gemc

Geant4 MonteCarlo

Overview

- Introduction to gemc
- Optical Processes in Geant4
- Cerenkov Light in Geant4
- Optical Processes in gemc
- RICH simple prototype

What is gemc?

Usual simulation:

- Write code for geometry
- Write code for hits
- Write code for the output
- Debug, make sure code doesn't break your simulation

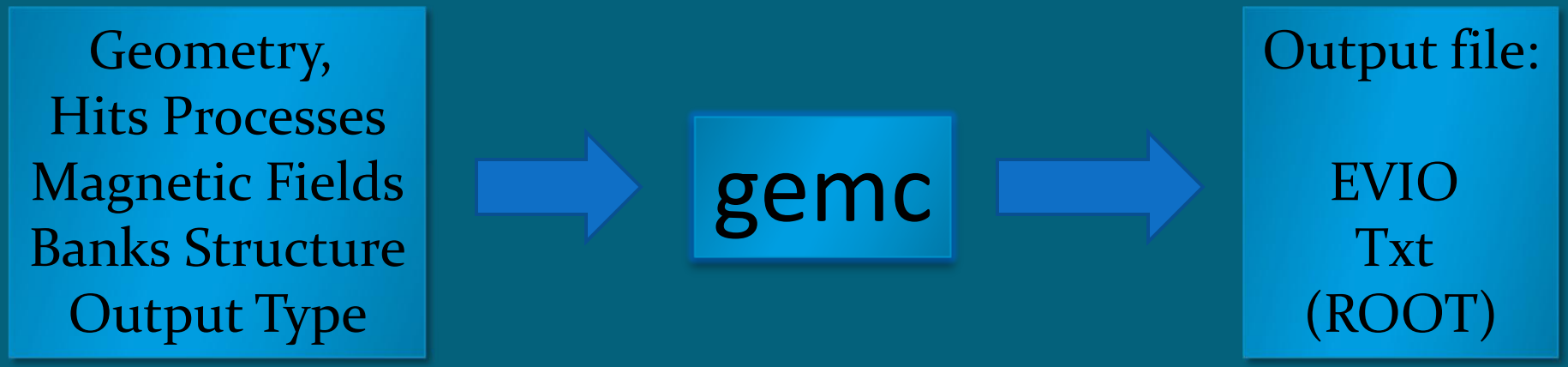
What is gemc?

gemc

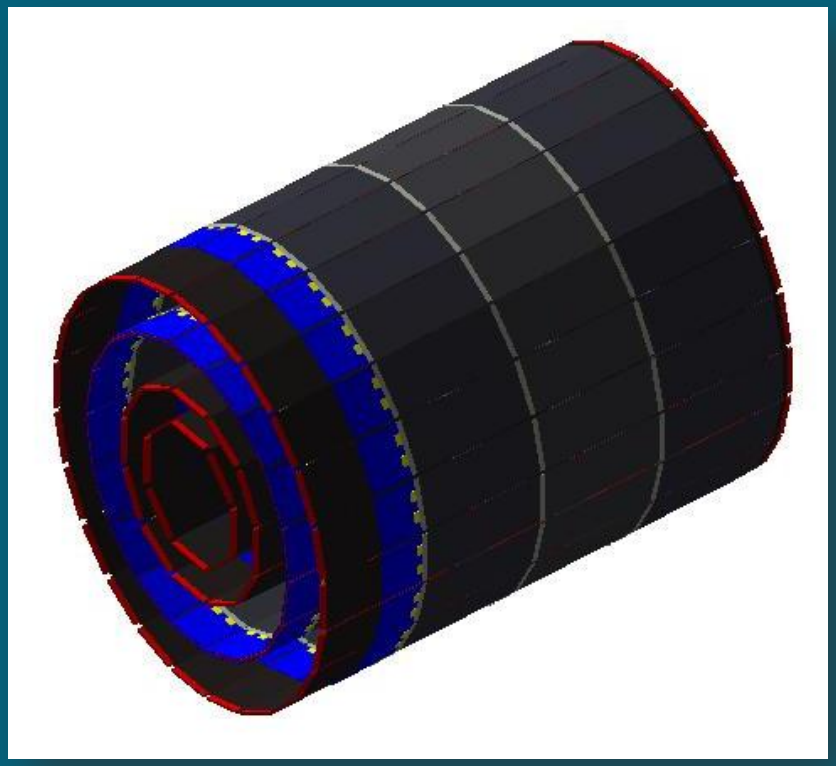
- No code writing.
- Write the geometry/hits/output parameters to external database.
- No code debugging. Each detector is C++ object.

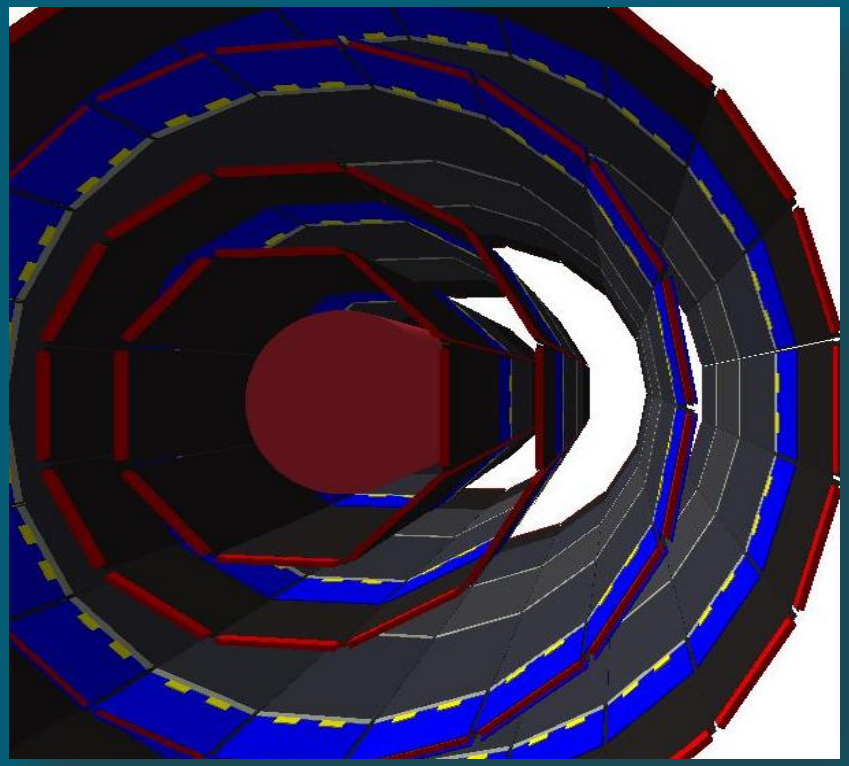
External Database:

- geometry infos not hard-coded
- geometry accessible by reconstruction, display, calibration, etc.

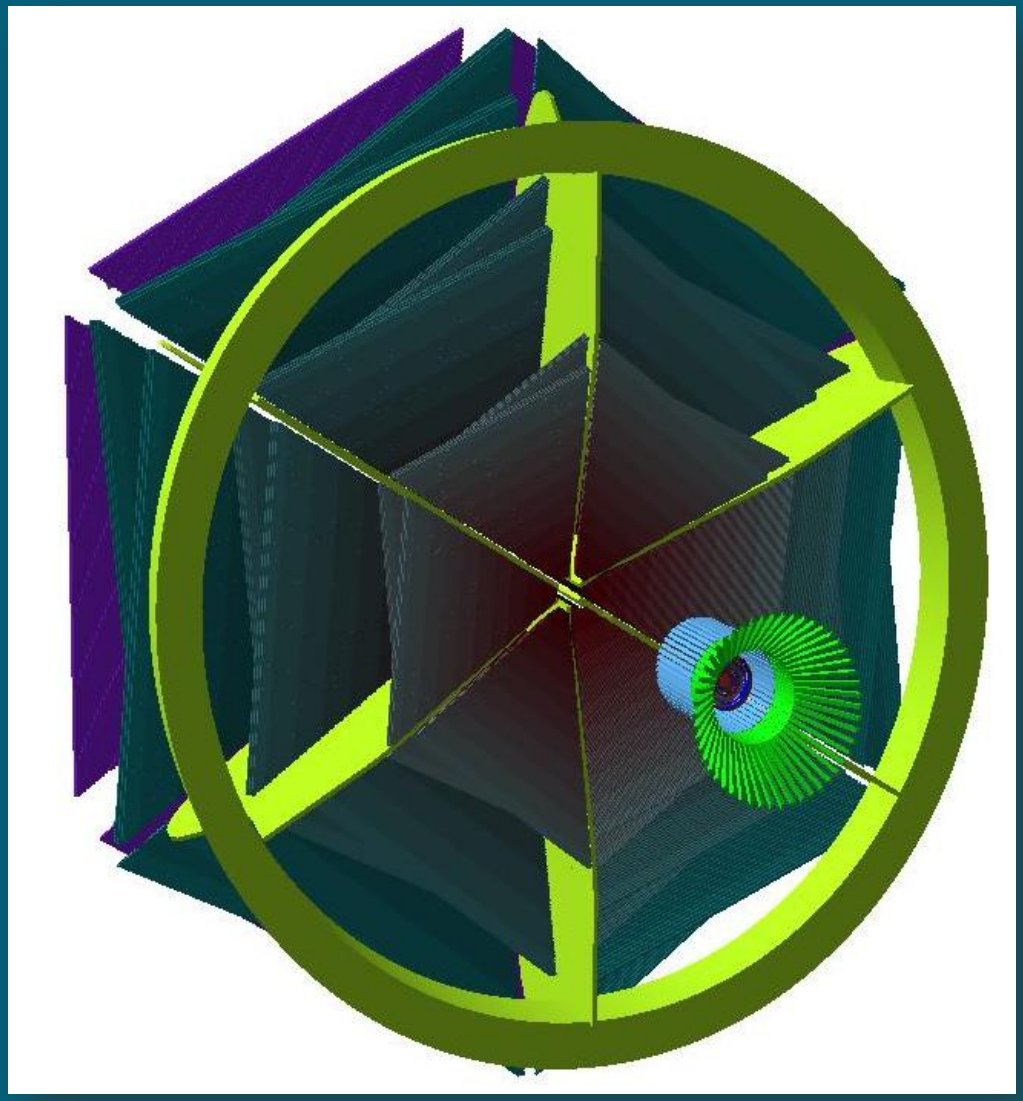

Geometry,
Hits Processes
Magnetic Fields
Banks Structure
Output Type
gemc
Output file:
EVIO
Txt
(ROOT)

SVT





CLAS12



Optical Processes in Geant4

- Concept of "optical Photon" in G4

  λ >> atomic spacing

- G4OpticalPhoton: wave like nature of EM radiation
- G4OpticalPhoton <=|=> G4Gamma

  (no smooth transition)

Optical Processes in Geant4

- Cerenkov Process
- Scintillation Process
- Transition Radiation

Optical Processes in Geant4: Cherenkov

- Cerenkov photon origins are distributed rectilinear over the step even in the presence of a magnetic field
- Cerenkov photons are generated only in media where the user has provided an index of refraction
- An average number of photon is calculated for the wavelength interval in which the index of refraction is given

Optical Processes in Geant4: Boundaries

- **Dielectric - Dielectric**

  Depending on the photon's wave length, angle of incidence, (linear) polarization, and refractive index on both sides of the boundary:

  (a) total internal reflected

  (b) Fresnel refracted

  (c) Fresnel reflected

- **Dielectric - Metal**

  (a) absorbed (detected)

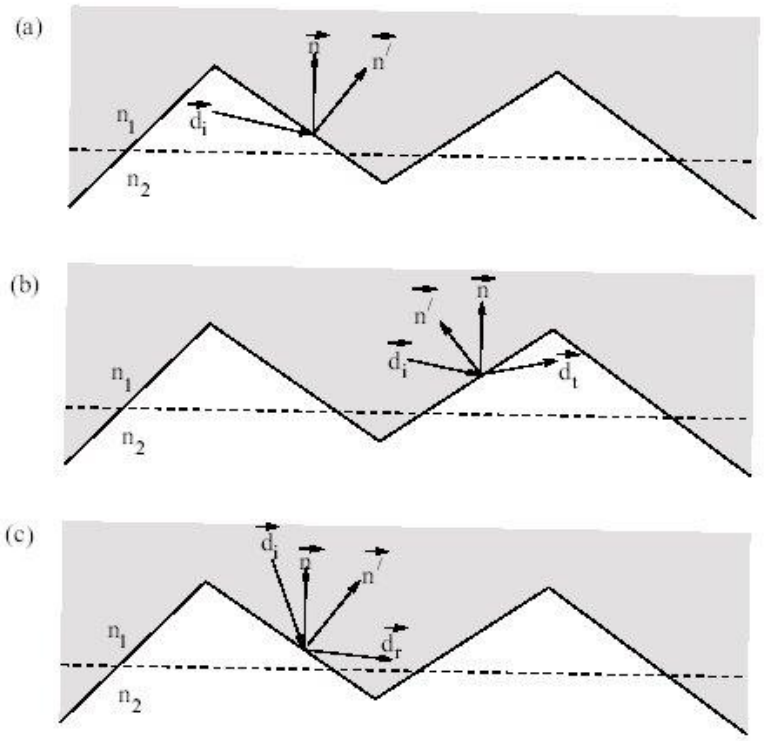
  (b) reflected

Optical Processes in Geant4

Can Chose Surface Type:

```
polished                // smooth perfectly polished surface
polishedfrontpainted    // polished top-layer paint
polishedbackpainted     // polished (back) paint/foil
ground                  // rough surface
groundfrontpainted      // rough top-layer paint
groundbackpainted       // rough (back) paint/foil
```

Optical Processes in Geant4



Special cases handled by the UNIFIED model:
(a) when the incident photon does not aim toward the local micro-facet; or when the transmitted (b) or reflected (c) photon heads in the wrong direction with respect to the average surface normal.

Optical Processes in gemc

1. Assign a material with an index of refraction
2. Assign a boundary surface type between two volumes with an index of refraction
3. Assign “sensitivity” to your detector volume

voila’:

Each Optical Photon will generate a hit in your sensitive detector.

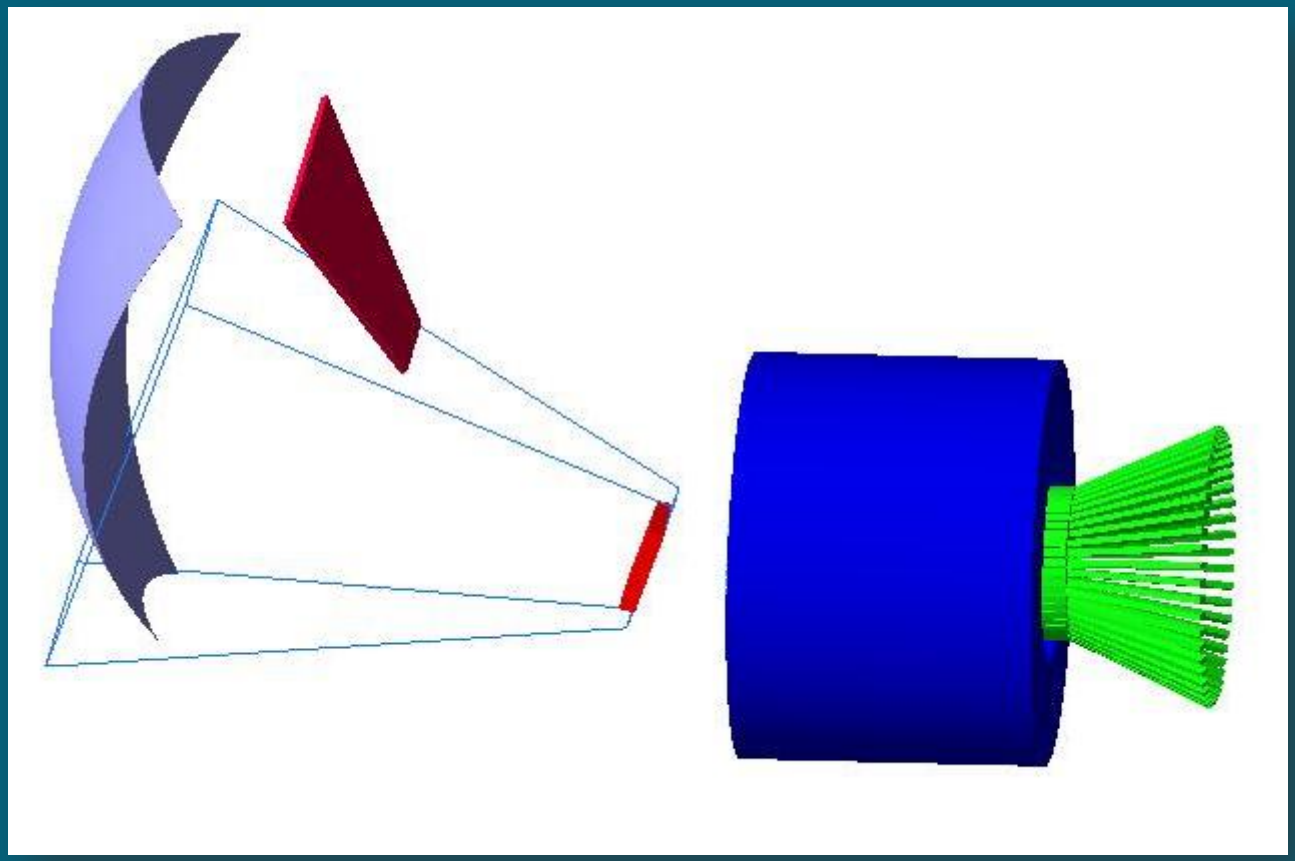
RICH simple prototype

Physics needs to be tuned (and is tunable)

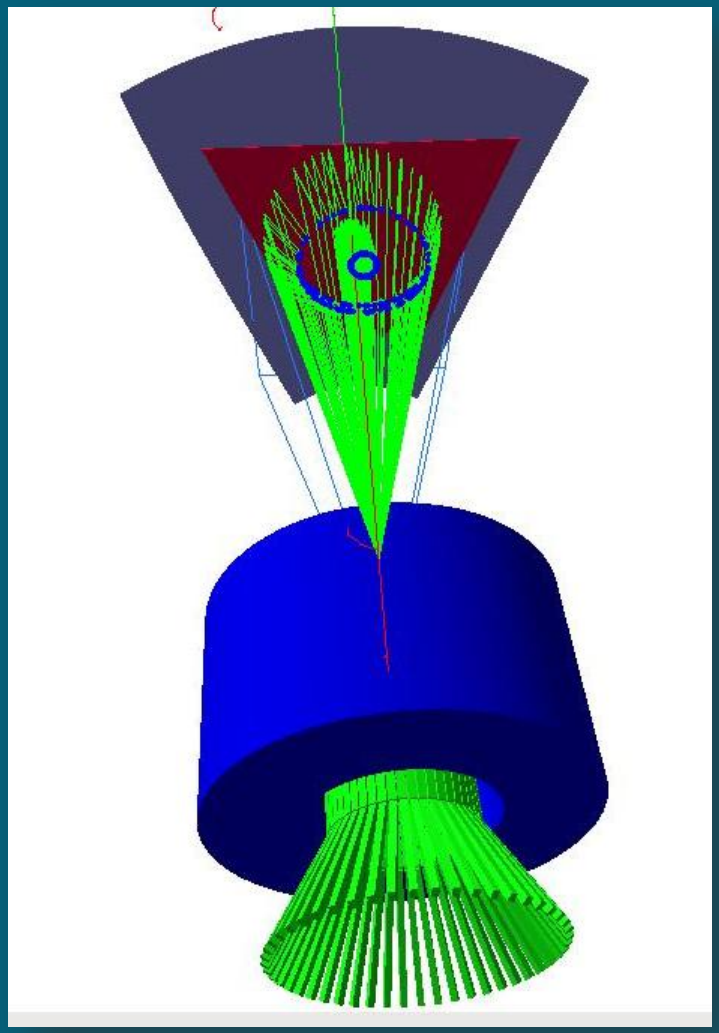
> refraction as a function of wavelength
> absorption as a function of wavelength
> max number of photons produced

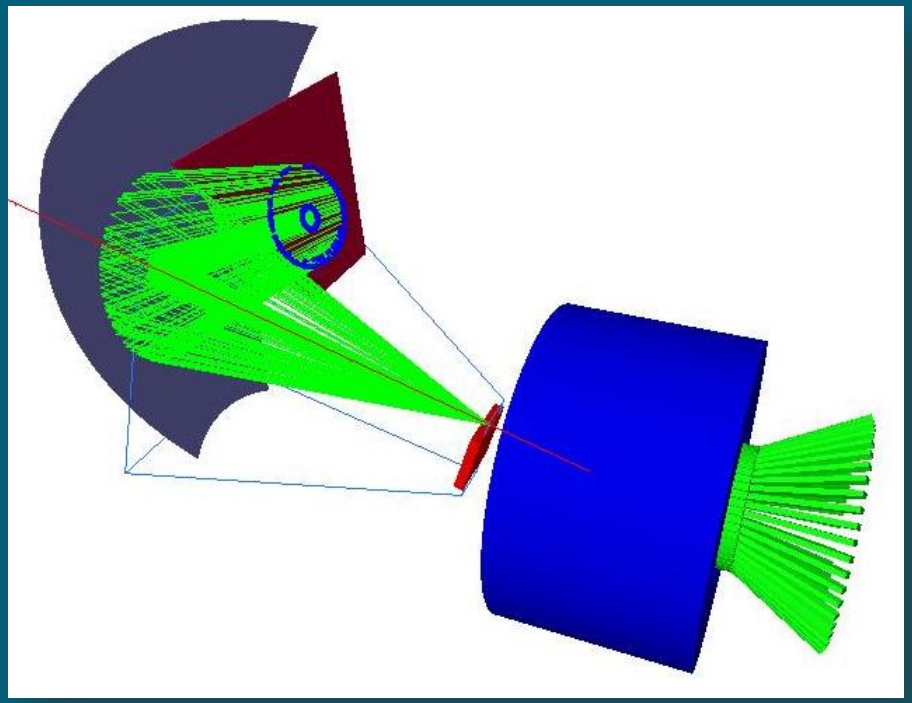
Aerogel, C4F10 Gas Volume, Mirror (polished metal), Detector

RICH simple prototype



RICH simple prototype





RICH simple prototype