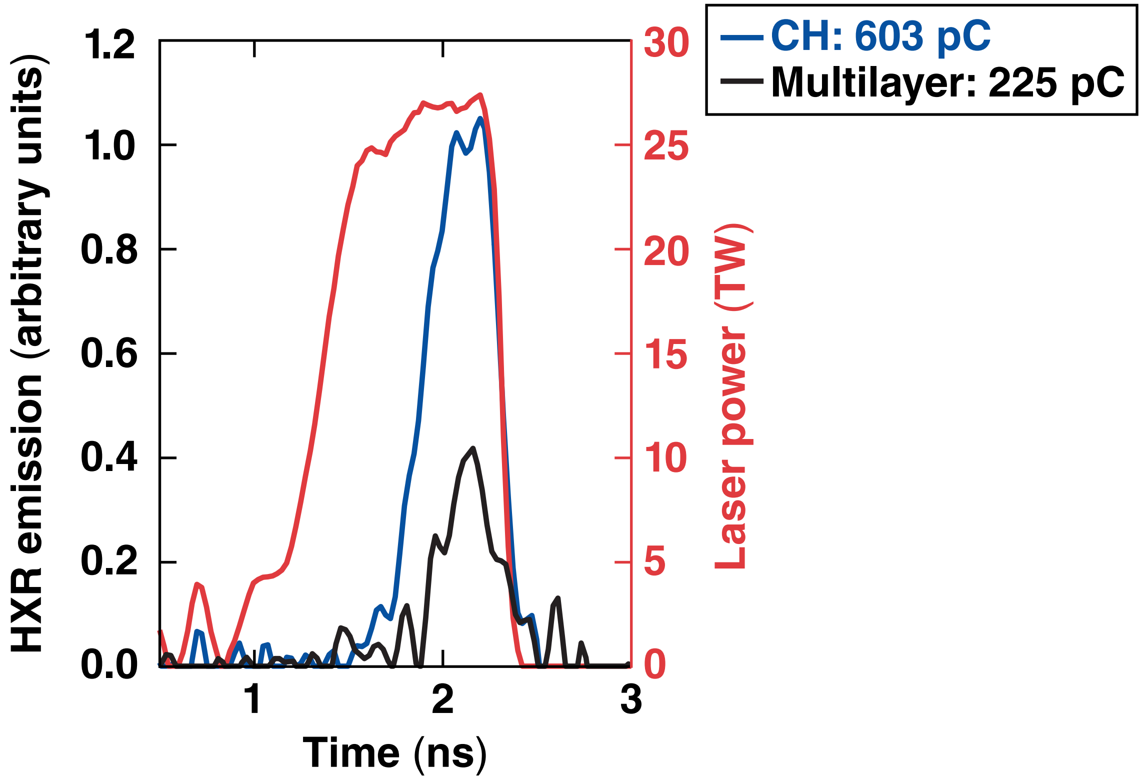
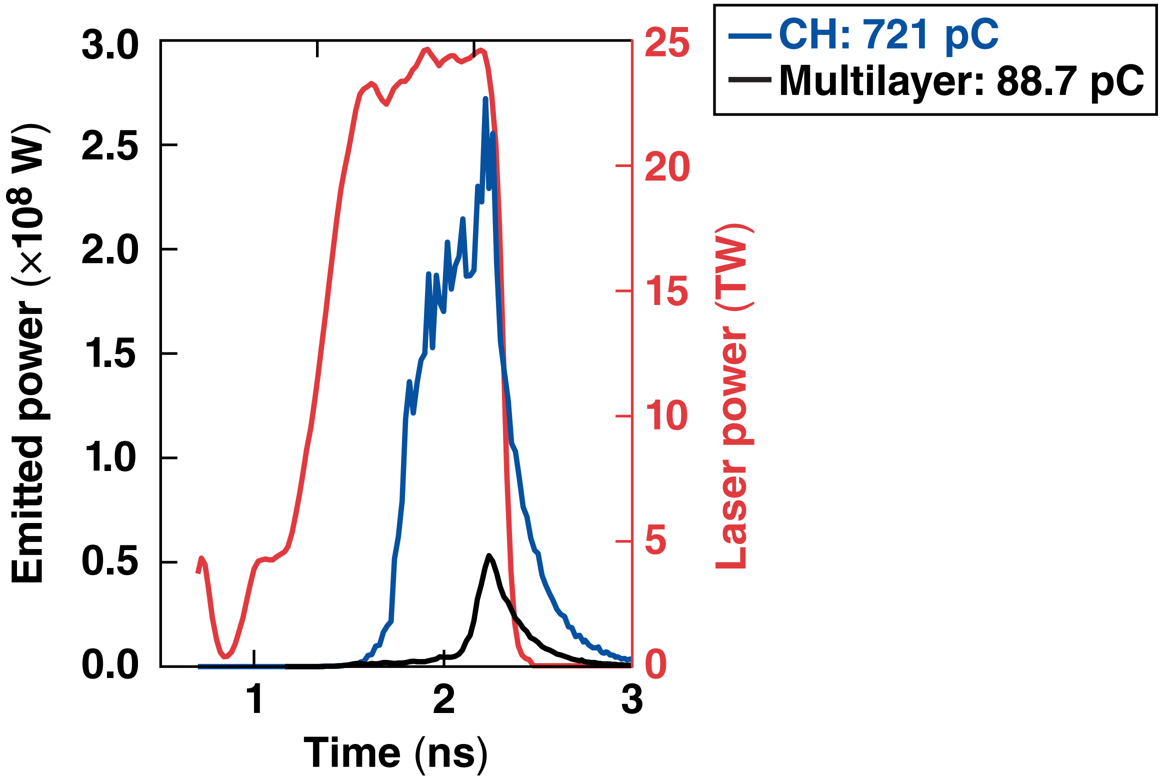
Recent Advances in the Transport Modeling of Two-Plasmon–Decay Electrons in the 1-D Hydrodynamics Code *LILAC*

Measured HXR emission



HXR emission from simulation



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LILAC simulations using an improved fast-electron transport model reproduce the timing of the hard x-ray (HXR) emission in OMEGA experiments

- Improvements have been added to the fast-electron straight-line transport model to study the effect of two-plasmon–decay (TPD) fast electrons
  - random departure from specular reflection at the target outer boundary
  - source divergence
- Two spherical OMEGA implosions with different shell materials (CH and a Si layer) were simulated
  - the relative HXR emission levels are well reproduced
  - the threshold parameter is lower for the Si-layer target than for the CH target, leading to a lower HXR emission

Collaborators

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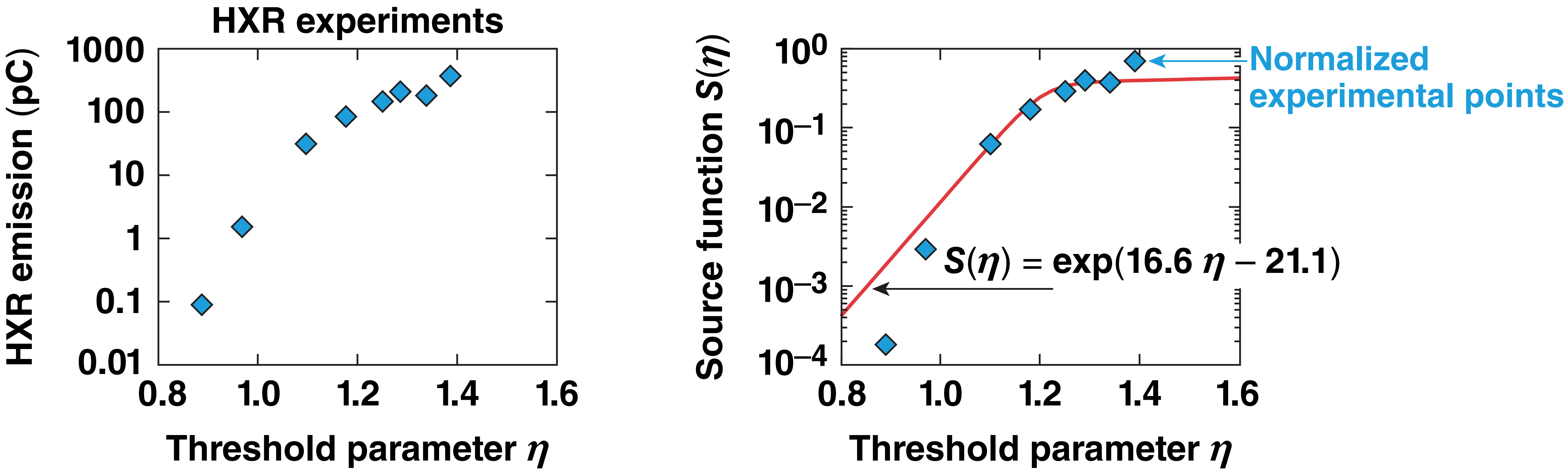
The source of fast electrons is based on the measured HXR emission from intensity sweep experiments



- The HXR emission depends on the threshold parameter: $\eta = I_{14}$ (at $n_c/4$)**L*(μm)/[233**T* (keV)]*
- The source function was designed to follow the same dependence as the HXR emission

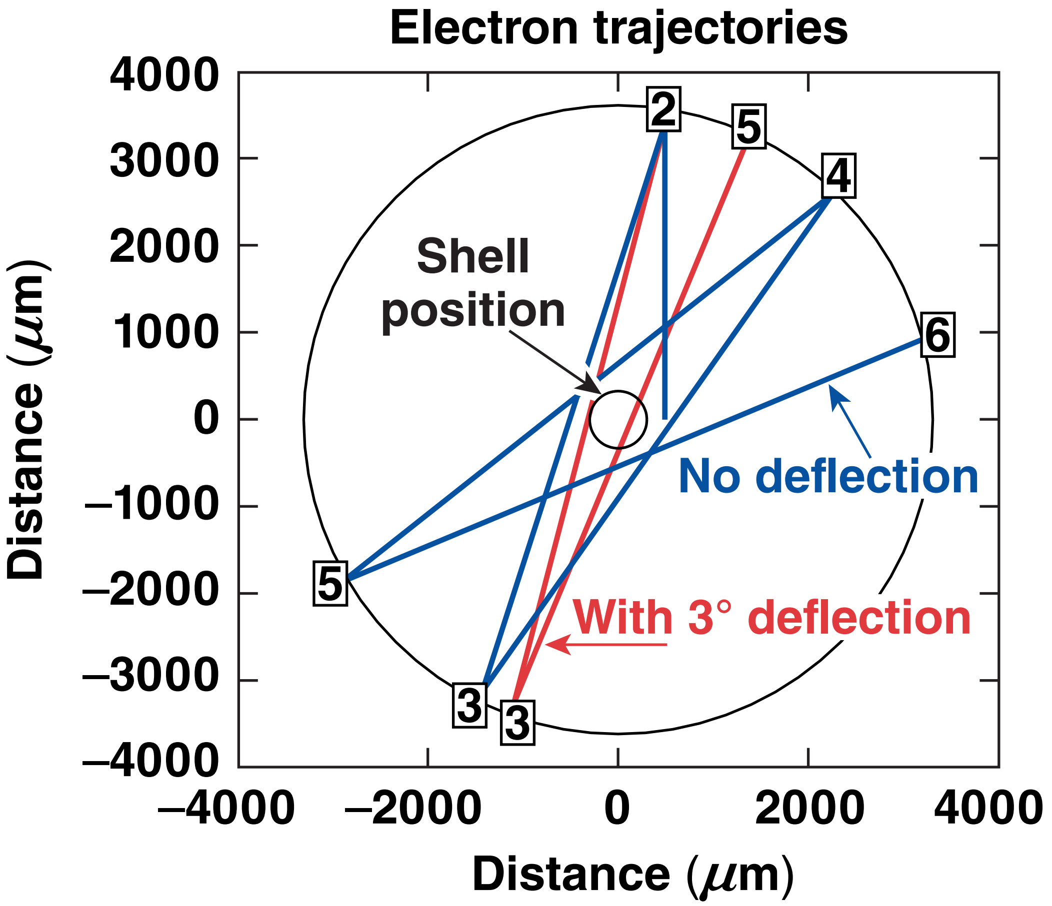
TC12479

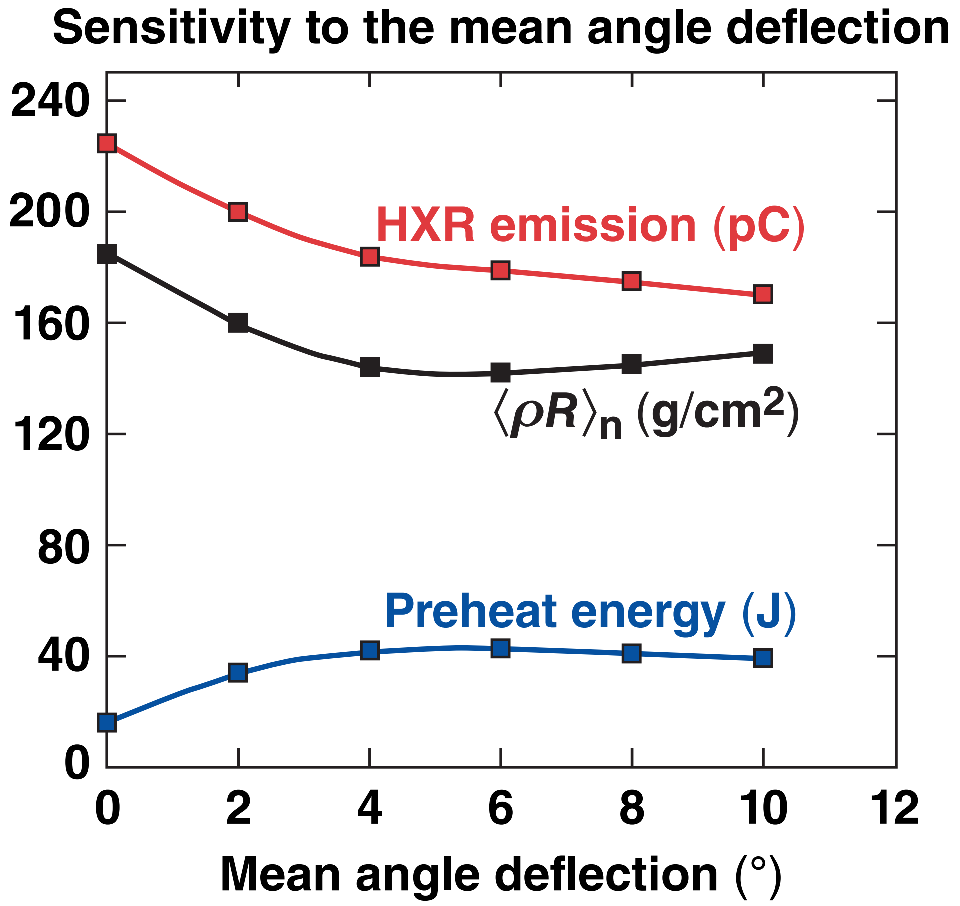
*A. Simon *et al.*, Phys. Fluids 26, 3107 (1983).

Target performance is not sensitive to random deflection of electrons above 4°

UR LLE

- Specularly reflecting an electron at the target boundary sends it along the same path until it stops
- To model the fact that the sheath is not smooth and E and B fields are present in the corona,* a random Gaussian angle is added to the reflected angle

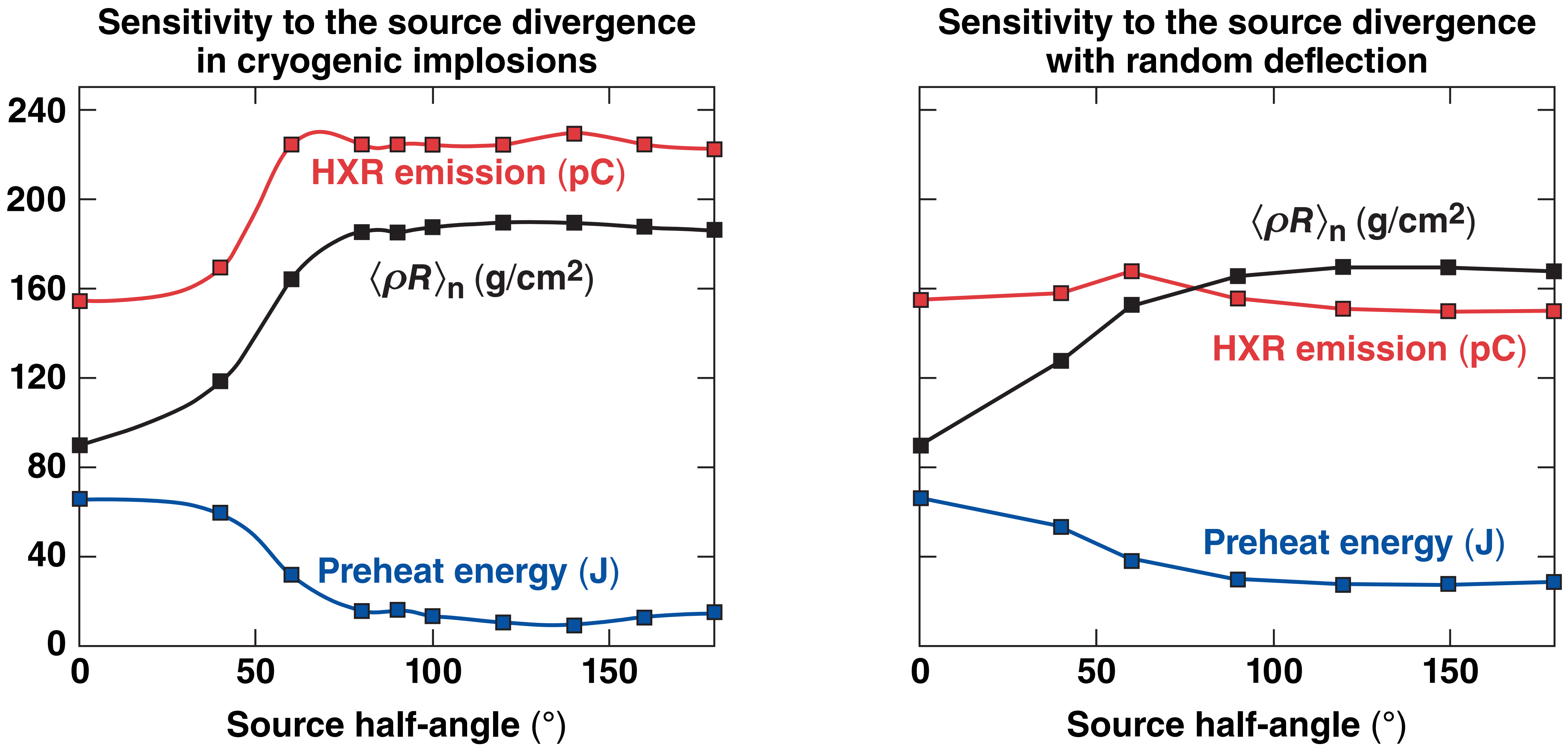




*F. H Séguin *et al.*, Phys. Plasma 19, 012701 (2012).

TC12481

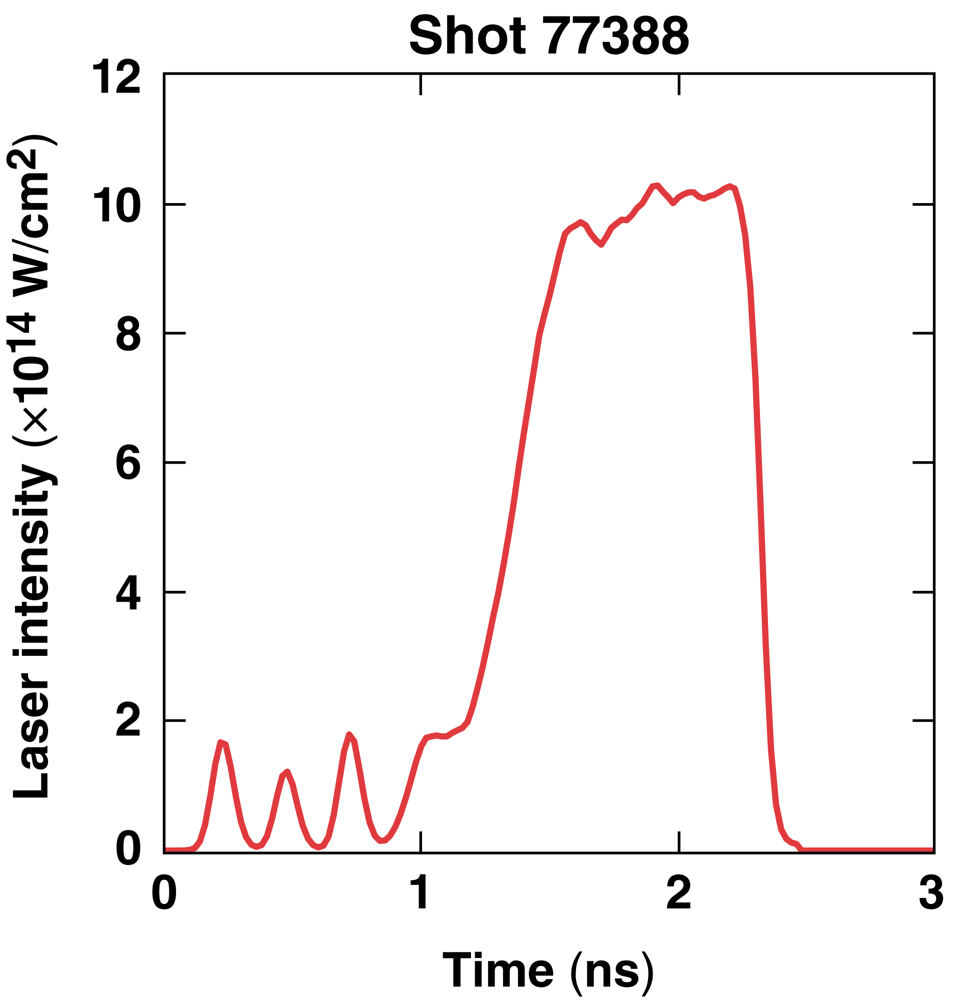
Target performance is insensitive to the source divergence angle above the 60° half-angle

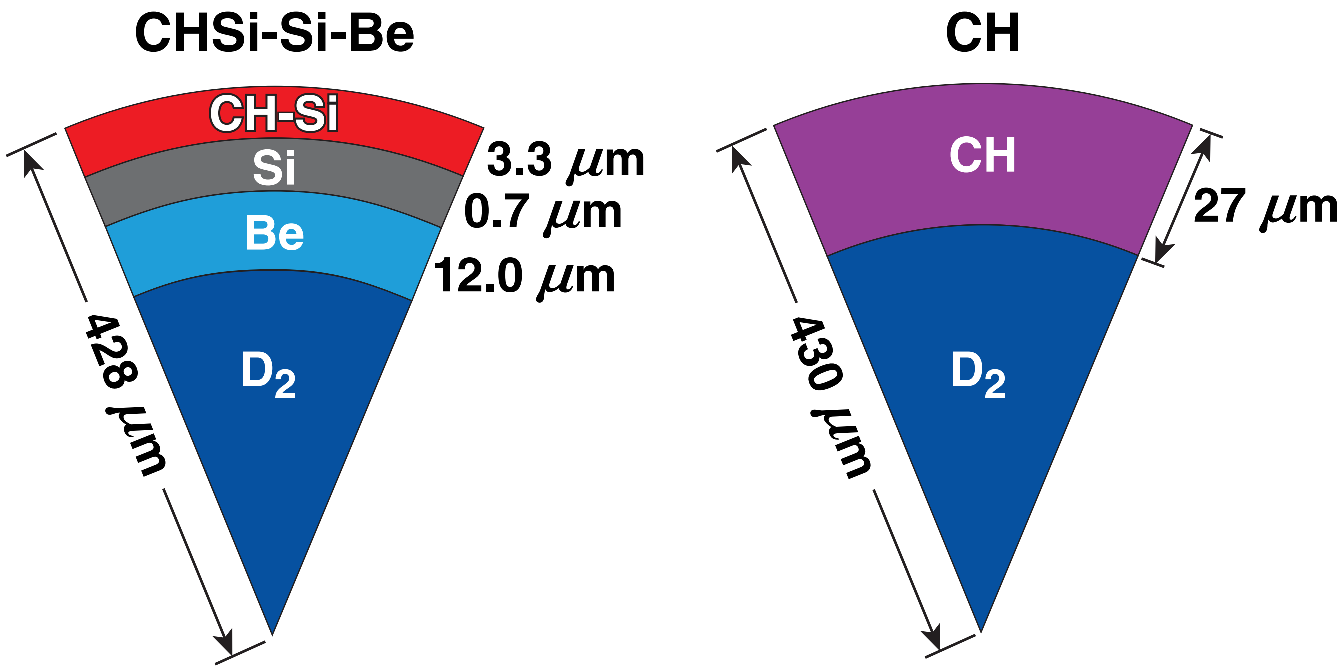


Simulations used a 90° half-angle source divergence.

TC12482

Various ablator designs are being studied to evaluate the mitigation of fast-electron production*





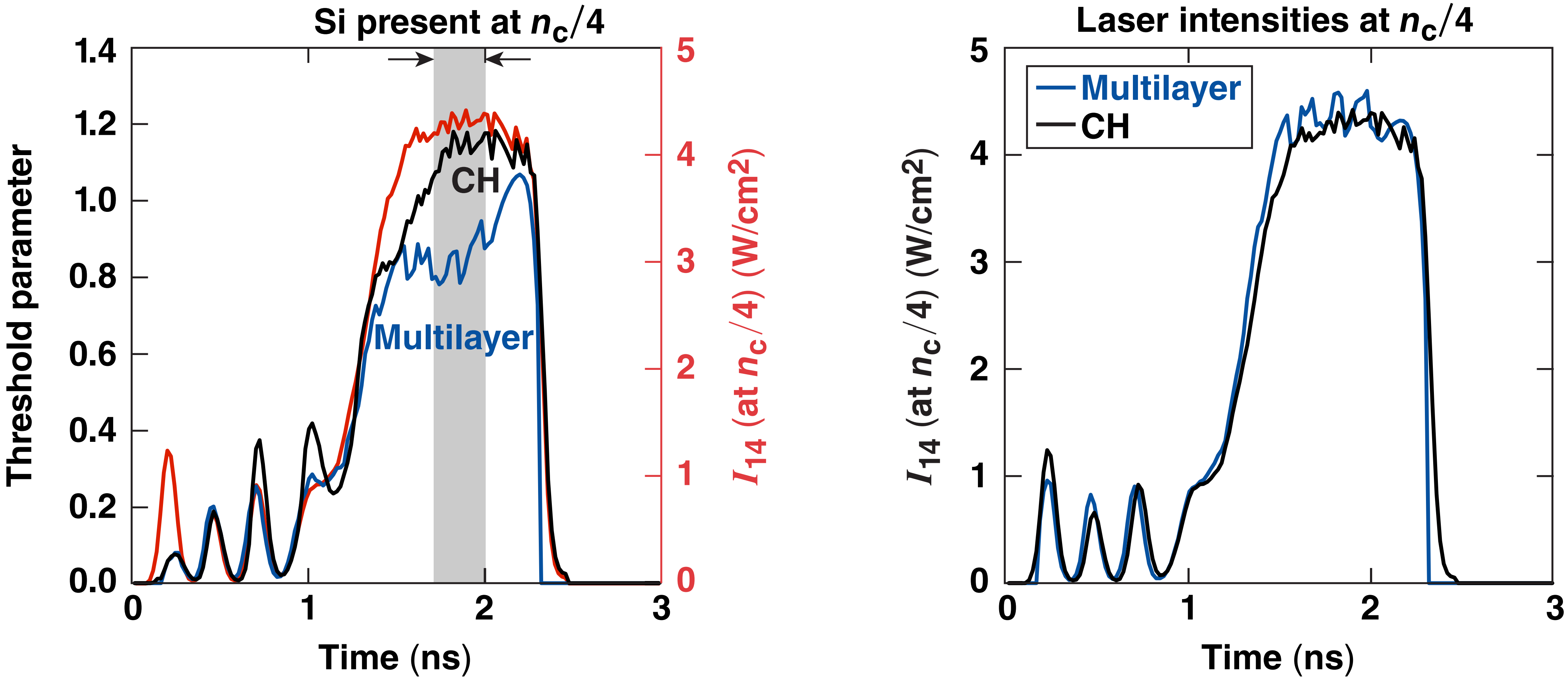
The simulations were carried out with cross-beam energy transfer (CBET) and nonlocal thermal transport in the 1-D hydrocode *LILAC* using the same fast-electron source parameters.

TC12483

*D. H. Froula *et al*., NO5.00001, this conference.

The threshold parameter for the multilayer target is reduced even though intensities at $n_c/4$ are identical

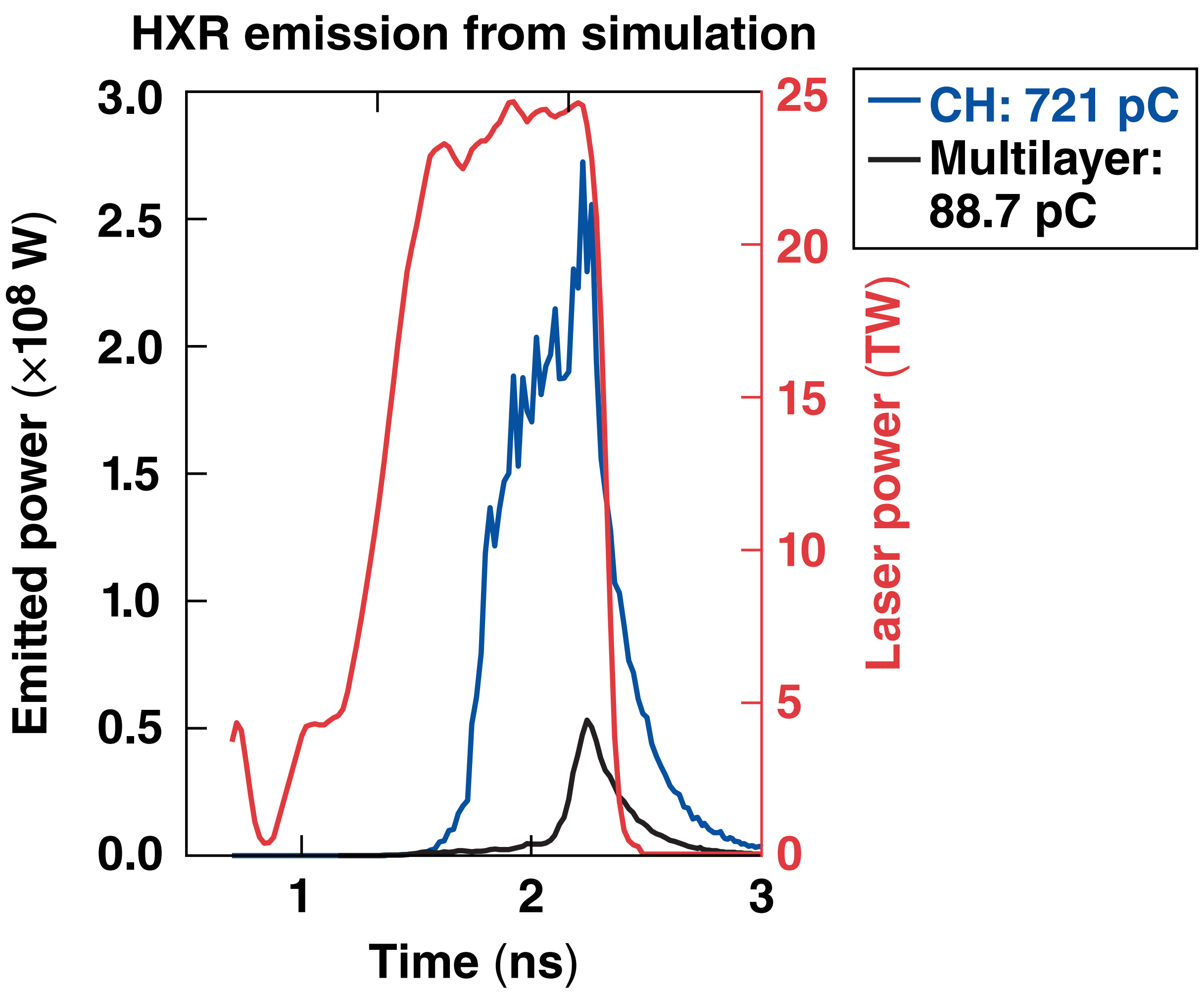
Threshold parameter: $\eta = I_{14}$ (at $n_c/4$)*$L(\mu m)/[233*T(keV)]$

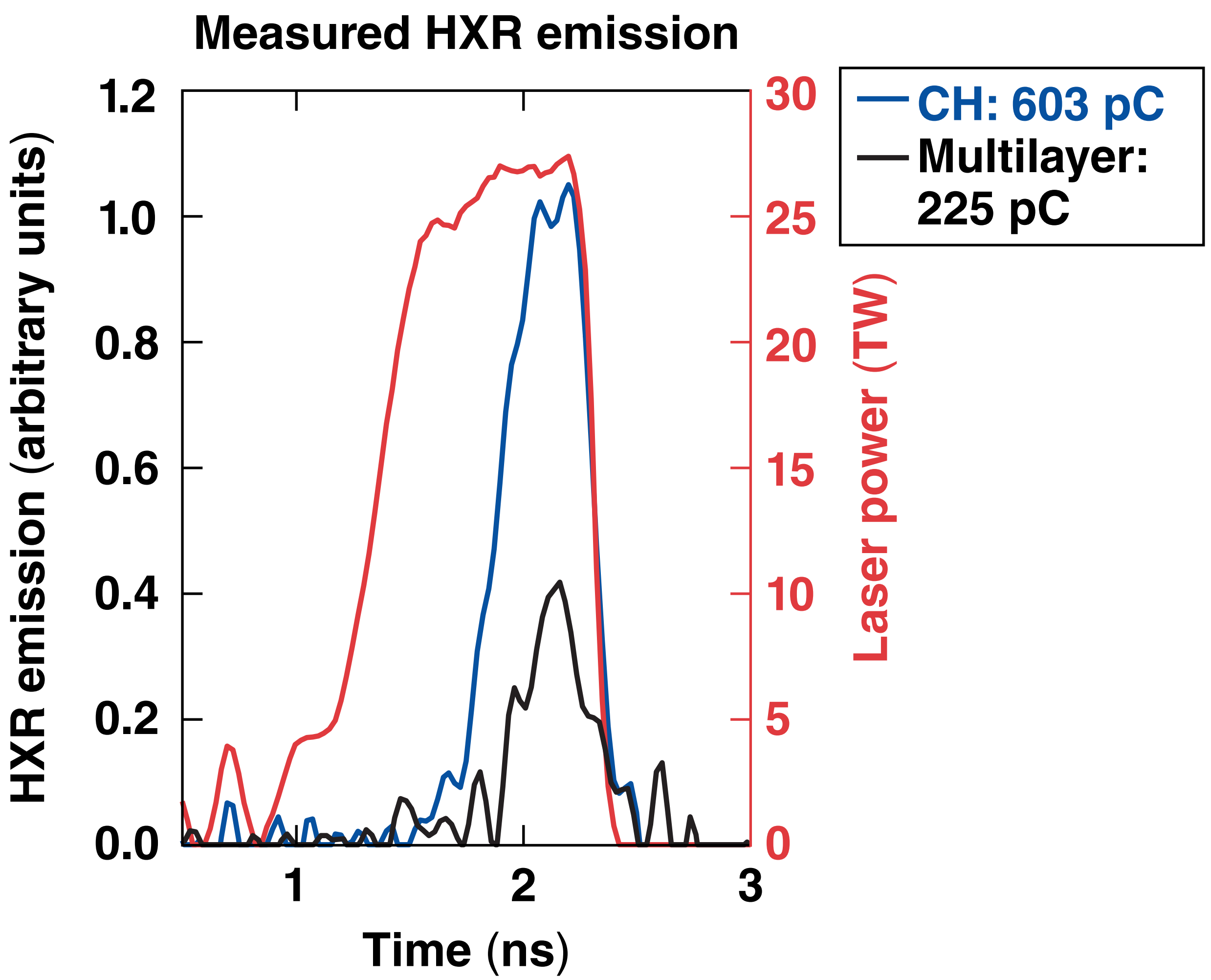


The smaller threshold parameter for the multilayer target is caused by lower scale lengths and higher temperatures compared to the CH target.

TC12520

The source model gives good agreement with experiment in the timing and relative levels of the HXR emission





The HXR emission is very sensitive to the steep source function; a 1% error in the threshold parameter leads to a 17% difference in the HXR emission.

TC12522

LILAC simulations using an improved fast-electron transport model reproduce the timing of the hard x-ray (HXR) emission in OMEGA experiments

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  - random departure from specular reflection at the target outer boundary
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- Two spherical OMEGA implosions with different shell materials (CH and a Si layer) were simulated
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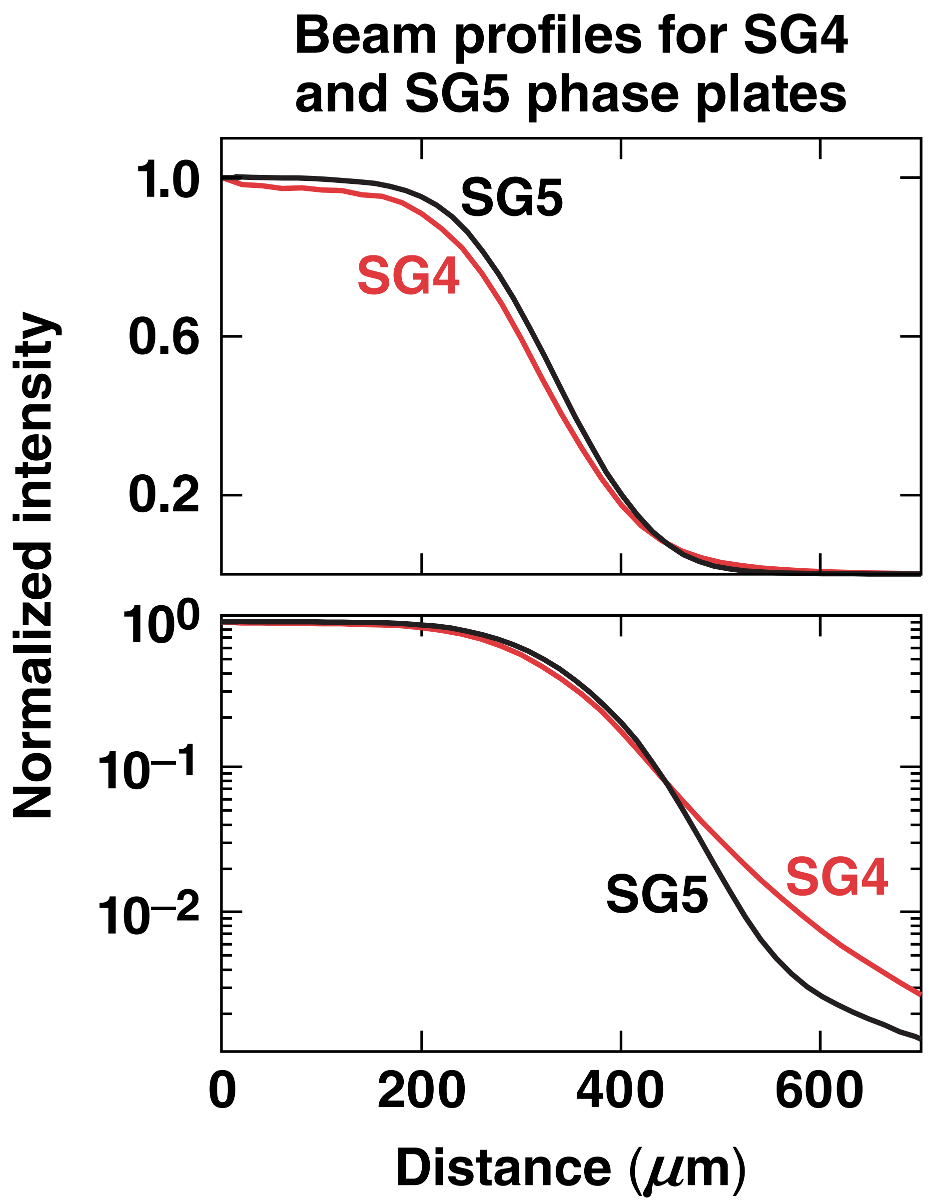
  - the threshold parameter is lower for the Si-layer target than for the CH target, leading to a lower HXR emission

Replacing the SG4 phase plate with SG5 plates increased the HXR emission

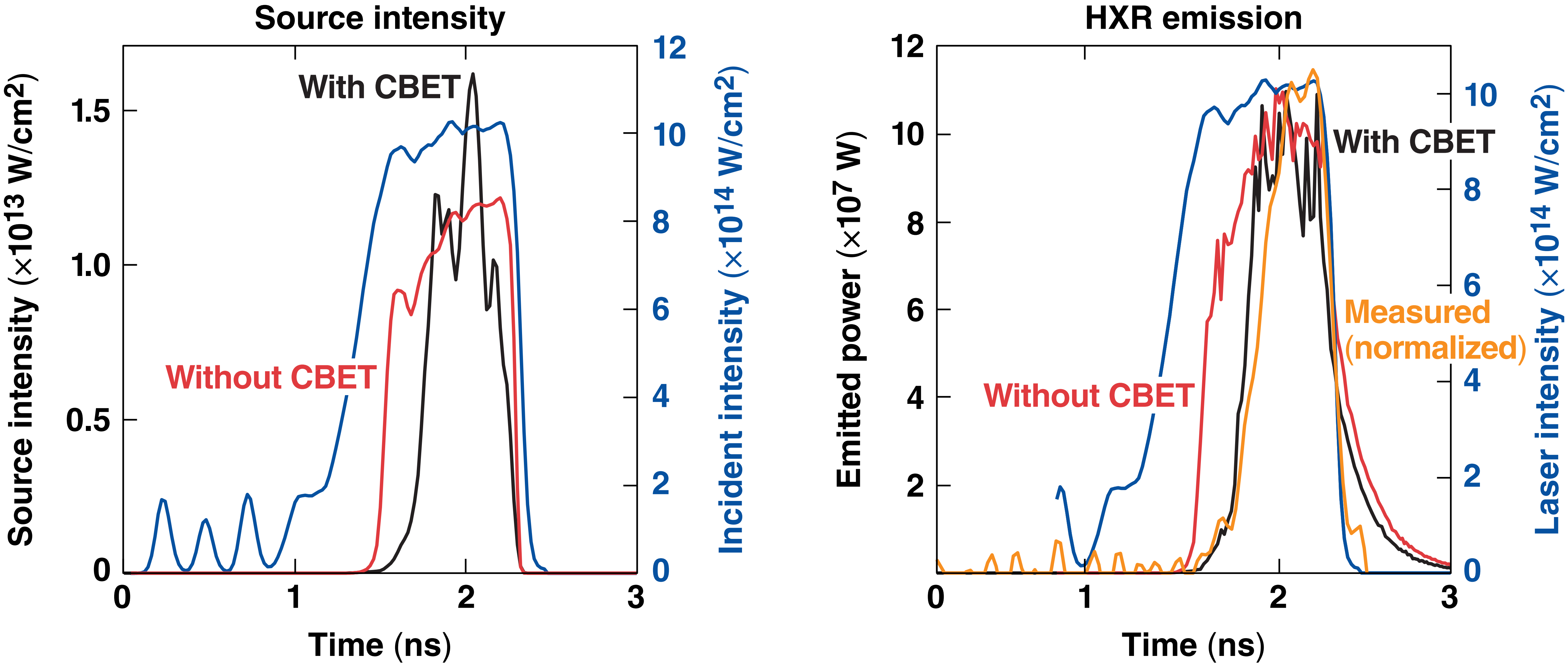


Shot #	Phase plate	HXR (pC)	ρR (mg/cm^2)
75588	SG4	129	183
76147	SG5	210	187

Detailed ray-trace simulations showed no difference in the TPD gain between the two shots.

TC12480

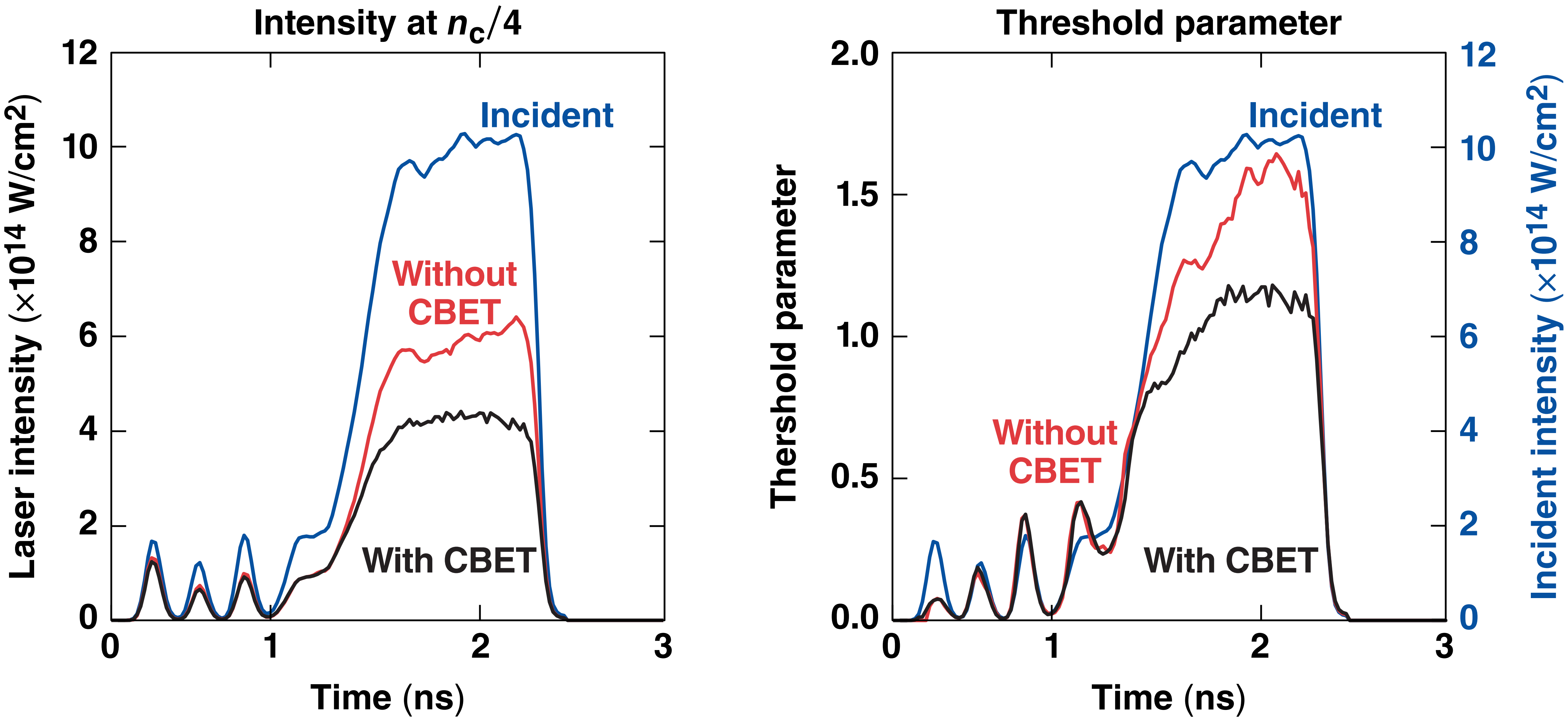
The source intensity and the HXR emission is narrower in time when CBET is included



TC12485

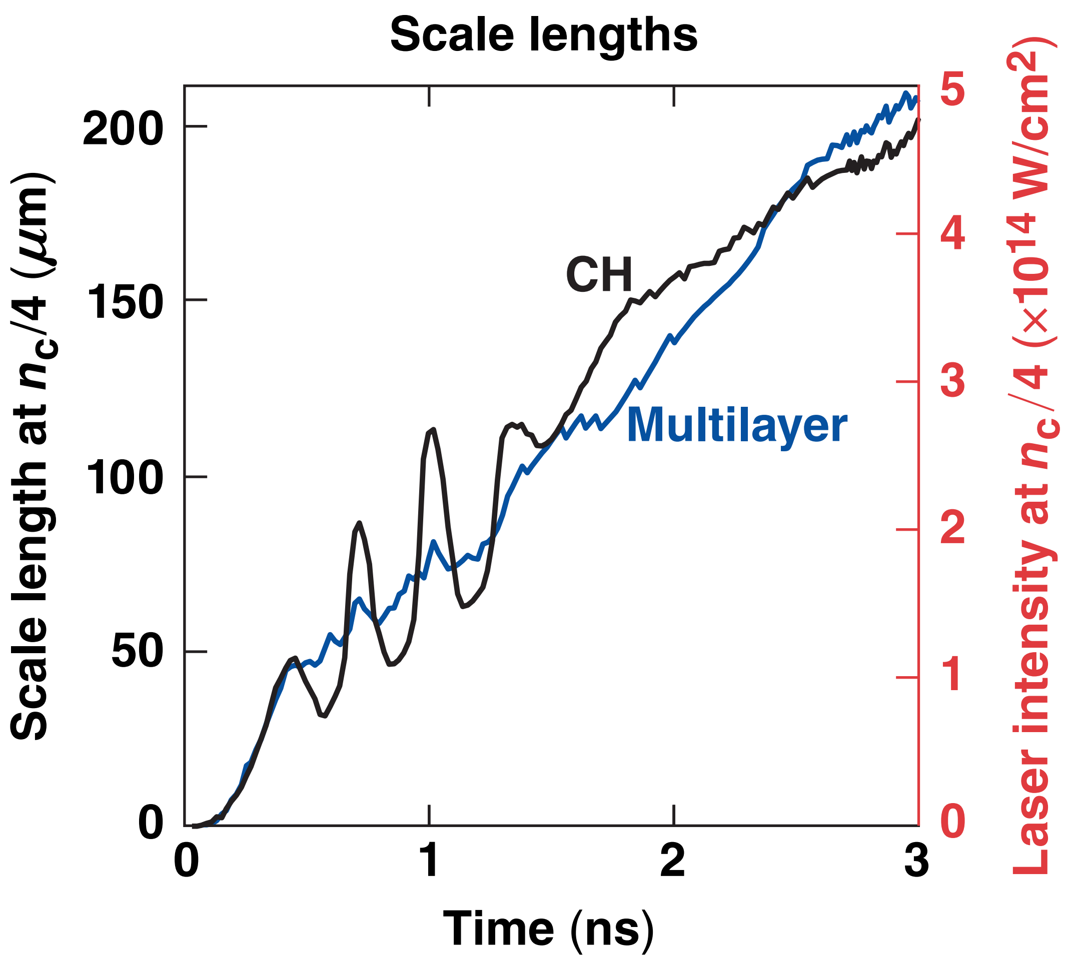
The threshold parameter in the case with CBET is below unity because of the lower intensity at the $n_c/4$ surface

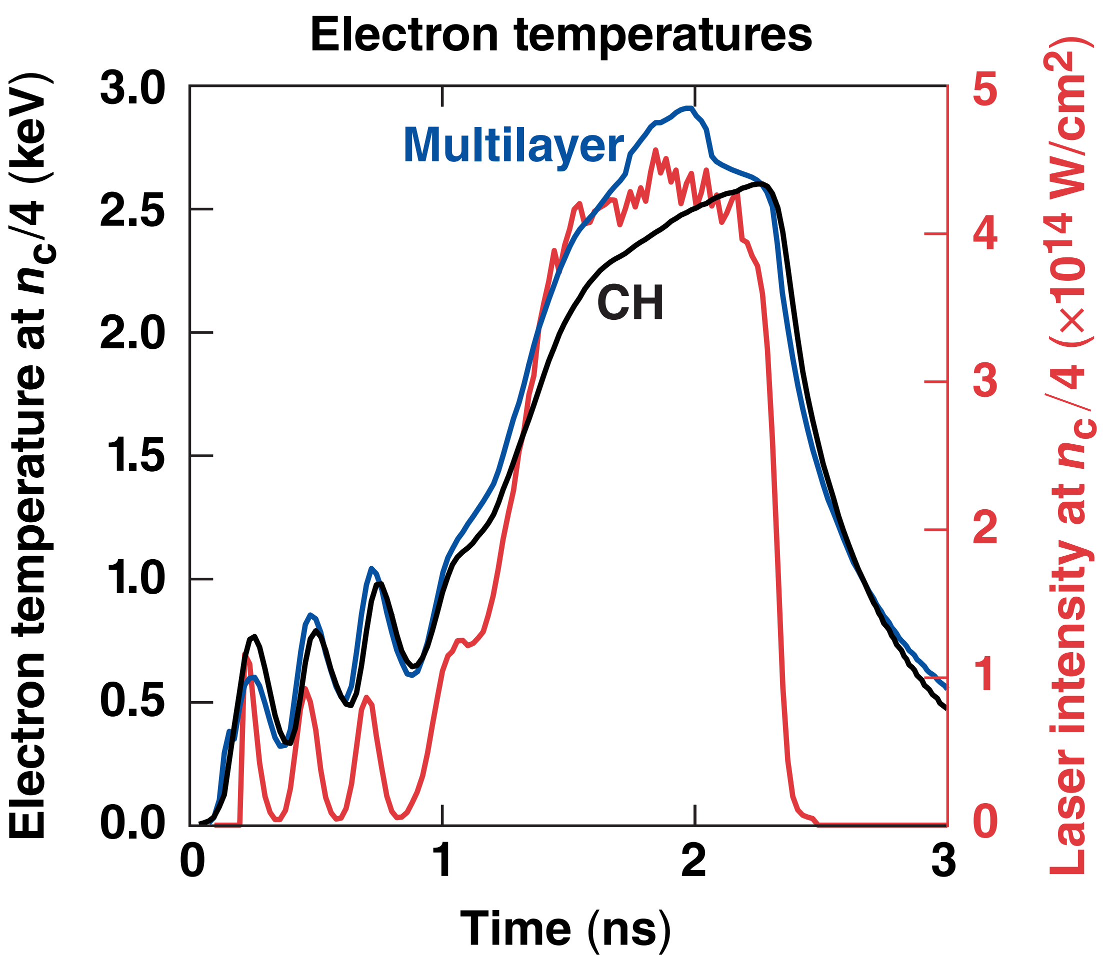
27-μm-thick CH target at 10^{15} W/cm^2



TC12484

For the multilayer target, the lower scale lengths and higher temperatures compared to the CH target give a smaller threshold parameter





TC12521