

FLUXANA®

XRF Application Solutions

RV-2017-02

Final Proficiency Test Report

for Lime

FLX-135, FLX-136



Bedburg-Hau, January 15, 2018

Coordinator of PT

Charlotte Winkels-Herding

Head of Laboratory

Dr. Barbara Schäfer

Statistics and Report

Dr. Rainer Schramm

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FLX-135	Al ₂ O ₃	CaO	Cr ₂ O ₃	Fe ₂ O ₃	K ₂ O-A ¹⁾	K ₂ O-O ²⁾	LOI	MgO
					Annealed	Original		
Unit	%	%	%	%	%	%	%	%
No. of laboratories	18	19	4	18	8	9	19	19
Mean m	0,503	56,819	0,002	0,314	0,024	0,121	47,125	40,295
Reproducibility standard deviation S _R	0,030	0,713	0,002	0,040	0,013	0,009	0,254	0,470
Repeatability standard deviation s _r	0,007	0,109	0,001	0,004	0,004	0,002	0,047	0,071
Robust standard deviation s*	0,027	0,657	0,002	0,040	0,014	0,005	0,290	0,558
Uncertainty U (s*)	0,016	0,377	0,002	0,024	0,012	0,004	0,166	0,320
Uncertainty U (S _R)	0,018	0,409	0,003	0,024	0,011	0,008	0,146	0,270
Mean - 2*S _R	0,444	55,392	-0,002	0,234	-0,002	0,102	46,618	39,354
Mean + 2*S _R	0,563	58,246	0,006	0,393	0,051	0,140	47,633	41,235
	Mn ₂ O ₃	Na ₂ O	P ₂ O ₅	SiO ₂	SO ₃	SrO	TiO ₂	ZnO
Unit	%	%	%	%	%	%	%	%
No. of laboratories	15	10	12	19	15	13	15	9
Mean m	0,100	0,071	0,014	1,865	0,063	0,020	0,028	0,007
Reproducibility standard deviation S _R	0,011	0,054	0,007	0,087	0,034	0,001	0,008	0,001
Repeatability standard deviation s _r	0,001	0,008	0,001	0,012	0,003	0,001	0,001	0,001
Robust standard deviation s*	0,010	0,026	0,011	0,080	0,037	0,001	0,011	0,001
Uncertainty U (s*)	0,007	0,041	0,005	0,051	0,022	0,001	0,006	0,001
Uncertainty U (S _R)	0,007	0,043	0,005	0,050	0,022	0,001	0,005	0,001
Mean - 2*S _R	0,078	-0,038	0,000	1,690	-0,006	0,017	0,011	0,004
Mean + 2*S _R	0,122	0,180	0,029	2,040	0,132	0,023	0,045	0,009

1) K₂O-A concentration was determined in annealed sample

2) K₂O-O concentration was determined in dried original sample

All values are in mass % and are based on annealed sample material (K₂O-O and LOI are based on original sample material).

Mean	calculated from laboratory means using traceable methods only
S _R	Reproducibility standard deviation
s _r	Repeatability standard deviation
s*	Robust standard deviation
U (s*)	uncertainty calculated for a confidence interval of P= 95% (k=2)
U (S _R)	uncertainty calculated for a confidence interval of P= 95% (k=2)
Range of tolerance	Mean ± 2 x S _R ; all labs within this range show satisfactory performance

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FLX-136	Al ₂ O ₃	CaO	Cr ₂ O ₃	Fe ₂ O ₃	K ₂ O-A ¹⁾	K ₂ O-O ²⁾	LOI	MgO
					Annealed	Original		
Unit	%	%	%	%	%	%	%	%
No. of laboratories	18	19	4	18	9	7	19	19
Mean m	0,339	97,400	0,002	0,214	0,024	0,090	43,572	0,754
Reproducibility standard deviation S _R	0,038	0,440	0,001	0,037	0,015	0,015	0,158	0,042
Repeatability standard deviation s _r	0,014	0,060	0,001	0,003	0,002	0,008	0,018	0,014
Robust standard deviation s*	0,037	0,424	0,001	0,038	0,016	0,017	0,151	0,037
Uncertainty U (s*)	0,022	0,243	0,001	0,022	0,013	0,017	0,087	0,021
Uncertainty U (S _R)	0,022	0,252	0,001	0,022	0,013	0,014	0,091	0,024
Mean - 2*S _R	0,262	96,520	0,000	0,140	-0,006	0,060	43,257	0,670
Mean + 2*S _R	0,416	98,279	0,004	0,289	0,054	0,120	43,888	0,838
	Mn ₂ O ₃	Na ₂ O	P ₂ O ₅	SiO ₂	SO ₃	SrO	TiO ₂	ZnO
Unit	%	%	%	%	%	%	%	%
No. of laboratories	15	7	12	18	15	13	14	8
Mean m	0,070	0,027	0,019	0,995	0,051	0,036	0,022	0,006
Reproducibility standard deviation S _R	0,010	0,027	0,011	0,083	0,038	0,002	0,011	0,002
Repeatability standard deviation s _r	0,001	0,002	0,001	0,013	0,003	0,001	0,002	0,001
Robust standard deviation s*	0,010	0,026	0,011	0,080	0,037	0,001	0,011	0,001
Uncertainty U (s*)	0,007	0,025	0,008	0,047	0,024	0,001	0,007	0,001
Uncertainty U (S _R)	0,006	0,026	0,008	0,049	0,025	0,001	0,007	0,002
Mean - 2*S _R	0,049	-0,027	-0,003	0,828	-0,025	0,033	0,000	0,003
Mean + 2*S _R	0,090	0,080	0,040	1,162	0,126	0,039	0,044	0,009

1) K₂O-A concentration was determined in annealed sample

2) K₂O-O concentration was determined in dried original sample

All values are in mass % and are based on annealed sample material (K₂O-O and LOI based on original sample material).

Mean	calculated from laboratory means using traceable methods only
S_R	Reproducibility standard deviation
s_r	Repeatability standard deviation
s*	Robust standard deviation
U (s*)	uncertainty calculated for a confidence interval of P= 95% (k=2)
U (S_R)	uncertainty calculated for a confidence interval of P= 95% (k=2)
Range of tolerance	Mean ± 2 x S_R ; all labs within this range show satisfactory performance



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Introduction

X-ray fluorescence analysis is a widely used technique for the rapid screening analysis of catalytic converter samples.

However, dedicated standard material is needed for the calibration of XRF instruments. As a worldwide supplier for XRF laboratories, FLUXANA has developed a number of services to support XRF users. One of these services is the production of new reference materials and the organization of proficiency tests (PT).

In 2011, FLUXANA introduced its own quality management.

In February 2014, FLUXANA received accreditation from German DAKKS according to DIN EN ISO/IEC 17025 for its test laboratory in Bedburg-Hau.

The production of reference materials and the performance of proficiency tests is not yet accredited. However, FLUXANA has applied for the accreditation process at DAKKS.

Nevertheless, all evaluations are performed in agreement with DIN EN ISO/IEC 17043:2010-05, ISO Guide 34:2009, ISO Guide 31:2000 and ISO Guide 35:2006.

Further information

All laboratory data are listed in the following evaluation report. Additional information about laboratory accreditation and analytical methods used is also provided. Calculation was done only on traceable methods. The laboratory performance is shown based on z-scores. The diagrams show the laboratory data in comparison with the calculated mean values.

Outliers

Outliers in the statistical sense are typically not detected when using robust statistical methods, because the robust A+S algorithms were found to work better for small populations than the classical approach (which is outlier detection plus arithmetic mean and classical s.d. formula). Analytical data identified as errors were removed before performing the statistical evaluation.

**RV-2017-02****Participants**

Cambridge Materials Testing Limited	Canada
FLSmidt	Denmark
BGH Edelstahl Siegen GmbH	Germany
Chemische Fabrik Budenheim KG	Germany
FLUXANA GmbH & Co.KG	Germany
Fraunhofer-Institut für Bauphysik IBP, Standort Holzkirchen	Germany
Georgsmarienhütte GmbH	Germany
Kalkwerk Kaltes Tal	Germany
Kalkwerk Münchhof	Germany
Kalkwerk Rüdersdorf	Germany
Monier Technical Centre GmbH	Germany
Zentrum für Glas- und Umweltanalytik GmbH	Germany
ACC Limited	India
Fassa srl	Italy
Rebasa, Refractorios Básicos S.A de C.V.	Mexico
PPC Cement Group Lab Services	South Africa
AZTERLAN	Spain
Jura-Cement-Fabriken AG	Switzerland
MTE Services, Inc.	USA



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Statistical Evaluation

Calculation of Mean m

The mean m for all laboratories was calculated using the Hampel estimator (ISO/TS 20612:2007 9.2.3) based on the laboratory means μ using traceable methods only.

Calculation of reproducibility standard deviation s_R

The reproducibility standard deviation s_R was calculated using the Q-method (ISO/TS 20612:2007 9.2.3).

Calculation of repeatability standard deviation s_r

The repeatability standard deviation s_r was also calculated using the Q-method.

Calculation of robust standard deviation s^*

The robust standard deviation s^* was calculated from the laboratory means μ using the Q-method.

Calculation of uncertainty U_{s_R} (according to Nordtest TR 537 ed 3.1.)

The **uncertainty U_{s_R}** for a confidence interval of $P=95\%$ ($k=2$) can be calculated from the **reproducibility standard deviation s_R** (factor 1.25 for average median, robust statistics):

$$U_{s_R} = 2 * 1.25 * \frac{s_R}{\sqrt{p}}$$

Calculation of uncertainty U_{s^*} (according to ISO 13528:2015)

The **uncertainty U_{s^*}** for a confidence interval of $P=95\%$ ($k=2$) can be calculated from the **robust standard deviation s^*** (factor 1.25 for average median, robust statistics):

$$U_{s^*} = 2 * 1.25 * \frac{s^*}{\sqrt{p}}$$

The **uncertainty U_{s^*}** only takes the between laboratories uncertainty into account while the **uncertainty U_{s_R}** also includes the within laboratories uncertainty. Therefore **U_{s_R}** is recommended for use in accredited laboratories.



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Laboratory performance

Laboratory proficiency assessment was based on z-scores.
The **z-score** z was calculated from all laboratory means μ :

$$z = \frac{m - \mu}{s_R}$$

m	Mean value for all laboratories (assigned value)
μ	Mean value of individual laboratory
s_R	Reproducibility standard deviation

Assessment on z-scores:

$ z \leq 2.0$	indicates "satisfactory" performance = generates no signal
$2.0 < z < 3.0$	indicates "questionable" performance = generates a warning signal
$ z \geq 3.0$	indicates "unsatisfactory" performance = generates an action signal

Z-scores with $|z| \geq 2$ were highlighted with a yellow color, z-scores with $|z| \geq 3$ were highlighted with a red color.

Traceable analytical methods used

XRF (fusion), XRF (fusion) ASTM C1271
ICP-OES, ICP-OES ASTM D6349-13 WR
AAS, AAS ASTM D6349-13 WR
CaO: Wet chemistry ASTM C25 cap.31, titration
LOI: Annealing @ 1050 °C with weighing
Na₂O: Wet chemistry ASTM C114
SO₃: Combustion with IR-Detection, Gravimetric

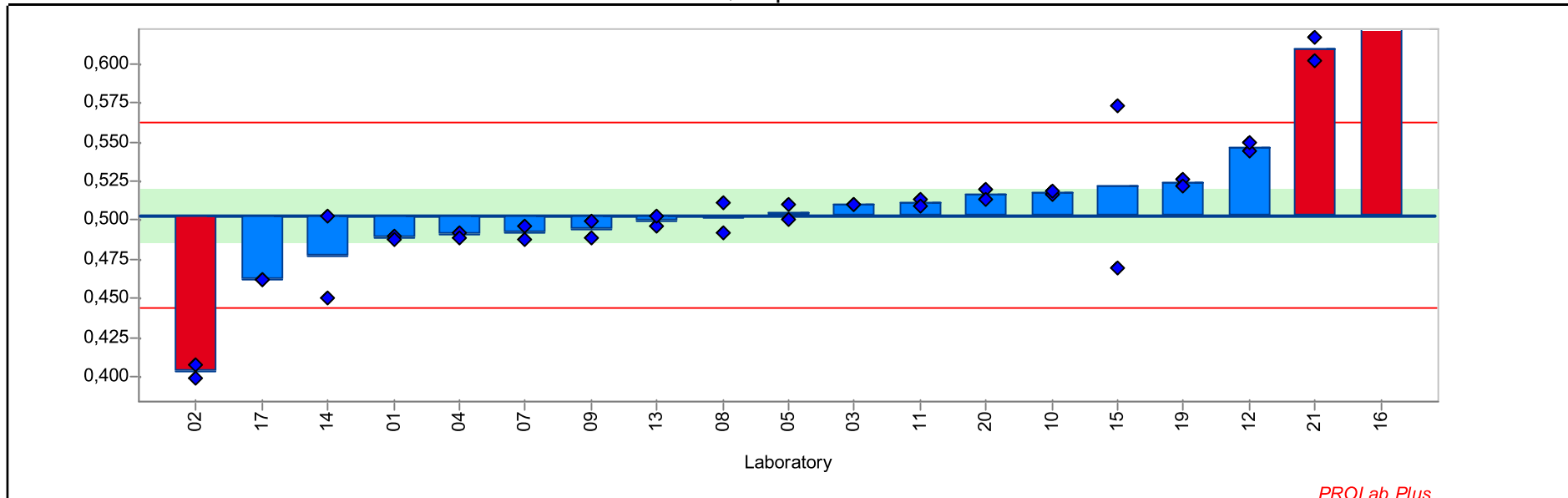
Analytical methods shown as info only

XRF (pellet)

RV_2017_02_Lime

Summary results

Sample: FLX-135 **Reprod. s.d.** 0,030
Measurand: Al2O3 **Repeat. s.d** 0,007
Mean ± U(Mean): 0,503 ± 0,016 **Range of tolerance:** 0,444 - 0,563 (|z-score| ≤ 2,000)
No. of laboratories: 18 **Statistical method** Q/Hampel



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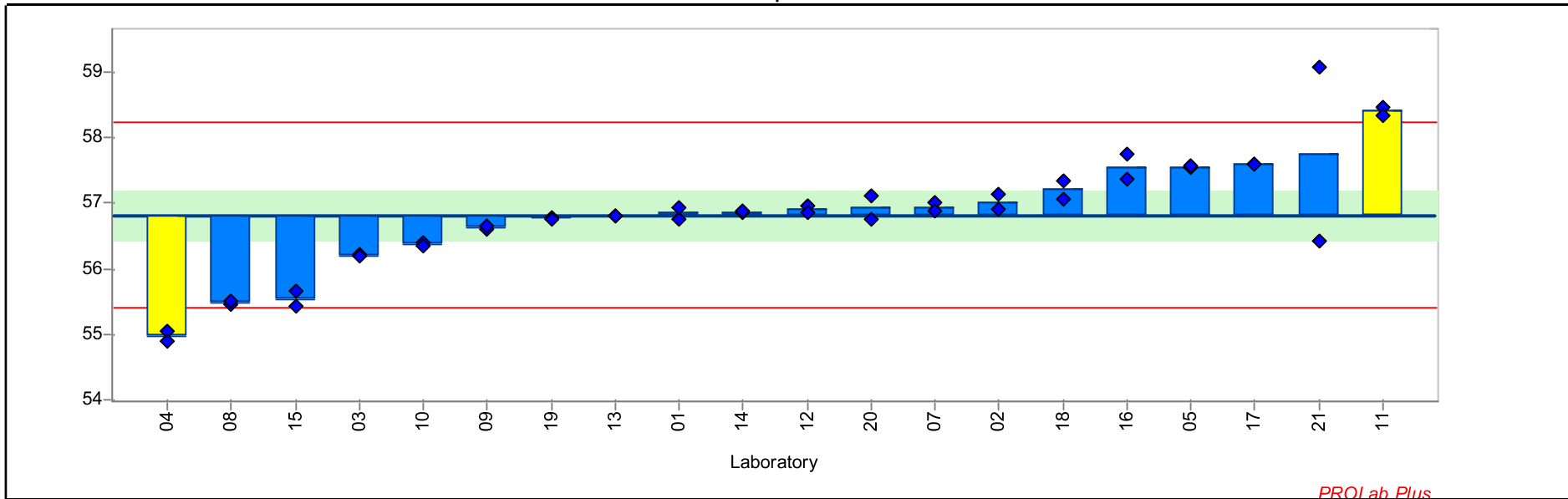
Lab code	Lab mean	s.d.	z-score	Conc. 1	Conc. 2	Accreditation	Analytical method	Comment
01	0,489	0,001	-0,478	0,490	0,488	no accreditation	XRF (fusion)	
02	0,403	0,006	-3,360	0,399	0,408	no accreditation	XRF (fusion)	
03	0,510	0,000	0,230	0,510	0,510	no accreditation	XRF (fusion)	
04	0,490	0,002	-0,427	0,492	0,489	no accreditation	XRF (fusion)	
05	0,505	0,007	0,061	0,510	0,500	no accreditation	XRF (fusion)	
07	0,492	0,006	-0,377	0,496	0,488	no accreditation	XRF (fusion)	

RV_2017_02_Lime

Lab code	Lab mean	s.d.	z-score	Conc. 1	Conc. 2	Accreditation	Analytical method	Comment
08	0,502	0,013	-0,057	0,492	0,511	no accreditation	XRF (fusion)	
09	0,494	0,007	-0,309	0,499	0,489	no accreditation	XRF (fusion)	
10	0,518	0,002	0,483	0,516	0,519	ISO 17025	Other Method	ICP, ASTM D6349-13 WR
11	0,511	0,003	0,264	0,513	0,509	ISO 17025	XRF (fusion)	
12	0,546	0,004	1,460	0,544	0,549	no accreditation	XRF (fusion)	
13	0,500	0,005	-0,124	0,496	0,503	ISO 17025	XRF (fusion)	
14	0,477	0,037	-0,882	0,503	0,451	no accreditation	XRF (fusion)	ASTM C 1271
15	0,521	0,073	0,618	0,470	0,573	no accreditation	XRF (fusion)	
16	0,785	0,008	9,499	0,791	0,779	no accreditation	Other Method	XRF (pellet); info only
17	0,462	0,000	-1,388	0,462	0,462	ISO 17025	XRF (fusion)	
19	0,524	0,003	0,702	0,526	0,522	ISO 17025	XRF (fusion)	
20	0,516	0,005	0,449	0,520	0,513	no accreditation	Other Method	ICP-OES
21	0,609	0,011	3,584	0,602	0,617	no accreditation	XRF (fusion)	

RV_2017_02_Lime

Sample: FLX-135 **Reprod. s.d.:** 0,713
Measurand: CaO **Repeat. s.d.:** 0,109
Mean ± U(Mean): 56,819 ± 0,377 **Range of tolerance:** 55,392 - 58,246 (|z-score| ≤ 2,000)
No. of laboratories: 19 **Statistical method:** Q/Hampel



Lab code	Lab mean	s.d.	z-score	Conc. 1	Conc. 2	Accreditation	Analytical method	Comment
01	56,855	0,130	0,050	56,763	56,947	no accreditation	XRF (fusion)	
02	57,023	0,168	0,286	56,905	57,142	no accreditation	XRF (fusion)	
03	56,195	0,021	-0,875	56,210	56,180	no accreditation	XRF (fusion)	
04	54,965	0,095	-2,599	55,032	54,898	no accreditation	Other Method	Titration
05	57,560	0,028	1,038	57,540	57,580	no accreditation	XRF (fusion)	
07	56,943	0,088	0,173	57,005	56,880	no accreditation	XRF (fusion)	
08	55,466	0,039	-1,896	55,439	55,494	no accreditation	Other Method	Titration

RV_2017_02_Lime

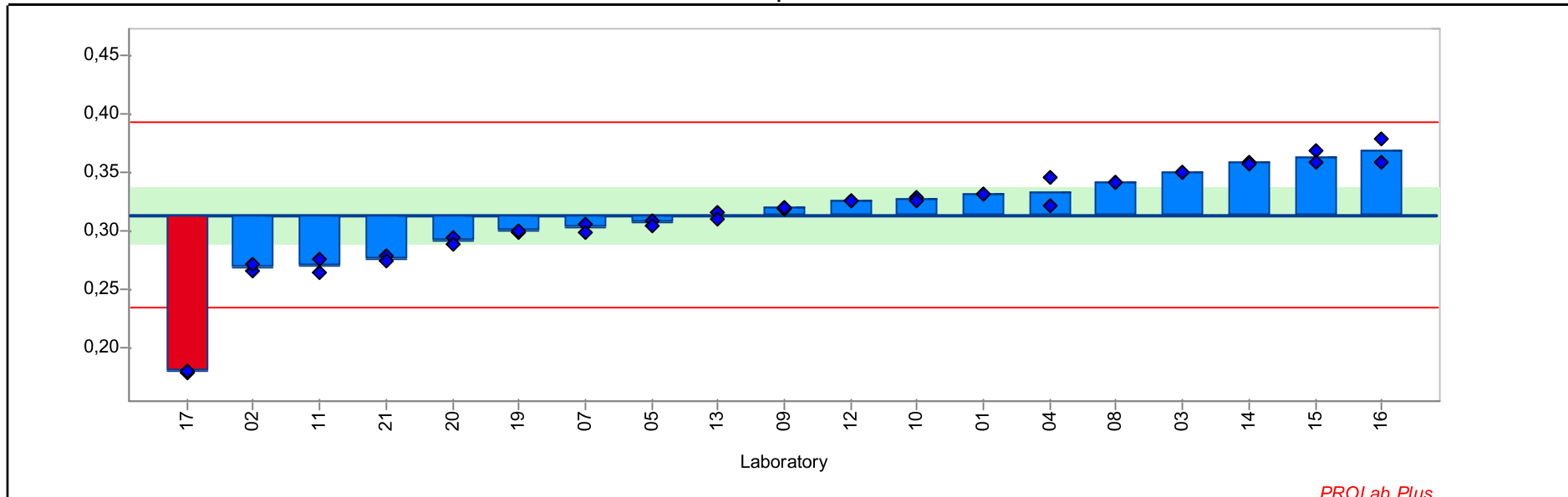
Lab code	Lab mean	s.d.	z-score	Conc. 1	Conc. 2	Accreditation	Analytical method	Comment
09	56,625	0,049	-0,272	56,590	56,660	no accreditation	XRF (fusion)	
10	56,375	0,035	-0,623	56,400	56,350	ISO 17025	Other Method	ICP, ASTM D6349-13 WR
11	58,409	0,086	2,228	58,469	58,348	ISO 17025	XRF (fusion)	
12	56,913	0,074	0,131	56,965	56,861	no accreditation	XRF (fusion)	
13	56,806	0,008	-0,018	56,801	56,812	ISO 17025	XRF (fusion)	
14	56,869	0,013	0,070	56,860	56,878	no accreditation	XRF (fusion)	ASTM C 1271
15	55,532	0,162	-1,803	55,418	55,647	no accreditation	XRF (fusion)	
16	57,556	0,274	1,033	57,750	57,362	no accreditation	Other Method	XRF (pellet); info only
17	57,599	0,008	1,092	57,593	57,604	ISO 17025	Other Method	AAS1
18	57,205	0,191	0,541	57,340	57,070	no accreditation	Other Method	ASTM C25 cap.31
19	56,772	0,018	-0,065	56,785	56,760	ISO 17025	XRF (fusion)	
20	56,933	0,253	0,159	57,112	56,754	no accreditation	Other Method	ICP-OES
21	57,755	1,894	1,312	56,416	59,094	no accreditation	XRF (fusion)	

RV_2017_02_Lime

Lab code	Lab mean	s.d.	z-score	Conc. 1	Conc. 2	Accreditation	Analytical method	Comment
15	<0,010			<0,010	<0,010	no accreditation	XRF (fusion)	
16	0,003	0,001	0,238	0,002	0,003	no accreditation	Other Method	XRF (pellet); info only
19	<0,006			<0,006	<0,006	ISO 17025	XRF (fusion)	

RV_2017_02_Lime

Sample: FLX-135 **Reprod. s.d.:** 0,040
Measurand: Fe2O3 **Repeat. s.d.:** 0,004
Mean ± U(Mean): 0,314 ± 0,024 **Range of tolerance:** 0,234 - 0,393 ($|z\text{-score}| \leq 2,000$)
No. of laboratories: 18 **Statistical method:** Q/Hampel



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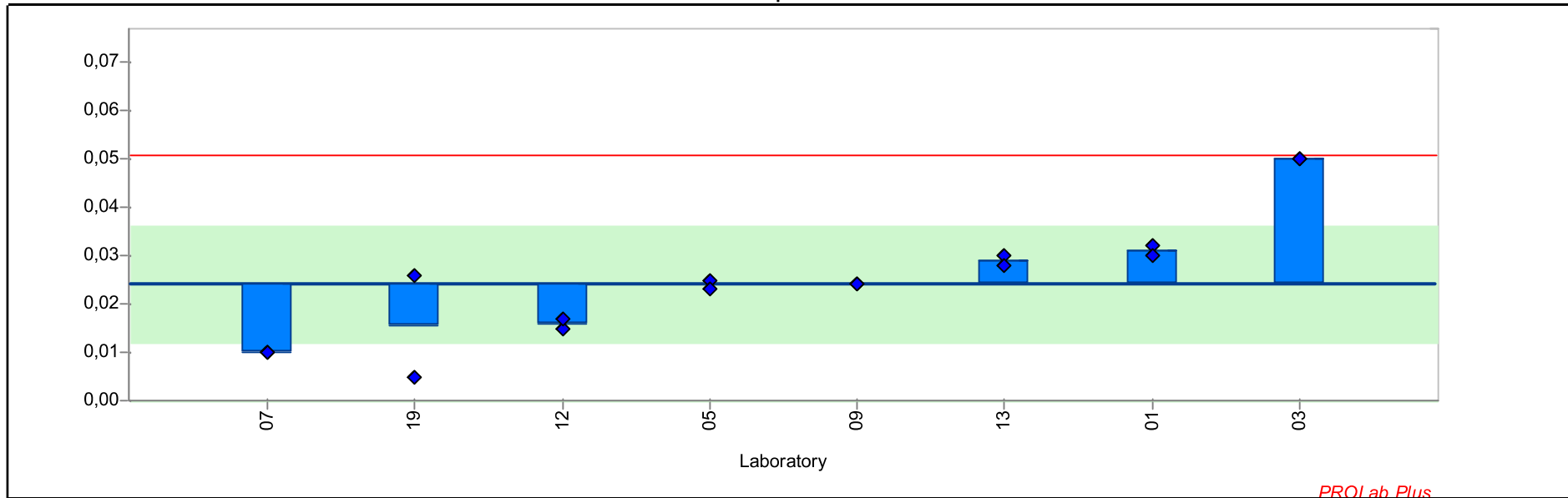
Lab code	Lab mean	s.d.	z-score	Conc. 1	Conc. 2	Accreditation	Analytical method	Comment
01	0,332	0,001	0,451	0,331	0,332	no accreditation	XRF (fusion)	
02	0,269	0,004	-1,119	0,266	0,272	no accreditation	XRF (fusion)	
03	0,350	0,000	0,915	0,350	0,350	no accreditation	XRF (fusion)	
04	0,334	0,018	0,501	0,321	0,346	no accreditation	XRF (fusion)	
05	0,306	0,004	-0,177	0,309	0,304	no accreditation	XRF (fusion)	
07	0,302	0,005	-0,278	0,306	0,299	no accreditation	XRF (fusion)	
08	0,341	0,000	0,689	0,341	0,341	no accreditation	XRF (fusion)	

RV_2017_02_Lime

Lab code	Lab mean	s.d.	z-score	Conc. 1	Conc. 2	Accreditation	Analytical method	Comment
09	0,320	0,001	0,149	0,319	0,320	no accreditation	XRF (fusion)	
10	0,327	0,002	0,325	0,328	0,325	ISO 17025	Other Method	ICP, ASTM D6349-13 WR
11	0,270	0,008	-1,106	0,264	0,275	ISO 17025	XRF (fusion)	
12	0,326	0,001	0,300	0,325	0,326	no accreditation	XRF (fusion)	
13	0,313	0,004	-0,026	0,315	0,310	ISO 17025	XRF (fusion)	
14	0,358	0,001	1,116	0,359	0,357	no accreditation	XRF (fusion)	ASTM C 1271
15	0,363	0,008	1,254	0,369	0,358	no accreditation	XRF (fusion)	
16	0,368	0,013	1,380	0,378	0,359	no accreditation	Other Method	XRF (pellet); info only
17	0,179	0,001	-3,367	0,179	0,180	ISO 17025	XRF (fusion)	
19	0,299	0,001	-0,353	0,299	0,300	ISO 17025	XRF (fusion)	
20	0,291	0,004	-0,566	0,294	0,288	no accreditation	Other Method	ICP-OES
21	0,276	0,003	-0,943	0,278	0,274	no accreditation	XRF (fusion)	

RV_2017_02_Lime

Sample: FLX-135 **Reprod. s.d.** 0,013
Measurand: K2O Annealed **Repeat. s.d** 0,004
Mean ± U(Mean): 0,024 ± 0,012 **Range of tolerance:** -0,002 - 0,051 (|z-score| <= 2,000)
No. of laboratories: 8 **Statistical method** Q/Hampel



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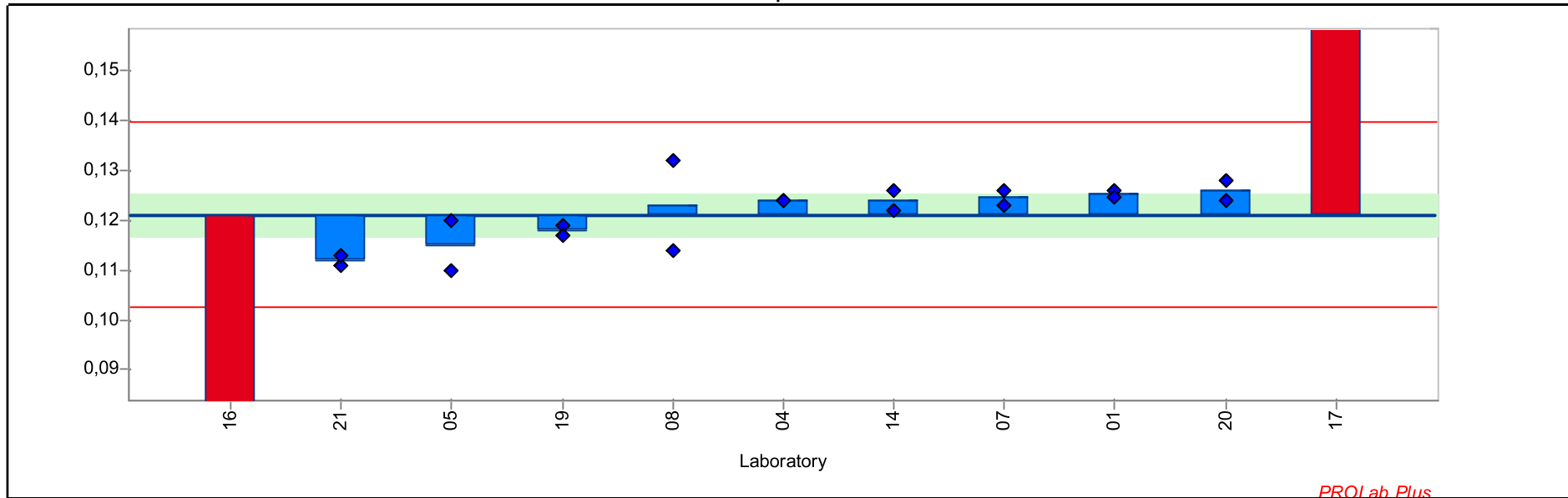
Lab code	Lab mean	s.d.	z-score	Conc. 1	Conc. 2	Accreditation	Analytical method	Comment
01	0,031	0,001	0,516	0,032	0,030	no accreditation	XRF (fusion)	K2O after treated @
02	<0,005			<0,005	<0,005	no accreditation	XRF (fusion)	K2O after treated @
03	0,050	0,000	1,955	0,050	0,050	no accreditation	XRF (fusion)	K2O after treated @
05	0,024	0,001	-0,014	0,025	0,023	no accreditation	XRF (fusion)	K2O after treated @
07	0,010	0,000	-1,074	0,010	0,010	no accreditation	XRF (fusion)	K2O after treated @
09	0,024	0,000	-0,014	0,024	0,024	no accreditation	XRF (fusion)	K2O after treated @
12	0,016	0,001	-0,620	0,015	0,017	no accreditation	XRF (fusion)	K2O after treated @

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Lab code	Lab mean	s.d.	z-score	Conc. 1	Conc. 2	Accreditation	Analytical method	Comment
13	0,029	0,001	0,365	0,030	0,028	ISO 17025	XRF (fusion)	K2O after treated @
19	0,015	0,015	-0,658	0,026	0,005	ISO 17025	XRF (fusion)	K2O after treated @

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Sample: FLX-135 **Reprod. s.d.** 0,009
Measurand: K2O Original **Repeat. s.d** 0,002
Mean ± U(Mean): 0,121 ± 0,004 **Range of tolerance:** 0,102 - 0,140 (|z-score| ≤ 2,000)
No. of laboratories: 9 **Statistical method** Q/Hampel



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Lab code	Lab mean	s.d.	z-score	Conc. 1	Conc. 2	Accreditation	Analytical method	Comment
01	0,125	0,001	0,452	0,126	0,125	no accreditation	Other Method	K2O after drying @ 105°C
04	0,124	0,000	0,308	0,124	0,124	no accreditation	XRF (fusion)	K2O after drying @ 105°C
05	0,115	0,007	-0,656	0,120	0,110	no accreditation	Other Method	K2O after drying @ 105°C
07	0,125	0,002	0,361	0,126	0,123	no accreditation	XRF (fusion)	K2O after drying @ 105°C
08	0,123	0,013	0,201	0,114	0,132	no accreditation	Other Method	K2O after drying @ 105°C
14	0,124	0,003	0,308	0,126	0,122	no accreditation	Other Method	K2O after drying @ 105°C
15	<0,020			<0,020	<0,020	no accreditation	Other Method	K2O after drying @ 105°C

RV_2017_02_Lime

Lab code	Lab mean	s.d.	z-score	Conc. 1	Conc. 2	Accreditation	Analytical method	Comment
16	0,057	0,018	-6,920	0,069	0,044	no accreditation	Other Method	XRF (pellet); info only
17	0,160	0,000	4,163	0,160	0,160	ISO 17025	Other Method	AAS1, info only
19	0,118	0,001	-0,335	0,119	0,117	ISO 17025	XRF (fusion)	K2O after drying @ 105°C
20	0,126	0,003	0,522	0,124	0,128	no accreditation	Other Method	K2O after drying @
21	0,112	0,001	-0,977	0,111	0,113	no accreditation	XRF (fusion)	K2O after drying @ 105°C

RV_2017_02_Lime

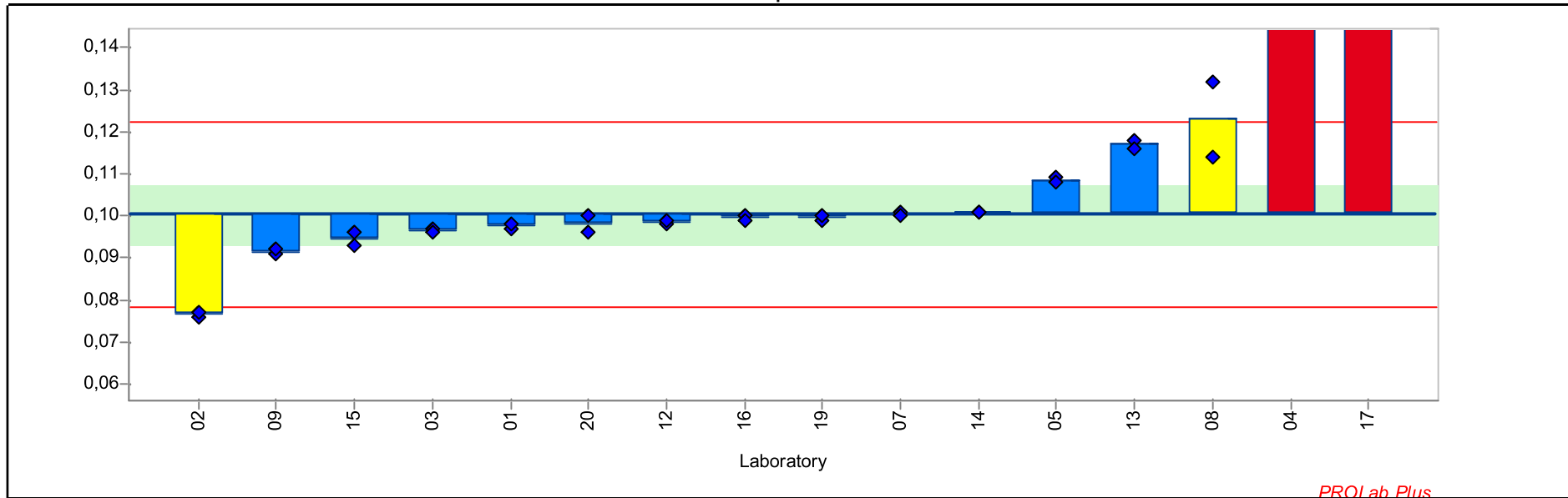
Lab code	Lab mean	s.d.	z-score	Conc. 1	Conc. 2	Accreditation	Analytical method	Comment
09	47,239	0,018	0,449	47,226	47,252	no accreditation	Other Method	LOI @ 1050°C
10	46,863	0,006	-1,034	46,859	46,867	ISO 17025	Other Method	LOI @ 1050°C
11	46,929	0,006	-0,774	46,933	46,925	ISO 17025	Other Method	LOI @ 1050°C
12	47,136	0,002	0,040	47,134	47,137	no accreditation	Other Method	LOI @ 1050°C
13	47,000	0,003	-0,494	46,998	47,002	ISO 17025	Other Method	LOI @ 1050°C
14	47,682	0,011	2,197	47,690	47,675	no accreditation	Other Method	LOI @ 1050°C
15	47,280	0,071	0,610	47,330	47,230	no accreditation	Other Method	LOI @ 1050°C
16	47,030	0,000	-0,375	47,030	47,030	no accreditation	Other Method	XRF (pellet); info only
17	46,950	0,000	-0,691	46,950	46,950	ISO 17025	Other Method	LOI @ 1050°C
18	47,377	0,053	0,995	47,340	47,415	no accreditation	Other Method	LOI @ 1050°C
19	47,090	0,085	-0,139	47,150	47,030	ISO 17025	Other Method	LOI @ 1050°C
20	46,929	0,006	-0,774	46,933	46,925	ISO 17025	Other Method	LOI @ 1050°C
21	50,070	3,974	11,610	47,260	52,880	no accreditation	Other Method	LOI @ 1050°C

RV_2017_02_Lime

Lab code	Lab mean	s.d.	z-score	Conc. 1	Conc. 2	Accreditation	Analytical method	Comment
09	40,160	0,028	-0,286	40,140	40,180	no accreditation	XRF (fusion)	
10	40,291	0,037	-0,006	40,265	40,318	ISO 17025	Other Method	ICP, ASTM D6349-13 WR
11	39,153	0,030	-2,426	39,132	39,174	ISO 17025	XRF (fusion)	
12	40,413	0,265	0,251	40,600	40,225	no accreditation	XRF (fusion)	
13	40,317	0,008	0,047	40,322	40,311	ISO 17025	XRF (fusion)	
14	40,078	0,034	-0,460	40,054	40,102	no accreditation	XRF (fusion)	ASTM C 1271
15	39,717	0,048	-1,228	39,683	39,751	no accreditation	XRF (fusion)	
16	38,809	0,257	-3,157	38,628	38,991	no accreditation	Other Method	XRF (pellet); info only
17	40,871	0,006	1,225	40,867	40,875	ISO 17025	XRF (fusion)	
18	39,732	0,161	-1,196	39,618	39,846	no accreditation	Other Method	ASTM C25 cap.31
19	40,416	0,001	0,259	40,417	40,416	ISO 17025	XRF (fusion)	
20	40,059	0,267	-0,500	39,871	40,248	no accreditation	Other Method	ICP-OES
21	41,168	1,841	1,856	39,866	42,469	no accreditation	XRF (fusion)	

RV_2017_02_Lime

Sample: FLX-135 **Reprod. s.d.** 0,011
Measurand: Mn2O3 **Repeat. s.d** 0,001
Mean ± U(Mean): 0,100 ± 0,007 **Range of tolerance:** 0,078 - 0,122 (|z-score| ≤ 2,000)
No. of laboratories: 15 **Statistical method** Q/Hampel



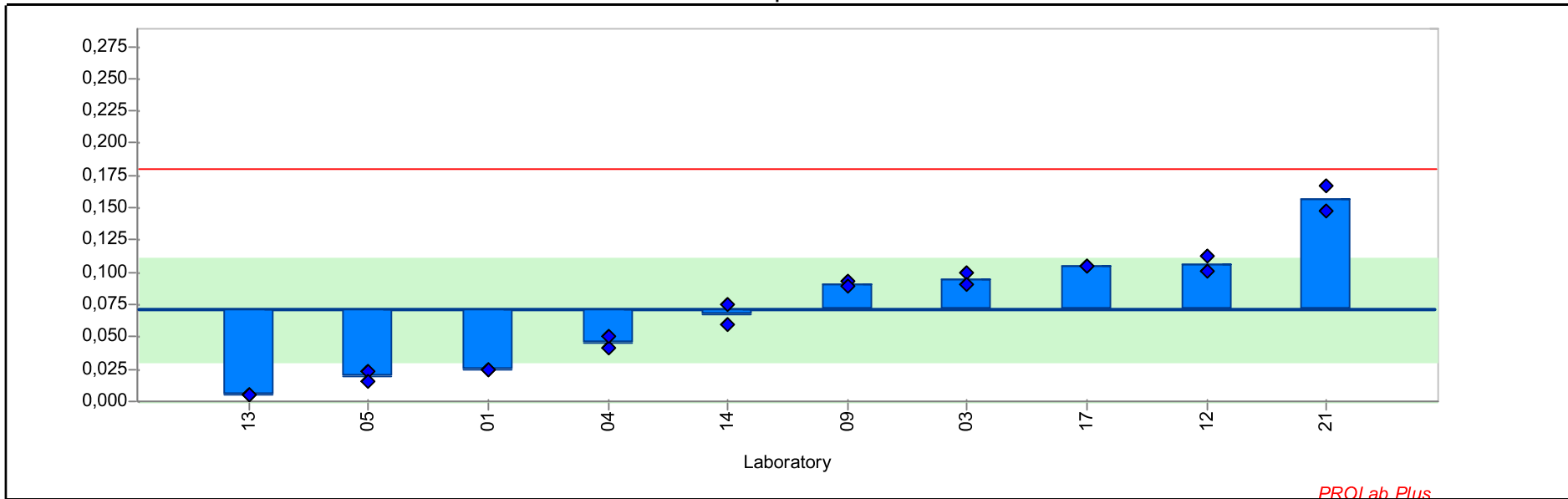
Lab code	Lab mean	s.d.	z-score	Conc. 1	Conc. 2	Accreditation	Analytical method	Comment
01	0,098	0,001	-0,249	0,097	0,098	no accreditation	XRF (fusion)	
02	0,076	0,001	-2,146	0,076	0,077	no accreditation	XRF (fusion)	
03	0,097	0,001	-0,340	0,097	0,096	no accreditation	XRF (fusion)	
04	0,185	0,001	7,700	0,185	0,186	no accreditation	XRF (fusion)	
05	0,108	0,001	0,744	0,109	0,108	no accreditation	XRF (fusion)	
07	0,101	0,001	0,022	0,101	0,100	no accreditation	XRF (fusion)	
08	0,123	0,013	2,054	0,132	0,114	no accreditation	XRF (fusion)	

RV_2017_02_Lime

Lab code	Lab mean	s.d.	z-score	Conc. 1	Conc. 2	Accreditation	Analytical method	Comment
09	0,091	0,001	-0,791	0,091	0,092	no accreditation	XRF (fusion)	
12	0,099	0,001	-0,159	0,098	0,099	no accreditation	XRF (fusion)	
13	0,117	0,001	1,512	0,118	0,116	ISO 17025	XRF (fusion)	
14	0,101	0,000	0,067	0,101	0,101	no accreditation	XRF (fusion)	ASTM C 1271
15	0,095	0,002	-0,520	0,093	0,096	no accreditation	XRF (fusion)	
16	0,100	0,001	-0,069	0,100	0,099	no accreditation	Other Method	XRF (pellet); info only
17	0,230	0,000	11,719	0,230	0,230	ISO 17025	XRF (fusion)	
19	0,100	0,001	-0,069	0,099	0,100	ISO 17025	XRF (fusion)	
20	0,098	0,003	-0,204	0,096	0,100	no accreditation	Other Method	ICP-OES

RV_2017_02_Lime

Sample: FLX-135 Reprod. s.d. 0,054
Measurand: Na2O Repeat. s.d 0,008
Mean ± U(Mean): 0,071 ± 0,041 Range of tolerance: -0,038 - 0,180 (|z-score| <= 2,000)
No. of laboratories: 10 Statistical method Q/Hampel



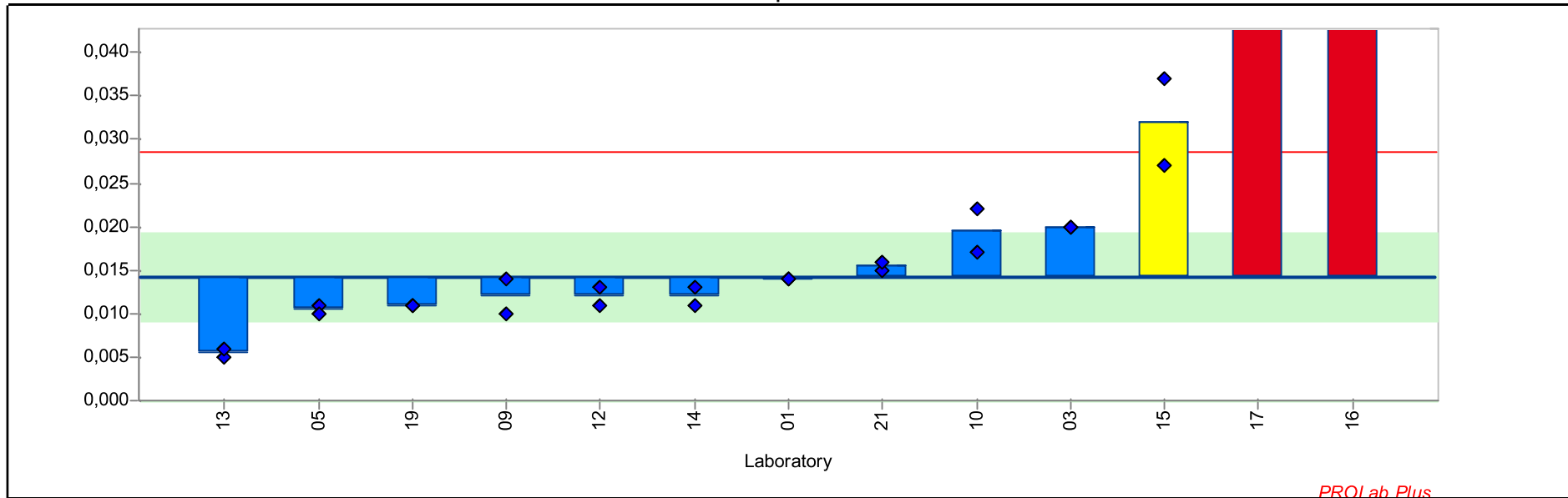
Lab code	Lab mean	s.d.	z-score	Conc. 1	Conc. 2	Accreditation	Analytical method	Comment
01	0,025	0,001	-0,858	0,025	0,024	no accreditation	XRF (fusion)	Some alkalichlorid are
02	<0,005			<0,005	<0,005	no accreditation	XRF (fusion)	
03	0,095	0,007	0,438	0,100	0,090	no accreditation	XRF (fusion)	
04	0,045	0,006	-0,472	0,041	0,050	no accreditation	XRF (fusion)	
05	0,019	0,006	-0,960	0,023	0,015	no accreditation	XRF (fusion)	
09	0,091	0,003	0,365	0,093	0,089	no accreditation	XRF (fusion)	
12	0,107	0,008	0,650	0,112	0,101	no accreditation	XRF (fusion)	

RV_2017_02_Lime

Lab code	Lab mean	s.d.	z-score	Conc. 1	Conc. 2	Accreditation	Analytical method	Comment
13	0,005	0,000	-1,217	0,005	0,005	ISO 17025	XRF (fusion)	Lower detection limit
14	0,068	0,011	-0,068	0,060	0,075	no accreditation	Other Method	ASTM C114
15	<0,020			<0,020	<0,020	no accreditation	XRF (fusion)	
17	0,105	0,000	0,622	0,105	0,105	ISO 17025	Other Method	AAS1
19	<0,120			<0,120	<0,120	ISO 17025	XRF (fusion)	
21	0,157	0,014	1,579	0,147	0,167	no accreditation	XRF (fusion)	

RV_2017_02_Lime

Sample: FLX-135 **Reprod. s.d.:** 0,007
Measurand: P2O5 **Repeat. s.d.:** 0,001
Mean ± U(Mean): 0,014 ± 0,005 **Range of tolerance:** 0,000 - 0,029 (|z-score| ≤ 2,000)
No. of laboratories: 12 **Statistical method:** Q/Hampel



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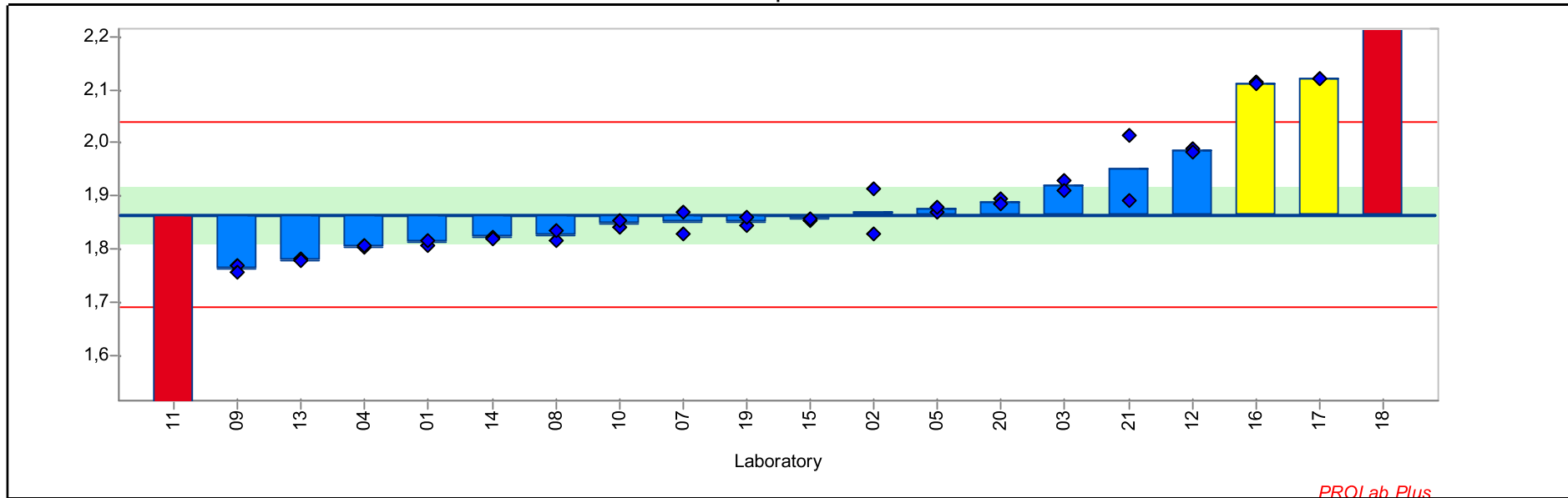
Lab code	Lab mean	s.d.	z-score	Conc. 1	Conc. 2	Accreditation	Analytical method	Comment
01	0,014	0,000	-0,038	0,014	0,014	no accreditation	XRF (fusion)	
02	<0,005			<0,005	<0,005	no accreditation	XRF (fusion)	
03	0,020	0,000	0,805	0,020	0,020	no accreditation	XRF (fusion)	
05	0,010	0,001	-0,529	0,011	0,010	no accreditation	XRF (fusion)	
09	0,012	0,003	-0,319	0,010	0,014	no accreditation	XRF (fusion)	
10	0,020	0,004	0,735	0,017	0,022	ISO 17025	Other Method	ICP, ASTM D6349-13 WR
12	0,012	0,001	-0,319	0,011	0,013	no accreditation	XRF (fusion)	

RV_2017_02_Lime

Lab code	Lab mean	s.d.	z-score	Conc. 1	Conc. 2	Accreditation	Analytical method	Comment
13	0,005	0,001	-1,232	0,005	0,006	ISO 17025	XRF (fusion)	
14	0,012	0,001	-0,319	0,013	0,011	no accreditation	XRF (fusion)	ASTM C 1271
15	0,032	0,007	2,491	0,037	0,027	no accreditation	XRF (fusion)	
16	0,055	0,007	5,722	0,060	0,050	no accreditation	Other Method	XRF (pellet); info only
17	0,051	0,000	5,160	0,051	0,051	ISO 17025	XRF (fusion)	
19	0,011	0,000	-0,459	0,011	0,011	ISO 17025	XRF (fusion)	
21	0,015	0,001	0,173	0,015	0,016	no accreditation	XRF (fusion)	

RV_2017_02_Lime

Sample: FLX-135 **Reprod. s.d.:** 0,087
Measurand: SiO2 **Repeat. s.d.:** 0,012
Mean ± U(Mean): 1,865 ± 0,051 **Range of tolerance:** 1,690 - 2,040 (|z-score| <= 2,000)
No. of laboratories: 19 **Statistical method:** Q/Hampel



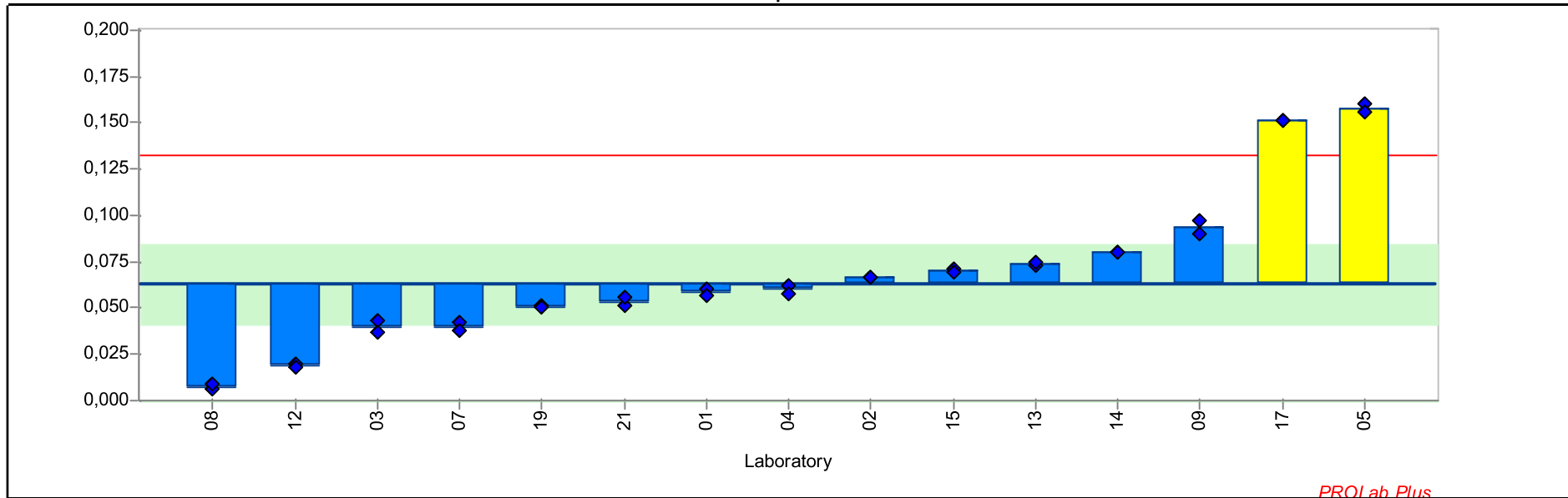
Lab code	Lab mean	s.d.	z-score	Conc. 1	Conc. 2	Accreditation	Analytical method	Comment
01	1,812	0,006	-0,604	1,808	1,816	no accreditation	XRF (fusion)	
02	1,871	0,061	0,071	1,914	1,828	no accreditation	XRF (fusion)	
03	1,920	0,014	0,631	1,930	1,910	no accreditation	XRF (fusion)	
04	1,804	0,002	-0,690	1,803	1,806	no accreditation	XRF (fusion)	
05	1,875	0,007	0,116	1,870	1,880	no accreditation	XRF (fusion)	
07	1,850	0,028	-0,169	1,830	1,870	no accreditation	XRF (fusion)	
08	1,826	0,014	-0,444	1,816	1,836	no accreditation	XRF (fusion)	

RV_2017_02_Lime

Lab code	Lab mean	s.d.	z-score	Conc. 1	Conc. 2	Accreditation	Analytical method	Comment
09	1,764	0,008	-1,158	1,769	1,758	no accreditation	XRF (fusion)	
10	1,848	0,009	-0,198	1,841	1,854	ISO 17025	Other Method	ICP, ASTM D6349-13 WR
11	1,171	0,013	-7,938	1,180	1,161	ISO 17025	XRF (fusion)	
12	1,986	0,004	1,391	1,989	1,984	no accreditation	XRF (fusion)	
13	1,780	0,001	-0,970	1,781	1,779	ISO 17025	XRF (fusion)	
14	1,821	0,003	-0,501	1,823	1,819	no accreditation	XRF (fusion)	ASTM C 1271
15	1,856	0,002	-0,107	1,854	1,857	no accreditation	XRF (fusion)	
16	2,112	0,004	2,832	2,115	2,110	no accreditation	Other Method	XRF (pellet); info only
17	2,122	0,001	2,935	2,121	2,122	ISO 17025	XRF (fusion)	
18	2,415	0,148	6,290	2,520	2,310	no accreditation	Other Method	ASTM C25 cap.9
19	1,852	0,013	-0,147	1,843	1,861	ISO 17025	XRF (fusion)	
20	1,889	0,007	0,276	1,894	1,884	no accreditation	Other Method	ICP-OES
21	1,952	0,087	1,002	1,891	2,014	no accreditation	XRF (fusion)	

RV_2017_02_Lime

Sample: FLX-135 **Reprod. s.d.:** 0,034
Measurand: SO3 **Repeat. s.d.:** 0,003
Mean ± U(Mean): 0,063 ± 0,022 **Range of tolerance:** -0,006 - 0,132 (|z-score| ≤ 2,000)
No. of laboratories: 15 **Statistical method:** Q/Hampel



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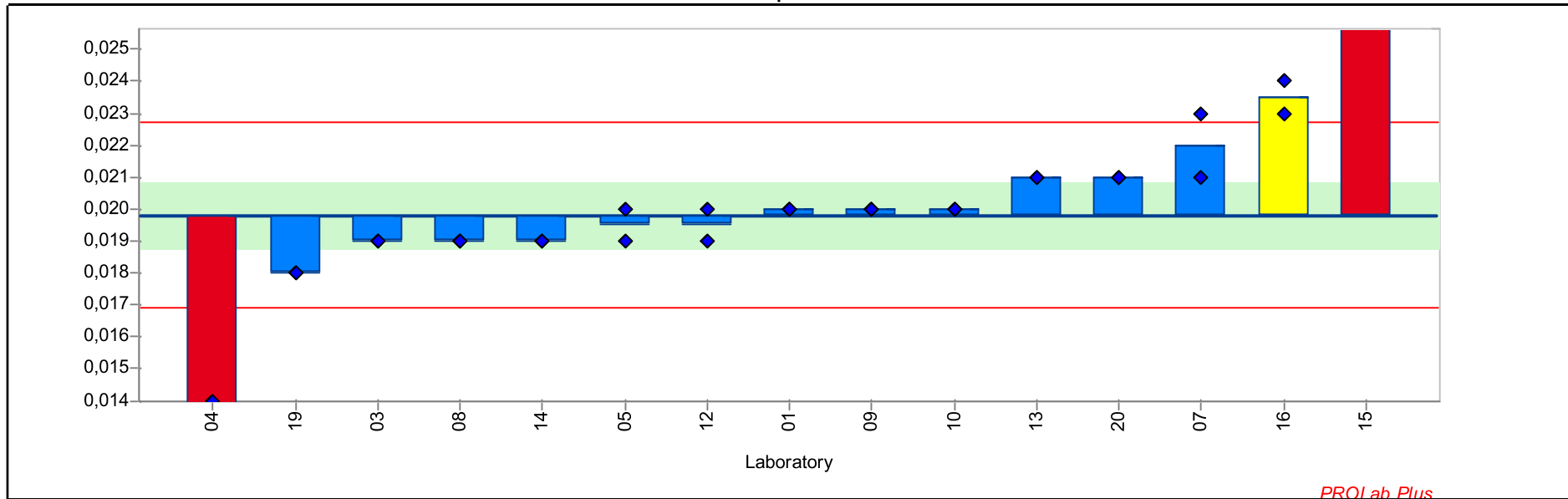
Lab code	Lab mean	s.d.	z-score	Conc. 1	Conc. 2	Accreditation	Analytical method	Comment
01	0,058	0,002	-0,135	0,060	0,057	no accreditation	XRF (fusion)	
02	0,067	0,000	0,112	0,067	0,067	no accreditation	Other Method	Combustion with IR-
03	0,040	0,004	-0,672	0,043	0,037	no accreditation	XRF (fusion)	
04	0,060	0,003	-0,091	0,062	0,058	no accreditation	Other Method	Combustion with IR-
05	0,158	0,003	2,756	0,160	0,156	no accreditation	XRF (fusion)	
07	0,040	0,003	-0,672	0,042	0,038	no accreditation	XRF (fusion)	
08	0,007	0,002	-1,616	0,006	0,009	no accreditation	Other Method	Combustion with IR-

RV_2017_02_Lime

Lab code	Lab mean	s.d.	z-score	Conc. 1	Conc. 2	Accreditation	Analytical method	Comment
09	0,093	0,005	0,882	0,097	0,090	no accreditation	XRF (fusion)	
12	0,019	0,001	-1,282	0,020	0,018	no accreditation	XRF (fusion)	
13	0,074	0,001	0,316	0,073	0,075	ISO 17025	XRF (fusion)	
14	0,080	0,000	0,490	0,080	0,080	no accreditation	XRF (fusion)	ASTM C 1271
15	0,070	0,001	0,199	0,071	0,069	ISO 17025	Other Method	Combustion with IR-
17	0,151	0,000	2,553	0,151	0,151	ISO 17025	Other Method	Gravimetric
19	0,051	0,001	-0,367	0,051	0,050	ISO 17025	XRF (fusion)	XRF (fusion) from original
21	0,053	0,004	-0,280	0,051	0,056	no accreditation	XRF (fusion)	

RV_2017_02_Lime

Sample: FLX-135 **Reprod. s.d.** 0,001
 Measurand: SrO **Repeat. s.d.** 0,001
 Mean ± U(Mean): 0,020 ± 0,001 **Range of tolerance:** 0,017 - 0,023 (|z-score| ≤ 2,000)
 No. of laboratories: 13 **Statistical method** Q/Hampel



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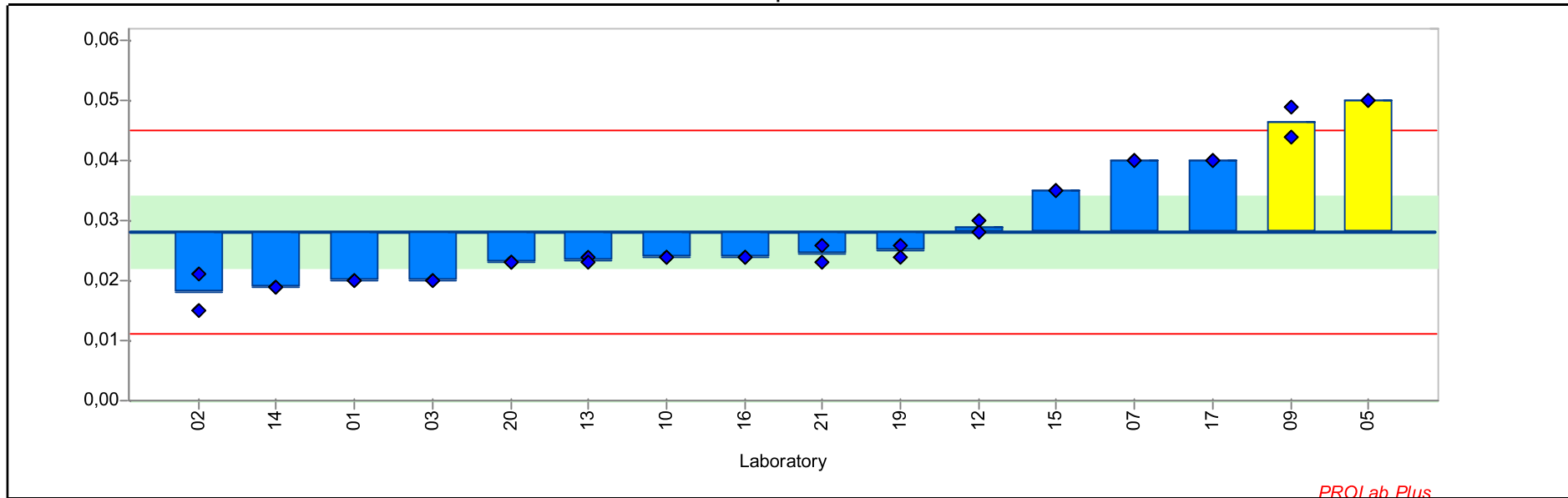
Lab code	Lab mean	s.d.	z-score	Conc. 1	Conc. 2	Accreditation	Analytical method	Comment
01	0,020	0,000	0,129	0,020	0,020	no accreditation	XRF (fusion)	
03	0,019	0,000	-0,557	0,019	0,019	no accreditation	XRF (fusion)	
04	0,013	0,001	-4,327	0,013	0,014	no accreditation	XRF (fusion)	
05	0,020	0,001	-0,214	0,020	0,019	no accreditation	XRF (fusion)	
07	0,022	0,001	1,500	0,023	0,021	no accreditation	XRF (fusion)	
08	0,019	0,000	-0,557	0,019	0,019	no accreditation	XRF (fusion)	
09	0,020	0,000	0,129	0,020	0,020	no accreditation	XRF (fusion)	

RV_2017_02_Lime

Lab code	Lab mean	s.d.	z-score	Conc. 1	Conc. 2	Accreditation	Analytical method	Comment
10	0,020	0,000	0,129	0,020	0,020	ISO 17025	Other Method	ICP, ASTM D6349-13 WR
12	0,020	0,001	-0,214	0,020	0,019	no accreditation	XRF (fusion)	
13	0,021	0,000	0,814	0,021	0,021	ISO 17025	XRF (fusion)	
14	0,019	0,000	-0,557	0,019	0,019	no accreditation	XRF (fusion)	ASTM C 1271
15	0,034	0,001	9,726	0,033	0,035	no accreditation	Other Method	info only
16	0,024	0,001	2,528	0,024	0,023	no accreditation	Other Method	XRF (pellet); info only
19	0,018	0,000	-1,242	0,018	0,018	ISO 17025	XRF (fusion)	
20	0,021	0,000	0,814	0,021	0,021	no accreditation	Other Method	ICP-OES

RV_2017_02_Lime

Sample: FLX-135 **Reprod. s.d.** 0,008
Measurand: TiO2 **Repeat. s.d** 0,001
Mean ± U(Mean): 0,028 ± 0,006 **Range of tolerance:** 0,011 - 0,045 (|z-score| ≤ 2,000)
No. of laboratories: 15 **Statistical method** Q/Hampel



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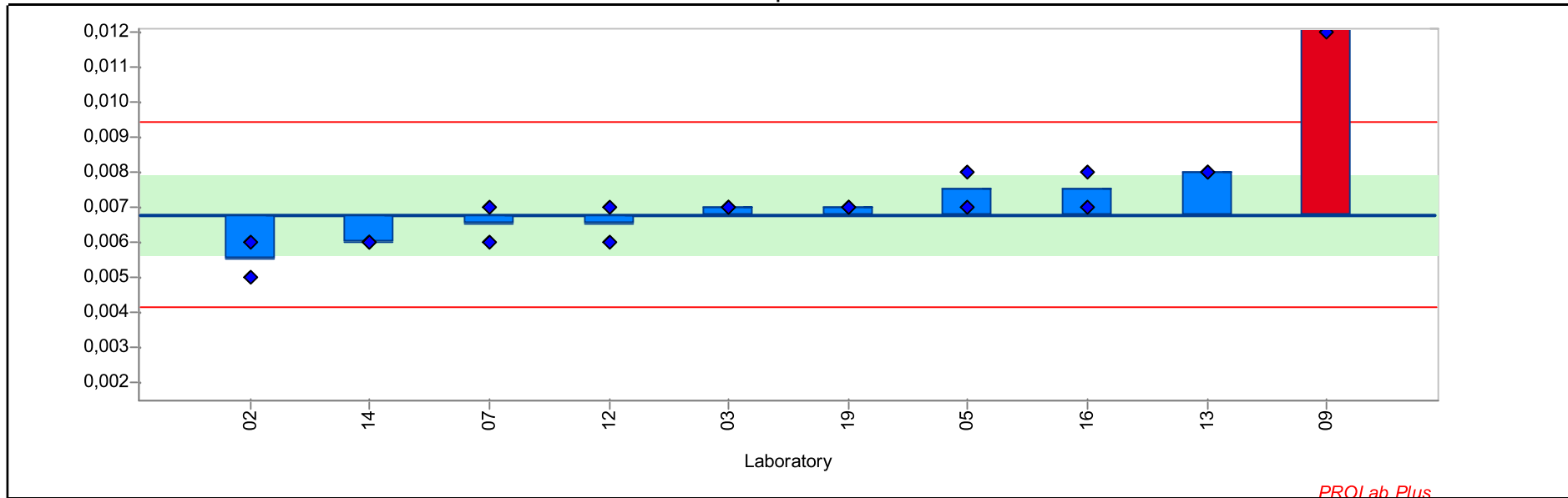
Lab code	Lab mean	s.d.	z-score	Conc. 1	Conc. 2	Accreditation	Analytical method	Comment
01	0,020	0,000	-0,967	0,020	0,020	no accreditation	XRF (fusion)	
02	0,018	0,004	-1,204	0,015	0,021	no accreditation	XRF (fusion)	
03	0,020	0,000	-0,967	0,020	0,020	no accreditation	XRF (fusion)	
05	0,050	0,000	2,579	0,050	0,050	no accreditation	XRF (fusion)	
07	0,040	0,000	1,397	0,040	0,040	no accreditation	XRF (fusion)	
09	0,046	0,004	2,165	0,049	0,044	no accreditation	XRF (fusion)	
10	0,024	0,000	-0,494	0,024	0,024	ISO 17025	Other Method	ICP, ASTM D6349-13 WR

RV_2017_02_Lime

Lab code	Lab mean	s.d.	z-score	Conc. 1	Conc. 2	Accreditation	Analytical method	Comment
12	0,029	0,001	0,097	0,030	0,028	no accreditation	XRF (fusion)	
13	0,024	0,001	-0,554	0,024	0,023	ISO 17025	XRF (fusion)	
14	0,019	0,000	-1,085	0,019	0,019	no accreditation	XRF (fusion)	ASTM C 1271
15	0,035	0,000	0,806	0,035	0,035	no accreditation	XRF (fusion)	
16	0,024	0,000	-0,494	0,024	0,024	no accreditation	Other Method	XRF (pellet); info only
17	0,040	0,000	1,397	0,040	0,040	ISO 17025	XRF (fusion)	
19	0,025	0,001	-0,376	0,026	0,024	ISO 17025	XRF (fusion)	
20	0,023	0,000	-0,613	0,023	0,023	no accreditation	Other Method	ICP-OES
21	0,025	0,002	-0,435	0,023	0,026	no accreditation	XRF (fusion)	

RV_2017_02_Lime

Sample: FLX-135 **Reprod. s.d.:** 0,001
Measurand: ZnO **Repeat. s.d.:** 0,001
Mean ± U(Mean): 0,007 ± 0,001 **Range of tolerance:** 0,004 - 0,009 (|z-score| ≤ 2,000)
No. of laboratories: 9 **Statistical method:** Q/Hampel



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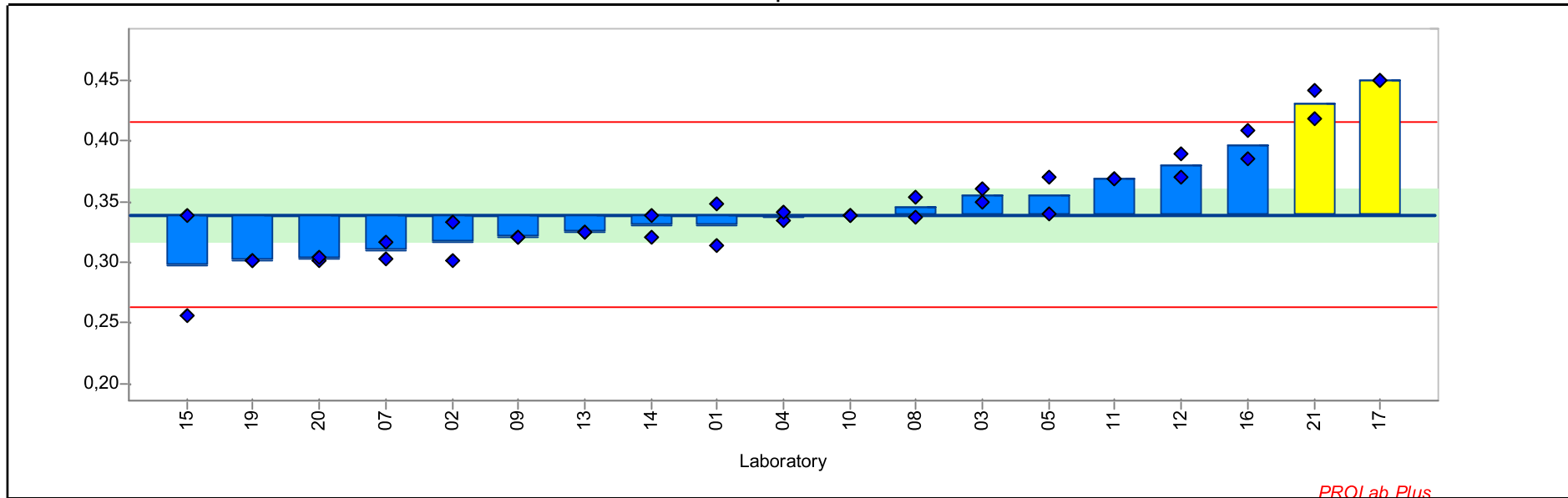
Lab code	Lab mean	s.d.	z-score	Conc. 1	Conc. 2	Accreditation	Analytical method	Comment
02	0,005	0,001	-0,966	0,005	0,006	no accreditation	XRF (fusion)	
03	0,007	0,000	0,165	0,007	0,007	no accreditation	XRF (fusion)	
05	0,007	0,001	0,543	0,008	0,007	no accreditation	XRF (fusion)	
07	0,007	0,001	-0,212	0,007	0,006	no accreditation	XRF (fusion)	
09	0,013	0,001	4,314	0,012	0,013	no accreditation	XRF (fusion)	
12	0,007	0,001	-0,212	0,006	0,007	no accreditation	XRF (fusion)	
13	0,008	0,000	0,920	0,008	0,008	ISO 17025	XRF (fusion)	

RV_2017_02_Lime

Lab code	Lab mean	s.d.	z-score	Conc. 1	Conc. 2	Accreditation	Analytical method	Comment
14	0,006	0,000	-0,589	0,006	0,006	no accreditation	XRF (fusion)	ASTM C 1271
15	<0,010			<0,010	<0,010	no accreditation	XRF (fusion)	
16	0,007	0,001	0,543	0,008	0,007	no accreditation	Other Method	XRF (pellet); info only
19	0,007	0,000	0,165	0,007	0,007	ISO 17025	XRF (fusion)	

RV_2017_02_Lime

Sample: FLX-136 **Reprod. s.d.:** 0,038
Measurand: Al₂O₃ **Repeat. s.d.:** 0,014
Mean ± U(Mean): 0,339 ± 0,022 **Range of tolerance:** 0,262 - 0,416 (|z-score| ≤ 2,000)
No. of laboratories: 18 **Statistical method:** Q/Hampel



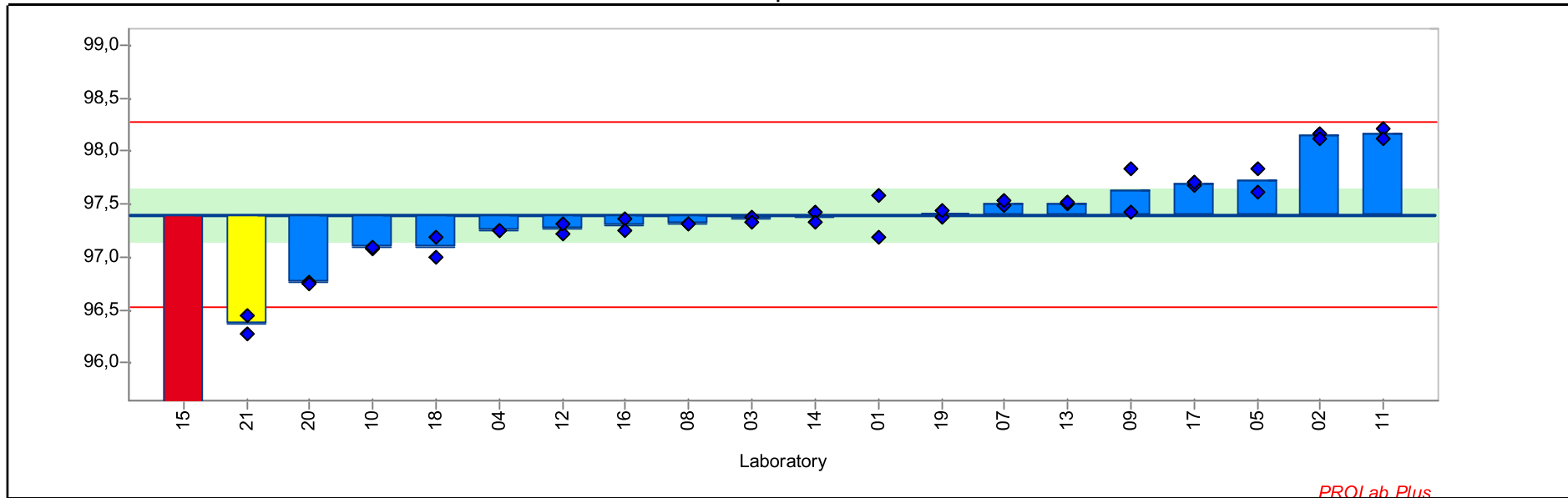
Lab code	Lab mean	s.d.	z-score	Conc. 1	Conc. 2	Accreditation	Analytical method	Comment
01	0,331	0,025	-0,225	0,348	0,313	no accreditation	XRF (fusion)	
02	0,317	0,023	-0,577	0,301	0,333	no accreditation	XRF (fusion)	
03	0,355	0,007	0,413	0,350	0,360	no accreditation	XRF (fusion)	
04	0,338	0,005	-0,043	0,334	0,341	no accreditation	XRF (fusion)	
05	0,355	0,021	0,413	0,370	0,340	no accreditation	XRF (fusion)	
07	0,309	0,010	-0,785	0,302	0,316	no accreditation	XRF (fusion)	
08	0,346	0,012	0,166	0,354	0,337	no accreditation	XRF (fusion)	

RV_2017_02_Lime

Lab code	Lab mean	s.d.	z-score	Conc. 1	Conc. 2	Accreditation	Analytical method	Comment
09	0,320	0,000	-0,499	0,320	0,320	no accreditation	XRF (fusion)	
10	0,338	0,000	-0,030	0,338	0,338	ISO 17025	Other Method	ICP, ASTM D6349-13 WR
11	0,369	0,000	0,778	0,369	0,369	ISO 17025	XRF (fusion)	
12	0,380	0,014	1,065	0,370	0,390	no accreditation	XRF (fusion)	
13	0,324	0,000	-0,394	0,324	0,324	ISO 17025	XRF (fusion)	
14	0,330	0,012	-0,251	0,321	0,338	no accreditation	XRF (fusion)	ASTM C 1271
15	0,297	0,059	-1,085	0,256	0,339	no accreditation	XRF (fusion)	
16	0,396	0,016	1,495	0,385	0,408	no accreditation	Other Method	XRF (pellet); info only
17	0,450	0,000	2,888	0,450	0,450	ISO 17025	XRF (fusion)	
19	0,301	0,000	-0,993	0,301	0,301	ISO 17025	XRF (fusion)	
20	0,302	0,002	-0,954	0,301	0,304	no accreditation	Other Method	ICP-OES
21	0,430	0,016	2,380	0,419	0,442	no accreditation	XRF (fusion)	

RV_2017_02_Lime

Sample: FLX-136 **Reprod. s.d.** 0,440
Measurand: CaO **Repeat. s.d** 0,060
Mean ± U(Mean): 97,400 ± 0,243 **Range of tolerance:** 96,520 - 98,279 (|z-score| ≤ 2,000)
No. of laboratories: 19 **Statistical method** Q/Hampel



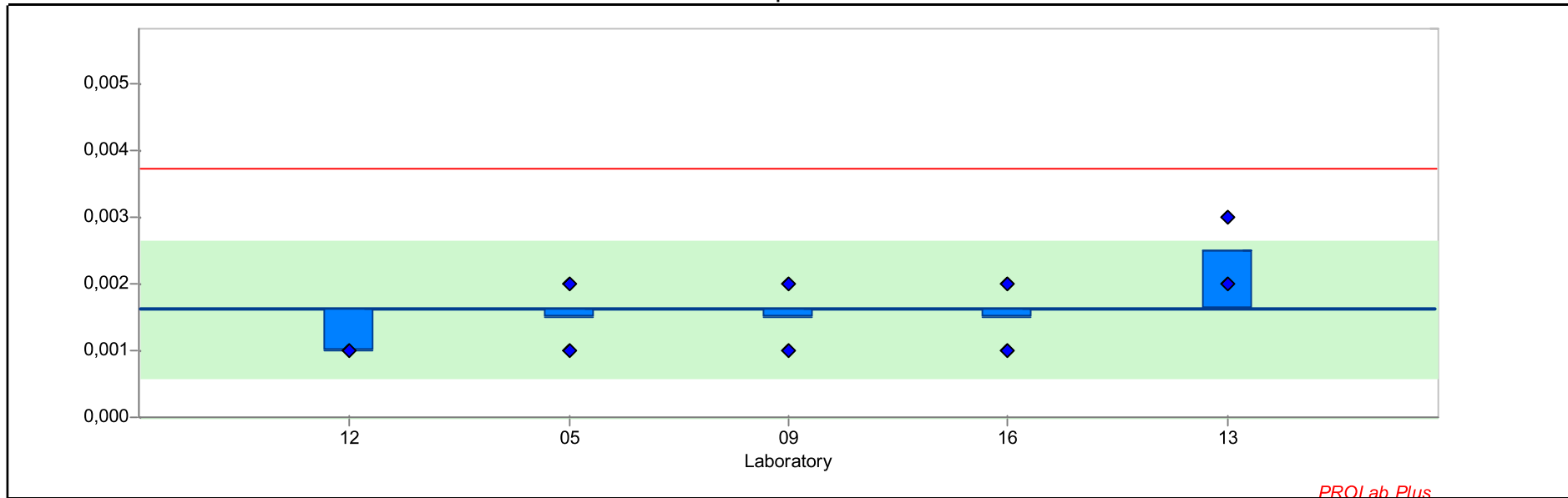
Lab code	Lab mean	s.d.	z-score	Conc. 1	Conc. 2	Accreditation	Analytical method	Comment
01	97,385	0,272	-0,033	97,193	97,577	no accreditation	XRF (fusion)	
02	98,142	0,026	1,687	98,160	98,123	no accreditation	XRF (fusion)	
03	97,355	0,035	-0,101	97,380	97,330	no accreditation	XRF (fusion)	
04	97,248	0,002	-0,346	97,249	97,246	no accreditation	Other Method	Titration
05	97,725	0,163	0,740	97,840	97,610	no accreditation	XRF (fusion)	
07	97,510	0,028	0,251	97,490	97,530	no accreditation	XRF (fusion)	
08	97,311	0,001	-0,200	97,311	97,312	no accreditation	Other Method	Titration

RV_2017_02_Lime

Lab code	Lab mean	s.d.	z-score	Conc. 1	Conc. 2	Accreditation	Analytical method	Comment
09	97,635	0,290	0,535	97,840	97,430	no accreditation	XRF (fusion)	
10	97,084	0,015	-0,716	97,074	97,095	ISO 17025	Other Method	ICP, ASTM D6349-13 WR
11	98,163	0,059	1,737	98,205	98,122	ISO 17025	XRF (fusion)	
12	97,260	0,064	-0,318	97,214	97,305	no accreditation	XRF (fusion)	
13	97,510	0,003	0,251	97,508	97,512	ISO 17025	XRF (fusion)	
14	97,371	0,067	-0,064	97,419	97,324	no accreditation	XRF (fusion)	ASTM C 1271
15	95,213	0,078	-4,971	95,158	95,268	no accreditation	XRF (fusion)	
16	97,300	0,078	-0,225	97,356	97,245	no accreditation	Other Method	XRF (pellet); info only
17	97,694	0,021	0,668	97,679	97,708	ISO 17025	Other Method	AAS1
18	97,085	0,134	-0,715	96,990	97,180	no accreditation	Other Method	ASTM C25 cap.31
19	97,407	0,040	0,018	97,379	97,436	ISO 17025	XRF (fusion)	
20	96,753	0,013	-1,470	96,762	96,744	no accreditation	Other Method	ICP-OES
21	96,361	0,120	-2,362	96,445	96,276	no accreditation	XRF (fusion)	

RV_2017_02_Lime

Sample: FLX-136 **Reprod. s.d.** 0,001
Measurand: Cr2O3 **Repeat. s.d** 0,001
Mean ± U(Mean): 0,002 ± 0,001 **Range of tolerance:** 0,000 - 0,004 (|z-score| ≤ 2,000)
No. of laboratories: 4 **Statistical method** Q/Hampel



PROLab Plus

Lab code	Lab mean	s.d.	z-score	Conc. 1	Conc. 2	Accreditation	Analytical method	Comment
02	<0,005			<0,005	<0,005	no accreditation	XRF (fusion)	
05	0,002	0,001	-0,119	0,001	0,002	no accreditation	XRF (fusion)	
07	<0,002			<0,002	<0,002	no accreditation	XRF (fusion)	
09	0,002	0,001	-0,119	0,001	0,002	no accreditation	XRF (fusion)	
12	<0,002		-0,596	<0,002	0,001	no accreditation	XRF (fusion)	
13	0,003	0,001	0,835	0,002	0,003	ISO 17025	XRF (fusion)	Lower detection limit
14	<0,010			<0,010	<0,010	no accreditation	XRF (fusion)	ASTM C 1271

RV_2017_02_Lime

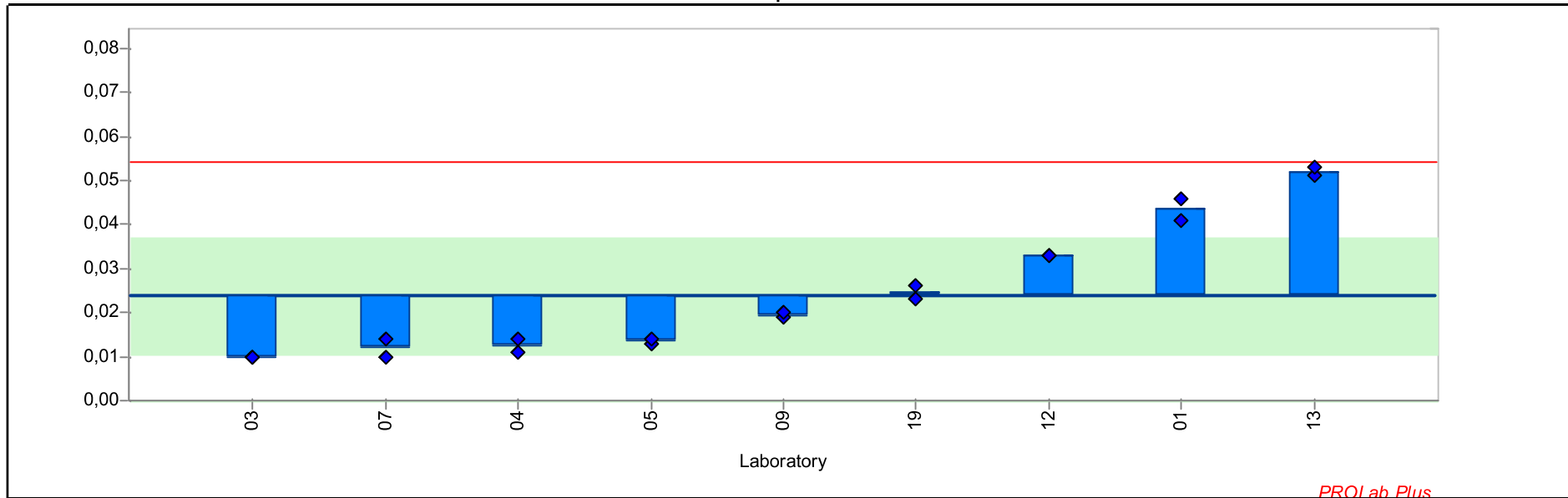
Lab code	Lab mean	s.d.	z-score	Conc. 1	Conc. 2	Accreditation	Analytical method	Comment
15	<0,010			<0,010	<0,010	no accreditation	XRF (fusion)	
16	0,002	0,001	-0,119	0,002	0,001	no accreditation	Other Method	XRF (pellet); info only
19	<0,006			<0,006	<0,006	ISO 17025	XRF (fusion)	

RV_2017_02_Lime

Lab code	Lab mean	s.d.	z-score	Conc. 1	Conc. 2	Accreditation	Analytical method	Comment
09	0,225	0,001	0,277	0,225	0,224	no accreditation	XRF (fusion)	
10	0,231	0,001	0,452	0,230	0,232	ISO 17025	Other Method	ICP, ASTM D6349-13 WR
11	0,178	0,001	-0,972	0,177	0,179	ISO 17025	XRF (fusion)	
12	0,228	0,001	0,358	0,228	0,227	no accreditation	XRF (fusion)	
13	0,213	0,007	-0,032	0,218	0,208	ISO 17025	XRF (fusion)	
14	0,264	0,003	1,338	0,266	0,262	no accreditation	XRF (fusion)	ASTM C 1271
15	0,235	0,013	0,572	0,226	0,245	no accreditation	XRF (fusion)	
16	0,232	0,009	0,492	0,239	0,226	no accreditation	Other Method	XRF (pellet); info only
17	0,072	0,000	-3,819	0,072	0,072	ISO 17025	XRF (fusion)	
19	0,196	0,001	-0,502	0,195	0,196	ISO 17025	XRF (fusion)	
20	0,206	0,001	-0,220	0,207	0,205	no accreditation	Other Method	ICP-OES
21	0,192	0,004	-0,609	0,194	0,189	no accreditation	XRF (fusion)	

RV_2017_02_Lime

Sample: FLX-136 **Reprod. s.d.** 0,015
Measurand: K2O Annealed **Repeat. s.d** 0,002
Mean ± U(Mean): 0,024 ± 0,013 **Range of tolerance:** -0,006 - 0,054 (|z-score| <= 2,000)
No. of laboratories: 9 **Statistical method** Q/Hampel



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Lab code	Lab mean	s.d.	z-score	Conc. 1	Conc. 2	Accreditation	Analytical method	Comment
01	0,043	0,004	1,294	0,046	0,041	no accreditation	XRF (fusion)	K2O after treated @
02	<0,005			<0,005	<0,005	no accreditation	XRF (fusion)	K2O after treated @
03	0,010	0,000	-0,918	0,010	0,010	no accreditation	XRF (fusion)	K2O after treated @
04	0,013	0,002	-0,753	0,011	0,014	no accreditation	XRF (fusion)	K2O after treated @
05	0,013	0,001	-0,687	0,013	0,014	no accreditation	XRF (fusion)	K2O after treated @
07	0,012	0,003	-0,786	0,010	0,014	no accreditation	XRF (fusion)	K2O after treated @
09	0,020	0,001	-0,291	0,019	0,020	no accreditation	XRF (fusion)	K2O after treated @

RV_2017_02_Lime

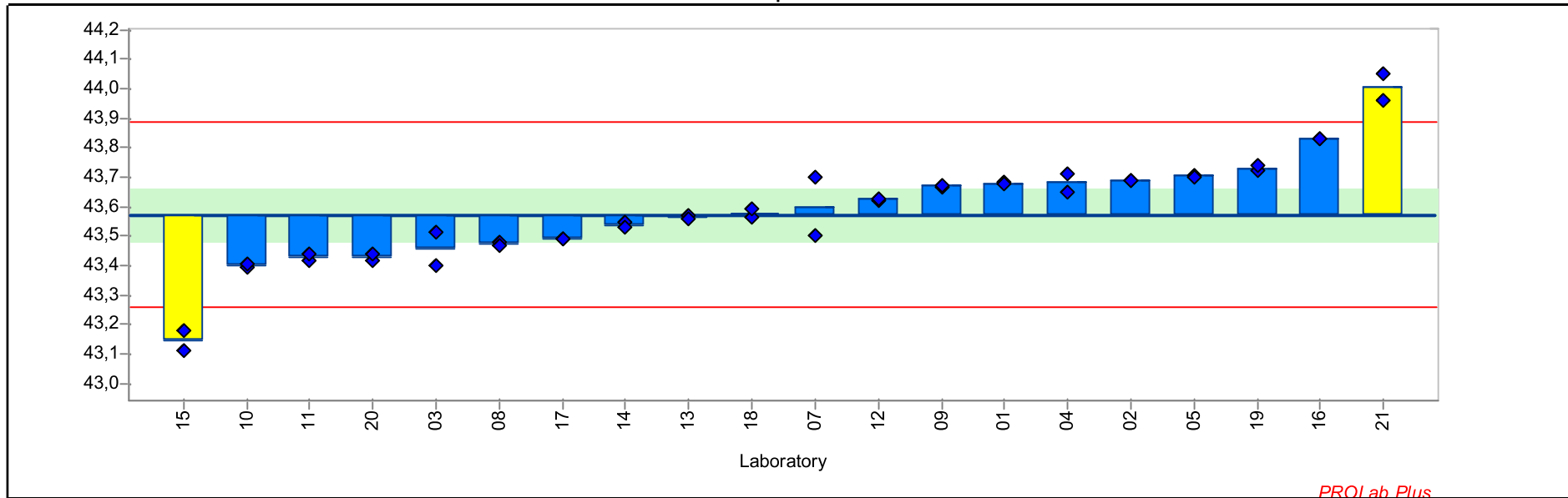
Lab code	Lab mean	s.d.	z-score	Conc. 1	Conc. 2	Accreditation	Analytical method	Comment
12	0,033	0,000	0,601	0,033	0,033	no accreditation	XRF (fusion)	K2O after treated @
13	0,052	0,001	1,856	0,051	0,053	ISO 17025	XRF (fusion)	K2O after treated @
19	0,025	0,002	0,040	0,023	0,026	ISO 17025	XRF (fusion)	K2O after treated @

RV_2017_02_Lime

Lab code	Lab mean	s.d.	z-score	Conc. 1	Conc. 2	Accreditation	Analytical method	Comment
19	0,090	0,000	-0,013	0,090	0,090	ISO 17025	XRF (fusion)	K2O after drying @ 105°C
20	0,054	0,014	-2,429	0,064	0,044	no accreditation	Other Method	K2O after drying @
21	0,083	0,000	-0,483	0,083	0,083	no accreditation	XRF (fusion)	K2O after drying @ 105°C

RV_2017_02_Lime

Sample: FLX-136 **Reprod. s.d.:** 0,158
Measurand: Loss on Ignition **Repeat. s.d.:** 0,018
Mean ± U(Mean): 43,572 ± 0,087 **Range of tolerance:** 43,257 - 43,888 (|z-score| ≤ 2,000)
No. of laboratories: 19 **Statistical method:** Q/Hampel



PROLab Plus

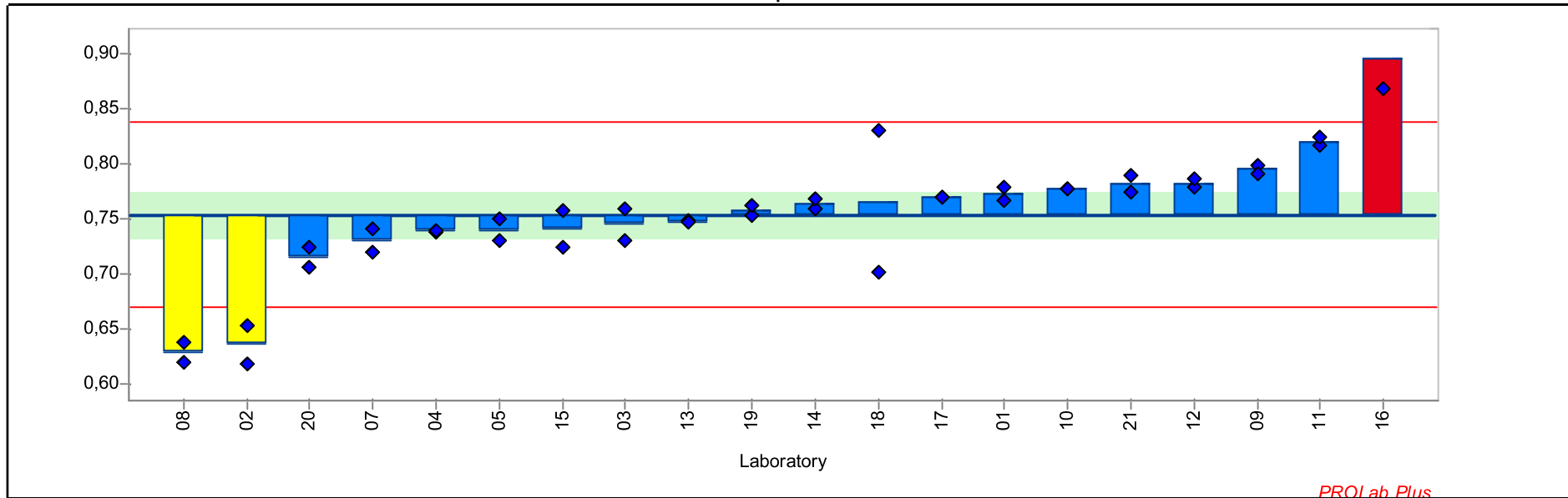
Lab code	Lab mean	s.d.	z-score	Conc. 1	Conc. 2	Accreditation	Analytical method	Comment
01	43,677	0,004	0,667	43,680	43,675	no accreditation	Other Method	LOI @ 1050°C
02	43,688	0,001	0,731	43,688	43,687	no accreditation	Other Method	LOI @ 1050°C
03	43,455	0,078	-0,743	43,400	43,510	no accreditation	Other Method	LOI @ 1050°C
04	43,680	0,042	0,683	43,650	43,710	no accreditation	Other Method	LOI @ 1050°C
05	43,703	0,002	0,826	43,704	43,701	no accreditation	Other Method	LOI @ 1050°C
07	43,600	0,141	0,176	43,500	43,700	no accreditation	Other Method	LOI @ 1050°C
08	43,475	0,007	-0,616	43,480	43,470	no accreditation	Other Method	LOI @ 1050°C

RV_2017_02_Lime

Lab code	Lab mean	s.d.	z-score	Conc. 1	Conc. 2	Accreditation	Analytical method	Comment
09	43,669	0,002	0,617	43,668	43,671	no accreditation	Other Method	LOI @ 1050°C
10	43,399	0,007	-1,098	43,394	43,404	ISO 17025	Other Method	LOI @ 1050°C
11	43,427	0,016	-0,917	43,416	43,439	ISO 17025	Other Method	LOI @ 1050°C
12	43,625	0,003	0,335	43,623	43,627	no accreditation	Other Method	LOI @ 1050°C
13	43,566	0,008	-0,039	43,572	43,560	ISO 17025	Other Method	LOI @ 1050°C
14	43,538	0,011	-0,217	43,546	43,530	no accreditation	Other Method	LOI @ 1050°C
15	43,145	0,049	-2,707	43,110	43,180	no accreditation	Other Method	LOI @ 1050°C
16	43,830	0,000	1,634	43,830	43,830	no accreditation	Other Method	XRF (pellet); info only
17	43,490	0,000	-0,521	43,490	43,490	ISO 17025	Other Method	LOI @ 1050°C
18	43,578	0,018	0,034	43,565	43,590	no accreditation	Other Method	LOI @ 1050°C
19	43,730	0,014	1,000	43,720	43,740	ISO 17025	Other Method	LOI @ 1050°C
20	43,427	0,016	-0,917	43,416	43,439	ISO 17025	Other Method	LOI @ 1050°C
21	44,005	0,064	2,743	43,960	44,050	no accreditation	Other Method	LOI @ 1050°C

RV_2017_02_Lime

Sample: FLX-136 **Reprod. s.d.:** 0,042
Measurand: MgO **Repeat. s.d.:** 0,014
Mean ± U(Mean): 0,754 ± 0,021 **Range of tolerance:** 0,670 - 0,838 (|z-score| ≤ 2,000)
No. of laboratories: 19 **Statistical method:** Q/Hampel



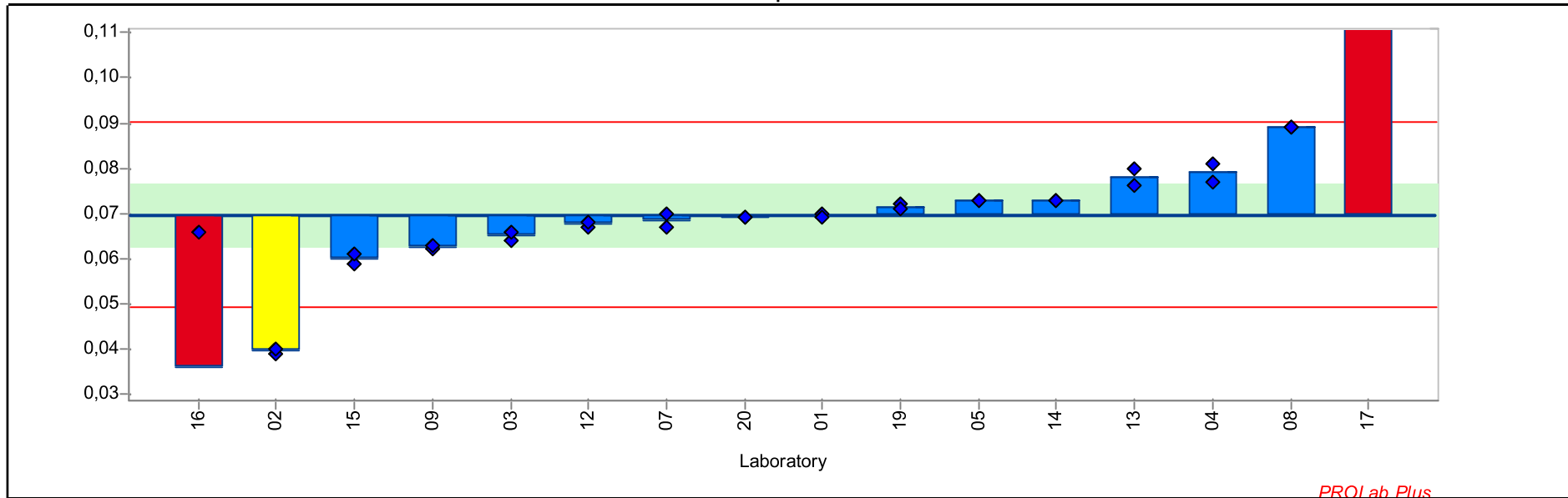
Lab code	Lab mean	s.d.	z-score	Conc. 1	Conc. 2	Accreditation	Analytical method	Comment
01	0,773	0,008	0,450	0,779	0,767	no accreditation	XRF (fusion)	
02	0,637	0,025	-2,787	0,654	0,619	no accreditation	XRF (fusion)	
03	0,745	0,021	-0,214	0,730	0,760	no accreditation	XRF (fusion)	
04	0,739	0,001	-0,356	0,738	0,740	no accreditation	XRF (fusion)	
05	0,740	0,014	-0,332	0,730	0,750	no accreditation	XRF (fusion)	
07	0,730	0,015	-0,558	0,720	0,741	no accreditation	XRF (fusion)	
08	0,629	0,013	-2,965	0,638	0,620	no accreditation	XRF (fusion)	

RV_2017_02_Lime

Lab code	Lab mean	s.d.	z-score	Conc. 1	Conc. 2	Accreditation	Analytical method	Comment
09	0,795	0,006	0,972	0,799	0,791	no accreditation	XRF (fusion)	
10	0,778	0,000	0,569	0,778	0,778	ISO 17025	Other Method	ICP, ASTM D6349-13 WR
11	0,821	0,005	1,577	0,817	0,824	ISO 17025	XRF (fusion)	
12	0,782	0,005	0,676	0,779	0,786	no accreditation	XRF (fusion)	
13	0,748	0,001	-0,155	0,748	0,747	ISO 17025	XRF (fusion)	
14	0,764	0,006	0,249	0,760	0,769	no accreditation	XRF (fusion)	ASTM C 1271
15	0,741	0,024	-0,309	0,758	0,724	no accreditation	XRF (fusion)	
16	0,895	0,039	3,355	0,868	0,923	no accreditation	Other Method	XRF (pellet); info only
17	0,770	0,000	0,379	0,770	0,770	ISO 17025	XRF (fusion)	
18	0,766	0,091	0,284	0,702	0,830	no accreditation	Other Method	ASTM C25 cap.31
19	0,758	0,007	0,094	0,753	0,763	ISO 17025	XRF (fusion)	
20	0,716	0,013	-0,902	0,707	0,725	no accreditation	Other Method	ICP-OES
21	0,782	0,011	0,652	0,789	0,774	no accreditation	XRF (fusion)	

RV_2017_02_Lime

Sample: FLX-136 **Reprod. s.d.** 0,010
Measurand: Mn2O3 **Repeat. s.d** 0,001
Mean ± U(Mean): 0,070 ± 0,007 **Range of tolerance:** 0,049 - 0,090 (|z-score| ≤ 2,000)
No. of laboratories: 15 **Statistical method** Q/Hampel



Lab code	Lab mean	s.d.	z-score	Conc. 1	Conc. 2	Accreditation	Analytical method	Comment
01	0,070	0,001	-0,020	0,070	0,069	no accreditation	XRF (fusion)	
02	0,040	0,001	-2,936	0,039	0,040	no accreditation	XRF (fusion)	
03	0,065	0,001	-0,458	0,064	0,066	no accreditation	XRF (fusion)	
04	0,079	0,003	0,903	0,077	0,081	no accreditation	XRF (fusion)	
05	0,073	0,000	0,320	0,073	0,073	no accreditation	XRF (fusion)	
07	0,069	0,002	-0,117	0,067	0,070	no accreditation	XRF (fusion)	
08	0,089	0,000	1,875	0,089	0,089	no accreditation	XRF (fusion)	

RV_2017_02_Lime

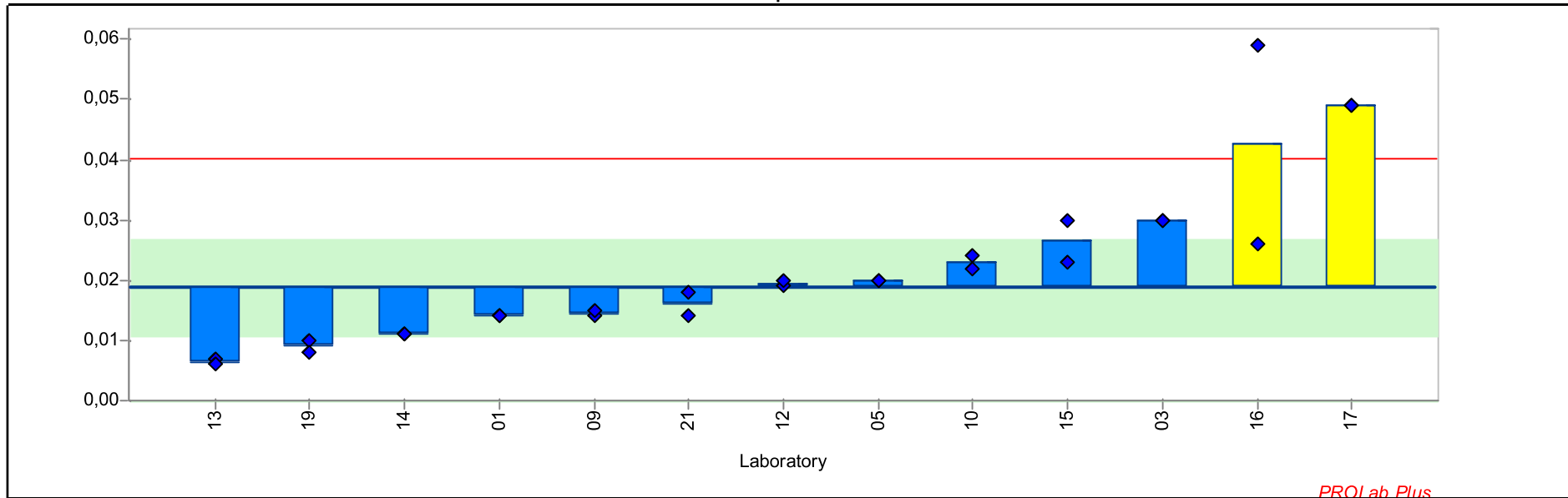
Lab code	Lab mean	s.d.	z-score	Conc. 1	Conc. 2	Accreditation	Analytical method	Comment
09	0,063	0,001	-0,701	0,062	0,063	no accreditation	XRF (fusion)	
12	0,068	0,001	-0,215	0,067	0,068	no accreditation	XRF (fusion)	
13	0,078	0,003	0,806	0,080	0,076	ISO 17025	XRF (fusion)	
14	0,073	0,000	0,320	0,073	0,073	no accreditation	XRF (fusion)	ASTM C 1271
15	0,060	0,001	-0,944	0,059	0,061	no accreditation	XRF (fusion)	
16	0,036	0,042	-3,276	0,006	0,066	no accreditation	Other Method	XRF (pellet); info only
17	0,199	0,000	12,567	0,199	0,199	ISO 17025	XRF (fusion)	
19	0,071	0,001	0,174	0,072	0,071	ISO 17025	XRF (fusion)	
20	0,069	0,000	-0,069	0,069	0,069	no accreditation	Other Method	ICP-OES

RV_2017_02_Lime

Lab code	Lab mean	s.d.	z-score	Conc. 1	Conc. 2	Accreditation	Analytical method	Comment
14	0,045	0,001	0,708	0,046	0,045	no accreditation	Other Method	ASTM C114
15	<0,020			<0,020	<0,020	no accreditation	XRF (fusion)	
17	0,057	0,000	1,140	0,057	0,057	ISO 17025	Other Method	AAS1
19	<0,120			<0,120	<0,120	ISO 17025	XRF (fusion)	

RV_2017_02_Lime

Sample: FLX-136 **Reprod. s.d.:** 0,011
Measurand: P2O5 **Repeat. s.d.:** 0,001
Mean ± U(Mean): 0,019 ± 0,008 **Range of tolerance:** -0,003 - 0,040 (|z-score| ≤ 2,000)
No. of laboratories: 12 **Statistical method:** Q/Hampel



Lab code	Lab mean	s.d.	z-score	Conc. 1	Conc. 2	Accreditation	Analytical method	Comment
01	0,014	0,000	-0,441	0,014	0,014	no accreditation	XRF (fusion)	
02	<0,005			<0,005	<0,005	no accreditation	XRF (fusion)	
03	0,030	0,000	1,048	0,030	0,030	no accreditation	XRF (fusion)	
05	0,020	0,000	0,117	0,020	0,020	no accreditation	XRF (fusion)	
09	0,014	0,001	-0,394	0,014	0,015	no accreditation	XRF (fusion)	
10	0,023	0,001	0,396	0,024	0,022	ISO 17025	Other Method	ICP, ASTM D6349-13 WR
12	0,020	0,001	0,071	0,019	0,020	no accreditation	XRF (fusion)	

RV_2017_02_Lime

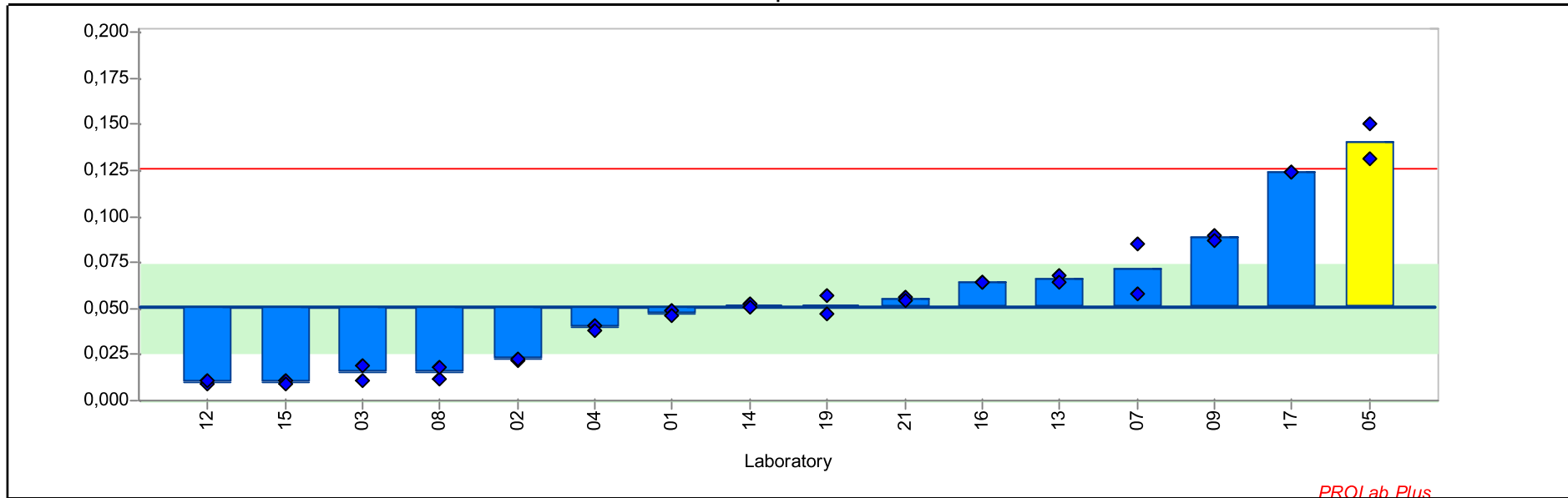
Lab code	Lab mean	s.d.	z-score	Conc. 1	Conc. 2	Accreditation	Analytical method	Comment
13	0,007	0,001	-1,139	0,007	0,006	ISO 17025	XRF (fusion)	
14	0,011	0,000	-0,720	0,011	0,011	no accreditation	XRF (fusion)	ASTM C 1271
15	0,026	0,005	0,722	0,030	0,023	no accreditation	XRF (fusion)	
16	0,042	0,023	2,210	0,059	0,026	no accreditation	Other Method	XRF (pellet); info only
17	0,049	0,000	2,815	0,049	0,049	ISO 17025	XRF (fusion)	
19	0,009	0,001	-0,906	0,010	0,008	ISO 17025	XRF (fusion)	
21	0,016	0,003	-0,255	0,014	0,018	no accreditation	XRF (fusion)	

RV_2017_02_Lime

Lab code	Lab mean	s.d.	z-score	Conc. 1	Conc. 2	Accreditation	Analytical method	Comment
09	0,901	0,004	-1,133	0,903	0,898	no accreditation	XRF (fusion)	
10	0,962	0,008	-0,396	0,968	0,956	ISO 17025	Other Method	ICP, ASTM D6349-13 WR
12	1,103	0,011	1,287	1,110	1,095	no accreditation	XRF (fusion)	
13	0,939	0,010	-0,672	0,932	0,946	ISO 17025	XRF (fusion)	
14	0,956	0,021	-0,462	0,942	0,971	no accreditation	XRF (fusion)	ASTM C 1271
15	1,015	0,008	0,239	1,009	1,021	no accreditation	XRF (fusion)	
16	0,879	0,062	-1,390	0,835	0,923	no accreditation	Other Method	XRF (pellet); info only
17	1,348	0,001	4,222	1,347	1,348	ISO 17025	XRF (fusion)	
18	1,530	0,071	6,408	1,480	1,580	no accreditation	Other Method	ASTM C25 cap.9
19	1,019	0,009	0,293	1,013	1,026	ISO 17025	XRF (fusion)	
20	0,976	0,018	-0,235	0,963	0,988	no accreditation	Other Method	ICP-OES
21	1,022	0,015	0,328	1,012	1,033	no accreditation	XRF (fusion)	

RV_2017_02_Lime

Sample: FLX-136 **Reprod. s.d.:** 0,038
Measurand: SO3 **Repeat. s.d.:** 0,003
Mean ± U(Mean): 0,051 ± 0,024 **Range of tolerance:** -0,025 - 0,126 (|z-score| <= 2,000)
No. of laboratories: 15 **Statistical method:** Q/Hampel



Lab code	Lab mean	s.d.	z-score	Conc. 1	Conc. 2	Accreditation	Analytical method	Comment
01	0,048	0,002	-0,082	0,049	0,046	no accreditation	XRF (fusion)	
02	0,022	0,001	-0,743	0,022	0,023	no accreditation	Other Method	Combustion with IR-
03	0,015	0,006	-0,941	0,019	0,011	no accreditation	XRF (fusion)	
04	0,040	0,002	-0,294	0,041	0,038	no accreditation	Other Method	Combustion with IR-
05	0,141	0,013	2,373	0,150	0,131	no accreditation	XRF (fusion)	
07	0,072	0,019	0,551	0,085	0,058	no accreditation	XRF (fusion)	
08	0,015	0,004	-0,941	0,012	0,018	no accreditation	Other Method	Combustion with IR-

RV_2017_02_Lime

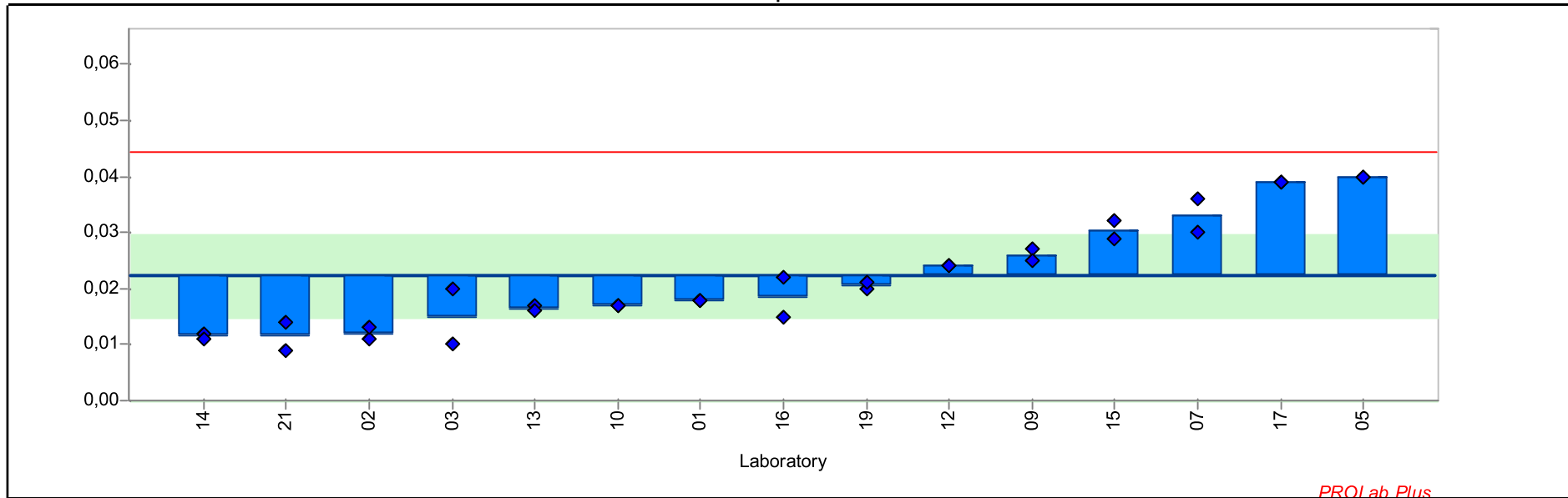
Lab code	Lab mean	s.d.	z-score	Conc. 1	Conc. 2	Accreditation	Analytical method	Comment
09	0,088	0,002	1,000	0,090	0,087	no accreditation	XRF (fusion)	
12	0,010	0,001	-1,073	0,009	0,011	no accreditation	XRF (fusion)	
13	0,066	0,003	0,406	0,068	0,064	ISO 17025	XRF (fusion)	
14	0,052	0,001	0,036	0,053	0,051	no accreditation	XRF (fusion)	ASTM C 1271
15	0,010	0,001	-1,073	0,011	0,009	ISO 17025	Other Method	Combustion with IR-
16	0,064	0,000	0,353	0,064	0,064	no accreditation	Other Method	XRF (pellet); info only
17	0,124	0,000	1,937	0,124	0,124	ISO 17025	Other Method	Gravimetric
19	0,052	0,007	0,036	0,047	0,057	ISO 17025	XRF (fusion)	XRF (fusion) from original
21	0,055	0,001	0,116	0,056	0,054	no accreditation	XRF (fusion)	

RV_2017_02_Lime

Lab code	Lab mean	s.d.	z-score	Conc. 1	Conc. 2	Accreditation	Analytical method	Comment
10	0,035	0,000	-0,535	0,035	0,035	ISO 17025	Other Method	ICP, ASTM D6349-13 WR
12	0,035	0,000	-0,535	0,035	0,035	no accreditation	XRF (fusion)	
13	0,037	0,001	1,088	0,037	0,038	ISO 17025	XRF (fusion)	
14	0,035	0,000	-0,535	0,035	0,035	no accreditation	XRF (fusion)	ASTM C 1271
15	0,046	0,001	6,605	0,047	0,045	no accreditation	Other Method	info only
16	0,042	0,004	4,333	0,040	0,045	no accreditation	Other Method	XRF (pellet); info only
19	0,036	0,001	0,114	0,035	0,037	ISO 17025	XRF (fusion)	
20	0,037	0,000	0,763	0,037	0,037	no accreditation	Other Method	ICP-OES

RV_2017_02_Lime

Sample: FLX-136 **Reprod. s.d.:** 0,011
Measurand: TiO2 **Repeat. s.d.:** 0,002
Mean ± U(Mean): 0,022 ± 0,007 **Range of tolerance:** 0,000 - 0,044 (|z-score| ≤ 2,000)
No. of laboratories: 14 **Statistical method:** Q/Hampel



PROLab Plus

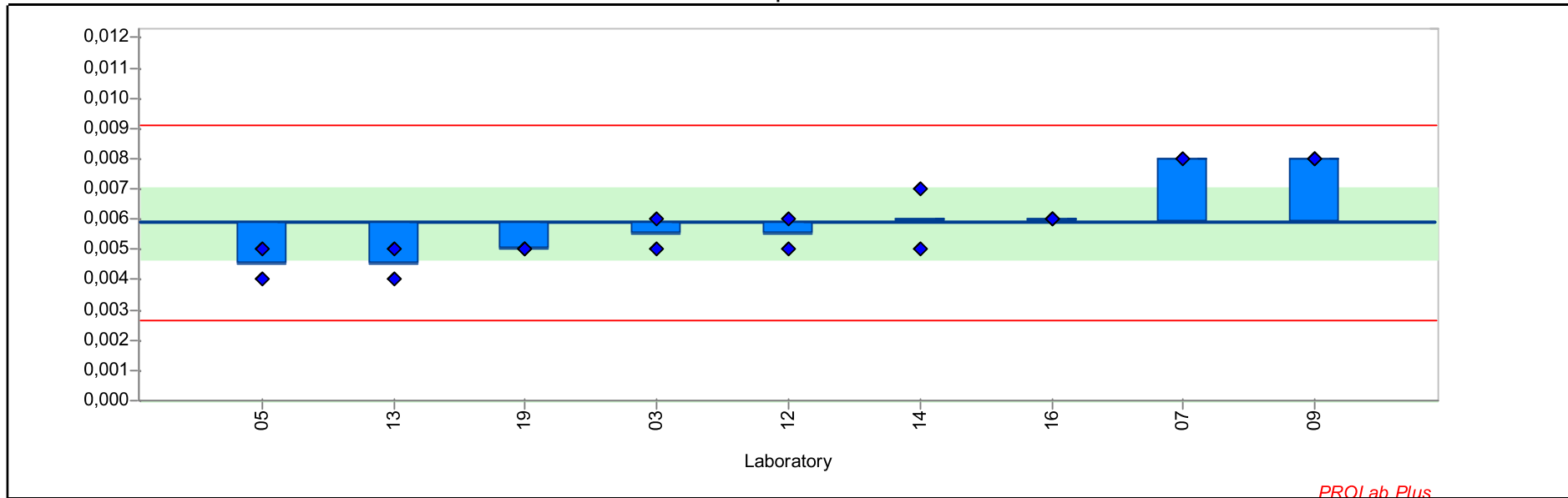
Lab code	Lab mean	s.d.	z-score	Conc. 1	Conc. 2	Accreditation	Analytical method	Comment
01	0,018	0,000	-0,398	0,018	0,018	no accreditation	XRF (fusion)	
02	0,012	0,001	-0,943	0,011	0,013	no accreditation	XRF (fusion)	
03	0,015	0,007	-0,671	0,010	0,020	no accreditation	XRF (fusion)	
05	0,040	0,000	1,603	0,040	0,040	no accreditation	XRF (fusion)	
07	0,033	0,004	0,966	0,036	0,030	no accreditation	XRF (fusion)	
09	0,026	0,001	0,330	0,027	0,025	no accreditation	XRF (fusion)	
10	0,017	0,000	-0,489	0,017	0,017	ISO 17025	Other Method	ICP, ASTM D6349-13 WR

RV_2017_02_Lime

Lab code	Lab mean	s.d.	z-score	Conc. 1	Conc. 2	Accreditation	Analytical method	Comment
12	0,024	0,000	0,148	0,024	0,024	no accreditation	XRF (fusion)	
13	0,017	0,001	-0,534	0,017	0,016	ISO 17025	XRF (fusion)	
14	0,011	0,001	-0,989	0,012	0,011	no accreditation	XRF (fusion)	ASTM C 1271
15	0,030	0,002	0,739	0,032	0,029	no accreditation	XRF (fusion)	
16	0,018	0,005	-0,352	0,015	0,022	no accreditation	Other Method	XRF (pellet); info only
17	0,039	0,000	1,512	0,039	0,039	ISO 17025	XRF (fusion)	
19	0,021	0,001	-0,170	0,020	0,021	ISO 17025	XRF (fusion)	
21	0,011	0,004	-0,989	0,009	0,014	no accreditation	XRF (fusion)	

RV_2017_02_Lime

Sample: FLX-136 **Reprod. s.d.:** 0,002
Measurand: ZnO **Repeat. s.d.:** 0,001
Mean ± U(Mean): 0,006 ± 0,001 **Range of tolerance:** 0,003 - 0,009 (|z-score| ≤ 2,000)
No. of laboratories: 8 **Statistical method:** Q/Hampel



PROLab Plus

Lab code	Lab mean	s.d.	z-score	Conc. 1	Conc. 2	Accreditation	Analytical method	Comment
02	<0,005			<0,005	<0,005	no accreditation	XRF (fusion)	
03	0,005	0,001	-0,233	0,005	0,006	no accreditation	XRF (fusion)	
05	0,005	0,001	-0,856	0,004	0,005	no accreditation	XRF (fusion)	
07	0,008		1,323	0,008	<0,002	no accreditation	XRF (fusion)	
09	0,008	0,000	1,323	0,008	0,008	no accreditation	XRF (fusion)	
12	0,005	0,001	-0,233	0,005	0,006	no accreditation	XRF (fusion)	
13	0,005	0,001	-0,856	0,005	0,004	ISO 17025	XRF (fusion)	

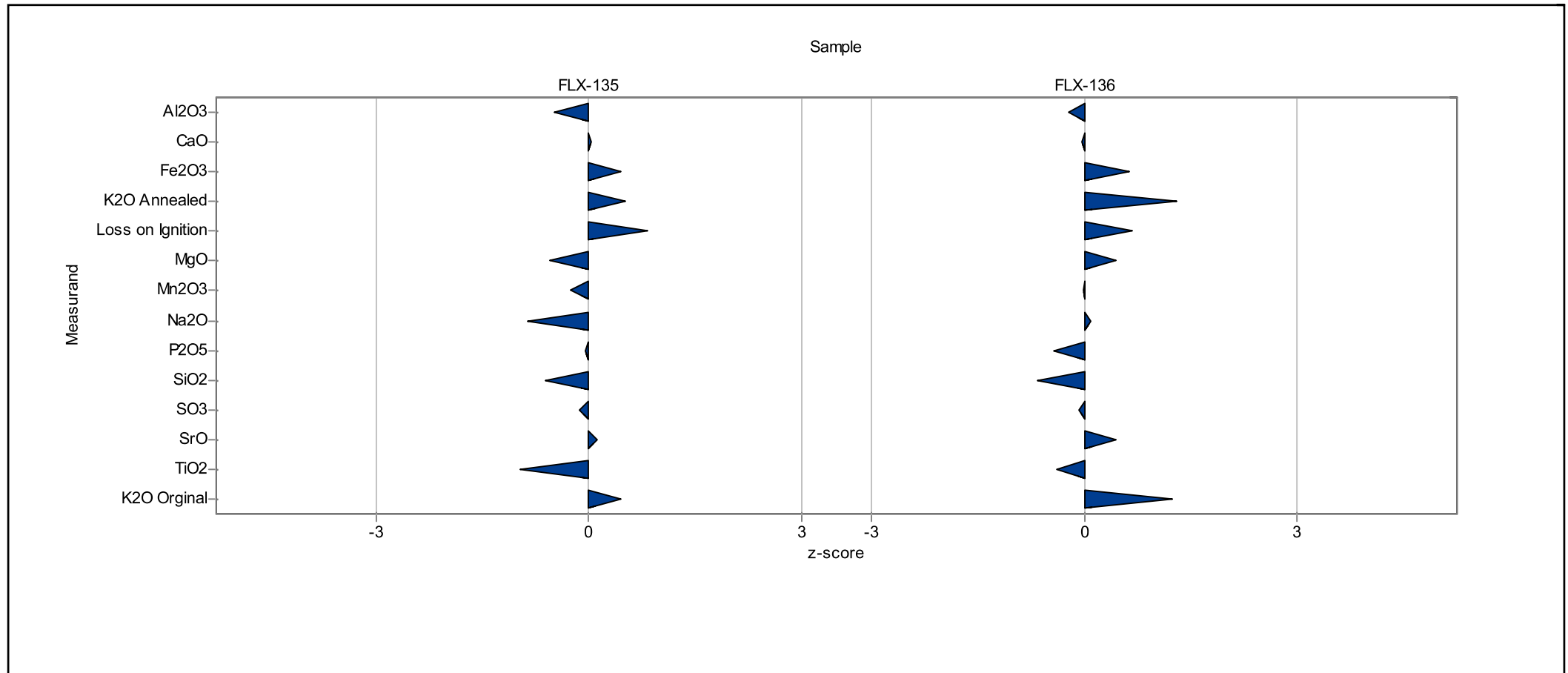
RV_2017_02_Lime

Lab code	Lab mean	s.d.	z-score	Conc. 1	Conc. 2	Accreditation	Analytical method	Comment
14	0,006	0,001	0,078	0,005	0,007	no accreditation	XRF (fusion)	ASTM C 1271
15	<0,010			<0,010	<0,010	no accreditation	XRF (fusion)	
16	0,006	0,000	0,078	0,006	0,006	no accreditation	Other Method	XRF (pellet); info only
19	0,005	0,000	-0,545	0,005	0,005	ISO 17025	XRF (fusion)	

RV_2017_02_Lime

Laboratory chart of z-scores

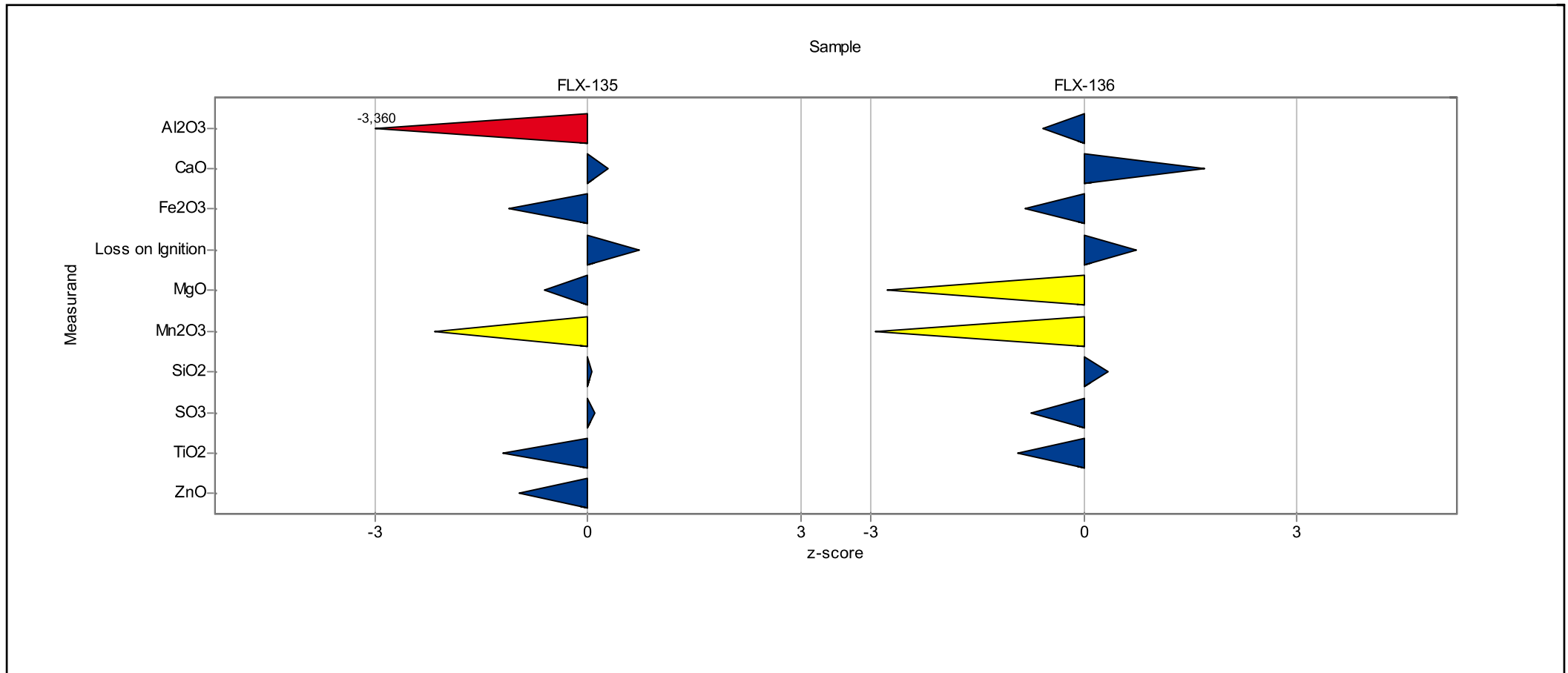
Laboratory: 01



RV_2017_02_Lime

Laboratory chart of z-scores

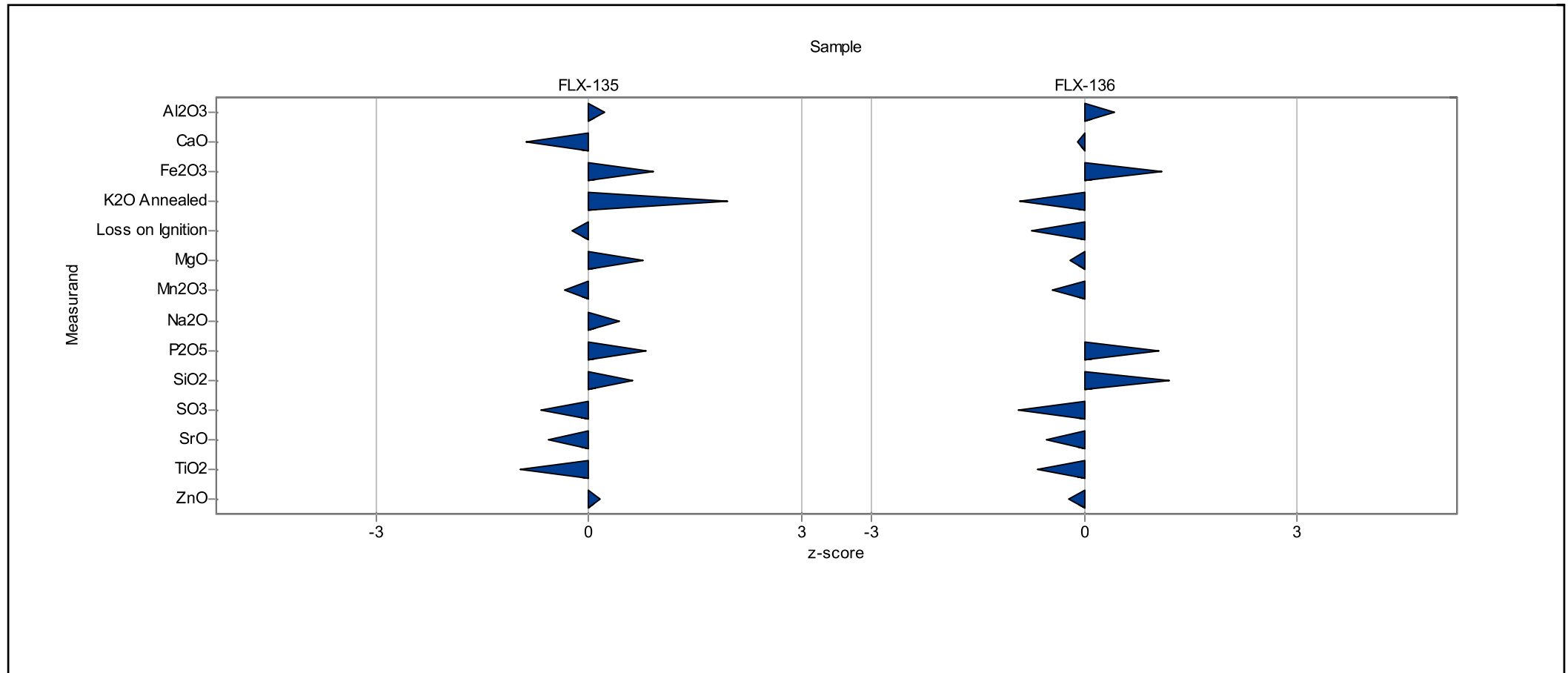
Laboratory: 02



RV_2017_02_Lime

Laboratory chart of z-scores

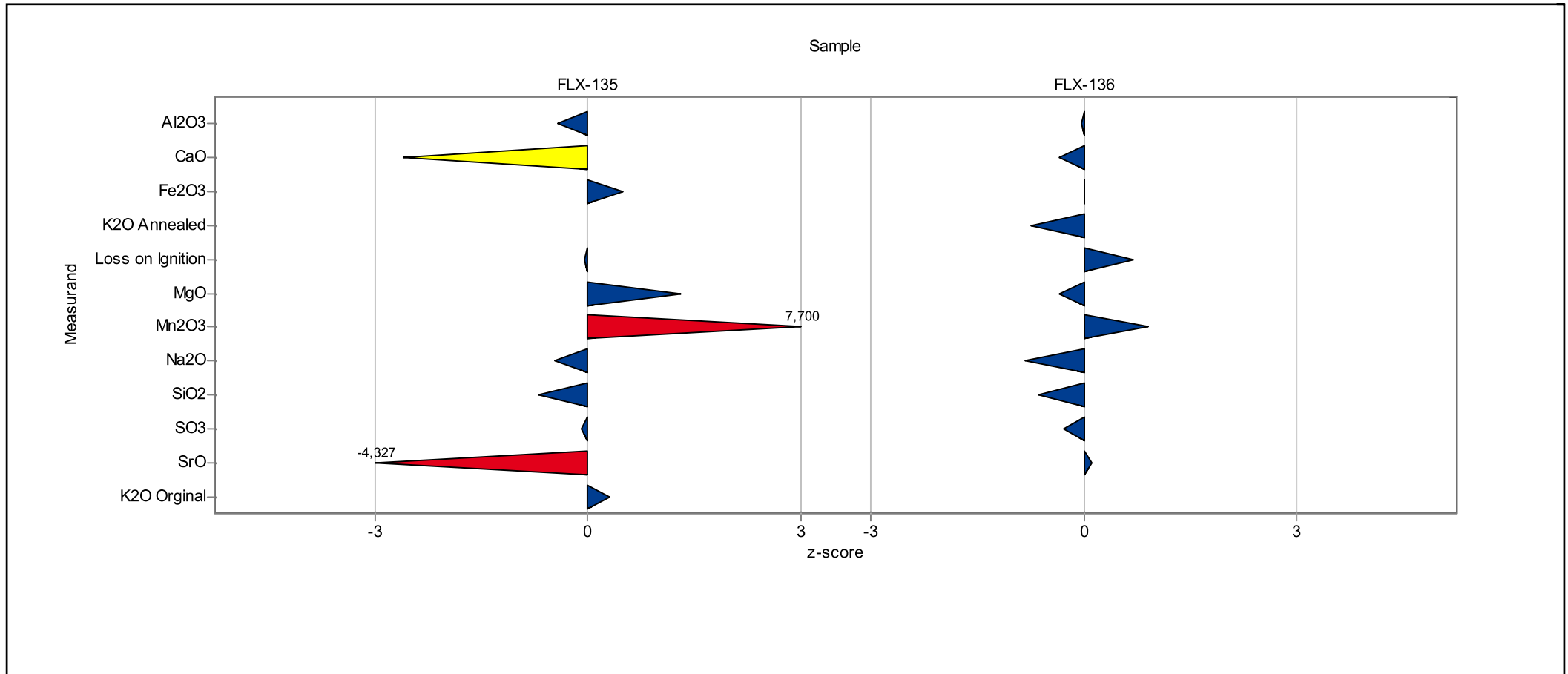
Laboratory: 03



RV_2017_02_Lime

Laboratory chart of z-scores

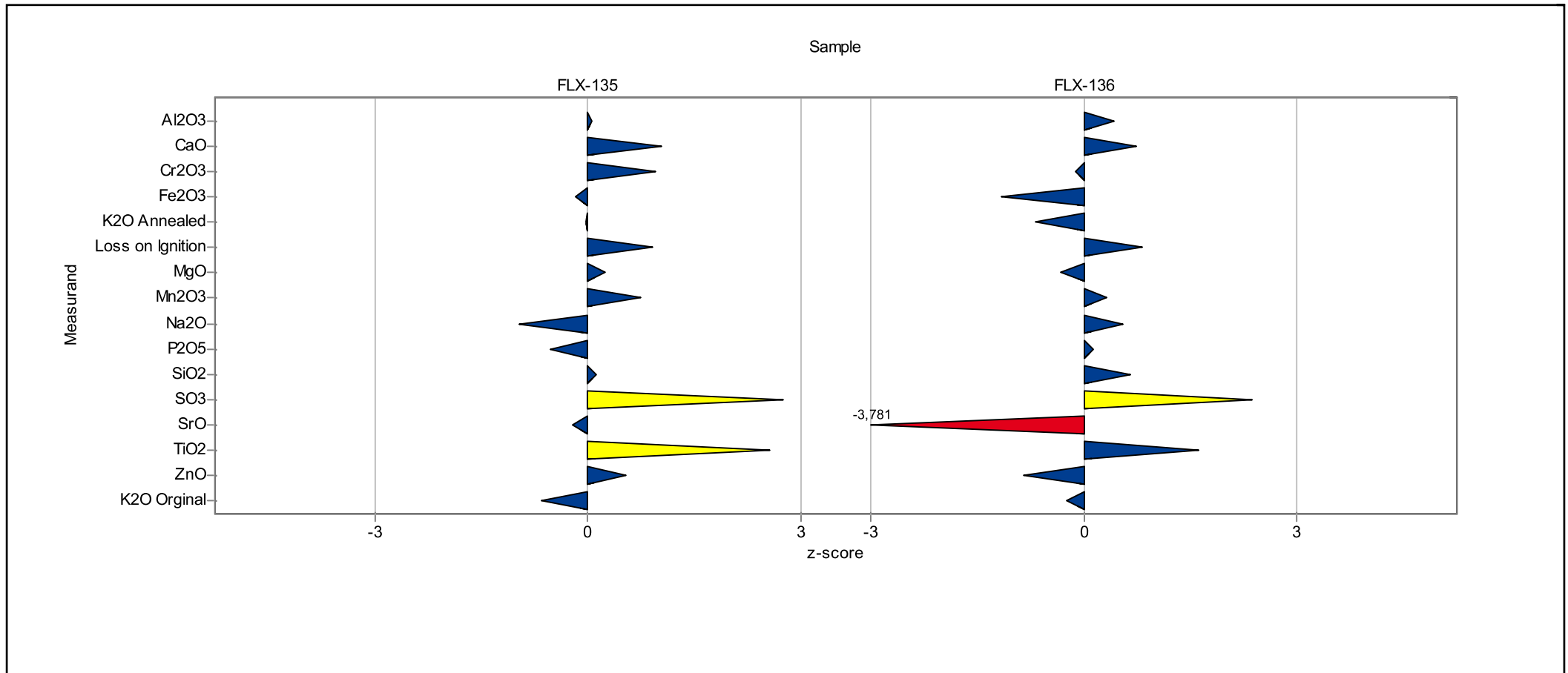
Laboratory: 04



RV_2017_02_Lime

Laboratory chart of z-scores

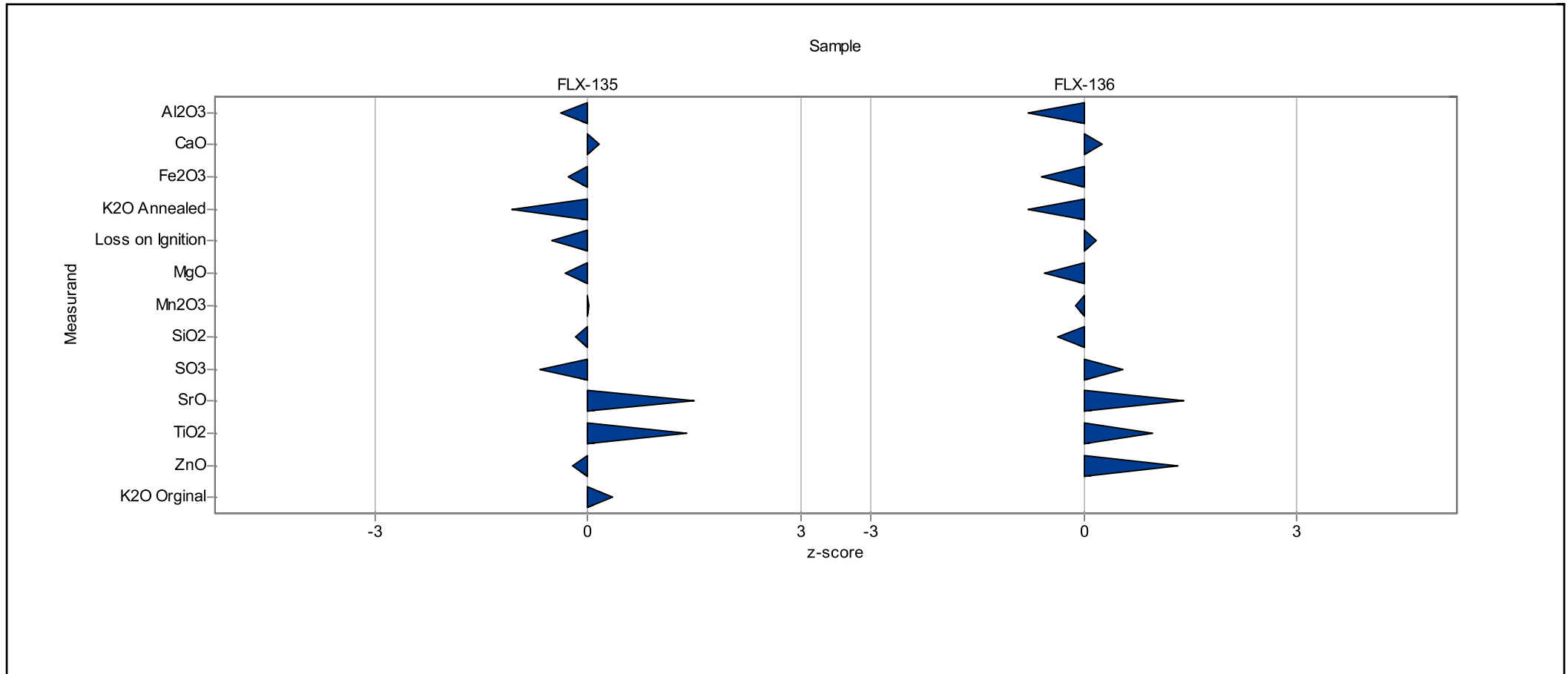
Laboratory: 05



RV_2017_02_Lime

Laboratory chart of z-scores

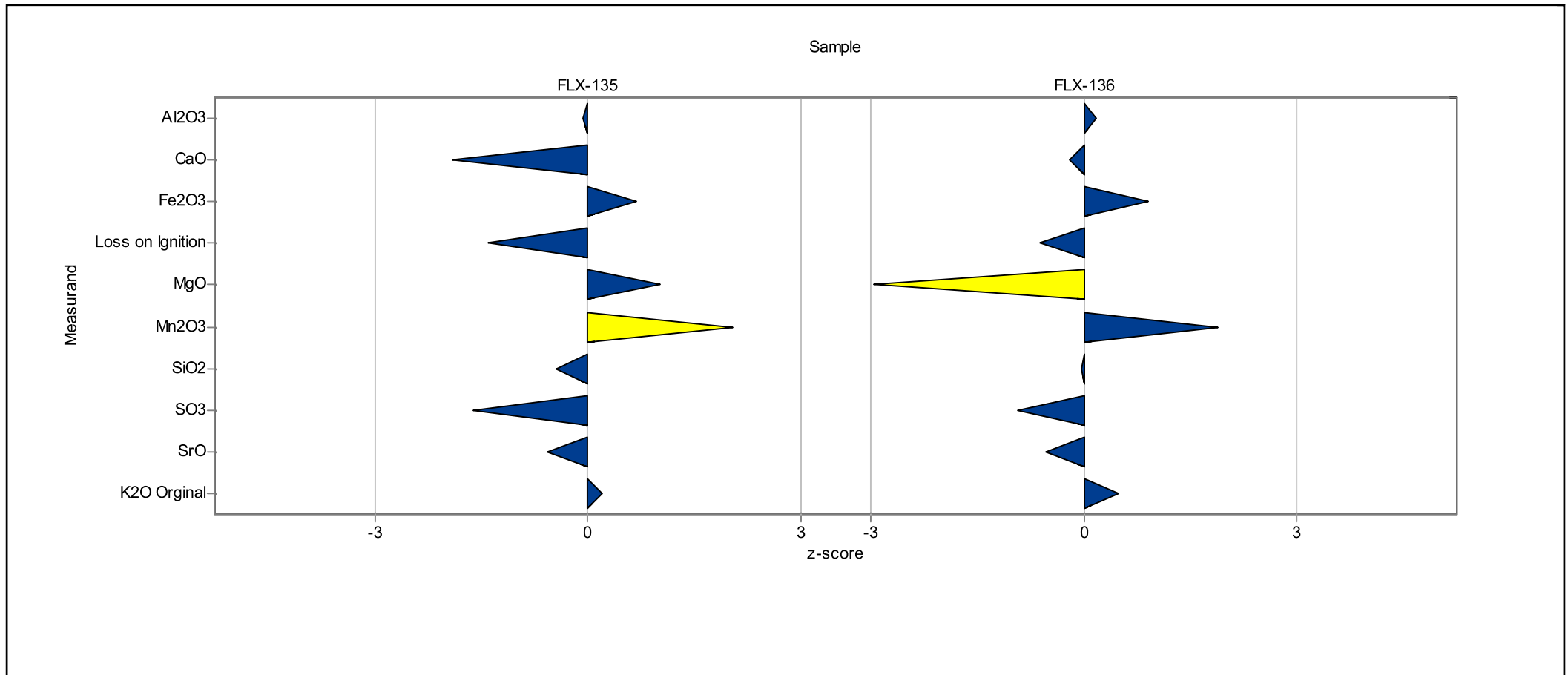
Laboratory: 07



RV_2017_02_Lime

Laboratory chart of z-scores

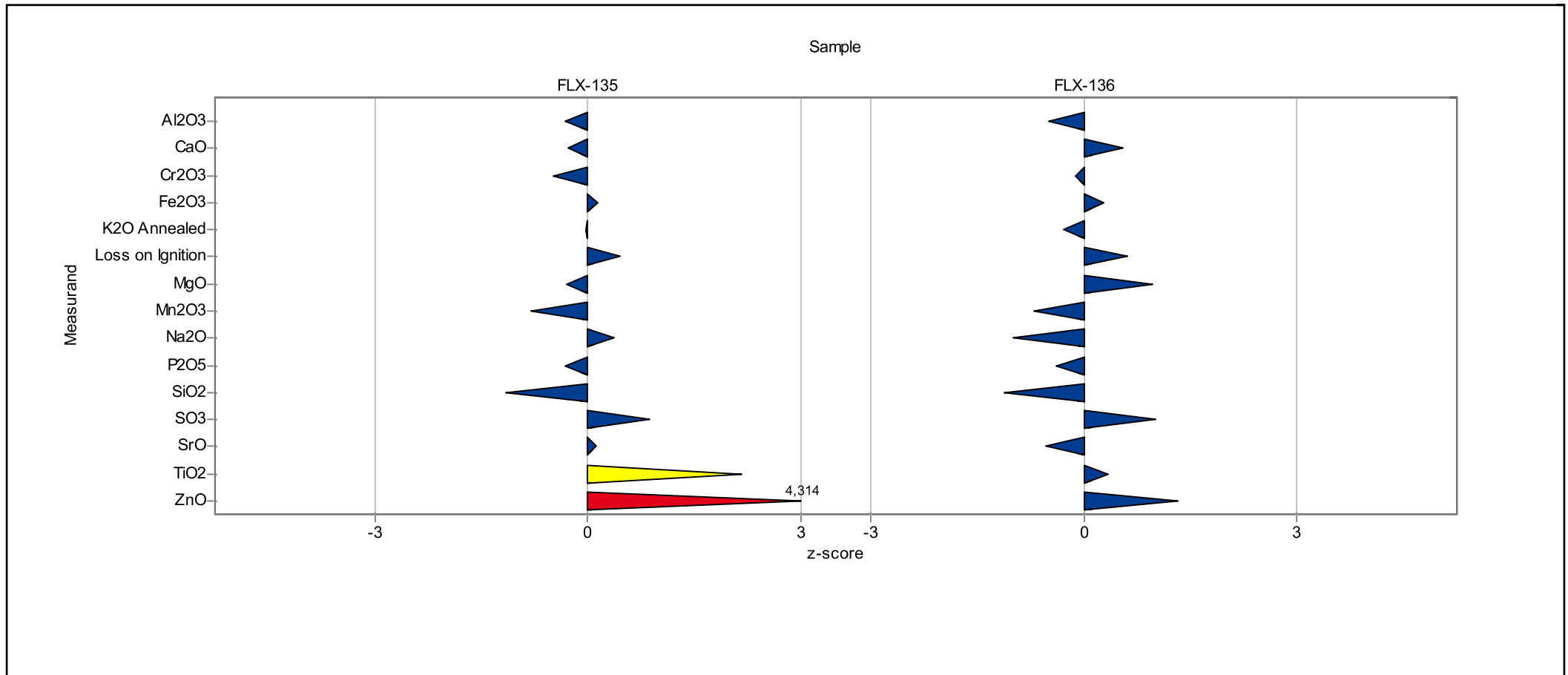
Laboratory: 08



RV_2017_02_Lime

Laboratory chart of z-scores

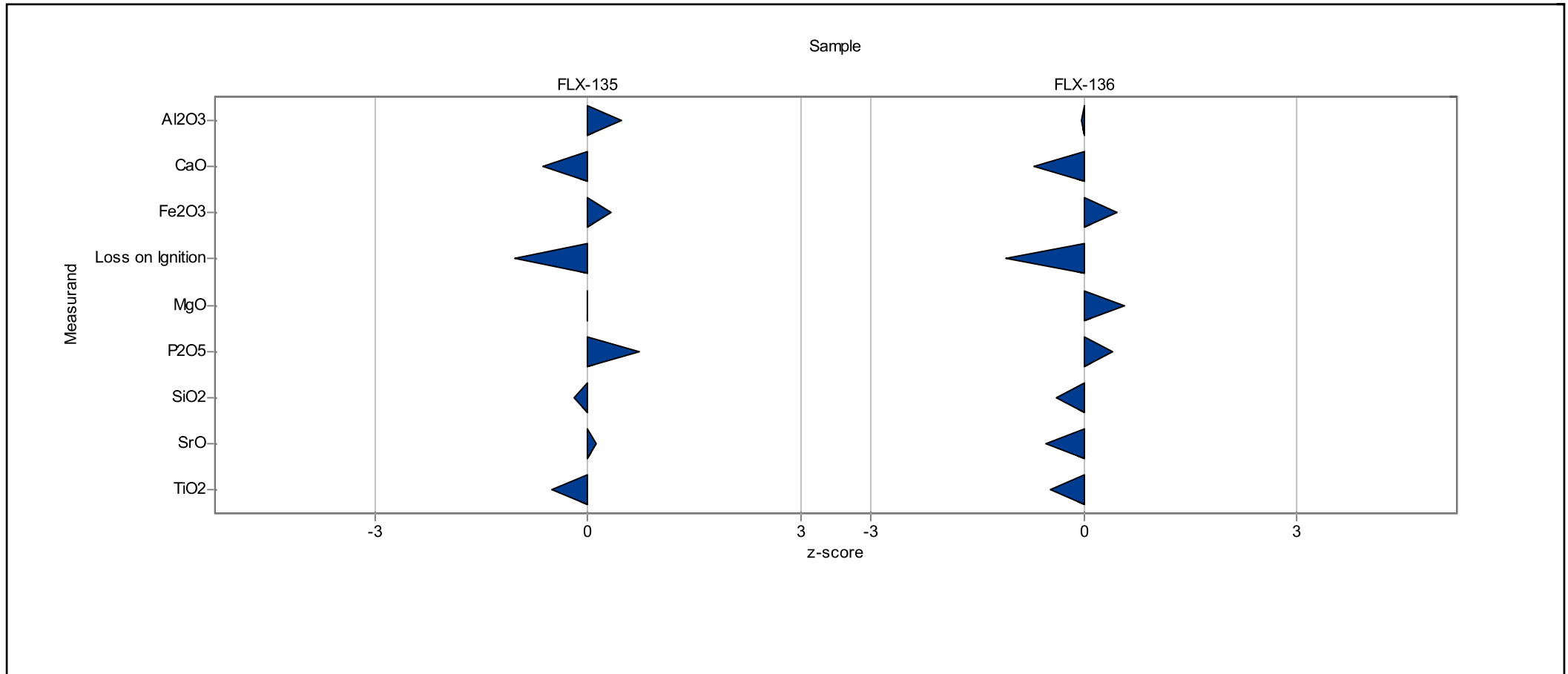
Laboratory: 09



RV_2017_02_Lime

Laboratory chart of z-scores

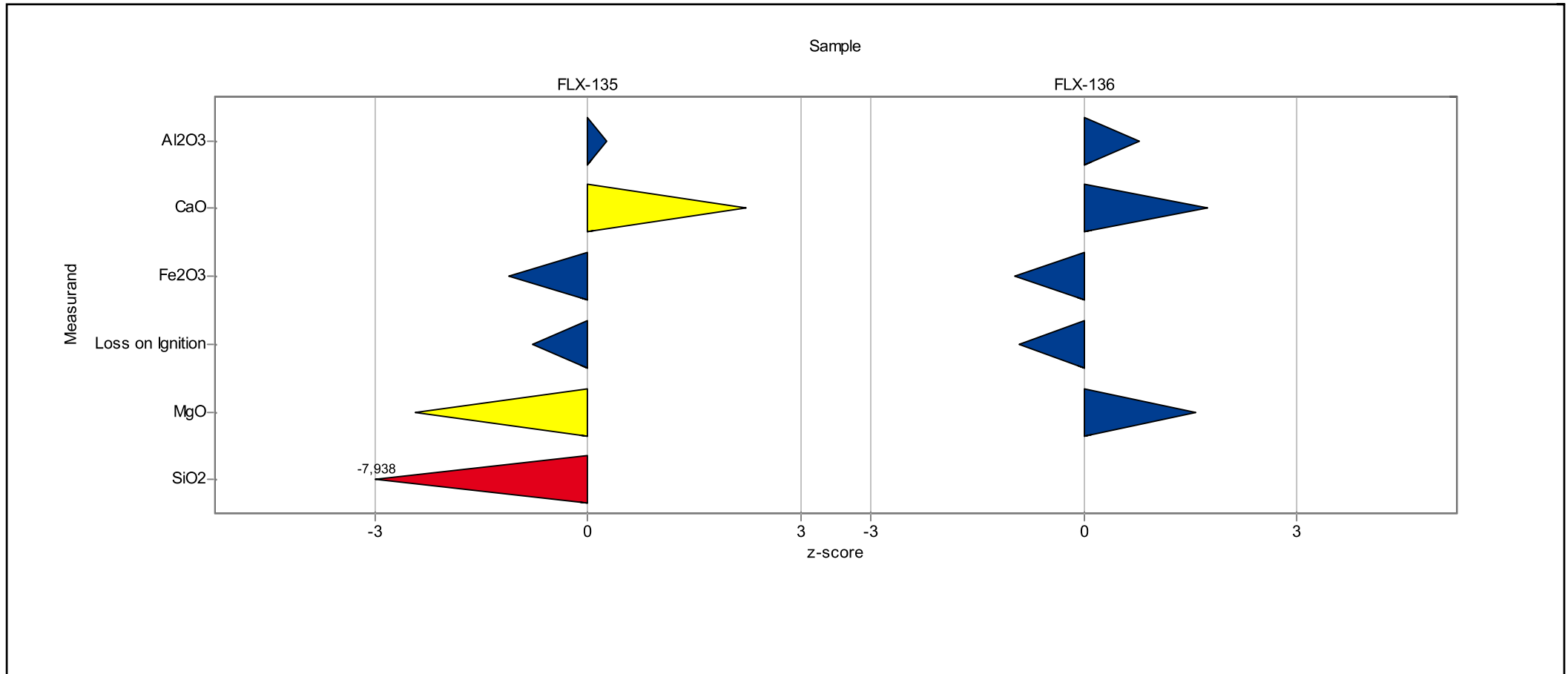
Laboratory: 10



RV_2017_02_Lime

Laboratory chart of z-scores

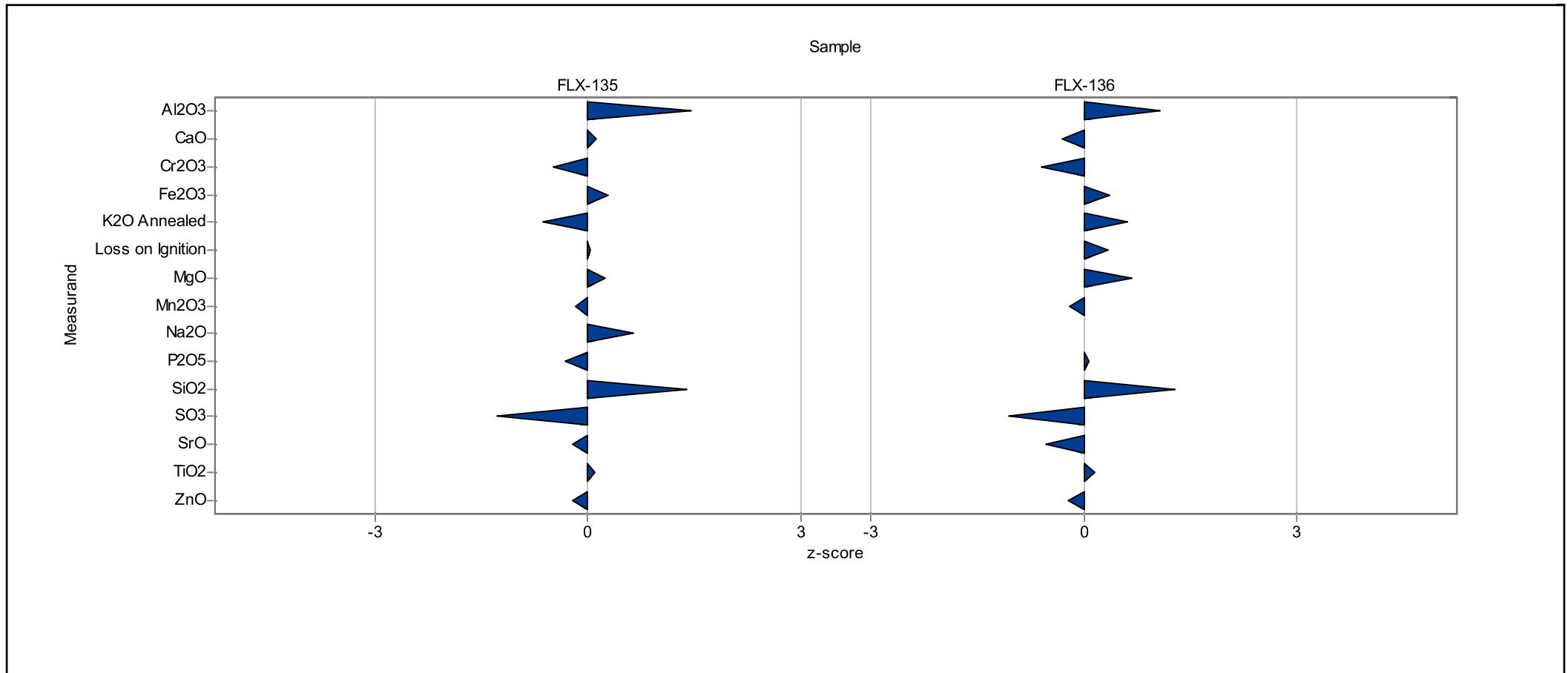
Laboratory: 11



RV_2017_02_Lime

Laboratory chart of z-scores

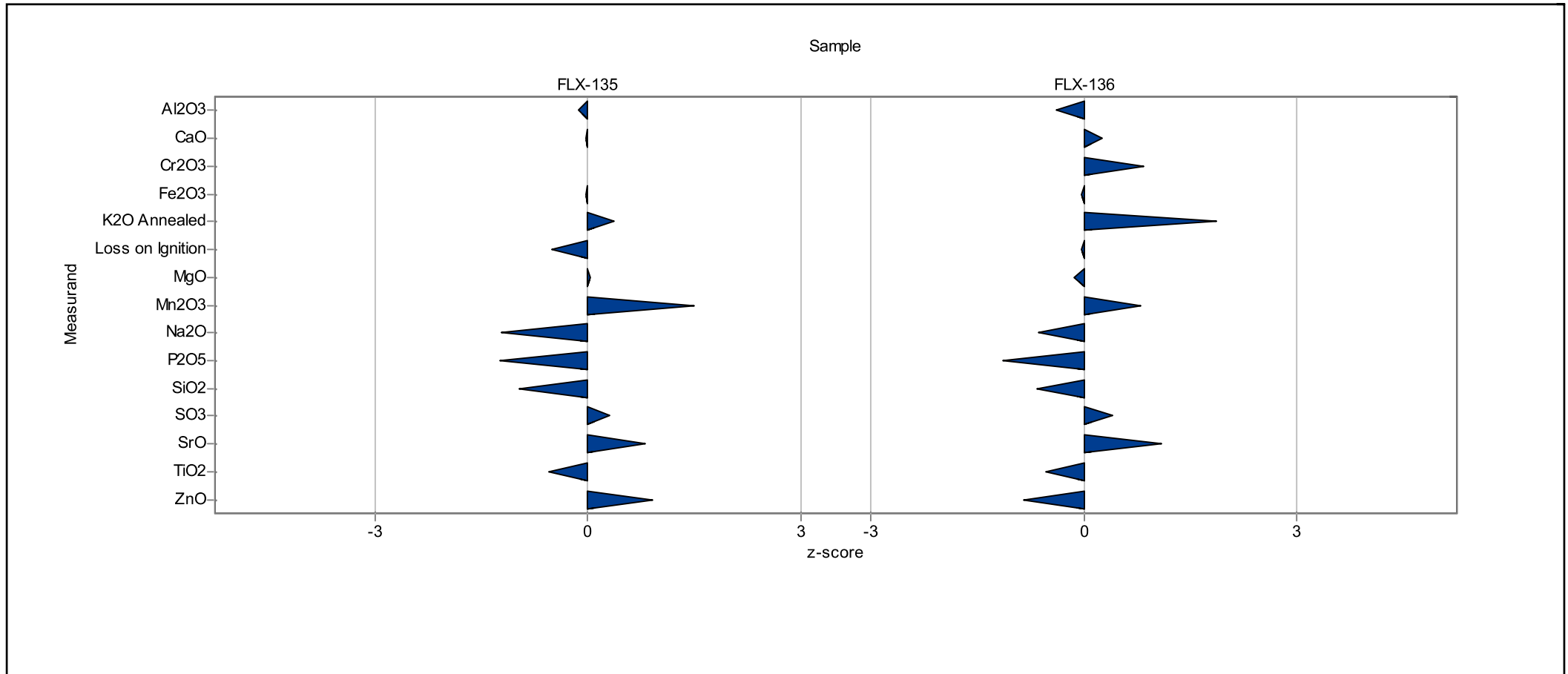
Laboratory: 12



RV_2017_02_Lime

Laboratory chart of z-scores

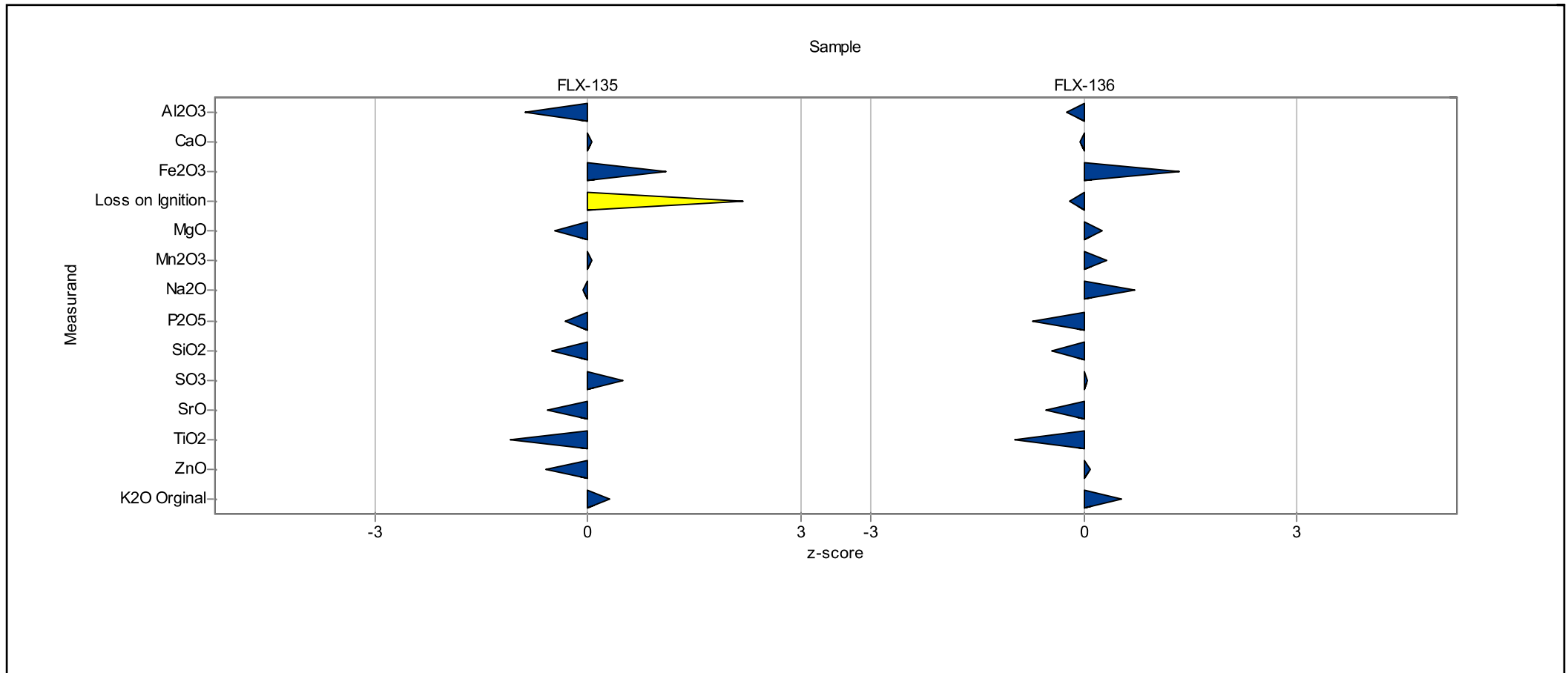
Laboratory: 13



RV_2017_02_Lime

Laboratory chart of z-scores

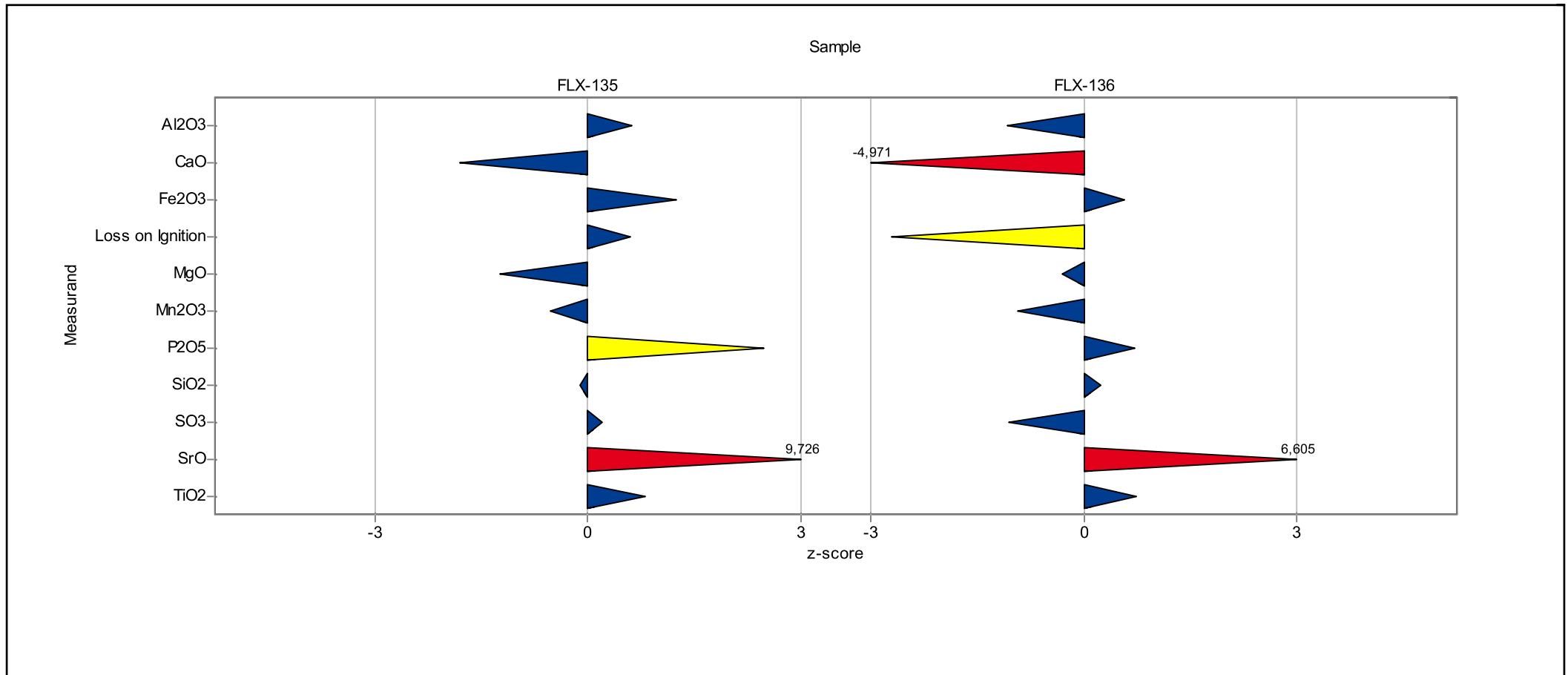
Laboratory: 14



RV_2017_02_Lime

Laboratory chart of z-scores

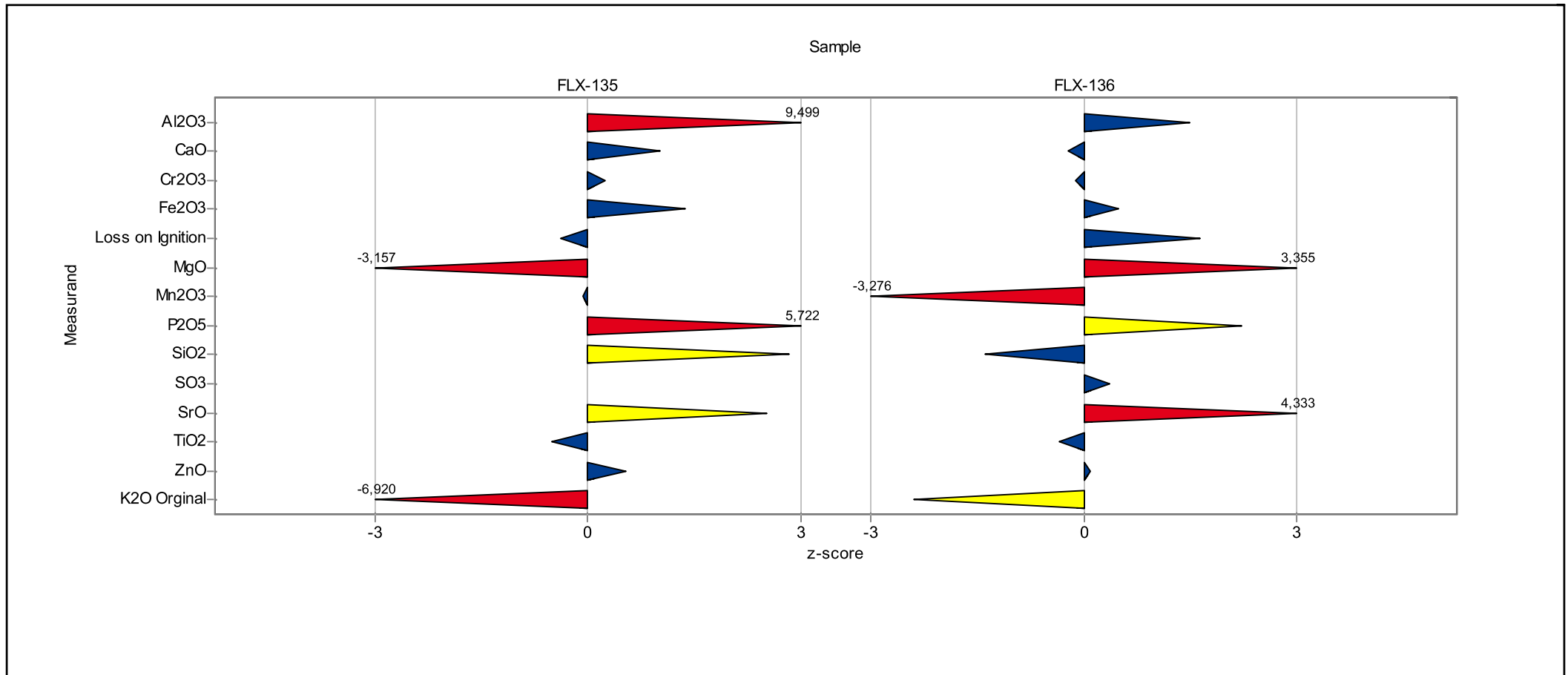
Laboratory: 15



RV_2017_02_Lime

Laboratory chart of z-scores

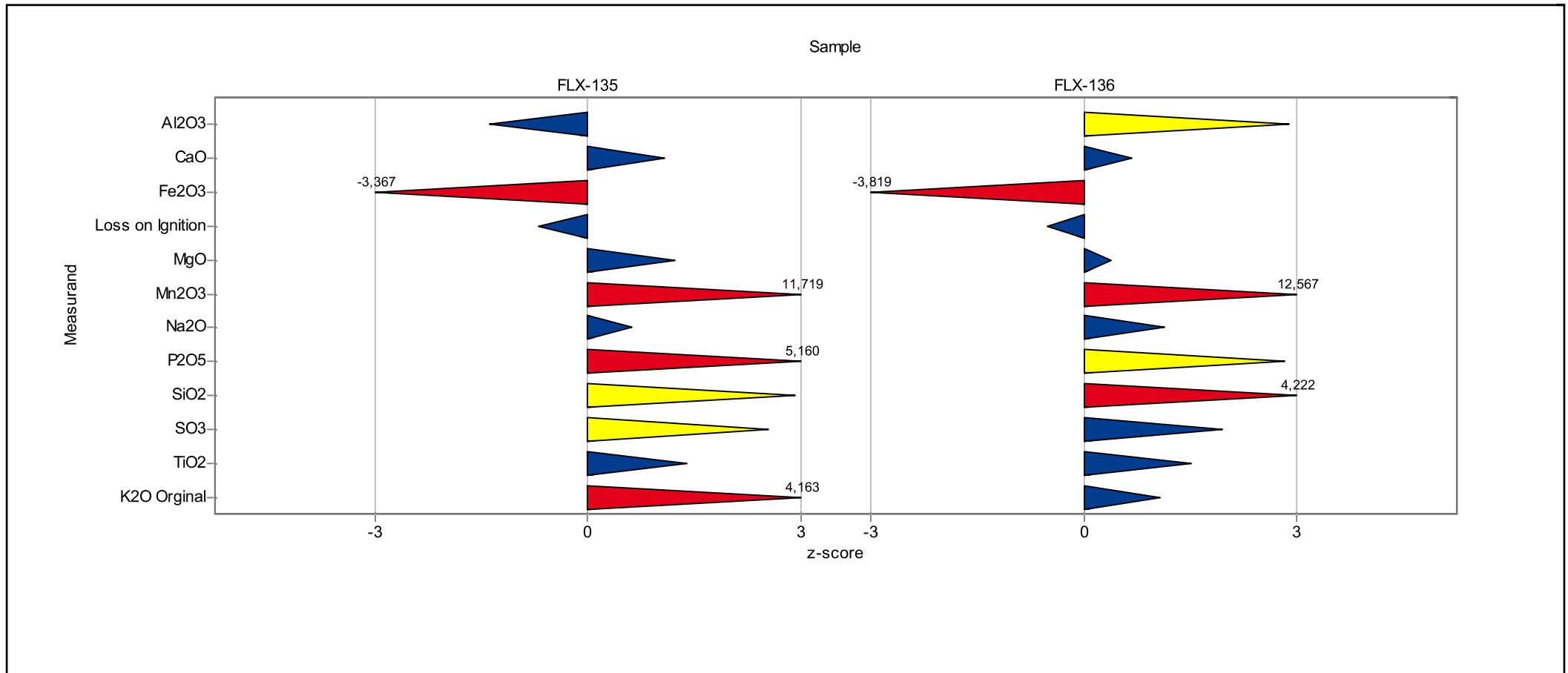
Laboratory: 16



RV_2017_02_Lime

Laboratory chart of z-scores

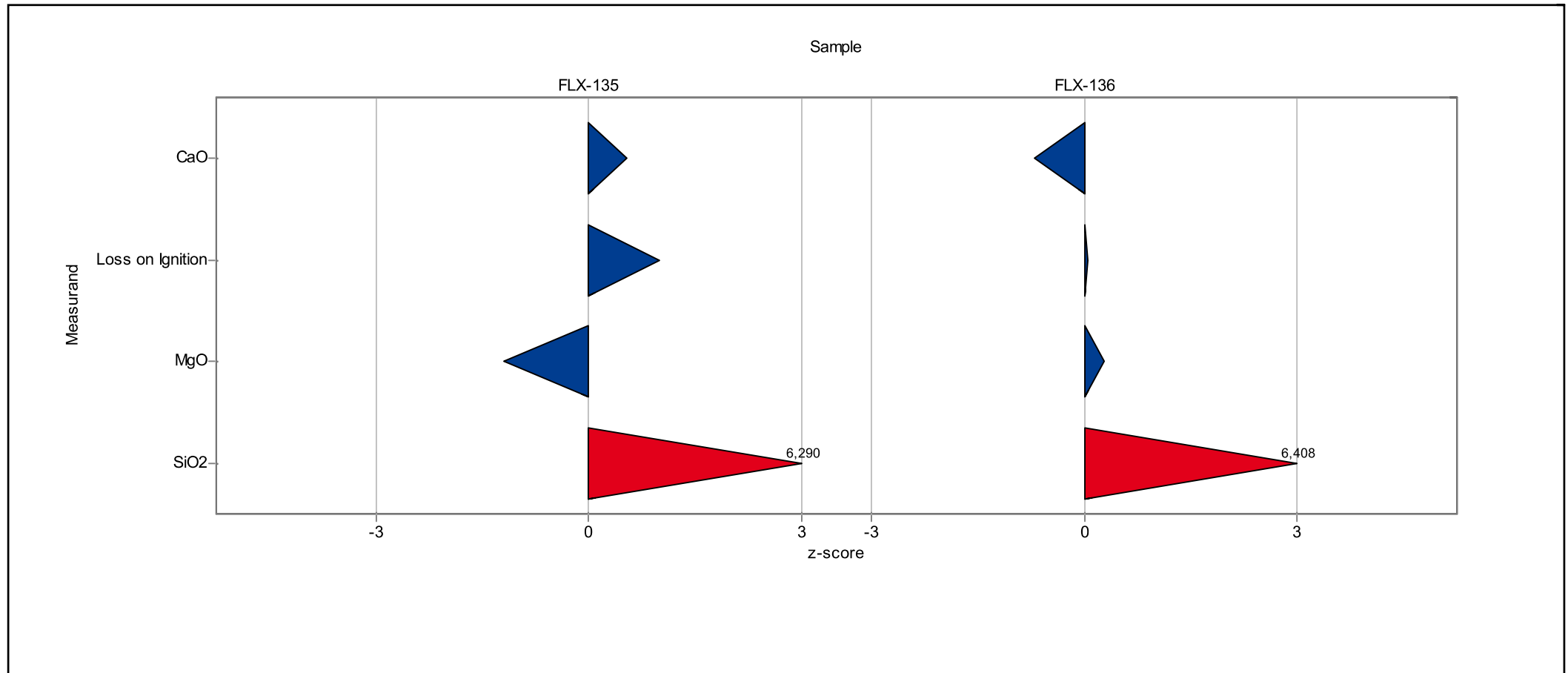
Laboratory: 17



RV_2017_02_Lime

Laboratory chart of z-scores

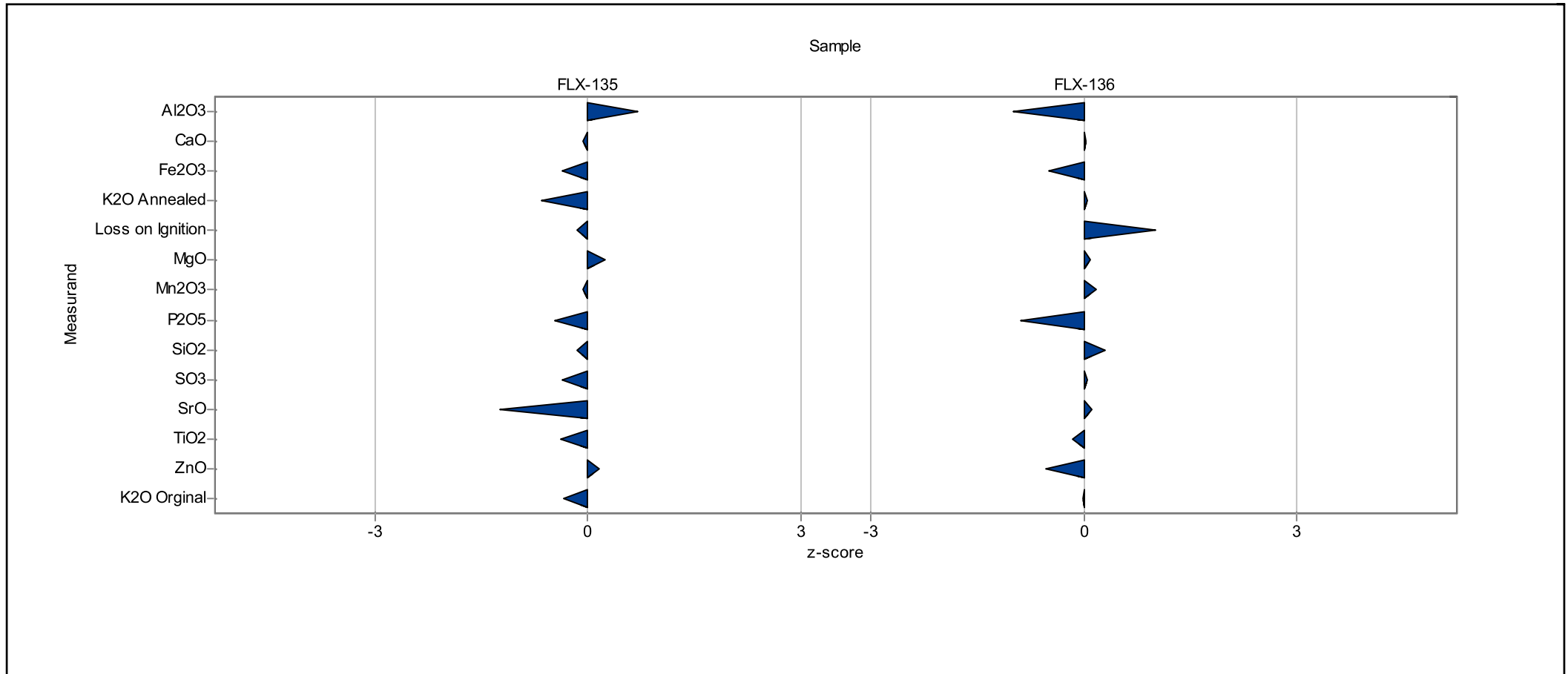
Laboratory: 18



RV_2017_02_Lime

Laboratory chart of z-scores

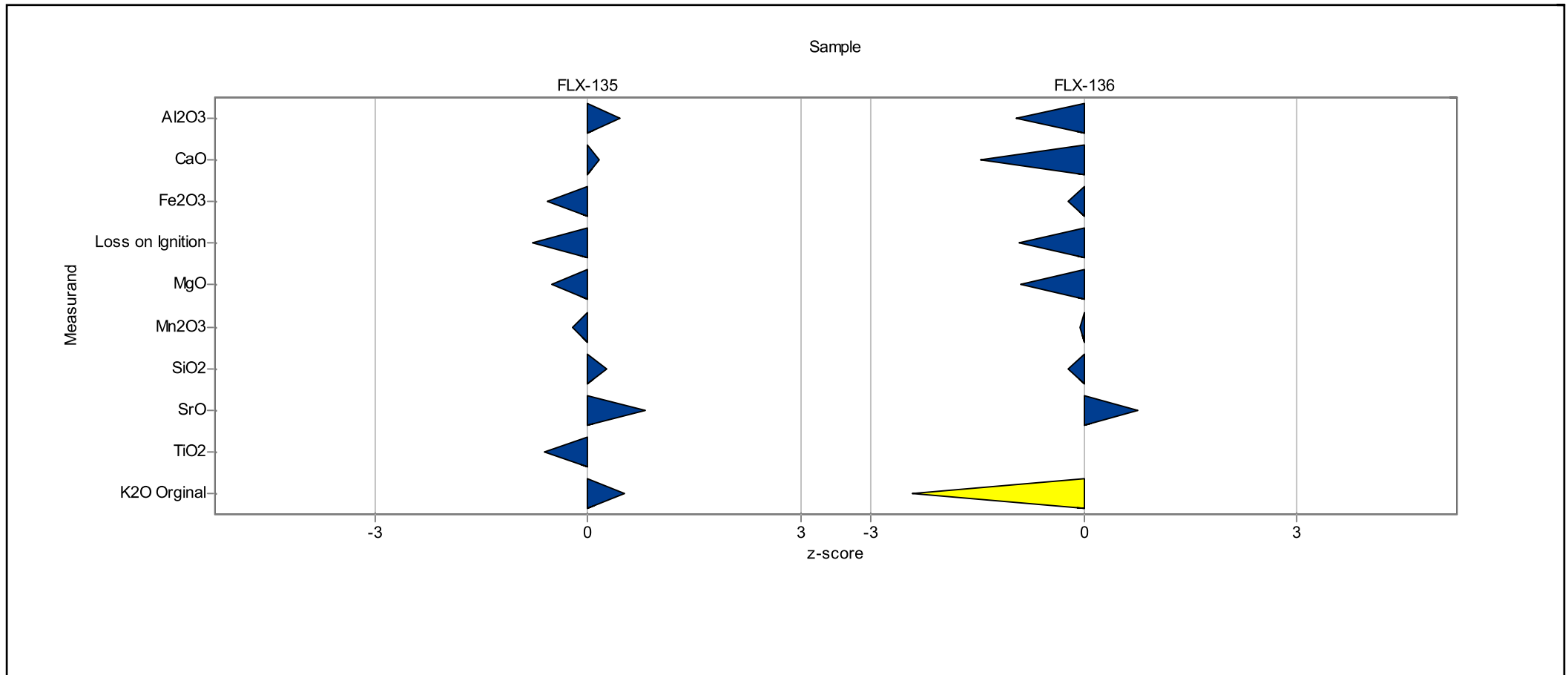
Laboratory: 19



RV_2017_02_Lime

Laboratory chart of z-scores

Laboratory: 20



RV_2017_02_Lime

Laboratory chart of z-scores

Laboratory: 21

