

Characterisation of Pulsed X-ray from a Plasma Focus for Superficial Radiation Therapy

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Abstract

Pulsed low dose rate radiation therapy has been investigated in a number of cancer clinical trials based on the in vitro and in vivo experimental findings indicating that many tumour cell lines exhibited hyper radio-sensitivities (HRS) at pulsed doses and enhanced normal tissue repair at low dose rates. Pulsed x-rays radiation produced by plasma focus at 3 kJ is investigated with the aim to study its effect on superficial cancer. The short-lived plasma pinch produced at the top of the anode is the primary source of X-ray radiation. The temporal and spatial structure of the plasma pinch is registered with a time resolved multi-frame microchannel plate (MCP). The images shown the plasma evolution over duration of about 30 ns. The plasma pinch is elongated on the axis and appears as point source in the end-on direction with a diameter of about 0.5 mm. The temporal profile and intensities of the X-ray pulses are dependent on the charging voltage and gas pressures. The dose rate and attenuation measurements of the x-rays are simulated by using a reference system with composition approximating skin: a stack of polyethylene terephthalate films. Dose rate of X-ray pulses is characterized by the PTW Unidos Universal Dosimeter with ion chamber and TLD dosimeters indicating dose rate of hundreds μGy per pulse.