Supplementary Material (ESI) for Lab on a Chip

Electronic Supplementary Information (ESI)

Lab-in-a-fiber based integrated particle separation and counting

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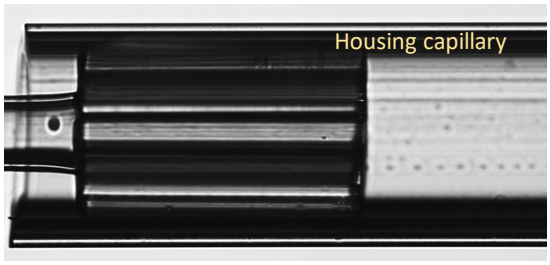
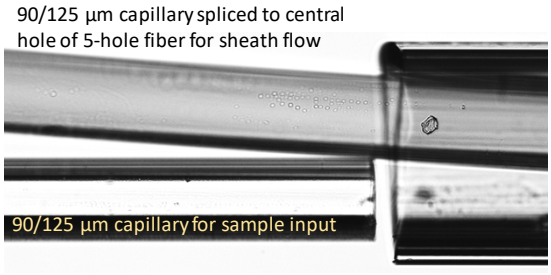
1. Fabrication of the fiber components

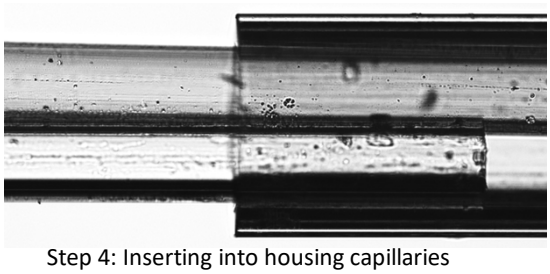
Step 1: Splice and cleave



Step 2: Inserting in the housing capillary (255/330 µm)

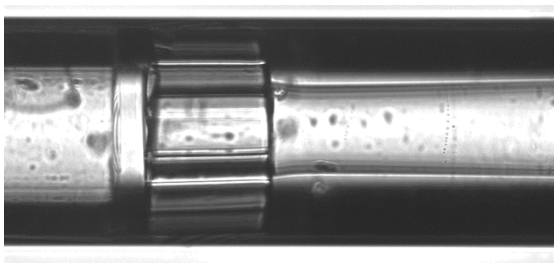


Step 3: Input capillaries for sheath and sample

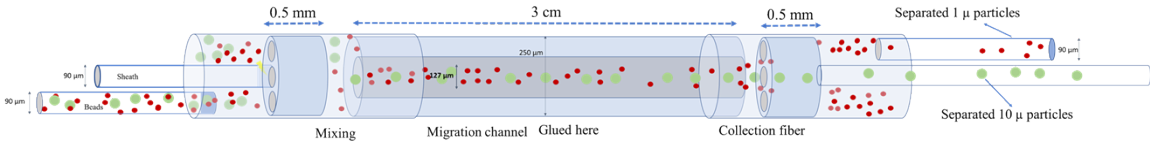


Step 4: Inserting into housing capillaries

Step 5: Inserting 127/250 capillary from other end of housing capillary for input to migration channel.



Step 6: Inserting 127/250 capillary from other end of housing capillary for output to migration channel.



Schematic of the full component to understand the fabrication process.

Fig. S1.: Separation component fabrication. Images of the step-by-step process of fabrication of the separation component are shown in this figure. Step 1: First we splice a 90/125 capillary to the central hole of the 5-hole fiber (a cross-section of the -hole fiber is shown in the inset). The spliced fiber is then cleaved such that the length of the 5-hole fiber is 0.5 mm. Step 2: We insert the whole assembly into a housing capillary (255/330 µm). Steps 3 and 4: We then insert another 90/125 µm capillary into the housing capillary to flow the sample. The capillary is pushed into the housing capillary and the assembly is glued with UV-curing glue. Step 5: From the distal end of the housing capillary, we insert the 127/250 µm capillary (cross-section picture shown in the inset) where the separation of migrating particles takes place. Step 6: A similar module fabricated as before in reverse order is built for the output of separated particles. The

remaining end of the 127/250 µm capillary is inserted into the housing capillary, concluding the full component as shown in the schematic.

2. Particle migration in circular microchannels

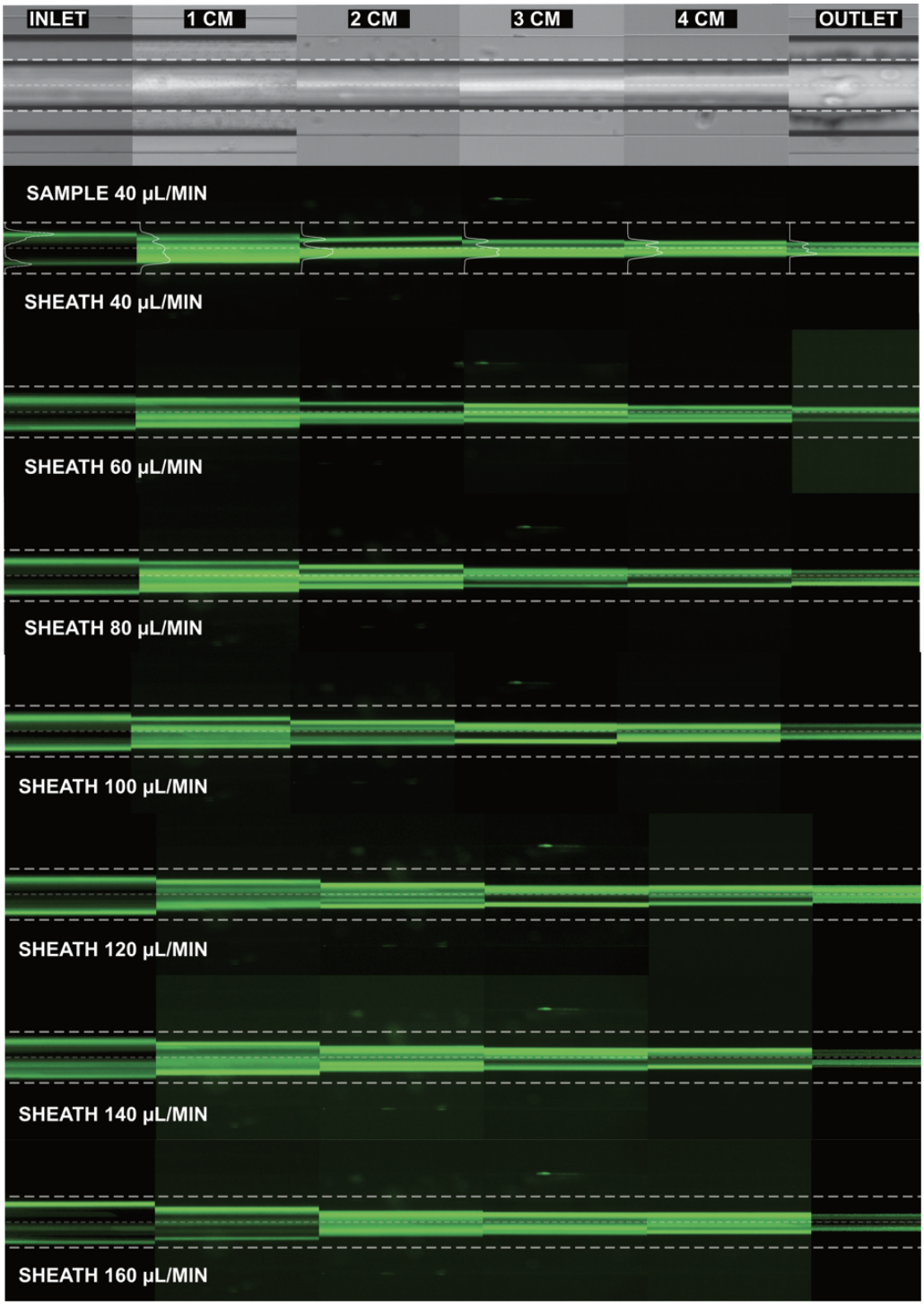


Fig. S2 A: Particle elasto-inertial migration. Fluorescent images of the separation capillary (127/250 µm capillary) at locations 0 to 5 cm showing the streamlines of the 10 µm particles. The particles migrate toward the center irrespective of sheath flow rates (ranging from 40-160 µL/min) at a fixed sample flow rate of 40 µL/min.

Fig. S2 B: Fluorescent images of the separation capillary at locations 0 to 5 cm showing the streamlines of the 1 µm particles. Contrary to the larger particles, the smaller 1µm particles

remain close to the wall and do not migrate to the center irrespective of the sheath flow rates (40-160µL/min) for the sheath and fixed 40 µL/min for the sample.

3. Separation and integrated counting

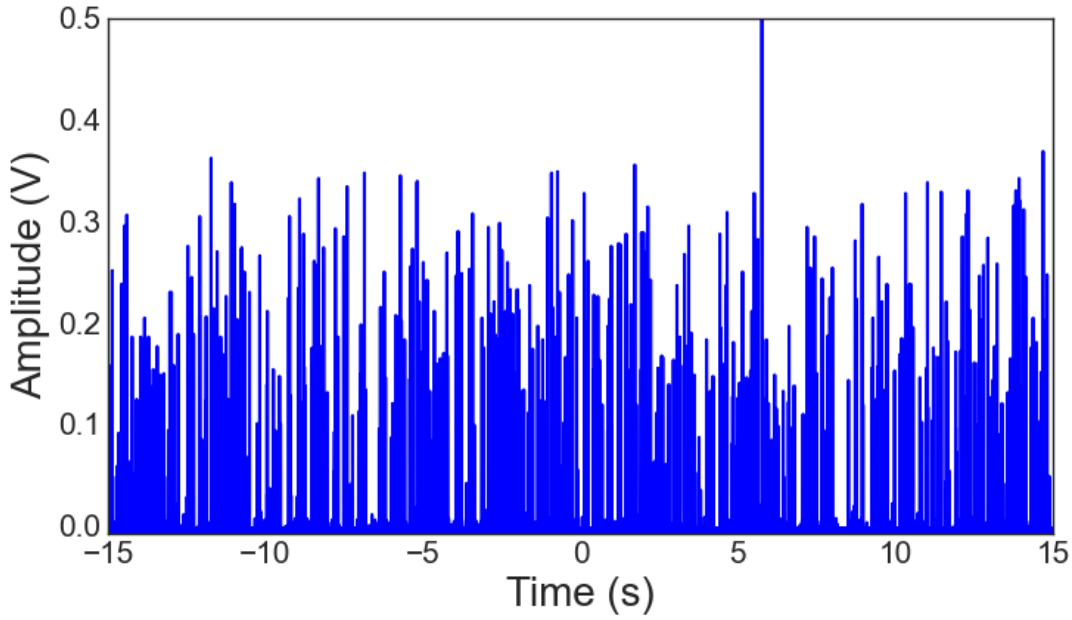


Fig. S3: Particle counting. Temporal trace showing the particle counting of separated 10 µm green fluorescent particles using the "all-fiber" cytometer that was integrated with the separation component. The variation in the amplitude measured is high due to weak particles focusing at a total flow rate of 50 µL/min (sample flow rate of 10 µL/min + sheath flow rate of 40 µL/min).