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Modeling of a Liquid Leaf Target TNSA Experiment Using Particle-In-Cell Simulations and Deep Learning

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Liquid leaf targets show promise as high repetition rate targets for laser-based ion acceleration using the Target Normal Sheath Acceleration (TNSA) mechanism and are currently under development. This work discusses the effects of different ion species and investigates how they can be leveraged as a laser-driven neutron source. Based on artificial neural networks, we developed a surrogate model for liquid leaf target laser-ion acceleration experiments to aid in this research. The model is trained using data from Particle-In-Cell (PIC) simulations. The fast inference speed of our deep learning model allows us to optimize experimental parameters for maximum ion energy and laser-energy conversion efficiency. An analysis of parameter influence on our model output, using Sobol'and PAWN indices, provides deeper insights into the laser-plasma system.

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