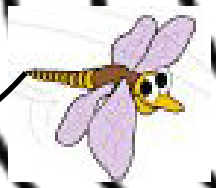
# The World Wide Web and The Virtual Scientific Instrument……

Ian Atkinson, Douglas du Boulay, Sandor Brockhauser, Rick McMullen, Romain Quilici, Andrew Sharpe, Peter Turner

Parts of collaborations between Adelaide University, European Molecular Biology Laboratory (ESRF), Indiana University, James Cook University, State University of New York (SUNY) at Binghamton, and the University of Sydney.

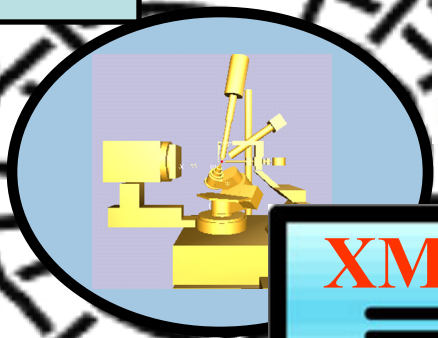
Exchange of XML message parcels



**S**imple **O**bject **A**ccess **P**rotocol – **SOAP**
**Re**presentational **S**tate **T**ransfer - **REST**

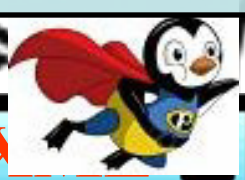
Port 80 – Firewall 'Friendly'

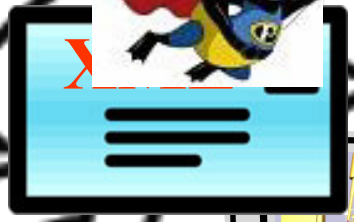
Location, Platform, Language Independent




Grid 'Friendly'

Integration of Multiple Services





Collaborative Services Linking Multiple Users

# Common Instrument Middleware Architecture (CIMA)

- Elegant, general and **re-usable architecture for instrument access**. Adaptable to different instrument settings. Facilitates **code reuse**. Basis for a **standardised implementation/deployment system**, and a common programmable interface.

- Flexible and extensible via **use of modular plug-ins.** Plugins contains all the logic to interact with instrument/sensors/systems and, at the other 'end-point', the user.

- Standard and reusable methodology to enable and embed **instruments as addressable Web resources** with the use of **Web services** .

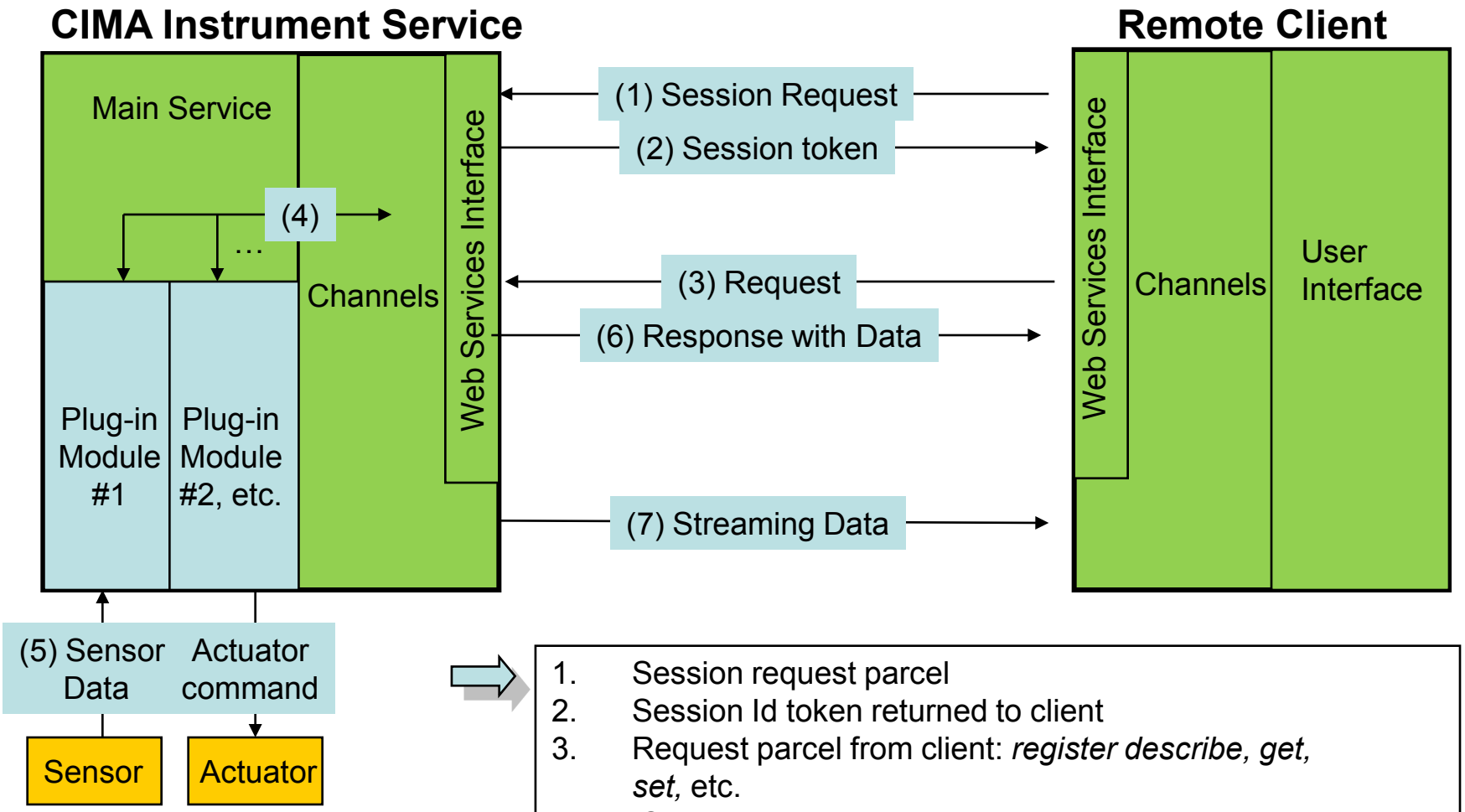
- Message oriented architecture based on **XML messages (parcels) defined wrt schema.** *E*asy to extend, adapt, maintain the use of parcels. Currently use only a **single method – receive parcel**.

# Remote Access *via* a Browser

***The Web browser is (pretty much) everywhere - so (in principle) can access a portal service from (pretty much) anywhere and anytime*, and from a variety of devices and platforms.**

**Web 2.0 technology** is enabling the Web as a distributed applications platform, and is changing the role of the 'ubiquitous' Web browser. For instance;

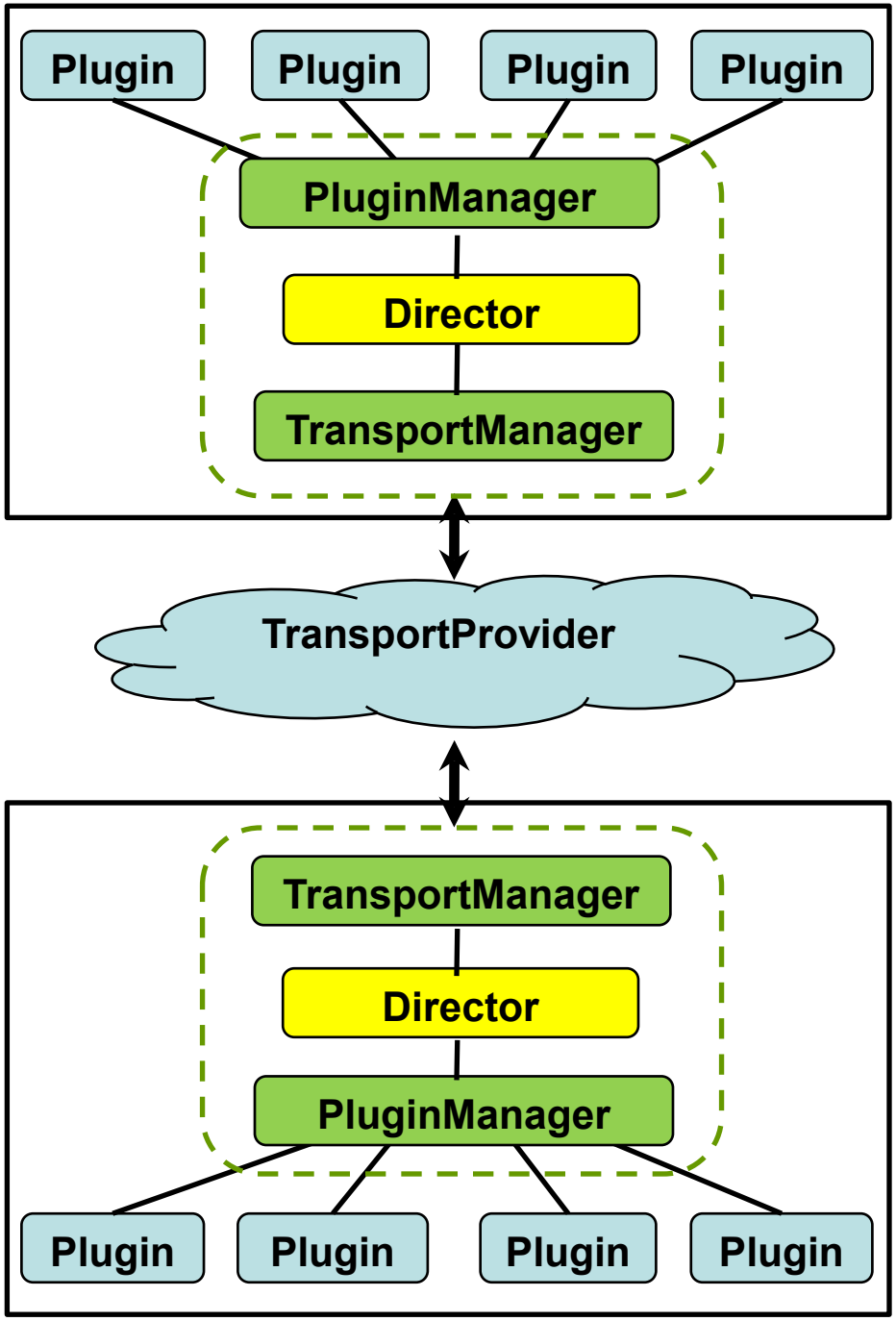
- **AJAX** (**A**synchronous **J**avascript **A**nd **X**ML) introduces a capability for a browser to function in a similar manner to a stand-alone GUI. In particular portlet specific dynamic 'refresh' of browser content,
- **Pushlets** allow information/data to be continuously *pushed* to a browser – in effect over-turning the original browser *get* 'paradigm'. Attractive for remote instrument control.




1. Session request parcel
2. Session Id token returned to client
3. Request parcel from client: *register describe, get, set,* etc.
4. 'Channell' used to call plug-in appropriate for request type and data source
5. Plug-in retrieves data or runs actuator
6. Response parcel is returned to client (data or operation result code)
7. Client can *register*/subscribe for 'event' or streaming data For an event service calls client periodically or when data is available (timer or event-driven from plug-in)

# CIMA Changes and Additions in Oz …

- Re-write of original C++ code in Java.
- Development of instrument control via CIMA – architecture extension – synchronous and asynchronous channels – new parcel types.
- Plugin development – including plugin control (stop/start, load/unload)
- Use of AJAX (via DWR) and Pushlets to enable ‘real time’ data push from the instrument to the client.
- Push-pull data transfer model., and use of REST for large data (image) transfer.




# … More Changes Made in Oz …

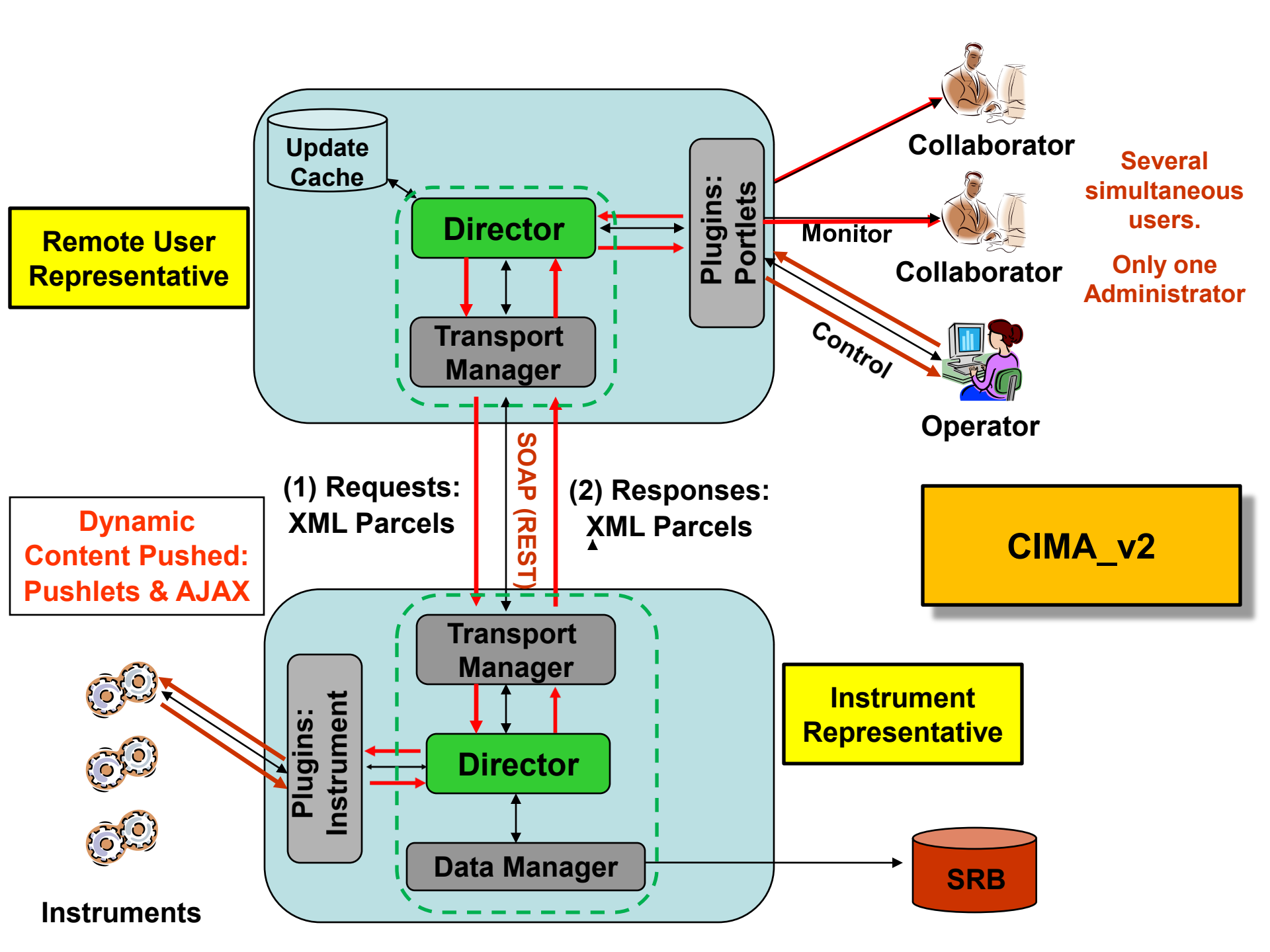
**Separation of Concern** - central object (Director) coordinating entities/modules and parcel exchange. Entities include:

- Plugin Controller
- Plugin Manager
- Session Manager
- Transport Manager
- Description Controller

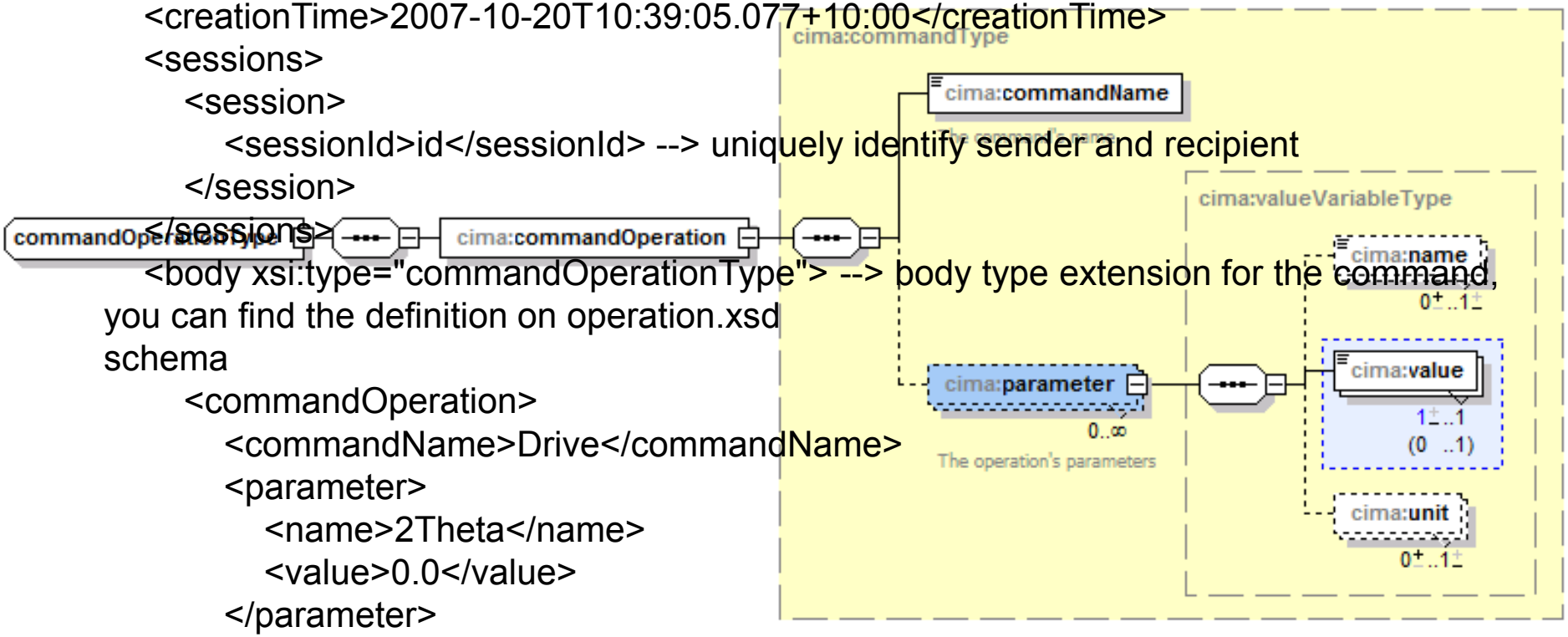
**New (schema based) XML parcels and new parcel structure**; 'header' and 'body' distinction. Provision for multiple recipients. Plugin 'extension' mechanism.

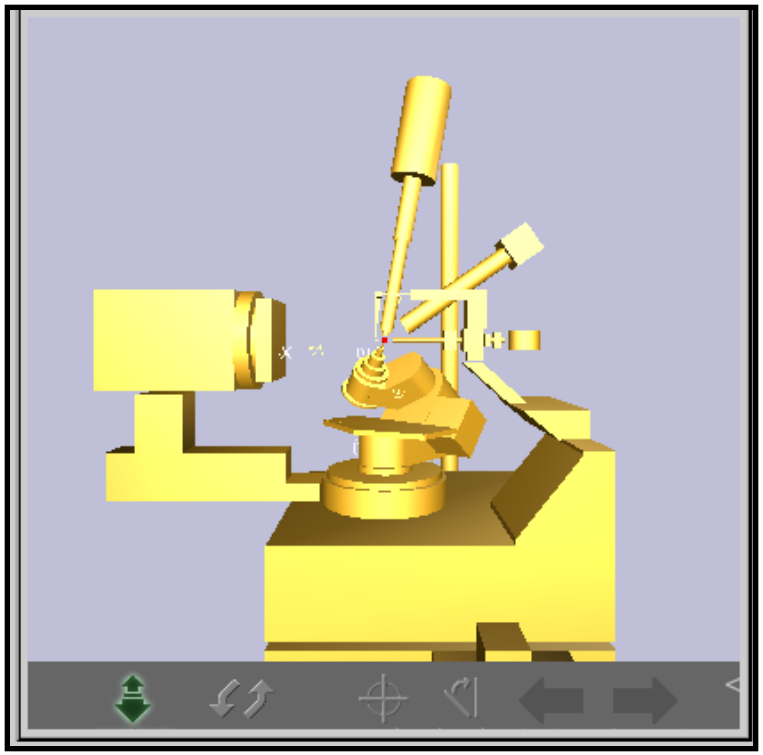
**Transport 'agnostic'** (SOAP, REST, …. ).

**XMLBeans and Spring** framework to configure/declare, instantiate and 'inject' CIMA entities. Spring MVC. Use of Spring to configure WS entities. Currently using CXF for WS.


Update Cache
Director
Transport Manager
Plugins: Portlets
Remote User Representative
Collaborator
Monitor
Collaborator
Several simultaneous users.
Only one Administrator
Control
Operator
(1) Requests: XML Parcels
SOAP (REST)
(2) Responses: XML Parcels
CIMA_v2
Dynamic Content Pushed: Pushlets & AJAX
Transport Manager
Plugins: Instrument
Director
Data Manager
Instrument Representative
SRB
Instruments

<?xml version="1.0" encoding="UTF-8"?>
<parcel
xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance"
xmlns="http://cima.instrumentmiddleware.org/parcel"
version="0.0"
sequenceId="0">
<type>plugin</type>
<creationTime>2007-10-20T10:39:05.077+10:00</creationTime>
<sessions>
<session>
<sessionId>id</sessionId> --> uniquely identify sender and recipient
</session>
</sessions>
<body xsi:type="commandOperationType"> --> body type extension for the command, you can find the definition on operation.xsd schema
<commandOperation>
<commandName>Drive</commandName>
<parameter>
<name>2Theta</name>
<value>0.0</value>
</parameter>
<parameter>
<name>Omega</name>
<value>10.0</value>
</parameter>
..... same with other required params
</commandOperation>
</body>





‘Hand-made’ X3D Model of a Diffractometer

## Virtual Instrument Use

A low-bandwidth, interactive and readily interpreted view (rendered client side) of the current state of the instrument (updated by Pushlets via SAI and Javascript). More view flexibility than Webcam.

Offsets ‘dark lab’ problem.

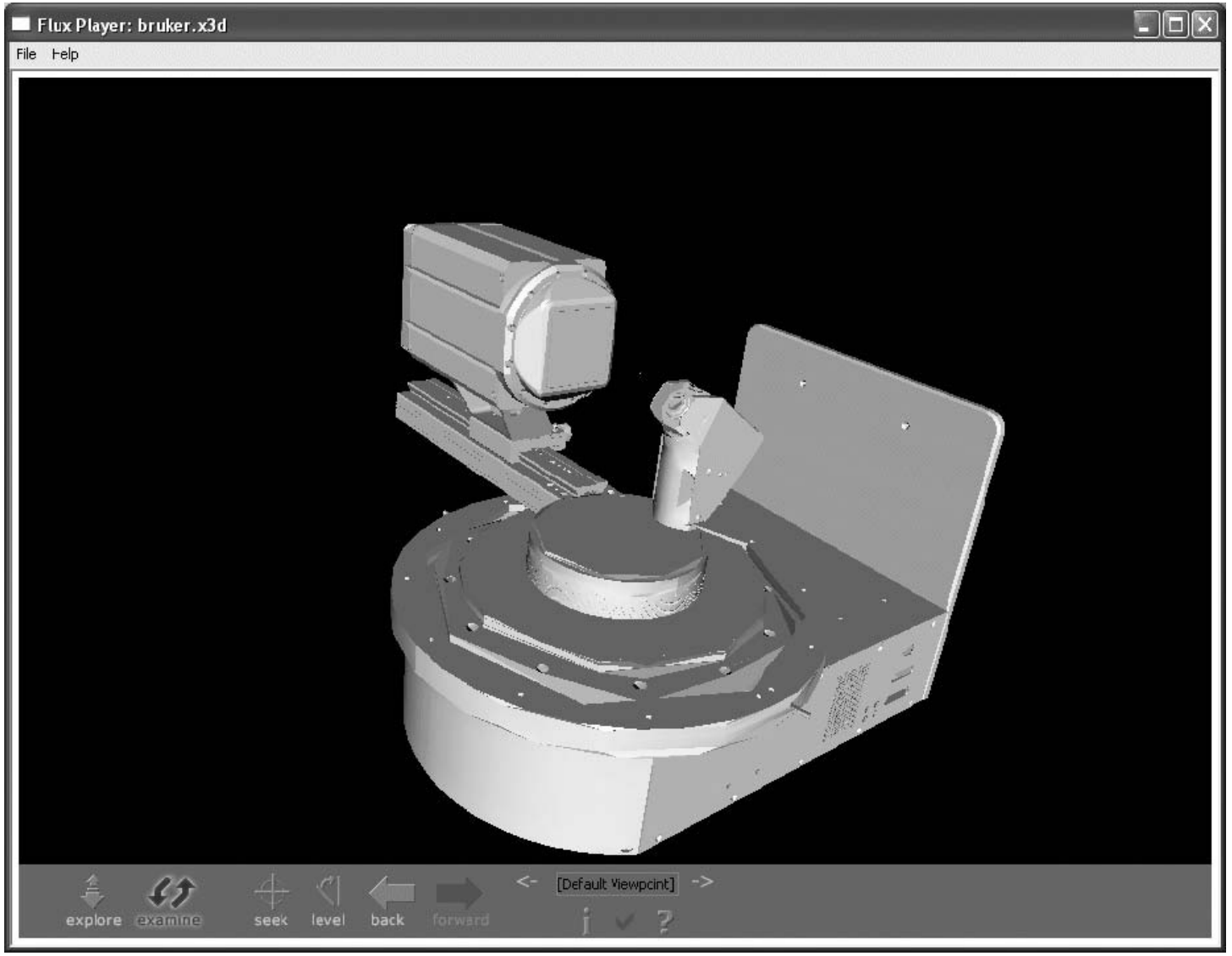
Visually assess collection safety or viability.

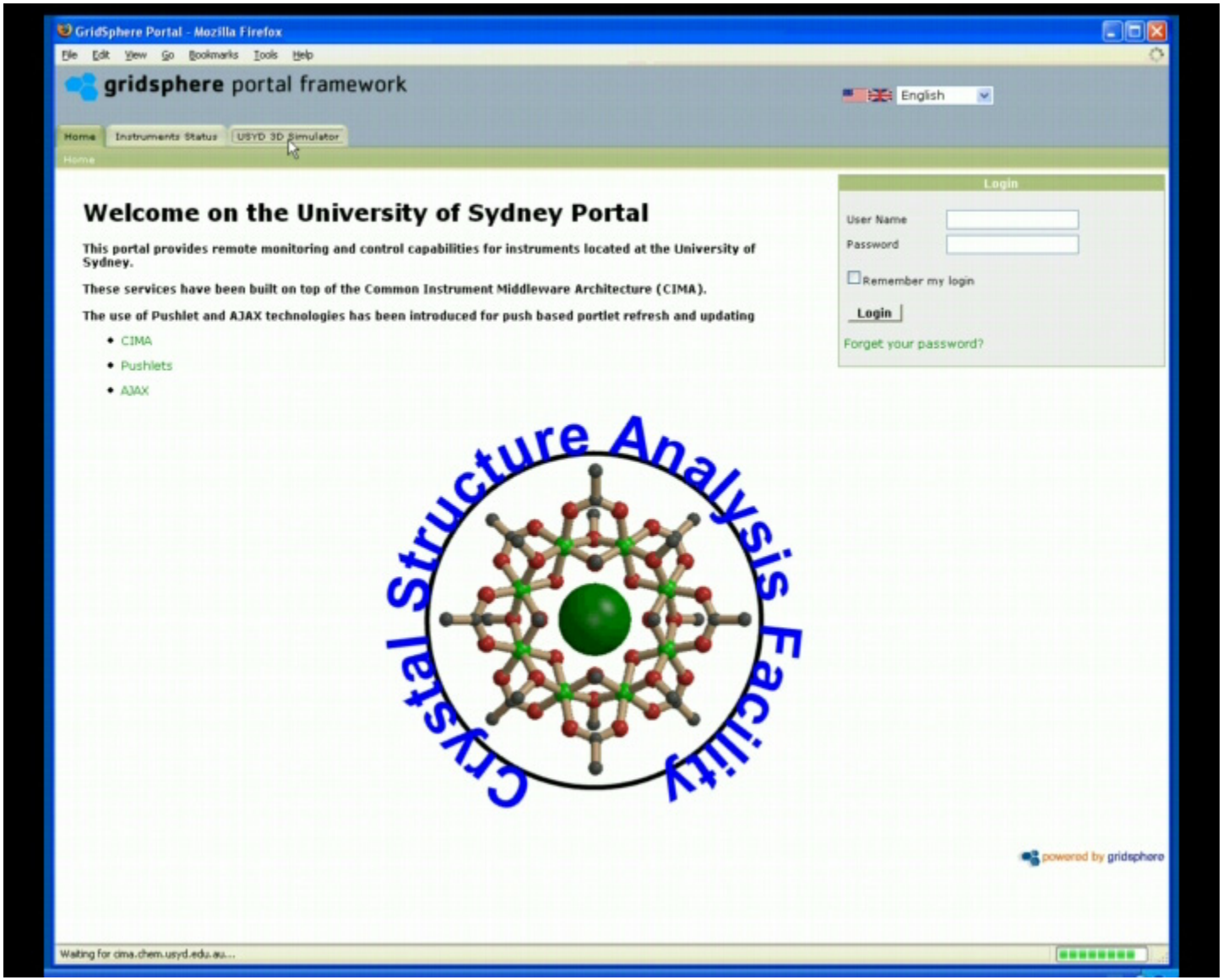
Safely test new remote access services.

Safe auto collision map determination.

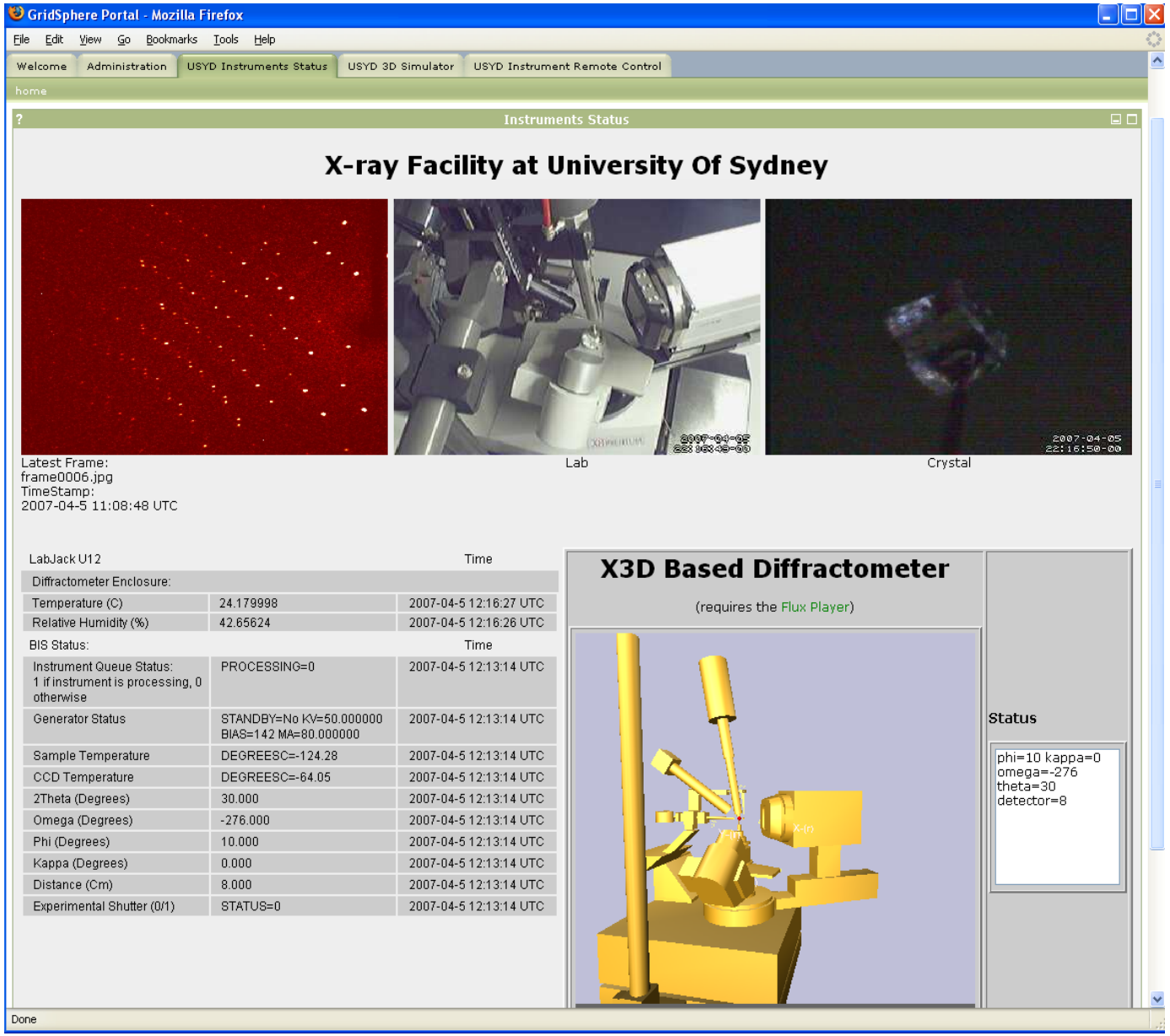
Safe means of training users.

Use ISO standard and XML schema based X3D virtual model format. Can be externally scripted by Javascript. Extensible – build library of components.

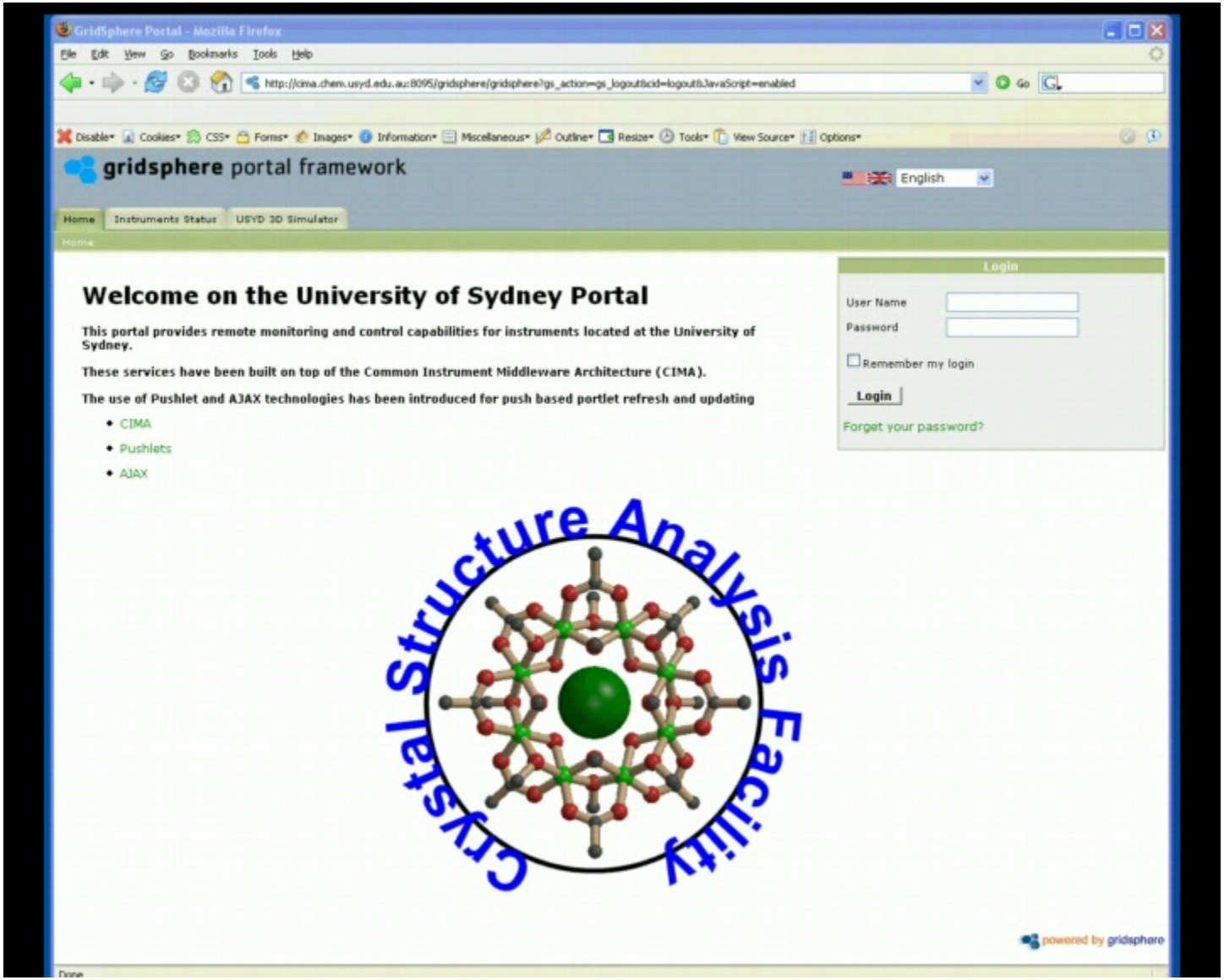

Flux Player: bruker.x3d
File Help
explore
examine
seek
level
back
forward
<-
[Default Viewpoint]
->
i
?




**Virtual Instrument Portlet**



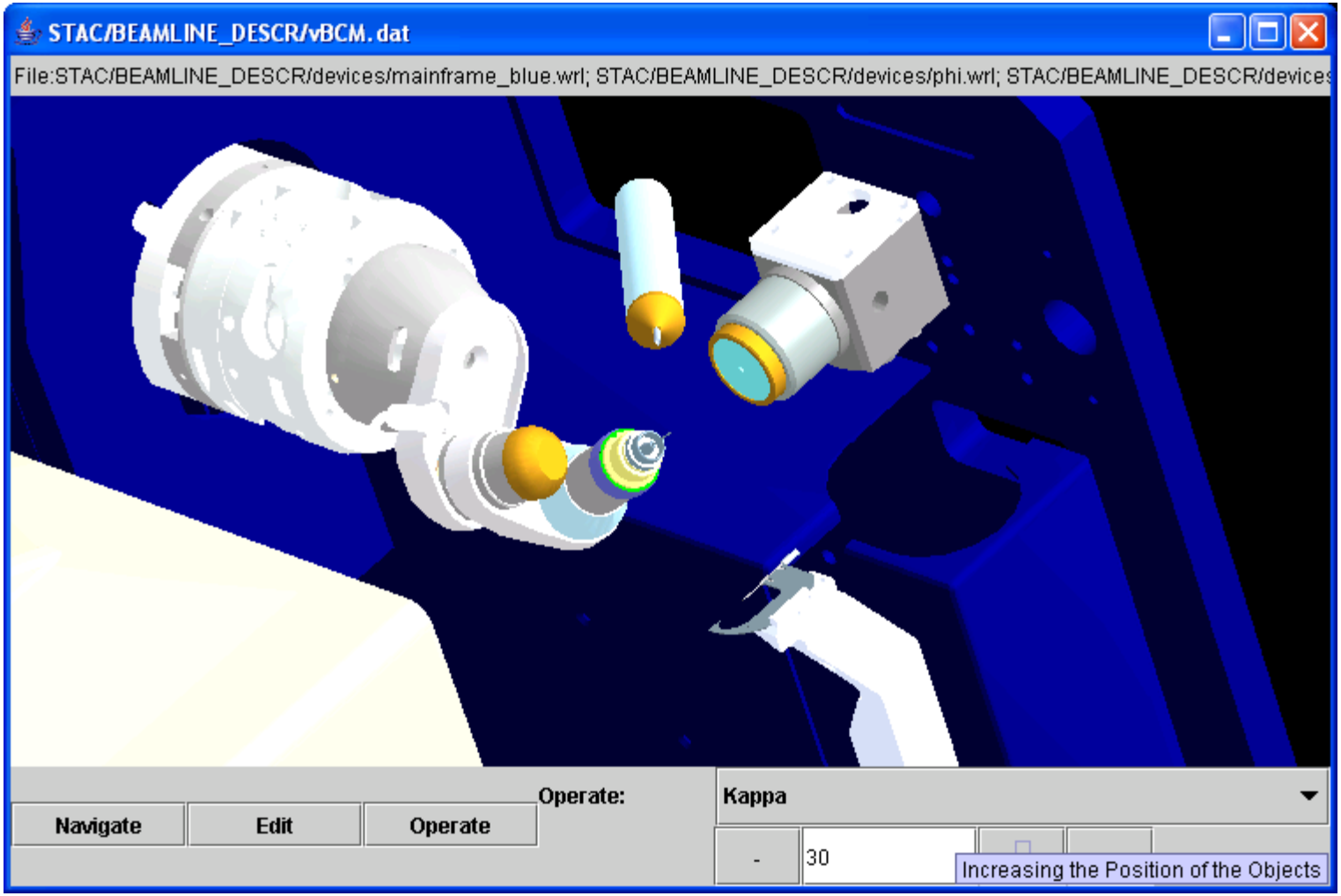

# Instrument Monitor Portlet




**Instrument Control Portlet**

**STAC - STrategy for Aligned Crystals - Object Oriented Software for Automated Kappa Collections.**

**Sandor Brockhauser**, EMBL Instrumentation Group at the European Syndhrotron Radiation Facility



DS X3D updated by streaming pushlet - Mozilla Firefox

File Edit View History Bookmarks Tools Help

SakaiVre/PlanningProgress/200610... | Guanxi:About - Guanxi | DS X3D updated by streaming pu...

## Simulator Variables

Speedup: 5

Auto delay: 300 (s)

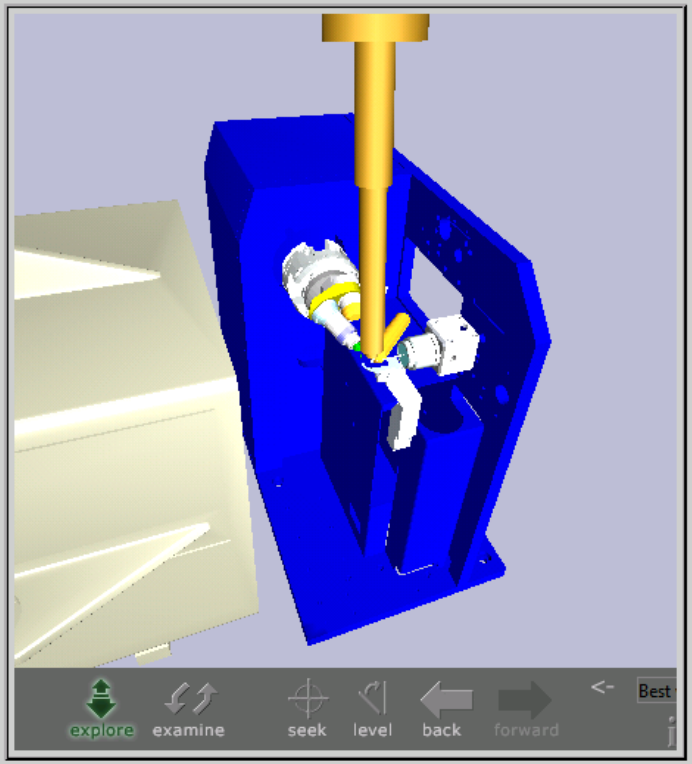
X3D duty-cycle: 3

## Geometric Variables

Kappa mode

| | | |
|---|---|---|
| Omega | 0.00 | (-720 ... 720°) |
| Kappa | 90.00 | (0 ... 250°) |
| Phi | 0.00 | (-720 ... 720°) |
| Z | 0.00 | (-10 ... 30mm) |
| Y | 0.00 | (-10 ... 10mm) |
| X | 0.00 | (-10 ... 10mm) |
| Beamstop | 0.00 | (0 ... 500mm) |
| Detector | 150.00 | (0 ... 500mm) |
| Xflash | 0.00 | (0 ... 500mm) |

Drive Reset




## Reflection Calculation

In auto mode: no Calc now

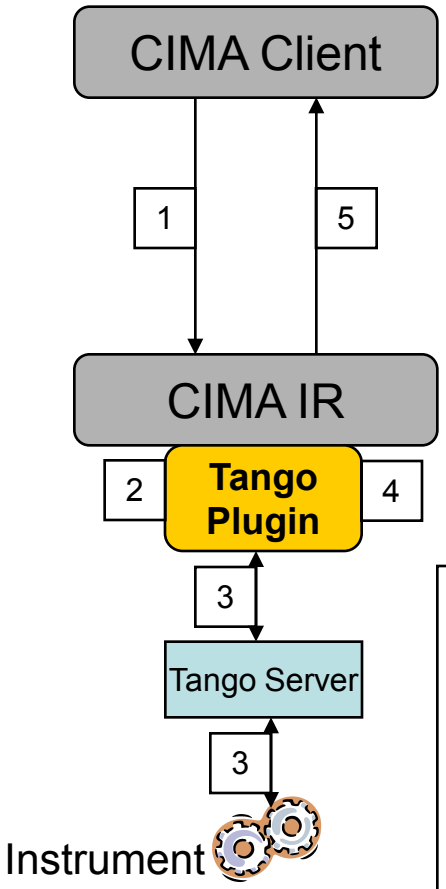
Whole sphere: no Erase refs

## Animation Control

Pause Resume Abort

Done

# Tango as a CIMA plugin




```
<?xml version="1.0" encoding="UTF-8"?>
<parcel>
  <type>http://www.usyd.edu.au/2007/Get</type>
  <body>
    <sender>
      <url>http://mymachine:myport/myservice</url>
      <name>senderPluginName</name>
    </sender>
    <channel>
    <time>2002-05-30T09:00:00</time>
      <plugin>Tango</plugin>
      <variable>
        <name>Omega</name>
      </variable>
      <variable>
        <name>Kappa</name>
      </variable>
    </channel>
  </body>
</parcel>
```

```
<?xml version="1.0" encoding="UTF-8"?>
<parcel>
  <type>http://www.usyd.edu.au/2006/Get_Response</type>
  <body>
    <sender>
      <url>http://mymachine:myport/myservice</url>
      <name>senderPluginName</name>
    </sender>
    <channel>
    <time>2002-05-30T09:00:00</time>
      <variable>
        <name>Omega</name>
        <value>10.0</value>
        <unit>degree</unit>
      </variable>
      <variable>
        <name>Kappa</name>
        <value>0.0</value>
        <unit>degree</unit>
      </variable>
    </channel>
  </body>
</parcel>
```

1) Get Parcel sent by the Client

2) Helper is retrieved with variables name

3) Read_attribute called on Tango Server, variables read

4) Values converted from Double to String

5) Get response Parcel returned to the client

iGoogle

http://www.google.com/ig

Google

Latest Headlines | Slashtmp | Wikipedia | Weather | Travel | Scaling Wiki | ISDEC – BluWiki | post to del.icio.us | Agenda for Sensor In... | Welcome to uExpress... | NSF FastLane Home

iGoogle

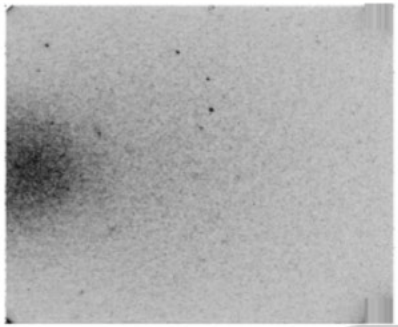
Advanced Search
Preferences
Language Tools

Google Search | I'm Feeling Lucky

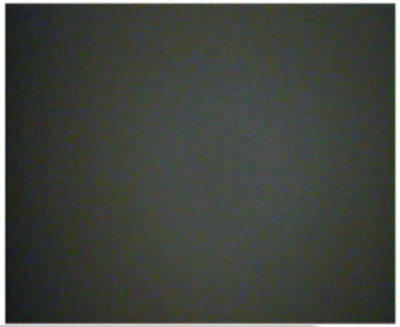
Home | Add a tab

Select theme | Add stuff »

## IUMSC Bruker S6K current CCD image



## IUMSC Bruker S6K Crystal Camera



## IUMSC Bay 1 Overview

## Exception Conditions IUMSC

- IUMSC Atom Feed – Abnormal Data

No abnormal data now.

view link »

- IUMSC Atom Feed – Abnormal Data
- IUMSC Atom Feed – Abnormal Data
- IUMSC Atom Feed – Abnormal Data
- IUMSC Atom Feed – Abnormal Data
- IUMSC Atom Feed – Abnormal Data

## IUMSC Atom Feed

Yu(Carol) Deng Aug 10, 2007 - Show original item

FrameBuffer_F_Usage 2007-08-09 23:10:10Z 89.8
FrameBuffer_E_Usage 2007-08-09 23:10:10Z 55.3
Bay1Temp 2007-08-09 23:10:12Z 16.7
CampCWInTemp 2007-08-09 23:10:25Z 13.5
LN2Levl 2007-08-09 23:10:15Z 41.5
LabCWInTemp 2007-08-09 23:10:25Z 16.4
LabCWOutTemp 2007-08-09 23:10:18Z -10000
CrystalTemp 2007-08-09 23:10:18Z -122
FrameBuffer_D_Usage 2007-08-09 23:10:13Z 84.4
DEHumid 2007-08-09 23:10:15Z 41.4
Bay1Humid 2007-08-09 23:10:18Z -10000
DETemp 2007-08-09 23:10:25Z 22.4

from IUMSC Atom Feed

## Date & Time

Wed
AUG 15

## Bay1Temp IUMSC

- IUMSC Bay1Temp Atom Feed

sensor=Bay1Temp date=2007-08-14 time=04:49:31Z value=16.1

## Google Calendar

« August 2007 »

| Su | M | Tu | W | Th | F | Sa |
|---|---|---|---|---|---|---|
| 22 | 23 | 24 | 25 | 26 | 27 | 28 |

Done

# CIMA Project People

| *Adelaide Uni* | *JCU* | *Indiana and SUNY* | *USyd* |
|---|---|---|---|
| P. Coddington | I.M. Atkinson | R. McMullen | P. Turner |
| A. Wendelborn | R. Feroze | K. Chiu | D. du Boulay |
| D. Zhang | M. Morgan | T. Devadithya | Clinton Chee |
| | A. Sharpe | K.Huffman | R. Leow |
| | M. Wyatt | | R. Quilici |

**ESRF:** Sandor Brockhauser and Alexandre Grobbo, EMBL Instrumentation Group

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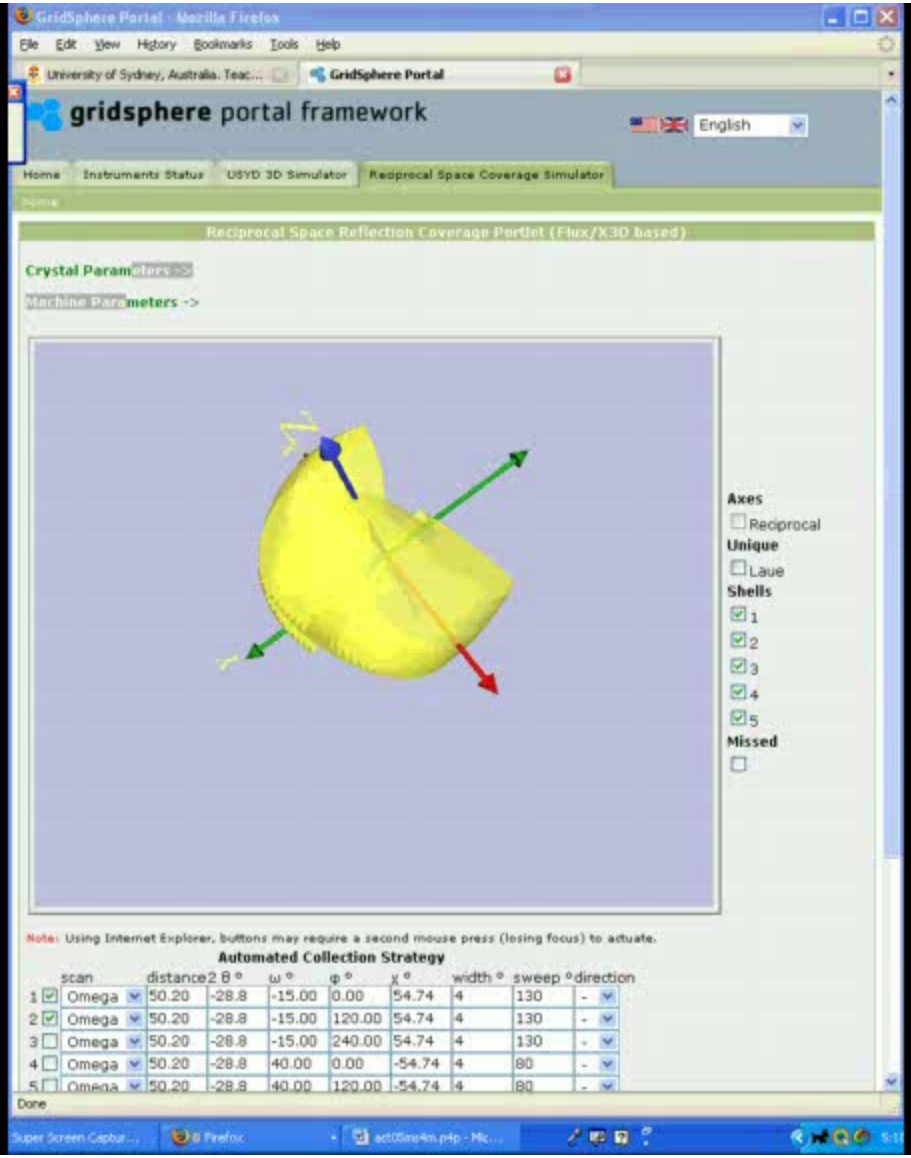
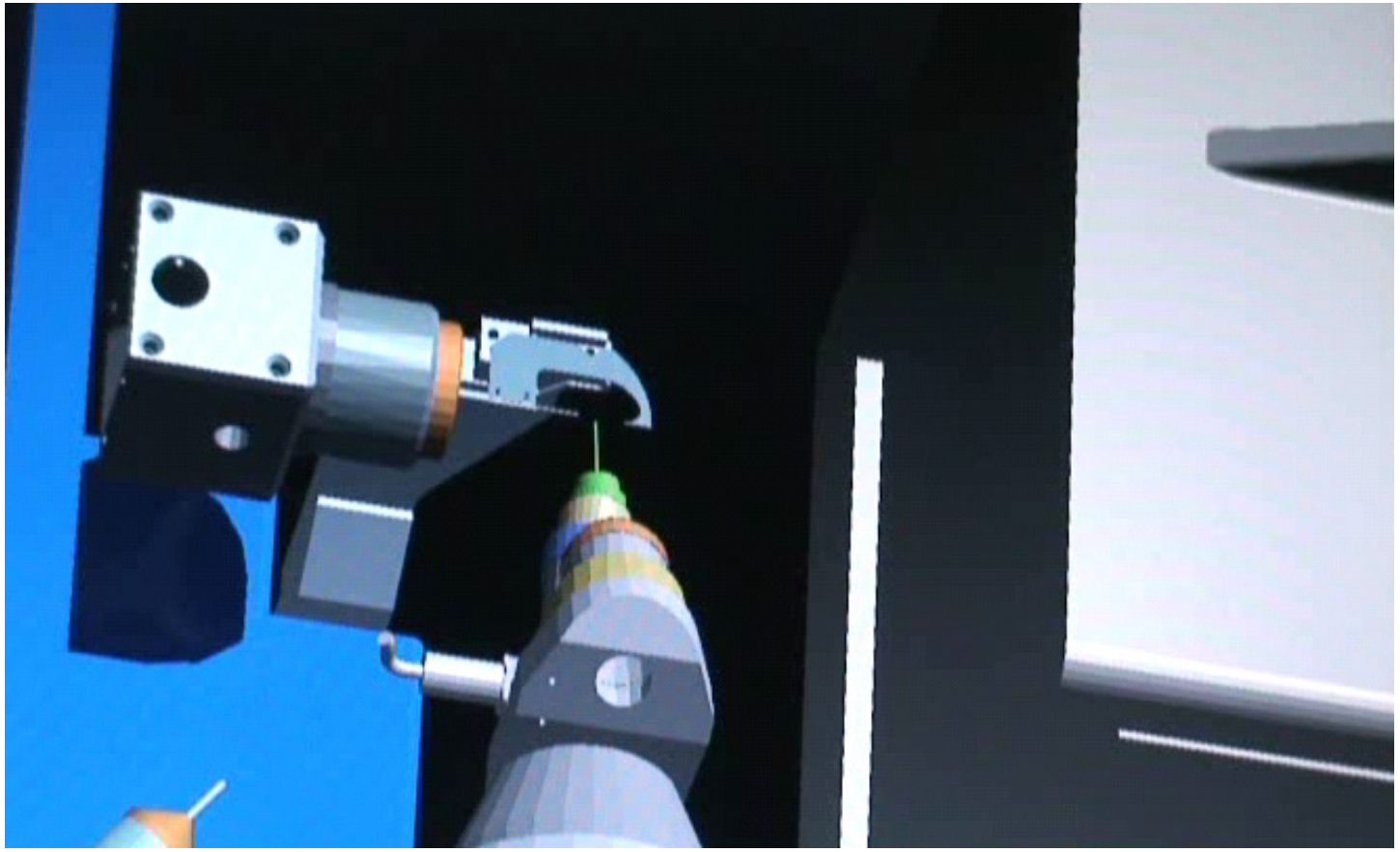
Thank you ….

**X3D** (ISO standard Extensible 3D Graphics) - some benefits**:**

- Uses XML files that are externalised from the source, and are ‘easily’ edited.
- Extensible – can exploit and extend X3D component architecture and XML schema.
- Can be read or written using standard XML tools and can be integrated seamlessly into any XML enabled application or Web service.
- X3D can be externally scripted via JavaScript - allows the direct inclusion of X3D models within XHTML pages.
- A picking extension is being introduced through the XJ3D toolkit (www.xj3d.org), offering a virtual instrument collision detection mechanism. Can provide physical property attributes.
- Although X3D is effectively in its infancy, X3D models can be examined by an increasing number of renderers and web-browser plugins:
    - FluxPlayer: www.mediamachines.com
    - Octaga: www.octaga.com
    - blaxxun: www.blaxxun.com


GridSphere Portal - Mozilla Firefox
File Edit View History Bookmarks Tools Help
University of Sydney, Australia. Teac...
GridSphere Portal
gridsphere portal framework
English
Home
Instruments Status
USYD 3D Simulator
Reciprocal Space Coverage Simulator
Reciprocal Space Reflection Coverage Portlet (Flux/X3D based)
Crystal Parameters ->
Machine Parameters ->
Axes
Reciprocal
Unique
Laue
Shells
1
2
3
4
5
Missed
Note: Using Internet Explorer, buttons may require a second mouse press (losing focus) to actuate.
Automated Collection Strategy
scan distance 2θ ° ω ° φ ° χ ° width ° sweep ° direction
1 Omega 50.20 -28.8 -15.00 0.00 54.74 4 130 -
2 Omega 50.20 -28.8 -15.00 120.00 54.74 4 130 -
3 Omega 50.20 -28.8 -15.00 240.00 54.74 4 130 -
4 Omega 50.20 -28.8 40.00 0.00 -54.74 4 80 -
5 Omega 50.20 -28.8 40.00 120.00 -54.74 4 80 -
Done



. STAC (**ST**rategy for **A**ligned **C**rystals) - Sandor Brockhauser

Australian Research Council
MOLECULAR + MATERIALS
STRUCTURE NETWORK

# NOBUGS
## Sydney November 3-5 2008