Certification Report

Certified Reference Material

ERM®-EB314a

AlSi11Cu2Fe

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Summary

This report describes preparation, analysis and certification of the aluminium alloy reference materials ERM®-EB314a.
The certified reference material is available in the form of discs (50 mm diameter and 40 mm height). It is intended for establishing and checking the calibration of optical emission and X-ray spectrometers (excluding micro-analysis) for the analysis of samples of similar matrix composition. It is also suitable for wet chemical analysis.

The following mass fractions and uncertainties have been certified:

Element	Mass fraction[1] in %	Uncertainty[2] in %
Si	11.51	0.15
Fe	0.992	0.017
Cu	2.08	0.07
Mn	0.404	0.008
Mg	0.196	0.004
Ni	0.242	0.006
Cr	0.0574	0.0012
Zn	1.100	0.015
Ti	0.188	0.004
Pb	0.189	0.010
Sn	0.201	0.004
	in mg/kg	in mg/kg
As	28	7
Be	4.65	0.22
Bi	92	6
Cd	5.2	1.0
Co	74	4
Ga	164	4
Sb	102	19
V	277	7
Zr	103	3

1 Unweighted mean value of the means of accepted sets of data, each set being obtained by at least 10 laboratories and/or with different methods of measurement. The values are traceable to the SI (Système International d'Unités) by the use of pure substances of known stoichiometry for calibration.

2 Estimated expanded uncertainty *U* with a coverage factor of *k* = 2, corresponding to a level of confidence of about
95 %, as defined in the ISO/IEC Guide 98-3:2008 [Uncertainty of measurement -- Part 3: Guide to the expression of uncertainty in measurement (GUM:1995)].

This report contains detailed information on the preparation of the CRMs as well as on homogeneity investigations and on the analytical methods used for certification analysis.
The certified values are based on the results of 10 laboratories which participated in the certification interlaboratory comparison.

Content

List of abbreviations
(if not explained elsewhere)

CRM	certified reference material
ERM	European reference material
FAAS	flame atomic absorption spectrometry
ICP-OES	inductively coupled plasma optical emission spectrometry
ICP-MS	inductively coupled plasma mass spectrometry
INAA	instrumental neutron activation analysis
SOES	spark optical emission spectrometry
XRF	X-ray fluorescence spectrometry
M	mean value
n	number of accepted data sets
s	standard deviation of an individual data set
s_M	standard deviation of laboratory means
s_{rel}	relative standard deviation
$\bar{s}_i$	square root of mean of variances of data sets under repeatability conditions
M_i	single result
I	ICP-OES (Tables 3 – 23)
I(R)	ICP-OES, revised value (Tables 3 – 23)
IMS	ICP-MS (Tables 3 – 23)
A	FAAS (Tables 3 – 23)
A(R)	FAAS, revised value (Tables 3 – 23)
P	spectrophotometry (Tables 3 – 23)
G	gravimetry (Tables 3 – 23)
NAA	instrumental neutron activation analysis (Tables 3 – 23)
-s	dissolution in acid (Tables 3 – 23)
-a	dissolution in base (Tables 3 – 23)
-v	higher dilution (Tables 3 – 23)

1. Introduction

In the metal-producing and metal-working industry mainly spark emission spectrometry (SOES) and X-ray fluorescence spectrometry (XRF) are used for reception inspection of raw materials, e.g. scrap, for quality control of end products and production control. These time saving analytical techniques require suitable reference materials for calibration and recalibration. The certified reference material ERM®-EB314a is based on the aluminium alloy AlSi11Cu2Fe. It replaces the exhausted CRM BAM-314.

The CRM was produced in close cooperation with the working group „Aluminium“ of the Committee of Chemists of the German Gesellschaft der Metallurgen und Bergleute e.V. (GDMB). Since all of the laboratories are highly experienced with aluminium analysis and had already participated in earlier interlaboratory comparisons, there was no preceding round for qualification.

Certification of reference materials is carried out on the basis of the relevant ISO-Guides [1-3], the „Guidelines for the production of BAM Reference Materials“ [4] and the “Technical Guidelines for the Production and Acceptance of a European Reference Material” [5].

2. Companies/laboratories involved

Preparation of the material:

- SUS Nell, Oberhausen, Germany

Test for homogeneity:

- BAM Bundesanstalt für Materialforschung und -prüfung, Berlin, Germany
- SUS Nell, Oberhausen, Germany

Participants in the certification interlaboratory comparison:

Suisse Technology Partners AG, Neuhausen, Switzerland
Constellium, Centre de Recherches de Voreppe, Voreppe, France
AMAG Austria Metall AG, Ranshofen, Austria
BAM Bundesanstalt für Materialforschung und -prüfung, Berlin, Germany
Hydro Aluminium Rolled Products GmbH, R&D-Bonn, Germany
Hydro Aluminium Rolled Products GmbH, Hamburg, Germany
Institute of Non-Ferrous Metals, Gliwice, Poland
Leichtmetall Aluminium Giesserei Hannover GmbH, Hannover, Germany
Otto Fuchs KG, Meinerzhagen, Germany
TRIMET Aluminium SE, Essen, Germany

Statistical evaluation of the data:

- BAM Bundesanstalt für Materialforschung und -prüfung, Berlin, Germany

3. Candidate material

The candidate material was produced by SUS Nell, Oberhausen, Germany. About 500 kg of an aluminium melt were doped with the desired elements. The melt was atomised in an inert gas stream with subsequent spray-compacting of the material. The compacted bolts (A – F) were pressed to rods and cut into approx. 450 discs with a diameter of ca. 50 mm and 40 mm height.

4. Homogeneity testing

Possible reasons for an inhomogeneous distribution of elements in the raw material may be a change of the composition of the melt during the casting procedure because some elements may volatise or segregate during the solidification of the material. Since the raw material was produced by casting of a rod, concentration gradients can occur over the length of the rod (axial) as well as over the area of the rod (radial, see Figures 1 and 2):

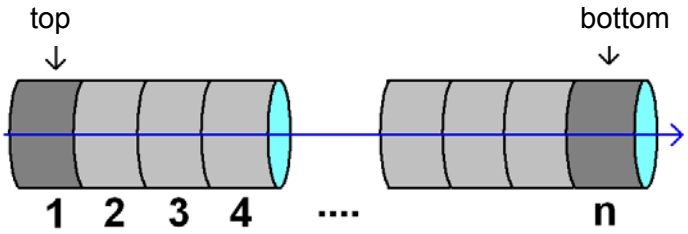

Fig. 1: Axial composition gradient

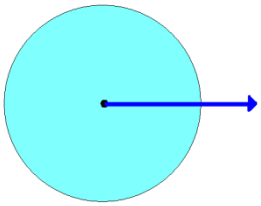

Fig. 2: Radial composition gradient

Therefore it is necessary to investigate the raw material for both axial and radial inhomogeneities. Radial homogeneity testing of the candidate material was performed on the discs listed in Tables 1a and 1b using spark emission spectrometry. At BAM ca. 6 % of the total number of discs were tested. All tests were carried out with an OBLF QSL 1500 spectrometer. For the elements As, Bi, Cd and Co data from SUS Nell (Table 1b) were used to calculate the inhomogeneity contribution to the total uncertainty.

Tab. 1a: Discs analysed for homogeneity testing of ERM®-EB314a (SOES, BAM)

A009	B007	C007	D009	E002	F003
A025	B051	C044	D040	E046	F044
A041	B083	C070	D068	E076	F054
A049	B103	C105	D098	E104	F080
A081*		C115*			F108*

*Homogeneity tested over area

Tab. 1b: Discs analysed for homogeneity testing of ERM®-EB314a (SOES, Nell)

A001	B001	C001	D001	E001	F001
A010	B010	C010	D010	E010	F010
A020	B020	C020	D020	E020	F020
A030	B030	C030	D030	E030	F030
A040	B040	C040	D040	E040	F040
A050	B050	C050	D050	E050	F050
A060	B060	C060	D060	E060	F060
A070	B070	C070	D070	E070	F070
A080	B080	C080	D080	E080	F080
A090	B090	C090	D090	E090	F090
A100	B100	C100	D100	E100	F100
A110	B114	C110	D110	E110	F110
A114		C115	D114	E114	F113

At BAM all samples were analysed 5 times (2 sparks per run) in a randomly chosen order. SUS Nell analysed each disc five times in one run.
The estimate of analyte-specific inhomogeneity contribution u_{bb} to be included into the total uncertainty budget was calculated according to ISO Guide 35 [4] using Eq. (1) and Eq. (2):

$$s_{bb} = \sqrt{\frac{MS_{among} - MS_{within}}{n}} \qquad (1)$$

$$u_{bb}^{*} = \sqrt{\frac{MS_{within}}{n}} \sqrt[4]{\frac{2}{N(n-1)}} \qquad (2)$$

where:

MS_{among}	mean of squared deviations between discs (from 1-way ANOVA, see Annex 1)
MS_{within}	mean of squared deviations within one disc (from 1-way ANOVA)
n	number of replicate measurements per disc
N	number of discs selected for homogeneity study

s_{bb}(1) signifies the between-discs standard deviation whereas u_{bb}^{*} denotes the maximum heterogeneity that can potentially be hidden by an insufficient repeatability of the applied measurement method (which has to be considered as the minimum uncertainty contribution). In any case the larger of the two values was used as u_{bb}. Eq. (1) does not apply if MS_{within} is larger than MS_{among}.
In addition to the tests performed over the length of the rods three discs (A081, C115, F108) were tested for homogeneity over the area (possible segregation from the outer part to the

centre). To perform this test SOES analysis was carried out in circles (outer circle: 12 sparks, inner circle: 6 sparks; centre: 1 spark).

The analyte-specific within-disc standard deviation $s_{bb}(2)$ as an additional uncertainty component was calculated in the same way as for the total batch. To calculate the necessary data an unbalanced ANOVA was carried out taking into account that the number of single measurements is different for the centre, the inner and the outer circle. For technical reasons, at r_0 (centre) only one measurement is possible. An ANOVA requires a minimum of two measurements per factor value. Thus, the value for r_0 should be replaced by a dummy. This dummy is defined as follows:

The two values replacing the one measured have a mean equal to the value measured, and a standard deviation equal to the average within-variation. This resembles the situation were one could take two independent measurements at the same place, with values deviating by the average standard deviation (non-destructive testing method). A first guess for the average standard deviation may be calculated from the data for r_in (inner circle) and r_out (outer circle). As results from these calculations an inhomogeneity factor for the radius and one for the height of the disc is obtained. From these values a combined inhomogeneity factor is calculated. This factor is compared with the within standard deviation calculated from the ANOVA-data. The higher factor is used for uncertainty calculation.

Annex 2 shows the results of the calculations.

For some of the analysed elements the instrument used in BAM for homogeneity testing over the area was not sensitive enough to get results suitable for an estimation of inhomogeneity. In these cases the inhomogeneity contribution to the total uncertainty was estimated taking the value of another element which is present in the material with a similar content. This estimation is justified since all impurities are present only in small quantities. Segregation effects are normally only occurring in case when elements are present in higher quantities, but not for traces. The elements concerned are highlighted yellow in the resp. Table 43.

5. Characterisation study

5.1 Analytical methods

10 laboratories participated in the certification interlaboratory comparison. For some elements part of the laboratories used more than one analytical method reporting more than one data set.

The laboratories were asked to analyse six subsamples. They were free to choose any suitable analytical method for analysis. Table 2 shows the analytical methods used by the participating laboratories.

For all analytical methods where a calibration was necessary this calibration was performed using liquid standard solutions. All participating laboratories were asked to use only standard solutions prepared from pure metals or stoichiometric compounds or well checked commercial calibration solutions.

Table 2: Analytical procedures used by the participating laboratories

Lab-No.	Element.	Sample mass	Sample pretreatment	Analytical method
1	Si, Fe, Cu, Mn, Mg, Cr, Ni, Zn, Ti, Pb, Sn, Bi, Co, Ga, V, Zr	0.5 g	Dissolution with NaOH	ICP-OES, calibration with commercial solutions (Merck)
	As, Be, Cd, Sb	0.5 g	Dissolution with HF/HNO_3	ICP-OES, calibration with commercial solutions (Merck)
2	Si, Fe, Cu, Mn, Mg, Cr, Ni, Zn, Ti, Pb, Sn	0.5 g	Dissolution with NaOH	ICP-OES, calibration with pure metals or pure chemicals
	As, Be, Sb, V, Zr	0.5 g	Dissolution with HNO_3/HF	ICP-OES, calibration with pure metals or pure chemicals
	Bi, Cd, Co, Ga	0.5 g	Dissolution with HNO_3/HF	ICP-MS, calibration with pure metals or pure chemicals
3	Si	0.5 g	Dissolution with NaOH	ICP-OES, calibration with commercial solution
	Fe, Cu, Mg, Mn, Cr, Ni, Zn, Ti, Pb, Zr, Be, Cd, Co, Ga, Sb, Pb, V	0.5 g	Dissolution with NaOH and with HCl/ HNO_3	ICP-OES, calibration with commercial mono-element solutions
	Sn,	0.5 g	Dissolution with HCl/ HNO_3	ICP-OES, calibration with commercial mono-element solutions
	As	0.5 g	Dissolution with H_2SO_4/ HNO_3	ICP-MS, calibration with commercial mono-element solutions
	Bi	0.5 g	Dissolution with H_2SO_4/ HNO_3 and with HCl/ HNO_3	ICP-OES, calibration with commercial mono-element solutions
4	Si	0.2 g	Dissolution with NaOH	Photometry with matrix matched standards (pure Al), commercial mono-element solution
	Fe, Cu, Mn, Mg, Cr, Ni, Zn, Ti, Pb, Sn, Cd, Co, Ga, Sb, V, Zr	0.5 g	Dissolution with HCl and HF/HNO_3/ H_2SO_4	ICP-OES with matrix matched standards (pure Al), commercial mono-element solutions
	As, Be, Bi	0.5 g	Dissolution with HNO_3 and HF/HNO_3/ H_2SO_4	ICP-OES with matrix matched standards (pure Al), commercial mono-element solutions
5	Si, Fe, Cu, Mn, Mg, Cr, Ni, Zn, Ti, Pb, Sn, As, Be, Bi, Cd, Co, Ga, Sb, V, Zr	0.5 g	Dissolution with NaOH	ICP-OES
6	Si, Fe, Cu, Mn, Mg, Cr, Ni, Zn, Ti, Pb, Sn, As, Be, Bi, Cd, Co, Ga, Sb, V, Zr	0.5 g	Dissolution with NaOH	ICP-OES, calibration with pure metals (Fe, Cu, Mn, Mg, Ni, Zn, Sn) or commercial mono element solution (Si) or commercial multi-element solutions
7	Si	0.5 g	Dissolution with HCl/ HNO_3	Gravimetry
	Fe, Cu, Mn, Mg, Cr, Ni, Zn, Ti, Pb, Sn, As, Be, Bi, Cd, Co, Ga, Sb, V, Zr	1 g	Dissolution with HCl/ HNO3/HF	ICP-OES with matrix matched standards (pure Al), commercial mono-element solutions

Table 2 (cont.): Analytical procedures used by the participating laboratories

8	Si, Fe, Cu, Mn, Cr, Ni, Zn, Ti, Sn, Bi, Cd, Co, Ga, Sb, Zr	0.5 g	Dissolution with NaOH	ICP-OES with matrix matched standards, commercial mono-element solutions
	Mg, Pb, Be, V	0.5 g	Dissolution with HCl/H_2O_2	ICP-OES with matrix matched standards, commercial mono-element solutions
	Si, Fe, Cu, Mn, Mg, Cr, Ni, Zn, Ti, Pb, Sn, V, Zr			XRF
9	Si	0.1 g	Dissolution with NaOH	Photometry
	Fe, Mg, Cr, Co, Ga, V	0.5 g	Dissolution with HCl/ HNO_3/HF	ICP-OES, calibration with commercial mono-element solutions
	Ni	0.5 g	Dissolution with NaOH	ICP-OES, calibration with commercial mono-element solution
	Cd	0.5 g	Dissolution with NaOH	ET AAS, calibration with commercial mono-element solution
	Fe, Cu, Mn, Cr, Ni, Zn, As, Cd, Co, Ga, Sb, V			INAA
10	Si, Fe, Cu, Mn, Mg, Cr, Ni, Zn, Ti, Pb, Sn, Be, Bi, Cd, Ga, V, Zr	0.5 g	Dissolution with NaOH	ICP-OES, calibration with pure chemicals

5.2 Analytical results and statistical evaluation

The analytical results of the certification interlaboratory comparison are listed in Tables 3 to 22. These tables show the single results (M_i) of each laboratory, the respective laboratories' mean values (M) absolute and relative intralaboratory standard deviation (s and s_{rel}, respectively), the standard deviation of laboratory means (s_M), and in addition the square root of mean of variances of data sets under repeatability conditions ($\bar{s}_i$). n is the number of accepted data sets. The continuous line marks the certified value (mean of the laboratories' means), the broken lines mark the standard deviation, calculated from the laboratories' means.
In the related figures for each laboratory its mean value and single standard deviation is given. Outliers which have been excluded are highlighted in yellow.

Lab./Meth.	10/I-a (R)	6/I-a	5/I-a	9/P	7/G	2/I-a	3/I-a	4/P	1/I-a	8/I-a-v	8/XRF	8/I-a		
M_i [%]	11.16	11.35	11.41	11.55	11.45	11.44	11.51	11.51	11.33	11.68	11.75	11.77		*n*
	11.19	11.48	11.43	11.44	11.35	11.42	11.49	11.52	11.57	11.64	11.76	11.79		12
	11.15	11.48	11.42	11.40	11.44	11.47	11.52	11.50	11.69	11.66	11.75	11.79		
	11.22	11.51	11.43	11.37	11.41	11.49	11.47	11.48	11.67	11.70	11.76	11.85		
	11.16	11.17	11.41	11.33	11.46	11.49	11.49	11.49	11.62	11.68	11.75	11.93		
	11.37	11.21	11.41		11.46	11.49	11.45	11.49	11.62	11.65	11.76	11.86		
***M* [%]**	**11.21**	**11.37**	**11.42**	**11.42**	**11.43**	**11.47**	**11.49**	**11.50**	**11.58**	**11.67**	**11.76**	**11.83**		**11.51**
s [%]	0.0833	0.1499	0.0089	0.0841	0.0426	0.0308	0.0256	0.0147	0.1311	0.0219	0.0047	0.0606	s_M [%]	0.1731
													$\bar{s}_i$ [%]	0.0716
s_{rel}	0.00743	0.01319	0.00078	0.00736	0.00373	0.00269	0.00223	0.00128	0.01132	0.00187	0.00040	0.00512		0.01504

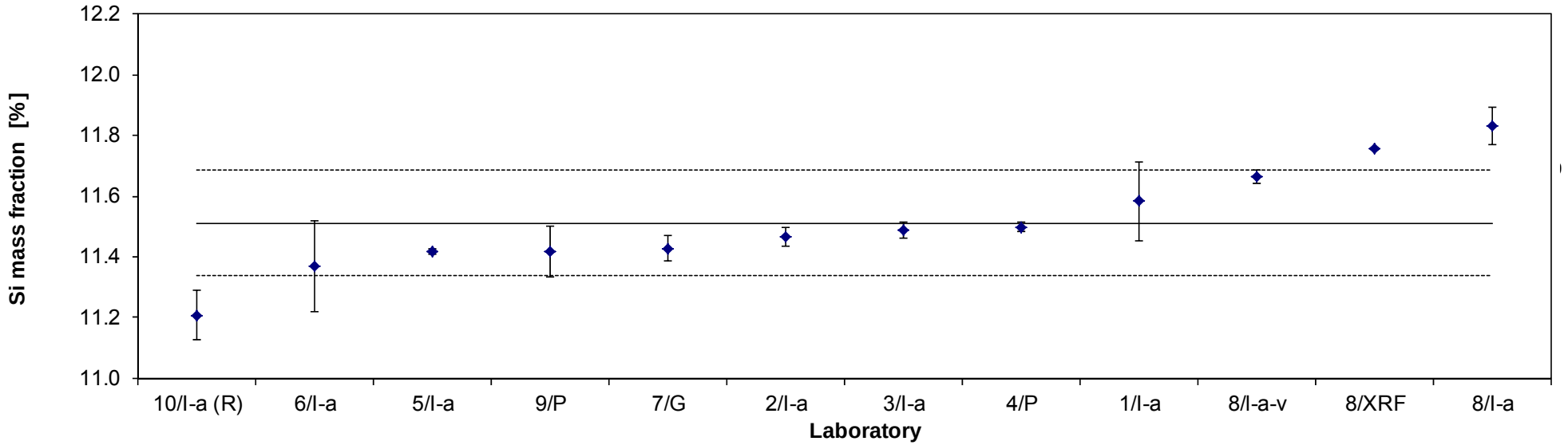

Table 3: Results for Si

Lab./Meth.	10/I-a (R)	8/XRF	6/I-a	4/I-s	3/I	2/I-a	1/I-a	9/NAA	5/I-a	8/I-a-v	9/I-s	8/I-a	7/I-s (R)		
M_i [%]	0.9750	0.9808	0.9780	0.9856	0.9880	0.9902	0.970	0.982	0.9977	1.0043	0.9800	1.0157	1.0440		*n*
	0.9690	0.9803	0.9927	0.9922	0.9872	0.9895	0.990	0.984	0.9966	0.9993	1.0120	1.0196	1.0580		12
	0.9650	0.9809	0.9849	0.9859	0.9861	0.9865	0.990	0.989	0.9964	0.9968	1.0080	1.0133	1.0220		
	0.9670	0.9810	0.9923	0.9803	0.9879	0.9887	0.990	1.000	0.9981	1.0001	1.0100	1.0191	1.0530		
	0.9690	0.9815	0.9699	0.9839	0.9899	0.9854	1.000	1.007	0.9948	1.0038	1.0090	1.0267	1.0140		
	0.9790	0.9801	0.9762	0.9788	0.9835	0.9827	0.990	1.006	0.9943	1.0067		1.0276	1.0630		
***M* [%]**	**0.9707**	**0.9808**	**0.9823**	**0.9845**	**0.9871**	**0.9872**	**0.9883**	**0.9947**	**0.9963**	**1.0018**	**1.0038**	**1.0203**	**1.0423**		**0.9915**
s [%]	0.0053	0.0005	0.0092	0.0048	0.0022	0.0028	0.0098	0.0111	0.0015	0.0037	0.0134	0.0058	0.0200	s_M [%]	0.0130
														$\bar{s}_i$ [%]	0.0071
s_{rel}	0.00544	0.00051	0.00938	0.00483	0.00219	0.00288	0.00995	0.01115	0.00153	0.00369	0.01334	0.00565	0.01921		0.01309

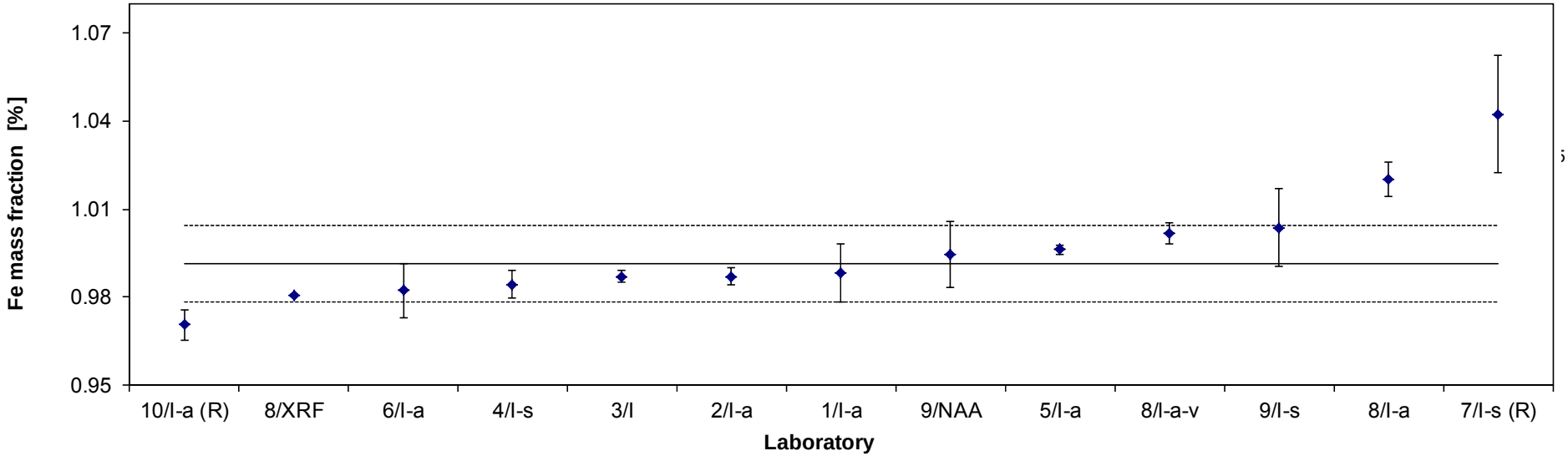

Table 4: Results for Fe

Lab./Meth.	10/I-a (R)	9/NAA	6/I-a	3/I	5/I-a	8/XRF	2/I-a	1/I-a	4/I-s	8/I-a-v	7/I-s	8/I-a		
M_i [%]	1.990	2.031	2.036	2.075	2.079	2.076	2.088	2.050	2.090	2.112	2.117	2.104		*n*
	2.000	2.022	2.066	2.078	2.082	2.076	2.083	2.080	2.108	2.102	2.122	2.107		12
	2.020	2.011	2.042	2.061	2.074	2.076	2.090	2.120	2.112	2.111	2.113	2.114		
	2.000	2.008	2.058	2.083	2.073	2.077	2.107	2.120	2.101	2.116	2.097	2.117		
	2.000	2.016	2.007	2.080	2.067	2.077	2.091	2.090	2.103	2.111	2.112	2.134		
	2.040	2.029	2.016	2.069	2.080	2.077	2.104	2.110	2.103	2.103	2.121	2.126		
***M* [%]**	**2.008**	**2.020**	**2.037**	**2.074**	**2.076**	**2.076**	**2.094**	**2.095**	**2.103**	**2.109**	**2.114**	**2.117**		**2.077**
s [%]	0.0183	0.0094	0.0229	0.0081	0.0056	0.0007	0.0094	0.0274	0.0075	0.0053	0.0091	0.0114	s_M [%]	0.0367
													$\bar{s}_i$ [%]	0.0135
s_{rel}	0.00914	0.00467	0.01125	0.00390	0.00270	0.00034	0.00451	0.01307	0.00355	0.00253	0.00431	0.00539		0.01767

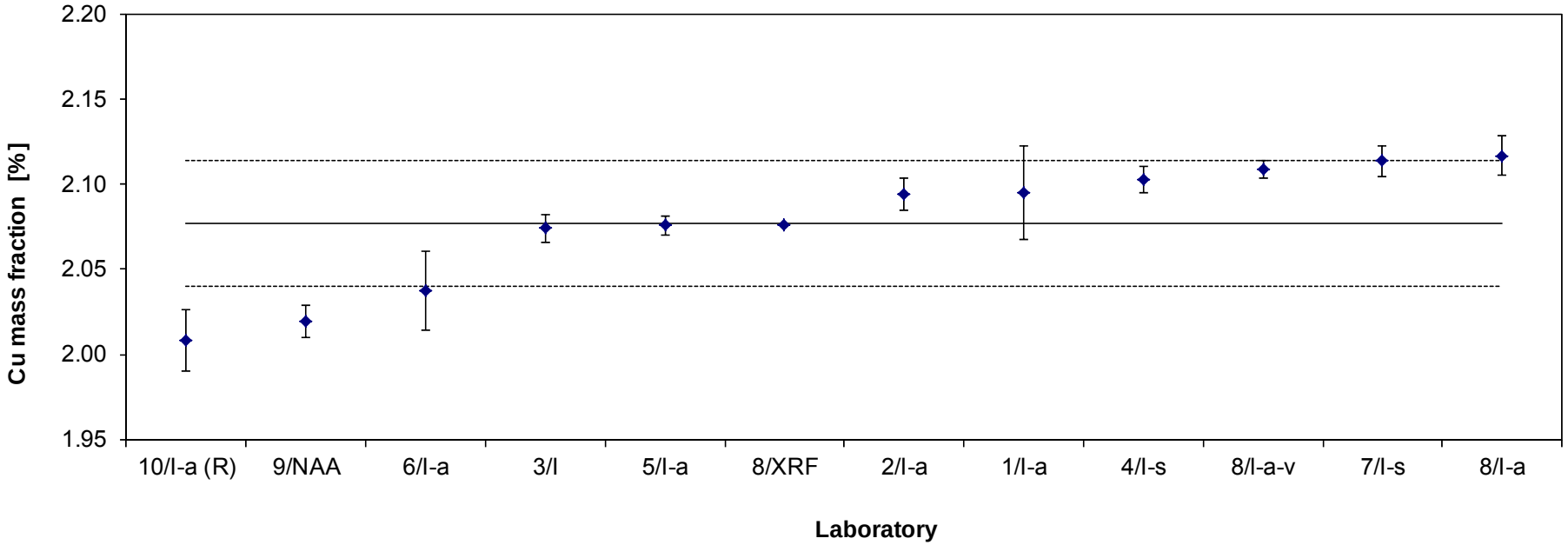

Table 5: Results for Cu

Lab./Meth.	7/I-s	9/NAA	10/I-a (R)	6/I-a	3/I	5/I-a	4/I-s (R)	2/I-a	8/XRF	1/I-a	8/I-a	8/I-a-v		
M_i [%]	0.3959	0.4110	0.4010	0.4065	0.4035	0.4048	0.4063	0.4059	0.4064	0.4160	0.4092	0.4158		*n*
	0.3934	0.3840	0.3990	0.4056	0.4022	0.4022	0.4064	0.4049	0.4070	0.4090	0.4102	0.4150		12
	0.3953	0.3880	0.3970	0.4014	0.4025	0.4039	0.4083	0.4050	0.4064	0.4050	0.4082	0.4152		
	0.3930	0.3990	0.4060	0.4041	0.4026	0.4044	0.4044	0.4097	0.4069	0.4100	0.4079	0.4146		
	0.3927	0.3960	0.3980	0.3972	0.4033	0.4032	0.4035	0.4072	0.4066	0.4020	0.4131	0.4147		
	0.3962	0.3980	0.4050	0.3970	0.4017	0.4046	0.4017	0.4081	0.4078	0.4070	0.4115	0.4153		
M [%]	**0.3944**	**0.3960**	**0.4010**	**0.4020**	**0.4026**	**0.4039**	**0.4051**	**0.4068**	**0.4069**	**0.4082**	**0.4100**	**0.4151**		**0.4043**
s [%]	0.0016	0.0094	0.0037	0.0041	0.0007	0.0010	0.0024	0.0019	0.0005	0.0048	0.0020	0.0004	s_M [%]	0.0057
													$\bar{s}_i$ [%]	0.0037
s_{rel}	0.00395	0.02385	0.00933	0.01032	0.00167	0.00246	0.00584	0.00465	0.00130	0.01174	0.00490	0.00107		0.01422

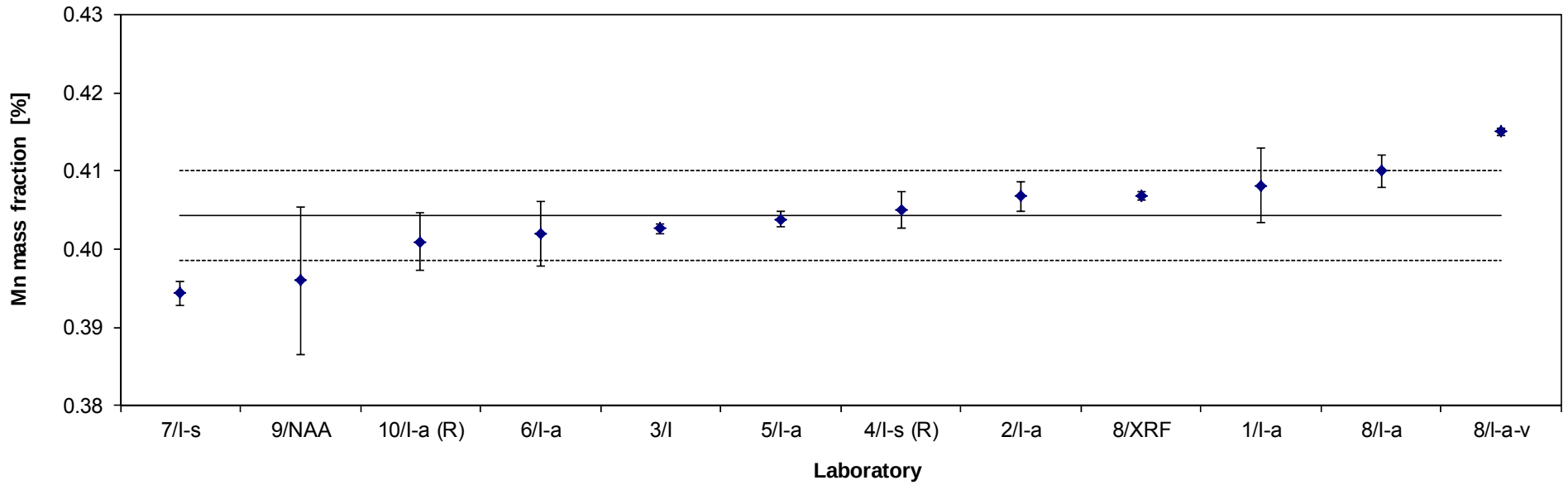

Table 6: Results for Mn

Lab./Meth.	9/I-s	6/I-a	5/I-a	1/I-a	3/I	4/I-s	8/I-s	8/XRF	7/I-s	2/I-a	10/I-a (R)		
M_i [%]	0.182	0.193	0.193	0.196	0.194	0.194	0.198	0.198	0.209	0.200	0.205		*n*
	0.188	0.195	0.193	0.191	0.194	0.197	0.198	0.199	0.197	0.201	0.203		11
	0.196	0.193	0.192	0.193	0.194	0.198	0.195	0.199	0.195	0.200	0.205		
	0.192	0.194	0.191	0.192	0.194	0.192	0.197	0.198	0.196	0.200	0.212		
	0.195	0.188	0.191	0.193	0.194	0.194	0.195	0.199	0.198	0.204	0.203		
	0.189	0.189	0.194	0.193	0.193	0.191	0.197	0.199	0.202	0.204	0.208		
***M* [%]**	**0.1903**	**0.1920**	**0.1921**	**0.1930**	**0.1939**	**0.1940**	**0.1965**	**0.1986**	**0.1995**	**0.2014**	**0.2060**		**0.1961**
s [%]	0.0052	0.0028	0.0011	0.0017	0.0005	0.0026	0.0014	0.0004	0.0051	0.0019	0.0035	s_M [%]	0.0048
												$\bar{s}_i$ [%]	0.0029
s_{rel}	0.02713	0.01470	0.00583	0.00867	0.00276	0.01344	0.00723	0.00206	0.02571	0.00935	0.01682		0.02444

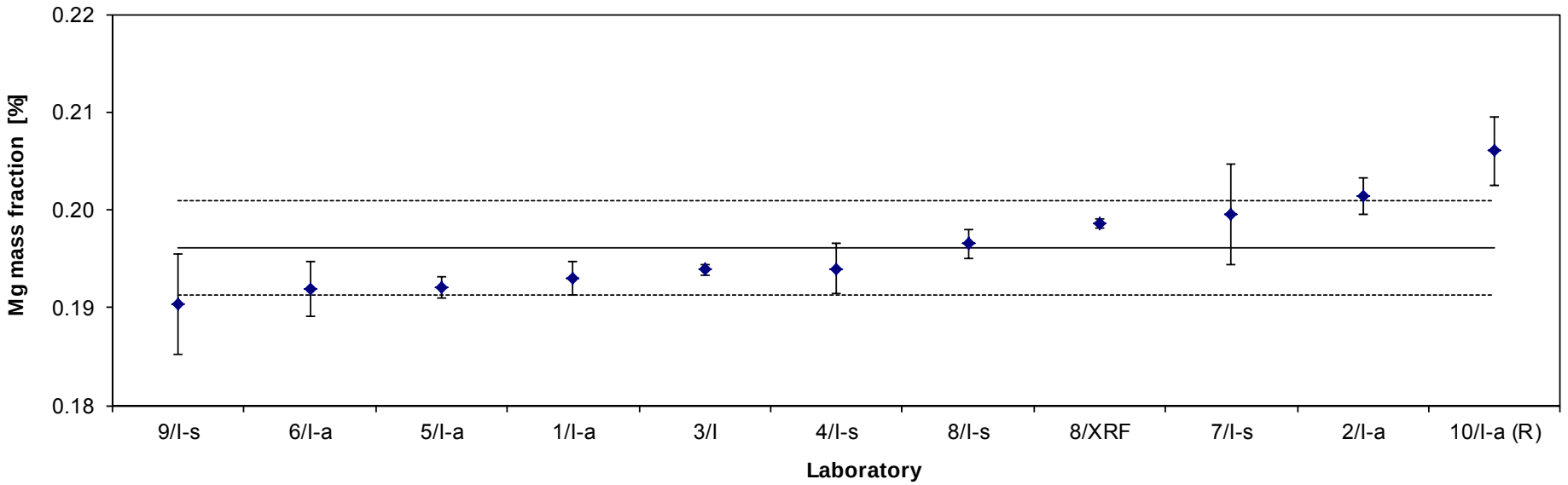

Table 7: Results for Mg

Lab./Meth.	9/I-s	9/NAA	5/I-a	10/I-a (R)	6/I-a	3/I	8/XRF	8/I-a-v	1/I-a	4/I-s	2/I-a	7/I-s (R)	8/I-a		
M_i [%]	[0.0528]	0.0558	0.0558	0.0568	0.0564	0.0571	0.0575	0.0574	0.0589	0.0580	0.0582	0.0582	0.0600		*n*
	0.0546	0.0556	0.0565	0.0563	0.0568	0.0569	0.0575	0.0576	0.0576	0.0584	0.0581	0.0591	0.0598		13
	0.0568	0.0562	0.0572	0.0560	0.0565	0.0566	0.0573	0.0574	0.0576	0.0581	0.0581	0.0604	0.0595		
	0.0556	0.0558	0.0555	0.0562	0.0569	0.0571	0.0572	0.0574	0.0577	0.0577	0.0585	0.0592	0.0604		
	0.0567	0.0562	0.0559	0.0561	0.0557	0.0573	0.0574	0.0572	0.0576	0.0586	0.0584	0.0620	0.0604		
	0.0552	0.0562	0.0569	0.0569	0.0562	0.0571	0.0573	0.0576	0.0579	0.0580	0.0583	0.0591	0.0603		
***M* [%]**	**0.0558**	**0.0560**	**0.0563**	**0.0564**	**0.0564**	**0.0570**	**0.0574**	**0.0574**	**0.0579**	**0.0581**	**0.0582**	**0.0597**	**0.0601**		**0.0574**
s [%]	0.0010	0.0003	0.0007	0.0004	0.0004	0.0002	0.0001	0.0001	0.0005	0.0003	0.0002	0.0013	0.0004	s_M [%]	0.0013
														$\bar{s}_i$ [%]	0.0006
s_{rel}	0.01712	0.00475	0.01194	0.00668	0.00772	0.00421	0.00211	0.00245	0.00884	0.00526	0.00288	0.02248	0.00611		0.02345

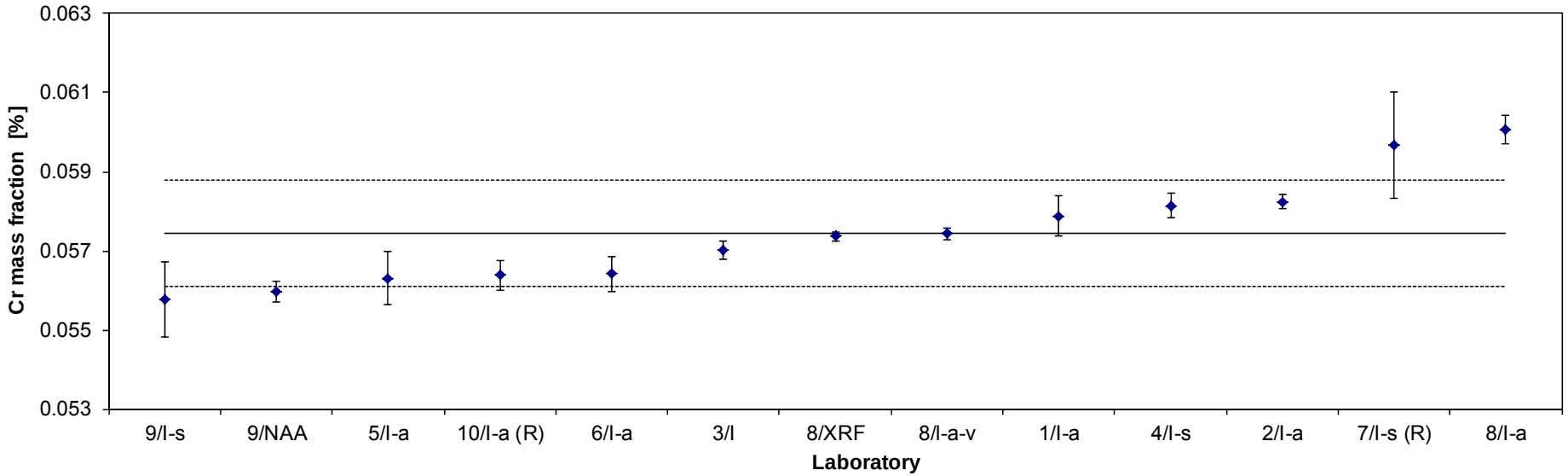

Table 8: Results for Cr

Lab./Meth.	9/NAA	6/l-a	3/l	4/l-s	2/l-a	1/l-a	7/l-s (R)	8/XRF	8/l-a	8/l-a-v	5/l-a	10/l-a	9/l-a		
M_i [%]	0.210	0.2298	0.2387	0.2399	0.2373	0.2440	0.2353	0.2415	0.2478	0.2477	0.2493	0.2580	0.2550		*n*
	0.220	0.2323	0.2372	0.2407	0.2378	0.2390	0.2380	0.2415	0.2480	0.2482	0.2497	0.2460	0.2540		13
	0.220	0.2305	0.2374	0.2377	0.2383	0.2400	0.2434	0.2414	0.2464	0.2474	0.2497	0.2540	0.2520		
	0.230	0.2325	0.2374	0.2390	0.2414	0.2380	0.2386	0.2416	0.2457	0.2471	0.2488	0.2480	0.2580		
	0.240	0.2280	0.2378	0.2387	0.2407	0.2400	0.2398	0.2414	0.2496	0.2488	0.2482	0.2480	0.2460		
	0.240	0.2302	0.2370	0.2379	0.2409	0.2400	0.2485	0.2414	0.2492	0.2489	0.2499	0.2550	0.2480		
***M* [%]**	**0.2267**	**0.2306**	**0.2376**	**0.2390**	**0.2394**	**0.2402**	**0.2406**	**0.2415**	**0.2478**	**0.2480**	**0.2493**	**0.2515**	**0.2522**		**0.2419**
s [%]	0.0121	0.0017	0.0006	0.0012	0.0018	0.0020	0.0047	0.0001	0.0015	0.0007	0.0007	0.0048	0.0045	s_M [%]	0.0078
														$\bar{s}_i$ [%]	0.0042
s_{rel}	0.05343	0.00727	0.00256	0.00484	0.00750	0.00850	0.01947	0.00034	0.00615	0.00297	0.00262	0.01911	0.01781		0.03209

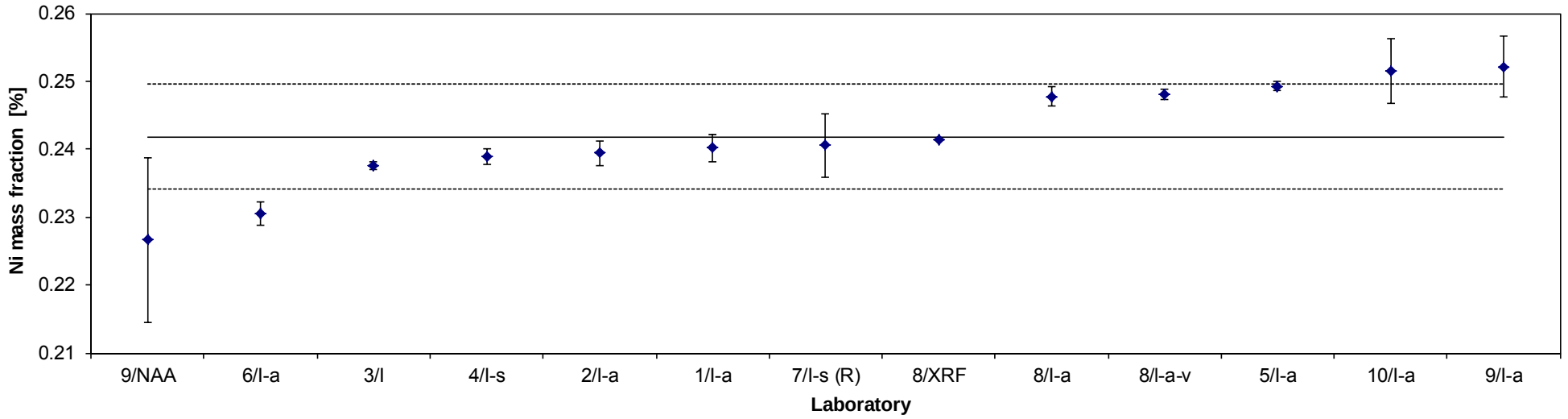

Table 9: Results for Ni

Lab./Meth.	8/XRF	4/I-s	9/NAA	5/I-a	1/I-a	6/I-a	3/I	10/I-a	8/I-a-v	2/I-a	8/I-a	7/I-s (R)		
M_i [%]	1.074	1.085	1.058	1.097	1.070	1.1080	1.114	1.110	1.122	1.124	1.162	1.208		*n*
	1.074	1.092	1.056	1.093	1.100	1.1146	1.115	1.110	1.109	1.118	1.162	1.236		10
	1.073	1.079	1.068	1.095	1.100	1.1138	1.115	1.120	1.113	1.117	1.161	1.179		
	1.073	1.065	1.098	1.095	1.100	1.1154	1.119	1.110	1.118	1.124	1.166	1.221		
	1.074	1.069	1.102	1.095	1.110	1.0930	1.112	1.120	1.124	1.125	1.169	1.170		
	1.074	1.054	1.102	1.097	1.100	1.0981	1.109	1.120	1.133	1.124	1.173	1.228		
***M* [%]**	**1.074**	**1.074**	**1.081**	**1.095**	**1.097**	**1.107**	**1.114**	**1.115**	**1.120**	**1.122**	**1.165**	**1.207**		**1.100**
s [%]	0.0004	0.0140	0.0223	0.0015	0.0137	0.0095	0.0033	0.0055	0.0084	0.0034	0.0045	0.0270	s_M [%]	0.0187
													$\bar{s}_i$ [%]	0.0105
s_{rel}	0.00036	0.01301	0.02059	0.00139	0.01246	0.00857	0.00300	0.00491	0.00753	0.00304	0.00387	0.02233		0.01697

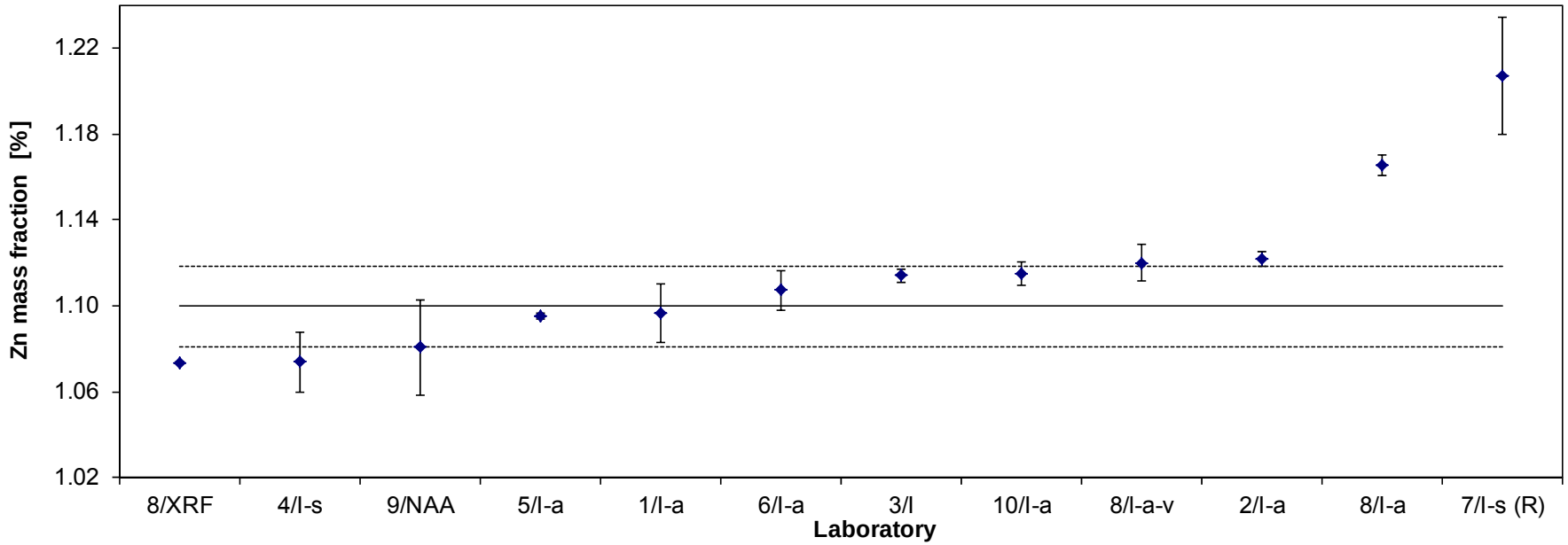

Table 10: Results for Zn

Lab./Meth.	3/I	6/I-a	10/I-a	1/I-a	8/XRF	2/I-a	5/I-a	8/I-a	4/I-s	7/I-s (R)		
M_i [%]	0.1847	0.1843	0.1850	0.1900	0.1883	0.1899	0.1893	0.1905	0.1920	0.1900		*n*
	0.1841	0.1870	0.1840	0.1860	0.1886	0.1894	0.1894	0.1905	0.1905	0.1940		10
	0.1837	0.1854	0.1850	0.1860	0.1882	0.1893	0.1892	0.1900	0.1922	0.1933		
	0.1852	0.1866	0.1850	0.1860	0.1876	0.1896	0.1892	0.1915	0.1904	0.1936		
	0.1847	0.1823	0.1850	0.1840	0.1885	0.1891	0.1891	0.1920	0.1923	0.1949		
	0.1849	0.1838	0.1860	0.1860	0.1875	0.1889	0.1902	0.1928	0.1911	0.1955		
***M* [%]**	**0.1846**	**0.1849**	**0.1850**	**0.1863**	**0.1881**	**0.1894**	**0.1894**	**0.1912**	**0.1914**	**0.1936**		**0.1884**
s [%]	0.0006	0.0018	0.0006	0.0020	0.0005	0.0004	0.0004	0.0011	0.0009	0.0019	s_M [%]	0.0031
											$\bar{s}_i$ [%]	0.0012
s_{rel}	0.00298	0.00964	0.00342	0.01055	0.00246	0.00188	0.00214	0.00559	0.00450	0.00994		0.01664

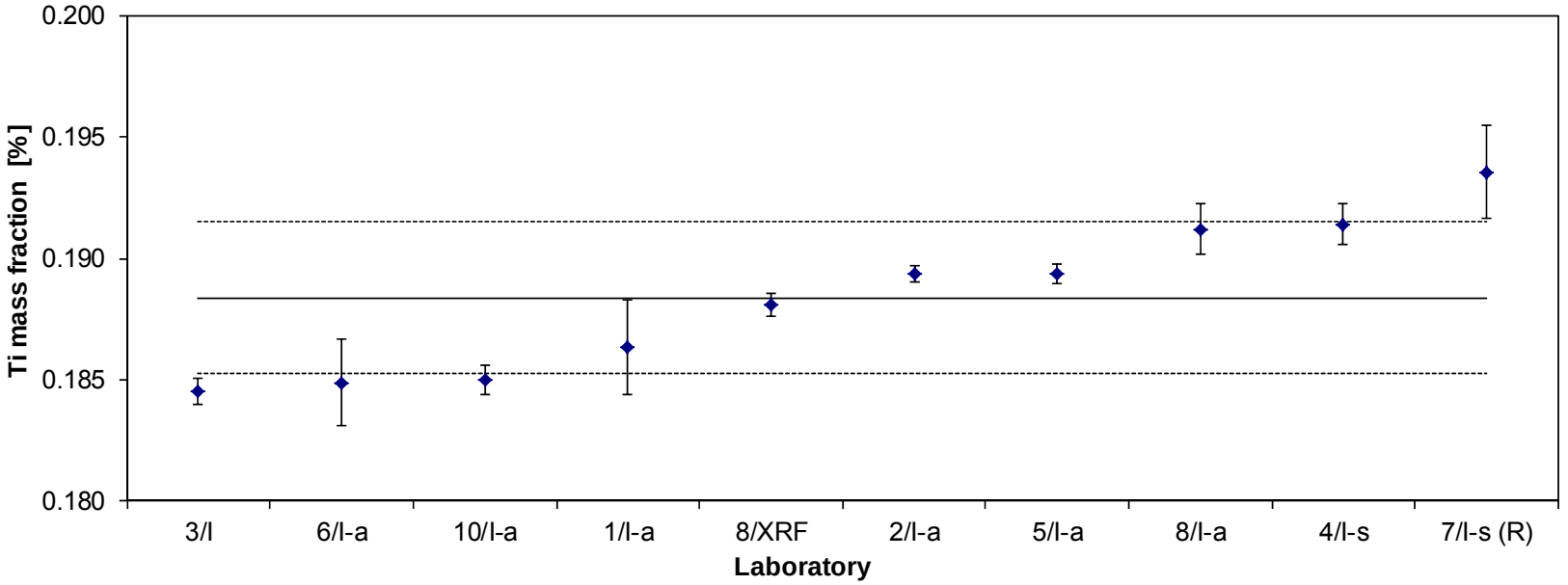

Table 11: Results for Ti

Lab./Meth.	1/l-a	2/l-s	7/l-s (R)	4/l-s	10/l-a	5/l-a	8/l-s	3/l	6/l-a	8/XRF		
M_i [%]	0.175	0.176	0.167	0.179	0.183	0.196	0.200	0.203	0.201	0.211		*n*
	0.174	0.174	0.184	0.179	0.183	0.193	0.200	0.202	0.203	0.211		10
	0.171	0.175	0.179	0.177	0.183	0.195	0.196	0.202	0.200	0.211		
	0.175	0.178	0.186	0.179	0.183	0.191	0.200	0.201	0.205	0.211		
	0.169	0.176	0.171	0.177	0.183	0.196	0.198	0.200	0.200	0.211		
	0.173	0.176	0.170	0.177	0.184	0.191	0.201	0.199	0.200	0.211		
***M* [%]**	**0.173**	**0.176**	**0.176**	**0.178**	**0.183**	**0.194**	**0.199**	**0.201**	**0.201**	**0.211**		**0.189**
s [%]	0.002	0.001	0.008	0.001	0.000	0.002	0.002	0.001	0.002	0.000	s_M [%]	0.0136
											$\bar{s}_i$ [%]	0.0029
s_{rel}	0.014	0.007	0.045	0.005	0.002	0.011	0.008	0.007	0.010	0.000		0.0721

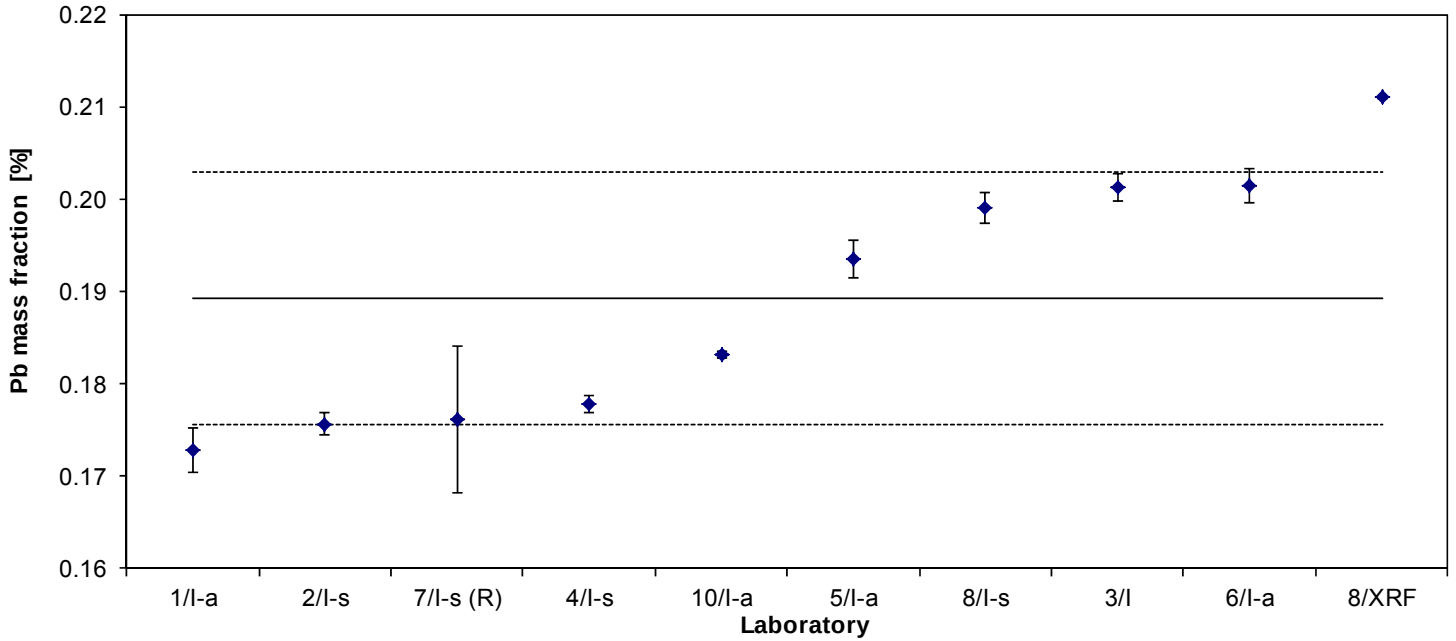

Table 12: Results for Pb

Lab./Meth.	8/XRF	6/I-a	7/I-s	9/I-a	10/I-a (R)	3/I	8/I-a	5/I-a	1/I-a	4/I-s	2/I-a		
M_i [%]	0.195	0.198	0.201	0.196	0.201	0.202	0.200	0.203	0.208	0.205	0.204		*n*
	0.195	0.198	0.214	0.199	0.200	0.200	0.201	0.202	0.206	0.206	0.204		11
	0.194	0.200	0.197	0.200	0.201	0.200	0.201	0.201	0.202	0.204	0.205		
	0.195	0.201	0.197	0.201	0.198	0.201	0.201	0.200	0.206	0.205	0.208		
	0.195	0.196	0.200	0.201	0.202	0.201	0.203	0.202	0.201	0.205	0.207		
	0.195	0.195	0.191	0.202	0.200	0.200	0.202	0.200	0.204	0.204	0.207		
***M* [%]**	**0.195**	**0.198**	**0.200**	**0.200**	**0.200**	**0.201**	**0.201**	**0.201**	**0.205**	**0.205**	**0.206**		**0.201**
s [%]	0.000	0.002	0.008	0.002	0.001	0.001	0.001	0.001	0.003	0.001	0.002	s_M [mg/kg]	0.0032
												$\bar{s}_i$ [mg/kg]	0.0028
s_{rel}	0.001	0.011	0.039	0.011	0.007	0.004	0.005	0.006	0.013	0.004	0.008		0.0160

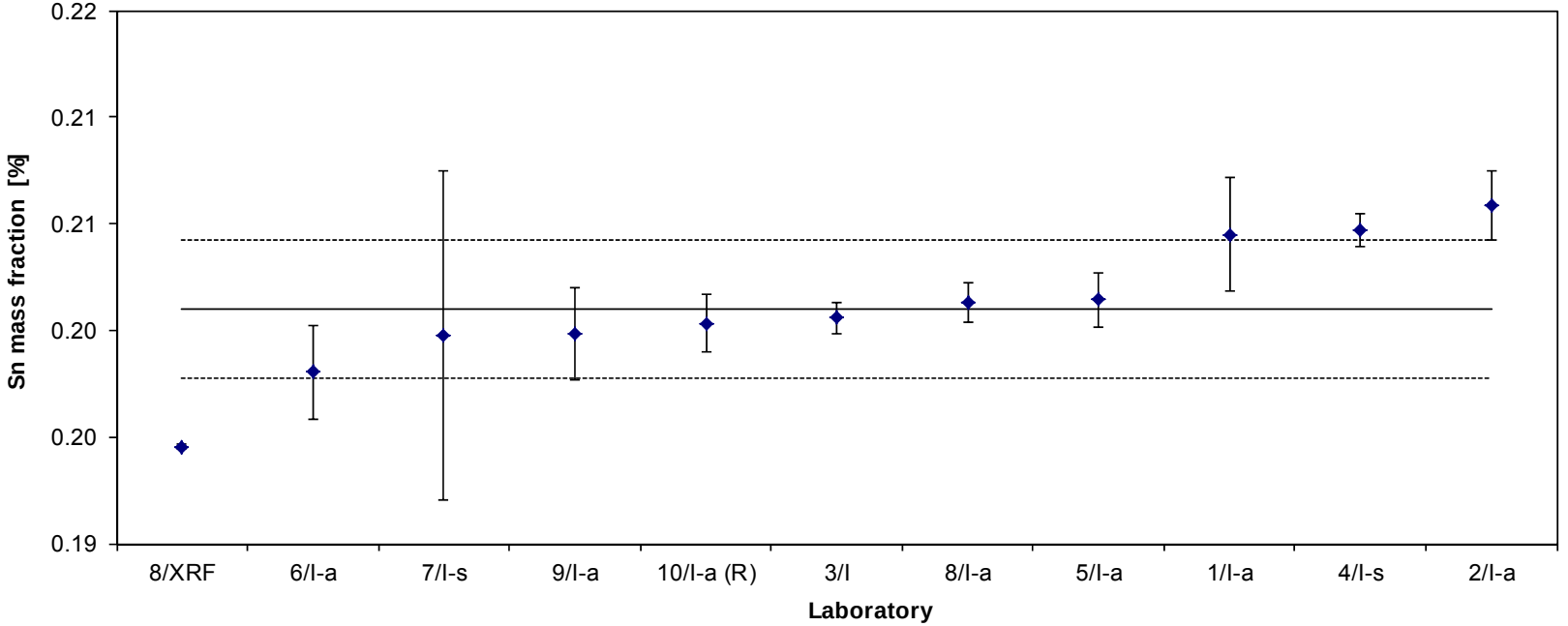

Table 13: Results for Sn

Lab./Meth.	4/I-s	6/I-s	1/I-s	9/NAA	2/IMS-s	3/I		
M_i [mg/kg]	21.1	31.3	27.0	28.6	29.9	35.1		*n*
	22.7	25.1	26.0	28.2	30.0	31.4		6
	22.0	26.3	26.0	28.4	29.8	35.5		
	21.0	26.0	26.0	27.9	29.6	35.5		
	20.7	23.4	26.0	27.8	29.8	35.6		
	21.1	24.3	26.0	27.6	29.7	35.6		
***M* [mg/kg]**	**21.43**	**26.03**	**26.17**	**28.08**	**29.79**	**34.78**		**27.71**
s [mg/kg]	0.752	2.771	0.408	0.382	0.158	1.668	s_M [mg/kg]	4.453
							$\bar{s}_i$ [mg/kg]	1.376
s_{rel}	0.035	0.106	0.016	0.014	0.005	0.048		0.161

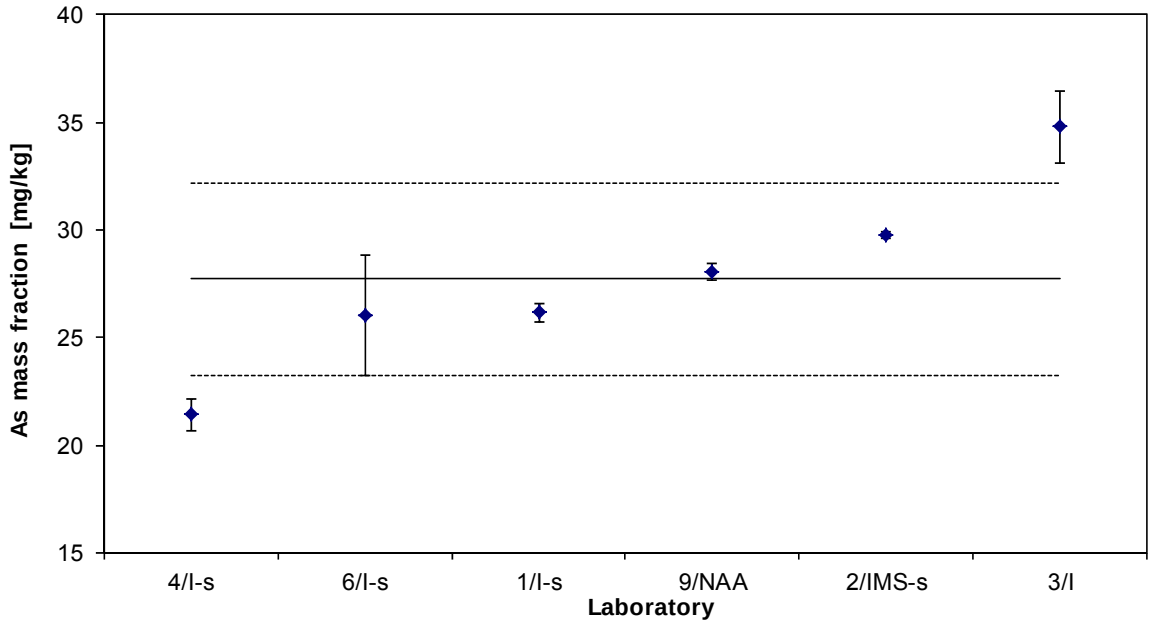

Table 14: Results for As

Lab./Meth.	8/I-s	1/I-s (R)	2/I-s(R)	4/I-s	3/I	5/I-a	6/I-a	10/I-a		
M_i [mg/kg]	3.7	4.2	4.5	4.5	4.8	4.8	4.9	4.9		*n*
	3.6	4.2	4.5	4.6	4.8	4.8	4.9	4.9		7
	3.7	4.2	4.4	4.6	4.7	4.8	4.9	4.9		
	3.6	4.3	4.4	4.6	4.7	4.8	4.9	4.9		
	3.7	4.2	4.5	4.5	4.7	4.8	4.8	4.9		
	3.6	4.0	4.5	4.5	4.7	4.8	4.8	4.9		
***M* [mg/kg]**	**3.63**	**4.18**	**4.46**	**4.55**	**4.74**	**4.80**	**4.89**	**4.90**		**4.65**
s [mg/kg]	0.033	0.098	0.041	0.034	0.025	0.000	0.057	0.000	s_M [mg/kg]	0.263
									$\bar{s}_i$ [mg/kg]	0.048
s_{rel}	0.009	0.024	0.009	0.007	0.005	0.000	0.012	0.000		0.057

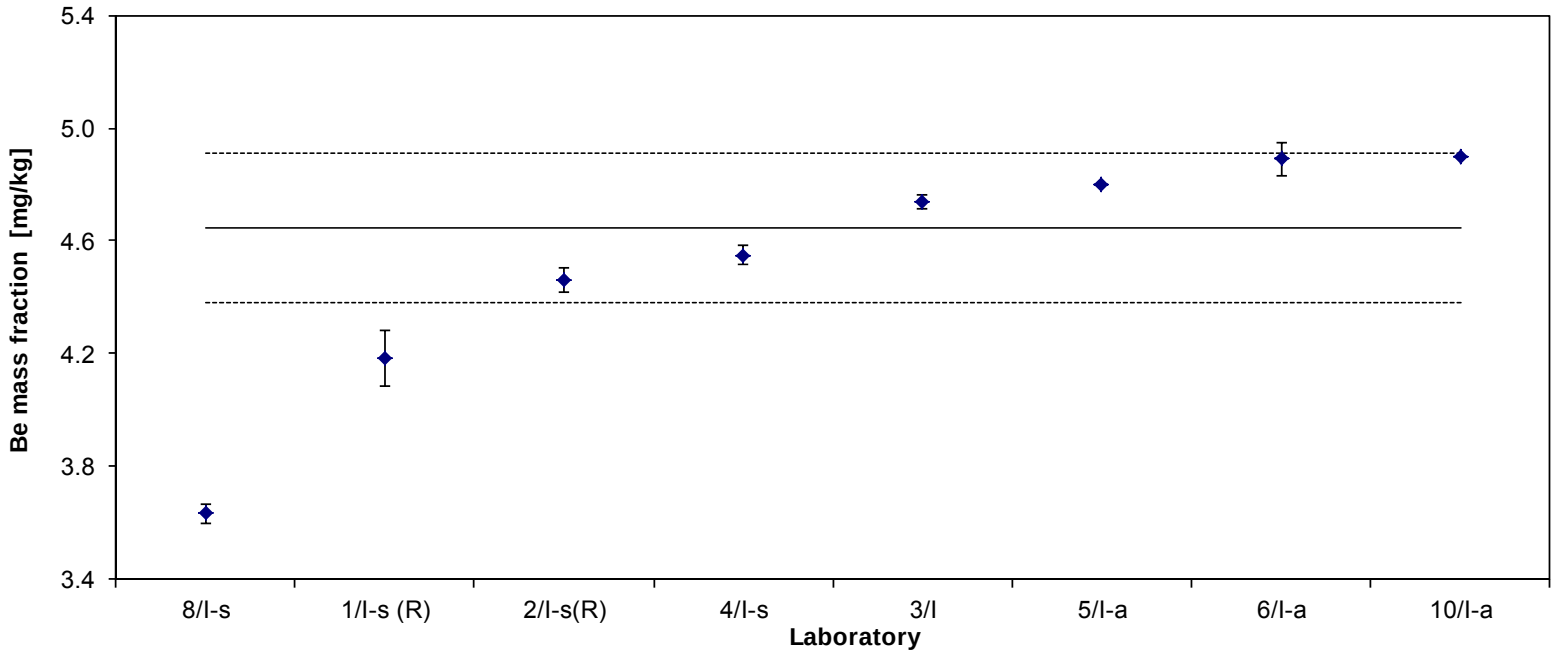

Table 15: Results for Be

Lab./Meth.	7/I-s	10/I-a	1/I-a	3/I	4/I-s	5/I-a	2/IMS-s	8/I-a	6/I-a		
M_i [mg/kg]	83.0	89.2	89.0	92.7	92.2	94.7	96.8	96.4	101.8		*n*
	83.6	87.8	89.0	90.3	94.5	92.7	96.0	104.6	121.4		9
	92.1	88.0	89.0	92.5	88.8	94.8	96.3	107.1	85.0		
	89.3	88.0	90.0	92.1	92.5	93.5	94.5	102.4	91.8		
	90.1	87.3	90.0	91.3	92.3	94.3	95.1	96.2	117.8		
	82.1	89.8	85.0	91.2	90.9	92.4	94.5	103.9	97.9		
***M* [mg/kg]**	**86.70**	**88.35**	**88.67**	**91.68**	**91.88**	**93.73**	**95.54**	**101.77**	**102.60**		**92.29**
s [mg/kg]	4.285	0.946	1.862	0.913	1.887	1.029	0.967	4.481	14.388	s_M [mg/kg]	4.825
										$\bar{s}_i$ [mg/kg]	2.480
s_{rel}	0.049	0.011	0.021	0.010	0.021	0.011	0.010	0.044	0.140		0.052

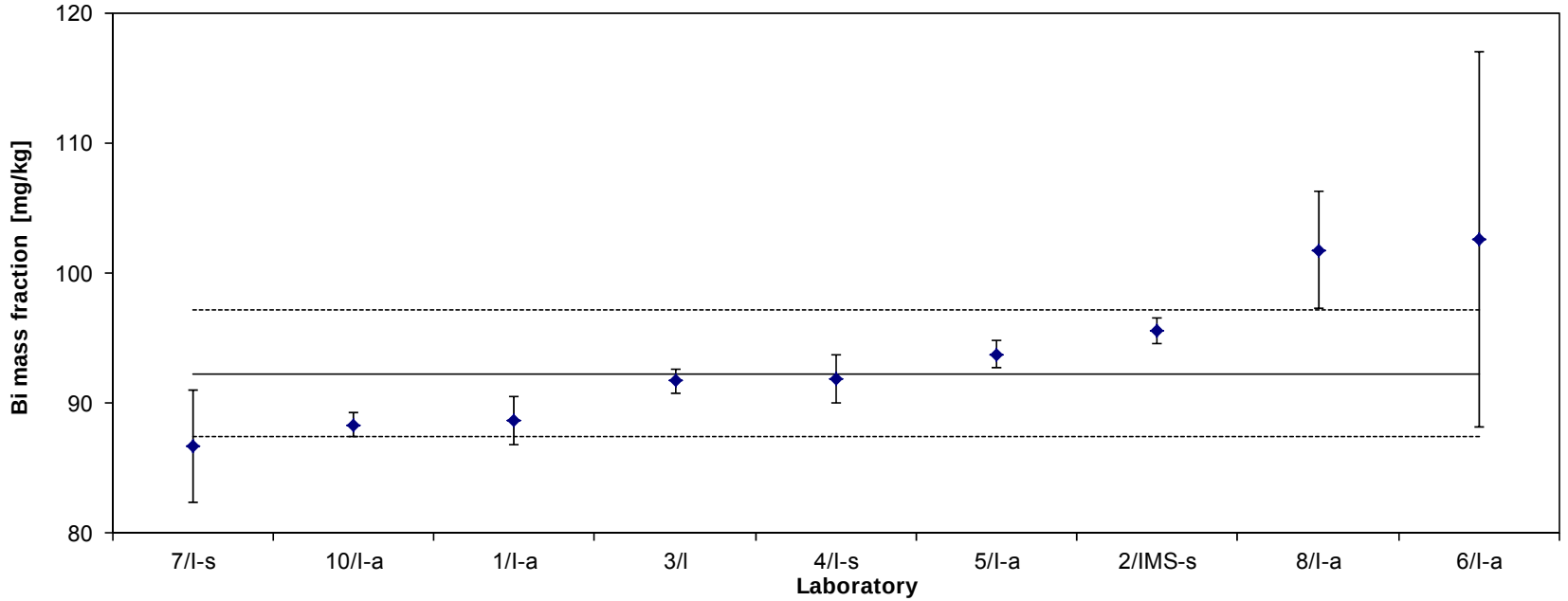

Table 16: Results for Bi

Lab./Meth.	4/I-s (R)	9/NAA	5/I-a	1/I-s	8/I-a	3/I	7/I-s	6/I-a	9/EA	2/IMS-s	10/I-a (R)		
M_i [mg/kg]	4.0	4.8	4.4	5.00	5.1	5.63	5.7	6.0	6.37	5.94	6.40		*n*
	4.0	3.4	4.5	5.00	5.1	5.45	5.5	5.6	5.86	5.96	6.40		11
	3.0	[2,8]	4.5	5.00	5.2	5.39	5.6	5.6	5.99	5.93	6.10		
	4.0	3.8	4.4	5.00	5.2	5.39	5.5	5.7	5.92	6.29	6.00		
	4.0	4.1	4.3	5.00	5.1	5.44	5.7	5.6	5.90	6.18	7.10		
	4.0	3.6	4.5	5.00	5.1	5.33	5.5	5.6	5.87	6.28	7.30		
***M* [mg/kg]**	**3.83**	**3.94**	**4.43**	**5.00**	**5.13**	**5.44**	**5.59**	**5.67**	**5.98**	**6.10**	**6.55**		**5.24**
s [mg/kg]	0.408	0.546	0.082	0.000	0.063	0.103	0.091	0.164	0.192	0.173	0.532	s_M [mg/kg]	0.880
												$\bar{s}_i$ [mg/kg]	0.281
s_{rel}	0.106	0.139	0.018	0.000	0.012	0.019	0.016	0.029	0.032	0.028	0.081		0.168

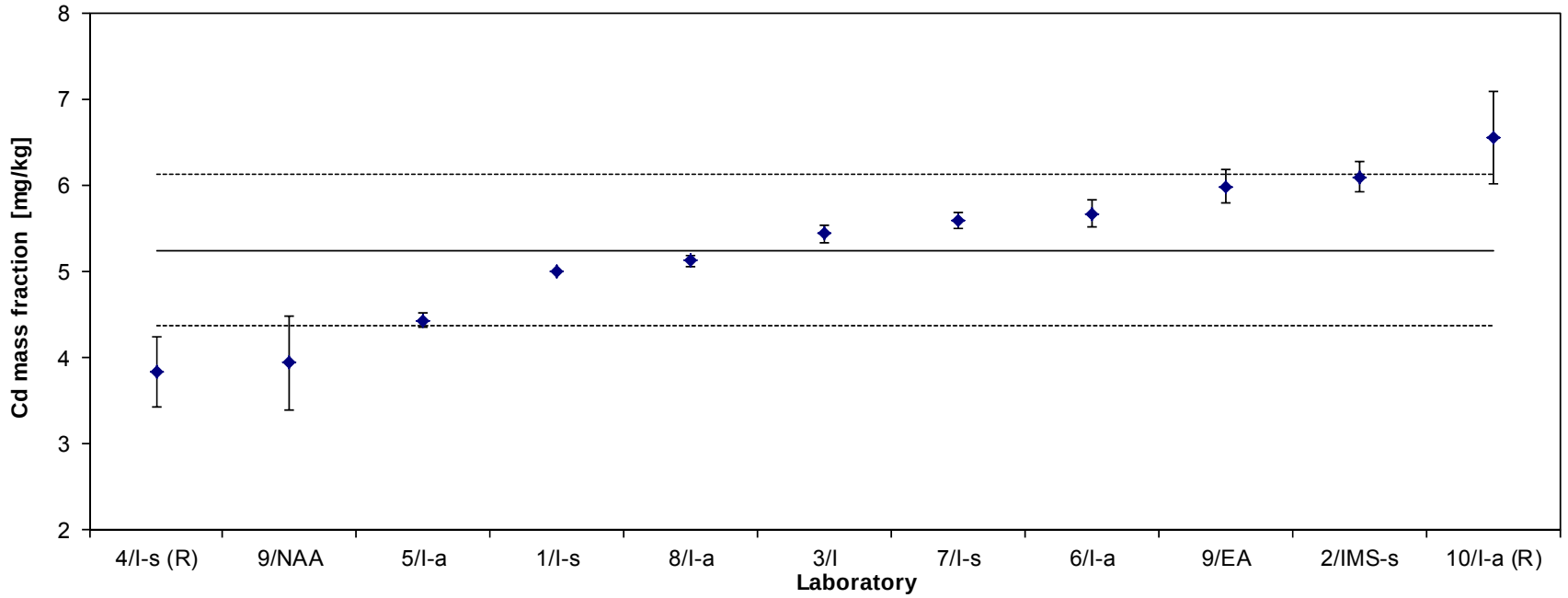

Table 17: Results for Cd

Lab./Meth.	9/I-s	4/I-s	9/NAA	2/IMS-s	3/I	6/I-a	7/I-s	5/I-s	1/I-a (R)	8/I-a	10/I-a		
M_i [mg/kg]	68.0	70.1	72.0	72.1	73.3	72.9	74.3	75.0	75.0	77.2	77.5		*n*
	70.0	71.8	71.7	72.0	73.5	74.2	74.8	74.7	73.7	77.4	77.3		11
	70.0	71.1	72.7	72.5	73.1	73.5	74.9	74.7	75.2	76.4	77.7		
	68.0	70.4	72.0	71.7	73.1	74.6	73.5	74.2	76.5	76.4	78.1		
	70.0	70.5	72.5	74.3	72.3	73.2	73.5	74.1	74.4	77.2	78.2		
		70.6	72.6	72.9	73.1	74.3	73.5	74.7	76.7	77.9	78.5		
***M* [mg/kg]**	**69.20**	**70.75**	**72.25**	**72.57**	**73.07**	**73.77**	**74.08**	**74.57**	**75.25**	**77.07**	**77.88**		**73.68**
s [mg/kg]	1.095	0.608	0.404	0.929	0.408	0.692	0.684	0.344	1.171	0.591	0.458	s_M [mg/kg]	2.548
												$\bar{s}_i$ [mg/kg]	0.723
s_{rel}	0.016	0.009	0.006	0.013	0.006	0.009	0.009	0.005	0.016	0.008	0.006		0.035

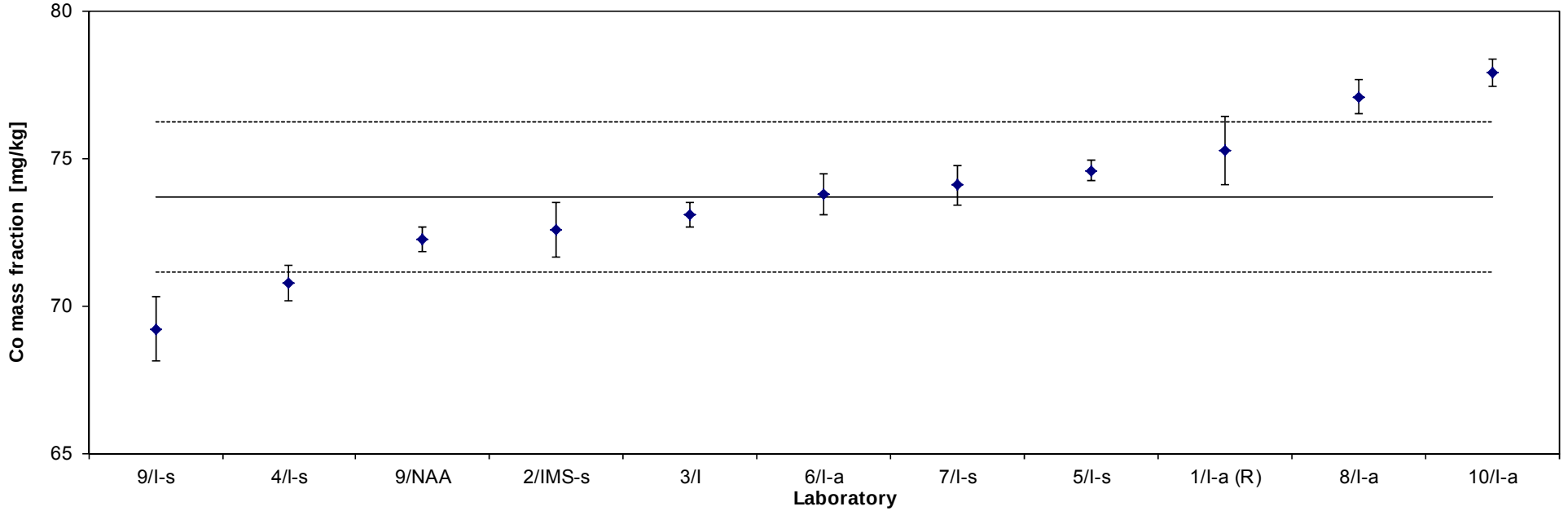

Table 18: Results for Co

Lab./Meth.	10/I-a (R)	9/NAA	3/I	2/IMS-s	1/I-a	6/I-a	4/I-s	5/I-a	8/I-a	9/I-s		
M_i [mg/kg]	147.0	160.1	159.0	161.9	165.0	164.0	164.4	166.4	168.4	170.0		*n*
	140.0	160.5	160.0	161.9	162.0	164.6	166.6	165.9	170.2	174.0		9
	144.0	158.0	160.0	163.2	163.0	165.3	166.5	167.1	170.3	174.0		
	141.0	159.8	161.0	161.8	162.0	164.5	165.9	164.6	167.9	172.0		
	151.0	156.8	160.0	160.5	162.0	160.0	163.7	166.5	170.8	169.0		
	136.0	159.1	161.0	160.4	162.0	159.5	164.9	167.0	170.9			
***M* [mg/kg]**	**143.2**	**159.1**	**160.2**	**161.6**	**162.7**	**163.0**	**165.3**	**166.3**	**169.7**	**171.8**		**164.4**
s [mg/kg]	5.345	1.410	0.753	1.040	1.211	2.533	1.184	0.918	1.282	2.280	s_M [mg/kg]	4.282
											$\bar{s}_i$ [mg/kg]	1.513
s_{rel}	0.037	0.009	0.005	0.006	0.007	0.016	0.007	0.006	0.008	0.013		0.026

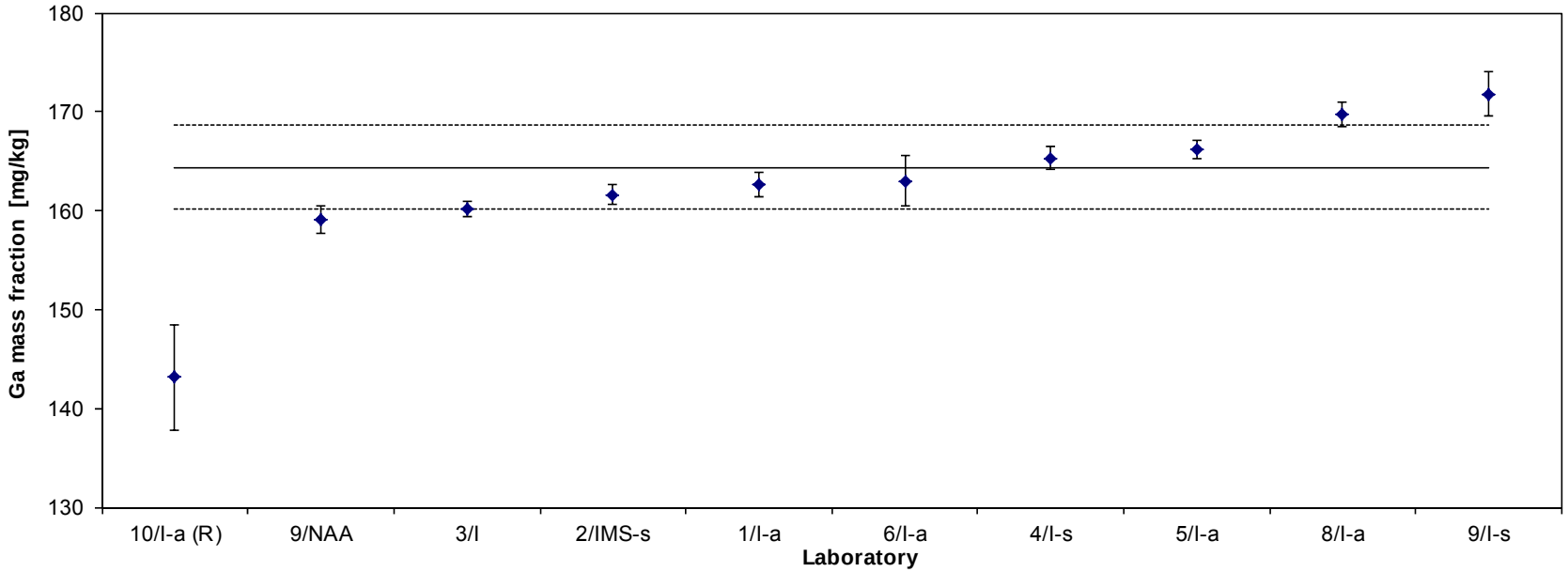

Table 19: Results for Ga

Lab./Meth.	5/I-a	7/I-s (R)	4/I-s	3/I	6/I-a	9/NAA	2/IMS-s	8/I-a	1/I-s		
M_i [mg/kg]	91.6	97.7	96.3	99.7	101.4	106.3	106.9	109.8	108.0		*n*
	90.7	92.5	98.3	100.7	106.1	106.3	106.6	108.7	113.0		9
	91.7	96.6	96.2	101.2	97.7	107.6	106.4	108.6	110.0		
	88.8	95.9	97.1	103.4	105.5	106.3	107.9	112.0	110.0		
	88.8	94.2	96.7	103.3	102.1	106.5	107.9	112.3	111.0		
	89.3	92.6	96.3		101.5	106.7	106.3	111.5	112.0		
***M* [mg/kg]**	**90.2**	**94.9**	**96.8**	**101.7**	**102.4**	**106.6**	**107.0**	**110.5**	**110.7**		**102.3**
s [mg/kg]	1.355	2.119	0.794	1.635	3.090	0.508	0.728	1.695	1.751	s_M [mg/kg]	7.160
										$\bar{s}_i$ [mg/kg]	1.697
s_{rel}	0.015	0.022	0.008	0.016	0.030	0.005	0.007	0.015	0.016		0.070

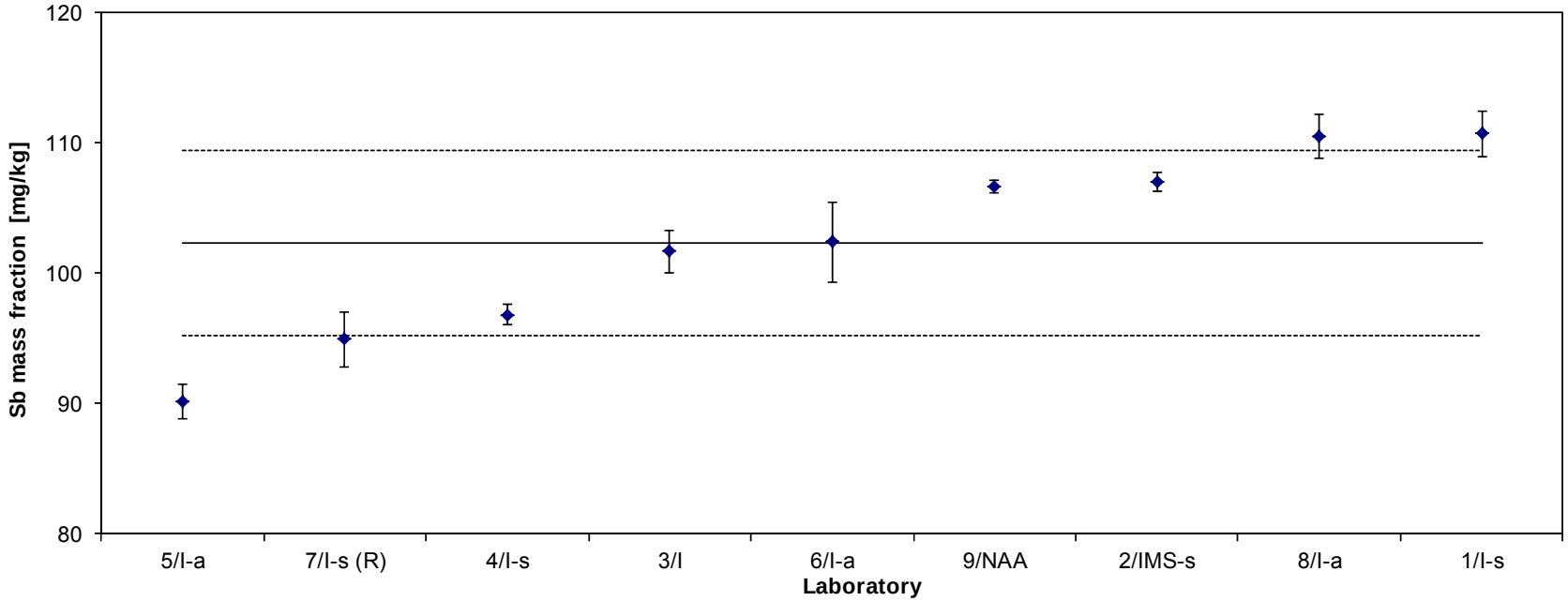

Table 20: Results for Sb

Lab./Meth.	6/l-a	5/l-a	8/XRF	3/l	7/l-s (R)	2/l-s	1/l-a	4/l-s	9/l-s	8/l-s		
M_i [mg/kg]	270.3	275.0	275.3	276.0	282.5	275.5	285.0	280.5	280.0	282.1		*n*
	274.1	274.9	273.9	275.0	274.6	275.5	279.0	282.1	281.0	283.2		9
	271.9	275.3	274.0	276.0	290.3	275.9	277.0	281.0	283.0	278.9		
	274.4	273.4	275.8	276.0	276.0	281.4	279.0	280.2	279.0	282.2		
	267.5	273.3	275.2	276.0	260.6	280.4	276.0	278.0	280.0	280.8		
	267.5	274.6		275.0	275.9	279.9	279.0	280.5		284.1		
***M* [mg/kg]**	**271.0**	**274.4**	**274.8**	**275.7**	**276.7**	**278.1**	**279.2**	**280.4**	**280.6**	**281.9**		**277.3**
s [mg/kg]	3.076	0.857	0.844	0.516	9.832	2.737	3.125	1.347	1.517	1.839	s_M [mg/kg]	3.389
											$\bar{s}_i$ [mg/kg]	3.828
s_{rel}	0.011	0.003	0.003	0.002	0.036	0.010	0.011	0.005	0.005	0.007		0.012

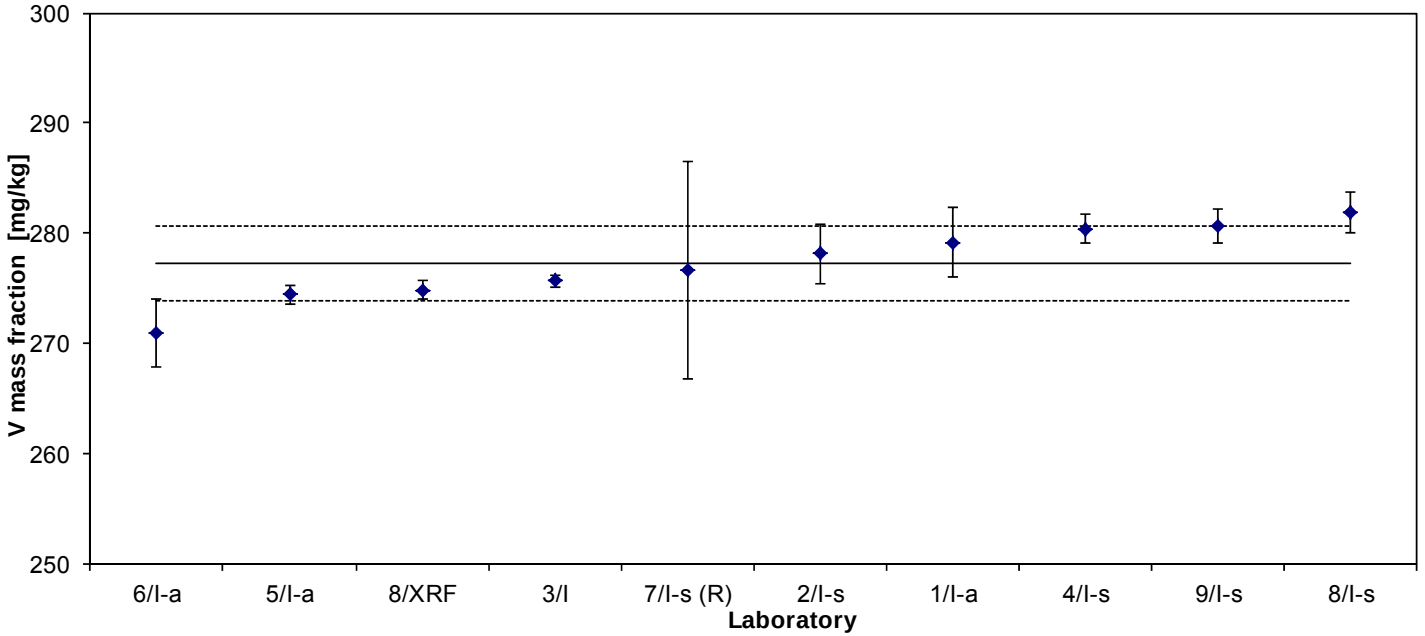

Table 21: Results for V

Lab./Meth.	8/XRF	5/l-a	7/l-s (R)	6/l-a	8/l-a	3/l	1/l-a	4/l-s	2/l-s		
M_i [mg/kg]	97.0	100.0	98.5	97.6	101.6	104.0	106.0	106.4	108.3		*n*
	96.8	100.0	99.6	103.0	103.6	103.0	104.0	106.8	108.3		8
	97.1	100.0	101.9	101.4	104.7	103.0	104.0	106.2	108.2		
	96.9	99.0	99.9	104.2	107.0	104.0	104.0	104.8	105.8		
	97.1	100.0	96.8	104.8	103.7	105.0	103.0	104.8	105.7		
		100.0	102.9	101.9	102.4	104.0	104.0	106.2	105.7		
***M* [mg/kg]**	**97.0**	**99.8**	**99.9**	**102.1**	**103.8**	**103.8**	**104.2**	**105.9**	**107.0**		**102.6**
s [mg/kg]	0.1304	0.4082	2.2291	2.5714	1.8917	0.7528	0.9832	0.8548	1.3903	s_M [mg/kg]	3.2027
										$\bar{s}_i$ [mg/kg]	1.562
s_{rel}	0.00134	0.00409	0.02231	0.02517	0.01822	0.00725	0.00944	0.00807	0.01299		0.03121

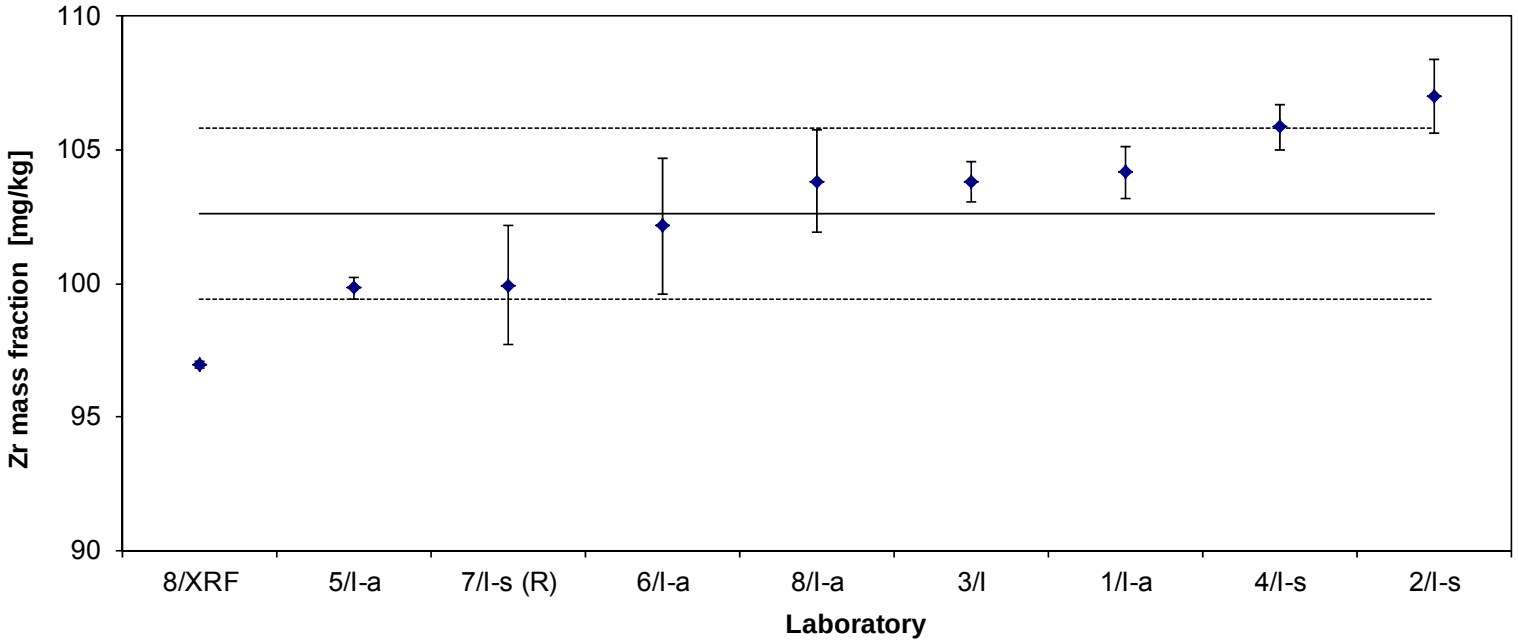

Table 22: Results for Zr

The statistical evaluation of the data was performed using the software program SoftCRM 1.2.2. [6]. The following results were obtained:

Table 23: Outcome of statistical tests of results obtained for Si

Number of data sets	12
Snedecor-F-Test and Bartlett-Test	Pooling not allowed
Dixon (α = 0.05)	---
Dixon (α = 0.01)	---
Nalimov (α = 0.05)	Lab. 8/I-a
Nalimov (α = 0.01)	---
Grubbs (α = 0.05)	---
Grubbs (α = 0.01)	---
Grubbs Pair (α = 0.05)	---
Grubbs Pair (α = 0.01)	---
Cochran	---
Kolmogorov-Smirnov-Lilliefors Test (α = 0.05)	Distribution: normal
Kolmogorov-Smirnov-Lilliefors Test (α = 0.01)	Distribution: normal
Skewness & Kurtosis Test (α = 0.05)	Distribution: normal
Skewness & Kurtosis Test (α = 0.01)	Distribution: normal

The straggler (Lab. 8/I-a) was not removed.

Table 24a: Outcome of statistical tests of results obtained for Fe

Number of data sets	13
Snedecor-F-Test and Bartlett-Test	Pooling not allowed
Dixon (α = 0.05)	Laboratory 7
Dixon (α = 0.01)	Laboratory 7
Nalimov (α = 0.05)	Laboratory 7
Nalimov (α = 0.01)	Laboratory 7
Grubbs (α = 0.05)	Laboratory 7
Grubbs (α = 0.01)	---
Grubbs Pair (α = 0.05)	---
Grubbs Pair (α = 0.01)	---
Cochran	---
Kolmogorov-Smirnov-Lilliefors Test (α = 0.05)	Distribution: normal
Kolmogorov-Smirnov-Lilliefors Test (α = 0.01)	Distribution: normal
Skewness & Kurtosis Test (α = 0.05)	Distribution: not normal
Skewness & Kurtosis Test (α = 0.01)	Distribution: normal

The outlying value (Lab. 7) was removed.

Table 24b: Outcome of statistical tests of results obtained for Fe (after removal of outlier)

Number of data sets	12
Snedecor-F-Test and Bartlett-Test	Pooling not allowed
Dixon (α = 0.05)	---
Dixon (α = 0.01)	---
Nalimov (α = 0.05)	Laboratory 8/I-a
Nalimov (α = 0.01)	---
Grubbs (α = 0.05)	---
Grubbs (α = 0.01)	---
Grubbs Pair (α = 0.05)	---
Grubbs Pair (α = 0.01)	---
Cochran	---
Kolmogorov-Smirnov-Lilliefors Test (α = 0.05)	Distribution: normal
Kolmogorov-Smirnov-Lilliefors Test (α = 0.01)	Distribution: normal
Skewness & Kurtosis Test (α = 0.05)	Distribution: normal
Skewness & Kurtosis Test (α = 0.01)	Distribution: normal

The straggler (Lab. 8/I-a) was not removed.

Table 25: Outcome of statistical tests of results obtained for Cu

Number of data sets	12
Snedecor-F-Test and Bartlett-Test	Pooling not allowed
Dixon (α = 0.05)	---
Dixon (α = 0.01)	---
Nalimov (α = 0.05)	Lab. 10
Nalimov (α = 0.01)	---
Grubbs (α = 0.05)	---
Grubbs (α = 0.01)	---
Grubbs Pair (α = 0.05)	---
Grubbs Pair (α = 0.01)	---
Cochran	---
Kolmogorov-Smirnov-Lilliefors Test (α = 0.05)	Distribution: normal
Kolmogorov-Smirnov-Lilliefors Test (α = 0.01)	Distribution: normal
Skewness & Kurtosis Test (α = 0.05)	Distribution: normal
Skewness & Kurtosis Test (α = 0.01)	Distribution: normal

The straggler (Lab. 10) was not removed.

Table 26: Outcome of statistical tests of results obtained for Mn

Number of data sets	12
Snedecor-F-Test and Bartlett-Test	Pooling not allowed
Dixon (α = 0.05)	---
Dixon (α = 0.01)	---
Nalimov (α = 0.05)	Laboratory 8/I-a-v
Nalimov (α = 0.01)	---
Grubbs (α = 0.05)	---
Grubbs (α = 0.01)	---
Grubbs Pair (α = 0.05)	---
Grubbs Pair (α = 0.01)	---
Cochran	---
Kolmogorov-Smirnov-Lilliefors Test (α = 0.05)	Distribution: normal
Kolmogorov-Smirnov-Lilliefors Test (α = 0.01)	Distribution: normal
Skewness & Kurtosis Test (α = 0.05)	Distribution: normal
Skewness & Kurtosis Test (α = 0.01)	Distribution: normal

The straggler (Lab. 8/I-a-v) was not removed.

Table 27: Outcome of statistical tests of results obtained for Mg

Number of data sets	11
Snedecor-F-Test and Bartlett-Test	Pooling not allowed
Dixon (α = 0.05)	---
Dixon (α = 0.01)	---
Nalimov (α = 0.05)	Lab. 10
Nalimov (α = 0.01)	---
Grubbs (α = 0.05)	---
Grubbs (α = 0.01)	---
Grubbs Pair (α = 0.05)	---
Grubbs Pair (α = 0.01)	---
Cochran	---
Kolmogorov-Smirnov-Lilliefors Test (α = 0.05)	Distribution: normal
Kolmogorov-Smirnov-Lilliefors Test (α = 0.01)	Distribution: normal
Skewness & Kurtosis Test (α = 0.05)	Distribution: normal
Skewness & Kurtosis Test (α = 0.01)	Distribution: normal

The straggler (Lab. 10) was not removed.

Table 28: Outcome of statistical tests of results obtained for Cr

Number of data sets	13
Snedecor-F-Test and Bartlett-Test	Pooling not allowed
Dixon (α = 0.05)	---
Dixon (α = 0.01)	---
Nalimov (α = 0.05)	Lab. 8/I-a
Nalimov (α = 0.01)	---
Grubbs (α = 0.05)	---
Grubbs (α = 0.01)	---
Grubbs Pair (α = 0.05)	---
Grubbs Pair (α = 0.01)	---
Cochran	---
Kolmogorov-Smirnov-Lilliefors Test (α = 0.05)	Distribution: normal
Kolmogorov-Smirnov-Lilliefors Test (α = 0.01)	Distribution: normal
Skewness & Kurtosis Test (α = 0.05)	Distribution: normal
Skewness & Kurtosis Test (α = 0.01)	Distribution: normal

The straggler (Lab. 8/I-a) was not removed.

Table 29: Outcome of statistical tests of results obtained for Ni

Number of data sets	13
Snedecor-F-Test and Bartlett-Test	Pooling not allowed
Dixon (α = 0.05)	---
Dixon (α = 0.01)	---
Nalimov (α = 0.05)	Lab. 9/NAA
Nalimov (α = 0.01)	---
Grubbs (α = 0.05)	---
Grubbs (α = 0.01)	---
Grubbs Pair (α = 0.05)	---
Grubbs Pair (α = 0.01)	---
Cochran	---
Kolmogorov-Smirnov-Lilliefors Test (α = 0.05)	Distribution: normal
Kolmogorov-Smirnov-Lilliefors Test (α = 0.01)	Distribution: normal
Skewness & Kurtosis Test (α = 0.05)	Distribution: normal
Skewness & Kurtosis Test (α = 0.01)	Distribution: normal

The straggler (Lab. 9/NAA) was not removed.

Table 30a: Outcome of statistical tests of results obtained for Zn

Number of data sets	12
Snedecor-F-Test and Bartlett-Test	Pooling not allowed
Dixon (α = 0.05)	Lab. 7
Dixon (α = 0.01)	Lab. 7
Nalimov (α = 0.05)	Lab. 7
Nalimov (α = 0.01)	Lab. 7
Grubbs (α = 0.05)	Lab. 7
Grubbs (α = 0.01)	---
Grubbs Pair (α = 0.05)	Labs. 7 and 8/I-a*
Grubbs Pair (α = 0.01)	Labs. 7 and 8/I-a*
Cochran	---
Kolmogorov-Smirnov-Lilliefors Test (α = 0.05)	Distribution: not normal
Kolmogorov-Smirnov-Lilliefors Test (α = 0.01)	Distribution: normal
Skewness & Kurtosis Test (α = 0.05)	Distribution: not normal
Skewness & Kurtosis Test (α = 0.01)	Distribution: normal

*Laboratories 7 and 8/I-a were detected as Grubbs Pair outliers and removed.

Table 30b: Outcome of statistical tests of results obtained for Zn (after removal of outliers)

Number of data sets	10
Snedecor-F-Test and Bartlett-Test	Pooling not allowed
Dixon (α = 0.05)	---
Dixon (α = 0.01)	---
Nalimov (α = 0.05)	---
Nalimov (α = 0.01)	---
Grubbs (α = 0.05)	---
Grubbs (α = 0.01)	---
Grubbs Pair (α = 0.05)	---
Grubbs Pair (α = 0.01)	---
Cochran	---
Kolmogorov-Smirnov-Lilliefors Test (α = 0.05)	Distribution: normal
Kolmogorov-Smirnov-Lilliefors Test (α = 0.01)	Distribution: normal
Skewness & Kurtosis Test (α = 0.05)	Distribution: normal
Skewness & Kurtosis Test (α = 0.01)	Distribution: normal

Table 31: Outcome of statistical tests of results obtained for Ti

Number of data sets	10
Snedecor-F-Test and Bartlett-Test	Pooling not allowed
Dixon (α = 0.05)	---
Dixon (α = 0.01)	---
Nalimov (α = 0.05)	---
Nalimov (α = 0.01)	---
Grubbs (α = 0.05)	---
Grubbs (α = 0.01)	---
Grubbs Pair (α = 0.05)	---
Grubbs Pair (α = 0.01)	---
Cochran	---
Kolmogorov-Smirnov-Lilliefors Test (α = 0.05)	Distribution: normal
Kolmogorov-Smirnov-Lilliefors Test (α = 0.01)	Distribution: normal
Skewness & Kurtosis Test (α = 0.05)	Distribution: normal
Skewness & Kurtosis Test (α = 0.01)	Distribution: normal

Table 32: Outcome of statistical tests of results obtained for Pb

Number of data sets	10
Snedecor-F-Test and Bartlett-Test	Pooling not allowed
Dixon (α = 0.05)	---
Dixon (α = 0.01)	---
Nalimov (α = 0.05)	---
Nalimov (α = 0.01)	---
Grubbs (α = 0.05)	---
Grubbs (α = 0.01)	---
Grubbs Pair (α = 0.05)	---
Grubbs Pair (α = 0.01)	---
Cochran	---
Kolmogorov-Smirnov-Lilliefors Test (α = 0.05)	Distribution: normal
Kolmogorov-Smirnov-Lilliefors Test (α = 0.01)	Distribution: normal
Skewness & Kurtosis Test (α = 0.05)	Distribution: normal
Skewness & Kurtosis Test (α = 0.01)	Distribution: normal

Table 33: Outcome of statistical tests of results obtained for Sn

Number of data sets	11
Snedecor-F-Test and Bartlett-Test	Pooling not allowed
Dixon (α = 0.05)	---
Dixon (α = 0.01)	---
Nalimov (α = 0.05)	Laboratory 8/XRF
Nalimov (α = 0.01)	---
Grubbs (α = 0.05)	---
Grubbs (α = 0.01)	---
Grubbs Pair (α = 0.05)	---
Grubbs Pair (α = 0.01)	---
Cochran	---
Kolmogorov-Smirnov-Lilliefors Test (α = 0.05)	Distribution: normal
Kolmogorov-Smirnov-Lilliefors Test (α = 0.01)	Distribution: normal
Skewness & Kurtosis Test (α = 0.05)	Distribution: normal
Skewness & Kurtosis Test (α = 0.01)	Distribution: normal

The straggler (Lab. 8/XRF) was not removed.

Table 34: Outcome of statistical tests of results obtained for As

Number of data sets	6
Snedecor-F-Test and Bartlett-Test	Pooling not allowed
Dixon (α = 0.05)	---
Dixon (α = 0.01)	---
Nalimov (α = 0.05)	---
Nalimov (α = 0.01)	---
Grubbs (α = 0.05)	---
Grubbs (α = 0.01)	---
Grubbs Pair (α = 0.05)	---
Grubbs Pair (α = 0.01)	---
Cochran	---
Kolmogorov-Smirnov-Lilliefors Test (α = 0.05)	Distribution: normal
Kolmogorov-Smirnov-Lilliefors Test (α = 0.01)	Distribution: normal
Skewness & Kurtosis Test (α = 0.05)	Insufficient data
Skewness & Kurtosis Test (α = 0.01)	Insufficient data

Table 35a: Outcome of statistical tests of results obtained for Be

Number of data sets	8
Snedecor-F-Test and Bartlett-Test	Pooling not allowed
Dixon (α = 0.05)	---
Dixon (α = 0.01)	---
Nalimov (α = 0.05)	Laboratory 8/l-s
Nalimov (α = 0.01)	---
Grubbs (α = 0.05)	Laboratory 8/l-s
Grubbs (α = 0.01)	---
Grubbs Pair (α = 0.05)	---
Grubbs Pair (α = 0.01)	---
Cochran	---
Kolmogorov-Smirnov-Lilliefors Test (α = 0.05)	Distribution: normal
Kolmogorov-Smirnov-Lilliefors Test (α = 0.01)	Distribution: normal
Skewness & Kurtosis Test (α = 0.05)	Distribution: normal
Skewness & Kurtosis Test (α = 0.01)	Distribution: normal

The outlying value (Lab. 8/l-s) was removed.

Table 35b: Outcome of statistical tests of results obtained for Be (after removal of outlier)

Number of data sets	7
Snedecor-F-Test and Bartlett-Test	Pooling not allowed
Dixon (α = 0.05)	---
Dixon (α = 0.01)	---
Nalimov (α = 0.05)	Laboratory 1-s
Nalimov (α = 0.01)	---
Grubbs (α = 0.05)	---
Grubbs (α = 0.01)	---
Grubbs Pair (α = 0.05)	---
Grubbs Pair (α = 0.01)	---
Cochran	---
Kolmogorov-Smirnov-Lilliefors Test (α = 0.05)	Distribution: normal
Kolmogorov-Smirnov-Lilliefors Test (α = 0.01)	Distribution: normal
Skewness & Kurtosis Test (α = 0.05)	Distribution: normal
Skewness & Kurtosis Test (α = 0.01)	Distribution: normal

The straggler (Lab. 1) was not removed.

Table 36a: Outcome of statistical tests of results obtained for Bi

Number of data sets	9
Snedecor-F-Test and Bartlett-Test	Pooling not allowed
Dixon (α = 0.05)	---
Dixon (α = 0.01)	---
Nalimov (α = 0.05)	---
Nalimov (α = 0.01)	---
Grubbs (α = 0.05)	---
Grubbs (α = 0.01)	---
Grubbs Pair (α = 0.05)	---
Grubbs Pair (α = 0.01)	---
Cochran (α = 0.01)	Lab. 6
Kolmogorov-Smirnov-Lilliefors Test (α = 0.05)	Distribution: normal
Kolmogorov-Smirnov-Lilliefors Test (α = 0.01)	Distribution: normal
Skewness & Kurtosis Test (α = 0.05)	Distribution: normal
Skewness & Kurtosis Test (α = 0.01)	Distribution: normal

The outlying value (Lab. 6) was removed.

Table 36b: Outcome of statistical tests of results obtained for Bi (after removal of outlier)

Number of data sets	8
Snedecor-F-Test and Bartlett-Test	Pooling not allowed
Dixon (α = 0.05)	---
Dixon (α = 0.01)	---
Nalimov (α = 0.05)	---
Nalimov (α = 0.01)	---
Grubbs (α = 0.05)	---
Grubbs (α = 0.01)	---
Grubbs Pair (α = 0.05)	---
Grubbs Pair (α = 0.01)	---
Cochran	---
Kolmogorov-Smirnov-Lilliefors Test (α = 0.05)	Distribution: normal
Kolmogorov-Smirnov-Lilliefors Test (α = 0.01)	Distribution: normal
Skewness & Kurtosis Test (α = 0.05)	Distribution: normal
Skewness & Kurtosis Test (α = 0.01)	Distribution: normal

Table 37: Outcome of statistical tests of results obtained for Cd

Number of data sets	11
Snedecor-F-Test and Bartlett-Test	Pooling not allowed
Dixon (α = 0.05)	---
Dixon (α = 0.01)	---
Nalimov (α = 0.05)	---
Nalimov (α = 0.01)	---
Grubbs (α = 0.05)	---
Grubbs (α = 0.01)	---
Grubbs Pair (α = 0.05)	---
Grubbs Pair (α = 0.01)	---
Cochran	---
Kolmogorov-Smirnov-Lilliefors Test (α = 0.05)	Distribution: normal
Kolmogorov-Smirnov-Lilliefors Test (α = 0.01)	Distribution: normal
Skewness & Kurtosis Test (α = 0.05)	Distribution: normal
Skewness & Kurtosis Test (α = 0.01)	Distribution: normal

Table 38: Outcome of statistical tests of results obtained for Co

Number of data sets	11
Snedecor-F-Test and Bartlett-Test	Pooling not allowed
Dixon (α = 0.05)	---
Dixon (α = 0.01)	---
Nalimov (α = 0.05)	---
Nalimov (α = 0.01)	---
Grubbs (α = 0.05)	---
Grubbs (α = 0.01)	---
Grubbs Pair (α = 0.05)	---
Grubbs Pair (α = 0.01)	---
Cochran	---
Kolmogorov-Smirnov-Lilliefors Test (α = 0.05)	Distribution: normal
Kolmogorov-Smirnov-Lilliefors Test (α = 0.01)	Distribution: normal
Skewness & Kurtosis Test (α = 0.05)	Distribution: normal
Skewness & Kurtosis Test (α = 0.01)	Distribution: normal

Table 39a: Outcome of statistical tests of results obtained for Ga

Number of data sets	10
Snedecor-F-Test and Bartlett-Test	Pooling not allowed
Dixon (α = 0.05)	Lab. 10
Dixon (α = 0.01)	---
Nalimov (α = 0.05)	Lab. 10
Nalimov (α = 0.01)	Lab. 10
Grubbs (α = 0.05)	Lab. 10
Grubbs (α = 0.01)	Lab. 10
Grubbs Pair (α = 0.05)	---
Grubbs Pair (α = 0.01)	---
Cochran	---
Kolmogorov-Smirnov-Lilliefors Test (α = 0.05)	Distribution: normal
Kolmogorov-Smirnov-Lilliefors Test (α = 0.01)	Distribution: normal
Skewness & Kurtosis Test (α = 0.05)	Distribution: normal
Skewness & Kurtosis Test (α = 0.01)	Distribution: normal

The outlying value (Lab. 10) was removed.

Table 39b: Outcome of statistical tests of results obtained for Ga (after removal of outlier)

Number of data sets	9
Snedecor-F-Test and Bartlett-Test	Pooling not allowed
Dixon (α = 0.05)	---
Dixon (α = 0.01)	---
Nalimov (α = 0.05)	---
Nalimov (α = 0.01)	---
Grubbs (α = 0.05)	---
Grubbs (α = 0.01)	---
Grubbs Pair (α = 0.05)	---
Grubbs Pair (α = 0.01)	---
Cochran	---
Kolmogorov-Smirnov-Lilliefors Test (α = 0.05)	Distribution: normal
Kolmogorov-Smirnov-Lilliefors Test (α = 0.01)	Distribution: normal
Skewness & Kurtosis Test (α = 0.05)	Distribution: normal
Skewness & Kurtosis Test (α = 0.01)	Distribution: normal

Table 40: Outcome of statistical tests of results obtained for Sb

Number of data sets	9
Snedecor-F-Test and Bartlett-Test	Pooling not allowed
Dixon (α = 0.05)	---
Dixon (α = 0.01)	---
Nalimov (α = 0.05)	---
Nalimov (α = 0.01)	---
Grubbs (α = 0.05)	---
Grubbs (α = 0.01)	---
Grubbs Pair (α = 0.05)	---
Grubbs Pair (α = 0.01)	---
Cochran	---
Kolmogorov-Smirnov-Lilliefors Test (α = 0.05)	Distribution: normal
Kolmogorov-Smirnov-Lilliefors Test (α = 0.01)	Distribution: normal
Skewness & Kurtosis Test (α = 0.05)	Distribution: normal
Skewness & Kurtosis Test (α = 0.01)	Distribution: normal

Table 41a: Outcome of statistical tests of results obtained for V

Number of data sets	11
Snedecor-F-Test and Bartlett-Test	Pooling not allowed
Dixon (α = 0.05)	Lab. 10
Dixon (α = 0.01)	Lab. 10
Nalimov (α = 0.05)	Lab. 10
Nalimov (α = 0.01)	Lab. 10
Grubbs (α = 0.05)	Lab. 10
Grubbs (α = 0.01)	---
Grubbs Pair (α = 0.05)	---
Grubbs Pair (α = 0.01)	---
Cochran	---
Kolmogorov-Smirnov-Lilliefors Test (α = 0.05)	Distribution: normal
Kolmogorov-Smirnov-Lilliefors Test (α = 0.01)	Distribution: normal
Skewness & Kurtosis Test (α = 0.05)	Distribution: normal
Skewness & Kurtosis Test (α = 0.01)	Distribution: normal

Laboratory 10 withdrew its results after technical discussion

Table 41b: Outcome of statistical tests of results obtained for V (after removal of outlier)

Number of data sets	10
Snedecor-F-Test and Bartlett-Test	Pooling not allowed
Dixon (α = 0.05)	---
Dixon (α = 0.01)	---
Nalimov (α = 0.05)	Lab. 6
Nalimov (α = 0.01)	---
Grubbs (α = 0.05)	---
Grubbs (α = 0.01)	---
Grubbs Pair (α = 0.05)	---
Grubbs Pair (α = 0.01)	---
Cochran	---
Kolmogorov-Smirnov-Lilliefors Test (α = 0.05)	Distribution: normal
Kolmogorov-Smirnov-Lilliefors Test (α = 0.01)	Distribution: normal
Skewness & Kurtosis Test (α = 0.05)	Distribution: normal
Skewness & Kurtosis Test (α = 0.01)	Distribution: normal

The straggler (Lab. 6) was not removed.

Table 42a: Outcome of statistical tests of results obtained for Zr

Number of data sets	10
Snedecor-F-Test and Bartlett-Test	Pooling not allowed
Dixon (α = 0.05)	---
Dixon (α = 0.01)	---
Nalimov (α = 0.05)	Lab. 10
Nalimov (α = 0.01)	Lab. 10
Grubbs (α = 0.05)	Lab. 10
Grubbs (α = 0.01)	---
Grubbs Pair (α = 0.05)	---
Grubbs Pair (α = 0.01)	---
Cochran	---
Kolmogorov-Smirnov-Lilliefors Test (α = 0.05)	Distribution: not normal
Kolmogorov-Smirnov-Lilliefors Test (α = 0.01)	Distribution: not normal
Skewness & Kurtosis Test (α = 0.05)	Distribution: normal
Skewness & Kurtosis Test (α = 0.01)	Distribution: normal

Laboratory 10 withdrew its results after technical discussion.

Table 42b: Outcome of statistical tests of results obtained for Zr (after removal of outlier)

Number of data sets	9
Snedecor-F-Test and Bartlett-Test	Pooling not allowed
Dixon (α = 0.05)	---
Dixon (α = 0.01)	---
Nalimov (α = 0.05)	---
Nalimov (α = 0.01)	---
Grubbs (α = 0.05)	---
Grubbs (α = 0.01)	---
Grubbs Pair (α = 0.05)	---
Grubbs Pair (α = 0.01)	---
Cochran	---
Kolmogorov-Smirnov-Lilliefors Test (α = 0.05)	Distribution: normal
Kolmogorov-Smirnov-Lilliefors Test (α = 0.01)	Distribution: normal
Skewness & Kurtosis Test (α = 0.05)	Distribution: normal
Skewness & Kurtosis Test (α = 0.01)	Distribution: normal

The certified mass fractions of all elements were calculated as mean of the accepted data sets. These values are given in Table 43.
The resp. combined uncertainties were calculated from the spread resulting from the certification interlaboratory comparison (u_{ilc}) and the uncertainty contributions from possible inhomogeneity over the length ($u_{bb}(1)$) and over area ($u_{bb}(2)$) of the material using Equation 3.

$$u_{\text{combined}} = \sqrt{u_{ilc}^2 + u_{bb}^2(1) + u_{bb}^2(2)} \qquad (3)$$

with

$u_{ilc} = \sqrt{\frac{s_M^2}{n}}$: uncertainty contribution resulting from interlaboratory comparison

n : number of data sets used for calculating the certified mass fraction of each element

Table 43: Uncertainty calculation

			uncertainty contribution from							u_{bb} (rel)	
	M	n	s_M	u_{ilc}	u_{bb} (1) Length	u_{bb} (2) Area	u(comb)	U		Length	Area
	%		%	%	%	%	%	%			
Si	11.5100	12	0.1731	0.0500	0.0455	0.0284	0.0733	0.1466		0.3952	0.2467
Fe	0.9915	12	0.0130	0.0038	0.0062	0.0041	0.0083	0.0167		0.6270	0.4152
Cu	2.0769	12	0.0367	0.0106	0.0257	0.0123	0.0304	0.0608		1.2380	0.5917
Mn	0.4043	12	0.0057	0.0016	0.0030	0.0016	0.0038	0.0075		0.7349	0.3965
Mg	0.1960	11	0.0048	0.0014	0.0013	0.0006	0.0020	0.0040		0.6437	0.3035
Cr	0.0574	13	0.0013	0.0004	0.0004	0.0002	0.0006	0.0012		0.7487	0.2616
Ni	0.2419	13	0.0078	0.0022	0.0017	0.0008	0.0029	0.0057		0.6943	0.3470
Zn	1.0998	10	0.0187	0.0059	0.0039	0.0025	0.0075	0.0150		0.3519	0.2318
Ti	0.1884	10	0.0031	0.0010	0.0015	0.0005	0.0018	0.0036		0.7747	0.2538
Pb	0.1890	10	0.0136	0.0043	0.0012	0.0009	0.0045	0.0091		0.6207	0.4560
Sn	0.2010	11	0.0032	0.0010	0.0016	0.0006	0.0019	0.0039		0.7840	0.3030
	mg/kg		mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg			
As	27.7000	6	4.4530	1.8179	2.2963	1.8614	3.4703	6.9406		8.2900	6.7200
Be	4.6500	7	0.2630	0.0994	0.0288	0.0200	0.1054	0.2108		0.6188	0.4309
Bi	92.2900	8	4.8250	1.7059	0.3606	2.3396	2.9178	5.8356		0.3907	2.5350
Cd	5.2400	11	0.8800	0.2653	0.2955	0.2919	0.4929	0.9858		5.6400	5.5700
Co	73.6800	11	2.5480	0.7683	0.5040	1.3999	1.6745	3.3491		0.6841	1.9000
Ga	164.4000	9	4.2820	1.4273	0.9739	0.7372	1.8786	3.7572		0.5924	0.4484
Sb	102.3000	9	7.1600	2.3867	5.7491	6.8008	9.2195	18.4389		5.6198	6.6479
V	278.4000	9	2.6210	0.8737	1.7465	2.4334	3.1201	6.2401		0.6273	0.8741
Zr	103.8000	8	2.3200	0.8202	0.7619	0.3220	1.1649	2.3298		0.7340	0.3102

The expanded uncertainties U are calculated by multiplication of u_{combined} with a coverage factor of k = 2 using Equation 4.

$$U = k \cdot u_{\text{combined}} \qquad (4)$$

The calculated mass fractions and their resp. expanded uncertainties are given on Page 3 of this report.

In addition to the wet chemical characterization most of the laboratories analysed the material with spark emission to check if the samples behave similarly to casted samples. Tab. 44 shows the mean values of wet chemical and spark emission results as well as their standard deviations. It can be seen that only for Sb there is a certain difference between the wet chemical and the spark emission results.

Tab. 44: Comparison wet chemistry (incl. XRF and INAA) vs. SOES

Element	Wet chemical analysis			Spark emission		
	Mass fraction in %	Std.-dev. in %	N	Mass fraction in %	Std.-dev. in %	N
Si	11.51	0.18	12	11.42	0.15	9
Fe	0.992	0.013	12	0.970	0.021	9
Cu	2.077	0.037	12	2.072	0.063	8
Mn	0.404	0.006	12	0.404	0.008	8
Mg	0.196	0.005	11	0.200	0.009	9
Ni	0.242	0.008	13	0.236	0.007	9
Cr	0.0574	0.0013	13	0.0578	0.0011	8
Zn	1.100	0.019	10	1.101	0.020	9
Ti	0.188	0.003	10	0.186	0.002	8
Pb	0.189	0.014	10	0.191	0.010	9
Sn	0.201	0.004	11	0.195	0.003	7
	in mg/kg	in mg/kg		in mg/kg	in mg/kg	
As	28	5	6	29	4	4
Be	4.65	0.27	7	4.76	0.26	9
Bi	92	5	8	94	6	7
Cd	5.2	0.9	11	5.1	3.0	6
Co	73.7	2.6	11	72.8	3.2	7
Ga	164	5	9	164	5	7
Sb	102	8	9	89	10	5
V	277	4	10	277	10	7
Zr	103	4	9	102	5	8

6. Instructions for users and stability

The certified reference material ERM®-EB314a is intended for the calibration and quality control of spark emission and X-ray fluorescence spectrometers used for the analysis of similar materials. It is also suitable for wet chemical analysis.
The surface of the material should be cleaned by turning or milling before analysis.
If chips prepared from the compact material are used for wet chemical analysis, a minimum sample intake of 0.1 g has to be used.
The material will remain stable provided that it is not subjected to excessive heat (eg, during preparation of the working surface).

7. Literature

[1] ISO Guide 31, Contents of certificates of reference materials, 1981

[2] ISO Guide 34, General requirements for the competence of reference material producers, 2000

[3] ISO Guide 35, Reference materials - General and statistical principles for certification. Third edition, 2006

[4] Guidelines for the production of BAM Reference Materials, 2010

[5] Technical Guidelines for the Production and Acceptance of a European Reference Material (www.erm-crm.org)

[6] Bonas G, Zervou M, Papaeoannou T, Lees M: Accred Qual Assur (2003) 8:101-107

8. Information on and purchase of the CRM

Certified reference material ERM®-EB314a is supplied by

Bundesanstalt für Materialforschung und -prüfung (BAM)
Fachbereich 1.6: Anorganische Referenzmaterialien
Richard-Willstätter-Str. 11, D-12489 Berlin, Germany
Phone +49 (0)30 - 8104 2061 or 1119
Fax: +49 (0)30 - 8104 1117
E-Mail: sales.crm@bam.de

Each disc of ERM®-EB314a will be distributed together with a detailed certificate containing the certified values and their uncertainties, the mean values and standard deviations of all accepted data sets and information on the analytical methods used and the names of the participating laboratories.
Information on certified reference materials can be obtained from BAM,
http://www.bam.de/en/fachthemen/referenzmaterialien/index.htm
www.webshop.bam.de
Tel. +49 30 8104 1111.

Annex 1: Calculation of uncertainty contribution of potential inhomogeneity (length)

Silicon:

Sample No.	Meas. 1	Meas. 2	Meas. 3	Meas. 4	Meas. 5	
A009	11.736	11.806	11.871	12.0779	11.9334	
A025	11.762	11.851	12.1449	12.0999	12.0654	
A041	11.847	11.905	11.8849	12.0979	11.6374	
A049	12.039	11.866	11.737	12.1409	12.0154	
A081	11.883	11.751	11.7879	10.3189	11.8944	
B007	11.871	11.791	11.697	11.6509	11.8764	
B051	11.872	11.547	11.9079	10.7209	11.8374	
B083	11.785	11.894	11.946	11.0439	11.8124	
B103	11.899	11.791	11.722	11.8399	11.9934	
C007	11.865	11.874	11.71	10.7639	11.9624	
C044	11.879	11.809	12.0949	11.8329	11.8654	
C070	11.591	11.76	11.8559	11.5889	11.3994	
C105	11.811	11.641	11.826	12.0289	11.7854	
C115	11.796	11.718	11.679	11.9999	11.8644	
D009	11.855	12.057	11.825	12.0859	12.1094	
D040	11.863	12.132	12.2739	11.2979	11.9244	
D068	11.888	11.788	11.88	11.3119	11.7054	
D098	11.862	11.994	11.834	12.1959	11.5344	
E002	11.858	11.905	11.869	12.2999	11.9804	
E046	11.689	12.226	12.083	11.9089	11.9814	
E076	11.826	12.032	12.1129	10.7669	11.8744	
E104	11.768	11.844	12.306	12.0059	11.7164	
F003	11.775	11.636	12.1249	11.8289	11.9814	
F044	11.892	11.997	11.9219	12.2999	11.9734	
F054	11.922	11.953	12.2079	11.4689	11.8414	
F080	11.882	11.992	11.696	11.5479	11.9194	
F107	11.789	11.845	11.759	11.8619	11.6164	

ANOVA

Source of variation	*sums of squares (SS)*	*degrees of freedom (df)*	*Mean squares (MS)*	*F-value*	*P-value*	*critical F-value*
Between groups	2.27907299	26	0.08765665	1.09153602	0.363961	1.59842323
Within groups	8.67302444	108	0.08030578			
Total	10.9520974	134				

(sbb)^2	0.00147017
ubb	0.0467509
u_bb(rel.)	0.3952376

Iron:

Sample No.	Meas. 1	Meas. 2	Meas. 3	Meas. 4	Meas. 5	
A009	0.965	0.9602	0.9154	0.9629	1.0031	
A025	0.9445	0.9374	1.0035	0.9679	1.0297	
A041	0.9745	0.9769	0.9718	0.9905	0.9788	
A049	0.9096	0.9748	0.9325	0.9745	1.0575	
A081	0.9678	0.9541	0.9834	0.9114	1.0399	
B007	0.9668	0.9769	0.9152	0.9853	1.0476	
B051	0.957	0.9818	0.986	0.9483	0.9959	
B083	0.9718	0.9798	0.9288	0.9649	1.0473	
B103	0.9566	0.9723	0.918	0.9781	1.0508	
C007	0.9724	0.972	0.9321	0.925	1.0125	
C044	0.9599	0.9677	0.9906	0.9526	1.0583	
C070	0.943	0.9641	0.9814	0.9891	1.0033	
C105	0.9692	0.9576	0.9331	0.9799	1.0434	
C115	0.9752	0.9758	0.9292	0.9605	1.032	
D009	0.9334	0.9846	0.9164	0.9492	1.0239	
D040	0.9621	0.9939	1.0107	0.9522	1.0128	
D068	0.9608	0.9592	0.8941	0.9673	1.0092	
D098	0.978	0.9591	0.9137	1.0104	1.0185	
E002	0.9762	0.9704	0.9273	1.0154	1.004	
E046	0.9374	0.9589	0.9266	0.9801	1.0276	
E076	0.9728	0.9823	1.0042	0.9461	1.0344	
E104	0.9593	0.9542	0.9629	0.9849	1.0046	
F003	0.9527	0.9681	0.9874	0.9731	0.9917	
F044	0.9552	0.9719	0.9871	0.9846	1.0088	
F054	0.9549	0.9763	1.0195	0.9599	1.0282	
F080	0.9288	0.9539	0.9361	0.981	1.0376	
F107	0.9393	0.9851	0.9081	0.9743	0.9949	

ANOVA

Source of variation	*sums of squares (SS)*	*degrees of freedom (df)*	*Mean squares (MS)*	*F-value*	*P-value*	*critical F-value*
Between groups	0.00924965	26	0.00035576	0.25962688	0.99989195	1.59842323
Within groups	0.14798777	108	0.00137026			
Total	0.15723741	134				

(sbb)^2	-0.0002029
ubb	0.00610685
u_bb(rel.)	0.62696664

Copper:

Sample No.	Meas. 1	Meas. 2	Meas. 3	Meas. 4	Meas. 5	
A009	1.68	1.687	1.749	1.8327	1.8744	
A025	1.75	1.8187	1.8387	1.704	1.691	
A041	1.7127	1.8277	1.873	1.68	1.614	
A049	1.8287	1.743	1.707	1.7037	1.1597	
A081	1.75	1.675	1.697	1.5857	1.735	
B007	1.563	1.7297	1.698	1.702	1.756	
B051	1.4147	1.754	1.66	1.7	1.6697	
B083	1.727	1.699	1.647	1.2287	1.749	
B103	1.694	1.8867	1.8277	1.689	1.69	
C007	1.7117	1.6097	1.718	1.649	1.697	
C044	1.8177	1.708	1.668	1.679	1.749	
C070	1.701	1.675	1.8167	1.696	1.724	
C105	1.8587	1.4317	1.72	1.67	1.746	
C115	1.4407	1.697	1.71	1.709	1.7967	
D009	1.688	1.673	1.659	1.8457	1.708	
D040	1.854	1.748	1.6767	1.665	1.717	
D068	1.8517	1.715	1.704	1.856	1.7097	
D098	1.691	1.627	1.9047	1.7037	1.732	
E002	1.688	1.6897	1.8837	1.698	1.668	
E046	1.7417	1.4787	1.813	1.749	1.65	
E076	1.6434	1.746	1.689	1.752	1.3364	
E104	1.715	1.704	1.856	1.7097	1.6224	
F003	1.691	1.627	1.9047	1.7037	2.1484	
F044	1.732	1.688	1.6897	1.8837	1.8144	
F054	1.698	1.668	1.7417	1.4787	1.3364	
F080	1.813	1.749	1.65	1.5617	1.6434	
F107	1.746	1.689	1.752	1.6377	1.3364	

ANOVA

Source of variation	*sums of squares (SS)*	*degrees of freedom (df)*	*Mean squares (MS)*	*F-value*	*P-value*	*critical F-value*
Between groups	0.40127541	26	0.01543367	0.94631617	0.545208	1.59842323
Within groups	1.76139474	108	0.01630921			
Total	2.16267015	134				

(sbb)^2	-0.00017511
ubb	0.02106847
u_bb(rel.)	1.23797868

Manganese:

Sample No.	Meas. 1	Meas. 2	Meas. 3	Meas. 4	Meas. 5	
A009	0.396	0.3961	0.4015	0.4073	0.4026	
A025	0.3974	0.3997	0.4177	0.4133	0.4181	
A041	0.3998	0.3975	0.395	0.4101	0.3802	
A049	0.4119	0.3963	0.3886	0.414	0.4143	
A081	0.405	0.3969	0.3966	0.317	0.4114	
B007	0.4047	0.3958	0.3947	0.3832	0.4051	
B051	0.4044	0.3847	0.4006	0.3347	0.4007	
B083	0.4005	0.4009	0.4034	0.3603	0.398	
B103	0.405	0.394	0.3921	0.3951	0.4119	
C007	0.4037	0.399	0.3892	0.3282	0.4089	
C044	0.405	0.3963	0.4206	0.4062	0.4063	
C070	0.3922	0.3959	0.3982	0.3846	0.357	
C105	0.4003	0.3902	0.3939	0.4133	0.3964	
C115	0.4004	0.3922	0.3948	0.4088	0.4088	
D009	0.3981	0.4008	0.3912	0.4057	0.415	
D040	0.3974	0.4055	0.4207	0.3581	0.3944	
D068	0.3979	0.3887	0.3948	0.3622	0.3784	
D098	0.3958	0.3964	0.3925	0.4108	0.3563	
E002	0.4002	0.3978	0.3943	0.4276	0.415	
E046	0.3971	0.4176	0.404	0.3908	0.4127	
E076	0.3978	0.4011	0.4189	0.3377	0.3986	
E104	0.3988	0.3985	0.4201	0.4015	0.3877	
F003	0.3993	0.389	0.4236	0.3974	0.4173	
F044	0.4011	0.4006	0.3983	0.4265	0.4026	
F054	0.4004	0.3969	0.4143	0.3656	0.3796	
F080	0.3985	0.3967	0.3841	0.3747	0.3938	
F107	0.4015	0.3945	0.3983	0.387	0.3681	

ANOVA

Source of variation	*sums of squares (SS)*	*degrees of freedom (df)*	*Mean squares (MS)*	*F-value*	*P-value*	*critical F-value*
Between groups	0.0081455	26	0.00031329	1.00409329	0.46956179	1.59842323
Within groups	0.03369722	108	0.00031201			
Total	0.04184272	134				

(sbb)^2	2.5543E-07
ubb	0.00291408
u_bb(rel.)	0.73487985

Magnesium

Sample No.	Meas. 1	Meas. 2	Meas. 3	Meas. 4	Meas. 5	
A009	0.2011	0.1986	0.1902	0.1951	0.1798	
A025	0.1969	0.1958	0.2019	0.1956	0.183	
A041	0.2032	0.2037	0.1984	0.1988	0.1775	
A049	0.1893	0.2031	0.1955	0.1961	0.1892	
A081	0.2018	0.2003	0.2002	0.1913	0.1861	
B007	0.2005	0.2024	0.1913	0.2013	0.189	
B051	0.1977	0.2037	0.2001	0.1969	0.1786	
B083	0.2024	0.2032	0.1937	0.1972	0.1895	
B103	0.1998	0.2024	0.1924	0.1996	0.1878	
C007	0.2008	0.2005	0.1951	0.1927	0.1812	
C044	0.1985	0.2008	0.1977	0.1935	0.1913	
C070	0.1972	0.1999	0.1984	0.2007	0.1864	
C105	0.2	0.198	0.1948	0.1958	0.1872	
C115	0.2018	0.2021	0.1934	0.1949	0.1833	
D009	0.1924	0.2008	0.1901	0.189	0.1789	
D040	0.1978	0.2038	0.2001	0.1936	0.1805	
D068	0.2013	0.2016	0.1876	0.1966	0.1845	
D098	0.2034	0.2003	0.1929	0.2041	0.1917	
E002	0.1966	0.1963	0.1886	0.1955	0.171	
E046	0.1927	0.1961	0.1921	0.1985	0.1813	
E076	0.2007	0.2037	0.1988	0.1963	0.1839	
E104	0.1987	0.1967	0.1974	0.1979	0.1806	
F003	0.1955	0.1988	0.1958	0.1936	0.172	
F044	0.1942	0.1968	0.1965	0.1919	0.1772	
F054	0.1942	0.1973	0.1988	0.1927	0.1837	
F080	0.1947	0.199	0.195	0.1976	0.1847	
F107	0.191	0.2026	0.1874	0.1969	0.1813	

ANOVA

Source of variation	*sums of squares (SS)*	*degrees of freedom (df)*	*Mean squares (MS)*	*F-value*	*P-value*	*critical F-value*
Between groups	0.00066252	26	2.5481E-05	0.4426659	0.99049029	1.59842323
Within groups	0.00621686	108	5.7563E-05			
Total	0.00687937	134				

(sbb)^2	-6.4164E-06
ubb	0.00125167
u_bb(rel.)	0.64367712

Nickel:

Sample No.	Meas. 1	Meas. 2	Meas. 3	Meas. 4	Meas. 5	
A009	0.2471	0.2465	0.248	0.2583	0.25363	
A025	0.2476	0.2516	0.2621	0.2575	0.25963	
A041	0.2517	0.2494	0.2511	0.2591	0.24043	
A049	0.2565	0.2499	0.2427	0.2573	0.25643	
A081	0.2537	0.2476	0.2499	0.1971	0.25613	
B007	0.2512	0.2487	0.2463	0.2441	0.25213	
B051	0.2508	0.2386	0.2534	0.2099	0.25163	
B083	0.2495	0.2515	0.2543	0.2214	0.24883	
B103	0.2537	0.2489	0.2465	0.2496	0.25583	
C007	0.251	0.2504	0.2443	0.2108	0.25673	
C044	0.2519	0.2486	0.26	0.252	0.25393	
C070	0.2438	0.2484	0.2505	0.2415	0.22873	
C105	0.2496	0.2442	0.2489	0.2561	0.24723	
C115	0.25	0.2468	0.2423	0.2553	0.25413	
D009	0.247	0.2542	0.2462	0.2544	0.25953	
D040	0.2492	0.2566	0.2616	0.2268	0.24723	
D068	0.2522	0.2495	0.2512	0.2275	0.24263	
D098	0.2519	0.2526	0.2477	0.2619	0.23453	
E002	0.2486	0.2501	0.2454	0.2643	0.25603	
E046	0.2427	0.2621	0.2566	0.2521	0.25593	
E076	0.2471	0.2564	0.2587	0.212	0.24803	
E104	0.2477	0.2494	0.2632	0.2524	0.24243	
F003	0.2452	0.2423	0.2602	0.2459	0.25653	
F044	0.2514	0.2494	0.2488	0.2602	0.25233	
F054	0.2487	0.2477	0.2595	0.2318	0.24193	
F080	0.2572	0.2548	0.2475	0.2407	0.25233	
F107	0.2491	0.2513	0.246	0.2522	0.23933	

ANOVA

Source of variation	*sums of squares (SS)*	*degrees of freedom (df)*	*Mean squares (MS)*	*F-value*	*P-value*	*critical F-value*
Between groups	0.00216717	26	8.3353E-05	0.76044837	0.78650493	1.59842323
Within groups	0.01183786	108	0.00010961			
Total	0.01400503	134				

(sbb)^2	-5.2514E-06
ubb	0.00172719
u_bb(rel.)	0.69431535

Chromium:

Sample No.	Meas. 1	Meas. 2	Meas. 3	Meas. 4	Meas. 5	
A009	0.06282	0.06373	0.06436	0.06503	0.06396	
A025	0.06402	0.06392	0.06703	0.06654	0.06538	
A041	0.06339	0.06376	0.06314	0.06677	0.06079	
A049	0.06605	0.06349	0.06219	0.0667	0.06546	
A081	0.06408	0.0634	0.06407	0.0525	0.0658	
B007	0.06431	0.06269	0.0631	0.06013	0.06243	
B051	0.06498	0.06116	0.06372	0.05461	0.06392	
B083	0.0634	0.06358	0.06308	0.05636	0.06033	
B103	0.06382	0.06296	0.06318	0.06327	0.06472	
C007	0.06392	0.06365	0.06207	0.05232	0.06459	
C044	0.06462	0.06333	0.06679	0.06549	0.06365	
C070	0.06262	0.06373	0.06404	0.06119	0.05712	
C105	0.06373	0.0624	0.06285	0.06677	0.06323	
C115	0.06342	0.06287	0.06259	0.06512	0.06466	
D009	0.06402	0.06402	0.06275	0.06452	0.06535	
D040	0.06371	0.06431	0.0673	0.05512	0.0639	
D068	0.06304	0.06204	0.06396	0.05735	0.06028	
D098	0.06384	0.0638	0.06375	0.06642	0.0567	
E002	0.06367	0.06341	0.06273	0.06747	0.06527	
E046	0.06392	0.06635	0.06415	0.06198	0.06525	
E076	0.06298	0.06363	0.06696	0.05215	0.06394	
E104	0.06329	0.06396	0.06705	0.06571	0.06186	
F003	0.0634	0.06208	0.06714	0.06462	0.0661	
F044	0.06378	0.06376	0.06459	0.06756	0.06407	
F054	0.06349	0.06362	0.06629	0.05688	0.05984	
F080	0.06342	0.06281	0.06223	0.0597	0.06201	
F107	0.06401	0.06331	0.06411	0.0617	0.05847	

ANOVA

Source of variation	*sums of squares (SS)*	*degrees of freedom (df)*	*Mean squares (MS)*	*F-value*	*P-value*	*critical F-value*
Between groups	0.00021632	26	8.3201E-06	1.01132766	0.46035623	1.59842323
Within groups	0.0008885	108	8.2269E-06			
Total	0.00110482	134				

(sbb)^2	1.8638E-08
ubb	0.00047319
u_bb(rel.)	0.74873285

Zinc:

Sample No.	Meas. 1	Meas. 2	Meas. 3	Meas. 4	Meas. 5	
A009	1.1403	1.1296	1.0818	1.1095	1.1031	
A025	1.1197	1.117	1.1448	1.1187	1.1207	
A041	1.1498	1.1544	1.1248	1.1288	1.0873	
A049	1.0919	1.1486	1.0984	1.118	1.1421	
A081	1.1454	1.1355	1.1354	1.0643	1.1298	
B007	1.1247	1.1295	1.0556	1.1091	1.1202	
B051	1.1159	1.1353	1.1173	1.081	1.0862	
B083	1.1317	1.1378	1.0751	1.0881	1.121	
B103	1.1238	1.1317	1.0665	1.1084	1.1257	
C007	1.1378	1.1408	1.0903	1.0717	1.1022	
C044	1.1262	1.1379	1.1245	1.1062	1.1443	
C070	1.1185	1.1343	1.1182	1.1218	1.1069	
C105	1.1354	1.1241	1.084	1.1099	1.1205	
C115	1.1408	1.1456	1.0829	1.1069	1.1144	
D009	1.0993	1.1335	1.0601	1.0794	1.0931	
D040	1.1233	1.1517	1.1301	1.0825	1.0927	
D068	1.1168	1.1153	1.0419	1.077	1.0917	
D098	1.1048	1.0914	1.0593	1.1072	1.0872	
E002	1.151	1.1463	1.0888	1.1435	1.1048	
E046	1.1283	1.1458	1.1003	1.1397	1.1314	
E076	1.1581	1.1738	1.1518	1.1074	1.1386	
E104	1.138	1.1316	1.1161	1.1283	1.109	
F003	1.1235	1.1346	1.1279	1.1128	1.0844	
F044	1.1085	1.1204	1.1107	1.1062	1.0875	
F054	1.1091	1.1244	1.1264	1.0829	1.1024	
F080	1.0784	1.1007	1.0606	1.0827	1.108	
F107	1.0841	1.1349	1.0482	1.0893	1.0659	

ANOVA

Source of variation	*sums of squares (SS)*	*degrees of freedom (df)*	*Mean squares (MS)*	*F-value*	*P-value*	*critical F-value*
Between groups	0.02854866	26	0.00109803	1.94762994	0.00935473	1.59842323
Within groups	0.06088772	108	0.00056378			
Total	0.08943638	134				

(sbb)^2	0.00010685
ubb	0.00391714
u_bb(rel.)	0.35194277

Titanium:

Sample No.	Meas. 1	Meas. 2	Meas. 3	Meas. 4	Meas. 5	
A009	0.1848	0.1882	0.19	0.19268	0.18798	
A025	0.1875	0.1885	0.19748	0.19608	0.19318	
A041	0.187	0.1884	0.18518	0.19758	0.17928	
A049	0.1946	0.1877	0.1837	0.19648	0.19218	
A081	0.1894	0.1871	0.18838	0.15368	0.19358	
B007	0.1901	0.1857	0.1862	0.17678	0.18438	
B051	0.1902	0.1813	0.18828	0.15978	0.18858	
B083	0.1871	0.1882	0.1861	0.16538	0.17888	
B103	0.1886	0.1864	0.1872	0.18678	0.18988	
C007	0.1893	0.1885	0.1836	0.15458	0.19248	
C044	0.1893	0.1872	0.19688	0.19238	0.18848	
C070	0.1846	0.1888	0.18928	0.18038	0.17098	
C105	0.1886	0.1843	0.1855	0.19828	0.18838	
C115	0.1885	0.1864	0.1846	0.19288	0.19118	
D009	0.1874	0.1892	0.184	0.18888	0.19268	
D040	0.1877	0.1906	0.19718	0.15858	0.18678	
D068	0.1868	0.1842	0.1896	0.16618	0.17778	
D098	0.1872	0.1879	0.1868	0.19638	0.16898	
E002	0.1858	0.1856	0.184	0.19958	0.18968	
E046	0.1861	0.1955	0.1891	0.18308	0.19078	
E076	0.185	0.1878	0.19568	0.15128	0.18898	
E104	0.1848	0.1879	0.1979	0.19388	0.18178	
F003	0.1861	0.1829	0.19678	0.18858	0.19318	
F044	0.1875	0.189	0.18998	0.19928	0.18848	
F054	0.1872	0.1876	0.19448	0.16658	0.17788	
F080	0.1862	0.1863	0.1827	0.17298	0.18248	
F107	0.1876	0.188	0.1895	0.18328	0.17368	
ANOVA						

Source of variation	*sums of squares (SS)*	*degrees of freedom (df)*	*Mean squares (MS)*	*F-value*	*P-value*	*critical F-value*
Between groups	0.00174971	26	6.7297E-05	0.88008823	0.63418079	1.59842323
Within groups	0.00825831	108	7.6466E-05			
Total	0.01000803	134				

(sbb)^2	-1.8338E-06
ubb	0.00144261
u_bb(rel.)	0.77470142

Lead:

Sample No.	Meas. 1	Meas. 2	Meas. 3	Meas. 4	Meas. 5	
A009	0.1764	0.1762	0.1779	0.1828	0.1803	
A025	0.1776	0.1792	0.1881	0.1858	0.1843	
A041	0.1814	0.1813	0.1825	0.1859	0.1723	
A049	0.1848	0.1813	0.1785	0.1869	0.1841	
A081	0.1855	0.182	0.1838	0.1495	0.1835	
B007	0.1866	0.1842	0.1808	0.1815	0.1853	
B051	0.189	0.1819	0.195	0.1635	0.1867	
B083	0.1923	0.193	0.1953	0.1743	0.1895	
B103	0.1948	0.1913	0.19	0.1953	0.1938	
C007	0.1761	0.1763	0.1742	0.1526	0.1781	
C044	0.175	0.1746	0.1802	0.1761	0.1766	
C070	0.1699	0.172	0.1748	0.1676	0.1621	
C105	0.1736	0.1684	0.1735	0.177	0.171	
C115	0.1739	0.1716	0.1691	0.1781	0.1736	
D009	0.1689	0.1737	0.1695	0.1726	0.1748	
D040	0.1692	0.1764	0.1766	0.1549	0.1687	
D068	0.1734	0.1704	0.1712	0.1571	0.167	
D098	0.1706	0.1716	0.1688	0.1761	0.1627	
E002	0.2014	0.2048	0.2015	0.2138	0.2021	
E046	0.211	0.2259	0.2232	0.2242	0.2166	
E076	0.2186	0.2277	0.2313	0.1966	0.212	
E104	0.2166	0.2171	0.2283	0.2263	0.2075	
F003	0.2127	0.2095	0.2288	0.2167	0.2127	
F044	0.2072	0.2074	0.2137	0.2193	0.2045	
F054	0.1997	0.2	0.2104	0.191	0.1923	
F080	0.1956	0.1973	0.1933	0.1878	0.1923	
F107	0.1908	0.1932	0.188	0.1946	0.1856	
ANOVA						

Source of variation	*sums of squares (SS)*	*degrees of freedom (df)*	*Mean squares (MS)*	*F-value*	*P-value*	*critical F-value*
Between groups	0.03754374	26	0.00144399	29.0041736	1.9632E-37	1.59842323
Within groups	0.00537684	108	4.9786E-05			
Total	0.04292058	134				

(sbb)^2	0.00027884
ubb	0.00116404
u_bb(rel.)	0.77470142

Tin:

Sample No.	Meas. 1	Meas. 2	Meas. 3	Meas. 4	Meas. 5	
A009	0.2011	0.1993	0.1929	0.2129	0.2165	
A025	0.1984	0.197	0.2206	0.2149	0.2186	
A041	0.2025	0.2018	0.214	0.2185	0.2099	
A049	0.1944	0.2022	0.197	0.2121	0.2233	
A081	0.2024	0.2	0.2167	0.1972	0.226	
B007	0.2008	0.2	0.1948	0.2099	0.2201	
B051	0.1983	0.2006	0.2158	0.2023	0.2166	
B083	0.2008	0.2021	0.198	0.2048	0.2184	
B103	0.1985	0.202	0.1978	0.213	0.2224	
C007	0.1996	0.1999	0.1971	0.1964	0.2198	
C044	0.2	0.2006	0.2189	0.2135	0.2257	
C070	0.198	0.1977	0.2102	0.2116	0.2122	
C105	0.2016	0.1987	0.1973	0.214	0.2215	
C115	0.2016	0.2007	0.1948	0.215	0.2207	
D009	0.1972	0.2012	0.1935	0.2083	0.2244	
D040	0.1959	0.2038	0.2179	0.2033	0.2183	
D068	0.2011	0.2012	0.1932	0.2043	0.2135	
D098	0.2018	0.2008	0.1976	0.2214	0.2176	
E002	0.1972	0.1995	0.1936	0.2158	0.2115	
E046	0.1942	0.2027	0.2003	0.2144	0.2213	
E076	0.2021	0.2055	0.216	0.2015	0.221	
E104	0.1998	0.1992	0.2065	0.2153	0.2143	
F003	0.2	0.197	0.2169	0.2117	0.2125	
F044	0.1991	0.2015	0.2154	0.2147	0.2163	
F054	0.2	0.2001	0.2204	0.2035	0.2156	
F080	0.2009	0.202	0.1987	0.2121	0.2195	
F107	0.1962	0.2047	0.1938	0.215	0.2131	

ANOVA

Source of variation	*sums of squares (SS)*	*degrees of freedom (df)*	*Mean squares (MS)*	*F-value*	*P-value*	*critical F-value*
Between groups	0.00063917	26	2.4583E-05	0.25482388	0.99990941	1.59842323
Within groups	0.010419	108	9.6472E-05			
Total	0.01105817	134				

(sbb)^2	-1.4378E-05
ubb	0.00162038
u_bb(rel.)	0.78397218

Arsenic

Sample No.	Meas. 1	Meas. 2	Meas. 3	Meas. 4	Meas. 5	
A001	0.007	0.008	0.008	0.008	0.007	
A010	0.007	0.008	0.007	0.007	0.008	
A020	0.007	0.007	0.008	0.008	0.008	
A030	0.008	0.008	0.008	0.007	0.007	
A040	0.007	0.008	0.007	0.008	0.008	
A050	0.007	0.008	0.007	0.007	0.007	
A060	0.007	0.007	0.007	0.007	0.007	
A070	0.009	0.008	0.008	0.008	0.008	
A080	0.008	0.007	0.007	0.007	0.008	
A090	0.008	0.008	0.007	0.008	0.009	
A100	0.008	0.009	0.008	0.008	0.008	
A110	0.008	0.008	0.009	0.008	0.008	
A114	0.009	0.008	0.009	0.008	0.007	
B001	0.008	0.009	0.008	0.008	0.008	
B010	0.007	0.008	0.007	0.007	0.008	
B020	0.008	0.008	0.008	0.008	0.008	
B030	0.008	0.008	0.007	0.008	0.008	
B040	0.008	0.009	0.007	0.008	0.008	
B050	0.008	0.008	0.007	0.008	0.007	
B060	0.008	0.009	0.008	0.008	0.009	
B070	0.009	0.008	0.008	0.008	0.008	
B080	0.009	0.008	0.008	0.009	0.008	
B090	0.008	0.008	0.008	0.008	0.009	
B100	0.008	0.007	0.008	0.008	0.008	
B114	0.008	0.009	0.008	0.008	0.008	
D001	0.009	0.008	0.008	0.009	0.008	
D010	0.009	0.007	0.008	0.008	0.009	
D020	0.009	0.008	0.008	0.008	0.008	
D030	0.008	0.007	0.008	0.008	0.007	
D040	0.009	0.008	0.007	0.008	0.008	
D050	0.007	0.008	0.008	0.009	0.008	
D060	0.009	0.007	0.008	0.009	0.007	
D070	0.009	0.01	0.009	0.009	0.008	
D080	0.008	0.008	0.008	0.007	0.007	
D090	0.007	0.006	0.007	0.006	0.007	
D100	0.007	0.009	0.009	0.008	0.009	
D110	0.008	0.11	0.009	0.01	0.009	
D114	0.008	0.008	0.009	0.009	0.008	
C001	0.008	0.009	0.008	0.007	0.008	
C010	0.008	0.008	0.009	0.008	0.008	
C020	0.009	0.009	0.009	0.008	0.009	
C030	0.009	0.008	0.009	0.009	0.01	
C040	0.009	0.009	0.008	0.008	0.008	
C050	0.008	0.008	0.009	0.009	0.009	
C060	0.009	0.009	0.008	0.01	0.009	
C070	0.009	0.009	0.009	0.008	0.008	
C080	0.009	0.009	0.007	0.008	0.008	
C090	0.009	0.009	0.009	0.007	0.009	
C100	0.009	0.008	0.008	0.009	0.008	
C110	0.008	0.009	0.008	0.008	0.008	
C115	0.009	0.009	0.009	0.008	0.008	

E001	0.008	0.009	0.008	0.007	0.007	
E010	0.008	0.008	0.008	0.008	0.008	
E020	0.008	0.009	0.007	0.007	0.008	
E030	0.008	0.008	0.007	0.008	0.008	
E040	0.008	0.008	0.008	0.007	0.007	
E050	0.008	0.008	0.008	0.007	0.008	
E060	0.008	0.008	0.008	0.009	0.007	
E070	0.008	0.008	0.008	0.008	0.008	
E080	0.008	0.008	0.007	0.007	0.008	
E090	0.008	0.008	0.008	0.008	0.007	
E100	0.008	0.007	0.008	0.008	0.007	
E110	0.009	0.008	0.009	0.008	0.009	
E114	0.008	0.008	0.008	0.008	0.008	
F001	0.008	0.007	0.008	0.008	0.008	
F010	0.008	0.008	0.007	0.007	0.008	
F020	0.007	0.007	0.007	0.008	0.008	
F030	0.008	0.008	0.008	0.008	0.007	
F040	0.008	0.008	0.008	0.008	0.007	
F050	0.007	0.008	0.008	0.008	0.008	
F060	0.008	0.007	0.008	0.007	0.007	
F070	0.008	0.007	0.008	0.008	0.008	
F080	0.008	0.007	0.007	0.007	0.007	
F090	0.007	0.008	0.007	0.007	0.007	
F100	0.01	0.008	0.008	0.008	0.009	
F110	0.008	0.009	0.009	0.009	0.008	
F113	0.009	0.008	0.008	0.009	0.007	
			0.00793506			
ANOVA						
Source of variation	*sums of squares (SS)*	*degrees of freedom (df)*	*Mean squares (MS)*	*F-value*	*P-value*	*critical F-value*
Between groups	0.0023045	76	3.0322E-05	1.13011922	0.23607075	1.32815812
Within groups	0.008264	308	2.6831E-05			
Total	0.0105685	384				
(sbb)^2	6.9825E-07					
ubb	0.00065759					
u_bb(rel.)	8.28712956					

Beryllium:

Sample No.	Meas. 1	Meas. 2	Meas. 3	Meas. 4	Meas. 5	
A009	0.0005175	0.0005154	0.0005049	0.0005469	0.0005509	
A025	0.0005114	0.000512	0.0005545	0.0005495	0.0005544	
A041	0.0005158	0.0005179	0.0005527	0.0005538	0.0005451	
A049	0.0005151	0.000518	0.0005039	0.0005496	0.0005562	
A081	0.0005245	0.0005198	0.0005541	0.0005115	0.0005602	
B007	0.0005181	0.000513	0.0005098	0.000536	0.0005491	
B051	0.0005113	0.0005129	0.0005553	0.0005227	0.0005546	
B083	0.0005189	0.0005193	0.0005133	0.0005193	0.00055	
B103	0.0005153	0.0005184	0.00051	0.000542	0.0005582	
C007	0.0005207	0.0005188	0.0005134	0.0005153	0.0005511	
C044	0.0005149	0.00052	0.0005591	0.0005532	0.0005602	
C070	0.0005096	0.0005109	0.0005461	0.0005419	0.0005409	
C105	0.0005148	0.0005101	0.0005114	0.00055	0.0005543	
C115	0.0005223	0.0005193	0.0005111	0.0005575	0.0005617	
D009	0.0005131	0.0005176	0.0005052	0.0005418	0.0005599	
D040	0.0005159	0.000527	0.0005592	0.000523	0.0005516	
D068	0.0005118	0.0005134	0.0005026	0.0005284	0.0005402	
D098	0.0005157	0.0005132	0.0005125	0.000557	0.0005402	
E002	0.0005143	0.0005115	0.0005089	0.0005479	0.0005483	
E046	0.0005061	0.0005226	0.0005151	0.0005435	0.000554	
E076	0.0005122	0.000521	0.0005471	0.0005129	0.0005596	
E104	0.0005139	0.0005126	0.0005229	0.0005442	0.0005461	
F003	0.0005118	0.0005111	0.000554	0.0005438	0.0005474	
F044	0.0005124	0.0005201	0.0005471	0.0005489	0.00055	
F054	0.0005117	0.0005167	0.0005561	0.0005245	0.0005477	
F080	0.0005053	0.0005166	0.0005014	0.0005293	0.0005487	
F107	0.0005059	0.0005205	0.0005068	0.0005461	0.0005413	
ANOVA						
Source of variation	*sums of squares (SS)*	*degrees of freedom (df)*	*Mean squares (MS)*	*F-value*	*P-value*	*critical F-value*
Between groups	3.5907E-09	26	1.381E-10	0.35000872	0.99846918	1.59842323
Within groups	4.2614E-08	108	3.9458E-10			
Total	4.6205E-08	134				
(sbb)^2	-5.1294E-11					
ubb	3.277E-06					
u_bb(rel.)	0.61882064					

Bismuth

Sample No.	Meas. 1	Meas. 2	Meas. 3	Meas. 4	Meas. 5	
A001	0.01	0.011	0.011	0.011	0.011	
A010	0.01	0.01	0.011	0.011	0.011	
A020	0.01	0.01	0.01	0.011	0.011	
A030	0.011	0.011	0.011	0.011	0.011	
A040	0.011	0.011	0.011	0.011	0.011	
A050	0.011	0.011	0.01	0.01	0.01	
A060	0.011	0.01	0.011	0.011	0.011	
A070	0.011	0.011	0.011	0.011	0.011	
A080	0.01	0.011	0.011	0.011	0.011	
A090	0.011	0.01	0.011	0.011	0.011	
A100	0.011	0.011	0.011	0.011	0.011	
A110	0.011	0.011	0.011	0.011	0.011	
A114	0.011	0.011	0.011	0.011	0.011	
B001	0.011	0.011	0.011	0.01	0.011	
B010	0.011	0.011	0.011	0.01	0.011	
B020	0.011	0.011	0.01	0.011	0.011	
B030	0.01	0.011	0.011	0.011	0.011	
B040	0.01	0.011	0.011	0.011	0.011	
B050	0.011	0.011	0.01	0.011	0.011	
B060	0.011	0.011	0.011	0.01	0.011	
B070	0.011	0.011	0.011	0.011	0.011	
B080	0.011	0.011	0.011	0.011	0.011	
B090	0.011	0.011	0.011	0.011	0.011	
B100	0.011	0.012	0.011	0.011	0.012	
B114	0.01	0.011	0.011	0.011	0.011	
D001	0.011	0.011	0.011	0.011	0.011	
D010	0.011	0.011	0.011	0.011	0.011	
D020	0.011	0.011	0.011	0.011	0.011	
D030	0.011	0.011	0.011	0.011	0.011	
D040	0.011	0.011	0.011	0.011	0.011	
D050	0.011	0.011	0.011	0.011	0.011	
D060	0.011	0.011	0.011	0.011	0.011	
D070	0.011	0.011	0.011	0.011	0.012	
D080	0.011	0.011	0.011	0.011	0.011	
D090	0.011	0.011	0.011	0.011	0.011	
D100	0.011	0.011	0.011	0.011	0.011	
D110	0.011	0.011	0.011	0.011	0.011	
D114	0.011	0.011	0.011	0.011	0.011	
C001	0.011	0.011	0.01	0.011	0.011	
C010	0.011	0.01	0.011	0.011	0.011	
C020	0.011	0.011	0.011	0.011	0.011	
C030	0.011	0.011	0.01	0.011	0.011	
C040	0.011	0.011	0.011	0.011	0.011	
C050	0.011	0.011	0.011	0.011	0.011	
C060	0.011	0.011	0.011	0.011	0.011	
C070	0.011	0.011	0.01	0.011	0.011	
C080	0.011	0.011	0.011	0.011	0.011	
C090	0.011	0.011	0.011	0.011	0.01	
C100	0.011	0.011	0.011	0.011	0.011	
C110	0.01	0.011	0.011	0.011	0.011	
C115	0.011	0.011	0.01	0.011	0.011	

E001	0.011	0.011	0.011	0.011	0.011	
E010	0.011	0.011	0.011	0.011	0.012	
E020	0.011	0.011	0.011	0.012	0.011	
E030	0.011	0.011	0.011	0.012	0.011	
E040	0.011	0.011	0.011	0.011	0.011	
E050	0.011	0.011	0.011	0.011	0.011	
E060	0.011	0.011	0.011	0.011	0.012	
E070	0.011	0.011	0.011	0.011	0.011	
E080	0.011	0.012	0.011	0.011	0.011	
E090	0.011	0.011	0.011	0.011	0.011	
E100	0.011	0.011	0.011	0.011	0.012	
E110	0.011	0.011	0.011	0.011	0.011	
E114	0.011	0.011	0.011	0.011	0.011	
F001	0.011	0.011	0.011	0.011	0.011	
F010	0.011	0.011	0.011	0.011	0.011	
F020	0.011	0.012	0.011	0.012	0.011	
F030	0.011	0.011	0.011	0.011	0.011	
F040	0.011	0.011	0.011	0.011	0.012	
F050	0.011	0.012	0.011	0.011	0.011	
F060	0.011	0.012	0.012	0.011	0.012	
F070	0.011	0.011	0.011	0.012	0.012	
F080	0.012	0.011	0.011	0.012	0.012	
F090	0.011	0.012	0.012	0.011	0.012	
F100	0.011	0.011	0.011	0.012	0.011	
F110	0.011	0.011	0.011	0.011	0.011	
F113	0.011	0.011	0.011	0.012	0.011	
			0.01092208			
ANOVA						

Source of variation	*sums of squares (SS)*	*degrees of freedom (df)*	*Mean squares (MS)*	*F-value*	*P-value*	*critical F-value*
Between groups	1.8197E-05	76	2.3944E-07	2.11917725	3.8446E-06	1.32815812
Within groups	0.0000348	308	1.1299E-07			
Total	5.2997E-05	384				

(sbb)^2	2.529E-08					
ubb	4.2673E-05					
u_bb(rel.)	0.39070036					

Cadmium

Sample No.	Meas. 1	Meas. 2	Meas. 3	Meas. 4	Meas. 5	
A001	0.0005	0.0008	0.0007	0.0007	0.0008	
A010	0.0007	0.0007	0.0008	0.0008	0.0009	
A020	0.0007	0.0008	0.0008	0.0009	0.0008	
A030	0.0008	0.0009	0.0009	0.0009	0.001	
A040	0.001	0.001	0.001	0.0011	0.001	
A050	0.0009	0.0009	0.001	0.0008	0.0008	
A060	0.0009	0.0008	0.0011	0.0009	0.0008	
A070	0.001	0.0008	0.001	0.001	0.001	
A080	0.0007	0.001	0.001	0.0009	0.0009	
A090	0.001	0.0008	0.001	0.0008	0.0009	
A100	0.0009	0.0011	0.001	0.001	0.0009	
A110	0.0008	0.0009	0.0009	0.0009	0.0009	
A114	0.0009	0.001	0.0009	0.0009	0.001	
B001	0.0009	0.001	0.001	0.0007	0.001	
B010	0.0009	0.0009	0.0009	0.0011	0.001	
B020	0.0008	0.0009	0.0008	0.0009	0.0011	
B030	0.0009	0.0011	0.001	0.0011	0.001	
B040	0.0008	0.0009	0.0009	0.008	0.008	
B050	0.001	0.0009	0.0008	0.0009	0.0012	
B060	0.001	0.001	0.001	0.0008	0.0012	
B070	0.0011	0.001	0.0011	0.001	0.0011	
B080	0.001	0.001	0.001	0.0011	0.0011	
B090	0.001	0.001	0.001	0.0011	0.0012	
B100	0.001	0.0013	0.0013	0.001	0.0013	
B114	0.0008	0.0012	0.0011	0.0012	0.001	
D001	0.001	0.0011	0.0011	0.0012	0.001	
D010	0.001	0.001	0.0012	0.0011	0.0012	
D020	0.0012	0.0012	0.0011	0.0011	0.0012	
D030	0.0012	0.0012	0.0012	0.0012	0.0012	
D040	0.0012	0.0011	0.0011	0.0011	0.0011	
D050	0.0012	0.0011	0.0011	0.0012	0.0012	
D060	0.0012	0.0012	0.0011	0.0011	0.0011	
D070	0.001	0.0011	0.0012	0.0013	0.0014	
D080	0.001	0.0011	0.001	0.0012	0.001	
D090	0.0009	0.001	0.0011	0.0009	0.0012	
D100	0.001	0.0011	0.0011	0.0011	0.0011	
D110	0.0011	0.0012	0.0012	0.001	0.0012	
D114	0.0011	0.0011	0.0012	0.001	0.0011	
C001	0.0012	0.0011	0.001	0.0009	0.0012	
C010	0.0011	0.0009	0.0012	0.0013	0.0011	
C020	0.0011	0.0012	0.0012	0.0011	0.0011	
C030	0.0011	0.0011	0.001	0.001	0.001	
C040	0.001	0.001	0.0011	0.0011	0.0011	
C050	0.0011	0.001	0.0011	0.0012	0.0012	
C060	0.0011	0.0011	0.0012	0.001	0.0011	
C070	0.0013	0.0011	0.001	0.0011	0.0011	
C080	0.001	0.0011	0.0011	0.0012	0.0011	
C090	0.001	0.001	0.0011	0.0011	0.001	
C100	0.0011	0.0012	0.0011	0.0011	0.001	
C110	0.0009	0.0011	0.0011	0.001	0.0013	
C115	0.0011	0.001	0.0009	0.0012	0.0012	

E001	0.0008	0.0009	0.001	0.0009	0.0009	
E010	0.001	0.001	0.0009	0.0009	0.001	
E020	0.001	0.0009	0.001	0.0011	0.0011	
E030	0.0009	0.001	0.001	0.0011	0.001	
E040	0.001	0.0009	0.001	0.0008	0.0009	
E050	0.001	0.0009	0.001	0.001	0.001	
E060	0.001	0.0009	0.001	0.001	0.0011	
E070	0.0009	0.0009	0.0011	0.001	0.0011	
E080	0.001	0.0012	0.0008	0.001	0.001	
E090	0.0008	0.0008	0.001	0.001	0.001	
E100	0.0009	0.001	0.001	0.001	0.0011	
E110	0.0008	0.001	0.0009	0.0011	0.0011	
E114	0.0011	0.0009	0.0011	0.001	0.0011	
F001	0.0008	0.0009	0.0009	0.0009	0.001	
F010	0.0007	0.0008	0.0008	0.0009	0.0009	
F020	0.0008	0.0009	0.0007	0.001	0.001	
F030	0.0008	0.0011	0.0009	0.0009	0.0009	
F040	0.001	0.001	0.001	0.001	0.0011	
F050	0.0009	0.0011	0.001	0.0009	0.0009	
F060	0.001	0.0013	0.0012	0.0012	0.0013	
F070	0.0011	0.0012	0.0012	0.0013	0.0012	
F080	0.0011	0.0012	0.001	0.0011	0.0012	
F090	0.001	0.0011	0.0012	0.001	0.0011	
F100	0.0011	0.001	0.0009	0.001	0.001	
F110	0.001	0.0011	0.0012	0.001	0.0011	
F113	0.001	0.0011	0.0011	0.0012	0.0011	
			0.00102208			

ANOVA

Source of variation	*sums of squares (SS)*	*degrees of freedom (df)*	*Mean squares (MS)*	*F-value*	*P-value*	*critical F-value*
Between groups	4.0208E-05	76	5.2906E-07	2.55374347	7.6585E-09	1.32815812
Within groups	6.3808E-05	308	2.0717E-07			
Total	0.00010402	384				

(sbb)^2	6.4377E-08
ubb	5.7783E-05
u_bb(rel.)	5.65344301

Cobalt

Sample No.	Meas. 1	Meas. 2	Meas. 3	Meas. 4	Meas. 5
A001	0.007	0.007	0.007	0.007	0.007
A010	0.007	0.007	0.008	0.008	0.009
A020	0.007	0.007	0.007	0.007	0.007
A030	0.007	0.008	0.007	0.007	0.007
A040	0.007	0.007	0.008	0.008	0.007
A050	0.007	0.007	0.007	0.007	0.007
A060	0.007	0.007	0.007	0.007	0.007
A070	0.007	0.007	0.007	0.007	0.007
A080	0.007	0.007	0.007	0.007	0.007
A090	0.008	0.007	0.008	0.007	0.007
A100	0.007	0.008	0.007	0.008	0.007
A110	0.007	0.007	0.007	0.007	0.007
A114	0.007	0.008	0.007	0.007	0.007
B001	0.007	0.008	0.007	0.007	0.008
B010	0.007	0.007	0.007	0.008	0.007
B020	0.007	0.007	0.007	0.007	0.008
B030	0.007	0.008	0.007	0.007	0.007
B040	0.007	0.007	0.007	0.008	0.007
B050	0.008	0.007	0.007	0.007	0.008
B060	0.008	0.007	0.007	0.007	0.008
B070	0.007	0.007	0.007	0.007	0.007
B080	0.008	0.007	0.007	0.007	0.007
B090	0.008	0.007	0.007	0.007	0.008
B100	0.007	0.008	0.007	0.007	0.008
B114	0.007	0.008	0.007	0.008	0.007
D001	0.008	0.007	0.007	0.007	0.007
D010	0.007	0.007	0.008	0.007	0.007
D020	0.008	0.008	0.007	0.007	0.007
D030	0.008	0.008	0.008	0.008	0.007
D040	0.008	0.008	0.007	0.008	0.007
D050	0.008	0.008	0.007	0.008	0.008
D060	0.007	0.007	0.007	0.007	0.008
D070	0.007	0.008	0.008	0.008	0.008
D080	0.008	0.008	0.008	0.008	0.008
D090	0.008	0.008	0.008	0.008	0.008
D100	0.008	0.008	0.008	0.008	0.008
D110	0.008	0.008	0.008	0.007	0.008
D114	0.007	0.008	0.008	0.007	0.008
C001	0.007	0.007	0.007	0.007	0.008
C010	0.008	0.007	0.008	0.008	0.008
C020	0.008	0.008	0.008	0.008	0.007
C030	0.008	0.008	0.007	0.007	0.007
C040	0.007	0.007	0.007	0.007	0.007
C050	0.007	0.008	0.007	0.008	0.008
C060	0.007	0.007	0.008	0.007	0.007
C070	0.008	0.007	0.007	0.007	0.008
C080	0.007	0.008	0.008	0.008	0.007
C090	0.007	0.007	0.007	0.007	0.007
C100	0.007	0.008	0.008	0.008	0.007
C110	0.007	0.007	0.007	0.007	0.007
C115	0.008	0.007	0.007	0.008	0.007

E001	0.007	0.007	0.007	0.007	0.007	
E010	0.007	0.007	0.007	0.007	0.007	
E020	0.007	0.007	0.007	0.007	0.007	
E030	0.007	0.007	0.007	0.007	0.007	
E040	0.007	0.007	0.007	0.007	0.007	
E050	0.007	0.007	0.007	0.007	0.007	
E060	0.007	0.007	0.007	0.007	0.007	
E070	0.007	0.007	0.007	0.007	0.008	
E080	0.007	0.007	0.007	0.007	0.007	
E090	0.007	0.007	0.007	0.007	0.007	
E100	0.007	0.007	0.007	0.007	0.007	
E110	0.007	0.007	0.007	0.007	0.007	
E114	0.007	0.007	0.007	0.007	0.007	
F001	0.007	0.007	0.007	0.007	0.007	
F010	0.007	0.007	0.007	0.007	0.007	
F020	0.007	0.007	0.007	0.007	0.007	
F030	0.007	0.007	0.007	0.007	0.007	
F040	0.007	0.007	0.007	0.007	0.007	
F050	0.007	0.007	0.007	0.007	0.007	
F060	0.007	0.008	0.008	0.007	0.007	
F070	0.007	0.008	0.007	0.007	0.008	
F080	0.008	0.008	0.007	0.007	0.007	
F090	0.008	0.008	0.008	0.007	0.007	
F100	0.008	0.007	0.007	0.007	0.007	
F110	0.007	0.008	0.007	0.007	0.007	
F113	0.007	0.007	0.007	0.008	0.007	
			0.00723377			

ANOVA

Source of variation	*sums of squares (SS)*	*degrees of freedom (df)*	*Mean squares (MS)*	*F-value*	*P-value*	*critical F-value*
Between groups	3.334E-05	76	4.3869E-07	2.88708952	5.5494E-11	1.32815812
Within groups	0.0000468	308	1.5195E-07			
Total	8.014E-05	384				

(sbb)^2	5.7348E-08
ubb	4.9486E-05
u_bb(rel.)	0.68409736

Gallium:

Sample No.	Meas. 1	Meas. 2	Meas. 3	Meas. 4	Meas. 5	
A009	0.02378	0.02353	0.02203	0.02378	0.02183	
A025	0.02344	0.02319	0.02482	0.02416	0.02205	
A041	0.0237	0.02388	0.02417	0.0246	0.02152	
A049	0.0227	0.02388	0.02265	0.02395	0.02288	
A081	0.02408	0.02356	0.02476	0.02269	0.02309	
B007	0.02381	0.02376	0.02241	0.02364	0.02265	
B051	0.02345	0.02401	0.02435	0.02326	0.02218	
B083	0.02387	0.02398	0.02273	0.02332	0.02282	
B103	0.02345	0.02403	0.02266	0.02418	0.02313	
C007	0.02378	0.0238	0.02268	0.02242	0.02222	
C044	0.02372	0.02376	0.02456	0.02394	0.02325	
C070	0.02331	0.02339	0.02382	0.02414	0.02271	
C105	0.0238	0.02348	0.02261	0.02423	0.02306	
C115	0.02388	0.02393	0.02268	0.02447	0.02271	
D009	0.0231	0.02373	0.022	0.0231	0.02245	
D040	0.02319	0.0241	0.02439	0.02308	0.02248	
D068	0.02367	0.02379	0.02207	0.02327	0.0219	
D098	0.02376	0.02366	0.02253	0.02489	0.02271	
E002	0.02368	0.02366	0.02249	0.02455	0.02142	
E046	0.02284	0.02373	0.02285	0.02411	0.02249	
E076	0.024	0.02429	0.02427	0.02292	0.02296	
E104	0.02354	0.02341	0.02353	0.02458	0.02205	
F003	0.02353	0.02337	0.0243	0.02422	0.02117	
F044	0.0236	0.02392	0.02447	0.02427	0.02232	
F054	0.02347	0.02387	0.02513	0.02325	0.02274	
F080	0.02316	0.02361	0.02257	0.02386	0.02256	
F107	0.02315	0.02411	0.02219	0.02412	0.02212	
ANOVA						
Source of variation	*sums of squares (SS)*	*degrees of freedom (df)*	*Mean squares (MS)*	*F-value*	*P-value*	*critical F-value*
Between groups	8.6059E-06	26	3.31E-07	0.46998862	0.98546859	1.59842323
Within groups	7.6061E-05	108	7.0427E-07			
Total	8.4667E-05	134				
(sbb)^2	-7.4654E-08					
ubb	0.00013845					
u_bb(rel.)	0.59239125					

Antimony:

Sample No.	Meas. 1	Meas. 2	Meas. 3	Meas. 4	Meas. 5	
A009	0.00485	0.00483	0.00791	0.01148	0.00741	
A025	0.00595	0.00819	0.00942	0.0121	0.00646	
A041	0.00382	0.00545	0.01135	0.00907	0.00875	
A049	0.00904	0.00469	0.00713	0.00911	0.00456	
A081	0.00587	0.00593	0.00906	0.01028	0.0073	
B007	0.0048	0.00403	0.0094	0.00701	0.00473	
B051	0.00612	0.00411	0.00987	0.00933	0.00921	
B083	0.00422	0.00387	0.00832	0.00694	0.00478	
B103	0.00432	0.00509	0.00956	0.01028	0.00407	
C007	0.00459	0.00422	0.00898	0.0093	0.00649	
C044	0.00686	0.00587	0.01007	0.01225	0.00441	
C070	0.00679	0.00358	0.00949	0.00748	0.00727	
C105	0.00416	0.00447	0.00851	0.00927	0.00595	
C115	0.00296	0.00513	0.00787	0.01105	0.0064	
D009	0.00819	0.00389	0.00748	0.01078	0.00801	
D040	0.00403	0.00362	0.00813	0.00862	0.00836	
D068	0.00581	0.00446	0.01003	0.00826	0.00615	
D098	0.00356	0.00527	0.01074	0.00946	0.00663	
E002	0.00481	0.00618	0.00779	0.00777	0.00766	
E046	0.00541	0.00765	0.01061	0.009	0.00724	
E076	0.00497	0.00438	0.00718	0.00869	0.00788	
E104	0.00623	0.00686	0.0091	0.01065	0.00827	
F003	0.00632	0.00289	0.00937	0.01115	0.00798	
F044	0.0049	0.00606	0.01028	0.01047	0.00893	
F054	0.00551	0.00527	0.0089	0.00865	0.00617	
F080	0.00707	0.00581	0.00643	0.00761	0.00466	
F107	0.00547	0.00262	0.00978	0.0106	0.0079	

ANOVA

Source of variation	*sums of squares (SS)*	*degrees of freedom (df)*	*Mean squares (MS)*	*F-value*	*P-value*	*critical F-value*
Between groups	6.376E-05	26	2.4523E-06	0.41436622	0.99416329	1.59842323
Within groups	0.00063917	108	5.9182E-06			
Total	0.00070293	134				

(sbb)^2	-6.9318E-07
ubb	0.00040134
u_bb(rel.)	5.61983588

Vanadium:

Sample No.	Meas. 1	Meas. 2	Meas. 3	Meas. 4	Meas. 5	
A009	0.04137	0.04211	0.04138	0.04302	0.04237	
A025	0.04155	0.04183	0.04371	0.04309	0.04291	
A041	0.04187	0.04213	0.04256	0.04373	0.04029	
A049	0.04236	0.04244	0.04121	0.04328	0.04228	
A081	0.04219	0.04156	0.04264	0.03524	0.04259	
B007	0.04219	0.04169	0.04102	0.03981	0.04131	
B051	0.04196	0.04057	0.0431	0.03693	0.04227	
B083	0.04174	0.04189	0.04166	0.03722	0.04083	
B103	0.0418	0.0419	0.0414	0.04177	0.0424	
C007	0.04233	0.04227	0.04123	0.03676	0.04281	
C044	0.04201	0.04191	0.0434	0.04195	0.04184	
C070	0.04103	0.04165	0.04309	0.0405	0.03979	
C105	0.04206	0.041	0.04151	0.04319	0.04196	
C115	0.04232	0.04196	0.04083	0.04297	0.04275	
D009	0.04134	0.04223	0.04068	0.04131	0.04259	
D040	0.04152	0.04283	0.04339	0.03629	0.04173	
D068	0.04176	0.0416	0.04169	0.03799	0.04035	
D098	0.04202	0.04211	0.04136	0.04338	0.04001	
E002	0.04198	0.04184	0.04142	0.04412	0.04263	
E046	0.04078	0.04364	0.04265	0.04185	0.04229	
E076	0.04198	0.0426	0.04337	0.03538	0.04196	
E104	0.04078	0.04165	0.04354	0.04288	0.04054	
F003	0.04175	0.04087	0.04302	0.04153	0.04205	
F044	0.04189	0.04247	0.0429	0.0437	0.04236	
F054	0.04204	0.04235	0.04349	0.03812	0.04134	
F080	0.04113	0.04197	0.04058	0.03897	0.04138	
F107	0.04096	0.04209	0.04095	0.04197	0.04047	
ANOVA						
Source of variation	*sums of squares (SS)*	*degrees of freedom (df)*	*Mean squares (MS)*	*F-value*	*P-value*	*critical F-value*
Between groups	4.8658E-05	26	1.8715E-06	0.7466261	0.8023457	1.59842323
Within groups	0.00027071	108	2.5066E-06			
Total	0.00031937	134				
(sbb)^2	-1.2702E-07					
ubb	0.00026119					
u_bb(rel.)	0.62733505					

Zirconium:

Sample No.	Meas. 1	Meas. 2	Meas. 3	Meas. 4	Meas. 5	
A009	0.011325	0.011393	0.011192	0.012075	0.012173	
A025	0.011319	0.011319	0.012279	0.012116	0.012404	
A041	0.01132	0.011438	0.012145	0.012332	0.01204	
A049	0.011524	0.011412	0.011044	0.012139	0.012535	
A081	0.011573	0.011388	0.012442	0.011176	0.012519	
B007	0.011584	0.011199	0.010958	0.011892	0.01231	
B051	0.01129	0.011281	0.012183	0.011492	0.012292	
B083	0.011342	0.011504	0.011215	0.011548	0.012228	
B103	0.011342	0.011502	0.011346	0.012112	0.012467	
C007	0.011445	0.01159	0.011075	0.011155	0.012415	
C044	0.011424	0.011546	0.01243	0.012187	0.012476	
C070	0.011299	0.011293	0.012025	0.011822	0.011943	
C105	0.011465	0.011177	0.011176	0.012294	0.012632	
C115	0.011383	0.011628	0.010951	0.012348	0.012397	
D009	0.011227	0.011429	0.010904	0.012191	0.012469	
D040	0.011236	0.011663	0.012393	0.011365	0.012274	
D068	0.011407	0.01131	0.011063	0.011441	0.012022	
D098	0.01133	0.011273	0.011279	0.012416	0.012002	
E002	0.011176	0.01142	0.010899	0.01235	0.012233	
E046	0.011076	0.01151	0.011237	0.012008	0.012397	
E076	0.011447	0.01142	0.012246	0.011093	0.012288	
E104	0.011261	0.011291	0.011528	0.012091	0.012024	
F003	0.011227	0.011628	0.012172	0.012103	0.012261	
F044	0.011307	0.011488	0.012064	0.012371	0.012387	
F054	0.011426	0.011431	0.012436	0.01156	0.012216	
F080	0.011267	0.01126	0.01112	0.011624	0.012218	
F107	0.011193	0.011577	0.011008	0.012377	0.011926	
ANOVA						

Source of variation	*sums of squares (SS)*	*degrees of freedom (df)*	*Mean squares (MS)*	*F-value*	*P-value*	*critical F-value*
Between groups	2.3556E-06	26	9.06E-08	0.33387058	0.99896997	1.59842323
Within groups	2.9307E-05	108	2.7136E-07			
Total	3.1663E-05	134				

(sbb)^2	-3.6152E-08
ubb	8.5939E-05
u_bb(rel.)	0.73400226

Annex 2: Calculation of uncertainty contribution of potential inhomogeneity (area)

Silicon:

r_0	11.77897823	11.77902177									
r_in	11.71	11.7	11.759	11.729	11.789	11.791					
r_out	11.717	11.723	11.635	11.679	11.821	11.789	11.683	11.715	11.826	11.775	11.324
Source of variation	*sums of squares (SS)*	*degrees of freedom (df)*	*Mean squares (MS)*	*F-value*	*P-value*	*critical F-value*					
Between groups	0.015960715	2	0.007980357	0.641105289	0.539716283	3.633723468					
Within groups	0.199164971	16	0.012447811								
Total	0.215125685	18									
within-sd	0.111569757			status:	homogeneous						
effective n	5.26										
s_bb	0										
s_bb_min	0.028916837										
u_bb	0.028916837			11.72226316							
u_bb(rel.)	0.246683058										

Iron:

r_0	0.947478228	0.947521772									
r_in	0.9088	0.9288	0.9536	0.9468	0.9431	0.9527					
r_out	0.911	0.9402	0.9373	0.9227	0.9499	0.9419	0.9596	0.9518	0.9495	0.9515	0.928
Source of variation	*sums of squares (SS)*	*degrees of freedom (df)*	*Mean squares (MS)*	*F-value*	*P-value*	*critical F-value*					
Between groups	0.000112124	2	5.60619E-05	0.246923824	0.784122709	3.633723468					
Within groups	0.003632663	16	0.000227041								
Total	0.003744787	18									
within-sd	0.015067895			status:	homogeneous						
effective n	5.26										
s_bb	0										
s_bb_min	0.003905322										
u_bb	0.003905322			0.940642105							
u_bb(rel.)	0.415176224										

Copper:

r_0	1.722978228	1.723021772									
r_in	1.806	1.751	1.744	1.732	1.733	1.708					
r_out	1.825	1.751	1.743	1.758	1.782	1.76	1.724	1.747	1.763	1.73	1.641
Source of variation	*sums of squares (SS)*	*degrees of freedom (df)*	*Mean squares (MS)*	*F-value*	*P-value*	*critical F-value*					
Between groups	0.001040753	2	0.000520376	0.328133593	0.725000708	3.633723468					
Within groups	0.02537388	16	0.001585867								
Total	0.026414633	18									
within-sd	0.039822952			status:	homogeneous						
effective n	5.26										
s_bb	0										
s_bb_min	0.01032138										
u_bb	0.01032138			1.744421053							
u_bb(rel.)	0.591679376										

Manganese:

r_0	0.393678228	0.393721772									
r_in	0.4024	0.3975	0.4006	0.396	0.3968	0.3957					
r_out	0.4074	0.4036	0.3968	0.3935	0.4007	0.3997	0.3958	0.3976	0.399	0.394	0.3782
Source of variation	*sums of squares (SS)*	*degrees of freedom (df)*	*Mean squares (MS)*	*F-value*	*P-value*	*critical F-value*					
Between groups	2.99865E-05	2	1.49932E-05	0.406513776	0.672655138	3.633723468					
Within groups	0.00059012	16	3.68825E-05								
Total	0.000620106	18									
within-sd	0.006073095			status:	homogeneous						
effective n	5.26										
s_bb	0										
s_bb_min	0.001574035										
u_bb	0.001574035			0.396984211							
u_bb(rel.)	0.396498135										

Magnesium:

r_0	0.195579284	0.195620716										
r_in	0.1932	0.1986	0.1979	0.1985	0.1994	0.1965						
r_out	0.1949	0.1965	0.1952	0.2014	0.1998	0.1967	0.2012	0.1971	0.1961	0.198	0.2011	0.2014
Source of variation	*sums of squares (SS)*	*degrees of freedom (df)*	*Mean squares (MS)*	*F-value*	*P-value*	*critical F-value*						
Between groups	1.36138E-05	2	6.80692E-06	1.200482956	0.325324922	3.591530568						
Within groups	9.63925E-05	17	5.67015E-06									
Total	0.000110006	19										
within-sd	0.002381207			status:	homogeneous							
effective n	5.40											
s_bb	0.000458817											
s_bb_min	0.00060013											
u_bb	0.00060013			0.197735								
u_bb(rel.)	0.30350235											

Nickel:

r_0	0.244578228	0.244621772									
r_in	0.2455	0.2443	0.2466	0.2463	0.2463	0.2471					
r_out	0.245	0.2446	0.2437	0.2462	0.2486	0.2487	0.2459	0.2479	0.2494	0.248	0.2347
Source of variation	*sums of squares (SS)*	*degrees of freedom (df)*	*Mean squares (MS)*	*F-value*	*P-value*	*critical F-value*					
Between groups	3.01693E-06	2	1.50846E-06	0.139423134	0.870905205	3.633723468					
Within groups	0.000173109	16	1.08193E-05								
Total	0.000176126	18									
within-sd	0.003289275			status:	homogeneous						
This data set now can be handled according to ISO G35. The result for u_bb is:											
effective n	5.26										
s_bb	0										
s_bb_min	0.00085252										
u_bb	0.00085252			0.245684211							
u_bb(rel.)	0.346998217										

Chromium:

r_0	0.062504477	0.062555523										
r_in	0.06376	0.06328	0.06332	0.06257	0.06248	0.06246						
r_out	0.06225	0.06305	0.06239	0.06265	0.06402	0.06251	0.06234	0.06313	0.06325	0.06314	0.06369	0.06458
Source of variation	*sums of squares (SS)*	*degrees of freedom (df)*	*Mean squares (MS)*	*F-value*	*P-value*	*critical F-value*						
Between groups	5.27705E-07	2	2.63852E-07	0.617185854	0.551117245	3.591530568						
Within groups	7.26765E-06	17	4.27509E-07									
Total	7.79536E-06	19										
within-sd	0.000653842			status:	homogeneous							
effective n	5.40											
s_bb	0											
s_bb_min	0.000164786											
u_bb	0.000164786			0.0629965								
u_bb(rel.)	0.261580034											

Zinc:

r_0	1.115979284	1.116020716										
r_in	1.1058	1.1284	1.1193	1.1248	1.1276	1.1189						
r_out	1.1102	1.1191	1.1141	1.1399	1.1317	1.1179	1.1389	1.1154	1.1062	1.1144	1.1306	1.1325
Source of variation	*sums of squares (SS)*	*degrees of freedom (df)*	*Mean squares (MS)*	*F-value*	*P-value*	*critical F-value*						
Between groups	7.7043E-05	2	3.85215E-05	0.36199547	0.70152462	3.591530568						
Within groups	0.001809043	17	0.000106414									
Total	0.001886086	19										
within-sd	0.010315731			status:	homogeneous							
effective n	5.40											
s_bb	0											
s_bb_min	0.002599851											
u_bb	0.002599851			1.121385								
u_bb(rel.)	0.231842832											

Titanium:

r_0	0.186074477	0.186125523										
r_in	0.1863	0.1855	0.1848	0.184	0.183	0.1833						
r_out	0.1827	0.1849	0.1834	0.1839	0.1841	0.1823	0.1825	0.1839	0.1846	0.1859	0.187	0.1898
Source of variation	*sums of squares (SS)*	*degrees of freedom (df)*	*Mean squares (MS)*	*F-value*	*P-value*	*critical F-value*						
Between groups	4.3645E-06	2	2.18225E-06	0.630640517	0.544252322	3.591530568						
Within groups	5.88263E-05	17	3.46037E-06									
Total	6.31908E-05	19										
within-sd	0.001860207			status:	homogeneous							
effective n	5.40											
s_bb	0											
s_bb_min	0.000468824											
u_bb	0.000468824			0.184705								
u_bb(rel.)	0.253823047											

Lead:

r_0	0.183278228	0.183321772									
r_in	0.1766	0.1785	0.1804	0.1803	0.1821	0.1818					
r_out	0.1768	0.1777	0.1781	0.1789	0.1822	0.1822	0.181	0.1808	0.1834	0.1831	0.1738
Source of variation	*sums of squares (SS)*	*degrees of freedom (df)*	*Mean squares (MS)*	*F-value*	*P-value*	*critical F-value*					
Between groups	2.11855E-05	2	1.05927E-05	1.505020413	0.251823041	3.633723468					
Within groups	0.000112612	16	7.03827E-06								
Total	0.000133798	18									
within-sd	0.002652974			status:	homogeneous						
effective n	5.26										
s_bb	0.000821796										
s_bb_min	0.000687602										
u_bb	0.000821796			0.180226316							
u_bb(rel.)	0.455980224										

Tin:

r_0	0.197579284	0.197620716										
r_in	0.197	0.2014	0.1969	0.1998	0.2	0.2006						
r_out	0.1982	0.1987	0.1983	0.2008	0.2037	0.201	0.2025	0.1959	0.1957	0.1982	0.2028	0.2021
Source of variation	*sums of squares (SS)*	*degrees of freedom (df)*	*Mean squares (MS)*	*F-value*	*P-value*	*critical F-value*						
Between groups	8.69717E-06	2	4.34858E-06	0.756571864	0.484433717	3.591530568						
Within groups	9.77117E-05	17	5.74775E-06									
Total	0.000106409	19										
within-sd	0.002397446			status:	homogeneous							
effective n	5.40											
s_bb	0											
s_bb_min	0.000604223											
u_bb	0.000604223			0.19944								
u_bb(rel.)	0.302959746											

Arsenic:

r_0	13.79344688	18.04655312									
r_in	24.25	21.32	16.86	19.49	19.74	15.82	22.33	18.64			
r_out	24.19	25.06	22.12	20.1	19.02	18.2	16.87	20.43	21.55	15.83	24.73
Source of variation	*sums of squares (SS)*	*degrees of freedom (df)*	*Mean squares (MS)*	*F-value*	*P-value*	*critical F-value*					
Between groups	39.43422462	2	19.71711231	2.197119883	0.140031465	3.554557146					
Within groups	161.5332984	18	8.974072131								
Total	200.967523	20									
within-sd	2.995675572			status:	homogeneous						
effective n	6.00										
s_bb	1.338098164										
s_bb_min	0.706087504										
u_bb	1.338098164			19.92333333							
u_bb(rel.)	6.716236393										

Beryllium:

r_0	0.000488928	0.000532472									
r_in	0.0005156	0.0005074	0.0005103	0.0005059	0.0005113	0.0005073					
r_out	0.0005112	0.0005118	0.0004998	0.0005081	0.00051	0.0005094	0.0005087	0.000511	0.0005081	0.000512	0.0005041
Source of variation	*sums of squares (SS)*	*degrees of freedom (df)*	*Mean squares (MS)*	*F-value*	*P-value*	*critical F-value*					
Between groups	9.97805E-12	2	4.98903E-12	0.069635914	0.933014452	3.633723468					
Within groups	1.14631E-09	16	7.16445E-11								
Total	1.15629E-09	18									
within-sd	8.4643E-06			status:	homogeneous						
effective n	5.26										
s_bb	0										
s_bb_min	2.19379E-06										
u_bb	2.19379E-06			0.000509126							
u_bb(rel.)	0.430893608										

Bismuth:

r_0	93.3725838	104.2274162									
r_in	102.2	105.2	113.2	118.1	113.8	110.1	106.1	106.3			
r_out	113.4	113.8	98.7	114.2	90.1	92.9	102.7	116	103.5	105.3	106.5
Source of variation	*sums of squares (SS)*	*degrees of freedom (df)*	*Mean squares (MS)*	*F-value*	*P-value*	*critical F-value*					
Between groups	201.3540043	2	100.6770022	1.759236906	0.200516148	3.554557146					
Within groups	1030.097784	18	57.22765467								
Total	1231.451788	20									
within-sd	7.56489621			status:	homogeneous						
effective n	6.00										
s_bb	2.691014291										
s_bb_min	1.783063136										
u_bb	2.691014291			106.1761905							
u_bb(rel.)	2.53447998										

Cadmium:

r_0	8.539760032	11.24023997									
r_in	11.15	13.87	13.09	12.85	10.75	15.75	11.15	12.83			
r_out	10.27	11	10.58	14.84	12.29	8.67	14.49	11.69	13.52	14.07	10.12
Source of variation	*sums of squares (SS)*	*degrees of freedom (df)*	*Mean squares (MS)*	*F-value*	*P-value*	*critical F-value*					
Between groups	12.5951316	2	6.297565801	1.750186514	0.202040573	3.554557146					
Within groups	64.76805958	18	3.598225532								
Total	77.36319118	20									
within-sd	1.896898925			status:	homogeneous						
effective n	6.00										
s_bb	0.670738432										
s_bb_min	0.447103364										
u_bb	0.670738432			12.03619048							
u_bb(rel.)	5.572680441										

Cobalt:

r_0	70.01201614	74.58798386									
r_in	74.9	74.9	78.9	82.6	77.8	77.4	78.7	75.6			
r_out	79.4	80.8	73.1	79.4	70.8	70.9	76	80.2	74.8	76.9	75.4
Source of variation	*sums of squares (SS)*	*degrees of freedom (df)*	*Mean squares (MS)*	*F-value*	*P-value*	*critical F-value*					
Between groups	45.72225108	2	22.86112554	2.22869864	0.136526749	3.554557146					
Within groups	184.637013	18	10.25761183								
Total	230.3592641	20									
within-sd	3.202750667			status:	homogeneous						
effective n	6.00										
s_bb	1.449339718										
s_bb_min	0.754895572										
u_bb	1.449339718			76.33809524							
u_bb(rel.)	1.898579881										

Gallium:

r_0	0.022738228	0.022781772									
r_in	0.02231	0.02286	0.02292	0.02293	0.0235	0.02332					
r_out	0.0223	0.02309	0.02249	0.02305	0.0231	0.02337	0.02353	0.02341	0.02338	0.0236	0.02314
Source of variation	*sums of squares (SS)*	*degrees of freedom (df)*	*Mean squares (MS)*	*F-value*	*P-value*	*critical F-value*					
Between groups	2.77859E-07	2	1.3893E-07	0.874148611	0.436220747	3.633723468					
Within groups	2.5429E-06	16	1.58931E-07								
Total	2.82076E-06	18									
within-sd	0.000398662			status:	homogeneous						
effective n	5.26										
s_bb	0										
s_bb_min	0.000103326										
u_bb	0.000103326			0.023043158							
u_bb(rel.)	0.448401356										

Antimony:

r_0	0.004998228	0.005041772									
r_in	0.00767	0.00459	0.00531	0.00375	0.00715	0.00474					
r_out	0.00849	0.00766	0.00566	0.00962	0.00467	0.00628	0.00547	0.00481	0.00498	0.0077	0.00669
Source of variation	*sums of squares (SS)*	*degrees of freedom (df)*	*Mean squares (MS)*	*F-value*	*P-value*	*critical F-value*					
Between groups	6.43745E-06	2	3.21873E-06	1.329013949	0.292438102	3.633723468					
Within groups	3.87503E-05	16	2.42189E-06								
Total	4.51877E-05	18									
within-sd	0.001556243			status:	homogeneous						
effective n	5.26										
s_bb	0.0003891										
s_bb_min	0.00040335										
u_bb	0.00040335			0.006067368							
u_bb(rel.)	6.64785082										

Vanadium:

r_0	0.041568228	0.041611772									
r_in	0.04042	0.04111	0.0413	0.04123	0.04162	0.04116					
r_out	0.03991	0.04036	0.03904	0.04028	0.0411	0.04144	0.04131	0.04091	0.04141	0.04108	0.03992
Source of variation	*sums of squares (SS)*	*degrees of freedom (df)*	*Mean squares (MS)*	*F-value*	*P-value*	*critical F-value*					
Between groups	2.18874E-06	2	1.09437E-06	2.591441014	0.10594476	3.633723468					
Within groups	6.75682E-06	16	4.22301E-07								
Total	8.94556E-06	18									
within-sd	0.000649847			status:	homogeneous						
effective n	5.26										
s_bb	0.000357341										
s_bb_min	0.000168428										
u_bb	0.000357341			0.040883158							
u_bb(rel.)	0.874055172										

Zirconium:

r_0	0.011072228	0.011115772									
r_in	0.011141	0.011108	0.011137	0.01094	0.011044	0.011112					
r_out	0.010977	0.011183	0.010919	0.010901	0.011322	0.011225	0.011073	0.011274	0.011348	0.011021	0.011123
Source of variation	*sums of squares (SS)*	*degrees of freedom (df)*	*Mean squares (MS)*	*F-value*	*P-value*	*critical F-value*					
Between groups	7.85156E-09	2	3.92578E-09	0.222142889	0.803229659	3.633723468					
Within groups	2.82757E-07	16	1.76723E-08								
Total	2.90609E-07	18									
within-sd	0.000132937			status:	homogeneous						
effective n	5.26										
s_bb	0										
s_bb_min	3.44549E-05										
u_bb	3.44549E-05			0.011107158							
u_bb(rel.)	0.310204459										