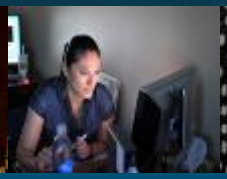
SAND2022-6569C

Sandia National Laboratories

Solar Flux Sensor Development and Calibration for Commercial Concentrating Solar Power Research and Application



Concentrating Solar Technologies

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Date: 22 June 2022

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Overview

- Introduction – Project Background
- Motivation
- Stakeholder Outreach
- Sensor Development
- Testing at NSTTF
- Calibration Capability
- Project Outcome

Introduction

- Novel flux sensor development
- Partner with commercial entity
- Calibration and sensor verification under solar condition
- Robust design
- CSP commercial application
- Motivation

Gardon Gauge style sensor from Hukseflux: https://www.hukseflux.com/

Motivation

- **CSP research needs are unique**
  - **Cost** of new sensors
  - Lead **time** for new sensors
  - Not on-sun rated

- ✓ Create a novel solution
- ✓ Work with the experts

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Stakeholder Outreach

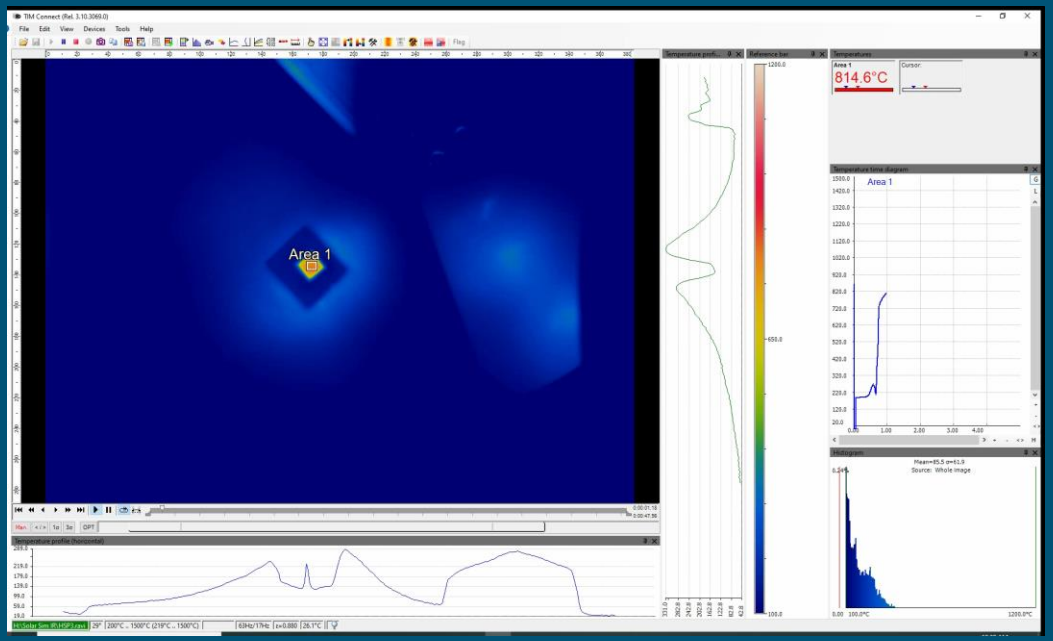
- **Identify design specifications for sensor**
- **Focus on CSP application**
  - Response time
  - Peak flux
  - Exposure duration
  - Sensitivity
  - Material stability

Sensor Development

- **Hukseflux sensor development process**
  - Design for enhanced cooling
  - Surface coating
  - Interfaces and connections methods
  - Adapt design for higher flux value
  - Based on Gardon Gauge

Testing at NSTTF

- **Surface coating**
  - Materials testing
  - Thermal cycling
  - Solar flux cycling
  - Accelerated aging
  - Coating selection



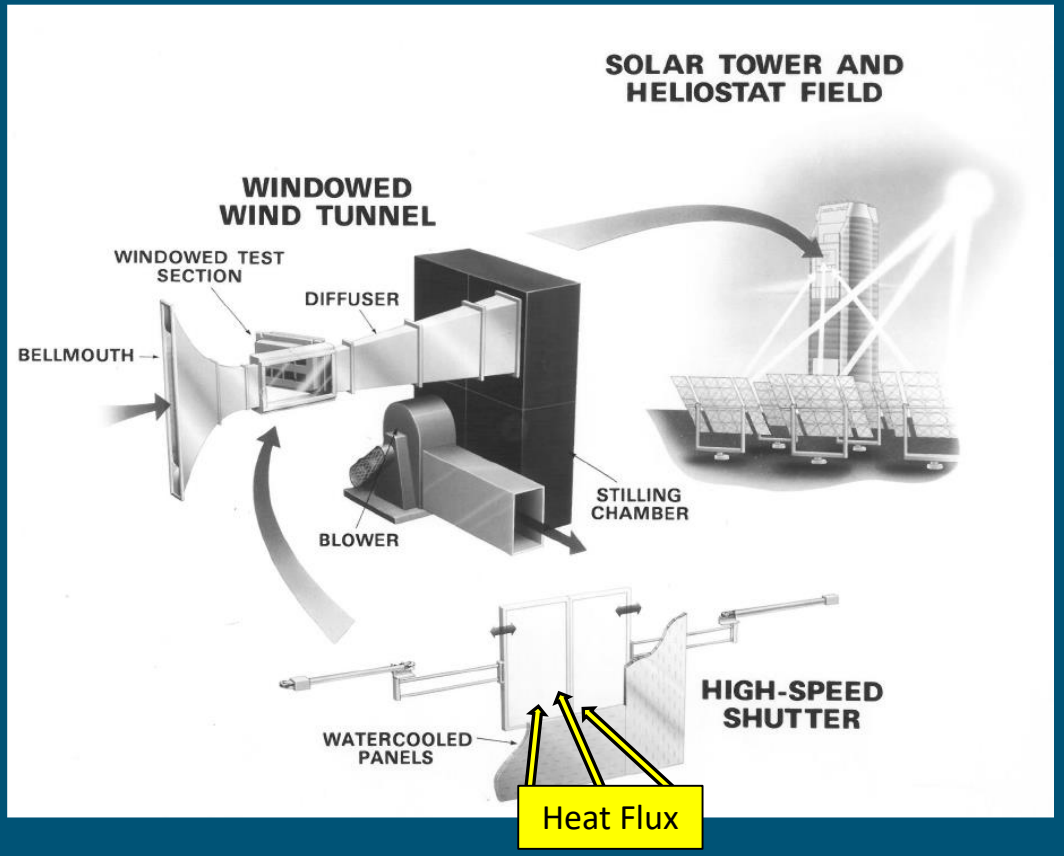
Testing at NSTTF

- **Test facilities capabilities**

➢ Solar furnace
  - up to 6000 kW/m^2

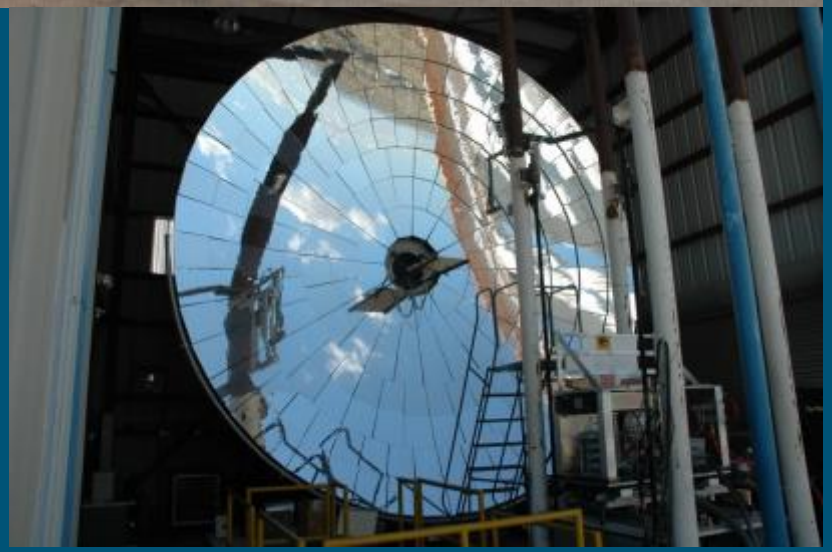
➢ Wind tunnel
  - Convective cooling

➢ Solar simulator
  - Accelerated aging
  - Thermal cycling
  - Durability
  - Lifetime analysis



Calibration

- **Calibration capabilities**
  - Solar furnace
    - up to 6000 kW/m^2
  - Reference sensor
    - Cavity style radiometer
  - Solar heat source
  - Controlled environment
  - Controlled coolant



Solar Furnace facility at the NSTTF; https://www.osti.gov/servlets/purl/1146926

Project Outcome

- **Project results and products**
  - ➢ Affordable & available sensors
  - ➢ Cost effective calibration
  - ➢ Improved measurements
  - ➢ Better controllability
  - ➢ Higher reliability
  - ➢ Larger capacity factor
  - ➢ More metrology in Component R&D

The Ivanpah Solar Electric Generating System (source: BrightSource Energy)


Thank you.
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