## Electronic Supplementary Information:

The two filtering regimes, i.e. slow and fast filtering, are achieved by changing the splitting ratio at the channel junction of the input flow (from well 1) into the other three wells (2, 3 and 4). In order to do this we control the volume of solution deposited in the 4 reservoirs of the cartridge. The relative height difference determines the flow rate in the channels and the splitting ratio at the junction. Moreover, we keep constant the flow rate from the input well (1) in order to compare experimental results by changing the splitting ratio only. First we fill wells 2, 3 and 4 with buffer solution and then we fill well 1 with the mixture of 3 µm beads in fluorescent solution. Figure A shows the chip layout with solution volumes used for the experiments in the two filtering regimes.

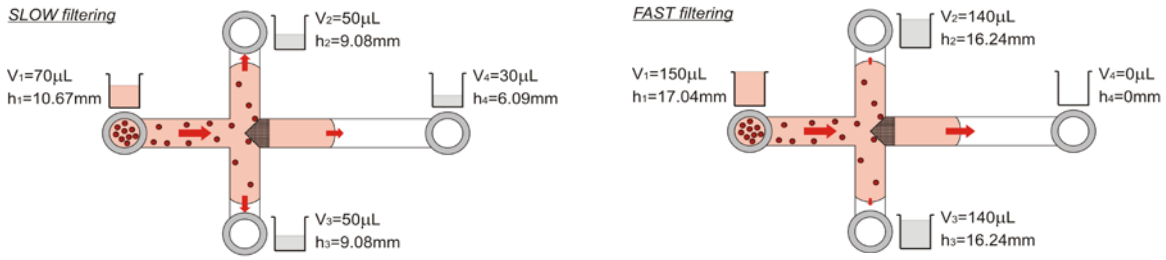


**Figure A** *Cartoons of the chip layout with volume and relative height of the solution in each well for the two filtering regimes. Well 1 is filled with a mixture of 3 µm beads in fluorescent solution, wells 2, 3 and 4 are filled with buffer solution.*

In order to estimate the fluorescent forefront speed, we analyze the intensity profile of the fluorescent signal captured along the channel; The front position is set to half maximum of such an intensity. We measure the time $\Delta t$ for this point to travel through a known length $\Delta x$ of the channel and we estimate the flow speed by calculating the ratio between these two values $v = \Delta x/\Delta t$. Representation of this technique is shown in Figure B.

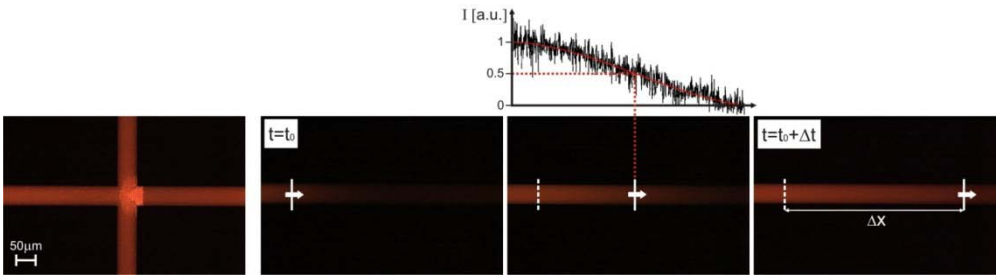


**Figure B** *Time-lapsed fluorescent microscope images for forefront speed estimation in the fast filtering regime after 10 minutes. The first frame shot shows the filter situation; The last three frame shots show the translation of the front toward well 4. The intensity profile along the channel is shown in the upper inset and front position is set at half maximum. At time t0 the initial front position is indicated. The distance Δx covered in a time Δt is then measured through the acquired movie (Video 4) and is used to estimate the flow speed.*

## Captions of supplementary videos:

***Video 1*** *Movie of the filtering experiment performed with a mixture of 3 µm beads in a buffer solution. It shows the filter initial condition, the arrival of the beads to the filter, the situation after 2, 5 and 25 minutes and the filter after cleaning. The concentration of the test beads is about 120 beads/nL and the solution is flowed from well 1 through the input channel with an estimated rate of 50 pL/s. 100% of beads are blocked by the filter. Movie is capture with an inverted optical microscope in bright field.*

***Video 2*** *Movie of the slow filtering regime experiment performed with a mixture of 3 µm beads in a 40 µM Rhodamine 6G solution. It shows the filter initial condition, the arrival of the fluorescent forefront, the crossing of the filter and the filling of the channel beyond the filter. The 2PP polymeric resist is fluorescent in the green so it is clearly visible at the channel junction. The concentration of the test beads is 120 beads/nL and the solution is flowed from well 1 through the input channel with a measured rate of 51 pL/s. The filter crossing time of the forefront is about 20 s and the splitting ratio toward well 4 after the filter is about 30%. Movie is capture with an inverted fluorescence microscope.*

***Video 3*** *Movie of the fast filtering regime experiment performed with a mixture of 3 µm beads in a 40 µM Rhodamine 6G solution. It shows the filter initial condition, the arrival of the fluorescent forefront, the crossing of the filter and the filling of the channel beyond the filter. The concentration of the test beads is 120 beads/nL and the solution is flowed from well 1 through the input channel with an measured rate of 47 pL/s. The filter crossing time of the forefront is about 9 s and the splitting ratio toward well 4 is about 79%. Movie is capture with an inverted fluorescence microscope.*

***Video 4*** *Movie of the measurement of the flow rate toward well 4 beyond the filter in the fast filtering regime after 10 minutes from the arrival of the fluorescent forefront to the filter. Experimental conditions are the same described for Video 3. The movie shows the situation at the junction after 10 minutes and then the chip is translated to follow the fluorescent forefront movement; we stop the translation in a dark portion of the channel not yet filled by the solution and we wait for the transition of the fluorescent front in order to measure its speed (about 22 pL/s in this case). The movement of the forefront after 10 minutes is the proof that the filter is still working and it is not completely clogged. Movie is capture with an inverted fluorescence microscope.*