XAL Status

Thomas Pelaia II, Ph.D.

Application Programming

EPICS Collaboration Meeting

June 12-16, 2006

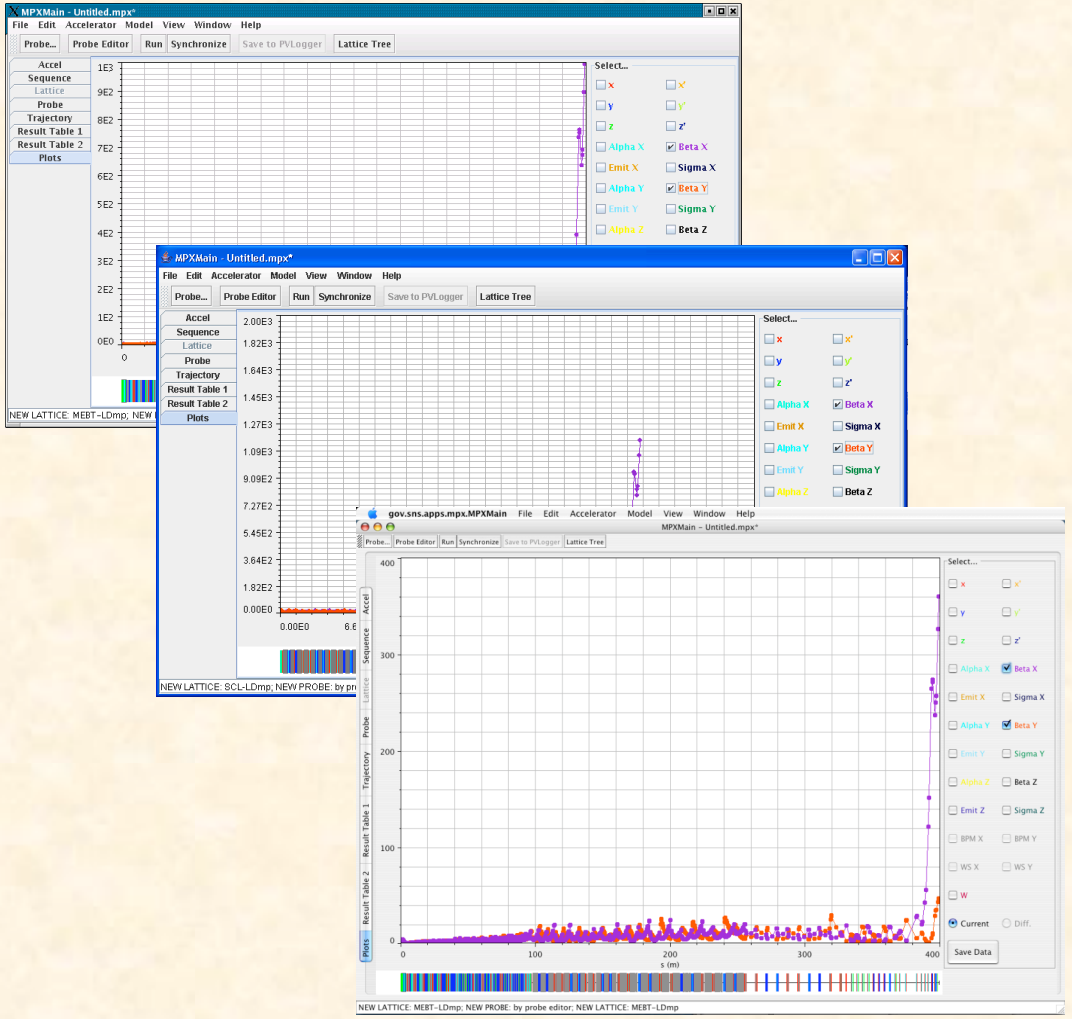
OAK RIDGE NATIONAL LABORATORY
U. S. DEPARTMENT OF ENERGY

Active Core Developers

- John Galambos (ORNL/SNS)
- Chris Allen (LANL)
- Paul Chu (ORNL/SNS)
- Tom Pelaia (ORNL/SNS)
- Andrei Shishlo (ORNL/SNS)
- Numerous people have contributed and are contributing to XAL

We deliver, you choose…

- XAL is built upon 100% pure Java offering platform independence for free
- Users can run and/or develop XAL applications on any platform with Java J2SE 5.0
- Convenient Java Web Start deployment



What is XAL?

- Foundation framework of generic tools
  - Optimization
  - Numerical analysis
  - Messaging
  - Plotting
- Application framework for rapid development of applications which share a common look and feel
- Accelerator modeling
- EPICS interface
- Applications (currently 46 applications in addition to Jeri)
- Numerous Jython scripts

EPICS Channel Access

- EPICS Channel Access is accessible through a high level XAL API and a JCA adaptor
- Users can choose between JCA JNI and CAJ pure Java provided by CosyLab
  - JCA is available from CosyLab at http://jca.cosylab.com/downloads.html
  - CAJ is available from Cosylab at http://caj.cosylab.com/
  - CAJ is the default channel access provider
- Both JCA JNI and CAJ work very well, but both have issues when monitoring thousands of PVs
  - JCA JNI effectively has a memory leak
  - CAJ stops making new connections

Performance

- **Performance has been good**
  - **Java performance has been very good since upgrading to Java J2SE 5.0 and has not limited operations**
  - **JCA issues need to be resolved since more applications are accessing thousands of PVs**
  - **Applications have been well received by end users and are contributing to successful operations**
  - **More developers and physicists are turning to XAL for new applications**

SNS Applications

- Physics
  - Simulation
  - Optics Design
  - Optics Measurement and Correction
- Controls
  - MPS status, masks, limits
  - Knobs
- Diagnostics
  - BPM Configuration (timing, gains, etc.)
  - Beam Loss Monitoring
- Operations
  - Save and restore
  - PV Logging
  - Beam based alignment

Application Framework

- Very stable
- Rapid application development with a consistent look and feel
- Latest feature highlights
  - Added support for Desktop Panes
  - Includes standard Java icons in menus
  - Copy, Cut and Paste menu items now automatically apply to any TransferHandler enabled component without any additional code and they automatically enable/disable as appropriate
  - Documents have a default location with the root specified by the user
  - Added a Java Logger view to display logged messages and exceptions

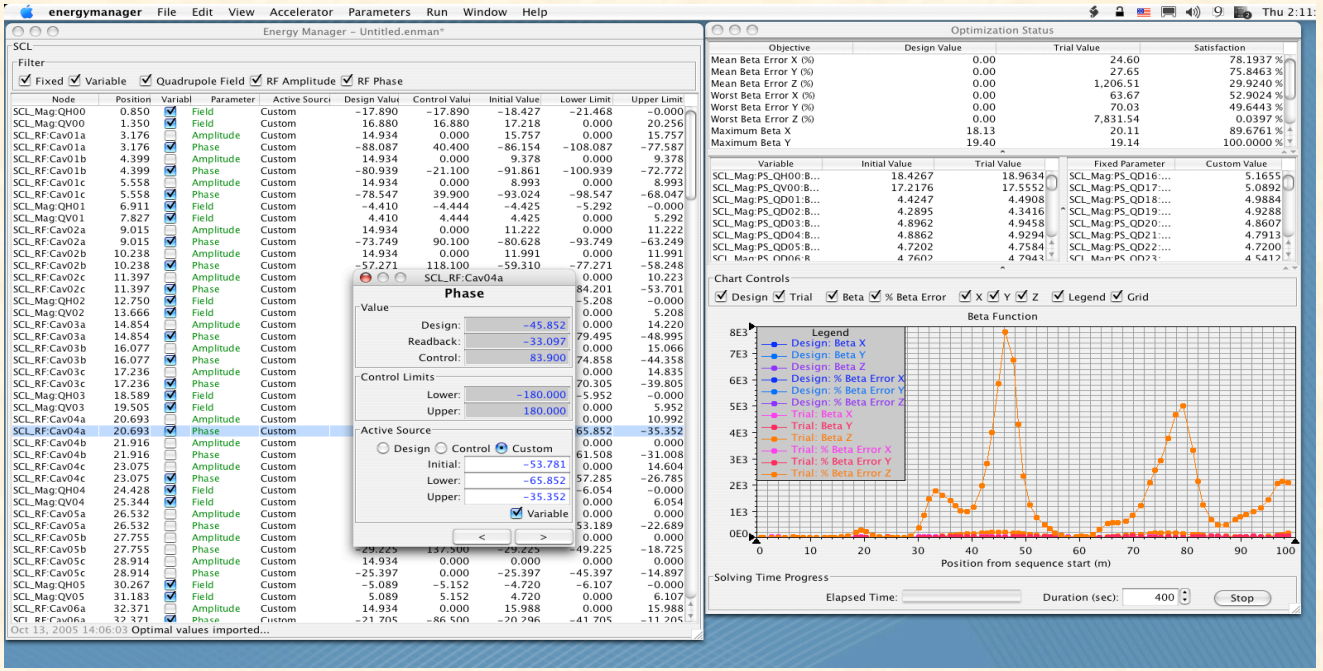
Optimizer Enhancements

- Begun by summer student (Adrian Kennedy)
- Third Generation of optimizers in XAL
- Extensible, object-oriented and event based
- Supports satisfaction curves
- Multiple objectives and multiple variables
- Implemented a smart algorithm strategy picker to dynamically select the best algorithm strategy for solving a problem as the problem is being solved
- Currently four algorithms
  - Simplex
  - Accelerated Gradient Step
  - Random Shrink Search
  - Random

Online Model Framework

- Object-Oriented
- Algorithms, probes and states for Linac and Ring with a common Interface for states
  - Twiss Parameters
  - Energy
  - Orbit
  - Dispersion
  - Tracking
- Convenient model parameter file for a concise specification of input parameters throughout the accelerator
- Agrees well with the real accelerator, and we continue to make improvements to performance and realism

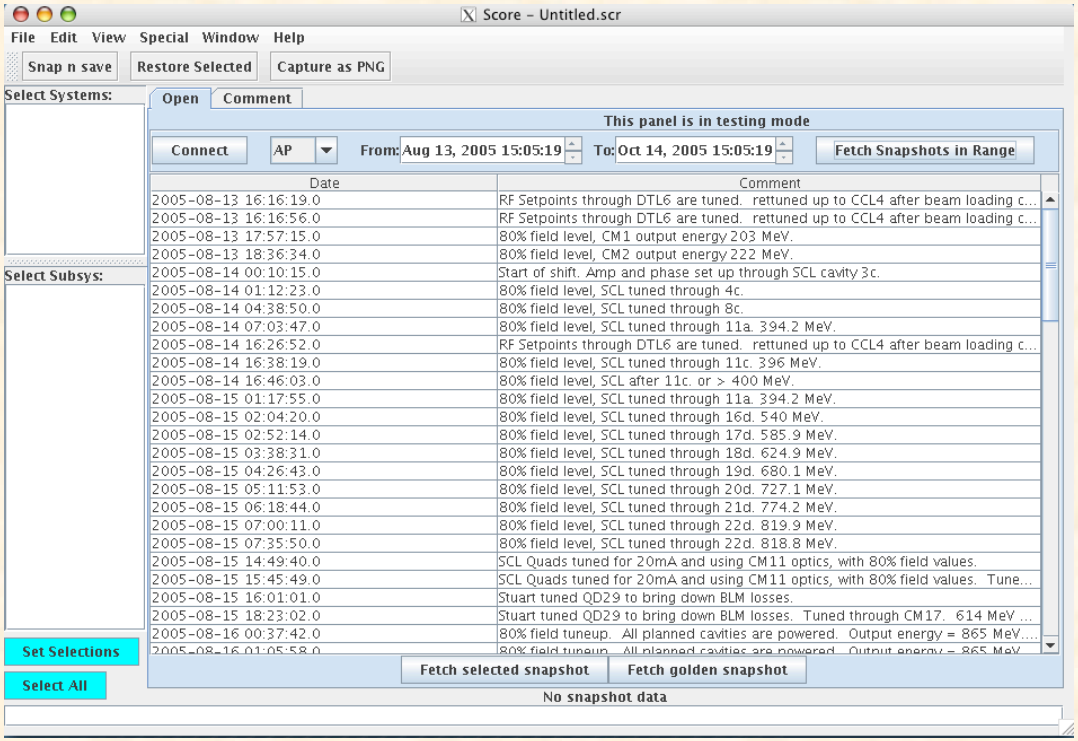
Energy Manager developed by Tom Pelaia



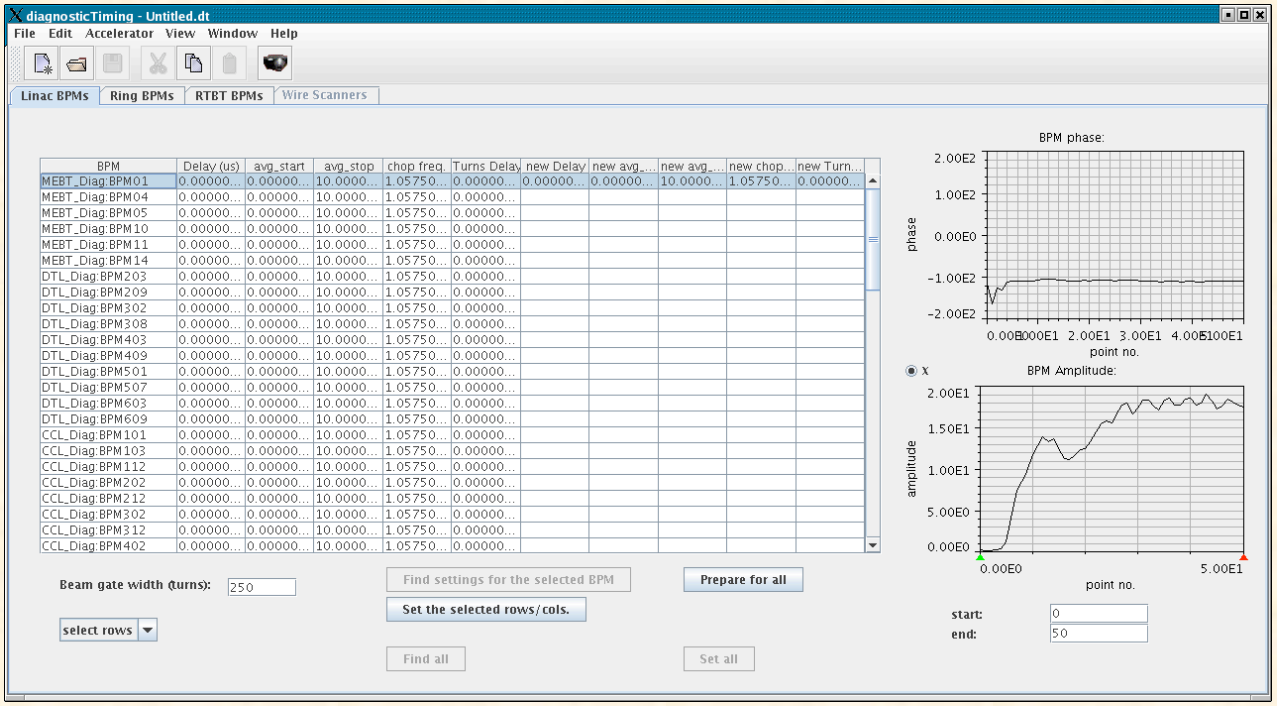
- Generate a new optics from an initial one based on user specified satisfaction criteria
- Variables include Quadrupole fields, RF Cavity phases and RF Cavity Fields

Save Compare Restore (SCORE) developed by John Galambos

- Allows users to save, compare and restore machine settings
- Settings are saved in a database for easy retrieval



Diagnostic Timing developed by Paul Chu



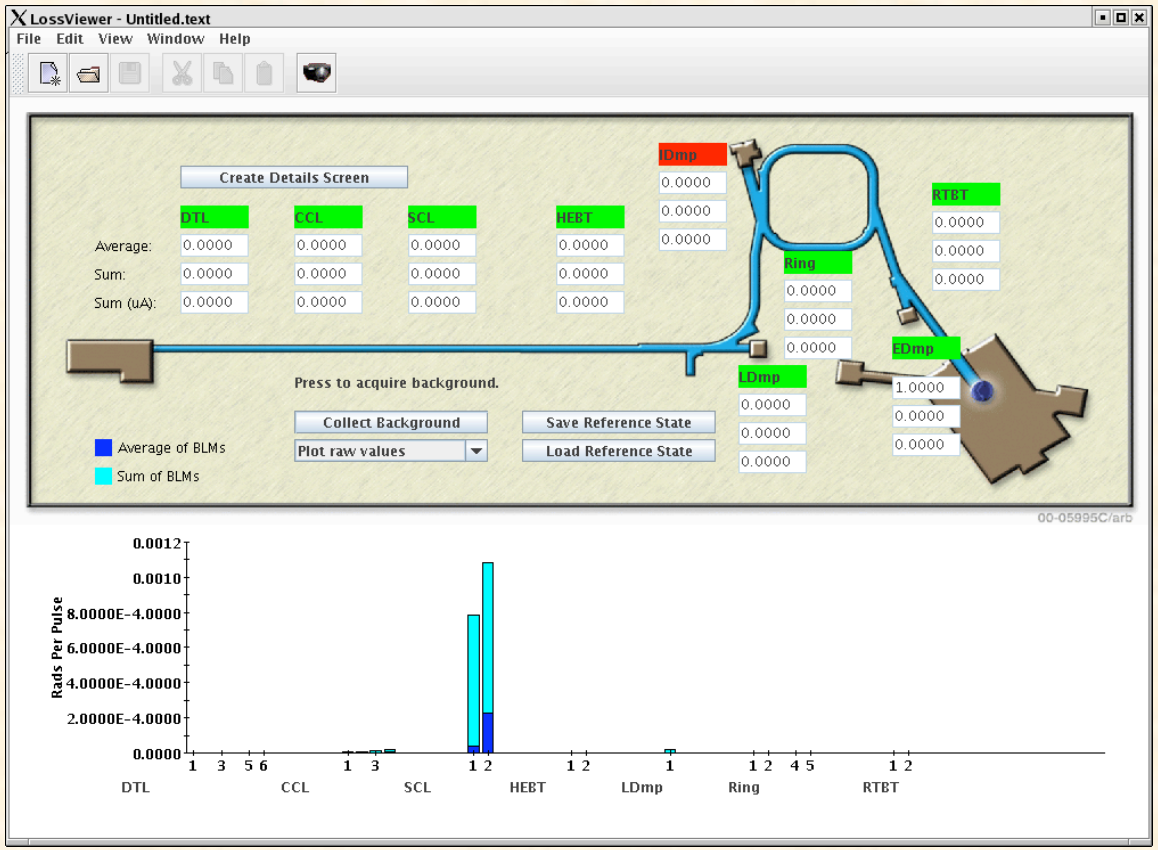
- **Provides a convenient way to view, analyze and set diagnostic timing, gains and other settings individually or in batch**

Ring BPM Viewer developed by Andrei Shishlo

- Displays live Ring BPM data along with a memory buffer of recent data
- Allows averaging over user specified turns
- Displays turn by turn data

Loss Viewer developed by Sarah Cousineau

- Displays BLM losses
- Provides a detail screen to aid tuning while viewing losses in any portion of the accelerator
- Shows MPS BLM alarm and warning status



Directions

- XAL continues to be a very productive tool
  - Contributed to SNS successes
- We need to address the JCA issues
- We continue to improve the online model
- More applications are in the works
- GUI tool under development for building user interfaces