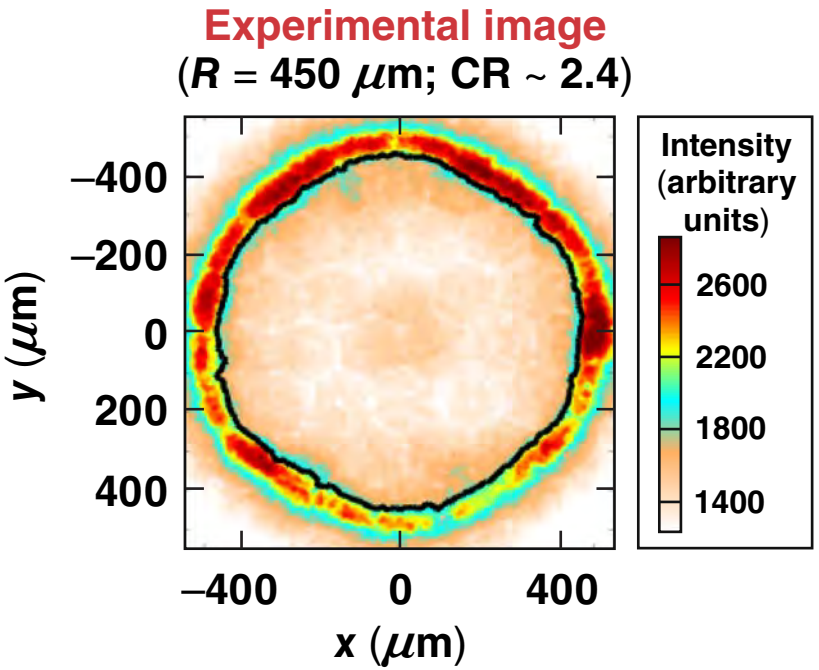
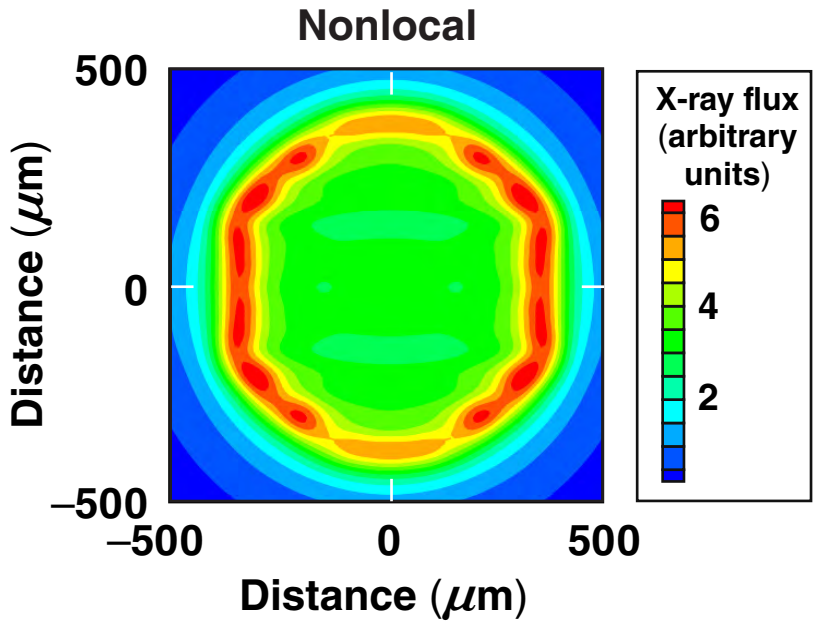
Effect of Nonlocal Thermal-Electron Transport on the Symmetry of Polar-Drive Experiments





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55th Annual Meeting of the
American Physical Society
Division of Plasma Physics
Denver, CO
11–15 November 2013

Summary

Nonlocal electron transport must be considered to model polar-drive implosions

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- A 2-D nonlocal electron thermal-transport model (iSNB)* has been added to the 2-D hydrodynamics code *DRACO*
- The warm CH shell NIF** shot N130731 was simulated with both flux-limited electron-heat transport and the iSNB model
- The iSNB model resulted in higher drive near the equator from
  - higher electron temperatures than at the pole
  - larger effective radial flux limiter in the transport region
- Simulations of polar-drive implosions requires modeling both nonlocal thermal electron transport and cross-beam energy transfer (CBET)***

*Implicit Schurtz–Nicolaï–Busquet model
**National Ignition Facility
***J. Marozas *et al*., CO7.00004, this conference;
T. J. B. Collins *et al*., UO4.00008, this conference.

Collaborators

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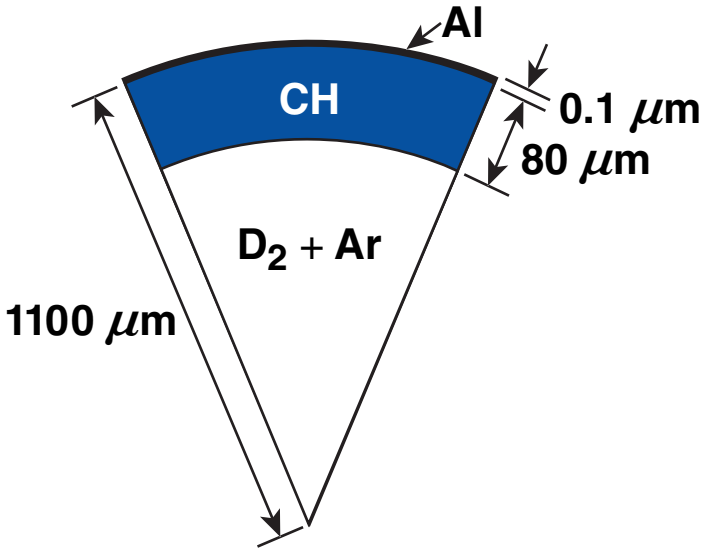
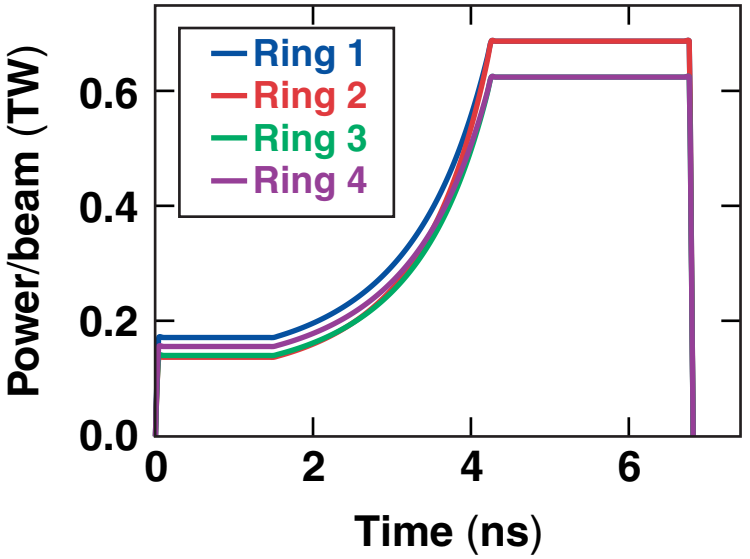
The 2-D iSNB scheme in *DRACO* was developed at the University of Wisconsin*

- One-dimensional simulations have shown that nonlocal heat transport is required to reproduce experimental results**
- The iSNB scheme in *DRACO* uses a modified implicit version of the Schurtz–Nicolaï–Busquet model***
- A correction to the local Spitzer flux is obtained from a set of multi-energy-group diffusion equations, which are iterated to a self-consistent solution

*D. Cao *et al.*, TP8.00081, this conference.
**I. V. Igumenshchev *et al.*, Phys. Plasmas 19, 056314 (2012).
***G. P. Schurtz, Ph. D. Nicolaï, and M. Busquet, Phys. Plasmas 7, 4238 (2000).

A Eulerian simulation was carried out for polar-drive NIF shot N130731* with the iSNB model





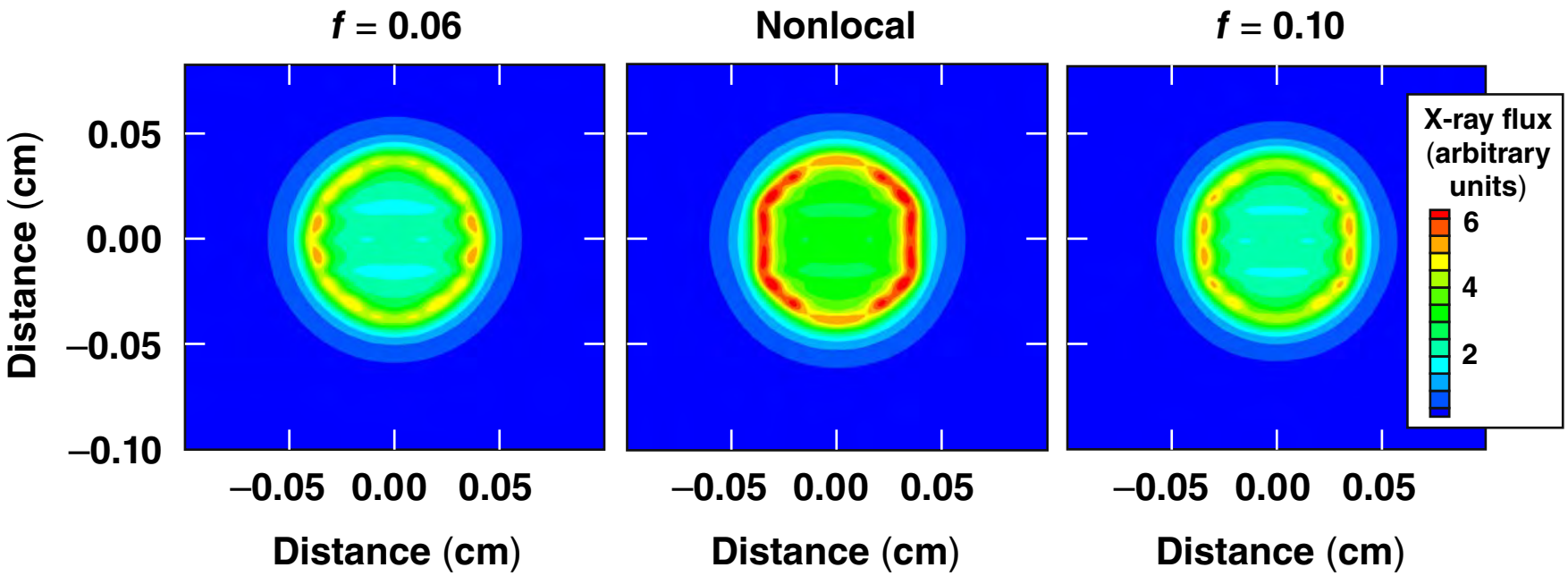
$I_L \sim 8 \times 10^{14}$ W/cm^2

Simulations were also carried out for two values of the flux limiter: 0.06 (standard) and 0.1.

E22290c

*P. B. Radha *et al.*, UO4.00001, this conference.

Nonlocal transport drives the equator more strongly than the f = 0.06 flux-limited Spitzer transport

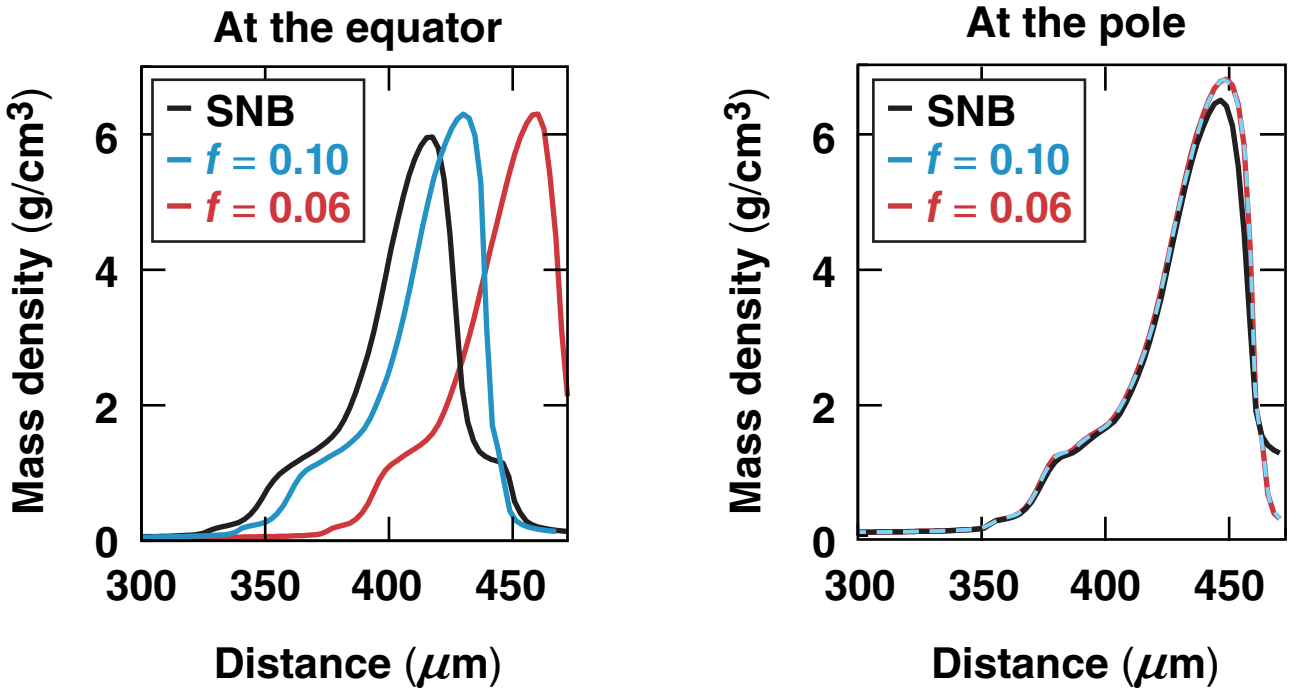


Simulation images generated at ~5.5 ns with *Spect3D**

*J. J. MacFarlane *et al.*, High Energy Density Physics 3, 181 (2007).

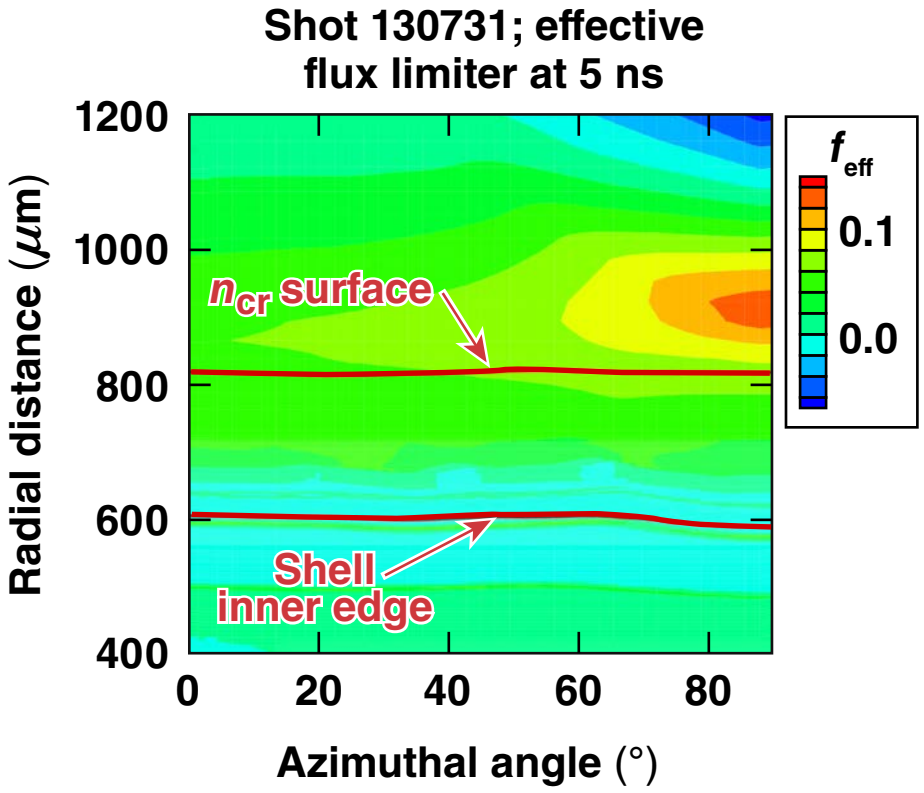
The drive at the equator is more sensitive to the flux limiter and nonlocal transport than at the pole

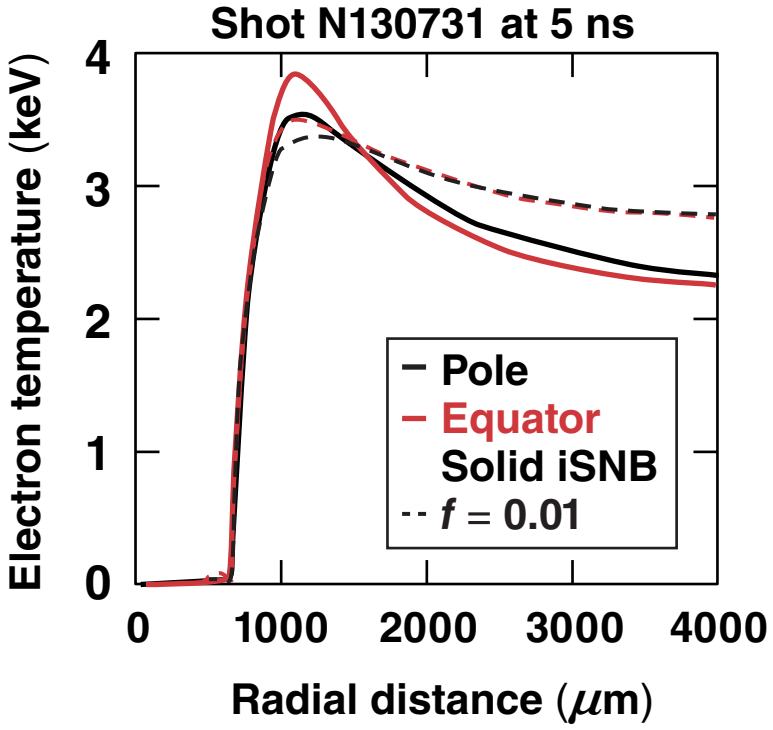
- Profiles taken at 6 ns



TC10843

The radial effective flux limiter (f_{eff}) is higher at the equator than at the pole because of the higher coronal temperature



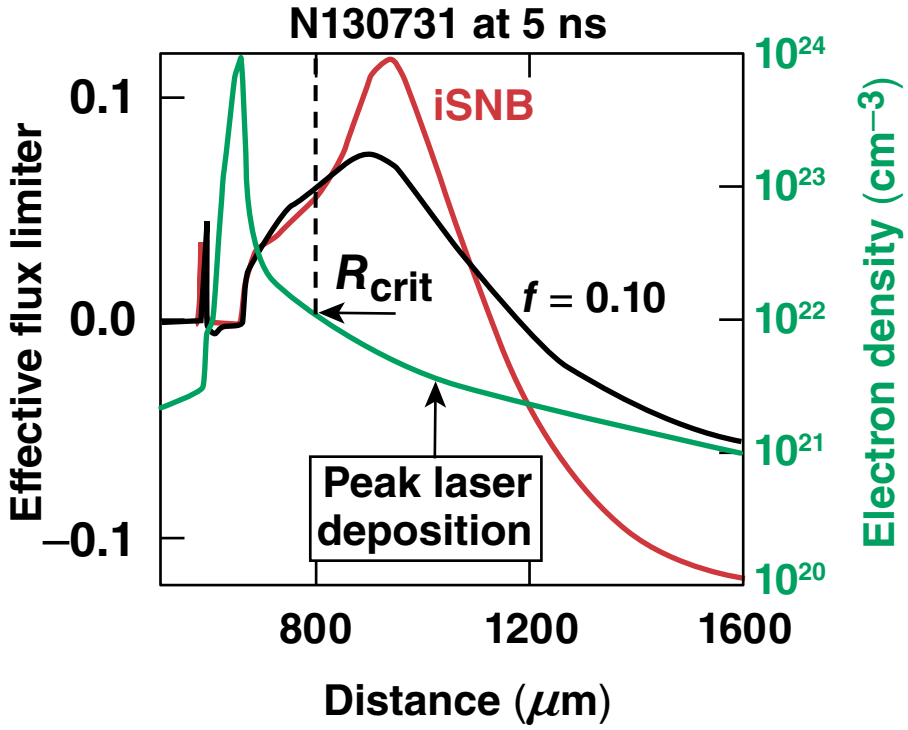


$f_{eff} = -Q_{iSNB}/Q_{fs}$

Larger laser deposition in the iSNB model produces higher temperatures than for $f = 0.1$.

TC10845

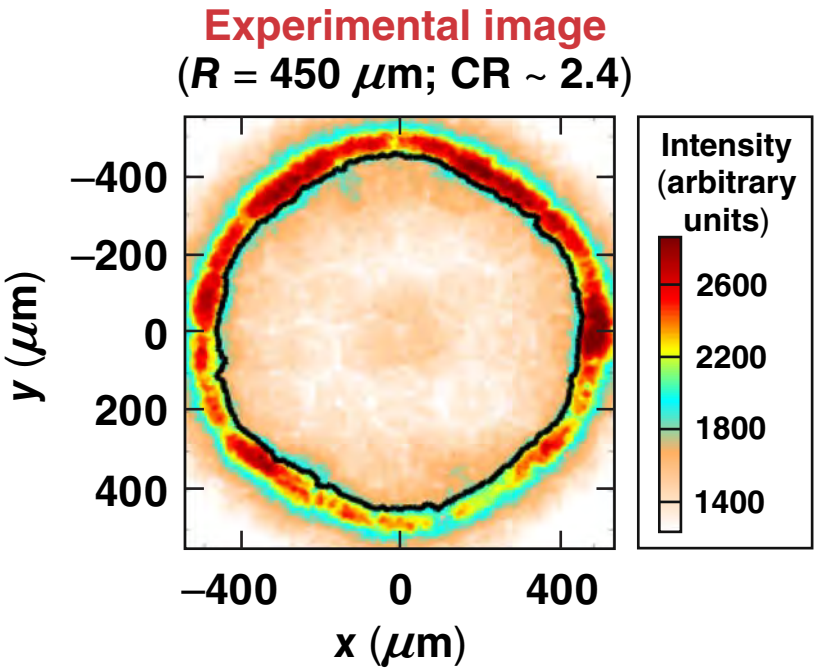
The nonlocal radial effective flux limiter at the equator is larger than that for $f = 0.1$ near the peak laser deposition

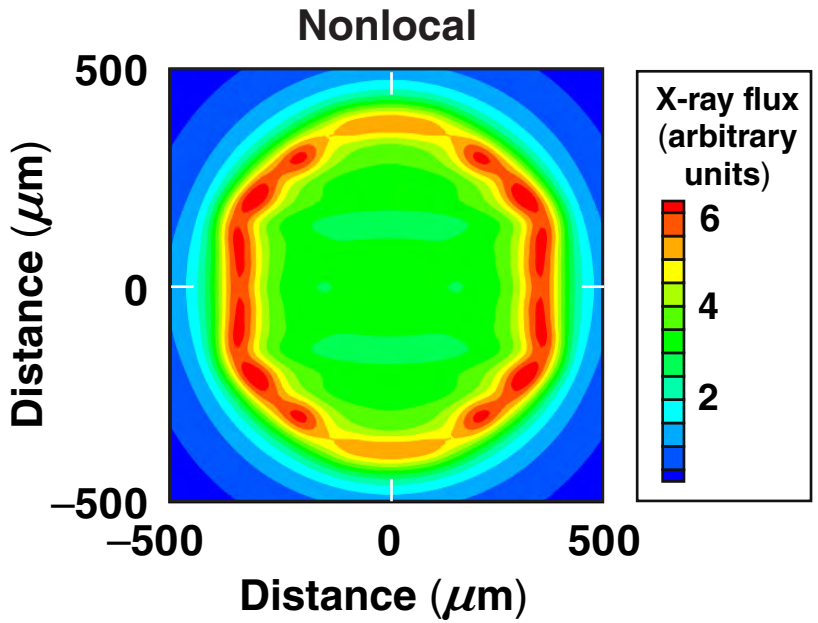


Simulations cannot be carried out with a single flux limiter.

TC10844

Simulations with CBET will make the oblate simulation image prolate*





CBET reduces absorption mostly at the equator, reducing the drive and improving agreement with the experimental shape.

*J. Marozas *et al.*, CO7.00004, this conference;
T. J. B. Collins *et al.*, UO4.00008, this conference.

TC11039

Summary/Conclusions

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