Semi-automated imaging station dedicated to quantitative phase imaging for high content screening

S. Aknoun[1], A. Saintoyant[1], B. Wattellier[1]

[1] *PHASICS, Route de l'Orme des Merisiers, 91190 Saint Aubin, FRANCE*

Email: aknoun@phasics.fr

Keywords: quantitative phase imaging, high content screening, label free, living cells, machine learning

High content screening consists in acquiring a large number of samples to obtain statistically significant information on cell populations and their changes over time. It is also used to compare different growth conditions or effect of different drugs.
Quantitative phase imaging enables to image semi-transparent samples without any label. This technology has the advantage of not modifying samples so as not to disturb them and to study them over a long period of time (> 3 days) by providing relevant quantitative phase information.

We develop a solution to follow a very large number of cells (> 1000) over a long period of time (> 72 h). We set up a semi-automated imaging station using QuadriWave Lateral Shearing Interferometry. This station solves at least four challenges:

- Scan an entire multi-well plate within minutes
- Keep focus over time and distance at high magnification
- Correct for meniscus effect at the well edges
- Process data as fast as it is acquired

To image wide fields, sample is scanned thanks to the microscope stage. Work on synchronization and analysis' speed with GPU made it possible to perform such a scan at a speed making possible the cell follow-up between two acquisitions.
As scanned surface is large and time lapse can be performed over long periods of time, a numerical refocusing algorithm processes phase images even after acquisition. Performances and limitations of this approach will be presented.
Different algorithms developed to stitch phase images together enable to get quantitative phase information over the whole field of view.

With this system, we perform scans of entire surface of tissue samples with high resolution. We are also able to image entire wells of multiwell plates with phase modality. It is then possible to study the evolution of quantitative phase and morphological features for long time periods at the individual cell level for a large number of cells evolving in different wells according to different conditions. We will present cell growth comparison for different experimental culture conditions.