Bayesian Decision Threshold, Detection Limit and Confidence Limits in Ionising Radiation Measurements

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Abstract

Based on Bayesian statistics and a Bayesian theory of measurement uncertainties, characteristic limits such as decision threshold, detection limit, and limits of the confidence interval can be calculated taking into account all sources of experimental uncertainties. This approach separates the complete evaluation of a measurement according to the ISO Guide to the Expression of Uncertainty in Measurement from the determination of the characteristic limits. Using the principle of maximum information entropy the characteristic limits are determined from the complete standard uncertainty of the measurand. This procedure is elaborated here for a several particular models of evaluation. It is, however, so general that it allows for a large variety of applications to similar measurements. It is proposed for the revision of those parts of DIN 25482 and ISO 11929 which are still based on conventional statistics and, therefore, do not allow to take into account the complete measurement uncertainties in the calculation of the characteristic limits.