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Low Voltage Beam Experiments on the PLIA

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Abstract. A new accelerator concept called the Pulse-Line Ion Accelerator (PLIA) has been developed. The PLIA is operated by pulsed power sources generating a ramped traveling wave voltage on a helical coil. The helix is surrounded by an oil dielectric that slows the traveling wave speed to 1% of the speed of light nearly matching the ion bunch speed. The axial wavelength is large compared to the helix radius making it possible to model the PLIA as a transmission line. The PLIA is expected to accelerate ion bunches to energies much greater than the peak applied voltage and over distances much larger than the ramp length. Low voltage beam experiments ranging from 10-80 kV have begun on the 1-m PLIA test section to verify the ability to accelerate an ion bunch and to investigate breakdown issues. Short-pulsed, pencil-like beams with energy ranges of 200-400 keV have been used for the acceleration experiments. Discharge issues have been addressed and evaluated for possible solutions. A semi-conductive chromium oxide film with a low secondary emission coefficient will be tested for elimination of the discharge. It is expected that the discharge issues will be resolved and beam experiments with high voltages will commence. Different acceleration scenarios will be examined relative to the axial focusing requirements. Experimental results and possible solutions for the elimination of the discharge will be described.

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