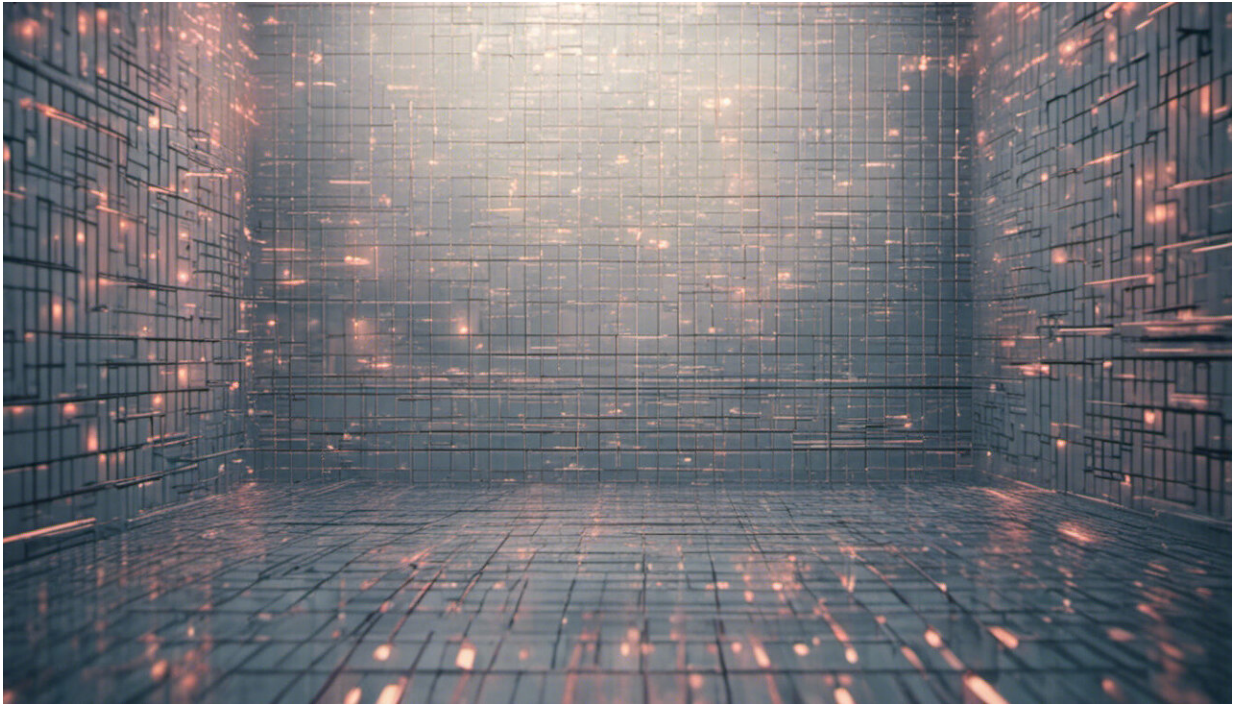


New approach to particle therapy dosimetry

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Credit: AI-generated image ([disclaimer](#))

Researchers at the National Physical Laboratory (NPL), in collaboration with EMRP partners, are working towards a universal approach to particle beam therapy dosimetry.

The increasing incidence of cancer as a leading cause of mortality worldwide is driving the development of advanced [radiotherapy](#) techniques, such as particle beam therapy, for the treatment of

aggressive tumours. Compared to X-rays, [particle beam](#) therapies exhibit superior dose characteristics, delivering similar radiation doses to the targeted area while sparing surrounding healthy tissue.

For proton and carbon ion beam radiotherapy, the administered dose is quantified in terms of the product of the absorbed dose to water and a biological weighting factor. This weighting factor depends on both physical factors, relating to the particle type and energy, and [biological processes](#), relating to the response of cells in the body to radiation.

Currently, various different (and often inconsistent) approaches are used to determine this biological weighting factor, potentially leading to confusion in interpretation and possible risks to patients. In order to counter this problem and aid comparison of treatment efficacies for different radiotherapy techniques, a new universal approach for the use of weighting factors has been proposed.

The EMRP-funded BioQUART project aims to facilitate this by establishing new dosimetric quantities which allow the physical components of the biological weighting factor to be separated from the biological ones.

The team of researchers, from National Measurement Institutes and Designated Institutes across Europe, are developing measurement and simulation techniques to determine the physical properties of ionising particle track structure over a range of length scales. The particle track structure is the way charged particles from radiotherapy interact as they pass through human tissue, and it depends on properties such as the velocity and charge of the particles, as well as the characteristics of the target cells in the patient.

By modelling the biological response of tissue to radiation, the team are investigating how the track structure characteristics correlate with the

biological effects at the level of DNA molecules (~2 nm) and at the cellular level (~10 μm). This will eventually lead to the definition of new dosimetric parameters relating particle track structure to the biological effectiveness of proton and ion beam therapy.

NPL's Hugo Palmans, Sebastian Galer, Giuseppe Schettino and Peter Sharpe recently described the BioQUART project and the future of biologically relevant dosimetry in a review paper published in the *British Journal of Radiology*.

More information: "Future development of biologically relevant dosimetry." DOI: [dx.doi.org/10.1259/bjr.20140392](https://doi.org/10.1259/bjr.20140392)

Provided by National Physical Laboratory

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