EM physics validation results for Geant4 11.2ref04

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Modifications in EM utils for11.2ref04

- ## 2024-04-04 V. Ivanchenko (materials-V11-02-00)
  - G4_BRASS, G4_BRONZE, and G4_STAILESS_STEEL are defined using mass fractions of components instead of number of atoms to have more natural description (problem #2601). Results may be changed on level 10^-5 due to numerical differences.

- ## 2024-04-21 Gabriele Cosmo (emutils-V11-02-03)
  - Fixed compilation error in G4EmConfigurator on Windows VC++ with C++20 Standard enabled. Based on [GitHub PR#69] (https://github.com/Geant4/geant4/pull/69).

- ## 2023-04-04 V.Ivanchenko (emutils-V11-02-02)
  - G4EmParameters - increased low-limit on maxKinEnergy parameter from 10 MeV to 600 MeV in order to have standard ionisation and multiple scattering always defined for DNA physics configurations.

- ## 2024-04-03 S.Okada (emutils-V11-02-01)
  - G4LowEnergyEmProcessSubType add fLowEnergyTripleIonisation and fLowEnergyQuadrupleIonisation for implementing multiple-ionization processes in Geant4-DNA

Modifications in EM dna for 11.2ref04 (1/3)

- ## 2024-04-25 Hoang Tran (emdna-V11-02-09)
  - Delete DelayLists at the end of chemistry stage clean the G4Scheduler

- ## 2024-04-24 W.G.Shin (emdna-V11-02-08)
  - G4DNAELSEPAElasticModel modified to be compatible with density scaling

- ## 2024-04-19 Gabriele Cosmo (emdna-V11-02-07)
  - Fixed compilation error on Windows VC++ with C++20 Standard enabled. Added missing declarations for TG4MoleculeShoot specializations on G4Track. Based on [GitHub PR#69] (https://github.com/Geant4/geant4/pull/69).

- ## 2024-04-18 Hoang Tran (emdna-V11-02-06)
  - debug invalid KDTree node.

Modifications in EM dna for11.2ref04 (2/3)

- ## 2024-04-15 Vladimir Ivanchenko (emdna-V11-02-05)
  - G4GeneralIonIonisationModel, G4DNAIonChargeIncreaseModel, G4DNAIonChargeDecreaseModel - new classes implementing general models for ions heavier than Helium G4DNAChargeDecrease, G4DNAChargeIncrease - removed obsolete definition of min/max model energy inside processes class, code clean-up
  - G4DNARuddIonisationExtendedModel - updated initialisation to allow be called from the general model
  - source.cmake in dna/models sub-directory become using alphabetical order for both .hh and .cc files

- ## 2024-04-05 Vladimir Ivanchenko (emdna-V11-02-03)
  - G4DNARuddIonisationExtendedModel - updated model: do not use autolock but upload data in the class constructor once in all threads, use effective charge approach for all ions with Z > 2 (to have more correct computation of stopping power and ranges), precompute internal variables before sampling, optimized algorithm of sampling (at 10 MeV it becomes ~10 times faster), removed unused parameters.
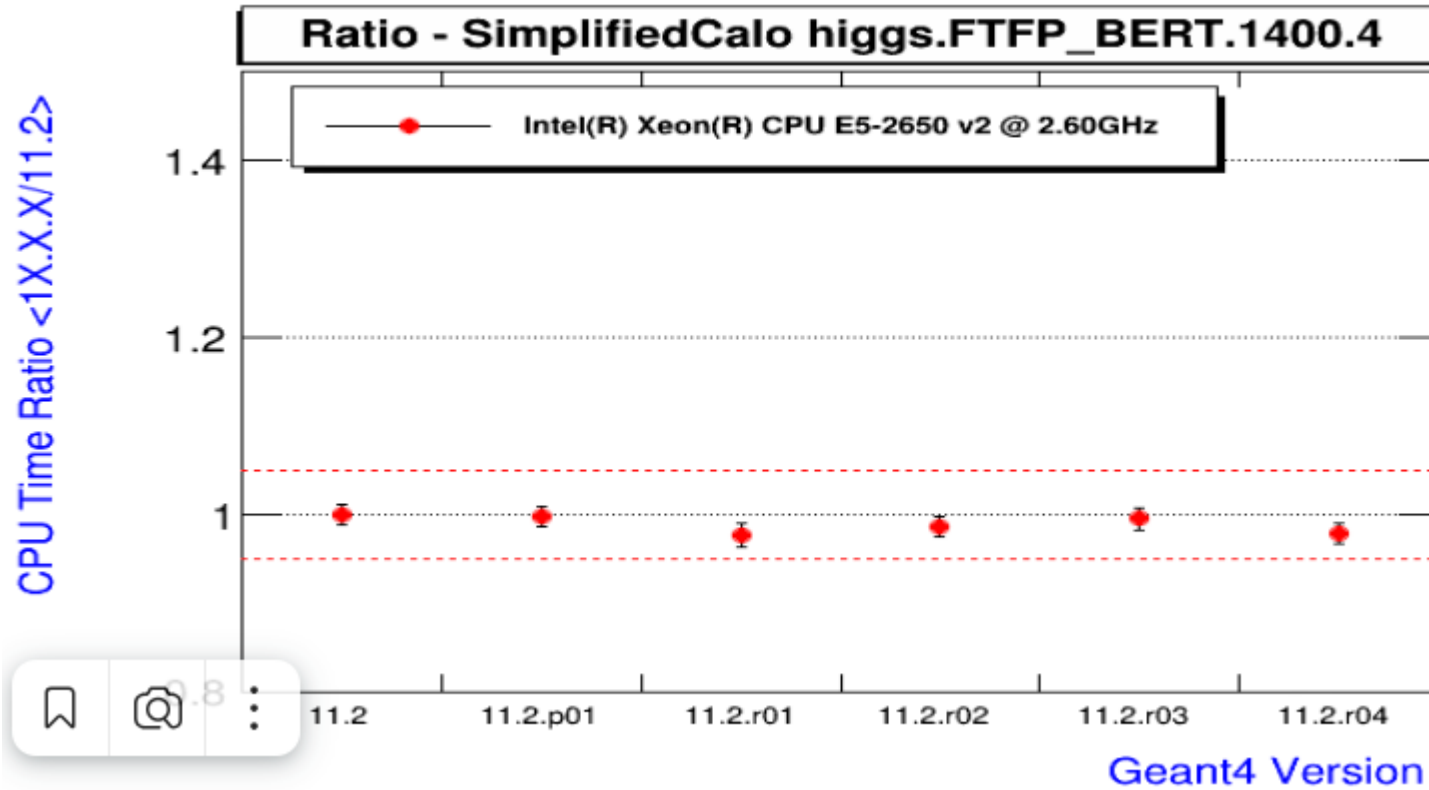
Modifications in EM dna for11.2ref04 (3/3)

- ## 2024-04-10 Shogo Okada (emdna-V11-02-04)
  - G4DNAElectronHoleRecombination - changed the branch condition in FindReactant() to select only H2O+ ions involved in electron-hole recombination
  - G4DNAWaterDissociationDisplacer - added dissociative decay channels for multiple-ionized water ions
  - G4DNAMultipleIonisationManager – a new class focusing on generation of multiple-ionized water ions and calculation of scale parameter to compute cross-section of each multiple-ionization process
  - G4DNADoubleIonisation, G4DNATripleIonisation, G4DNAQuadrupleIonisation - new process classes for multiple-ionization
  - G4DNADoubleIonisationModel, G4DNATripleIonisationModel, G4DNAQuadrupleIonisationModel - new model classes related to multiple-ionization

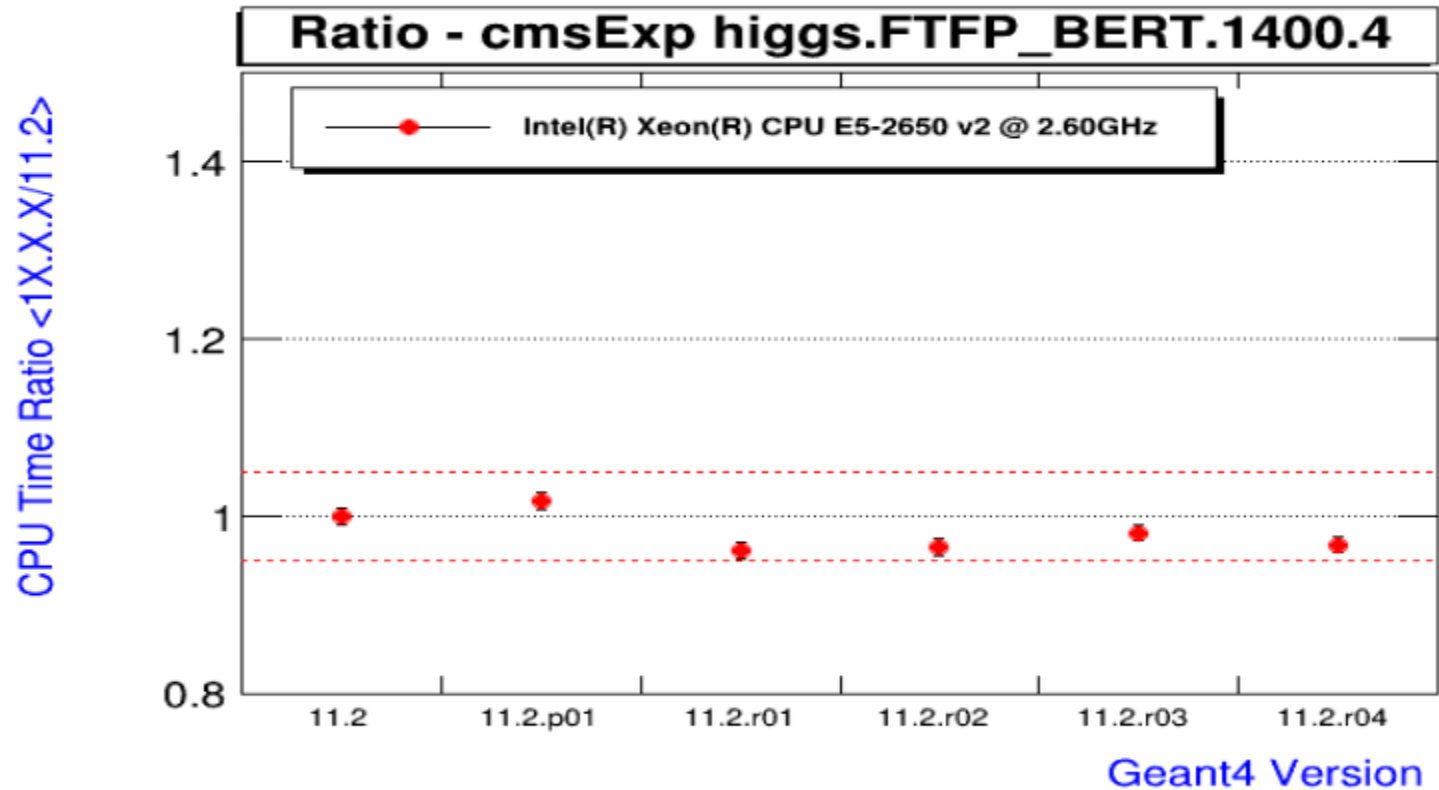# Modifications in EM dna Physics Lists for11.2ref04

- ## 2024-04-05 Vladimir Ivanchenko (phys-ctor-em-V11-02-04)
  - G4EmDNABuilder - added nuclear stopping process for G4GenericIon below 1 MeV/u.
  - G4EmDNAPhysics, G4EmDNAPhysicsActivator, G4EmDNAPhysics_option2, G4EmDNAPhysics_option4, G4EmDNAPhysics_option6, G4EmDNAPhysics_option8 change upper limit for DNA physics of Helium ions from 300 MeV to 400 MeV.

- ## 2024-04-04 Vladimir Ivanchenko (phys-ctor-em-V11-02-03)
  - G4EmDNAPhysics - define default maximum kinetic energy 600 MeV instead of 300 MeV to have standard ionisation and multiple scattering always defined for DNA physics configurations. This allows avoid situations when low-energy ions path DNA region without interaction

FNAL Geant4 Profiling (J. Yarba)

Ratio - SimplifiedCalo higgs.FTFP_BERT.1400.4

A small CPU improvement likely introduced in ref-01

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A small CPU improvement likely achieved in ref-01

Test Results

- Testing results will be available:
  - https://test-geant4-tools.web.cern.ch/test-geant4-tools/emtesting/
- EM results are stable since 11.1.X