



Remote Control of the VESPERs Beamline using Science Studio



canarie



October 7, 2010

What is Science Studio?



Science Studio is a web portal, and framework, that provides scientists with a platform to collaborate in distributed teams, and to remotely access the resources of research facilities.

What is Science Studio?



❑ Experiment Management

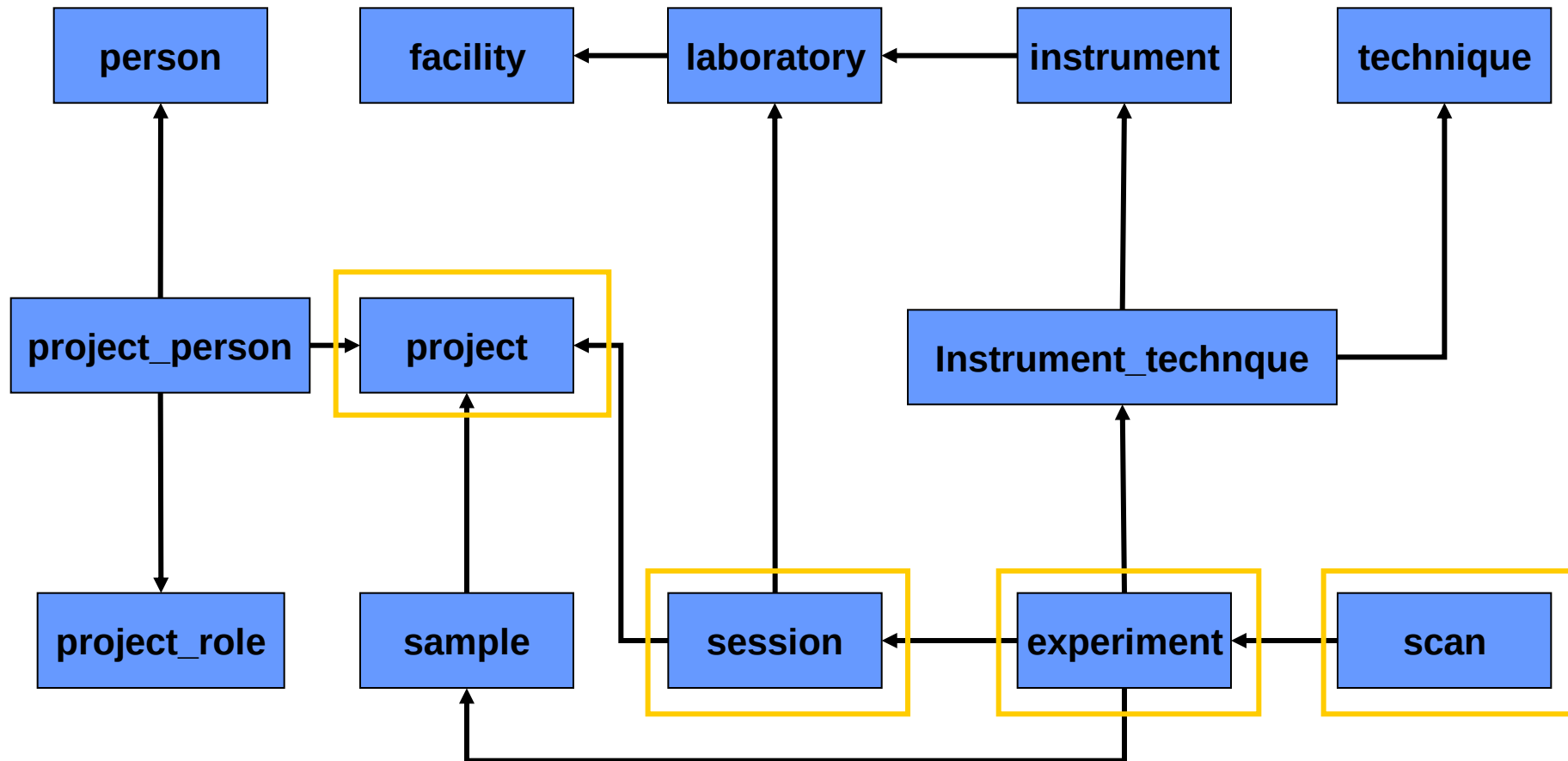
- Experiment (Meta-)Data Model
- Scheduling and Allocation of Remote Access
- Organization and Sharing of Experimental Data

❑ Remote Access

- Data Acquisition Resources (ie VESPERS)
- Data Processing Resources (ie SHARCNET)

❑ Access Control and Security

❑ Rich Web Application



(Meta-)Data Model



□ Project

- Top level organizational unit
- *Persons* (Team of Collaborators)
- *Samples* (ie Meteorite or X3454)

□ Session

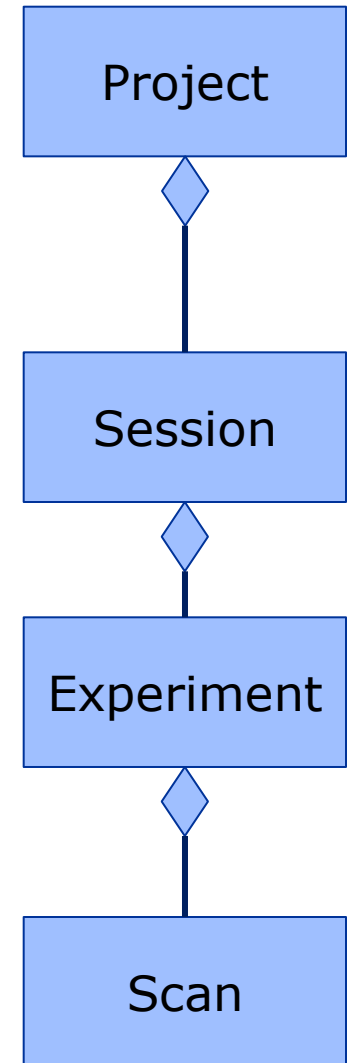
- Allocation of a resource to a project
- *Laboratory* (ie VESPERS)

□ Experiments

- *Sample* (those associated with the project)
- *Instrument* (ie Microprobe Endstation)
- *Technique* (ie XRF or XRD)

□ Scan

- Experimental data file location and format



Web Portal - Login



Web Portal - Home



Science Studio - Mozilla Firefox

File Edit View History Bookmarks Tools Help

http://test-sciencestudio.lightsource.ca:8080/ss/app/mainPage.html?ssHiddenId=34bb6ef8-479e-4383-aba4-525666fd488

Science Studio

Logged in as: maxweld
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Project Navigator

- MyProjects
 - Project_One
 - Demo_Project
 - Sim_Project
 - test_queue
 - CANARIE_visit
 - Demo_Project
 - Tom_Ks_Project
 - Project_Two
 - Demo_Project_1
 - IBM_Project
 - Jinru_and_Pans_Project
 - Test_Project
 - Nanofab_Project
 - Hong_Cavell_Project
 - Flemming_Fuller
 - Team
 - Marina_Suominen_Fuller
 - Stewart_McIntyre
 - Anand_Chandra
 - Andrea_Gerson
 - Chris_Myers
 - Dylan_Maxwell
 - Dong_Liu
 - Roberta_Flemming
 - New_Person
 - Samples
 - Sessions

Home Current Item

Projects

Name	Start Date	End Date	Status
Project_One	03/25/2009	06/30/2009	Active
Demo_Project			Active
Sim_Project	06/11/2009	10/31/2009	Active
test_queue	06/30/2009	07/03/2009	Active
CANARIE_visit	07/07/2009	07/07/2009	Active
Demo_Project	07/08/2009	07/29/2009	Active
Tom_Ks_Project	07/17/2009		Active
Project_Two	08/14/2009	01/08/2010	Active
Demo_Project_1	01/05/2010	01/07/2010	Active

Calendar

October 2010

S	M	T	W	T	F	S
26	27	28	29	30	1	2
3	4	5	6	7	8	9
10	11	12	13	14	15	16
17	18	19	20	21	22	23
24	25	26	27	28	29	30
31	1	2	3	4	5	6

Today

Skype Gadget

Call me!

GTalk Gadget

Google talk

Done

Web Portal - Session



Science Studio - Mozilla Firefox

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 - Hong_Cavell_Project
 - Flemming_Fuller
 - Team
 - Samples
 - New_Lovina
 - Old_Lovina
 - New Sample
 - Sessions
 - VESPERS_Lovina
 - Experiments
 - NLov_xrf
 - Scans
 - demo_area
 - Scans
 - area1
 - area2
 - spot7

Home Current Item

Session

Session Name: VESPERS_Lovina

Proposal ID: 12-3021

Beamline: VESPERS

Start Date: 09/28/2010

Start Time: 08:00:00

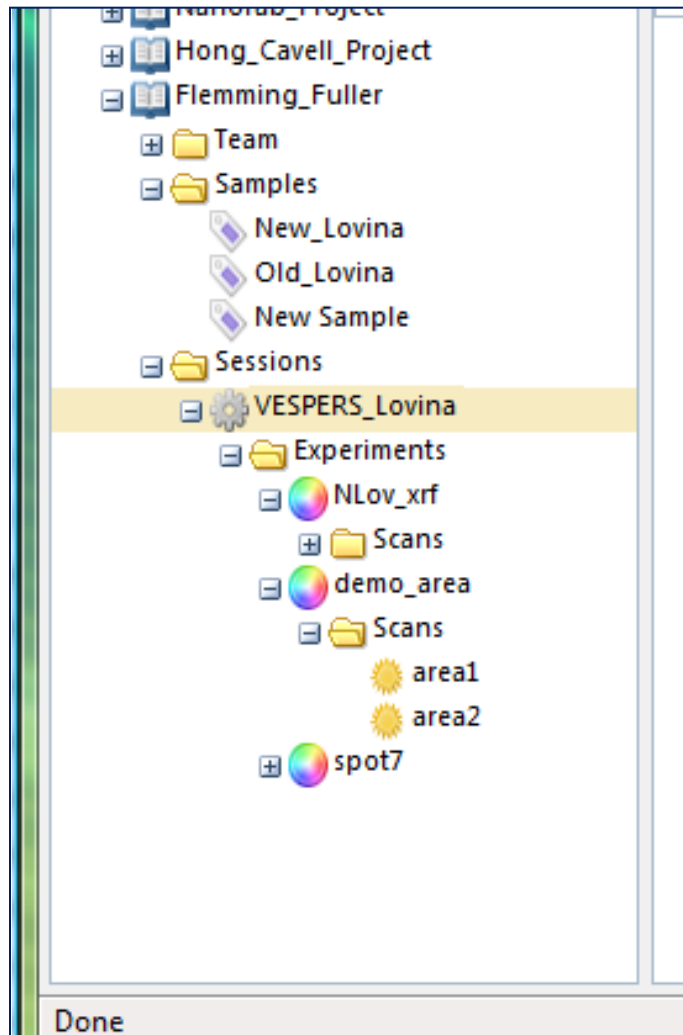
End Date: 09/29/2010

End Time: 08:00:00

Update Join Session

Done

Web Portal - Session



The screenshot shows the 'Current Item' tab of the web portal. The session details are as follows:

Session	
Session Name:	VESPERS_Lovina
Proposal ID:	12-3021
Beamline:	VESPERS
Start Date:	09/28/2010
Start Time:	08:00:00
End Date:	09/29/2010
End Time:	08:00:00

At the bottom of the form, there are two buttons: "Update" and "Join Session".

Web Portal - Scan



Science Studio - Mozilla Firefox

File Edit View History Bookmarks Tools Help

http://test-sciencestudio.lightsource.ca:8080/ss/app/mainPage.html

Science Studio

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 - area2
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Home Current Item

Data Viewer

Scan

Scan Name: area1

Data URL: /home/scstudio/scanData/scan_281/

Parameters: #
Tue Sep 28 19:19:51 CST 2010
dataFileBase=scanData.001
nPointsY=10

Start Time: 09/28/2010 19:19:52

End Time: 09/28/2010 19:31:59

Scale: linear

Scan Point: scanPoint_001_002

Update

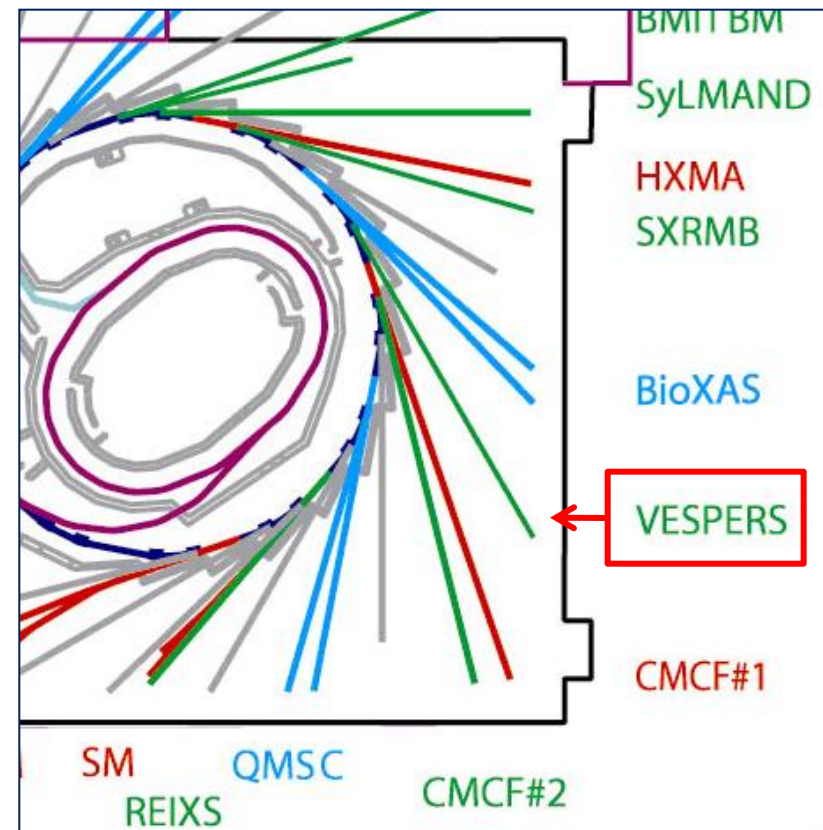
VESPERS Beamline



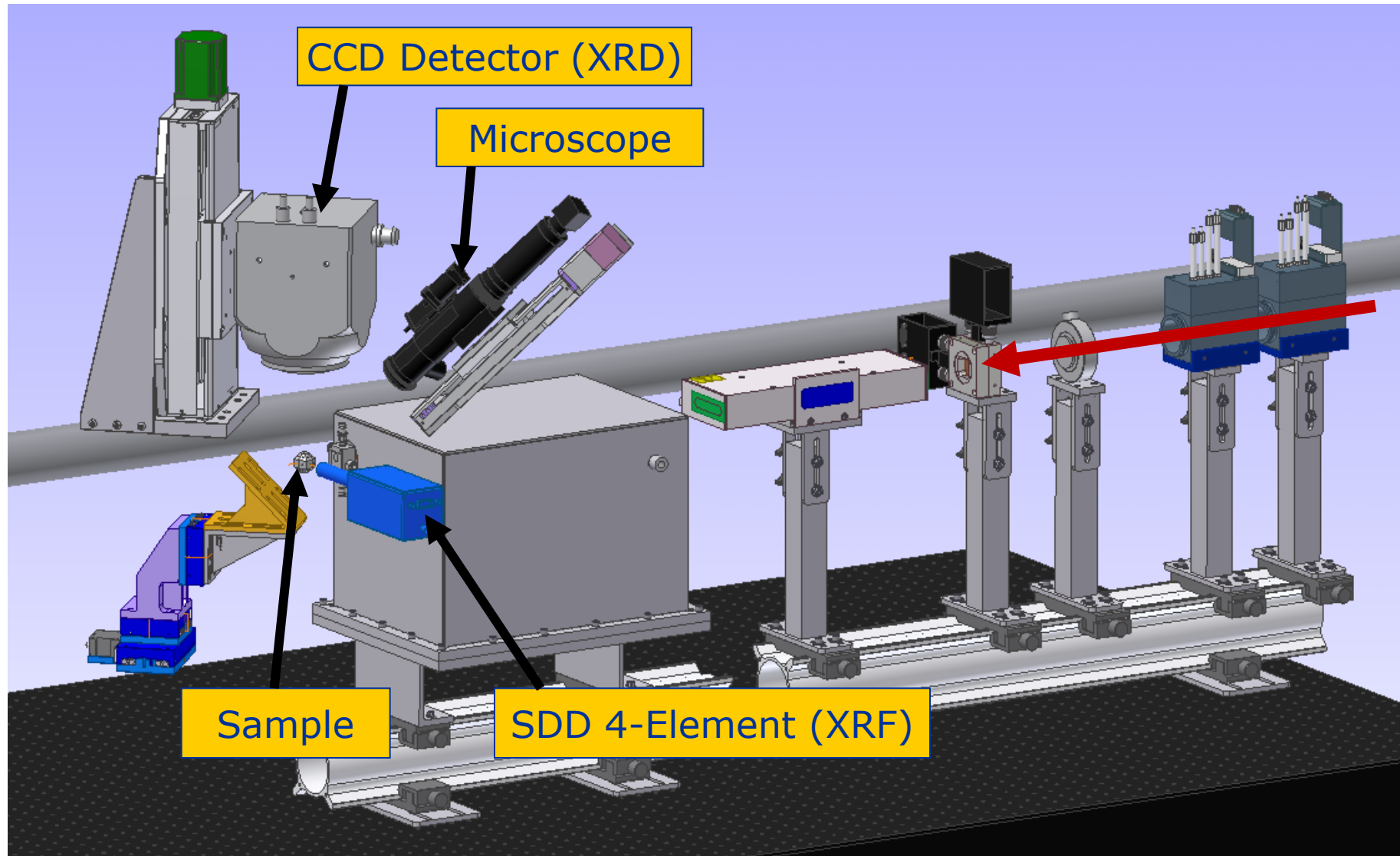
Very Sensitive Elemental and Structural Probe Employing Radiation from a Synchrotron

- ❑ Bending magnet (6 to 30keV)
- ❑ Microprobe endstation (~ 2 micron)

- ❑ CCD Area Detector
 - 2084 x 2084 (~ 8 MB)
 - X-Ray Diffraction (XRD)
- ❑ Silicon Drift Detector
 - Four Elements
 - X-Ray Fluorescence (XRF)



VESPERs Microprobe Endstation



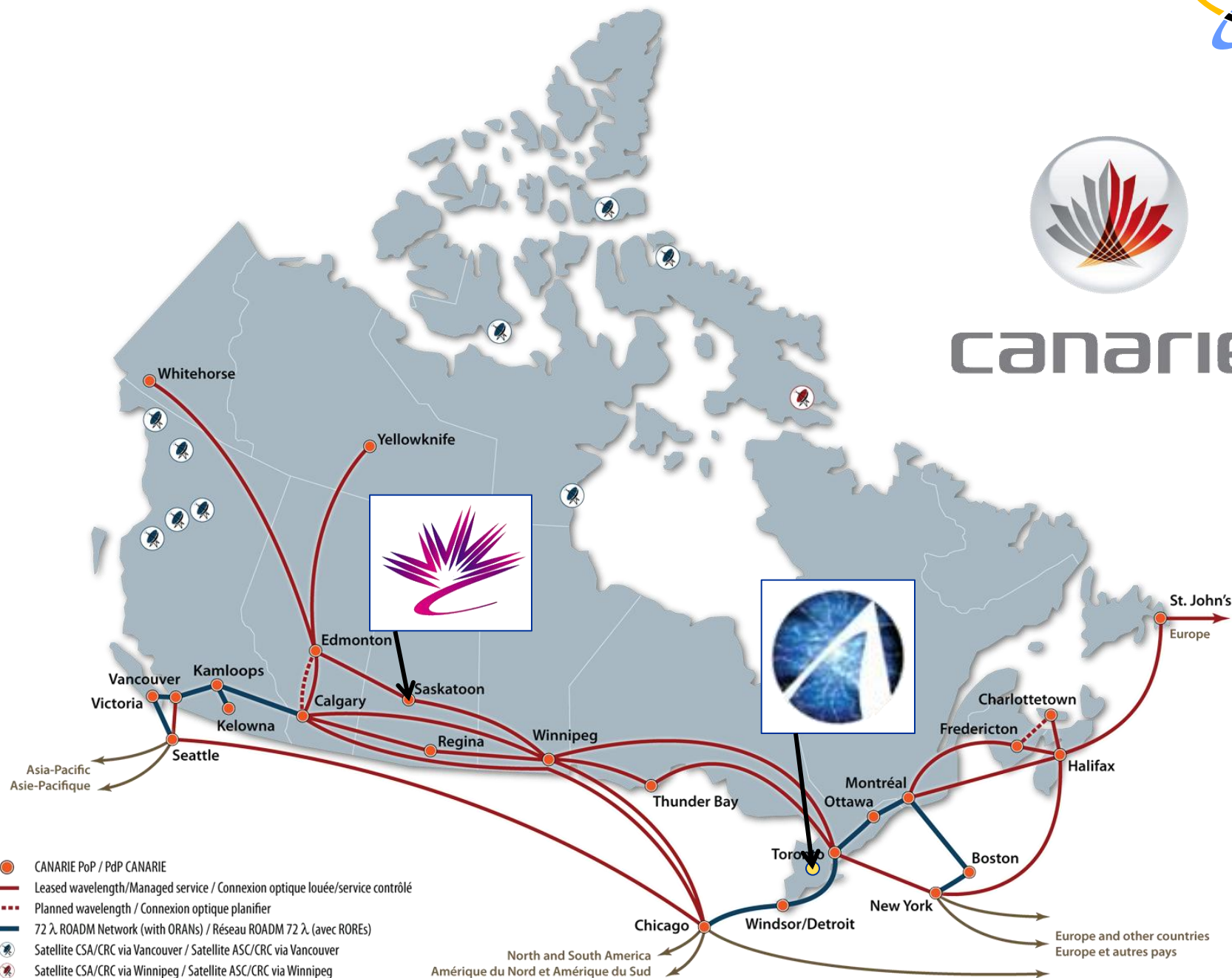


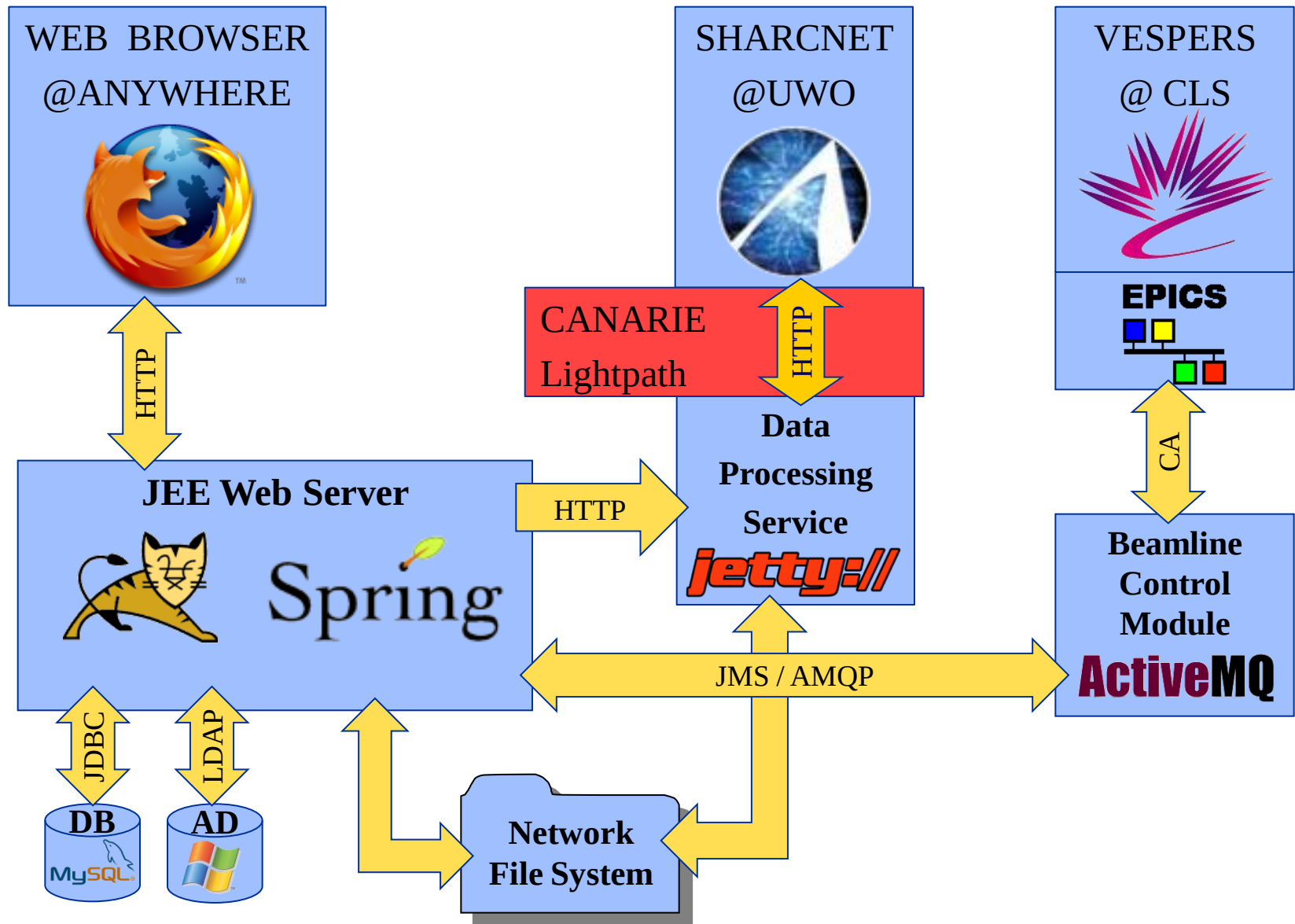
- ❑ Consortium of 17 Ontario research and education institutions that share a network of high performance computers.
- ❑ Connected by Ontario Research and Innovation Optical Network (ORION)
- ❑ Dedicated hardware at University of Western Ontario (UWO)
- ❑ Pseudo-realtime processing of diffraction images using **Cell** microprocessors





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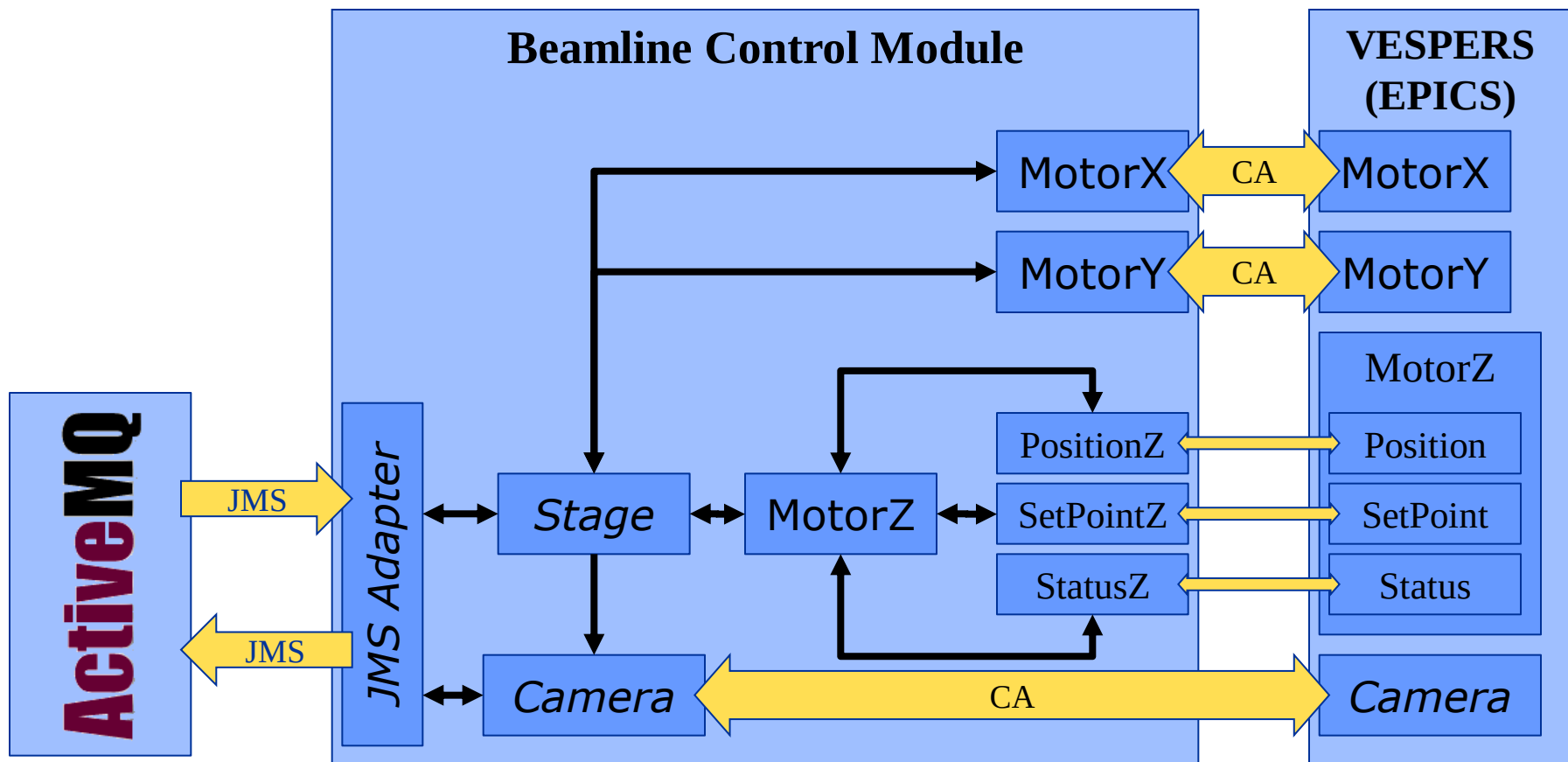




Beamline Control Module (BCM)



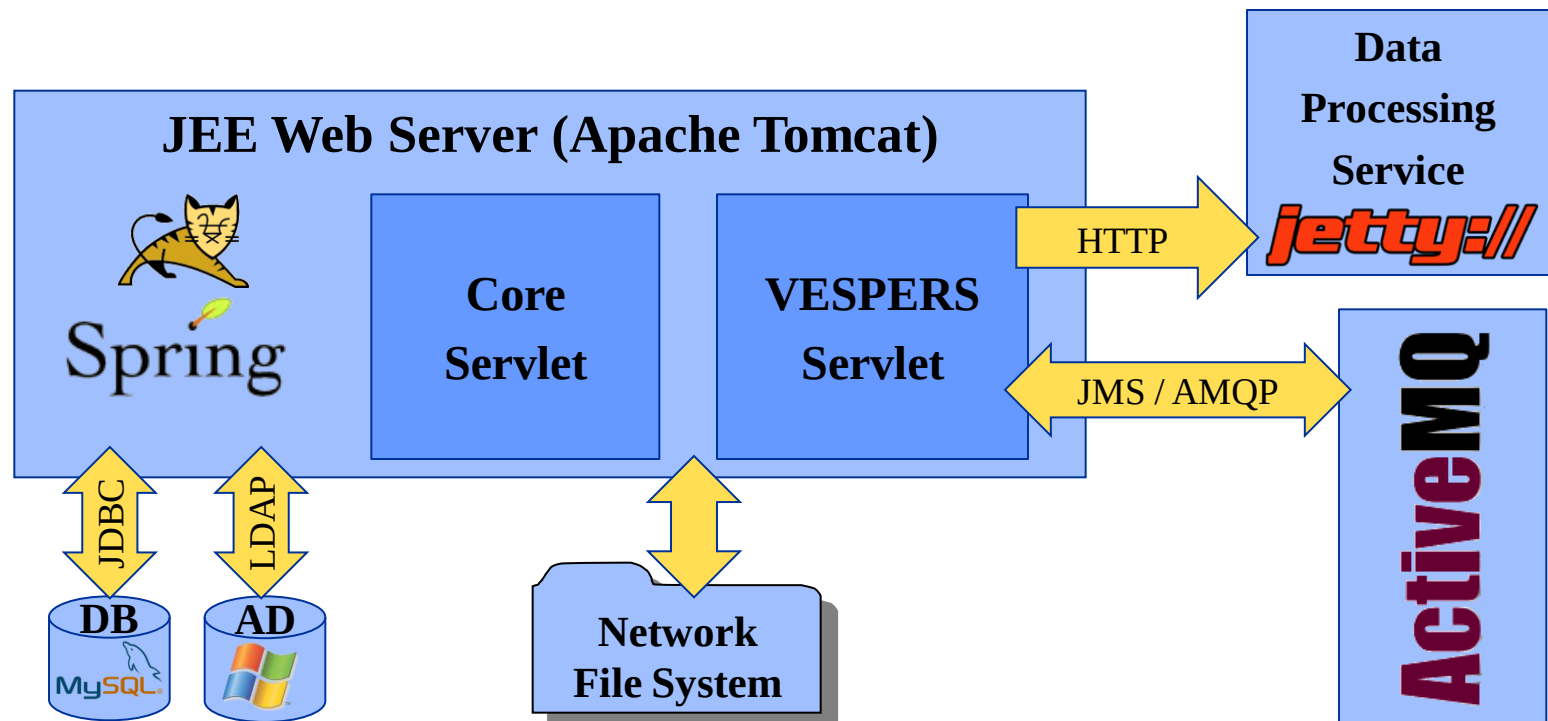
- ❑ Logical and physical separation of business logic and control logic
- ❑ Virtual device abstraction that provides independence from low-level control system
- ❑ Virtual devices can be logically organized into a device hierarchy using XML configuration
- ❑ Communication with external applications using two message queues



Web Server



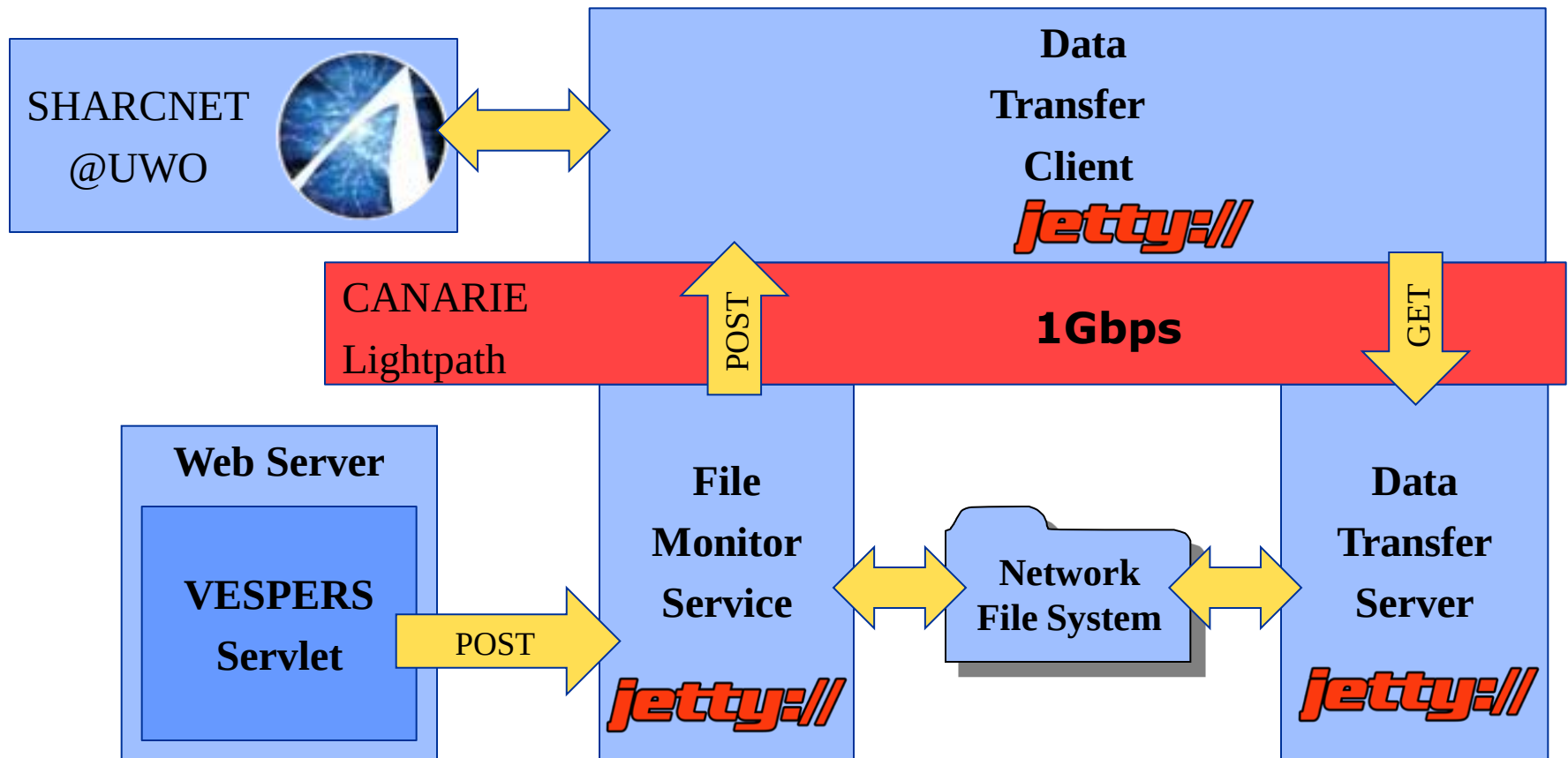
- ❑ Tools: Spring (MVC), iBATIS (ORM), JSecurity (Apache Shiro), Apache Tomcat
- ❑ Divided into two parts: the Core application and the VESPERs beamline application.
- ❑ Core application is responsible for providing access to the Experiment Model.
- ❑ VESPERs application is responsible for remote control of the VESPERs beamline.



Data Processing Service



- ❑ Pseudo-realtime data processing of XRD data
- ❑ 100 x 100 data points is ~80GB of image data



Data Processing Service



□ File Monitor Service

- File system event notification through HTTP
- Using native *inotify* with *inotify-java* library

□ File Transfer Service

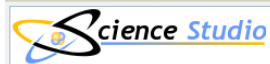
- Simultaneous TCP connections.
- Asynchronous client using non-blocking I/O.
- Start transferring multiple files with one request
- File range transfer over multiple connections
- File content compression using *gzip*

VESPERS Web Interface



- ❑ Rich web interface to the VESPERS beamline
 - Ext JavaScript framework provides GUI elements
 - Designed to be used over commodity internet
- ❑ Developed for the Firefox web browser
 - No additional plug-ins or extensions
 - Known to work with other browsers
 - Requires the *canvas* tag
- ❑ Only one user has control at any time

Beamline Setup



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 - Dong_Liu
 - Samples
 - Ore_Sample_1
 - Sessions
 - Session_1
 - Experiments
 - Experiment1
 - Scans
 - Scan1

Home Current Item Session

Beamline Setup Experiment Setup XRF XRD Focus Cameras Help

Beamline Information

Session

Project: Demo_Project_1

Session: Session_1

Proposal: 12-1234

Timeout: 3:35

Controller: Dylan Maxwell (maxweld)

Control Session

Storage Ring

Energy: 2.9 GeV

Current: 0.01 mA

HalfLife: 0.00 hr

Message: 16:00 - 08:00 BMIT radiation measurements

Shutters: DISABLED

Injecting: FALSE

Shutters

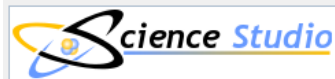
Monochrometer

Mirrors

Beamline

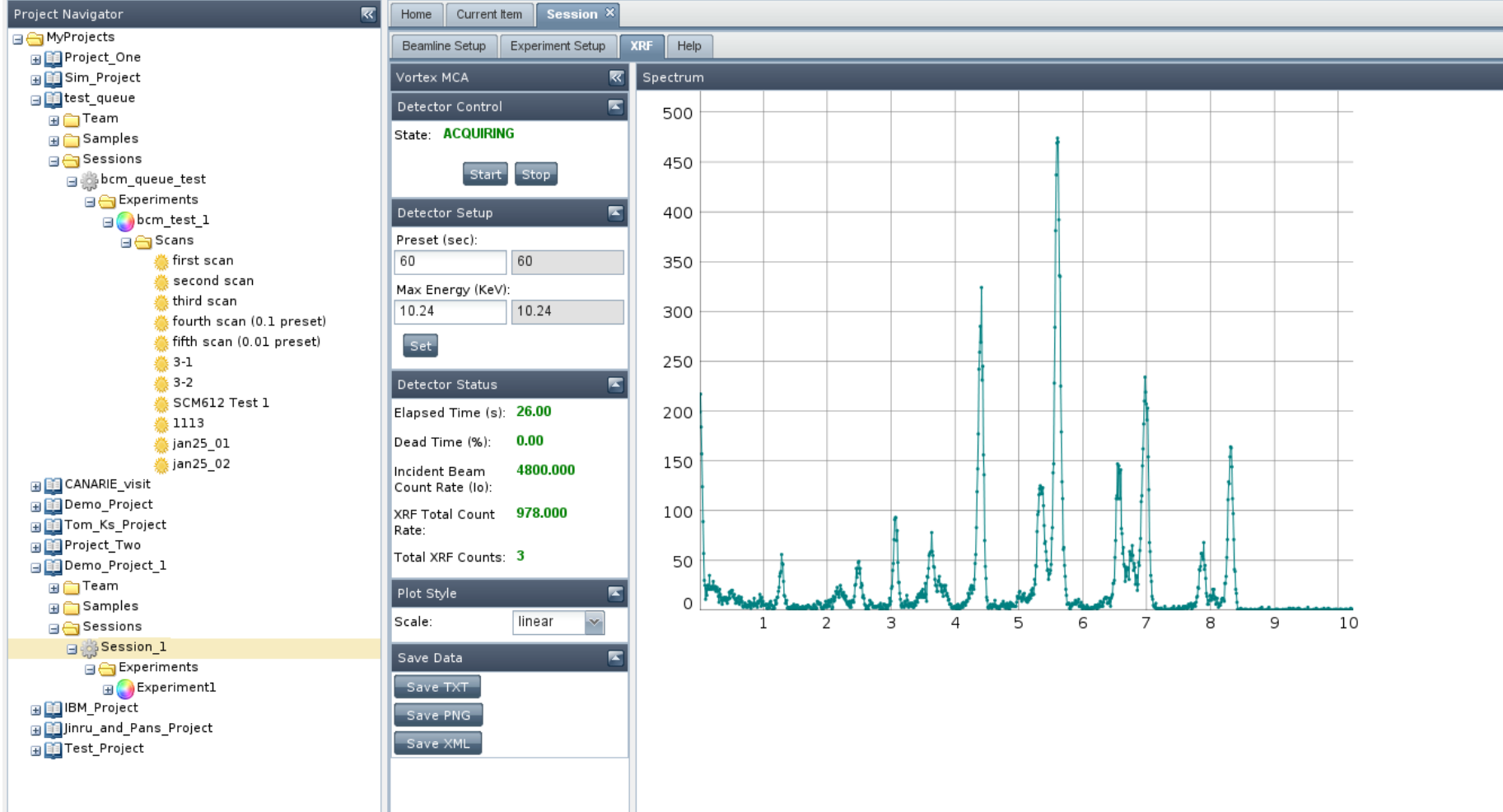
A 3D CAD model of a particle accelerator beamline. It shows a long horizontal pipe (the beam pipe) with various components mounted along its length. From left to right, there's a vertical assembly with a green top, a large blue and grey rectangular component, a smaller blue component, and several vertical support structures with sensors or cameras. The entire setup is mounted on a black base. A 3D coordinate system (red, green, blue axes) is visible in the bottom left corner of the 3D view.

XRF (X-Ray Fluorescence)



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XRD (X-Ray Diffraction)



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Project Navigator Home Current Item Session Beamline Setup Experiment Setup XRF **XRD Focus** Cameras Help

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 - Testing_One
 - Testing_Two
 - Banff_demo
 - Testing_Three
 - Friday_demo_test
 - Nov14_workshop_demo
 - Testing_Four
 - Testing_Five

CCD Detector

CCD Setup

Provided via: **null**

Binning X: **1**
Y: **1**

Reverse X: **No**
Y: **No**

Date type Auto: **No**
current: **UInt16**

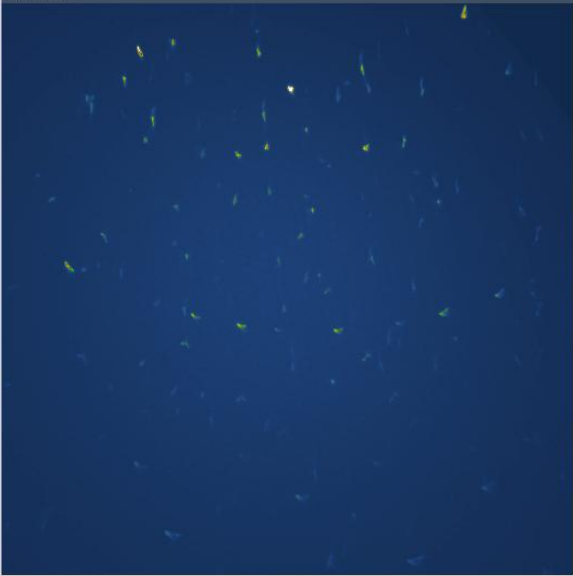
Gain: **0.0**

Temperature:

CCD Stage Position (mm)

Z:

CCD Image



Focus

CCD Collection

Acquire period: **0.5**
Exposures per image: **1**
Exposures completed: **0**
Images per acquisition: **0**
Images completed: **0**
Acquisitions to do: **1**
Acquisitions completed: **0**
Image mode: **Normal**
Trigger mode: **Unavailable**
Time remaining: **0.0**

Exposure time:

CCD Focus

Acquiring: **Unavailable**



Experiment Setup



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Home

Current Item

Session X

Beamline Setup

Experiment Setup

XRF

XRD Focus

Cameras

Help

Controls

HV Position (mm)
X: 0.3527 0.52
V: 0.590322 0.70046
Move
XYZ Position (mm)
X: 5.66
Y: 14.1955
Z: -6.7572
Move
Sample Image Calibration
Scale: 0.0025
Set
Setup Information
Spot Size: Not Available
Comment: No Comment

Sample Image

A dark, noisy image of a sample. A red rectangular box is drawn around a small, bright green spot in the center-right area.

Experiment Parameters

Scan Information
Experiment: Experiment1
Scan: Scan2
Scan Setup
Experiment: Experiment1
Step Size (mm)
0.025 0.025
Start Position (mm)
X: 0.47 0.47
V: 0.700363 0.700363
End Position (mm)
X: 0.67 0.67
V: 0.835363 0.825363
Number of Points
X: 41 9
V: 28 6
Get
Scan Control
Start Stop Pause
Scan Status
Status: ACQUIRING
Progress: 4%

Experimental Data



ScienceStudio

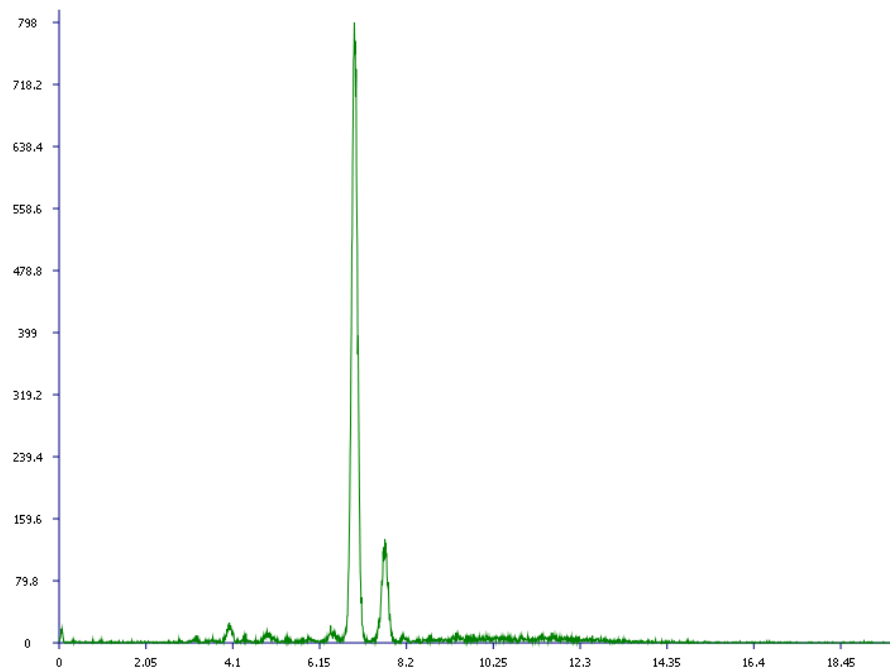
Logged in as: maxweld

[Settings](#) [Logout](#)

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 - Lovina_Session
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 - Exp_One
 - Scans
 - scan1
 - uwo_scan
 - Exp_AP5
 - Scans
 - test1
 - test2
 - test1
 - test2
 - dtest3
 - dtest5
 - dtest6
 - dtest7
 - dtest8

Data Viewer



Scan

Scan Name:

Data URL:

Parameters:

Start Time:

End Time:

Scale:

Scan Point:

- scanPoint_13.xml
- scanPoint_14.xml
- scanPoint_15.xml
- scanPoint_16.xml
- scanPoint_17.xml
- scanPoint_18.xml
- scanPoint_19.xml
- scanPoint_20.xml
- scanPoint_21.xml
- scanPoint_22.xml
- scanPoint_23.xml
- scanPoint_24.xml
- scanPoint_25.xml
- scanPoint_26.xml
- scanPoint_27.xml

Acknowledgements



- Dong Liu, CLS
- Jinhui Qin, UWO
- Diony Medrano, CLS
- Daron Chabot, BNL



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More Information



- ❑ Dylan Maxwell *et al.*, **THCOAA02**,
"Remote Access to the VESPERs
Beamline using Science Studio"
- ❑ Dylan Maxwell *et al.*, **THPL007**,
"Remote Access to a Scanning Electron
Microscope using Science Studio"
- ❑ Jinhui Qin *et al.*, **WECOMA01**,
"Use of the Cell Accelerator Platform
for Synchrotron Data Analysis"
- ❑ D. Medrano *et al.*, **THPL008**,
"CLS User Services Web Portal"