C-AD

Radiation

Safety Minutes of RSC Subcommittee of October 22, 2015

Committee

Issued: Oct. 28, 2015

Subject: Activities at SVTF, LVTF, and 56 MHz Testing at IR4

Present: D. Beavis, J. Sandberg, R. Karol, C. Schaefer, M. Minty, J. Reich, C. Naylor, A. Etkin, E. Wang, C. Xu, E.T. Lessard, C. Theisen, Q. Wu, D. Hillis, P. Bergh, and B. Xiao

The committee met to discuss the planned activities for the SVTF and the LVTF. Testing of the 56 MHz cavity at IR4 was also discussed. Although some of the activities have been conducted in the past there has been substantial time since the initial designs of the blockhouses and changes in personnel. Q. Wu lead the discussion with a Powerpoint presentation[1] provided by the SRF team.

SVTF

The 1.3 GHz gun will be tested in early Nov. in the SVTF. This is the gun the was used in the initial design parameters for the blockhouse. It was thought that the gun had been operated in the SVTF is the past. After examining records the RSC Chair concluded that this gun was never operated in the SVTF. Past operation was reported to have occurred in building 939. The cavity is expected to operate at about 0.8 MeV with a beam power of 0.13W. The cavity will quench with about 4 Watts of power.

The blockhouse was reviewed by an RSC subcommittee[2] in 2009. In that review the beam was assumed to have 1 MeV of energy with 10 Watts of beam power. The roof thickness was changed in the design from 28 inches to 56 inches over the central portion of the room that contains the Dewar with the cavity. The shielding ports were estimated to have an exit dose rate up to 190 mrads/hr. Scaling by the beam power gives an upper limit for this test of 80 mrads/hr. The areas outside the ports have posted barriers to prevent access and a shadow block in the forward direction.
Surveys of these ports must be made during early beam operation. **(CK-SVTF-Nov. 15,2015-Q. Wu &P. Bergh-974)**

The blockhouse has a single layer of shielding for most walls. Most of the interfaces between shield blocks are tight. There is a section of the north wall were the interface has a gap that is larger than desired. No radiation has ever been detected outside the blockhouse for previous cavities.

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[1] Q. Wu, RSC Review for near-Term SRF Testing
[2] RSC minutes of March 17, 2009; http://www.c-ad.bnl.gov/esfd/RSC/Minutes/3_17_09Minutes.pdf

After the meeting the RSC Chair, the SVTF LE, and another engineer examined the seams of concern. It was agreed that the area would be roped off pending surveys unless the gaps are filled with steel shims. The plan is to fill the gaps with steel shims in the long term but the material may not be available before the gun testing.

(CK-SVTF-Nov. 15,2015-S. Pontiere& D. Beavis-975) Shim gaps

(CK-SVTF-Nov. 15,2015-P. Bergh& Q. Wu-976) rope off area near seams and post appropriately if the steel shims are not installed.

(CK-SVTF-Nov. 15,2015-Q. Wu & P. Bergh-977) Conduct radiation surveys at gap area with the gun operating.

(CK-SVTF-Nov. 15,2015-Q. Wu& J. Reich-978) The gun power supply must be explicitly listed on the check-off sheet and verified that it is connected to the pass system and configuration managed.

(CK-SVTF-Nov. 15,2015-Q. Wu& J. Reich-979) Before the Dewar with the gun is filled and until it is warn the connector at the Dewar for the PS will be booted and RS LOTO to the correct power supply to maintain strict configuration control.

A small coated bellow will be tested after the 1.2 GHz is complete. The bellows sits very low in the Dewar and cannot directly shine through any of the horizontal seams. The power supply has a rated power of 10 W. However, the maximum voltage gain is only 37.5 kV. No surveys should be required for this cavity. The only issue is that the correct power supply be connected to the Pass system and the bellows.

(CK-SVTF-Nov. 20,2015-Q. Wu& J. Reich-980) Hughes power supply TWTA 1177HO2 connected to the pass system.

(CK-SVTF-Nov. 20,2015-Q. Wu& J. Reich-981) Before the Dewar is filled and until it is warn the connector at the Dewar for the PS will be booted and RS LOTO applies to maintain strict configuration control.

During and after the meeting there discussion on why connectors had to be booted and RS LOTOed. It was explained that the RSC wants to maintain strict configuration control over what PSs are connected to the cavity. Although there may not be an issue in one particular case now sometime in the future people may attach the wrong supply to a cold cavity and it may be capable of making radiation. At least one cavity is the past had multiple supplies used as was approved and properly configuration managed.

LVTF

The Large Vertical Test Facility (LTVF) design and construction was started in 2009. The first use of the facility was in 2013. The RSC subcommittee reviewed[3] the block house for first use with the 56 MHz cavity with expected operations of up to 100W and 3 MV. The review used the analysis provided by D. Beavis[4] which explicitly examined 1 MeV, 3 MeV, and 10 MeV radiation levels with 200 Watts of power.

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[3] RSC minutes of April 2, 2013; http://www.c-ad.bnl.gov/esfd/RSC/Minutes/4_2_13Minutes.pdf

[4] D. Beavis, "Update on VTF Shielding and Radiation Analysis", March 25, 2013; http://www.c-ad.bnl.gov/esfd/RSC/Memos/VTF_Sheilding_032513.pdf

During testing of the NSLSII superconducting RF cavity the first x-ray leakage out some seams in this single layer blockhouse were detected. The seams were lined with lead and ECNs generated for the shielding change. Afterwards no leakage was seen while testing the NSLSII RF cavity.

The present test is for a 400 MHz cavity. It is expected to develop a maximum voltage of 6.25 MV. The field orientation is such that the maximum energy x-rays would be emitted towards the roof or the floor. The roof has an interlocking chipmunk if the field emission becomes high enough to generated substantial x-rays.

As the cavity is conditioned periodic radiation surveys will be conducted around the blockhouse. Changes in operating conditions should trigger consideration by RF personnel to request radiation surveys.
(CK-LVTF-Nov. 20,2015-Q. Wu& P. Bergh-982)

The explicit RF power supply will be listed on the check-off list and configuration controlled to the PASS. The connector to the cavity should also be booted and RS LOTOed to ensure no other connection is made.
(CK-LVTF-Nov. 20,2015-Q. Wu& J. Reich-983)

56MHz Cavity at IR4

The 56 MHz cavity will be tested in IR4 before RHIC becomes operational. The cavity has had the HOM coupler changed. The goal of the test is to determine the maximum voltage the cavity can reach without quenching the cavity or the HOM coupler. The test will be conducted by filling with Dewars. The Dewars will be brought into the tunnel through the labyrinth at 1004A. The 3.5 kW amplifier for conditioning is inside the ring and the 1 kW amplifier is outside the ring in building 1004D. These supplies must be configuration managed with the pass system. The test will be operated with IR4 in RFNA mode. This mode allows any of the cavities at the IR to be operated. The check-off list will be essentially the same as for beam operations with all adjacent areas swept, locked, and secured. All portions of the PASS system for IR 4 must be functionally checked for all modes that will be used during the tests. If possible the beam modes should also be tested so the IR testing is complete.
A check-off list was generated for the test on Oct.27, 2015.

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