AbstractID: 7519 Title: A New Generation of Electronic Portal Imaging Devices (EPID) Using Thin-Film CdTe for Radiation Oncology Applications

Purpose: The commercially available EPIDs today commonly manufactured from amorphous-Silicone (a-Si) materials display numerous problems in image contrast & resolution. These are related to poor radiation hardness and low Z which is detrimental to their detecting capabilities. The CdTe-based thin film devices with superior radiation hardness and much higher Z (~50) have not yet found many applications in medical physics. Here we report first promising results on polycrystalline thin film CdTe-based prototype EPID.

Method and Materials: The proposed design utilizes a layer of high atomic number and density functioning as a converter transforming high energy X-rays into the Compton electrons impeding onto CdTe detector operating in pulse mode. Such a converter can replace the standard scintillators used with a-Si devices. We conducted Monte Carlo simulations testing the proposed structure and verified them with measurements using a prototype thin film CdTe cells. Our modeling was amplified with a semi-empirical algorithm accounting for the processes of device degradation, simultaneously applied to the a-Si devices for comparative study.

Results: We found that a layer of Pb less than 3 mm thick in combination with low-Z material such as polystyrene, used for filtering out low-energy scatter, is suitable for the converter. Detector output voltage in the range of the tenths of Volt for the typical radiation therapy dose rates allowed for a possibility of using the device without biasing. We have carried out verifying experiments with polycrystalline CdTe based cells: good agreement with our MC simulations was obtained.

Conclusion: CdTe based thin film detectors have a high potential to become the next generation EPID's. They feature: small thickness <10 μm; efficient collection; exceptional radiation hardness; inexpensive deposition technology; sensitivity to low intensity radiation; excellent room temperature characteristics without biasing; small integration time < 500 ns.