Axial Electrokinetic Trapping of Label-free Nanoparticles Using Evanescent Field Scattering

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Supplementary Information

Number of pages: 3
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Content:

1. **Figures:**

Supplementary figures

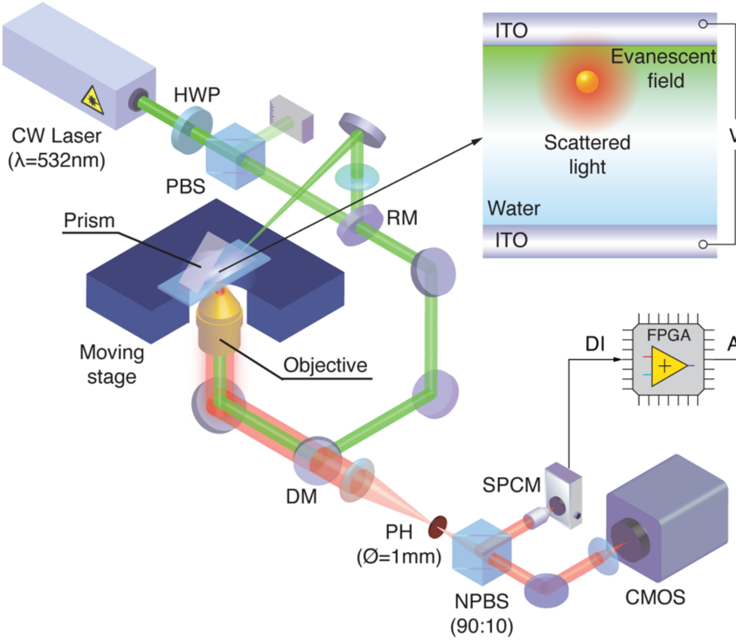

Figure S1. Total internal reflection microscopy setup. A schematic illustration of the developed setup (not to scale) shows the sample with nanoparticles placed on a moving stage. The microfluidic chamber is illuminated with a focused green laser beam through the prism at a critical angle to generate the evanescent field (inset zoom-in image). The light scattered by the particles is collected with a 100× objective lens and divided by a non-polarizing beam splitter (NPBS) between a single-photon counting module (SPCM) and a complementary metal-oxide-semiconductor (CMOS) imaging camera. Based on the digital input (DI) signal from the SPCM, the analog output (AO) voltage is generated on an FPGA board to maintain the nanoparticle at the desired axial position (see Methods for details).

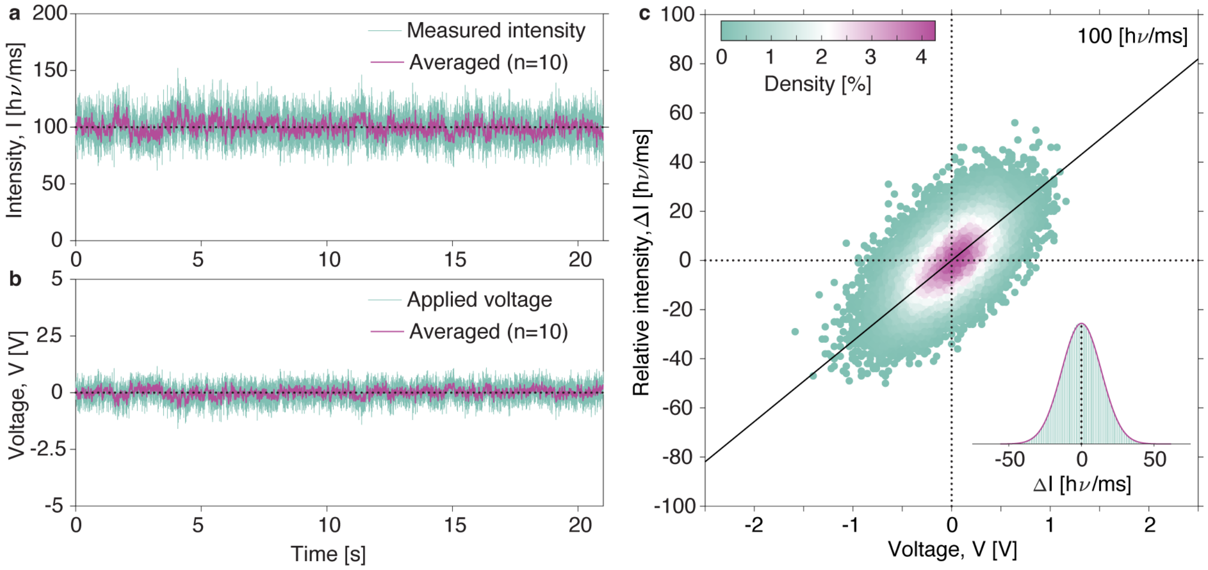

Figure S2. Electrokinetic trapping of 520 nm polystyrene nanoparticles. a. Intensity time trace of the scattered evanescent field from a nanoparticle electrokinetically trapped at a targeted distance from the glass surface. **b.** Feedback voltage as a function of time, applied to maintain the trapped particle shown in (**a**). **c.** Relative intensity difference *ΔI* as a function of the applied voltage *V*, illustrating the particle's response to the electric field when trapped at a target intensity of 100 photons/ms. The inset graph presents the normalized density distribution as a function of photon counts for *V* = 0.

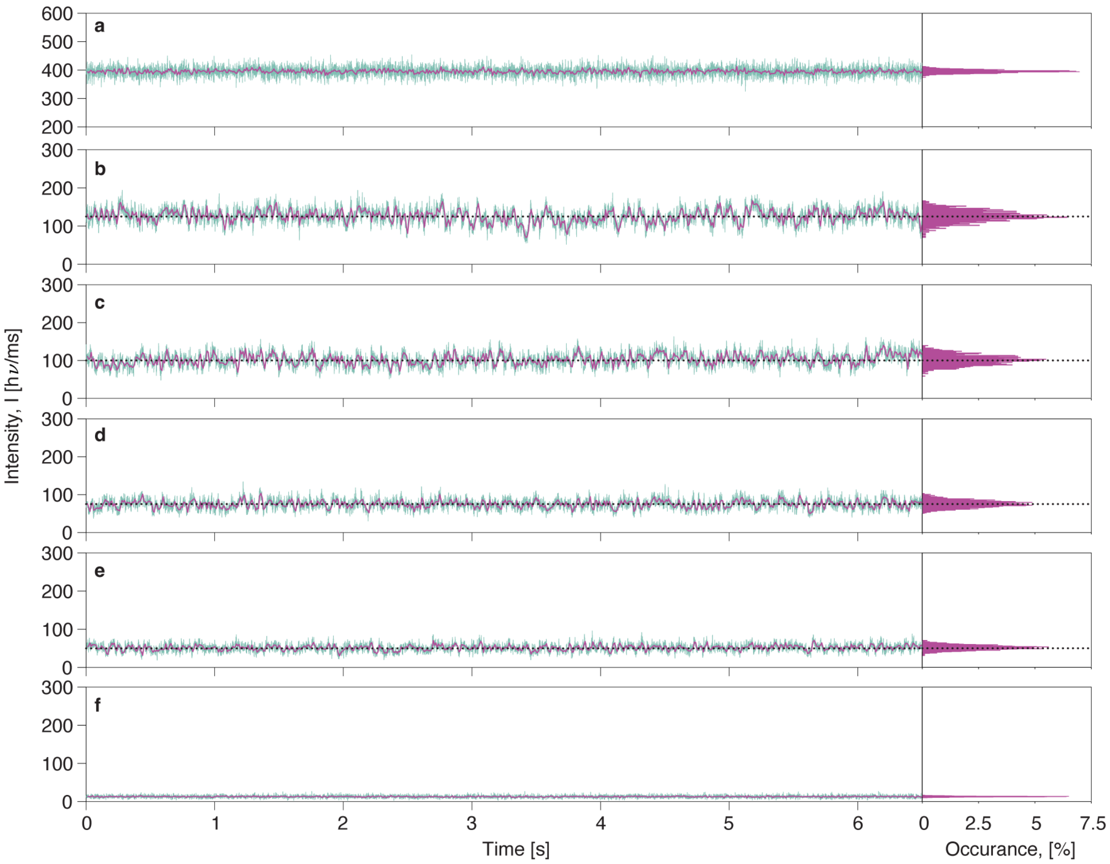

Figure S3. ABEL trapping at different target intensities (distances from the surface). The intensity time traces (left) are shown for a particle stuck to the surface (**a**), nanoparticles that remain electrokinetically trapped at various target intensities (**b-e**), and background noise (**f**), with corresponding histograms (right).

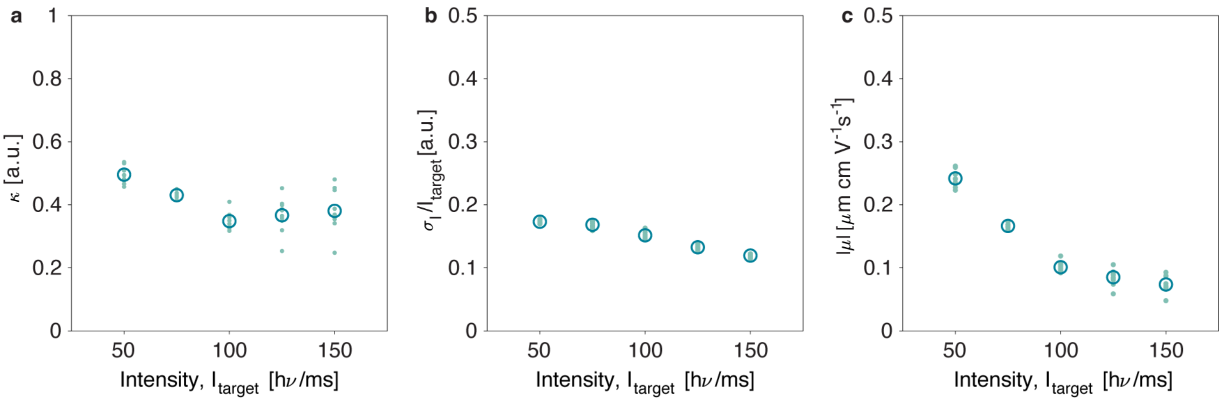

Figure S4. Analyzed data parameters obtained from the measurements with ABEL trapping of nanoparticles. a. Trap strength as a function of target intensity, demonstrating the effectiveness of the trapping mechanism across different proximities to the glass surface. **b.** Normalized intensity variance as a function of target intensity, showing how the fluctuation in light scattering is modulated by proximity to the surface. **c.** Estimated absolute value of electrophoretic mobility plotted against target intensity, illustrating the relationship between particle mobility and the distance from the surface. The green filled dots and open circles represent the measured and averaged data, respectively.

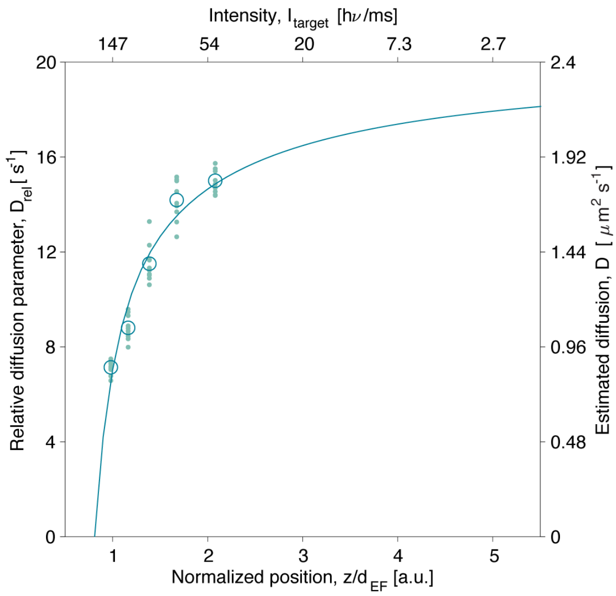

Figure S5. Calibration of diffusion constants and particle position. The diffusion of nanoparticles as a function of normalized distance z/d_{EF} from the surface (bottom axis) and corresponding target intensities (top axis). The measured relative diffusion parameters are plotted on the left axis, with the estimated diffusion constants on the right axis. The green filled dots and open circles show the measured and averaged data, respectively, while the green solid line represents the fitting to Faxén's law, using equation (6).