UHDR example

Hoang Tran

Univ. Bordeaux CNRS, LP2I Bordeaux, UMR 5797, F-33170 Gradignan, France

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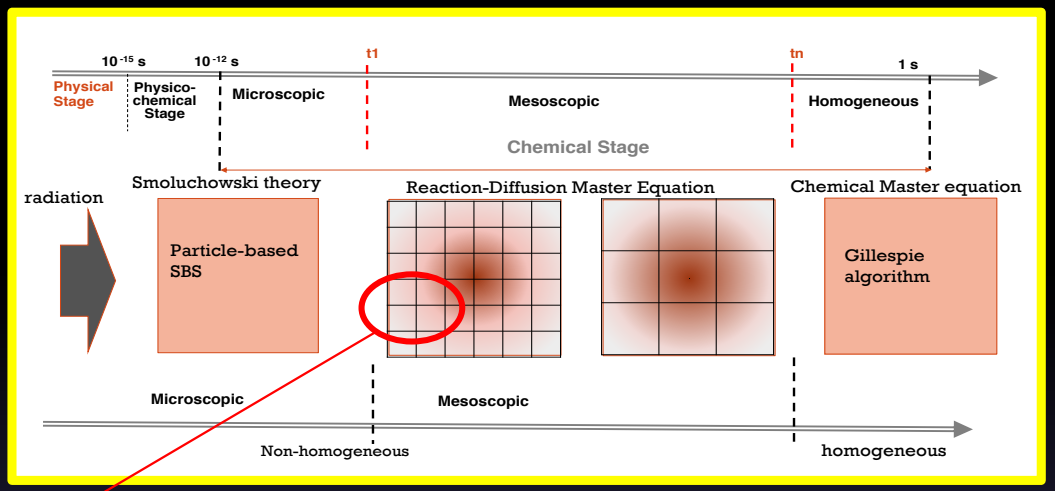
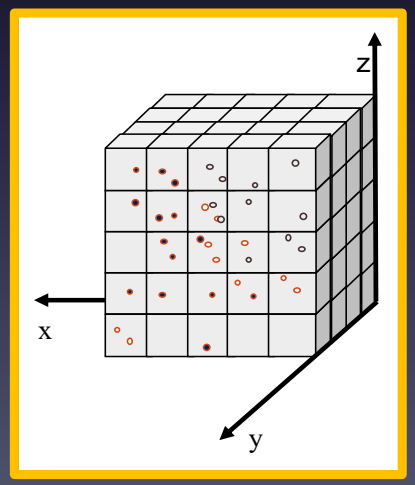
New « UHDR » example

Tran et al., Int. J. Mol. Sci. (2021) 22 (link)

- Use new « mesoscopic » approach to study the production and evolution of reactive oxygen species generated under irradiation with different dose rate conditions, such as in FLASH RT
- Coarse-grained model: "compartment based"
- Simulation from heterogeneous (SBS, microsecond) to homogeneous states (beyond)
- Developed in Geant4-DNA by the MAGIC Collaboration
  - CHUV, Switzerland & CNRS/LP2i, France



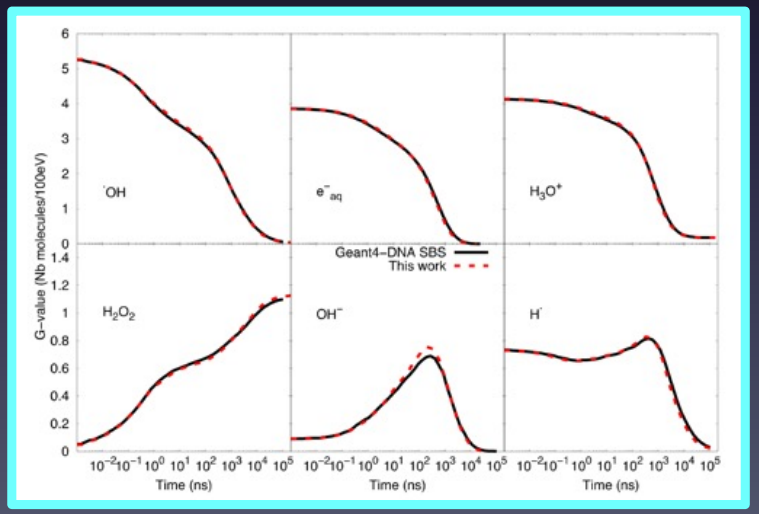
Principle of the combination of the particle-based SBS model with the compartment-based model



1. *Well mixed species in voxels*
2. *Species can react with each other in the voxels*
3. *Diffusion is modelled by jumps between adjacent voxels*

Voxelization of the simulation volume into smaller sub-volumes. Species are represented by different types of circles

Comparison of time-dependent G-values as computed with the particle-based SBS model and the SBS-RDME model (this work) from 1 ns until 100 us, for 1 MeV e-.



New « UHDR » example

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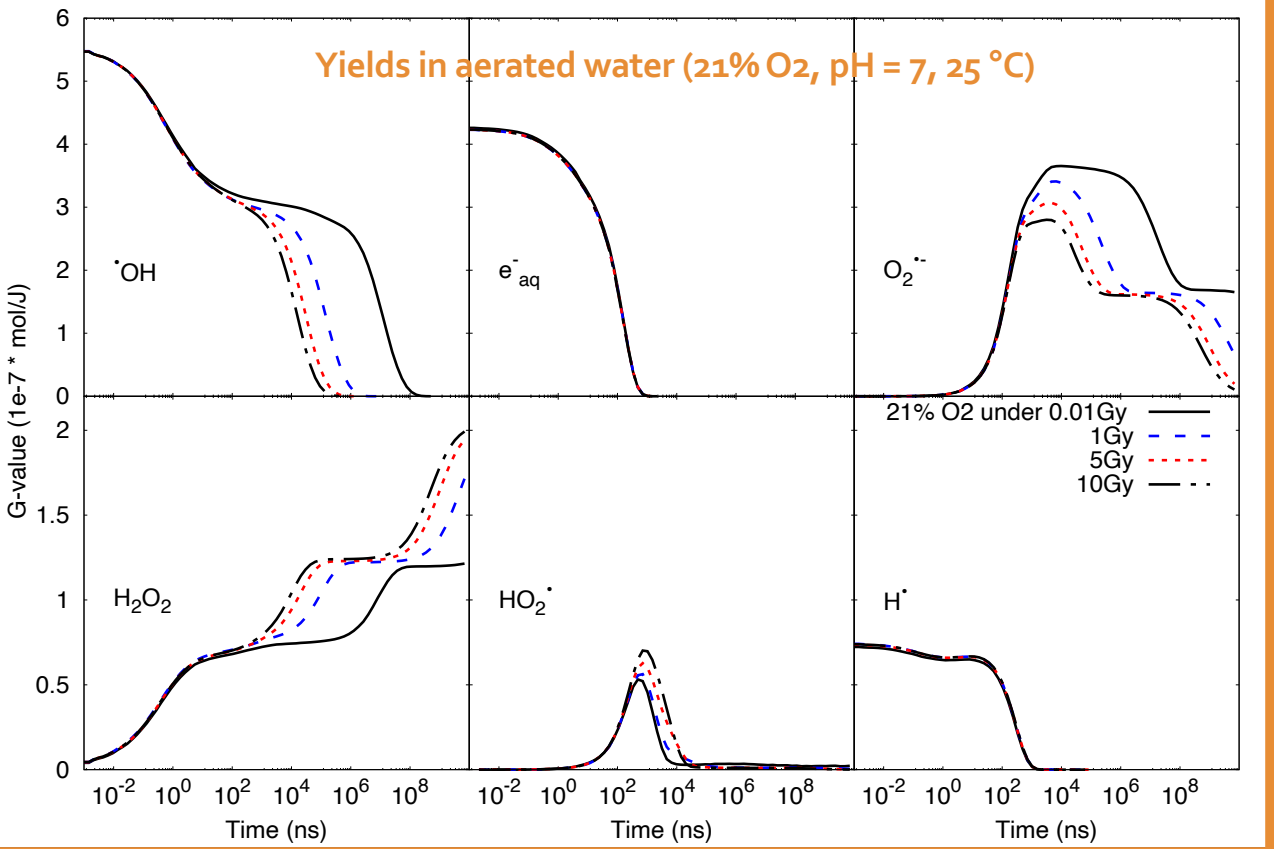
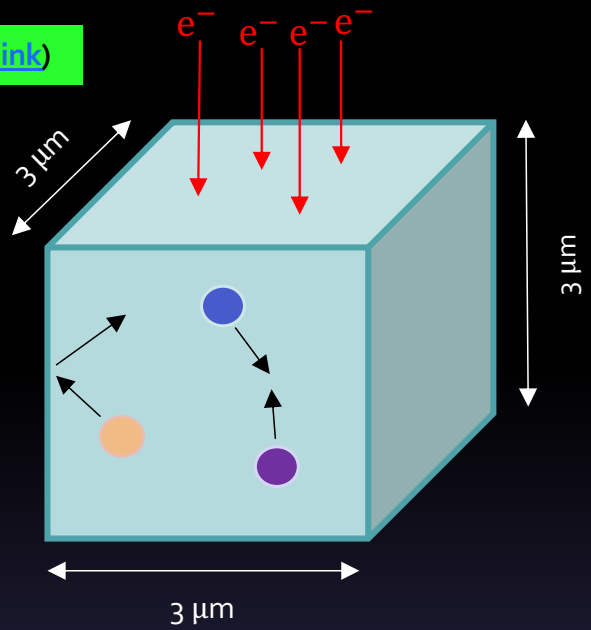
Modelling of ultra-high dose rate (UHDR) electron beams





- Source: 1 MeV electron beam
- Simulation volume: water cube taking into account radiolytic species rebound (closed system)
- Electron irradiation until the total energy deposition reaches 1-10 Gy (UHDR) or ~ 0.01 Gy (conventional)
- Instantaneous pulse (all species are produced simultaneously)
- Extension of the chemical stage beyond the microsecond
- Study the evolution of ROS such as HO2• and O2•- produced by irradiation, pH is considered
- Currently being validated with exp. data