WG4 – INFN and University of Perugia

DRD3

· Perugia Unit:

Tommaso Croci, Alessandro Fondacci, Arianna Morozzi, Francesco Moscatelli, Daniele Passeri

• Expertise:

 Development of the combined surface and bulk "New University of Perugia" TCAD radiation damage modeling scheme for silicon detectors up to HL-LHC fluences.

 Development of ad-hoc numerical models for device-/circuit-level simulation of solid-state detectors manufactured with innovative materials.

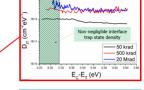
 Development of robust TCAD simulation flows for planar, 3D and LGAD-based silicon sensors → performance optimization.

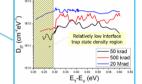
· Research interests:

- Extension of the "New University of Perugia" TCAD radiation damage modeling scheme to extreme fluences.
- Design, simulation and characterization of planar, 3D silicon sensors, (DC-)RSD LGADs and compensated LGADs.
- Innovative materials modeling and characterization: diamond, SiC, a-Si:H.

$\sqrt{\text{Surface damage (+ Q}_{OX})}$

Туре	Energy (eV)	Band width (eV)	Conc. (cm ⁻²)
Acceptor	$E_C \le E_T \le E_C$ -0.56	0.56	$D_{IT} = D_{IT}(\Phi)$
Donor	$E_V \le E_T \le E_V + 0.6$	0.60	$D_{IT} = D_{IT}(\Phi)$





√ Bulk damage

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•		Donor	E _C - 0.23	0.006		10-14	2.3×10 ⁻¹⁵			
	1e-2	Acceptor	F _c - 0.42	1.6	1×1	LO ⁻¹⁵	1×10 ⁻¹⁴			
	1е-3			•••	7×1	LO ⁻¹⁴	7×10 ⁻¹³			
	€ 1e-4 1e-5				XY cut			I		
) le-6									
	Signal Current (A) 1e-2 (A) 1e-8 (A) 1e-8 (A) 1e-9 (A) 1e	— Not Irr.					2		Р	
	Te le-8	$\begin{split} & \longrightarrow \varphi = 2.0e{+}14 \; n_{eq}/cm^2 \; (Sim.) \\ & \longrightarrow \varphi = 1.5e{+}15 \; n_{eg}/cm^2 \; (Sim.) \\ & \longrightarrow \varphi = 1.0e{+}16 \; n_{eg}/cm^2 \; (Sim.) \\ & \times \; \; Not \; Irr. \; (Meas.) \\ & \times \; \; \varphi = 2.0e{+}14 \; n_{eg}/cm^2 \; (Meas.) \end{split}$			<u>a</u>		Resistive sheet (n Oxide			A
	50 1e-9 V 1e-10				xial aye					
	1е-11 ↑ф	× φ = 1.5	e+15 n _{eq} /cm ²	(Meas.)	Epitaxial (p)	Gain Layer (p ⁺)	O			
þ	1e-12 0 -	× φ = 1.0	e+16 n _{eq} /cm²	-1000		Ga	estis			
	Substrate	e Voltage (V)			-					W
þ		4			Doping Conc. (c]			
<u>'</u>		CurrentDensity 2.9 17.3	(A*cm^-2) 101.9 600	0.0		•	T _{Si}	ТОР	y z x	

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Collaborations

• HEPHY of Vienna, CERN, INFN of Torino, UniTN, FBK of Trento.

Infrastructures and equipment

- Probe station (T-controlled down to -60C up to 200°C, CV, IV up to 1 kV).
- · DLTS system setup ongoing.
- High-end computing infrastructure (3 dedicated WorkStations with ≥ 80 CPUs each)

Software

- Synopsys Sentaurus TCAD (device/circuit level simulations)
- Synopsys Front End and Verification Suite (FEV) and Analogue Simulation & Modelling Suite (ASM)