

# LABWEB

# **LNLS Beamlines Remote Operation System**

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## **About LabWeb Project**

- Aimed to allow remote operation of LNLS beamlines by the user community.
- Beta version in 2010 as proof of concept.
- New version in 2012 using open source platform Science Studio developed at CLS.
- So far provided remote operation of three LNLS beamlines: SAXS1, XAFS1 and XRD1.
- Expectation to provide this remote way of performing experiments to all other beamlines.

#### Figure 4: SAXS1, XAFS1 and XRD1 Data View Tab



### **Project Structure**

WebApp: Web application divided between

Data: Creates an exclusive visualization tool for the specific data generated by each beamline

administration page, for experimental setup, and beamline page, where all user interfaces for remote experiment are located

> Service: Part of the WebApp project and contains controllers where the messages between equipments and user interfaces are exchanged



**BCM or Beamline Control Module:** Responsible for the experiment execution and devices communication

Figure 2: Example of Samples Tab

### **Science Studio at LNLS**

•SAXS1 (Small Angle X-Ray Scattering): first beamline ported to Science Studio. Experiment Consists in sample change, scattering image acquisition and data preprocessing (background subtraction and azimuthal integrations).

•XAFS1 (X-Ray Absorption and Fluorescence Spectroscopy): second beamline ported to Science Studio which experiment is an x-ray absorption spectroscopy where users can specify a maximum of five energy ranges to launch scans, users can also define optimization strategies for ion chambers and specify wetter wave-vector or energy steps are required.

•XRD1 (X-Ray Driffraction) : powder samples in capilary can be changed by remote control of a robotic arm and diffractograms can be acquired remotly with a DECTRIS Mythen 24k.

#### Figure 5: SAXS1, XAFS1 and XRD1 Data Comparison Tab

K XRD	1					Session Controller
Beamline	Samples	Experiment Setup	Data	Cameras	Help	
XRDI - LNI		8-061112229				

📉 XRD1				Session Controller
Beamline Sample	s Experiment Setup	Data Ca	ameras Help	
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	ble to manage the samp			
To add a samples h	older to represent your	samples, cli	ck the button "Ad	d holder". You can select a previously added samples holder in the combobox to begin registering your samples.
Samples Information	on	~		
Holder				
Sample Grid:	5 X 10			
Samples Holder:	1 👻 🗐	Add holder		
Sample				
Sample Name:				
Sample Description:				
Sample Position:	12			
Set selected	Remove selected			
Z Load from file				
With a samples hold finally click the "Set		anel will sho	w a representation	n of the physical samples holder. To register a sample, first click over a sample in the samples panel. Then fill out the "Sample Name" and "Sample Description" fields an
-				
Samples Informatio	'n	*	Samples	
Holder Sample Grid:	5 X 10	<b></b>	Ó	
Sample Grid: Samples Holder:		Add holder		
			6	
		•		
Sample				
Sample Name:	teste sample			

Figure 6: Example of Camera and Help Tabs

### **Experimental Data**

A major concern in this new version of LabWeb was the file format used to store data.
Based on technical requirements we decided to use NeXus Scientifc Data Format (NeXus).

• A web application for opening NeXus/HDF files was created to avoid third party software.

- HDF Viewer is capable of browse NeXus/HDF files, plot graphs and display images.
- New types of data (3D Plots, Images, and more) can be inserted creating Plugins.

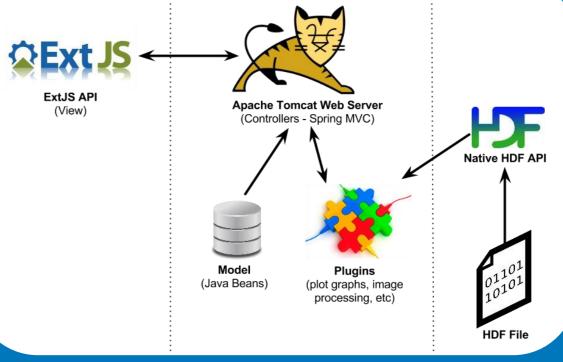
### •All beamline portal homepages have six main tabs:

- Beamline Storage Ring and Session Informations
- **Samples –** Sample registering and parameters
- **Experimental Setup –** Data Acquisition parameters, progress and sample selection
- Data Live Data and Data Comparison
- Cameras Live View of PZT cameras
- Help Help of all functionalities of the remote operation

KRD1					Session Controller			
1		Experiment Setup	Data	Cameras	Help			
Beamline Infor	rmation		~	Beamline				
Session				•				
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Session:	teste xrd1							
Proposal:	1							
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Controller:	Hugo Slep	icka						
Control Sessio	on							
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Current:	230.07 mA							
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Message:		ARA PESSO						
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Figure 1: Exa	mple of Beamline Tab

SAXS	XAFS	XRD1	XAFS
teamline Samples Experiment Setup SAXS	Beamline Samples Experiment Setup Data Cameras Help	Beamline Samples Experiment Setup Data Cameras Help	Beamline Samples Experiment Setup Data Cameras Help
<b>*</b>	»		~
ample Information	Sample Information	Information	00:00:00
mple Position: 3-12		Energy: 12000 Distance: 758 Central Pixel: 640 Pixel Cutout: 50	Experiment Log
mple Name:	Sample Position: INVALID	Angular Range: 5 Pixel Per Degree: 264.6 Offset Step: 5	
atus: STOPPED	Sample Name:		
cquire Params	Status: STOPPED	Sample Information	
	Monochromator Info	Sample Position: Sample Name:	
age: teste.tif	Monochromator into	Robotic Arm Status: STOPPED	



#### Figure 7: HDF Viewer Workflow

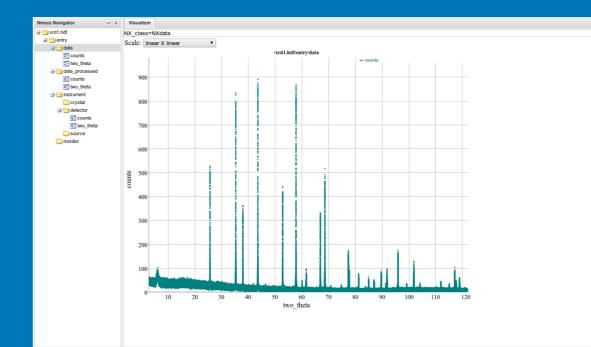




Figure 8: Example of Graph Data and Image of a HDF File generated at LNLS

### Conclusion

Almost 15% of SAXS1 beamline users are already using LabWeb to run experiments.
XAFS1 and XRD1 beamlines will start remote operations with users in the next months.
Next beamlines on sight for remote operations are IMX(X-Ray Tomography) and XRF (X-Ray Fluorescence).

All measurements were carried out successfully and the quality of acquired data were as good as those obtained by local beamline operation.
In the future we intend to implement upgrades to perform more complex experiments with temperature control and gas devices to increase the range of remote users.

	Selected Crystal. Silli		Batter Excertion
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Execution Information		Sample: 2 - test sample	* Values relatives to Edge Energy * Fill the repeat from/to parameter with line-column format. Ex: 1-2, 4-4. Or leave blank
White File: 0.tif	Acquire Params	Filename: N/A	for only current sample!
Browse Change Clean	* Energy in eVs * Values relatives to Edge Energy	Start Angle: 0 20 °	# sample 1 sample 1-1 scan {
Batch Execution	File name:	Final Angle: 22 °	night 5998
	Edge Energy:	# Steps: 5	5998 -50, -20, 5, 1, N, Y -20, 80, 2, 1
	# Start End Step Time (s) K Calib	Exposure Time: s 20 s	80, 120, 5, 1
		Desired Step: ° 0.005 °	1-1, 1-2
Save Successful Save Successful Save	2	Pixel Cutout: 50	# sample 2 without changing the filename sample 2-2
Experiment Control		Load defaults	scan { night 5998
( Calibrate White Acquire X Cancel	5 0 0	Experiment Control	5998 -50, -20, 5, 1, N, N
Experiment Log	* Fill with line-column format. Ex: 1-2. Or leave blank for only current sample!	Acquire Stop Remove Sample	-20, 80, 2, 1 80, 120, 5, 1
	Repeat from Sample: to	Experiment Status	
	Set Params	Status: STOPPED	
	Experiment Control	Progress: 0%	
Experiment Status		Elapsed Time: 00:00	
Status: STOPPED	Acquire Cancel	Experiment Log	
	Experiment Status		
	Status: CTOPPED		Save Z Load Validate 🔅 Execute X Cancel

Figure 3: SAXS1, XAFS1 and XRD1 Experimental Setup Tab Acquisition Parameters and XAFS 1 Batch Execution

### Acknowledgment

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