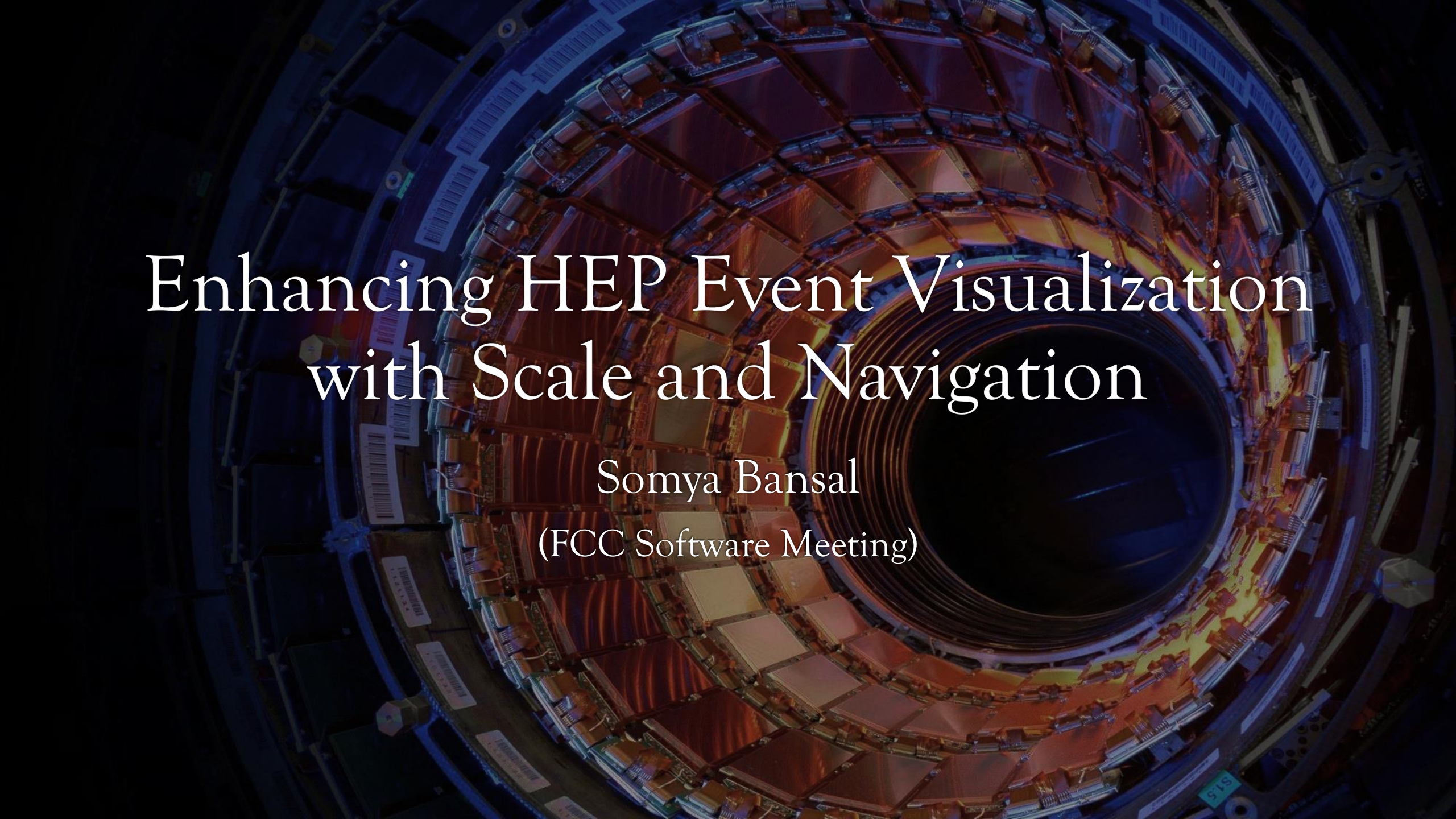


Enhancing HEP Event Visualization with Scale and Navigation

Somya Bansal

(FCC Software Meeting)

Brief description of Phoenix

- Application for visualizing High Energy Physics data, used by LHCb, ATLAS, CMS, FCC.
- Hosted at https://hepsoftwarefoundation.org/phoenix
- There are two sections:
  - Phoenix Event Display
  - Phoenix Angular Application
- Browser based application, server-independent.

Phoenix Event Display

- Event display – modular, experiment-independent.
- Uses ThreeJS for displaying detector geometry and event data.
- Three Manager includes the functions related to playing with ThreeJS features.
- UI Manager is for UI related operations.

PHOENIX

Application for visualizing High Energy Physics data.

Playground

Get started with the different Phoenix features.

Show

Geometry display

This test should show some simple geometry.

Show

ATLAS EXPERIMENT

ATLAS

Show the ATLAS detector. One simple event.

Show

LHCb

LHCb

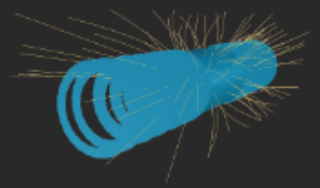
Show the LHCb detector. One simple event.

Show

CMS

Show the CMS detector. One simple event.

Show

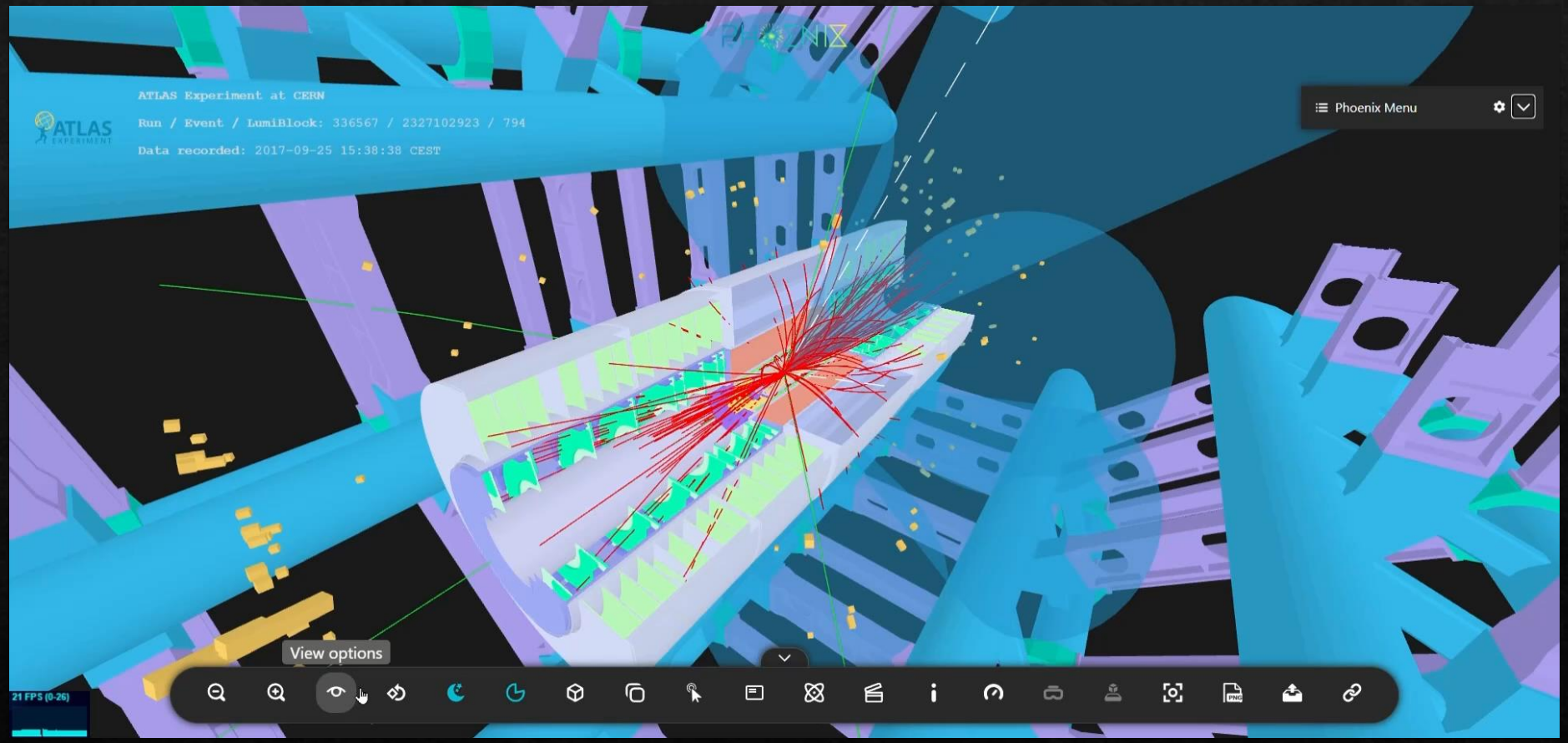


TrackML

Visualisation for TrackML. Shows how to write a custom event loader.

Show

Let's navigate through ATLAS...



Phoenix Angular Application

- Uses Angular CLI v16 to render events and geometry in the frontend.
- Phoenix-ui-components uses event-display-service to make up the UI Menu layout.
- Phoenix-app has 6 scenarios that use the UI Menu and their own detector geometries:
  - **Playground**: To play with the various features, such as UI Menu.
  - **Geometry Display**: This test renders a simple geometry.
  - **ATLAS, LHCb, CMS**: Show the ATLAS, LHCb and CMS detectors respectively.
  - **TrackML**: To write a custom event loader.

The project has been divided into two parts:-

01

SCALING:

Measure relative and absolute locations of particles and distances between them

02

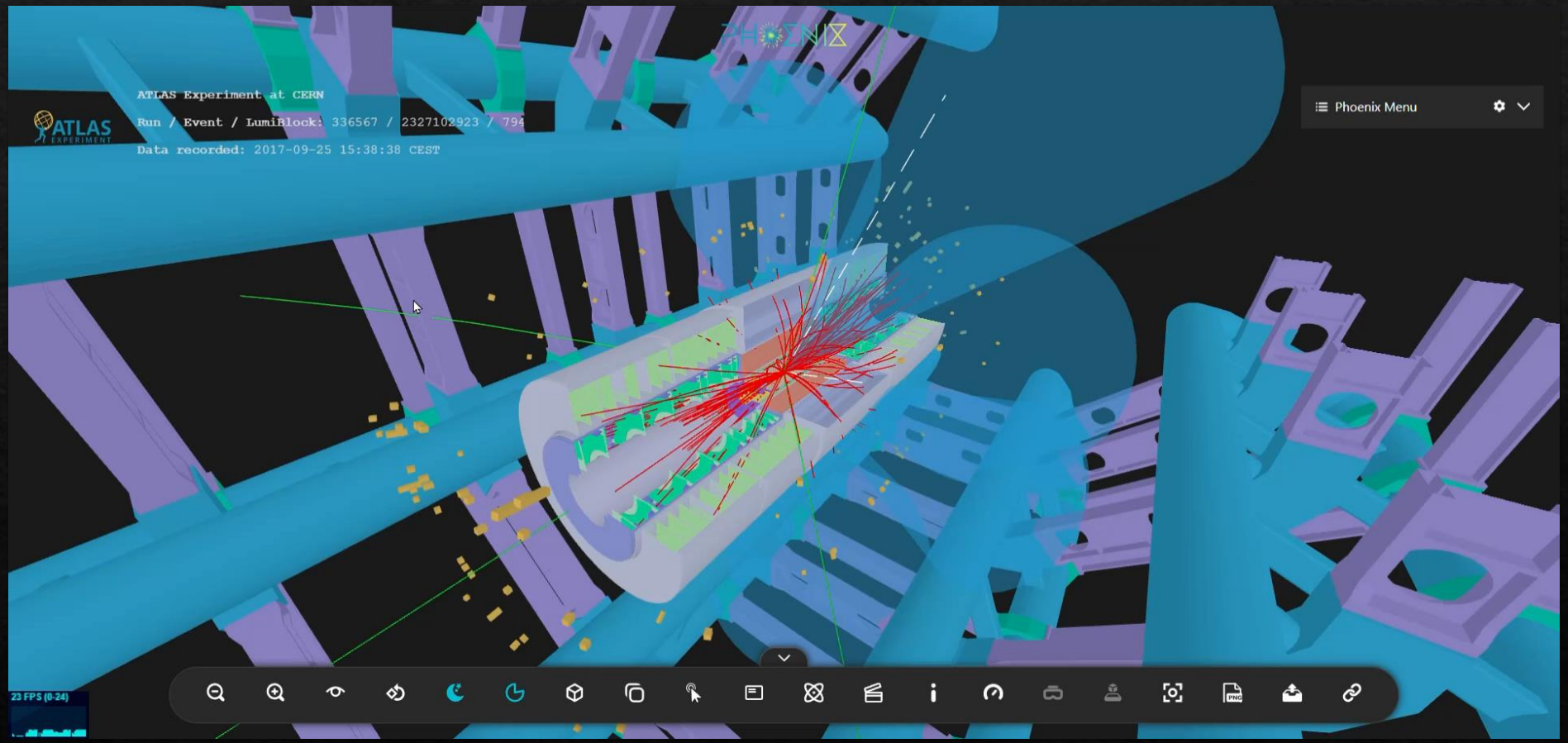
NAVIGATION:

Navigate to and highlight subdetectors/ detector subparts

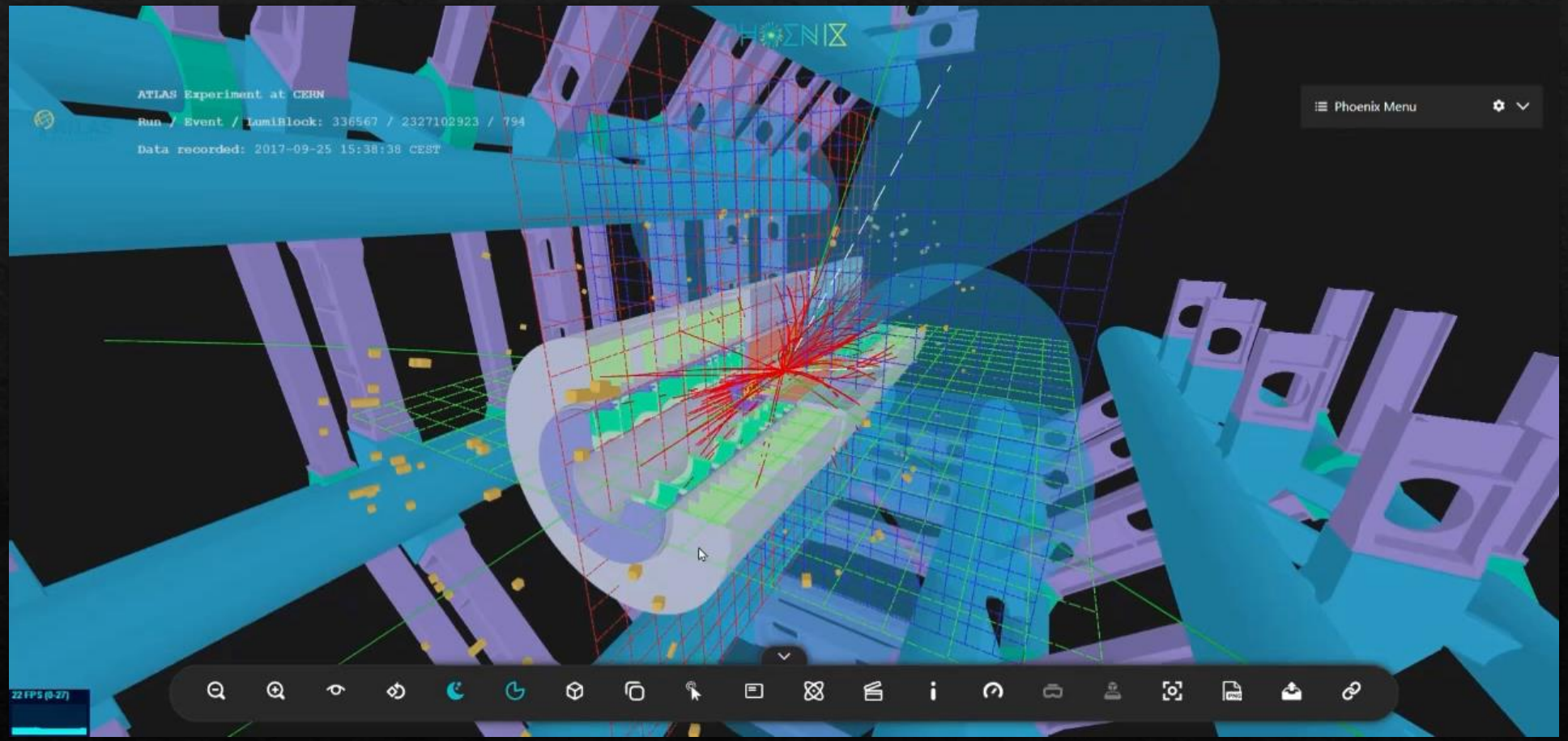
SCALING: Grid

- Added a 3D cartesian grid at the origin of the geometry.
- There are multiple XY, YZ, ZX planes in the Z, X and Y directions resp.
- The number of planes and their sparsity is customizable.
- Grid can be translated in two ways:
  - Manually entering the (x, y, z) values of the new origin.
  - Click on the new desired origin in the scene.
- The unit of distances and coordinates expressed is cm.

Grid display



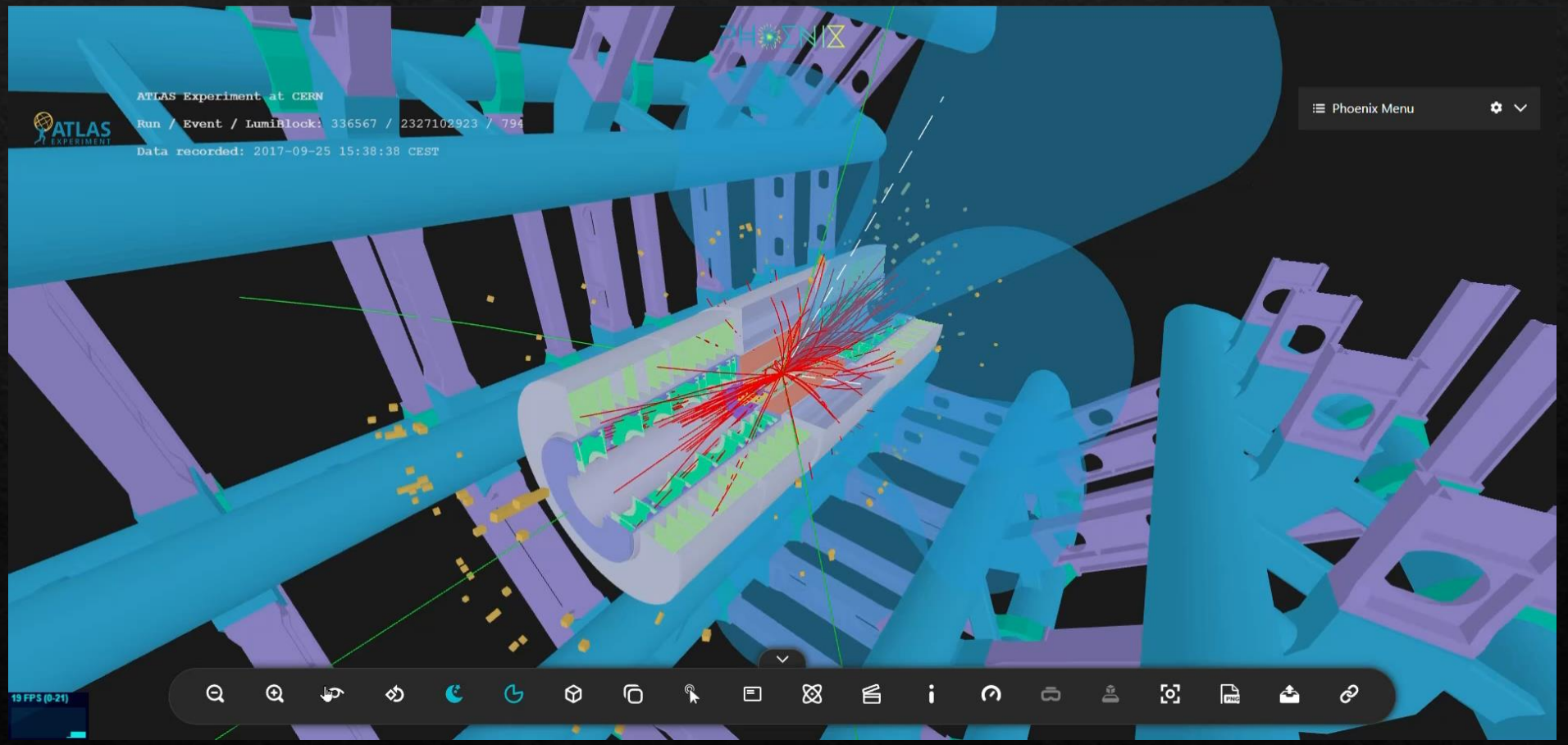
Grid Translation



SCALING (Cont'd)

- Shows 3D coordinates of a point clicked.
  - Absolute coordinates + Relative to grid origin
  - Closest visible point under the mouse is considered.
- Shows 3D distance between any two points.
  - Zooming in/out feature works while measuring distance.
  - Just like 3D coordinates of a clicked point, here also, the coordinates of the two clicked points are calculated and their Euclidean distance is rendered.

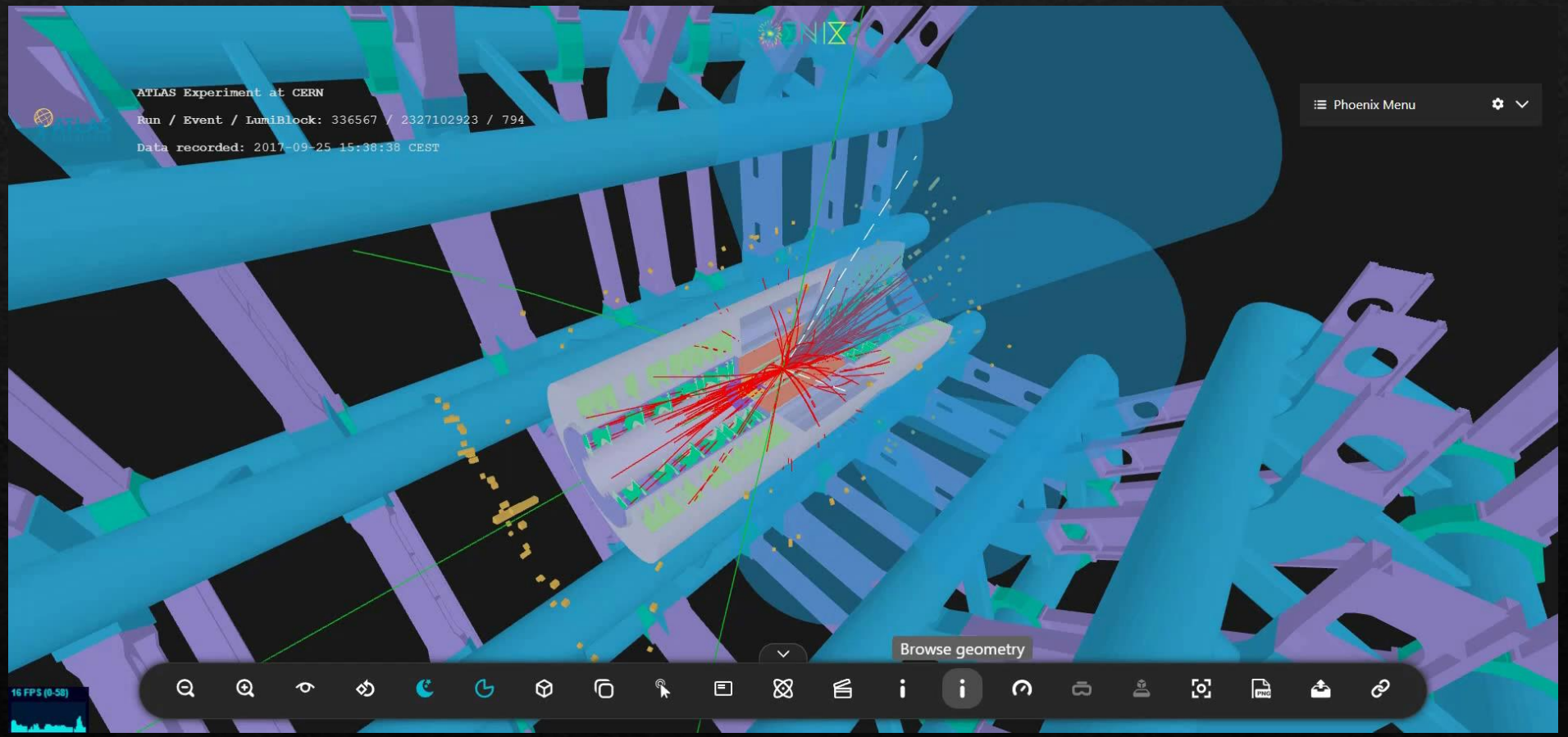
Demo of 3D coordinates and distances



NAVIGATION

- A new UI Menu icon – Browse Geometry – has been added.
- It lists down all the subparts of the detector geometry.
- Clicking on any subpart zooms into its origin and highlights it.

Demo for navigation



Conclusion

- 3D customizable and translatable cartesian grid was introduced.
- Axis labels were added.
- 3D coordinates of a clicked point can be rendered.
- 3D distance between two points can be rendered.
- Sub-parts of detector can be highlighted and zoomed into.
- Future work:
  - Mention info about subpart of detector while highlighting.
  - Add a functionality to render dimensions of sub-parts.