
MenloSystems

Application Note

# Probing the Ultimate Limit of Fiber-Optic Strain Sensing

**Authors:** Gianluca Gagliardi (CNR-INO, LENS)

**Contact email address:** b.sprenger@menlosystems.com

The measurement of relative displacements and deformations is important in many fields such as structural engineering, aerospace, geophysics, and nanotechnology. Optical-fiber sensors have become key tools for strain measurements, with sensitivity limits ranging between $10^{-9}$ and $10^{-6}$ e $(Hz)^{-1/2}$ (where e is the fractional length change). We report on strain measurements at the $10^{-13}$ e $Hz^{-1/2}$ level using a fiber Bragg-grating resonator with a diode-laser source that is stabilized against a quartz-disciplined optical frequency comb, thus approaching detection limits set by thermodynamic phase fluctuations in the fiber. This scheme may provide a route to a new generation of strain sensors that is entirely based on fiber-optic systems, which are aimed at measuring fundamental physical quantities; for example, in gyroscopes, accelerometers, and gravity experiments.

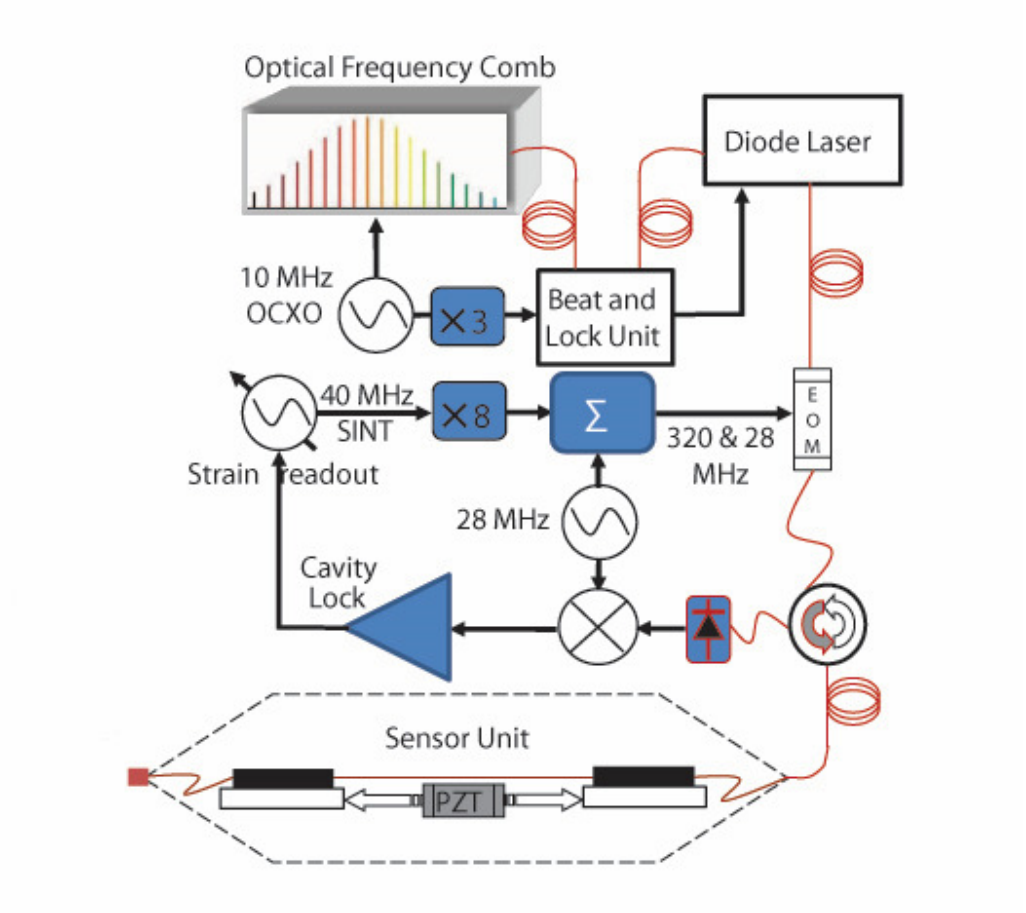


**Figure:** Experimental scheme

**Publications:**

G. Gagliardi, et al.: Probing the Ultimate Limit of Fiber-Optic Strain Sensing; Science 330, 1081 (2010); DOI: 10.1126/science.1195818

**Weblinks:**

Research group:
www.inoa.it/Napoli