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Technical Note: Use of a beam width probe in an Aerosol Mass Spectrometer to monitor particle collection efficiency in the field

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Abstract. Two Aerodyne Aerosol Mass Spectrometers (Q-AMS) were deployed in Mexico City, during the Mexico City Metropolitan Area field study (MCMA-2003) from 29 March–4 May 2003 to investigate particle concentrations, sources, and processes. We report the use of a particle beam width probe (BWP) in the field to quantify potential losses of particles due to beam broadening inside the AMS caused by particle shape (nonsphericity) and particle size. Data from this probe show that no significant mass of particles was lost due to excessive beam broadening; i.e. the shape- and size-related collection efficiency (E_S) of the AMS during this campaign was approximately one. Comparison of the BWP data from MCMA-2003 with other campaigns shows that the same conclusion holds for several other urban, rural and remotes sites. This means that the aerodynamic lens in the AMS is capable of efficiently focusing ambient particles into a well defined beam and onto the AMS vaporizer for particles sampled in a wide variety of environments. All the species measured by the AMS during MCMA-2003 have similar attenuation profiles which suggests that the particles that dominate the mass concentration were internally mixed most of the time. Only for the smaller particles (especially below 300 nm), organic and inorganic species show different attenuation versus particle size which is likely due to partial external mixing of these components. Changes observed in the focusing of the particle beam in time can be attributed, in part, to changes in particle shape (i.e. due to relative humidity) and size of the particles sampled. However, the relationships

between composition, atmospheric conditions, and particle shape and size appear to be very complex and are not yet completely understood.

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