Interaction Chamber in GEANT4

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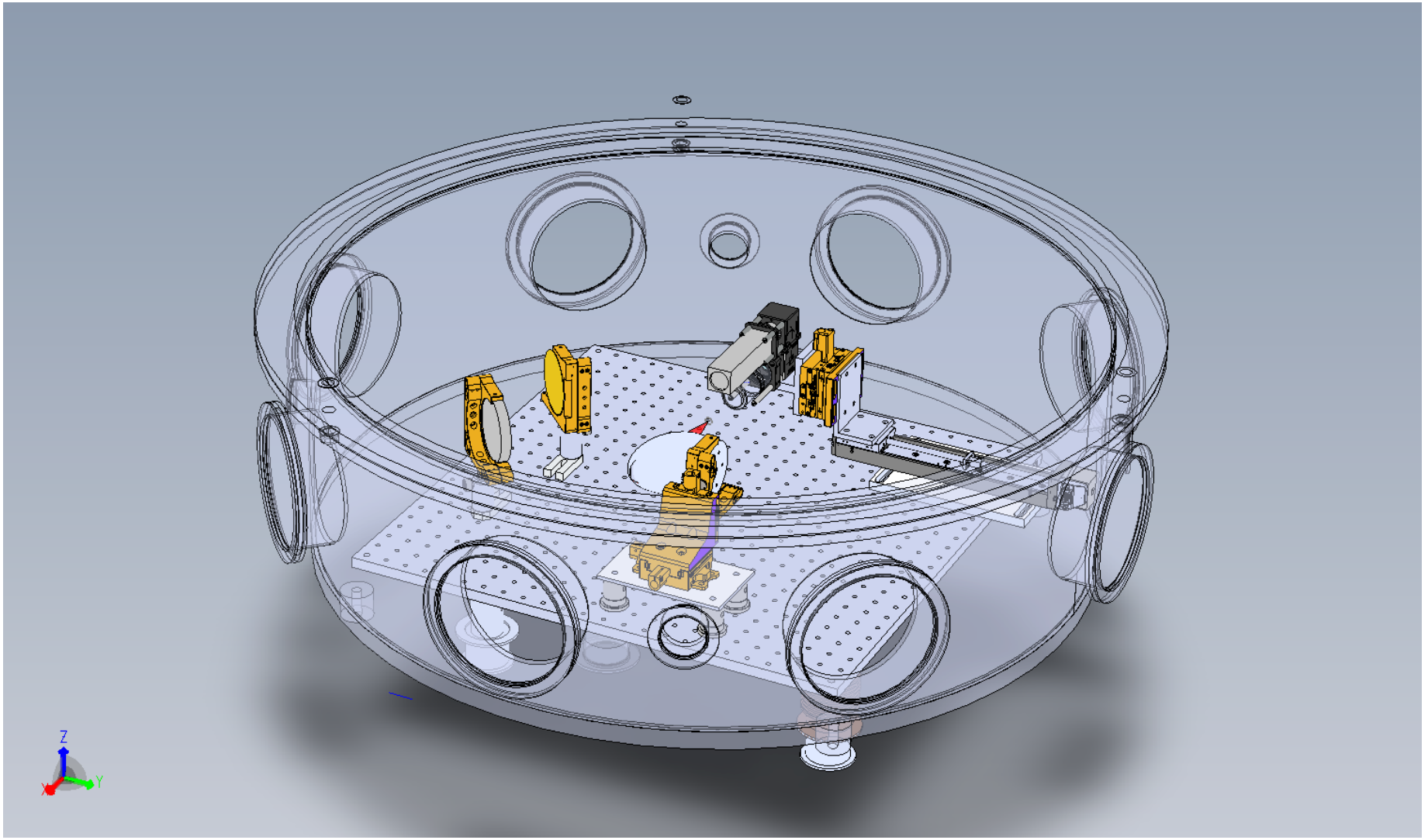
Outline

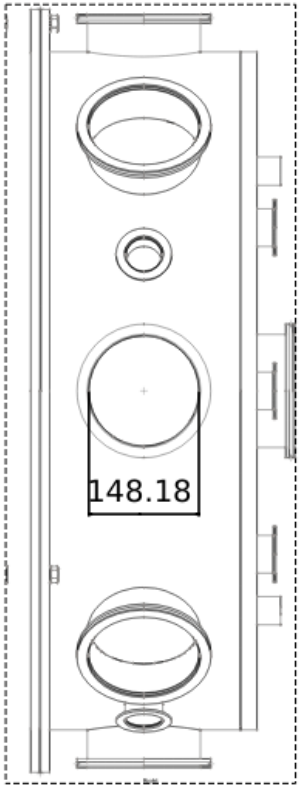
- 3D CAD model of interaction chamber
- Importing interaction chamber 3D CAD model to GEANT4 geometry

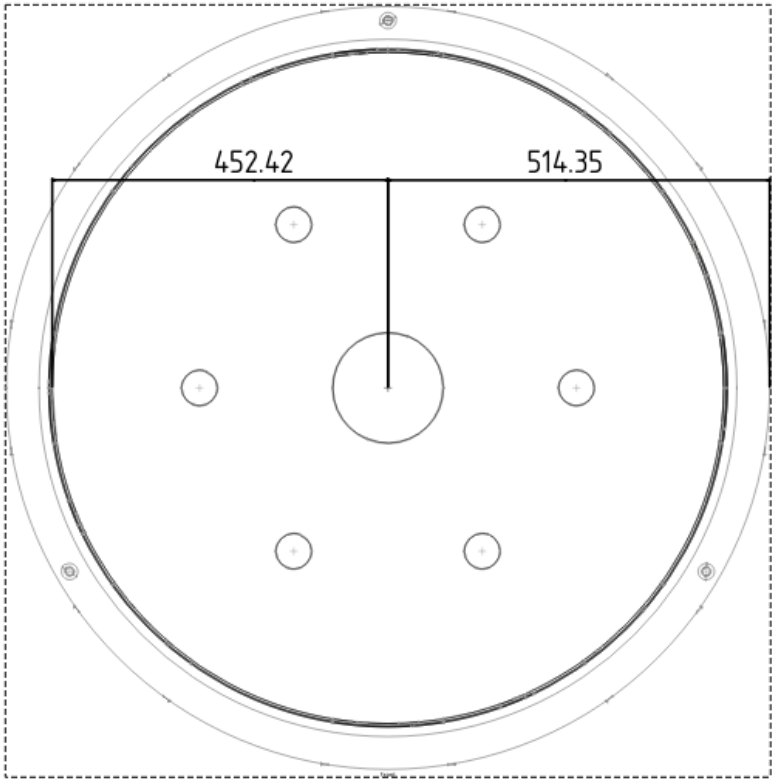
Interaction Chamber

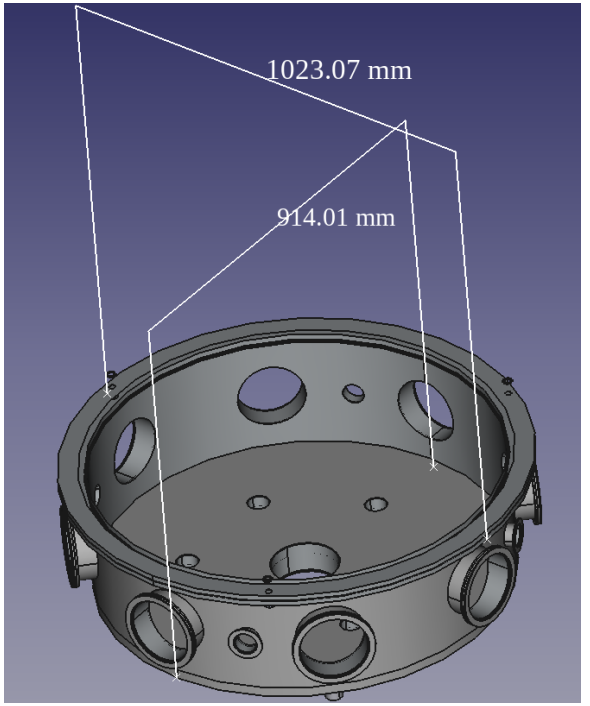
- Exported from SOLIDWORS 3D CAD;
- Assembly contains more than 50 components.



View of exported STEP file in FreeCAD







Geant4 model imported from GDML

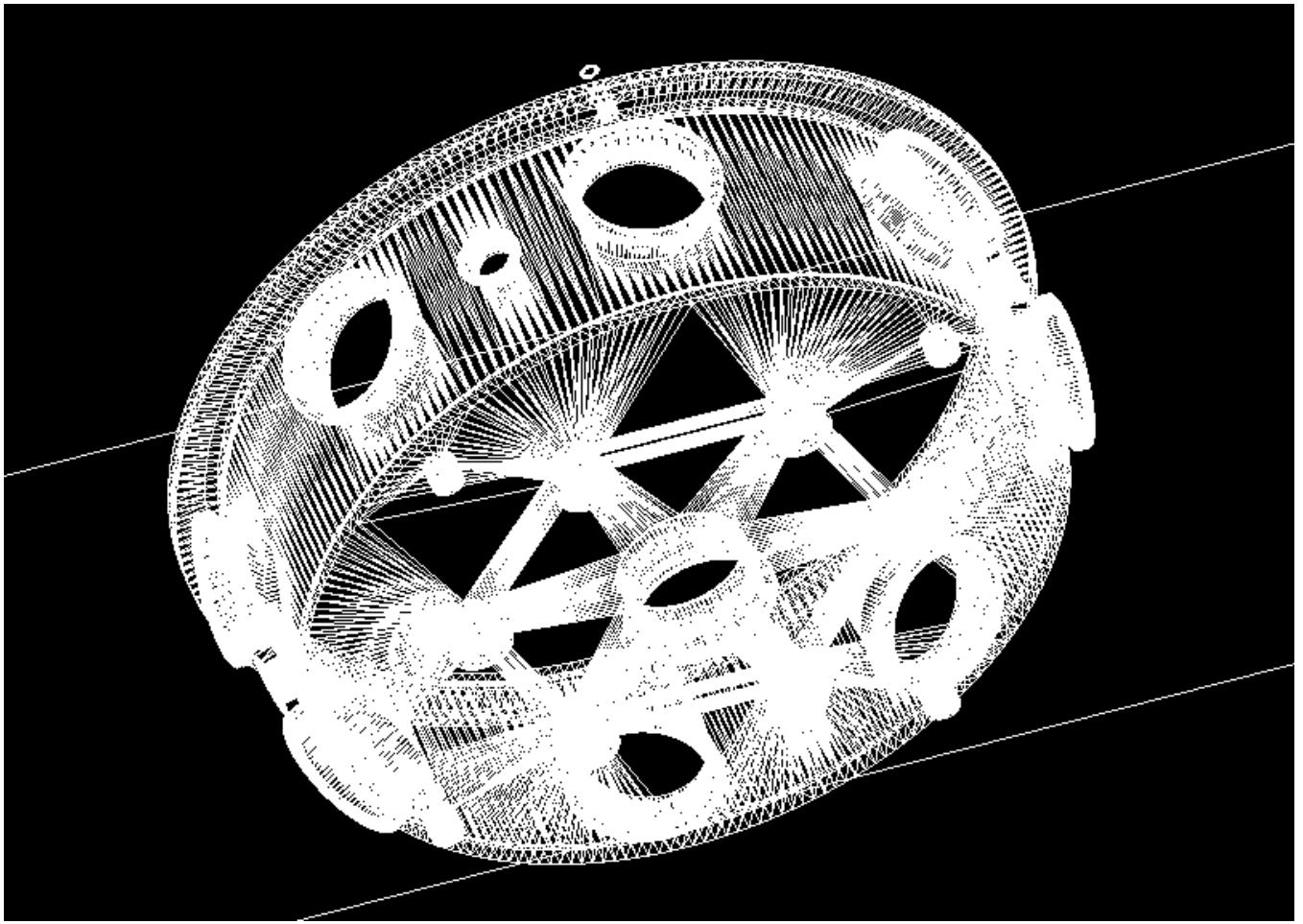
Geant4 documentation suggests a chain:
3D CAD -> STL -> GDML;

The first step is simple, almost all 3D CAD can export a model to STL (for 3D printing);

STL file format encodes the surface geometry of a 3D object approximated with triangles;

There are some tools to convert STL to GDML, but those which are relatively simple did not work for me...

FreeCAD could export to html and then several pipes with sed could convert it to GDML.

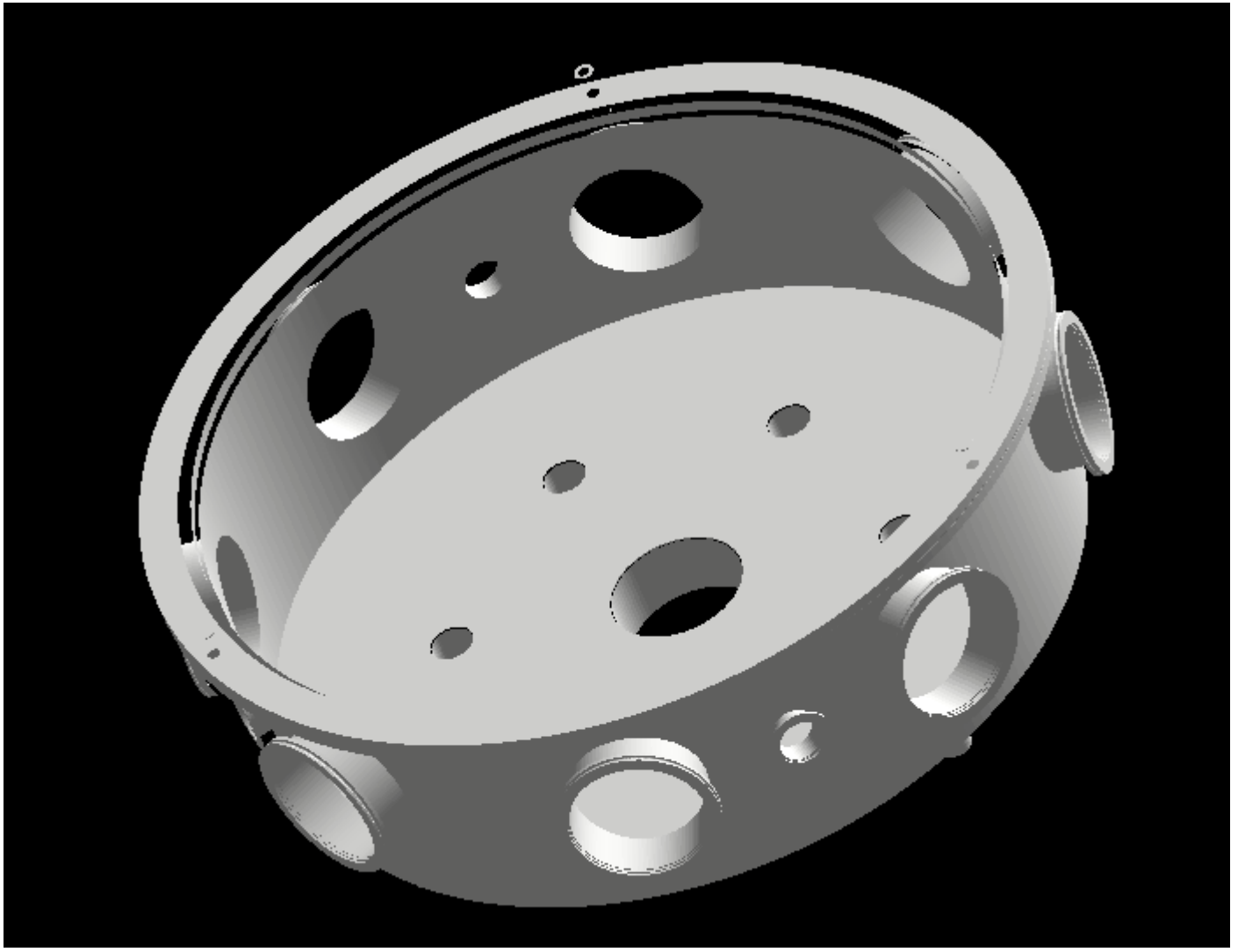


For the chamber:

- 80047 vertexes;
- 152299 tessellated triangles.

Geant4 model imported from GDML

Surface view



Conversion from BREP to CSG

BRL-CAD Tutorial Series:
Volume IV – Converting Geometry Between BRL-CAD and Other Formats

by John R. Anderson and Eric W. Edwards

ARL-SR-121 **May 2004**

Data [STEP]). In fact, when it comes to converting from BRL-CAD, the widely accepted Stereo Lithography Tessellation Language (STL) format offers a crude path to convert BRL-CAD objects to virtually any commercial CAD system. The user is reminded, however, that such forced conversions can sometimes produce geometry of such poor quality (e.g., low-resolution or lossy output formats) or poor performance characteristics (e.g., large or computationally intensive output files) that completely rebuilding a model from scratch might be a preferable alternative.

CSG vs BREP

CSG - Constructive Solid Geometry;
GEANT4 approach.

BREP - advanced boundary representation;
3D CAD approach.

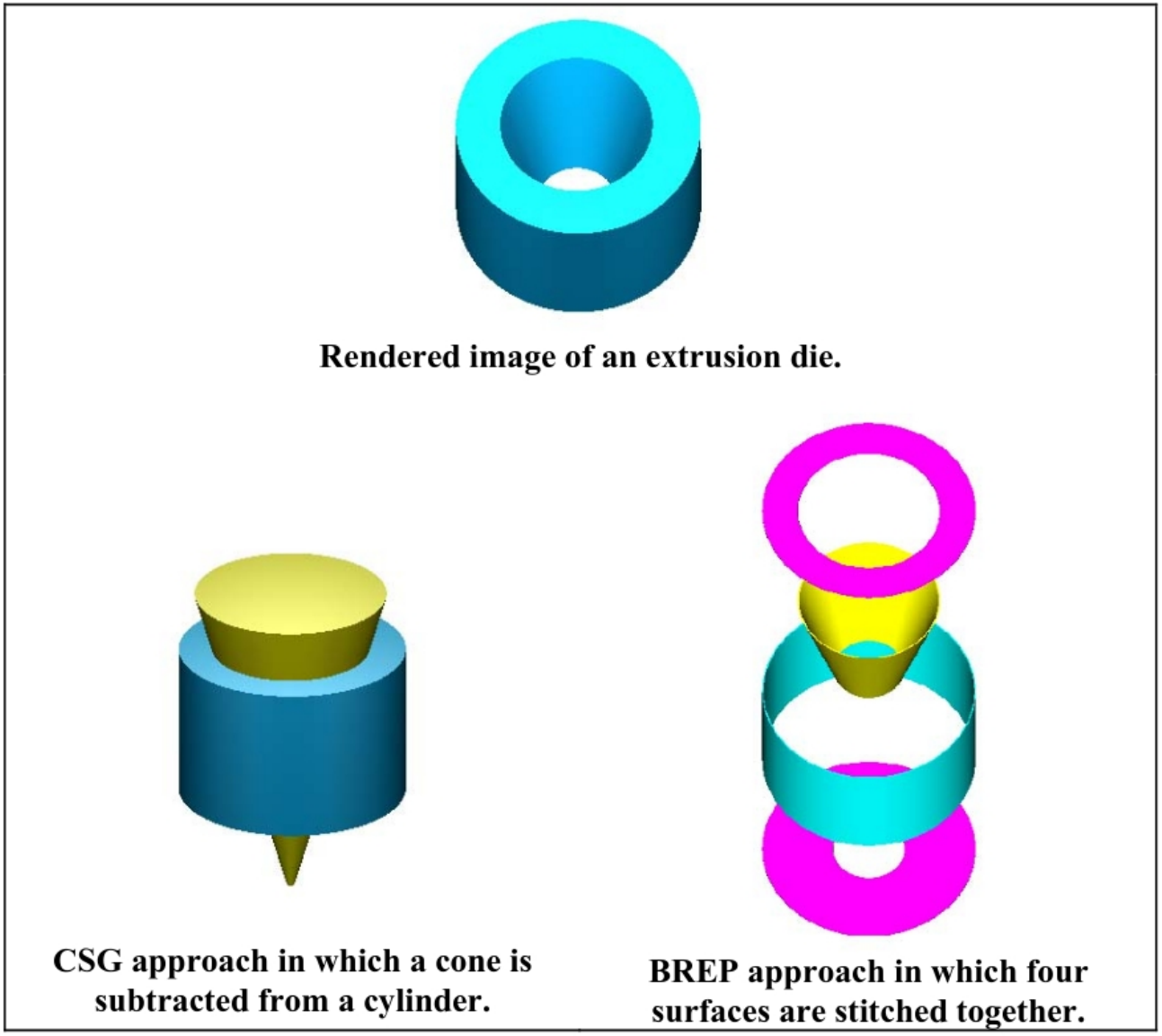
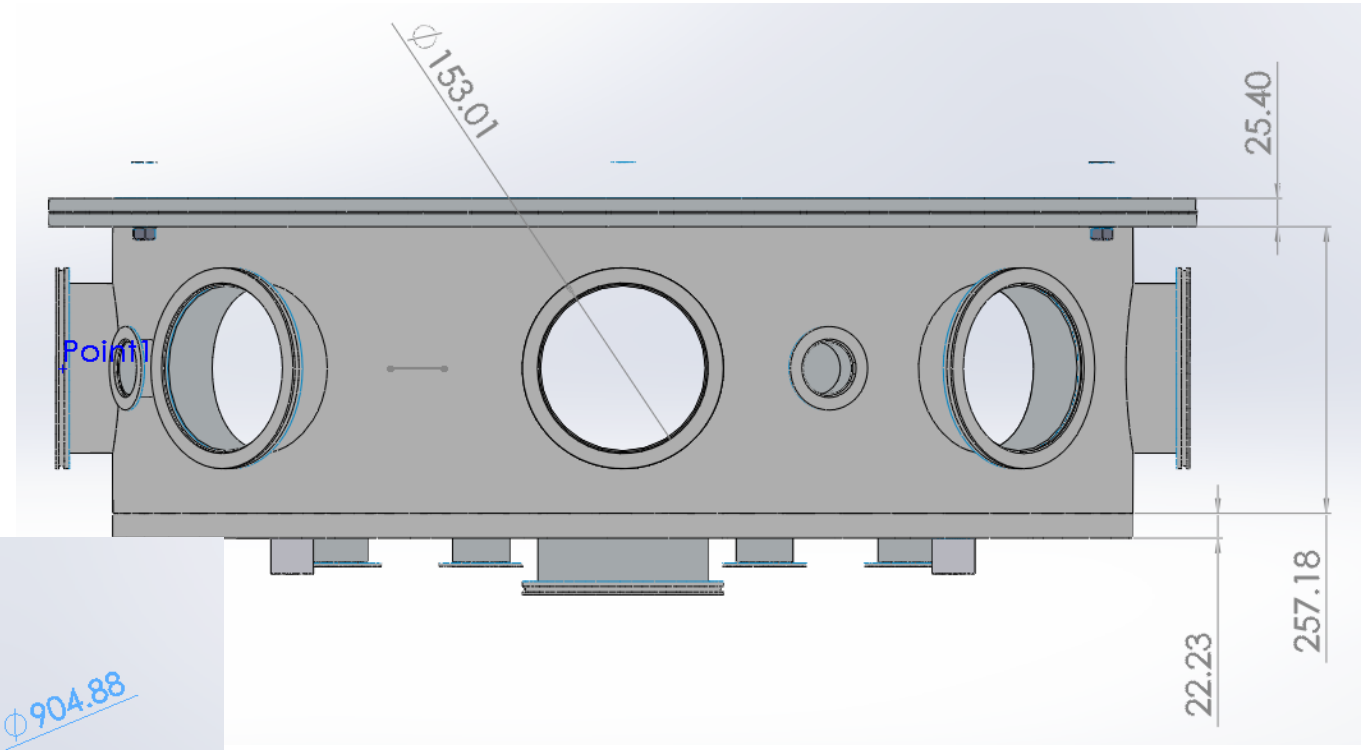
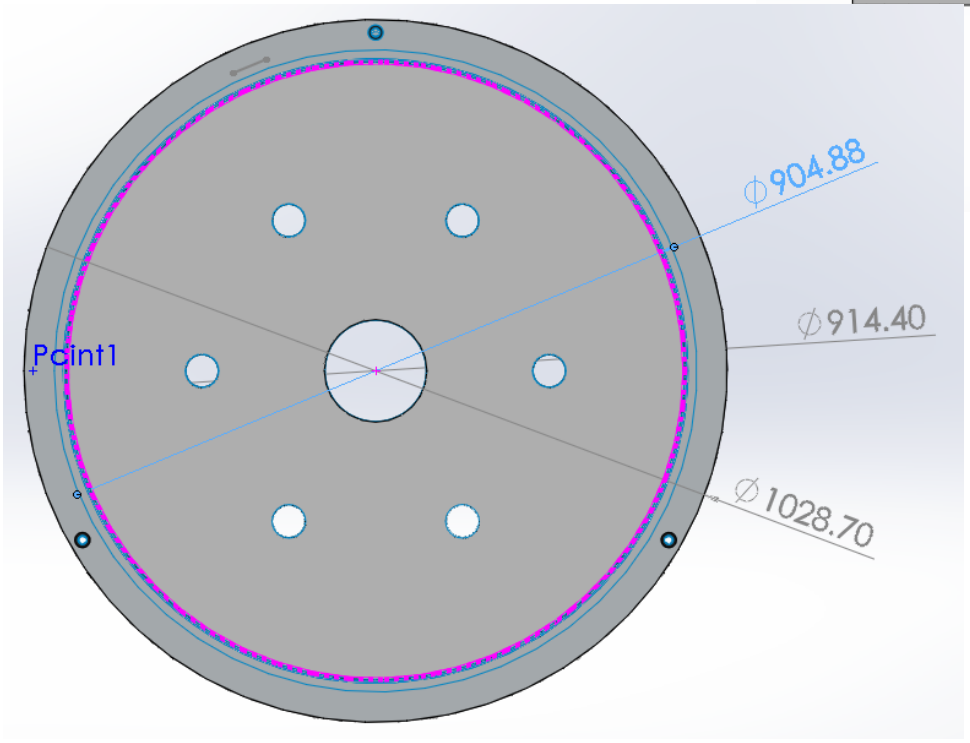


Figure 1. CSG and BREP approaches to representing an extrusion die (Tanenbaum, 2001).

Dimensions from SOLIDWORKS





Background

- Since there Pz<0, moving background particles to a fixed z position (downstream plane of the magnet) prevent their correct propagation in GEANT4.
- Or it would require there special processing.