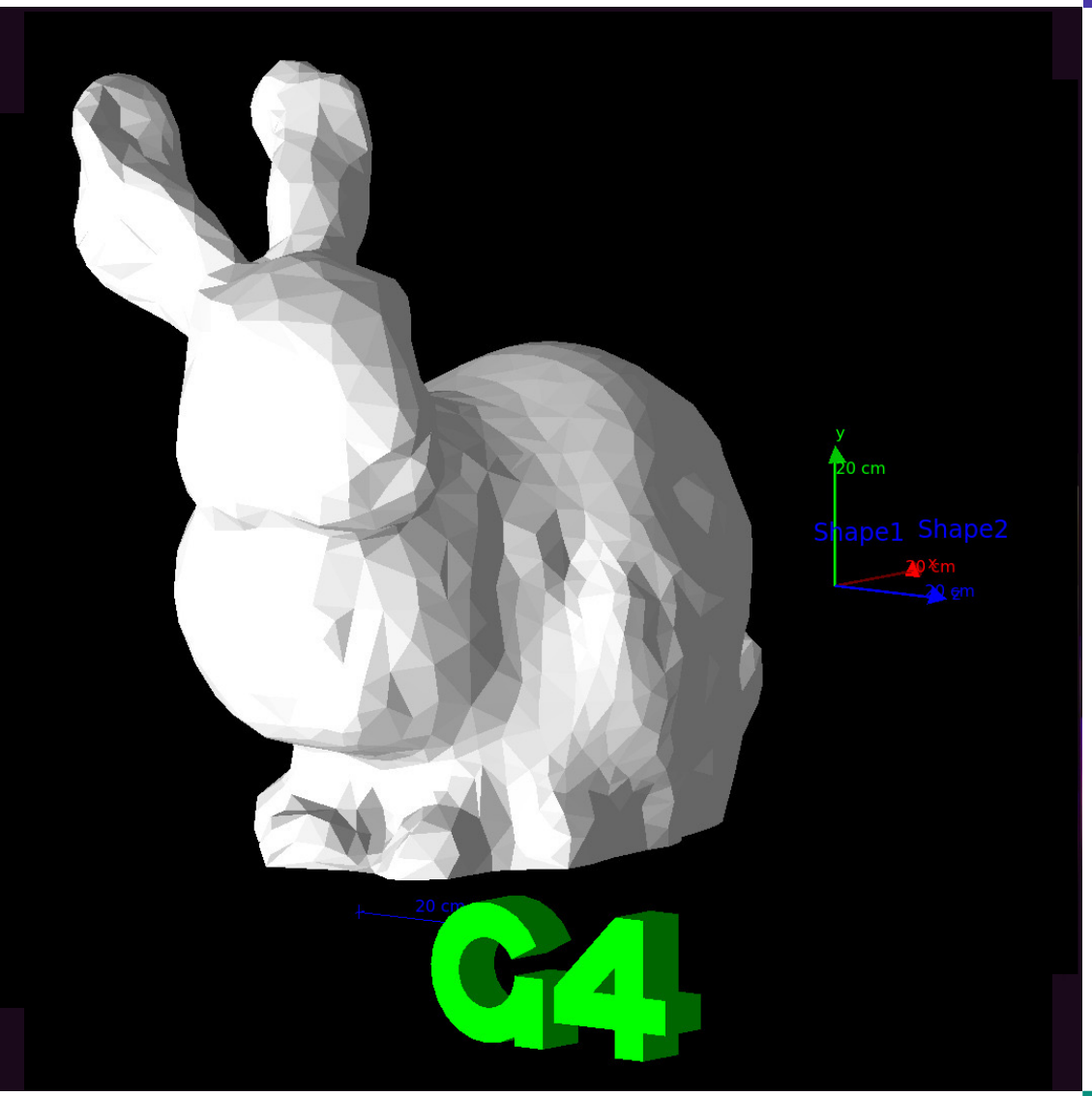


Geant4 simulation

Marwa and Geant4 group

Muography Workshop
BND 2023

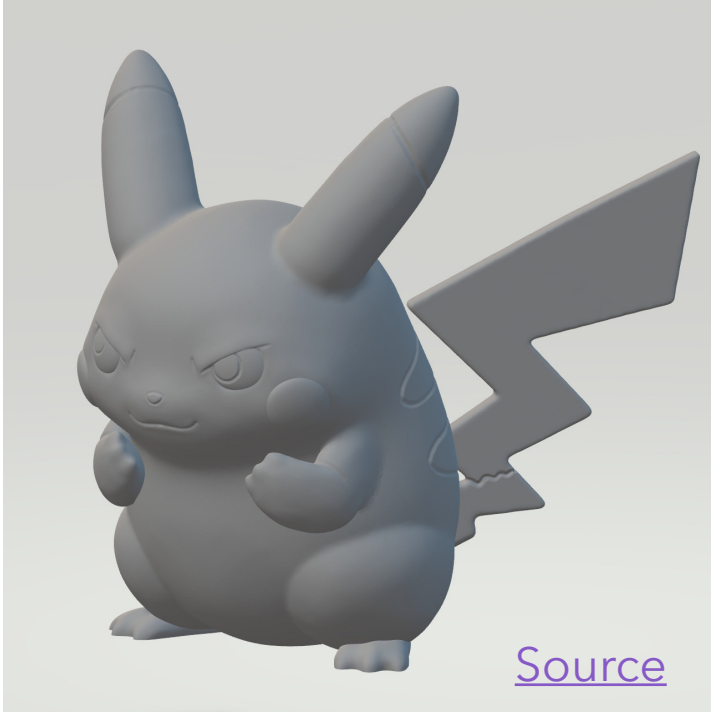
Define geometry

Geometry is made of volumes

+ World: the biggest volume that contains all other volumes
+ Detector volume
+ Volume of interest

Set for each volume:

+ shape (can be everything)
+ position
+ size
+ material



Sensitive Detector

Volume(s) that you assign to be sensitive

Can provide information about particles that pass through it:

+ particle ID
+ coordinates
+ energy deposit
+ momentum
+ …

One just have to ask G4 to print/save needed information in the desired format: ROOT file, csv, txt, …

Particle Generator

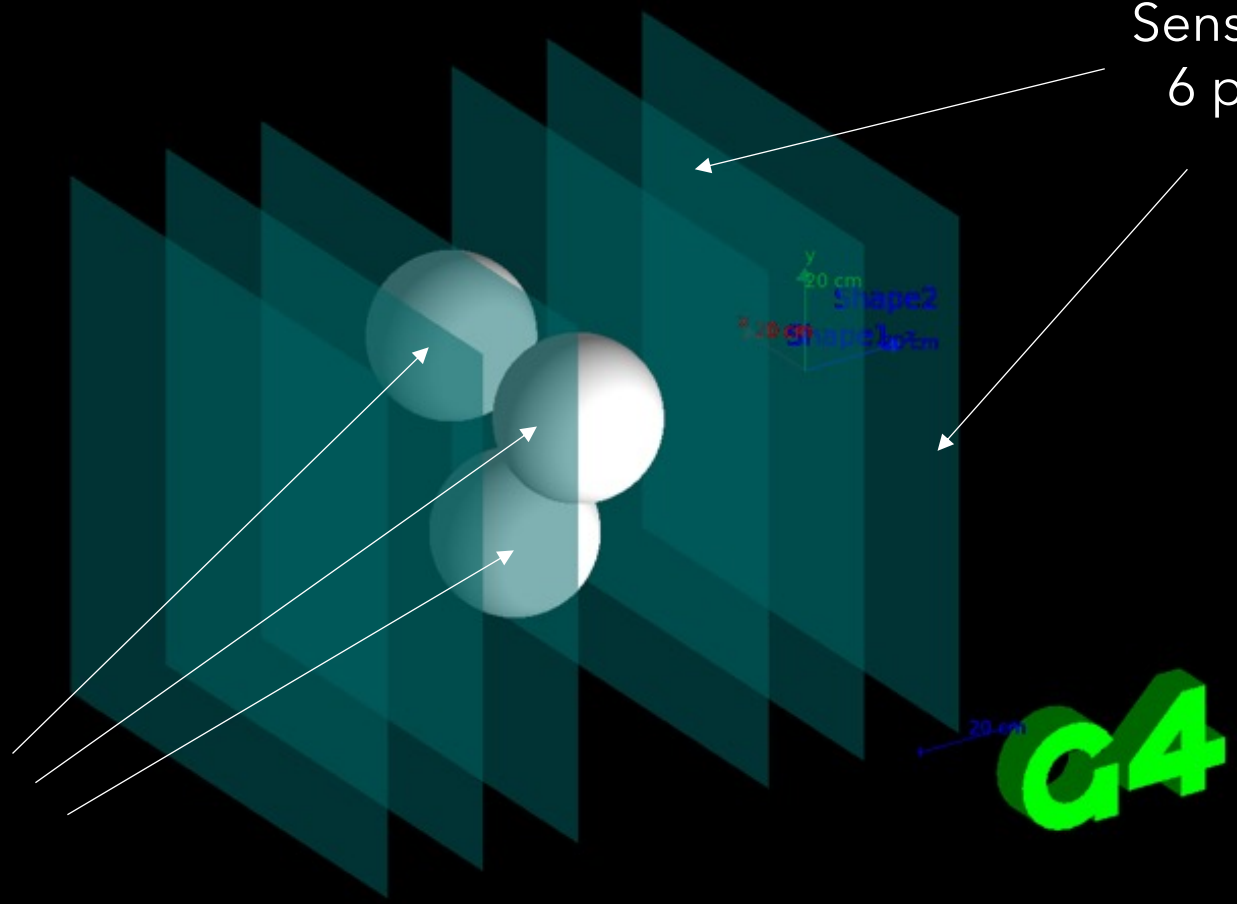
Default generator include a variety of particles, including atomic nuclei

We use CRY: Cosmic RaY Shower Library:

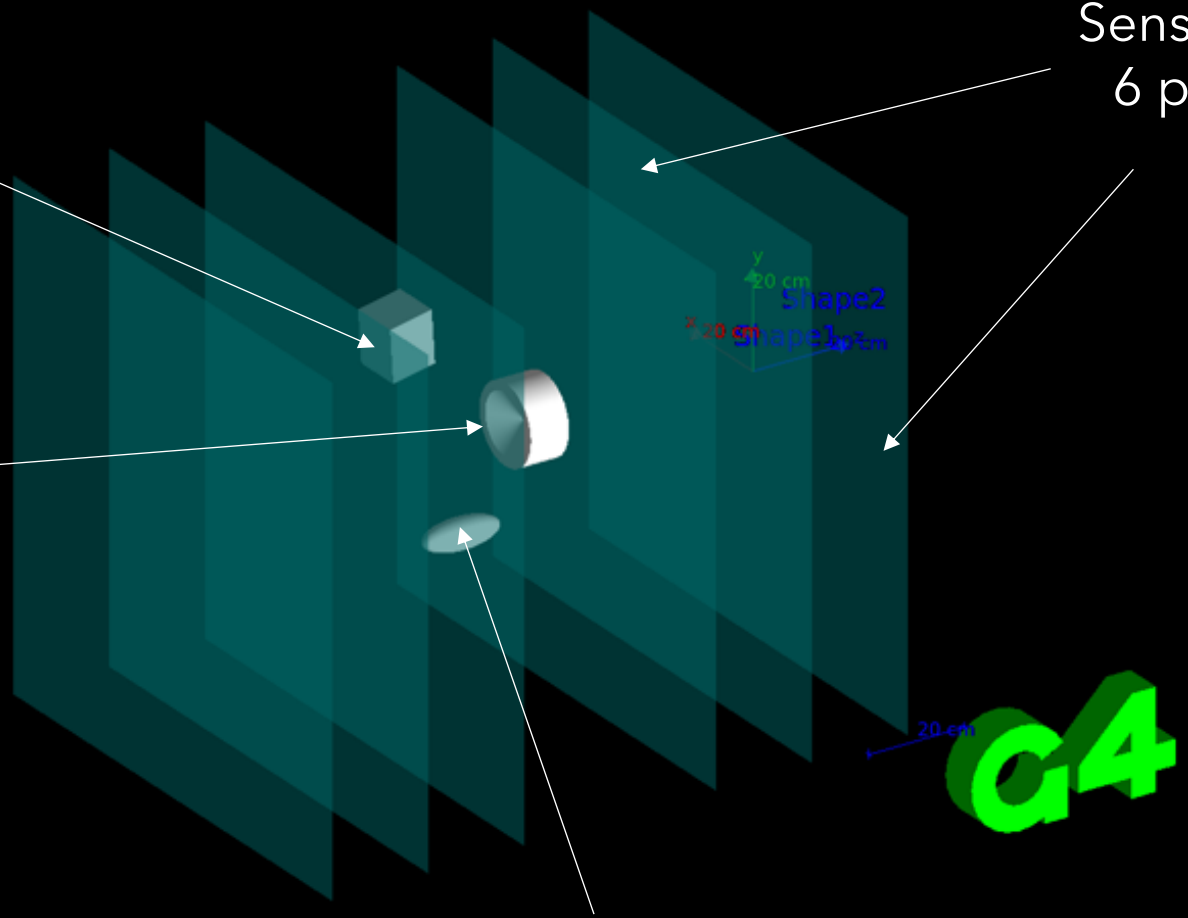
+ select particles what will be included into the shower
+ direction and opening angle
+ source area

Geometry example

cr. Marten
and Liza



Geometry example



Aluminium
G4Para

Sensitive Detector:
6 plastic planes

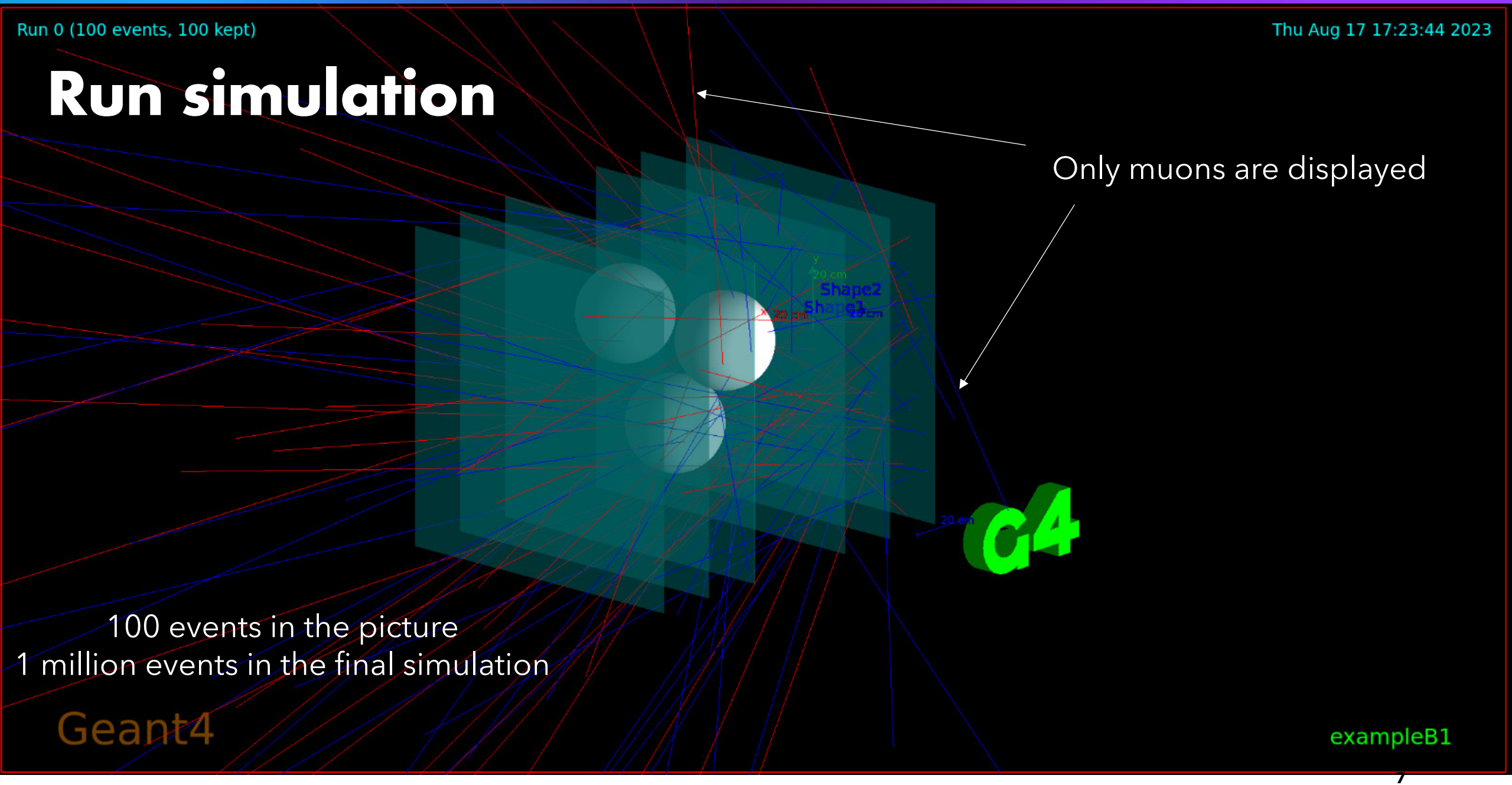
Silver
G4Hype

Volumes of Interests:
3 carbon spheres
with 3 other volumes inside

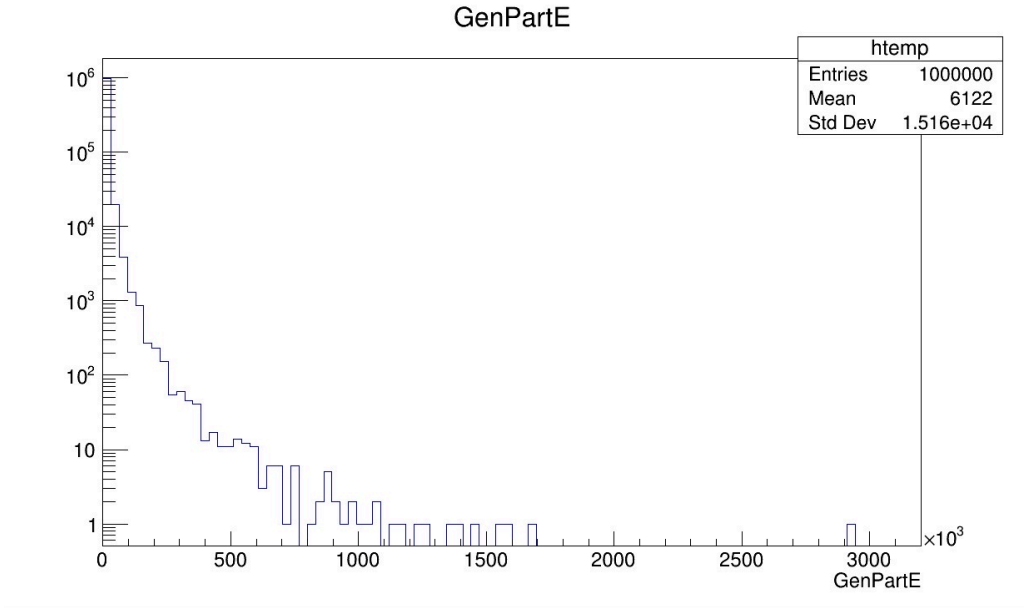
Uranium
G4Ellipsoid

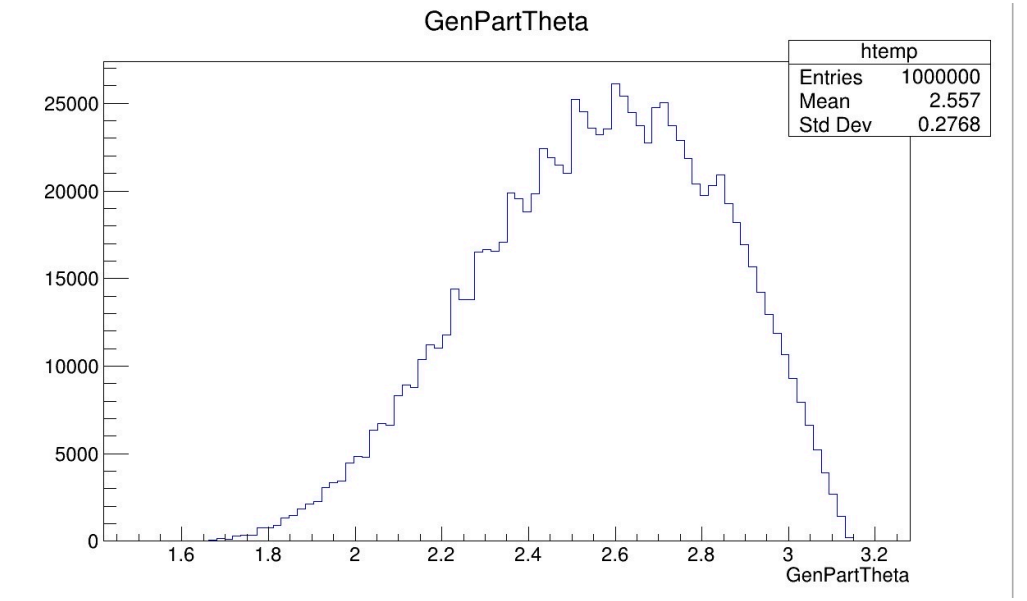
Geant4

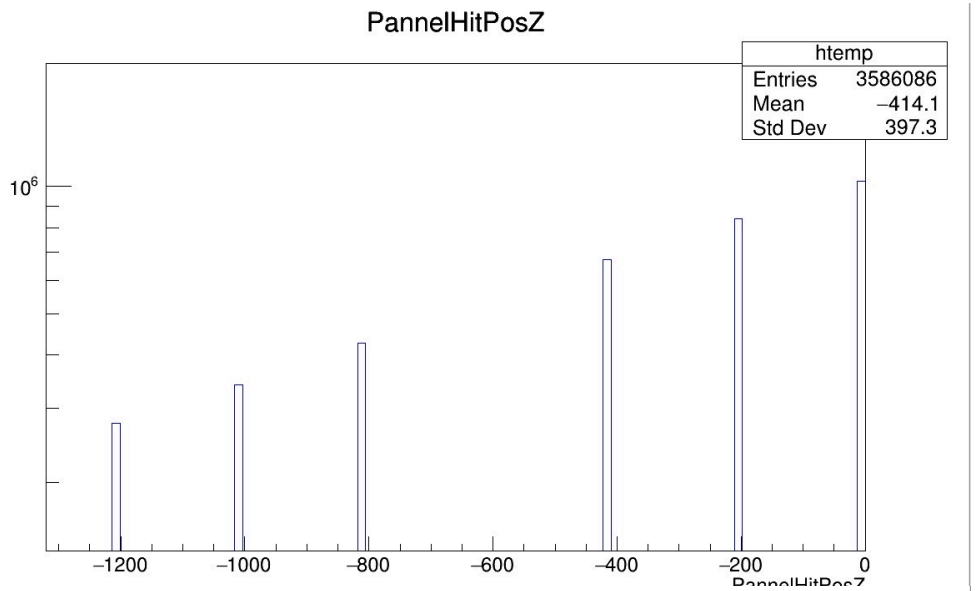
exampleB1

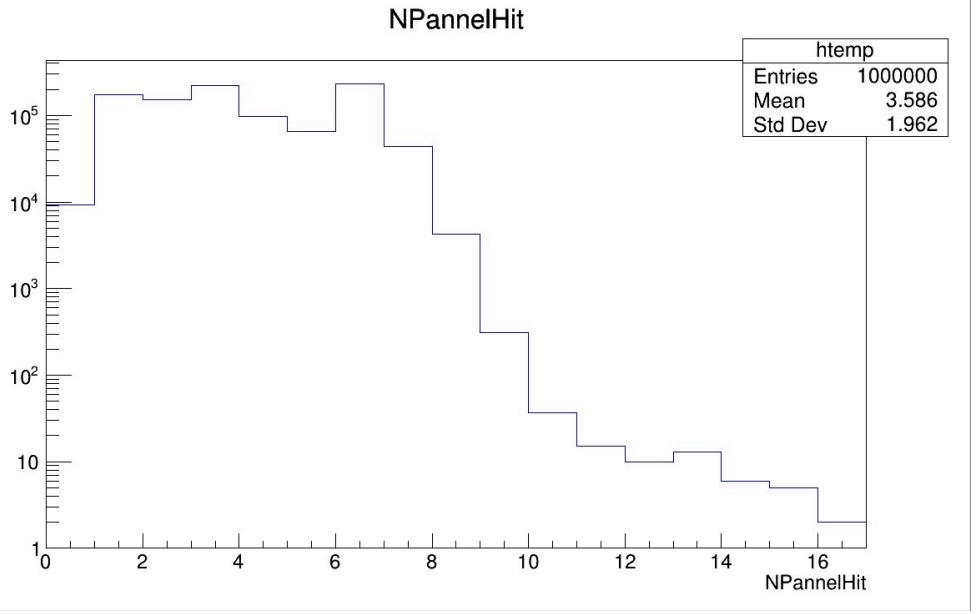

Run 0 (100 events, 100 kept)
Thu Aug 17 17:23:44 2023
Run simulation
Only muons are displayed
Shape2
Shape1
20 cm
100 events in the picture
1 million events in the final simulation
Geant4
exampleB1

Output information









Output information

Saved only **muons** that passed through **all 6 panels**:

+ Event Number
+ X, Y, Z coordinates in all panels
+ Energy of the generated particle

Output saved into csv file:

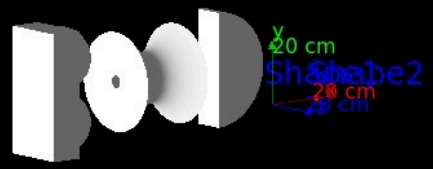
Event	X0	Y0	Z0	X1	Y1	Z1	X2	Y2	Z2	X3	Y3	Z3	X4	Y4	Z4	X5	Y5	Z5	E
9	-205.759	-201.61	-9.5	-173.842	-174.13	-209.5	-141.948	-146.603	-409.5	-78.0065	-91.2349	-809.5	-45.8387	-63.3321	-1009.5	-13.6949	-35.4593	-1209.5	2021.65
10	-136.5	163.955	-9.5	-166.288	105.09	-209.5	-196.059	46.1946	-409.5	-255.675	-71.6095	-809.5	-285.475	-130.504	-1009.5	-315.336	-189.36	-1209.5	4230.7
13	-357.318	-340.649	-9.5	-299.412	-308.44	-209.5	-241.494	-276.247	-409.5	-125.754	-211.93	-809.5	-67.896	-179.803	-1009.5	-10.0478	-147.729	-1209.5	3690.06

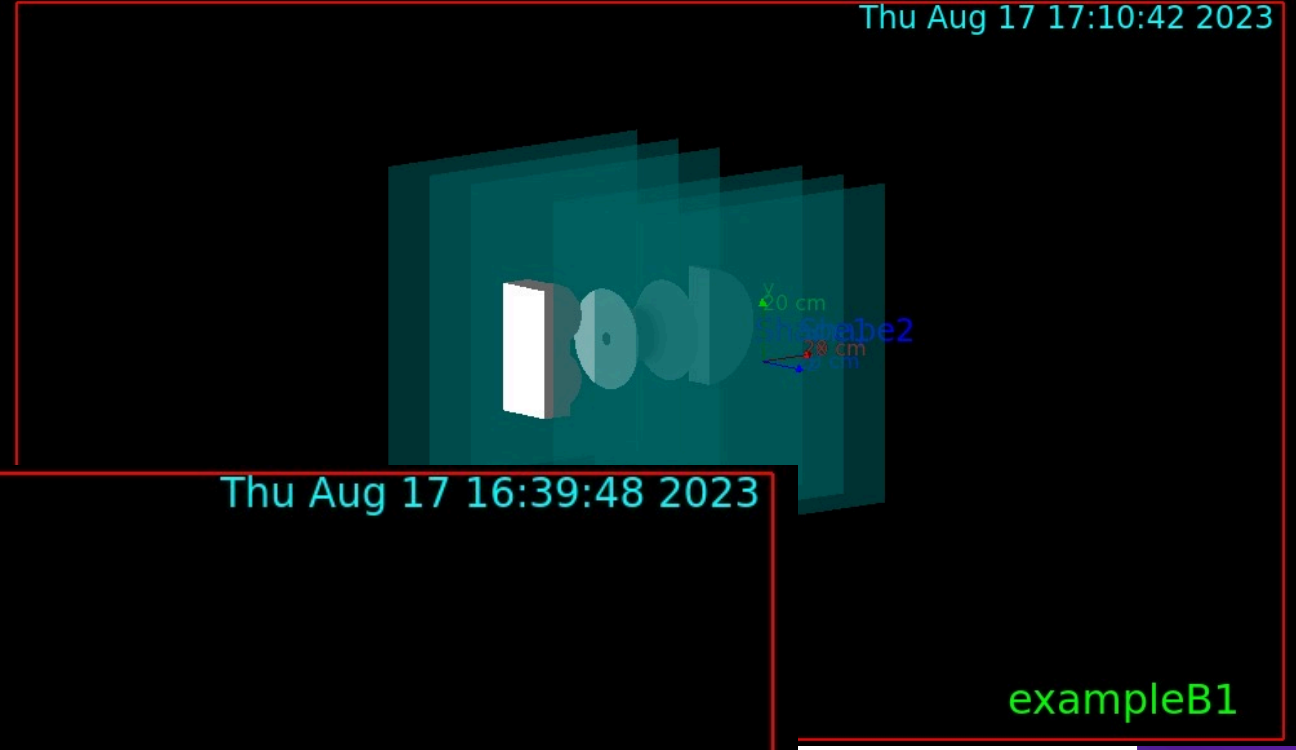
Issues

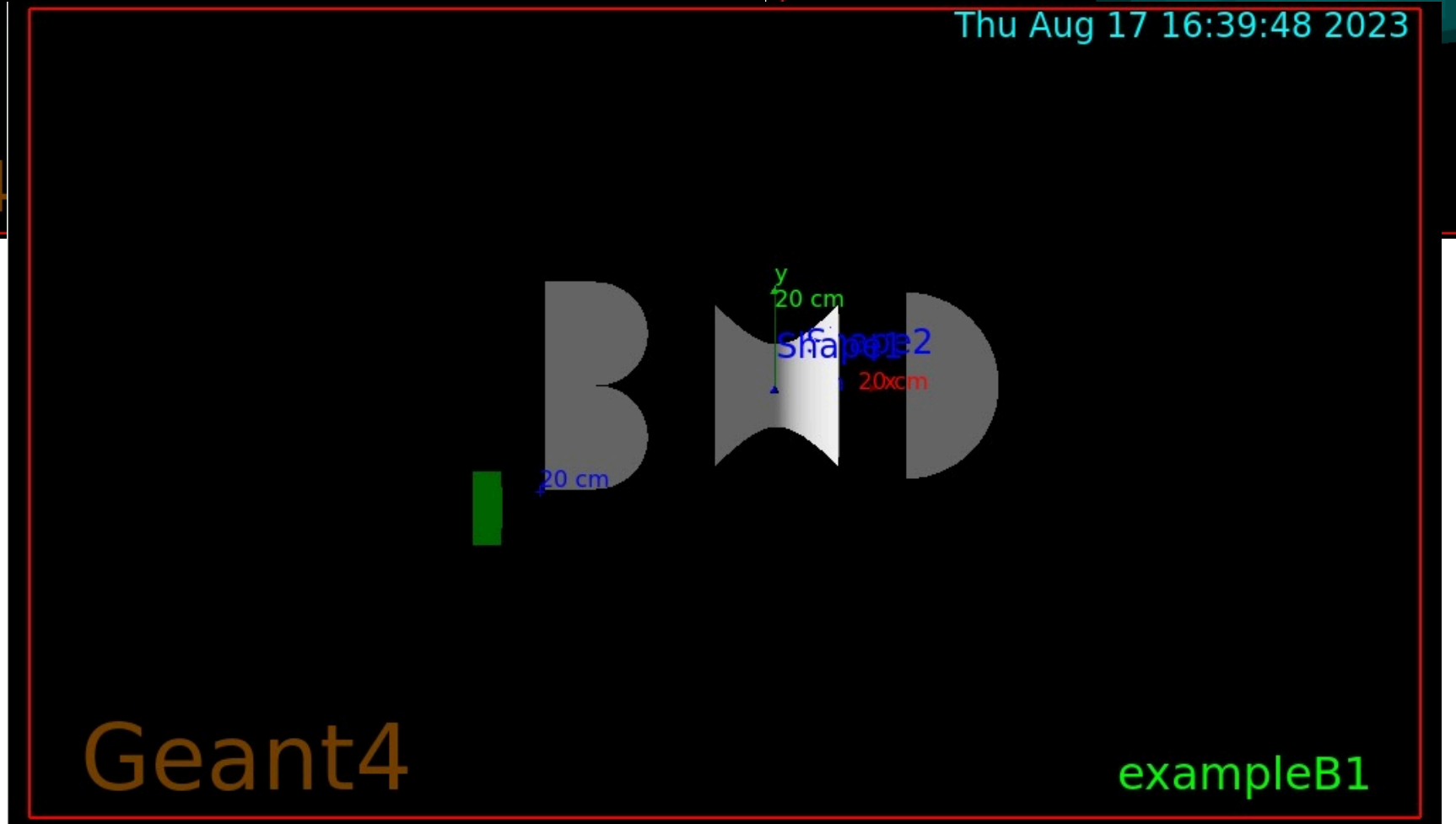
- Tried to move the ‘world’
- Volumes intersection
- Model is not centered at the origin, hard to put it where you want
- Put the hit collection outside the ProcessHits loop
- Wrongly assigned type of a variable (e.g. float to int)
- Beam size is too small

Our geometries

cr. Hugues

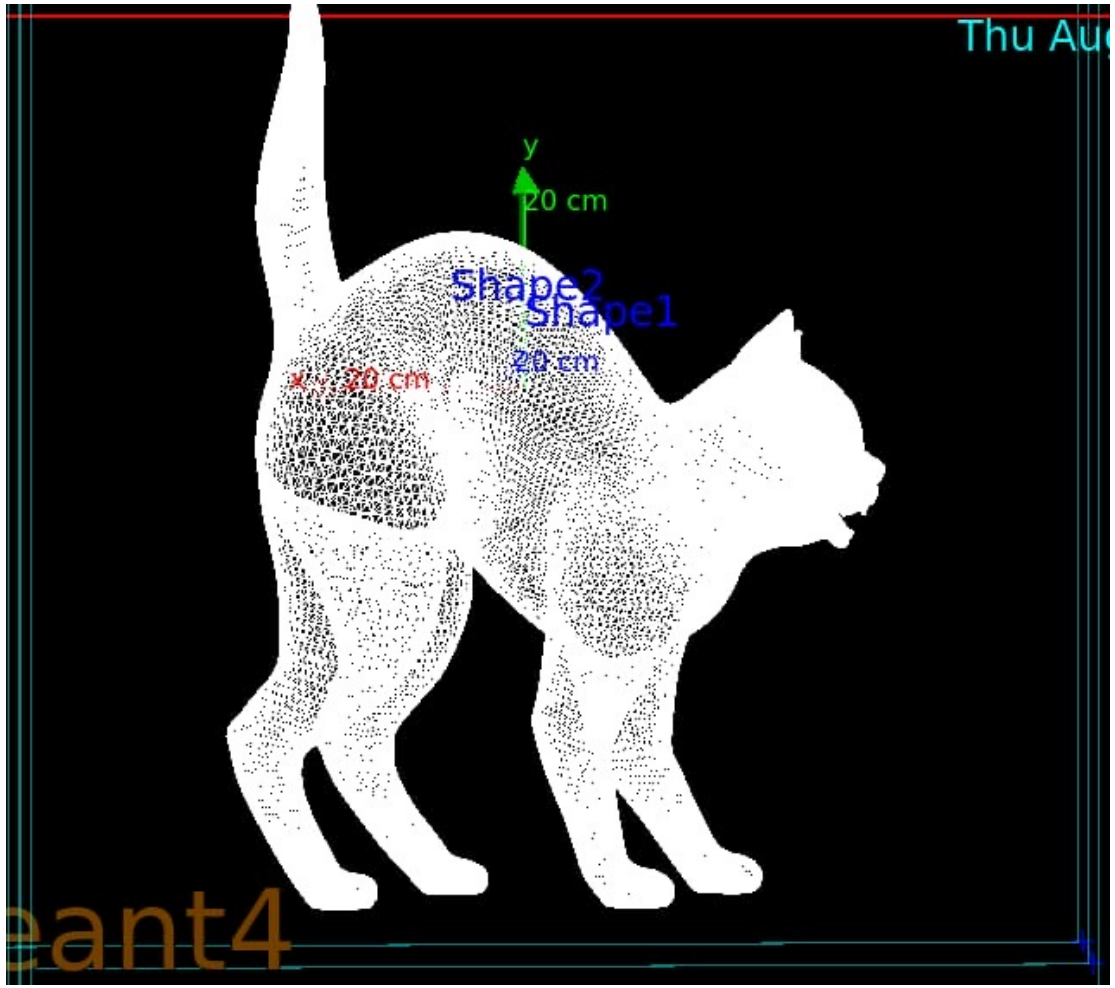






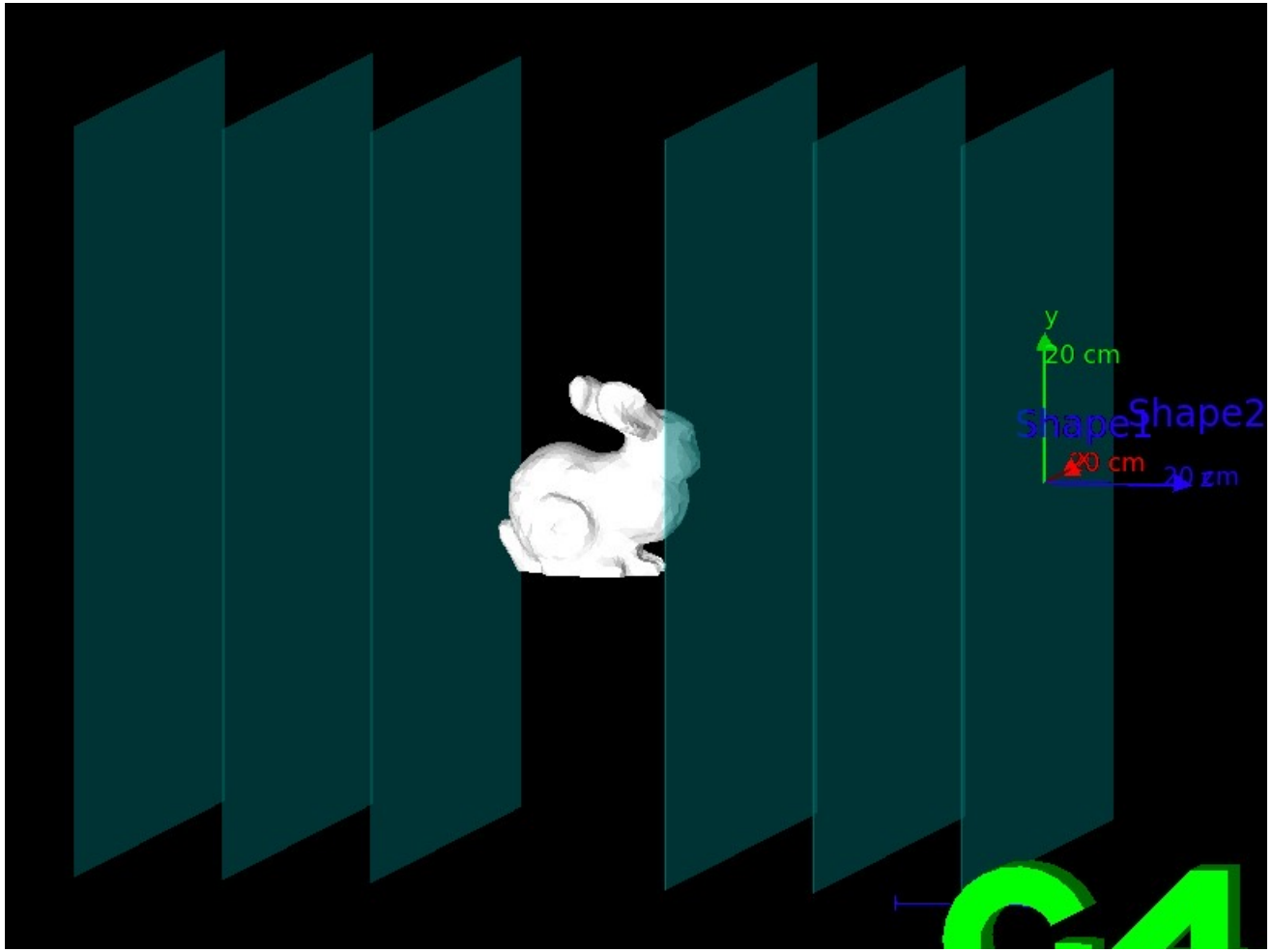
Our geometries

cr. Tomek



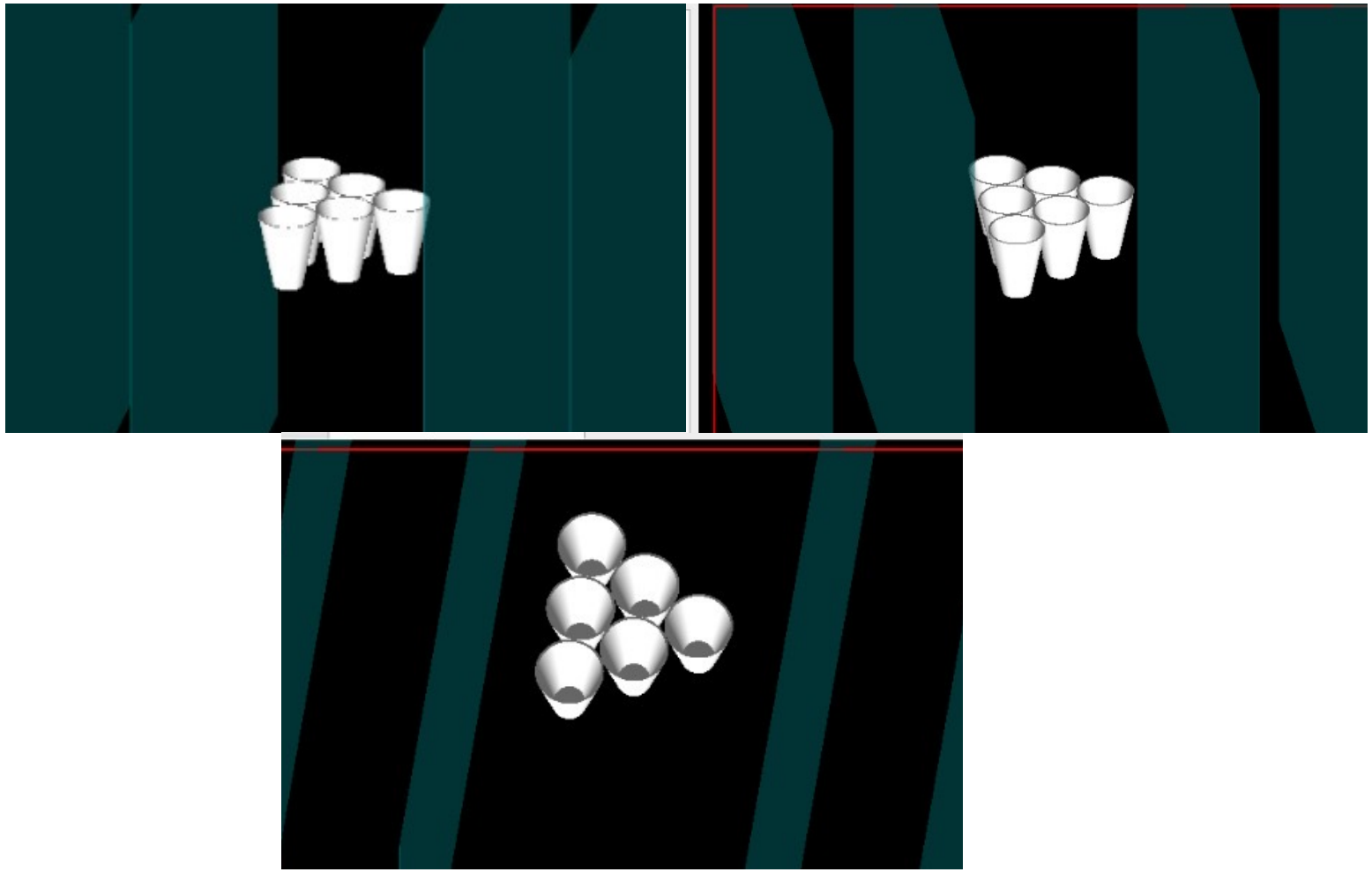
Our geometries

cr. Mohit



Our geometries

cr. Theumes

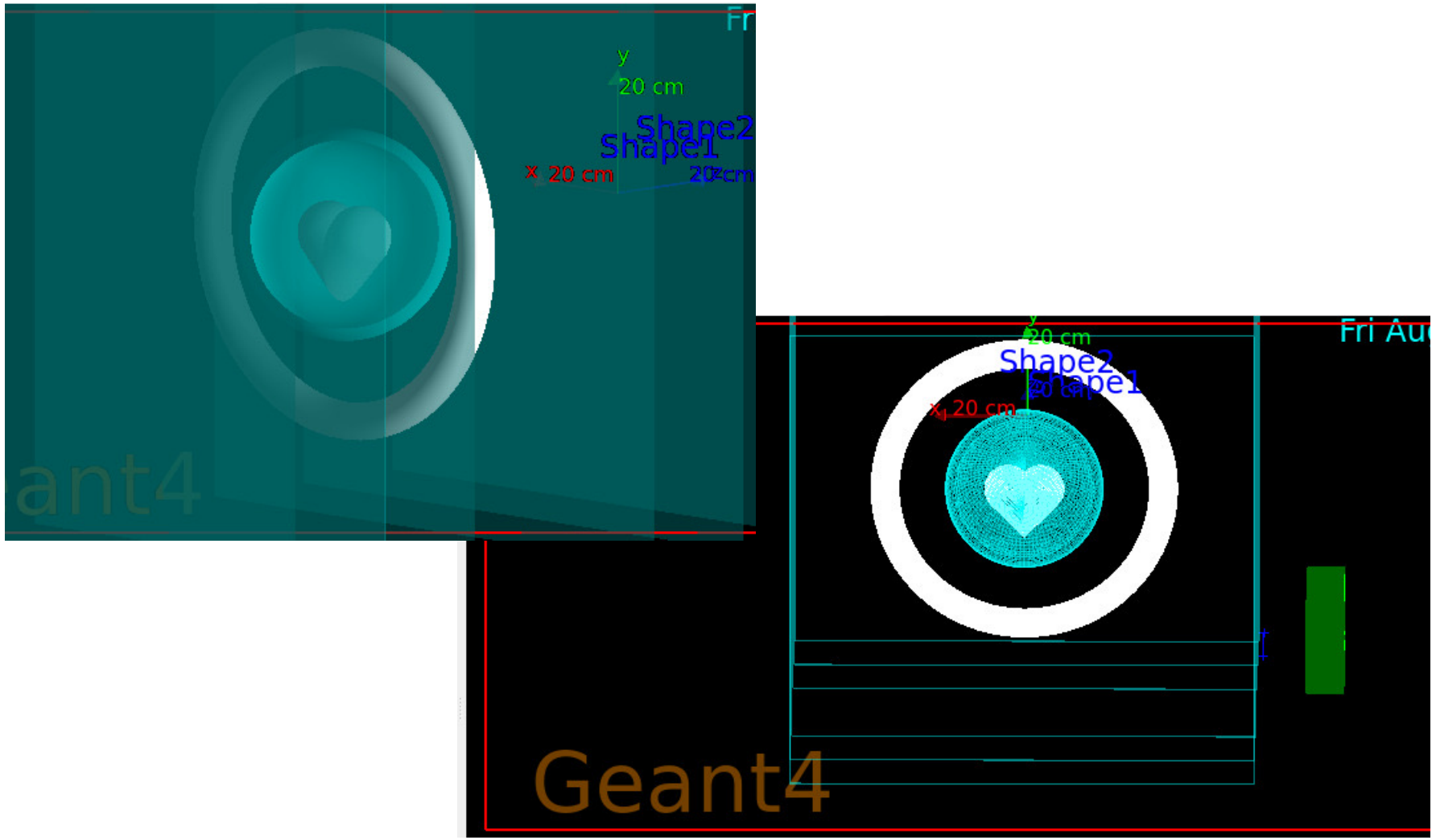


Our geometries

cr. Anna

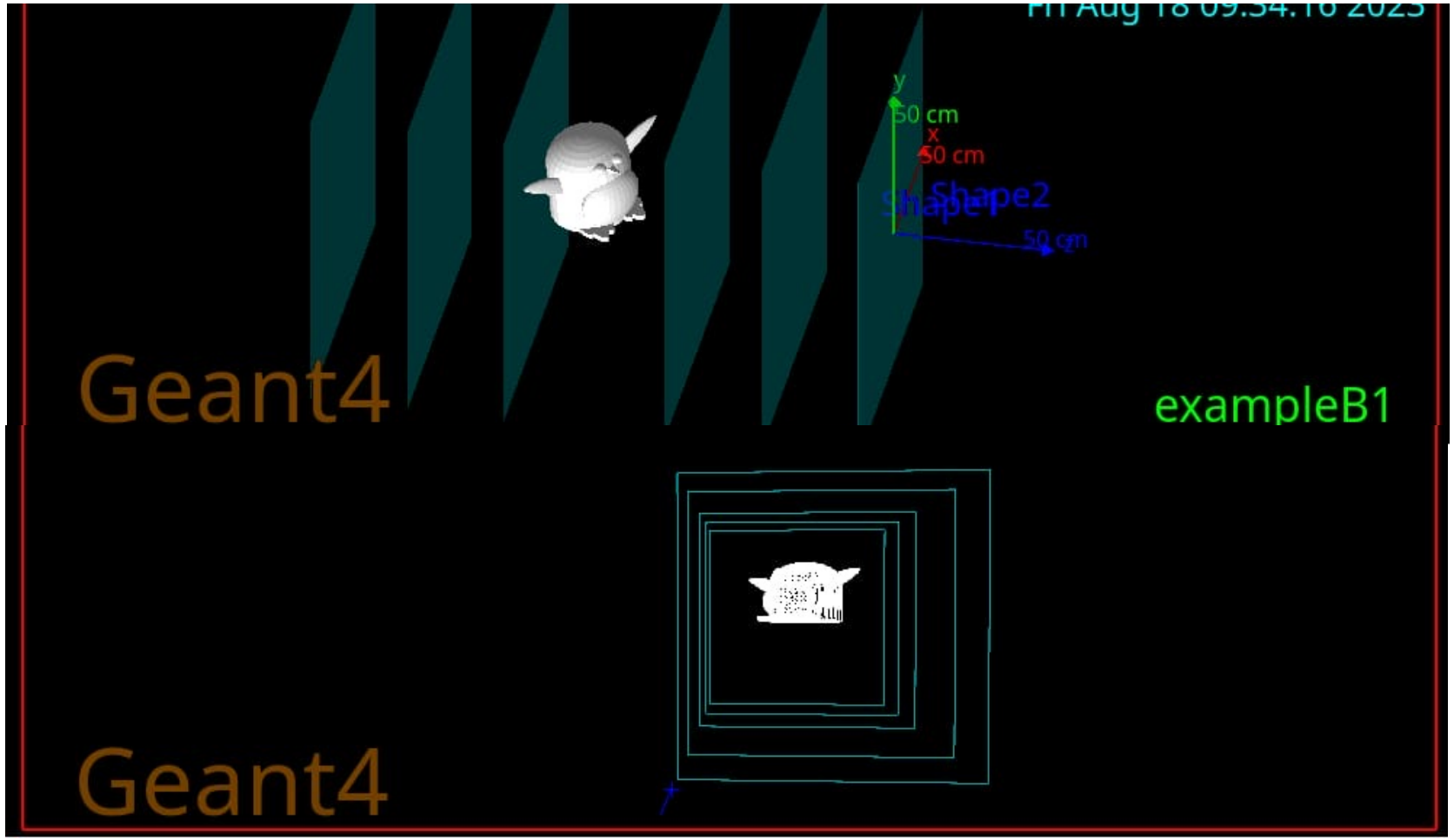
Our geometries

cr. Merle



Our geometries

cr. Itana

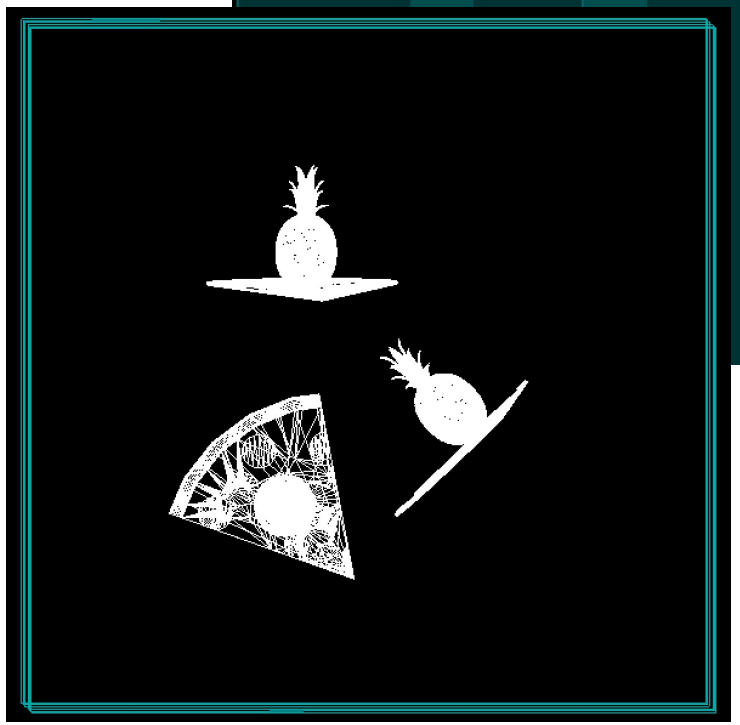


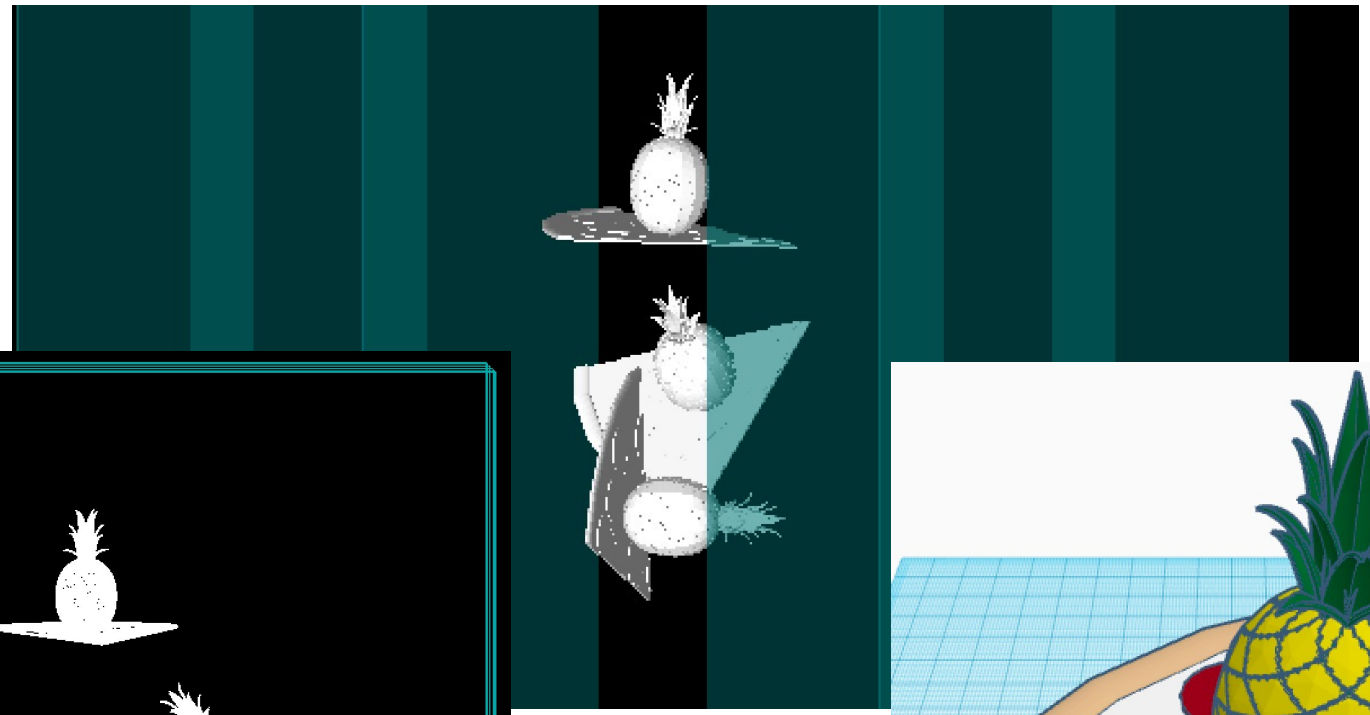
Our geometries

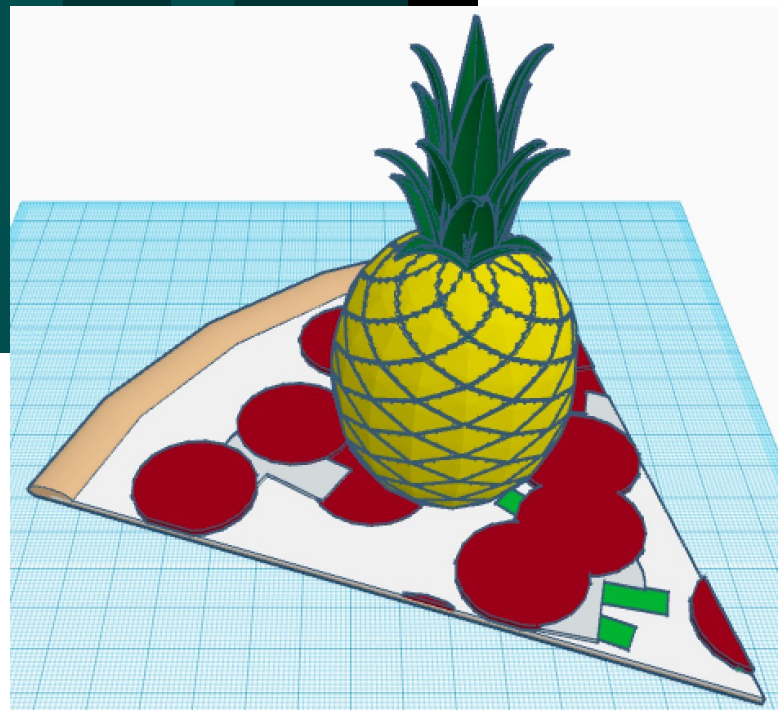
cr. Rik

Our geometries

cr. Max



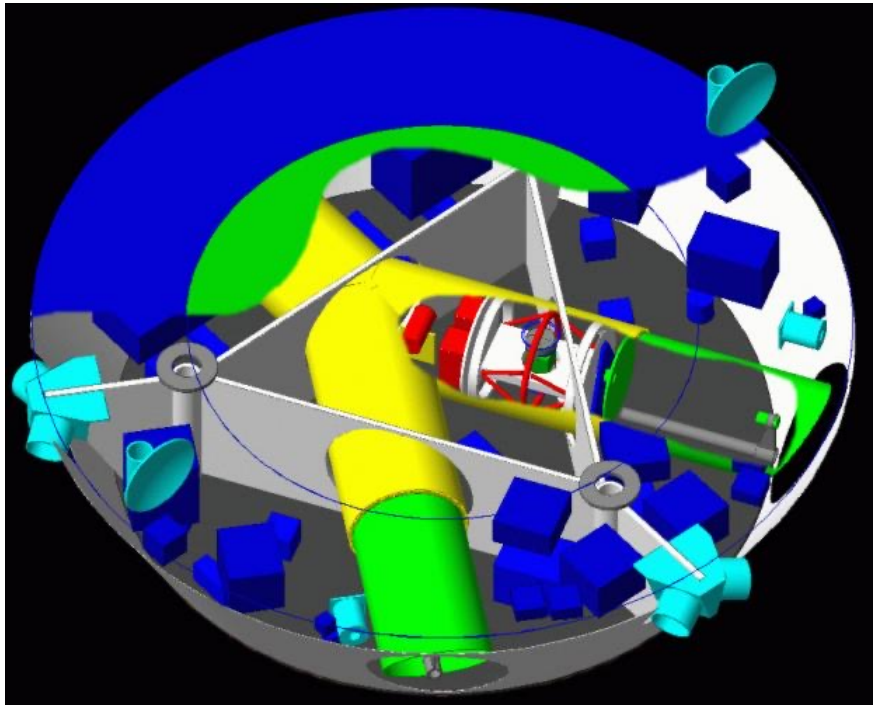




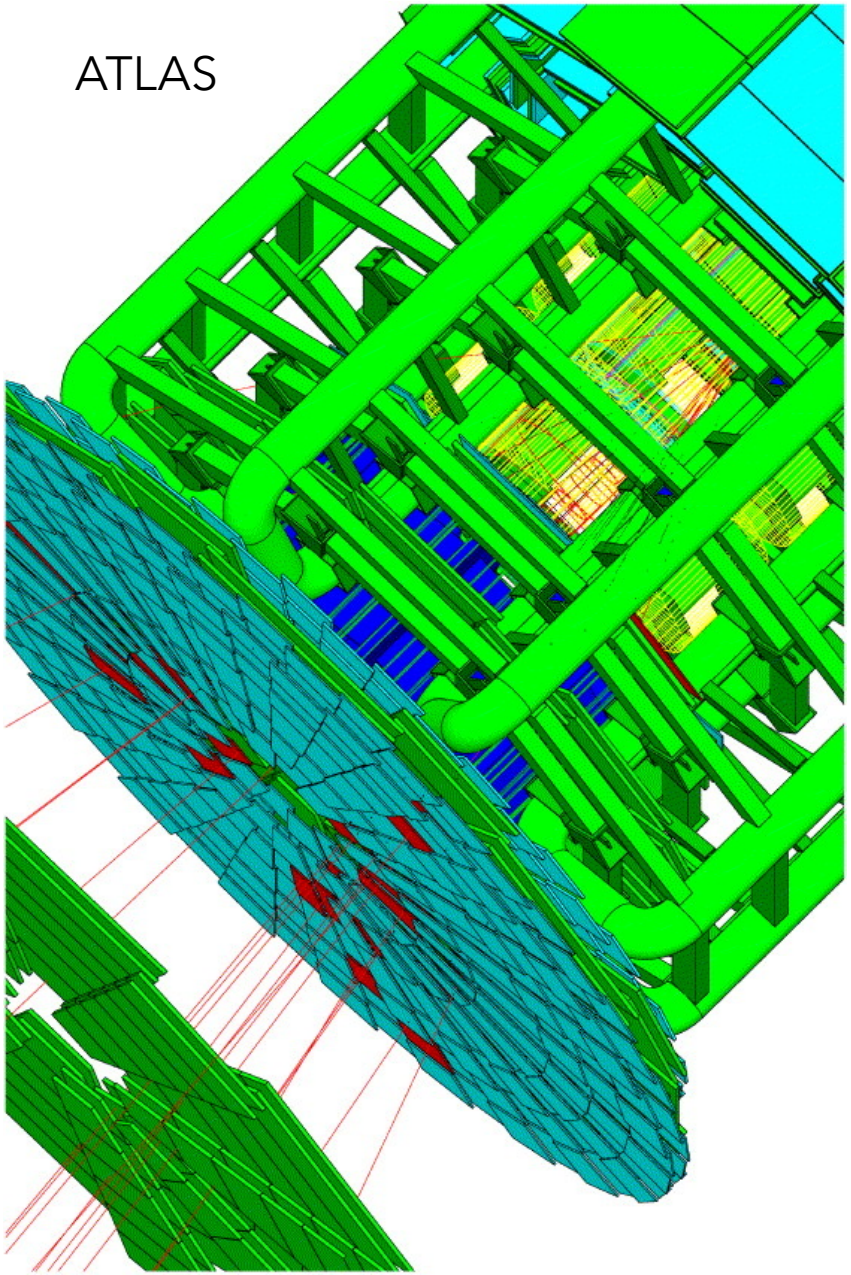
Add fancy meshes..

- can be imported from CAD models
- G4 accepts .stl, .obj formats

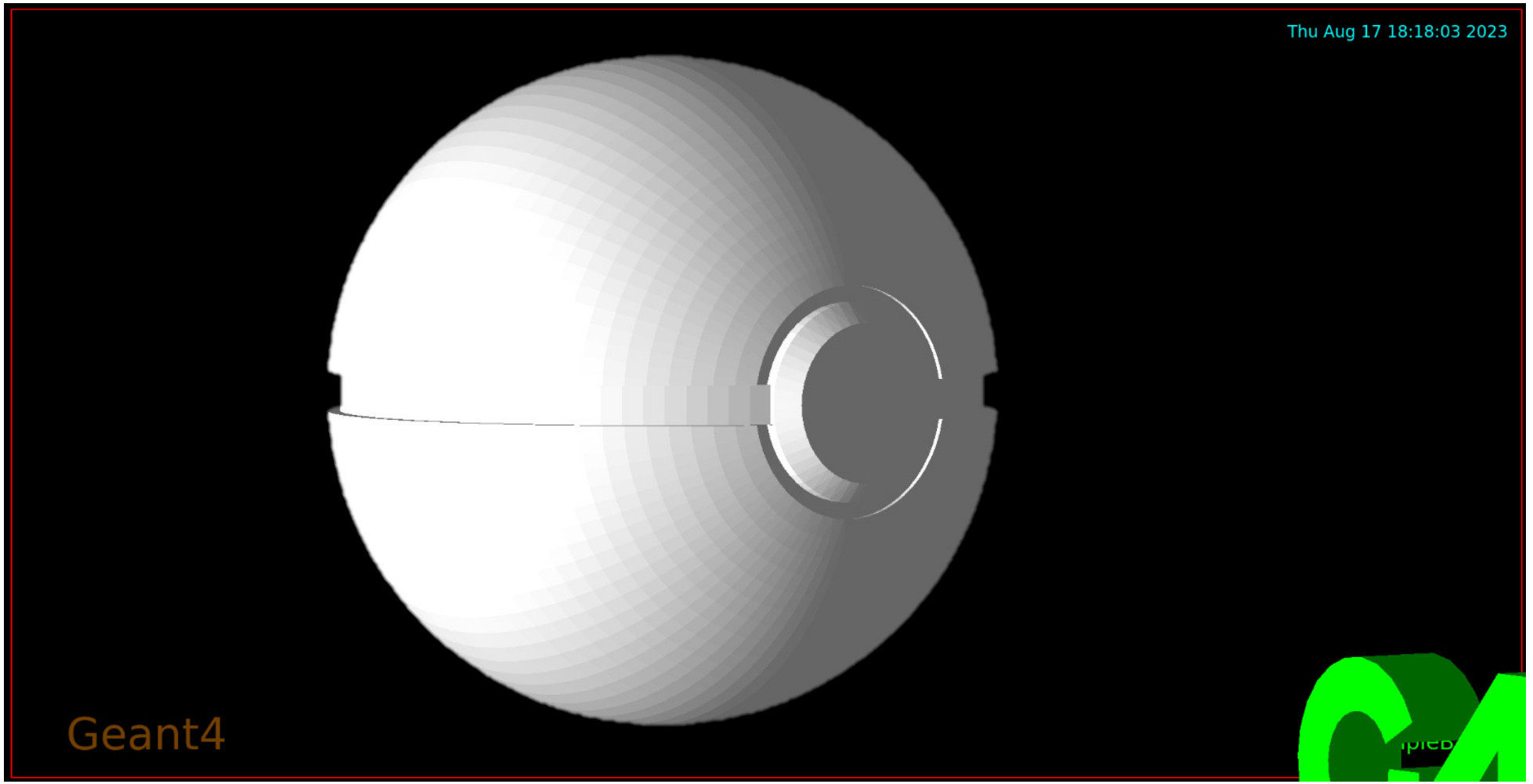
LISA



ATLAS



Add fancy meshes..



Add fancy meshes..

Thanks!