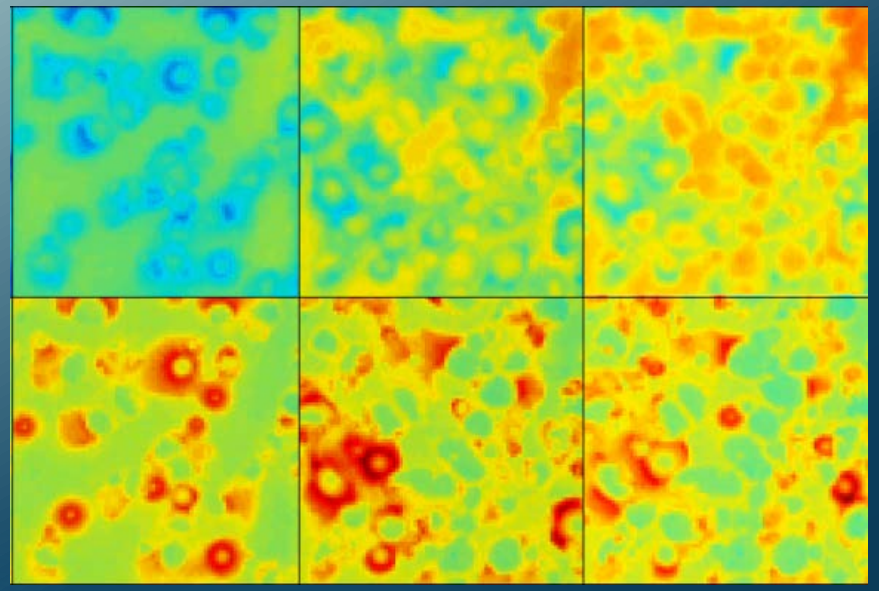

Thermal-hydraulics Experimental Facilities at MIT NSE

NSE
Nuclear Science and Engineering

Massachusetts Institute of Technology
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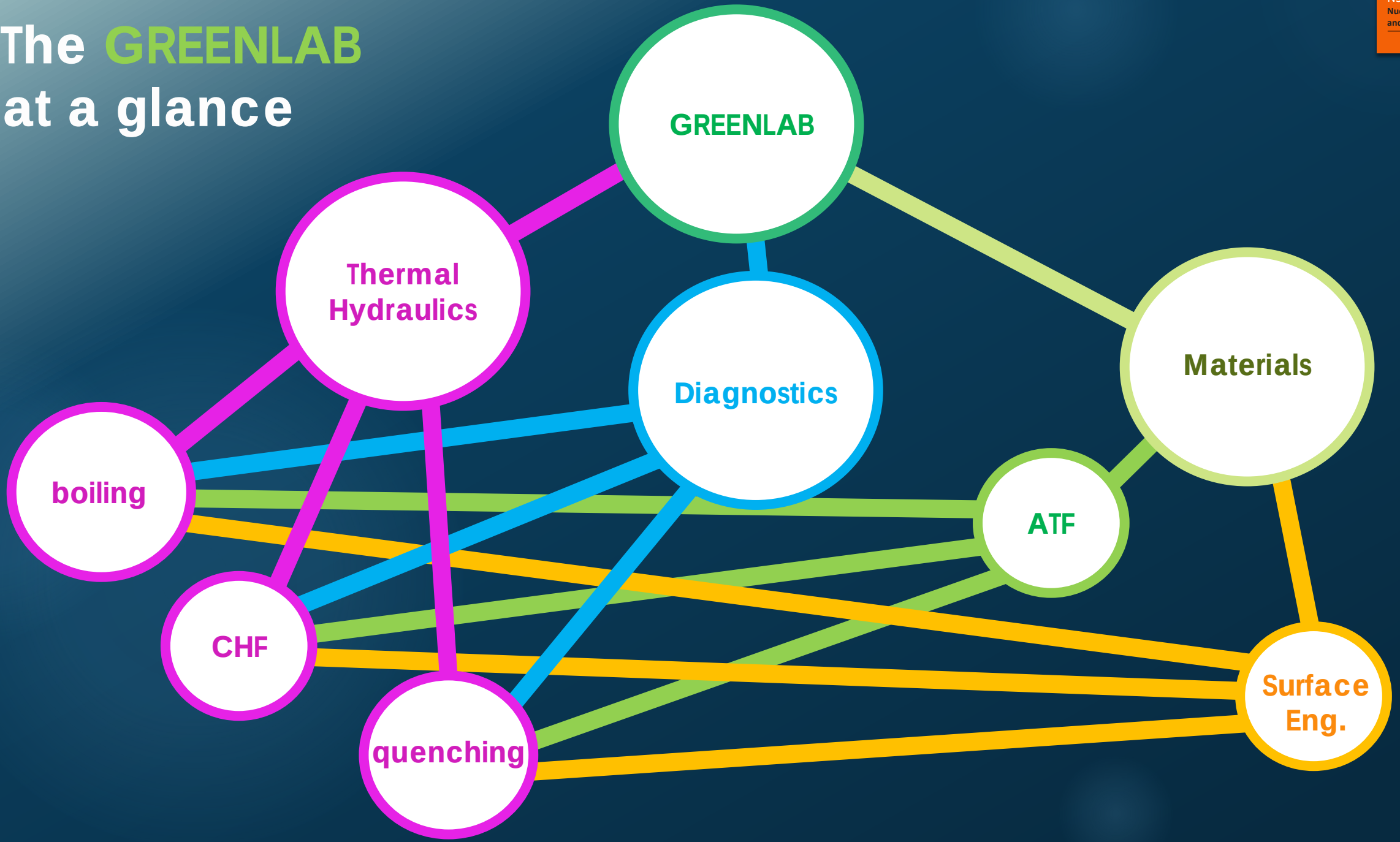
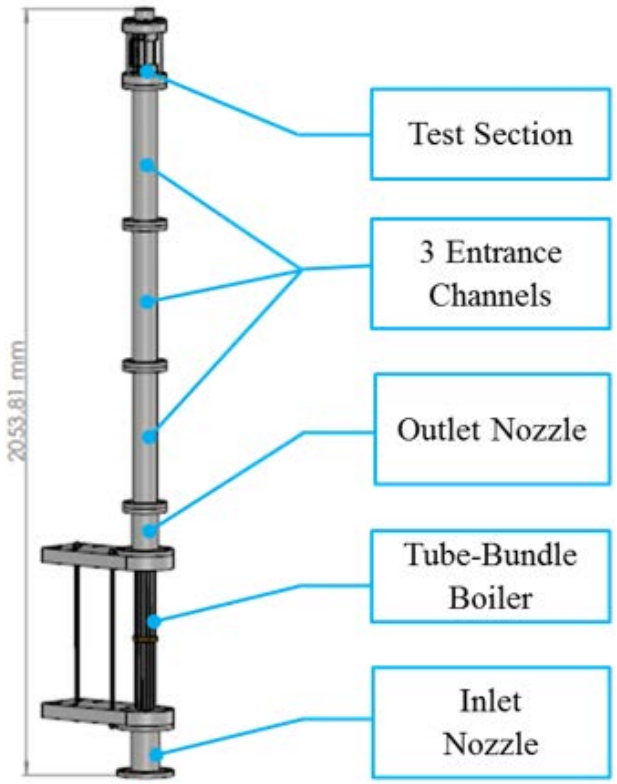
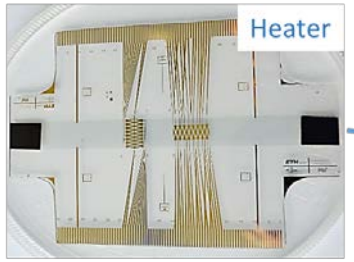
The GREENLAB at a glance



Onset and Suppression of Boiling in Annular Flow

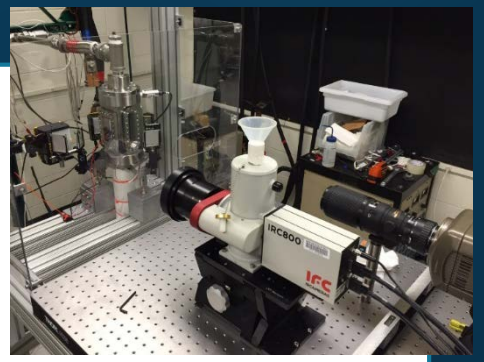




A unique experimental platform…with unique diagnostics

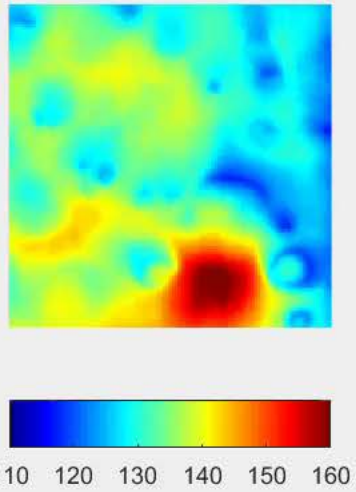
- **Up to10 bars**
- Ambient temperature to saturation
- 400 to 1250 kg/m^2/s
- **Up to CHF**

PEThER | NSE Nuclear Science and Engineering

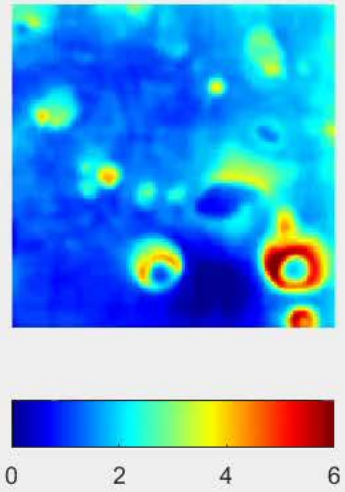


Pressure 1atm - Subcooling 10K - Mass Flux 500 kg/m2 – 1750 kW/m^2

TEMPERATURE [C]



HEAT FLUX [MW/m^2]



HIGH SPEED VIDEO

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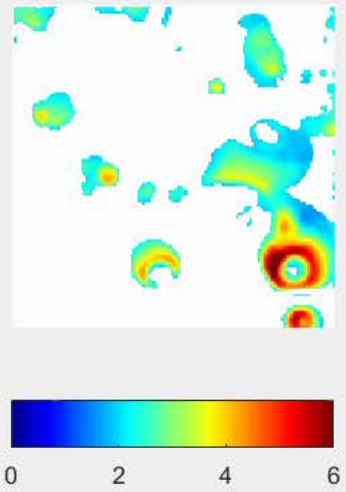
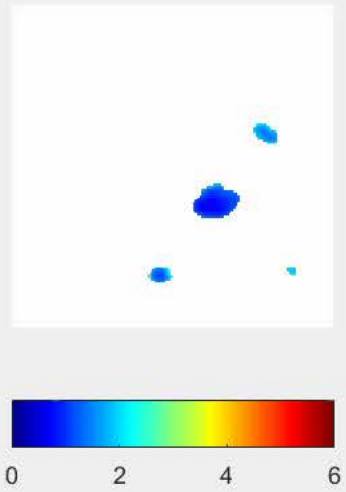
HEAT FLUX [MW/m^2]



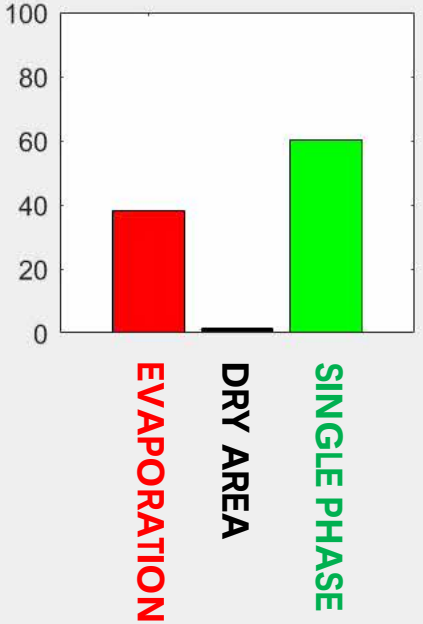
EVAPORATION

HEAT FLUX [MW/m^2]



DRY AREA

PARTITIONING [%]

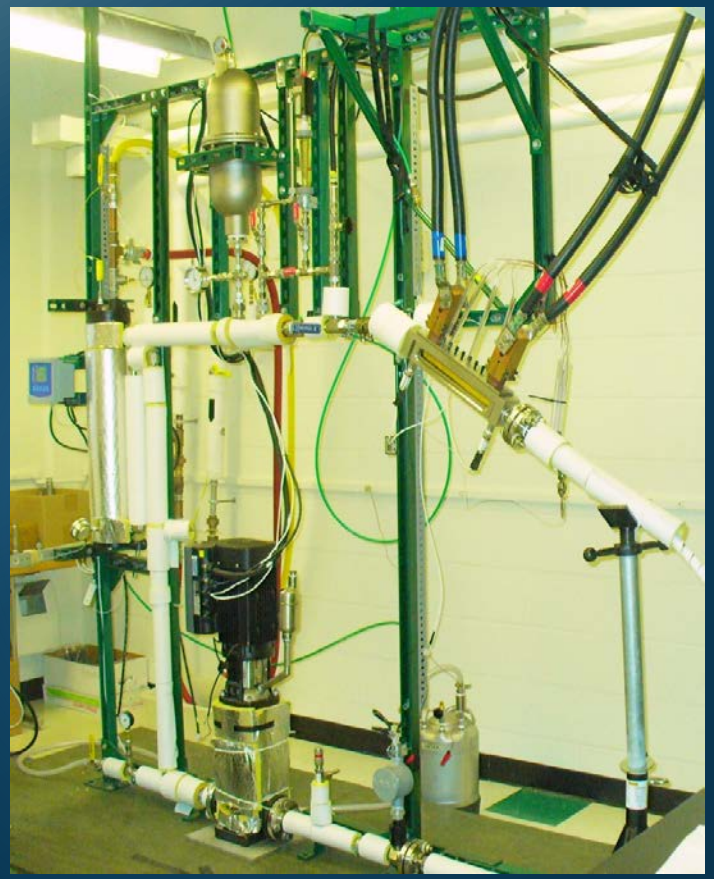


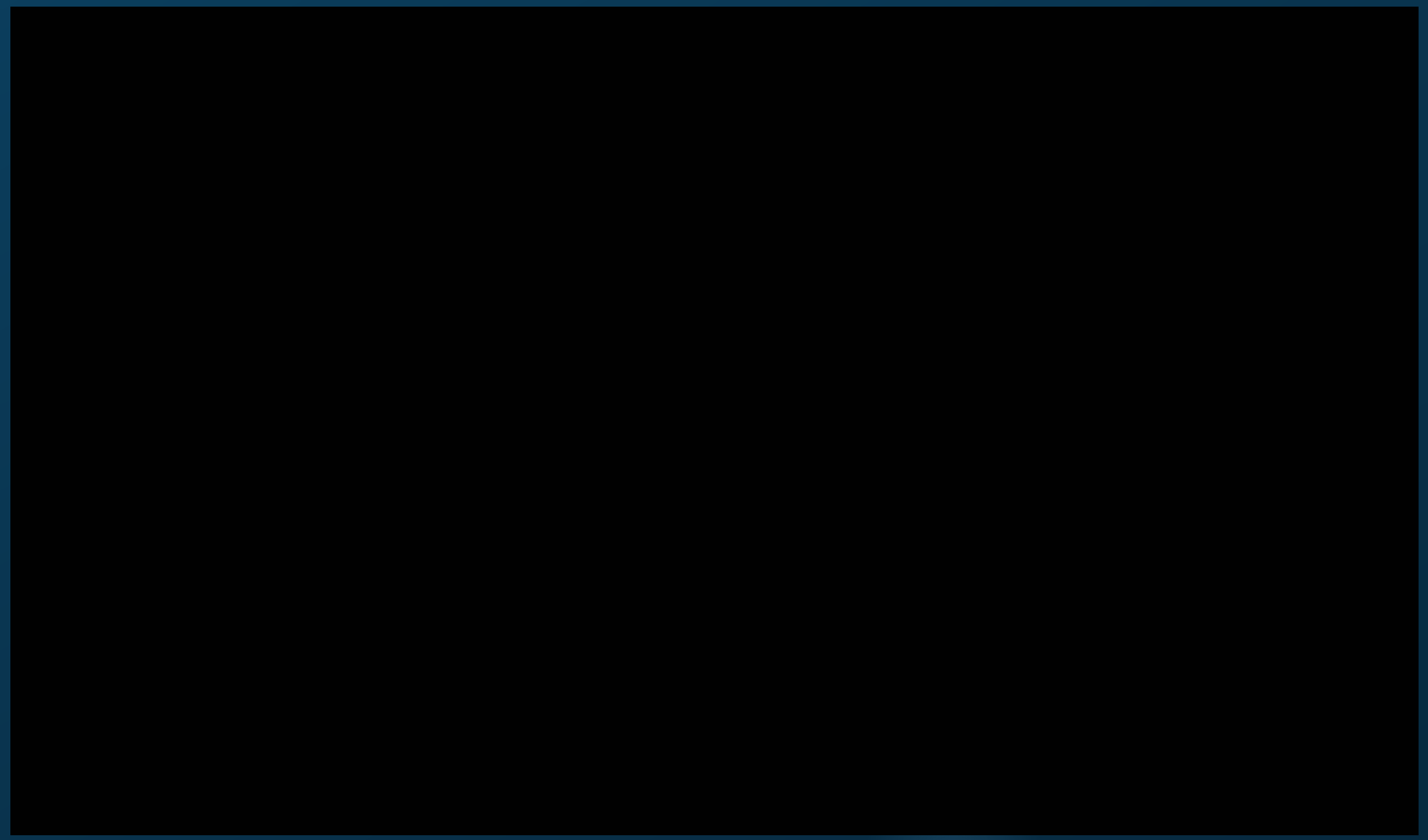
(1x1 cm^2 active heating area – flow is upward)

CHF in In Vessel Retention (IVR)

- **DI water or Primary coolant Chemistry**
- **Up to 10 bars**
- Ambient temperature to saturation
- 400 to 2500 kg/m^2/s
- **Up to CHF**

- **Vary:**
  - **Heater Material & Oxidation**
  - **Inclination Angle**
  - **Water Chemistry**
  - **Mass Flux, Inlet subcooling, Pressure**





Facility Summary & Questions

- Suppression of nucleate boiling in Annular Flow Facility
- PeThER facility
- In Vessel Retention Facility
- High temperature steam oxidation facility (~1500 °C)
- Quench Facility (~1500 °C)
- Molten salt optical transmission measurement (~800 °C)
- Drop facility for drag measurements
- Multiple Pool Boiling Facilities
- High speed optical camera
- Two high speed IR cameras
- Time resolved PIV at 10 kHz
- Contact Dr. Bren Phillips (bren@mit.edu)