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PULSED POWER PERFORMANCE OF THE NEW RLA

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The Recirculating Linear Accelerator (RLA) is returning to operation with a new electron beam injector and a modified accelerating cavity. Upon completion of our experimental program the RLA will capture the injected beam on an IFR guiding plasma channel in either a spiral or a closed racetrack drift tube. The relativistic beam will be efficiently recirculated for up to four passes through two or more accelerating cavities, in phase with the ringing cavity voltage waveforms, and thereby increased in energy to 10 MeV before being extracted. The inductively isolated four-stage injector was designed to produce beam parameters of 4 MeV, 10-20 kA, and 40-55 ns FWHM. The three-line radial cavity is being modified to improve the 1-MV accelerating voltage pulse shape while an advanced cavity design study is in progress. The actual versus predicted pulsed-power performance of the RLA injector and cavity and the associated driving hardware will be discussed in this paper.

This work was funded by Navy SPAWAR under SPACETASK No. 145-SNL-1-8-1, DARPA/AFWL-ARPA Order 5789, DARPA/NSWC-ARPA Order 4395, and by DOE under contract DE-AC04-76DP00789.

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The Recirculating Linear Accelerator (RLA) is returning to operation with a new relativistic electron beam (REB) injector and a modified accelerating cavity. Upon completion of our experimental program the RLA will capture the injected beam on an IFR guiding plasma channel in either a spiral or a closed racetrack drift tube. The REB will be efficiently recirculated for up to four passes through two or more accelerating cavities, in phase with the ringing cavity voltage waveforms, and thereby increased in energy to about 10 MeV before being extracted. This is a continuation of the Sandia program to develop compact, high-voltage gradient, linear induction accelerators.

We are installing the new REB injector because of the need for a higher amplitude, longer duration, and more flat-topped pulse shape with a colder beam than that produced by the previous injector. We designed the Metglas[1] ribbon-wound core, inductively isolated, four-stage injector to produce beam parameters of 4 MeV, 10-20 kA, and 40-55 ns FWHM. The more constant REB energy can be more efficiently matched to the IFR plasma channel and turning section magnetic fields. The three-line radial ET-2 cavity[2] is being modified to improve the 1-MV accelerating voltage pulse shape while an advanced cavity design study is in progress. A longer, flatter accelerating pulse with a minimum degradation in shape and amplitude of the repeating pulses is desired.

We have made extensive use of computer simulations in the form of network solver and electrostatic field stress analysis codes to aid in the design and modifications for the new RLA. The actual versus predicted pulsed-power performance of the RLA injector and cavity and the associated driving hardware will be discussed in this paper.

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1 Metglas is Allied Corporation's registered trademark for an amorphous alloy of metals.

2 D. Ecclechall and J. K. Temperly, J. Appl. Phys. 49, 1981, p. 3649.

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