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Prediction of scaling physics laws for proton acceleration with extended parameter space of the NIF ARC[1] KRISH BHUTWALA, FARHAT BEG, University of California, San Diego, DEREK MARISCAL, SCOTT WILKS, TAMMY MA, Lawrence Livermore National Laboratory — The Advanced Radiographic Capability (ARC) laser at the National Ignition Facility (NIF) at Lawrence Livermore National Laboratory is the world's most energetic short-pulse laser. It comprises four beamlets, each of substantial energy (˜1.5 kJ), extended short-pulse duration (10-30 ps), and large focal spot ($\geq$50% of energy in 150 m spot). This allows ARC to achieve proton and light ion acceleration via the Target Normal Sheath Acceleration (TNSA) mechanism, but it is yet unknown how proton beam characteristics scale with ARC-regime laser parameters. As theory has also not yet been validated for laser-generated protons at ARC-regime laser parameters, we attempt to formulate the scaling physics of proton beam characteristics as a function of laser energy, intensity, focal spot size, pulse length, target geometry, etc. through a review of relevant proton acceleration experiments from laser facilities across the world. These predicted scaling laws should then guide target design and future diagnostics for desired proton beam experiments on the NIF ARC.

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