INSTRUMENT READINESS PLAN (IRP)

FOR THE

NSLS–II 6-BM (BMM) BEAMLINE

JULY 2017

NSLSII-6BM-PLN-002

PREPARED BY

BROOKHAVEN NATIONAL LABORATORY
P.O. BOX 5000
UPTON, NY 11973–5000

MANAGED BY

BROOKHAVEN SCIENCE ASSOCIATES

FOR THE

U.S. DEPARTMENT OF ENERGY
OFFICE OF SCIENCE BASIC ENERGY SCIENCE
UNDER CONTRACT DE–SC0012704

BROOKHAVEN
NATIONAL LABORATORY

INSTRUMENT READINESS PLAN (IRP)

FOR THE

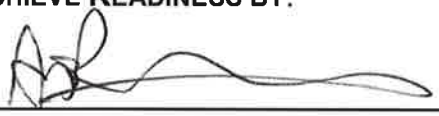
NSLS–II 6-BM (BMM) BEAMLINE

JULY 2017

REVIEWED BY:

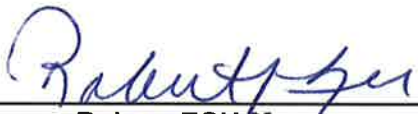
A. Ackerman, Instrument Readiness Coordinator

APPROVED AS A PLAN TO ACHIEVE READINESS BY:



A. Broadbent, IRR Technical Authority

CONCURRENCE BY:



R. Lee, ESH Manager

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

A. Broadbent, IRR Technical Authority

CONCURRENCE BY:

R. Lee, ESH Manager

REVISION HISTORY

REVISION	DESCRIPTION	LIST OF REVIEWERS	DATE
1	First Issue	See completed tables	July 2017

TABLE OF CONTENTS

ATTACHMENTS

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 6-BM (Beamline for Materials Measurement [BMM]) Beamline ready for commissioning. The scope of this IRP includes the 6-BM Beamline and End Station Diagnostics, and was prepared in accordance with the *Instrument Readiness Review Procedure* (PS-C-ESH-PRC-001). Experimental equipment that is installed and operational in the End Station will be included in the scope of this plan. The Front End and Three Pole Wiggler were previously reviewed and commissioned in June 2017.

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 6-BM Beamline

The 6-BM Beamline is a three pole wiggler (3PW) beamline at NSLS II which will provide -x-ray absorption spectroscopy and diffraction capabilities for structural studies of complex materials of interest to materials science communities. The first fixed aperture mask accepts a fan of 0.3 mrad x 2 mrad (V x H). The 3PW source delivers beam to a parabolic collimating mirror located at 13 meters and inside the shield wall. Then to a double crystal (Si (111), (311) switchable pairs) monochromator located in the First Optical Enclosure (FOE, Hutch 6-BM-A). A beryllium window located in Front End separates the accelerator vacuum from the beamline vacuum. The monochromatic beam in the energy range of 4.9-22 keV is delivered to a bendable cylindrical mirror and finally to a flat order sorting mirror, all in the FOE. The focused or unfocussed beam is delivered to experimental apparatus located in the End Station (Hutch 6-BM-B). The credited controls include shielding and personnel protection system (PPS) interlocks, in accordance with the *NSLS-II Accelerator Safety Envelope (ASE)* (PS-C-ESH-ROASE-001).

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 6-BM Beamline are ready for commissioning in accordance with the appropriate Commissioning Plans. 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 6-BM Beamline.

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 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 Beamline 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, if identified, the IRR Technical Authorities and the ESH Manager will certify that all IRR pre-start findings relative to the 6-BM Beamline 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.

4.0 REFERENCES

4.1 PS-C-ESH-PRC-001, *Instrument Readiness Review Procedure*

4.2 PS-C-ESH-ROASE-001, *NSLS-II Accelerator Safety Envelope (ASE)*

ATTACHMENT A – PILLAR I DOCUMENTATION

6-BM BEAMLINE

	READINESS CRITERIA	RESPONSIBLE PERSON	ACTIONS	DOCUMENTED EVIDENCE	CERTIFICATION OF READINESS*
PILLAR I DOCUMENTATION (PLANNING & PROCEDURES)	**Functional Description** An overview presentation is prepared that defines the scope of the IRR and includes the following Beamline specific information: – Primary capabilities – Physical layout and location (includes Beamline location on the experiment floor) – Design reviews and performance parameters – 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	B. Ravel Lead Beamline Scientist	• Develop the presentation described for the Beamline	• Presentation • Functional Description Document	Signature:
	Beamline Design Components are designed in accordance with PS-QAP-0412, *Design Reviews* and PS-C-QAS-PRC-010, *Engineering Design by Others*.	B. Ravel Lead Beamline Scientist	• Complete Engineering Design Reviews for the Beamline that address thermal management, mechanical support, configuration control, and vacuum	• Internal and contractor supplied PDR and FDR documents and reports	Signature:

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

ATTACHMENT A – PILLAR I DOCUMENTATION

6-BM BEAMLINE

	READINESS CRITERIA	RESPONSIBLE PERSON	ACTIONS	DOCUMENTED EVIDENCE	CERTIFICATION OF READINESS*
PILLAR I DOCUMENTATION (PLANNING & PROCEDURES)	**Radiation Safety Components Design** Radiation Safety Components for the Beamline are designed in accordance with NSLS-II requirements, PS-QAP-0412, *Design Reviews* and PS-C-QAS-PRC-010, *Engineering Design by Others*.	B. Ravel Lead Beamline Scientist	• Complete requirements analysis and design of radiation safety components for the Beamline	• Internal FDR documents and reports • RSC Report	Signature:
	Top-Off Safety System (TOSS) FE has been analyzed for Top-Off Safety in accordance with PS-C-ASD-PRC-183, *Approval of New and Modified NSLS-II Beamline Front Ends for Top Off Safety.*	R. Fliller Coordinator for Top Off Safety	• Complete TOSS analysis	• TOSS Analysis Report • Updated FE layout drawings • Updated *Beamlines Approved for Top-Off Operations* list	Signature:
	Ray Traces Bremsstrahlung and Synchrotron Ray Traces generated in accordance with PS-C-XFD-PRC-008, *Synchrotron and Bremsstrahlung Ray Trace Procedure.*	B. Ravel Lead Beamline Scientist	• Prepare the Ray Traces for the Beamline	• Approved Primary Bremsstrahlung Ray Traces • Approved Maximum Synchrotron Ray Traces	Signature: Ray trace to be revised to match as built conditions. will be tracked by ATS.
	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: Done

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

ATTACHMENT A – PILLAR I DOCUMENTATION

6-BM BEAMLINE

	READINESS CRITERIA	RESPONSIBLE PERSON	ACTIONS	DOCUMENTED EVIDENCE	CERTIFICATION OF READINESS*
PILLAR I DOCUMENTATION (PLANNING & PROCEDURES)	**National Environmental Protection Act (NEPA) Evaluation** NEPA requirements evaluation completed.	L. Stiegler ESH Operations Group Leader	• Complete a NEPA evaluation	• NEPA Evaluation Report	Signature:
	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, FE and 3PW; including temporary systems	• SAD and ASE USI screenings/evaluations • Applicable waivers	Signature:
	Resolution of Open Action Tracking System (ATS) Actions Instrument specific action items from previous internal and external oversight groups (e.g., RSC, Design Reviews, etc.) are addressed. Previous IRR action items are addressed.	J. Zipper QA Engineer	• ATS action items for the instrument are satisfied. • ATS action items from previous IRRs are evaluated for impact to the instrument	• ATS System	Signature:
	Procedures Procedures needed for safe, secure, and environmentally sound commissioning have been developed, reviewed, validated (where applicable), and approved. Existing procedures are verified as sufficient for new hazards introduced by this Beamline, if any.	K. Rubino Procedure Support	• Develop any system specific procedures	• 6-BM Radiological Interlock Test Checklist • Search and Secure Sketch	Signature:

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

ATTACHMENT A – PILLAR I DOCUMENTATION

6-BM BEAMLINE

	READINESS CRITERIA	RESPONSIBLE PERSON	ACTIONS	DOCUMENTED EVIDENCE	CERTIFICATION OF READINESS*
PILLAR I DOCUMENTATION (PLANNING & PROCEDURES)	**Commissioning Plans** Commissioning plan has been generated for the Beamline and FE Mirror to address the task sequence required for technical commissioning (safe photon transport).	B. Ravel Lead Beamline Scientist	• Prepare a Beamline Commissioning Plan to define technical objectives and operational readiness requirements	• Approved Beamline Commissioning Plan	Signature:
	Radiation Survey Procedures A survey procedure has been generated for the Beamline in accordance with PS-C-XFD-PRC-004, *NSLS-II Beamlines Radiation Safety Commissioning Plan*.	M. Benmerrouche Radiation Physicist	• Prepare the Radiation Survey Procedure for the Beamline • Obtain RSC review of the procedure	• Approved Beamline Radiation Survey Procedure	Signature:
	Experiment Safety Review An Experiment Safety Review has been submitted, executed and approved within the BNL ESR System.	B. Ravel Lead Beamline Scientist	• Complete submission and pursue approval of an ESR through use of the BNL electronic system	• Completed ESR	Signature:
	Partner User Agreement A Partner User Agreement is submitted and agreed upon by all parties involved.	D. Fischer Authorized Beamline Staff	• Prepare and Submit a PUA	• Final PUA	Signature:

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

ATTACHMENT A – PILLAR I DOCUMENTATION

6-BM BEAMLINE

	READINESS CRITERIA	RESPONSIBLE PERSON	ACTIONS	DOCUMENTED EVIDENCE	CERTIFICATION OF READINESS*
	Proposal Allocation Safety & Scheduling (PASS) The instrument is active within PASS with approvals to proceed with Technical Commissioning.	B. Ravel Lead Beamline Scientist	• Assure that PASS is configured to administer the instrument	• Defined resource within PASS • Submitted Technical commissioning proposal • Submitted Safety Approval Form	Signature:

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

ATTACHMENT B – PILLAR II HARDWARE

6-BM BEAMLINE

	READINESS CRITERIA	RESPONSIBLE PERSON	ACTIONS	DOCUMENTED EVIDENCE	CERTIFICATION OF READINESS*
PILLAR II SAFETY CRITICAL HARDWARE (INSTALLATION)	**Radiation Safety Components: Installation** Radiation Safety Components, including Top Off components are installed in accordance with the Traveler.	B. Ravel Lead Beamline Scientist	• Generate and execute Traveler	• Completed Traveler	Signature: Photon shutter drawing to be revised to as built conditions. To be tracked by ATS.
	Radiation Safety Components: Configuration Control A Radiation Safety Component Checklist Template is generated in accordance with NSLSII-ESH-PRC-004, *Radiation Safety Component Inspection Procedure.*	B. Ravel Lead Beamline Scientist	• Develop Radiation Safety Component Checklist Template	• Approved beamline specific Radiation Safety Component Checklist Template w/ RSC review	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	• Perform analysis to prove that no ARM is required	• Analysis and RSC Memo	Signature:
	Personnel Protection System (PPS) Interlocks: Installed and Certified 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 • Certify PPS	• Overall PPS Checklist • Executed Beamline Radiological Interlock Certification Checklist	Signature:

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

ATTACHMENT B – PILLAR II HARDWARE

6-BM BEAMLINE

	READINESS CRITERIA	RESPONSIBLE PERSON	ACTIONS	DOCUMENTED EVIDENCE	CERTIFICATION OF READINESS*
PILLAR II SAFETY CRITICAL HARDWARE (INSTALLATION)	**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 execute 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: 
	Hutch Structures Hutch structures installed with adequate provision for life safety issues (egress and fall protection) in accordance with NX-C-XFD-SOW-HU-002, "*NSLS-II Steel Beamline Shielding Enclosures Statement of Work*" and NX-C-XFD-SPC-HU-002, "*NSLS-II Steel Beamline Shielding Enclosures Technical Specifications.*"	L. Lienhard Beamline Engineer	• Generate and execute Traveler for inspection	• Completed Traveler	Signature: 

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

ATTACHMENT B – PILLAR II HARDWARE

6-BM BEAMLINE

	READINESS CRITERIA	RESPONSIBLE PERSON	ACTIONS	DOCUMENTED EVIDENCE	CERTIFICATION OF READINESS*
PILLAR II SAFETY CRITICAL HARDWARE (INSTALLATION)	**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 entries	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 • Perform pressure test	• Approved system schematics • System pressure testing reports	Signature: 

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

ATTACHMENT B – PILLAR II HARDWARE

6-BM BEAMLINE

	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 Travelers. Diagnostic equipment needed to begin technical commissioning is installed and tested.	B. Ravel Lead Beamline Scientist	• Generate and execute Traveler	• Completed Traveler	Signature:
	Equipment Protection System (EPS) Interlocks Hardware/Software installed and tested in accordance with the Traveler.	H. Bassan Controls Infrastructure Group Leader	• Generate and execute Traveler • Verify EPICS integration • Test system performance	• Test Report • Completed Traveler	Signature:
	Front End Equipment Protection System (FEEPS) (Phase 2 Installation needed for beamline operation) Hardware/Software installed and tested in accordance with the traveler.	G. Ganetis Electrical Engineering Group Leader	• Verify integration • Test system performance	• Test Report Phase 2 Installation	Signature:
	Controls Hardware/Software installed and tested in accordance with NSLS-II requirements.	J. Kirkland Controls Engineer	• Test system performance • Complete integrated testing	• Performance and integrated testing documentation	Signature: All requirements met for IRR as per conversation with Andrew Broadbent

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

ATTACHMENT B – PILLAR II HARDWARE

6-BM BEAMLINE

	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 execute Top Level Traveler • Identify overpressure devices • Test system performance	• Completed Top Level Traveler • Test Report	Signature: 

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

ATTACHMENT C – PILLAR III PERSONNEL

6-BM BEAMLINE

	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:
	Support Staff Other, non-beamline dedicated personnel needed to begin commissioning (e.g., Beamline Engineers and Controls Personnel) are assigned and Trained/Qualified for the Beamline.	B. Lein Training Group Leader	• Assign JTA	• BTMS record	Signature:
	Lead Operators, Scientific Operators & FLOCOS (Accelerator Division) Trained/Qualified to: – Execute the Beamline Enable procedure – Perform roles assigned in any Beamline-specific procedures – Perform tasks related to FE and ID commissioning	B. Lein Training Group Leader	• Train Operators	• BTMS record	Signature:

* READINESS CERTIFICATION	B. Ravel - 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

6-BM BEAMLINE

	READINESS CRITERIA	RESPONSIBLE PERSON	DOCUMENTED EVIDENCE	CERTIFICATION OF READINESS*
IRR PRE–START FINDINGS	**No Pre-Start Findings Identified (Beamline)** No pre-start findings associated with the 6-BM Beamline have been identified by the Review Team and therefore the following lines do not require sign-off.	R. Lee ESH Manager	• IRR Preliminary Report	Signature:
		M. Hauptmann Independent Verifier	• IRR Preliminary Report	Signature:
	Pre-Start Actions Complete All actions associated with the 6-BM Beamline IRR pre-start findings are completed and the ATS Actions are closed.	A. Broadbent IRR Technical Authority	• Pertinent closure evidence	Signature:
	Pre-Start Actions Verified All actions associated with the 6-BM Beamline IRR pre-start findings have been verified complete.	R. Lee ESH Manager	• Pertinent closure evidence	Signature:
	Pre-Start Actions Independently Verified Actions associated with the 6-BM Beamline IRR pre-start findings have been satisfactorily completed.	M. Hauptmann Independent Verifier	• Pertinent closure evidence	Signature:

– END –

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