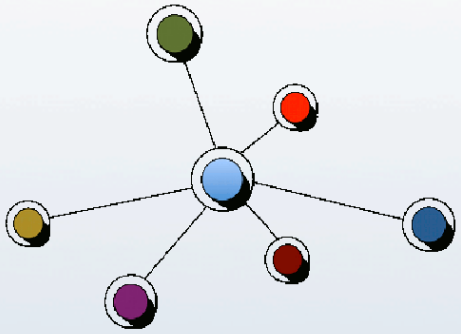
GEMC Tutorial



GEMC

This Tutorial and Support Files Can be Found at gemc.jlab.org under “Documentation”.

Please send any inaccuracies, improvements or features requests to ungaro@jlab.org

Lesson 2:
Using Run Control to Launch Primary Particles

In this lesson:

Run Control:

- Simulating One Primary Particle with the GEMC GUI
- Particle Color Codes
- Generating Output

Pre-requisites:

g2.gcard, available at gemc.jlab.org under “Documentation”.

The g2.gcard looks like this:

```
<gcard>

<!-- Central Detectors: -->
        <sqltable name="LH2target"/>
        <sqltable name="CTOF"/>


<!-- Forward Detectors (NEED SECTOR): -->
        <sqltable name="SECTOR"/>
        <sqltable name="DC12"/>
        <sqltable name=”OTOF"/>

</gcard>
```

It has the following CLAS12 components: LH2 target, the Central Detector and the Drift Chambers and the Outer Time of Flight.

Starting GEMC

Let's start gemc with the g2.gcard. We will also save our events in a text file. Notice that this time gemc will load the torus magnetic field map, because it's associated with "SECTOR"

```
gemc -gcard=g1.gcard -OUTPUT="txt, out.txt"
```

txt ouput filename

✓ Later we'll use EVIO format by changing "txt" to "evio"
✓ If you don't specify an output, no hit process routine will be called.

Random Seed

Let's take a look at the log output on screen

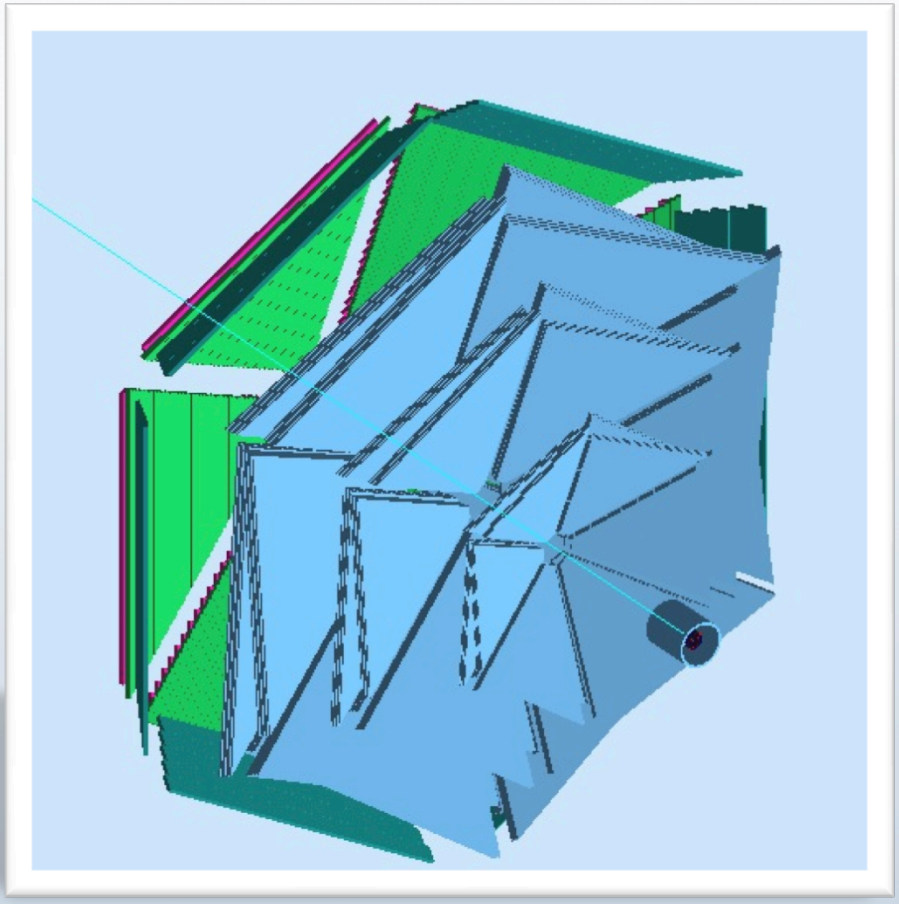
```
 >>> gemc Init: >>  Setting CLHEP Random Engine...
 >>> gemc Init: >>  Initializing CLHEP Random Engine
from time, cpu clock and process id...
 >>> gemc Init: >>  Random Seed Initialised to:
1274662142
```

By default, gemc initialize the seed based on local clock and process pid.

The random engine can be fixed with a user random seed number with the option:

```
-RANDOM=<user number>
```

Beam On



Adjust rotation, zoom, camera lights until you're happy.

Go to Run Control.

Click **Beam On**

A default 11 GeV Electron is produced along the beam.

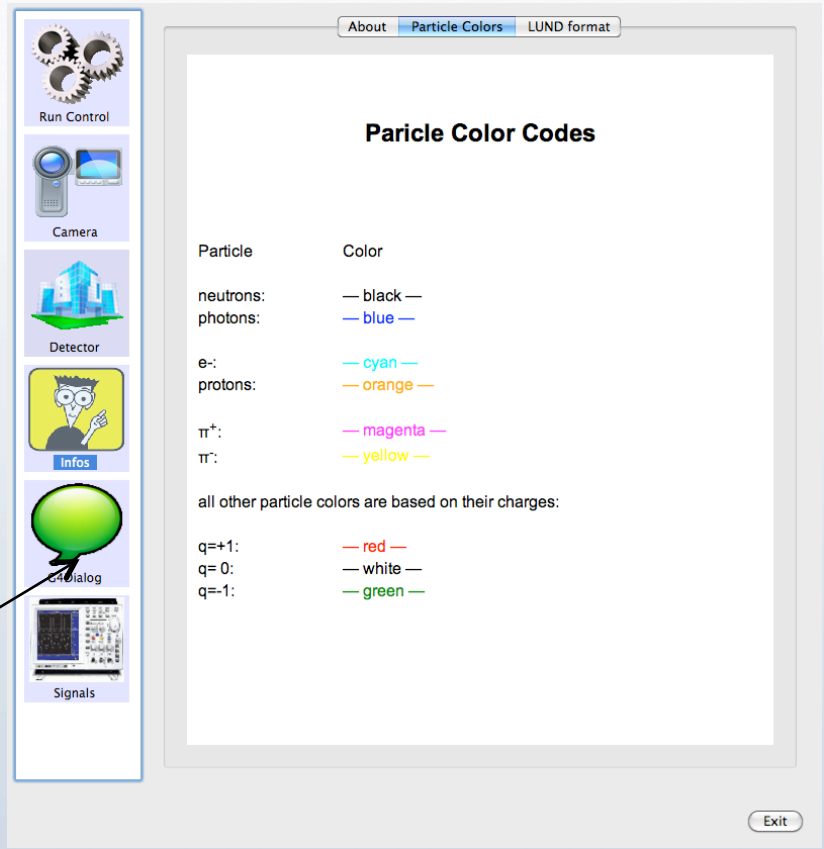
Color Codes

The tracks colors are:

- neutrons black
- photons blue
- e- cyan
- protons orange
- pi+ magenta
- pi- yellow

all other particle colors will be based on their charges:

- q=+1 red
- q= 0 white
- q=-1 green



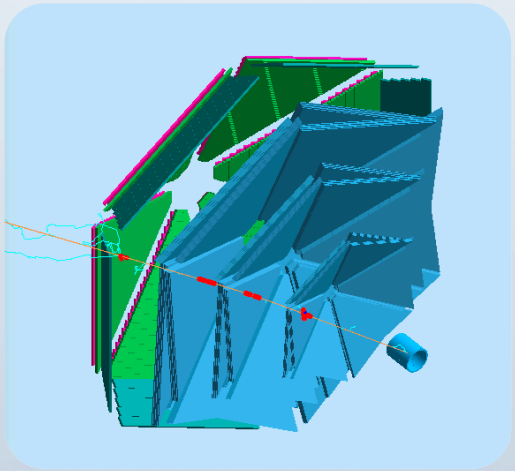
... can also be accessed on the Infos Tab "Particle Colors"

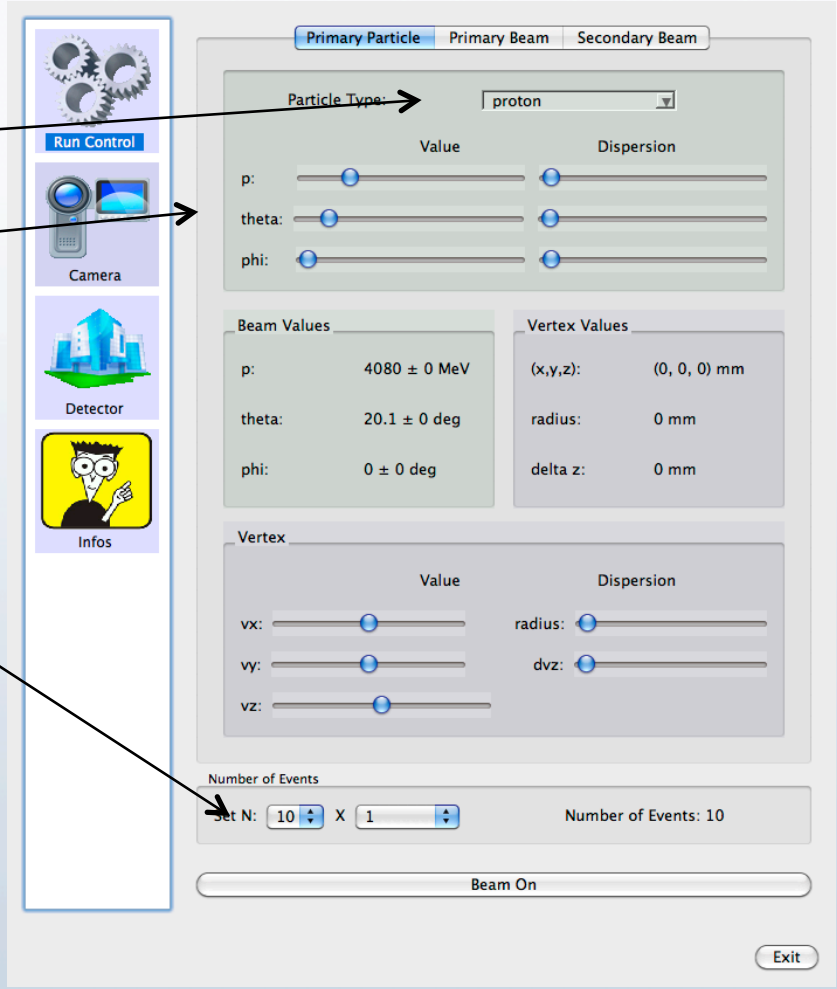
Run Control

Select Particle Type

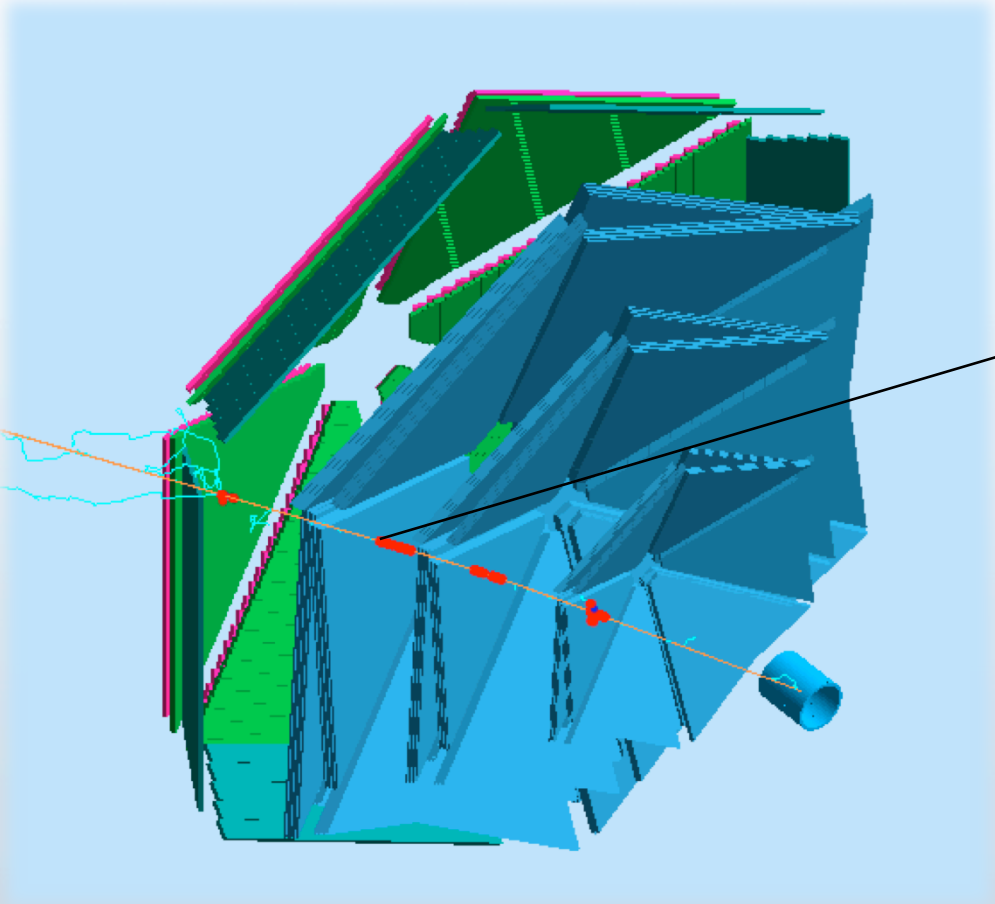
Particle Momentum

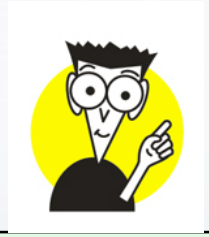
Example: proton, 4 GeV at θ=20
Select N=10 events





Run Control





Red Circles: Hits on the detector. They are displayed because –OUTPUT
was passed on the command line.

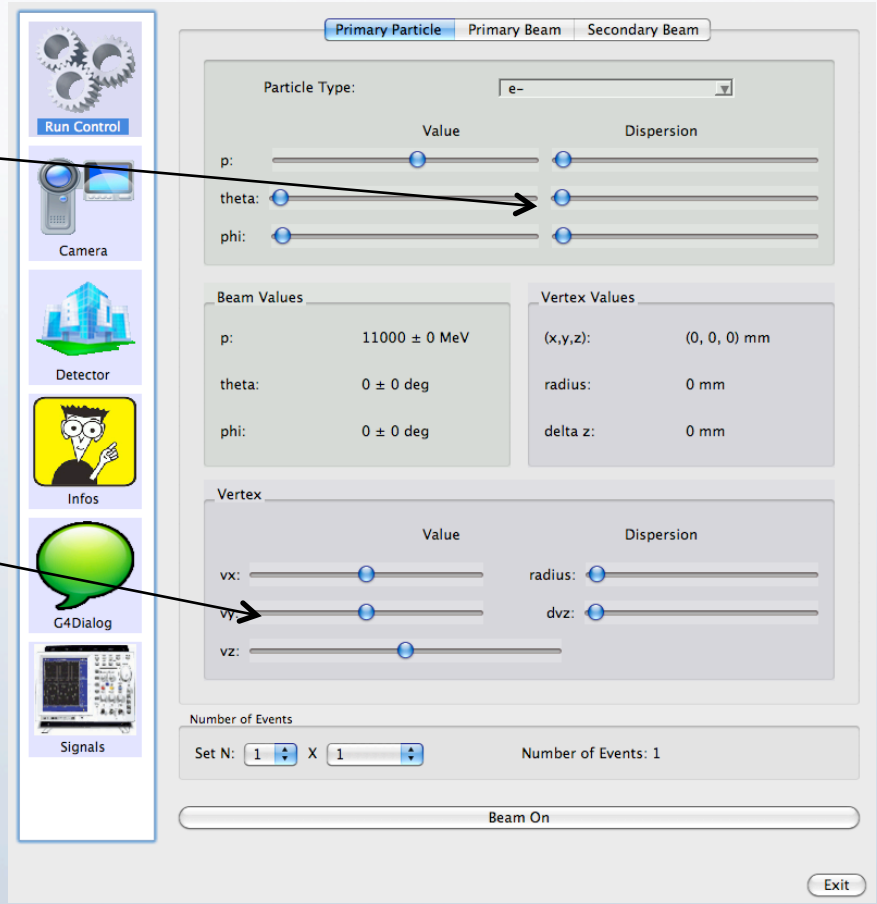
Hits are saved in the output file

Notice the protons are out bending because of the Torus Magnetic Field

Run Control

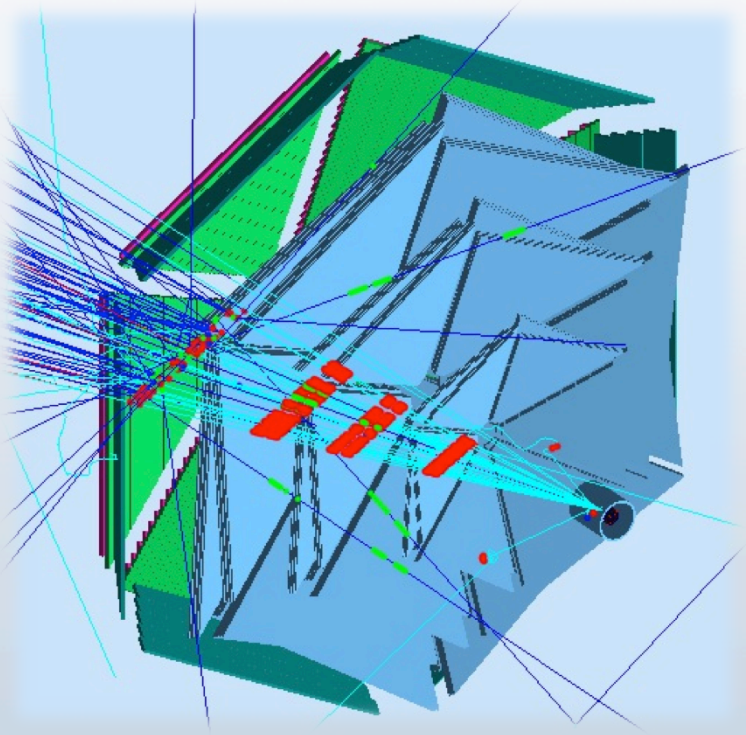
P, θ, ϕ Dispersion

Vertex Dispersion



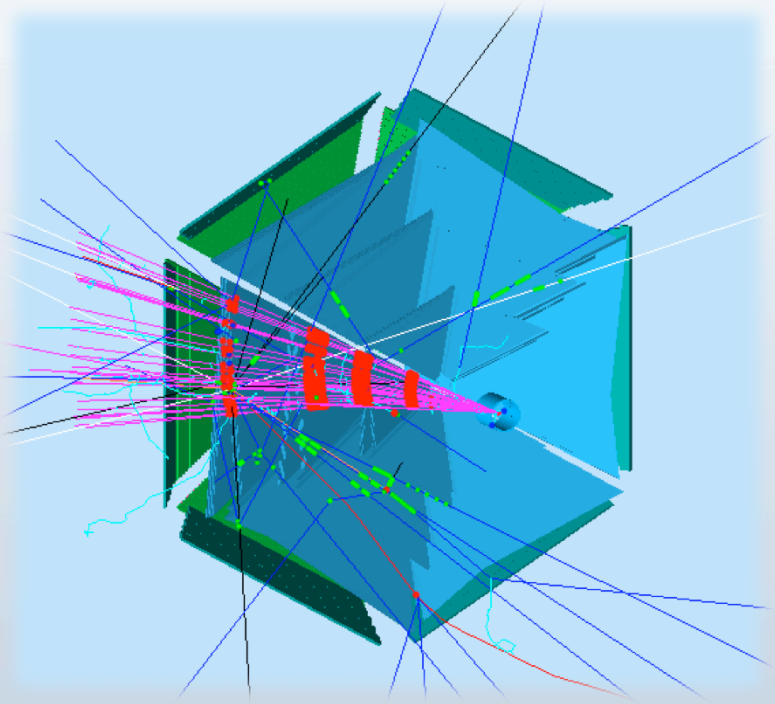
Exercise 1

Simulate 30 events with e- at fixed phi, theta from 0 to 30 degrees
Hint: set theta to 15, theta dispersion to 15



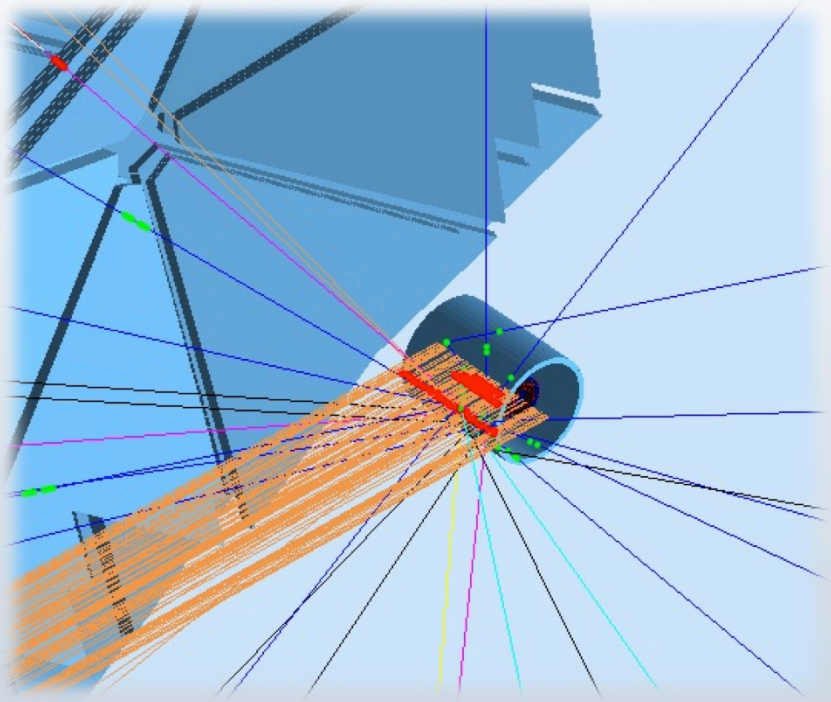
Exercise 2

Simulate 30 events with 2 GeV π+ with fixed θ (15 degrees) to cover Sector 1
Hint: set ϕ to 0 and ϕ dispersion to 30



Exercise 3

Simulate 100 protons with max dvz smear along z axis, at 90 degrees



Primary Particles with command line

```
gemc -GT=CTOF                                    # Geometry Table:  CTOF
     -USE_QT=0                                   # Batch Mode
     -PRINT_EVENT=1                              # Log message on screen every event.
     -OUTPUT="txt, out.txt"                      # TEXT output, filename = out.txt
     -N=100                                      # Process 100 events
     -BEAM_P="proton, 0.8*GeV, 60*deg, 0*deg"    # 800 MeV proton, θ=60⁰, ϕ=0⁰.
     -SPREAD_P="0.2*GeV, 20*deg, 180*deg"        # Spread by 200 MeV, 20⁰ in q, 180⁰ in ϕ
     -BEAM_V="(0.1, 0.1, 2.5)cm"                 # Vertex position
```

Primary Particles with gcard

```
<gcard>

<!-- Central Detectors: -->
    <sqltable name="CTOF"/>


<!— OPTIONS -->
 <option name="USE_QT"       value="0"/>
 <option name="PRINT_EVENT" value="1"/>
 <option name="OUTPUT"       value="txt, out.txt"/>
 <option name="BEAM_P"       value="proton, 0.8*GeV, 60*deg, 0*deg"/>
 <option name="SPREAD_V"     value="0.2*GeV, 20*deg, 180*deg"/>
 <option name="BEAM_V"       value="(0.1, 0.1, 2.5)cm"/>
</gcard>
```

These are the same options as before, but embedded in the gcard.

End of Lesson 2:
Using Run Control to Launch Primary Particles