Application Programming

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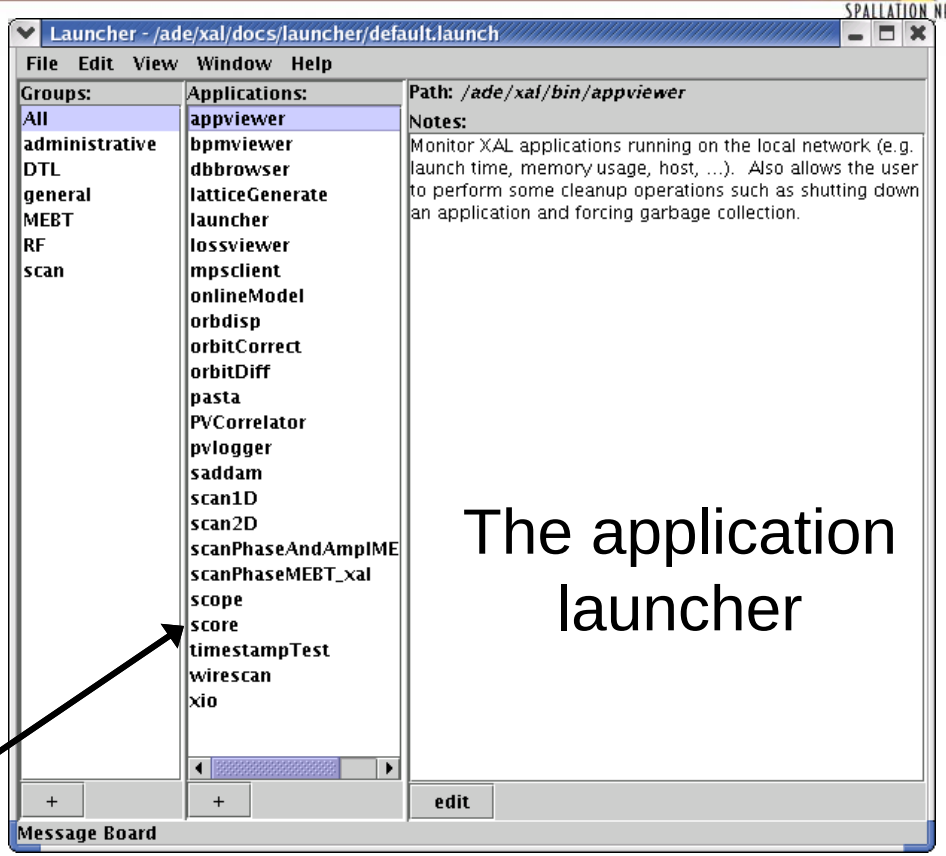
November 16-18, 2004

Application Programming Update Since May 2004

- XAL Infrastructure
  - Framework, services
  - Online model



The application launcher

- Data Analysis

- Applications
  - ~ 25 XAL applications (+ 5 under active development)
  - Performance improvement
  - Bug fixes
- General performance optimization (work with Controls)

XAL Infrastructure Progress *(T. Pelaia, A. Shishlo)*

- PV logger (Service)
  - General capability to log groups of signals to the database

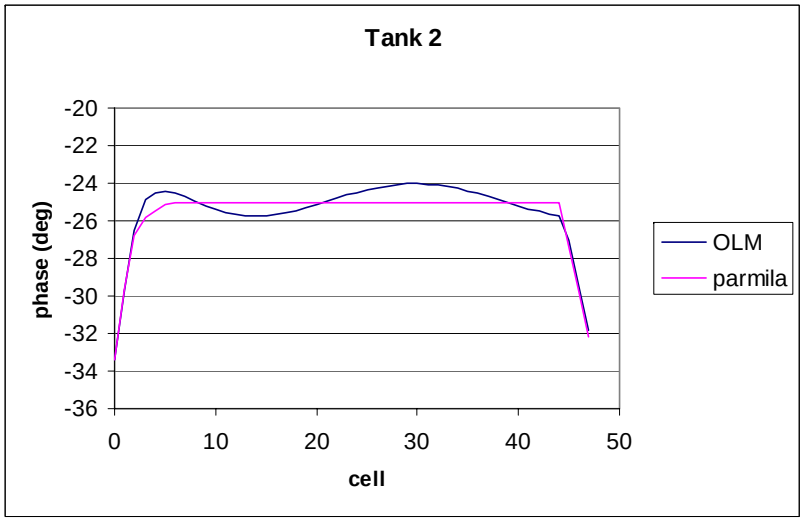
- Application Framework
  - Application error logging

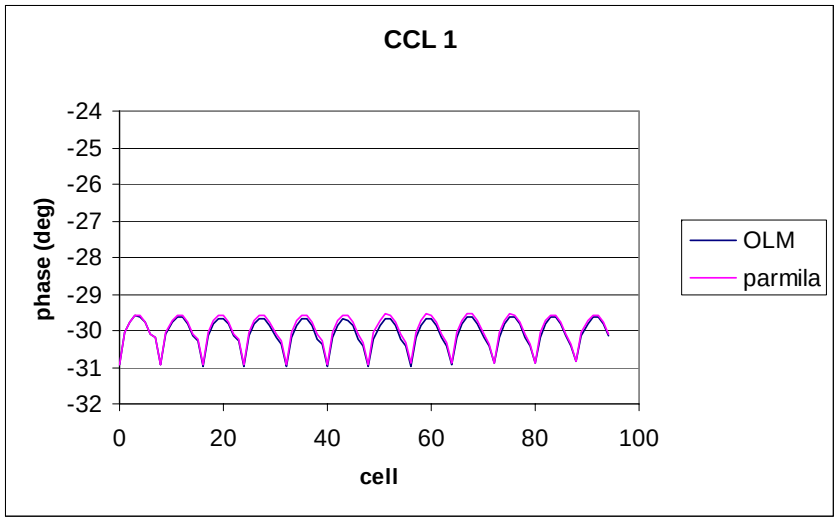
- Tools
  - Optimization/fitting routines: new infrastructure set up
    - Random algorithm, etc.
  - Graphics package features

- Java Channel Access upgrade
  - Native Java interface
    - More portable for different OS platforms

XAL Infrastructure Progress: Online Model *(C. Allen, J. Galambos)*

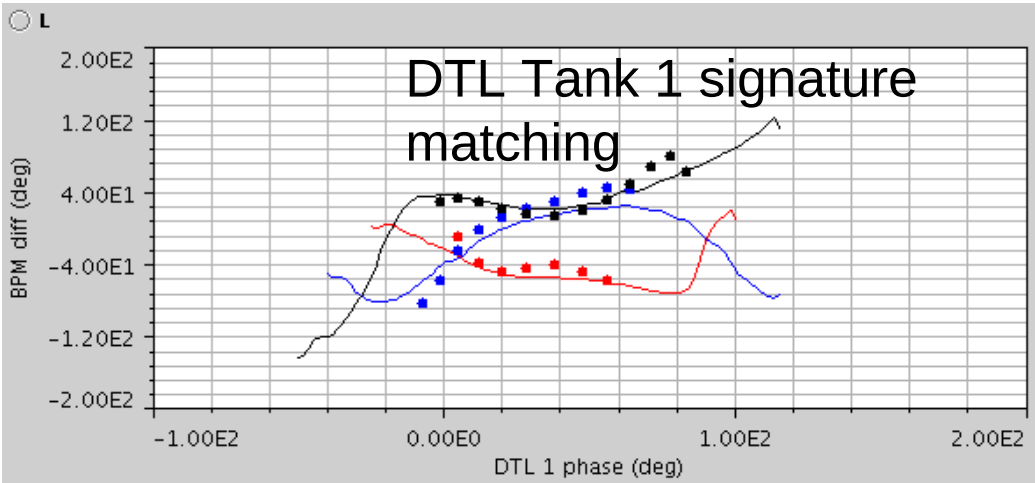
- Added longitudinal phase tracking
  - Advance both phase and energy (coupled equations)
  - Generalized the procedure, database configured.
  - Allows us to compare the model with measurements as RF phase/amplitude is adjusted.
- Benchmarked to parmila
  - Phase good to ~ 1 deg, energy good to ~ 10's of keV





Online model: Longitudinal Tracking *(J. Galambos)*

- Compared longitudinal phase calculations to data taken during the last commissioning run
  - scanned DTL phase at different amplitudes and monitored downstream BPM phases
- Using a script, work out the algorithm to do the "phase signature matching"
- Solve for the cavity amplitude (MV/m), cavity phase relative to the beam, and incident beam energy



Red = lower amp.

Blue = middle amplitude

Black = higher amplitude

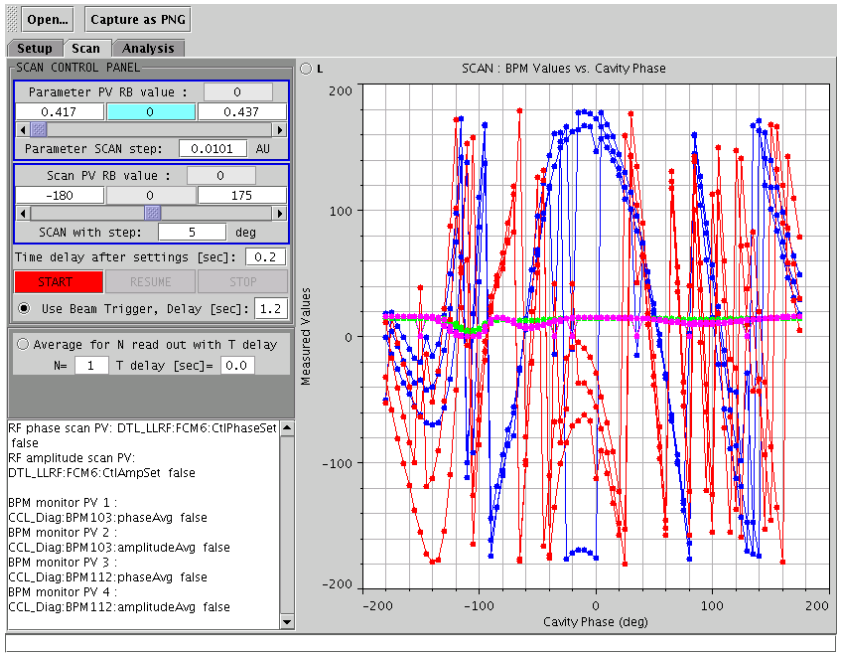
Curves = measurements

Dots = model

- Made an application

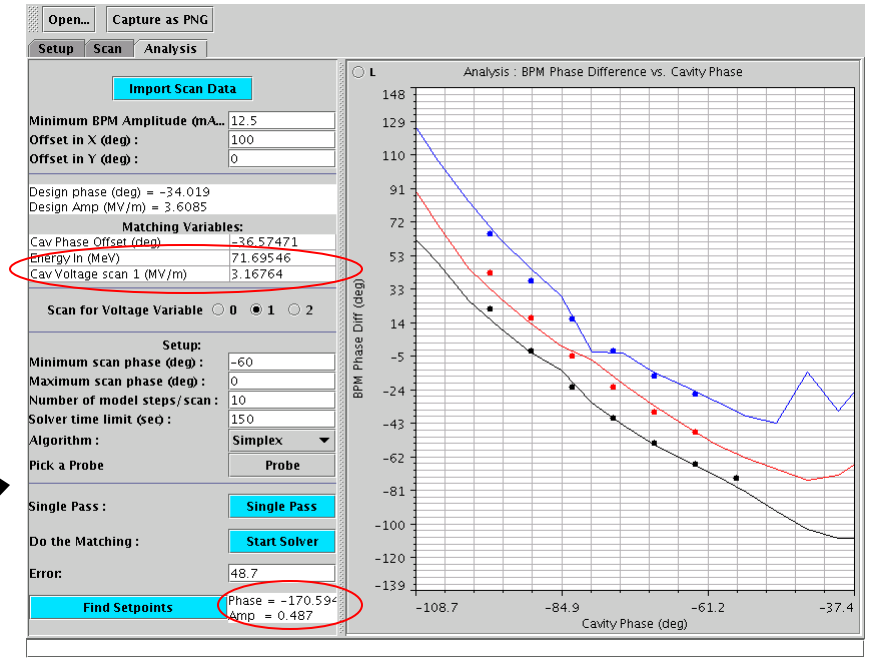
PASTA (Phase / Amplitude Scan and Tuning Application) *(J. Galambos)*

- General cavity phase / amplitude scan and analysis application
  - Needs speeding up and robustness features



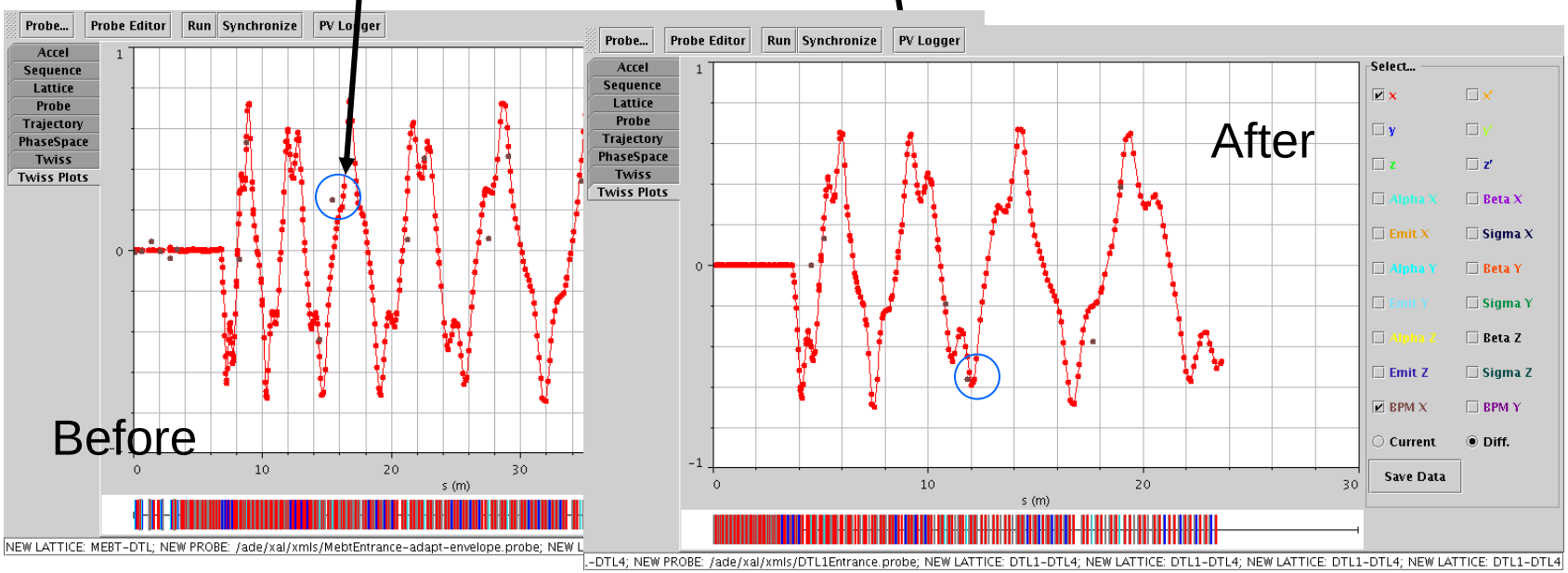
Do the cavity scans

Solve for incoming beam energy, cavity phase and amplitude calibrations :

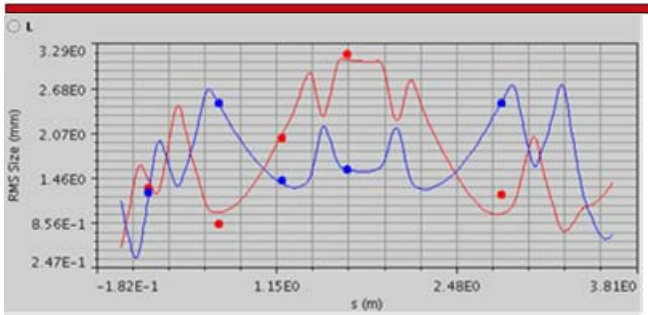


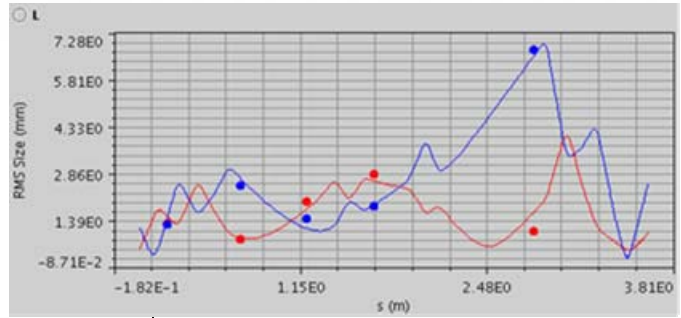
Beam Trajectory Study with Online Model App

- Found following problems from orbit difference when comparing model with BPM data
  - MEBT dipole corrector H polarity
  - CCL dipole corrector field strengths
  - DTL3 BPM308 H polarity



Transverse Beam Property Analysis *(J. Galambos)*





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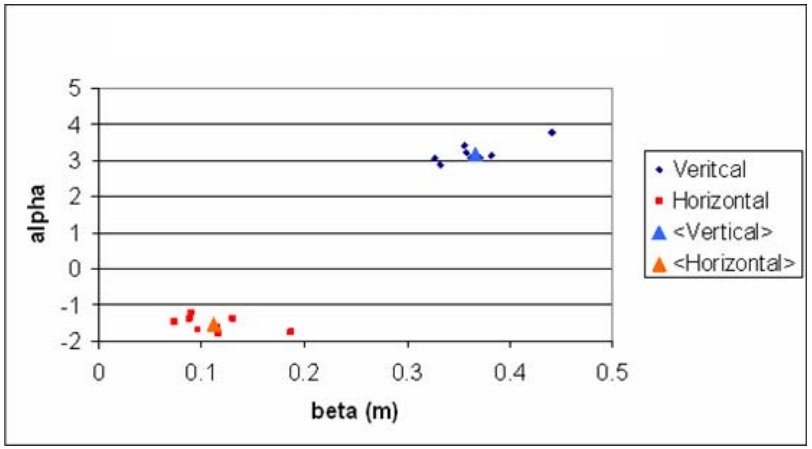
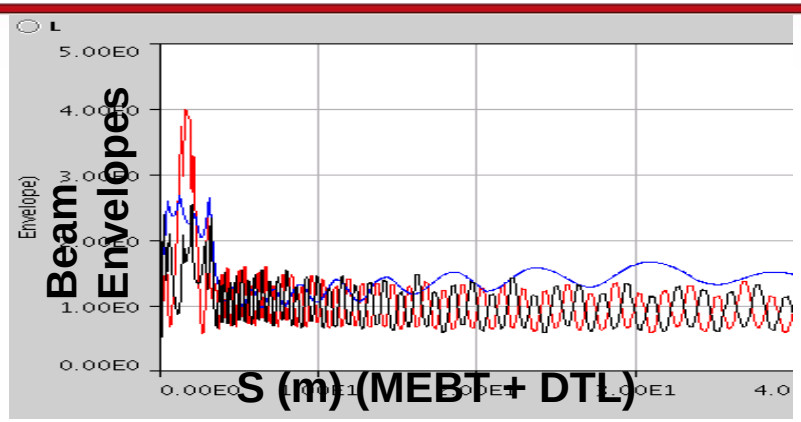


- Compare measured and model predicted beam sizes in the MEBT for a variety of MEBT magnet settings
- Solve for MEBT entrance twiss parameters to best match measured wire profiles under a variety of quad settings
- Uses solver + online model packages within a script.
- Agrees with independent Aleksandrov analysis

MEBT Quad Matching, for New Input Twiss Parameters *(J. Galambos)*

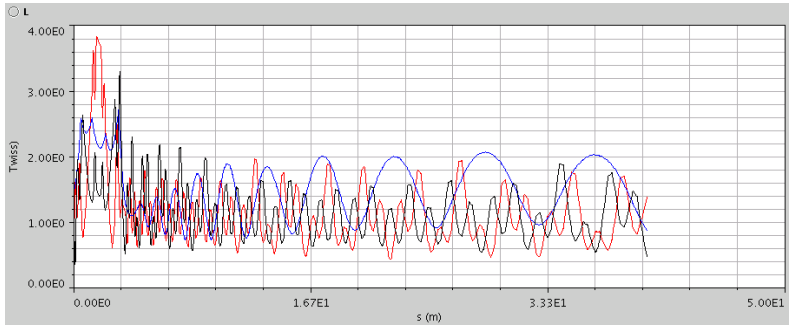


Red: Hori.

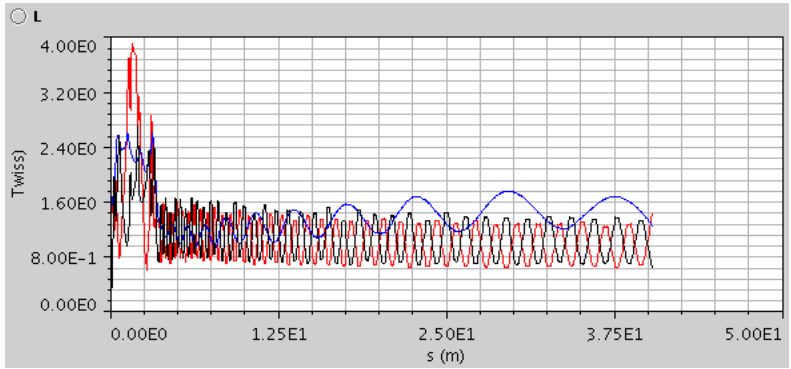
Black: Vert.

Blue:Long.

Old input Twiss, Old MEBT quad settings



New input Twiss, Old MEBT quad settings



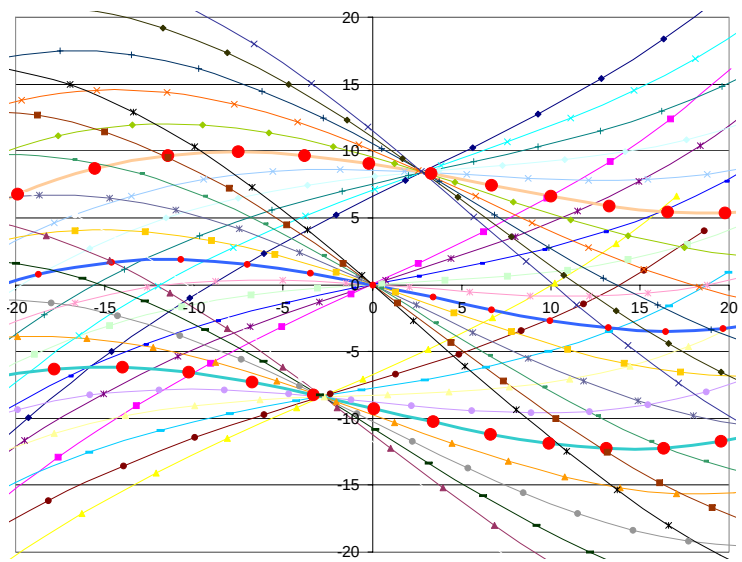
New input Twiss, New MEBT quad settings

Longitudinal Beam Dynamics For CCL *(Institute Nuclear Research, Moscow)*

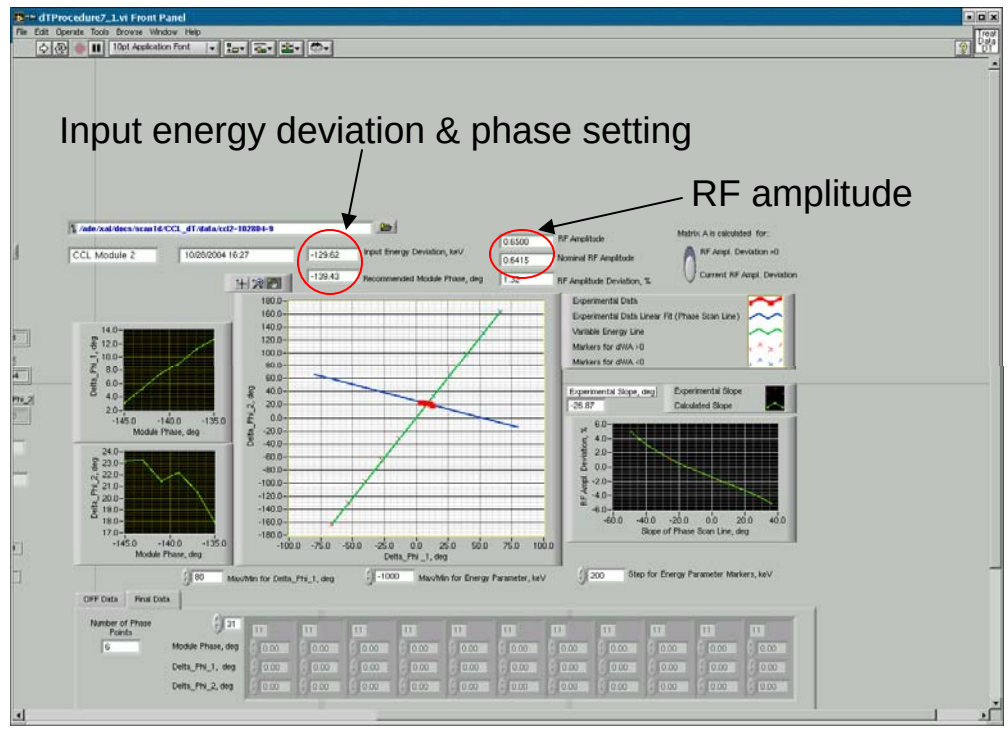
- Perform parametric scans of CCL cavity phase, cavity amplitude and input energy
  - Calculate downstream BPM phases
  - Used in INR Delta-T measurement

Online model input calculations

(Downstream BPM phase changes vs. CCL phase, amplitude and input energy)

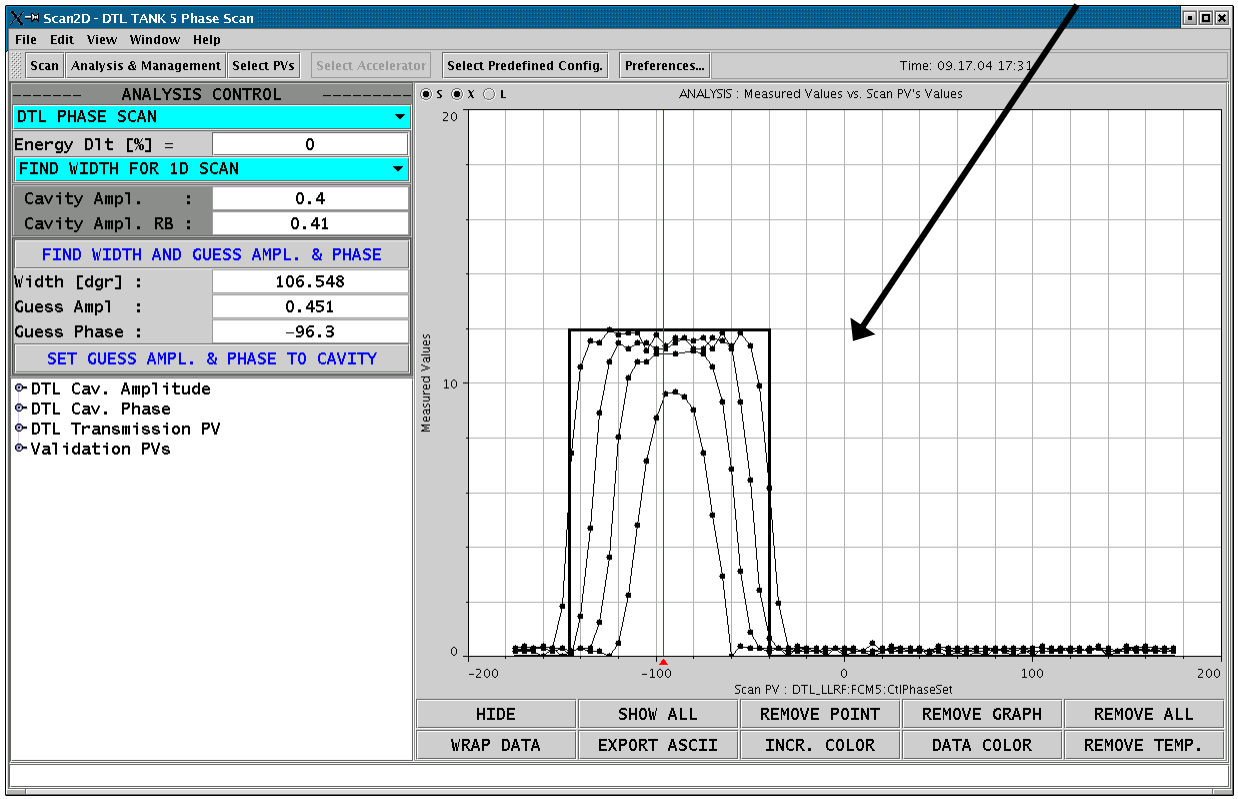


INR Delta-T Application



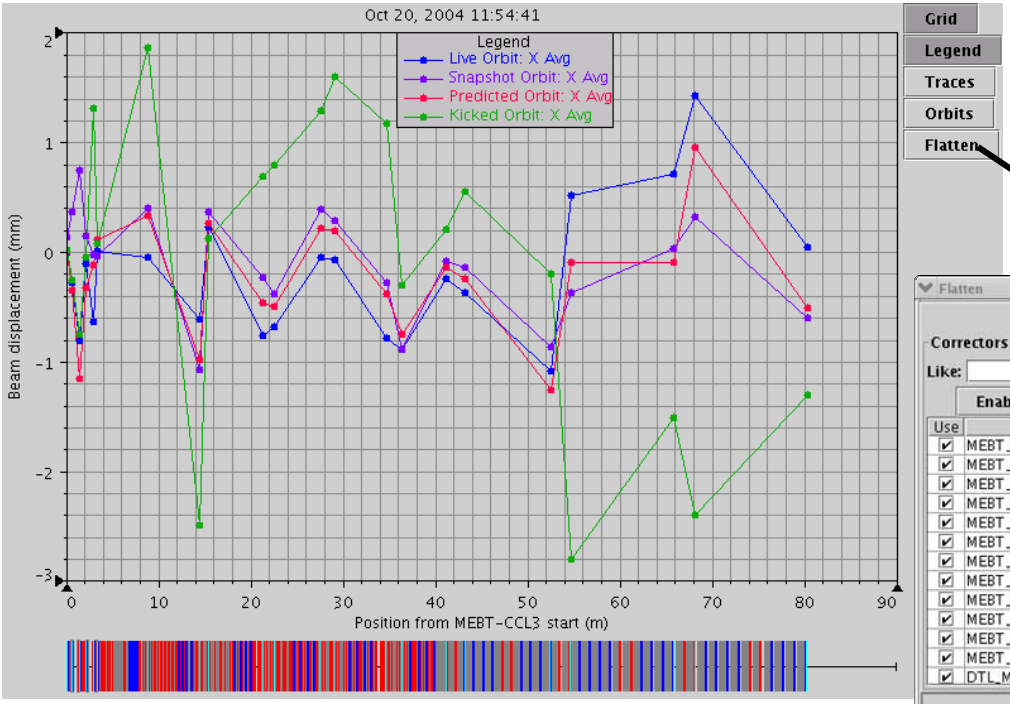
(New) 2-D Scan Application *(A. Shishlo)*

- Added 2-D scan capability (parametric scans)
- Define preset configurations
  - Optional analysis capability
- Used for DTL acceptance scans for phase/amplitude setting
  - Scan DTL phase + amplitude, monitor Faraday Cup signal

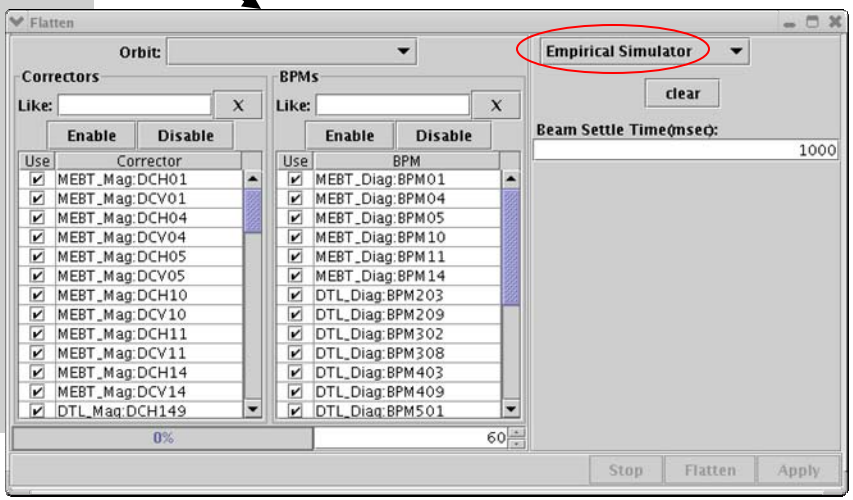


(New) Orbit Correction Application *(T. Pelaia)*

- Automatically flatten orbit:
  - Use online model or empirical method
  - Use newly developed solver/optimizer
  - View live orbit
  - Can flatten to any reference orbit



MEBT-CCL3 horizontal orbit

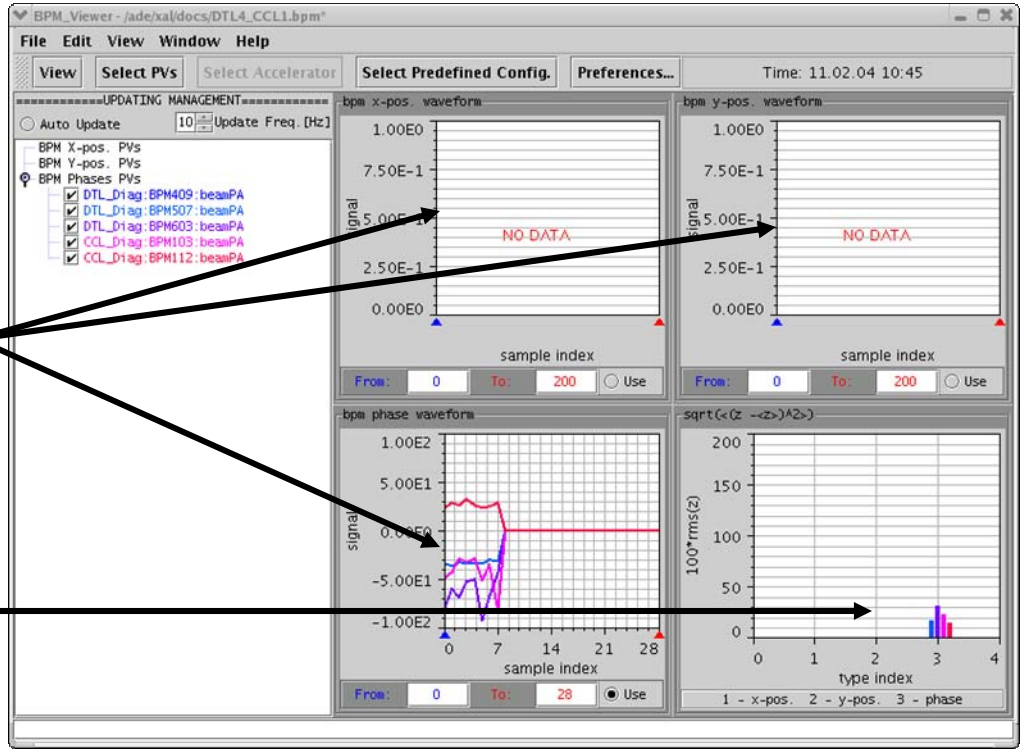


(New) "BPM" Viewer *(A. Shishlo)*

- Display multiple waveforms
  - Generic tool for displaying any waveforms (not limited to BPMs')
  - For beam tuning

Showing 3 sets of waveforms

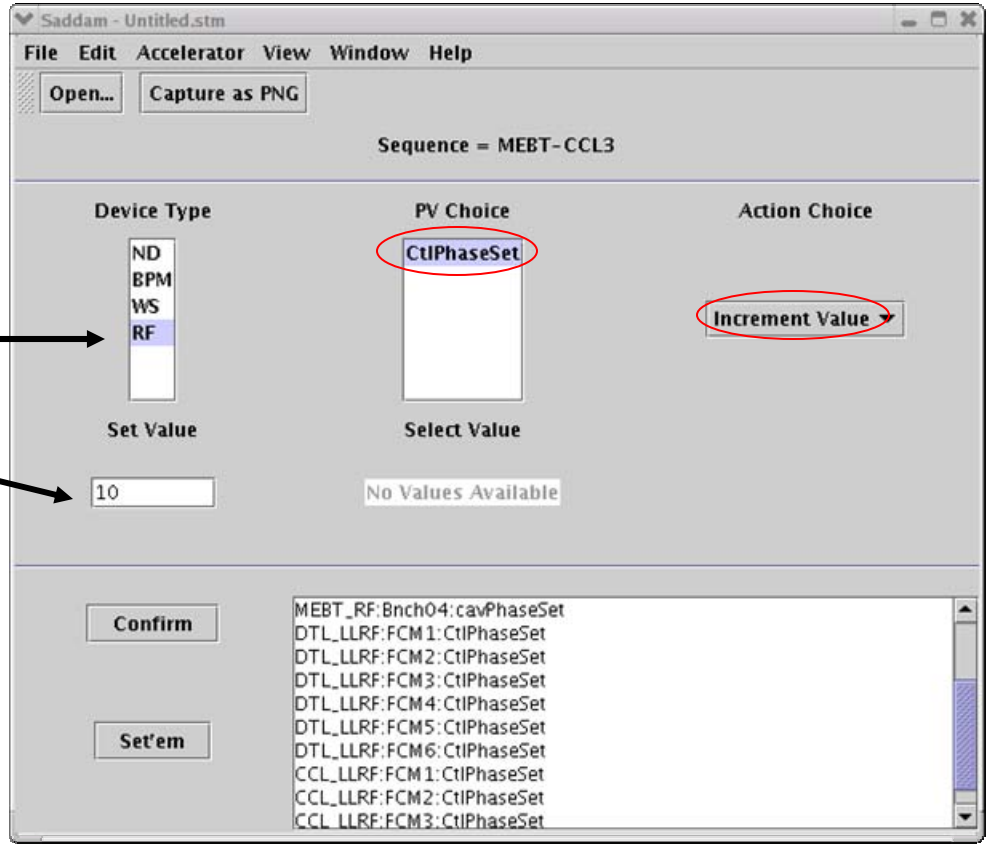
Standard deviation



(New) SADDAM (Set A lot Different Devices All Mutually) *(J. Galambos)*

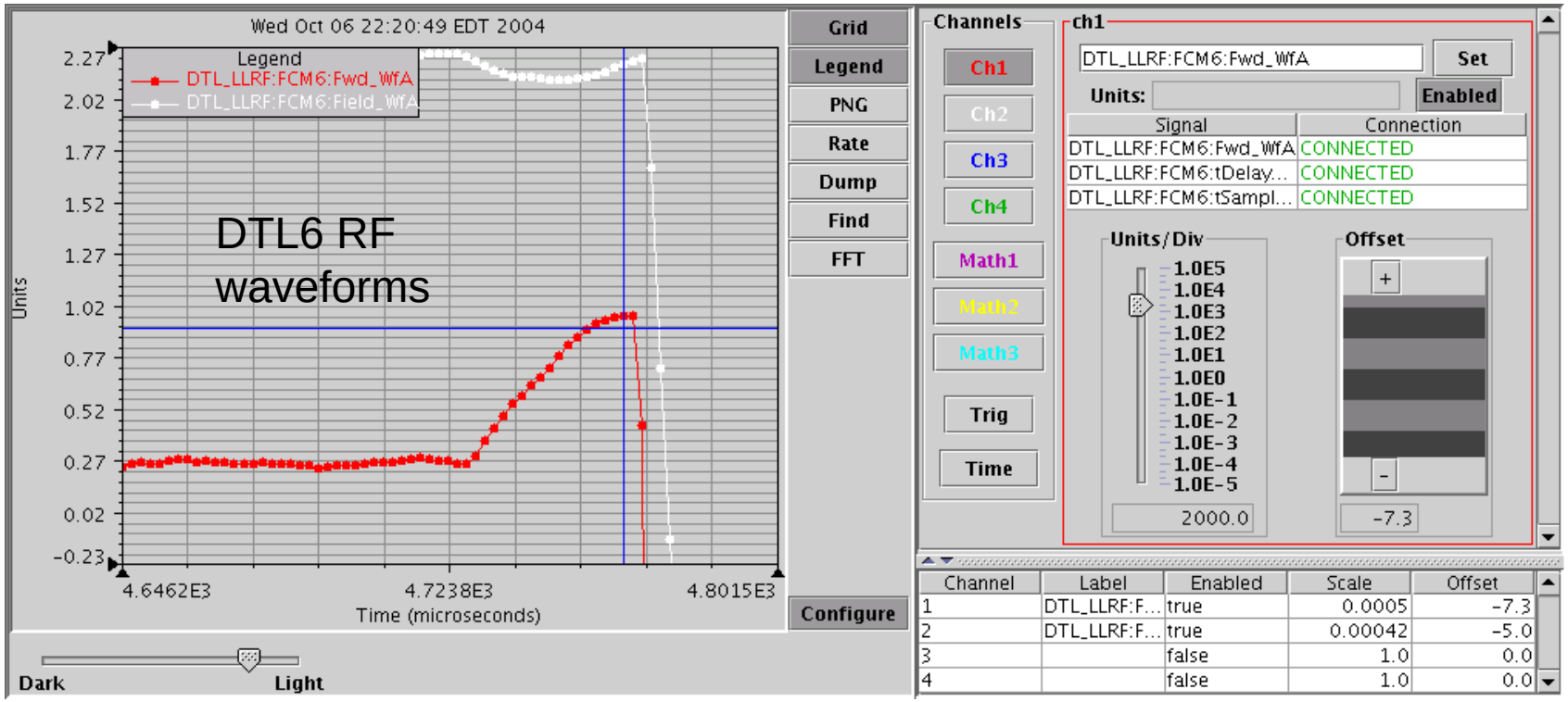
- A global knob tool
- Mainly for RF and diagnostic devices

Shifting all RF cavity phases by 10°



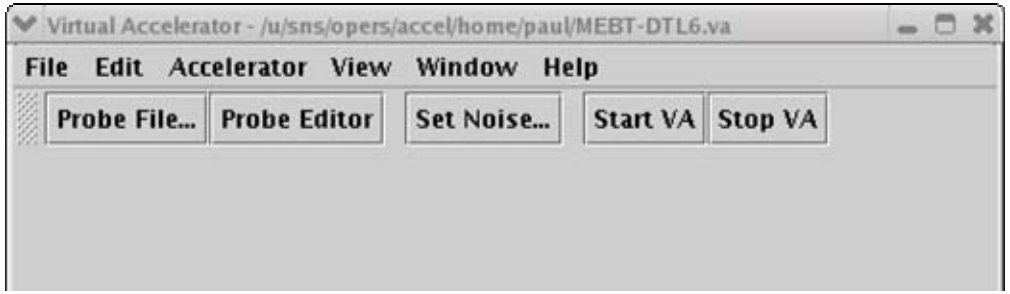
(Improved) Scope Application *(T. Pelaia)*

- The Digital Oscilloscope – display waveforms vs. <u>time</u>
- Triggered RF waveform display
  - Only display RF waveform with beam (RF = 20 Hz, beam = 1 Hz)
- Can be used for tuning

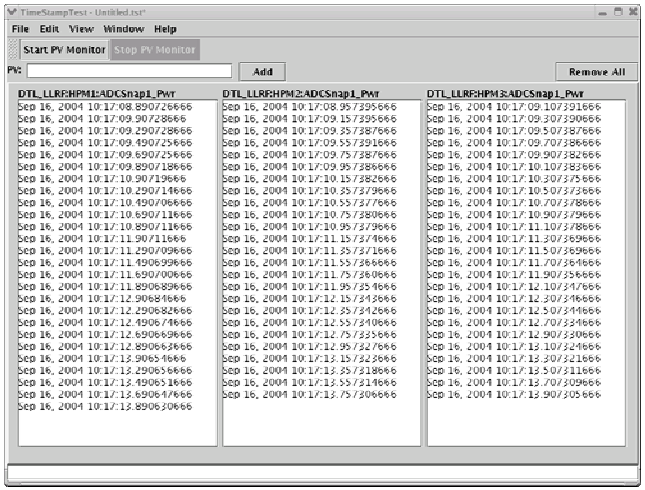


Other New Applications

- Virtual Accelerator – Generalized to work for any accelerator sequence
  - Provides model based EPICS signals for application development



- Timestamp checker – verify signal timestamps are reasonable



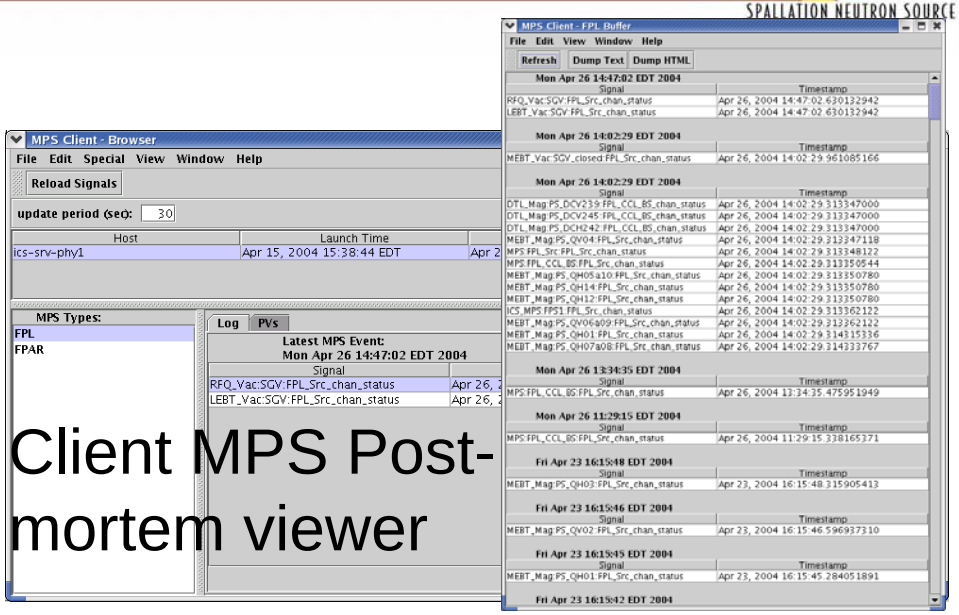
Summary

- The XAL application programming infrastructure is in place and working.
  - ~ 25 applications written – actively used in commissioning activities
  - Online model used more extensively

- Issues
  - Java – “heavier” than typical X-widgets.
    - Network bandwidth, OS fine tuning (with Controls)
    - New version of Java SDK and compilation optimization
  - Need to revisit some applications to make them more efficient.
  - Provide a systematic data save scheme for applications.

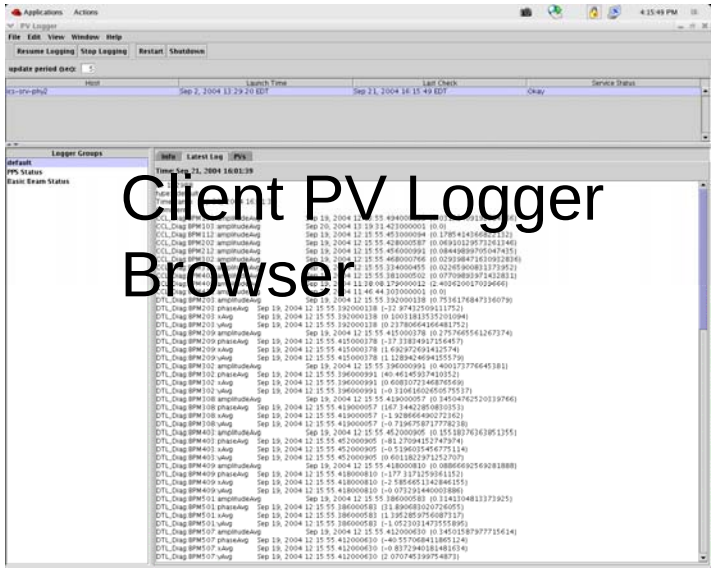
(Improved) Service Applications *(T. Pelaia)*

- MPS post-mortem (tracks first fault incidents)
  - posts statistics to elog daily
  - history views



Client MPS Post-mortem viewer

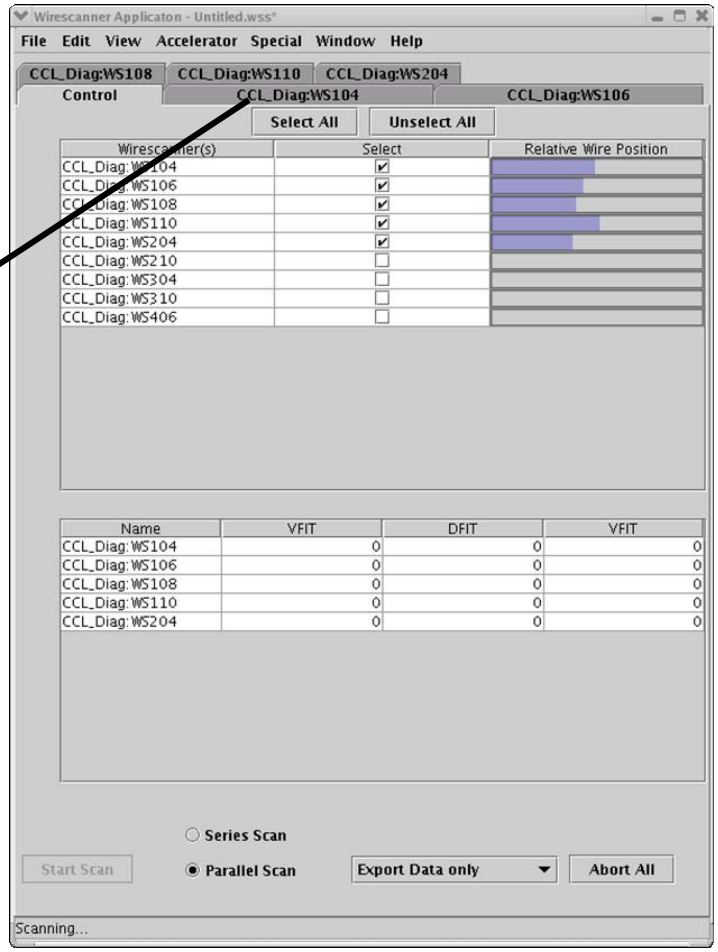
- PV Logger – posts sets of data to the database
  - periodically or pushbutton
  - Generalized to allow for custom PV sets

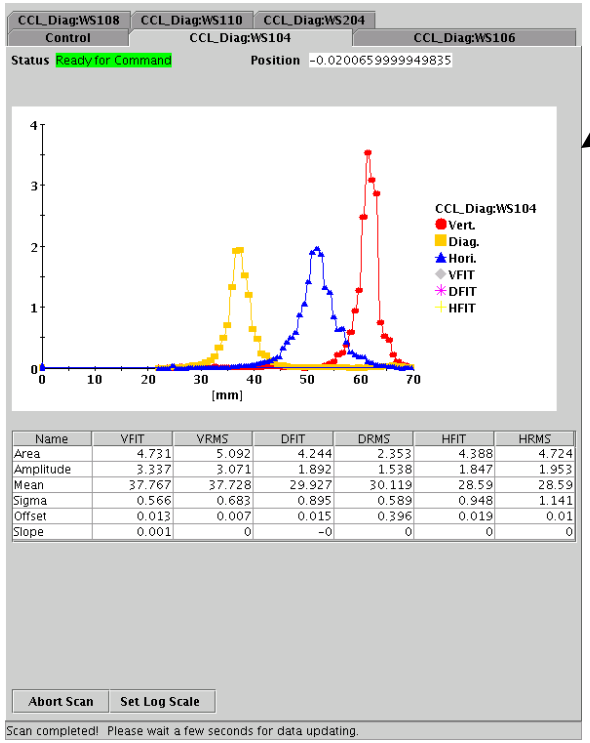


Client PV Logger Browser

(Improved) Wire Scanner Application *(P. Chu, S. Bunch)*

- Provides an easy way to quickly run many wire scans at once
  - Export wire data to a file
  - Save machine status to PV logger
  - View individual profile results
  - Translate data to Matlab format



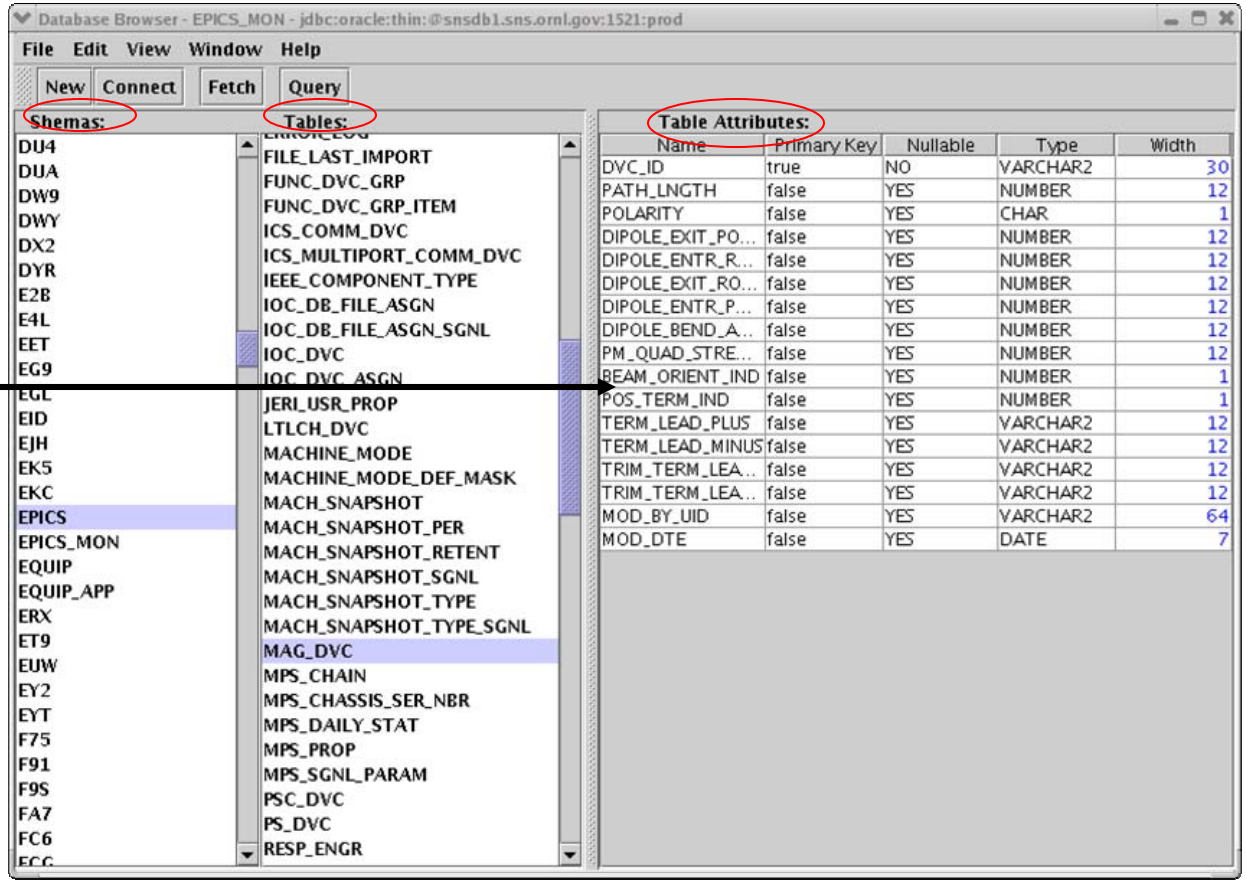


Used for CCL entrance optimization

(New) DB Browser *(T. Pelaia)*

- Tool for querying database table attributes.

Querying magnet device table



Name	Primary Key	Nullable	Type	Width
DVC_ID	true	NO	VARCHAR2	30
PATH_LNGTH	false	YES	NUMBER	12
POLARITY	false	YES	CHAR	1
DIPOLE_EXIT_PO...	false	YES	NUMBER	12
DIPOLE_ENTR_R...	false	YES	NUMBER	12
DIPOLE_EXIT_RO...	false	YES	NUMBER	12
DIPOLE_ENTR_P...	false	YES	NUMBER	12
DIPOLE_BEND_A...	false	YES	NUMBER	12
PM_QUAD_STRE...	false	YES	NUMBER	12
BEAM_ORIENT_IND	false	YES	NUMBER	1
POS_TERM_IND	false	YES	NUMBER	1
TERM_LEAD_PLUS	false	YES	VARCHAR2	12
TERM_LEAD_MINUS	false	YES	VARCHAR2	12
TRIM_TERM_LEA...	false	YES	VARCHAR2	12
TRIM_TERM_LEA...	false	YES	VARCHAR2	12
MOD_BY_UID	false	YES	VARCHAR2	64
MOD_DTE	false	YES	DATE	7