# SKRT

**S**crew **K**lassification and **R**ecognition **T**ool

Optical Screw Classifier

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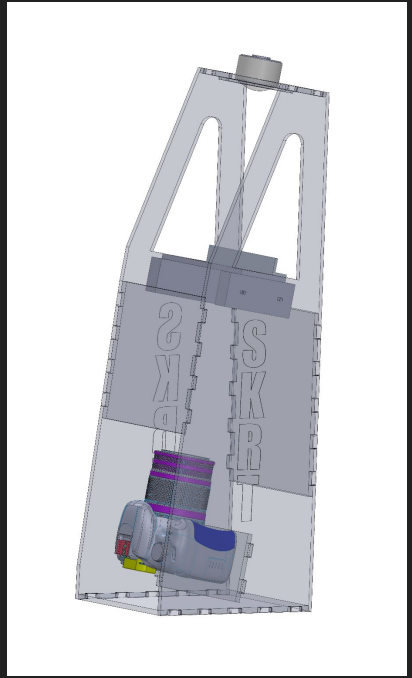
# Concept

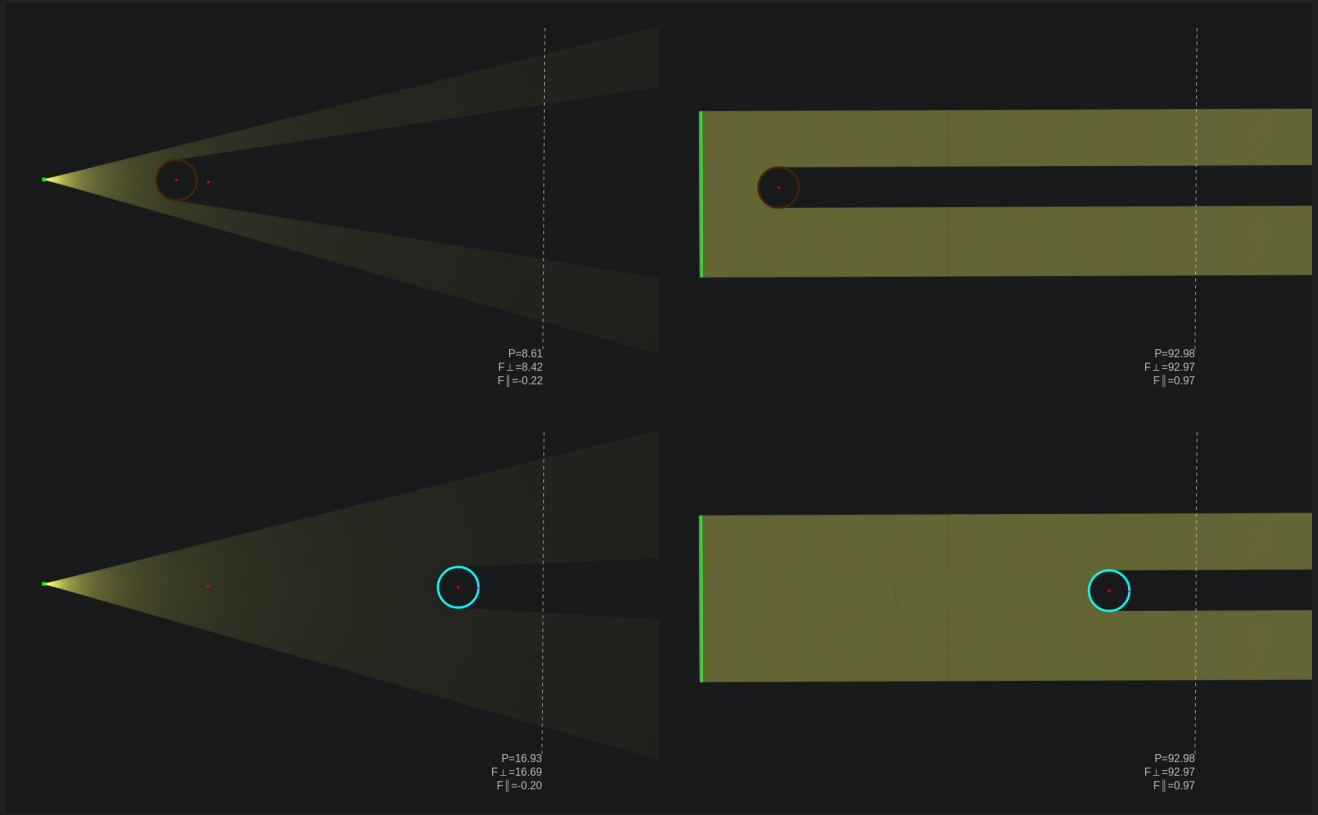
- Put a machine screw in a jig
- Camera takes a picture
- Software processes the image and reports:
  - Screw diameter
  - Screw length
  - Thread pitch

# Mechanical

- Holds components securely in place
  - DSLR camera
  - Light source
  - Screw alignment jig and shadow screen
- Light projects a shadow of the screw onto the screen
- Camera takes a picture of the underside of the screen
- Ideally light source would be collimated
  - We’re using a lens to somewhat collimate the light source, but not quite completely

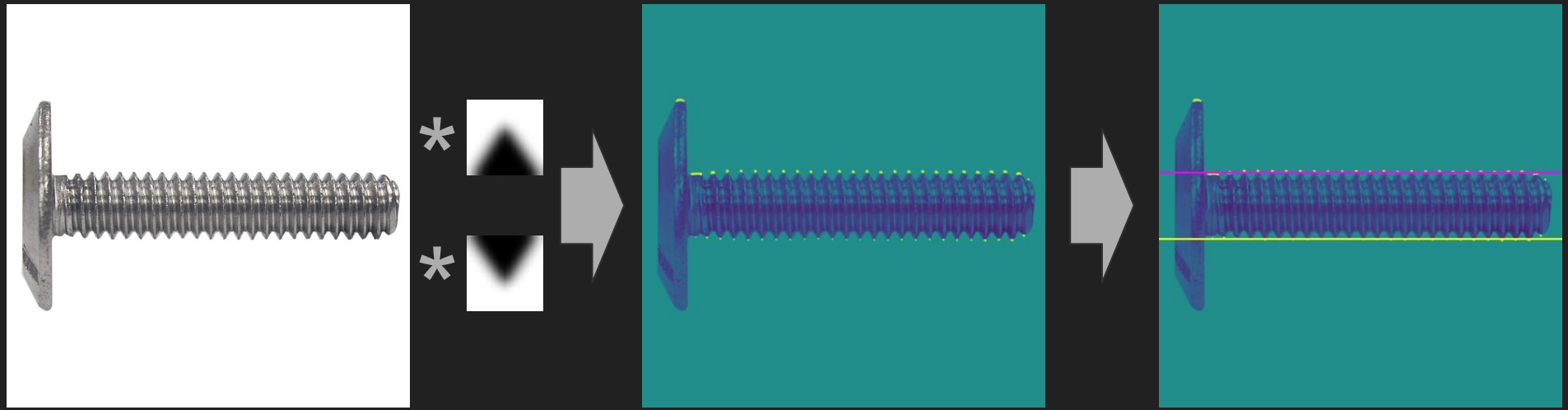


# Point Source vs. Collimated



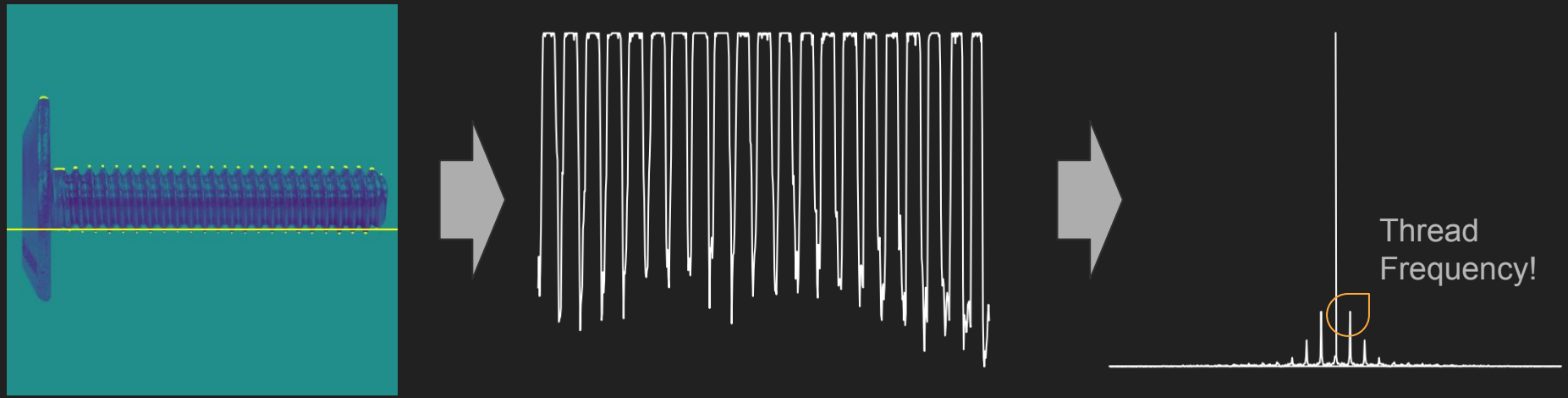
# Thread Identification: Diameter

- Convolve thread kernels with screw image
  - Identifies possible thread points
- Use RANSAC to match a line to the top and bottom convolution responses
- Distance between these two lines is the screw diameter



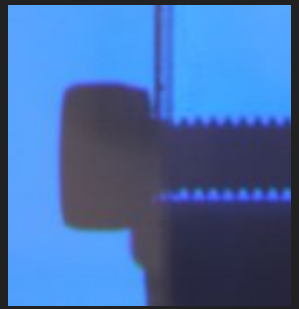
# Thread Identification: Pitch

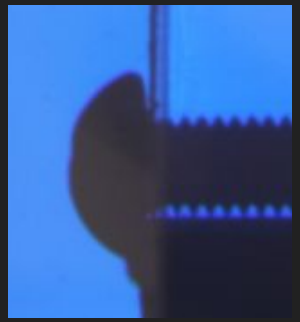
- Step one of the thread point lines a bit closer to the center of the screw
- Take the intensity along this line between the first and last thread points
- Compute the Fast Fourier Transform along this intensity curve
- The most prominent peak in the response corresponds to the thread pitch

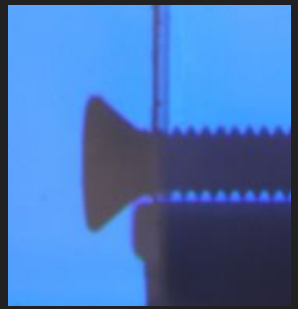


# Screw Identification: Head

- Went through a number of challenges with this.
- Planned on doing statistical pattern recognition, but ended up taking different approaches.

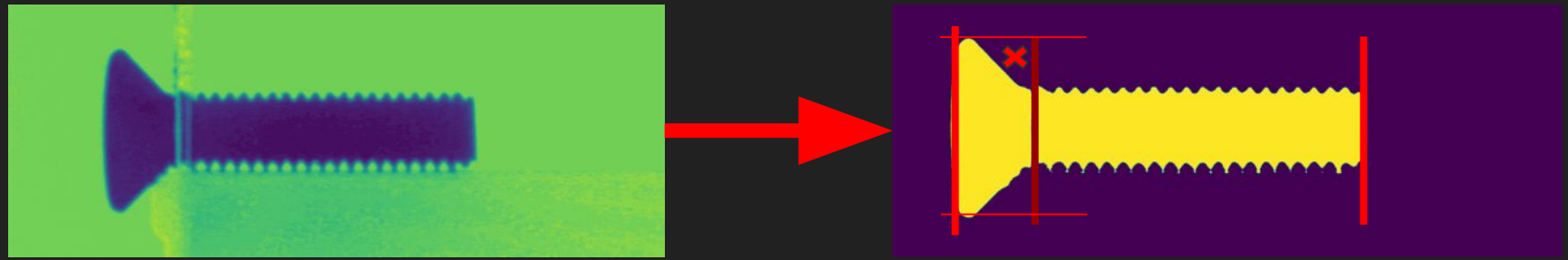






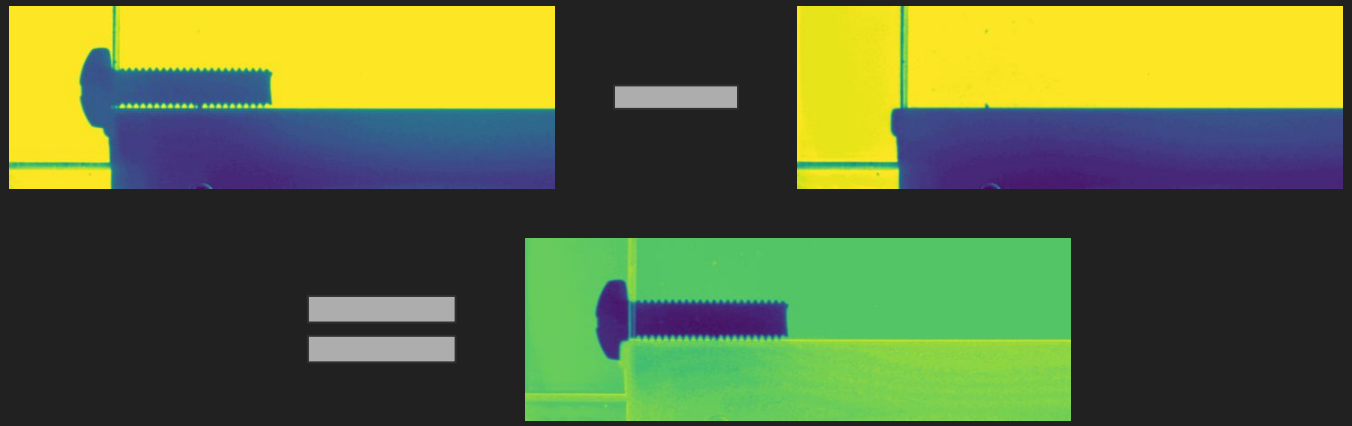
# Screw Identification: Length

- Threshold the image.
- Sweep through horizontally and vertically.
- Take location where number of “true” pixels > THRESH as a boundary



# Background Removal

- Using the SKRT jig complicates things
- We calibrate before using by taking a shot of the empty jig
- We subtract this image from the image we want to klassify a screw in



# DEMO