Evaluation of the Mismatches Between DRR’s and Port Films for IMRT Fields

Port films are an important tool to prevent errors in radiation therapy delivery. For IMRT fields, use of port films is complicated because the MLC shape varies during the treatment of the field, but the port film MLC aperture must be one static shape. One option is to not include the MLC shape on the port film and use it solely for isocenter placement; however, in this approach important clinical information, namely the treatment area, is lost, which could be useful in preventing treatment errors. At our clinic we use the Philips Pinnacle planning system to generate DRR’s and the Mosaiq record-and-verify system to generate the MLC shapes for the port films for our Varian Clinac 2100C accelerator. We noticed in a substantial number of cases that there was a significant discrepancy between the MLC shape on the DRR and the port film. This project explores the causes, frequency, and magnitude of the mismatches.

![DRR and port film images. Note the substantial difference, especially in the bottom left quadrant. The chart shows the frequency of mismatches by anatomical category.](image)

For port films of segmented fields, Mosaiq sets the leaves at the CIAO—the Complete Irradiated Area Outline, which is the area receiving treatment. Pinnacle displays the first segment, but can be set to have a heavy dashed line to represent the maximum leaf motion. For small fields these are the same, because leaves which abut do so under the collimator jaws. Once the field width exceeds 14.5 cm on a Varian machine, however, either the field must be split (which can create an unwieldy number of beams) or leaves which abut must do so within the opening of the jaws. In this case the DRR then shows the literal maximum motion of the leaves, even if those leaf positions are not used to delineate a treatment field. This can lead to port films which look dramatically different from their DRR.

We examined the DRR’s and port film images for the most recent 60 IMRT treatments at our facility and found that 20 of them had at least one field affected by this issue (142 of 573 fields). The discrepancy for every mismatched leaf (985 total) was measured. Affected patients had on average 59% of their fields with at least one mismatched leaf. For each affected field, the mean number of leaves with a mismatch was 6.7, with a mean discrepancy of 27mm, which is non-trivial. The average maximum discrepancy per patient was 69mm. Head and neck cancers had the highest rate of mismatches.

The only known solution is to remove the MLC information form the port films, but as noted, this removes valuable clinical information also. The persons assessing the films must be aware of this issue and evaluate the films carefully.