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(G*) (POS-65) A Monte Carlo simulation of the feasibility of detecting bone tungsten using X-ray fluorescence

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Title: A Monte Carlo simulation of the feasibility of detecting bone tungsten using X-ray fluorescence
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An increased number of studies are introducing use of tungsten in medicine in the form of sodium tungstate as an antidiabetic medicine t[1], and tungsten nanoparticles as a contrast agent for CT scanning [2] or enhancers of cancer therapy [3]. On the other side, human exposure to tungsten could lead to adverse health effects, including tumour promotion, pulmonary dysfunction, or immune dysfunction [4]. Therefore, it is timely to develop a diagnostic tool to monitor medical exposure to tungsten.
To address this need, we propose developing a robust non-invasive technique to detect bone tungsten in-vivo based on the x-ray fluorescence (XRF). A HPGe detector along with homogenous bone phantoms were modeled using Monte Carlo software TOPAS, 3.3 version. A cylindrical shape bone phantom constituted of percent mass as Ca10(PO4)6(OH)2 [5] (2.7 cm diameter and 8 cm height) were modeled simulating human tibia measurements. The simulation model generated XRF spectra using 109 particles, which were then analyzed to decide on the best excitation source and geometry to optimize the detection limit
The TOPAS simulation showed that Cd-109 is a potential excitation source to detect tungsten in tibia with a minimum detection limit equal to 0.3 ppm W/Ca for 180-degree geometry.

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