

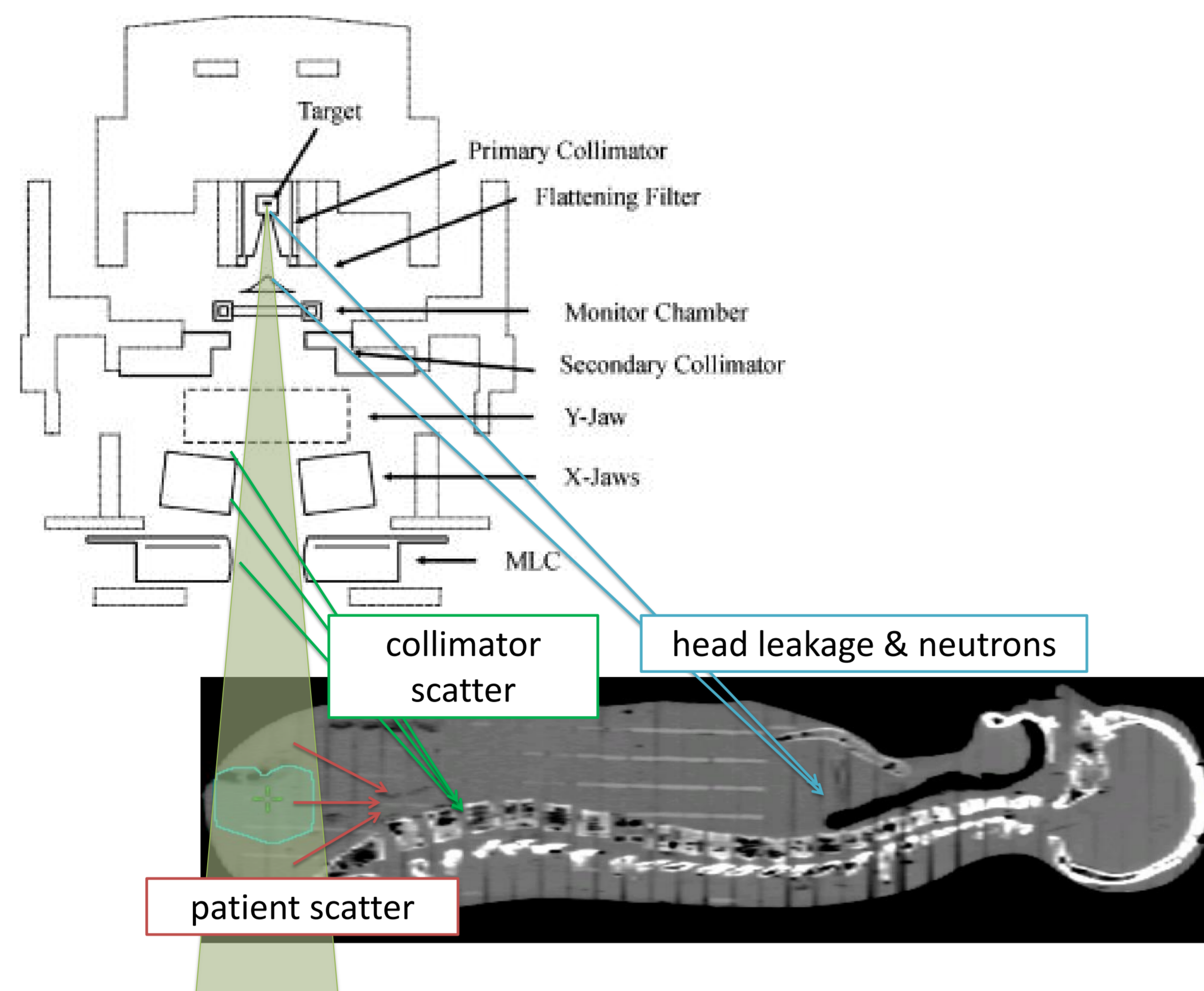
# Modeling Whole-Body Dose in Radiotherapy

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**Total out-of-field dose = patient scatter + collimator scatter + head leakage + neutrons**



- **patient scatter**: mechanistic model, based on simple training measurements using ionization chamber
- **collimator scatter and head leakage**: empirical models, based on extended training measurements using ionization chamber
- **neutron dose equivalent**: simple empirical model, based on TLD600 measurements corrected with MC-simulated neutron spectra in tissue (Kry et al. 2009)

Figure 1: Different scatter contributions in photon radiotherapy.

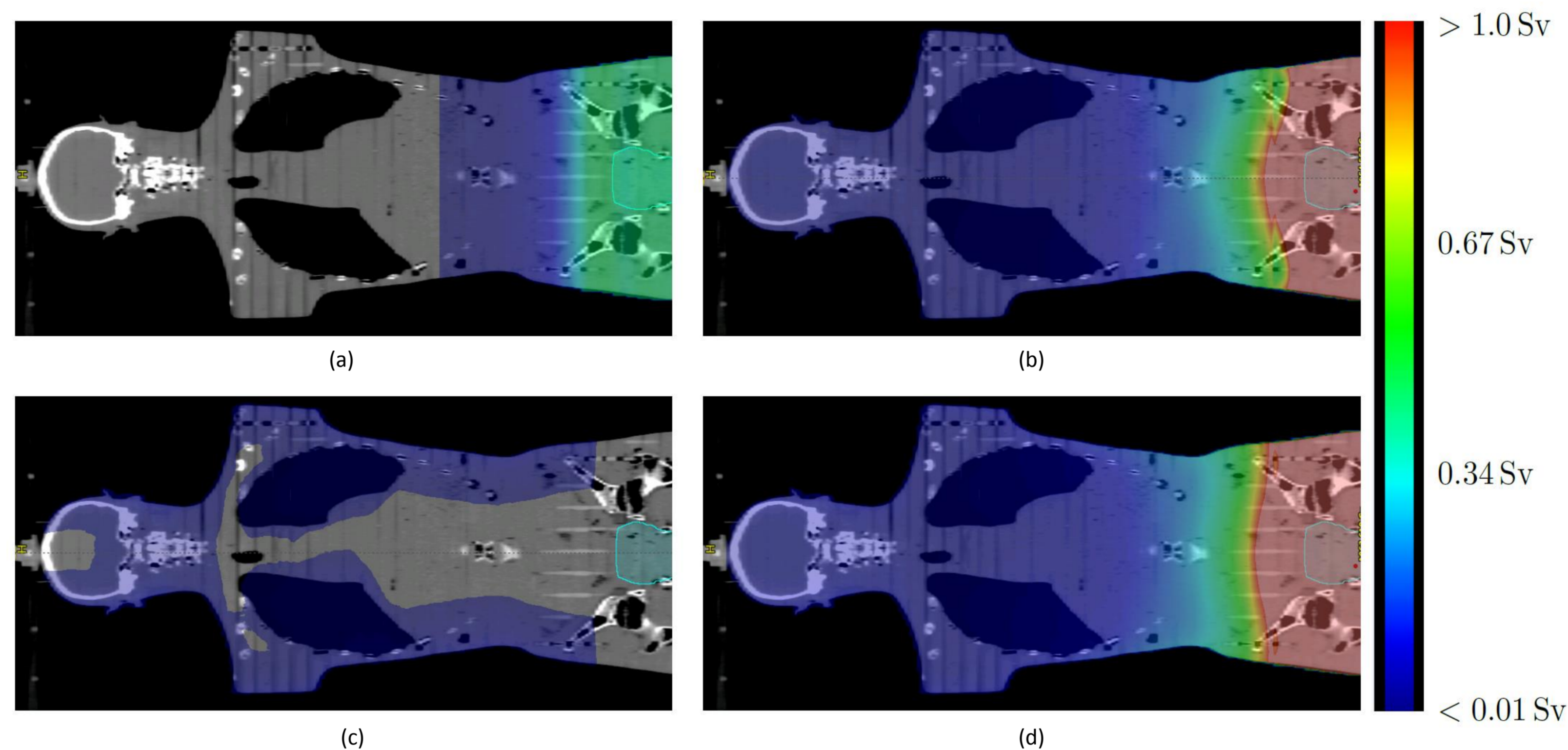


Figure 2: The whole-body dose equivalent for a 15 MV IMRT treatment with a daily CBCT. The dose equivalent is shown for (a) 23 times a CBCT, (b) photon scatter radiation fused with the treatment planning system (TPS) calculation, (c) neutrons and (d) the summation of (a)-(c). Furthermore, the outline of the rhabdomyosarcoma in the prostate can be seen.

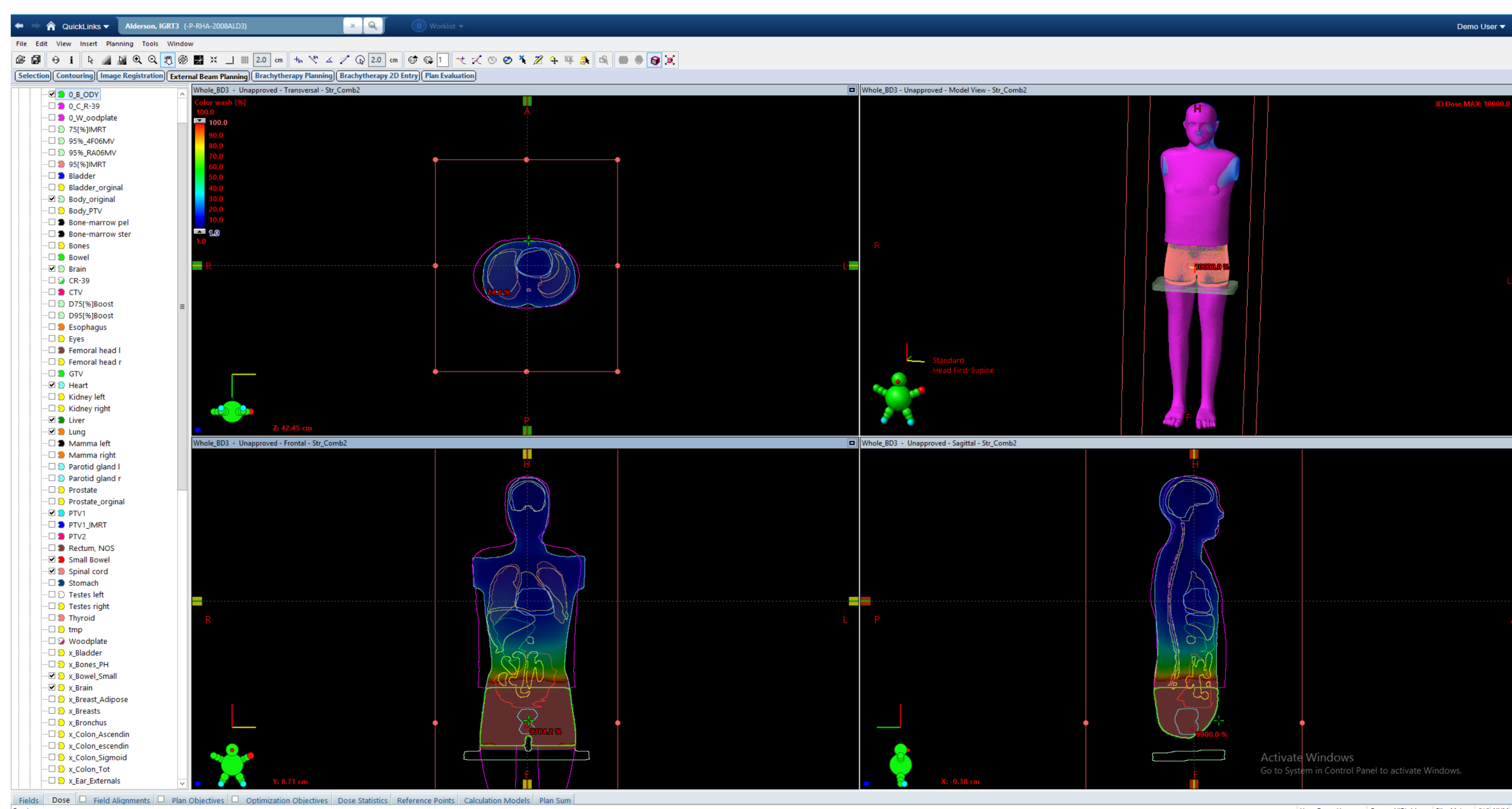


Figure 3: The Alderson patient fused with a computational human phantom using the Eclipse scripting API. The body structure of the pelvis (green outline) represents the limited patient CT which was fused with the US National Cancer Institute phantom, resulting in a whole-body representation of the patient. The outline of the patient's and the phantom's organs at risk (brain, heart, liver, lung, small bowel, and spinal cord) can be seen. The TPS-calculated dose was fused with the model-calculated out-of-field dose, resulting in the whole-body dose shown in color wash. In the hip region, the outline of the rhabdomyosarcoma in the prostate can be seen.