# Mu2e experiment: Simulation of the Production Target

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Introduction

The Mu2e experiment will search for coherent, neutrinoless conversion of muons to electrons in an aluminum stopping target. Mu2e requires a high-intensity muon beam originating from 8 GeV protons striking the Production Target. The design and performance of the Production Target is evaluated in simulations using Geant4. Presented here is a text-file based interface for constructing and simulating cylindrical shapes for studying alternative designs of the Mu2e Production Target. The project is fully compatible with the official Mu2e Offline software framework.

Model of the structure to hold the production target.
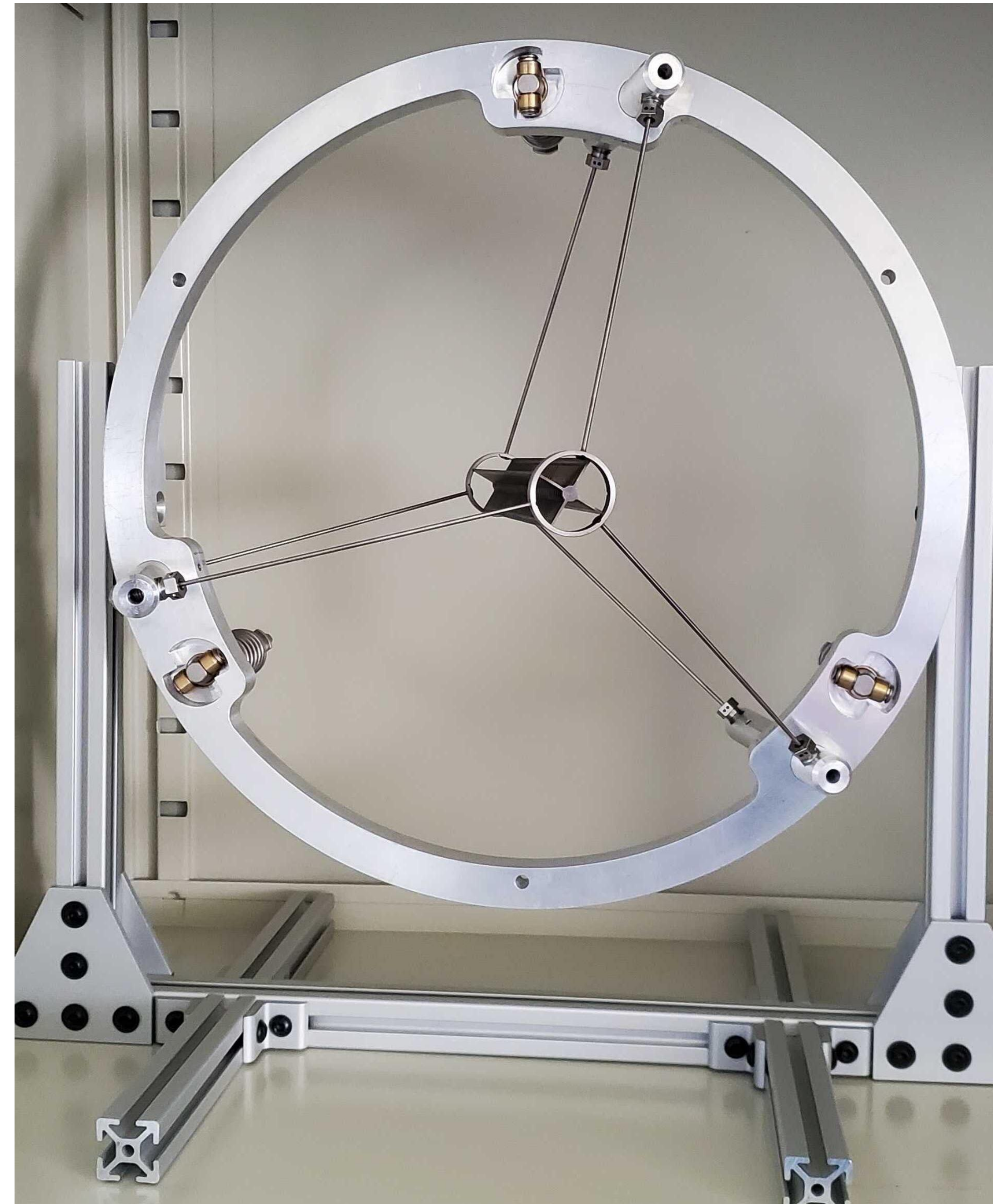
Geant4 implementation of current Mu2e Production Target Design
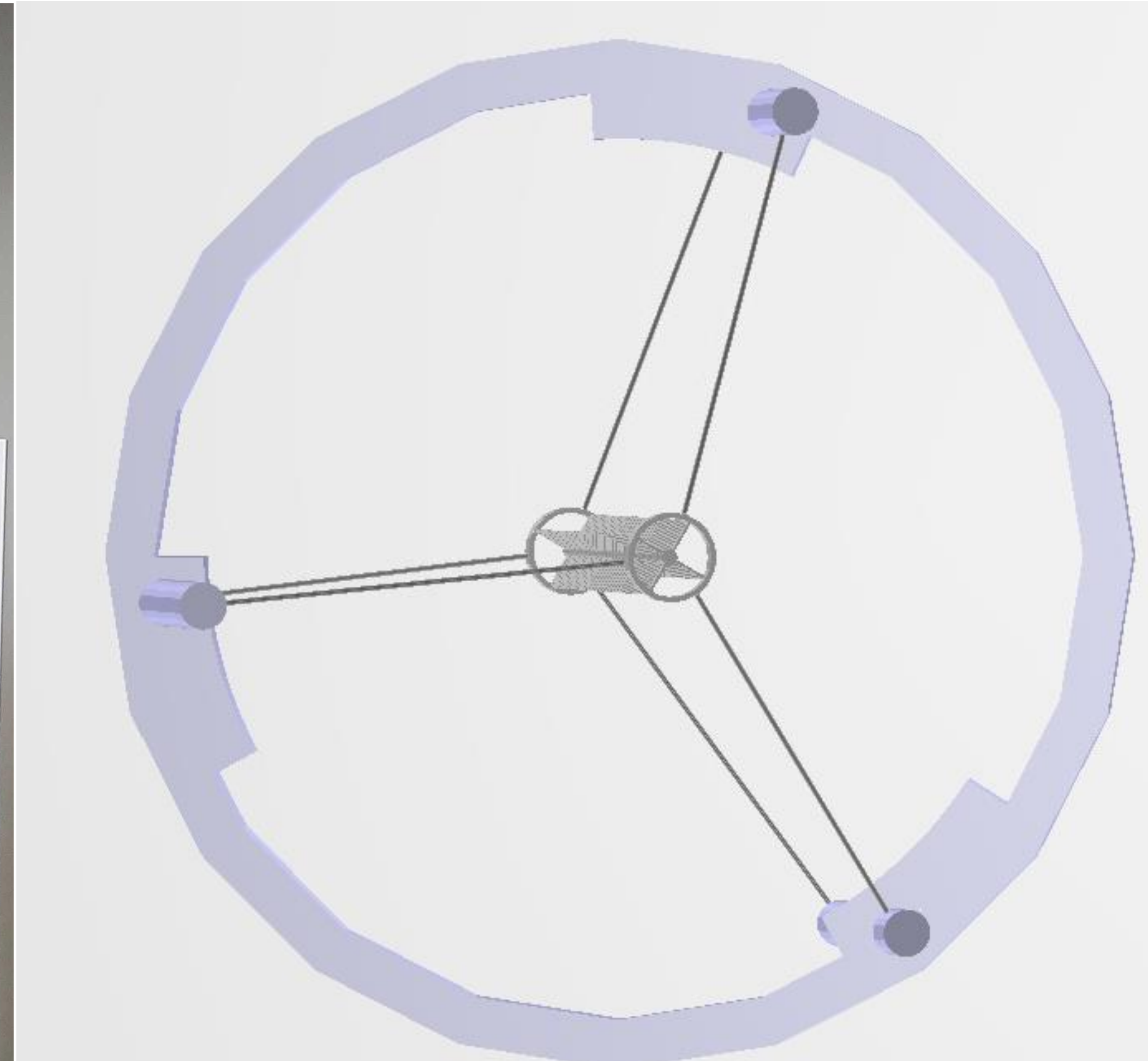
The tools to develop arbitrary cylindrical shapes were done for the module by editing a text file. The text file can take in arrays of parameters of cylinders, without having the need to recompile the simulation program or directly interact with the Geant4 interface. In addition, tube wire meshes can be constructed that are relatively accurate. The meshes can be constructed and simulated with a few parameters implemented in the geometry file. With these few parameters, an algorithm can be performed to create a set of tubes to form a tube mesh of wires.

Cad model of a potential target prototype to be implemented in Geant4
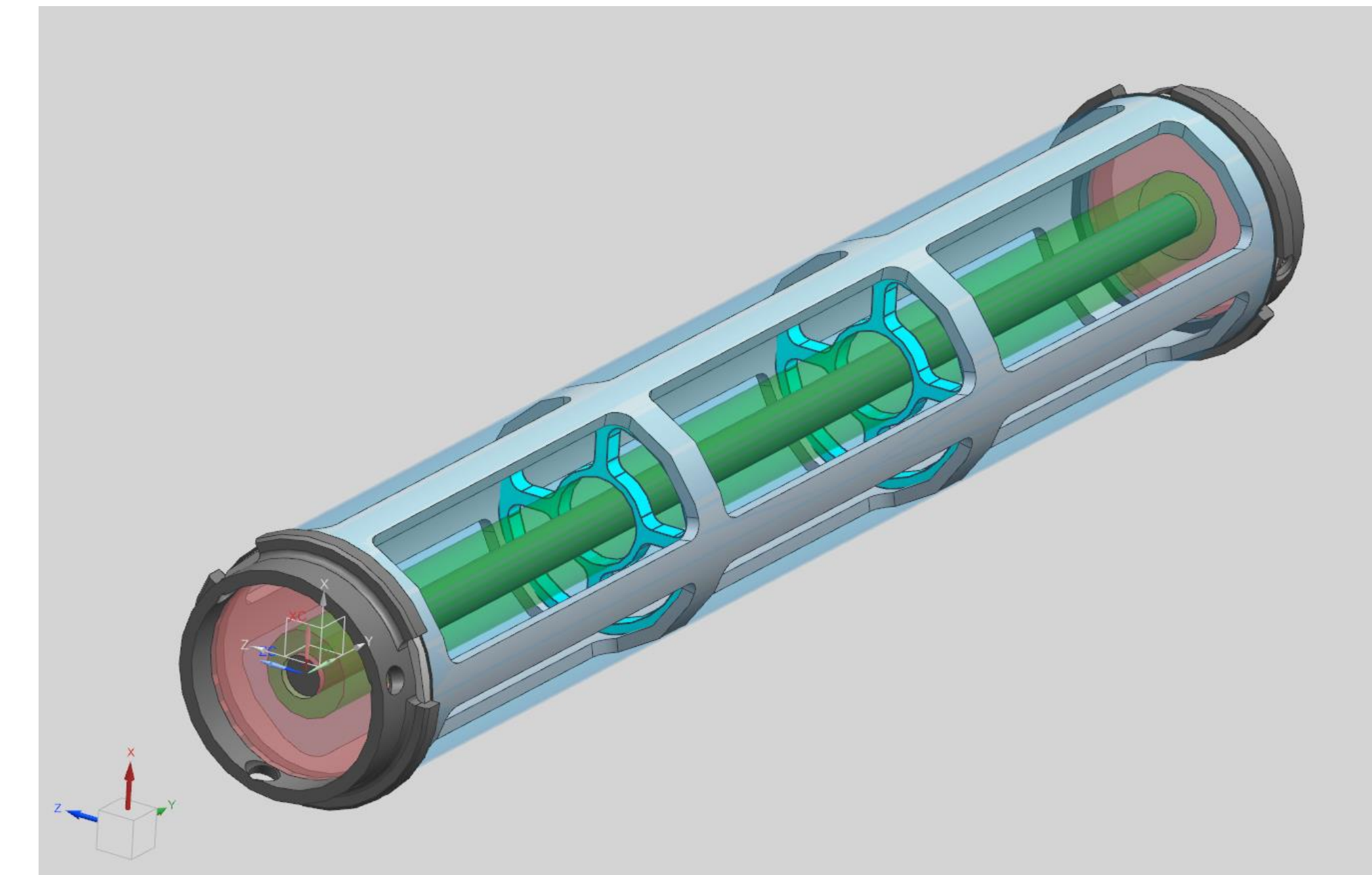
Geant4 implementation of a potential target prototype
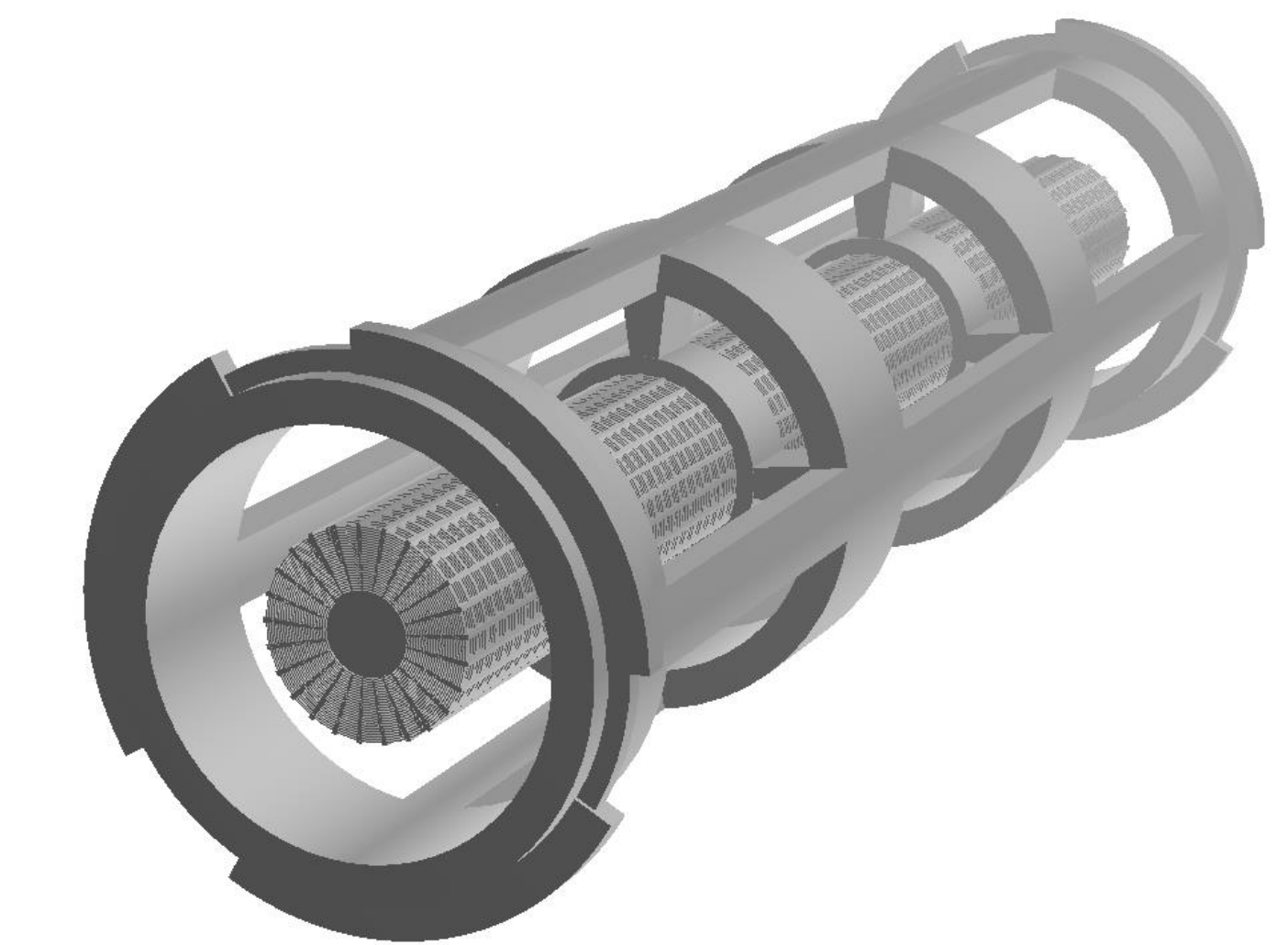
Methods and Troubleshooting

To design the target to be used in the simulation, a module called ProdTgtG4 was made with a geometry text file. The module was modified to create multiple tubes with sets of data to make a user-friendly environment. A set of parameters were taken from the geometry file and were used to create multiple solids using Geant4. Parameters were changed after running ROOT to see the constructed tube. If an exception was thrown, the program was debugged for the parameters being passed from the geometry file.

View of a dense wire mesh in the GDML tube
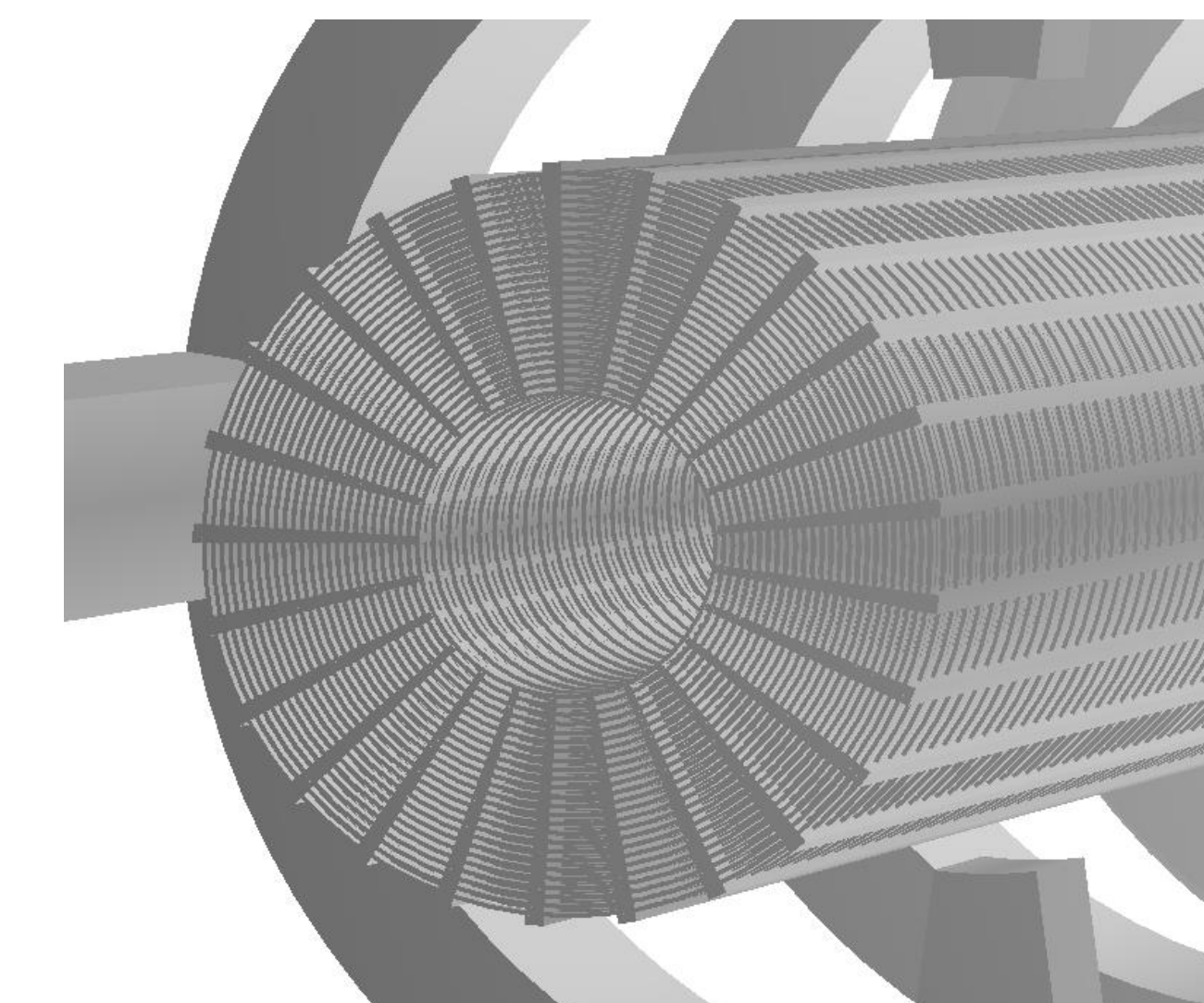
Zoomed in view of the tube without the wire mesh
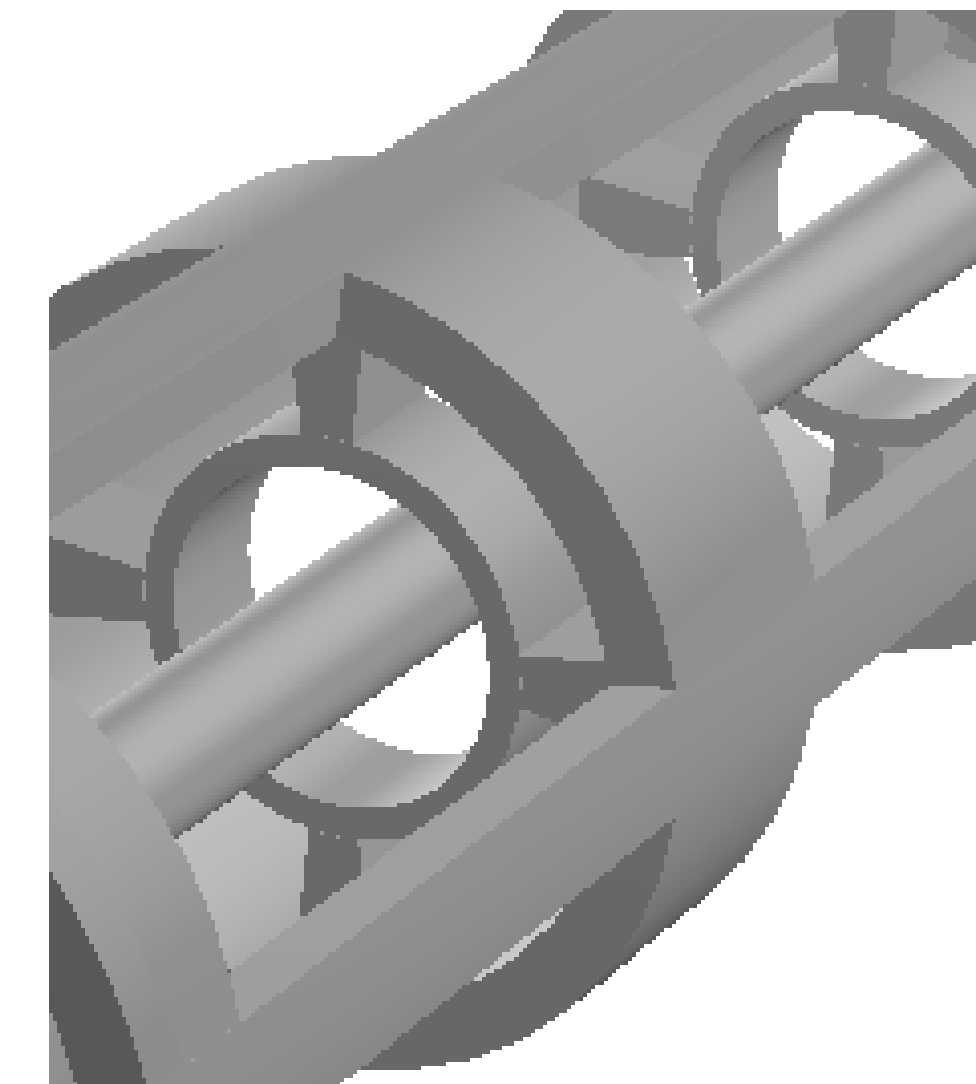
QR code to scan to view the repository involving the simulation of the production target.

Results

Using the Mu2e Offline framework, we developed a complex prototype target design using simple cylindrical models with a simple text file interface. This allows users to quickly and intuitively iterate design ideas by varying shapes and materials without detailed Geant4 or C++ expertise. In addition, we were able to create an algorithm to create a mesh of wires in the shape of a tube to fit into the Production Target.