Analysis of the Effect of High-Z-Doped CH on Preheat and Hard X-Ray Radiation from Two-Plasmon-Decay Electrons

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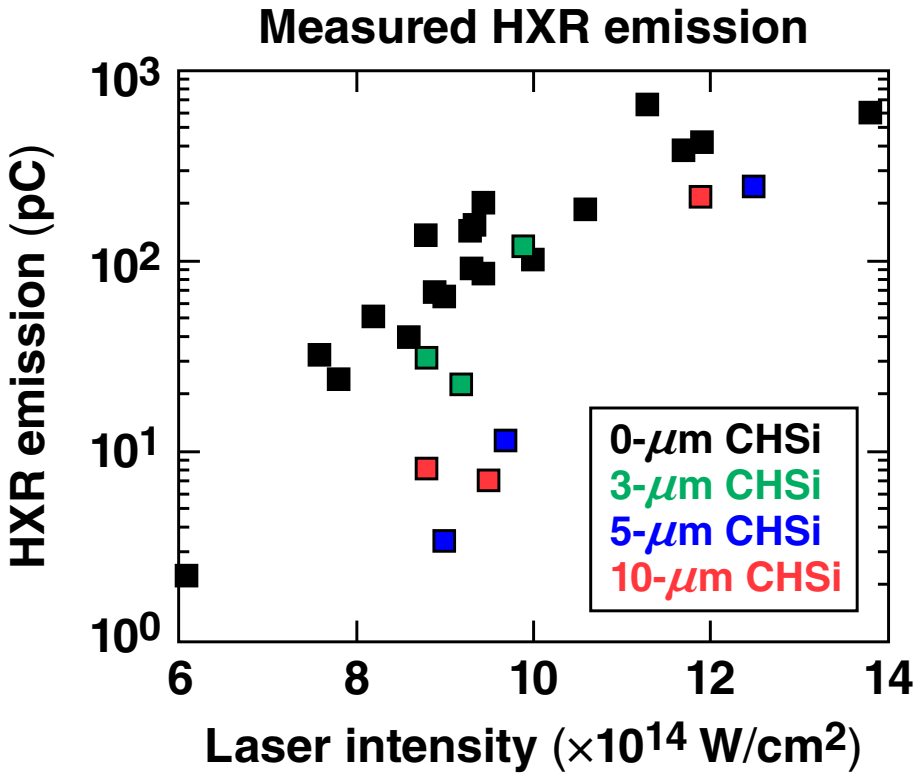

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Summary

Doping CH shells with Si raises the threshold intensity and slightly reduces HXR emission above intensities of 10^{15} W/cm^2

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- Experiments were carried out with varying thicknesses of CHSi over CH shells to study the effect of high-*Z* doping on HXR emission.
- The increase in the threshold intensity is due to higher electron temperatures in the corona caused by the higher $\langle Z \rangle$ of CHSi.
- For intensities above 10^{15} W/cm^2, the HXR emission is similar for CH and CHSi.
- The source and transport model in the 1-D code *LILAC* for doping the fast electrons reproduces well the HXR emission for both CH and CHSi targets.

Collaborators

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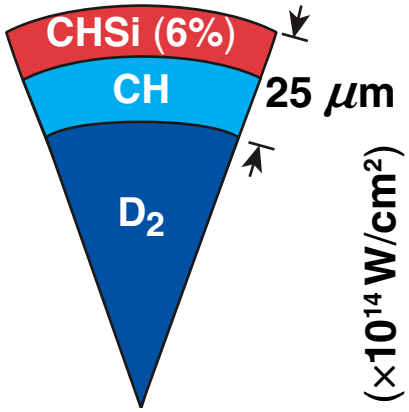
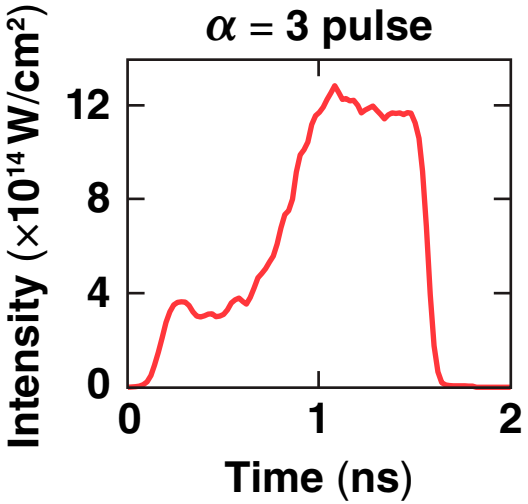
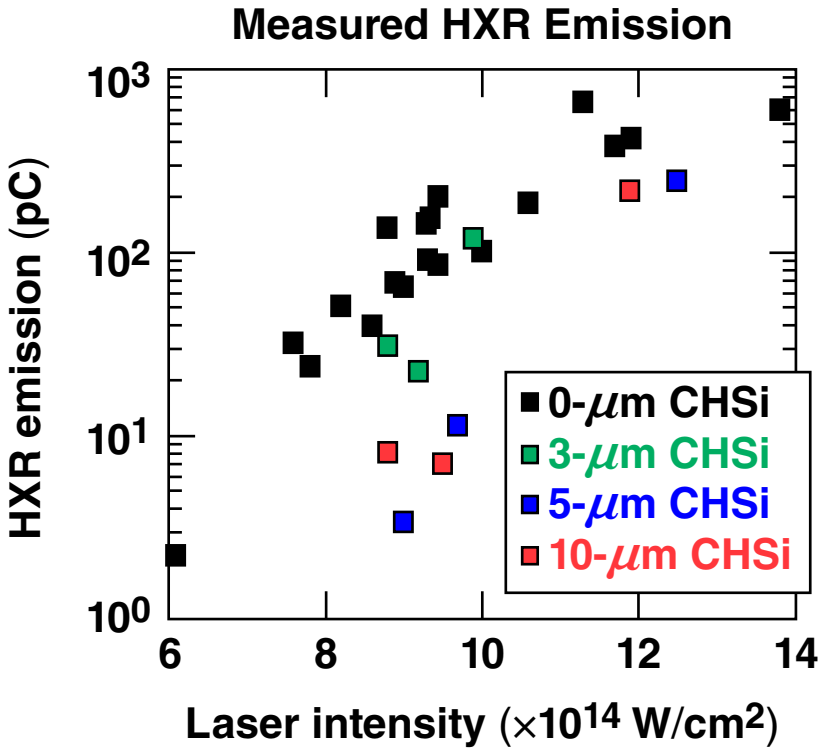
Si doping leads to a higher intensity threshold but similar HXR emission above 10^{15} W/cm^2







- CHSi thicknesses: 0, 3, 5, 10 μm
- CH layer reaches quarter critical at the end of the pulse for the 5-μm CHSi case.

The fast-electrons are created at the $\eta_c/4$ surface and transported using a radial straight-line model

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- The energy source is taken to scale as

$$\frac{E_{\text{fast}}}{E_{1/4\,N_c}} = F_{\text{fe}}\,S(\eta).$$

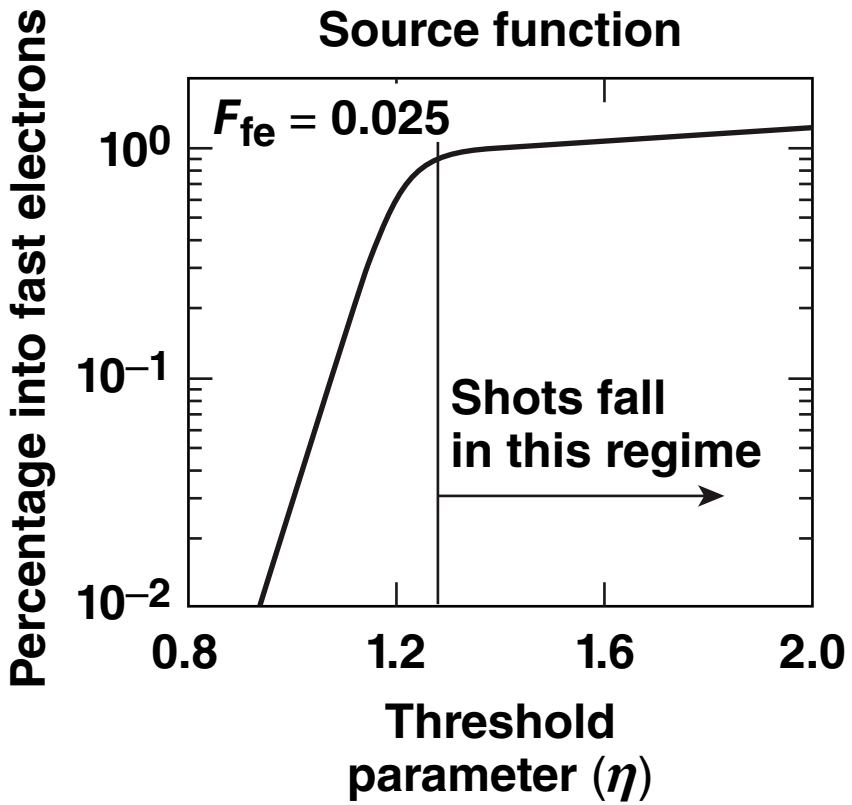
  - F_{fe}, the energy fraction taken from each ray in the laser ray trace, is a free parameter.

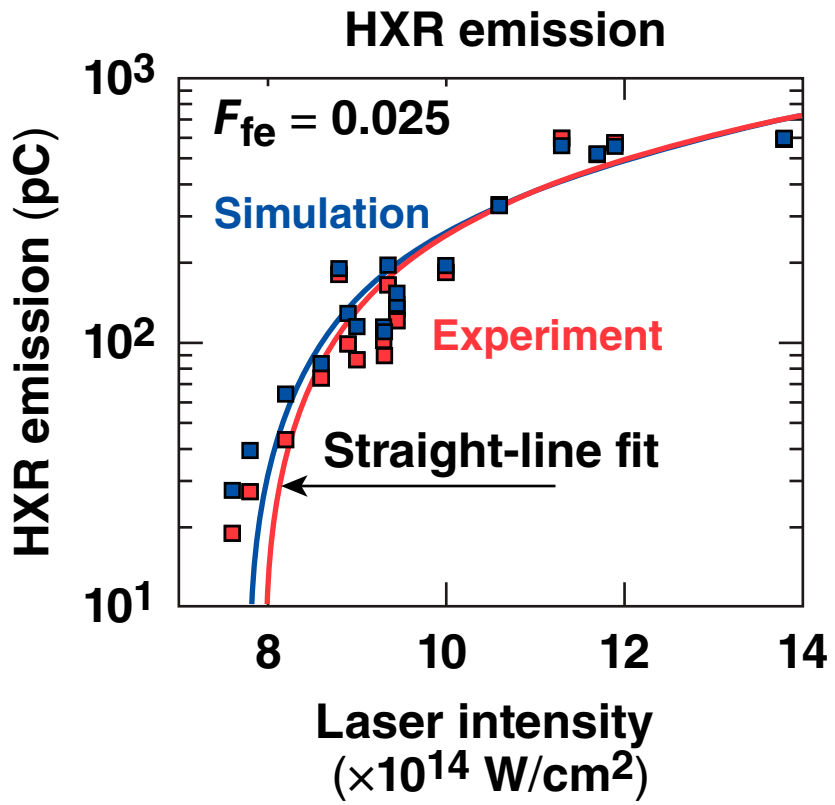
  - $\eta = I_{14}L_{\mu\text{m}}/233\,T_c$ (kev) is the threshold parameter[1] evaluated at the $N_c/4$ surface.

  - $S(\eta)$ is a source function determined from experiment results.

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

The source function was chosen to match the integrated HXR emission from warm CH targets over all intensities



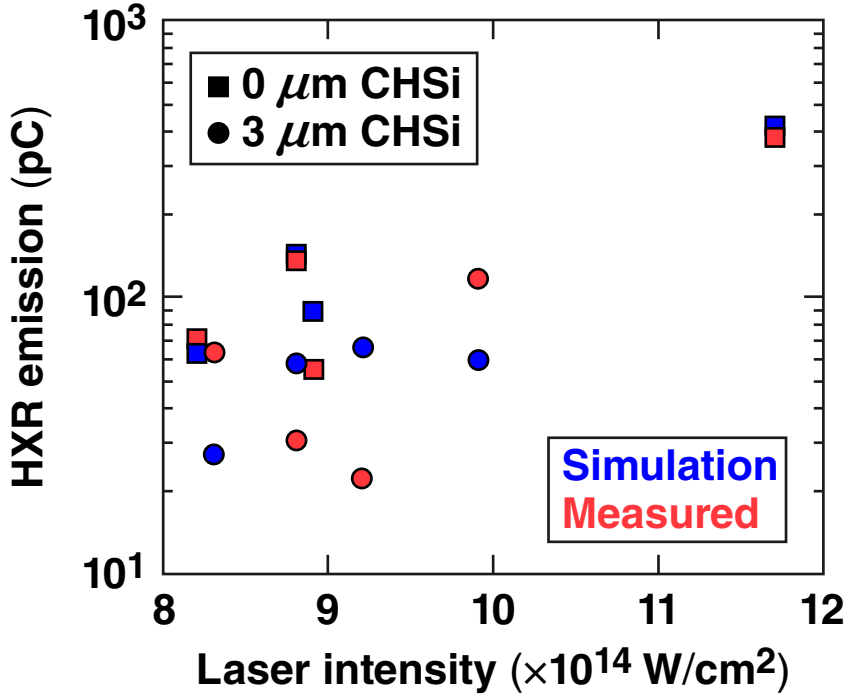


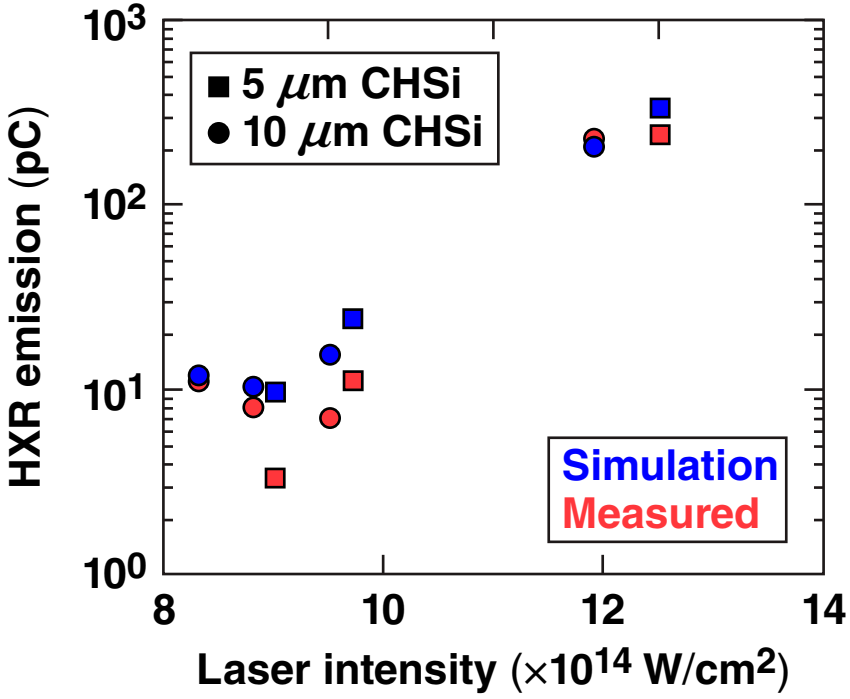
32 pC/mJ used to convert simulation emission*

*B. Yaakobi *et al.*, Phys. Plasmas 12, 062703 (2005) and private communication.

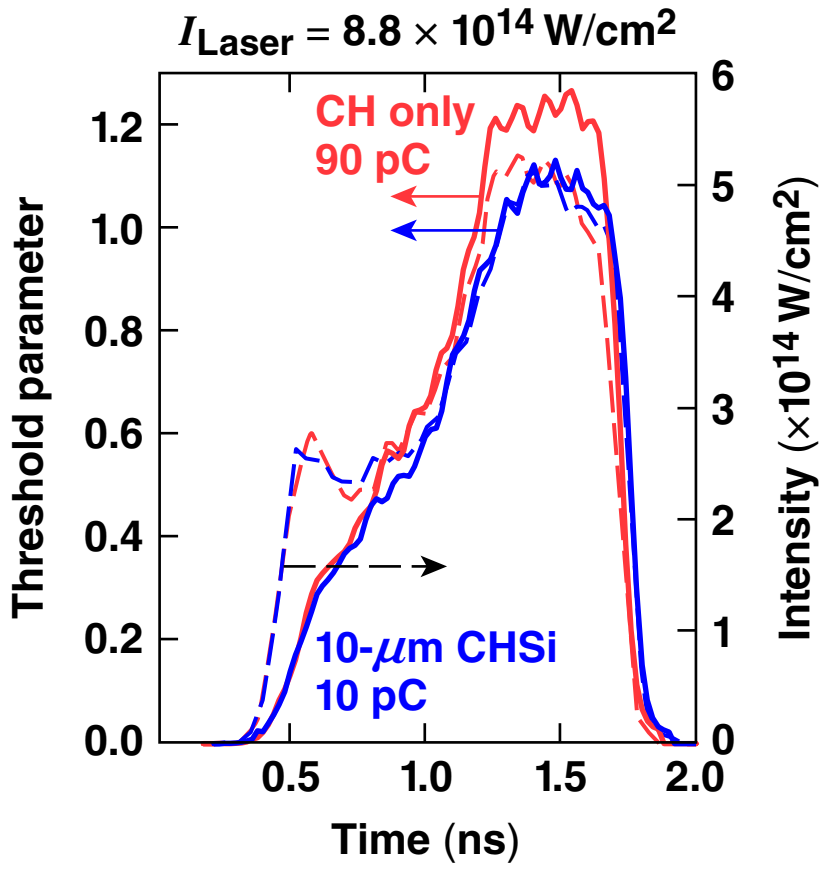
TC8255

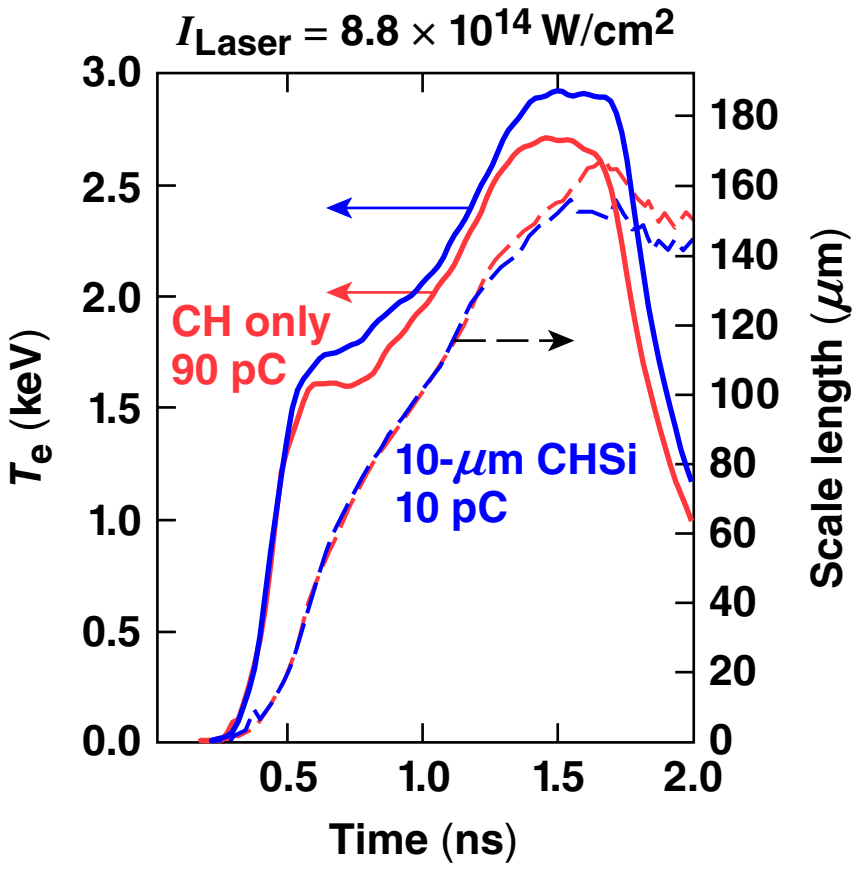
Simulations reproduce well the trend in HXR emission for the various CHSi thicknesses





The Si doping reduces the threshold parameter because it increases laser absorption, which produces higher coronal temperatures





All values taken at the quarter-critical surface.

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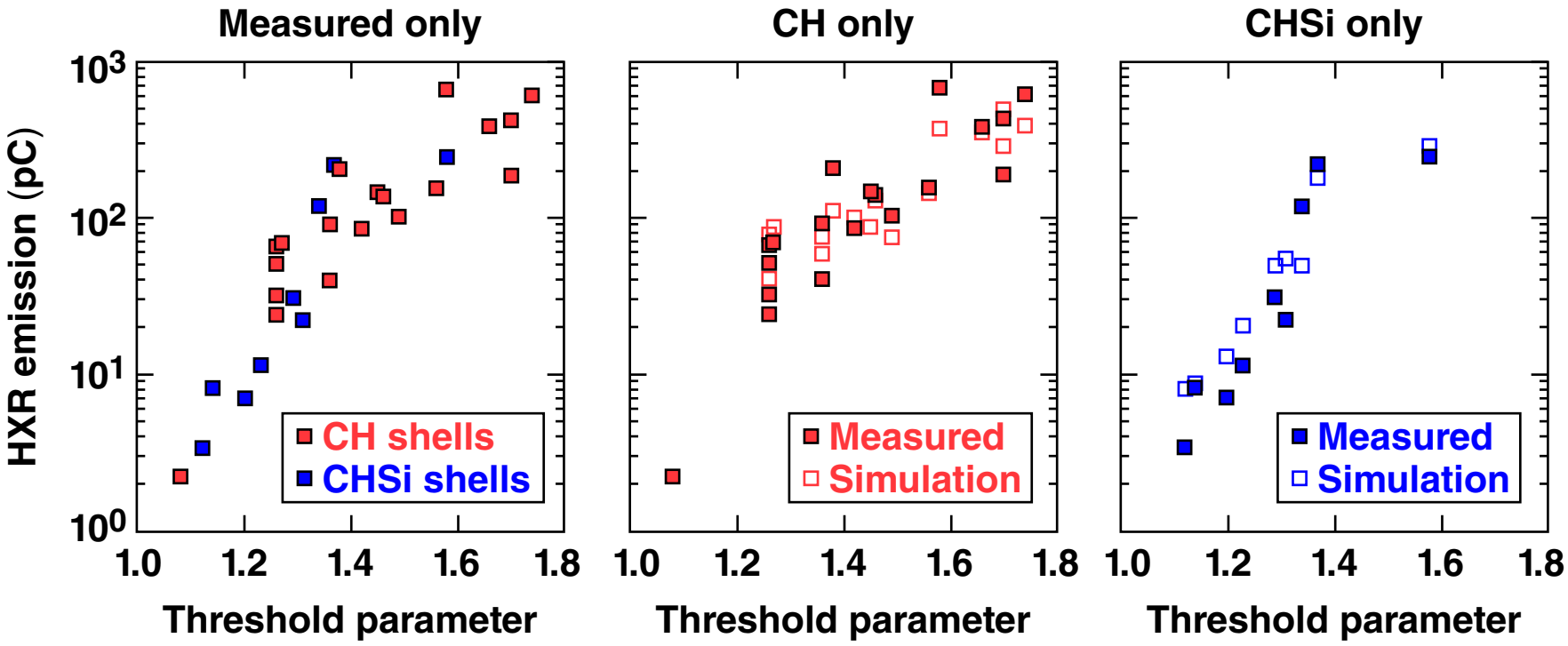
Measured HXR emissions for both CH and CHSi targets have the same dependence on the threshold parameter



For CHSi the HXR emission from simulations is slightly higher than measured, possibly caused by the effect of the higher ⟨Z⟩ on saturation.*

*See A. V. Maximov, JO5.00011

Summary/Conclusions

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