

UT³ Laser System Components and Specifications

Main components of the Ti: sapphire system:

- 1.1 KHz, 30 fs, 1 mJ FEMTOPOWER Compact Pro front end**, including
 - Femtolasers Ti:S oscillator (Model Synergy 20), with Spectra-Physics Millennia pump.
 - chirped mirror stretcher
 - 9-pass amplifier
 - prism compressor
- 2. Cross-Polarized Wave (XPW) Filter** to enhance pulse duration and contrast
- 3. 10 Hz, 45 TW amplifier system:**
 - Öffner triplet stretcher
 - 2 pass Ti:S booster amplifier
 - Pockels cell 10 Hz pulse selector
 - PREAMP and POWERAMP multi-pass amplifiers with water-cooled Ti:S crystals.
 - ~ 30 mJ uncompressed output split off to drive Raman shifter/amplifier subsystem
- 4. 1 KHz, 20 W Nd:YLF laser (Model JADE)** to pump 9-pass kHz amplifier and booster amplifier, with remote computer control.
- 5. 4 Nd:YAG lasers (3 Model SAGA HP and 1 Continuum)** to pump 10 Hz amplifiers, with remote computer control.
- 6. Grating Pair COMPRESSOR** (in vacuum tank).
- 7. MASTER CLOCK** to synchronize all signals and secure laser operation.

Specifications of the Ti: sapphire system:

Peak power: >30 TW

Center Wavelength: 800 nm

Pulse duration: 30 fs

Output energy: 1.1 J

Repetition rate: 10 Hz

Pointing Stability: < 20 μ rad

Energy stability: 1.5 % (rms)

Contrast ratio: >10¹⁰: 1 @ > 20 ps; > 10⁸ @ 10 ps; >10⁷:1 @ 5 ps
>10⁶: 1 @ 1 ps (> 10⁷:1 ns prepulse contrast)

Spectral width: > 50nm

Strehl ratio: > 0.7

Synchronization: < 30 ps

Main Components of the Chirped-Pulse Raman Amplifier (CPRA):

1. Multistage barium nitrate (Ba(NO₃)₂) Raman shifter-amplifier, pumped by ~ 30 mJ of chirped 800 nm light split off after the pre-amplifier of the main Ti:S system, to produce ~ 5 mJ of chirped sideband pulse of high beam quality synchronized with the main pulse. This requires no additional pump lasers and does not compromise the energy, duration or beam quality of the fully amplified 800 nm main pulse. Output energy is channeled into the desired sideband by using spectral filters between SRS amplifier stages.

2. Bow-tie Ti:S amplifier pumped by a Nd:YAG laser increases energy to > 150 mJ.

3. Custom grating pair compressor the sideband pulse to ~ 60 fs duration.

Specifications of the CPRA output are:

Peak power: ~ 3 TW

Center Wavelengths: 873 nm, 961, 738, 685, 639 nm

Pulse duration: 60 fs

Output energy: 0.15 J

Repetition rate: 10 Hz

Spectral width: > 20nm