TEMPO High Frequency Vibrometer

TECHNICAL SPECIFICATIONS

NESD (Noise Equivalent Surface Displacement)	2. 10^{-7} nm (W/Hz)$^{1/2}$ (measured on the photodetector)
Analog outputs	- AC signal (50 ohms BNC) proportional to surface displacement - DC signal (SMB), proportional to object reflectivity - Calibration output in mV/nm (SMB)
Detection bandwidth: upper limit	200 MHz or 1 GHz
Detection bandwidth: lower limit	20 KHz standard
Photorefractive low frequency cut-off	10Hz – 100Hz (depending on laser power and crystal) *5kHz with the internal electro-optic compensation loop ON*
Suitable CW Laser power	0.5W (standard), 1W or 1.5W internal/ up to 15 W external at 532 nm
Focusing	Motorized and controllable via USB port / Auto-focus available
Spot diameter on sample	50 to 100 microns (standard)
Optical stand-off	100, 200 and 500 mm (standard)
Optical collection F number	N = 2, 4, 10 (standard)
Depth of focus	From 2 to 50 mm (standard)
Absolute displacement calibration (internal calibrated piezo mirror)	Automatic mode (100mV/nm) or free mode Analog Output (High impedance) of the Calibration coefficient
TEMPO dimensions - Weight	495 x 305 x 124 mm (19.5”x12”x4.875”) – 14 kg
Electrical requirements	110/220 V, 50/60 Hz
Options	2D module with 2 outputs proportional to surface in-plane and out-of-plane displacements
	2D scanning set-up including, PC, software, Scope card and XY translations

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TEMPO 1D

High Frequency Laser Ultrasonic receiver & vibrometer

PERFORMS

- Ultrasonic measurements up to 1 GHz bandwidth
- Calibrated sub-picometer displacement measurement on any surface or material
- Auto-calibrated output

ENABLES

- Non-destructive testing in laboratory environment
- Wave propagation studies
- Transducer characterization

TEMPO High Frequency Vibrometer

Thanks to Bossa Nova Technologies innovative approach, it is possible to measure *sub-picometer* displacement/vibrations at *high frequency* on *any surface type*.

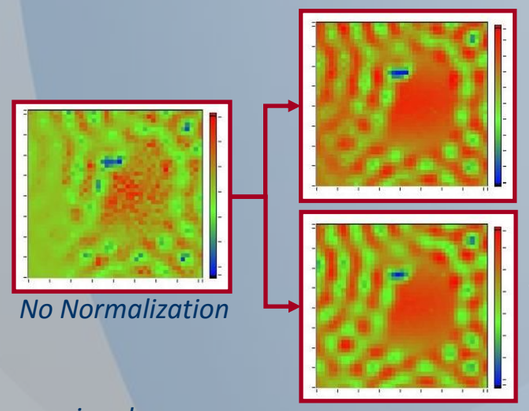
Based on photorefractive two-wave mixing, **TEMPO** works at optimum performances even with a *multi-speckle beam*. **TEMPO**'s large aperture collects much more optical power on diffusing surfaces than a classical interferometer, which directly translates into higher sensitivity and signal to noise ratio.

FEATURES

- Internal electro-optic **compensation loop** for superior signal stability
- Broadband measurements (up to 1 GHz)
- High sensitivity on all surface types and materials: composites, paper, rusted metals, ceramics, rocks, concrete, silicon, copper
- Point & shoot operation: easy signal optimization
- **Absolute Calibration** of output signal in Angstroms or nm
- Fine motorized focusing controlled via USB port for **auto-focus**
- Indicator for out-of-range displacement

• Calibrated output and auto-normalization feature

Thin aluminum plate glued on a piezoelectric transducer and vibrating at the resonance



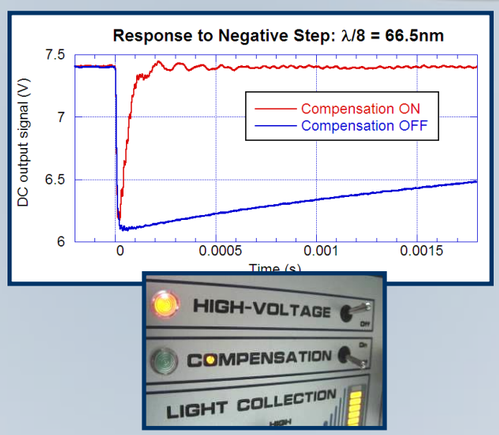
No Normalization

Normalized via post-processing

Auto-normalized output provided

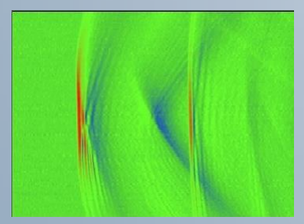
• Compensation loop

The compensation loop improves signal stability and correct external vibration.



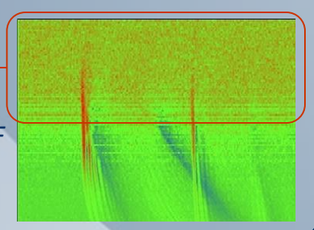
• Autofocus

B-scan AUTOFOCUS ON



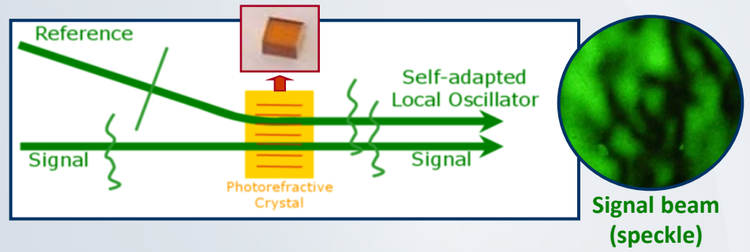
Out-of-focus
No signal

B-scan AUTOFOCUS OFF



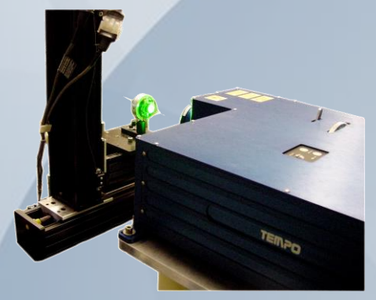
TECHNICAL BACKGROUND

A dynamic hologram resulting from the interferences between the reference beam and the signal beam is recorded in the photorefractive crystal. The response time of the process allows for compensation of the slow phase change of the signal beam. The diffraction of the reference beam by the *dynamic hologram* creates a local oscillator adapted to the signal (i.e. same wave front and same direction). As a result, *optimum efficiency* is obtained between the two beams interfering on the detector. Two-wave mixing in a photorefractive material is equivalent to an *adaptive beam splitter*.



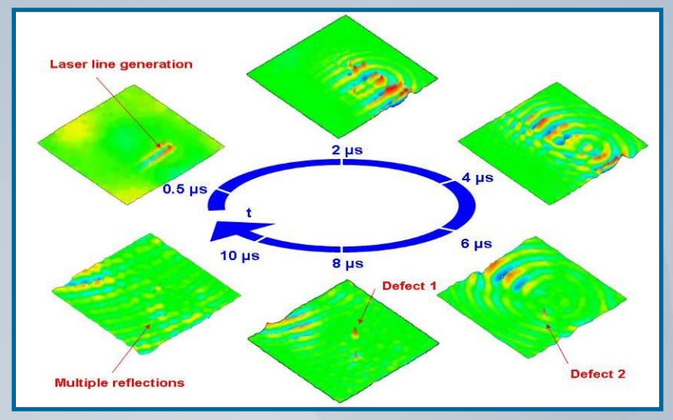
FULL-FIELD ANALYSIS – 2D SCANNER

By adding a *scanner*, **TEMPO** allows a full field analysis of ultrasonic signals by providing a 3D mapping of the surface with ns time resolution. Turn-key systems (**TEMPO** + SCANNER + OSCILLOSCOPE + COMPUTER + SOFTWARE) are available.

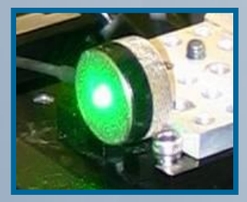


Turn-key system for full-field analysis

Wave propagation study (Al sample)

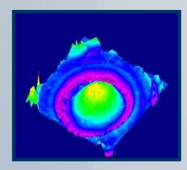


Transducer characterization

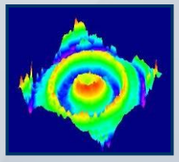


1 MHz piezo, 1 inch Φ
1 µs pulse excitation

Sample surface at t_0



At t_0+1 µs



At t_0+2 µs