High resolution whole cell imaging using focused MeV ion beam

Xiao CHEN, Chen Ce-Belle, CNB Udalagama, AA Bettiol, and F Watt,

Centre for Ion Beam Applications, Dept of Physics, National University of Singapore,
Singapore 117542

Email: g0800641@nus.edu.sg

Observations of the interior structure of cells and sub-cellular organelles are important steps in unravelling organelle functions. Microscopy using MeV Protons and Helium ions can play an important role in sub-cellular imaging due to its ability of penetrating whole cell without a significant loss of resolution. A dedicated whole cell imaging beam line has been built up in Centre for Ion Beam Application, which enables us to focus MeV ion beam to 25nm. By mapping the energy loss of transmitted ions, high resolution whole cell STIM (Scanning transmission ion microscopy) images including cell density information can be obtained, as shown in figure 1a. PIF (proton induced fluorescence) images with specific structure information can also be achieved by detection of fluorescence excited by MeV ion beam, as shown in figure 1b. These results will be presented in details. In the mean time, several critical challenges and some future studies will also be discussed.

![Figure 1](image_url)

**Figure 1** (a) on axis STIM image using 1.8 MeV alpha particles: MRC5 - normal human fetal lung fibroblasts grown on 100nm Silicon Nitride windows; (b) Proton induced Fluorescence image. MRC5 lung cell stained with DAPI: A cell-nucleic acid stain that binds to DNA and exhibits a 20-fold increase in fluorescence upon DNA binding.