

Because of high doses in interventional radiology procedures, accurate dose determination for low energy x-rays is important. The use of sophisticated 3D dose deposition algorithms designed originally for radiation therapy treatment planning can be extended to lower energy photon regions. In order to use 3D treatment planning systems in the kilovoltage region, low energy (<100 keV) monoenergetic energy deposition kernels are needed.

We have used the EGS4 system of Monte Carlo codes to generate kernels from 20 to 90 keV and have implemented them in a commercial 3D treatment planning system. The kernels were generated using the "scasph" EGS4 user code by selecting the appropriate transport parameters suitable for the relative low energy of the incident photons. The kernels have been used to model diagnostic quality beams in the planning system and to calculate depth dose and cross profile curves. Comparisons of the calculated data have been made with measurements made in a homogeneous water phantom. The comparisons showed that calculated depth dose and cross profile curves were in good agreement with measured data at energies of 60, 80, 100 and 120 kVp. Details of this work and the results of the comparisons will be given along with the challenges that remain to be overcome.

In conclusion, we have determined that the method which we have developed satisfactorily calculates 3D dose distribution in water at diagnostic x-ray energies.