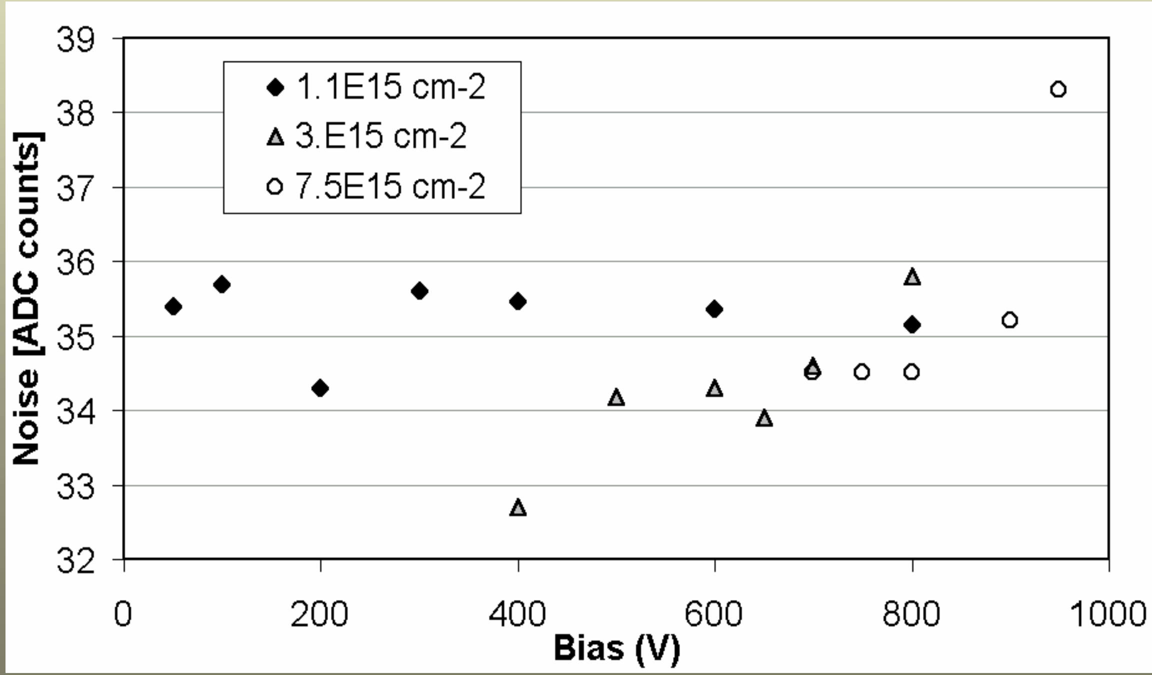
Noise behaviours

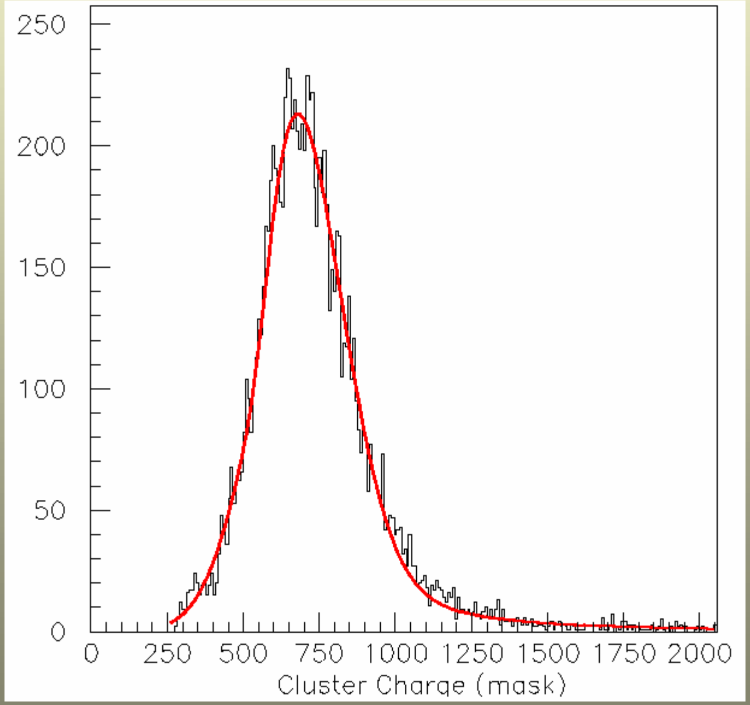
Read-out with SCT129 (40MHz) electronics

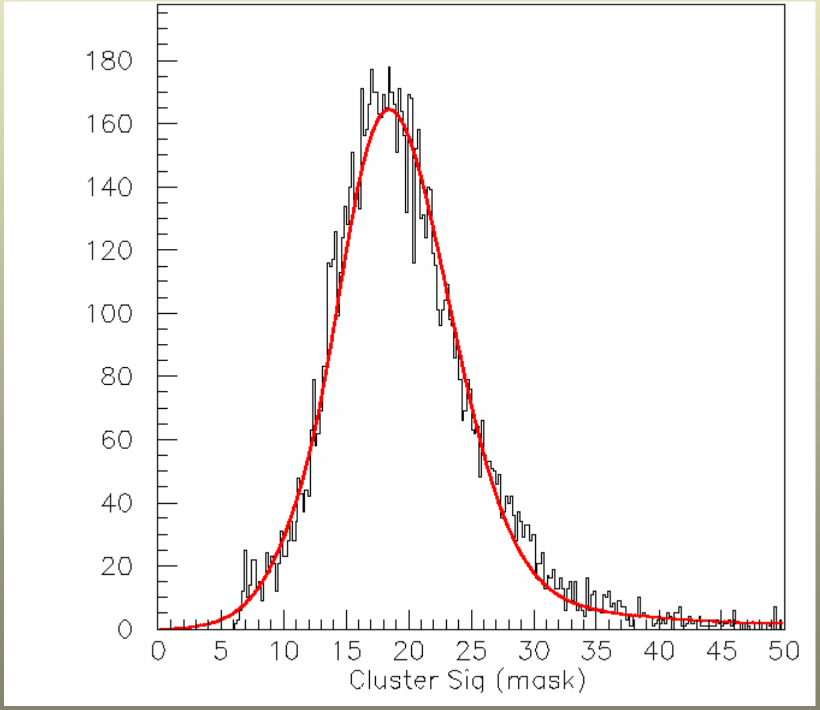
Noise as a function of the applied voltage for three different irradiation doses. The pre-irradiation value is about 35 ADC counts, similar to the value found after irradiation!.



Charge collection behaviours

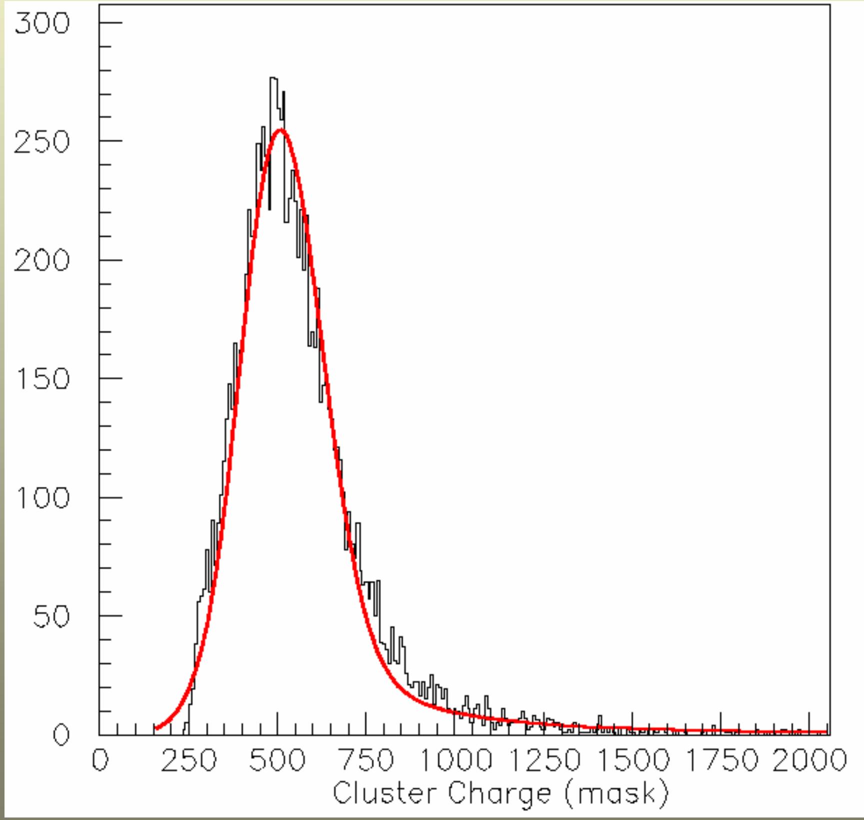
Signal and cluster significance after 1.1 10^{15} p cm^{-2}
(800 V)





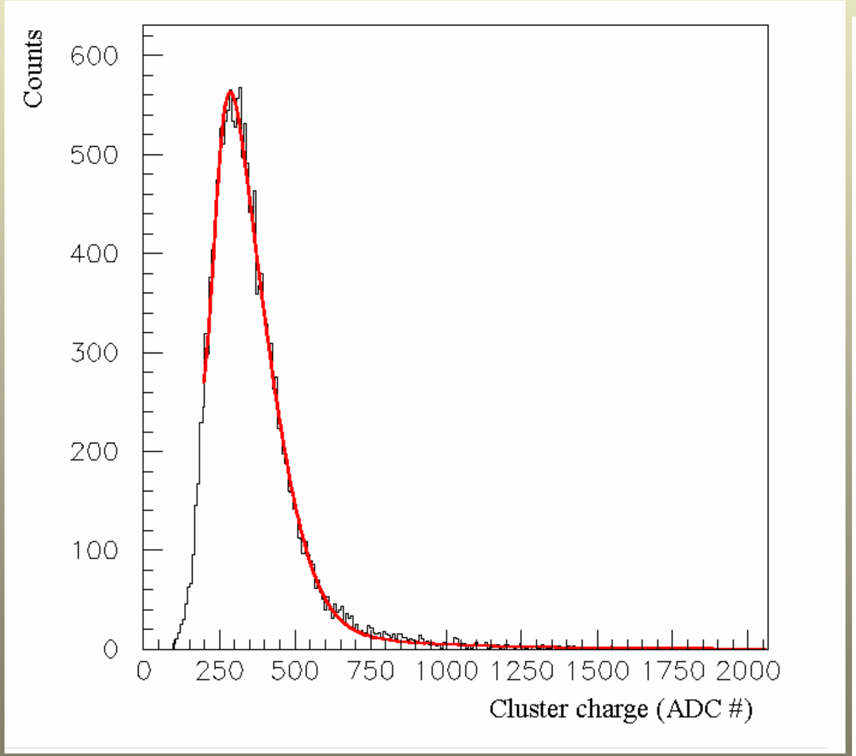
Charge collection behaviours

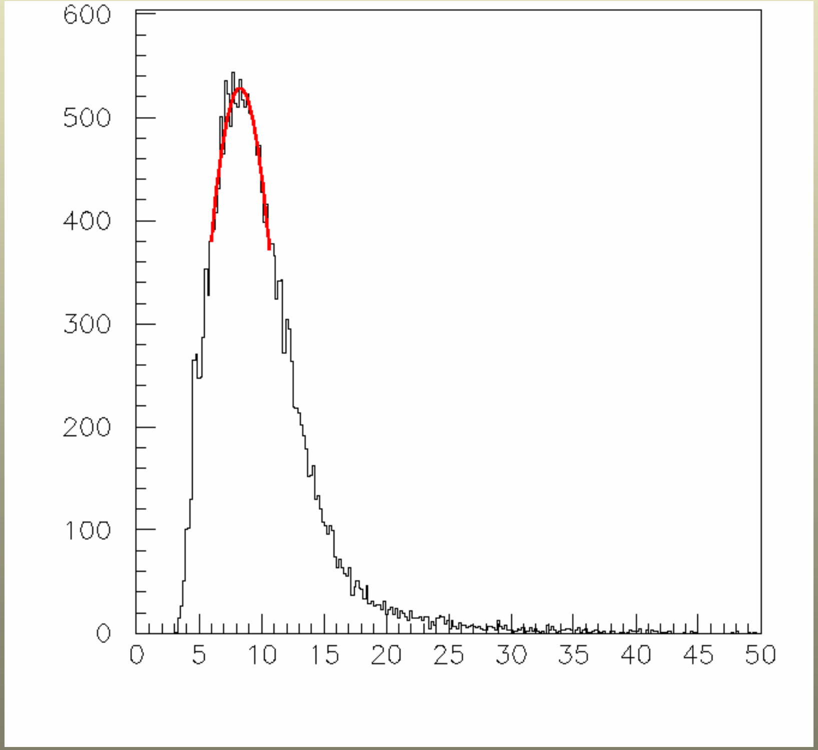
Signal after 3. 10^{15} p cm^{-2} (700 V)



Charge collection behaviours

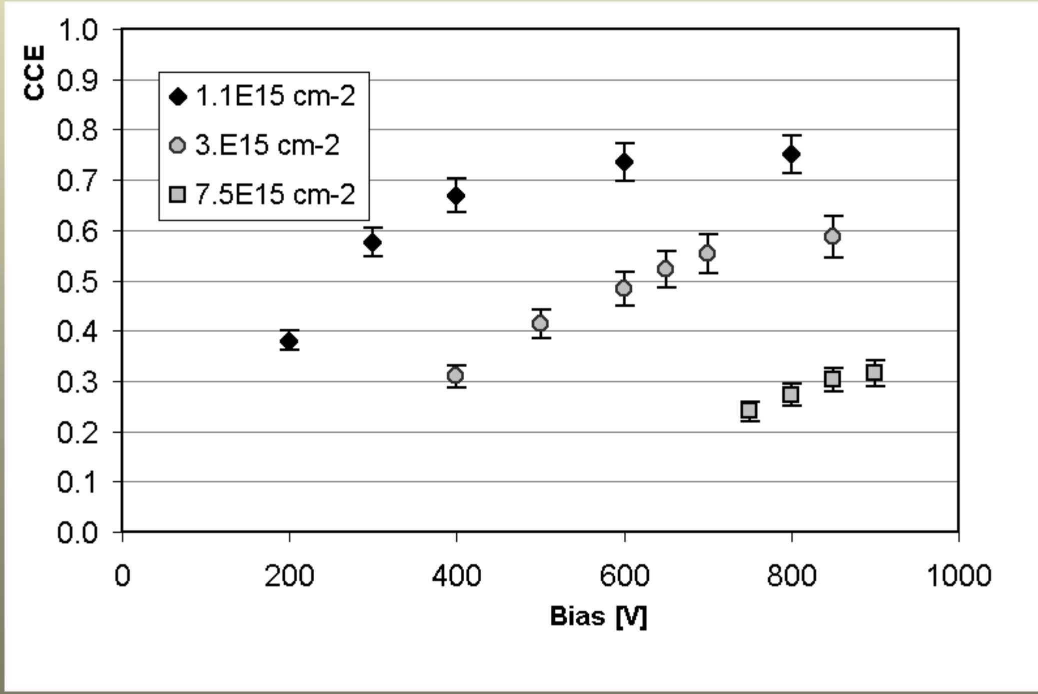
Signal and cluster significance after 7.5 10^{15} p cm^{-2} (900 V)





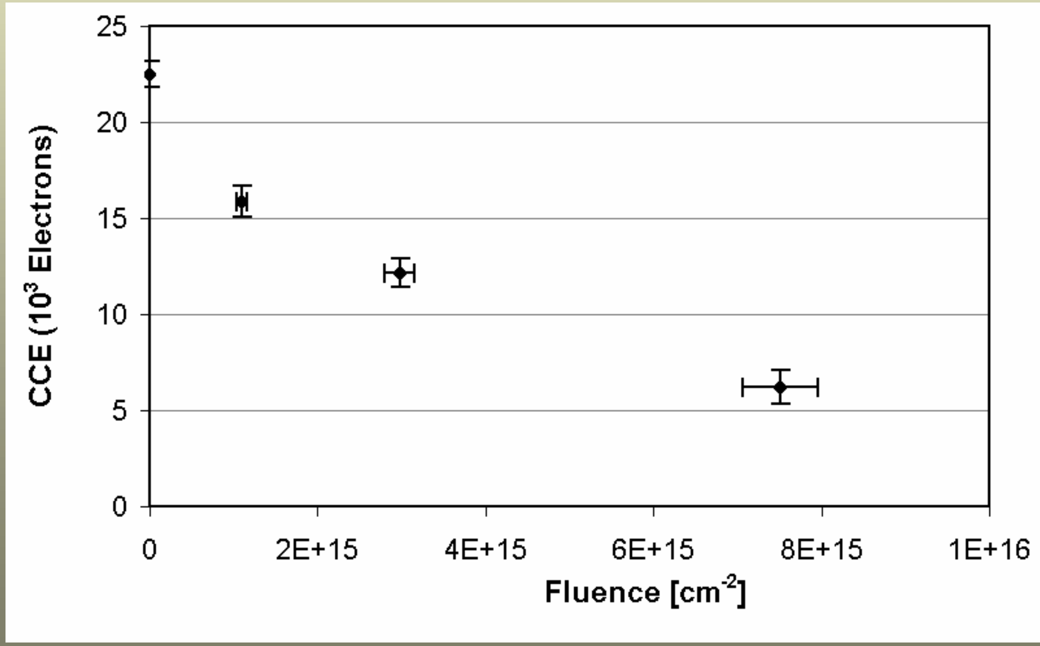
Charge collection behaviours

CCE(V) vs applied bias voltage, normalised to the pre-irradiation value, of n-in-p detectors after 1.1, 3 and 7.5 10^{15} p cm^{-2}. The detector irradiated to 3. 10^{15} cm^{-2} is standard p-type substrate, while the other devices are oxygen-enriched.



Charge collection behaviours

Degradation of the collected charge as a function of the irradiation fluence for n-in-p microstrip detectors. The applied voltages are 800, 800 and 900 volts for the three different irradiation fluences, respectively.



Comments:

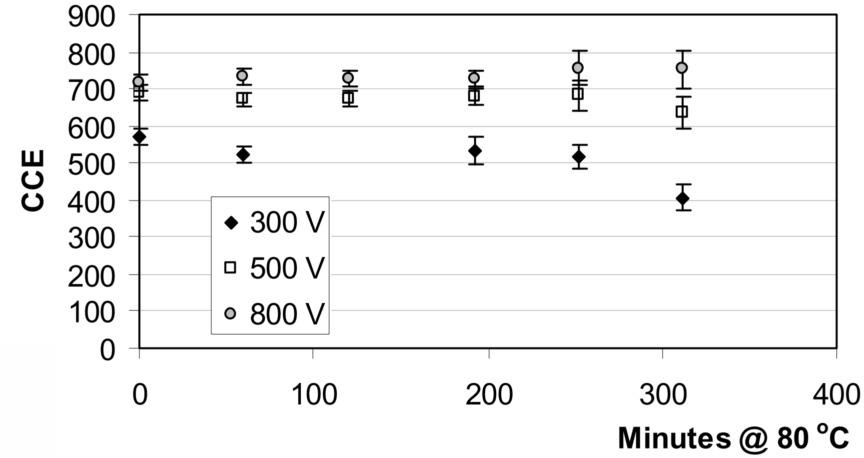
p-type substrates have been successfully used to produce miniature microstrip detectors which were able to operate adequately for use as tracking detectors after doses of up to 7.5 10^{15} p cm^{-2}. The noise is not affected by applied voltage and dose (with LHC speed electronics).

The detectors, operated at low temperature (-20^{o}C) could stand bias voltages up to 900V.

The collected charge even after the higher dose is sufficient to efficient tracking in HEP experiments.

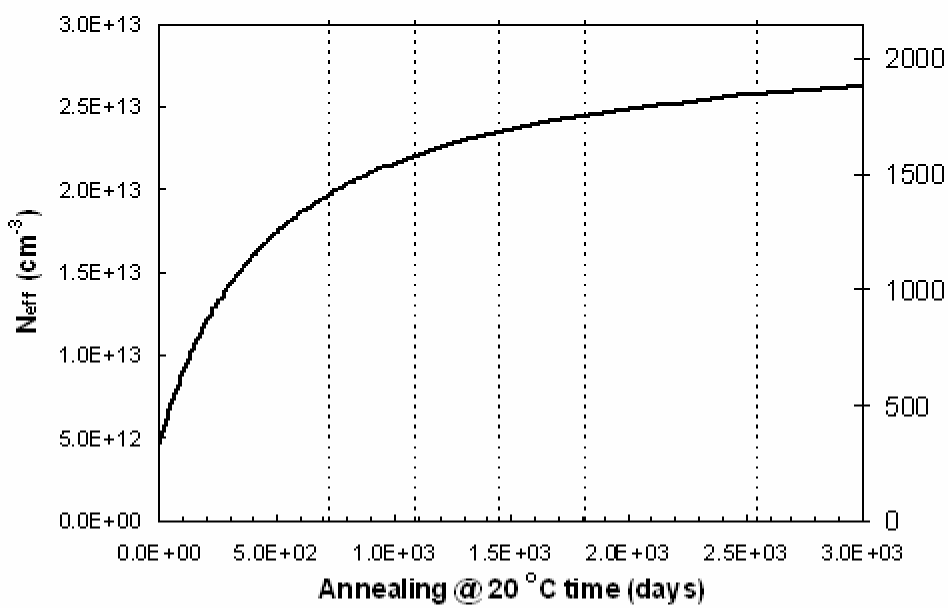
Annealing behaviours

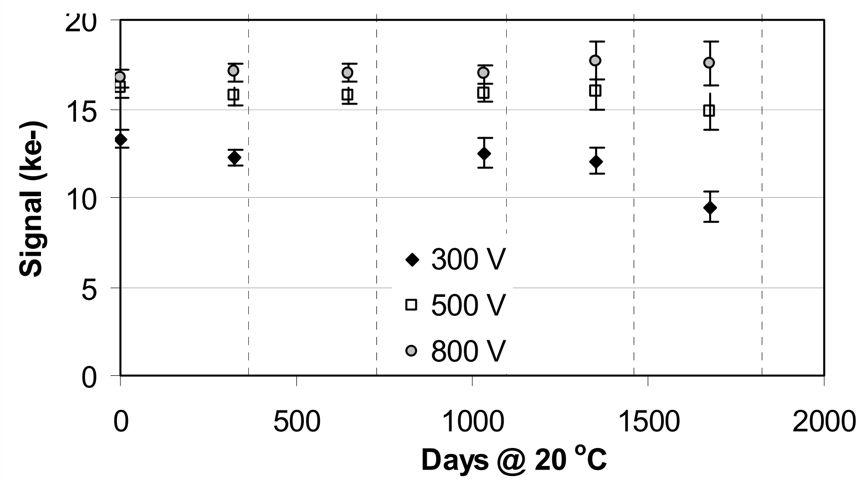
P-type detector irradiated to 1.1 10^{15} p cm^{-2}



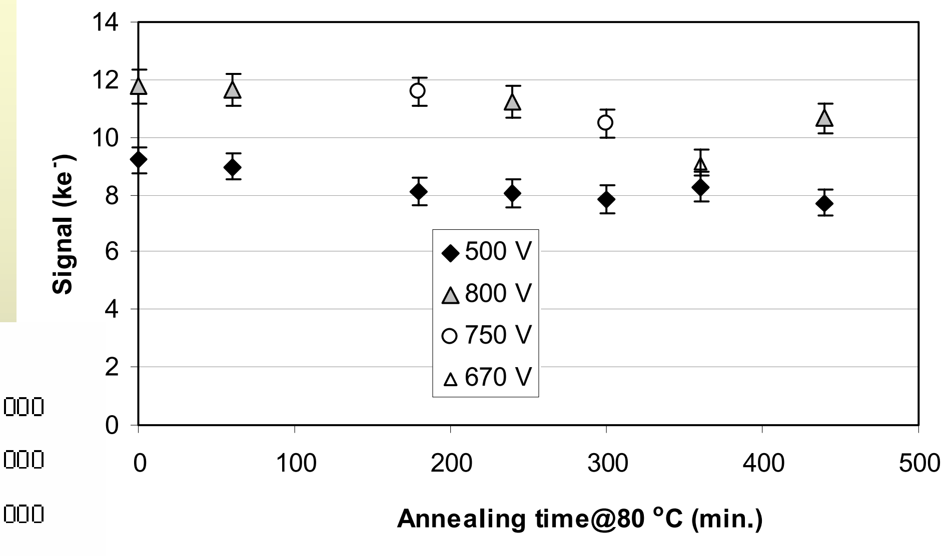
Initial V_{FD} ~ 420V

Final V_{FD} ~ 1900V



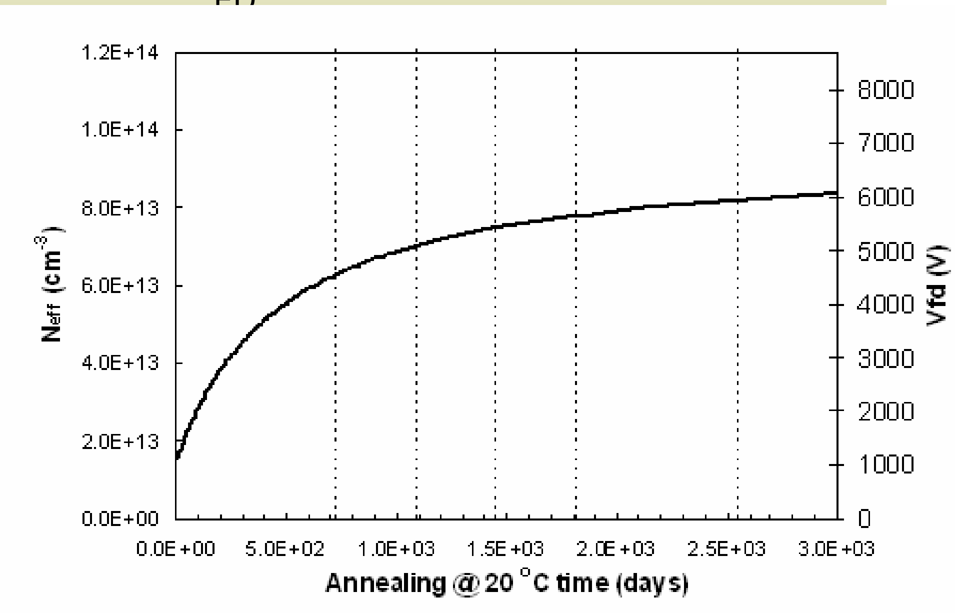


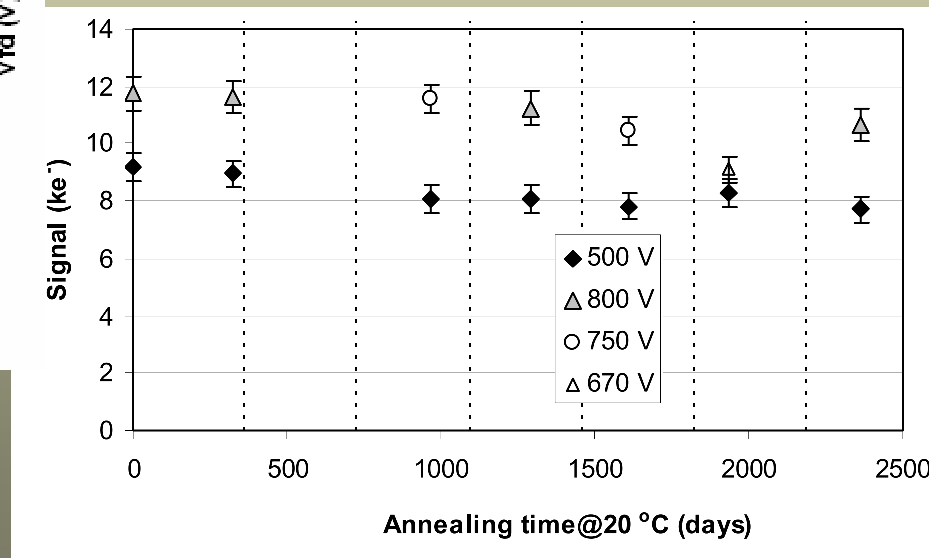
Annealing behaviours
P-type detector irradiated to 3.5 10^{15} p cm^{-2}



Initial V_{FD} ~ 1300V

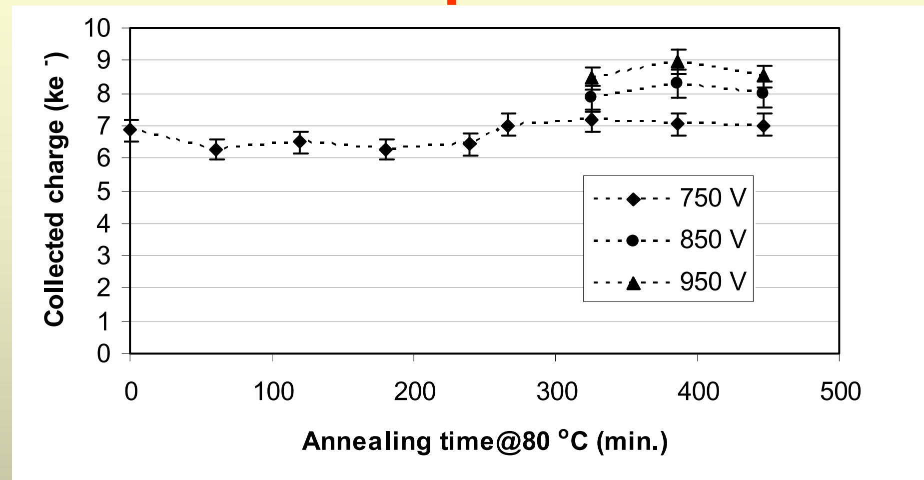
Final V_{FD} ~ 6000V



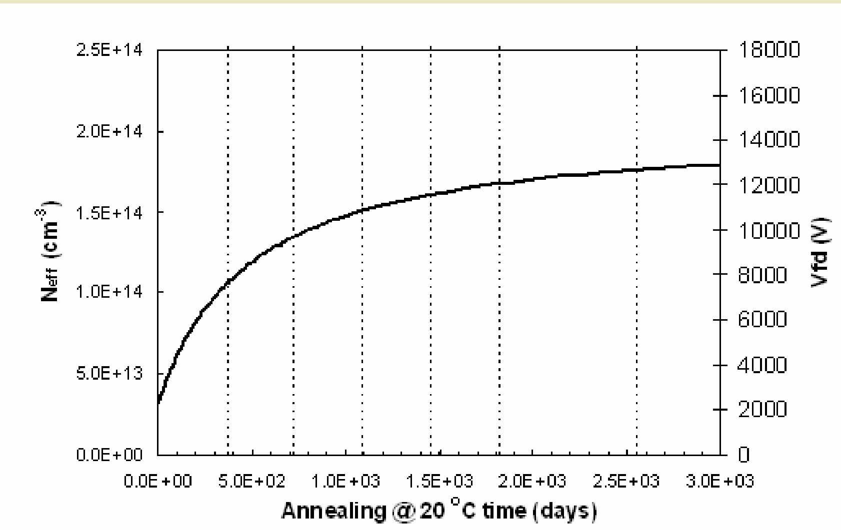


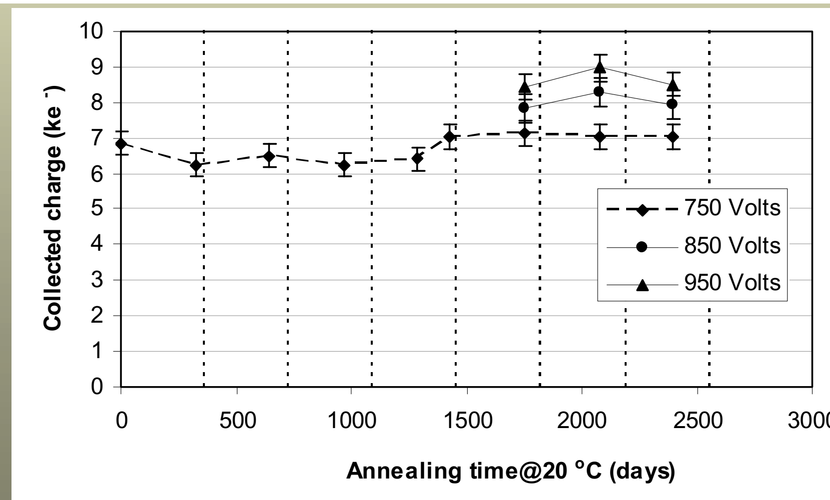
Annealing behaviours

P-type detector irradiated to 7.5 10^{15} p cm^{-2}



Initial V_{FD} ~ 2800V





Predictions from RD48 parameters for Oxygen enriched devices (best scenario: after 7 RT annealing years the V_{fd} goes from ~2800V to ~12000 V!

Comments:

It is noticeable that for the three different fluences, and at all voltages (even at the lowest voltage measured, namely 300 V after 1.1 10^{15} cm^{-2}, and 500 V after 3.5 and 7.5 10^{15} cm^{-2}), the collected charge doesn't decrease sensitively up to an entire year at R.T. This allows an easy maintenance schedule throughout the all experimental lifetime of the detector in sLHC experiments. The decrease of the CCE is observed only for the lower voltages after a few years at R.T. Basically, given the necessity of providing high voltages for the operation of silicon microstrip detectors in a sLHC-like environment, the annealing effects can be neglected. It must be stressed that the detector cooling during operation is necessary (the detectors must be kept at temperature safely below the thermal run-away limit) to be able to apply the required high voltage.