

## DCCC annual report

**PhD project:** improving patient safety through online treatment monitoring in brachytherapy.

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### Report

One sub aim of my PhD project has changed since the report from 2019 so here are the overall aim and the three sub aims (the new aim is highlighted with bold):

To demonstrate that online monitoring is possible in brachytherapy (BT). The online monitoring tool will provide clinically relevant information to the clinical staff during treatment, to aid them in real-time identification and interruption of treatment in case of mis-administrations. The overall aim will be addressed through:

- Realising a source tracking accuracy of <1mm.
- **Characterising an inorganic scintillation detector based in vivo dosimetry system.**
- Propagating source tracking into online reconstruction of dose for prostate cancer patients treated with BT.

The new sub aim replaces the multi centre study. Changing one of the sub aims from a multicentre study to a characterisation study will allow me to include many more patients in the online dose reconstruction study of prostate cancer patients (third bullet point) as many of these patients now has been monitored with our new system.

The sub aims will now be addresses one by one:

#### **Realising a source tracking accuracy of <1mm:**

Throughout this year the results from last year has been improved and an article was submitted late 2020. The review process yielded many valuable suggestions from the reviews and the conclusion on the review ended up with the article being deferred. I am now implementing the suggestions from the reviews and am preparing to submit again within six weeks.

#### **Characterising an inorganic scintillation detector based in vivo dosimetry system.**

The preparation and characterisation of an inorganic scintillation detector based in vivo dosimetry system has been underway in our group for a few years. A previous post doc in our group, Gustavo Kertzscher has published on the feasibility of using inorganic scintillators for in vivo dosimetry in brachytherapy [1]. In this publication the focus is on the basic properties of the crystals such as light yield, afterglow, stability, dose linearity, energy dependence. The article recommends two crystals for in vivo dosimetry in BT: ZnSe:O and CsI:Tl. After this publication an end to end in vivo dosimetry system was developed which uses these two crystals and includes hardware and software to read out the signal from these. My characterisation project is then to make a full characterisation of this system for applications in vivo dosimetry in high-dose-rate and pulsed-dose-rate brachytherapy. The project is far on the way and includes the temperature dependence of the hardware box, temperature dependence of the crystals, signal linearity of the hardware box, measurements of the 3D energy dependence of the crystals, stability measurements across more than one year. The final measurements are planned to be performed within the next two weeks and the first draft of the article is being written. The aim is to submit in January.

### **Propagating source tracking into online reconstruction of dose.**

No work was done on this project in 2020.

#### **Publication:**

None.

#### **Poster presentations**

PhD day 2020, Graduate school of health, Aarhus university, Denmark, 24. January: Poster presentation. An abstract submitted to World Congress of Brachytherapy (WCB) in April 2020 was accepted for a poster. The WCB was however delayed to May 2021 due to Covid-19. An updated version of the abstract has been resubmitted.

#### **Presentation**

Unfortunately, the number of opportunities to present this year has been limited because of COVID-19.

#### **Planned activities in 2021:**

- Presenting in a DCCC webinar.
- I am looking forward to hearing back from my resubmitted abstract to the World Congress of Brachytherapy 2021.
- 1st publication: On the accuracy of in vivo dosimetry based source tracking.
- 2nd Publication: On the characterisation of an inorganic scintillation detector based in vivo dosimetry system.
- 3<sup>rd</sup> Publication: On 3D dose reconstruction based on in vivo dosimetry measurements.
- PhD thesis and defence in Autumn 2021.

[1] Kertzsch G, Beddar S. Inorganic scintillation detectors for <sup>192</sup>Ir brachytherapy. *Phys Med Biol.* 2019;64(22):225018. doi:[10.1088/1361-6560/ab421f](https://doi.org/10.1088/1361-6560/ab421f)