Optimization of a Five Cell Niobium Cavity

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One means of handling nuclear spent fuel is to transmute the waste with the aid of an accelerator. In this approach, a particle accelerator produces protons that react with a heavy metal target to produce neutrons. A major component of the system is a linear accelerator that can accelerate protons to GeV energies. Los Alamos National Laboratory (LANL) was developing a superconducting rf (SCRF) high-current linear accelerator for this purpose. One of the major components of SCRF is the multiple-cell niobium cavity. A localized resonant process known as multipacting has been a concern in the design of such cavities. Multipacting absorbs the rf power such that it becomes difficult to increase the cavity field strength when increasing the input power. At the University of Nevada Las Vegas, an optimization procedure using commercial field modeling codes developed by Field Precision Inc. (MESH, WAVSIM) coupled with optimization and controlling codes written in MATLAB has been developed for multipacting studies. Currently, the fully automated system of codes modifies a five-cell niobium seed cavity geometry until the desired mode and resonant frequency of the cavity is obtained. Results will be compared with LANL’s existing five-cell niobium cavity. In the future, this optimization procedure is planned to be incorporated into an existing rf multipacting code.