Date: March 09, 2017
To: RSC, A. Fedotov, J. Tuozzolo, A. Zaltsman, and A. Drees
From: D. Beavis
Subject: HV Conditioning of the LEReC 2.1 GHz Warm Cavity

The LEReC project has requested that the 2.1 GHz warm cavity be allowed to be conditioned as soon as the interlocks have been certified. The interlock requirements are given in RSC minutes\(^1\) of April 16, 2016. The minutes specified dual interlocks for the cavity and noted the cavity as 250 kV and 50 kW. The 50 kW is a mistake and it should be listed as 14 kW. The cavity is not in the final location in the IR but is in a temporary position about 135 cm inside the ring at beam height and essentially at the IP position along the beam direction.

The interlocks for the 2.1 GHz cavity will use different power contactors in the two software divisions and will share a co-axial switch in the waveguide as a reach-back device. The interlocks will be functionally checked before the cavity is operated. Like other devices in IR2 the cavity will not operate unless the IR is in RFNA (RF no access) or NA (no access) modes.

An extremely conservative upper limit on the x-ray production can be obtained by assuming that the 14 kV of power goes into acceleration of electrons to 250 kV that then strike the cavity surface. This would result\(^2\) in 3400 rad/hr of x-rays at a meter. The cavity has a wall thickness of about one cm of copper which would provide a reduction of 0.3. Thus the conservative estimate is 1100 rads/hr at a meter. The cavity is expected to generate at least a factor of 100 times less x-rays. The committee will be requested in the future to provide guidance on a methodology to reduce these overly conservative estimates of x-ray production to more reasonable values. A. Zaltsman noted that the high frequency will also reduce the ability to generate x-rays. The LEReC Dc gun can be estimated in the same manner and would produce 60,000 rads/hr at a meter. During actual HV conditioning the gun created 7 rads/hr at a foot. This illustrates how conservative these estimates are. This shielding for the LEReC gun was

\(^1\) RSC Minutes of April 15, 2016; [http://www.c-ad.bnl.gov/esfd/RSC/Minutes/04_15_16Minutes.pdf](http://www.c-ad.bnl.gov/esfd/RSC/Minutes/04_15_16Minutes.pdf)
\(^2\) NCRP Report No. 51, Figure E.1
found to be acceptable in the analysis and therefore the shielding should also be acceptable\(^3\) for the test of the 2.1 GHz cavity.

Based on this analysis the cavity will be allowed to be conditioned once the interlocks are certified.

\(^3\) The difference in location was considered in this evaluation.