

AbstractID: 12307 Title: Clinical Dosimetry of Photon Sources used in Brachytherapy: Need for ISO Standardization, based on and extending the AAPM TG-43U1 Formalism by Calibration in Terms of Absorbed Dose to Water

Purpose: By calibrating brachytherapy (BT) sources to the TG-43U1 reference position at 1cm in water, named the *nominal absorbed dose-rate to water*, $D_{w,1}$, accuracy and precision for patient treatment will be increased. Traceability must be provided to $D_{w,1}$ -primary-standards; which soon become available. **Methods and Materials:** Efforts have been made in discussions with fellow scientists from many countries, by reviewing concerned literature, and similarities are drawn from documents (e.g. extending TG-43U1). **Results:** From the study of primary photon interaction mechanisms, a need was recognized to classify BT-photon radiation qualities as: *high-energy* >100keV, *medium energy* 40keV to 100keV, and *low energy* <40keV. It was further recognized that Monte Carlo simulation based primary and scatter dose separation provides characterization for radionuclide BT-sources and electronic X-ray BT-sources, for BT-detectors and BT-phantoms. A need was felt for developing reference data-sets and calibration data of BT-sources, -detectors and -phantoms, through which the end-user medical-physicist could critically evaluate the data supplied by the manufacturer by using established methods, prior to clinical application. Plastic scintillators appeared to be a choice of detector as future high precision transfer-standard and high resolution, fast, direct reading dosimeter for detailed quality assurance of BT-sources, -software, -planning, and -verification. **Conclusion:** There is the need for international standardization of clinical dosimetry in photon radiation brachytherapy similar to that described in ISO-21439 (2009) for beta radiation BT-sources. Based on AAPM TG-43U1, this planned ISO-standard will provide guidance for clinical BT-dosimetry in terms of *absorbed dose to water* and for estimating the uncertainty of this quantity. Most standardized procedures can be given by referring to AAPM- and ESTRO-reports. Recommendations will be prepared to replace the reference air-kerma-rate (air-kerma strength) by the *nominal absorbed dose-rate to water* as basic dosimetric quantity, to increase brachytherapy accuracy and precision and to become consistent with external beam radiotherapy.