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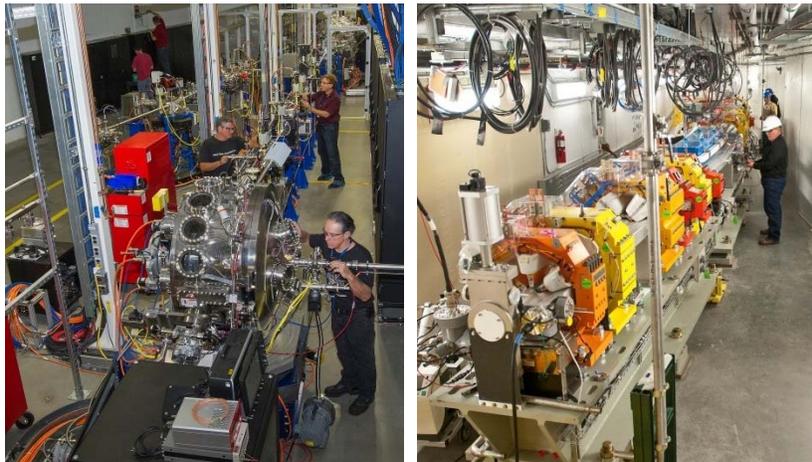
Doc No: NSLSII-7BM-PRC-001

## **NSLS-II PROCEDURE: BEAMLINER QAS (07-BM) RADIATION SURVEY PROCEDURE**

August 8, 2017

Rev. 1

M. Benmerrouche



 **Think Act  
Safety. Safely.**

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Doc No. NSLSII-7BM-PRC-001	Author: M. Benmerrouche	Review Frequency: 3 yrs	Rev. 1
Title: <b>Beamline QAS (07-BM) Radiation Survey Procedure</b>			Effective Date: 08AUG2017

### ESH Review:

8/21/2017

**X** Kim Wehunt

Kim Wehunt  
Facility Support Representative  
Signed by: Wehunt, Kimberly

By signing this Procedure I acknowledge that it complies with all ESH requirements and if performed correctly, will not present a significant hazard to personnel or equipment.

### Beamline Review:

8/17/2017

**X** Steven N. Ehrlich

Steve Ehrlich  
QAS Lead Beamline Scientist  
Signed by: Ehrlich, Steven

By signing this Procedure I acknowledge that it is comprehensive and can be performed as written at the beamline.

### Authorization Basis Review:

8/14/2017

**X** 

Steve Moss  
Authorization Basis Manager  
Signed by: Moss, Steven H

By signing this Procedure I acknowledge that a USI Screening/Evaluation has been performed and this Procedure does not adversely impact the NSLS-II Authorization Basis Documents.

### Approved:

8/18/2017

**X** 

Robert Lee  
ESH Manager  
Signed by: Lee, Robert J

By approving this Procedure I agree that the appropriate personnel have reviewed this document and I authorize this work to commence as written.

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### REVISION HISTORY

REVISION	SECTION(S)	PAGE	DATE	List of Reviewers	DESCRIPTION
1	All	All	08AUG2017	S. Chitra B. Lein K. Rubino Z. Zhong	First Issue. Validation waived by Author M. Benmerrouche and Acting Conduct of Operations Manager, S. Moss.

### ACRONYMS

3PW	Three-Pole Wiggler	NSLS-II	National Synchrotron Light Source II
BM	Bending Magnet	PBS	Pink Beam Stop
BS	Beam Stop	PCM	Photon Collimating Mirror
BRS	Bremsstrahlung Stop	PFM	Photon Focusing Mirror
BTS	Booster to Storage Ring	PSD	Photon Science Division
CO	Collimator	PSH	Photon Shutter
DCM	Double Crystal Monochromator	QAS	Quick X-ray Absorption and Scattering
ESH	Environment, Safety and Health	RCT	Radiological Control Technician
FE	Front End	RSC	Radiation Safety Component
FOE	First Optical Enclosure	RSL	Radiation Safety Limit
FS	Fluorescent Screen	SAF	Safety Approval Form
GB	Gas Bremsstrahlung	SBMS	Standards-Based Management System
GV	Gate Valve	SCHM	Sample Chamber
IFB	Indistinguishable From Background	SLT	X-Y Slits
LOTO	Lockout/Tagout	SR	Synchrotron Radiation
mrem/hr	millirem per hour		
MSK	Mask		

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## 1 PURPOSE AND SCOPE

This purpose of this procedure is to perform a comprehensive commissioning radiation survey on the 07-BM beamline, as directed by PS-C-XFD-PRC-004, *NSLS-II Beamlines Radiation Safety Commissioning Plan*.

The survey scenarios are covered in the *Beamline QAS (07-BM, 3PW) Comprehensive Commissioning Radiation Survey*, provided as Attachment A.

## 2 PREREQUISITES

- 2.1 Authorization/approval from the NSLS-II Director to initiate commissioning of the beamline has been received.
- 2.2 A Beamline System Readiness Checklist has been completed in accordance with PS-C-XFD-PRC-003, *Enabling Beamlines for Operations*.
- 2.3 The area(s) around the beamline are posted in accordance with SBMS Program Description: *Radiological Control Manual*.
- 2.4 All shutters are closed.
- 2.5 FE slits are fully open (near maximum extent range).

**Note:** If FE slits cannot be fully open, record the FE slits parameter here: \_\_\_\_\_

- 2.6 All beamline slits are fully open.
- 2.7 All mirrors and filters are retracted out from beam.

## 3 HAZARDS, CONTROLS AND LIMITS

- 3.1 If at any point during performance of this procedure a radiation dose rate of 5 mrem/hr or higher on contact is identified, the radiation survey shall be terminated and the cause investigated, and any hazards shall be mitigated before continuing.

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- 3.2 Minor deviations on Attachment A are allowed in the field; however the deviation shall be documented and submitted to the PSD Director and the ESH Manager for review after the survey.
- 3.3 During surveys performed in top-off mode, top-off will be adjusted for more frequent injections to keep the stored beam current within the allowable specifications.

#### 4 PROCEDURE

**Note:** Execution of this Comprehensive Commissioning Radiation Survey, along with the evaluation of the data collected, may only be used as a basis by the PSD Director and the ESH Manager to approve commissioning activities at an electron beam current of up to 3 times the electron beam current measured during this survey. Approval of commissioning of the beamline at a higher electron beam current requires re-execution of this Comprehensive Commissioning Radiation Survey.

**Note:** The step sequences of the survey may be completed out of sequence.

- 4.1 Authorized Beamline Staff and RCTs establish the initial conditions and record them on Attachment A, *Beamline QAS (07-BM, 3PW) Comprehensive Commissioning Radiation Survey*.
- 4.2 Authorized Beamline Staff and RCTs complete the Comprehensive Commissioning Radiation Survey in accordance with Attachment A.
- 4.3 Throughout the radiation survey, Authorized Beamline Staff ensure that the photon beam is where it should be using the appropriate diagnostic tools AND ensure that the FE shutter remains open.

**Note:** Attachment A, with the filled information from the measurements, acts as the Beamline Radiation Survey Interim Report.

- 4.4 After the survey, the RCT provides the completed Beamline Radiation Survey Interim Report to the PSD Director and the ESH Manager for review.

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## 5 REFERENCES

- 5.1 PS-C-CMD-PRC-002, *Records Management Procedure*
- 5.2 PS-C-XFD-PRC-003, *Enabling Beamlines for Operations*
- 5.3 PS-C-XFD-PRC-004, *NSLS-II Beamlines Radiation Safety Commissioning Plan*
- 5.4 PS-C-XFD-PRC-024, *Beamline Photon Shutter Centrally Controlled Lockout/Tagout Procedure*
- 5.5 SBMS Program Description: *Radiological Control Manual*

## 6 ATTACHMENTS

Attachment A, *Beamline QAS (07-BM, 3PW) Comprehensive Commissioning Radiation Survey*

Attachment B, *Beamline Enclosure Diagram, 07-BM-A and 07-BM-B*

## 7 DOCUMENTATION

The following records are generated as a result of this procedure, and shall be maintained in accordance with PS-C-CMD-PRC-002, *Records Management Procedure*:

- Completed Comprehensive Commissioning Radiation Surveys/Beamline Radiation Survey Interim Report

## 8 DEFINITIONS

None.

[If you have any questions or feedback regarding this document, please click this link.](#)

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**Attachment A**  
**Beamline QAS (07-BM, 3PW)**  
**Comprehensive Commissioning Radiation Survey**

Date: \_\_\_\_\_

**The following scenarios are covered:**

**I. GB/SR Radiation Survey**

- a. Integrity of the FOE (07-BM-A), RSCs and FOE PSH with GB and SR (Pink Beam and Monochromatic Beam) on beamline fixed/moveable components.
- b. Integrity of components outside the FOE including transport pipe, and inside 07-BM-B enclosure with GB and SR (Pink Beam and Monochromatic Beam) on beamline fixed/moveable components.

**II. Monochromatic Beam Radiation Survey**

- a. Integrity of the transport pipe and 07-BM-B and 07-BM-C enclosures with monochromatic beam on beamline fixed/moveable components and scatter targets at sample locations.

**Survey Conditions:**

**HOLD POINT:** Evaluate and ensure that all applicable controls listed in the Commissioning SAF are in place, including LOTO requirements for the beamline photon shutters (in accordance with PS-C-XFD-PRC-024, *Beamline Photon Shutter Centrally Controlled Lockout/Tagout Procedure*).

**HOLD POINT:** Before opening safety shutters in the FE, survey the upstream wall of the FOE to make sure no radiation comes through.

**RSLs to Be Identified:** FE Slits, Electron Beam Current

**General Area Surveys:**

For general area surveys, the following steps identify the "key targets" to use during the surveys at a minimum (see the appropriate sections below for details):

1. Step I.5
2. Step II.8.1

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**Initial Settings:**

Electron Beam Current: \_\_\_\_\_

Injection Rate: \_\_\_\_\_      BTS Injection Efficiency: \_\_\_\_\_

Straight Section Vacuum Condition: \_\_\_\_\_

Mirror PCM setting: \_\_\_\_\_

DCM Settings: \_\_\_\_\_

Mirror PFM setting: \_\_\_\_\_

Set up neutron detectors at:

1. Outside the FOE in the vicinity of CO1/BRS, outboard.
2. Outside the FOE on contact with downstream wall at beam centerline above the guillotine.

Background Radiation Levels:

Gamma Dose Rate/Count Rate: \_\_\_\_\_ / \_\_\_\_\_

Neutron Dose Rate: \_\_\_\_\_

Survey start date and time: \_\_\_\_\_

Authorized Beamline Staff & RCTs:

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Additional information: \_\_\_\_\_

**Note:** The step sequences of this procedure can be changed.

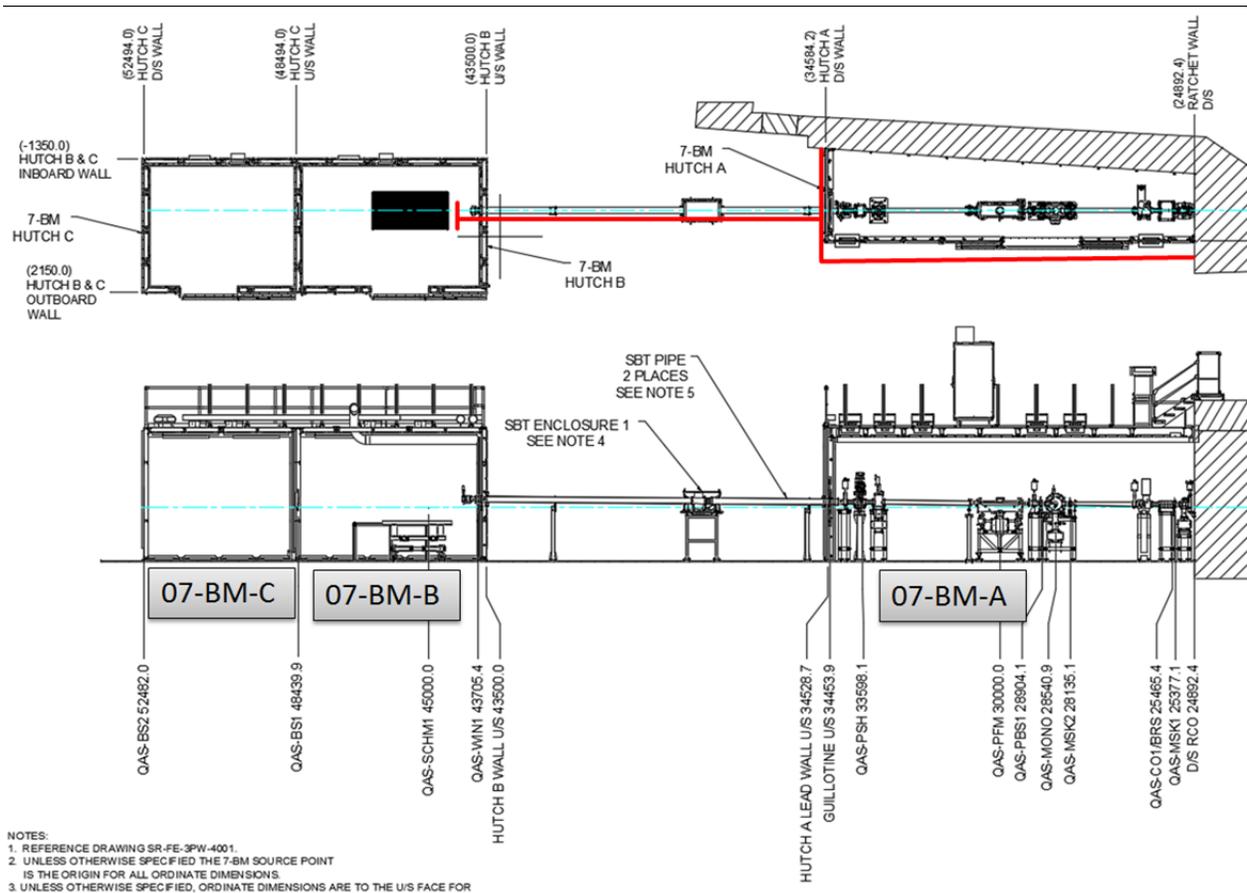
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## I. GB/SR Radiation Survey

- GB/SR Radiation Survey: FE slits fully open, FE shutters open, FOE PSH Closed, PCM, DCM, PFM, X-Y Slits, and FS out of the beam.** Survey all walls and roof of 07-BM-A, the area around the transport pipe, as well as at the exit of mono beam transport pipe inside the 07-BM-B enclosure to verify the integrity of FOE PSH.

Component:	FE Slits	PCM	FE FS	FE Shutter	X-Y Slits	DCM	FS	PFM	FS	FOE PSH
Position:	Fully Open	Out	Out	Open	Out	Out	Out	Out	Out	Closed



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***Straight Section Vacuum Conditions:*** \_\_\_\_\_

***Angle of Mirror PCM*** \_\_\_\_\_

***Direct Frisk Survey Results:***  IFB  other (described below)

***Dose Rate Survey Results:***  IFB  other (described below)

**Additional information/comments:**

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***Signature (ESH)*** \_\_\_\_\_ ***Signature (Beamline)*** \_\_\_\_\_

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**2. Insert PCM in its nominal position (typically 2.7 mrad).** Survey all walls and roof of 07-BM-A, the area around the transport pipe, as well as at the exit of mono beam transport pipe inside the 07-BM-B enclosure to verify the integrity of FOE PSH.

<b>Component:</b>	FE Slits	PCM	FE FS	FE Shutter	X-Y Slits	DCM	FS	PFM	FS	FOE PSH
<b>Position:</b>	Fully Open	In	Out	Open	Out	Out	Out	Out	Out	Closed

**Straight Section Vacuum Conditions:** \_\_\_\_\_

**Angle of Mirror PCM** \_\_\_\_\_

**Direct Frisk Survey Results:**  IFB  other (described below)

**Dose Rate Survey Results:**  IFB  other (described below)

**Additional information/comments:**

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**3. Insert X-Y slits (FS).** Survey the walls and roof of 07-BM-A in the vicinity of the X-Y slits.

<b>Component:</b>	FE Slits	PCM	FE FS	FE Shutter	X-Y Slits	DCM	FS	PFM	FS	FOE PSH
<b>Position:</b>	Fully Open	In	Out	Open	In	Out	Out	Out	Out	Closed

**Straight Section Vacuum Conditions:** \_\_\_\_\_

**Angle of Mirror PCM** \_\_\_\_\_

**Direct Frisk Survey Results:** IFB other (described below)

**Dose Rate Survey Results:** IFB other (described below)

**Additional information/comments:**

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**4. Retract X-Y slits. Set the DCM to its nominal position and insert FS upstream of PFM to verify monochromatic beam presence on FS.**

<b>Component:</b>	FE Slits	PCM	FE FS	FE Shutter	X-Y Slits	DCM	FS	PFM	FS	FOE PSH
<b>Position:</b>	Fully Open	In	Out	Open	Out	In	In	Out	Out	Closed

*Straight Section Vacuum Conditions:* \_\_\_\_\_

*Angle of Mirror PCM* \_\_\_\_\_

*Angle of DCM* \_\_\_\_\_ / \_\_\_\_\_ *Mono Beam Energies* \_\_\_\_\_ / \_\_\_\_\_

*Angle of Mirror PFM* \_\_\_\_\_

**4.1 Set monochromatic beam energy around 10 keV.** Survey all walls and roof of 07-BM-A, the area around the transport pipe, as well as at the exit of mono beam transport pipe inside the 07-BM-B enclosure to verify the integrity of FOE PSH.

*Direct Frisk Survey Results:*  IFB  other (described below)

*Dose Rate Survey Results:*  IFB  other (described below)

**4.2 Set monochromatic beam energy around 25 keV.** Survey all walls and roof of 07-BM-A, the area around the transport pipe, as well as at the exit of mono beam transport pipe inside the 07-BM-B enclosure to verify the integrity of FOE PSH.

*Direct Frisk Survey Results:*  IFB  other (described below)

*Dose Rate Survey Results:*  IFB  other (described below)

**Additional information/comments:**

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**5. Retract upstream FS, insert PFM into the beam at its nominal position and insert FS downstream of PFM to verify monochromatic beam presence on FS, and then retract FS.**

<b>Component:</b>	FE Slits	PCM	FE FS	FE Shutter	X-Y Slits	DCM	FS	PFM	FS	FOE PSH
<b>Position:</b>	Fully Open	In	Out	Open	Out	In	Out	In	In	Closed

*Straight Section Vacuum Conditions:* \_\_\_\_\_

*Angle of Mirror PCM* \_\_\_\_\_

*Angle of DCM* \_\_\_\_\_ / \_\_\_\_\_ *Mono Beam Energies* \_\_\_\_\_ / \_\_\_\_\_

*Angle of Mirror PFM* \_\_\_\_\_

**5.1 Set monochromatic beam energy around 10 keV.** Survey all walls and roof of 07-BM-A, the area around the transport pipe as well as at the exit of mono beam transport pipe inside the 07-BM-B enclosure to verify the integrity of FOE PSH.

*Direct Frisk Survey Results:*  IFB  other (described below)

*Dose Rate Survey Results:*  IFB  other (described below)

**5.2 Set monochromatic beam energy around 25 keV.** Survey all walls and roof of 07-BM-A, the area around the transport pipe as well as at the exit of mono beam transport pipe inside the 07-BM-B enclosure to verify the integrity of FOE PSH.

*Direct Frisk Survey Results:*  IFB  other (described below)

*Dose Rate Survey Results:*  IFB  other (described below)

**Additional information/comments:**

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**6. Open FOE PSH.**

<b>Component:</b>	FE Slits	PCM	FE FS	FE Shutter	X-Y Slits	DCM	FS	PFM	FS	FOE PSH
<b>Position:</b>	Fully Open	In	Out	Open	Out	In	Out	In	Out	Open

**Straight Section Vacuum Conditions:** \_\_\_\_\_

**Angle of Mirror PCM** \_\_\_\_\_

**Angle of DCM** \_\_\_\_\_ / \_\_\_\_\_ **Mono Beam Energies** \_\_\_\_\_ / \_\_\_\_\_

**Angle of Mirror PFM** \_\_\_\_\_

**6.1 Set monochromatic beam energy around 10 keV.** Survey the area around the transport pipe downstream of the FOE PSH.

**Direct Frisk Survey Results:**  IFB  other (described below)

**Dose Rate Survey Results:**  IFB  other (described below)

**6.2 Set monochromatic beam energy around 25 keV.** Survey the area around the transport pipe downstream of the FOE PSH.

**Direct Frisk Survey Results:**  IFB  other (described below)

**Dose Rate Survey Results:**  IFB  other (described below)

**Additional information/comments:**

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**7. Retract PFM.**

<b>Component:</b>	FE Slits	PCM	FE FS	FE Shutter	X-Y Slits	DCM	FS	PFM	FS	FOE PSH
<b>Position:</b>	Fully Open	In	Out	Open	Out	In	Out	Out	Out	Open

*Straight Section Vacuum Conditions:* \_\_\_\_\_

*Angle of Mirror PCM* \_\_\_\_\_

*Angle of DCM* \_\_\_\_\_ / \_\_\_\_\_ *Mono Beam Energies* \_\_\_\_\_ / \_\_\_\_\_

*Angle of Mirror PFM* \_\_\_\_\_

**7.1 Use the DCM to transmit the beam into the transport pipe.** Survey along the full length of the transport pipe.

*Direct Frisk Survey Results:*  IFB  other (described below)

*Dose Rate Survey Results:*  IFB  other (described below)

**7.2 Set monochromatic beam energy around 10 keV and use PFM to transmit mono beam up and down the transport pipe.** Survey along the full length of the transport pipe.

*Direct Frisk Survey Results:*  IFB  other (described below)

*Dose Rate Survey Results:*  IFB  other (described below)

**7.3 Set monochromatic beam energy around 25 keV and use PFM to transmit mono beam up and down the transport pipe.** Survey along the full length of the transport pipe.

*Direct Frisk Survey Results:*  IFB  other (described below)

*Dose Rate Survey Results:*  IFB  other (described below)

**Additional information/comments:**

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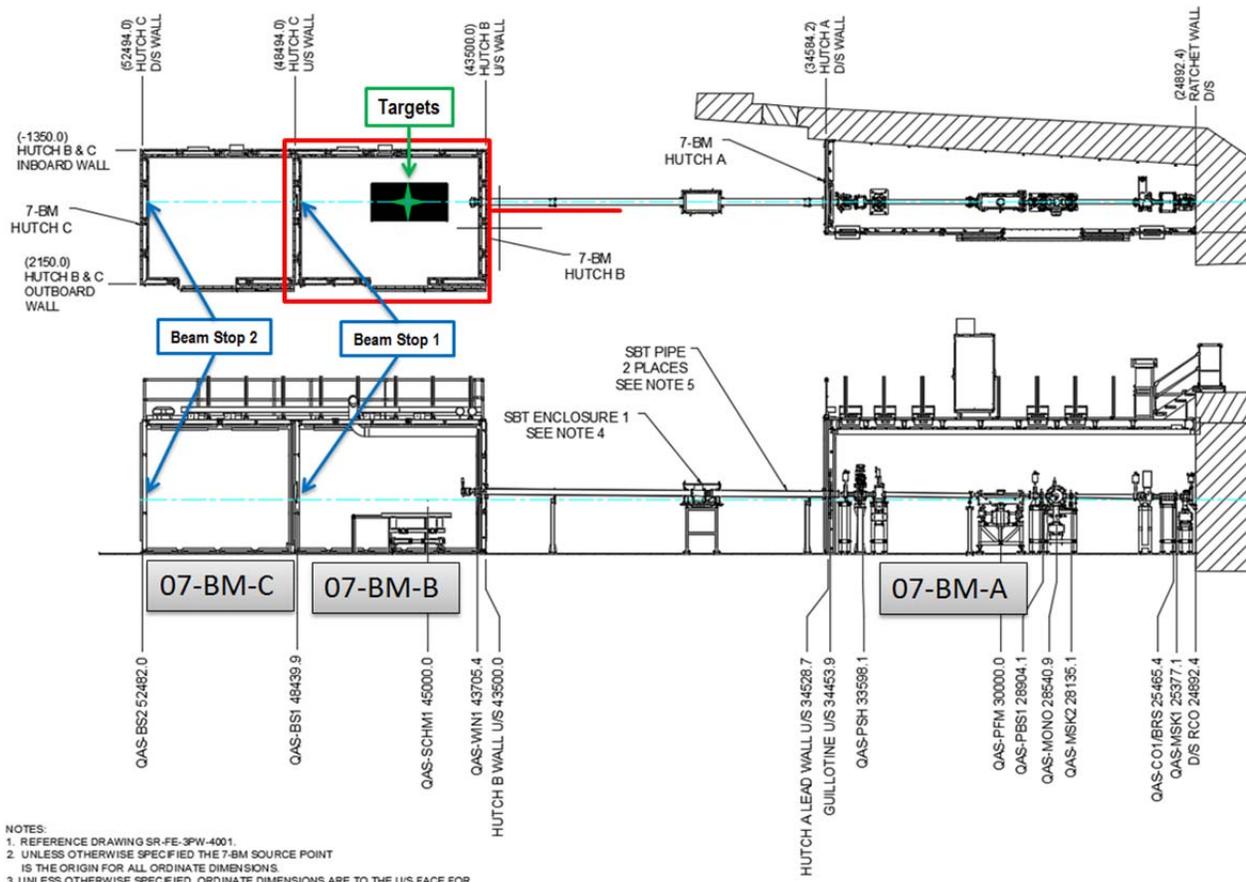
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## II. Monochromatic Beam Radiation Survey

8. **Monochromatic Beam Survey:** FE slits fully open, FE shutters open, FOE PSH open, PCM, DCM and PFM in their nominal positions. Open X-Y slits and retract FS out of the beam. **Set BS1 inside 07-BM-B enclosure in closed position.** Set monochromatic beam energy to about 10 keV and use PFM to bring the mono beam into the 07-BM-B enclosure.

Component:	FE Slits	PCM	FE FS	FE Shutter	X-Y Slits	DCM	FS	PFM	FS	FOE PSH
Position:	Fully Open	In	Out	Open	Out	In	Out	In	Out	Open



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**Straight Section Vacuum Conditions:** \_\_\_\_\_

**Angle of Mirror PCM** \_\_\_\_\_

**Angle of DCM** \_\_\_\_\_ / \_\_\_\_\_ **Mono Beam Energies** \_\_\_\_\_ / \_\_\_\_\_

**Angle of Mirror PFM** \_\_\_\_\_

**8.1 Insert the 07-BM-B slits.** Survey all walls and roof of 07-BM-B and the area around the transport pipe upstream of the slits.

**1. Set monochromatic beam energy around 10 keV.**

**Direct Frisk Survey Results:**  IFB  other (described below)

**2. Set monochromatic beam energy around 25 keV.**

**Direct Frisk Survey Results:**  IFB  other (described below)

**8.2 Retract 07-BM-B slits and insert a standard scatter target (e.g.: few mm thick Al) at sample position.** Survey all walls and roof of 07-BM-B enclosure.

**1. Set monochromatic beam energy around 25 keV.**

**Direct Frisk Survey Results:**  IFB  other (described below)

**2. Set monochromatic beam energy around 10 keV.**

**Direct Frisk Survey Results:**  IFB  other (described below)

**8.3 Retract 07-BM-B slits and remove scatter target so mono beam can strike the beam stop BS1 (to minimize attenuation/scatter by air, install a helium flight path tube if required).** Survey all walls and roof of 07-BM-B enclosure.

**1. Set monochromatic beam energy around 10 keV.**

**Direct Frisk Survey Results:**  IFB  other (described below)

**2. Set monochromatic beam energy around 25 keV.**

**Direct Frisk Survey Results:**  IFB  other (described below)

**Additional information/comments:**

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

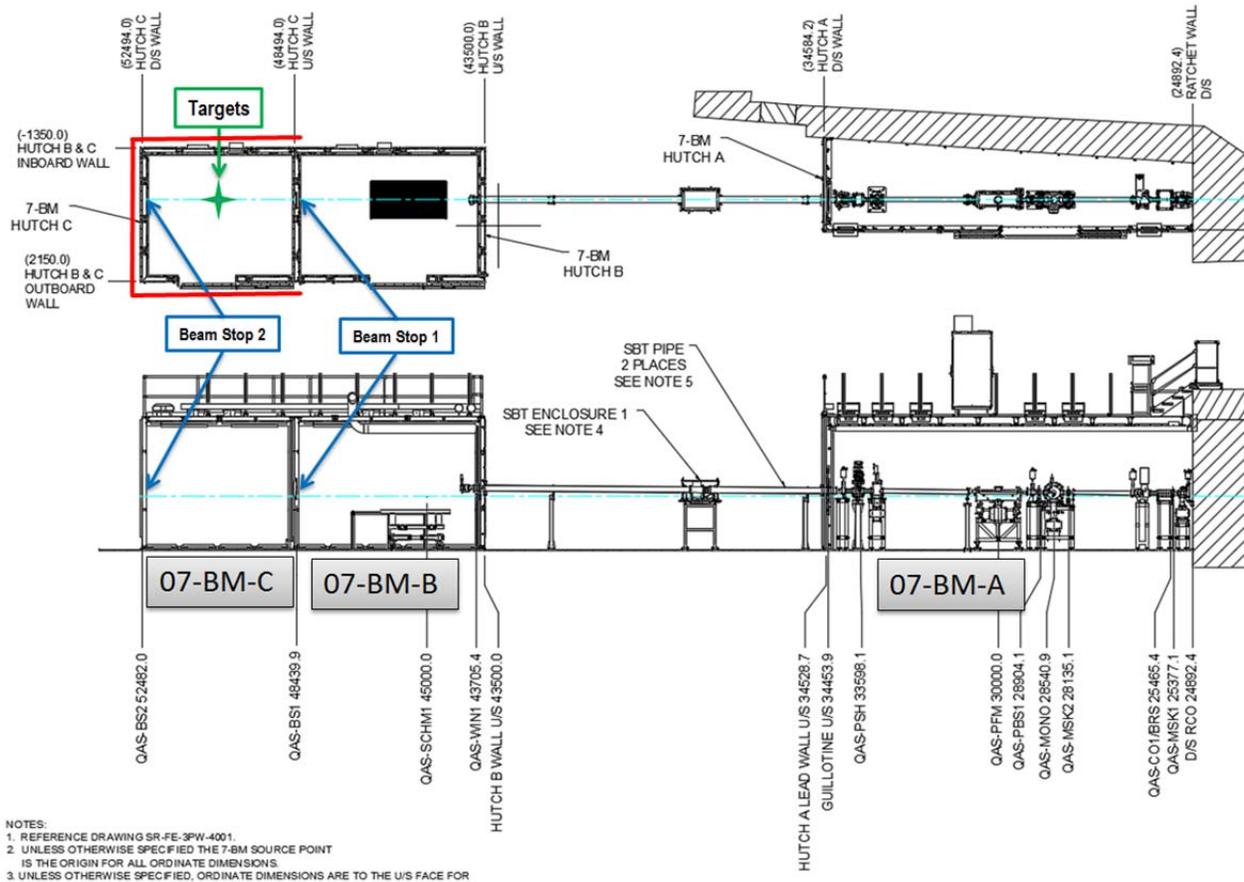
**Signature (ESH)** \_\_\_\_\_ **Signature (Beamline)** \_\_\_\_\_

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National Synchrotron Light Source II, Brookhaven National Laboratory			
Doc No. NSLSII-7BM-PRC-001	Author: M. Benmerrouche	Review Frequency: 3 yrs	Rev. 1
Title: <b>Beamline QAS (07-BM) Radiation Survey Procedure</b>			Effective Date: 08AUG2017

**9. Monochromatic Beam Survey: FE slits fully open, FE shutters open, FOE PSH open, PCM, DCM and PFM in their nominal positions. Open X-Y slits and retract FS out of the beam. Set BS1 inside 07-BM-B enclosure in open position. Keep monochromatic beam energy set in previous step to about 25 keV and use PFM to bring the mono beam into the 07-BM-C enclosure.**

<b>Component:</b>	FE Slits	PCM	FE FS	FE Shutter	X-Y Slits	DCM	FS	PFM	FS	FOE PSH
<b>Position:</b>	Fully Open	In	Out	Open	Out	In	Out	In	Out	Open



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**Straight Section Vacuum Conditions:** \_\_\_\_\_

**Angle of Mirror PCM** \_\_\_\_\_

**Angle of DCM** \_\_\_\_\_ / \_\_\_\_\_ **Mono Beam Energies** \_\_\_\_\_ / \_\_\_\_\_

**Angle of Mirror PFM** \_\_\_\_\_

**9.1 Insert a standard scatter target (e.g.: few mm thick Al) at sample position. Survey all walls and roof of 07-BM-C enclosure.**

**1. Set monochromatic beam energy around 25 keV.**

**Direct Frisk Survey Results:**  IFB  other (described below)

**2. Set monochromatic beam energy around 10 keV.**

**Direct Frisk Survey Results:**  IFB  other (described below)

**9.2 Remove scatter target so mono beam can strike the beam stop BS2 (to minimize attenuation/scatter by air, install a helium flight path tube if required). Survey all walls and roof of 07-BM-C enclosure.**

**1. Set monochromatic beam energy around 10 keV.**

**Direct Frisk Survey Results:**  IFB  other (described below)

**2. Set monochromatic beam energy around 25 keV.**

**Direct Frisk Survey Results:**  IFB  other (described below)

**Additional information/comments:**

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**Signature (ESH)** \_\_\_\_\_ **Signature (Beamline)** \_\_\_\_\_

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**Integrated Survey Results:**

\*Integrated readings are performed for the duration of the survey.

1) Neutron

a) Meter location: \_\_\_\_\_

- Survey duration: \_\_\_\_\_
- Result: \_\_\_\_\_
- Dose rate: \_\_\_\_\_

b) Meter location: \_\_\_\_\_

- Survey duration: \_\_\_\_\_
- Result: \_\_\_\_\_
- Dose rate: \_\_\_\_\_

c) Meter location: \_\_\_\_\_

- Survey duration: \_\_\_\_\_
- Result: \_\_\_\_\_
- Dose rate: \_\_\_\_\_

2) Gamma

a) Meter location: \_\_\_\_\_

- Survey duration: \_\_\_\_\_
- Result: \_\_\_\_\_
- Exposure rate: \_\_\_\_\_

b) Meter location: \_\_\_\_\_

- Survey duration: \_\_\_\_\_
- Result: \_\_\_\_\_
- Exposure rate: \_\_\_\_\_

c) Meter location: \_\_\_\_\_

- Survey duration: \_\_\_\_\_
- Result: \_\_\_\_\_
- Exposure rate: \_\_\_\_\_

d) Meter location: \_\_\_\_\_

- Survey Duration: \_\_\_\_\_
- Result: \_\_\_\_\_
- Exposure rate: \_\_\_\_\_



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### Attachment B – Beamline Enclosure Diagram for 07-BM-A, 07-BM-B and 07-BM-C

