



Total Body Irradiation's Dosimetric Features by Volumetric Modulated Arc Therapy Method



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Purpose:

- To compare three different types of volumetric modulated arc therapy (VMAT) treatment planning techniques using Elekta Versa HD linear accelerator to deliver total body irradiation (TBI) treatment on the couch.

Methods:

- Five TBI patient's treatment planning performed using Monaco5.1[®] treatment planning system with three different VMAT techniques for each patient. First one was single arc VMAT technique, second one was double arc VMAT technique and third one was two fields arc VMAT technique for one isocentre. The VMAT-TBI technique consisted of three isocentres and three overlapping arcs. 6 MV photon beam was used for the arc fields. The prescribed dose was 95% of target volume receiving dose of 12 Gy in 10 fractions. The planning target volumes (PTV) included entire body trimmed to 3 mm below the skin.

- The organs at risk (OAR) included the lungs, kidneys and lens, further in order to ensure adequate sparing of the OARs dummy structures were created by expanding the contours of these organs by 3 mm. The total PTV was trimmed from these dummy structures. Mean dose to lungs and kidneys were restricted less than 9.0 Gy and maximum dose to lens were restricted less than 11 Gy.

Results:

- An average monitor unit (MU)s was determined 2202 ± 254 MUs for double arc VMAT technique. This study demonstrates that double arc VMAT technique has got less MUs than other techniques. When we compared lungs and kidneys mean doses for all techniques, we determined $\%5.9 \pm 3$ less doses than single arc VMAT and $\%5.8 \pm 4$ less doses than two fields arc VMAT techniques for lung, $\%6.8 \pm 3$ less doses than single arc VMAT and $\%6.7 \pm 4$ less doses than two fields arc VMAT techniques for kidney with double arc VMAT technique. Additionally, Heterogeneity Index (HI) of target was lower than other techniques with double arc VMAT, also an average maximum dose was $\%7.3 \pm 3$ less than single arc VMAT and $\%6.6 \pm 3$ less than two fields arc VMAT techniques.

Figure 1: Axial plane of TBI patient

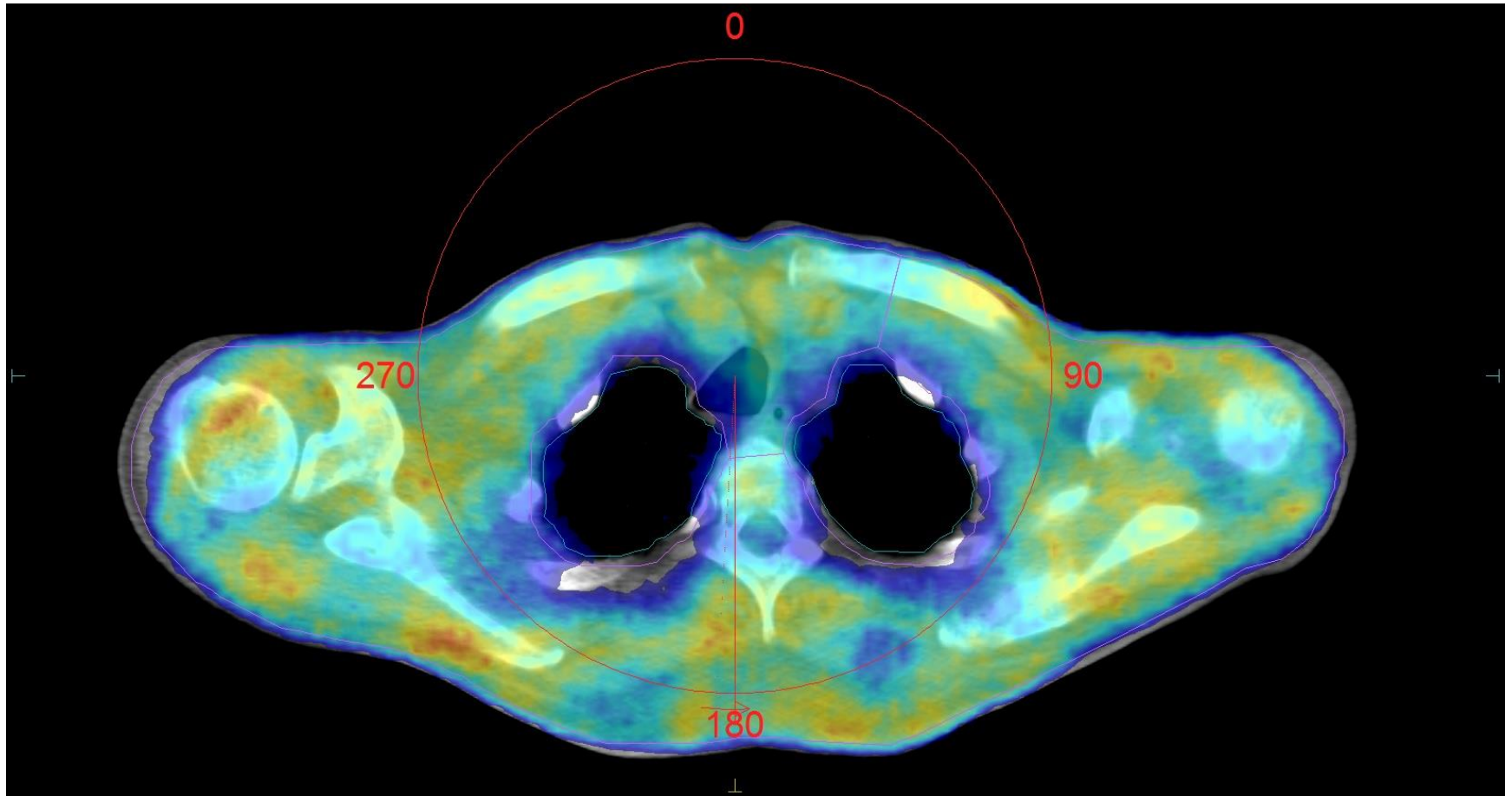


Figure 2: Coronal plane of TBI patient

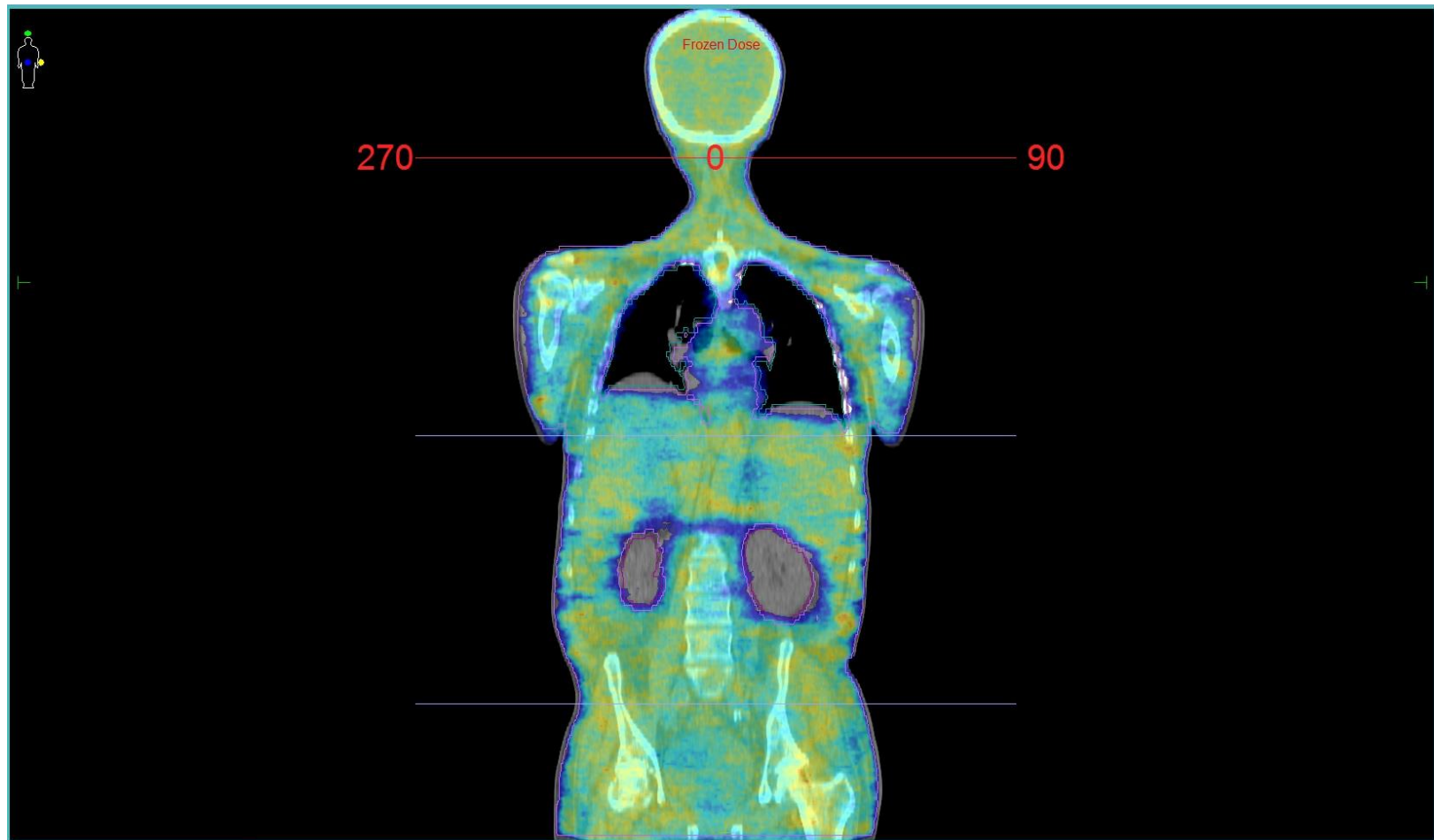


Figure 3: Sagittal plane of TBI patient

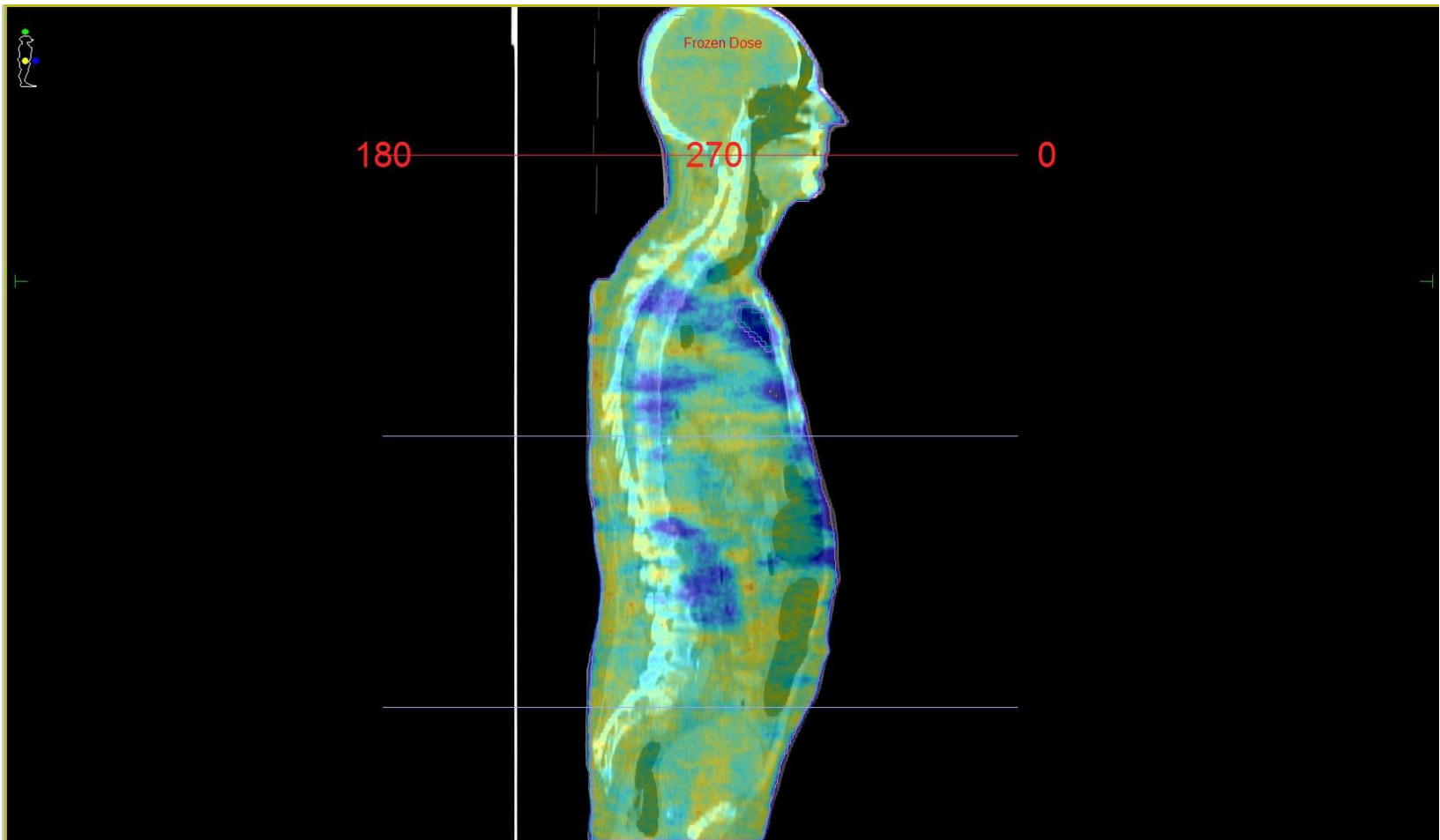
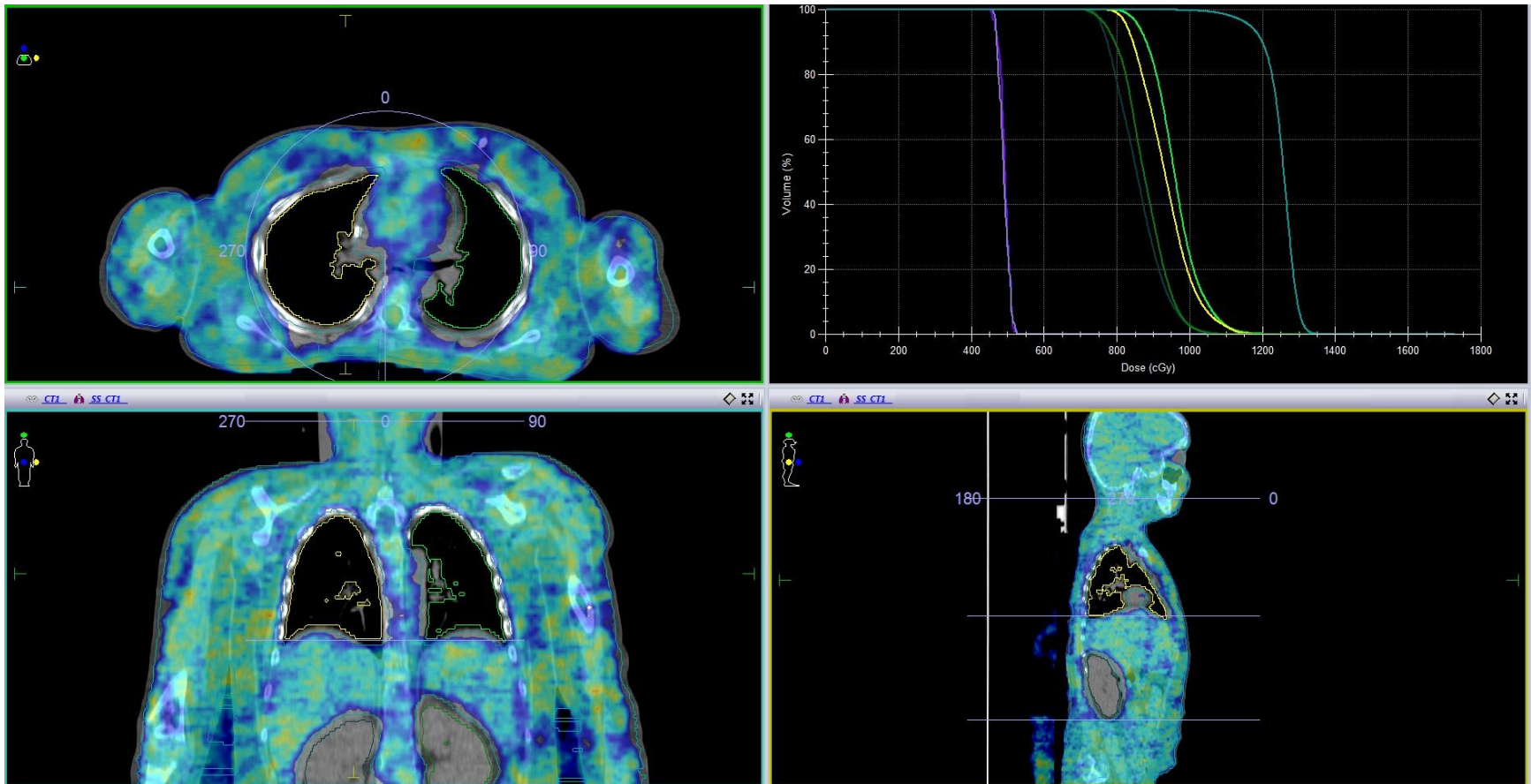


Figure 4: Treatment planning of TBI patient



Conclusions:

- These results show that dose coverage of target and OAR's also depend significantly VMAT techniques. The study demonstrates that double arc VMAT technique is feasible for total body irradiation (TBI) treatment in linear accelerator on the couch.