



Jupiter Laser Facility Status

2026 NIF/JLF User Group Meeting
February 11, 2026

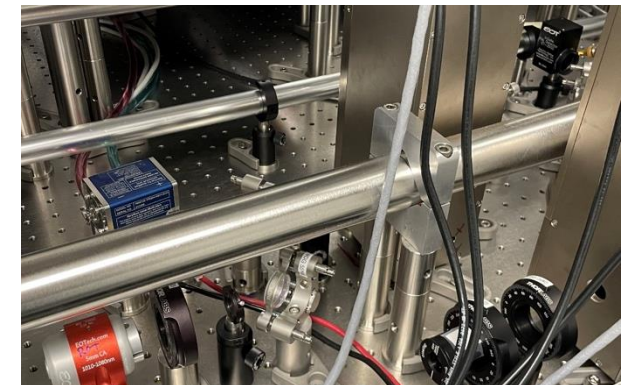
Brent Stuart, Operations Manager – Jupiter Laser Facility

PLS PAD Office

Prepared by LLNL under Contract DE-AC52-07NA27344.

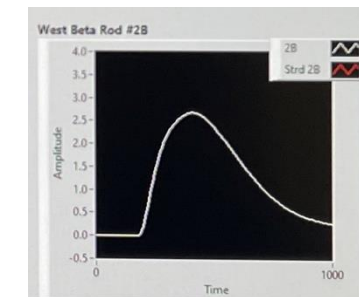
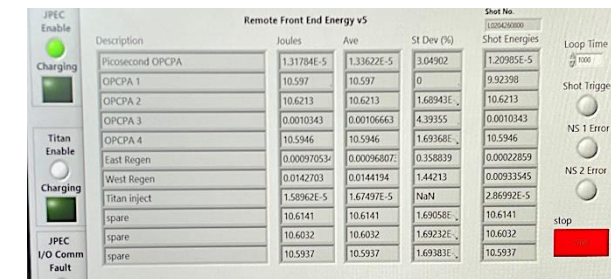
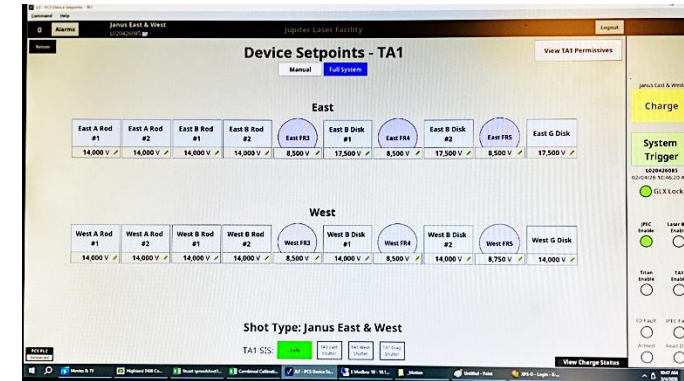
We continue to improve JLF capabilities

- Vacuum upgrades to Laser Bay, COMET, Titan
- New off-axis parabolas – COMET (1w, 2w), Titan (5) f/3 and (5) f/10
- New doubling crystals – COMET, East&West 20-mm KD*P
- New 1053-nm oscillators – Montfort, Light Conversion FLINT
- Titan psOPA to reduce prepulse
- Titan prepulse regen to add prepulse in controlled manner
- Titan split-beam delay – adding capability for 10-ns separation (delay primary side)
- STILETTO activation and commissioning experiment
- Long-pulse temporal shaping – ModBox
- SSD on East and West
- TA1 diagnostics upgrade



Controls enhancements continue

- Activated new shot sequencer
 - Converted from Labview to Ignition
 - Shot permissives
- Capture laser diagnostics on shot
 - spatial, energy, temporal, spectral
 - 5-Hz energy system activated
- Simplify beamline timing adjustments
- Automation of long-pulse shaping
 - User-defined energy and shapes
 - New shapers (ModBox)
- Shot database and dissemination to users
- Network upgrade



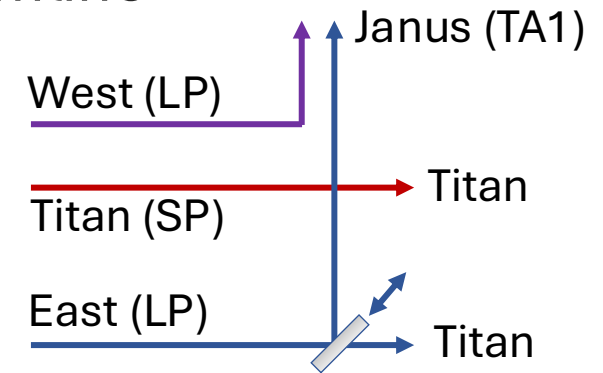
The DOE/FES-funded third beamline helps to increase the rate of shots

- Titan and TA1 each have one dedicated beamline

- Easier (quicker) for setup and alignment
- Reduces shot conflicts
- Experiments scheduled to avoid shared use of East beam

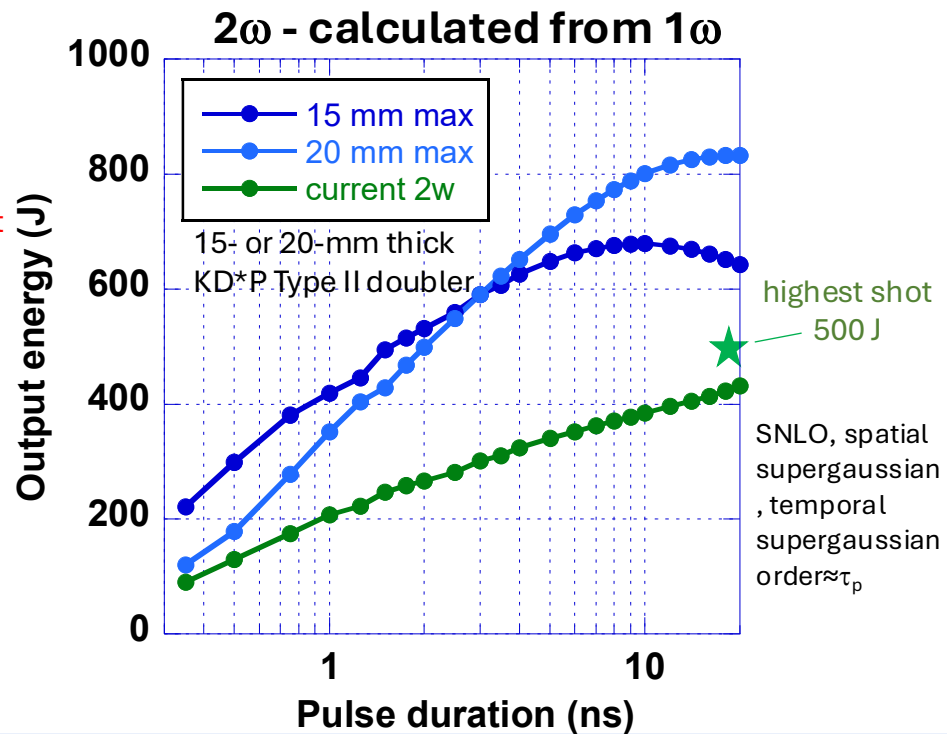
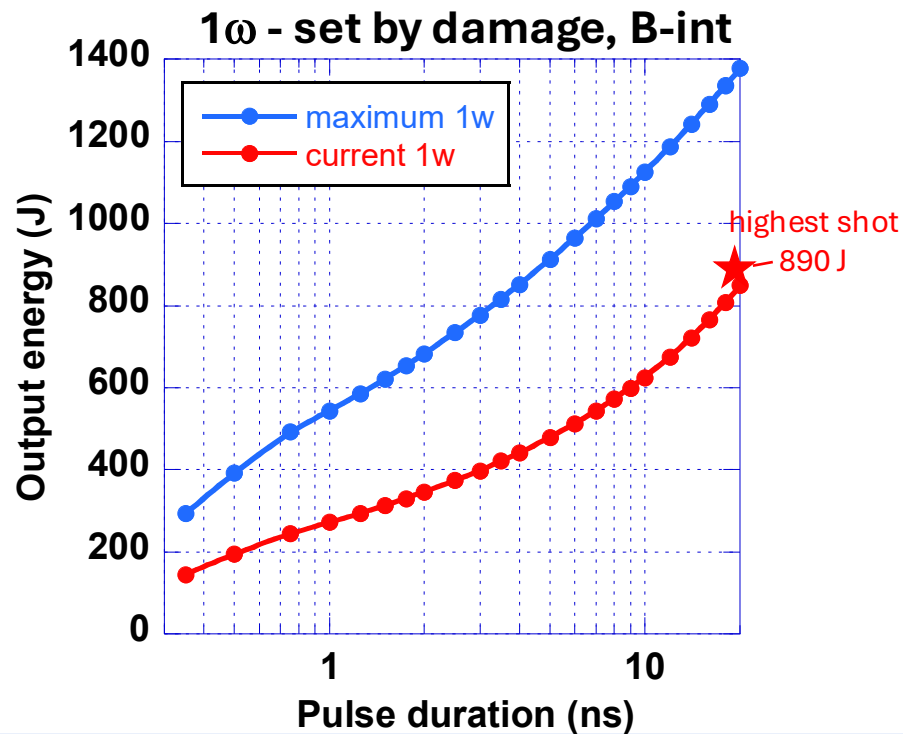
- New beamline is optimized for Titan:

- Eliminates many prepulse sources
- Lower B-integral (<1.0)
- Reduced radial group delay
- ps-OPA in front-end to improve contrast
- Temporal pulse shape optimization



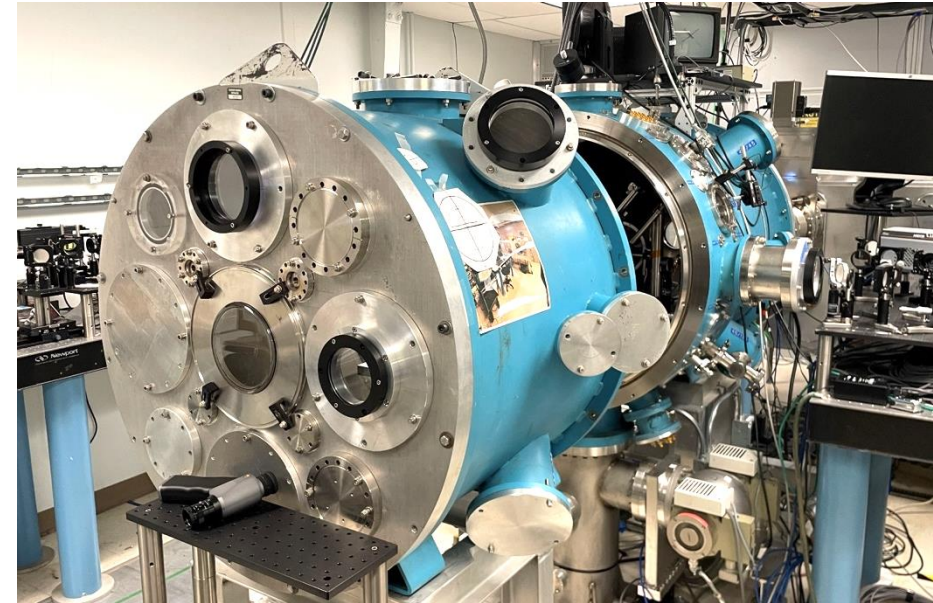
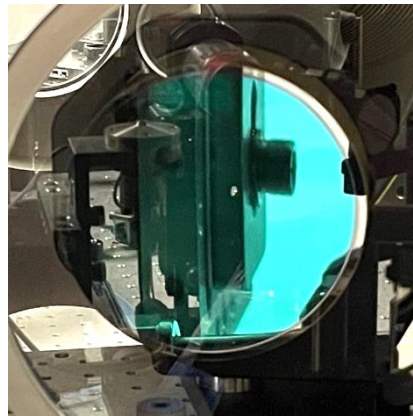
We will ramp up the long-pulse energy as allowed by beam quality and optical damage

- Maximum energy limited by nonlinear effects, optical damage
 - Final values will depend on beam quality
 - Shots were restarted at about 60% of the maximum 1ω level
- Added bandwidth is available for higher-energy long-pulse shots
 - Wavelength tuning with narrow bandwidth will need to be done at lower energies



COMET operates at the 10-J level with sub-ps pulses

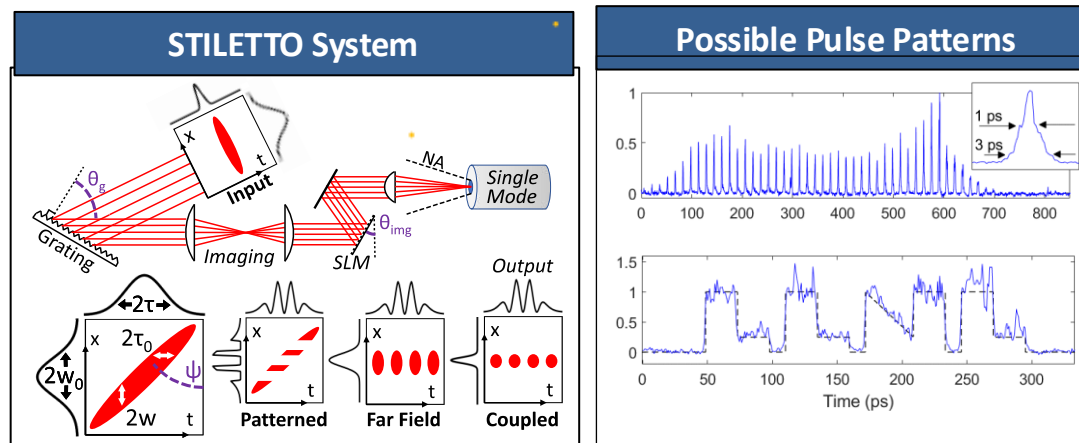
- The damaged grating and a few other optics were replaced
 - Beam spatial fill was improved to smooth out energy distribution
- We also have new:
 - 2ω doubling crystal
 - 2ω parabola
 - 1ω parabola
 - Turbo pumps



STILETTO* has been activated at JLF

- Internally-funded partnership with NIF&PS to build and field this instrument
- Fiber output of STILETTO injected into East long-pulse regen and amplifier chain
 - Nominal use in TA1 (Janus)
 - Will be able to support combined Titan/STILETTO shots with STILETTO on East beam
- Record length of 700 ps demonstrated with <ps resolution

*Space-Time Induced Linearly Encoded Transcription for Temporal Optimization



D. E. Mittelberger, R. Muir, D. Perlmutter, and J. Heebner, Opt. Lett. **46**, 1832 (2021)

D. E. Mittelberger, R.D.Muir, and J.E. Heebner, Opt. Exp. **30**, 1875 (2022)

A. Longman, et al., PRL **135**, 175103 (2025) – commissioning experiment

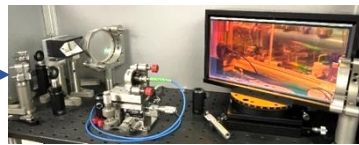
- Laser-Plasma Instability (LPI) mitigation
 - via amplitude modulation: *e.g.* STUD pulses
 - via λ modulation: *e.g.* time-dependent color
- Time-dependent pointing & focusing for ICF
 - dynamically pointing the laser to a “fresh spot” on an indirect drive target after plasma generation
 - dynamically zooming the laser focus to chase an imploding direct drive target

In a change from original plans, STILETTO implementation is independent of Titan operations

Oscillator, 300 fs, 2 nJ



300-ps stretcher



fiber

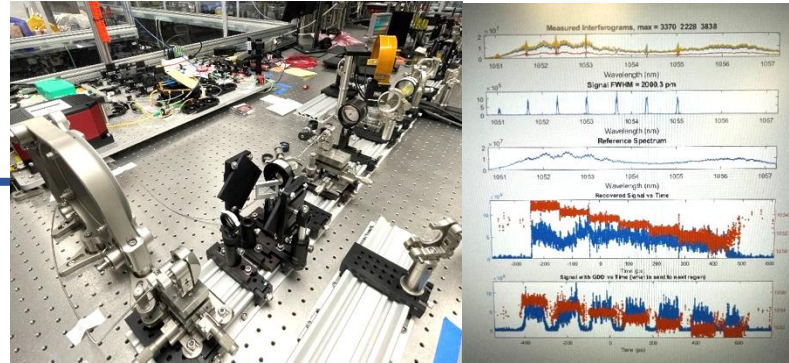
Regenerative amplifier



Red = new items

1 nJ
fiber

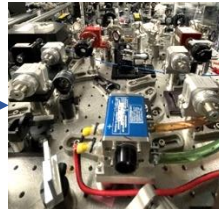
STILETTO and 3PSI



0.3 mJ

* Energies depend on pulse shape/fill

East main regen

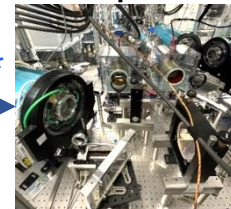


Compressor



1 mJ*

East amplifier chain Janus target chamber



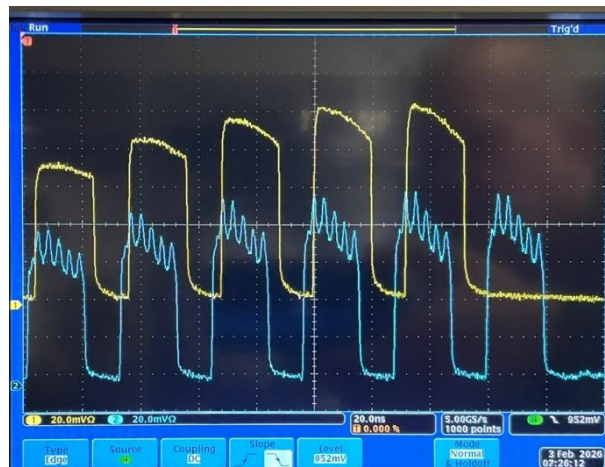
200 J*



We are planning to implement an amplified-pulse diagnostic and a simplified user interface

Pulse shaping for the long-pulse beamlines is being improved

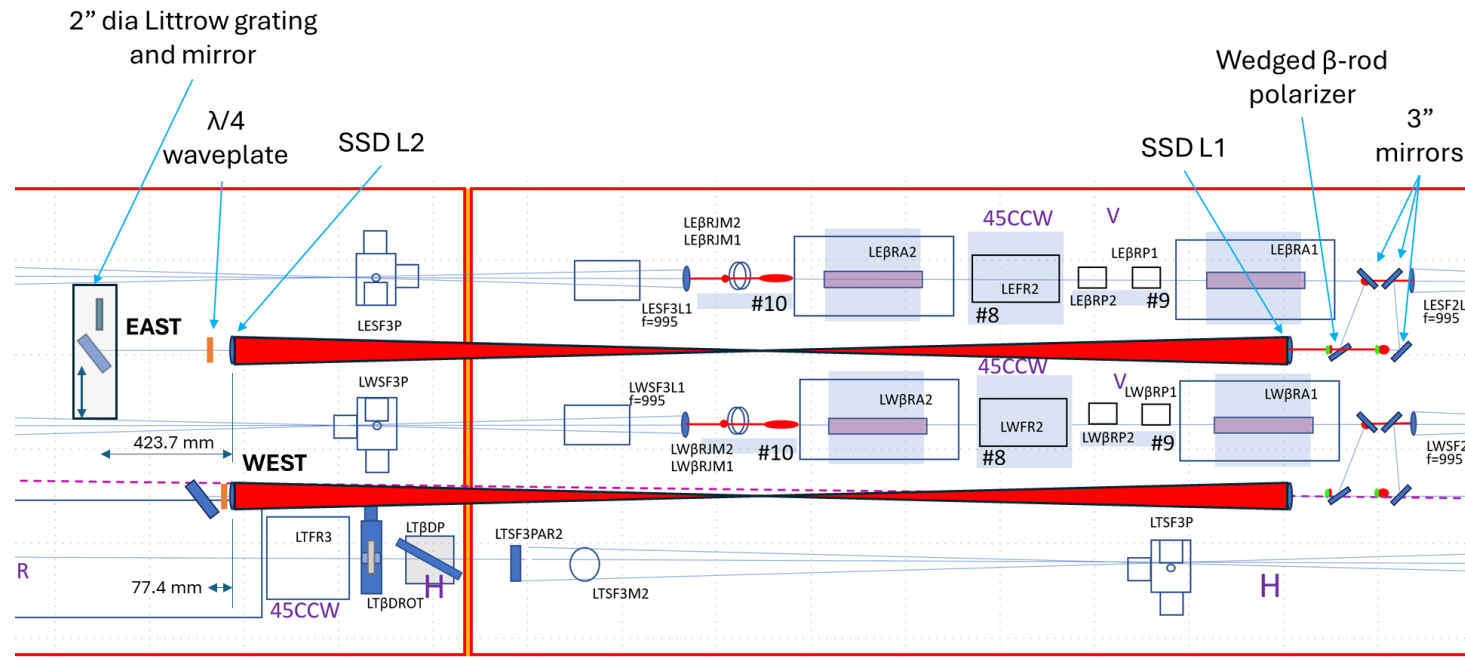
- New ModBox pulse shapers activated
 - One on East beamline
 - One on new Titan prepulse injection regen
 - One on regen in setup room for testing controls
- Temporal shaping resolution now 0.125 ns (2x better)
- ModBox has automatic bias control and 60 dB extinction ratio



Regen buildup with 20-ns “square” pulse input:
Blue = West regen seeded by Highland T400B
Yellow = East regen seeded by ModBox-FE

Smoothing by Spectral Dispersion (SSD) is being added to the East and West beamlines

- 1-D SSD with 14-GHz modulator and 1160 line/mm grating
 - Add new vacuum relay and grating after SF2 and before 50-mm dia. rods
 - Vacuum parts and optics on order



FY26 MPIC* funding is allowing us to upgrade Janus target-area (TA1) diagnostics

- Replacement for Hydra Ti:sapphire system (~ 10 mJ, <100 fs, 800 nm)

- VISAR and SOP upgrade:
 - Three new streak cameras
 - New fiducial generator
 - New comb generator
 - New optics



*Multi-Programmatic Instrumentation Committee, LLNL

JLF is always looking to add new capabilities for the users



Evaluating:

- Auxillary beamline (50 J level, range of pulse duration)
 - Send to TA1, Titan or COMET
- Ti:sapphire system in Titan
- Long-pulse 3ω capability
- Diagnostics calibration area:
 - ~100 mJ, 100 fs, doubled to 400 nm
 - 20-150 ps, 200 or 266 nm, few 100 mJ in UV



We welcome further suggestions for new and improved capabilities at JLF