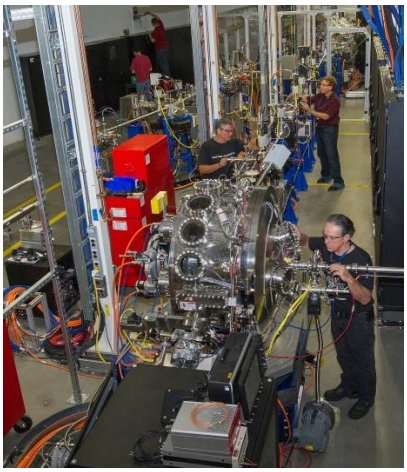
Doc No: NSLSII-6BM-PRC-001

NSLS-II PROCEDURE: BEAMLINE BMM (06-BM) RADIATION SURVEY PROCEDURE

June 28, 2017

Rev. 1

M. Benmerrouche



Think Safety. Act Safely.

National Synchrotron Light Source II, Brookhaven National Laboratory			
Doc No. NSLSII-6BM-PRC-001	Author: M. Benmerrouche	Review Frequency: 3 yrs	Rev. 1
Title: Beamline BMM (06-BM) Radiation Survey Procedure			Effective Date: 28JUN2017

ESH Review:

6/27/2017

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:

6/28/2017

X Bruce Ravel

Bruce Ravel
BMM Lead Beamline Scientist
Signed by: Ravel, Bruce

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

Authorization Basis Review:

6/27/2017

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:

6/28/2017

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.

REVISION HISTORY

REVISION	SECTION(S)	PAGE	DATE	List of Reviewers	DESCRIPTION
1	All	All	28Jun2017	S. Chitra J. Jordan-Sweet B. Lein H. Robinson 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	mrem/hr	millirem per hour
BM	Bending Magnet	NSLS-II	National Synchrotron Light Source II
BMM	Beamline for Materials Measurement	PSD	Photon Science Division
BTS	Booster to Storage Ring	PSH	Photon Shutter
DCM	Double Crystal Monochromator	RCT	Radiological Control Technician
DM	Diagnostic Module	RSC	Radiation Safety Components
ESH	Environment, Safety and Health	RSL	Radiation Safety Limit
FE	Front End	SAF	Safety Approval Form
FOE	First Optical Enclosure	SBMS	Standards-Based Management System
FS	Fluorescent Screen	SR	Synchrotron Radiation
GB	Gas Bremsstrahlung	XAS	X-ray Absorption Spectroscopy
IFB	Indistinguishable From Background	XRD	X-ray Diffraction
LOTO	Lockout/Tagout		

1 PURPOSE AND SCOPE

This purpose of this procedure is to perform a comprehensive commissioning radiation survey on the 06-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 BMM (06-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 closed.

2.5 FE slits 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 fully open.

2.7 All mirrors and filters 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.

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 BMM (06-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.

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 BMM (06-BM, 3PW) Comprehensive Commissioning Radiation Survey*

Attachment B, *Beamline Enclosure Diagram, 06-BM-A and 06-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.

Attachment A
Beamline BMM (06-BM, 3PW)
Comprehensive Commissioning Radiation Survey

Date: _____

The following scenarios are covered:

I. **GB/SR Radiation Survey**

a. Integrity of the FOE (06-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 06-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 06-BM-B enclosure 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.6
2. Step II.9.1

Initial Settings:

Electron Beam Current: _____

Injection Rate: _____ BTS Injection Efficiency: _____

Straight Section Vacuum Condition: _____

Mirror M1 setting: _____

DCM Settings: _____

Mirror M2 setting: _____

Mirror M3 setting: _____

Set up neutron detectors at:

1. Outside the FOE in the vicinity of Secondary Bremsstrahlung shield 1, outboard.
2. Outside the FOE in the vicinity of the Bremsstrahlung Stop, outboard.

Background Radiation Levels:
Gamma Dose Rate/Count Rate: _____ / _____
Neutron Dose Rate: _____

Survey start date and time: _____

Authorized Beamline Staff & RCTs:

_____
_____
_____

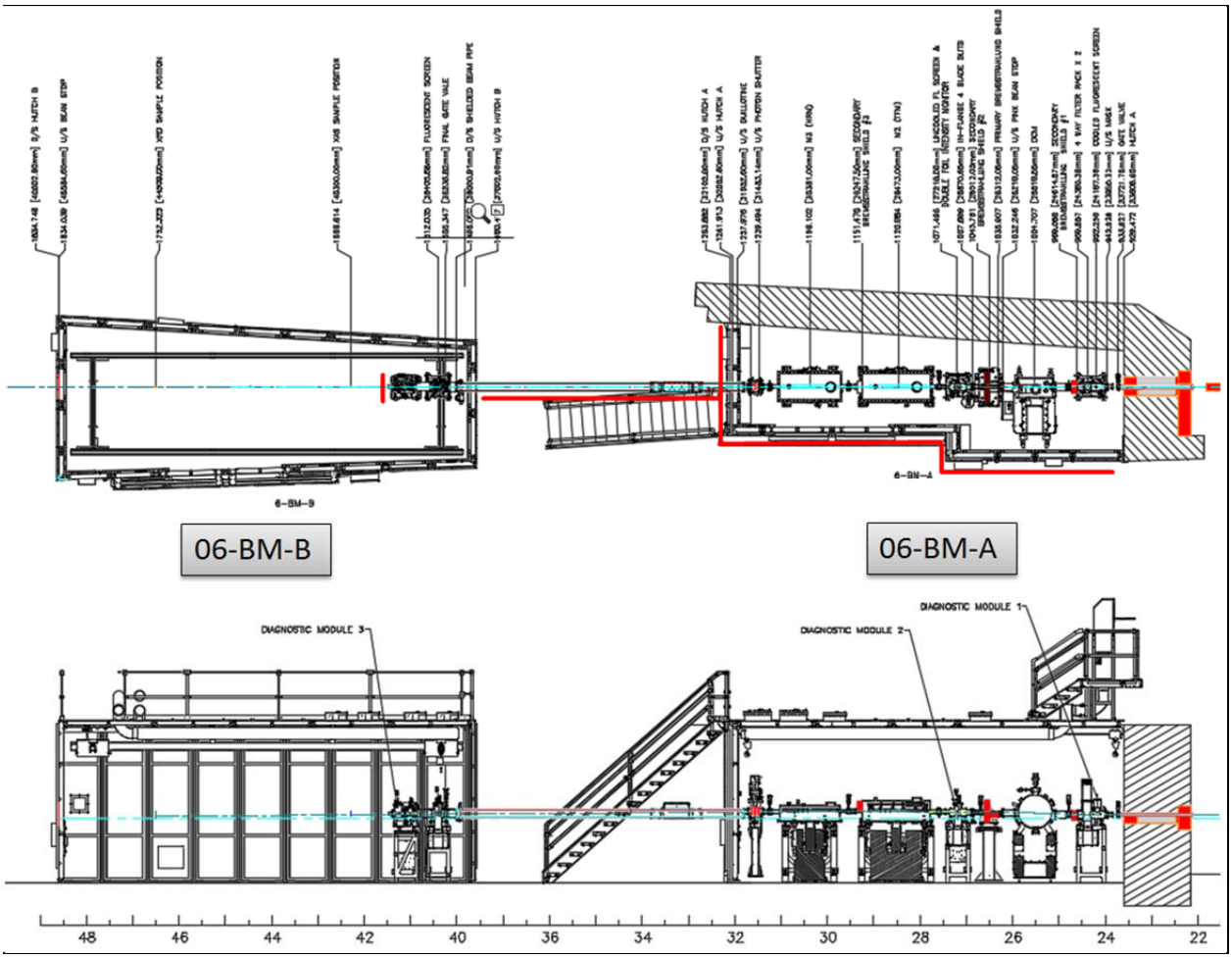
Additional information: _____

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

I. GB/SR Radiation Survey

1. **GB/SR radiation survey: FE slits fully open, FE shutters open, FOE PSH closed, M1, DCM, M2, M3, screens, filters and slits out of the beam.** Survey all walls and roof of 06-BM-A, the area around the transport pipe as well as at the exit of mono beam transport pipe inside the 06-BM-B enclosure to verify the integrity of FOE PSH.

Component:	FE Slits	M1	FE Shutter	FS	Filters	DCM	DCM Slits	M2	M3	FOE PSH
Position:	Fully Open	Out	Open	Out	Out	Out	Fully Open	Out	Out	Closed



Straight Section Vacuum Conditions: _____

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)***_____

2. **Insert M1 in its nominal position (typically 3.5 mrad).** Survey all walls and roof of 06-BM-A, the area around the transport pipe as well as at the exit of mono beam transport pipe inside the 06-BM-B enclosure to verify the integrity of FOE PSH.

Component:	FE Slits	M1	FE Shutter	FS	Filters	DCM	DCM Slits	M2	M3	FOE PSH
Position:	Fully Open	In Nominal Position	Open	Out	Out	Out	Fully Open	Out	Out	Closed

Straight Section Vacuum Conditions: _____

Angle of Mirror M1 _____

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)***_____

3. Configure Fluorescence Screen (FS) and Filters Copper Holder of DM1as scatter targets.

Straight Section Vacuum Conditions: _____

Angle of Mirror M1 _____

3.1 Insert Fluorescence Screen (FS). Survey the walls and roof of 06-BM-A in the vicinity of the DM1.

Component:	FE Slits	M1	FE Shutter	FS	Filters	DCM	DCM Slits	M2	M3	FOE PSH
Position:	Fully Open	In Nominal Position	Open	In	Out	Out	Fully Open	Out	Out	Closed

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

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

3.2 Retract FS and insert Filters Copper Holder (use the thick copper between the filters). Survey the walls and roof of 06-BM-A in the vicinity of DM1.

Component:	FE Slits	M1	FE Shutter	FS	Filters	DCM	DCM Slits	M2	M3	FOE PSH
Position:	Fully Open	In Nominal Position	Open	Out	In	Out	Fully Open	Out	Out	Closed

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)***_____

4. Retract FS and Filters of DM1. Set the DCM to its nominal position. Fully close the slits in DM2.

Component:	FE Slits	M1	FE Shutter	FS	Filters	DCM	DCM Slits	M2	M3	FOE PSH
Position:	Fully Open	In Nominal Position	Open	Out	Out	In Nominal Position	Fully Closed	Out	Out	Closed

Straight Section Vacuum Conditions: _____

Angle of Mirror M1 _____ ***Angle of DCM*** _____/_____

Angle of Mirror M2 _____ ***Angle of Mirror M3***_____

Monochromatic Beam Energies _____/_____

4.1 Set monochromatic beam energy around 10 keV. Survey all walls and roof of 06-BM-A, the area around the transport pipe as well as at the exit of mono beam transport pipe inside the 06-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 20 keV. Survey all walls and roof of 06-BM-A, the area around the transport pipe as well as at the exit of mono beam transport pipe inside the 06-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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Signature (ESH) _____ ***Signature (Beamline)***_____

5. Fully open slits in DM2. Insert M2 into the beam at its nominal position.

Component:	FE Slits	M1	FE Shutter	FS	Filters	DCM	DCM Slits	M2	M3	FOE PSH
Position:	Fully Open	In Nominal Position	Open	Out	Out	In Nominal Position	Fully Open	In Nominal Position	Out	Closed

Straight Section Vacuum Conditions: _____

Angle of Mirror M1 _____ ***Angle of DCM*** _____/_____

Angle of Mirror M2 _____ ***Angle of Mirror M3***_____

Monochromatic Beam Energies _____/_____

5.1 Set monochromatic beam energy around 10 keV. Survey all walls and roof of 06-BM-A, the area around the transport pipe as well as at the exit of mono beam transport pipe inside the 06-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 20 keV. Survey all walls and roof of 06-BM-A, the area around the transport pipe as well as at the exit of mono beam transport pipe inside the 06-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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Signature (ESH) _____ ***Signature (Beamline)***_____

6. Retract M2 and insert M3 into the beam at its nominal position.

Component:	FE Slits	M1	FE Shutter	FS	Filters	DCM	DCM Slits	M2	M3	FOE PSH
Position:	Fully Open	In Nominal Position	Open	Out	Out	In Nominal Position	Fully Open	Out	In Nominal Position	Closed

Straight Section Vacuum Conditions: _____

Angle of Mirror M1 _____ ***Angle of DCM*** _____/_____

Angle of Mirror M2 _____ ***Angle of Mirror M3***_____

Monochromatic Beam Energies _____/_____

6.1 Set monochromatic beam energy around 10 keV. Survey all walls and roof of 06-BM-A, the area around the transport pipe as well as at the exit of mono beam transport pipe inside the 06-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)

6.2 Set monochromatic beam energy around 20 keV. Survey all walls and roof of 06-BM-A, the area around the transport pipe as well as at the exit of mono beam transport pipe inside the 06-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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Signature (ESH) _____ ***Signature (Beamline)***_____

7. Open FOE PSH.

Component:	FE Slits	M1	FE Shutter	FS	Filters	DCM	DCM Slits	M2	M3	FOE PSH
Position:	Fully Open	In Nominal Position	Open	Out	Out	In Nominal Position	Fully Open	Out	Out	Open

Straight Section Vacuum Conditions: _____

Angle of Mirror M1 _____ ***Angle of DCM*** _____/_____

Angle of Mirror M2 _____ ***Angle of Mirror M3***_____

Monochromatic Beam Energies _____/_____

7.1 Insert M2 into the beam at its nominal position. Set monochromatic beam energy around 10 keV, and 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)

7.2 Retract M2 and insert M3 into the beam at its nominal position. Set monochromatic beam energy around 10 keV, and 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)

7.3 Retract M3 and insert M2 into the beam at its nominal position. Set monochromatic beam energy around 20 keV, and 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)

7.4 Retract M2 and insert M3 into the beam at its nominal position. Set monochromatic beam energy around 20 keV, and 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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Signature (ESH) _____ ***Signature (Beamline)***_____

8. Retract M2 and M3.

Component:	FE Slits	M1	FE Shutter	FS	Filters	DCM	DCM Slits	M2	M3	FOE PSH
Position:	Fully Open	In Nominal Position	Open	Out	Out	In Nominal Position	Fully Open	Out	Out	Open

Straight Section Vacuum Conditions: _____

Angle of Mirror M1 _____ ***Angle of DCM*** _____/_____

Angle of Mirror M2 _____ ***Angle of Mirror M3***_____

Monochromatic Beam Energies _____/_____

8.1 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)

8.2 Set monochromatic beam energy around 10 keV and use M3 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)

8.3 Set monochromatic beam energy around 20 keV and use M3 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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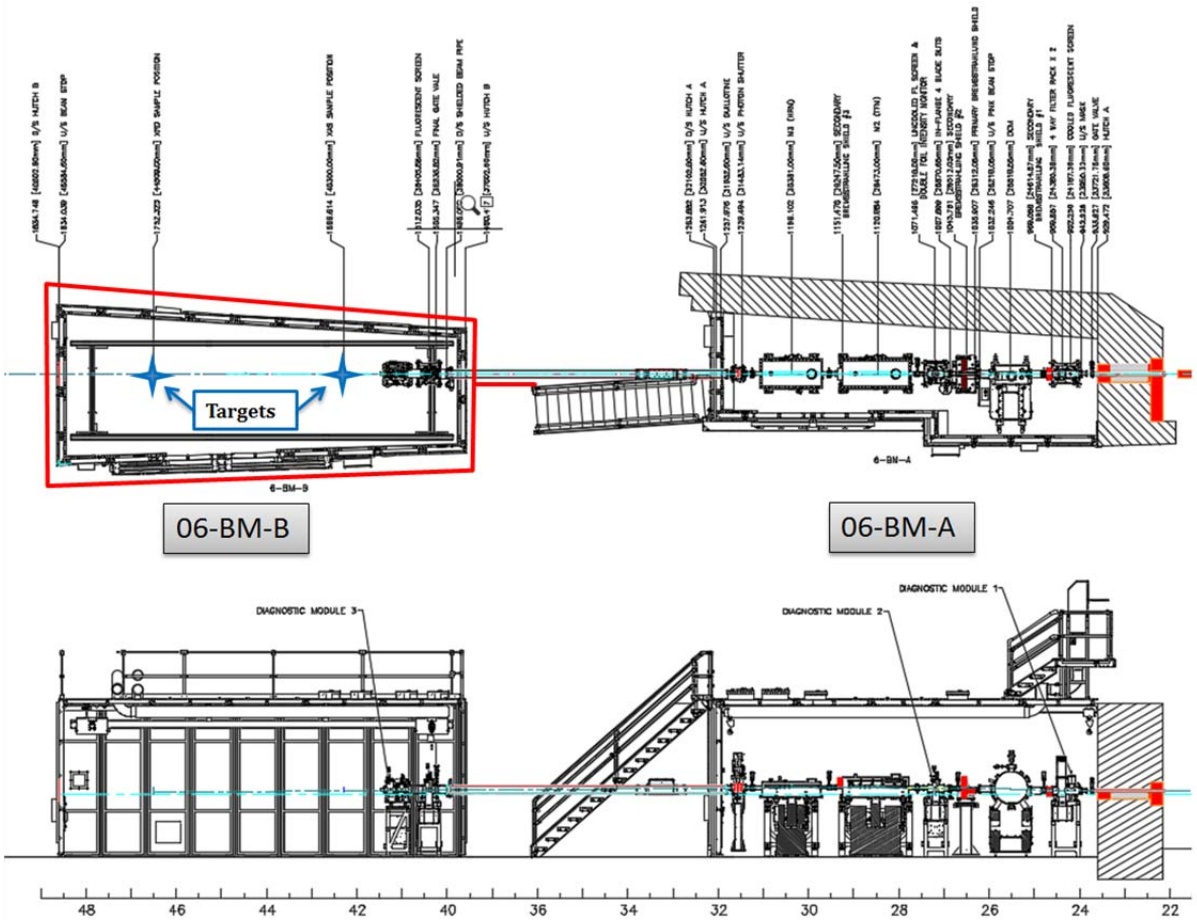
Signature (ESH) _____ ***Signature (Beamline)***_____

II. Monochromatic Beam Radiation Survey

9. Monochromatic beam survey: FE slits fully open, FE shutters open, FOE PSH open, M1, DCM and M3 in their nominal positions. Retract FS and Filters in DM1 out of the beam and open the slits in DM2. Set monochromatic beam energy to about 10 keV and use M3 to bring the mono beam into the 06-BM-B enclosure.

Component:	FE Slits	M1	FE Shutter	FS	Filters	DCM	DCM Slits	M2	M3	FOE PSH
Position:	Fully Open	In Nominal Position	Open	Out	Out	In Nominal Position	Fully Open	Out	In Nominal Position	Open



Straight Section Vacuum Conditions: _____

Angle of Mirror M1 _____ ***Angle of DCM*** _____/_____

Angle of Mirror M2 _____ ***Angle of Mirror M3***_____

Monochromatic beam Energies _____/_____

9.1 Insert the slits in DM3. Survey all walls and roof of 06-BM-B and the area around the transport pipe in the vicinity of DM2.

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

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

2. **Set monochromatic beam energy around 20 keV.**

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

9.2 Retract slits in DM3 and insert a standard aluminum target (few mm thick) at sample position for XAS. Survey all walls and roof of 06-BM-B enclosure.

1. **Set monochromatic beam energy around 20 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)

9.3 Retract slits in DM3, remove XAS target, and install a helium flight path tube. Insert a standard aluminum target (few mm thick) at sample position for XRD. Survey all walls and roof of 06-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 20 keV.**

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

9.4 Retract slits in DM3 and remove all targets so mono beam can strike the 06-BM-B beam stop. Install a helium flight path tube. Survey walls and roof in the vicinity of the of 06-BM-B beam stop.

1. **Set monochromatic beam energy around 20 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)

Additional information/comments:

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Signature (ESH) _____ ***Signature (Beamline)***_____

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: _____

Additional Information/Comments:

_____

_____

_____

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_____

Instrument Information:

Model Number	Serial Number	Calibration Due Date	Source Checked? (Y/N)

RCT Signature(s): _____

Date: _____

FS Rep Signature: _____

Date: _____

National Synchrotron Light Source II, Brookhaven National Laboratory			
Doc No. NSLSII-6BM-PRC-001	Author: M. Benmerrouche	Review Frequency: 3 yrs	Rev. 1
Title: Beamline BMM (06-BM) Radiation Survey Procedure		Effective Date: 28JUN2017	

Attachment B – Beamline Enclosure Diagram for 06-BM-A and 06-BM-B