The purpose of this study was to evaluate the implementation of an FFT convolution algorithm available in the CMS FOCUS treatment planning system, version 2.0, which is in use at our department. The FOCUS system was commissioned and validated as recommended by the manufacturer using an automated beam commissioning procedure provided with the system. The effects of using custom calculated x-ray spectra, off-axis energy spectra, and an extra-focal radiation source for simulation of head-scatter were investigated. Isodose distributions calculated for open fields and wedged fields incident on a homogeneous cubic phantom were compared to measured distributions. For distributions in the presence of inhomogeneities, where measurements are difficult to perform, Monte Carlo simulations using the EGS4/BEAM/DOSXYZ system were used as a benchmark. Finally, the distributions calculated for patients at selected sites were compared with the distributions calculated by the EGS4/BEAM/DOSXYZ system. The open-field calculated isodose distributions are found to agree very well with the measured data. The wedged-field isodose distributions exhibited the effects of wedge hardening, although differences persisted with the measured data greater than 3%. For inhomogeneity corrections, FOCUS was found to overestimate the dose in low-density material and to underestimate the dose in high-density material. Using the SGI Indigo platform and a 125x125x125 dose calculation matrix, the computation time was not significantly slower compared to the Clarkson-type algorithm in use in the FOCUS system.