



# Memo

Date: May 22, 2017  
To: Elio Vescovo, Steven Hulbert, and Paul Zschack  
From: Zhong Zhong (chair), Photon Science Radiation Safety Committee  
Subject: Review of the radiation safety impact of the new EPU105 on the ESM beamline

Dear Elio, Steve, and Paul

The Photon Science Radiation Safety Committee (RSC) reviewed the impact on the ESM beamline of the recently-installed EPU105 on Wednesday May 10. Subjects reviewed include the revised ray-tracing, updated secondary Bremsstrahlung and synchrotron radiation shielding analysis, and recent addition of hard-stops on the PGM.

## Written documents

The following documents and drawings were reviewed:

1. NSLS-II-21ID-PRC-001, "NSLS-II Procedure: Beamline ESM (21-ID) Radiation Survey Procedure", Rev. 3, by S. Chitra.
2. Configuration control checklist for 21-ID
3. Power point presentation "ESM Beamline: Radiation Safety Revision", by Elio Vescovo dated May 10, 2017.
4. NSLS-II technical note by S. Chitra and M. Benmerrouche entitled "21-ID ESM Beamline Radiation Shielding Analysis - Addendum" dated May 4, 2017. The document presents analysis results of Gas Bremsstrahlung (GB) as well as Synchrotron Radiation (SR) at 500 mA .

## Oral Presentation

Attendance: Andrew Ackerman, Mo Benmerrouche, Andi Barbour, Edward Cheswick, Sunil Chitra, Ray Fliller, Robert Lee, Boris Podobedov, Howard Robinson, Chuck Schaefer, Lutz Wiegart, Joseph Woicik, Emil Zitvogel, Yi Zhu, and Zhong Zhong

A new undulator EPU105 was recently installed to provide more photon flux. Our review last year actually covered EPU105 in terms of power/heatload and in terms of radiation shielding. Nevertheless, the undulator is a new, significant modification to the beamline. Elio Vescovo consulted with the RSC chair and it was determined that the RSC would review the addition of EPU105.

Elio gave the presentation entitled “ESM Beamline: Radiation Safety Revision “. Following the guideline from the memo by Paul Zschack to the RSC on May 29, 2014, the following were discussed:

1. ESM is a soft x-ray spectroscopy beamlines that operates from 15 to 1500 eV with flux on the sample in the  $10^{10}$  to  $10^{12}$  ph/s range. The beamline serves two endstations, ARPES and XPEEM, which along with the planar grating monochromator (PGM) are on the experimental floor. The sources, un-canted, are EPU57 and EPU105.
2. The RSC reviewed 21-ID (ESM) beamline about a year ago and it has been in safe operation with EPU57. Results of surveys during the past year, while EPU57 was used, validate prior shielding calculations.
3. Simulation of scattered radiation, from GB and pink EPU105 synchrotron beam, by the PGM baffle slits was presented.
4. Elio discussed the addition of hard-stops to limit the angular range of the PGM, thus allowing safe operation of the PGM even when the gratings are absent.
5. Simulation results for the dose of monochromatic beam through the wave-front analyzer was presented.
6. Configuration control of the radiation safety component was discussed.

Peet’s coffee was dutifully served and enjoyed by many.

## Notes

The following comments are noted for completeness:

1. The two undulators will not be used at the same time. However, this is an EPS (Equipment Protection System) issue, not a radiation safety issue.
2. Andi Barbour and Mo Benmerrouche reviewed the ESM configuration control checklist, and conduct a walk-through of the ESM beamline.

## Recommendations

1. Since the bellows are thinner than the beam-pipes, we recommend that additional simulations be performed for the bellows located downstream and upstream of the pink beam baffle slits, for the case of the pink beam from EPU105 striking the slits.
2. We recommend that the consideration of mirror-roughness be removed from the addendum report. The reason for this recommendation is that consideration of roughness, though more realistic, may not be conservative. Also, the shielding is sufficient, at 30 cm, without consideration of roughness.

We note that Sunil Chitra completed the above two recommendations on May 17. The updated results conform to the NSLS-II shielding policy.

## Conclusions

1. The hard-stops installed on the PGM to limit the angular range allow safe operation of the PGM.
2. Based on our assessment of the simulation results, the RSC find that with the addition of a new EPU105, the ESM beamline shielding design still meets the NSLS-II shielding policy. Subject to experimental verification by radiation survey, we believe the shielding will provide adequate personnel protection for normal operation and against failures of synchrotron orbit.

## **Radiation Safety Committee**

| <i>Name</i>                        | <i>Expertise</i>                      | <i>Directorate</i> |
|------------------------------------|---------------------------------------|--------------------|
| Andrew Ackerman                    | Deputy ESH Manager                    | PS                 |
| Dana Beavis                        | Experimental Nuclear Particle Physics | NPP                |
| Andi Barbour                       | Beam Line Physicist                   | PS                 |
| Mohamed Benmerrouche               | Nuclear and Radiation Physics         | PS                 |
| Scott Buda                         | Personnel Protective Systems          | PS                 |
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| Boris Podobedov                    | Accelerator Physics                   | PS                 |
| Chuck Schaefer                     | Accelerator SME                       | ESH                |
| Om Singh                           | Accelerator Controls                  | PS                 |
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| Zhong Zhong                        | Beam Line Physicist                   | PS                 |
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| Chuck Schaefer                     | Accelerator SME                       | ESH                |
| Christopher Stelmach               | Designer                              | PS                 |
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| Robert Lee                         | ESH manager                           | PS                 |
| Zhong Zhong                        | Beam Line Physicist                   | PS                 |
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| <i>RSC checklist sub-committee</i> |                                       |                    |
| Andi Barbour                       | Beam Line Physicist                   | PS                 |
| Mohamed Benmerrouche               | Nuclear and Radiation Physics         | PS                 |
| Ray Fliller                        | Accelerator Physicist                 | PS                 |