

Measurement Techniques for Ultra-short Laser Pulses

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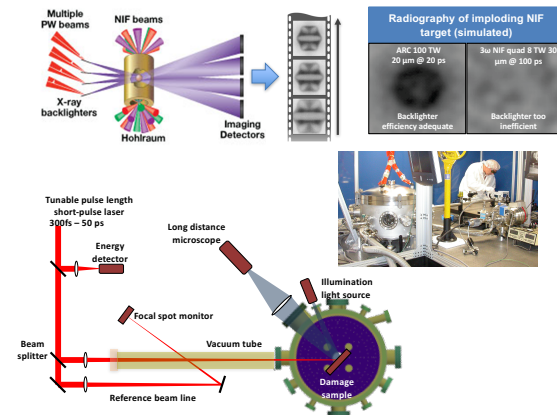
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The Advanced Radiographic Capability (ARC) laser will convert 4 NIF beamlines to 1-50 ps duration making it the world's highest energy petawatt laser system. The maximum energy of ARC is limited by the laser damage threshold of optical coatings for ARC optics. These are tested in the precision damage test station using a 10 Hz terawatt class short pulse laser. Tracking the exact pulse profile is crucial for understanding the physics and phenomenon of ps-optical change. Here we present single shot short pulse diagnostics we have developed for the PDTs.

Advanced Radiographic Capability (ARC)

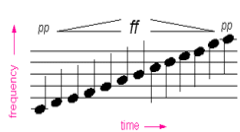
ARC is built to enable high energy x-ray Compton radiography of NIF targets.



ARC optics are tested in the ARC damage test station.

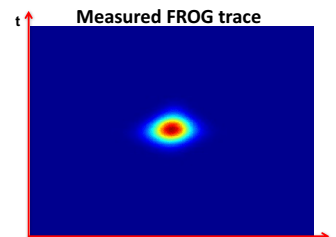
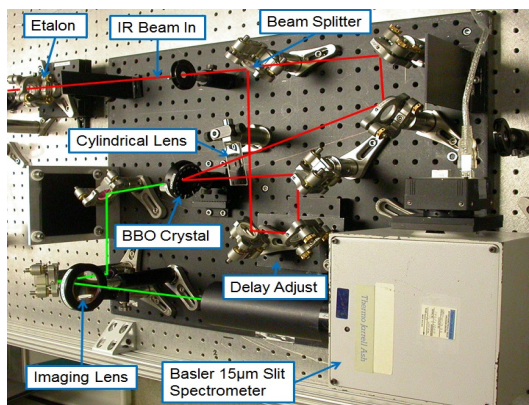
What is FROG?

FROG provides a high resolution analysis in the time-frequency domain. The pulse width, spectrum, temporal and spectral phase can be determined from a FROG image.



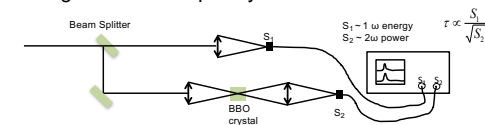
Single Shot SHG FROG

Single shot FROGs are optimum for retrieving pulses with a duration in the femtosecond regime. However, they reach their limit at 5 ps due to crystal aperture, and cannot be used for the full ARC range.

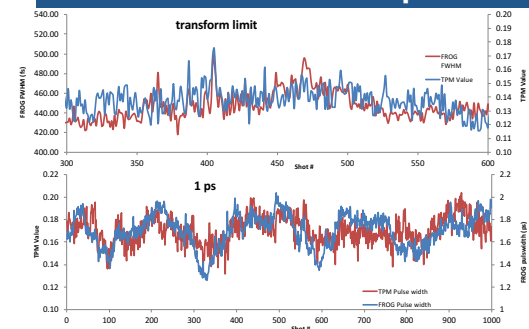


Temporal Pulse Monitor (TPM)

The TPM measures the relative shot-to-shot change in pulse width of a short pulse laser at high repetition rate using nonlinear frequency conversion.



FROG and TPM Comparison



Conclusions

- A single shot SHG FROG was designed, built, and testing is in progress
- Initial testing of the TPM shows qualitative tracking with FROG measurements at transform limit (300-400 fs) and 1 ps pulse durations. We are currently investigating noise sources in the TPM

References:

- LLNL S&T Review December 2011
- Trebino, Rick "Frequency Resolved Optical Gating: The Measurement of Ultra-short Laser Pulses," Kluwer Academic Publishers, 2000.

