In the Theraplan Plus 3D treatment planning system, a new electron beam algorithm has been implemented. The basis of this algorithm is the separation of the primary and scatter parts of the electron beam. The calculations of dose are performed using a pencil beam. Correction for inhomogeneities is carried out by equivalent depth scaling of the pencil beam.
We have performed a rigorous evaluation of this planning system (version 2.1). A set of measurements in a homogeneous water phantom for electron beams with various field sizes and energies 6-20 MeV from a Siemens KD2 linear accelerator was compared with the calculations. In general, an agreement better than 5% was found with exception of the surface dose, where the calculations are lower by up to 10% in case of the larger field sizes. Comparisons of experimental and calculated data in heterogeneous phantoms were done for inhomogeneities consisting of aluminum, bone, and air, for energies 9 and 20 MeV. Four inhomogeneous geometries were studied: slab, 2D(long ribs), 3D(small cylinders) and a combination of 2D and 3D (trachea and spine phantom). Measurements were done using a Scanditronics electron diode and RFA300 dosimetry system. The Theraplan Plus predicted the qualitative shape of hot and cold spots behind the 3D inhomogeneities very well. The quantitative agreement between experimental and calculated data was similar to that found for the Hogstrom 2D algorithm, with the calculations always overestimating the effect of inhomogeneities. The largest discrepancy found at distances just behind the inhomogeneities was about 15%.