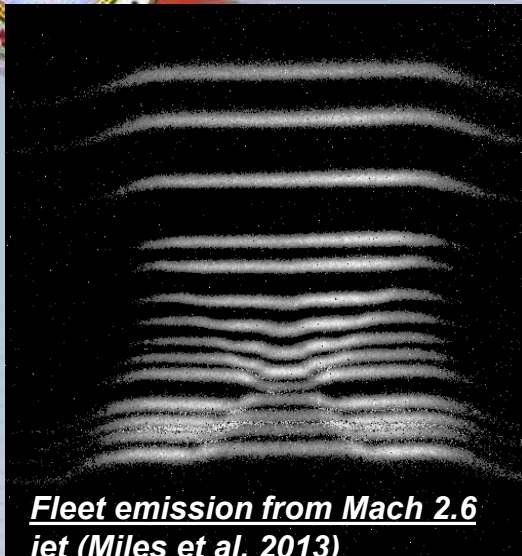


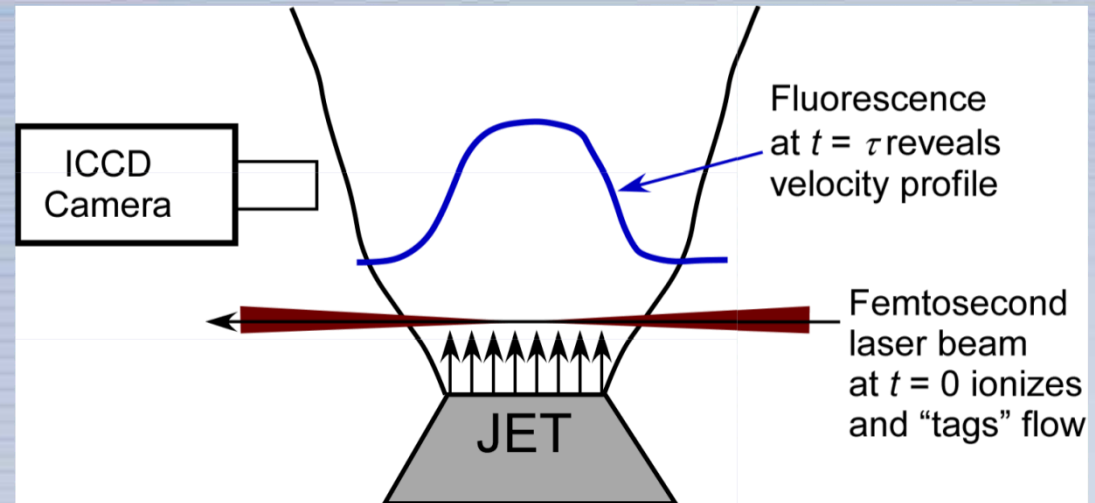


FLEET Velocity Diagnostic

SAND2016-2516PE



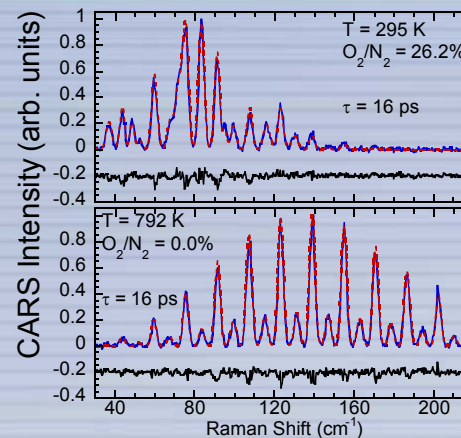
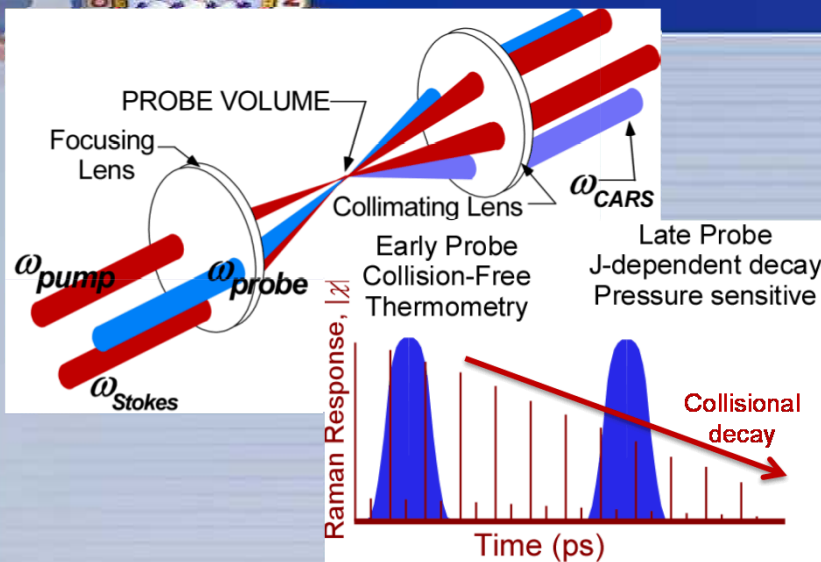
Fleet emission from Mach 2.6 jet (Miles et al. 2013)



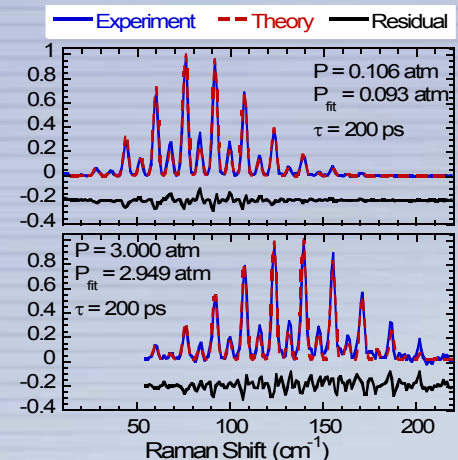
Femtosecond Laser Electronic Excitation Tagging (FLEET)

- **Molecular tagging approach to velocimetry**
- **“Tag” flow field along a line by dissociating N_2 with focused fs pulse**
- **Tagged line is transported downstream as it recombines and emits fluorescence**
- **Image fluorescence with fast (ns-duration) exposure by intensified CCD**
- **Displacement and time delay yield direct measurement of velocity profile!**
- **Noninvasive and free of chemical or particle seeding requirements**
- **Key challenge: water- N_2 collisions will reduce FLEET lifetime**

CARS Temperature/Pressure/Species Diagnostic



Temperature/species at short delay



Pressure at long delay, $T = 290 \text{ K}$

- **Shape of CARS signal beam spectrum is analyzed for multiple flow parameters**
- **Fast alignment of flowfield molecules by femtosecond pulses**
- **Probe resulting transient using time-delayed picosecond pulse**
- **Short delays \rightarrow collision free Temp/species**
- **Long delays \rightarrow pressure/collisions dominate spectrum**
- **Key challenges for AF-M315E:**
 - **Extend pressure measurements to real flow field**
 - **Add CO_2 , H_2 species detection**
 - **Include effects of water- N_2 collisions on pressure data**

P & T in plume flow field, 1st time for AF-M315E



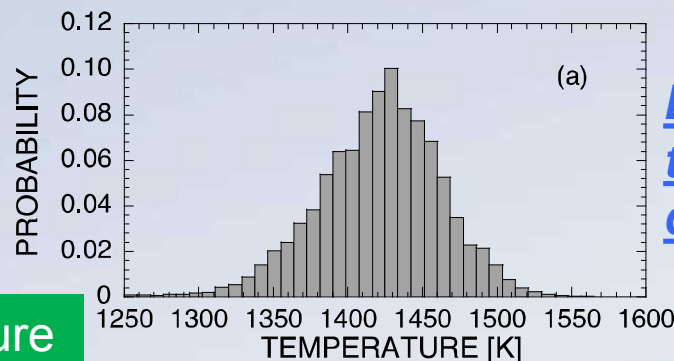
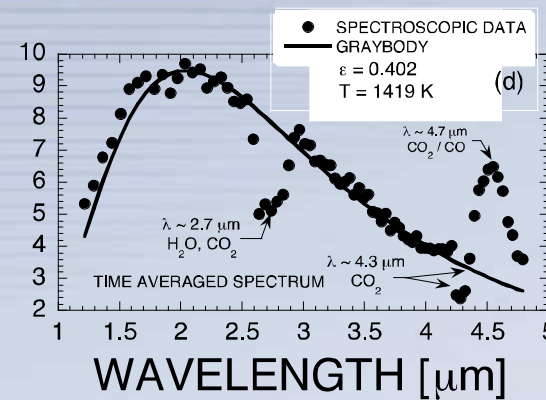
Emission spectroscopy diagnostic for infrared signature

- *Plume data can validate CFD which couples to radiative transfer calculation*
- *Correlate flowfield T/P/Velocity predictions with plume and surface radiation*
- *In-house (1500) IR spectrometers*
- *Spectral range = 1.3 – 4.8 μm (75% of 1400 K blackbody spectrum)*
- *Over 100 bands detected at > 1 kHz*
- *Multiple-wavelength pyrometer and emissivity capability*
- *Scanning module available to map fields of view*



Spectraline
ES200

Sooting
flame
emission
spectrum



Emission
temperature
data

AF-M315E Radiative signature
characterization and pyrometry