AbstractID: 10870 Title: Quantitative Determination of the Alignment of Accelerator Light and Radiation Fields Using Optical Methods

Purpose: The evaluation of the coincidence of light vs. radiation fields is an important and mandatory component of linear accelerator QA. Currently, the fields' alignment is often only coarsely estimated visually. We describe a new methodology that enables actual quantification of the differences between the light and radiation fields of accelerators.
Method and Materials: A fluorescent screen was positioned at a 100 cm SSD reference plane of a Varian 21EX accelerator. The screen was imaged during irradiation with a consumer grade 8.0 Mega pixel camera mounted on a tripod next to the accelerator's couch. A computer generated grid with 1 cm spacing printed on a high-resolution printer was used for system calibration. Three series of images were taken: (i) a 10X10 light field projected on the screen, (ii) the corresponding radiation field as defined by the screen's fluorescence and (iii) the calibration grid placed on top of the screen. The images were registered with the ideal grid using a projective transformation algorithm.
Results: The half height positions of the penumbrae for the light and radiation fields respectively were obtained by analyzing 1D profiles of the images. With the current setup, it is possible to determine fields' mismatch at the order of 0.05 mm.
Conclusion: Traditional methods for checking of the field alignment such as pin-pricking radiological film are somewhat subjective as they greatly depend on the operator's skills. We have developed a novel method that enables accurate quantitative determination of the fields' overlap. The method utilizes inexpensive off-the-shelf components and produces results an order of magnitude more accurate. We believe that use of this quantitative and precise optical methodology could be expanded into other areas of accelerator mechanical QA.