**Introduction**

To characterize the mechanical behavior of the red blood cell (RBC), a contactless experiment is designed in the form of a cross-slot microfluidics device (Figure 1). To be able to perform dynamic measurements, the flow amplitude through the cross-slot model $Q(t)$, which scales with the RBC membrane stress, must be tunable in time.

**Aim**

The design, manufacturing, and characterization of a pumping setup that can drive pulsatile flows with a frequency up to 10’s of Hz, and amplitudes down to the order of 10 nl/s.

**Approach**

A new pump is designed, which is put in series with a syringe pump. The small scale (10nl/s) demands an unorthodox flow measurement: particle image velocimetry measurements under a microscope are performed (µ-PIV), which give velocity fields that translate into flow.

By periodically deflecting a steel membrane into a fluidic chamber by a voice coil (Figure 2), an oscillatory flow is produced, which is superimposed to a steady flow of a syringe pump.

A glass rectangular capillary is used as model, chosen for its rigidity and optical accessibility. Patterns of fluorescent beads are captured. Velocity fields are obtained by correlation of multiple areas between two consecutive frames [1].

Confocal microscopy is used for the excitation of fluorescent beads in the plane of symmetry. It efficiently filters out photons inheriting from out-of-plane beads, which have a different velocity. By using a setup equipped with a Nipkow disk [2], sufficient temporal resolution is obtained (50Hz) for the characterization of frequencies up to 10 Hz.

**Results**

First measurements, in which the velocity fields are spatially averaged, show that the pumping setup is generating a pulsatile flow in time. Different amplitudes and frequencies are tested. Figure 5 shows the flow and the pump driving signal in time for a 1 Hz pulse.

**Future work**

Up to here, only preliminary measurements are performed. More experiments are needed to characterize the pump completely in terms of reproducibility and susceptibilities to disturbances like air bubbles.

**References**

[1] GPIV software, Gerber van der Graaf, Multiscale Physics TUD.