ST 3: Medical Physics

Time: Tuesday 9:30–10:10 Location: HFT-FT 101

ST 3.1 Tue 9:30 HFT-FT 101

A microfluidic flow cytometer concept based on spatially modulated emission — •Christian Sommer[1], Tobias Broger[1], Peter Spang[1], Stephan Quint[1], Thomas Walther[2], and Michael Bassler[1] — [1]Institut für Mikrotechnik Mainz, Carl-Zeiss-Straße 18-20, 55129 Mainz, Germany — [2]TU Darmstadt, Institut für angewandte Physik, Schlossgartenstraße 7, 64289 Darmstadt, Germany

Flow cytometers are indispensable tools in medical diagnosis routines. In conventional flow cytometry fluorescently tagged biological cells in suspension are passed through a narrow laser focus and a fluorescent pulse is detected for each cell. The fluorescent intensity is recorded on a single cell level enabling the sizing of cell populations differentiated by various, cell specific fluorescent markers. The microfluidic flow cytometer concept based on spatially modulated emission uses a widened detection zone, which is superimposed with a pseudo-random pattern leading to a temporally extended, distinctly coded signal recorded for each fluorescent cell. Each cell is reconstructed from the coded signal by correlation techniques. An improved signal to noise ratio and cell discrimination capability is achieved in respect to conventional flow cytometry. Both, fluorescent intensity and particle velocity are determined simultaneously for each individual cell. In the microfluidic channel, the cell is subjected to a flow profile. According to the Segré-Silberberg effect cells align in the flow profile at distinct distance to the channel wall. This effect is investigated in detail and its benefit for flow cytometry is presented.

ST 3.2 Tue 9:50 HFT-FT 101

Flow cytometry with improved signal-to-noise discrimination building on radar technology — •Stephan Quint[1,2], Christian Sommer[1,2], Michael Bassler[2], and Thomas Walther[1] — [1]TU Darmstadt, Institut für angewandte Physik, Schlossgartenstraße 7,64289 Darmstadt, Germany — [2]Institut für Mikrotechnik Mainz, Carl-Zeiss-Straße 18-20, 55129 Mainz, Germany

Flow cytometry is a growing field in both research and application and enables the observation of individual cells. Conventional flow cytometers use a bright spot of focused laser light to excite single dyed cells. The cell specific fluorescence signal is recorded and gives information on the cell type. Cytometers require a sophisticated and delicate optical system restricting their use to laboratory settings.

We propose a new approach based on a microfluidic disposable chip. The key feature is a spatially widened detection zone in combination with a distinctively coded signal in the time domain for each traversing cell. The concept enables a higher signal-to-noise ratio (SNR) in comparison to conventional flow cytometers. Due to an extended time of flight, the amount of light, seen by the detector, is much increased. The modulation in time is either created by the use of spatial masks or by spatially selective readings from pixelated detectors. Lock-in-techniques, similar to those used in radar applications are applied to the signal in order to extract the cell signature, resulting in a highly specific cell detection. We can experimentally and theoretically demonstrate how this approach classes out conventional flow cytometers in respect to SNR by far.