

Experiments and Simulation of High Current Operation at CEBAF*, L. MERMINGA, J.R. DELAYEN, G. KRAFFT, S. SIMROCK, M. TIEFENBACK, CEBAF - The superconducting RF, CW electron accelerator at CEBAF has achieved the design energy of 4 GeV using five-pass recirculation through a pair of 400 MeV linacs. Stable beam current of 25 mA has been delivered to the Experimental Hall C. At the design current of 200 mA which results in a beam loading of up to 1 mA, the beam induced voltage will be approximately equal to the accelerating voltage in the superconducting cavities. Measurements of the performance of the RF control system have been made in both pulsed and CW mode to quantify the system performance and to develop procedures to improve stability of operation. Experimental data on transient beam loading, the effect of by-passed cavities, the effect of beam current modulation, and a new technique for cavity phasing are presented here. Furthermore, a numerical model of the RF feedback system has been developed which describes the beam-cavity interaction, includes amplitude and phase feedback, klystron characteristics, and microphonic noise. The model has been benchmarked against experimental data and has been used to predict and provide insight into the data with significant success. Finally, tests that aim towards demonstrating stable operation at the design current are described.

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