

UNCLASSIFIED

3 wavelength photoacoustic at SGP-AOS: Comparisons with nephelometer and PSAP

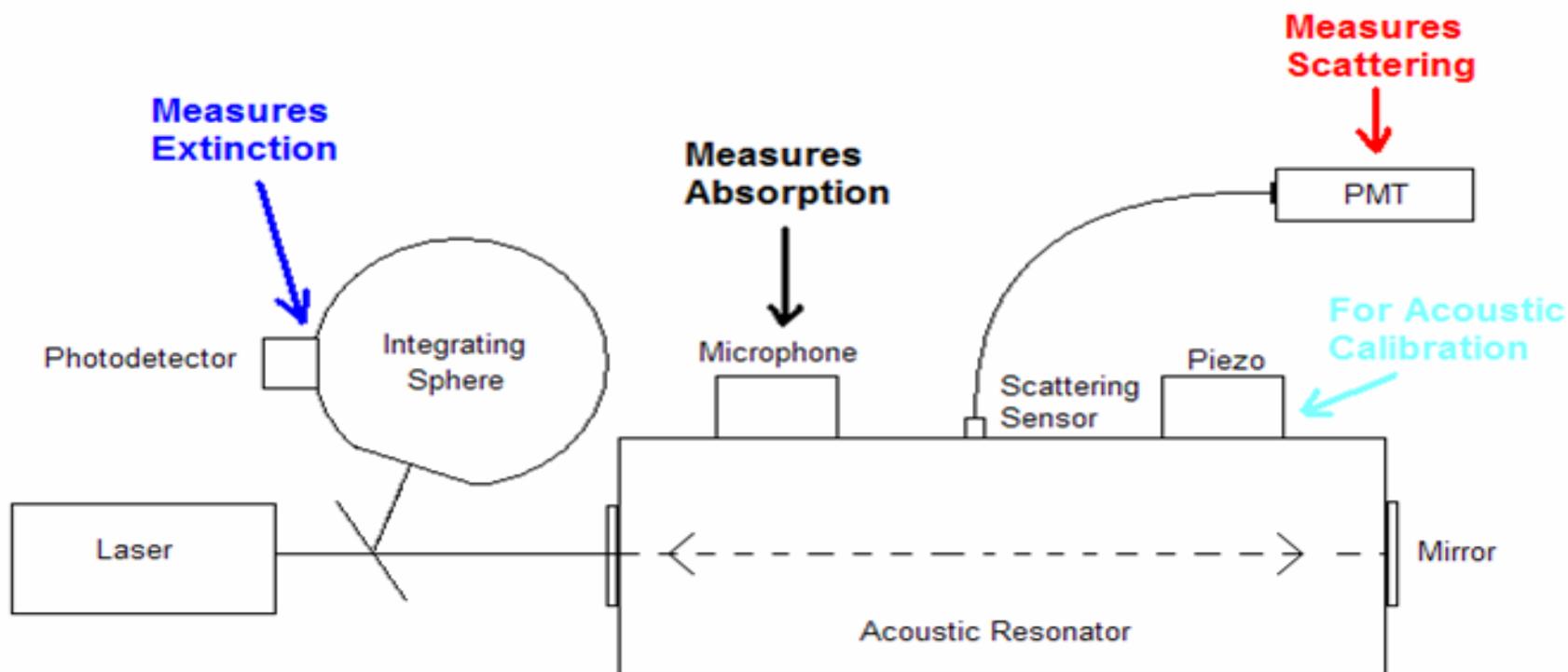


M. Dubey, B. Flowers and A. Jefferson

ARM-AWG meeting, Sept 29, 2009, Boulder CO

Photoacoustic Spectrometer and Nephelometer to Measure Aerosol Optical Properties (781, 532, 405 nm)

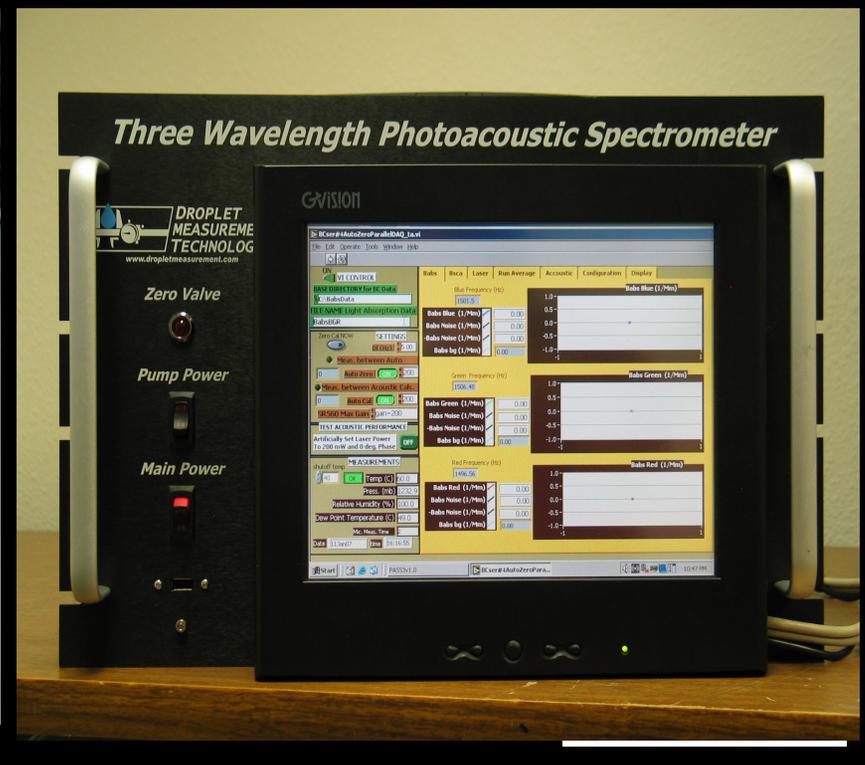
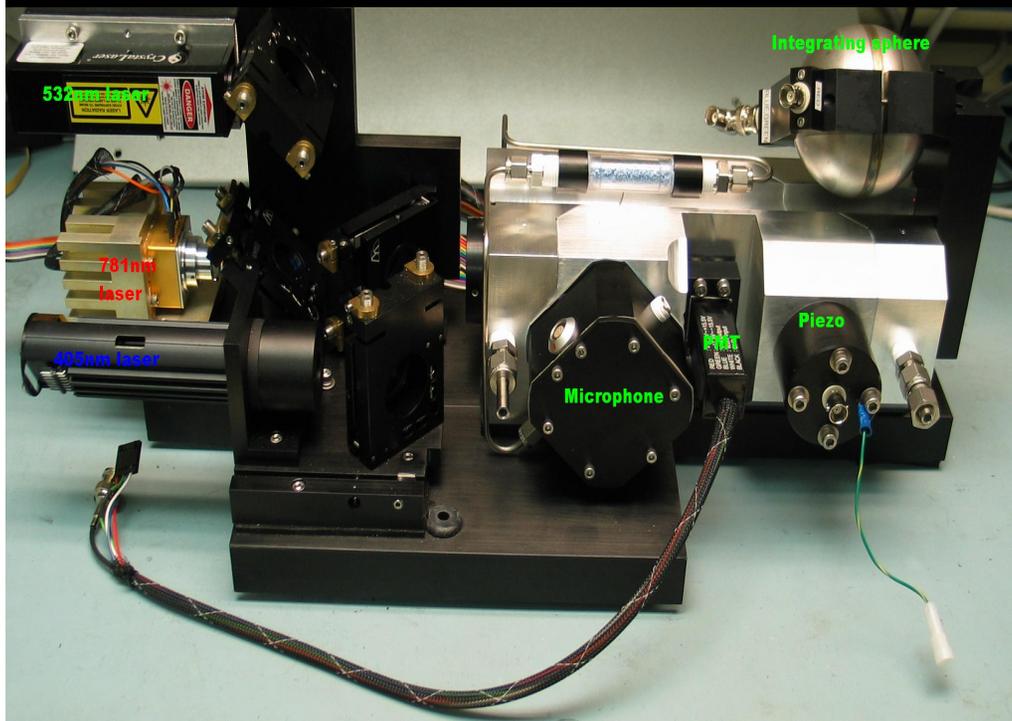
DMT Inc.



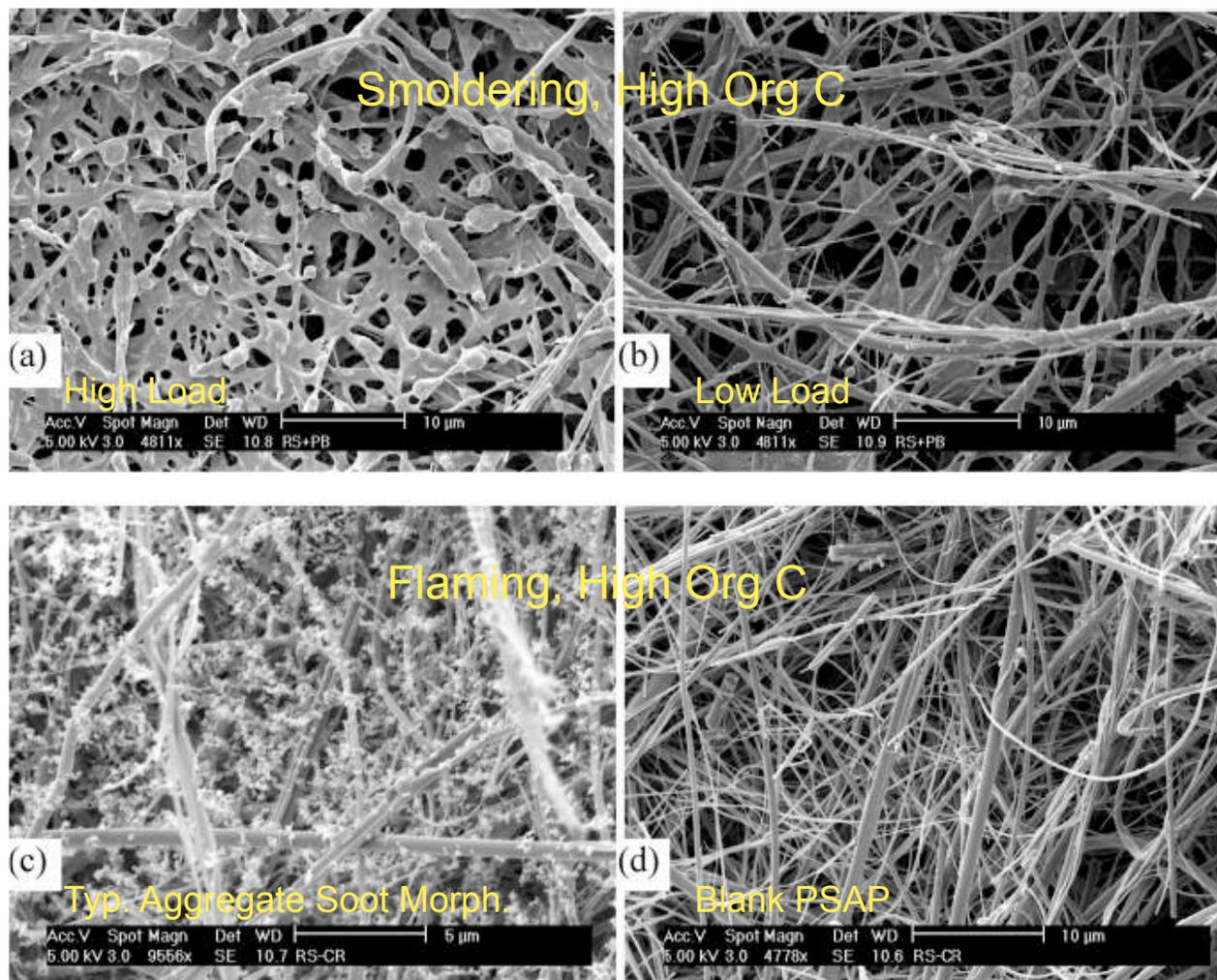
Single scattering albedo $\omega = \text{scattering} / (\text{absorption} + \text{scattering})$
 Filter-free direct measurements of abs, scat, ω of dry aerosols

Los Alamos 3-Laser Photoacoustic Absorption and Scattering 405, 532, 781nm

- Optical properties of mixed soot, organics, dust and sulfate aerosols (dry).
- How dark (warming) or light (cooling) are aerosols?
- Wavelength dependence of light absorption: soot, organics and dust ?



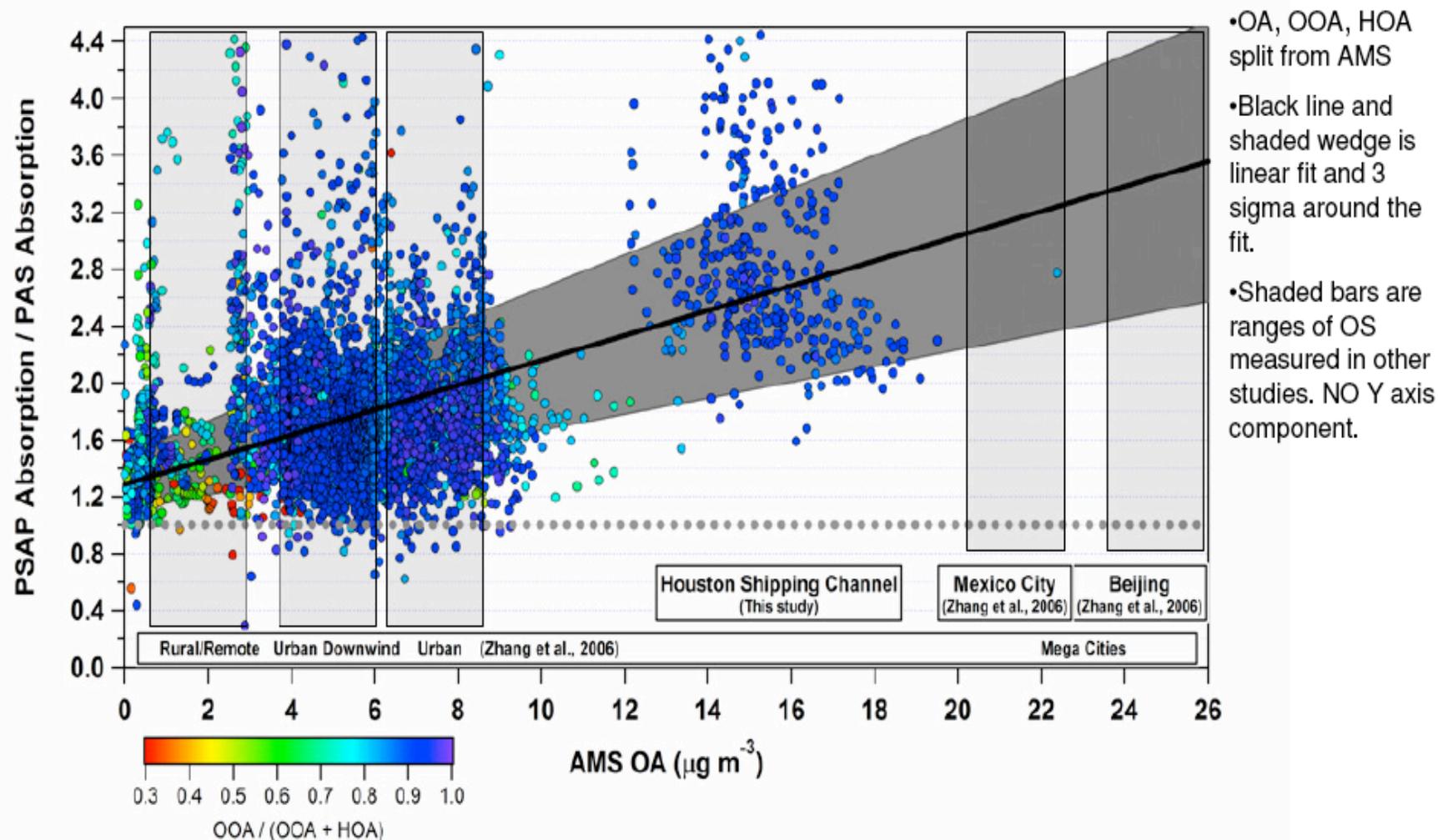
Traditional Filter Absorption Measurements: SEM of PSAP filter samples of rice-straw burning in lab. suggest problems at high organic carbon



Data courtesy of Dan Lack and Chris Cappa

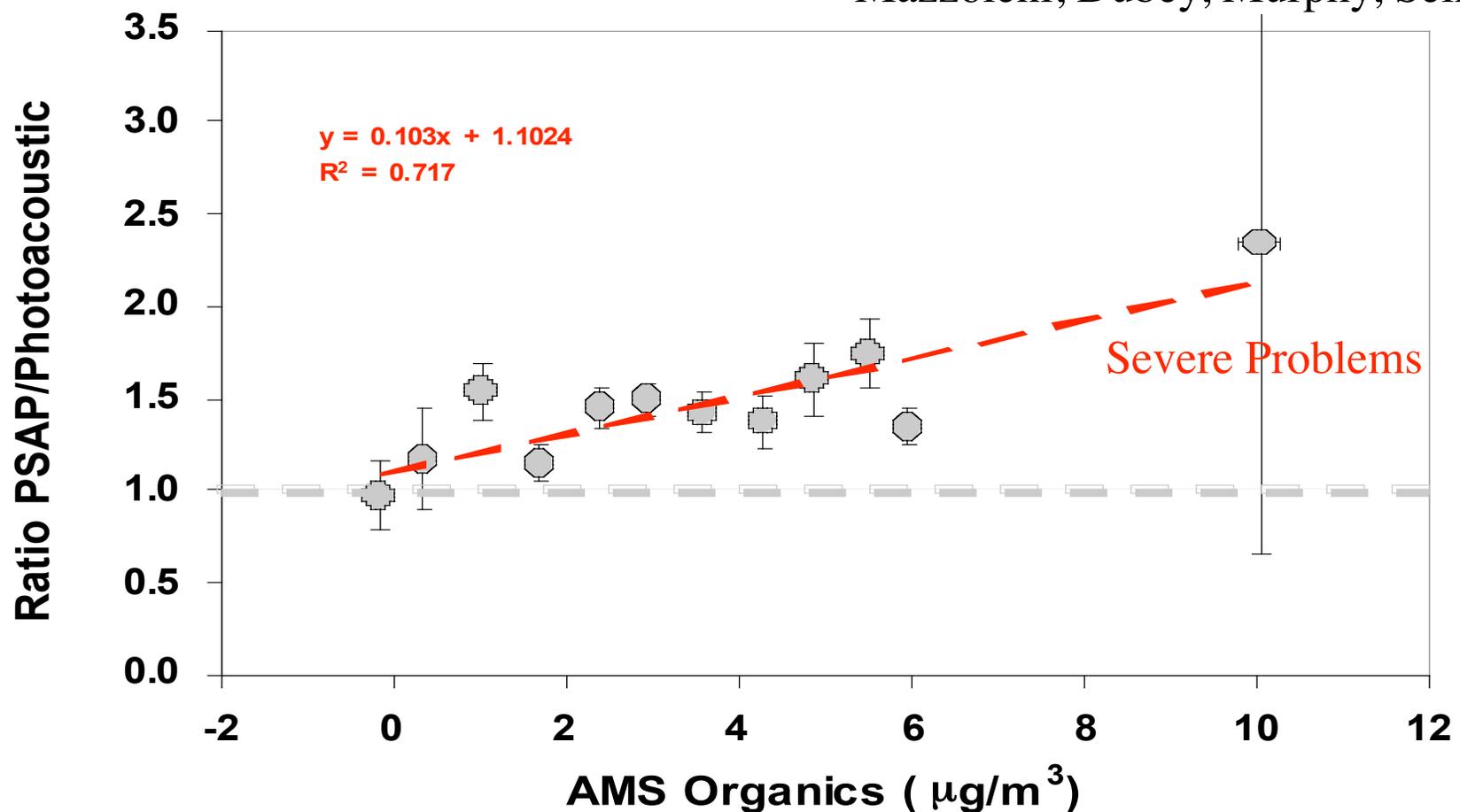
NOAA ESRL and UC California, Davis

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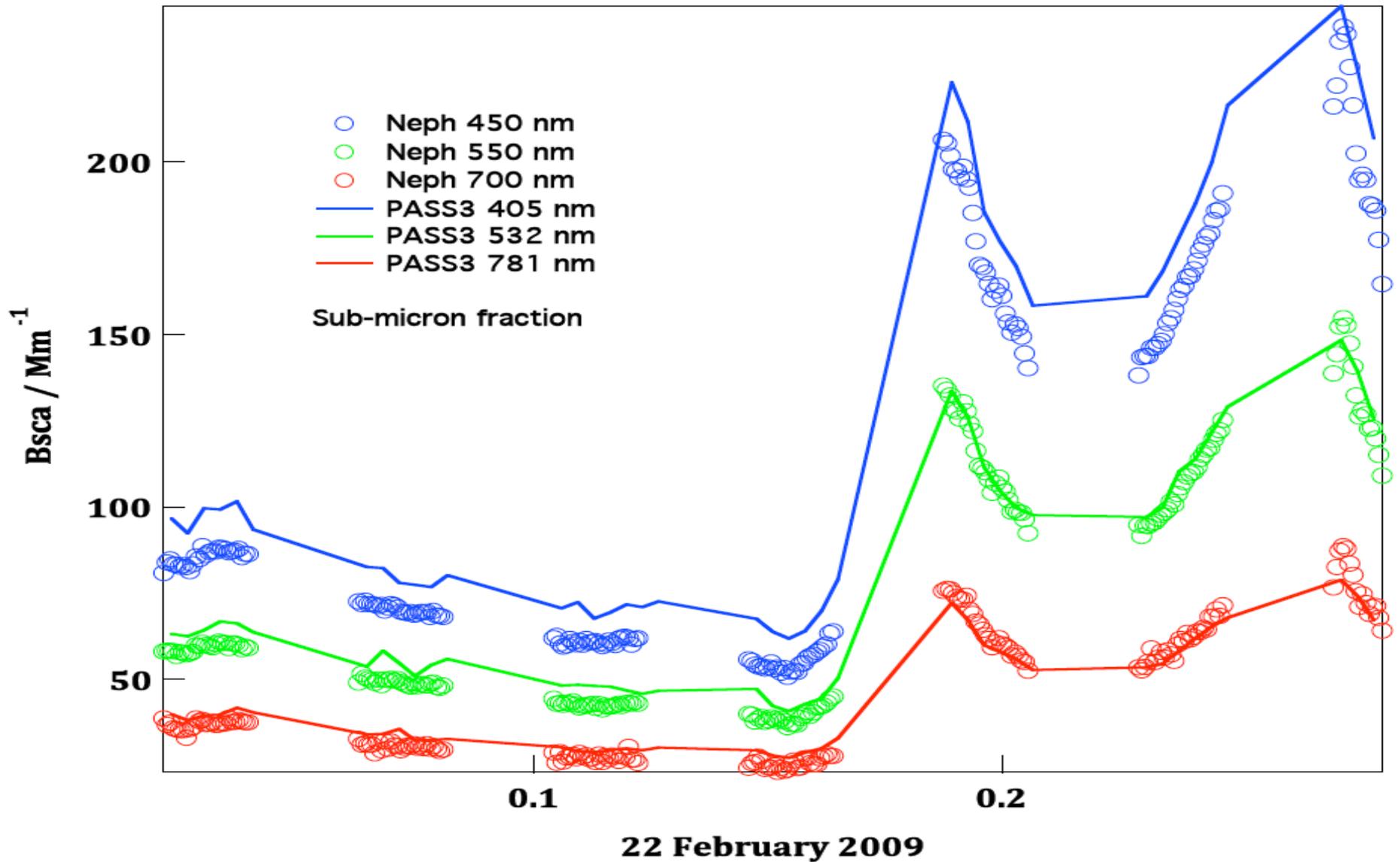
Houston Texas '06: PSAP/PASS Abs. vs AMS Organic

Mazzoleni, Dubey, Murphy, Seinfeld

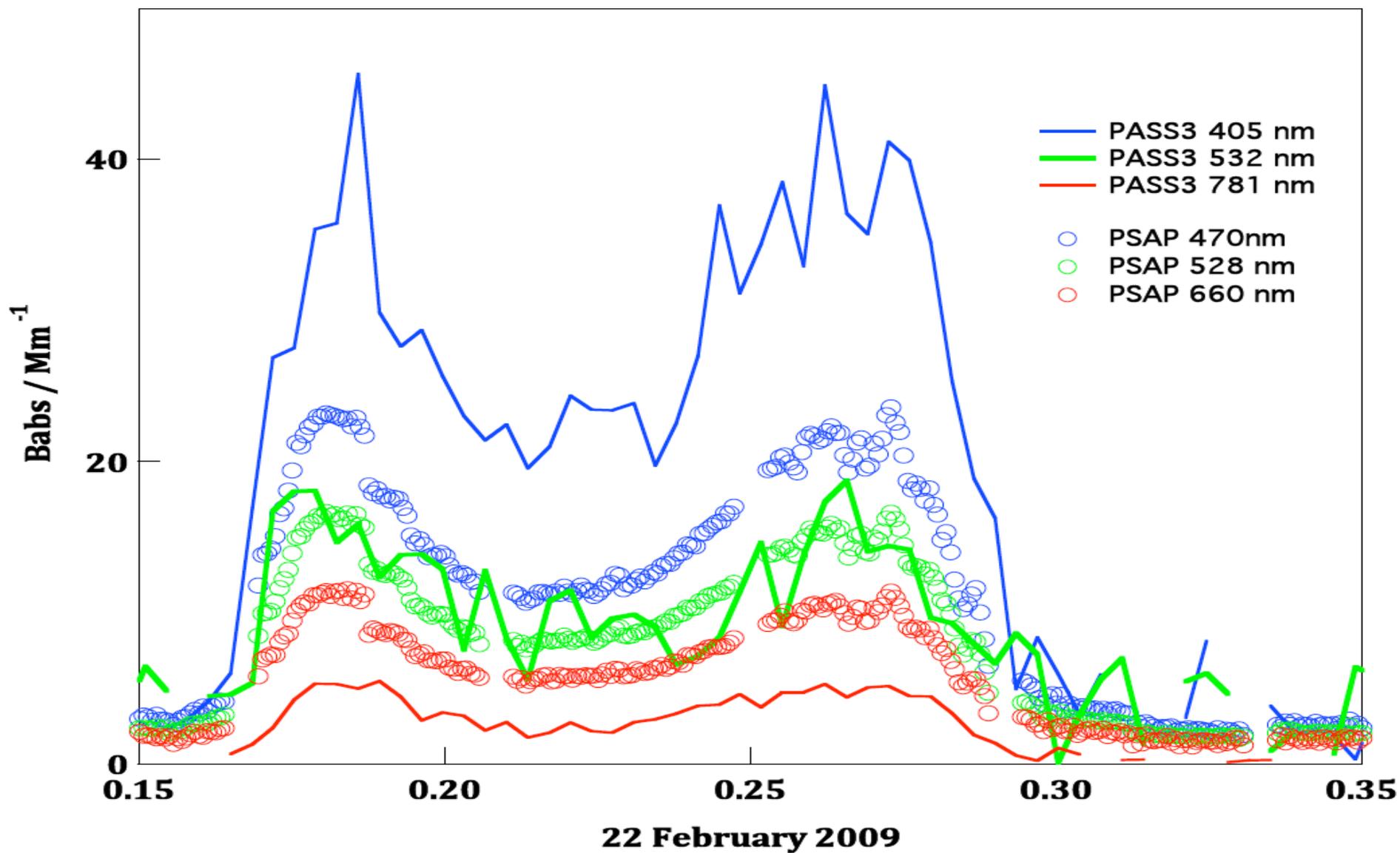


Filter based methods can suffer from large systematic high bias under certain conditions (high organic, sulfate, water etc..)

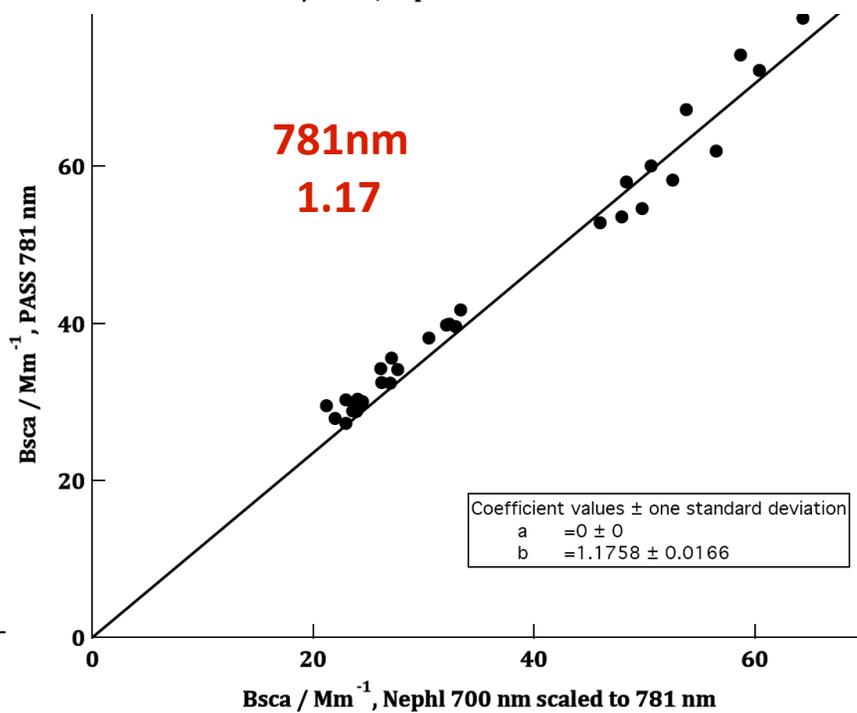
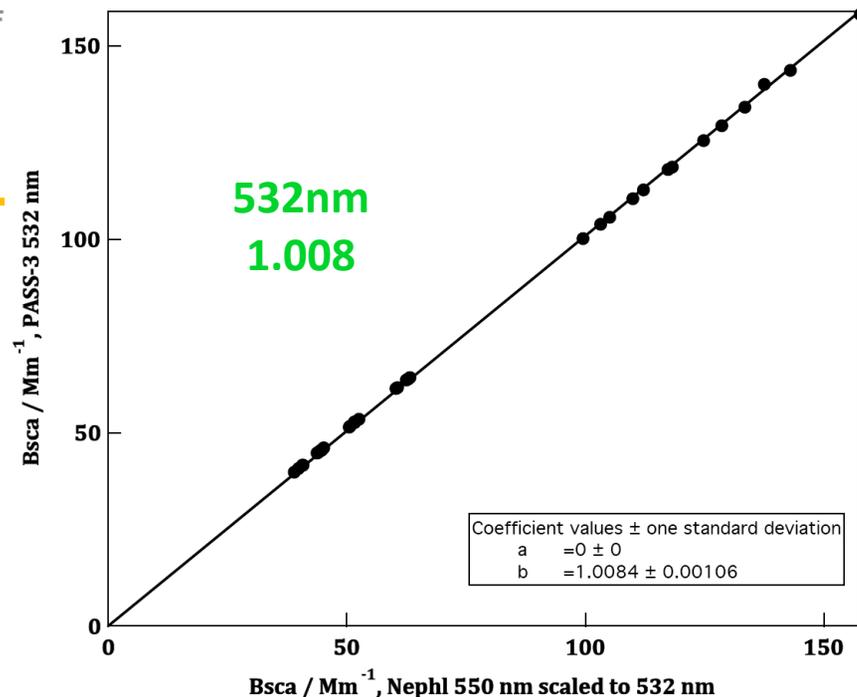
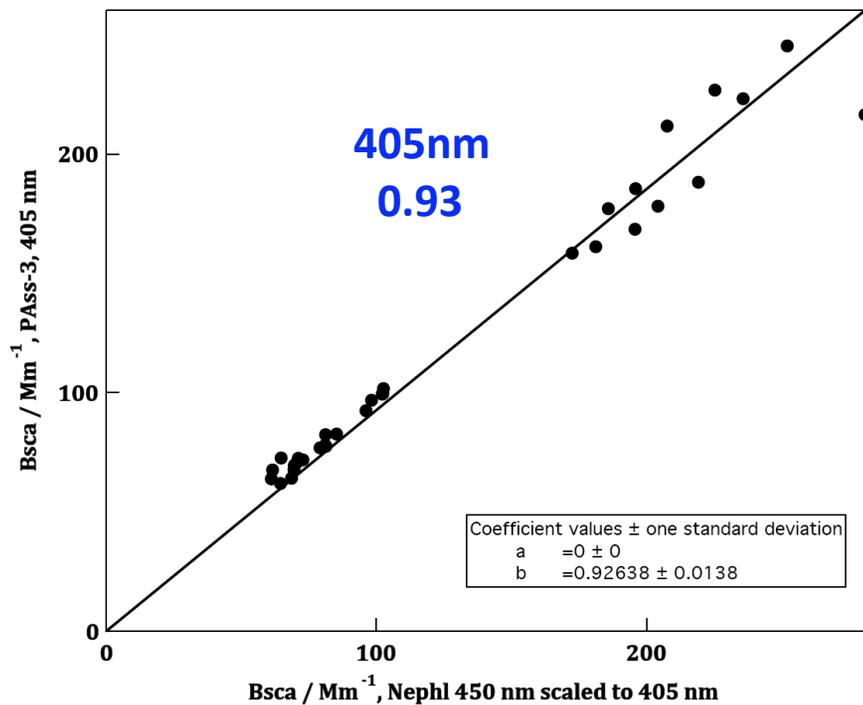
Scattering: PASS-3 and Nephelometer ($<1\mu$)



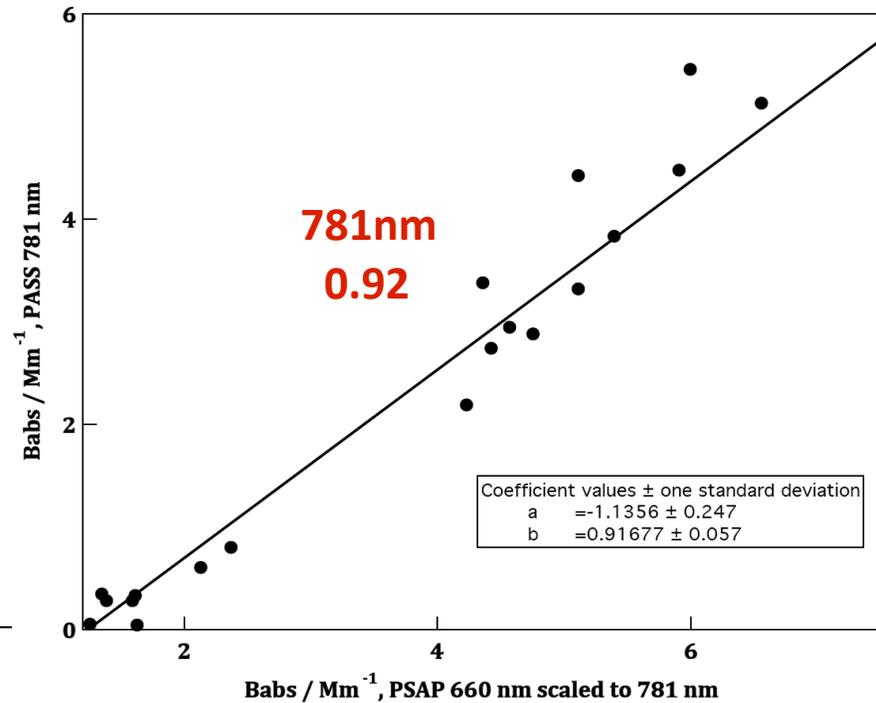
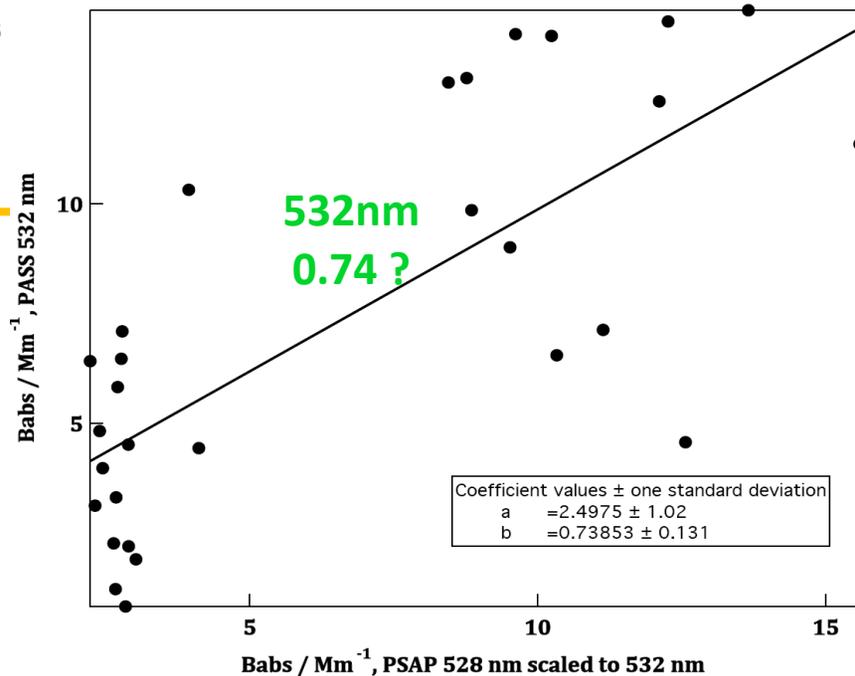
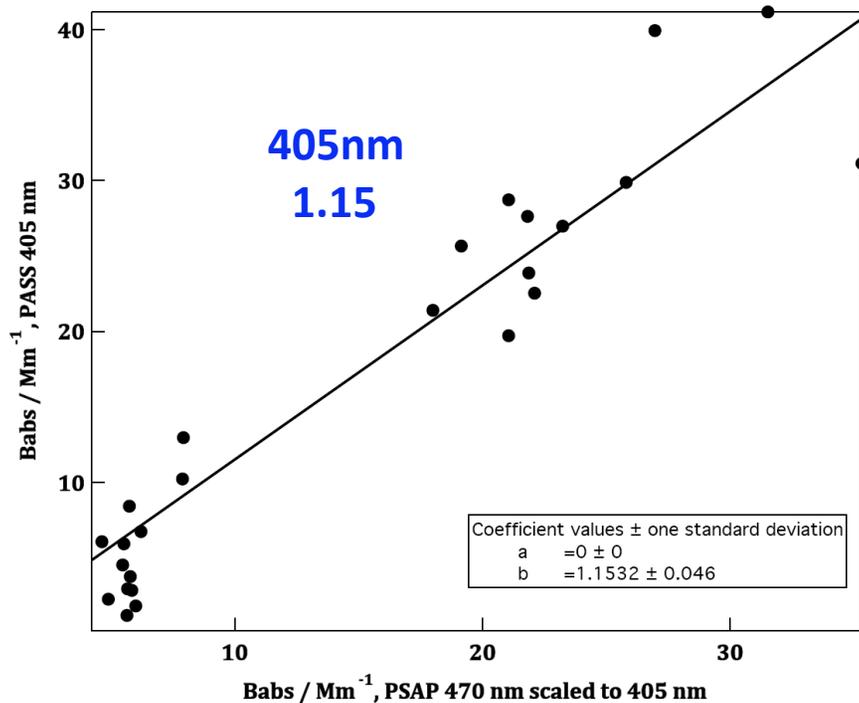
Absorption: PASS-3 and PSAP (<math><1\mu</math>)



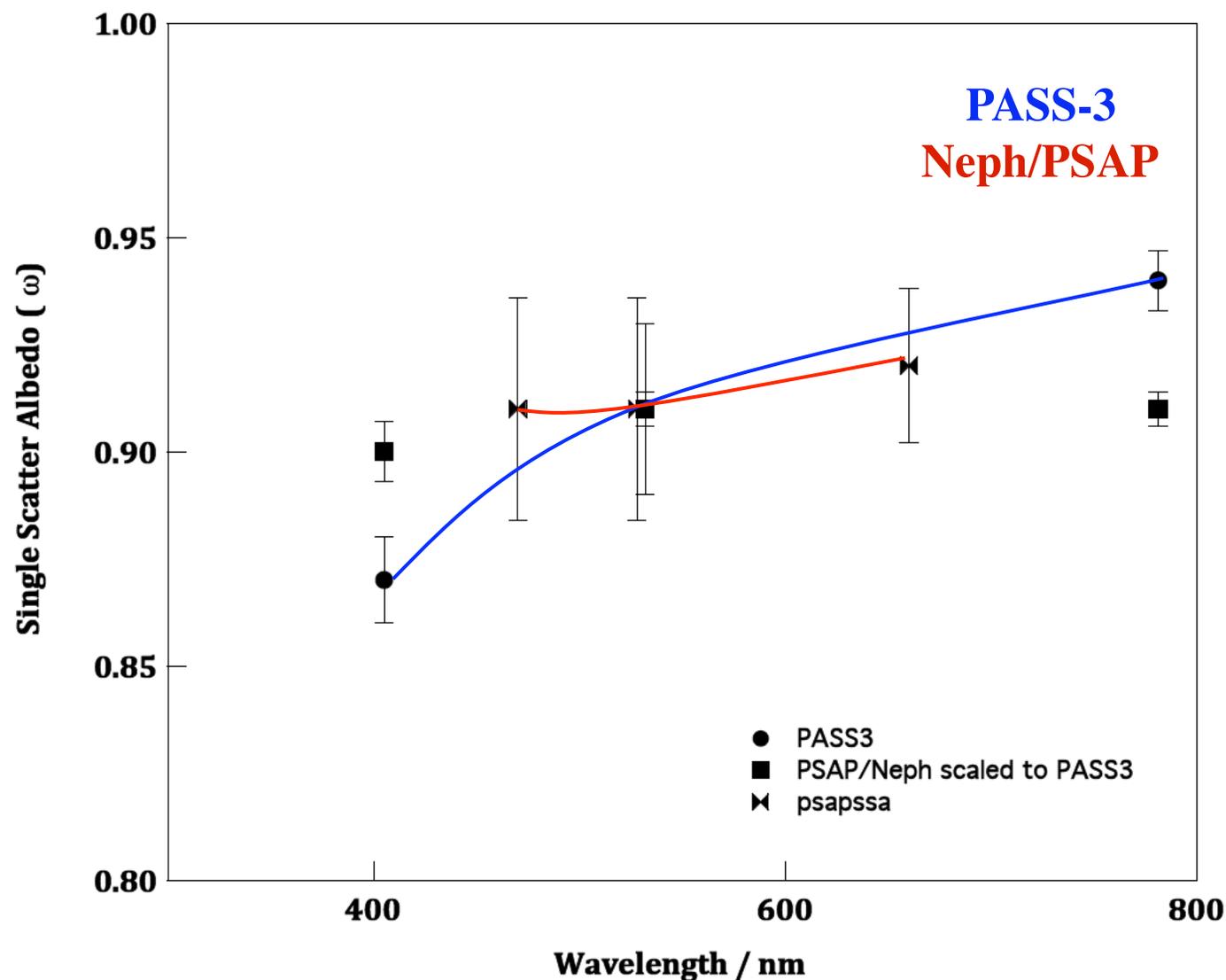
Scattering PASS vs Nephelometer with Angstrom λ extrapolation to PASS, $<1\mu$



Absorption PASS vs PSAP with Angstrom λ extrapolation to PASS



Mean SSA of light absorbing aerosols in plume



Ongoing Work

- PASS-3 running routinely for 6 months at AOS-SGP
- Scattering agrees with nephelometer (2/22/09)
- Absorption agrees in blue and red, green ? (2/22/09)
- Independent and expanded optical property data
- Green laser power is variable and has degraded
- Stable green laser refurbishment by DMT
- Identification and analysis of more plumes
- Value added products: SSA (λ) expanded