

# IX SEMINAR ON SOFTWARE FOR NUCLEAR, SUBNUCLEAR AND APPLIED PHYSICS

Porto Conte, Alghero, Italy  
28<sup>th</sup> May - 1<sup>th</sup> June 2012

## Description of a typical **Geant 4** application

**Geant 4** tutorial course



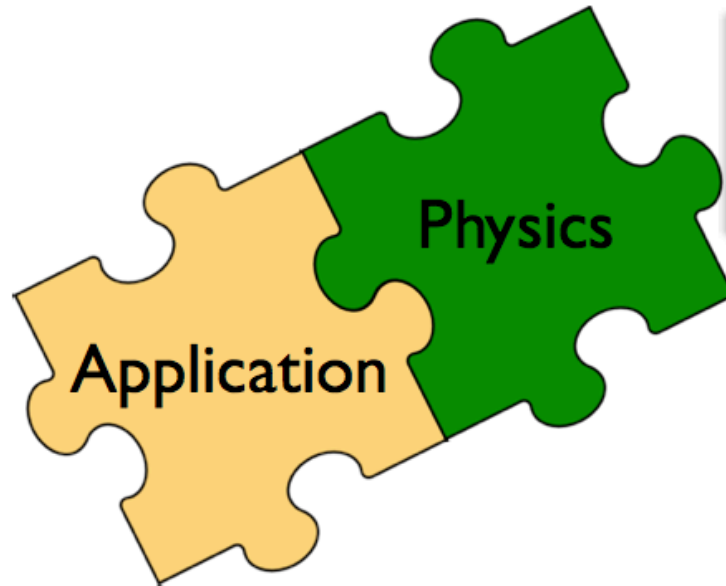
# Introduction

- Geant4 is a **toolkit**: no “main” program
- User is responsible of building an application
- Increased flexibility, but...
  - ... more work to be done

# Introduction



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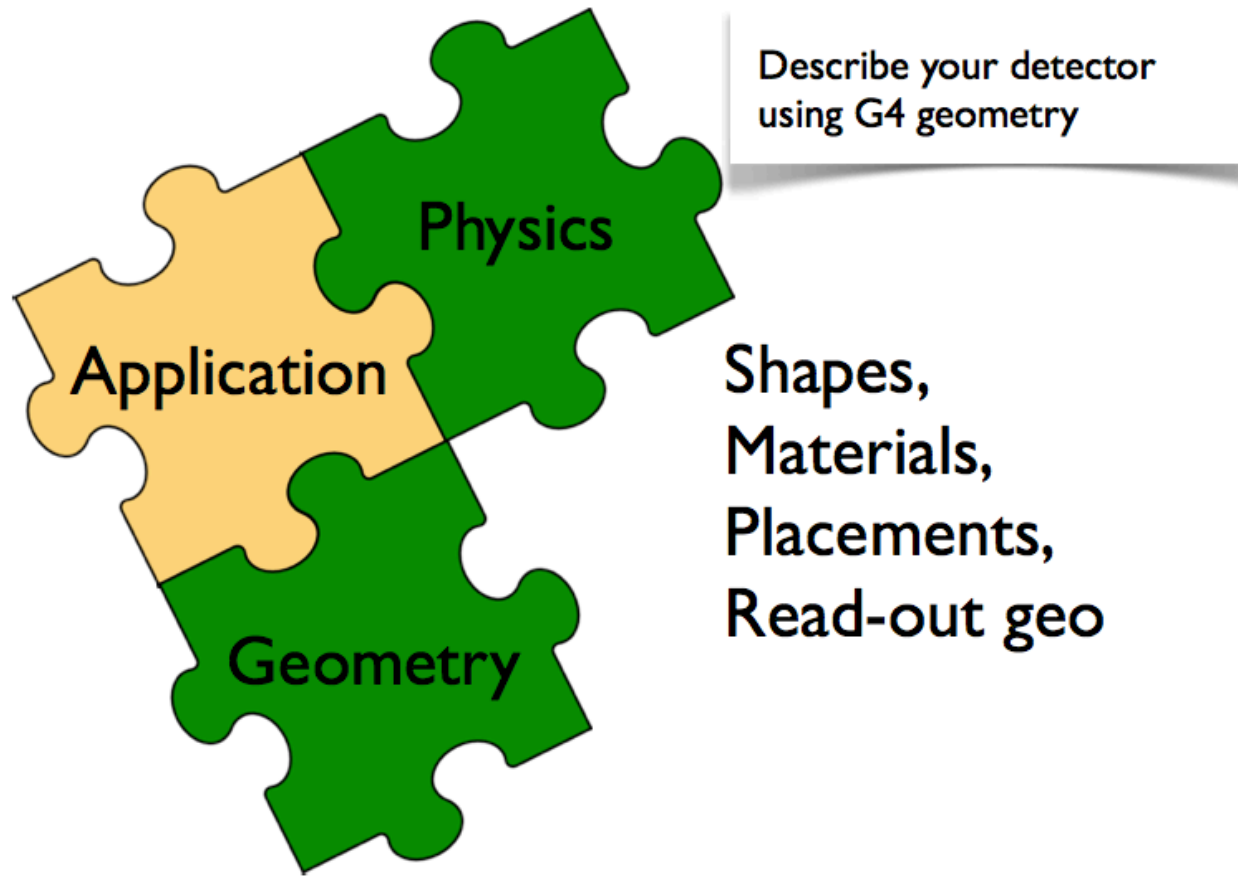


From Geant4:  
One of the provided Physics  
lists or build/tailor your own

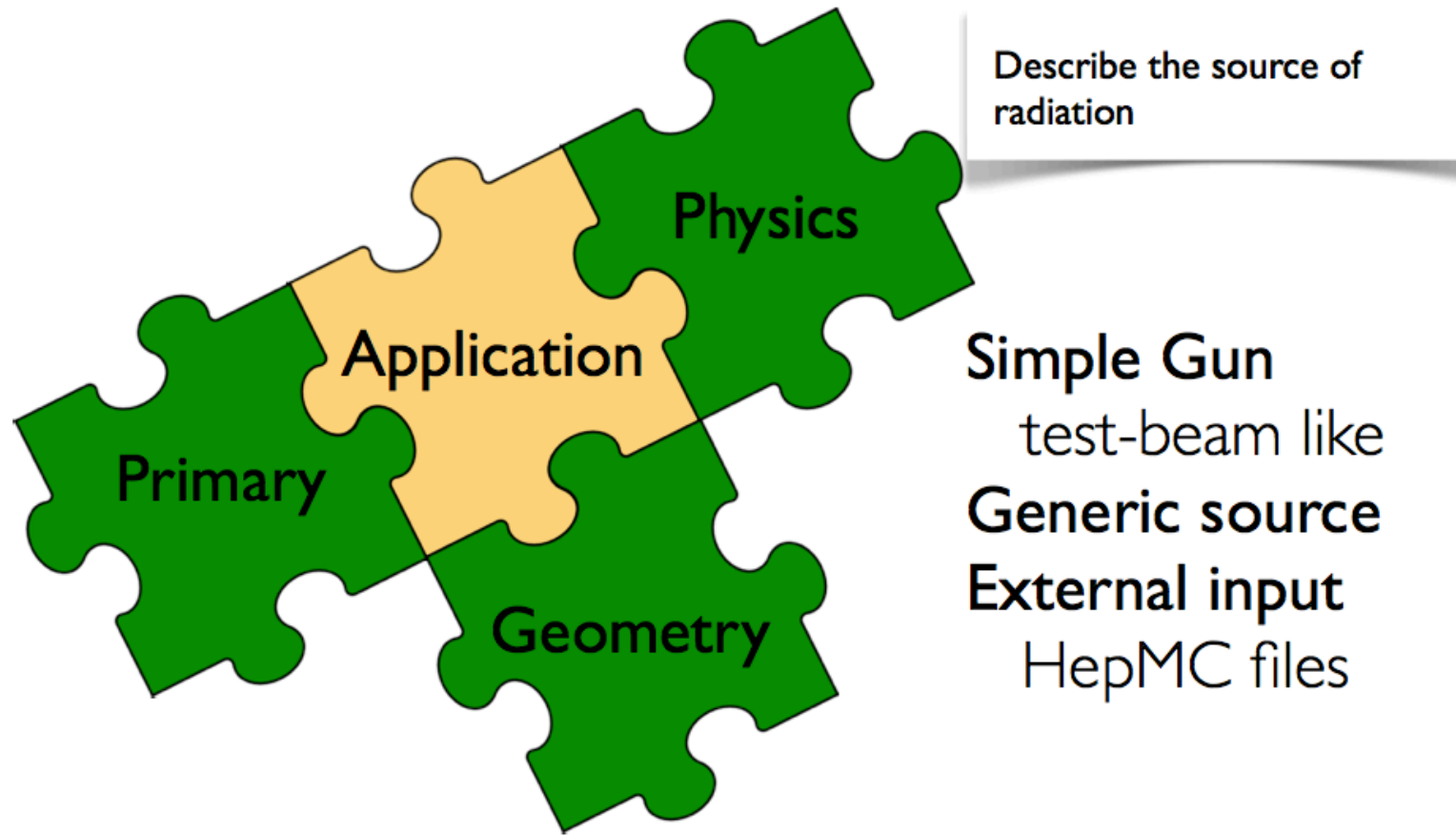
QGSP\_BERT  
FTFP\_BERT  
LHEP  
QGSP\_BIC  
CHIPS

....

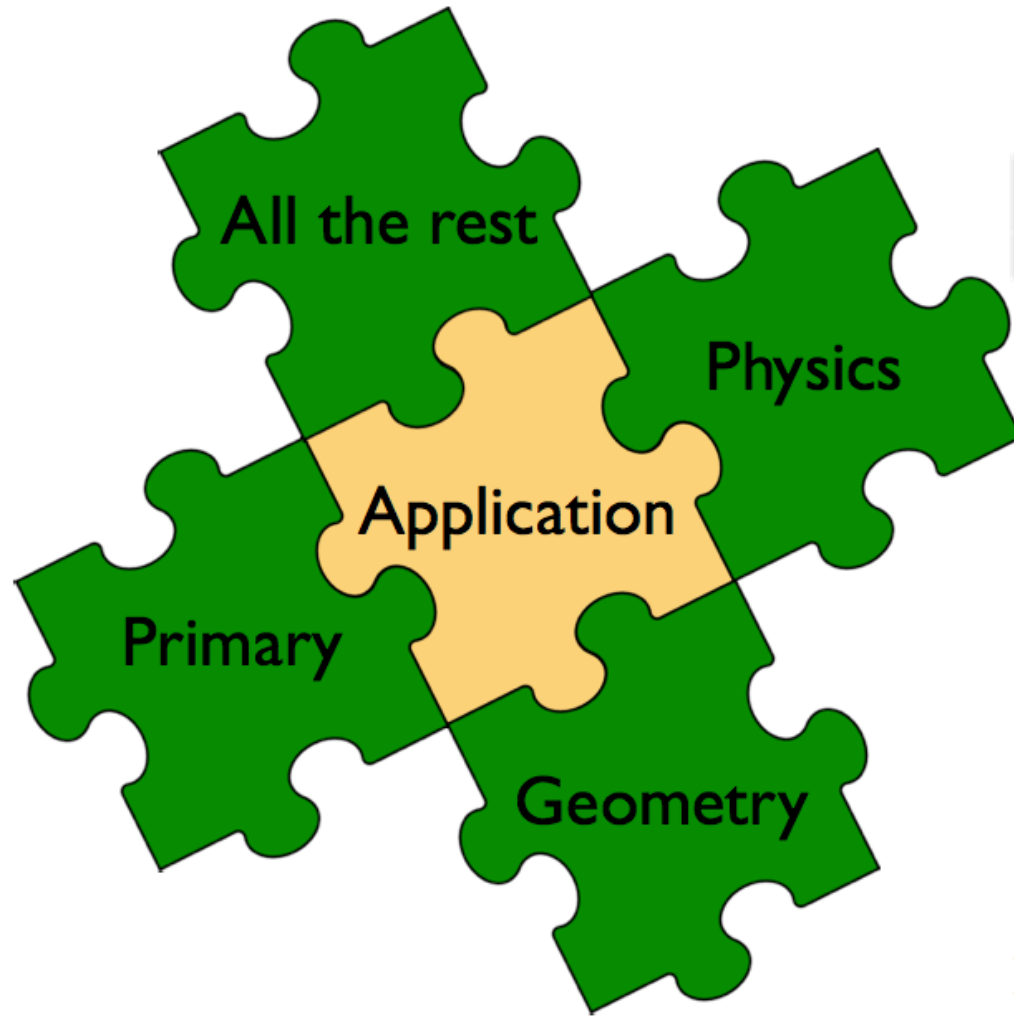
# Introduction



# Introduction



# Introduction



Add all the rest

**G4UserActions**

interact with  
simulation

**G4Hits/Digits**

read-out

**Analysis**

**Visualization**

# Introduction

Mandatory user classes in a Geant4:

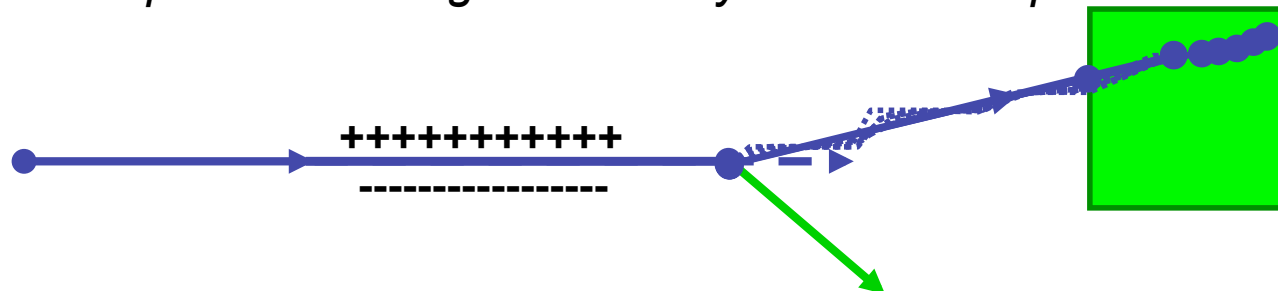
- **G4VUserPrimaryGeneratorAction**
- **G4VUserDetectorConstruction**
- **G4VUserPhysicsList**



# Basic scheme of Geant4 tracking

- STAGE 1: a particle is shot and “transported”
- STAGE 2: all processes associated to the particle propose a geometrical step length (depends on process cross-section)
- STAGE 3: The process proposing the shortest step “wins” and the particle is moved to destination (if shorter than “Safety”)
- STAGE 4: All processes “along the step” are executed (e.g. ionization)
- STAGE 5: “post step” phase of the process that limited the step is executed (e.g. delta-ray production). New tracks are “pushed” to the stack.
- STAGE 6: If  $E_{\text{kin}}=0$  all “at rest” processes are executed. If particle is stable the track is killed
- STAGE 7: A new step starts and sequence repeats...

*Processes return a “true path length”. The multiple scattering “virtually folds up” this true path length into a shorter “geometrical” path length. Based on this new length, the transportation can geometrically limit the step.*



# **Compilation and run of a Geant4 application**

# The Geant4 example categories

- ▶ **Basic examples**
  - ✘ Most typical use-cases Geant4 application (keeping simplicity and easy of use)
- ▶ **Novice examples**
  - ✘ Applications ranging from non-interacting particle to very complex detectors simulation
- ▶ **Extended examples** (Demonstration of Geant4 specific usage)
  - ✘ Electromagnetic
  - ✘ Analysis
  - ✘ Biasing
  - ✘ visualisation
  - ✘ .....
- ▶ **Advanced examples** (Simulation of real experimental set-up or devices)
  - ✘ Brachytherapy
  - ✘ Gammaray\_telescope
  - ✘ Medical\_linac
  - ✘ Hadrontherapy

# Compilation and run of an application

- `source geant4.9.5.p01-install/share/Geant4-9.5.1/.../geant4make/geant4make.sh`  
Or `source yourCustomizedGeant4Setup.sh`  
*(to configure the G4 environment variables when you open a new shell)*
- `cd /.../.../geant4.9.5.p01-install/share/Geant4-9.5.1/.../examples/novice/N03`
- `make` *(to compile the application)*
- type “`ls`” to see the files and folders contained in the main directory
  - ▶ `exampleN03.cc`: the main file
  - ▶ `/src`: source file container
  - ▶ `/include`: header file container
  - ▶ `.mac` files: a set of already prepared macro files
  - ▶ other eventual directories/files
- `$G4WORKDIR/bin/$G4SYSTEM/exampleN03` *(run the application)*

**Thanks for your attention**