National Synchrotron Light Source

Building 743, National Synchrotron Light Source
Brookhaven National Laboratory
Upton, NY 11973-5000
Phone 631 344-2117
Fax 631 344-3238
zhong@bnl.gov

managed by Brookhaven Science Associates
for the U.S. Department of Energy

Memo

Date: April 24, 2019
To: Cherno Jaye, Dan Fischer, and Paul Zschack
From: Zhong Zhong (chair), Photon Science Radiation Safety Committee
Subject: Review of the radiation safety aspects of the LARIAT-1 endstation at SST

Dear Cherno, Dan, and Paul

The Photon Science Radiation Safety Committee (RSC) met with the LARIAT-1 team on April 16 to review the radiation safety of the LARIAT-1 (Large Area Rapid Imaging Analysis Tool 1), MICROCAL, and I0-UP endstations/chamber at the SST-1 beamline. Subjects reviewed include synchrotron radiation shielding impacts, beam stop in the LARIAT-1 chamber, and configuration control of radiation safety components.

Documents Reviewed

1. Updated SST beamline ray-tracing drawing, PD-SST-RAYT-0001 Rev. F, by J. Fabijanic. Sheet 1 is updated to include LARIAT-1, MICROCAL and I0-UP chambers.
2. Survey and alignment drawing for LARIAT-1, PD-SST-BL-LAY-1070 rev. A by J. Fabijanic, sheets 1 and 2. The drawings show that the max. monochromatic beam is stopped either by > 3.2 mm thick stainless steel chamber wall or by 12.7 mm thick titanium chamber wall.
3. Memo from Sunil Chitra, "Dose rates outside the LARIAT-1 and μCAL experimental stations", dated April 23, 2019. This memo is updated from the April 15 memo sent to RSC. The memo summarizes STAC-8 simulation results for SST-1 beam entering the LARIAT-1, MICRO-CAL and I0_UP chambers. The memo concludes that the LARIAT-1 chamber walls are thick enough to stop the direct beam, and that walls and glass view ports (> 3 mm thickness) in all three chambers are sufficient for shielding against the scattered beam.

Presentation

Cherno led the discussion by presenting the features of LARIAT-1, MICROCAL and I0-UP chambers. Following the guideline from the memo by Paul Zschack to the RSC on May 29, 2014, the following were discussed:

1. The LARIAT-1 endstation, the MICROCAL endstation and the I0-UP chamber have been repurposed from the NSLS and installed at the SST-1 beamline. Currently a shutter (#PSH7) upstream of these chambers is used to prevent synchrotron monochromatic beam from entering the chambers. This shutter is the standard NSLS-II shutter.

2. The endstations receives soft, monochromatic x-ray beam with energies from 150 to 2200 eV. Ray tracing of the SST beamline, reviewed by the RSC before, shows that it is not possible for the chambers, which are downstream of the monochromator exit slit, to receive white or pink beam.
3. From prior Tech Note #275 (S. Chitra), stainless steel of 1 mm thickness, at normal incidence, is sufficient to stop the SST1 monochromatic beam. Sunil's simulation considers contributions from all possible source harmonics. The design of the chambers assures that the minimum wall thickness is 3.2 mm stainless steel. This is sufficient for shielding against both direct beam and scattered radiation.
4. Sunil's recent memo, "Dose rates outside the LARIAT-1 and μCAL experimental stations", documents new simulations of dose rate outside of the LARIAT-1 chamber and glass viewports when a generic scattering target is in the zero-order beam. The simulated dose-rates are below 0.05 mrem/hr. We note that the simulation assuming zero-order beam is conservative since the design of the PGM (Planar Grating Monochromator) at SST-1 does not allow zero-order beam to propagate into the endstation chambers.
5. The side wall of the on LARIAT-1 vacuum chamber acts as the beamstop when LARIAT-1 is in use. This beamstop is either stainless steel of greater than 3.2 mm thickness or 12.7 mm thick Titanium. Sunil's memo shows that these are sufficient to stop the SST1 beam.
6. Redundant vacuum switches are installed on the LARIAT-1 chamber. Redundant vacuum switches are also installed on the MICROCAL chamber. These switches are integrated into PPS system to prevent x-ray beam from entering the experimental chamber when it is vented.

Notes

We note that a radiation survey is needed around the LARIAT-1, MICROCAL and I0-UP chambers. Since the risk of radiation exposure is extremely low, the commissioning survey of the chamber can be performed at normal operating ring current.

Conclusion

1. The RSC concurs with the radiation safety design and analysis of the LARIAT-1 endstation, the MICROCAL endstation, and the I0-UP chamber.
2. The RSC checklist sub-committee reviewed the updated radiation safety component checklist for SST-1 and completed a walk-through of the chamber to inspect the configuration control stickers on the chambers. The sub-committee recommends approval of the updated radiation safety component checklist.

Radiation Safety Committee

Name	*Expertise*	*Directorate*
Andrew Ackerman	Deputy ESH Manager	PS
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
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Ray-tracing sub-committee

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Christopher Stelmach	Designer	PS
John Fabijanic	Designer	PS
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Zhong Zhong	Beam Line Physicist	PS

PPS sub-committee

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

RSC checklist sub-committee

Andi Barbour	Beam Line Physicist	PS
Mohamed Benmerrouche	Nuclear and Radiation Physics	PS
Ray Fliller	Accelerator Physicist	PS