

INSTRUMENT READINESS PLAN (IRP)

FOR THE

NSLS-II 4-BM (XFM) BEAMLINE, FRONT END AND THREE POLE WIGGLER



AUGUST 2017

NSLSII-4BM-PLN-001

PREPARED BY
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FOR THE
U.S. DEPARTMENT OF ENERGY
OFFICE OF SCIENCE BASIC ENERGY SCIENCE
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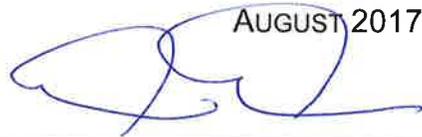
INSTRUMENT READINESS PLAN (IRP)

FOR THE

NSLS-II 4-BM (XFM) BEAMLINE, FRONT END

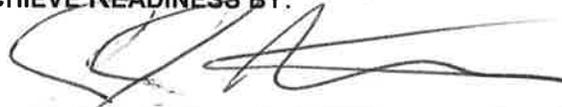
AND THREE POLE WIGGLER

REVIEWED BY:

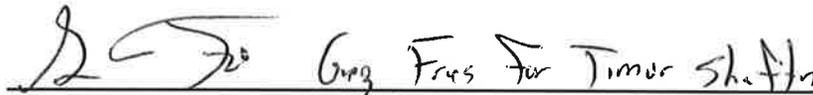
 AUGUST 2017

A. Ackerman, Instrument Readiness Coordinator

APPROVED AS A PLAN TO ACHIEVE READINESS BY:



J. Adams, IRR Technical Authority (Beamline)

 Greg Fees for Timur Shaftan

T. Shaftan, IRR Technical Authority (FE and 3PW)

CONCURRENCE BY:



R. Lee, ESH Manager

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

 J. Adams, IRR Technical Authority (Beamline)

 T. Shaftan, IRR Technical Authority (FE and 3PW)

CONCURRENCE BY:

 R. Lee, ESH Manager

REVISION HISTORY

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

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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 4-BM (X-ray Fluorescence Microprobe [XFM]) Beamline, Front End (FE) and Three Pole Wiggler (3PW) ready for commissioning. The scope of this IRP includes the 4-BM source (3PW), FE, Photon Delivery System 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.

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 4-BM Beamline

The 4-BM Beamline is a three pole wiggler (3PW) beamline at NSLS II which will provide XRF imaging, spatially-resolved X-ray absorption spectroscopy and diffraction capabilities for investigation of heterogeneous materials. The first fixed aperture mask accepts a fan of 0.117 mrad x 0.4 mrad x (H x V). The 3PW source delivers beam to a toroidal focusing mirror located at 25.167 meters in the First Optical Enclosure (FOE, Hutch 4-BM-A) and focuses onto a secondary source aperture (SSA) located at 50.334 meters. Beam diverging from the SSA is delivered to a vertical collimating mirror located at 54.334 meters and then to a double crystal (Si (111), (220), (311) switchable pairs) monochromator located in the Second Optical Enclosure (SOE, Hutch 4-BM-B). A beryllium window located in the End Station (Hutch 4-BM-C) separates beamline vacuum from the experimental apparatus. Monochromatic or pink beam in the energy range of 2.05-23 keV is delivered to a set of bendable Kirkpatrick-Baez (KB) micro-focusing mirrors located in the End station. The credited controls include shielding, an area radiation monitor (ARM), 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 4-BM Beamline, FE and 3PW 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 4-BM Beamline, FE and 3PW.

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.

The Insertion Devices Group Leader and the Mechanical Engineering Group Leader are responsible for certifying that all of the readiness criteria associated with the subject Front End and Insertion Device are 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

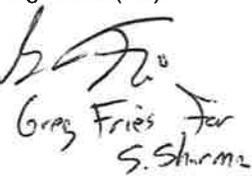
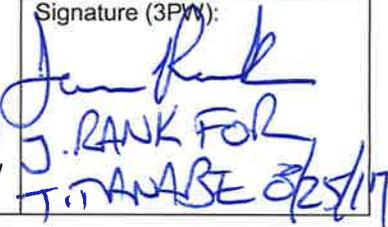
Upon completion of the readiness criteria, the Readiness Team members will certify that the criteria for which they are responsible for are complete by signing the Attachments in the appropriate section. The Attachments shall not be signed until the readiness criteria have been fully achieved.

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 4-BM Beamline, FE and 3PW 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

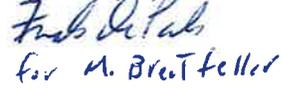
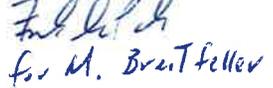
- 4.1 PS-C-ESH-PRC-001, *Instrument Readiness Review Procedure*
- 4.2 PS-C-ESH-ROASE-001, *NSLS-II Accelerator Safety Envelope (ASE)*

ATTACHMENT A – PILLAR I DOCUMENTATION
4-BM BEAMLINE, FRONT END AND THREE POLE WIGGLER

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 FE, 3PW and Beamline specific information: <ul style="list-style-type: none"> - 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 	R. Tappero Lead Beamline Scientist	<ul style="list-style-type: none"> • Develop the presentation and document described 	Beamline: <ul style="list-style-type: none"> • Presentation • Functional Description Document 	Signature (Beamline): 
		G. Fries Accelerator Division Liaison Engineer	<ul style="list-style-type: none"> • Develop the presentation described 	FE and 3PW: <ul style="list-style-type: none"> • Presentation 	Signature (FE and 3PW): 
	Beamline, FE & ID Design Beamline, FE & 3PW components are designed in accordance with PS-QAP-0412, <i>Design Reviews</i> and PS-C-XFM-PRC-010, <i>Engineering Design by Others</i> .	R. Tappero Lead Beamline Scientist	<ul style="list-style-type: none"> • Complete Engineering Design Reviews for the Beamline, FE and 3PW that address thermal management, mechanical support, configuration control, and vacuum 	Beamline: <ul style="list-style-type: none"> • Internal and contractor supplied design review documents and reports 	Signature (Beamline): 
		S. Sharma Mechanical Engineering Group Leader		FE: <ul style="list-style-type: none"> • Requirements, Specifications, and Interface report (RSI) Internal and contractor supplied design review documents 	Signature (FE): 
		T. Tanabe Insertion Devices Group Leader		3PW: <ul style="list-style-type: none"> • Requirements, Specifications, and Interface report (RSI) Internal and contractor supplied design review documents 	Signature (3PW): 

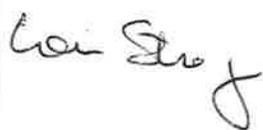
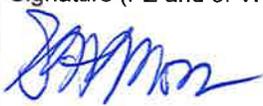
*Signature certifies that the readiness criteria are met. The Responsible Person shall not sign prior to completion.

ATTACHMENT A – PILLAR I DOCUMENTATION
4-BM BEAMLINE, FRONT END AND THREE POLE WIGGLER

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 and FE are designed in accordance with NSLS-II requirements, PS-QAP-0412, <i>Design Reviews</i> and PS-C-XFM-PRC-010, <i>Engineering Design by Others</i> .	R. Tappero Lead Beamline Scientist	<ul style="list-style-type: none"> Complete requirements analysis and design of radiation safety components for the Beamline 	Beamline: <ul style="list-style-type: none"> Internal design review documents and reports RSC Report 	Signature (Beamline): 
		M. Breitfeller Mechanical Engineer	<ul style="list-style-type: none"> Complete requirements analysis and design of radiation safety components for the FE 	FE: <ul style="list-style-type: none"> Internal design review documents RSC Report 	Signature (FE): 
	Top-Off Safety System (TOSS) FE has been analyzed for Top-Off Safety in accordance with PS-C-ASD-PRC-183, <i>Approval of New and Modified NSLS-II Beamline Front Ends for Top Off Safety</i> .	R. Filler Coordinator for Top Off Safety	<ul style="list-style-type: none"> Complete TOSS analysis 	<ul style="list-style-type: none"> TOSS Analysis Report Updated FE layout drawings Updated <i>Beamlines Approved for Top-Off Operations</i> list 	Signature: 
	Ray Traces Bremsstrahlung and Synchrotron Ray Traces generated in accordance with PS-C-XFD-PRC-008, <i>Synchrotron and Bremsstrahlung Ray Trace Procedure</i> .	R. Tappero Lead Beamline Scientist	<ul style="list-style-type: none"> Prepare the Ray Traces for the Beamline 	Beamline: <ul style="list-style-type: none"> Approved Primary Bremsstrahlung Ray Traces Approved Maximum Synchrotron Ray Traces 	Signature (Beamline): 
		M. Breitfeller Mechanical Engineer	<ul style="list-style-type: none"> Prepare the Ray Traces for the Front End 	FE: <ul style="list-style-type: none"> Approved Primary Bremsstrahlung Ray Traces Approved Maximum Synchrotron Ray Traces 	Signature (FE): 

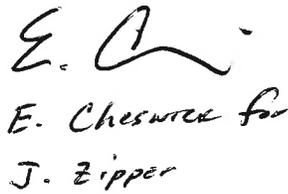
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**ATTACHMENT A – PILLAR I DOCUMENTATION
4-BM BEAMLINE, FRONT END AND THREE POLE WIGGLER**

	READINESS CRITERIA	RESPONSIBLE PERSON	ACTIONS	DOCUMENTED EVIDENCE	CERTIFICATION OF READINESS*
PILLAR I DOCUMENTATION (PLANNING & PROCEDURES)	<p>Secondary Radiation Scatter Analysis Secondary Bremsstrahlung and Synchrotron scatter is analyzed in accordance with LT-C-ESH-STD-001, <i>Guidelines for the NSLS-II Beamline Radiation Shielding Design</i>.</p>	<p>S. Chitra Health Physics</p>	<ul style="list-style-type: none"> • Complete FLUKA analysis • Complete STAC8 analysis 	<ul style="list-style-type: none"> • BNL Technical Note Report 	<p>Signature:</p> 
	<p>National Environmental Protection Act (NEPA) Evaluation NEPA requirements evaluation completed.</p>	<p>L. Stiegler ESH Operations Group Leader</p>	<ul style="list-style-type: none"> • Complete a NEPA evaluation 	<ul style="list-style-type: none"> • NEPA Evaluation Report 	<p>Signature:</p> 
	<p>Unreviewed Safety Issue (USI) Evaluations/Screenings Authorization basis hazard identification is managed through USI evaluation/screening.</p>	<p>S. Moss Authorization Basis Manager</p>	<ul style="list-style-type: none"> • Verify that the SAD and ASE accurately cover the hazards associated with the subject Beamline, FE and 3PW; including temporary systems 	<ul style="list-style-type: none"> • SAD and ASE USI screenings/evaluations • Applicable waivers 	<p>Signature (Beamline):</p>  <p>Signature (FE and 3PW):</p> 

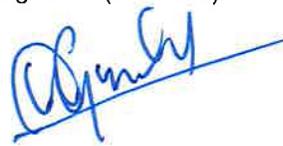
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**ATTACHMENT A – PILLAR I DOCUMENTATION
4-BM BEAMLINE, FRONT END AND THREE POLE WIGGLER**

READINESS CRITERIA		RESPONSIBLE PERSON	ACTIONS	DOCUMENTED EVIDENCE	CERTIFICATION OF READINESS*
PILLAR I DOCUMENTATION (PLANNING & PROCEDURES)	<p>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.</p> <p>Previous IRR action items are addressed.</p>	J. Zipper QA Engineer	<ul style="list-style-type: none"> • ATS action items for the instrument are satisfied. • ATS action items from previous IRRs are evaluated for impact to the instrument 	Beamline: <ul style="list-style-type: none"> • ATS 	Signature (Beamline):  E. Cheswick for J. Zipper
		E. Cheswick QA Engineer	<ul style="list-style-type: none"> • ATS action items for the FE and 3PW are satisfied. • ATS action items from previous IRRs are evaluated for impact to the instrument 	FE and 3PW: <ul style="list-style-type: none"> • ATS 	Signature (FE and 3PW): 
	<p>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.</p>	K. Rubino Procedure Support	<ul style="list-style-type: none"> • Develop any system specific procedures • Verify that existing procedure are sufficient for any new hazards introduced 	<ul style="list-style-type: none"> • 4-BM Radiological Interlock Test Checklist • Search and Secure Sketch • 3PW LOTO Procedure (NSLSII-ID-PRC-003) • Gallium Fill SOP 	Signature: 

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

**ATTACHMENT A – PILLAR I DOCUMENTATION
4-BM BEAMLINE, FRONT END AND THREE POLE WIGGLER**

READINESS CRITERIA		RESPONSIBLE PERSON	ACTIONS	DOCUMENTED EVIDENCE	CERTIFICATION OF READINESS*
PILLAR I DOCUMENTATION (PLANNING & PROCEDURES)	Commissioning Plans Commissioning plans have been generated for the Beamline and FE and 3PW to address the task sequence required for technical commissioning (safe photon transport).	R. Tappero Lead Beamline Scientist	<ul style="list-style-type: none"> Prepare a Beamline Commissioning Plan to define technical objectives and operational readiness requirements 	Beamline: <ul style="list-style-type: none"> Approved Beamline Commissioning Plan 	Signature (Beamline): 
		G. Wang Accelerator Coordination Group Leader	<ul style="list-style-type: none"> Verify that NSLS-II ID and Front End Commissioning Sequence (PS-C-ASD-PRC-166) adequately covers commissioning for the FEs and IDs 	FE and 3PW: <ul style="list-style-type: none"> NSLS-II ID and Front End Commissioning Sequence (PS-C-ASD-PRC-166) 	Signature (FE and 3PW): 
	Radiation Survey Procedures A survey procedure has been generated for the Beamline in accordance with PS-C-XFD-PRC-004, <i>NSLS-II Beamlines Radiation Safety Commissioning Plan</i> and the existing NSLS-II Insertion Devices and Front End Radiation Survey Plan (PS-C-ESH-PRC-061) has been reviewed and updated as necessary for the FE and 3PW.	S. Chitra Radiation Physicist	<ul style="list-style-type: none"> Prepare the Radiation Survey Procedure for the Beamline Obtain RSC review of the procedure 	<ul style="list-style-type: none"> Approved Beamline Radiation Survey Procedure 	Signature (Beamline): 
		M. Benmerrouche Radiation Physicist	<ul style="list-style-type: none"> Verify that the NSLS-II ID and Front End Radiation Survey Plan (PS-C-ESH-PRC-061) adequately covers commissioning for the FEs and IDs 	<ul style="list-style-type: none"> NSLS-II Insertion Devices and Front End Radiation Survey Plan (PS-C-ESH-PRC-061) 	Signature (FE and 3PW): 

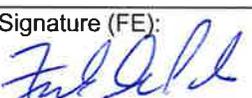
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**ATTACHMENT A – PILLAR I DOCUMENTATION
4-BM BEAMLINE, FRONT END AND THREE POLE WIGGLER**

	READINESS CRITERIA	RESPONSIBLE PERSON	ACTIONS	DOCUMENTED EVIDENCE	CERTIFICATION OF READINESS*
PILLAR I DOCUMENTATION (PLANNING & PROCEDURES)	<p>Experiment Safety Review An Experiment Safety Review has been submitted, executed and approved within the BNL ESR system.</p>	<p>R. Tappero Lead Beamline Scientist</p>	<ul style="list-style-type: none"> • Complete submission and pursue approval of an Experiment Safety Review through use of the BNL electronic system 	<ul style="list-style-type: none"> • Approved BNL ESR 	<p>Signature:</p> 
	<p>Proposal Allocation Safety & Scheduling (PASS) The instrument is active within PASS with approvals to proceed with Technical Commissioning.</p>	<p>R. Tappero Lead Beamline Scientist</p>	<ul style="list-style-type: none"> • Assure that PASS is configured to administer the instrument 	<ul style="list-style-type: none"> • Defined resource within PASS • Submitted Technical commissioning proposal • Submitted Safety Approval Form 	<p>Signature:</p> 

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

**ATTACHMENT B – PILLAR II HARDWARE
4-BM BEAMLINE, FRONT END AND THREE POLE WIGGLER**

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.	R. Tappero Lead Beamline Scientist	<ul style="list-style-type: none"> • Generate and execute Traveler 	Beamline: <ul style="list-style-type: none"> • Completed Traveler 	Signature (Beamline): 
		M. Breitfeller Mechanical Engineer	<ul style="list-style-type: none"> • Generate and execute Traveler 	FE: <ul style="list-style-type: none"> • Completed Traveler 	Signature (FE): 
		L. Doom Accelerator Coordination	<ul style="list-style-type: none"> • Generate and execute Top-Off Traveler 	Completed Traveler	Signature: 
	Radiation Safety Components: Configuration Control A Radiation Safety Component Checklist template is generated in accordance with PS-C-ESH-PRC-025, <i>NSLS-II Radiation Safety Component Inspection Procedure</i> .	R. Tappero Lead Beamline Scientist	<ul style="list-style-type: none"> • Develop Radiation Safety Component Checklist 	Beamline: <ul style="list-style-type: none"> • Approved beamline specific Radiation Safety Component Checklist w/ RSC review 	Signature (Beamline): 
		L. Doom Accelerator Coordination	<ul style="list-style-type: none"> • Verify that the existing checklist adequately covers the subject FE and ID 	FE: <ul style="list-style-type: none"> • Approved Storage Ring Radiation Safety Component Checklist Template 	Signature (FE): 

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

**ATTACHMENT B – PILLAR II HARDWARE
4-BM BEAMLINE, FRONT END AND THREE POLE WIGGLER**

READINESS CRITERIA		RESPONSIBLE PERSON	ACTIONS	DOCUMENTED EVIDENCE	CERTIFICATION OF READINESS*
PILLAR II SAFETY CRITICAL HARDWARE (INSTALLATION)	<p>Area Radiation Monitors (ARMs) ARMs are installed in accordance with PS-C-ESH-ARN-SPC-001, <i>NSLS-II Area Radiation Monitor (ARM) System Description</i> and PS-C-ESH-STD-002, <i>Technical Basis Document for Interlocked Area Monitors Placement Outside the Accelerator and Beamlines Enclosures.</i></p>	M. Benmerrouche ARM Technical Authority	<ul style="list-style-type: none"> • Install, calibrate, and test (EPICS integration) ARMs • Certify (PPS) 	<ul style="list-style-type: none"> • ARM Layout Drawing • ARM calibration certificates • ARM EPICS Interface Integration Test Sheet • ARM PPS Test checklist 	Signature: 
	<p>Personnel Protection System (PPS) Interlocks: Installed and Certified Hardware/Software installed in accordance with PS-C-XFD-SPC-PPS-001, <i>Beamline Personnel Protection System (BLPPS) and Front End Personnel Protection System (FEPPS) Design Description.</i></p>	G. Ganetis Electrical Engineering Group Leader	<ul style="list-style-type: none"> • Generate system schematics and logic diagrams • Install PPS components • Certify PPS 	<ul style="list-style-type: none"> • Overall PPS Checklist • Executed Beamline Radiological Interlock Certification Checklist 	Signature: 
	<p>Hutch Structures Hutch structures installed with adequate provision for life safety issues (egress and fall protection) in accordance with LT-SOW-XF-HU-0001, <i>Statement of Work for NSLS-II Beamline Shielding Enclosures ("Hutches")</i>, LT-C-XFD-SPC-HU-001, <i>NSLS-II Lead/Steel Beamline Shielding Enclosures</i>, and LT-C-XFD-SPC-HU-002, <i>NSLS-II Steel Beamline Shielding Enclosures.</i></p>	E. Haas/L. Lienhard Beamline Engineer	<ul style="list-style-type: none"> • Generate and execute Traveler for inspection 	<ul style="list-style-type: none"> • Completed Traveler 	Signature: 

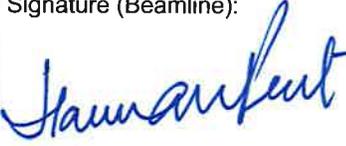
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**ATTACHMENT B – PILLAR II HARDWARE
4-BM BEAMLINE, FRONT END AND THREE POLE WIGGLER**

READINESS CRITERIA		RESPONSIBLE PERSON	ACTIONS	DOCUMENTED EVIDENCE	CERTIFICATION OF READINESS*
PILLAR II SAFETY CRITICAL HARDWARE (INSTALLATION)	<p>Electrical Power SBMS electrical power distribution requirements are satisfied. SBMS Electrical Equipment Inspection (EEI) requirements are satisfied.</p>	A. Boerner Electrical Distribution Engineer	<ul style="list-style-type: none"> • Generate and approve one-line drawings • Complete system electrical inspection • Complete needed EEI inspections 	<ul style="list-style-type: none"> • Approved AC Power one-line drawings • EEI database entries 	Signature: 
	<p>Utilities Permanent facility and beamline utility systems are installed and tested (i.e., Compressed Air, DI Water, Gaseous Nitrogen, Process Chilled Water) in accordance with design, labeling, and attachment requirements.</p>	J. Gosman Mechanical Utilities Group Leader	<ul style="list-style-type: none"> • Generate system schematics • Perform pressure test • Assure SBMS and NSLS-II labeling and hardware attachment requirements are met. 	<ul style="list-style-type: none"> • Approved system schematics • System pressure testing reports 	Signature (FE): 
		R. Tappero Lead Beamline Scientist			Signature (Beamline): 

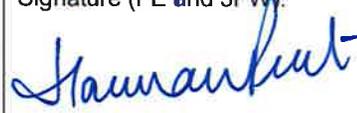
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**ATTACHMENT B – PILLAR II HARDWARE
4-BM BEAMLINE, FRONT END AND THREE POLE WIGGLER**

READINESS CRITERIA		RESPONSIBLE PERSON	ACTIONS	DOCUMENTED EVIDENCE	CERTIFICATION OF READINESS*
PILLAR II OTHER HARDWARE (INSTALLATION)	Other FE Components, Photon Transport Components, Optics, and Diagnostics FE and 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.	R. Tappero Lead Beamline Scientist	<ul style="list-style-type: none"> • Generate and execute Traveler • Complete acceptance inspections 	Beamline: <ul style="list-style-type: none"> • Completed Traveler • Acceptance inspection documentation, as needed 	Signature (Beamline): 
		M. Breitfeller Mechanical Engineer	<ul style="list-style-type: none"> • Generate traveler and drawing • Execute Traveler • Perform pressure test 	FE: <ul style="list-style-type: none"> • Completed Traveler • System pressure testing reports 	Signature (FE): 
		J. Rank Insertion Devices Engineer	<ul style="list-style-type: none"> • Generate traveler and drawing • Execute Traveler 	3PW: <ul style="list-style-type: none"> • Completed Traveler 	Signature (3PW): 
	Equipment Protection System (EPS) Interlocks Hardware/Software installed and tested in accordance with the Traveler.	H. Bassan Controls Infrastructure Group Leader	<ul style="list-style-type: none"> • Generate and execute Traveler • Verify EPICS integration • Test system performance 	Beamline: <ul style="list-style-type: none"> • Test Report • Completed Traveler 	Signature (Beamline): 
	Front End Equipment Protection System (FEEPS) (Installation needed for beamline operation) Hardware/Software installed and tested in accordance with the traveler.	G. Ganetis Electrical Engineering Group Leader	<ul style="list-style-type: none"> • Verify integration • Test system performance 	FE and 3PW ^{ALB} : <ul style="list-style-type: none"> • Test Report 	Signature (FE and 3PW): 

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

**ATTACHMENT B – PILLAR II HARDWARE
4-BM BEAMLINE, FRONT END AND THREE POLE WIGGLER**

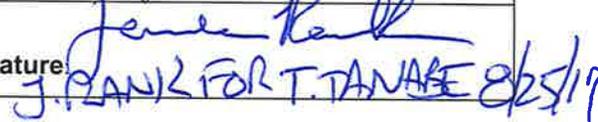
READINESS CRITERIA		RESPONSIBLE PERSON	ACTIONS	DOCUMENTED EVIDENCE	CERTIFICATION OF READINESS*
PILLAR II OTHER HARDWARE (INSTALLATION)	Controls Hardware/Software installed and tested in accordance with NSLS-II requirements.	J. Ma Controls Engineer	<ul style="list-style-type: none"> • Test system performance • Complete integral testing 	Beamline: <ul style="list-style-type: none"> • Performance and integral testing documentation 	Signature (Beamline): 
		H. Bassan Controls Group Engineer	<ul style="list-style-type: none"> • Test system performance • Complete integral testing 	FE and 3PW: <ul style="list-style-type: none"> • Performance and integral testing checklist 	Signature (FE and 3PW): 
	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	<ul style="list-style-type: none"> • Generate and execute Top Level Traveler • Identify overpressure devices • Test system performance 	Beamline: <ul style="list-style-type: none"> • Completed Top Level Traveler • Test Report 	Signature (Beamline): 
		C. Hetzel Vacuum Group Leader	<ul style="list-style-type: none"> • Generate and execute Top Level Traveler • Identify overpressure devices • Test system performance 	FE and 3PW: <ul style="list-style-type: none"> • Completed Top Level Traveler • Test Report 	Signature (FE and 3PW): 

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

READINESS CRITERIA		RESPONSIBLE PERSON	ACTIONS	DOCUMENTED EVIDENCE	CERTIFICATION OF READINESS*
PILLAR II OTHER HARDWARE (INSTALLATION)	Controls Hardware/Software installed and tested in accordance with NSLS-II requirements.	D. Padrazo Deputy Instrumentation Group Leader	<ul style="list-style-type: none"> • Test system performance • Complete integral testing 	FE and 3PW: <ul style="list-style-type: none"> • Performance and integral testing checklist 	

**ATTACHMENT C – PILLAR III PERSONNEL
4-BM BEAMLINE, FRONT END AND THREE POLE WIGGLER**

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 • Sufficient Staff Documentation	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	R. Tappero - Lead Beamline Scientist	Signature: 
* READINESS CERTIFICATION	S. Sharma - Mechanical Engineering Group Leader	Signature: 
* READINESS CERTIFICATION	T. Tanabe - Insertion Devices Group Leader	Signature:  J. PLANK FOR T. TANABE 8/25/19

*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
4-BM BEAMLINE, FRONT END AND INSERTION DEVICE**

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 4-BM Beamline have been identified by the Review Team and therefore the following lines do not require sign-off.	R. Lee ESH Manager	<ul style="list-style-type: none"> • IRR Preliminary Report 	Signature:
		M. Hauptmann Independent Verifier		Signature:
	No Pre-Start Findings Identified (FE and 3PW) No pre-start findings associated with the FE and 3PW have been identified by the Review Team and therefore the following lines do not require sign-off.	R. Lee ESH Manager	<ul style="list-style-type: none"> • IRR Preliminary Report 	Signature:
		M. Hauptmann Independent Verifier		Signature:
	Pre-Start Actions Complete (Beamline) All actions associated with the 4-BM Beamline IRR pre-start findings are complete.	J. Adams IRR Technical Authority (Beamline)	<ul style="list-style-type: none"> • Pertinent closure evidence 	Signature:
	Pre-Start Actions Complete (FE and 3PW) All actions associated with the FE and 3PW Beamline IRR pre-start findings are complete.	T. Shaftan IRR Technical Authority (FE & 3PW)	<ul style="list-style-type: none"> • Pertinent closure evidence 	Signature:
	Pre-Start Actions Verified (Beamline) All actions associated with the 4-BM Beamline IRR pre-start findings have been verified complete.	R. Lee ESH Manager	<ul style="list-style-type: none"> • Pertinent closure evidence 	Signature:
	Pre-Start Actions Verified (FE and 3PW) All actions associated with the FE and 3PW IRR pre-start findings have been verified complete.	R. Lee ESH Manager	<ul style="list-style-type: none"> • Pertinent closure evidence 	Signature:
	Pre-Start Actions Independently Verified (Beamline) Actions associated with the 4-BM Beamline IRR pre-start findings have been satisfactorily complete.	M. Hauptmann Independent Verifier	<ul style="list-style-type: none"> • Pertinent closure evidence 	Signature:
Pre-Start Actions Independently Verified (FE and 3PW) Actions associated with the FE and 3PW IRR pre-start findings have been satisfactorily complete.	M. Hauptmann Independent Verifier	<ul style="list-style-type: none"> • Pertinent closure evidence 	Signature:	

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