Radiotherapy uses various techniques and equipment for localized treatment of cancer with ionizing radiation. Medical linear accelerators (linacs) are routinely used to produce high-energy beams of ionizing radiation. Among the many algorithms employed for calculation of dose distribution, Monte Carlo based methods have proven to be the most promising in terms of accuracy. Full Monte Carlo calculations of dose are viewed as the "gold" standard in dosimetric measurements, however are not yet practical for clinical use as they are computationally intense. These calculations determine the transport of radiation and its energy deposition in complex and clinically significant configurations. Monte Carlo calculations for application in radiotherapy are divided into two parts. The first part entails modelling of the radiation beam produced by the linac, which results in a phase space representation of physical properties of the beam. The phase space contains information such as energy, position and direction for millions of particles constituting the beam. The second part of the calculation projects the informations contained within the phase space file upon user-defined structures to determine the dose distribution. The aim of the current work is to create a model of a 6 MV radiotherapy beam produced by a medical linac. The Monte Carlo code BEAMnrc is used for the generation of phase space files that are often used to determine dose distributions. Validation of this model is achieved through comparison of calculated and measured dose.