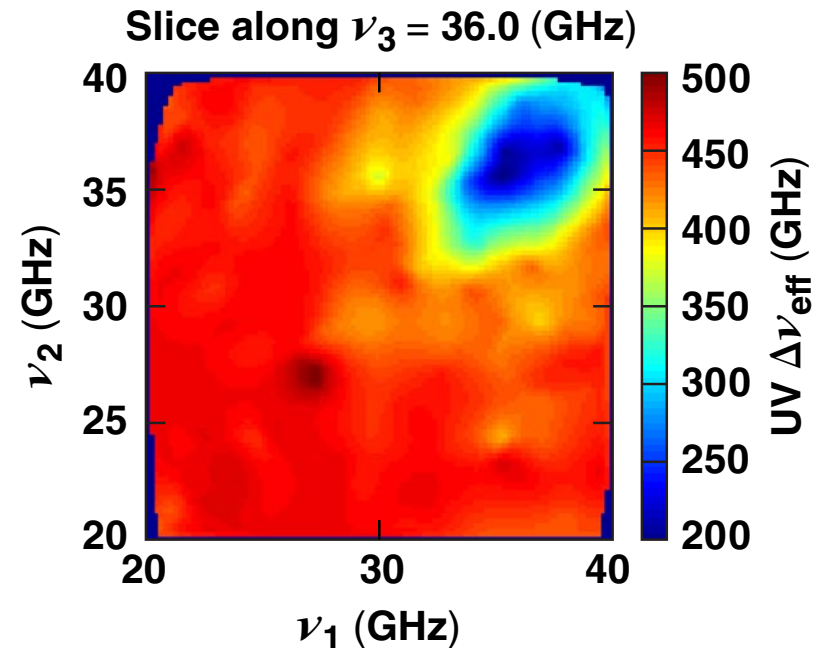
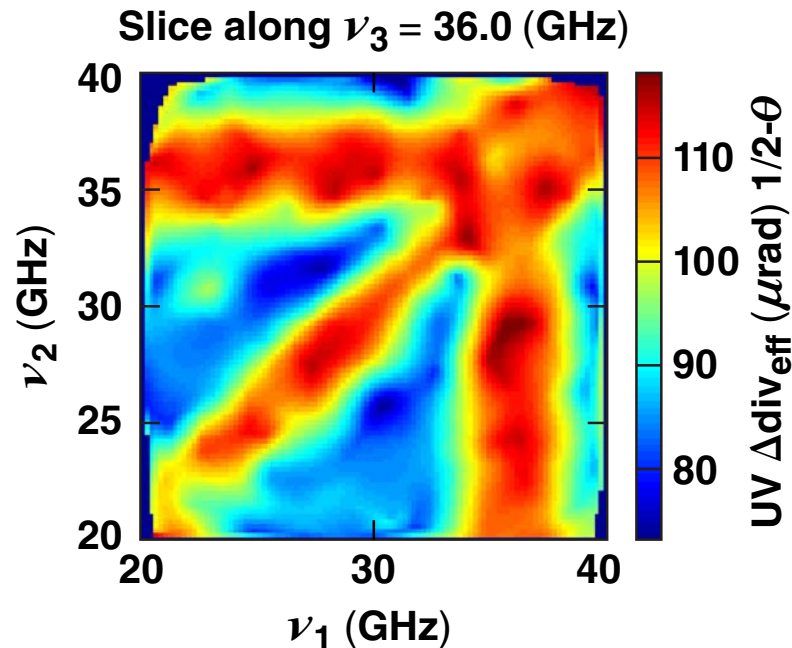


Picket Pulses with 1-D Multi-FM Smoothing by Spectral Dispersion (SSD) for the NIF



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52nd Annual Meeting of the
American Physical Society
Division of Plasma Physics
Chicago, IL
8–12 November 2010

Summary

The 1-D Multi-FM SSD System provides sufficient smoothing levels for igniting NIF polar-drive (PD) targets*



- A 1-D Multi-FM SSD System will be deployed on OMEGA EP in FY11 to demonstrate laser and beam-smoothing performance
- Monte Carlo Multi-FM design space surveys predict optimal Multi-FM modulator-frequency combinations
- Asymptotic-smoothing levels are achieved during a single NIF picket pulse

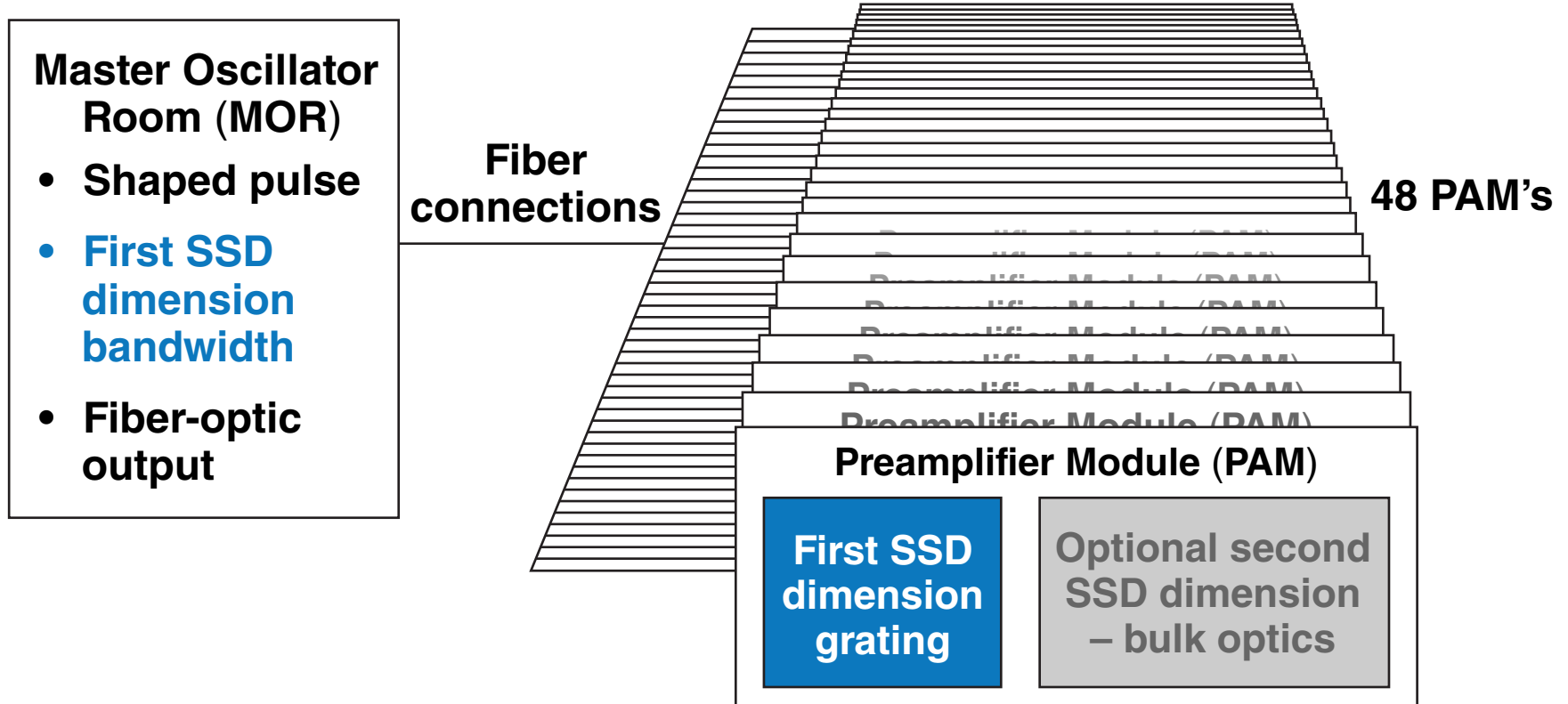
Contributors



T. J. B. Collins and J. D. Zuegel

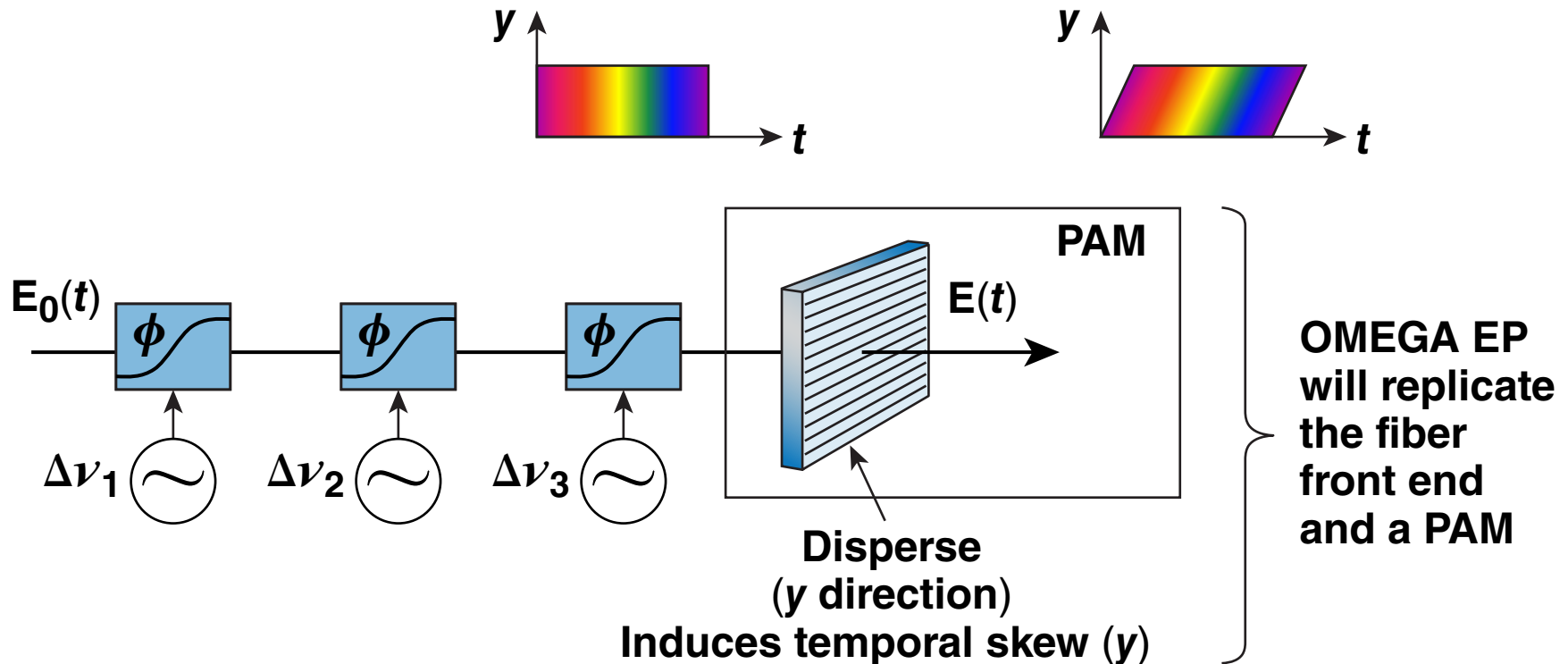
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The 1-D Multi-FM SSD System is a cost-effective alternative to 2-D SSD on the NIF



- The 2-D SSD System is an expensive option because it requires duplication in 48 PAM's
- Multi-FM is generated as a fiber-based system in the MOR
- Multi-FM will be tested on OMEGA EP

The current 1-D Multi-FM SSD design employs three FM modulators

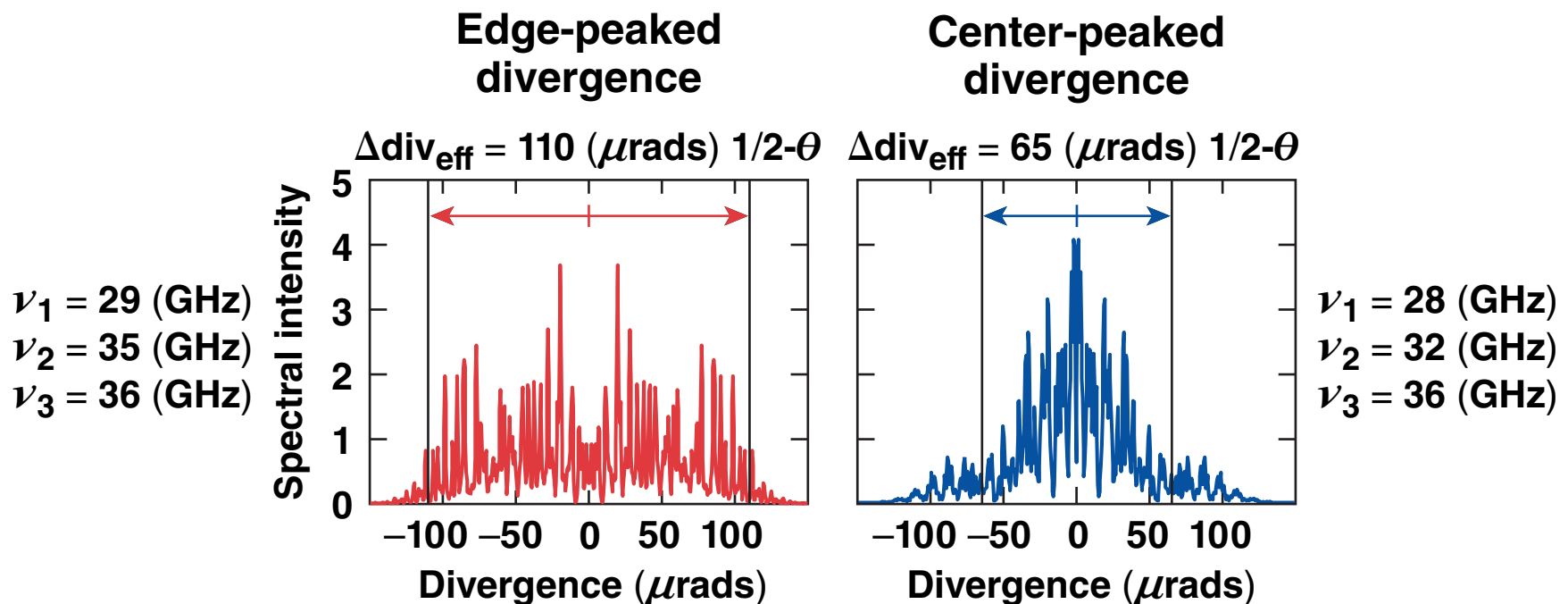


- Total bandwidth and divergence are distributed across the modulators
- Multi-FM can be designed for a bandwidth of $\Delta\nu_{UV} = 0.5 \text{ THz}$ ($\Delta\lambda_{IR} = 6 \text{ \AA}$)
 - only a single frequency-tripler crystal is needed

Two performance metrics are used to predict the smoothing of 1-D Multi-FM SSD designs



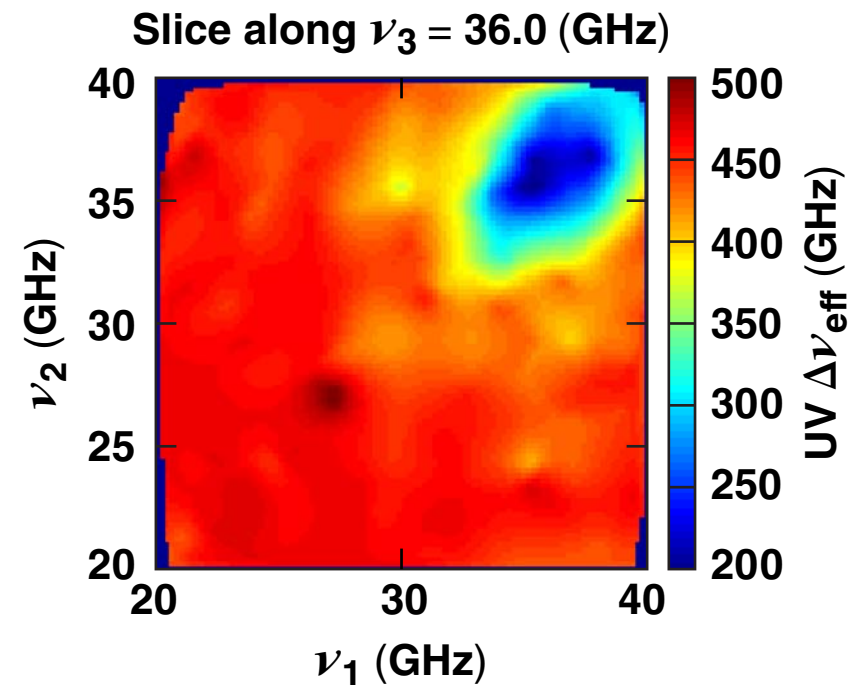
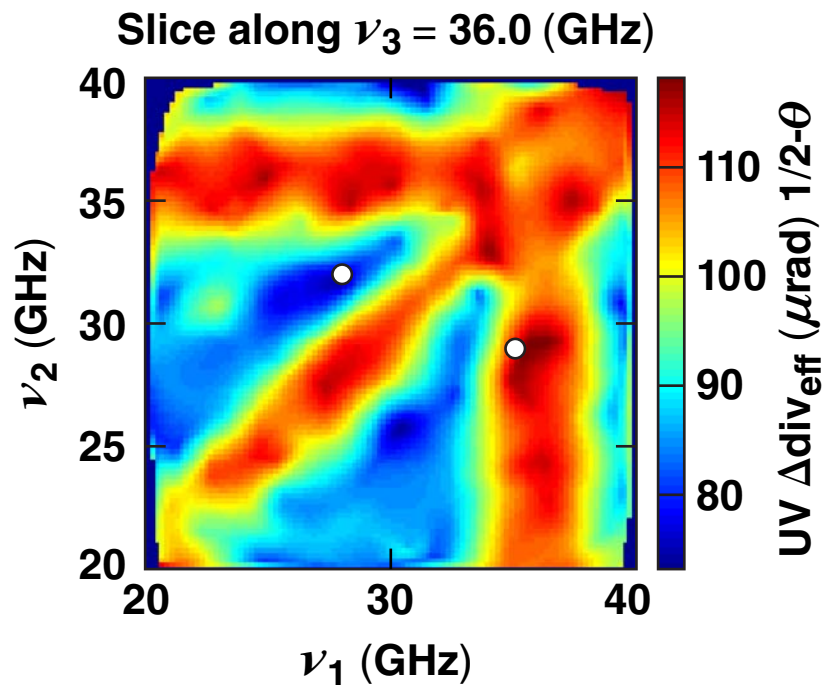
- The autocorrelation width is used to measure both the effective temporal bandwidth $\Delta\nu_{\text{eff}}$ and the effective divergence $\Delta\text{div}_{\text{eff}}$ in the far field
- The values of effective bandwidth $\Delta\nu_{\text{eff}}$ and divergence $\Delta\text{div}_{\text{eff}}$ distinguish between edge-peaked and center-peaked spectra



Monte Carlo simulations are used to survey the large design space available for 1-D Multi-FM SSD



- The frequency design space for the FM modulators is 20 to 40 GHz
- This is guided by commercial RF modulators and amplifiers

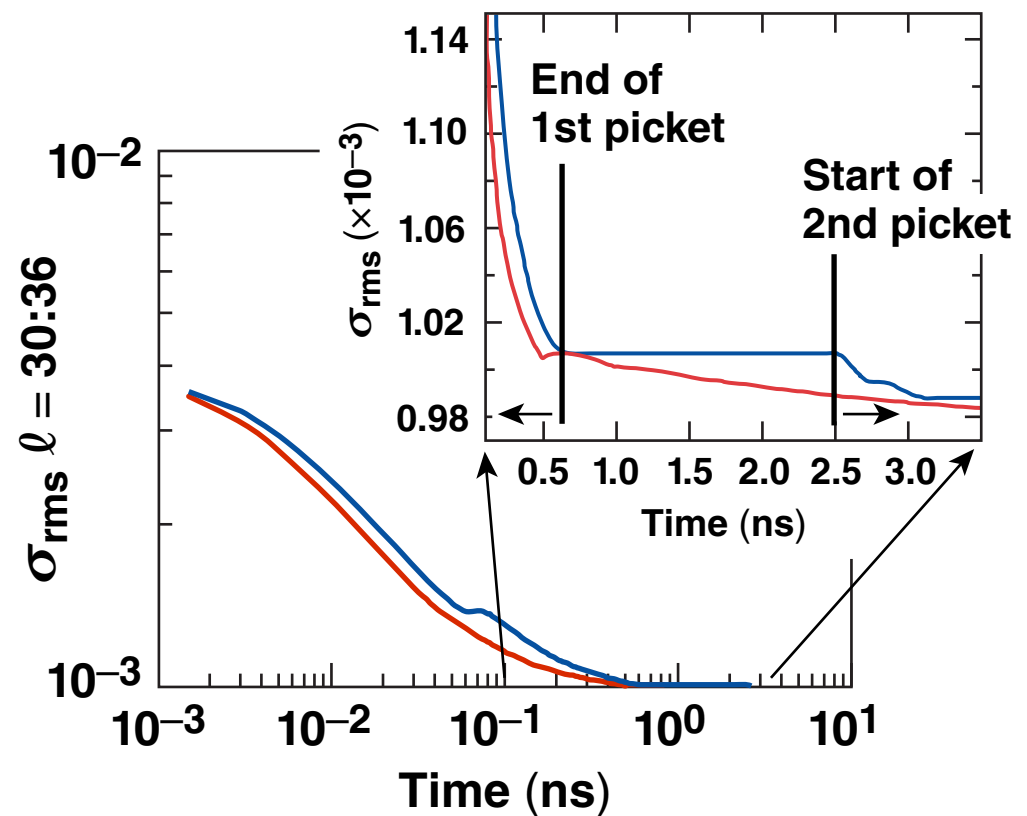
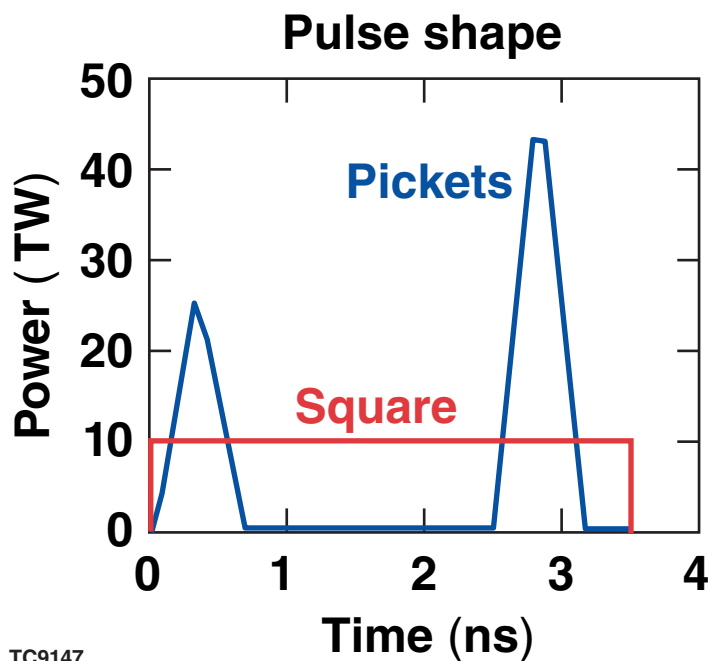


These performance metrics are optimized when two frequencies are similar and one is not.

NIF-scale picket pulses have smoothing characteristics similar to a square pulse

- Asymptotic levels are reached by the end of the first picket

$$\left. \begin{array}{l} \nu_1 = 20 \text{ (GHz)} \quad \nu_2 = 22 \text{ (GHz)} \quad \nu_3 = 28 \text{ (GHz)} \\ \Delta\nu_{\text{eff}} = 508 \text{ (GHz)} \quad \Delta\text{div}_{\text{eff}} = 101 \text{ } (\mu\text{rads)} \text{ } 1/2-\theta \end{array} \right\} \text{mFM32}$$



A triple-picket PD design for the NIF attains a gain of 19, using the proposed 1-D Multi-FM SSD System

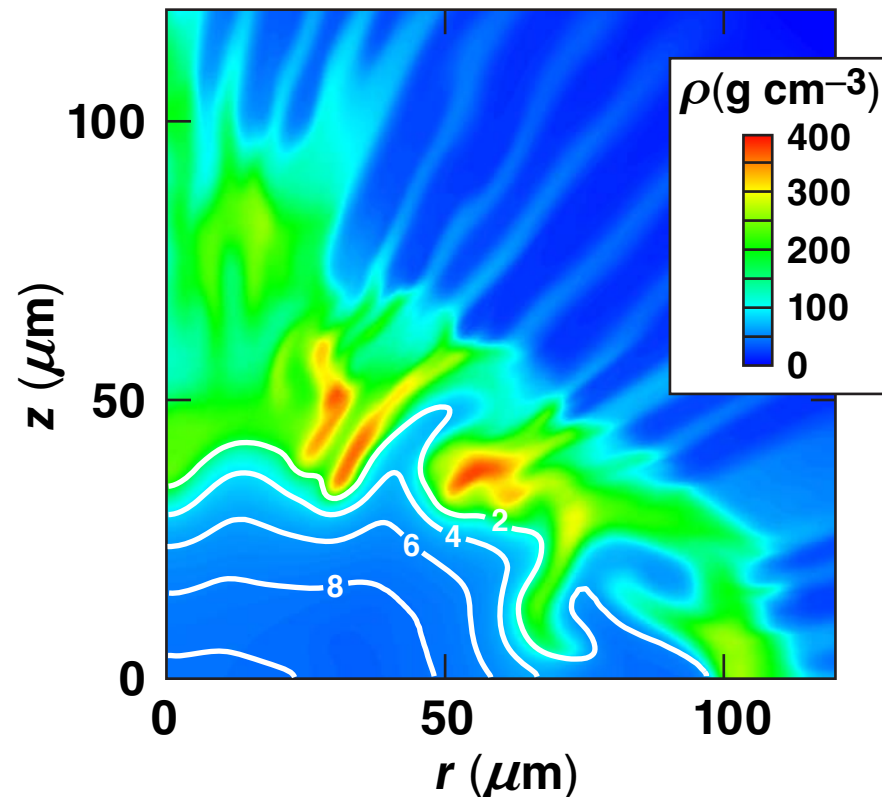


1.6-MJ triple-picket PD DT target:
shown near peak compression at 10.1 ns,
including nonuniformity sources*

Nonuniformities

- Imprint; ℓ modes 2:100
- Ice roughness; 1- μm rms
- Mistiming; 30-ps rms
- Power imbalance; 8% rms

0.5-THz 1-D Multi-FM SSD; mFM32



Summary/Conclusions

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