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Interactive comment on "On the time-averaging of ultrafine particle number size spectra in vehicular plumes" *by* X. Yao et al.

X. Yao et al.

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This is a very short article containing interesting data which to my opinion could be useful if more constrained and amended by additional assessments. The too numerous citations preclude any informative help and in this context the introduction especially should be tightened and cited papers carefully chosen.

Response: In the revised version, we reduce the number of the citations accordingly without affecting the completeness and clarity of the paper.

I believe that motivations for such a work are primarily emission process studies; however this is not explicitly postulated and it might be argued that for a health point of view average data are probably more adequate. Some basic assessments appear evident such as bimodal distribution distorsion or the appearance of 3 modes when the traffic

may be characterised as a "mixed" traffic.

Response: The objective of this paper (ACPD, 6, 6825-6839, 2006) is to address the validity of using averages of long scan-time particle size distribution spectra in rapidly and perhaps randomly varying high concentration environments such as at roadside, on road and in tunnels under the context that when the measurement is slower than the process, sampling problems will invariably exist (Yao, et al., in press, AST). This is demonstrated by averaging 1-second EEPS data after the fashion that is commonly reported in the literature. We will further clarify this in the last paragraph of the introduction of the revised paper as follows: “The objective of this study is to address the question raised earlier, by comparing 1-second EEPS ultrafine vehicular particle number size distributions with those obtained by time-averaging (5, 10, 30 and 120 s) the same 1-second EEPS dataset”.

It may very well be true from the point of view of health impact that very high time-resolution particle size distribution data are not needed and average data (especially those taken in slow varying environments) will be sufficient. However, we believe that we have raised an important and fundamental question in aerosol sampling, i.e., long scan-time particle size distribution spectra in rapidly and perhaps randomly varying high concentration environments can introduce distortions due to the mixing of particles from different sources (Yao et al., in press, AST), and time-averaging of these distorted data will further exacerbate the problem, thus causing difficulties in interpreting the data.

Conversely what is (for me) most important is not actually clarified enough or even stated. Discussion could be substantiated by the followings: - what is the size distribution to be characteristic of plumes from gasoline-powered vehicles? light duty diesel? high duty diesel? - for these distributions what mode (and properties: diameter, sigma) can be attributed to nucleation (secondary particles), primary particles, particle growth by condensation and/or coagulation? -what is the BC particle size?

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EGU

Response: Characterizing nano-particles in vehicle plumes is not the focus of this paper (ACPD6, 6825-6839, 2006) since such information has already been reported by the authors in a previous paper (Yao et al., AST, 39, 831-841, 2005, the reference was cited in the paper). In brief, vehicular particles from gasoline vehicle emissions are characterized by a dominant mode at 101 nm and a minor mode at 505 nm in Hong Kong. Vehicular particles from diesel vehicle emissions are characterized by a minor mode at 101 nm and a dominant mode at 20-30 nm in vehicle plumes.

Nucleated particles are commonly believed to be smaller than 3 nm in the literature. The ˜10 nm, ˜20 nm and ˜50 nm modes observed in this study have been documented in the literature and they are believed to be due to the growth of nucleated particles by condensation and/or coagulation (Kim et al., 2002; Gidhagen et al., 2003; Jacobson and Seinfeld, 2004; Zhang et al., 2004). Primary soot particles usually exhibit particle mode at ˜100 nm (Harris and Maricq. 2001, Bukowiecki et al., 2003 and Kittelson et al., 2004).

BC mass concentrations are for the total particles and this is clarified in the revised version.

Interactive comment on Atmos. Chem. Phys. Discuss., 6, 6825, 2006.