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Bremsstrahlung Heat load Scaling Measurements for Future ECRIS Cryostat

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In order to push the intensities of beam production capabilities, 3rd generation ECR ion sources such as VENUS have implemented the use of superconducting radial and axial confinement magnets that allow for higher fields and higher frequency heating. VENUS'NbTi superconducting magnets are enclosed in a 4.2K liquid helium reservoir to maintain their temperature and prevent quenching. During operation, electron losses to the plasma chamber produce a significant amount of bremsstrahlung radiation, and these x-rays can deposit several watts of heating to the cold mass and cryostat. The amount of heat load these x-rays deliver is dependent on the total microwave power and the source's minimum B-field (B_{min}). The 4th generation MARS-D Ion Source is currently being developed at LBNL to meet the beam intensity needs of future heavy ion research. MARS-D uses NbTi magnets in a novel configuration, and will operate with 45 GHz heating and higher B_{min}, which are expected to produce higher energy electrons than VENUS. In order to anticipate and design MARS-D for this increased load, we have undertaken a series of cryostat heat load experiments with VENUS where we vary B_{min}, microwave power, and different heating frequencies. Measured results will be presented, as will heat load projections for expected MARS-D operating conditions.

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