AbstractID: 6600 Title: Intercomparison of primary standards at PTB and NIST for the realization of the unit of absorbed dose to water for beta particle brachytherapy sources

Purpose:
With the completion of a new primary standard (the so-called "multi-electrode extrapolation chamber", MEC), PTB is now able to realize a three-dimensional dose distribution absolutely with high spatial resolution at clinically relevant depths for beta brachytherapy sources without having to rely on an additional relative dosimetry system. The need for such a realization has mainly been for the dosimetry of eye tumor and intravascular brachytherapy sources. Together with NIST, the primary standards for the realization of the unit of absorbed dose to water for beta brachytherapy sources were compared bilaterally.

Method and Materials:
The primary standard of the PTB is based on an extrapolation chamber with a segmented collecting electrode, which was manufactured by means of lithography on a silicon wafer in the PTB's Clean Room Center. Due to this novel collecting electrode, simultaneous measurements at 28 measuring points with a spatial resolution of 1 mm^2 are possible. After a successful internal PTB comparison, a bilateral comparison with NIST was arranged. For this purpose, a line source was constructed at PTB in an appropriate holding device and measured two-dimensionally at a water-equivalent depth of 2 mm. At NIST, the absorbed dose rate to water was determined absolutely at the dose rate maximum with a conventional extrapolation chamber (diameter of the collecting electrode used: 1 mm). In order to determine the position of the dose rate maximum and likewise a two-dimensional dose distribution, further measurements were carried out with radiochromic dye film.
Results:
The comparison of the absorbed dose to water in the dose maximum yielded a relative difference of 6.4%, which is within the uncertainty intervals of the two laboratories. The relative combined uncertainty (1 sigma) of the PTB primary standard determined according to the GUM amounts to 3.4%, and that of NIST to 5%.