ALIAS Instrument Capabilities and Tracer Measurements

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ALIAS Characteristics

- Laser absorbance/2f detection, 80-m or 160-m pathlength.

- Four channels, broad spectral coverage:

1) Methane	3.4 µm	IC laser
2) Water Isotopes	6.7 µm	QC laser
3) Water Isotopes	6.7 µm	QC laser
4) Water	1.9 µm	Near-IR laser

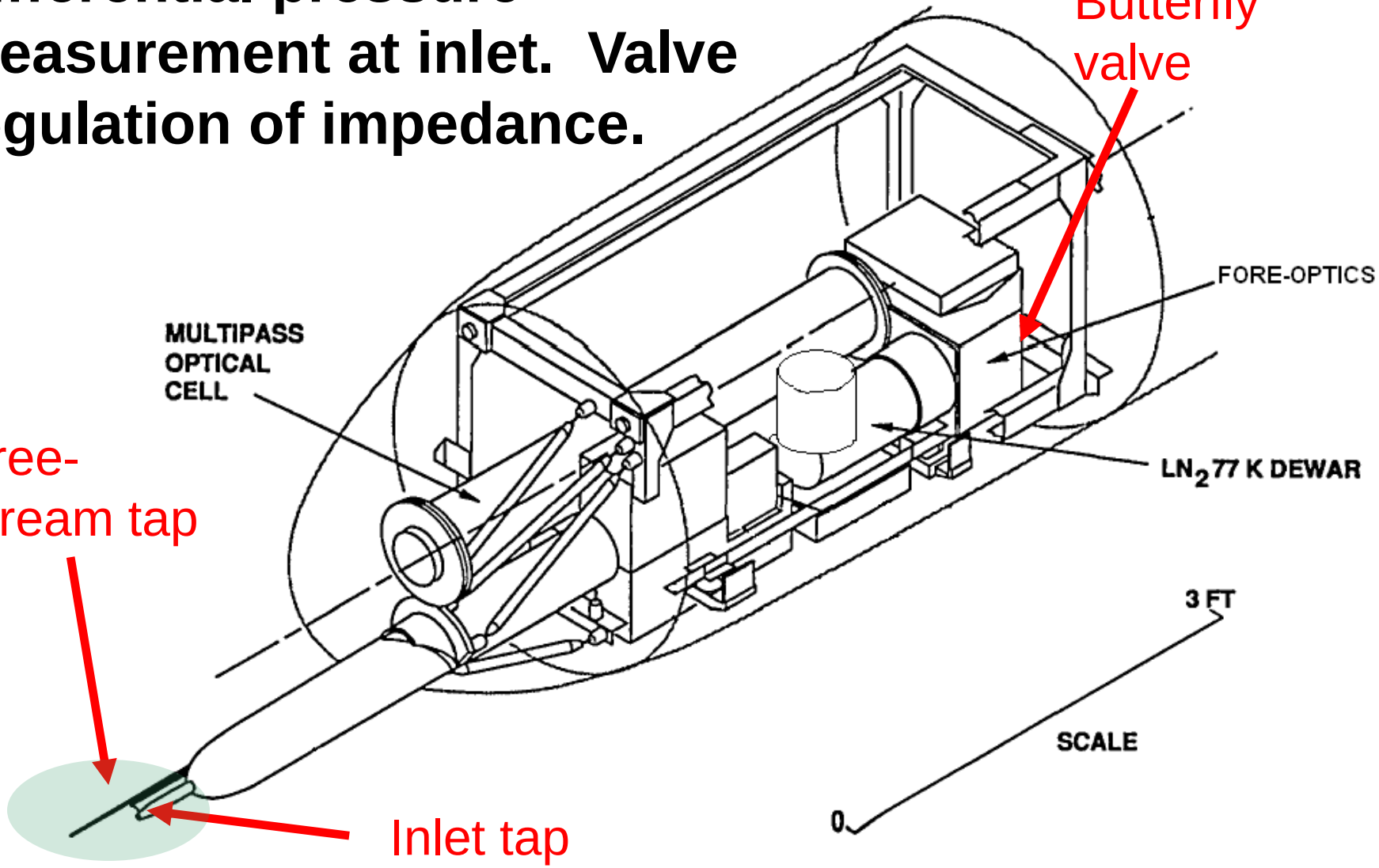
- Regulated inlet flow - isokinetic.

- 16 L sec^{-1} flow through instrument.

- Temperature of measured gas is regulated.

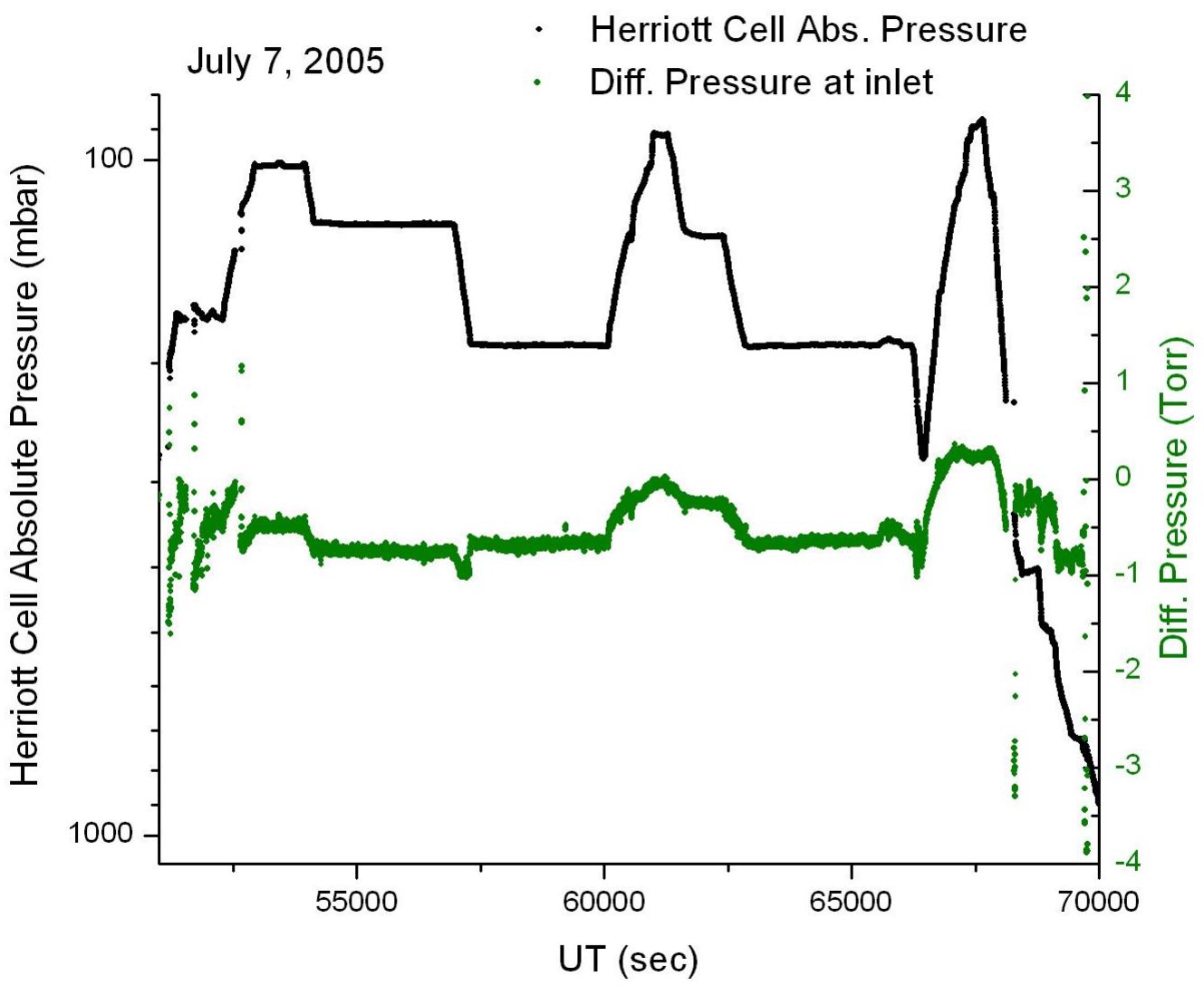
Inlet/airflow

Differential pressure measurement at inlet. Valve regulation of impedance.



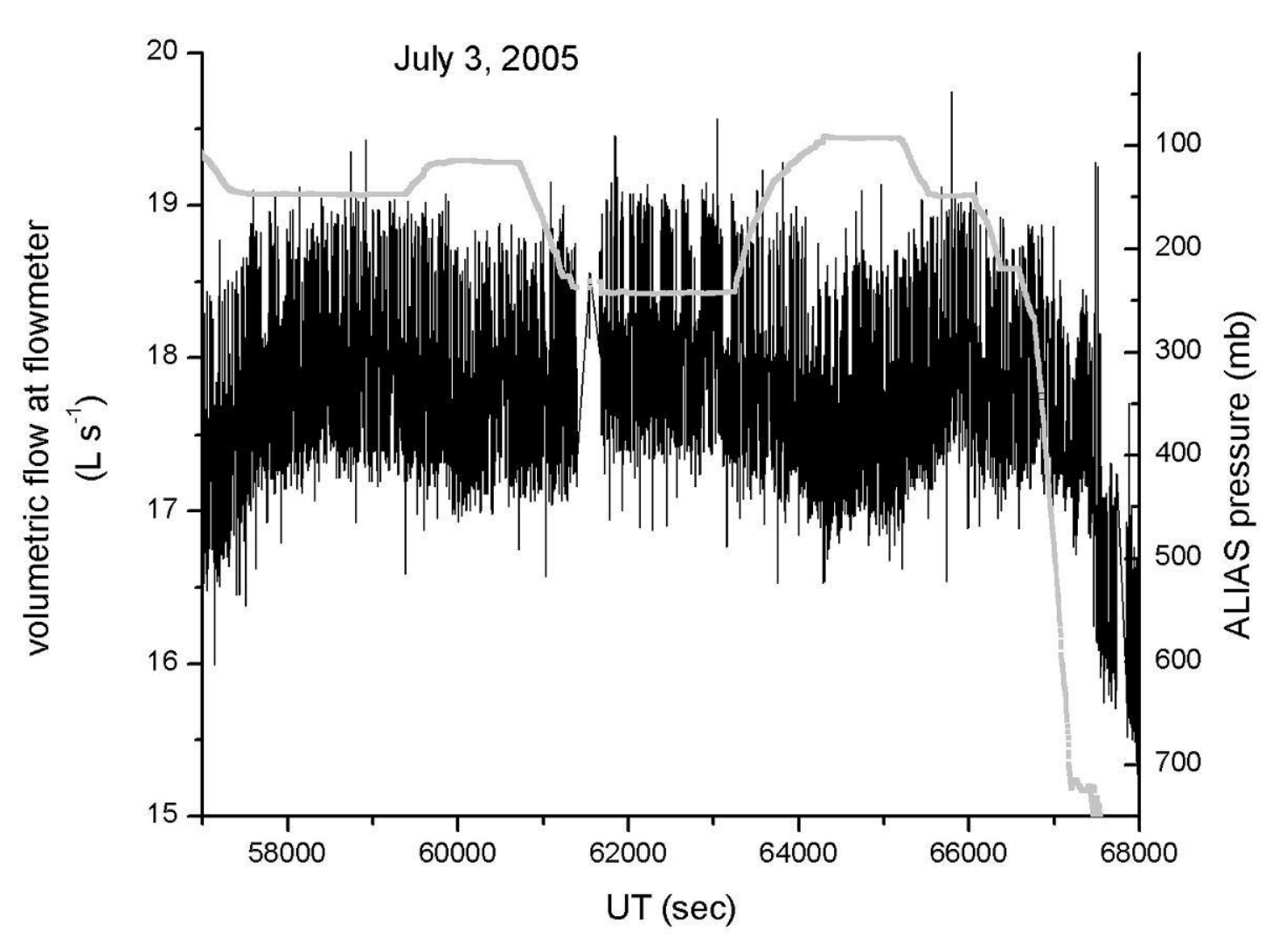
Inlet/airflow

Isokinetic flow



Inlet/airflow

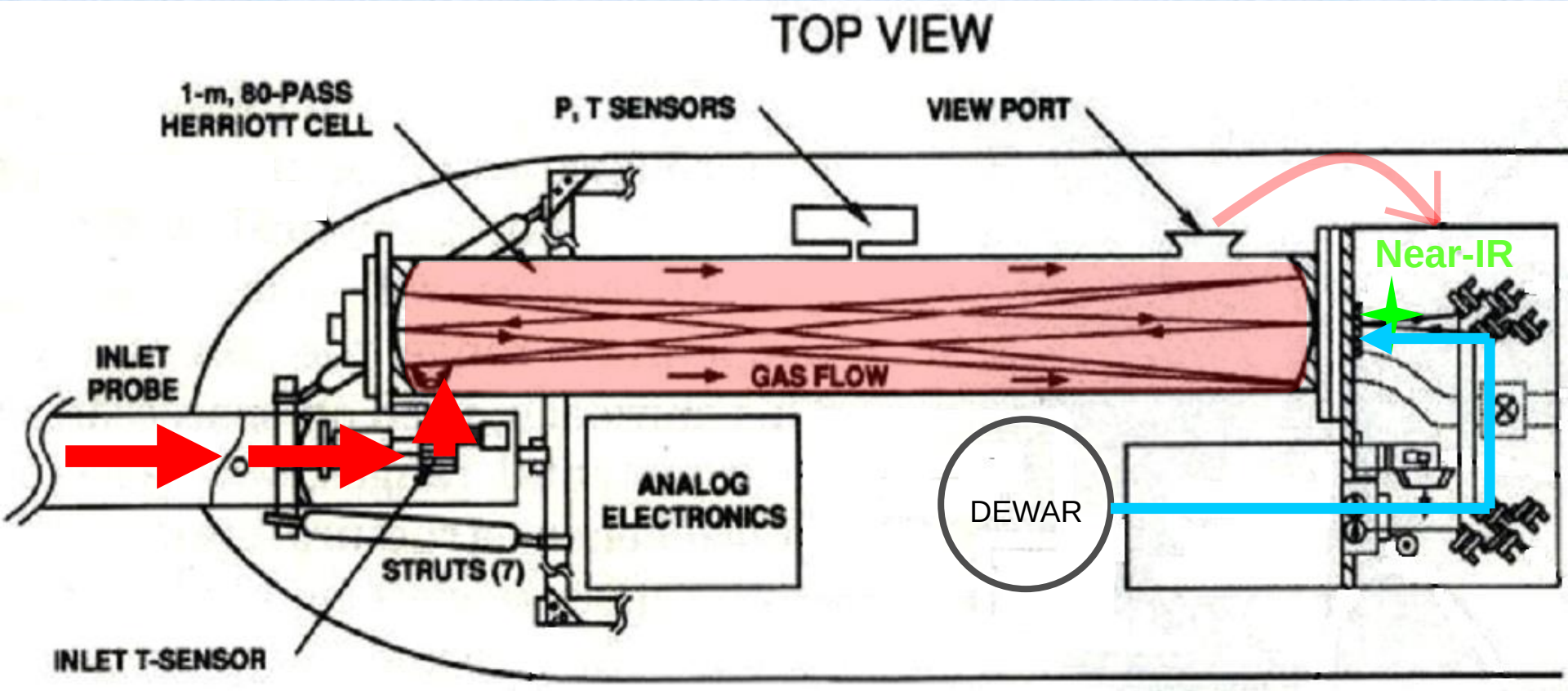
Orifice-plate Flowmeter confirms flow through instrument



Airflow/water signal.

No significant contamination from fore-optics.

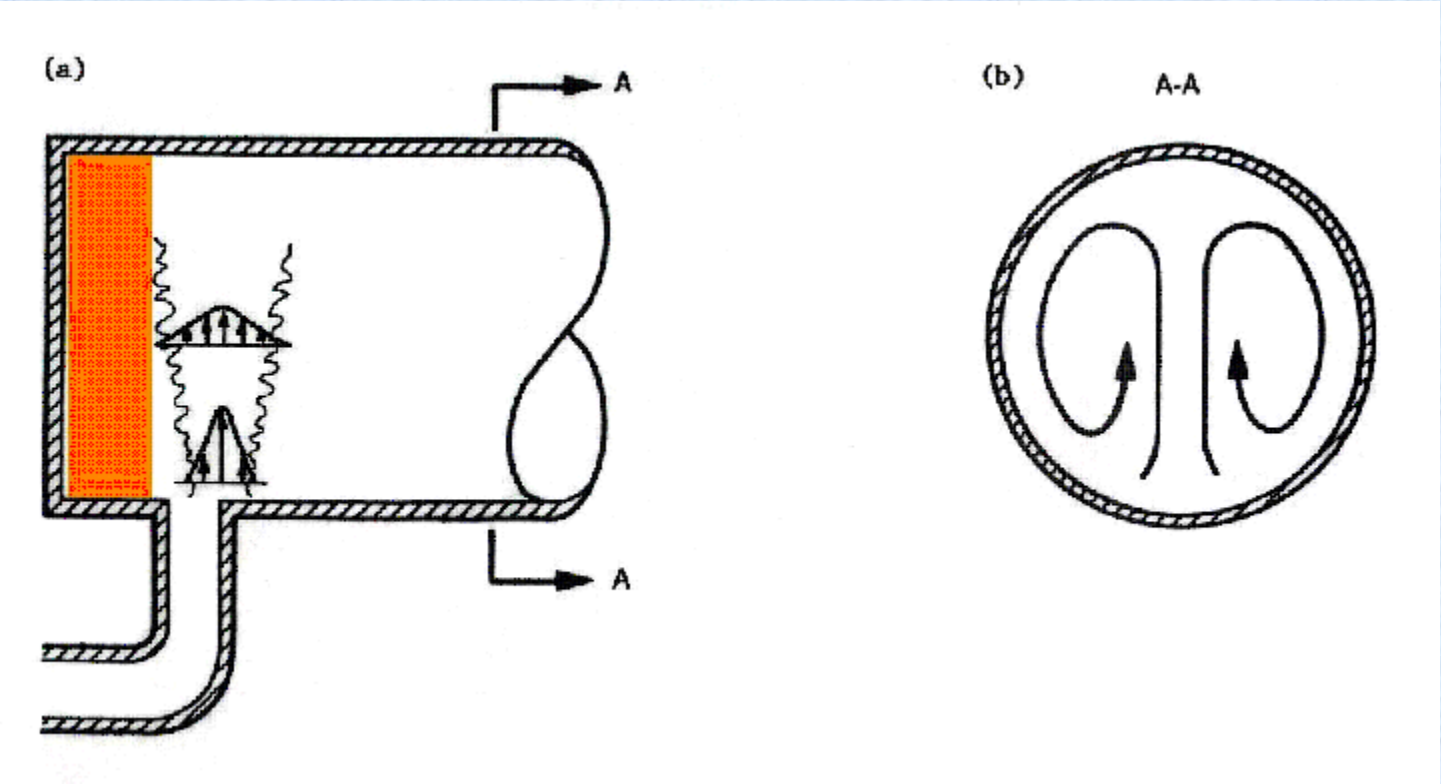
Herriott cell: 80-160m. Near-IR laser: 0.14m



Airflow/water signal.

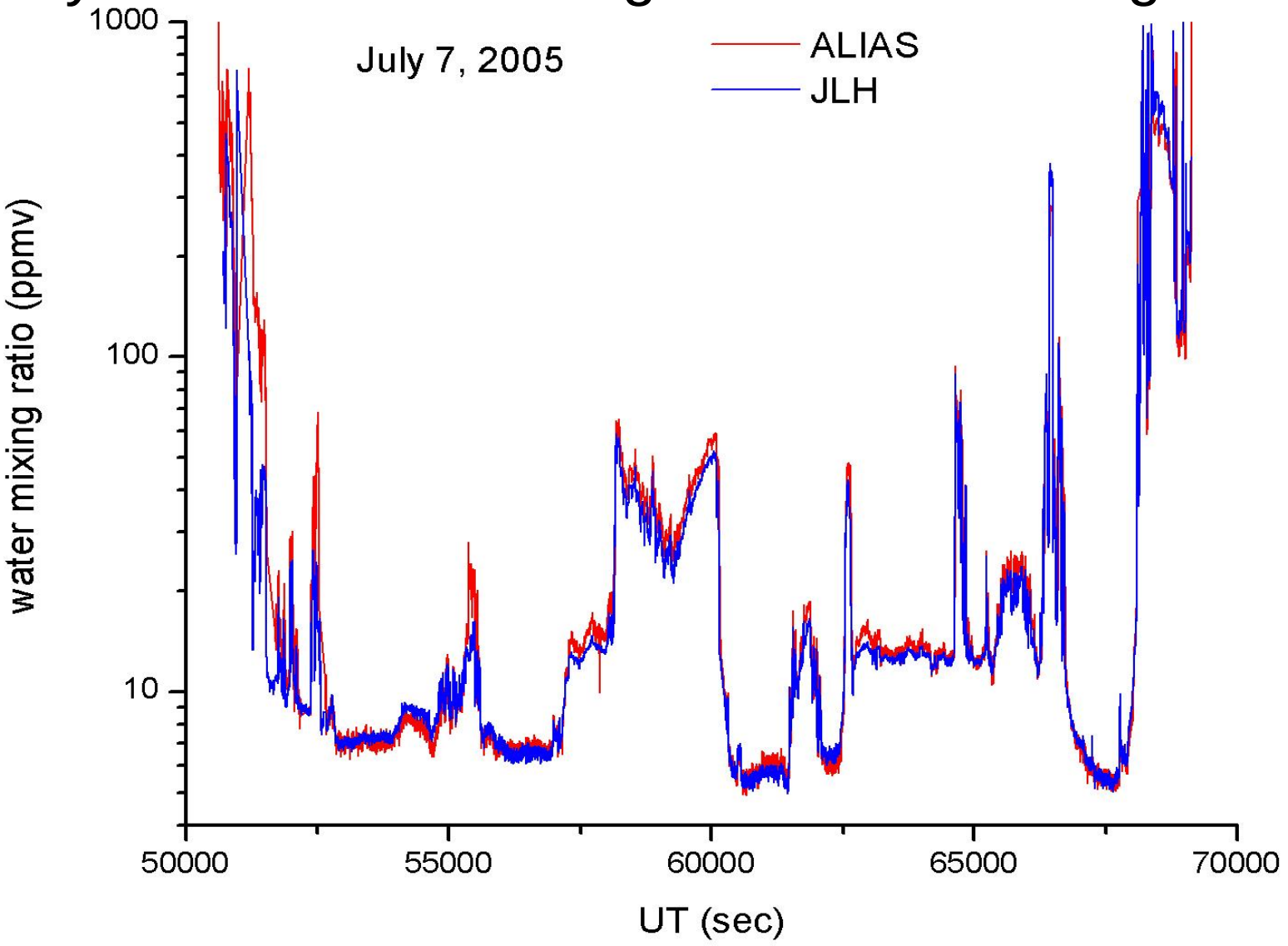
Wind-tunnel experiments, scale-model water experiments, and numerical analysis indicate:

- Virtually no end-to-end pressure difference.
- Gas is well mixed throughout the analysis cell.
- 1/e residence time is 1.7 sec.



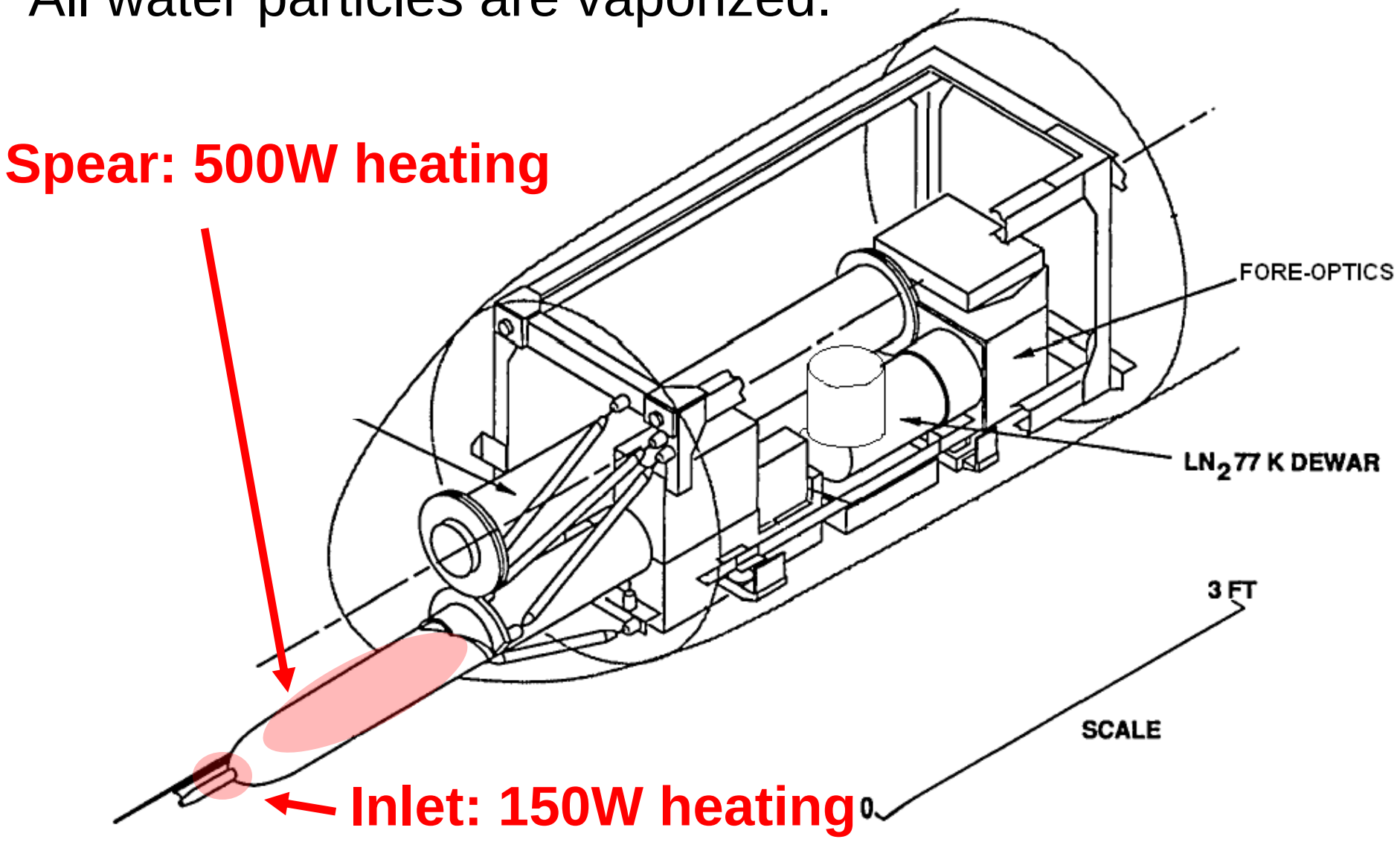
Airflow/water signal.

Very little evidence of significant water outgassing.

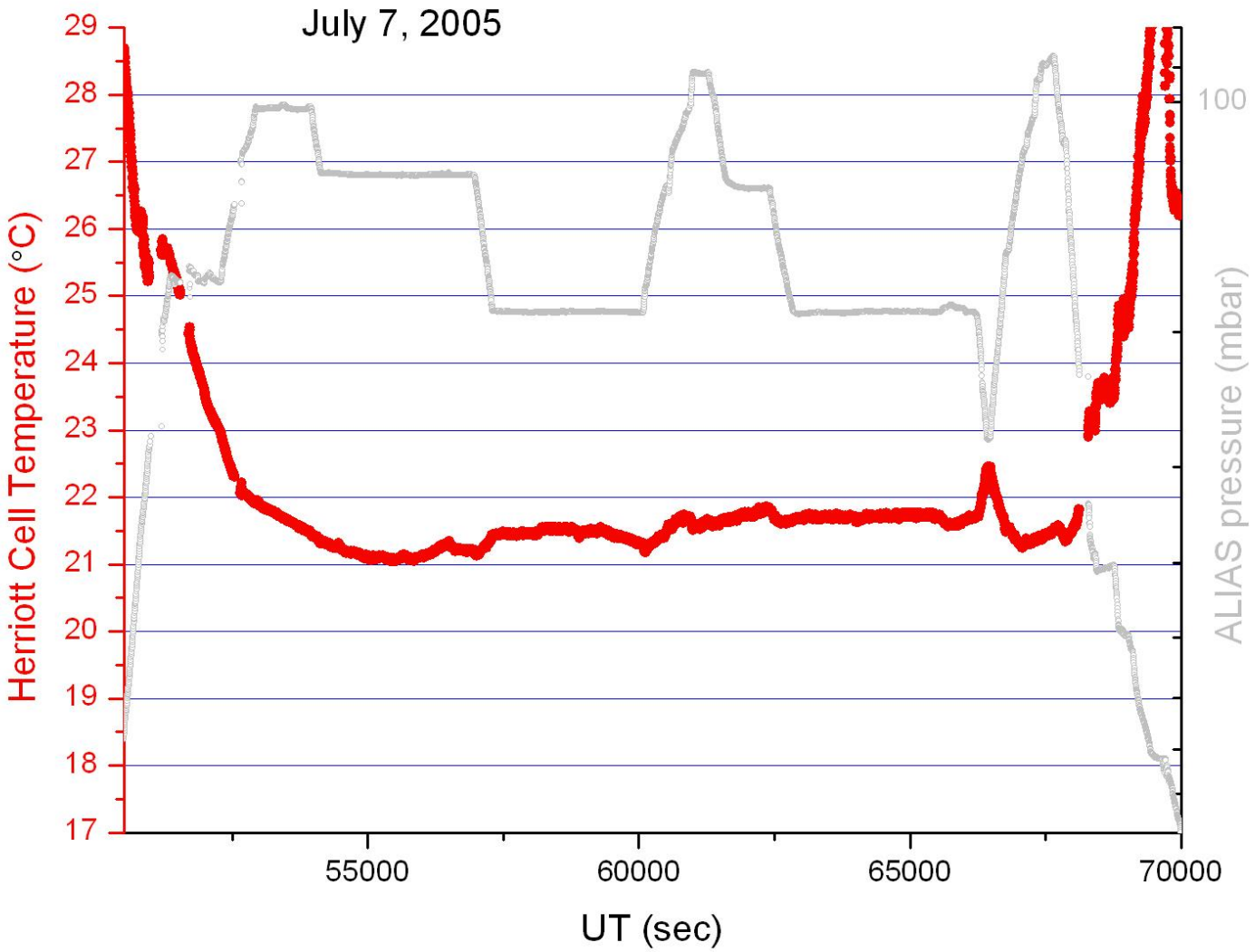


Temperaure control

All water particles are vaporized.

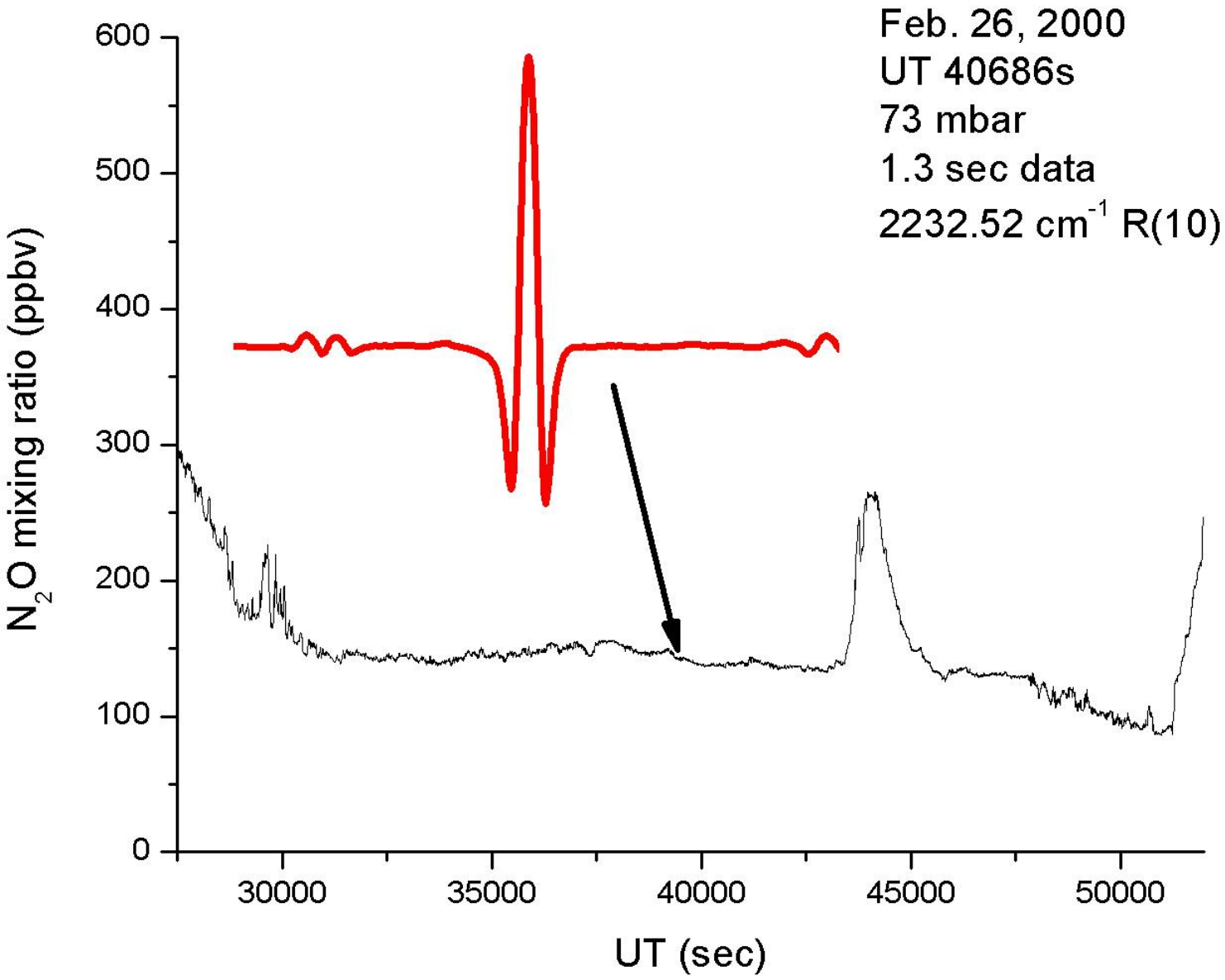


Temperaure control

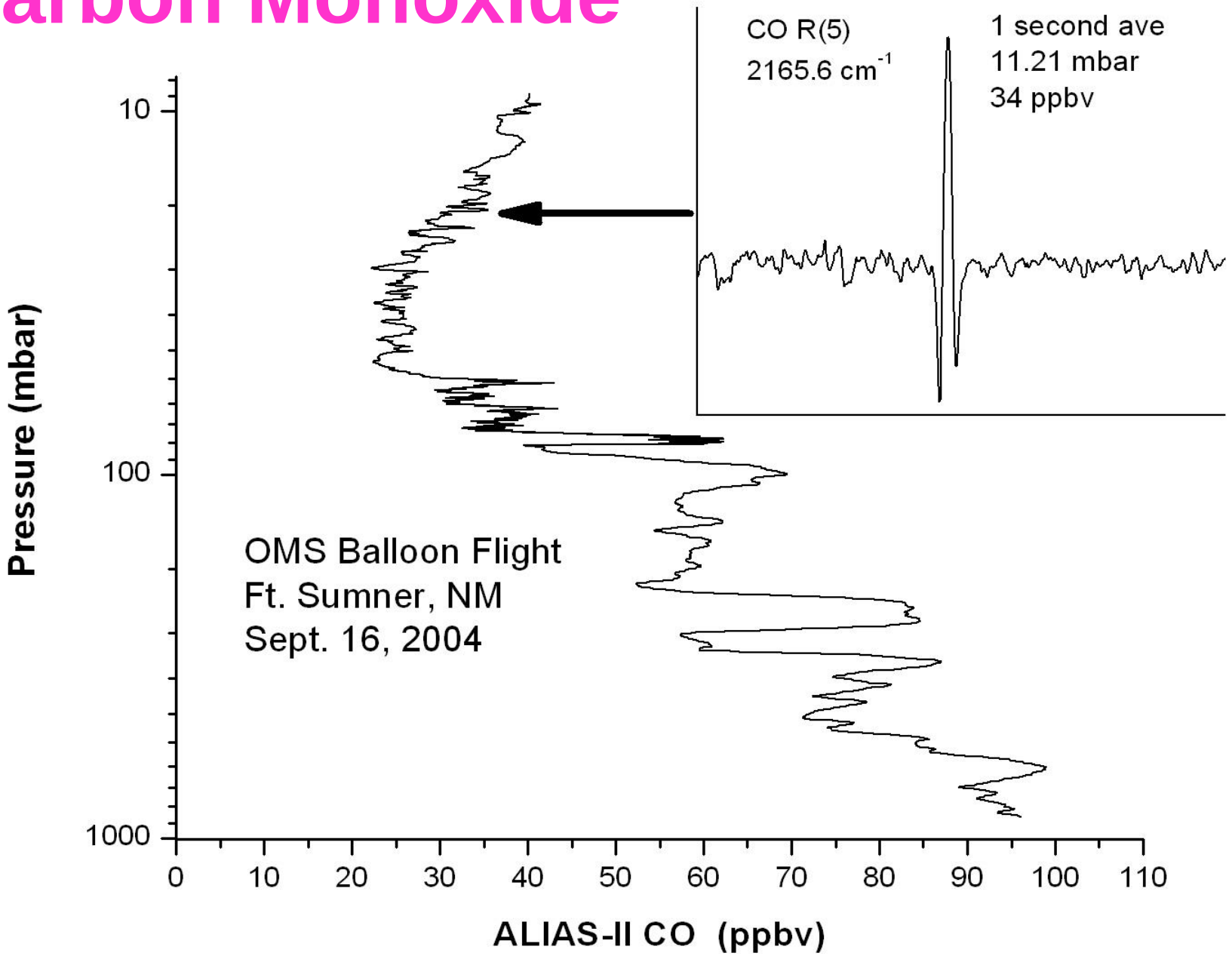


Temperature is well regulated during flight.

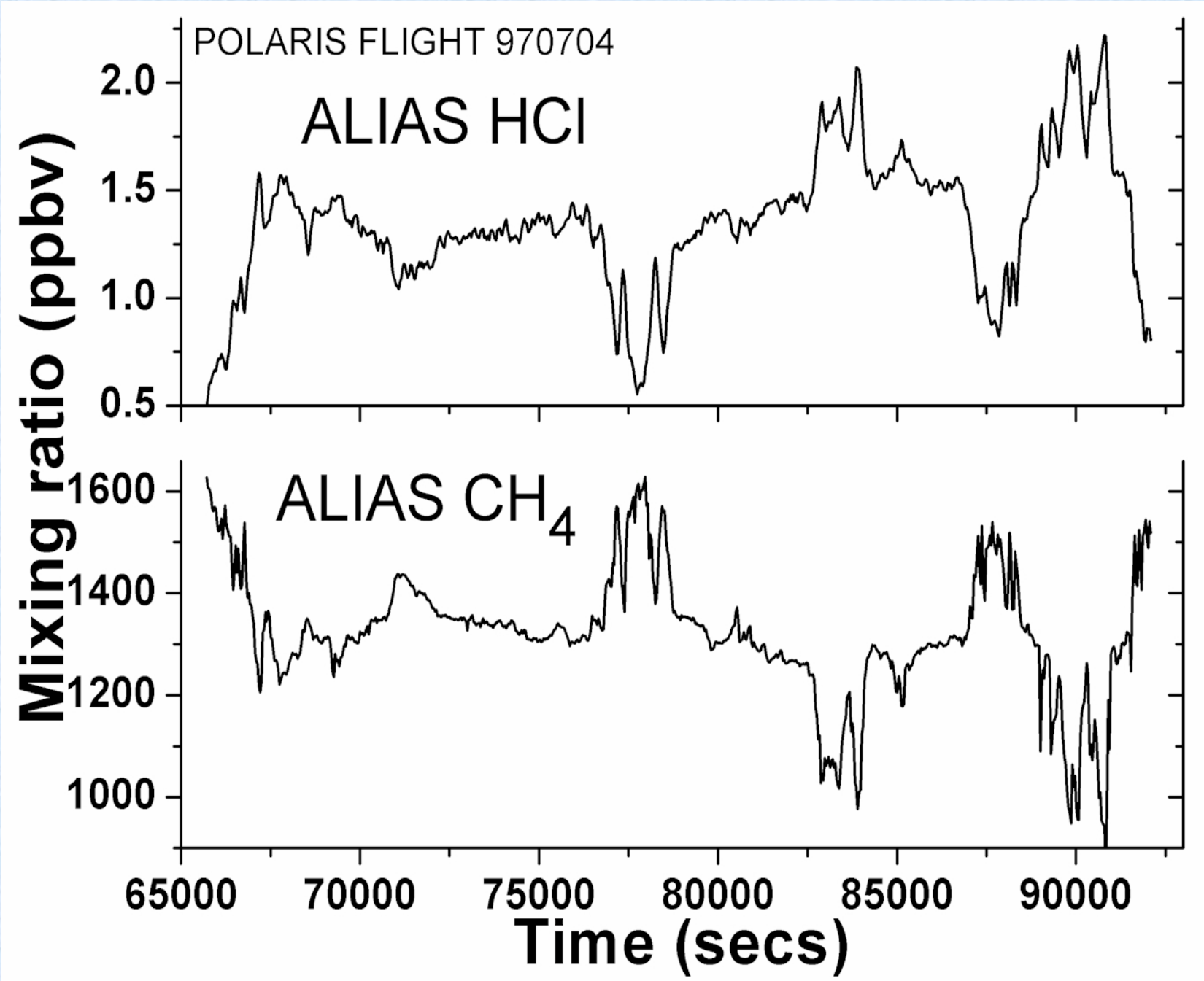
N_2O


Feb. 26, 2000
UT 40686s
73 mbar
1.3 sec data
2232.52 cm-1 R(10)
N2O mixing ratio (ppbv)
600
500
400
300
200
100
0
30000
35000
40000
45000
50000
UT (sec)

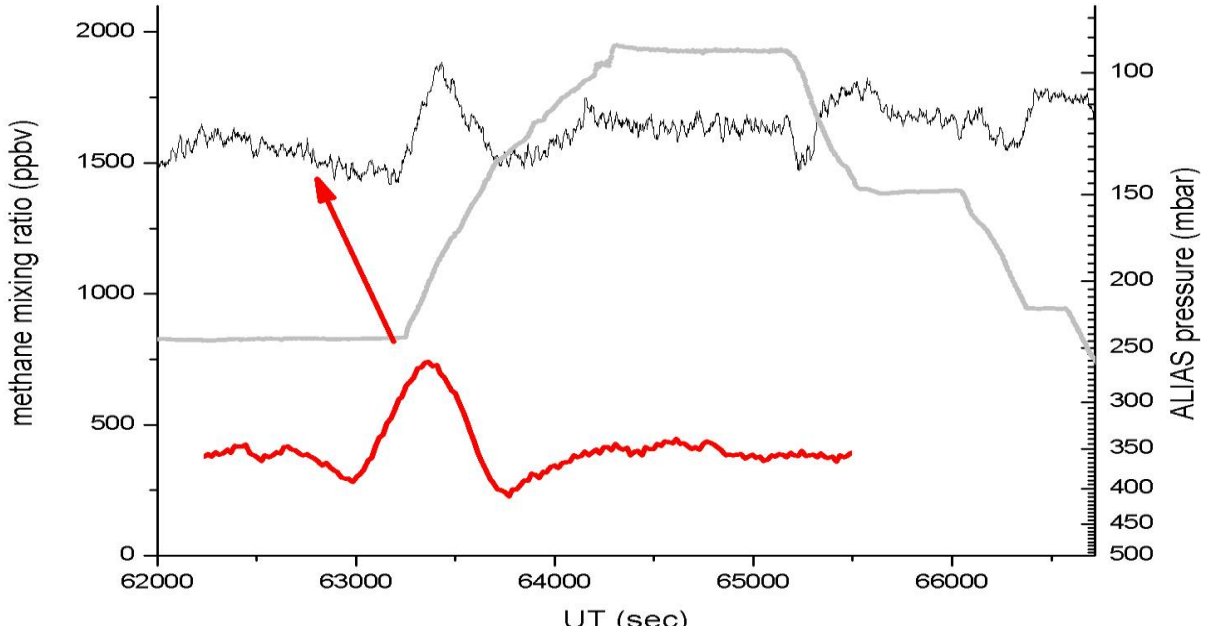
Carbon Monoxide



CH_4

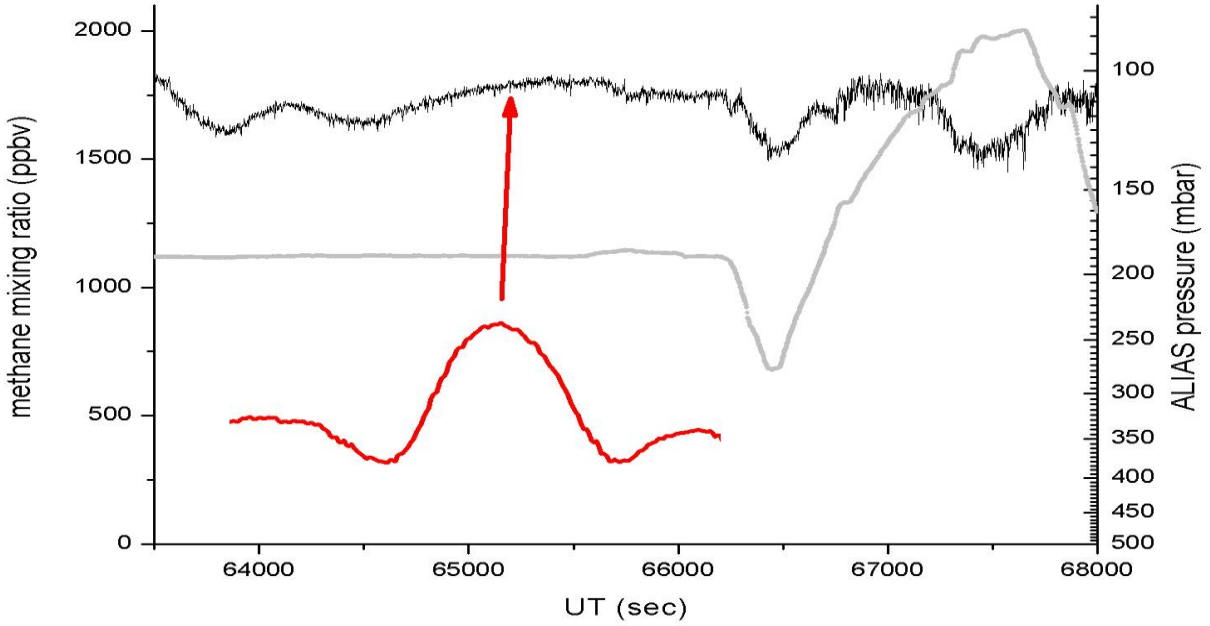

POLARIS FLIGHT 970704
ALIAS HCl
ALIAS CH4
Mixing ratio (ppbv)
2.0
1.5
1.0
0.5
1600
1400
1200
1000
65000
70000
75000
80000
85000
90000
Time (secs)

CH_4



July 3, 2005

descent

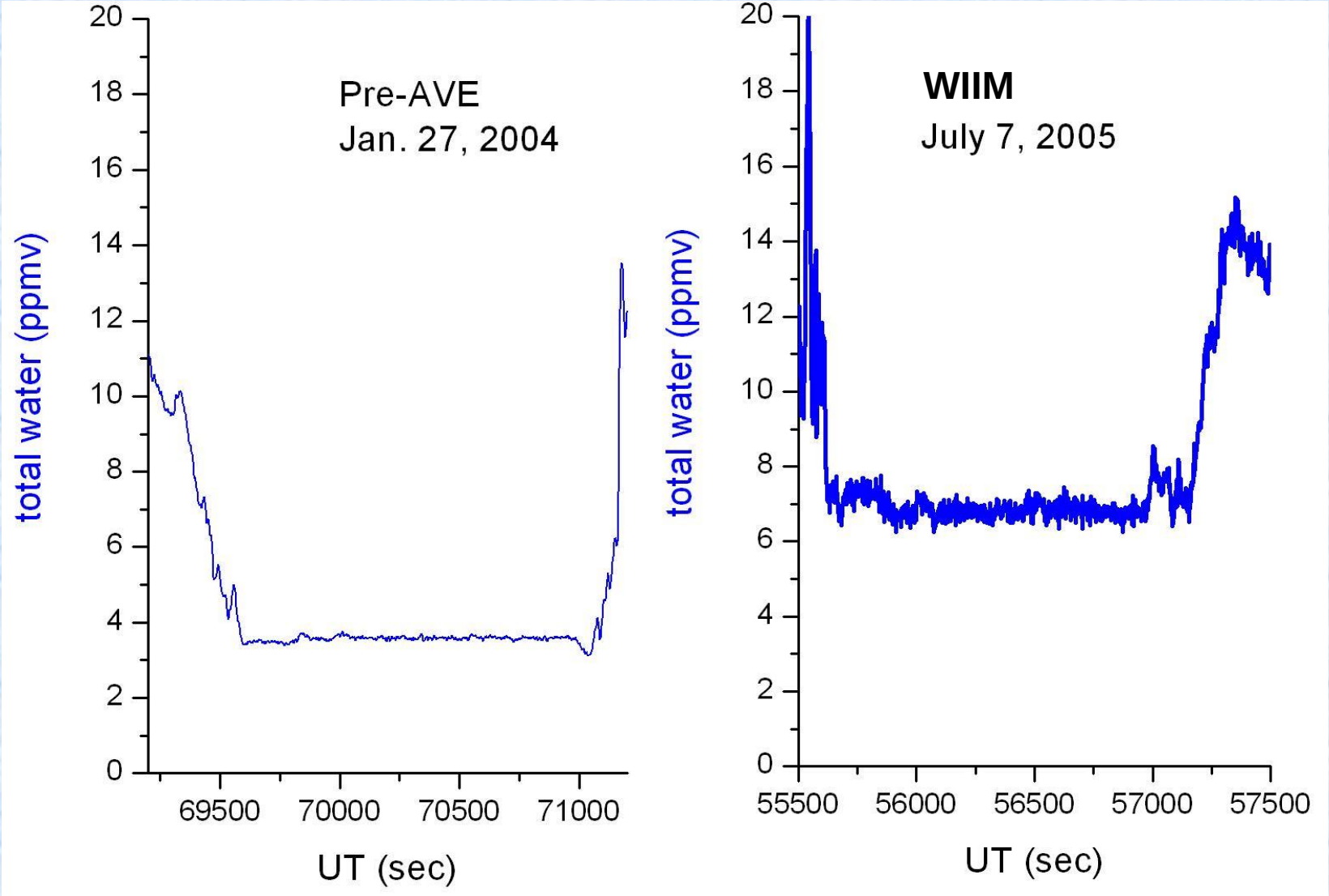


July 7, 2005

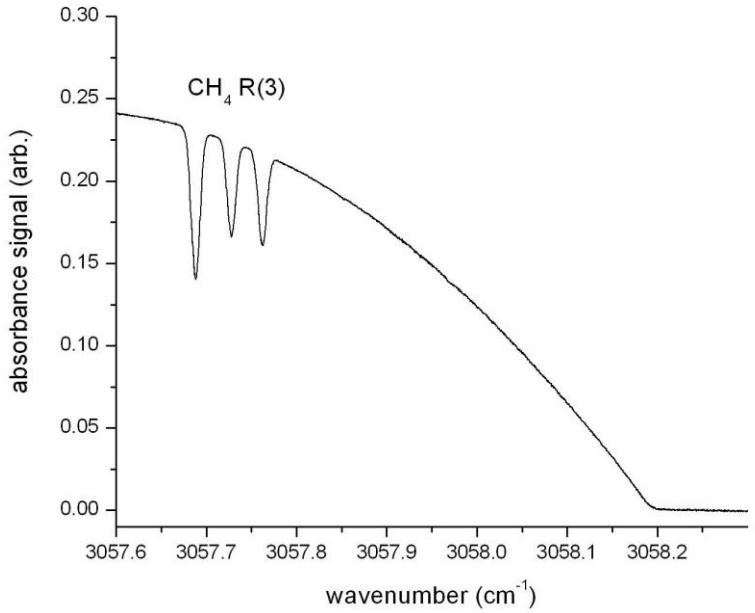
descent

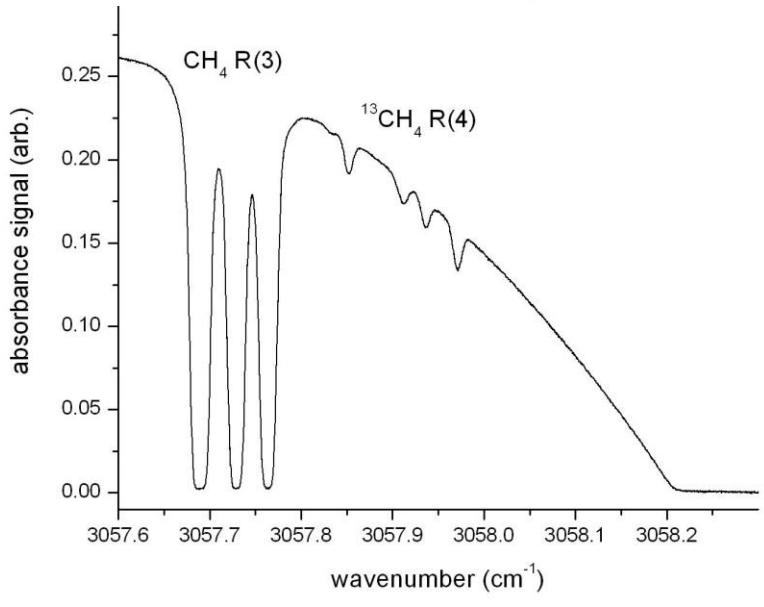
Better Signal-to-Noise for water has been achieved.

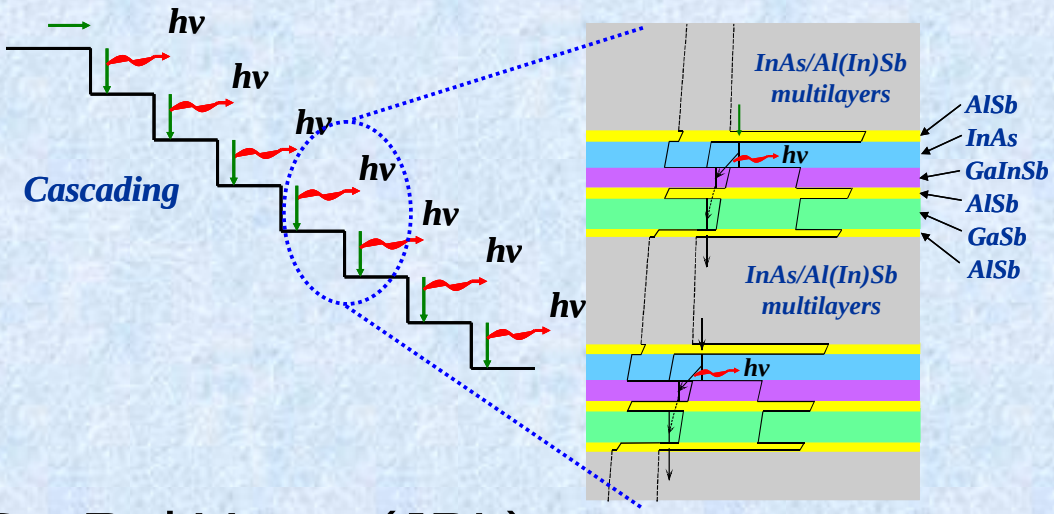
Shielding and filtering have been improved.



ALIAS employs a novel semi-conductor laser







Dr. Rui Yang, (JPL)

Interband Cascade Lasers (ICL):

- Cover 2.5 to 5 μm spectral region.
- High power.
- Single-mode emission (DFB).
- High efficiency (5-20mA threshold).
- Progress towards room T devices.

Conclusions

- AVE-WIIF mission confirmed that ALIAS is:
  - Isokinetic
  - Isothermal
  - not contaminated by water outgassing

- Tracer sensitivities (3 sec):
  - CH_4 50 pptv
  - N_2O 60 pptv
  - CO 300 pptv

- ALIAS has integrated and employed IC Lasers.