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## mesh2gdml: Importing CAD and meshed geometries into Geant4

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Geant4 is the de facto HEP standard for simulating the interaction of particles with materials and fields. The software toolkit provides a very rich library of basic geometrical shapes, often referred to as “primitives”, plus the ability to define compound geometries, making it capable of supporting extremely complex physical structures. The ability to directly import CAD geometries into Geant4 is an often requested feature, despite the recognized limitations of the difficulty in accessing proprietary formats, the mismatch between level of detail in producing a part and simulating it, the often disparate approaches to parent-child relationships and the difficulty in maintaining or assigning material definitions to parts. The main impediment to the importation of CAD files into Geant4 has been their proprietary formats. Thanks to the proliferation of rapid prototyping and additive manufacturing processes, the surface tessellation language (STL) format is the industrial standard for handling triangulated meshes and is ubiquitous as an export format for both CAD and other 3D modelling software. Geant4 fully and natively supports an xml-based Geometry Description Markup Language (GDML) which supports tessellated volumes to define geometries. By targeting meshed geometries instead of specific CAD formats, this approach also provides a useful solution in cases where the objects are intrinsically irregular, such as biological phantoms. The STL format consists of a plain list of three-dimensional corner point coordinates (vertex) and flat triangles (facet) with an associated normal vector, making it an ideal candidate for importation of volumes into Geant4 as G4TessellatedSolids. Since there is no other structure in an STL file, one has to also solve the problem of creating “topology from a bucket of facets”, which we have done. The one area requiring manual intervention is the assignment of material to the newly created solid or solids. We discuss a few pathways forward to solve this issue, including the use of a graphical user interface. Despite the inherent performance issues related to navigating through geometries composed of many individual facets and the requirement that material be assigned manually to volumes during the translation process, we believe the approach outlined in this talk provides access to a wider range of geometry inputs and will prove to be useful to a number of user communities from disparate fields. In this talk, we present the current status of mesh2gdml, a solution which can be used to convert an STL file into a collection of G4TessellatedSolids which can be imported directly into Geant4 via GDML.

### Consider for promotion

Yes

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