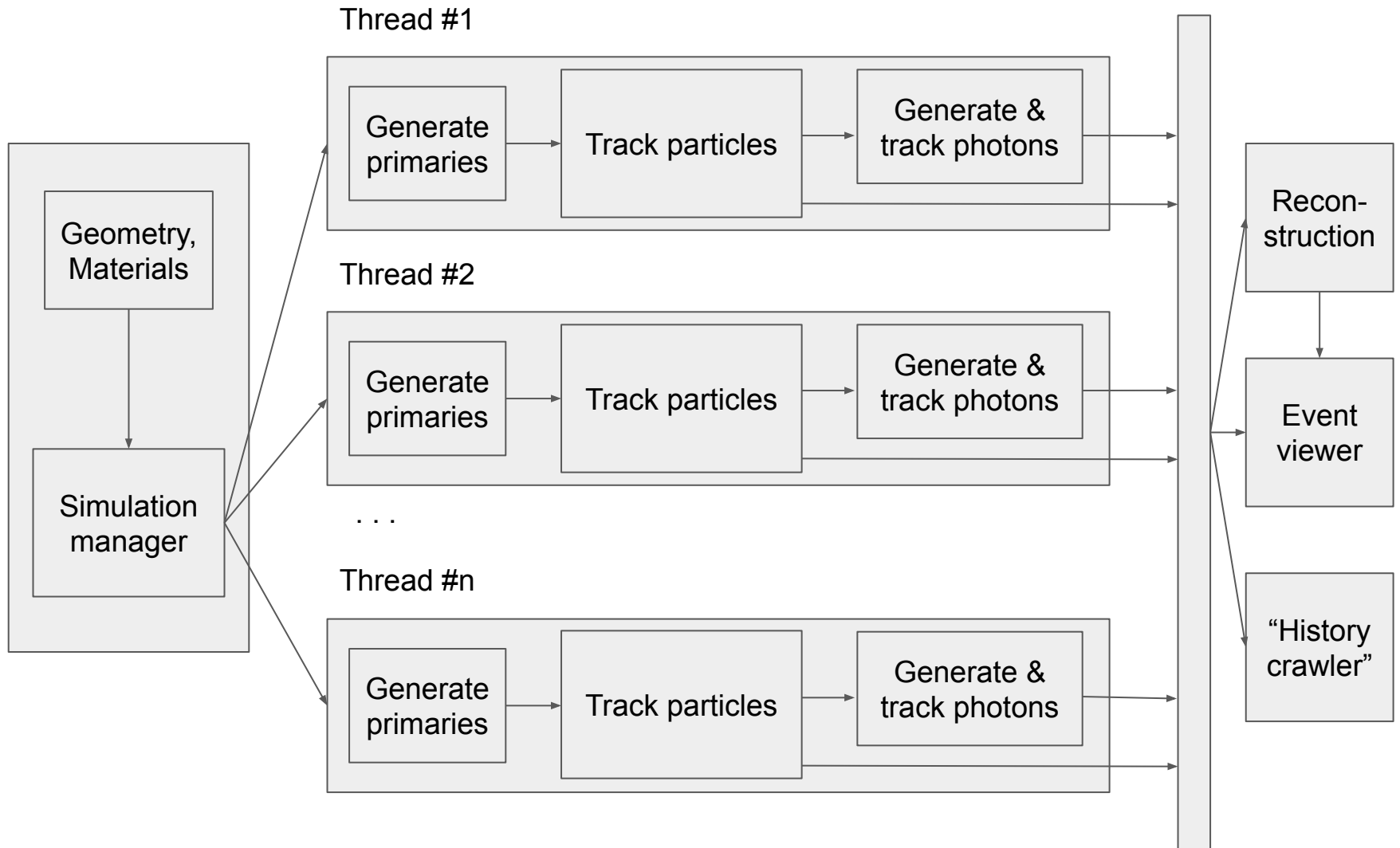


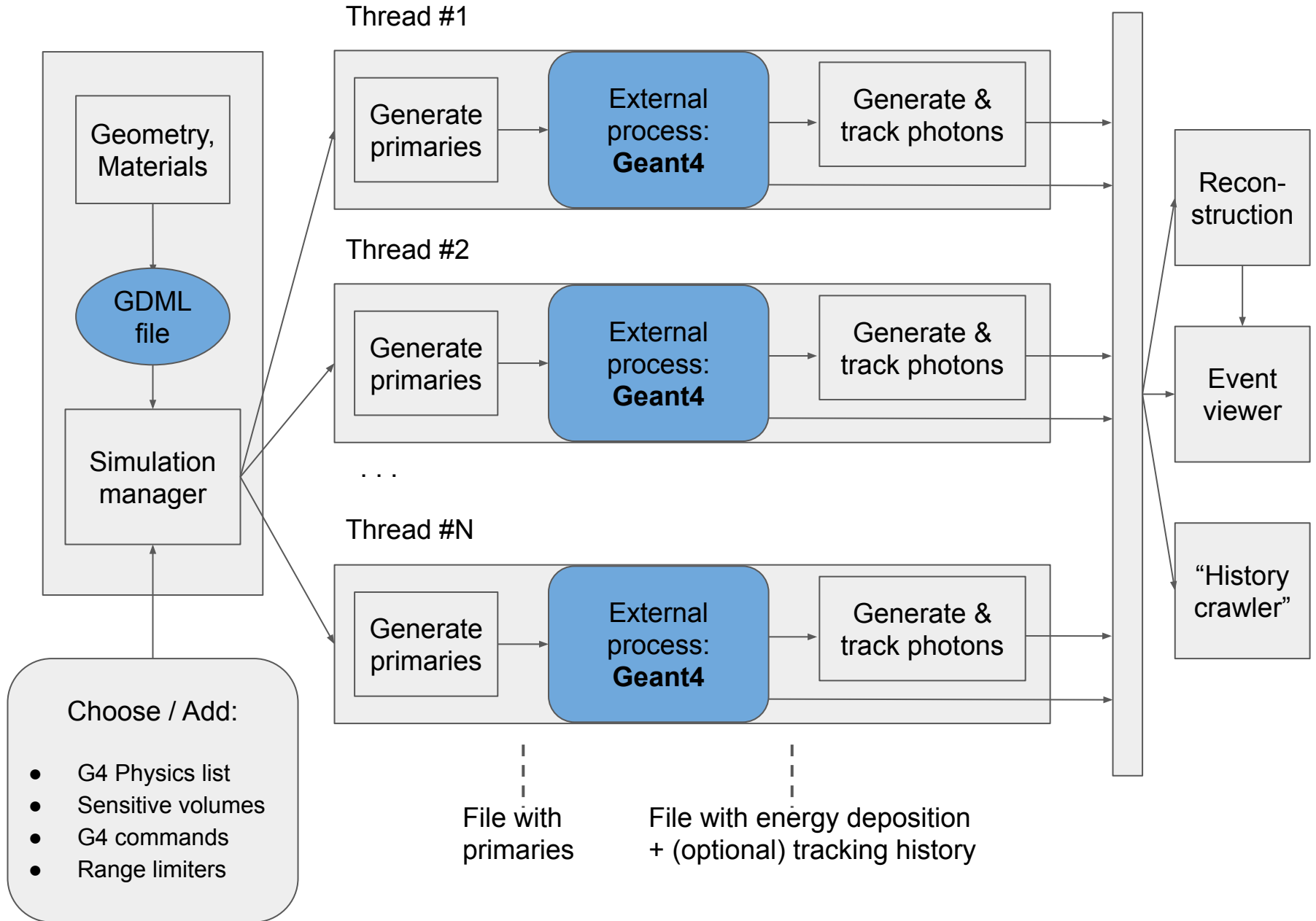
# ANTS2: integration of Geant4

- ANTS2 now gives a possibility to delegate particle tracking to Geant4
- The deposition data produced in Geant4 can be used to generate and track optical photons in ANTS2
- The simulation cycle is fully automatic
- The new features are accessible both from GUI and scripting (JavaScript, Python)
- Geant4 tracking can be used in the semi-automatic multiparameter detector optimization of ANTS2
- Docker container with GUI (X11) is available

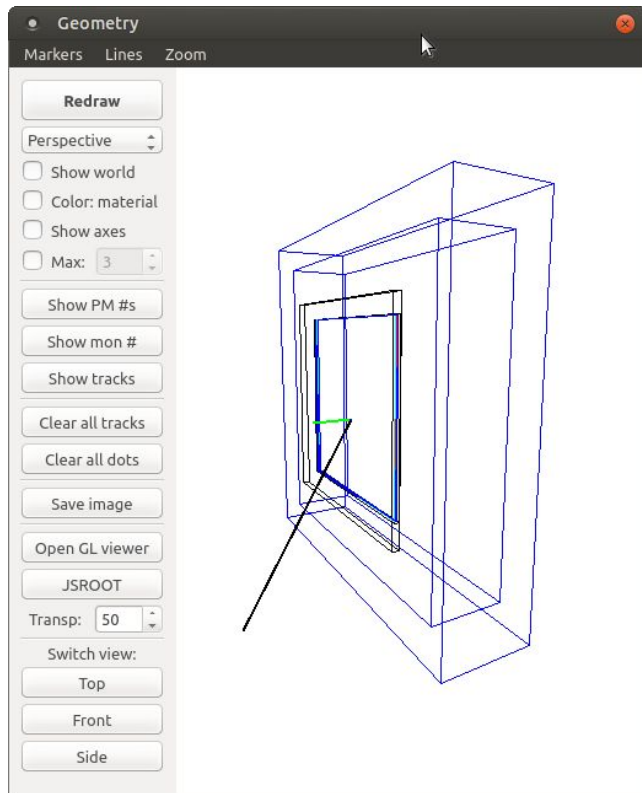
# Without Geant4:



# With Geant4:



# New Event viewer



The Results/Output window features a tabbed interface with 'Text log', 'PM signals', 'PM signals viz', 'Event viewer', 'Particle log', 'Photon log', and 'Monitors'. The 'Event viewer' tab is active, showing event filters and a particle tracking history.

Show event filters (affect 'Next' and 'Previous' navigation buttons at the bottom)

Limit events to ones which have (or should not have) these processes:

Limit to:   for the primaries

Exclude:   for the primaries

Particle tracking history

```
▼ neutron
  C 0mm World Vacuum depo=0 E=2.5e-5
  ▼ neutronInelastic 0.0011mm Converter0 B4C depo=0 E=0
    ► alpha
    ► gamma
    ▼ Li7
      C 0mm Converter0 B4C depo=0 E=841
      StepLimiter 1.01e-5mm Converter0 B4C depo=8.51 E=832
      StepLimiter 1.01e-5mm Converter0 B4C depo=6.78 E=826
      StepLimiter 9.83e-7mm Converter0 B4C depo=8.93 E=817
      StepLimiter 1.02e-5mm Converter0 B4C depo=6.37 E=810
      StepLimiter 1.01e-5mm Converter0 B4C depo=6.53 E=804
      StepLimiter 1.01e-5mm Converter0 B4C depo=6.55 E=797
      StepLimiter 1.01e-5mm Converter0 B4C depo=5.4 E=792
      StepLimiter 0.000101mm Al Al depo=7.67 E=784
      StepLimiter 1.01e-5mm Al Al depo=8.67 E=775
      StepLimiter 1.01e-5mm Al Al depo=9.63 E=766
      StepLimiter 1.01e-5mm Al Al depo=7.37 E=758
      StepLimiter 1.01e-5mm Al Al depo=9.92 E=749
      StepLimiter 2.03e-6mm Al Al depo=8.74 E=740
      StepLimiter 9.59e-6mm Al Al depo=8.38 E=731
      StepLimiter 1.01e-5mm Al Al depo=9.09 E=722
      StepLimiter 1.01e-5mm Al Al depo=8.24 E=714
      T 0mm Al->Al Al->Al depo=1.32 E=713
      ionIoni 0.00171mm Al Al depo=713 E=0
```

Hide all transportation steps

Hide transportation of primaries

Precision:  Default expansion level:

Position, mm  Step, mm  Kinetic energy

Volume name  Volume index  Deposited energy

Material  Time

Show tracks  Show PM signals

Suppress indication of secondaries

Inspect event:  Previous Next Number of events: 50000

# “History crawler” - GUI (and script too)

Results/Output

Text log PM signals PM signals viz Event viewer Particle log Photon log Monitors

Before simulation activate acquisition of particle tracking log!

Limit to particle: neutron  
 Only primaries  Limit to the first interaction of the primary  
 Only secondaries

In volumes On the borders

Request what: Get processes

Limit to material: R134A  
 Limit to volume:  
 Limit to volume index: 0

Request

Processes found:

```
C 210 times
In 105509 times
Out 104743 times
StepLimiter 132004 times
eloni 37 times
hloni 4 times
hadElastic 8 times
ionloni 4 times
msc 188 times
phot 201 times
```

Available options:

- Particles
- Processes
- Travelled distances
- Deposited energy

Results/Output

Text log PM signals PM signals viz Event viewer Particle log Photon log Monitors

Before simulation activate acquisition of particle tracking log!

Limit to particle: neutron  
 Only primaries  Limit to the first interaction of the primary  
 Only secondaries

In volumes On the borders

Energy\*1e6 vs: X

average per bin  and vs (3D):

Conditions: Z<0 && (Energy < 2.49e-5 || Energy > 2.51e-5)

Limit material from: Vacuum  Limit material to: Vacuum  
 Limit volume from: Converter  Limit volume to: R134A  
 Limit vol index from: 0  Limit vol index to: 0

- Bins: 100 From: 0 to: 0

Request

For a selected transition:

- Show distribution of values for any parameter calculated using particle's position (X, Y, Z), direction vector (Vx, Vy, Vz), Time and Energy.
- Arbitrary cuts using the same properties!

# Future plans for ANTS2 (3?)

- Implement ANTS2 *monitors* in Geant4-delegated tracking
- Semi-automatic optimization to use the distributed simulation/reconstruction engine of ANTS2
- Docker container with GPU support
- Docker container targeting computer grids and clusters
  
- Tracking of optical photons on GPU
- Possibility to delegate tracking of optical photons to Geant4
- Web interface for didactics / outreach
- ANTS2 as a library for Python

ANTS2 on Github: [github.com/andrmor/ANTS2](https://github.com/andrmor/ANTS2)

Use the Dev branch for the newest features!