Preliminary Evaluation of the Maximum Electric Field on Implants of Silicon Detectors

(T. Ohsugi, 4/25/2000)

The maximum electric field strength was simulated for a few detector geometries which are being explored for GLAST. The issue is the increase of the field at the corner of the implant for detectors with wide gaps: “all” field lines from the gap converge at the outer edge of the implants and increase the field. This could cause micro-discharge. The detectors from the BTEM and GLAST99 series with 50micron implant and close to 200micron pitch seem to be robust. In Figure 1, the relative maximum field is shown for pitch of 235micron and 201 micron and several implant width: as can be seen, the implant width of 64micron on 235micron pitch is equivalent to the base line of 51 micron implant on 201 micron pitch. A wild guess was made by HS as to how the 282 pitch line might look like, leading to an acceptable implant width of 100micron.

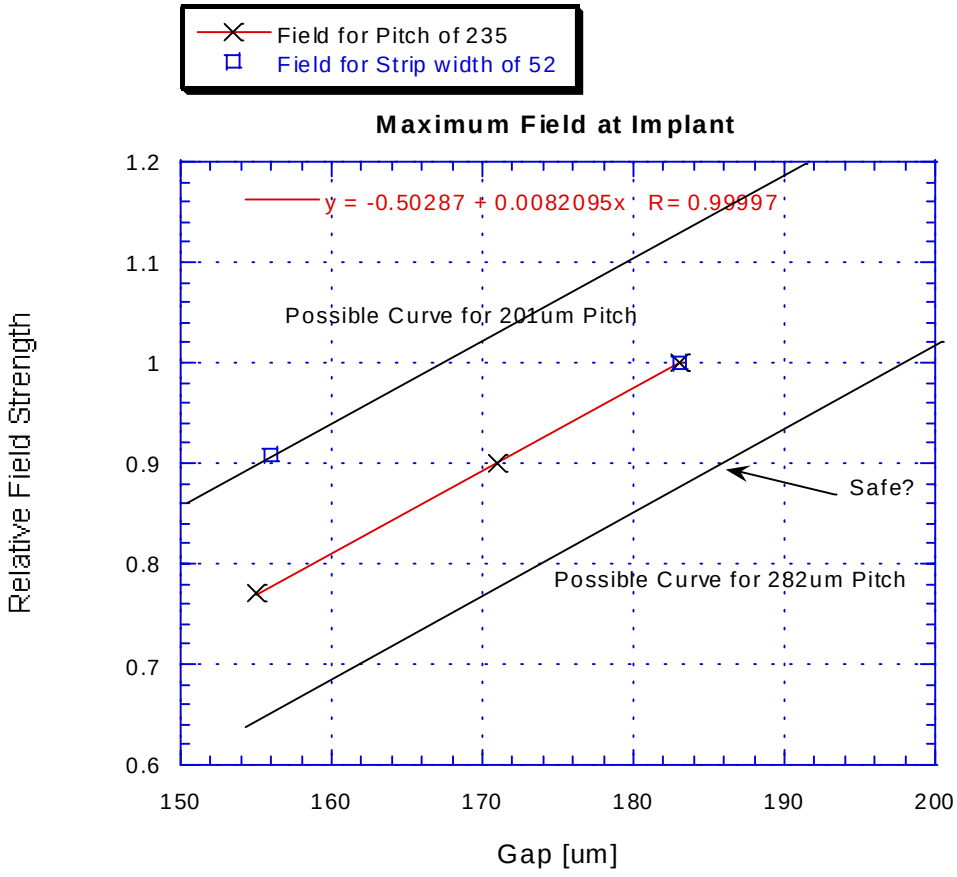

Figure 1: Relative maximum field strength at the implants as a function of the gap.

Note that CMS has found no problem with micro-discharge up to a bias voltage of 400V, when the detector were conditioned carefully, even for detectors with much smaller implants. It is not clear that that could be done in orbit. We need to test detectors in vacuum asap.

Maximum Field strength at the Implants

(Ohsugi et al [Hiroshima Univ.], April 24,2000),
(Piemonte et al [INFN Trieste], May 12,2000)

1) Constant pitch 235micron, vary strip width 52, 64, 80 micron [HU]

2) Constant strip width 52micron, vary pitch 208 to 235micron [HU].

3) Constant strip width 50micron, vary pitch 208 to 235micron [INFN].

Plot maximum relative filed strength (Pitch, Strip Width) as a function of gap. The HU and INFN data are normalized to one independently. But they show the same approximate behavior as a function of pitch for constant implant width.