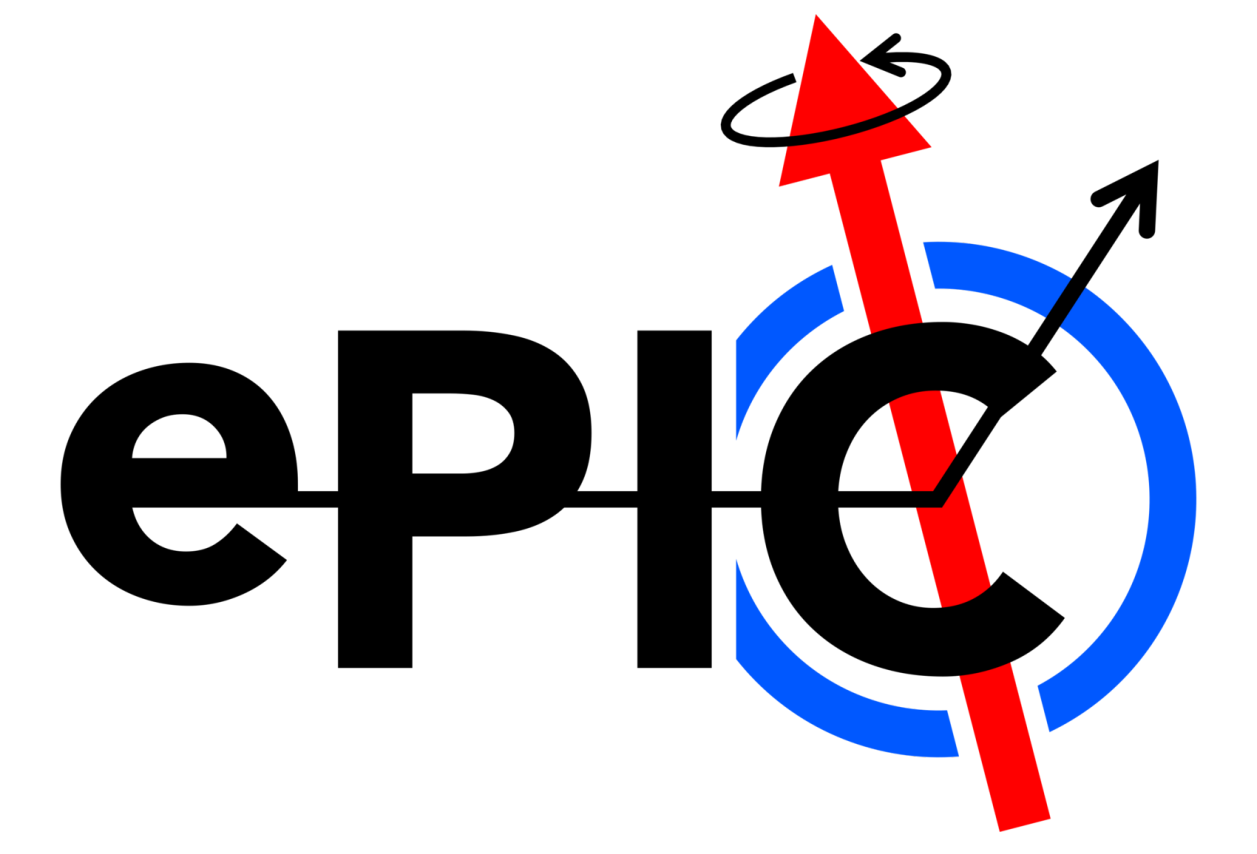


VIRTUE: Virtual Interactive Reality Toolkit for Understanding the EIC

Sean Preins

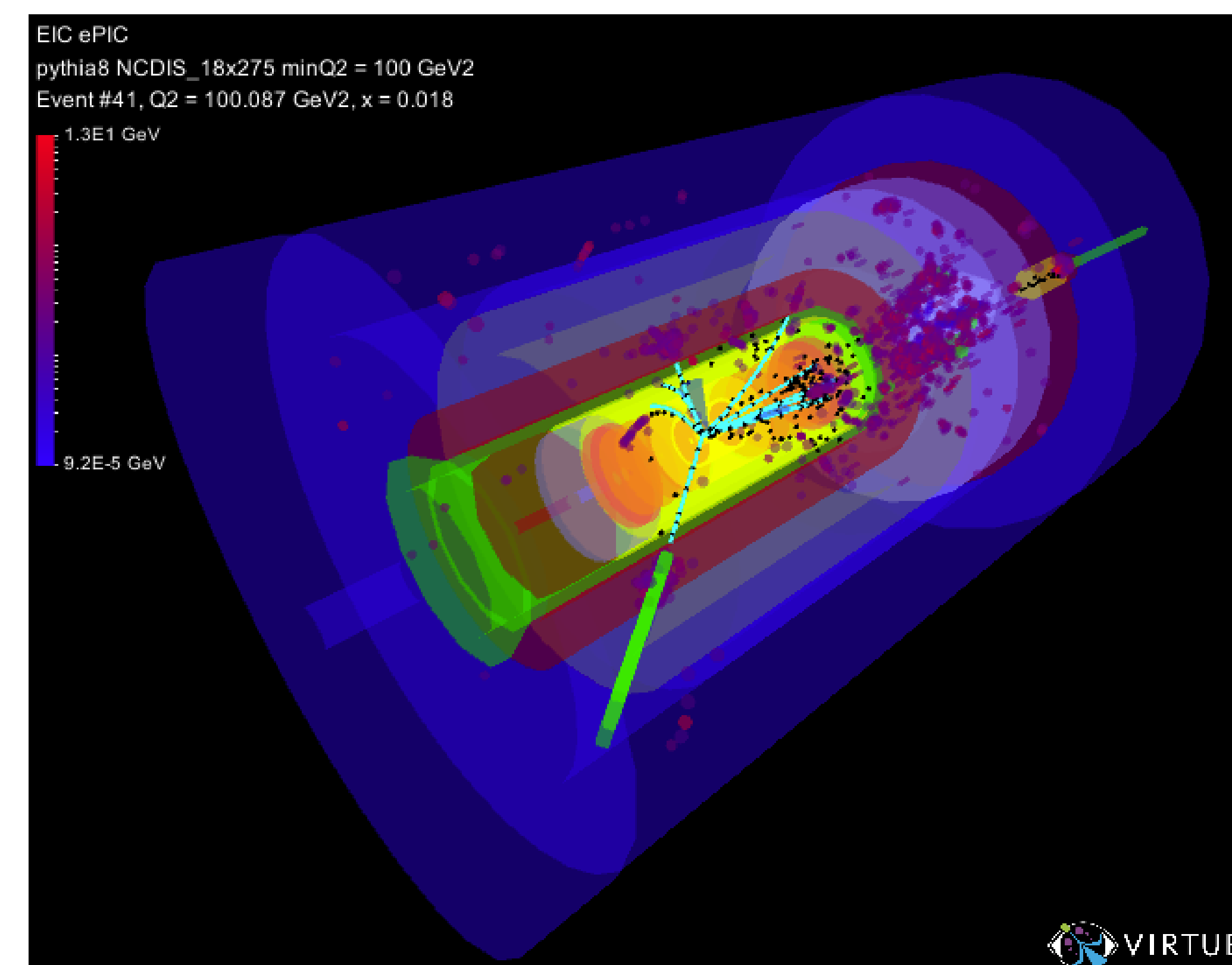
Interactive Event Display and Detector Visualization for the Electron-Ion Collider



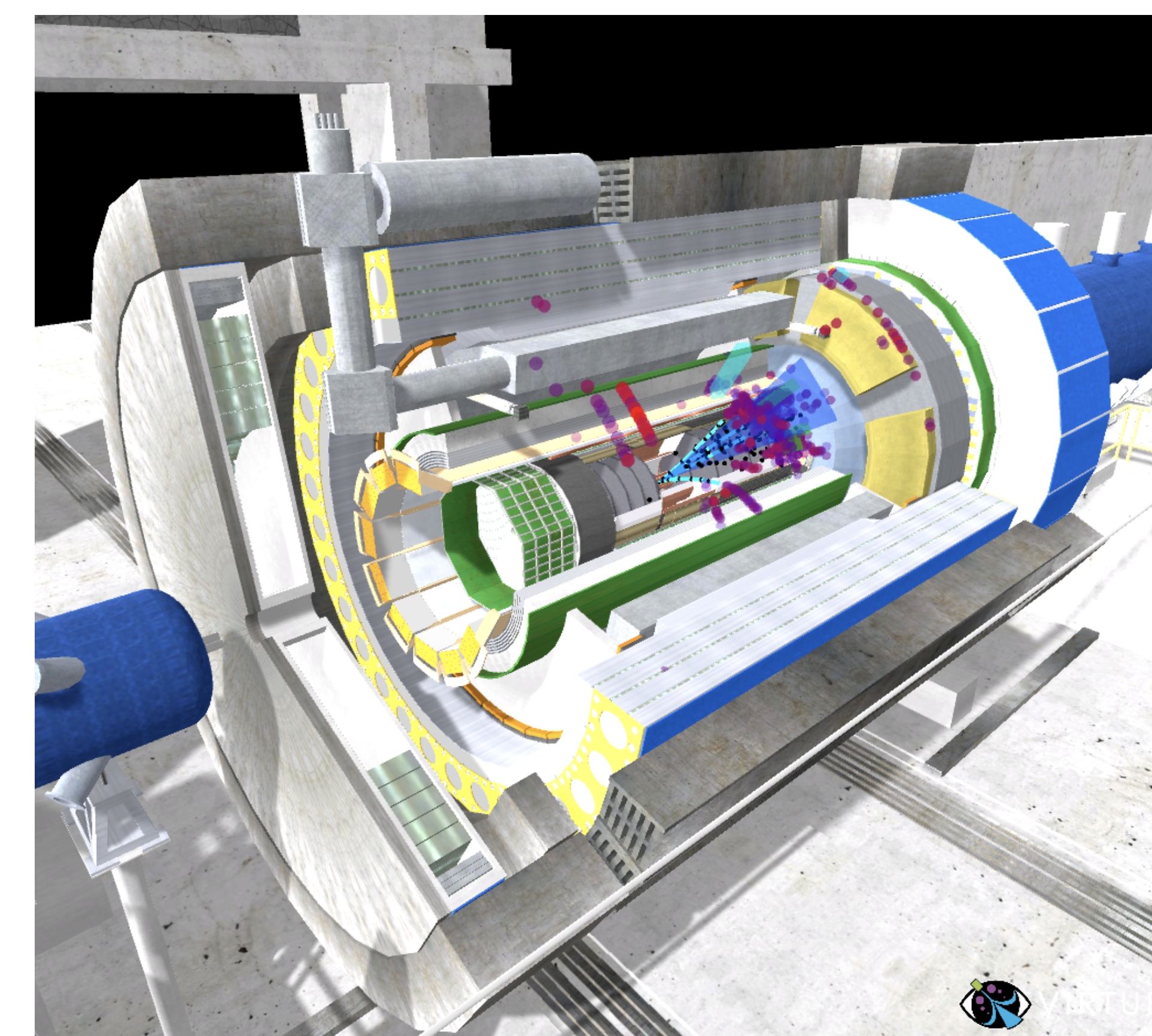
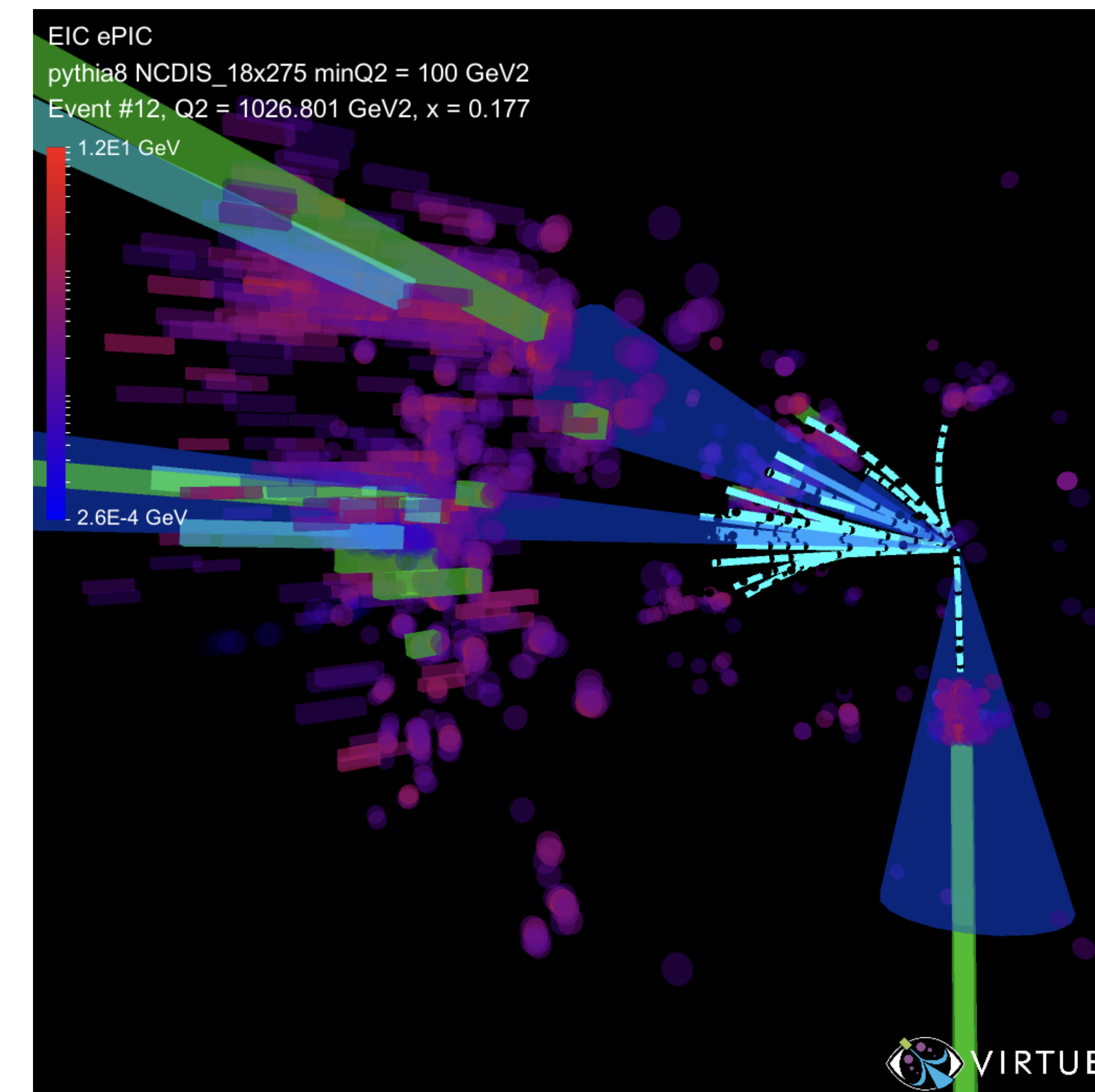
VIRTUE Overview

VIRTUE is a standalone application for visualizing detector geometries and collision event data in an interactive three-dimensional environment. Developed in Unity, the software supports both conventional displays and immersive virtual reality platforms, providing a flexible framework for detector exploration, outreach activities, and educational demonstrations.

- ▶ Available for Windows, macOS, Linux, Android, and virtual reality platforms
- ▶ Includes engineering and simplified models of the ePIC detector
- ▶ Supports interactive navigation, detector inspection, and event animation
- ▶ Distributed through Steam, Google Play, and Zenodo



Visualizing Collision Event Data



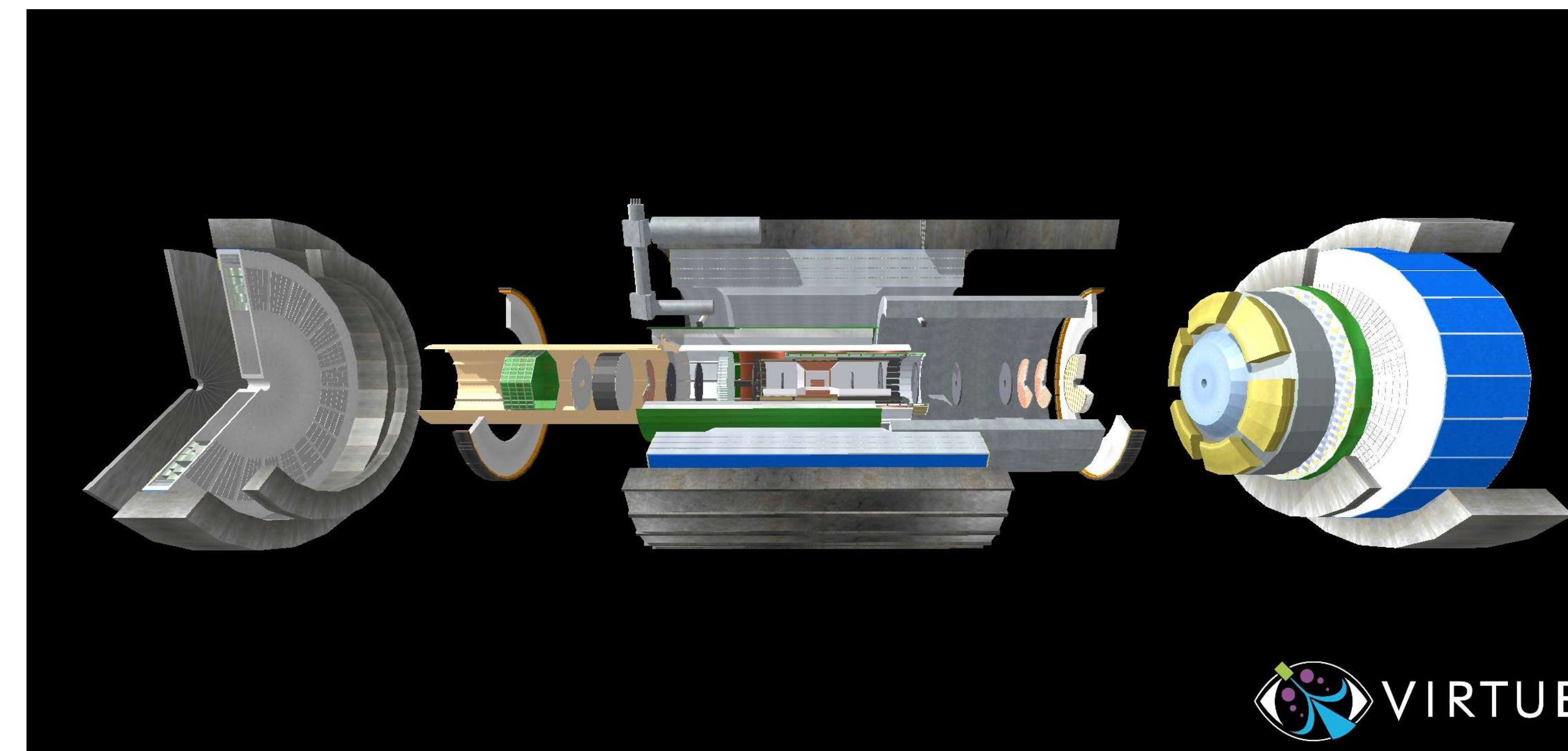
VIRTUE provides animated visualization of detector response and reconstructed event data within the detector geometry. Event information is displayed in three dimensions and can be explored interactively using playback controls and free camera movement.

- ▶ Supports visualization of tracks, hits, clusters, jets, and custom detector objects
- ▶ Event displays can be animated as a function of time
- ▶ Conversion tools are available for translating EDM4eic ROOT files into the VIRTUE JSON event format
- ▶ Users can navigate between events, adjust playback speed, and control viewing angles

Visualizing Detector Geometry

VIRTUE supports the visualization of detector geometries ranging from detailed engineering models to simplified representations designed for clearer event visualization. Detector components can be viewed individually, made transparent, or hidden to expose internal subsystems and improve visibility of event data.

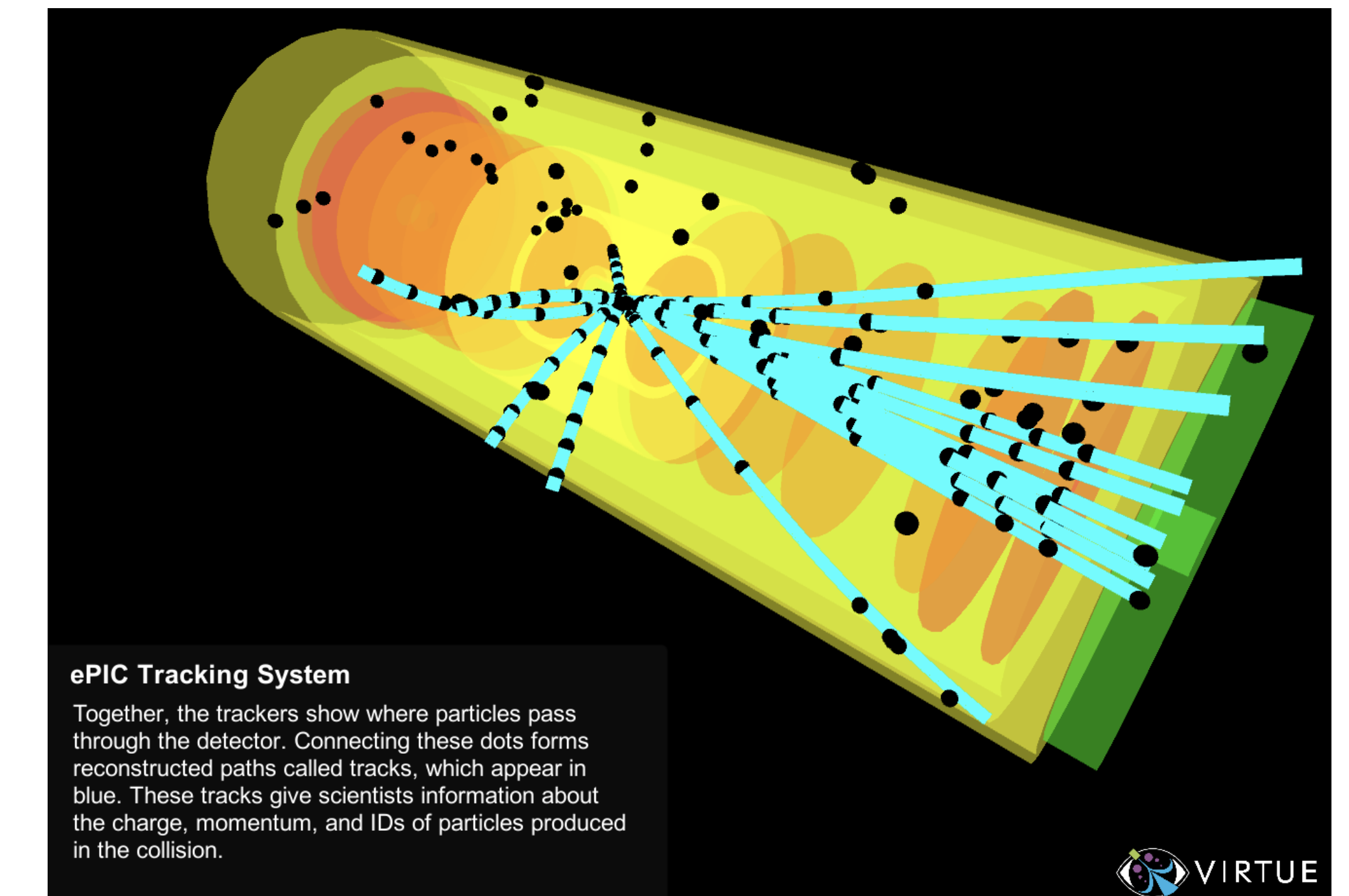
- ▶ Engineering detector models can be imported from standard FBX CAD files
- ▶ A custom JSON geometry format supports simplified detector representations
- ▶ Components can be labeled, isolated, and rendered with adjustable transparency
- ▶ Distributed with both engineering and simplified models of the ePIC detector



Tour Mode

Tour Mode provides a guided presentation framework for detector systems and collision events. A tour consists of a sequence of scenes that control detector visibility, event selection, camera position, and explanatory text, allowing complex topics to be presented in a structured format.

- ▶ Individual scenes can focus on specific detector subsystems or physics signatures
- ▶ Camera positions and displayed components are configurable for each scene
- ▶ Tours are defined through JSON files and can be customized without modifying the application
- ▶ Includes a preconfigured tour introducing the major ePIC detector subsystems



Applications

VIRTUE has been used as a visualization platform for outreach activities, educational demonstrations, and detector presentations. Its support for custom geometries and event data also makes it useful for illustrating detector concepts and simulated collision events.

- ▶ Outreach events and public demonstrations
- ▶ Classroom and student instruction
- ▶ Conference presentations and event visualizations
- ▶ Detector design and geometry exploration

