

Progress Towards Realistic Simulation of the SiD Tracker

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A More Detailed Simulation of the Tracker Would...

❖ *Perform realistic charge-deposition on readout strips*

- ❖ Lorentz-angle effects
- ❖ Cluster merging
- ❖ Effects of noise/thresholds on single-hit resolution and efficiency
- ❖ **Effect of different strip orientations on track finding and resolution**

❖ *Have realistic detector segmentation*

- ❖ Additional constraints for track finding/fitting
- ❖ **Along with strip orientation, defines ghosting in double-sided layers**
- ❖ **Realistic modeling of occupancies**

❖ *Have overlapping, planar silicon*

- ❖ Study correction of Lorentz angle with sensor tilt
- ❖ Study efficiency loss from cracks between phi/z overlaps
- ❖ Study alignment

Some are absolutely critical to understanding forward tracking!

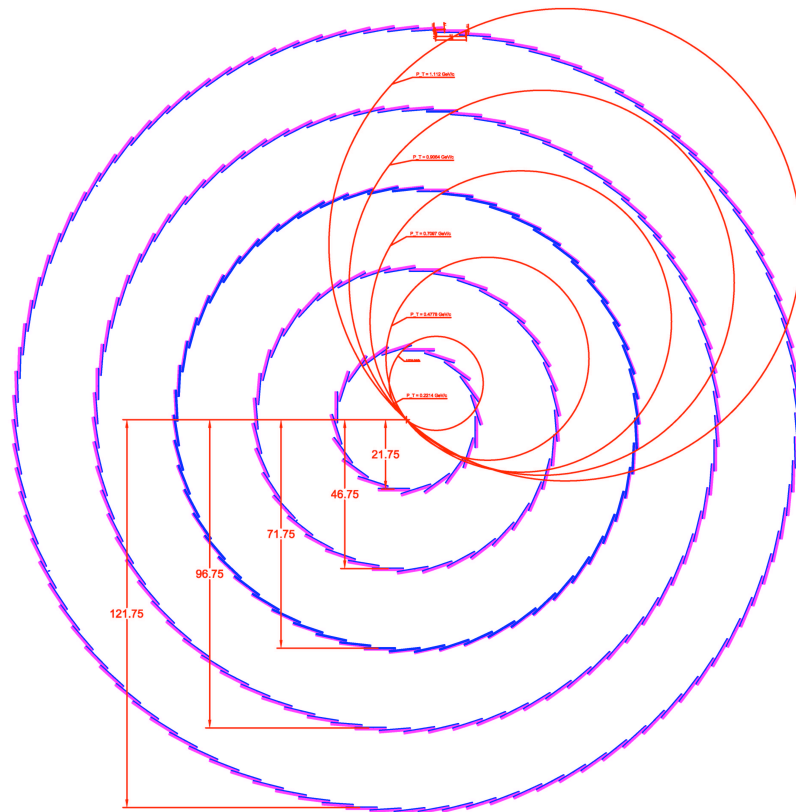
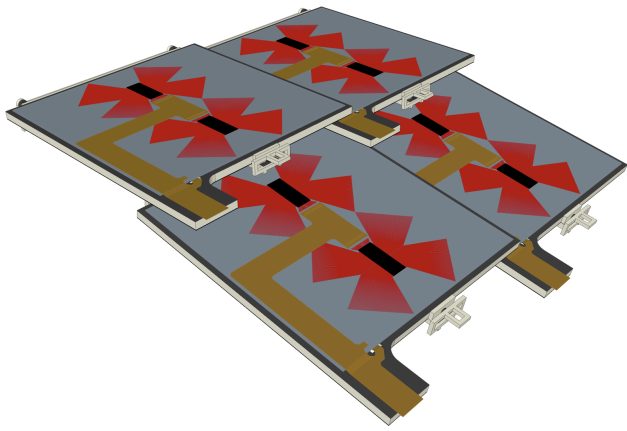


Necessary Components

- ❖ **New subdetector type: SiTrackerBarrel - (Jeremy/Tim)**
 - ❖ .xml description / simulation of planar geometries
 - ❖ Complete representation of planar geometries in reconstruction
- ❖ **Simulation of charge deposition in sensors - (Tim)**
- ❖ **Changes to tracking infrastructure in org.lcsim and freehep tools (Tony/Norman)**

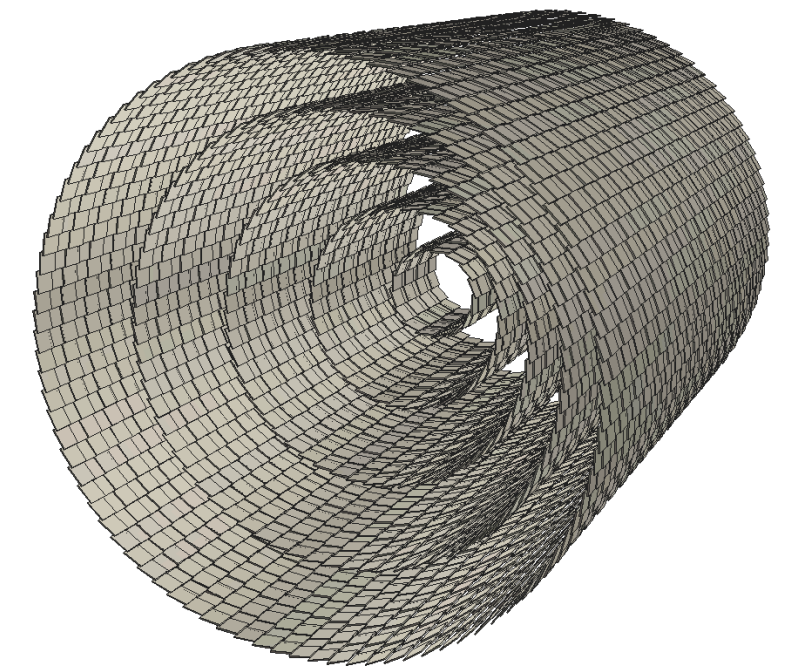
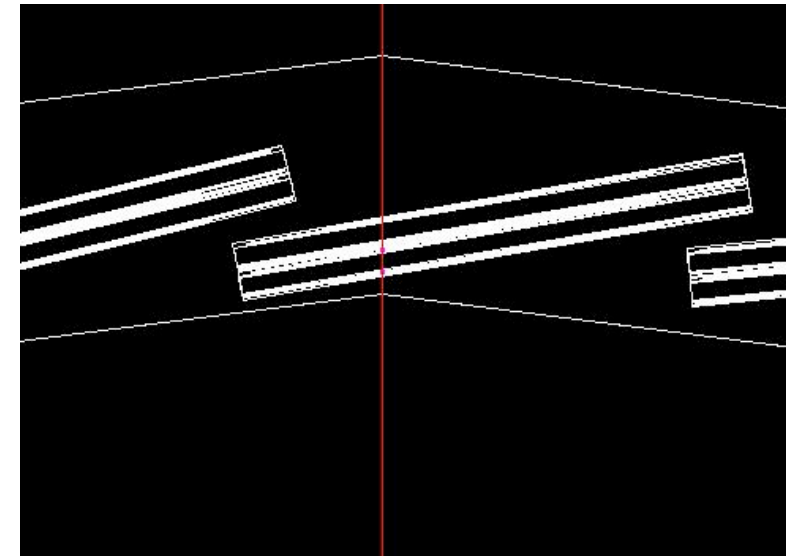


Simulation of Planar Geometries - Outer Tracker

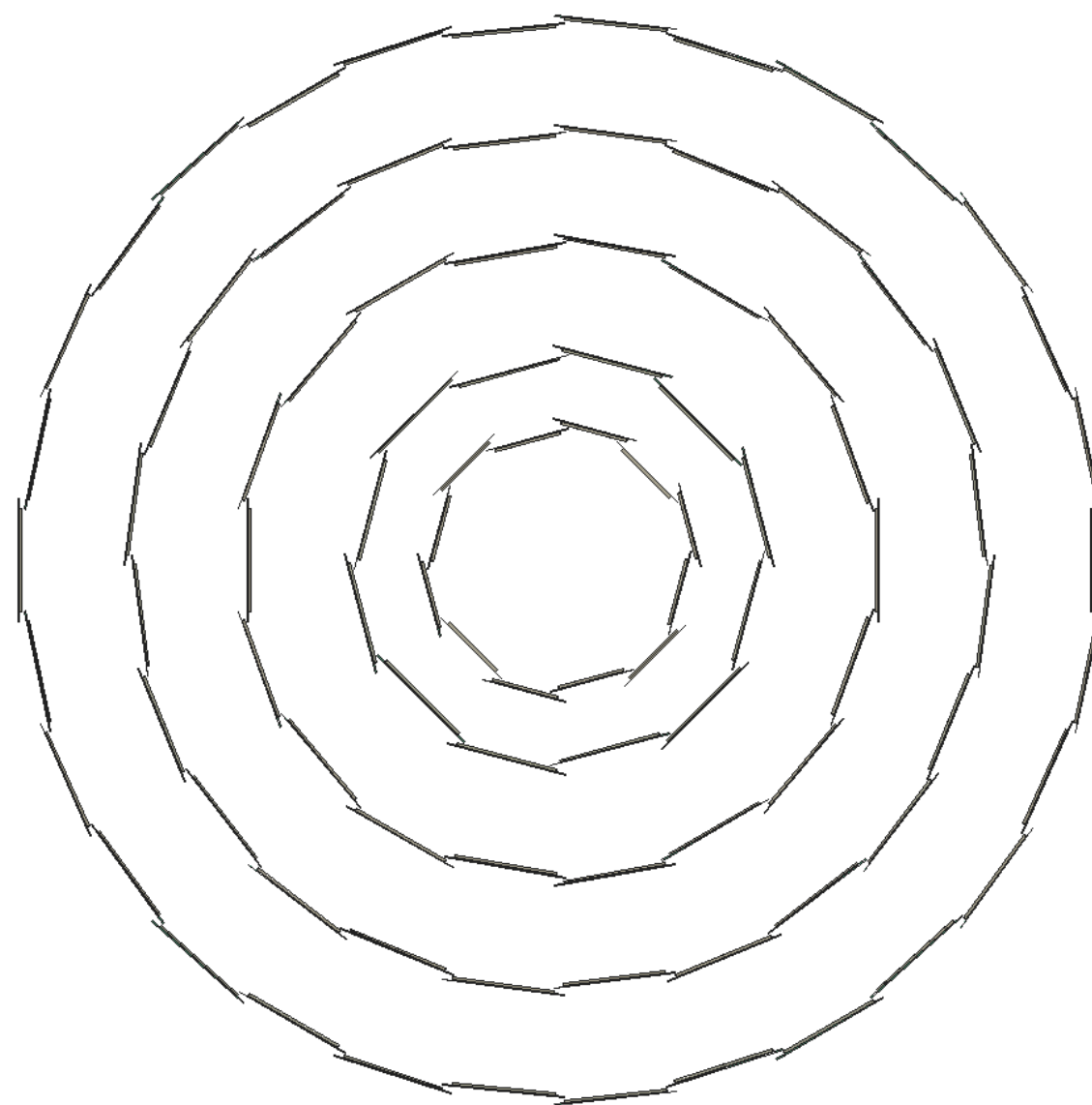
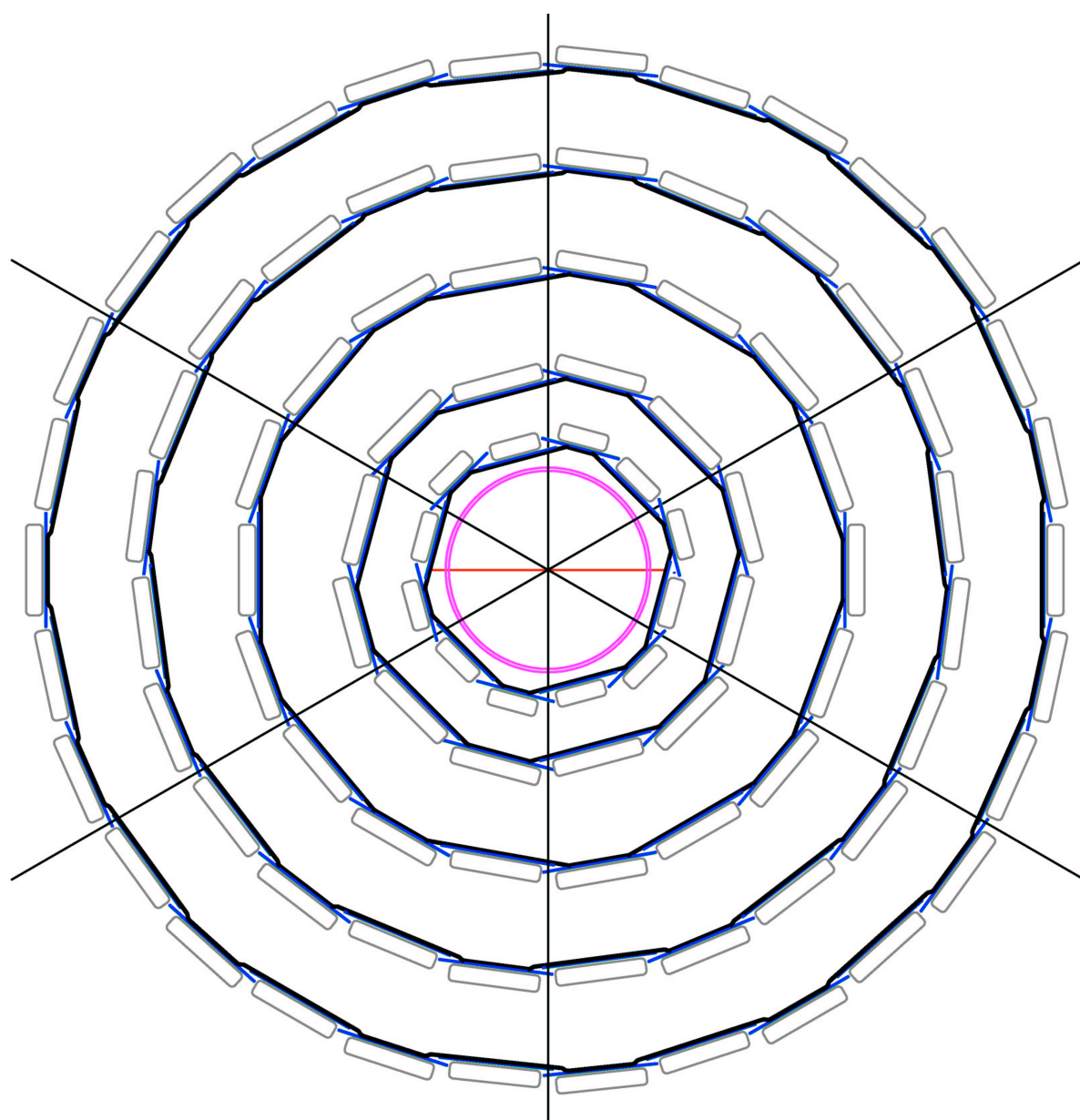


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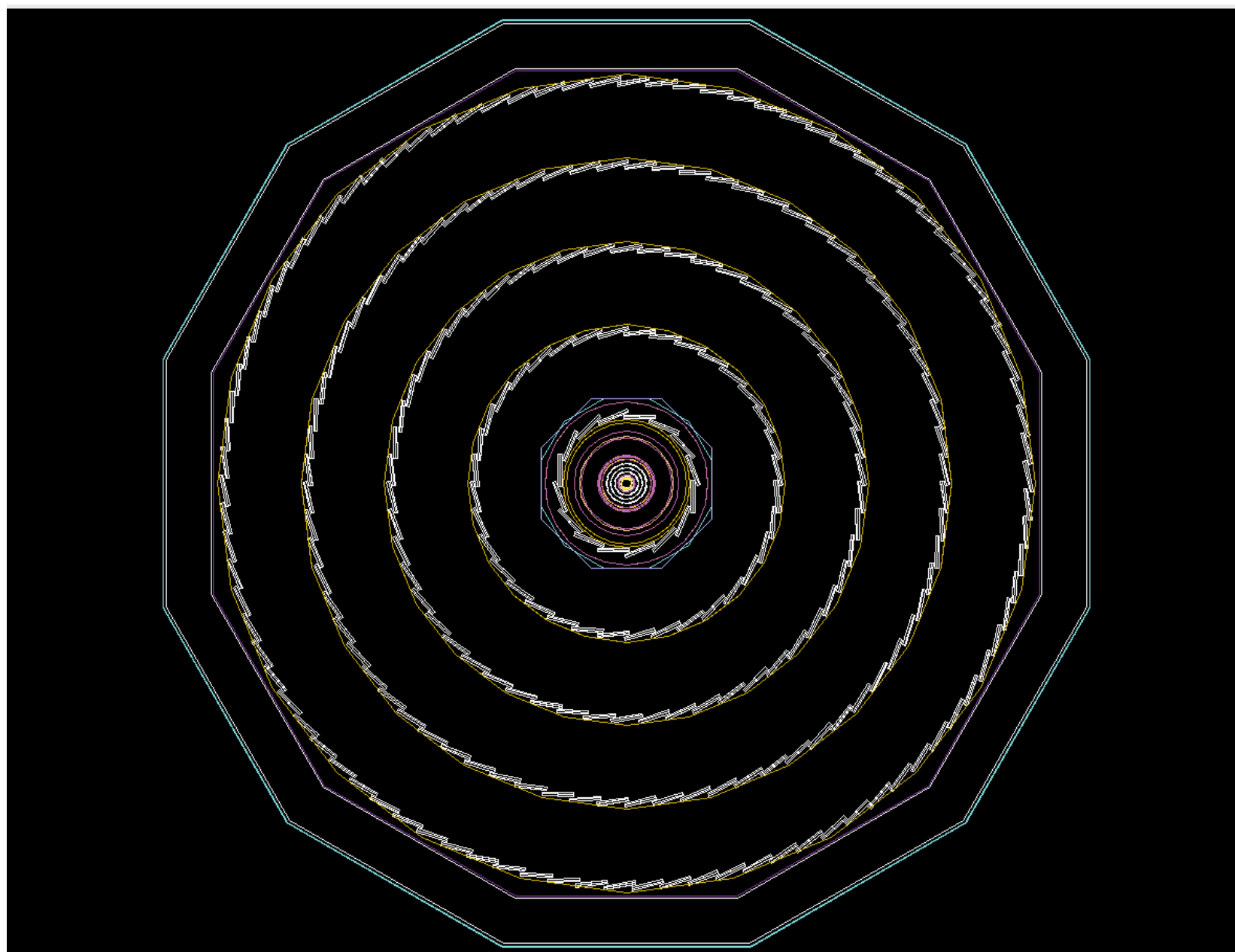
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```



Simulation of Planar Geometries - VXD



sid01_polyhedra Tracker



Reconstruction Software

- ❖ **org.lcsim.geometry.subdetector.SiTrackerBarrel**
 - ❖ reads in .xml and builds an internal representation of the entire nested geometry (barrel, layer, module, component)
 - ❖ creates material Layering that approximates all module material as nested cylinders within the layer envelope
 - ❖ a fair approximation that will allow application of existing tracking algorithms that use HelixSwimmer to the new geometry
- ❖ **SiStripSim - complete/tested outside org.lcsim, core now in CVS**
- ❖ **Still in progress...**
 - ❖ code connecting sensor geometry to SiStripSim.SiStripSensor objects
 - ❖ code for accessing geometry information during reconstruction



Changes to org.lcsim / freehep

- ❖ Addition of `hep.physics.matrix` and new methods to `hep.physics.vec.VecOp` for handling matrixes in freehep
 - ❖ needed for sensor \leftrightarrow global coordinate transformations
 - ❖ attempting more general architecture for nested geometries
- ❖ Addition of `RawTrackerHit` to `org.lcsim`
 - ❖ `org.lcsim` variant of LCIO `TrackerRawData`
 - ❖ includes everything needed to represent readout of an individual silicon strip (or pixel)



Conclusions

- ❖ Progressing towards realistic simulation of tracker in org.lcsim
- ❖ Expect to produce clustered TrackerHits within next few weeks
- ❖ Existing tracking algorithms usable with little or no modification
- ❖ Looking into more advanced track swimmers and material intersection algorithms that will allow us to get as realistic as speed/complexity allows
- ❖ When complete and working in outer tracker barrel...
 - ❖ SiTrackerEndcap
 - ❖ SiStripSim.SiPixelSensor

