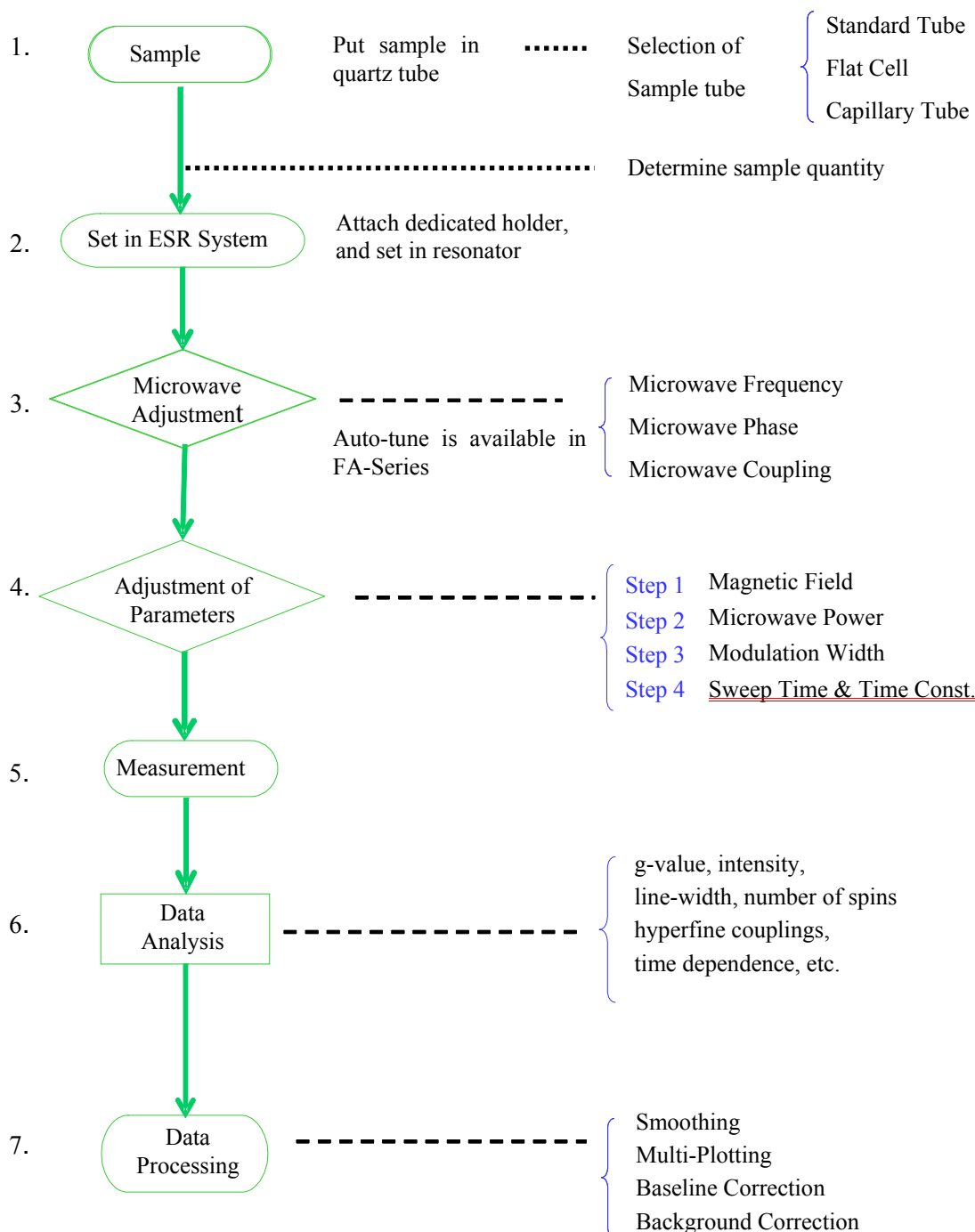


Let's Use ESR VII - Adjustment of Sweep Time & Time Constant

ESR may be used to measure a wide range of samples. However, it is necessary to determine the most appropriate conditions for each sample. The following measurement flow chart gives a step-by-step approach. Here, we explain how to adjust the sweep time and time constant.

ESR Measurement Flow



Step 4. How to the Select Sweep Time and Time Constant Values

Once the appropriate modulation width has been determined, the next step is to select values for the sweep time and time constant. In setting these parameters, it is important to consider their ratio and if the selection is not appropriate, it is likely that spectral resolution is lost and the sensitivity reduced. The smaller the time constant is, the more accurate the line-shape will be, however, the S/N will become worse. Usually, setting the time constant slightly too large is necessary to obtain spectra of good S/N, but if the sweep time is not enough, it is likely that line-shape will be distorted. ESR spectra of carbon-centered radical measured with different time constants are shown below.

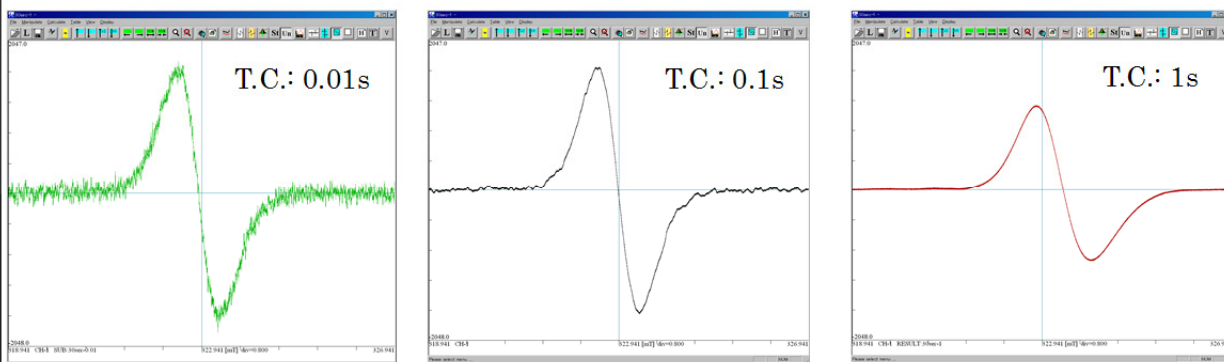


Fig.1. ESR line-shape of carbon-centered radical recorded with different time constants.

When the time constant was the smallest (0.01sec), the waveform was correct but the noise level is high. When the time constant was increased to 0.1 sec, the noise was reduced, and when it was increased to 1 sec, the noise was greatly reduced. However, the signal intensity was also reduced and the signal position is shifted to the right. Clearly, for the purpose of structural analysis, this could prevent correct interpretation, so great care caution is needed.

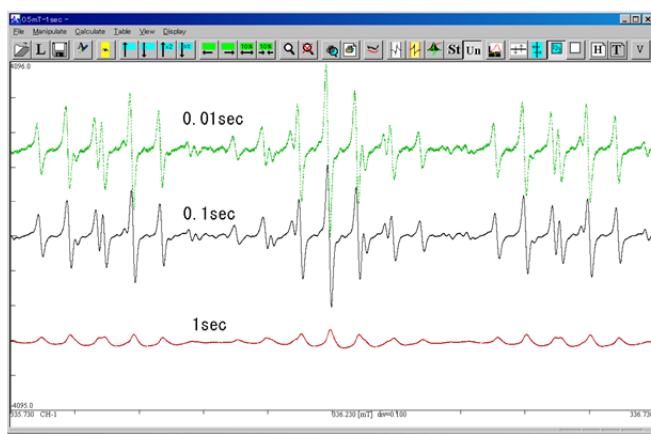


Fig.2 Affect of time constant to the resolution

Fig. 2 shows the ESR spectrum of the perylene cation with many sharp lines. Using a 2min sweep time, we compared the spectra obtained with different time constant. For time constant of 0.01 and 0.1sec, the resolution was maintained although the S/N ratio was different. However, using time constant of 1 sec, the signal intensity was significantly reduced and the line-shape was distorted. In this case, it is necessary to use a longer sweep time. By comparing with spectra measured with different time constants, it is easy to select the optimum sweep time. Therefore, to obtain good spectra, it is important to adjust the sweep time and time constant for each sample.