UCLA plans for VR in data analysis and particle interaction simulations

Workshop at UCLA

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II) UCLA plans for VR in data analysis and particle interaction simulations

We are bringing VR to two extremely useful packages:

1. ROOT is a general-purpose data analysis package

2. GEANT4 is the de facto standard package for simulating the interaction of particles with matter

We submitted a 3-year proposal towards that end, now being evaluated by the Department of Energy

ROOT VR

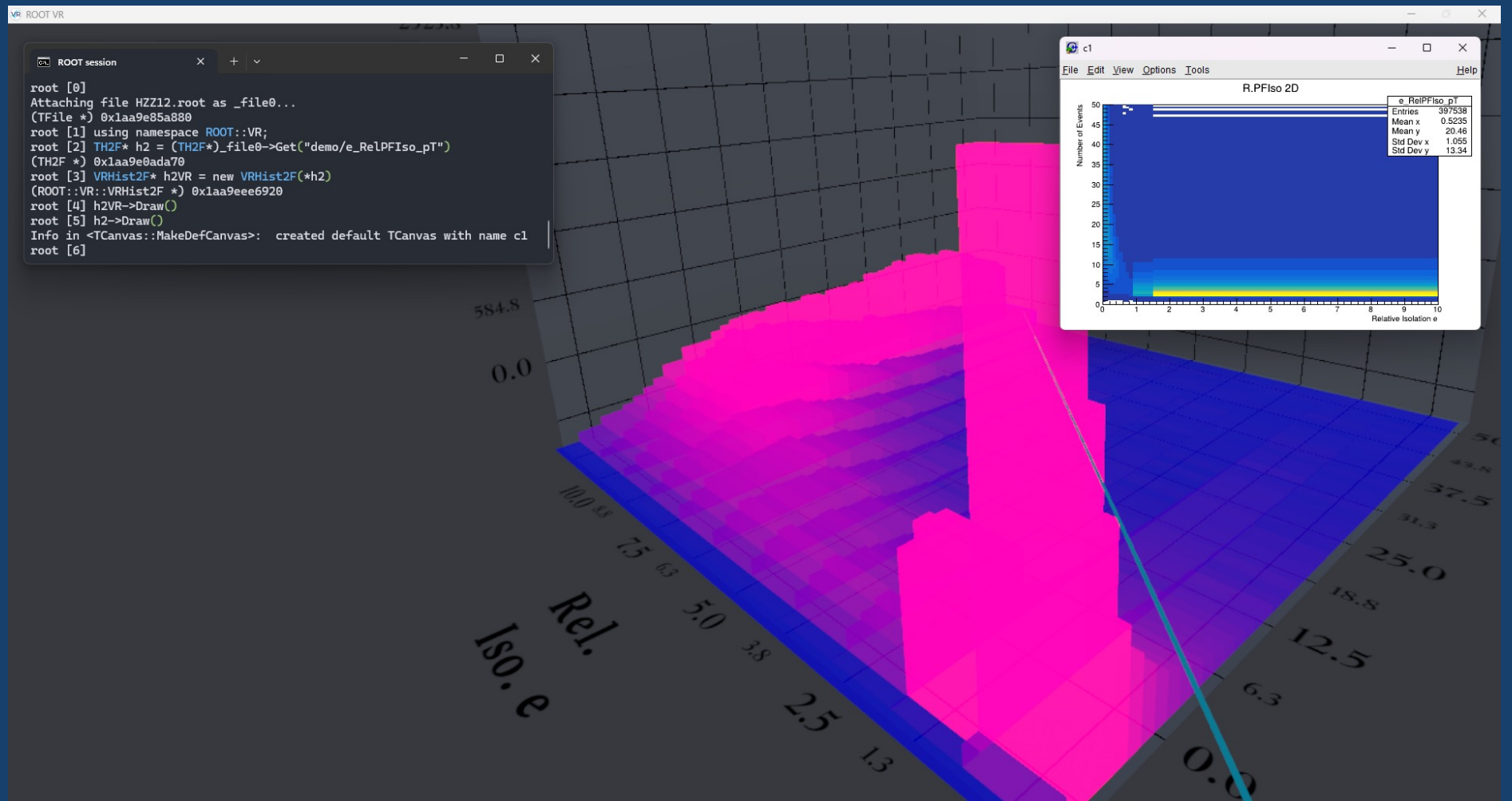
- A large part of a scientist's career is sitting in front of a computer screen making plots of data
- In the particle physics community, people mostly use a powerful package called ROOT that was developed at CERN decades ago
- So far, ROOT does not yet allow to make immersive plots in VR

- We are now trying to make ROOT VR easy to use

- Later, we will try to make it as powerful as possible, e.g. with new types of displays tailored to VR

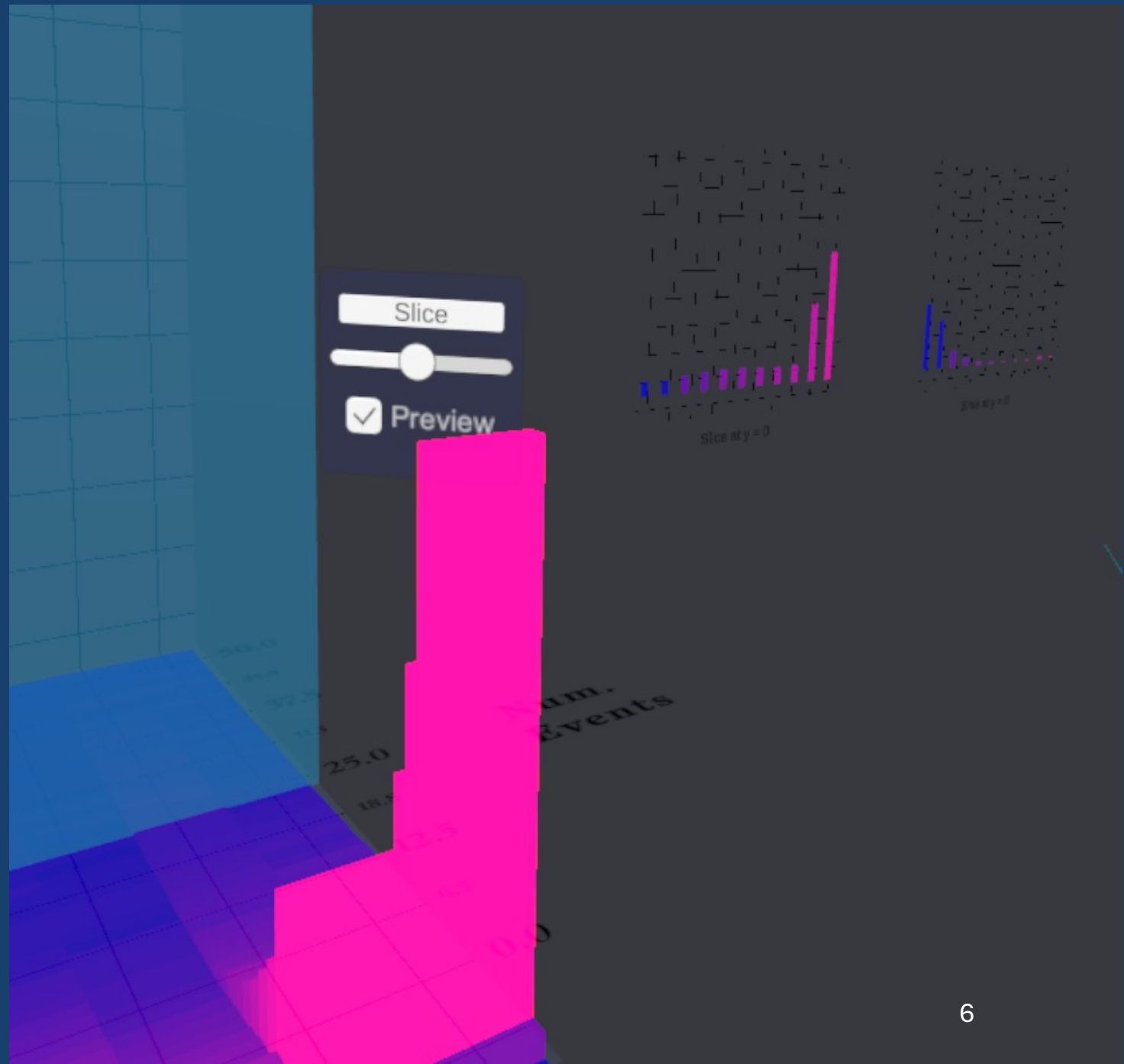
ROOT VR demo

- A 2D histogram plot, similar to the LEGO plot in our VR Spy
- Here's what you do at a terminal to bring it up:



ROOT VR demo

- Slices: choose the line of data, then the relevant 1D plot shows up in VR on the side



G4 VR

- The interactions of keV+ particles with matter are key to many branches of physics:
  - Experimental particle physics
  - Astroparticle physics
  - Nuclear physics
  - Medical physics (X-rays, nuclear medicine)

- Scientists mostly use a powerful package called GEANT4

- G4VR adds VR capability to GEANT4 visualization

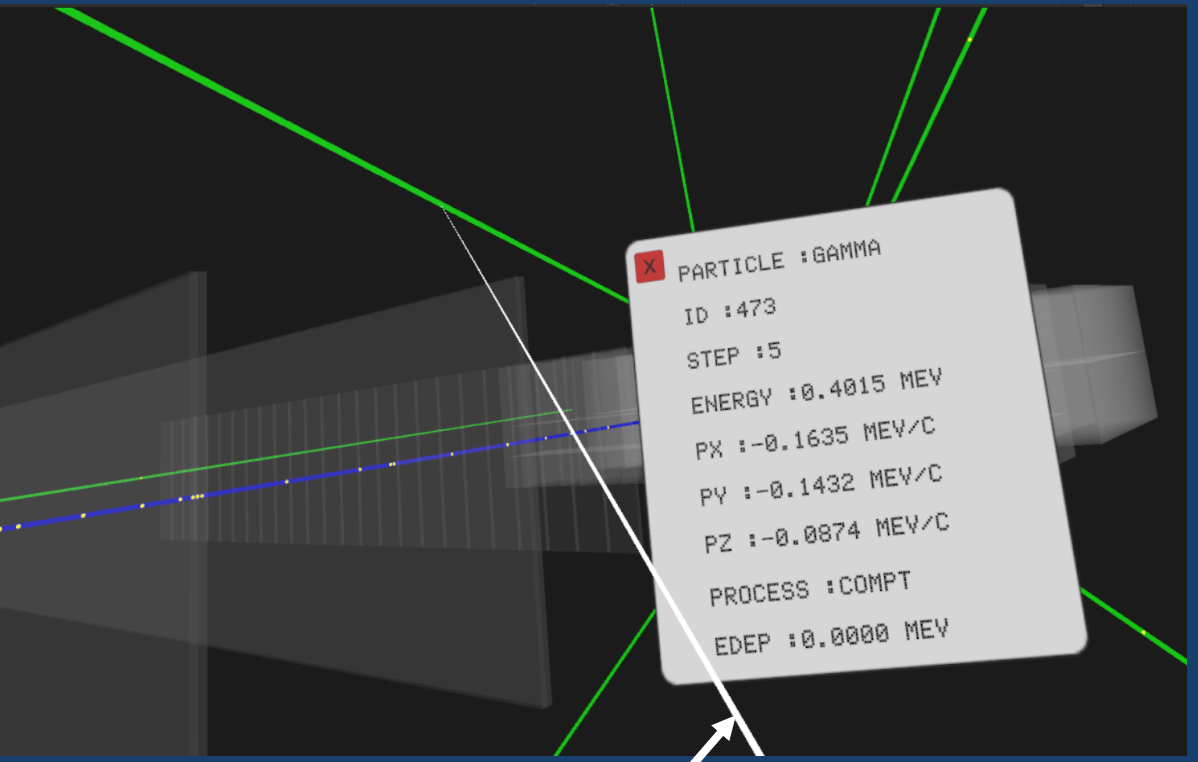
G4 VR Examples

Built-in G4VR visualizations are:

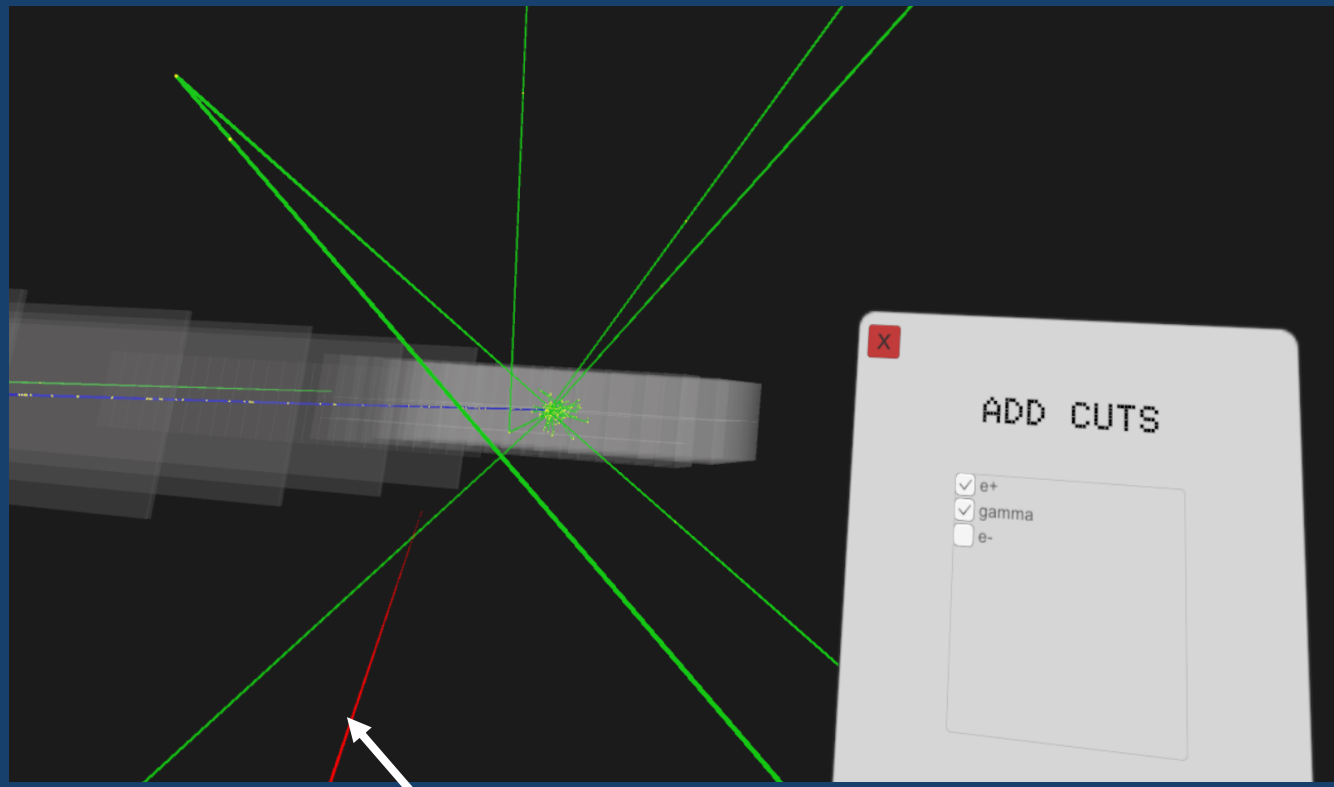
- A positron-emission tomography (PET) medical device
- A sampling calorimeter to measure high-energy particle energies
- A “double-arm spectrometer” that measures particle momenta by bending before they reach a calorimeter to measure energy

G4 VR features: hovering and filters

- Interaction with tracks to get track data
- Employ filters/cuts on specific particles

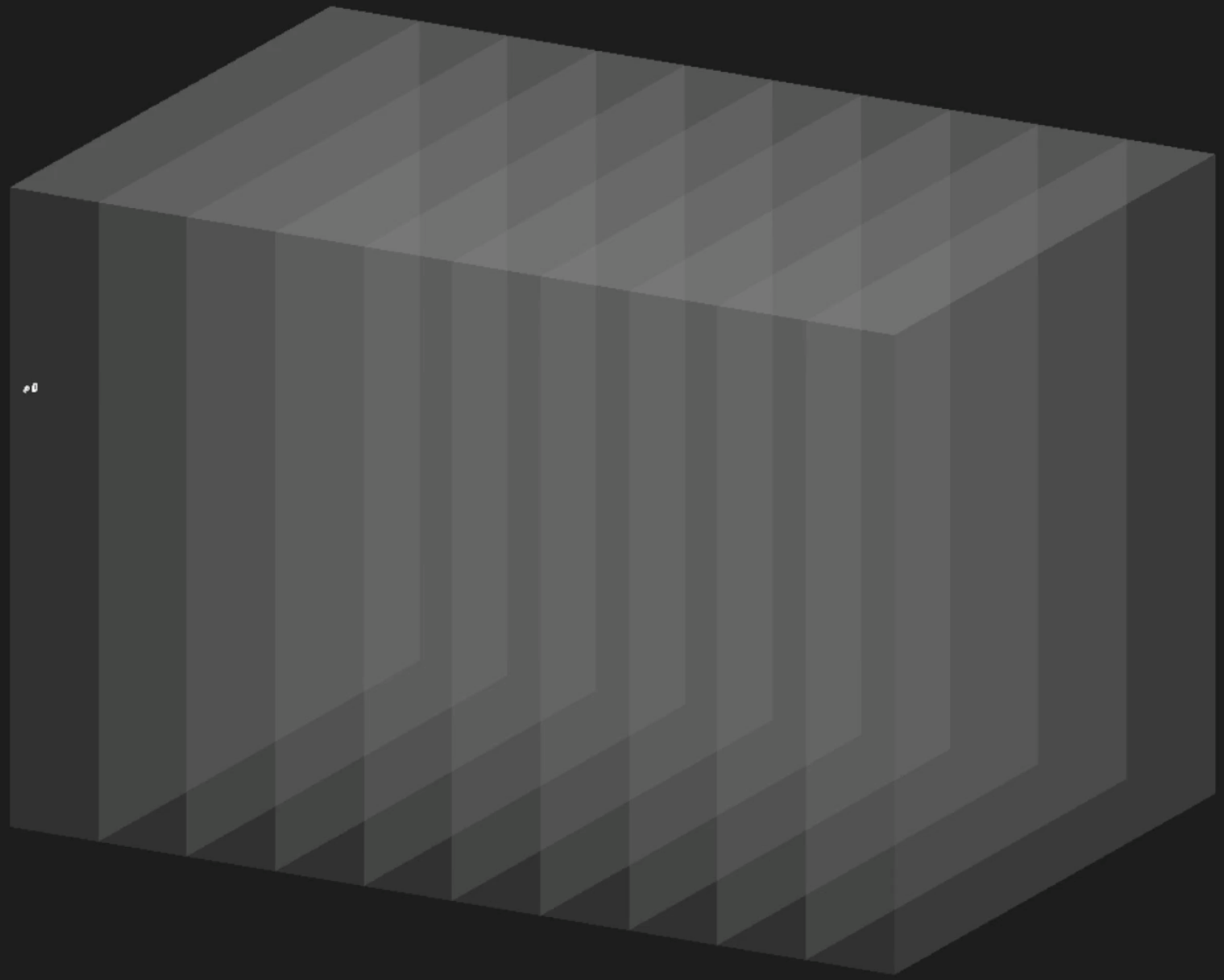


Controller ray



Controller ray

G4 VR feature: movies on pico-second time scale



Near-term G4 VR future development

- Alpha user feedback is needed
  - There is a huge range of applications of GEANT4
  - Application to UCLA Dark Matter detection prototypes is well underway

- The “driver” end needs to be officially incorporated into GEANT4