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Precision Measurements of Beta Spectra using Metallic Magnetic Calorimeters within the European Metrology Research Project MetroBeta

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MetroBeta is a European metrology research project aiming at the improvement of the knowledge of the shapes of beta spectra, both in terms of theoretical calculation and measurement. The most prominent experimental work package deals with the measurement of the spectrum shapes of several beta emitters by means of metallic magnetic calorimeters (MMCs) with the beta emitter embedded in the absorber. This approach has in the past proven to be among the best beta spectrometry techniques, in particular for low energy beta transitions.
New MMC chips have been designed and optimized for five different absorber heat capacities, enabling the measurement of beta spectra with Q values ranging from few tens of keV up to ~ 1 MeV. Four beta spectra have been measured with high energy resolution and statistics up to 10E7 counts within the project, three from pure beta emitters (C-14, Q = 156.5 keV; Tc-99, Q = 293.8 keV; Cl-36, Q = 709.5 keV) and one having a small decay branch to an excited level at 21.5 keV of its daughter (Sm-151, Q = 76.3 keV).
This contribution focuses mainly on the measurement of Cl-36. Whereas for the lower energy spectra of Sm-151, C-14 and Tc-99 simple gold or silver absorbers can be used, spectra with Q values higher than ~ 500 keV will be distorted by the escape of bremsstrahlung from the absorber. This is the case of Cl-36. Monte Carlo simulations indicate that composite absorbers with the beta emitter embedded in a low atomic number material (Cu) and an outer layer of high atomic number (Au) can minimize this source of spectrum distortion. The spectrum of Cl-36 measured using both gold and composite copper-gold absorbers will be presented and compared with the corresponding Monte Carlo simulations. The spectra of the other nuclides will also be shown.

Less than 5 years of experience since completion of Ph.D

N

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N

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