DEPARTMENT OF ELECTRONIC &
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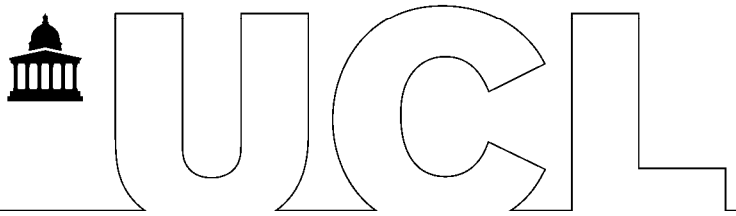

MSc NANO STUDENT NAME: Adam Orchard

PROJECT SUPERVISOR: Dr Guy Moss

PAPER TITLE: Design of a Calibration Target for the Scanning Ion Conductance Microscope

AUTHOR LIST: A. Orchard, G. Moss, S. Lee, S. Hughes, M. Caldwell, D. Benton.

ABSTRACT:

A calibration target has been designed to allow further study of the imaging mechanisms involved in Scanning Ion Conductance Microscopy (SICM). This is a relatively new scanning probe microscopy technique, which allows for the imaging of live biological cells and the study of their electrical properties on the nanometre scale. A glass capillary is pulled to a sub-micron diameter pipette tip, filled with a salt solution and used to scan an immersed sample by passing a current between the inside of the pipette and the sample bath. Imaging is performed by detection of the reduction in current as the pipette approaches the sample surface, occluding ion flow, and repeating this across the imaging region as with other scanning probe microscope techniques.

The microscope has provided some exceptional imaging capabilities however some of the electrical characteristics of the system are still not fully understood, impacting on the accuracy of image processing and analysis. Sensitivity of the system to features to the side of the pipette tip; unknown tip defects; and sloped surfaces all impact the imaging to an uncertain extent.

Finite element method analysis has been used to model the electrodynamics involved in the system and to design a range of ideal features for a calibration target. Scanning of features smaller than the pipette tip is shown to provide information on the tip construction such as tip diameter, and slopes of known angles can be scanned to identify skewed tips.

The process for producing a suitable calibration target has been investigated and basic targets have been produced by casting atomic force microscope (AFM) calibration grids in poly(dimethylsiloxane) (PDMS). A complete SICM calibration target has been designed for manufacture using Focused Ion Beam (FIB) lithography to produce a silicon master, which would subsequently be cast in PDMS.