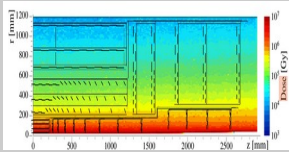


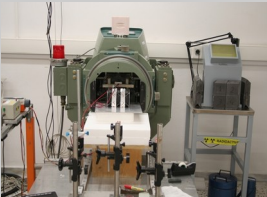
Study of p-type silicon MOS, GCD and FET structures irradiated with a ⁶⁰Co gamma source at HL-LHC radiation levels and TCAD simulations.

P. Assiouras, I. Kazas, A. Kyriakis, D. Loukas

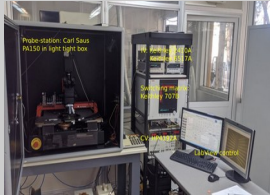
- Irradiation studies with C-60 gamma photons (~ 100 kGy). Comparable with the radiation exposure of Outer Tracker layers of ATLAS/CMS at HL-LHC.



- Picker therapy unit used as Co-60 source
 - Dose rate = 0.96 kGy/h
 - During irradiation, the samples were cooled down to (at \pm 0.5 ° C)

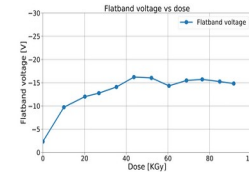
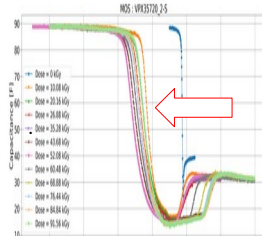


- Automatic probe station (Carl Suss PA 150) for electrical characterization of microelectronic devices
- Environmental conditions are constantly monitored:
 - Relative humidity < 30%
 - Temperature fixed at 20 ° C

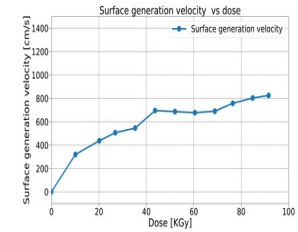
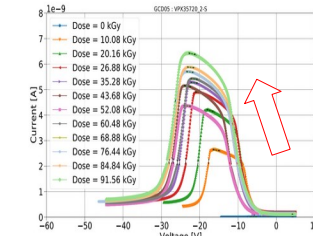


- Test structures fabricated on 6" wafers; thinned at 290 μ m produced by Hamamatsu
- Each test structure contains among others a MOS, GCD and FET
- Measurement configuration:
 - **MOS capacitor:** oscillation level = 250 mV, frequency = 10 kHz, waiting time = 0.5s
 - **GCD:** diode bias varying from -5 to -11 V, waiting time = 0.5s
 - **FET:** V_{DS} 100 mV, waiting time = 0.5s

- **MOS:** The flatband voltage ($V_{fb} \propto N_{ox}$) shifts to higher absolute values with due to the increase of the effective oxide concentration
 - Clear evidence of positive charge induced in the oxide of the MOS capacitor after exposure to gamma photons



- **GCD:** Increase of surface generation current due to radiation-induced defects in the interface
 - Surface generation velocity (S_0) and surface current (I_s) increase with total irradiation dose ($S_0 \propto D_{it-}$)



- **FET:** Shift of the slope of the IV curve
 - Threshold voltage almost stable. Good quality of channel isolation
 - Mobility degradation due to charged trapped close to the interface
 - Maximum transconductance decreased, due to reduction in mobility+++

