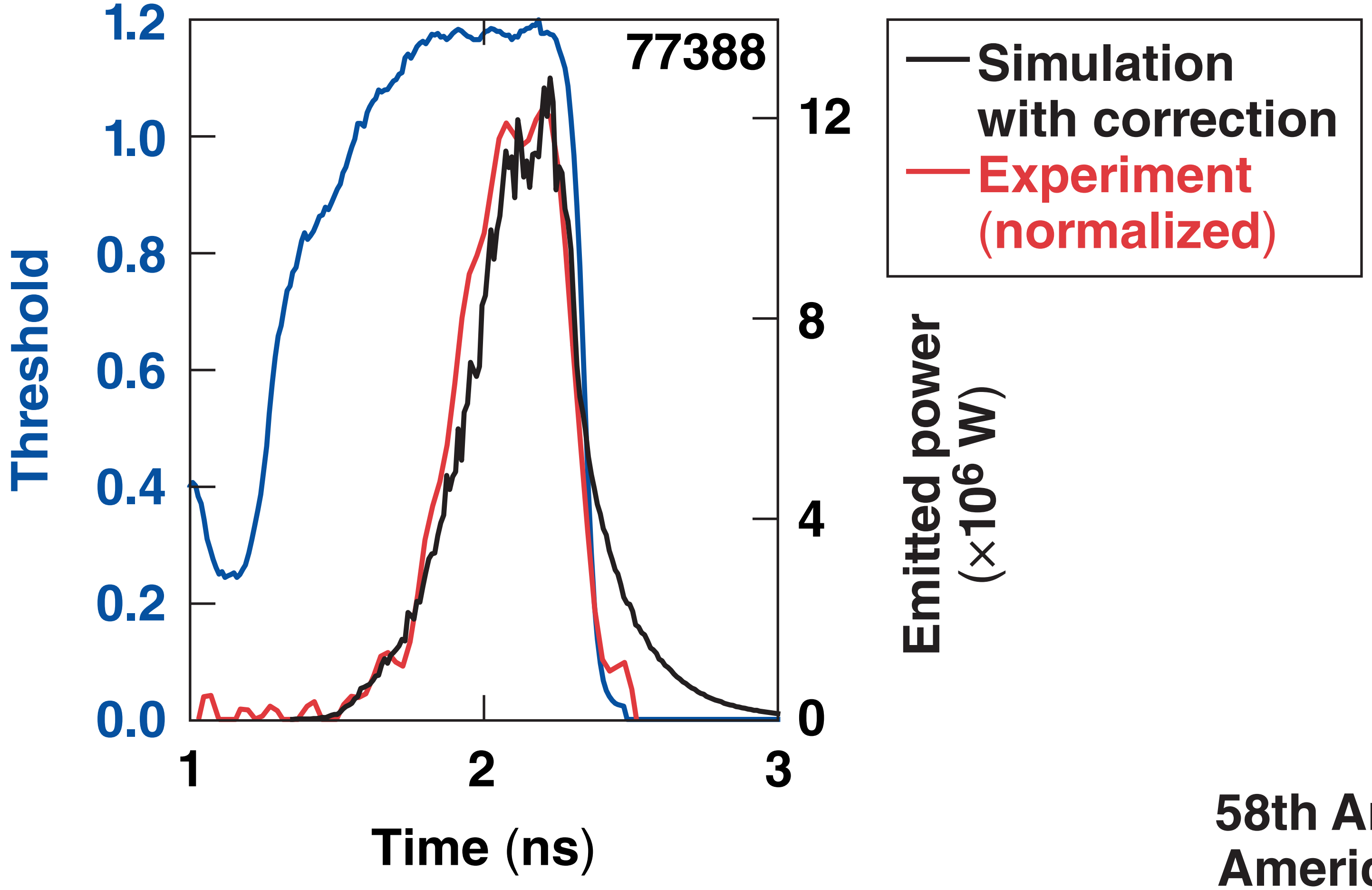
Evaluation of the Fast-Electron Source Function for Two-Plasmon Decay from the Temporal Hard X-Ray Emission



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Summary

Calculation of two-plasmon decay (TPD) fast-electron source near and below threshold are very sensitive to the simulated hydrodynamic profile

UR LLE

- The effects of the TPD electrons are simulated in the 1-D hydrodynamic code *LILAC* with a straight-line transport model
- Source characteristics are not well known from theory or experiments
- The source algorithm, based on the TPD threshold parameter, produces hard x-ray (HXR) emission time histories earlier than observed
- The measured HXR emission can be reproduced by limiting the source energy with a 200-ps exponential reduction factor

Collaborators

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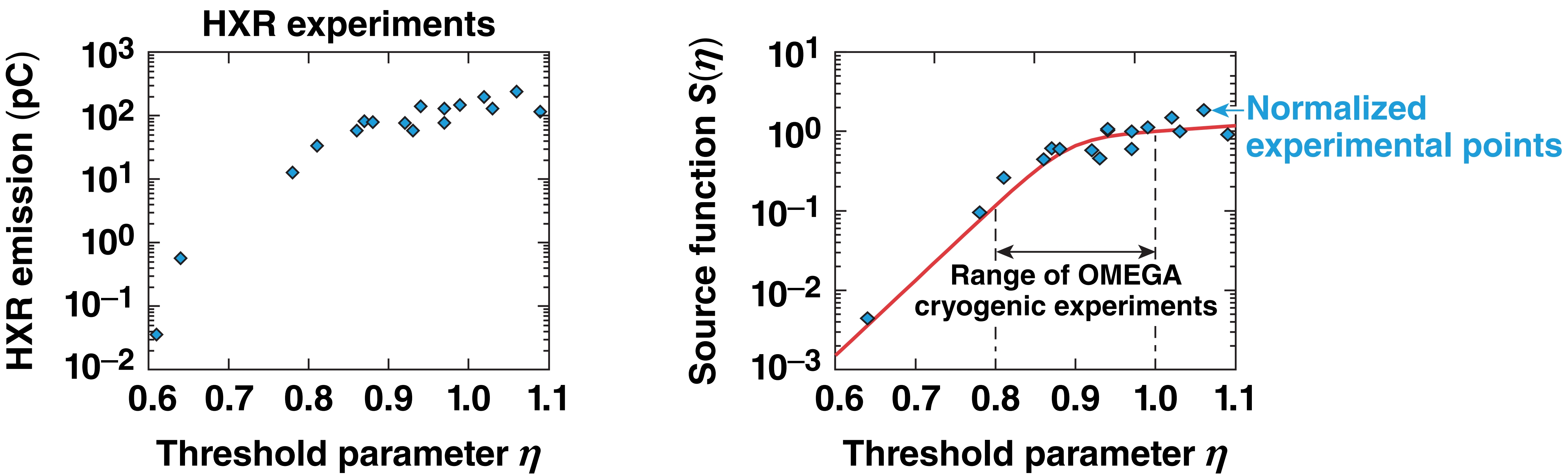
The source of fast electrons is based on the measured HXR emission from intensity sweep experiments



- **The HXR emission depends on the threshold parameter: $\eta = I_{14}$ (at $n_c/4$)*$L(\mu m)/[233*T$ (keV)]***
- **The source function was designed to follow the same dependence as the HXR emission**
- **The source energy is given by $E_s = F_s * S(\eta)$, where F_s is adjusted to give the measured HXR total emission energy**

TC12479a

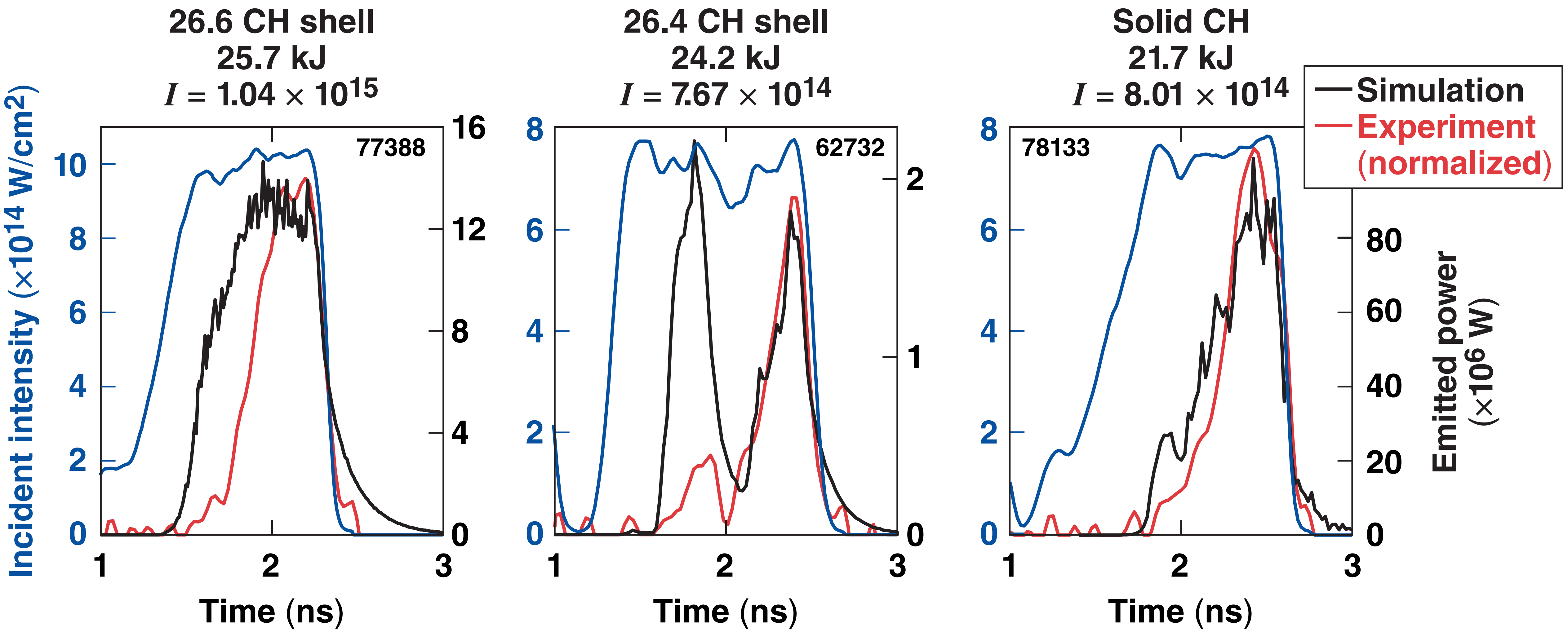
*A. Simon *et al*., Phys. Fluids 26, 3107 (1983).

Simulations were carried out for room-temperature CH targets with the standard TPD source parameters

- The simulations were carried out with CBET and nonlocal thermal-electron transport
- The electrons are transported in a straight line and are reflected at a random angle at the target outer boundary
- Fast-electron source conditions
  - the source function is applied during the entire laser pulse with a source factor F_s of 0.02
  - source angular half-angle divergence is 90°
  - Maxwellian distribution with temperature ~45 keV

TC13043

The computed HXR emission starts earlier than the measured emission for most shots



TC13044

The observed HXR timing can be reproduced by applying a reduction factor to the source energy

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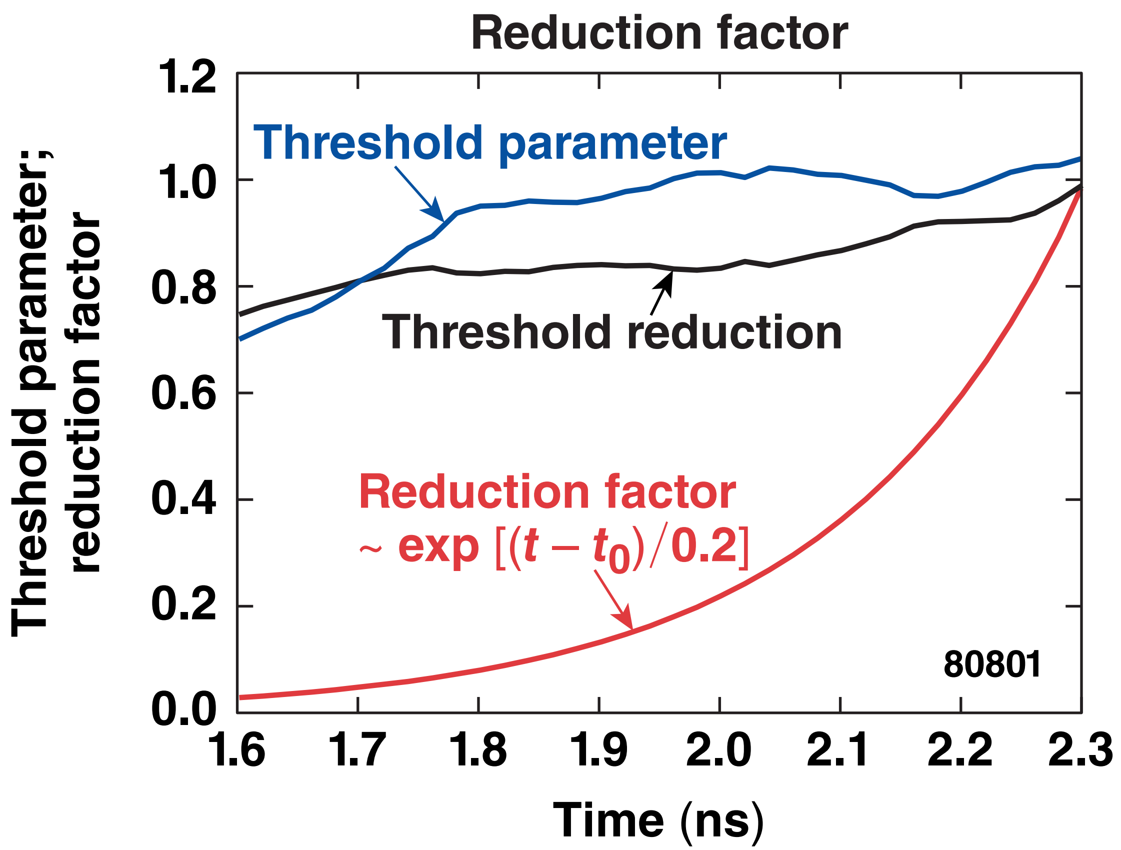


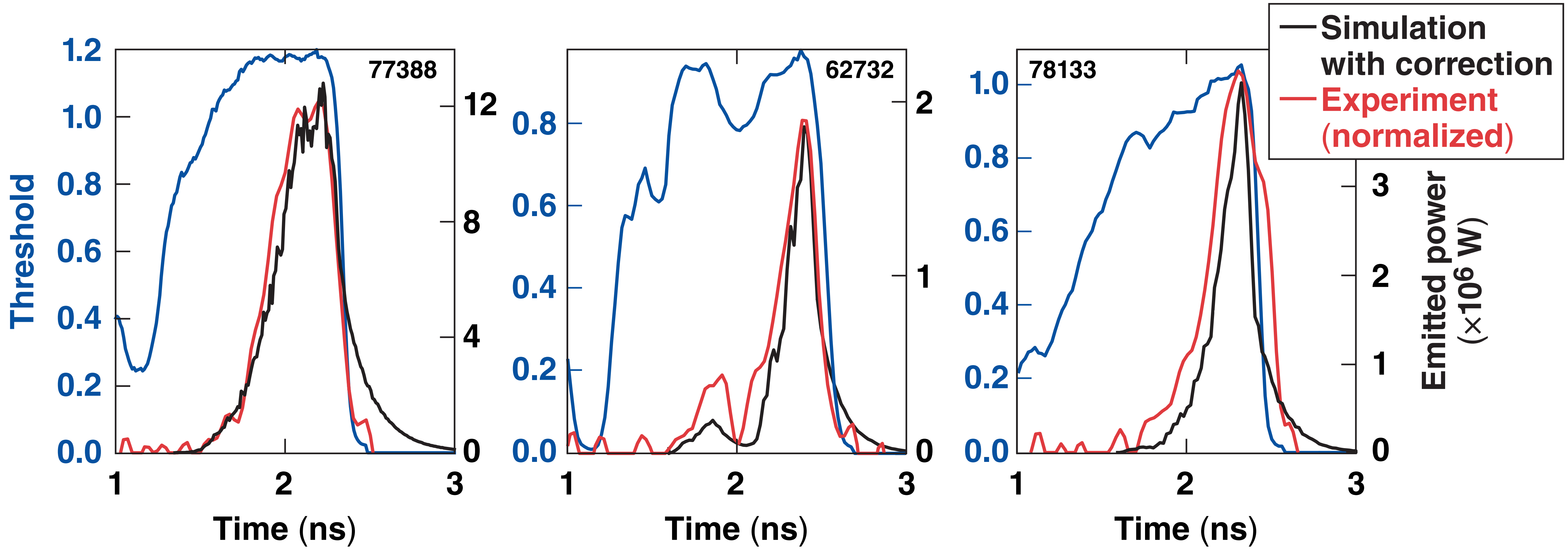
The reduction factor is applied for $\eta > 0.75$.

- Possible reasons for the reduction
  - hydrodynamics not perfectly simulated; e.g., experimental results hint of slightly different coronal scale lengths than computed*
  - source model requires more physics; will be explored with the laser–plasma interaction code *LPSE*

*D. Haberberger *et al.*, Phys. Plasma 21, 056304 (2014).

TC13045

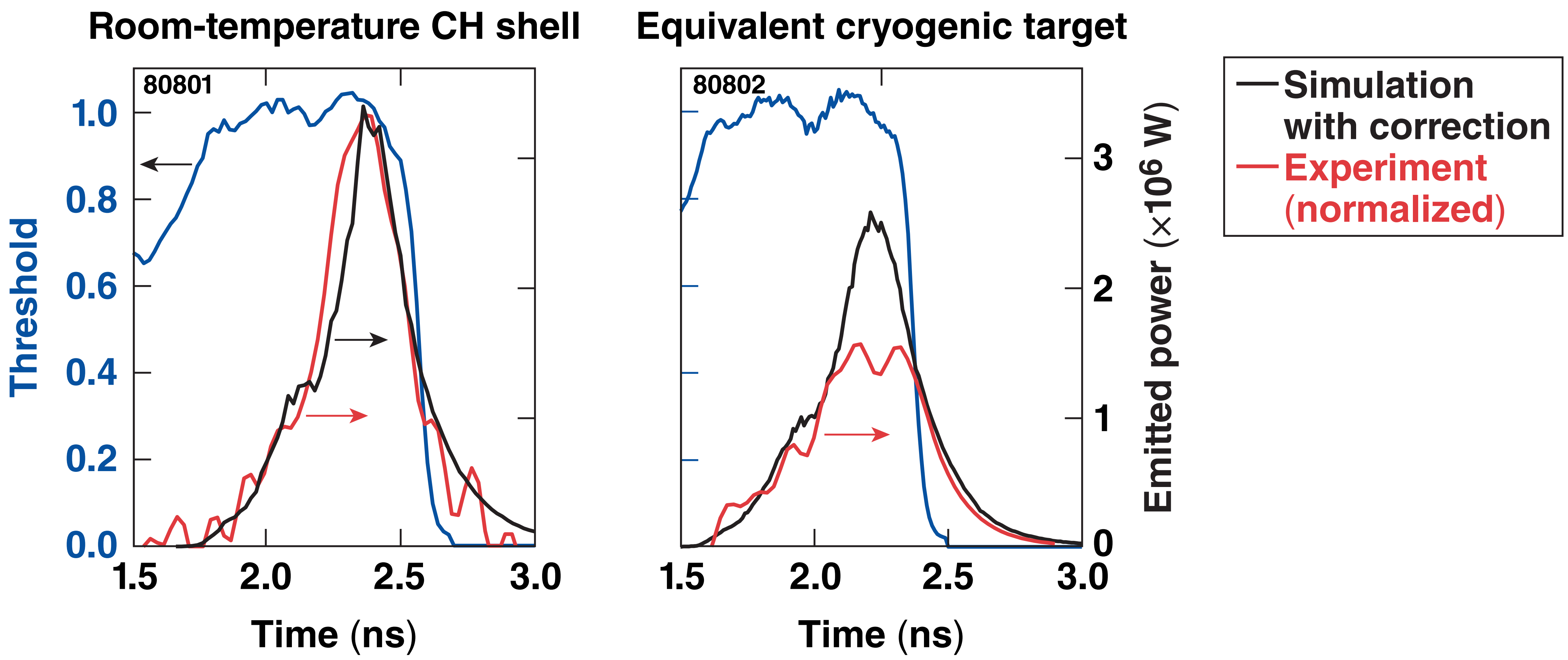
The computed HXR emission from the reduced source matches well with the observed emission for room-temperature CH targets



The match is good for several different types of shell implosions but not as good for the solid CH target.

TC13046

For a cryogenic target the reduced computed HXR matches the timing but not the peak value



Another method to reproduce the emission timing and the resulting preheat is to have the source follow the emission timing.*

*A. R. Christopherson *et al.*, NO5.00007, this conference.

TC13047

Summary/Conclusions

Calculation of two-plasmon-decay (TPD) fast-electron source near and below threshold are very sensitive to the simulated hydrodynamic profile

- The effects of the TPD electrons are simulated in the 1-D hydrodynamic code *LILAC* with a straight-line transport model
- Source characteristics are not well known from theory or experiments
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TC13042