

Terminal Sterilization Subsystem (TSS) Advanced Development to TRL6

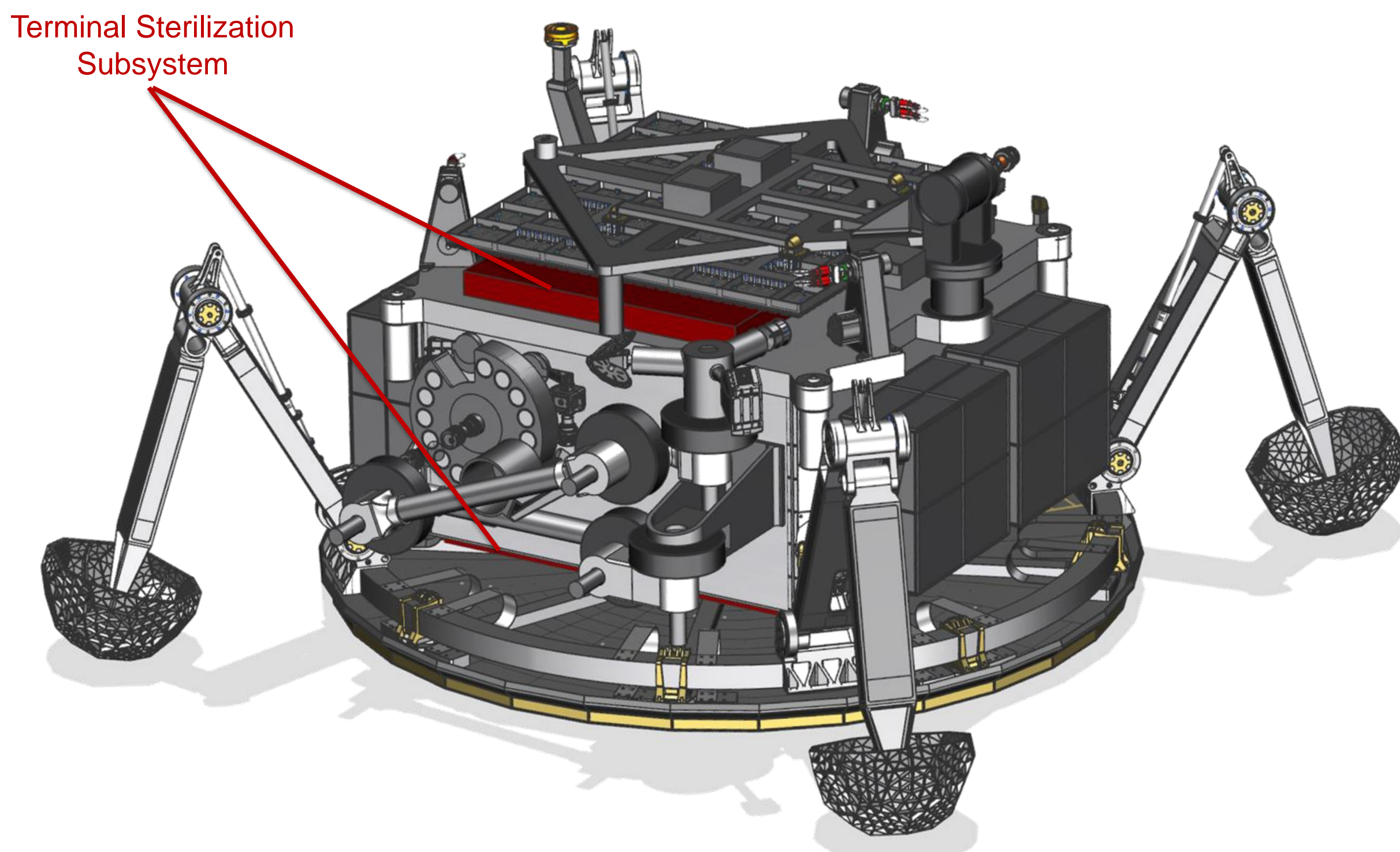


The Terminal Sterilization Subsystem (TSS) represents a revolutionary approach to Planetary Protection that uses energetic materials to rapidly heat up organic material and can be applied to other future icy moon exploration missions.

Mellisa Heller, Tyler Voskuilen, Shawn Stacy, Daniel Sandoval, Morgan Warren, Sandia National Laboratories

Objectives

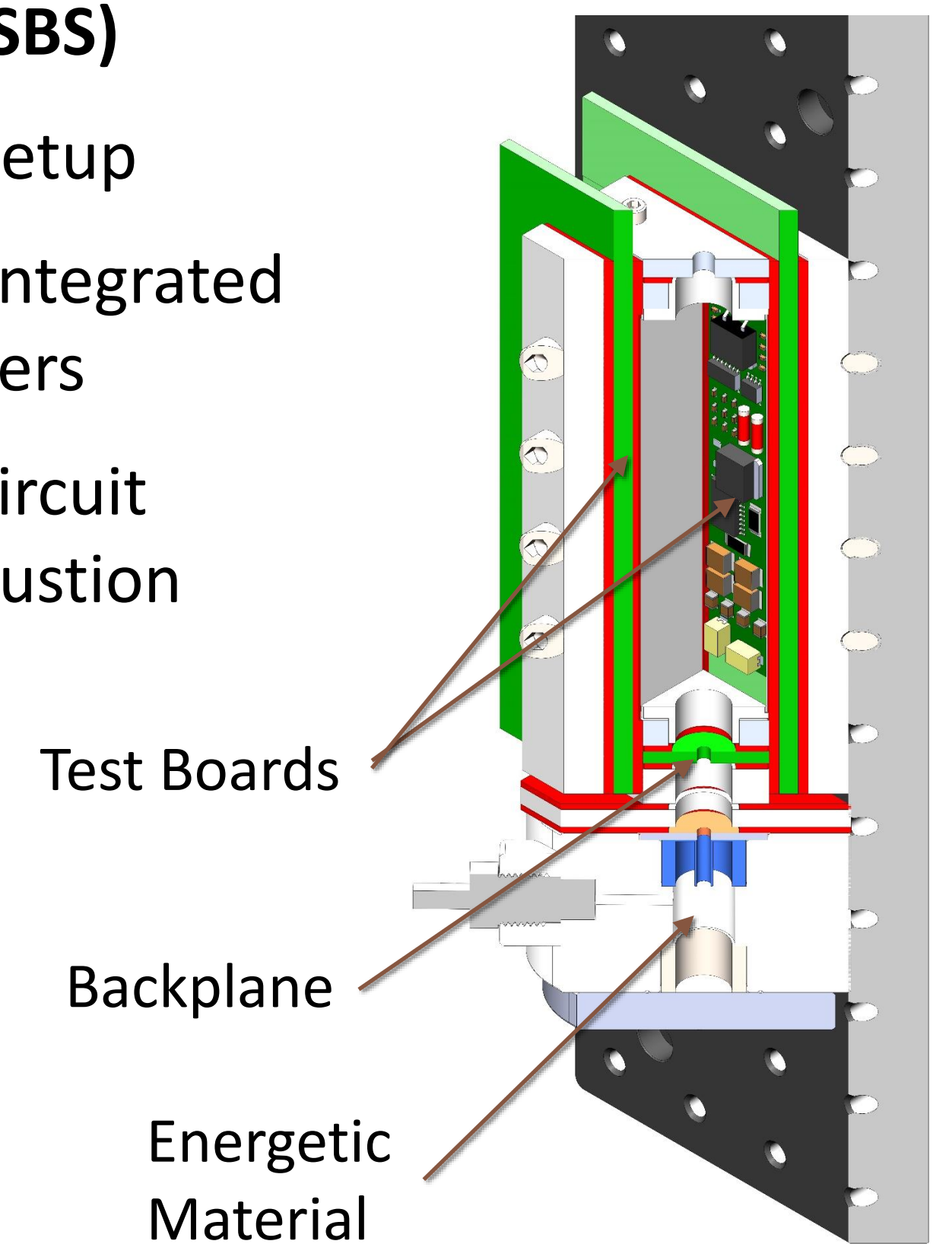
- Heat relevant components enough to sterilize them
- Apply heat within a 10 second window in accident scenarios
- Apply heat at end of successful mission



(Artist's Concept)
Pre-decisional Graphic courtesy of JPL
For Planning and Discussion Only

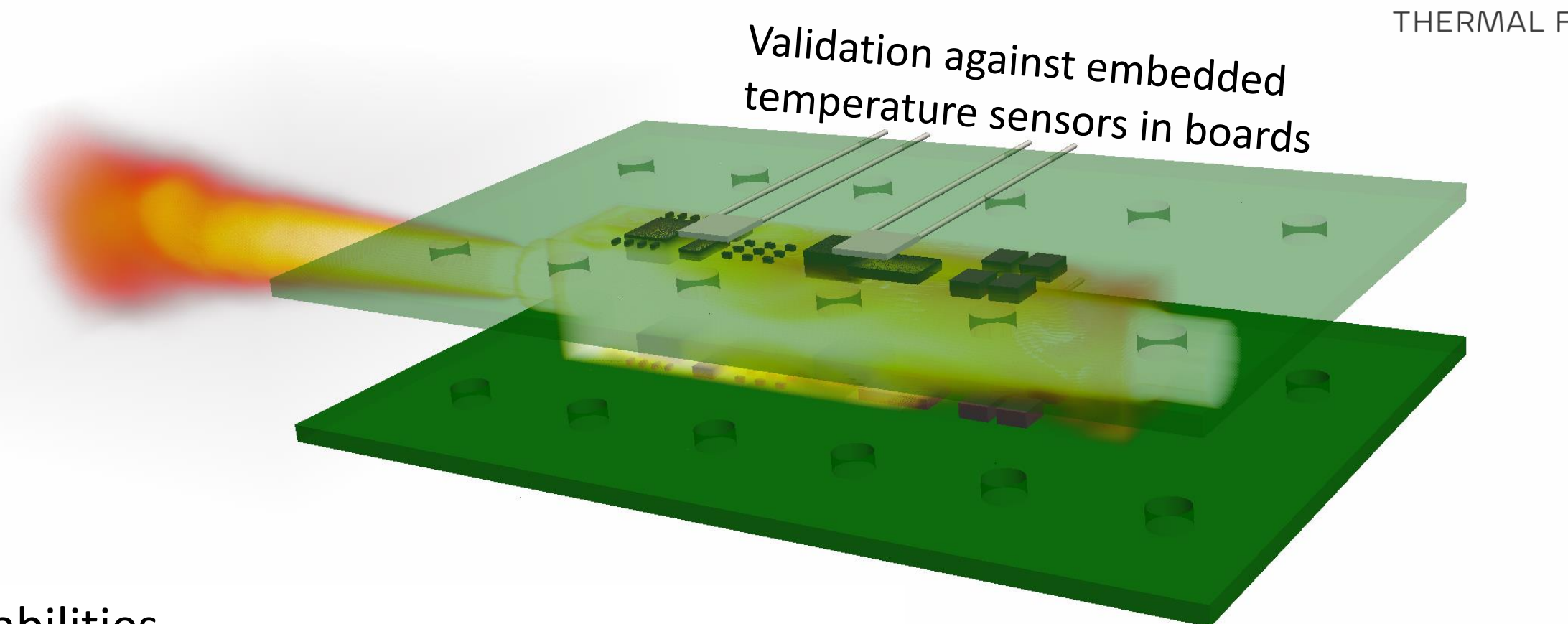
Experimental Prototype (SBS)

- Fully instrumented test setup
 - Temperature sensors integrated into board internal layers
- Realistically configured circuit boards exposed to combustion products
- Computationally tractable domain
- Flexible design to explore parameter space



Computational Model

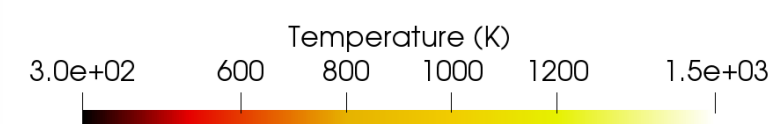
- Uses Sandia Sierra codes
- Developing multiple tiers of model fidelity



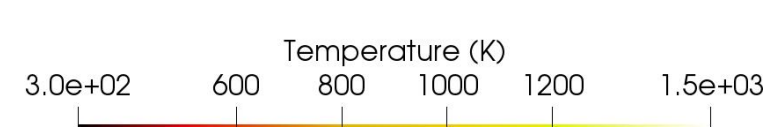
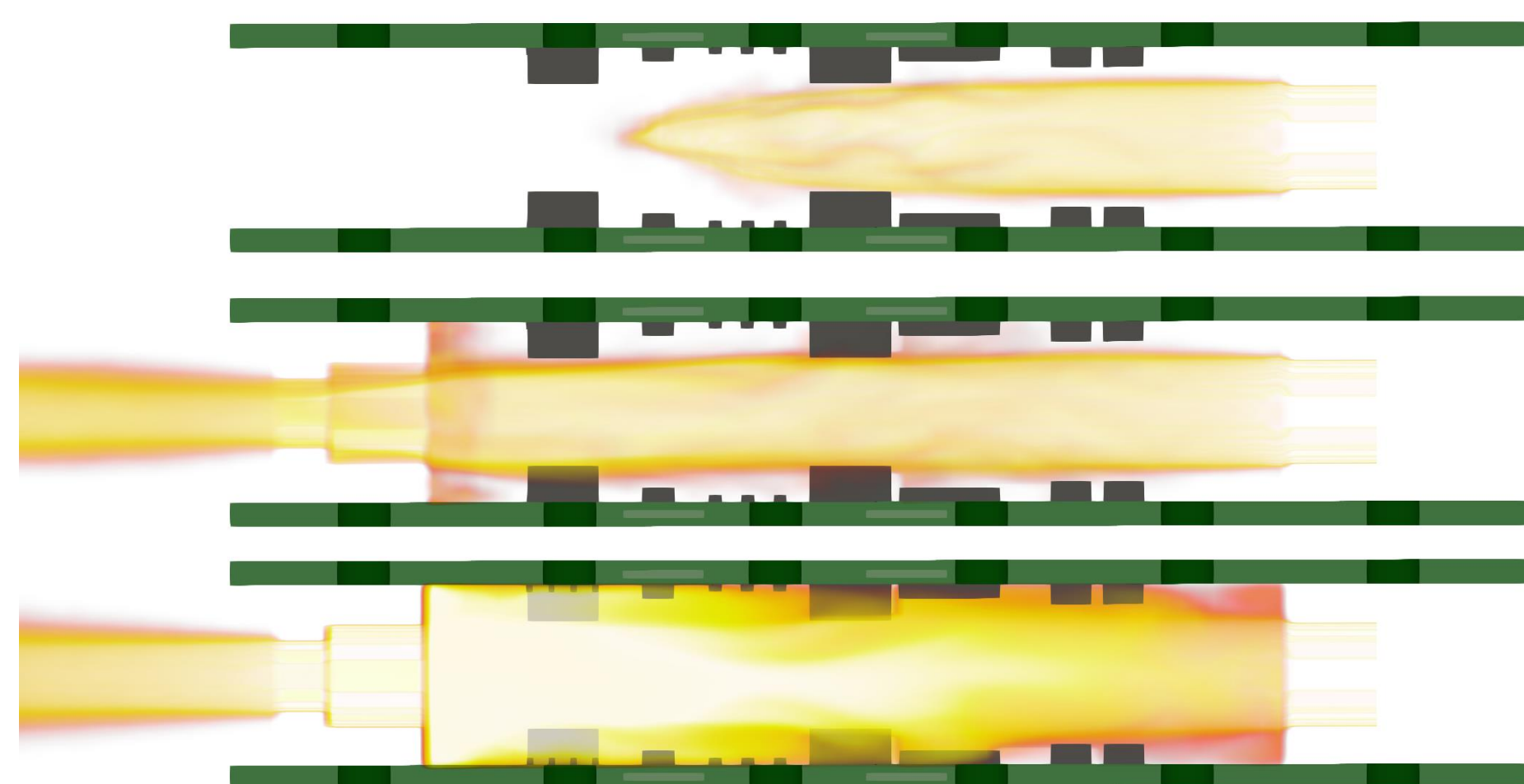
Validation against embedded temperature sensors in boards

Capabilities

- Participating media radiation
- Mixed phase (gas + particles)
- Combustion & decomposition reactions
- Conjugated heat transfer coupling
- Parallel scaling to billions of elements



Developing Flow Field in SBS

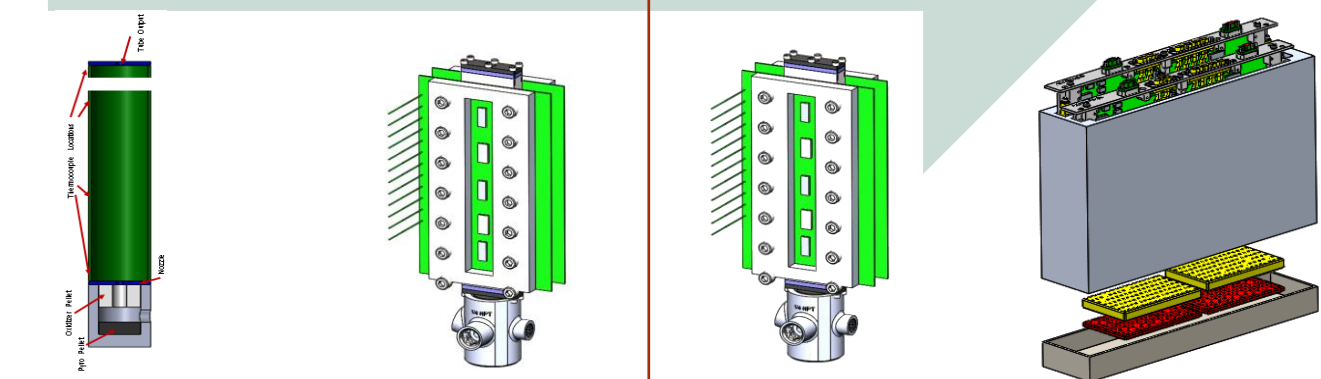


Credibility & Development Approach

Material Formulation & Characterization



Demonstrate Function & Scaling



Environments Testing



Desired Outcomes:

- Technology demonstrated at a range of scales on realistic geometries
- Experimentally validated model able to predict sterilization behavior on a variety of geometries
- Well defined process for manufacturing and operating the TSS
- Documented environmental robustness and measured limitations

Model Calibration & Validation Approach

