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Pulse Compression Considerations for High Current Ranchero Generators

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The Los Alamos Ranchero Flux Compression Generator (FCG) has been tested at the 76 MA level, and a 36 MA experiment was recently conducted demonstrating the functionality of an improved performance design. That test was performed with 3.5 MA initial current, which is the limit available from the capacitor bank at our high explosive pulsed power (HEPP) firing point. Computations show that the improved "Ranchero-S" FCG can generate currents of over 80 MA with 10 nH loads given sufficient initial flux. A program to develop the MK-X generator, which will be a replacement for the MK-IX FCG fielded through the 1980s and 1990s, is on-going at Los Alamos to provide initial flux for Ranchero FCGs and facilitate these very high current experiments. The function time of the improved Ranchero FCG is ˜25 μs, and for powering loads requiring short pulses, pulse conditioning is required. In this paper we investigate issues relating to switching the output of a Ranchero-S FCG into meaningful loads given peak currents of 80 MA while desiring load pulses in the 1 μs range for realistic inductance loads. 2D-MHD computations are used to assess design configurations, and significant issues include flux diffusion through any conductor that can hold the 80 MA and rupture rapidly, closing switches that can isolate the load from the diffused flux and then carry the desired current, and dynamic effects seen on vacuum transmission lines operating at such currents.

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