

NPL REPORT IR 32

**Environmental Radioactivity  
Proficiency Test Exercise 2013**

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## Environmental Radioactivity Proficiency Test Exercise<sup>†</sup> 2013

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### ABSTRACT

The results of NPL's nineteenth Environmental Radioactivity Proficiency Test Exercise are reported. Eight different sample types were offered: an aqueous mixture of five alpha emitters (designated 'AL'), a second aqueous mixture of five alpha emitters ('AH'), an aqueous mixture of three beta emitters ('B1'), an second aqueous beta mixture containing four beta emitters ('B2'), an aqueous mixture of four gamma emitters ('GL'), a second aqueous mixture of four gamma emitters ('GH'), a peat sample containing four radionuclides ('P') and a sandy soil sample containing four radionuclides ('S'). A total of 721 results were submitted; 78 % of the results were in agreement with the Assigned Values.

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<sup>†</sup> NPL is accredited to ISO/CASCO 17043:2010 (Conformity Assessment – General Requirements for Proficiency Testing) for this PTE scheme

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Approved on behalf of NPLML by Professor Patrick Regan, Science Area Leader,  
Radioactivity Group

**Assigned Values**

<b>Nuclide (AH)</b>	<b>Assigned Value (Bq g<sup>-1</sup>)</b>
<sup>226</sup> Ra	1.630 ± 0.044 (± 2.6 %)
<sup>237</sup> Np	15.12 ± 0.32 (± 2.0 %)
<sup>238</sup> Pu	16.77 ± 0.12 (± 0.8 %)
<sup>241</sup> Am	5.010 ± 0.034 (± 0.8 %)
<sup>244</sup> Cm	15.13 ± 0.12 (± 0.8 %)
<b>Nuclide (AL)</b>	<b>Assigned Value (Bq kg<sup>-1</sup>)</b>
<sup>232</sup> Th	1.551 ± 0.032 (± 2.0 %)
<sup>234</sup> U	19.3 ± 0.6 (± 2.8 %)
<sup>235</sup> U	0.921 ± 0.024 (± 2.6 %)
<sup>238</sup> U	19.3 ± 0.6 (± 2.8 %)
<sup>239</sup> Pu	1.332 ± 0.012 (± 0.8 %)
<b>Nuclide (B1)</b>	<b>Assigned Value (Bq g<sup>-1</sup>)</b>
<sup>3</sup> H	1.026 ± 0.014 (± 1.4 %)
<sup>14</sup> C	1.032 ± 0.010 (± 1.0 %)
<sup>99</sup> Tc	0.1478 ± 0.0026 (± 1.8 %)
<b>Nuclide (B2)</b>	<b>Assigned Value (Bq g<sup>-1</sup>)</b>
<sup>3</sup> H	1.051 ± 0.016 (± 1.4 %)
<sup>63</sup> Ni	1.650 ± 0.034 (± 2.0 %)
<sup>90</sup> Sr	0.4746 ± 0.0020 (± 0.42 %)
<sup>241</sup> Pu	0.957 ± 0.022 (± 2.2 %)
<b>Nuclide (GH)</b>	<b>Assigned Value (Bq g<sup>-1</sup>)</b>
<sup>60</sup> Co	11.06 ± 0.06 (± 0.6 %)
<sup>133</sup> Ba	12.98 ± 0.20 (± 1.6 %)
<sup>134</sup> Cs	1.915 ± 0.026 (± 1.4 %)
<sup>137</sup> Cs	8.10 ± 0.12 (± 1.4 %)
<b>Nuclide (GL)</b>	<b>Assigned Value (Bq kg<sup>-1</sup>)</b>
<sup>60</sup> Co	13.23 ± 0.22 (± 1.6 %)
<sup>134</sup> Cs	3.42 ± 0.06 (± 1.6 %)
<sup>137</sup> Cs	1.766 ± 0.032 (± 1.8 %)
<sup>152</sup> Eu	21.9 ± 0.8 (± 3.6 %)

**UNCERTAINTIES**

The reported expanded uncertainty is based on a standard uncertainty multiplied by a coverage factor  $k = 2$ , providing a coverage probability of approximately 95 %. The uncertainty evaluation has been carried out in accordance with UKAS requirements.



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## 1. SUMMARY

This environmental radioactivity Proficiency Test Exercise (PTE) was the nineteenth in a series of such exercises run by NPL over the last 25 years. The exercises help analysts to identify measurement problems and also support UKAS accreditations in this area, and they are run on an annual basis by NPL. A range of sample types have been made available over the course of these exercises; these have been mostly aqueous in nature, although in recent years solid samples have been included.

Eight sample types were made available for analysis in the 2013 PTE:

- (i) **AH:** a 'high-level' mixture of five  $\alpha$ -emitting radionuclides  
20 g of dilute nitric acid (1 – 20 Bq g<sup>-1</sup> per radionuclide)
- (ii) **AL:** a 'low-level' mixture of five  $\alpha$ -emitting radionuclides  
500 g of dilute nitric acid (1 – 20 Bq kg<sup>-1</sup> per radionuclide)
- (iii) **B1:** a mixture of three  $\beta$ -emitting radionuclides  
500 g of very dilute NaOH solution (0.1 – 2 Bq g<sup>-1</sup> per radionuclide)
- (iv) **B2:** a mixture of four  $\beta$ -emitting radionuclides  
500 g of dilute nitric acid (0.1 – 2 Bq g<sup>-1</sup> per radionuclide)
- (v) **GH:** a 'high-level' mixture of four  $\gamma$ -emitting radionuclides  
100 g of dilute nitric acid (1 – 20 Bq g<sup>-1</sup> per radionuclide)
- (vi) **GL:** a 'low-level' mixture of four  $\gamma$ -emitting radionuclides  
500 g of dilute nitric acid (1 – 30 Bq kg<sup>-1</sup> per radionuclide)
- (vii) **P:** a peat sample containing four radionuclides  
100 g (1 – 20 Bq g<sup>-1</sup> per radionuclide)
- (viii) **S:** a sandy soil sample containing four radionuclides  
100 g (0.1 – 5 Bq g<sup>-1</sup> per radionuclide)

As in previous years, the main objective was to assess the performance of the participating laboratories. This required the participants to identify (and/or measure) the activity concentrations of the radionuclides present in the samples, whereas the tasks of NPL were to prepare and distribute the samples, to collect, analyse and interpret the results and to compile an exercise report.

The Assigned Values for the activity concentrations of the radionuclides in the aqueous sample types were traceable to national standards of radioactivity, which in turn provide traceability at an international level to the ultimate reference point of all measurements (the SI reference value maintained by the Bureau International des Poids et Mesures (BIPM)).

Each aqueous sample type was prepared (as a bulk sample) by combining weighed aliquots of standard solutions of the individual radionuclides with a weighed amount of carrier solution and then diluting the mixture further to achieve the target activity concentrations. Dilution factors were measured gravimetrically and were validated by counting sources prepared at the various dilution levels using either liquid scintillation counting or gamma spectrometry. The Assigned Value for each nuclide was calculated by dividing the activity concentration of the original standard solution by the dilution factor(s). The bulk solution was subdivided into (typically) 40 bottles and homogeneity was checked by gamma spectrometry where

applicable. Solution stability was checked by counting one or more bottles at NPL at regular intervals throughout the course of the PTE.

The Assigned Value for each nuclide in the peat sample type was calculated from the data reported by the PTE participants. Firstly, the bulk raw material was procured from Public Health England (Chilton, Oxfordshire, UK). It was spiked in 1984 and had been used for determining soil-to-plant transfer factors. On receipt by NPL, it was visually inspected and homogenised before being oven-dried and sub-divided into bottles. All the bottles were measured by gamma spectrometry at NPL to determine homogeneity, and a subset of the bottles were issued to the participants. On receipt of the participants' data, the Assigned Value for a given nuclide was calculated as the Weighted Mean of the Largest Consistent Subset (WM LCS) of the data for that nuclide. The sandy soil bulk sample was procured also from Public Health England and had also been spiked in 1984. At NPL, it was processed and measured in the same way as the peat sample, and the Assigned Value for each nuclide present was again calculated from the WM LCS of the reported data.

The NPL data analysis method is described in Section 2.

**Note that, unless otherwise stated, all uncertainties quoted in this report are standard uncertainties multiplied by a coverage factor of  $k = 1$ , providing a level of confidence of approximately 68 %.**

## 2. TREATMENT OF DATA

The data were analysed using the same methods as in the 2012 exercise (Dean et al., 2013). The deviation 'D' from the assigned value from each laboratory value was calculated from:

$$D = \frac{L - N}{N} = \left( \frac{L}{N} - 1 \right) \quad [1]$$

The standard uncertainty ( $k=1$ ) ' $u_D$ ' of the deviation was calculated from:

$$u_D = \frac{L}{N} \sqrt{\left( \frac{u_L}{L} \right)^2 + \left( \frac{u_N}{N} \right)^2} \quad [2]$$

The quantities zeta ( $\zeta$ ), the relative uncertainty of a laboratory's value ( $R_L$ ) and the z-score were calculated from:

$$\zeta = \frac{L - N}{\sqrt{u_L^2 + u_N^2}} \quad [3]$$

$$R_L = \frac{u_L}{L} \quad [4]$$

$$z = \frac{L - N}{\sigma_p} = \frac{L - N}{0.05823 N} \quad [5]$$

where:

$L$  is the participant's value;

$N$  is the Assigned Value;

$u_L$  is the standard uncertainty of the participants' value;

$u_N$  is the standard uncertainty of the Assigned Value;

$\sigma_p$  is the standard uncertainty for proficiency assessment.

The zeta and z-scores were used to determine whether the difference between the participant's value and the Assigned Value was significantly different from zero. The Interquartile Range outlier test (Harms and Gilligan, 2011) was used to determine whether the relative uncertainty  $R_L$  was significantly larger than the other values in the data set. Note that this test is unable to identify outliers if the data set is smaller than 7.

Results for which the absolute values of the zeta score and the z-score are both  $\leq 2.576$  and for which  $R_L$  is not significantly larger than the other values in the data set are taken to mean that the participant's value is 'in agreement' with the Assigned Value. These results are plotted as dark blue points in this report.

If (i)  $R_L$  is significantly larger than the other values in the data set, or (ii) the result passes the zeta test but not the z-test (i.e., there is a large deviation from the Assigned Value combined with a large uncertainty), or (iii) the result passes the z-test but not the zeta test (where there is a small deviation from the Assigned Value and a small uncertainty), the participant's value is classified as 'questionable' (plotted in yellow).

If the absolute values of both the zeta score and the z-score are greater than 2.576, then the participant's value is classified as 'discrepant' from the Assigned Value (plotted in red), regardless of the value of  $R_L$ . The factor of 0.05823 used to calculate the z-score is the ratio of 0.15 (i.e. a deviation of 15%) to 2.576. In other words, a participant value with a deviation  $D$  having an absolute value of  $\leq 15\%$  will pass the z-test.

Table 1 Summary of data classification criteria

zeta test	$R_L$ test	z test	Classification
pass	pass	pass	in agreement
pass	fail	pass	questionable
fail	pass	pass	questionable
pass	-	fail	questionable
fail	-	fail	discrepant

## 3. SUMMARY OF PARTICIPANTS' RESULTS

In addition to the analyses of individual participants' data as described in Section 2, the Weighted Mean of the Largest Consistent Subset (WM LCS) of the reported results for each radionuclide in the aqueous sample types was calculated using the method described previously (Harms and Gilligan, 2011) and then compared with the NPL Assigned Values. The results are given in Tables 2 to 7.

The WM LCS of the P and S sample types are also given, in Table 8.

Table 2 AH summary

Nuclide (AH)	NPL Assigned Values (Bq g <sup>-1</sup> )	WM LCS (Bq g <sup>-1</sup> )	Deviation %	Zeta	Critical Value
<sup>226</sup> Ra	1.630 ± 0.022 (± 1.3 %)	1.72 ± 0.03 (± 1.7 %)	5.7	2.52	2.75
<sup>237</sup> Np	15.12 ± 0.16 (± 1.0 %)	17.0 ± 0.4 (± 2.2 %)	12.3	<b>4.62</b>	3.36
<sup>238</sup> Pu	16.77 ± 0.06 (± 0.4 %)	16.27 ± 0.16 (± 1.0 %)	-3.0	-2.97	2.98
<sup>241</sup> Am	5.010 ± 0.017 (± 0.4 %)	4.94 ± 0.05 (± 1.0 %)	-1.5	-1.40	2.82
<sup>244</sup> Cm	15.13 ± 0.06 (± 0.4 %)	13.57 ± 0.24 (± 1.8 %)	-10.3	<b>-6.19</b>	3.36

Table 3 AL summary

Nuclide (AL)	NPL Assigned Values (Bq kg <sup>-1</sup> )	WM LCS (Bq kg <sup>-1</sup> )	Deviation %	Zeta	Critical Value
<sup>232</sup> Th	1.551 ± 0.016 (± 1.0 %)	1.562 ± 0.021 (± 1.3 %)	0.7	0.41	2.74
<sup>234</sup> U	19.3 ± 0.3 (± 1.4 %)	19.24 ± 0.08 (± 0.4 %)	-0.2	-0.14	2.58
<sup>235</sup> U	0.921 ± 0.012 (± 1.3 %)	0.904 ± 0.017 (± 1.9 %)	-1.8	-0.80	2.70
<sup>238</sup> U	19.3 ± 0.3 (± 1.4 %)	19.42 ± 0.21 (± 1.1 %)	0.7	0.43	2.58
<sup>239</sup> Pu	1.332 ± 0.006 (± 0.4 %)	1.307 ± 0.021 (± 1.6 %)	-1.9	-1.18	2.88

Table 4 B1 summary

Nuclide (B1)	NPL Assigned Values (Bq g <sup>-1</sup> )	WM LCS (Bq g <sup>-1</sup> )	Deviation %	Zeta	Critical Value
<sup>3</sup> H	1.026 ± 0.007 (± 0.7 %)	1.018 ± 0.010 (± 1.0 %)	-0.8	-0.63	2.66
<sup>14</sup> C	1.032 ± 0.005 (± 0.50 %)	1.027 ± 0.017 (± 1.7 %)	-0.5	-0.28	2.92
<sup>99</sup> Tc	0.1478 ± 0.0013 (± 0.9 %)	0.1420 ± 0.0020 (± 1.4 %)	-4.0	-2.43	2.81

Table 5 B2 summary

Nuclide (B2)	NPL Assigned Values (Bq g <sup>-1</sup> )	WM LCS (Bq g <sup>-1</sup> )	Deviation %	Zeta	Critical Value
<sup>3</sup> H	1.051 ± 0.008 (± 0.7 %)	1.077 ± 0.011 (± 1.0 %)	2.5	1.94	2.67
<sup>63</sup> Ni	1.650 ± 0.017 (± 1.0 %)	1.57 ± 0.03 (± 1.8 %)	-4.6	-2.28	2.98
<sup>90</sup> Sr	0.4746 ± 0.0010 (± 0.21 %)	0.476 ± 0.005 (± 1.1 %)	0.3	0.27	2.82
<sup>241</sup> Pu	0.957 ± 0.011 (± 1.1 %)	0.924 ± 0.019 (± 2.1 %)	-3.4	-1.51	2.80

Table 6 GH summary

Nuclide (GH)	NPL Assigned Values (Bq g <sup>-1</sup> )	WM LCS (Bq g <sup>-1</sup> )	Deviation %	Zeta	Critical Value
<sup>60</sup> Co	11.06 ± 0.03 (± 0.3 %)	10.73 ± 0.04 (± 0.4 %)	-3.0	-7.14	2.64
<sup>133</sup> Ba	12.98 ± 0.10 (± 0.8 %)	12.99 ± 0.05 (± 0.4 %)	0.0	0.03	2.58
<sup>134</sup> Cs	1.915 ± 0.013 (± 0.7 %)	1.866 ± 0.012 (± 0.7 %)	-2.6	-2.72	2.58
<sup>137</sup> Cs	8.10 ± 0.06 (± 0.7 %)	8.16 ± 0.04 (± 0.50 %)	0.8	0.93	2.58

Table 7 GL summary

Nuclide (GL)	NPL Assigned Values (Bq kg <sup>-1</sup> )	WM LCS (Bq kg <sup>-1</sup> )	Deviation %	Zeta	Critical Value
<sup>60</sup> Co	13.23 ± 0.11 (± 0.8 %)	12.96 ± 0.07 (± 0.6 %)	-2.0	-2.12	2.58
<sup>134</sup> Cs	3.42 ± 0.03 (± 0.8 %)	3.22 ± 0.03 (± 0.9 %)	-5.8	-4.76	2.58
<sup>137</sup> Cs	1.766 ± 0.016 (± 0.9 %)	1.830 ± 0.021 (± 1.1 %)	3.6	2.41	2.63
<sup>152</sup> Eu	21.9 ± 0.4 (± 1.8 %)	21.00 ± 0.14 (± 0.7 %)	-3.9	-2.11	2.58

Table 8 P and S summaries

Nuclide (P)	WM LCS (Bq g <sup>-1</sup> )	Nuclide (S)	WM LCS (Bq g <sup>-1</sup> )
<sup>90</sup> Sr	2.51 ± 0.11 (± 5.0 %)	<sup>90</sup> Sr	0.276 ± 0.023 (± 8 %)
<sup>137</sup> Cs	2.71 ± 0.12 (± 5.0 %)	<sup>137</sup> Cs	0.80 ± 0.07 (± 8 %)
<sup>239</sup> Pu	3.97 ± 0.18 (± 5.0 %)	<sup>239</sup> Pu	1.06 ± 0.09 (± 9 %)
<sup>241</sup> Am	4.35 ± 0.19 (± 5.0 %)	<sup>241</sup> Am	1.34 ± 0.11 (± 8 %)

## 4. DESCRIPTION OF DEVIATION PLOTS

Figure 1 below illustrates the format of the deviation plots using some hypothetical values and uncertainties. Results 'in agreement' are represented by dark blue points whereas 'questionable' and 'discrepant' results are given in yellow and red respectively. The error bars represent the standard uncertainties  $u_D$  (with a coverage factor of  $k=1$ ). The light blue lines represent z-scores of  $-2.576$  and  $2.576$  ( $-15\%$  or  $+15\%$  deviation). The dashed line represent the standard uncertainty of the Assigned Value. Table 9 explains the classification of each value.

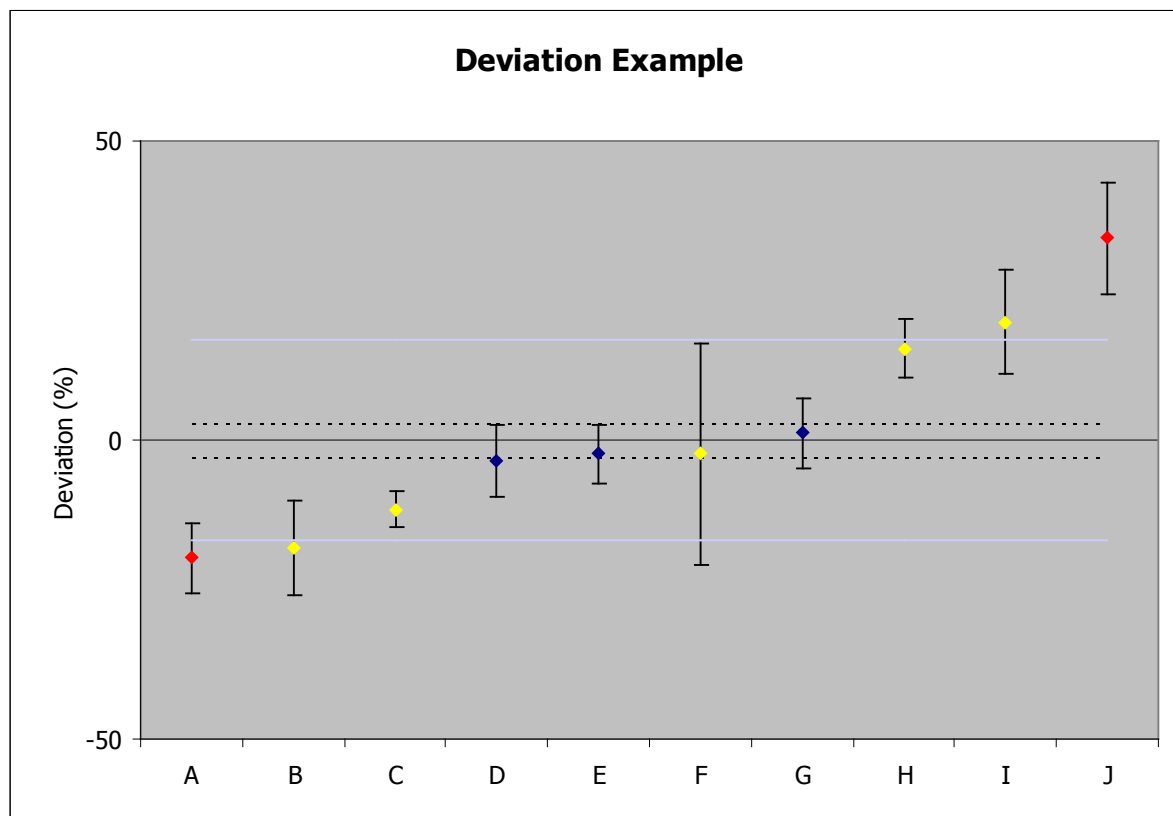
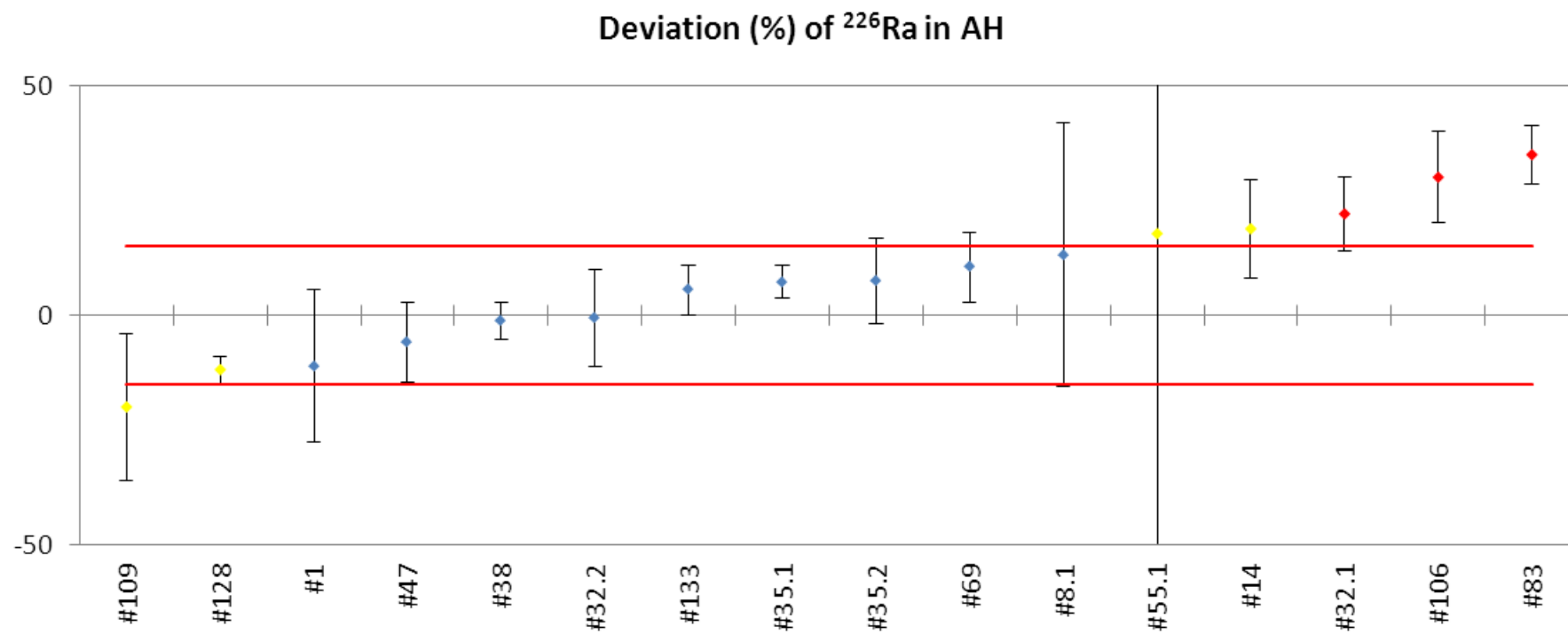


Figure 1 Deviation plot example

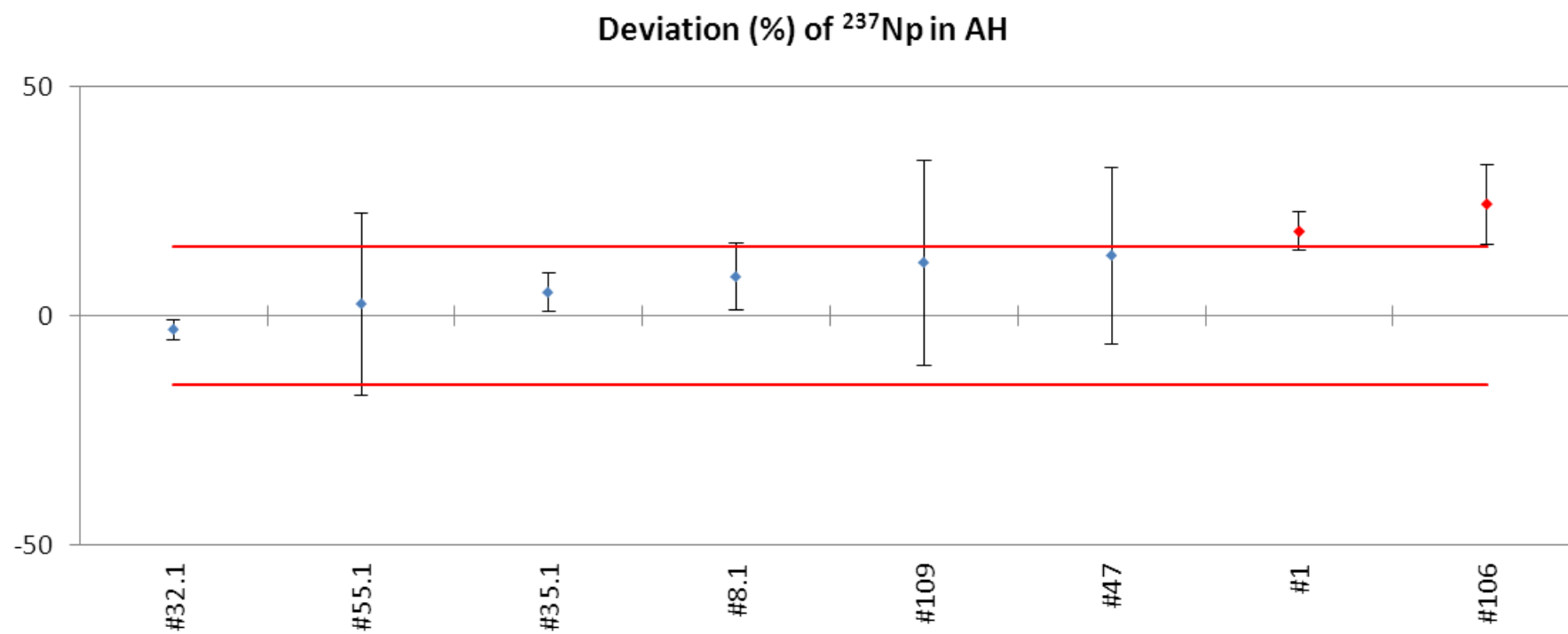
Table 9 Data classification

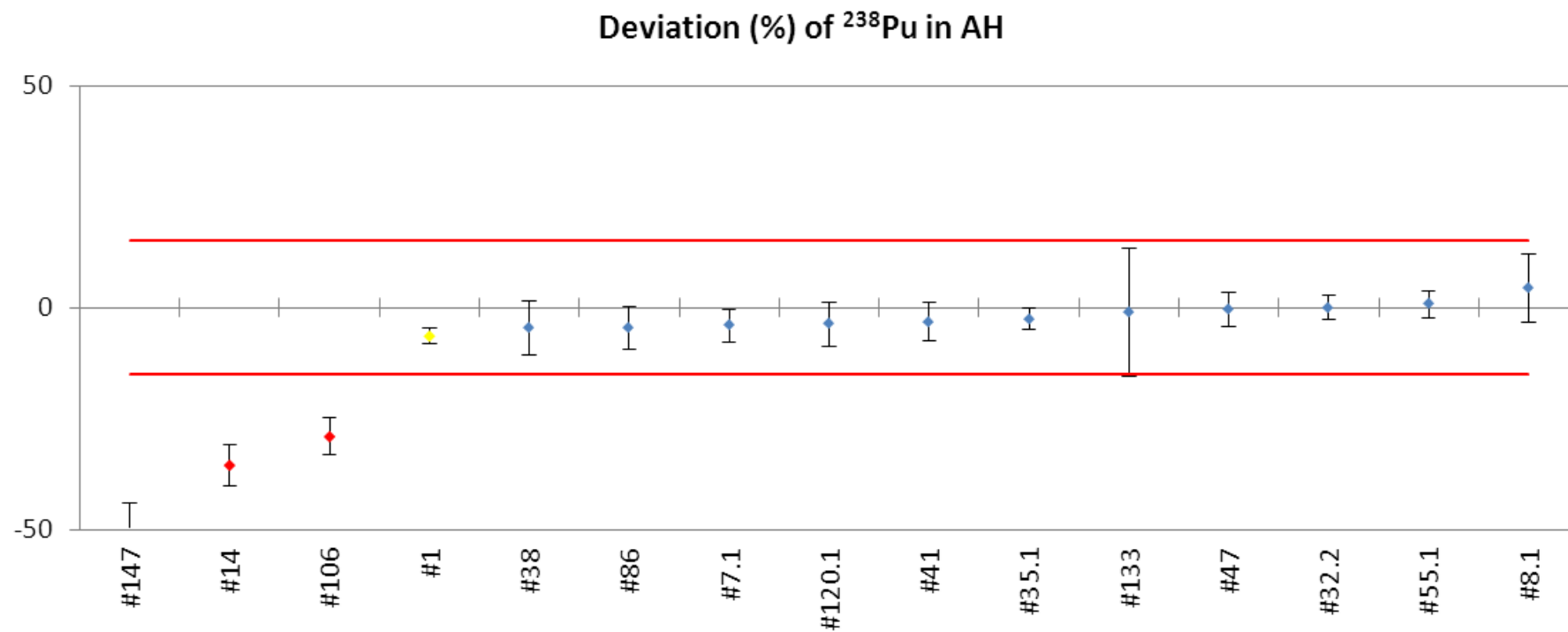
Lab	Zeta test	$R_L$ outlier test	z test	Classification
A	fail	pass	fail	discrepant
B	pass	pass	fail	questionable
C	fail	pass	pass	questionable
D	pass	pass	pass	in agreement
E	pass	pass	pass	in agreement
F	pass	fail	pass	questionable
G	pass	pass	pass	in agreement
H	fail	pass	pass	questionable
I	pass	pass	fail	questionable
J	fail	pass	fail	discrepant

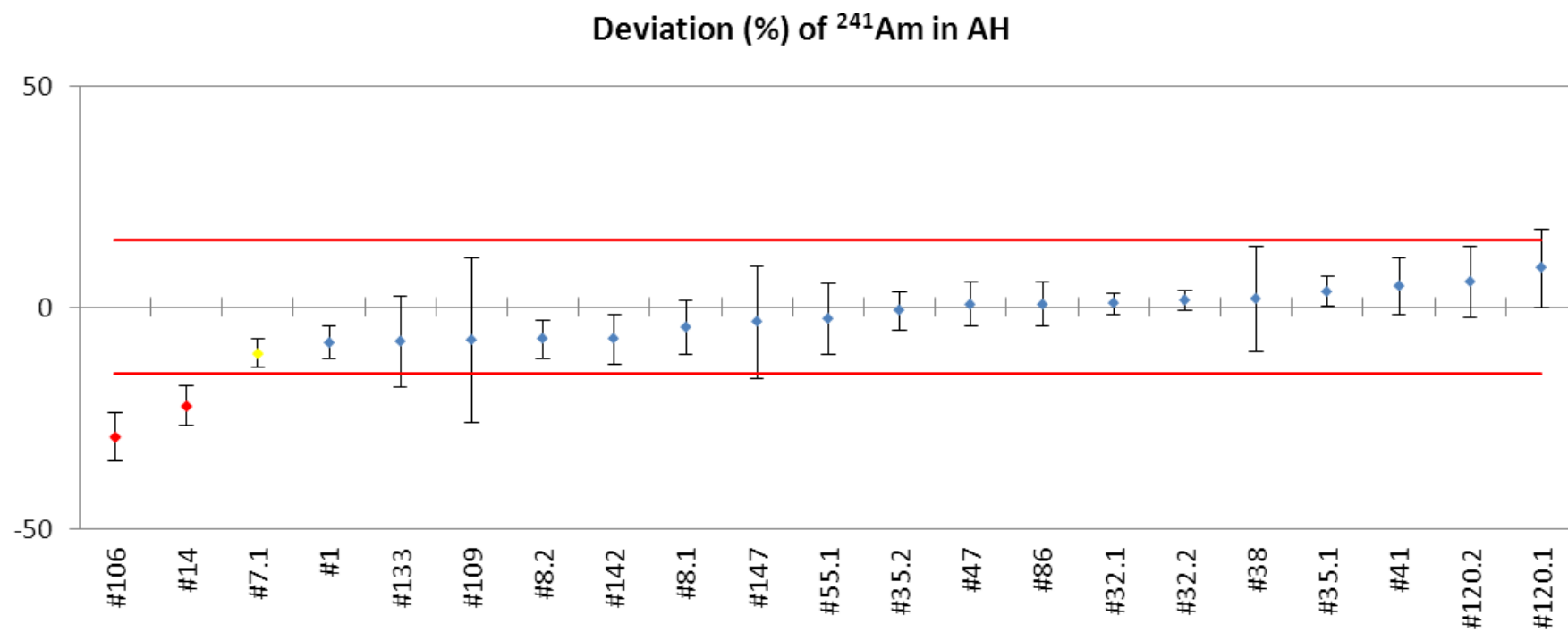
## 5. Alpha High (AH) Deviation Plots

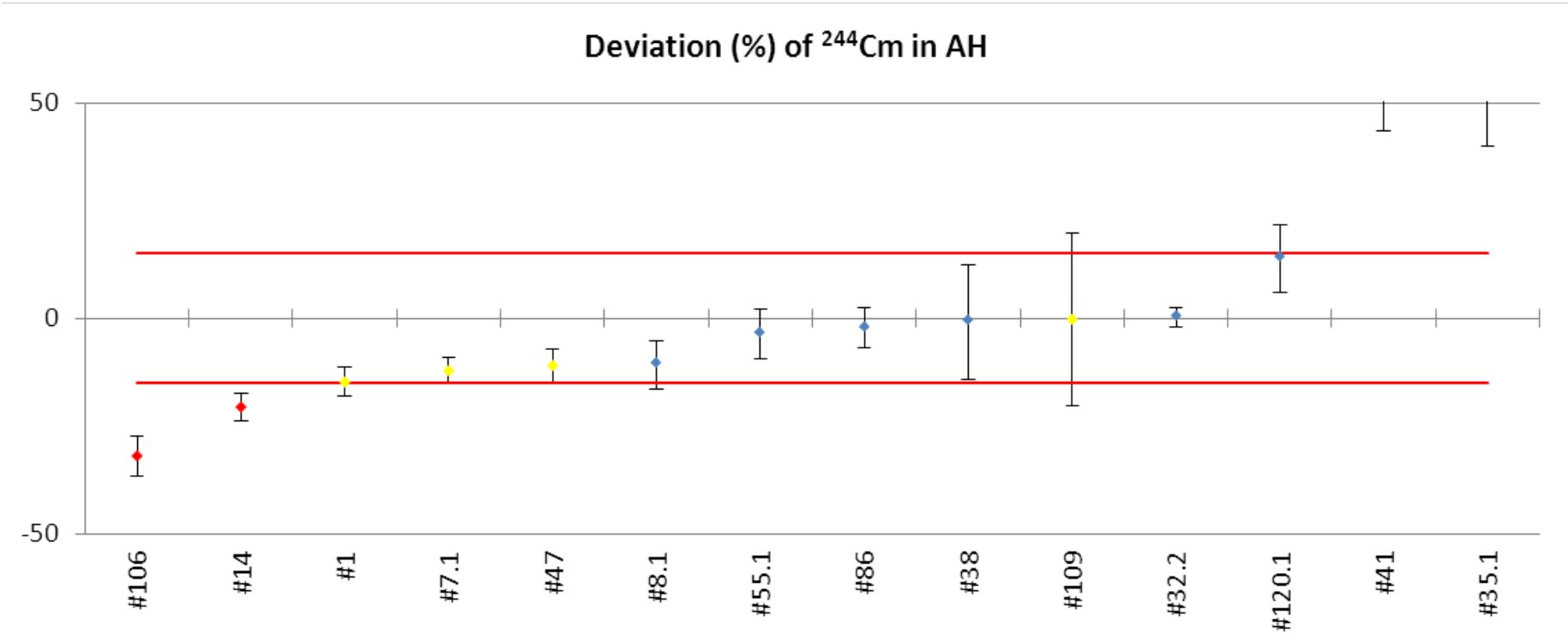




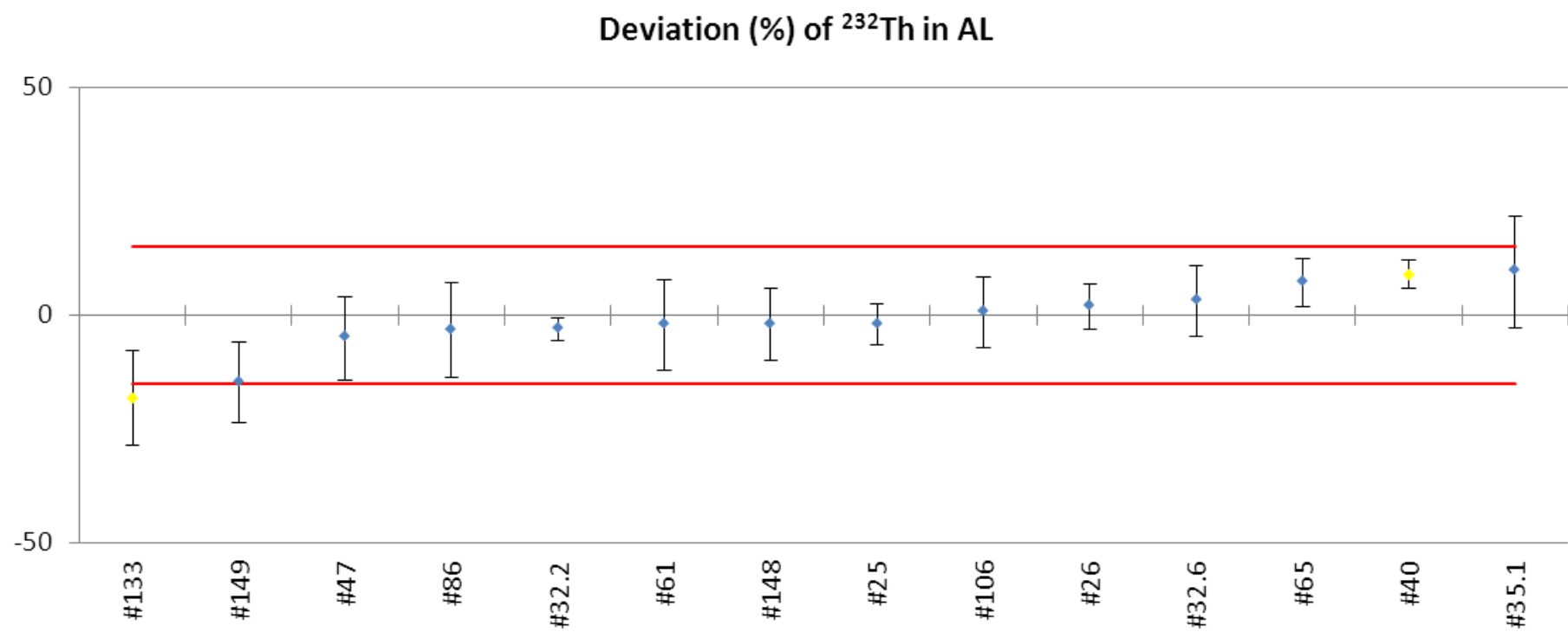


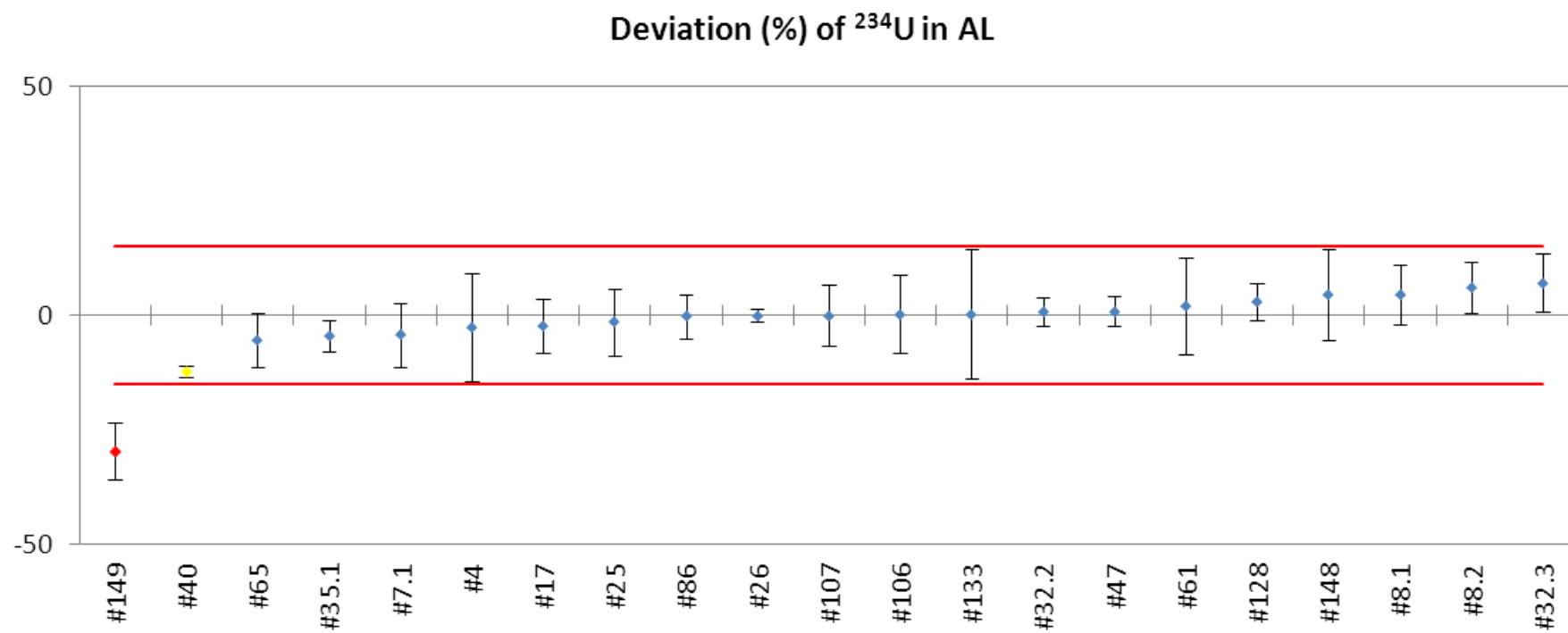


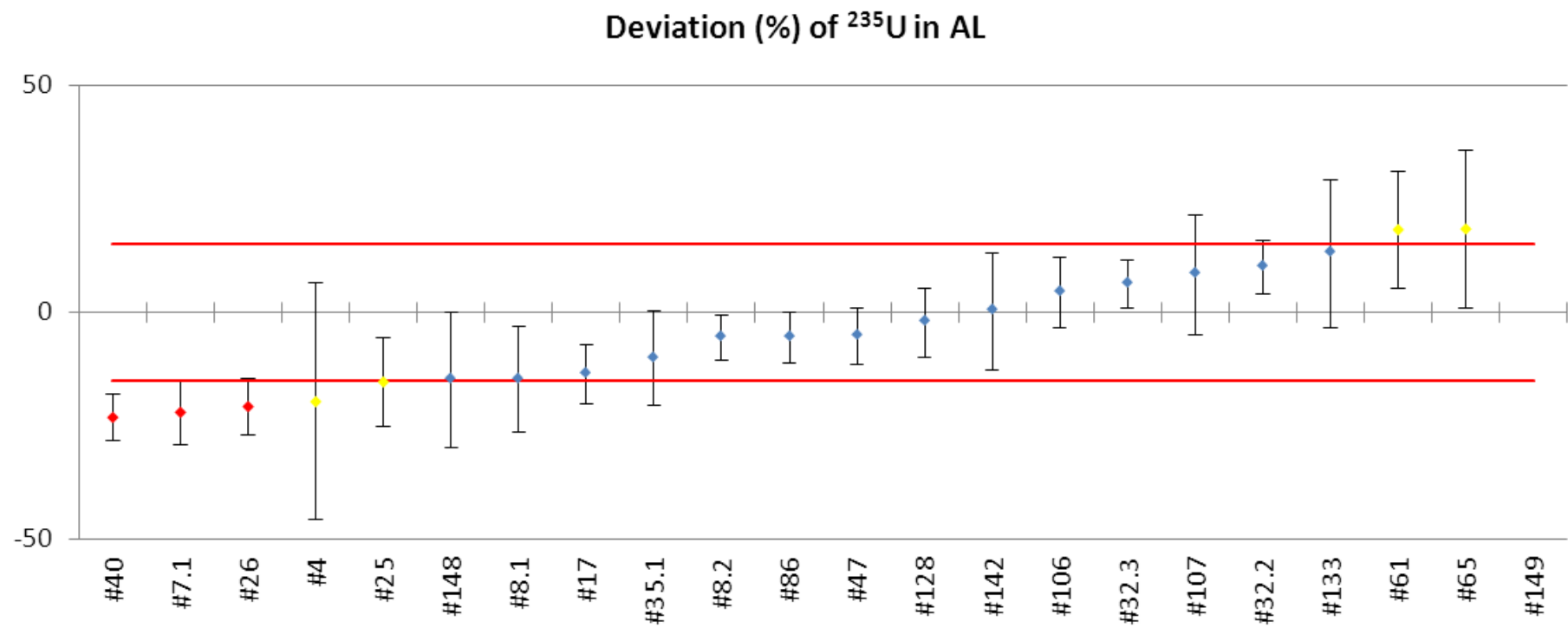




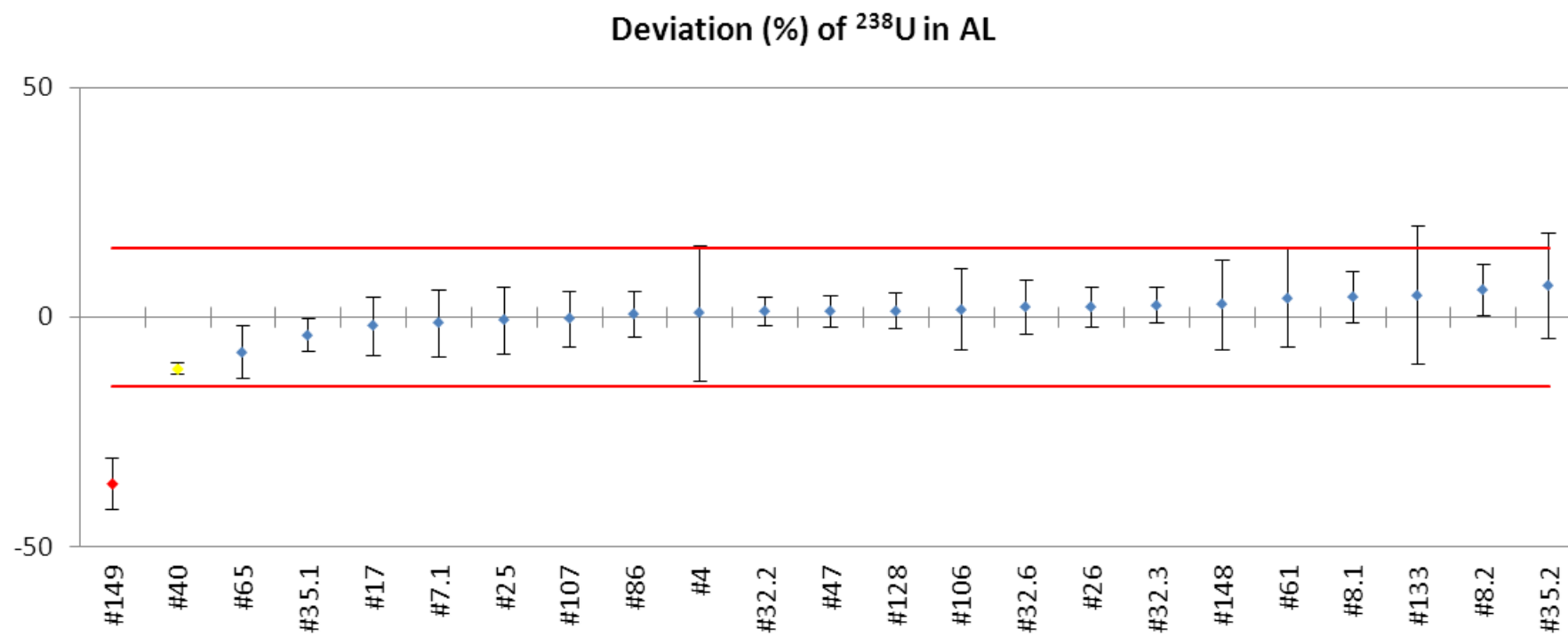
## 6. Alpha Low (AL) Deviation Plots

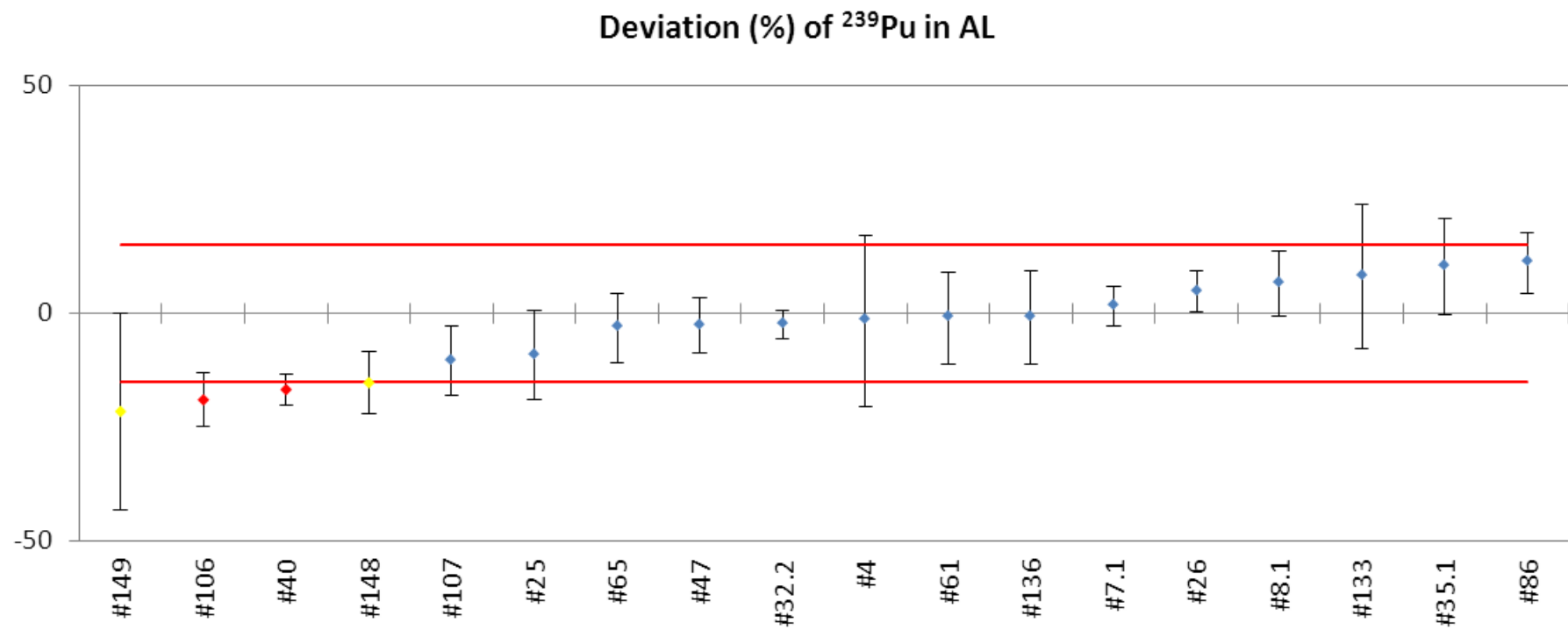




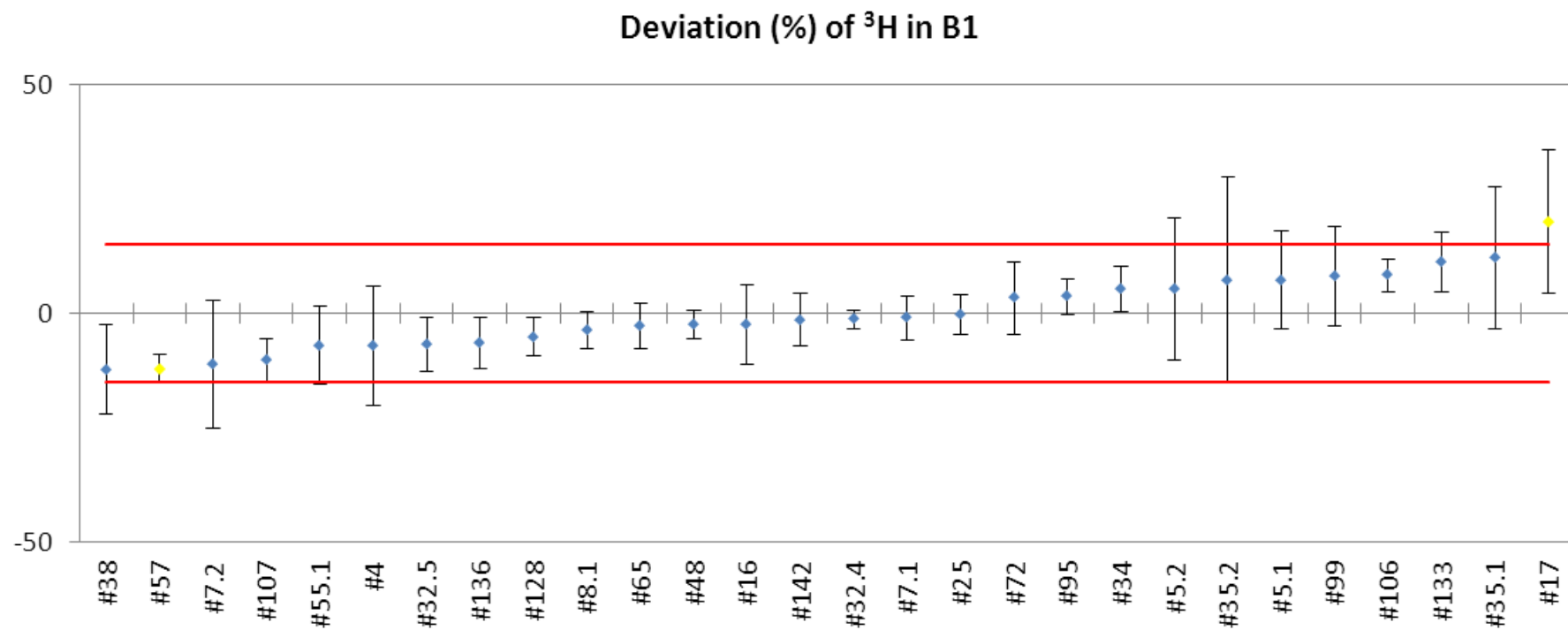


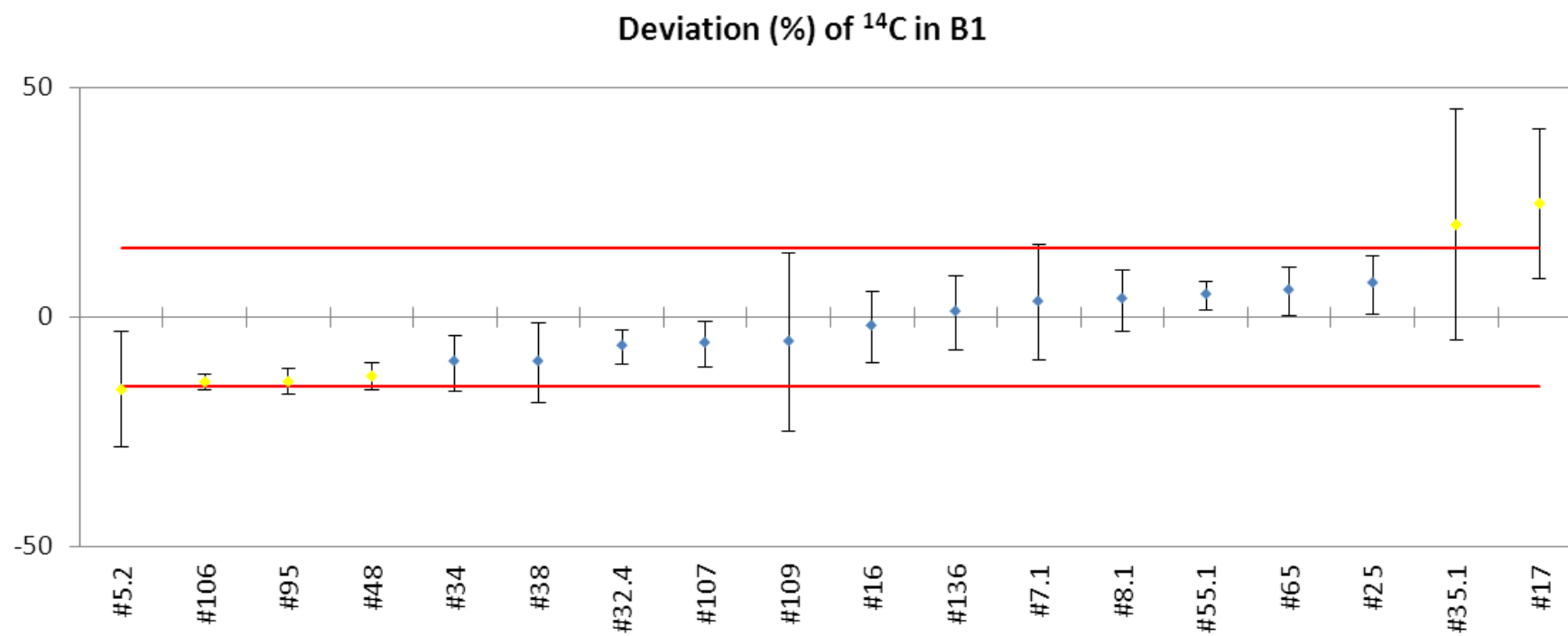


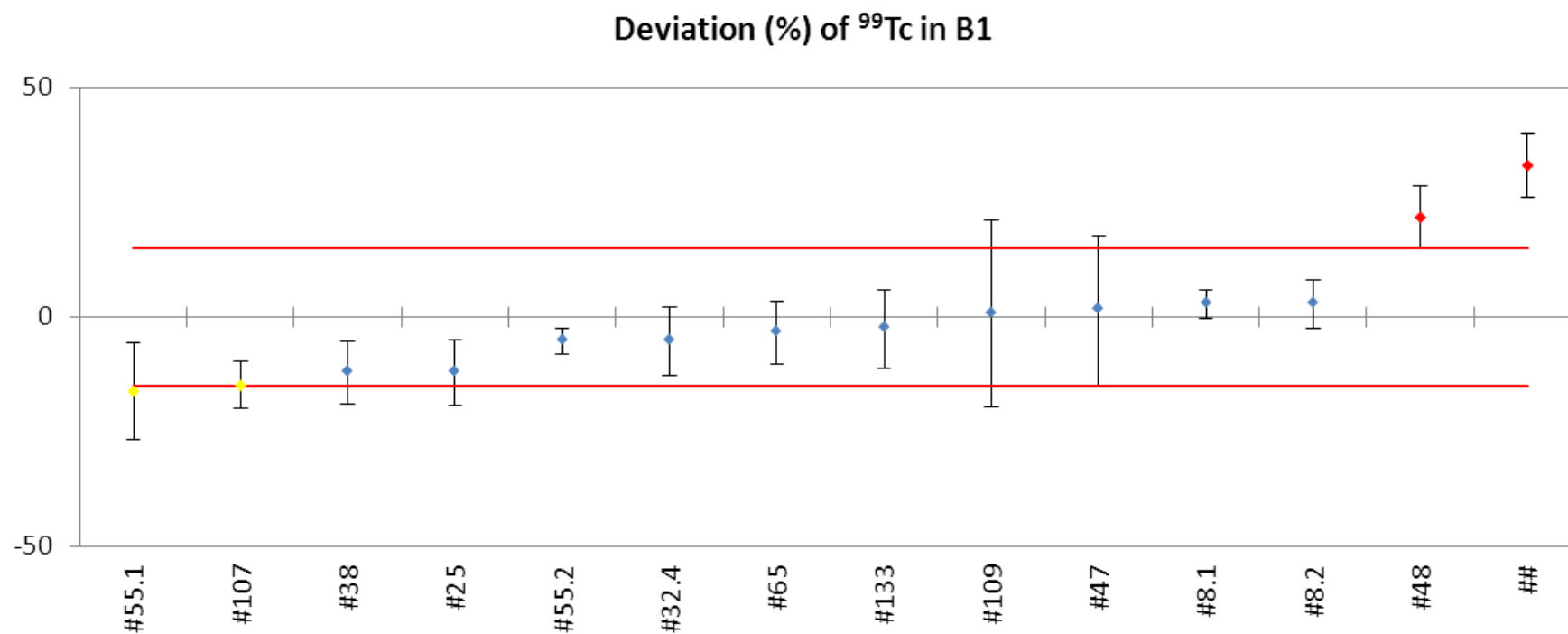




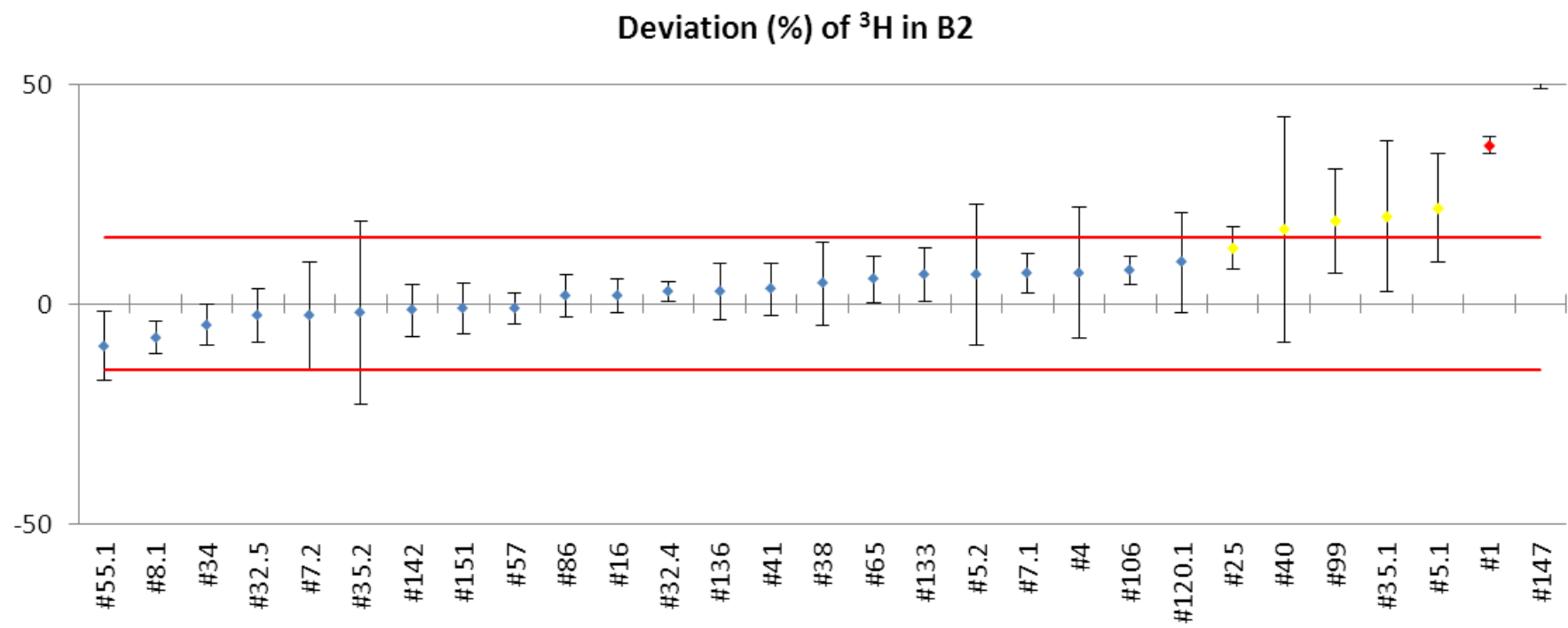
# 7. Beta One (B1) Deviation Plots



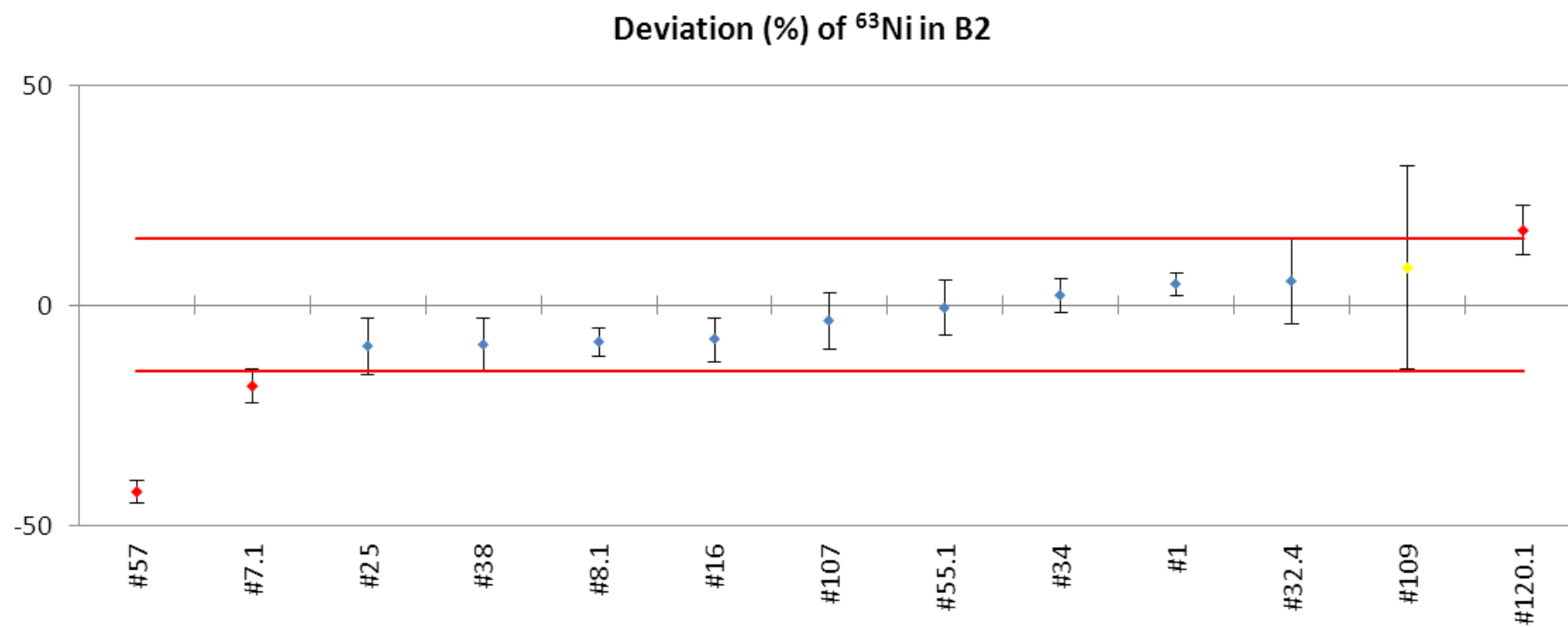


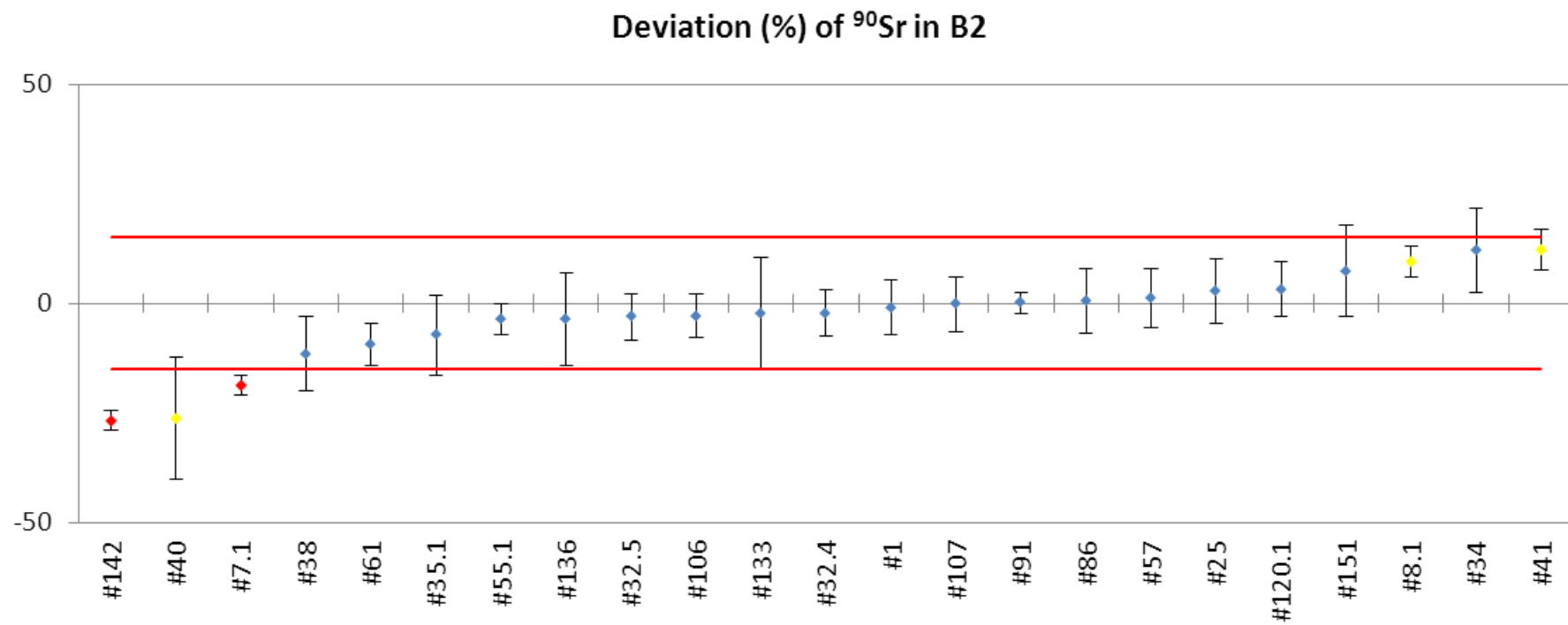


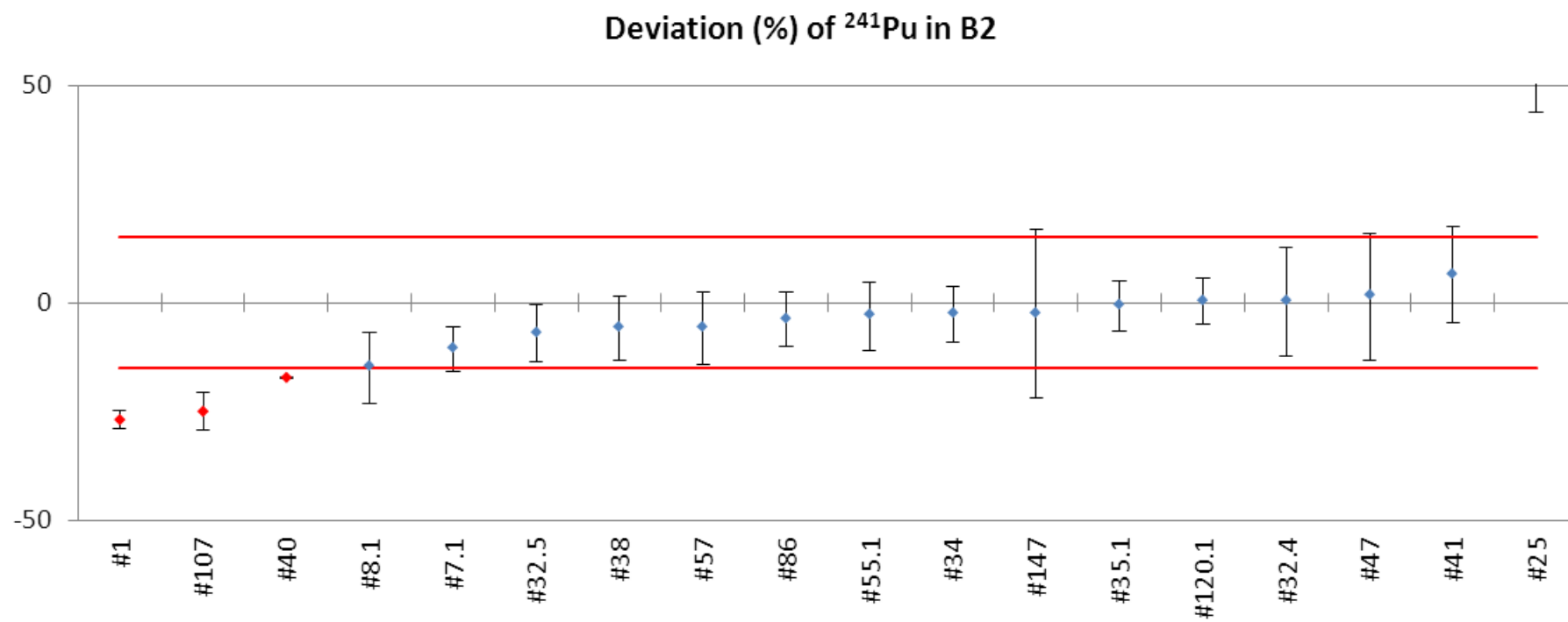
## 8. Beta Two (B2) Deviation Plots



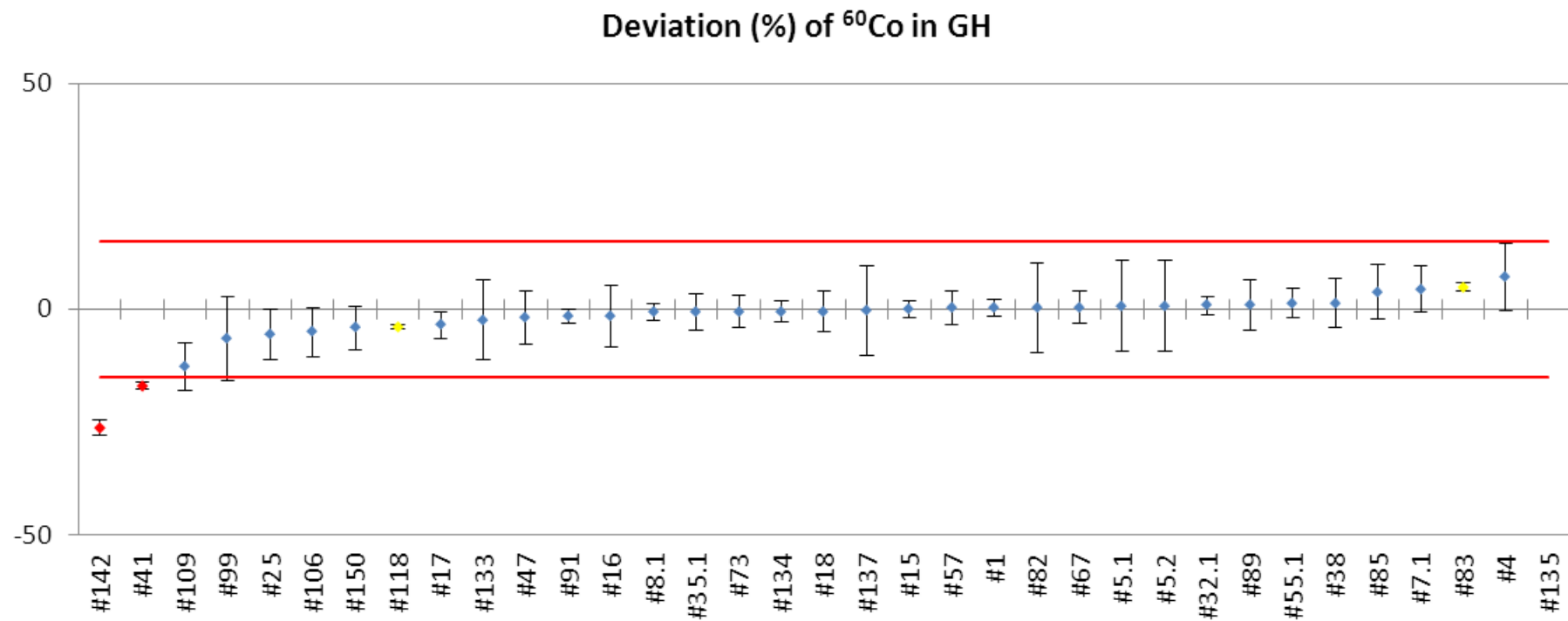


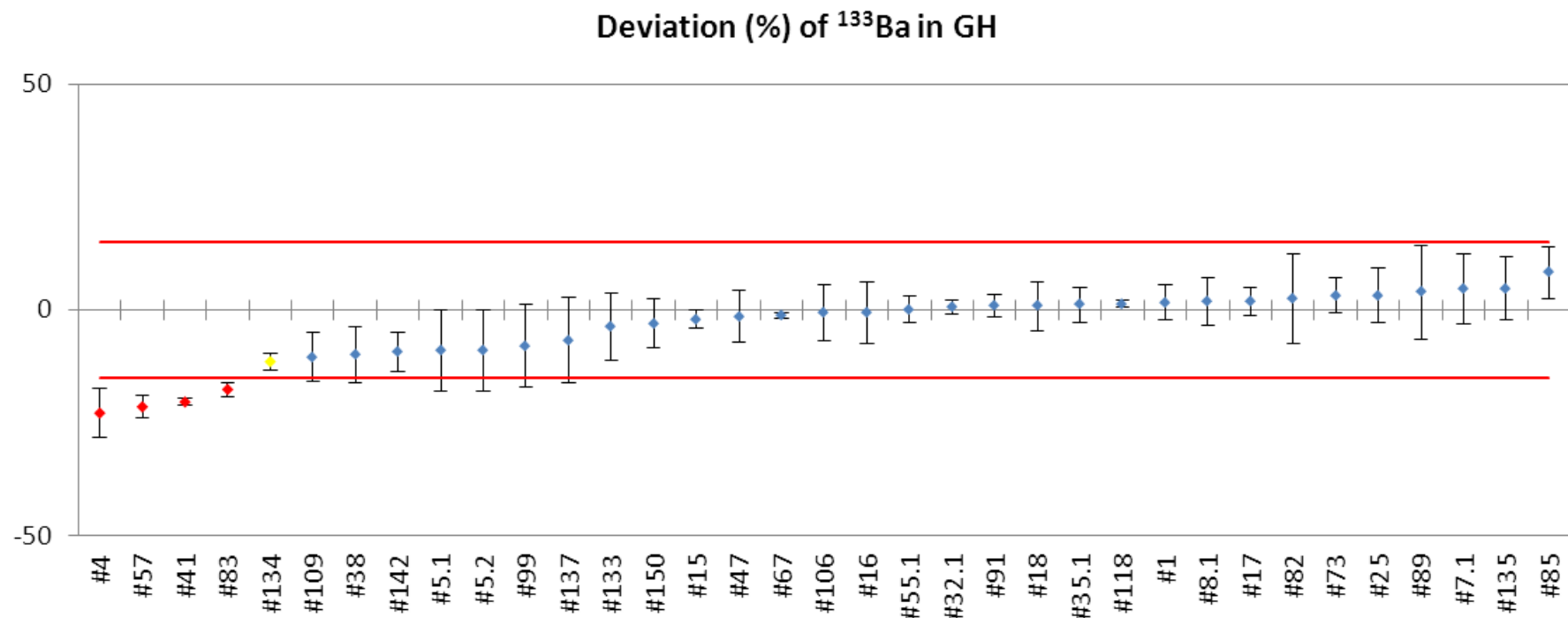


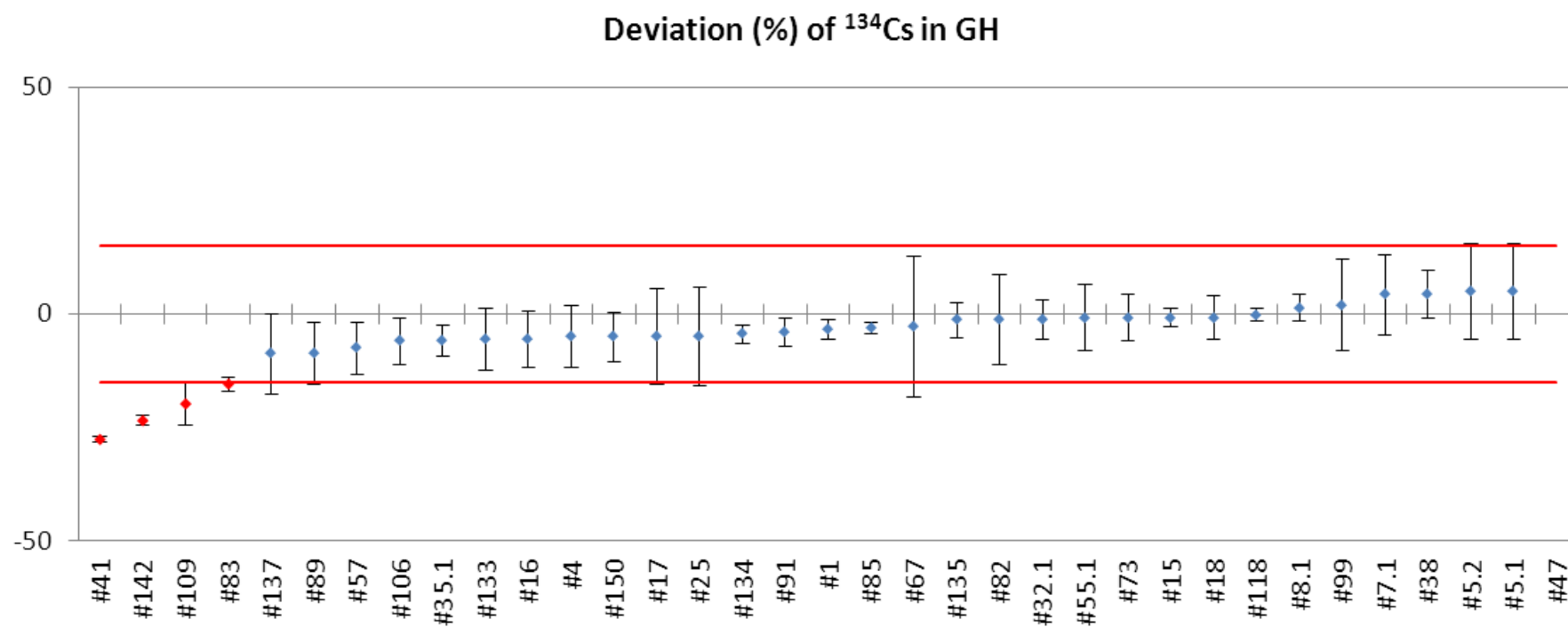


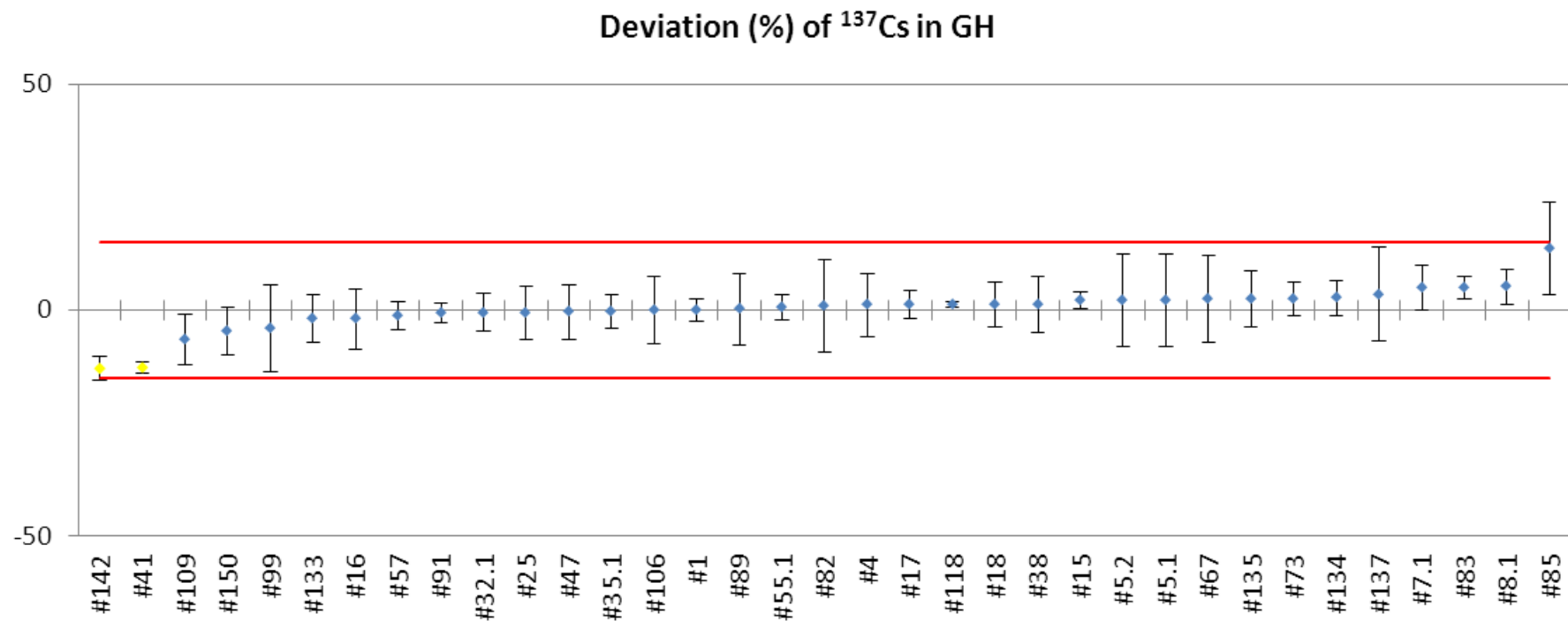


## 9. Gamma High (GH) Deviation Plots



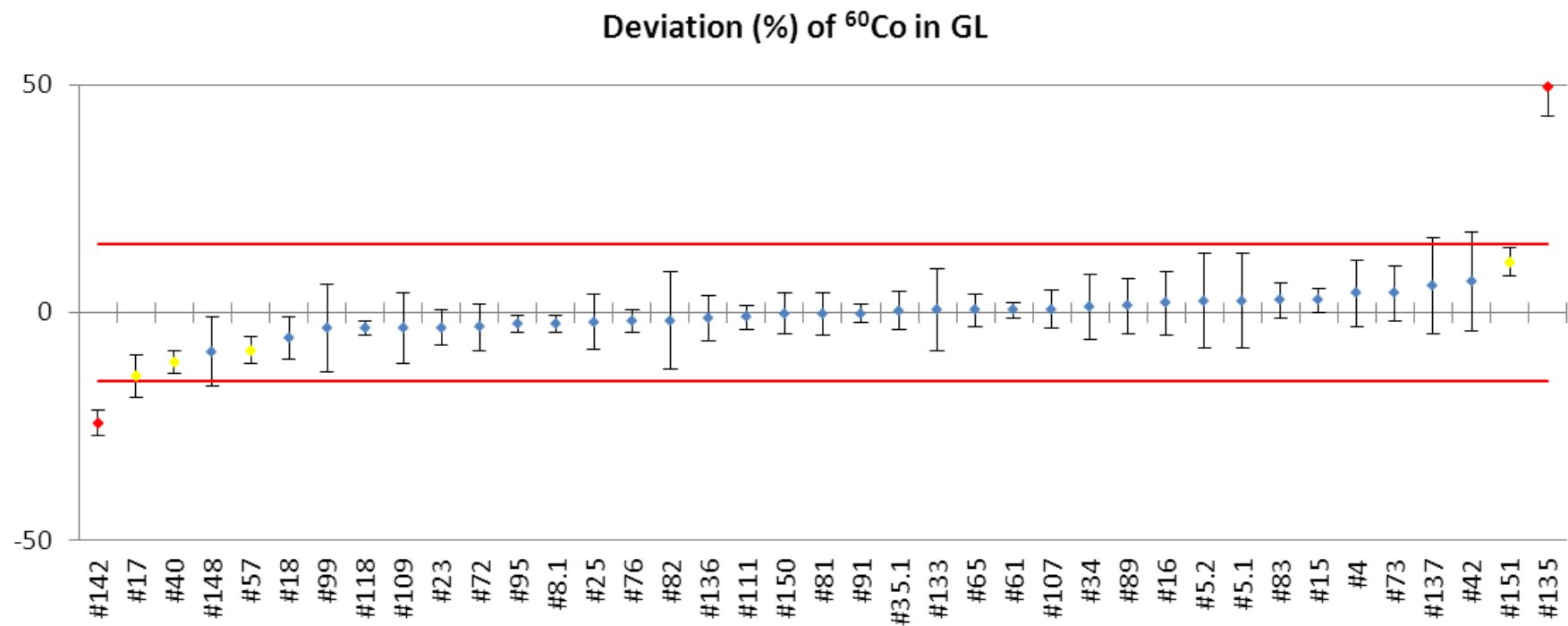


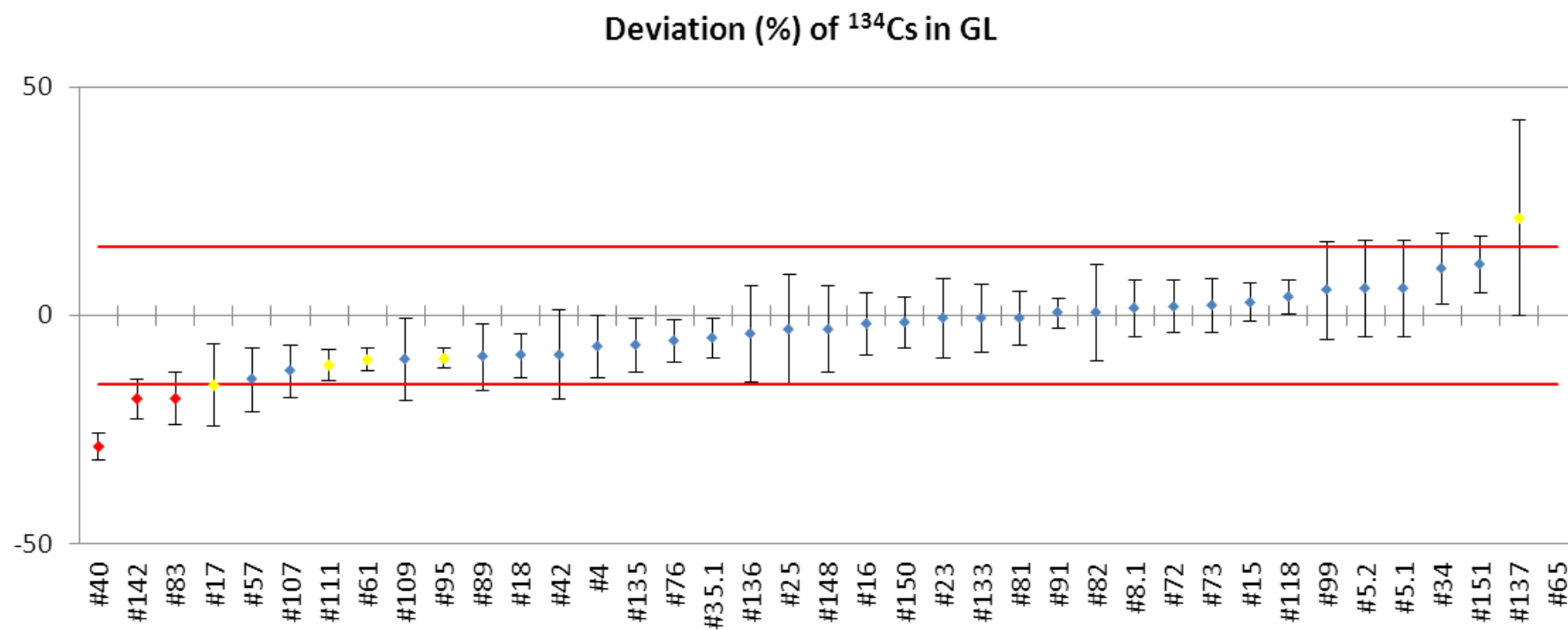


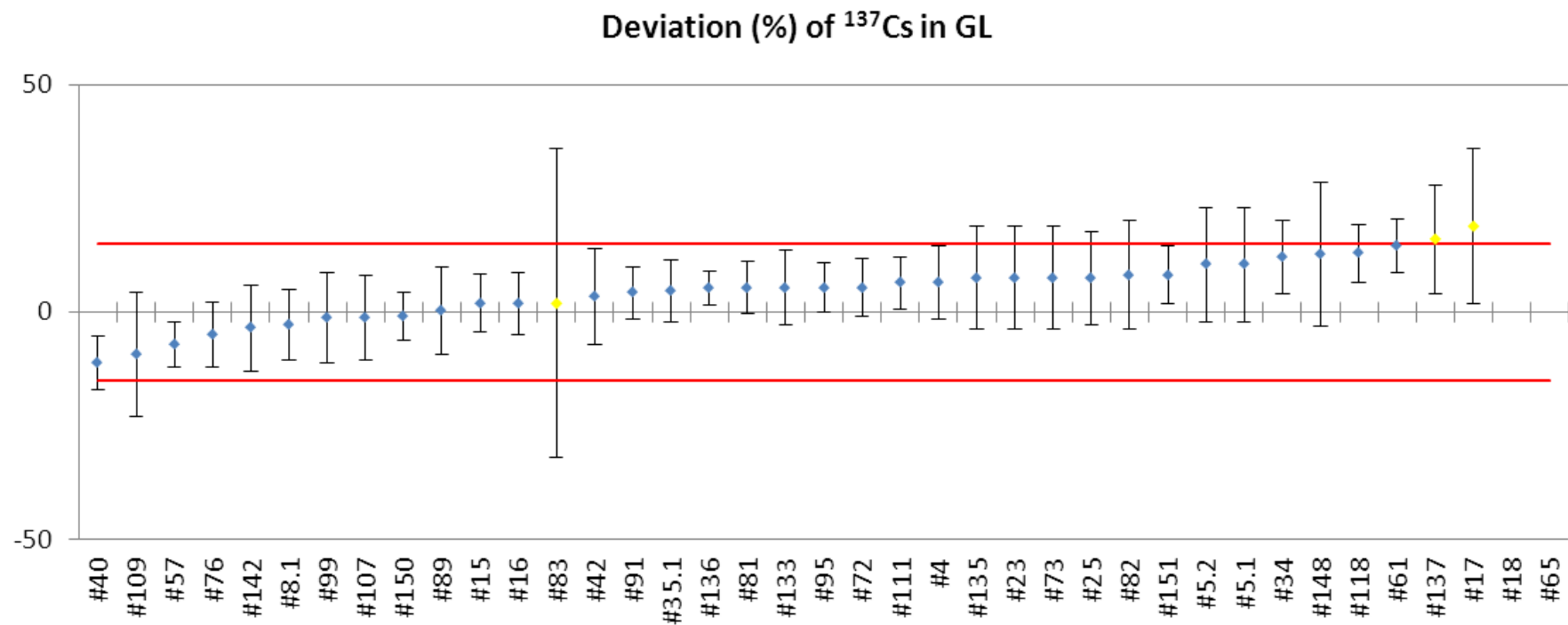


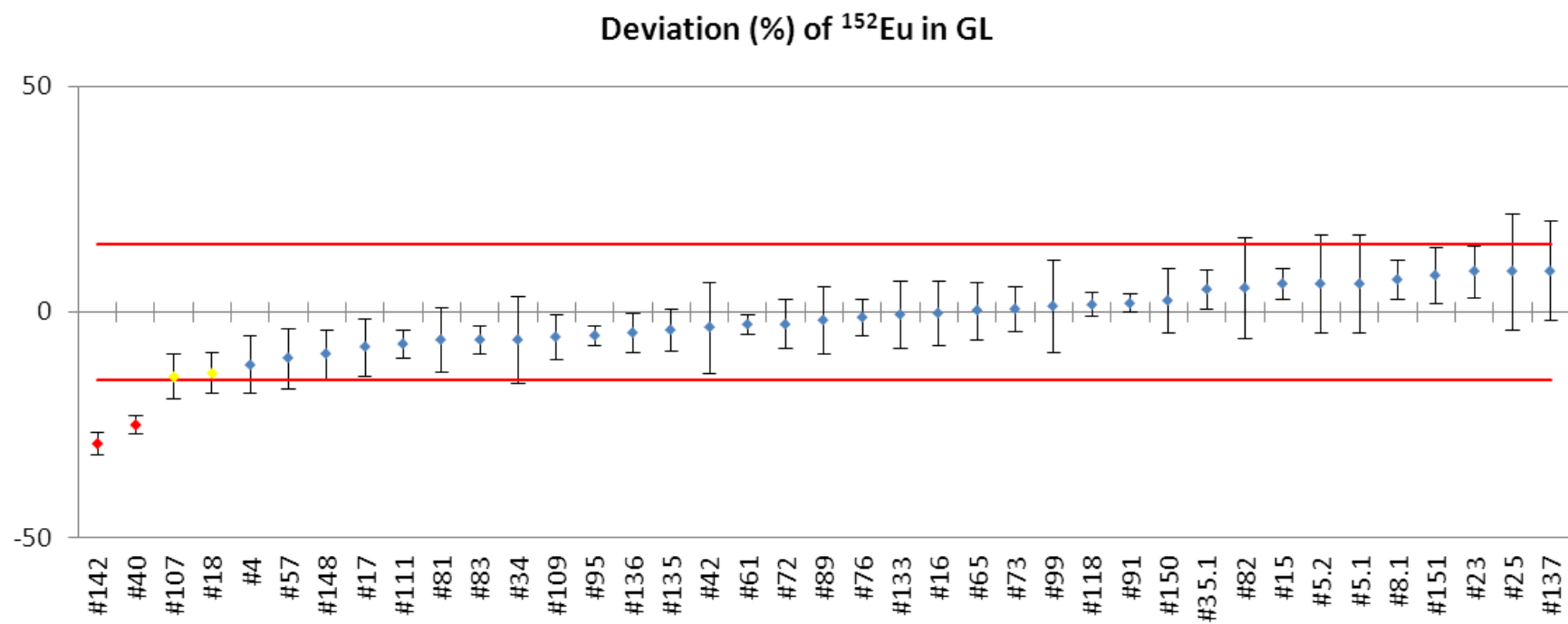


# 10. Gamma Low (GL) Deviation Plots

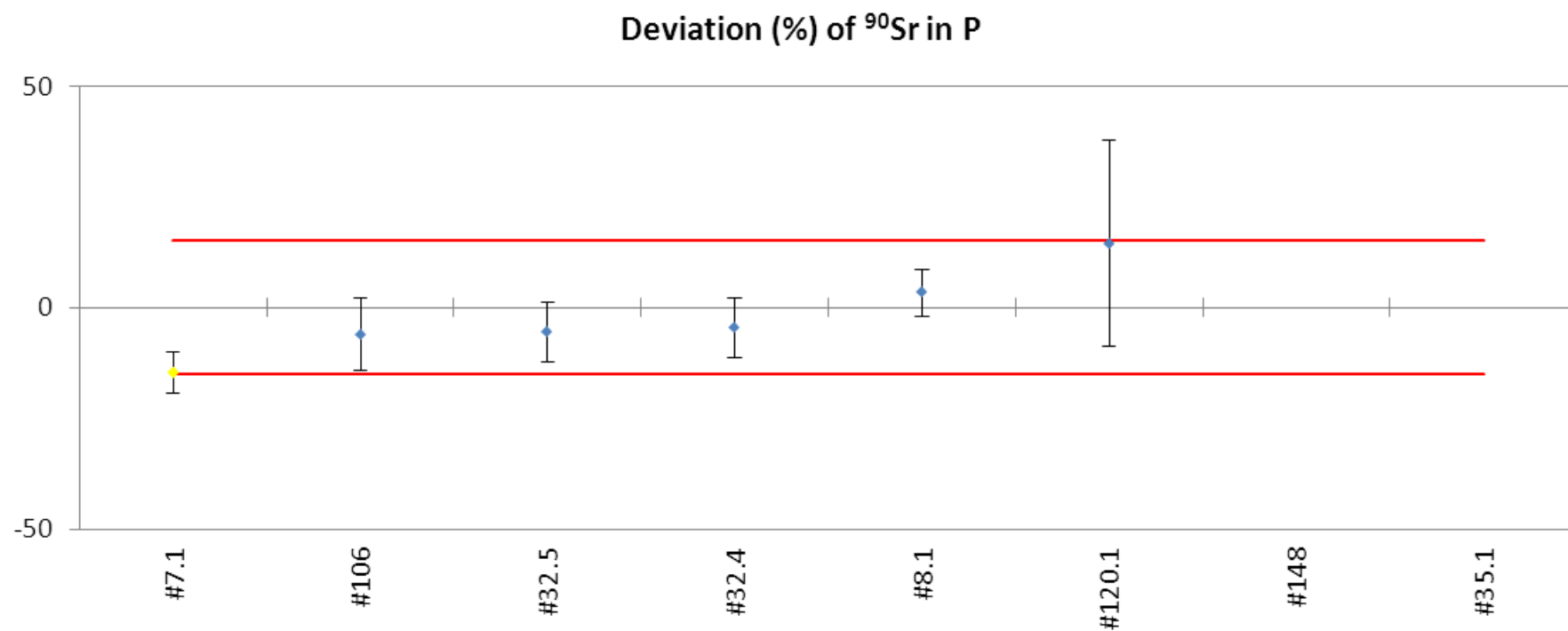


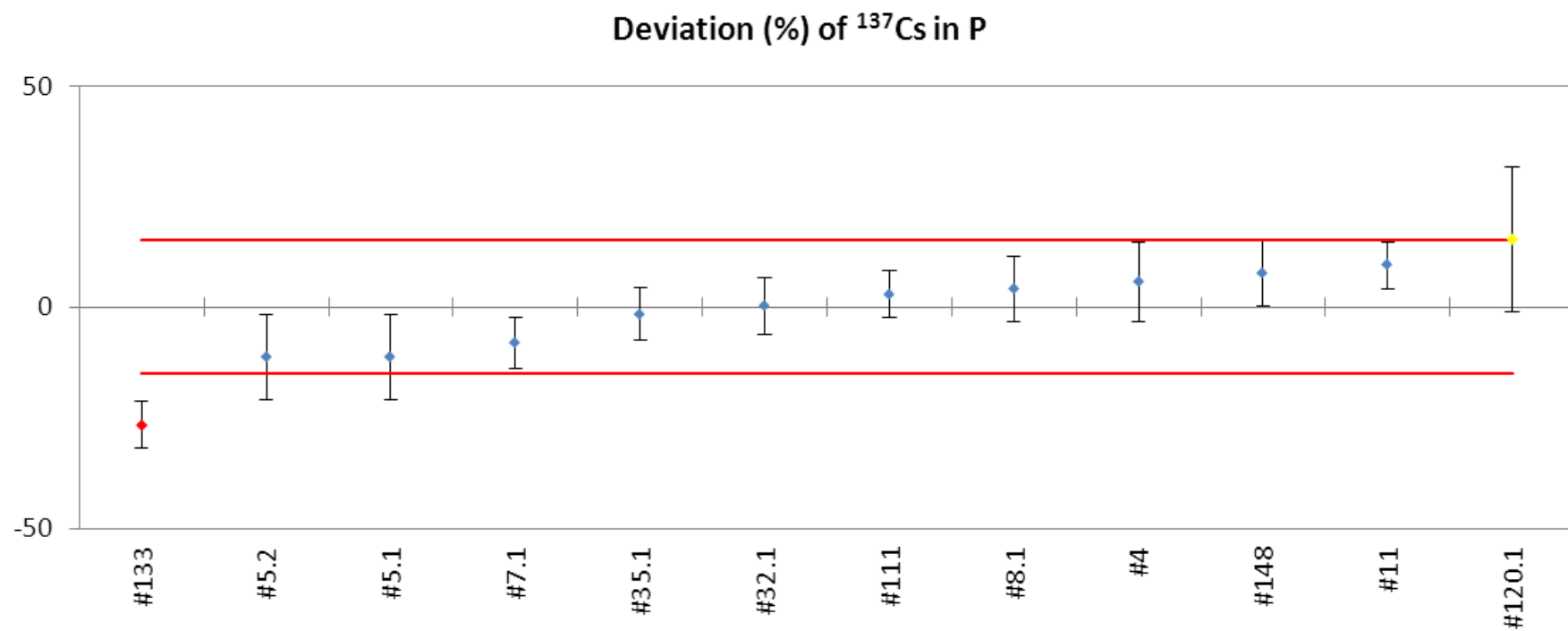




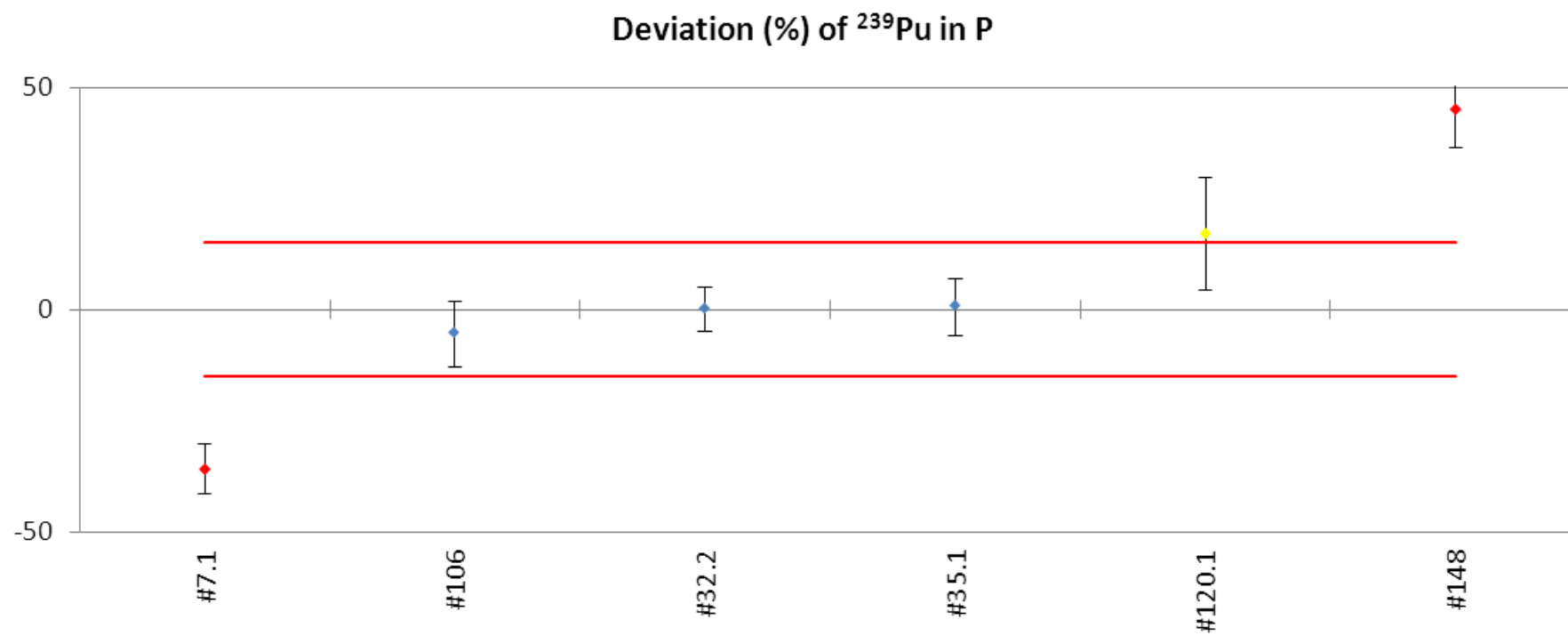


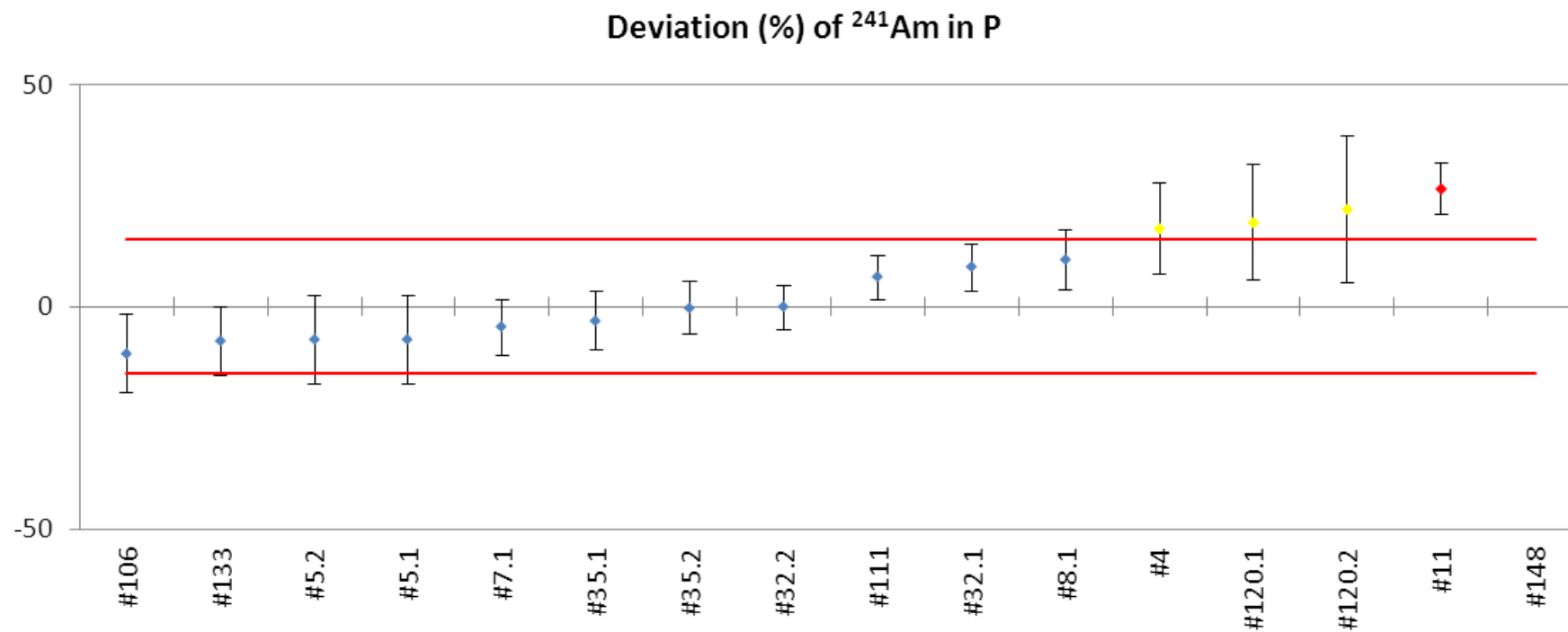
# 11. Peat (P) Deviation Plots



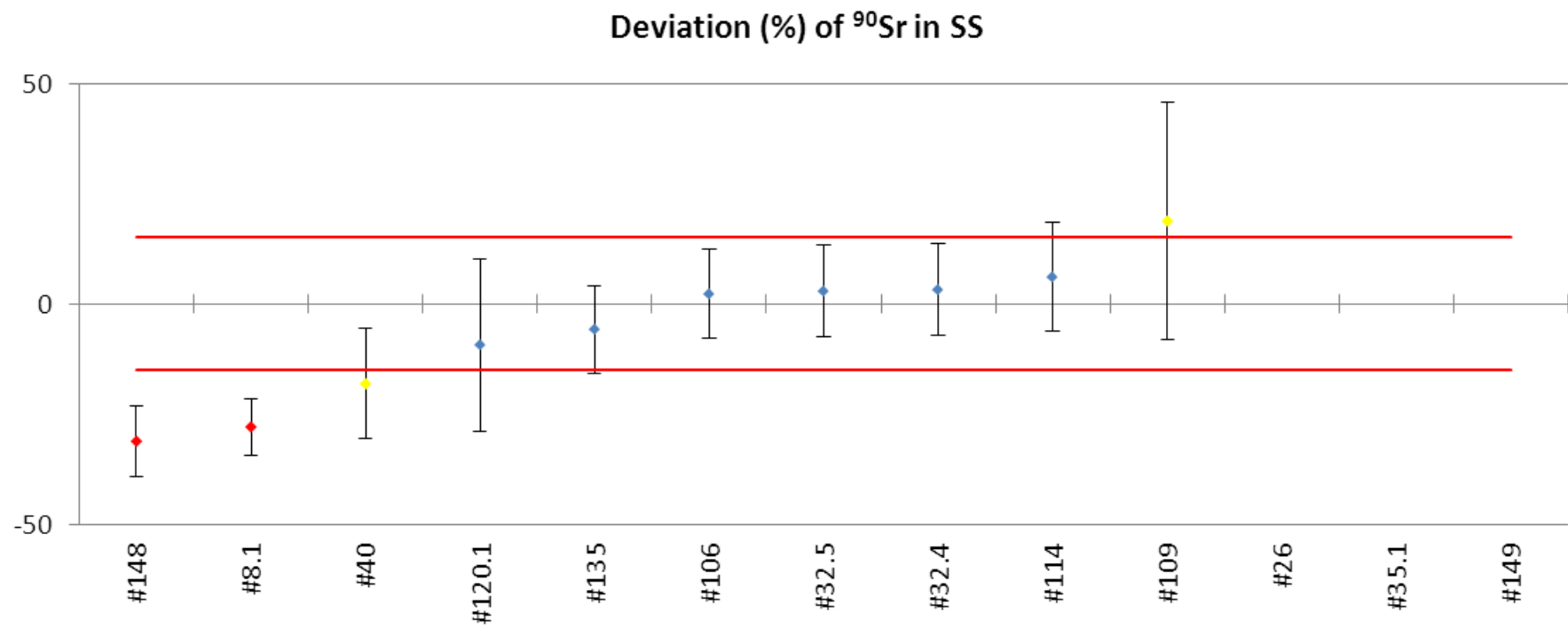


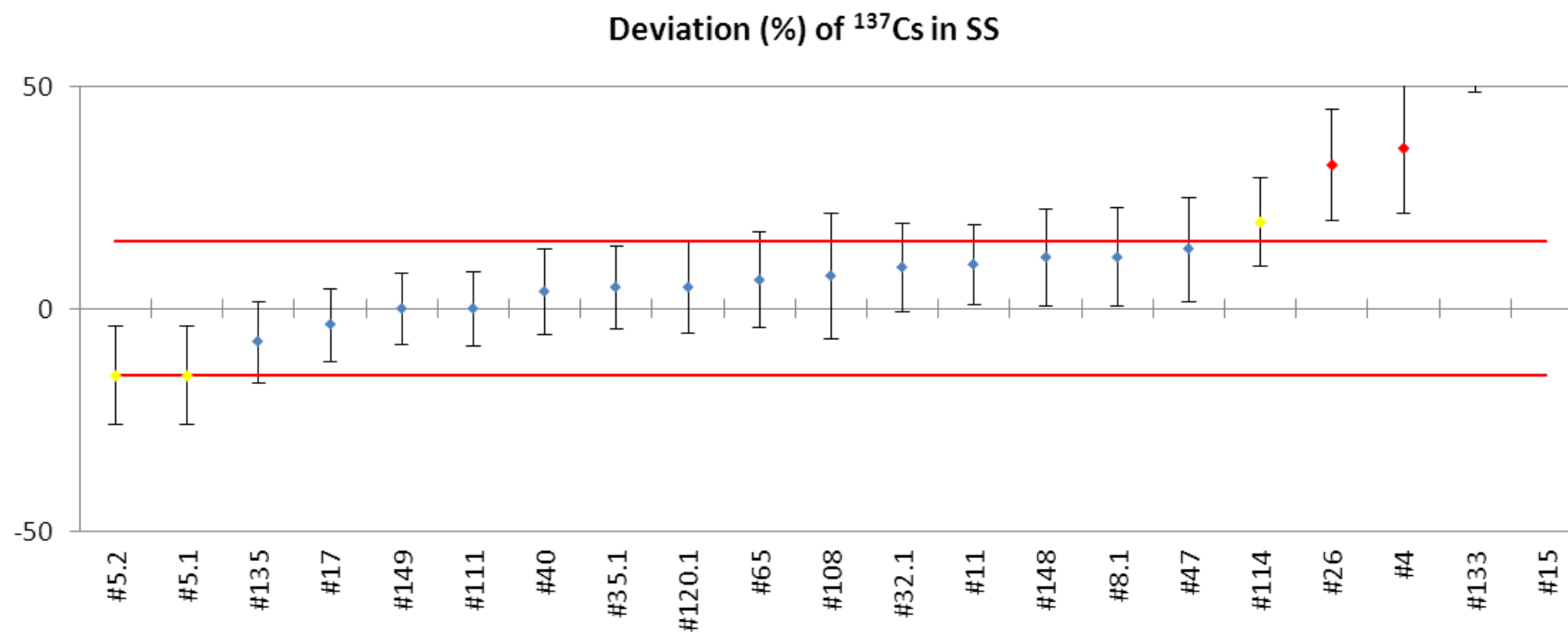


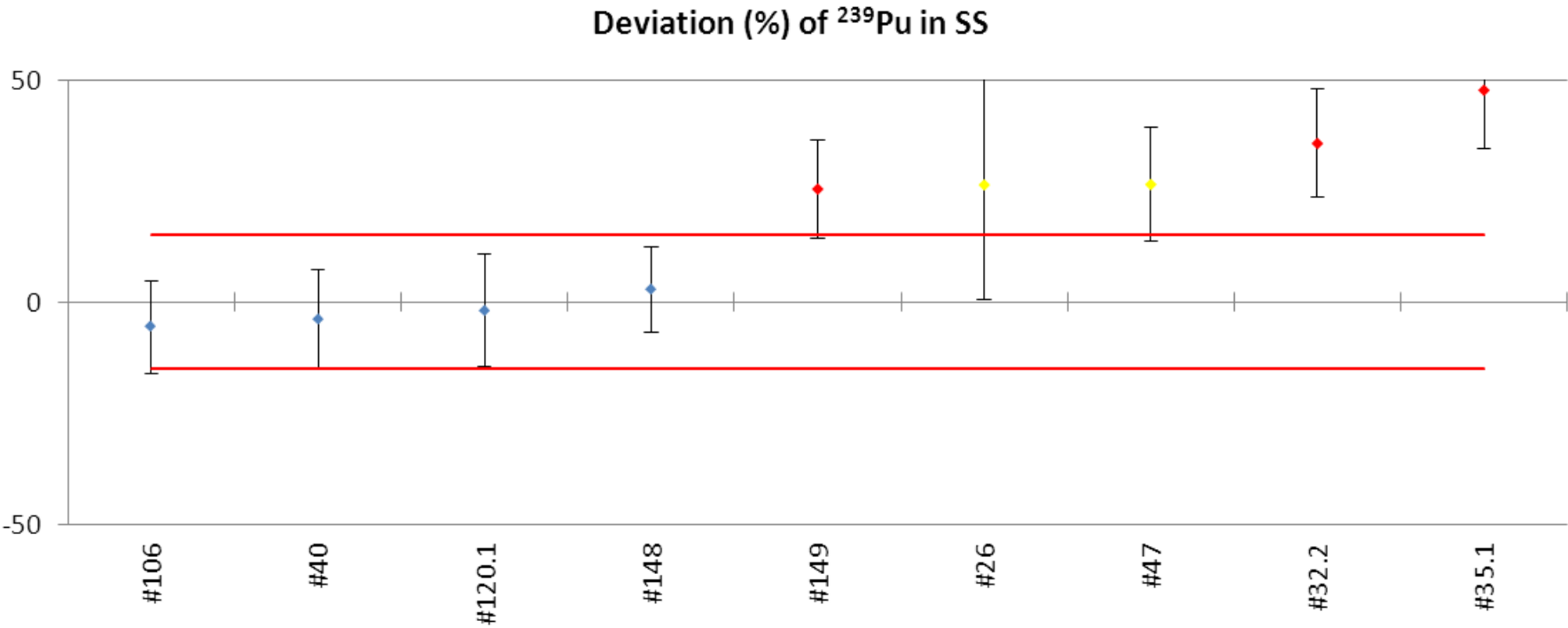


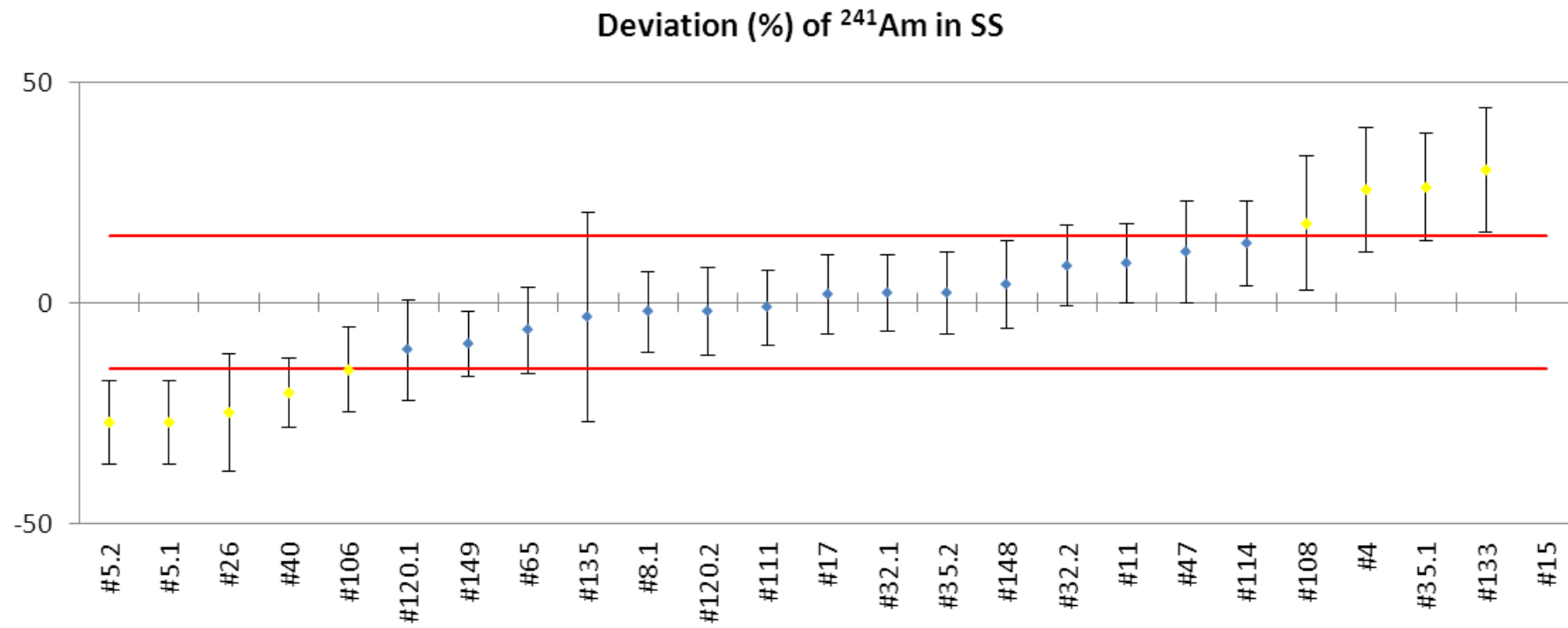


# 12. Sandy Soil (S) Deviation Plots







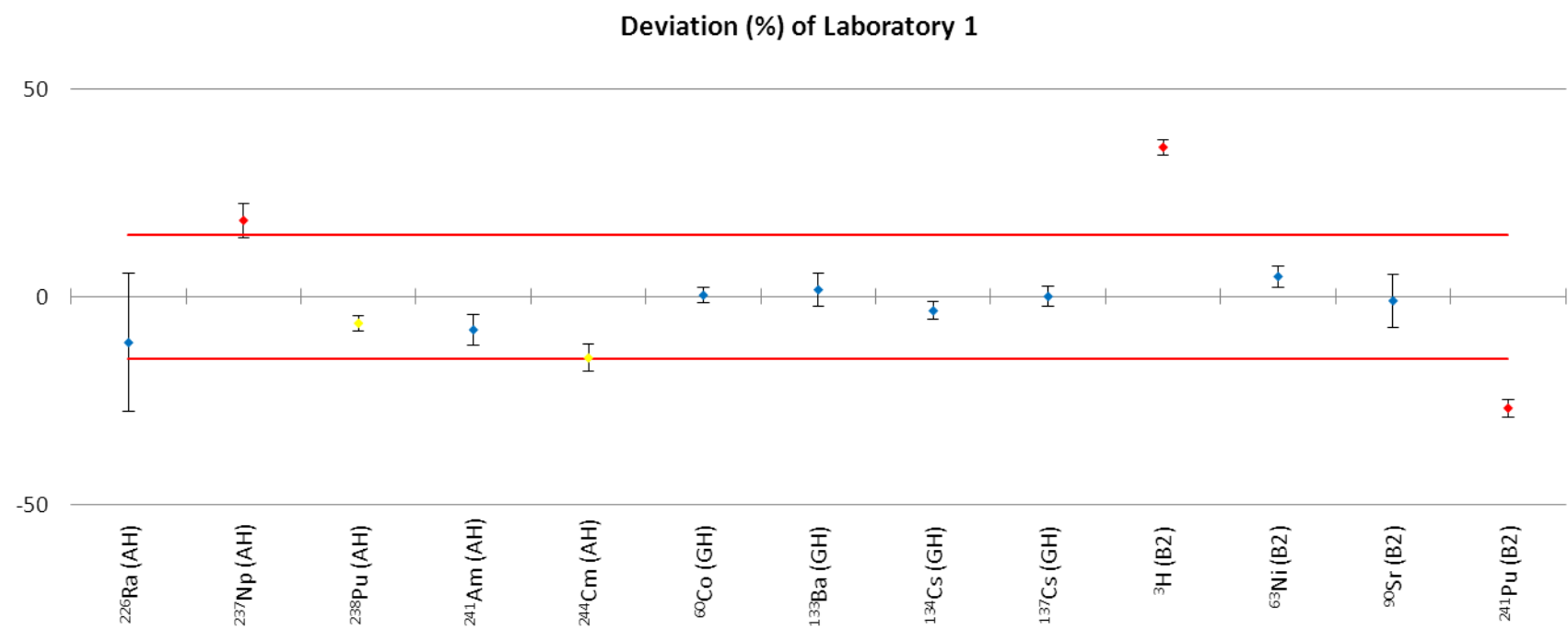




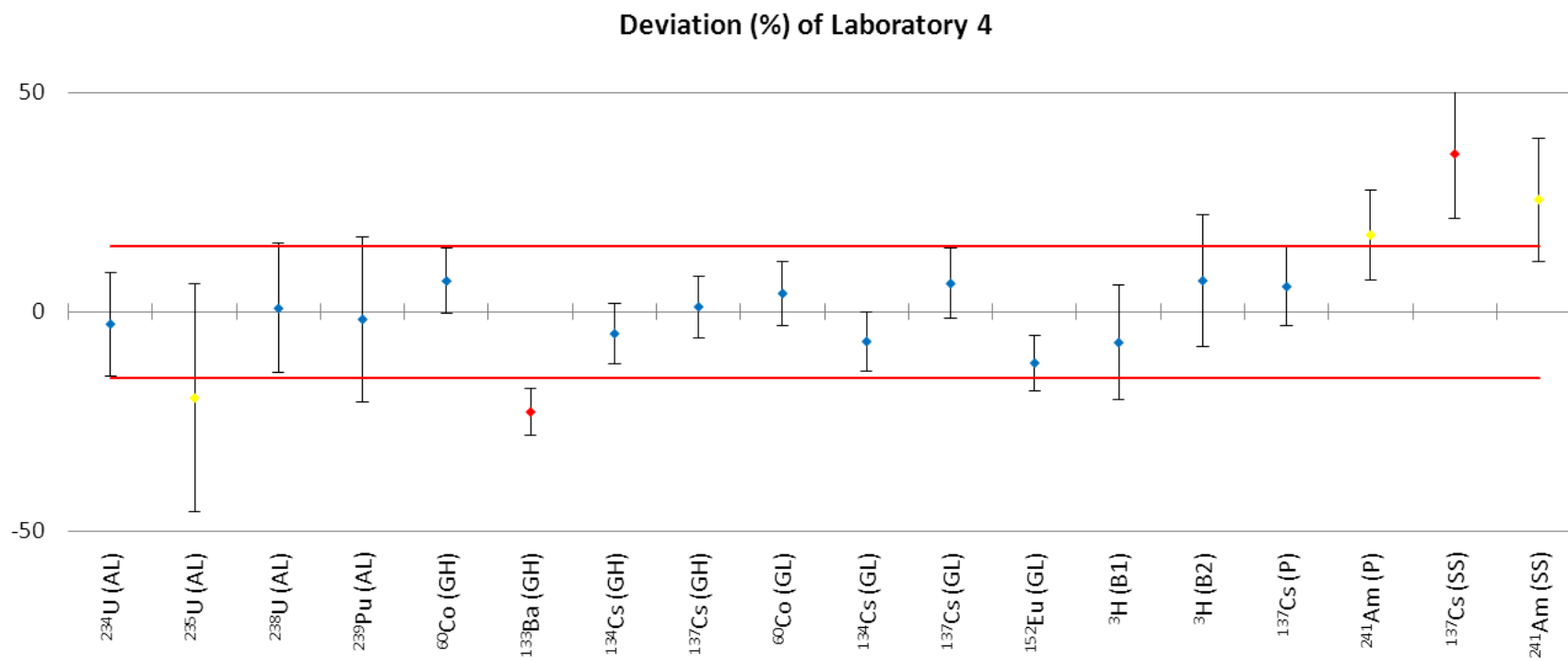


# 13. Deviation Plots and Tabulated Results Arranged by Lab Number

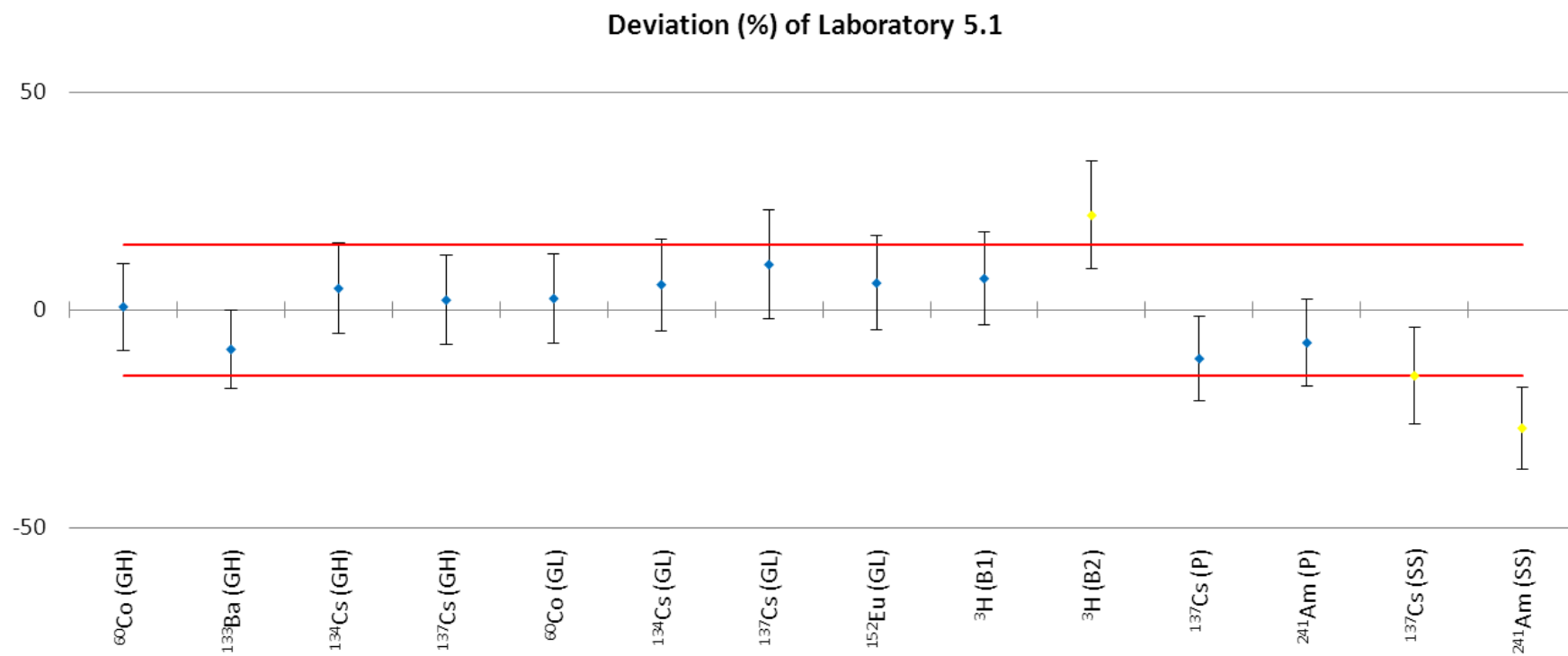
**NOTE:** Data are quoted rounded, at  $k=1$  (standard uncertainty). Data analysis was carried out on data as reported (i.e. before rounding). Uncertainties have been rounded such that the significant figures of the standard uncertainty lie between 3 and 25. The standard rules of rounding have been applied, except in cases where rounding down would have reduced the uncertainty by more than 5 %, in which cases the uncertainty was rounded up.



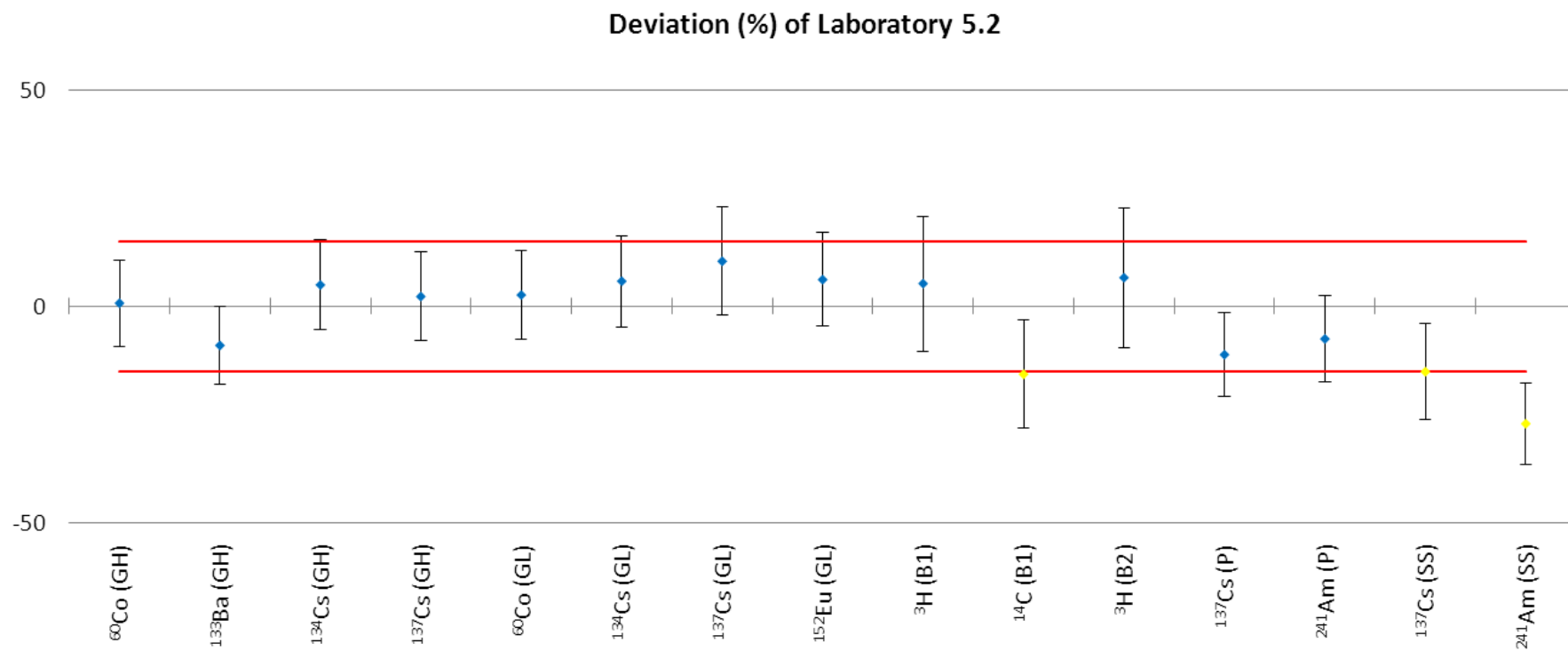
Radionuclide	Laboratory 1	NPL Assigned Value	Deviation /%	Zeta	Z Score
<sup>226</sup> Ra (AH)	1.4 ± 0.3 (± 19 %)	1.630 ± 0.022 (± 1.3 %)	-11.0	-0.66	-1.90
<sup>237</sup> Np (AH)	17.9 ± 0.6 (± 4 %)	15.12 ± 0.16 (± 1.0 %)	18.4	4.48	3.16
<sup>238</sup> Pu (AH)	15.7 ± 0.3 (± 1.9 %)	16.77 ± 0.06 (± 0.4 %)	-6.4	-3.51	-1.10
<sup>241</sup> Am (AH)	4.61 ± 0.18 (± 4 %)	5.010 ± 0.017 (± 0.4 %)	-8.0	-2.21	-1.37
<sup>244</sup> Cm (AH)	12.9 ± 0.5 (± 4 %)	15.13 ± 0.06 (± 0.4 %)	-14.7	-4.43	-2.53
<sup>60</sup> Co (GH)	11.10 ± 0.20 (± 1.8 %)	11.06 ± 0.03 (± 0.3 %)	0.4	0.21	0.06
<sup>133</sup> Ba (GH)	13.2 ± 0.5 (± 4 %)	12.98 ± 0.10 (± 0.8 %)	1.7	0.43	0.29
<sup>134</sup> Cs (GH)	1.85 ± 0.04 (± 2.2 %)	1.915 ± 0.013 (± 0.7 %)	-3.4	-1.54	-0.58
<sup>137</sup> Cs (GH)	8.10 ± 0.20 (± 2.5 %)	8.10 ± 0.06 (± 0.7 %)	0.1	0.02	0.01
<sup>3</sup> H (B2)	1.430 ± 0.020 (± 1.4 %)	1.051 ± 0.008 (± 0.7 %)	36.0	17.76	6.19
<sup>63</sup> Ni (B2)	1.73 ± 0.04 (± 2.3 %)	1.650 ± 0.017 (± 1.0 %)	4.9	1.85	0.84
<sup>90</sup> Sr (B2)	0.47 ± 0.03 (± 7 %)	0.4746 ± 0.0010 (± 0.21 %)	-1.0	-0.15	-0.17
<sup>241</sup> Pu (B2)	0.700 ± 0.020 (± 3 %)	0.957 ± 0.011 (± 1.1 %)	-26.8	-11.35	-4.61



Radionuclide	Laboratory 4	NPL Assigned Value	Deviation /%	Zeta	Z Score
<sup>234</sup> U (AL)	18.7 ± 2.3 (± 12 %)	19.3 ± 0.3 (± 1.4 %)	-2.8	-0.23	-0.47
<sup>235</sup> U (AL)	0.74 ± 0.24 (± 40 %)	0.921 ± 0.012 (± 1.3 %)	-19.6	-0.75	-3.37
<sup>238</sup> U (AL)	19 ± 3 (± 15 %)	19.3 ± 0.3 (± 1.4 %)	0.8	0.06	0.14
<sup>239</sup> Pu (AL)	1.31 ± 0.25 (± 19 %)	1.332 ± 0.006 (± 0.4 %)	-1.7	-0.09	-0.29
<sup>60</sup> Co (GH)	11.8 ± 0.8 (± 7 %)	11.06 ± 0.03 (± 0.3 %)	7.1	0.94	1.21
<sup>133</sup> Ba (GH)	10.0 ± 0.7 (± 7 %)	12.98 ± 0.10 (± 0.8 %)	-22.8	-4.19	-3.92
<sup>134</sup> Cs (GH)	1.82 ± 0.13 (± 7 %)	1.915 ± 0.013 (± 0.7 %)	-5.0	-0.73	-0.85
<sup>137</sup> Cs (GH)	8.2 ± 0.6 (± 7 %)	8.10 ± 0.06 (± 0.7 %)	1.2	0.17	0.20
<sup>60</sup> Co (GL)	13.8 ± 1.0 (± 7 %)	13.23 ± 0.11 (± 0.8 %)	4.2	0.57	0.73
<sup>134</sup> Cs (GL)	3.19 ± 0.23 (± 7 %)	3.42 ± 0.03 (± 0.8 %)	-6.7	-1.00	-1.16
<sup>137</sup> Cs (GL)	1.88 ± 0.14 (± 8 %)	1.766 ± 0.016 (± 0.9 %)	6.5	0.81	1.11
<sup>152</sup> Eu (GL)	19.3 ± 1.3 (± 7 %)	21.9 ± 0.4 (± 1.8 %)	-11.7	-1.83	-2.00
<sup>3</sup> H (B1)	0.95 ± 0.13 (± 14 %)	1.026 ± 0.007 (± 0.7 %)	-7.0	-0.54	-1.20
<sup>3</sup> H (B2)	1.13 ± 0.16 (± 14 %)	1.051 ± 0.008 (± 0.7 %)	7.1	0.47	1.22
<sup>137</sup> Cs (P)	2.87 ± 0.21 (± 7 %)	2.71 ± 0.12 (± 5.0 %)	5.8	0.65	0.99
<sup>241</sup> Am (P)	5.1 ± 0.4 (± 8 %)	4.35 ± 0.19 (± 5.0 %)	17.6	1.77	3.01
<sup>137</sup> Cs (SS)	1.09 ± 0.08 (± 7 %)	0.80 ± 0.07 (± 8 %)	36.1	2.82	6.20
<sup>241</sup> Am (SS)	1.69 ± 0.13 (± 8 %)	1.34 ± 0.11 (± 8 %)	25.7	2.03	4.41

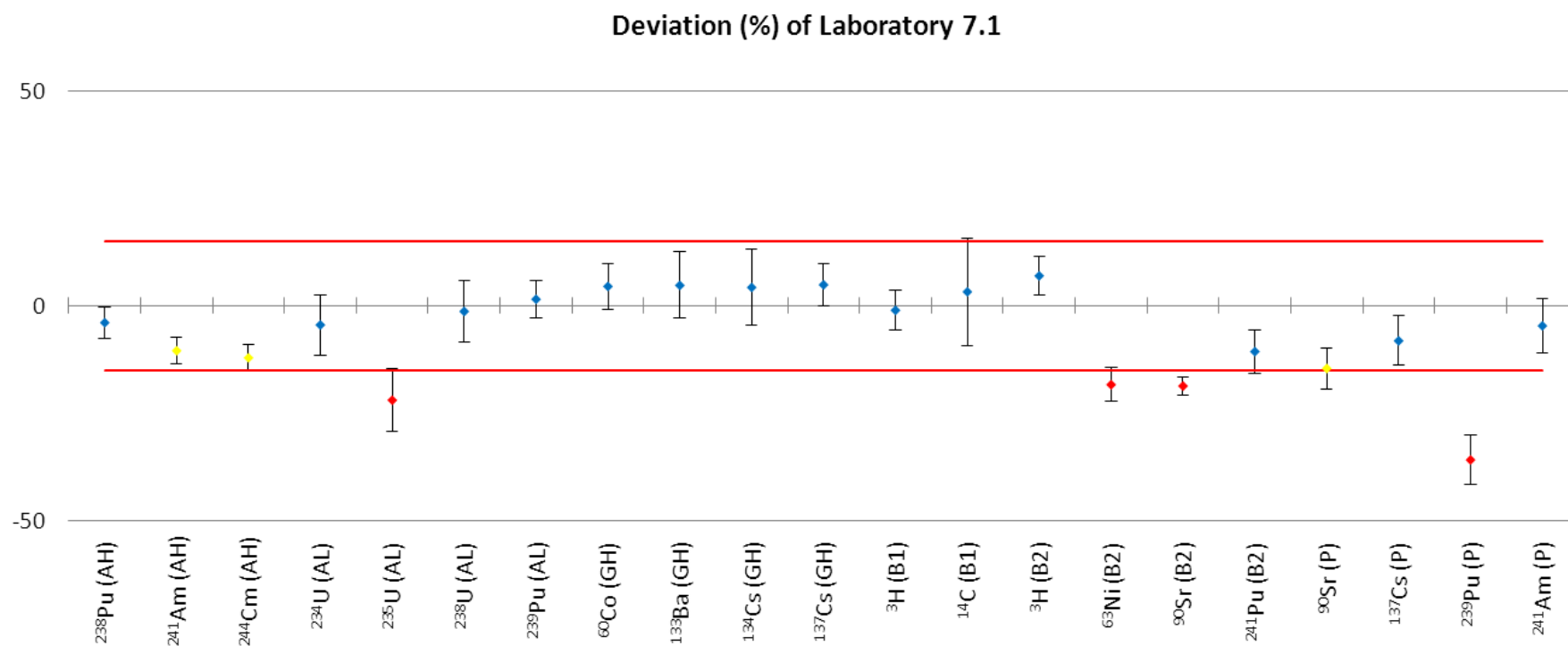


Radionuclide	Laboratory 5.1	NPL Assigned Value	Deviation /%	Zeta	Z Score
<sup>60</sup> Co (GH)	11.1 ± 1.1 (± 10 %)	11.06 ± 0.03 (± 0.3 %)	0.7	0.07	0.13
<sup>133</sup> Ba (GH)	11.8 ± 1.2 (± 10 %)	12.98 ± 0.10 (± 0.8 %)	-9.0	-0.99	-1.55
<sup>134</sup> Cs (GH)	2.01 ± 0.20 (± 10 %)	1.915 ± 0.013 (± 0.7 %)	5.0	0.47	0.85
<sup>137</sup> Cs (GH)	8.3 ± 0.8 (± 10 %)	8.10 ± 0.06 (± 0.7 %)	2.3	0.22	0.39
<sup>60</sup> Co (GL)	13.6 ± 1.4 (± 10 %)	13.23 ± 0.11 (± 0.8 %)	2.6	0.26	0.45
<sup>134</sup> Cs (GL)	3.6 ± 0.4 (± 10 %)	3.42 ± 0.03 (± 0.8 %)	5.8	0.55	1.00
<sup>137</sup> Cs (GL)	1.95 ± 0.22 (± 11 %)	1.766 ± 0.016 (± 0.9 %)	10.4	0.84	1.79
<sup>152</sup> Eu (GL)	23.2 ± 2.3 (± 10 %)	21.9 ± 0.4 (± 1.8 %)	6.2	0.58	1.06
<sup>3</sup> H (B1)	1.10 ± 0.11 (± 10 %)	1.026 ± 0.007 (± 0.7 %)	7.2	0.67	1.24
<sup>3</sup> H (B2)	1.28 ± 0.13 (± 10 %)	1.051 ± 0.008 (± 0.7 %)	21.8	1.76	3.74
<sup>137</sup> Cs (P)	2.41 ± 0.24 (± 10 %)	2.71 ± 0.12 (± 5.0 %)	-11.2	-1.13	-1.92
<sup>241</sup> Am (P)	4.0 ± 0.4 (± 10 %)	4.35 ± 0.19 (± 5.0 %)	-7.5	-0.74	-1.29
<sup>137</sup> Cs (SS)	0.68 ± 0.07 (± 10 %)	0.80 ± 0.07 (± 8 %)	-15.1	-1.28	-2.59
<sup>241</sup> Am (SS)	0.98 ± 0.10 (± 10 %)	1.34 ± 0.11 (± 8 %)	-27.1	-2.47	-4.66

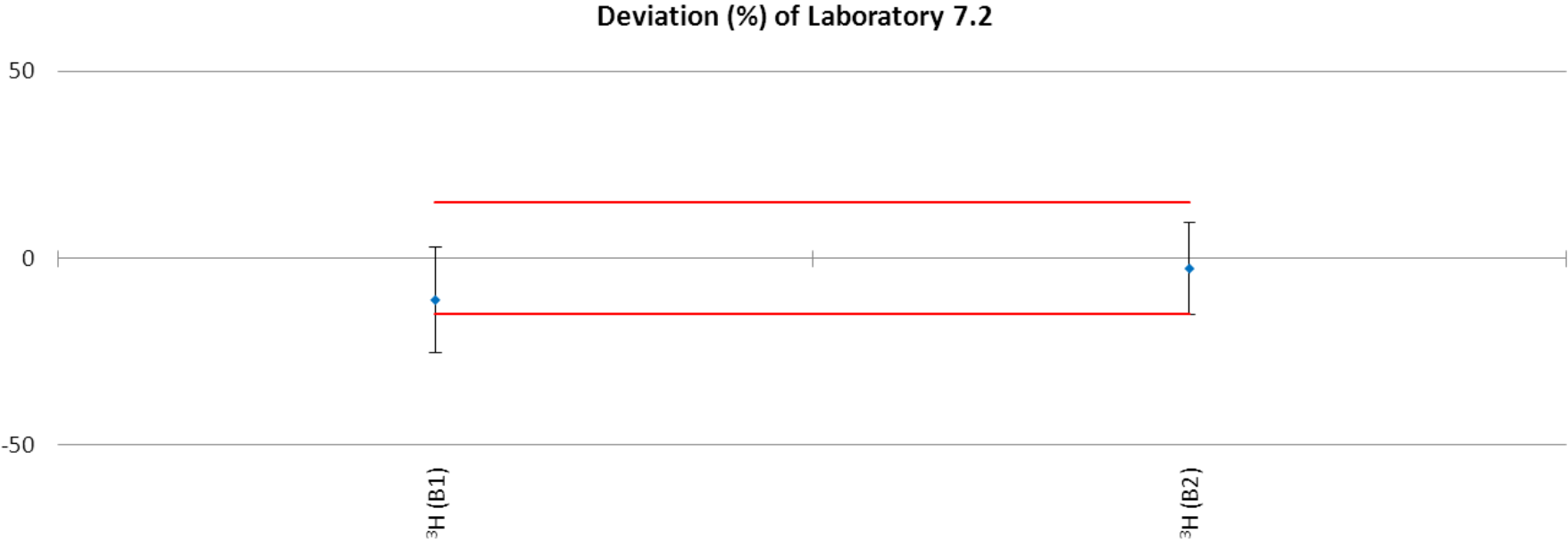




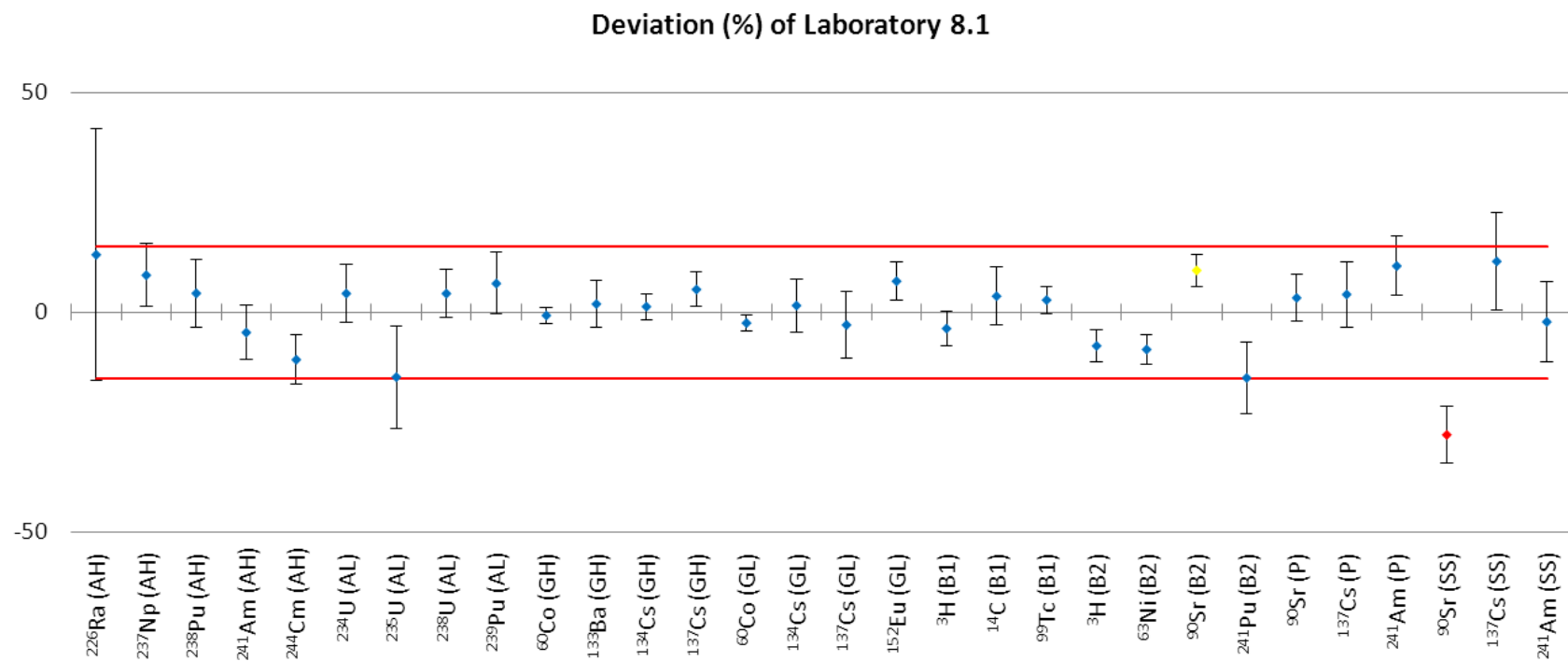
Radionuclide	Laboratory 5.2	NPL Assigned Value	Deviation /%	Zeta	Z Score
<sup>60</sup> Co (GH)	11.1 ± 1.1 (± 10 %)	11.06 ± 0.03 (± 0.3 %)	0.7	0.07	0.13
<sup>133</sup> Ba (GH)	11.8 ± 1.2 (± 10 %)	12.98 ± 0.10 (± 0.8 %)	-9.0	-0.99	-1.55
<sup>134</sup> Cs (GH)	2.01 ± 0.20 (± 10 %)	1.915 ± 0.013 (± 0.7 %)	5.0	0.47	0.85
<sup>137</sup> Cs (GH)	8.3 ± 0.8 (± 10 %)	8.10 ± 0.06 (± 0.7 %)	2.3	0.22	0.39
<sup>60</sup> Co (GL)	13.6 ± 1.4 (± 10 %)	13.23 ± 0.11 (± 0.8 %)	2.6	0.26	0.45
<sup>134</sup> Cs (GL)	3.6 ± 0.4 (± 10 %)	3.42 ± 0.03 (± 0.8 %)	5.8	0.55	1.00
<sup>137</sup> Cs (GL)	1.95 ± 0.22 (± 11 %)	1.766 ± 0.016 (± 0.9 %)	10.4	0.84	1.79
<sup>152</sup> Eu (GL)	23.2 ± 2.3 (± 10 %)	21.9 ± 0.4 (± 1.8 %)	6.2	0.58	1.06
<sup>3</sup> H (B1)	1.08 ± 0.16 (± 15 %)	1.026 ± 0.007 (± 0.7 %)	5.3	0.34	0.91
<sup>14</sup> C (B1)	0.87 ± 0.13 (± 15 %)	1.032 ± 0.005 (± 0.50 %)	-15.7	-1.25	-2.70
<sup>3</sup> H (B2)	1.12 ± 0.17 (± 15 %)	1.051 ± 0.008 (± 0.7 %)	6.6	0.41	1.14
<sup>137</sup> Cs (P)	2.41 ± 0.24 (± 10 %)	2.71 ± 0.12 (± 5.0 %)	-11.2	-1.13	-1.92
<sup>241</sup> Am (P)	4.0 ± 0.4 (± 10 %)	4.35 ± 0.19 (± 5.0 %)	-7.5	-0.74	-1.29
<sup>137</sup> Cs (SS)	0.68 ± 0.07 (± 10 %)	0.80 ± 0.07 (± 8 %)	-15.1	-1.28	-2.59
<sup>241</sup> Am (SS)	0.98 ± 0.10 (± 10 %)	1.34 ± 0.11 (± 8 %)	-27.1	-2.47	-4.66



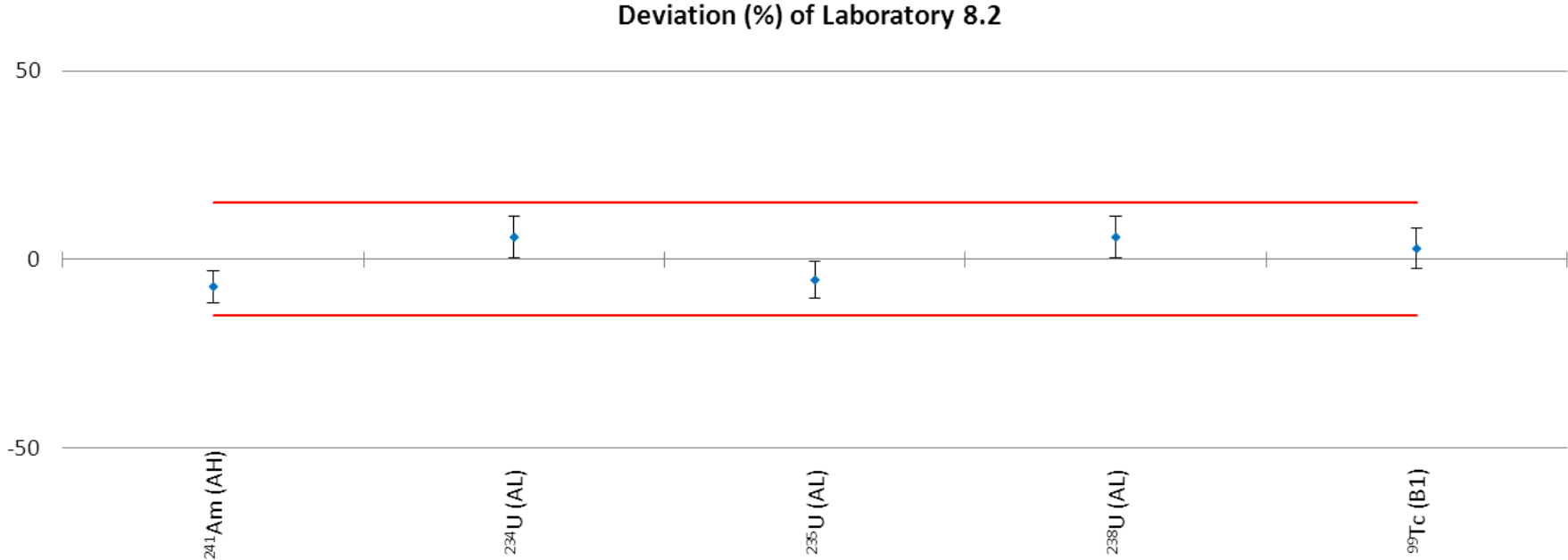
Radionuclide	Laboratory 7.1	NPL Assigned Value	Deviation /%	Zeta	Z Score
<sup>238</sup> Pu (AH)	16.1 ± 0.6 (± 4 %)	16.77 ± 0.06 (± 0.4 %)	-3.9	-1.07	-0.68
<sup>241</sup> Am (AH)	4.48 ± 0.16 (± 4 %)	5.010 ± 0.017 (± 0.4 %)	-10.5	-3.29	-1.80
<sup>244</sup> Cm (AH)	13.3 ± 0.5 (± 4 %)	15.13 ± 0.06 (± 0.4 %)	-12.1	-3.99	-2.08
<sup>234</sup> U (AL)	18.4 ± 1.3 (± 7 %)	19.3 ± 0.3 (± 1.4 %)	-4.5	-0.63	-0.77
<sup>235</sup> U (AL)	0.72 ± 0.07 (± 9 %)	0.921 ± 0.012 (± 1.3 %)	-22.0	-3.03	-3.78
<sup>238</sup> U (AL)	19.0 ± 1.4 (± 7 %)	19.3 ± 0.3 (± 1.4 %)	-1.3	-0.18	-0.23
<sup>239</sup> Pu (AL)	1.35 ± 0.06 (± 5.0 %)	1.332 ± 0.006 (± 0.4 %)	1.5	0.34	0.26
<sup>60</sup> Co (GH)	11.6 ± 0.6 (± 5.0 %)	11.06 ± 0.03 (± 0.3 %)	4.5	0.86	0.77
<sup>133</sup> Ba (GH)	13.6 ± 1.0 (± 7 %)	12.98 ± 0.10 (± 0.8 %)	4.8	0.61	0.82
<sup>134</sup> Cs (GH)	2.00 ± 0.17 (± 9 %)	1.915 ± 0.013 (± 0.7 %)	4.3	0.48	0.73
<sup>137</sup> Cs (GH)	8.5 ± 0.4 (± 5.0 %)	8.10 ± 0.06 (± 0.7 %)	4.9	0.98	0.84
<sup>3</sup> H (B1)	1.01 ± 0.05 (± 5.0 %)	1.026 ± 0.007 (± 0.7 %)	-1.1	-0.22	-0.18
<sup>14</sup> C (B1)	1.07 ± 0.13 (± 12 %)	1.032 ± 0.005 (± 0.50 %)	3.3	0.26	0.56
<sup>3</sup> H (B2)	1.12 ± 0.05 (± 4 %)	1.051 ± 0.008 (± 0.7 %)	7.0	1.56	1.20
<sup>63</sup> Ni (B2)	1.35 ± 0.07 (± 5.0 %)	1.650 ± 0.017 (± 1.0 %)	-18.4	-4.53	-3.16
<sup>90</sup> Sr (B2)	0.386 ± 0.010 (± 3 %)	0.4746 ± 0.0010 (± 0.21 %)	-18.7	-8.65	-3.21
<sup>241</sup> Pu (B2)	0.85 ± 0.05 (± 6 %)	0.957 ± 0.011 (± 1.1 %)	-10.7	-2.03	-1.83
<sup>90</sup> Sr (P)	2.14 ± 0.07 (± 4 %)	2.51 ± 0.11 (± 5.0 %)	-14.6	-2.77	-2.51
<sup>137</sup> Cs (P)	2.49 ± 0.11 (± 5.0 %)	2.71 ± 0.12 (± 5.0 %)	-8.2	-1.36	-1.40
<sup>239</sup> Pu (P)	2.54 ± 0.20 (± 8 %)	3.97 ± 0.18 (± 5.0 %)	-35.9	-5.40	-6.17
<sup>241</sup> Am (P)	4.14 ± 0.20 (± 5.0 %)	4.35 ± 0.19 (± 5.0 %)	-4.7	-0.74	-0.80



Radionuclide	Laboratory 7.2	NPL Assigned Value	Deviation /%	Zeta	Z Score
$^3\text{H}$ (B1)	$0.91 \pm 0.14$ ( $\pm 16$ %)	$1.026 \pm 0.007$ ( $\pm 0.7$ %)	-11.1	-0.79	-1.91
$^3\text{H}$ (B2)	$1.02 \pm 0.13$ ( $\pm 13$ %)	$1.051 \pm 0.008$ ( $\pm 0.7$ %)	-2.7	-0.22	-0.46

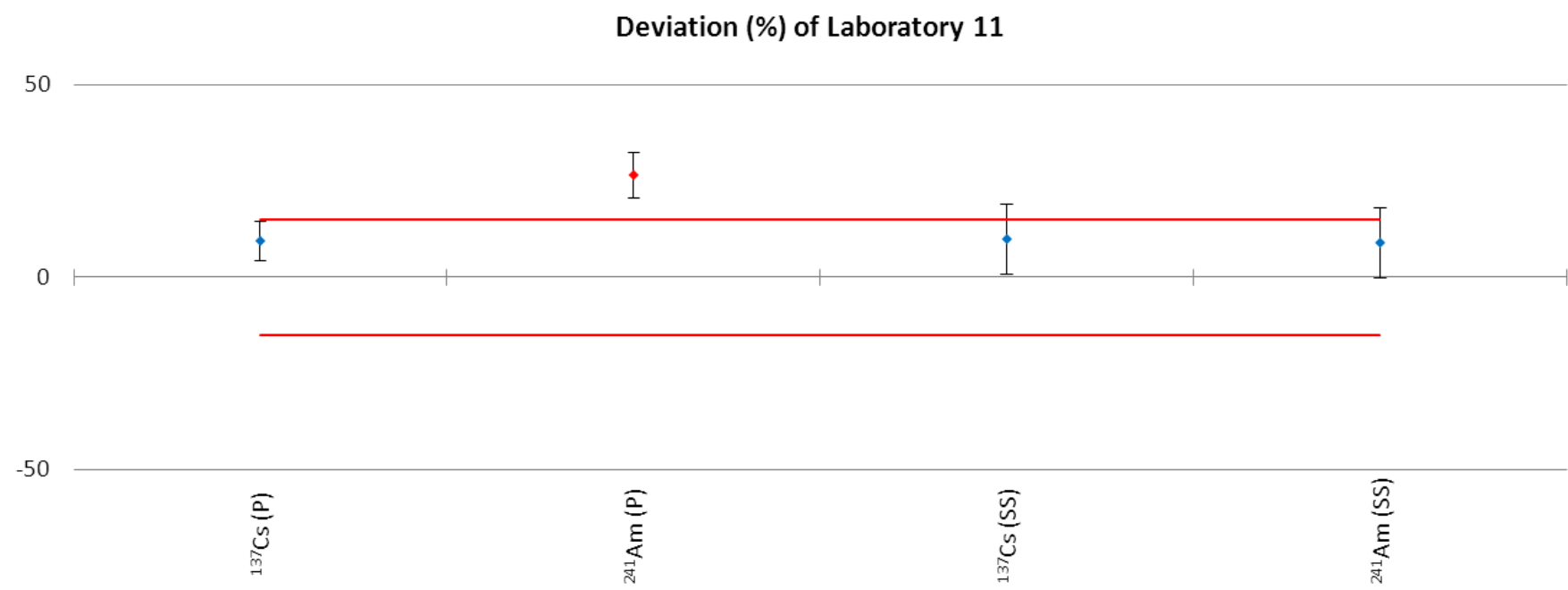


Radionuclide	Laboratory 8.1	NPL Assigned Value	Deviation /%	Zeta	Z Score
<sup>226</sup> Ra (AH)	1.8 ± 0.5 (± 25 %)	1.630 ± 0.022 (± 1.3 %)	13.1	0.46	2.25
<sup>237</sup> Np (AH)	16.4 ± 1.1 (± 7 %)	15.12 ± 0.16 (± 1.0 %)	8.5	1.17	1.46
<sup>238</sup> Pu (AH)	17.5 ± 1.3 (± 7 %)	16.77 ± 0.06 (± 0.4 %)	4.3	0.57	0.75
<sup>241</sup> Am (AH)	4.8 ± 0.3 (± 7 %)	5.010 ± 0.017 (± 0.4 %)	-4.6	-0.75	-0.79
<sup>244</sup> Cm (AH)	13.5 ± 0.8 (± 6 %)	15.13 ± 0.06 (± 0.4 %)	-10.8	-1.94	-1.85
<sup>234</sup> U (AL)	20.1 ± 1.2 (± 6 %)	19.3 ± 0.3 (± 1.4 %)	4.3	0.65	0.74
<sup>235</sup> U (AL)	0.78 ± 0.11 (± 14 %)	0.921 ± 0.012 (± 1.3 %)	-14.7	-1.26	-2.53
<sup>238</sup> U (AL)	20.1 ± 1.0 (± 5.0 %)	19.3 ± 0.3 (± 1.4 %)	4.3	0.78	0.74
<sup>239</sup> Pu (AL)	1.42 ± 0.09 (± 7 %)	1.332 ± 0.006 (± 0.4 %)	6.6	0.93	1.13
<sup>60</sup> Co (GH)	10.98 ± 0.20 (± 1.8 %)	11.06 ± 0.03 (± 0.3 %)	-0.7	-0.39	-0.12
<sup>133</sup> Ba (GH)	13.2 ± 0.7 (± 5.0 %)	12.98 ± 0.10 (± 0.8 %)	1.9	0.36	0.33
<sup>134</sup> Cs (GH)	1.94 ± 0.06 (± 3 %)	1.915 ± 0.013 (± 0.7 %)	1.3	0.42	0.22
<sup>137</sup> Cs (GH)	8.5 ± 0.4 (± 4 %)	8.10 ± 0.06 (± 0.7 %)	5.2	1.31	0.90
<sup>60</sup> Co (GL)	12.91 ± 0.23 (± 1.8 %)	13.23 ± 0.11 (± 0.8 %)	-2.4	-1.26	-0.42
<sup>134</sup> Cs (GL)	3.47 ± 0.21 (± 6 %)	3.42 ± 0.03 (± 0.8 %)	1.6	0.25	0.27
<sup>137</sup> Cs (GL)	1.72 ± 0.14 (± 8 %)	1.766 ± 0.016 (± 0.9 %)	-2.9	-0.37	-0.49
<sup>152</sup> Eu (GL)	23.4 ± 0.9 (± 4 %)	21.9 ± 0.4 (± 1.8 %)	7.1	1.67	1.22
<sup>3</sup> H (B1)	0.99 ± 0.04 (± 4 %)	1.026 ± 0.007 (± 0.7 %)	-3.7	-0.92	-0.63
<sup>14</sup> C (B1)	1.07 ± 0.07 (± 7 %)	1.032 ± 0.005 (± 0.50 %)	3.7	0.55	0.63
<sup>99</sup> Tc (B1)	0.152 ± 0.005 (± 3 %)	0.1478 ± 0.0013 (± 0.9 %)	2.8	0.94	0.48
<sup>3</sup> H (B2)	0.97 ± 0.04 (± 4 %)	1.051 ± 0.008 (± 0.7 %)	-7.6	-1.99	-1.31
<sup>63</sup> Ni (B2)	1.51 ± 0.06 (± 4 %)	1.650 ± 0.017 (± 1.0 %)	-8.5	-2.49	-1.45
<sup>90</sup> Sr (B2)	0.520 ± 0.017 (± 4 %)	0.4746 ± 0.0010 (± 0.21 %)	9.6	2.67	1.64
<sup>241</sup> Pu (B2)	0.81 ± 0.08 (± 10 %)	0.957 ± 0.011 (± 1.1 %)	-14.9	-1.81	-2.56
<sup>90</sup> Sr (P)	2.59 ± 0.07 (± 3 %)	2.51 ± 0.11 (± 5.0 %)	3.3	0.63	0.57
<sup>137</sup> Cs (P)	2.82 ± 0.16 (± 6 %)	2.71 ± 0.12 (± 5.0 %)	4.1	0.56	0.70
<sup>241</sup> Am (P)	4.81 ± 0.21 (± 5.0 %)	4.35 ± 0.19 (± 5.0 %)	10.6	1.64	1.81
<sup>90</sup> Sr (SS)	0.199 ± 0.006 (± 3 %)	0.276 ± 0.023 (± 8 %)	-27.9	-3.24	-4.79
<sup>137</sup> Cs (SS)	0.89 ± 0.06 (± 6 %)	0.80 ± 0.07 (± 8 %)	11.6	1.12	2.00
<sup>241</sup> Am (SS)	1.32 ± 0.06 (± 5.0 %)	1.34 ± 0.11 (± 8 %)	-2.2	-0.24	-0.37

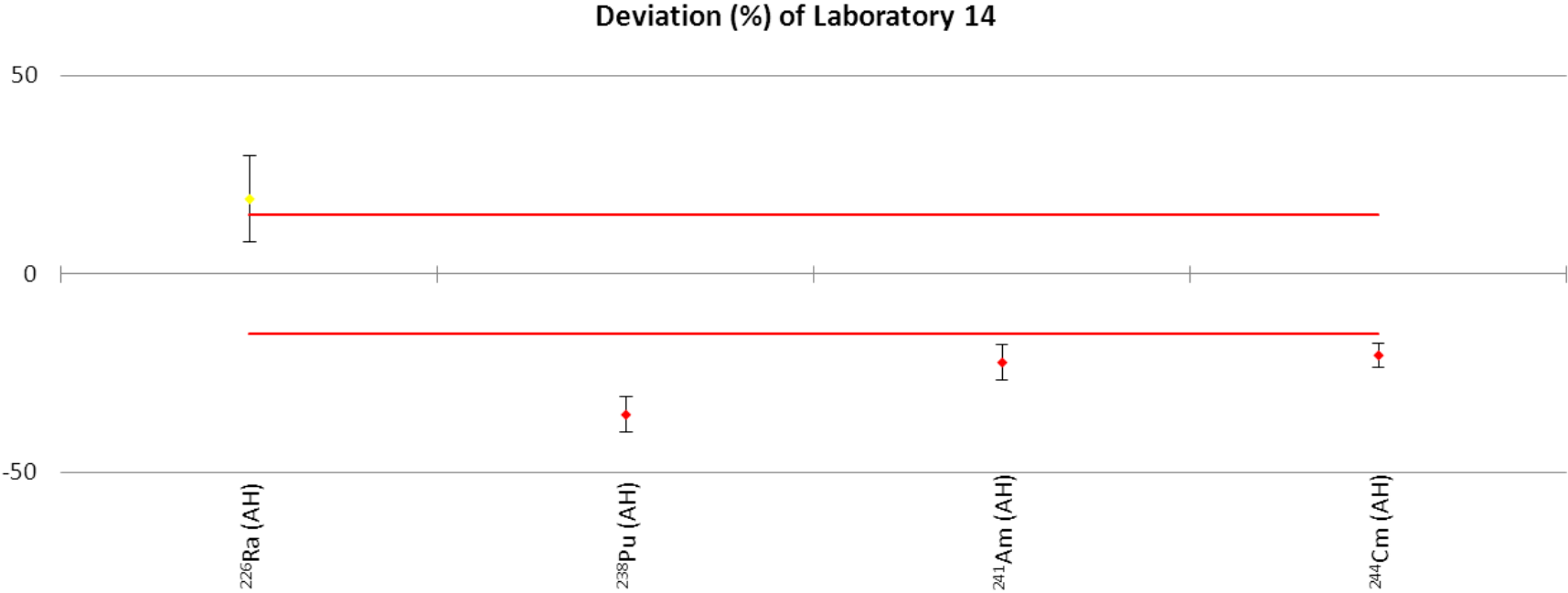




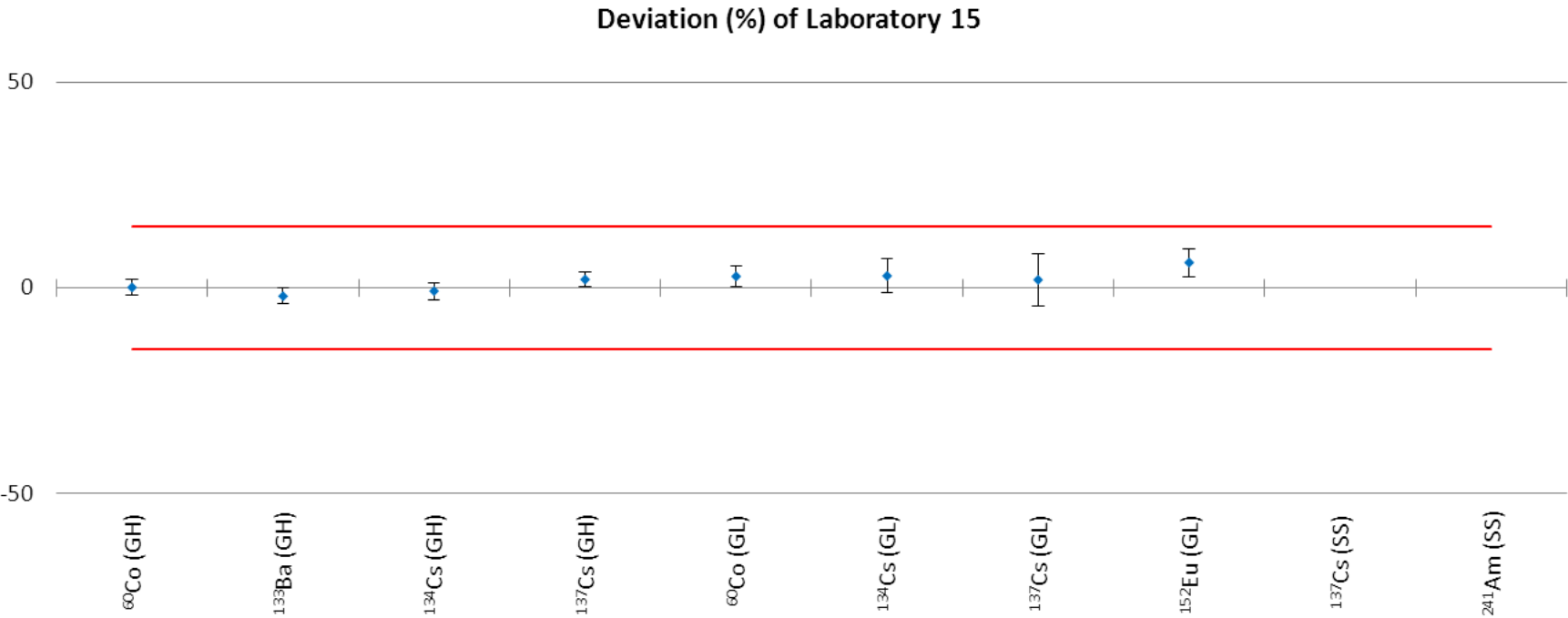
Radionuclide	Laboratory 8.2	NPL Assigned Value	Deviation /%	Zeta	Z Score
<sup>241</sup> Am (AH)	4.64 ± 0.21 (± 5.0 %)	5.010 ± 0.017 (± 0.4 %)	-7.3	-1.72	-1.25
<sup>234</sup> U (AL)	20.4 ± 1.0 (± 5.0 %)	19.3 ± 0.3 (± 1.4 %)	5.9	1.05	1.00
<sup>235</sup> U (AL)	0.87 ± 0.05 (± 5.0 %)	0.921 ± 0.012 (± 1.3 %)	-5.5	-1.10	-0.95
<sup>238</sup> U (AL)	20.4 ± 1.0 (± 5.0 %)	19.3 ± 0.3 (± 1.4 %)	5.9	1.05	1.00
<sup>99</sup> Tc (B1)	0.152 ± 0.008 (± 5.0 %)	0.1478 ± 0.0013 (± 0.9 %)	2.8	0.53	0.48



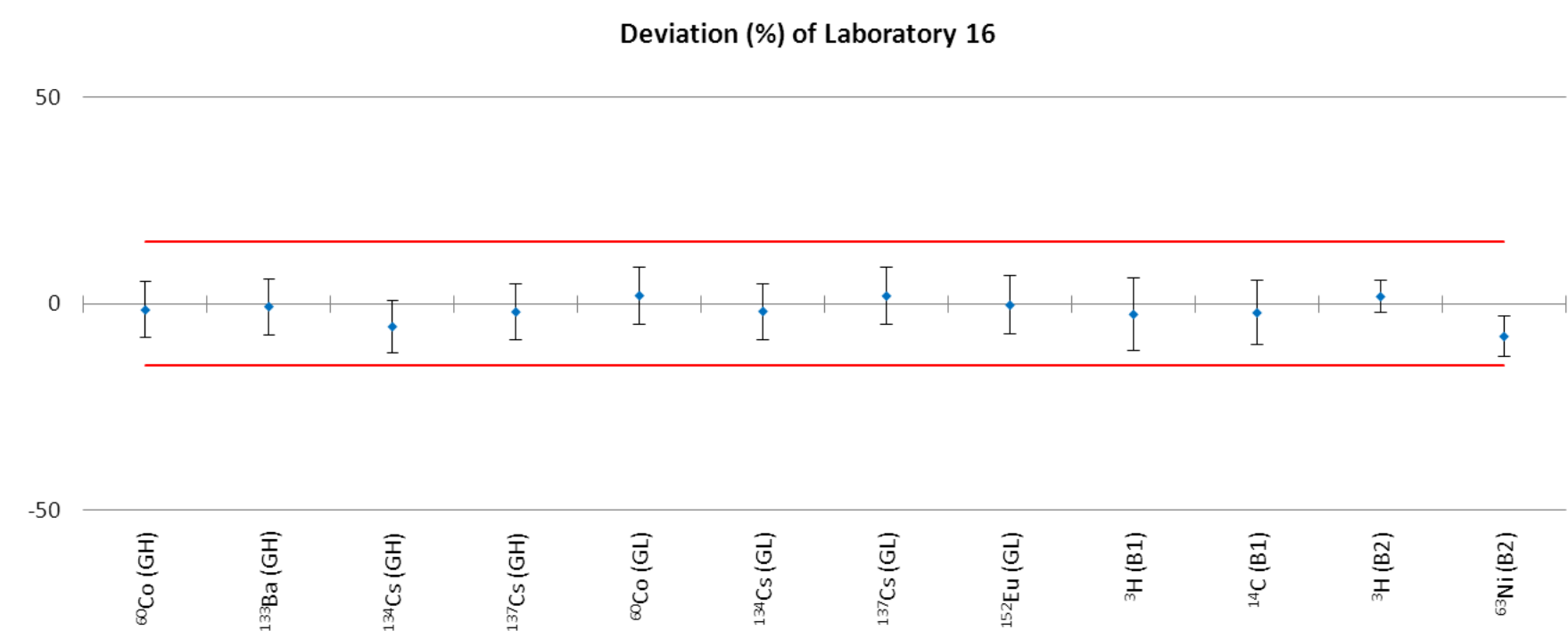
Radionuclide	Laboratory 11	NPL Assigned Value	Deviation /%	Zeta	Z Score
<sup>137</sup> Cs (P)	2.97 ± 0.06 (± 1.9 %)	2.71 ± 0.12 (± 5.0 %)	9.4	1.97	1.61
<sup>241</sup> Am (P)	5.50 ± 0.10 (± 1.9 %)	4.35 ± 0.19 (± 5.0 %)	26.5	5.42	4.56
<sup>137</sup> Cs (SS)	0.880 ± 0.017 (± 1.9 %)	0.80 ± 0.07 (± 8 %)	9.9	1.19	1.69
<sup>241</sup> Am (SS)	1.46 ± 0.03 (± 1.9 %)	1.34 ± 0.11 (± 8 %)	8.9	1.07	1.53



Radionuclide	Laboratory 14	NPL Assigned Value	Deviation /%	Zeta	Z Score
<sup>226</sup> Ra (AH)	1.94 ± 0.17 (± 9 %)	1.630 ± 0.022 (± 1.3 %)	18.9	1.76	3.24
<sup>238</sup> Pu (AH)	10.8 ± 0.8 (± 7 %)	16.77 ± 0.06 (± 0.4 %)	-35.5	-7.82	-6.10
<sup>241</sup> Am (AH)	3.89 ± 0.22 (± 6 %)	5.010 ± 0.017 (± 0.4 %)	-22.3	-4.99	-3.84
<sup>244</sup> Cm (AH)	12.0 ± 0.5 (± 4 %)	15.13 ± 0.06 (± 0.4 %)	-20.6	-6.54	-3.53

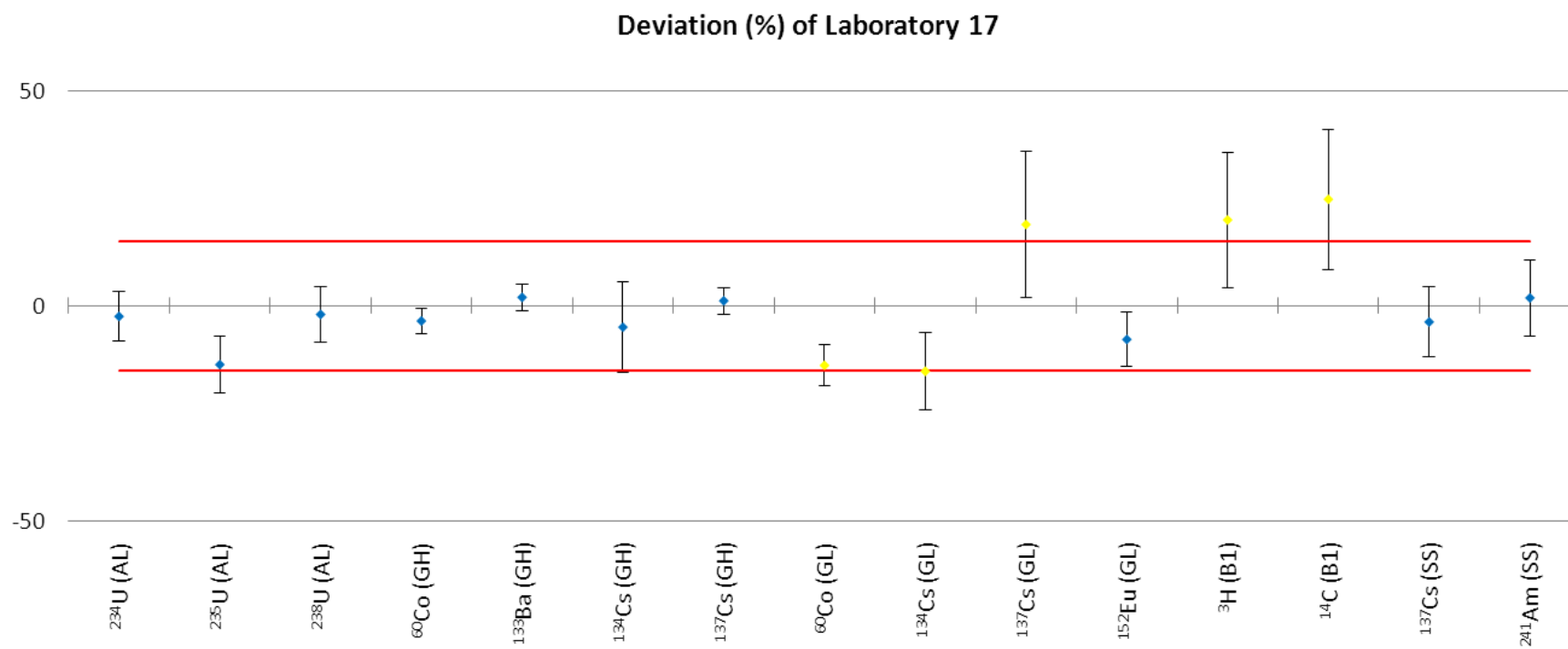


Radionuclide	Laboratory 15	NPL Assigned Value	Deviation /%	Zeta	Z Score
<sup>60</sup> Co (GH)	11.07 ± 0.20 (± 1.8 %)	11.06 ± 0.03 (± 0.3 %)	0.1	0.06	0.02
<sup>133</sup> Ba (GH)	12.72 ± 0.24 (± 1.9 %)	12.98 ± 0.10 (± 0.8 %)	-2.0	-1.00	-0.35
<sup>134</sup> Cs (GH)	1.90 ± 0.04 (± 2.1 %)	1.915 ± 0.013 (± 0.7 %)	-0.8	-0.36	-0.13
<sup>137</sup> Cs (GH)	8.26 ± 0.15 (± 1.8 %)	8.10 ± 0.06 (± 0.7 %)	2.0	1.02	0.35
<sup>60</sup> Co (GL)	13.6 ± 0.4 (± 2.4 %)	13.23 ± 0.11 (± 0.8 %)	2.8	1.06	0.48
<sup>134</sup> Cs (GL)	3.52 ± 0.14 (± 4 %)	3.42 ± 0.03 (± 0.8 %)	2.9	0.69	0.50
<sup>137</sup> Cs (GL)	1.80 ± 0.11 (± 6 %)	1.766 ± 0.016 (± 0.9 %)	1.9	0.31	0.33
<sup>152</sup> Eu (GL)	23.2 ± 0.6 (± 3 %)	21.9 ± 0.4 (± 1.8 %)	6.1	1.82	1.06
<sup>137</sup> Cs (SS)	1.393 ± 0.009 (± 0.7 %)	0.80 ± 0.07 (± 8 %)	73.9	9.16	12.69
<sup>241</sup> Am (SS)	5.20 ± 0.03 (± 0.6 %)	1.34 ± 0.11 (± 8 %)	287.0	34.14	49.29

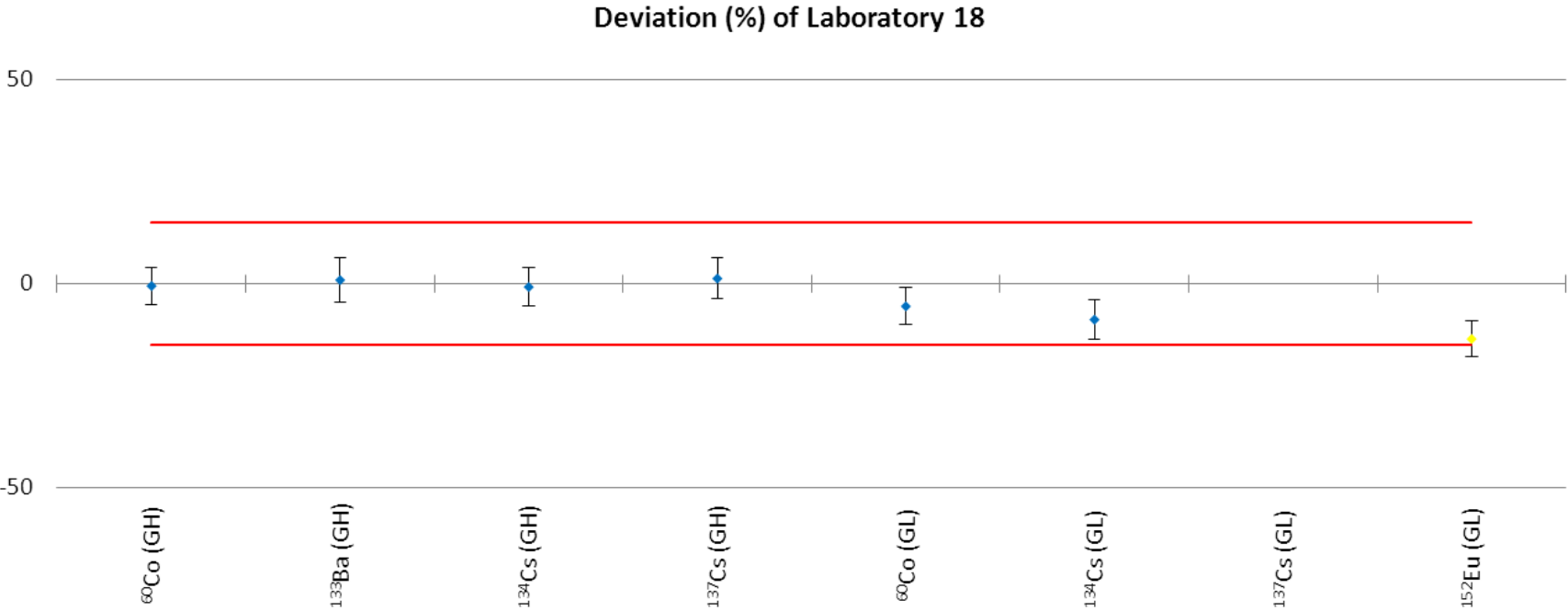




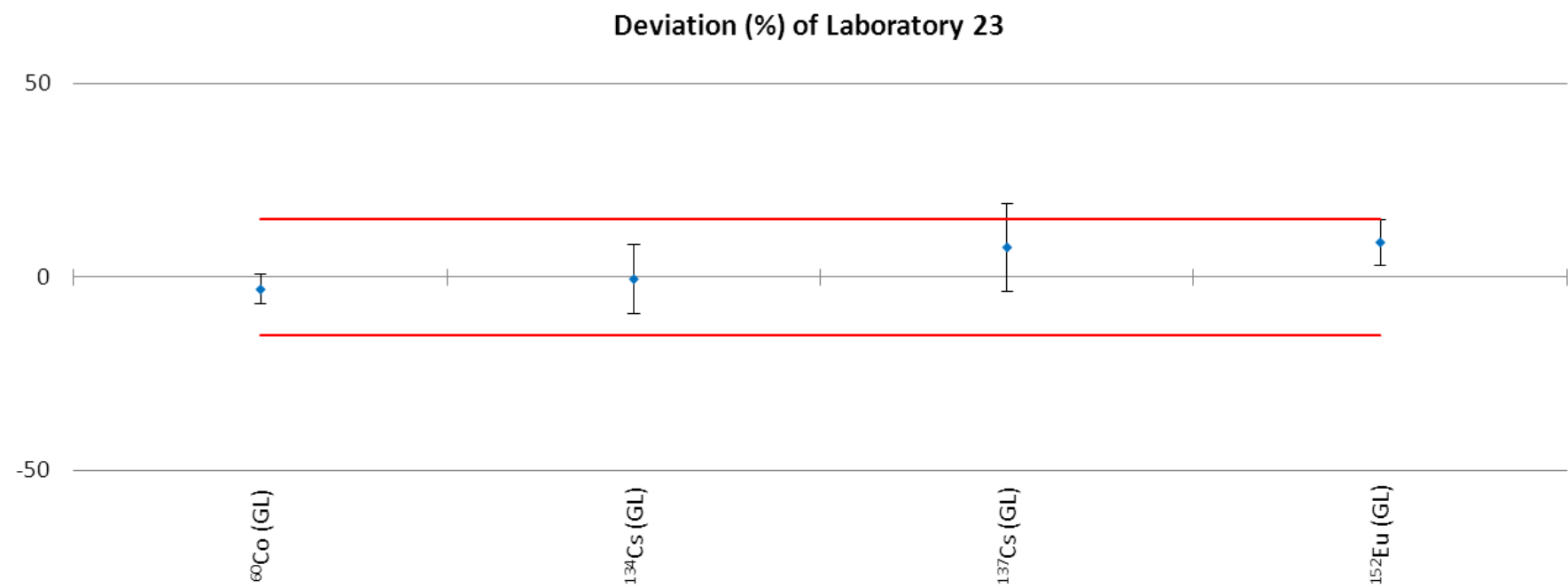
Radionuclide	Laboratory 16	NPL Assigned Value	Deviation /%	Zeta	Z Score
<sup>60</sup> Co (GH)	10.9 ± 0.8 (± 7 %)	11.06 ± 0.03 (± 0.3 %)	-1.4	-0.21	-0.25
<sup>133</sup> Ba (GH)	12.9 ± 0.9 (± 7 %)	12.98 ± 0.10 (± 0.8 %)	-0.6	-0.09	-0.11
<sup>134</sup> Cs (GH)	1.81 ± 0.12 (± 7 %)	1.915 ± 0.013 (± 0.7 %)	-5.5	-0.87	-0.94
<sup>137</sup> Cs (GH)	7.9 ± 0.6 (± 7 %)	8.10 ± 0.06 (± 0.7 %)	-1.9	-0.29	-0.33
<sup>60</sup> Co (GL)	13.5 ± 0.9 (± 7 %)	13.23 ± 0.11 (± 0.8 %)	2.0	0.29	0.35
<sup>134</sup> Cs (GL)	3.36 ± 0.23 (± 7 %)	3.42 ± 0.03 (± 0.8 %)	-1.8	-0.26	-0.31
<sup>137</sup> Cs (GL)	1.80 ± 0.12 (± 7 %)	1.766 ± 0.016 (± 0.9 %)	1.9	0.28	0.33
<sup>152</sup> Eu (GL)	21.8 ± 1.5 (± 7 %)	21.9 ± 0.4 (± 1.8 %)	-0.3	-0.04	-0.04
<sup>3</sup> H (B1)	1.00 ± 0.09 (± 9 %)	1.026 ± 0.007 (± 0.7 %)	-2.5	-0.29	-0.43
<sup>14</sup> C (B1)	1.01 ± 0.08 (± 8 %)	1.032 ± 0.005 (± 0.50 %)	-2.1	-0.27	-0.37
<sup>3</sup> H (B2)	1.07 ± 0.04 (± 4 %)	1.051 ± 0.008 (± 0.7 %)	1.8	0.46	0.31
<sup>63</sup> Ni (B2)	1.52 ± 0.08 (± 5.0 %)	1.650 ± 0.017 (± 1.0 %)	-7.9	-1.58	-1.35



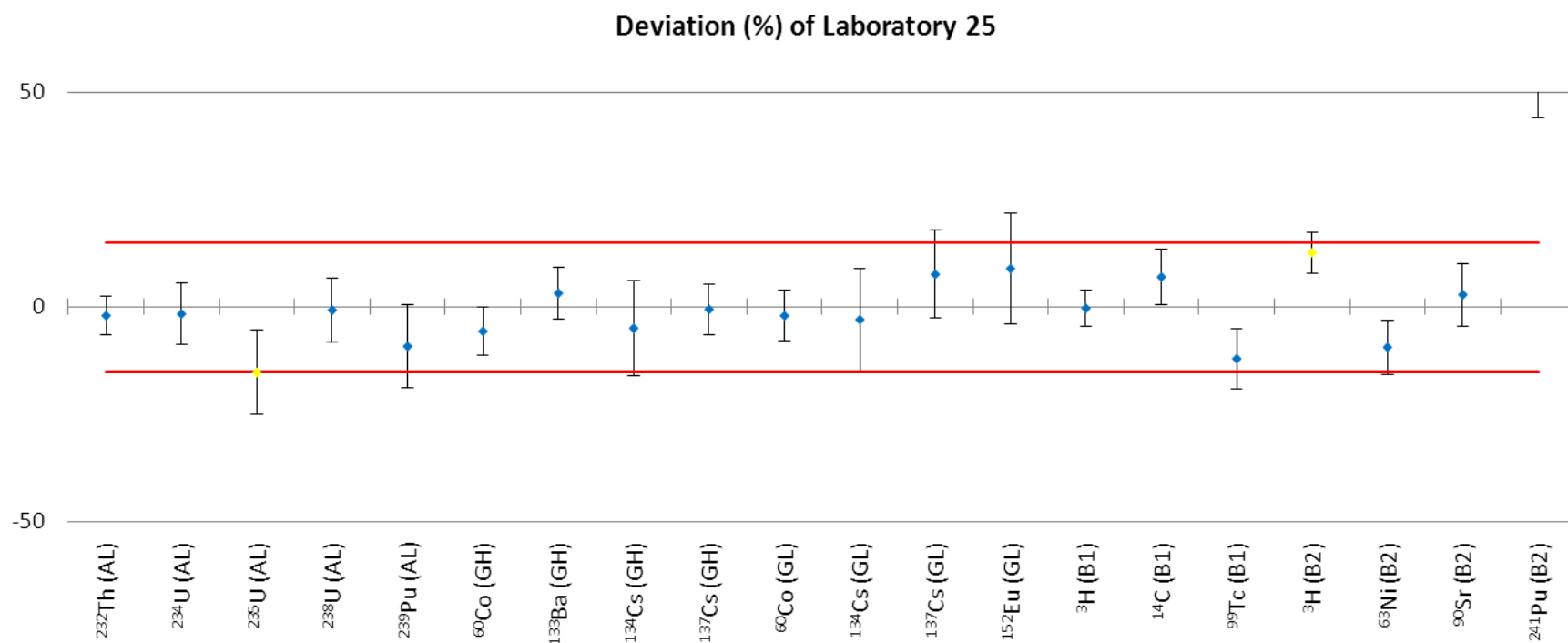
Radionuclide	Laboratory 17	NPL Assigned Value	Deviation /%	Zeta	Z Score
<sup>234</sup> U (AL)	18.8 ± 1.1 (± 6 %)	19.3 ± 0.3 (± 1.4 %)	-2.5	-0.42	-0.42
<sup>235</sup> U (AL)	0.80 ± 0.06 (± 8 %)	0.921 ± 0.012 (± 1.3 %)	-13.7	-2.09	-2.35
<sup>238</sup> U (AL)	18.9 ± 1.2 (± 7 %)	19.3 ± 0.3 (± 1.4 %)	-2.0	-0.31	-0.34
<sup>60</sup> Co (GH)	10.7 ± 0.4 (± 3 %)	11.06 ± 0.03 (± 0.3 %)	-3.5	-1.17	-0.60
<sup>133</sup> Ba (GH)	13.2 ± 0.4 (± 3 %)	12.98 ± 0.10 (± 0.8 %)	2.0	0.62	0.34
<sup>134</sup> Cs (GH)	1.82 ± 0.20 (± 11 %)	1.915 ± 0.013 (± 0.7 %)	-5.0	-0.47	-0.85
<sup>137</sup> Cs (GH)	8.19 ± 0.25 (± 3 %)	8.10 ± 0.06 (± 0.7 %)	1.2	0.37	0.20
<sup>60</sup> Co (GL)	11.4 ± 0.6 (± 6 %)	13.23 ± 0.11 (± 0.8 %)	-13.8	-2.96	-2.38
<sup>134</sup> Cs (GL)	2.9 ± 0.3 (± 11 %)	3.42 ± 0.03 (± 0.8 %)	-15.2	-1.67	-2.61
<sup>137</sup> Cs (GL)	2.1 ± 0.3 (± 14 %)	1.766 ± 0.016 (± 0.9 %)	18.9	1.11	3.25
<sup>152</sup> Eu (GL)	20.2 ± 1.3 (± 7 %)	21.9 ± 0.4 (± 1.8 %)	-7.8	-1.22	-1.34
<sup>3</sup> H (B1)	1.23 ± 0.16 (± 13 %)	1.026 ± 0.007 (± 0.7 %)	20.0	1.27	3.44
<sup>14</sup> C (B1)	1.29 ± 0.17 (± 13 %)	1.032 ± 0.005 (± 0.50 %)	24.8	1.52	4.26
<sup>137</sup> Cs (SS)	0.771 ± 0.021 (± 3 %)	0.80 ± 0.07 (± 8 %)	-3.7	-0.45	-0.64
<sup>241</sup> Am (SS)	1.37 ± 0.05 (± 4 %)	1.34 ± 0.11 (± 8 %)	1.9	0.21	0.32



Radionuclide	Laboratory 18	NPL Assigned Value	Deviation /%	Zeta	Z Score
<sup>60</sup> Co (GH)	11.0 ± 0.5 (± 5.0 %)	11.06 ± 0.03 (± 0.3 %)	-0.5	-0.12	-0.09
<sup>133</sup> Ba (GH)	13.1 ± 0.7 (± 6 %)	12.98 ± 0.10 (± 0.8 %)	0.9	0.17	0.16
<sup>134</sup> Cs (GH)	1.90 ± 0.09 (± 5.0 %)	1.915 ± 0.013 (± 0.7 %)	-0.8	-0.16	-0.13
<sup>137</sup> Cs (GH)	8.2 ± 0.4 (± 5.0 %)	8.10 ± 0.06 (± 0.7 %)	1.3	0.26	0.22
<sup>60</sup> Co (GL)	12.6 ± 0.6 (± 5.0 %)	13.23 ± 0.11 (± 0.8 %)	-5.5	-1.20	-0.95
<sup>134</sup> Cs (GL)	3.12 ± 0.16 (± 5.0 %)	3.42 ± 0.03 (± 0.8 %)	-8.8	-1.85	-1.51
<sup>137</sup> Cs (GL)	5.3 ± 0.3 (± 5.0 %)	1.766 ± 0.016 (± 0.9 %)	198.5	12.96	34.08
<sup>152</sup> Eu (GL)	18.9 ± 0.9 (± 5.0 %)	21.9 ± 0.4 (± 1.8 %)	-13.5	-3.02	-2.32

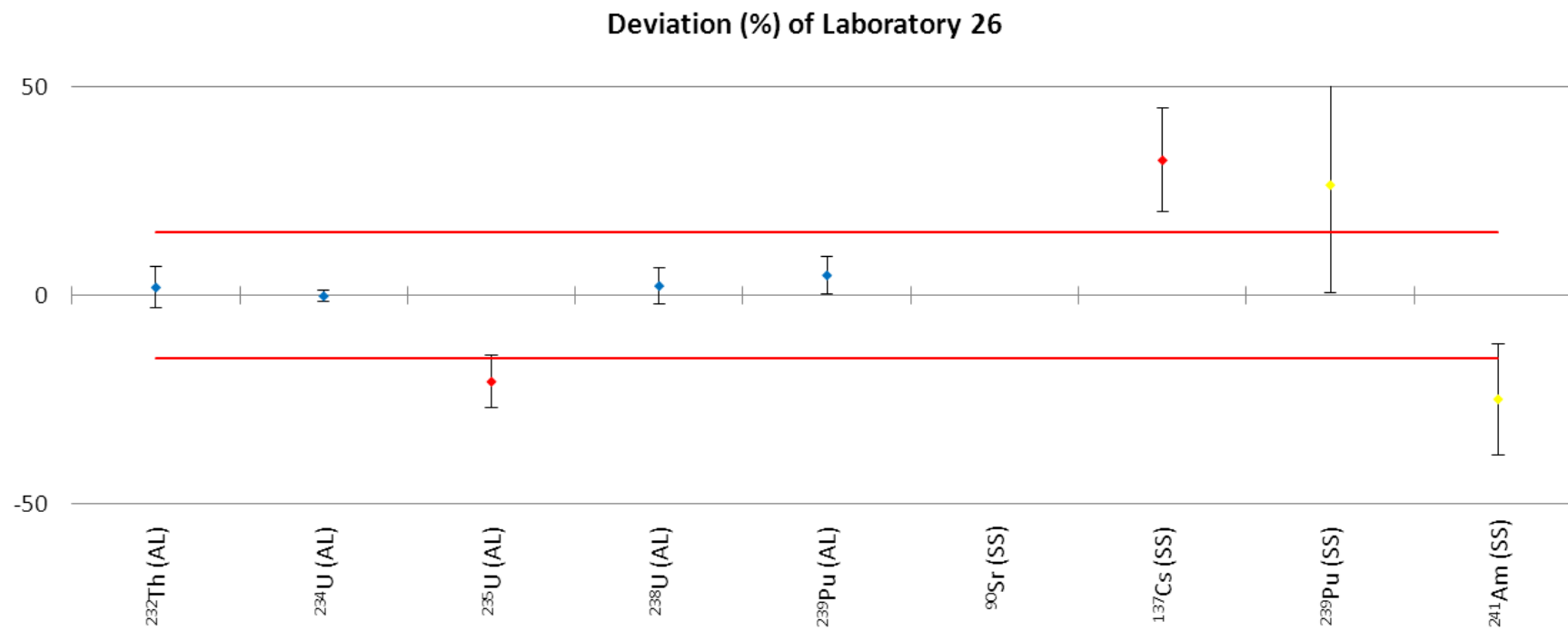


Radionuclide	Laboratory 23	NPL Assigned Value	Deviation /%	Zeta	Z Score
<sup>60</sup> Co (GL)	12.8 ± 0.5 (± 4 %)	13.23 ± 0.11 (± 0.8 %)	-3.3	-0.84	-0.56
<sup>134</sup> Cs (GL)	3.4 ± 0.3 (± 9 %)	3.42 ± 0.03 (± 0.8 %)	-0.6	-0.07	-0.10
<sup>137</sup> Cs (GL)	1.90 ± 0.20 (± 11 %)	1.766 ± 0.016 (± 0.9 %)	7.6	0.67	1.31
<sup>152</sup> Eu (GL)	23.8 ± 1.2 (± 5.0 %)	21.9 ± 0.4 (± 1.8 %)	8.9	1.54	1.53

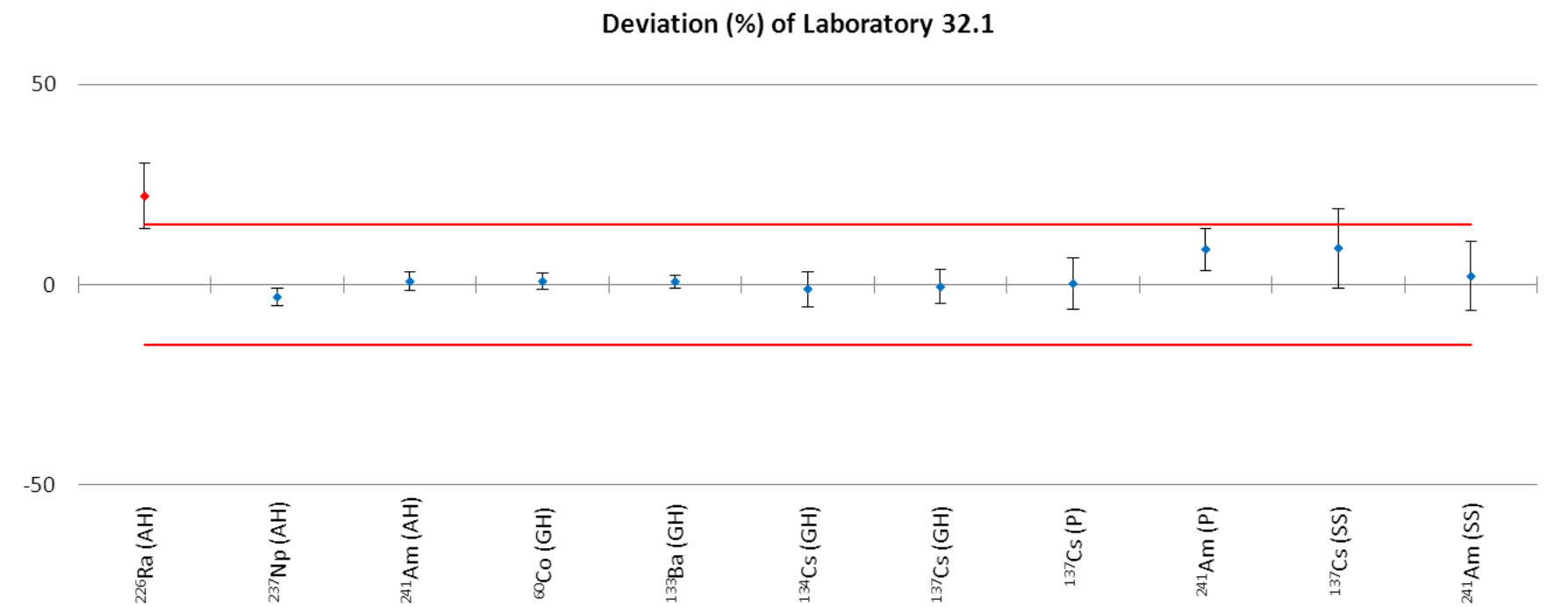




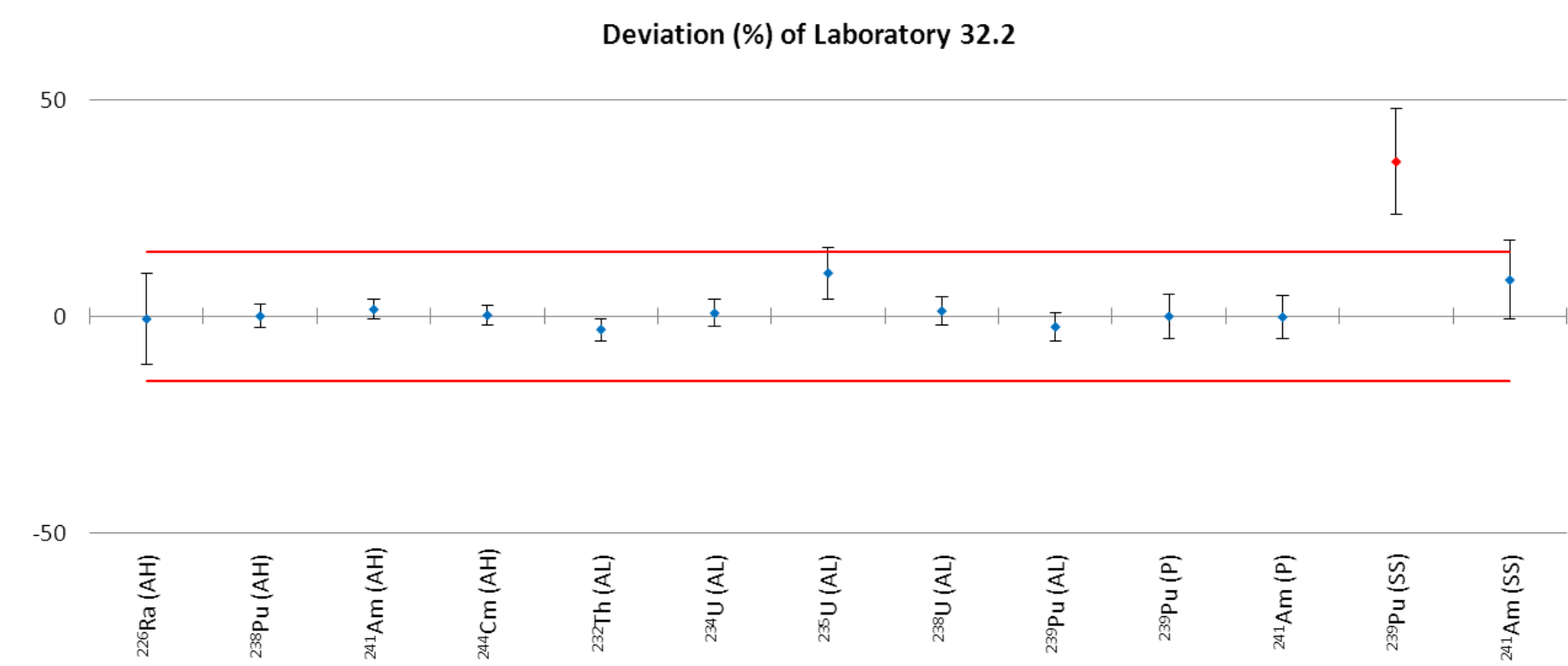
Radionuclide	Laboratory 25	NPL Assigned Value	Deviation /%	Zeta	Z Score
<sup>232</sup> Th (AL)	1.52 ± 0.07 (± 5.0 %)	1.551 ± 0.016 (± 1.0 %)	-2.0	-0.44	-0.35
<sup>234</sup> U (AL)	19.0 ± 1.4 (± 7 %)	19.3 ± 0.3 (± 1.4 %)	-1.6	-0.22	-0.28
<sup>235</sup> U (AL)	0.78 ± 0.09 (± 12 %)	0.921 ± 0.012 (± 1.3 %)	-15.3	-1.55	-2.63
<sup>238</sup> U (AL)	19.1 ± 1.4 (± 7 %)	19.3 ± 0.3 (± 1.4 %)	-0.7	-0.10	-0.13
<sup>239</sup> Pu (AL)	1.21 ± 0.13 (± 11 %)	1.332 ± 0.006 (± 0.4 %)	-9.2	-0.94	-1.58
<sup>60</sup> Co (GH)	10.4 ± 0.6 (± 6 %)	11.06 ± 0.03 (± 0.3 %)	-5.7	-1.01	-0.98
<sup>133</sup> Ba (GH)	13.4 ± 0.8 (± 6 %)	12.98 ± 0.10 (± 0.8 %)	3.2	0.53	0.55
<sup>134</sup> Cs (GH)	1.82 ± 0.21 (± 12 %)	1.915 ± 0.013 (± 0.7 %)	-5.0	-0.45	-0.85
<sup>137</sup> Cs (GH)	8.0 ± 0.5 (± 6 %)	8.10 ± 0.06 (± 0.7 %)	-0.6	-0.10	-0.10
<sup>60</sup> Co (GL)	13.0 ± 0.8 (± 6 %)	13.23 ± 0.11 (± 0.8 %)	-2.1	-0.34	-0.35
<sup>134</sup> Cs (GL)	3.3 ± 0.4 (± 12 %)	3.42 ± 0.03 (± 0.8 %)	-2.9	-0.25	-0.51
<sup>137</sup> Cs (GL)	1.90 ± 0.18 (± 9 %)	1.766 ± 0.016 (± 0.9 %)	7.6	0.74	1.31
<sup>152</sup> Eu (GL)	24 ± 3 (± 12 %)	21.9 ± 0.4 (± 1.8 %)	8.9	0.69	1.53
<sup>3</sup> H (B1)	1.02 ± 0.05 (± 5.0 %)	1.026 ± 0.007 (± 0.7 %)	-0.3	-0.07	-0.05
<sup>14</sup> C (B1)	1.10 ± 0.07 (± 6 %)	1.032 ± 0.005 (± 0.50 %)	7.0	1.09	1.20
<sup>99</sup> Tc (B1)	0.130 ± 0.010 (± 8 %)	0.1478 ± 0.0013 (± 0.9 %)	-12.1	-1.70	-2.07
<sup>3</sup> H (B2)	1.18 ± 0.05 (± 5.0 %)	1.051 ± 0.008 (± 0.7 %)	12.7	2.64	2.18
<sup>63</sup> Ni (B2)	1.49 ± 0.10 (± 7 %)	1.650 ± 0.017 (± 1.0 %)	-9.4	-1.46	-1.61
<sup>90</sup> Sr (B2)	0.49 ± 0.04 (± 7 %)	0.4746 ± 0.0010 (± 0.21 %)	2.9	0.39	0.49
<sup>241</sup> Pu (B2)	1.53 ± 0.15 (± 10 %)	0.957 ± 0.011 (± 1.1 %)	60.1	3.73	10.32



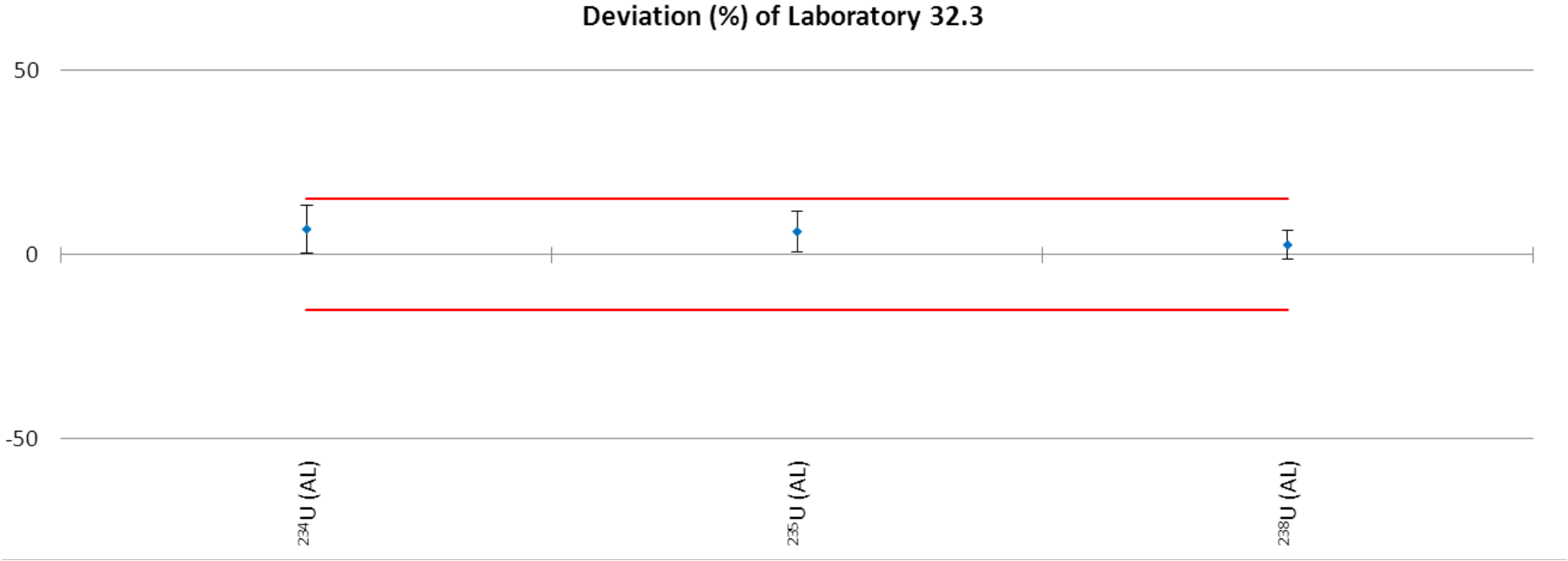
Radionuclide	Laboratory 26	NPL Assigned Value	Deviation /%	Zeta	Z Score
<sup>232</sup> Th (AL)	1.58 ± 0.08 (± 5.0 %)	1.551 ± 0.016 (± 1.0 %)	1.9	0.37	0.32
<sup>234</sup> U (AL)	19.23 ± 0.08 (± 0.4 %)	19.3 ± 0.3 (± 1.4 %)	-0.2	-0.16	-0.04
<sup>235</sup> U (AL)	0.73 ± 0.06 (± 8 %)	0.921 ± 0.012 (± 1.3 %)	-20.7	-3.27	-3.56
<sup>238</sup> U (AL)	19.7 ± 0.8 (± 4 %)	19.3 ± 0.3 (± 1.4 %)	2.2	0.51	0.38
<sup>239</sup> Pu (AL)	1.40 ± 0.06 (± 5.0 %)	1.332 ± 0.006 (± 0.4 %)	4.8	1.05	0.82
<sup>90</sup> Sr (SS)	0.80 ± 0.12 (± 15 %)	0.276 ± 0.023 (± 8 %)	189.9	4.29	32.60
<sup>137</sup> Cs (SS)	1.06 ± 0.05 (± 5.0 %)	0.80 ± 0.07 (± 8 %)	32.3	3.14	5.55
<sup>239</sup> Pu (SS)	1.34 ± 0.25 (± 19 %)	1.06 ± 0.09 (± 9 %)	26.4	1.05	4.54
<sup>241</sup> Am (SS)	1.01 ± 0.16 (± 16 %)	1.34 ± 0.11 (± 8 %)	-24.9	-1.73	-4.28



Radionuclide	Laboratory 32.1	NPL Assigned Value	Deviation /%	Zeta	Z Score
<sup>226</sup> Ra (AH)	1.99 ± 0.13 (± 7 %)	1.630 ± 0.022 (± 1.3 %)	22.1	2.73	3.79
<sup>237</sup> Np (AH)	14.6 ± 0.3 (± 2.0 %)	15.12 ± 0.16 (± 1.0 %)	-3.1	-1.39	-0.53
<sup>241</sup> Am (AH)	5.05 ± 0.12 (± 2.4 %)	5.010 ± 0.017 (± 0.4 %)	0.8	0.33	0.14
<sup>60</sup> Co (GH)	11.15 ± 0.23 (± 2.1 %)	11.06 ± 0.03 (± 0.3 %)	0.8	0.40	0.14
<sup>133</sup> Ba (GH)	13.08 ± 0.19 (± 1.5 %)	12.98 ± 0.10 (± 0.8 %)	0.8	0.45	0.13
<sup>134</sup> Cs (GH)	1.89 ± 0.08 (± 5.0 %)	1.915 ± 0.013 (± 0.7 %)	-1.1	-0.25	-0.19
<sup>137</sup> Cs (GH)	8.1 ± 0.4 (± 5.0 %)	8.10 ± 0.06 (± 0.7 %)	-0.6	-0.13	-0.10
<sup>137</sup> Cs (P)	2.72 ± 0.13 (± 5.0 %)	2.71 ± 0.12 (± 5.0 %)	0.3	0.04	0.04
<sup>241</sup> Am (P)	4.73 ± 0.11 (± 2.3 %)	4.35 ± 0.19 (± 5.0 %)	8.8	1.77	1.51
<sup>137</sup> Cs (SS)	0.87 ± 0.04 (± 5.0 %)	0.80 ± 0.07 (± 8 %)	9.1	0.98	1.57
<sup>241</sup> Am (SS)	1.37 ± 0.04 (± 2.5 %)	1.34 ± 0.11 (± 8 %)	2.1	0.25	0.36

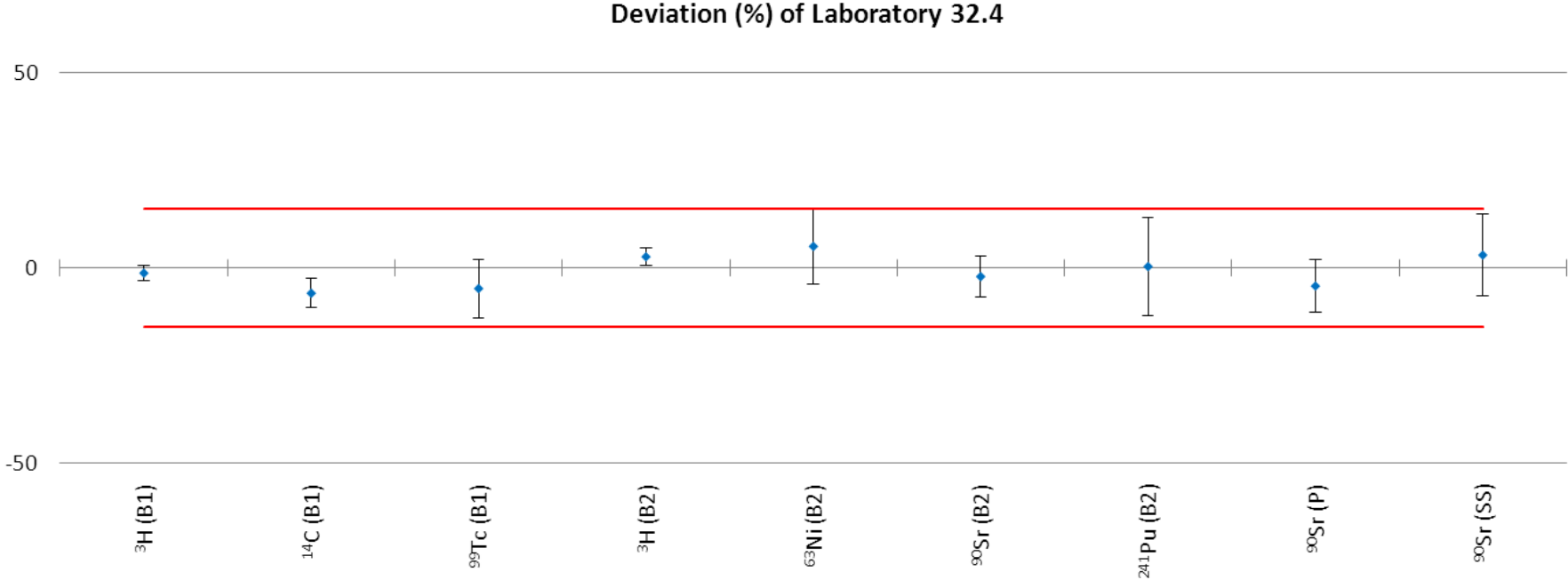


Radionuclide	Laboratory 32.2	NPL Assigned Value	Deviation /%	Zeta	Z Score
<sup>226</sup> Ra (AH)	1.62 ± 0.17 (± 10 %)	1.630 ± 0.022 (± 1.3 %)	-0.6	-0.06	-0.11
<sup>238</sup> Pu (AH)	16.8 ± 0.5 (± 3 %)	16.77 ± 0.06 (± 0.4 %)	0.0	0.02	0.01
<sup>241</sup> Am (AH)	5.09 ± 0.11 (± 2.2 %)	5.010 ± 0.017 (± 0.4 %)	1.6	0.72	0.27
<sup>244</sup> Cm (AH)	15.2 ± 0.4 (± 2.2 %)	15.13 ± 0.06 (± 0.4 %)	0.3	0.12	0.05
<sup>232</sup> Th (AL)	1.50 ± 0.04 (± 2.5 %)	1.551 ± 0.016 (± 1.0 %)	-3.0	-1.18	-0.52
<sup>234</sup> U (AL)	19.4 ± 0.6 (± 3 %)	19.3 ± 0.3 (± 1.4 %)	0.7	0.23	0.12
<sup>235</sup> U (AL)	1.01 ± 0.06 (± 5.0 %)	0.921 ± 0.012 (± 1.3 %)	10.0	1.69	1.72
<sup>238</sup> U (AL)	19.5 ± 0.6 (± 3 %)	19.3 ± 0.3 (± 1.4 %)	1.2	0.39	0.21
<sup>239</sup> Pu (AL)	1.30 ± 0.04 (± 4 %)	1.332 ± 0.006 (± 0.4 %)	-2.4	-0.77	-0.42
<sup>239</sup> Pu (P)	3.97 ± 0.09 (± 2.4 %)	3.97 ± 0.18 (± 5.0 %)	0.0	0.00	0.00
<sup>241</sup> Am (P)	4.34 ± 0.11 (± 2.5 %)	4.35 ± 0.19 (± 5.0 %)	-0.2	-0.03	-0.03
<sup>239</sup> Pu (SS)	1.44 ± 0.04 (± 3 %)	1.06 ± 0.09 (± 9 %)	35.8	3.82	6.14
<sup>241</sup> Am (SS)	1.46 ± 0.03 (± 2.1 %)	1.34 ± 0.11 (± 8 %)	8.4	1.00	1.44

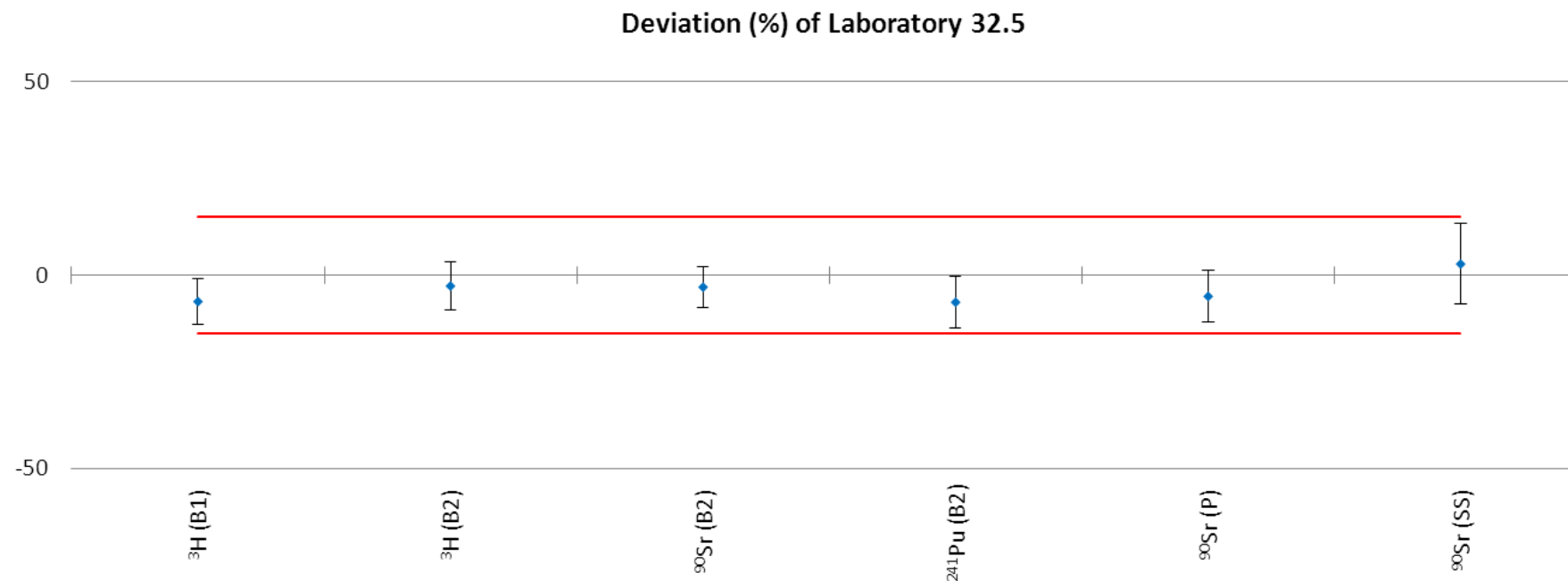




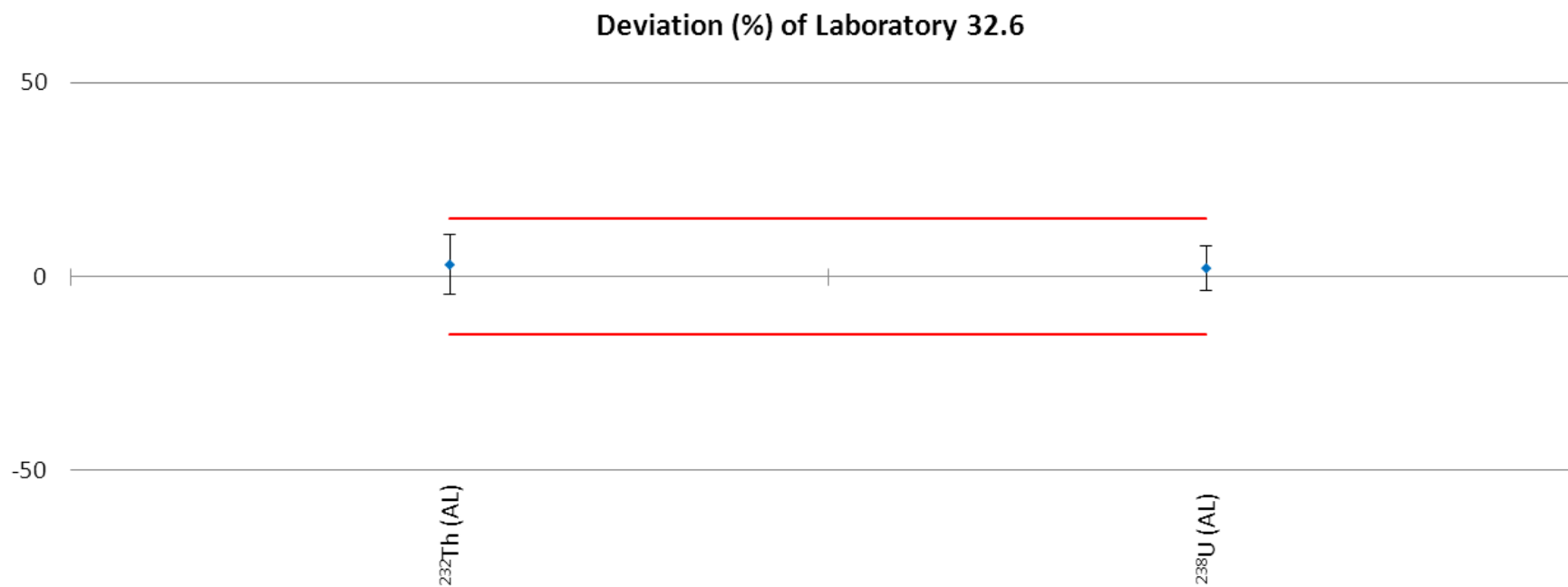
<b>Radionuclide</b>	<b>Laboratory 32.3</b>	<b>NPL Assigned Value</b>	<b>Deviation /%</b>	<b>Zeta</b>	<b>Z Score</b>
<sup>234</sup> U (AL)	20.6 ± 1.2 (± 6 %)	19.3 ± 0.3 (± 1.4 %)	6.9	1.08	1.18
<sup>235</sup> U (AL)	0.98 ± 0.05 (± 5.0 %)	0.921 ± 0.012 (± 1.3 %)	6.2	1.15	1.07
<sup>238</sup> U (AL)	19.8 ± 0.7 (± 4 %)	19.3 ± 0.3 (± 1.4 %)	2.6	0.68	0.45



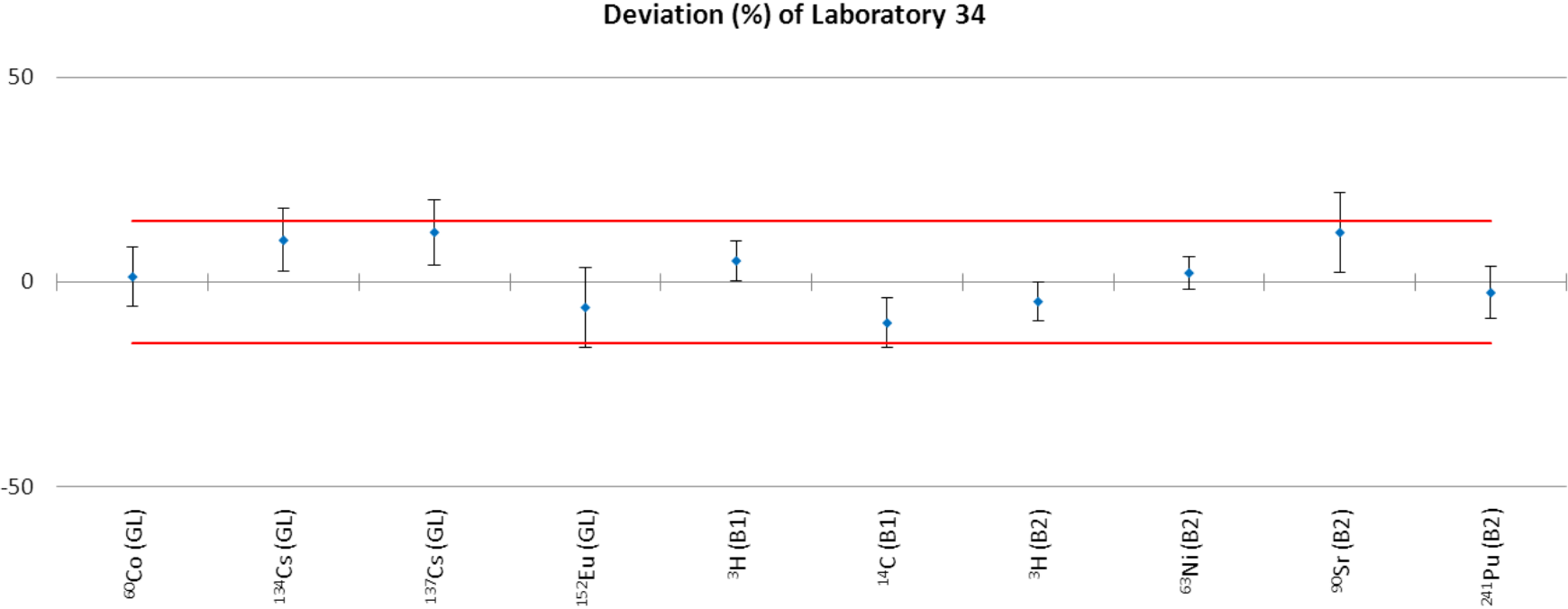
Radionuclide	Laboratory 32.4	NPL Assigned Value	Deviation /%	Zeta	Z Score
<sup>3</sup> H (B1)	1.012 ± 0.020 (± 2.0 %)	1.026 ± 0.007 (± 0.7 %)	-1.3	-0.65	-0.23
<sup>14</sup> C (B1)	0.96 ± 0.04 (± 4 %)	1.032 ± 0.005 (± 0.50 %)	-6.5	-1.75	-1.11
<sup>99</sup> Tc (B1)	0.140 ± 0.011 (± 8 %)	0.1478 ± 0.0013 (± 0.9 %)	-5.3	-0.71	-0.91
<sup>3</sup> H (B2)	1.081 ± 0.025 (± 2.3 %)	1.051 ± 0.008 (± 0.7 %)	2.8	1.14	0.49
<sup>63</sup> Ni (B2)	1.74 ± 0.16 (± 9 %)	1.650 ± 0.017 (± 1.0 %)	5.5	0.56	0.94
<sup>90</sup> Sr (B2)	0.464 ± 0.025 (± 6 %)	0.4746 ± 0.0010 (± 0.21 %)	-2.2	-0.42	-0.38
<sup>241</sup> Pu (B2)	0.96 ± 0.12 (± 12 %)	0.957 ± 0.011 (± 1.1 %)	0.3	0.03	0.06
<sup>90</sup> Sr (P)	2.39 ± 0.13 (± 6 %)	2.51 ± 0.11 (± 5.0 %)	-4.7	-0.68	-0.80
<sup>90</sup> Sr (SS)	0.285 ± 0.016 (± 6 %)	0.276 ± 0.023 (± 8 %)	3.3	0.32	0.56



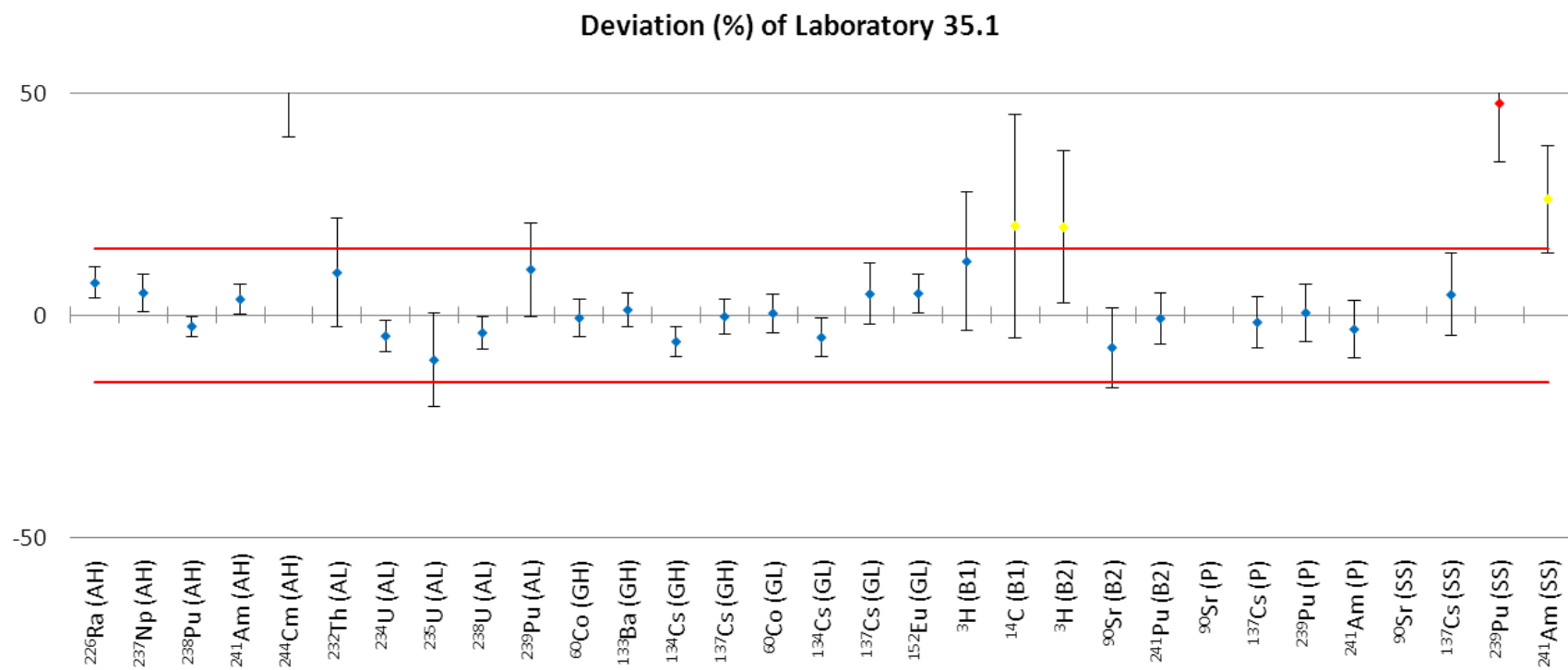
Radionuclide	Laboratory 32.5	NPL Assigned Value	Deviation /%	Zeta	Z Score
$^3\text{H}$ (B1)	$0.96 \pm 0.06$ ( $\pm 7\%$ )	$1.026 \pm 0.007$ ( $\pm 0.7\%$ )	-6.8	-1.14	-1.17
$^3\text{H}$ (B2)	$1.02 \pm 0.07$ ( $\pm 6\%$ )	$1.051 \pm 0.008$ ( $\pm 0.7\%$ )	-2.8	-0.45	-0.48
$^{90}\text{Sr}$ (B2)	$0.460 \pm 0.025$ ( $\pm 6\%$ )	$0.4746 \pm 0.0010$ ( $\pm 0.21\%$ )	-3.1	-0.58	-0.53
$^{241}\text{Pu}$ (B2)	$0.89 \pm 0.07$ ( $\pm 7\%$ )	$0.957 \pm 0.011$ ( $\pm 1.1\%$ )	-7.0	-1.03	-1.20
$^{90}\text{Sr}$ (P)	$2.37 \pm 0.13$ ( $\pm 6\%$ )	$2.51 \pm 0.11$ ( $\pm 5.0\%$ )	-5.5	-0.80	-0.94
$^{90}\text{Sr}$ (SS)	$0.284 \pm 0.016$ ( $\pm 6\%$ )	$0.276 \pm 0.023$ ( $\pm 8\%$ )	2.9	0.29	0.50



Radionuclide	Laboratory 32.6	NPL Assigned Value	Deviation /%	Zeta	Z Score
$^{232}\text{Th}$ (AL)	$1.60 \pm 0.12$ ( $\pm 8 \%$ )	$1.551 \pm 0.016$ ( $\pm 1.0 \%$ )	3.1	0.40	0.54
$^{238}\text{U}$ (AL)	$19.7 \pm 1.1$ ( $\pm 6 \%$ )	$19.3 \pm 0.3$ ( $\pm 1.4 \%$ )	2.2	0.38	0.38

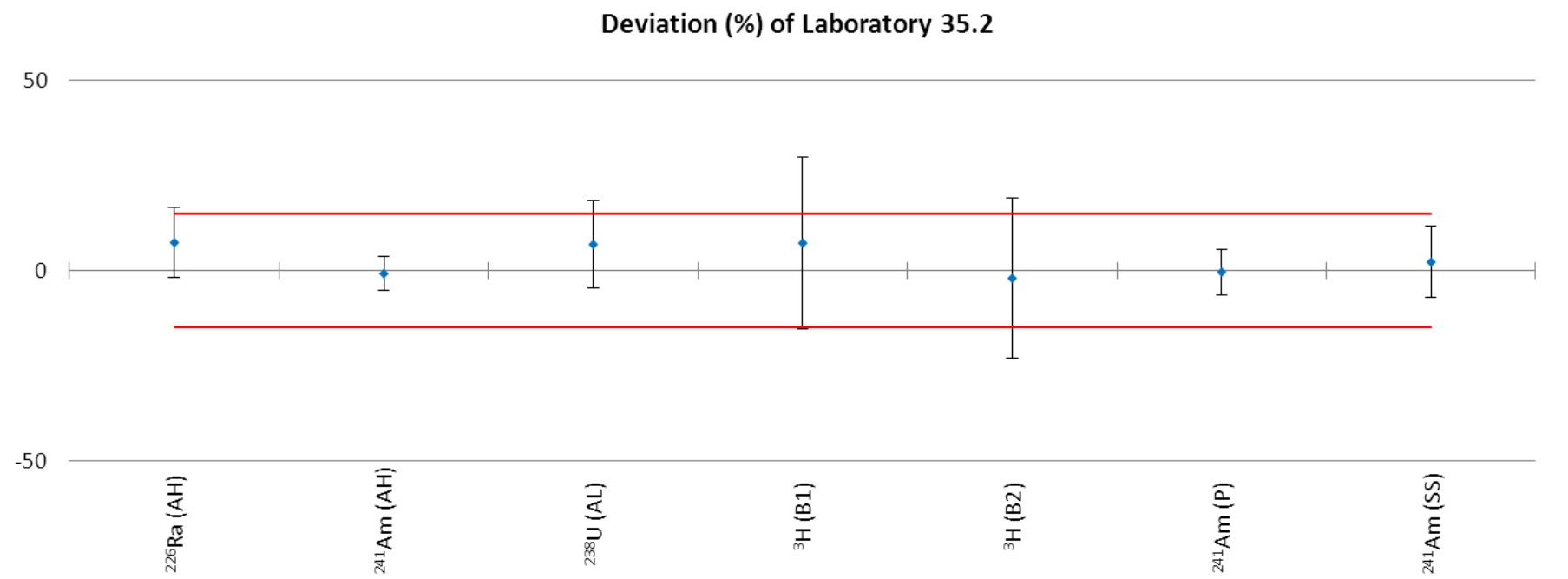


Radionuclide	Laboratory 34	NPL Assigned Value	Deviation /%	Zeta	Z Score
<sup>60</sup> Co (GL)	13.4 ± 0.9 (± 7 %)	13.23 ± 0.11 (± 0.8 %)	1.3	0.18	0.22
<sup>134</sup> Cs (GL)	3.8 ± 0.3 (± 7 %)	3.42 ± 0.03 (± 0.8 %)	10.2	1.34	1.75
<sup>137</sup> Cs (GL)	1.98 ± 0.14 (± 7 %)	1.766 ± 0.016 (± 0.9 %)	12.1	1.52	2.08
<sup>152</sup> Eu (GL)	20.5 ± 2.1 (± 10 %)	21.9 ± 0.4 (± 1.8 %)	-6.2	-0.64	-1.07
<sup>3</sup> H (B1)	1.08 ± 0.05 (± 5.0 %)	1.026 ± 0.007 (± 0.7 %)	5.2	1.05	0.89
<sup>14</sup> C (B1)	0.93 ± 0.06 (± 7 %)	1.032 ± 0.005 (± 0.50 %)	-10.0	-1.66	-1.71
<sup>3</sup> H (B2)	1.00 ± 0.05 (± 5.0 %)	1.051 ± 0.008 (± 0.7 %)	-4.8	-1.01	-0.82
<sup>63</sup> Ni (B2)	1.69 ± 0.06 (± 4 %)	1.650 ± 0.017 (± 1.0 %)	2.2	0.56	0.38
<sup>90</sup> Sr (B2)	0.53 ± 0.05 (± 9 %)	0.4746 ± 0.0010 (± 0.21 %)	12.1	1.25	2.08
<sup>241</sup> Pu (B2)	0.93 ± 0.06 (± 7 %)	0.957 ± 0.011 (± 1.1 %)	-2.6	-0.40	-0.45

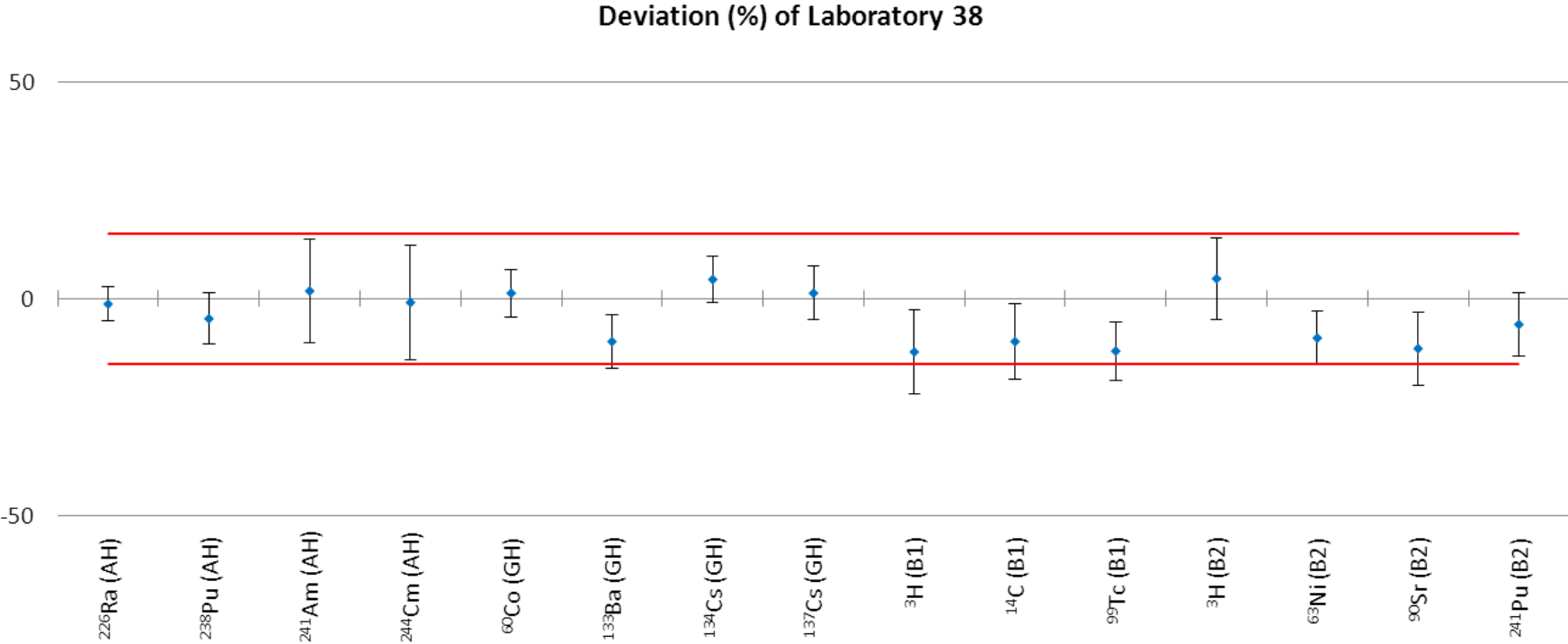




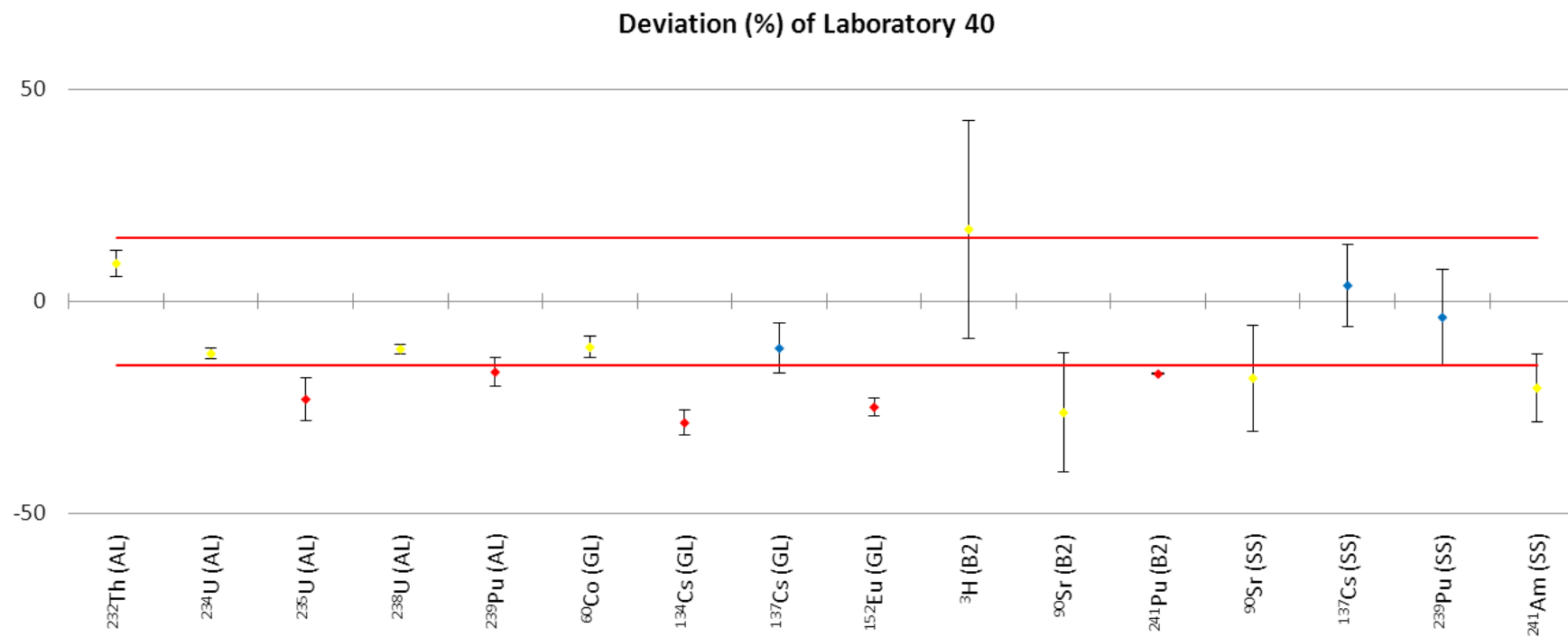
Radionuclide	Laboratory 35.1	NPL Assigned Value	Deviation /%	Zeta	Z Score
<sup>226</sup> Ra (AH)	1.75 ± 0.06 (± 3 %)	1.630 ± 0.022 (± 1.3 %)	7.3	2.08	1.25
<sup>237</sup> Np (AH)	15.9 ± 0.6 (± 4 %)	15.12 ± 0.16 (± 1.0 %)	5.0	1.21	0.86
<sup>238</sup> Pu (AH)	16.4 ± 0.4 (± 2.3 %)	16.77 ± 0.06 (± 0.4 %)	-2.5	-1.10	-0.43
<sup>241</sup> Am (AH)	5.19 ± 0.17 (± 4 %)	5.010 ± 0.017 (± 0.4 %)	3.6	1.05	0.62
<sup>244</sup> Cm (AH)	23.4 ± 2.2 (± 9 %)	15.13 ± 0.06 (± 0.4 %)	54.7	3.76	9.39
<sup>232</sup> Th (AL)	1.70 ± 0.19 (± 11 %)	1.551 ± 0.016 (± 1.0 %)	9.6	0.78	1.65
<sup>234</sup> U (AL)	18.4 ± 0.6 (± 4 %)	19.3 ± 0.3 (± 1.4 %)	-4.7	-1.36	-0.80
<sup>235</sup> U (AL)	0.83 ± 0.10 (± 12 %)	0.921 ± 0.012 (± 1.3 %)	-10.1	-0.96	-1.73
<sup>238</sup> U (AL)	18.5 ± 0.7 (± 4 %)	19.3 ± 0.3 (± 1.4 %)	-4.0	-1.09	-0.68
<sup>239</sup> Pu (AL)	1.47 ± 0.14 (± 10 %)	1.332 ± 0.006 (± 0.4 %)	10.3	0.98	1.77
<sup>60</sup> Co (GH)	11.0 ± 0.5 (± 4 %)	11.06 ± 0.03 (± 0.3 %)	-0.6	-0.15	-0.11
<sup>133</sup> Ba (GH)	13.1 ± 0.5 (± 4 %)	12.98 ± 0.10 (± 0.8 %)	1.2	0.31	0.21
<sup>134</sup> Cs (GH)	1.80 ± 0.07 (± 4 %)	1.915 ± 0.013 (± 0.7 %)	-6.0	-1.69	-1.02
<sup>137</sup> Cs (GH)	8.1 ± 0.3 (± 4 %)	8.10 ± 0.06 (± 0.7 %)	-0.3	-0.08	-0.05
<sup>60</sup> Co (GL)	13.3 ± 0.6 (± 5.0 %)	13.23 ± 0.11 (± 0.8 %)	0.4	0.10	0.08
<sup>134</sup> Cs (GL)	3.25 ± 0.15 (± 5.0 %)	3.42 ± 0.03 (± 0.8 %)	-5.0	-1.12	-0.86
<sup>137</sup> Cs (GL)	1.85 ± 0.12 (± 7 %)	1.766 ± 0.016 (± 0.9 %)	4.8	0.70	0.82
<sup>152</sup> Eu (GL)	22.9 ± 0.9 (± 4 %)	21.9 ± 0.4 (± 1.8 %)	4.9	1.14	0.84
<sup>3</sup> H (B1)	1.15 ± 0.16 (± 14 %)	1.026 ± 0.007 (± 0.7 %)	12.1	0.78	2.08
<sup>14</sup> C (B1)	1.2 ± 0.3 (± 21 %)	1.032 ± 0.005 (± 0.50 %)	20.2	0.80	3.46
<sup>3</sup> H (B2)	1.26 ± 0.18 (± 14 %)	1.051 ± 0.008 (± 0.7 %)	19.9	1.16	3.41
<sup>90</sup> Sr (B2)	0.44 ± 0.05 (± 10 %)	0.4746 ± 0.0010 (± 0.21 %)	-7.3	-0.80	-1.25
<sup>241</sup> Pu (B2)	0.95 ± 0.06 (± 6 %)	0.957 ± 0.011 (± 1.1 %)	-0.7	-0.12	-0.12
<sup>90</sup> Sr (P)	6.2 ± 0.6 (± 10 %)	2.51 ± 0.11 (± 5.0 %)	145.7	5.89	25.02
<sup>137</sup> Cs (P)	2.67 ± 0.11 (± 4 %)	2.71 ± 0.12 (± 5.0 %)	-1.6	-0.27	-0.27
<sup>239</sup> Pu (P)	3.99 ± 0.19 (± 5.0 %)	3.97 ± 0.18 (± 5.0 %)	0.6	0.08	0.10
<sup>241</sup> Am (P)	4.21 ± 0.22 (± 5.0 %)	4.35 ± 0.19 (± 5.0 %)	-3.2	-0.48	-0.54
<sup>90</sup> Sr (SS)	0.91 ± 0.09 (± 10 %)	0.276 ± 0.023 (± 8 %)	228.6	6.72	39.26
<sup>137</sup> Cs (SS)	0.84 ± 0.04 (± 4 %)	0.80 ± 0.07 (± 8 %)	4.6	0.52	0.79
<sup>239</sup> Pu (SS)	1.57 ± 0.04 (± 3 %)	1.06 ± 0.09 (± 9 %)	47.7	5.14	8.20
<sup>241</sup> Am (SS)	1.70 ± 0.09 (± 5.0 %)	1.34 ± 0.11 (± 8 %)	26.2	2.52	4.49



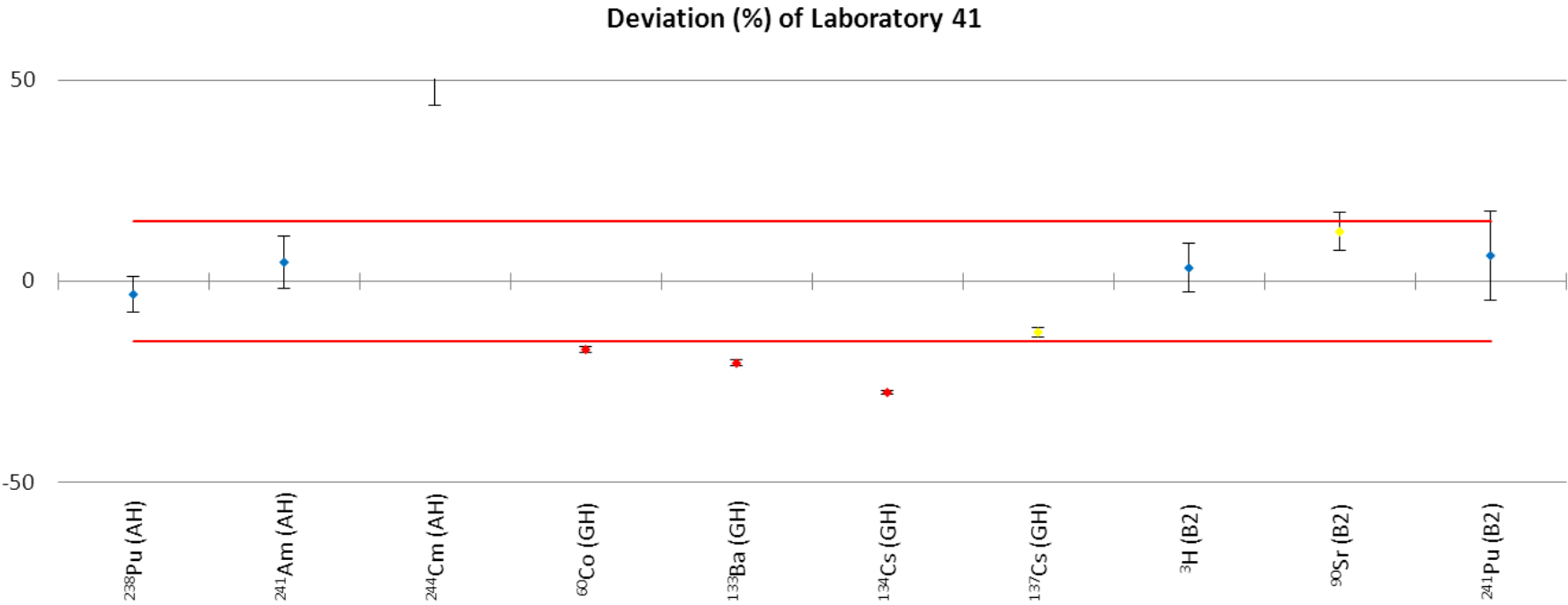
Radionuclide	Laboratory 35.2	NPL Assigned Value	Deviation /%	Zeta	Z Score
<sup>226</sup> Ra (AH)	1.75 ± 0.15 (± 9 %)	1.630 ± 0.022 (± 1.3 %)	7.4	0.79	1.26
<sup>241</sup> Am (AH)	4.97 ± 0.22 (± 5.0 %)	5.010 ± 0.017 (± 0.4 %)	-0.8	-0.18	-0.14
<sup>238</sup> U (AL)	20.6 ± 2.2 (± 11 %)	19.3 ± 0.3 (± 1.4 %)	6.9	0.60	1.18
<sup>3</sup> H (B1)	1.10 ± 0.23 (± 21 %)	1.026 ± 0.007 (± 0.7 %)	7.2	0.32	1.24
<sup>3</sup> H (B2)	1.03 ± 0.22 (± 21 %)	1.051 ± 0.008 (± 0.7 %)	-2.0	-0.10	-0.35
<sup>241</sup> Am (P)	4.33 ± 0.18 (± 4 %)	4.35 ± 0.19 (± 5.0 %)	-0.4	-0.07	-0.07
<sup>241</sup> Am (SS)	1.38 ± 0.06 (± 4 %)	1.34 ± 0.11 (± 8 %)	2.2	0.24	0.38



Radionuclide	Laboratory 38	NPL Assigned Value	Deviation /%	Zeta	Z Score
<sup>226</sup> Ra (AH)	1.61 ± 0.06 (± 4 %)	1.630 ± 0.022 (± 1.3 %)	-1.2	-0.31	-0.21
<sup>238</sup> Pu (AH)	16.0 ± 1.0 (± 6 %)	16.77 ± 0.06 (± 0.4 %)	-4.6	-0.77	-0.79
<sup>241</sup> Am (AH)	5.1 ± 0.6 (± 12 %)	5.010 ± 0.017 (± 0.4 %)	1.8	0.15	0.31
<sup>244</sup> Cm (AH)	15.0 ± 2.0 (± 13 %)	15.13 ± 0.06 (± 0.4 %)	-0.9	-0.06	-0.15
<sup>60</sup> Co (GH)	11.2 ± 0.6 (± 6 %)	11.06 ± 0.03 (± 0.3 %)	1.3	0.24	0.22
<sup>133</sup> Ba (GH)	11.7 ± 0.8 (± 7 %)	12.98 ± 0.10 (± 0.8 %)	-9.9	-1.59	-1.70
<sup>134</sup> Cs (GH)	2.00 ± 0.10 (± 5.0 %)	1.915 ± 0.013 (± 0.7 %)	4.4	0.84	0.76
<sup>137</sup> Cs (GH)	8.2 ± 0.5 (± 6 %)	8.10 ± 0.06 (± 0.7 %)	1.3	0.21	0.22
<sup>3</sup> H (B1)	0.90 ± 0.10 (± 11 %)	1.026 ± 0.007 (± 0.7 %)	-12.3	-1.25	-2.11
<sup>14</sup> C (B1)	0.93 ± 0.09 (± 10 %)	1.032 ± 0.005 (± 0.50 %)	-9.9	-1.13	-1.70
<sup>99</sup> Tc (B1)	0.130 ± 0.010 (± 8 %)	0.1478 ± 0.0013 (± 0.9 %)	-12.1	-1.77	-2.07
<sup>3</sup> H (B2)	1.10 ± 0.10 (± 9 %)	1.051 ± 0.008 (± 0.7 %)	4.6	0.49	0.80
<sup>63</sup> Ni (B2)	1.50 ± 0.10 (± 7 %)	1.650 ± 0.017 (± 1.0 %)	-9.1	-1.47	-1.56
<sup>90</sup> Sr (B2)	0.42 ± 0.04 (± 10 %)	0.4746 ± 0.0010 (± 0.21 %)	-11.5	-1.36	-1.98
<sup>241</sup> Pu (B2)	0.90 ± 0.07 (± 8 %)	0.957 ± 0.011 (± 1.1 %)	-5.9	-0.80	-1.02

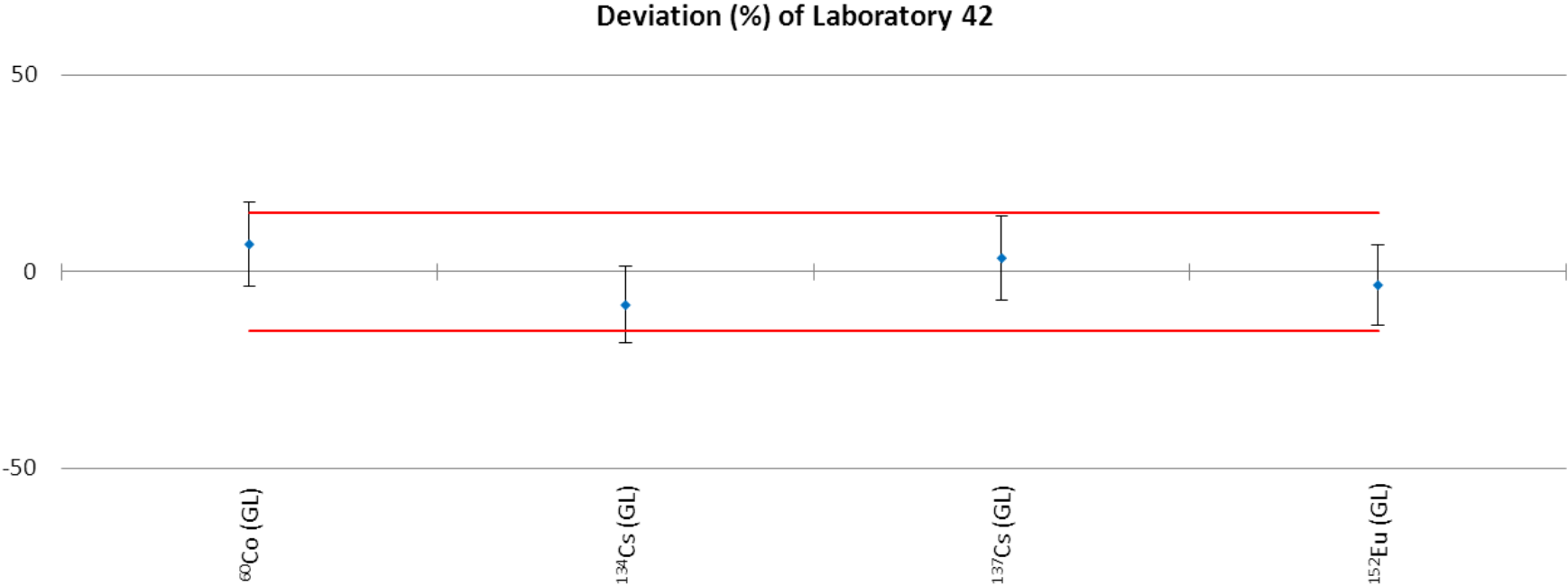


Radionuclide	Laboratory 40	NPL Assigned Value	Deviation /%	Zeta	Z Score
<sup>232</sup> Th (AL)	1.69 ± 0.05 (± 3 %)	1.551 ± 0.016 (± 1.0 %)	8.9	2.89	1.54
<sup>234</sup> U (AL)	16.90 ± 0.03 (± 0.18 %)	19.3 ± 0.3 (± 1.4 %)	-12.3	-9.00	-2.11
<sup>235</sup> U (AL)	0.71 ± 0.05 (± 7 %)	0.921 ± 0.012 (± 1.3 %)	-23.1	-4.46	-3.97
<sup>238</sup> U (AL)	17.10 ± 0.03 (± 0.18 %)	19.3 ± 0.3 (± 1.4 %)	-11.3	-8.25	-1.94
<sup>239</sup> Pu (AL)	1.11 ± 0.05 (± 4 %)	1.332 ± 0.006 (± 0.4 %)	-16.7	-4.91	-2.87
<sup>60</sup> Co (GL)	11.8 ± 0.4 (± 3 %)	13.23 ± 0.11 (± 0.8 %)	-10.8	-4.29	-1.86
<sup>134</sup> Cs (GL)	2.44 ± 0.10 (± 4 %)	3.42 ± 0.03 (± 0.8 %)	-28.7	-9.54	-4.92
<sup>137</sup> Cs (GL)	1.57 ± 0.10 (± 7 %)	1.766 ± 0.016 (± 0.9 %)	-11.1	-1.86	-1.90
<sup>152</sup> Eu (GL)	16.4 ± 0.4 (± 2.1 %)	21.9 ± 0.4 (± 1.8 %)	-25.0	-10.69	-4.29
<sup>3</sup> H (B2)	1.2 ± 0.3 (± 22 %)	1.051 ± 0.008 (± 0.7 %)	17.0	0.66	2.92
<sup>90</sup> Sr (B2)	0.35 ± 0.07 (± 19 %)	0.4746 ± 0.0010 (± 0.21 %)	-26.3	-1.87	-4.51
<sup>241</sup> Pu (B2)	0.7930 (no uncertainty reported)	0.957 ± 0.011 (± 1.1 %)	-17.1	-15.46	-2.94
<sup>90</sup> Sr (SS)	0.23 ± 0.03 (± 13 %)	0.276 ± 0.023 (± 8 %)	-18.1	-1.36	-3.11
<sup>137</sup> Cs (SS)	0.83 ± 0.04 (± 5.0 %)	0.80 ± 0.07 (± 8 %)	3.7	0.40	0.64
<sup>239</sup> Pu (SS)	1.02 ± 0.08 (± 8 %)	1.06 ± 0.09 (± 9 %)	-3.8	-0.33	-0.65
<sup>241</sup> Am (SS)	1.07 ± 0.07 (± 6 %)	1.34 ± 0.11 (± 8 %)	-20.4	-2.18	-3.51

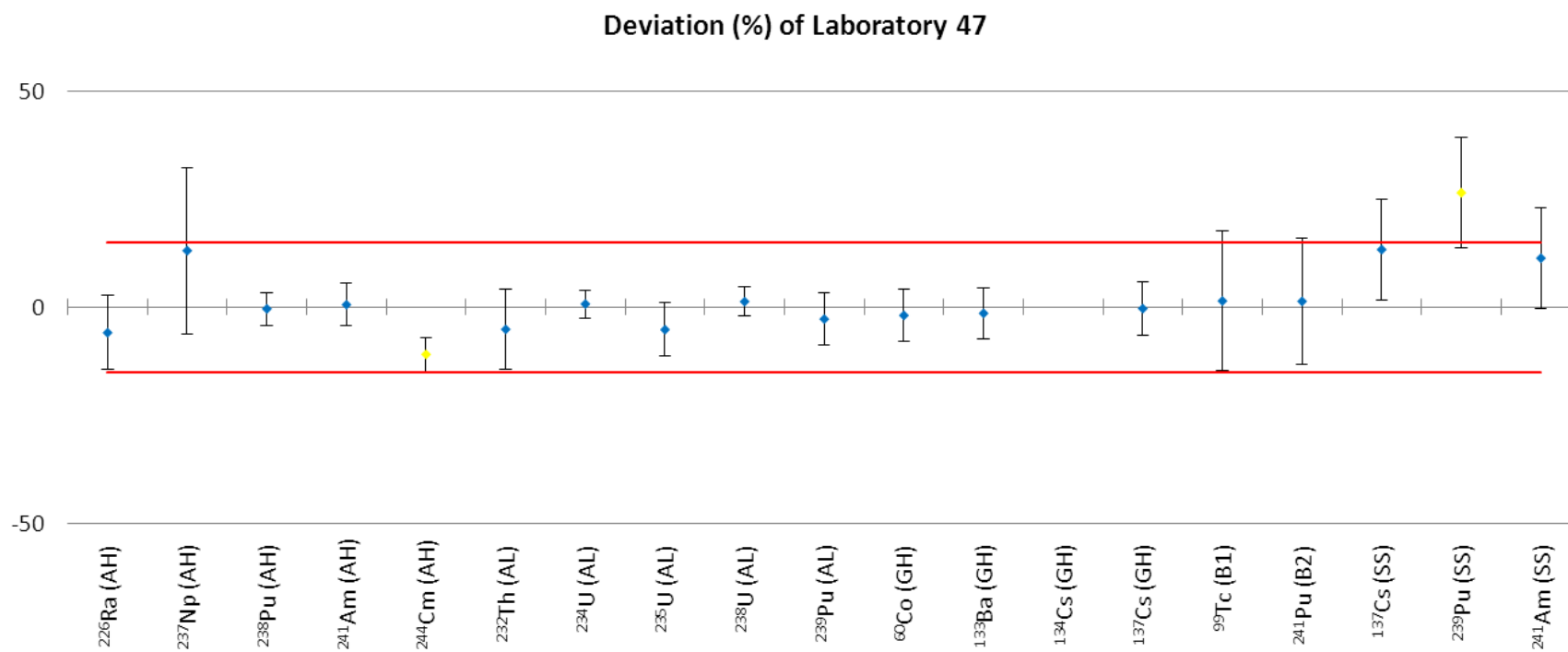




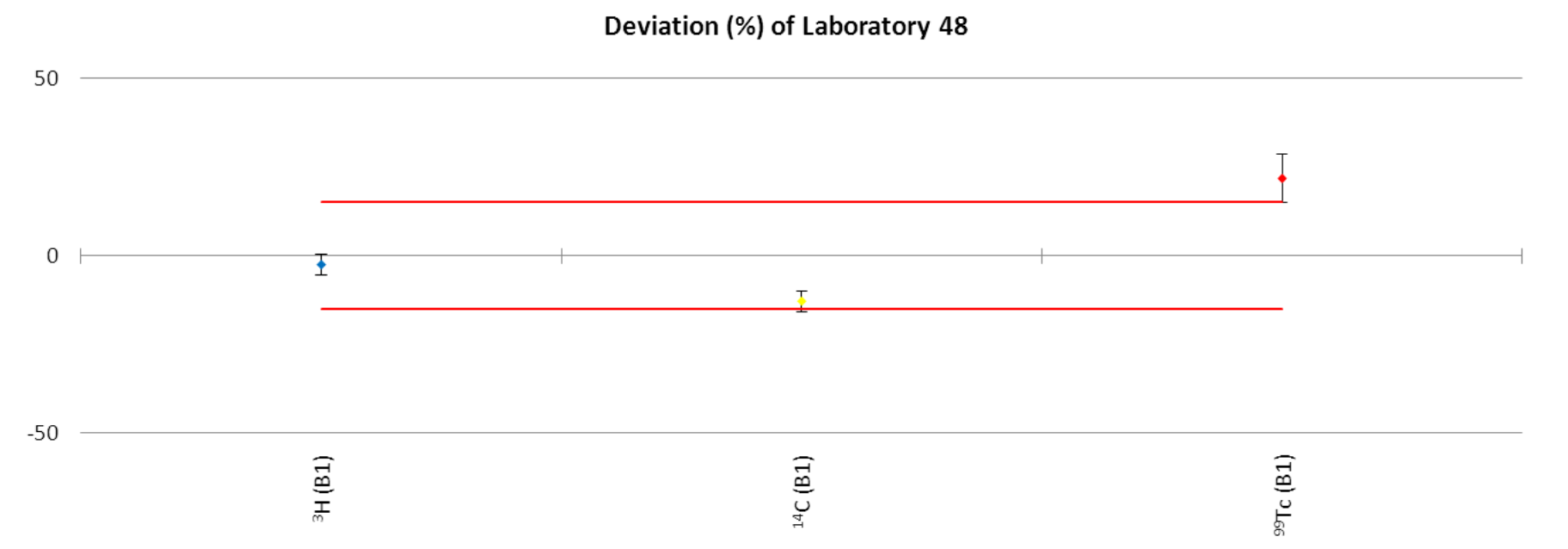
Radionuclide	Laboratory 41	NPL Assigned Value	Deviation /%	Zeta	Z Score
<sup>238</sup> Pu (AH)	16.2 ± 0.7 (± 5.0 %)	16.77 ± 0.06 (± 0.4 %)	-3.3	-0.75	-0.56
<sup>241</sup> Am (AH)	5.2 ± 0.4 (± 6 %)	5.010 ± 0.017 (± 0.4 %)	4.7	0.72	0.81
<sup>244</sup> Cm (AH)	23.0 ± 1.3 (± 6 %)	15.13 ± 0.06 (± 0.4 %)	52.0	6.24	8.93
<sup>60</sup> Co (GH)	9.18 ± 0.08 (± 0.8 %)	11.06 ± 0.03 (± 0.3 %)	-17.0	-23.55	-2.91
<sup>133</sup> Ba (GH)	10.34 ± 0.09 (± 0.9 %)	12.98 ± 0.10 (± 0.8 %)	-20.4	-19.22	-3.50
<sup>134</sup> Cs (GH)	1.386 ± 0.011 (± 0.8 %)	1.915 ± 0.013 (± 0.7 %)	-27.6	-30.40	-4.74
<sup>137</sup> Cs (GH)	7.07 ± 0.10 (± 1.4 %)	8.10 ± 0.06 (± 0.7 %)	-12.7	-8.99	-2.17
<sup>3</sup> H (B2)	1.09 ± 0.07 (± 6 %)	1.051 ± 0.008 (± 0.7 %)	3.3	0.54	0.57
<sup>90</sup> Sr (B2)	0.533 ± 0.023 (± 5.0 %)	0.4746 ± 0.0010 (± 0.21 %)	12.3	2.58	2.11
<sup>241</sup> Pu (B2)	1.02 ± 0.11 (± 10 %)	0.957 ± 0.011 (± 1.1 %)	6.4	0.58	1.10



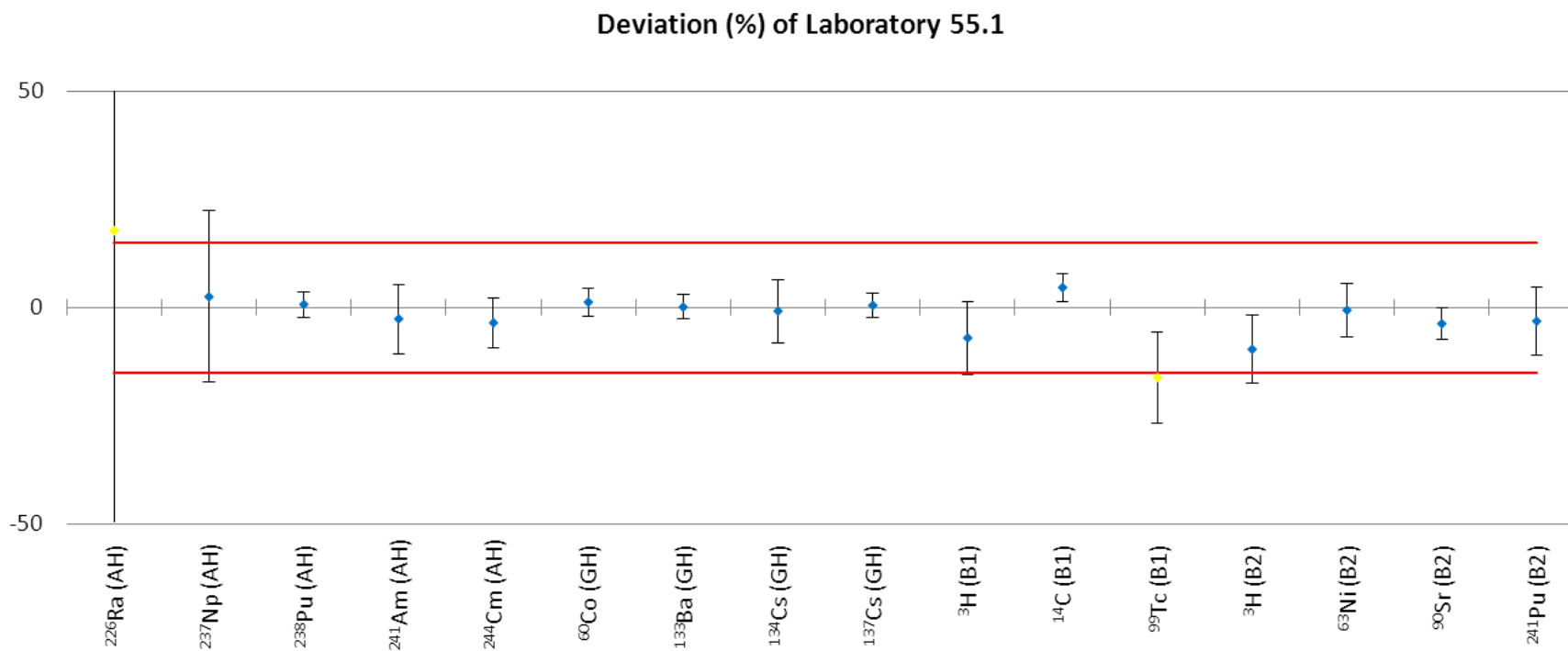
<b>Radionuclide</b>	<b>Laboratory 42</b>	<b>NPL Assigned Value</b>	<b>Deviation /%</b>	<b>Zeta</b>	<b>Z Score</b>
<sup>60</sup> Co (GL)	14.1 ± 1.4 (± 10 %)	13.23 ± 0.11 (± 0.8 %)	6.9	0.64	1.18
<sup>134</sup> Cs (GL)	3.1 ± 0.4 (± 11 %)	3.42 ± 0.03 (± 0.8 %)	-8.5	-0.88	-1.47
<sup>137</sup> Cs (GL)	1.83 ± 0.19 (± 10 %)	1.766 ± 0.016 (± 0.9 %)	3.4	0.32	0.58
<sup>152</sup> Eu (GL)	21.1 ± 2.2 (± 10 %)	21.9 ± 0.4 (± 1.8 %)	-3.5	-0.34	-0.60



Radionuclide	Laboratory 47	NPL Assigned Value	Deviation /%	Zeta	Z Score
<sup>226</sup> Ra (AH)	1.53 ± 0.14 (± 9 %)	1.630 ± 0.022 (± 1.3 %)	-5.9	-0.69	-1.01
<sup>237</sup> Np (AH)	17 ± 3 (± 17 %)	15.12 ± 0.16 (± 1.0 %)	13.1	0.68	2.25
<sup>238</sup> Pu (AH)	16.7 ± 0.7 (± 4 %)	16.77 ± 0.06 (± 0.4 %)	-0.4	-0.10	-0.06
<sup>241</sup> Am (AH)	5.04 ± 0.25 (± 5.0 %)	5.010 ± 0.017 (± 0.4 %)	0.6	0.12	0.10
<sup>244</sup> Cm (AH)	13.5 ± 0.6 (± 5.0 %)	15.13 ± 0.06 (± 0.4 %)	-10.9	-2.78	-1.87
<sup>232</sup> Th (AL)	1.47 ± 0.14 (± 10 %)	1.551 ± 0.016 (± 1.0 %)	-5.1	-0.55	-0.88
<sup>234</sup> U (AL)	19.4 ± 0.6 (± 3 %)	19.3 ± 0.3 (± 1.4 %)	0.7	0.23	0.13
<sup>235</sup> U (AL)	0.87 ± 0.06 (± 7 %)	0.921 ± 0.012 (± 1.3 %)	-5.2	-0.83	-0.89
<sup>238</sup> U (AL)	19.5 ± 0.6 (± 3 %)	19.3 ± 0.3 (± 1.4 %)	1.3	0.38	0.22
<sup>239</sup> Pu (AL)	1.30 ± 0.08 (± 6 %)	1.332 ± 0.006 (± 0.4 %)	-2.7	-0.45	-0.47
<sup>60</sup> Co (GH)	10.8 ± 0.7 (± 6 %)	11.06 ± 0.03 (± 0.3 %)	-1.9	-0.32	-0.32
<sup>133</sup> Ba (GH)	12.8 ± 0.8 (± 6 %)	12.98 ± 0.10 (± 0.8 %)	-1.4	-0.24	-0.24
<sup>134</sup> Cs (GH)	18.10 ± 0.11 (± 0.6 %)	1.915 ± 0.013 (± 0.7 %)	845.2	146.06	145.14
<sup>137</sup> Cs (GH)	8.1 ± 0.5 (± 6 %)	8.10 ± 0.06 (± 0.7 %)	-0.3	-0.05	-0.05
<sup>99</sup> Tc (B1)	0.150 ± 0.024 (± 16 %)	0.1478 ± 0.0013 (± 0.9 %)	1.5	0.09	0.25
<sup>241</sup> Pu (B2)	0.97 ± 0.14 (± 14 %)	0.957 ± 0.011 (± 1.1 %)	1.4	0.09	0.24
<sup>137</sup> Cs (SS)	0.91 ± 0.06 (± 7 %)	0.80 ± 0.07 (± 8 %)	13.4	1.23	2.29
<sup>239</sup> Pu (SS)	1.34 ± 0.08 (± 6 %)	1.06 ± 0.09 (± 9 %)	26.5	2.40	4.55
<sup>241</sup> Am (SS)	1.50 ± 0.10 (± 7 %)	1.34 ± 0.11 (± 8 %)	11.4	1.04	1.95

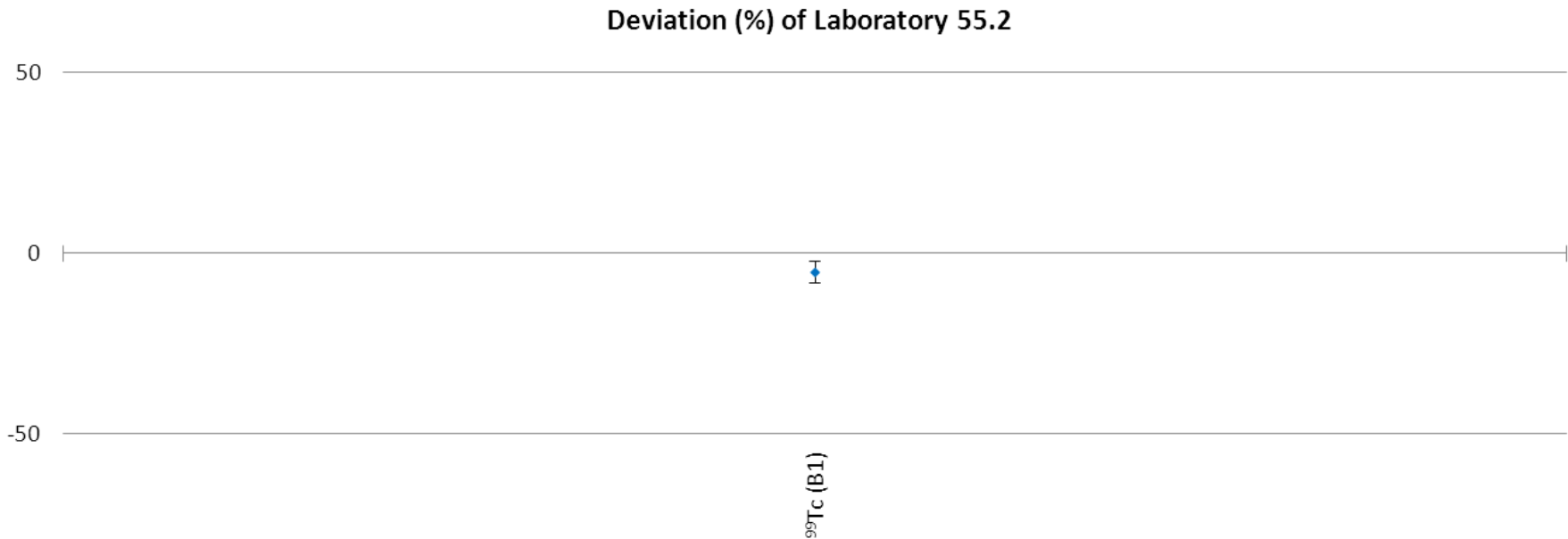


Radionuclide	Laboratory 48	NPL Assigned Value	Deviation /%	Zeta	Z Score
$^3\text{H}$ (B1)	1.00 $\pm$ 0.03 ( $\pm$ 3 %)	1.026 $\pm$ 0.007 ( $\pm$ 0.7 %)	-2.5	-0.84	-0.43
$^{14}\text{C}$ (B1)	0.90 $\pm$ 0.03 ( $\pm$ 4 %)	1.032 $\pm$ 0.005 ( $\pm$ 0.50 %)	-12.8	-4.35	-2.20
$^{99}\text{Tc}$ (B1)	0.180 $\pm$ 0.010 ( $\pm$ 6 %)	0.1478 $\pm$ 0.0013 ( $\pm$ 0.9 %)	21.7	3.19	3.74

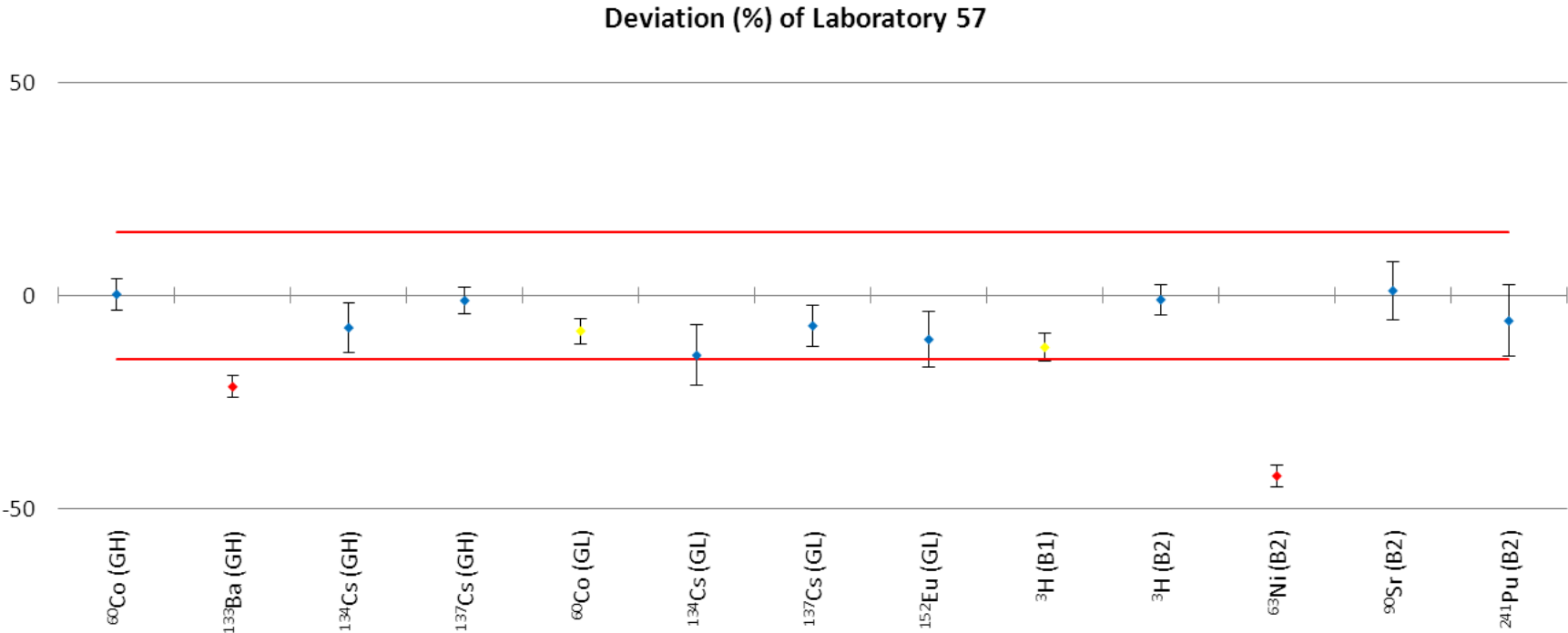




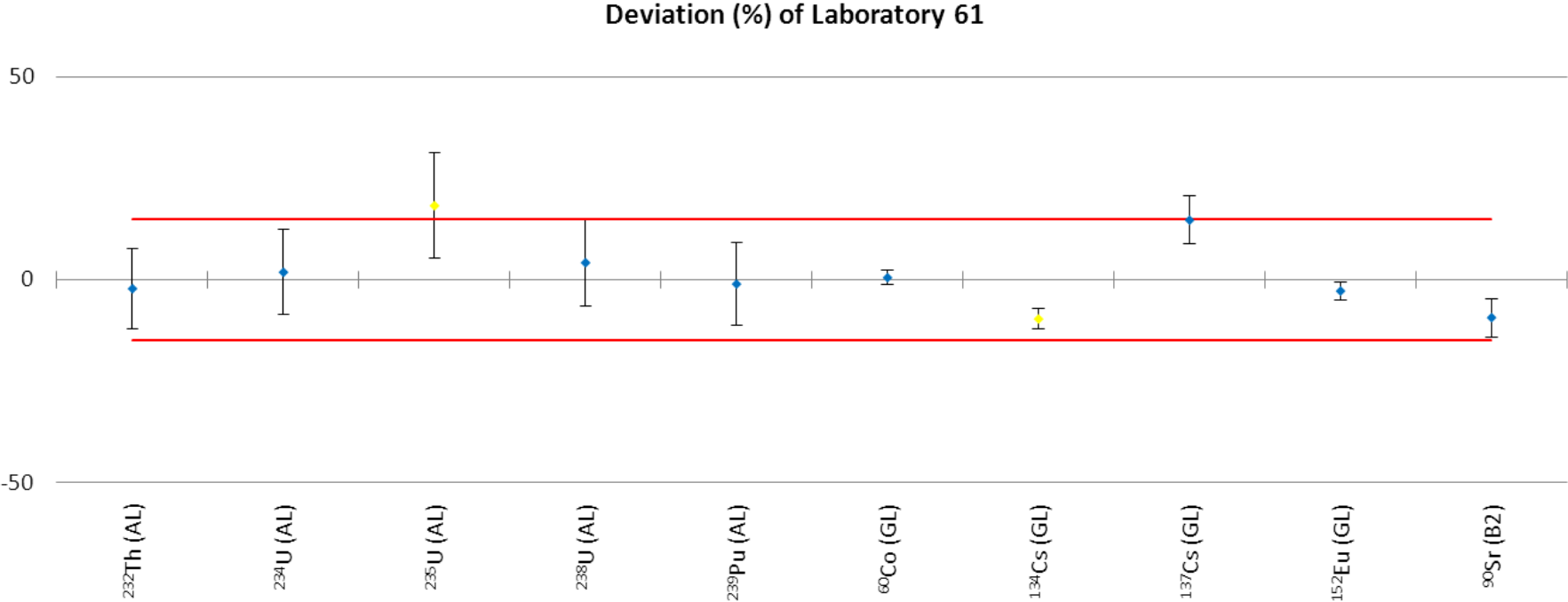
Radionuclide	Laboratory 55.1	NPL Assigned Value	Deviation /%	Zeta	Z Score
<sup>226</sup> Ra (AH)	1.9 ± 2.3 (± 120 %)	1.630 ± 0.022 (± 1.3 %)	17.8	0.13	3.06
<sup>237</sup> Np (AH)	16 ± 3 (± 19 %)	15.12 ± 0.16 (± 1.0 %)	2.5	0.13	0.43
<sup>238</sup> Pu (AH)	16.9 ± 0.5 (± 3 %)	16.77 ± 0.06 (± 0.4 %)	0.8	0.26	0.13
<sup>241</sup> Am (AH)	4.9 ± 0.4 (± 8 %)	5.010 ± 0.017 (± 0.4 %)	-2.6	-0.32	-0.45
<sup>244</sup> Cm (AH)	14.6 ± 0.9 (± 6 %)	15.13 ± 0.06 (± 0.4 %)	-3.5	-0.61	-0.60
<sup>60</sup> Co (GH)	11.2 ± 0.4 (± 4 %)	11.06 ± 0.03 (± 0.3 %)	1.3	0.39	0.22
<sup>133</sup> Ba (GH)	13.0 ± 0.4 (± 3 %)	12.98 ± 0.10 (± 0.8 %)	0.1	0.05	0.02
<sup>134</sup> Cs (GH)	1.90 ± 0.14 (± 7 %)	1.915 ± 0.013 (± 0.7 %)	-0.8	-0.11	-0.13
<sup>137</sup> Cs (GH)	8.14 ± 0.23 (± 3 %)	8.10 ± 0.06 (± 0.7 %)	0.6	0.19	0.09
<sup>3</sup> H (B1)	0.95 ± 0.09 (± 9 %)	1.026 ± 0.007 (± 0.7 %)	-7.0	-0.83	-1.20
<sup>14</sup> C (B1)	1.08 ± 0.04 (± 3 %)	1.032 ± 0.005 (± 0.50 %)	4.7	1.46	0.80
<sup>99</sup> Tc (B1)	0.124 ± 0.016 (± 12 %)	0.1478 ± 0.0013 (± 0.9 %)	-16.1	-1.53	-2.77
<sup>3</sup> H (B2)	0.95 ± 0.08 (± 9 %)	1.051 ± 0.008 (± 0.7 %)	-9.6	-1.22	-1.65
<sup>63</sup> Ni (B2)	1.64 ± 0.10 (± 6 %)	1.650 ± 0.017 (± 1.0 %)	-0.6	-0.09	-0.10
<sup>90</sup> Sr (B2)	0.457 ± 0.017 (± 4 %)	0.4746 ± 0.0010 (± 0.21 %)	-3.7	-1.05	-0.64
<sup>241</sup> Pu (B2)	0.93 ± 0.08 (± 8 %)	0.957 ± 0.011 (± 1.1 %)	-3.1	-0.40	-0.54



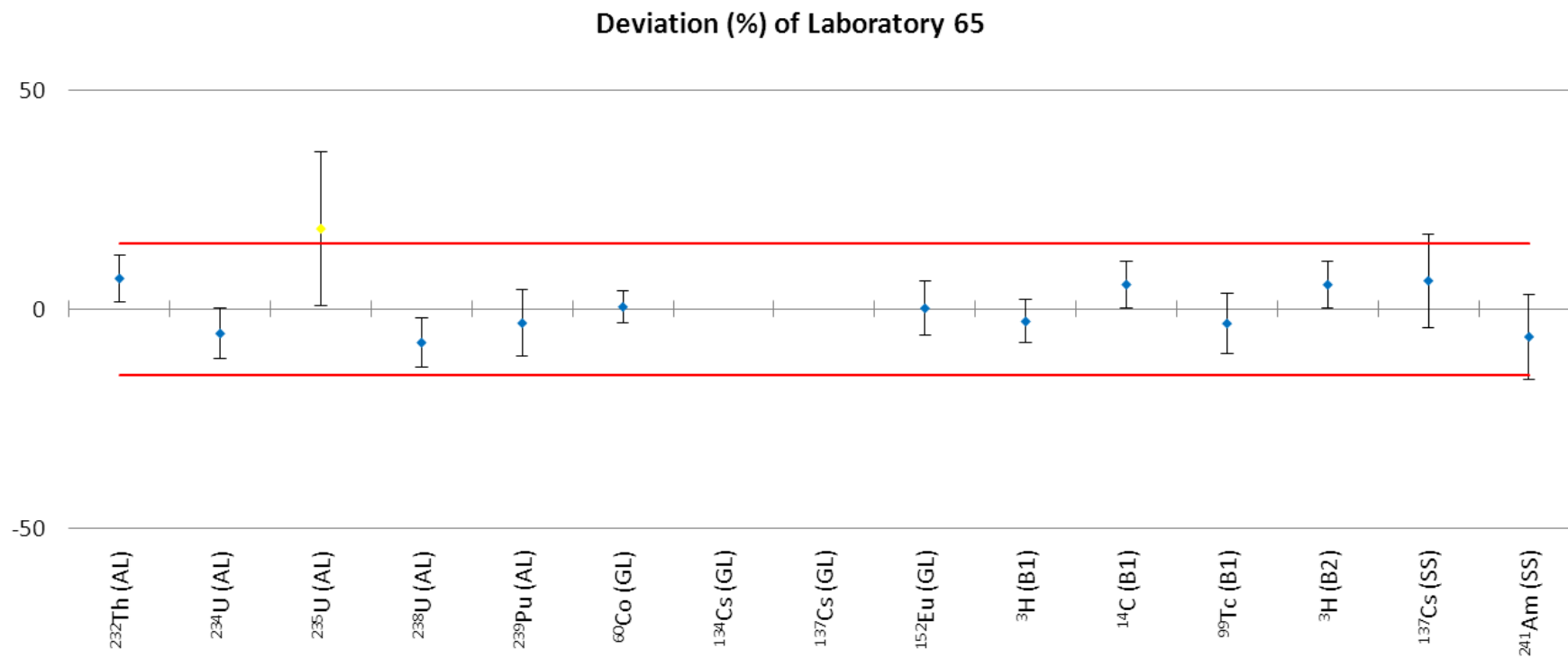
Radionuclide	Laboratory 55.2	NPL Assigned Value	Deviation /%	Zeta	Z Score
<sup>99</sup> Tc (B1)	0.140 ± 0.004 (± 3 %)	0.1478 ± 0.0013 (± 0.9 %)	-5.3	-1.82	-0.91



Radionuclide	Laboratory 57	NPL Assigned Value	Deviation /%	Zeta	Z Score
<sup>60</sup> Co (GH)	11.1 ± 0.4 (± 4 %)	11.06 ± 0.03 (± 0.3 %)	0.3	0.08	0.05
<sup>133</sup> Ba (GH)	10.2 ± 0.4 (± 3 %)	12.98 ± 0.10 (± 0.8 %)	-21.4	-8.26	-3.68
<sup>134</sup> Cs (GH)	1.77 ± 0.11 (± 6 %)	1.915 ± 0.013 (± 0.7 %)	-7.6	-1.31	-1.30
<sup>137</sup> Cs (GH)	8.00 ± 0.25 (± 3 %)	8.10 ± 0.06 (± 0.7 %)	-1.2	-0.37	-0.20
<sup>60</sup> Co (GL)	12.1 ± 0.4 (± 3 %)	13.23 ± 0.11 (± 0.8 %)	-8.3	-2.79	-1.43
<sup>134</sup> Cs (GL)	2.94 ± 0.24 (± 8 %)	3.42 ± 0.03 (± 0.8 %)	-14.1	-1.99	-2.41
<sup>137</sup> Cs (GL)	1.64 ± 0.09 (± 5.0 %)	1.766 ± 0.016 (± 0.9 %)	-7.1	-1.45	-1.22
<sup>152</sup> Eu (GL)	19.6 ± 1.4 (± 7 %)	21.9 ± 0.4 (± 1.8 %)	-10.3	-1.55	-1.77
<sup>3</sup> H (B1)	0.90 ± 0.04 (± 4 %)	1.026 ± 0.007 (± 0.7 %)	-12.2	-3.80	-2.09
<sup>3</sup> H (B2)	1.04 ± 0.04 (± 4 %)	1.051 ± 0.008 (± 0.7 %)	-1.0	-0.27	-0.17
<sup>63</sup> Ni (B2)	0.95 ± 0.05 (± 5.0 %)	1.650 ± 0.017 (± 1.0 %)	-42.4	-15.13	-7.28
<sup>90</sup> Sr (B2)	0.48 ± 0.04 (± 7 %)	0.4746 ± 0.0010 (± 0.21 %)	1.1	0.17	0.20
<sup>241</sup> Pu (B2)	0.90 ± 0.08 (± 9 %)	0.957 ± 0.011 (± 1.1 %)	-5.9	-0.70	-1.02

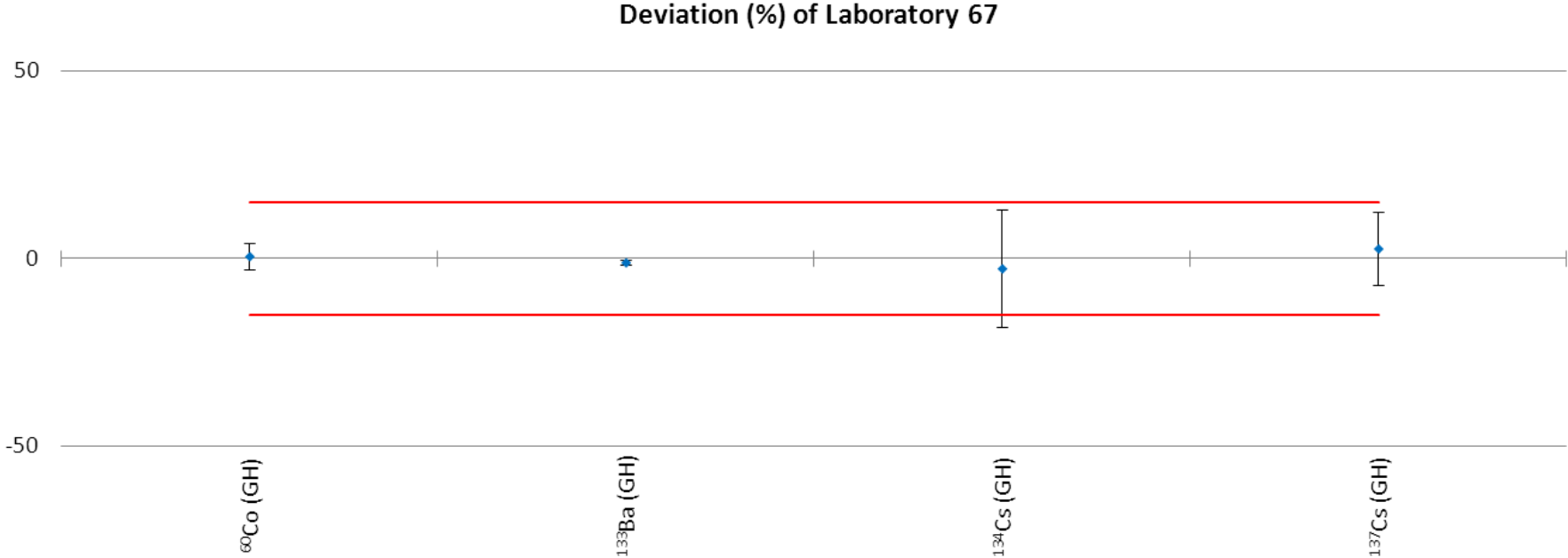


Radionuclide	Laboratory 61	NPL Assigned Value	Deviation /%	Zeta	Z Score
<sup>232</sup> Th (AL)	1.52 ± 0.15 (± 10 %)	1.551 ± 0.016 (± 1.0 %)	-2.2	-0.22	-0.38
<sup>234</sup> U (AL)	19.6 ± 2.0 (± 10 %)	19.3 ± 0.3 (± 1.4 %)	1.8	0.18	0.32
<sup>235</sup> U (AL)	1.09 ± 0.12 (± 11 %)	0.921 ± 0.012 (± 1.3 %)	18.2	1.42	3.13
<sup>238</sup> U (AL)	20.1 ± 2.1 (± 10 %)	19.3 ± 0.3 (± 1.4 %)	4.2	0.39	0.72
<sup>239</sup> Pu (AL)	1.32 ± 0.13 (± 10 %)	1.332 ± 0.006 (± 0.4 %)	-1.0	-0.10	-0.18
<sup>60</sup> Co (GL)	13.30 ± 0.20 (± 1.5 %)	13.23 ± 0.11 (± 0.8 %)	0.5	0.30	0.09
<sup>134</sup> Cs (GL)	3.09 ± 0.08 (± 3 %)	3.42 ± 0.03 (± 0.8 %)	-9.7	-3.84	-1.66
<sup>137</sup> Cs (GL)	2.02 ± 0.10 (± 5.0 %)	1.766 ± 0.016 (± 0.9 %)	14.7	2.52	2.52
<sup>152</sup> Eu (GL)	21.2 ± 0.3 (± 1.3 %)	21.9 ± 0.4 (± 1.8 %)	-2.8	-1.27	-0.48
<sup>90</sup> Sr (B2)	0.430 ± 0.022 (± 5.0 %)	0.4746 ± 0.0010 (± 0.21 %)	-9.3	-1.97	-1.60

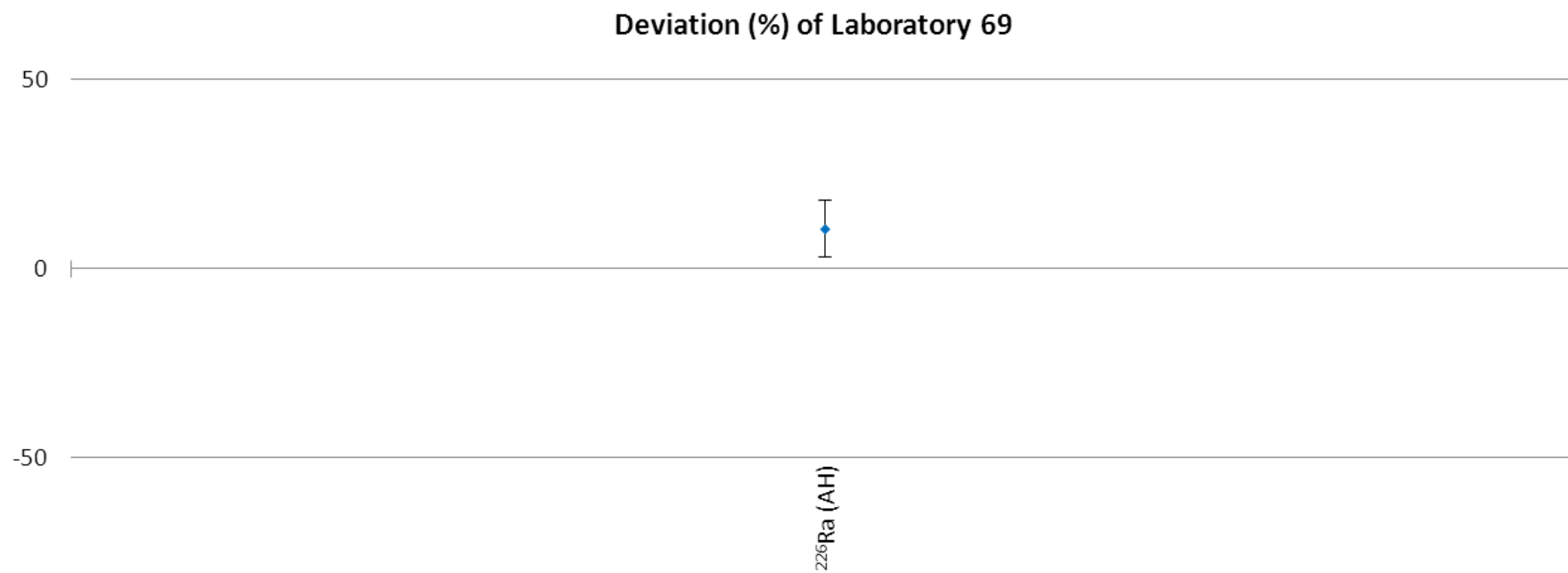




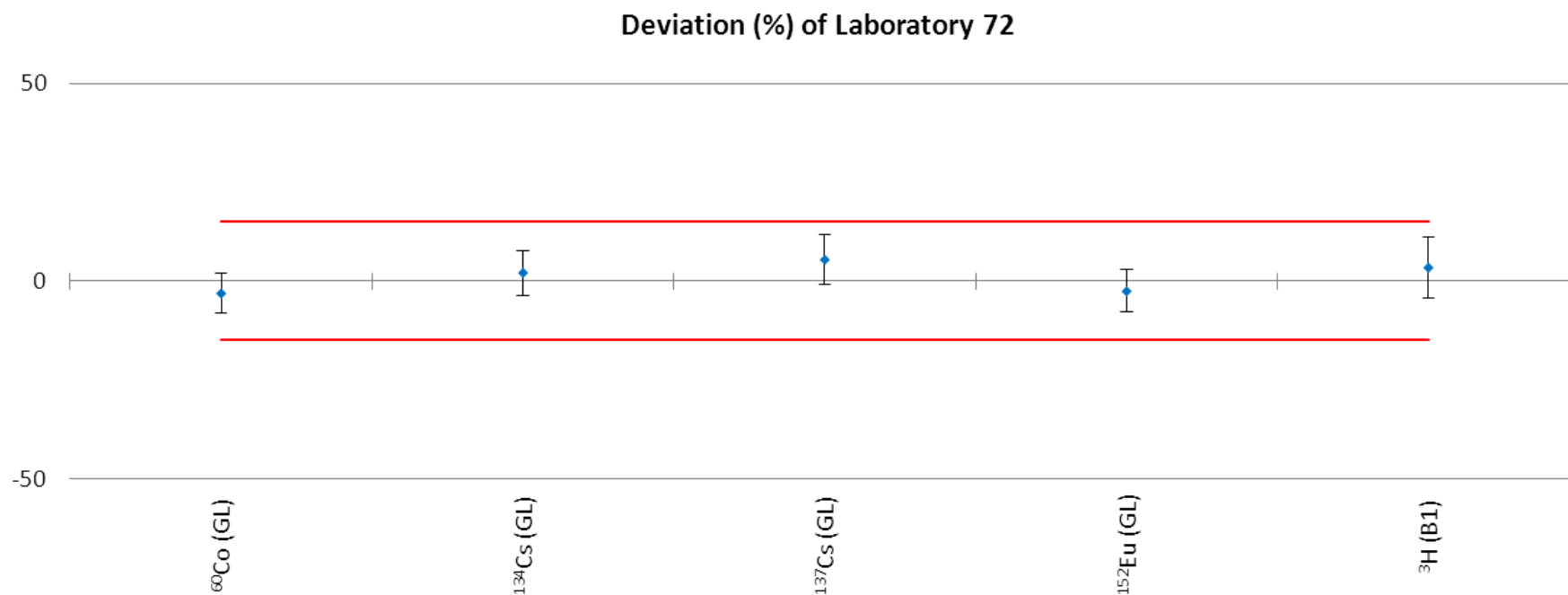
Radionuclide	Laboratory 65	NPL Assigned Value	Deviation /%	Zeta	Z Score
<sup>232</sup> Th (AL)	1.66 ± 0.08 (± 5.0 %)	1.551 ± 0.016 (± 1.0 %)	7.0	1.33	1.20
<sup>234</sup> U (AL)	18.2 ± 1.1 (± 6 %)	19.3 ± 0.3 (± 1.4 %)	-5.6	-0.96	-0.96
<sup>235</sup> U (AL)	1.09 ± 0.16 (± 15 %)	0.921 ± 0.012 (± 1.3 %)	18.4	1.05	3.16
<sup>238</sup> U (AL)	17.8 ± 1.1 (± 6 %)	19.3 ± 0.3 (± 1.4 %)	-7.6	-1.34	-1.31
<sup>239</sup> Pu (AL)	1.29 ± 0.10 (± 8 %)	1.332 ± 0.006 (± 0.4 %)	-3.2	-0.42	-0.55
<sup>60</sup> Co (GL)	13.3 ± 0.5 (± 4 %)	13.23 ± 0.11 (± 0.8 %)	0.5	0.14	0.09
<sup>134</sup> Cs (GL)	31.7 ± 2.4 (± 8 %)	3.42 ± 0.03 (± 0.8 %)	826.7	11.88	141.97
<sup>137</sup> Cs (GL)	18.6 ± 0.9 (± 5.0 %)	1.766 ± 0.016 (± 0.9 %)	953.4	18.10	163.74
<sup>152</sup> Eu (GL)	21.9 ± 1.3 (± 6 %)	21.9 ± 0.4 (± 1.8 %)	0.2	0.03	0.03
<sup>3</sup> H (B1)	1.00 ± 0.05 (± 5.0 %)	1.026 ± 0.007 (± 0.7 %)	-2.8	-0.57	-0.48
<sup>14</sup> C (B1)	1.09 ± 0.06 (± 5.0 %)	1.032 ± 0.005 (± 0.50 %)	5.6	1.05	0.97
<sup>99</sup> Tc (B1)	0.143 ± 0.010 (± 7 %)	0.1478 ± 0.0013 (± 0.9 %)	-3.3	-0.48	-0.56
<sup>3</sup> H (B2)	1.11 ± 0.06 (± 5.0 %)	1.051 ± 0.008 (± 0.7 %)	5.6	1.04	0.96
<sup>137</sup> Cs (SS)	0.85 ± 0.05 (± 6 %)	0.80 ± 0.07 (± 8 %)	6.5	0.64	1.11
<sup>241</sup> Am (SS)	1.26 ± 0.08 (± 7 %)	1.34 ± 0.11 (± 8 %)	-6.3	-0.62	-1.09



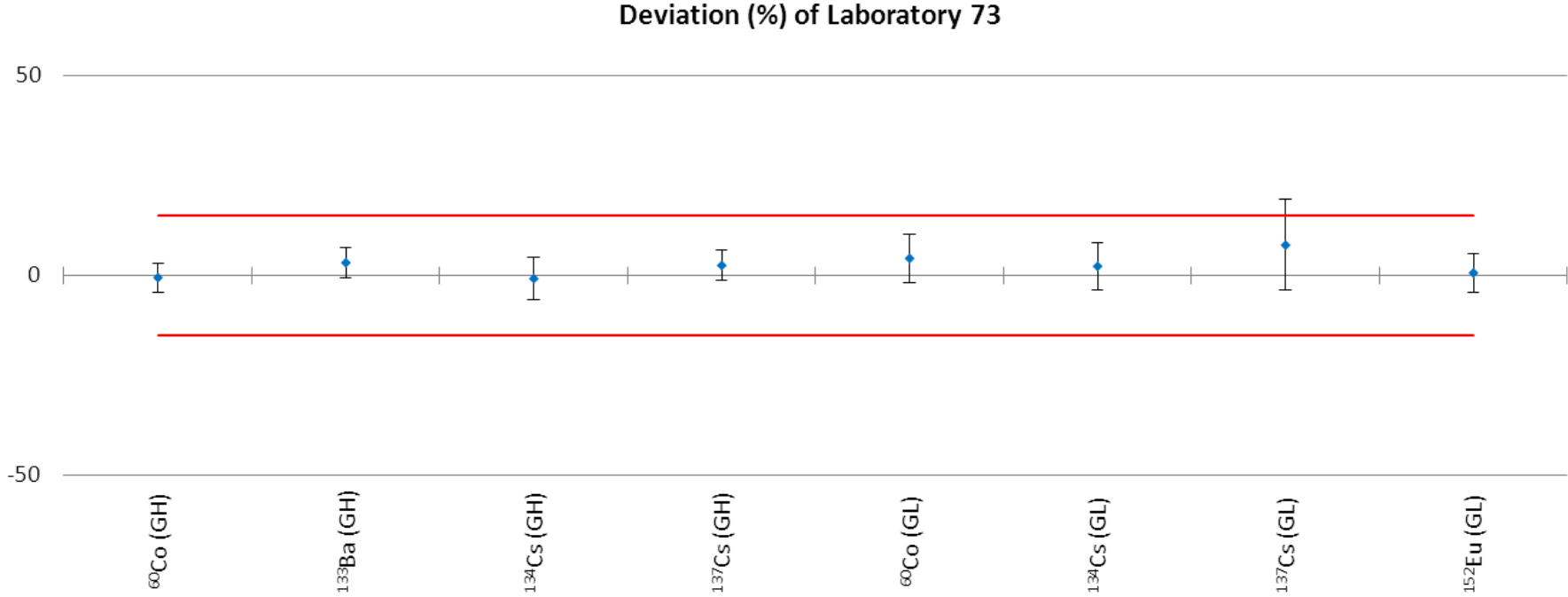
Radionuclide	Laboratory 67	NPL Assigned Value	Deviation /%	Zeta	Z Score
$^{60}\text{Co}$ (GH)	$11.1 \pm 0.4$ ( $\pm 4\%$ )	$11.06 \pm 0.03$ ( $\pm 0.3\%$ )	0.4	0.12	0.07
$^{133}\text{Ba}$ (GH)	$12.82 \pm 0.08$ ( $\pm 0.6\%$ )	$12.98 \pm 0.10$ ( $\pm 0.8\%$ )	-1.2	-1.22	-0.21
$^{134}\text{Cs}$ (GH)	$1.9 \pm 0.3$ ( $\pm 16\%$ )	$1.915 \pm 0.013$ ( $\pm 0.7\%$ )	-2.8	-0.18	-0.48
$^{137}\text{Cs}$ (GH)	$8.3 \pm 0.8$ ( $\pm 9\%$ )	$8.10 \pm 0.06$ ( $\pm 0.7\%$ )	2.5	0.26	0.43



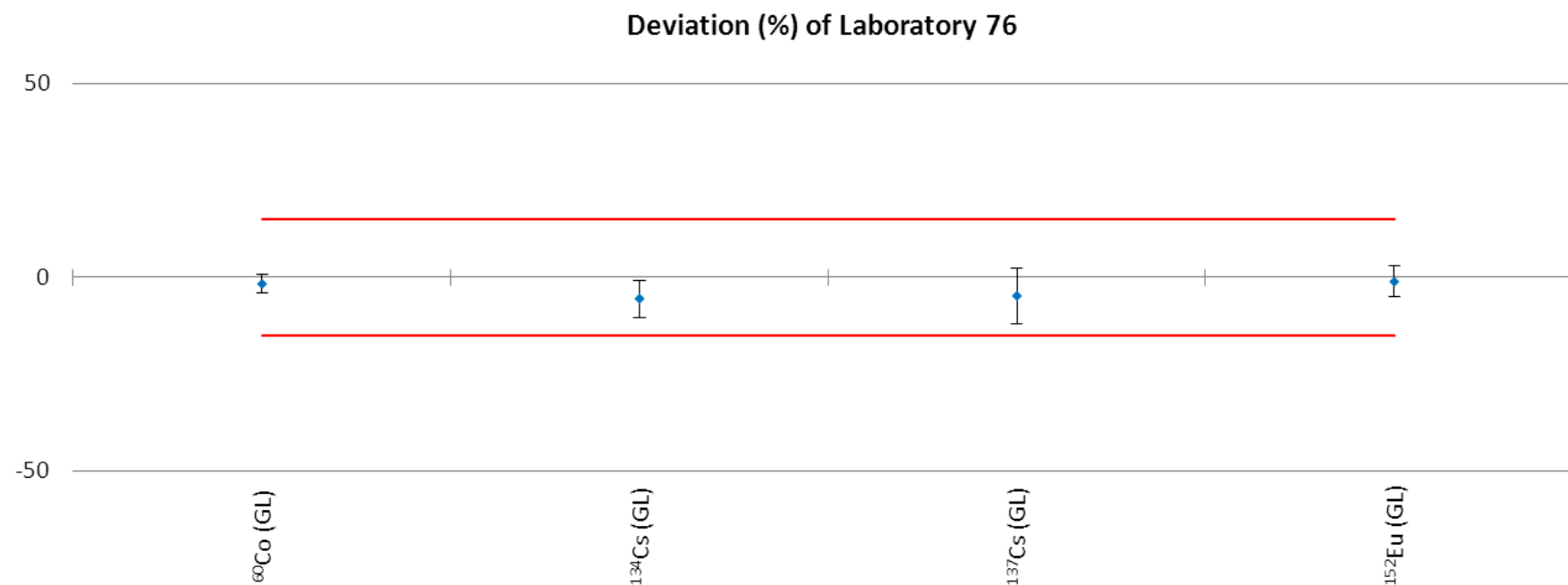
Radionuclide	Laboratory 69	NPL Assigned Value	Deviation /%	Zeta	Z Score
$^{226}\text{Ra (AH)}$	1.80 ± 0.12 (± 7 %)	1.630 ± 0.022 (± 1.3 %)	10.4	1.39	1.79



Radionuclide	Laboratory 72	NPL Assigned Value	Deviation /%	Zeta	Z Score
$^{60}\text{Co}$ (GL)	$12.8 \pm 0.7$ ( $\pm 5.0$ %)	$13.23 \pm 0.11$ ( $\pm 0.8$ %)	-3.2	-0.62	-0.55
$^{134}\text{Cs}$ (GL)	$3.49 \pm 0.19$ ( $\pm 6$ %)	$3.42 \pm 0.03$ ( $\pm 0.8$ %)	2.0	0.36	0.35
$^{137}\text{Cs}$ (GL)	$1.86 \pm 0.11$ ( $\pm 6$ %)	$1.766 \pm 0.016$ ( $\pm 0.9$ %)	5.3	0.85	0.92
$^{152}\text{Eu}$ (GL)	$21.3 \pm 1.1$ ( $\pm 5.0$ %)	$21.9 \pm 0.4$ ( $\pm 1.8$ %)	-2.6	-0.49	-0.45
$^3\text{H}$ (B1)	$1.06 \pm 0.08$ ( $\pm 8$ %)	$1.026 \pm 0.007$ ( $\pm 0.7$ %)	3.3	0.43	0.57



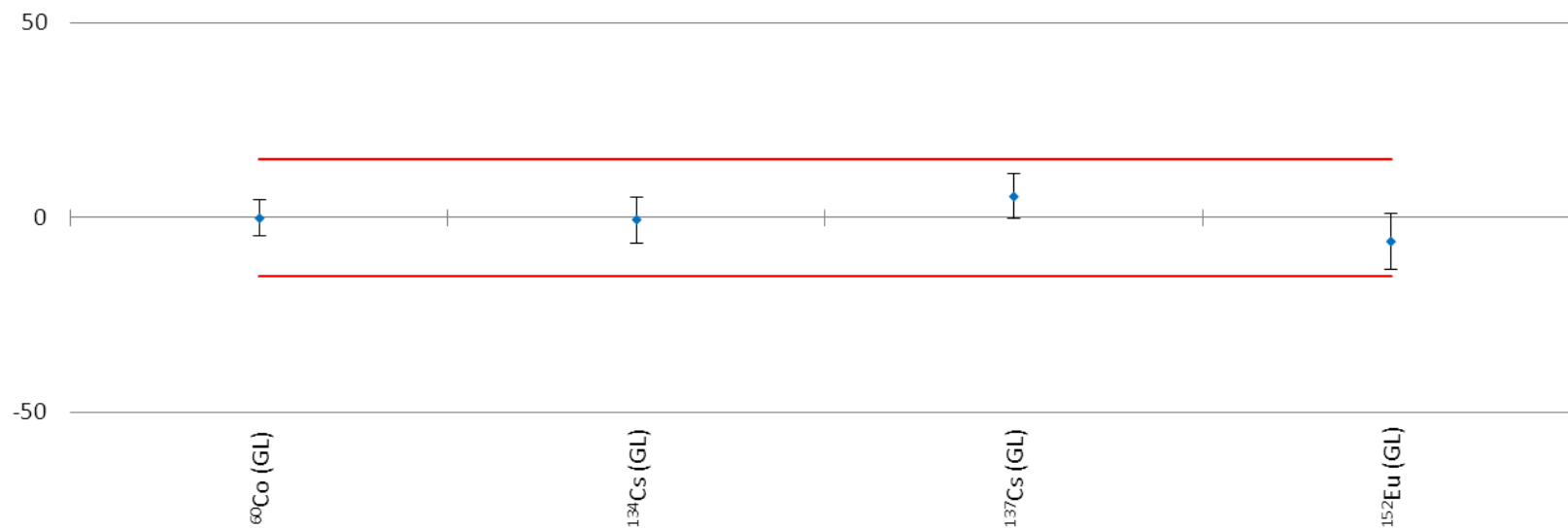
Radionuclide	Laboratory 73	NPL Assigned Value	Deviation /%	Zeta	Z Score
<sup>60</sup> Co (GH)	11.0 ± 0.4 (± 4 %)	11.06 ± 0.03 (± 0.3 %)	-0.5	-0.15	-0.09
<sup>133</sup> Ba (GH)	13.4 ± 0.5 (± 4 %)	12.98 ± 0.10 (± 0.8 %)	3.2	0.82	0.55
<sup>134</sup> Cs (GH)	1.90 ± 0.10 (± 5.0 %)	1.915 ± 0.013 (± 0.7 %)	-0.8	-0.15	-0.13
<sup>137</sup> Cs (GH)	8.3 ± 0.3 (± 4 %)	8.10 ± 0.06 (± 0.7 %)	2.5	0.67	0.43
<sup>60</sup> Co (GL)	13.8 ± 0.8 (± 6 %)	13.23 ± 0.11 (± 0.8 %)	4.3	0.70	0.74
<sup>134</sup> Cs (GL)	3.50 ± 0.20 (± 6 %)	3.42 ± 0.03 (± 0.8 %)	2.3	0.39	0.40
<sup>137</sup> Cs (GL)	1.90 ± 0.20 (± 11 %)	1.766 ± 0.016 (± 0.9 %)	7.6	0.67	1.31
<sup>152</sup> Eu (GL)	22.0 ± 1.0 (± 5.0 %)	21.9 ± 0.4 (± 1.8 %)	0.7	0.13	0.11



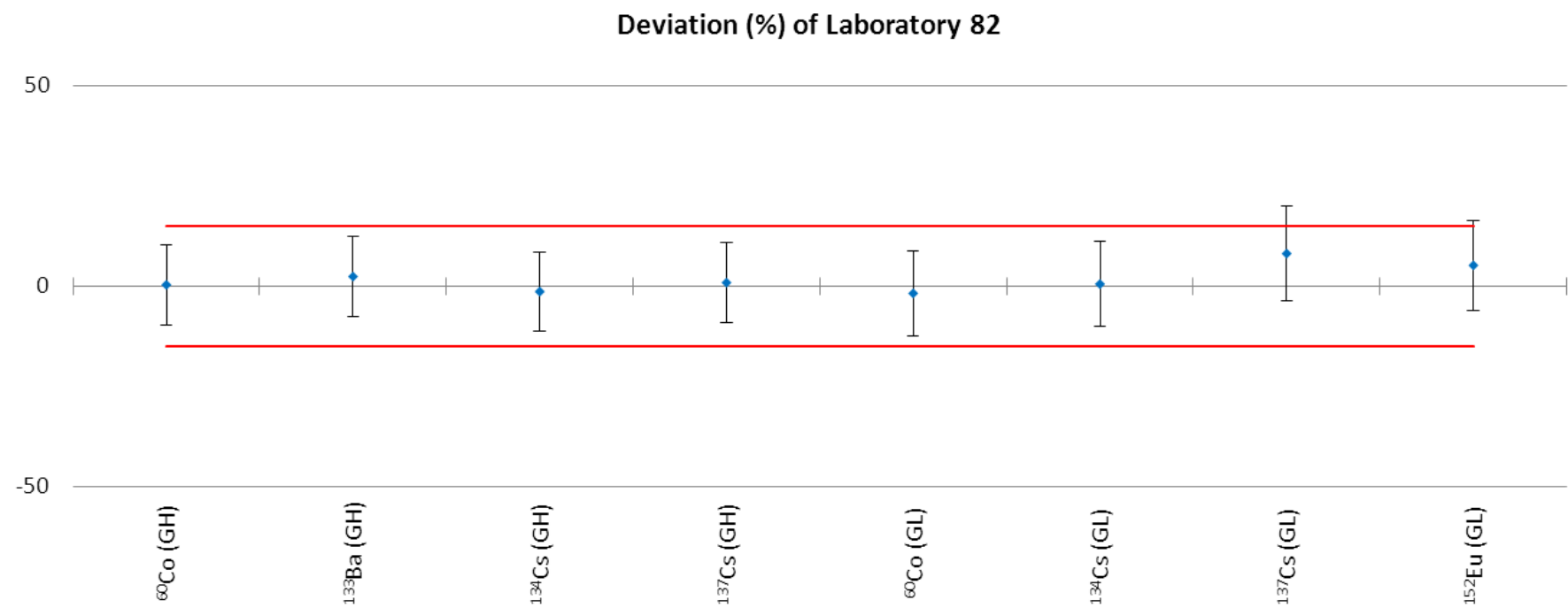
Radionuclide	Laboratory 76	NPL Assigned Value	Deviation /%	Zeta	Z Score
$^{60}\text{Co}$ (GL)	13.0 $\pm$ 0.3 ( $\pm$ 2.4 %)	13.23 $\pm$ 0.11 ( $\pm$ 0.8 %)	-1.7	-0.71	-0.30
$^{134}\text{Cs}$ (GL)	3.23 $\pm$ 0.16 ( $\pm$ 5.0 %)	3.42 $\pm$ 0.03 ( $\pm$ 0.8 %)	-5.6	-1.17	-0.96
$^{137}\text{Cs}$ (GL)	1.68 $\pm$ 0.12 ( $\pm$ 8 %)	1.766 $\pm$ 0.016 ( $\pm$ 0.9 %)	-4.9	-0.68	-0.83
$^{152}\text{Eu}$ (GL)	21.6 $\pm$ 0.8 ( $\pm$ 4 %)	21.9 $\pm$ 0.4 ( $\pm$ 1.8 %)	-1.2	-0.30	-0.20



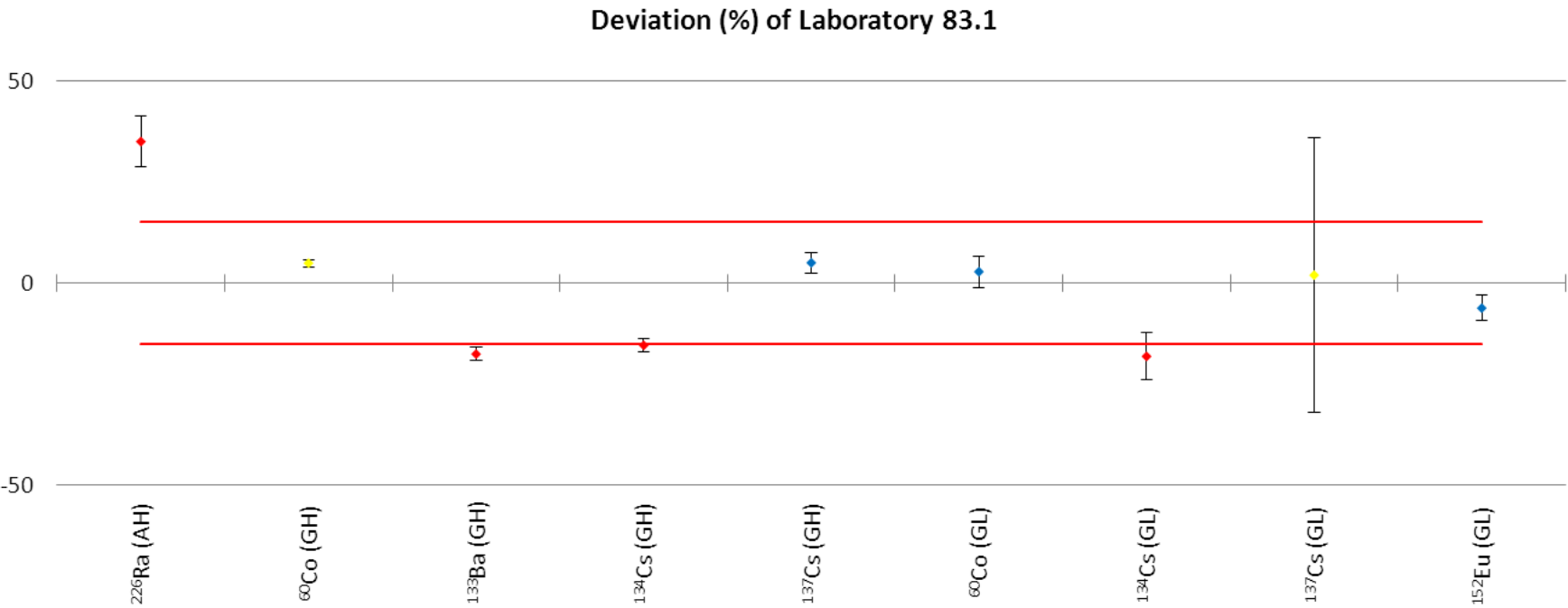
## Deviation (%) of Laboratory 81



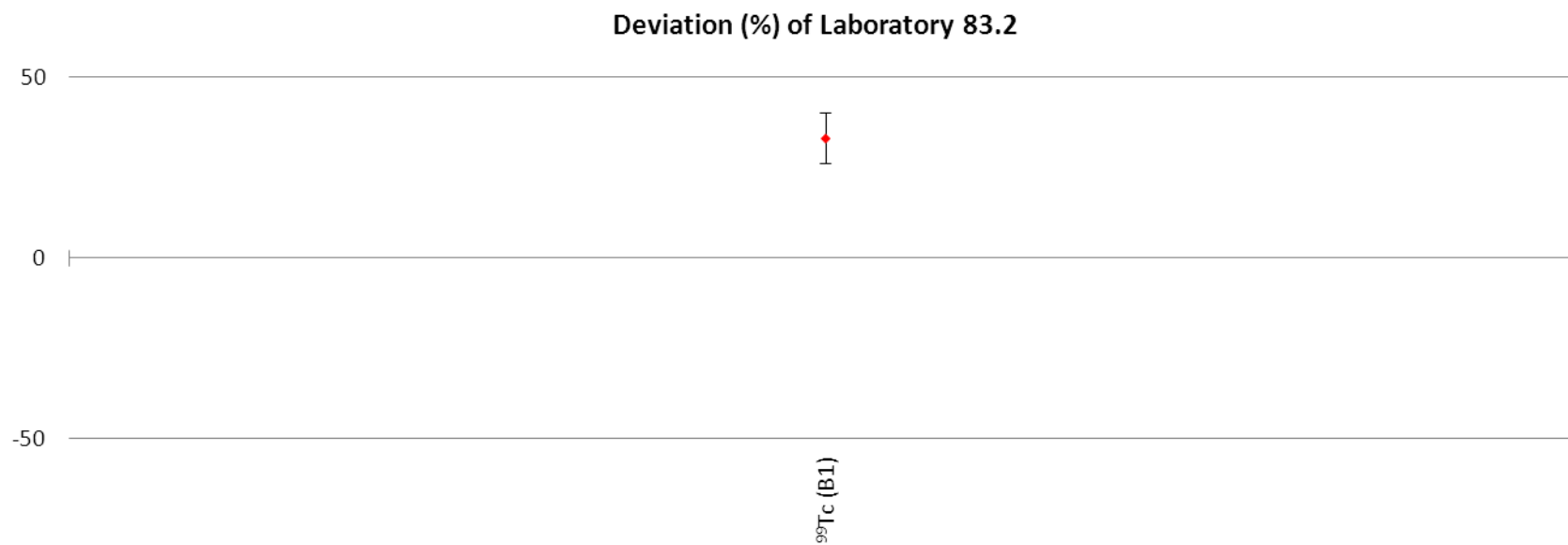
Radionuclide	Laboratory 81	NPL Assigned Value	Deviation /%	Zeta	Z Score
$^{60}\text{Co}$ (GL)	$13.2 \pm 0.6$ ( $\pm 5.0$ %)	$13.23 \pm 0.11$ ( $\pm 0.8$ %)	-0.2	-0.05	-0.04
$^{134}\text{Cs}$ (GL)	$3.40 \pm 0.20$ ( $\pm 6$ %)	$3.42 \pm 0.03$ ( $\pm 0.8$ %)	-0.6	-0.10	-0.10
$^{137}\text{Cs}$ (GL)	$1.86 \pm 0.10$ ( $\pm 6$ %)	$1.766 \pm 0.016$ ( $\pm 0.9$ %)	5.3	0.93	0.92
$^{152}\text{Eu}$ (GL)	$20.5 \pm 1.5$ ( $\pm 7$ %)	$21.9 \pm 0.4$ ( $\pm 1.8$ %)	-6.2	-0.88	-1.07



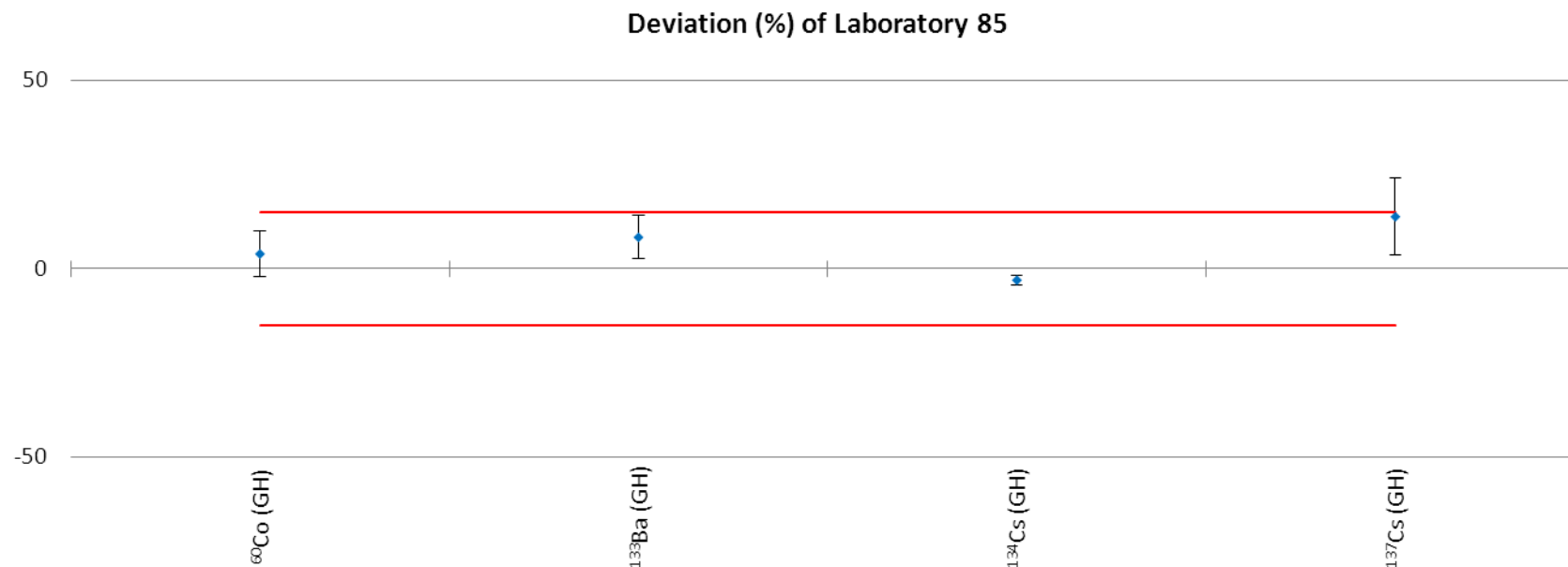
Radionuclide	Laboratory 82	NPL Assigned Value	Deviation /%	Zeta	Z Score
<sup>60</sup> Co (GH)	11.1 ± 1.1 (± 10 %)	11.06 ± 0.03 (± 0.3 %)	0.4	0.04	0.06
<sup>133</sup> Ba (GH)	13.3 ± 1.3 (± 10 %)	12.98 ± 0.10 (± 0.8 %)	2.4	0.24	0.42
<sup>134</sup> Cs (GH)	1.89 ± 0.19 (± 10 %)	1.915 ± 0.013 (± 0.7 %)	-1.3	-0.13	-0.22
<sup>137</sup> Cs (GH)	8.2 ± 0.8 (± 10 %)	8.10 ± 0.06 (± 0.7 %)	0.9	0.09	0.16
<sup>60</sup> Co (GL)	13.0 ± 1.4 (± 11 %)	13.23 ± 0.11 (± 0.8 %)	-1.7	-0.16	-0.30
<sup>134</sup> Cs (GL)	3.4 ± 0.4 (± 10 %)	3.42 ± 0.03 (± 0.8 %)	0.6	0.05	0.10
<sup>137</sup> Cs (GL)	1.91 ± 0.21 (± 11 %)	1.766 ± 0.016 (± 0.9 %)	8.2	0.69	1.40
<sup>152</sup> Eu (GL)	23.0 ± 2.4 (± 10 %)	21.9 ± 0.4 (± 1.8 %)	5.2	0.47	0.90



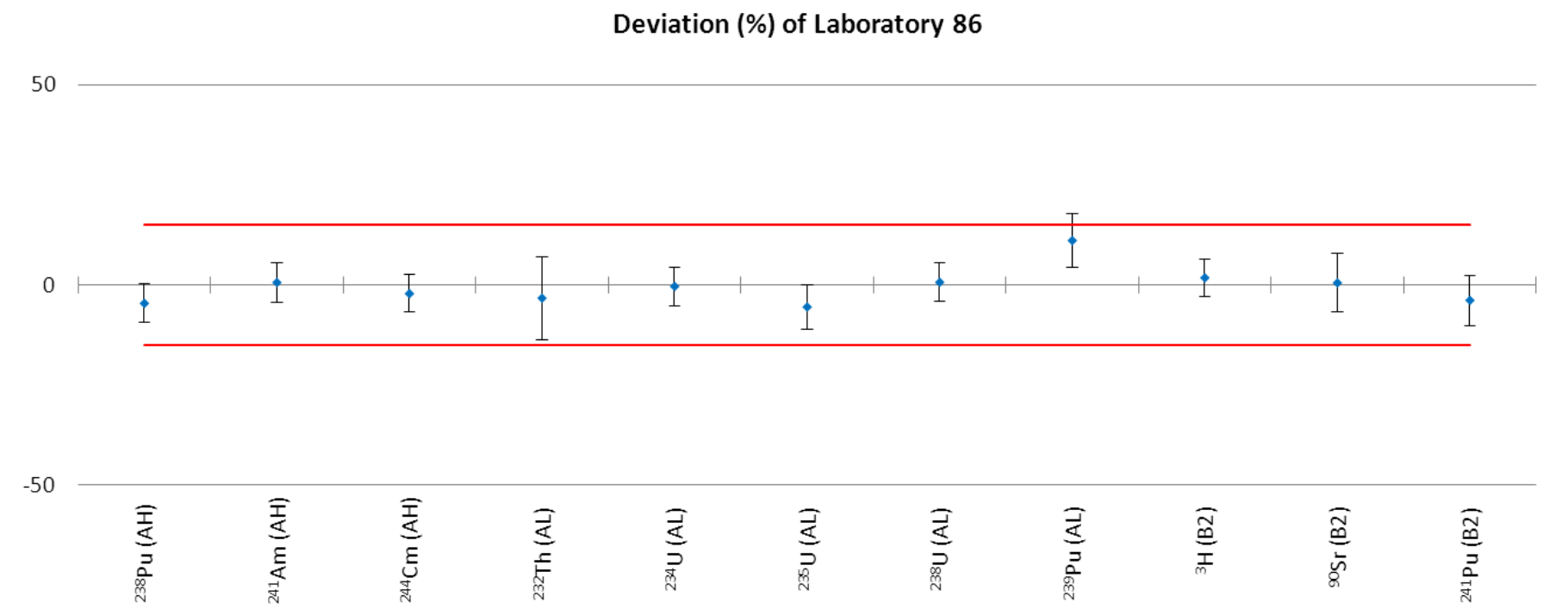
Radionuclide	Laboratory 83.1	NPL Assigned Value	Deviation /%	Zeta	Z Score
<sup>226</sup> Ra (AH)	2.20 ± 0.10 (± 5.0 %)	1.630 ± 0.022 (± 1.3 %)	35.0	5.57	6.01
<sup>60</sup> Co (GH)	11.60 ± 0.10 (± 0.9 %)	11.06 ± 0.03 (± 0.3 %)	4.9	5.21	0.84
<sup>133</sup> Ba (GH)	10.70 ± 0.20 (± 1.9 %)	12.98 ± 0.10 (± 0.8 %)	-17.6	-10.11	-3.02
<sup>134</sup> Cs (GH)	1.62 ± 0.03 (± 1.9 %)	1.915 ± 0.013 (± 0.7 %)	-15.4	-8.98	-2.65
<sup>137</sup> Cs (GH)	8.50 ± 0.20 (± 2.4 %)	8.10 ± 0.06 (± 0.7 %)	5.0	1.94	0.86
<sup>60</sup> Co (GL)	13.6 ± 0.5 (± 4 %)	13.23 ± 0.11 (± 0.8 %)	2.8	0.72	0.48
<sup>134</sup> Cs (GL)	2.80 ± 0.20 (± 7 %)	3.42 ± 0.03 (± 0.8 %)	-18.1	-3.07	-3.12
<sup>137</sup> Cs (GL)	1.8 ± 0.6 (± 40 %)	1.766 ± 0.016 (± 0.9 %)	1.9	0.06	0.33
<sup>152</sup> Eu (GL)	20.6 ± 0.6 (± 3 %)	21.9 ± 0.4 (± 1.8 %)	-6.2	-1.91	-1.07



Radionuclide	Laboratory 83.2	NPL Assigned Value	Deviation /%	Zeta	Z Score
$^{99}\text{Tc}$ (B1)	0.197 ± 0.010 (± 5.0 %)	0.1478 ± 0.0013 (± 0.9 %)	33.0	4.75	5.67

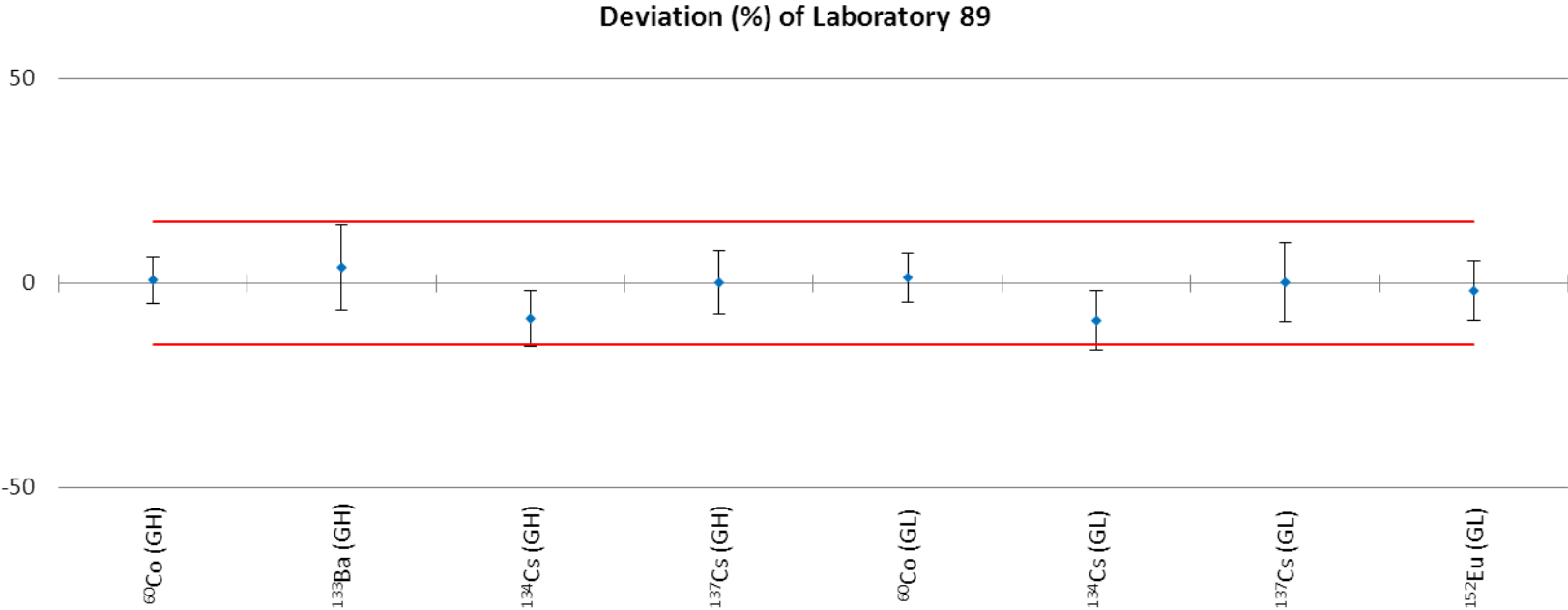


Radionuclide	Laboratory 85	NPL Assigned Value	Deviation /%	Zeta	Z Score
$^{60}\text{Co}$ (GH)	$11.5 \pm 0.7$ ( $\pm 6\%$ )	$11.06 \pm 0.03$ ( $\pm 0.3\%$ )	3.9	0.64	0.66
$^{133}\text{Ba}$ (GH)	$14.1 \pm 0.8$ ( $\pm 6\%$ )	$12.98 \pm 0.10$ ( $\pm 0.8\%$ )	8.3	1.41	1.42
$^{134}\text{Cs}$ (GH)	$1.855 \pm 0.023$ ( $\pm 1.3\%$ )	$1.915 \pm 0.013$ ( $\pm 0.7\%$ )	-3.1	-2.21	-0.54
$^{137}\text{Cs}$ (GH)	$9.2 \pm 0.8$ ( $\pm 9\%$ )	$8.10 \pm 0.06$ ( $\pm 0.7\%$ )	13.7	1.34	2.36

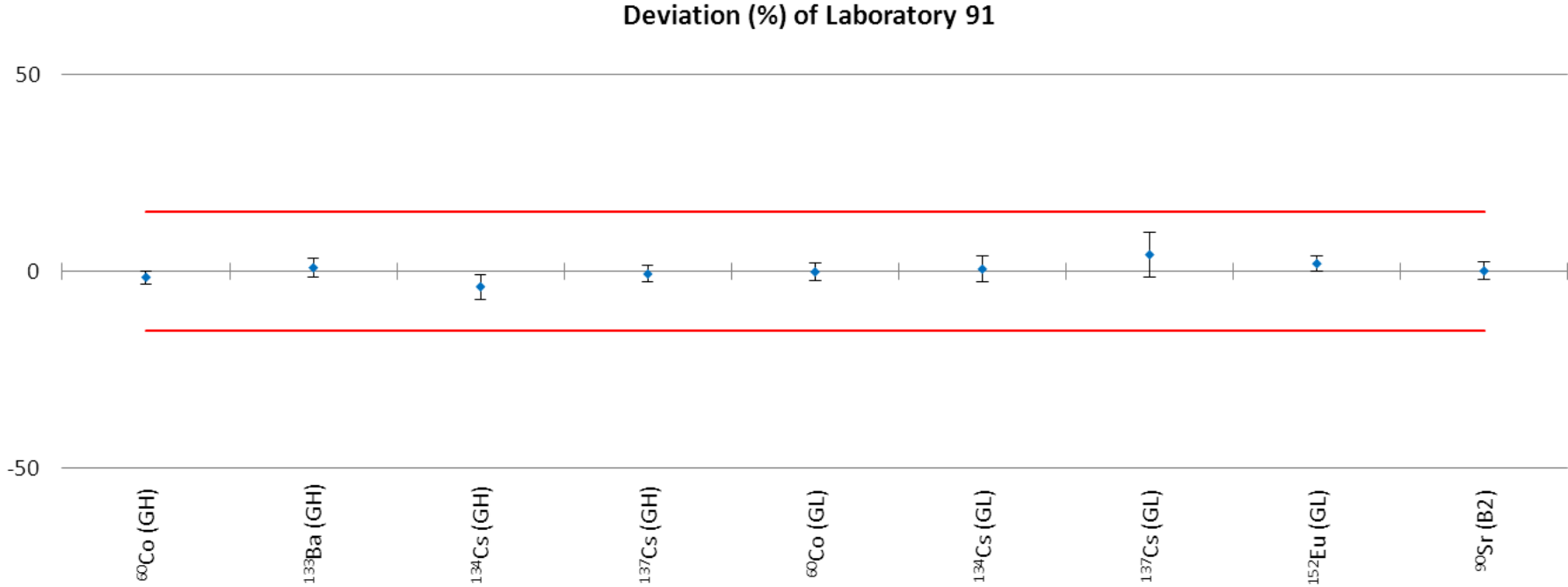




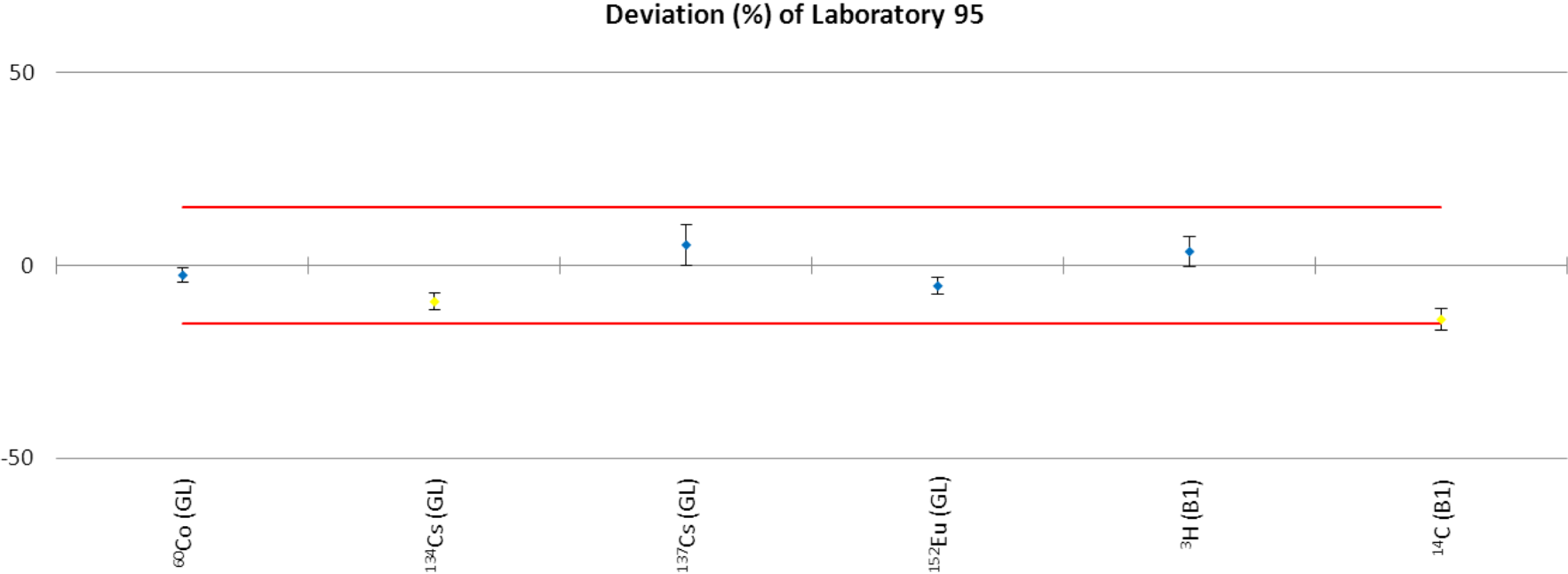
Radionuclide	Laboratory 86	NPL Assigned Value	Deviation /%	Zeta	Z Score
<sup>238</sup> Pu (AH)	16.0 ± 0.8 (± 5.0 %)	16.77 ± 0.06 (± 0.4 %)	-4.6	-0.96	-0.79
<sup>241</sup> Am (AH)	5.04 ± 0.25 (± 5.0 %)	5.010 ± 0.017 (± 0.4 %)	0.6	0.12	0.10
<sup>244</sup> Cm (AH)	14.8 ± 0.7 (± 5.0 %)	15.13 ± 0.06 (± 0.4 %)	-2.2	-0.47	-0.37
<sup>232</sup> Th (AL)	1.50 ± 0.16 (± 11 %)	1.551 ± 0.016 (± 1.0 %)	-3.3	-0.32	-0.57
<sup>234</sup> U (AL)	19.2 ± 0.9 (± 5.0 %)	19.3 ± 0.3 (± 1.4 %)	-0.4	-0.08	-0.06
<sup>235</sup> U (AL)	0.87 ± 0.05 (± 6 %)	0.921 ± 0.012 (± 1.3 %)	-5.5	-0.99	-0.95
<sup>238</sup> U (AL)	19.4 ± 0.9 (± 5.0 %)	19.3 ± 0.3 (± 1.4 %)	0.7	0.14	0.11
<sup>239</sup> Pu (AL)	1.48 ± 0.09 (± 6 %)	1.332 ± 0.006 (± 0.4 %)	11.1	1.64	1.90
<sup>3</sup> H (B2)	1.07 ± 0.05 (± 5.0 %)	1.051 ± 0.008 (± 0.7 %)	1.8	0.37	0.31
<sup>90</sup> Sr (B2)	0.48 ± 0.04 (± 7 %)	0.4746 ± 0.0010 (± 0.21 %)	0.5	0.07	0.09
<sup>241</sup> Pu (B2)	0.92 ± 0.06 (± 7 %)	0.957 ± 0.011 (± 1.1 %)	-3.9	-0.60	-0.66



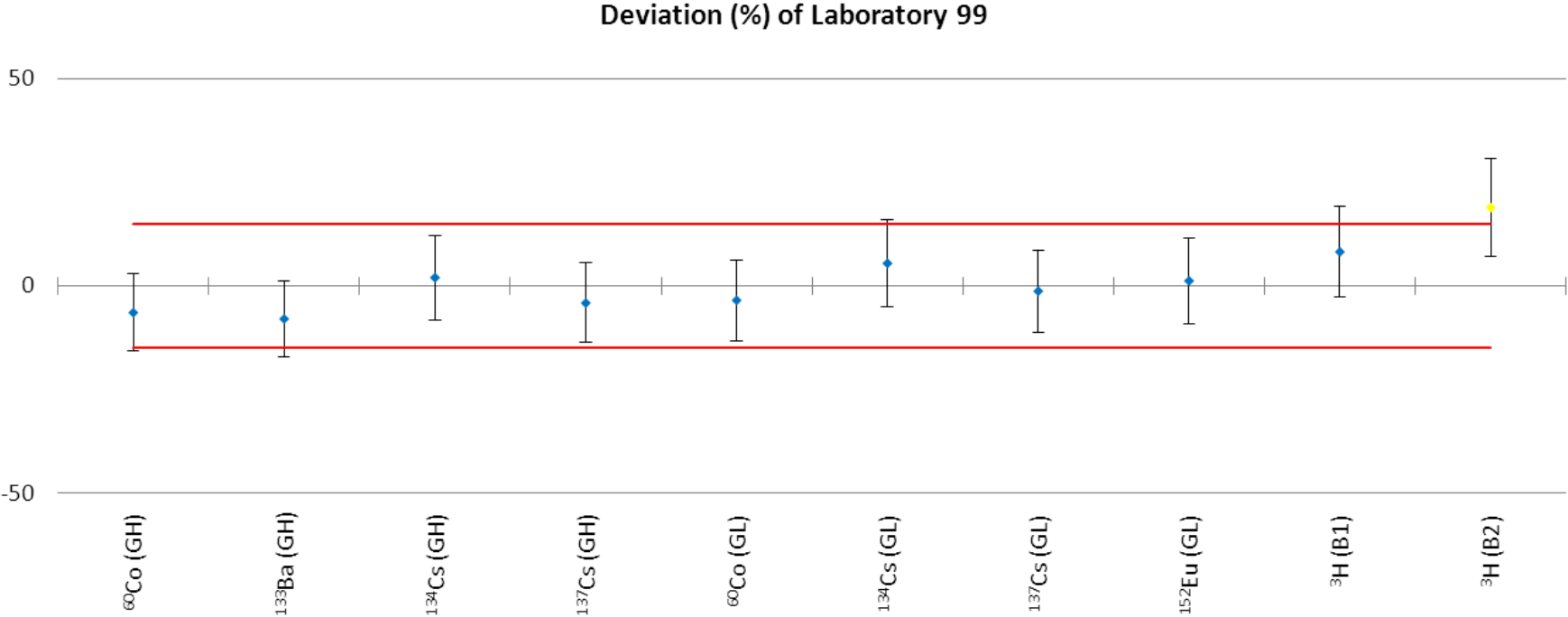
Radionuclide	Laboratory 89	NPL Assigned Value	Deviation /%	Zeta	Z Score
<sup>60</sup> Co (GH)	11.2 ± 0.6 (± 6 %)	11.06 ± 0.03 (± 0.3 %)	0.8	0.15	0.14
<sup>133</sup> Ba (GH)	13.5 ± 1.4 (± 10 %)	12.98 ± 0.10 (± 0.8 %)	3.9	0.37	0.67
<sup>134</sup> Cs (GH)	1.75 ± 0.13 (± 8 %)	1.915 ± 0.013 (± 0.7 %)	-8.6	-1.26	-1.48
<sup>137</sup> Cs (GH)	8.1 ± 0.6 (± 8 %)	8.10 ± 0.06 (± 0.7 %)	0.2	0.02	0.03
<sup>60</sup> Co (GL)	13.4 ± 0.8 (± 6 %)	13.23 ± 0.11 (± 0.8 %)	1.4	0.24	0.24
<sup>134</sup> Cs (GL)	3.11 ± 0.25 (± 8 %)	3.42 ± 0.03 (± 0.8 %)	-9.1	-1.24	-1.56
<sup>137</sup> Cs (GL)	1.77 ± 0.17 (± 10 %)	1.766 ± 0.016 (± 0.9 %)	0.2	0.03	0.04
<sup>152</sup> Eu (GL)	21.5 ± 1.6 (± 7 %)	21.9 ± 0.4 (± 1.8 %)	-1.8	-0.25	-0.31



Radionuclide	Laboratory 91	NPL Assigned Value	Deviation /%	Zeta	Z Score
<sup>60</sup> Co (GH)	10.89 ± 0.18 (± 1.7 %)	11.06 ± 0.03 (± 0.3 %)	-1.5	-0.92	-0.26
<sup>133</sup> Ba (GH)	13.1 ± 0.3 (± 2.4 %)	12.98 ± 0.10 (± 0.8 %)	0.9	0.36	0.16
<sup>134</sup> Cs (GH)	1.84 ± 0.06 (± 4 %)	1.915 ± 0.013 (± 0.7 %)	-3.9	-1.22	-0.67
<sup>137</sup> Cs (GH)	8.04 ± 0.17 (± 2.1 %)	8.10 ± 0.06 (± 0.7 %)	-0.7	-0.31	-0.12
<sup>60</sup> Co (GL)	13.2 ± 0.3 (± 2.0 %)	13.23 ± 0.11 (± 0.8 %)	-0.2	-0.08	-0.03
<sup>134</sup> Cs (GL)	3.44 ± 0.11 (± 4 %)	3.42 ± 0.03 (± 0.8 %)	0.6	0.17	0.10
<sup>137</sup> Cs (GL)	1.84 ± 0.10 (± 6 %)	1.766 ± 0.016 (± 0.9 %)	4.2	0.73	0.72
<sup>152</sup> Eu (GL)	22.28 ± 0.23 (± 1.0 %)	21.9 ± 0.4 (± 1.8 %)	1.9	0.95	0.33
<sup>90</sup> Sr (B2)	0.475 ± 0.011 (± 2.3 %)	0.4746 ± 0.0010 (± 0.21 %)	0.1	0.04	0.01

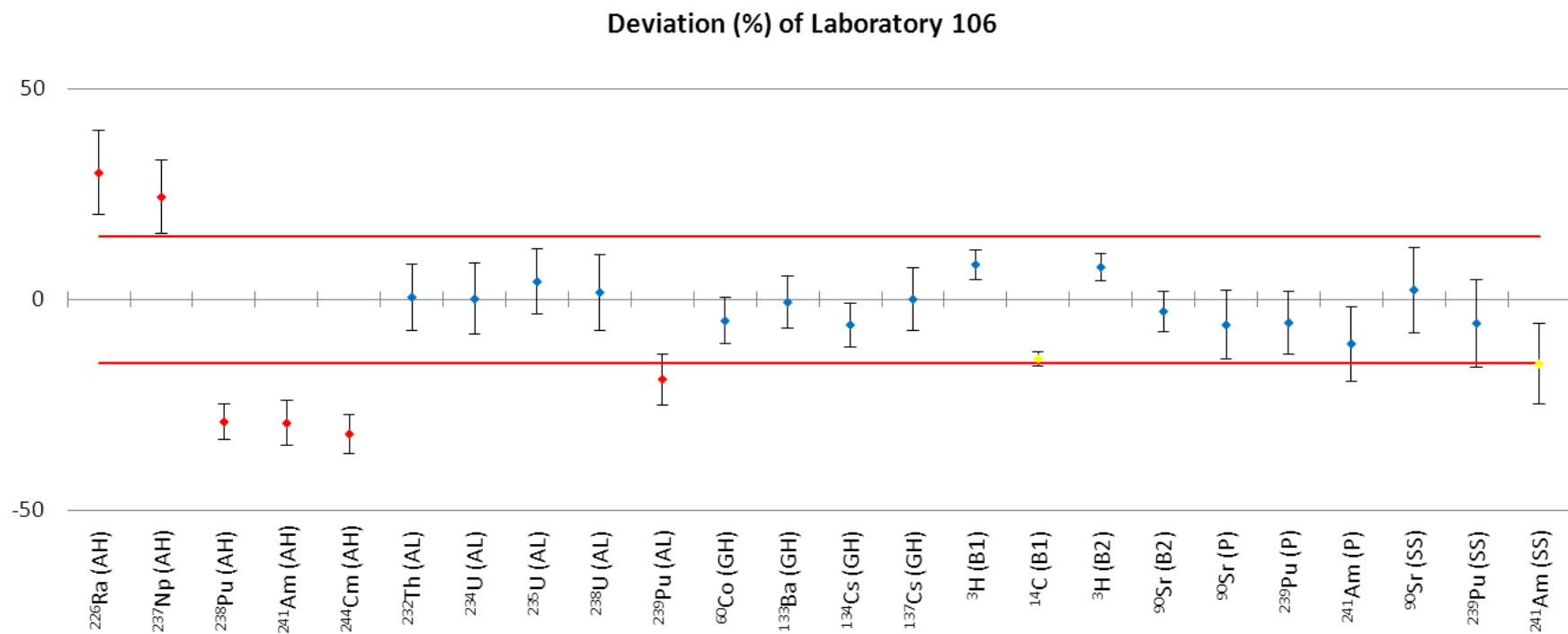


Radionuclide	Laboratory 95	NPL Assigned Value	Deviation /%	Zeta	Z Score
$^{60}\text{Co}$ (GL)	12.90 $\pm$ 0.21 ( $\pm$ 1.6 %)	13.23 $\pm$ 0.11 ( $\pm$ 0.8 %)	-2.5	-1.39	-0.43
$^{134}\text{Cs}$ (GL)	3.10 $\pm$ 0.07 ( $\pm$ 2.3 %)	3.42 $\pm$ 0.03 ( $\pm$ 0.8 %)	-9.4	-4.17	-1.61
$^{137}\text{Cs}$ (GL)	1.86 $\pm$ 0.09 ( $\pm$ 5.0 %)	1.766 $\pm$ 0.016 ( $\pm$ 0.9 %)	5.3	0.99	0.92
$^{152}\text{Eu}$ (GL)	20.7 $\pm$ 0.3 ( $\pm$ 1.4 %)	21.9 $\pm$ 0.4 ( $\pm$ 1.8 %)	-5.3	-2.44	-0.91
$^3\text{H}$ (B1)	1.06 $\pm$ 0.04 ( $\pm$ 4 %)	1.026 $\pm$ 0.007 ( $\pm$ 0.7 %)	3.6	0.95	0.62
$^{14}\text{C}$ (B1)	0.89 $\pm$ 0.03 ( $\pm$ 4 %)	1.032 $\pm$ 0.005 ( $\pm$ 0.50 %)	-14.0	-4.83	-2.40

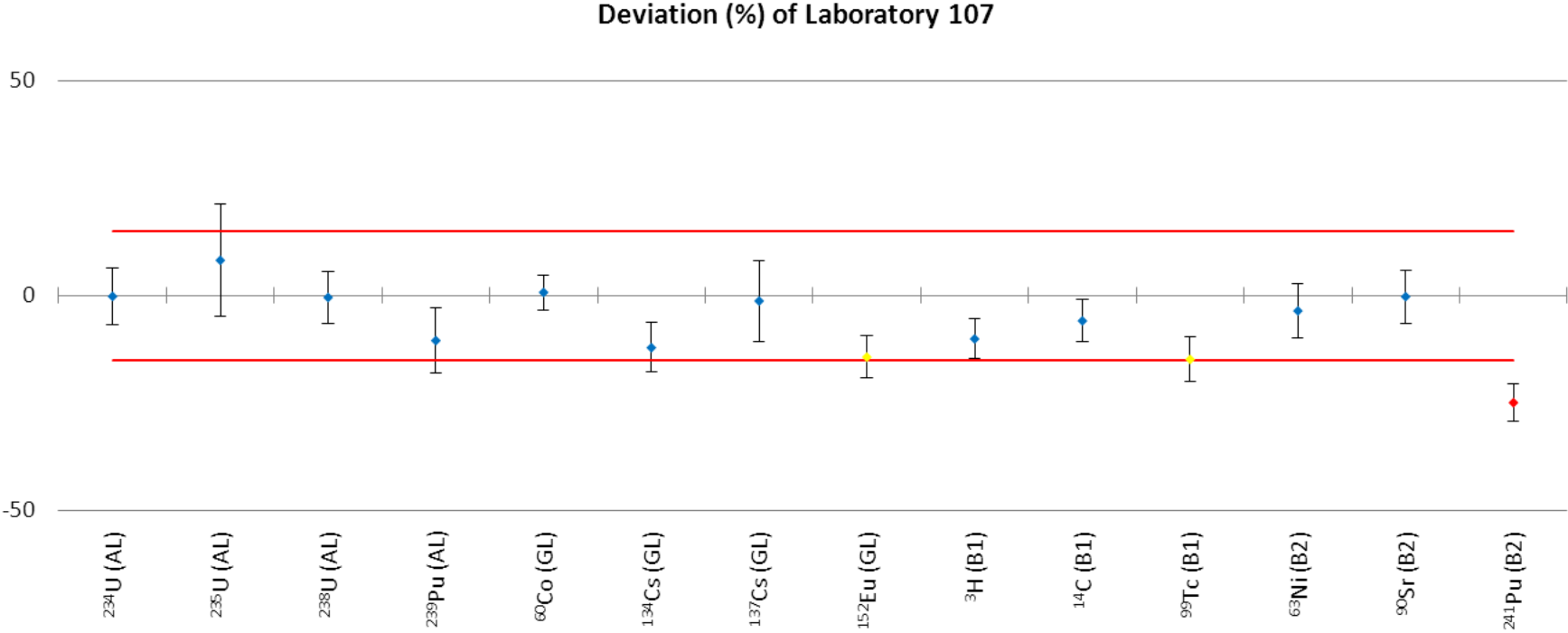




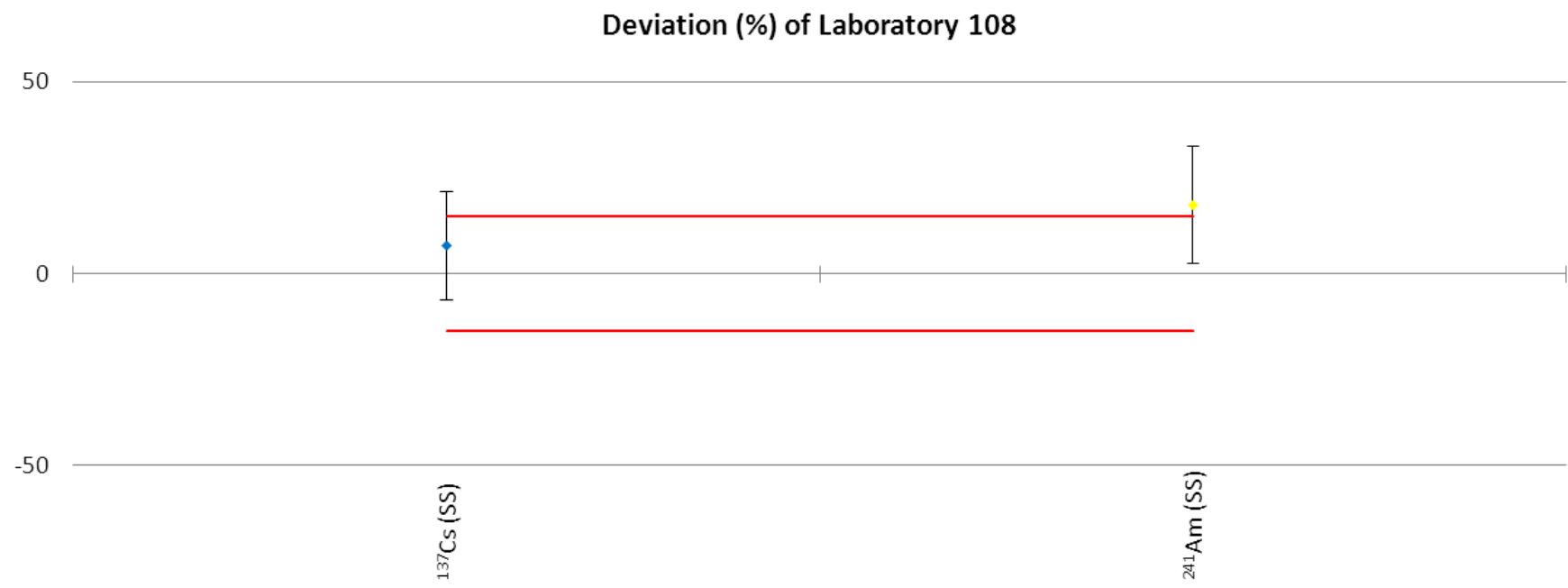
Radionuclide	Laboratory 99	NPL Assigned Value	Deviation /%	Zeta	Z Score
$^{60}\text{Co}$ (GH)	$10.3 \pm 1.0$ ( $\pm 10\%$ )	$11.06 \pm 0.03$ ( $\pm 0.3\%$ )	-6.4	-0.69	-1.11
$^{133}\text{Ba}$ (GH)	$12.0 \pm 1.2$ ( $\pm 10\%$ )	$12.98 \pm 0.10$ ( $\pm 0.8\%$ )	-8.0	-0.86	-1.37
$^{134}\text{Cs}$ (GH)	$1.95 \pm 0.20$ ( $\pm 10\%$ )	$1.915 \pm 0.013$ ( $\pm 0.7\%$ )	2.0	0.20	0.34
$^{137}\text{Cs}$ (GH)	$7.8 \pm 0.8$ ( $\pm 10\%$ )	$8.10 \pm 0.06$ ( $\pm 0.7\%$ )	-4.1	-0.43	-0.71
$^{60}\text{Co}$ (GL)	$12.8 \pm 1.3$ ( $\pm 10\%$ )	$13.23 \pm 0.11$ ( $\pm 0.8\%$ )	-3.5	-0.36	-0.60
$^{134}\text{Cs}$ (GL)	$3.6 \pm 0.4$ ( $\pm 10\%$ )	$3.42 \pm 0.03$ ( $\pm 0.8\%$ )	5.5	0.52	0.94
$^{137}\text{Cs}$ (GL)	$1.74 \pm 0.17$ ( $\pm 10\%$ )	$1.766 \pm 0.016$ ( $\pm 0.9\%$ )	-1.3	-0.13	-0.22
$^{152}\text{Eu}$ (GL)	$22.1 \pm 2.2$ ( $\pm 10\%$ )	$21.9 \pm 0.4$ ( $\pm 1.8\%$ )	1.2	0.12	0.21
$^3\text{H}$ (B1)	$1.11 \pm 0.11$ ( $\pm 10\%$ )	$1.026 \pm 0.007$ ( $\pm 0.7\%$ )	8.2	0.76	1.41
$^3\text{H}$ (B2)	$1.25 \pm 0.12$ ( $\pm 10\%$ )	$1.051 \pm 0.008$ ( $\pm 0.7\%$ )	18.9	1.59	3.25



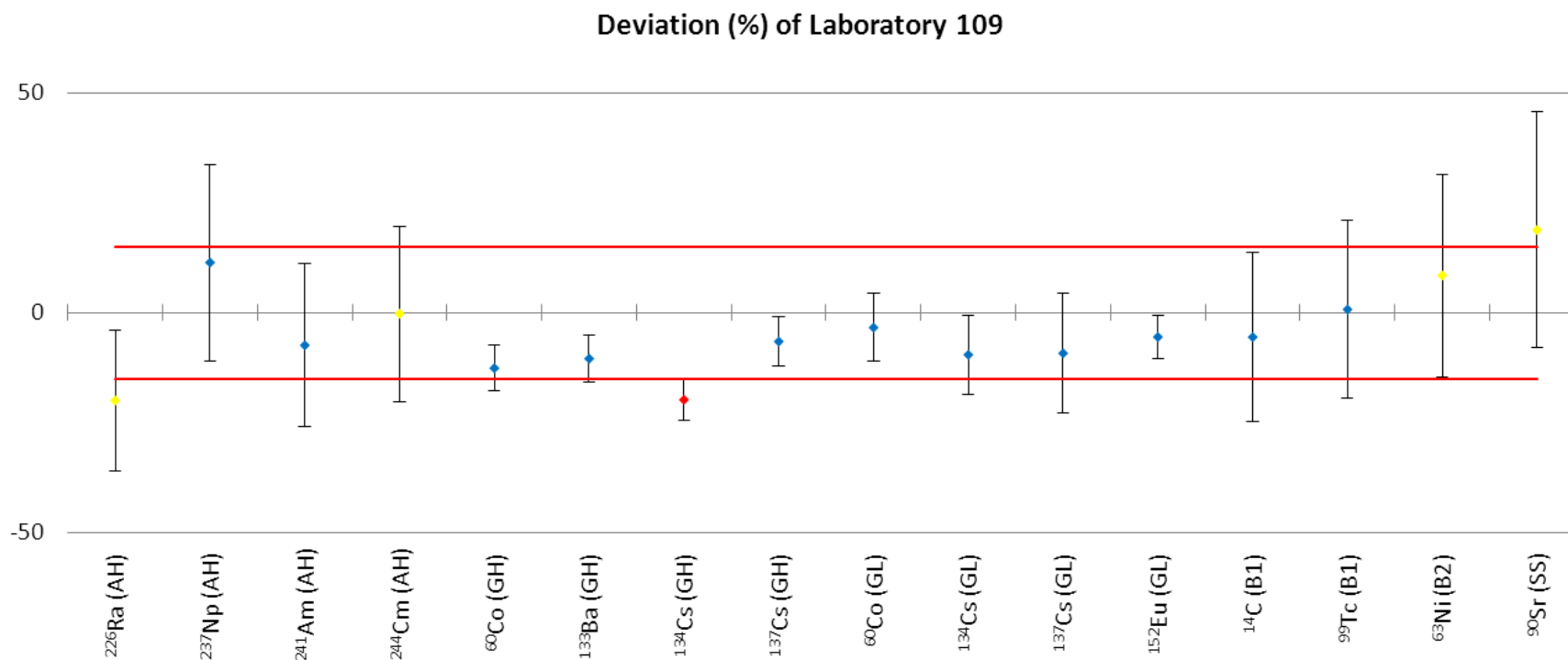
Radionuclide	Laboratory 106	NPL Assigned Value	Deviation /%	Zeta	Z Score
<sup>226</sup> Ra (AH)	2.12 ± 0.16 (± 8 %)	1.630 ± 0.022 (± 1.3 %)	30.1	3.04	5.16
<sup>237</sup> Np (AH)	18.8 ± 1.3 (± 7 %)	15.12 ± 0.16 (± 1.0 %)	24.3	2.81	4.18
<sup>238</sup> Pu (AH)	11.9 ± 0.7 (± 6 %)	16.77 ± 0.06 (± 0.4 %)	-29.0	-6.94	-4.99
<sup>241</sup> Am (AH)	3.5 ± 0.3 (± 8 %)	5.010 ± 0.017 (± 0.4 %)	-29.3	-5.43	-5.04
<sup>244</sup> Cm (AH)	10.3 ± 0.7 (± 7 %)	15.13 ± 0.06 (± 0.4 %)	-31.9	-6.87	-5.48
<sup>232</sup> Th (AL)	1.56 ± 0.12 (± 8 %)	1.551 ± 0.016 (± 1.0 %)	0.6	0.07	0.10
<sup>234</sup> U (AL)	19.3 ± 1.6 (± 8 %)	19.3 ± 0.3 (± 1.4 %)	0.1	0.02	0.02
<sup>235</sup> U (AL)	0.96 ± 0.07 (± 7 %)	0.921 ± 0.012 (± 1.3 %)	4.3	0.55	0.73
<sup>238</sup> U (AL)	19.6 ± 1.7 (± 9 %)	19.3 ± 0.3 (± 1.4 %)	1.7	0.19	0.29
<sup>239</sup> Pu (AL)	1.08 ± 0.08 (± 8 %)	1.332 ± 0.006 (± 0.4 %)	-18.9	-3.15	-3.25
<sup>60</sup> Co (GH)	10.6 ± 0.6 (± 6 %)	11.06 ± 0.03 (± 0.3 %)	-5.0	-0.93	-0.87
<sup>133</sup> Ba (GH)	12.9 ± 0.8 (± 6 %)	12.98 ± 0.10 (± 0.8 %)	-0.6	-0.10	-0.11
<sup>134</sup> Cs (GH)	1.80 ± 0.10 (± 6 %)	1.915 ± 0.013 (± 0.7 %)	-6.0	-1.14	-1.03
<sup>137</sup> Cs (GH)	8.1 ± 0.6 (± 8 %)	8.10 ± 0.06 (± 0.7 %)	0.1	0.01	0.01
<sup>3</sup> H (B1)	1.11 ± 0.04 (± 3 %)	1.026 ± 0.007 (± 0.7 %)	8.3	2.38	1.43
<sup>14</sup> C (B1)	0.887 ± 0.018 (± 2.0 %)	1.032 ± 0.005 (± 0.50 %)	-14.1	-7.79	-2.41
<sup>3</sup> H (B2)	1.13 ± 0.04 (± 3 %)	1.051 ± 0.008 (± 0.7 %)	7.7	2.39	1.32
<sup>90</sup> Sr (B2)	0.461 ± 0.023 (± 5.0 %)	0.4746 ± 0.0010 (± 0.21 %)	-2.8	-0.58	-0.48
<sup>90</sup> Sr (P)	2.36 ± 0.18 (± 8 %)	2.51 ± 0.11 (± 5.0 %)	-6.0	-0.72	-1.03
<sup>239</sup> Pu (P)	3.75 ± 0.24 (± 7 %)	3.97 ± 0.18 (± 5.0 %)	-5.5	-0.73	-0.94
<sup>241</sup> Am (P)	3.9 ± 0.4 (± 9 %)	4.35 ± 0.19 (± 5.0 %)	-10.5	-1.15	-1.81
<sup>90</sup> Sr (SS)	0.282 ± 0.015 (± 6 %)	0.276 ± 0.023 (± 8 %)	2.3	0.23	0.39
<sup>239</sup> Pu (SS)	1.00 ± 0.07 (± 7 %)	1.06 ± 0.09 (± 9 %)	-5.7	-0.53	-0.97
<sup>241</sup> Am (SS)	1.14 ± 0.09 (± 8 %)	1.34 ± 0.11 (± 8 %)	-15.2	-1.45	-2.62



Radionuclide	Laboratory 107	NPL Assigned Value	Deviation /%	Zeta	Z Score
<sup>234</sup> U (AL)	19.2 ± 1.3 (± 7 %)	19.3 ± 0.3 (± 1.4 %)	-0.2	-0.03	-0.03
<sup>235</sup> U (AL)	1.00 ± 0.12 (± 12 %)	0.921 ± 0.012 (± 1.3 %)	8.2	0.63	1.41
<sup>238</sup> U (AL)	19.2 ± 1.2 (± 6 %)	19.3 ± 0.3 (± 1.4 %)	-0.4	-0.07	-0.07
<sup>239</sup> Pu (AL)	1.19 ± 0.10 (± 9 %)	1.332 ± 0.006 (± 0.4 %)	-10.5	-1.37	-1.80
<sup>60</sup> Co (GL)	13.3 ± 0.6 (± 4 %)	13.23 ± 0.11 (± 0.8 %)	0.8	0.18	0.13
<sup>134</sup> Cs (GL)	3.01 ± 0.20 (± 7 %)	3.42 ± 0.03 (± 0.8 %)	-12.1	-2.10	-2.08
<sup>137</sup> Cs (GL)	1.74 ± 0.17 (± 10 %)	1.766 ± 0.016 (± 0.9 %)	-1.3	-0.13	-0.22
<sup>152</sup> Eu (GL)	18.7 ± 1.0 (± 6 %)	21.9 ± 0.4 (± 1.8 %)	-14.3	-2.85	-2.46
<sup>3</sup> H (B1)	0.92 ± 0.05 (± 5.0 %)	1.026 ± 0.007 (± 0.7 %)	-10.1	-2.16	-1.73
<sup>14</sup> C (B1)	0.97 ± 0.05 (± 5.0 %)	1.032 ± 0.005 (± 0.50 %)	-5.9	-1.20	-1.01
<sup>99</sup> Tc (B1)	0.126 ± 0.008 (± 6 %)	0.1478 ± 0.0013 (± 0.9 %)	-14.8	-2.88	-2.55
<sup>63</sup> Ni (B2)	1.59 ± 0.10 (± 7 %)	1.650 ± 0.017 (± 1.0 %)	-3.5	-0.55	-0.61
<sup>90</sup> Sr (B2)	0.47 ± 0.03 (± 6 %)	0.4746 ± 0.0010 (± 0.21 %)	-0.2	-0.04	-0.04
<sup>241</sup> Pu (B2)	0.72 ± 0.04 (± 6 %)	0.957 ± 0.011 (± 1.1 %)	-24.9	-5.52	-4.28

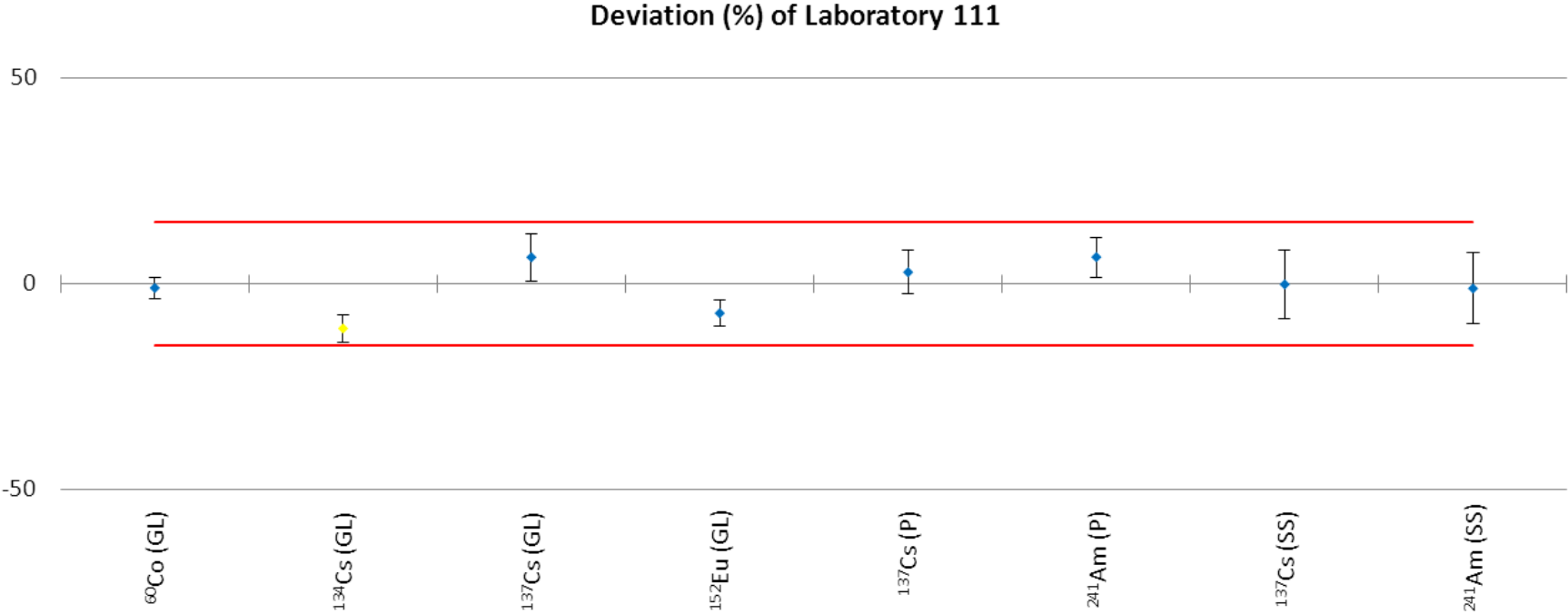


Radionuclide	Laboratory 108	NPL Assigned Value	Deviation /%	Zeta	Z Score
<sup>137</sup> Cs (SS)	0.86 ± 0.09 (± 10 %)	0.80 ± 0.07 (± 8 %)	7.4	0.53	1.26
<sup>241</sup> Am (SS)	1.59 ± 0.16 (± 10 %)	1.34 ± 0.11 (± 8 %)	17.9	1.24	3.08

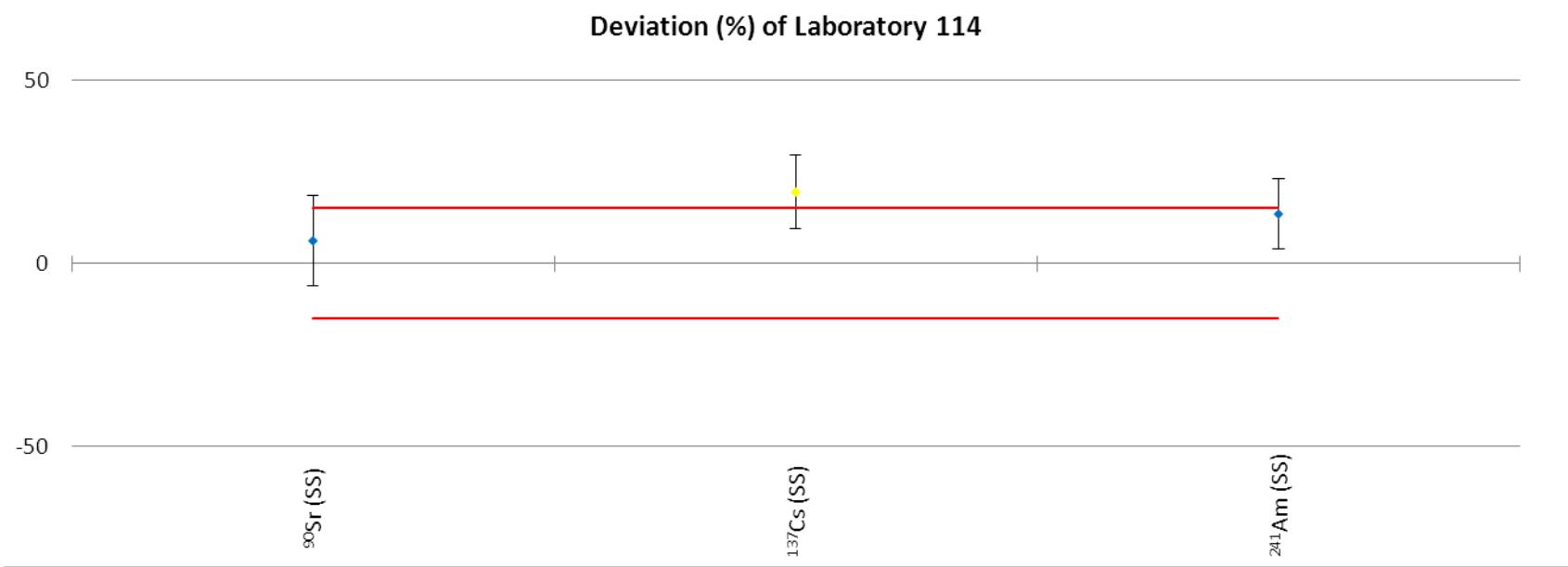




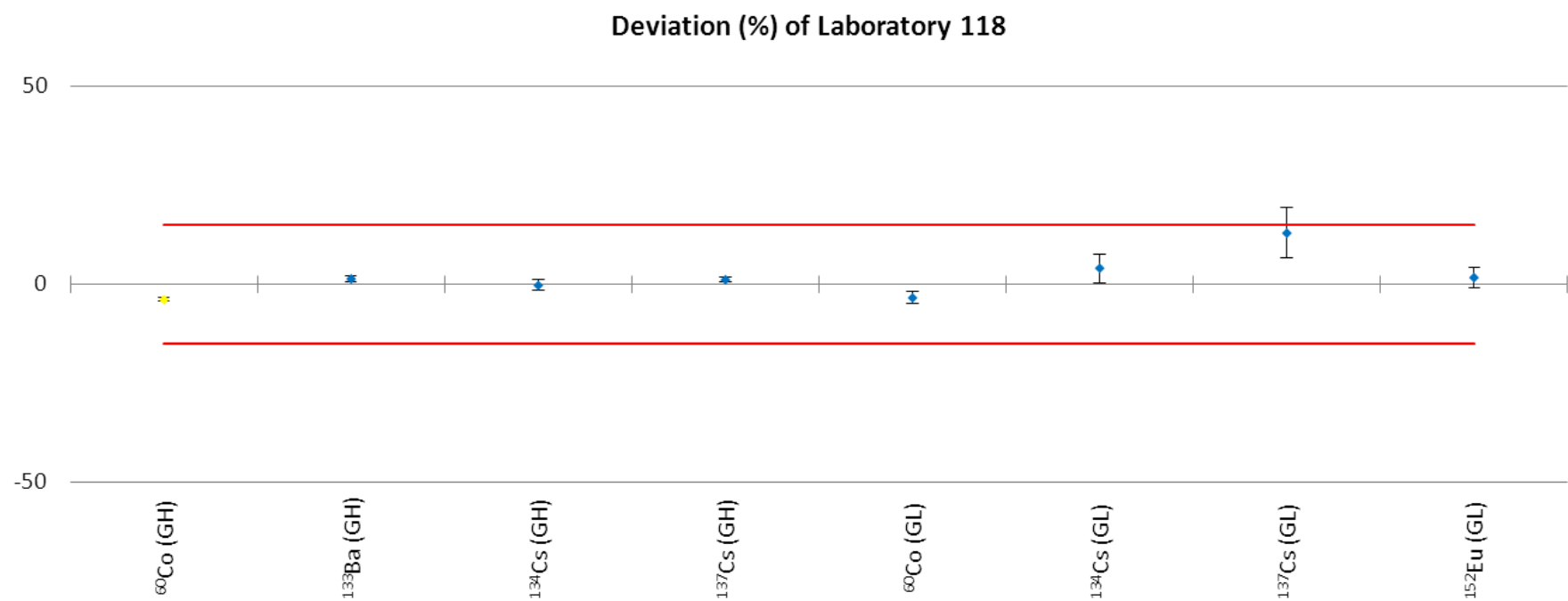
Radionuclide	Laboratory 109	NPL Assigned Value	Deviation /%	Zeta	Z Score
<sup>226</sup> Ra (AH)	1.3 ± 0.3 (± 20 %)	1.630 ± 0.022 (± 1.3 %)	-19.9	-1.24	-3.42
<sup>237</sup> Np (AH)	17 ± 4 (± 20 %)	15.12 ± 0.16 (± 1.0 %)	11.4	0.51	1.97
<sup>241</sup> Am (AH)	4.6 ± 0.9 (± 20 %)	5.010 ± 0.017 (± 0.4 %)	-7.4	-0.40	-1.27
<sup>244</sup> Cm (AH)	15 ± 3 (± 20 %)	15.13 ± 0.06 (± 0.4 %)	-0.2	-0.01	-0.03
<sup>60</sup> Co (GH)	9.7 ± 0.6 (± 6 %)	11.06 ± 0.03 (± 0.3 %)	-12.6	-2.40	-2.16
<sup>133</sup> Ba (GH)	11.6 ± 0.7 (± 6 %)	12.98 ± 0.10 (± 0.8 %)	-10.4	-1.92	-1.79
<sup>134</sup> Cs (GH)	1.54 ± 0.09 (± 6 %)	1.915 ± 0.013 (± 0.7 %)	-19.8	-4.07	-3.40
<sup>137</sup> Cs (GH)	7.6 ± 0.5 (± 6 %)	8.10 ± 0.06 (± 0.7 %)	-6.5	-1.15	-1.12
<sup>60</sup> Co (GL)	12.8 ± 1.0 (± 8 %)	13.23 ± 0.11 (± 0.8 %)	-3.4	-0.43	-0.58
<sup>134</sup> Cs (GL)	3.1 ± 0.3 (± 10 %)	3.42 ± 0.03 (± 0.8 %)	-9.6	-1.05	-1.64
<sup>137</sup> Cs (GL)	1.60 ± 0.24 (± 15 %)	1.766 ± 0.016 (± 0.9 %)	-9.2	-0.67	-1.58
<sup>152</sup> Eu (GL)	20.7 ± 1.0 (± 5.0 %)	21.9 ± 0.4 (± 1.8 %)	-5.5	-1.09	-0.94
<sup>14</sup> C (B1)	0.98 ± 0.20 (± 21 %)	1.032 ± 0.005 (± 0.50 %)	-5.5	-0.28	-0.95
<sup>99</sup> Tc (B1)	0.15 ± 0.03 (± 20 %)	0.1478 ± 0.0013 (± 0.9 %)	0.8	0.04	0.13
<sup>63</sup> Ni (B2)	1.8 ± 0.4 (± 21 %)	1.650 ± 0.017 (± 1.0 %)	8.5	0.37	1.46
<sup>90</sup> Sr (SS)	0.33 ± 0.07 (± 21 %)	0.276 ± 0.023 (± 8 %)	18.8	0.71	3.24



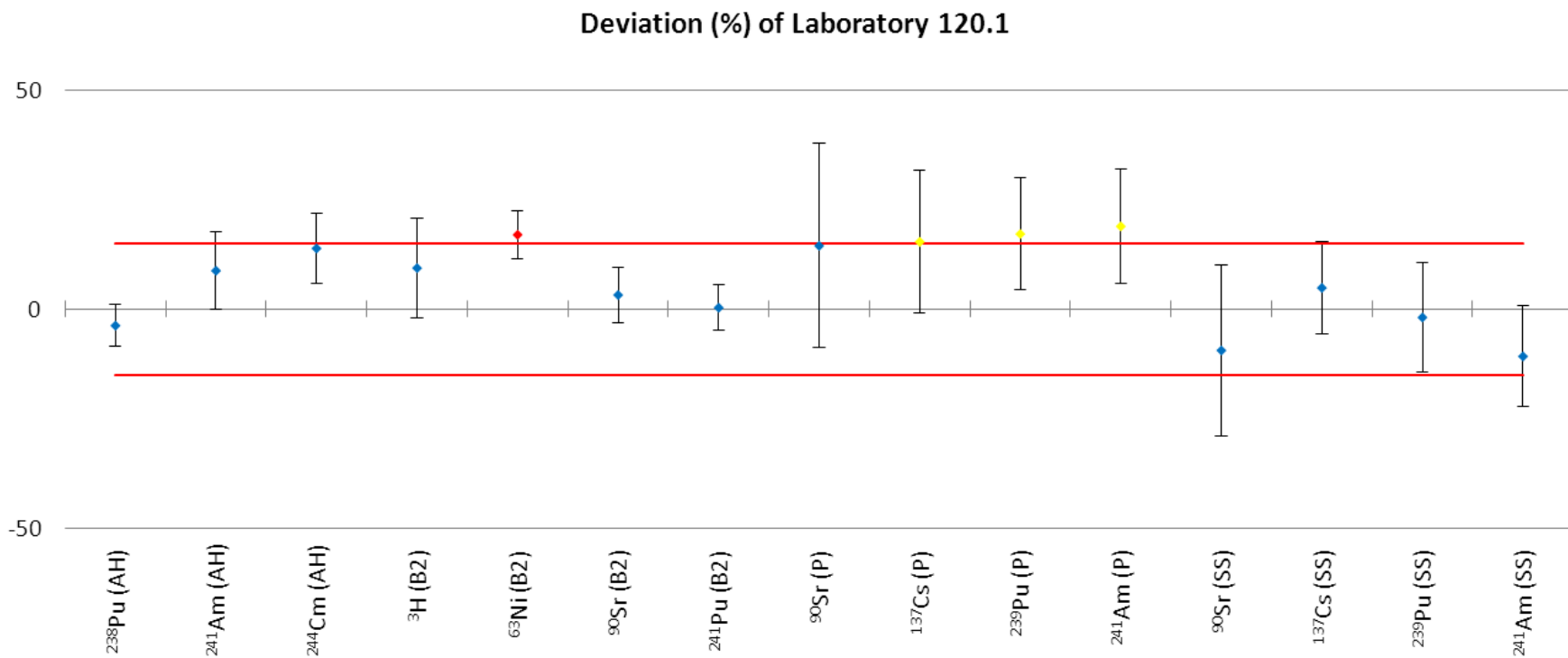
Radionuclide	Laboratory 111	NPL Assigned Value	Deviation /%	Zeta	Z Score
<sup>60</sup> Co (GL)	13.1 ± 0.4 (± 2.5 %)	13.23 ± 0.11 (± 0.8 %)	-1.0	-0.38	-0.17
<sup>134</sup> Cs (GL)	3.05 ± 0.11 (± 4 %)	3.42 ± 0.03 (± 0.8 %)	-10.8	-3.26	-1.86
<sup>137</sup> Cs (GL)	1.88 ± 0.10 (± 6 %)	1.766 ± 0.016 (± 0.9 %)	6.5	1.13	1.11
<sup>152</sup> Eu (GL)	20.3 ± 0.6 (± 3 %)	21.9 ± 0.4 (± 1.8 %)	-7.1	-2.24	-1.22
<sup>137</sup> Cs (P)	2.79 ± 0.08 (± 3 %)	2.71 ± 0.12 (± 5.0 %)	2.8	0.55	0.49
<sup>241</sup> Am (P)	4.63 ± 0.07 (± 1.5 %)	4.35 ± 0.19 (± 5.0 %)	6.5	1.42	1.12
<sup>137</sup> Cs (SS)	0.800 ± 0.022 (± 3 %)	0.80 ± 0.07 (± 8 %)	-0.1	-0.01	-0.02
<sup>241</sup> Am (SS)	1.33 ± 0.04 (± 3 %)	1.34 ± 0.11 (± 8 %)	-1.1	-0.13	-0.19



Radionuclide	Laboratory 114	NPL Assigned Value	Deviation /%	Zeta	Z Score
<sup>90</sup> Sr (SS)	0.293 ± 0.024 (± 8 %)	0.276 ± 0.023 (± 8 %)	6.2	0.51	1.06
<sup>137</sup> Cs (SS)	0.957 ± 0.023 (± 2.4 %)	0.80 ± 0.07 (± 8 %)	19.5	2.29	3.34
<sup>241</sup> Am (SS)	1.53 ± 0.04 (± 2.4 %)	1.34 ± 0.11 (± 8 %)	13.5	1.58	2.31

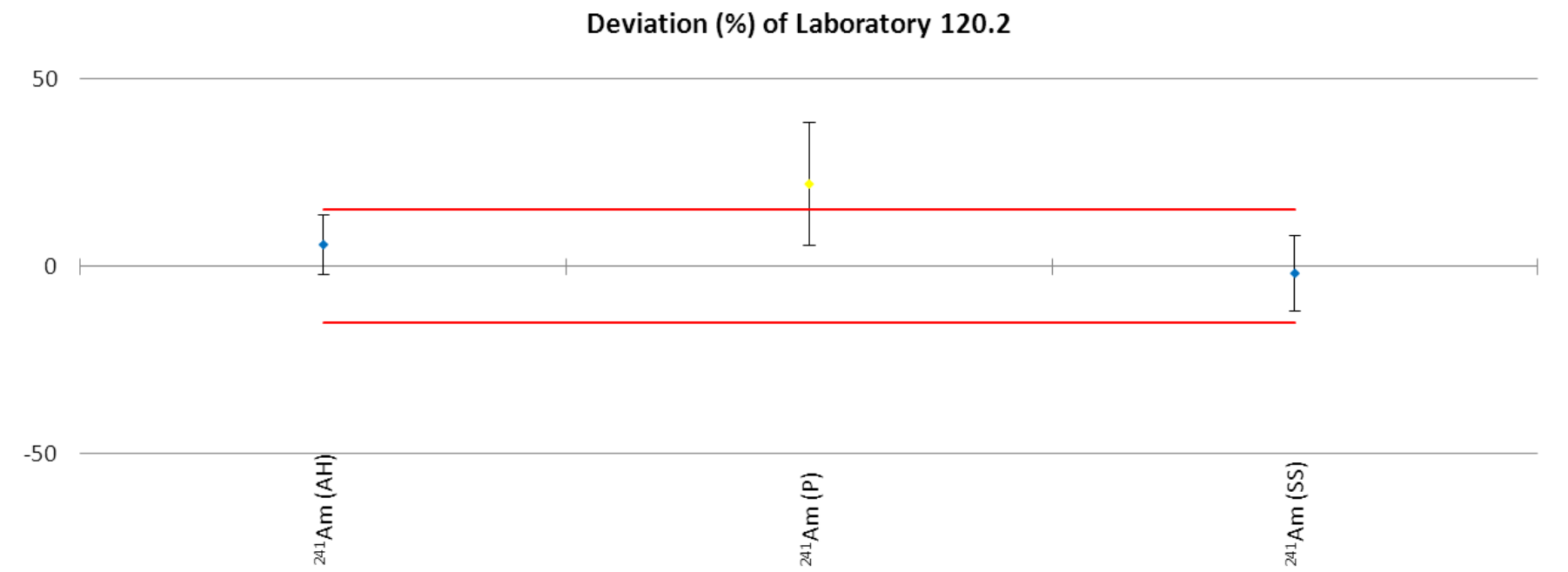


Radionuclide	Laboratory 118	NPL Assigned Value	Deviation /%	Zeta	Z Score
<sup>60</sup> Co (GH)	10.63 ± 0.04 (± 0.4 %)	11.06 ± 0.03 (± 0.3 %)	-3.9	-8.45	-0.67
<sup>133</sup> Ba (GH)	13.16 ± 0.08 (± 0.6 %)	12.98 ± 0.10 (± 0.8 %)	1.4	1.38	0.23
<sup>134</sup> Cs (GH)	1.91 ± 0.03 (± 1.4 %)	1.915 ± 0.013 (± 0.7 %)	-0.3	-0.17	-0.04
<sup>137</sup> Cs (GH)	8.19 ± 0.05 (± 0.6 %)	8.10 ± 0.06 (± 0.7 %)	1.2	1.31	0.20
<sup>60</sup> Co (GL)	12.78 ± 0.17 (± 1.3 %)	13.23 ± 0.11 (± 0.8 %)	-3.4	-2.25	-0.59
<sup>134</sup> Cs (GL)	3.56 ± 0.12 (± 4 %)	3.42 ± 0.03 (± 0.8 %)	4.1	1.13	0.70
<sup>137</sup> Cs (GL)	1.99 ± 0.11 (± 6 %)	1.766 ± 0.016 (± 0.9 %)	12.9	2.05	2.22
<sup>152</sup> Eu (GL)	22.2 ± 0.4 (± 1.7 %)	21.9 ± 0.4 (± 1.8 %)	1.7	0.69	0.29



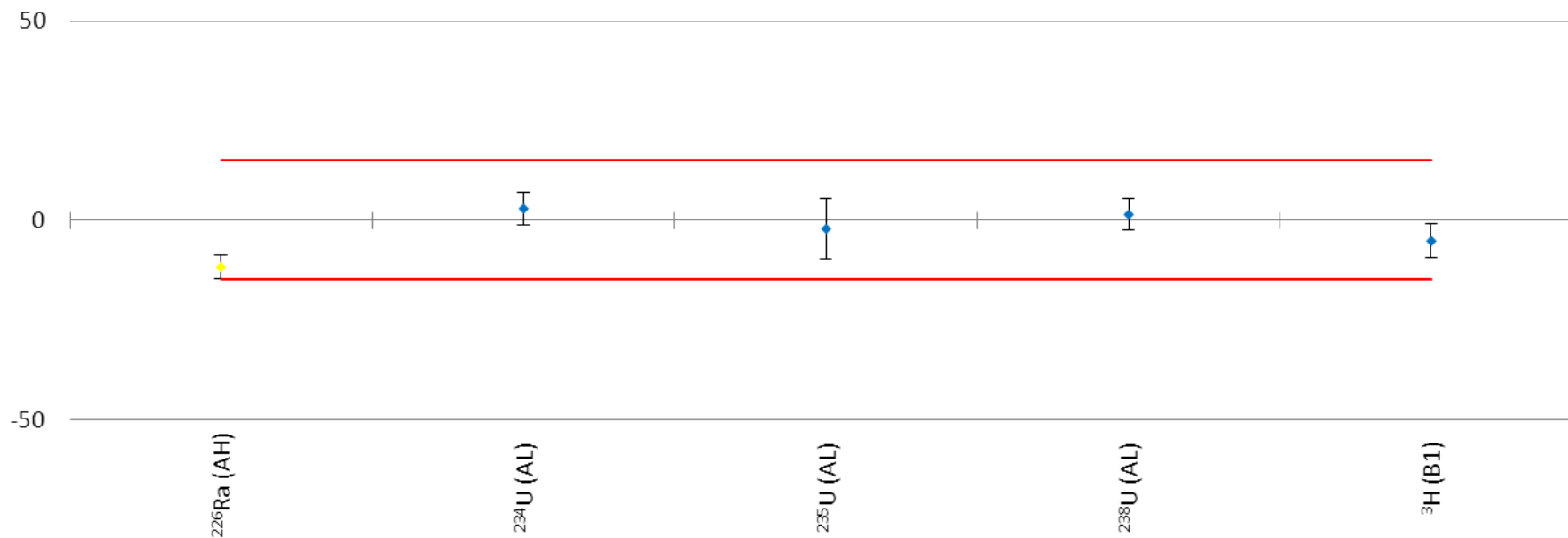


Radionuclide	Laboratory 120.1	NPL Assigned Value	Deviation /%	Zeta	Z Score
<sup>238</sup> Pu (AH)	16.1 ± 0.8 (± 5.0 %)	16.77 ± 0.06 (± 0.4 %)	-3.8	-0.78	-0.65
<sup>241</sup> Am (AH)	5.5 ± 0.5 (± 8 %)	5.010 ± 0.017 (± 0.4 %)	8.8	1.00	1.51
<sup>244</sup> Cm (AH)	17.2 ± 1.2 (± 7 %)	15.13 ± 0.06 (± 0.4 %)	13.9	1.73	2.38
<sup>3</sup> H (B2)	1.15 ± 0.12 (± 10 %)	1.051 ± 0.008 (± 0.7 %)	9.4	0.82	1.61
<sup>63</sup> Ni (B2)	1.93 ± 0.09 (± 5.0 %)	1.650 ± 0.017 (± 1.0 %)	17.0	3.06	2.92
<sup>90</sup> Sr (B2)	0.49 ± 0.03 (± 6 %)	0.4746 ± 0.0010 (± 0.21 %)	3.2	0.51	0.56
<sup>241</sup> Pu (B2)	0.96 ± 0.05 (± 5.0 %)	0.957 ± 0.011 (± 1.1 %)	0.3	0.06	0.06
<sup>90</sup> Sr (P)	2.9 ± 0.6 (± 20 %)	2.51 ± 0.11 (± 5.0 %)	14.5	0.62	2.49
<sup>137</sup> Cs (P)	3.1 ± 0.4 (± 13 %)	2.71 ± 0.12 (± 5.0 %)	15.4	0.96	2.64
<sup>239</sup> Pu (P)	4.6 ± 0.5 (± 10 %)	3.97 ± 0.18 (± 5.0 %)	17.2	1.38	2.95
<sup>241</sup> Am (P)	5.2 ± 0.5 (± 10 %)	4.35 ± 0.19 (± 5.0 %)	18.9	1.49	3.25
<sup>90</sup> Sr (SS)	0.25 ± 0.05 (± 20 %)	0.276 ± 0.023 (± 8 %)	-9.4	-0.47	-1.62
<sup>137</sup> Cs (SS)	0.84 ± 0.05 (± 6 %)	0.80 ± 0.07 (± 8 %)	4.9	0.48	0.84
<sup>239</sup> Pu (SS)	1.04 ± 0.10 (± 10 %)	1.06 ± 0.09 (± 9 %)	-1.9	-0.15	-0.32
<sup>241</sup> Am (SS)	1.20 ± 0.12 (± 10 %)	1.34 ± 0.11 (± 8 %)	-10.8	-0.89	-1.85

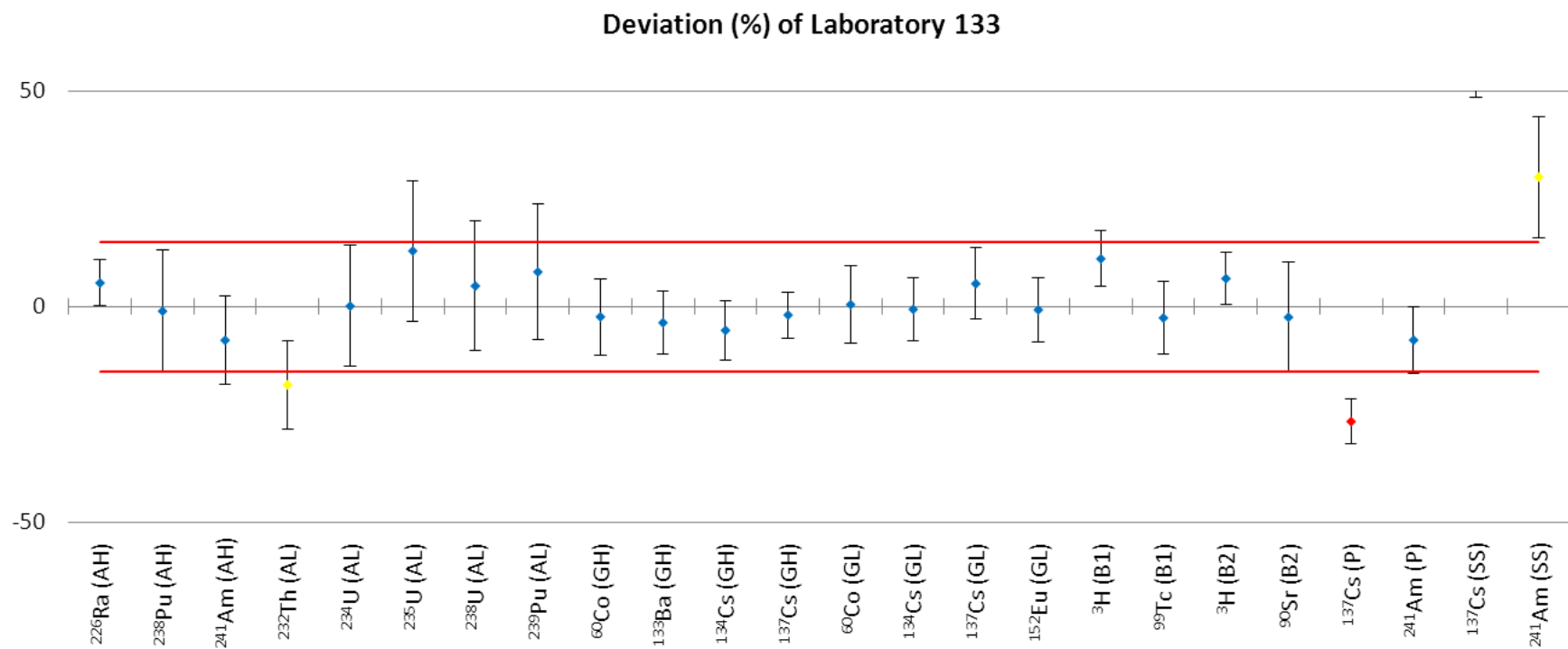


Radionuclide	Laboratory 120.2	NPL Assigned Value	Deviation /%	Zeta	Z Score
<sup>241</sup> Am (AH)	5.3 ± 0.4 (± 8 %)	5.010 ± 0.017 (± 0.4 %)	5.8	0.72	0.99
<sup>241</sup> Am (P)	5.3 ± 0.7 (± 13 %)	4.35 ± 0.19 (± 5.0 %)	21.9	1.35	3.76
<sup>241</sup> Am (SS)	1.32 ± 0.08 (± 6 %)	1.34 ± 0.11 (± 8 %)	-1.9	-0.18	-0.32

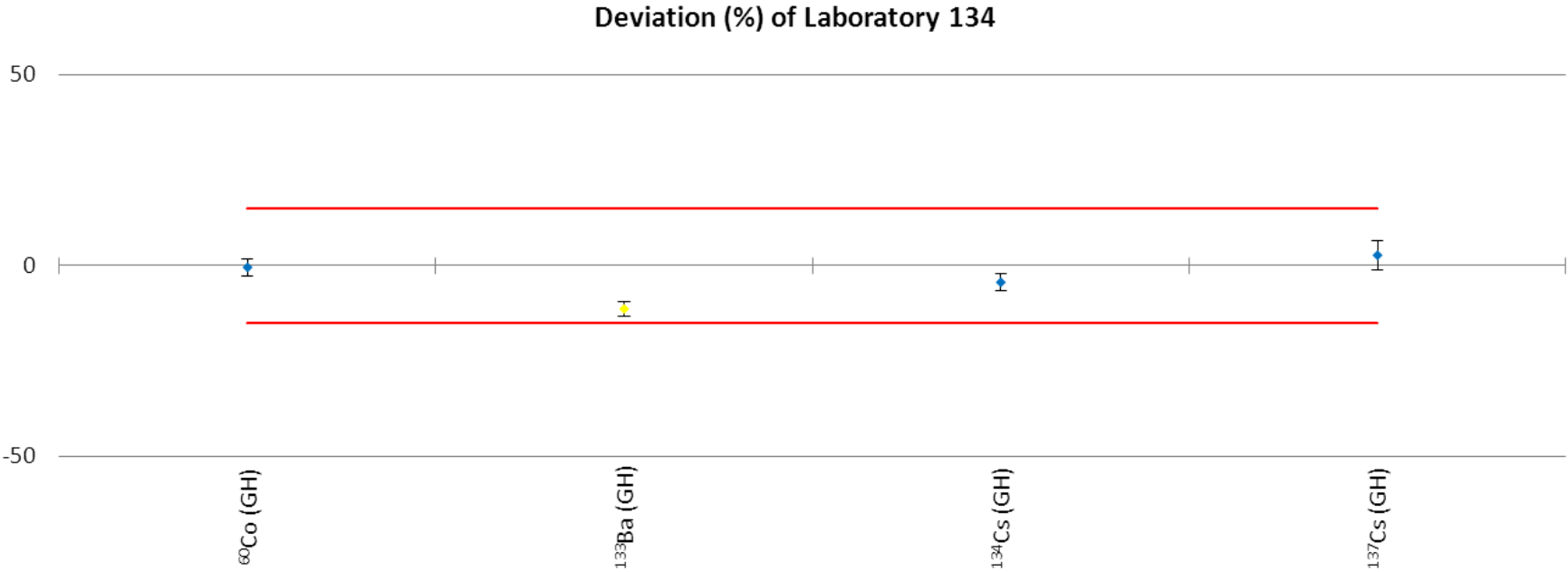
## Deviation (%) of Laboratory 128



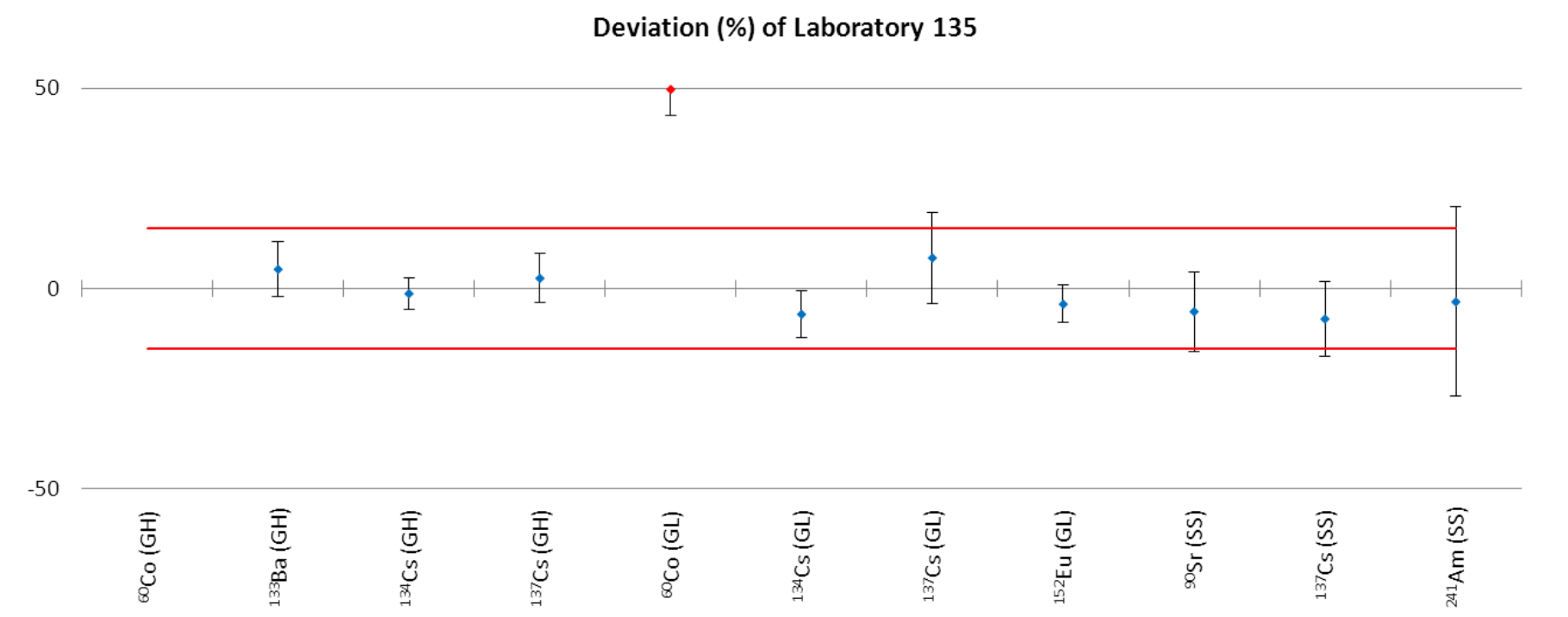
Radionuclide	Laboratory 128	NPL Assigned Value	Deviation /%	Zeta	Z Score
<sup>226</sup> Ra (AH)	1.44 ± 0.05 (± 3 %)	1.630 ± 0.022 (± 1.3 %)	-11.8	-3.95	-2.03
<sup>234</sup> U (AL)	19.8 ± 0.7 (± 4 %)	19.3 ± 0.3 (± 1.4 %)	2.9	0.71	0.49
<sup>235</sup> U (AL)	0.90 ± 0.07 (± 8 %)	0.921 ± 0.012 (± 1.3 %)	-2.2	-0.29	-0.37
<sup>238</sup> U (AL)	19.5 ± 0.7 (± 4 %)	19.3 ± 0.3 (± 1.4 %)	1.4	0.35	0.24
<sup>3</sup> H (B1)	0.97 ± 0.05 (± 5.0 %)	1.026 ± 0.007 (± 0.7 %)	-5.2	-1.25	-0.90



Radionuclide	Laboratory 133	NPL Assigned Value	Deviation /%	Zeta	Z Score
<sup>226</sup> Ra (AH)	1.72 ± 0.09 (± 5.0 %)	1.630 ± 0.022 (± 1.3 %)	5.5	1.03	0.95
<sup>238</sup> Pu (AH)	16.6 ± 2.4 (± 14 %)	16.77 ± 0.06 (± 0.4 %)	-1.0	-0.07	-0.18
<sup>241</sup> Am (AH)	4.6 ± 0.5 (± 11 %)	5.010 ± 0.017 (± 0.4 %)	-7.8	-0.75	-1.34
<sup>232</sup> Th (AL)	1.27 ± 0.16 (± 13 %)	1.551 ± 0.016 (± 1.0 %)	-18.1	-1.75	-3.11
<sup>234</sup> U (AL)	19 ± 3 (± 14 %)	19.3 ± 0.3 (± 1.4 %)	0.1	0.01	0.02
<sup>235</sup> U (AL)	1.04 ± 0.15 (± 14 %)	0.921 ± 0.012 (± 1.3 %)	12.9	0.79	2.22
<sup>238</sup> U (AL)	20 ± 3 (± 14 %)	19.3 ± 0.3 (± 1.4 %)	4.8	0.32	0.83
<sup>239</sup> Pu (AL)	1.44 ± 0.21 (± 15 %)	1.332 ± 0.006 (± 0.4 %)	8.1	0.51	1.39
<sup>60</sup> Co (GH)	10.8 ± 1.0 (± 9 %)	11.06 ± 0.03 (± 0.3 %)	-2.3	-0.26	-0.40
<sup>133</sup> Ba (GH)	12.6 ± 1.0 (± 8 %)	12.98 ± 0.10 (± 0.8 %)	-3.7	-0.50	-0.64
<sup>134</sup> Cs (GH)	1.81 ± 0.13 (± 7 %)	1.915 ± 0.013 (± 0.7 %)	-5.5	-0.80	-0.94
<sup>137</sup> Cs (GH)	7.9 ± 0.5 (± 6 %)	8.10 ± 0.06 (± 0.7 %)	-1.9	-0.36	-0.33
<sup>60</sup> Co (GL)	13.3 ± 1.2 (± 9 %)	13.23 ± 0.11 (± 0.8 %)	0.5	0.06	0.09
<sup>134</sup> Cs (GL)	3.40 ± 0.25 (± 7 %)	3.42 ± 0.03 (± 0.8 %)	-0.6	-0.08	-0.10
<sup>137</sup> Cs (GL)	1.86 ± 0.14 (± 8 %)	1.766 ± 0.016 (± 0.9 %)	5.3	0.65	0.92
<sup>152</sup> Eu (GL)	21.7 ± 1.6 (± 7 %)	21.9 ± 0.4 (± 1.8 %)	-0.7	-0.10	-0.12
<sup>3</sup> H (B1)	1.14 ± 0.07 (± 6 %)	1.026 ± 0.007 (± 0.7 %)	11.1	1.71	1.91
<sup>99</sup> Tc (B1)	0.144 ± 0.012 (± 9 %)	0.1478 ± 0.0013 (± 0.9 %)	-2.6	-0.31	-0.45
<sup>3</sup> H (B2)	1.12 ± 0.07 (± 6 %)	1.051 ± 0.008 (± 0.7 %)	6.5	1.07	1.12
<sup>90</sup> Sr (B2)	0.46 ± 0.06 (± 13 %)	0.4746 ± 0.0010 (± 0.21 %)	-2.4	-0.19	-0.42
<sup>137</sup> Cs (P)	1.99 ± 0.12 (± 6 %)	2.71 ± 0.12 (± 5.0 %)	-26.6	-4.41	-4.58
<sup>241</sup> Am (P)	4.0 ± 0.3 (± 7 %)	4.35 ± 0.19 (± 5.0 %)	-7.8	-0.98	-1.33
<sup>137</sup> Cs (SS)	1.32 ± 0.08 (± 6 %)	0.80 ± 0.07 (± 8 %)	64.8	5.26	11.13
<sup>241</sup> Am (SS)	1.75 ± 0.12 (± 7 %)	1.34 ± 0.11 (± 8 %)	30.1	2.44	5.17

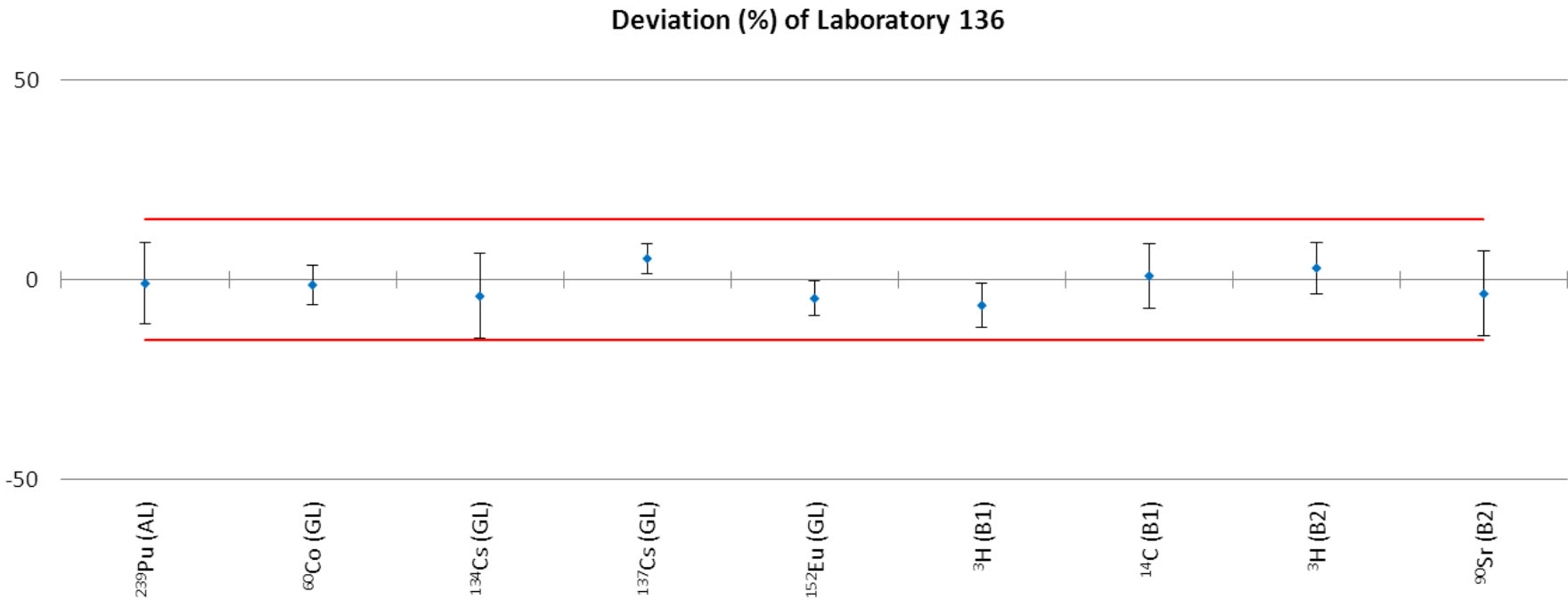


Radionuclide	Laboratory 134	NPL Assigned Value	Deviation /%	Zeta	Z Score
<sup>60</sup> Co (GH)	11.00 ± 0.25 (± 2.3 %)	11.06 ± 0.03 (± 0.3 %)	-0.5	-0.23	-0.09
<sup>133</sup> Ba (GH)	11.50 ± 0.23 (± 2.0 %)	12.98 ± 0.10 (± 0.8 %)	-11.4	-5.86	-1.96
<sup>134</sup> Cs (GH)	1.83 ± 0.04 (± 2.2 %)	1.915 ± 0.013 (± 0.7 %)	-4.4	-2.01	-0.76
<sup>137</sup> Cs (GH)	8.3 ± 0.3 (± 4 %)	8.10 ± 0.06 (± 0.7 %)	2.7	0.68	0.46

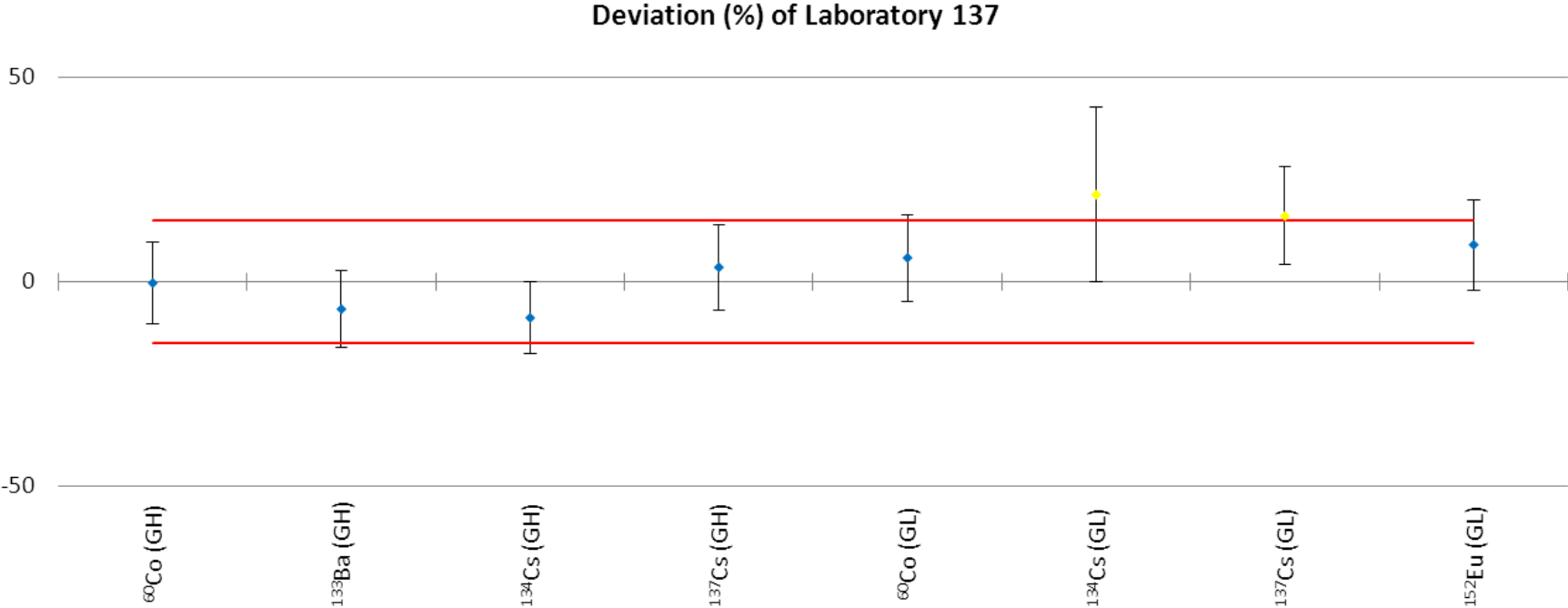




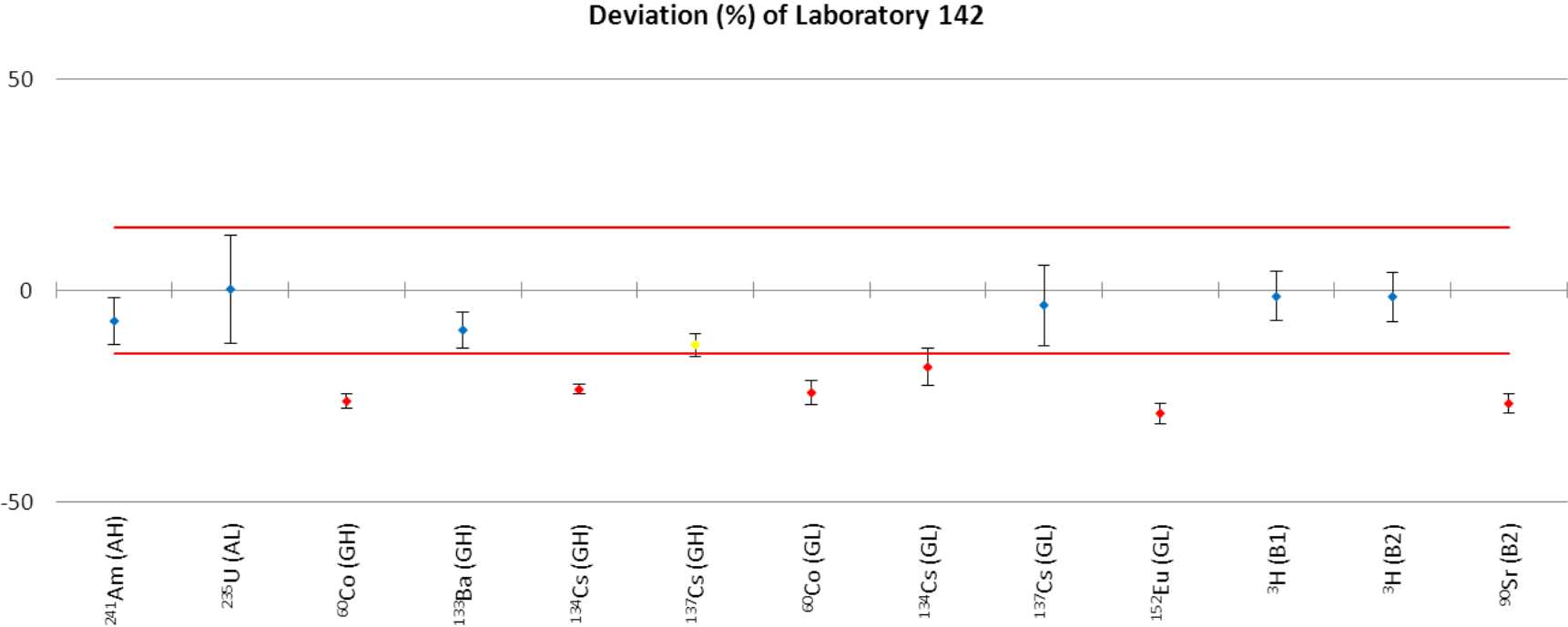
Radionuclide	Laboratory 135	NPL Assigned Value	Deviation /%	Zeta	Z Score
<sup>60</sup> Co (GH)	17.6 ± 0.6 (± 4 %)	11.06 ± 0.03 (± 0.3 %)	59.2	10.89	10.16
<sup>133</sup> Ba (GH)	13.6 ± 0.9 (± 7 %)	12.98 ± 0.10 (± 0.8 %)	4.8	0.68	0.82
<sup>134</sup> Cs (GH)	1.89 ± 0.08 (± 4 %)	1.915 ± 0.013 (± 0.7 %)	-1.3	-0.33	-0.22
<sup>137</sup> Cs (GH)	8.3 ± 0.5 (± 6 %)	8.10 ± 0.06 (± 0.7 %)	2.5	0.41	0.43
<sup>60</sup> Co (GL)	19.8 ± 0.9 (± 5.0 %)	13.23 ± 0.11 (± 0.8 %)	49.6	7.67	8.53
<sup>134</sup> Cs (GL)	3.20 ± 0.20 (± 6 %)	3.42 ± 0.03 (± 0.8 %)	-6.5	-1.09	-1.11
<sup>137</sup> Cs (GL)	1.90 ± 0.20 (± 11 %)	1.766 ± 0.016 (± 0.9 %)	7.6	0.67	1.31
<sup>152</sup> Eu (GL)	21.0 ± 1.0 (± 5.0 %)	21.9 ± 0.4 (± 1.8 %)	-3.9	-0.84	-0.67
<sup>90</sup> Sr (SS)	0.260 ± 0.017 (± 7 %)	0.276 ± 0.023 (± 8 %)	-5.8	-0.56	-1.00
<sup>137</sup> Cs (SS)	0.74 ± 0.05 (± 6 %)	0.80 ± 0.07 (± 8 %)	-7.6	-0.78	-1.31
<sup>241</sup> Am (SS)	1.3 ± 0.3 (± 23 %)	1.34 ± 0.11 (± 8 %)	-3.3	-0.14	-0.57



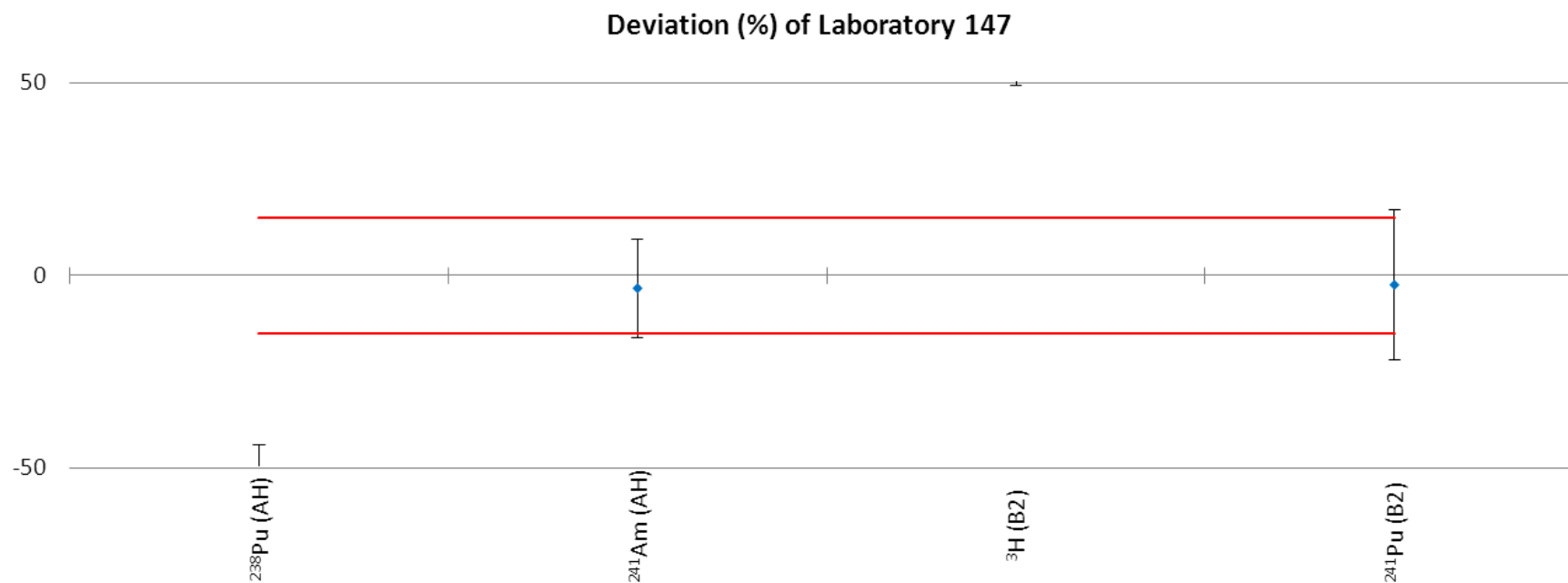
Radionuclide	Laboratory 136	NPL Assigned Value	Deviation /%	Zeta	Z Score
<sup>239</sup> Pu (AL)	1.32 ± 0.14 (± 10 %)	1.332 ± 0.006 (± 0.4 %)	-1.0	-0.09	-0.16
<sup>60</sup> Co (GL)	13.1 ± 0.7 (± 5.0 %)	13.23 ± 0.11 (± 0.8 %)	-1.3	-0.26	-0.23
<sup>134</sup> Cs (GL)	3.3 ± 0.4 (± 11 %)	3.42 ± 0.03 (± 0.8 %)	-4.1	-0.39	-0.71
<sup>137</sup> Cs (GL)	1.86 ± 0.07 (± 4 %)	1.766 ± 0.016 (± 0.9 %)	5.3	1.39	0.91
<sup>152</sup> Eu (GL)	20.8 ± 0.9 (± 4 %)	21.9 ± 0.4 (± 1.8 %)	-4.7	-1.08	-0.81
<sup>3</sup> H (B1)	0.96 ± 0.06 (± 6 %)	1.026 ± 0.007 (± 0.7 %)	-6.4	-1.15	-1.10
<sup>14</sup> C (B1)	1.04 ± 0.08 (± 8 %)	1.032 ± 0.005 (± 0.50 %)	0.9	0.12	0.16
<sup>3</sup> H (B2)	1.08 ± 0.07 (± 6 %)	1.051 ± 0.008 (± 0.7 %)	2.9	0.45	0.50
<sup>90</sup> Sr (B2)	0.46 ± 0.05 (± 11 %)	0.4746 ± 0.0010 (± 0.21 %)	-3.5	-0.33	-0.61



Radionuclide	Laboratory 137	NPL Assigned Value	Deviation /%	Zeta	Z Score
$^{60}\text{Co}$ (GH)	$11.0 \pm 1.1$ ( $\pm 10\%$ )	$11.06 \pm 0.03$ ( $\pm 0.3\%$ )	-0.3	-0.03	-0.05
$^{133}\text{Ba}$ (GH)	$12.1 \pm 1.2$ ( $\pm 10\%$ )	$12.98 \pm 0.10$ ( $\pm 0.8\%$ )	-6.7	-0.71	-1.15
$^{134}\text{Cs}$ (GH)	$1.75 \pm 0.17$ ( $\pm 10\%$ )	$1.915 \pm 0.013$ ( $\pm 0.7\%$ )	-8.8	-0.99	-1.51
$^{137}\text{Cs}$ (GH)	$8.4 \pm 0.8$ ( $\pm 10\%$ )	$8.10 \pm 0.06$ ( $\pm 0.7\%$ )	3.6	0.34	0.61
$^{60}\text{Co}$ (GL)	$14.0 \pm 1.4$ ( $\pm 10\%$ )	$13.23 \pm 0.11$ ( $\pm 0.8\%$ )	5.9	0.55	1.01
$^{134}\text{Cs}$ (GL)	$4.2 \pm 0.7$ ( $\pm 18\%$ )	$3.42 \pm 0.03$ ( $\pm 0.8\%$ )	21.3	1.00	3.66
$^{137}\text{Cs}$ (GL)	$2.05 \pm 0.21$ ( $\pm 10\%$ )	$1.766 \pm 0.016$ ( $\pm 0.9\%$ )	16.1	1.35	2.77
$^{152}\text{Eu}$ (GL)	$23.8 \pm 2.4$ ( $\pm 10\%$ )	$21.9 \pm 0.4$ ( $\pm 1.8\%$ )	9.1	0.82	1.56

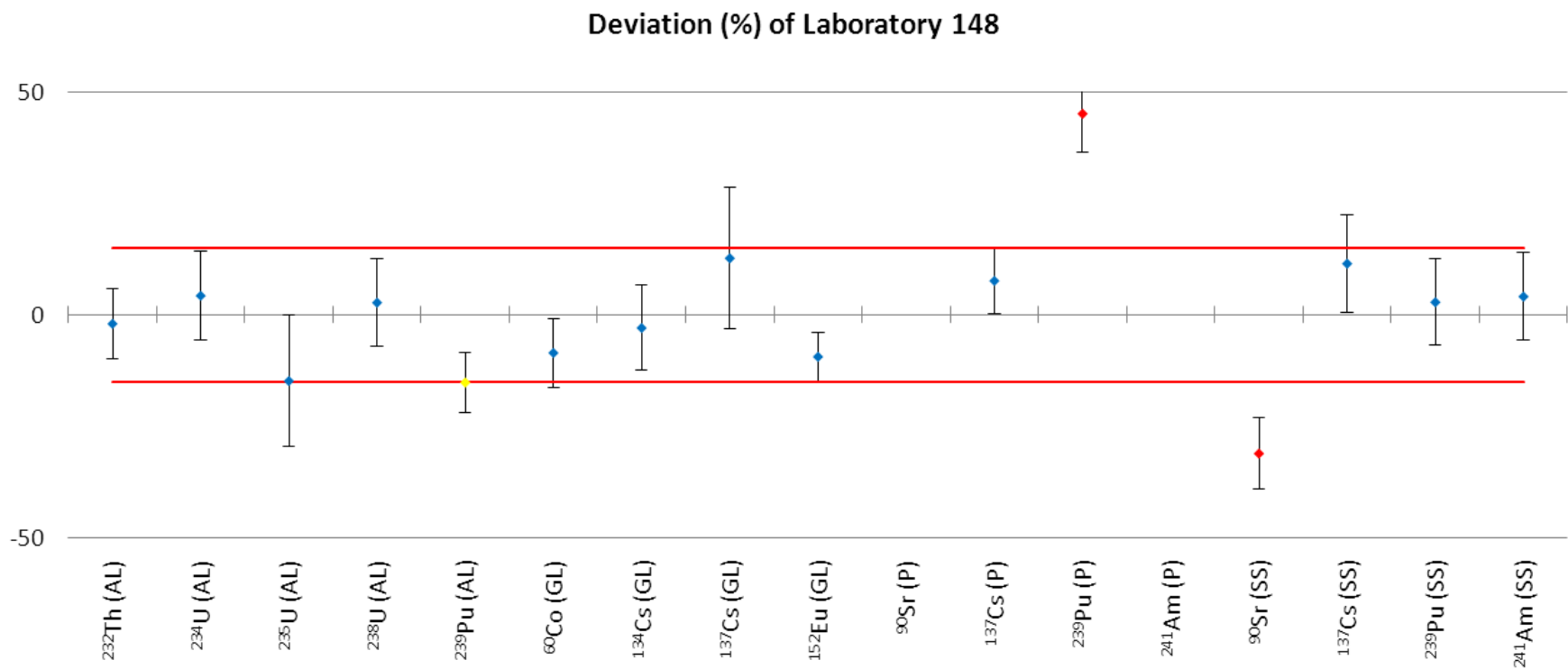


Radionuclide	Laboratory 142	NPL Assigned Value	Deviation /%	Zeta	Z Score
<sup>241</sup> Am (AH)	4.6 ± 0.3 (± 6 %)	5.010 ± 0.017 (± 0.4 %)	-7.3	-1.30	-1.25
<sup>235</sup> U (AL)	0.92 ± 0.12 (± 13 %)	0.921 ± 0.012 (± 1.3 %)	0.3	0.02	0.05
<sup>60</sup> Co (GH)	8.16 ± 0.20 (± 2.4 %)	11.06 ± 0.03 (± 0.3 %)	-26.3	-14.51	-4.51
<sup>133</sup> Ba (GH)	11.8 ± 0.6 (± 5.0 %)	12.98 ± 0.10 (± 0.8 %)	-9.4	-2.12	-1.61
<sup>134</sup> Cs (GH)	1.465 ± 0.022 (± 1.5 %)	1.915 ± 0.013 (± 0.7 %)	-23.5	-17.46	-4.03
<sup>137</sup> Cs (GH)	7.05 ± 0.22 (± 3 %)	8.10 ± 0.06 (± 0.7 %)	-12.9	-4.60	-2.21
<sup>60</sup> Co (GL)	10.0 ± 0.4 (± 4 %)	13.23 ± 0.11 (± 0.8 %)	-24.2	-8.65	-4.16
<sup>134</sup> Cs (GL)	2.80 ± 0.15 (± 6 %)	3.42 ± 0.03 (± 0.8 %)	-18.2	-4.13	-3.12
<sup>137</sup> Cs (GL)	1.70 ± 0.17 (± 10 %)	1.766 ± 0.016 (± 0.9 %)	-3.5	-0.36	-0.60
<sup>152</sup> Eu (GL)	15.5 ± 0.5 (± 3 %)	21.9 ± 0.4 (± 1.8 %)	-29.1	-10.63	-5.00
<sup>3</sup> H (B1)	1.01 ± 0.06 (± 6 %)	1.026 ± 0.007 (± 0.7 %)	-1.4	-0.25	-0.25
<sup>3</sup> H (B2)	1.04 ± 0.06 (± 6 %)	1.051 ± 0.008 (± 0.7 %)	-1.5	-0.25	-0.26
<sup>90</sup> Sr (B2)	0.347 ± 0.010 (± 3 %)	0.4746 ± 0.0010 (± 0.21 %)	-26.8	-12.17	-4.60

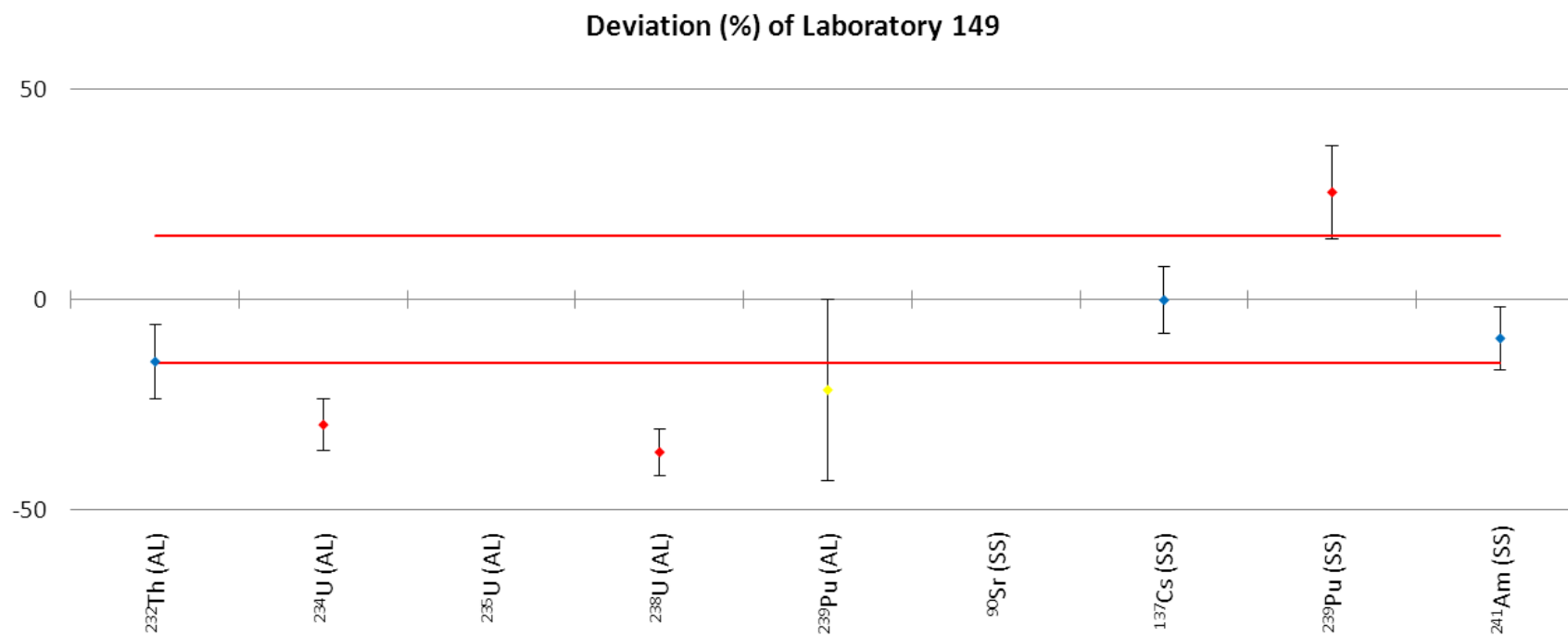




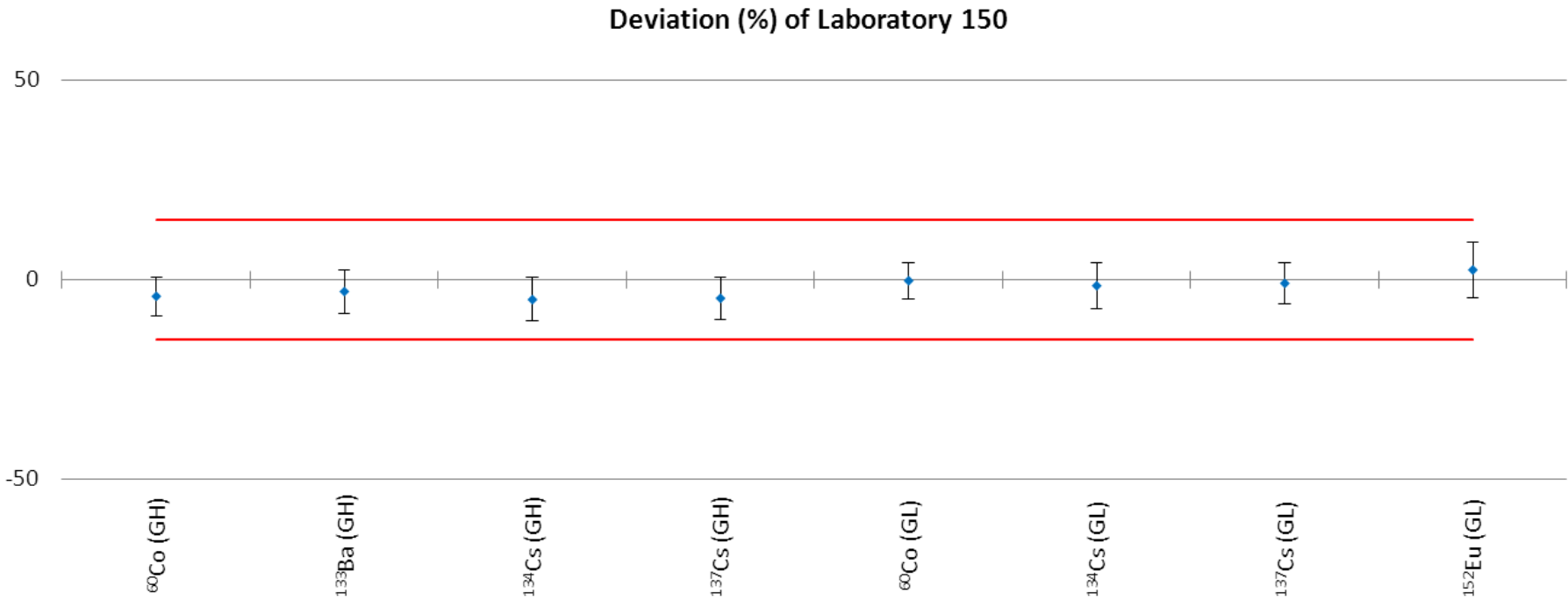
Radionuclide	Laboratory 147	NPL Assigned Value	Deviation /%	Zeta	Z Score
<sup>238</sup> Pu (AH)	8.2 ± 1.2 (± 15 %)	16.77 ± 0.06 (± 0.4 %)	-51.3	-7.01	-8.81
<sup>241</sup> Am (AH)	4.8 ± 0.7 (± 13 %)	5.010 ± 0.017 (± 0.4 %)	-3.4	-0.27	-0.58
<sup>3</sup> H (B2)	1.74 ± 0.17 (± 10 %)	1.051 ± 0.008 (± 0.7 %)	65.7	3.96	11.29
<sup>241</sup> Pu (B2)	0.93 ± 0.19 (± 20 %)	0.957 ± 0.011 (± 1.1 %)	-2.5	-0.13	-0.43



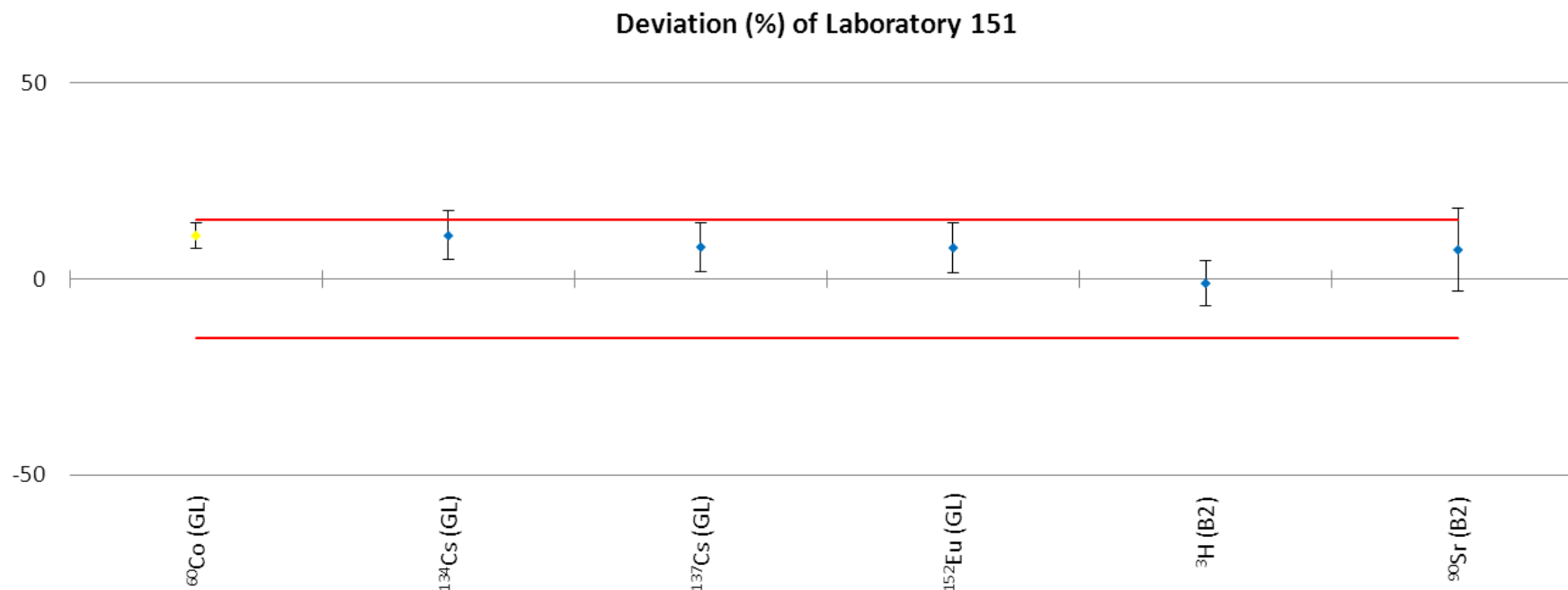
Radionuclide	Laboratory 148	NPL Assigned Value	Deviation /%	Zeta	Z Score
<sup>232</sup> Th (AL)	1.52 ± 0.12 (± 8 %)	1.551 ± 0.016 (± 1.0 %)	-2.0	-0.26	-0.35
<sup>234</sup> U (AL)	20.1 ± 1.9 (± 9 %)	19.3 ± 0.3 (± 1.4 %)	4.3	0.43	0.74
<sup>235</sup> U (AL)	0.78 ± 0.14 (± 17 %)	0.921 ± 0.012 (± 1.3 %)	-14.9	-1.00	-2.55
<sup>238</sup> U (AL)	19.8 ± 1.9 (± 9 %)	19.3 ± 0.3 (± 1.4 %)	2.7	0.28	0.47
<sup>239</sup> Pu (AL)	1.13 ± 0.09 (± 8 %)	1.332 ± 0.006 (± 0.4 %)	-15.2	-2.23	-2.61
<sup>60</sup> Co (GL)	12.1 ± 1.0 (± 8 %)	13.23 ± 0.11 (± 0.8 %)	-8.6	-1.11	-1.47
<sup>134</sup> Cs (GL)	3.3 ± 0.4 (± 10 %)	3.42 ± 0.03 (± 0.8 %)	-2.9	-0.31	-0.51
<sup>137</sup> Cs (GL)	2.0 ± 0.3 (± 14 %)	1.766 ± 0.016 (± 0.9 %)	12.7	0.80	2.18
<sup>152</sup> Eu (GL)	19.8 ± 1.2 (± 6 %)	21.9 ± 0.4 (± 1.8 %)	-9.4	-1.70	-1.62
<sup>90</sup> Sr (P)	4.2 ± 0.4 (± 8 %)	2.51 ± 0.11 (± 5.0 %)	66.3	4.60	11.39
<sup>137</sup> Cs (P)	2.92 ± 0.16 (± 6 %)	2.71 ± 0.12 (± 5.0 %)	7.6	1.04	1.31
<sup>239</sup> Pu (P)	5.76 ± 0.22 (± 4 %)	3.97 ± 0.18 (± 5.0 %)	45.2	6.35	7.76
<sup>241</sup> Am (P)	7.1 ± 0.4 (± 5.0 %)	4.35 ± 0.19 (± 5.0 %)	62.6	6.75	10.76
<sup>90</sup> Sr (SS)	0.190 ± 0.016 (± 8 %)	0.276 ± 0.023 (± 8 %)	-31.2	-3.09	-5.35
<sup>137</sup> Cs (SS)	0.89 ± 0.05 (± 6 %)	0.80 ± 0.07 (± 8 %)	11.5	1.14	1.97
<sup>239</sup> Pu (SS)	1.09 ± 0.05 (± 4 %)	1.06 ± 0.09 (± 9 %)	2.8	0.30	0.49
<sup>241</sup> Am (SS)	1.40 ± 0.07 (± 5.0 %)	1.34 ± 0.11 (± 8 %)	4.1	0.43	0.70



Radionuclide	Laboratory 149	NPL Assigned Value	Deviation /%	Zeta	Z Score
<sup>232</sup> Th (AL)	1.32 ± 0.14 (± 10 %)	1.551 ± 0.016 (± 1.0 %)	-14.8	-1.66	-2.54
<sup>234</sup> U (AL)	13.5 ± 1.2 (± 9 %)	19.3 ± 0.3 (± 1.4 %)	-29.8	-4.78	-5.11
<sup>235</sup> U (AL)	8.0 ± 0.7 (± 9 %)	0.921 ± 0.012 (± 1.3 %)	765.6	10.20	131.47
<sup>238</sup> U (AL)	12.3 ± 1.1 (± 9 %)	19.3 ± 0.3 (± 1.4 %)	-36.3	-6.38	-6.23
<sup>239</sup> Pu (AL)	1.0 ± 0.3 (± 30 %)	1.332 ± 0.006 (± 0.4 %)	-21.5	-1.00	-3.69
<sup>90</sup> Sr (SS)	3.2 ± 0.3 (± 9 %)	0.276 ± 0.023 (± 8 %)	1059.4	9.72	181.94
<sup>137</sup> Cs (SS)	0.800 ± 0.009 (± 1.1 %)	0.80 ± 0.07 (± 8 %)	-0.2	-0.02	-0.03
<sup>239</sup> Pu (SS)	1.33 ± 0.03 (± 2.3 %)	1.06 ± 0.09 (± 9 %)	25.5	2.85	4.37
<sup>241</sup> Am (SS)	1.221 ± 0.008 (± 0.7 %)	1.34 ± 0.11 (± 8 %)	-9.2	-1.14	-1.59



Radionuclide	Laboratory 150	NPL Assigned Value	Deviation /%	Zeta	Z Score
<sup>60</sup> Co (GH)	10.6 ± 0.6 (± 5.0 %)	11.06 ± 0.03 (± 0.3 %)	-4.1	-0.86	-0.71
<sup>133</sup> Ba (GH)	12.6 ± 0.7 (± 6 %)	12.98 ± 0.10 (± 0.8 %)	-2.9	-0.53	-0.51
<sup>134</sup> Cs (GH)	1.82 ± 0.10 (± 6 %)	1.915 ± 0.013 (± 0.7 %)	-5.0	-0.91	-0.85
<sup>137</sup> Cs (GH)	7.7 ± 0.5 (± 6 %)	8.10 ± 0.06 (± 0.7 %)	-4.6	-0.86	-0.80
<sup>60</sup> Co (GL)	13.2 ± 0.6 (± 5.0 %)	13.23 ± 0.11 (± 0.8 %)	-0.2	-0.05	-0.04
<sup>134</sup> Cs (GL)	3.37 ± 0.19 (± 6 %)	3.42 ± 0.03 (± 0.8 %)	-1.5	-0.26	-0.25
<sup>137</sup> Cs (GL)	1.75 ± 0.09 (± 5.0 %)	1.766 ± 0.016 (± 0.9 %)	-0.9	-0.17	-0.15
<sup>152</sup> Eu (GL)	22.4 ± 1.5 (± 7 %)	21.9 ± 0.4 (± 1.8 %)	2.5	0.35	0.43



Radionuclide	Laboratory 151	NPL Assigned Value	Deviation /%	Zeta	Z Score
$^{60}\text{Co}$ (GL)	$14.7 \pm 0.4$ ( $\pm 3\%$ )	$13.23 \pm 0.11$ ( $\pm 0.8\%$ )	11.1	3.55	1.91
$^{134}\text{Cs}$ (GL)	$3.80 \pm 0.21$ ( $\pm 6\%$ )	$3.42 \pm 0.03$ ( $\pm 0.8\%$ )	11.1	1.79	1.90
$^{137}\text{Cs}$ (GL)	$1.91 \pm 0.11$ ( $\pm 6\%$ )	$1.766 \pm 0.016$ ( $\pm 0.9\%$ )	8.2	1.30	1.40
$^{152}\text{Eu}$ (GL)	$23.6 \pm 1.3$ ( $\pm 6\%$ )	$21.9 \pm 0.4$ ( $\pm 1.8\%$ )	8.0	1.29	1.37
$^3\text{H}$ (B2)	$1.04 \pm 0.06$ ( $\pm 6\%$ )	$1.051 \pm 0.008$ ( $\pm 0.7\%$ )	-1.1	-0.19	-0.18
$^{90}\text{Sr}$ (B2)	$0.51 \pm 0.05$ ( $\pm 10\%$ )	$0.4746 \pm 0.0010$ ( $\pm 0.21\%$ )	7.5	0.71	1.28



## 14. DISCUSSION

### 14.1 Alpha High results

The data sets for  $^{244}\text{Cm}$  and  $^{226}\text{Ra}$  were less good than those obtained in the 2012 PTE (Dean et al., 2013) in that the proportion of results 'in agreement' with the NPL Assigned Value fell from 93% to 43% for  $^{244}\text{Cm}$  and from 75% to 56% for  $^{226}\text{Ra}$ . However, the proportion for  $^{241}\text{Am}$  improved (from 71% to 86%). The deviation of the WM LCS from the Assigned Value was significantly high for both  $^{237}\text{Np}$  and  $^{244}\text{Cm}$ ; as details of analytical methods were not requested from the participants, it is difficult to investigate the reasons for these differences.

### 14.2 Alpha Low results

The proportion of reported data in agreement with the NPL Assigned Values in this sample type (all nuclides combined) was 82%. The nuclide with the lowest proportion in agreement was  $^{235}\text{U}$  (64%), although the proportions in agreement for the other uranium nuclides were higher.

Data for this sample type cannot be compared with data from the 2012 PTE owing to the withdrawal of the Alpha Low data from the 2012 PTE. However, an Alpha Low sample type had been included in the 2011 PTE (Gilligan and Harms, 2012) and this contained  $^{232}\text{Th}$  and  $^{239}\text{Pu}$ . It is interesting to note that the proportion of data in agreement with NPL for  $^{232}\text{Th}$  in the current PTE (86%) was much higher than the equivalent figure in the 2011 PTE (53%). Conversely, the figure for  $^{239}\text{Pu}$  decreased from 94% in 2011 to 78% in the current exercise.

### 14.3 Beta One results

A total of 93% of the results submitted for  $^3\text{H}$  were in agreement with NPL. The level of performance was slightly lower for  $^{14}\text{C}$  and  $^{99}\text{Tc}$ , with 67% and 71% of results respectively being in agreement with NPL. These performance levels were similar to those observed in the 2012 PTE.

### 14.4 Beta Two results

The data set for  $^3\text{H}$  in this sample type showed a lower level of agreement with NPL than in Beta One, with 76% of results being in agreement. However, this was an improvement on the equivalent figure for  $^3\text{H}$  in Beta Two in 2012 (61%). Similarly, the figure for  $^{241}\text{Pu}$  in the current PTE (78%) was higher than that observed in 2012 (47%). Likewise, there was an improvement for  $^{90}\text{Sr}$  (68% in 2012 to 78% in this exercise).

### 14.5 Gamma High results

Very few questionable or discrepant results were reported for the nuclides in this sample type, and the data plots for the nuclides were similar to those obtained in the 2012 PTE.

### 14.6 Gamma Low results

Again, the data plots for the nuclides in this sample type were similar to those observed in the 2012 exercise. The nuclide  $^{152}\text{Eu}$  was added in the current exercise, and only two results were questionable, and two discrepant, for this nuclide. The WM LCS for the  $^{134}\text{Cs}$  data was significantly low, possibly due to cascade summing effects.

#### 14.7 Peat and sandy soil results

NPL had not included soil samples in any of the previous PTEs in this series. As stated on p.12, the Assigned Value for each radionuclide in each soil type was determined by calculating the WM LCS of the participants' results for that radionuclide in that soil type. Overall, 69% of the reported results for peat were in agreement with the WM LCS; the equivalent figure for sandy soil was 57%.

It should be noted that this data analysis method has limitations; for example, as the value being determined is the weighted mean of the consistent subset, the final WM LCS will tend to be biased towards the most precise values within the selected consistent subset. Additionally, in cases where there are multiple equally-sized consistent subsets within the total dataset, the method will 'select' one of the subsets, even if the subsets are of equal consistency. Such limitations need to be borne in mind when interpreting the results of the data analysis.

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