Evaluation of Wavelength Detuning to Mitigate Cross-Beam Energy Transfer Using the Nike Laser

Backlighter beams
$\Delta \lambda: \pm 3 \text{ Å KrF}$
10 J in 400 ps (FWHM*)

Drive beams
$\Delta \lambda: \pm 3 \text{ Å} \text{ (KrF)}$
1.8 kJ in 4 ns

Target
200-μm outer diameter

Nike target chamber

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Summary

The Nike laser can be employed to examine the effects of laser wavelength detuning to mitigate cross-beam energy transfer (CBET)

- Wavelength detuning is predicted to shift the CBET interaction region within the corona, affecting the gains/losses because of CBET
- The Nike platform is well suited for these studies, providing a well-diagnosed system over a range of detunings ($\Delta \lambda \sim 6$ Å KrF)
- Initial experiments have commenced on Nike, measuring energy dependence of wavelength detuning
Collaborators

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Successful wavelength detuning shifts the resonance location sufficiently to mitigate CBET

When probe rays are **blue-shifted**, the resonance shifts to a higher Mach number where intersecting probe rays are negligible.

When probe rays are **red-shifted**, the resonance shifts to a lower Mach number where probe rays are blocked and/or have negligible intensity.

**Parabolic locus of turning points**

**Target** $r_c$

**Pump beam**

**CBET** causes probe rays to extract energy from high-intensity pump rays.

**Probe beam**
The NIKE experiments will evaluate the disposition of the scattered light at two specific locations.

D. H. Edgell et al., JO5.00004, this conference.
The predicted scattered light from the single probe beam failed to produce discernible signals.
Enhancement of CBET requires using all backlighter beams and retiming them to come on earlier in the implosion.
The Nike experiment will be able to evaluate spatial and spectral mitigation of CBET.
Analysis of the scattered light (SL) looks at the temporal behavior of the spatial average behind the target.

Scattered-light diagnostic surface

Scattered-light diagnostic surface

Average SL at 700 ps
6.40 mJ/cm²
total 4.95 J
The averaged scattered light tracks that predicted by the CBET gain term

\[ D_m = -6 \text{ Å} \]
\[ D_m = +6 \text{ Å} \]
\[ D_m = 0 \]

No BL

Scattered light (J)

Time (ns)

0.6 0.8 1.0
Evaluation of the temporal histories of the scattered-light spectra yields unique signatures
Initial experiments have commenced on Nike, examining energy dependence of spectral shifts.

![Graph showing Nike energy output at various imposed wavelength shifts](image)

- Energy (J)
- Wavelength shift (angle)

Energy output varies with wavelength shift, indicating a dependence on spectral shifts.
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