maximum allowable CT number (3071) to the shield region for eMC and by assigning real mass densities and materials of the metallic shields for EGS-based MC. The calculated doses were transferred to CERR with RT structure files. **Results:** For an eye shield case, the MC doses on the right lens were less than 20% of prescription dose, while the corresponding eMC calculated doses were unrealistic values of approximately 50% of prescription dose. For two lip cases, eMC results also showed unrealistic doses of approximately 80%–90% behind the shield, while the MC results were more realistic doses of approximately 20%–40% behind the shield. **Conclusion:** A dummy shield for electron radiation therapy can be easily produced and implemented into the patients utilizing a 3D scanner and a 3D printer. The artifact-free CT images were successfully incorporated into the CT-based Monte Carlo simulations. The developed method can predict the realistic dose distributions around a metallic shield.

TU-L-GePD-T-04

Experiment to Access Iodine-125 Leakage in Different Vials

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Purpose: There are several challenges when developing a laboratory to produce radioactive sources. From choosing a prototype to radiation safety, the task is enormous. During the past 15 years, our research group is developing a laboratory to produce iodine-125 seed. These seeds are placed inside the cancer and release radiation directly in the target. The whole production line is full of new process and innovations. Among those, a new chemical reaction that deposit iodine-125 onto silver (core) was developed. This paper presents a comparison between vials in order to access their capability to retain radioactive iodine. Also, the fixation percentage in a silver core was taken into account. This information will be used to select a vial to be implemented at the iodine-125 sources manufacture laboratory. **Methods:** Vials made with polymers and glass was tested. Iodine-125 were placed in the vials overnight at rt. Seven vials with different materials (glass, dark glass, and plastics) were evaluated. **Results:** The selected vial (borosilicate glass 1 mL total volume) loss 17.61% of iodine in 24 hours and presented the highest iodine intake. It was noticeable that the vial material influenced both iodine intake and iodine loss. The goal is to maximize the reaction yield to result in a less costly product. **Conclusion:** We have selected the best vial for our reaction in regards to leakage and yield.

TU-L-GePD-T-05

Dosimetric Verification of a Ru-106 Eye Plaque

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Purpose: To perform a dosimetric verification of a Ru-106 eye plaque using radiochromic films (EBT3). **Methods:** The radioactive eye plaque used for this study was an Eckert & Ziegler type CCB, with a diameter of 20 mm. Plastic phantoms were designed to hold a plaque with its concave side up, with the top of the phantom either even with the plaque rim, or even with the plaque eyelets used for suturing. The cavity can either be filled with water or left in ambient air. In water, a 3×3 cm^2 film covered by a single layer of cellophane is placed on the phantom surface with 8 mm of plastic water miniature slabs for backscatter. In air, a similar film is placed on the phantom surface without backscatter material. Films were exposed to obtain a dose at the center between 1 and 2 Gy. Dose profiles were also obtained from the Plaque Simulator software for comparison. **Results:** Two measurements in air showed good reproducibility. Three dose measurements in water at a distance of 4.7 mm of the plaque inner center and two at a distance of 7.5 mm were performed. The absolute dose measured at the center of the plaque was compared to the absolute calculated dose based on dosimetric data provided by the manufacturer. At a depth of 4.7 mm the difference between measured and calculated dose was −11.4%, and at 7.5 mm the difference was 1.1%, which are both within the uncertainty reported by the manufacturer. **Conclusion:** The absolute dose rate provided by the manufacturer could be independently checked at two depths using radiochromic films. Radial profiles obtained from the Plaque Simulator were also within reasonable agreement with those obtained from the radiochromic films. Measurements in air showed that the plaque radioactive integrity can be easily verified as a periodic constancy check.

TU-L-GePD-T-06

Dosimetric Impact of Radioisotope Type On Permanent Brain Seed Implants

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Purpose: The utility of seed based brain brachytherapy is hampered by frequent brain necrosis. We modeled dosimetric differences between Cs-131, Pd-103 and I-125 isotopes in permanent brain brachytherapy using an intraoperative seed carrier/spacer designed to avoid necrosis from direct seed/tissue contact. **Methods:** We retrospectively identified thirteen patients who previously underwent intraoperative brachytherapy with Cs-131 seeds imbedded in a biocompatible collagen carrier/spacer on an IRB approved trial. For each patient Cs-131 dosimetric plans were compared to plans for I-125 and Pd-103 seeds, respectively. Substituting these isotopes, we used the exact same seed locations and modified the activities to match the previously achieved 60 Gy Cs-131 dose volumes. The collagen seed carrier/spacers provide approximately 3 mm offset between the long axis of the seeds and tissue. **Results:** To create 60 Gy volumes, average seed strengths of 3.68, 0.69 and 4.1U, for Cs-131, I-125 and Pd-103 were necessary and the average 60 Gy volume was 32 cm³. On average, Pd resulted in an increase of 4.5 cm³ at 150 Gy and 4.3 cm³ at 200 Gy over Cs; with I-125 the increase was 1.35 cm³ at 150 Gy and 1.26 cm³ at 200 Gy over Cs. Average 30 Gy volumes were higher for Cs by 16.7 cm³ vs. Pd, and by 5.1 cm³ vs I-125. Pd exhibited the steepest dose fall-off; the Gradient Index (GI) was 1.88 vs. 2.23 with I-125, and 2.40 with Cs. Compared to Cs, the mean implant dose was higher by 1.3× and 1.1× with Pd and I-125, respectively. Dose/volume differences between radioisotopes increased with increasing volume. **Conclusion:** Dose fall off was fastest with Pd followed by I-125, then Cs. However, Pd and I-125 resulted in higher intra-target doses and higher inhomogeneity compared to Cs. The larger high-dose volume with Pd and I-125 potentially increase the risk for radiation necrosis, and the inhomogeneity becomes more pronounced with increasing target volume.

Imaging General ePoster Discussion

Nuclear Medicine

Imaging ePoster Theater

TU-L-GePD-IT-01

Characterization of a Scintillating Radiation Detector for Emission Tomography Imaging Utilizing a Compact Acquisition System That Improves Affordability

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Purpose: To characterize a compact data acquisition system (CDA) with applications in emission tomography in terms of: homogeneity response maps and energy spectra. **Methods:** Two experimental setups were compared. The novel consisted of a crystal detector with an array of 20×20 LYSO:Ce scintillator crystals attached to a position-sensitive multianode photomultiplier tube. A resistive chain encoded the signals of the tube. The four output signals were digitalized by the CDA and processed with an in-house programmed python script. The CDA ($10 \times 6 \times 2$ cm3) was a commercial compact FPGA platform (RedPitaya ®) with a bandwidth of 50 MHz, mainly used for teaching purposes. The CDA was programmed to acquire data at 120 samples per second from each channel of the resistive chain separately. Homogeneity maps and energy spectra of the detector system in presence and absence of a 137Cs source were acquired for comparison purposes. These data were compared to results obtained with a regular laboratory system composed of: a 200 MHz oscilloscope and an external power supply. This system was controlled and data were analyzed using LabVIEW applications (National Instruments ®). **Results:** We obtained the response maps and energy spectra when 137Cs was not present and when it was. **Conclusion:** The CDA system resulted in a more compact and affordable DAQ system to retrieve homogeneity response maps for emission tomography in real time.