Building Geometry using DD4hep Plugin

Yufeng Wang
Mar 20, 2025

HELMHOLTZ

DESY.

Geometry building procedure (old)

ACTSTrackingProc.cxx
ACTSProcBase.cxx

trackinggeometry() is used to find **surface** in the main tracking code.
Then, **surface** (containing **geometryID**) is used to:

- Convert LCIO hits to ACTS hits
- Create sourcelinks between measurement and hit
- Get track parameters once seeds are found
- (hits & tracks back to LCIO collection)

---

trackingGeometry() is build through **buildDetector()** in the base code.

trackingGeometryBuilder::Config tgConfig → cylinderGeometryBuilder

- materialDecorator (_matFile.json)
- trackingVolumeBuilders
  - CylinderVolumeBuilder ← layerBuilder ← Acts::TGeoLayerBuilder ← **TGeoManager**

TGeoMenager reads from _tgeoFile (ROOT).

Geometry building procedure (new)

ACTSTrackingProc.cxx
ACTSProcBase.cxx

trackinggeometry() is used to find **surface** in the main tracking code.
Then, **surface** (containing **geometryID**) is used to:

- Convert LCIO hits to ACTS hits
- Create sourcelinks between measurement and hit
- Get track parameters once seeds are found
- (hits & tracks back to LCIO collection)

---

trackingGeometry() is build through **buildDetector()** in the base code.

trackingGeometryBuilder::Config tgConfig → cylinderGeometryBuilder

- materialDecorator (_matFile.json)
- trackingVolumeBuilders
  - CylinderVolumeBuilder ← layerBuilder ← Acts::TGeoLayerBuilder **← DD4hep Detector**

dd4hep::Detector& dd4hepDetector = dd4hep::Detector::getInstance();

- DD4hep description (xml)
- Detector constructor (cxx)

_trackingGeometry = geometryService->trackingGeometry(); **← DD4hepPlugin**

Modified code

- DD4hep description xml and detector constructor
  - Dd4hep plugin
  - geoID

- TGeoLayerBuilder
  - Detector elements can be provided by DD4hep now.

- Magnetic field (not an issue for LUXE but need to be checked)

- Material （only silicon – but funny thing happens if I play with it; not reading json file correctly in v32?）

18 surfaces/disk,
18*4=72 surfaces in total.
8 detector layers.

ongoing

- Material
- Seeding/Tracking efficiency comparison: **v13** vs. **Tgeo v32** vs. **DD4hep plugin v32**
  - 365 hits, 275 spacepoints, 18 surfaces, 72 layers (wrong!)

Surface visualization

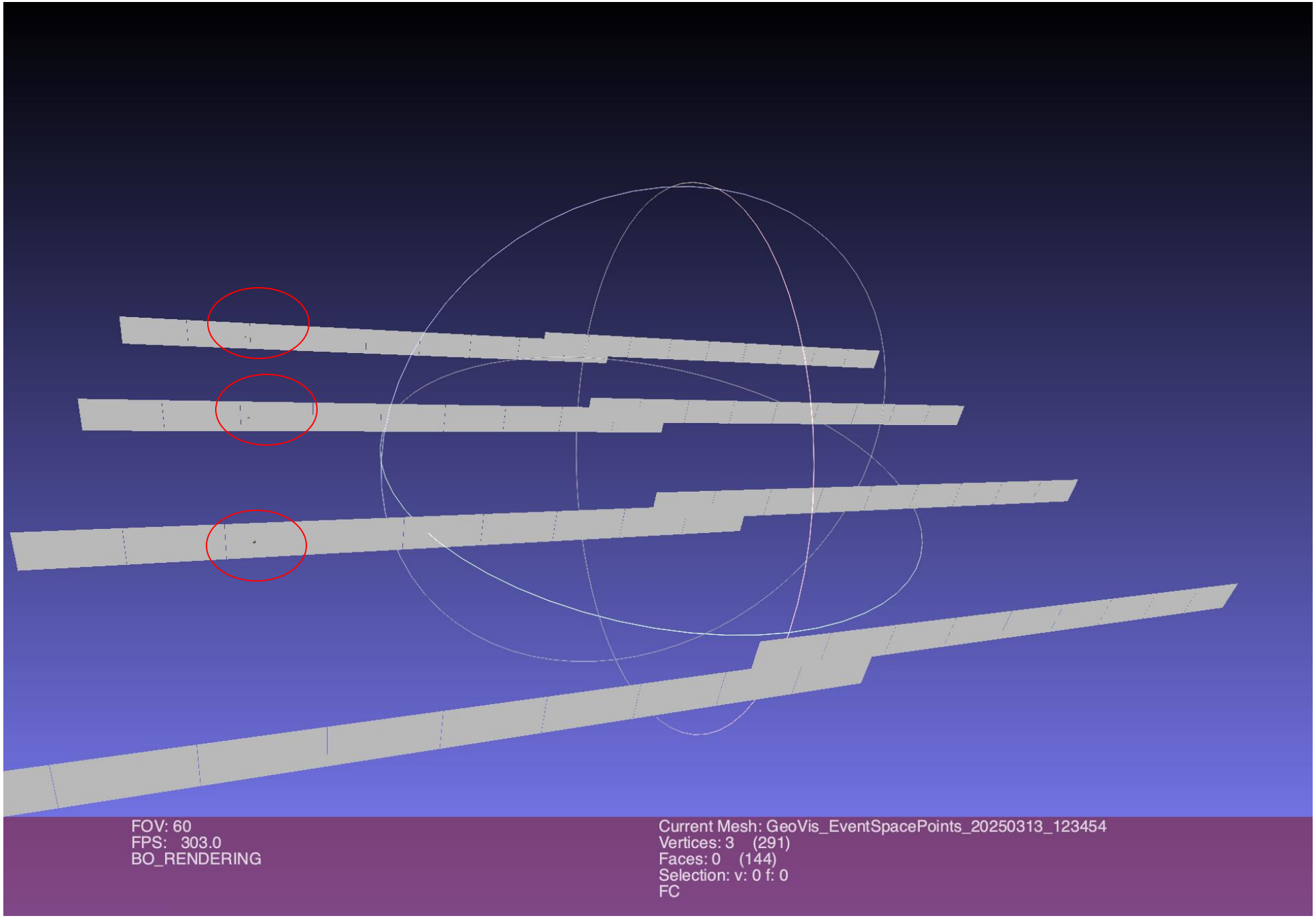
```
// visualization global geometry
Acts::ObjVisualization3D geoVis;

Acts::ViewConfig sConfig;
sConfig.triangulate = true;
sConfig.color = {200, 200, 200}; // grey

trackingGeometry()->visitSurfaces([&](const Acts::Surface* surface) {
  if (surface) {
    Acts::GeometryView3D::drawSurface(
        geoVis,
        *surface,
        geometryContext(),
        Acts::Transform3::Identity(),
        sConfig
    );
  }
});
```

Traverse all surfaces

trackingGeometry & geometryContext built by cylinderGeometryBuilder

Saved an .obj file

- Cleaning up the codes to separate the geometry translation part
- visualize space points → still tiny


FOV: 60
FPS: 303.0
BO_RENDERING
Current Mesh: GeoVis_EventSpacePoints_20250313_123454
Vertices: 3 (291)
Faces: 0 (144)
Selection: v: 0 f: 0
FC

Back up