Los Alamos
NATIONAL LABORATORY
EST. 1943

LA-UR-17-20910
Approved for public release; distribution is unlimited.

Title: Kinetic Modeling of Next-Generation High-Energy, High-Intensity Laser-Ion Accelerators

Author(s): Albright, Brian James
Yin, Lin
Stark, David James

Intended for: Highlight slides for Institutional Computing project

Issued: 2017-02-06

Disclaimer:
Los Alamos National Laboratory, an affirmative action/equal opportunity employer, is operated by the Los Alamos National Security, LLC for the National Nuclear Security Administration of the U.S. Department of Energy under contract DE-AC52-06NA25396. By approving this article, the publisher recognizes that the U.S. Government retains nonexclusive, royalty-free license to publish or reproduce the published form of this contribution, or to allow others to do so, for U.S. Government purposes. Los Alamos National Laboratory requests that the publisher identify this article as work performed under the auspices of the U.S. Department of Energy. Los Alamos National Laboratory strongly supports academic freedom and a researcher's right to publish; as an institution, however, the Laboratory does not endorse the viewpoint of a publication or guarantee its technical correctness.

Kinetic Modeling of Next-Generation High-Energy, High-Intensity Laser-Ion Accelerators

PI: Brian Albright (XTD-PRI)

Co-Is: Lin Yin (XCP-6), David Stark (XCP-6)

Los Alamos NATIONAL LABORATORY EST.1943

Project Highlights

15 December, 2016

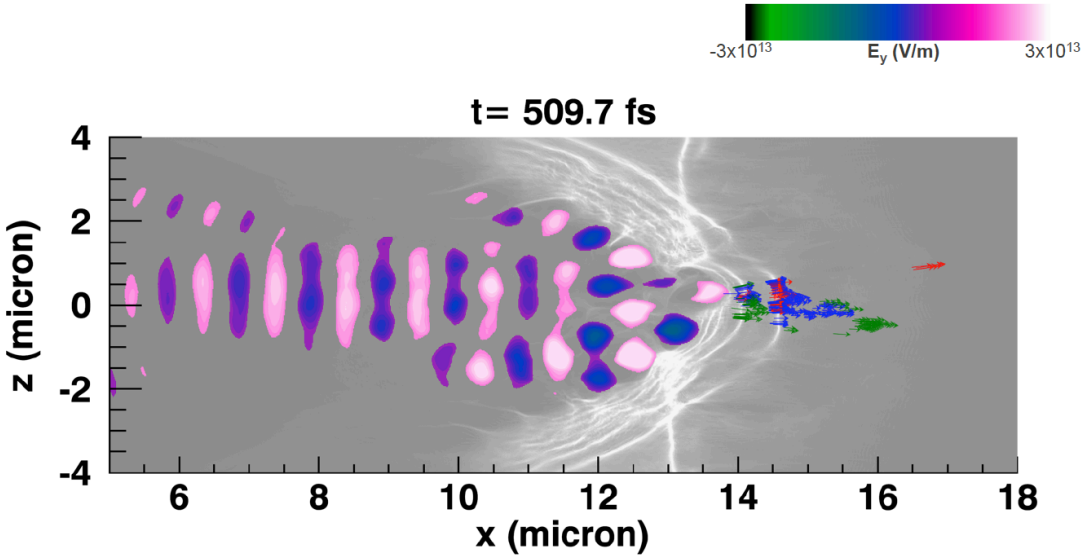
NNSA National Nuclear Security Administration

Operated by Los Alamos National Security, LLC for the U.S. Department of Energy's NNSA

Institutional Computing enabled VPIC calculations that advanced significantly our understanding of laser-ion acceleration

- One of the long-standing problems in the community is the question of how we can model "next-generation" laser-ion acceleration in a computationally tractable way
  - 3D is heroic: how can we capture the physics faithfully in 2D simulations?
- A new particle tracking capability in the LANL VPIC kinetic plasma modeling code has enabled us to solve this long-standing problem

D. J. Stark, L. Yin, B. Albright, and F. Guo, "Effects of dimensionality on computer simulations of laser-ion acceleration in the transparency regime," Phys. Plasmas (submitted)



t=840 fs
x > 31μm
29μm<x<31μm
25μm<x<29μm

- Above is a snapshot of the 2D-S setup showing the ion density and the electric field E_y. Select tracer ions are displayed, all > 270 MeV at t=840 fs.

This work is helping to resolve a long-standing debate in the community

Though an interim award, this project has nevertheless led to several papers

- D. J. Stark, L. Yin, B. J. Albright, F. Guo, “Toward Extrapolating Two-Dimensional High-intensity Laser-Plasma Ion Acceleration Particle-in-Cell Simulations to Three Dimensions,” 58th Annual Meeting of the APS Division of Plasma Physics, October 31–November 4, San Jose, California (2016).
- L. Yin, D. J. Stark, B. J. Albright, “Effects of dimensionality on computer simulations of laser-ion acceleration: When are three-dimensional simulations needed?” 58th Annual Meeting of the APS Division of Plasma Physics, October 31–November 4, San Jose, California (2016).
- B. J. Albright, L. Yin, A. Favalli, “Neutron Generation from Laser-Accelerated Ion Beams: Use of Alternative Deuteron-Rich Targets for Improved Neutron Yield and Control of Neutron Spectra", 58th Annual Meeting of the APS Division of Plasma Physics, October 31-November 4, San Jose, California (2016).
- B. J. Albright, L. Yin, and A. Favalli, “Neutron Generation from Laser-Accelerated Ion Beams: Use of Alternative Deuteron-Rich Targets for Improved Neutron Yield and Control of Neutron Spectra”, submitted to Physical Review Accelerators and Beams (2016).
- An additional journal article (to be submitted to Physics of Plasmas) is in preparation on these results.