CONTACT INFO

CFD

Elia Merzari
emerzari@anl.gov

Aleks Obabko
obabko@mcs.anl.gov

Paul Fischer
fischer@mcs.anl.gov

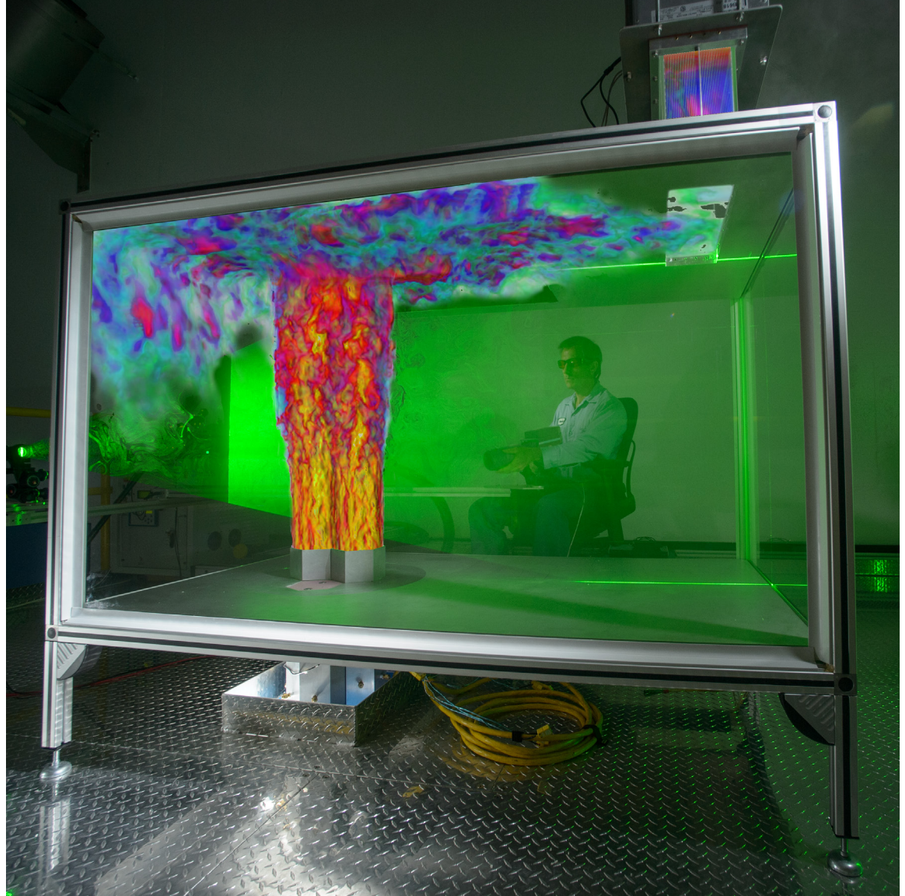
Experiment

Steve Lomperski
lomperski@anl.gov

Dave Pointer
pointerwd@ornl.gov

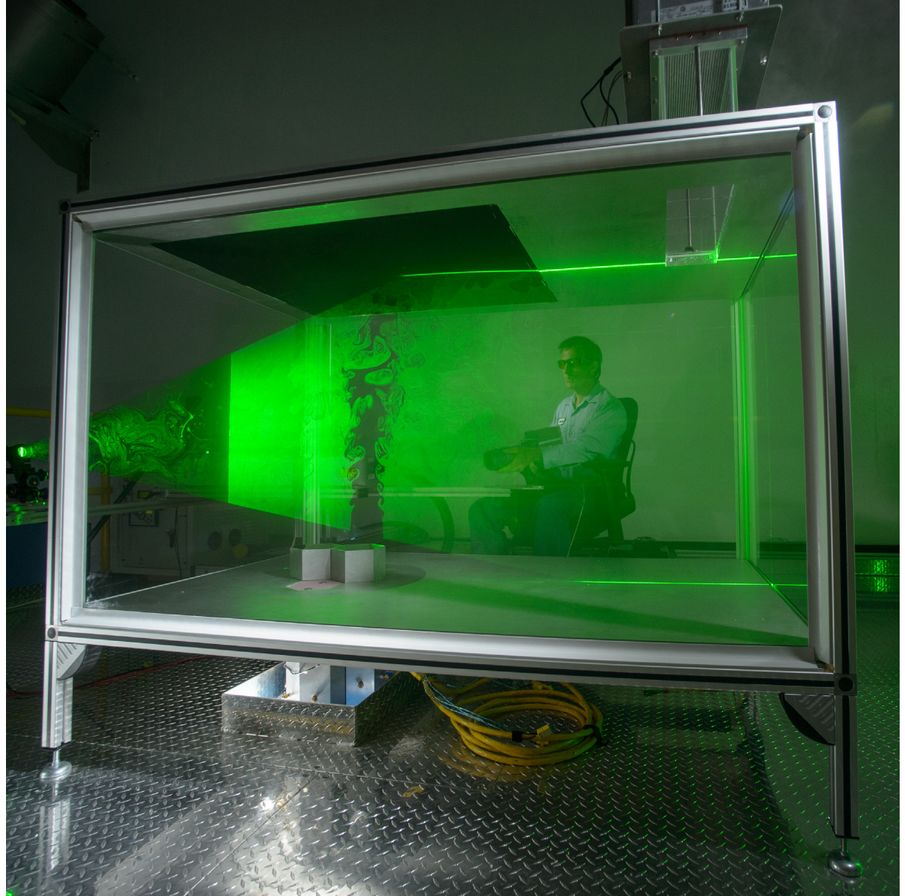
www.ne.anl.gov/capabilities/rsta

Photos: Wes Agresta
Artwork: Sana Sandler
Scientific Data Visualization: Visit



CFD Code Validation
SIMULATION

Argonne NATIONAL LABORATORY



VS

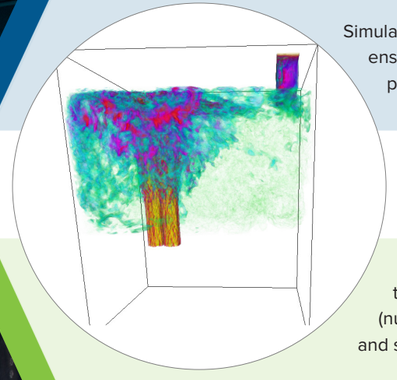
REALITY

ANALYSTS

Simulate flows using high-performance computational fluid dynamics (CFD) tools

The Argonne Leadership Computing Facility is used to analyze the physics of fluid flow and heat transfer in unprecedented detail. It provides insights that are difficult or impossible to obtain with prototypes.

Complex machines such as aircraft and nuclear reactors were once tested almost entirely with physical prototypes, but now cheaper and faster numerical simulations are often used instead.



Simulation tools must be validated to ensure trustworthiness. This is being performed at Argonne using the MAX experiment, which stages complex flow configurations that are then simulated by analysts. Together we compare results to validate and improve the predictive power of the computational tools. The work is being performed under the Department of Energy's NEAMS (nuclear energy advanced modeling and simulation) program.

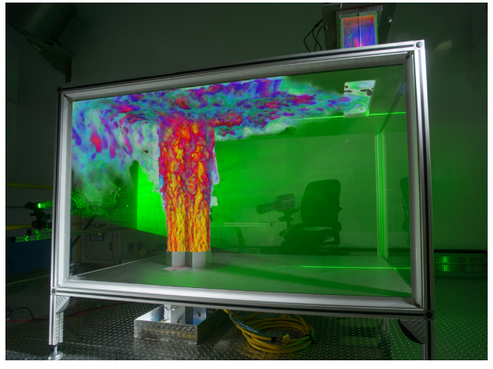
EXPERIMENTALISTS

Measure flows using a collection of high-resolution instruments

A laser illuminates particles suspended in air jets for imaging by a high-speed camera to measure turbulence.

A fiber optic distributed temperature sensor generates thousands of data points along a single strand of glass as slender as human hair.

WHO IS RIGHT?

Simulation tools are becoming ever more powerful, sometimes even revealing phenomena that remain beyond the reach of instruments. Experiments, on the other hand, always harbor uncertainties. And advanced instruments often generate "real" data using abstract models akin to those in CFD codes. Both are tools for examining the physical world. Which is closer to the "truth," that is, to nature?

In code validation, the answer can be unexpected.