Event Display in JUNO Experiment

Jiang Zhu, Zhengyun You, Yumei Zhang
Sun Yat-sen University

ACAT 2017, Seattle
August 24th , 2017

Outline

Overview of Event Display

Event Display based on ROOT in JUNO
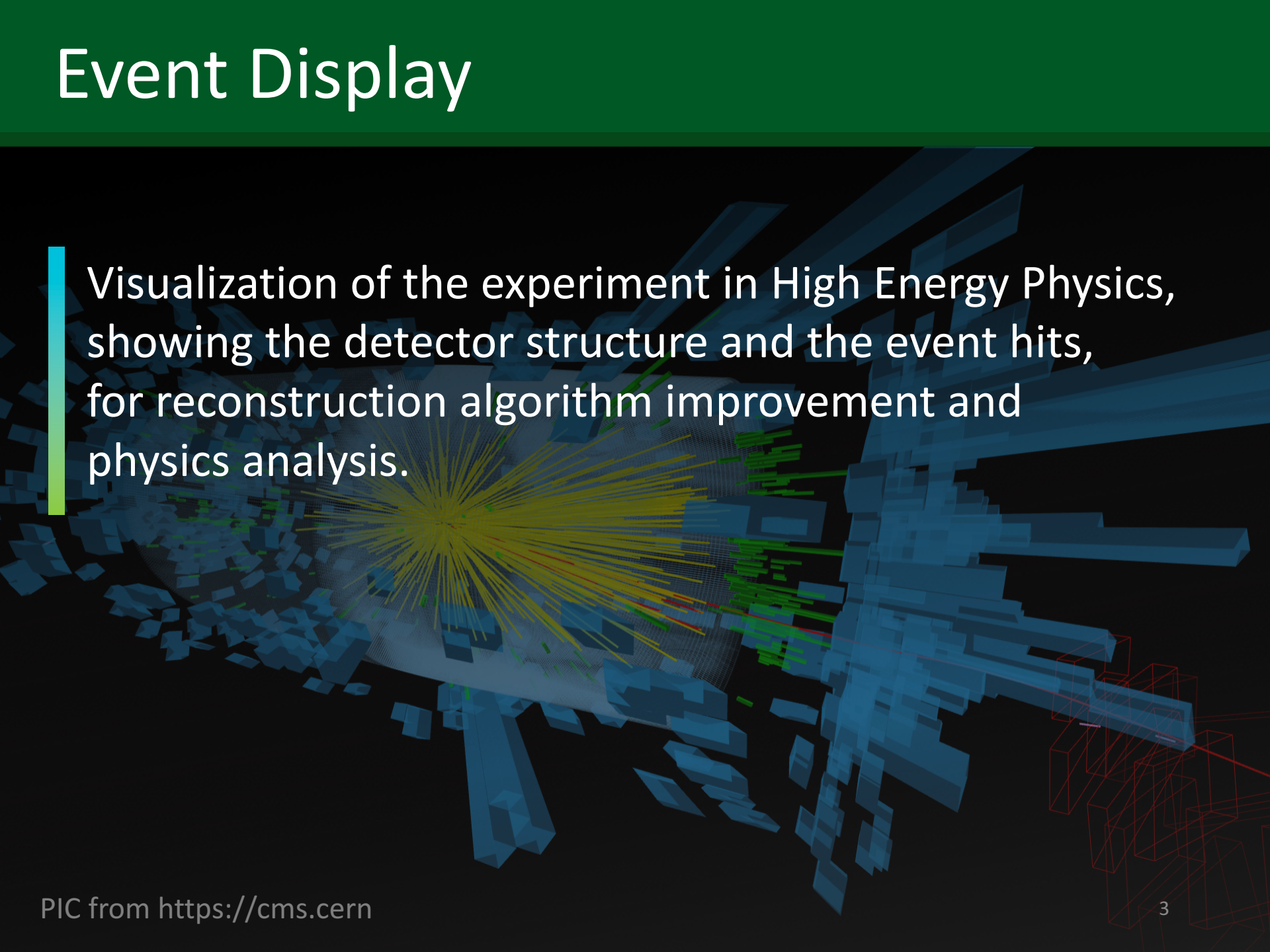
Event Display based on Unity in JUNO

·Detector Visualization

·Event

·Reconstruction

Unity V.S. ROOT
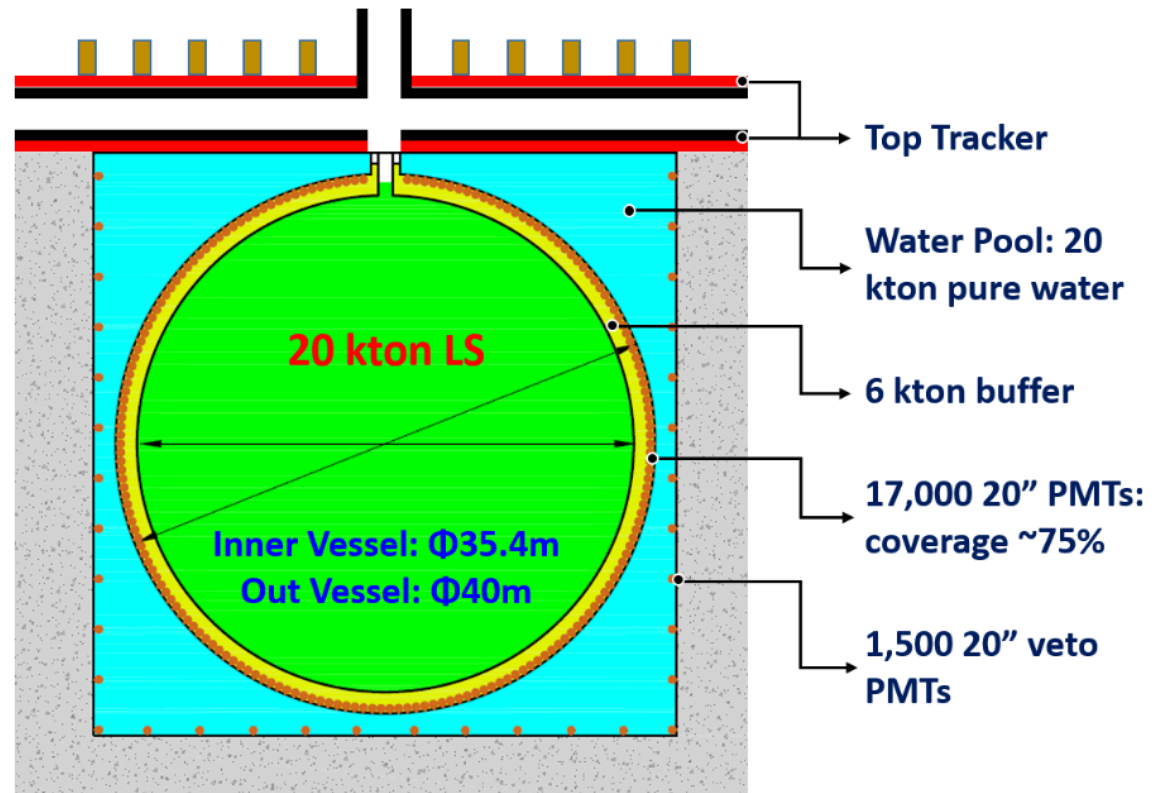
Future Plan

Event Display

Visualization of the experiment in High Energy Physics, showing the detector structure and the event hits, for reconstruction algorithm improvement and physics analysis.

JUNO Detector

Jiangmen Underground Neutrino Observatory (JUNO)

Reactor neutrinos experiment, using Inverse Beta Decay(IBD) to measure the neutrinos mass hierarchy

Top Tracker

Water Pool: 20 kton pure water

6 kton buffer

17,000 20" PMTs: coverage ~75%

1,500 20" veto PMTs

20 kton LS

Inner Vessel: Φ35.4m
Out Vessel: Φ40m

arXiv:1508.07166v2

Event Display Based on ROOT

SERENA (Software for Event display with Root EVE in Neutrino Analysis)

ROOT

- Geometry File
- Geometry Service
- Geometry Objects
- Hits / Digits Objects
- Scene Display
- Event Files (Sim/Calib/Rec)
- Event Manager
- Sim Track Rec Header
- Histograms
- GUI Event Control
- GUI Display Control
- GUI widgets

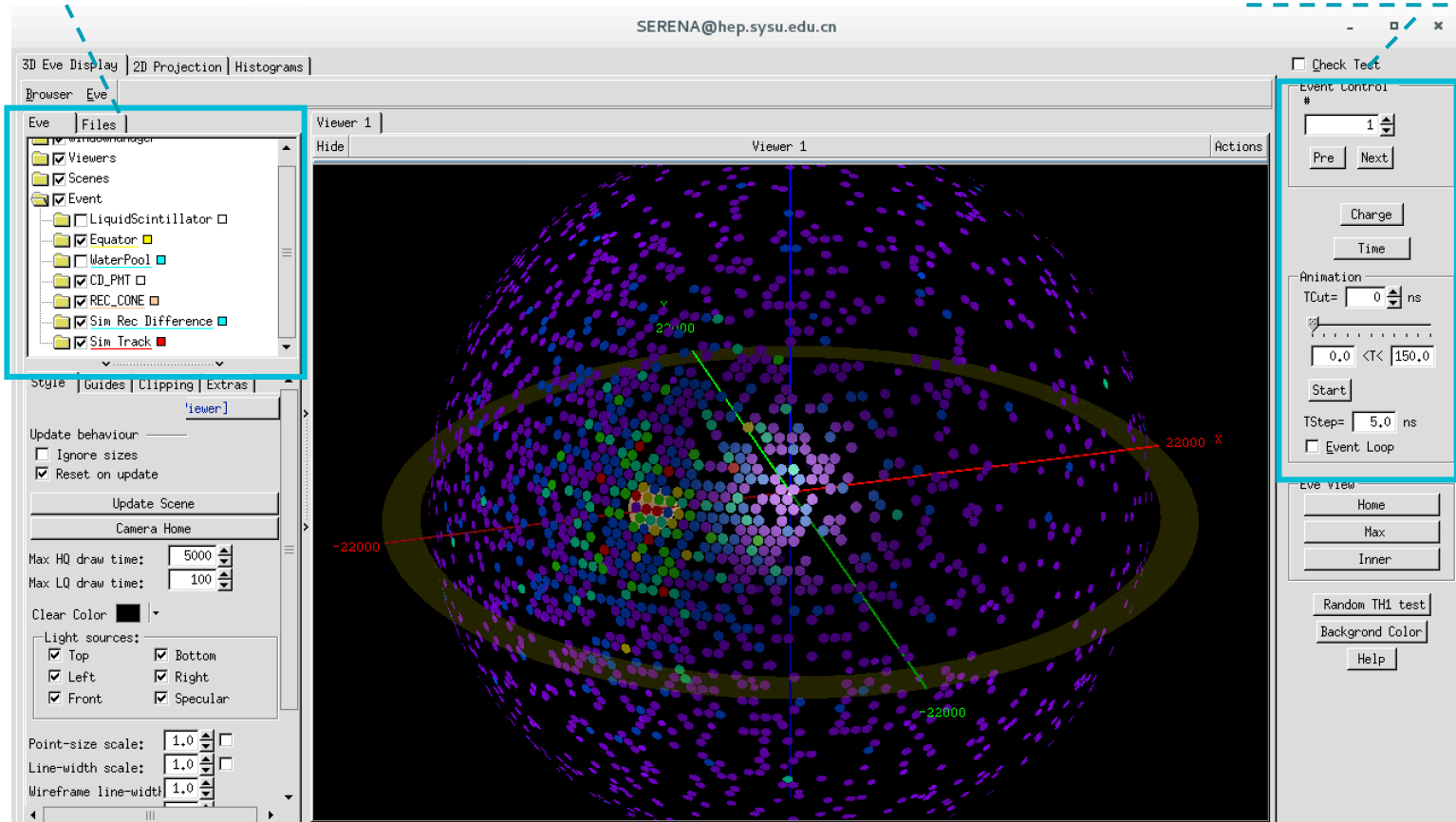**Display Engine EVE/Graf2d**
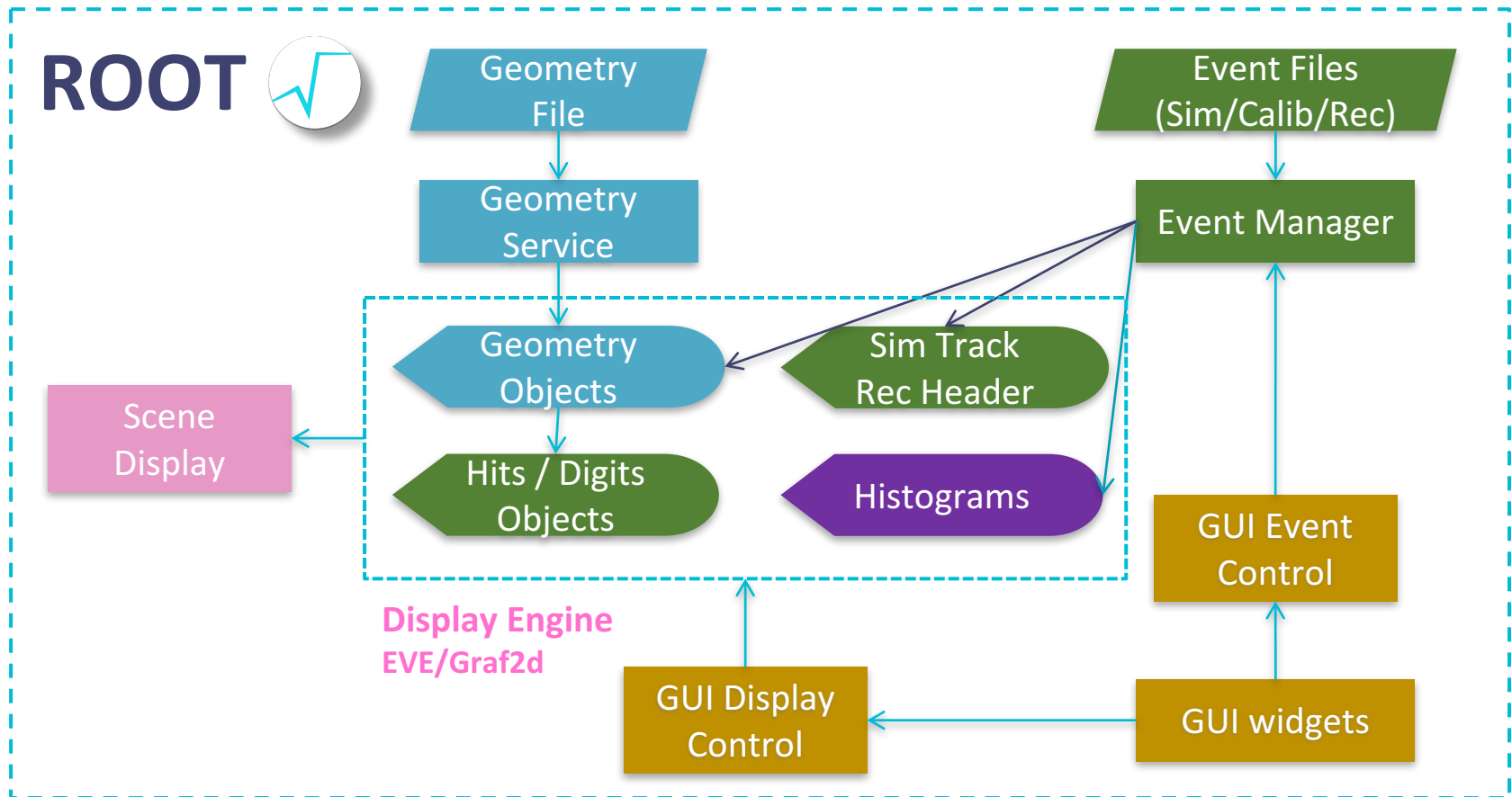
Current Event Display Scheme in JUNO Offline

GUI of SERENA

Components to display

Event control

PMT Hits distribution

Event hits with SERENA
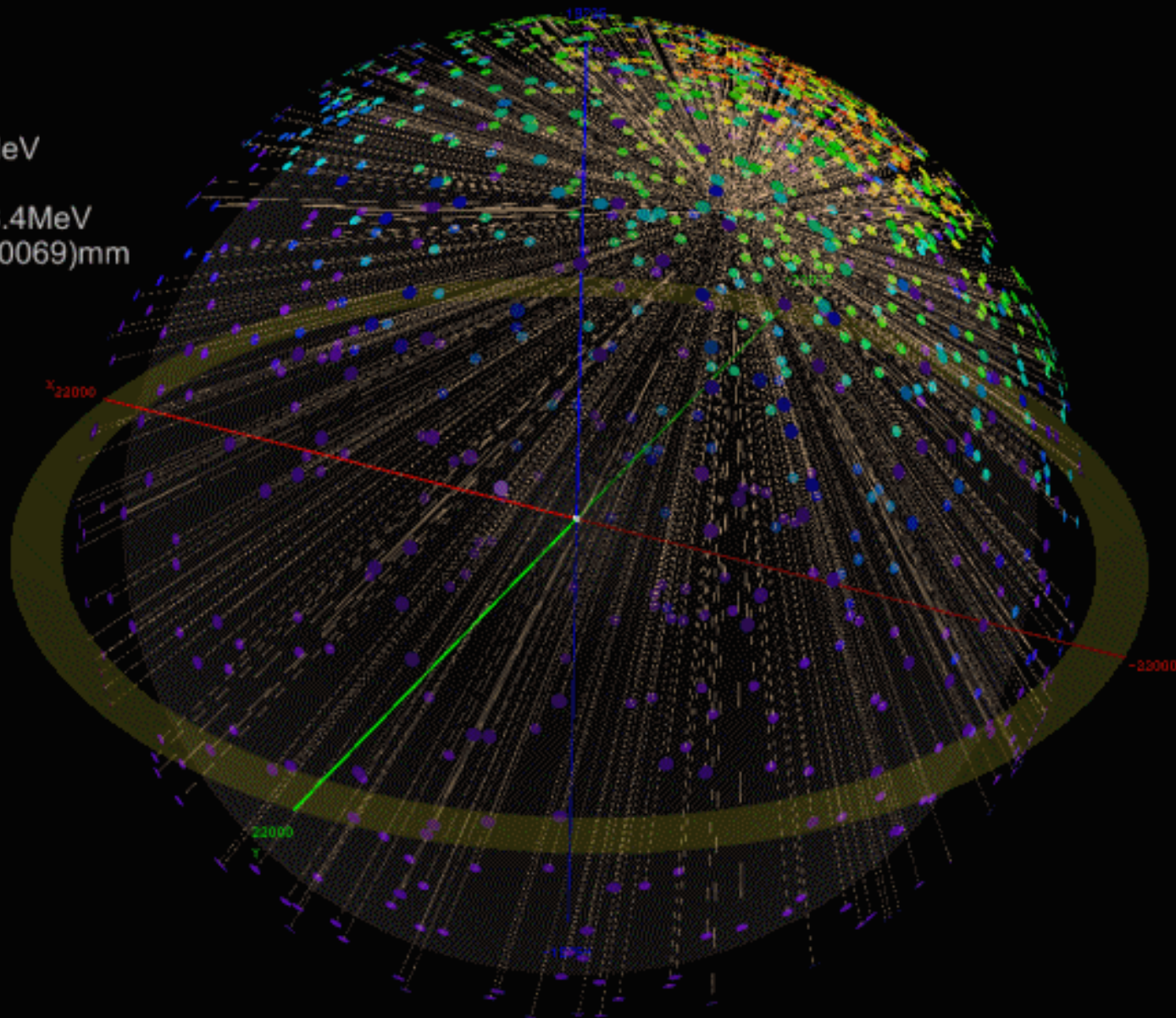

Fri Feb 3 09:43:25 2017
SimEvent:9
nTracks=1 nCDHits=1356
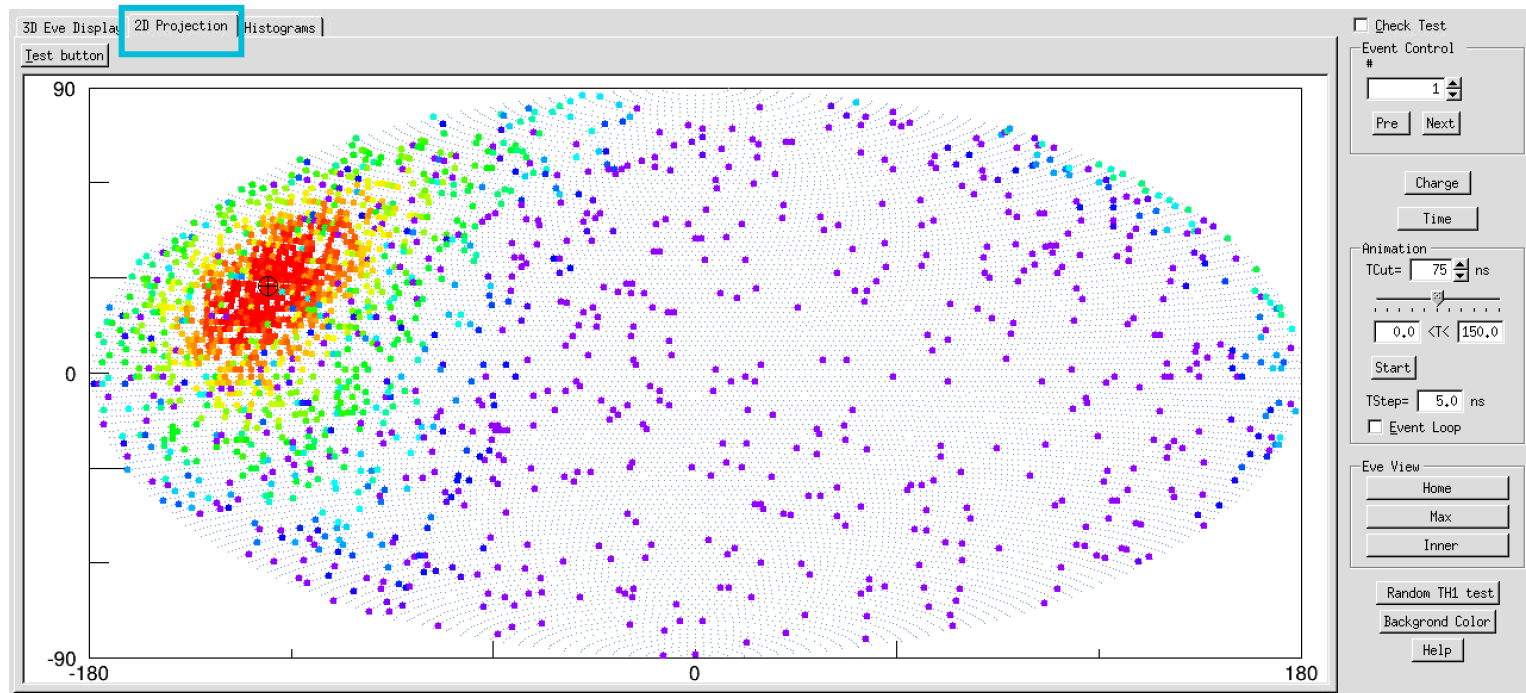Trk0 pdg=22 Edep=1.000MeV
RecEvent:
peSum=1356 energy=2668.4MeV
RecVertex (-2350, -8942, 10069)mm
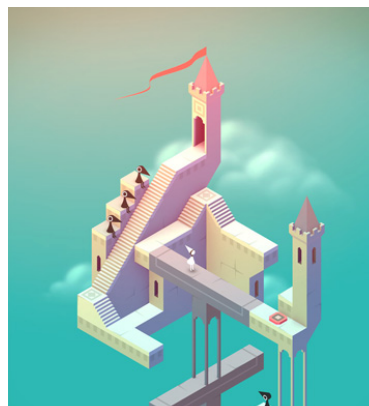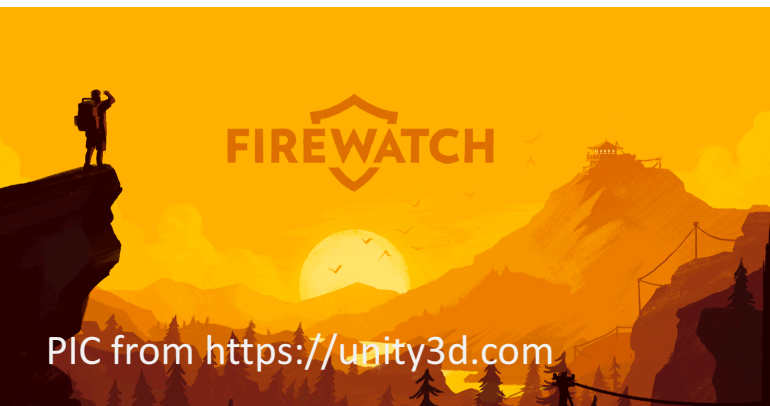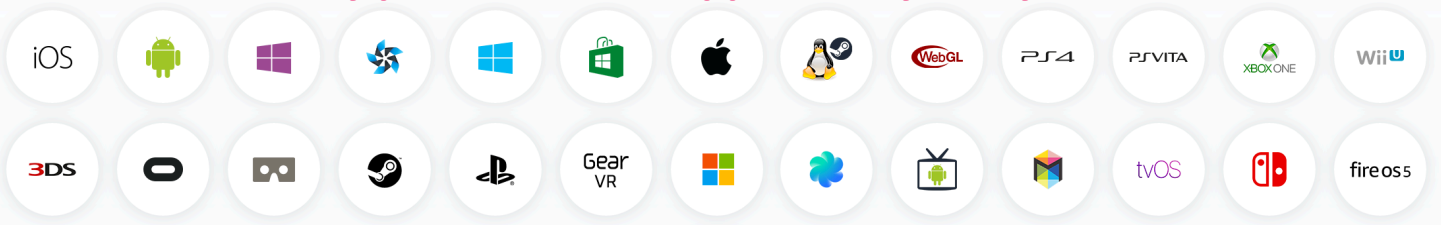
GUI of SERENA

2D Projection

What is Unity

A renowned game engine

- Unity allows developers to target more devices very easily.
- Not just for game, it can be also used for education, simulation, visualization and so on.
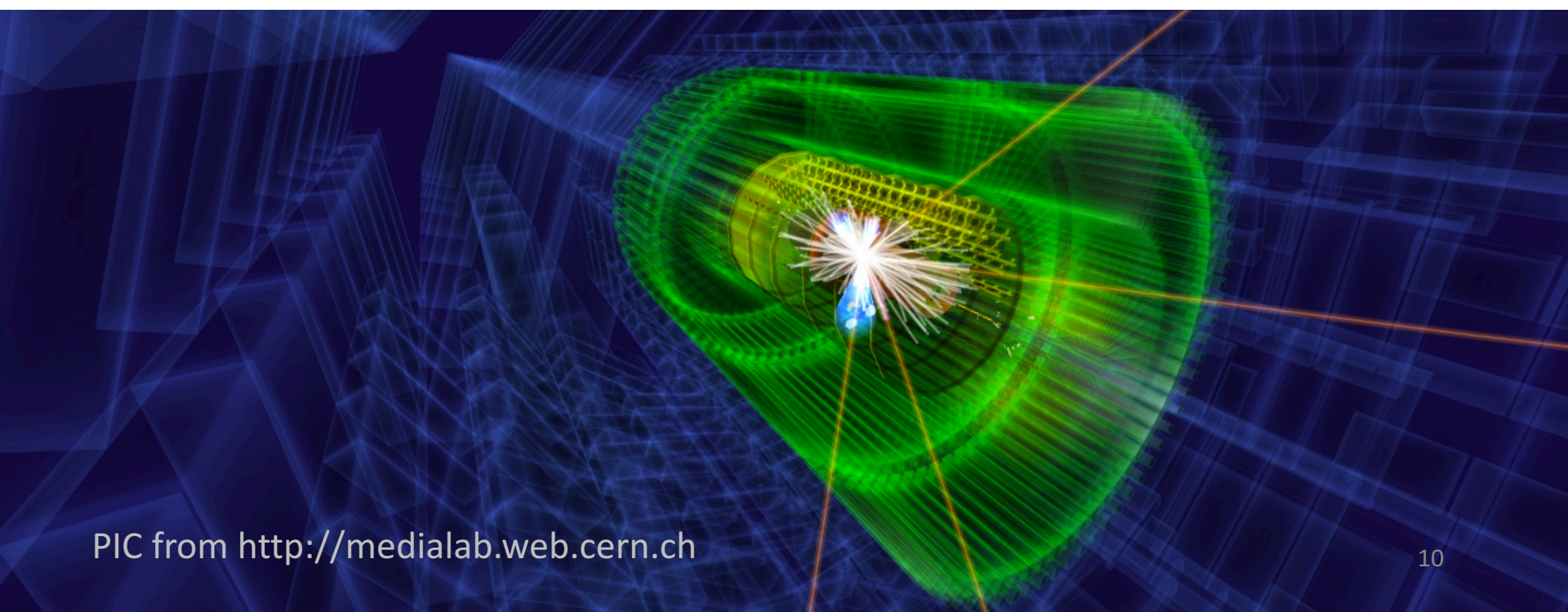
More than twenty platforms are supported by Unity.

9

Application in HEP based on Unity

CAMELIA (Cross-platform Atlas Multimedia Educational Lab for Interactive Analysis)

Software for analysis, learning and exploration of real LHC events
Demonstration for ATLAS experiment

PIC from http://medialab.web.cern.ch

A new Event Display based on Unity

Less dependent on the offline software
Built as a client for running on user's own PC

Event Display Based on Unity
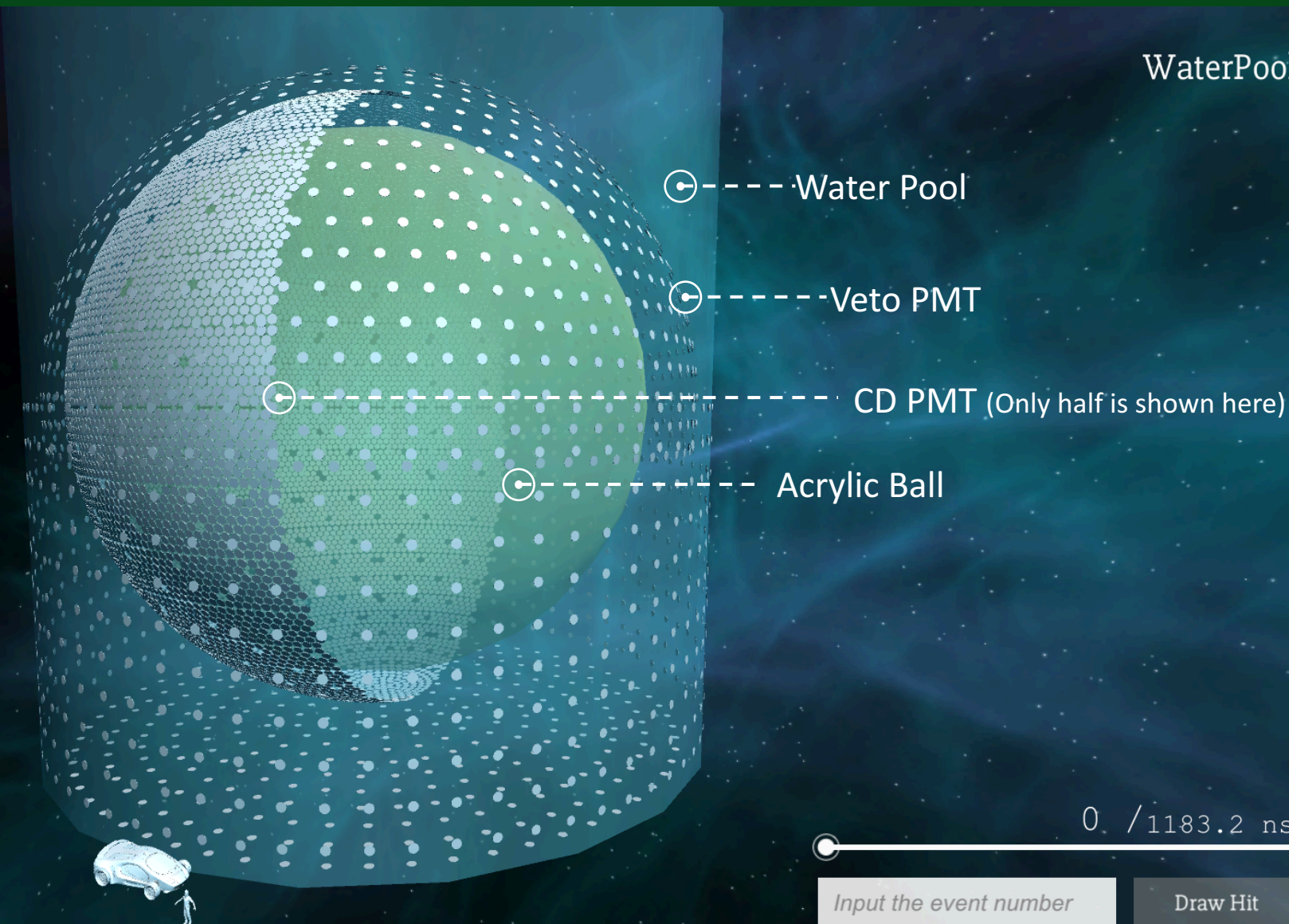
Data Flow in JUNO Experiment for Event Display

Geometry File **->** Detector structure

Event & MC truth File **->** PMT hits and simulation info

Reconstruction File **->** Reconstructed vertex and energy

Detector Visualization

WaterPool

Water Pool

Veto PMT

CD PMT (Only half is shown here)

Acrylic Ball

0 /1183.2 ns
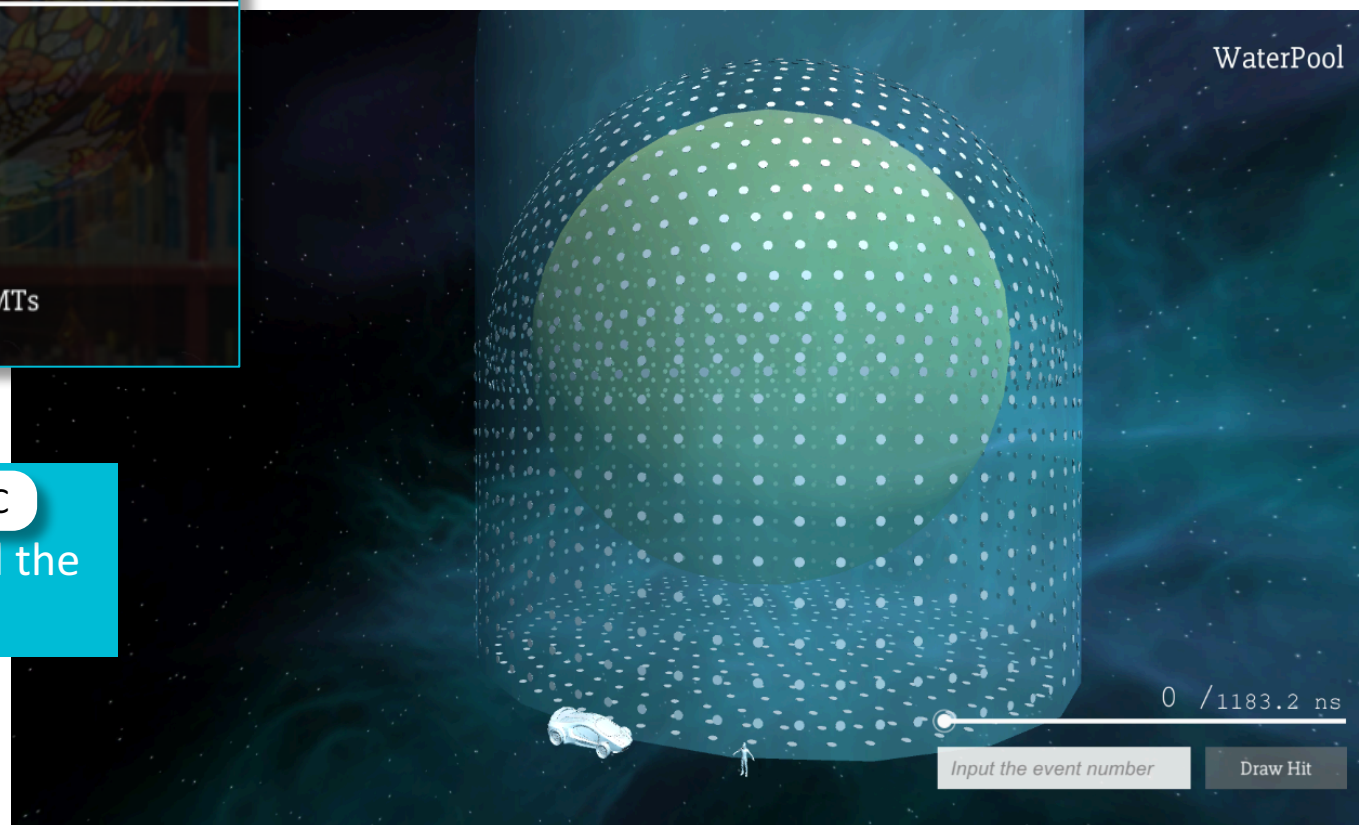
Input the event number   Draw Hit

Detector Visualization

Component On/Off

- ☑ AcrylicBall
- ☑ Water Pool
- ☐ CD PMTs
- ☑ Water Pool PMTs

Push the ESC button to call the setting menu
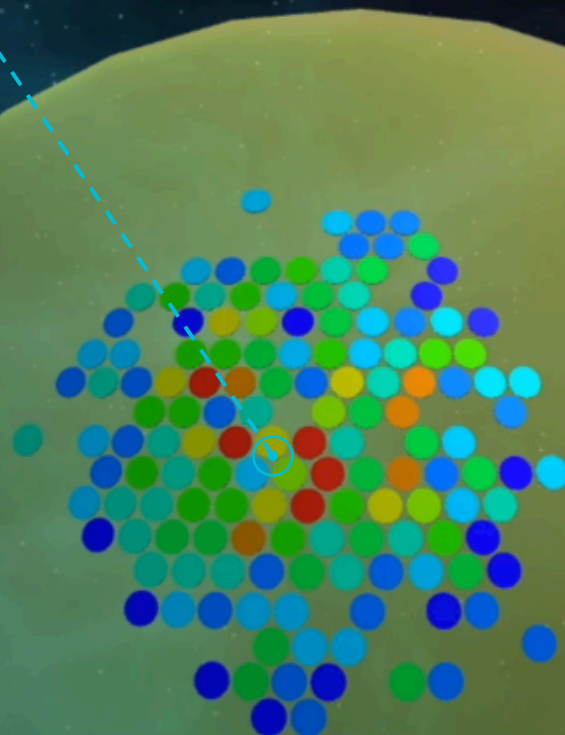
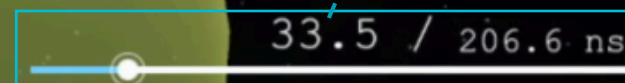Maximize the view of users.

WaterPool

0 /1183.2 ns

Input the event number   Draw Hit

Event Hits

Color means the hits number of the PMT

AcrylicBall

Drag the slider to change the time

33.5 / 206.6 ns

Input the event number 8

Draw Hit

Event Hits

Event Hits

PMT
ID 6167
Located in (1.1,5.8,18.6)
First hit in 13.4357 ns

Move the mouse pointer to show the info

95.2 / 617.7 ns
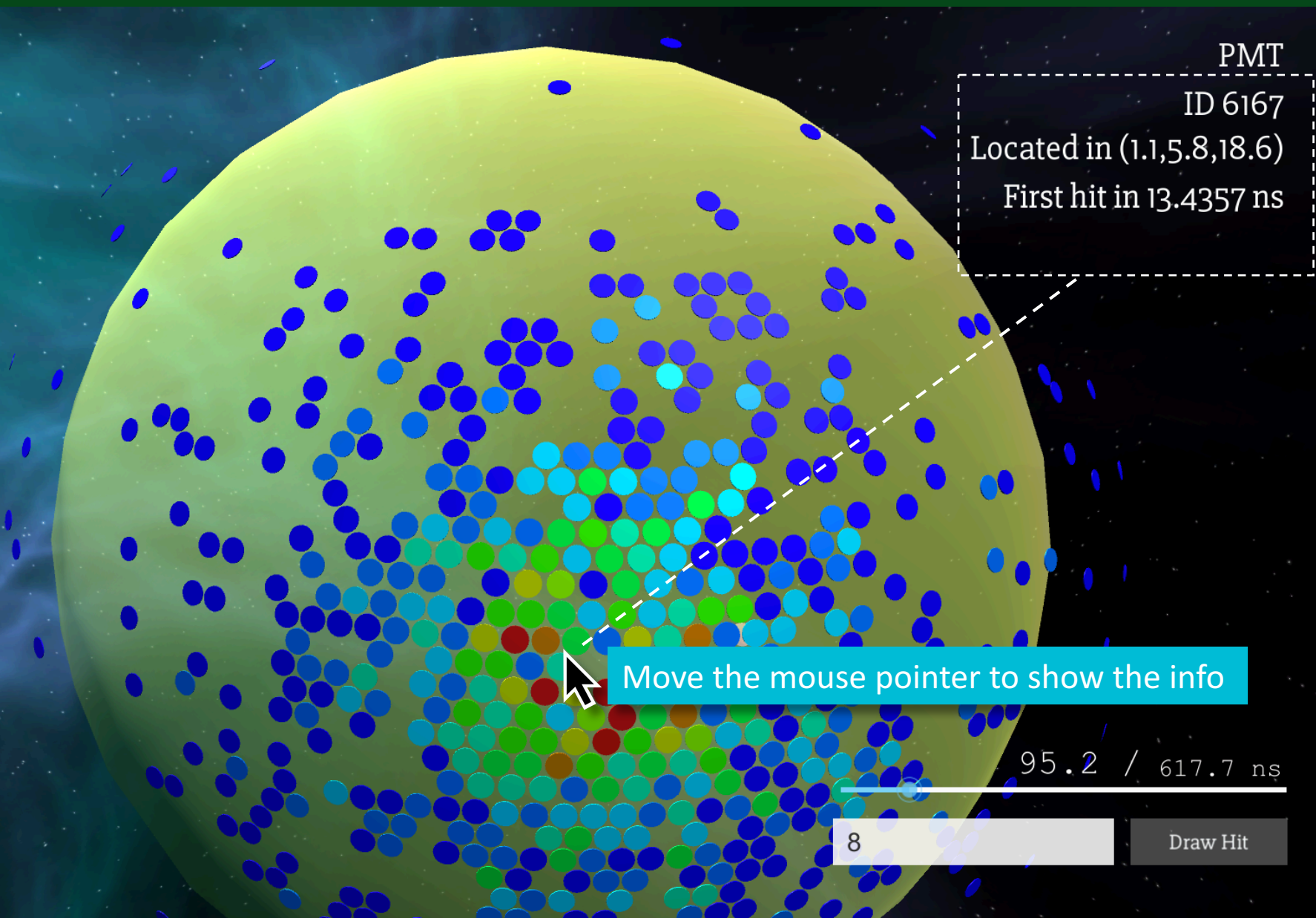
8   Draw Hit

Reconstruction Point

RecVertex
Located in (-2.6,-13.2,10.8)
Rec energy is 1.62605 MeV

Recontrution Point

1082.9 / 1082.9 ns

7   Draw Hit

Multiplatform

Test in different platform

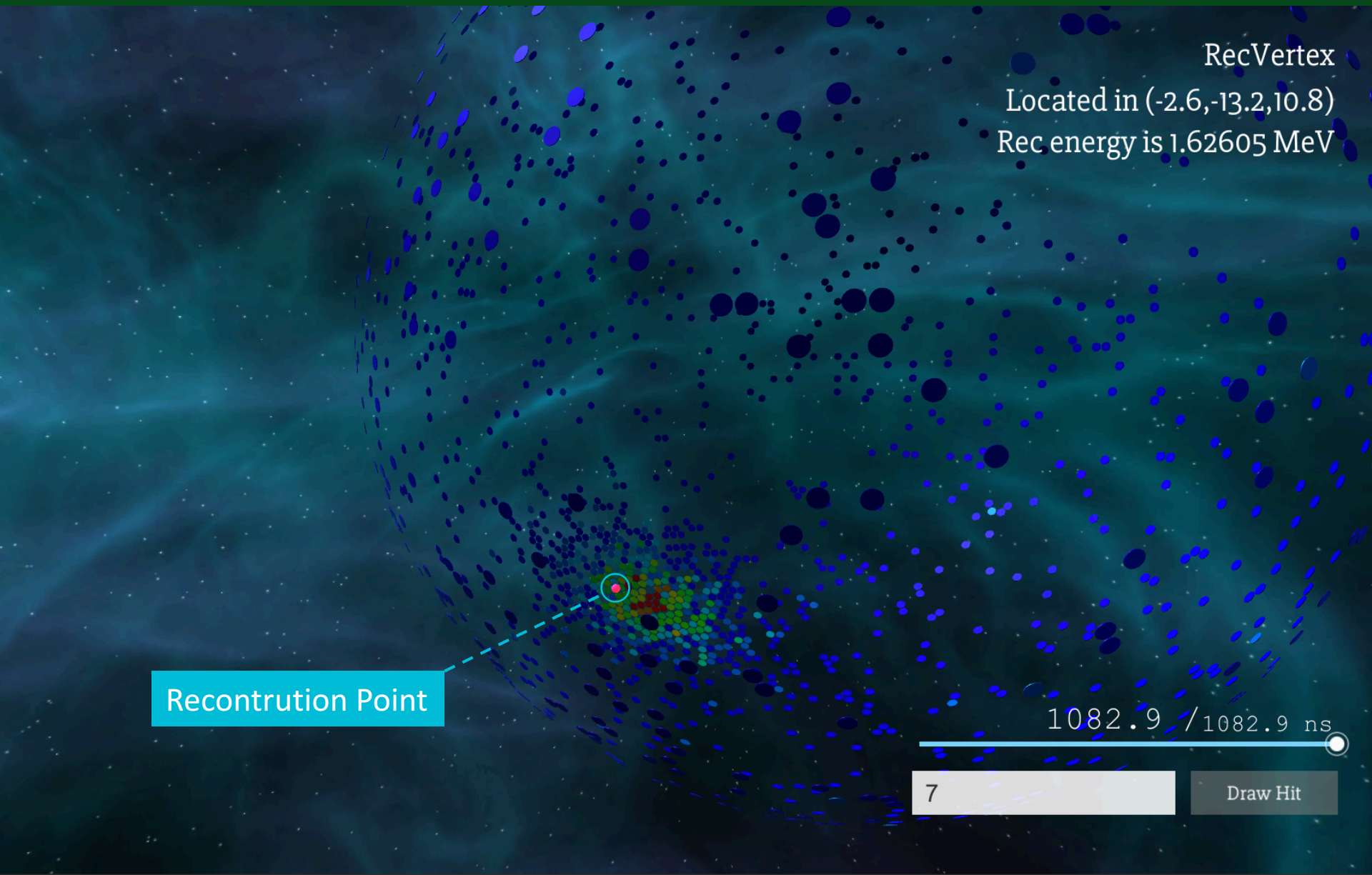The software has successfully run in the following platform:

Windows 8.1

Scientific Linux 7.2

macOS 10.12

Web (Google Chrome 58.0)

Unity v.s. ROOT

ROOT(SERENA)

Easy to input and output the data in root file format.
Well developed for now. (Geometry, Event, Mc truth and Reconstruction)

Integrated in JUNO offline as a part of JUNO offline.
Plugin is needed if users want to display remotely.
Visual effect is limited by ROOT.

Unity

Easy to transplant to other platform like windows, Linux, mac, web.
Built as a client, which can be run in user's own PC without JUNO offline.
Fancy visual effect is available as a game engine.

Need the data conversion when loading a root file.

Future Plan

Development for Event Display based on Unity

- Data encapsulation
- MC truth display
- More user friendly GUI
- Shortcut and help documentation
- Detail model (like the structure of PMT)
- Histograms
- …

Summary

Two event display systems have been built for JUNO.
The one based on ROOT is approaching full functionality.
The other one based on Unity is basically available.

Event Display with Unity is strongly transplantable and able to realize fancier effect easily.

More functions will be added in the Event Display system soon.