Gen3 CSP Lab Support – Particle Imaging & Sampling - 33869

Novel particle and heat loss imaging method developed

1. Impact

This project developed novel camera-based imaging methods to detect particle and convective heat losses from an open-aperture high-temperature particle receiver, which can enable lower-cost CSP systems for power, process heat, and thermochemical applications.

2. Project Goal

The goal of this work was to develop characterization methods to quantify the particle and heat losses from the open aperture of a particle receiver.

3. Method(s)

Camera-based imaging methods were developed using both bench-scale testing at the University of New Mexico and on-sun tests at Sandia. Verification of the imaging methods was performed using gravimetric and calorimetric methods. In addition, conventional particle-sampling methods and modeling were applied to the on-sun tests to compare particle emission rates with regulatory standards for worker safety and pollution.

4. Outcome(s)

Results showed that particle emissions and concentrations were well below regulatory standards for worker safety and pollution. In addition, estimated particle temperatures and advective heat losses from the camera-based imaging methods correlated well with measured values during the on-sun tests.

5. Conclusion/Risks

New non-invasive camera-based imaging methods can be used in particle-based CSP systems to assess particle and heat losses. Designs for commercial scale-up have been developed, but larger-scale testing is required.

6. Team

Sandia National Laboratories, University of New Mexico, AirPhoton

Visuals

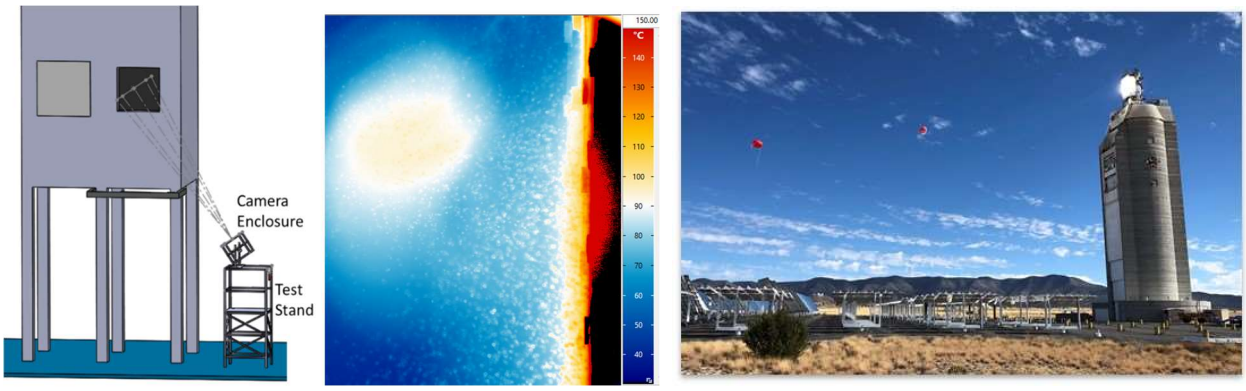

Figure 1. Left: Schematic of camera-based imaging of particle losses from aperture of falling particle receiver at Sandia's National Solar Thermal Test Facility. Middle: Infrared image of particle emissions during on-sun test (aperture on right side). Right: Tethered-balloon particle sampling to compare emissions to regulatory standards.

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