Electronic Supplementary Material (ESI) for Journal of Analytical Atomic Spectrometry

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

SUPPLEMENTARY INFORMATION

Jani Tuoriniemi[1], *Geert Cornelis*[1], *Martin Hassellöv*[1,*]

[1]Department of Chemistry and molecular biology, University of Gothenburg, SE-412 96 Gothenburg, Sweden

[*]CORRESPONDING AUTHOR: martin.hassellov@chem.gu.se, tel. +46-31-786 9050

Table of Contents

S2…………….....**ESI-1** SEM images of Au particles deposited on filters

S3……………**ESI-2** Derivation of equation for estimation of error in particle mass due to incomplete particle events

S5………….... **ESI-3** Determination of noise levels in dissolved signals

ESI-1 SEM images of particles deposited on filters

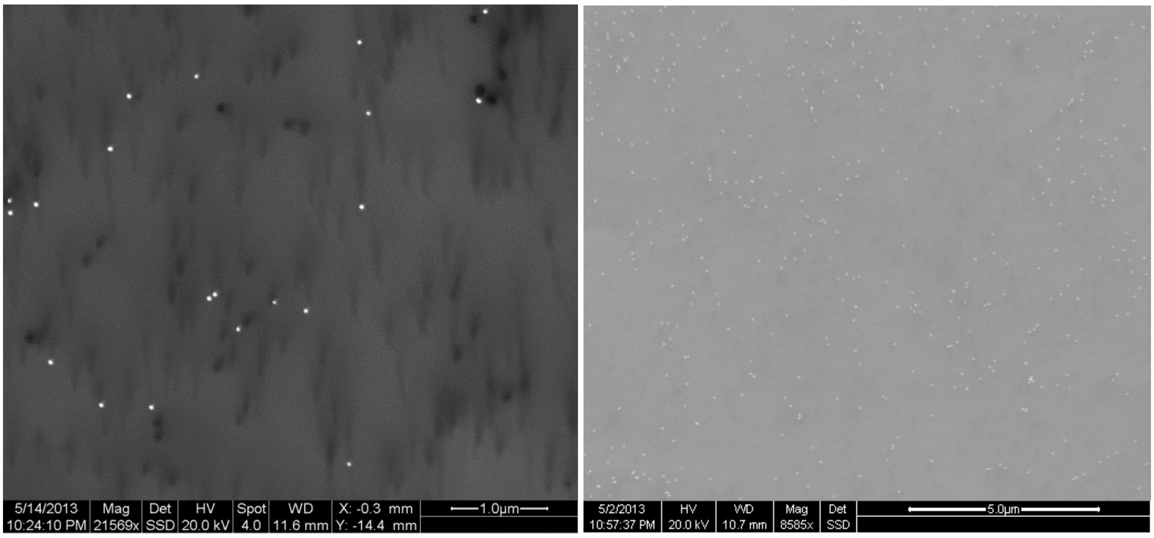

Figure S-1 50 nm AuNP deposited on a filter. Left: a high magnification (21569 X) BSE image used for particle sizing. Right: A low magnification (8585 X) BSE survey image for particle counting.

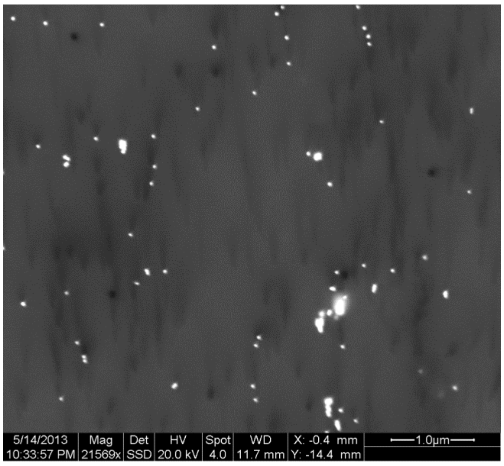

Figure S-2 50 nm AuNP deposited on filter. (BSE, 21589 X magnification). The particles tended to occasionally aggregate on the surface, as can be seen in the above image.

Electronic Supplementary Material (ESI) for Journal of Analytical Atomic Spectrometry

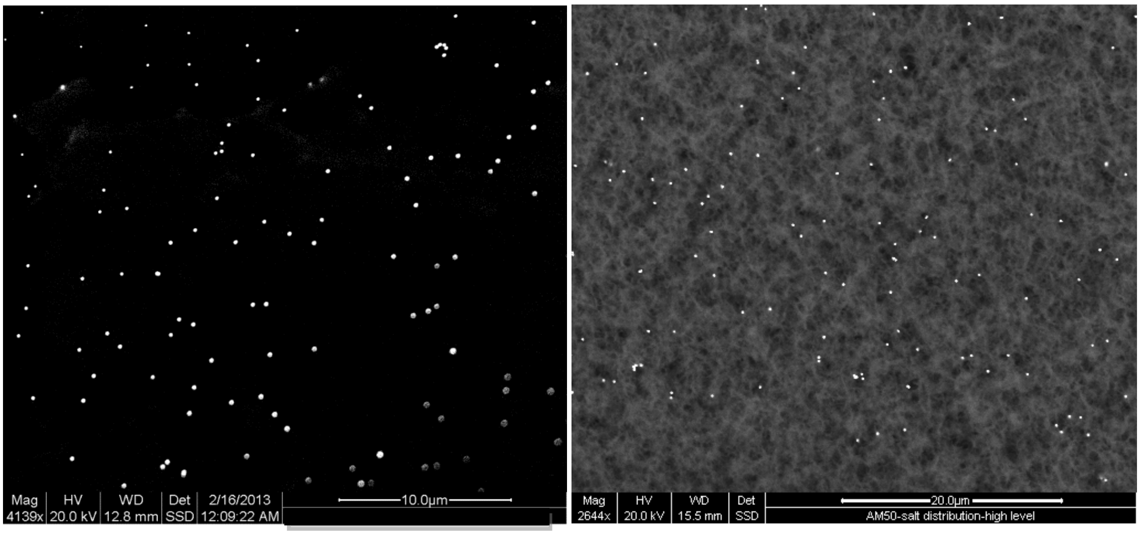

Figure S-3 BSE images of: Left) 100 nm AuNP on filter, 4139 X magnification, Right) 250 nm AuNP, 2644 X magnification. These images were used both for particle sizing and counting.

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

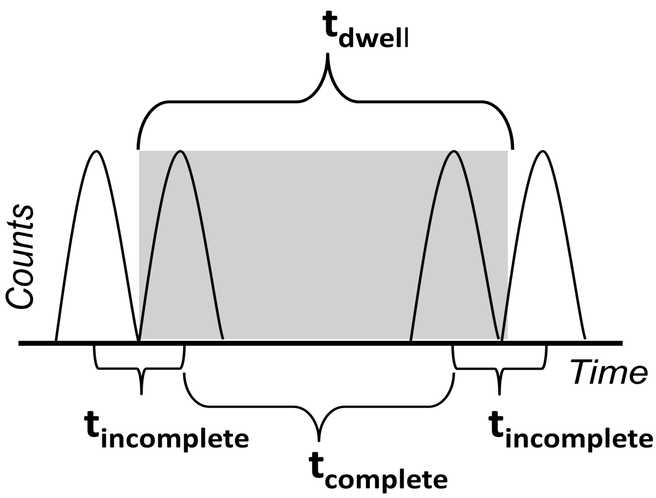

Figure S-4 The time intervals during which particle events become completely and incompletely measured.

The above figure illustrates the times during which an ion burst becomes comes 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 ½ 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 ½ 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 $t_{complete}$:

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

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. $I_{incomplete} = ½ I_{part}$. The average signal due to complete and incomplete particle events, I_{avg} is then given by:

$$I_{avg} = I_{part}(1-½F_i) \qquad \text{(SI-2)}$$

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:

$$f_d = \frac{t_{dwell}}{t_{dwell}+t_b} \times 100\ \% \qquad \text{(SI-3)}$$

ESI-3 Determination of noise in dissolved Ag signal.

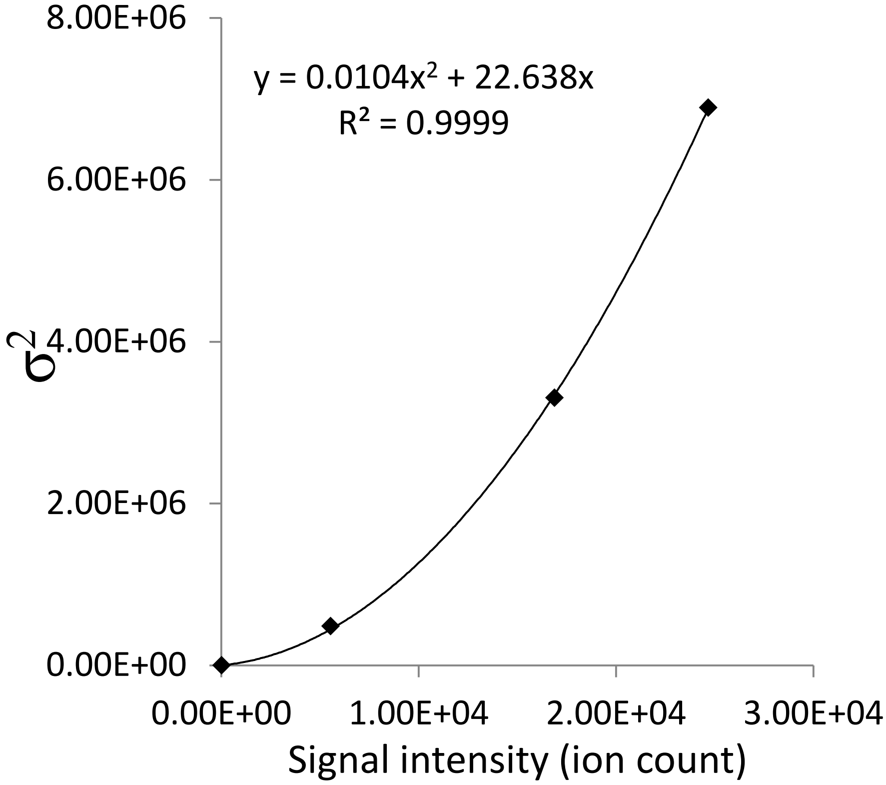

Figure S-5 The square of the standard deviation of dissolved Ag signal as a function of signal intensity.

The noise in signal originating from dissolved ions, σ_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:

$$\beta I+(c_{pr}I)^2=\sigma_I^2 \quad \text{(SI-4)}$$

Where c_{pr} is the flicker factor. The β 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 β and c_{pr} were determined to 22.64 and 0.102 respectively.