

17-BM (XFP) XAS Endstation Equipment Readiness Overview



**Erik Farquhar (CWRU), XFP Lead Beamline Scientist
on behalf of the XAS@XFP Team
9 August 2018**

Outline

➤ Background

Scientific Program and Endstation Parameters, Beamline Layout, Scope

➤ Pillar I: Documentation:

Endstation Installation Traveler, Radiation Reanalysis, Hazard Identification and Mitigation, ESR/PASS

➤ Pillar II: Hardware

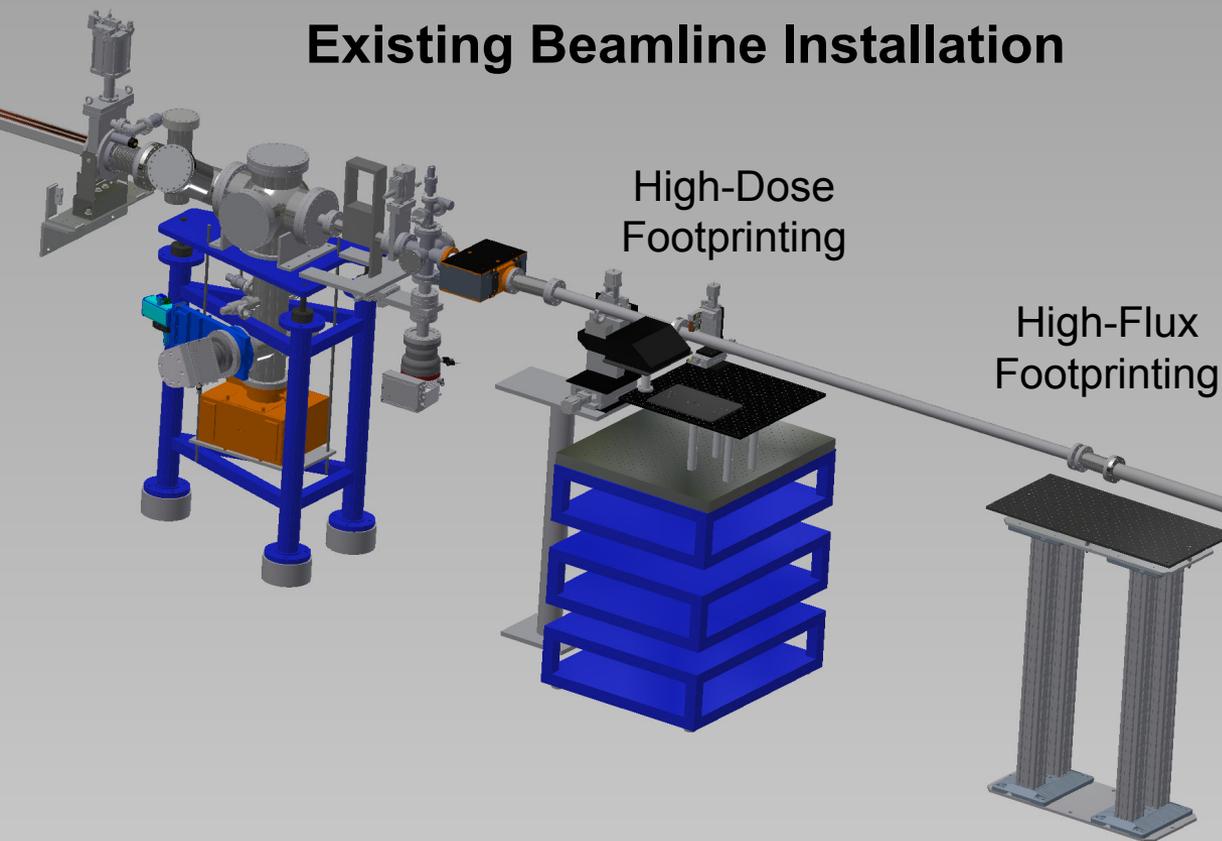
PPS, Utilities, EPS, Controls

➤ Pillar III: Personnel

Beamline Staff

The 17-BM (XFP) Beamline

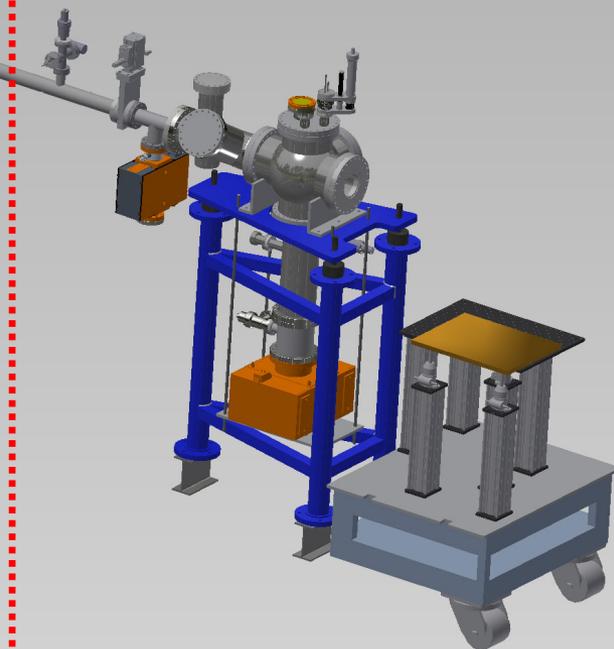
Existing Beamline Installation



Existing XFP beamline completed in 2016. IRR in June 2016, first light in July 2016, and commissioning of beamline and endstation devices for footprinting thereafter.

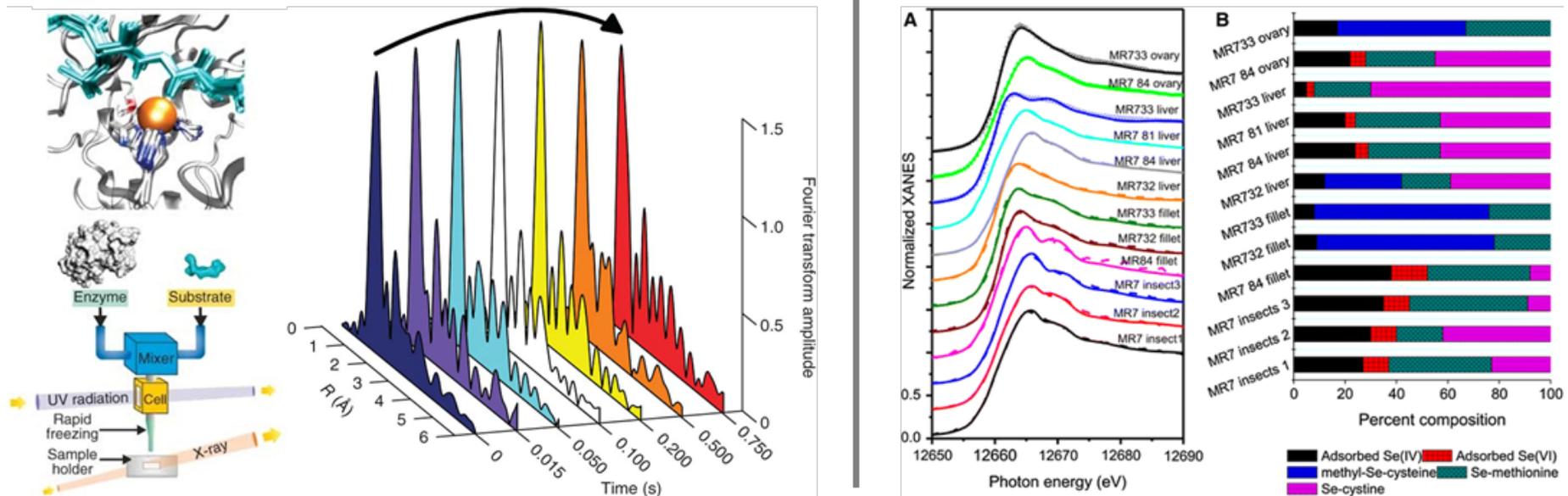
In general user operations since May 2017 for X-ray footprinting experiments at two endstations

XAS Endstation ES:3 (this review)



XAS Science Program & Performance Goals

- Enable evaluation of metal site structure (e.g. oxidation state, symmetry, bond lengths) role in metalloproteins, homogeneous catalysts, and other bio/enviro-relevant specimens, in order to uncover structure-function roles of the metal center in (bio)chemical systems.
- Expand NSLS-II Structural Biology capabilities to include a dedicated spectroscopy capability, while transitioning a program from NSLS beamline X3B to NSLS-II.
- Alternating operation with existing X-ray footprinting science program on 17-BM (XFP, X-ray Footprinting and Spectroscopy), enabling effective full usage of available beamtime.

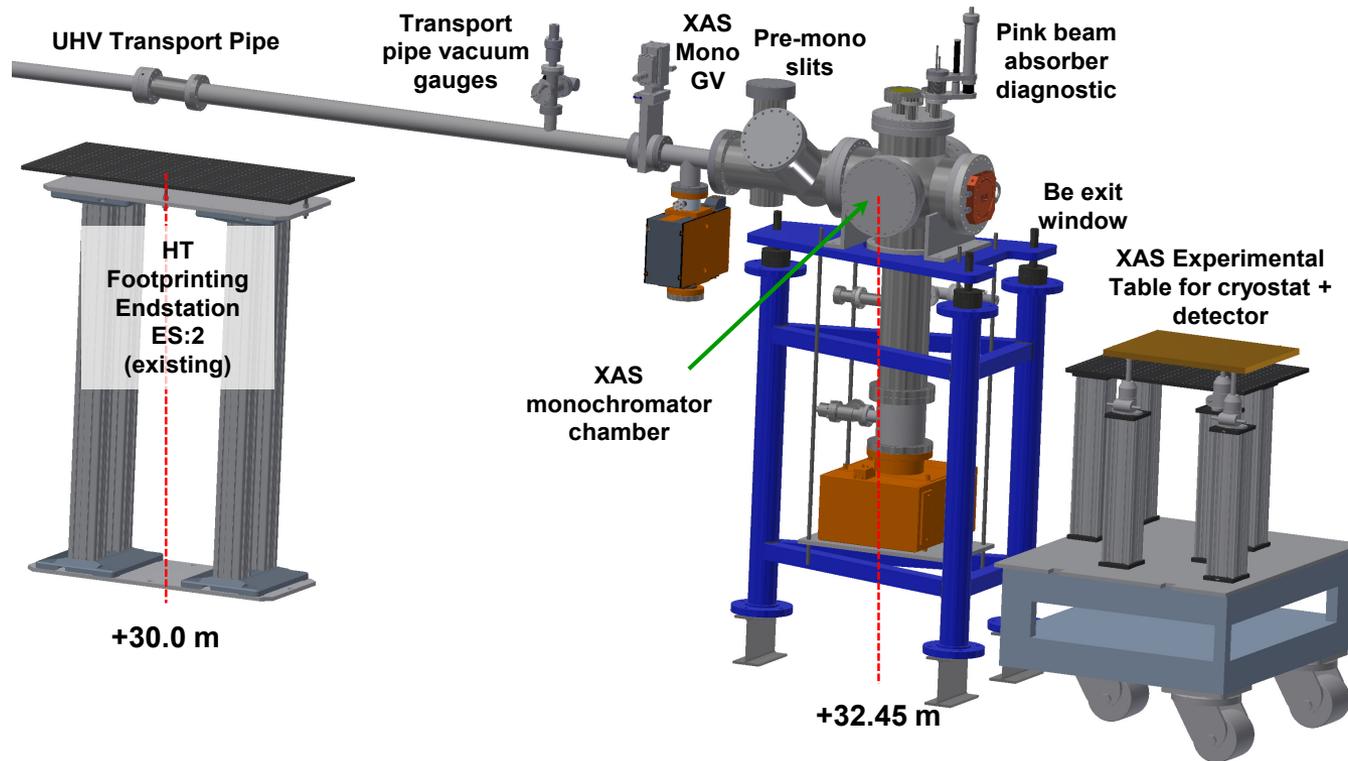


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Parameter	Specification/Description
Energy Range	4500 eV to 16000 eV (def'd by Rh-coated FE mirror at 4.2 mrad)
Monochromator	Channel-cut Si(111) water-cooled double crystal
Expected Source Acceptance	1.0 mrad H x 0.33 mrad V
Beam size at sample (FWHM)	4 mm (V) x 6 mm (H) (collimated, unfocused)
Flux at sample (500 mA storage ring current)	7×10^{11} ph./sec at 10 keV (1x5mm (VxH) aperture).
Sample environment	He Displex-type vacuum cryostat (6.5 – 300 K), mounted on three-axis motion stage
Detector system	Ionization chambers, multi-element Ge fluorescence detector

Layout & NSLS(-II) Origins



- Monochromator, premono slits, and pink beam absorber from **NSLS X6A** (in use 2001-2014). Upgraded to NSLS-II vacuum/motion control standard.
- Be exit window of standard NSLS-II design (FE-3PW-WIN-253-RevB). Specific window was installed in 17-BM FE 2016 (fully vetted through that effort). Removed August 2017 due to 3PW BL FE Be window design revision, repurposed for 17-BM XAS endstation.
- XAS Experimental Table, associated stages from **NSLS X3A** (in use 2010-2014), upgraded to NSLS-II motion control standard.

See it all in person on the tour!

XAS ERR Scope

ERR Scope Includes:

1. XAS monochromator chamber and controls
2. Installation and basic control of experimental table and sample stages.
3. Modifications to 17-BM EPS, PPS, mechanical/electrical utilities to support XAS endstation.

ERR Scope Excludes:

- 1. Existing 17-BM beamline up to XAS Mono gate valve.***
2. Detectors (germanium detector), including controls and integration

Self Identified Pre- and Post-Start Findings

Pre-start findings:

None

Post-start findings:

None

Pillar I: Documentation

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Reviews / Endstation Installation Traveler

NSLS-II

NATIONAL SYNCHROTRON LIGHT SOURCE II

17BM XAS END STATION
EQUIPMENT INSTALL/TEST

Doc No. BL-ES-001 Rev: C
Page 1 of 9
Rev Date: 10/02/2017
Author: Joseph Zipper
Approved: 10/02/2017

Title	Name	Approval Date
NPB Portfolio Manager	Andrew Broadbent	10/02/2017
Deputy Director for Construction	Erik Johnson	10/02/2017
ESH Manager	Robert Lee	10/02/2017
Quality Assurance Engineer	Joseph Zipper	10/02/2017

Serial No	Part No	Part Rev	ECN	Rev	ECN	Rev
	PD-XFP-ES-1000					
Deviation & Waiver: _____						

OP	Description	Name/Life #	Date	DR
10	TRAVELER INFORMATION This traveler shall be used for the installation and testing of end station equipment previously installed and operated at NSLS or another facility, that is now being installed at NSLSII. This traveler goes beyond the typical installation/test traveler that instructs/documents installation qualification. It will also: 1) confirm that the re-purposing of this equipment was reviewed and approved for its intended use 2) collect upgrade information from subject matter experts (SME) that they deem necessary for the equipment's safe operation at NSLSII, and 3) confirm that any new upgrades have been implemented.	E. FARQUHAR Y5735	8/2/18	

COMPLETE OP#20 THRU OP#130 BEFORE INSTALLATION

Endstation traveler developed to:

- Review/approve previously used equipment and document SME identified improvements (walkthrough held 6 Nov. 2017)
- Track installation, document that improvements were carried out.

Intended for repurposed equipment from NSLS, elsewhere, of known function. No formal design review held.

Endstation traveler completed 2 August 2018.

One design review was held related to XAS activities:

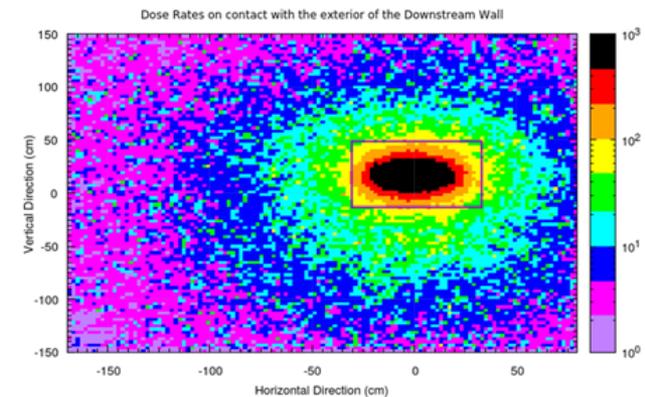
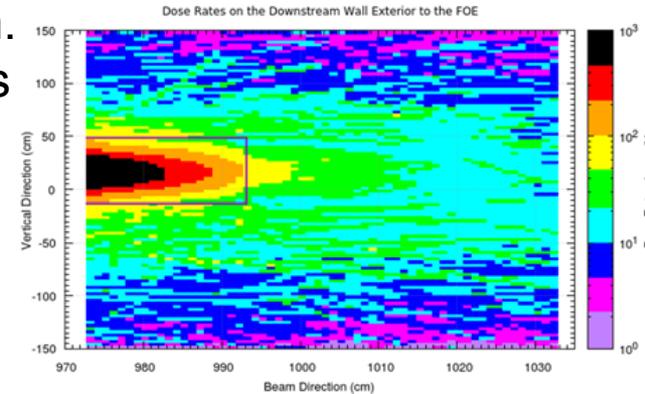
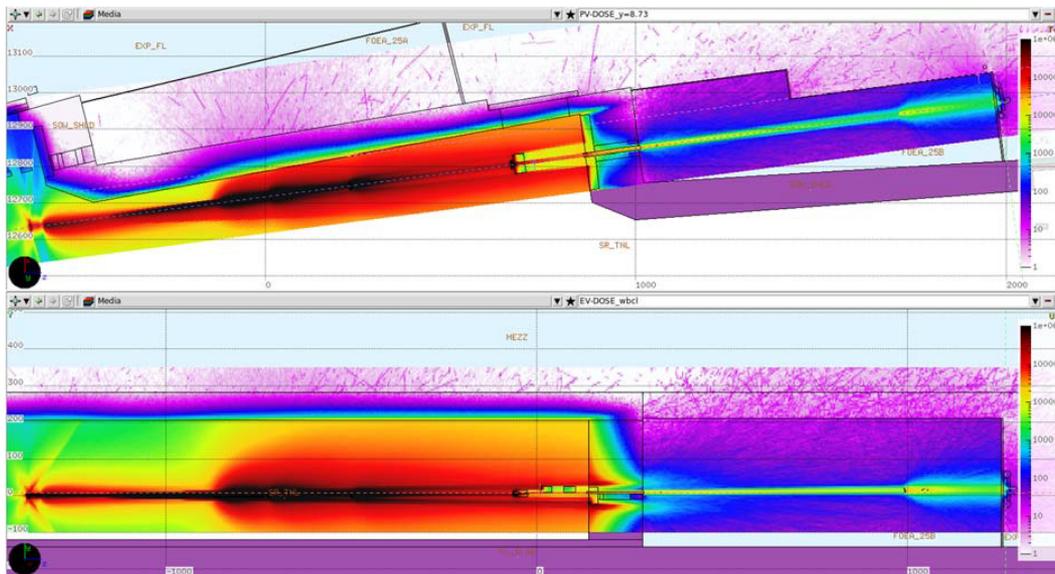
17-BM (XFP) Ge Detector LN2 Fill System Review, held 25 May 2017
Report: PS-DRR-1059; all associated ATS items have been closed

Radiation Safety Re-Analysis

Top-off and Bremsstrahlung thoroughly analyzed in original XFP construction project, (PS-C-ASD-TOS-RPT-004 and NSLS-II Technical Note #218).

Reeval. w/ XAS scatter sources (NSLSII-ESH-TN-281):

- Scattered GB collimated by ratchet wall collimator, brem. stop captures forward scattering from hutch components
- FOE shielding adequate for SR beam
- For top-off, dose rates calculated to be below 100 mrem/hr requirement with added XAS components



“...dose rates meet the shielding design criteria established in the NSLS-II Shielding Policy and confirms that the earlier 17-BM beamline radiation shielding analysis ... remain unaffected by the introduction of XAS.”

Hazard Identification & Mitigation

USI (Unreviewed Safety Issue) Evaluation Negative. XAS ES hazards:

Hazard	Mitigation
Radiation	Analysis shows no impact to existing configuration
Cryogenics	ODH system in 17-BM-A (existing installation), LN ₂ manual shut-off installed
Pressure Safety	burst disk on XAS mono, 1/2 or 1/3 psi pressure reliefs on gN ₂ venting system and XAS cryostat assembly
Electrical	EEL, grounding, installation according to code

ESR & NSLS-II PASS

- 17-BM Beamline ESR updated with new XAS components. Approved on 8 August 2018.
- 17-BM defined as a single resource in PASS as footprinting and XAS do not run in parallel (NSLS-II User Admin.)
- Technical commissioning proposal (#303842) and SAF (#302841) submitted, awaiting ESH & management review and approval.

Pillar I: Hardware

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Electrical Power & Utilities Additions

Additional electrical power pole for XAS endstation in hutch, power for XAS compressor on mezzanine

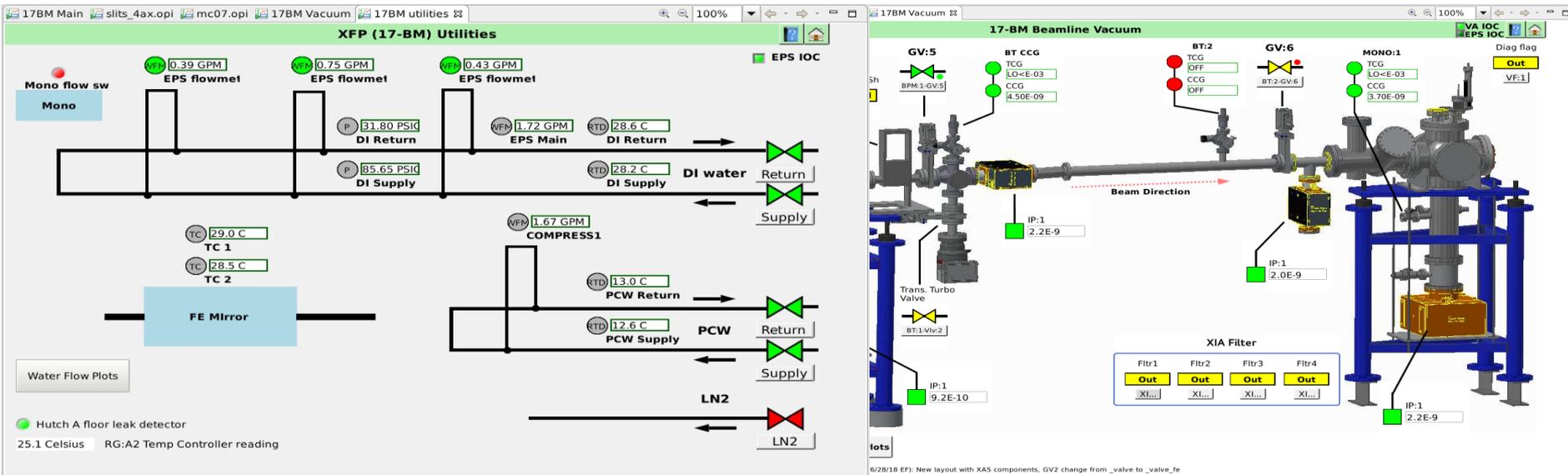


New LN₂ distribution line from 17-ID with manual shut-off



Add PCHW tap, flowmeter, filter for XAS compressor on mezzanine
PD-XFP-UT-1500 Rev B.

XAS EPS Additions



- Monitoring of new XAS mono vacuum, DI water flows, and Proteus flowmeter for XAS monochromator chiller (interlocked)
- Beampipe sensor switch for configuration control between XAS and footprinting configurations to determine interlock response.
- Monitoring of PCHW flow for XAS compressor (no interlock role)
- Control of LN2 pneumatic supply valve to 17-BM (on 17-ID-B).
- Control of XIA filter box assembly (no interlock role)



Beampipe sensor switch

XAS Controls

NSLS-II NATIONAL SYNCHROTRON LIGHT SOURCE II XFP (17-BM)

User Screens: Capillary Flow

Webapps: Beamline Status, Shutter Control

Machine: Accel. Main, NSLS-II Status

XFP Support:
Jen (FP), x4613, jbohon@bnl.gov
Erik (XAS), x8174, efarquhar@bnl.gov
Don, x5154, dabel@bnl.gov
Mike, x3800, msullivan@bnl.gov

SCHOOL OF MEDICINE
CASE WESTERN RESERVE UNIVERSITY

Components: Table 1, Capillary Flow XY, Syringe Pump, ES Camera 1, HT MSH

Optics: Front End Slits, FE Mirror, Encoder Pos., Pink Beam Slits, DBPM Stage, Beampipe Stage

Vacuum/Utilities: FE Vacuum, Mirror RGA, BL Vacuum, Utilities

Tools: Plot Launcher, BL Logbook, PV Archiver

Controls: IOC Monitor, PPS Status, Legacy + Obsolete

Monochromator / XAS ES (highlighted): Pre Mono Slits, ADC Slits, Table 3 (XAS), VME, Lakeshore 336, Wiener HVPS

NSLS-II NATIONAL SYNCHROTRON LIGHT SOURCE II 17BM XAS

mc07

Mono_kev	11.41000 keV	11.41000 keV	< 0.01000 keV >	STOP More
Mono Theta	9.97880 deg	9.97880 deg	< 0.20000 deg >	STOP More Kill all mot...
Pico th2f	-100.000 um	-99.981 um	< 0.000 um >	STOP More
Pico ch2f	0.000 um	0.000 um	< 0.000 um >	STOP More
PB Diagnostic Y	0.000 mm	0.000 mm	< 0.000 mm >	STOP More
XAS Det Y	0.000 mm	0.001 mm	< 0.000 mm >	STOP More
XAS Cryo Y	29.999 mm	29.999 mm	< 10.000 mm >	STOP More
XAS Cryo X	0.000 mm	0.000 mm	< 0.000 mm >	STOP More
XAS Cryo Z	200.000 mm	200.000 mm	< 100.000 mm >	STOP More
Table3 Y Vertical	0.000 mm	0.000 mm	< 1.000 mm >	STOP More Table 3 (XAS)

- Motors required for first light and initial technical commissioning of XAS endstation have been tested, with CSS screens available.
- Supporting devices (VME scaler, temperature controller, HVPS) coming online.
- Ongoing integration (as of 8 August 2018):
 - Coordinated motions of slits and table (single axis moves functional)
 - Direct readback of Heidenhain angle encoder (interpolator due October 2018)

Pillar III: Personnel

Lead Beamline Scientist	Erik Farquhar
Authorized Beamline Staff	Jen Bohon (FP BL scientist) Don Abel (technical support) Mike Sullivan (technical support)

- No change in beamline staffing composition, role, or training requirements.
- Hutch search and secure OJT renewed with all BL personnel following publication of new search pattern.
- All NSLS-II ABS/LBS + 17-BM-specific ABS/LBS JTA training up to date as of 8 August 2018.

Let's Go Take a Look!

Also, Contributors:

XFP Team:

Erik Farquhar
Don Abel
Mike Sullivan
John Toomey
Jen Bohon

Management:

Andy Broadbent
Howard Robinson
Mark Chance
Sean McSweeney

Coordination:

Chris Stebbins
Greg Fries

XAS Mono:

Steve Ehrlich
Syed Khalid
Julian Adams

\$\$\$: NIH

PPS:

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Scott Buda

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Al Boerner

Vacuum:

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Charlie Hetzel
Walter DeBoer
Pete De Toll
Charles De La Parra
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Ed Granger

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Rich Iaccarino

Radiation Safety:

Mo Benmerrouche

ESH:

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Kristen Rubino

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ZY
Chris Guerrero
Ji Li
Alex Sobhani
Chanaka De Silva

Be Window:

Sushil Sharma
Oleg Chubar

EPS/Cables:

Garrett Bischof
Barrett Clay
Rick Skelaney
Travis Herbst
Ke Zhang
Dennis Poshka

Survey:

Rodger Hubbard
Don Davis

LN2:

Steve LaMarra
Tom Langdon

And many others . . .