Monte Carlo based treatment planning systems require input distributions describing the phase space of the photons and secondary electrons prior to the patient dependent part of the beam line geometry. The accuracy of the treatment planning simulation itself is thus dependent upon the accuracy of this distribution. We have compared phase space distributions (PSDs) generated with the MCNP and BEAM/EGS Monte Carlo codes for the 6 and 18 MV photon modes of the Varian 2100C. Calculations were performed without variance reduction. With the same energy cut-off (Photons 0.01 MeV, Electrons Ek=0.189 MeV), running on similar single processor hardware, MCNP simulations require 6 times more CPU time than BEAM. At 6 MV, target bremsstrallung production for MCNP was about 10% less than for BEAM. Although the absolute bremsstrallung production differs between MCNP and BEAM, normalized PSDs compare favorably at the end of the patient independent geometry (exit of the monitor chamber), resulting in similar dose distributions in a homogeneous phantom.