Brian Fehring

M.S. Graduate Student

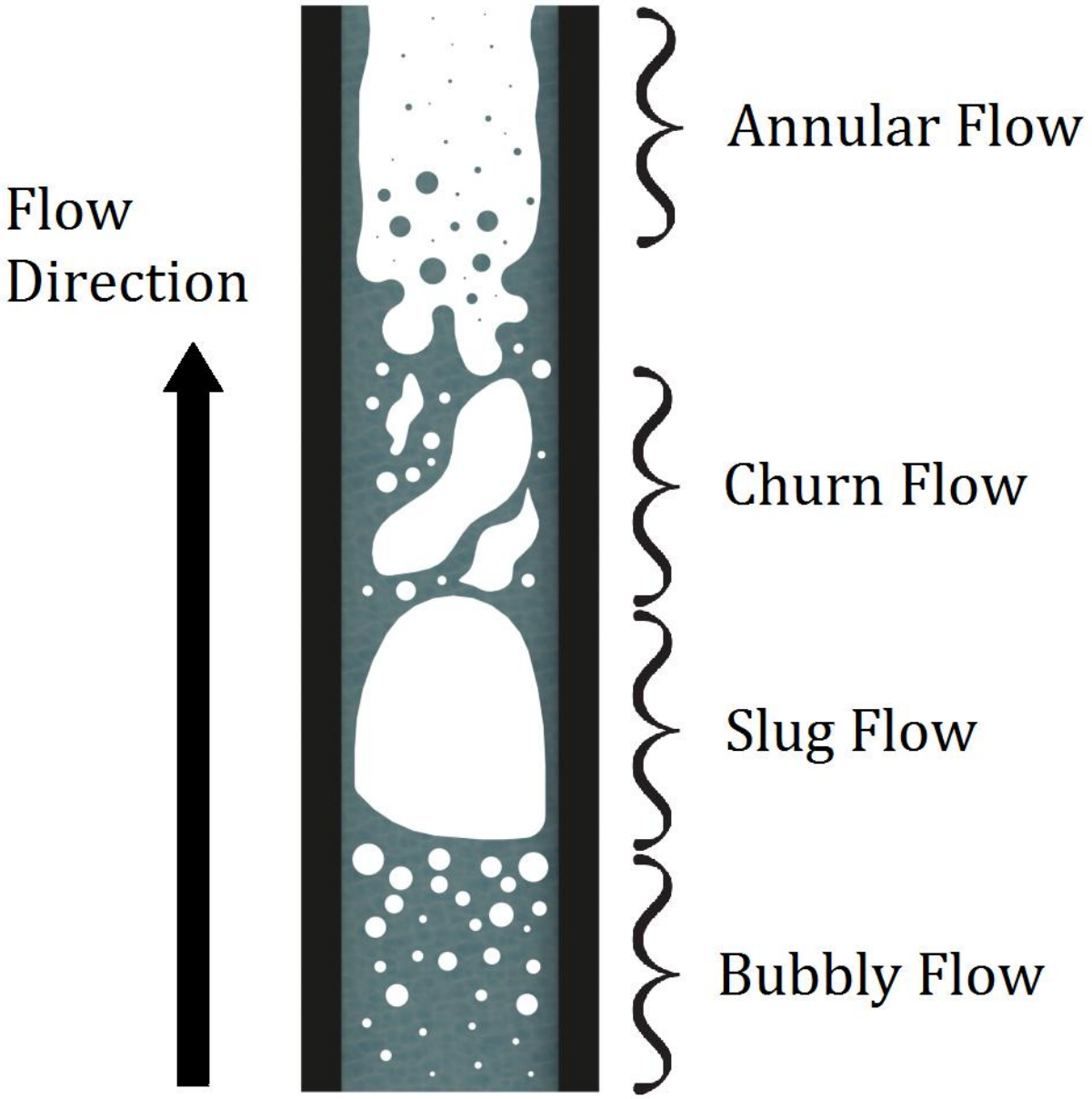
Mechanical Engineering

Office: ERB 126
Lab: ERB 138

Email: bfehring@wisc.edu

Hometown: West Bend, WI

Project: Transient Wall Temperature and Film Thickness of Vertical Annular Two-Phase Pulsatile Flow



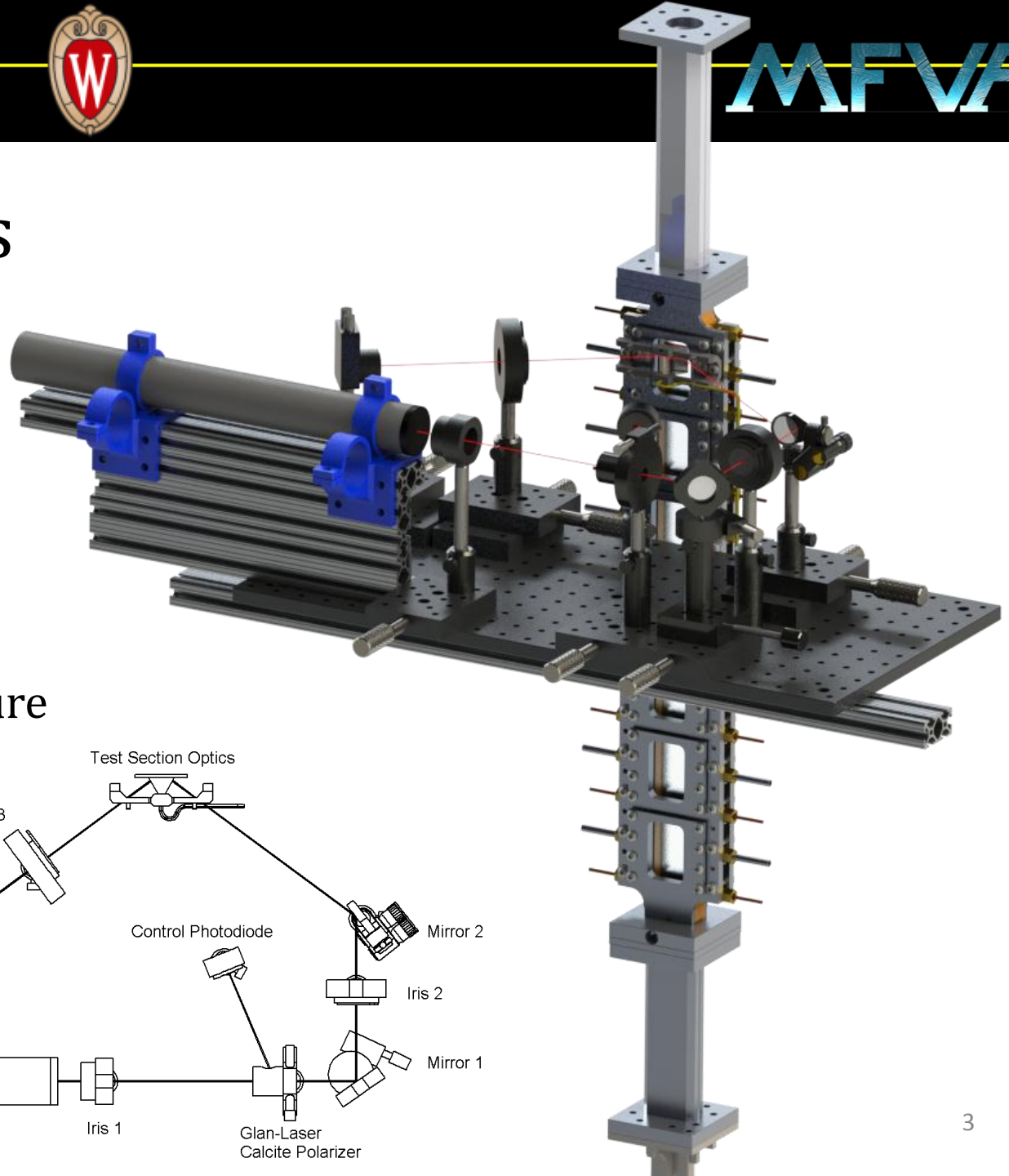
Motivation

- Two-phase annular flow is common in industrial cooling applications
- If the liquid phase fully evaporates, system cooling may be lost
- Understanding liquid film and heat transfer behavior in two-phase annular flow is critical for maintaining safe operation
- Liquid film thickness and temperature measurements are needed for calculating the heat transfer coefficient

Temperature Measurements

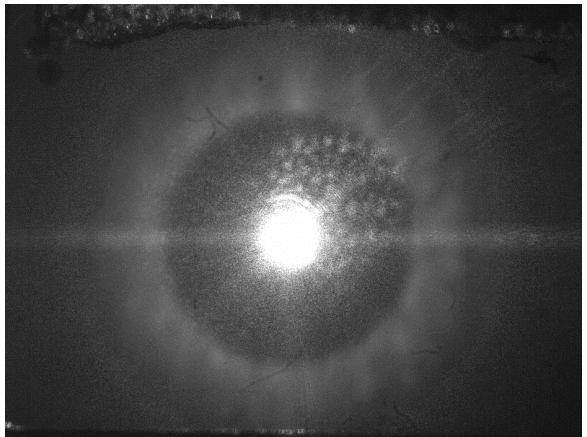
- A laser is used to measure the instantaneous temperature of the liquid film at the test section wall with a resolution of ± 0.2 °C change in temperature

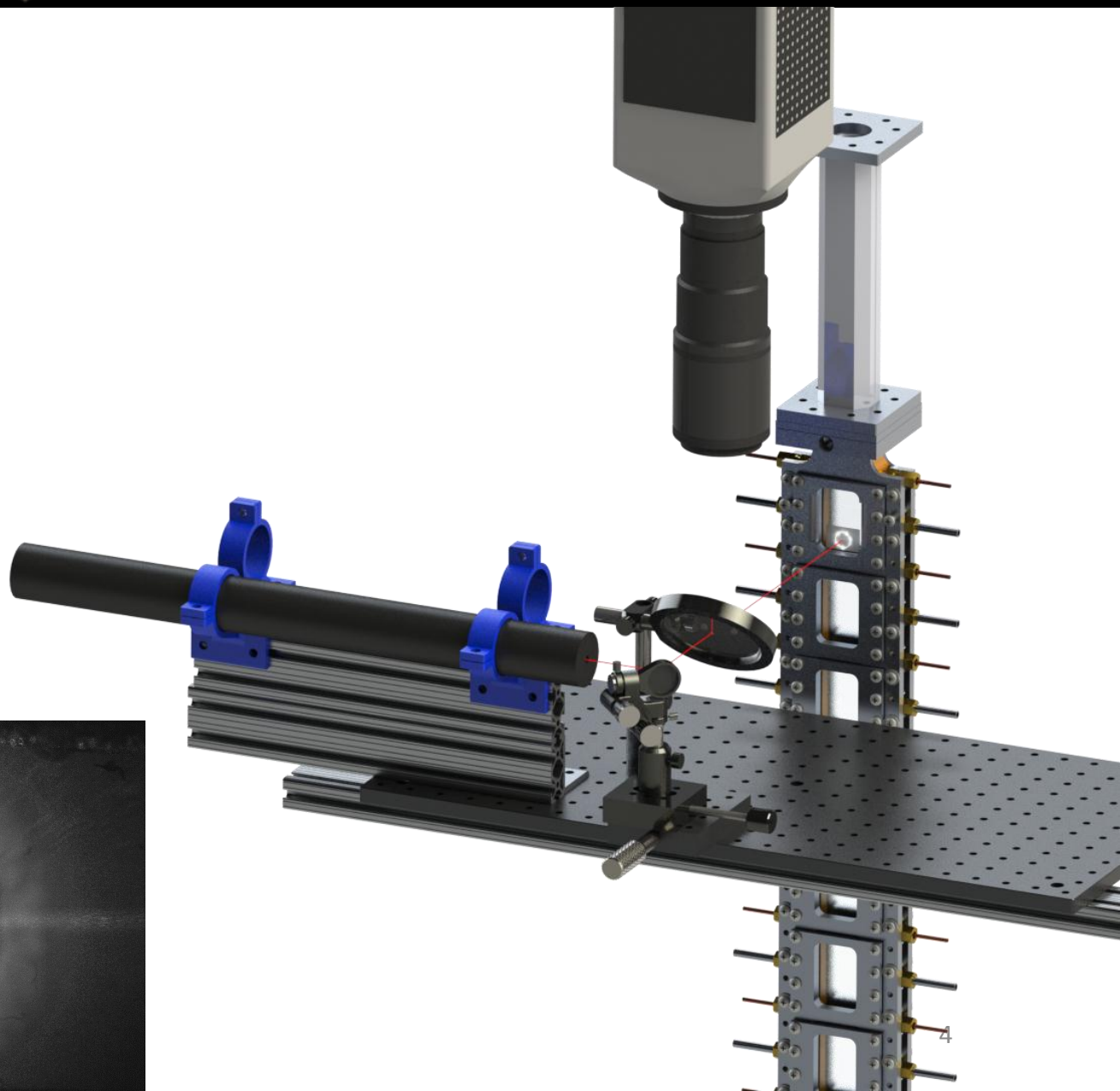
- The technique is based on the temperature dependence of the liquid's index of refraction



Liquid Film Thickness Measurements

- A laser is used to measure the thickness of the liquid film with a resolution of ± 10 μm
- The technique is based on the total internal reflection of light, which creates a measurable ring of light (around 12 mm in diameter)





Pulse Generator

- A large refrigerant boiler was constructed to send pulses of vapor through the annular flow test loop
- The pulse generator boils refrigerant using six, individually-controlled, finned cartridge heaters and is designed for operation at gauge pressures up to 400 kPa
- Pulses are released from the storage tank using a stepper motor connected to a butterfly valve at pulsing frequencies between 1-15 Hz