WISCONSIN
UNIVERSITY OF WISCONSIN-MADISON

Joe Farrell

M.S. Student
Mechanical Engineering

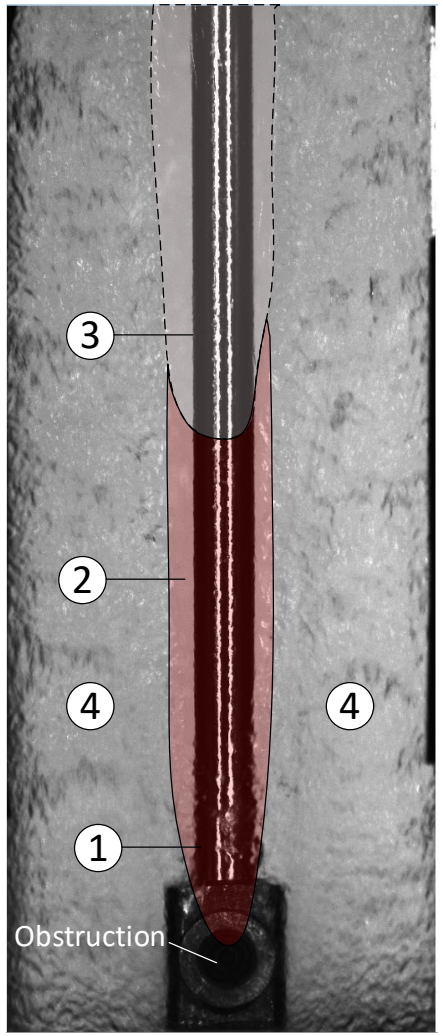
Office: ERB 126
Email: jnfarrell@wisc.edu
Hometown: Sugar Grove, IL

Project: Obstructed Two-Phase Annular Flow: Altering Dryout Behavior
Advisor(s): Allison Mahvi & Arganthäel Berson
Sponsor: Naval Nuclear Lab

SCL

Laboratory for Energy Transport and Storage

Background



Two-phase annular flow is widely seen in high heat flux applications such as nuclear power due to its large heat transfer coefficient. A key part of determining how well the flow can cool a heated wall is the behavior of the thin liquid film. If there is enough heat applied to the wall, the liquid film will eventually dry out, causing a large and potentially dangerous spike in temperature. This project explores how putting a small cylindrical obstruction in the flow changes dryout behavior. The image displays our test section and calls out the different flow regions that develop with the presence of an obstruction:

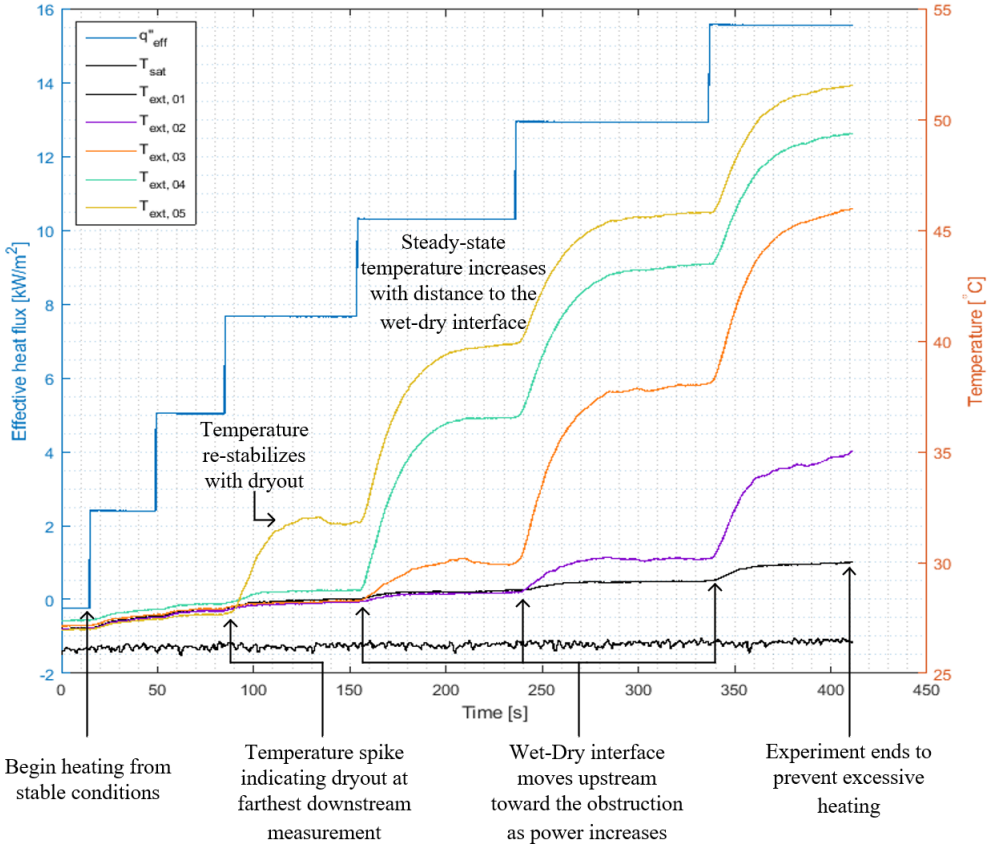
1. Liquid recirculation in the immediate wake
2. Slow moving, calm, very thin liquid film
3. Dryout area
4. Free stream unaffected by the obstruction

Our goal is to characterize the heat transfer performance of these regions through measurements of the liquid film thickness, high-speed video analysis, and wall temperature monitoring.

Laboratory for Energy Transport and Storage

Project Goals

1. Map the temperature response of a range of inlet mass fluxes, qualities, and heat fluxes for two different diameter obstructions
2. Compare the liquid film thickness measurements between obstruction diameters to identify liquid film behavior variations
3. Utilize high-speed video to measure the size of any dry regions
4. Utilize high-speed video to determine the behavior of waves in the liquid film after contacting the obstruction
5. Create a 2D liquid mass flow map around the obstruction
6. Compare liquid mass flow to dryout behavior



Time-trace of wall temperature measured at 5 locations downstream of the obstruction

Laboratory for Energy Transport and Storage