Polarized Imaging Nephelometer (PI-Neph)

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The Polarized Imaging Nephelometer is an in situ instrument designed and built at the Laboratory for Aerosols, Clouds and Optics (LACO) at the University of Maryland Baltimore County for the measurement of components of the aerosol phase matrix in high angular resolution between 2 to 178 deg scattering angles. The measured phase matrix provides extensive characterization of the scattering properties of the studied aerosols allowing for a very comprehensive set of aerosol scattering parameters. These measurements are essential for the validation of the new generation of aerosol remote sensors like the APS polarimeter in the Glory satellite, and for the construction of accurate models of real aerosol particles, specially the non-spherical ones. Figure 1 shows results of the aerosol phase function (P11 component of the phase matrix) of aerosol particles measured with the PI-Neph instrument aboard the NASA Langley B-200 aircraft in different ambient conditions and with artificial latex sphere particles generated during a test flight.

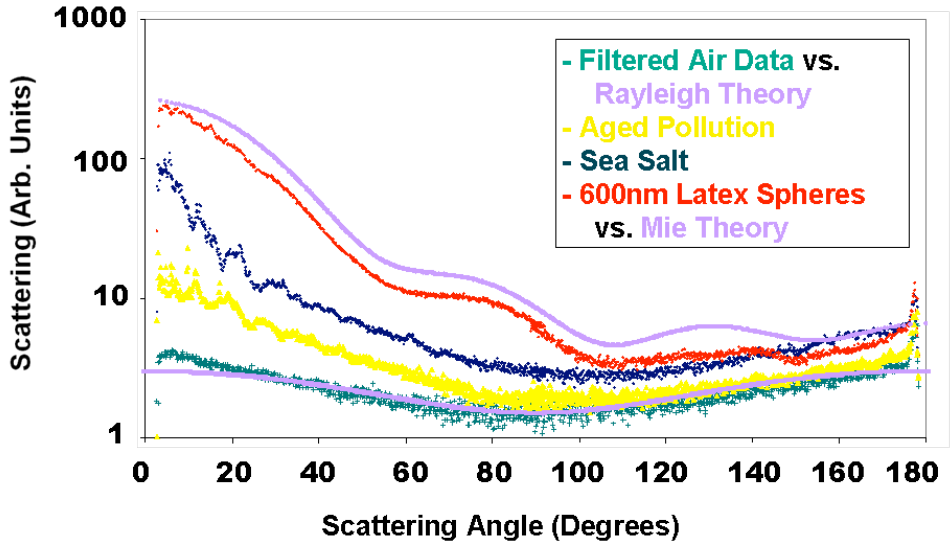

Figure 2 - Phase function measurements with the PI-Neph instrument inside the NASA Langley B-200 aircraft during the DEVOTE experiment.

The PI-Neph is composed of an enclosure chamber where the ambient aerosols are fed through an inlet system. Inside the PI-Neph a laser beam illuminates the aerosol

volume sequentially with 3 different polarization angles, and 3 wavelengths. The system can be programmed for multiple combinations of wavelengths and polarization angles. In each case a wide field of view camera measures the intensity of the scattered light and can determine up to two parameters of the aerosol phase matrix (P11 and P12) as a function of the scattering angle. Other parameters of the phase matrix can also be obtained with the measurement of additional Stokes parameters by using a wide field of view imaging polarimeter. A full measurement set takes less than 3 seconds. Faster measurements (a fraction of a second) are also possible for selected measurement subsets depending on the aerosol concentration.

Figure 2 shows a picture of PI-Neph system before installation in the aircraft. The system is integrated inside the aircraft and needs to be connected to an inlet/outlet system for the aerosol sampling.

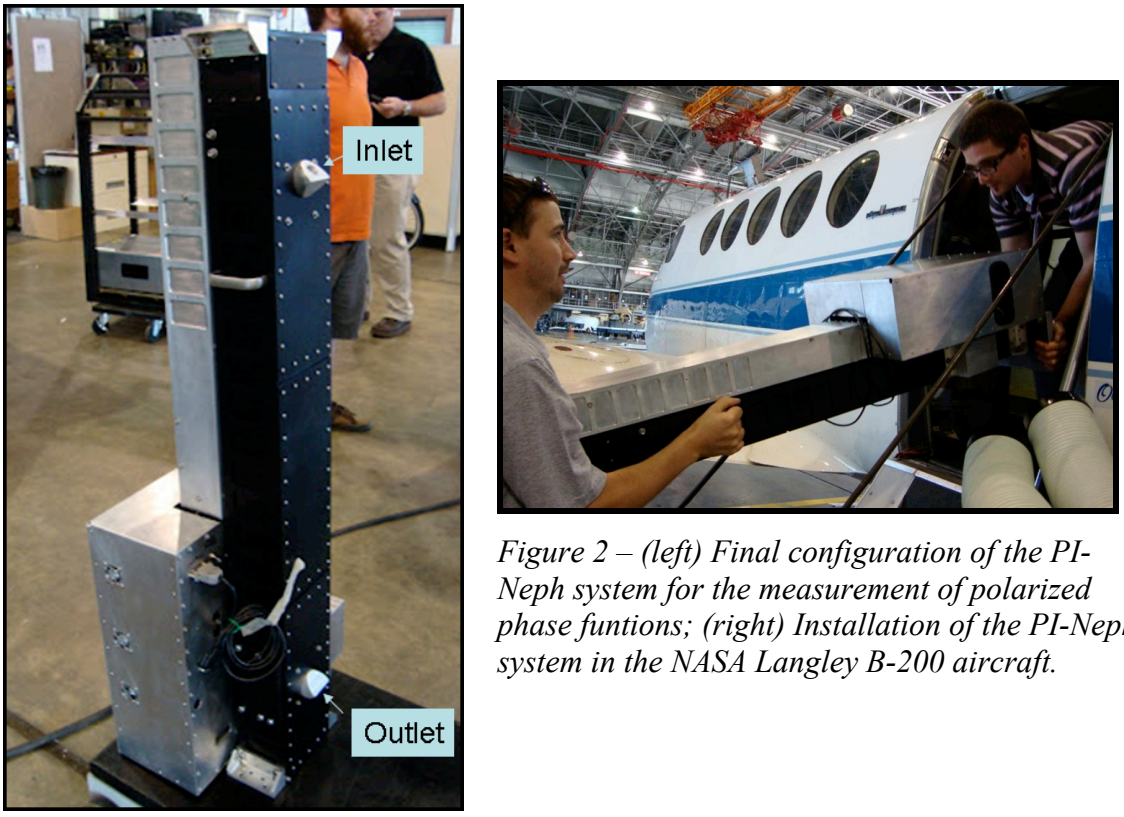

Figure 2 – (left) Final configuration of the PI-Neph system for the measurement of polarized phase funtions; (right) Installation of the PI-Neph system in the NASA Langley B-200 aircraft.