

Abstract: Joint Training Course on Ion Beam Microscopy, INFN-LNL , Legnaro (Italy): July 3-4, 2014

The use of MeV ion nanobeams for microscopy of whole biological cells

Frank Watt
Centre for Ion beam Applications
Dept of Physics
National University of Singapore.

MeV proton and alpha (helium ion) particle beams can now be focused to 20 nm spot sizes [1,2], and ion/matter simulations using the DEEP computer code show that not only are these resolutions maintained through the top micrometre or so of organic material, but the energy deposition profiles of the transmitted ions are laterally constrained to a few nanometers from the initial ion path: This paves the way for high resolution structural and fluorescence imaging of relatively thick biological material, eg whole biological cells. Since this is difficult to carry out using any other technique, whole cell imaging at high spatial resolutions represents a new exciting area for nuclear microprobes,

This talk will review the following:

1. Nanoprobe formation and state-of-the-art spatial resolutions for focused MeV ions.
2. Examples of high resolution whole cell microscopy using both low energy helium ions (HIM) and MeV alpha particles (Scanning Transmission Ion Microscopy - STIM).
3. Examples of whole cell microscopy using proton induced fluorescence (PIF) imaging.
4. Examples of whole 3D imaging of whole cells which have internalized gold nanoparticles, using the techniques of RBS and forward scattering transmission ion microscopy (FSTIM).

[1] J. A. van Kan, P. Malar, and Armin Baysic de Vera: The second generation Singapore high resolution proton beam writing facility; REVIEW OF SCIENTIFIC INSTRUMENTS **83**, 02B902 (2012)

[2] F Watt, X Chen, C Chen, CNB Udalagama, JA van Kan and AA Bettioli, Whole cell structural imaging at 20 nanometre resolutions using MeV ions, Nuclear Instr and Meths B (2013) accepted for publication: DOI information: 10.1016/j.nimb.2012.11.047.