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BOOK OF ABSTRACT

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2000 eV), opens new possibilities to study the ultrafast dynamics of processes exploiting the capability of Hard X-ray Photoelectron Spectroscopy (HAXPES) to measure core-level spectra of elements with bulk sensitivity.
In order to detect the intense bursts of high kinetic energy electrons generated by the X-ray pulses with an energy resolution comparable to that offered by the existing category of electron analysers, a new class of spectrometers also able to discriminate between electron bunches generated by consecutive photon pulses must be designed. A natural choice may be that of time-of-flight (TOF) spectrometers, which require a time reference in order to measure kinetic energies.
We present a characterisation of two different TOF spectrometers, namely one based on a standard retarding cylindrical lens and one based on the spherical reflector geometry[1]. SIMION® software has been used in order to evaluate electron trajectories of high kinetic energy electrons (5000 – 10000 eV) and extract transmission properties, angular acceptance and energy resolution. It resulted that while the linear system is able to accept a larger solid angle (cone aperture ±7° for the linear TOF and ±2° for the spherical reflector), the spherical mirror offers a better energy resolution (about 60 meV at 5000 eV kinetic energy compared to 1.5 eV at 10250 eV for the linear lens). This energy resolution values are obtained considering only the time resolution of the detector (such as a microchannel plate, MCP). Both analysers are capable to transmit a range of kinetic energies with a transmission above 90% wide enough to measure at the same time core level spectra from most elements (110 eV for the linear lens and 40 eV for the spherical reflector). Furthermore, we proved that both instruments are able to discriminate between two consecutive electron bunches having a temporal separation of about 220 ns as in the case of the European X-ray Free Electron Laser (EXFEL), which is currently under construction at Hamburg.

[1] V. Lollobrigida *et al*., in preparation

#P106 - Alanine/ESR dosimetry for electron Intra-Operative RadioTherapy: output factor measurements and Monte Carlo-GEANT4 simulations for IORT mobile dedicate accelerator

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Intra-operative radiation therapy (IORT) is a treatment modality where a single high dose of radiation is delivered directly to the tumor bed or to the exposed tumor during the surgical intervention, while avoiding surrounding dose-limiting structures. Mobile electron linear accelerators dedicated to IORT have been manufactured which have promoted a local large diffusion of this radiotherapy modality.
For breast irradiation, a single fraction of 21 Gy delivered on the target volume during the surgical procedure is equivalent to the total dosage (60 Gy) usually delivered during 30 external fractionated radiotherapy at 2Gy/fraction. Alternatively, a single dose of 10 Gy can be administered as Intra-Operative Boost to the tumor bed, followed by hypo-fractionated or conventional external beam whole breast radiotherapy.
This work reports a comparison between the response of alanine and Markus ionization chamber carried out for measurements of the output factors (OF) of electron beams produced by a linear accelerator used for IORT. Output factors (OF) for conventional high-energy electron beams are normally measured using ionization chamber according to international dosimetry protocols. However, the electron beams used in IORT have characteristics of dose per pulse, energy spectrum and angular distribution quite different from beams usually used in external radiotherapy, so the direct application of international dosimetry protocols may introduce additional uncertainties in dosimetric determinations. The high dose per pulse could lead to an inaccuracy in dose measurements with ionization chamber, due to overestimation of ks recombination factor. Furthermore, the electron fields obtained with IORT-dedicated applicators have a wider energy spectrum and a wider angular distribution than the conventional fields, due to the presence of electrons scattered by the applicator's wall. For this reason, a dosimetric system should be characterized by a minimum dependence from the beam energy and from angle of incidence of electrons. This become particularly critical for small and bevelled applicators. All of these reasons lead to investigate the use of detectors different from the ionization chamber for measuring the OFs.
Furthermore, the complete characterization of the radiation field is achieved also by the use of Monte Carlo Geant4 simulations which allows to obtain detailed information on dose distributions. We compared the output factors obtained by means of alanine dosimeters and Markus ionization chamber. The results are characterized by a good agreement of response of alanine pellets and Markus ionization chamber and Monte Carlo results (within about 3%) for both flat and bevelled applicators.

#P107 - N-doped TiO2 thin films photocatalytic applications

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