

PIC simulations of liner-fuel compression in PLX



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Osiris 4.0



osiris framework

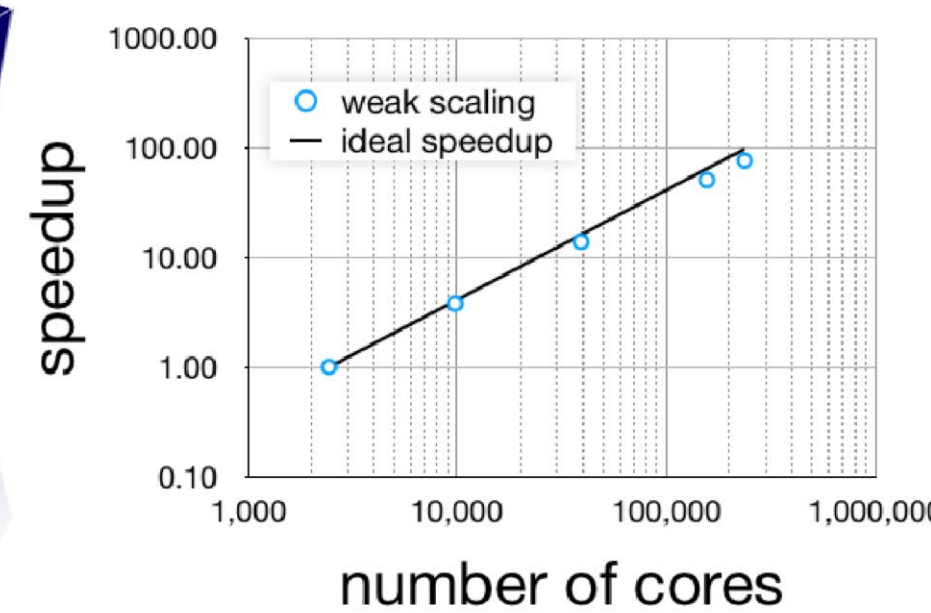
- Massively Parallel, Fully Relativistic Particle-in-Cell (PIC) Code
- Visualization and Data Analysis Infrastructure
- Developed by the osirisconsortium ⇒ UCLA + IST



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<http://epp.tecnico.ulisboa.pt/>
<http://plasmasim.physics.ucla.edu/>

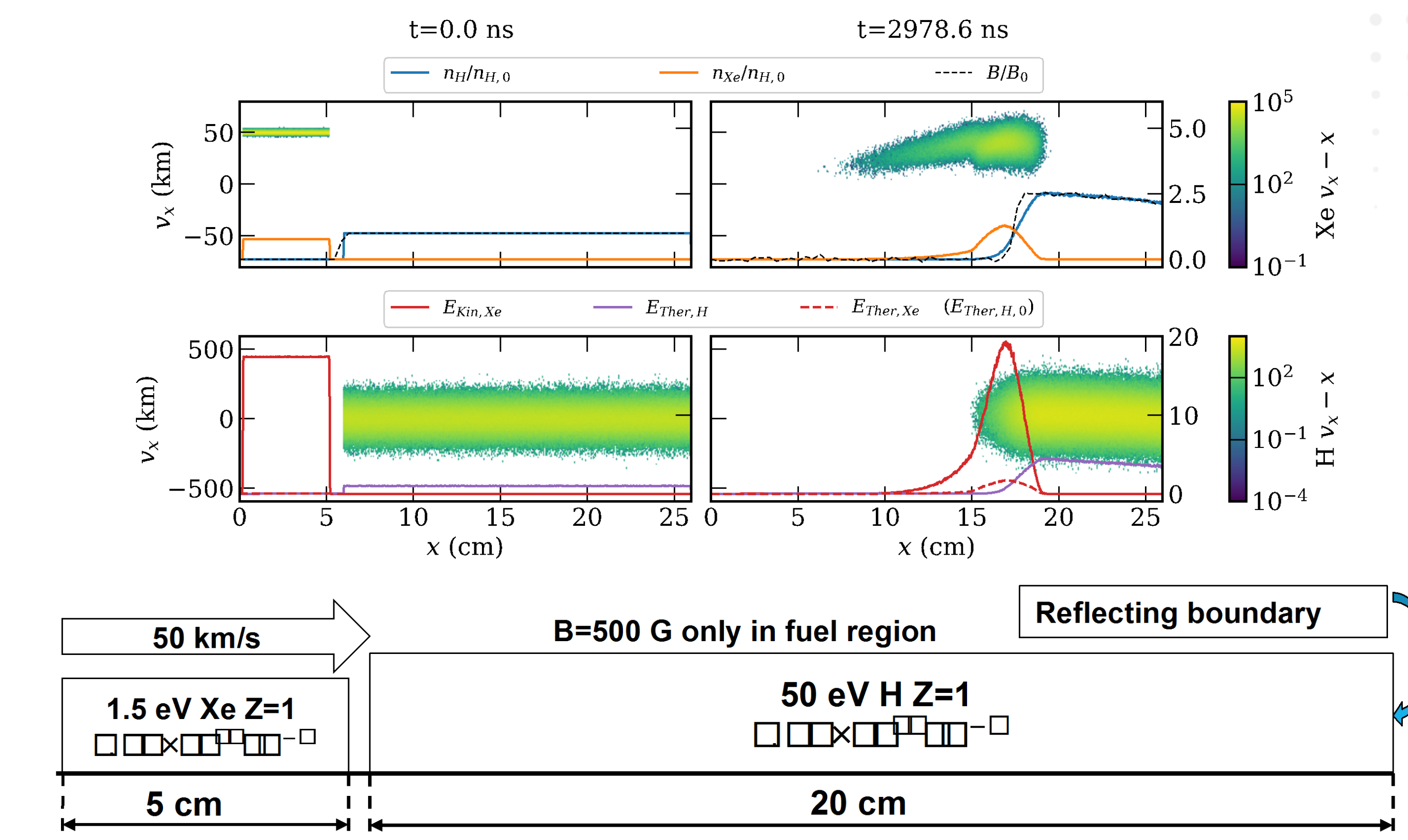
Parallel performance on the Cori Supercomputer @NERSC (Intel KNL processors)



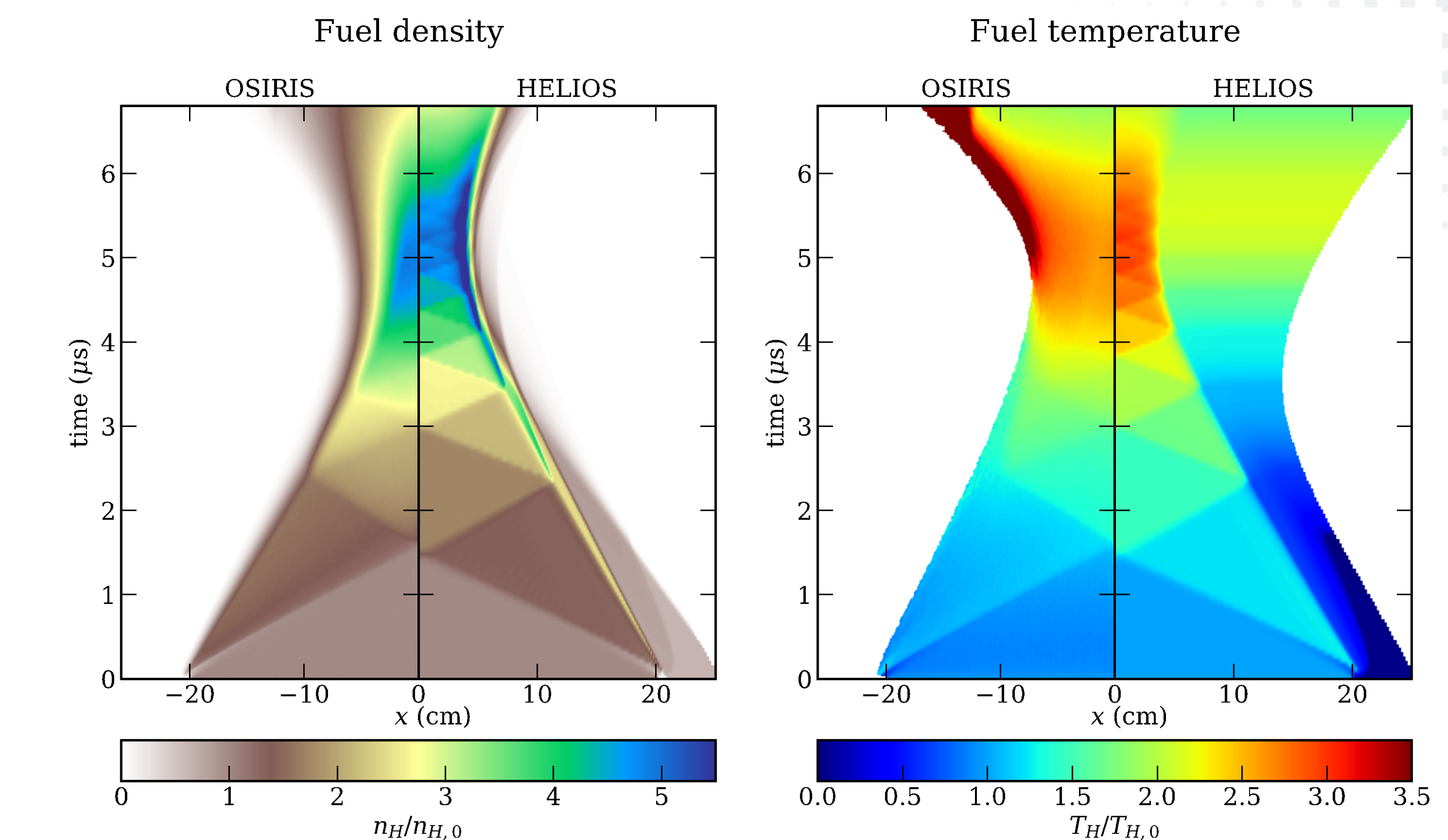
code features

- Scalability to ~ 1.6 M cores (on sequoia) and achieved sustained speed of > 2.2PetaFLOPS on Blue Waters
- Parallel I/O
- Dynamic Load Balancing
- Binary Collisions
- QED module
- Quasi-3D (r-z with modal expansion)
- OpenMP/MPI/vector parallelism
- Intel Phi support (see above) & CUDA branch

1D OSIRIS simulations were conducted to model the liner-fuel compression with parameters relevant to PLX



The kinetic and fluid models predicted quantitatively similar fuel density and temperature



Plasma-Jet Driven MIF (PJMIF) investigates a “reactor-friendly” approach using spherical compression

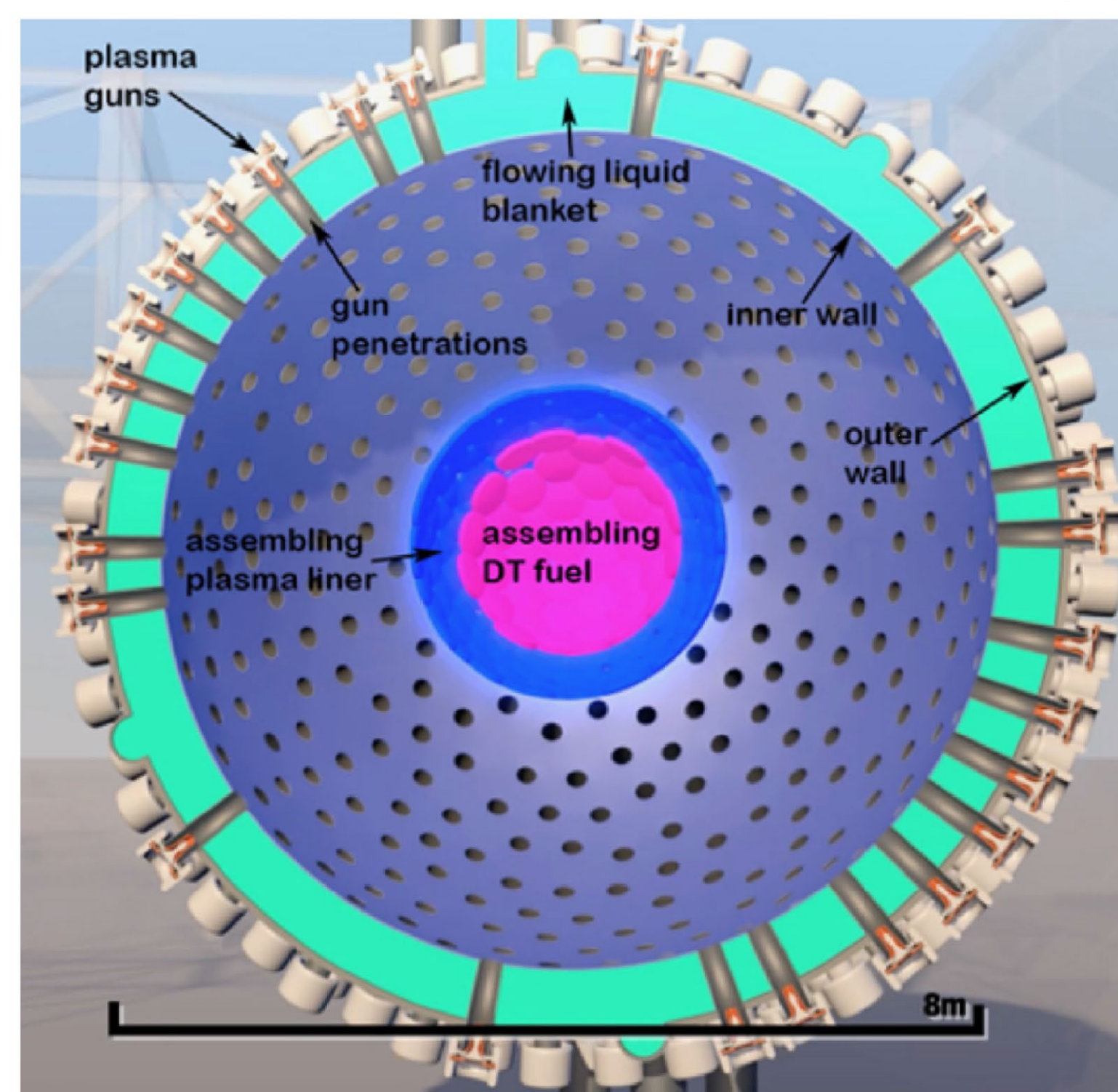
- Target assembled* from plasma jets launched from a “standoff” distance

- No repetitive hardware destruction in all-gas / plasma architecture

- Spherical compression allows dramatic improvement in pressure scaling

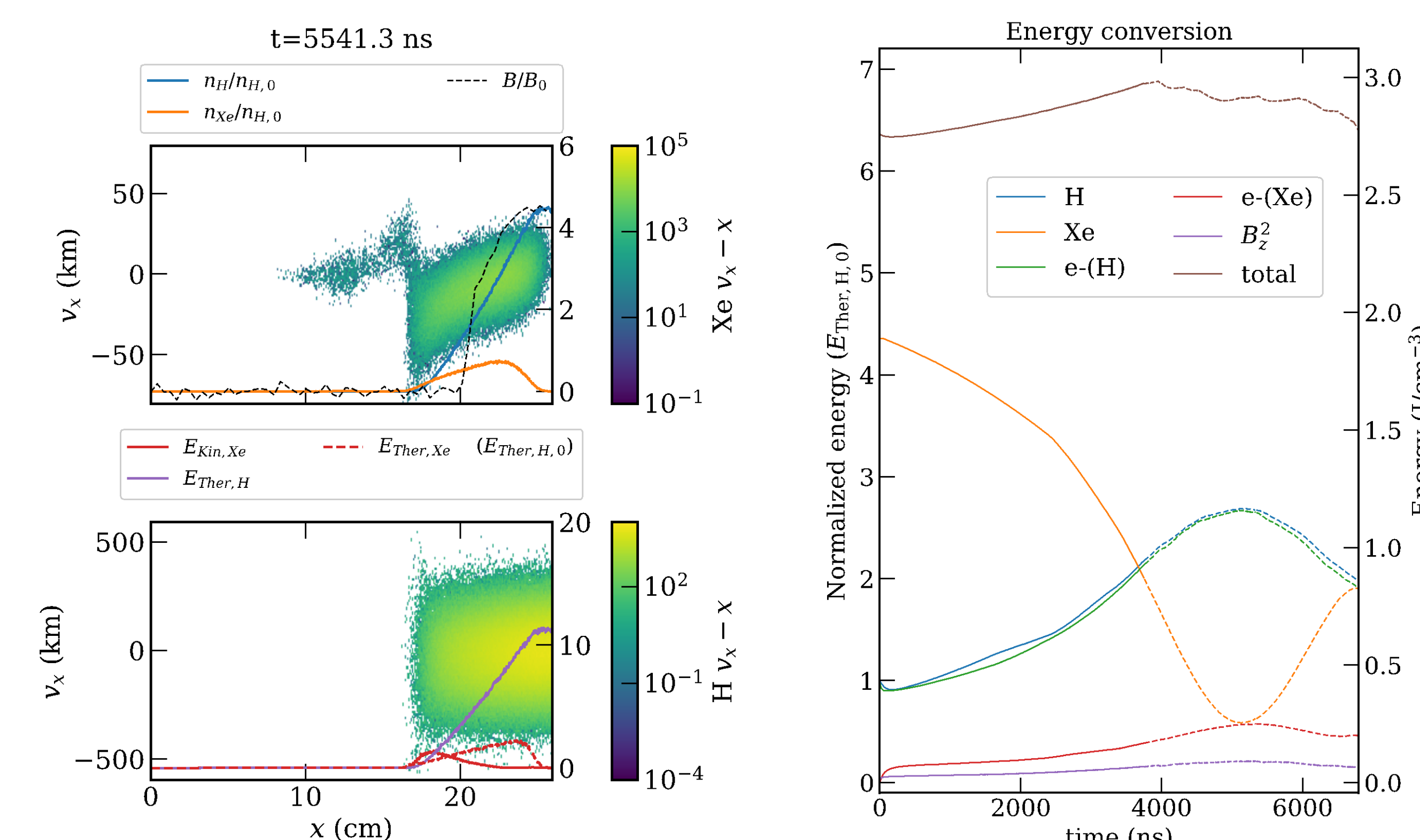
- $P \sim CR^5$ vs $CR^{3.33}$ (Cylindrical)

- PLX with 36 liners and 0.25 MJ stored energy aims to generate cm/! “/Mbar plasmas**

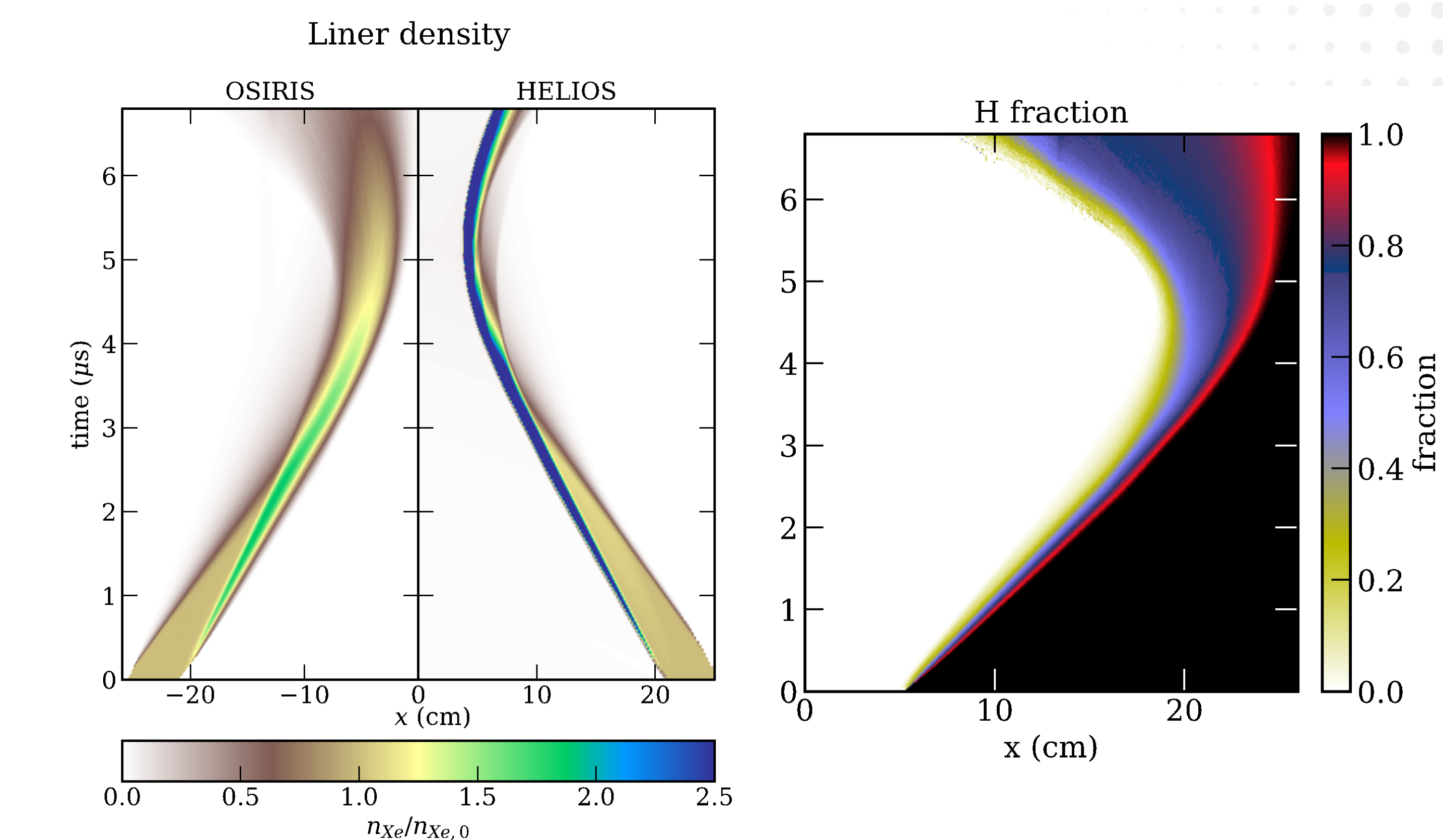


Courtesy of S. Langendorf, LANL

The translational kinetic energy of the liner was converted to the thermal energy of the liner and fuel



The kinetic simulation can model the inter-species mixing during the compression



* Wen et al. *Physics of Plasmas* 29, 062706 (2022)
** Hsu et al. *IEEE Transaction on Plasma Science* 40, 1287 (2012)

