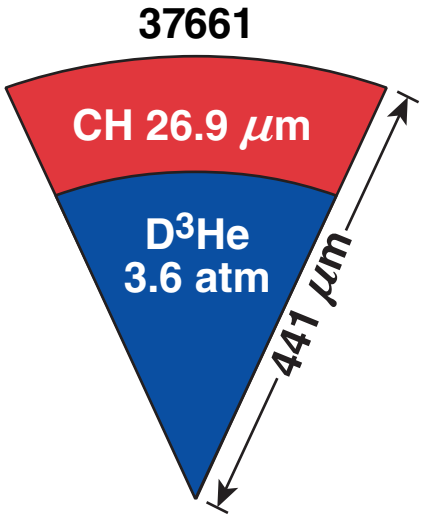
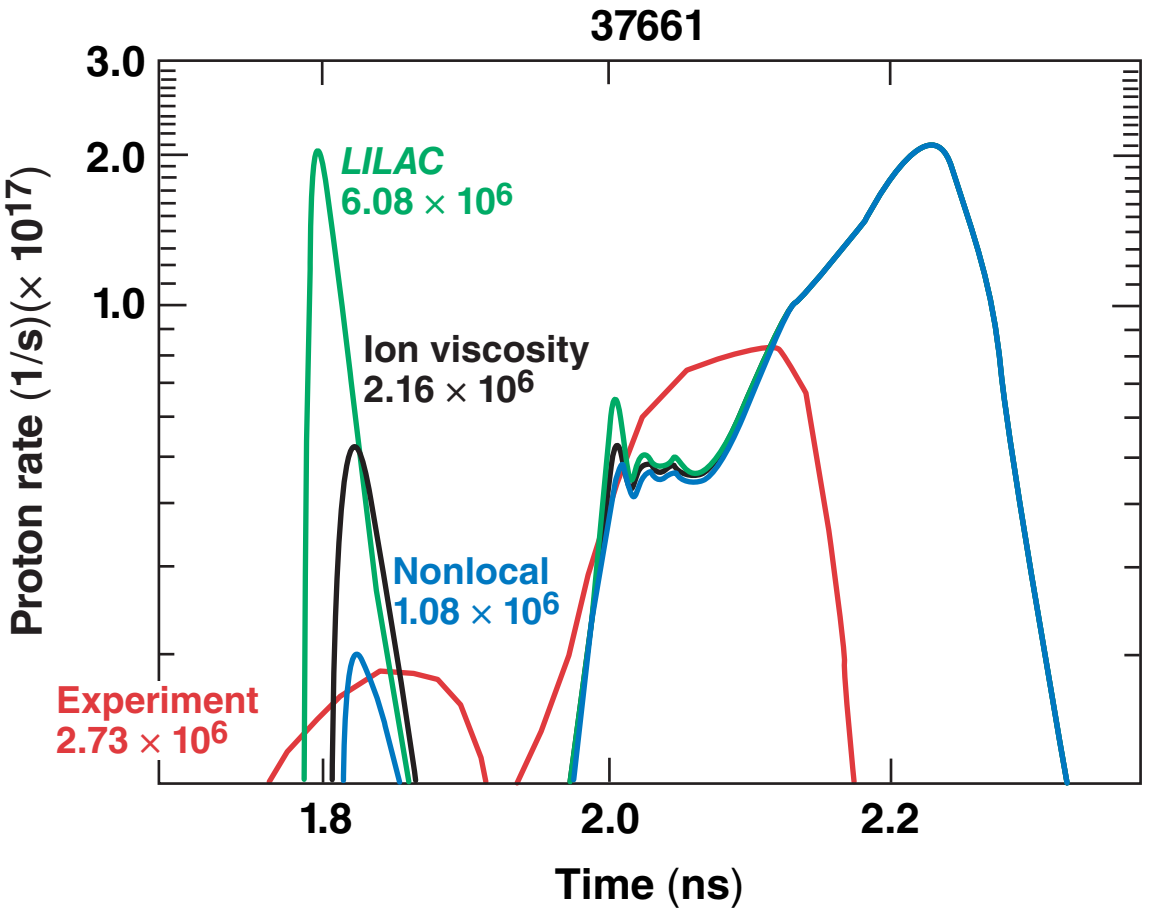
Modeling Ion-Heat Transport in ICF Targets





D. Li
University of Rochester
Laboratory for Laser Energetics

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Summary

The new nonlocal ion-heating transport model is being developed to study hot-spot formation in ICF designs

UR LLE

- The model is based on the solution of a simplified Boltzmann equation.
- The hot spot can be preheated by the nonlocal effect.
- The model prediction for the peak proton shock-yield rate is in good agreement with the experimental data.
- The model is currently being applied to cryogenic targets.

Collaborators

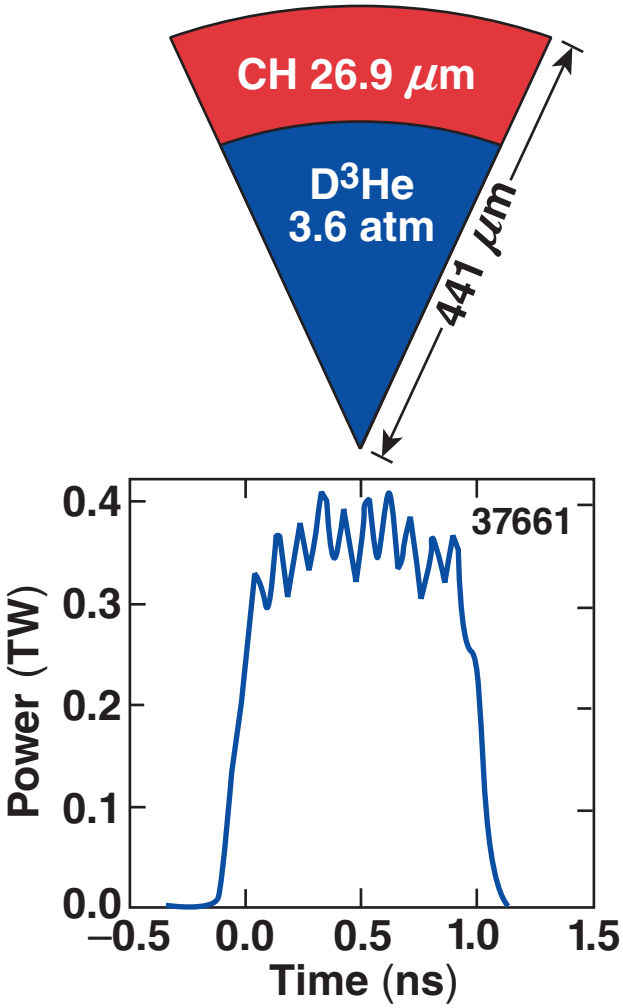
V. N. Goncharov, I. V. Igumenshchev, and S. Skupsky

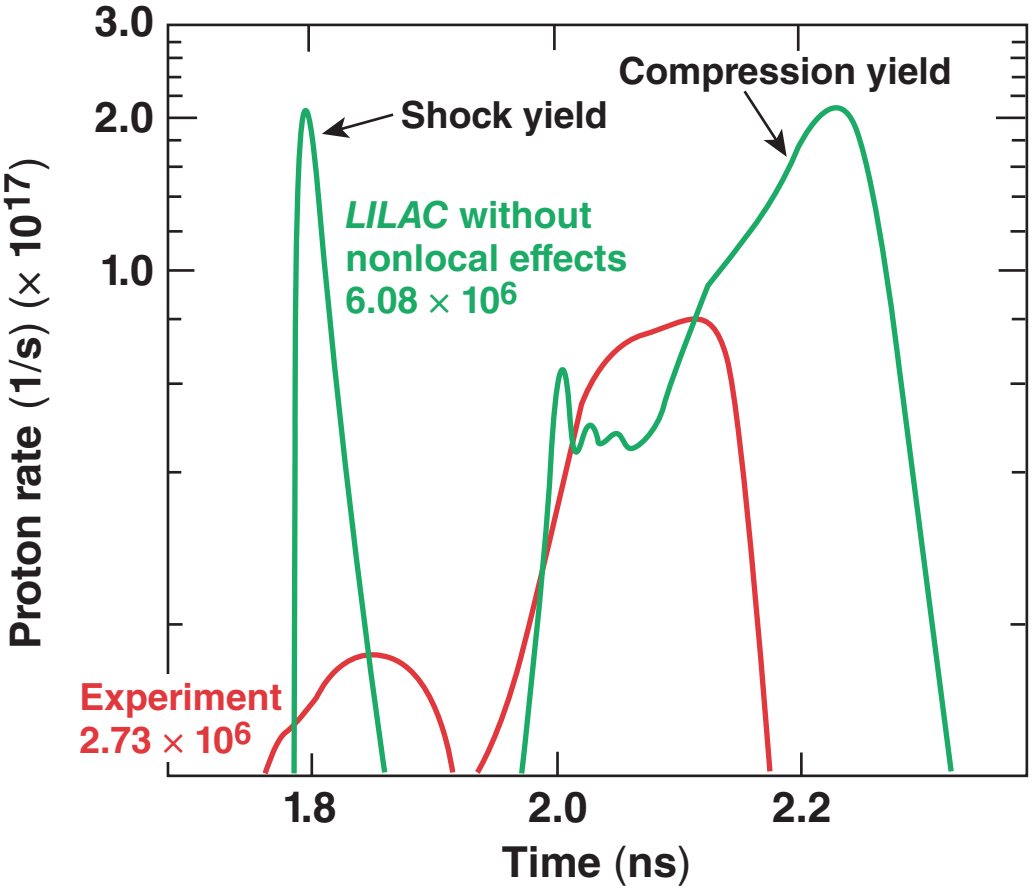
Laboratory for Laser Energetics
University of Rochester

J. A. Frenje, J. R. Rygg, C. K. Li, R. D. Petrasso, and F. H. Séguin

Plasma Science and Fusion Center
Massachusetts Institute of Technology

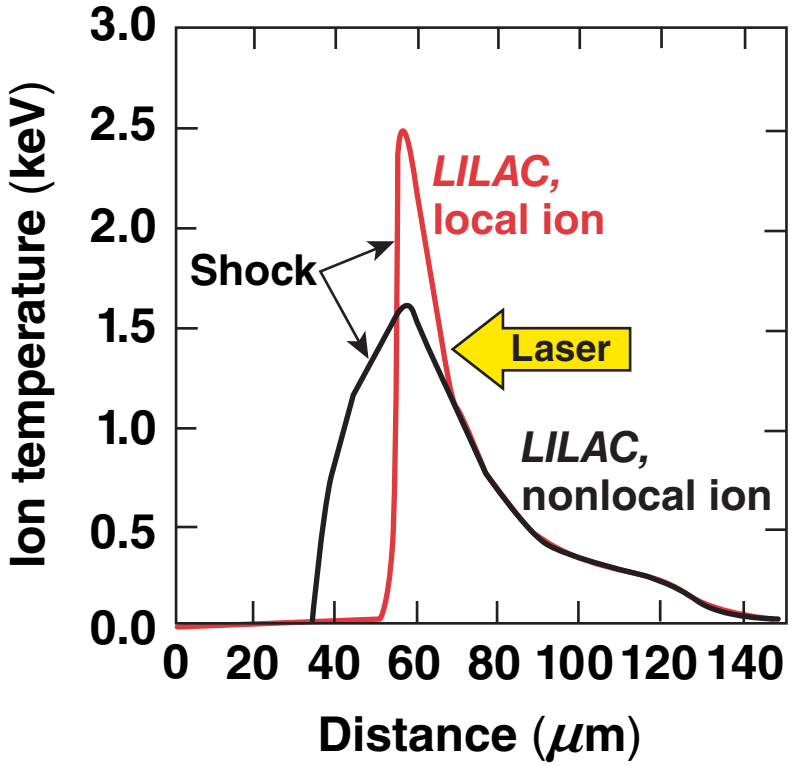
A local ion-heat transport model does not agree with experimental results

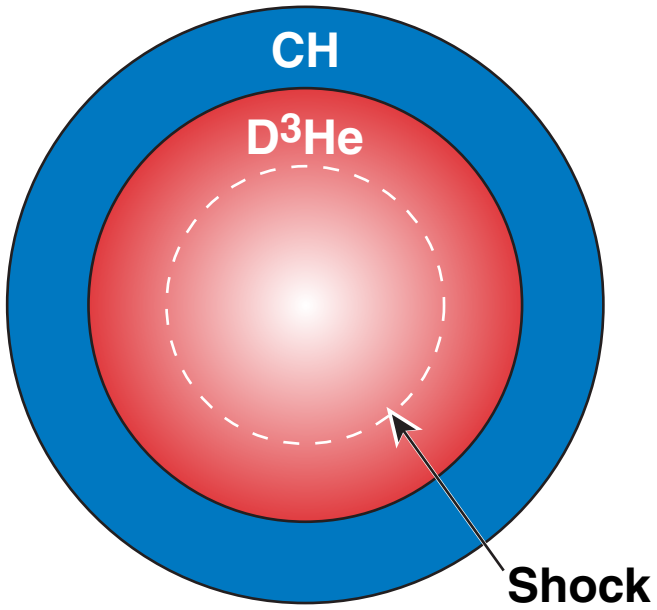




TC7521a

Nonlocal ion transport affects hot-spot formation in ICF targets





TC7924

A new model has been developed to calculate the ion-heat flux and ion viscosity

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- **A simplified Boltzmann equation (Krook model)**

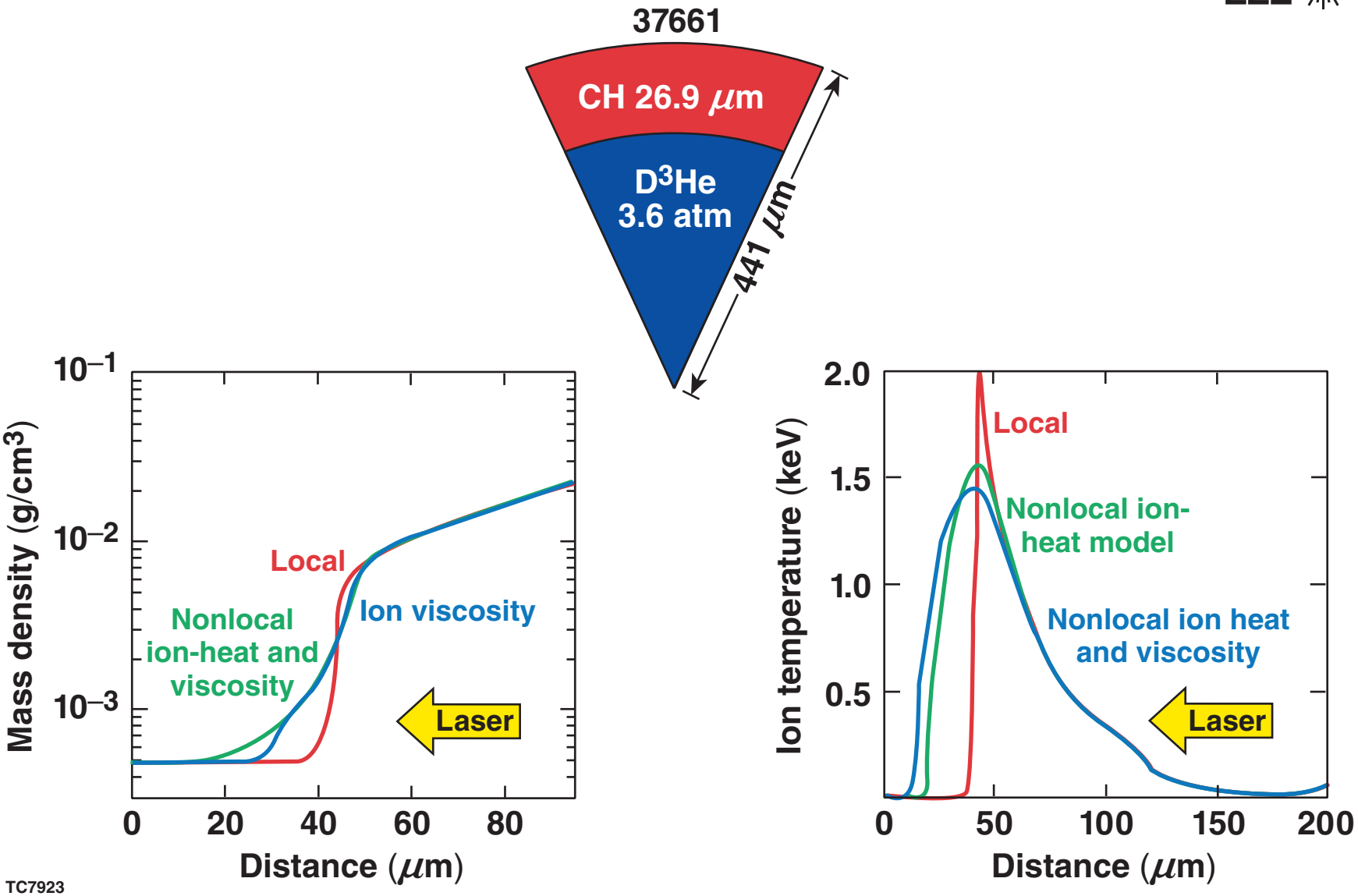
$$\nu_x \frac{\partial f}{\partial x} = -\nu(f - f_0) \qquad f_0 = \frac{n}{(2\pi T/m)^{3/2}} e^{\frac{m(\nu - V_x)^2}{2T}}$$

$$f = \int^{x} f_0 \, e^{-\xi/\cos\theta} \frac{dx'}{\lambda \cos\theta} \qquad \xi = \int_{x'}^{x} \frac{dx''}{\lambda} \qquad \lambda = \frac{\nu}{V}$$

- **Ion heat flux** $q_x = \int \frac{m}{2}(\nu - V_x)^2 \nu_x f d^3\nu$

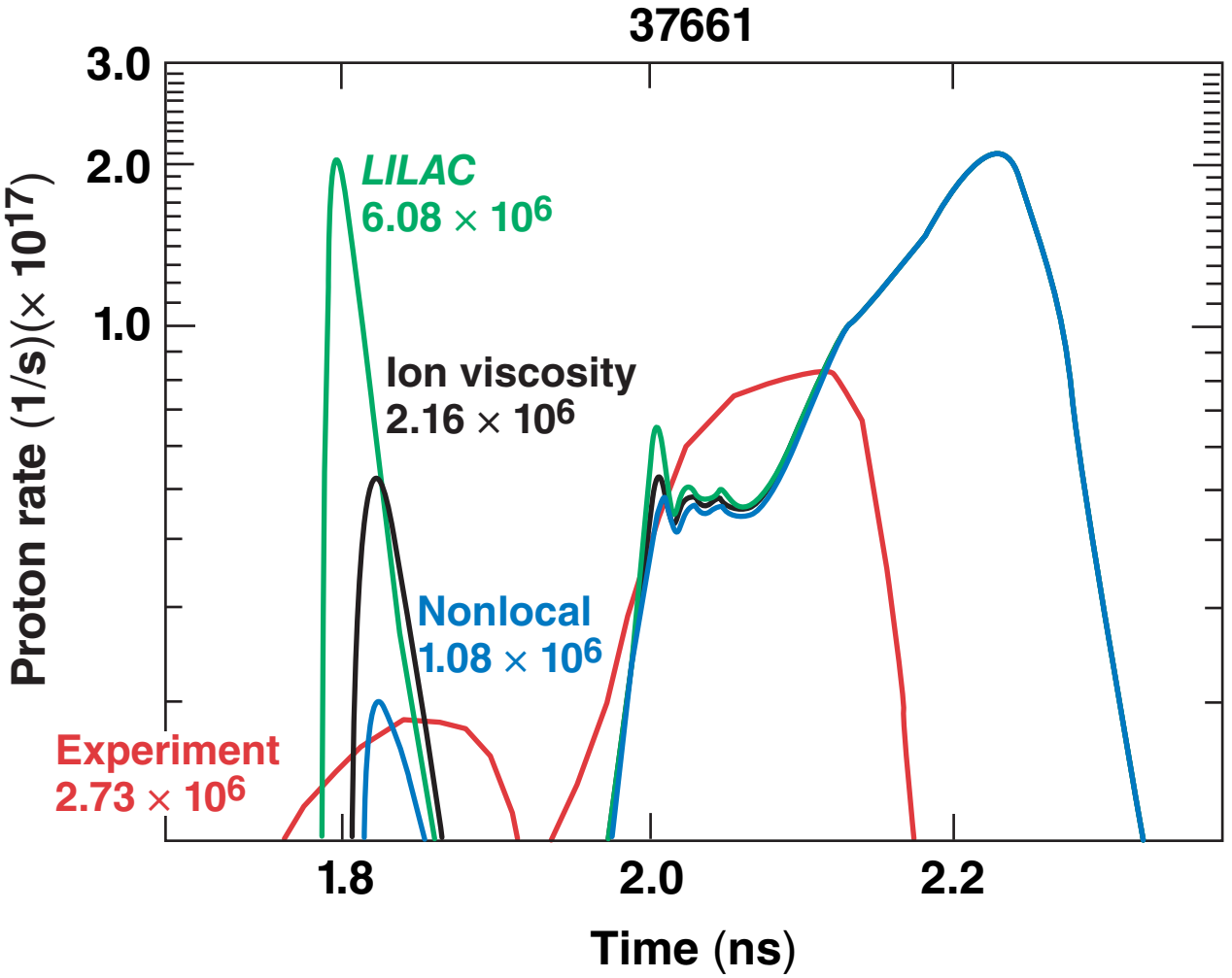
- **Ion viscosity** $\pi_{xx} = \int m\left[(\nu_x - V_x)^2 - \frac{1}{3}(\nu - V_x)^2\right] f d^3\nu$

The shock profiles are modified by nonlocal ion-heat flux and ion viscocity



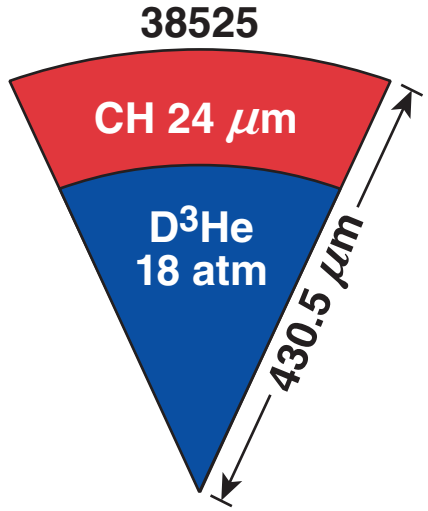
TC7923

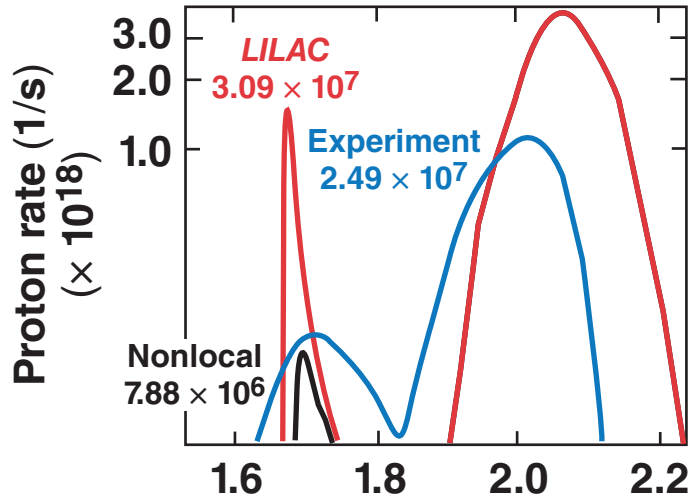
The shock yield is reduced by nonlocal modes, which is in better agreement with experiments

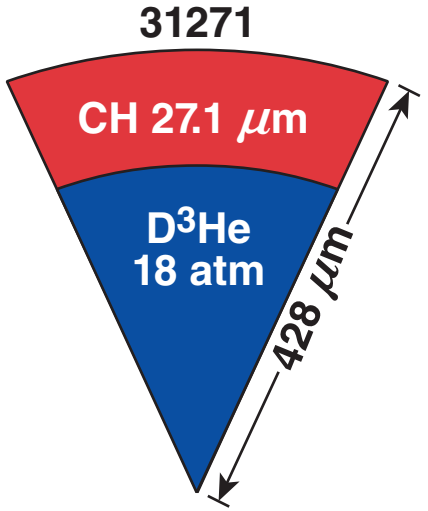


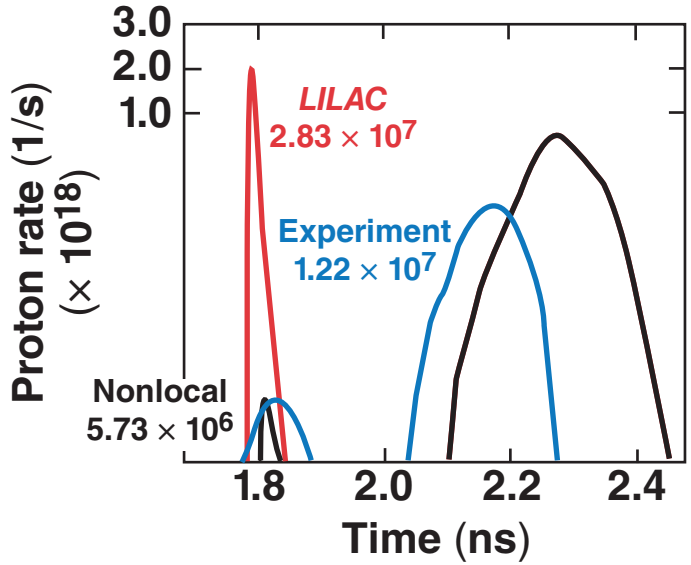
- Shock nonuniformity can contribute to the burn broadening.

The new nonlocal model is applied into the high-pressure gas target with different thicknesses









TC7932

Summary/Conclusions

The new nonlocal ion-heating transport model is being developed to study hot-spot formation in ICF designs

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