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USE OF HERMES-III FOR PULSED NEUTRON PRODUCTION PRODUCED BY INTENSE ION BEAMS AT THE 14 MEV LEVEL AT SANDIA NATIONAL LABORATORIES*

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The HERMES-III accelerator (18 MV, 700kA, 40 ns) uses Inductive Voltage Adder (IVA) architecture to drive a magnetically insulated transmission line (MITL) with a 34-ohm vacuum impedance. In normal operation, the load is a Bremsstrahlung diode operated in negative polarity, from which an intense electron beam can be extracted for gamma generation. The relatively high output voltage makes HERMES attractive as a source for high-energy ions which could be used to generate pulsed neutrons using high-cross section metal targets. To preserve the dominant negative polarity mode, ion beams are generated and propagated to neutron targets and objects for neutron exposure inside the HERMES center conductor. A radial self-field (no external coils) ion diode is designed to be compatible with the MITL impedance, and operated undermatched (˜17 ohms) to capture the incoming MITL flow (2/3 of the output current).
Previous experiments indicate a diode operating voltage of 13-14 MV, with proton beam currents propagating in both the 'forward'(e.g. into the accelerator) and 'backward'directions, with each beam in the 50-100 kA range, all consistent with LSP simulations. Extensive use has been made of the MCNP code design the neutron target to maximize a) neutron energy spectrum, and b) neutrons in the forward direction. Compared to a reference thick-target tantalum plate, two combined sub-range Co-Nb foils produce twice the total neutron yield, 3 times the number of neutrons > 1 MeV energy (about 70% of the total), and factor 1.4 in the forward as opposed to rear direction. Additional experiments are planned, and latest results will be discussed.

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