Application Programming

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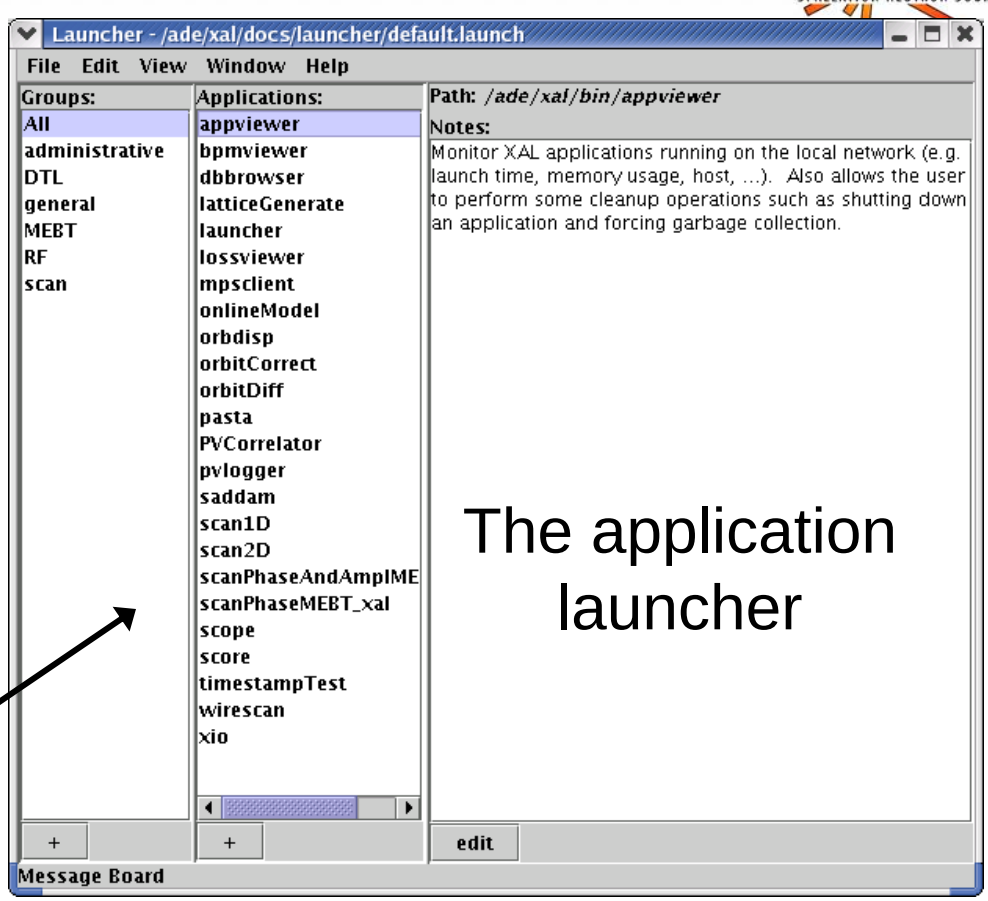
Application Programming Update Since March 2004

- XAL Infrastructure
  - Framework, services
  - Online model
- Data Analysis
- Applications
  - Over 20 XAL applications (+ 5 under active development)



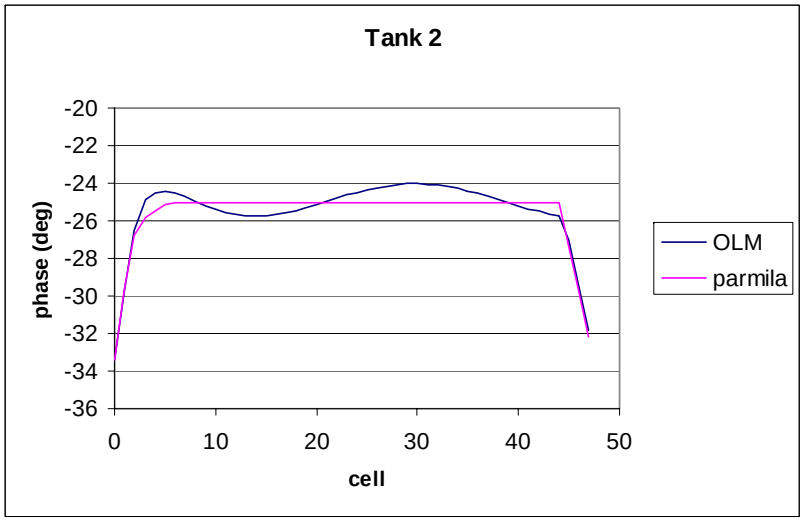
The application launcher

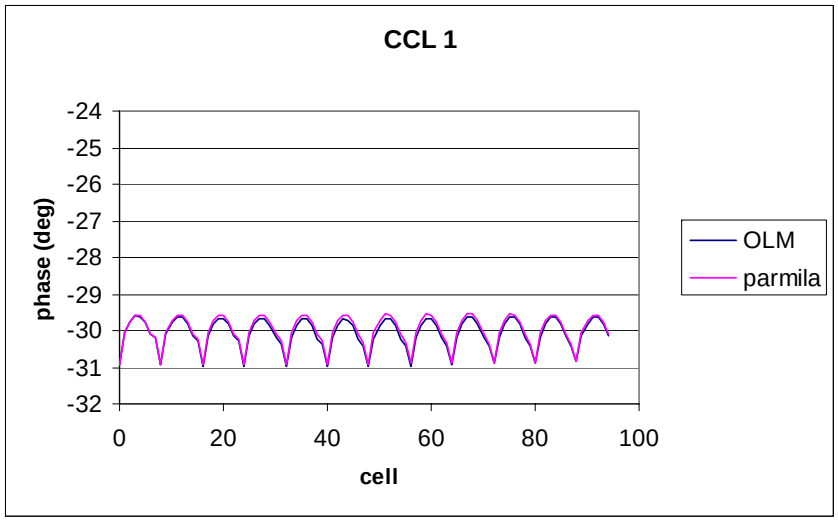
XAL Infrastructure Progress *(T. Pelaia)*

- PV logger
  - General capability to log groups of signals to the database
- Application Framework
  - Log errors
- Tools
  - Solver: new infrastructure set up
  - Graphics package features
- Java Channel Access upgrade

XAL Infrastructure Progress: Online model

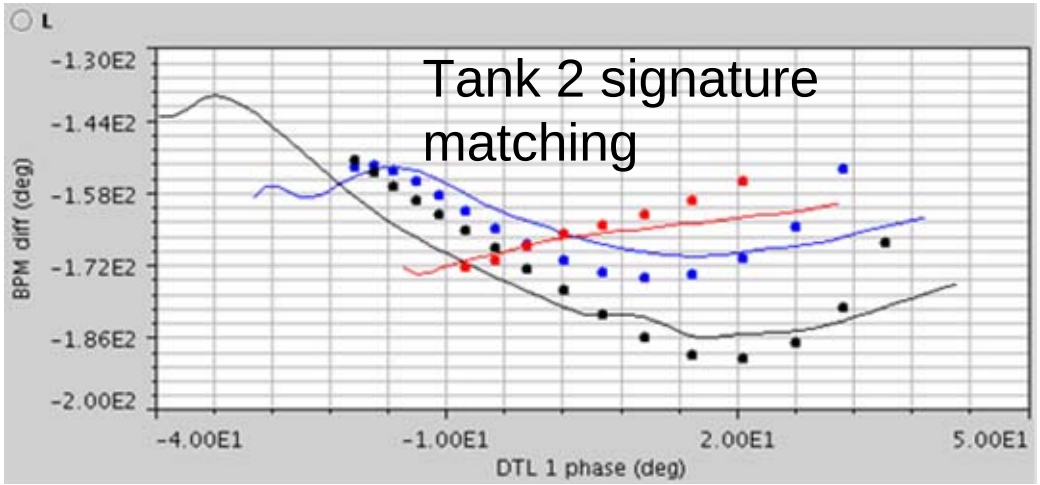
- Added longitudinal phase tracking
  - Advance both phase and energy (coupled equations)
  - Generalized the procedure, database configured.
  - Allows us to compare the model with measurements as RF phase/amplitude is adjusted.
- Benchmarked to parmila
  - Phase good to ~ 1 deg, energy good to ~ 10's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





Online model: Longitudinal Tracking

- 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

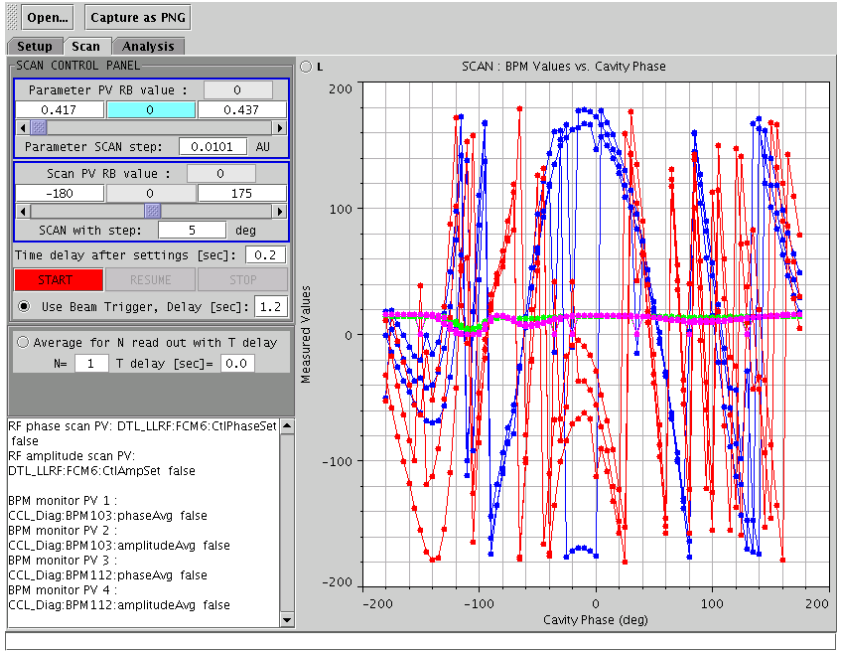
Curves = measurements

Dots = model

- Made an application

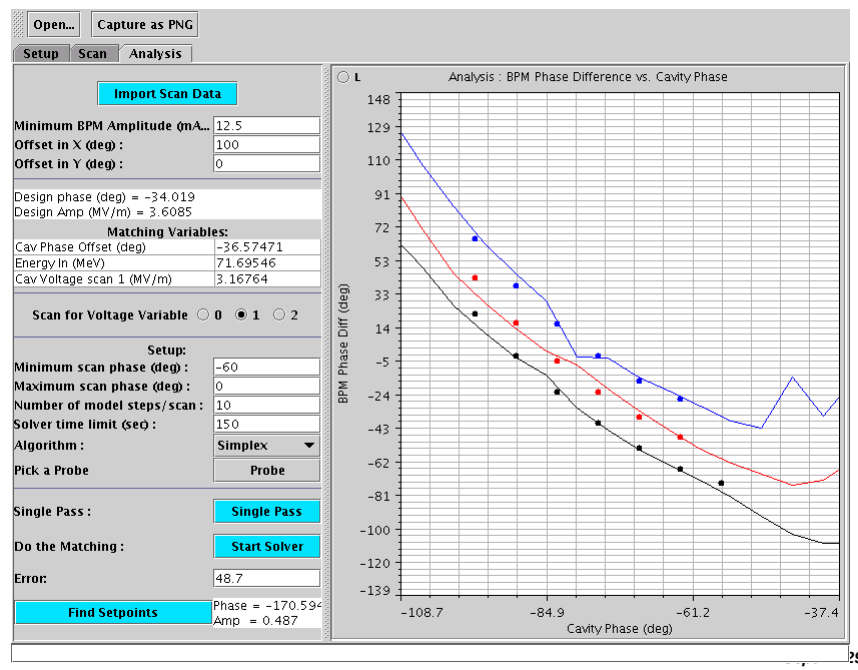
PASTA (Phase / Amplitude Scan and Tuning Application)

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

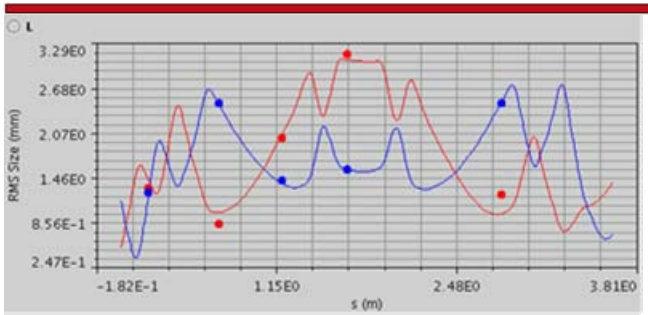


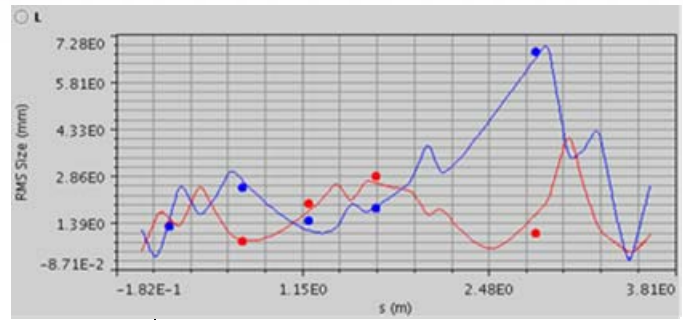
Do the cavity scans

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



Transverse Beam Property Analysis





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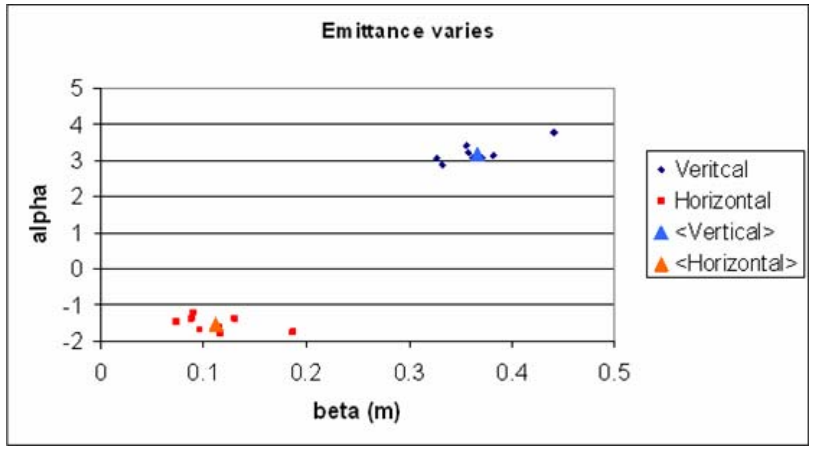
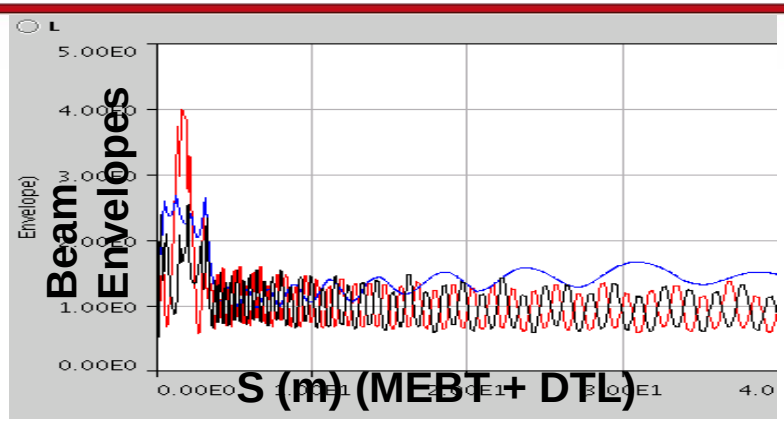
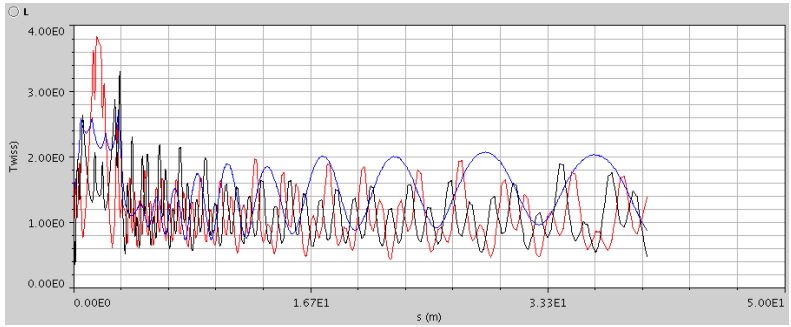


- Compare measured and model predicted beam sizes in the MEBT for a variety of MEBT magnet settings
- Solve for MEBT entrance twiss parameters to best match measured wire profiles under a variety of quad settings
- Uses solver + online model packages within a script.
- Agrees with independent Aleksandrov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

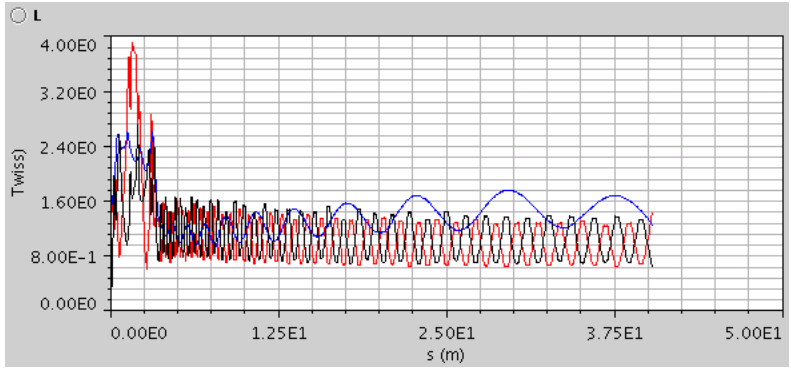
MEBT Quad Matching, for new input Twiss Parameters



Old input Twiss, Old MEBT quad settings



New input Twiss, Old MEBT quad settings



New input Twiss, New MEBT quad settings

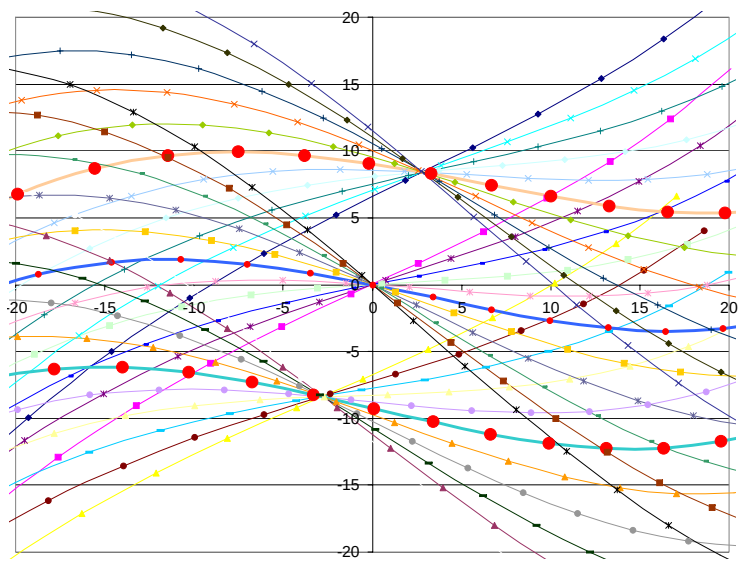
Longitudinal Beam Dynamics For CCL

(Institute Nuclear Research, Moscow)

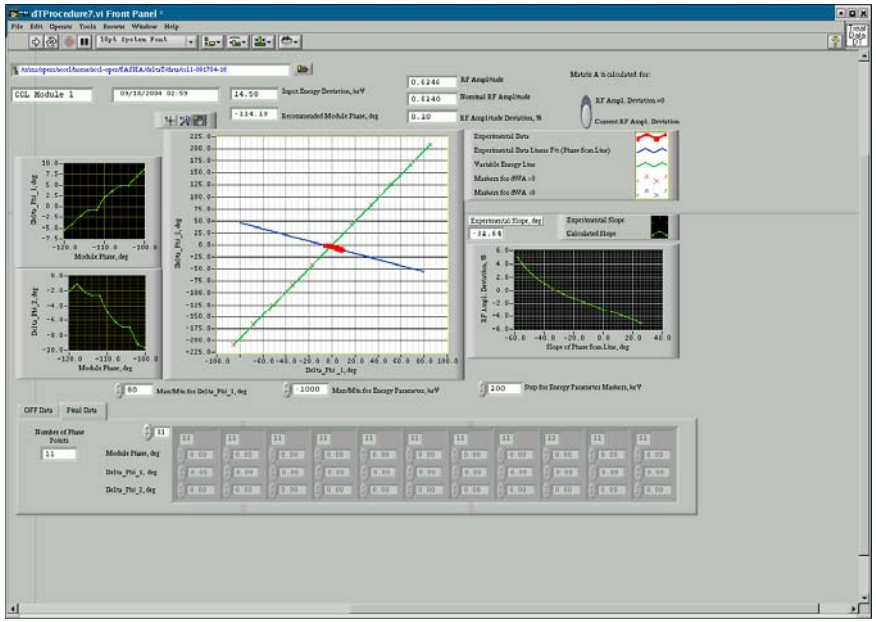
- Perform parametric scans of CCL cavity phase, cavity amplitude and input energy
  - Calculate downstream BPM phases
  - Used in INR Delta-T measurement

Online model input calculations

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

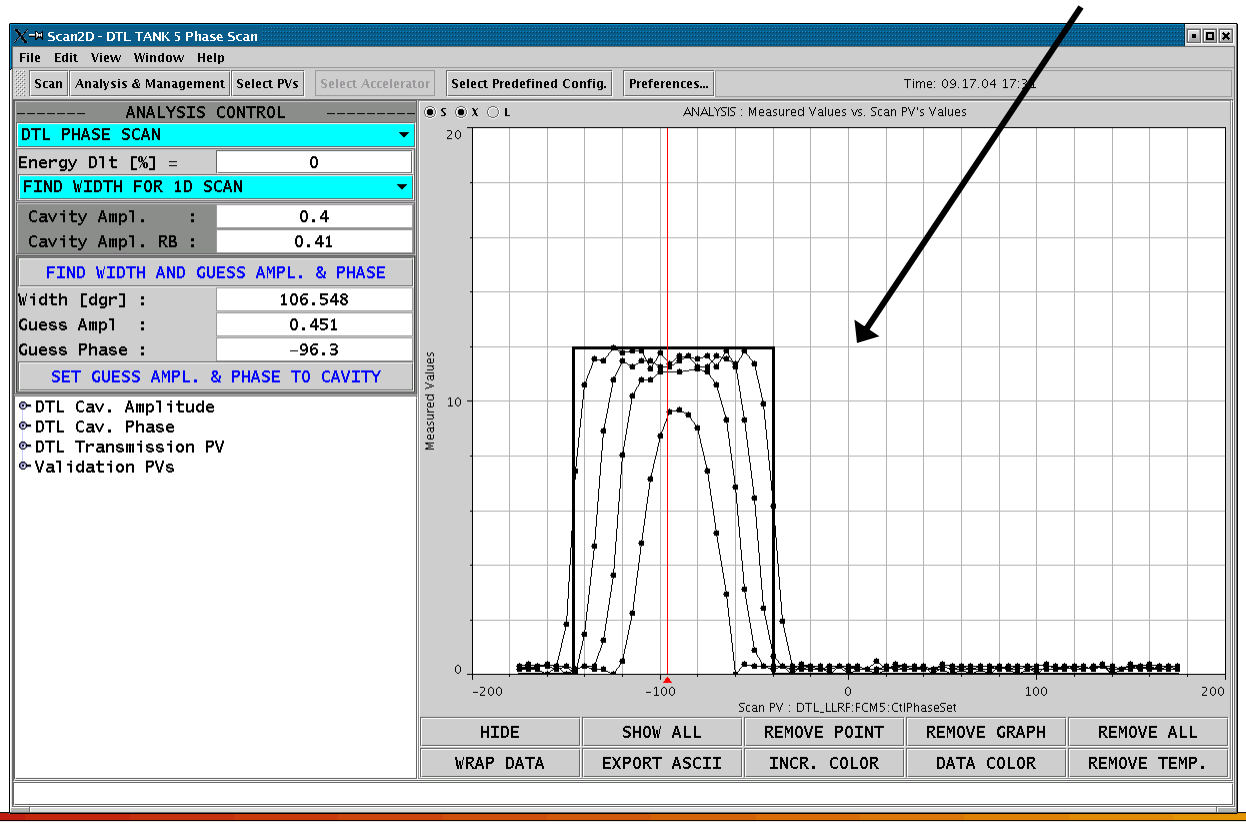


INR Delta-T Application



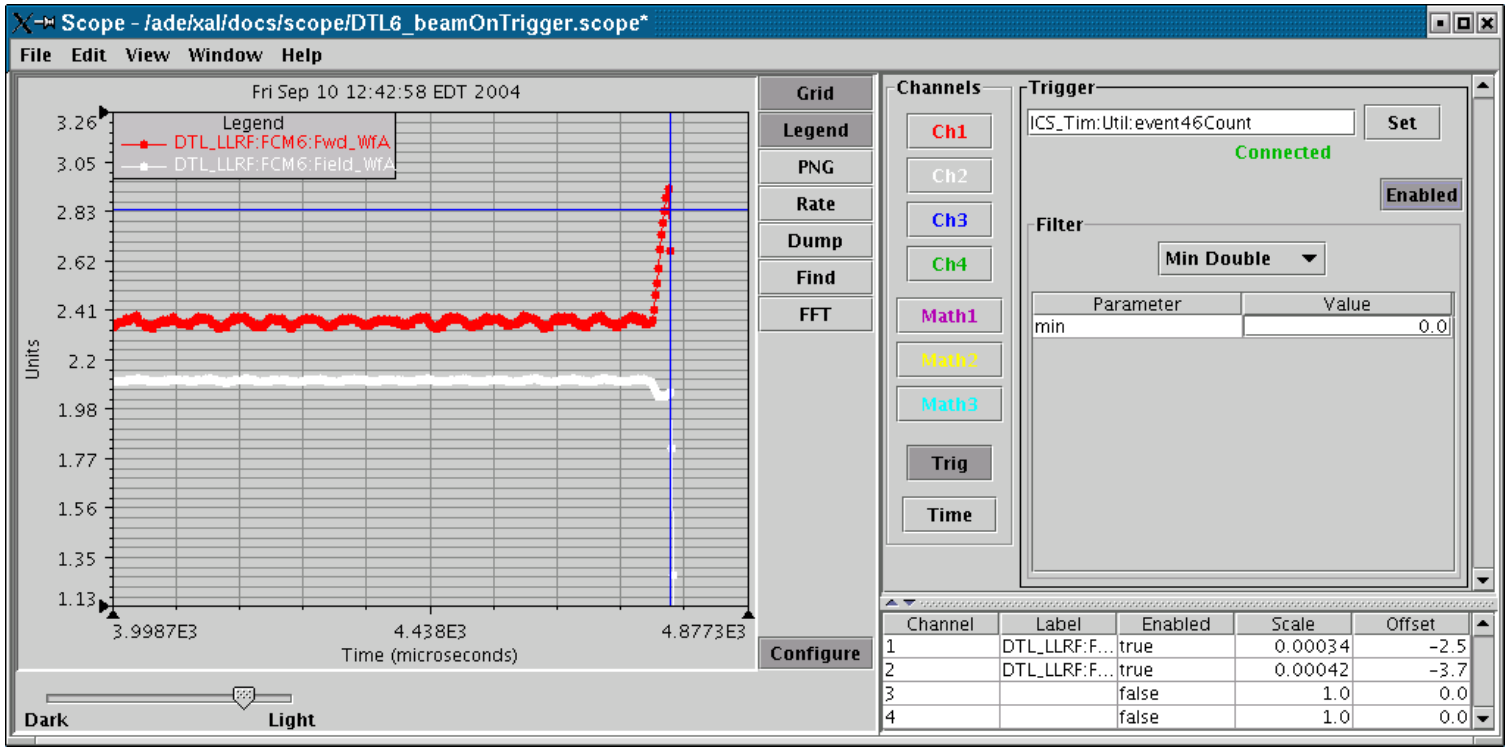
2-D Scan Application *(A. Shishlo)*

- 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



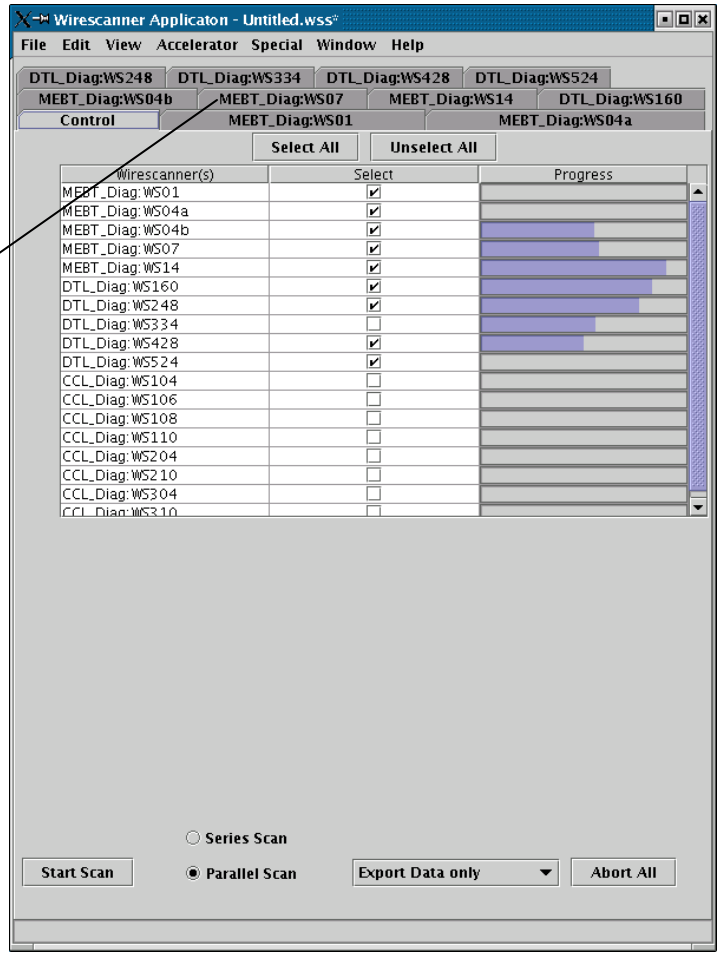
Scope Application *(T. Pelaia)*

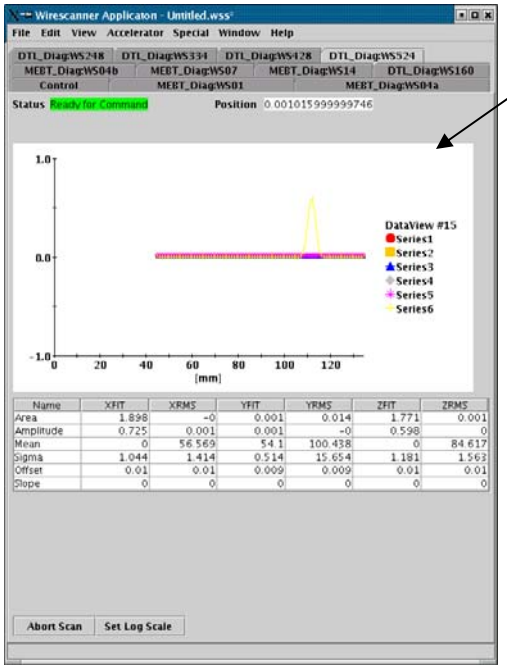
- The Digital Oscilloscope – display waveforms vs. <u>time</u>
- Triggered RF waveform display
  - Only display RF waveform with beam (RF = 20 Hz, beam = 1 Hz)
- Can be used for tuning



Wirescanner Application *(P. Chu, S. Bunch)*

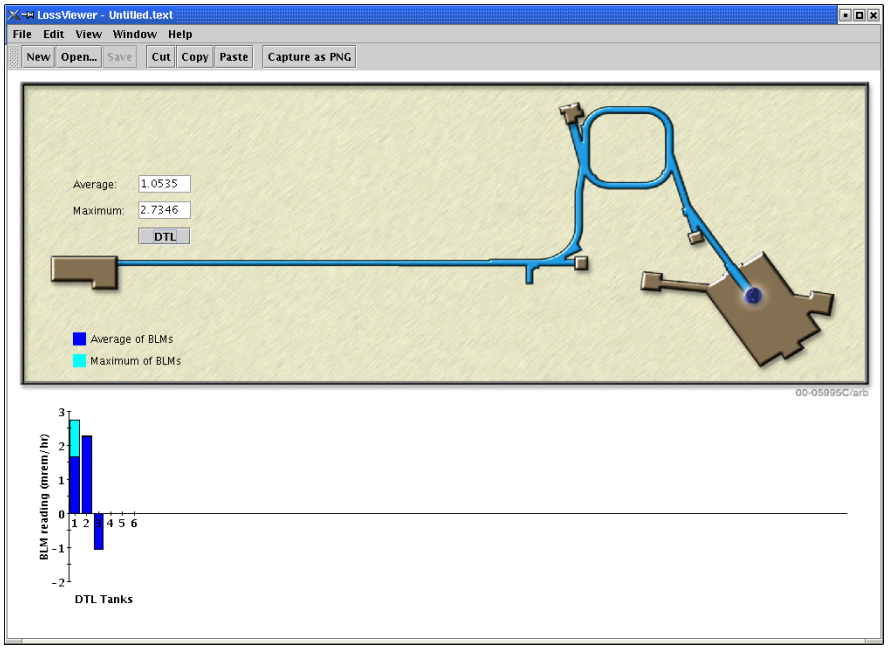
- Provides an easy way to quickly run many wire scans at once
  - Standard accelerator browser
  - Exports wire data to a file
  - View individual profile results
  - Translate data to Matlab format

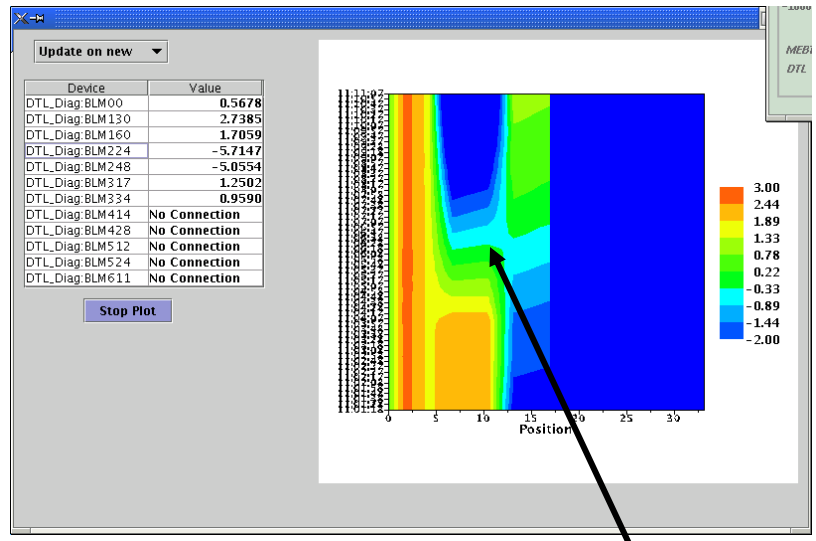


- 

Used for MEBT input Twiss parameter study

Loss Viewer Application *(S.Cousineau)*

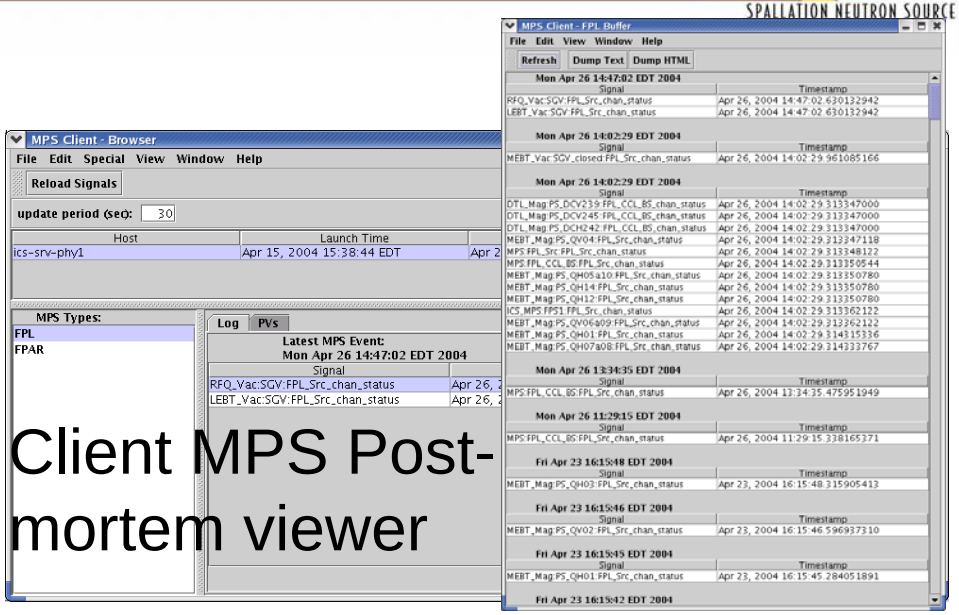




- View a summary of beam loss by machine section
  - "Zoomable" to specific BLMs
  - Viewable as fraction of permissible loss
- Waterfall display of a specific beamline portion
  - Faraday cup retracted here

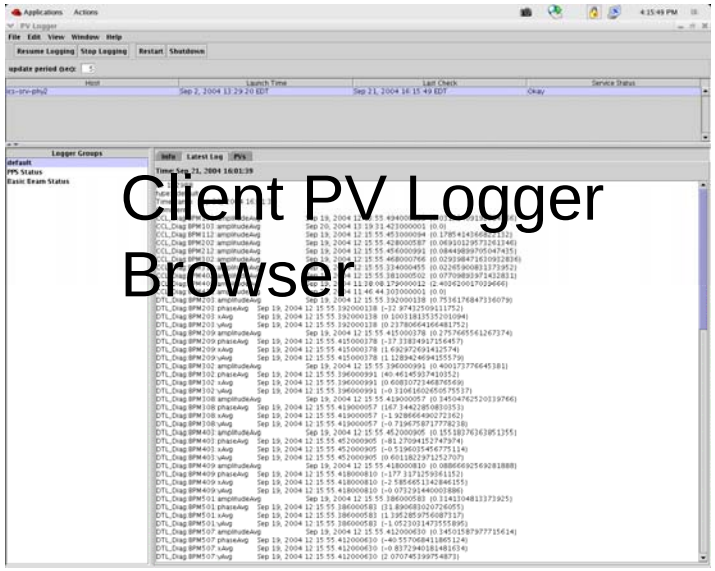
Service Applications *(T. Pelaia)*

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



Client MPS Post-mortem viewer

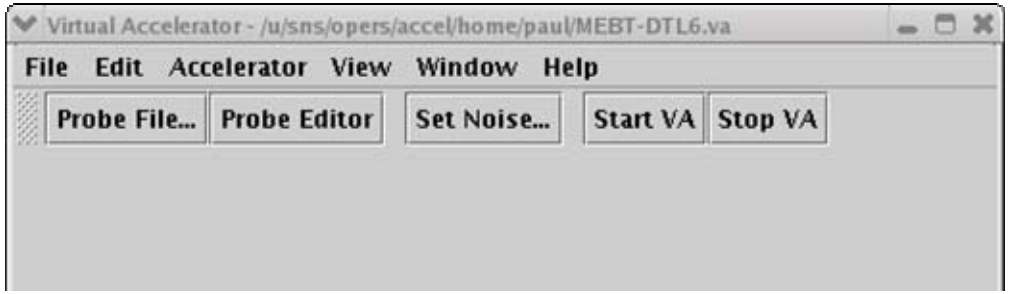
- PV Logger – posts sets of data to the database
  - periodically or pushbutton
  - Generalized to allow for custom PV sets



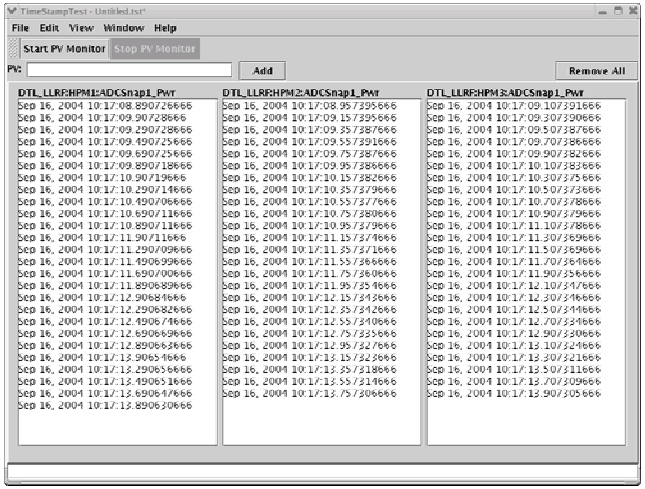
Client PV Logger Browser

New applications *(P. Chu)*

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

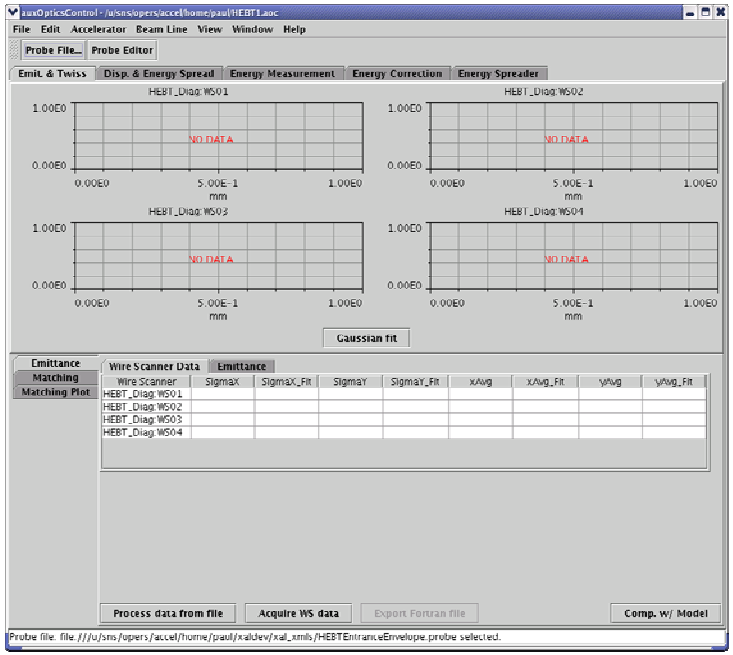


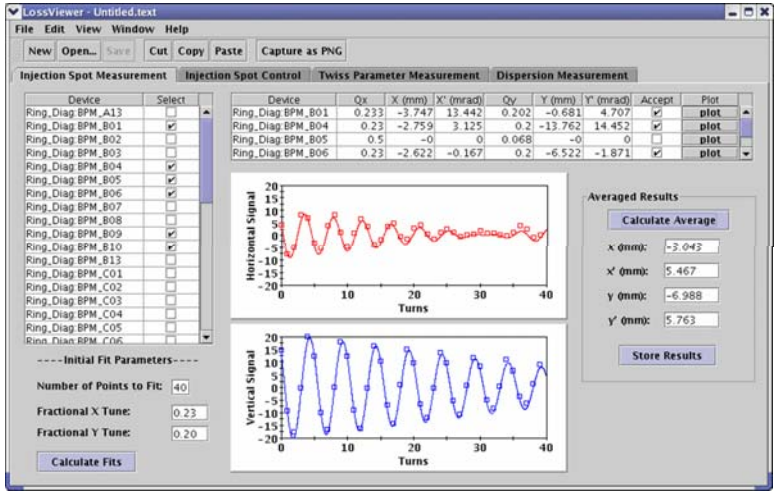
- Timestamp checker – verify signal timestamps are reasonable



Ring Applications Under Development *(P. Chu, S. Cousineau, S. Danilov)*

- HEBT tuning application





- Ring injection tuning application

Summary

- The XAL application programming infrastructure is in place and working.
  - > 20 applications written – actively used in commissioning activities
  - Online model used more extensively

- Issues
  - Java – “heavier” than typical X-widgets.
  - Need to revisit some applications to make them more efficient.
  - Provide a systematic data save scheme for applications.