Accuracy of measurements with Hidex 300 SL according to DIN ISO 5725, demonstrated with repeat measurements[1]

exemplary investigation with a standard Hidex 300 SL

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In this work investigations regarding the accuracy of measurements with Hidex 300 SL system had been performed.

The essential quality criterion for a measurement procedure is the accuracy of a measurement; the accuracy of a measurement itself is characterized with the additional criteria according to DINISO 5725 „bias of a measurement“ and „repeatability of measurement“.

Characteristic for the „bias of a measurement“ is the mean relative deviation of a given value; characteristic for the „repeatability of measurement“ are the standard deviation of the relative deviation referred to the given value **and** the standard deviation referred to the mean value of the measured given values. The „bias of a measurement“ gives information, if a result is correct or false, the „repeatability of measurement“ gives information, how much the results scatter.

This paper only deals with the „repeatability of measurement“.

Measurements

The measurements have been done with a standard Hidex 300 SL from serial production in Hidex-Oy, Turku (Finland). An unquenched C-14 standard in 20 ml glas vial was used, activity of the standard was 98.693 DPM = 1645 Bq ± 16 Bq. The sample first was made 2 hour dark adaptation, then it was measured with 2 hour measurement time for 24 hour period (12 measurements). The efficiency has been determined previous with ε=0,975 (97,5 %).

[1] In principle these measurements can be done with any Hidex 300 SL

cpm of the measurments 11 measurements, each 2 hours
96336.17
96309.19
96276.02
96212.53
96244.51
96185.48
96140.78
96193.53
96183.24
96220.76
96180.32

Table 1: Results

Determination of „repeatability of measurement“

Characteristic for the „repeatability of measurement“ are the standard deviation s_B of the relative deviation referred to the given value **and** the standard deviation s_A referred to the mean value $\overline{A}$ of the n measured given values.

The „repeatability of measurement“ is sufficient, if for the standard deviation s_B of the relative deviation $B_{r,i}$ referred to the given value **and** for the standard deviation s_A referred to the mean value $\overline{A}$ of the n measured given values the following criteria are fulfilled:

$$s_B = \sqrt{\frac{1}{n-1} \bullet \sum_{i=1}^{n} (B_{rj} - B_r)^2} \leq 0{,}4 \qquad (3)$$

and

$$s_A = \sqrt{\frac{1}{n-1} \bullet \sum_{i=1}^{n} (\frac{A_i}{\overline{A}} - 1)^2} \leq 0{,}4 \qquad (4)$$

and

$$\overline{A} = \frac{1}{n} \bullet \sum_{i=1}^{n} A_i = \text{Average} \qquad (5)$$

with: A_I activity of the repeat measurement i of the sample;

A true reference value of the activity

$$B_r = \frac{1}{n} \bullet \sum_{i=1}^{n} B_{rj} \qquad (2)$$

= mean relative deviation

$$B_{rj} = \frac{A_i}{A_a} - 1$$

= relative deviation

N = number of the repeats ($n \geq 5$), here: 10

Result regarding these formulae and table 1:

B_r: - 0,25 < **0,0006** < 0,5
s_B = 0,0009 $\leq$ 0,4
s_A= 0,0007 $\leq$ 0,4

Résumé:

Hidex 300 SL fulfills the criterion "Determination of repeatability of measurement" according to DINISO 5725.

The stability of counting during long-term measurements is excellent; the deviation of counting has been determined with <0,1 %.

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