Stony Brook University
The Graduate School

Doctoral Defense Announcement

A Study of Higher-Order Mode Damping

in the

Superconducting Energy Recovery LINAC

at Brookhaven National Laboratory

by

Lee Reginald Hammons III

An energy recovery LINAC (ERL) is being constructed at Brookhaven National Laboratory that will involve a superconducting LINAC along with a superconducting electron gun, all operating at 703.75 MHz. Effective higher-order mode (HOM) damping is an essential component of the R&D program. This thesis focuses on three areas of HOM characterization and damping development: damping in the five-cell LINAC, use of the electron gun fundamental power couplers (FPCs) to damp HOMs, and the development of a ceramic/ferrite damper for the electron gun.

The five-cell LINAC uses an HOM load lined with ferrite and attached to the beampipe on either side of the cavity. These studies characterized the frequency-dependent nature of the ferrite-absorbing material. It was subsequently determined that the ferrite absorber is effective in damping the HOMs of the five-cell cavity over a range of frequencies.

In addition, higher-order mode damping in the superconducting electron gun was studied using the fundamental power couplers. Simulation studies determined that the FPCs couple strongly to many of the HOMs studied. However, the transition between the coaxial FPCs and the waveguide that feeds power to the FPCs shows the best transmission qualities between 1 and 2 GHz, limiting the damping to this bandwidth.

Finally, the development of a ceramic/ferrite damper was described for the electron gun. The damper features a lossless alumina ceramic break surrounded by a ferrite load and was designed to isolate the vacuum chamber from the ferrite tiles. Measurements determined that the ceramic/ferrite load can be effective in damping higher-order modes and analytical calculations show that the ceramic tends to alter the field distribution of higher-order modes. The effectiveness of the damping for a given mode depends on a variety of factors including the thickness of the ceramic, the spacing between the ceramic and ferrite layers, and the diameter of the inner ceramic surface.

Date: November 28, 2011
Time: 2:30 pm
Place: Physics Building, Room C-133

Program: Physics
Dissertation Advisor: Dr. V. Litvinenko