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Full-Machine Circuit Model of the Saturn Accelerator

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A recent shot series on the Saturn accelerator was done to both better diagnose machine and load operating parameters, and to examine whether more current to Saturn's ring-diode radiation load could increase radiation output. This work is being done in preparation for a potential upgrade to the machine. Critical to this experiment was current measurement in the vacuum magnetically-insulated transmission lines (MITLs) near the load that is not possible with normal shot configurations. Therefore, the load region was configured with only one cathode with its upper and lower anodes, thus driving two parallel MITLs. This configuration allowed installing calibrated current monitors in the MITLs shortly upstream of the load. To examine current scaling the pulse power was configured so that either 12 (1/3 of the machine) or 18 (1/2 of the machine) pulse-forming lines were connected to this single cathode. Shots were done with either a short-circuit or a ring-diode radiation load for both configurations. A full-machine 36-line model was constructed for these configurations and compared to current and voltage measurements within the machine and at the load. Results of these comparisons and validation of the model will be presented.

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