AbstractID: 9462 Title: New high-resolution method to measure the 3D dose distribution around brachytherapy seeds using BANG3-Pro gel dosimetry

Purpose: In this work, we propose a new method to measure absorbed dose distribution in 3D imparted by low-energy photon sources used for cancer treatment using high-resolution gel dosimetry. **Method and Materials:** BANG3-Pro (12% Gelatin, 12% proprietary high-viscosity-component, 6% Methacrylic Acid and 70% Water) gel, which is a muscle, tissue and water-equivalent polymer gel, originally known as BANG (bis, acrylamide, nitrogen and gelatin) gel has been used as a dosimeter and phantom. We have studied the properties of the gel under different irradiation conditions and measured the dose distribution around three different brachytherapy seeds: ^{192}Ir, ^{125}I or ^{103}Pd, each one with a particular internal geometry. For the seed irradiations, a 200 μm wall Barex tube is embedded inside the gel phantom. To calibrate the gel, a small ^{60}Co gamma ray field of 1 x 1 cm^2 has been used as a reference radiation field. The gel response was quantified using a special high-resolution DRYOCTOPUS laser CT scanner recently developed by MGS Research Inc. with a resolution of 100 μm in all dimensions for brachytherapy seeds and 330 μm for ^{60}Co irradiations. **Results:** The response of the gel to gamma rays is almost linear up to 15 Gy; for higher doses, the response decreases as a function of the time between irradiation and readout (scanning). At low doses, the gel is reproducible and stable. Based on these results and due to the high dose rate gradient at short distances from the sources, the dose distributions were measured using accumulative time exposures in order to evaluate the dose with acceptable accuracy very close to the seed. The spatial uncertainty was about 100 μm. **Conclusion:** To our knowledge, this study is the first high-resolution gel measurement of the dose distribution in 3D for brachytherapy seeds at distances under 5 mm from the seeds.