CALIBRATION OF RADIATION SURVEY METERS USING THE BRAKING RAYS OF AN ELECTRON BEAM

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CERAP has developed an innovative method to calibrate radiation survey meters (fig. 1) through large ranges of energy and dose-rate [1]. It consists in using the braking rays produced by an electron beam as calibration source instead of a high activity radioactive source [2].
The production rate and reliability of the process are much better than the standard method. It is also safer for workers and for environment, and the shape of the calibration X-spectrum is fairly representative of the typical one experienced in nuclear power plants, as shown on figure 2.

figure 1. Some examples of radiation survey meters

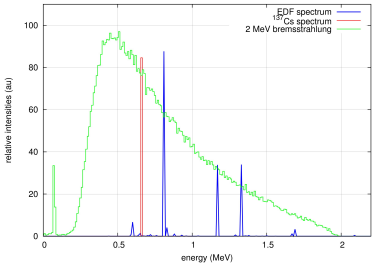

figure 2. Spectra of calibration sources and typical gamma spectrum found on nuclear power plants

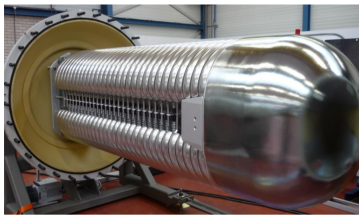

figure 3. HVEE Singletron accelerator – electron beam up to 3,5 MeV and 1 mA

Braking rays are generated by interaction of an electron beam in a W target. The beam is delivered by a HVEE Singletron accelerator [3] which allows to produce mono-kinetic electrons with an energy set to a value between 200 keV and 3,5 MeV. An other strong chalenge comes from the large range of dose rate through which we have to calibrate radiation survey meters: it goes from few 0,1 µSv/h to about 100 Sv/h. It is allowed by the wide range of currents, from 10 pA to 1 mA!

To summarize, we will have a HVEE Singletron accelerator (fig. 3) which will produce mono-kinetic electrons with an energy range going from 200 keV to 3,5 MeV and a current from 10 pA to 1 mA and a removable target allowing to irradiate setups either with electrons or X-rays. Furthermore, as the setup will not be full time used, it will be available for many other applications and research in domains of irradiation of polymers, electronics, composite materials...

References

[1] *Vérification de l'étalonnage de radiamètres au moyen d'un accélérateur d'électrons*, A. Chapon, J.-M. Bordy, SFRP (2015).
[2] Reference radiation fields for radiation protection – Definitions and fundamental concepts, ISO 29661.
[3] Singletron accelerator systems, High Voltage Engineering.