Purpose:

To validate the generic phase space files for Varian TrueBeam linac head simulations.

Methods:

The generic phase space files include the simulation results of 6MV, 10MV, 6MV FFF, and 10MV FFF (flattening-filter free) operating modes of TrueBeam for patient-independent linac head components. Using the generic phase space files as the radiation sources, the BEAMnrc Monte Carlo codes are used to simulate the patient-dependent parts of the TrueBeam linac and the resulting phase space files are generated at a plane just before entering a water phantom for 4 different field sizes (5—5, 10—10, 20—20, and 40—40 cm2). Dose distributions are calculated by DOSXYZnrc in the water phantom of size 50—50—40 cm3. The percentage-depth-dose (PDD) curves and lateral dose profiles at three different depths (dmax, 10cm, 20cm) are obtained. Comprehensive comparisons have been made for a total of 64 dose profiles (including PDDs) between the Monte Carlo calculations and the measured data. The gamma index analysis is performed for all the comparisons.

Results:

The matching of the calculated dose distributions to the measured ones is analyzed by the gamma index method with a criterion of 2% dose tolerance and 2 mm distance-to-agreement. Of the 64 comparisons, the minimum gamma index passing rate is at least 92%, after taking into account the statistical nature of the Monte Carlo calculated dose values. Despite the existence of latent variance of phase space files, the phantom dose calculation uncertainty can be less than 1% for field sizes as small as 5—5 cm2. The computing time saved by using phase space files could be a factor of 5-10.

Conclusions:

The Varian generic phase space files are accurate and efficient radiation sources for Monte Carlo calculations of radiation dose distributions for TrueBeam linac head.

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