Supplementary Methods

Description of Determination of Particle Blinking Frequency

To address blinking frequencies that are commonly experienced in microfluidics PT experiments, we analyzed experiments in a 2D geometry composed by pillars with power-law distributed radius between 25 and 250 ums and randomly displaced in order to have the smallest pore size of the same order as the smallest radius. For these experiments, we continuously injected a colloidal suspension of polystyrene micro-spheres (diameter 1.1 μm and density $\rho = 1.05$ g/mL Thermofischer Fluoromax B100) in a 1:1 milliQ water and D2O mixture in order to match the fluid and particles' density to avoid sedimentation. Injection was imposed by a syringe pump (Harvard Apparatus PHD-ULTRA) at a flow rate of 0.5 uL/min that correspond to an average interstitial velocity of $q = Q/A\phi = 0.13$ mm/s, where $A = hw = 0.15$ mm^2 is the chip cross-sectional surface and $\phi = 0.4$. The flow condition was advection dominated with a Peclet number of $Pe \sim 10^4$, assuming a diffusion coefficient $D = 1.410^{-7}$ mm^2/s for the latex particle. Timelapse image acquisition was performed in the fluorescent channel through a Nikon Ti-2 scope equipped with an Hamatsu FLASH Orca 4.0 at a frame rate of 60 fps at 4X magnification, covering an area of 2x2 mm. In this configuration, fluorescent particles appear as bright spots of roughly 5x5 pixels with a signal/background ratio higher than a factor of 10. Under these optimal conditions, blinking frequency can happen due to diffusion in and out the focus depth (15 um), and perfect overlap between fast and slow particles, and/or between moving and attached particles in the vertical direction. To evaluate the overall blinking frequency, it is sufficient to note that, due to the homogeneous particle concentration, at every frame the same number of particles is expected to be detected. Fluctuations in the number of particles can be further given by particles entering and exiting the boundaries of the field of view. Even if these fluctuations are expected to be negligible for incompressible fluid and the free divergency condition, it is possible to count them by labeling the particles that are close enough to cross the boundaries between two consequent frames: this quantity will represent a flux-boundary correction F_{corr}. Considering F0 the total number of particles detected at frame t0 and F1 the number detected at t1, we thus measure the fluctuations in particle count between adjacent frames, after the boundaries correction, by normalizing for the average total number $\frac{|F_1 - F_0 - F_{\mathrm{corr}}|}{\frac{1}{2}(F_0 + F_1)}$. This ratio might represent a good estimation of the order of blinking frequency for a typical PT experiment. In our setup, we found the blinking frequency to be around 0.5%. However, the experimental conditions adopted might be too optimal for PT and not representative of broader PT conditions, where phase contrast image acquisition is only accessible at lower frame rate or rod shape particles are injected, increasing the probability of the particle's overlap. Thus, to test the four algorithms, a blinking frequency of 2% is chosen as a realistic factor for more general PT conditions.