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Calibration of X-ray computed tomography (XCT) using a flat flame burner PRIYANKA MUHUNTHAN, SADAF SOBHANI, EMERIC BOIGNE, DANYAL MOHADDES, WALDO HINSHAW, MATTHIAS IHME, Stanford University — As a non-invasive, high-resolution technique, X-ray computed tomography (XCT) enables interrogation of three-dimensional field data, such as temperature and density variations, in a combustion context. The objective of this research is the calibration and uncertainty quantification of X-ray based diagnostics using a well-characterized, stable flame, where temperature, concentration, and flow speed can be predictably controlled. To this end, a flat-flame burner is designed and used for the calibration of a tabletop X-ray system consisting of a source, collimator, and flat-panel detector. A premixed methane/air flame, operated from fuel-lean to fuel-rich conditions, is used to characterize features of the scanner, such as drift, attenuation, and noise. Implied temperature fields based on X-ray attenuation are compared to thermocouple measurements. This work furthers the development of XCT as a combustion diagnostic capable of yielding non-intrusive 3D temperature datasets in optically inaccessible environments.

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