## Controlled microfluidic switching in arbitrary time-sequences with low drag

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Switching time dependence on diffusion coefficient

The concentration dependence on the diffusion coefficient of the solute, D, is described by equations 7 and 8 of the main text. We determined t_s numerically because a function describing the dependence of t_s on D is not available in closed, analytic form. In Figure S-1 we show t_s for varying D at a constant average fluid velocity, $v = 3.3$ mm/s. The solid lines show the region where Taylor-Aris theory is expected to be valid, that is, where $y > 100\, y_D$ with

$$y_D = \frac{a^2 v}{288 D_0} \qquad\qquad (S\text{-}1)$$
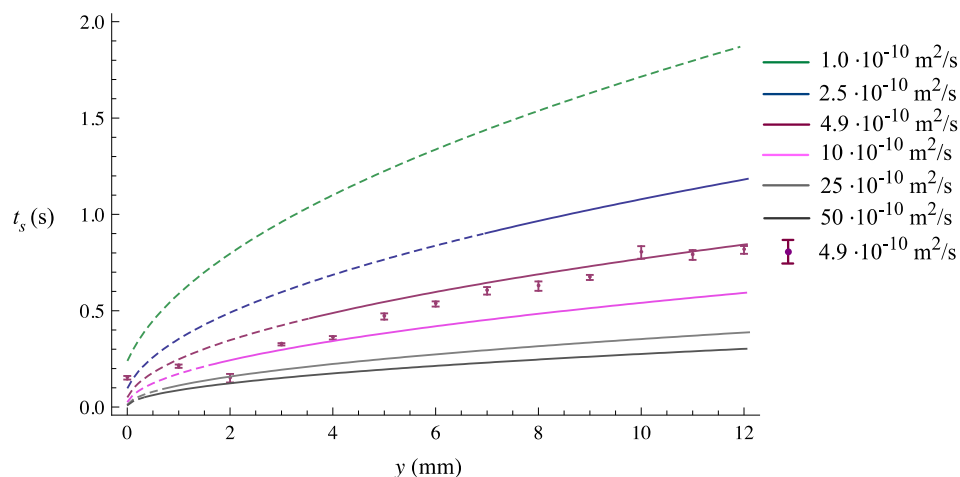
Figure S-1: The switching time, t_s as a function of position y along the channel ($y = 0$ as defined by the red dot in Figure 4). The curves show the predicted results for switching times t_s from the Taylor-Aris model for different solute diffusion coefficients, as indicated, for $v = 3.3$ mm/s. The solid lines indicate where the theory is within its range of validity, $y \gg y_D$ (see Eqs. S-1). The dashed lines show the region where $y < 100\, y_D$. Also shown are the switching times measured with TIRFM at multiple positions along the channel for one pressure settings, corresponding to $v = 3.3$ mm/s and $D = 4.9 \cdot 10^{-10}$ mm^2/s.

We observe t_s to decrease for increasing D, and attribute this behavior to improved diffusional mixing: for a higher D, it takes the molecules less time to diffuse from the boundary of the channel where fluid velocity is low to a region of higher fluid velocity.