

Update on the Advanced Examples

27th Geant4 Collaboration Meeting
26th-30th September 2022, Rennes, France

S. Guatelli and F. Romano

On behalf of the Geant4 Advanced Examples Working Group

28 Advanced Examples

Coord.: S. Guatelli (UOW), Deputy: F. Romano (INFN)

air_shower	B. Tomè	Detection system for cosmic ray shower simulation
ams_Ecal	M. Maire	Simulation of an Electromagnetic calorimeter
brachytherapy	S. Guatelli, D. Cutajar	Dosimetry for endocavitary, interstitial and superficial brachytherapy
composite_calorimeter	A. Ribon	A composite electromagnetic and hadronic calorimeter
ChargeExchangeMC	A. Radkov	Simulation of charge exchange real experiment
doiPET	A. Ahmed , S. Guatelli , M. Safavi	Simulation of a detector system for PET
eRosita	F. Longo, A. Polsini	PIXE simulation with Geant4
fastAerosol	A. Knaian, N. MacFadden	Modelling of particle interactions with
gammaknife	F. Romano	A device for Stereotactic Radiosurgery with Co60 sources for treatment of cerebral diseases
gammaray_telescope	F.Longo	A simplified typical gamma-ray telescope with advanced description of the detector response
gorad	M. Asai	Model of a NASA space mission
hadrontherapy	G.A.P.Cirrone	Simulation of a transport beam line for proton and ion therapy
HGCal_testbeam	A. Zaborowska	High-end High Energy Physics test beam setup, for the endcap electromagnetic calorimeter of the CMS detector [CERN-LHCC-2017-023]
human_phantom	S. Guatelli	Dosimetry in analytical anthropomorphic phantoms
ICRP110_HumanPhantoms	S. Guatelli, M. Large, A. Malaroda, J. Allison	Dosimetry in ICRP110 Phantoms
ICRP145HumanPhantom	H. Han, J. Allison, S. Guatelli	Dosimetry in ICRP145 Phantoms
lort_therapy	G. Miluzzo, J. Pensavalle , F. Romano	Simulation of a IORT device
lAr_Calorimeter	A. Dotti	Simulation of the Forward Liquid Argon Calorimeter of the ATLAS Detector at LHC
medical_linac	B. Caccia, S. Pozzi, C. Mancini, G.A.P. Cirrone	A typical LINAC accelerator for IMRT,
microbeam	S. Incerti	Simulation of a cellular irradiation microbeam line using a high resolution cellular phantom
microelectronics	M. Raine	Simulation of tracks of few MeV protons in silicon
nanobeam	S. Incerti	Simulation of a nanobeam line facility
purging_magnet	J. Apostolakis	Electrons travelling through the magnetic field of a purging magnet in a radiotherapy treatment head
radioprotection	D. Bolst, S. Guatelli, J. Magini, G. Miluzzo, F. Romano	Microdosimetry with diamonds and silicum detectors for radioprotection in space missions
STCyclotron	F. Poignant, S. Guatelli	Modelling the production of radio-isotopes
underground_physics	A. Howard	A simplified typical dark matter detector (such as the Boulby Mine experiment)
xray_fluorescence	A. Mantero	Elemental composition of material samples through X-ray fluorescence spectra
xray_telescope	G. Santin	A simplified typical X-ray telescope (such as XMM-Newton or Chandra)

2022 Census

- 2021 Census: 1.21 FTE
- 2022 Census: 1.84 FTE

To note that the census includes Geant4 Collaborators only

Members (Census 2022)

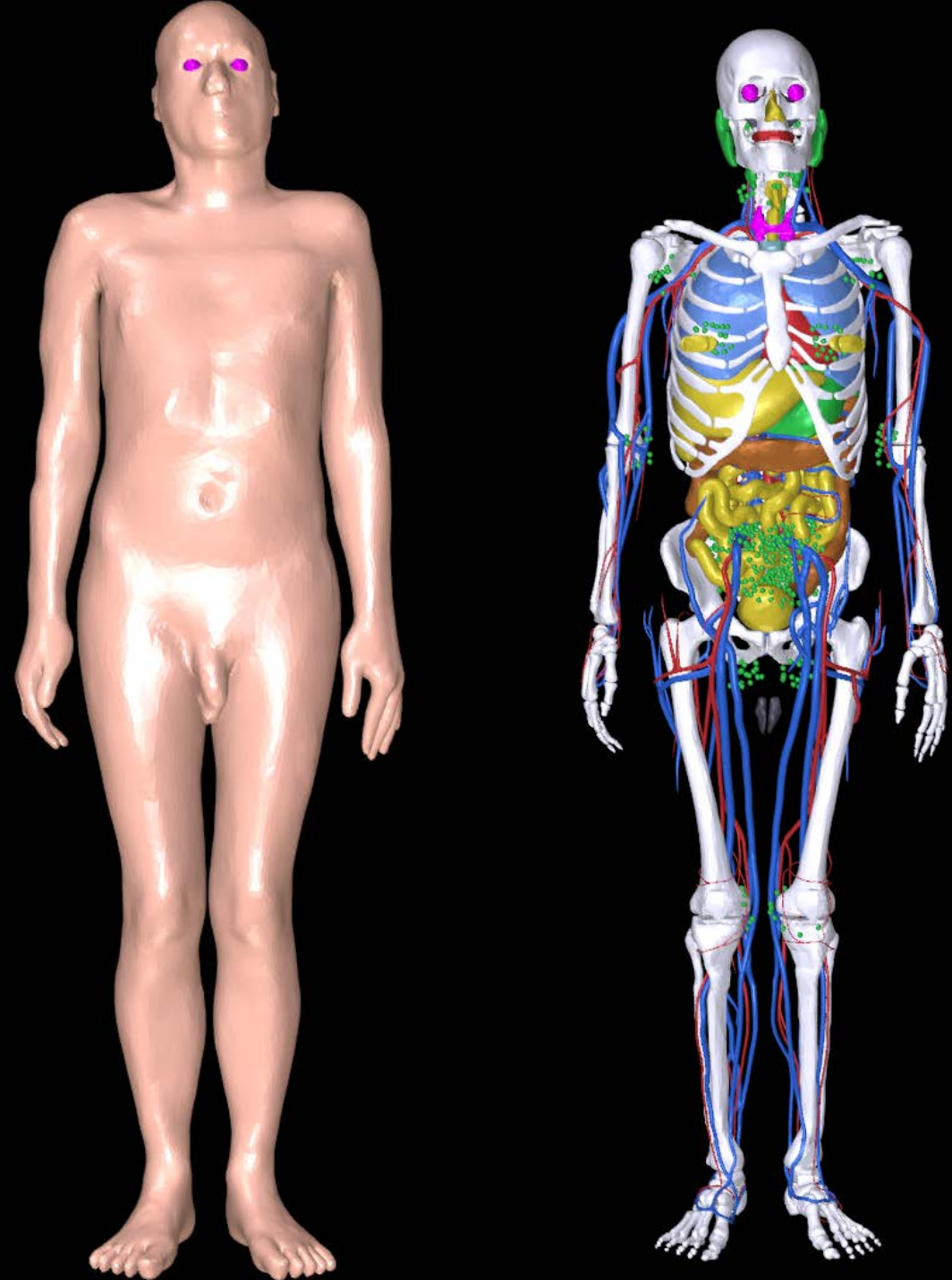
- [Susanna Guatelli](#) (University of Wollongong, Australia) **WG Coordinator**
- [Francesco Romano](#) (INFN-CT, Catania, Italy) **WG Deputy Coordinator**
- [Abdella Ahmed](#) (former ANSTO, Lucas Heights, NSW, Australia)
- [John Apostolakis](#) (CERN, Switzerland)
- [Makoto Asai](#) (SLAC, Stanford, US)
- [Jeremy Brown](#) (ANSTO, Lucas Heights, NSW, Australia)
- [Barbara Caccia](#) (ISS, Rome, Italy)
- [Pablo Caron](#) (ONERA, France)
- [Pablo Cirrone](#) (INFN-LNS, Catania, Italy)
- [Miguel Cortes-Giraldo](#) (Sevilla University, Sevilla, Spain)
- [Gabriele Cosmo](#) (CERN, Switzerland)
- [Milos Dordevic](#) (Vinca Institute of Nuclear Sciences, University of Belgrade, Serbia)
- [Alex Howard](#) (CERN, Switzerland)
- [Sebastien Incerti](#) (CNRS/IN2P3/CENBG, France)
- [Christophe Inguibert](#) (ONERA, France)
- [Paul Gueye](#) (Michigan State University/Facility for Rare Isotope Beams, US)
- [Omrane Kadri](#) (King Saud University, Saudi Arabia)
- [Ara Knaian](#) (NK Labs, LLC, US)
- [Damien Lambert](#) (CEA, France)
- [Zhuxin Li](#) (CENBG, France)
- [Francesco Longo](#) (INFN-Ts, Trieste, Italy)
- [Michel Maire](#) (LAPP, IN2P3, France)
- [Alfonso Mantero](#) (SWHARD srl, Italy)
- [Nate McFadden](#) (NK Labs, LLC, US)
- [Claire Michelet](#) (CENBG/LP2I Bordeaux, France)
- [Luciano Pandola](#) (INFN-LNS, Catania, Italy)
- [Giada Petringa](#) (INFN-LNS, Catania, Italy)
- [Ivan Petrovic](#) (Vinca Institute, Belgrad, Serbia)
- [Maria Grazia Pia](#) (INFN-Ge, Genova, Italy)
- [Floriane Poignant](#) (National Institute of Aerospace (NIA)/NASA Langley Research Center, USA)
- [Alexey Radkov](#) (Ringcentral)
- [Mélanie Raine-Theillet](#) (CEA, France)
- [Alberto Ribon](#) (CERN, Switzerland)
- [Alexandra Ristic-Fira](#) (Vinca Institute, Belgrad, Serbia)
- [Giorgio Russo](#) (CNR-Lato, Cefalù, Italy)
- [Mitra Safavi](#) (ANSTO, Lucas Heights, NSW, Australia)
- [Giovanni Santin](#) (ESA, The Netherlands)
- [Bernardo Tomè](#) (LIP, Portugal)
- [Hans-Joachim Wenzel](#) (Fermilab, US)
- [Anna Zaborowska](#) (CERN, Geneva, Switzerland)

Work Plan 2022/Progress (1)

- Release of a new example showing how to import in Geant4 simulations IAEA Phase Space Files (2)[*] (M. Cortes Giraldo): [postponed to next year](#)
- Development of a specific advanced example for proton tomography (1,2) (C. Michelet): [Presented in Parallel Session 3A](#)
- Development of a SPring-8 synchrotron x-ray polarimetry example for testing low energy polarised gamma-ray physics (1,2) (J. Brown): [postponed to next year](#)
- Further developments of in-silico experimental microdosimetry in the Radioprotection example (1,2): [Presented in Parallel Session 3A](#)
- Development of a mammography example (1,2) (O. Kadri): [NA](#)
- Microelec advanced example: [to include new Geant4-DNA cross sections for solid state materials beyond silicon \(see talk in 5A by C. Inguibert\)](#)
- Measurements and statistical analysis of size, McCabe, Halstead, Chidamber and Kemerer software metrics over at least 50% of the advanced examples; explication of the results in relation to ISO/IEC 9126 and ISO/IEC 25000 (1,2) (M. G. Pia): [In progress](#)
- Migration and improvement of the webpage (1,2) (S. Guatelli) - [Done. Webpage migrated and information has been updated](#)
- Maintenance and code review (e.g. implementation of the extended examples coding guidelines and migration to C++17) in selected examples (1,2)
 - [Technical meeting done with Ben; migration to C++11/14/17 done in brachytherapy, eRosita, human_phantom, ICRP110Phantom, ICRP145Phantom](#)
 - [In-depth code review in the human_phantom](#)
 - [Make sure that all the examples use pre-built physics lists \(where appropriate\)](#)
- Remove Ranecu Engine and make sure to use the default (MIXMAX): [Done](#)

New Advanced example: ICRP145Phantom

- ICRP Publication 145 on Adult Mesh-type Reference Computational Phantoms
 - Ann ICRP . 2020 Oct;49(3):13-201. doi: 10.1177/0146645319893605.
- Use of the General Particle Source
- Calculation of the **dose in the organs of the phantoms**
- To be released in Geant4 v.11.01, with the permission of the ICRP, in agreement with the original developers of the models/Geant4 simulation (available on the web):
 - Haeginh Han / Hanyang University, Republic of Korea
 - Min Cheol Han / Yonsei University Health System, Republic of Korea
 - Banho Shin / Hanyang University, Republic of Korea
 - Chansoo Choi / University of Florida, USA
 - Yeon Soo Yeom / Yonsei University, Republic of Korea
 - Jonghwi Jeong / National Cancer Center, Republic of Korea
 - Chan Hyeong Kim / Hanyang University, Republic of Korea
- [Code review done](#)



Other major developments in 2023

- Code review in **iort_therapy**
 - Adaptation to FLASH electron radiotherapy
 - By G. Miluzzo, J. Pensavalle & F. Roman
- Code review in **medical_linac**:
 - Revision of the example
 - Inclusion of comparison to experimental data documented in EURADOS Report 2020-05
 - By B. Caccia, S. Pozzi, C. Mancini, et al

Other matters

- Give appropriate acknowledgment to external contributors to the Geant4 Collaboration
 - Delicate matter, especially for students
 - So far, we acknowledge the contribution in the README file and in the webpage
 - Can we do more?
 - E.g. certificate of contribution?
 - Other ideas?