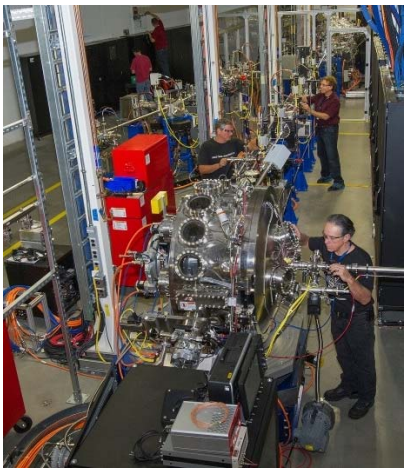
Doc No: NSLSII-21ID-PRC-001

NSLS-II PROCEDURE: BEAMLINE ESM (21-ID) RADIATION SURVEY PROCEDURE

May 12, 2017

Rev. 3

S. Chitra & M. Benmerrouche



Think Safety. Act Safely.

National Synchrotron Light Source II, Brookhaven National Laboratory			
Doc No. NSLSII-21ID-PRC-001	Author: S. Chitra & M. Benmerrouche	Review Frequency: 3 yrs	Rev. 3
Title: Beamline ESM (21-ID) Radiation Survey Procedure			Effective Date: 12MAY2017

ESH Review:

5/17/2017

X John Aloi

John Aloi
Facility Support Representative
Signed by: Aloi Jr, John

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:

5/19/2017

X Elio Vescovo

Elio Vescovo
EMS Lead Beamline Scientist
Signed by: Vescovo, Elio

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

Authorization Basis Review:

5/17/2017

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:

5/17/2017

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	17JUN2016	See cover page	First Issue
2	NA	NA	30JUN2016	See cover page	Removed "B is reflected down to the FOE photon shutter" from scenario 1.
3	All	All	12May2017	See signature page and K. Wehunt, RSC Committee	Procedure number changed from PS-C-XFD-PRC-063 and reformatted in accordance with NSLSII-DPT-PDN-001, *Management of NSLS-II Documents.* Updates throughout to make applicable for new EPU105 at 21-ID Beamline.

ACRONYMS

ARPES	Angle Resolved Photoemission Spectroscopy
BTS	Booster to Storage Ring
ESH	Environment, Safety and Health
ESM	Electron Spectro Microscopy
FE	Front End
FOE	First Optical Enclosure
GB	Gas Bremsstrahlung
ID	Insertion Device
IFB	Indistinguishable From Background
EPU105	Elliptical Polarized Undulator, 105mm period
LOTO	Lockout/Tagout
mrem/hr	Millirem per hour
NSLS-II	National Synchrotron Light Source II
PBBS	Pink Beam Baffle Slit
PBM	Pink Beam Mask
PEEMS	Photo Electron Emission Microscopy
PGM	Plane Grating Monochromator
PRBC	Primary Bremsstrahlung Collimator
PRBS	Primary Bremsstrahlung Stop
PSD	Photon Science Division
PSH	Photon Shutter
RCT	Radiological Control Technician
RSC	Radiation Safety Components
RSL	Radiation Safety Limit
SAF	Safety Approval Form
SBMS	Standards-Based Management System
SGBC	Secondary Gas Bremsstrahlung Collimator
SR	Synchrotron Radiation
WBM	White Beam Mask
WBS	White Beam Stop

1 PURPOSE AND SCOPE

This purpose of this procedure is to perform a comprehensive commissioning radiation survey on the 21-ID beamline, as directed by PS-C-XFD-PRC-004, *NSLS-II Beamlines Radiation Safety Commissioning Plan.*

The survey scenarios are covered in the *Beamline ESM (21-ID, EPU105) 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 ID gap closed to minimum permitted setting.

2.7 All beamline slits fully open.

2.8 All mirrors 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 ESM (21-ID, EPU105) 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 ESM (21-ID, EPU105) Comprehensive Commissioning Radiation Survey*

Attachment B, *21-ID Beamline Components Diagram*

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 ESM (21-ID, EPU105)

Comprehensive Commissioning Radiation Survey

Date: _____

The following scenarios are covered:

I. **GB Radiation Survey**

II. **White and Pink Beam radiation Survey**

III. **Radiation Survey covering non-standard settings**

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: ID Gap, FE Slits, Electron Beam Current

Initial Settings:

ID gap: _____ Electron Beam Current: _____

Injection Rate: _____ BTS Injection Efficiency: _____

Straight Section Vacuum Condition: _____

Mirror M1 setting: _____ Mirror M2 setting: _____

Grating setting: _____

Mirror M3 setting: _____

Set up neutron detectors:

1. Outside the FOE, in the vicinity of the white beam stop, slightly ahead of the WBM, outboard.
2. Outside the FOE, downstream wall edge of guillotine inboard, close to the beam pipe.

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

Survey start date and time: _____

Authorized Beamline Staff & RCTs:

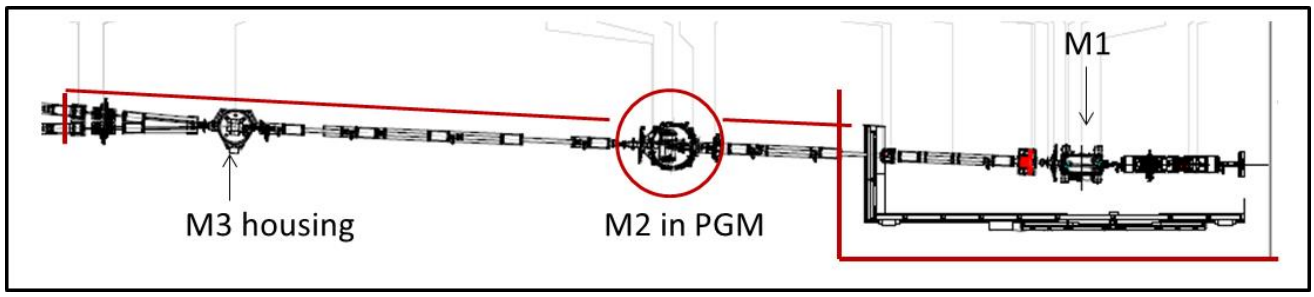
_____
_____
_____

Additional information: _____

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

I: GB Radiation Survey

1. **GB radiation survey to check integrity of FOE: Gap open, FE shutter open, FOE shutter closed, white beam mirror M1 in 2 positions (in and out), nominal angle (1.2deg).** Survey all walls and roof of 21-ID-A.



Straight Section Vacuum Conditions: _____
ID Gap: _____

FOE Shutter (open/closed)_____
Angle of mirror M1 _____

1. **Mirror M1 out of the beam to maximize GB on WBS.** Survey all walls and roof of the FOE.

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

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

2. **Bring mirror M1 into the beam. Set mirror M1 in its nominal position (typically 1.2 deg).** Survey all walls and roof of the FOE.

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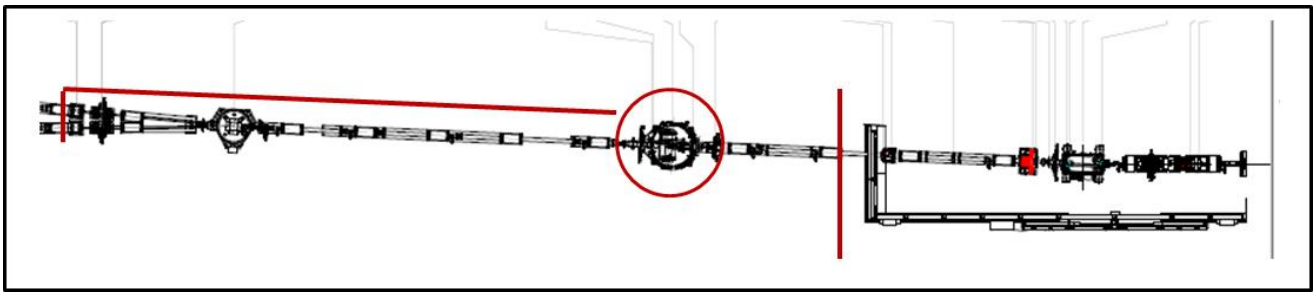
Signature (ESH) _____ ***Signature (Beamline)***_____

2. GB radiation survey to check integrity of beam transport pipe, PGM housing and secondary beamstop: Conditions are the same as case 1, except that the FOE shutter is open; Mirror M2 is at minimum angle (2.2 degrees) to the beam.



Straight Section Vacuum Conditions: _____
ID Gap: _____

Angle of mirror M1 _____ **Angle of mirror M2** _____
FOE Shutter (open/closed) _____

1. **Mirror M1 out of the beam to maximize GB on WBS.** Survey the transport pipe, PGM housing and the transport pipe downstream of the PGM housing up to photon shutter-A and photon shutter-P.

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

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

2. **Bring mirror M1 into the beam. Set mirror M1 in its nominal position (typically 1.2 deg)** Survey the transport pipe, PGM housing and the transport pipe downstream of the PGM housing up to photon shutter-A and photon shutter-P.

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

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

Additional information/comments:

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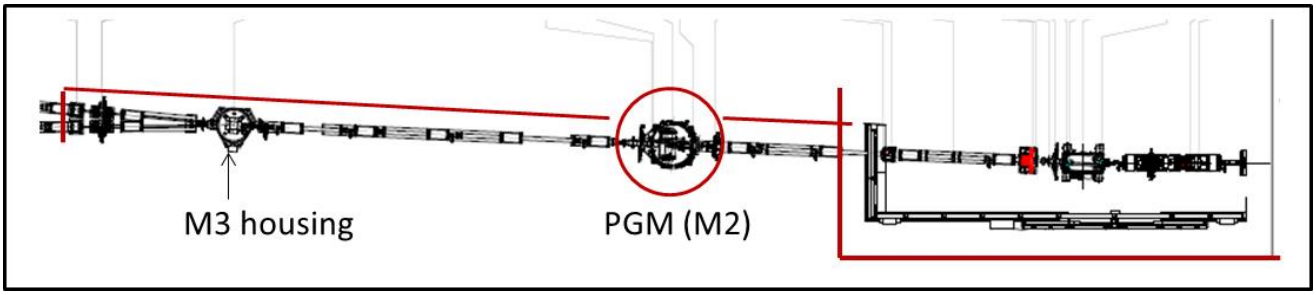
Signature (ESH) _____ ***Signature (Beamline)***_____

II: White and Pink Beam Survey

3a. White beam survey: EPU105 gap fully closed, FE shutter open, FOE shutter closed, white beam mirror M1 in nominal position (1.25 deg), so the pink beam is reflected to the FOE photon shutter.



Straight Section Vacuum Conditions: _____
ID Gap: _____

Angle of mirror M1 _____

1. Survey all walls and roof of 21-ID.

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

Additional information/comments:

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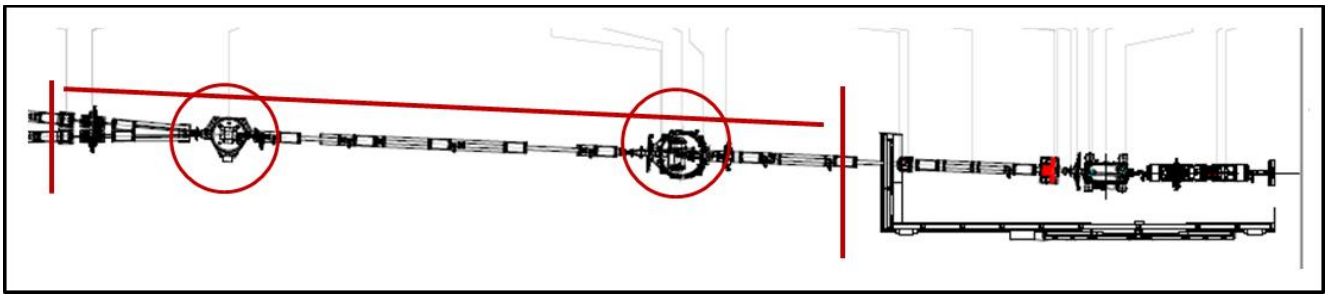
Signature (ESH) _____ ***Signature (Beamline)***_____

3b. Pink/synchrotron beam survey: Same conditions as case 3a, except FOE Shutter open, and Mirror M2 and one of the gratings is in the nominal position. Mirrors M3-A and M3-P out of the beam.



Straight Section Vacuum Conditions: _____
ID Gap: _____

Angle of mirror M1 _____ **Angle of mirror M2** _____

Angle of grating _____

Position of mirror M3-A_____ **Position of mirror M3-P**_____

1. Survey downstream wall of 21-ID-A, the transport pipe to PGM housing, the PGM housing, M3 housing and the transport pipe up to photon shutter-A and photon shutter-P.

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

Additional information/comments:

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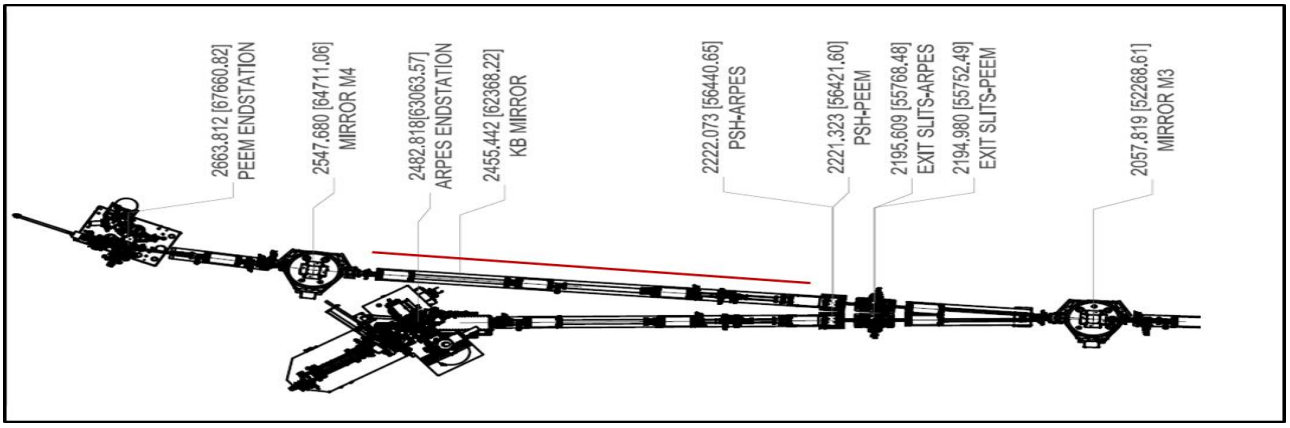
Signature (ESH) _____ ***Signature (Beamline)***_____

4a. Same settings as case 3b. Mirror M3-P in nominal position, toward photon shutter-P. Open photon shutter-P.



Straight Section Vacuum Conditions: _____

ID Gap: _____

Angle of mirror M1 _____ **Angle of mirror M2** _____

Angle of grating_____ **Angle of mirror M3-P** _____

1. Survey the transport pipe downstream of photon shutter-A up to and around the PEEM end station.

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

Additional information/comments:

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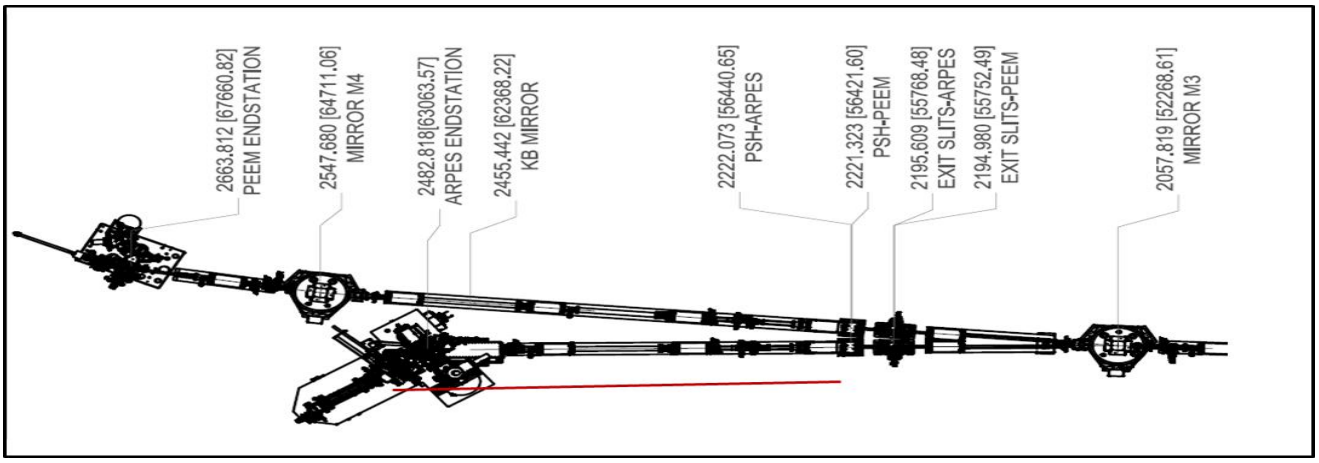
Signature (ESH) _____ ***Signature (Beamline)***_____

4b. Same settings as case 3b. Close photon shutter-P. Open photon shutter-A.



1. Survey the transport pipe downstream of photon shutter-A, up to and around the ARPES end station.

   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)***_____

National Synchrotron Light Source II, Brookhaven National Laboratory			
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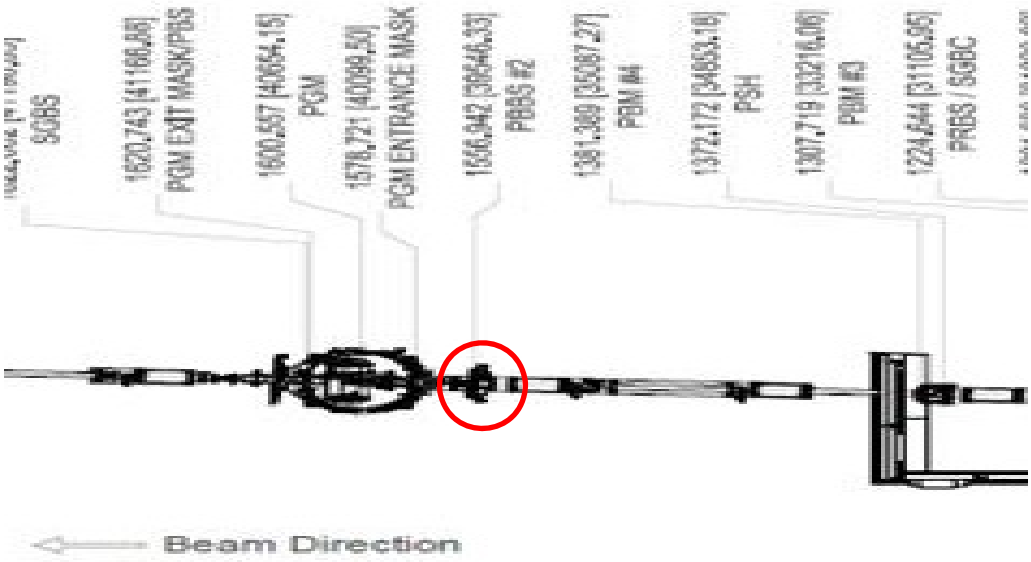
III: Radiation Survey covering non-standard settings

5. GM upstream baffle slits survey: M1 in the nominal position and FOE shutter open, bring one of the PGM upstream baffle slits in, completely blocking the beam path.



Straight Section Vacuum Conditions: _____

ID Gap: _____

Angle of mirror M1 _____ **Angle of mirror M2** _____

Angle of grating _____ **Angle of mirror M3-P** _____

1. Measure the dose rates outside the slits chamber, and at the joint of the beam pipe with the slits chamber, with EPU gap fully open.
   Direct Frisk Survey Results: ☐IFB ☐other (described below)
   Dose Rate Survey Results: ☐IFB ☐other (described below)
2. Measure the dose rates outside the slits chamber, and at the joint of the beam pipe with the slits chamber, with EPU gap fully closed.
   Direct Frisk Survey Results: ☐IFB ☐other (described below)
   Dose Rate Survey Results: ☐IFB ☐other (described below)

Additional information/comments:

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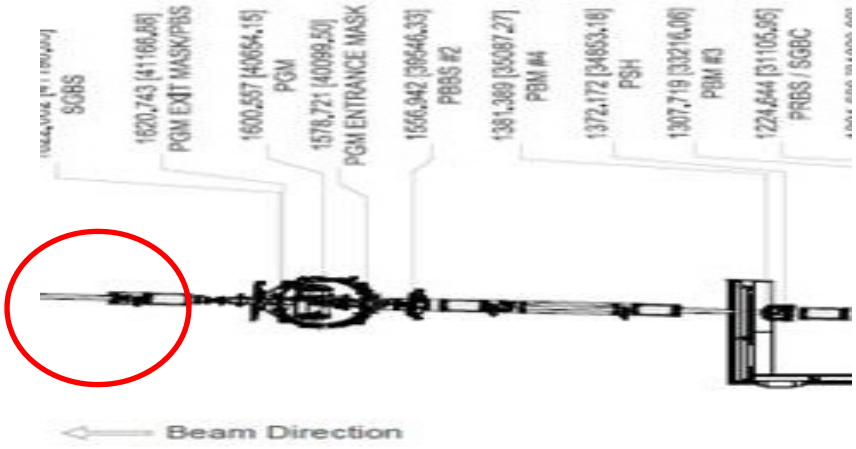
Signature (ESH) _____ ***Signature (Beamline)***_____

6. **PGM enclosure when gratings are removed**: **M1 in the nominal position and FOE shutter open, let the synchrotron beam on M2 closing the EPU105 gap to its minimum. Move the grating out of the beam. Rotate the mirror through 2, 4 and 6 degrees and direct frisk outside the PGM chamber downstream.**



Straight Section Vacuum Conditions: _____
ID Gap: _____

Angle of mirror M1 _____ **Angle of mirror M2** _____

Angle of grating _____ **Angle of mirror M3-P** _____

1. **Angle of M2: 2 degrees**

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

2. **Angle of M2: 4 degrees**

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

3. **Angle of M2: 6 degrees**

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

Additional information/comments:

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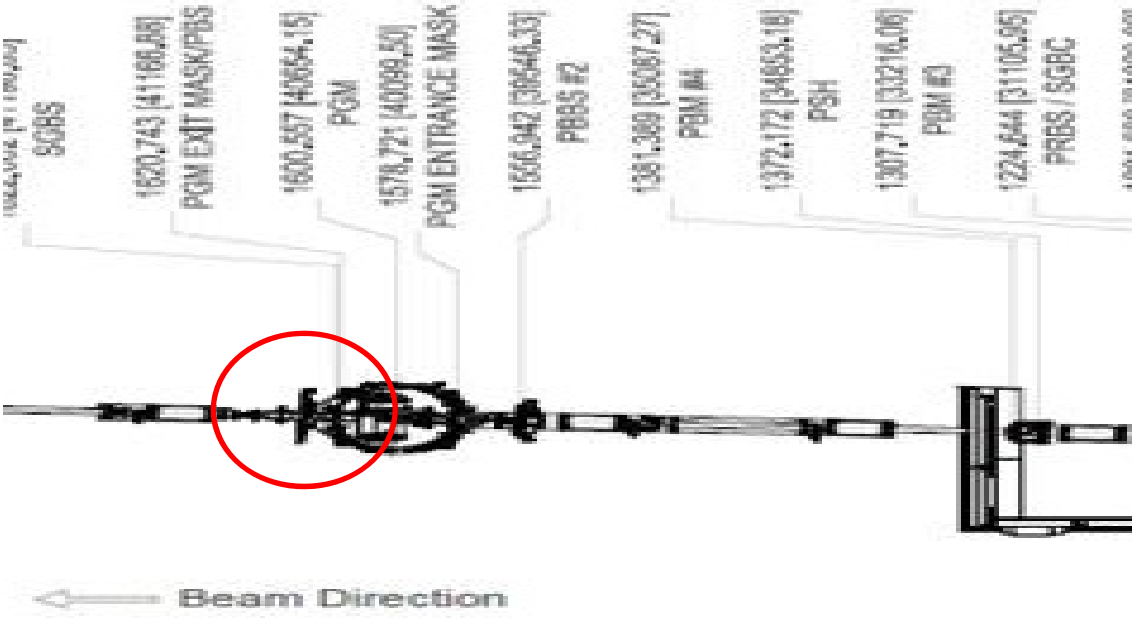
Signature (ESH) _____ ***Signature (Beamline)*** _____

7. Integrity of transport pipe while PGM downstream baffle slits block the pink beam. With M1 in the nominal position and FOE shutter open, let the synchrotron beam on M2 at 2.2 degrees and the grating in zero order position. Close the EPU105 gap to its minimum. Insert baffle slit downstream of the PGM.



ID Gap:_____
Radiation Survey Results_____
Additional information/comments:

Angle of mirror M1 _____ Angle of mirror M2 _____

Angle of grating _____

1. Direct frisk outside the PGM slit chamber downstream.

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

Additional information/comments:

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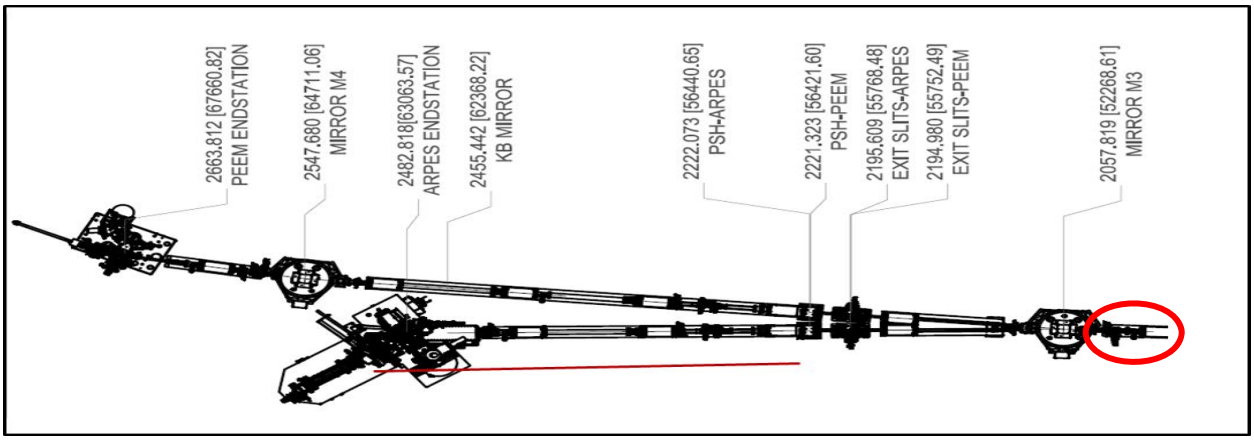
Signature (ESH) _____ Signature (Beamline) _____

8. Integrity of the transport pipe while M3 upstream baffle slit blocks the pink beam. M1 in nominal position and FOE shutter open, let the synchrotron beam incident on M2 at 2.2 degrees and the grating in the zero order position. Close the EPU gap to its minimum. Insert the baffle slit upstream of M3.



Angle of mirror M1 _____ Angle of mirror M2 _____

Angle of grating _____

1. Measure the dose rate at the M3 upstream slit chamber.

   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			
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Attachment B – 21-ID Beamline Components Diagram