Problem: How can a detector design in a CAD program be transferred into a Geant4 simulation?

Solution: Automated conversion of the CAD design into GDML for importation into Geant4

Iterative Design Process

The LUX-ZEPLIN Dark Matter Experiment is building a detector that will hold 7 tonnes of liquid xenon to be installed at the Sanford Underground Research Facility in the former Homestake gold mine in Lead, South Dakota. The detector is being designed with the SOLIDWORKS computer-aided design program, developed by Dassault Systèmes SOLIDWORKS Corporation in Waltham, MA.

The figures below show an overview of the design of the LZ detector.

Automated conversion from SOLIDWORKS to Geant4

SOLIDWORKS CAD

Simplified LZ model

Simplified LZ inner tank

Geant4

Proof-of-concept Geant4 model of spiral-cut tube created manually. Next step is to enhance SW2GDML to read needed parameters from SOLIDWORKS and generate corresponding GDML for spiral-cut tubes.

Other development plans include adding support for:
- Additional shapes
- More complex combinations of coordinate systems
- More complex patterns of repeated parts

Current Capabilities of SW2GDML

- Converts simple SOLIDWORKS designs
- Supports the following shapes and features:
  - Board
  - Cone
  - Cylinder, full and partial
  - Disk, full and partial
  - Half-ellipsoid with circular face
  - Torus
  - Cylindrical holes in parts
  - Multiple coordinate systems in simple configurations
  - Repeated parts in linear patterns
  - Geant4 parts retain material properties given in SOLIDWORKS

Further Development Plans

Seeking partners interested in using SW2GDML and providing feedback for ongoing development

Working with American Science and Engineering, Inc., Billerica, MA on conversion of an x-ray collimator design

Proof-of-concept SOLIDWORKS model courtesy of Dan Cristian Dinca, American Science and Engineering, Inc.