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Optimizing the resolution and the sensitivity of a scanning NV magnetometer SUNGKUN HONG, PATRICK MALETINSKY, MICHAEL GRINOLDS, LAN LUAN, BIRGIT HAUSMANN, MIKHAIL LUKIN, RONALD WALSWORTH, MARKO LONCAR, AMIR YACOBY, Harvard University — A nitrogen-vacancy (NV) center in diamond has been recently considered as an outstanding atomic-scale magnetic field sensor. At the heart of NV based magnetometry is the ability to control the position of an NV within few nanometers to a sample, while preserving its spin coherence and readout fidelity. To this end, we previously developed a fabrication procedure for creating a monolithic scanning diamond nanopillar containing a single NV center. Here we present further optimization of our devices by locating NV centers with nanoscale accuracy as well as improving their magnetic field sensitivty. For locating the NV center, we developed a nanoscale imaging of a NV center in the device via near-field fluorescence quenching, which facilitates post selection of devices with NV centers being closer to the surface. In addition to enhancing photon collection via wave guiding through the nanopillar, we also significantly improved the spin coherence times of our devices via dynamic decoupling. This results in a magnetic field sensitivity of 30 nT/sqrt(Hz), unprecedented for scanning NV centers.

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