Based on Monte-Carlo calculations a superposition/convolution model of photon pencil beams has been developped that includes the phase space of photon beams and the density correction in inhomogeneous media. The influence of the phase space is evaluated by an analysis of depth-dose curves and transverse profiles of various field sizes measured in water phantoms. The incident photon fluence is determined by a convolution with jaws and/or MLC positions as boundary conditions. The photon fluence has also determined experimentally by profile measurements in air with a ionization chamber covered by a brass cup to eliminate contamination electrons. The radial change of the energy spectrum (decrease of the average energy at surface $z = 0$) has been determined by Monte-Carlo calculations and an analytical formula for the description of this behaviour has been derived.

The handling of inhomogeneity problems is implemented by a superposition/convolution of divergent photon pencil beams and electron transport of Compton electrons in media with different electrons density ρ. The validitation of the model is reached by calculations and measurements (6 MV and 18 MV) of depth-dose curves and profiles of phantoms containing different slabs and boxes. Depth-dose curves and profidles of small photon beams (field-size ≤ 6 cm^2) show a quite different behaviour than beam with field-size ≥ 10 cm^2 (additional build-up and build-down effects and changes of the penumbra). Experimental data only differ ca. 2 % – 4 % from the predicted results. The model has been implemented in the Ecclipse version.