

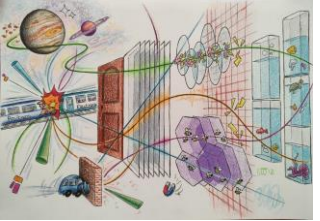


# WG 4 - simulations

## Proposal for workplan and milestones

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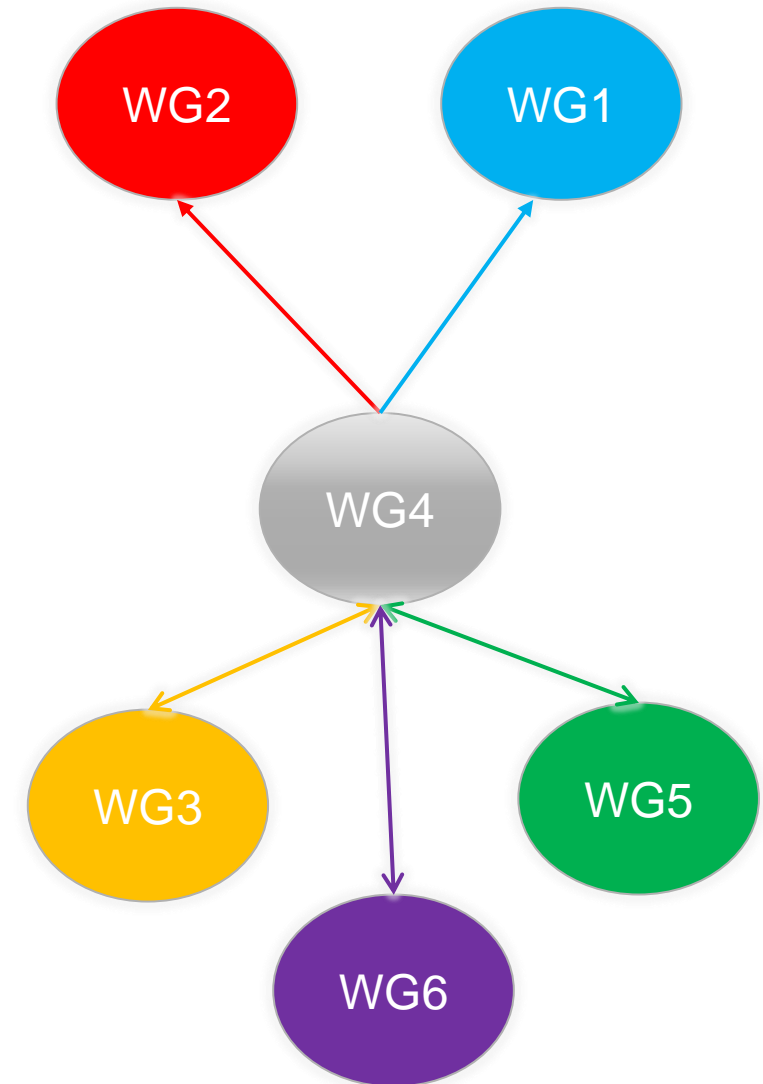
WP4 preparation/proposal group

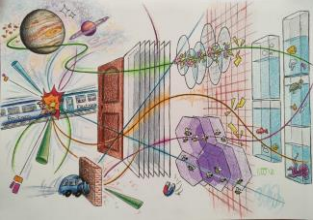


# WG 4 (part of all DRD3 themes)

# DRD3

- Simulations **are part of three/four Detector R&D Themes (DRDT)** and are essential to planning, understanding the performance and designing new devices.
- Simulations WG **will not** follow a **specific detector technology** (LGAD, CMOS, 3D...) or **performance goals** (extreme fluence, temporal and spatial resolution, rate capabilities...), but will focus on:
  - common tools (TCAD, Monte-Carlo, GEANT4 interface, digitization, ...)
  - radiation damage models based on defects (microscopically identified and effective)
  - implementation of improved parametrization of **semiconductor** (not only Silicon) properties such as impact ionization, mobility, trapping/de-trapping ... and their verification
  - Implement and verify Wide Band Gap semiconductors in TCAD and MC tools
  - outreach/dissemination activities (“Toy” simulations, TCAD training events)
- Simulation research line will therefore assist/facilitate in implementation of the above tools for specific detector technology, performance studies, verification of measurements (test beam, macroscopic damage measurements) and experiment requirements.





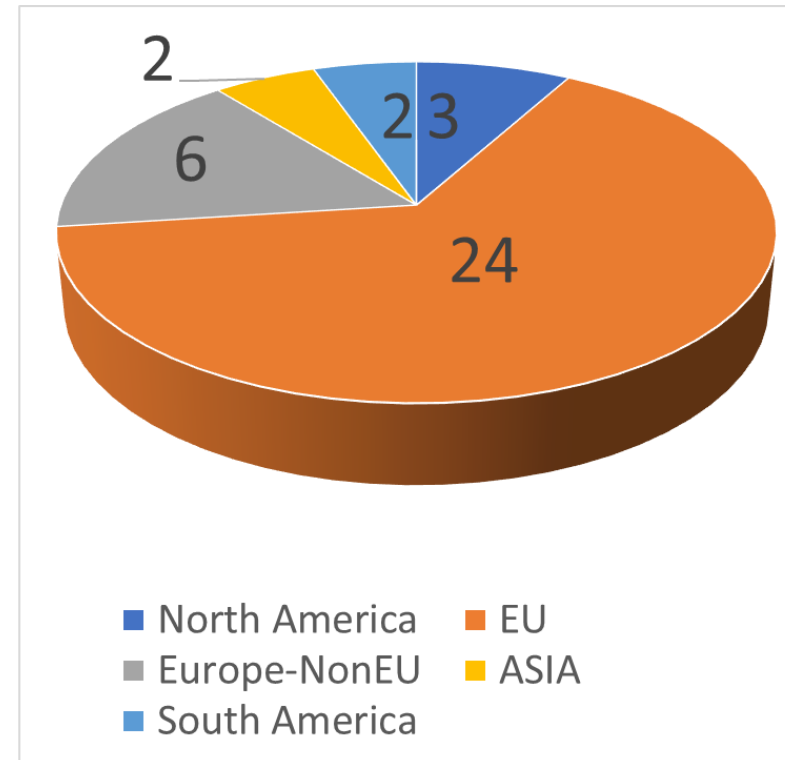
# Community composition

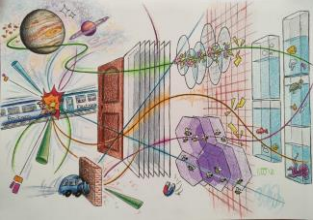
DRD3

- The feedback from simulations was good 37/89 (from a ~week ago) participating institutes expressed the interest to take part in the activities.
- WP4 will be linked to all other research topics both on input (identified defects, measured semiconductor properties) and output (response/performance of the various sensors, verification of models...)

37/89

We expect more to join - we consider that as a lower limit.

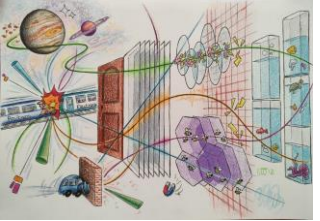




# Activities expressed by the institutes

**DRD3**

- Note, “Simulations” were not listed in the “Technological areas of interest within the DRD3 collaboration - FTE table) so the information on the FTE involvement and investments (capital and operations) is approximated from the past experience and reasonable resources needed for the planned activities.
- TCAD simulation of detector design and manufacturing (LGAD,3D,CMOS,planar) – 12 institutions
- Simulations of radiation damage creation (NIEL, Geant4) – 3 institutions
- TCAD and MC modelling of the damage – 12 institutions
  - space charge/electric field models
  - leakage current
  - trapping/de-trapping
- Simulations of detector response (incl. Electronics, Geant4) - 14 institutions
  - Test-Beam,
  - $^{90}\text{Sr}$  ion-beams
  - Transient Current Technique (SPA/TPA)
- Integration of other WBS materials in the simulation tools, TCAD & MC - 3 institutions
- Outreach: TCAD/GEANT4 training, toy simulations for student - 7 institutions



# Outline of the session

# DRD3

Verification of tools  
Implementation of radiation effects in TCAD  
Cooperation with nearing experiments  
WBS implementation

Developing common MC platform  
Implementation of adaptive fields in simulations  
Common tools (digitisation/electronics)  
WBS implementation

<b>TCAD Simulations</b> 222/R-001, CERN	<i>Marco Bomben et al.</i> 17:07 - 17:14
<b>Monte-Carlo Simulations</b> 222/R-001, CERN	<i>Simon Spannhagel et al.</i> 17:14 - 17:21
<b>Radiation damage models</b> 222/R-001, CERN	<i>Arianna Morozzi et al.</i> 17:21 - 17:28
<b>Discussion on WP4</b> 222/R-001, CERN	17:28 - 18:00

Evolution and improving the Radiation hardness models  
Implementation of radiation effects in TCAD  
Verification and benchmarking the models

- Three different talks will be given – grouped according to the purpose and tools
- These are not independent – milestones and deliveries shown are common