Calibration Optimisation, Sustainability and Uncertainty Estimation

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Introduction

A calibration should be designed to suit the subsequent use of the device under calibration, i.e. it should be 'fit-for-purpose'. A useful calibration would be one that is optimised in terms of serving the application of the device, but also minimises the cost of the calibration and subsequent use of the device. Several different measurands may in fact be defined for the same output quantity indicated by the same device, measured not only under different conditions (i.e. influence factors), but in a different application of that device. The difficulty is that such different uses of a device may arise within the normal scope of use. A worst-case scenario is that a given calibration report is essentially (unknowingly) invalid, as the calibration has not considered the actual use of the device. The uncertainty components for different measurands are invariably different and hence the uncertainty components of a calibration will vary, depending on the application of the scientific instrument. It is usually not cost-effective or sustainable, but also unnecessary, to carry out a calibration to cover all conceivable conditions and applications. A sustainable calibration is one which is optimised, so that the measurand is usefully defined, with a reported uncertainty suitable for the application, which incurs minimal cost to the client and is efficiently deliverable by the calibrating laboratory. Another benefit of calibration optimisation is that the consideration of the uncertainty analysis undertaken may uncover inefficiency in the calibrating laboratory's system.

Abstract

This paper uses examples in the area of calibration of some types of high-voltage devices to discuss and demonstrate the process of optimising the calibration and its uncertainty estimation. The paper concludes that a preliminary mutual understanding between the calibration laboratory and its client, with regard to the calibration capability and the intended use of the device, is an essential first step in optimising a calibration. The paper also concludes that uncertainty analysis is a useful tool in identifying inefficiencies in a calibration system.