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#04-185 Calibration of CFUL01 fission chambers in the standard neutron fields of BR1 reactor at SCK CEN

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Recent subcritical VENUS-F experiments showed that fission chambers with a threshold deposit like U-238 can essentially improve the on-line sub-criticality monitoring with the beam interruption method, which is currently supposed to be the main method for the ADS MYRRHA. To suppress the uncertainty caused by fissions in the U-235 impurities, the fraction of U-235 in the U deposit should be accurately known. Three PHOTONIS CFUL01 type fission chambers with a high purity of U-238 were purchased for sub-critical experiments in the VENUS-F reactor. To verify the nominal purity (U-235 content) of the deposits of these fission chambers, the effective U-235 masses were measured in 2017 in the empty cavity of the BR1 reactor with a well-known thermal neutron spectrum. The measured effective mass was determined as the mass of the isotope corresponding to a certain discrimination level and is obviously expected to be smaller than the total mass of the isotope, especially for heavy, thick deposits, which is the case for the fission chambers under investigation. It turned out that the measured effective U-235 mass in two fission chambers is lower than the nominal (as it should be), but this is not the case for the U-235 content in the third fission chamber. To obtain the correct U-238 content in these three FCs, the effective U-238 mass was measured in the well-known fast spectrum of the MARK-III convertor in the BR1 reactor. Finally, the isotopic composition was obtained by dividing the U-238 effective mass (measured in MARK-III) by the U-235 effective mass (measured in the empty cavity) at the same discrimination levels. It was found that the purity of two CFUL01 FCs is in agreement with the values declared in the certificates but it is not the case for the third fission chamber. The statistical and systematic uncertainties and corrections applied in the data analysis are discussed. The developed procedure using the BR1 standard irradiation fields can be of interest for calibration and impurity determination of large fission chambers.

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