TOWARDS MAKING NIST-QUALITY MEASUREMENTS OF RADIATION AND RADIOACTIVITY USING COMMERCIAL ANALYTICAL INSTRUMENTS

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Precision measurements of radiation and radioactivity are carried out in laboratories across the US for many important applications: to make sure the tens of millions of Americans who undergo cancer treatment or nuclear stress tests every year are given just enough radiation to be effective, but not too much to be harmful; for critical applications like nuclear power plants to detect the first trace evidence of an anomaly; and for vast fields of science from astrophysics to archaeology to forensics which rely on radioactive dating to understand the origin of materials.

These analytic measurements and more all currently depend on NIST Standard Reference Materials (SRMs), calibrations, and data to provide traceability to NIST primary standards. Until now the primary standardization methods used by National Metrology Institutes like NIST have been out of reach to analytical testing labs due to their dependence on numerous highly-specialized instruments and methods. And too often the necessary accuracy of measurements, and traceability to the SI, is in question when translated to the analytical laboratory or manufacturing floor.

In this talk, we will present a high-level overview of a few primary standardization methods at NIST, some of which could be implemented on commercial laboratory equipment, or could be commercialized in the future. By leveraging advances in sensors, modelling and electronics – especially the user-friendliness of all three, we are able to achieve fundamental measurements of radioactivity without needing external calibration sources.

We will present examples of ongoing research at NIST on real-time measurement of industrial radiation and self-calibrating measurements of medical radionuclides, used to detect and treat cancer.

Finally, we will share lessons learned about how to maintain accuracy when translating from reference measurements to practical laboratory applications of radiation and radioactivity.