

One year Post-Doctoral Position at the Laboratory of Mechanics and Acoustics - LMA (France) on the project:

Live single cell sensing using high frequency ultrasonic scattering measurements

A post-doctoral position is available for one year starting between April and June 2017 at the Laboratory of Mechanics and Acoustics LMA-CNRS UPR 7051, a CNRS laboratory based in Marseille in the South of France.

Description: Sensing and sorting of cells have a wide range of applications in biomedical applications including diagnostics, therapy and cell biology. Samples of interest are often heterogeneous populations of cells in culture or that comprise in a tissue. For example, the separation and characterization of circulating tumour cells, found in the peripheral blood of cancer patient, provide a potentially accessible source for cancer diagnosis and prognosis. There is an increasing interest in replicating the functions of conventional fluorescence activated cell sorting (FACS) flow cytometry on integrated on-chip systems. The combination of surface acoustic waves (SAW) and microfluidic channels is a promising alternative to replace FACS, since they constitute low-cost and compact devices, capable to separate the cells (according to their size, density or compressibility) without any labelling step nor pre-treatments.

Our project aims to develop a compact acoustic cell sorting and sensing system in order to characterize cell mechanical/acoustical properties and to monitor cell viability during sorting. The cancerous versus normal cells, or the dead versus viable cells, exhibit different mechanical/acoustical properties that could be probed using high frequency ultrasonic scattering. In order to incorporate sensing capabilities during dynamic acoustic field sorting, the candidate will investigate the ability of measuring the backscatter ultrasound response from single cell/particle using (standard) bulk acoustic wave (BAW) transducers and/or using SAW transducers. This will involve a novel design and development of acoustically cell sorting and sensing device integrated with a polydimethylsiloxane (PDMS) microfluidic channel, together with the development of a specific calibration procedure for measuring accurately the response from cell/particle and the use of excitation pulse compression techniques for improving cell detection sensibility. These experiments will be conducted together with experiments on cell pellet biophantoms (to mimic densely packed cells in tumors) and progress in the understanding of ultrasonic scattering from viable versus apoptotic cells (Fig. 1). The candidate will work on this collaborative project between the Laboratory of Mechanics and Acoustics (LMA UPR 7051, Marseille) and Research Institute of Signals, Sensors and Systems (ISSS) of Heriot Watt University (Scotland).

Profile: Candidates should have a PhD degree in acoustics or signal processing. Knowledge of quantitative ultrasound techniques is also desirable. The position is funded for 1 year and the net salary is approximately 25 000 euros per year. **Starting date:** between April and June 2017

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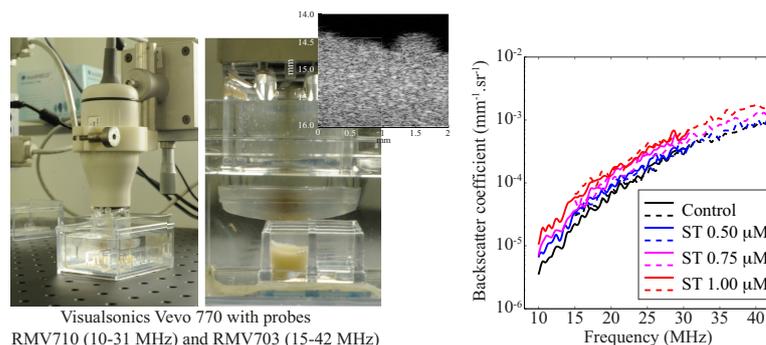


Figure 1: (On the left) Experimental set-up on cell pellet biophantoms with a Visualsonics high-frequency US device. (On the right) Measured backscatter coefficients on viable and apoptotic cells treated with staurosporine (ST) drug.

M. Andrade, G. Skotis, S. Ritchie, D. Cumming, M. Riehle, A. Bernassau, Contactless acoustic manipulation and sorting of particles by dynamic acoustic fields, IEEE UFFC 63 1593-1600 (2016)

E. Franceschini, R. de Monchy, J. Mamou, Quantitative characterization of tissue microstructure on concentrated cell pellet biophantoms based on the structure factor model, IEEE UFFC 63 1321-1334 (2016)

E. Franceschini, P. Pognonec, B. Guillet, T. Pourcher, Polydisperse structure factor model for understanding the ultrasonic scattering from apoptotic cells, IEEE Ultrasonics symposium, 18-21 Sept. (2016)