Gamma-ray Large Area Space Telescope

X-Talk in the tracker: the final answer

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Introduction

- ➢ **2 x-talk sources:**

  - ❑ **Capacitive coupling between neighboring strips (well known, expected to be ~2%, see following slide)**

  - ❑ **Pure electronic x-talk within GTFE chips (much more difficult to model)**

- ➢ **With standard ¼ MIP threshold setting, measuring a 1% effect requires 25 MIPs input charge**

  - ❑ **The internal CI circuitry allows a max of 930 mV on 46 fF (~43 fC or ~8 MIP)**

  - ❑ **The internal CI system is not suitable for this measurement**

- ➢ **Need a dedicated setup with an external probe**

Capacitive x-talk

Al strip

580 pF

p+ strip implant

0.31 pF/cm
➔ 11.2 pF

0.53 pF/cm
➔ 19.1 pF

Back
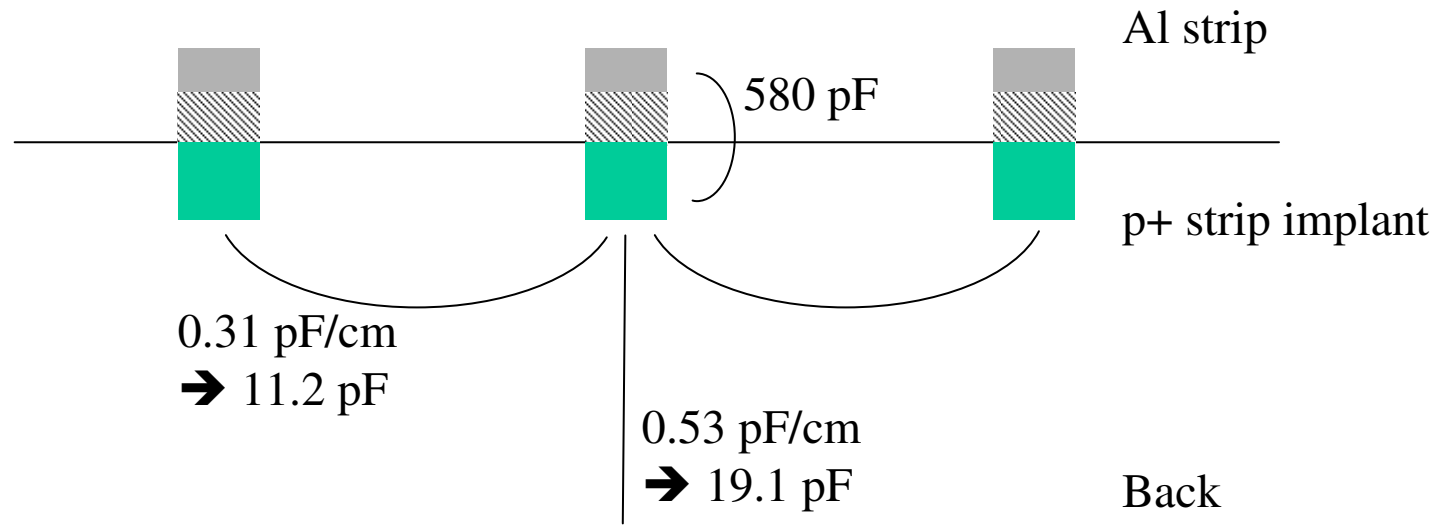
➢ **Schematic cross section of a SSD (not to scale) to show the capacitances involved**

➢ **Quoted numbers are taken from measurements performed during the construction**

➢ **Expected capacitive x-talk between two consecutive strips is of the order of 11.2/580 = 1.9 %**
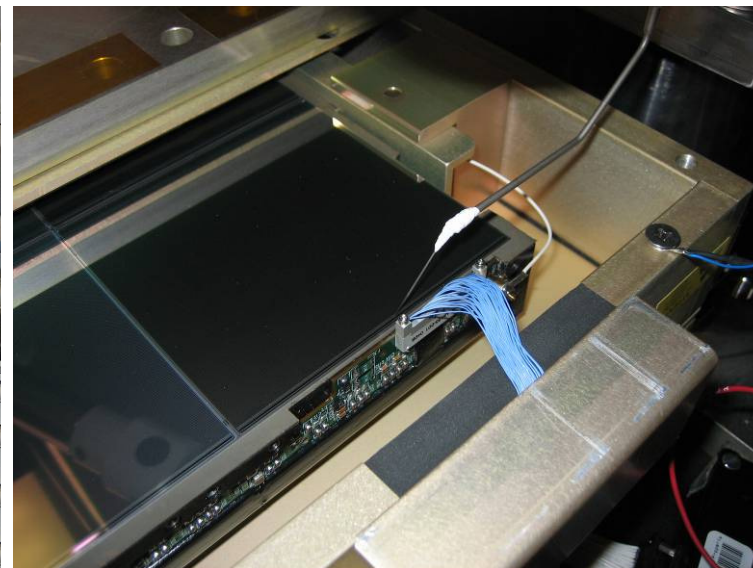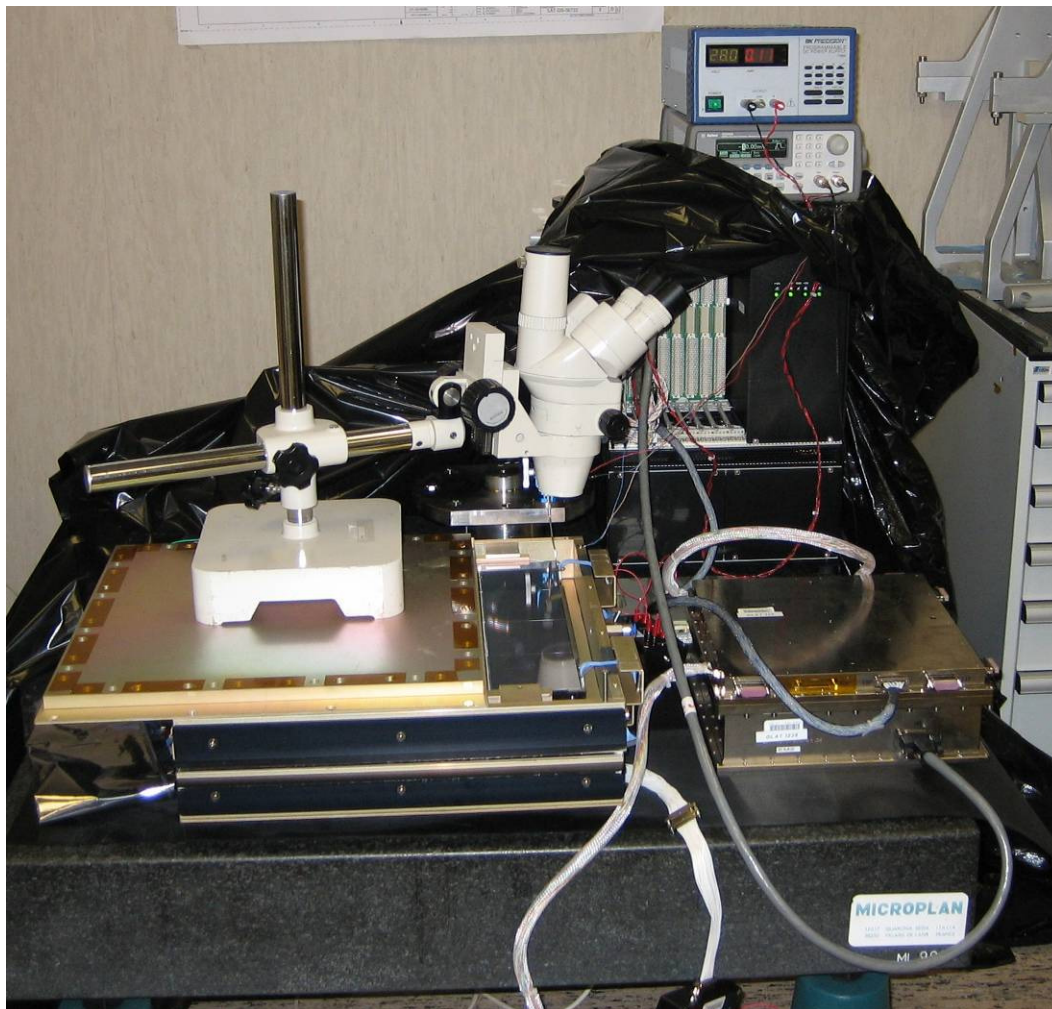
- ➢ **Test on a spare tray**
- ➢ **2.2 pF calibration capacitor connected to a pulse generator (22 fC @ 10 mV)**
  - ❑ **Readout on external trigger**
- ➢ **Probe connected to the DC pad of a strip on a SSD**
  - ❑ **Close to the GTFE center**
- ➢ **We measure the average hit multiplicity as a function of the pulse height**
- ➢ **Threshold = 30 DAC (~1.395 fC)**
- ➢ **Similar setup with single MCM to measure "Electronic" component only**

Test results

Average Hit Multiplicity
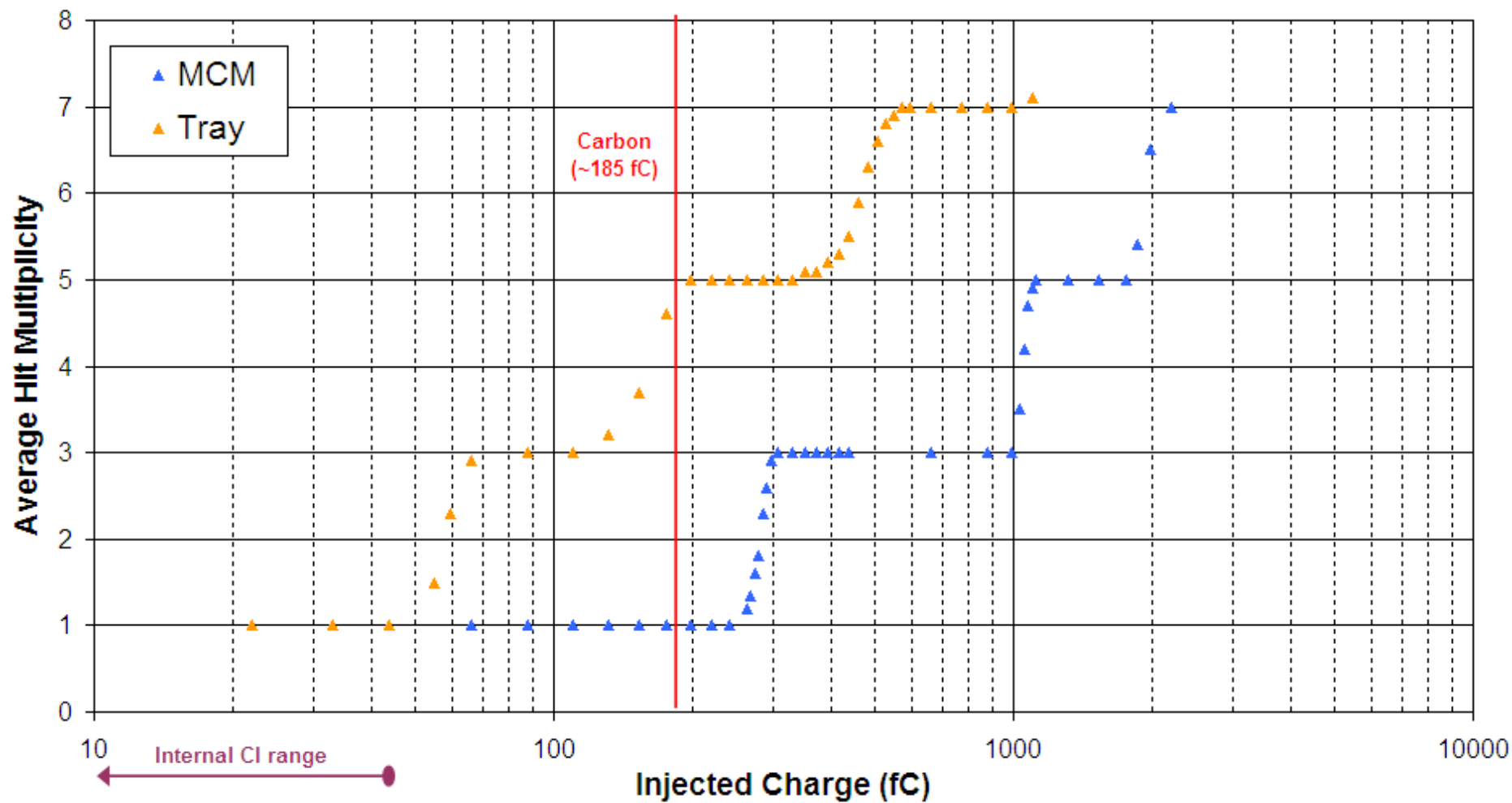
Test results II

➢ **Transitions from 1 strip to 3, 5, 7 strips are clearly visible**

➢ **X-talk between the pulsed strip and the strips at ±1, ±2, ±3… pitches is measured as the ratio between the threshold and the input charge at which the average hit multiplicity is 2, 4, 6… (i.e. when the average multiplicity is 2, the signal induced on the two neighbor strips equals the threshold)**

    ❑ **The test on the MCM measures the "electronic" contribution**

    ❑ **The test on the Tray is sensitive to the whole x-talk (as in real data taking)**

Tray

Strip position	x-talk (%)
± 1	2.4
± 2	0.9
± 3	0.3

MCM

Strip position	x-talk (%)
± 1	0.5
± 2	0.1
± 3	0.07

Conclusions

➢ **The estimation of the capacitive x-talk (Tray - MCM) is consistent with the naive model (2.4 – 0.5 = 1.9)**

➢ **The effect is too small to explain the excess of TKR hits in the beam test data**

➢ **Not sure it is worth to include this effect in the simulation**

  ❑ **In this case we would probably need measurements on a larger sample:**

   • **Repeat the measurement on other strips**

   • **Repeat the measurement across two GTFEs**