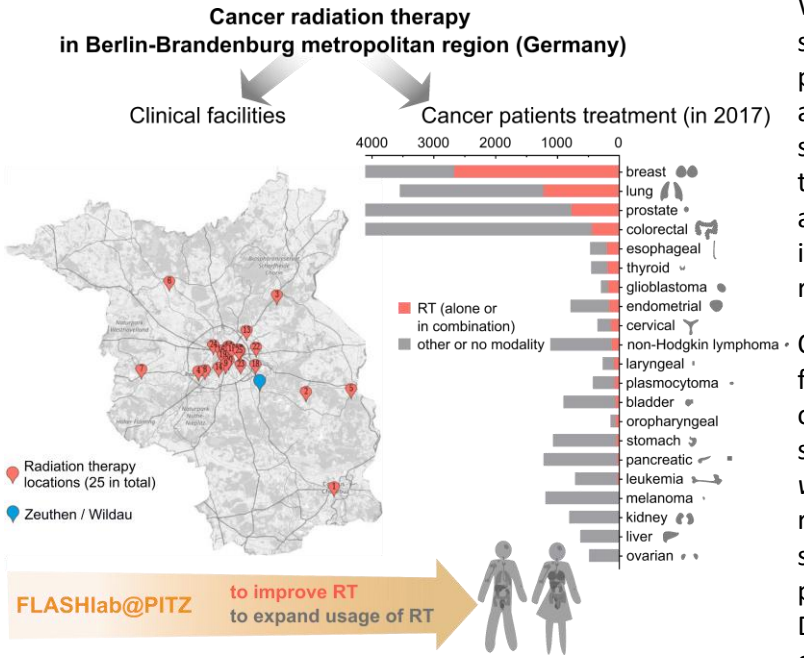
THE BIOMED RESOURCE AT TH WILDAU TO SUPPORT FLASHlab@PITZ

Marcus Frohme[1], Anna Grebinyk[1], Frank Stephan[2]
[1] Technical University of Applied Sciences Wildau (TH Wildau), Germany; [2] Deutsches Elektronen-Synchrotron (DESY) Zeuthen , Germany

The R&D platform for FLASH and very high energy electron (VHEE) radiation therapy and radiation biology as part of the Photo Injector Test facility at DESY in Zeuthen (FLASHlab@PITZ) closely works together with the division Molecular Biotechnology and Functional Genomics at the Technical University Wildau as partner in close vicinity for the biological resources (THWi biomed).

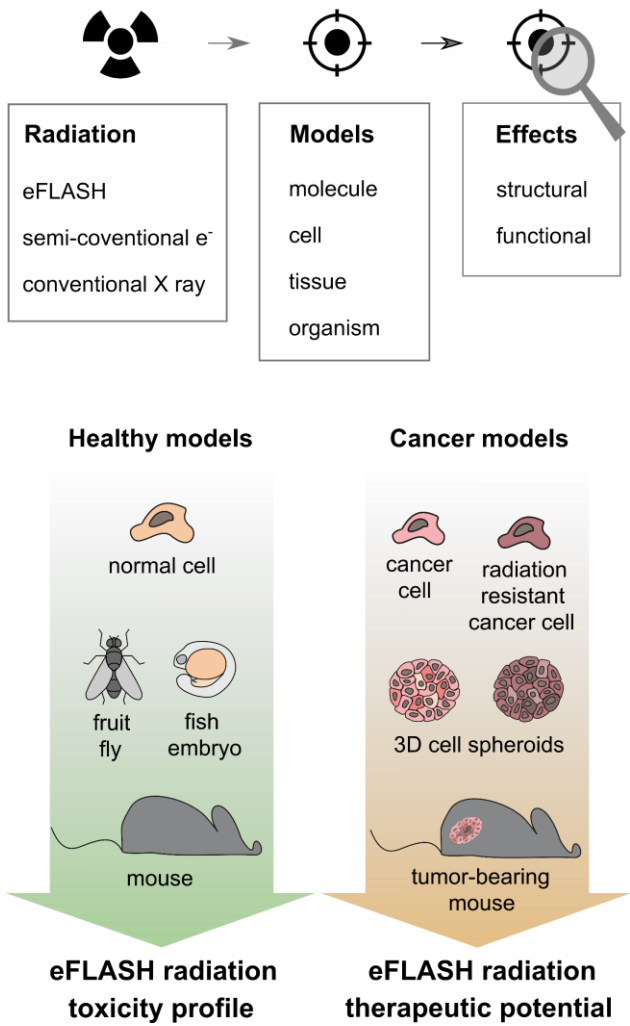
FLASHlab@PITZ aims to establish worldwide unique R&D opportunities for FLASH radiation therapy as a new treatment modality against cancer at ultra high dose irradiation. *THWi biomed* contributes with biomedical knowledge and technology with the far aim to optimize the treatment of different kinds of cancer in the human body. VHEE is part of this endeavor to be able to treat tumors in larger depth.



The facilities in the Berlin-Brandenburg region are shown according to the German Society of Radiation Oncology (DEGRO) e. V. (DEGRO e. V., 2021).
The cancer treatments in Berlin-Brandenburg are shown for the year 2017 according to the report by Klinisches Krebsregister Brandenburg Berlin gGmbH for 91 % of all cancer modalities. "RT (alone or in combination)" means any type of radiation therapy used alone or in the combination with any other therapy (Pflüger et al., 2020).

We expect that besides the scientific impact, this approach will positively impact the local economy, attract qualified employees and specialists, contribute to the training of the medical, scientific and technical personnel, and increase the international reputation of the region.

On the development path from fundamental physics to treatment of tumor patients biomedical studies will cover the *in silico*, *in vitro* and *in vivo* evaluation of radiation effects. In a hierarchical setup, materials (e.g. polymers), phantoms, biological samples (e.g. DNA and biochemical reactions), cellular systems (e.g. cell cultures and organoids), simple organisms (e.g. fruit flies) as well as animal models (e.g. mice) have to be investigated. Two classes of main biological models will be integrated in the research, including healthy and cancer models to allow the evaluation of electronFLASH (eFLASH) toxicity profile and therapeutic potential. A critical requirement towards the understanding includes an *in vivo* biological validation of the eFLASH effect. Naturally in animal experiments 3R strategy, i.e. replace, reduce and refine animal experiments, is followed.



Here furthermore, all stages are accompanied by extensive modelling and simulation experiments. For that, prior to the experiments with mice, the general beam parameters will be optimized and refined with *in silico* simulation and prediction. Furthermore experiments with more simple biological models are set first.

All this will open ground for the fundamental understanding of the FLASH effect. After upgrade of the electron beam from 22 MeV to 250 MeV at PITZ the irradiation of more voluminous samples becomes possible and the experimental parameters have to be adjusted. Potentially animal tumor patients can be integrated in the studies before first clinical studies with humans can be planned.

www.th-wildau.de/molekularbiologie
mfrohme@th-wildau.de

References:
DEGRO e. V. 2021. Abteilungen und Praxen für Strahlentherapien in Deutschland – DEGRO, https://www.degro.org/patienten/kliniken-2/, 2021-11-15 08:05:34.
Pflüger M., Tillack A., Schneider C., Niepmann D., Schauder F., Stötzer U., Kindt B. & Vorreiter G. 2020. Jahresbericht 2019 - Klinisches Krebsregister Brandenburg Berlin, Berichtsjahre 2009–2018. Klinisches Krebsregister für Brandenburg und Berlin gGmbH, 250 pp.