

Radio-frequency antenna lifetime studies for high-current, high-duty-cycle H⁻ volume sources (abstract)

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The Spallation Neutron Source requires an ion source capable of delivering a high current (~50 mA) H⁻ beam with a 6% duty cycle continuously for the 3 weeks between the scheduled maintenance periods. The integrated test facility at LBNL delivers H⁻ ion currents up to 50 mA, increasing approximately linearly with the rf power. Initial experience using porcelain-coated copper antennas, however, indicates lifetimes will fall below the desired 3-week period, mostly limited by antenna failures. In an effort to improve our understanding of the antenna problems, we have reanalyzed published and unpublished antenna lifetime data from rf-driven volume sources. As one can expect, various scaling give a range of results. The general trend, however, suggests that the peak power is the main parameter. A reanalysis of published DESY antenna data reveals significant infant mortality but shows no sign of old age failures. This result is very encouraging and suggests to rethink all maintenance plans.

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