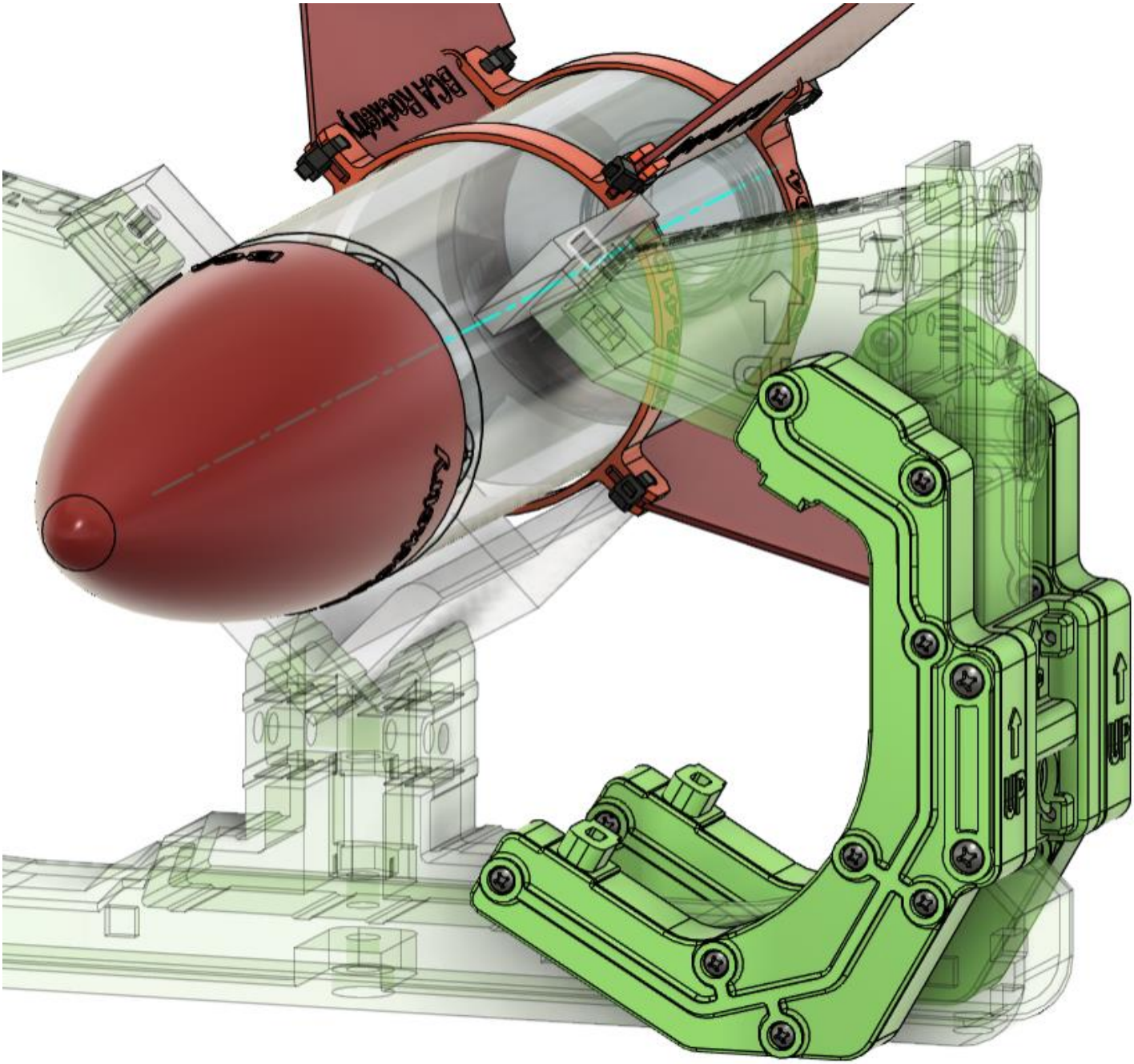
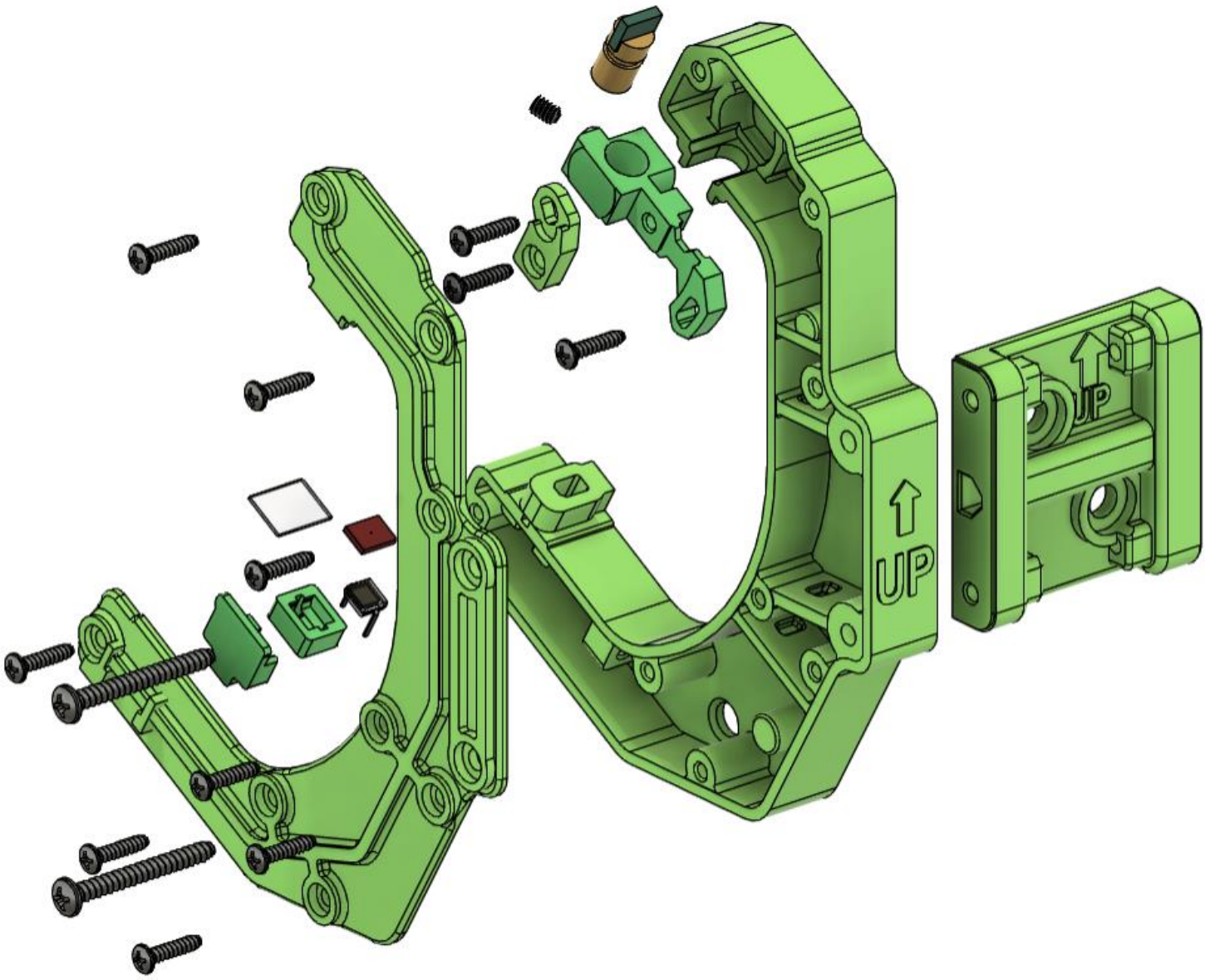
Laser Chronograph

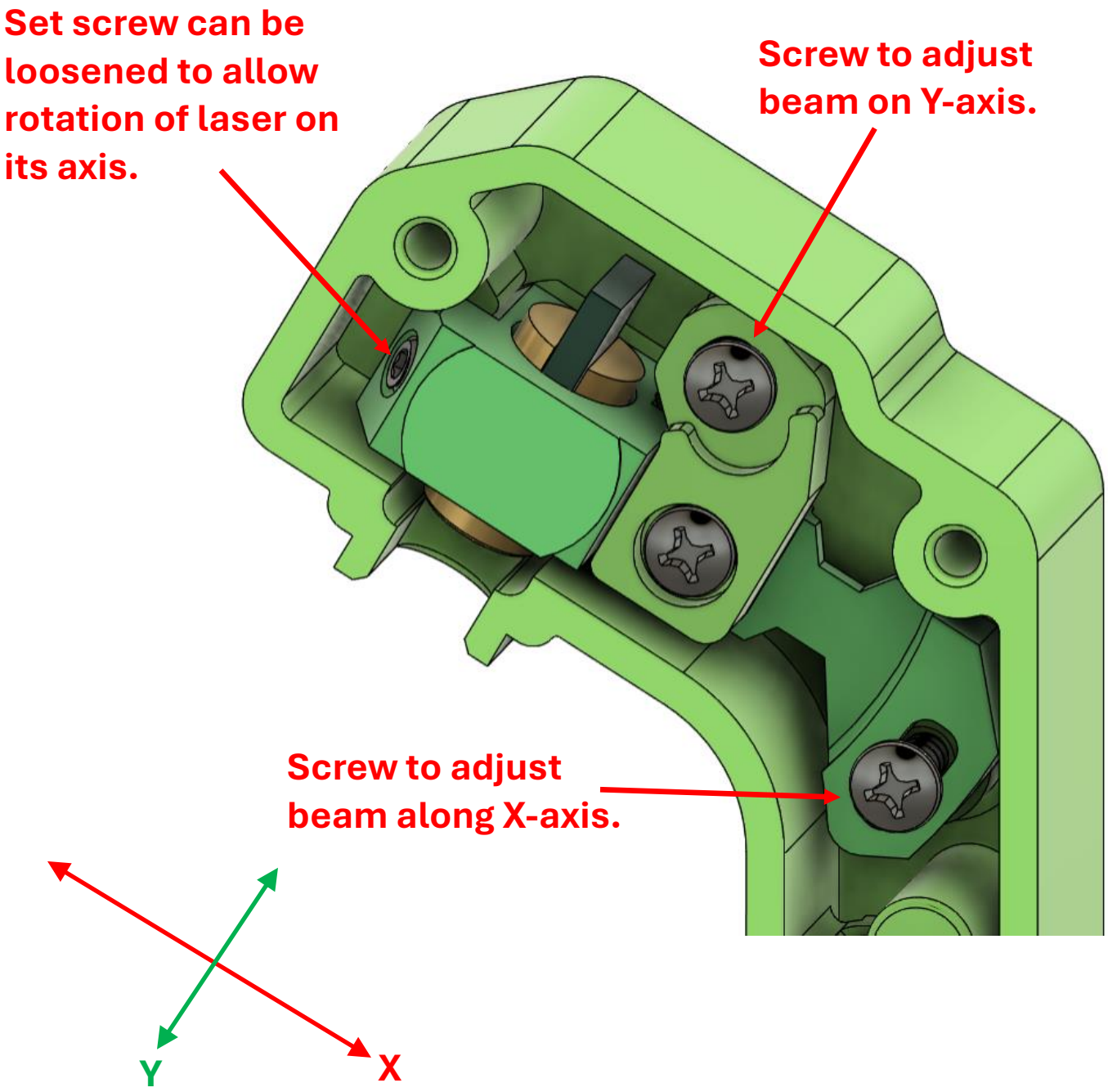


Exploded view of single assembly



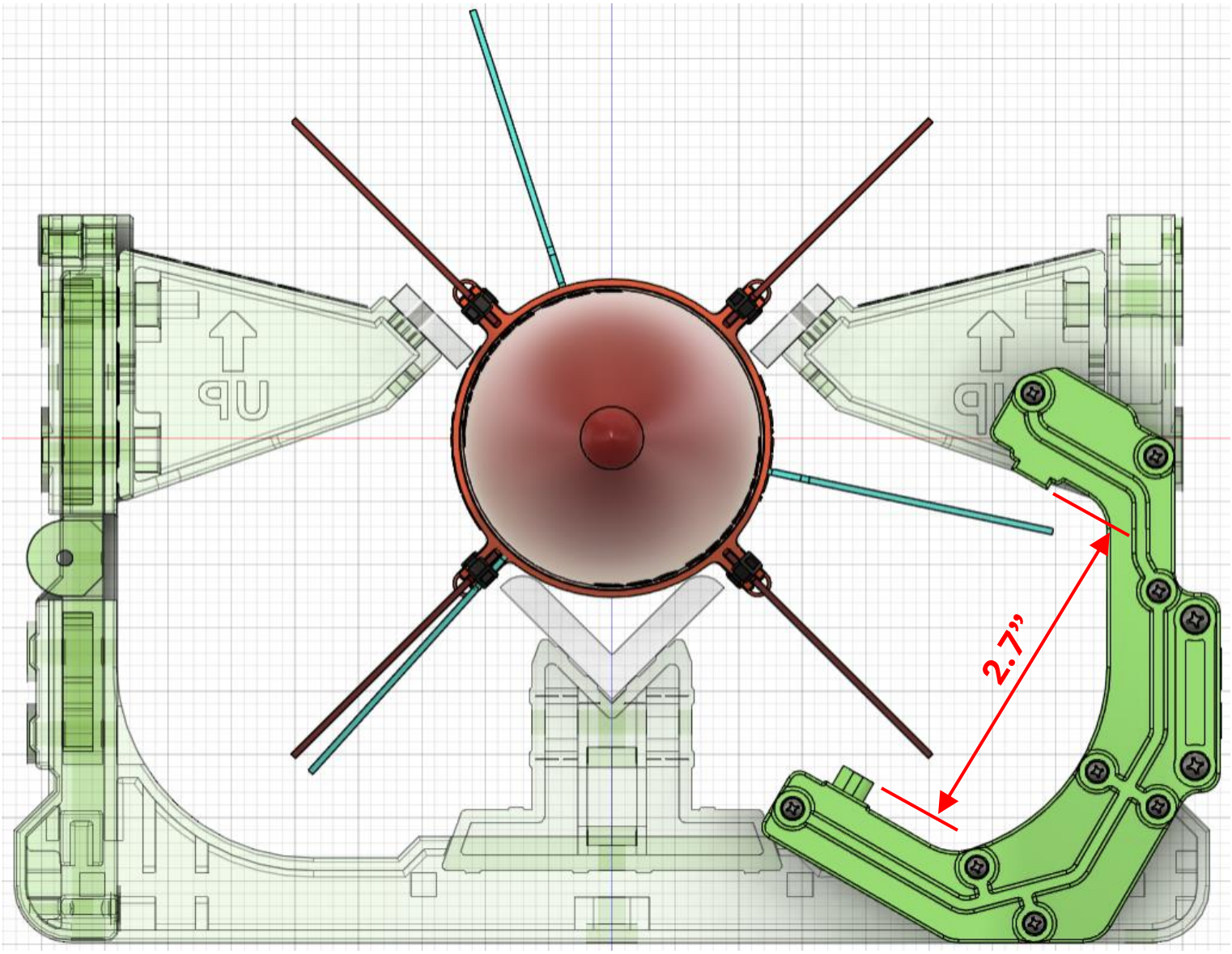
Laser Alignment

The laser beam is unlikely to be on the same axis as the body and the beam angles can be adjusted to ensure the beam is hitting the sensor.



Chronograph opening considerations

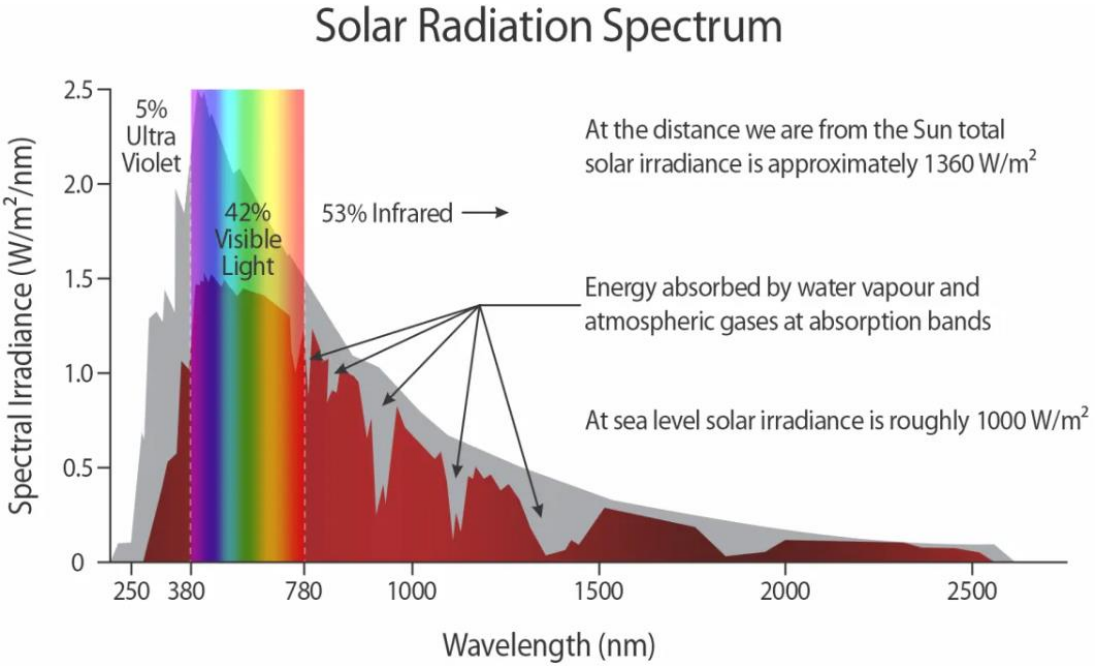
The opening of 2.7” accomodates both four fin (red) and three fin (blue) rockets. Also note how the three fin group is at its limit of rotation. There is adequate clearance to accommodate fin flutter as well.



Optics – 650nm 5mW laser diode

The primary challenge was developing a interference sensor that is tolerant to bright outdoor sunlight. The sensor also needs a wide opening and hence a long beam length without shielding that can interfere with a rocket fin passing through the beam.

As can be seen in the solar radiation spectrum below, there is a lot of energy in the near infra-red spectrum, and thus using an IR source and detector, would still like have problems.



It was decided to use a small, cheap, and readily available 650nm (red) diode laser. This would provide a bright source to compete with sunlight. The use of a visible laser, as opposed to an IR laser, allows one to see the beam spot when aligning the laser with the sensor. It was surprising that such cheap lasers have good beam quality. Each one in the batch seemed to work well. They also do not dissipate much heat and thus can be used in a plastic housing.

HiLetgo 10pcs 5V 650nm 5mW Red Dot Laser Head Red Laser Diode Laser Tube with Leads Head Outer Diameter 6mm

Visit the HiLetgo Store

4.3 ★★★★½ (745) | Search this page

Amazon's Choice

200+ bought in past month

$6.79

Price history

prime Overnight

FREE Returns

Brand	HiLetgo
Material	Copper
Color	Red
Product Dimensions	0.71"L x 0.26"W
Style	Laser

The below sensor was chosen because of its sensitivity in the visible region and the large sensitivity area of 7.5mm^2, which will help with alignment. As shown in the sensitivity curve below 650nm is not at its peak sensitivity, but 60% is fine.

VISHAY
www.vishay.com

BPW34, BPW34S

Vishay Semiconductors

Silicon PIN Photodiode

FEATURES

- Package type: leaded
- Package form: top view
- Dimensions (L x W x H in mm): 5.4 x 4.3 x 3.2
- Radiant sensitive area (in mm^2): 7.5
- High photo sensitivity
- High radiant sensitivity
- Suitable for visible and near infrared radiation
- Fast response times
- Angle of half sensitivity: $\varphi = \pm 65°$
- Compliant to RoHS Directive 2002/95/EC and in accordance to WEEE 2002/96/EC

Pb-free
e3
RoHS COMPLIANT
GREEN (5-2008)**

Note

** Please see document "Vishay Material Category Policy": www.vishay.com/doc?99902

DESCRIPTION

BPW34 is a PIN photodiode with high speed and high radiant sensitivity in miniature, flat, top view, clear plastic package. It is sensitive to visible and near infrared radiation. BPW34S is packed in tubes, specifications like BPW34.

APPLICATIONS

- High speed photo detector

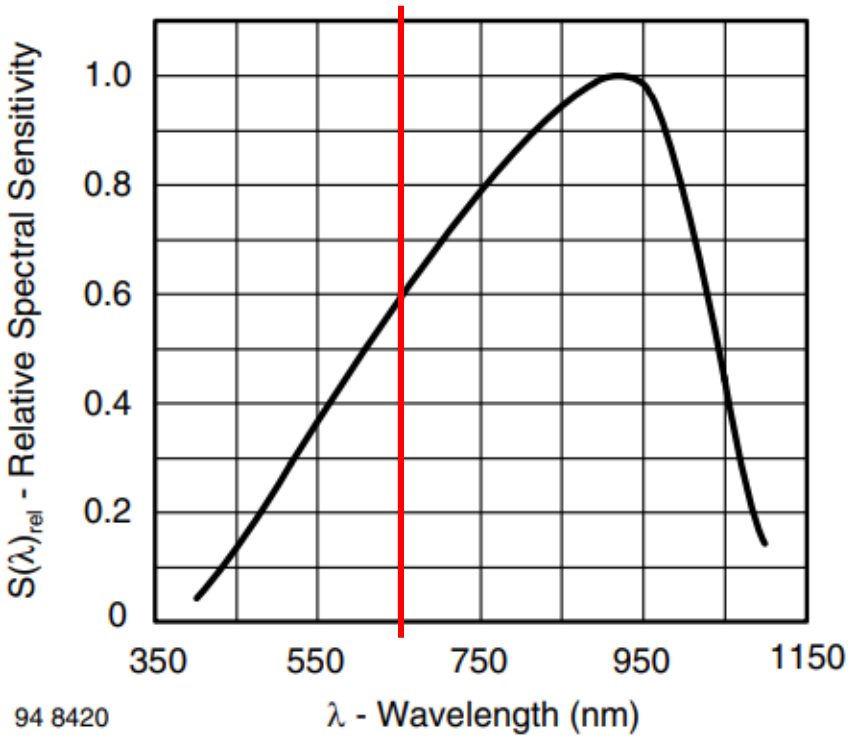
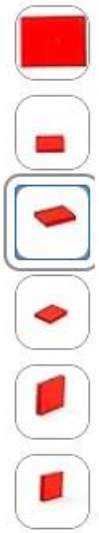


Fig. 7 - Relative Spectral Sensitivity vs. Wavelength

To reduce the contribution of energy from sunlight a 650nm bandpass filter is located in front of the sensor. As can be seen from the plot it greatly attenuates light in lower wavelengths of the visible spectrum and in the IR region.

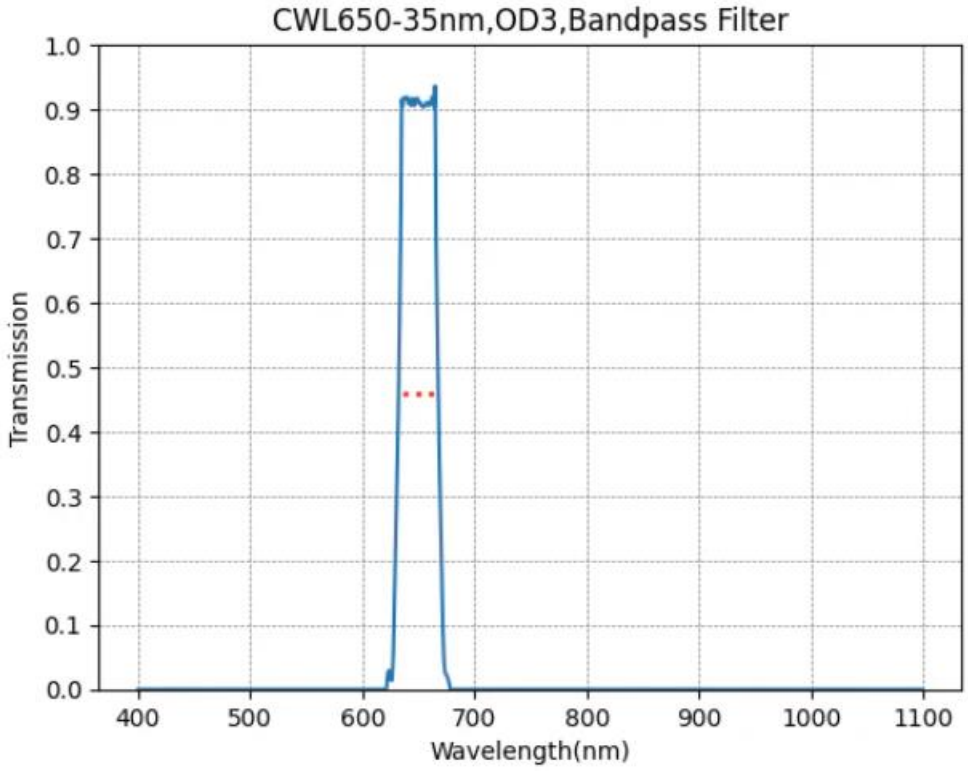


2pcs 4.6mm x 6mm x1mm 650nm Bandpass Filter +/- 30nm for Laser Bar Code Engine Dedicated Filter

Visit the Q-BAIHE Store

Search this page

Brand	Q-BAIHE
Coating Description	Multi Coating



Testing in bright sunlight found that the sensor was tolerant to bright summer sunlight, unless the axis of the sensor opening was within 5% of being directly aligned with the sun. By having the sensor assembly oriented so that the sensor is aimed towards the ground should eliminate the possibility of sunlight directly entering the sensor.

BOM (Bill Of Materials)

Line	Qty	Type	Description	Part Num	Price
1	2	screw	Set 4-40 5/32"L 18-8SS CupTip	92311A318	$3.46(25)
2	4	screw	#4 1"L RoundHead 18-8SS SheetMetalBlunt	92525A126	$8.61(25)
3	24	screw	#2 3/8" SheetMetalBlunt 18-8SS	92525A118	$5.69(100)
4	2	printPLA	ShellFwd		
5	2	printPLA	CoverFwd		
6	2	printPLA	LaserMount		
7	2	printPLA	LaserAdjustArm		
8	2	printPLA	SensorMount		
9	2	printPLA	SensorMountBack		
10	2	printPLA	SensorMountTop		
11	1	printPLA	PhotoInterrupterMount		
12	2	undef	LaserDiode		
13	2	undef	Filter 650nm		
14	2	undef	Photodiode BPW34		