Contribution ID: **79** Type: **Poster Presentation**

Radiation-induced charge trapping in n- and p-channel CCDs

Wednesday 10 September 2014 14:00 (1h 40m)

Recent developments in pocket pumping techniques have enabled the study of charge-trapping defects in both n-channel and p-channel CCDs. These techniques allow for analysis of individual defects, which can be located in the device to within a few microns.

The ability of pocket pumping to analyse individual traps coupled with the large number of defects present within the silicon lattice after irradiation allows for determination of the trap properties, such as the emission time constants, of single defects for each of the main trap species, giving a much greater degree of accuracy than is available with methods which analyse bulk trap properties such as deep level transient spectroscopy (DLTS).

Pocket pumping and related techniques can be used on both n-channel and p-channel devices, permitting the study of both electron and hole traps in silicon across the entire band gap. Furthermore, the ability to study defects in situ and with precise localisation allows for different charge states of defects to be studied where they exist, for example in the case of the negative and doubly negative charge states of the divacancy as an electron trap.

In this study we have encountered many examples of defects within both types of device. Whilst many of these charge traps behave as one might expect, the most interesting points of this research are those which have certain peculiarities. Here we present the latest results across a range of devices, with particular interest paid to how the defects interact with signal charge as it is transferred through the device.

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Session Classification: Session 10: Posters 1 (Particle Physics, Pixel Detectors and Lifesciences)

Track Classification: Detectors for High Radiation and Extreme Environments