Atmospheric Monitoring with Tunable UV Lasers

John A.J. Matthews
University of New Mexico
Atmospheric Transmission Correction to Fluorescence Signal

- Air fluorescence signal is in the wavelength range: 300nm to 420nm
- Transmission of this light is reduced by molecular (Rayleigh) and aerosol (Mie) scattering
- As the scattering decreases at longer wavelengths fluorescence light near 400nm is significantly less attenuated than light near 300nm
- This wavelength variation must be monitored!
Relative Contributions of Different Spectral Lines at Different Horizontal Distances
Aerosol Optical Depth Measurement

• A vertical laser beam is located ~30km from the fluorescence detector
• Comparison of the *predicted* to *observed* scattered light intensity by the fluorescence detector measures the aerosol vertical optical depth: AVOD(h)
• This must be done at >1 wavelength!
The light measured at the detector from height \( \text{``h''} \) is determined by the vertical transmission (T1), by the scattering (S) and by the transmission (T2) back to the detector.
R&D for *tunable* UV lasers

- Most of the atmospheric monitoring for TA will use frequency tripled 355nm YAG lasers
- What is needed is another laser matched to the fluorescence lines near 390nm and 400/406nm
- Tunable, dye lasers provide a good candidate with the desired energy of 5 ~ 10 mJ/pulse and ~1mrad beam divergence
The laser, monitoring and control electronics are housed in a *refurbished* shipping container.
At 355nm the UNM group already has done this with the Central Laser Facility for Auger
What is needed now is to learn how to operate *tunable* lasers in harsh, desert, field-conditions!