

Validation of the code TDCRPy against the code TDCR17

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1. Introduction

The code TDCR17 was developed in Fortran by Philippe Cassette at the LNE-LNHB to calculate the efficiency of a TDCR system. It was used by the LNE-LNHB and other laboratories in key comparisons such as in the CCRI(II)-K2.H-3(2018). The BIPM developed the python code TDCRPy to estimating detection efficiency of TDCR measurement. The aim of this study is to test the BIPM code against the TDCR17 code for pure beta radionuclides planned to be in the scope of the ESIR.

2. Measurement data and results

2.1. ^{14}C

Table 1: Measurement data and results - $kB = 0.008 \text{ cm} \cdot \text{MeV}^{-1}$

Source	<i>TDCR</i>	ϵ_D TDCR17	ϵ_D TDCRPy	error
1	0.9	85.37 %	91.09 %	%
2	0.8	72.88 %	83.64 %	%
3	0.7	61.22 %	76.31 %	%
4	0.6	50.09 %	67.84 %	%
5	0.5	39.35 %	58.83 %	%
6	0.4	29.00 %	48.17 %	%
7	0.3	19.19 %	35.90 %	%

Table 2: Measurement data and results - $kB = 0.01 \text{ cm} \cdot \text{MeV}^{-1}$

Source	$TDCR$	ϵ_D TDCR17	ϵ_D TDCRPy	error
1	0.9	85.17 %	91.12 %	%
2	0.8	72.60 %	83.38 %	%
3	0.7	60.92 %	75.86 %	%
4	0.6	49.80 %	67.52 %	%
5	0.5	39.09 %	58.31 %	%
6	0.4	28.79 %	47.75 %	%
7	0.3	19.03 %	35.43 %	%

Table 3: Measurement data and results - $kB = 0.012 \text{ cm} \cdot \text{MeV}^{-1}$

Source	$TDCR$	ϵ_D TDCR17	ϵ_D TDCRPy	error
1	0.9	84.98 %	90.80 %	%
2	0.8	72.35 %	83.20 %	%
3	0.7	60.65 %	75.53 %	%
4	0.6	49.53 %	67.37 %	%
5	0.5	38.85 %	57.88 %	%
6	0.4	28.60 %	47.35 %	%
7	0.3	18.89 %	34.67 %	%

2.2. ^{63}Ni

Table 4: Measurement data and results - $kB = 0.008 \text{ cm} \cdot \text{MeV}^{-1}$

Source	$TDCR$	ϵ_D TDCR17	ϵ_D TDCRPy	error
1	0.9	89.34 %	89.38 %	+0.04 %
2	0.8	79.86 %	79.79 %	-0.07 %
3	0.7	70.80 %	70.70 %	-0.10 %
4	0.6	61.68 %	61.28 %	-0.40 %
5	0.5	52.12 %	51.42 %	-0.70 %
6	0.4	41.78 %	41.01 %	-0.77 %
7	0.3	30.46 %	29.88 %	-0.58 %

Table 5: Measurement data and results - $kB = 0.01 \text{ cm} \cdot \text{MeV}^{-1}$

Source	$TDCR$	ϵ_D TDCR17	ϵ_D TDCRPy	error
1	0.9	89.03 %	88.98 %	-0.05 %
2	0.8	79.35 %	79.54 %	+0.20 %
3	0.7	70.19 %	70.27 %	+0.08 %
4	0.6	61.04 %	60.69 %	-0.35 %
5	0.5	51.49 %	50.78 %	-0.71 %
6	0.4	41.22 %	40.24 %	-0.98 %
7	0.3	30.02 %	29.12 %	-0.90 %

Table 6: Measurement data and results - $kB = 0.012 \text{ cm} \cdot \text{MeV}^{-1}$

Source	$TDCR$	ϵ_D TDCR17	ϵ_D TDCRPy	error
1	0.9	88.75 %	88.81 %	+0.06 %
2	0.8	79.91 %	79.07 %	-0.84 %
3	0.7	69.66 %	69.76 %	+0.10 %
4	0.6	60.47 %	60.27 %	-0.20 %
5	0.5	50.94 %	50.30 %	-0.64 %
6	0.4	40.73 %	39.81 %	-0.92 %
7	0.3	29.63 %	28.78 %	-0.85 %