Electronic Supplementary Material (ESI) for Lab on a Chip.

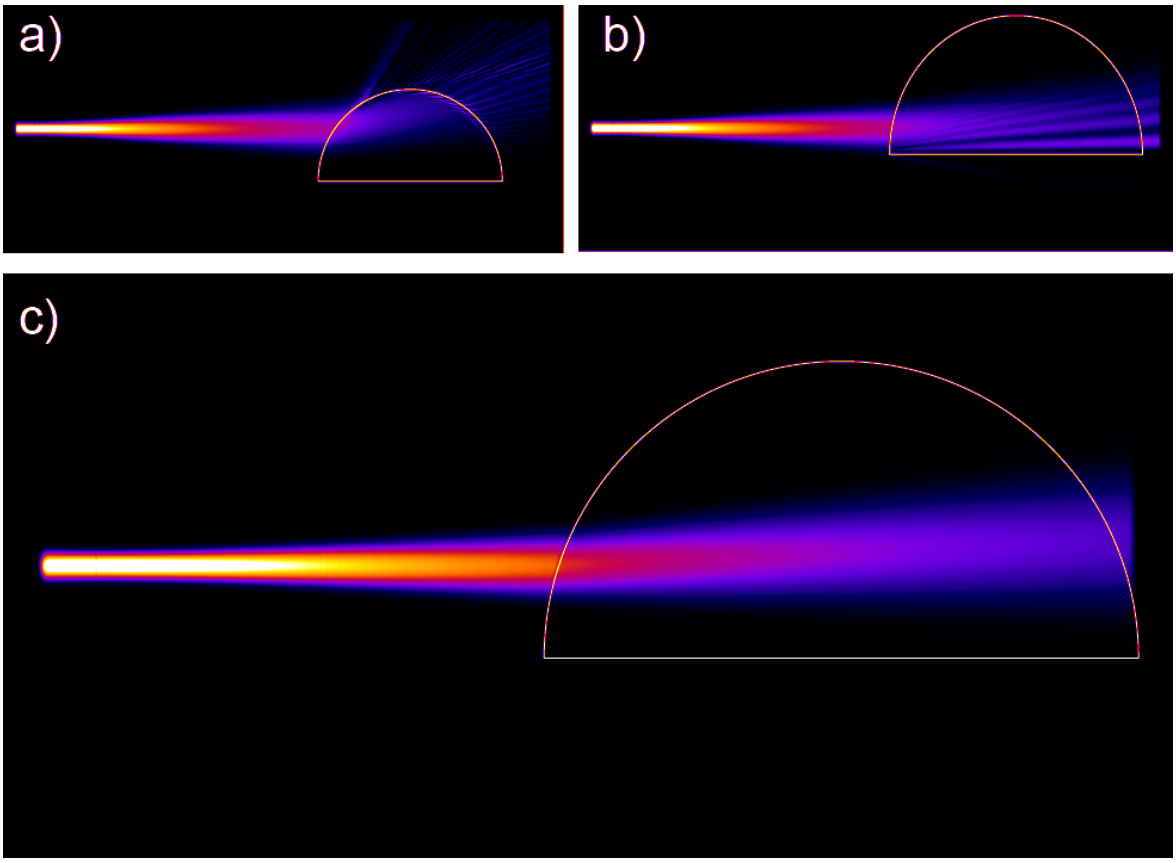

Figure S1: MEEP Simulations of laser beam propagation for different dimensions. The flow channel is outlined for better comprehension. (a) The flow channel is placed too low, the beam is refracted upwards into the glass chip. (b) The flow channel is placed too high, the flat bottom surface causes interference. (c) Final design.

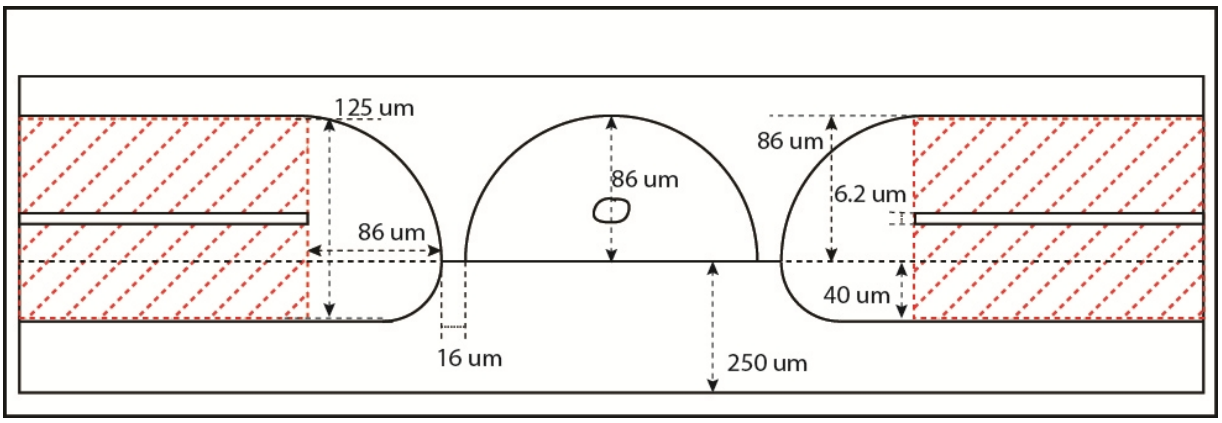

Figure S2: Measures of the final chip design, side view

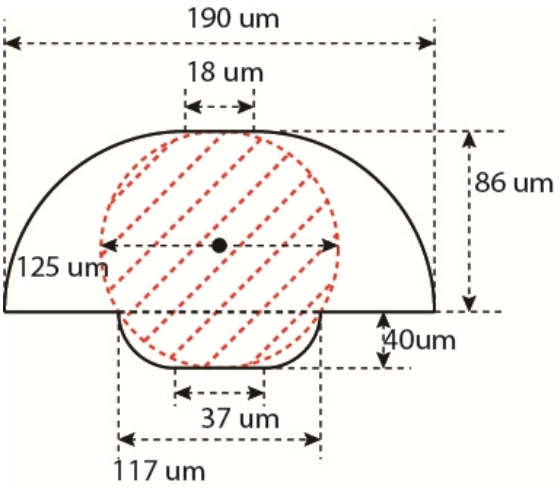

Figure S3: Measures of the final chip design, three-point fiber alignment

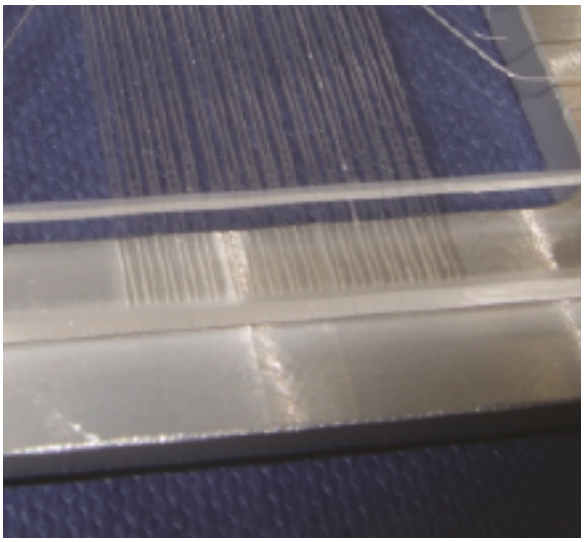

Figure S4: Insertion grooves for simple fiber insertion

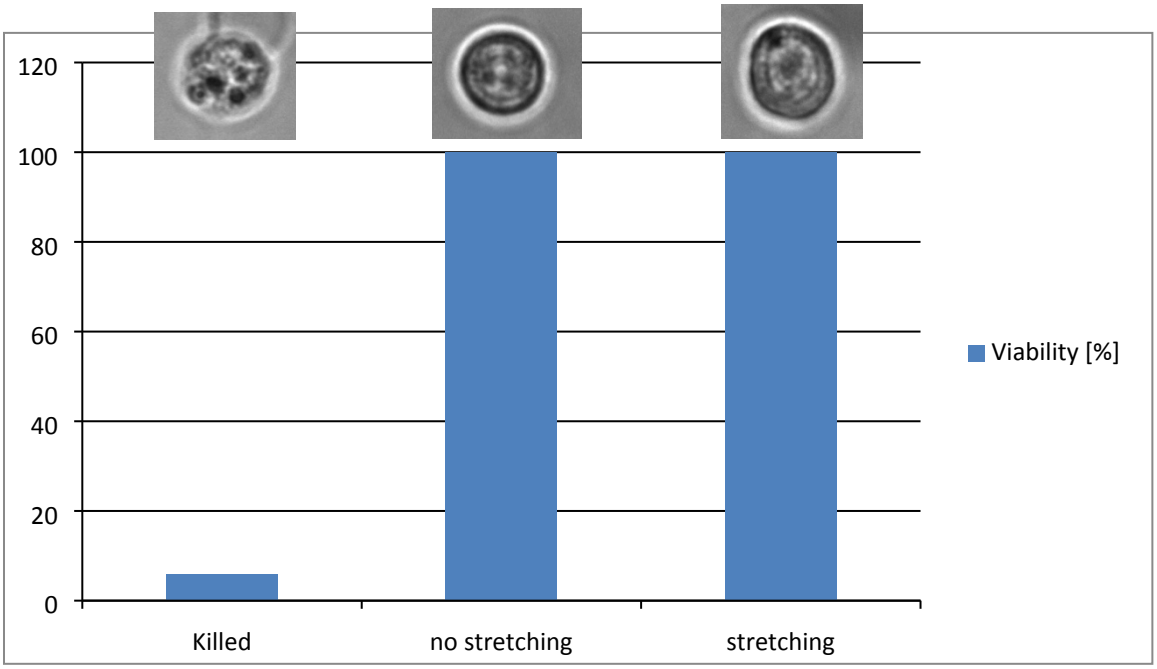

Figure S5: Viability tests. **Left**: Freshly split cells were incubated with 30-40% ethanol for 2 minutes to kill them, then 10% trypan blue was added, cells were inserted into the optical stretcher chip without stretching and checked for trypan blue exclusion. (n=50). **Middle:** 10% trypan blue was added to the cell suspension, which was inserted into the optical stretcher, but not stretched. All cells (n=50) remained viable as evidenced by trypan blue exclusion and a bright halo.. **Right:** The same procedure was repeated, but now cells were optically stretched (0.2 W trapping, 1.2 W stretching power per fiber), left in the channel for 5 minutes and then checked for trypan blue exclusion and bright halo. All cells (n=30) remained viable. Images show typical cells for each condition.