**Evaluating the impact of RBE/LET variations on dose distribution in proton therapy for prostate cancer**

Radiotherapy is an important part of the treatment of cancer. However, high levels of dose in organs and normal tissue may lead to side effects that could impact the patient's quality of life. It is therefore essential to spare orangs of risk from dose during radiotherapy treatment while ensuring that the prescribed dose is delivered to the target volume.

In proton therapy (PT), the physical dose is related to the conventional radiotherapy dose by the relative biological effectiveness (RBE) to account for the biological effect of radiation compared to photon radiation. RBE has been shown to depend on several parameters in *in vitro* cell experiments, but the exact clinical relevance is uncertain. RBE is known to increase with the physical quantity of linear energy transfer (LET). LET describes the mean energy deposited by charged particles per unit track length. Monte Carlo (MC) simulations can be used to estimate the LET of a proton beam as it interacts with material. This can be done by tracing the energy loss of particles at each step of its path through the material.

PT has shown great potential due to its ability to deliver a highly conformal and shaped dose to tumors such that surrounding normal tissue receives less radiation. This makes PT an effective method for treating prostate cancer, particularly to reduce radiation to surrounding normal tissue and organs. However, both the prostate and the surrounding organs are subject to anatomical changes during a treatment period. The impact of these anatomical variations on the delivered dose has been investigated in patients treated at the Danish Center of Particle Therapy DCPT using weekly control computed tomography (CT) scans. Therefore, this project aims to explore whether variations in RBE/LET during the treatment in the same patients account for significant dose differences in organs at risk over a full treatment course. Further, the project aims to investigate whether the potential variations in dose due to RBE/LET are of similar magnitude to the variations found due to anatomical changes.

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| Måned | Mål/arbejde |
| August | Opstart  Problemformulering/Tidsplan godkendes inden 01.09.24 |
| September | Læser litteratur:   * Protokol om Prostata trial * LET/Stopping Power * Relative biological effectiveness RBE * Simuleringer, dosis beregninger   Adgang og introduceret til Eclipse  Påbegynde dataopsamling, simulation af dosis og LET. |
| Oktober | Litteratur læsning  Påbegynde planlægning af beregninger, oversigt over hvad der er patient materiale osv. |
| November | Samme som oktober |
| December | Dataopsamling, simulation af LET fordelinger  Analyse af resultater og databehandling, herunder beregning af:   * dosis-volume histogrammer * RBE - beregninger |
| Januar | Dataopsamling  Analyse af resultater og databehandling |
| Februar | Dataopsamling  Analyse af resultater og databehandling. Herunder dosis fordelinger i target og organer. |
| Marts | Resultater og figurer evalueres, hvad skal bruges og optimeres til rapporten  Analyse og fortolkning af resultater, herunder dosis fordelinger i target og organer |
| April | Færdiggørelse af resultater og finjustering  Påbegynde skrive rapport |
| Maj | Rapportskrivning |
| Juni | Skal have sat en dato for afleveringsfrist. 1/6? Afslutningsdato 30.06.2025. Her skal specialet være forsvaret og bedømt. |