

Release Notes – Sébastien JAN (sebastien.jan@cea.fr) – For the OpenGATE Collaboration

gate_v1.0.1 - 03/06/2004

- ✗ root macro *benchSPECT.C* added in *benchmarks/benchmarkSPECT* to analyse the root output (*benchSPECT.root*) of the SPECT benchmark
- ✗ *README.doc* in *benchmarks/benchmarkSPECT* updated to account for the use of *benchSPECT.C*
- ✗ *benchSPECT.gif* and *benchSPECT.log* added in *benchmarks/benchmarkSPECT* to provide examples of the resulting display and output

gate_v1.0.2 - 09/09/2004

- ✗ new version of the two programs (*benchmark_spectra* and *benchmark projection*) added in *benchmarks/benchmarkSPECT* to analyse the SPECT benchmark ASCII output

gate_v1.1.0 - 04/03/2005

- ✗ new version of GATE which is validated for Geant4 6.2.p02
- ✗ compilation is validated with gcc3.3 (and other previous gcc versions)
- ✗ !!!!! this version doesn't support gcc3.4
- ✗ this version support lmf_v2.0
- ✗ recommended CLHEP version : 1.8.1.0

gate_v1.2.0 - 04/03/2005

- ✗ new version of GATE which is validated for Geant4 7.0
- ✗ compilation is validated with gcc3.4
- ✗ this version support lmf_v2.0
- ✗ recommended CLHEP version : 1.8.1.0

gate_v2.1.0 03/08/2005

This version is based on gate v1.1.0 with new developments and bugfix :

- ✗ bugfix for voxelized phantom
- ✗ bugfix for variable template in the ASCII output file
- ✗ modification of the examples / example_PHAMTOM_SOURCE / Voxelized_Phantom_Source
- ✗ modification of the benchmarkPET (see the Installation Guide for details)
- ✗ new fonctionalities with parameterized volumes (see the user's guide for details)
- ✗ new digitizer modules for dead time implementations (see the user's guide for details)

gate_v2.2.0 03/08/2005

This version is based on gate v2.1.0 with new developments and bugfix :

- ✗ bugfix for voxelized phantom
- ✗ bugfix for variable template in the ASCII output file
- ✗ modification of the examples / example_PHAMTOM_SOURCE / Voxelized_Phantom_Source
- ✗ modification of the benchmarkPET (see the Installation Guide for details)
- ✗ new fonctionalities with parameterized volumes (see the user's guide for details)

- ✧ new digitizer modules for dead time implementations (see the user's guide for details)

gate_v3.0.0 01/06/2006

- ✧ New GATE version is validated for Geant4 8.0.p01 (10 February 2006)
- ✧ New GATE version is validated for Geant4 7.1.p01 (25 October 2005)
- ✧ Compilation is validated with gcc4.0 / gcc3.4 / gcc3.3 / gcc3.2
- ✧ This version support lmf_v3.0
- ✧ Recommended CLHEP versions :
 - 2.0.2.2 & 1.9.2.2 with Geant4 8.0.p01
 - 1.9.2.1 with Geant4 7.1.p01

New developments and bugfix :

- ✧ Bugfix : GateVSourceVoxelReader / GateTemporalResolution / GPS
- ✧ Implementation of compressed phantoms and variable size voxels for voxelized phantoms (see the user's guide for details)
- ✧ New source implementation: Iodine-124 (see the users guide for details)
- ✧ New system : ecatAccel (see the users guide for details)
- ✧ Optical tracking : see the Installation guide to set the environment variable and Users Guide to track the optical photons and use the new functionalities
- ✧ ECAT7 output : delays and scattered sinograms output (see examples/example_PET_Scanner/PET_Ecat_System.mac for details about all new options)
- ✧ Modifications of the example "example_PET_Scanner/PET_Ecat_System.mac" : new coincidence sorter including the new functionalities of the ECAT7 output

WARNING : with Geant4 8.0.p01 there is a well known problem with the ion source production -> simulation crashed or doesn't produce any particle. This bug didn't appear with Geant4 7.1.p01 and will be fixed with next Geant4 release.

gate_v3.1.0 13/03/2007

- ✧ Validated for Geant4 8.1.p02 (10 November 2006)
- ✧ Validated for Geant4 8.0.p01 (10 February 2006)
- ✧ Validated for Geant4 7.1.p01 (25 October 2005)
- ✧ Compilation is validated with gcc4.0 / gcc3.4 / gcc3.3 / gcc3.2
- ✧ This version support lmf_v3.0
- ✧ Recommended CLHEP versions :
 - 2.0.2.3 & 1.9.2.3 with Geant4 8.1.p02
 - 2.0.2.2 & 1.9.2.2 with Geant4 8.0.p01
 - 1.9.2.1 with Geant4 7.1.p01

New developments:

- ✧ Cluster tools: see User's Guide version 3.1.0 for details
- ✧ *New collimator design (parametrization): User's Guide for details*

gate_v3.1.1 04/05/2007

This version is based on gate_v3.1.0 including following features:

- ✗ Validated with the gcc 4,1 compiler version
- ✗ *Included a env_gate.sh file for bash shell users*
- ✗ *Cleaned of warning messages*

gate_v3.1.2 17/09/2007

- ✗ PET benchmark bug fixed
- ✗ Some classes be cleaned
- ✗ Bug fixed for the “Polycone” volume
- ✗ Mouse with the geometrical description is available
- ✗ Validated for Geant4 9.0 (29 June 2007)
- ✗ Validated for Geant4 8.1.p02 (10 November 2006)
- ✗ Compilation is validated with gcc4.1/gcc4.0 / gcc3.4 / gcc3.3 / gcc3.2
- ✗ This version support lmf_v3.0
- ✗ Recommended CLHEP versions :
2.0.3.1 & 1.9.3.1 with Geant4 9.0 - 2.0.2.3 & 1.9.2.3 with Geant4 8.1.p02

gate_v4.0.0 20/08/2008

About the general set-up:

- ✗ *This version is validated for Geant4 9.1.p02 & p01*
- ✗ *The Compilation is validated with gcc4.1 / gcc4.0 / gcc3.4 / gcc3.3 / gcc3.2*
- ✗ *This version support lmf_v3.0*
- ✗ *Recommended CLHEP version : 2.0.3.2*
- ✗ *Value for G4VERSION environment variable: 9.1*

Regarding the new developments & available functionalities for this version:

- ✗ *Wedge volume available (section 3.2.4 in the users guide)*
- ✗ *2 new systems : CTscanner & OPET (users guide section 4.3)*
- ✗ *New raw output format (users guide section 10.9)*
- ✗ *"Cold " phantom description (users guide section 7.2.9)*
- ✗ *New navigator for voxelized phantom description to speed-up the simulation (users guide section 7.3.3)*
- ✗ *Implementation of Fictitious cross section to reduce the computing time (users guide section 7.3.4)*
- ✗ *RecordStepping optimisation to speed-up the tracking*
- ✗ *Mersenne Twister Random engine is used by default – Users can change the random engine directly in the main program (Gate.cc)*
- ✗ *Code sources organised with thematic folders and new Makefile to compile Gate (no modification for users regarding the Gate installation)*

New example folders are also included:

- ✗ *example_CT*
- ✗ *example_Scorer (command-based scoring: for details see the Geant4 usersGuide section 4.8 - <https://geant4.web.cern.ch/geant4/support/userdocuments.shtml>)*
- ✗ *example_SpeedUp_Simulation (the file Reduce_Computing_Time.mac gives an overview on this release specificities regarding the computing time optimisation)*

gate_v5.0.0 10/06/2009

About the general set-up:

- ✖ This version is validated for Geant4 9.1 and 9.2
- ✖ The Compilation is validated with gcc4.2 / gcc4.1 / gcc4.0 / gcc3.4 / gcc3.3 / gcc3.2
- ✖ This version support lmf_v3.0
- ✖ Recommended CLHEP version : 2.0.3.2 & 2.0.4.2
- ✖ Value for G4VERSION environment variable: 9.1 or 9.2

Regarding the new developments & available functionalities for this version:

- ✖ Options and command lines to visualize the source positions – Section 7.2.10 in the Users guide for details
- ✖ Real time management for voxelized source and phantom – Possibility to manage with a macro file time activity curves and organ motions – Section 7.4 in the Users guide for details
- ✖ Analytical modelling for SPECT collimator – Speed up option using the Angular Response Function (ARF) techniques – See the section 8.9 in the users guide for details
- ✖ Options and command lines for Random engine and seed selection mechanism – Section 9.2 in the Users guide
- ✖ Separated particle tracking between the phantom and the detector in the way to speed up the simulation – This is a pure phase space approach with the possibility to store the phantom tracking particle history and to use it as an input file for the detector tracking – See the section 13.6 in the Users guide for details

New example folders are also included:

- ✖ example_TrackerDetector: How to use the Gate capabilities about the separated tracking between the phantom and detector volumes
- ✖ example_TimeActivityCurve: How to define a full simulation including phantom motions and Time Activity Curves management
- ✖ example_ARF: A set of macros to describe analytical modelling of SPECT collimator

gate_v6.0.0 05/02/2010

About the general set-up:

- ✖ This version is validated for Geant4 9.1 and 9.2
- ✖ The Compilation is validated with gcc4.4 / gcc4.2 / gcc4.1 / gcc4.0 / gcc3.4 / gcc3.3 / gcc3.2
- ✖ This version support lmf_v3.0
- ✖ Recommended CLHEP version : 2.0.3.2 & 2.0.4.2
- ✖ Value for G4VERSION environment variable: 9.1 or 9.2

Important points related to the macro file modifications between Gate V6 and the previous versions:

- ✖ The Path of the material database needs to be specified before the volume description. According to the following example:
/gate/geometry/setMaterialDatabase \$path/GateMaterials.db

This because it's possible to use more than one material database with this Gate version for specific applications.

- ✕ The command lines to describe physic processes which are involved, are completely changed – Because this version includes hadronic physic processes. Users should define carefully their physicist macro files and it's seriously recommended to read carefully the Users Guide.*
- ✕ The command line to initialize the simulation is modified and should be the following: /gate/run/initialize (replace the previous one : /run/initialize)*
- ✕ Regarding the geometry description : all commands related to the “updating” are removed – User should remove /gate/geometry/enableAutoUpdate from the macro file.*
- ✕ By default, all output format are disable – User need to specify which format should be save – ex. for root output : /gate/output/root/enable*
- ✕ The Interfile output command line /gate/output/interfile/setFileName is replaced by /gate/output/projection/setFileName – And projections are still an Interfile format.*
- ✕ New command lines related to the new Gate capabilities (dosimetry ; radiotherapy ...) are defined and described in the Users Guide.*

PLEASE, FEEL FREE TO READ AND TEST EXAMPLE MACRO FILES WHICH ARE PROVIDE WITH THIS RELEASE – IT WILL BE AN OPPORTUNITY TO CHECK COMMAND LINE MODIFICATIONS AND NEW AVAILABLE OPTIONS

Regarding the new developments & available functionalities for this version:

- ✕ This version is based on a new core architecture to simplify future developments*
- ✕ New system for CT scan applications – Including variance reduction technics to speed up simulation*
- ✕ New management for source description – Motion source is now available*
- ✕ New physicist management including hadronic processes*
- ✕ New “cutting” approach to speed-up computation efficiency – Including cut value per region (volume name)*
- ✕ New application sectors for dosimetry, standard radiotherapy and hadrontherapy*
- ✕ New tools are dedicated for “radiotherapy” applications : voxelized phantom management ; dedicated output format (dose map etc...) ; phase space approach ; variance reduction technics*
- ✕ The cluster tools are now available for every Gate applications*

New example folders based on GATE tutorial

Applicative examples

- ✕ CT*
- ✕ SPECT*
- ✕ PET*
- ✕ Optical Photon (crystal scintillation)*
- ✕ Radiotherapy : standard and hadrontherapy*

Specific applications

- ✕ Analytic Response Function (ARF) to speed-up SPECT simulation*
- ✕ Physics list descriptions for electromagnetic and hadronic processes*
- ✕ Phantom and source descriptions – Analytic and voxelized approach*
- ✕ Data analysis with the ROOT software*

- ✗ Phantom motions and Time Activity Curves
- ✗ Separate tracking between phantom and detector – A phase space approach for imaging applications

gate_v6.1.0 01/03/2011

About the general set-up:

- ✗ This version is validated for Geant4 9.3 and 9.4
- ✗ The Compilation is validated with gcc4.4 / gcc4.2 / gcc4.1 / gcc4.0 / gcc3.4 / gcc3.3 / gcc3.2
- ✗ This version support lmf_v3.0
- ✗ Recommended CLHEP version : 2.0.4.5 & 2.1.0.1 (according to the Geant4 version)
- ✗ Value for G4VERSION environment variable: 9.3 or 9.4 (according to the Geant4 version)

Important points related to the macro file modifications between Gate V6.1.0 and the previous one 6.0:

- ✗ This version is specially customized to use the new physic approaches which are available in Geant4 since the version 9.3. Users can selected the physical process and the model which is associated. Also, Geant4 9.3 (& 9.4) includes several upgrades regarding the hadronic processes ans model associated. All details are available on the Geant4 web site.
- ✗ For Gate Users, it's seriously recommended to read carefully the Users Guide to modify ans adapt correctly all macro files.

Regarding the new developments & bug reporting:

- ✗ Back To Back gamma emission : bug corrected
- ✗ Fast I124 isotope emission : bug corrected
- ✗ Using CPET system : bug corrected
- ✗ Spatial blurring in the case of SPECT Interfile projections : bug corrected
- ✗ ARF tools : bug corrected
- ✗ For radiotherapy applications : pensil beam and TPS pensil beam source tools are available
- ✗ Phase space concept for radiotherapy : two “How To” sections in the users guide – Create and Use a phase space with Gate
- ✗ New digitizer module : A Compton Adder – See the users guide for details

New radiotherapy benchmark

- ✗ In the following folder : \$GATEHOME/benchmarks/benchRT
Users should launch the script “exeBench.script” to run this simulation and perform the data analysis. Proton and photon beams are modelled in this benchmark and the energy deposited in the water tank is stored in a dose map. The dose profiles are plotted during the analysis and confronted to reference results.