Main Detector Module Assembly and Light-Sealing Concept – Using Ring 4 as Example

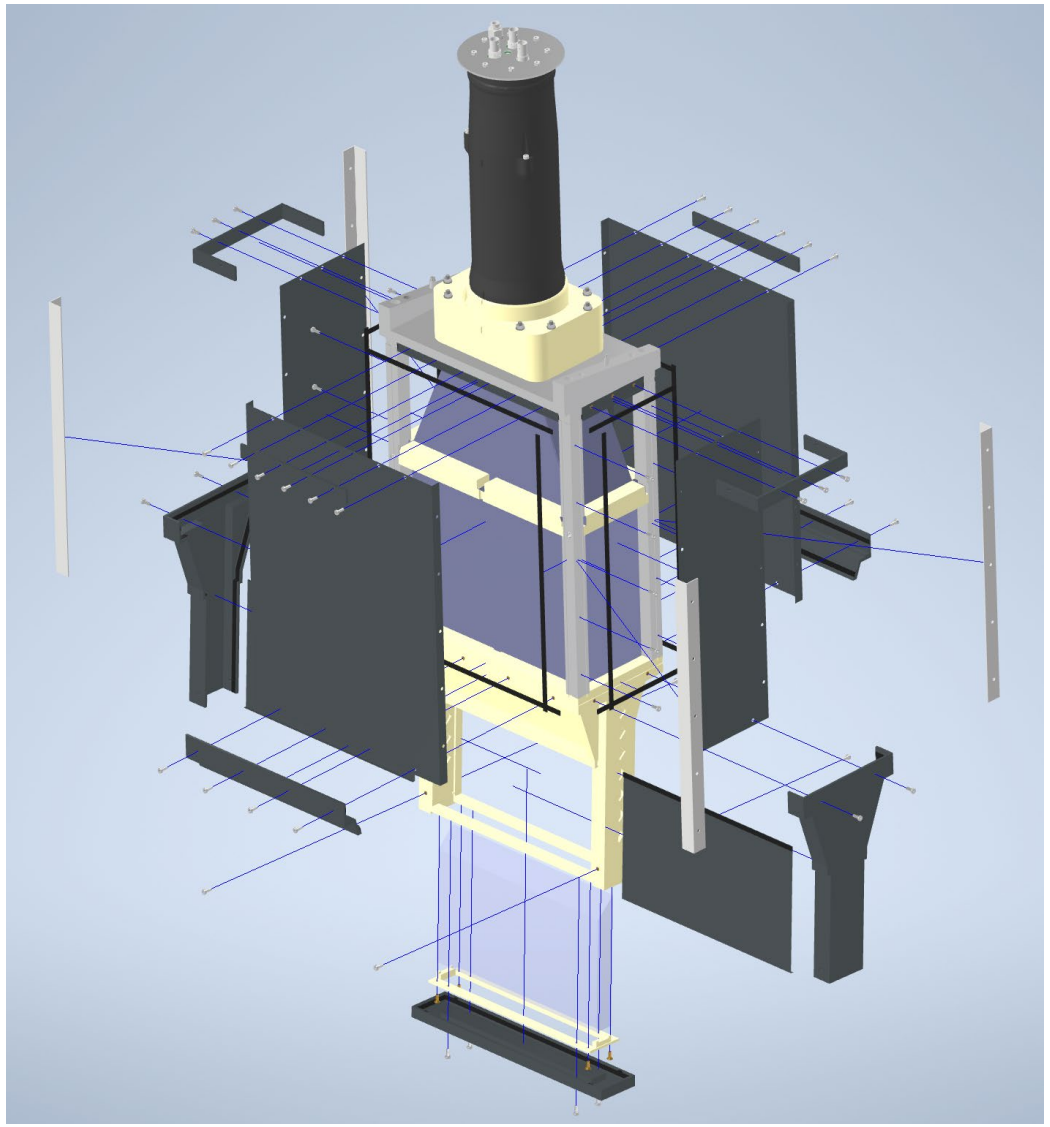
The clearance between detector modules during the segment insertion process is very small (less than 1 cm).

That means that a simple box around the modules for light sealing will not work.

Any light sealing will have to adhere closely to the shape of the as-designed modules.

Constraints are:

- Radiation resistant
- No glues - if possible
- Not taping (without support – see later)
- Minimize material budget (space and physics)
- Moderately straight forward accessibility of parts and repeatability
- Separate sealing of quartz tray to allow feducialization and subsequent light sealing of the quartz tray as the final step
- Reasonably straight forward manufacturability
- Allow for air flow through the module

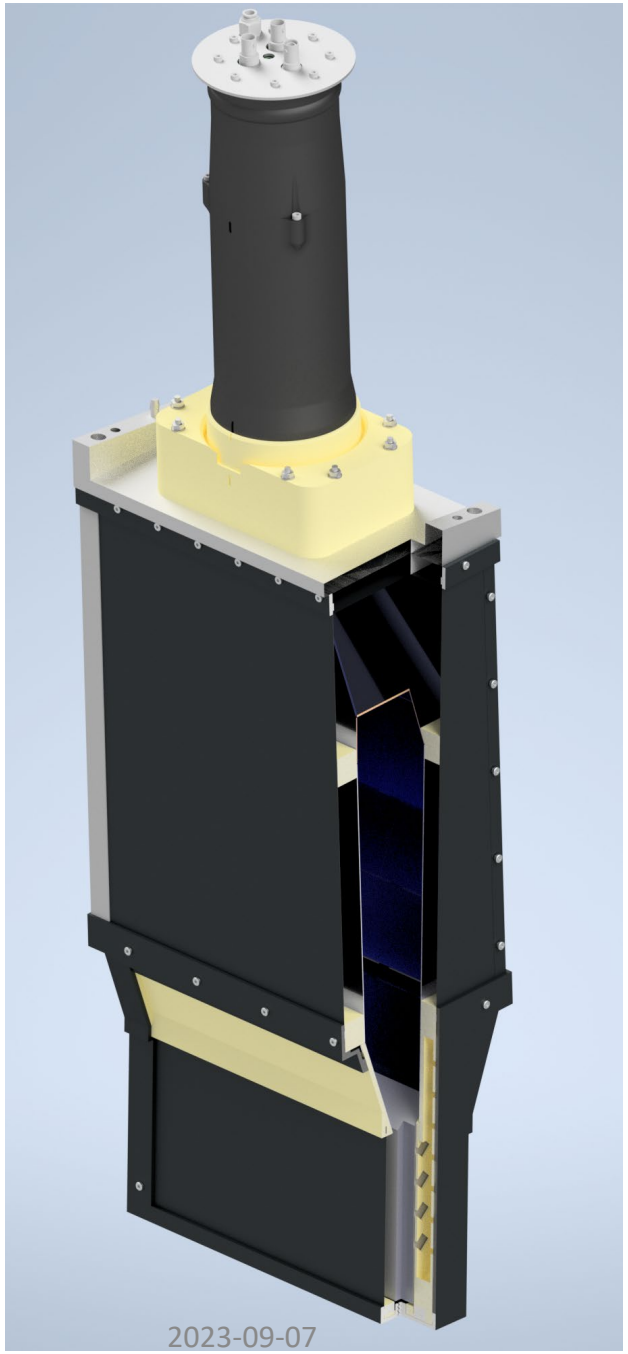


Main Detector Module Assembly and Light-Sealing Concept – Using Ring 4 as Example

Materials:

- CF-ABS for 3D printed parts
- Sheets of 5 mil (~$125\ \mu m$) light-tight polyimide film
- Self-adhesive felt-tape (to be evaluated)

https://www.cgstape.com/product/black-polyimide-film/



Lower body (excluding PMT housing):

Yellow:

- 3D printed module structure is yellow for distinguishability but will be light tight black CF-ABS.

Black:

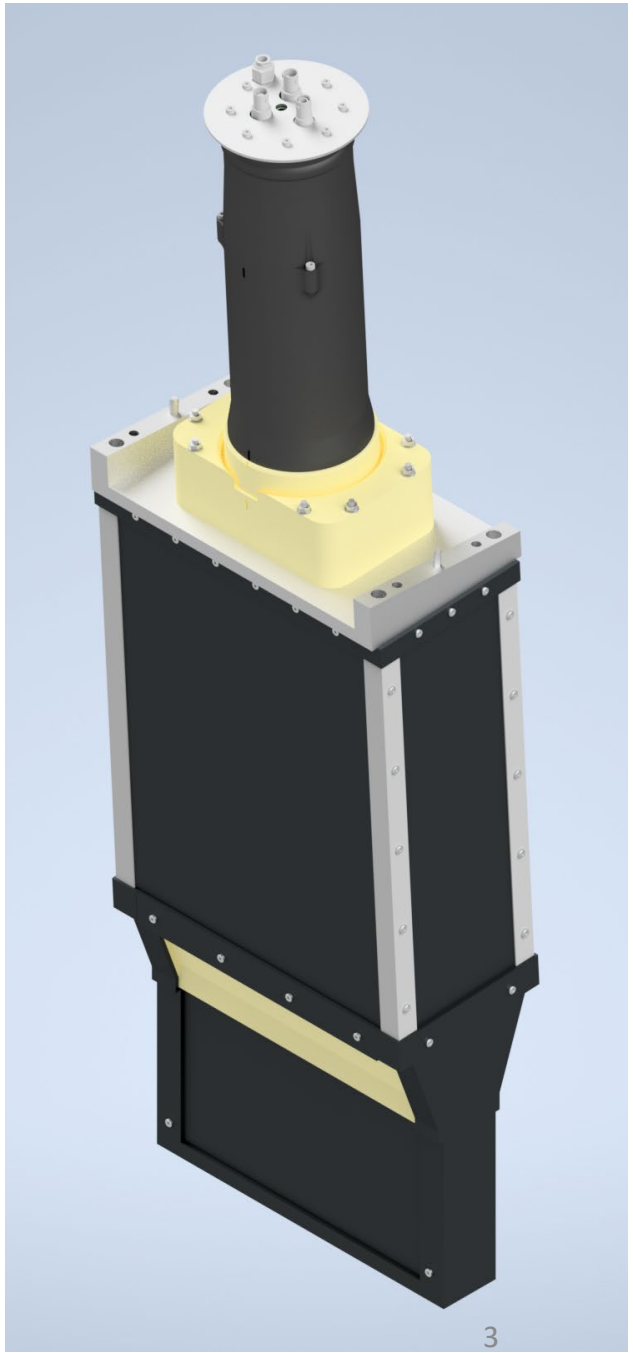
- Large sheets are 5 mil (~$125\ \mu m$) light-tight polyimide film (i.e. Kapton)
- Smaller parts (braces and side covers) are 3D printed CF-ABS
- Strips of self-adhesive felt tape (1 mm thick)

Grey:

- Aluminum parts or other metals (bolts etc.)

Brown:

- Brass threaded inserts



New Parts:

There are several new 3D printed parts (but small).

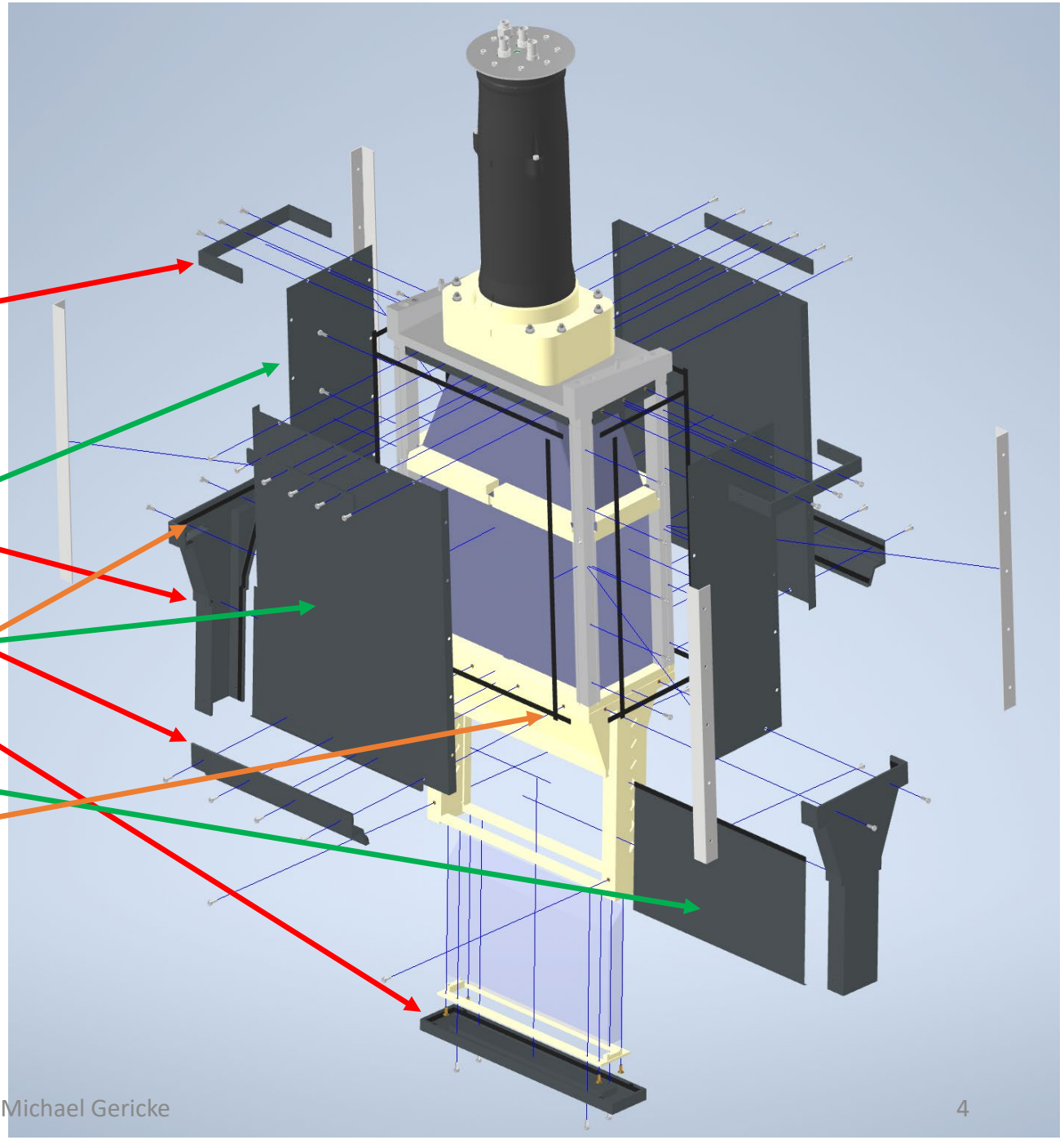
Several sheets of polyimide, covering the large areas.

Strips of 1 mm thick self adhesive felt tape – located in grooves to prevent coming off over time.

3D printed parts

Polyimide sheets

Felt adhesive strips



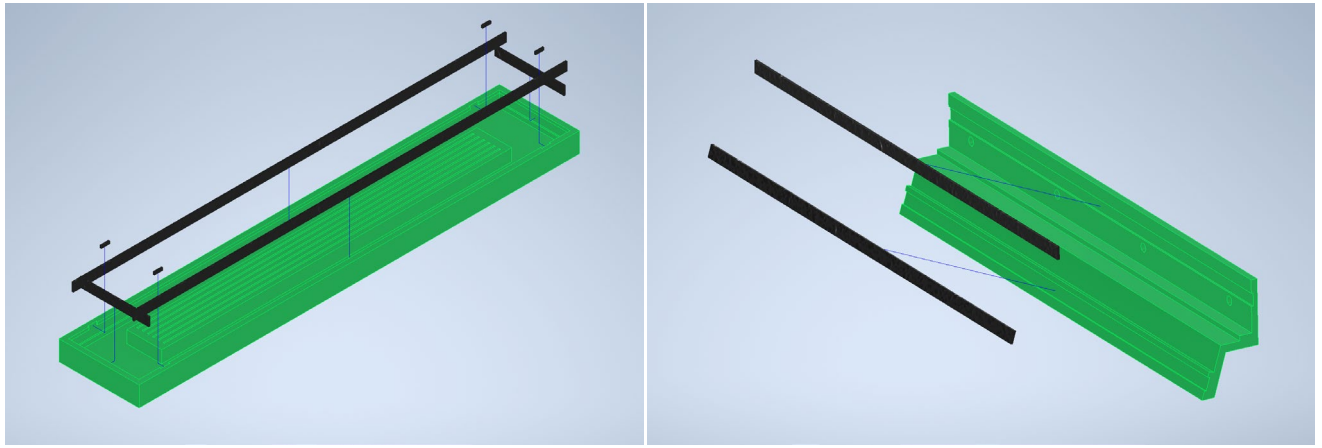
The 3D printed parts:

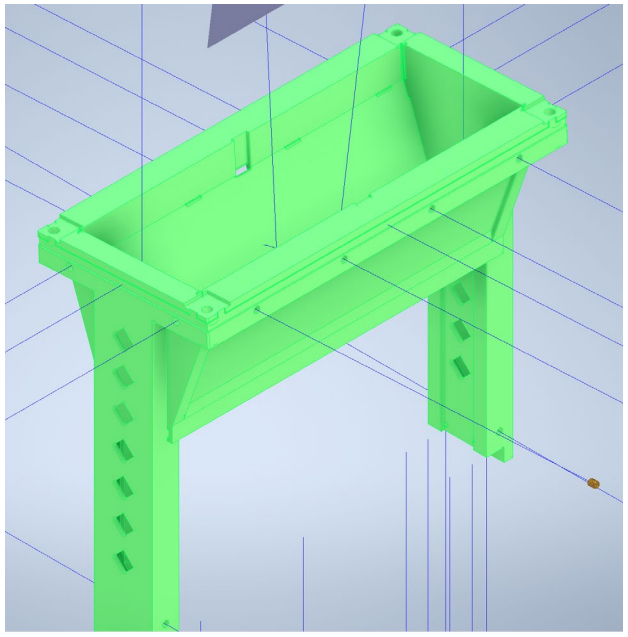
3D printed pieces (highlighted green) have groves to cradle strips of 1 mm thick and 5 mm wide felt tape.

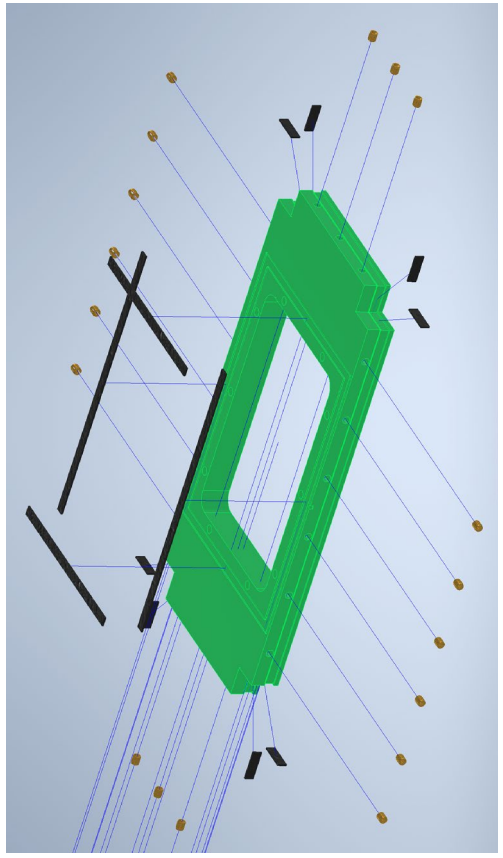
The groves keep the strips from falling out, even if the adhesive loosens.

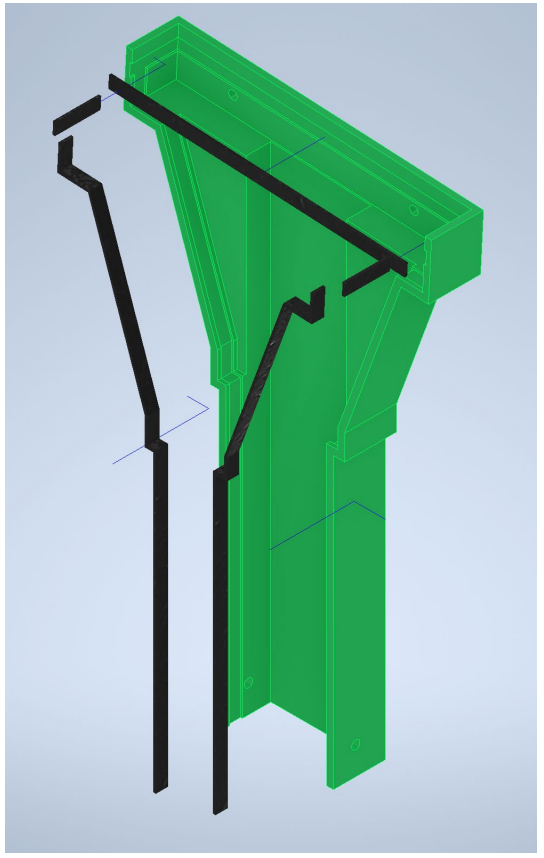
The groves are 0.75 mm deep, assuming a 0.25 mm compressibility (to be verified).

The idea used through this design is that and light would need many bounces to make into the detector active volume.



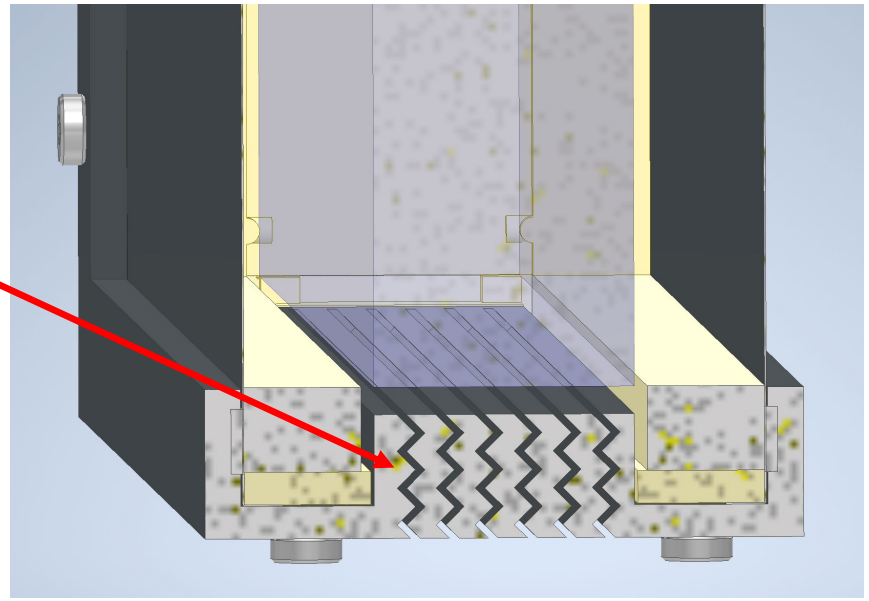


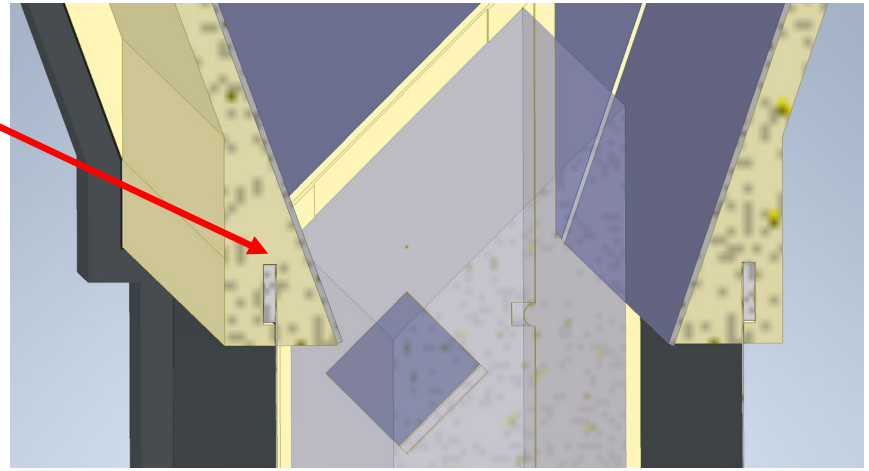


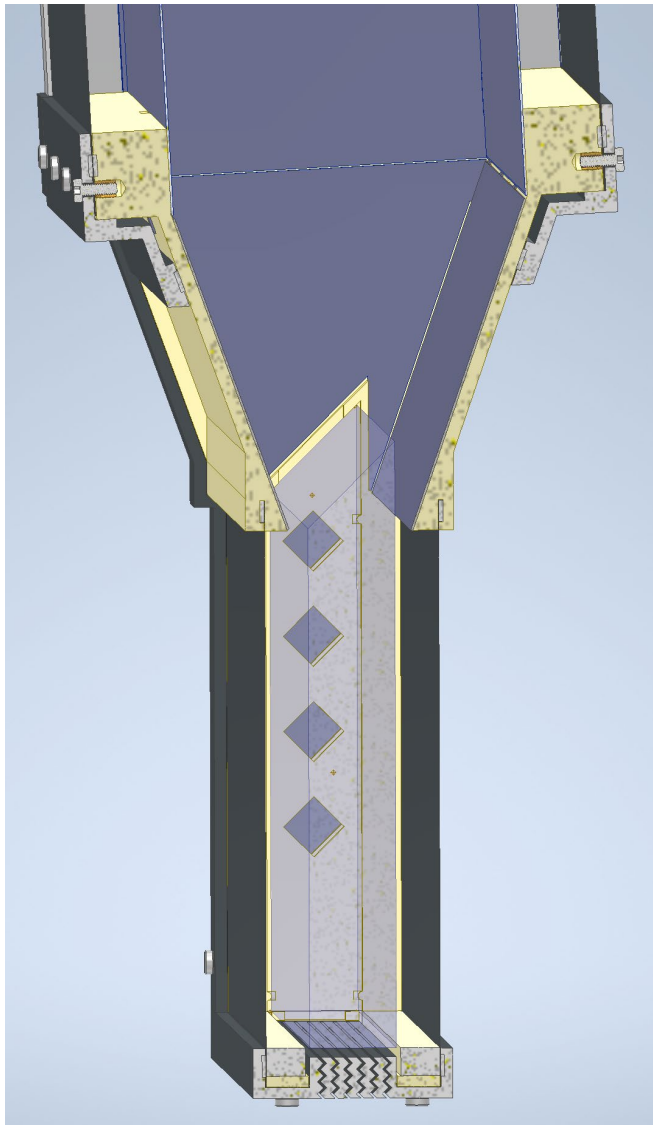


Air flow:

- Bottom air outlet (based on Laheji Mohammad's design – light tightness already verified)
- Possible bulging (ballooning) effect on polyimide sheets and light tightness needs to be verified
- Potential weak point from air pressure (to be verified)







Metal parts:

- Design changes to the support bars include groves for the felt tape and mounting new holes
- Stock extrusion L-profile aluminum with mounting holes
- Not changes to anything that interfaces with the segment plates