Optical near-field scanning using self-propelled quantum dot sensors

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The characterization of optical near-fields and near-field enhancement effects in the proximity of optical antennas is a challenge in modern microscopy. Here, we use the intracellular transport system of kinesin and microtubules to self-propel single fluorescent quantum dots over a substrate surface with velocities in the 20 nm/s range (see Fig. 1). Recording the emission of the quantum dots as they pass a subwavelength nanoscopic structure, allows us to directly observe the interaction characteristics and intensity distribution with nanometer precision [1, 2]. We used this method to characterize the near-field excitation profile of light emanating from subwavelength slits in a gold surface. The illumination profile could be obtained with 10-nm resolution. In contrast to conventional near-field investigation methods (e.g. SNOM or microsphere-based nanoscopy), our approach offers the advantage of minimal optical interaction with the nanoscopic structures to be characterized.
Therefore, our method will allow the characterization of a broad range of illumination fields and to study near-field effects between small optical probes (e.g. optical antenna) with nanometer resolution.

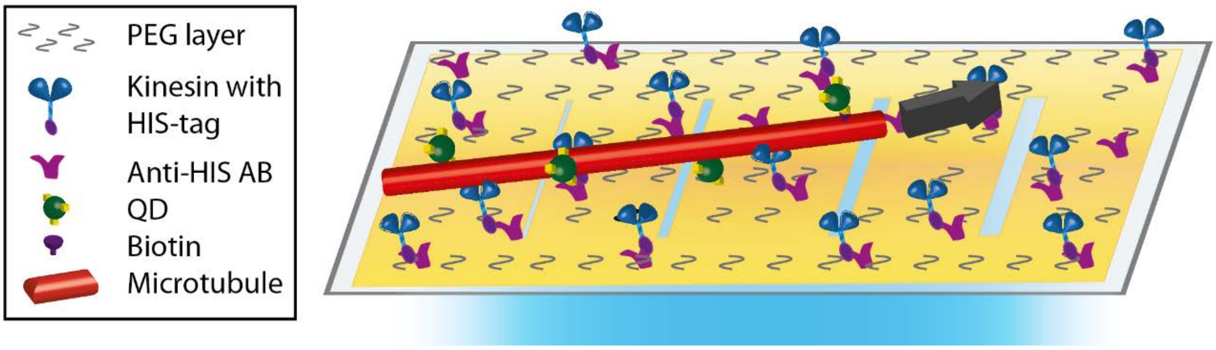

***Fig. 1:** Schematics of the characterization of nano-slit illumination profiles by self-propelled quantum dot sensors.*

[1] F. Ruhnow, D. Zwicker, and S. Diez, "Tracking single particles and elongated filaments with nanometer precision.," Biophys J, vol. 100, no. 11, pp. 2820–2828, Jun. 2011.
[2] H. Brutzer, F. W. Schwarz, and R. Seidel, "Scanning evanescent fields using a pointlike light source and a nanomechanical DNA gear.," Nano Lett, vol. 12, no. 1, pp. 473–478, Jan. 2012.