25, SCL\_Diag:BPM26
- SCL\_Diag:BPM27, SCL\_Diag:BPM28
- SCL\_Diag:BPM29, SCL\_Diag:BPM30
- SCL\_Diag:BPM31, SCL\_Diag:BPM32

**Custom Pair**

Select BPM1      Select BPM2

- SCL\_Diag:BPM00a      SCL\_Diag:BPM00a
- SCL\_Diag:BPM00b      SCL\_Diag:BPM00b
- SCL\_Diag:BPM01      SCL\_Diag:BPM01
- SCL\_Diag:BPM02      SCL\_Diag:BPM02
- SCL\_Diag:BPM03      SCL\_Diag:BPM03
- SCL\_Diag:BPM04      SCL\_Diag:BPM04
- SCL\_Diag:BPM05      SCL\_Diag:BPM05
- SCL\_Diag:BPM06      SCL\_Diag:BPM06
- SCL\_Diag:BPM07      SCL\_Diag:BPM07

**Energy Guess (MeV)**

950

**BCM Filter**      **Min. Cur (mA)**

None      5

MEBT\_Diag:BCM02

DTL\_Diag:BCM200

Reset      Remove Selected      Export Table

Add selected      Start Monitoring      Stop Monitoring

# Knobs

- *Purpose*

- Provide common knob for changing a group of process variables (PVs)

- *Features*

- ✓ Multiple process variables (PVs) controlled through a single wheel switch
- ✓ Each PV assigned a coefficient for change relative to master knob
- ✓ Generates knobs for closed angle and offset bumps
- ✓ Generate a knob from initial and final machine states

# Knobs

The screenshot shows a Mac OS X window titled "Knobs" with a menu bar (Main, File, Edit, Accelerator, Knobs, View, Window, Help) and a title bar indicating the file path: "/Users/t6p/Projects/xal/documents/Knobs/Bumps.knobs".

The interface is divided into two main sections:

- Left Panel (List):** A list of "Groups" and "Knobs". The "Groups" column includes "All", "MEBT-DTL H 3", "MEBT-DTL H 4", "MEBT-DTL V 3", "Ring H 3 Bump:", "Ring H 4 Bump:", and "Ring V 3 Bump:". The "Knobs" column lists individual parameters such as "3Hbump - DTL\_Diag:BPM203" through "3Hbump - Ring\_Diag:BPM\_B08".
- Right Panel (Grid):** A grid of control panels for selected knobs. Each panel includes:
  - A title: "3Hbump - [Category]:BPM[Number]" (e.g., "3Hbump - DTL\_Diag:BPM409").
  - An edit icon (pencil).
  - A numerical display showing a value of "0" with a decimal point and several zeros (e.g., "+ 0 . 0 0 0 0 0 0").
  - A horizontal slider below the display.
  - Three buttons: "Ready", "Resync", and "zero".

At the bottom left, there is a "Message Board" icon.

# Linac Tuning

- *Purpose*
  - Measure and set the amplitude and phase for each RF Cavity
- *Features*
  - ✓ Separate warm and cold linac applications
  - ✓ Measure downstream BPM phases to compute optimal RF Cavity amplitude and phase
  - ✓ Compute output energy
  - ✓ About One hour to tune warm linac
  - ✓ About a Half hour to tune cold linac

# Linac Tuning

Apple **jython** File Edit Accelerator View Window Help

SCL Wizard - Untitled.sclw

Acc. Seq. SetUp Transverse Twiss SCL Long. TuneUp

Init Phase Scan BPM Offsets Phase Analysis Rescale SCL Energy Meter Long. Twiss Laser Stripping

Set BPM1 to Selected Cavs Set BPM2 to Selected Cavs Clear BPM1/BPM2 for Selected Cavs Min. BPM 1-2 Dist.[m]= 22 Max.= 75

Init BPMs and Cavities  
Get Quad Fields  
Restore Cavities' Phases  
Un-blank all Cavities

Checks response from BPMs and memorizes initial amp./phases of cavities.  
D - Design, I.L. - Initial Live values.  
BPM1 and BPM2 will be used for the cavity phase setup during the raw phase scan.

BPM	Z[m]	Use	Cavity	Z[m]	Use	RF A <sub>design</sub> (MV)	RF φ <sub>design</sub> (deg)	RF A <sub>live</sub> (MV)	RF φ <sub>live</sub> (deg)	BPM <sub>1</sub>	BPM <sub>2</sub>
SCL:BPM00a	0.203	<input checked="" type="checkbox"/>	Cav01a	3.176	<input checked="" type="checkbox"/>	21.7991	-83.8629	0	0		
SCL:BPM00b	1.505	<input checked="" type="checkbox"/>	Cav01b	4.399	<input checked="" type="checkbox"/>	18.2533	-76.3208	0	0		
SCL:BPM01	7.574	<input checked="" type="checkbox"/>	Cav01c	5.558	<input checked="" type="checkbox"/>	19.0707	-70.7136	0	0		
SCL:BPM02	13.41	<input checked="" type="checkbox"/>	Cav02a	9.015	<input checked="" type="checkbox"/>	14.317	-64.9625	0	0		
SCL:BPM03	19.249	<input checked="" type="checkbox"/>	Cav02b	10.238	<input checked="" type="checkbox"/>	17.0764	-60.4688	0	0		
SCL:BPM04	25.088	<input checked="" type="checkbox"/>	Cav02c	11.397	<input checked="" type="checkbox"/>	15.059	-55.1403	0	0		
SCL:BPM05	30.926	<input checked="" type="checkbox"/>	Cav03a	14.854	<input checked="" type="checkbox"/>	20.1111	-50.5618	0	0		
SCL:BPM06	36.766	<input checked="" type="checkbox"/>	Cav03b	16.077	<input checked="" type="checkbox"/>	20.0377	-44.1016	0	0		
SCL:BPM07	42.609	<input checked="" type="checkbox"/>	Cav03c	17.236	<input checked="" type="checkbox"/>	20.5996	-38.118	0	0		
SCL:BPM08	48.442	<input checked="" type="checkbox"/>	Cav04a	20.693	<input checked="" type="checkbox"/>	17.5371	-33.0506	0	0		
SCL:BPM09	54.286	<input checked="" type="checkbox"/>	Cav04b	21.916	<input checked="" type="checkbox"/>	20.9525	-28.1671	0	0		
SCL:BPM10	60.123	<input checked="" type="checkbox"/>	Cav04c	23.075	<input checked="" type="checkbox"/>	18.1753	-22.433	0	0		
SCL:BPM11	65.96	<input checked="" type="checkbox"/>	Cav05a	26.532	<input checked="" type="checkbox"/>	9.0754	-20.3722	0	0		
SCL:BPM12	73.852	<input checked="" type="checkbox"/>	Cav05b	27.755	<input checked="" type="checkbox"/>	19.8891	-14.3816	0	0		
SCL:BPM13	81.743	<input checked="" type="checkbox"/>	Cav05c	28.914	<input checked="" type="checkbox"/>	19.3018	-11.2414	0	0		
SCL:BPM14	89.634	<input checked="" type="checkbox"/>	Cav06a	32.371	<input checked="" type="checkbox"/>	18.3298	-6.6099	0	0		
SCL:BPM15	97.525	<input checked="" type="checkbox"/>	Cav06b	33.594	<input checked="" type="checkbox"/>	21.077	-2.9953	0	0		
SCL:BPM16	105.418	<input checked="" type="checkbox"/>	Cav06c	34.753	<input checked="" type="checkbox"/>	20.3382	2.4215	0	0		
SCL:BPM17	113.309	<input checked="" type="checkbox"/>	Cav07a	38.21	<input checked="" type="checkbox"/>	20.3425	5.0245	0	0		
SCL:BPM18	121.188	<input checked="" type="checkbox"/>	Cav07b	39.433	<input checked="" type="checkbox"/>	19.6563	8.1608	0	0		
SCL:BPM19	129.088	<input checked="" type="checkbox"/>	Cav07c	40.592	<input checked="" type="checkbox"/>	15.0129	12.7356	0	0		
SCL:BPM20	136.978	<input checked="" type="checkbox"/>	Cav08a	44.049	<input checked="" type="checkbox"/>	16.3784	15.2594	0	0		
SCL:BPM21	144.873	<input checked="" type="checkbox"/>	Cav08b	45.272	<input checked="" type="checkbox"/>	17.7664	15.5383	0	0		
SCL:BPM23	160.653	<input checked="" type="checkbox"/>	Cav08c	46.431	<input checked="" type="checkbox"/>	21.6022	19.9043	0	0		
SCL:BPM24	168.541	<input checked="" type="checkbox"/>	Cav09a	49.888	<input checked="" type="checkbox"/>	20.922	23.8674	0	0		
SCL:BPM25	176.432	<input checked="" type="checkbox"/>	Cav09b	51.111	<input checked="" type="checkbox"/>	16.7631	23.6713	0	0		
SCL:BPM26	184.328	<input checked="" type="checkbox"/>	Cav09c	52.27	<input checked="" type="checkbox"/>	18.3386	26.6963	0	0		
SCL:BPM27	192.215	<input checked="" type="checkbox"/>	Cav10a	55.727	<input checked="" type="checkbox"/>	18.6694	28.9572	0	0		
SCL:BPM29	208	<input checked="" type="checkbox"/>	Cav10b	56.95	<input checked="" type="checkbox"/>	19.1211	28.2409	0	0		
SCL:BPM30	215.89	<input checked="" type="checkbox"/>	Cav10c	58.109	<input checked="" type="checkbox"/>	14.4243	32.1201	0	0		
SCL:BPM31	223.779	<input checked="" type="checkbox"/>	Cav11a	61.566	<input checked="" type="checkbox"/>	18.1686	33.607	0	0		
SCL:BPM32	231.672	<input checked="" type="checkbox"/>	Cav11b	62.789	<input type="checkbox"/>	0	0	0	0		
HEBT:BPM01	239.507	<input checked="" type="checkbox"/>	Cav11c	63.948	<input checked="" type="checkbox"/>	19.2424	37.2563	0	0		
HEBT:BPM02	243.507	<input checked="" type="checkbox"/>	Cav12a	67.498	<input checked="" type="checkbox"/>	23.0399	-81.8505	0	0		

Time: 05.22.15 15:10

# Launcher

- *Purpose*

- Launch and monitor applications

- *Features*

- ✓ Automatically displays built applications and scripts with description
- ✓ Can launch executables round robin across servers
- ✓ Monitors currently running applications
  - Covers local network
  - Displays name, launch time, memory usage and server
  - Bring forward and force quit options

# Launcher

The screenshot shows the Launcher application window with the following components:

- Menu Bar:** Main, File, Edit, View, Window, Help
- Title Bar:** Launcher - /Users/t6p/Projects/OpenXAL/Documents/Launcher/default.launch
- Toolbar:** Standard file management icons (New, Open, Save, Copy, Paste, Print, etc.).
- Buttons:** Run, Monitor, Watch, Rules, Hosts
- Filter:** Q:Application Filter
- Table:** A table listing various applications with columns for Label, Last Launch Time, Kind, and Notes.
- Messages:** A section at the bottom showing a "Welcome" message.

Label	Last Launch Time	Kind	Notes
ArrayPVs' Waveform Viewer		Application	This application shows live Array PVs' waveform data.
Beam at Foil		Application	This application controls H- and H+(ring) beam positions at the foil
Beam Matcher		Application	Matching using equivalent beam sizes
BPMs' Waveform Viewer		Application	This application shows live BPMs' waveform data.
Bricks		Application	GUI Builder.
Bricks Application Demo		Application	This application demonstrates how to create a custom application using the X...
bsmanalysis		Application	This application is for analyzing BSM data.
capture_scl_waveforms		Jython	This script allows the user to capture correlated waveforms for a selected SC...
ccI_orbit_corrector		Jython	This script finds the initial conditions at the CCL entrance
Database Browser		Application	This application allows the user to browse the database.
db2xal		Application	This application generates XAL accelerator XDXF file from database.
Diagnostic Timing Application		Application	This application displays and sets some SNS diagnostics parameters.
empty_openxal_application		Jython	This script is a Template for the OpenXAL Application
Energy Manager		Application	This application manages the optics to account for changes in accelerating str...
Energy Meter		Application	This application monitors the beam energy
Escap		Application	Electron Scanner detects the beam profile in the ring using an electron gun.
event_monitor_application		Jython	This Event Monitor App will monitor one PV and creates time buffers for others
External Lattice Generator		Application	This application generates lattice files for Trace-3D, DYNAC and MAD.
Fingerprint		Application	This application shows live scalar PV's data and compares them with default.
fit_chicane_magnets		Jython	This script fits chicane magnets to ring orbit ripple.
fit_injection_kickers		Jython	This script fits kicker amplitude fields to orbit ripple.
Injection Dump Wizard		Application	This application calculates the beam position at the injection dump
Injection Painting		Application	This application is for development and loading of SNS ring injection kicker w...
ioc2db		Application	
Knobs		Application	This application allows the user to define knobs of PVs and to use them.
Labbook		Application	Characterize the machine and allow users to make logbook entries with the ...
Launcher		Application	The launcher allows users to launch XAL applications.
LossViewer		Application	Plots machine losses
Machine Recorder		Application	Record channels in a buffer for playback later.
Machine Simulator		Application	Machine Simulator runs the online model to simulate the machine and generat...
Magnet Cycling		Application	This application cycles the magnet to get rid of hysteresis
mebt_magnet_polarity_test		Jython	This script is MEBT Orbit Difference and Polarity Tests OpenXAL Application
MPS First Faults		Application	This application is used to monitor the MPS tool.
My Tuner Viewer		Application	This application is a general purpose device tuner / viewer
Optics Editor		Application	Optics Editor provides a convenient way to enable and disable nodes.
Optics Switcher		Application	Allows the user to specify the default optics.

**Messages**  
Welcome

# Loss Viewer

- *Purpose*

- Monitor and display beam loss throughout machine
- Administratively required during machine studies
- Tuning machine to reduce beam loss

- *Features*

- ✓ Input

- Beam Loss Monitor (BLM) Ionization Chambers
- Neutron Detectors (ND)

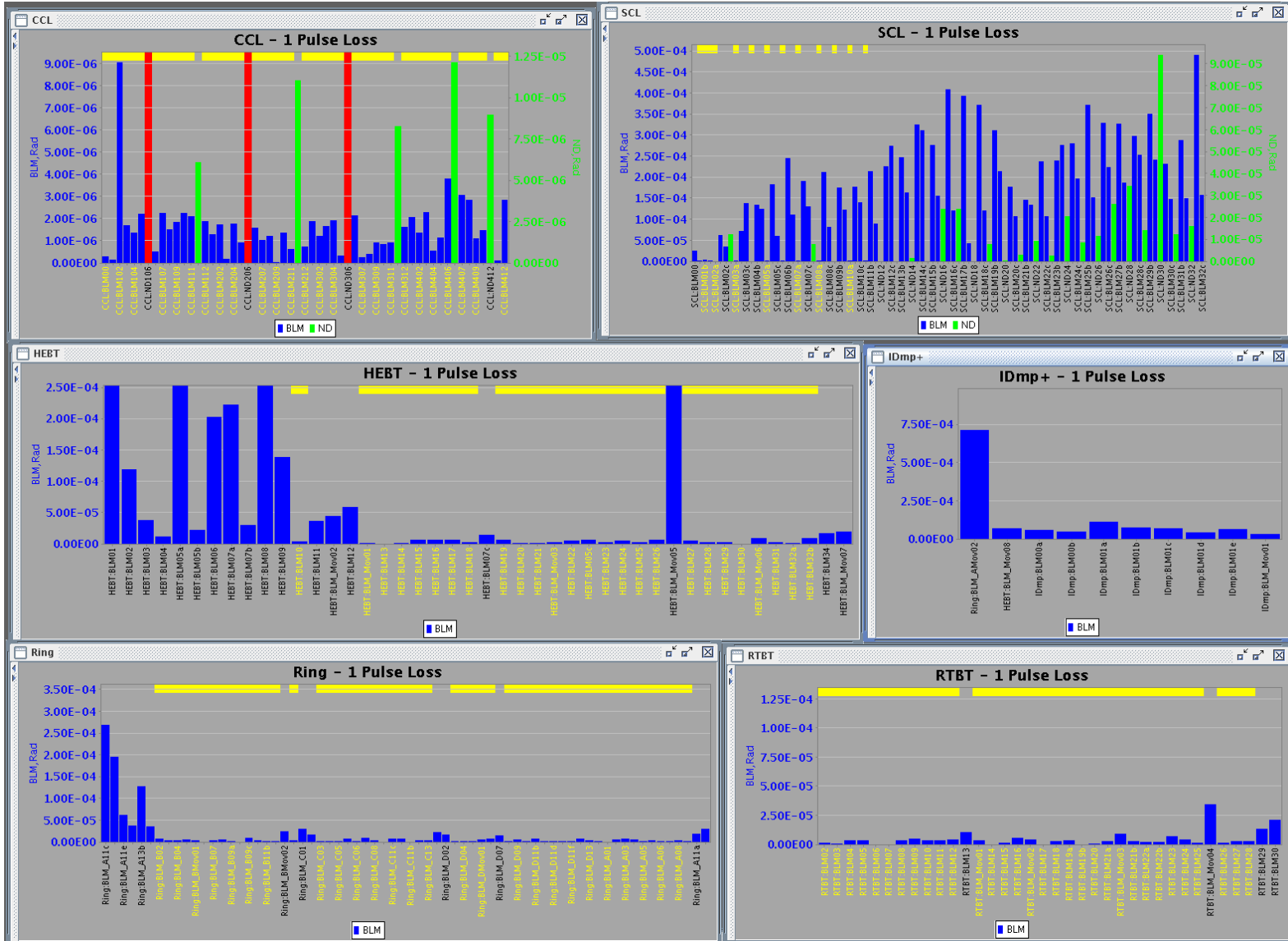
- ✓ Table and plot views

- ✓ Averaging and Charge Normalization options

- ✓ Trip limits display



# Loss Viewer



# Machine Simulator

- *Purpose*
  - Calculate and display machine computations
  - Diagnose magnet and BPM polarity errors
- **Still under development**
- *Current Features*
  - Replacement for XAL MPX application
  - Calculates and Displays beam energy and twiss parameters
- *Future Features*
  - What-If computations
  - Difference calculations

# Machine Simulator

Machine Simulator - (MEBT) - Untitled.msimg

Run  Calculate Phase Slip

States Table States Plot

Filter:

Scalars  Kinetic Energy

Plane  X  Y  Z

Vector Parameters   $\beta$    $\alpha$    $\gamma$    $\epsilon$    $\sigma$    $\varphi$

Element	Positi...	Kineti...	$\beta_x$	$\alpha_x$	$Y_x$	$\epsilon_x$	$\sigma_x$	$\varphi_x$	$\beta_y$	$\alpha_y$	$Y_y$	$\epsilon_y$	$\sigma_y$	$\varphi_y$	$\beta_z$	$\alpha_z$	$Y_z$	$\epsilon_z$	$\sigma_z$	$\varphi_z$
BEGI...	0	2,50...	0.155	-1.62	23.383	0	0.001	0	0.381	3.23	30.008	0	0.001	0	0.584	0.02	1.712	0	0.002	0
Begin...	0	2,50...	0.155	-1.62	23.383	0	0.001	0	0.381	3.23	30.008	0	0.001	0	0.584	0.02	1.712	0	0.002	0
MEBT...	0	2,50...	0.155	-1.62	23.383	0	0.001	0	0.381	3.23	30.008	0	0.001	0	0.584	0.02	1.712	0	0.002	0
DR1	0.098	2,50...	0.728	-4.343	27.289	0	0.001	0.298	0.041	0.329	27.143	0	0	0.92	0.62	-0.391	1.859	0	0.002	0.164
MEBT...	0.128	2,50...	0.898	-0.977	2.177	0	0.002	0.335	0.052	-0.715	29.05	0	0	1.67	0.648	-0.522	1.964	0	0.002	0.212
ELEM...	0.128	2,50...	0.898	-0.977	2.177	0	0.002	0.335	0.052	-0.715	29.05	0	0	1.67	0.648	-0.522	1.964	0	0.002	0.212
MEBT...	0.128	2,50...	0.898	-0.977	2.177	0	0.002	0.335	0.052	-0.715	29.05	0	0	1.67	0.648	-0.522	1.964	0	0.002	0.212
MEBT...	0.128	2,50...	0.898	-0.977	2.177	0	0.002	0.335	0.052	-0.715	29.05	0	0	1.67	0.648	-0.522	1.964	0	0.002	0.212
MEBT...	0.128	2,50...	0.898	-0.977	2.177	0	0.002	0.335	0.052	-0.715	29.05	0	0	1.67	0.648	-0.522	1.964	0	0.002	0.212
MEBT...	0.158	2,50...	0.836	2.919	11.389	0	0.002	0.369	0.137	-2.209	42.899	0	0.001	2.049	0.684	-0.649	2.078	0	0.002	0.258
DR2	0.201	2,50...	0.612	2.359	10.729	0	0.001	0.428	0.406	-4.126	44.411	0	0.001	2.23	0.746	-0.82	2.242	0	0.002	0.317
MEBT...	0.201	2,50...	0.612	2.359	10.729	0	0.001	0.428	0.406	-4.126	44.411	0	0.001	2.23	0.746	-0.82	2.242	0	0.002	0.317
DR3	0.242	2,50...	0.437	1.86	10.204	0	0.001	0.508	0.828	-6.064	45.606	0	0.002	2.301	0.821	-0.985	2.399	0	0.002	0.37
MEBT...	0.273	2,50...	0.394	-0.36	2.869	0	0.001	0.583	1.082	-1.835	4.034	0	0.002	2.332	0.885	-1.105	2.511	0	0.002	0.406
ELEM...	0.273	2,50...	0.394	-0.36	2.869	0	0.001	0.583	1.082	-1.835	4.034	0	0.002	2.332	0.885	-1.105	2.511	0	0.002	0.406
MEBT...	0.303	2,50...	0.486	-2.814	18.362	0	0.001	0.654	1.03	3.466	12.632	0	0.002	2.36	0.956	-1.227	2.621	0	0.002	0.439
DR4	0.345	2,50...	0.757	-3.656	18.968	0	0.002	0.723	0.763	2.886	12.22	0	0.002	2.407	1.066	-1.399	2.774	0	0.002	0.481
MEBT...	0.345	2,50...	0.757	-3.656	18.968	0	0.002	0.723	0.763	2.886	12.22	0	0.002	2.407	1.066	-1.399	2.774	0	0.002	0.481
DR5	0.387	2,50...	1.101	-4.529	19.539	0	0.002	0.768	0.544	2.333	11.836	0	0.001	2.471	1.191	-1.577	2.927	0	0.002	0.518
MEBT...	0.418	2,50...	1.253	-0.279	0.86	0	0.002	0.793	0.468	0.255	2.274	0	0.001	2.532	1.291	-1.709	3.037	0	0.002	0.543
ELEM...	0.418	2,50...	1.253	-0.279	0.86	0	0.002	0.793	0.468	0.255	2.274	0	0.001	2.532	1.291	-1.709	3.037	0	0.002	0.543
MEBT...	0.448	2,50...	1.132	4.096	15.7	0	0.002	0.818	0.511	-1.699	7.608	0	0.001	2.595	1.4	-1.845	3.147	0	0.002	0.565
DR6	0.528	2,50...	0.587	2.783	14.911	0	0.001	0.914	0.837	-2.415	8.165	0	0.002	2.715	1.723	-2.221	3.444	0	0.003	0.616
BEGI...	0.528	2,50...	0.587	2.783	14.911	0	0.001	0.914	0.837	-2.415	8.165	0	0.002	2.715	1.723	-2.221	3.444	0	0.003	0.616
MEBT...	0.528	2,50...	0.586	2.274	10.521	0	0.001	0.914	0.837	-3.141	12.983	0	0.002	2.715	1.72	0.768	0.924	0	0.003	0.616
DR7	0.607	2,50...	0.296	1.392	9.921	0	0.001	1.104	1.428	-4.313	13.722	0	0.002	2.787	1.612	0.587	0.834	0	0.002	0.664
MEBT...	0.638	2,50...	0.239	0.527	5.347	0	0.001	1.218	1.592	-0.943	1.186	0	0.002	2.807	1.579	0.52	0.804	0	0.002	0.683
MEBT...	0.638	2,50...	0.239	0.527	5.347	0	0.001	1.218	1.592	-0.943	1.186	0	0.002	2.807	1.579	0.52	0.804	0	0.002	0.683
MEBT...	0.638	2,50...	0.239	0.527	5.347	0	0.001	1.218	1.592	-0.943	1.186	0	0.002	2.807	1.579	0.52	0.804	0	0.002	0.683
MEBT...	0.638	2,50...	0.239	0.527	5.347	0	0.001	1.218	1.592	-0.943	1.186	0	0.002	2.807	1.579	0.52	0.804	0	0.002	0.683
MEBT...	0.638	2,50...	0.239	0.527	5.347	0	0.001	1.218	1.592	-0.943	1.186	0	0.002	2.807	1.579	0.52	0.804	0	0.002	0.683
ELEM...	0.638	2,50...	0.239	0.527	5.347	0	0.001	1.218	1.592	-0.943	1.186	0	0.002	2.807	1.579	0.52	0.804	0	0.002	0.683
MEBT...	0.668	2,50...	0.229	-0.18	4.516	0	0.001	1.349	1.538	2.69	5.356	0	0.002	2.826	1.549	0.453	0.778	0	0.002	0.702

# My Tuner Viewer (MTV)

- *Purpose*
  - Utility for changing process variables (PVs)
- *Features*
  - ✓ Displays Process Variables (PV) for magnet fields
  - ✓ Convenient wheel switch control of selected PV
  - ✓ Can change PV's Machine Protection System (MPS) target (B\_Book)
  - ✓ Optionally bind field setting to B\_Book
  - ✓ Memorize and restore values

# My Tuner Viewer

Selected Sequence is SCL

Magnets Arbitrary PVs

magnet  QH  DCH  QV  DCV

Make Table

Magnet	B Set Main	B Set Trim	B readback	B Book
SCL_Mag:QH00	18.82		18.799	18
SCL_Mag:DCH00	-0		-0	
SCL_Mag:QV00	17.598		17.627	17.5
SCL_Mag:DCV00	0.009		0.009	
SCL_Mag:QH01	4.481		4.449	4.324
SCL_Mag:DCH01	-0.002		-0.002	
SCL_Mag:QV01	4.481		4.448	4.324
SCL_Mag:DCV01	-0		-0	
SCL_Mag:QH02	4.574		4.547	4.8
SCL_Mag:DCH02	0		0	
SCL_Mag:QV02	4.574		4.548	4.8
SCL_Mag:DCV02	-0		-0	
SCL_Mag:QH03	4.512		4.602	4.6
SCL_Mag:QV03	4.512		4.606	4.6
SCL_Mag:QH04	3.881		3.891	4
SCL_Mag:QV04	3.881		3.892	4
SCL_Mag:QH05	3.927		3.949	4
SCL_Mag:DCH05	0.002		0.002	
SCL_Mag:QV05	3.927		3.95	4
SCL_Mag:DCV05	0.001		0.001	
SCL_Mag:QH06	4.174		4.173	4.3
SCL_Mag:DCH06	-0.002		-0.002	
SCL_Mag:QV06	4.174		4.172	4.3
SCL_Mag:DCV06	0		0	
SCL_Mag:QH07	3.85		3.881	3.874
SCL_Mag:QV07	3.85		3.883	3.874

SCL\_Mag:PS\_DCV00:B\_Set   Bind to B\_Book

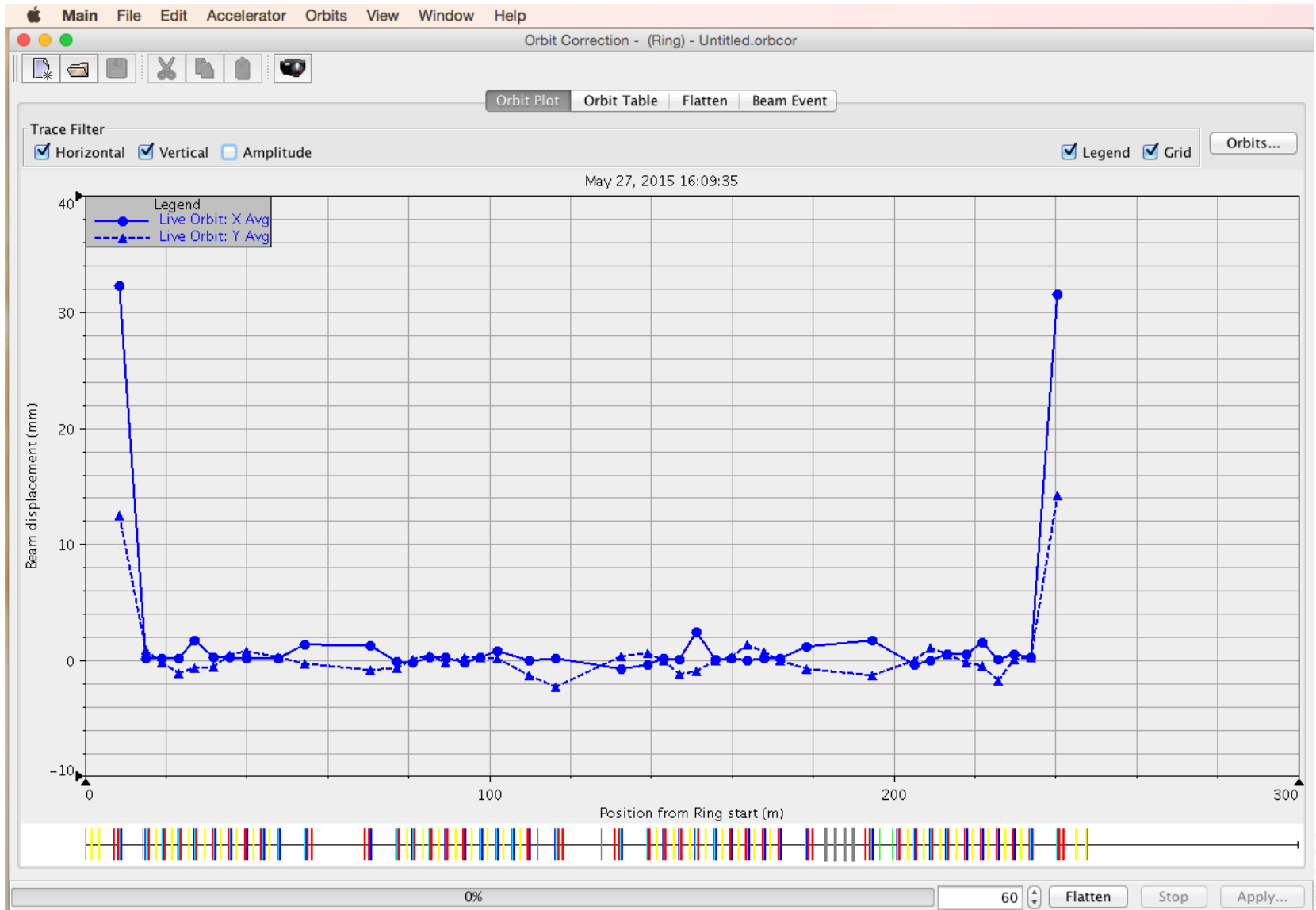
Upper Lim = 0.0125141 Lower Lim = -0.0125141

Restore Original Value 0.009 Memorize Value as Original

# Orbit Correction

- *Purpose*
  - Measure and correct the transverse orbit
- *Features*
  - ✓ Monitor and display live orbit (x, y and amplitude averages)
  - ✓ Save snapshot orbit and compute difference orbit
  - ✓ Manually specify custom orbit
  - ✓ Flatten orbit to reference and optionally apply fraction of correction
  - ✓ Batch setting of corrector field and limits

# Orbit Correction



# Profile Tools and Analysis

- *Purpose*
  - Wire scan and analysis
- *Features*
  - ✓ Perform wire scan and wire harp data acquisition
  - ✓ Display scan statistics
  - ✓ Analyze the scans
  - ✓ Perform matching



# Profile Tools and Analysis

MainApplication File Edit Accelerator View Help

Profile Tools and Analysis - Untitled.pta

Wire Scanner Acquisition Harp Acquisition Data Inspection Data Analysis Courant-Snyder

Select Profile Devices

Device ID	Status	Key
MEBT_Diag:...	<input checked="" type="checkbox"/>	
MEBT_Diag:...	<input checked="" type="checkbox"/>	
MEBT_Diag:...	<input checked="" type="checkbox"/>	

Latest Scan Mode: Unspecified

Data Acquisition

Start Scan Easy Scan Abort Scan Stop Fork Park (re)Acquire

Current Data: Live

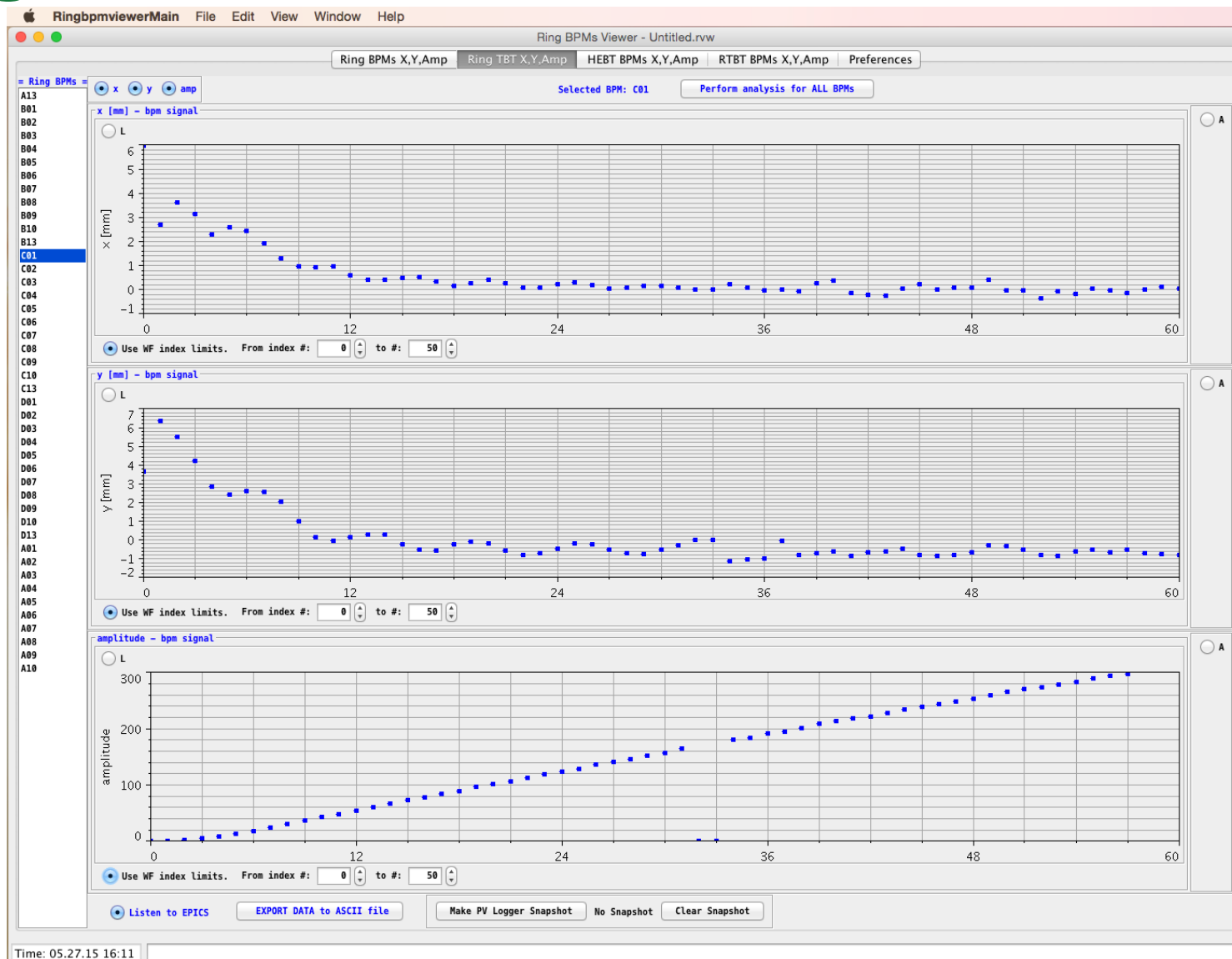
Horizontal Vertical Diagonal

NO DATA NO DATA NO DATA

# Ring BPM Viewer

- *Purpose*
  - Measure beam position attributes in the Ring
- *Features*
  - ✓ Monitor and Display Beam Position History
  - ✓ Monitor and Display Beam Position Turn by Turn Waveforms
    - Suitable for single bunch injection
    - Damped Sinusoid parameter fitting

# Ring BPM Viewer



# Ring Injection

- *Purpose*
  - Measure and correct the beam injection position and angle
- *Features*
  - ✓ Measure single bunch turn by turn beam positions
  - ✓ Compute position and angle at injection spot from measurements at beam position monitors and online model projections
  - ✓ Solve for corrector fields to adjust injection spot position and angle

# Ring Injection

Injection Spot Measurement
Injection Spot Control

Turn-by-Turn Analysis
One-Turn Analysis

Device	Select
Ring_Diag:BPM_A13	<input type="checkbox"/>
Ring_Diag:BPM_B01	<input checked="" type="checkbox"/>
Ring_Diag:BPM_B02	<input checked="" type="checkbox"/>
Ring_Diag:BPM_B03	<input checked="" type="checkbox"/>
Ring_Diag:BPM_B04	<input checked="" type="checkbox"/>
Ring_Diag:BPM_B05	<input checked="" type="checkbox"/>
Ring_Diag:BPM_B06	<input checked="" type="checkbox"/>
Ring_Diag:BPM_B07	<input checked="" type="checkbox"/>
Ring_Diag:BPM_B08	<input checked="" type="checkbox"/>
Ring_Diag:BPM_B09	<input checked="" type="checkbox"/>
Ring_Diag:BPM_B10	<input checked="" type="checkbox"/>
Ring_Diag:BPM_B13	<input checked="" type="checkbox"/>
Ring_Diag:BPM_C01	<input type="checkbox"/>
Ring_Diag:BPM_C02	<input type="checkbox"/>
Ring_Diag:BPM_C03	<input type="checkbox"/>
Ring_Diag:BPM_C04	<input type="checkbox"/>
Ring_Diag:BPM_C05	<input type="checkbox"/>

BPM	X (mm)	X' (mrad)	Y (mm)	Y' (mrad)	Accept	Plot
g_Diag:BPM_B01	15.544 +/- .770	-1.089 +/- .065	13.039 +/- 1.523	-.469 +/- .093	<input checked="" type="checkbox"/>	plot ▲
g_Diag:BPM_B02	16.729 +/- 1.065	-.930 +/- .250	12.764 +/- 3.034	-.510 +/- .189	<input checked="" type="checkbox"/>	plot ≡
g_Diag:BPM_B03	14.377 +/- .837	-.920 +/- .124	11.918 +/- 1.300	-.386 +/- .300	<input checked="" type="checkbox"/>	plot
g_Diag:BPM_B04	15.142 +/- 2.097	-1.149 +/- .098	12.166 +/- .958	-.492 +/- .131	<input checked="" type="checkbox"/>	plot ▼

Number of Points to Fit:

Model Design Lattice ▼

Calculate Fits

S  L    Ring\_Diag:BPM\_B05: HORIZONTAL

S  L    Ring\_Diag:BPM\_B05: VERTICAL

Calculate Average

**Averaged Results (w.r.t. closed orbit)**

x (mm):	16.733	+/-	0.296
x' (mrad):	-0.932	+/-	0.035
y (mm):	12.459	+/-	0.426
y' (mrad):	-0.388	+/-	0.035

Store Results

**OAK RIDGE**  
 National Laboratory

SPALLATION  
 NEUTRON  
 SOURCE

33 SNS High Level Control Room and Physics Applications

# RTBT Wizard

- *Purpose*

- Measure and tune beam in Ring to Target Beam Transferline (RTBT)
- Measure beam characteristics on target

- *Features*

- ✓ Project Target beam parameters from RTBT and Harp measurements

- Beam position
- Beam width, height and rotation
- Beam density

- ✓ Archive projected Target beam parameters

# RTBT Wizard

The screenshot displays the RTBT Wizard software interface with the following components:

- Menu Bar:** Main, File, Edit, View, Window, Help
- Toolbar:** Standard file operations (New, Open, Save, Copy, Paste, Print, etc.)
- Navigation Tabs:** Beam Position Tracking, Beam Orbit Matching, Beam Size Tracking, Profile Analysis Tool (active), Peak Density Prediction, Target Beam Archive
- File List:**

File Name	Wire	Analyze H	Analyze V
WireAnalysisFmt-2013.05.31_15.00.55.pta.txt	RTBT_Diag:WS20	Analyze	Analyze
WireAnalysisFmt-2013.05.31_15.00.55.pta.txt	RTBT_Diag:WS23	Analyze	Analyze
WireAnalysisFmt-2013.05.31_15.00.55.pta.txt	RTBT_Diag:WS24	Analyze	Analyze
WireAnalysisFmt-2013.05.31_15.00.55.pta.txt	RTBT_Diag:WS21	Analyze	Analyze
- Profile Analysis Panel:**
  - Buttons: Add New Wirescan File, Clear Loaded Data
  - Radio buttons:  S  L
  - Plot: Profile graph showing a peak at approximately x=100. Y-axis ranges from 0 to 0.9.
  - Controls: Plot Linear Values, Target Profile, Remove Point, Fit & Store All, Fit Current Data, Stat RMS Current Data Set
  - Normalization: H Normalize By: 1.000, H Offset By: 0.000, V Normalize To: 1.000, V Cut Below: 0.010
  - Fit Results Table:

Parameter	Value
Amp1 (a1)	1.002
Amp2 (a2)	0.249
Sigma1 (s1)	13.755
Sigma2 (s2)	5.635
RMS	9.368
Center (x0)	96.436
Offset (y0)	0.007
  - Buttons: Store Results, Clear Stored Results
- View Stored Results Panel:**
  - Radio button:  L
  - Plot: Selected Profiles graph showing a peak at approximately x=100. Y-axis ranges from -0.1 to 1.0.
  - Controls: Plot Linear Values, Plot Raw and Fit Data, Refresh Table, Plot Selected Profiles
  - Table:

File	Wire	H/V	RMS	Plot
WireAnalysisFmt-2013.0...	RTBT_Diag:WS21	H	23.1...	<input type="checkbox"/>
WireAnalysisFmt-2013.0...	RTBT_Diag:WS24	H	14.2...	<input type="checkbox"/>
WireAnalysisFmt-2013.0...	RTBT_Diag:WS23	V	9.016	<input checked="" type="checkbox"/>
WireAnalysisFmt-2013.0...	RTBT_Diag:WS20	H	14.8...	<input type="checkbox"/>
  - Button: Export Results

# SCAN 1D/2D

- *Purpose*

- Scan 1 (or 2) process variables (PVs) and measure other PVs

- *Features*

- ✓ Vary 1 (or 2) process variables (PVs) over a range

- Varies the scan PV by specified step
- Validation PV for good data
- Records other PVs for each step

- ✓ Data Analysis

- ✓ Data Export

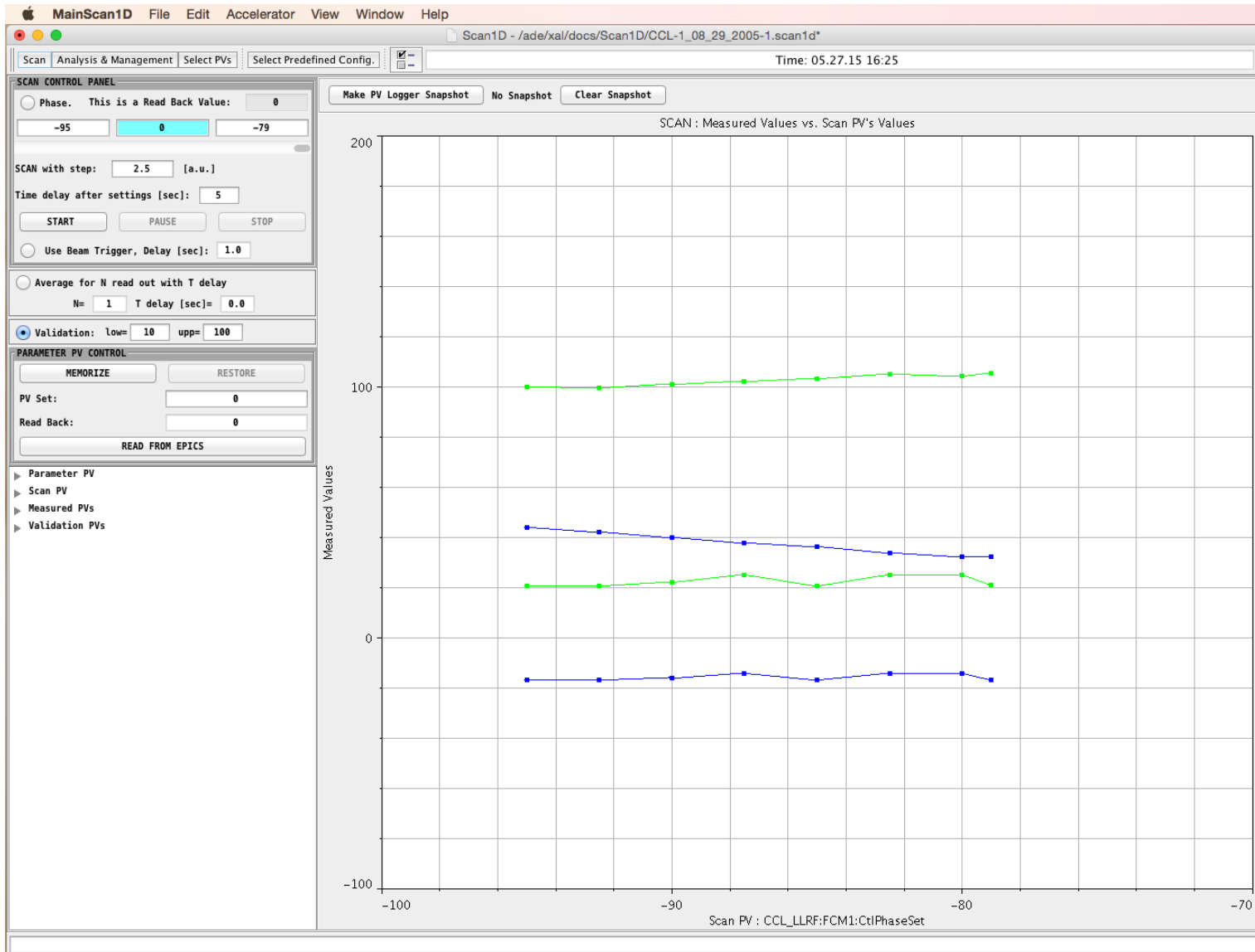
- ✓ Very useful for general machine studies

- ✓ Common 1D/2D scan packages incorporated into multiple applications

- ✓ Standalone 1D/2D applications



# SCAN 1D



# Save Compare Restore (SCORE)

- *Purpose*
  - Record and restore machine state
- *Features*
  - ✓ Record snapshot PVs to database
  - ✓ Compare snapshot with live state
  - ✓ Filter by system, subsystem and PV
  - ✓ Restore selected PV values from snapshot

# Save Compare Restore

Apple Main File Edit View Special Window Help

Score

Snap n save Restore Selected Red Threshold

Select Systems:

- CCL
- CF
- DTL
- EDmp
- HEBT
- ICS
- IDmp
- LDmp
- LEBT
- MEBT
- RFO
- RTBT
- Ring
- SCL
- Src

Select Subsystems:

- BLM
- Chop
- Foil
- HPRF
- Mag
- RF
- Scrp
- Src
- Steer
- Tim
- TP
- Tim

Open Score

System	Signal Type	Setpoint PV	Saved Setpoint	Live Setpoint	Readback PV	Saved Readback	Live Readback	Setpoint Error(...)	Readback Error(...)
CCL	HPRF				CCL_HPRF:Kly1:Pwr_Fwd_Out	3492.50269	<b>3485.28516</b>	0.000	0.207
CCL	HPRF				CCL_HPRF:Kly2:Pwr_Fwd_Out	2705.32275	<b>2710.76880</b>	0.000	0.201
CCL	HPRF				CCL_HPRF:Kly3:Pwr_Fwd_Out	4245.35010	<b>4234.86426</b>	0.000	0.247
CCL	HPRF				CCL_HPRF:Kly4:Pwr_Fwd_Out	3594.01440	<b>3583.58862</b>	0.000	0.291
CCL	Mag	CCL_Mag:PS_DCH104:I_Set	1.94500	1.94500	CCL_Mag:PS_DCH104:I	1.94370	<b>1.93295</b>	0.000	0.621
CCL	Mag	CCL_Mag:PS_DCH106:I_Set	-0.81500	-0.81500	CCL_Mag:PS_DCH106:I	-0.82120	<b>-0.83748</b>	0.000	2.721
CCL	Mag	CCL_Mag:PS_DCH110:I_Set	0.05000	0.05000	CCL_Mag:PS_DCH110:I	0.04772	<b>0.04500</b>	0.000	10.564
CCL	Mag	CCL_Mag:PS_DCH112:I_Set	-1.10000	-1.10000	CCL_Mag:PS_DCH112:I	-1.10030	<b>-1.10030</b>	0.000	0.027
CCL	Mag	CCL_Mag:PS_DCH204:I_Set	1.77900	1.77900	CCL_Mag:PS_DCH204:I	1.77436	<b>1.77374</b>	0.000	0.296
CCL	Mag	CCL_Mag:PS_DCH206:I_Set	0.65200	0.65200	CCL_Mag:PS_DCH206:I	0.64692	<b>0.64738</b>	0.000	0.711
CCL	Mag	CCL_Mag:PS_DCH210:I_Set	0.21200	0.21200	CCL_Mag:PS_DCH210:I	0.20974	<b>0.19676</b>	0.000	7.469
CCL	Mag	CCL_Mag:PS_DCH212:I_Set	0.52000	0.52000	CCL_Mag:PS_DCH212:I	0.51804	<b>0.50475</b>	0.000	2.976
CCL	Mag	CCL_Mag:PS_DCH304:I_Set	0.15849	0.15849	CCL_Mag:PS_DCH304:I	0.15587	<b>0.16033</b>	0.000	2.819
CCL	Mag	CCL_Mag:PS_DCH306:I_Set	1.30374	1.30374	CCL_Mag:PS_DCH306:I	1.30226	<b>1.29699</b>	0.000	0.519
CCL	Mag	CCL_Mag:PS_DCH310:I_Set	1.01130	1.01130	CCL_Mag:PS_DCH310:I	1.00981	<b>1.00393</b>	0.000	0.731
CCL	Mag	CCL_Mag:PS_DCH312:I_Set	-0.64246	-0.64246	CCL_Mag:PS_DCH312:I	-0.64314	<b>-0.63411</b>	0.000	1.415
CCL	Mag	CCL_Mag:PS_DCH402:I_Set	0.72600	0.72600	CCL_Mag:PS_DCH402:I	0.71800	<b>0.71688</b>	0.000	1.264
CCL	Mag	CCL_Mag:PS_DCH404:I_Set	1.99500	1.99500	CCL_Mag:PS_DCH404:I	1.99011	<b>1.97229</b>	0.000	1.145
CCL	Mag	CCL_Mag:PS_DCH406:I_Set	-2.07000	-2.07000	CCL_Mag:PS_DCH406:I	-2.07182	<b>-2.05438</b>	0.000	0.846
CCL	Mag	CCL_Mag:PS_DCH408:I_Set	2.57486	2.57486	CCL_Mag:PS_DCH408:I	2.56770	<b>2.56833</b>	0.000	0.254
CCL	Mag	CCL_Mag:PS_DCH410:I_Set	0.48349	0.48349	CCL_Mag:PS_DCH410:I	0.47865	<b>0.47810</b>	0.000	1.122
CCL	Mag	CCL_Mag:PS_DCV103:I_Set	-1.00000	-1.00000	CCL_Mag:PS_DCV103:I	-1.00826	<b>-1.00530</b>	0.000	0.528
CCL	Mag	CCL_Mag:PS_DCV105:I_Set	-2.50000	-2.50000	CCL_Mag:PS_DCV105:I	-2.50664	<b>-2.49523</b>	0.000	0.456
CCL	Mag	CCL_Mag:PS_DCV109:I_Set	0.95300	0.95300	CCL_Mag:PS_DCV109:I	0.95113	<b>0.93744</b>	0.000	1.646
CCL	Mag	CCL_Mag:PS_DCV111:I_Set	0.000E0	0.000E0	CCL_Mag:PS_DCV111:I	-2.308E-3	<b>-0.01409</b>	0.000	∞
CCL	Mag	CCL_Mag:PS_DCV203:I_Set	-0.30000	-0.30000	CCL_Mag:PS_DCV203:I	-0.30211	<b>-0.30464</b>	0.000	1.534
CCL	Mag	CCL_Mag:PS_DCV205:I_Set	-0.70000	-0.70000	CCL_Mag:PS_DCV205:I	-0.70365	<b>-0.70264</b>	0.000	0.376
CCL	Mag	CCL_Mag:PS_DCV209:I_Set	-1.00000	-1.00000	CCL_Mag:PS_DCV209:I	-1.00325	<b>-1.00030</b>	0.000	0.294
CCL	Mag	CCL_Mag:PS_DCV211:I_Set	0.20000	0.20000	CCL_Mag:PS_DCV211:I	0.19118	<b>0.19532</b>	0.000	2.370
CCL	Mag	CCL_Mag:PS_DCV303:I_Set	1.75000	1.75000	CCL_Mag:PS_DCV303:I	1.74785	<b>1.74319</b>	0.000	0.390
CCL	Mag	CCL_Mag:PS_DCV305:I_Set	-0.40000	-0.40000	CCL_Mag:PS_DCV305:I	-0.39935	<b>-0.38310</b>	0.000	4.318
CCL	Mag	CCL_Mag:PS_DCV309:I_Set	0.70000	0.70000	CCL_Mag:PS_DCV309:I	0.70129	<b>0.68403</b>	0.000	2.492
CCL	Mag	CCL_Mag:PS_DCV311:I_Set	0.000E0	0.000E0	CCL_Mag:PS_DCV311:I	1.734E-3	<b>8.081E-3</b>	0.000	∞
CCL	Mag	CCL_Mag:PS_DCV401:I_Set	0.000E0	0.000E0	CCL_Mag:PS_DCV401:I	-7.988E-4	<b>-1.581E-3</b>	0.000	∞
CCL	Mag	CCL_Mag:PS_DCV403:I_Set	0.10000	0.10000	CCL_Mag:PS_DCV403:I	0.09865	<b>0.09159</b>	0.000	8.793
CCL	Mag	CCL_Mag:PS_DCV405:I_Set	0.000E0	0.000E0	CCL_Mag:PS_DCV405:I	-1.899E-3	<b>-0.01534</b>	0.000	∞
CCL	Mag	CCL_Mag:PS_DCV407:I_Set	0.68300	0.68300	CCL_Mag:PS_DCV407:I	0.68390	<b>0.66961</b>	0.000	2.112
CCL	Mag	CCL_Mag:PS_DCV409:I_Set	-2.20000	-2.20000	CCL_Mag:PS_DCV409:I	-2.22488	<b>-2.22003</b>	0.000	0.906
CCL	Mag	CCL_Mag:PS_DCV411:I_Set	0.52741	0.52741	CCL_Mag:PS_DCV411:I	0.52537	<b>0.52492</b>	0.000	0.472
CCL	Mag	CCL_Mag:PS_Q104t111:B_Book	21.88434	21.88434				0.000	0.000
CCL	Mag	CCL_Mag:PS_Q104t111:I_Set	277.00000	277.00000	CCL_Mag:PS_Q104t111:I	273.91350	<b>273.94582</b>	0.000	1.109
CCL	Mag	CCL_Mag:PS_Q112t207:B_Book	20.02100	20.02100				0.000	0.000
CCL	Mag	CCL_Mag:PS_Q112t207:I_Set	234.00000	234.00000	CCL_Mag:PS_Q112t207:I	231.46373	<b>231.54342</b>	0.000	1.055

Select All

Snapshot taken: 2015-05-26 18:34:35.0, Production restored - CCP

Some channels are not connected - see console output

# Virtual Accelerator

- *Purpose*
  - Simulate a live machine for debugging applications offline
- *Features*
  - ✓ Add noise and offsets
  - ✓ Manually edit process variables (PVs)
  - ✓ Critical for application testing!

# Virtual Accelerator

Virtual Accelerator - (MEBT-DTL) - Untitled.va\*

Probe Editor | Set Noise... | Sync Period... | Start VA | Stop VA

VAData | DiagPlot

Filter:

Node	Readback PV	Readback	Setpoint PV	Setpoint
MEBT_Mag:QH01	MEBT_Mag:QH01:B	34.636	MEBT_Mag:PS_QH01:B_Set	34.636
MEBT_Mag:DCH01	MEBT_Mag:DCH01:B	0.0	MEBT_Mag:PS_DCH01:B_Set	-0
MEBT_Mag:DCV01	MEBT_Mag:DCV01:B	0.0	MEBT_Mag:PS_DCV01:B_Set	-0
MEBT_Mag:QV02	MEBT_Mag:QV02:B	37.85	MEBT_Mag:PS_QV02:B_Set	37.85
MEBT_Mag:QH03	MEBT_Mag:QH03:B	28.3266	MEBT_Mag:PS_QH03:B_Set	28.327
MEBT_RF:Bnch01	MEBT_LLRF:FCM1:cavV	1.3	MEBT_LLRF:FCM1:CtlAmpSet	1.3
MEBT_RF:Bnch01	MEBT_LLRF:FCM1:cavPhaseAvg	-90.0	MEBT_LLRF:FCM1:CtlPhaseSet	-90
MEBT_Mag:QV04	MEBT_Mag:QV04:B	17.69	MEBT_Mag:PS_QV04:B_Set	17.69
MEBT_Mag:DCH04	MEBT_Mag:DCH04:B	0.0	MEBT_Mag:PS_DCH04:B_Set	0
MEBT_Mag:DCV04	MEBT_Mag:DCV04:B	0.0	MEBT_Mag:PS_DCV04:B_Set	-0
MEBT_RF:Bnch02	MEBT_LLRF:FCM2:cavV	1.01	MEBT_LLRF:FCM2:CtlAmpSet	1.01
MEBT_RF:Bnch02	MEBT_LLRF:FCM2:cavPhaseAvg	-90.0	MEBT_LLRF:FCM2:CtlPhaseSet	-90
MEBT_Mag:QH05	MEBT_Mag:QH05:B	17.0	MEBT_Mag:PS_QH05a10:B_Set	17
MEBT_Mag:DCH05	MEBT_Mag:DCH05:B	0.0	MEBT_Mag:PS_DCH05:B_Set	-0
MEBT_Mag:DCV05	MEBT_Mag:DCV05:B	0.0	MEBT_Mag:PS_DCV05:B_Set	0
MEBT_Mag:QV06	MEBT_Mag:QV06:B	26.2	MEBT_Mag:PS_QV06a09:B_Set	26.2
MEBT_Mag:QH07	MEBT_Mag:QH07:B	11.7	MEBT_Mag:PS_QH07a08:B_Set	11.7
MEBT_Mag:QH08	MEBT_Mag:QH08:B	11.7	MEBT_Mag:PS_QH07a08:B_Set	11.7
MEBT_Mag:QV09	MEBT_Mag:QV09:B	26.2	MEBT_Mag:PS_QV06a09:B_Set	26.2
MEBT_Mag:QH10	MEBT_Mag:QH10:B	17.0	MEBT_Mag:PS_QH05a10:B_Set	17
MEBT_Mag:DCH10	MEBT_Mag:DCH10:B	0.0	MEBT_Mag:PS_DCH10:B_Set	-0
MEBT_Mag:DCV10	MEBT_Mag:DCV10:B	0.0	MEBT_Mag:PS_DCV10:B_Set	0
MEBT_RF:Bnch03	MEBT_LLRF:FCM3:cavV	1.03	MEBT_LLRF:FCM3:CtlAmpSet	1.03
MEBT_RF:Bnch03	MEBT_LLRF:FCM3:cavPhaseAvg	-90.0	MEBT_LLRF:FCM3:CtlPhaseSet	-90
MEBT_Mag:QV11	MEBT_Mag:QV11:B	16.63	MEBT_Mag:PS_QV11:B_Set	16.63
MEBT_Mag:DCH11	MEBT_Mag:DCH11:B	0.0	MEBT_Mag:PS_DCH11:B_Set	-0
MEBT_Mag:DCV11	MEBT_Mag:DCV11:B	0.0	MEBT_Mag:PS_DCV11:B_Set	0
MEBT_Mag:QH12	MEBT_Mag:QH12:B	29.02	MEBT_Mag:PS_QH12:B_Set	29.02
MEBT_RF:Bnch04	MEBT_LLRF:FCM4:cavV	1.63	MEBT_LLRF:FCM4:CtlAmpSet	1.63
MEBT_RF:Bnch04	MEBT_LLRF:FCM4:cavPhaseAvg	-90.0	MEBT_LLRF:FCM4:CtlPhaseSet	-90
MEBT_Mag:QV13	MEBT_Mag:QV13:B	26.1	MEBT_Mag:PS_QV13:B_Set	26.1
MEBT_Mag:QH14	MEBT_Mag:QH14:B	10.44	MEBT_Mag:PS_QH14:B_Set	10.44
MEBT_Mag:DCH14	MEBT_Mag:DCH14:B	0.0	MEBT_Mag:PS_DCH14:B_Set	0
MEBT_Mag:DCV14	MEBT_Mag:DCV14:B	0.0	MEBT_Mag:PS_DCV14:B_Set	0
DTL1	DTL_LLRF:FCM1:cavAmpAvg	1.13	DTL_LLRF:FCM1:CtlAmpSet	1.13
DTL1	DTL_LLRF:FCM1:cavPhaseAvg	-45.0	DTL_LLRF:FCM1:CtlPhaseSet	-45
DTL_Mag:DCH149	DTL_Mag:DCH149:B	0.0	DTL_Mag:PS_DCH149:B_Set	0
DTL_Mag:DCV152	DTL_Mag:DCV152:B	0.0	DTL_Mag:PS_DCV152:B_Set	0
DTL_Mag:DCH155	DTL_Mag:DCH155:B	0.0	DTL_Mag:PS_DCH155:B_Set	0
DTL_Mag:DCV158	DTL_Mag:DCV158:B	0.0	DTL_Mag:PS_DCV158:B_Set	0
DTL2	DTL_LLRF:FCM2:cavAmpAvg	3.052	DTL_LLRF:FCM2:CtlAmpSet	3.052