Transient Mixed Convection Validation for NGNP

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ABSTRACT

In this work, we will perform high-fidelity experiments on steady and transient natural and mixed convection (with buoyancy aiding and opposing the flow direction) to be used as Computational Fluid Dynamics (CFD) validation data. *Validation of CFD and other codes using these data will provide the necessary confidence to use such codes for nuclear safety and design, reducing cost compared to full-scale tests.*

The experimental data will be compared to Computation Fluid Dynamics (CFD) simulations, (performed by both the USU and INL) also performed as part of this work. We will assess the CFD model's performance for steady and mixed convection for cases with the flow with and against gravity using our unique facility.

All data generated in the proposed work will be deposited in a new validation database under development at INL (NE-CAMS), making them available to a wide range of numerical researchers. Along with the data, all details of the experiment, including all velocity and thermal boundary conditions, inflow conditions, and as-built geometries, will be submitted to the database.

Experiments will be performed in the USU Transient Mixed Convection Wind Tunnel. This unique facility was created specifically for the task of providing flow and thermal validation data for Computation Fluid Dynamics (CFD) for transient and steady mixed convection. Mixed convection refers to the domain between forced convection, where the fluid motion is provided by an external source (e.g., a blower) and natural convection, where the motion is due to density gradients in a gravitational field, or buoyancy. For mixed convection, buoyancy forces remain important, even though an external source of motion is used.