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A new regime of short-pulse laser-particle acceleration: an overview of results from the NIF-ARC protons campaign T MA, D MARISCAL, LLNL, J KIM, UCSD, SC WILKS, A KEMP, G COCHRAN, LLNL, J PARK, UCSD, N LEMOS, C HAEFNER, D ALESSI, D MARTINEZ, LLNL, C MCGUFFEY, UCSD, A MORACE, Osaka University, M MANUEL, General Atomics, G SCOTT, LLNL, D NEELY, STFC, Central Laser Facility, K FLIPPO, LANL, R SIMPSON, MIT — A high energy, high flux short-pulse driven proton source has been demonstrated and characterized on the NIF's Advanced Radiographic Capability (ARC) laser. The ARC laser resides in a unique parameter space: 4 separate beamlets, very high-energy (kJ), relatively long (multi-ps), large focal spot, quasi-relativistic (~10^18 W/cm^2) intensities. The proton campaign at the NIF-ARC has focused on exploring proton acceleration via TNSA and investigating the underlying time-dependent physics of particle acceleration via an integrated experimental and simulation effort. A significant (~5x) enhancement of maximum proton energy over that predicted by conventional scalings is observed at these laser intensities, definitively establishing a new superponderomotive acceleration regime. Furthermore, a high conversion efficiency of ~2.5-5% laser energy into protons yields a record flux (~50 J) of laser-accelerated protons. This opens exciting new applications such as proton isochoric heating of solids to several 100's of eV temperatures, and 3D tomography of evolving plasma conditions with <10 ps temporal resolution. We will show results from proton heating and radiography and provide a prospective for future HED experiments with the NIF-ARC protons.

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