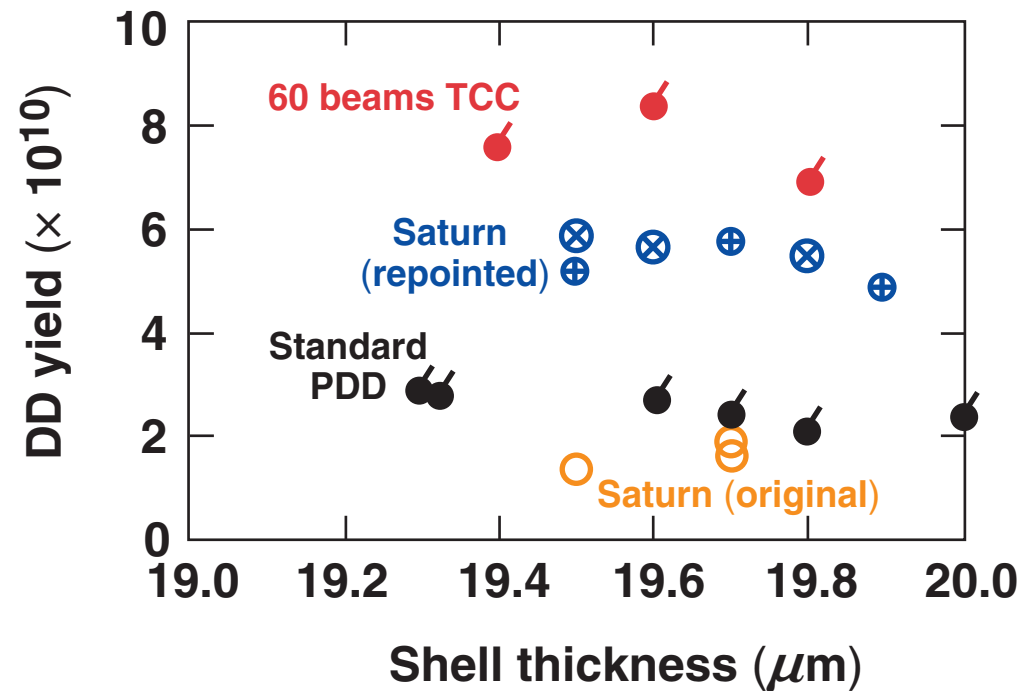
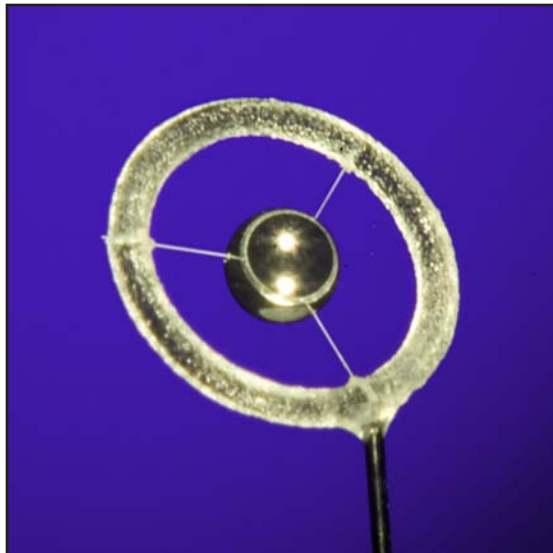


Radiation Transport in Saturn Targets Used for Polar Direct Drive

Spoke-mounted
Saturn target



R. S. Craxton, F. J. Marshall, *et al.*
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Laboratory for Laser Energetics

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Summary

When allowance is made for radiation transport, Saturn targets on OMEGA perform almost as well as symmetrically irradiated targets



- **The initial experiments suffered from excessive drive on the equator.**
- **A new radiation model in *SAGE* shows that this was due to x rays from the ring being absorbed in the capsule.**
- **Yields up to ~75% of symmetric have been obtained after adjusting the beam pointings.**

Contributors



**F. J. Marshall, M. J. Bonino,
S. G. Noyes, and V. A. Smalyuk**

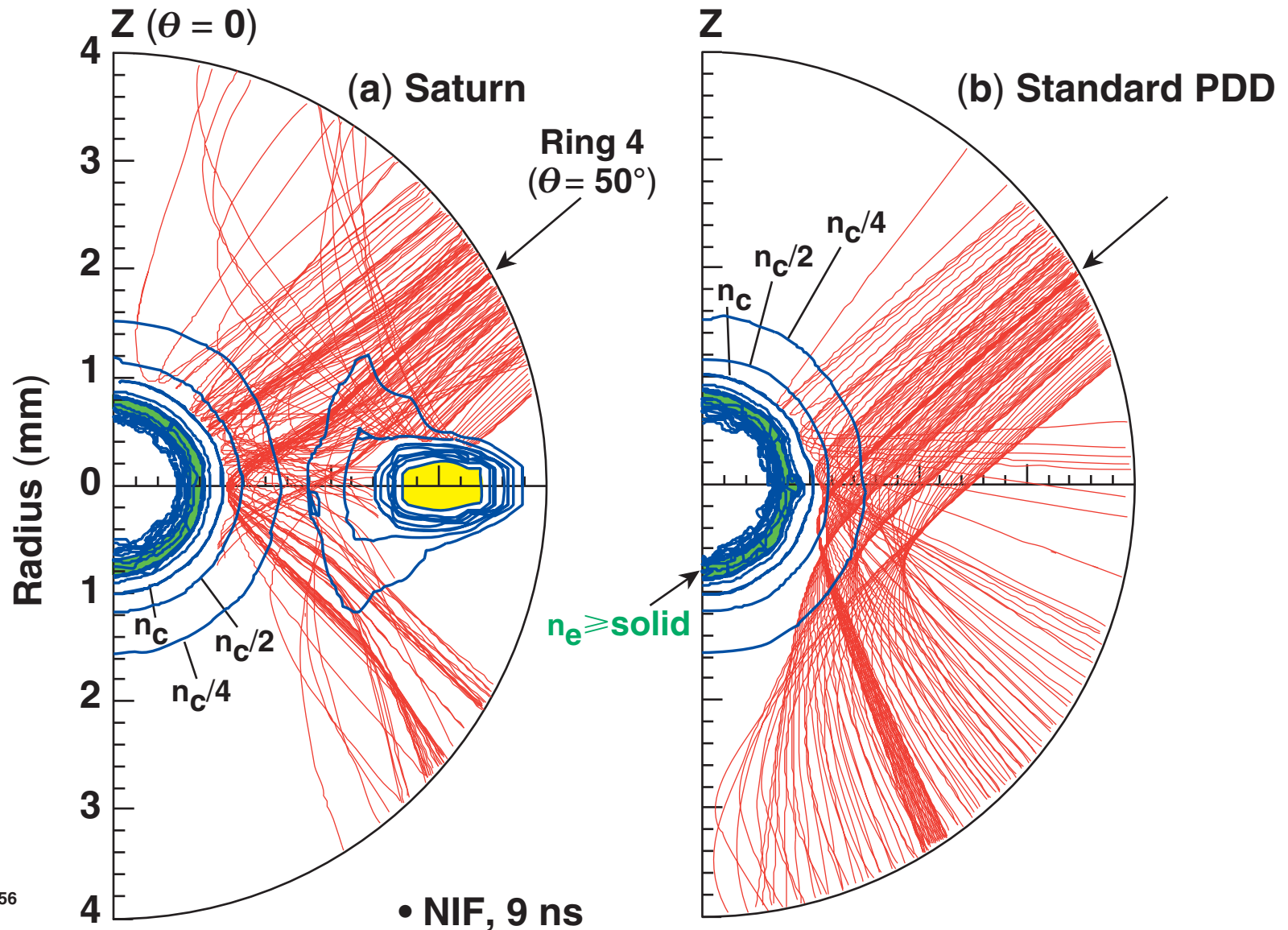
**University of Rochester
Laboratory for Laser Energetics**

Outline



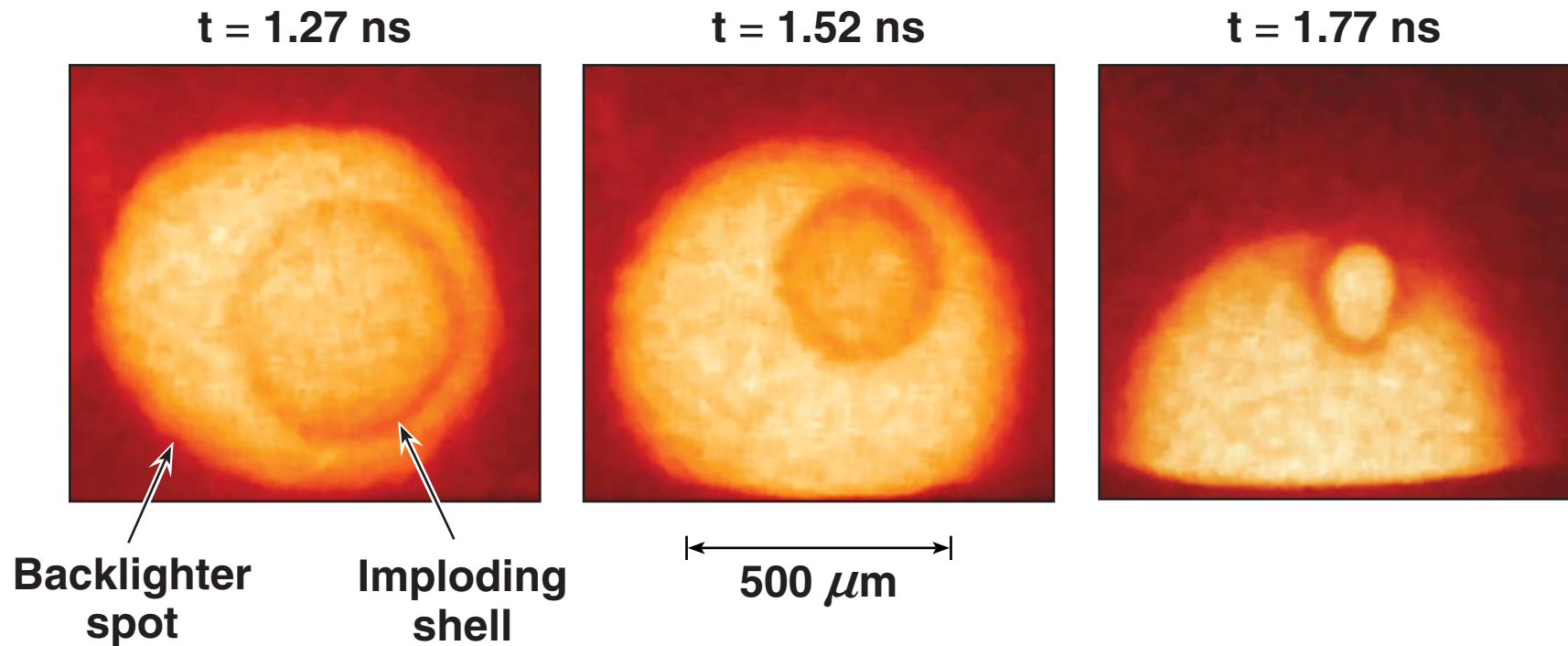
- **Saturn targets**
- **Experimental results for original beam pointings**
- **Radiation model in *SAGE***
- **Experimental results for adjusted beam pointings**
 - **see following paper by F. J. Marshall**

As the critical surface moves in, the ring of the Saturn target refracts rays back toward the equator



Framing-camera backlit images of the original Saturn experiment showed increased drive on the equator

P6 view (26.6° above equator)

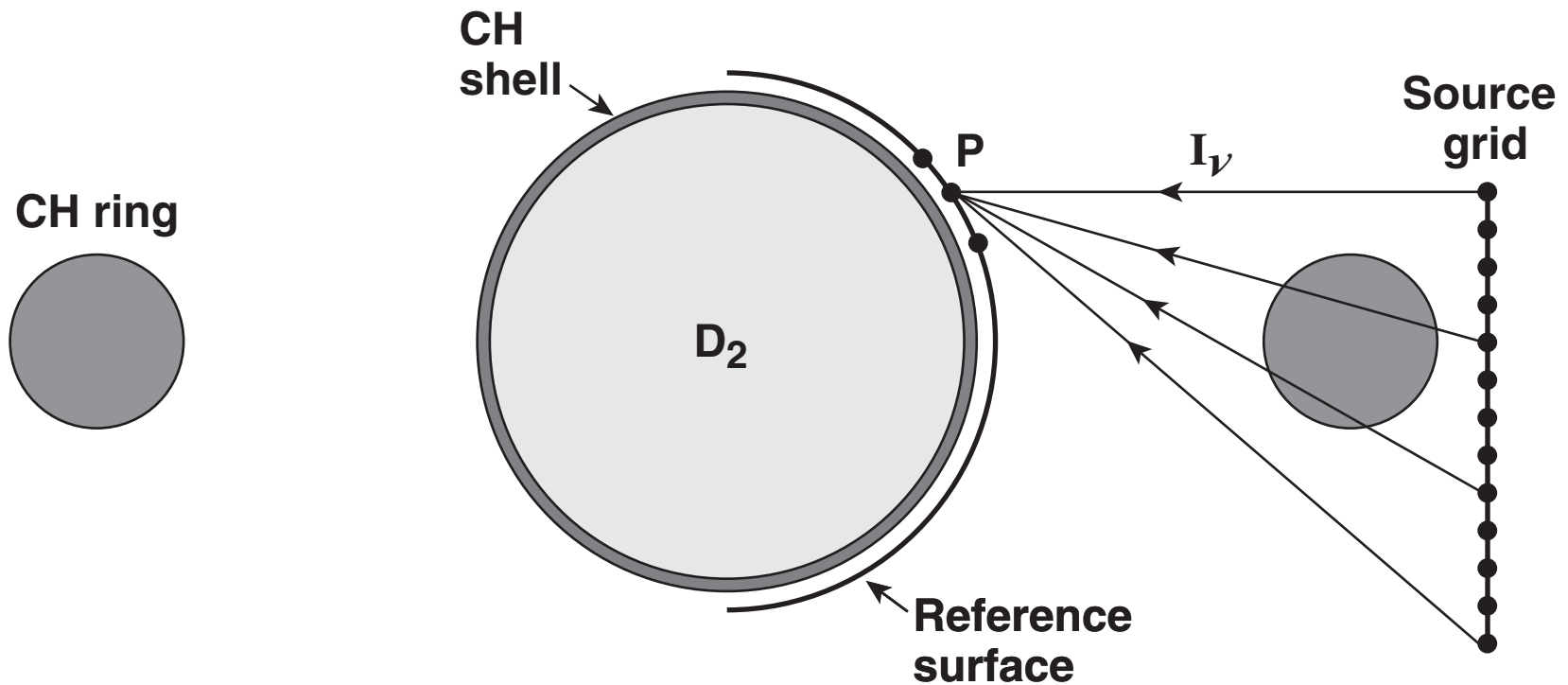


***SAGE* models the radiation from the ring plasma to the capsule using a new model**



- The model is similar to “view-factor” models.
- Full directional and spectral information is retained.
- The model is implemented within the *SAGE* optical ray-tracing package.
- The algorithm is divided into two stages:
 - transport
 - deposition

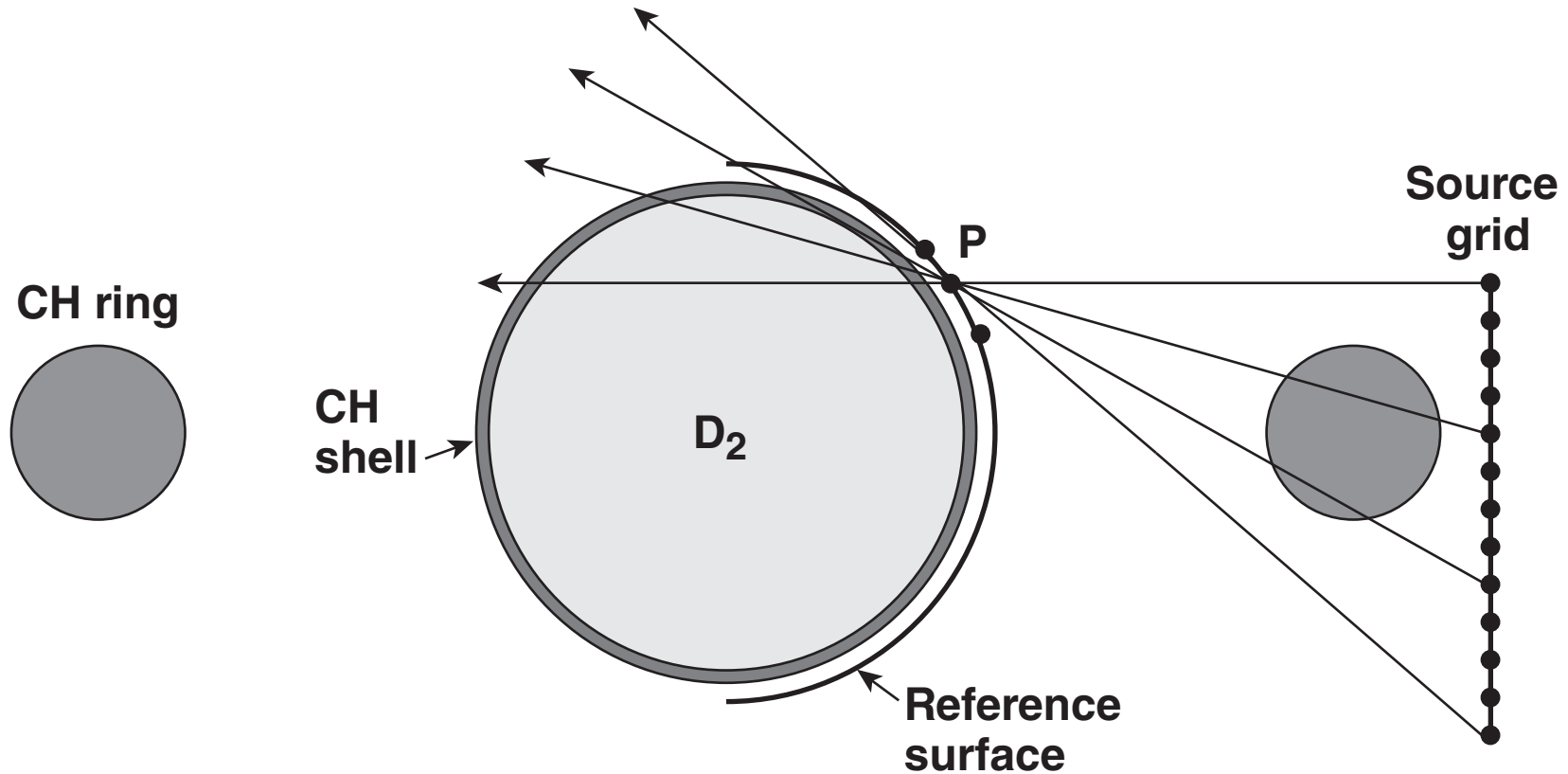
In the “transport” stage, the incident spectral intensity is calculated as a function of angle and wavelength



$$\frac{dI_{\nu}}{ds} = \kappa_{\nu} (B_{\nu} - I_{\nu})$$

Opacity Blackbody

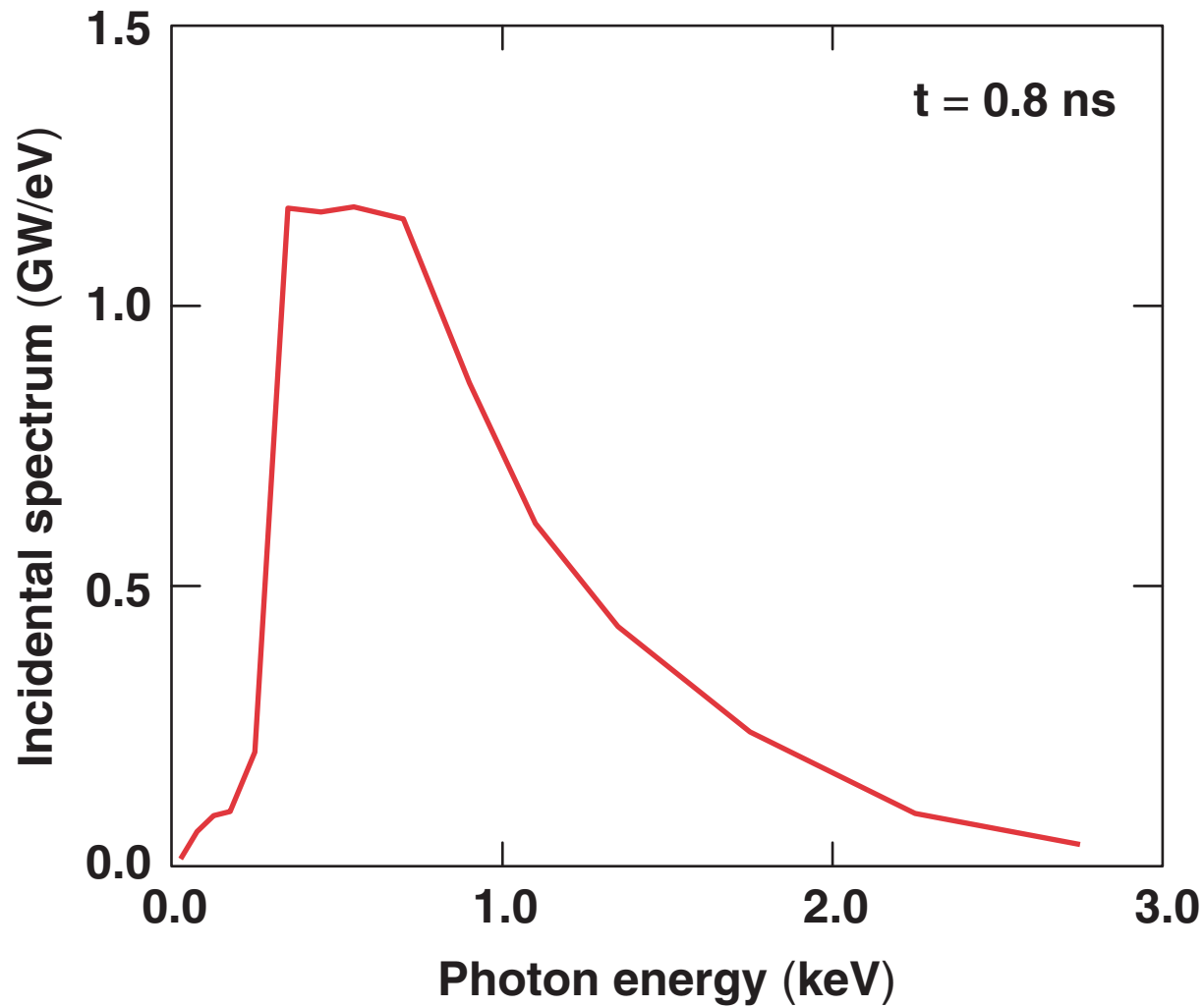
In the “deposition” stage, rays with known incident energy are propagated into the capsule and attenuated



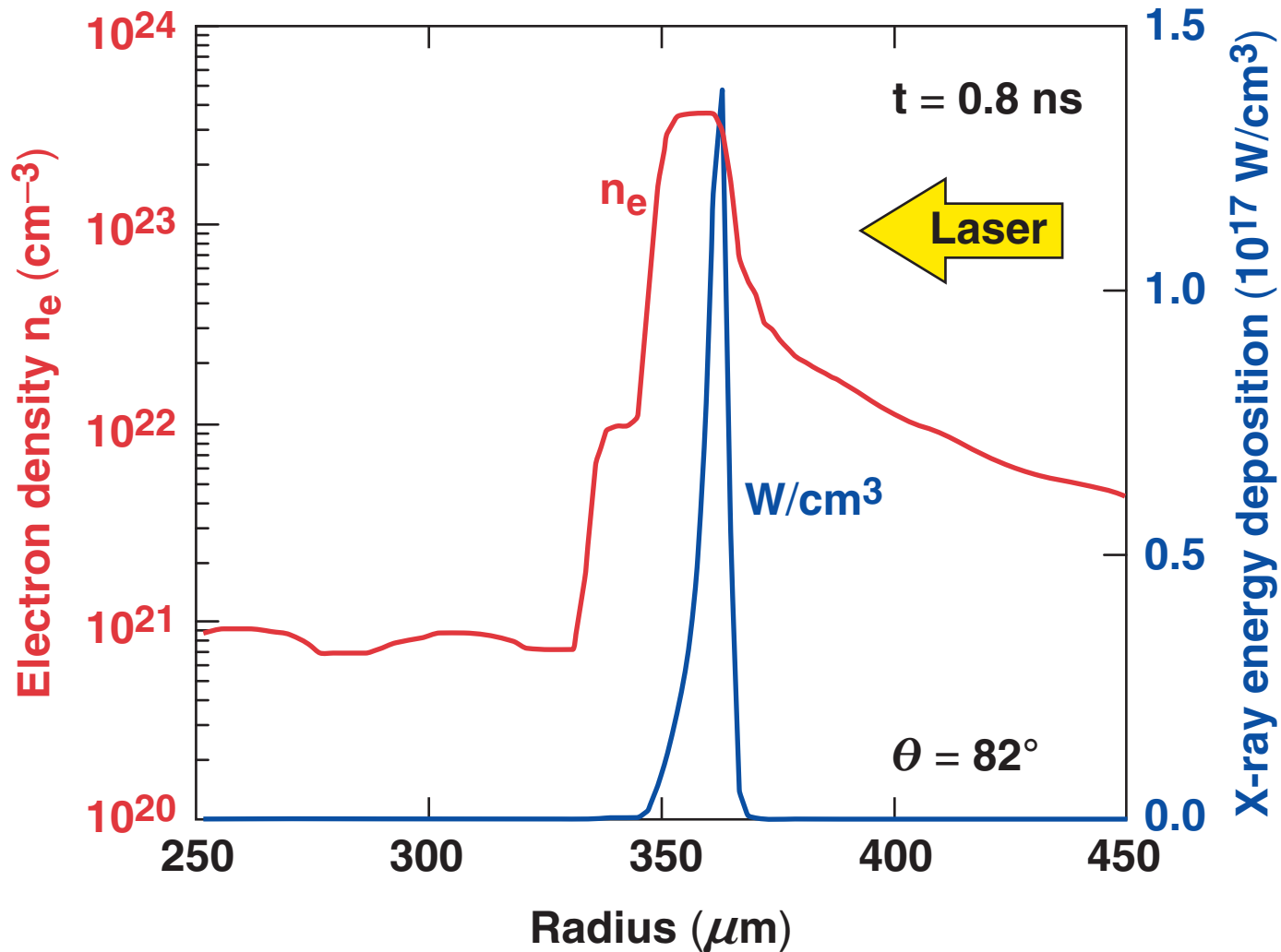
Ray energy: $\delta E = I_{\nu} dt \times dS \times d\Omega \times d\nu$

Along ray: $\frac{d}{ds} \delta E = -\kappa_{\nu} \delta E$

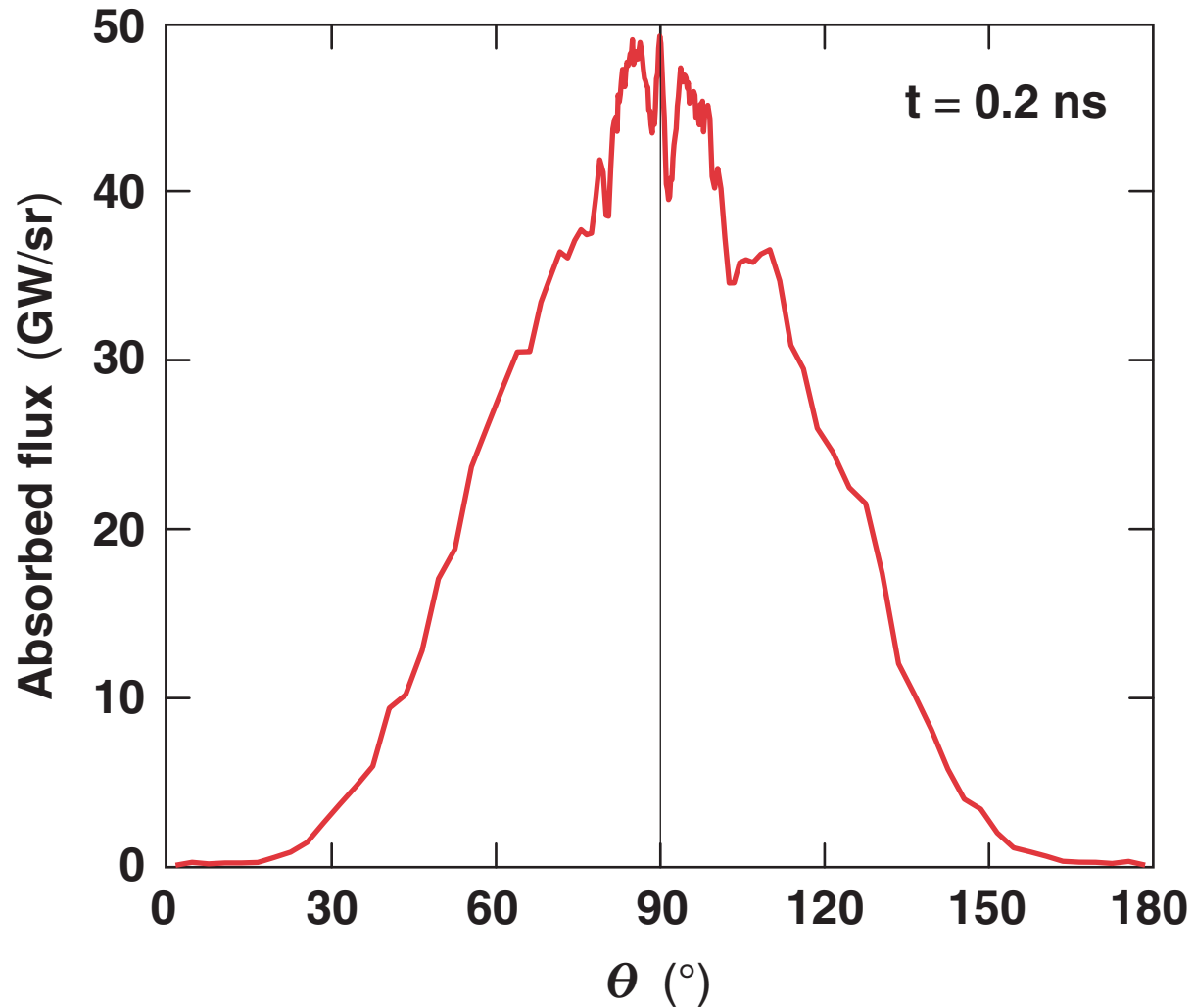
The incident spectrum is dominated by x rays between 300 and 1000 eV



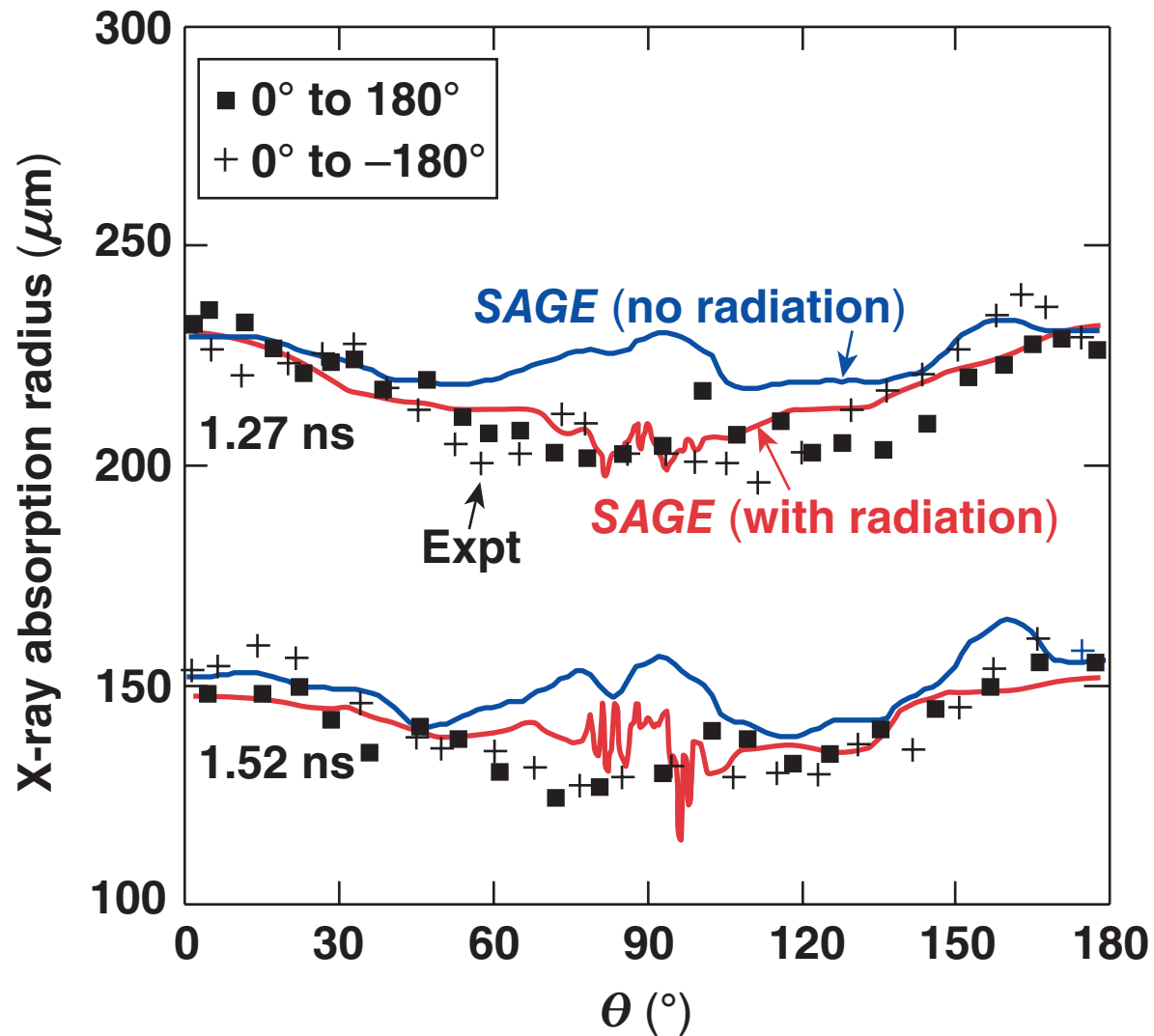
The x-ray energy deposition is mostly localized on the outer portion of the CH shell



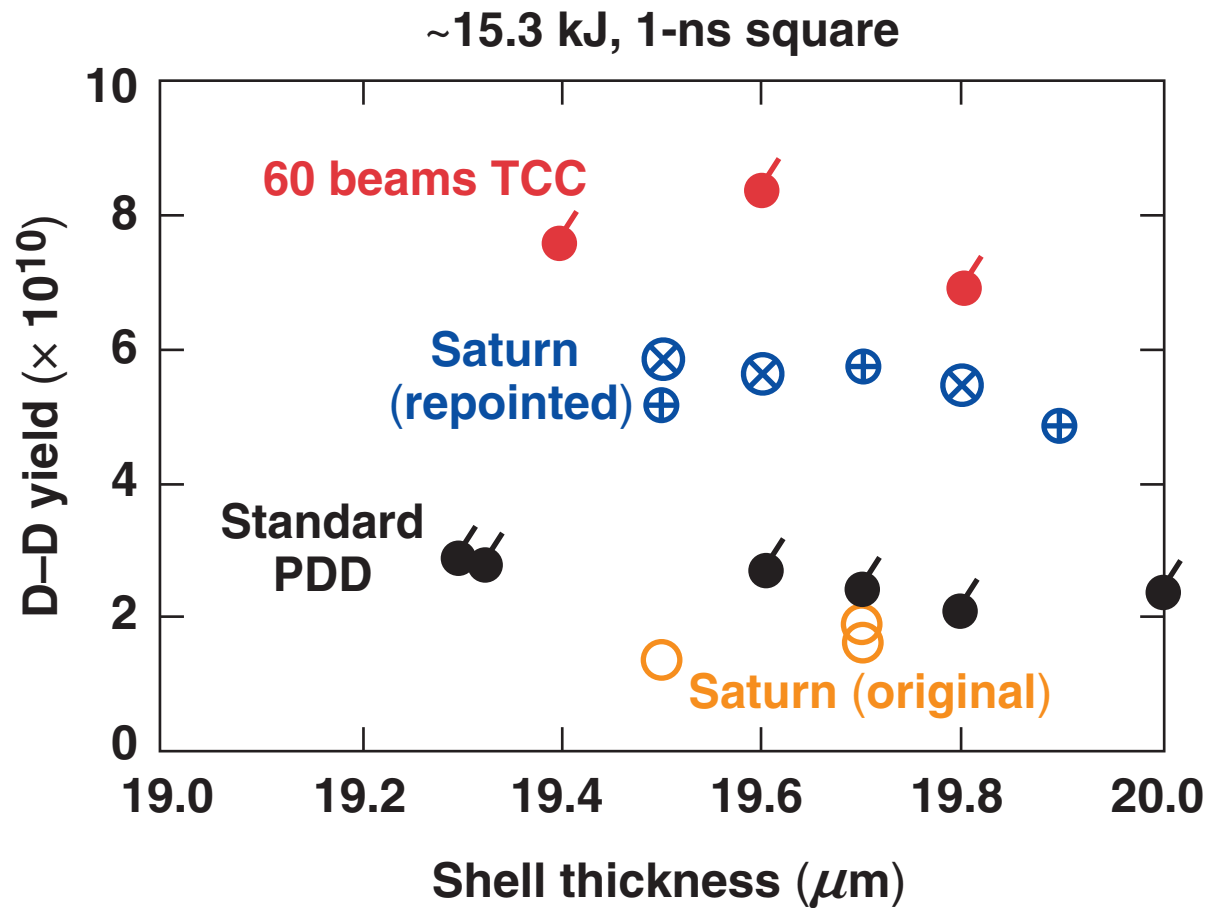
The deposited x-ray energy peaks at the equator



The additional drive at the equator for the original Saturn target is due to radiation



The best Saturn targets perform almost as well as symmetrically irradiated targets



Summary/Conclusions

When allowance is made for radiation transport, Saturn targets on OMEGA perform almost as well as symmetrically irradiated targets



- The initial experiments suffered from excessive drive on the equator.
- A new radiation model in *SAGE* shows that this was due to x rays from the ring being absorbed in the capsule.
- Yields up to ~75% of symmetric have been obtained after adjusting the beam pointings.

These results strengthen the prospects for direct-drive ignition on the NIF.

See also F. J. Marshall, RO1, 2:12 pm
I. V. Igumenshchev, RO1, 2:24 pm
S. Skupsky, RO2, 3:00 pm
J. A. Marozas, Friday, UI1