



Contribution ID: 5

Type: **Poster Presentation**

CALCULATION OF DECISION THRESHOLDS ACCORDING TO THE ISO 11929 (2019) STANDARD IN THE PRESENCE OF PEAKED BACKGROUND

Thursday, 5 May 2022 12:50 (20 minutes)

The standard ISO 11929-3:2019 (ISO 2019) warmly recommends the use of the (generalised) least-squares method (LSQ) in the determination of characteristic limits, calculated from gamma-ray spectra. To calculate the decision threshold, it prescribes the analysis of the spectral region, comprising the most prominent peak of the gamma-ray emitter of interest i.e. the measurand. As the decision threshold is determined by the null measurement uncertainty, the spectrum in the absence of the indication must be analysed. To achieve this, the contribution of the indication must be stripped off the spectrum and the decision threshold is calculated from the uncertainties of the difference, i.e. the background. The variance of the content of an individual channel of the background spectrum is then the sum of the variances of the measured channel content, the calculated channel content depending on shape of the response of the spectrometer to the measurand (shape contribution) and the variance due to the uncertainty of the observed value of the measurand (scaling contribution). While the uncertainty matrix of the measured channel contents is diagonal, because the channel contents are statistically independent, the uncertainty matrix due to the uncertainty of the observed value has off-diagonal elements different from zero, since a change of the uncertainty changes the variances of all channel contents subject to the presence of the measurand. The uncertainty matrix of the calculated channel contents of the response may be diagonal or not, depending on how these channel contents were determined. The construction of the uncertainty matrix of channel contents, described by the Standard, can't be applied directly to the case when the measurand is present in the background. Its presence may be due to the spectrometer background, the interferences with other gamma-ray emitters or the sample blank. In the presence of sources of peaked background, additional contributions to the uncertainty matrix of channel contents have to be taken into account. For each contribution to the peaked background two contributions to the uncertainty matrix must be included: the first one, due to the channel contents given by the height of the peaked background (shape contribution) and the second one, due to the background height uncertainty (scaling contribution).

In the paper the extension of the Standard to the case when the peaked background is present will be described in detail and numerical examples illustrating the calculation of detection limits in the case of various sources of peaked background having different intensities and uncertainties will be presented.

ISO 2019. ISO 11929-3, Determination of the characteristic limits (decision threshold, detection limit and limits of the coverage interval) for measurements of ionizing radiation –Fundamentals and application part 3: Application to unfolding methods, ISO, Geneva.

Primary authors: Dr ZORKO, Benjamin ("Jožef Stefan" Institute); Mr VODENIK, Branko ("Jožef Stefan" Institute); Dr KORUN, Matjaž ("Jožef Stefan" Institute); Dr PETROVIČ, Toni ("Jožef Stefan" Institute)

Presenter: Dr KORUN, Matjaž ("Jožef Stefan" Institute)

Session Classification: Low Level γ -ray Spectrometry

Track Classification: Low level γ -ray spectrometry