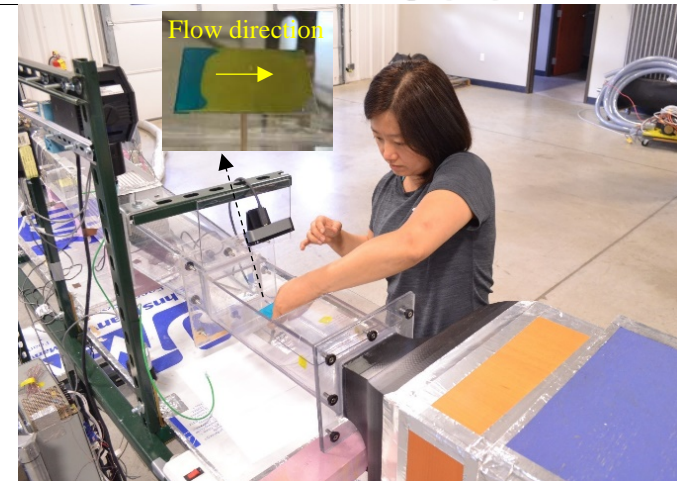
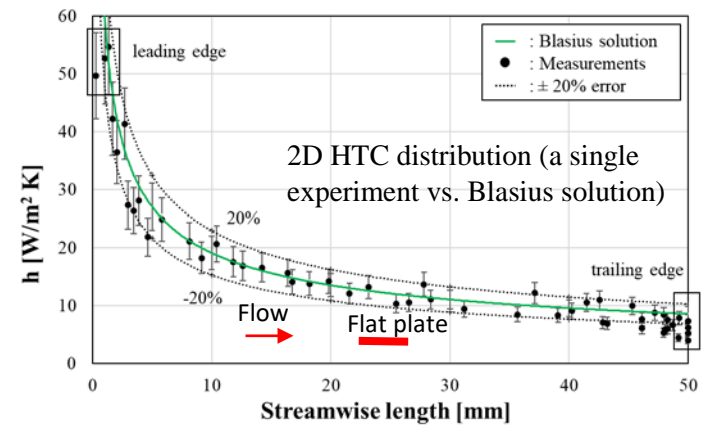


4. ACRC Lab in CTS Building 4.4: Wind Tunnel Facility to Study Air-side Heat Transfer

- Purpose: This open-loop wind tunnel was designed to study local air-side heat transfer for a variety of different heat transfer surfaces. Different heat transfer geometries can be explored in the wind tunnel, including flat plates, round-tube-plate-fin, louver-fin, and samples of actual heat exchanger geometries.
- Capability: The size of test section is 120 mm (W) x 100 mm (H) x 400 mm (L). The total length of the wind tunnel facility is approximately 5 m. Special care was taken to design and implement a bell-shaped contraction that ensures that the test section is approached by uniform flow velocity. The test section is made of transparent materials which allows convenient optical observation. Flow temperature, relative humidity, velocity, and tracer gas concentration can be measured and controlled.
- Current project: Air-side heat transfer coefficients are obtained through a new optical method using the analogy between heat and mass transfer. A 3D printed multi-leg injector provides uniform tracer gas concentrations upstream of the test section, which is important for the new heat transfer measurement method. This method relies on gas absorption of the tracer into a thin film coating which undergoes a color change proportional to the absorber amount of tracer.
- Sensors and data acquisition: The measurements include temperature, pressure, flow velocity, relative humidity ratio and tracer gas concentration. All sensors are connected to an automatic data acquisition system utilizing LabVIEW to continuously monitor the experimental conditions and test results.
- Operating conditions: The current wind tunnel design provides face velocities between 0 and 5 m/s with a cross-sectional non-uniformity of less than 1%.



Installation of test sample for quantification of air-side heat transfer coefficient through a new optical method

- Uncertainty: tracer concentration has ± 5 ppm uncertainty, image processing method has $\pm 1s$ uncertainty and the local heat transfer coefficient has a total uncertainty of 15%