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Three-Dimensional Model of the Saturn Accelerator Water Tri-plate Transmission Line Connection to the Vacuum Insulator Stack

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Calculation of the power flow from the 36 pulse forming lines to the vacuum region of Saturn has always been complicated by the three-dimensional structure of the rod and bottle connections to the vacuum insulator stack. Recently we have completed a 3-D calculation of the bottle configuration and found a large error in previous impedance estimates. We have used this calculation to determine impedance and to construct a 2-D model of each of the 36 bottles of each level of the insulator using the Transmission Line Matrix (TLM) technique. These TLM models are then used in a 2-D model for each of the three levels of the insulator. Each model starts at a measured forward-going pulse in the water tri-plate, and ends at the Brehmstrahlung load at the center of the machine. Because of transmission line lengths, and because of the short pulse lengths, each can be considered independent of the others. Thus the combination of the three models represents a quasi-3-D model of the load region of the machine. The results of these calculations agree well with measurement and thereby provide confidence in simulation predictions for those areas where measurements are not possible. Details of the 3-D bottle calculation, the TLM model, and results of the load region simulations using this model will be given.

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