Abstract Submitted
for the DPP11 Meeting of
The American Physical Society

Numerical methods for laser-plasma interactions J. PAXON REYES, B.A. SHADWICK, University of Nebraska - Lincoln — We have studied numerical methods for solving the fluid equations in a moving window coordinate system. Previously we have solved the full fluid model using explicit methods and we compare these results to new results using the quasistatic approximation (QSA) with full- and reduced-wave equations. The new results were obtained using the Crank-Nicolson method which permits larger time steps due to its unconditional stability and these new codes are orders of magnitude faster, at similar levels of accuracy, than the previous explicit fluid code. Although the QSA models show nearly identical laser evolution as the full fluid model, the plasma response in the QSA models develops a phase error in time. Also, there is only a forward-propagating mode in the reduced-wave equation and the dispersion relation agrees with that of the full-wave equation only to second order; we have found a superluminal window velocity β_t that can reconcile the dispersion relation for one particular wave number, producing a nominal improvement in the phase error. The plasma behavior with the full-wave and QSA model is closest to that of the full fluid model, and it is clear that the discrepancy originates with the quasistatic assumption.

J. Paxon Reyes
University of Nebraska - Lincoln

Date submitted: 26 Jul 2011 Electronic form version 1.4