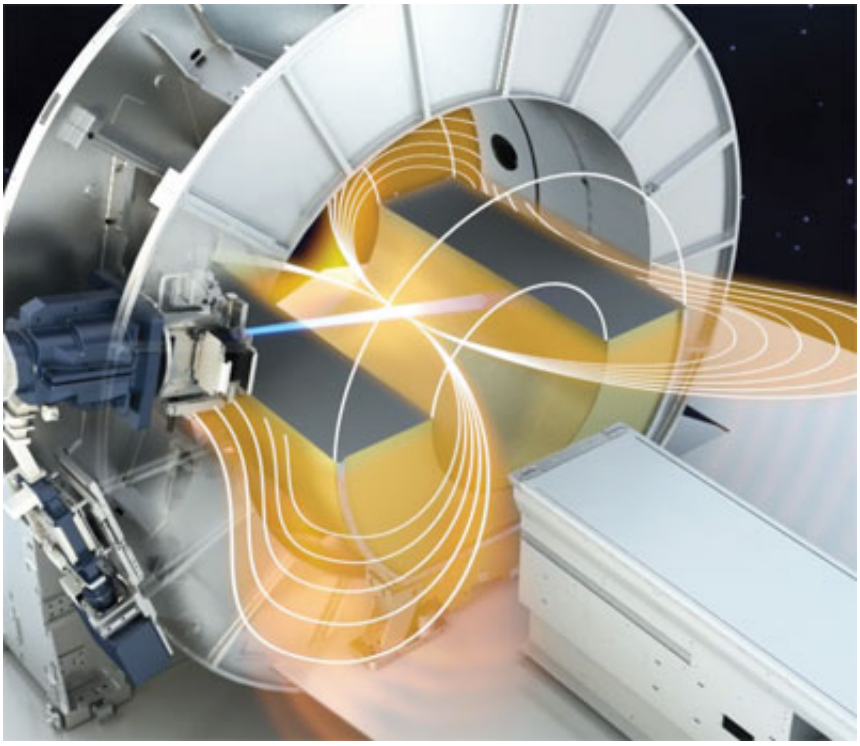
# New tests provide assurance to MRI-guided radiotherapy

September 16 2015



Representation of an MRI linear accelerator, a proposed system for radiotherapy treatment. Credit: Elekta

Researchers from the National Physical Laboratory (NPL), VSL and the University of Michigan have taken a crucial step towards accurate dosimetry for MRI-guided radiotherapy - a state-of-the-art cancer treatment.

Radiotherapy treatment focuses beams of ionising radiation on a tumour to kill cancerous cells. New MRI-guided technology provides real-time images during treatment, in contrast to current X-ray techniques, and offers more-detailed, higher-contrast images for the identification of tumours and soft tissues. This boosts tumour targeting accuracy, reducing side-effects and increasing survival rates.

The first clinical prototypes are expected in 2016, but before MRI-guided radiotherapy can be widely adopted, we need to understand the effect of the magnetic fields involved in MRI imaging on the radiation dose received by a patient. Early studies showed that the presence of a magnetic field can lead to measurement errors in the absorbed radiation dose of around 10%, which could impact patient safety and treatment efficacy.

Monte Carlo simulations are a type of computational method used to model radiation transport and play an important role in the calibration of radiotherapy machines. These simulations are benchmarked before use by the Fano test, developed by NPL consultant Vere Smyth in the 1980s - a Monte Carlo code must pass the Fano test to assure accurate results. But recent work has shown that Fano's theorem, on which the Fano test is based, does not always hold in the presence of external magnetic fields.

A team of researchers from NPL, VSL and the University of Michigan have adapted Fano's theorem and designed new Fano tests which can be applied in the presence of magnetic fields. This will allow MRI-guided radiotherapy users to validate Monte Carlo simulations and increase the accuracy with which machines are calibrated, ensuring safe, effective treatment with the new technology. The results are already being used by at least four major research groups.

**More information:** "Reference dosimetry in the presence of magnetic

fields: conditions to validate Monte Carlo simulations." *Physics in Medicine and Biology*, Volume 60, Number 17 Published 13 August 2015. DOI: 10.1088/0031-9155/60/17/6639