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High-throughput continuous millisecond solution exchange for particle suspensions DANIEL GOSSETT, HENRY TSE, JAIDEEP DUDANI, DINO DI CARLO, UCLA — Mixing and solution exchange are routine tasks in macroscale systems. However, they can be challenging and slow in microfluidic systems which lack turbulence, and mixing is often achieved by manipulation of passive diffusion. In previous work we characterized geometry-dependent inertial lift forces which act on objects entrained in high velocity flows in confined microchannels. Using inertial focusing we can precisely focus spherical particles or cells to equilibrium positions with throughputs of thousands per second. Inertial forces have been employed in microfluidic systems for membrane-free filtration, size-based sorting, and cytometry. Here, we present a novel microfluidic system which manipulates these lift forces to rapidly transfer particles and cells from one solution to another by geometrically defining a new equilibrium position in a coflow. Due to the high Peclet number convection is dominant and diffusion is negligible for the length of the channel. We intend to use this technique for on-chip, in-line sample preparation or for studying reaction kinetics and molecular binding events where rapid and complete solution exchange or mixing is required.

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