

Monte Carlo Simulations and Measurements with the Accelerator of the department



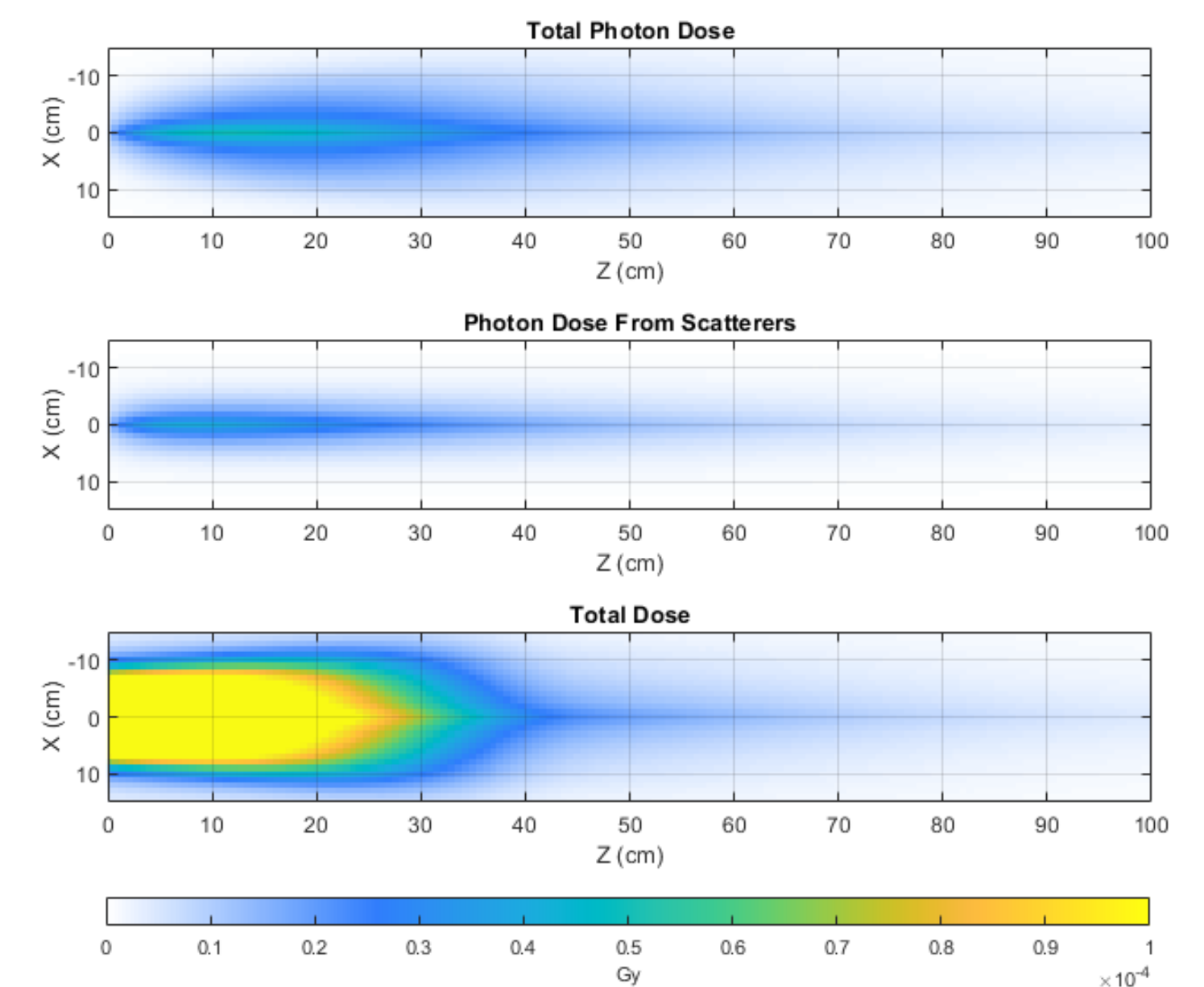
In particle physics, Monte Carlo algorithms are primarily used to estimate physical quantities during particle interactions. It is a standard approach for radioprotection studies used to estimate the energy deposition in different materials.



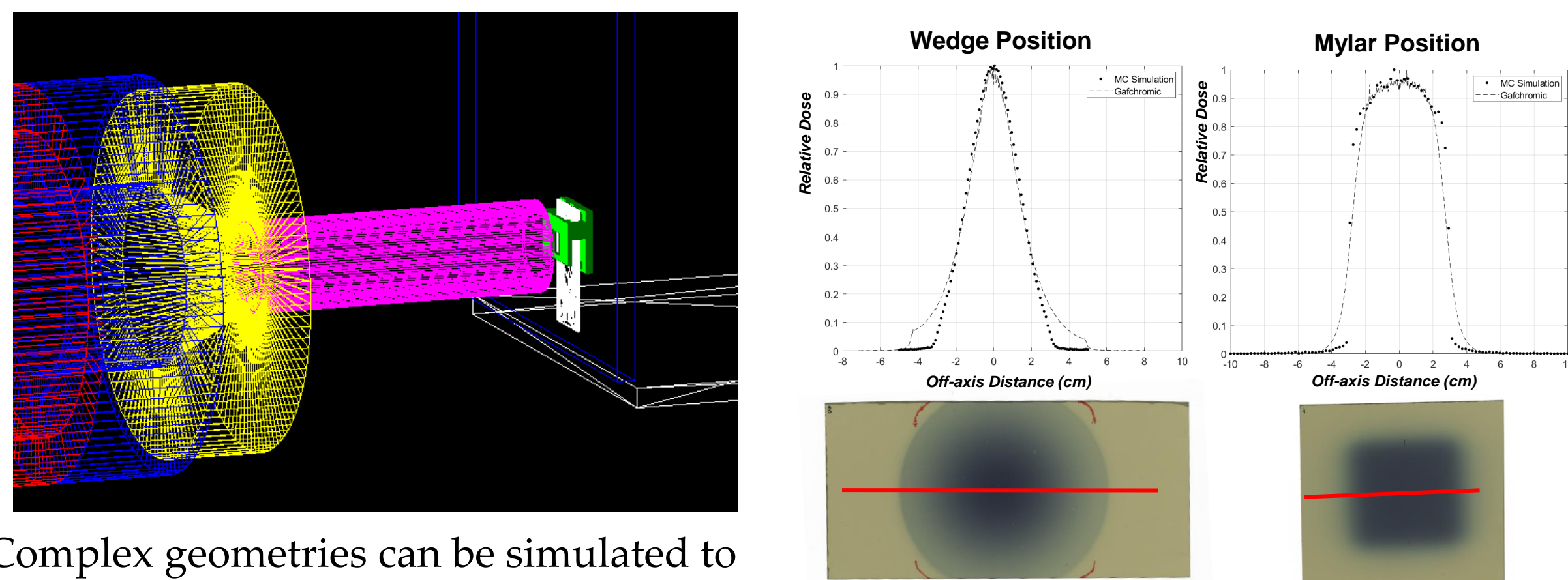
Geant4 libraries are based on validated data of particle cross-sections for a wide range of energies and allow to study the biological damage on both macro and micro scales. At the molecular level these algorithms can quantify radicals or single and double-strand breaks of the DNA.



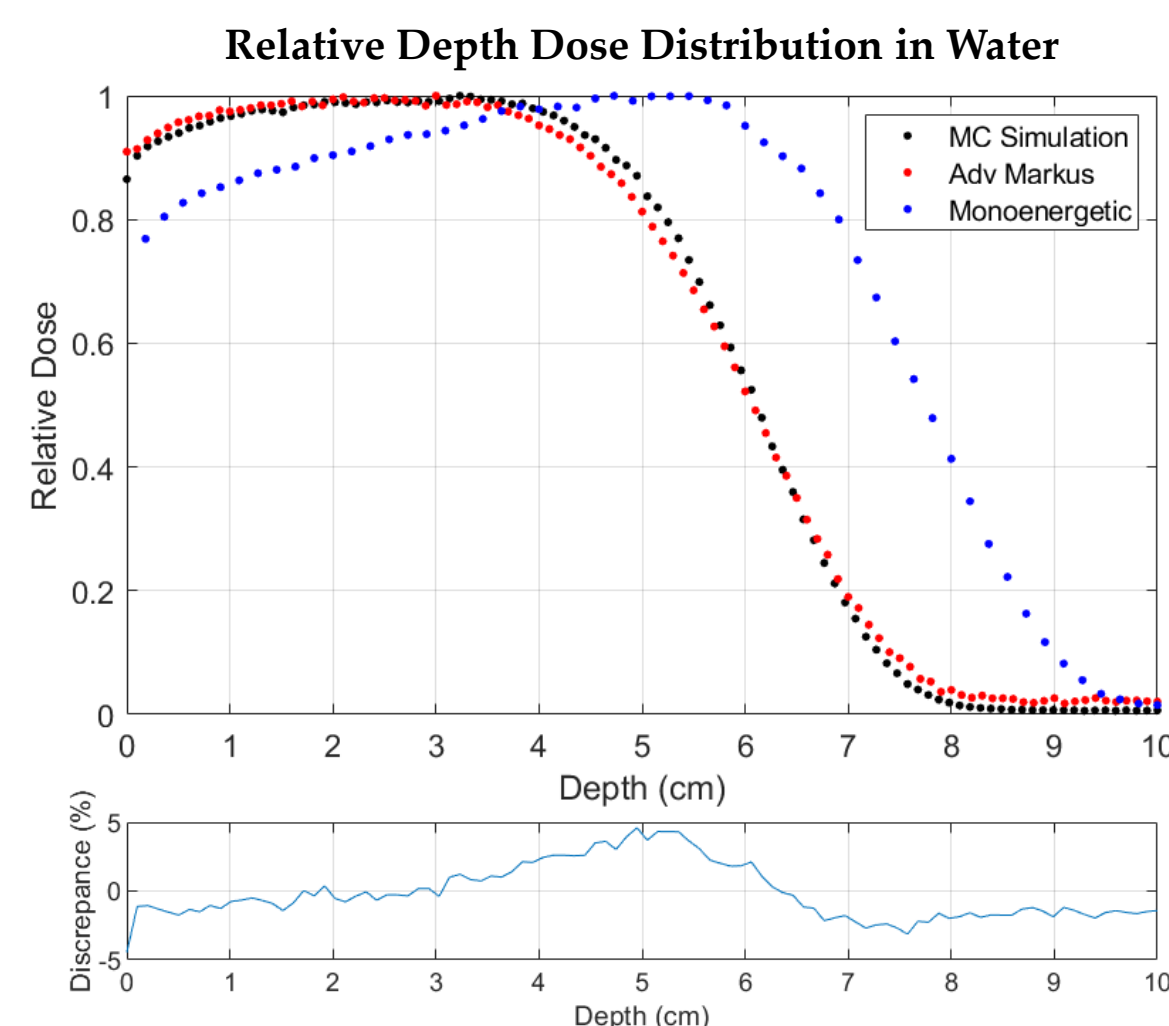
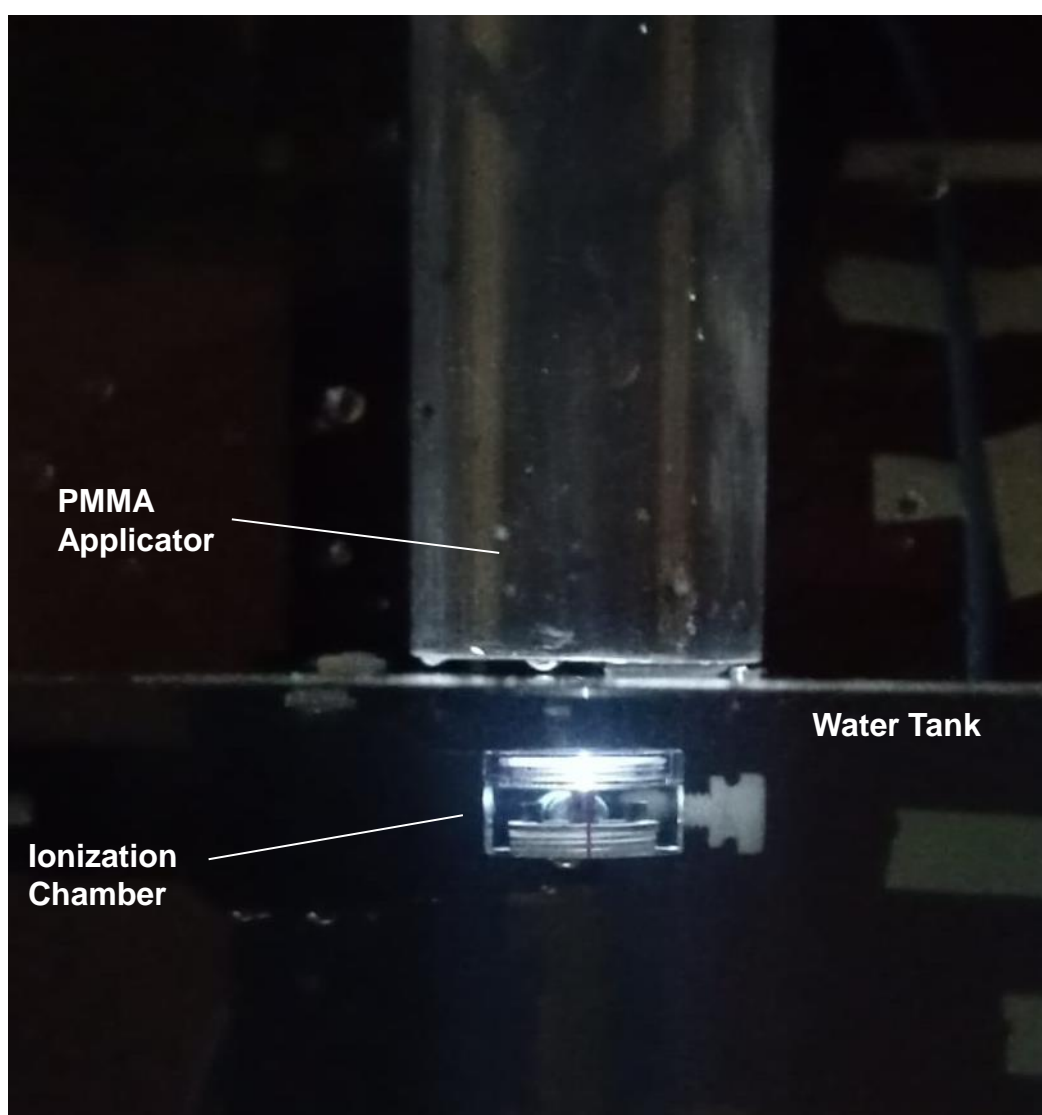
TOPAS MC wraps and extends the Geant4 libraries and has been designed for medical physics applications to produce fast results by a broad spectrum of users, from clinicians to researchers. It is the primary tool used by researchers in medical accelerator facilities. Similarly, AllPix Squared toolkit can be used to track the deposited charges inside silicon sensors by taking into account charge carriers mobility and diffusion models



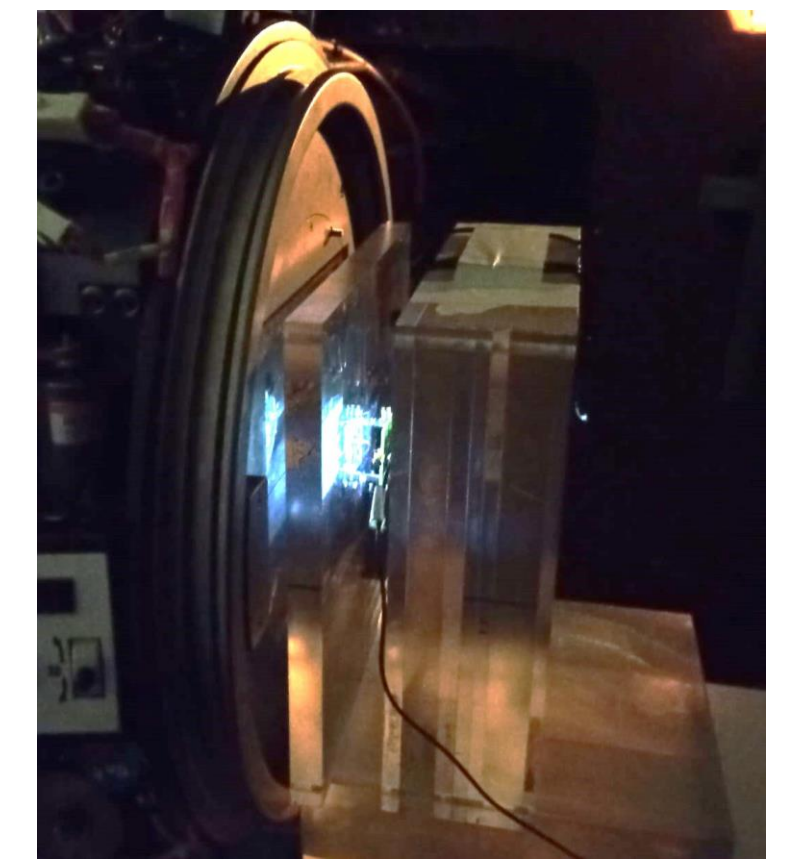
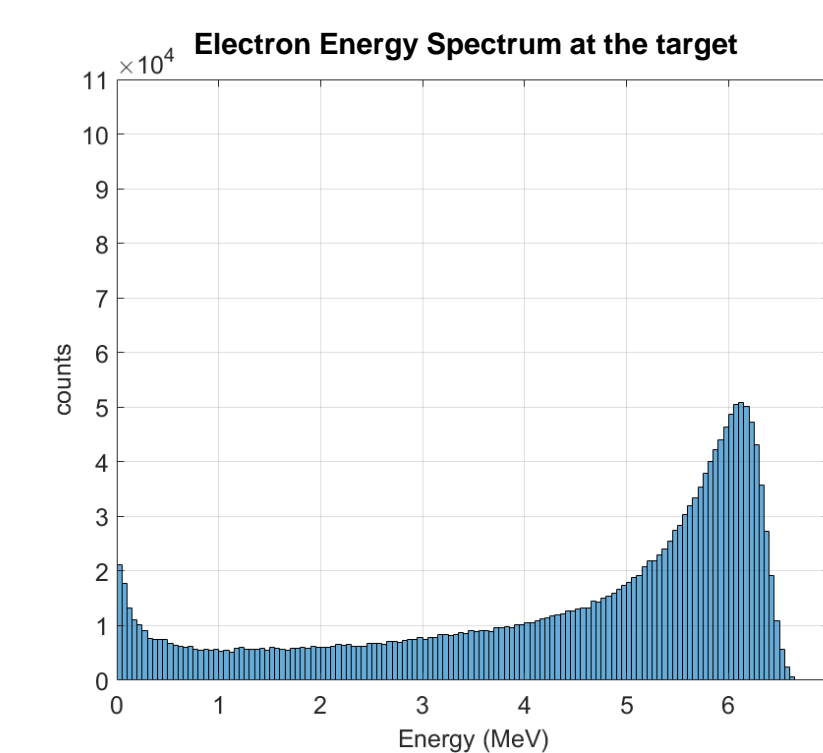
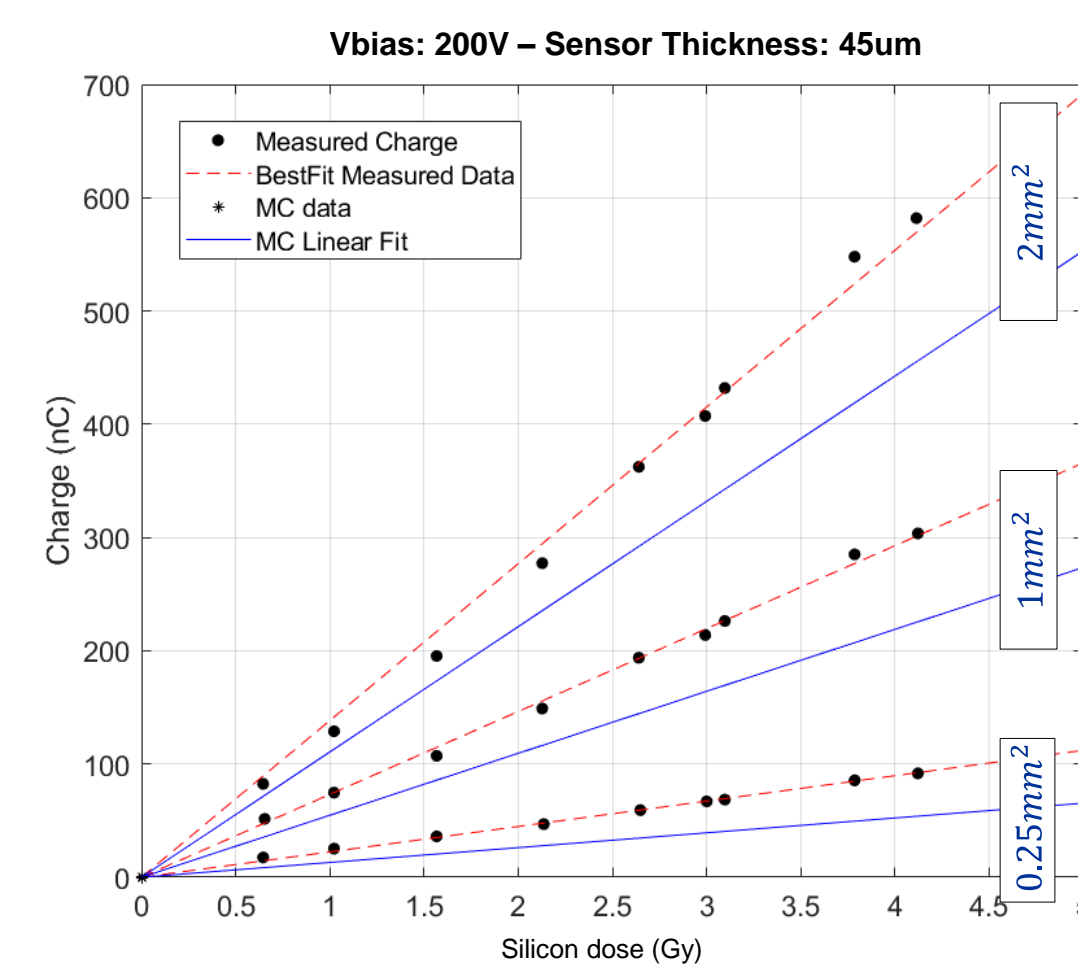
Comparison of dose profiles for electrons of 10 MeV



Complex geometries can be simulated to quantify the contribution to the dose of different objects in an experimental setup



Simulated Deposited Charge in Silicon Sensor

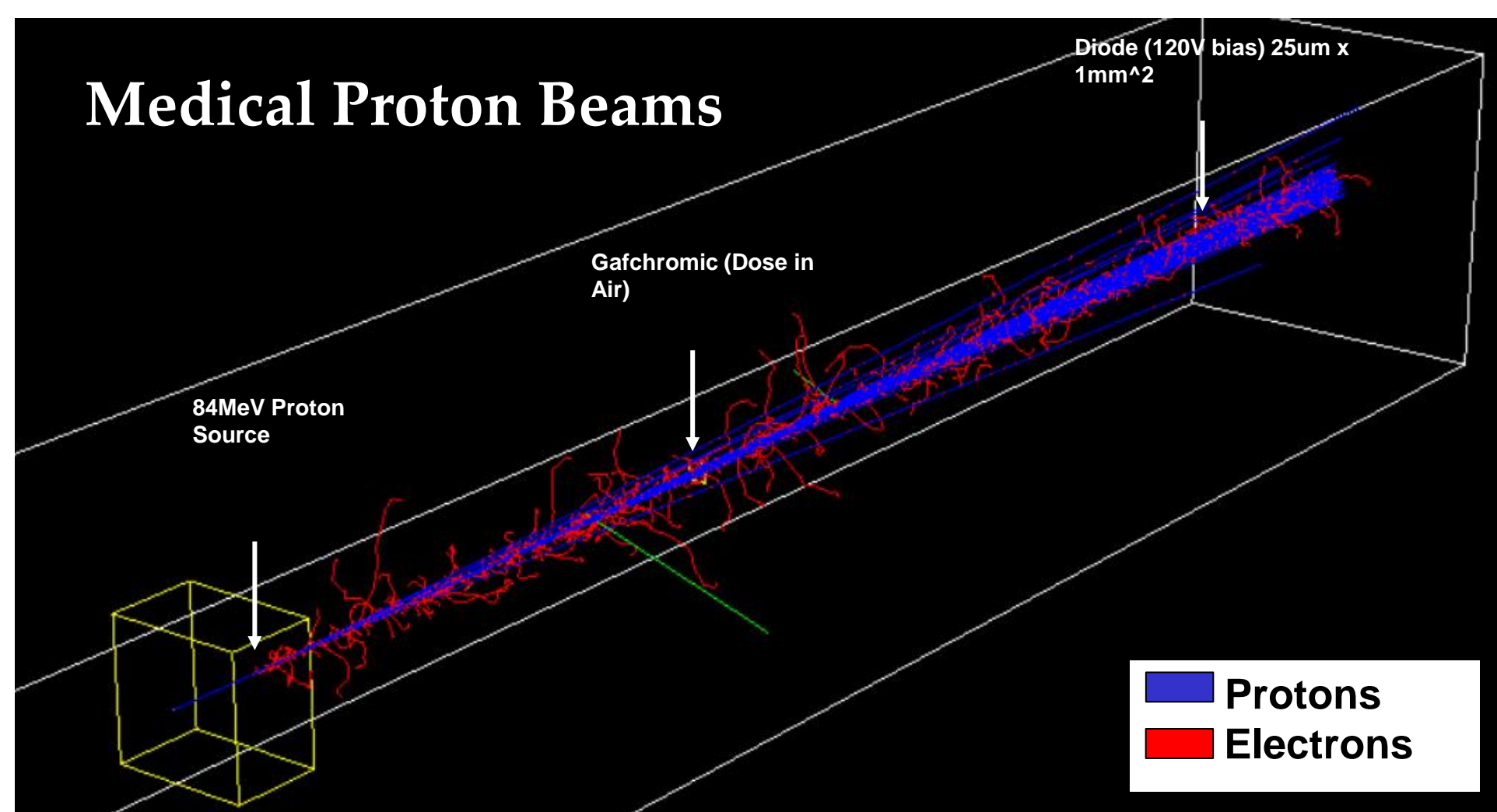
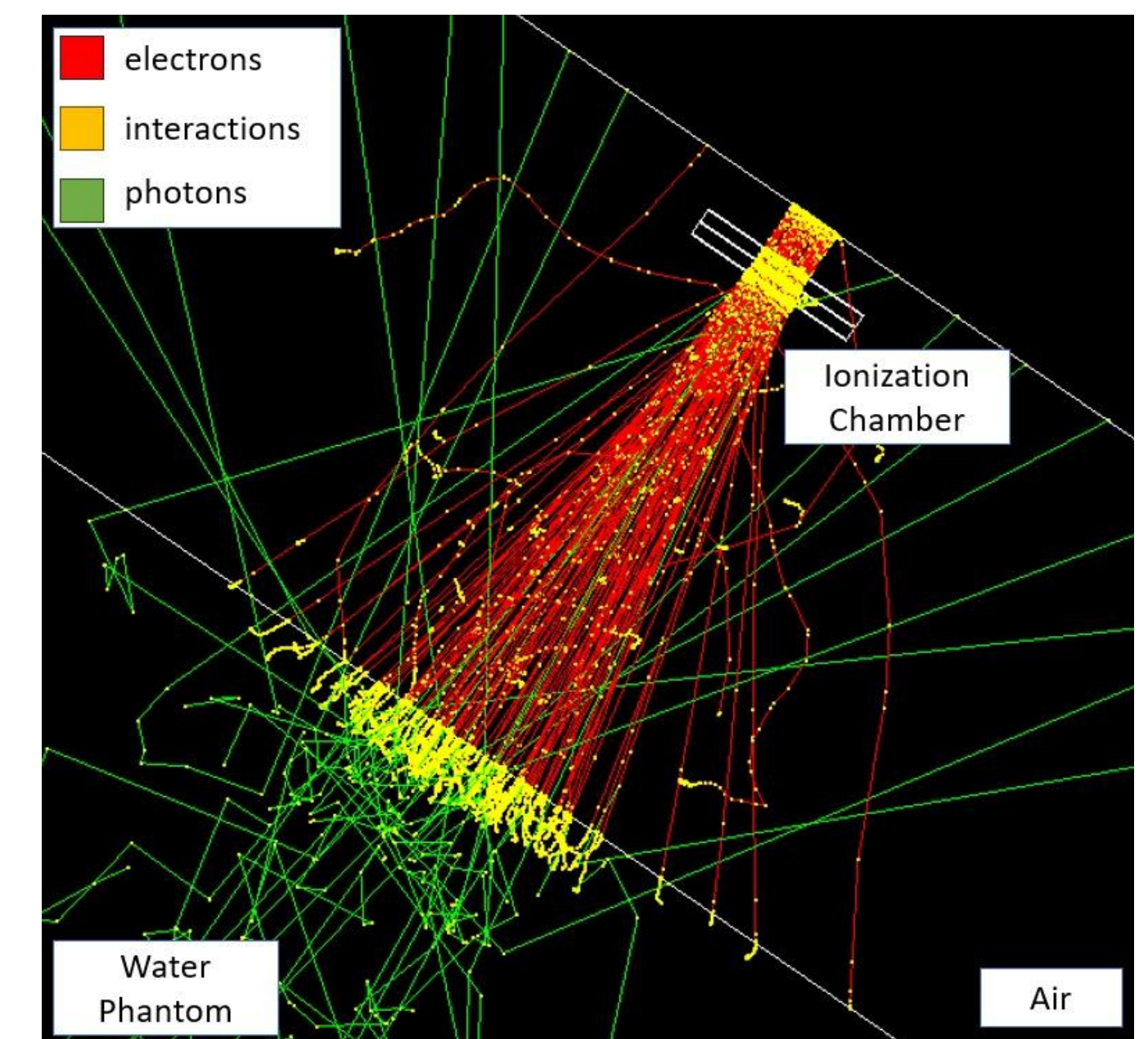
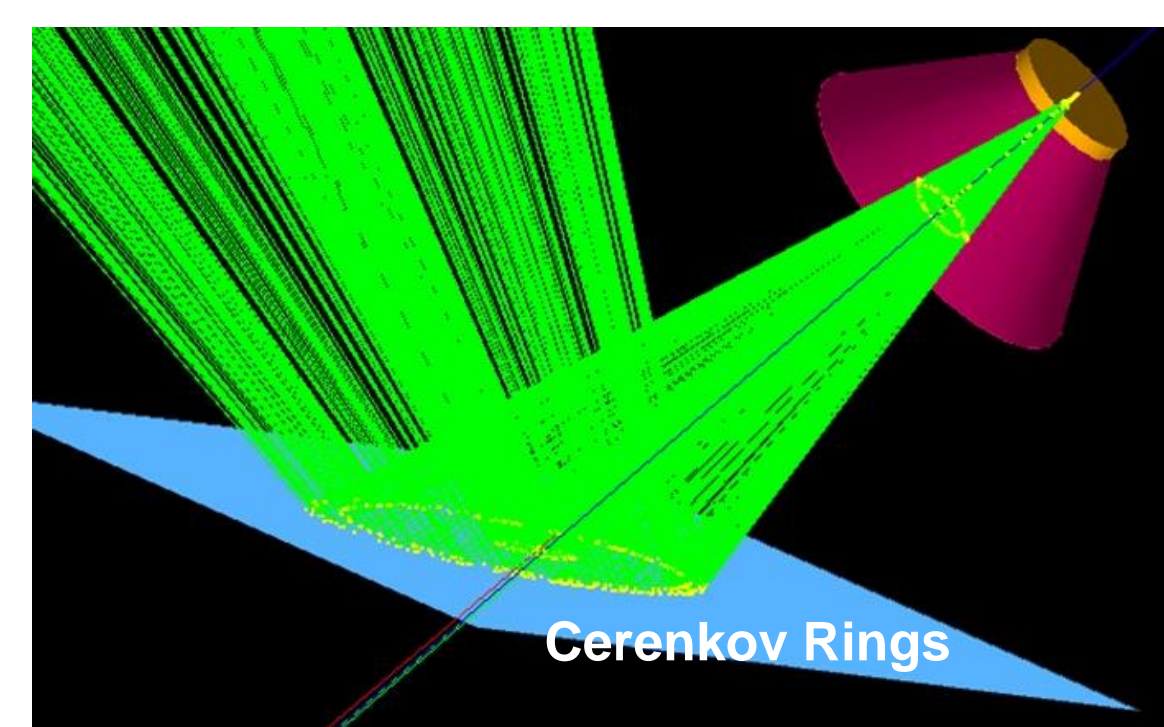


In collaboration with ReCaS-Bari INFN computing center

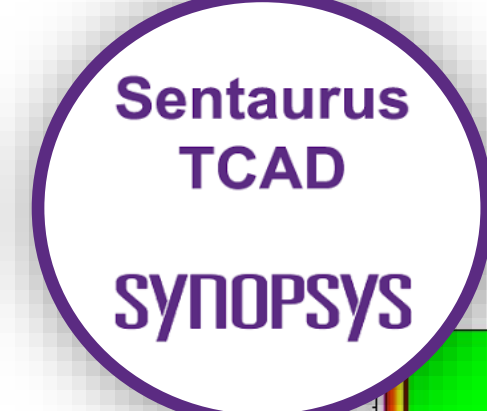


Cerenkov radiation simulations with optical photons and Ionization Chamber

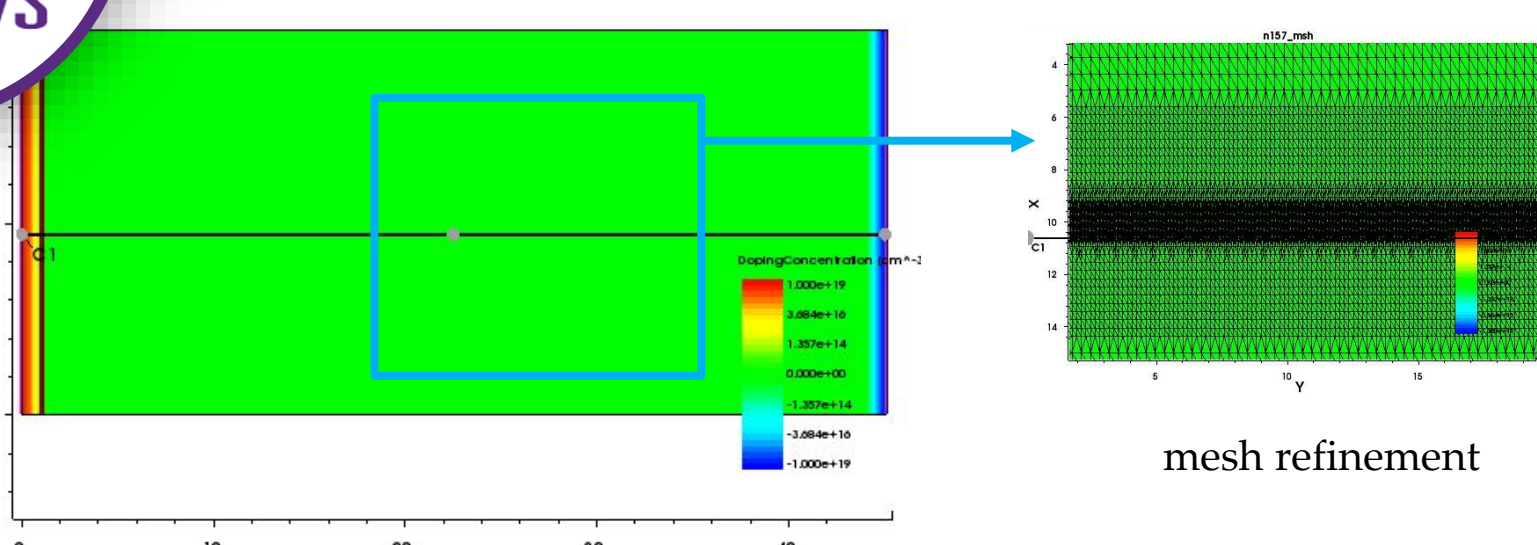
Cerenkov radiation is a promising candidate for Ultra-High Dose Rates Dosimetry (FLASH) because the energy loss has a very weak dependence on the energy, therefore the light intensity should be proportional to the deposited dose inside the medium.



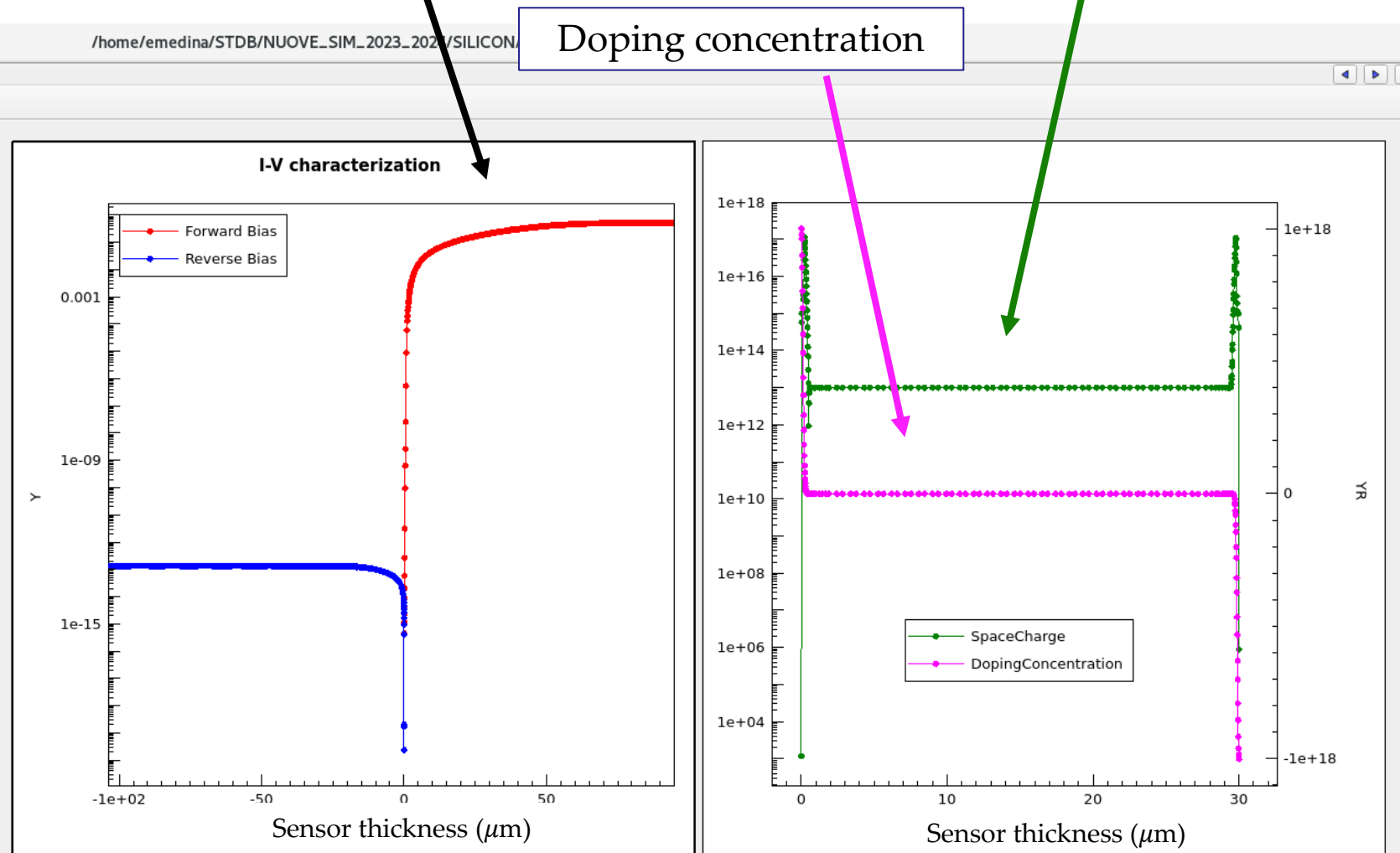
TCAD Sentaurus Synopsis



Geometry, doping, mesh definitions

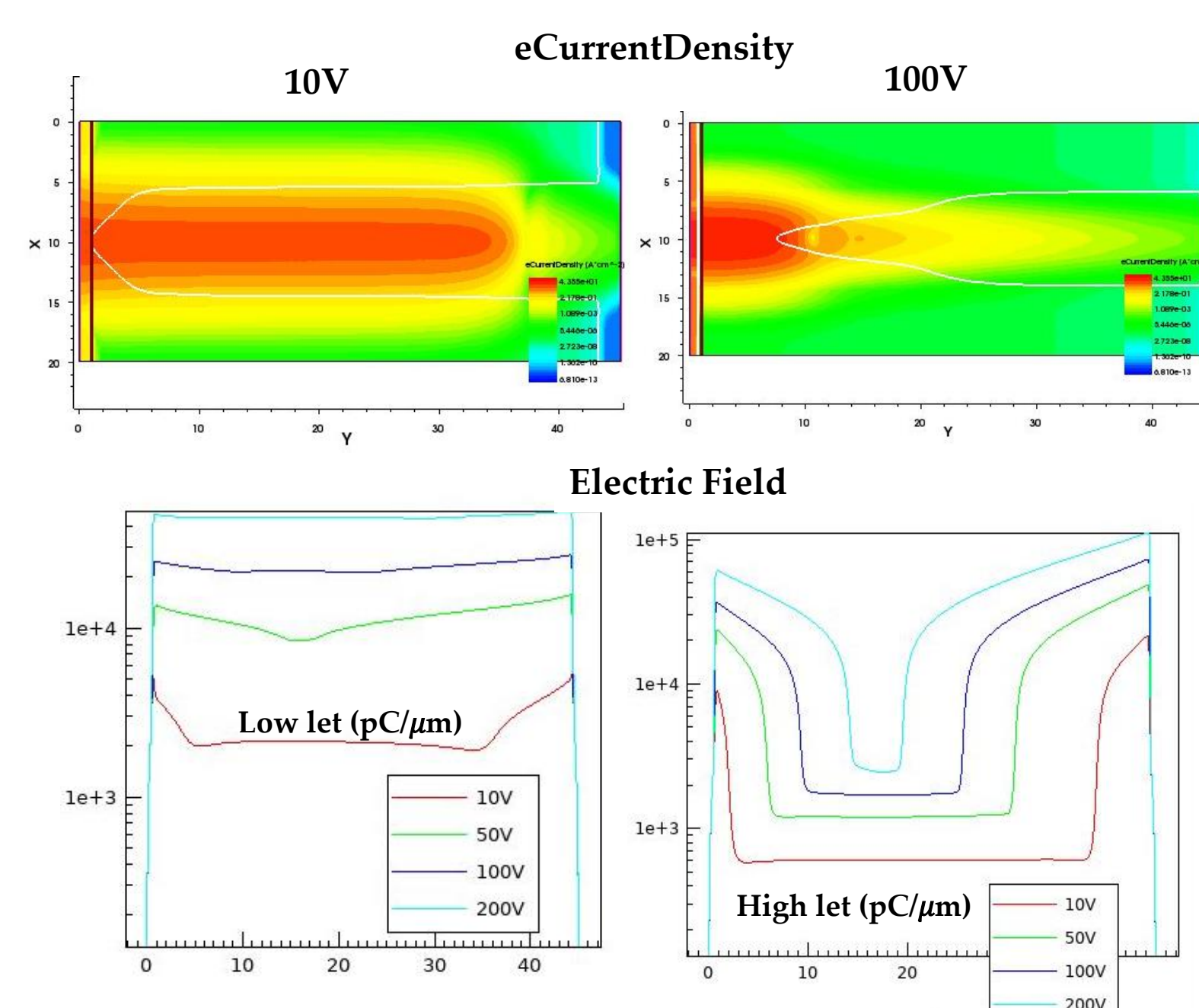
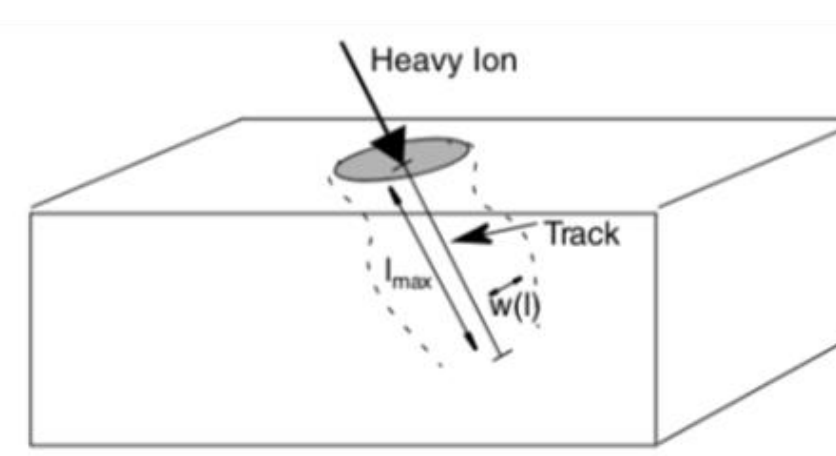


I-V characterization



Charge carriers distributions in semiconductors

- Optical generation
- Gamma radiation
- Alpha particles
- Heavy Ions



Output signals study

- Signal generated on the electrodes from carriers (electrons and holes)

