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High Precision Interferometric Dilatometer For Cryogenic Environments.

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Dimensional changes of solids in varying external conditions such as temperature, pressure, magnetic and electric fields or even light play important role in material science, cryogenic and aerospace engineering. Often the measurements of dimensional changes require high precision combined with ease of use and absence of gravitational effects. We developed a dilatometer based on our miniature fiber based Fabry–Pérot interferometric sensor with a resolution down to 1pm. A differential measurement method provides simple data acquisition of linear dilation with high bandwidth ˜10 MHz and use of telecom fibers allows flexibility in contactless measurement setup. First tests of the prototype have shown full compatibility of the dilatometer with cryogenic environment (down to 3.7K) and magnetic fields (at least up to 9T) as well as nanometer resolution on mm-sized sample (ppm) in non-optimized conditions. We present first data obtained with our dilatometer prototype and discuss its advantages and limitations.

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