

INSTRUMENT READINESS PLAN (IRP)

FOR THE

NSLS-II 28-ID-1 (PDF) BEAMLINE



FEBRUARY 2018

NSLSII-28ID1-PLN-001

PREPARED BY

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FOR THE

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

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NSLS-II 28-ID-1 (PDF) BEAMLINE

FEBRUARY 2018

REVIEWED BY:



1/10/18

A. Ackerman, Instrument Readiness Coordinator

APPROVED AS A PLAN TO ACHIEVE READINESS BY:



1/10/2018

J. Adams, IRR Technical Authority (Beamline)

CONCURRENCE BY:



1-12-18

R. Lee, ESH Manager

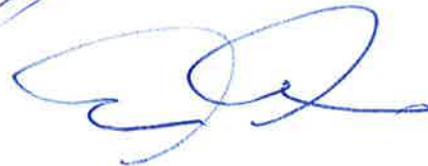
APPROVED – IRP HAS BEEN FULLY IMPLEMENTED AND INSTRUMENT IS READY FOR COMMISSIONING:



3/12/2018

J. Adams, IRR Technical Authority (Beamline)

CONCURRENCE BY:



3/12/18

R. Lee, ESH Manager

REVISION HISTORY

REVISION	DESCRIPTION	LIST OF REVIEWERS	DATE
1	First Issue	See completed tables	February 2018

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1.0 INTRODUCTION

1.1 Purpose and Scope

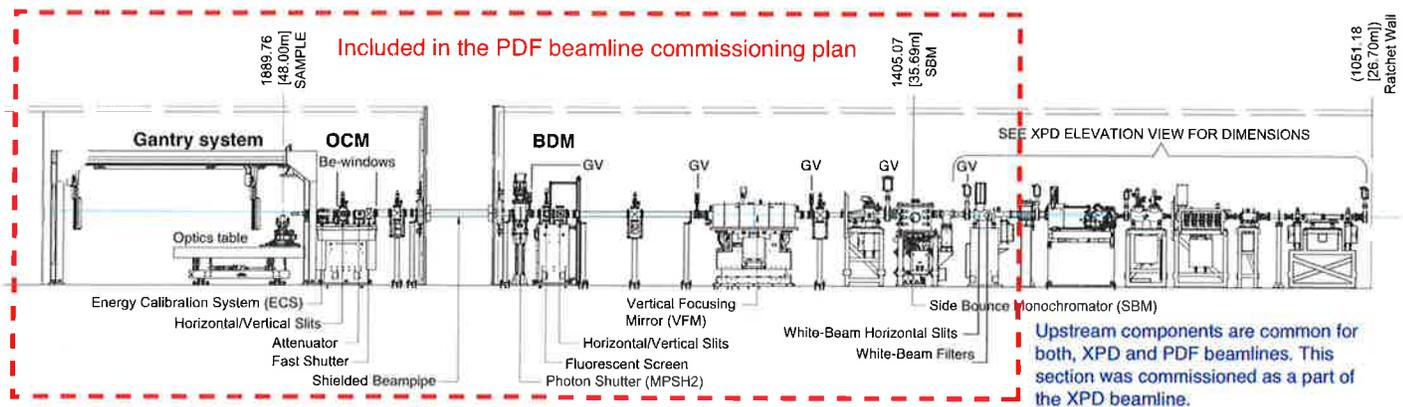
The purpose of this Instrument Readiness Plan (IRP) is to establish the readiness criteria required to declare the NSLS-II 28-ID-1 (X-ray Pair Distribution Function [PDF]) Beamline ready for commissioning. The scope of this IRP includes the 28-ID-1 Beamline and End Station, and was prepared in accordance 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 28-ID-1 Damping Wiggler and Front End were previously reviewed in August 2014.

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 28-ID-1 Beamline

The 28-ID Beamline consists of two branch lines, Pair Distribution Function beamline, PDF (28-ID-1), and X-ray Powder Diffraction beamline, XPD (28-ID-2). The damping wiggler, DW100 delivers a large energy band-pass white X-ray beam into the First Optical Enclosure (FOE) of the beamline. The first optical component of the PDF beamline, Side Bounce Monochromator (SBM) receives the transmitted part of white X-ray beam through the first crystal of the Double Laue Monochromator (DLM) of the XPD beamline. The SBM is used to select the energy and to focus the X-ray beam in the horizontal plane. Water-cooled horizontal white beam slits and a filter array are located between the SBM and DLM. The second optical component of the PDF beamline, Vertically Focusing Mirror (VFM) is used to focus the monochromatic X-ray beam in the vertical plane. A beam diagnostic module consists of horizontal and vertical slits and a beam visualization screen is located downstream of the VFM. The photon shutter is the last component in the FOE. The Optics Conditioning Module (OCM) in hutch B contains two Be vacuum windows, fast shutter, attenuators, horizontal and vertical slits, beam alignment LASER, and a portable 2 cycle Diffractometer. A large gantry system that facilitates the translation of area detectors in 3-D space is located downstream of the OCM. Underneath the gantry system, a heavy-duty optics table supports sample environments.

All components located upstream of the PDF white-beam horizontal slits serve both XPD and PDF beamlines. These components are fully commissioned and currently operational. The credited controls include shielding, oxygen deficiency monitors and personnel protection system (PPS) interlocks, in accordance with the NSLS-II Accelerator Safety Envelope (ASE) (PS-C-ESH-ROASE-001). The figure below shows the beamline component layout.



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 28-ID-1 Beamline is 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 28-ID-1 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 28-ID-1 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

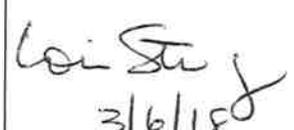
- 4.1 PS-C-ESH-PRC-001, *Instrument Readiness Review Procedure*
- 4.2 PS-C-ESH-ROASE-001, *NSLS-II Accelerator Safety Envelope (ASE)*

**ATTACHMENT A – PILLAR I DOCUMENTATION
28-ID-1 BEAMLINE**

	READINESS CRITERIA	RESPONSIBLE PERSON	ACTIONS	DOCUMENTED EVIDENCE	CERTIFICATION OF READINESS*
PILLAR I DOCUMENTATION (PLANNING & PROCEDURES)	<p>Functional Description An overview presentation is prepared that defines the scope of the IRR and includes the following Beamline specific information:</p> <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 	<p>M. Abeykoon Lead Beamline Scientist</p>	<p>Develop the presentation and document described</p>	<ul style="list-style-type: none"> • Presentation • Functional Description Document 	<p>Signature:  03/08/18</p>
	<p>Beamline Design Beamline components are designed in accordance with PS-QAP-0412, <i>Design Reviews</i> and PS-C-QAS-PRC-010, <i>Engineering Design by Others</i>.</p>	<p>M. Abeykoon Lead Beamline Scientist</p>	<p>Complete Engineering Design Reviews for the Beamline that address thermal management, mechanical support, configuration control, and vacuum</p>	<ul style="list-style-type: none"> • Internal and contractor supplied design review documents and reports 	<p>Signature:  03/07/18</p>
	<p>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-QAS-PRC-010, <i>Engineering Design by Others</i>.</p>	<p>M. Abeykoon Lead Beamline Scientist</p>	<ul style="list-style-type: none"> • Complete requirements analysis and design of radiation safety components for the Beamline 	<ul style="list-style-type: none"> • Internal design review documents and reports • RSC Report 	<p>Signature:  03/07/18</p>

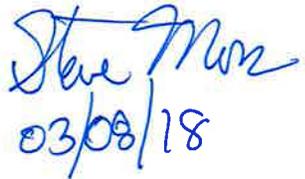
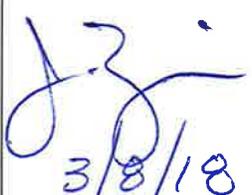
*Signature certifies that the readiness criteria are met. The Responsible Person shall not sign prior to completion.

ATTACHMENT A – PILLAR I DOCUMENTATION
28-ID-1 BEAMLINE

	READINESS CRITERIA	RESPONSIBLE PERSON	ACTIONS	DOCUMENTED EVIDENCE	CERTIFICATION OF READINESS*
PILLAR I DOCUMENTATION (PLANNING & PROCEDURES)	<p>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></p>	<p>R. Filler Coordinator for Top Off Safety</p>	<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 	<p>Signature:</p>  <p>3/6/18</p>
	<p>Ray Traces Bremsstrahlung and Synchrotron Ray Traces generated in accordance with PS-C-XFD-PRC-008, <i>Synchrotron and Bremsstrahlung Ray Trace Procedure.</i></p>	<p>M. Abeykoon Lead Beamline Scientist</p>	<ul style="list-style-type: none"> • Prepare the Ray Traces for the Beamline 	<ul style="list-style-type: none"> • Approved Primary Bremsstrahlung Ray Traces • Approved Maximum Synchrotron Ray Traces 	<p>Signature (Beamline):</p>  <p>03/12/18</p>
	<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>M. Benmerrouche 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>03/09/2018</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>3/6/18</p>

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**ATTACHMENT A – PILLAR I DOCUMENTATION
28-ID-1 BEAMLINE**

READINESS CRITERIA		RESPONSIBLE PERSON	ACTIONS	DOCUMENTED EVIDENCE	CERTIFICATION OF READINESS*
PILLAR I DOCUMENTATION (PLANNING & PROCEDURES)	<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; including temporary systems 	<ul style="list-style-type: none"> SAD and ASE USI screenings/evaluations Applicable waivers 	<p>Signature (Beamline):</p>  <p>03/08/18</p>
	<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>	<p>J. Zipper QA Engineer</p>	<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 	<ul style="list-style-type: none"> ATS System 	<p>Signature (Beamline):</p>  <p>3/8/18</p>
	<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>	<p>K. Rubino Procedure Support</p>	<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"> 28-ID-1 Radiological Interlock Test Checklist Search and Secure Sketch Interlock Test Procedure for moving stage Procedure for crystal change out and gallium fill Cryocooler Operations (NSLSII-ROS-PRC-001) 	<p>Signature:</p>  <p>2/28/18</p>

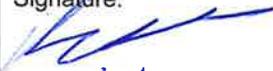
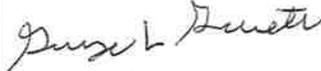
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28-ID-1 BEAMLINE**

	READINESS CRITERIA	RESPONSIBLE PERSON	ACTIONS	DOCUMENTED EVIDENCE	CERTIFICATION OF READINESS*
PILLAR I DOCUMENTATION (PLANNING & PROCEDURES)	<p>Commissioning Plans Commissioning plans have been generated for the Beamline to address the task sequence required for technical commissioning (safe photon transport).</p>	M. Abeykoon Lead Beamline Scientist	<ul style="list-style-type: none"> • Prepare a Beamline Commissioning Plan to define technical objectives and operational readiness requirements 	<ul style="list-style-type: none"> • Approved Beamline Commissioning Plan 	Signature (Beamline):  03/27/18
	<p>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>.</p>	M. Benmerrouche Health Physics	<ul style="list-style-type: none"> • Prepare the Radiation Survey Procedure for the Beamline 	<ul style="list-style-type: none"> • Approved Beamline Radiation Survey Procedure 	Signature (Beamline):  02/28/2018
	<p>Experiment Safety Review An Experiment Safety Review has been submitted, executed and approved within the BNL ESR system.</p>	M. Abeykoon Lead Beamline Scientist	<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 	Signature:  03/12/2018
	<p>Proposal Allocation Safety & Scheduling (PASS) The instrument is active within PASS with approvals to proceed with Technical Commissioning.</p>	M. Abeykoon Lead Beamline Scientist	<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 	Signature:  03/07/18

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**ATTACHMENT B – PILLAR II HARDWARE
28-ID-1 BEAMLINE**

	READINESS CRITERIA	RESPONSIBLE PERSON	ACTIONS	DOCUMENTED EVIDENCE	CERTIFICATION OF READINESS*
PILLAR II SAFETY CRITICAL HARDWARE (INSTALLATION)	<p>Radiation Safety Components: Installation Radiation Safety Components, including Top Off components are installed in accordance with the Traveler.</p>	<p>M. Abeykoon Lead Beamline Scientist</p>	<ul style="list-style-type: none"> • Generate and execute Traveler 	<ul style="list-style-type: none"> • Completed Traveler 	<p>Signature (Beamline):  03/02/18</p>
		<p>L. Doom Accelerator Coordination</p>	<ul style="list-style-type: none"> • Generate and execute Top-Off Traveler 	<p>Completed Traveler</p>	<p>Signature:  3/7/18</p>
	<p>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>.</p>	<p>M. Abeykoon Lead Beamline Scientist</p>	<ul style="list-style-type: none"> • Develop Radiation Safety Component Checklist 	<ul style="list-style-type: none"> • Approved beamline specific Radiation Safety Component Checklist w/ RSC approval 	<p>Signature (Beamline):  03/02/18</p>
	<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>	<p>G. Ganetis Electrical Engineering Group Leader</p>	<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 	<p>Signature:  3/5/18</p>

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**ATTACHMENT B – PILLAR II HARDWARE
28-ID-1 BEAMLINE**

READINESS CRITERIA	RESPONSIBLE PERSON	ACTIONS	DOCUMENTED EVIDENCE	CERTIFICATION OF READINESS*
<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>	<p align="center">E. Haas Beamline Engineer</p>	<ul style="list-style-type: none"> • Generate and execute Traveler for inspection 	<ul style="list-style-type: none"> • Completed Traveler 	<p>Signature: <i>Edwin Haas</i> 2/16/2018</p>
<p>Electrical Power SBMS electrical power distribution requirements are satisfied. SBMS Electrical Equipment Inspection (EEI) requirements are satisfied.</p>	<p align="center">A. Boerner Electrical Distribution Engineer</p>	<ul style="list-style-type: none"> • Approved one-line drawings • System electrical inspection • EEI inspection 	<ul style="list-style-type: none"> • Approved AC Power one-line drawings • EEI database entries 	<p>Signature: <i>[Signature]</i> 3/6/18</p>

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**ATTACHMENT B – PILLAR II HARDWARE
28-ID-1 BEAMLINE**

READINESS CRITERIA		RESPONSIBLE PERSON	ACTIONS	DOCUMENTED EVIDENCE	CERTIFICATION OF READINESS*
PILLAR II SAFETY CRITICAL HARDWARE (INSTALLATION)	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	<ul style="list-style-type: none"> • Generate system schematics • Perform pressure test 	<ul style="list-style-type: none"> • Approved system schematics • System pressure testing reports 	Signature:  3/7/18
		M. Abeykoon Lead Beamline Scientist			Signature:  02/16/18

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**ATTACHMENT B – PILLAR II HARDWARE
28-ID-1 BEAMLINE**

READINESS CRITERIA		RESPONSIBLE PERSON	ACTIONS	DOCUMENTED EVIDENCE	CERTIFICATION OF READINESS*
PILLAR II OTHER HARDWARE (INSTALLATION)	Other Components, 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.	M. Abeykoon Lead Beamline Scientist	<ul style="list-style-type: none"> • Generate and execute Traveler • Complete acceptance inspections 	<ul style="list-style-type: none"> • Completed Traveler • Acceptance inspection documentation, as needed 	Signature (Beamline):  03/08/18
	Equipment Protection System (EPS) Interlocks Hardware/Software installed and tested in accordance with the Traveler.	G. Bischof Controls Infrastructure Group Leader	<ul style="list-style-type: none"> • Generate and execute Traveler • Verify EPICS integration • Test system performance 	<ul style="list-style-type: none"> • Test Report • Completed Traveler 	Signature (Beamline):  3/7/18
	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	<ul style="list-style-type: none"> • Verify integration • Test system performance 	<ul style="list-style-type: none"> • Test Report Phase 2 Installation 	Signature (FE): N/A 
	Controls Hardware/Software installed and tested in accordance with NSLS-II requirements.	O. Ivashkevych Controls Engineer	<ul style="list-style-type: none"> • Test system performance • Complete integral testing 	<ul style="list-style-type: none"> • Performance and integral testing documentation 	Signature (Beamline):  02/28/2018

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**ATTACHMENT B – PILLAR II HARDWARE
28-ID-1 BEAMLINE**

READINESS CRITERIA		RESPONSIBLE PERSON	ACTIONS	DOCUMENTED EVIDENCE	CERTIFICATION OF READINESS*
PILLAR II OTHER HARDWARE (INSTALLATION)	<p>Vacuum Vacuum hardware has been installed and tested in accordance with the Traveler and has the capability of achieving full vacuum needed during commissioning.</p>	<p>R. Todd Vacuum Engineer</p>	<ul style="list-style-type: none"> • Generate and execute Top Level Traveler • Identify overpressure devices • Test system performance 	<ul style="list-style-type: none"> • Completed Top Level Traveler • Test Report 	<p>Signature:</p>  <p>3/7/18</p>

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**ATTACHMENT C – PILLAR III PERSONNEL
28-ID-1 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: <i>Bruce Lein</i> 3-9-18
	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: <i>Bruce Lein</i> 3-9-18
	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: <i>Bruce Lein</i> 3-7-18
	Lead Operators, Scientific 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: <i>Bruce Lein</i> 3-7-18

* READINESS CERTIFICATION	M. Abeykoon - Lead Beamline Scientist	Signature: <i>M. Abeykoon</i> 03/12/18
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*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
28-ID-1 BEAMLIN**

READINESS CRITERIA		RESPONSIBLE PERSON	DOCUMENTED EVIDENCE	CERTIFICATION OF READINESS*
IRR PRE-START FINDINGS	<p>No Pre-Start Findings Identified No pre-start findings associated with the 28-ID-1 Beamline have been identified by the Review Team and therefore the following lines do not require sign-off.</p>	R. Lee ESH Manager	<ul style="list-style-type: none"> • IRR Preliminary Report 	Signature:
		C. Gortakowski Independent Verifier		Signature:
	<p>Pre-Start Actions Complete All actions associated with the 28-ID-1 Beamline IRR pre-start findings are complete.</p>	J. Adams IRR Technical Authority	<ul style="list-style-type: none"> • Pertinent closure evidence 	Signature:
	<p>Pre-Start Actions Verified All actions associated with the 28-ID-1 Beamline IRR pre-start findings have been verified complete.</p>	R. Lee ESH Manager	<ul style="list-style-type: none"> • Pertinent closure evidence 	Signature:
	<p>Pre-Start Actions Independently Verified (Beamline) Actions associated with the 28-ID-1 Beamline IRR pre-start findings have been satisfactorily complete.</p>	C. Gortakowski 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.
Page 14 of 14