



Centre for Advanced
Photonics and Electronics
"Technology from Science"



UNIVERSITY OF
CAMBRIDGE
Department of Engineering

CAPE Lecture Series:

"Hybrid pixel detectors – from hunting the Higgs Boson to medical X-ray imaging"

Monday 23 February 2015
4:00pm

Lecture Room LTO
Engineering Department
Trumpington Street

Speaker: Dr Michael Campbell from CERN



Everyone is welcome.

Coffee, tea and biscuits will be provided from 3:45pm.

Abstract:

Hybrid pixel detectors were developed to equip the inner layers of the enormous detectors at CERN's Large Hadron Collider. The basic building block of these detectors is a monolithic matrix of fully depleted semiconductor diodes connected by high density bump bonding to equally segmented readout chips. In each ASIC readout channel every particle which deposits enough charge in the detector element is detected and assigned to a particular bunch crossing of the LHC beam. The extremely high threshold to noise ratios which are obtained in such systems produce almost noise-free particle images even at very high frame rates. The same detection mechanism can be applied to X-rays and, as each X-ray photon is detected individually, its energy can be measured and spectroscopic or 'colour' X-ray images produced.

This presentation will cover the basic concepts of ASIC design for such detectors and recount how the transition from High Energy Physics to X-ray imaging was made. Access to very deep sub-micron CMOS has allowed the implementation of sophisticated on-pixel front-end architectures designed to overcome some of the inherent limitations in the detection process.

Dr Michael Campbell joined CERN in 1988. After an initial period of training in CMOS (Complementary Metal Oxide Semiconductor) circuit design, he started designing pixel detector electronics for High Energy Physics (HEP) experiments. The first full hybrid pixel detector system was used at the WA97 (West Area 97) experiment in the mid-90s. Several generations of CMOS technology later he was a major contributor to the design of the silicon pixel detector of the ALICE (A Large Ion Collider Experiment) experiment and the pixel readout system of the RICH (Ring-imaging Cherenkov) detector of the LHCb (Large Hadron Collider beauty) experiment at the LHC (Large Hadron Collider).

In parallel with his activity in HEP Dr Campbell founded the Medipix Collaborations which have used successive generations of CMOS technology to bring spectroscopic X-ray imaging closer to reality. He is the spokesman of the Medipix2 and Medipix3 Collaborations and has authored or co-authored over 100 scientific publications, mostly in the field of hybrid pixel detectors.