

Quantum sensing

From diamond development all the way to industrial applications

Fraunhofer IAF ventures into quantum sensing technologies with solid-state spins in the form of nitrogen-vacancy (NV) centers in diamond. Extensive knowledge of diamond growth allows the assembly of different types of quantum sensors. The main focus is on magnetic field detection, complemented by nuclear spin detection and relaxometry.

In general, measurements with quantum sensors based on NV centers are absolute and do not require calibration. Therefore, the processes are robust and reproducible

Systems based on nitrogen-vacancy centers

- Single nitrogen-vacancy scanner for magnetometry with high spatial resolution
- Confocal microscope for magnetometry and relaxometry
- Wide-field imaging for fast 2D magnetic field maps
- Laser threshold magnetometry for extremely high sensitivity

Technical specifications

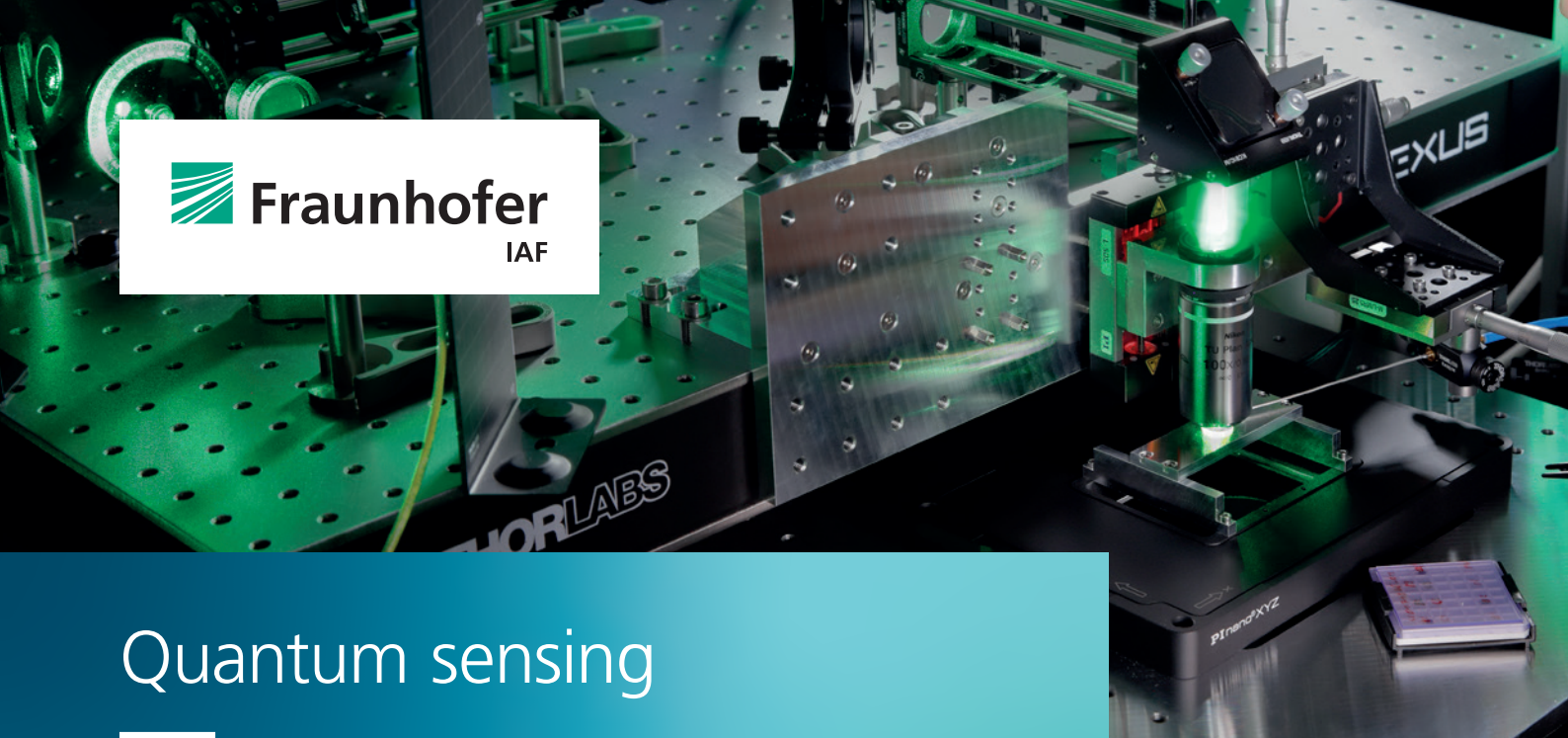
- Spatial resolution < 15 nm
- Sensitivity < $1\text{pT}/\sqrt{\text{Hz}}$
- 2D magnetic field maps in minutes
- Fiber-coupled sensors with sensor volume $\sim 1\text{ mm}^3$

< 15
nm spatial
resolution

More information:



Development of various approaches to quantum sensing of magnetic fields
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From research projects to industrial applications

The aim of Fraunhofer IAF is to transfer quantum magnetometry from research laboratories to concrete industrial applications. Thanks to the physical properties of the crystal, diamond-based quantum sensors operate at room temperature – ideal for industrial applications.

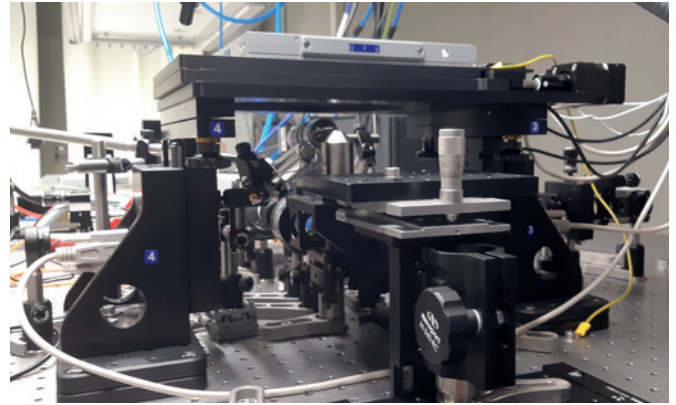
To assist the industry, Fraunhofer IAF operates an Application Lab for its quantum innovation and development needs.

Our services

- Exploring novel use-cases of quantum sensing, magnetic field sensing
- Validation of samples and measurements
- Test and verification of components
- Benchmark sensors or full imaging instruments with state-of-the-art

Application areas

- Micro- and nano-electronics industry
- Material science and chemical industry
- Pharmaceutical sector, health diagnosis and bio-chemistry
- Engineering and control components
- Medical sensors and technologies
- Laser technologies
- Battery technologies



Detail of the wide-field magnetometer mounted at Fraunhofer IAF

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