

Next steps for cut tube support in ACTS

Sakib Rahman, Wouter Deconinck

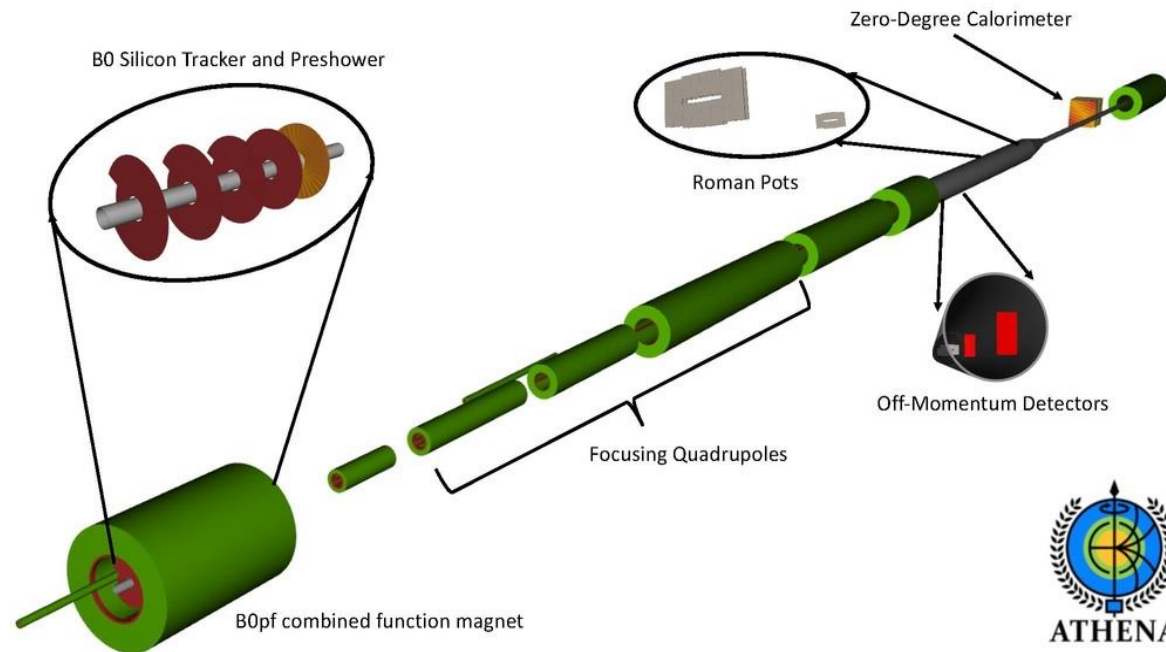
University of Manitoba

7 February, 2022

Motivation in the context of ATHENA far forward

Introduce ACTS tracking support for the BO tracker

- Challenge: Not symmetric about the global z-axis
- Solution: Model as a cylinder segment with bevel cuts at ends



Proposed next steps on cut tube support that touch the Acts code base

<https://github.com/acts-project/acts/issues/1146>

1. Extend TGeoTubeConversionTests.cpp with a TGeoCtub. This test will fail until support below is added,

- a) Extend Acts::TGeoSurfaceConverter::cylinderComponents and Acts::TGeoSurfaceConverter::discComponents to support TGeoCtub

The test above should now succeed.

2. extend Acts::DD4hepLayerBuilder::endcapLayers and Acts::DD4hepLayerBuilder::centralLayers to support TGeoCtub.

N.B. Implementing these changes on [this fork](#)

1. [Extend TGeoTubeConversionTests.cpp with a TGeoCtub](#)

```
/// CylinderBounds also supports beveled sides defined by an angle.  
/// Different angles can be defined on both sides of the cylinder.  
/// A positive angle is defined as "extruding" from the defined Zlength,  
/// while a negative angle is "intruding" on the Zlength.  
/// +   -           -   +  
/// _____  
/// \ | /           \ | /  
/// \ | /           \ | /  
///  \|/_____| \|/  
///      2 * ZhalfLength
```

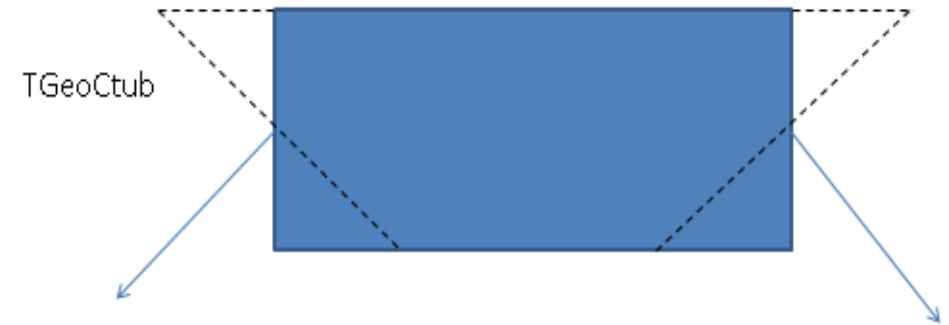
ACTS cylinder surface

Question:

- Is there a straight correspondence between the end cuts defined by normals in TGeoCtub and the angles in ACTS cylinder surface?
- How are the allowed axes for transformation determined for ACTS surfaces?

1 a) [Extend Acts::TGeoSurfaceConverter::cylinderComponents and Acts::TGeoSurfaceConverter::discComponents to support TGeoCtub](#)

Question: Why is the condition " $\text{halfZ} > \text{deltaR}$ " used before checking if the shape is tube segment when defining [cylinder bounds](#) but not disc bounds?



2. Extend Acts::DD4hepLayerBuilder::endcapLayers and Acts::DD4hepLayerBuilder::centralLayers to support TGeoCtub

- How is a simple TGeoTube supported?

```
root [15] TGeoMedium *vacuum = new TGeoMedium("vacuum", 1, new TGeoMaterial("vacuum"));
root [16] TGeoVolume *vol_tub = gGeoManager->MakeTube("TUB_VOL", vacuum, 2, 4,10);
root [17] TGeoTube* tub = dynamic_cast<TGeoTube*>(vol_tub->GetShape())
(TGeoTube *) 0x278c330
root [18] TGeoTubeSeg* tubs = dynamic_cast<TGeoTubeSeg*>(vol_tub->GetShape())
(TGeoTubeSeg *) nullptr
```

- Where is the information from phi range?
- Are there any DD4Hep unit tests that need to be updated?

```
TGeoShape* geoShape =
    detElement.placement().ptr()->GetVolume()->GetShape();
// create the proto layer
ProtoLayer pl(gctx, layerSurfaces);

if (detExtension->hasValue("r_min", "envelope") &&
    detExtension->hasValue("r_max", "envelope") &&
    detExtension->hasValue("z_min", "envelope") &&
    detExtension->hasValue("z_max", "envelope")) {
    // set the values of the proto layer in case envelopes are handed over
    pl.envelope[Acts::binR] = {detExtension->getValue("r_min", "envelope"),
                               detExtension->getValue("r_max", "envelope")};
    pl.envelope[Acts::binZ] = {detExtension->getValue("z_min", "envelope"),
                               detExtension->getValue("z_max", "envelope")};
} else if (geoShape != nullptr) {
    TGeoTubeSeg* tube = dynamic_cast<TGeoTubeSeg*>(geoShape);
    if (tube == nullptr)
        ACTS_ERROR(
            " Cylinder layer has wrong shape - needs to be TGeoTubeSeg!");
}
```