Supplementary Material (ESI) for Lab on a Chip

ESI: Video clip caption (Manneberg *et al.*)

"Manneberg_LOC_ESI_1.AVI"
The clip shows flow-free transport of aggregates of 5-µm beads, including reversed transport by changing from positive to negative slope of the sawtooth-shaped frequency sweep. 0 – 16 seconds: Positive slope. 16 – 34 seconds: Negative slope. 34 – 42 seconds: Positive slope. A set of three selected frames from this clip is shown in Fig. 3a.

"Manneberg_LOC_ESI_2.AVI"
The clip shows flow-free transport and caging of individual HEK cells. A set of three selected frames from this clip is shown in Fig. 3c.

"Manneberg_LOC_ESI_3.AVI"
The clip shows flow-free transport and caging of 5-µm beads (green). The yellow beads are 1-µm tracer particles that are used for tracking the fluid motion. Due to the particle-volume dependence of the acoustic forces, the smaller beads are not manipulated by ultrasound at the employed actuation voltage (10 V_{pp}). Two frames from the clip are shown in Figs. 4a-b.

"Manneberg_LOC_ESI_4.AVI"
The clip shows the time-dependence of the fluid velocity field, acquired by performing time-resolved particle image velocimetry (PIV) on the yellow 1-µm beads in the clip "Manneberg_LOC_ESI_3.AVI". Note that at 5-second intervals, e.g. around 12 and 17 seconds, the fluid velocity increases in the cage due to rapid movement of the caged aggregate as the frequency jumps back to its lowest value. Additionally, the rapid transport of aggregates in the inlet channel is also apparent at these times, with a leftward flow in front of and behind the aggregate and a rightward flow over its sides, as it pushes through the fluid. The velocity field has been numerically smoothed. The average velocity field during the full clip is shown in Fig. 4c.

In the first, second and third clips, the chip was actuated by two transducers; one driven in linear sweeps from 2.60 – 2.64 MHz at a rate of 0.5 Hz (first clip) or 0.2 Hz (second and third clips), and the other driven from 6.90 – 7.00 MHz at a rate of 1 kHz.