4-STAR Instrumentation and 4-STAR Science

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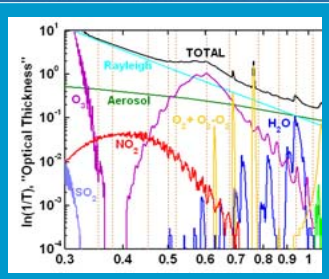
Spectrometer + Sky-Scanning + Sun-Tracking = Atmospheric Research!



Spectral Measurements…
- Improve H_2O, O_3…
- Provide NO_2
- Improve AOD

Goal: airborne profiles of trace gas + aerosol type via Aeronet-like retrievals

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AERONET-like
- Phase function
- Size mode distributions
- $n_{re}(\lambda)$, $n_{im}(\lambda)$
- Single-scattering albedo
- Asymmetry parameter
- Shape
- Hence aerosol type

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AATS-14 like retrievals of column amount and profiles of aerosol and gaseous atmospheric components.

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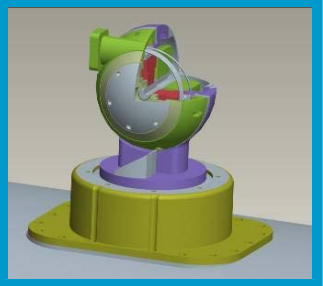
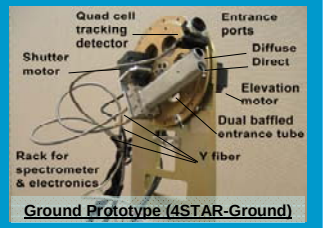
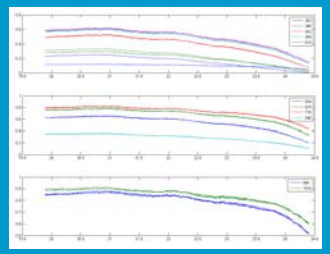




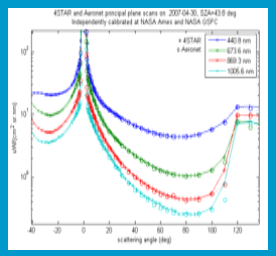
Ground Prototype (4STAR-Ground)

Why 4-STAR?:
AATS-14 retrievals, Aeronet-like retrievals, and spectroscopy from a single instrument.

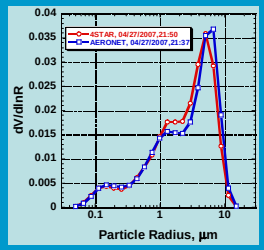
- Combining AOD(l), SSA(l), and g(l) for aerosol layers aloft yields heating rates for aerosol semidirect effect studies.
- AOD(l), when combined with radiative flux(l), enables measuring aerosol direct effect efficiency.
- Improved size distributions from combined sun & sky data enable more complete closure studies.
- Improved gas measurements from spectroscopy enable more comprehensive satellite validation and description of radiation budget.



Atmospheric transmittance comparison with AATS-14 shows short term stability within 1%.



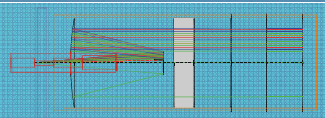
4-STAR diffuse radiance calibration at NASA ARC agrees well with NASA GSFC Cimel calibration.



Processing with Aeronet retrieval code yields near match with co-located Cimel sun photometer.

Remaining hurdles, next steps…

- New collector design, 100X power
- Spectral Langley calibration, MLO
- Add SWIR spectrometer for more size and absorption information
- Continue spectral inversion development
- Harden design for airborne deployment



Reflective power optics yield:
- Negligible chromatic effects
- > 100X light collecting power

SWIR spectrometer:
Zeiss PGS NIR 1.7
WL: 960 nm -1690 nm
Resolution: ~ 5nm
Pixels: 512

Quasi-monolithic Zero moving parts