

Research profile for applicants

Name of DKFZ research division/group:	Biomedical Physics in Radiation Oncology (E041)
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Group homepage: <i>Visit this website for further information on current research and recent publications.</i>	https://www.dkfz.de/en/biomedical-physics-in-radiation-oncology

RESEARCH PROFILE AND PROJECT TOPICS

The division was established in 2016, when Prof. Seco moved from the Department of Radiation Oncology at Massachusetts General Hospital in Boston to the DKFZ in Heidelberg to work on new methods and technology for ion beams. The initial focus was two-fold: (1) developing novel imaging technologies to reduce Bragg peak positioning uncertainties during ion-beam radiotherapy, and (2) assessing the radiation biology of reactive oxygen species (ROS) produced during radiation delivery.

In February 2019, Prof. Seco attended a conference organized by the National Physical Laboratory in London, where one of the main topics was FLASH radiation therapy. During this conference, Prof. Seco recognized the importance of FLASH in radiation therapy and decided to investigate the FLASH effect.

In 2021, the group published a breakthrough paper challenging the “oxygen depletion hypothesis” (Jansen J, 2021, Medical Physics, 3982–3990). From that conference onwards, Prof. Seco’s main research gradually transitioned to FLASH, ultimately leading to the discovery of the molecular mechanism of the FLASH effect (Seco J, Patent, Achieving FLASH protection during irradiation using Cu-inhibitor of superoxide dismutase (SOD), patent submitted, February 2023).

Building on this work, the division’s current research integrates both FLASH and Spatially Fractionated Radiation Therapy (SFRT) to explore novel treatment paradigms that maximize tumor control while minimizing normal tissue toxicity. The group is investigating how ultra-high dose rate delivery in FLASH and the spatial modulation of dose in SFRT can be combined or optimized to enhance therapeutic outcomes. This includes studying biological mechanisms, refining treatment delivery technologies, and developing translational strategies aimed at bringing FLASH and SFRT from preclinical studies into clinical practice.



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