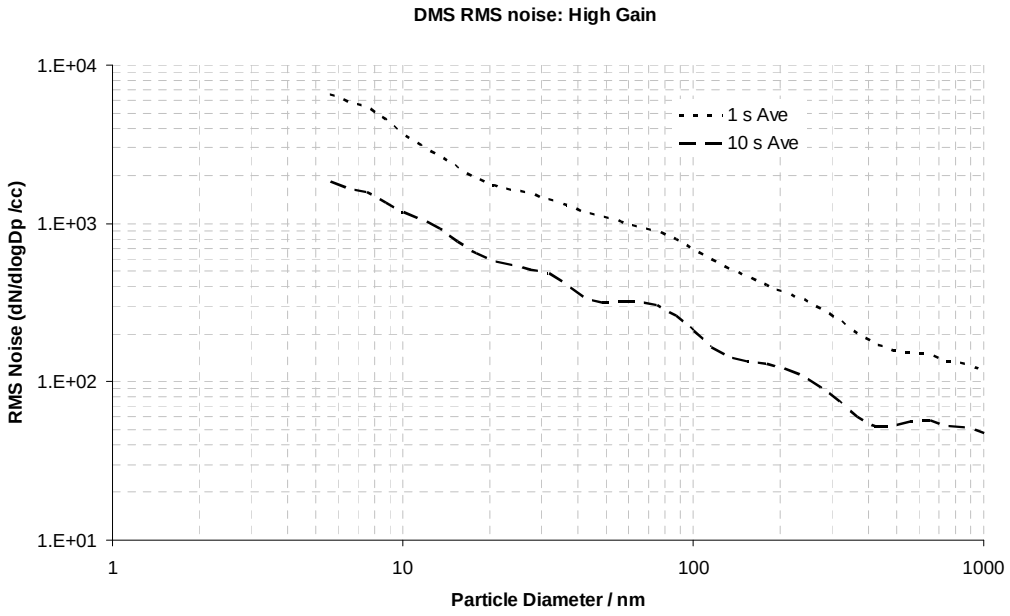
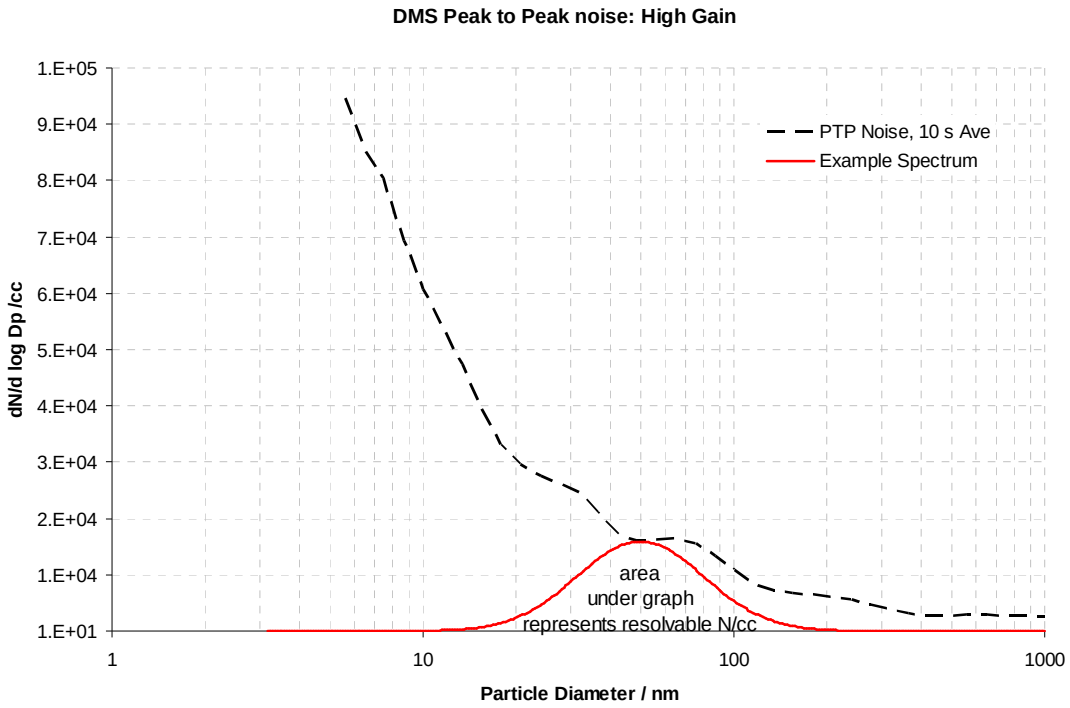
The sensitivity is defined as the smallest signal which exceeds the peak to peak noise, or, if the peak to peak noise is not well defined (as, for example, for Gaussian noise) as the smallest signal which can be identified from the noise with a 99% confidence.

The noise level of the instrument can be reduced by averaging the data over a time interval. The fastest data output rate of the DMS500 is 10Hz, but for the majority of applications a 1Hz data rate is satisfactory, reducing data file sizes to more manageable proportions, and improving the sensitivity. The broad spectrum ($dN/dlogd_p$ /cc) RMS noise for the DMS500 at typical operating conditions are shown below (see specifications for accurate figures), for both 1s and 10s sample intervals.



The 99% confidence interval is simply 5.1x the rms noise magnitude. The ptp (or 99%) $dN/dlogd_p$ is generally the most informative sensitivity specification.

For convenience, the noise in $dN/dlogd_p$ may be related to the detectable particle concentration, N/cc. We define the resolvable N/cc as that which, at the peak of the distribution, exceeds the peak to peak noise $dN/dlogd_p$:



Clearly, detectable N/cc depends on both the aerosol mean diameter and distribution width. It can be calculated from:

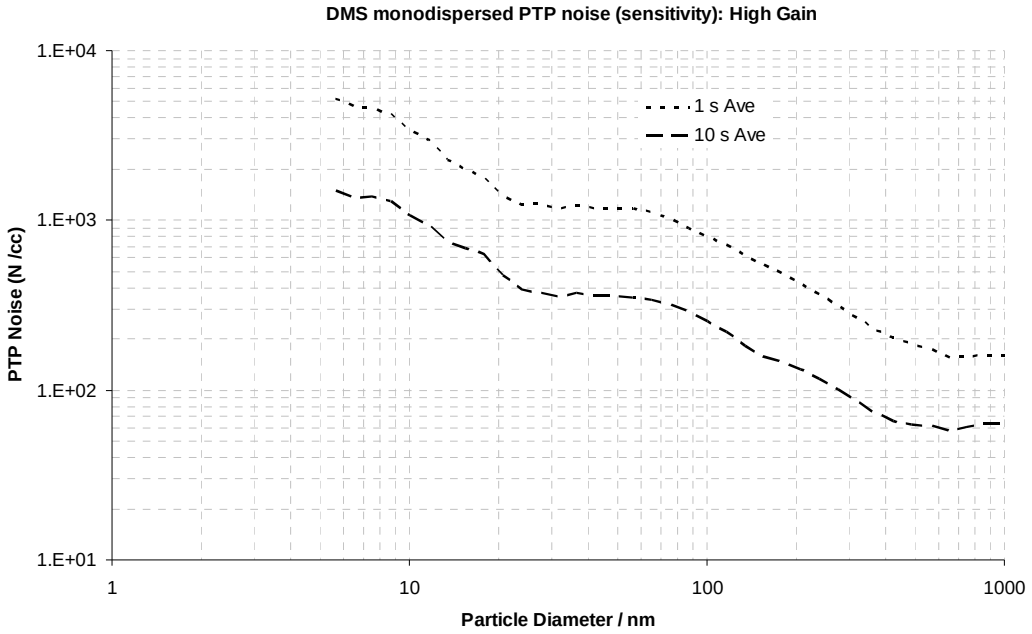
$$\text{detectable } N = \text{ptp}\left(dN / d\log d_p\right)\cdot\sqrt{2\pi}\,\log\left(\sigma_g\right)$$

For typical nucleation and accumulation mode aerosols, the corresponding sensitivity is for 1 second average on high gain is:

	nucleation	accumulation
typical mean diameter	10nm	60nm
typical σ_g	1.3	1.9
ptp noise $dN/d\log d_p$ /cc	1.96×10^4	5.44×10^3
detectable N/cc	5.58×10^3	3.80×10^3

For the narrowest aerosols, another limit comes into play: due to its finite resolution, the DMS (or any other instrument) overpredicts the width (σ_g) of very narrow size distributions, and it is the width of the estimated spectrum which must be used when calculating detectable N/cc as above. This gives a fixed lower bound on the N/cc detectable, but is only applicable for distributions narrower than $\sigma_g \approx 1.2$, generally only encountered in laboratory work.

The monodispersed (N/cc) peak to peak sensitivity limits for the DMS500 at typical operating conditions are shown below, for both 1 s and 10 s sample intervals:



Finally, RMS N/cc per *size class* (i.e. much narrower than any real aerosol) noise limits are often quoted as standard by instrument manufacturers; as we have seen, this representation does not give the whole picture, but for completeness and comparison, the equivalent data are shown below for the DMS500: