

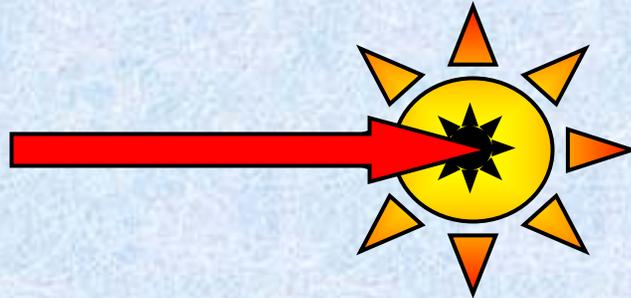
# Measurements of Aerosol Black Carbon During SOLVE II with the SP2

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# Motivation

- The current models of atmospheric aerosols used in algorithms to extract aerosol properties from measurements by remote sensors, i.e. satellites and lidars, ignore the contribution by absorbing aerosols and assume homogenous distributions of internally mixed composition.
- There are very few measurements in the UT/LS of single particle size and composition. Measurements by Murphy et al. (1998) suggest that the aerosol population is a highly inhomogeneous mixture of particles of many different compositions.
- More measurements are needed of the properties of individual particles over a size range from at least  $0.1 \mu\text{m}$  to  $> 1 \mu\text{m}$ , especially of black carbon (BC), for better characterizing the aerosol population in the UT/LS.
- A better knowledge the fraction of aerosols that have absorbing material will improve the interpretation of measurements from conventional optical particle spectrometers.
- The currently available instruments for measuring BC are too slow, too insensitive, and too inaccurate to measure BC from aircraft.

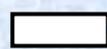
# Principal Features of the Single Particle Soot Photometer (SP2)

- Size measurement of particles that scatter light.
- Size and mass of particles that scatter and absorb light.
- Single Particle Detection Limit  $< 0.1 \mu\text{m}$  using Diode-pumped Nd:YAG laser providing  $10^6 \text{ W cm}^{-2}$  of power.
- Derivation of vaporization temperature from which composition can be deduced for absorbing particles, e.g., BC, metals and dust.

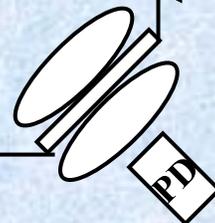
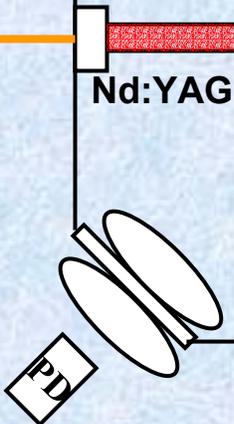
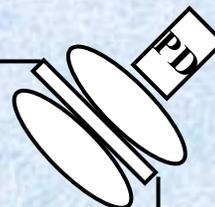
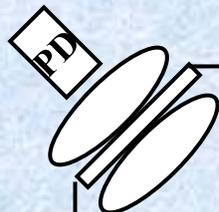
**Broadband Incandescence Detector  
(350-800 nm)**

**Narrowband Incandescence Detector 1  
(630-800 nm)**

**810 nm Diode**



**Optical Fiber**



**Nd:YAG**

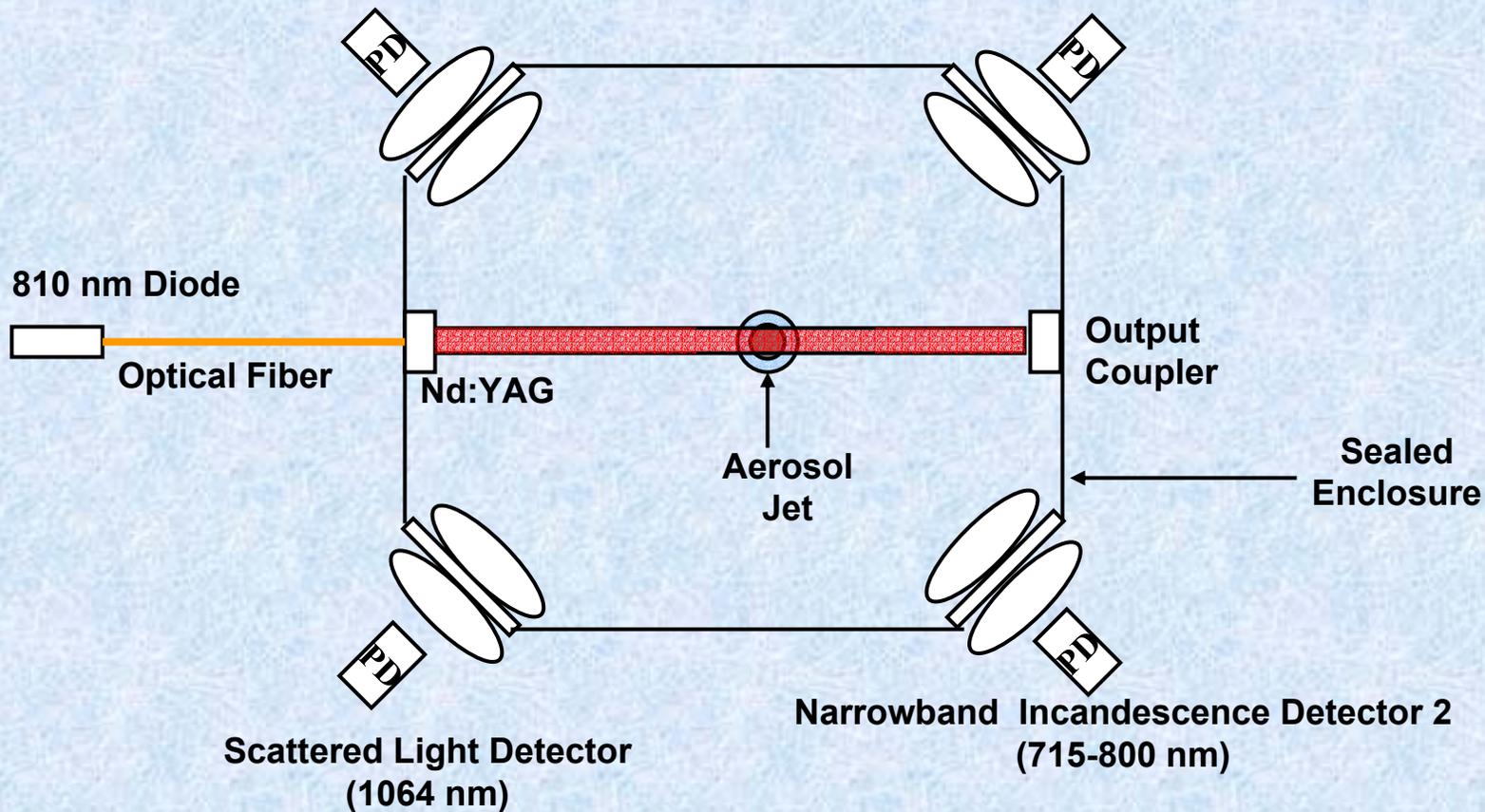


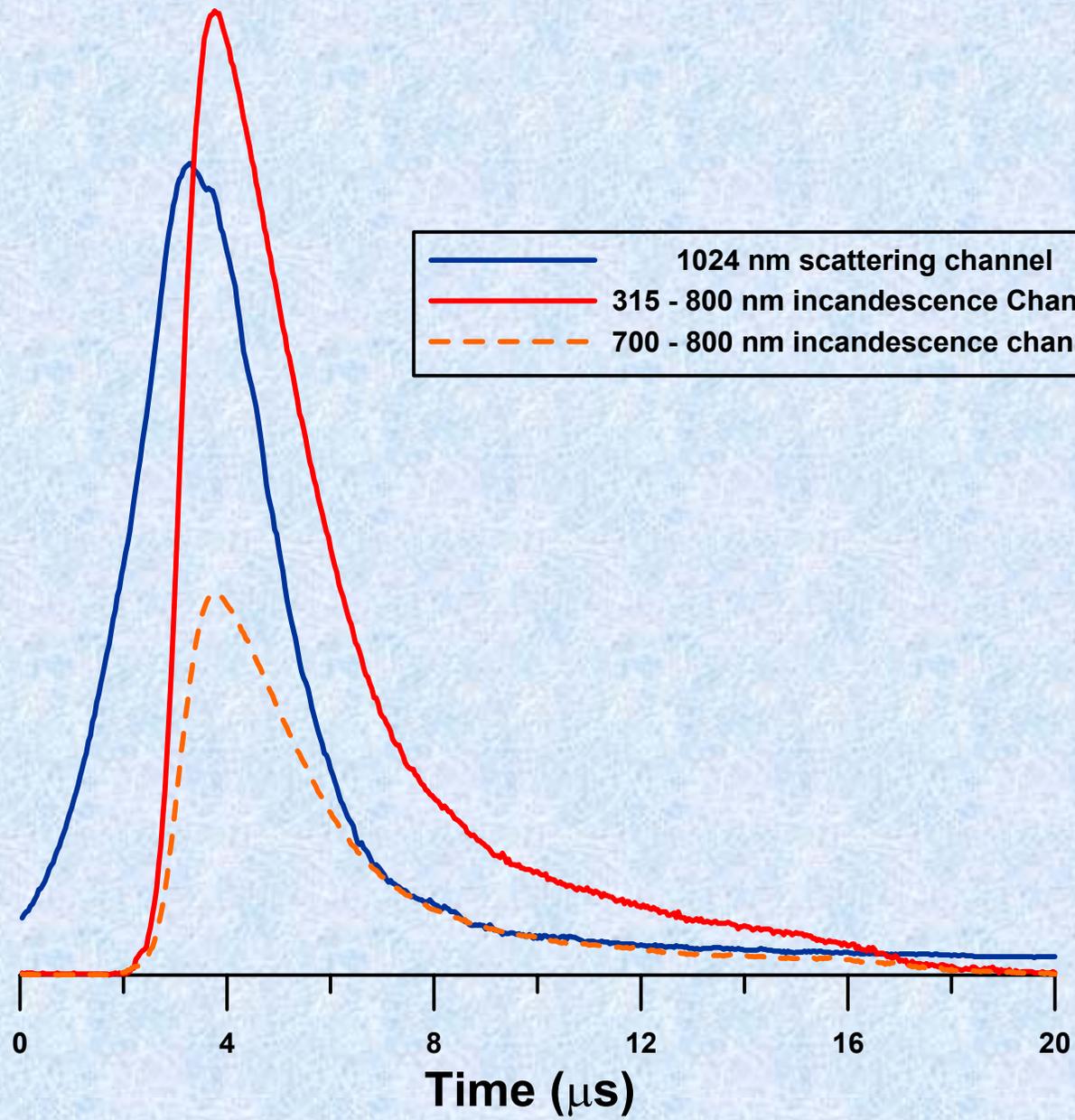
**Output  
Coupler**

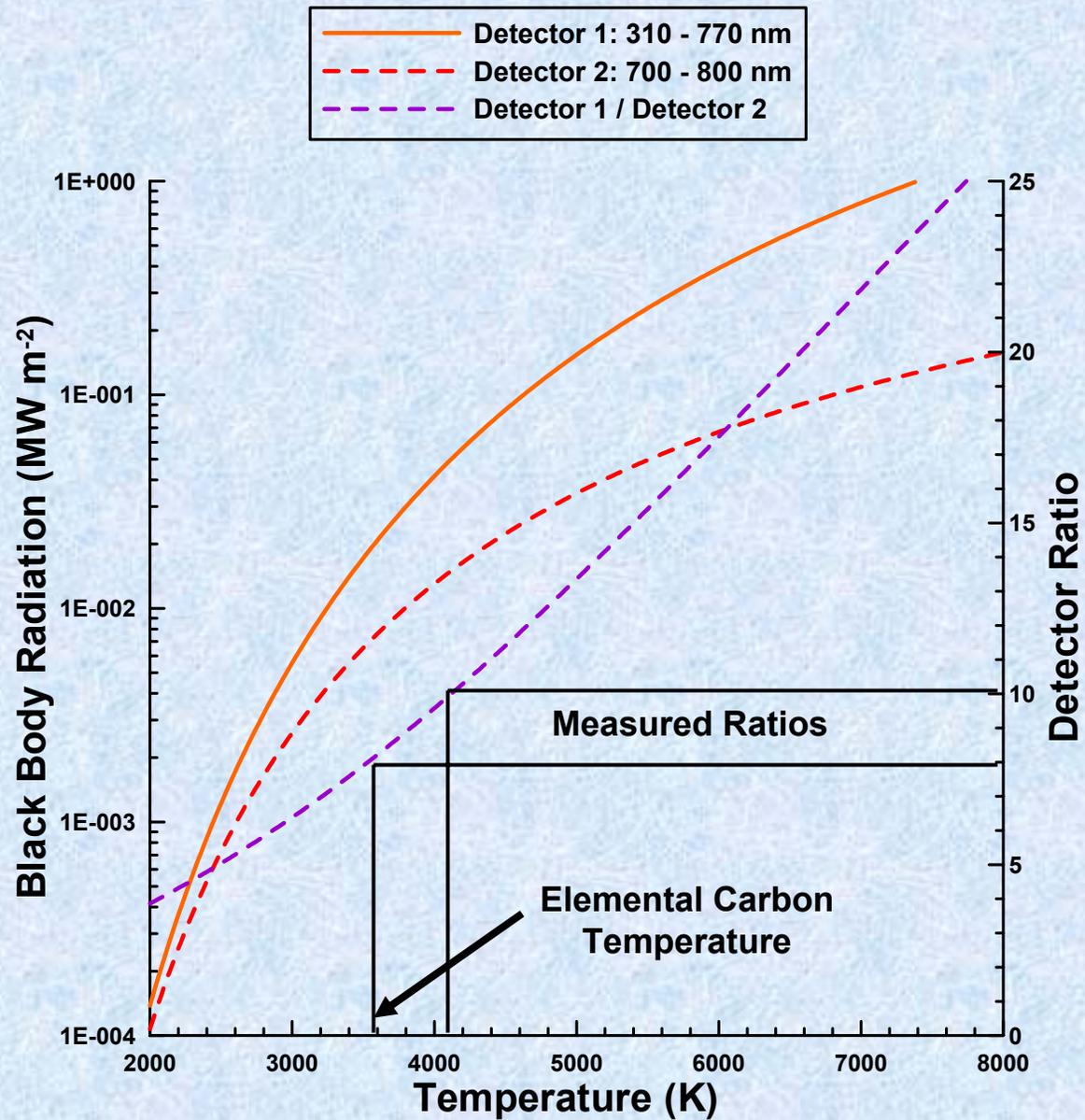
**Sealed  
Enclosure**

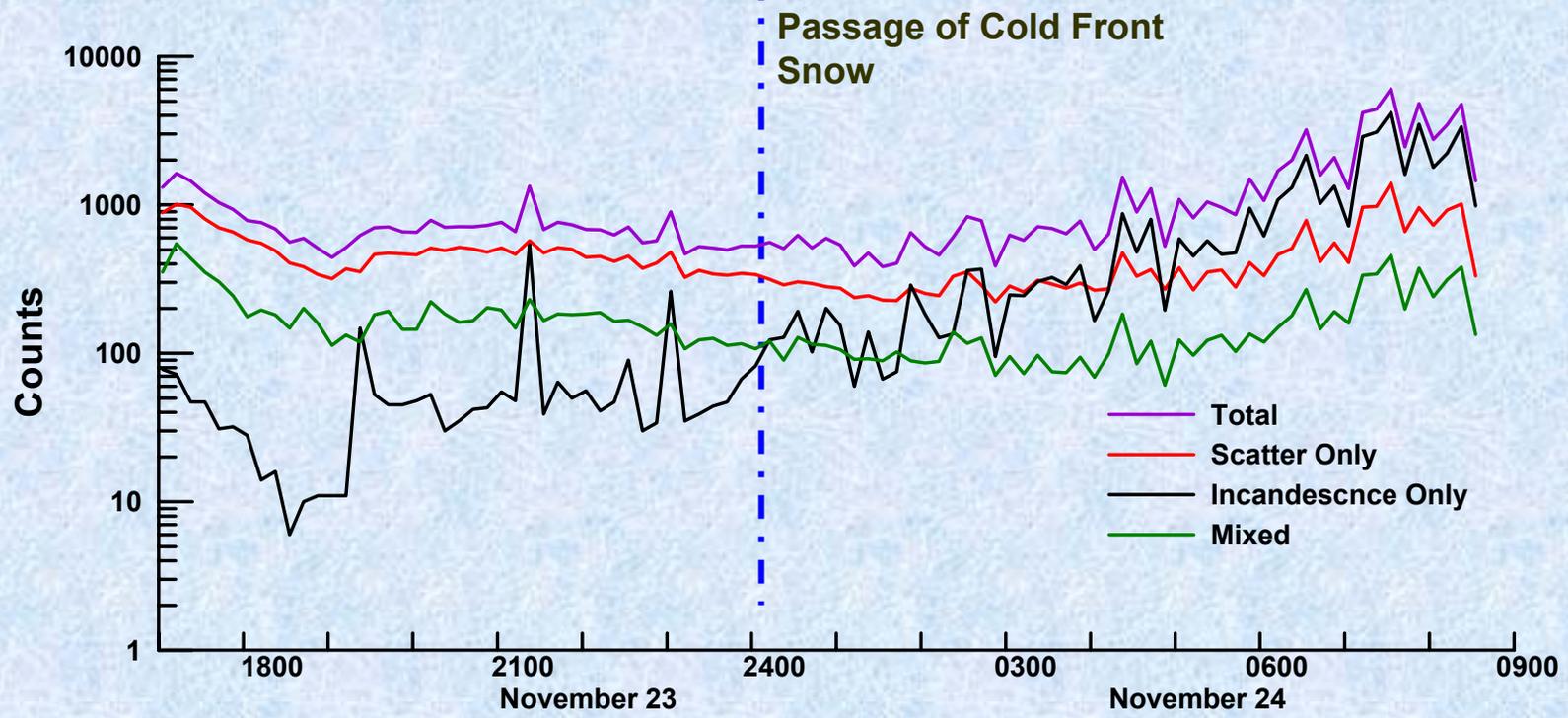
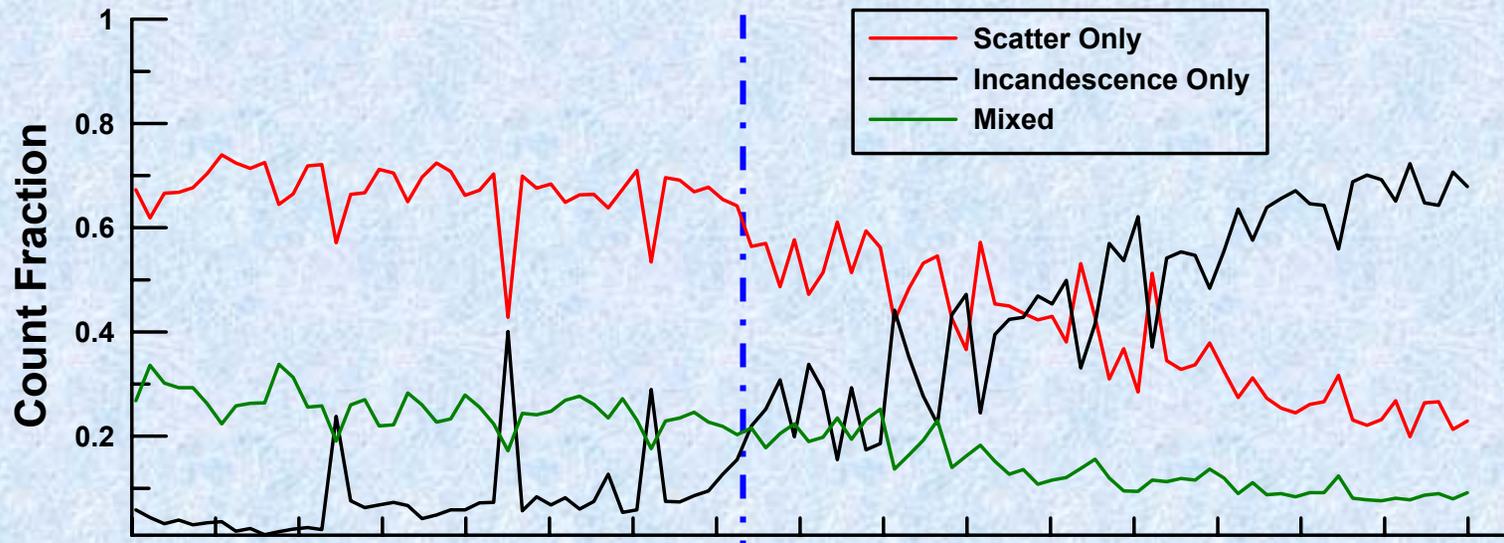
**Scattered Light Detector  
(1064 nm)**

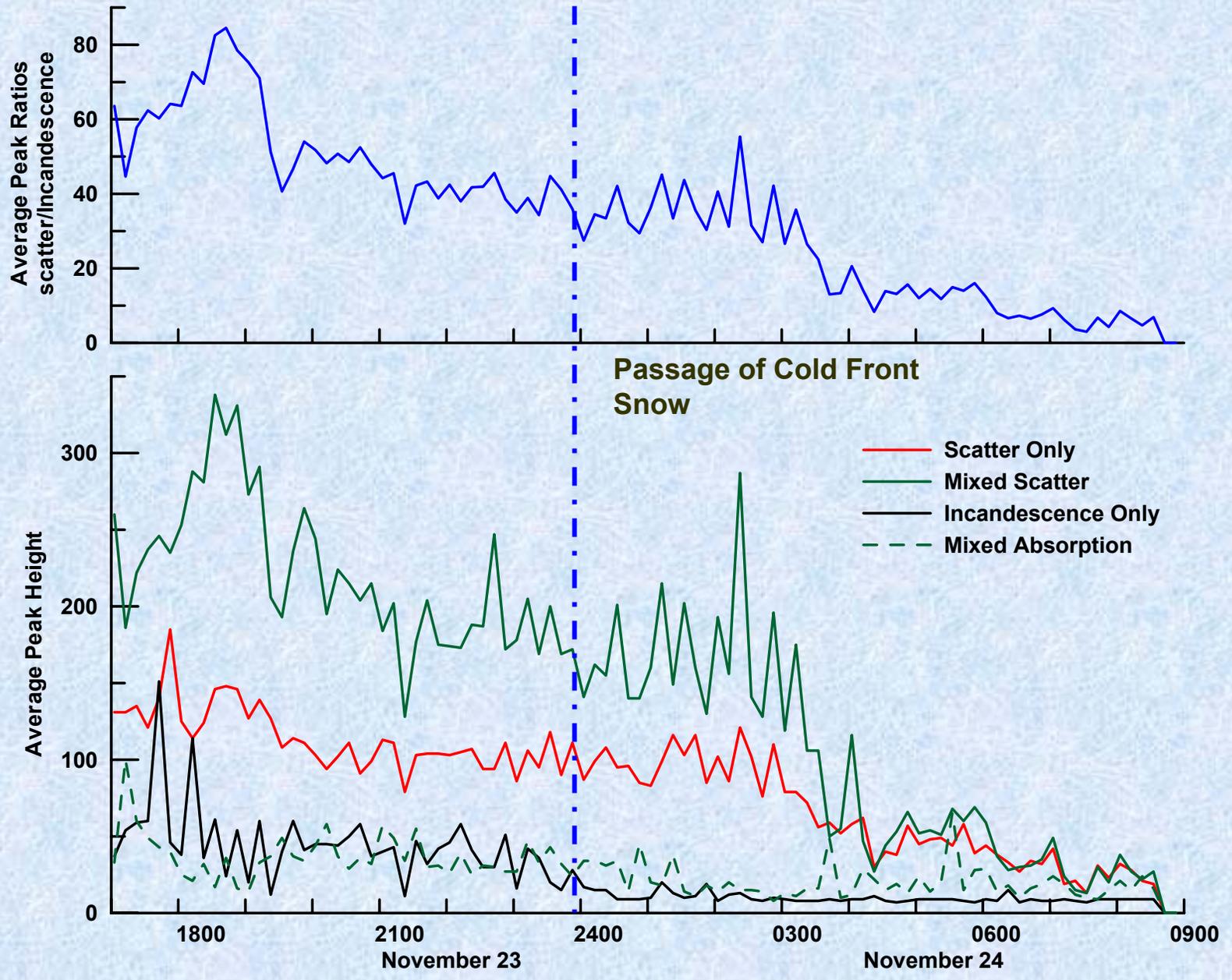
**Narrowband Incandescence Detector 2  
(715-800 nm)**

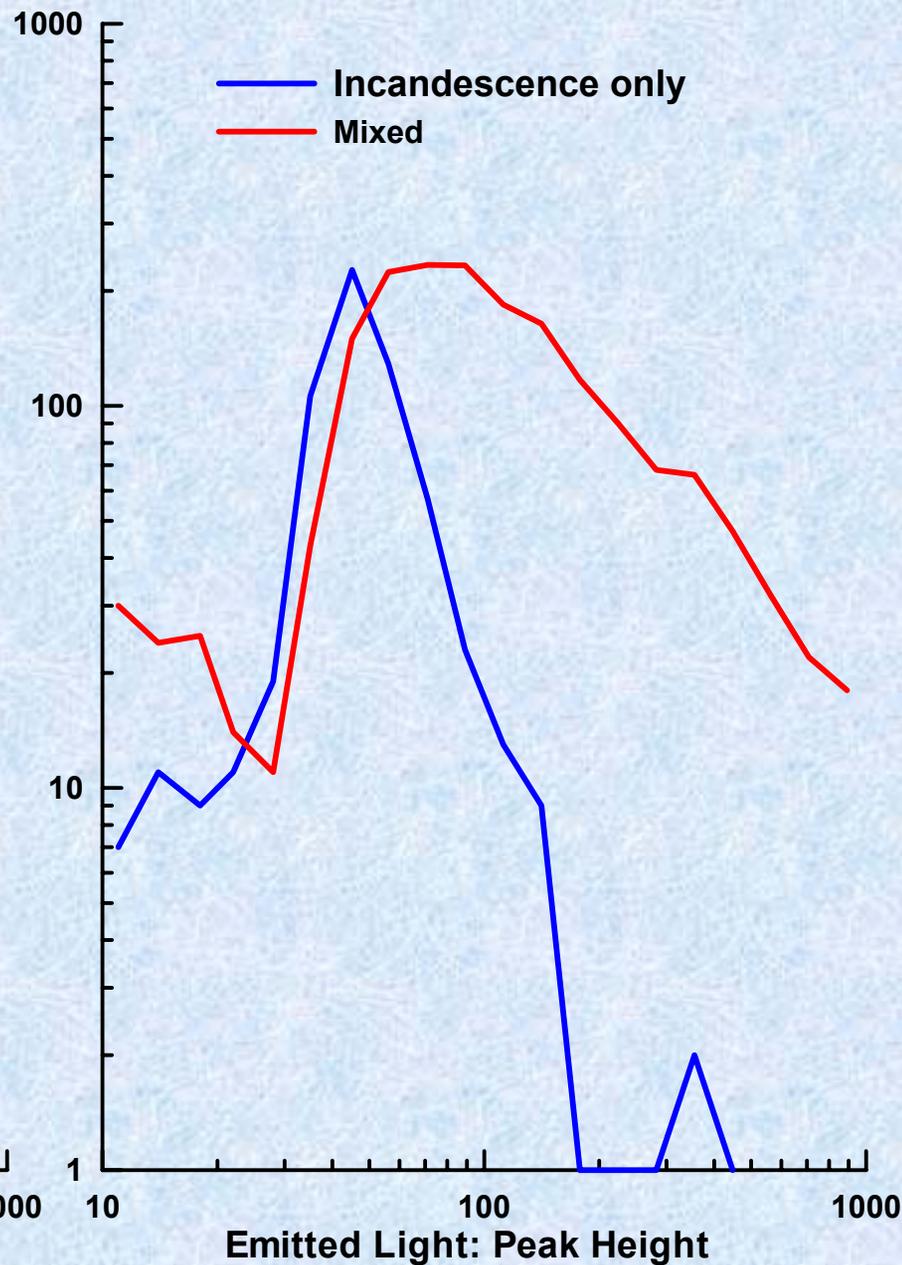
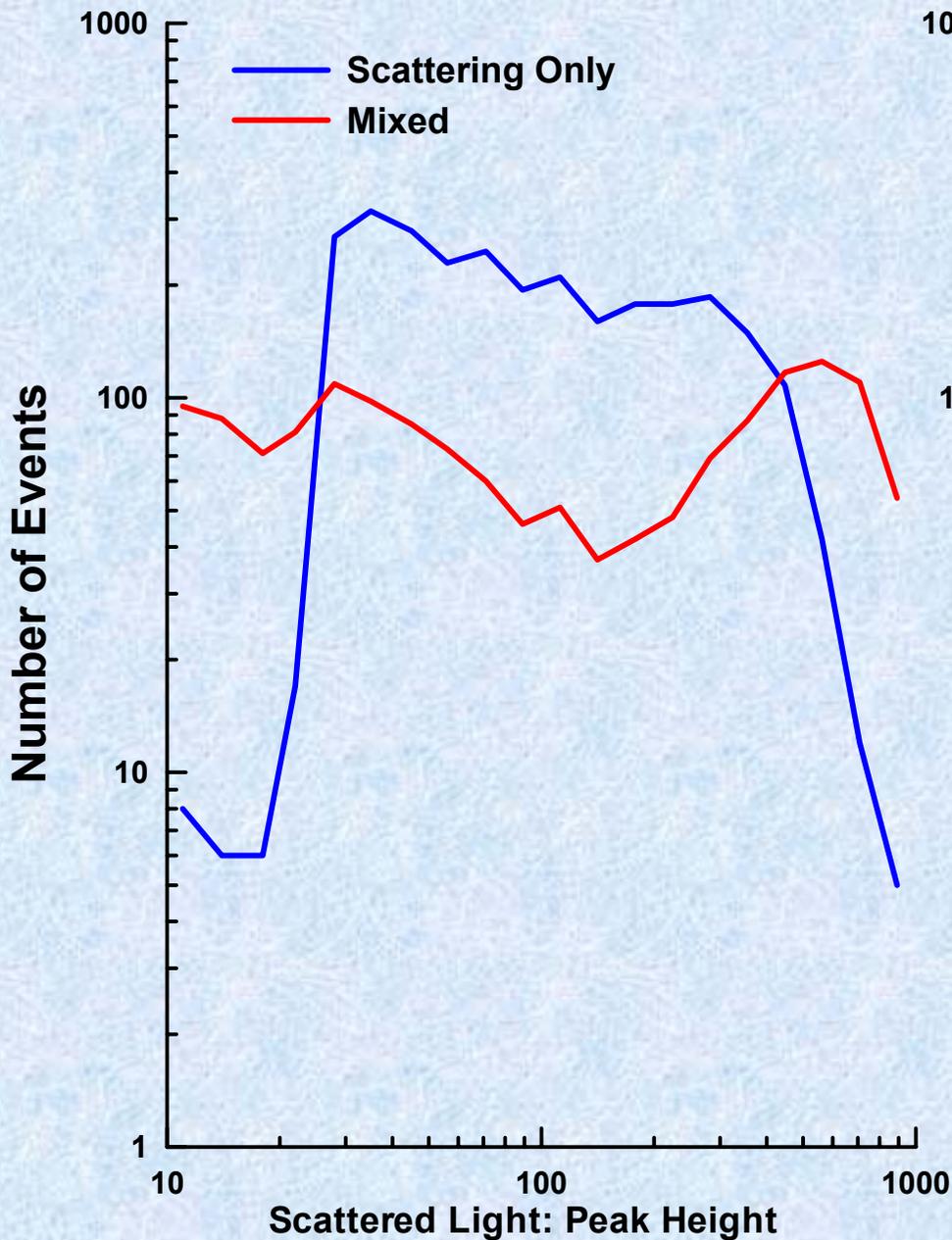


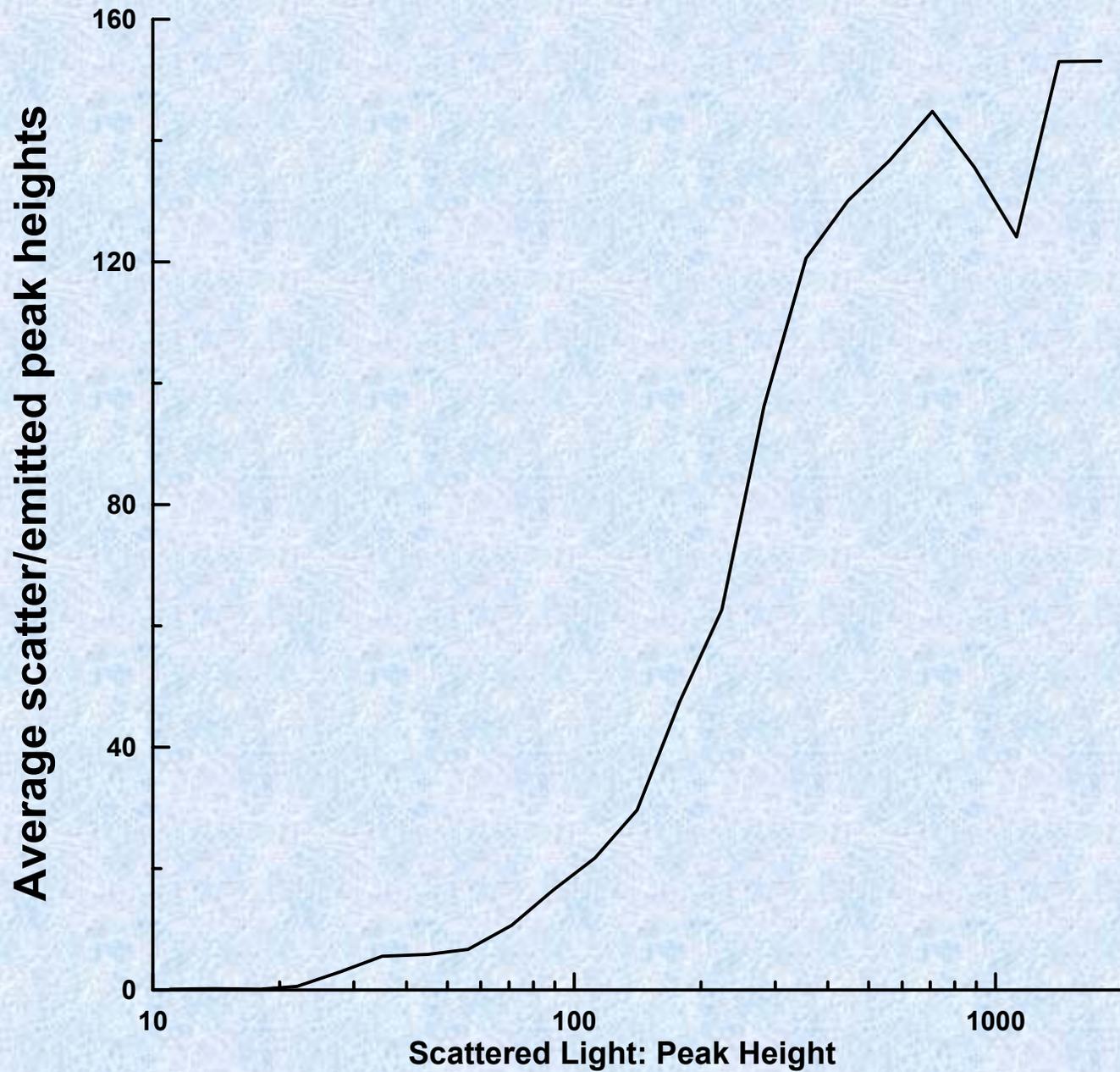












# SP-2 SCIENCE

- **Measurement and differentiation of particle types, i.e. scattering, incandescing and scattering + incandescing as a function of location and environmental conditions**
- **Comparison of size distributions with other OPCs**
- **Post project analysis of aerosol characteristics to contribute to a better model for atmospheric aerosols**
- **Evaluation of incandescence temperatures for identifying possible sources of aerosol.**
- **Collaboration with modelers to put aerosol measurements into the broader context of transport and evolution of UT/LS aerosoles.**