

Inferring Titan's Mesospheric Properties From The Dragonfly Entry Aerosciences Measurements (DrEAM) Suite

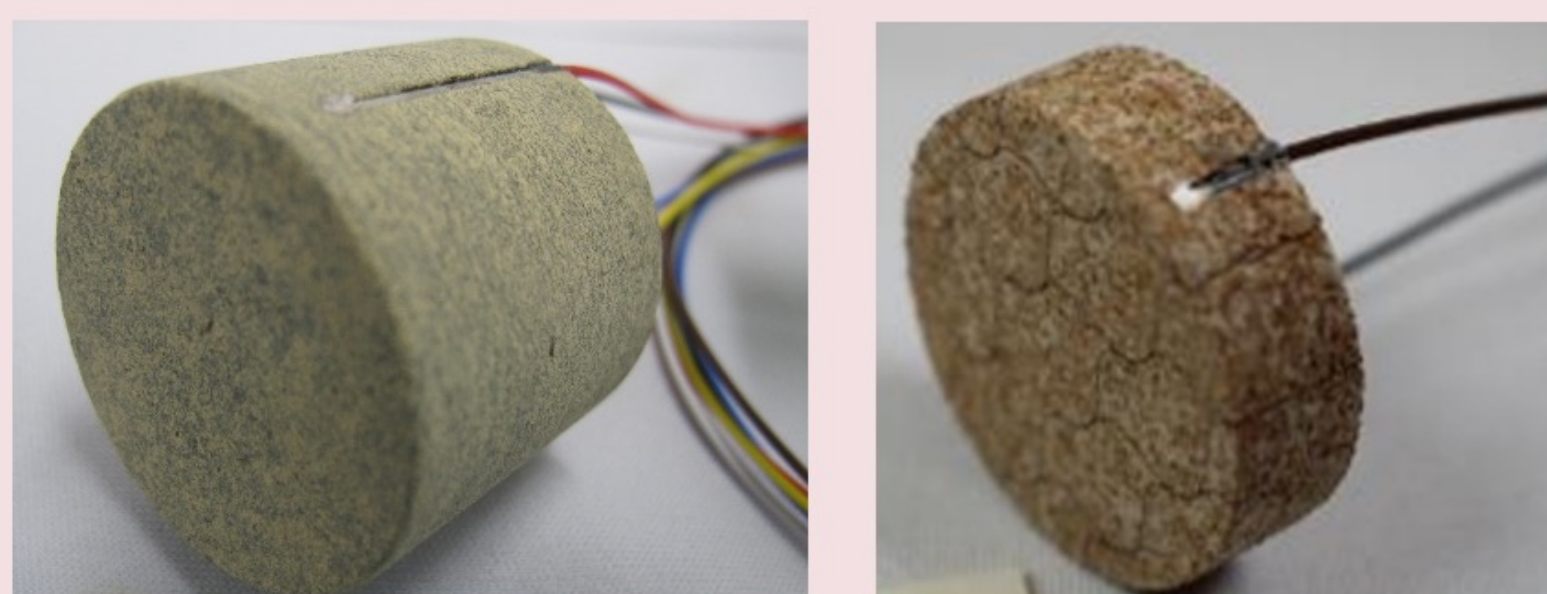
DrEAM provides a unique opportunity to infer the methane abundance of Titan's upper atmosphere

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Dragonfly Sensors for Thermal Reconstruction (DragSTR)

- (NASA) In-depth thermocouples to back out the aerothermal environment and understand the Thermal Protection System (TPS) material response



Dragonfly Atmospheric Flight Transducers (DrAFT)

- (NASA) Hypersonic pressure transducers on the forebody for atmospheric and aerodynamic reconstruction



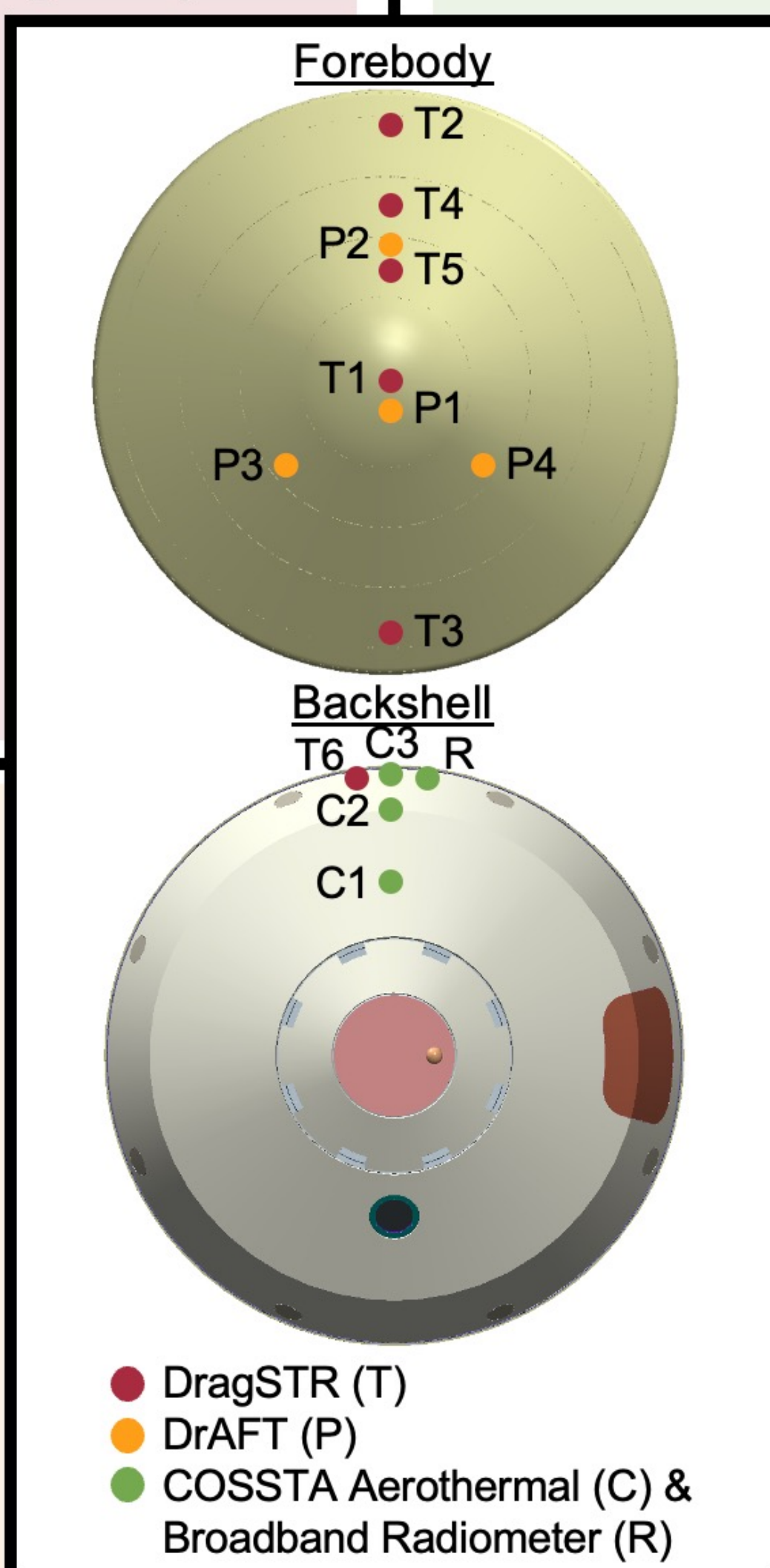
Combined Sensor System for Titan Atmosphere (COSSTA)

- (DLR) Radiometers, total heat flux sensors, and pressure transducers on the backshell to quantify radiative heating from CN and vehicle dynamics



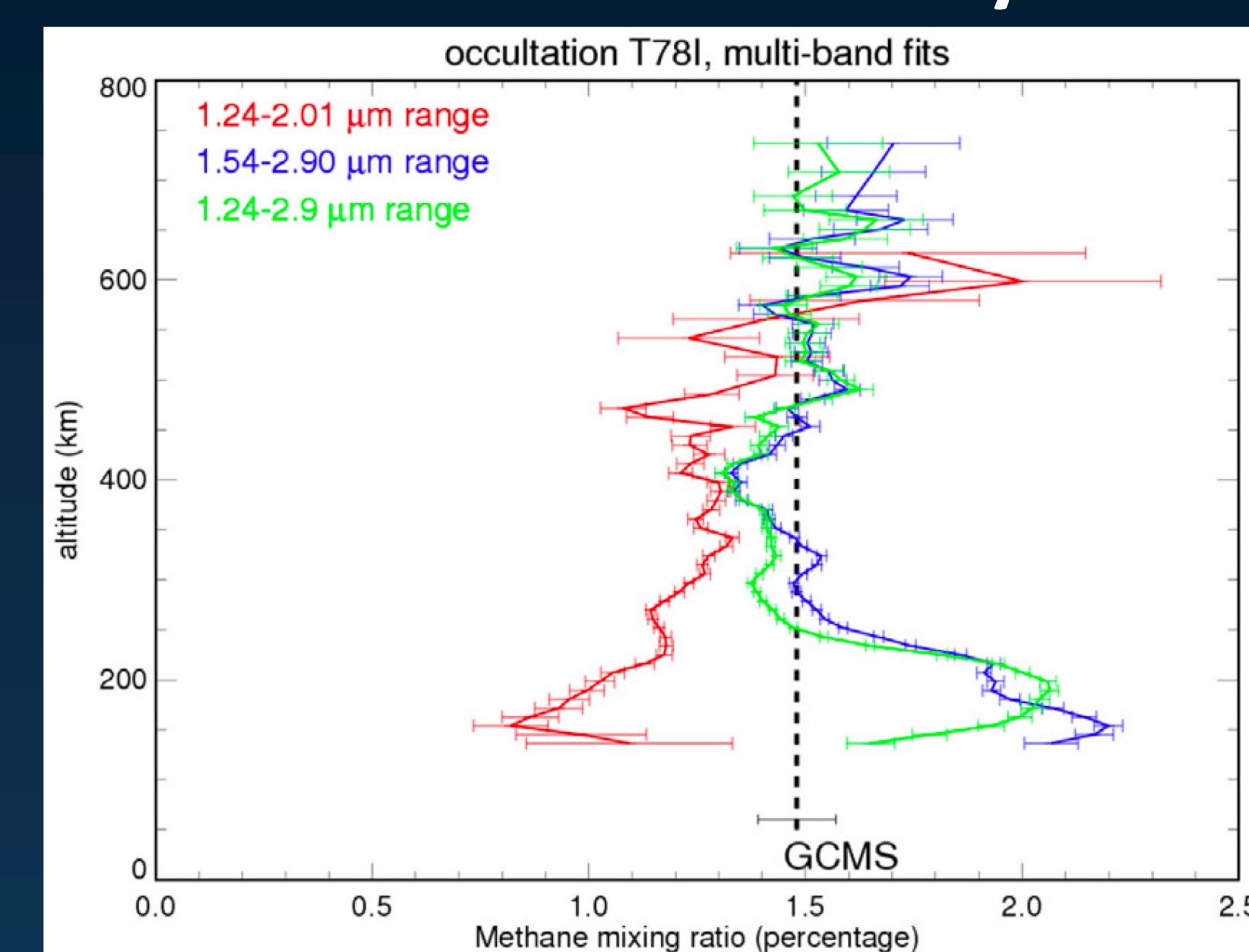
Data Acquisition System (DAS)

- (DLR) Two boxes (1) Digital Processing Unit and (2) Multiplexing Signal Conditioner which collect DrEAM instrumentation data for transmission back to Earth



Methane Variation

CH₄ abundance as a function of altitude as measured by Cassini

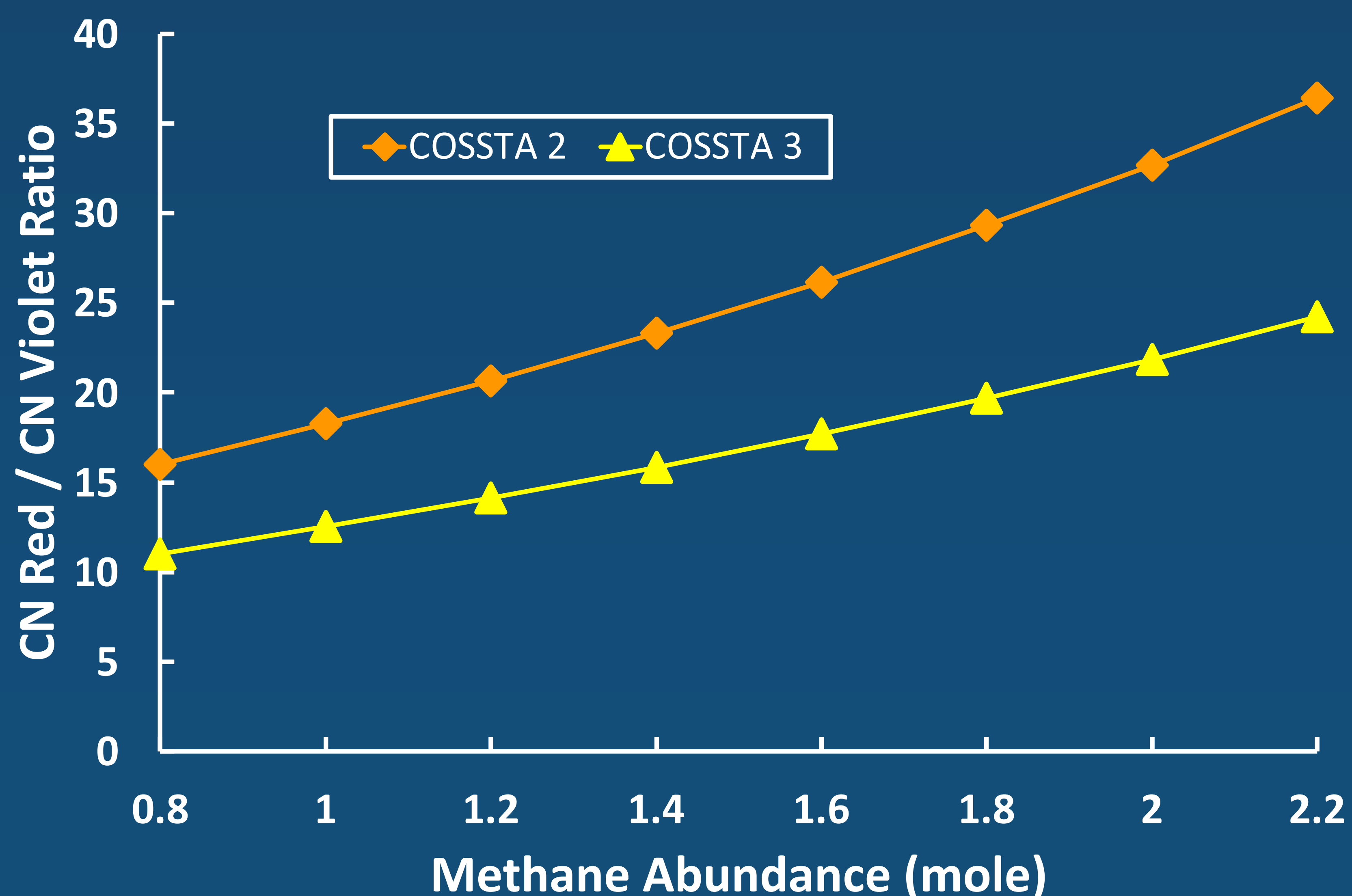


Maltagliati et al "Titan's atmosphere as observed by Cassini/VIMS solar occultations: CH₄, CO and evidence for C₂H₆ absorption" Icarus 248 (2015)

How to Infer Methane Abundance

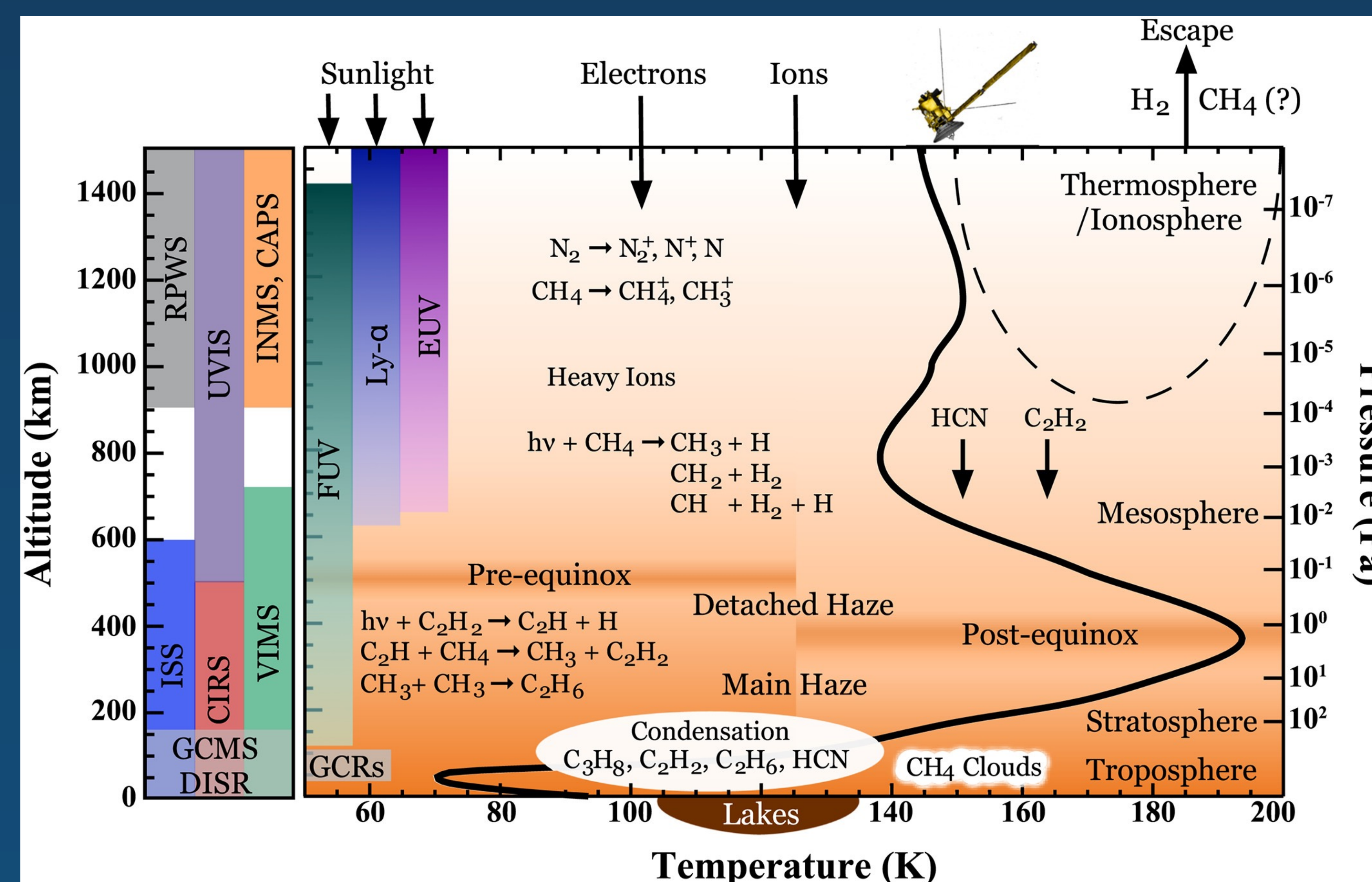
- Radiative heating is sensitive to the amount of CH₄
- We need the atmospheric composition to reconstruct DrEAM data
- DrEAM measurement range is for altitudes ~500 to 180 km
- The CH₄ uncertainty bound for upper altitudes is ~0.9 to 2.2%.
- DrEAM will make narrow band radiative heating measurements of CN Violet & CN Red at three backshell locations.

Can we determine a non-dimensional ratio from COSSTA data that correlates with CH₄ abundance?



Titan Atmospheric Science

By inferring CH₄ abundance, provide insight into chemistry mechanisms found in Titan's mesosphere.



Hörst. "Titan's atmosphere and climate" Journal of Geophysical Research: Planets (2017)

Goal: Infer Titan's mesospheric properties from DrEAM data during Dragonfly EDL