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Memo

Date: Feb. 2, 2017
To: Ignace Jarrige, Steven Hulbert, and Paul Zschack
From: Zhong Zhong (chair), Photon Science Radiation Safety Committee
Subject: Follow up of recommendations from the RSC on the radiation safety configuration design of the 2-ID, SIX, beamline

Dear Ignace, Steve, and Paul

I would like to thank you for inviting members of the ray-tracing subcommittee of the Photon Science Radiation Safety Committee (RSC) to discuss actions the SIX team took to address the recommendations from our recent review of the SIX beamline. Wah-Keat Lee, Lutz Wiegart, Mary Carlucci-Dayton and myself met with Ignace Jarrige and Steve Hulbert on January 20 and January 26, 2017. Hardcopies of the updated SIX ray-tracing were distributed to us before the meetings. The updated SIX ray-tracing and updated radiation analysis report were submitted to the RSC for final review.

The following documents and drawings were reviewed:

1. SIX assembly drawing, PD-SIX-RAYT-0001 rev. A, by S. Pjerov, sheet 1, “SIX Beamline Ray Tracing”.
2. SIX Bremsstrahlung ray-tracing drawings, PD-SIX-RAYT-0001 rev. A, sheets 6 and 7 for horizontal and vertical projections, respectively.
3. SIX max. synchrotron ray-tracing drawings, PD-SIX-RAYT-0001 rev. A, sheets 2 and 4 for horizontal and vertical projections, respectively, and sheet 8 for mirror- mis-steered synchrotron ray tracing. Additional details for the masks and collimators are shown on sheets 3, 5, and 9.
4. Power point presentation “Radiation Safety Committee Meeting for 2-ID” by Ignace Jarrige dated January 12, 2017.
5. NSLS-II technical note, #235, by M. Benmerrouche entitled “02-ID SIX Beamline Radiation Shielding Analysis” dated January 10, 2017. The document presents analysis results of Gas Bremsstrahlung (GB) as well as Synchrotron Radiation (SR) at 500 mA.

Recommendations from the recent RSC review are listed below:

1. The sample chamber and diffractometer, both located in the satellite building, are being fabricated and installed. Thus the sample chamber is not in the scope of current review. Due to the complexity and uniqueness of the sample chamber, we recommend that the SIX team seek RSC review of the sample chamber after its installation, prior to its commissioning.

2. While there were omissions and errors, detailed above in note 2, in the ray-tracing drawings, these do not impact the radiation safety of the SIX beamline. Thus we recommend that the SIX beamline team proceed to the Instrument Readiness Review (IRR), and that the team submit the updated ray-tracing to the RSC for final review after the IRR, before commissioning of the FOE optics.
3. The mirror-mis-steering drawings on pages 8 and 9 are not clear due to the low resolution of the pdf file. Thus we recommend that the SIX designer and engineer make a presentation using CAD computer to the RSC ray-tracing subcommittee to demonstrate to the subcommittee that the M1- mis-steered beams are adequately intercepted by downstream water-cooled masks. The demonstration is required before commissioning of the FOE optics.
4. On Page 5, detail N, in the absence of M2, there is only a 0.5mm clearance between the pink beam ray and the aperture of the PGM exit mask. We recommend that the SIX team lower the pink-beam mask immediately upstream of the PGM by approximately 2 mm, thus allowing for a clearance of approximately 2.5 mm on the PGM exit mask/pink beam stop. The drawings must be updated to reflect this change. SIX team should also address the issue of M2 potentially steering the beam past the PGM exit mask/pink beam stop assembly. The updated drawings and RSC final review is required before commissioning of the PGM optics on the experimental floor.

To address recommendation 2, the SIX ray-tracing was updated by Sal Pjerov to correct the errors and omissions. A memo from Jarrige to the RSC describing the updates is attached.

Recommendation 3 is addressed by presentation of high-resolution hard-copy drawings and on-screen demonstration at the meeting. We concur that the clearance of 2.66 mm, shown in detail B sheet 3, is adequate due to the small distance between the mask and white-beam stop.

To address recommendation 4, the SIX team lowered the entrance mask for PGM by approximately 2 mm, and taking credit for a zero-order mask downstream of the PGM. Updated ray-tracing shows that M2-mis-steered beam is stopped either by the PGM exit mask or the zero-order mask. Furthermore, Benmerrouche performed STAC8 simulation to analyze the scattered radiation from the M2 mis-steered beam, a scenario that was not previously analyzed. The radiation dose analysis was for two M2 vertical mis-steering scenarios: Through the internal exit mask hitting the external exit mask; Above the internal exit mask hitting the PGM tank backwall. Both scenarios result in doses that are under 0.05 mrem/h.

Conclusions

As a result of the RSC ray-tracing sub-committee review and subsequent RSC review of the revised radiation simulation, we conclude that recommendations 2, 3, and 4, listed above are satisfactorily addressed. The only outstanding recommendation 1 will be addressed after the endstation is installed.

Radiation Safety Committee

Name	*Expertise*	*Directorate*
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
Ray Fliller	Accelerator Physicist	PS
Wah-Keat Lee	Beam Line Physicist	PS
Boris Podobedov	Accelerator Physics	PS
Chuck Schaefer	Accelerator SME	ESH
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Lutz Wiegart	Beam Line Physicist	PS
Zhong Zhong	Beam Line Physicist	PS
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