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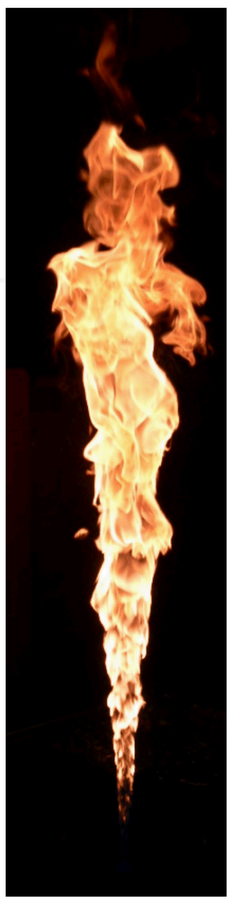
Measurements of soot concentrations, soot temperatures, and thermal radiation from a turbulent, non-premixed, pre-vaporized aviation fuel jet flame

Christopher Shaddix, Timothy Williams, Jiayao Zhang
Sandia National Laboratories
Livermore, CA USA

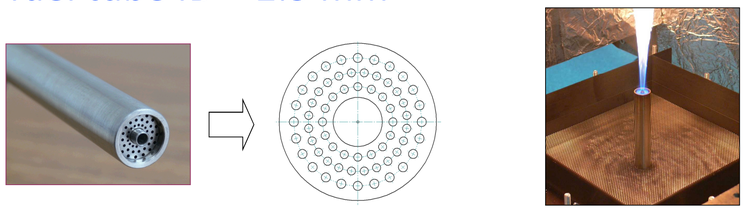


Motivation

Provide canonical dataset for non-premixed turbulent sooty flame fueled by aviation fuel, without complications of flame lift or spray formation and evaporation

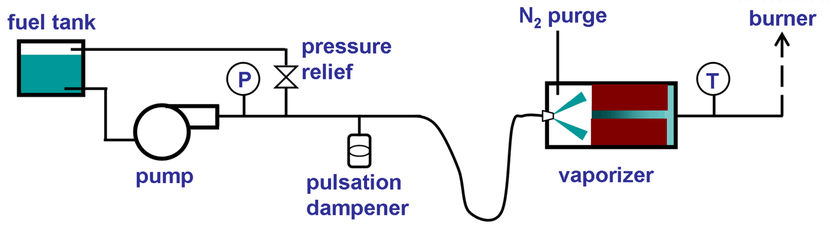
Experimental Approach

- Utilize depth of knowledge built up in TNF Workshop to design readily modelable flame configuration
  - ethylene-air premixed flame pilot (2% of aviation fuel heating rate)
  - 0.6 m/s dry air coflow outside of flame
  - straight-cut tubing to facilitate meshing
  - fully developed turbulent fuel flow profile
  - fuel jet Re = 20 000
  - fuel tube ID = 2.5 mm



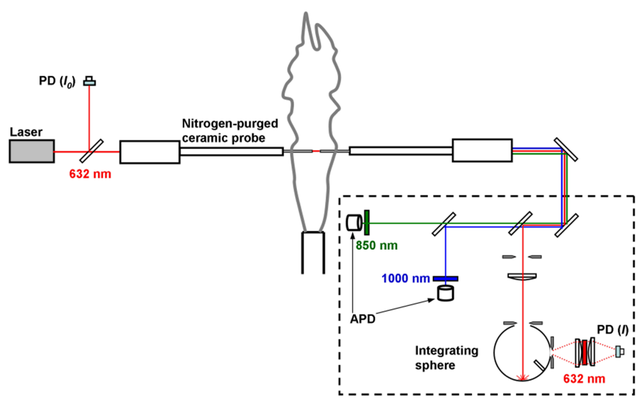
- Use simple 2-component aviation fuel surrogate with a sooting tendency representative of typical aviaition fuel: 77 vol-% n-dodecane
  23 vol-% m-xylene

- Employ a custom-built flash vaporizer to vaporize fuel and convey to burner at 300 deg C



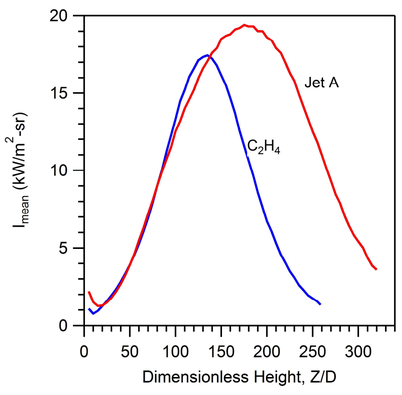
Measurements

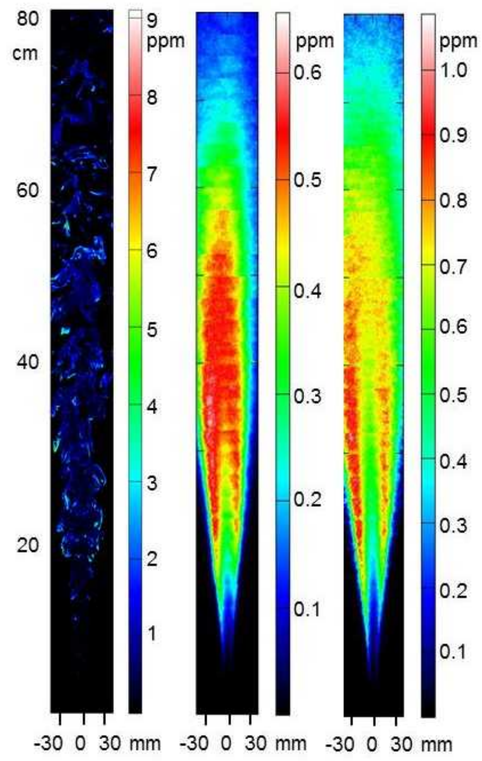
- Calibrated Planar Laser-Induced Incandescence (PLII) to quantify soot concentrations
  - apply mean signal trapping correction
  - utilize experimentally determined K_e to quantify laser extinction
  - verify final soot concentrations via full-field extinction measurements
- Thermopile with anodized sight tub for localized radiation emission
- OH PLIF for flame width and height
- 3-line technique for localized soot temperature and volume fraction (verification of LII measurement)

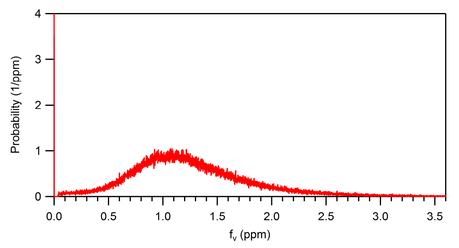


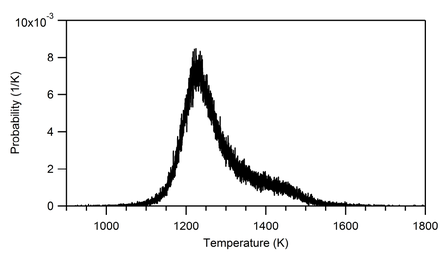
Current Status

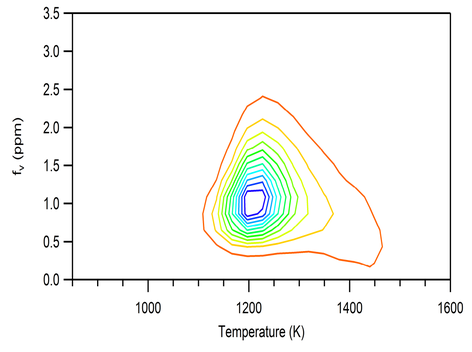
- PLII data analyzed
  - Still need to apply signal trapping correction and compare to full-field extinction and 3-line results
- Radiation data analyzed
- 3-line data analyzed











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