PROJECT NAME: Characterization of Convective and Particle Losses in High-Temperature Particle Receivers

Last 5 digits of project number: 33869

Principal Investigator (PI): Clifford K. Ho, SNL

PI Email: ckho@sandia.gov

BACKGROUND / INDUSTRY IMPACT

- Particle and heat losses occur from the open aperture of a falling particle receiver
- Need in-situ methods to characterize particle and heat losses to address performance and environmental concerns

PROJECT OVERVIEW / OBJECTIVES

- Develop in-situ imaging methods to quantify particle and heat losses
- Perform exposure assessments to determine inhalation and pollution hazards

METHODS

- Develop imaging tools and algorithms to quantify particle loss and convective heat loss from infrared and visible cameras
- Monitor and assess particle plume concentrations using traditional air samplers and compare to NIOSH and EPA standards

KEY OUTCOMES / MILESTONES

- Performed lab-scale imaging tests and developed algorithms to determine particle temperatures and mass flow
- Sampled particle concentrations during on-sun tests using traditional air monitors
- Simulated and measured particle concentrations were significantly lower than NIOSH (15 mg/m^3) and EPA (12 μg/m^3) standards

CONCLUSION / REMAINING RISK

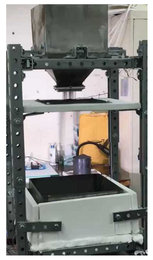
- In-situ imaging and air-sampling methods developed to characterize particle and heat losses from particle receiver aperture
- Needs: Determine impact of concentrated light on imaging methods and perform additional on-sun tests to evaluate in-situ imaging methods.

SAND2020-28850

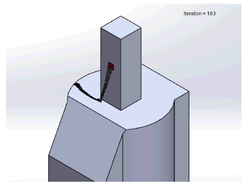
CONCENTRATING SOLAR-THERMAL POWER TRACK (Gen 3 Lab Call)

Developed **in-situ imaging** methods to **quantify particle and heat losses** from falling particle receivers

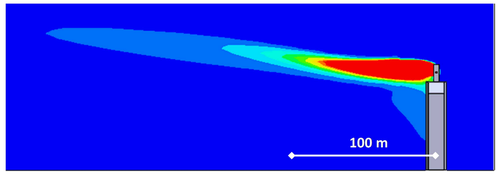
Scan for more information

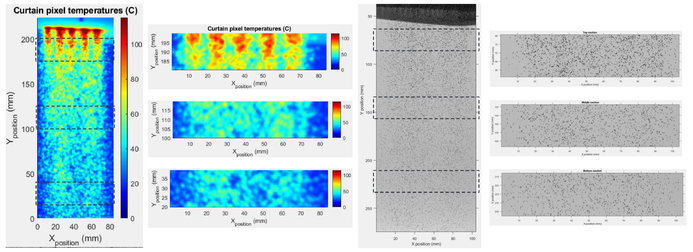


Infratec high-speed IR camera and bench-scale particle-flow test



CFD simulations of large (350 μm, left) and small (<10 μm, below) particles with 2 m/s west wind





Infrared (left) and visible (right) camera images for determination of particle temperatures and opacities

Above: Volumetric air sampling of small (<10 μm) particles during on-sun particle-receiver test

Left: Sampling of large (>10 μm) particles using Malvern Spraytec laser diffraction system during on-sun testing

Project contributors: Sandia National Laboratories, University of New Mexico, AirPhoton