L-Egant Solutions

Dispersion Interferometer

A Dispersion Interferometer (DI) is a optical instrument used to measure density precisely. The DI uses beam paths that are co-linear, unlike that of a conventional dual-beam interferometer. The result is an instrument characterized by high sensitivity, immunity to mechanical vibrations, reduced maintenance, and low cost. The DI is available in a 1-dimensional and 2-dimensional configurations. The DI's primary features are as follows:

- The DI instrument is stable and beam re-alignment is rarely needed, since the probe- and reference-beams are co-linear, suppressing common-mode noise.
- The DI is comprised of two compact optical units that may be mounted directly on the experiment/test chamber. Vibration isolation systems are typically not needed.
- The DI instrument may be used to measure large, and small sample sizes. DIs have been used to study object sizes 0.1- 10 mm, and as a multi-path 12-m long instrument.
- The characteristics of the laser source (power, CW/pulsed, line width, fiber coupling, etc.) are tailored to the requirements of the application, in order to keep cost low.
- The DI can measure line-integrated density with a high time- and phase-sensitivity, $\Delta t \sim 1$ ns and $\Delta\Phi \sim 10^{-3} - 10^{-2}$ radians, as a single-chord, or multi-cord instrument.
- The DI's time resolution is determined by the detector system used. Bandwidth and sensitivity can be customized to accommodate specific requirements.
- As a 2-D instrument, the DI can provide $mm^2 - cm^2$ mapping, and larger. The rate at which images are recorded depends on the laser and camera used.
- The minimum sensitivity for the DI depends on the details of the investigation. Large gradients, beam deflections, and fringe jumps may limit the resolution.
- User-friendly software provides for quick-image visualization and data analysis, enhancing workflow and decreasing the timescale for discovery.

General specifications for the 1-D, and 2-D instruments are listed on the next page.

L-Egant Solutions, LLC, P.O.Box 16475, Irvine CA 92623
http://www.l-egantsolutions.com, (657) 210-2997, sales@l-egantsolutions.com

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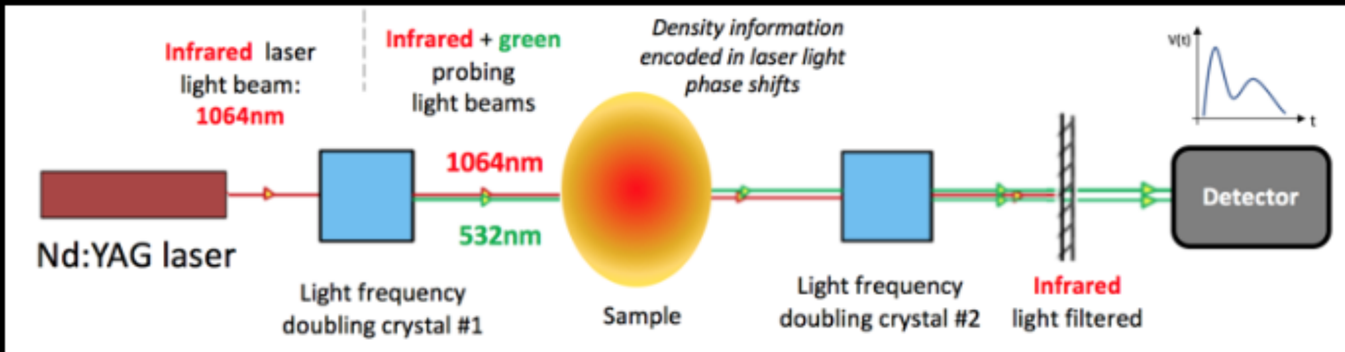
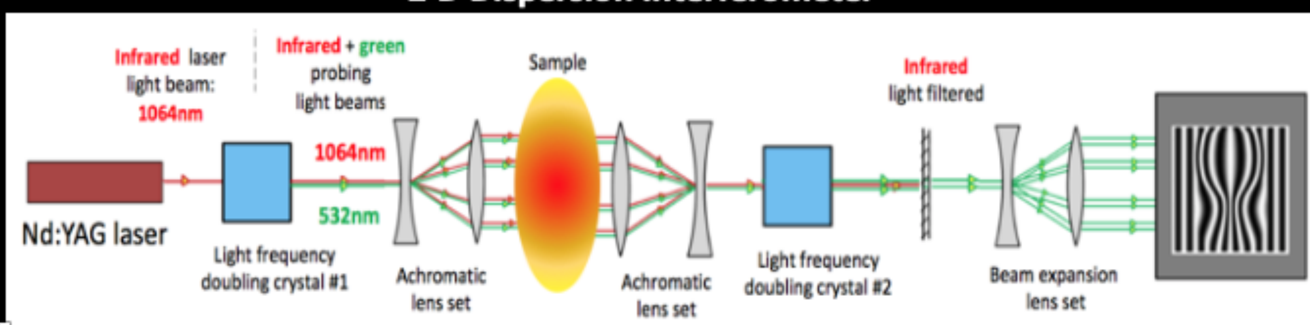


- An infrared-laser (IR) beam is (partially) converted to visible light in doubling crystal #1. The IR and visible beams are collinear. Beam alignment/re-alignment is minimal.
- After the sample, the residual IR beam is converted in crystal #2 and then filtered.
- The sample encodes a phase difference between two visible (532 nm) beams and a fast detector measures the (interference) fringe shift.
- The 2-D instrument is similar to the above 1-D instrument, except with expanded beams, to probe a large sample cross-section and thereby provide a 2-D profile.

2-D Dispersion Interferometer



	1DDI	2DDI
Nd: YAG laser	CW	pulsed
Time resolution (ns)	200	1
Spatial resolution (mm)	-	0.25
Beam diameter (mm)	< 2	>10
Phase-equivalent noise (rad)	0.005	0.1
Minimum line density (m^{-2})	> $1x10^{18}$	$1x10^{19}$
Maximum line density (m^{-2})	< 10^{22}	<10^{22}

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