# Simulating Multi-PMT Optical Module for SWGO

Roberta Colalillo, Vincenzo Grieco, Fausto Guarino

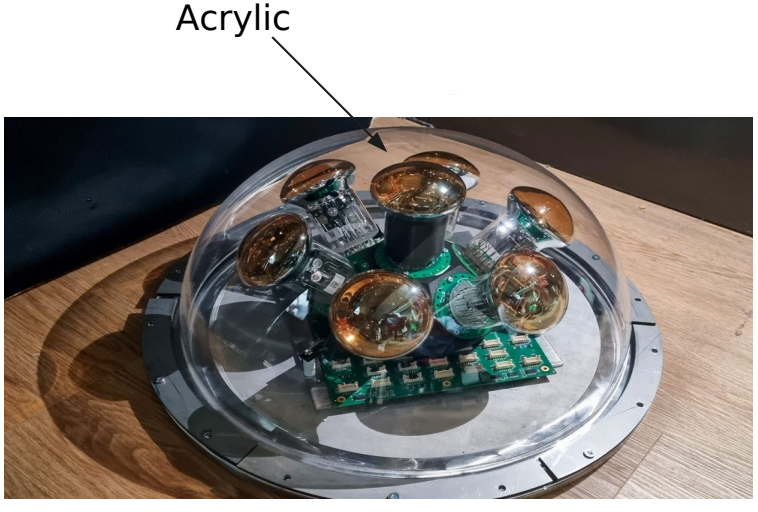
Muhammad Waqas

24/Nov/2023

SWGO IT Meeting

# Our Goal

- To Implement **Multi-PMT Module**
- To Simulate the Multi-PMT in SWGO tanks,
  - → we started with **Double Layer Cylindrical Tank** and **Mercedes Tank**

# Our Progress

- Proceeding in branch **#32-multi-pmt simulation**

- Created a new class Multi-PMT_NA
- Defined the geometry of the dome in hawcsim/MultiPMT.cc

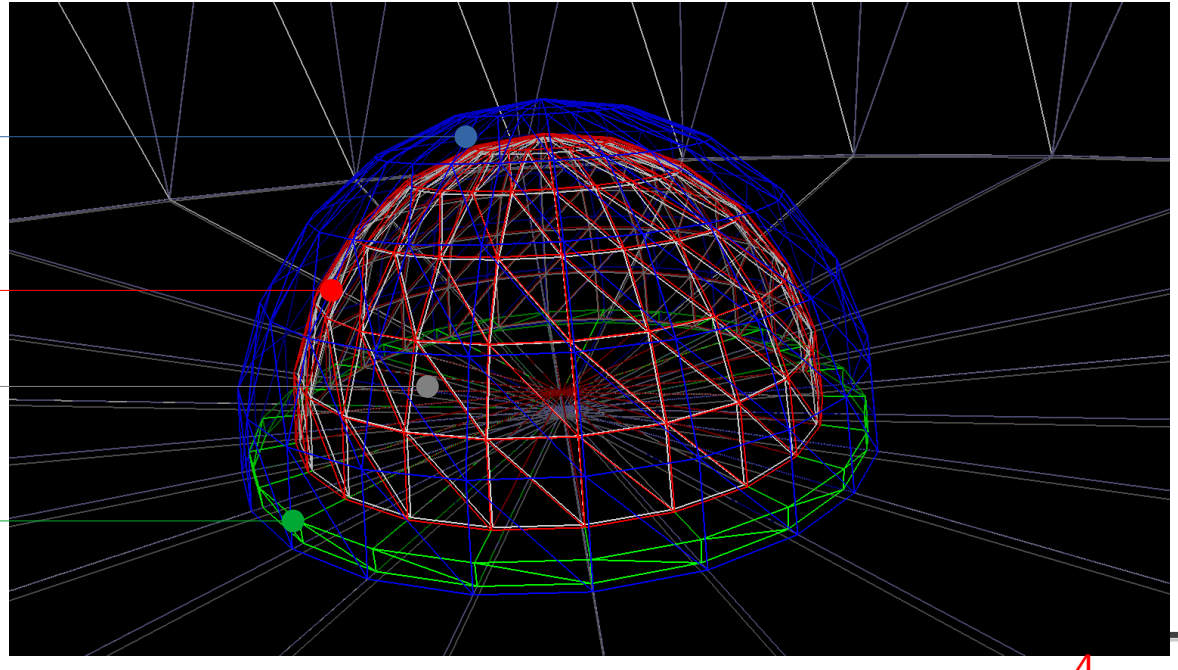
- We started creating two new types of Tank containing Multi-PMT Named as TankDLWCcMultiPMT.cc and TankMERCEDESMultiPMT.cc as Type 8 and 9 that we are using right now with the idea of having tanks with multiPMT only as photosensors
- Then we realised that we want to simulate more complex structures, for instance a DL Tank: Multi-PMT in **both upper and lower chambers** or either **Multi-PMT in upper chamber and single PMT in lower chamber**

- This requires adding functionality to the existing tank rather then defining a new one
- We are now adding functionalities to the multiPMT tanks, but hopefully this will not be needed at the end. (and all tanks will be hosting PMT and/or multiPMT according to the specifications in survey.xml (see Vincenzo's presentation)

# Dome Structure

This structure Consist of:

- Sphere of Water as mother Volume
- Acrylic Sphere with Air inside
- Base Plate of Steel material



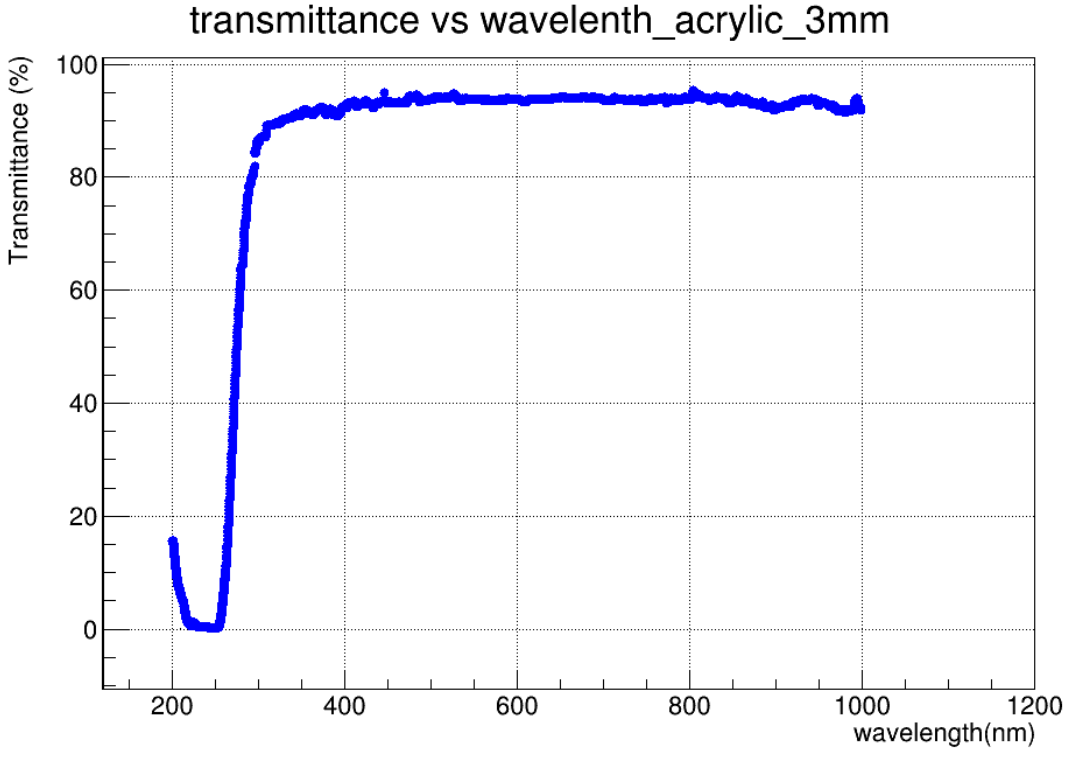
# Optical Properties of Acrylic

G4_PLEXIGLASS material from the Nist library in Geant4 has been used to simulate the Acrylic dome

The same has been used in HyperKamiokande

Measurements of the Transmittance of the dome have been made in the Department

Based on further optical analysis we will add optical properties table for Acrylic dome

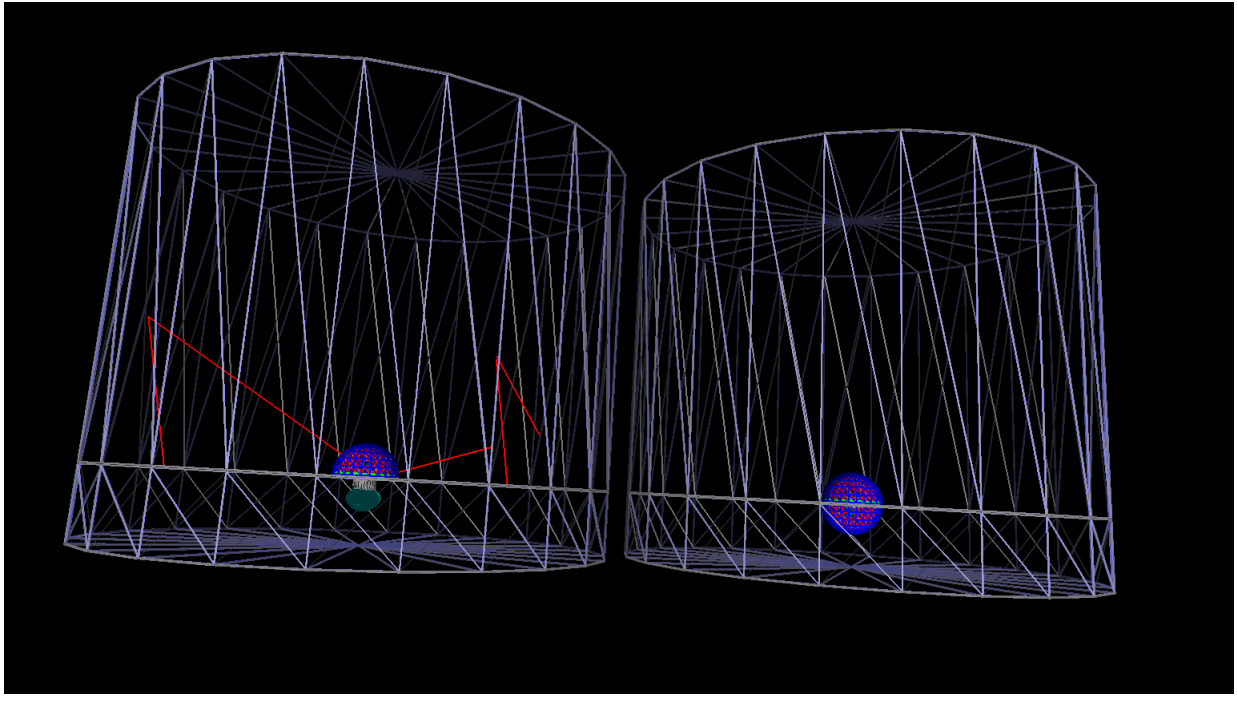


# Multi-PMT inside Double Layer Tank

Pictures for double layer tank simulating Multi-PMT in both configuration.
Tank Type-8
named as TankDLWCcMultiPMT

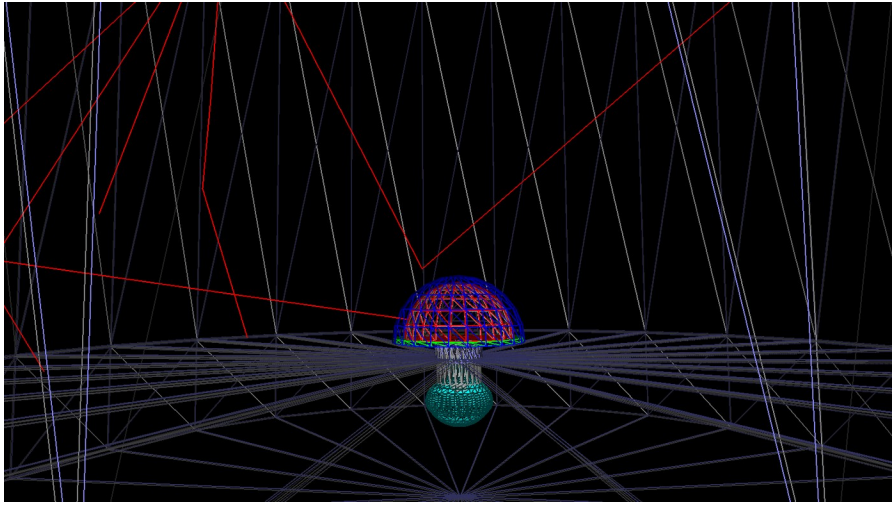
**LEFT**: Multi-PMT on Upper and Single PMT in Lower chamber

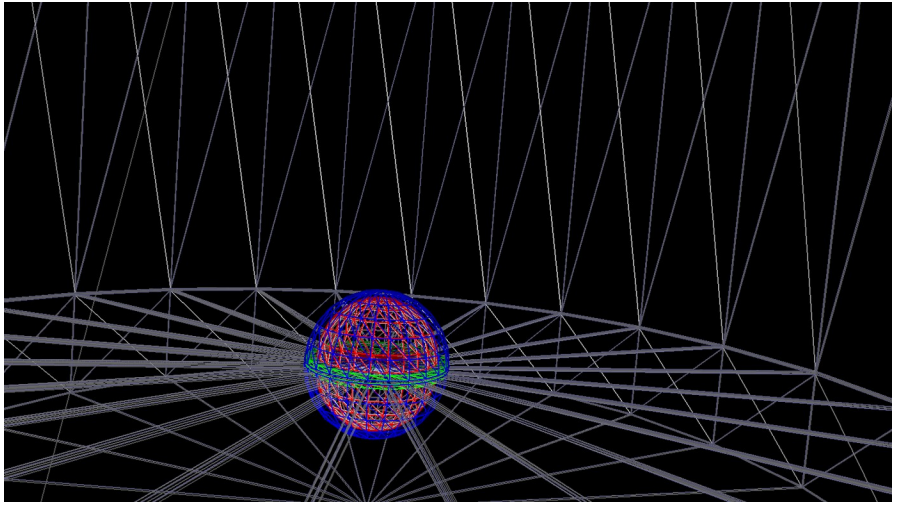
**RIGHT** : Multi-PMT on both Upper and Lower chamber



# Double Layer tank configuration

Closer look for configurations in double layer tank



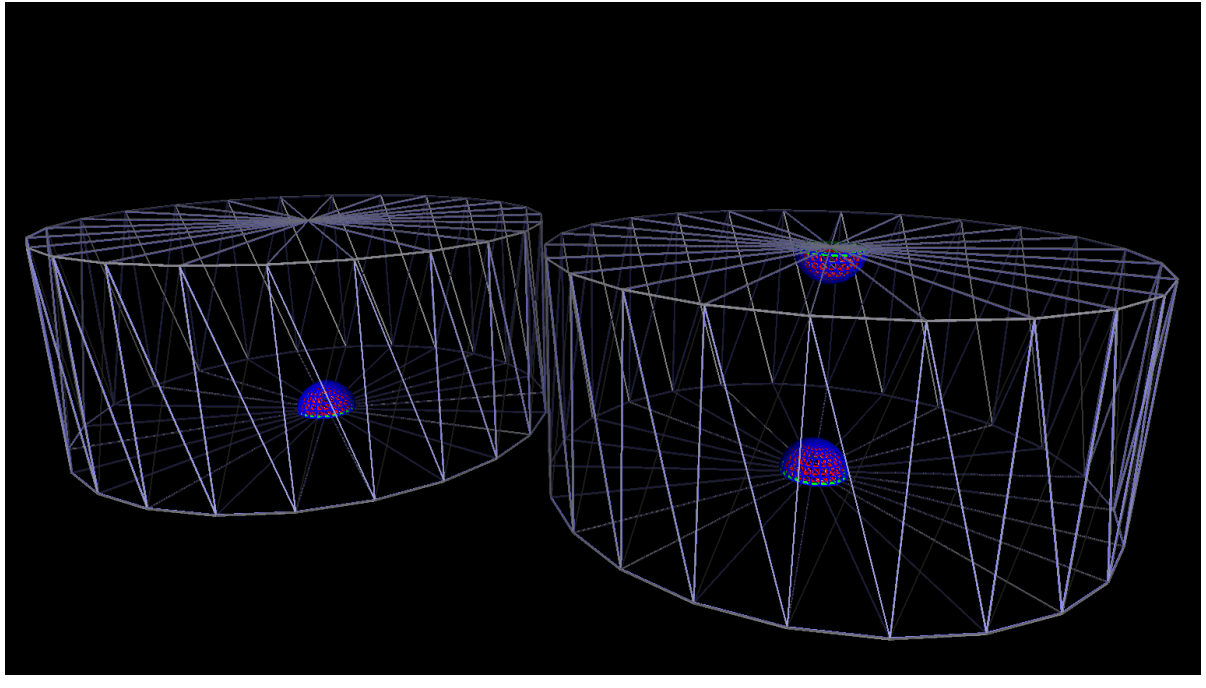


# Multi-PMT inside Mercedes Tank

Two possible configurations for the MERCEDES TANK using the MultiPMT:
Tank Type-9
named as
TankMERCEDESMultiPMT

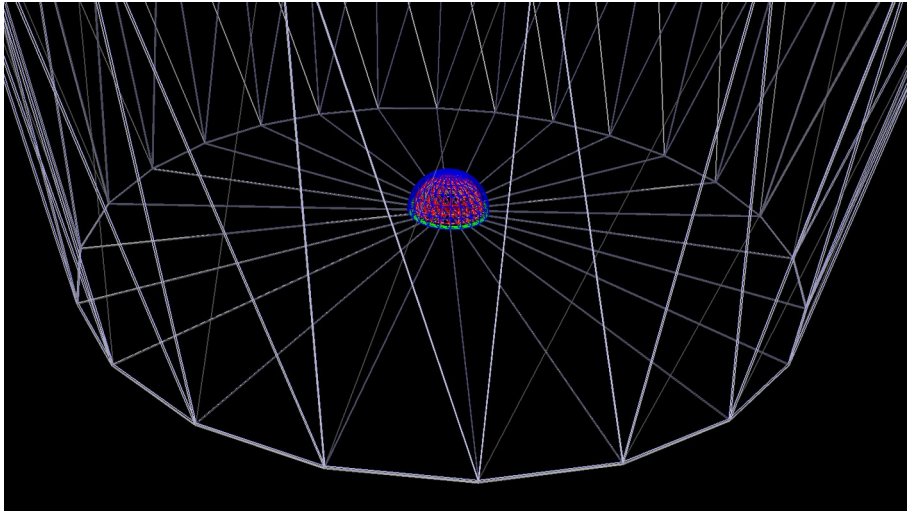
**LEFT**: one Multi-PMT on the lower surface of the Tank

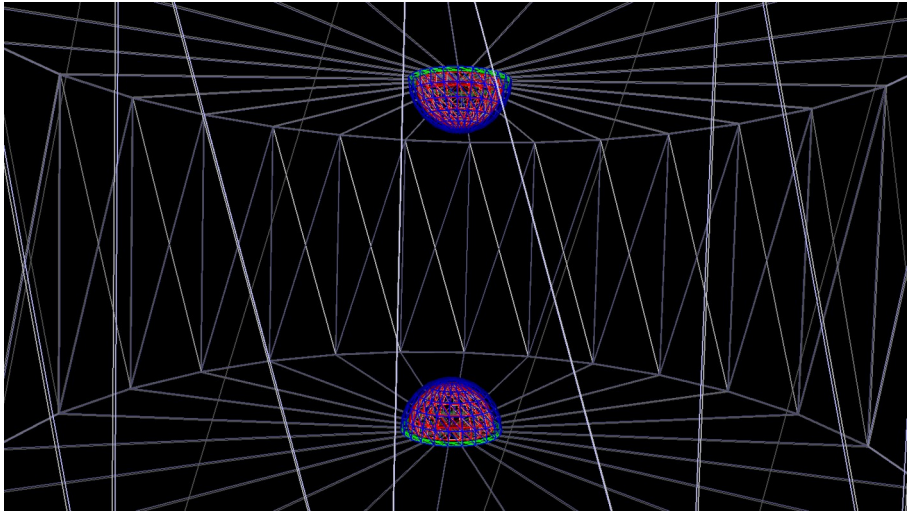
**RIGHT**: one Multi-PMT on the top surface and one at the bottom



# Mercedes Tank Configuration

Closer look for configurations in Mercedes tank





# Up Coming work to do

- Positioning and rotation inside module for 3 inches PMT has yet to be defined
- Andrew has defined 3inches PMTs in a separate branch. We agreed on how to merge (This will be done next week)
- Set up configuration files to simulate Multi-PMT with all possible configuration of tanks

# What we aim for

- To simulate these configurations for better gamma and hadrons separation

- Optimize the module to better understand reflections and asses the necessity of optical gel