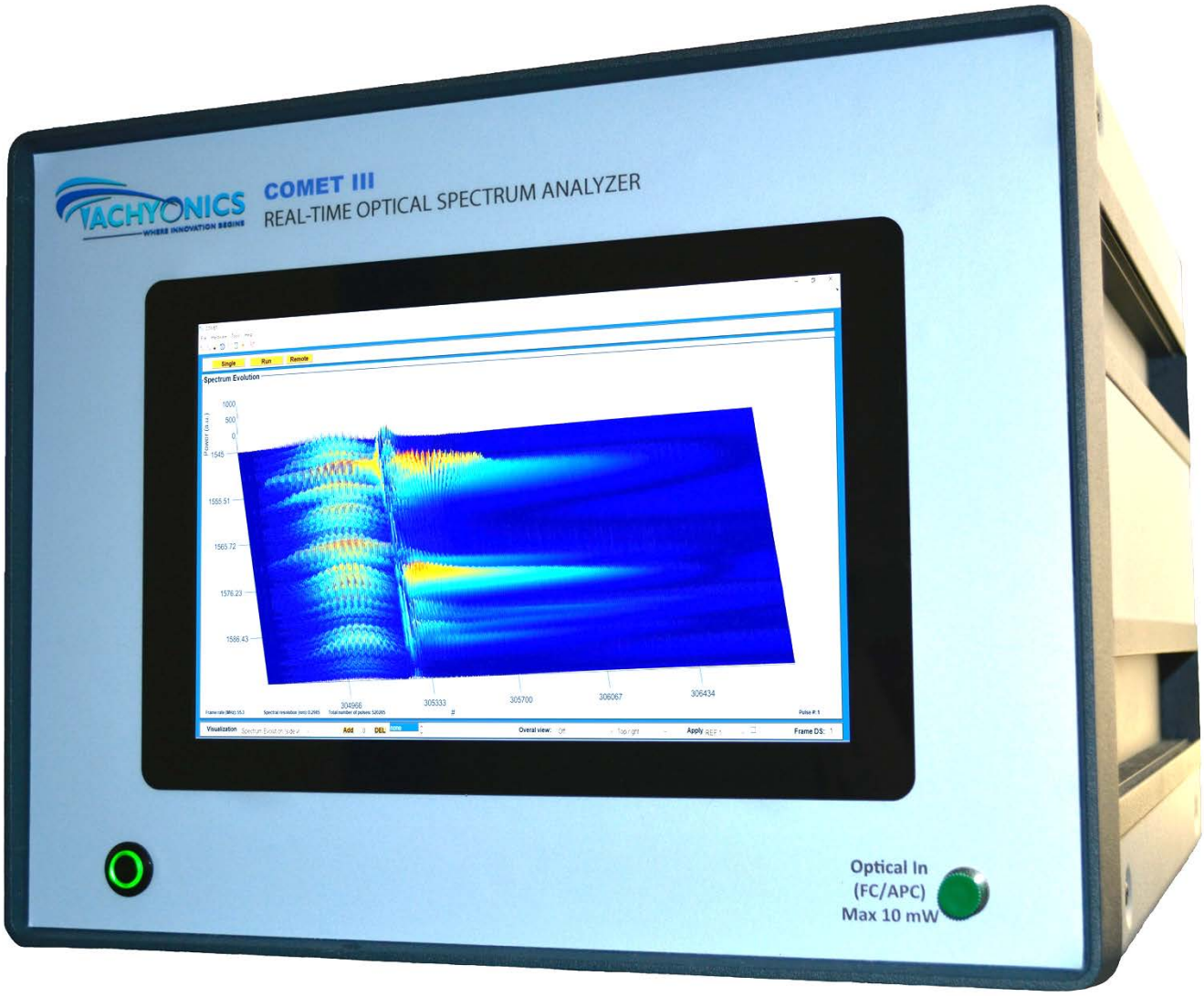
COMET III: Single-Shot Billion Frame-Rate Optical Spectrometer



DESRIPTION

COMET III is a real-time single-shot optical spectrometer with a frame rate of up to billion frames per second, at least one thousand times faster than the next fastest spectrometer. The *COMET* real-time capability is enabled by Time-Stretch Dispersive Fourier Transform. The *COMET III* can capture large data sets to reveal optical dynamics and rare events with high accuracy.

Main FEATURES

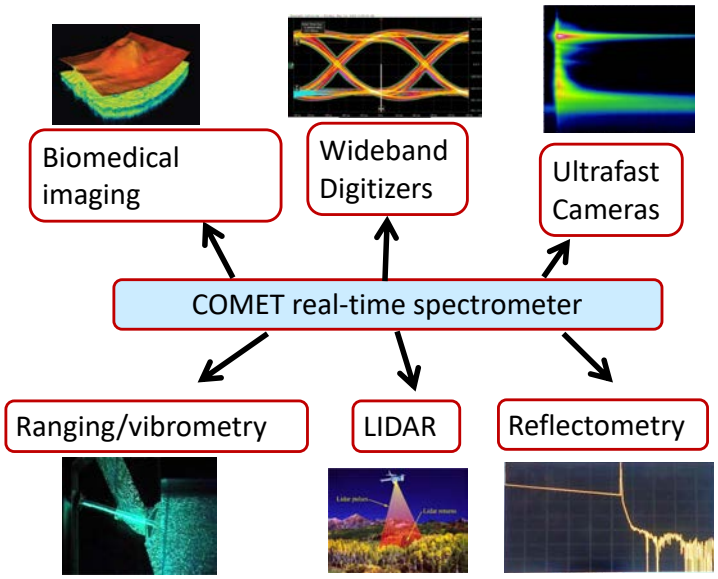
- Real-time Single-shot (no sweeping) at Extremely High Capture Rate: up to 1 billion frames/second
- Can capture up to millions of constitutive pulse spectra in single shot
- Wide Spectral Bandwidth: up to 650nm
- High Spectral Resolution: > 10pm
- High Sensitivity: as low as μW
- All Fiber-based for Rugged and Field-use

APPLICATIONS OF COMET III AS SPECTROMETER

- Laser transients, non-repetitive dynamics of laser mode locking, Q-switching, solitons, spectral stability
- Rare events in optical systems
- Measurements of fast stochastic processes
- Capturing non-Gaussian statistics that are signature of complex dynamics
- Modulation Instability
- High through-put spectroscopy
- Transients of non-linear optics

APPLICATIONS OF COMET AS PERFORMNACE BOOSTER FOR OTHER INSTRUMENTS

For more information please contact info@tachyonicsinc.com



COMET III FEATURES

- COMET III expands the capabilities of COMET II and is currently the most advanced time-stretch spectrometer in the world.
- COMET III has an embedded high-speed 2-channel real-time digitizer (customizable, up to 8 GHz analog bandwidth, up to 10 GS/s, up to 12 bits of accuracy per sample, up to 1 Giga samples record length). The embedded digitizer inside COMET III can be also used independently as an 8 GHz real-time oscilloscope for other applications.
- COMET III comes with an embedded powerful workstation computer (i9 Intel processor, 10 cores (20 threads), 64GB high-speed RAM, 1 TB NVMe hard drive, Gbps ethernet and WIFI) and a beautiful 10.1 inch HD touch-screen monitor.
- COMET III allows user to choose between many spectral resolution settings (spectral resolution up to 10 pm) which enable the user to employ COMET III for virtually any application of interest.
- COMET III benefits from a new technology that allows unprecedented variable frame-rate spectral measurements

from 0.01 frames/second up to billion frames/second allowing the user to study complex events at different speeds.

- COMET III employs new technology to measure real-time single-shot spectra with absolute wavelength information. Conventional time-stretch systems can only reveal relative wavelength information.
- COMET III comes with very powerful software, called COMET, which allows the user to perform sophisticated mathematical operations and post-processing on the captured data. It also provides a variety of visualization tools.
- COMET III software uses parallel processing and hardware acceleration to process the Big Data generated by the COMET instrument at unprecedented processing speeds.
- COMET III has an input signal power indicator on the screen and makes sure input power does not go beyond maximum ratings.
- With more than a decade of experience in our team for designing time-stretch systems, COMET III components are selected from top brands and are specially designed for high-performance and high-sensitivity.

SOFTWARE

The COMET III spectrometer comes with analytics software to enable real-time capturing of large datasets and perform signal analysis. It works on major operating systems like Mac OS and Windows. The software features include advanced synchronization tools, 2D and 3D spectral transients visualization, movie of transients, spectral persistence evolution, spectral statistics, and variety of mathematical operations.

SPECIFICATIONS[1]

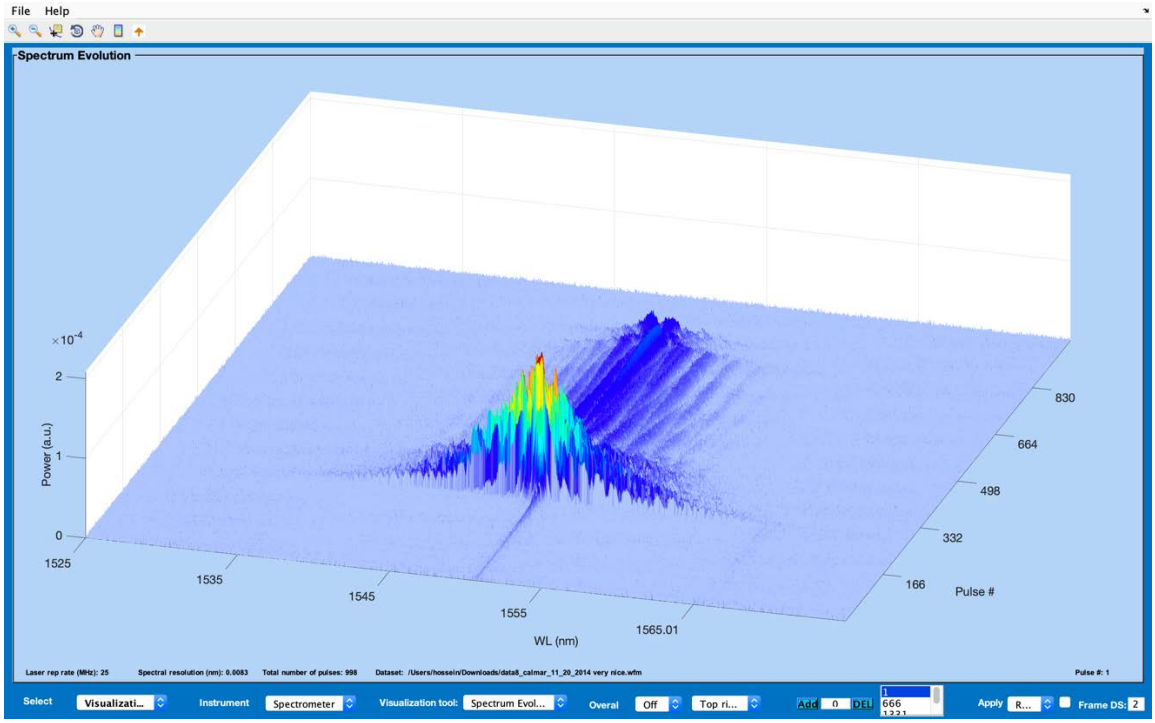
OPTICAL AND ELECTRICAL CHARACTERISTICS (T_{amb} = 25 °C, unless otherwise specified)[1]	
	COMET III
Wavelength Range	650 nm – 1000 nm[2] & 1000 nm – 1750 nm[2]
Spectral Resolution	>10 pm[3]
Absolute wavelength information	Yes
Acquisition Frame Rate	User-set from 0.01 frames/sec to 1 billion frames/sec
Temporal Range	<1000 ps[4]
Temporal Resolution	>15 fs
Pulse Complexity	TBWP < 20,000
Minimum Input Pulse Energy	20 femto Jouls
Maximum Optical Input power	10 mW
Input Power Indicator	Yes
Touchscreen monitor	Yes
WIFI Hotspot, Wireless Communication	Yes
Intensity Accuracy	3%
Input Polarization	Not required
Input Fiber Type	Single-mode Fiber
Fiber Connector Type	FC/APC
Electrical Power Supply	90 to 270 VAC, 50/60 Hz
Dimensions (WxHxD) and Weight	14.33”x11.04”15.39”, 20 lbs.

Note

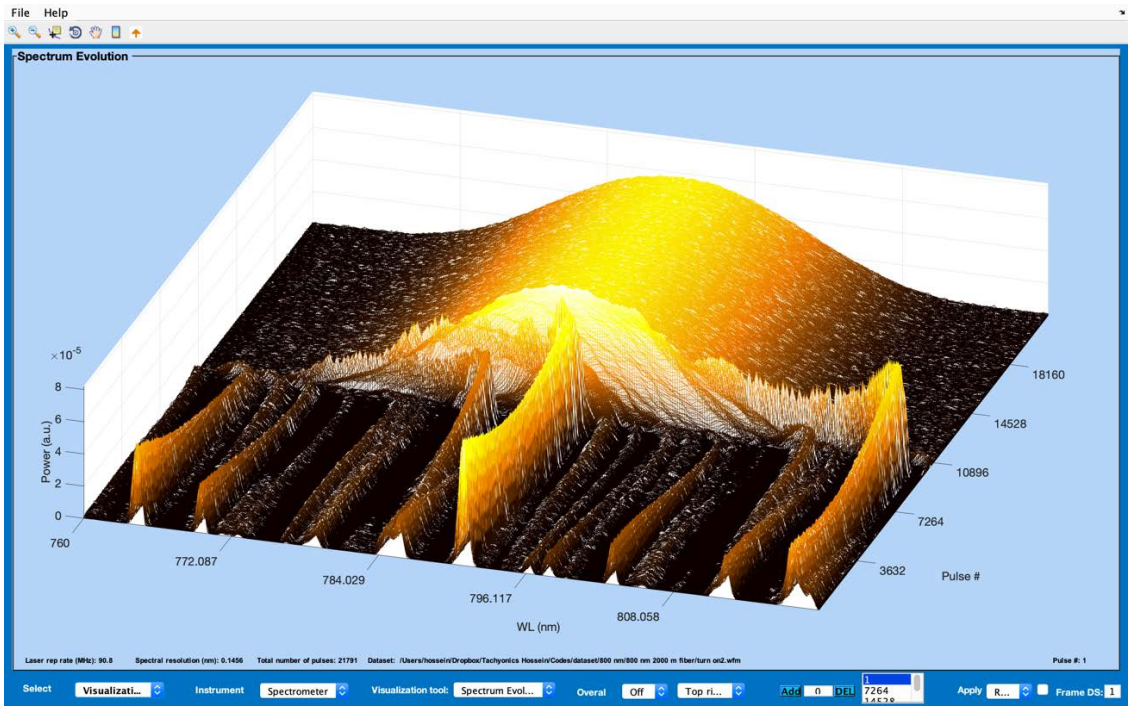
1. Stresses beyond those listed under “Absolute Maximum Ratings” may cause permanent damage to the device. This is a stress rating only and functional operation of the device at these or any other conditions beyond those indicated in the operational sections of this specification is not implied. Exposure to absolute maximum rating conditions for extended periods may affect the device reliability.
2. We are able to custom build *COMET* instrument with wider bandwidths or in other wavelength regions, please contact Tachyonics Inc. for more information.
3. Better resolutions are possible as a custom order. Please contact Tachyonics Inc. for more information.
4. Longer durations are possible as a custom order. Please contact Tachyonics Inc. for more information.

SAMPLE APPLICATION SPECTRA

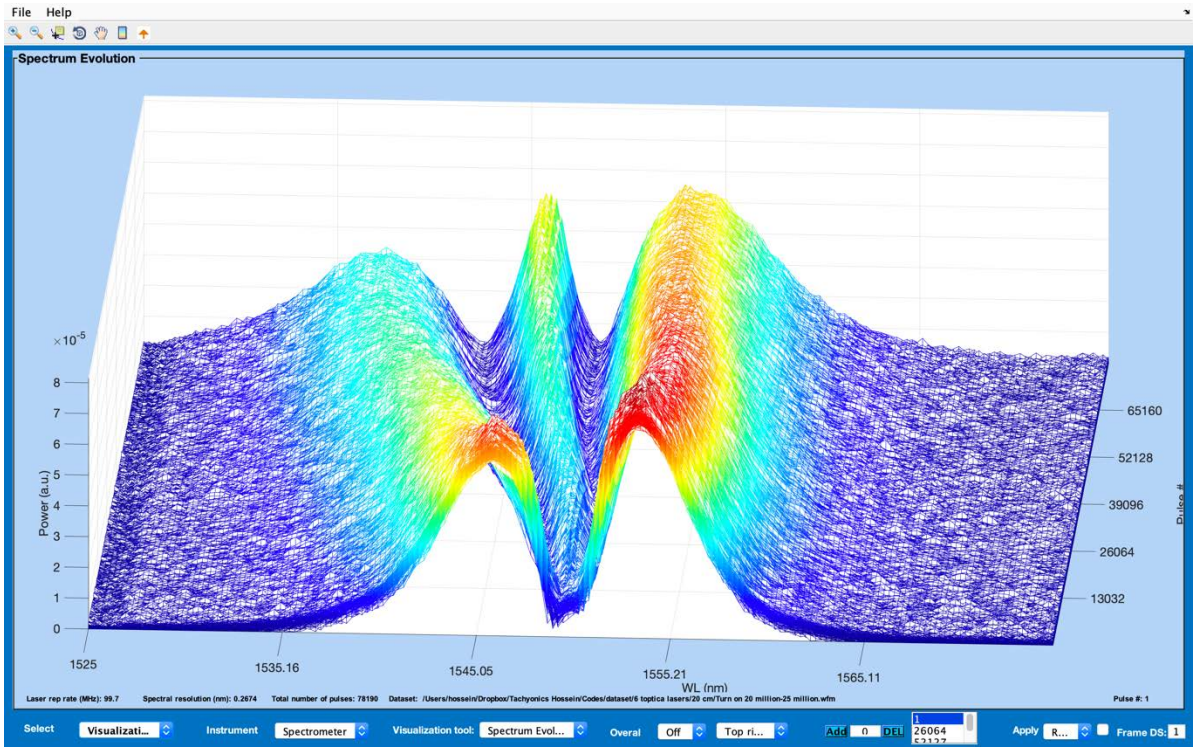
500 single-shot spectra during a Q-switching event is captured at 25 Million frames/sec over 20 µs.



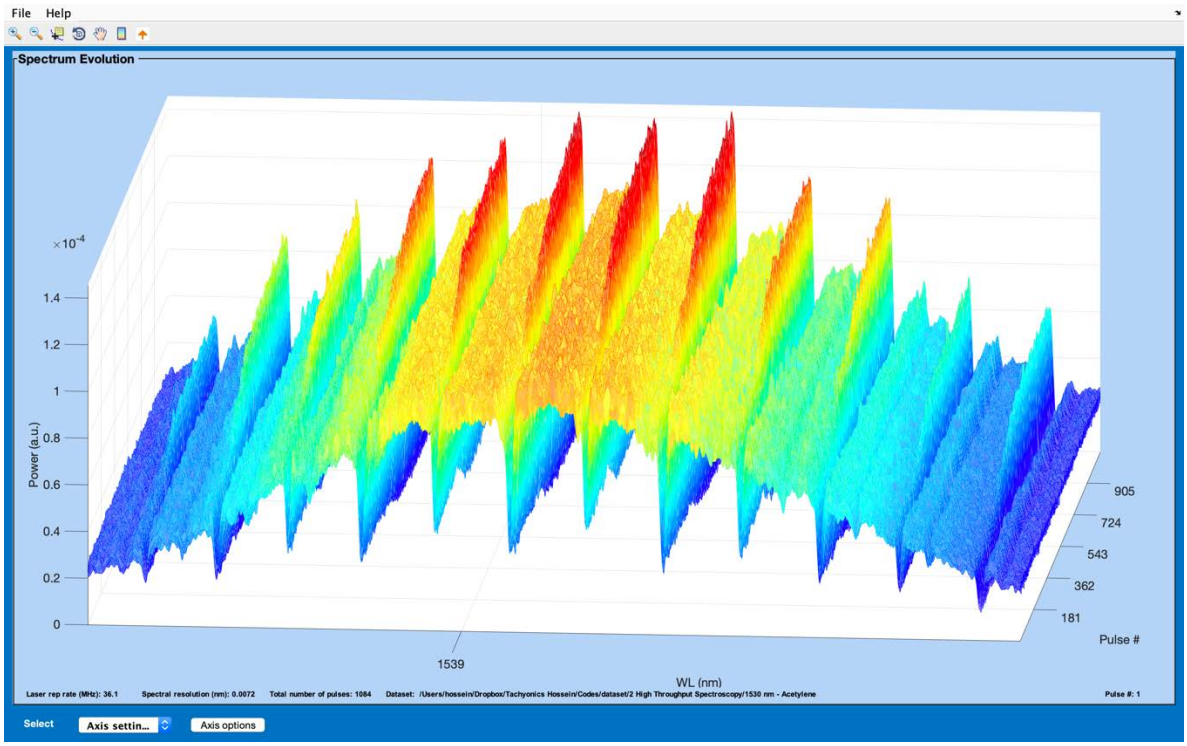
20,000 Single-shot spectra of turn-on transients, Ti-Sapphire laser, captured at 90.8 Million frames/second.



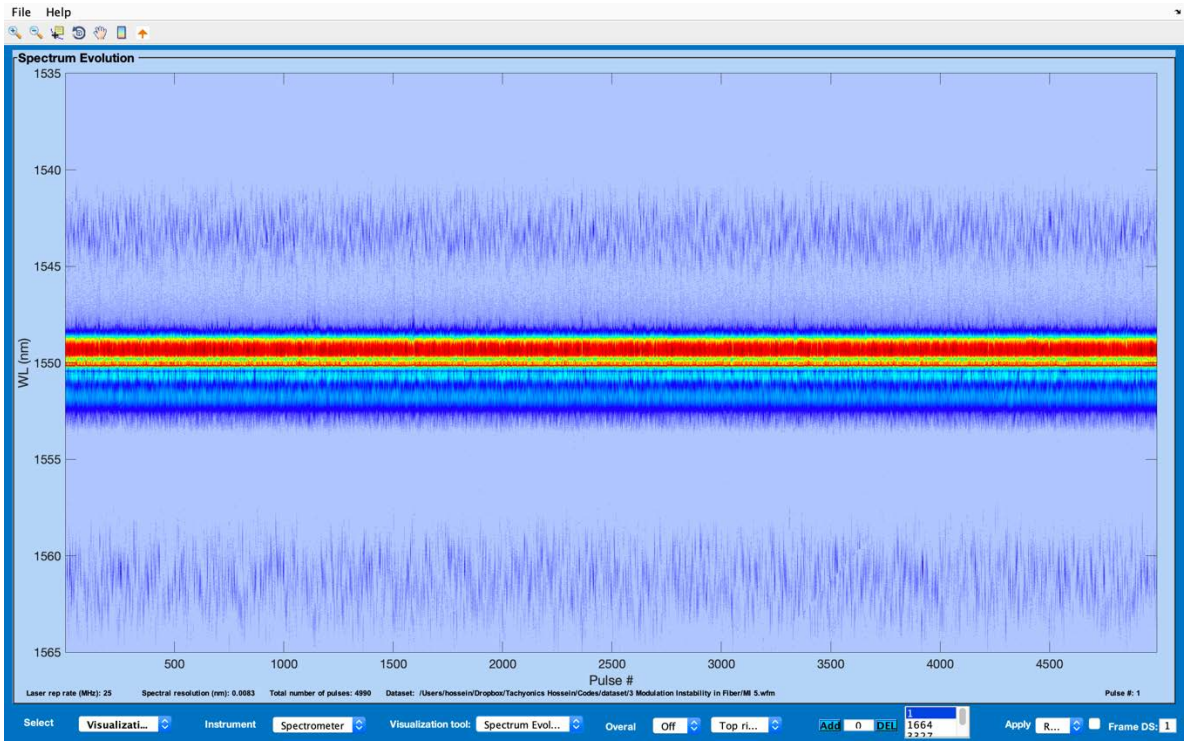
Spectral evolution of a supercontinuum laser during turn on event captured by COMET spectrometer.



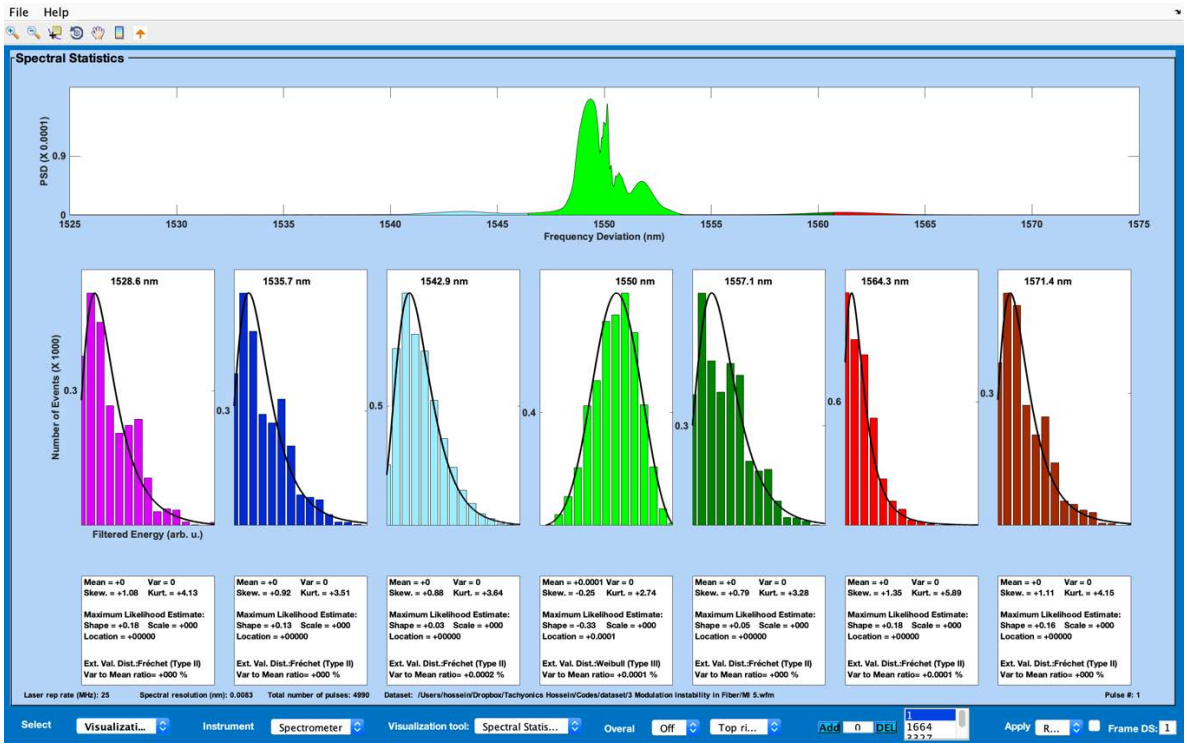
Single-shot transient of Acetylene gas absorption spectra captured at 36.1 Million frames/sec



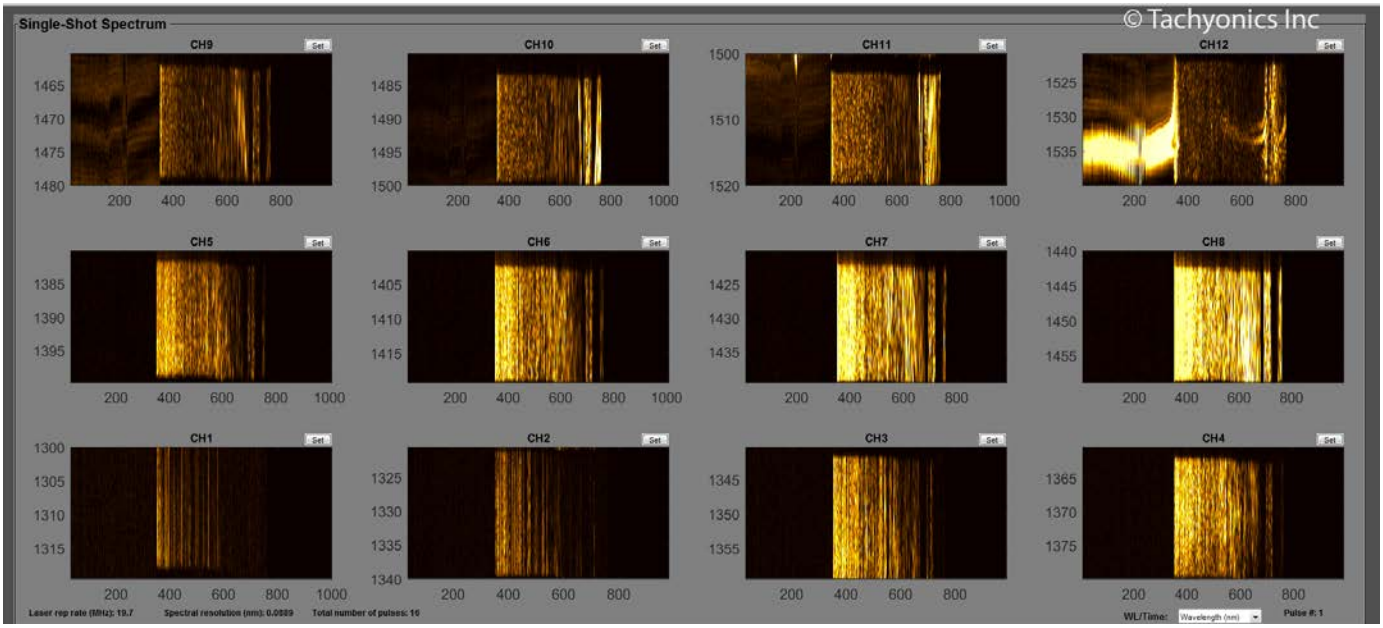
Spectral evolution of an unstable laser during a non-linear process analyzed by COMET software.



Spectral statistics of the above non-linear process analyzed by COMET software.



12-probe ultrafast imaging/vibrometry system enabled by single COMET spectrometer:
Transients of a 12-probe imaging system operated at 30 million frames/sec analyzed by COMET software.



Ultrafast Optical Coherence Tomography (OCT) imaging system enabled by COMET spectrometer:
720,000 single-shot consecutive line images at image acquisition speed of 36,000,000 lines per second.