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Ultra-high Contrast Third-order Autocorrelator TUNDRA

Our third-order autocorrelator serves as a highly sensitive diagnostic toole contrast measurements. The dynamic range reaches up to 12 orders of magnitude, sufficient to characterize background or trace tiniest pre- and post-pulse replica. The autocorrelator generates the third harmonic signal sequentially in two nonlinear crystals and is set up with all-reflective components, guaranteeing correlation traces without measure-ment artefacts.

The high-sensitivity correlator can be employed in a wide range of applications. In particular, high-field experiments in plasma physics require the in-depth measurement of the pulse contrast behavior and possible parasitic pulse structures. Compared to second-order autocorrelators, the third-harmonic nature of the signal allows to distinguish between pre- and postpulses. All these features make our specialized autocorrelator an invaluable tool for state-of-the-art characterization of ultrashort laser pulse contrast.

Key Product Features:

- Ultra-sensitive pulse contrast measurement
- Up to 12 orders of magnitude dynamic range with 100-150 μJ input pulses
- up to 3.7 ns scan range
- no ghost pulse artefacts
- available wavelenghts: 800, 1030, customizable in a wide range
- Easy to set up and use.
- Full user-friendly software package

Characteristics

	Tundra	Tundra +	Tundra 2 ns	Tundra 4 ns
Signal dynamic range	up to 11 orders of magnitude	up to 12 orders of magnitude	as Tundra or Tundra + version available	
Pulse energy for full dynamic range	50-100 µJ	100-150 µJ		
Delay range	633 ps	633 ps	1930 ps	3700 ps
Variable time-zero position	±67 ps	±67 ps	1930 ps range	±67 ps
Wavelengths	800 nm, 1030 nm, customizable in a wide range			
Scan resolution	down to 1 fs		down to 2 fs	
Input polarization	s-polarized beam (vertical)			
Footprint	54 x 37 cm^2		54x 52 cm^2	

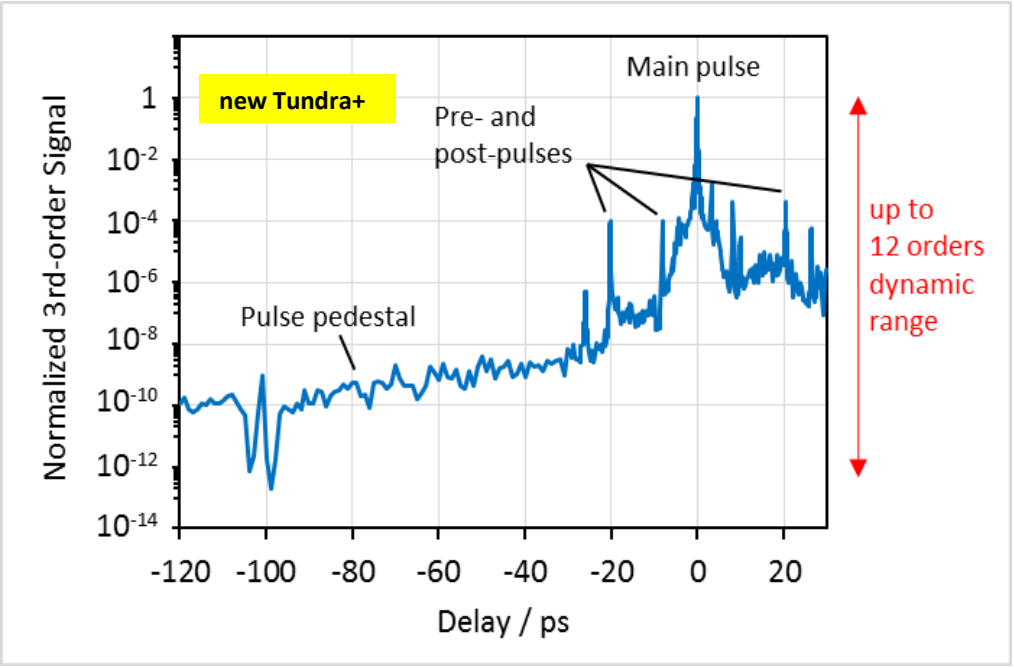

Figure 1: Contrast measurement of a high-power Ti:Sa laser with the new Tundra+. The pulse levels off to a pedestal of ca. 10^{-10}, still 2 orders of magnitude above the detection limit of the device.

User-Friendly Software Interface

The autocorrelator is fully automatized and comes with a user-friendly software interface:

The Autocorrelator Control program lets the user set up a measurement in an instance and includes variable step size options. Custom settings can be saved as default or loaded from other measurements.

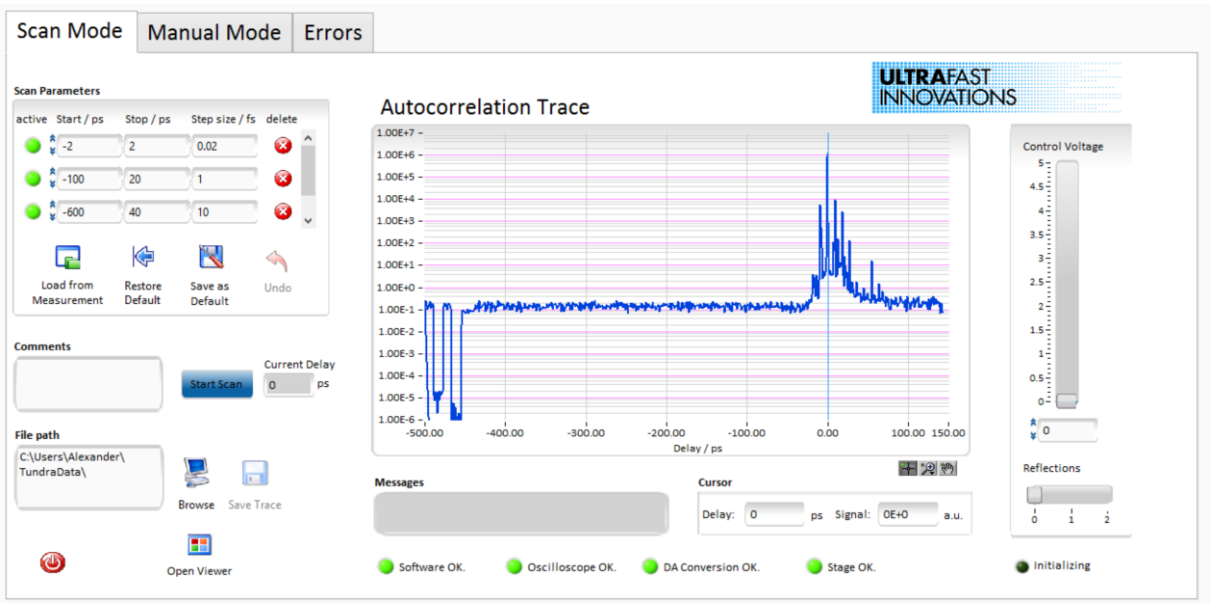

Figure 2: Screen shot of the user-friendly autocorrelator control interface.

The Data Viewer program has all the tools to compare different measurements, analyze a trace or calculate the thickness of optical elements generating pulse replica.

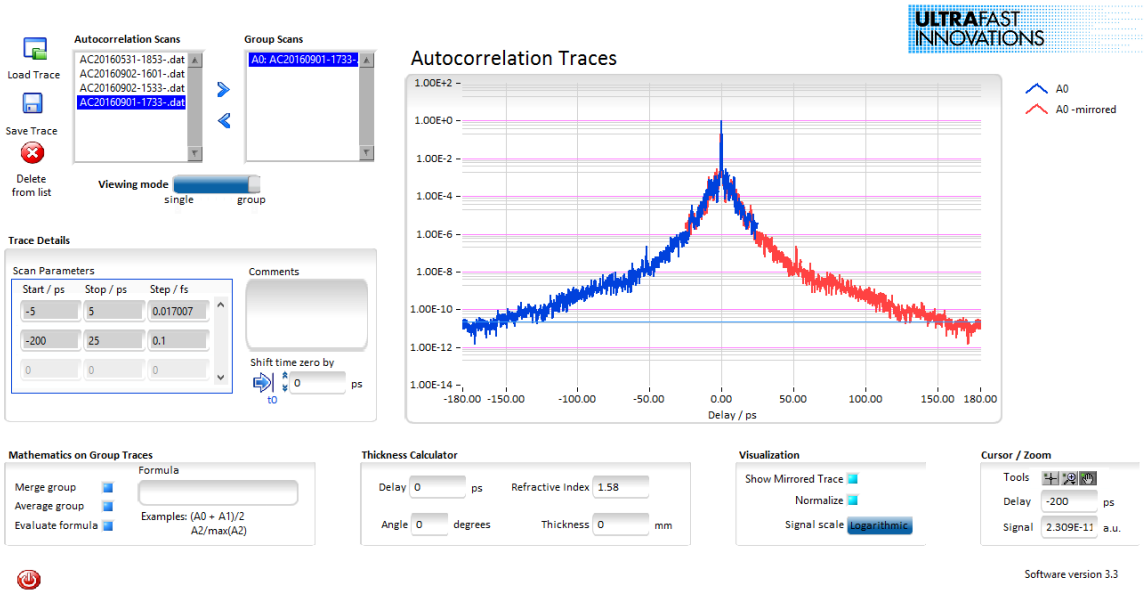

Figure 3: : Screen shot of the Viewer program. Currently displayed is a measurement of a high-power laser frontend, compared with the same trace, mirrored around time zero. The long pulse tails are here totally symmetric around time zero.

Tundra

Our Tundra autocorrelator features an outstanding dynamic range of up to 11 orders of magnitude already with 50-100 µJ input energy and covers a delay range of 633 ps. The device has been used successfully by facilities worldwide and is valued by customers not only for its excellent performance but also for its user-friendliness and ease of use.

Tundra+

In the new Tundra+ we have boosted the already excellent dynamic range of our standard device by another order of magnitude to up 12 orders of magnitude. This huge dynamic range is particularly suited to characterize the contrast of newest Terawatt and Petawatt high-energy laser systems, for which even smallest pulse background can have detrimental effects in experiments.

Tundra 2ns

Complex laser amplifiers implement multiple components like Pockels cells or compressor gratings that can introduce pulse pedestals or multi-pulses on the many-hundreds of picoseconds or even nanosecond time scale. In order to capture also such contributions we have developed a Tundra version spanning an almost 2 ns delay range. As an additional feature the time zero position is in this device freely variable over the full delay range. Our long-delay range devices are also available as Tundra+ versions with enhanced dynamic range.

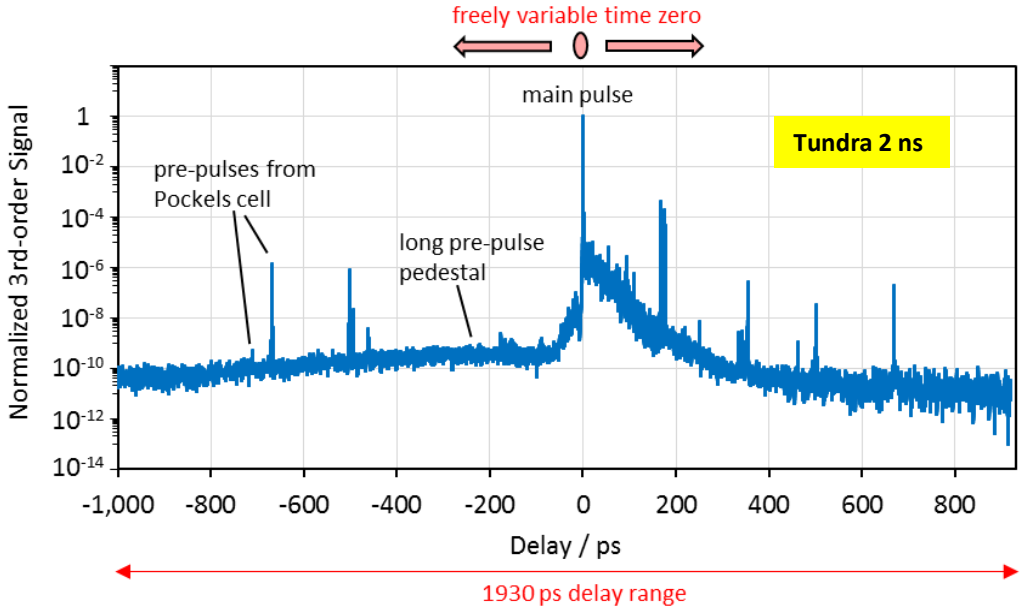

Figure 4: Long-delay contrast measurement of the 50-250 TW ATLAS laser system in Garching, Germany, with the Tundra 2ns.

Tundra 4ns

Our longest delay range device implements an additonal motorized stages to cover delays from -1850 ps to 1850 ps in a single scan.

Reference Measurements

Tundra autocorrelators have been used sucessfully to characterize some of the most powerful and unique Terawatt and Petawatt laser systems in the world, including

● ATLAS laser, MAP, Garching, Germany (50-250 TW, 25 fs) ● Petawatt Field Synthesizer, MPQ, Garching, Germany (100 TW, < 10 fs) ● Light Wave Synthesizer 20, MPQ, Garching, Germany (18 TW, < 5 fs) ● SYLOS high-contrast OPCPA project test laser (5 TW, 9 fs)