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Abstract:

A dedicated compact device has been developed, optimized and realized for treatment of breast cancer in prone position. The prone position increases the separation of the target and critical organs and minimizes target motion caused by breathing; in addition, it decreases dose delivered to Organs at Risk (OARs), such as lung and heart, allowing hypo-fractionated conformal RT treatments. Based on a design made by Monte Carlo simulation, a prototype has been realized at APAM (Accelerators of Particles for Medical Application) Laboratory in the ENEA-Frascati Research Center in the framework of the TECHEA (Technology for Health) Project.

The prototype object of the measurements consists of a compact linear accelerator (linac) capable of producing a 3 MeV electron beam subsequently converted into a photon beam by means of an electron-X Tungsten-Copper (W-Cu) converter target. The linac parameters are: 100Hz pulse repetition frequency, 3.5 □s pulse duration and 120mA peak current. The primary collimator, consisting of a lead cone with an aperture of 13.5° and a length of 31 cm, is positioned after the target. The beam was characterized in terms of dose profiles, Percentage Depth Dose (PDD) and TMR (mettere acronimo)TPR20,10. Measurements were carried out by means of Gafchromic EBT3 films and Semiflex PTW 31010 ionization chamber positioned in a solid water phantom. Radioprotection (RP) ambient dosimetry was also carried out.

The measurement of the PDD showed that the beam has a depth dose curve comparable to that obtained with a Co60 source, already used in the past for breast treatments. A beam quality TPR20,10 of 0.52 was measured. RP measurements have shown values compatible with the simulation and will be used for the calculation of the final shielding.

This first experimental characterization of this new type of X-ray source has been very encouraging and has shown us the way to best optimize the prototype being studied.