ST 3: Radiation Monitoring and Dosimetry

Time: Wednesday 11:00–12:30 Location: ZHG003

ST 3.1 Wed 11:00 ZHG003

Dosimetry for sub-relativistic electrons and their potential use in radiotherapy — •Julian Freier[1], Leon Brückner[1], Stefanie Kraus[1], Julian Litzel[1], Bastian Löhrl[1], Christoph Bert[2], Luitpold Distel[2], and Peter Hommelhoff[1,3] — [1]Department Physik, Friedrich-Alexander-Universität Erlangen-Nürnberg (FAU), 91058 Erlangen — [2]Department Strahlenbiologie, Universitätsklinikum Erlangen, Friedrich-Alexander-Universität Erlangen-Nürnberg (FAU), 91054 Erlangen — [3]Department Physik, Ludwig-Maximilians-Universität München (LMU), 80799 München

The acceleration of electrons based on nanophotonic structures may lead to dice-sized accelerators, emitting electrons with energies in the sub-MeV to MeV regime for potential use in radiotherapy [1,2,3]. Leveraging electron energies in the keV range and their proposed high biological efficiency [4], we present a method for calibrating EBT3 GafChromic films for low-energy electrons to be used in future experiments in biology. The used setup employs an ultrafast electron source, utilizing photoemission from a sharp nano-tip array that enables irradiation of cells with electrons up to 50keV for comparison with x-ray samples. This method allows to estimate the biological impact of such electron radiation on cells. References [1] England, et al., Rev.Mod.Phys.86.4 1337 (2014)[2] Chlouba, Shiloh, Kraus, Brückner, et al. Nature 622, 476 480 (2023) [3] Broaddus, et al. PRL 132, 085001 (2024) [4] Tye, et al, R.Soc. Open Sci.11240898 (2024)

ST 3.2 Wed 11:15 ZHG003

Investigating Regenerating Profiles for TL-Dos Detectors — •Paula Harnisch[1], Kevin Kröninger[1], Jörg Walbersloh[2], and Jens Weingarten[1] — [1]TU Dortmund — [2]MPA NRW

Reliable personal monitoring is essential for occupational radiation exposures. Lately, a thermoluminescence-based monitoring system was developed by MPA Dortmund and TU Dortmund, offering the advantage of reusable detectors. This study systematically examines the effects of different regeneration profiles on the lifetime dose signal and the fading characteristics of TL-DOS detectors.
Regeneration, the process of thermally exciting electrons trapped during radiation exposure, restores the detector to a baseline, signal-free state, making it ready for reuse. Traditionally, detectors are briefly heated to a high temperature post-readout, but recent findings suggest this method may not fully reset the signal. To address this, alternative regeneration profiles are being explored, with promising potential to reduce or even eliminate signal fading in TL-DOS detectors.
This presentation will provide an introduction to TL-DOS detector functionality and an overview of the various regeneration profiles tested, highlighting advancements toward improved detector reliability and longevity.

ST 3.3 Wed 11:30 ZHG003

Development of an H*(10) neutron dosimeter based on the TL-DOS for neutron and gamma dose measurements at TRIGA reactor Mainz — •Andria Michael[1], Kevin Kröninger[1], Marion Schulte[2], Jörg Walbersloh[2], and Jens Weingarten[1] — [1]University of Dortmund, Dortmund, Germany — [2]Materials Testing Office, Dortmund, Germany

The PhyBioN project, involving the TU Dortmund, Materialprüfungsamt Nordrhein-Westfalen, and University Medical Center Mainz, aims to address critical gaps in neutron radiation research by providing precise neutron dosimetry and improving our understanding of the radiobiological effects of neutron exposure.

The TRIGA Mark II research reactor at the University of Mainz, equipped with a graphite thermal column, provides a source of thermalized neutrons suitable for the study of radiobiological effects of neutron exposure. For this study, the neutron field in the thermal column must be characterized. An ambient neutron dosimeter, H*(10), is being developed, specifically tailored for the TRIGA Mainz reactor. The dosimeter is based on the TL-DOS, which uses the thermoluminescence (TL) effect for personnel monitoring in photon fields. The design and optimization of the neutron dosimeter are conducted using Monte Carlo simulations. The dosimeter response is characterized using neutron reference fields and correction factors for angular and energy dependencies are defined. This talk will present the status of the dosimeter development and the measurements obtained at the TRIGA reactor.

ST 3.4 Wed 11:45 ZHG003

Development of an electronic read out board for analog and digital data acquisition of a semiconductor neutron detector — •Janina Bolles, Kevin Kröninger, Jens Weingarten, and Alina Landmann — TU Dortmund University

Neutrons are biological highly effective particles which leads to an increased health risk in work and research spaces where neutron or neutron/photon mixed fields are present. This includes medical facilities like nuklear and radiation medicin, nuclear reactor facilities and also the field of aeronautics and astronautics. Therefore, a proper neutron dosimetry is highly relevant to ensure radiation protection in such working areas. Still, the biological consequences and dosimetry of neutrons are afflicted by rather large uncertainties due to the complexity of neutron interactions. This work contributes to the optimization of measurement methods to estimate the neutron flux by developing a semiconductor detector for real time measurements. For the neutron detection a silicon diode with a boron carbide converter was designed previously within this project. Now, for a more compact read out handling and a faster data acquisition a first prototype of an electronic read out board was developed including an integrating amplifier and a simple pulse shaper. For future board versions more noise filtering components and a digitial read out system are intended. We will present first results of the neutron detection with the improved read out design.

ST 3.5 Wed 12:00 ZHG003

Update on Radiation Measurements on the International Space Station with the RadMap Telescope — •Martin J. Losekamm[1,2], Thomas Berger[3], Liesa Eckert[4], Luise Meyer-Hetling[1,2], Peter Hinderberger[1,2], Stephan Paul[1,2], and Thomas Pöschl[5] — [1]Technical University of Munich, School of Natural Sciences — [2]Excellence Cluster ORIGINS — [3]German Aerospace Center, Institute of Aerospace Medicine — [4]Technical University of Munich, School of Engineering and Design — [5]European Organization for Nuclear Research (CERN)

The RadMap Telescope is a radiation monitor with two sensors — a tracking calorimeter made from scintillating-plastic fibers and a silicon-diode dosimeter — operating on the International Space Station. In this contribution, we give an update on the current status of the experiment and the ongoing analysis of data gathered in three modules of the station. We also present a selection of preliminary results. Our work is funded by the German Research Foundation (DFG, project number 414049180) and under Germany's Excellence Strategy – EXC2094 – 390783311.

ST 3.6 Wed 12:15 ZHG003

Reconstructing Particle Tracks with the RadMap Telescope — •Luise Meyer-Hetling[1], Liesa Eckert[2], Peter Hinderberger[1], Martin J. Losekamm[1], Stephan Paul[1], and Thomas Pöschl[3] — [1]School of Natural Sciences, Technical University of Munich, Garching, Germany — [2]School of Engineering and Design, Technical University of Munich, Ottobrunn, Germany — [3]CERN, Geneva, Switzerland

The RadMap Telescope is a compact multi-purpose radiation detector developed to provide near-real-time monitoring of the radiation aboard crewed and uncrewed spacecraft. We operated a first prototype on the International Space Station (ISS) for an in-orbit demonstration of the instrument's capabilities. Its main sensor consists of a stack of scintillating-plastic fibers whose arrangement allows the three-dimensional tracking and identification of cosmic-ray nuclei by reconstruction of their energy-loss profiles. In this contribution, we give an overview of the current status of the track reconstruction. We describe our neural-network-based reconstruction methods and present the performance of the trained convolutional network on simulated detector data. We also discuss the progress of the analysis of real data gathered on the ISS and the applied preliminary tracking methods. Our work is funded by the German Research Foundation (DFG, project number 414049180) and under Germany's Excellence Strategy - EXC2094 - 390783311.