GEANT4
A SIMULATION TOOLKIT

cnrs
dépasser les frontières
IN2P3
Les deux infinis

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Scoring - 3

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Outline

- Geant4 scorers
- Command-based scoring
- Geant4 scorers & analysis

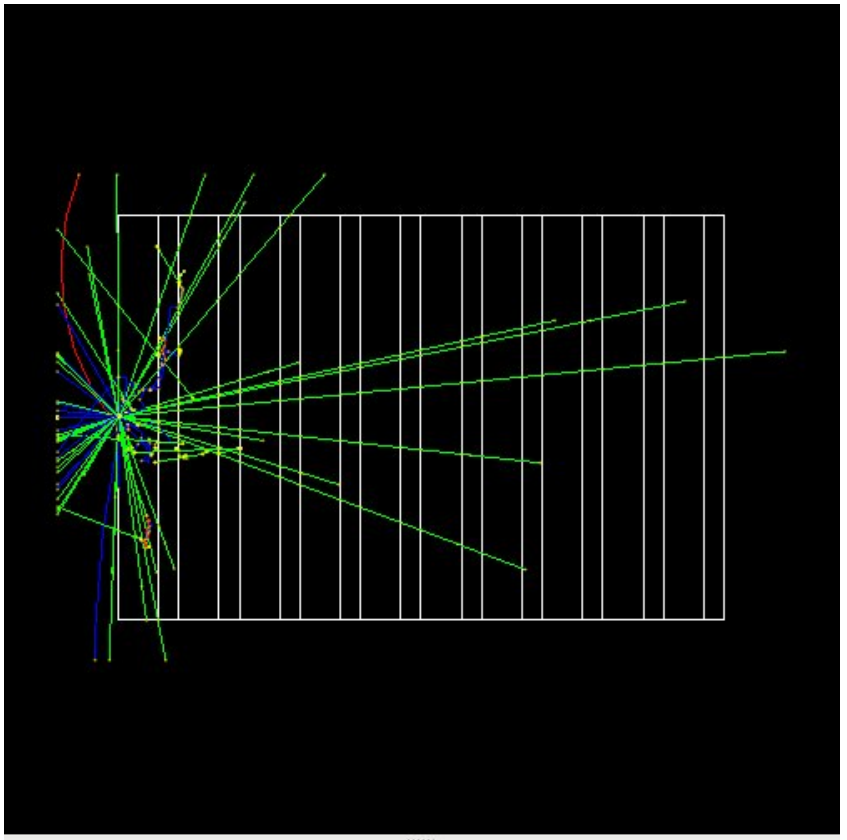
Geant4 Scorers

Ready to Use Scoring Classes

- A typical quantities, such as energy deposit, track length etc. can be accounted using the classes already available in Geant4:
  - G4MultiFunctionalDetector – a sensitive detector which can be associated with scorers to account physical quantities
  - **Various scorer classes** are available:
    - G4PSTrackLength, G4PSEnergyDepsit, G4PSDoseDeposit, G4PSChargeDeposit, G4PSFlatSurfaceCurrent, G4PSNofSecondary, G4PSNofStep, …
    - All scorer classes are derived from G4VPrimitiveScorer base class
    - See Application Developers Guide 4.4.5 for the complete list
  - **Filter classes** can be used to apply a selection on the quantities to be accounted:
    - G4SDCharged[Neutral]Filter, G4SDParticleFilter, G4SDKineticEnergyFilter, …
    - The filter classes are derived from G4VSDFilter base class
    - See Application Developers Guide 4.4.6 for the complete list

Example B4d

- An example of use of Geant4 scorers is provided in basic example B4d
- G4MultiFunctionalDetector
- Scorers accounting energy deposit and track length: G4PSEnergyDeposit, G4PSTrackLength
- Filter to select charged particles: G4SDCharchedFilter



Command-based scoring

Command-based scoring

- Command-based scoring functionality offers the built-in scoring mesh and various scorers for commonly-used physics quantities such as dose, flux, etc.
  - Due to small performance overhead, it does not come by default.
- To use this functionality, activate the G4ScoringManager after the instantiation of G4RunManager in your main()
- This will create the UI commands of this functionality in /score directory.

```
#include "G4ScoringManager.hh"
int main()
{
   // ...
   G4RunManager* runManager = new G4RunManager;
   G4ScoringManager::GetScoringManager();
   // ...
}
```

Command-based Scoring

Example Macro

```
# Define scoring mesh
/score/create/boxMesh boxMesh_1
/score/mesh/boxSize 100. 100. 100. cm
/score/mesh/nBin 30 30 30

# Define scoring quantity
/score/quantity/energyDeposit boxMash
keV

# Define a filter
/score/filter/charged

# Close mesh
/score/close
```

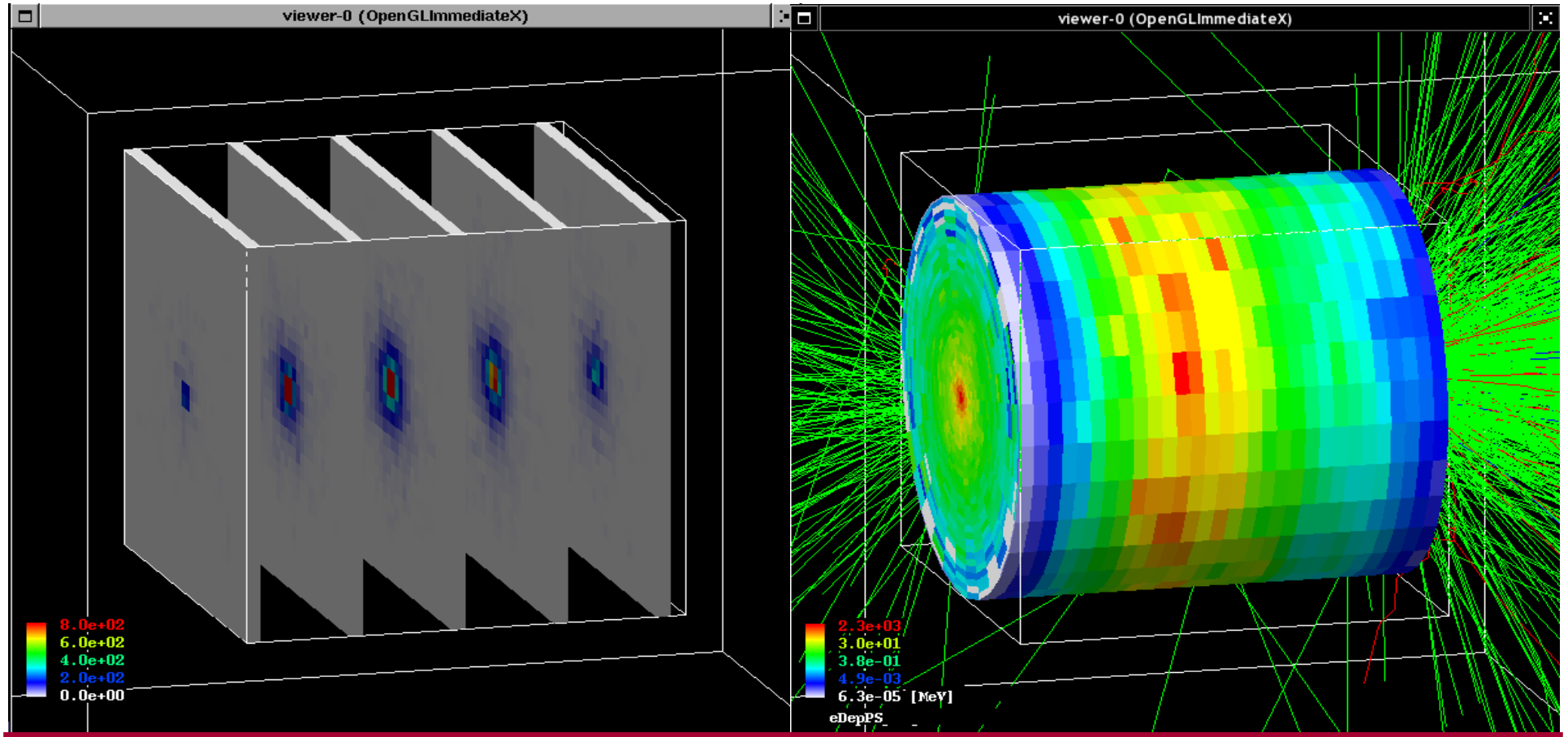
3D scoring mash:
name, shape&size, number of bins

Scoring quantity:
energyDeposit

Filter:
charged particles only

Close mash

Command-based Scoring Examples (2)



From M.Asai

Geant4 Scorers & Analysis

Score Ntuple Writer

- Since Geant4 10.5, it is also possible to save the scorers hits using Geant4 analysis tools. This functionality is assured by the G4VScoreNtupleWriter interface.
  - Demonstrated in the **B3aScoreWriter** and **B4dScoreWriter** extended examples in the analysis category, based on the basic B3a and B4d examples respectively.
- Storing hits is activated in the main() function with instantiating G4ScoreNtupleWriter.
  - The G4ScoreNtupleWriter and its messenger classes are provided in the 'scoreWriter' directory in each example. These classes are fully independent from the example classes and they can be reused in any Geant4 application.
- The Geant4 UI command defined in G4ScoreNtupleWriterMessenger can be used to choose the output file type, the file name and the level of verbosity

```
/score/writerType root
/score/fileName name
/score/writerVerbose 1
```

Summary

- The Geant4 toolkit provides dedicated classes/tools for user scoring:
  - Sensitive detectors
  - Geant4 scorers
  - Command-based scoring
  - Geant4 analysis tools