



Memo

Date: November 7, 2016

To: Doug Holmes, Joseph Lidestri, Howard Robinson, Andrew Broadbent, and Paul Zschack

From: Zhong Zhong (chair), Photon Science Radiation Safety Committee

Subject: Review of the radiation safety design of the 17-ID, NYX, beamline

Dear Doug, Joe, Howard, Andy, and Paul,

The Photon Science Radiation Safety Committee (RSC) conducted review of the design of the NYX (NYSBC Microdiffraction) beamline, 19-ID, on Tuesday, November 1, 2016. Subjects reviewed include synchrotron max-fan and Bremsstrahlung drawings, Secondary Bremsstrahlung and synchrotron radiation shielding analysis, top-off safety analysis, and aspects of thermal management that relate to radiation safety.

Written documents

The following documents and drawings were reviewed:

1. NYX assembly drawing, PD-NYX-RAYT-0001 rev. A, by L. Reffi, sheet 1, "NYX Beamline Ray Trace".
2. NYX Bremsstrahlung ray-tracing drawings, PD-NYX-RAYT-0001 rev. A, by L. Reffi, sheets 2 and 3 for horizontal and vertical projections, respectively. Sheet 3 also includes collimator and stop details looking downstream.
3. NYX max. synchrotron ray-tracing drawings, PD-NYX-RAYT-0001 rev. A, sheets 4 and 5 for horizontal and vertical projections, respectively.
4. NSLS II technical note "19-ID NYX beamline radiation shielding analysis" by X. Yang and M. Benmerrouche, dated 10/31/2016.
5. NSLS-II technical note, "19ID (NYX) top-off radiation safety analysis" by M. Benmerrouche, X. Yang, R. Fliller, and Y. Li.
6. Power point presentation "19-ID-NYX Radiation Safety Committee Presentation", by Joseph Lidestri, et al, NYSBC, and Mo Benmerrouche, Xi Yang, NSLS-II, dated November 1, 2016.

Oral Presentation

Attendance: Andrew Ackerman, Mo Benmerrouche, Andrew Broadbent, Edward Cheswick, Mary Carlucci-Dayton, Ray Flller, Douglas Holmes, Howard Robinson, Dan Fischer, Robert Lee, Lutz Wiegart, Xi Yang, Chuck Schaefer, Chris Stelmach, Patrick Sullivan, Emil Zitvogel, and Zhong Zhong

Joe Lidestri gave the presentation entitled “19-ID-NYX Radiation Safety Committee Presentation”. Following the guideline from the memo by Paul Zschack to the RSC on May 29, 2014, the following were discussed:

1. NYX is a partner beamline developed jointly by the NYSBC and the NSLS-II for advanced structural biology studies using x-ray crystallography. The development team includes Wayne Hendrickson, Joe Lidestri, Doug Holmes from Columbia/NYSBC, and Xi Yang, Mo Benmerrouche, Howard Robinson, Andrew Broadbent from the NSLS-II.
2. The x-ray optics includes a novel bent asymmetric crystal to match the divergence of the in-vacuum undulator.
3. The NYX beamline design includes a unique white-beam transport pipe between FOE (A) and the optics hutch (C). The pipe is shielded with 7-mm thick lead. Care was taken to assure sufficient clearance between the shielded beam-pipe and both the synchrotron white beam, and the Bremsstrahlung radiation.
4. The front-end is of the new design with the burn-through device outside of the ratchet-wall collimator. This design has been reviewed by the RSC before along with SST front-end using a similar design concept.
5. The source is an in-vacuum undulator that was previously used at the X25 beamline of the NSLS. This source is canted to allow for a future canted undulator. An asymmetric canting arrangement was noted.
6. Shielding for the primary Bremsstrahlung x-rays is designed using ray-tracing method. Preliminary reviews of the NYX beamline ray-tracing by the RSC occurred in late 2015 and early this year. Reports of both reviews are attached for reference.
7. Shielding and control of secondary Bremsstrahlung radiation is designed by ray-tracing from possible secondary scattering sources in FOE, and verified by FLUKA analysis performed by Yang and Benmerrouche.
8. Shielding of synchrotron x-ray in the transport pipes and experimental enclosures is supported by STAC8 simulations taking into account the output of the x-ray source and throughput of the optics.
9. Thermal protection of the beamline shielding components is designed using ray-tracing method. The design is supported by synchrotron ray-tracing drawings assuming maximum possible synchrotron fan and mirror alignment errors.
10. The heat-load of the IVU (X25 device) is 22.6 kW/mrad^2 , with total power not exceeding 2.5 kW. The NYX white-beam mask is designed assuming 10 kW total power, allowing for future addition of LAX canted undulator, and update of the current X25 undulator to a 7.6-kW SAGU.
11. The PPS logic diagram for the ISR beamline was reviewed separately by the RSC PPS subcommittee.
12. The NYX front-end ray-tracing was previously reviewed by the RSC ray-tracing subcommittee.

Coffee was dutifully served for the occasion.

Recommendations

There are no recommendations from the RSC at this time.

Conclusions

1. Based on our assessment of the ray-tracing drawings, thermal analysis, and simulation results, the RSC find that the NYX beamline shielding design meets the NSLS-II shielding policy. Subject to experimental verification by radiation survey, we believe the installed shielding will provide adequate personnel protection for normal operation and against failures of synchrotron orbit.
2. Based on our review of the and max. synchrotron ray-tracing drawings, the RSC believes that the NYX masks, mirror, white- and pink- beam-stops are adequately designed to protect against thermal failure of shielding components.

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
Mohamed Benmerrouche	Nuclear and Radiation Physics	PS
Scott Buda	Personnel Protective Systems	PS
Ray Filler	Accelerator Physicist	PS
Wah-Keat Lee	Beam Line Physicist	PS
Boris Podobedov	Accelerator Physics	PS
Chuck Schaefer	Accelerator SME	ESH
Om Singh	Accelerator Controls	PS
Lutz Wiegart	Beam Line Physicist	PS
Zhong Zhong	Beam Line Physicist	PS
Emil Zitvogel	Accelerator Operations	PS
Ashley Shoemaker-Skokov	Administrative Support	PS

Ray-tracing sub-committee

Andrew Ackerman	Deputy ESH Manager	PS
Mary Carlucci-Dayton	Mechanical Engineer	PS
Wah-Keat Lee	Beam Line Physicist	PS
Chuck Schaefer	Accelerator SME	ESH
Christopher Stelmach	Designer	PS
Lutz Wiegart	Beam Line Physicist	PS
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PPS sub-committee

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Mohamed Benmerrouche	Nuclear and Radiation Physics	PS
Scott Buda	Personnel Protective Systems	PS
Robert Lee	ESH manager	PS
Zhong Zhong	Beam Line Physicist	PS



Memo

Date: February 16, 2016

To: Doug Holmes, Joseph Lidestri, Howard Robinson, Andrew Broadbent, and Paul Zschack

From: Zhong Zhong (chair), Photon Science Radiation Safety Committee

Subject: Review of the ray-tracing design of the NYX beamline

Dear Doug, Joe, Howard, Andy, and Paul,

Thank you for your prompt response to my memo last month suggesting revisions to the NYX draft ray-tracing. The Photon Science Radiation Safety Committee (RSC)'s ray-tracing subcommittee concluded review of the revised ray-tracing for the NYX beamline.

Subjects reviewed include the synchrotron max-fan and Bremsstrahlung drawings revised by FMB-Oxford.

Written documents

The following documents were submitted to the RSC on February 4, 2015 for review:

1. NYX synchrotron PPS ray-tracing drawings for horizontal and vertical projections, AHB0560 Rev.15, by J. Randall, updated 02/04/2016.
2. NYX Bremsstrahlung ray-tracing drawings, or horizontal and vertical projections, AHB0560 Rev.15, by J. Randall, updated 02/04/2016.

Conclusions

Based on our assessment of the ray-tracing drawings, the RSC finds the updated NYX beamline Bremsstrahlung and synchrotron shielding design meeting the NSLS-II shielding policy.

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Boris Podobedov	Accelerator Physics	PS
Chuck Schaefer	Accelerator SME	ESH
Om Singh	Accelerator Controls	PS
Lutz Wiegart	Beam Line Physicist	PS
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Ray-tracing sub-committee

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Mary Carlucci-Dayton	Mechanical Engineer	PS
Wah-Keat Lee	Beam Line Physicist	PS
Chuck Schaefer	Accelerator SME	ESH
Christopher Stelmach	Designer	PS
Lutz Wiegart	Beam Line Physicist	PS
Zhong Zhong	Beam Line Physicist	PS



Memo

Date: January 19, 2016
To: Doug Holmes, Joseph Lidestri, Howard Robinson, Andrew Broadbent, and Paul Zschack
From: Zhong Zhong (chair), Photon Science Radiation Safety Committee
Subject: Review of the ray-tracing design of the NYX beamline

Dear Doug, Joe, Howard, Andy, and Paul,

The Photon Science Radiation Safety Committee (RSC)'s ray-tracing subcommittee concluded review of the ray-tracing for the NYX beamline.

Subjects reviewed include synchrotron max-fan and Bremsstrahlung drawings. The Secondary Bremsstrahlung and synchrotron radiation shielding analysis and thermal analysis were not reviewed.

Written documents

The following documents were submitted to the RSC on December 23, 2015 for review:

1. NYX synchrotron PPS ray-tracing drawings, AHB0560 Rev.15, by J. Randall, "NYSBC Beamline Raytrace", sheets 3 and 4 for horizontal and vertical projections.
2. NYX Bremsstrahlung ray-tracing drawings, AHB0560 Rev.15, by J. Randall, "NYSBC Beamline Raytrace", sheet 1 for horizontal, and sheet 2 for vertical projections.

Recommendations

1. Proceed to finalize the drawings and procure the shielding components.
2. Coordinate with Mohamed Benmerrouche to perform the shielding analysis validation. This should be performed as soon as possible given concern over the diameter of the white-beam transport pipe.

Conclusions

Based on our assessment of the ray-tracing drawings, the RSC find the NYX beamline Bremsstrahlung and synchrotron shielding design meets the NSLS-II shielding policy.

Please keep in mind that current review concerns only with the ray-tracing drawings. These drawings, along with shielding analysis and thermal analysis (if needed) should be presented to the RSC for review later, before the NYX IRR.

Notes

Prior versions of the drawings of were reviewed by the RSC before. The following notes were communicated to the NYX team and were subsequently addressed to our satisfaction by the team. These are included here for completeness:

1. On the Horizontal Bremsstrahlung there are two rays that originate at LCO1, they should extend back to the source.
2. In view DD (sheet 1), the distance between max extent of GB and edge of aperture should be displayed to make sure it meets requirement of section 6.2 of LT-ESH-STD-001 version 4.
3. In sheet 3 and 4, it indicates that the moveable mask travels +/- 1 mm, can it travel more than that?
4. In sheet 3 and 4, the thickness of the Lead beam stop @62245mm) should be displayed.
5. Sheet 4,
 - a. the SS1 And SS2 open positions should be shown in the drawing.
 - b. what is that component displayed in white just before the WBS/Aperture @ 29670.48 mm – it is not labeled and not shown in sheet 3.
 - c. the mono beam after the DCM and VFM are is shown for normal operations, correct? If so need to ensure that mono beam is still within the beam stop for abnormal DCM/VFM settings.
 - d. Aperture for LC02 not drawn

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Ray Fliller	Accelerator Physicist	PS
Les Hill	Conduct of Operations Manager	PS
PK Job	Radiation Physicist	PS
Wah-Keat Lee	Beam Line Physicist	PS
Boris Podobedov	Accelerator Physics	PS
Chuck Schaefer	Accelerator SME	ESH
Om Singh	Accelerator Controls	PS
Scott Walker	Health Physics	ESH
Lutz Wiegart	Beam Line Physicist	PS
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