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Low Voltage Beam Experiments on the Pulse Line Ion Accelerator

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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 20-50 kV on the 1-m PLIA test section have demonstrated the ability to accelerate ion bunches with initial energy of 350 keV, hundreds of nanoseconds long, to 500 keV. Charging the helix to its full potential is limited by a vacuum surface flashover. Discharge issues have been addressed and evaluated for possible solutions. A numerical model has been generated to investigate the breakdown phenomena. 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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