


# Parallel 3B: Basic, Extended and Advanced Examples

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<b>Extended examples: Progress with work plan items</b>	Ivana Hrivnacova	
<i>L102, Jefferson Lab</i>	14:00 - 14:15	
<b>Advanced examples: progress</b>	Susanna Guatelli	
<i>L102, Jefferson Lab</i>	14:15 - 14:30	
<b>Example dna/microprox</b>	Sebastien Incerti	
<i>L102, Jefferson Lab</i>	14:30 - 14:35	
<b>Example dna/chem5</b>	Jose Ramos Mendez	
<i>L102, Jefferson Lab</i>	14:35 - 14:40	
<b>Example dna/dnadamage1</b>	Tran Ngoc Hoang	
<i>L102, Jefferson Lab</i>	14:40 - 14:45	
<b>Calculation of microdosimetric quantities of proton track segments with Geant4-DNA</b>	Miguel Antonio Cortes Giraldo	
<i>L102, Jefferson Lab</i>	14:45 - 15:00	
<b>new MPI/exMPI04</b>	Ivana Hrivnacova	
<i>L102, Jefferson Lab</i>	15:00 - 15:05	
<b>Proposal for a new medical extended example</b>	Susanna Guatelli	
<i>L102, Jefferson Lab</i>	15:05 - 15:10	
<b>Hadrontherapy: status and validation</b>	Pablo Cirrone	
<i>L102, Jefferson Lab</i>	15:10 - 15:25	

# Extended Examples: Progress

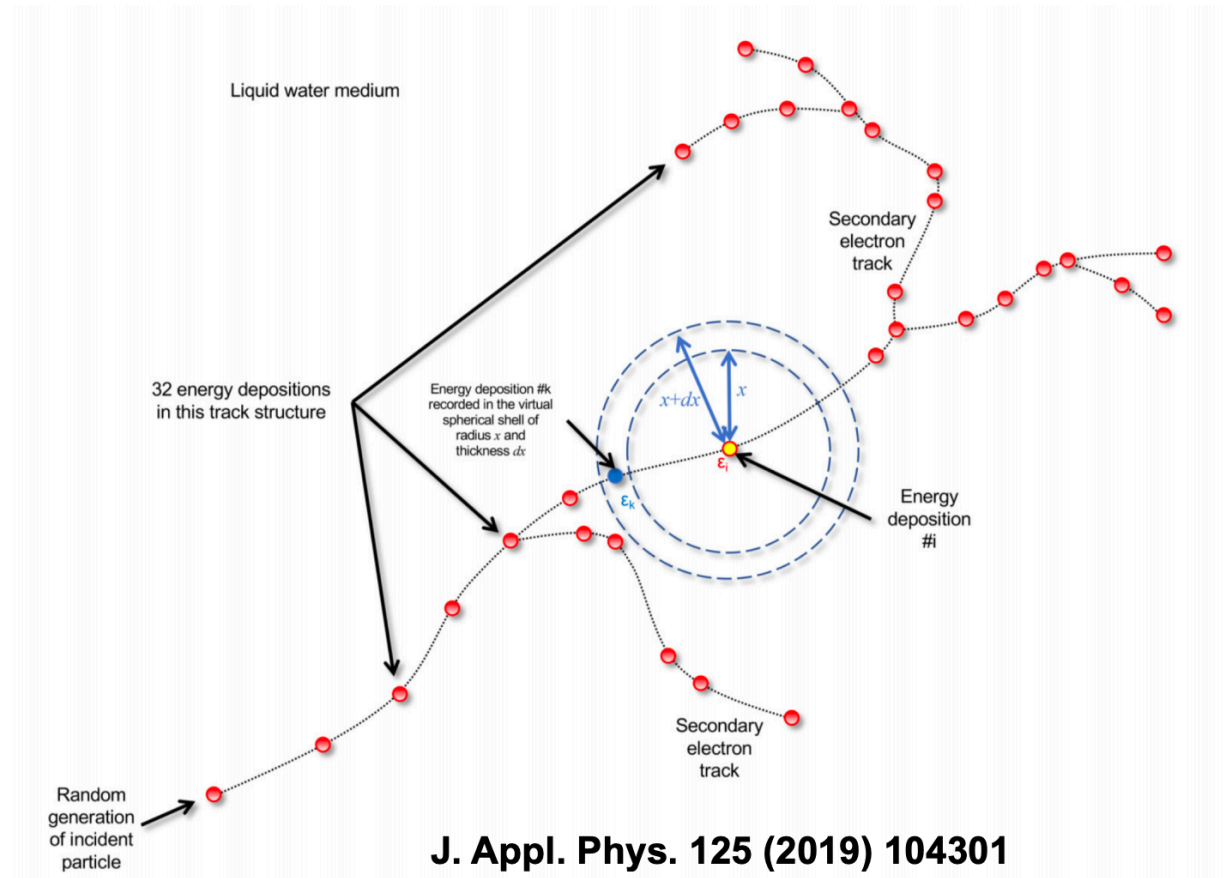
- **I. Hrivnacova, IPN Orsay (CNRS/IN2P3)**
- **Obsolete features: no new item**
  - Ongoing eliminating `std::cour`, `std::cerr`, `std::exit`
- **Macros review**
  - Started in 2018, to be continued
- **Coding guidelines**
  - In “maintenance” mode
- **Build Options in DICOM example**
  - A solution needs to be find how to include the example options in `ctest`

# Advanced examples: progress

- S. Guatelli, University of Wollongong
- **Maintenance and bug fixes**
  - Ongoing
- **Code review in selected examples**
  - `iort_therapy` and `medical_linac` updated in terms of scoring, general code review
  - Started in `x-ray fluorescence` example
  - To be started in 2020 for `purging_magnet` and `eRosita`
- **Developments of alternative approaches for LET calculation in hadrontherapy**
  - On-going
- **Migration of the `air_shower` advanced example to MT**
  - By B. Tome'
  - Target: next public release
- **New advanced example in Geant4 10.5 for nuclear medicine: doiPET**

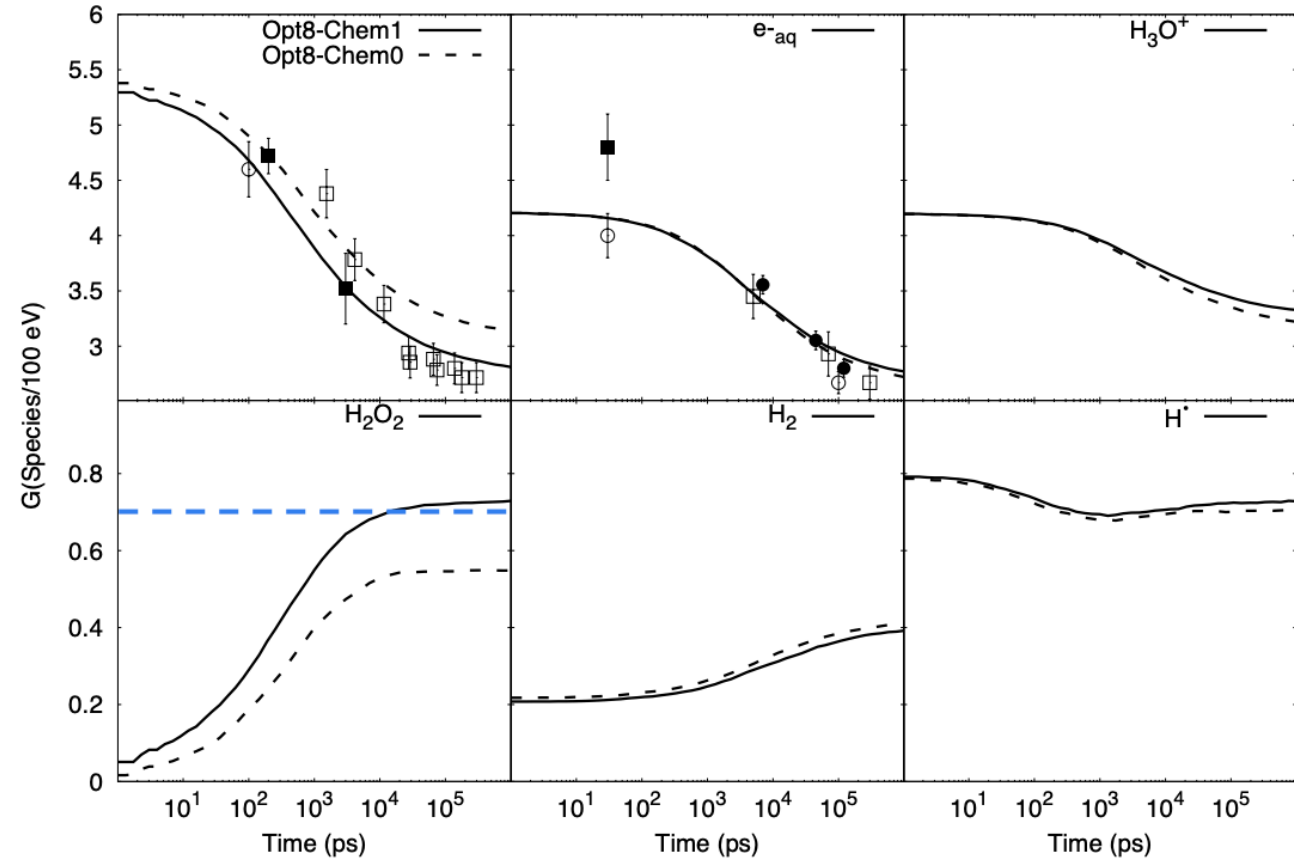
# Example dna/microprox

- S. Incerti et al, CENBG (IN2P3)
  - presented by S. Guatelli
- A way to quickly estimate radiobiological effectiveness of ionising radiation
  - The example calculates proximity functions in liquid water
- Domain of microdosimetry



# Example dna/chem5

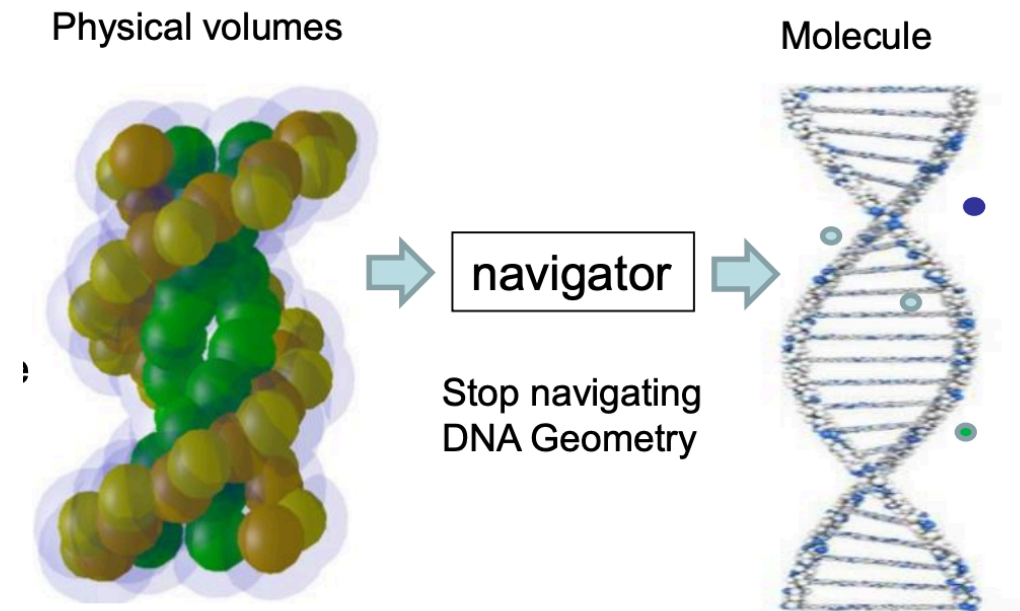
- **J. Ramos-Méndez and B. Faddegon, Department of Radiation Oncology UCSF**
- The example is a modified version of chem4.
- Geant4 modular list introducing two constructors:
  - G4EmDNAPhysics\_option8
  - G4EmDNAChemistry\_option1.
- Output: Tabulated data in ASCII format:
  - Time [ps] G-value (/eV) RMS Molecule's name.



For a comprehensive study on chemistry and physical parameters, see Wook-Geun's presentation in Parallel 8A

# Example DNADamage1

- Hoang TRAN, PSE-SANTE/SDOS/LDRI
- Dnadamage1: first Geant4 application showing how to simulate direct and indirect DNA damages in a segment of chromatin fiber
- Geometry: One voxel of 40 nm fiber heterochromatin generated from DNAFabric tool
  - Represents a big input file: automatically downloaded by cmake (thanks to Gunter)
- Physical stage:
  - Energy deposits and “damaged” DNA volumes are saved from SteppingAction
- Chemistry and DNA reaction
  - “Parallel world” for chemistry
- Analyse DNA hits using ROOT
  - Output file gives the distribution of DNA damage using the Standard DNA Damage data format



# Example exMPI04

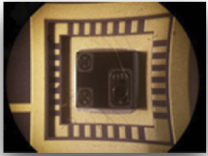
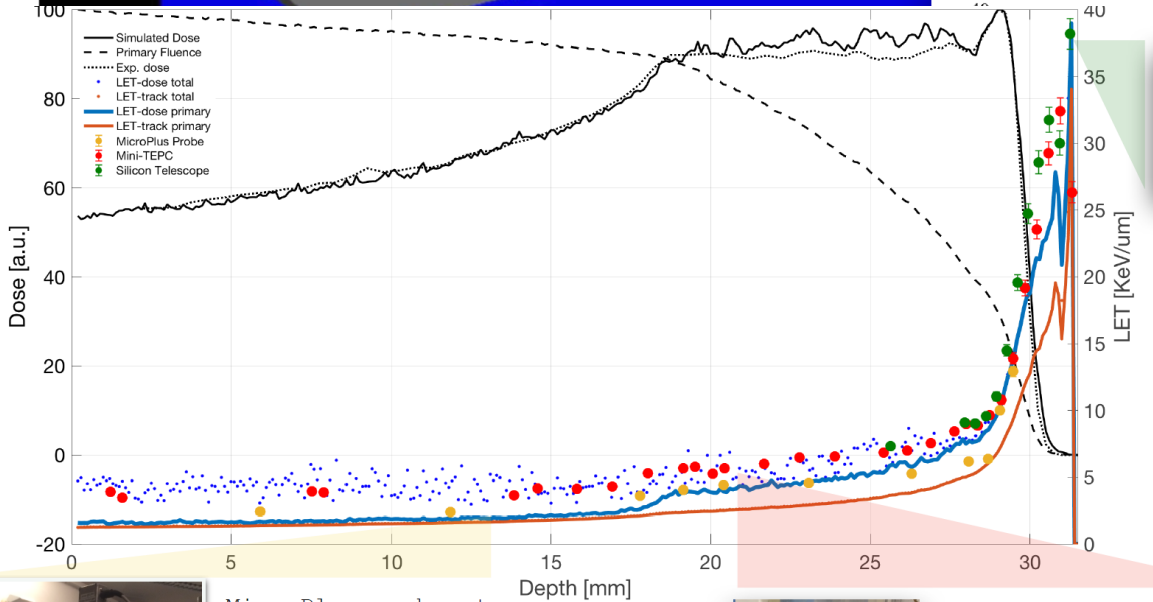
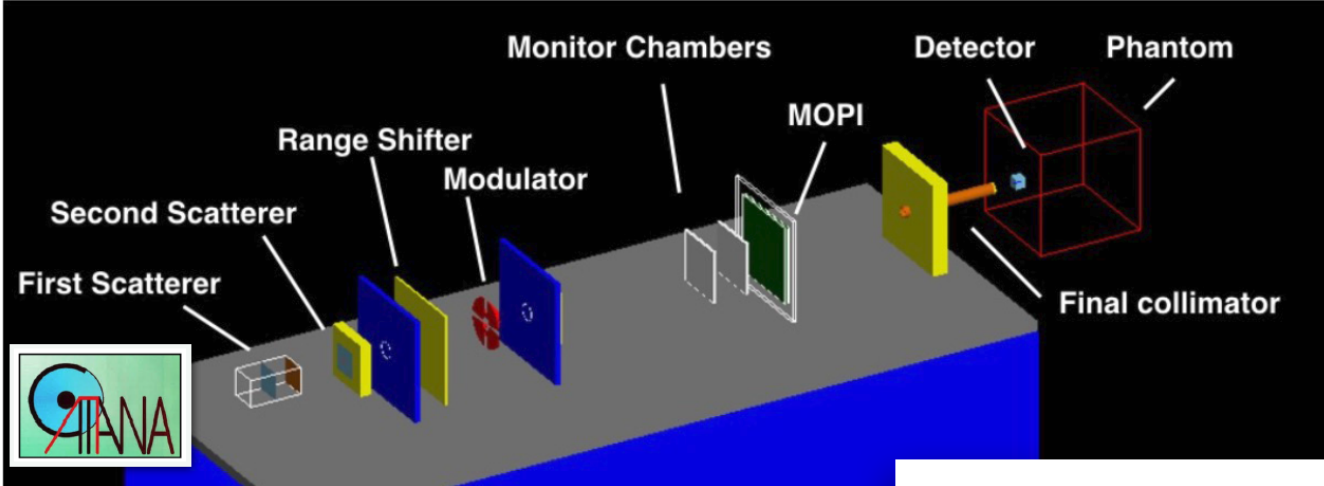
- I. Hrivnacova, IPN Orsay (CNRS/IN2P3)
- The same as exMPI03 with added ntuple.
- It uses Geant4 analysis for histogramming and ntuples.
- It shows how to merge, using Geant4 analysis, ntuples via MPI in sequential mode, so that the entire statistics is accumulated in a single output file.

# Hadrontherapy advanced example

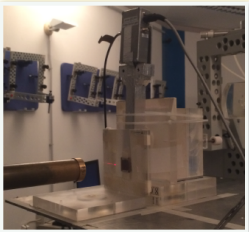
- G.A. P. Cirrone, L. Pandola, G. Petringa, D. Chiappara; INFN-LNS

## Recent update:

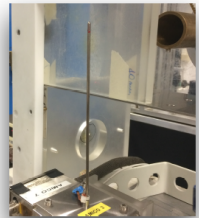
- Calculation of the damage estimation (RBE) with microdosimetric approach (MKM model)
- Simulation results validated against a set of different detectors for microdosimetry



Silicon Telescope at the isocenter position of the CATANA protontherapy facility



MicroPlus probe at the isocenter position of the CATANA protontherapy facility



Mini-TEPC at the isocenter position of the CATANA protontherapy facility



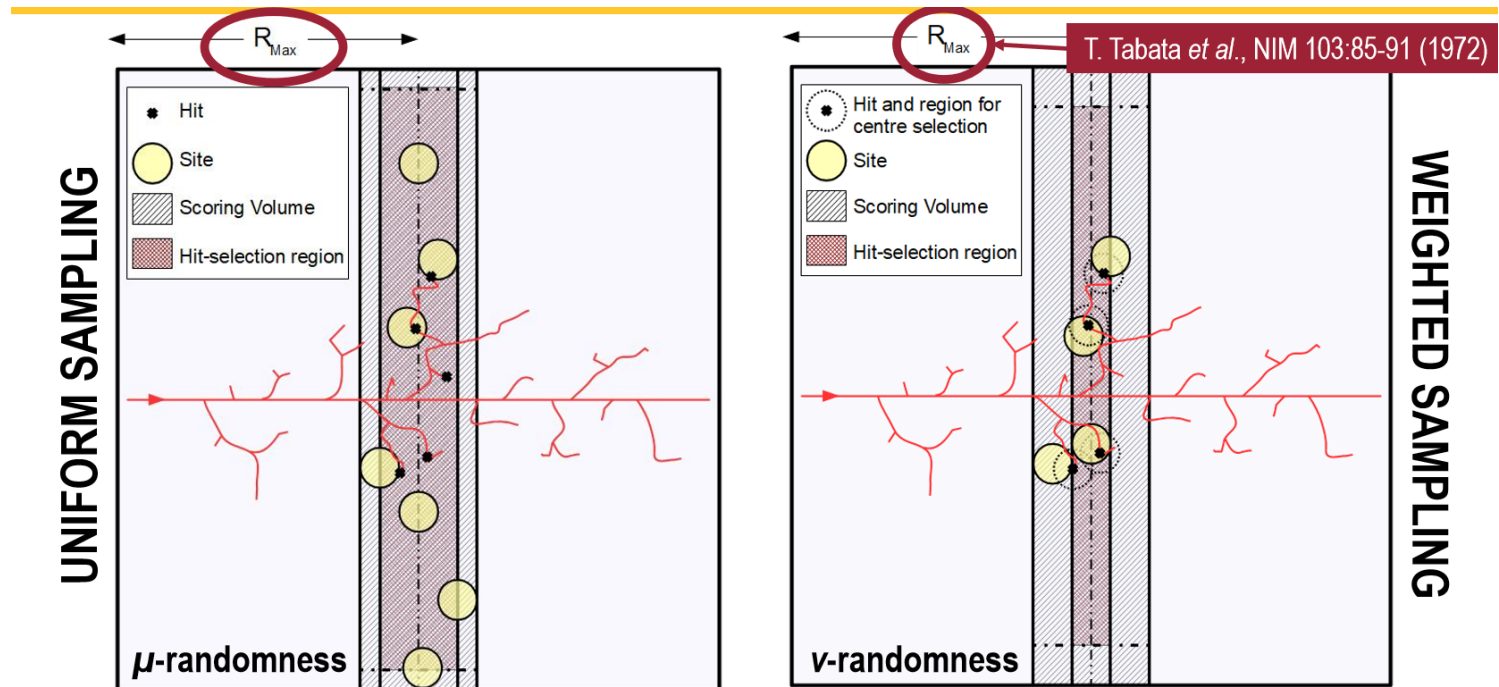


# Proposal of Example for dosimetry

- D. Bolst, S. Guatelli, University of Wollongong; M. Cortes-Giraldo, J.M. Quesada, University of Sevilla
- Goal: Provide a simple Geant4 simulation which shows how to perform dosimetry
  - From feedback of Geant4 users in medical physics
- Calculate the dose in a water phantom (Geant4 Scoring mesh)
- For protons, carbon ions and X-ray beams
  - Defined either by means of the General Particle Source or IAEA-Geant4 Phase Space Files
  - Investigate first the issue of specification of the phase space files
- Physics: G4QGSP\_BIC\_HP (G4EmPhysicsList Option 4)
- Output: ASCII file with Dose

# Calculation of microdosimetric quantities of proton track segments with Geant4-DNA

- A. Baratto-Roldán<sup>1,2</sup>, A. Bertolet<sup>1,3</sup>, A. Carabe<sup>3</sup>, M. A. Cortés-Giraldo<sup>1</sup>
  - <sup>1</sup>Universidad de Sevilla (Spain)
  - <sup>2</sup>Centro Nacional de Aceleradores (Spain)
  - <sup>3</sup>University of Pennsylvania (USA)
- **Proposal for a new example**
  - We will evaluate where to included (extended or advanced)
  - Target: Geant4 public release 2020
- Calculation of microdosimetric quantities of protons track segments in liquid water with Geant4-DNA



- UI commands to select:**
- Dimensions of scoring volume, hit selection region and site.
  - Beam characteristics (energy distribution).
  - Type of sampling (uniform or weighted sampling).