CORTES-800 40 TW

30 fs Amplified Ti:sapphire Laser

The new Cortes-800 amplification system provides terawatt peak power in a compact package. Seeded with our compact Trestles Ti:sapphire oscillator, the Cortes-800 consists of three chirped pulse amplification (CPA) stages that fit on a single optical table. Pulse energies of greater than 1.5 J are achieved before compression in a vacuum chamber. Active feedback and pulse shaping allows the Cortes-800 to produce extremely high contrast ratios, and sub 30 fs output pulses with peak powers greater than 40 terawatts. Fully integrated timing and control software make the Cortes-800 a perfect tool for the study of high energy laser- matter interaction.

CORTES-800

Specifications

Wavelength	795-820 nm
Pulse Duration	< 30 fs
Repetition Rate	10 ± 0.5 Hz
Output Energy	> 1 J
Energy Stability	< 2% RMS
Beam Size	~ 75 mm
M^2	< 1.6
Polarization	> 100:1
Contrast Ratio	
Replica	> 10^6:1
@ 1 ps	> 10^4:1
@ 5 ps	> 10^6:1
@ 10-20 ps	> 5x10^6:1
ASE (over 20 ps)	> 10^7:1

KLM Ti:sapphire Oscillator

Pulse Duration	20 fs
Center Wavelength	795-820 (fixed)
Pulse Energy	5 nJ
Repetition Rate	80 MHz

Stage-1 Amplifier

Pulse Duration	400 ps
Center Wavelength	795-820 (fixed)
Pulse Energy	2 mJ
Repetition Rate	10 Hz

Stage-2 Amplifier

Pulse Duration	400 ps
Center Wavelength	795-820 (fixed)
Pulse Energy	200 mJ
Repetition Rate	10 Hz

Stage-3 Amplifier

Pulse Duration	400 ps
Center Wavelength	795-820 (fixed)
Pulse Energy	1500 mJ
Repetition Rate	10 Hz

After Compressor

Pulse Duration	30 ps
Center Wavelength	795-820 (fixed)
Pulse Energy	1000 mJ
Repetition Rate	10 Hz

DEL MAR PHOTONICS

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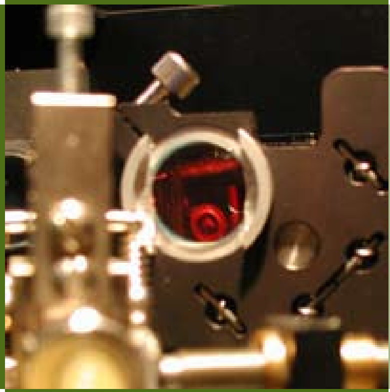
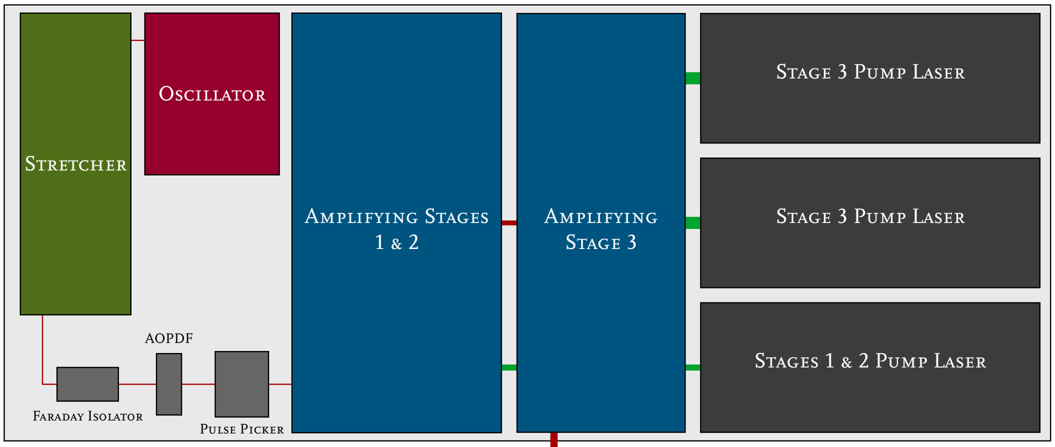
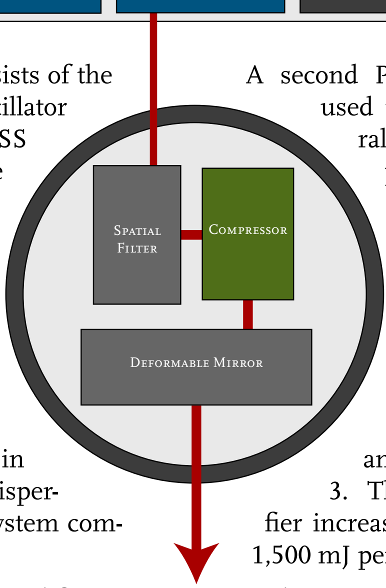


Pismo Control Center

The synchronization electronics controlling the trigger delays for CORTES-800 40 TW are controlled via a PC running LabView. The oscillator signal is fed into the synchronization electronics and sets the primary synchronization signal. The synchronization electronics then sends signals to trigger the two pulse pickers and amplifier pumps. Each signal must be delayed by the appropriate amount corresponding to the time it takes for the pulse to travel to the corresponding stage of the amplifier.





The initial stage of the system consists of the TRESTLES-20 femtosecond oscillator pumped with a 532 nm, 6 W DPSS laser. Generated 20 fs pulses are temporally stretched with Offner triplet technology to 400 ps. To pre-correct for spectral changes incurred as pulses pass through the system, the stretched pulses pass through an acousto-optic programmable dispersive filter. The AOPDF compensates for gain narrowing and wavelength shifting in the amplification stages and for dispersion due to propagation through system components.

Before insertion into the first amplification stage, a PISMO Pockels cell pulse picker is used to gate single pulses at a repetition rate of 10 Hz from the oscillator pulse train. The stretched, shaped and picked pulses are then amplified by a WEDGE-10 multi-pass amplifier, providing high contrast ratio.

After the initial amplification stage the pulses pass through a spatial filter to increase the beam diameter and improve the spatial quality of the beam.

A second PISMO Pockels cell is used to increase the temporal contrast ratio and to protect STAGE-1 from back reflections. The spatially expanded pulses pass through STAGE-2, a 5-pass multi-pass amplifier. Another spatial filter is used to clean the beam before the final amplifying stage, STAGE-3. The 4-pass power amplifier increases the pulse energy to 1,500 mJ per pulse.

Pulse compression takes place within a sealed vacuum chamber with a dielectric grating compressor. Grating position, and thus final pulse duration, are adjusted with the help of computer controlled motorized stages. A deformable mirror (DM) coupled with a Shack-Hartmann wavefront sensor is used to correct wavefront distortions, resulting in a 0.8 Strehl ratio.

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