

SHG V2.0 – Latest Update May 27

The following document gives you a brief description of my latest SpectroHelioGraph SHG V2.0. These files are free to use and modify. Be warned – I am not an expert and likely have found the hardest way to do some things. Despite this – the SHG works! [Link to zipped to FreeCad files](#). Brian Martin

Basic Design

The basic design is very similar to that of SolEx. Major differences with SolEx are:

- Collimator and imaging lenses are 150 mm f/4 Asahi Super Takumar lenses purchased used from [KEH camera](#).
- Slit is a 12 mm x 9 micron fused quartz purchased from [Douglas Smith](#) – UK. I would strongly recommend Doug’s slits – even as an upgrade to SolEx.
- A 30mm x 30mm 2400 l/mm [holographic grating](#) from Edmund Optics.



Figure 1: SHG V2.0 (bottom) compared to SolEx

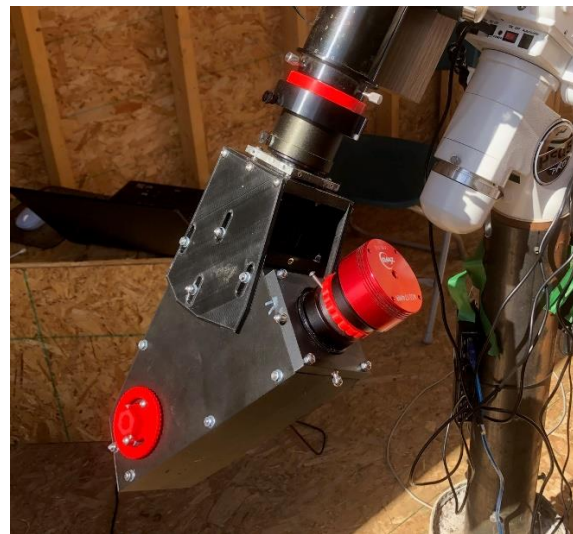


Figure 2: SHG V2.0 attached to Stellarvue 102RT

Figure 1 reveals that the SHG V2.0 is substantially larger than SolEx and – with the ASI 178 (uncooled) camera has a mass of about 1.8 kg.

Under the Hood and First Light

Figure 3 shows the SHG during assembly. The masking tape (elegantly positioned!) was to help prevent shift in the focus of the collimator and imaging lenses as well as provide additional friction to help hold the lens securely. Each lens is enclosed by a thin sheath that serves as a shim to ensure tight fit in the SHG cavity (as well as set-screws in the SHG body.) This would be a simple way to accommodate other lenses having different dimensions.



Figure 3: SHG V2.0 being assembled

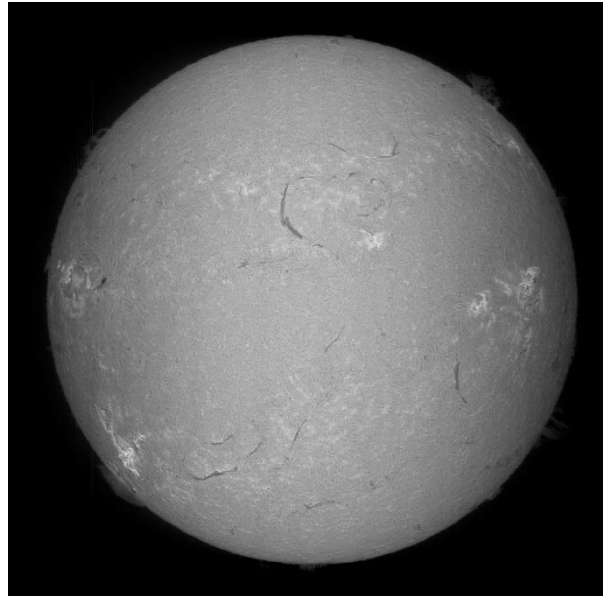
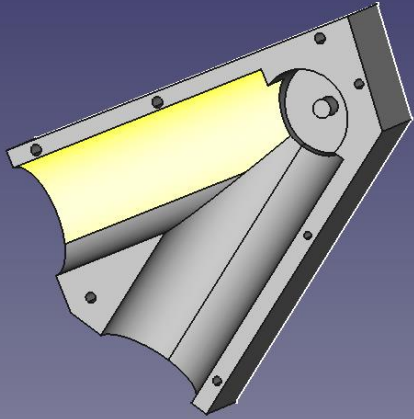
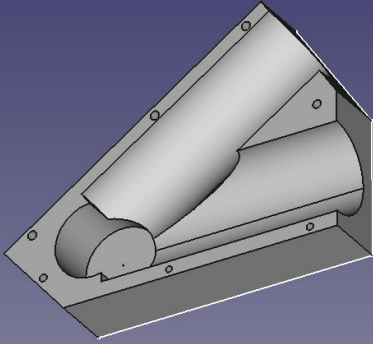
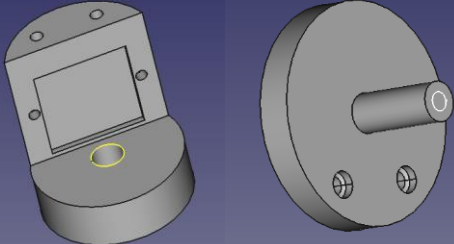
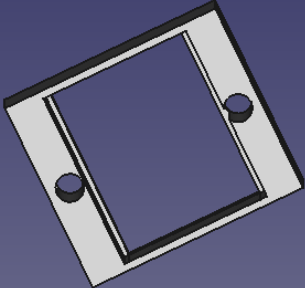
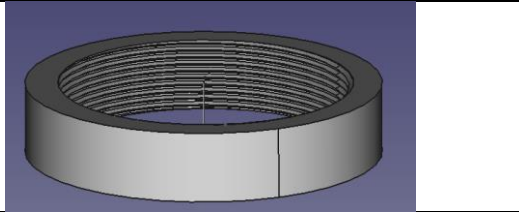
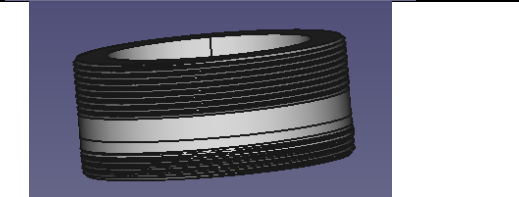
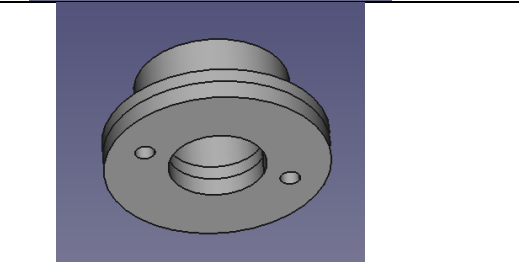
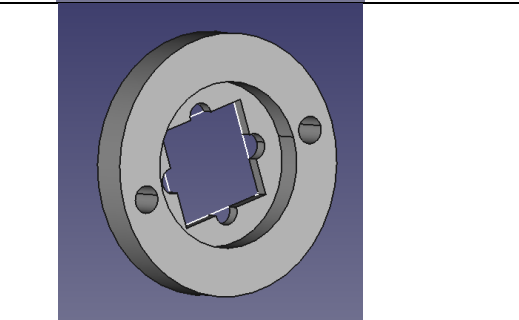
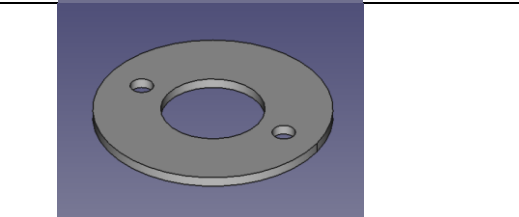



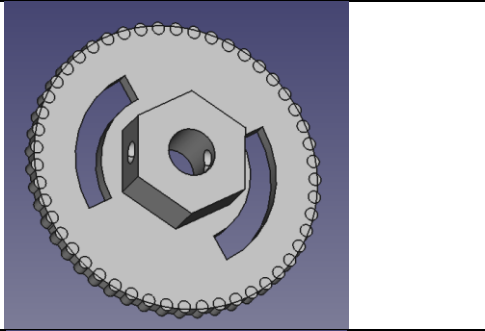
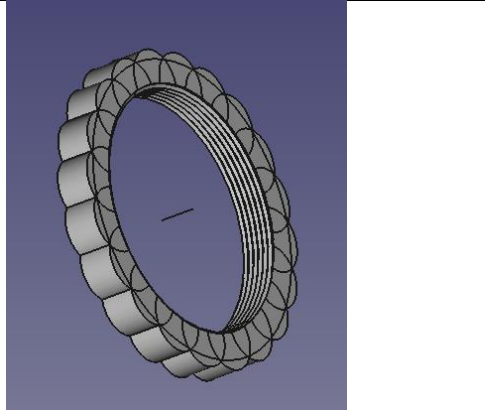
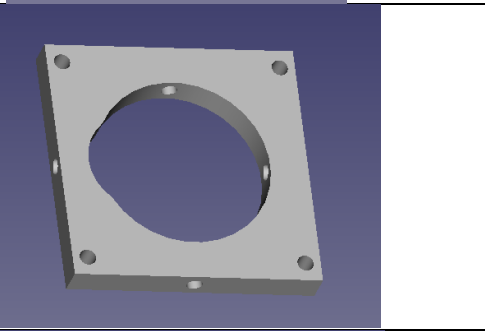
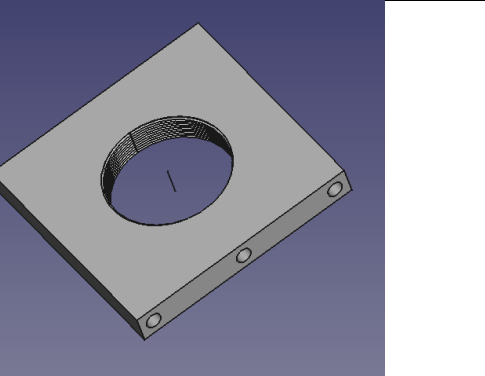
Figure 4: SHG V2.0 in $H\alpha$ – May 19, 2023

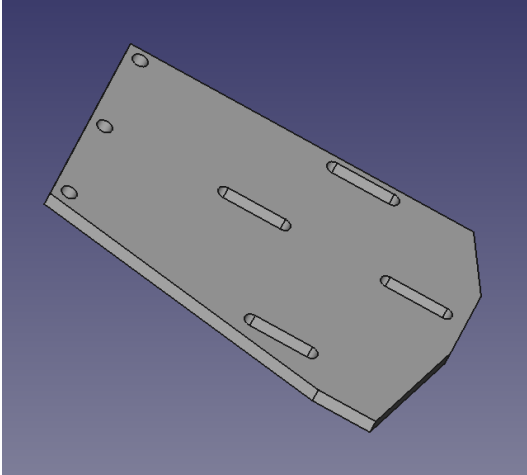
Figure 4 is a $H\alpha$ image with SHG V2.0 using a Stellarvue 102RT at 714 mm focal length taken under rather poor atmospheric conditions. Despite this – the image is encouraging.

Table of FreeCad Files

<p>Main Body (bottom)</p>		<p>base_plate2_bottom.FCStd base_plate2_top.FCStd</p>
<p>Main Body (top) – appropriate size hole will need to be created to accommodate shaft size for grating support</p>		<p>base_plate2_top.FCStd</p>
<p>Grating support (top and bottom)</p>		<p>grating_baseTop.FCStd grating_baseV2.FCStd</p>
<p>Grating retainer clip to mount grating</p>		<p>grating_retainer.FCStd</p>

Collimator base and tube – m42 thread to attach to SuperTak lens			collimator_base.FCStd
Collimator threaded tube			collimator_tube2.FCStd
Tube to hold slit in collimator.			slit_tube.FCStd
Slit assembly holder to accommodate fused-quartz slit from Doug Smith			slit_support.FCStd
Slit cap to capture slit assembly			slit_cap.FCStd
Focus tube – top end attaches to m42 female thread on ASI camera and bottom a m42 female that attaches to SuperTak imaging lens (same as collimator base) – see notes below for update on this			collimator_base.FCStd

<p>Knob for grating rotator assembly</p>			<p>knob3.FCStd</p>
<p>Focus ring - for camera and for collimator assembly</p>			<p>focus_ring.FCStd</p>
<p>Mounting flanges – one for each of collimator and image lens. The cut-out is to accommodate the SuperTak lens profile</p>			<p>front_flange.FCStd</p>
<p>Telescope attachment flange. Please see comment below.</p>			<p>telescope_flange.FCStd</p>

<p>Base plate connector from SHG main body to telescope flange (top and bottom)</p>		<p>brace_plate.FCStd</p>
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Construction Notes

1. **Telescope Attachment Flange** – In the original design the nosepiece to the telescope attached directly to this component. This was NOT a good idea and quickly failed. I replaced with an aluminum M42 threaded plate that was attached to this plate.
2. **Collimator and Slit Assembly** – This floats inside the opening of the Telescope Attachment Flange hence the original design that used an internal M42 thread is not needed. Just use enough clearance for the slit assembly to move freely when collimating the SHG. In this configuration there is no torque placed on the collimator – all torque is on the base plate connectors. For extra rigidity these could be fabricated from 3 mm aluminum without significantly increasing the SHG mass
3. **M4 and M3 Brass Inserts** were used in many places – placement should be self-explanatory.
4. **Update on focuser** – the printed focuser has been replaced by a very low profile helicoid focuser (see [Amazon for details](#)). You may need to fabricate a small m42-m42 adapter but this unit has proven to be an excellent and low cost improvement to the instrument.

Areas of Improvement

My focusers for both the collimator and camera are crude – simple threaded tubes. Each should be replaced with a suitable helical focuser. Since the collimator slit assembly floats in the telescope attachment assembly it is very easy to make fine tweaks to the collimation.