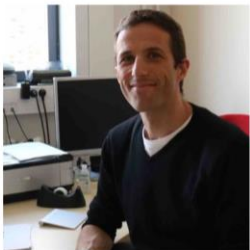# WP8: Complementary modelling tools

Frédéric Wrobel

(University of Montpellier)

WP leader

Giuseppe Lerner

(CERN)

Deputy WP leader

- ❑ **CERN**
  - • Giuseppe Lerner
  - • Ygor Aguiar
  - • Matteo Cecchetto
- ❑ **ELI**
  - • Roberto Versaci
  - • Illia Zymak
- ❑ **GSI**
  - • Marco Durante
  - • Tim Wagner
- ❑ **UM**
  - • Jérôme Boch
  - • Alain Michez
  - • Frédéric Wrobel
  - • Cleiton Marques
- ❑ **Univ. Saint Etienne**
  - • Sylvain Girard (WP5)

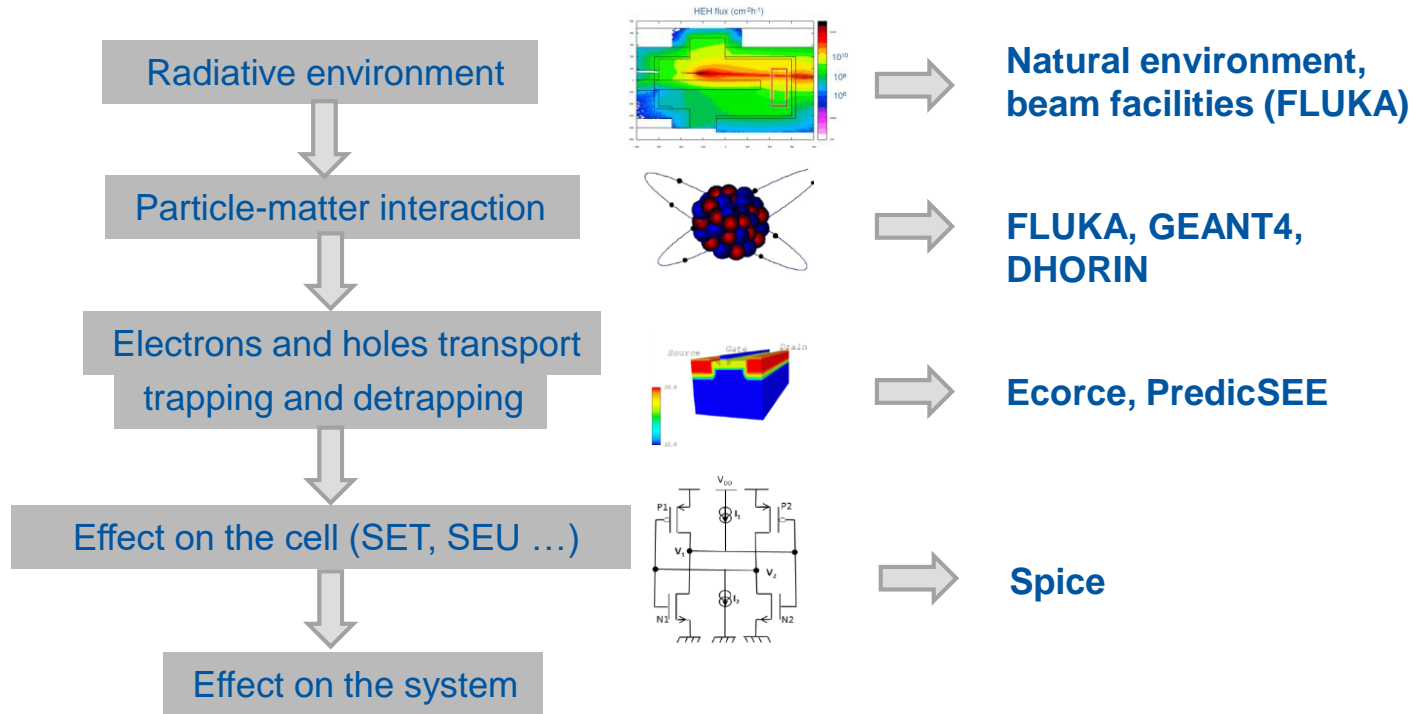GSI Helmholtzzentrum für Schwerionenforschung GmbH

Overview of the Activities

This WP will develop and apply tools and approaches for modelling radiation effects on electronics. The modelling efforts will be focused on:

- Benchmarking simulation tools to be used for SEE applications as complement to experimental data

- Establishing SEE equivalences between different radiation fields

- Providing transversal support to the RADNEXT TA and JRA activities in terms of Monte Carlo simulation studies aimed at improving the description and understanding of the radiation fields in experimental beam and facilities.

Multi-physics and multi-scale approach

Radiative environment → Natural environment, beam facilities (FLUKA)

Particle-matter interaction → FLUKA, GEANT4, DHORIN

Electrons and holes transport trapping and detrapping → Ecorce, PredicSEE

Effect on the cell (SET, SEU …) → Spice

Effect on the system

Main topic

- **Impact of low energy particles on SEU rate prediction**

- **Circuit level modelling with PredicSEE**

- **Facility/beam modelling with FLUKA/GEANT4**

- **Dose Effect/Dose rate effect with ECORCE**

- **Integration of SEE event-by-event scoring in FLUKA**
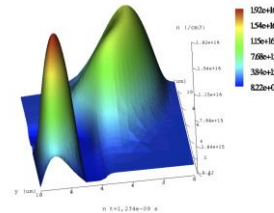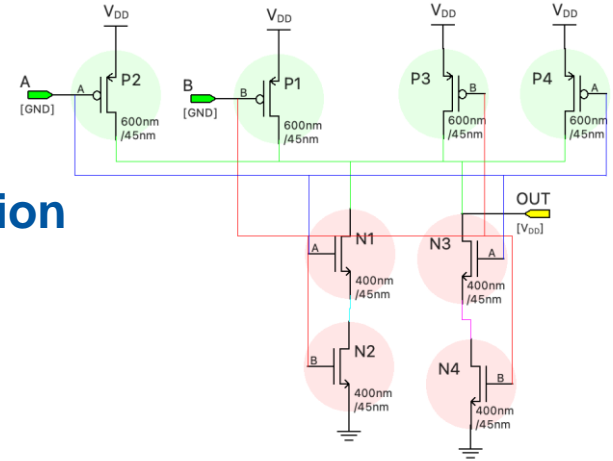
WP8: Work Package Overview

- **Task 8.1:** Coordination (UM, CERN, GSI, ELI)

- **Task 8.2:** Impact of low energy particles on SEU rate prediction (UM)

- **Task 8.3:** Circuit level modelling (UM)

- **Task 8.4:** Facility modelling (CERN, GSI, ELI)

- **Task 8.5:** Dose Effect with ECORCE (UM)

- **Task 8.6:** Integration of SEE event-by-event scoring in FLUKA (CERN)

Recruitment

- PhD student to develop the project "Impact of circuit modelling and low energy particles on Single-Event Effect rate prediction" was selected.
  - Recruitment of **Cleiton Marques**
  - Start date: january 2022

- 6 months postdoc GSI (Marco Durante) :
  - Recruitment of **Tim Wagner**
  - Post doc for 2 years (6 months for WP8)

- 6 months postdoc ELI :
  - 6months for WP8 + 6 months postdoc WP4 + 1 year ELI = 2 year postdoc
  - Illia Zymak will arrive on July 1st.

Deliverables and milestones

T0+18	déc-22	D8.1	Frederic Wrobel	+ Ygor Aguiar	+ Cleiton Marques
		M8.1	Roberto Versaci	+ All	+ Postdocs
		D8.2	Roberto Versaci	+ Jérôme Boch	+ Postdocs
T0+24	juin-23	D8.3	Frederic Wrobel	+ Ygor Aguiar	+ Cleiton Marques
T0+30	déc-23	D8.4	Frederic Wrobel	+ Ygor Aguiar	+ Cleiton Marques
		M8.2	Alain Michez	+ Jérôme Boch	
T0+36	juin-24	M8.3	Giuseppe Lerner	+ Matteo Cecchetto	
T0+42	déc-24	D8.5	Alain Michez	+ Jérôme Boch	

D8.1   **Simulation results of the importance of 1-10MeV energy range on the SER for neutrons (T0+18months)**

D8.2   **Modelling of the X-Ray generator and Co60 source (T0+18months)**

D8.3   Recommendation for simulating low energy protons (T0+24months)

D8.4   **Simulation results and report on circuit modelling (T0+30months)**

D8.5   Determination of the fitting parameters for the target device and comparison with the experimental results (T0+42months)
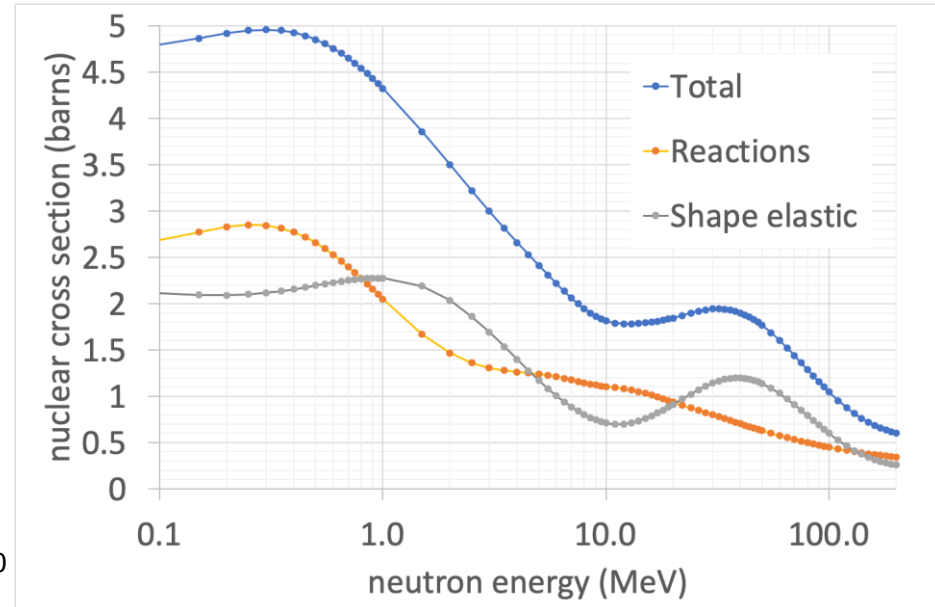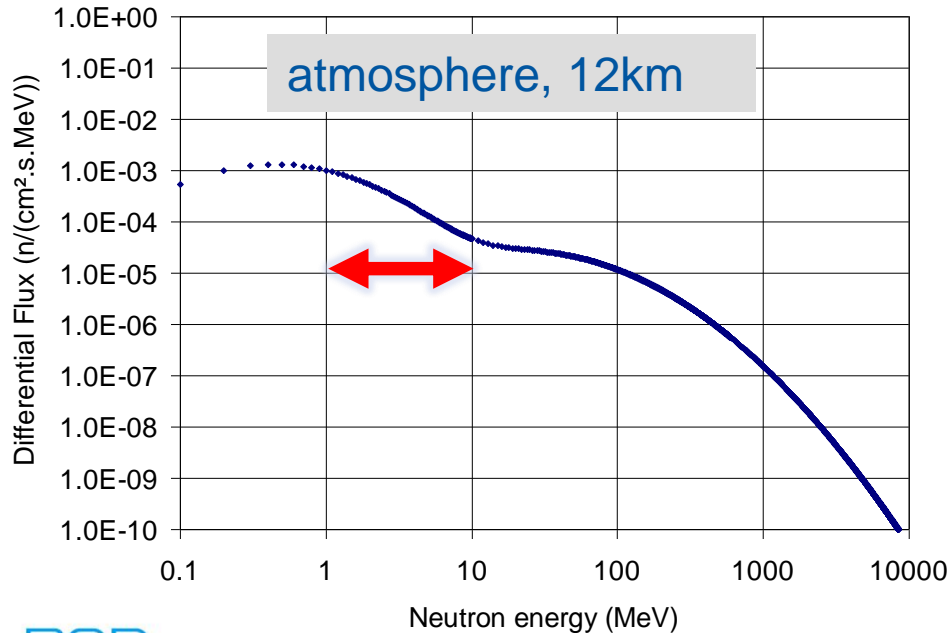
M8.1   **Facility modelling for RADNEXT experimental conditions (modelling released and simulations are running at T0+18months)**

M8.2   ECORCE evaluation (Modelling released and simulations are running at T0+30months)

M8.3   Validation of Fluka SEE module (Report including benchmark results and instructions for users at T0+36months)

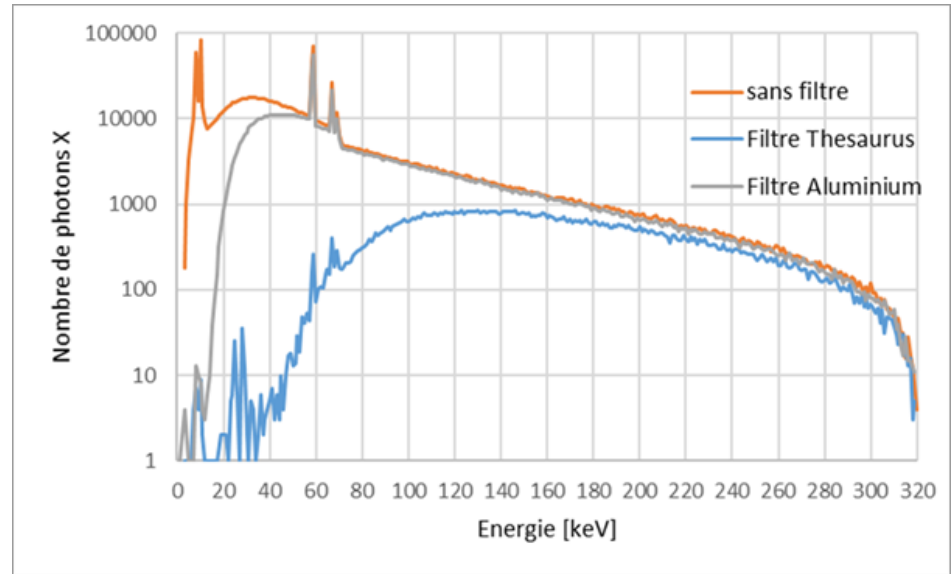# D8.1: Simulation results of the importance of 1-10MeV energy range on the SER for neutrons
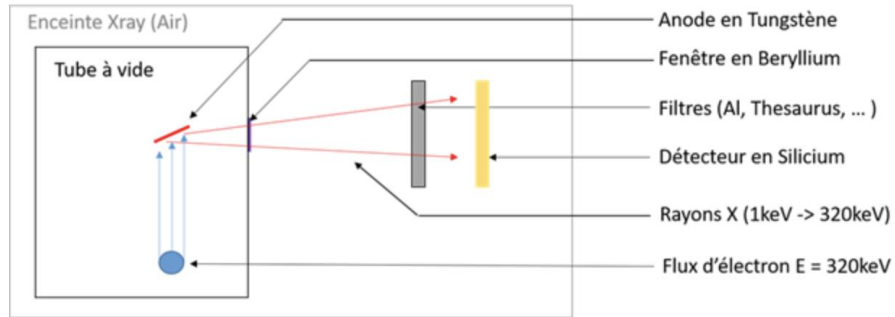
First step: nuclear cross section investigation (n-Si)

atmosphere, 12km

D8.2: Modelling of the X-Ray generator and Co60 source

- First results on the X-Ray Generator (GEANT 4 simulations)
- link with WP7

M8.1: Facility modelling for RADNEXT experimental conditions

In discussion to determine what should be:

- the facility of interest
- the main outputs.

D8.4: Simulation results and report on circuit modelling (T0+30months)

- Tools that predict SEE sensitivity need the electrical models of each component used in the circuits (SPICE).

- These models are generally difficult to obtain.

What is the impact of the model on the SEE sensitivity prediction?
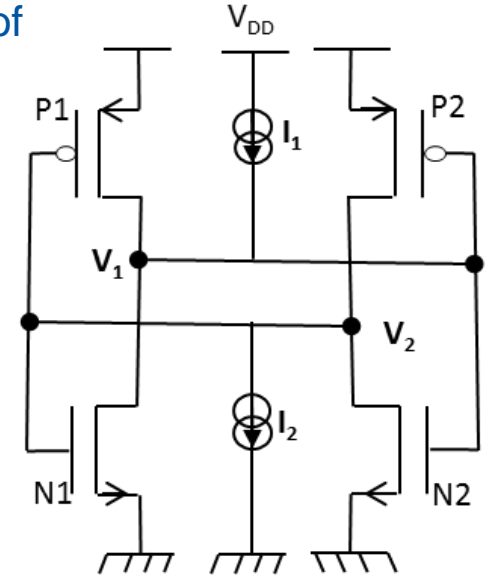
Part of Cleiton's PhD work, see next presentation.

Simulation tools and results in RADNEXT

- WP8 should be used to group simulation results:
    - facility modelling
    - nuclear cross sections
    - SEU, SER cross sections
    - Dose calculation
    - Calculation comparisons
    - ...

- WP8 should also be used to list simulation tools and ease their access
    - FLUKA
    - ECORCE
    - PredicSEE
    - G4SEE
    - SRIM
    - ...

- **To be defined: the way we share results!**

Thanks for your attention!