

### **XAL Status**

### Thomas Pelaia II, Ph.D. Application Programming

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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 <u>http://jca.cosylab.com/downloads.html</u>
  - CAJ is available from Cosylab at <u>http://caj.cosylab.com/</u>
  - 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

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Snap n save	Restore Selected Capture as PNG									
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		This nanel is in testing mode								
	Connect AP <b>v</b> From	: Aug 13, 2005 15:05:19 📩 To: Oct 14, 2005 15:05:19 📩 🛛 Fetch Snapshots in Range								
	Date	Comment								
	2005-08-13 16:16:19.0	RF Setpoints through DTL6 are tuned. rettuned up to CCL4 after beam loading c 🔺								
	2005-08-13 16:16:56.0	RF Setpoints through DTL6 are tuned. rettuned up to CCL4 after beam loading c								
	2005-08-13 17:57:15.0	80% field level, CM1 output energy 203 MeV.								
	2005-08-13 18:36:34.0	80% field level, CM2 output energy 222 MeV.								
Select Subsys:	2005-08-14 00:10:15.0	Start of shift. Amp and phase set up through SCL cavity 3c.								
	2005-08-14 01:12:23.0	80% field level, SCL tuned through 4c.								
	2005-08-14 04:38:50.0	80% field level, SCL tuned through 8c.								
	2005-08-14 07:03:47.0	80% field level, SCL tuned through 11a. 394.2 MeV.								
	2005-08-14 16:26:52.0	RF Setpoints through DTL6 are tuned, rettuned up to CCL4 after beam loading c								
	2005-08-14 16:38:19.0	80% field level, SCL tuned through 11c. 396 MeV.								
	2005-08-14 16:46:03.0	80% tield level, SCL after 11c. or > 400 MeV.								
	2005-08-15 01:17:55.0	80% field level, SCL tuned through 11a, 394.2 MeV.								
	2005-08-15 02:04:20.0	80% field level, SCL tuned through 16d, 540 MeV.								
	2005-08-15 02:52:14.0	80% field level, SCL tuned through 1/d, S85.9 MeV.								
	2005-08-15 03:38:31.0	80% field level, SCL tuned through 18d, 624.9 MeV.								
	2005-08-15 04.26.45.0	80% field level. SCL tured through 19d. 680.1 MeV.								
	2005-08-15 05:11:55:0	80% field level. SCL tured through 21d, 727.1 MeV.								
	2005-08-15 07:00:11 0	80% field level SCL tuned through 21d -819 A May								
	2005-08-15 07:35:50 0	80% field level, SCL tuned through 22d, 819.9 MeV.								
	2005-08-15 14:49:40.0	SCL Quads tuned for 20mA and using CM11 ontics, with 80% field values								
	2005-08-15 15:45:49.0	Sci Quads tuned for 20mA and using CM11 ontics, with 80% field values. Tune								
	2005-08-15 16:01:01 0	Stuart tuned OD29 to bring down BLM losses								
	2005-08-15 18:23:02.0	Stuart tuned OD29 to bring down BLM Josses. Tuned through CM17. 614 MeV								
	2005-08-16 00:37:42.0	80% field tuneup. All planned cavities are powered. Output energy = 865 MeV								
Set Selections	2005-08-16-01:05:58-0	80% field tuneun All planned cavities are nowered. Output energy - 865 MeV								
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## **Diagnostic Timing developed by Paul Chu**

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 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



