biological damages occur within short segments of DNA, the simplified geometry (GeomCyl) was modeled as 10 bp-long homogeneous cylinders (2.3 nm diameter and 3.4 nm height) randomly placed within the chromatin fiber volume. Ionization clusters were revealed by the DBSCAN algorithm according to a proximity criteria among energy transfer points separated by less than 3.4 nm (i.e. 10 bp). Cluster size probability distributions, deposited energy, and spatial extension of clusters were compared for the two geometries.

**Results:** The total number of clusters was comparable (differences, Δ, <5%) for both protons and alpha particles with LET>50 keV/μm. For lower LET values a larger number of clusters was found in the GeomCyl geometry (Δ up to 20%). The mean ionization cluster size increased linearly with LET, and was found to be systematically larger in the GeomCyl geometry (Δ of 6-7%) regardless of radiation quality. Similarly, the mean energy deposited per cluster was higher (up to 20%) in GeomCyl. The spatial extent of energy transfer points within clusters was systematically larger for GeomHist; the modeling of the DNA in GeomCyl as segments of constant length prevented the gathering of additional ionizations afforded by the DBSCAN algorithm, thus leading to clusters with a higher density of ionizations compared to GeomHist.

**Conclusions:** The two geometrical descriptions of the scoring volume led to significantly different ionization cluster-size distributions for both protons and alpha particles. The use of the simplified geometry led to more complex clusters compared to the detailed geometry. The modeling and arrangement of the DNA molecule significantly influences the frequency distributions, energy deposited and spatial extent of ionization clusters, from which strand breaks and higher-order biological endpoints are estimated.

### PO-0825

### Monte Carlo model for IOERT dose distribution studies

A. Esposito[1], T. Sakellaris[1], P. Limede[1], F. Costa[2], L.T. Cunha[3], A.G. Dias[3], J. Lencart[3], S. Sarmento[3], C.C. Rosa[4]
*[1]INESC TEC, Center for Applied Photonics, Porto, Portugal*
*[2]Centro de Investigação, IPOPFG EPE, Porto, Portugal*
*[3]Serviço de Física Médica & Centro de Investigação, IPOPFG EPE, Porto, Portugal*
*[4]Universidade do Porto, Departamento de Física e Astronomia da Faculdade de Ciências, Porto, Portugal*

**Purpose/Objective:** Intra-Operative Electron Radiation Therapy (IOERT) is a radiotherapeutic technique that uses high energy electron beams during surgical interventions to directly irradiate tumoral tissues, while minimizing the dose in adjacent sensitive tissues. The use of electrons is preferred due to their short range and low penetration. In abdominal or pelvic IOERT, shielding is sometimes used to partially block the radiation field. This work is the basis for the study of the influence on dose distributions of various factors that frequently occur in pelvic IOERT. Here, the effects of shielding, as well as the impact of irradiating non-flat surfaces will be addressed.

**Materials and Methods:** Treatment planning for IOERT procedures is based on measurements performed in reference conditions, on the depth of tissue to be treated. However the dose distribution is altered by shielding, and by the geometry of the irradiated area. To evaluate these effects, the Monte Carlo simulation codes BEAMnrc and EGS++ were used to model a Varian Clinac 2100 CD linear accelerator, its hard docking system, and the IOERT applicators.

Our model is validated with respect to measurement of dose distributions in a homogeneous water phantom (reference conditions). Percentage depth dose (PDD) curves and transversal dose profiles, at different depths, were measured for three different IOERT applicator diameters (6, 7 and 8cm), three energies (6, 9 and 12MeV) and four bevel angles (0, 15, 30 and 45°).

After validation, phantom measurements were performed in a situation with a lead shield placed in the beam field. This configuration was simulated and the results compared. Also, a situation where the IOERT beam irradiates a water equivalent volume with non-flat surface was modeled.

**Results:** All possible configurations of IOERT applicator diameter, energy and bevel angle were simulated and the results analyzed using the gamma index. Some results are shown in figure 1. The simulation results show a good agreement with experimental measurements, with 98.3% of analyzed points within gamma < 1, using a 2% difference dose and 2mm distance to agreement (DTA) as validation criteria. Comparisons between simulation and measurement for partial lead shielding situation were performed. Finally, the simulated dose distributions for IOERT beam irradiating both curved and flat surfaces were studied (a comparison in shown in fig 1c).

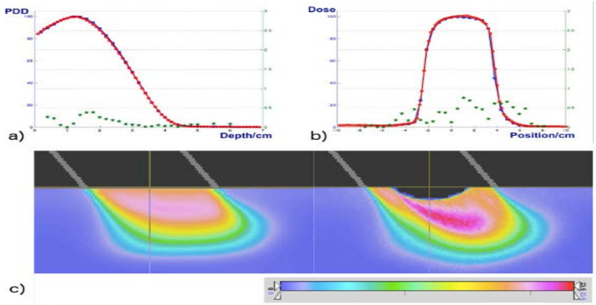

Figure 1: For 6cm beveld applicator: a) Measured (blue) and simulated (red) PDD for bevel 30, 9MeV; (b) dose profile at 1.1 cm depth for the same conditions - green dots/axis report to gamma index values; c) Dose distribution on tissue equivalent volume, overlay of 30° bevel applicator, 12 MeV: flat (left) and curved (right) surface.

**Conclusions:** A IOERT Monte Carlo model was implemented and validated by comparing the numerical data with measurements acquired at different beam energies, applicator diameters and bevel angles. The validation was quantified by gamma index analysis. The potential of this tool is exemplified by the study of dose distribution distortions when the IOERT beam irradiates a curved surface, and when shielding elements are introduced in the beam field. Further studies are in progress.

### PO-0826

### Novel epitaxial silicon array for small field dosimetry

C. Talamonti[1], M. Zani[1], D. Menichelli[2], F. Friedl[2], F. Bisello[3], P. Bonomo[4], M. Bruzzi[5], F. Paiar[4], M. Scaringella[5], M. Bucciolini[1]
*[1]University of Florence, Dip Scienze Biomediche Sperimantali e Cliniche, Firenze, Italy*
*[2]IBA, Dosimetry GmbH, Schwarzenbruck, Germany*
*[3]FAU University Erlangen-Nürnberg, Experimentalphysik, Erlangen, Germany*
*[4]Azienda Ospedaliera Universitaria Careggi, SOD Radioterapia, Firenze, Italy*