Improving Accuracy of Single particle ICPMS for Measurement of Size Distributions and Number Concentrations of Nanoparticles by Determining Analyte Partitioning During Nebulisation

SUPPLEMENTARY INFORMATION

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ESI-1 SEM images of particles deposited on filters

Figure S-1 50 nm AuNP deposited on a filter. Left: a high magnification (21569 X) BSE image used for particle sizing. Right: A low magnification (8585 X) BSE survey image for particle counting.

Figure S-2 50 nm AuNP deposited on filter. (BSE, 21589 X magnification). The particles tended to occasionally aggregate on the surface, as can be seen in the above image.
Figure S-3 BSE images of: Left) 100 nm AuNP on filter, 4139 X magnification, Right) 250 nm AuNP, 2644 X magnification. These images were used both for particle sizing and counting.

ESI-2 Derivation of equation for estimation of error in particle mass due to incomplete particle events

Figure S-4 The time intervals during which particle events become completely and incompletely measured.

The above figure illustrates the times during which an ion burst becomes completely and incompletely measured. If it is assumed that there is no signal intensity threshold for detecting a particle event, i.e. $DL_s=0$, particles may be detected even if the peak of an ion
burst occurs a time $\frac{1}{2} t_b$ (duration of ion burst) before a dwell starts or after it ends. However, in order for the particle event to be completely measured the particles must arrive $\frac{1}{2} t_b$ after the dwell starts or before it ends. For each dwell there is thus a time period of $2t_b$ during which an incoming ion burst may become only partially detected, $t_{incomplete}$, and a period of duration $t_{dwell} - t_b$ during which all ions are detected completely, $t_{complete}$. As the particles are assumed to arrive at random times, the fraction of particle events that are incompletely measured, $F_i$, is given by ratio of $t_{incomplete}$ and the total time for particle detection given by the sum of $t_{incomplete}$ and $t_{complete}$:

$$F_i = \frac{2t_b}{t_{dwell} + t_b}$$ (SI-1)

The equation is valid for $t_{dwell} > t_b$, since for shorter $t_{dwell}$ no particle events become completely measured. It can be assumed that the measured signal of an incomplete particle event, $I_{incomplete}$ is on the average half of the complete particle signal, $I_{part}$, i.e. $I_{incomplete} = \frac{1}{2}I_{part}$. The average signal due to complete and incomplete particle events, $I_{avg}$ is then given by:

$$I_{avg} = I_{part}(1 - \frac{1}{2}F_i)$$ (SI-2)

An expression for the fraction of $I_{part}$ that on average becomes measured $f_d$, $f_d = I_{avg}/I_{part}$, is obtained by combining equations SI-1 and SI-2 to:

$$f_d = \frac{t_{dwell}}{t_{dwell} + t_b} \times 100 \%$$ (SI-3)
**ESI-3 Determination of noise in dissolved Ag signal.**

The square of the standard deviation of dissolved Ag signal as a function of signal intensity.

The noise in signal originating from dissolved ions, $\sigma_I$ can be assumed to be composed of flicker noise proportional to the signal intensity, $I$ and shot noise given by $(\beta I)^{0.5}$. The noise as a function of signal intensity can then be written as:

$$\beta I + (c_{pr} I)^2 = \sigma_I^2$$  \hspace{1cm} (SI-4)

Where $c_{pr}$ is the flicker factor. The $\beta$ and $c_{pr}$ is determined by fitting the square of the noise amplitude as a function of signal intensity with a function of type $ax^2+bx$. The coefficients $\beta$ and $c_{pr}$ were determined to 22.64 and 0.102 respectively.

**Figure S-5** The square of the standard deviation of dissolved Ag signal as a function of signal intensity.