Treepath Based Instrument Control

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- The quest for a GUI for SICS
- SICS: client server DAQ system
  - SICS server: ANSI-C and Tcl which does all the work
  - Clients: implement UI
- Instrument scientists: parameter editor
- Communication problem
- Our solution has the potential to be generic

The Treepath Concept

- Map the aspects of instrument control:
  - Parameter editing
  - Command execution
  - Online data display
  - Batch processing
- into a tree stucture and operations on this tree.
- Protocol to communicate with the tree.

The Parameter Tree

- Tree of nodes
- Nodes have types: text, int, float, int and float arrays.
- Nodes have properties: key-value pairs
- Node properties give hints to the UI
- Property examples:
  - values
  - priv
  - type
  - viewer
- Notion for properties: (key=value)

Command Representation in the Tree

- Commands are mapped to tree nodes with child nodes representing the parameters.
- Example:
- count (type=command)
  - countmode
  - preset

Online Graphics Data in the Tree

- Example: a powder diagram
- powder-diagram(type=graphdata)
  - rank
  - dim
  - two_theta (type=axis) (dim=0)
  - counts (type=data)
- Scheme extends to n-dimensional data

Treepath Batch Processing

- Stored sequences of tree operations
- Execute in client
- Translate and execute on server

Tree Access Through the Network

- Nodes identified by unix path strings.
- Example: /instrument/monochromator/wavelength
- getgumtreexml path, returns tree structure in XML SDO format
- hset path value value ..
- hget path
- hnotify path
- hlist path
- hlistprop path
- hgetprop path key

Tree Access Protocol

- Errors prefixed with ERROR:
- Wrapped into asynchronous completion token scheme (ACT)
- contextdo 133 hset path value
  - 133 ::>response<::
- Other implementation: use json formatted messages
- All I/O asynchronous
- Messaging protocol

Divison of Labour

- Client operates on the tree
- Underlying control system (Treepath server)
  - Provides the tree and information on it
  - Implements Treepath protocol
  - Maps tree operations on device operations and measurement procedures
  - Optionally: updates parameter values in the tree
  - Optionally: updates data for online graphics

Implementation in SICS

- SICS has been extended to become a treepath server
- Some parts of this, i.e the tree node code, is reusable
- This is a working system!
- Configuration commands in SICS to configure tree
- 2 days to configure for an instrument.

CLI Access to Treepath

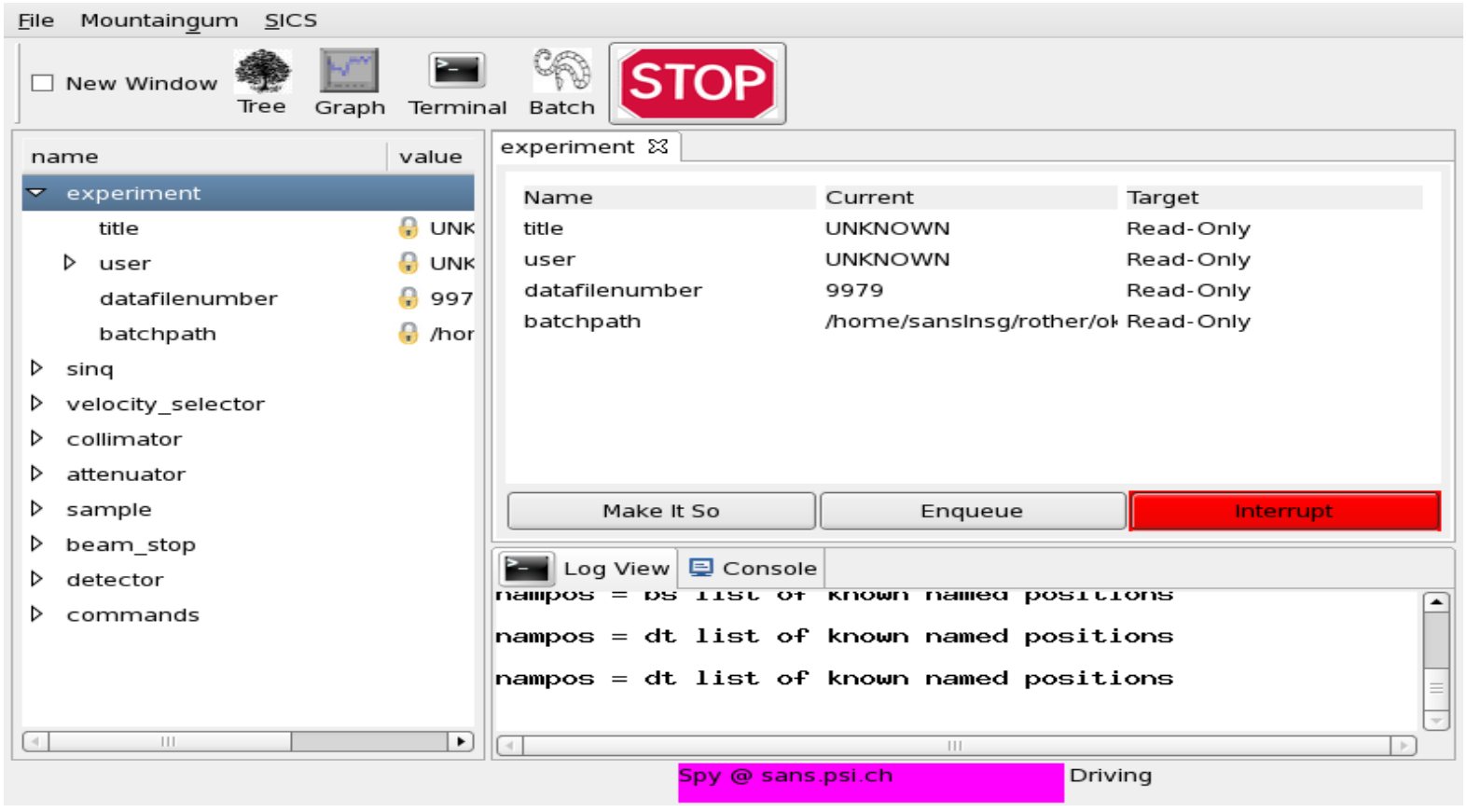
- Tree commands is already CLI!
- Generic wrapper: widget command syntax
  - object par value value ..
  - object par
  - object method par par ...
  - function par par ...
- Code generation from SDO or generic wrappers can map to an object hierarchy in the OO language of your choice. Been done for python!
- With a dictionary: code generation to functional or procedural languages
- Maps also to other concepts like ReST WWW-services

Graphical User Interfaces to Treepath

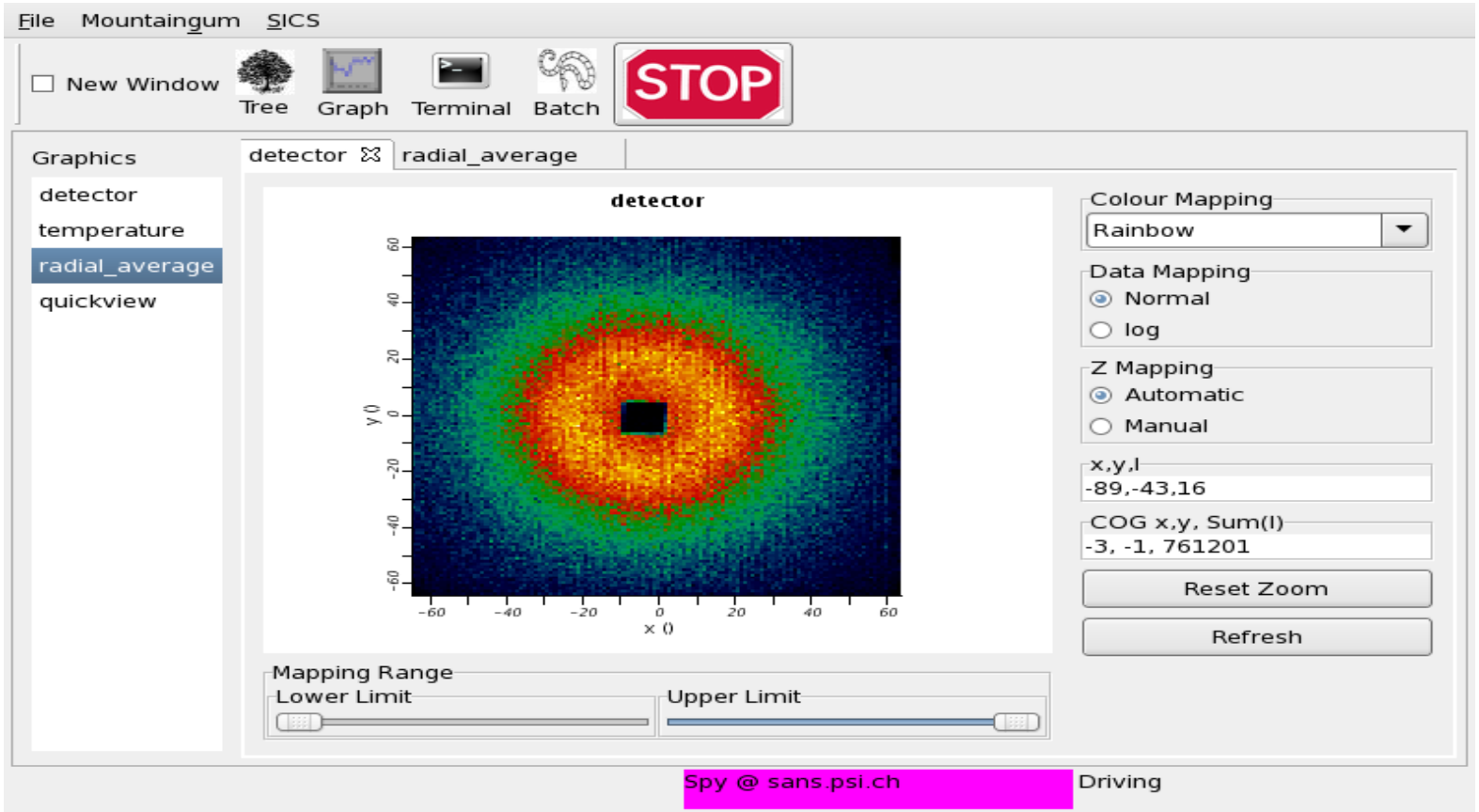
- The concept prefers tree interfaces
- But does not limit!
- Just map UI gestures to tree operations.
- GUI can introspect the tree and adapt itself
- Generic GUI's possible

- Eclipse-RCP based
- Shares many ideas with Gumtree ANSTO
- Instrument control only application
- Reproduce traditional SICS command set as closely as possible
- Supports 9 SINQ instrument now
- Had to be as generic as possible
- Still in development

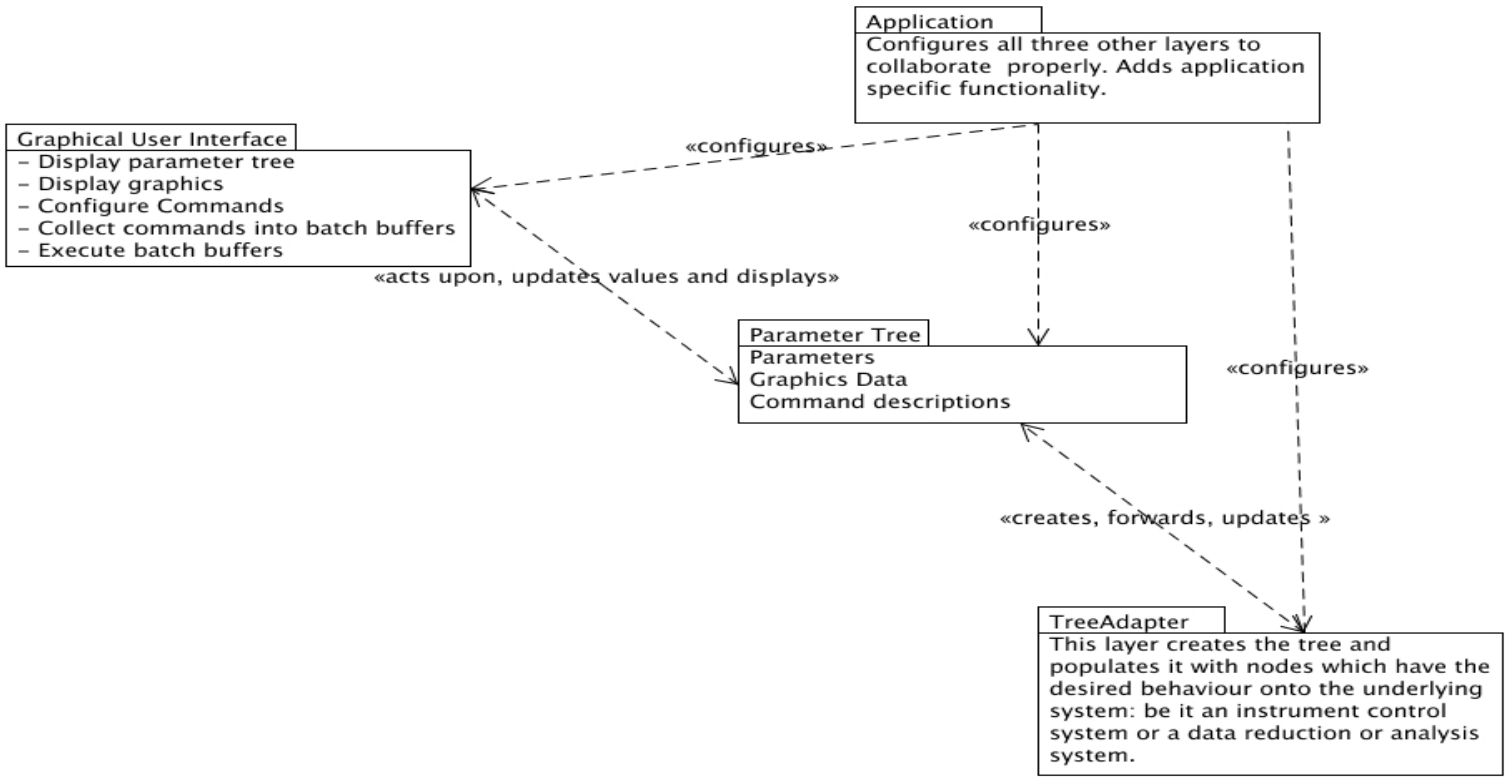
GTSE Tree Display



GTSE Graphics Display

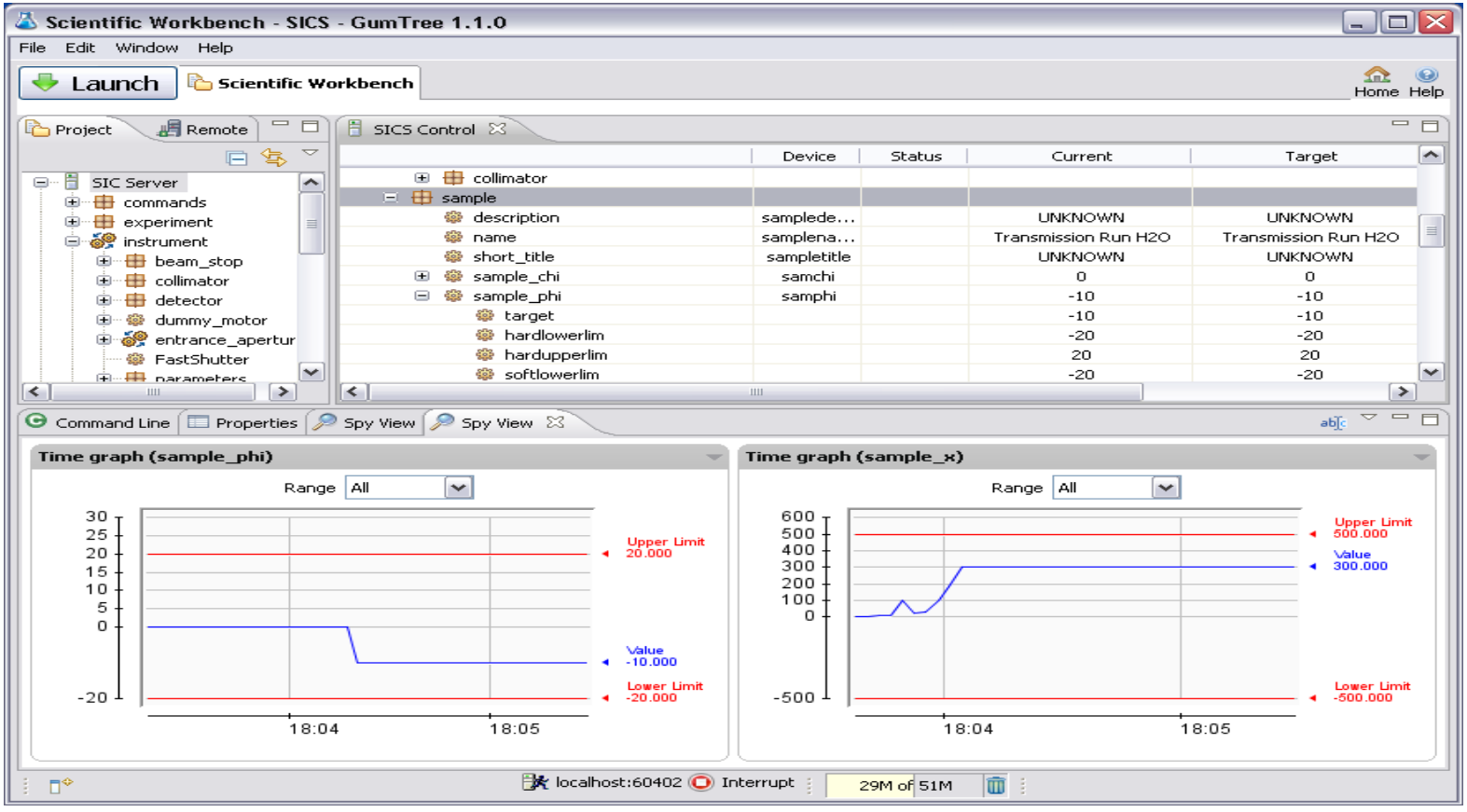


Gumtree SE Package Structure

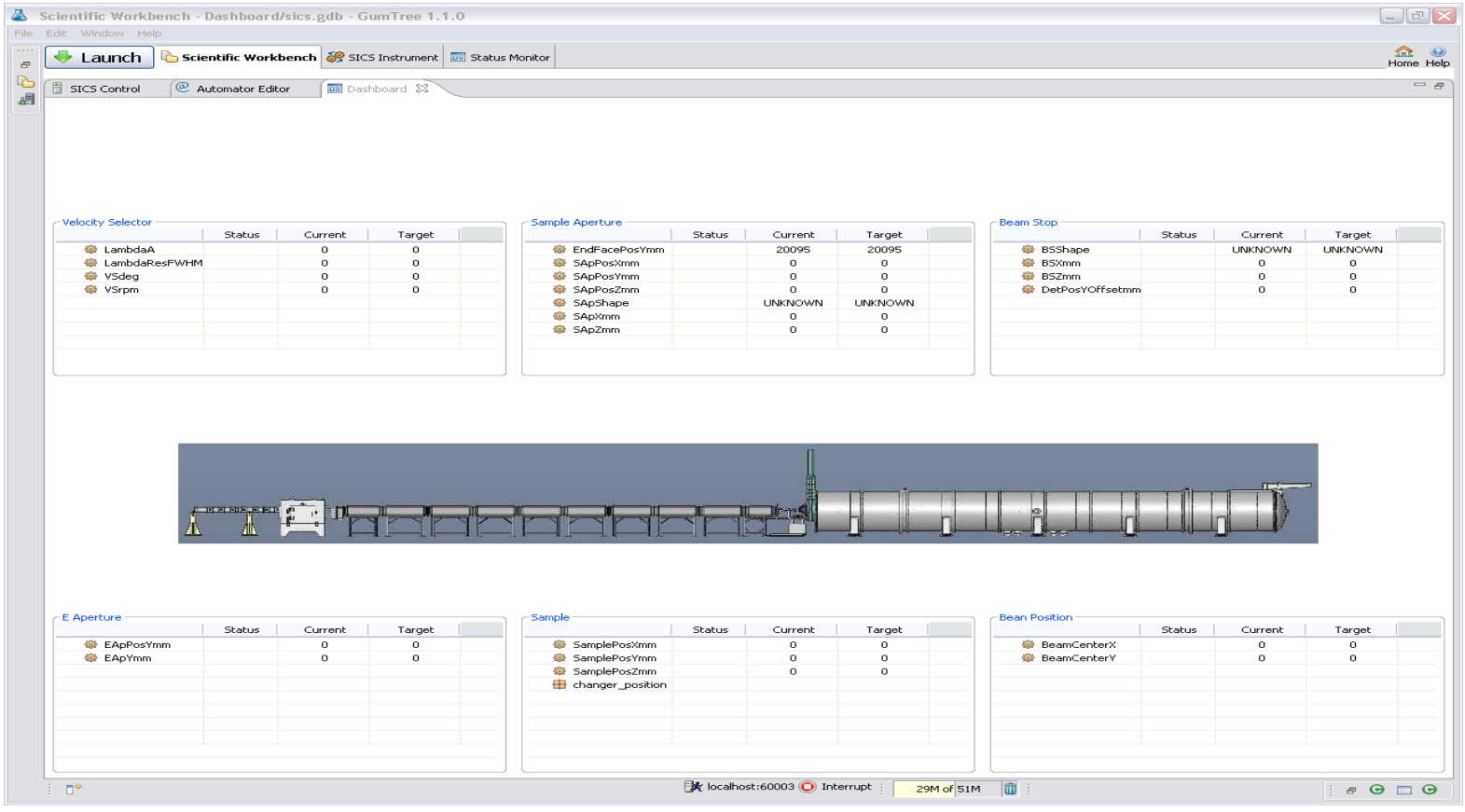


- Sophisticated integrated scientific workbench to cover DAQ, data reduction and data analysis
- Uses the tree in a more OO-way to generate different UI's
  - Python API
  - Dashboard interface
  - Graphical representations of devices

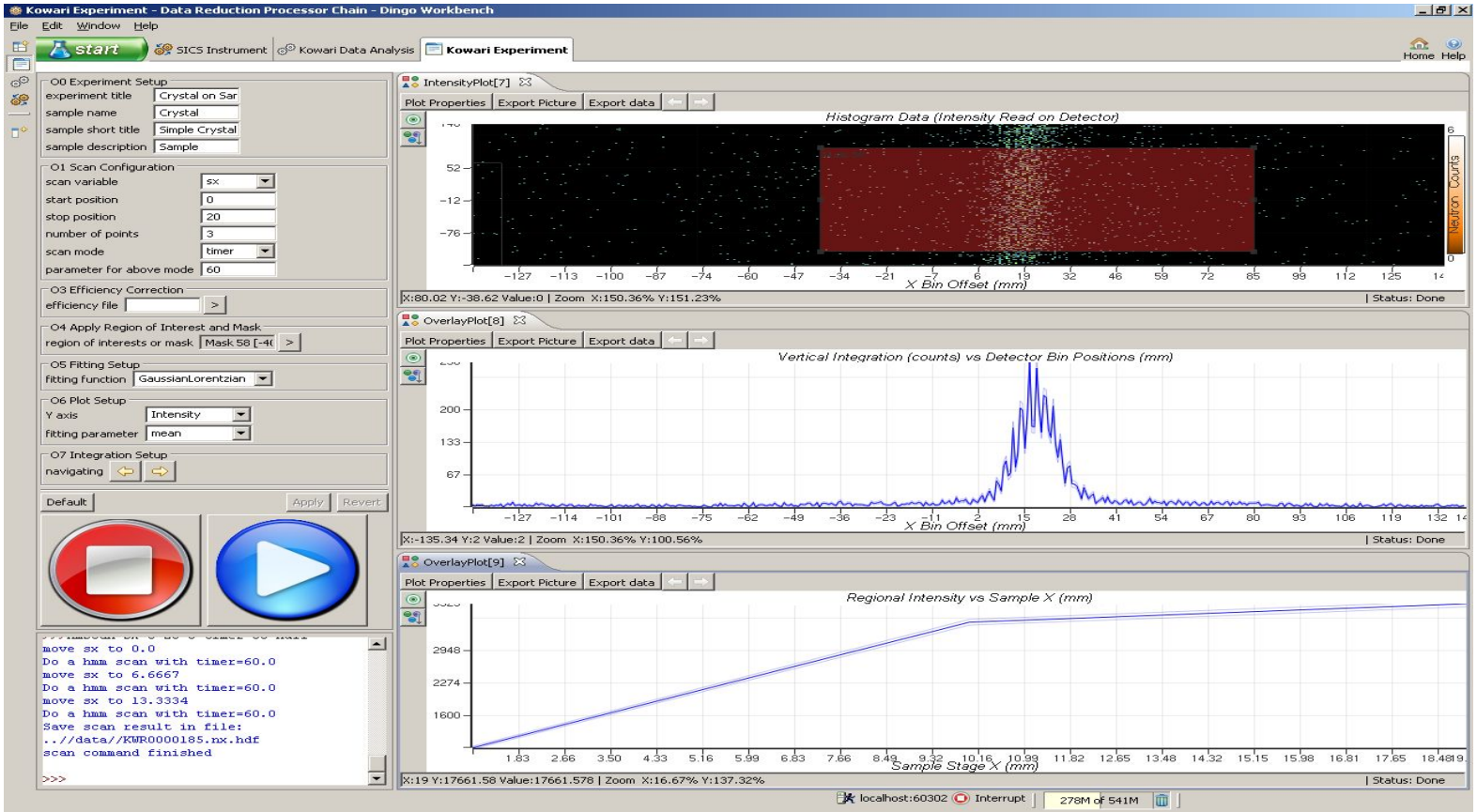
Gumtree ANSTO Instrument Perspective



Gumtree ANSTO Dashboard Display



Gumtree ANSTO Instrument Integrated DA



Conclusions

- Treepath maps parameters, commands and online data into a tree and operations on the trees
- Only abstraction covering all aspects of DAQ
- Scalable to a huge number of parameters
- Instrument becomes discoverable
- Tree layout can vary to a large degree
- Adaptable, generic and generative UI's possible
- CLI and scripting access well supported
- Generic if an agreement on details can be reached
- Possibly useful for data analysis, too