The Construction of a Fluorescence Spectroscopic 3D Imager

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Why Does It Matter?

- Allows one to determine the locations of certain elements
  - Related: FIB microscope
  - Difference: Working with plasma, not molecules

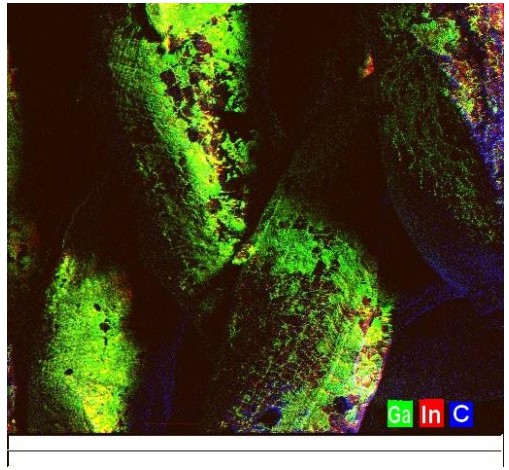


Image produced by FIB during Training Week

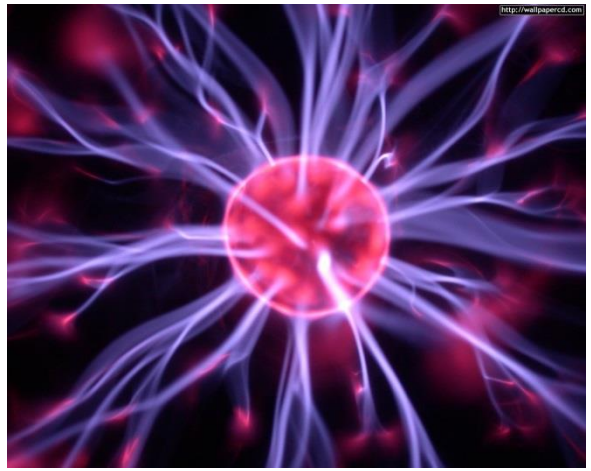


Image courtesy of RF Global Solutions Ltd

Fluorescence Spectroscopy

- Molecules become excited when electron goes from ground to the excited state.
- The molecules emit fluorescence (normally a different wavelength) when returning to the ground state

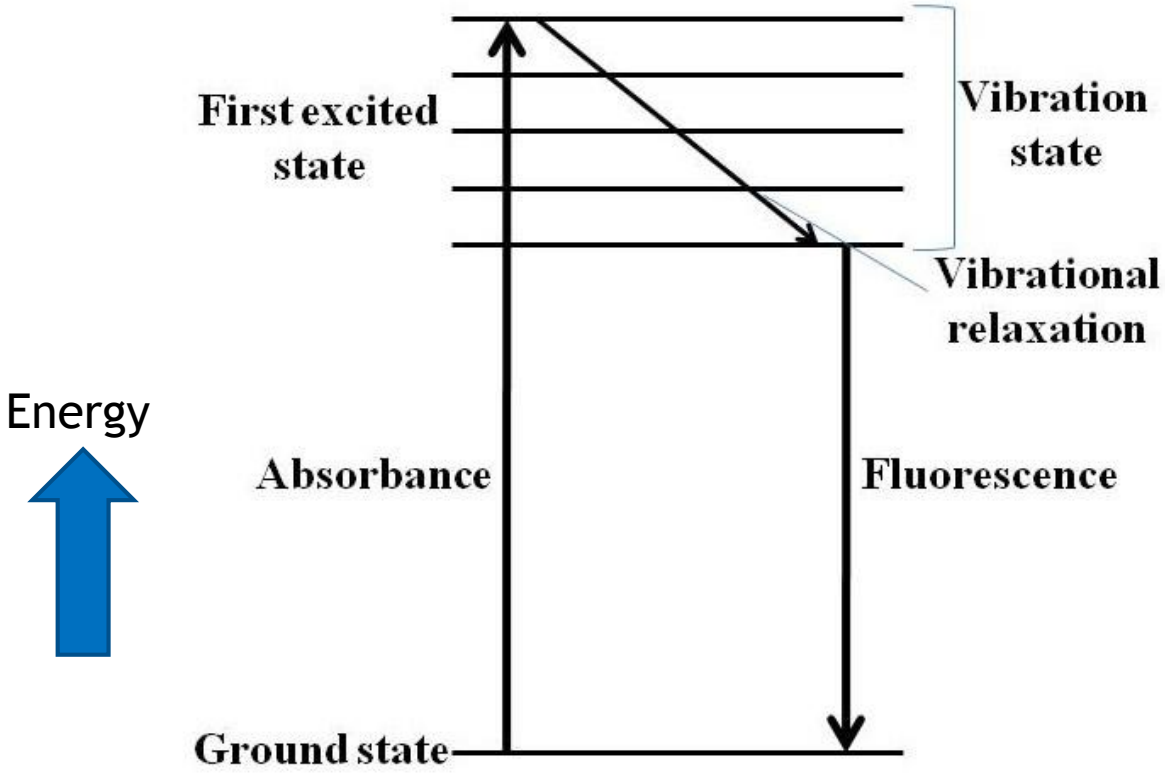
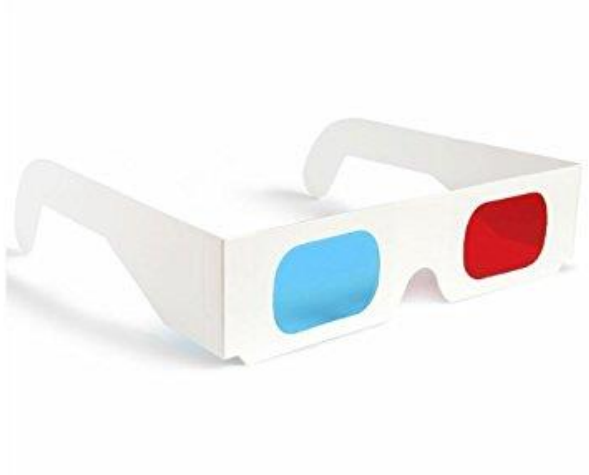


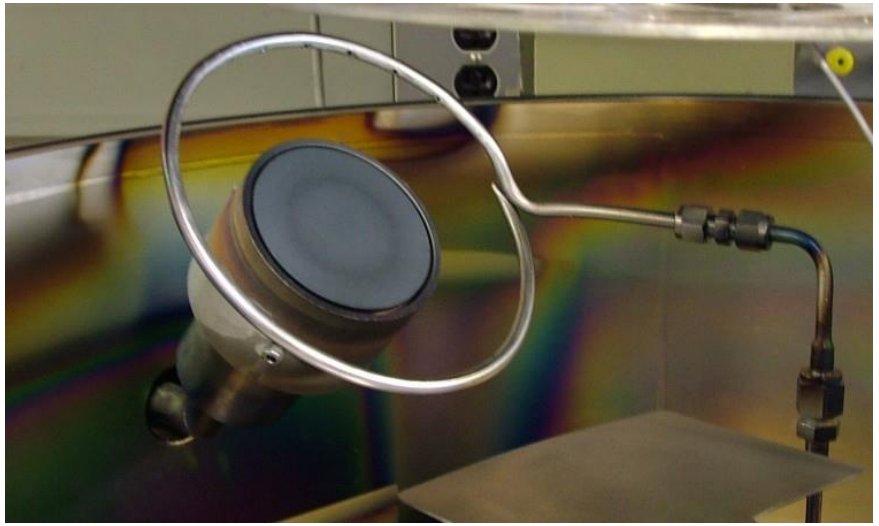
Image courtesy of archive.cnx.org

Stereo Imaging

- Mimics viewing an image out of both human eyes
- Creates the illusion of a 3D image
- Requires a **stereopair** – two overlapping images from two different perspectives



Mapping a Plasma Source in 3D



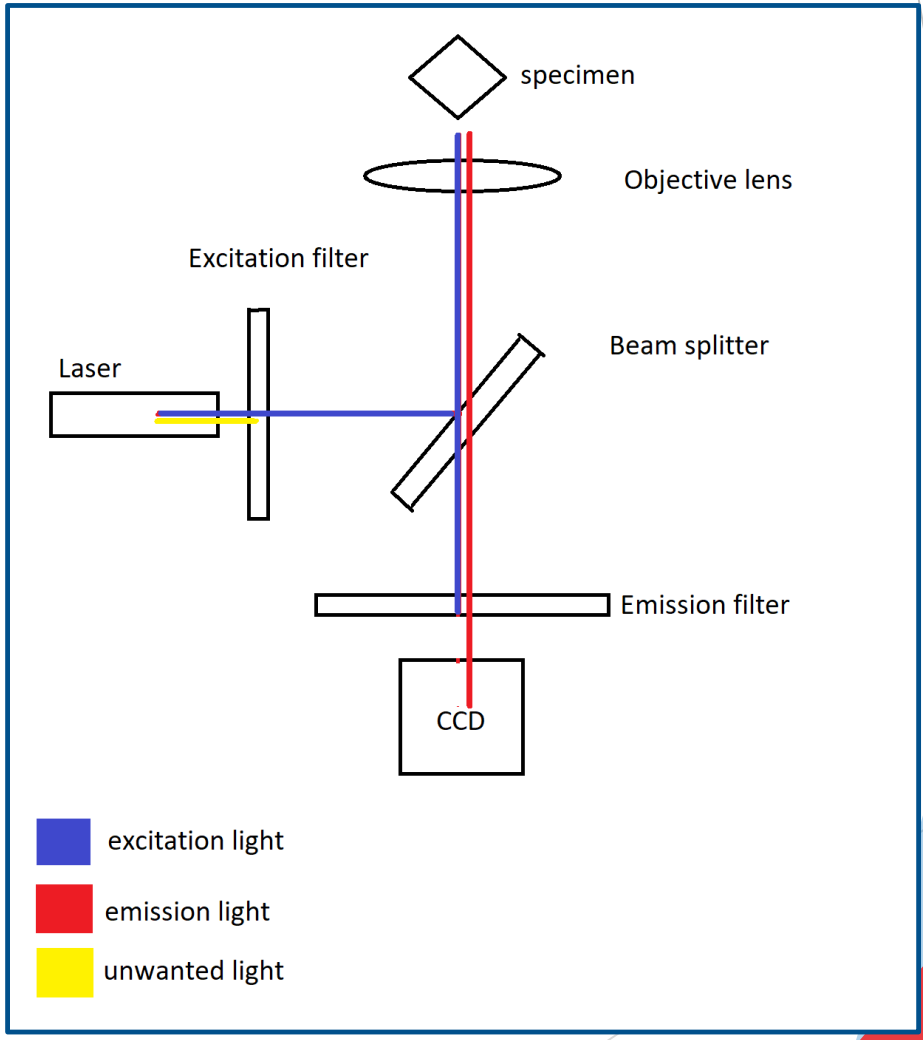
- Sputter gun for coating ITO

- Good Glow: nice coatings

- Bad Glow: slow coatings

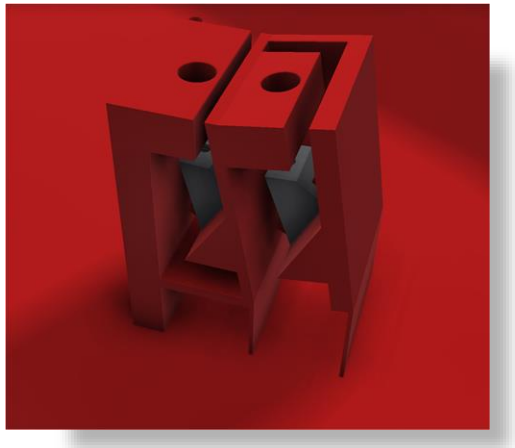
Building Blocks

- Emission and excitation filters
- Beam splitter
- Charge Coupled Device (CCD)
- Mirrors
- Light source
- Lens system

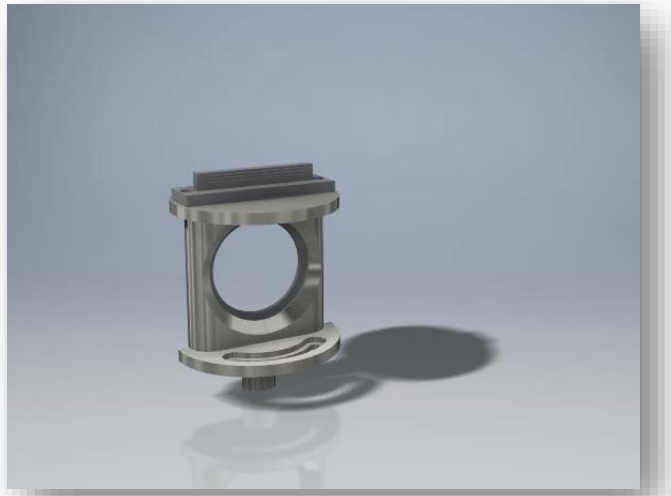


Internal Opto-Mechanical Components

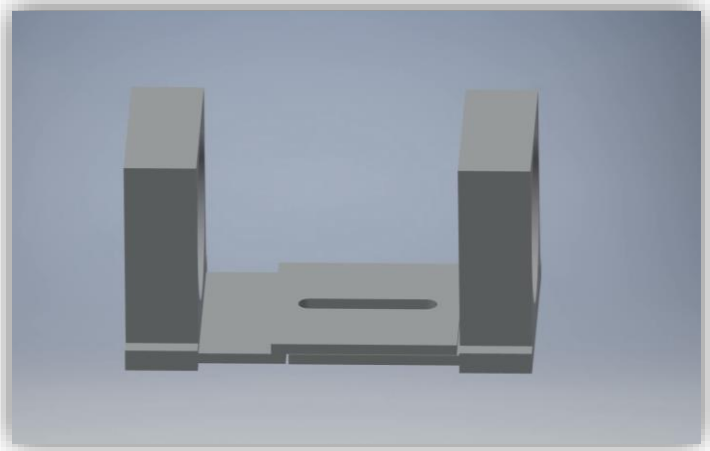
Mirror holder



Beam splitter holder

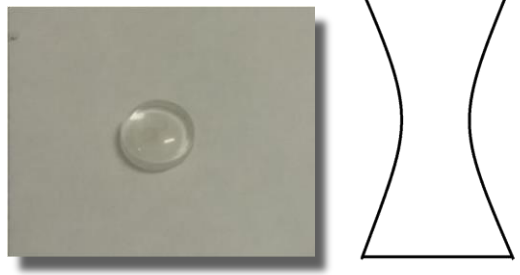


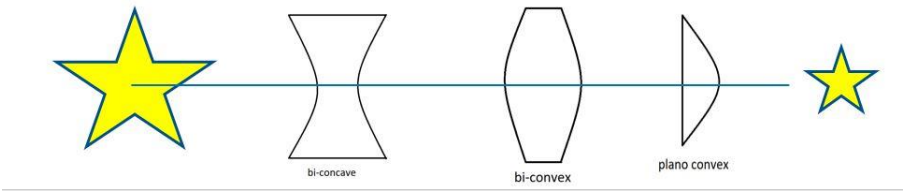
Lens holders

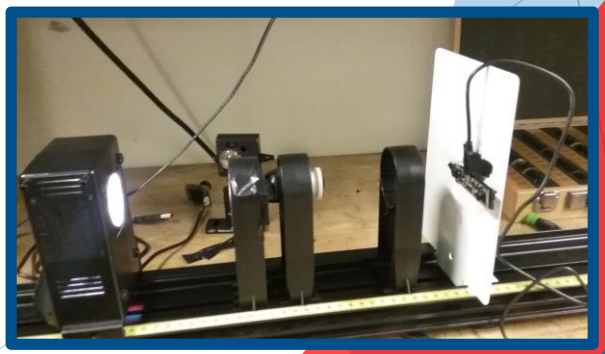


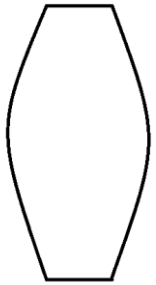
Optics System

- Limitations
  - 1/4 - 3/8” aperture
  - Image = 0.33”
  - Distance from object to 1st lens = 4-5”
  - Distance from object to camera < 12”
- Result
  - 3-Lens System
    - Bi-concave
    - Bi-convex
    - Plano-convex



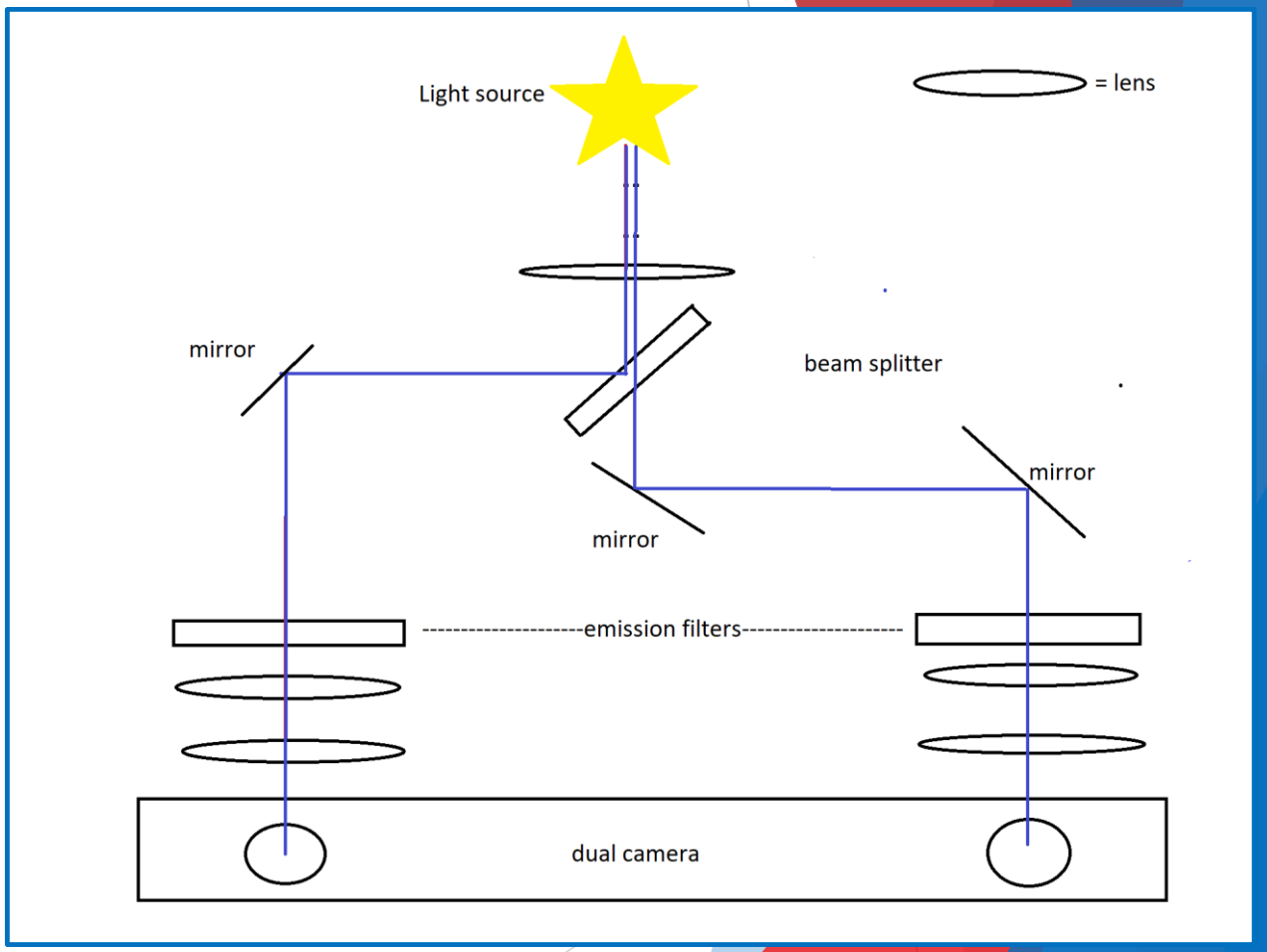






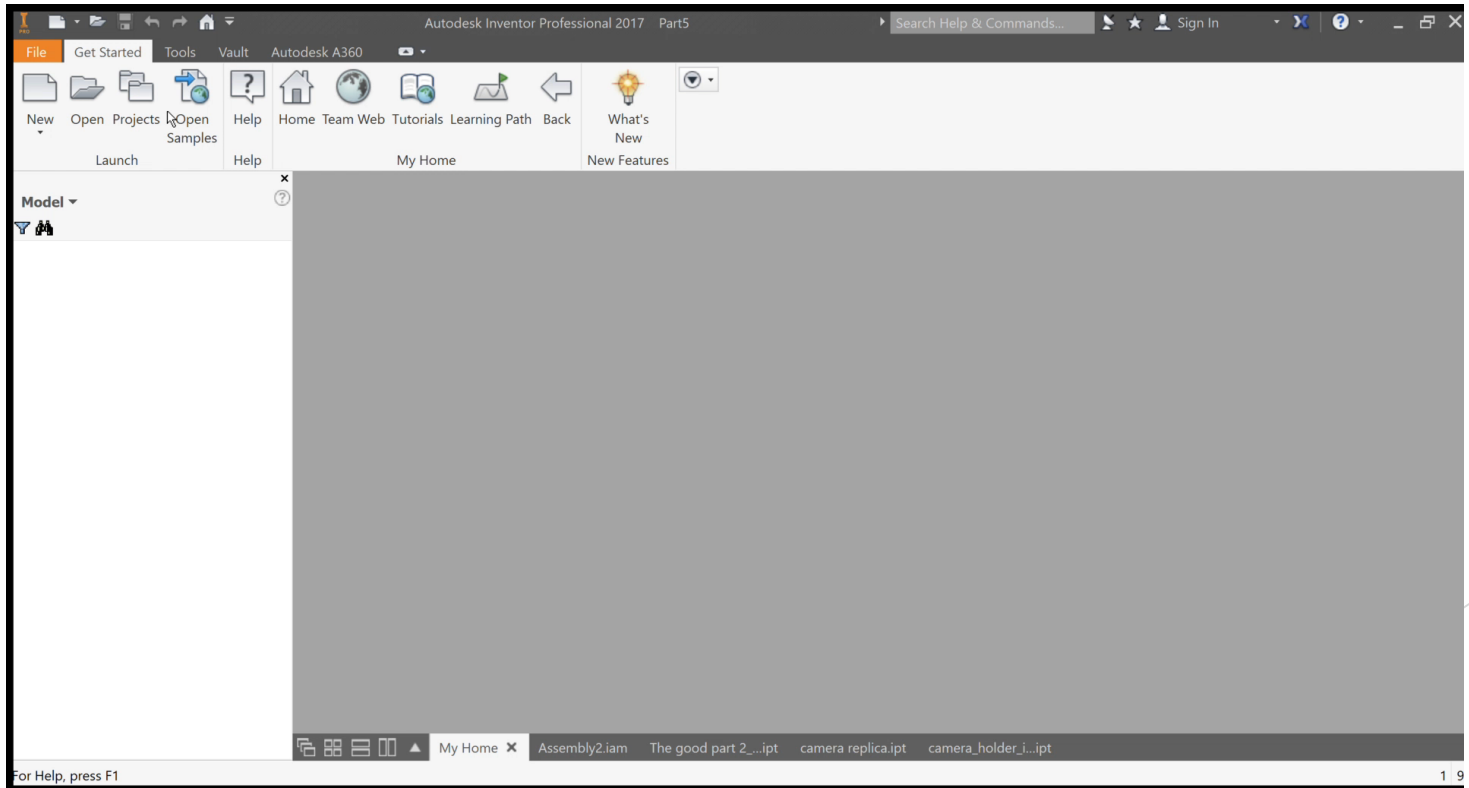
Pathway

- 1) Light splits directions, each with half the original intensity
- 2) Directed via mirrors to the emission filter
- 3) Arrives at the camera



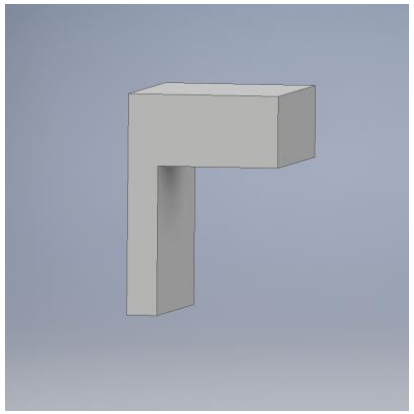
Inventor Program (AutoDesk)

- Computer Aided Design (CAD) program
- 3D renders a part, first by creating a sketch, then extruding, revolving, etc.
- Can create relationships between multiple parts with *Assembly*
- Useful for visualizing or 3D printing



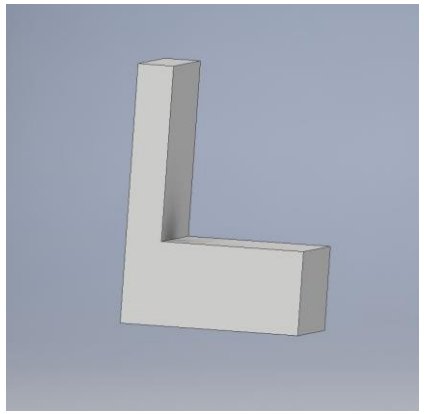
3D Printing the Parts

- Takes cross sections of the part
- Deposits material one thin layer at a time
- Requires the parts to have a particular orientation



Poor

vs.

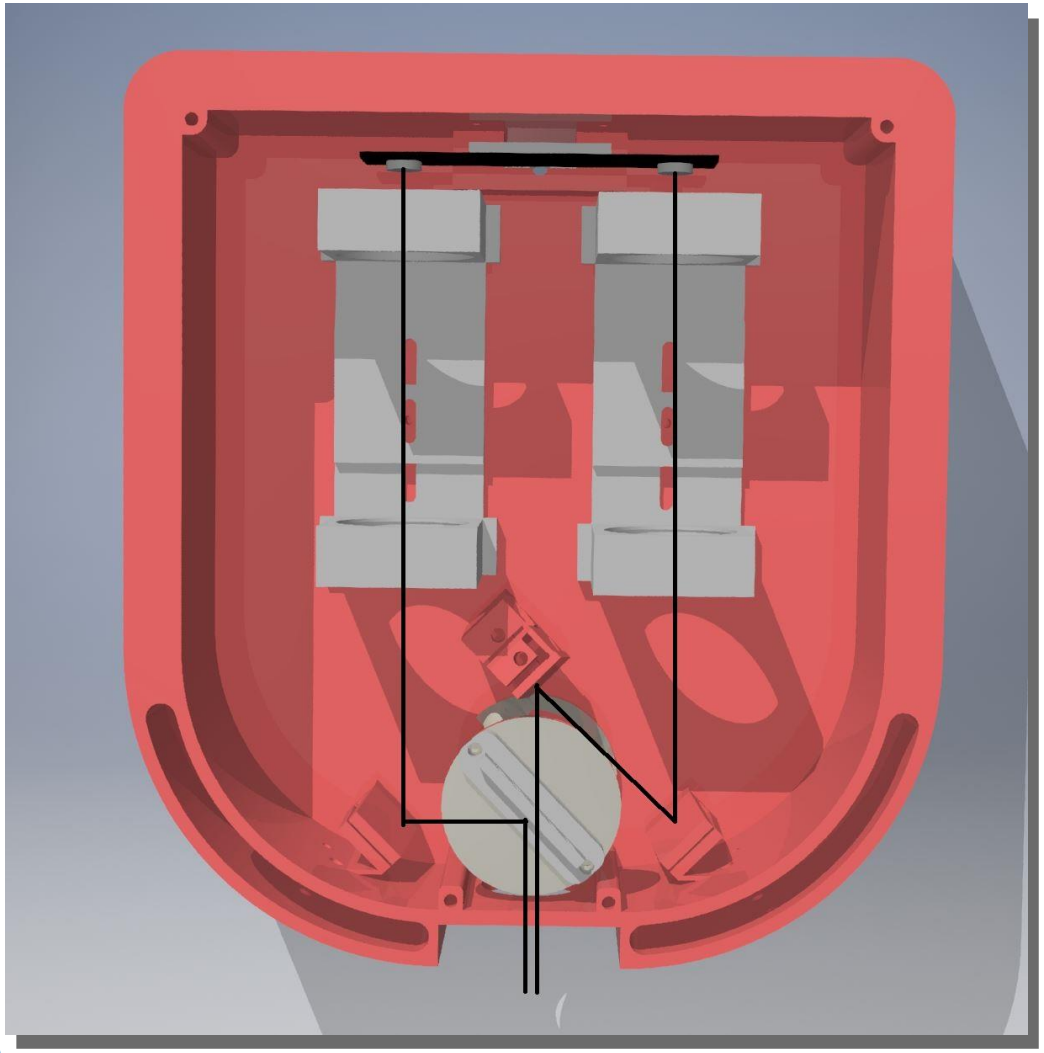


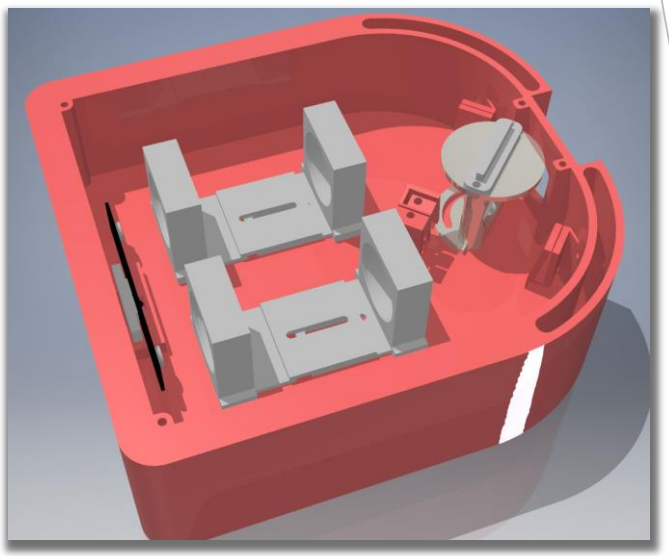
Better

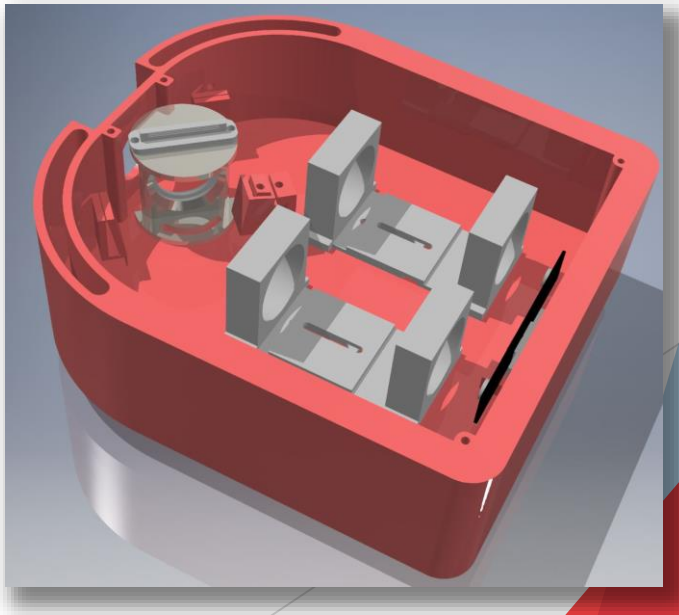
Image courtesy of pcmag.com

Image courtesy of pcmag.com

CAD Drawing of 3D Imager to be Printed







Expected Results

- To be determined…
- Expected to produce images like these:

Images courtesy of AnaMaker

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Questions?