Master's Thesis Engineering Technology

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Dose verification in lung SBRT and implications with clinical implementation of Acuros

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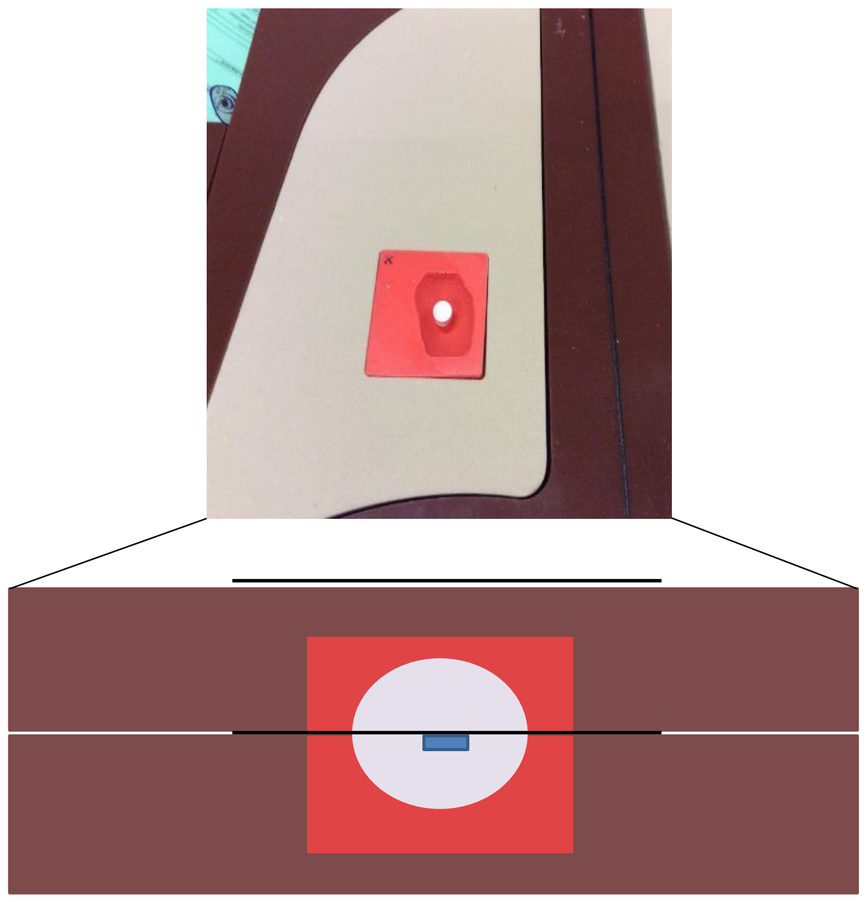
Master of Nuclear Engineering Technology

Aim: Acuros, a new, more accurate and faster dose calculation algorithm in radiotherapy is on the market. However, the switch from AAA, the current clinical standard, to Acuros has not been made. This Master's thesis focusses on the dose evaluation of lung SBRT. What are the dose implications for lung SBRT plans for a switch from AAA to Acuros as dose calculation algorithm?

Dose verification phantom

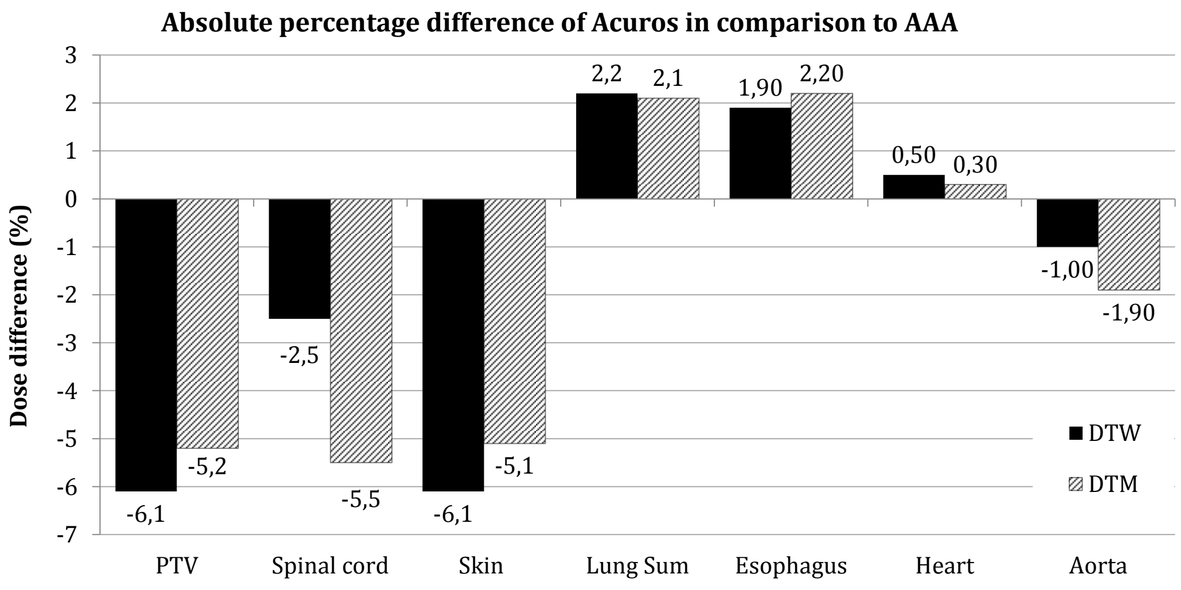


Method: The implications of the implementation are verified with firstly, recalculation of 60 SBRT plans and secondly an adapted dose verification phantom (Virtual Water Dose Verification Phantom) with hydrogel tumor. In two positions, the dose is compared after irradiation of the phantom for three different SBRT plans: in the center of the tumor and on the lung-soft tissue transition region above the tumor. The dose was verified using EBT3 films and alanine and the dose plan was recalculated for Acuros dose-to-medium and dose-to-water reporting method.

This thesis was based on SBRT plans of the Limburgs Oncologisch Centrum. The adjusted phantom was realized in cooperation with Beldart & Maastro Clinic.

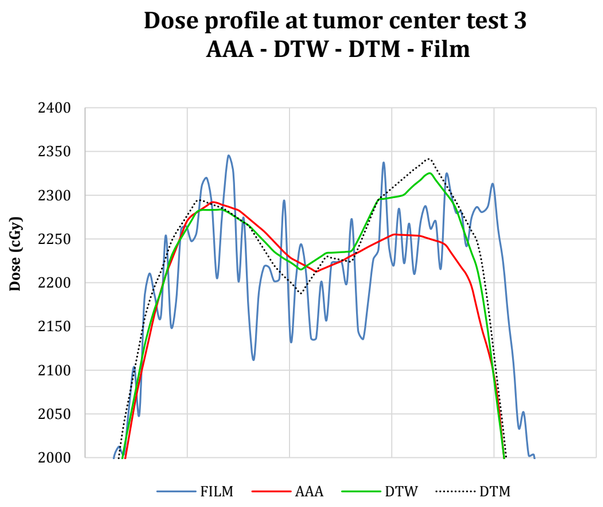
Implementation of Acuros

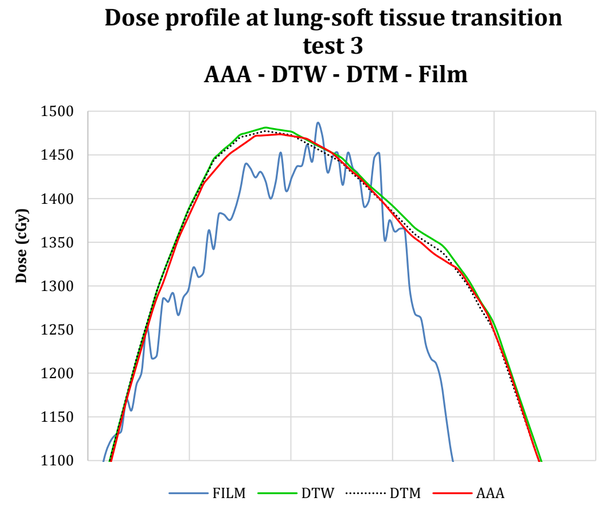
Plan recalculations



- **PTV, spinal cord, skin**: AAA overestimates by 5-6%
- **Lung sum, esophagus, heart**: AAA underestimates by 0,3-2,20%.
- **Aorta**: overestimation of AAA of 1-1,90%

Dose comparison with phantom tests





- **At tumor center:** good agreement of film and AAA dose map. Differences between AAA, AXB_W and AXB_M are small.
- **At lung –soft tissue transition:** significant dose differences between film and AAA dose map. Differences between AAA, AXB_W and AXB_M are small.

Conclusion: The results of the plan recalculations are not consistent with the individual phantom tests**.** On short term, there is no standard protocol to evaluate the dose differences between AAA and Acuros for lung SBRT. The phantom tests have proven that several uncertainties make it hard to evaluate the dose difference as well as the fact that the dose differences can vary a lot from plan to plan, especially at the lung tissue- soft tissue transition. Further long-term research needs to be done to evaluate the clinical progress and implications of Acuros dose calculation. However, a clear answer will quite certainly not be found. Since the dose differences are too small and other external factors should be considered, it will be very challenging to do research on the impact of this single effect.

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