

#### Measuring Size of Light Absorbing Materials with Dynamic Light Scattering

##### Introduction

Samples that absorb certain light wavelengths can pose problems with measurement on dynamic light scattering systems, as the technique relies on the laser signal being scattered by the nanoparticles being measured, rather than absorbed. Nanogold is an example of a sample that can be tricky to measure due to the surface plasmon resonance effect that leads to stronger than normal absorbance, drastically reducing the scattering signal.

In this application note, a ~26 nm nanogold sample was measured with two different setups of detector angle and detector position using the HORIBA SZ-100V2 nanoparticle analyzer. One setup was with the 90° detector and cell center position, and the other setup was with the 173° detector and cell wall position. The absorption spectrum of the nanogold was also confirmed using a HORIBA Duetta Fluorescence and Absorbance Spectrometer.

##### Analytical Test Method

- Dispersion medium: Water
- Measurement mode settings: General mode
- Scan Settings: Manual 120 seconds
- Detector Angle: 90° or 173°
- Detector Position: Cell center for 90°, Cell wall for 173°
- Form of distribution: Monodisperse/Standard

##### Test Procedure

1. Add sample as-is to a quartz cuvette.
2. Insert cuvette into the instrument and let the temperature equalize for 2-3 minutes at 25°C.
3. Perform 3 measurements.

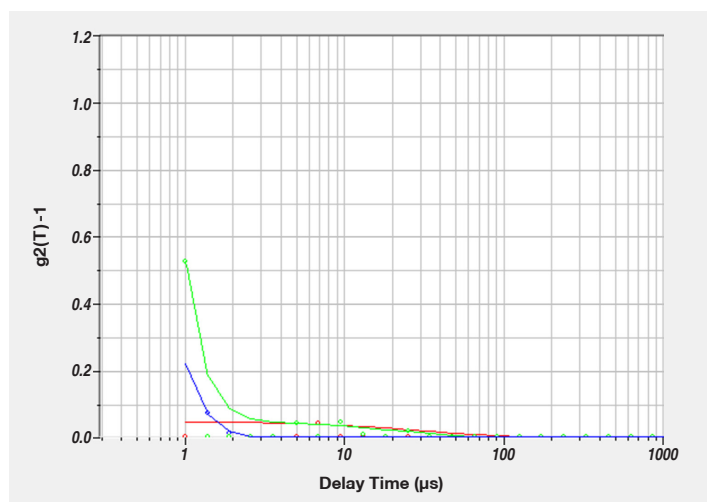


Figure 1a. Autocorrelation function with 90° detector and cell center position, poor signal.

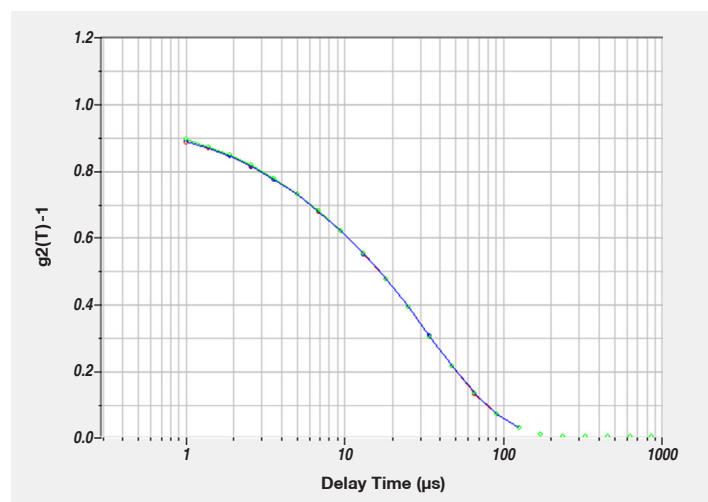


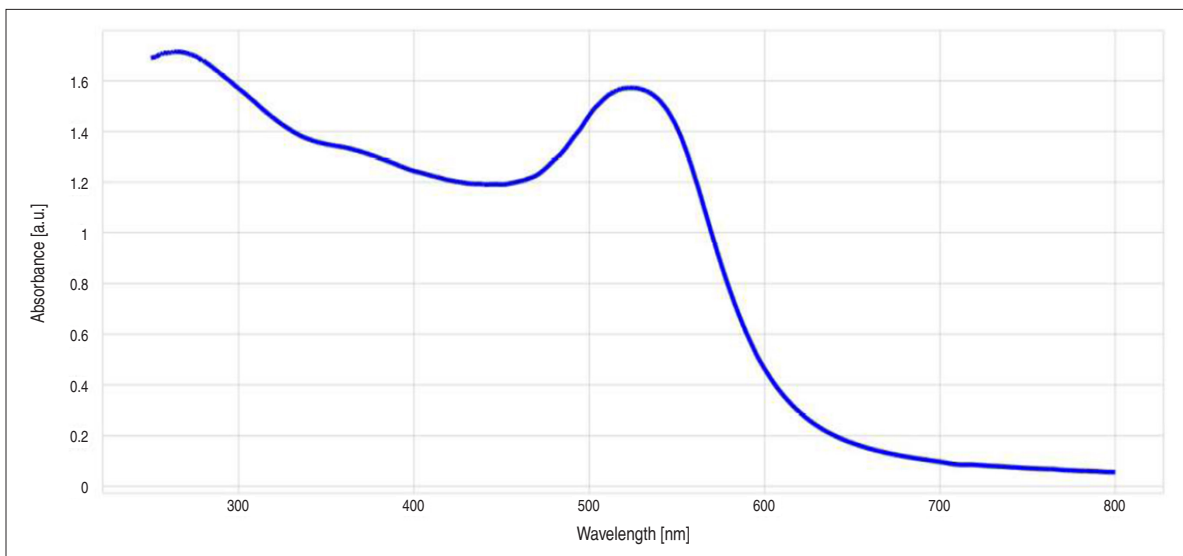
Figure 1b. Autocorrelation function with 173° detector and cell wall position, strong signal.

	Z-average	Polydispersity index
Measurement 1	1923.1	0.351
Measurement 2	---	---
Measurement 3	1067.0	0.223

**Table 1a. Z-average table with 90° detector and cell center position, bad matching with expected size and poor repeatability.**

	Z-average	Polydispersity index
Measurement 1	26.2	0.463
Measurement 2	26.2	0.468
Measurement 3	25.9	0.483

**Table 1b. Z-average table with 173° detector and cell wall position, good matching with expected size and good repeatability.**



**Figure 2. Absorption Spectrum for nanogold taken with HORIBA Duetta, 530 nm absorption peak.**

## Results

The 90° detector data shows very low signal from the autocorrelation function and unstable data as seen in Figure 1a and Table 1a, while the 173° cell wall detector data shows strong signal from the autocorrelation function as seen in Figure 1b and very stable data matching the expected size for the nanogold as seen in Table 1b. As seen in Figure 2, the absorption spectrum from the HORIBA Duetta for the ~26 nm nanogold shows a peak around 530 nm, matching the wavelength of the SZ-100V2.

The improvement of the data from the 90° detector data to the 173° cell wall detector data can be explained by measuring at the cell wall position, giving the laser less pathlength to potentially be absorbed due to the surface plasmon resonance effect from the sample. By contrast, measuring with the 90° detector at the cell center position means much more of the laser signal is absorbed due to the longer pathlength, leaving little actual scattered light to reach the detector.

Using the 173° detector with the cell wall position helps to maximize the scattering signal and minimize absorption of the laser by the sample. This technique can additionally be applied to fluorescent samples when used in conjunction with a filter to remove the effect of incoherent fluorescent signal. The absorption spectrum additionally confirms that the absorption peak lies right at the green laser wavelength of the SZ-100V2 (532 nm) and helps to explain the difference in the 90° detector cell center position data and the 173° detector cell wall position data.