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Methodology to Establish Bayesian Detection Limits for Radionuclide Monitoring

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The decision that a given detection level corresponds to the effective presence of a signal (i.e. a radionuclide activity) is currently widely made on the basis of a classic hypothesis test. However, the classic framework suffers several drawbacks, such as the impossibility to provide a probability of a given level of signal or a limitation on the type of distributions (ISO 11929). Furthermore, for heteroscedastic distributions, simulations have underlined the poor performance of these methods (Strom et al, Health Physics, 81(1), 2001). Several attempts have been made in the past to use a bayesian framework in detection and decision problems. Most have not been able to overcome some hurdles in the definition of hypothesis testing with a point like null hypothesis. We propose a method having good performances in terms of false positive rates, which can be applied to various type of distributions (analytically in some cases and at least numerically) and whose underlying principles are easy to understand. It relies on the interval estimation of the difference between two signals (noise versus noise added to the potential signal).

Primary author: MANIFICAT, Guillaume (Institut de Radioprotection et de Sûreté Nucléaire (IRSN))

Presenter: MANIFICAT, Guillaume (Institut de Radioprotection et de Sûreté Nucléaire (IRSN))

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