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Electromagnetic Design of 402 MHz Normal Conducting Coaxial Window for SNS Facility

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RadiaBeam has developed a novel design of high-power RF windows to be used in high-power proton accelerators, such as SNS. This design is based on the utilization of coaxial windows between two waveguides to coax transitions, instead of a ceramic window in a uniform cylindrical waveguide, which provides several significant benefits. First, the diameter of the ceramic disk in the coaxial line is reduced for the same RF power compared to in TE-mode waveguide design, since it operates in low impedance TEM-mode. For 500 kW average power at 400 MHz, the window size can be reduced from 13"to 8", which significantly reduces the fabrication complexity and improves structural stability, while keeping the TE11 mode cutoff frequency in the coax ˜50% higher than the operating frequency. Second, the cooling of coaxial windows can be performed from both the inner and outer conductor sides. Then, the field distribution in the coaxial line is more uniform, which reduces dielectric losses and thermal gradients. Importantly, the multipactor discharge in coaxial windows can be suppressed by applying DC voltage bias between inner and outer conductors. Last but not least, coaxial windows provide wider RF bandwidth without requiring cavity resonances, which is important for accelerating cavity operation. In this paper, we will present the RF and engineering design of such windows.

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