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X-Ray Fluorescence Imaging with a Laser-Wakefield Thomson X-Ray Source

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X-Ray fluorescence imaging (XFI) is a promising, new imaging method for in vivo localisation of low amounts of functionalised gold- nanoparticles (GNPs), enabling early cancer diagnostics and pharma- cokinetic tracking studies. At the moment, XFI is not applicable for human-scales, since the modality suffers from an intrinsic background, mainly caused by multiple Compton scattering processes. However, this limitation can be overcome by the use of highly brilliant X-Rays combined with advanced filtering schemes. Recent developments in high power laser technology offer the potential to develop very compact X-Ray sources by combining laser-wakefield acceleration and Thomson scattering. Such a source is capable of providing high flux X-Ray beams in the desired energy range around 100 keV, an energy that is high enough to penetrate through the body and is absorbed by GNPs. Further advantages are the tunability and the all-optical realisation of the source, making it compact enough to transfer XFI into clinical practice. To measure the outcoming X-Rays, detectors with high effiency and energy resolution at the desired energies are needed, ideally pixelated, spectroscopic devices, that have been tested beforehand. First results of a proof of principle experiment, based on theoretical and simulation work, are presented.

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