

# Geant 4

*IEEE Nuclear Science Symposium and Medical Imaging Conference  
Short Course*

## **Simulation Techniques Using Geant4**

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<http://www.ge.infn.it/geant4/events/nss2008/geant4course.html>

This course exploits training material developed by several Geant4  
Collaboration members: thanks to all of them!

# Introduction to the course

- This Short Course will provide an overview of Geant4, its capabilities and how they can be used in an experimental simulation application
- Geant4 is a complex and powerful toolkit
  - Impossible to teach everything in one day!
  - Impossible to learn everything in one day either...
- This course will provide you a vision of Geant4 and how to use it
  - Finding your way in Geant4 is not easy!
  - A clear vision will guide you in your further learning
  - Getting familiar with Geant4 concepts and tools will facilitate your learning path through Geant4 documentation and examples

# Plan of the course - 1) Geant4 at a glance

## • Overview of Geant4

- Geant4 vision: scope, fundamental concepts
- Geant4 architecture
- System of units
- Geant4 kernel (Run, Event, Tracking)
- Overview of the main simulation domains in Geant4 and their capabilities
- Examples of experimental applications

# Plan of the course – 2) Using Geant4

- **Refresher of basic concepts of Object Oriented Programming and C++ features** (*optional*)
  - Brief overview of basic technical concepts propaedeutic to the following lectures
  - Please let me know if you wish it
    - if the majority of the audience is familiar with such technical background, it will be skipped
- **Concepts of a Geant4 user application**
  - How Geant4 is used: a Geant4-based application
  - Design of a basic user application
  - User initialisation and actions

# Plan of the course – 3) Geant4 in detail

- **Modelling an experimental set-up with Geant4**
  - Primary particles generation
  - Materials
  - Geometry
  - Read-out and detector response
- **Geant4 kernel**
  - Basic concepts
- **Geant4 physics**
  - Particles and physics processes in Geant4 design
  - Electromagnetic physics
  - Hadronic physics
- **Overview of additional capabilities**
  - Visualisation
  - User interface
  - Event biasing
  - Parameterisation (fast simulation)
  - Parallelisation and execution in a distributed computing environment
  - Data analysis in a Geant4-based application

# Plan of the course – 4) Geant4 in practice

- **Geant4 in practice**

- Geant4 installation, supported platforms
- Guided tour of application code snapshots

- **How to learn more**

- Documentation
- User support

- **Conclusion and outlook**

- ***Questions, feedback and how to keep in touch***

# Course material

- All course material can be downloaded from <http://www.ge.infn.it/geant4/events/nss2008/geant4course.html>
- This course is a brief introduction to the functionality and use of the Geant4 Toolkit
  - it does not replace the study of Geant4 User Documentation
- Geant4 User Documentation and further training material can be found at Geant4 web site: <http://cern.ch/geant4>

# Geant4 Training and User Support

- Further training is provided by the Geant4 Collaboration
  - an international collaboration of scientists, developing and maintaining the Geant4 Simulation Toolkit
- Courses organized by the Geant4 Collaboration
  - information available from Geant4 web site <http://cern.ch/geant4>
- After this course, you may profit of Geant4 user support, provided by the Geant4 Collaboration
  - including a User Forum accessible through HyperNews
  - link from Geant4 home page



# Questions and feedback

- Your feedback is important
  - Please let me know if the pace is appropriate, if you need further clarifications etc.
- Geant4 is huge!
  - In spite of being a Geant4 developer since its early R&D days, my own expertise is not infinite...
  - Thanks for your patience, if I don't have the answers to all your questions
  - But I'll put you in touch with other Geant4 collaborators, should you need specific expertise on any of the topics outlined in this course
- Your feedback is important also after the course
  - I would like to hear from you!