SUPPORTING INFORMATION

1. Fig. S1 shows the relation between average velocity and particle-to-beam distance under different particle size. Although there is no obvious difference of the results between various nanoparticle sizes, the general distribution for a single particle size still follows the negative sloped trend. Therefore, the negative sloped distribution of Fig. 4B and 4C is not caused by the particle size variation.

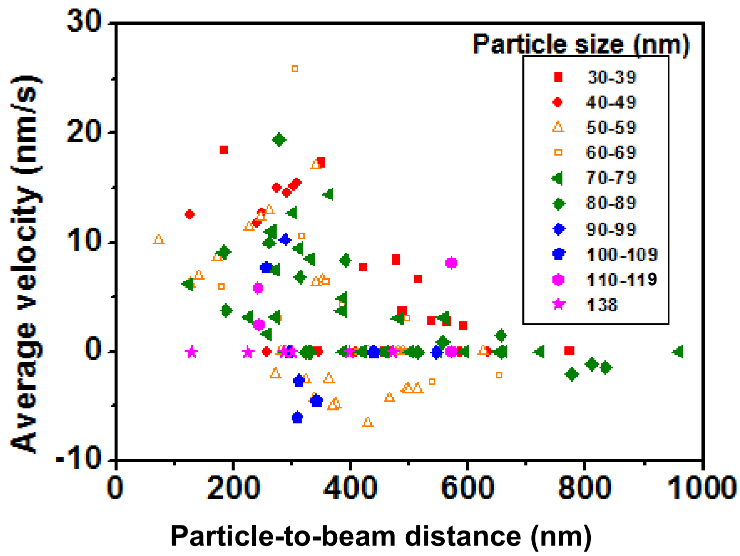

Fig. S1 Plot of average particle velocity versus particle-to-beam distances at various particle sizes.

2. The diffusion time for ions to diffuse a whole window area

The observation window is a 150 μm x 150 μm square. The longest diffusion distance is the diagonal, which is approximately 200 μm. Since the equation of diffusion length is:

$$l = (D \cdot t)^{1/2}$$

where l is the diffusion length, which is 200 μm in this case, and D is the diffusion coefficient, which is on the order of 10^{-5} $cm^2 \cdot s^{-1}$. Therefore, the diffusion time, t, for the ions to diffuse the whole observation window area is calculated as 40 s. And for diffusing a length of 900 nm, the largest e-beam effective distance observed in our experiment, it only takes about 1 ms.

3. Dielectrophoresis (or DEP) is a phenomenon in which a force is exerted on a polarizable particle when it is subjected to a non-uniform electric field.

   From basic electrostatics, when placed in an external electrical field E, a conductive particle will develop charge re-distribution so as to eliminate any field inside the conductive particle. This will result an electrical dipole moment P, which is proportional to E and names as induced dipole moment, and will interact with the external field to lower the energy by E·P. As a result, the interaction energy between the field and the dipole moment induced is proportional to E^2, the strength of electrical field squared.

Away from the e-beam, the force can be simplified as the derivative of this energy,

$$\mathrm{F} \propto \mathrm{E}\frac{\delta \mathrm{E}}{\delta \mathrm{r}} \propto r^{-3} \qquad (\check{r} \geq R) \qquad (3)$$

F represents the force of the dipole suffered in the electric field E, and other notations are the same as in equation (1) and (2).