



RADSAGA

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ESR9

Predictive tools and "Radiation Hardening By Design" (RHBD) for SEU and SET in digital circuits

RADSAGA Training Workshop – March 2018

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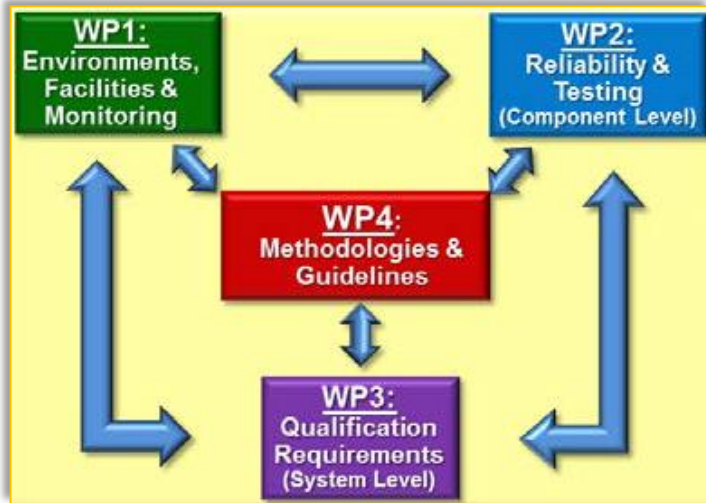
Who am I?

“*Carioca da Gema*” and Gaúcho by heart...

- BSc. in Automation Engineering, 2015
 - 1-year scholarship in Budapest, Hungary
- MSc. in Microelectronics, 2017
 - Radiation and Variability effects in FinFET based circuits



Technical Work Packages (WPs)



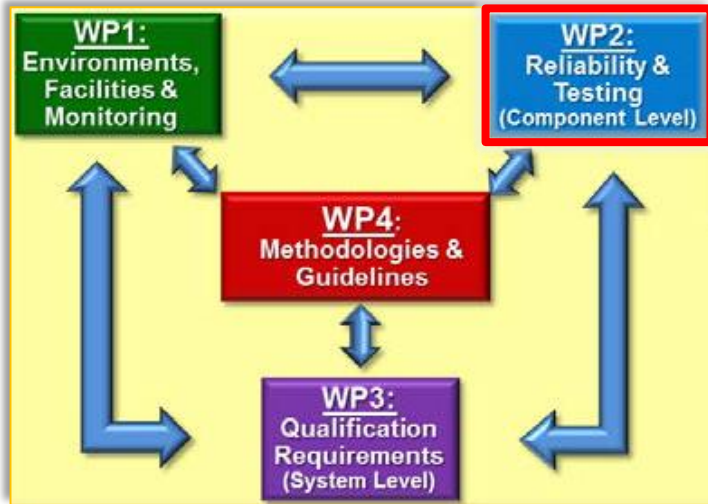
WP1:
ESR1, ESR2, ESR3, ESR4, ESR5

WP2:
ESR6, ESR7, ESR8, **ESR9**, ESR10, ESR11

WP3:
ESR12, ESR13, ESR14

WP4:
ESR15

Technical Work Packages (WPs)



State-of-the-art electronic components

- Time-based signal processing circuit
- CMOS imager
- Power device technologies

Synergetic and Coupled Effects

- Stochastic and cumulative radiation effects
- Aging effects

Predictive Tools and RHBD techniques

- Soft Errors (SET and SEU)
- Single Event Latchup

Expected Results for ESR9

- 1) A **simulation chain** including various environments building on existing methodologies and tools;
- 2) **Evaluation of the SEU cross section** for the defined technologies;
- 3) **Study, analysis and grouping of SET features** for selected CMOS transistor technologies;
- 4) Determination of **design rules** to minimize the effect of radiations.

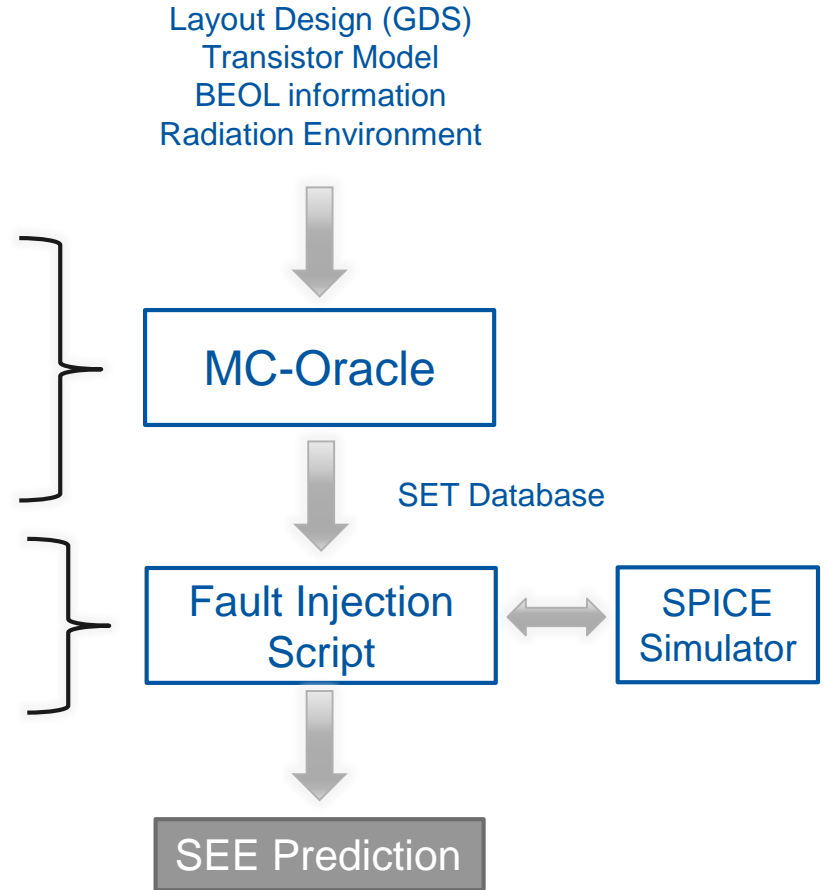
SEE Prediction

Particle Interaction Simulation:

Particle Transport
Charge Generation and Collection
-> Drift-Diffusion Model

Electrical Simulation:

Layout Effects (Parasitics Extraction)
Circuit Response Effects



Collaborative Work



ESR4:

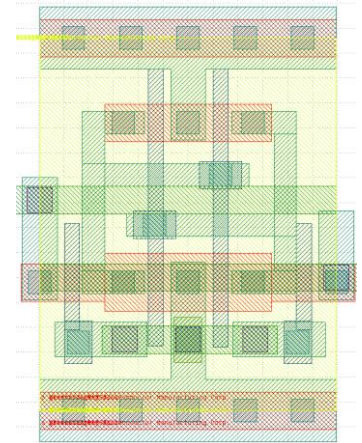
- Comparative analysis of the FLUKA and MC-Oracle tools

ESR5:

- Predict the SEU cross-section of the SRAM memory cell

ESR8:

- Address the aging mechanisms to the modeling of the prediction tool



Secondments

Aix-Marseille University, Marseille, France

- Prof. Jean-Luc Autran
- May to July of 2018 (2 months)



KU Leuven University, Leuven, Belgium

- Prof. Paul Leroux
- 2 months in 2019



CERN, Geneva, Switzerland

- Dr. Rúben Garcia Alia
- 1 month in 2019



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Thank you!

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Current Works

Analysis of the Charge Sharing effect in the SET sensitivity of bulk 45nm standard-cell layouts under heavy ions

- Submitted to ESREF2018

The Impact of Complex-logic cell layout on the SET response under heavy ions

- To be submitted to RADECS2018

Gantt Chart

	2.2017	1.2018	2.2018	1.2019	2.2019	1.2020
Literature Review	Active	Active	Completed	Completed	Completed	Completed
Simulation tools	Completed	Active	Active	Completed	Completed	Completed
Circuit Design	Completed	Active	Active	Active	Active	Completed
Methodology Development	Completed	Active	Active	Active	Completed	Completed
Radiation Testing	Completed	Completed	Completed	Active	Active	Completed
Publication	Completed	Completed	Active	Active	Active	Active
Secondments	Completed	Active	Completed	Active	Active	Completed
Thesis Writing	Completed	Completed	Completed	Active	Active	Active