INSTRUMENT READINESS PLAN (IRP)

FOR THE

NSLS–II 17-ID BEAMLINES (AMX/FMX)

FEBRUARY 2016

PS-C-XFD-PLN-025

PREPARED BY

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FOR THE

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BROOKHAVEN
NATIONAL LABORATORY

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PREPARED BY:

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APPROVED AS A PLAN TO ACHIEVE READINESS BY:

L. Berman, IRR Technical Authority

CONCURRENCE BY:

R. Lee, ESH Manager

APPROVED – IRP HAS BEEN FULLY IMPLEMENTED AND INSTRUMENT IS READY FOR COMMISSIONING:

L. Berman, IRR Technical Authority

CONCURRENCE BY:

R. Lee, ESH Manager

VERSION HISTORY LOG

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TABLE OF CONTENTS

1.0 INTRODUCTION 1
1.1 Purpose and Scope 1
1.2 17-ID Beamlines 1
1.3 Instrument Readiness Review (IRR) 1
1.4 Authorization to Proceed with Commissioning 2
2.0 INSTRUMENT READINESS PLAN 2
2.1 Readiness Criteria 2
3.0 IRP IMPLEMENTATION 2
3.1 Readiness Team 2
3.2 Achieving Readiness – Responsibilities 2
3.3 Execution of the IRP 3
3.4 Certifying Readiness 3

ATTACHMENTS

Attachment A, *Pillar I Documentation, 17-ID Beamlines (AMX/FMX)*

Attachment B, *Pillar II Hardware, 17-ID Beamlines (AMX/FMX)*

Attachment C, *Pillar III Personnel, 17-ID Beamlines (AMX/FMX)*

Attachment D, *Completion of IRR Pre-Start Findings*

1.0 INTRODUCTION

1.1 Purpose and Scope

The purpose of this Instrument Readiness Plan (IRP) is to establish the readiness criteria required to declare the NSLS-II 17-ID Beamlines [Highly Automated Macromolecular Crystallography/Frontier Macromolecular Crystallography/ (AMX/FMX)] ready for commissioning. The scope of this IRP includes the 17-ID Beamlines and End Station Diagnostics, and was prepared in accordance with the *Instrument Readiness Review Procedure* (PS-C-ESH-PRC-001). The Front End and Insertion Device were evaluated in a previous IRR. Experimental equipment that is installed and operational in the End Station will be included in the scope of this plan.

This IRP will be used as a tool for planning and certifying readiness. The completion of this IRP requires that all procedures, documentation and hardware listed in the plan are completed, tested, and, where required, independently certified. In addition, Staff and Users that will be involved in commissioning shall be trained and qualified to conduct their work safely, securely and in an environmentally sound manner.

1.2 17-ID Beamlines

The AMX and FMX Beamlines are on canted undulators. The AMX Beamline is designed to achieve best-in-class flux and beam quality among the macromolecular crystallography beamlines with focal spots in the 5-20 μm range (mini-beam) and to offer efficient ways of expanding its 5 μm focus up to 100 μm for the support of any crystallographic work. The FMX Beamline is designed to achieve best-in-class flux and beam quality among the macromolecular micro-crystallography beamlines by obtaining a focal spot size of one micrometer with the highest possible flux in the 12-13 keV photon energy range.

1.3 Instrument Readiness Review (IRR)

As part of the verification of readiness for commissioning, an IRR is required in accordance with the *Instrument Readiness Review Procedure* (PS-C-ESH-PRC-001). An independent IRR Team will use the readiness criteria developed as part of this IRP to verify that the 17-ID Beamlines are ready for commissioning in accordance with the Beamline Commissioning Plan. Pre-start and post-start findings will be identified by the team.

1.4 Authorization to Proceed with Commissioning

The completion of this IRP, together with closure of any pre-start findings from the IRR, is used as the basis for the NSLS-II Director to authorize the start of commissioning of the 17-ID Beamlines.

2.0 INSTRUMENT READINESS PLAN

2.1 Readiness Criteria

Readiness criteria are provided in Attachments A through D. The criteria were developed by the Instrument Readiness Coordinator (IRC) and Readiness Team members, using the *General Readiness Criteria* provided in Attachment A and the *Instrument Readiness Guide* provided in Attachment C of the *Instrument Readiness Review Procedure* (PS-C-ESH-PRC-001).

The readiness criteria for the 17-ID Beamlines are grouped into the following categories:

- Pillar I – Documentation
- Pillar II – Hardware
- Pillar III – Personnel
- Completion of IRR Pre–Start Findings

3.0 IRP IMPLEMENTATION

3.1 Readiness Team

A Readiness Team will be appointed by the NSLS-II Director in accordance with the *Instrument Readiness Review Procedure* (PS-C-ESH-PRC-001). The Readiness Team members that have responsibility for completing the IRP are listed as the Responsible Person in the Attachments.

3.2 Achieving Readiness – Responsibilities

The Readiness Team members are responsible for ensuring that their specific readiness criteria are achieved.

The Lead Beamline Scientist is responsible for certifying that all of the readiness criteria associated with the Beamlines is achieved.

3.3 Execution of the IRP

The Readiness Team members shall execute this IRP by preparing, installing, documenting, or training (as appropriate), the specific scope of work (readiness criteria) assigned to them as listed in the Attachments. The Readiness Team members shall develop, compile or assemble the documented evidence that clearly demonstrates that the readiness criteria have been met. This evidence shall be listed on the Attachments.

3.4 Certifying Readiness

Upon completion of the readiness criteria, the Readiness Team members will certify that the criteria for which they are responsible for are complete by signing the Attachments in the appropriate section. The Attachments shall not be signed until the readiness criteria have been fully achieved.

For completion of the IRR pre-start findings, the IRR Technical Authority and the ESH Manager will certify that all IRR pre-start findings relative to the 17-ID Beamlines have been completed, and that the associated ATS Actions have been closed by signing Attachment D in the appropriate section. The Independent Verifier will concur that these actions have been adequately completed and closed by signing Attachment D in the appropriate section.

ATTACHMENT A – PILLAR I DOCUMENTATION

17–ID BEAMLINES (AMX/FMX)

	READINESS CRITERIA	RESPONSIBLE PERSON	ACTIONS	DOCUMENTED EVIDENCE	CERTIFICATION OF READINESS*
PILLAR I DOCUMENTATION (PLANNING & PROCEDURES)	**Functional Description** An overview presentation is prepared that includes the following beamline specific information: – Primary research capabilities – Beamline layout (includes location on the experiment floor) – Design reviews – Source characteristics – Photon beam performance goals – Radiation Safety Committee reviews – Self-identified pre-start findings – Description and status for each item listed in this Instrument Readiness Plan	D. Schneider AMX Lead Beamline Scientist	• Develop the presentation described	• Presentation • Functional Description Document	Signature: D. Schneider 03/03/16
		M. Fuchs FMX Lead Beamline Scientist			Signature: M. Fuchs 3/3/16
	Beamline Design Beamline components are designed in accordance with PS-QAP-0412, *Design Reviews* and PS-C-QAS-PRC-010, *Engineering Design by Others*.	D. Schneider AMX Lead Beamline Scientist	• Complete Preliminary and Final Design Reviews (PDR & FDR)	• PDR and FDR reports	Signature: D. Schneider 03/01/2016
		M. Fuchs FMX Lead Beamline Scientist			Signature: M. Fuchs 3/1/16
	Radiation Safety Components Design Radiation Safety Components designed in accordance with NSLS-II requirements.	D. Schneider AMX Lead Beamline Scientist	• Complete requirements analysis and design of radiation safety components	• Requirements analysis • Component design documents • RSC Report	Signature: D. Schneider 03/02/2016

*Signature certifies that the readiness criteria are met. The Responsible Person shall not sign prior to completion.

ATTACHMENT A – PILLAR I DOCUMENTATION

17–ID BEAMLINES (AMX/FMX)

	READINESS CRITERIA	RESPONSIBLE PERSON	ACTIONS	DOCUMENTED EVIDENCE	CERTIFICATION OF READINESS*
PILLAR I DOCUMENTATION (PLANNING & PROCEDURES)	**Top-Off Safety System (TOSS)** Top-Off Safety System components designed in accordance with PS-R-ASD-RPT-DRV-001, *Top-Off Safety Analysis and Requirement of Hazard Mitigation for NSLS-II Facility*.	R. Fliller Coordinator for Top Off Safety	• Complete TOSS analysis	• TOSS analysis report	Signature:
	Ray Traces Bremsstrahlung and Synchrotron Ray Traces generated in accordance with PS-C-XFD-PRC-008, *Synchrotron and Bremsstrahlung Ray Trace Procedure*.	D. Schneider AMX Lead Beamline Scientist	• Prepare the Ray Traces	• Approved Ray Trace drawings	Signature: D. Schneider 03/01/2016
	Secondary Radiation Scatter Analysis Secondary Bremsstrahlung and Synchrotron scatter is analyzed in accordance with LT-C-ESH-STD-001, *Guidelines for the NSLS-II Beamline Radiation Shielding Design.*	M. Benmerrouche Health Physics	• Complete FLUKA analysis • Complete STAC8 analysis	• BNL Technical Note Report	Signature:
	Oxygen Deficiency Hazard (ODH) Analysis Completed ODH analysis including definition of control requirements.	L. Stiegler ESH Operations Group Leader	• Complete ODH analysis	• ODH analysis report	Signature:
	National Environmental Protection Act (NEPA) Evaluation NEPA requirements evaluation completed.	L. Stiegler ESH Operations Group Leader	• Complete a NEPA evaluation	• NEPA evaluation report	Signature:

*Signature certifies that the readiness criteria are met. The Responsible Person shall not sign prior to completion.

ATTACHMENT A – PILLAR I DOCUMENTATION

17–ID BEAMLINES (AMX/FMX)

	READINESS CRITERIA	RESPONSIBLE PERSON	ACTIONS	DOCUMENTED EVIDENCE	CERTIFICATION OF READINESS*
PILLAR I DOCUMENTATION (PLANNING & PROCEDURES)	**Unreviewed Safety Issue (USI) Evaluations/ Screenings** Authorization basis hazard identification is managed through USI evaluation/screening.	S. Moss Authorization Basis Manager	• Verify that the SAD and ASE accurately cover the hazards associated with the subject beamline; include temporary systems	• SAD and ASE USI screening/evaluation • Applicable waivers	Signature: Steven H Moss 01/29/2016
	Resolution of Open Action Tracking System (ATS) Actions All action items from previous internal and external oversight groups (e.g., RSC, Design Reviews, etc.) have been closed.	J. Zipper QA Engineer	• ATS action items shown as closed with supporting evidence	• ATS system	Signature: 2/10/16
	Procedures Procedures needed for safe, secure, and environmentally sound commissioning have been developed, reviewed, validated (where applicable), and approved. Existing procedures are sufficient for new hazards introduced by this beamline, if any.	K. Rubino Procedure Support	• Develop any system specific procedures • Verify that existing procedure are sufficient for any new hazards introduced, if any	• Insertion Device LOTO Procedures (PS-C-ASD-PRC-133) • 17-ID Radiological Interlock Test Procedure (PS-C-XFD-PRC-043) • Search and Secure Sketch • RI Cryocooler Procedure (PS-C-XFD-PRC-052)	Signature: K Rubino
	Commissioning Plan A commissioning plan generated to address the task sequence required for technical commissioning (safe photon transport).	D. Schneider AMX Lead Beamline Scientist	• Prepare a commissioning plan	• Approved commissioning plan	Signature: D. Schneider 03/03/16
		M. Fuchs FMX Lead Beamline Scientist			Signature: 3/3/16

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ATTACHMENT A – PILLAR I DOCUMENTATION

17–ID BEAMLINES (AMX/FMX)

	READINESS CRITERIA	RESPONSIBLE PERSON	ACTIONS	DOCUMENTED EVIDENCE	CERTIFICATION OF READINESS*
	Radiation Survey Plan A survey plan generated in accordance with PS-C-XFD-PRC-004, *NSLS-II Beamlines Radiation Safety Commissioning Plan.*	M. Benmerrouche Health Physics	• Prepare the radiation survey plan	• Approved Radiation Survey Plan	Signature:

*Signature certifies that the readiness criteria are met. The Responsible Person shall not sign prior to completion.

ATTACHMENT B – PILLAR II HARDWARE

17–ID BEAMLINES (AMX/FMX)

	READINESS CRITERIA	RESPONSIBLE PERSON	ACTIONS	DOCUMENTED EVIDENCE	CERTIFICATION OF READINESS*
PILLAR II SAFETY CRITICAL HARDWARE (INSTALLATION)	**Radiation Safety Components: Installation** Radiation safety components are installed in accordance with the Traveler.	D. Schneider AMX Lead Beamline Scientist	• Generate and execute Traveler	• Completed Traveler	Signature:
		M. Fuchs FMX Lead Beamline Scientist			Signature:
	Radiation Safety Components: Configuration Control A Radiation Safety Component Checklist template generated in accordance with PS-C-ESH-PRC-025, *NSLS-II Radiation Safety Component Inspection Procedure.*	D. Schneider AMX Lead Beamline Scientist	• Develop Radiation Safety Component Checklist	• Approved beamline specific Radiation Safety Component Checklist	Signature:
		M. Fuchs FMX Lead Beamline Scientist			Signature:
	Area Radiation Monitors (ARMs) ARMs are installed in accordance with, PS-C-ESH-ARN-SPC-001, *NSLS-II Area Radiation Monitor (ARM) System Description* and PS-C-ESH-STD-002, *Technical Basis Document for Interlocked Area Monitors Placement Outside the Accelerator and Beamlines Enclosures.*	M. Benmerrouche ARM Technical Authority	• Install, calibrate, and test (EPICS integration) ARM's • Certify (PPS)	• ARM Layout Drawing • ARM calibration certificates • ARM EPICS Interface Integration Test Sheet • ARM PPS Test checklist	Signature:
	Personnel Protection System (PPS) Interlocks: Install Hardware/Software installed in accordance with PS-C-XFD-SPC-PPS-001, *Beamline Personnel Protection System (BLPPS) and Front End Personnel Protection System (FEPPS) Design Description.*	G. Ganetis Electrical Engineering Group Leader	• Generate system schematics and logic diagrams • Install PPS components	• Overall PPS Checklist	Signature:

*Signature certifies that the readiness criteria are met. The Responsible Person shall not sign prior to completion.

ATTACHMENT B – PILLAR II HARDWARE

17–ID BEAMLINES (AMX/FMX)

	READINESS CRITERIA	RESPONSIBLE PERSON	ACTIONS	DOCUMENTED EVIDENCE	CERTIFICATION OF READINESS*
PILLAR II SAFETY CRITICAL HARDWARE (INSTALLATION)	**Personnel Protection System (PPS) Interlocks: Certify** PPS certified in accordance with the beamline specific interlock certification procedure.	R. Chmiel ESH Safety Officer	• Complete PPS certification	• Beamline specific certification procedure generated and exercised	Signature:
	O2 Sensors: Install Oxygen sensors and alarms required to alert personnel to oxygen deficiency hazard (ODH) conditions installed in accordance with the design drawing.	S. LaMarra ODH Technical Authority	• Generate design drawing • Generate and exercise Traveler	• Design drawing • Completed Traveler	Signature:
	O2 Sensors: Certify ODH monitoring system has been certified in accordance with PS-C-XFD-PRC-005, *Beamline Enclosures and Cryogen Fill Station ODH Monitoring and Alarm System Certification and Inspection.*	B. Heneveld ESH Engineer	• Perform certification	• Certification report	Signature:

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ATTACHMENT B – PILLAR II HARDWARE

17–ID BEAMLINES (AMX/FMX)

	READINESS CRITERIA	RESPONSIBLE PERSON	ACTIONS	DOCUMENTED EVIDENCE	CERTIFICATION OF READINESS*
PILLAR II SAFETY CRITICAL HARDWARE (INSTALLATION)	**Hutch Structures (Life Safety)** Hutch structures installed with adequate provision for life safety issues (egress and fall protection) in accordance with LT-SOW-XF-HU-0001, *Statement of Work for NSLS–II Beamline Shielding Enclosures ("Hutches")*, LT-C–XFD-SPC-HU-001, *NSLS-II Lead/Steel Beamline Shielding Enclosures*, and LT-C-XFD-SPC-HU-002, *NSLS-II Steel Beamline Shielding Enclosures.*	E. Haas Beamline Engineer	• Generate and execute Traveler for inspection	• Completed Traveler	Signature: Edwin Haas 1/29/2016
	Electrical Power SBMS electrical power distribution requirements are satisfied. SBMS Electrical Equipment Inspection (EEI) requirements are satisfied.	A. Boerner Electrical Distribution Engineer	• Generate and approve one-line drawings • Complete system electrical inspection • Complete needed EEI inspections	• Approved AC Power one–line drawings • EEI database entry	Signature:
	Utilities Permanent utility systems are installed and tested (i.e., Compressed Air, DI Water, Gaseous Nitrogen, Process Chilled Water) in accordance with design drawings.	J. Gosman Mechanical Utilities Group Leader	• Generate system schematics • Generate and execute Traveler • Perform pressure test	• Approved system schematics • System pressure testing reports • Completed Traveler	Signature: 3-1-16

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ATTACHMENT B – PILLAR II HARDWARE

17–ID BEAMLINES (AMX/FMX)

	READINESS CRITERIA	RESPONSIBLE PERSON	ACTIONS	DOCUMENTED EVIDENCE	CERTIFICATION OF READINESS*
PILLAR II OTHER HARDWARE (INSTALLATION)	**Other Photon Transport Components, Optics, and Diagnostics** Photon transport components that are not radiation safety components are installed and tested in accordance with the Traveler. Diagnostic equipment needed to begin technical commissioning is installed and tested.	D. Schneider AMX Lead Beamline Scientist	• Generate and exercise Traveler • Complete vendor acceptance tests	• Completed Traveler • Vendor acceptance test documentation	Signature: D. Schneider
		M. Fuchs FMX Lead Beamline Scientist			Signature: M. Fuchs
	Equipment Protection System (EPS) Interlocks Hardware/Software installed and tested in accordance with the Traveler.	R. Kadyrov Controls Infrastructure Group Leader	• Generate and exercise Traveler • Verify EPICS integration • Generate Test Report	• Test Report • Completed Traveler	Signature: 3/1/16
	Controls Hardware/Software installed and tested in accordance with NSLS-II requirements.	S. Myers Controls Group	• Complete factory acceptance tests • Complete integral testing	• Factory acceptance test report • Integral testing checklist	Signature:

*Signature certifies that the readiness criteria are met. The Responsible Person shall not sign prior to completion.

ATTACHMENT B – PILLAR II HARDWARE
17–ID BEAMLINES (AMX/FMX)

	READINESS CRITERIA	RESPONSIBLE PERSON	ACTIONS	DOCUMENTED EVIDENCE	CERTIFICATION OF READINESS*
PILLAR II OTHER HARDWARE (INSTALLATION)	**Vacuum** Vacuum hardware has been installed and tested in accordance with the Traveler and has the capability of achieving full vacuum needed during commissioning.	R. Todd Vacuum Engineer	• Generate and complete Traveler	• Completed Traveler	Signature:

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ATTACHMENT C – PILLAR III PERSONNEL

17–ID BEAMLINES (AMX/FMX)

	READINESS CRITERIA	RESPONSIBLE PERSON	ACTIONS	DOCUMENTED EVIDENCE	CERTIFICATION OF READINESS*
PILLAR III PERSONNEL	**Lead Beamline Scientist (LBS) / Cognizant Space Manager (CSM)** LBS and CSM personnel are assigned and Trained/Qualified.	B. Lein Training Group Leader	• Assign JTA for LBS and CSM	• BTMS record	Signature:
	Authorized Beamline Staff Sufficient personnel to begin commissioning are assigned and Trained/Qualified.	B. Lein Training Group Leader	• Assign JTA	• BTMS record	Signature: Bruce Lein
	Support Staff Other, non-beamline dedicated personnel needed to begin commissioning (e.g., Beamline Engineers and Controls Personnel) are assigned and Trained/Qualified.	B. Lein Training Group Leader	• Assign JTA	• BTMS record	Signature: Bruce Lein
	Lead Operators & FLOCOS (Accelerator Division) Trained/Qualified to: – Execute the Beamline Enable procedure – Perform roles assigned in any Beamline-specific procedures	B. Lein Training Group Leader	• Train Operators	• BTMS record	Signature: Bruce Lein

* READINESS CERTIFICATION	**D. Schneider – AMX Lead Beamline Scientist**	**Signature:**
* READINESS CERTIFICATION	**M. Fuchs – FMX Lead Beamline Scientist**	**Signature:**

*Signature certifies that the readiness criteria are met. The Responsible Person shall not sign prior to completion.

ATTACHMENT D – COMPLETION OF IRR PRE–START FINDINGS

17–ID BEAMLINES (AMX/FMX)

	READINESS CRITERIA	RESPONSIBLE PERSON	DOCUMENTED EVIDENCE	CERTIFICATION OF READINESS*
IRR PRE–START FINDINGS	**Actions Complete** All actions associated with the subject Beamline(s) IRR pre-start findings are completed and the ATS Actions are closed.	L. Berman IRR Technical Authority	• ATS	Signature:
	Actions Closed All actions associated with the 17-ID Beamlines IRR pre-start findings have been verified complete and the ATS Condition is closed. (ATS Condition No. _____)	R. Lee ESH Manager	• ATS	Signature:
	Actions Verified Actions associated with the 17-ID Beamlines IRR pre-start findings have been satisfactorily completed.	E. Cheswick Independent Verifier	• ATS	Signature:

– END –

*Signature certifies that the readiness criteria are met. The Responsible Person shall not sign prior to completion.