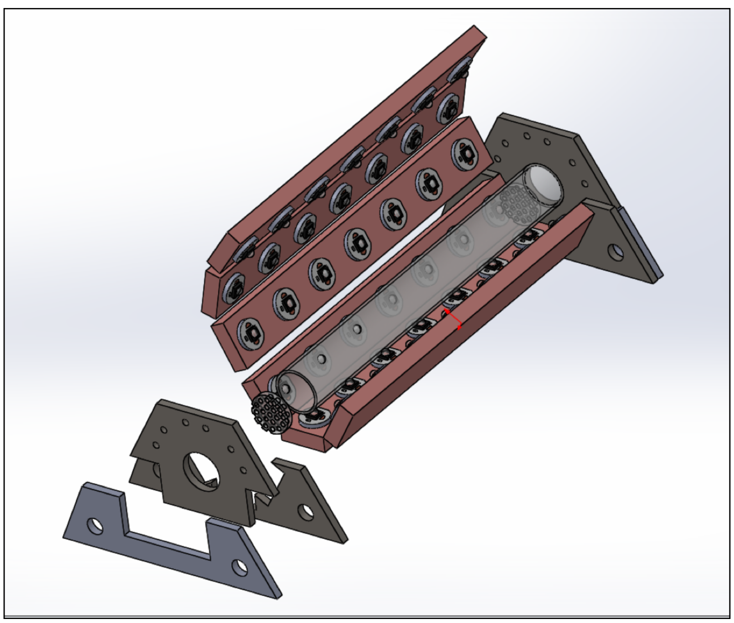
Ryan Catabay

# Development of a Photocatalytic System for Semiconductor Quantum Yield

The utilization of photocatalysis has a well-known potential for mineralizing organic contaminants in water purification processes. A continuous flow photocatalytic reactor was developed in order to test the quantum yield of titanium dioxide, a semiconductor material well known for its photocatalytic properties. In order to build this reactor, multiple manufacturing methods were performed: manual and CNC machining, laser cutting, waterjet cutting, and chemical synthesis. A continuous flow reactor was particularly designed for a controlled, variable radiant flux of ultraviolet light. This continuous UV radiation excites the photocatalyst, generating electron hole pairs that form hydroxyl radicals, which in turn mineralize organic pollutants. The design of the reactor also included a variable catalyst cartridge, allowing multiple catalyst thicknesses and positions to be tested. In having these controlled variables, this reactor allows for a consistent measurement of contaminant degradation. This information relates directly to the quantum yield of the catalyst, allowing for a higher understanding of the material and its photocatalytic activity. Results from testing will be compared to Monte Carlo simulations of electron hole pair generation that have been produced. Further, several testing methods were used in the characterization of the semiconductor thin-films, such as UV-Vis spectrophotometry, scanning electron microscopy and energy dispersive x-ray spectroscopy.



Exploded solid model representation of the photocatalytic reactor

Mentor: Dr. Jun Jiao

Maseeh College of Engineering and Computer Science
PORTLAND STATE UNIVERSITY

SRC®

EducationAlliance
for Science, Engineering & Technology