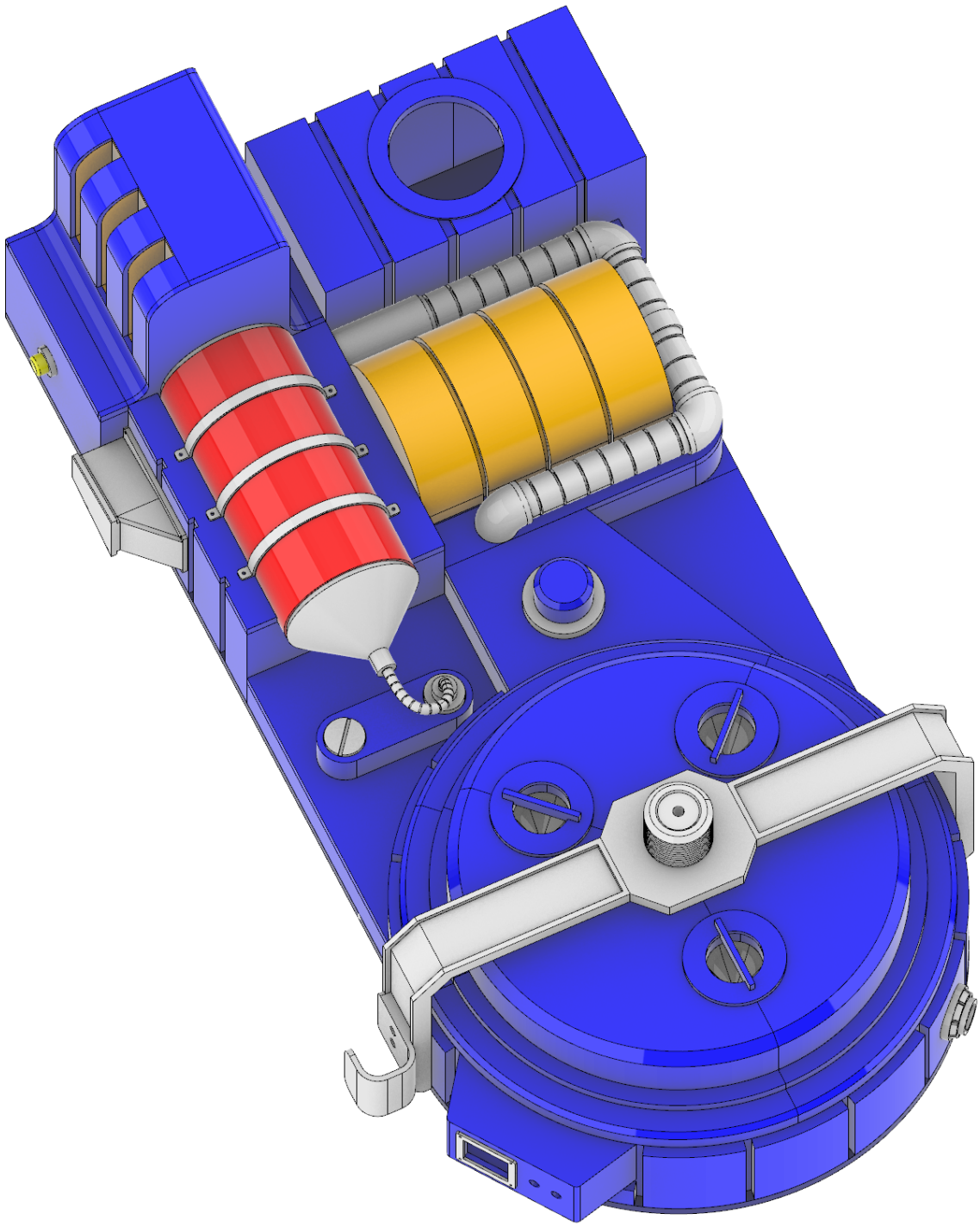
3D PRINTED PROTON PACK

ASSEMBLY INSTRUCTIONS v1.0

BY NATHAN MILLER

@GhostbustersGear



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The “PROTON PACK” is a fictional device that originally appeared in the 1984 movie “Ghostbusters” and the spin-off 1986 cartoon series “The Real Ghostbusters”.

The “3D Printed PROTON PACK” is inspired by the design as depicted in The Real Ghostbusters cartoon series. The 3D printed parts, models, and diagrams are unique artistic interpretations of elements, detailing, dimensions, proportions, and construction created by Nathan Miller (the “author”).

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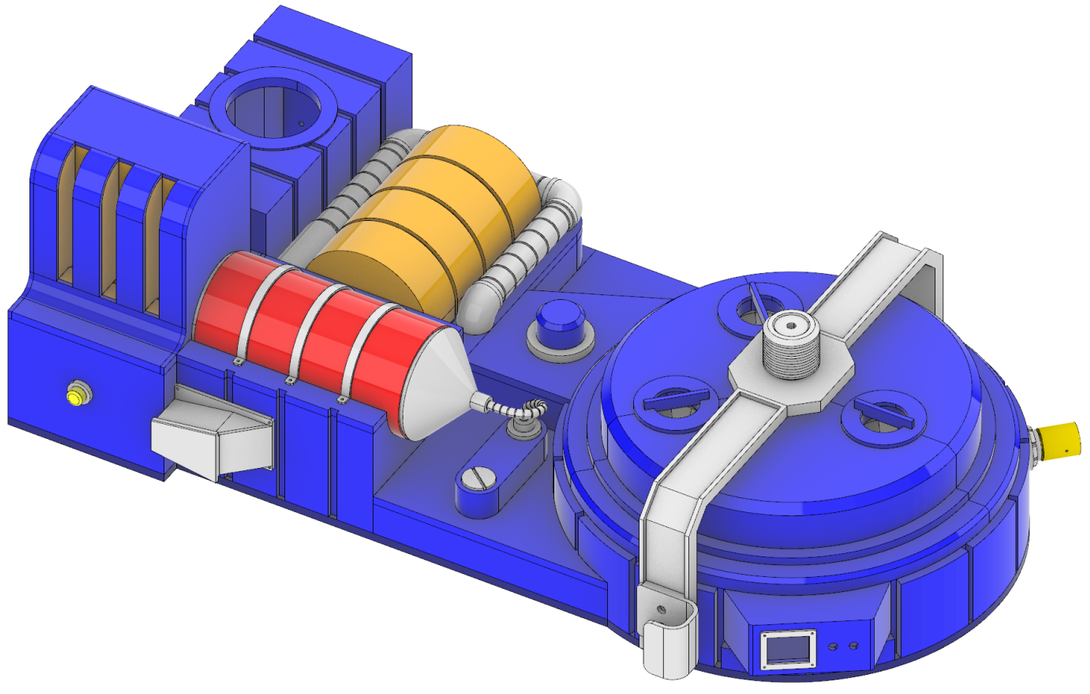
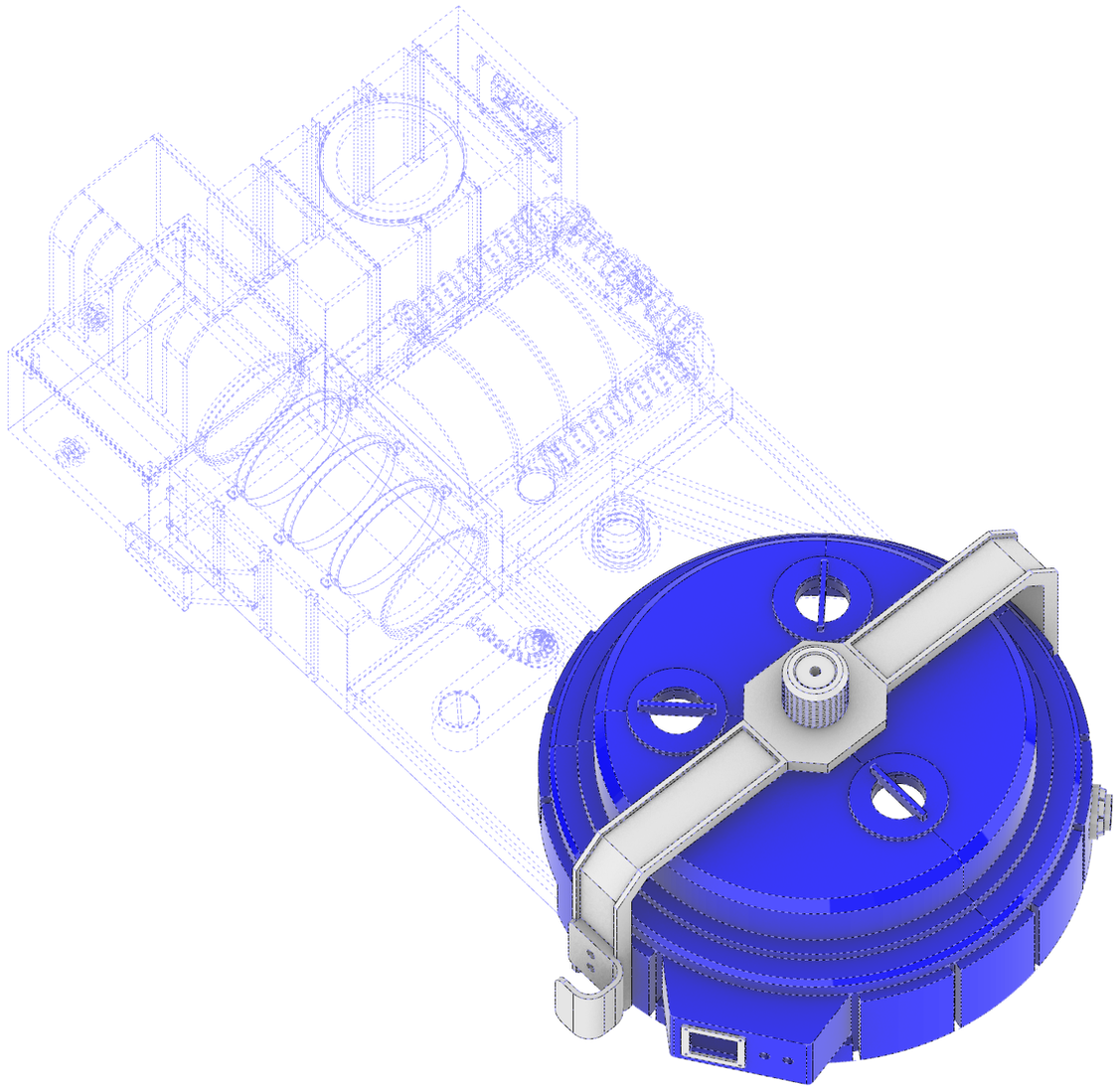
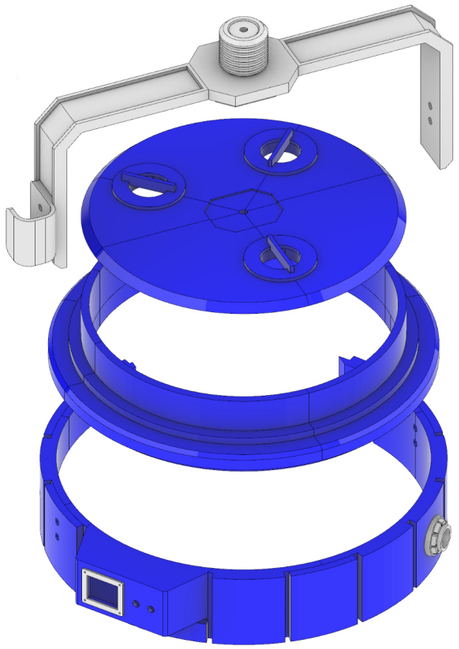


SECTION 1 - Cyclotron



General Notes

3D Models



The 3D models were authored from scatch using Rhinoceros 3D (Rhino) - a professional-grade CAD and geometry software package. Rhino is known for providing free-form modeling capabilities and achieving dimensionally accurate geometry.

Rhino also possesses robust geometry analysis tools allowing designers to test surface fidelity, solid, and edge analysis that are essential for producing high-quality, water-tight parts.

The files were exported to the STL file format using mesh settings that fall within a 0.01 mm tolerance from the original solid CAD model. STLs are readable by CURA software where the G-Code used by the 3D printer can be prepared.

The 3D printer parts, tolerances, constraints, and dimensions have been designed and tested with the basic Ender 3 by Creality which features a print bed area of 220 x 220 mm.

The Ender 3 is an affordable consumer-grade 3D printer and a great starting point for hobbyists interested in 3D printing. The author found this printer to be quite accurate and produce very good quality prints that can be used “off the bed” with very little post-modification.

G-Code files for the Ender 3 were prepared with the free and open source CURA Ultimaker software. Print settings were adjusted periodically for best results with attention to infill density, layer size, speed, and support strategy.

PLA Material

All 3D printed parts described in this document use a polylactic acid (PLA) material which is derived from renewable resources. The following PLA colors are used in the 3D Printed PROTON PACK

- **Blue** (Sapphire Metallic)
- **Silver** (Sapphire Metallic)

Special Parts

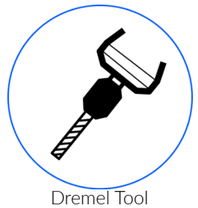
Rocker switch

Push Button

The PROTON PACK design requires several special parts be purchased to complete the design:

- **Flat Head Machine Screws** (10-24)
- **Red rocker switch** (30 x 21mm mounting size)
- **Push buttons** (various colors)

Tools



Dremel Tool

Metric Allen Key

Need Nose Pliers

Sand Paper

Quick Grip Clamps

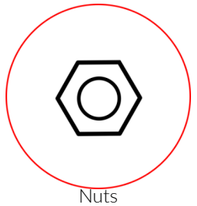
X-Acto Knife

When printing and assembling, it is recommended you have the following tools on hand:

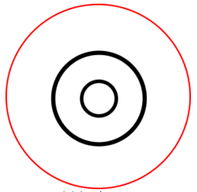
- **Dremel tool**
  - 1/16” drill bit
  - 3/32” drill bit
- **Metric Allen key wrenches** (2mm and 3mm)
- **Needle nose pliers**
- **Sand paper** (200 grit)
- **Quick grip clamps** (6 inch)
- **X-Acto knife**

Assembly Materials

Hex Machine Screws



Nuts



Washers

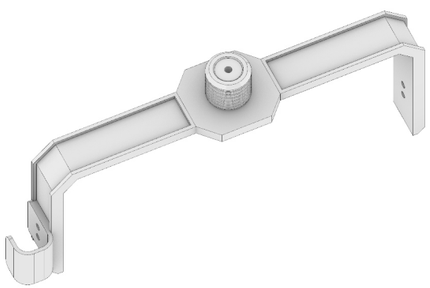
Super Glue

Various hardware is used to assemble the parts. Metric stainless steel hex machine screws, washers, and nuts are the primary hardware used for assembling the 3D Printed PROTON PACK. Gorilla Super Glue is used throughout.

- **Machine Screws, Nuts, Washers**
  - Diameter: 1/4”
  - Lengths: 3”,
- **Super Glue**

1 Bumper

Required Parts



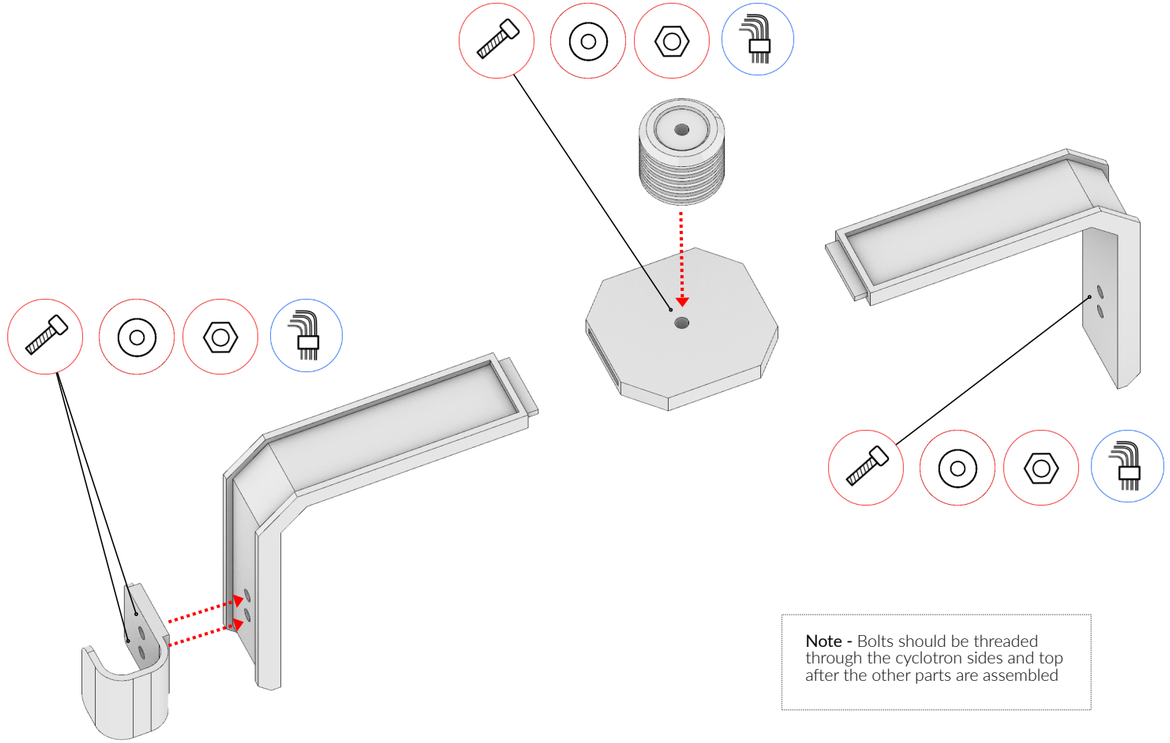
PARTS

- **Bellows**
- **Bumper Center**
- **Bumper Arm - Left**
- **Bumper Arm - Right**
- **Trap Hook**

PLA MATERIAL

- **Silver** (Sapphire Metallic)

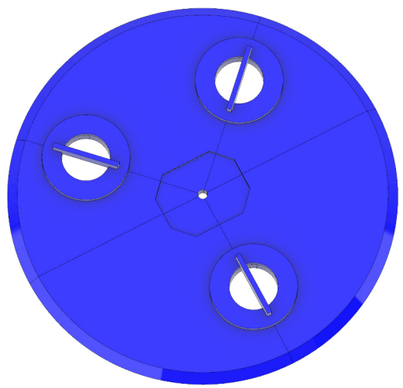
Assemble Bumper



Note - Bolts should be threaded through the cyclotron sides and top after the other parts are assembled

2 Front Face

Required Parts



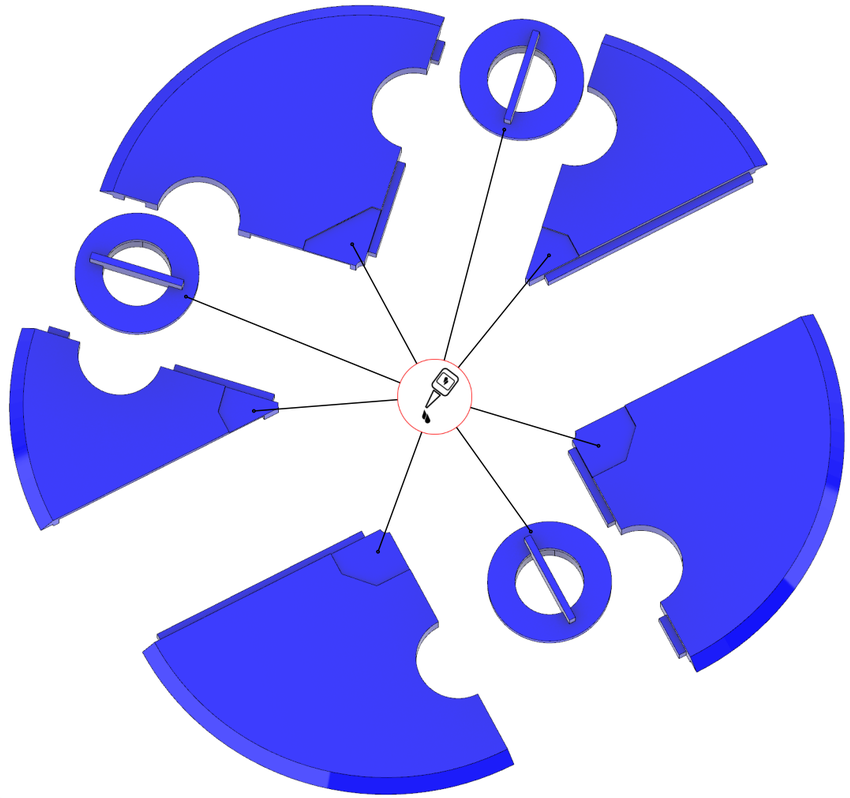
PARTS

- **Front Face - Lens**
- **Front Face Lower Left**
- **Front Face Lower Right**
- **Front Face Top Center**
- **Front Face Top Left**
- **Front Face Top Right**

PLA MATERIAL

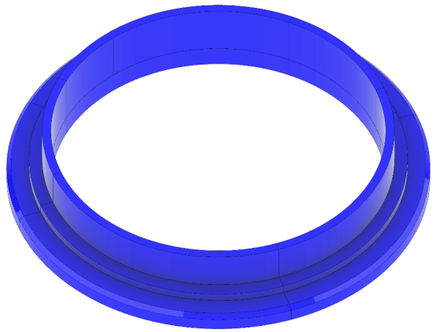
- **Blue** (Sapphire Metallic)

Assemble Front Face



3 Middle Sides

Required Parts

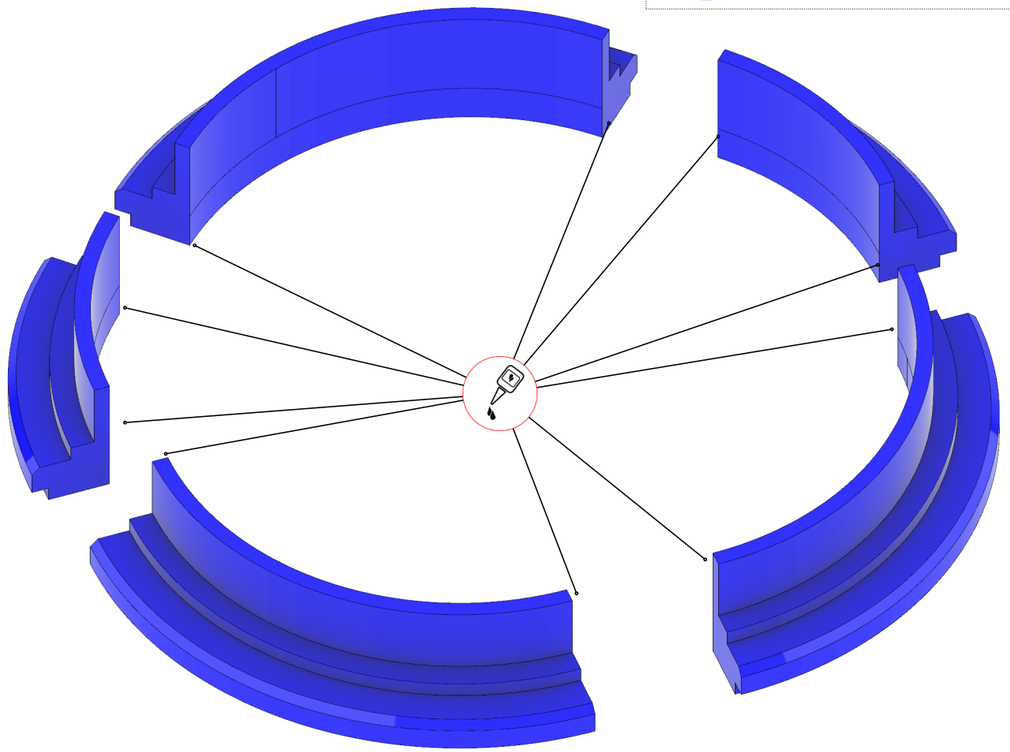


PARTS
- Mid-Side Lower Left
- Mid-Side Lower Right
- Mid-Side Top Center
- Mid-Side Top Left
- Mid-Side Top Right

PLA MATERIAL
- **Blue** (Sapphire Metallic)

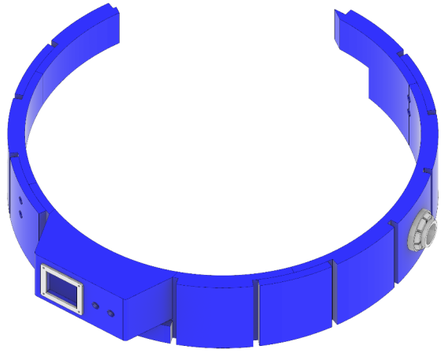
Assemble Middle

TIP - Sand the faces before gluing for a strong bond. Be prepared to secure pieces together while glue sets.



4 Lower Sides

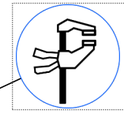
Required Parts



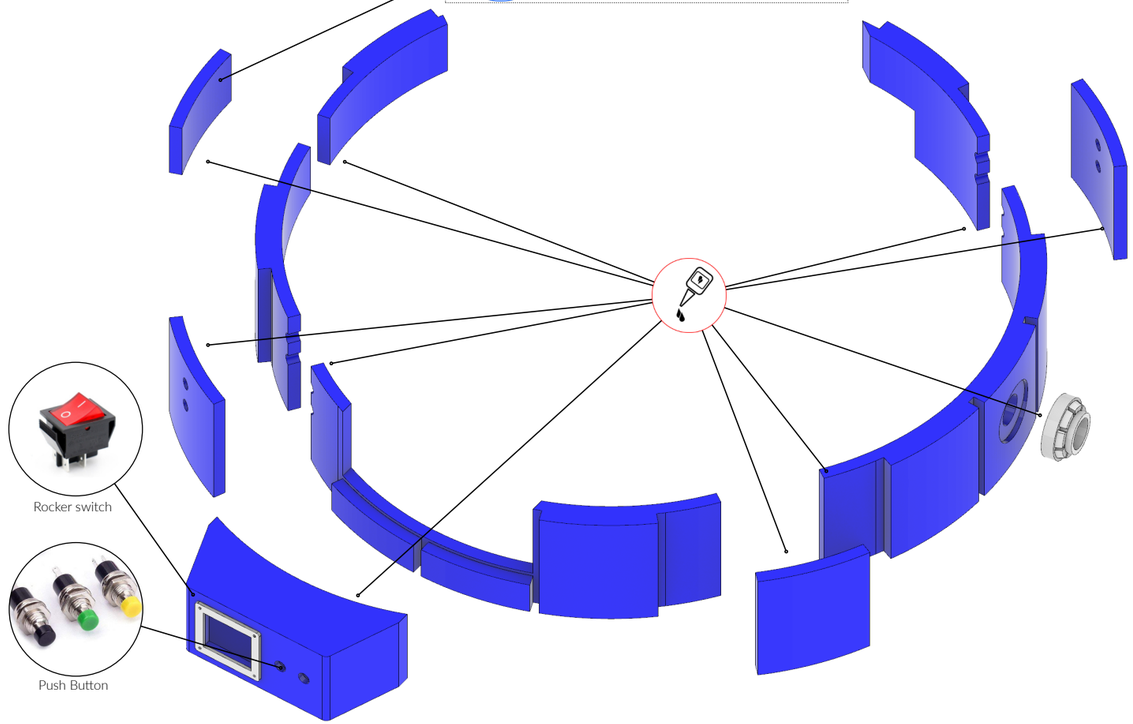
PARTS
- Lower Side Bottom Left
- Lower Side Bottom Right
- Lower Side Top Center
- Lower Side Top Left
- Lower Side Top Right
- Control Box
- Control Box Switch Plate

PLA MATERIAL
- **Blue** (Sapphire Metallic)
- **Sliver** (Sapphire Metallic)

Assemble Lower

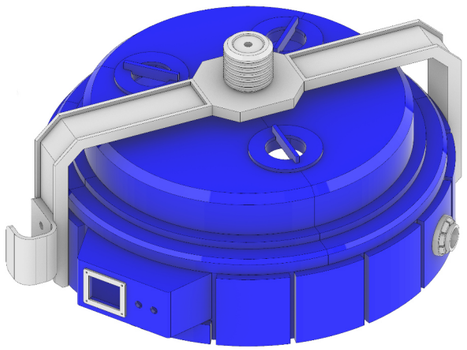


NOTE - The wedges pieces should have a liberal amount of glue applied. I recommend clamping the joints together.



5 Assemble Parts

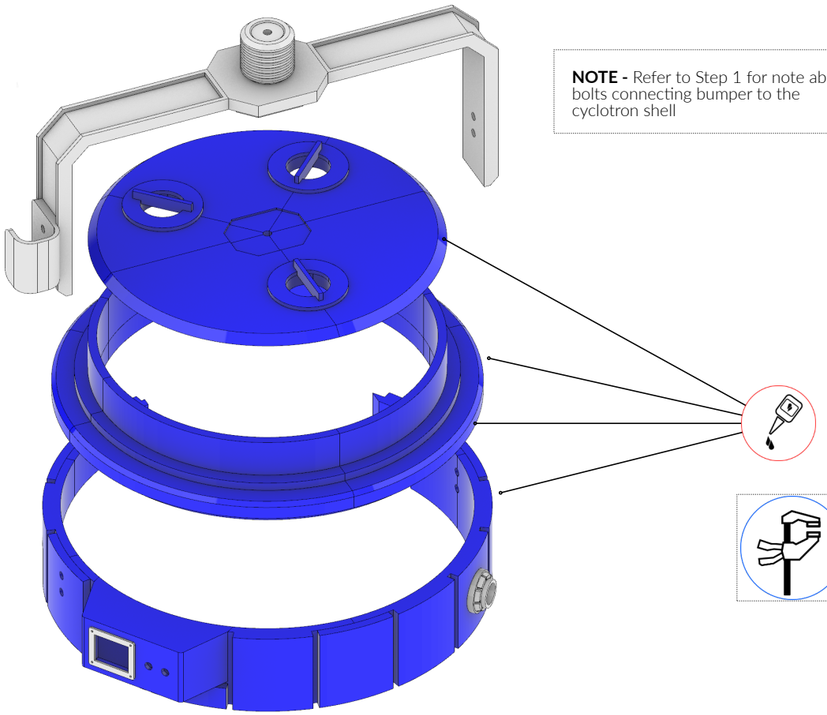
Required Parts



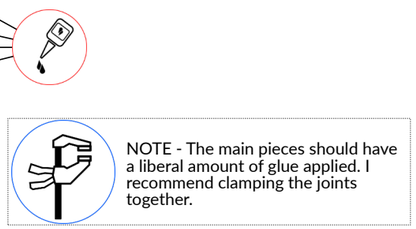
PARTS
- Previous Sections

PLA MATERIAL
- NA

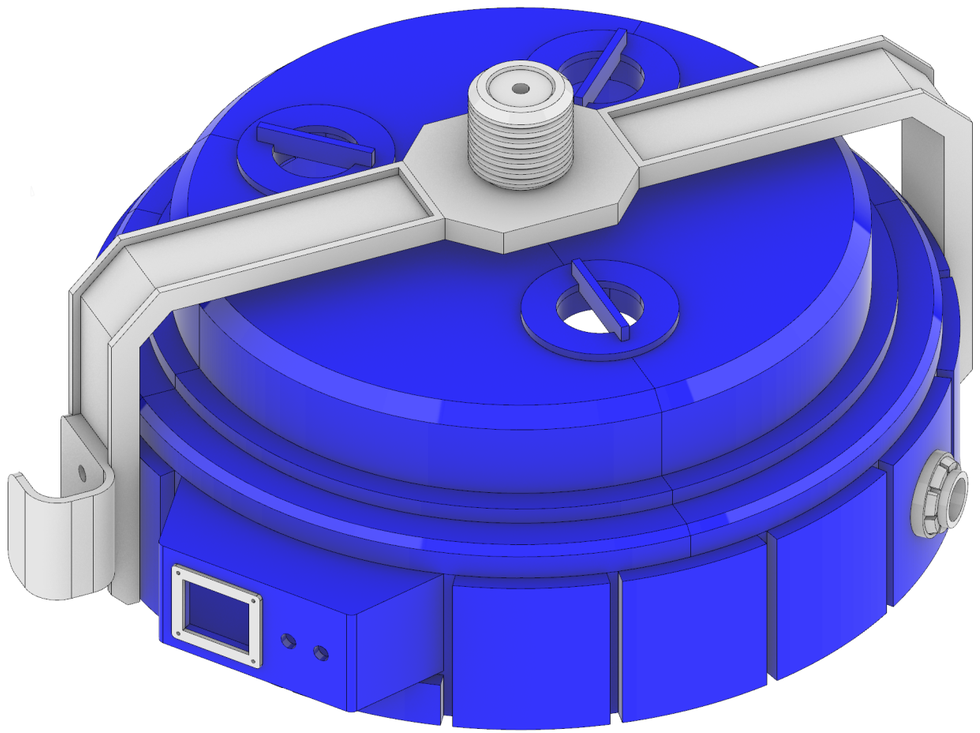
Assemble Cyclotron



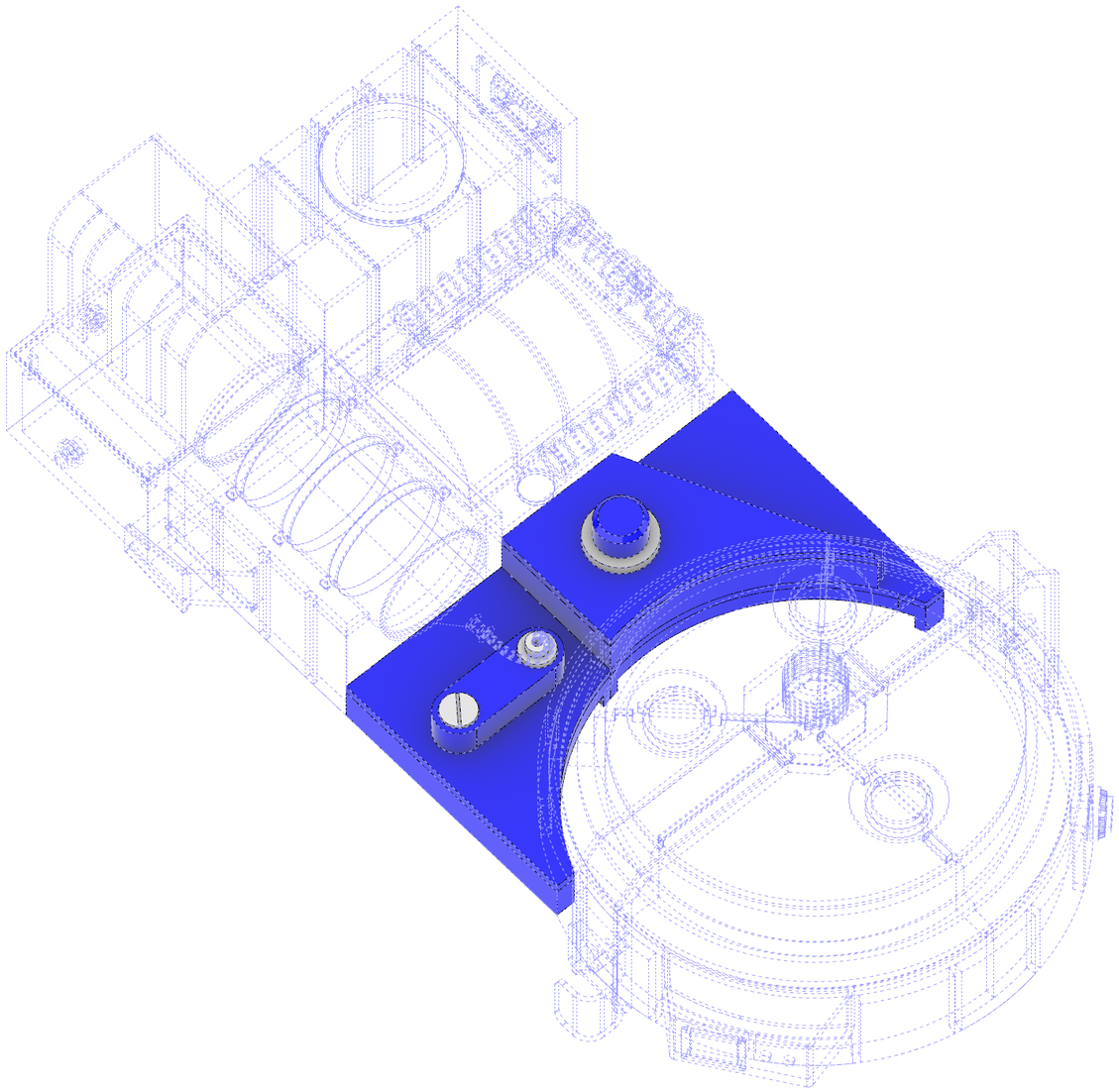
NOTE - Refer to Step 1 for note about bolts connecting bumper to the cyclotron shell



NOTE - The main pieces should have a liberal amount of glue applied. I recommend clamping the joints together.

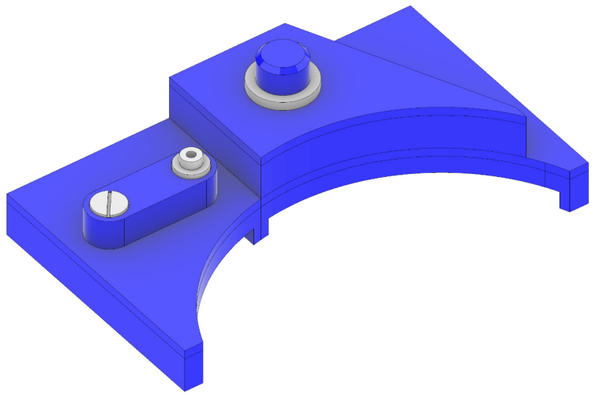


SECTION 2 - Regulator



General Notes

3D Models



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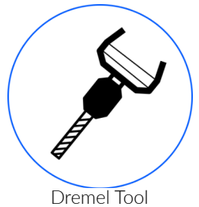
- **Silver** (Sapphire Metallic)

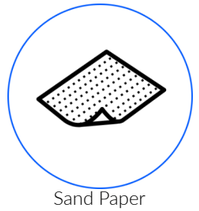
Tools



Dremel Tool

Need Nose Pliers

X-Acto Knife



Sand Paper

Quick Grip Clamps

When printing and assembling, it is recommended you have the following tools on hand:

- Dremel tool
  - 1/16” drill bit
  - 3/32” drill bit
- Needle nose pliers
- Sand paper (200 grit)
- Quick grip clamps (6 inch)
- X-Acto knife

Assembly Materials

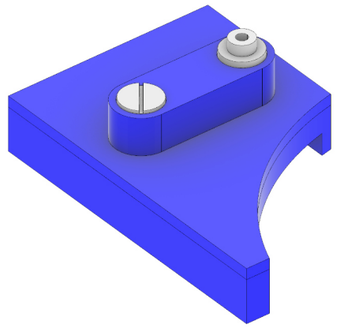
Super Glue

Various hardware is used to assemble the parts. Metric stainless steel hex machine screws, washers, and nuts are the primary hardware used for assembling the 3D Printed PROTON PACK. Gorilla Super Glue is used throughout.

- Super Glue

1 Left Side

Required Parts



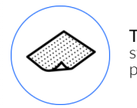
PARTS

- **Left - Frame**
- **Left - Top**
- **Left - Adjustor**
- **Left - Hose Port**

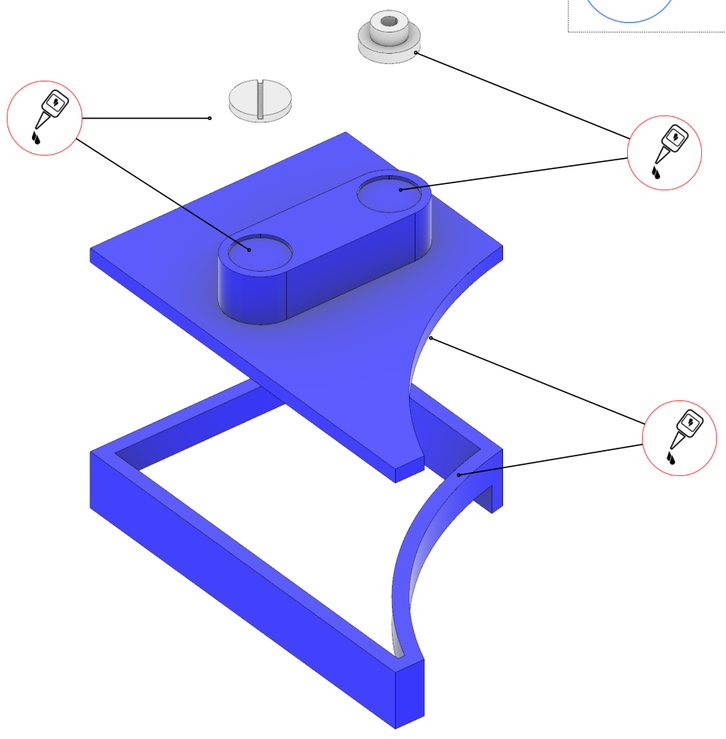
PLA MATERIAL

- **Blue** (Sapphire Metallic)
- **Silver** (Sapphire Metallic)

Assemble Left

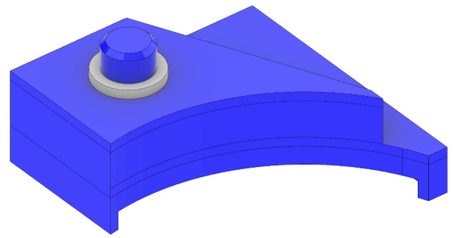


TIP - Sand the faces before gluing for a strong bond. Be prepared to secure pieces together while glue sets.



2 Right Side

Required Parts



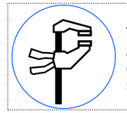
PARTS

- **Right - Lower Frame**
- **Right - Upper Frame**
- **Right Top**
- **Right Light Port**
- **Right Light Hat**

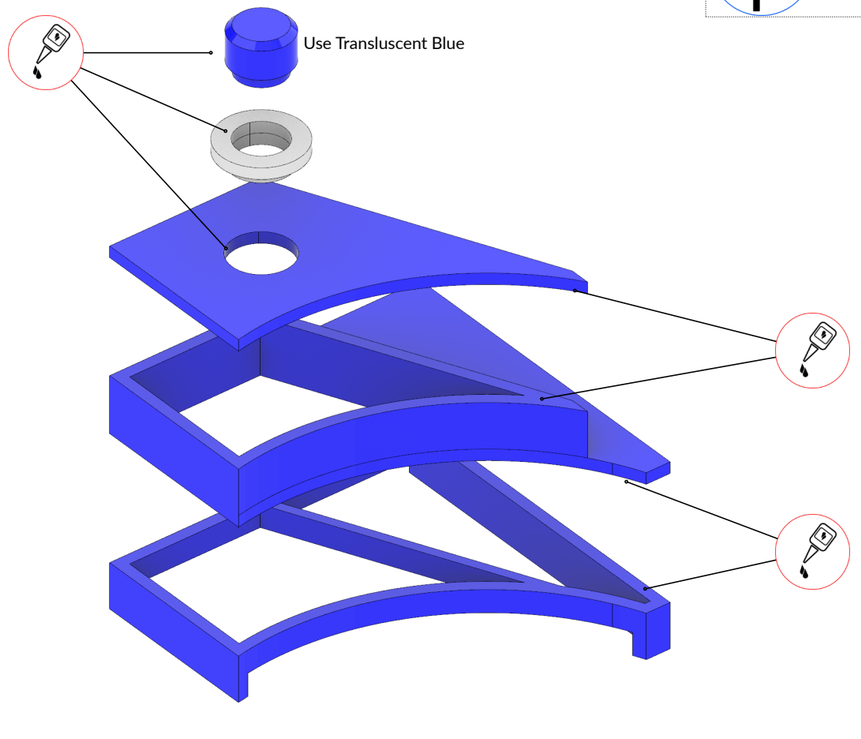
PLA MATERIAL

- **Blue** (Sapphire Metallic)
- **Blue** (Transluscent)
- **Silver** (Sapphire Metallic)

Assemble Right

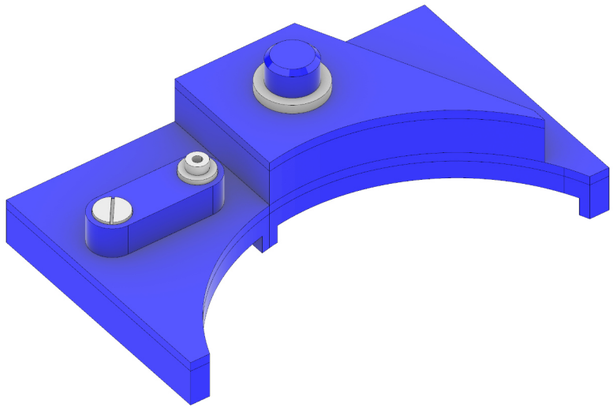


TIP - The pieces should have a liberal amount of glue applied. I recommend clamping the pieces together for a strong bond.



3 Connect Sides

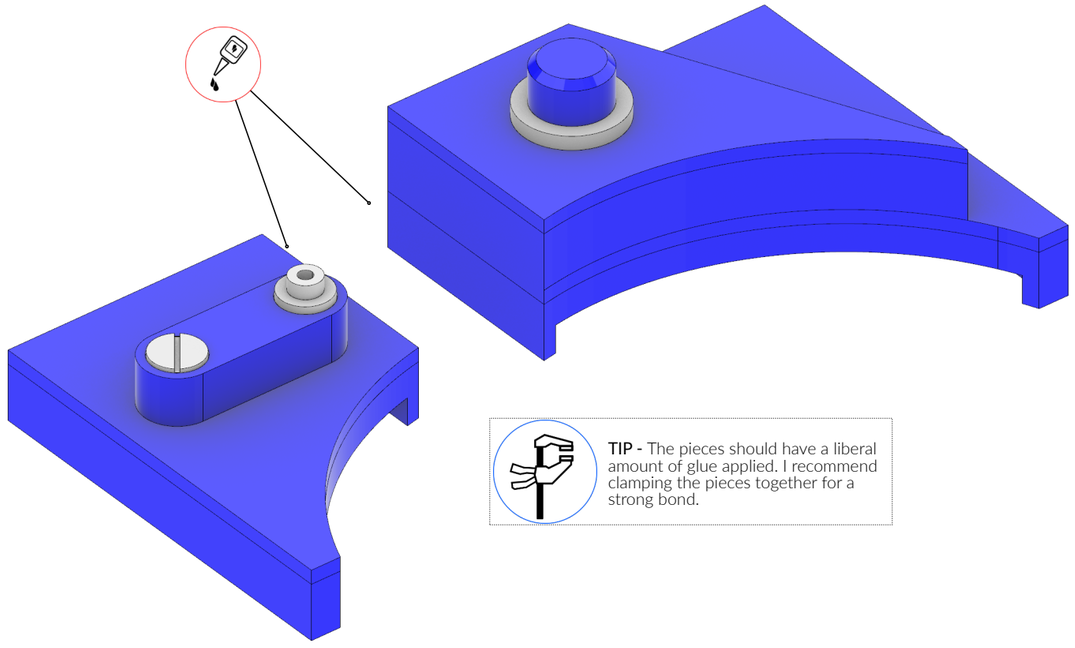
Required Parts



PARTS
- Left Regulator
- Right Regulator

PLA MATERIAL
- NA

Assemble Regulator Sides



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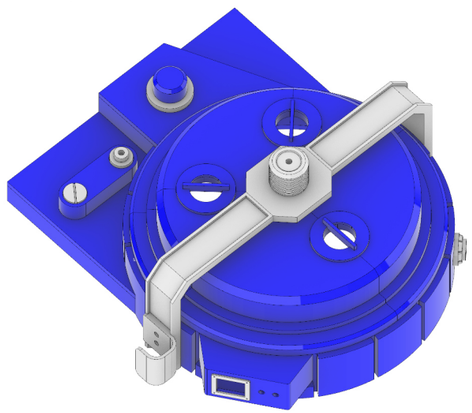
4 Connect Cyclotron

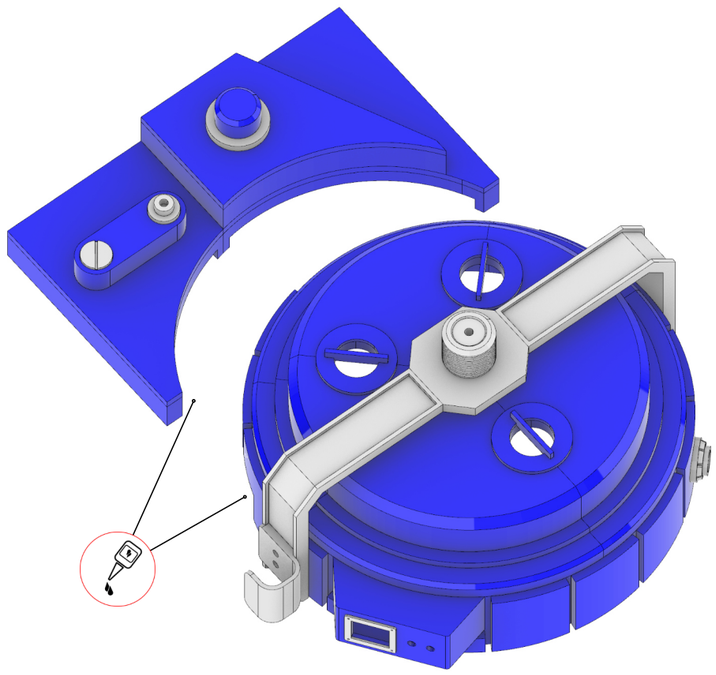
Required Parts

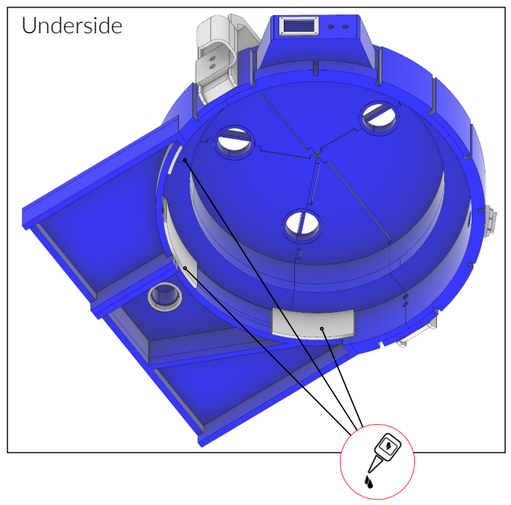


PARTS
- Regulator
- Cyclotron
- Wedge (x3)

PLA MATERIAL
- NA

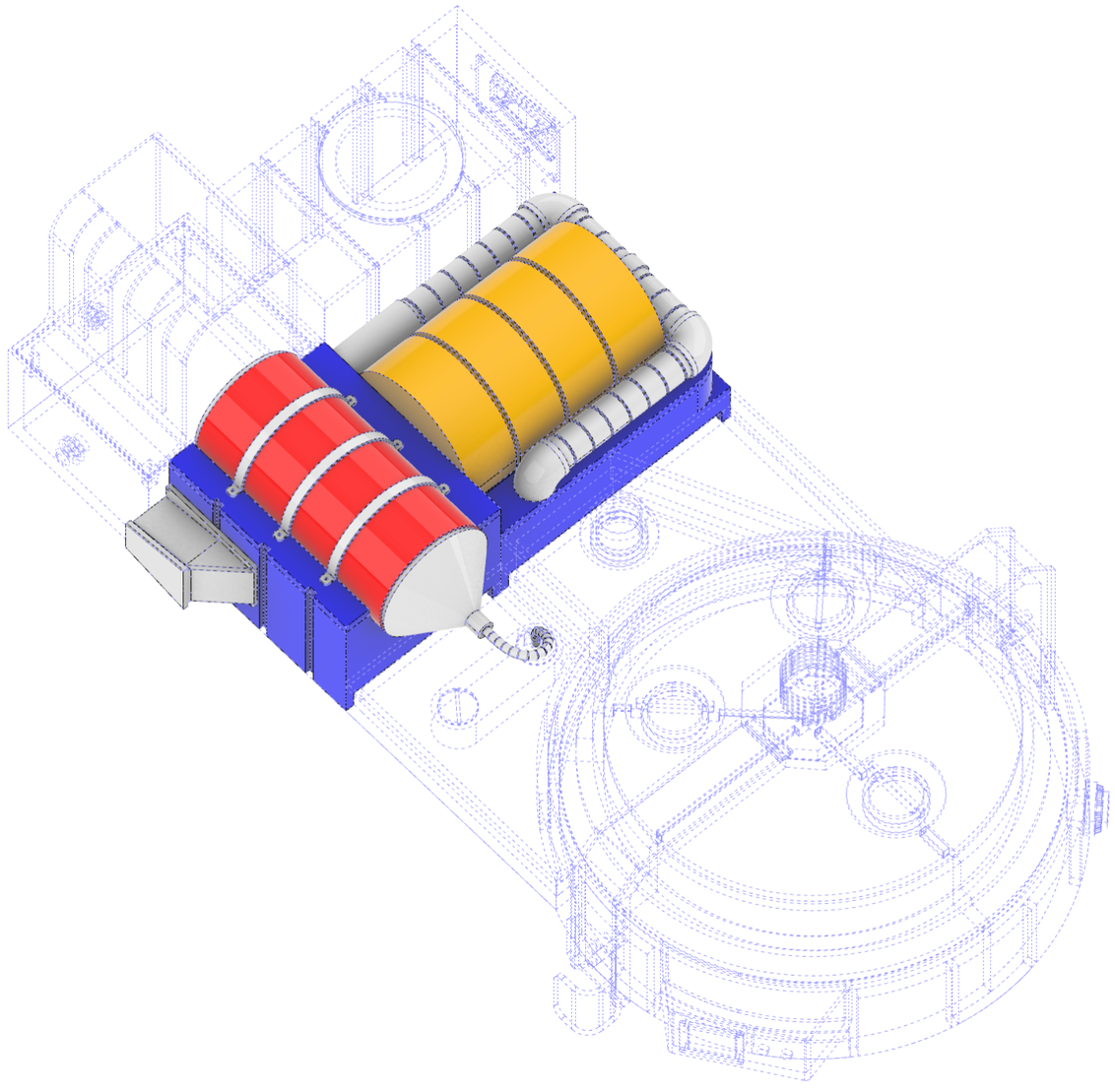
Assemble Regulator





TIP - The pieces should have a liberal amount of glue applied. I recommend clamping the pieces together for a strong bond and let set for 24 hours.

SECTION 3 - Injector & Generator



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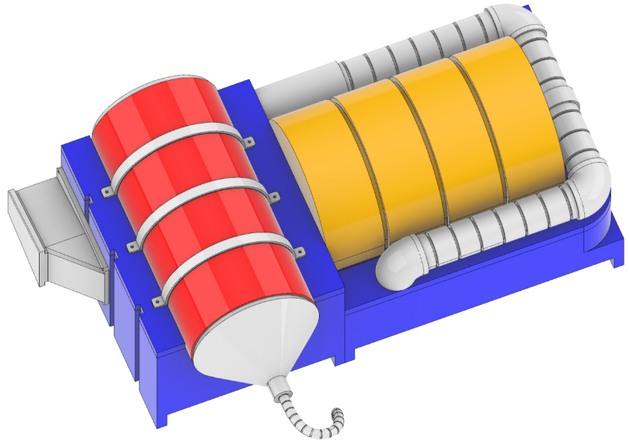

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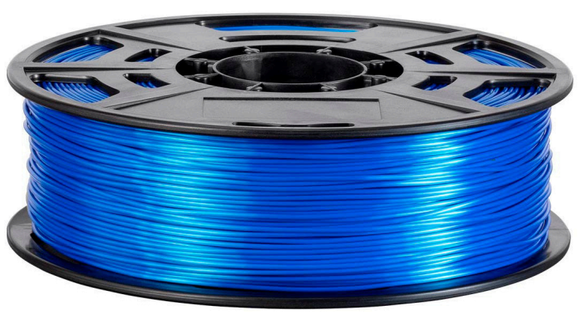

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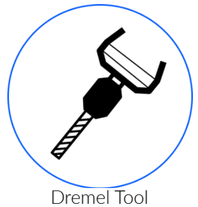
- **Silver** (Sapphire Metallic)

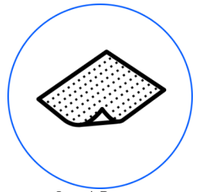
Tools



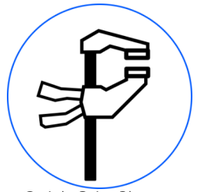
Dremel Tool

Need Nose Pliers

X-Acto Knife



Sand Paper



Quick Grip Clamps

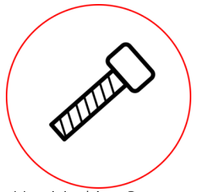
Metric Allen Key

When printing and assembling, it is recommended you have the following tools on hand:

- Allen Key Set (Metric)
- Dremel tool
  - 1/16” drill bit
  - 3/32” drill bit
- Needle nose pliers
- Sand paper (200 grit)
- Quick grip clamps (6 inch)
- X-Acto knife

Assembly Materials

Super Glue



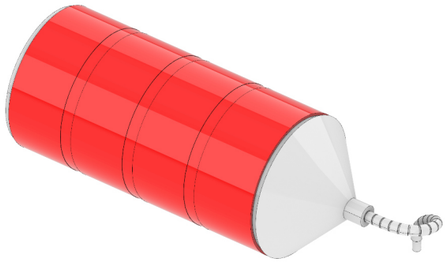
Hex Machine Screws

Various hardware is used to assemble the parts. Metric stainless steel hex machine screws, washers, and nuts are the primary hardware used for assembling the 3D Printed PROTON PACK. Gorilla Super Glue is used throughout.

- Super Glue
- **M2** Screw, Nuts, Washers
  - Diameter: 2mm
  - Lengths: 6mm, 8mm

1 Injector Cannister

Required Parts



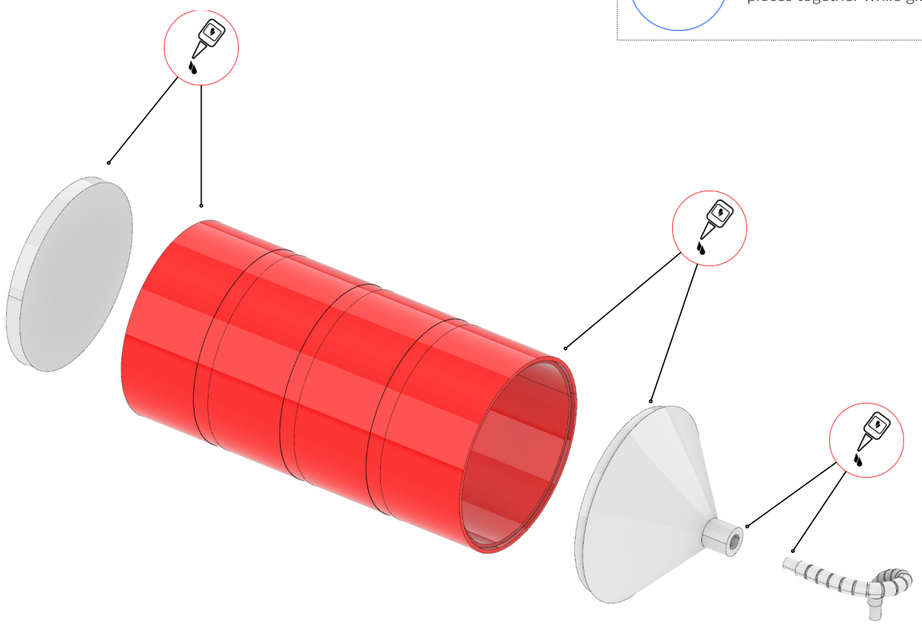
PARTS

- Injector Cannister
- Injector Case
- Funnel
- Regulator Tube

PLA MATERIAL

- **Silver** (Sapphire Metallic)
- **Red** (Sapphire Metallic)

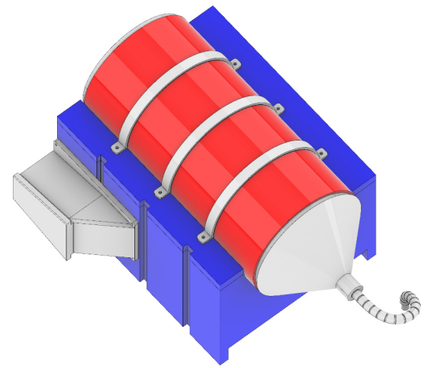
Assemble Injector Tube



TIP - Sand the faces before gluing for a strong bond. Be prepared to secure pieces together while glue sets.

2 Injector Case

Required Parts



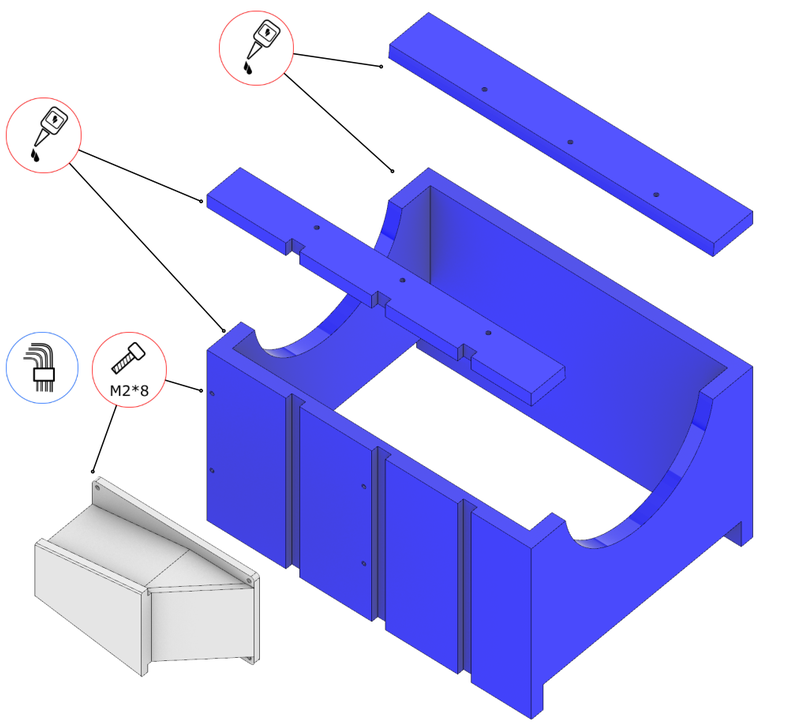
PARTS

- Case
- Case Top Right
- Case Top Left
- Trap Hook
- Support Band (x3)

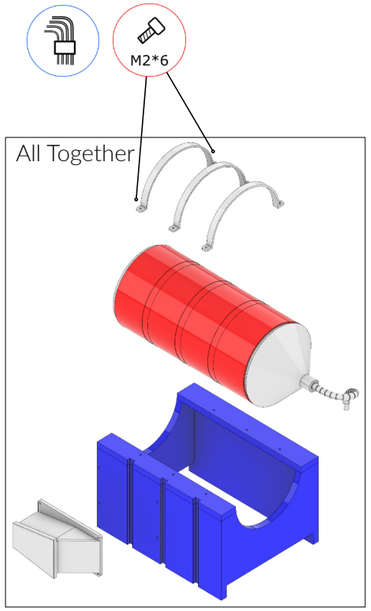
PLA MATERIAL

- **Blue** (Sapphire Metallic)
- **Blue** (Transluscent)
- **Silver** (Sapphire Metallic)

Assemble

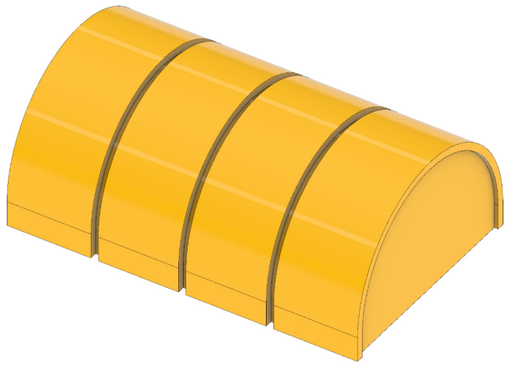


TIP - The pieces should have a liberal amount of glue applied. I recommend clamping the pieces together for a strong bond.



3 Generator Shell

Required Parts



PARTS

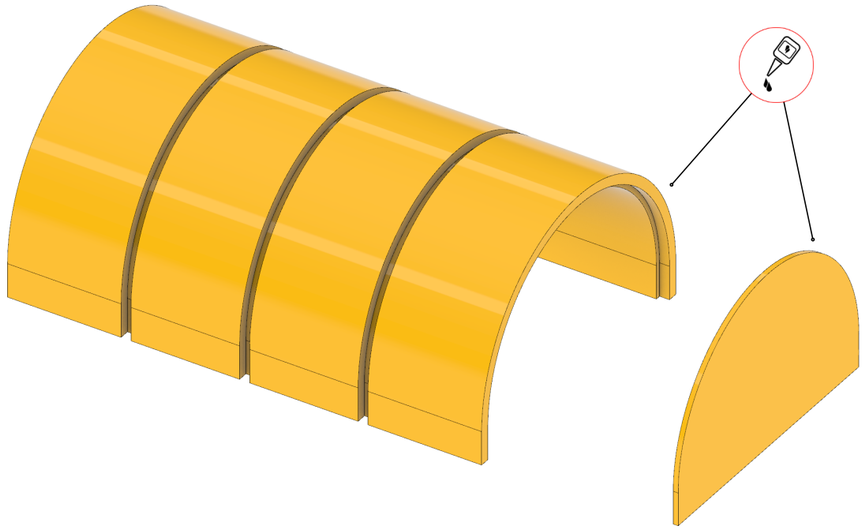
- **Generator Shell**
- **Generator Shell Cap**

PLA MATERIAL

- **Gold** (Sapphire Metallic)

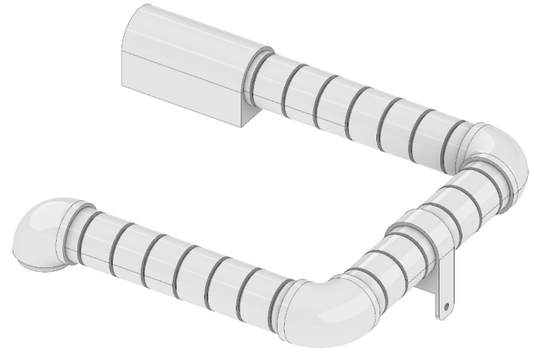
TIP - The pieces should have a liberal amount of glue applied. I recommend clamping the pieces together for a strong bond.

Assemble Generator Shell



4 Generator Tube

Required Parts



PARTS

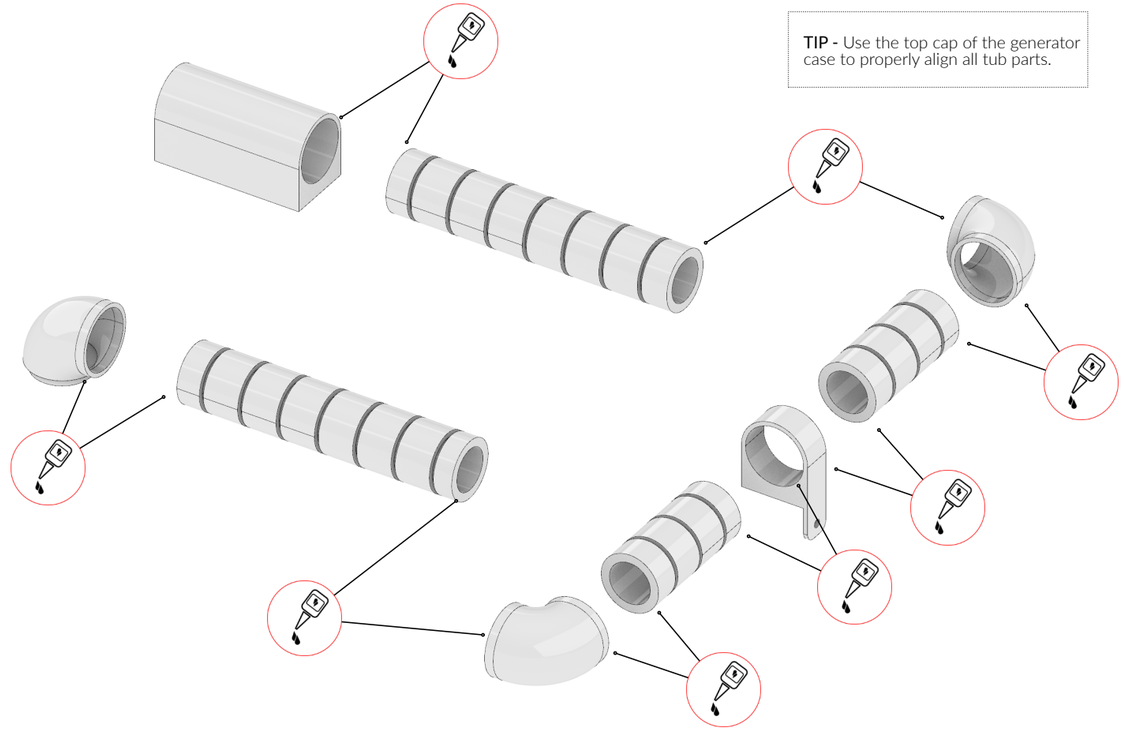
- **Tube - Elbow 1**
- **Tube - Elbow 2**
- **Tube - Fastener**
- **Tube - Intake**
- **Tube - Outtake**
- **Tube - Segment 1**
- **Tube - Segment 2**
- **Tube - Segment 3**
- **Tube - Segment 4**

PLA MATERIAL

- **Silver** (Sapphire Metallic)

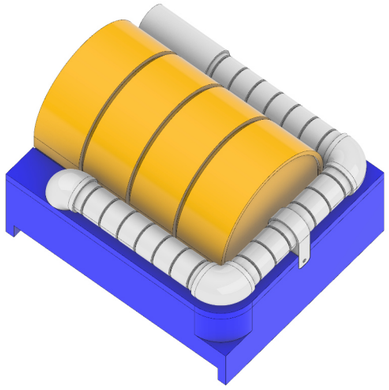
Assemble Generator Tube

TIP - Use the top cap of the generator case to properly align all tub parts.



5 Generator Case

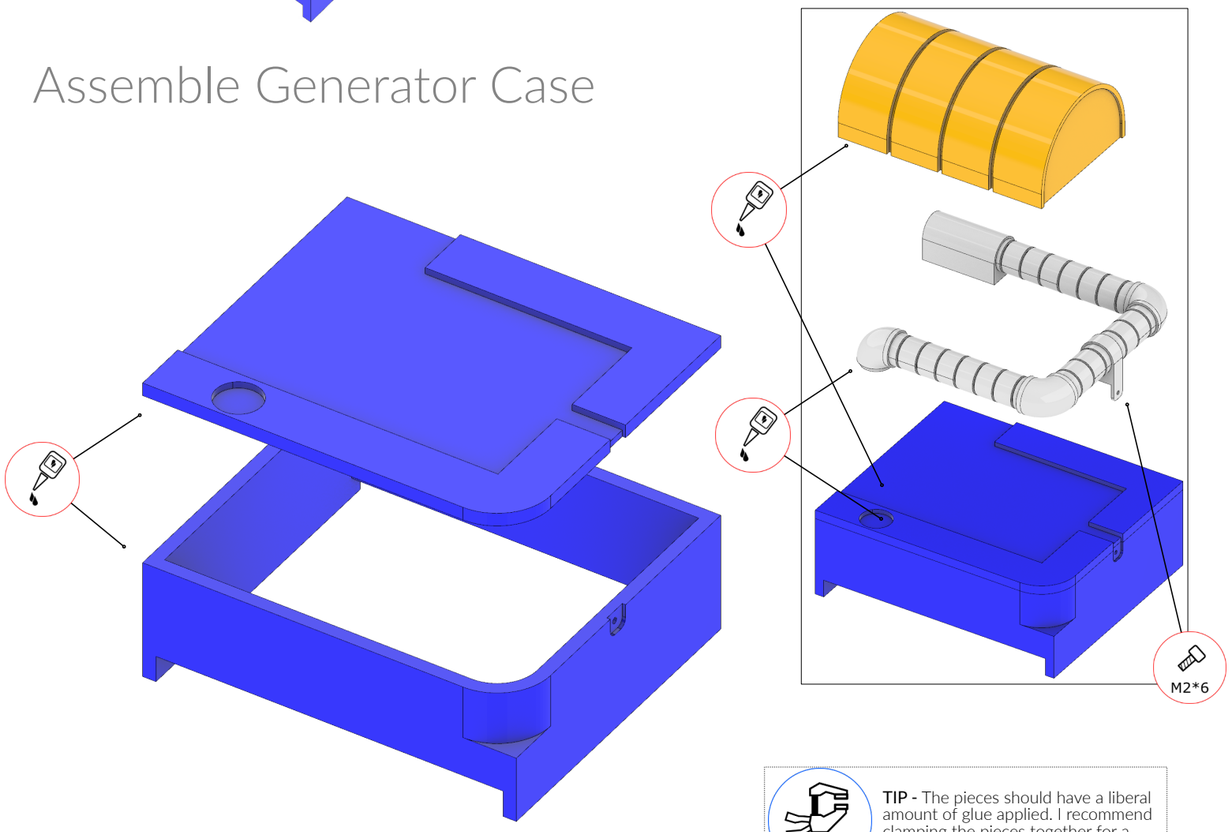
Required Parts



PARTS
- Case
- Case Top

PLA MATERIAL
- **Blue** (Sapphire Metallic)

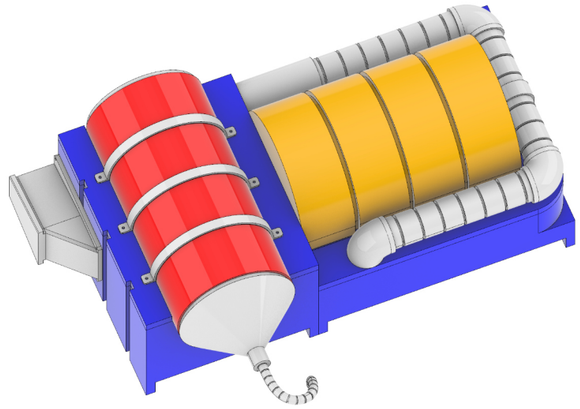
Assemble Generator Case



TIP - The pieces should have a liberal amount of glue applied. I recommend clamping the pieces together for a strong bond.

6 Final Assembly

Required Parts

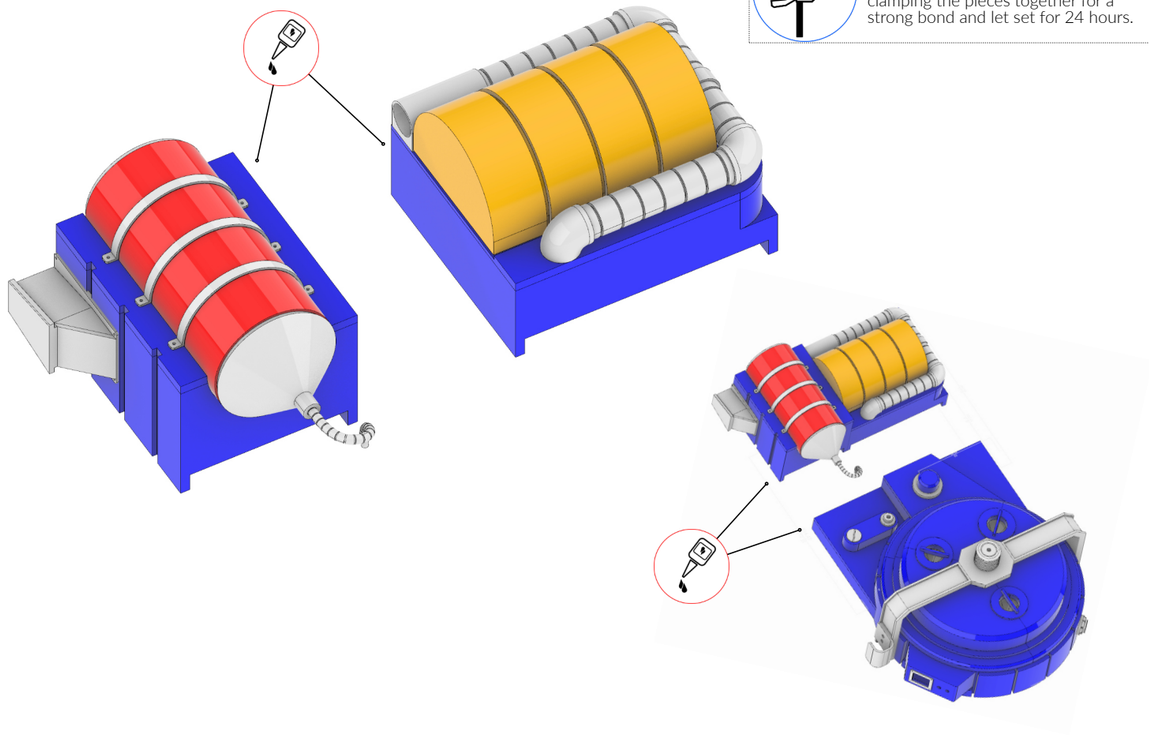


PARTS
- Injector
- Generator
-

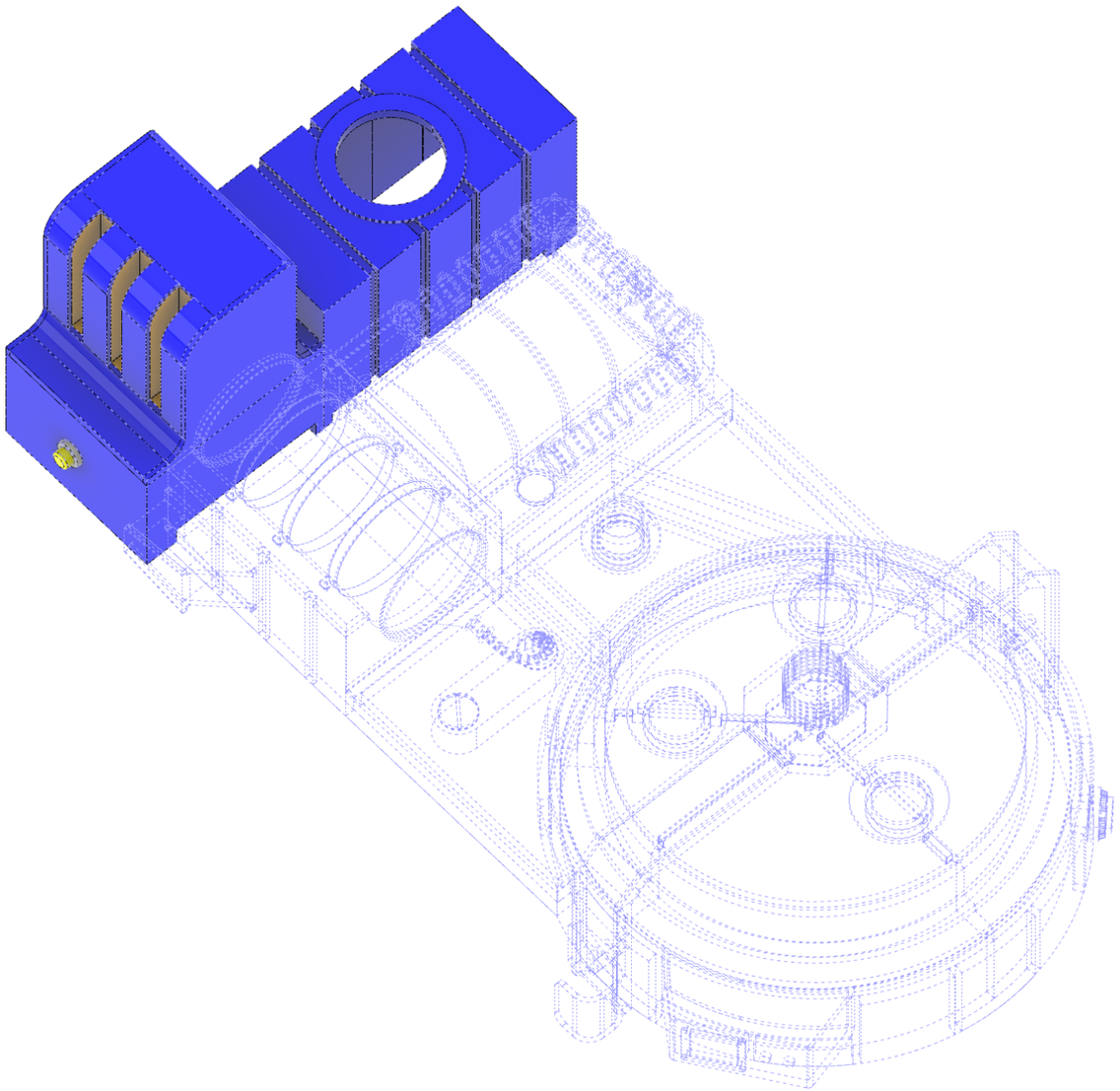
PLA MATERIAL
- NA

Assemble Injector & Generator

TIP - The pieces should have a liberal amount of glue applied. I recommend clamping the pieces together for a strong bond and let set for 24 hours.

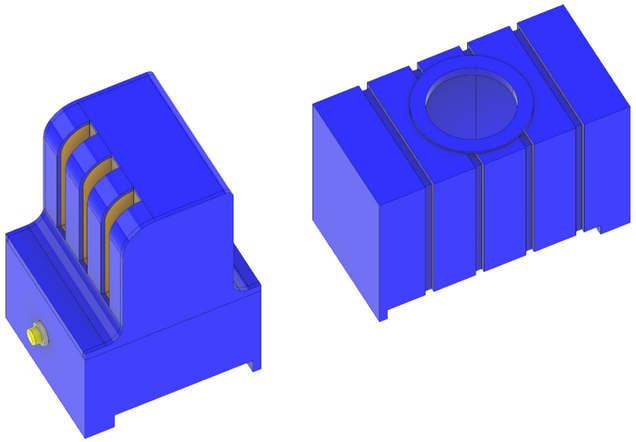


SECTION 3 - Ion Arm & Power Cell



General Notes

3D Models



The 3D models were authored from scatch using Rhinoceros 3D (Rhino) - a professional-grade CAD and geometry software package. Rhino is known for providing free-form modeling capabilities and achieving dimensionally accurate geometry.

Rhino also possesses robust geometry analysis tools allowing designers to test surface fidelity, solid, and edge analysis that are essential for producing high-quality, water-tight parts.

The files were exported to the STL file format using mesh settings that fall within a 0.01 mm tolerance from the original solid CAD model. STLs are readable by CURA software where the G-Code used by the 3D printer can be prepared.

The 3D printer parts, tolerances, constraints, and dimensions have been designed and tested with the basic Ender 3 by Creality which features a print bed area of 220 x 220 mm.

The Ender 3 is an affordable consumer-grade 3D printer and a great starting point for hobbyists interested in 3D printing. The author found this printer to be quite accurate and produce very good quality prints that can be used “off the bed” with very little post-modification.

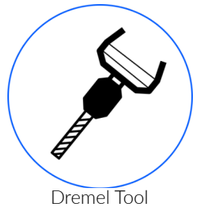
G-Code files for the Ender 3 were prepared with the free and open source CURA Ultimaker software. Print settings were adjusted periodically for best results with attention to infill density, layer size, speed, and support strategy.

PLA Material

All 3D printed parts described in this document use a polylactic acid (PLA) material which is derived from renewable resources. The following PLA colors are used in the 3D Printed PROTON PACK

- **Blue** (Sapphire Metallic)
- **Silver** (Sapphire Metallic)
- **Yellow** (Transluscent)
- **Red** (Transluscent)

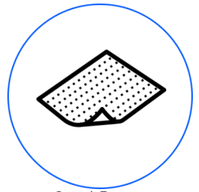
Tools



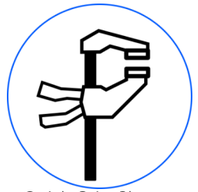
Dremel Tool

Need Nose Pliers

X-Acto Knife



Sand Paper



Quick Grip Clamps

Metric Allen Key

When printing and assembling, it is recommended you have the following tools on hand:

- Allen Key Set (Metric)
- Dremel tool
  - 1/16” drill bit
  - 3/32” drill bit
- Needle nose pliers
- Sand paper (200 grit)
- Quick grip clamps (6 inch)
- X-Acto knife

Assembly Materials

Super Glue

Hex Machine Screws

Various hardware is used to assemble the parts. Metric stainless steel hex machine screws, washers, and nuts are the primary hardware used for assembling the 3D Printed PROTON PACK. Gorilla Super Glue is used throughout.

- Super Glue
- **M3** Screw, Nuts, Washers
  - Diameter: 3mm
  - Lengths: 6mm, 8mm

Special Parts

Voltage Meter

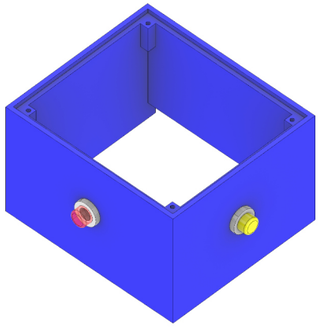
Flat Head Machine Screws

The PROTON PACK design requires several special parts be purchased to complete the design:

- Analog voltage meter
- Flat Head Machine Screws (10-24)

Ion Arm Base

Required Parts



PARTS

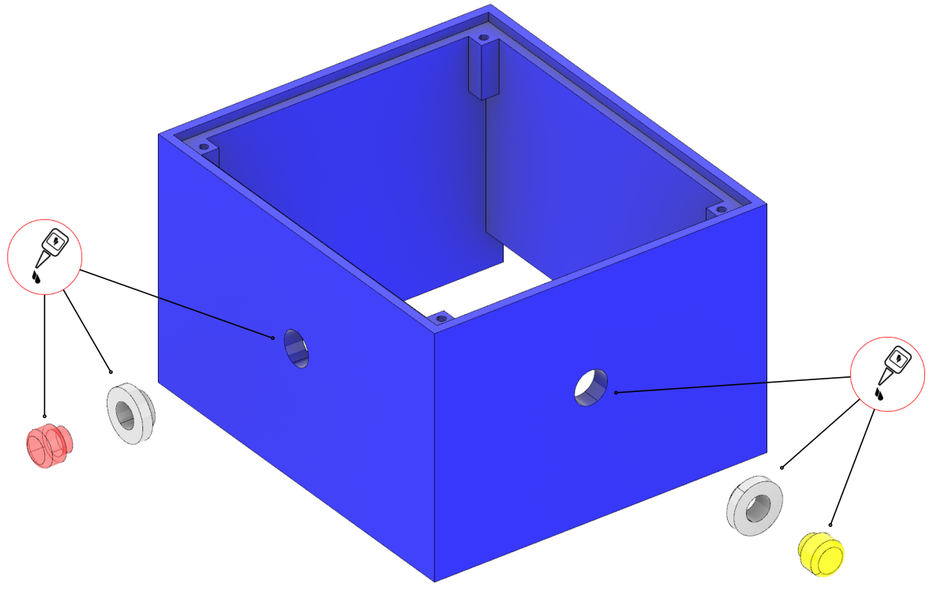
- **Light Hat (Yellow)**
- **Light Hat (Red)**
- **Light Base**
- **Lower Case**

PLA MATERIAL

- **Blue** (Sapphire Metallic)
- **Silver** (Sapphire Metallic)
- **Yellow** (Transluscent)
- **Red** (Transluscent)

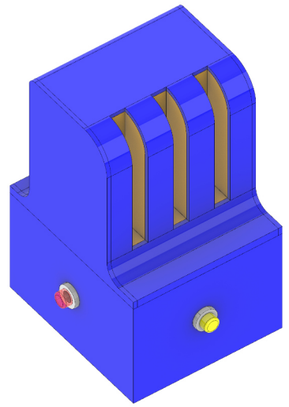
Assemble Base

TIP - Sand the faces before gluing for a strong bond. Be prepared to secure pieces together while glue sets.



Ion Arm Top

Injector Case



PARTS

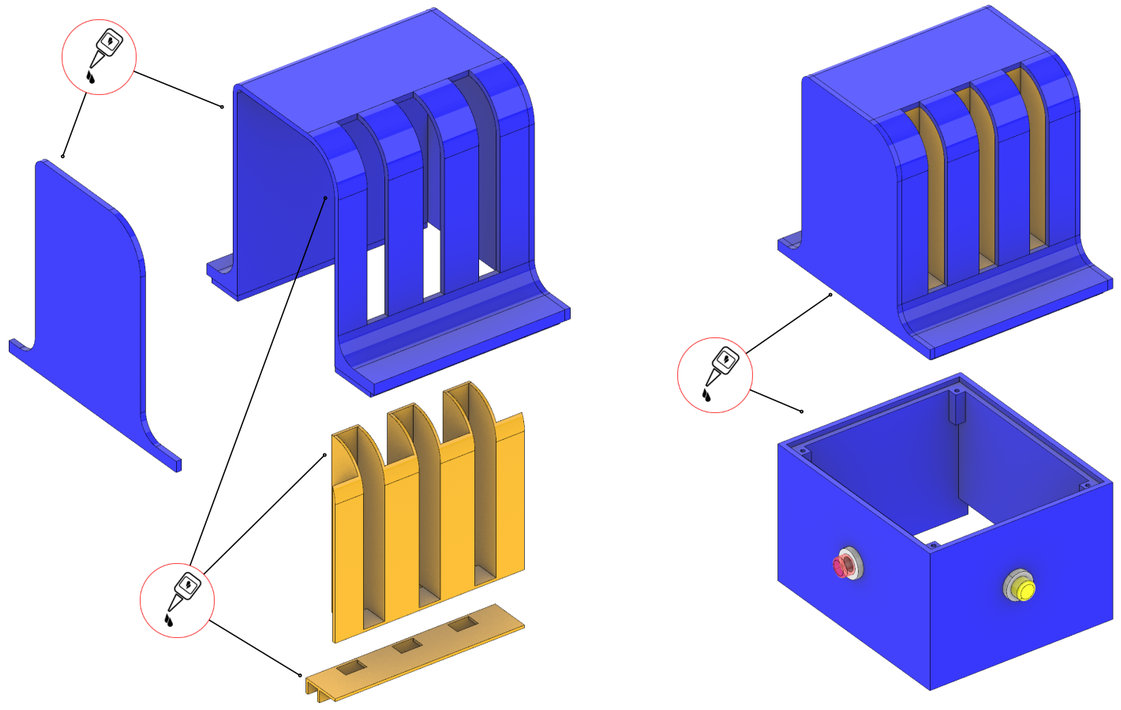
- **Light Reveal**
- **Light Ports**
- **Top Case**

PLA MATERIAL

- **Blue** (Sapphire Metallic)
- **Silver** (Sapphire Metallic)

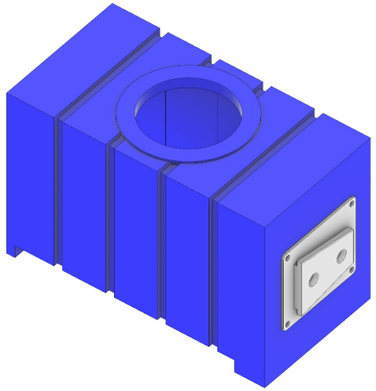
Assemble Top

TIP - The pieces should have a liberal amount of glue applied. I recommend clamping the pieces together for a strong bond.



3 Power Cell

Required Parts



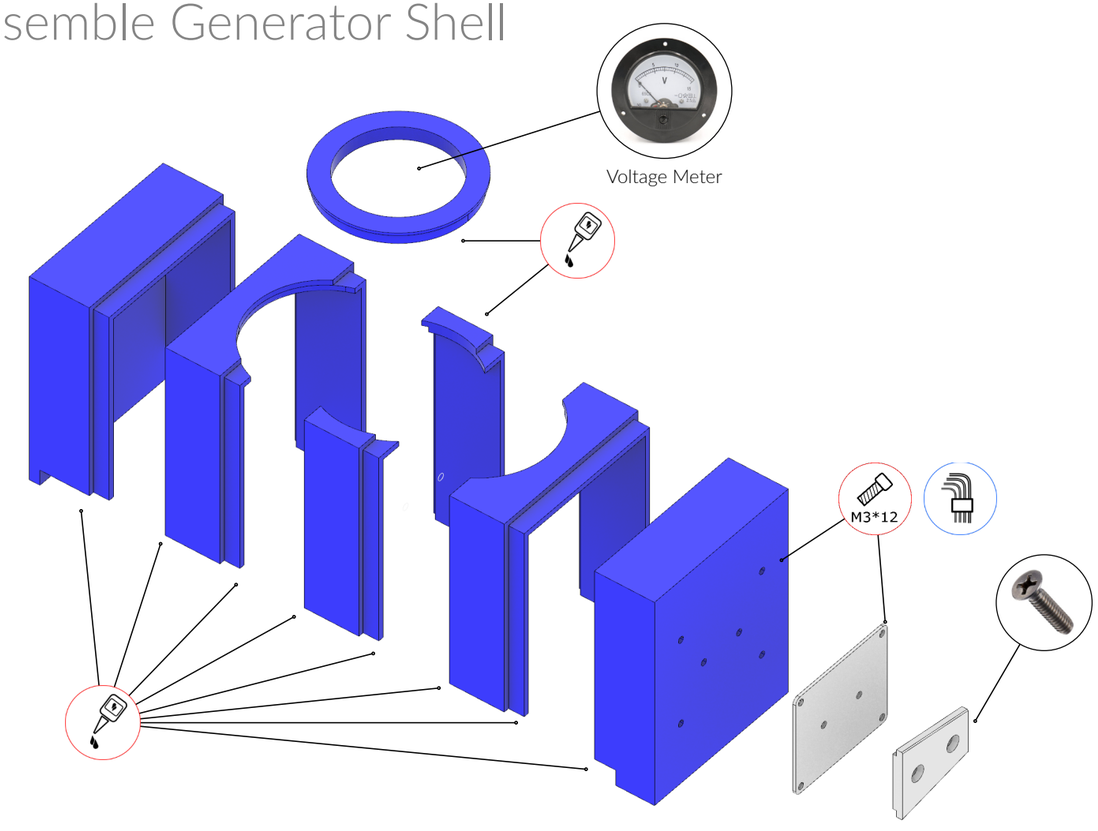
PARTS

- Section 1
- Section 2
- Section 3A
- Section 3B
- Section 4
- Section 5
- V-hook plate
- V-hook

PLA MATERIAL

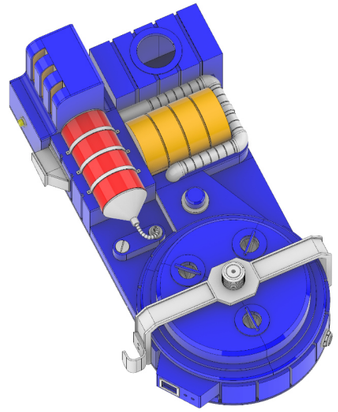
- **Blue** (Sapphire Metallic)
- **Silver** (Sapphire Metallic)

Assemble Generator Shell



4 Final Shell Assembly

Required Parts



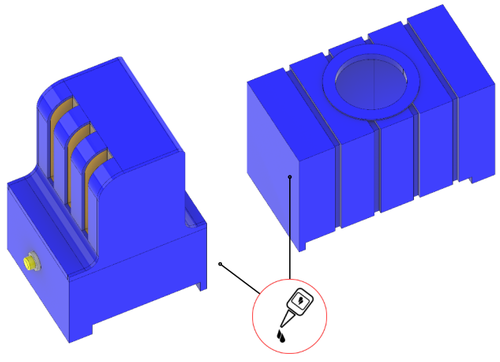
PARTS

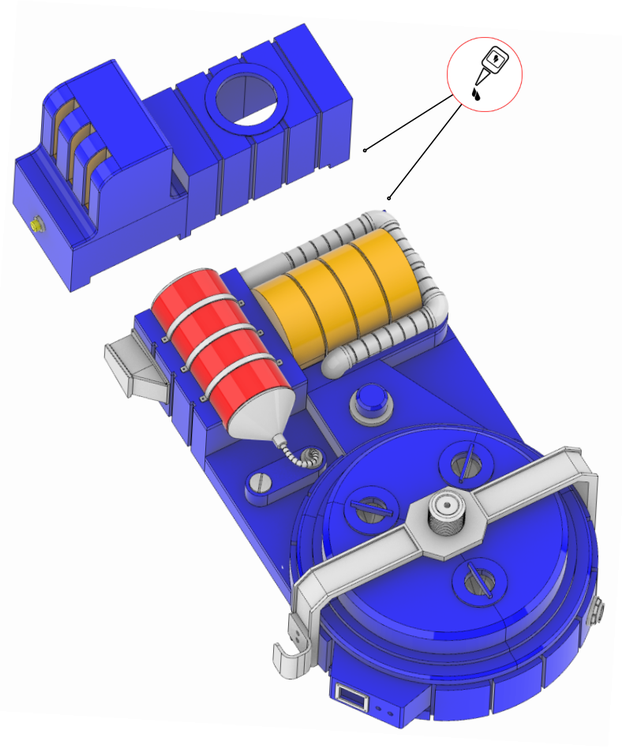
- Previous parts
- Cyclotron
- Regulator
- Injector
- Generator
- Ion Arm
- Power Cell

PLA MATERIAL

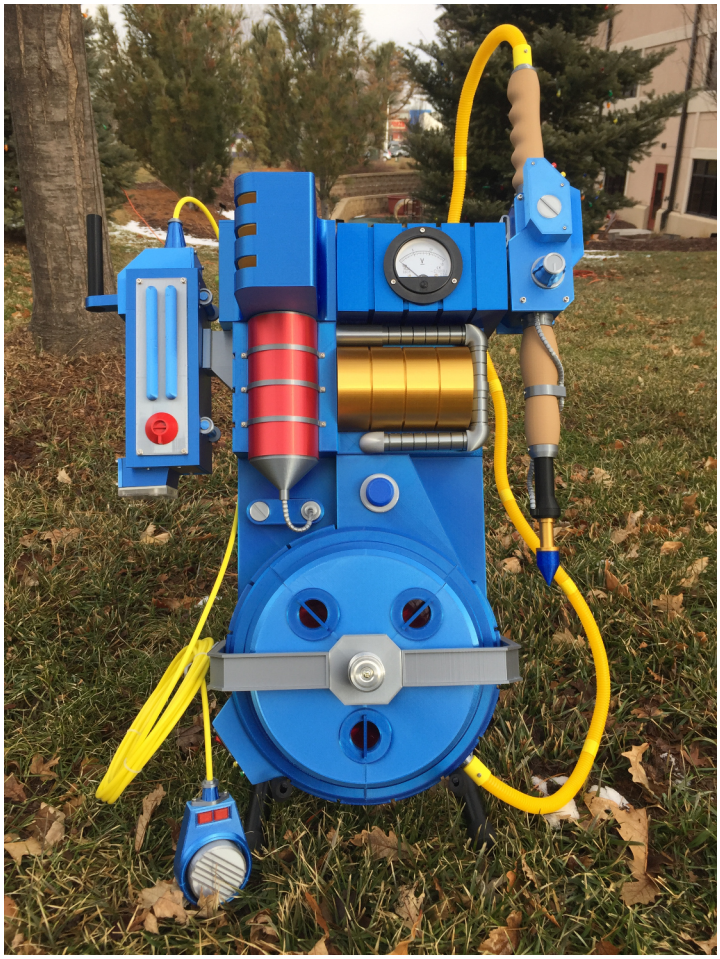
- NA

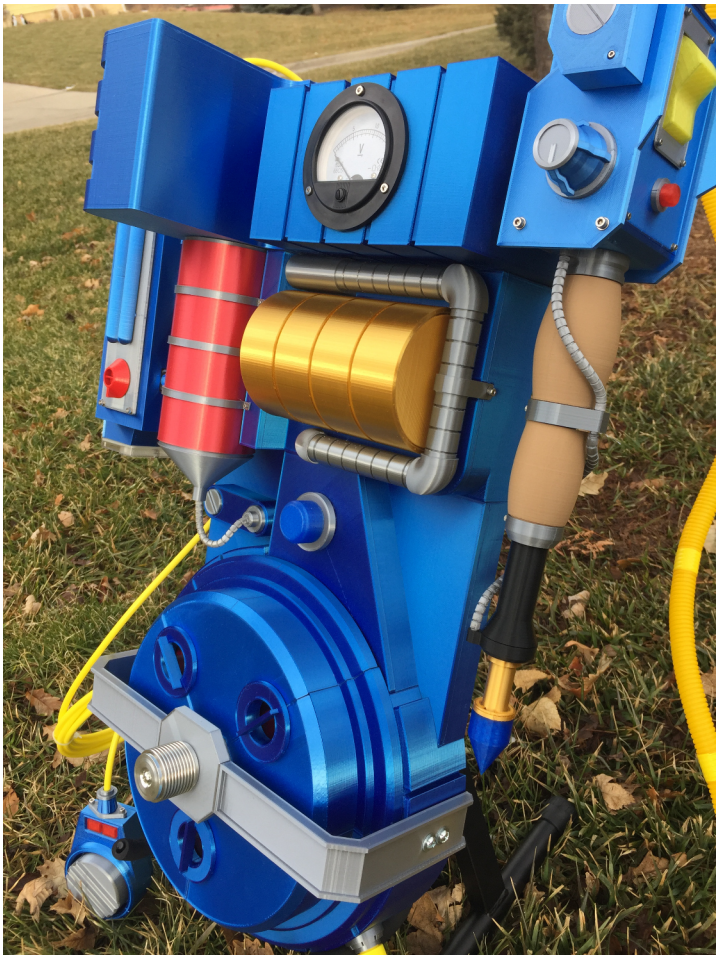
Assemble Generator Tube





TIP - The pieces should have a liberal amount of glue applied. I recommend clamping the pieces together for a strong bond.





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