Laser speckle contrast velocimetry with a microfludic channel

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Label-free quantitative imaging of microcirculatory blood flow can significantly help clinicians diagnose, treat, and monitor vascular diseases. The quantification blood flow provides great insight into brain function as neuronal activation modulates the regional flow due to the coupling between neurons and microcirculation from capillary RBC motions[1]. In this study, we present a new method of velocimetry to measure the red blood cell velocities with the help of speckle imaging based on spatiotemporal cross-correlation of dynamic speckle images. For this purpose, we used a very simple setup consisting of a green laser of wavelength λ=532 nm, an acousto optic modulation (AOM), a microscope and an sCMOS camera as shown in figure1. To validate our hypothesis, we used a straight microfluidic channel and polystyrene solution as a phantom flowing through the microfluidic channel. From this technique, we can measure up to 2.75 mm/s speed of polystyrene beads solution and also we can see the direction of the velocity. Our approach is a novel way of mapping blood velocity by combining the wide-field imaging capability of laser speckle and the spatiotemporal cross-correlation technique.

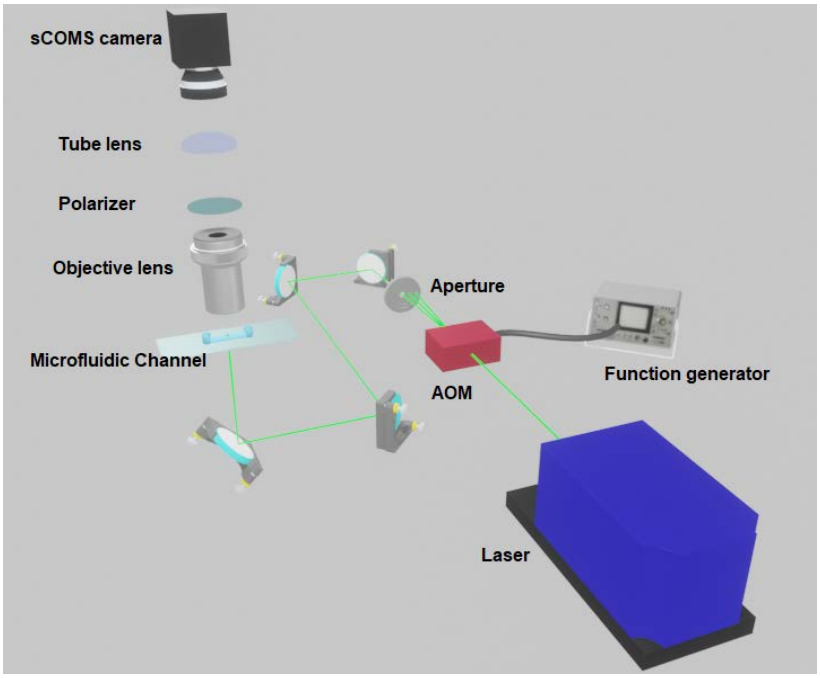

Figure 1. Experimental setup of laser speckle contrast velocimetry

Reference:

[1] Yeom, E. & Lee, S. J. Microfluidic-based speckle analysis for sensitive measurement of erythrocyte aggregation: A comparison of four methods for detection of elevated erythrocyte aggregation in diabetic rat blood. Biomicrofluidics 9, (2015).