The National Institute of Standards and Technology (NIST) is the National Measurement Institute (NMI) for the US. All dosimetric measurements made in American radiotherapy clinics should be traceable to the primary standards maintained by NIST. The accuracy of the NIST standards, and traceability to the Système Internationale (SI), is ensured through the Bureau International des Poids et Mesures (BIPM), the international laboratory that co-ordinates comparisons between NIST and other NMIs around the world (such as the National Research Council Canada). A continuous calibration chain, therefore, links the measurement of dose in the clinic to the internationally agreed-upon definition of the gray, an essential requirement in ensuring equivalence of clinical dose delivery irrespective of location.

Within the US, traceability of radiation dose measurements to the SI is ensured through activities of the Radiation Interactions and Dosimetry (RID) Group at NIST, whose primary mission is to develop, maintain, and disseminate the national measurement standards for the dosimetry of x rays, gamma rays, electrons, and other charged particles. In the case of medical dosimetry, relevant standards are disseminated both directly to the customer and through the AAPM Accredited Dosimetry Calibration Laboratory (ADCL) network by means of calibrations and proficiency testing services, provided to maintain measurement-quality assurance and traceability. The evolving measurement needs of industry, medicine and government provide impetus for the improvement of existing standards and the development of new standards. Research activities in support of this part of the RID Group's mission address a variety of topics in fundamental and applied radiation physics. These efforts are driven partly by advancements in instrumentation technology and partly by the ever expanding domain of measurement standards made possible by such advancements. The widespread adoption of conformal beam therapies, for example, has driven the standards community to develop new approaches for standard reference dosimetry of "nonstandard" beams. At NIST, this has spurred a research program in water calorimetry that is looking into ultrasonic time-of-flight approaches to imaging dose in water. Ultimately, this or similar approaches might lead to new ways of imaging complicated dose distributions in tissue as well as give the standards community new tools for reference dosimetry of present and future beam technologies.

In this session, attendees will learn how the accuracy of their clinical measurements is assured as a result of comparisons between NIST and other NMIs around the world as well as NIST proficiency tests and AAPM accreditation of the ADCLs. It will be shown how NIST staff members are active within critical AAPM scientific committees so that measurement needs in the clinic can be addressed by the standards laboratory, resulting in the development of new standards and/or methodologies.

Learning Objectives:
1. Understand the impact of measurement standards in general, and in particular the work of primary standards laboratories such as NIST, on clinical radiation dosimetry.
2. Understand the calibration chain from primary standards laboratory to radiotherapy clinic.
3. Understand how NIST interacts with various AAPM committees to ensure that the measurement needs of the user community are met.