AbstractID: 3004 Title: Accurate IMRT verification with fluoroscopic EPIDs: a generally applicable method based on direct imaging of cross-talk kernels

Purpose: CCD camera-based electronic portal imaging devices (CEPIDs) are well suited for absolute dosimetric measurements and are applied routinely for IMRT verification in our institute. CEPID dosimetry is mainly hampered by cross-talk, which originates predominantly from optical photons reflected within the EPID structure. Previously, this cross-talk was corrected for based on specific assumptions. However, the sensitive cameras in our present CEPIDs allow for direct imaging of the low-amplitude, spatially extended cross-talk kernels. Thus complete, position dependent characterization of the cross-talk has become feasible. Here, we investigate the accuracy with which portal dose images (PDIs) can be derived from CEPID images (EPIs), using this cross-talk characterization.

Method and Materials: Cross-talk kernels were obtained from EPIs of 2x2 cm^2 'pencil' beams, centered on a 30-position grid covering the EPID sensitive area. In the experimental set-up and post-processing, care was taken to exclude contributions of low-magnitude long-range incident MeV-radiation to the kernels. By interpolation of the measured kernels, a high resolution kernel-database was generated. Using this database, PDIs can be derived from EPIs by iterative deconvolution of the cross-talk contribution. Absolute PDI calibration was based on EPIs and corresponding PDIs, obtained by scanning a linear diode array (LDA), for two reference fields. To test the accuracy of this method, we compared EPI-derived PDIs with LDA-based PDIs for a series of symmetric and asymmetric fields, including Alderson-phantom thorax and IMRT fields.

Results: The measured cross-talk kernels were asymmetrical and position-dependent. PDIs derived from EPIs with these cross-talk kernels matched with LDA-based PDIs to within 1% (1 SD) for all investigated fields (including IMRT), both inside and outside the field penumbras.

Conclusion: We have developed a generally applicable method to determine position-dependent cross-talk kernels via direct imaging. With these kernels, we can derive accurate PDIs from EPIs that are well-suited for dosimetric IMRT verification.