The Basic Concept of Measurement Uncertainty

All measurements are affected by a certain error. The measurement uncertainty tells us what size the measurement error might be. Therefore, the measurement uncertainty is an important part of our reported results.

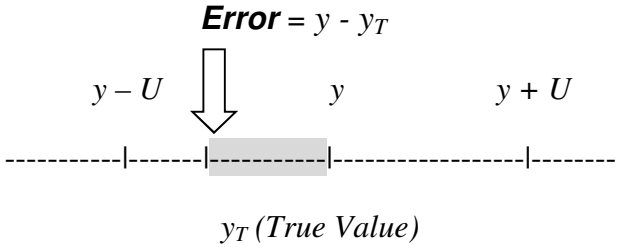
Measurement uncertainty is defined by ISO VIM (International Vocabulary of Basic and General Terms in Metrology) 1993 as: "a *parameter, associated with the result of a measurement that characterizes the dispersion of the values that could reasonably be attributed to the measurand (or analyte)*".

In other words, measurement uncertainty is a parameter, associated with a result of measurement (e.g. a calibration or test) that defines a range (or a *dispersion*) of the values that could reasonably be attributed to the measured quantity. When uncertainty is evaluated and reported in a specified manner, it indicates the level of confidence that the true value actually lies within the range defined by the uncertainty interval.

Hence, the objective of uncertainty evaluation is to determine an interval that can be expected to encompass a large fraction of the distribution of values that could reasonably be attributed to the measurand. When we have a measured value of y with an uncertainty of U, we shall write :

$$y \pm U$$

Uncertainty range : $y - U \ldots. y + U$ with 95% confidence



It must be stressed that uncertainty values obtained should be regarded as estimates because one can never be sure that all effects, including sample matrix effects and heterogeneity of sample are taken into account.

One must also not get confused between the terms "**error**" and "**uncertainty of measurement**":

- **Error** is generally defined as the *difference* between a reference or true value and a result obtained
- **Uncertainty of measurement** gives a dispersion of results, arising mainly from the random error in the measurement process. Uncertainty estimation can also cover many other factors such as bias of results, reproducibility of data, etc.