Determination of the beam hardness variation along anode cathode axis using x-ray spectra derived from filter transmission measurements

Transmission measurements using aluminum filters were made on a constant potential x-ray unit with a 12° anode angle. A collimation system was used to obtain good, narrow beam geometry at different distances from the central axis. Measurements were taken at 50 and 80 kV nominal tube potentials at various distance intervals along the anode cathode axis. The transmission measurements were utilized as input for a variational algorithm to obtain the x-ray spectrum. The algorithm utilizes a pre-spectrum, calculates the transmission and compares it to the measured transmission values. At each 1 keV energy interval, the assumed spectrum is perturbed by different amounts, both positive and negative, and a new transmission is calculated. The spectrum yielding the smallest difference between the calculated and measured transmission is selected as the actual spectrum. For each spectrum the average energy of the beam is calculated and shown as a function of the distance from the central axis.