



Bridges in Traceability from Primary Laboratories to the Use of X-ray Multimeters in Clinical Practice

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Non-invasive x-ray multimeters (XMMs) have been used for x-ray quality control for over 40 years. In the 80's and 90's the meters were designed with separate detectors for measurement of air kerma (or exposure), and tube potential respectively. Since then, the XMMs have developed to measure several parameters simultaneously. Today there are a range of different brands that measure tube potential, air kerma, HVL, and total filtration equivalent (TF) in one single exposure. The meters are designed to meet the demands on measurement on the broad range of x-ray units used in clinical practices. The spectral variation between various models of clinical units is big. To that one can also add the complexity of dynamic variations, such as pulse variations in energy, amplitude, width, and frequency. Bridging the traceability from standards in primary laboratories to clinical practice is many times a challenge. For tube potential and air kerma the variation in x-ray spectra is the main challenge. We do have well-established standards to rely on. But interpolation as well as extrapolation are used to cover the broad range of spectral variations.

What to expect when no primary reference is available? E.g. HVL

There is yet no primary laboratory that offers calibration of HVL. There are a few laboratories that offer accredited calibration of HVL based on own defined methodologies. The spread in CMC is quite wide (and maybe a bit too narrow in some cases). An international harmonized definition of HVL, and methods for calibration would help calibration laboratories establish their methods, aiming for trustable HVL calibration.

Summary

For reliability in use of XMM's in the daily quality control it starts with reliable calibration of the basic quantities. Users of XMM's must be aware of influencing parameters which may have major impact on the measurement uncertainty in the daily use.