

# The Geant4 Open Source toolkit for particle transport

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For the Geant4 Collaboration

# Brief history of Geant4

- Geant4 is the successor of Geant3, which was written in fortran code.
- Geant4 started in 1994, in the form of the RD44 project, with the mission to assess the relevance of Object Oriented technology for a simulation transport code.
- RD44 turned into the Geant4 collaboration, on the first of January 1999.

# Geant4 toolkit, applications and collaboration overview

- Geant4 is an open source physics software toolkit for particle transport
  - Transport performed by Monte Carlo technique
    - ie no deterministic transport for now
  - Toolkit approach offers a high level of possibility for the user to configure and customize for his/her needs for the application
    - Geometry, materials, particles, physics processes/models, readout, etc.
    - And makes it expandable (new solids, new physics models, etc.) through a set of abstract interfaces, at no impact/incidence on the kernel
- The major application domains are HEP, space and medical
  - Production simulation tool by the LHC experiments
- The Collaboration is made of laboratories, institutions, and individuals from North America, Europe, Japan
  - 90 members, HEP (75%), medical/biology (15-20%), space (5-10%)
    - But actual FTE manpower is about 15...
  - It is driven by the Steering Board, chair elected = spokesperson
  - Funding agencies represented in the Oversight Board

# Impact of Geant4

- Toolkit nature of Geant4 leads to direct or indirect uses of Geant4, with Geant4 embedded in applications
  - More than 2200 direct citations to Geant4 NIM paper
    - More than a citation per day
  - Indirect impact with for example GATE (OpenGATE collaboration)
    - OSS dedicated to numerical medical imaging
    - OpenGATE collaboration awarded in 2009 the Physics in Medicine and Biology (PMB) Citations Prize for the research paper "GATE: a simulation toolkit for PET and SPECT".
- Large impact inside HEP
- But also large impact outside HEP

# Tools based on Geant4

## -a sample-

- **Medical:**

- [GATE](#)
  - Tomography/dosimetry
  - 2000+ users.
- Ptssim
  - Target radiotherapy
- [GAMOS](#)
  - Cross purpose

- **Accelerator beamline:**

- G4BEAMLIN
- BDSIM

- **Space:**

- Embedded in many tools for space applic.
  - [GRAS](#) (radiation analysis)
  - [Planetocosmics](#) (planet environment),
  - SPENVIS
  - [CRÈME-MC](#)
  - [MULASSIS](#) (shielding)

# Choice of Geant4 license

- History:
  - First considerations regarding adopting a license since 2002
  - Requirements for a Geant4 license were drafted in 2005/06
  - Choice made, and EGEE-style license adopted June 2006
- Driving motivations:
  - Need for clarifying the use of the Geant4 software
  - Facilitate the use of Geant4 by external projects
    - Redistribution of Geant4 within external packages
  - Provide a disclaimer about uses of the Geant4 software
    - Risks associated with critical applications or military uses

# Some thoughts on OSS model

based on experience in Geant4

- Active contribution from users community
  - Help in providing input to the collaboration
- But has a cost:
  - Requires to identify and invest on a variety of expertise to adapt and support the code
  - Requires an international collaboration
- Importance in keeping the coherence of the overall system
  - Large variety of use cases, approaches / strategies, physics models, etc.
- Reduced manpower in the Geant4 core team

# Conclusion

- Geant4 : open source C++ toolkit for particle transport simulation
- Geant4 Collaboration : an international collaboration of institutes, laboratories and individuals
  - Critical role in users support and development
- Adopting EGEE-style license since 2006



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Version 1.0, 28 June 2006

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