



Fermilab

**Particle Physics Division
Mechanical Department Engineering Note**

Number: MD-ENG- 342

Date: May 26, 2011

Project Internal Reference:

Project: SCDMS

Title: Super CDMS Lead Shield Version 3 Design with Installation
Procedures.

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Reviewer(s):

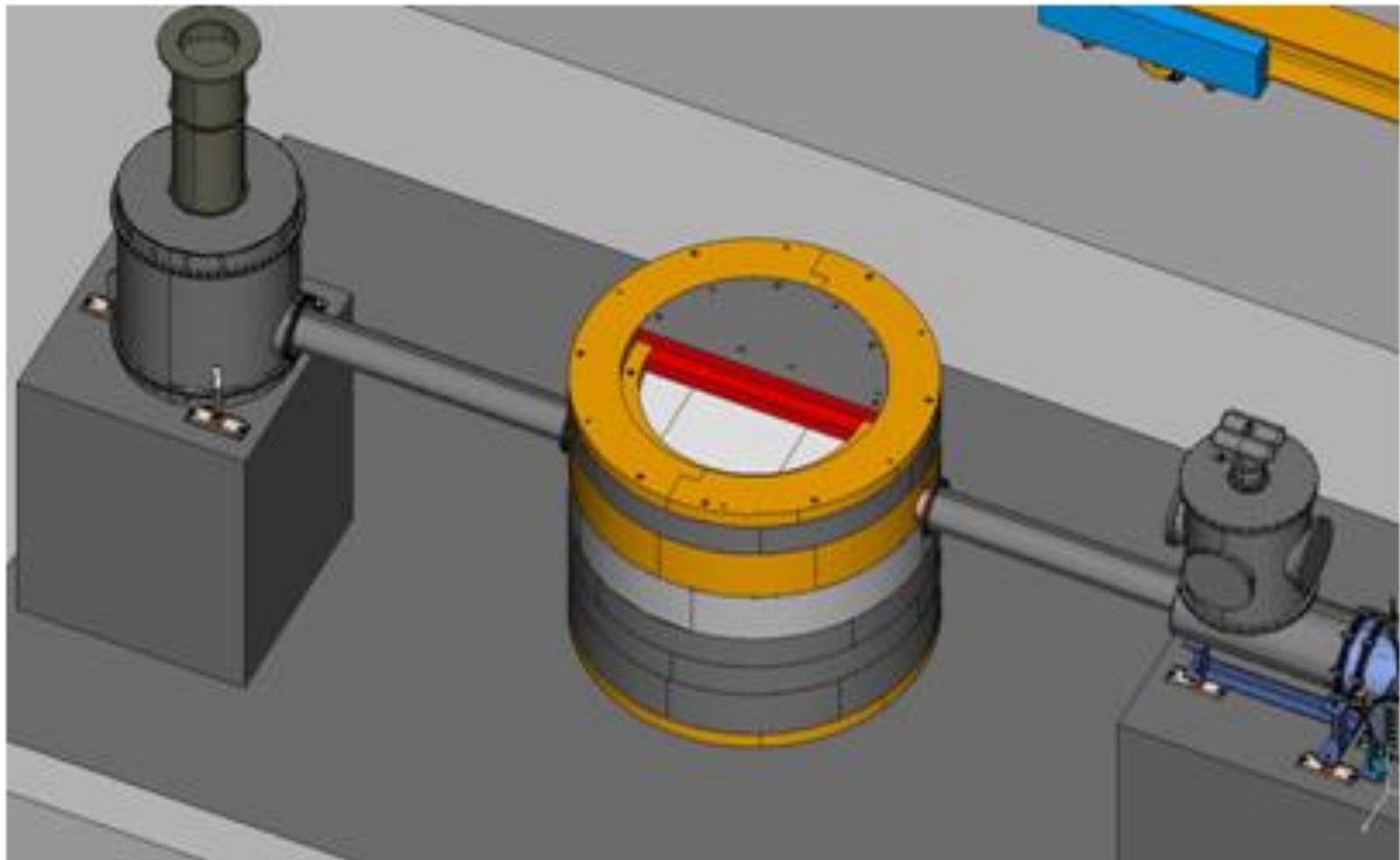
Key Words: Super CDMS, Lead Shield, Installation, Casting, Configuration
Specification, Snolab, Transport Box, Handling, Equipment

Abstract Summary:

To apply the restrictions of the material handling and material transport is an important part of the design of the SCDMS experiment at Snolab. The lead shield version 3 design is based on the criteria and specifications which are outlined on page 3 and page 4 of this note. The assembly procedures of the lead shield are presented step by step from page 5 through page 13.

Applicable Codes:

“Properties of Leads and Lead Alloys”, Metals Handbook, 9th ed. V2.
“User’s Handbook”, Snolab, Revision 2



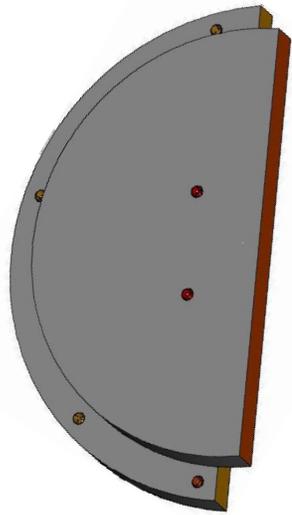
The overall view of the SCDMS lead shield and its application
(removed one part of the top inner cover for viewing purpose)

Major Design Criteria & Specifications:

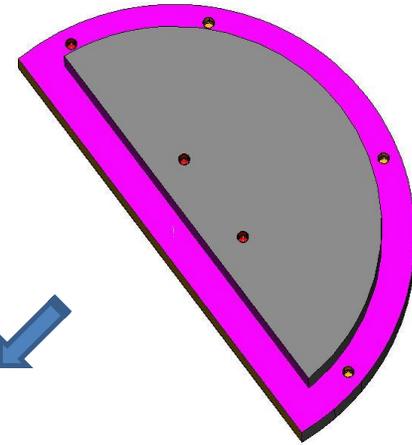
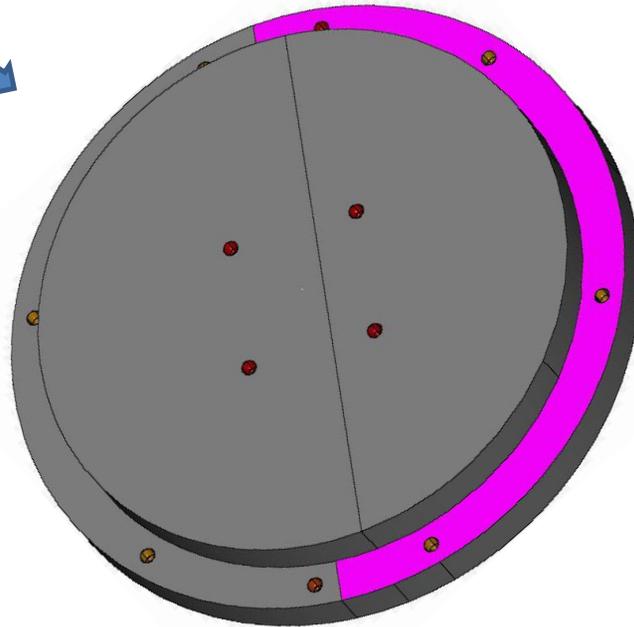
- 1 The overall lead shield configurations & dimensions are based on the SCDMS applications.
- 2 The overall weight of the lead shield is about 52,000 lbs.
The overall height is 65.50 inches, inside net height is 51.50 inches.
The outside diameter is 71", and the inside diameter is 54".
- 3 The SCDMS lead shield consists of 10 rings, **each ring has two casting parts.**
 - Vertical rings with 7.25" dia through hole (2).
 - Vertical rings with 11.25" overall height (3).
 - Lower vertical adapter ring (1).
 - Top & bottom outer cover shield (2).
 - Top & bottom Inner cover shield (2).

4. The configuration, weight and dimension of each casting part is decided by:
 - The specifications from the project experiment.
 - The transport box specifications (See figure 7.7, section 7.4.4, Snolab User's Handbook, rev 2).
 - The specifications of the existing and future handling equipments at Snolab.
 - The cost and availability of the manufacture.
 - The unique mechanical properties of the shield material – Lead.
 - To maximize the shielding and minimize the leaking.

The SCDMS lead shield installation procedures (steps):
(From page 5 to page 13)



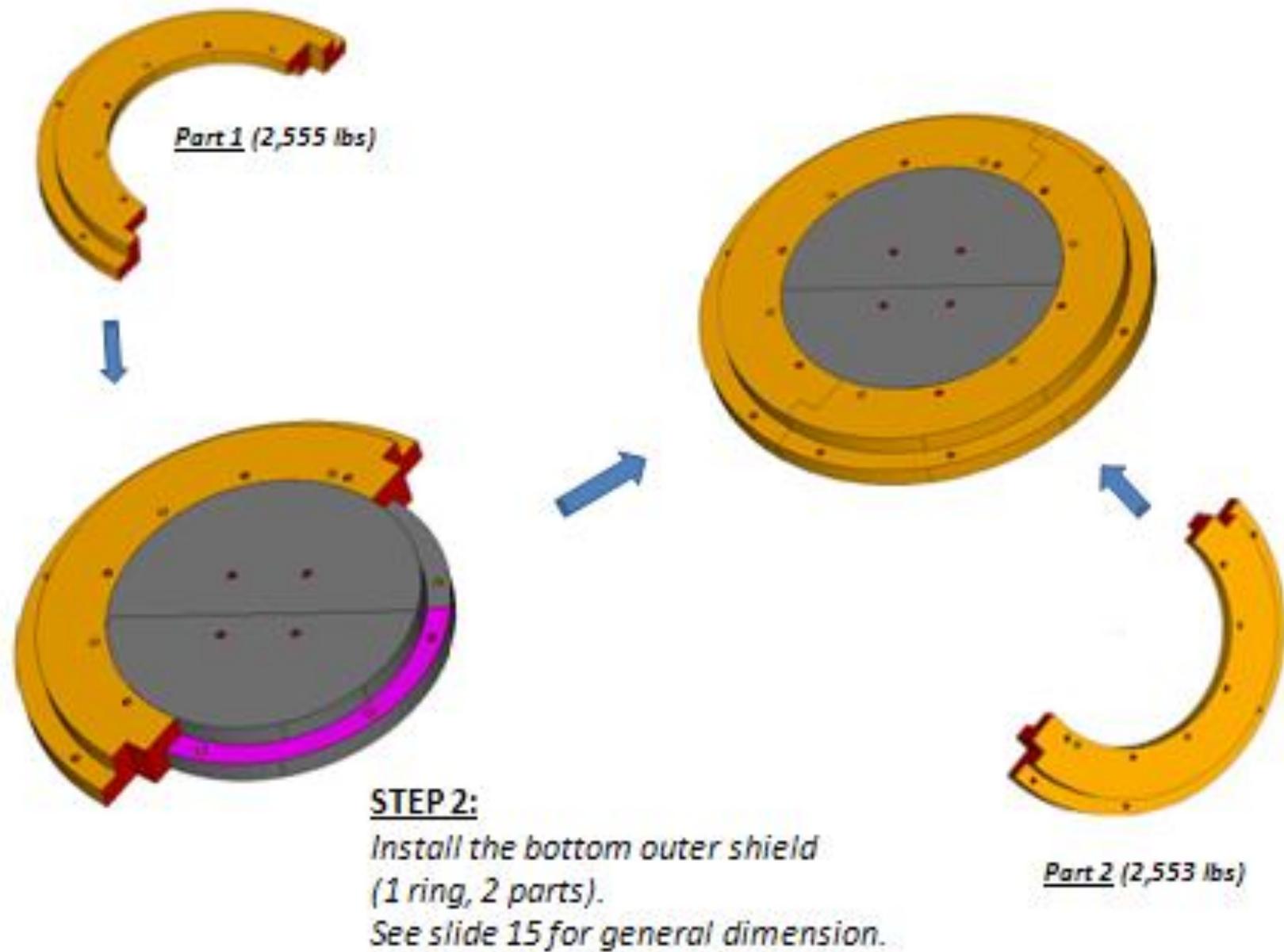
Part2 (2,561 lbs)

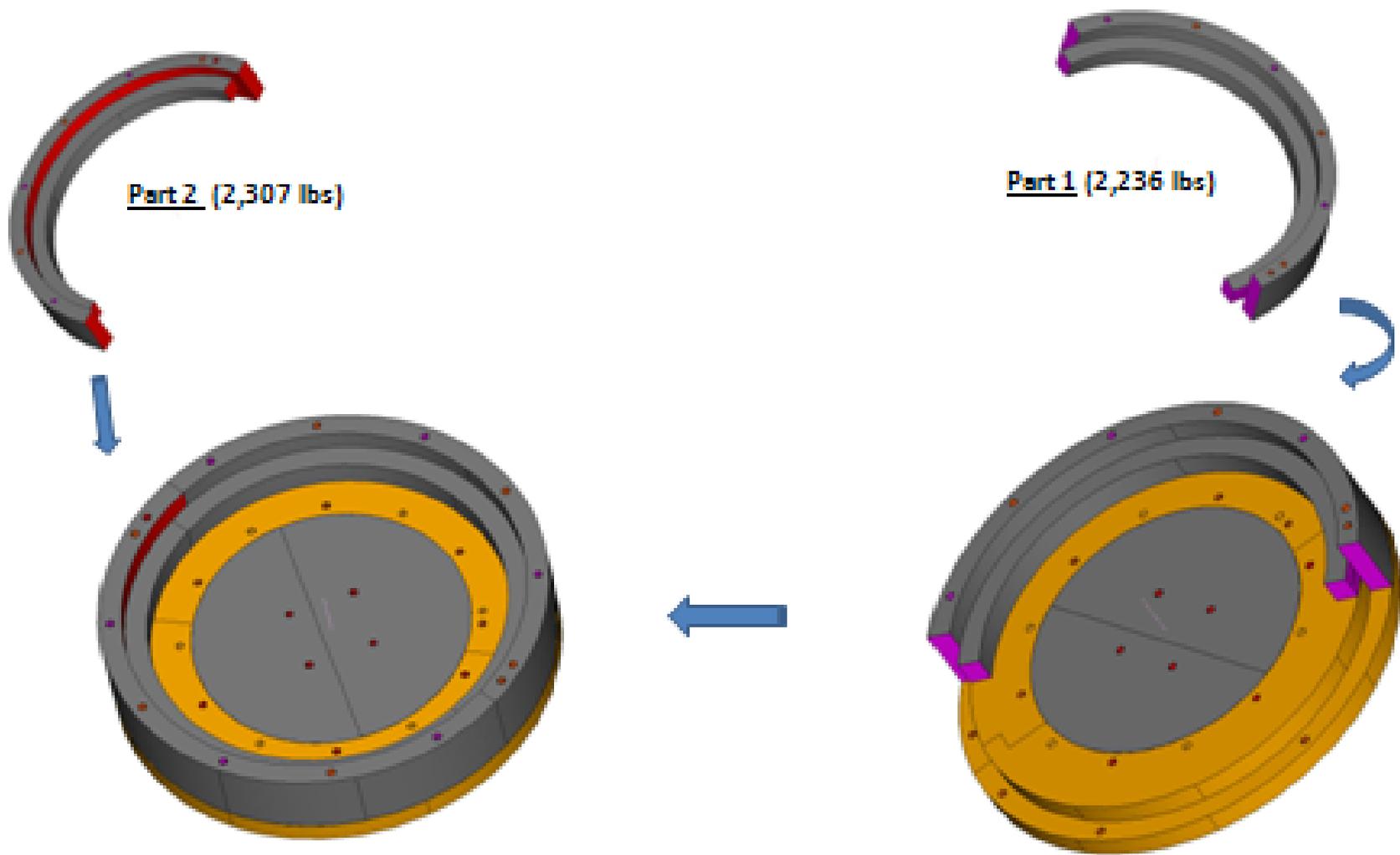


Part1 (2,596 lbs)

STEP 1:

Install the bottom inner shield (2 parts), see slide 16 for general dimension.

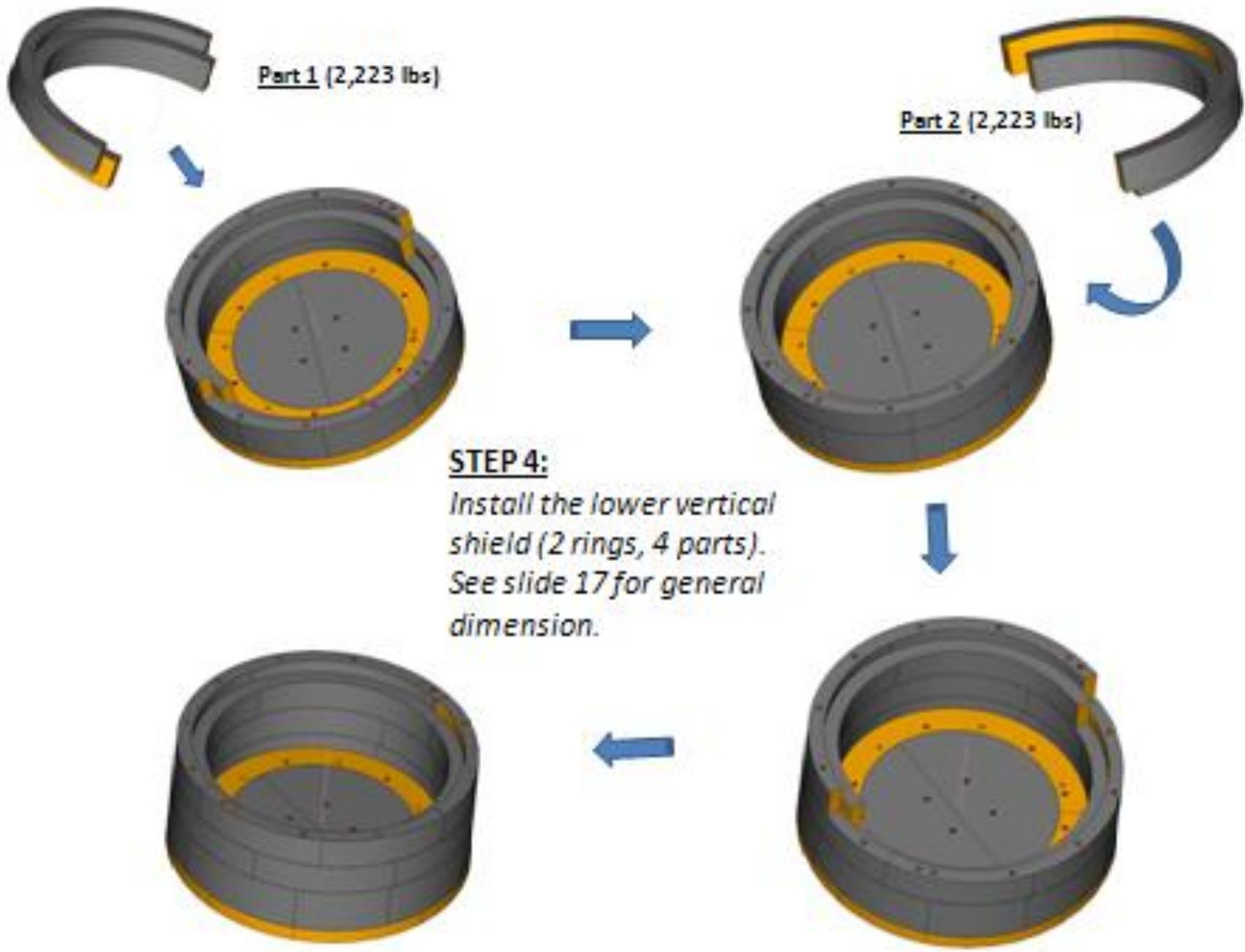


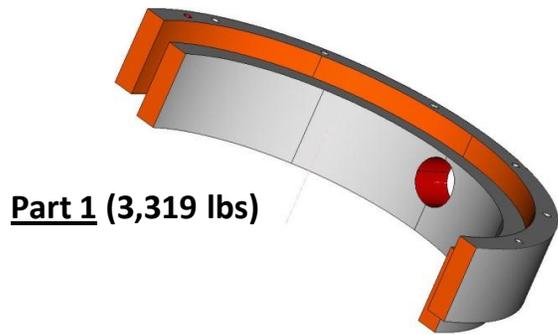


STEP 3:

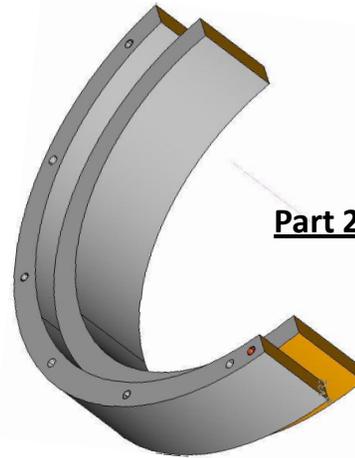
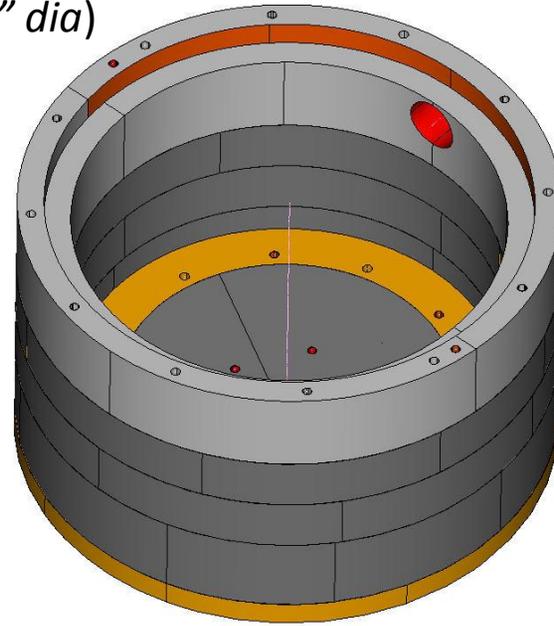
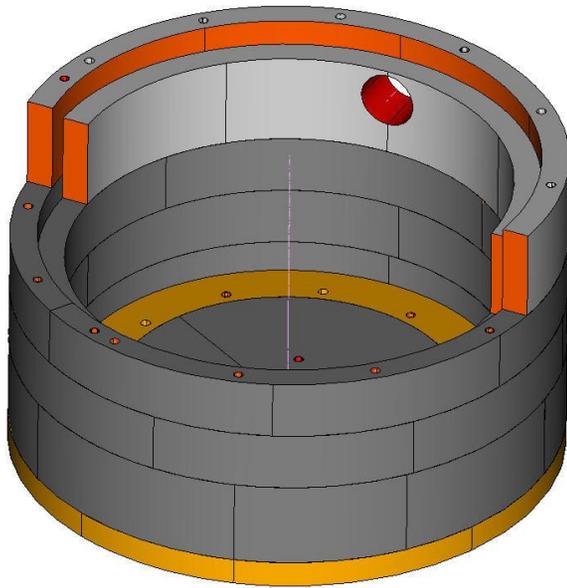
Install the bottom vertical adapter shield (1 ring, 2 parts)

See slide 19 for general dimension.





STEP 5:
*Install lower vertical shield
with access hole (7.25" dia)
(1 ring, 2 parts)*

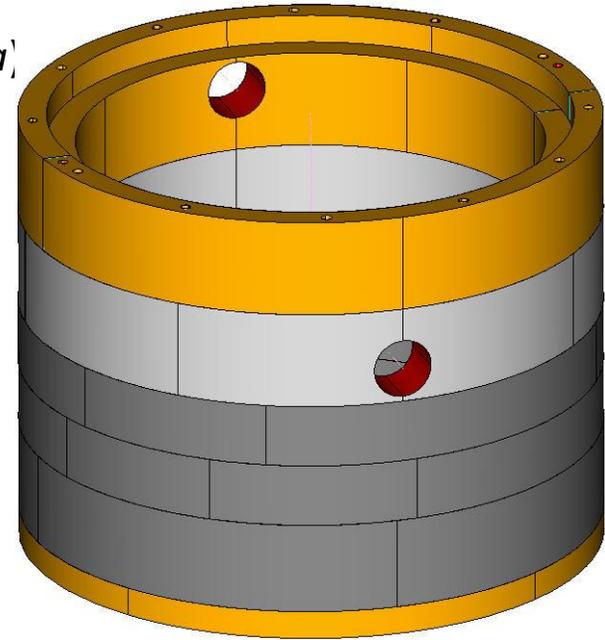
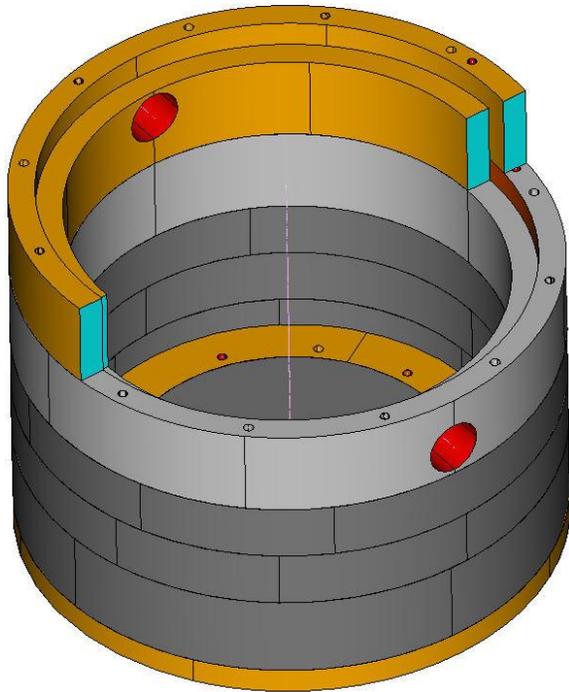


See slide 18 for general dimension.

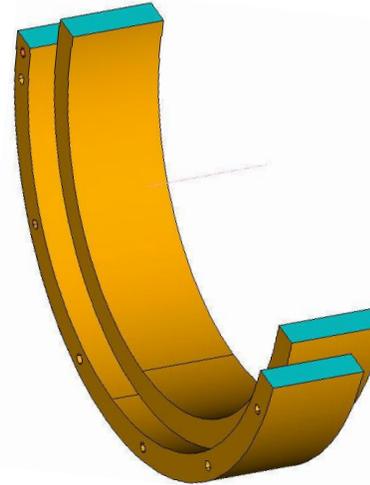
STEP 6:

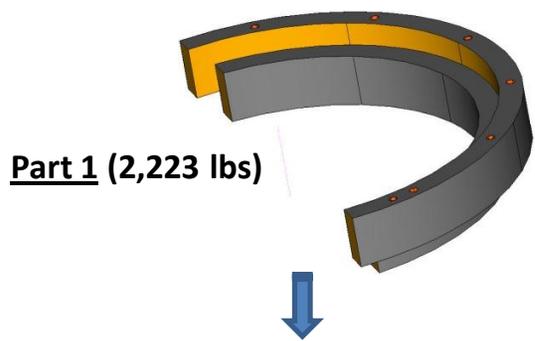
Install top vertical shield with access hole (7.25" dia), (1 ring, 2 parts).

Part 1 (3,319 lbs)

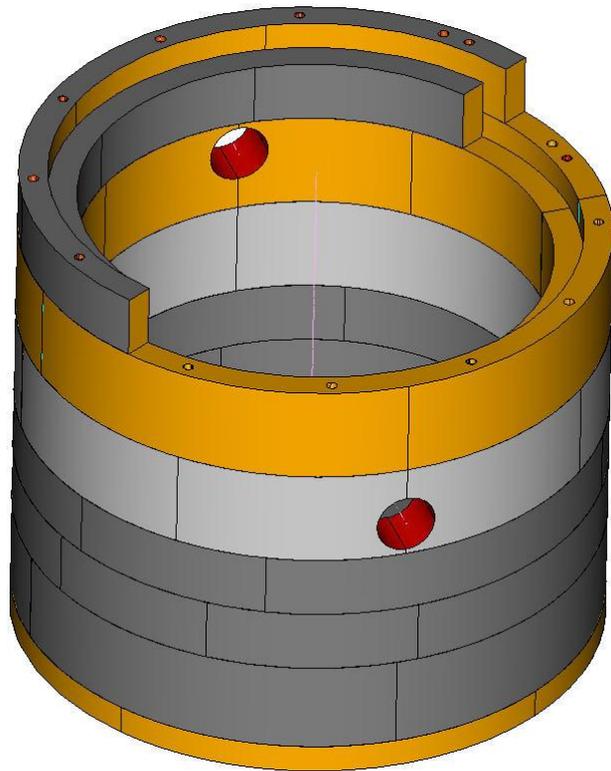


Part 2 (3,443 lbs)

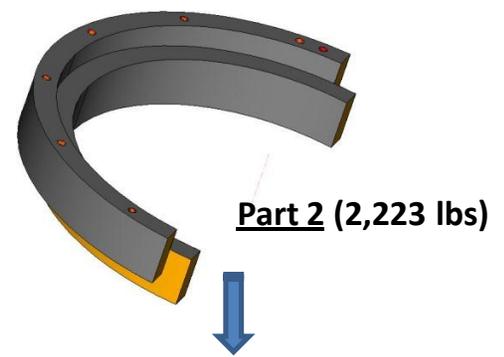




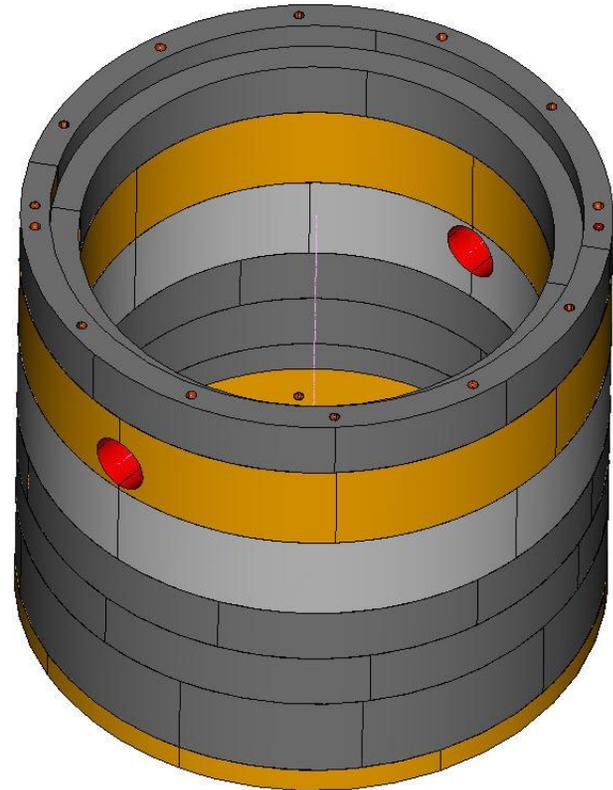
Part 1 (2,223 lbs)

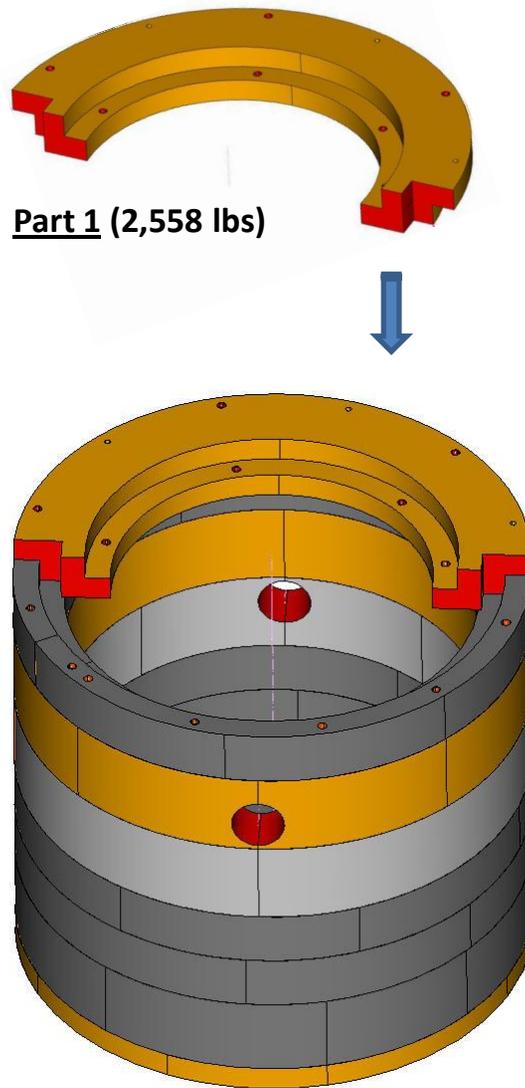


STEP 7:
Install the top vertical shield (1 ring, 2 parts).

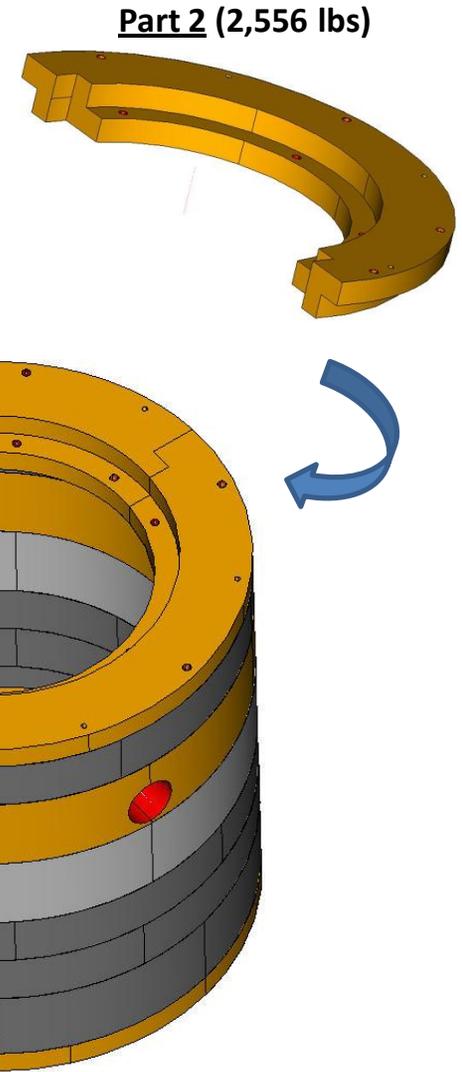


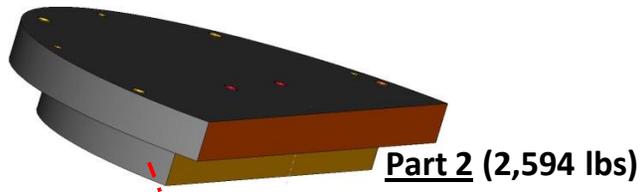
Part 2 (2,223 lbs)



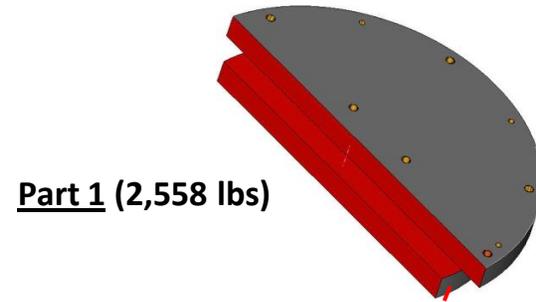
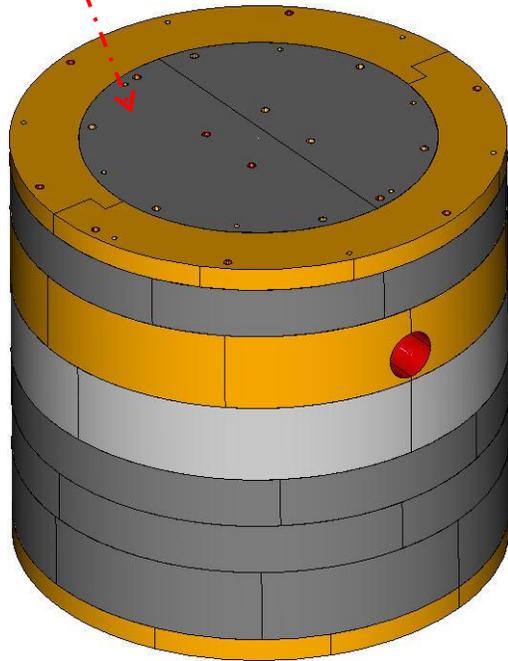


STEP 8:
Install the top outer cover shield (1 ring, 2 parts).

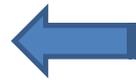
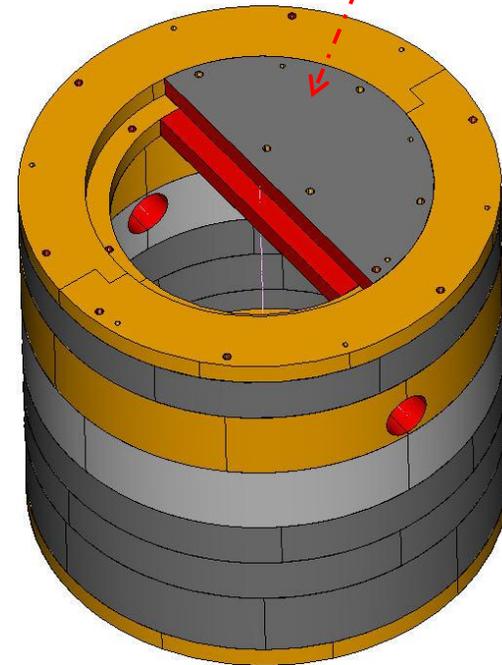




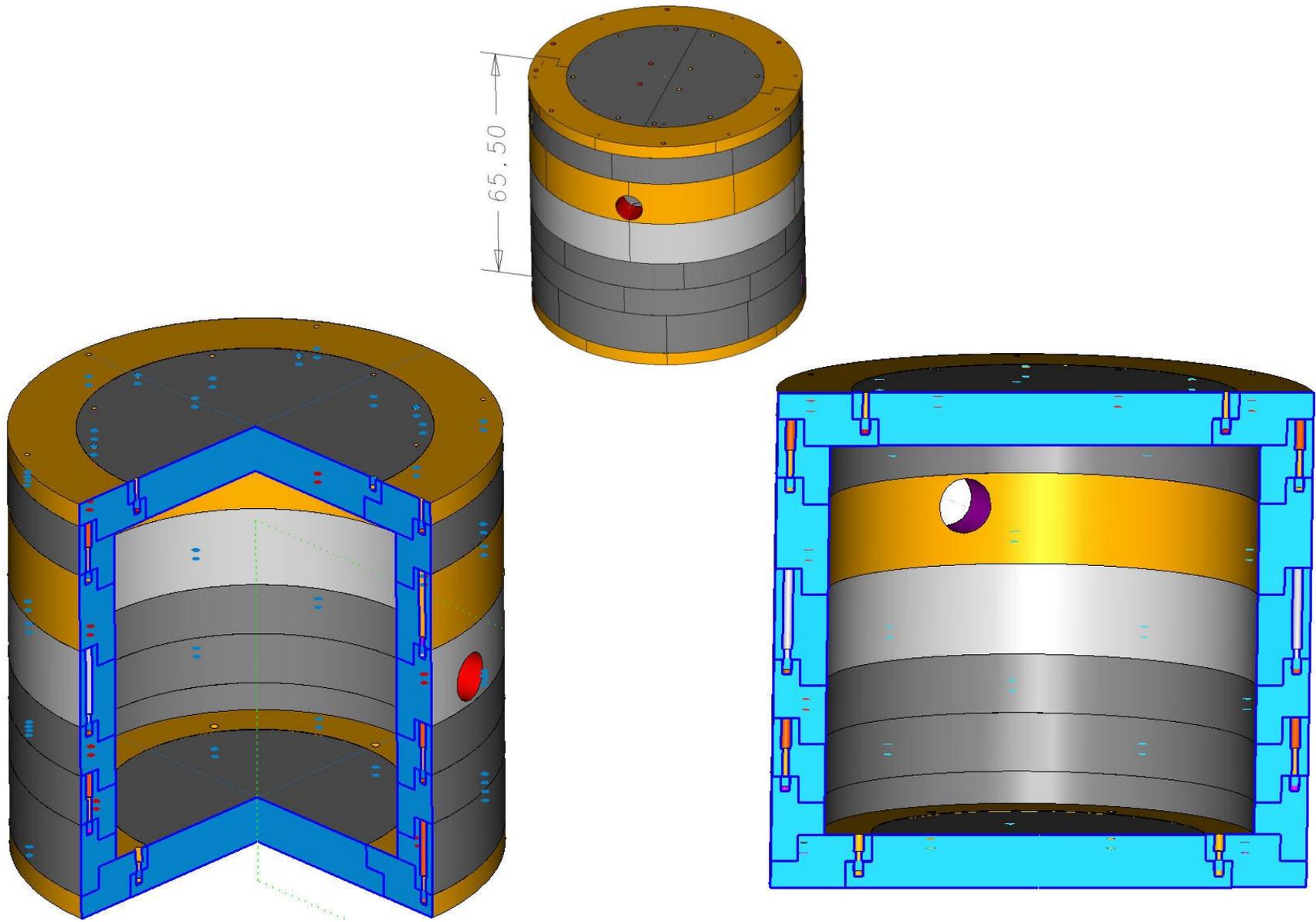
Part 2 (2,594 lbs)



Part 1 (2,558 lbs)

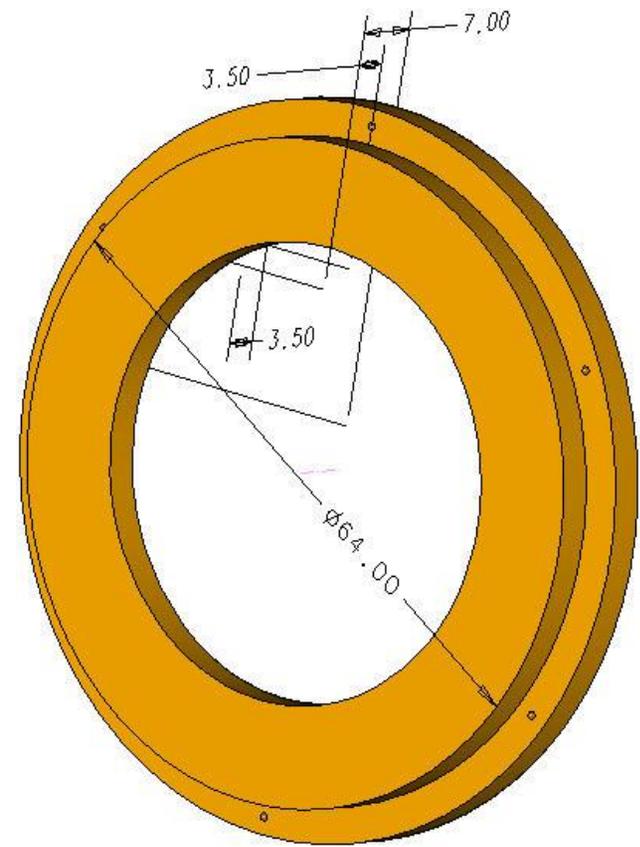
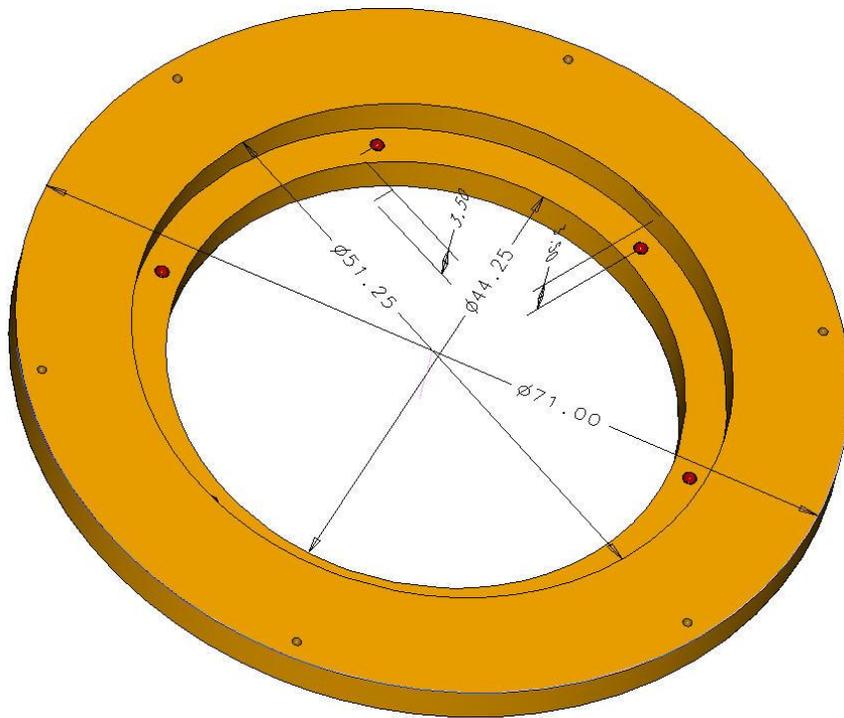


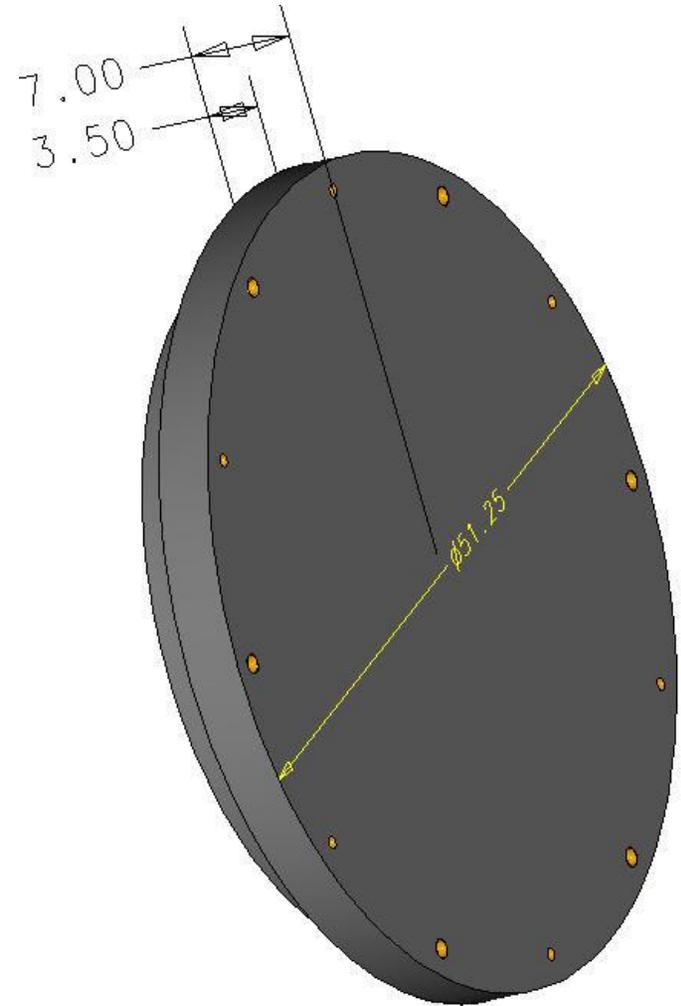
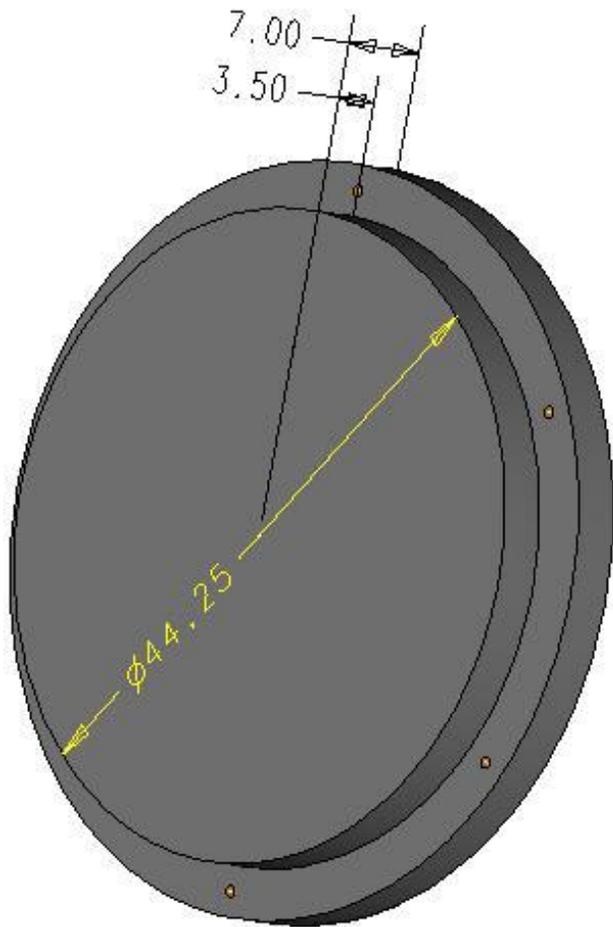
STEP 9:
*Install the top inner
cover shield (2 parts).*



Cross section view of the the assembled SCDMS lead shield

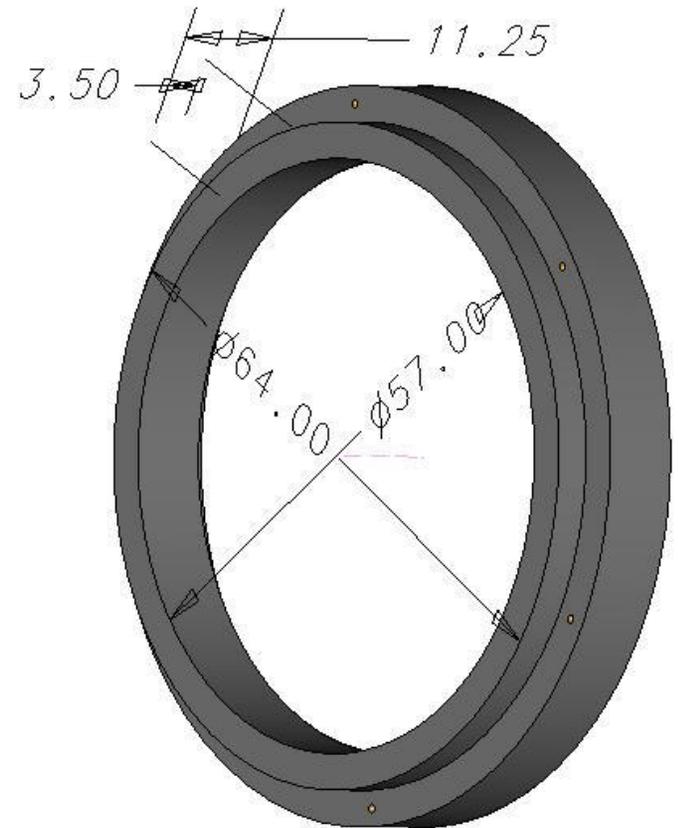
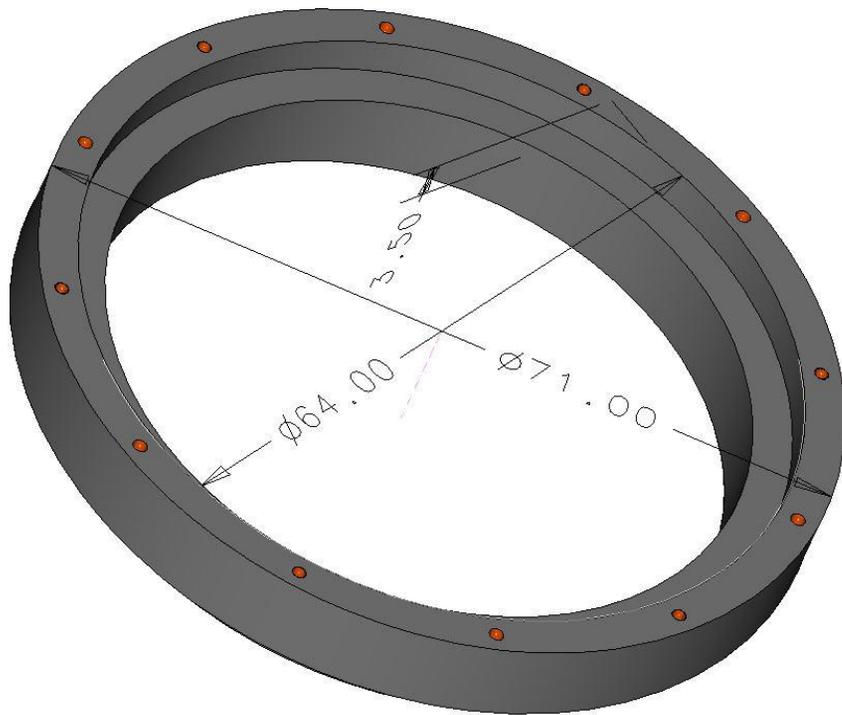
Outer ring-top/bottom
-pb-shield

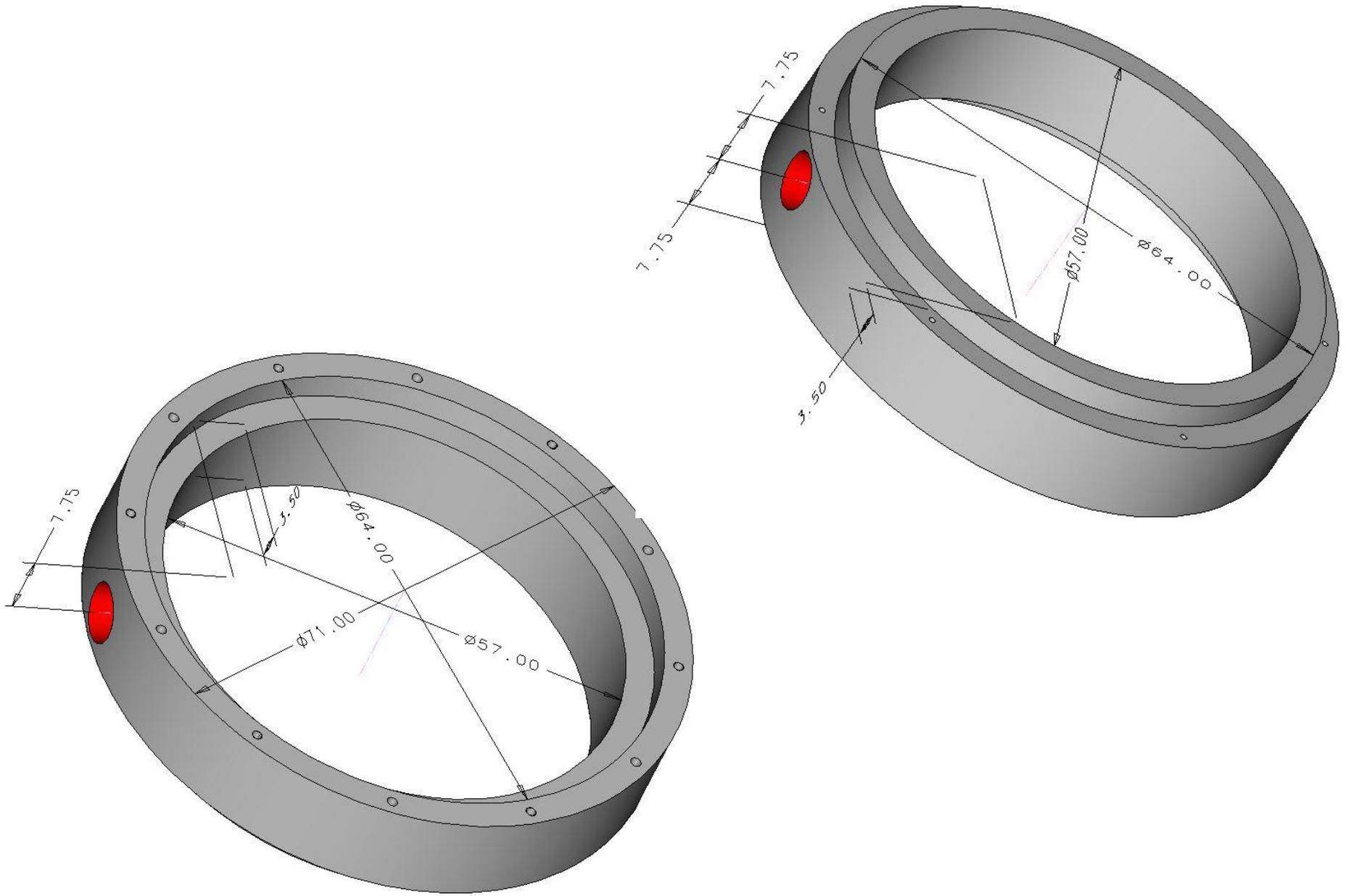




Inner plate – top/bottom
Cover- pb-shield

Ring-vertical-11.25"HT
-pb-shield





Ring-lower-adapter-
pb-shield

