

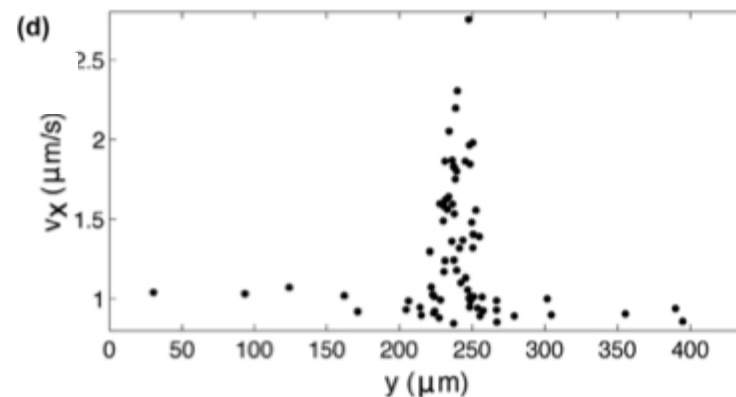
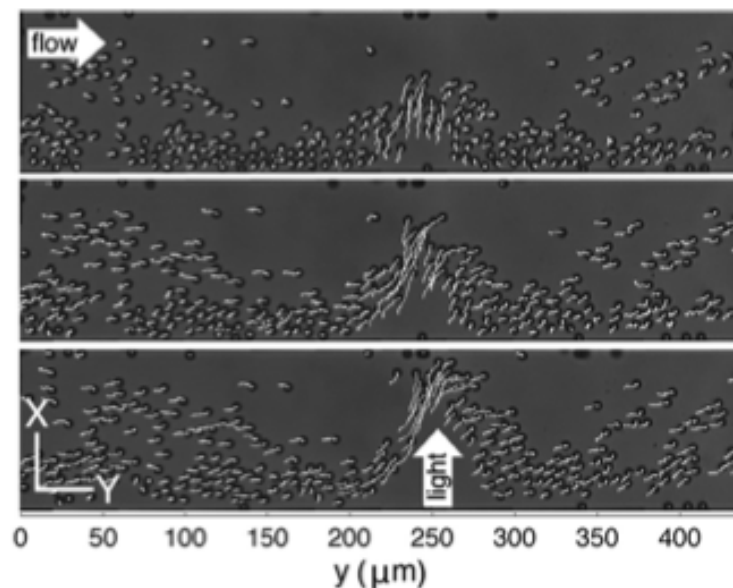
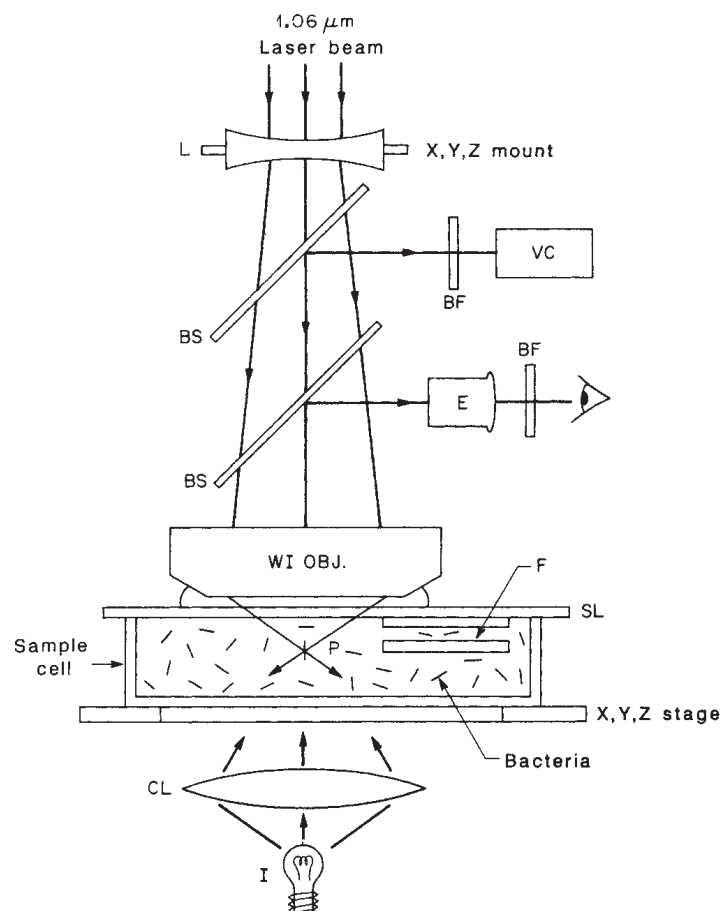
Microfluidic chips for optical manipulation of microbeads and red blood cells

Larisa Florea, Tie Yang, Robert Meißner
(Group B)

Outline

- Background
- Microchip fabrication
- Bead focusing
- Bead tracking
- Brownian motion
- Red blood cell stretching
- Conclusions

Background



[1] Ashkin, A., Dziedzic, J. M., & Yamane, T. *Nature*, 1987, 330(6150), 769-771.

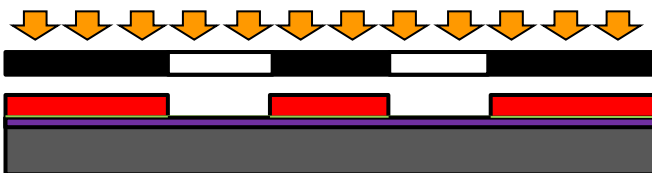
[2] Khoury, M., Vannahme, C., Sørensen, K. T., Kristensen, A., & Berg-Sørensen, K. *Microelectron. Eng.*, 2014, 121, 5-9.

Microchip Fabrication

- Shim Fabrication



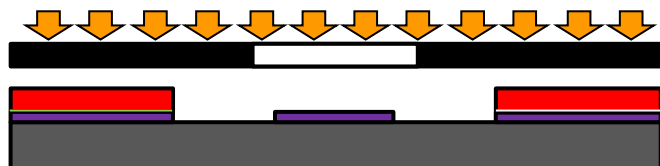
Spin coating UV-resist



UV exposure & development



Oxide wet etching



UV exposure & development



Deep reactive ion etching



Oxide etching



Deep reactive ion etching



Resist removal in plasma asher

Microchip Fabrication

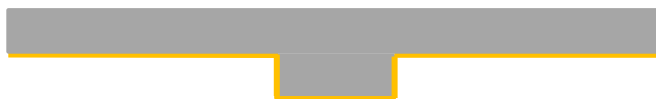
- Shim Fabrication



Cr-Au sputtering

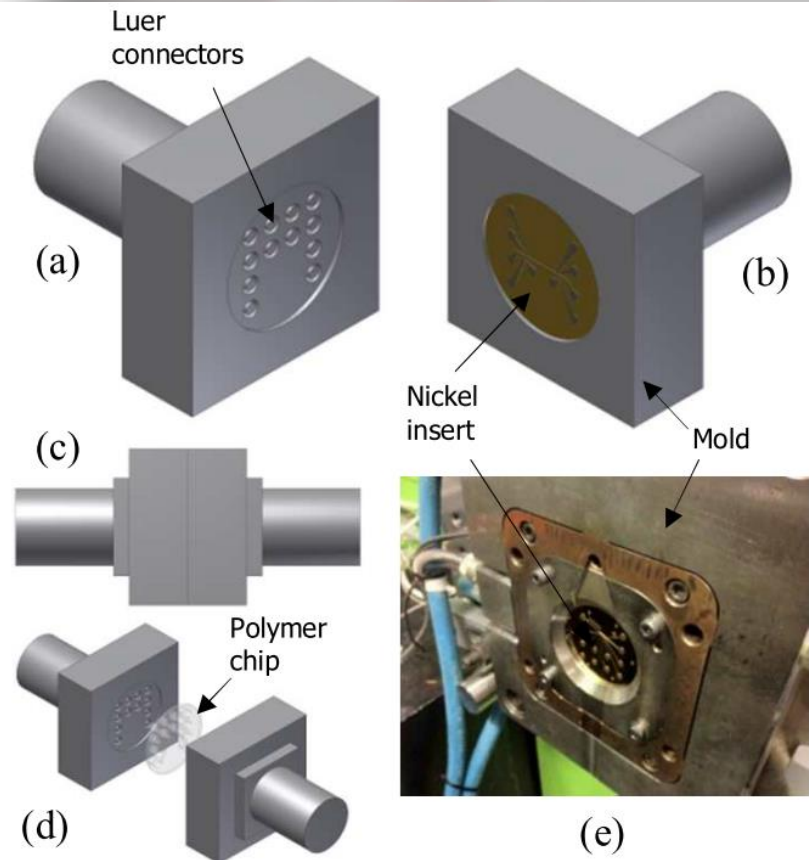


Nickel electroplating



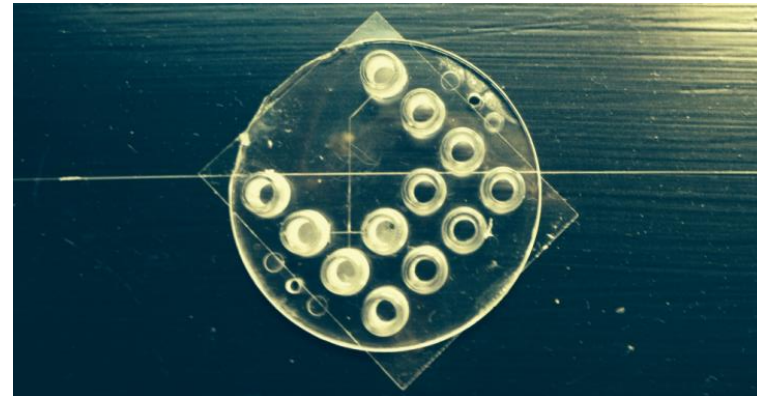
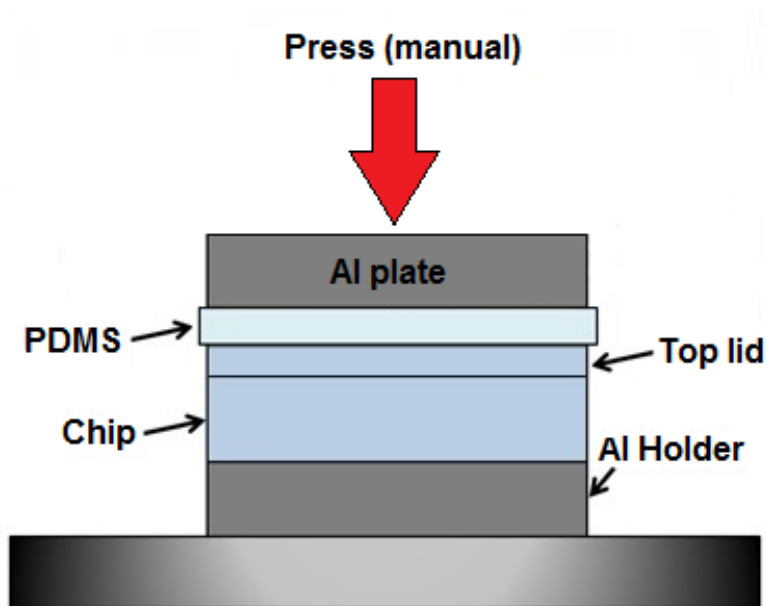
KOH Etching

- Injection Molding

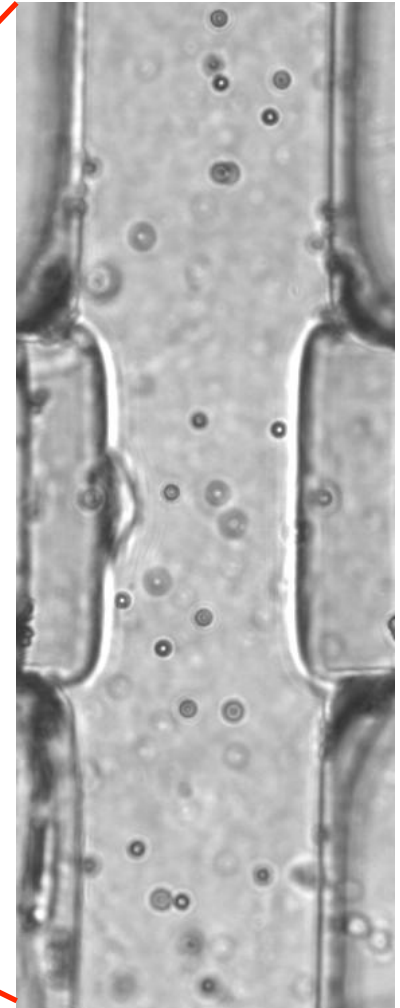
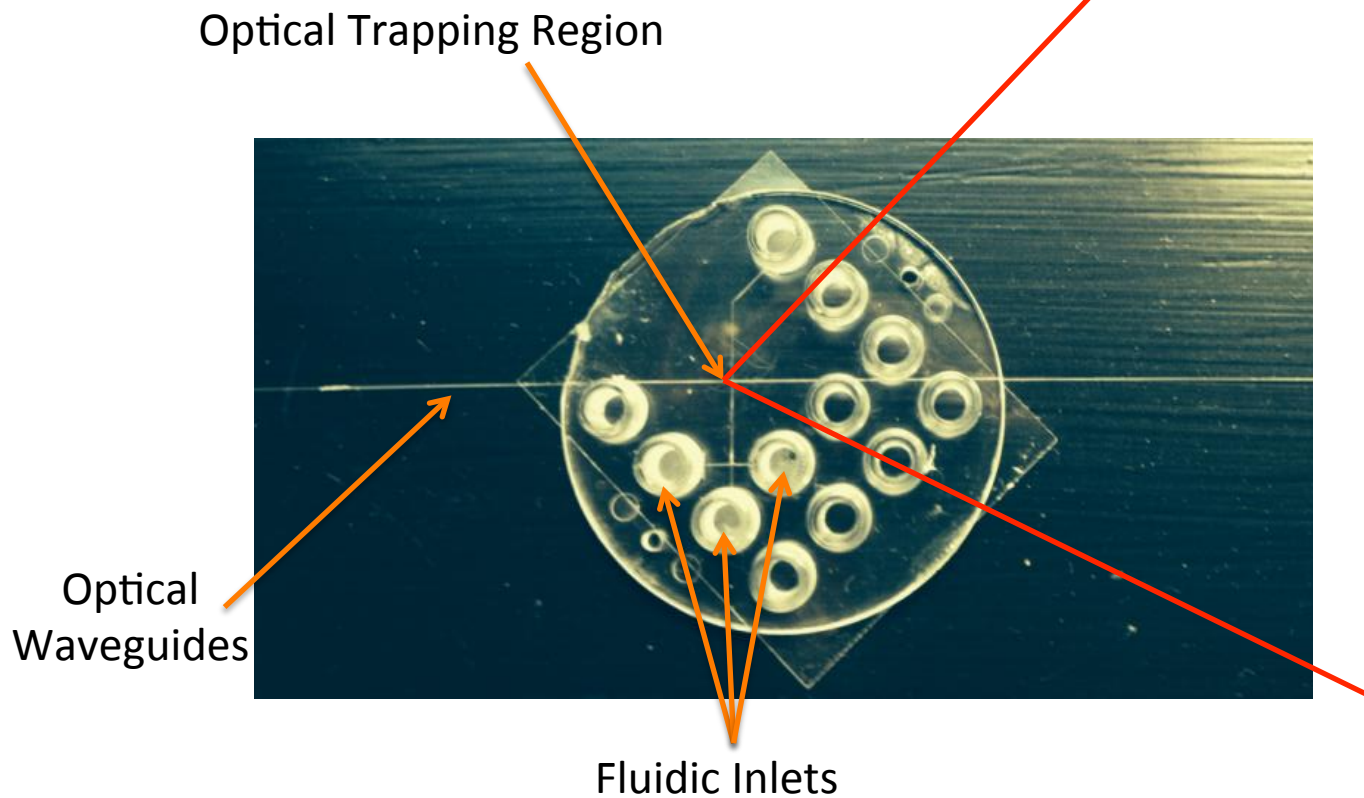


Microchip Fabrication

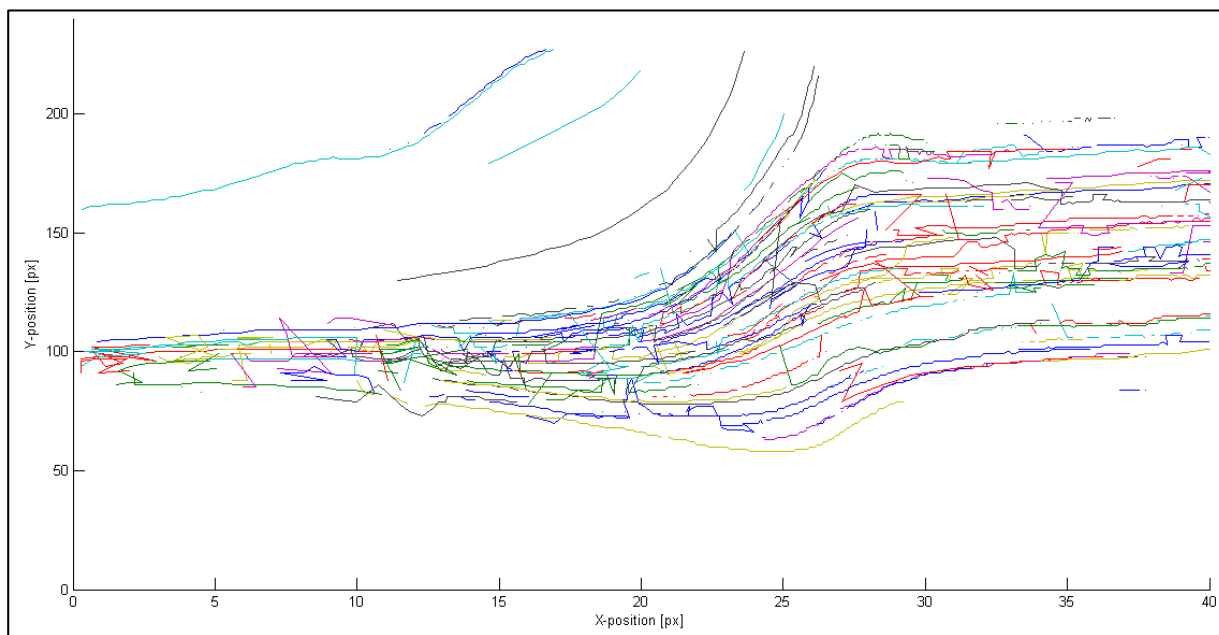
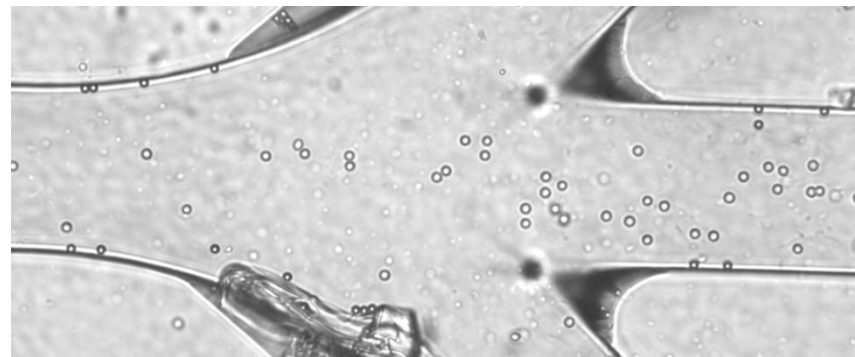
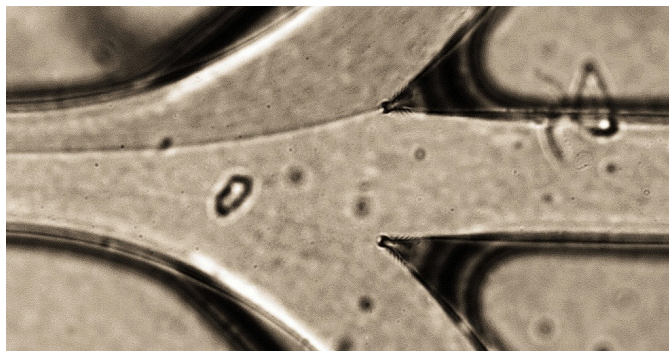
- Waveguide Insertion
- Sealing



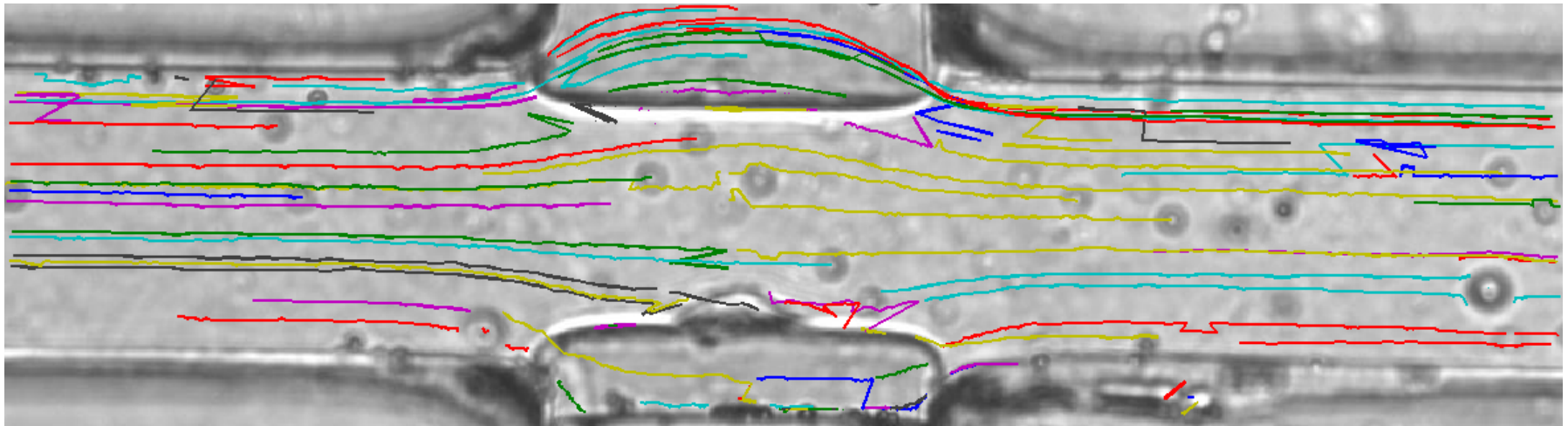
Microchip for optical trapping



Flow focusing

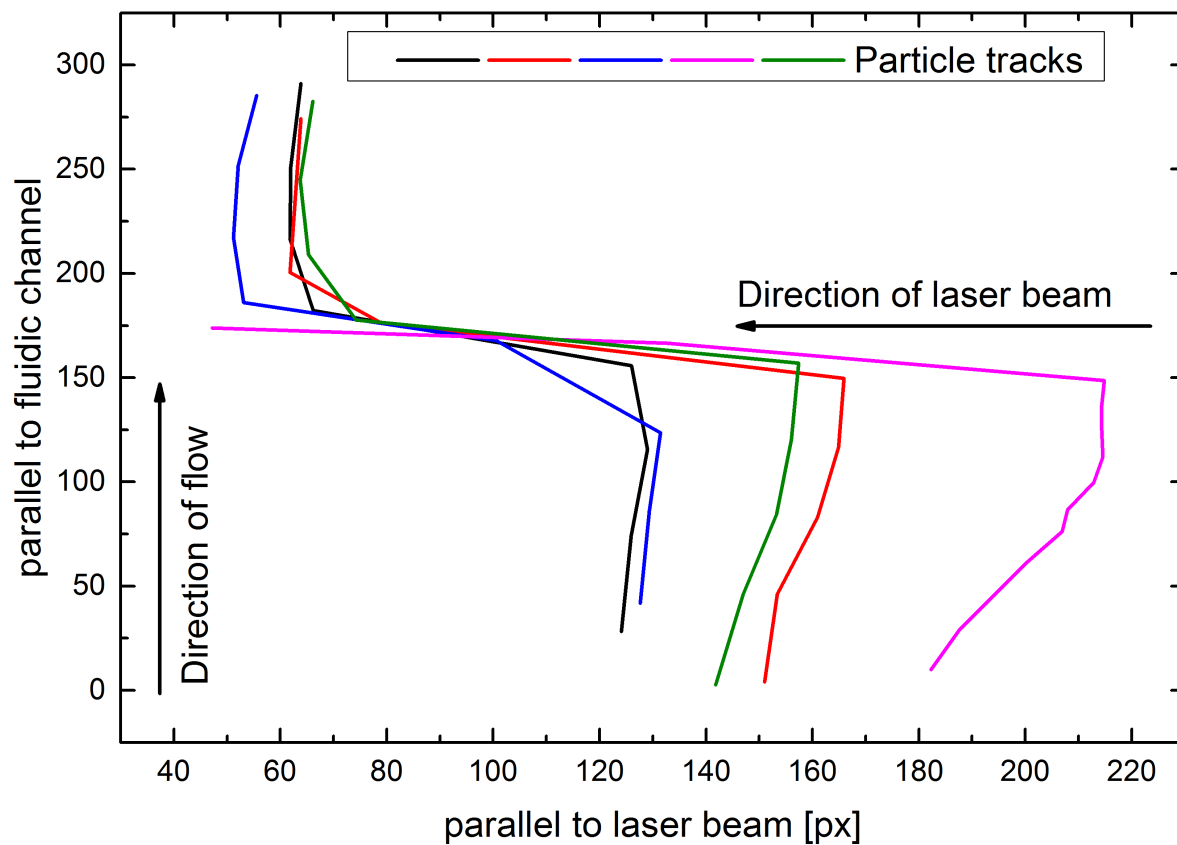
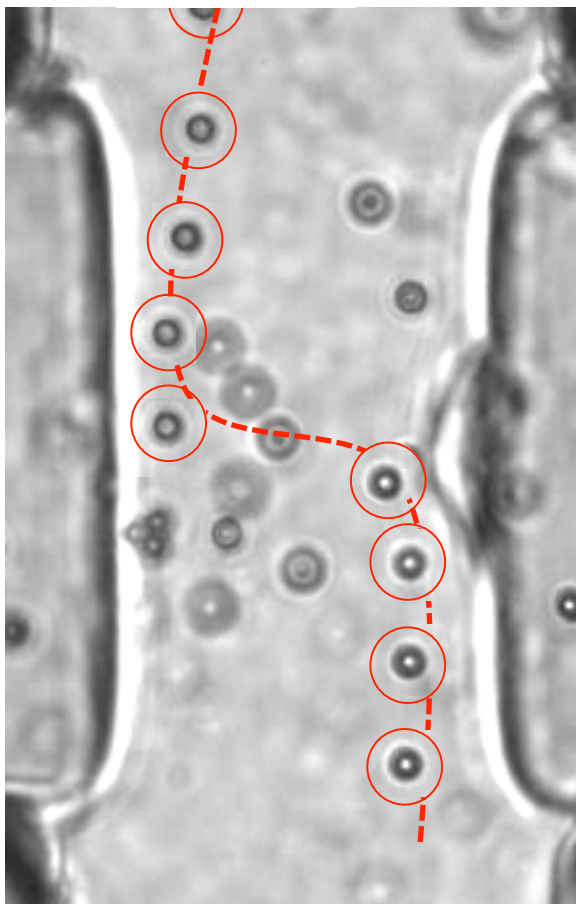


Waveguide insertion is crucial
Flow towards waveguide is visible

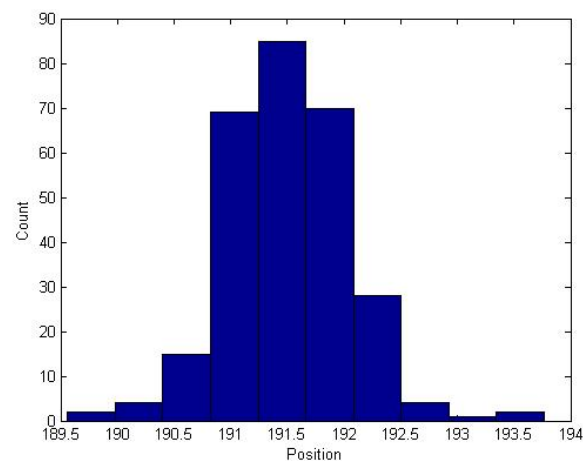
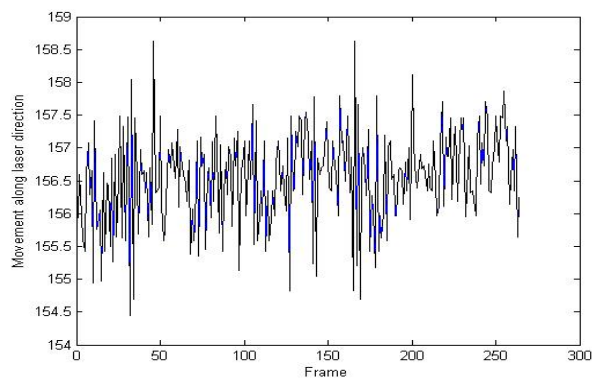
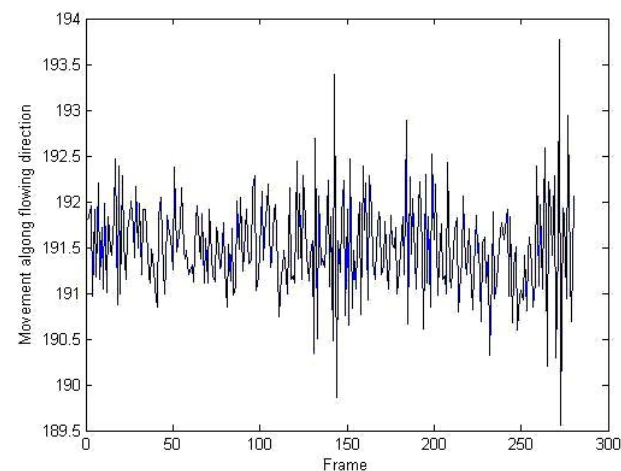
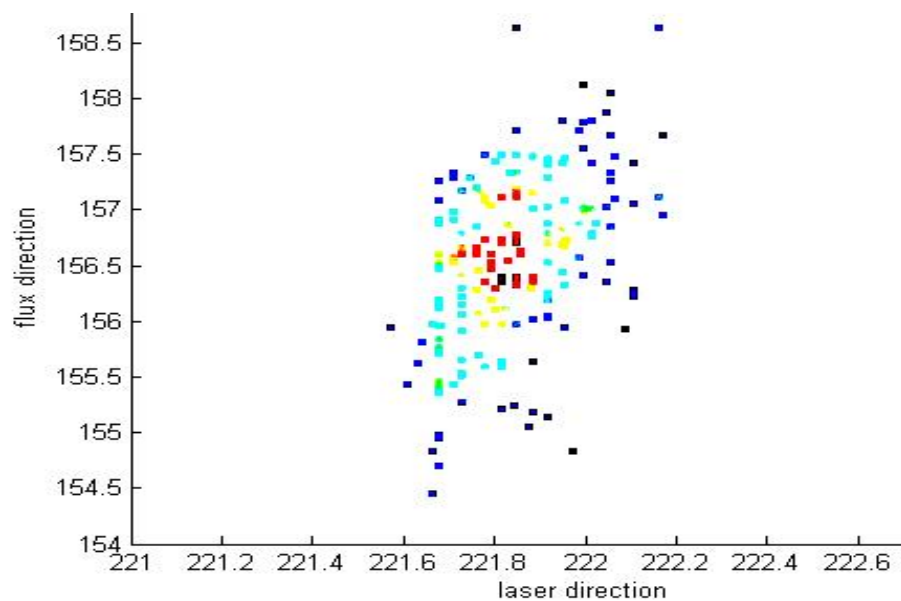


Waveguides
and trapping
zone

Bead tracking



Brownian motion

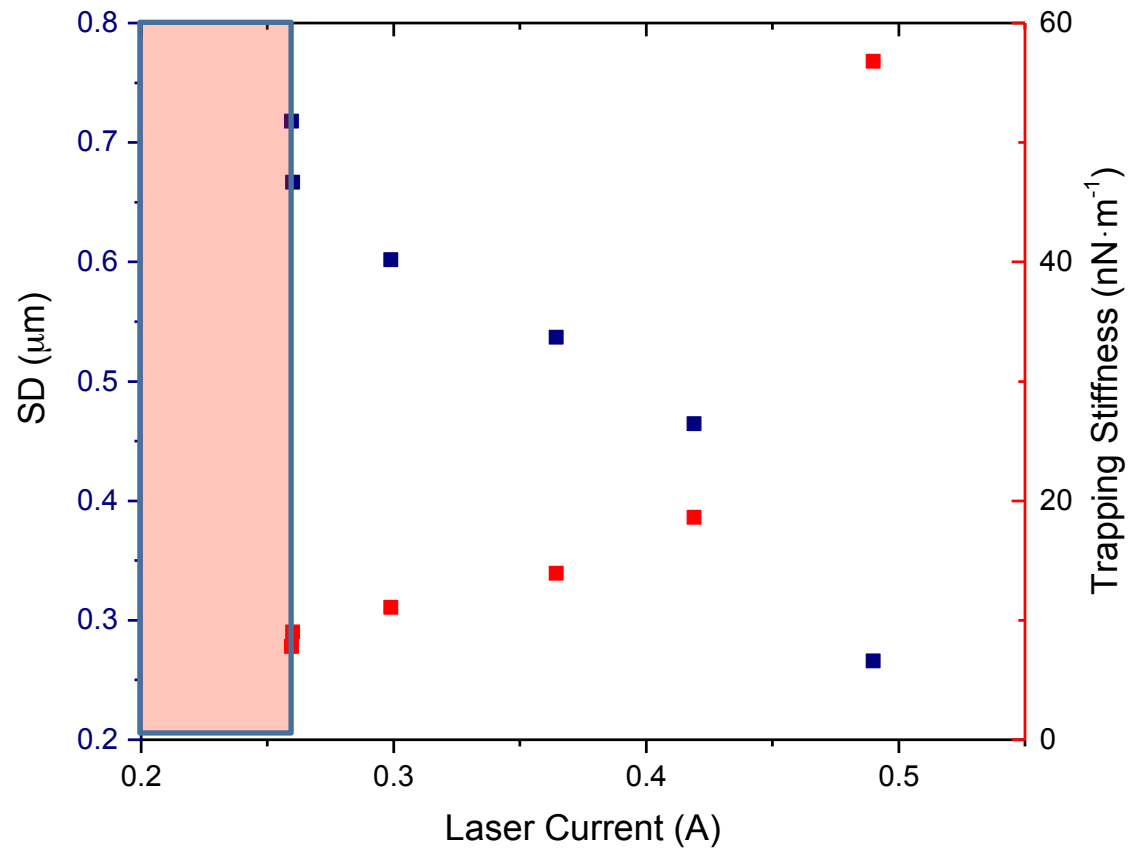


Brownian motion

thermal fluctuation equation

$$\frac{1}{2}K_bT = \frac{1}{2}k\langle x^2 \rangle$$

k is the trapping stiffness



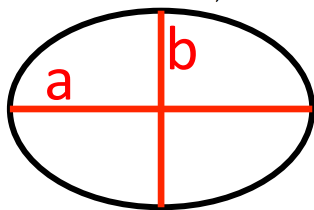
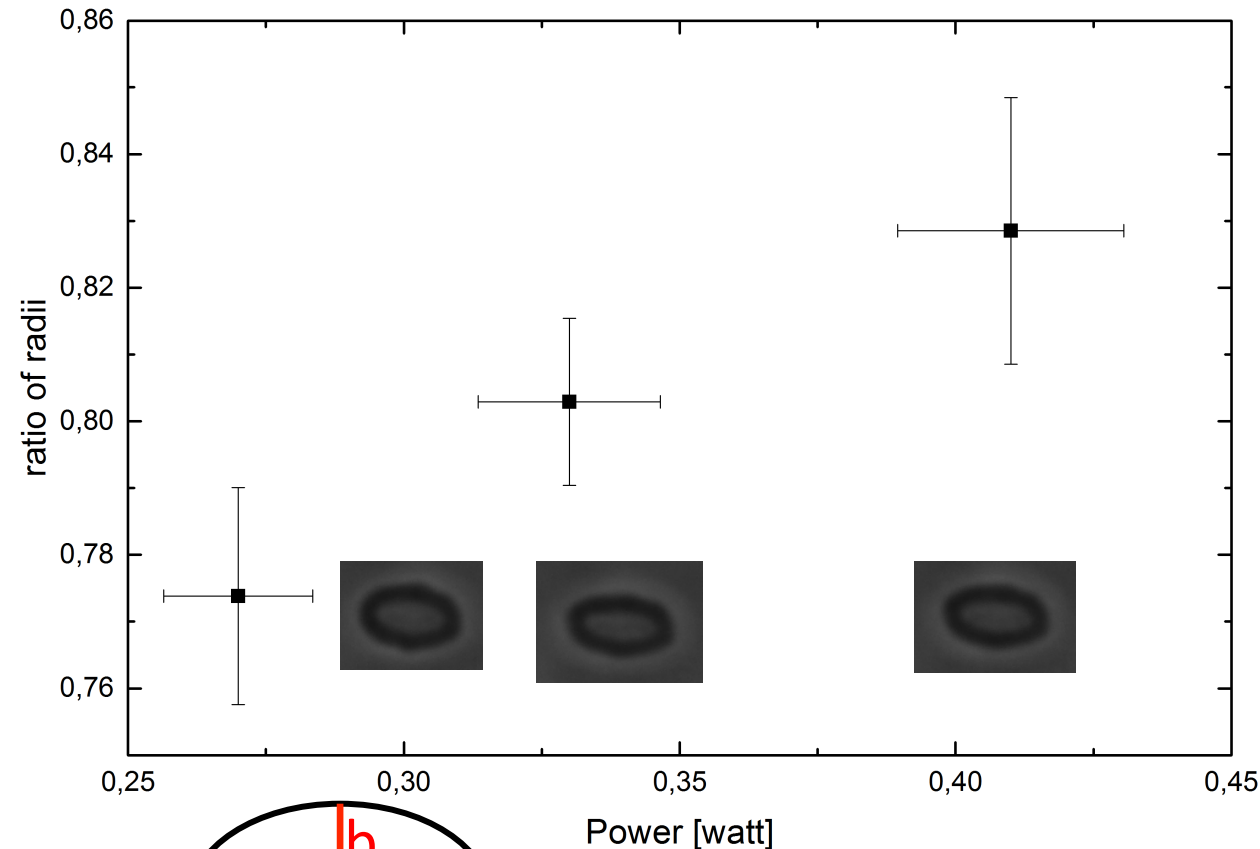
Red blood cell stretching

Young's modulus

$$E = \frac{FL_0}{A_o \Delta L}$$

F through Brownian motion

What is A_0 ?



Ratio of radii = b/a

Provided by other groups

Conclusions

- Fabrication of microchip for optical manipulation
- Bead focusing
- Bead tracking and optical deflection
- Study of Brownian motion
- Red blood cell stretching

Acknowledgements

- Prof. Ilaria Cristiani, Pavia University
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- COST Action **MP1205**

Thank you for your attention!

