

# **INSTRUMENT READINESS PLAN (IRP)**

**FOR THE**

## **NSLS-II ULTRA-HIGH VACUUM OPTICAL EXTRACTION (UHVOE) AT CELL 22**



OCTOBER 2018

NSLSII-22IR-PLN-003

PREPARED BY  
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FOR THE  
U.S. DEPARTMENT OF ENERGY  
OFFICE OF SCIENCE BASIC ENERGY SCIENCE  
UNDER CONTRACT DE-SC0012704

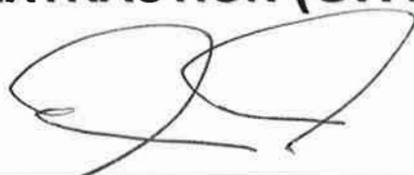
# INSTRUMENT READINESS PLAN (IRP)

FOR THE

## NSLS-II ULTRA HIGH-VACUUM

### OPTICAL EXTRACTION (UHVOE) AT CELL 22

PREPARED BY:



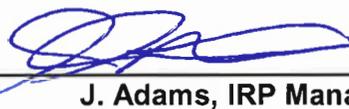
10/3/2018

A. Ackerman Instrument Readiness Coordinator

APPROVED AS A PLAN TO ACHIEVE READINESS BY:

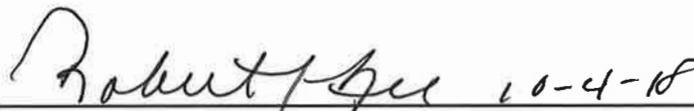
 10/3/18

G. Fries, IRP Manager

 10/4/2018

J. Adams, IRP Manager

CONCURRENCE BY:

 10-4-18

R. Lee, ESH Manager

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

 10/25/18

G. Fries, IRP Manager

 10/25/2018

J. Adams, IRP Manager

CONCURRENCE BY:

 10/25/2018

R. Lee, ESH Manager

4

**REVISION HISTORY LOG**

<b>REVISION</b>	<b>DESCRIPTION</b>	<b>DATE</b>
1	Initial Issue	OCTOBER 2018

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## ATTACHMENTS

Attachment A, *Pillar I Documentation, Cell 22 UHVOE*

Attachment B, *Pillar II Hardware, Cell 22 UHVOE*

Attachment C, *Pillar III Personnel, Cell 22 UHVOE*

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 UHVOE at cell 22 ready for commissioning. The scope of this IRP includes the UHVOE mechanical system, mechanical utilities, control system, EPS and shielding systems, and was prepared in accordance with *Instrument Readiness Reviews* (NSLSII-DPT-PDN-008). 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 UHVOE at Cell 22

The instrumentation to be reviewed is named "UHV Optical Extraction." It consists of all the vacuum, mechanical, electrical and optical components for extracting infrared and optical light produced as dipole bending magnet radiation (conventional synchrotron radiation) where the electron beam passes through the cell 23 BM-B large gap dipole magnet.

The light is intercepted by one mirror and a sequence of 5 additional mirrors guide the beam out from the storage ring tunnel and onto the NSLS II experimental floor. There it is re-focused through a pair of UHV exit windows. The construction and operation of the extraction mirrors are such that no ionizing radiation is collected or transmitted.

The spectral range of operation is for wavelengths of 0.25 microns and longer. The majority of this instrumentation was designed, constructed and installed by FMB-Berlin under a contract with NSLS II/BSA. This was done according to a specification requirement from NSLS II. The last UHV exit window chamber was designed and constructed/assembled here at NSLS-II. Though the chamber is designed for CVD diamond windows, conventional glass viewports will be installed for this IRR.

The UHV Optical Extraction has systems for vacuum and thermal management, including Equipment Protection Systems (EPS). Since the beamline is incapable of collecting or transmitting ionizing radiation, there are no requirements for safety shutters, photon masks or beam blocks. As such, ray tracing for ionizing radiation is not relevant and not provided. The light that is transmitted has a power well under 1 Watt and is readily stopped by a conventional vacuum gate valve.

### **1.3 Instrument Readiness Review (IRR)**

As part of the verification of readiness for commissioning, an IRR is required in accordance with *Instrument Readiness Reviews* (NSLSII-DPT-PDN-008). An independent IRR Team will use the readiness criteria developed as part of this IRP to verify that the UHVOE 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 Cell 22 UHVOE.

## 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 Reviews* (NSLSII-DPT-PDN-008).

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 IRP Team

An IRP Team will be appointed by the NSLS-II Director in accordance with *Instrument Readiness Reviews* (NSLSII-DPT-PDN-008). The IRP Team members that have responsibility for completing the IRP are listed as the Responsible Person in the Attachments.

### 3.2 Achieving Readiness – Responsibilities

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

The Mechanical Engineering Group Leader is responsible for certifying that all readiness criteria associated with the subject UHVOE is achieved.

### 3.3 Execution of the IRP

The IRP 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 IRP 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 IRP Team members will certify that the criteria for which they are responsible for are complete by signing and dating 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 IRP Manager and the ESH Manager will certify that all IRR pre-start findings relative to the UHVOE have been completed, and that the associated ATS Actions have been closed by signing and dating Attachment D in the appropriate section. The Independent Verifier will concur that these actions have been adequately completed and closed by signing and dating Attachment D in the appropriate section.

**ATTACHMENT A – PILLAR I DOCUMENTATION**

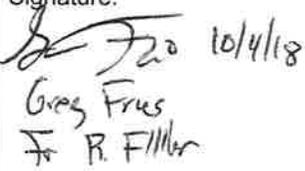
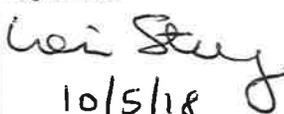
**CELL 22 UHVOE**

READINESS CRITERIA		RESPONSIBLE PERSON	ACTIONS	DOCUMENTED EVIDENCE	CERTIFICATION OF READINESS*
<b>PILLAR I DOCUMENTATION (PLANNING &amp; PROCEDURES)</b>	<p><b>Functional Description</b> An overview presentation is prepared that defines the scope of the IRR and includes the following UHVOE specific information:</p> <ul style="list-style-type: none"> <li>- Primary capabilities</li> <li>- Physical layout and location (includes beamline location on the experiment floor)</li> <li>- Design reviews and performance parameters</li> <li>- Source characteristics</li> <li>- Photon beam performance goals</li> <li>- Radiation Safety Committee reviews</li> <li>- Self-identified pre-start findings</li> <li>- Description and status for each item listed in this Instrument Readiness Plan</li> </ul>	C. Hetzel Vacuum Group Leader	<ul style="list-style-type: none"> <li>• Develop the presentation and document described for the beamline</li> </ul>	<ul style="list-style-type: none"> <li>• Presentation</li> <li>• Functional Description</li> </ul>	Signature:  10/10/18
		L. Carr Lead Beamline Scientist			Signature:  9-Oct-18
	<p><b>UHVOE Design</b> Beamline components are designed in accordance with NSLSII-DPT-PDN-006, <i>Engineering Design for NSLS-II Structures, Systems and Components (SSCs)</i></p>	C. Hetzel Vacuum Group Leader	<ul style="list-style-type: none"> <li>• Complete Engineering Design Reviews for the UHVOE that address thermal management, mechanical support, configuration control, and vacuum</li> </ul>	<ul style="list-style-type: none"> <li>• Technical Specification</li> <li>• Internal and contractor supplied design review documents</li> </ul>	Signature:  10/10/18
<p><b>Radiation Safety Components Design</b> Radiation Safety Components for the beamline and UHVOE designed in accordance with NSLS-II requirements.</p>	M. Breitfeller Mechanical Engineer	<ul style="list-style-type: none"> <li>• Complete requirements analysis and design of radiation safety components for the UHVOE</li> </ul>	<ul style="list-style-type: none"> <li>• Internal design review documents and reports</li> <li>• RSC Report</li> </ul>	Signature:  10-5-18	

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

**ATTACHMENT A – PILLAR I DOCUMENTATION**

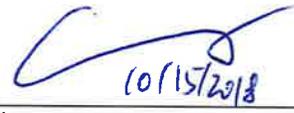
**CELL 22 UHVOE**

READINESS CRITERIA		RESPONSIBLE PERSON	ACTIONS	DOCUMENTED EVIDENCE	CERTIFICATION OF READINESS*
<b>PILLAR I DOCUMENTATION (PLANNING &amp; PROCEDURES)</b>	<b>Top-Off Safety System (TOSS)</b> Front End 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"> <li>• Technical Authority for Top-Off complete a review of Front End</li> </ul>	<ul style="list-style-type: none"> <li>• Memo from Technical Authority</li> <li>• <i>Beamlines Approved for Top-Off Operations</i> list</li> </ul>	Signature:  Greg Frus R. Filler 10/4/18
	<b>Secondary Radiation Scatter Analysis</b> 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>	M. Benmerrouche Radiation Physicist	<ul style="list-style-type: none"> <li>• Complete FLUKA analysis</li> <li>• <del>Complete STACs analysis</del></li> </ul> 	<ul style="list-style-type: none"> <li>• BNL Technical Note Report</li> </ul>	Signature:  10/09/2018
	<b>Non-ionizing Radiation Hazard Analysis</b> Non-ionizing radiation hazard analyzed in accordance with the relevant 2016 ACGIH/TLV® Standards.	C. Weilandics ESH Operations Group Leader	<ul style="list-style-type: none"> <li>• Complete a non-ionizing radiation hazard analysis for the synchrotron beam</li> </ul>	<ul style="list-style-type: none"> <li>• Hazard Analysis Report</li> </ul>	Signature: 10/27/18  NIA DR 10/15/18
	<b>National Environmental Protection Act (NEPA) Evaluation</b> NEPA requirements evaluation completed.	L. Stiegler ESH Operations Group Leader	<ul style="list-style-type: none"> <li>• Complete a NEPA evaluation</li> </ul>	<ul style="list-style-type: none"> <li>• NEPA evaluation report</li> </ul>	Signature:  10/5/18

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

**ATTACHMENT A – PILLAR I DOCUMENTATION**

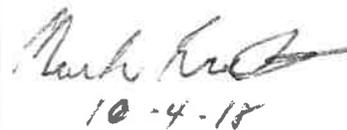
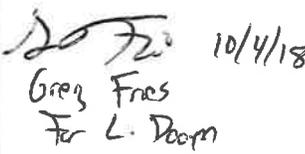
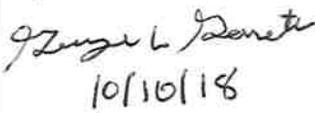
**CELL 22 UHVOE**

READINESS CRITERIA		RESPONSIBLE PERSON	ACTIONS	DOCUMENTED EVIDENCE	CERTIFICATION OF READINESS*
<b>PILLAR I DOCUMENTATION (PLANNING &amp; PROCEDURES)</b>	<p><b>Unreviewed Safety Issue (USI) Evaluations/ Screenings</b> Authorization basis hazard identification is managed through USI evaluation/screening.</p>	S. Moss Authorization Basis Manager	<ul style="list-style-type: none"> <li>Verify that the SAD and ASE accurately cover the hazards associated with the subject beamline and UHVOE; include temporary systems</li> </ul>	<ul style="list-style-type: none"> <li>SAD and ASE USI screenings/evaluations</li> <li>Applicable waivers</li> </ul>	Signature:  10/10/18
	<p><b>Resolution of Open Action Tracking System (ATS) Actions</b> All action items from previous internal and external oversight groups (e.g., RSC, Design Reviews, etc.) have been closed.  Previous IRR action items are addressed.</p>	J. Zipper QA Engineer	<ul style="list-style-type: none"> <li>ATS action items for the beamline shown as closed with supporting evidence</li> </ul>	<ul style="list-style-type: none"> <li>ATS System</li> </ul>	Signature:  10/9/18
	<p><b>Commissioning Plan</b> Commissioning plan has been generated for the M1 mirror to address the task sequence required for technical commissioning (safe photon transport).</p>	L. Carr Lead Beamline Scientist	<ul style="list-style-type: none"> <li>Prepare a commissioning plan for M1 – M7</li> </ul>	<ul style="list-style-type: none"> <li>Approved Commissioning Plan</li> </ul>	Signature:  J ADAMS 10/15/2018
		G. Wang Accelerator Coordination Group Leader			Signature:  10/15/2018
<p><b>Radiation Survey Procedure</b> A survey procedure has been generated for the M1 Mirror.</p>	M. Benmerrouche Radiation Physicist	<ul style="list-style-type: none"> <li>Include the requirement for general area radiation surveys to be conducted in the commissioning plan</li> </ul>	<ul style="list-style-type: none"> <li>Approved commissioning plan</li> </ul>	Signature:  10/15/2018	

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

**ATTACHMENT B – PILLAR II HARDWARE**

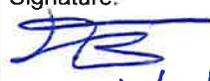
**CELL 22 UHVOE**

READINESS CRITERIA		RESPONSIBLE PERSON	ACTIONS	DOCUMENTED EVIDENCE	CERTIFICATION OF READINESS*
<b>PILLAR II SAFETY CRITICAL HARDWARE (INSTALLATION)</b>	<b>Radiation Safety Components: Installation</b> Radiation safety components are installed in accordance with the Traveler.	M. Breitfeller Mechanical Engineer	<ul style="list-style-type: none"> <li>• Generate and execute Traveler</li> </ul>	<ul style="list-style-type: none"> <li>• Completed Traveler</li> </ul>	Signature:  10-4-18
	<b>Radiation Safety Components: Configuration Control</b> A Radiation Safety Component Checklist template generated in accordance with NSLSII-ESH-PRC-004, <i>Radiation Safety Component Inspection Procedure</i> .	L. Doom Accelerator Coordination	<ul style="list-style-type: none"> <li>• Verify that the existing checklist adequately covers the subject UHVOE</li> </ul>	<ul style="list-style-type: none"> <li>• Approved Storage Ring Radiation Safety Component Checklist Template</li> </ul>	Signature:  10/4/18 Greg Fries For L. Doom
	<b>Electrical Power</b> SBMS electrical power distribution requirements are satisfied. SBMS Electrical Equipment Inspection (EEI) requirements are satisfied.	G. Ganetis Electrical Engineering Group Leader	<ul style="list-style-type: none"> <li>• Complete system electrical inspection</li> <li>• Complete needed EEI inspections</li> </ul>	<ul style="list-style-type: none"> <li>• EEI database entries</li> </ul>	Signature:  10/10/18
	<b>Utilities</b> Permanent facility and beamline utility systems are installed and tested (i.e., Compressed Air, DI Water) in accordance with design, labeling, and attachment requirements.	J. Gosman Mechanical Utilities Group Leader	<ul style="list-style-type: none"> <li>• Generate system schematics</li> <li>• Perform pressure test</li> <li>• Assure SBMS and NSLS-II labeling and hardware attachment requirements are met</li> </ul>	<ul style="list-style-type: none"> <li>• Approved system schematics</li> <li>• System pressure testing reports</li> </ul>	Signature:  10-4-18

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

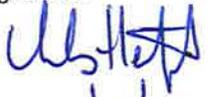
**ATTACHMENT B – PILLAR II HARDWARE**

**CELL 22 UHVOE**

READINESS CRITERIA		RESPONSIBLE PERSON	ACTIONS	DOCUMENTED EVIDENCE	CERTIFICATION OF READINESS*
<b>PILLAR II OTHER HARDWARE (INSTALLATION)</b>	<b>Accelerator Infrastructure Equipment Protection System (EPS)</b> (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"> <li>• Verify integration</li> <li>• Test system performance</li> </ul>	<ul style="list-style-type: none"> <li>• Test Report</li> </ul>	Signature:   10/4/18
	<b>Controls and Diagnostics</b> Hardware/Software installed and tested in accordance with NSLS-II requirements.	D. Padrazo Instrumentation Group Leader	<ul style="list-style-type: none"> <li>• Test system performance</li> <li>• Complete integral testing</li> </ul>	<ul style="list-style-type: none"> <li>• Performance and integral testing checklist</li> </ul>	Signature:   10/4/18
		J. Li Controls Engineer			Signature:   10/15/18
<b>Vacuum</b> Vacuum hardware has been installed and tested in accordance with the Traveler and has the capability of achieving full vacuum needed during commissioning.	C. Hetzel Vacuum Group Leader	<ul style="list-style-type: none"> <li>• Generate and execute Top Level Traveler</li> <li>• Identify overpressure devices</li> <li>• Test system performance</li> </ul>	<ul style="list-style-type: none"> <li>• Completed Top Level Traveler</li> <li>• Test Report</li> </ul>	Signature:   10/15/18	

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**ATTACHMENT B – PILLAR II HARDWARE  
CELL 22 UHVOE**

READINESS CRITERIA		RESPONSIBLE PERSON	ACTIONS	DOCUMENTED EVIDENCE	CERTIFICATION OF READINESS*
<b>PILLAR II OTHER HARDWARE</b>	<p><b>Other UHVOE Components</b> 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.</p>	<p>C. Hetzel Vacuum Group Leader</p>	<ul style="list-style-type: none"> <li>• Generate Traveler and drawing</li> <li>• Execute Traveler</li> </ul>	<ul style="list-style-type: none"> <li>• Completed Traveler</li> </ul>	<p>Signature:              10/15/18</p>

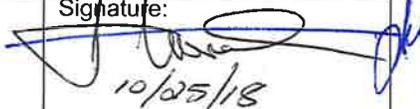
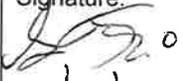
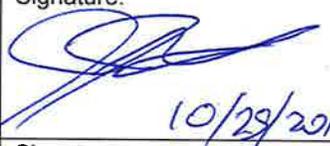
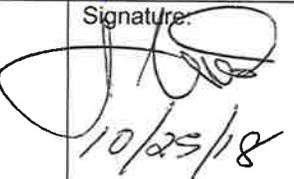
**ATTACHMENT C – PILLAR III PERSONNEL  
CELL 22 UHVOE**

READINESS CRITERIA		RESPONSIBLE PERSON	ACTIONS	DOCUMENTED EVIDENCE	CERTIFICATION OF READINESS*
<b>PILLAR III PERSONNEL</b>	<b>Lead Beamline Scientist (LBS) / Cognizant Space Manager (CSM)</b> LBS and CSM personnel are assigned and Trained/Qualified.	B. Lein Training Group Leader	<ul style="list-style-type: none"> <li>Assign JTA for LBS and CSM</li> </ul>	<ul style="list-style-type: none"> <li>BTMS record</li> </ul>	Signature:  10-11-18
	<b>Lead Operators &amp; FLOCOS (Accelerator Division)</b> Trained/Qualified to: – Perform tasks related to UHVOE Commissioning	B. Lein Training Group Leader	<ul style="list-style-type: none"> <li>Train Operators</li> </ul>	<ul style="list-style-type: none"> <li>BTMS record</li> </ul>	Signature:  10-11-18

* READINESS CERTIFICATION	C. Hetzel Vacuum Group Leader	Signature:  For Charles Hetzel 10/24/18
* READINESS CERTIFICATION	L. Carr Lead Beamline Scientist	Signature:  25-Oct-1

\*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  
CELL 22 UHVOE**

READINESS CRITERIA		RESPONSIBLE PERSON	DOCUMENTED EVIDENCE	CERTIFICATION OF READINESS*
<b>IRR PRE-START FINDINGS</b>	<b>No Pre-Start Findings Identified</b> No pre-start findings associated with the 22-IR UHVOE have been identified by the IRR Team and therefore the following lines do not require sign-off.	R. Lee ESH Manager	• IRR Preliminary Report	Signature:
		J. West Independent Verifier	IRR Preliminary Report	Signature:  10/25/18
	<b>Pre-Start Actions Complete</b> All actions associated with the 22-IR UHVOE IRR pre-start findings are complete.	G. Fries IRP Manager	• Pertinent closure evidence	Signature:  10/25/18
	<b>Pre-Start Actions Complete</b> All actions associated with the 22-IR UHVOE IRR pre-start findings are complete.	J. Adams IRP Manager	• Pertinent closure evidence	Signature:  10/29/2018
	<b>Pre-Start Actions Verified</b> All actions associated with the 22-IR UHVOE IRR pre-start findings have been verified complete.	R. Lee ESH Manager	• Pertinent closure evidence	Signature:  10/25/18
	<b>Pre-Start Actions Independently Verified</b> Actions associated with the 22-IR UHVOE IRR pre-start findings have been satisfactorily complete.	J. West Independent Verifier	• Pertinent closure evidence	Signature:  10/25/18

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