



User Guide

Simple Super Structure



Additional Instructions Available:

We encourage customers to seek product information at www.andymark.com. Contact us via e-mail at support@andymark.com, or call Toll-Free 877-868-4770 with questions about any of our products.

Revision History:










First Release 9/7/19

Simple Super Structure (S3):

The AndyMark Simple Super Structure (S3) system is designed as a bolt-together solution for rigid, robust structures. The small size is ideal for *FIRST* Tech Challenge robots, appendages and sub-frames of *FIRST* Robotics Competition robots, or other small mechanical structures. The system is designed around several key details:

- Custom Extruded 16mm square tubing, chosen for compatibility with common *FIRST* Tech Challenge parts while taking up less space on volume-limited robots.
- Fully-boxed profile, which is stronger than C-Channels for added robustness.
- Use of 6-32 hardware for easy integration with our other *FIRST* Tech Challenge friendly parts and other common building systems.
- 16mm slots on two faces of the tubing to allow for the adjustment you need on belt and chain runs and off-grid structures.
- 16mm global bolt spacing with 8mm bores every 32mm on two faces of the tubing to provide ample mounting possibilities for Nubs, PicoBox gears, 24-tooth pulleys, and more!
- Gussets provide robust and secure connections at a variety of pre-defined or adjustable positions and angles.

Recommended Tool List:

Component	Part Number	Part Photo
3mm Hex Driver	am-3688	
5/32 in. Ball End Hex Driver	am-2751	
3/32 in. Ball End Hex Driver	am-3173	
5/16 in. Nut Driver	am-1273	
1/4 in. Nut Driver	am-3677	
1/4 in. – 5/16 in. Open End Wrench	am-3174	
3/8 in. – 7/16 in Open End Wrench	am-2745	
5/8 in. Combination Wrench		
7mm Combination Wrench		

Extrusion

The S3 extrusion sets the tone for all other S3 related parts and products. Made from 6061-T6 Aluminum, this box tube is strong and sturdy. Clearance holes for 6-32 screws are spaced every 16mm creating a grid for interfacing with gussets, Nubs, PicoBoxes, gears, and sprockets. 8mm holes every 32mm also provide an interface for products with a boss. 16mm long slots on two faces also allow for adjustability in belt or chain driven mechanisms and enable precision alignment of your structure to get the exact fit your design requires.

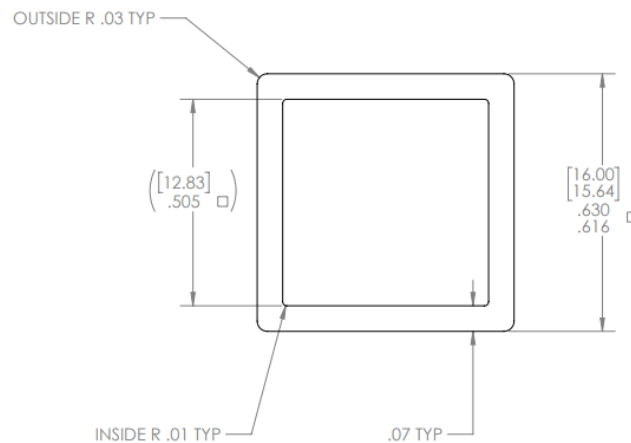


Figure 1: S3 Tube Cross Section

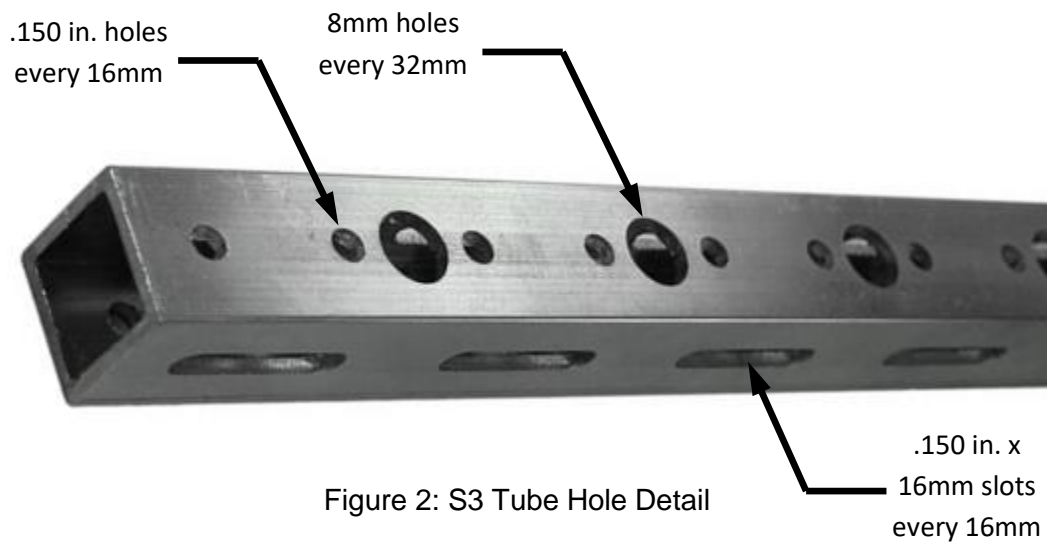


Figure 2: S3 Tube Hole Detail

Part Number	Extrusion Length
am-3594-128	128mm (5.04 in)
am-3594-256	256mm (10.08 in)
am-3594-336	336mm (13.23 in)
am-3594-448	448mm (17.64 in)

Gussets and Plates

All gussets and plates within the S3 system feature 6-32 mounting holes on a 16mm grid. This means gussets can be attached to a single piece of S3 tubing or can span multiple tubes to create larger structures. See individual product pages at www.andymark.com for more information.



Figure 3:
S3, Joiner Gusset
am-3601



Figure 4:
S3, Variable Degree Gusset
am-3603

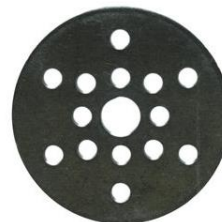


Figure 5:
S3, 32mm Pulley Plate
am-3686-32



Figure 6:
S3, Tee Gusset
am-3598



Figure 7:
S3, Corner Gusset
am-3606

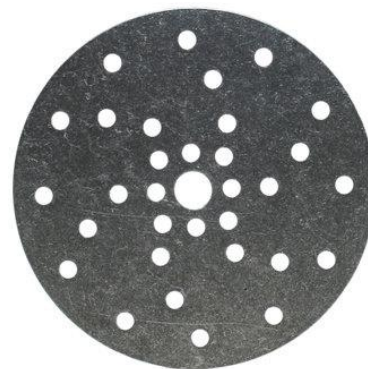


Figure 8:
S3, 64mm Pulley Plate
am-3686-64



Figure 9:
S3, 90 Degree Gusset
am-3602

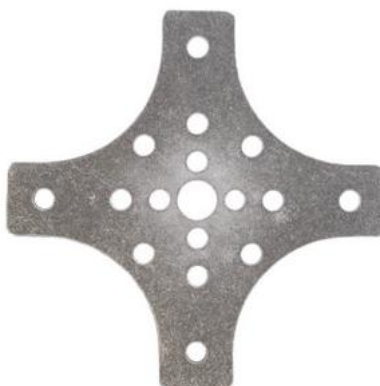


Figure 10:
S3, 90 Degree Gusset
am-3602



Figure 11:
S3, Battery Mount Bracket
am-3687

Gusseted Connections

You can join tubes together and create strong, structurally rigid connections using any of the gussets or brackets. You can use 1 gusset per joint, or 1 on each side for a stronger connection. The 6-32 hex head bolts (recommended) will go all the way through to a lock nut (am-1419 recommended) on the opposite side. We suggest using at least 2 bolts per tube per connection to ensure a secure joint. Even the slots may be used but additional hardware may be required to keep the tube from sliding (if desired). Try using Plastic Push in Rivets (am-1504) to temporarily hold your parts together during assembly!

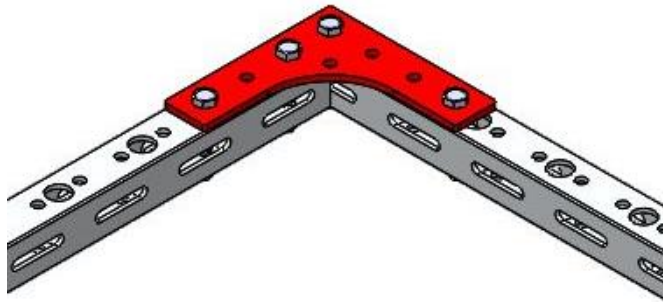


Figure 12: Single gusset on one side of the joint only



Figure 13: Gussets on both sides of the joint

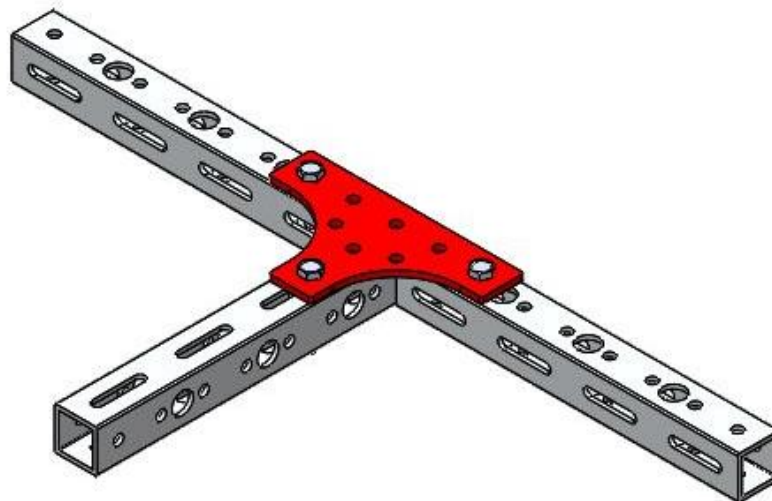


Figure 14: Single gusset used with the slots in one of the tubes. NOTE: The slotted tube is constrained from sliding by the bolt located at the end of a slot and the end of the tube being flush against the other tube – a tube cut shorter would be able to slide along the slot and/or pivot about the single bolt.

Angled Connections

By using the slotted face you can add triangular bracing at just about any angle you require. Insert a bolt all the way through both tubes and secure with a lock nut on the far side. If you don't need triangulation but simply need two tubes joined at an angle, try the Variable Degree Gusset for any angled joint between parallel and perpendicular.

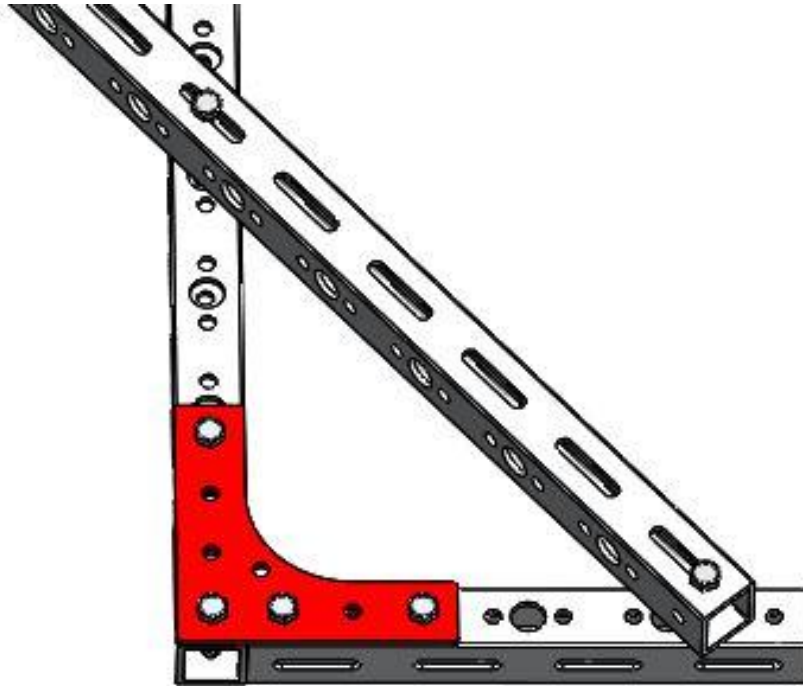


Figure 15: Use the slots to join tube to create strong triangles

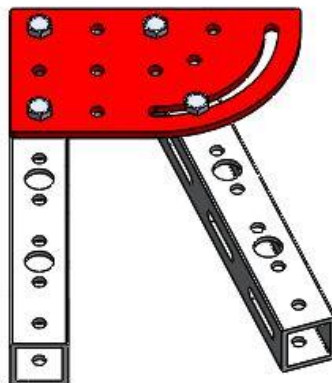


Figure 16: The Variable Degree Gusset has holes for 0, 45, or 90 degree connections but also features a slot for any other angle you may require.

Slotted Connections

The slotted face is perfect for adjustable elements like intakes. For these structures, a loose bolt through every other hole will give attachments the ability to slide along the face of the tube. Once your system is aligned, tighten the bolts and/or add additional bolts to prevent the gussets or brackets from moving.

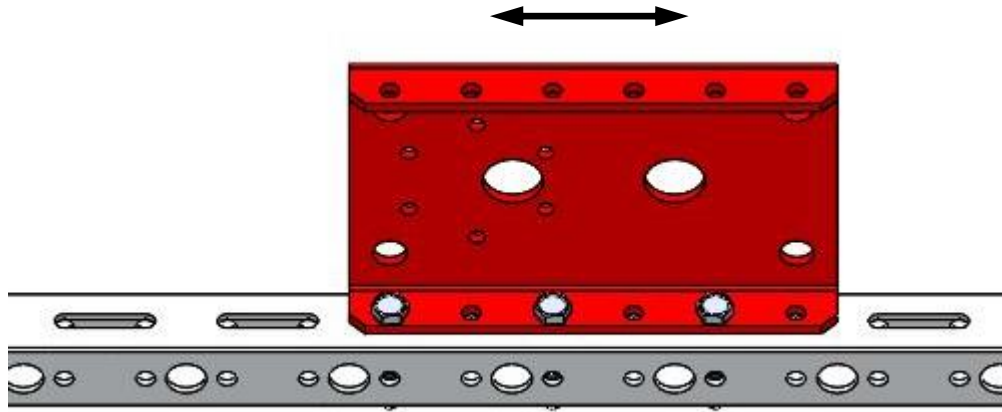


Figure 17: The PicoBox plate is adjustable along the length of the tube due to the slotted connections.

Compatibility

The S3 system is designed to interface with all PicoBox plates, TileRunner plates, and gears, sprockets, nubs, and wheels with a 16mm bolt circle around the center bore.

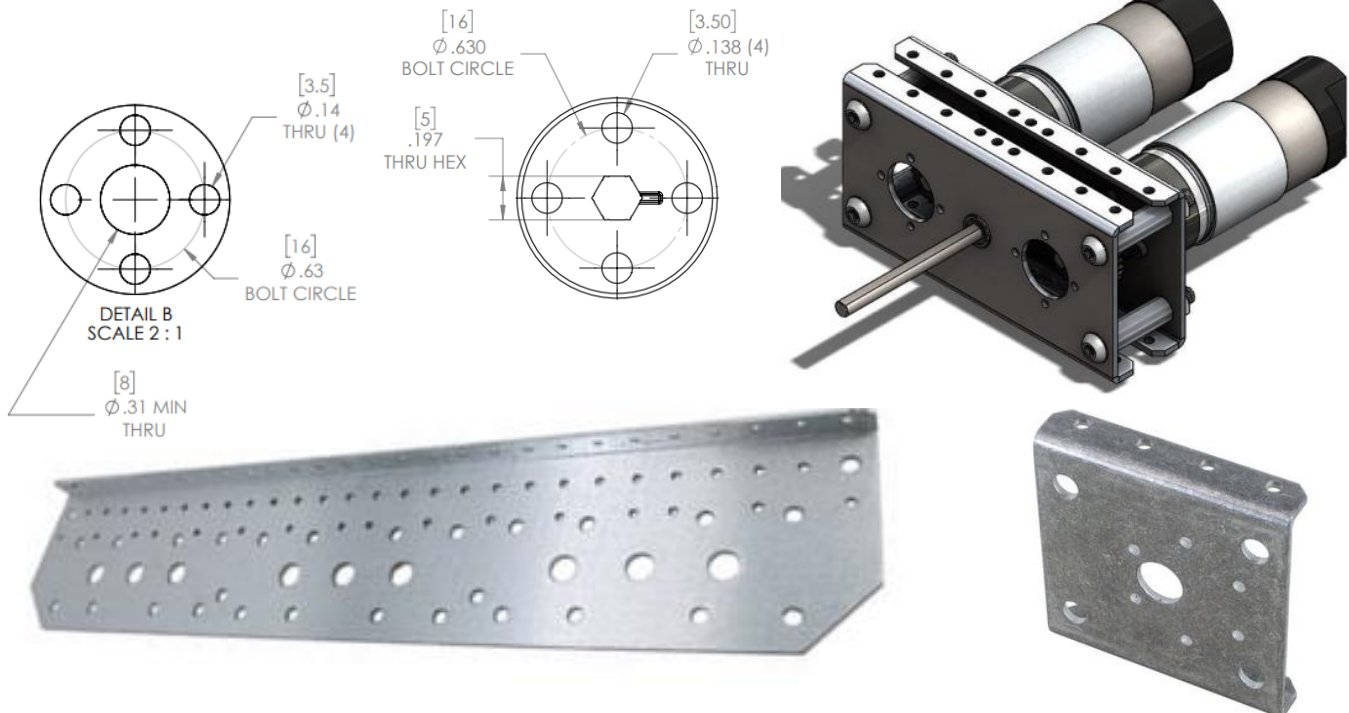


Figure 18: Different parts and patterns are designed to work with the S3 hole pattern.

Nub Attachments

Building a mechanism which requires a tube to be moved or rotated? Nubs can be directly attached to the S3 tubing by lining up the corners of the Nubs with the holes or slots of the tubing. Simply insert a 6-32 bolt from the opposite side and thread into the Nub corners to secure it like you would anywhere else you use a Nub. The 8mm holes on the tubing will accommodate the boss on a Nub and allow you to pass a 5mm hex, 6mm round, or 6mm D shaft through the nub and tube.

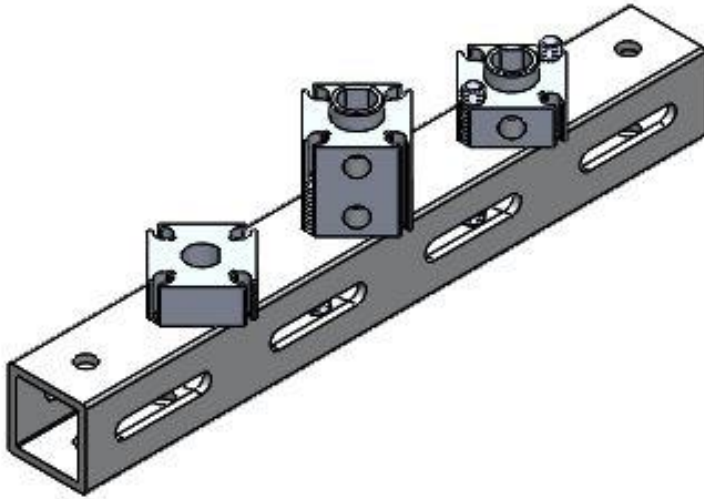


Figure 19: Any Nub can be attached to S3 Tubing

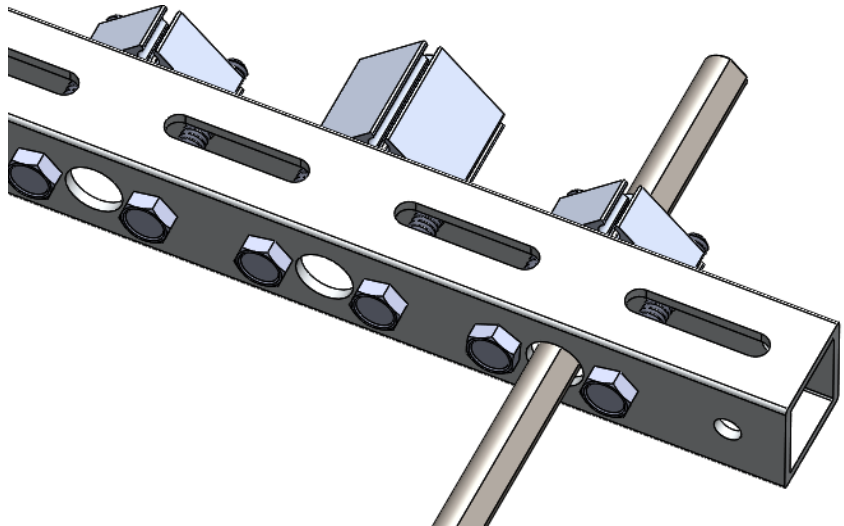


Figure 20: Shafts can be passed through the tubing

Note: The above images show multiple examples for how a Nub can be mounted to a tube – it is unlikely that multiple types of Nubs would be needed adjacent to each other but every design is unique and the possibilities are endless!

Gear Attachments

Gears can also be added to any tube face for when additional torque is needed to move the S3 tube. The gears can be mounted to a nub or could be bolted directly to the side of the S3 tube.

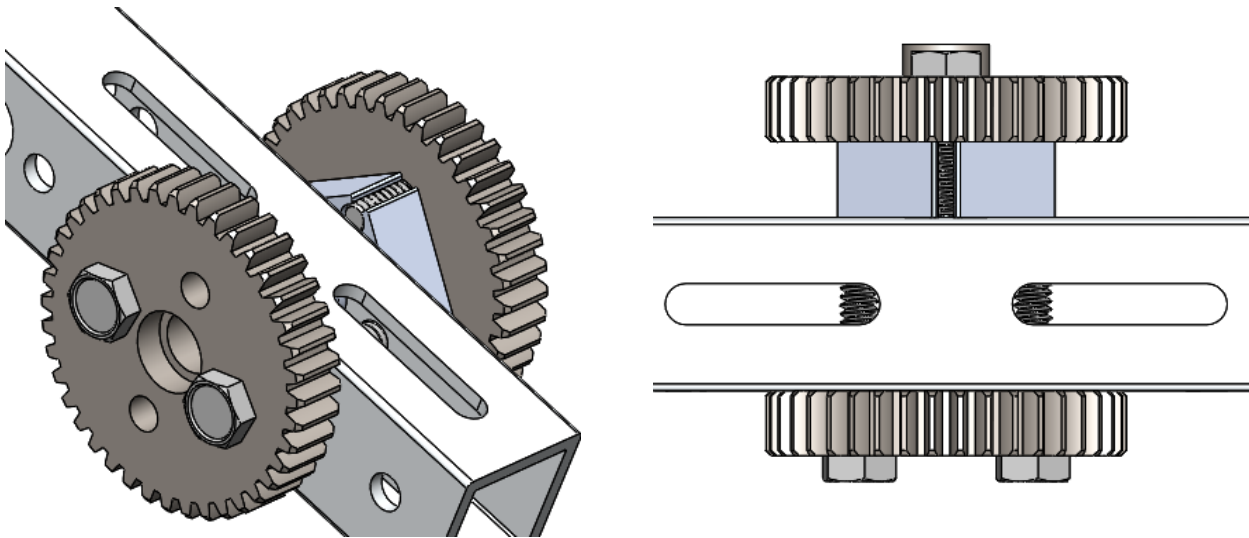


Figure 21: A pair of gears mounted coaxially

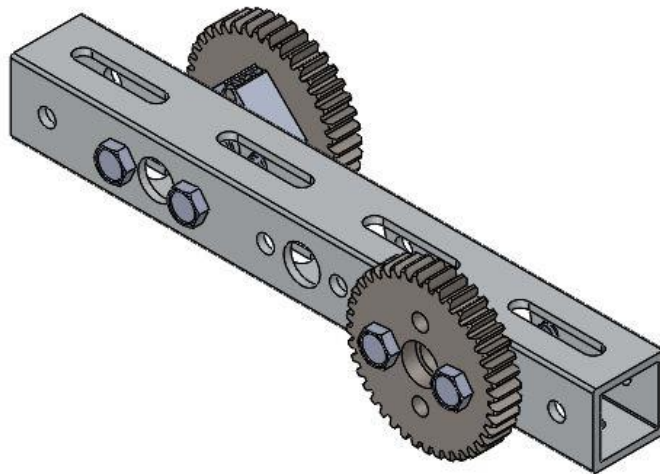


Figure 22: Gears can be mounted with or without the use of a Nub

Note: The above images show multiple examples for how a gear can be mounted to a tube – it is unlikely that multiple gears would be needed adjacent to each other but every design is unique and the possibilities are endless!

Pulley Attachment

Using a belt system instead of gears? No problem! Pulleys can also be mounted to the S3 tube directly or using nubs.

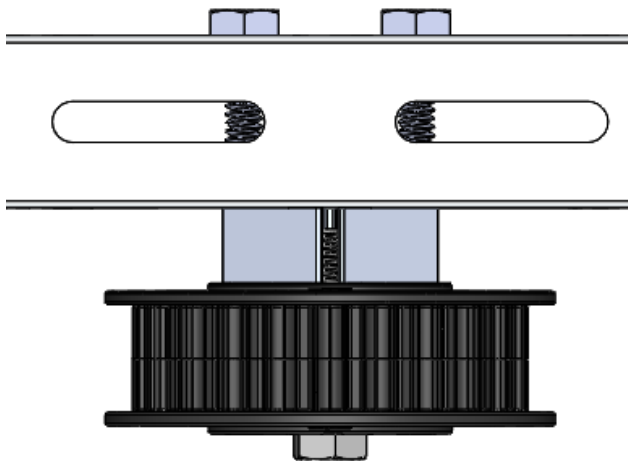


Figure 24: Pulleys can be mounted using a Nub

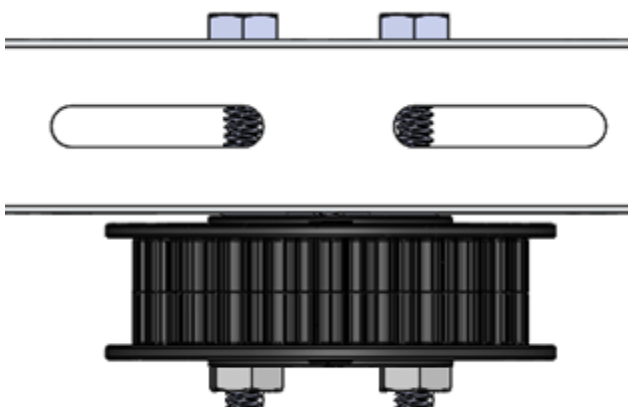


Figure 26: Pulleys can be mounted directly to the face of the Tube

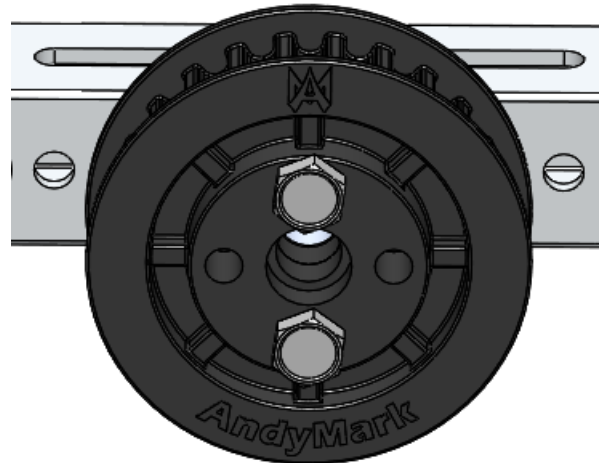


Figure 23: Pulleys can be mounted using a Nub

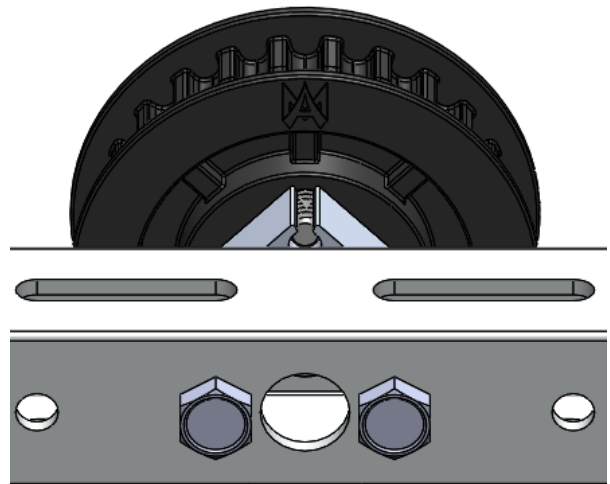


Figure 24: The Nub can be secured to the Tube

Sprocket Attachment

The S3 tube also supports Ninja Star and Samurai Sprockets if you are utilizing chain to move your mechanism. Unlike gears and pulleys, the sprockets must be used either with a Nub or spacers and not mounted directly to the S3 tube to allow space for the chain between the sprocket and the tube face.

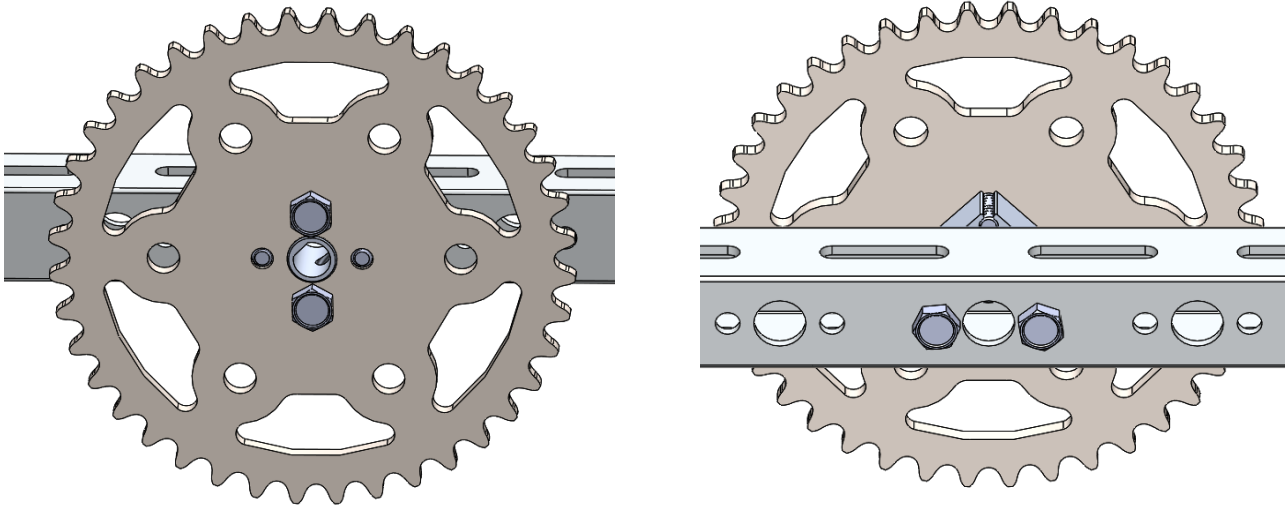


Figure 27: Sprockets can be mounted to the tube with Nubs or spacers

Pivots

If you are moving your S3 tube by some other means and simply need a pivot, the 8mm holes are sized for a pair of Nylon Bushings (am-1289) which allow for a 6mm D or round shaft to pass through. You can also use a Bearing Nub (am-3667) for added strength and stability.

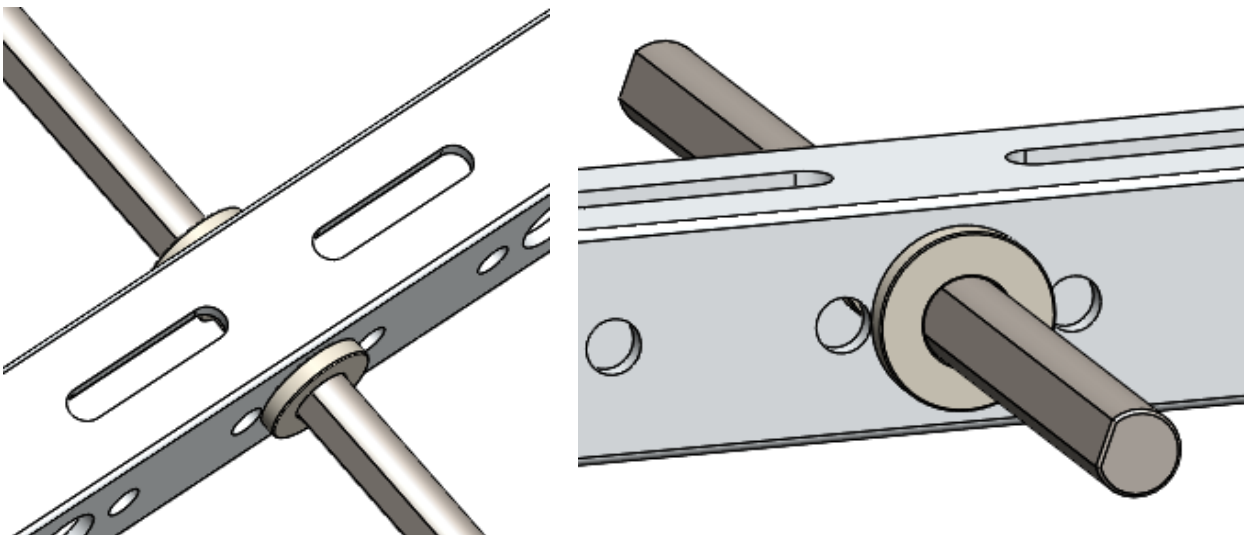


Figure 28: Use bushings to create pivot points