

# FLUXANA®

XRF Application Solutions

RV-2020-01

## Final Proficiency Test Report for Cement

FLX-1001

FLX-1002



Bedburg-Hau, April 16, 2021

**Coordinator of PT**

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**Statistics and Report**

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# FLUXANA®

## XRF Application Solutions

### RV-2020-01

#### FLX-1001

	Al <sub>2</sub> O <sub>3</sub>	BaO	CaO	Cr <sub>2</sub> O <sub>3</sub>	Fe <sub>2</sub> O <sub>3</sub>	K <sub>2</sub> O	LOI	MgO	Mn <sub>2</sub> O <sub>3</sub>
Unit	%	%	%	%	%	%	%	%	%
No. of laboratories	14	7	14	10	14	14	15	14	12
Mean m	8,120	0,052	56,688	0,011	3,083	1,409	5,413	1,470	0,039
Reproducibility standard deviation s <sub>R</sub>	0,129	0,019	0,418	0,005	0,057	0,047	0,100	0,032	0,003
Repeatability standard deviation s <sub>r</sub>	0,025	0,002	0,069	0,002	0,009	0,004	0,023	0,012	0,001
Robust standard deviation s*	0,120	0,019	0,383	0,005	0,057	0,048	0,111	0,033	0,003
Uncertainty U (s*)	0,080	0,018	0,256	0,004	0,038	0,032	0,072	0,022	0,002
Uncertainty U (s <sub>R</sub> )	0,086	0,018	0,279	0,004	0,038	0,031	0,065	0,021	0,002
Mean - 2*s <sub>R</sub>	7,862	0,015	55,852	0,001	2,970	1,315	5,213	1,407	0,033
Mean + 2*s <sub>R</sub>	8,377	0,089	57,523	0,022	3,197	1,503	5,613	1,534	0,045

	Na <sub>2</sub> O	P <sub>2</sub> O <sub>5</sub>	SiO <sub>2</sub>	SO <sub>3</sub>	SrO	TiO <sub>2</sub>	V2O5	ZnO	ZrO2
Unit	%	%	%	%	%	%	%	%	%
No. of laboratories	13	14	14	15	12	13	7	11	6
Mean m	0,295	0,279	24,777	3,058	0,176	0,395	0,012	0,039	0,021
Reproducibility standard deviation s <sub>R</sub>	0,027	0,013	0,163	0,131	0,011	0,011	0,004	0,003	0,006
Repeatability standard deviation s <sub>r</sub>	0,007	0,005	0,064	0,024	0,003	0,003	0,002	0,001	0,001
Robust standard deviation s*	0,030	0,013	0,175	0,158	0,010	0,009	0,005	0,003	0,007
Uncertainty U (s*)	0,021	0,009	0,117	0,102	0,007	0,006	0,005	0,002	0,007
Uncertainty U (s <sub>R</sub> )	0,019	0,009	0,109	0,085	0,008	0,008	0,004	0,002	0,006
Mean - 2*s <sub>R</sub>	0,241	0,253	24,451	2,796	0,155	0,374	0,003	0,033	0,008
Mean + 2*s <sub>R</sub>	0,350	0,306	25,104	3,321	0,198	0,416	0,020	0,044	0,033

All values are in mass % and are based on annealed sample material.

*Italic values: Info only (required amount of submissions was not reached)*

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

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#### FLX-1002

	Al <sub>2</sub> O <sub>3</sub>	CaO	Cl	Cr <sub>2</sub> O <sub>3</sub>	Fe <sub>2</sub> O <sub>3</sub>	K <sub>2</sub> O	LOI	MgO
Unit	%	%	%	%	%	%	%	%
No. of laboratories	14	14	5	10	14	14	15	14
Mean m	5,981	62,078	0,073	0,008	2,042	0,777	3,870	1,694
Reproducibility standard deviation s <sub>R</sub>	0,071	0,299	0,016	0,004	0,036	0,055	0,087	0,039
Repeatability standard deviation s <sub>r</sub>	0,016	0,064	0,001	0,001	0,004	0,007	0,021	0,016
Robust standard deviation s*	0,074	0,254	0,016	0,004	0,036	0,041	0,087	0,043
Uncertainty U (s*)	0,050	0,170	0,017	0,003	0,024	0,028	0,056	0,029
Uncertainty U (s <sub>R</sub> )	0,047	0,200	0,018	0,003	0,024	0,037	0,056	0,026
Mean - 2*s <sub>R</sub>	5,839	61,480	0,042	0,000	1,969	0,667	3,695	1,615
Mean + 2*s <sub>R</sub>	6,123	62,676	0,104	0,015	2,114	0,886	4,044	1,773

	Mn <sub>2</sub> O <sub>3</sub>	Na <sub>2</sub> O	P <sub>2</sub> O <sub>5</sub>	SiO <sub>2</sub>	SO <sub>3</sub>	SrO	TiO <sub>2</sub>	ZnO
Unit	%	%	%	%	%	%	%	%
No. of laboratories	12	13	14	14	15	11	13	11
Mean m	0,123	0,167	0,137	22,547	3,779	0,213	0,357	0,015
Reproducibility standard deviation s <sub>R</sub>	0,007	0,028	0,008	0,165	0,151	0,009	0,010	0,003
Repeatability standard deviation s <sub>r</sub>	0,001	0,004	0,003	0,037	0,033	0,003	0,004	0,001
Robust standard deviation s*	0,007	0,027	0,009	0,200	0,158	0,008	0,011	0,003
Uncertainty U (s*)	0,005	0,018	0,006	0,134	0,102	0,006	0,007	0,002
Uncertainty U (s <sub>R</sub> )	0,005	0,019	0,005	0,110	0,097	0,007	0,007	0,002
Mean - 2*s <sub>R</sub>	0,109	0,111	0,120	22,217	3,477	0,195	0,337	0,009
Mean + 2*s <sub>R</sub>	0,137	0,223	0,154	22,878	4,081	0,230	0,377	0,021

All values are in mass % and are based on annealed sample material.

*Italic values: Info only (required amount of submissions was not reached)*

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



## RV-2020-01

### Introduction

FLUXANA GmbH & Co. KG is a company providing services in the field of X-ray fluorescence analysis (XRF).

In 2011, FLUXANA introduced its own quality management.

In 2020 the accreditation of the FLUXANA Laboratory in Bedburg-Hau, Germany, was updated to DIN EN ISO/IEC 17025:2018 and FLUXANA received accreditation as Producer of Reference materials according to DIN EN ISO 17034:2017, as well.

The performance of proficiency tests is not yet accredited. However, the proficiency tests are conducted following the corresponding norms.

### 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 than the classical approach (which is outlier detection plus arithmetic mean and classical s.d. formula). Outliers shown in the evaluation are only based on z-scores and marked with yellow or red colours.

### Further Information

All laboratory data is 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.

## Participants

X-ray Mineral Services Ltd	United Kingdom
BMI Technical Center	Germany
Chemische Fabrik Budenheim KG	Germany
CRH Lab SP z o o	Poland
Dyckerhoff GmbH	Germany
FLUXANA GmbH & Co.KG	Germany
Holcim (Schweiz) AG, Zentral-Labor	Switzerland
Korea Atomic Energy Research Institute	Republic of Korea
Lafarge Cement S.A.	Poland
MPA Universität Stuttgart	Germany
RWTH-IME Metallurgische Prozesstechnik und Metallrecycl	Germany
Sharrcem Sh. P. K. - Titan Group	Kosovo
Thyssen Krupp	Germany
VBE Verein für Baustoffprüfung und -entwicklung	Austria

## Statistical Evaluation used for this PT

### Calculation of Mean $\bar{m}$

The mean  $\bar{m}$  for all laboratories is calculated using the Hampel estimator (ISO/TS 20612:2007 9.2.3) based on the laboratory means  $\mu$  using traceable methods only.

### Calculation of reproducibility standard deviation $s_R$

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

### Calculation of repeatability standard deviation $s_r$

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

### Calculation of robust standard deviation $s^*$

The robust standard deviation  $s^*$  is calculated from the laboratory means  $\mu$  using the Q-method.

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#### 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) and the number of participating laboratories  $p$ :

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

#### Calculation of uncertainty $U_{s^*}$ (according to ISO 13528:2020)

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)) and the number of participating laboratories  $p$ :

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

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.

#### Laboratory performance

Laboratory proficiency assessment is based on z-scores.

The **z-score**  $z$  is calculated from all laboratory means  $\mu$ :

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

$m$	Mean value for all laboratories (assigned value)
$\mu$	Mean value of individual laboratory
$S_R$	Reproducibility standard deviation

#### Assessment on z-scores:

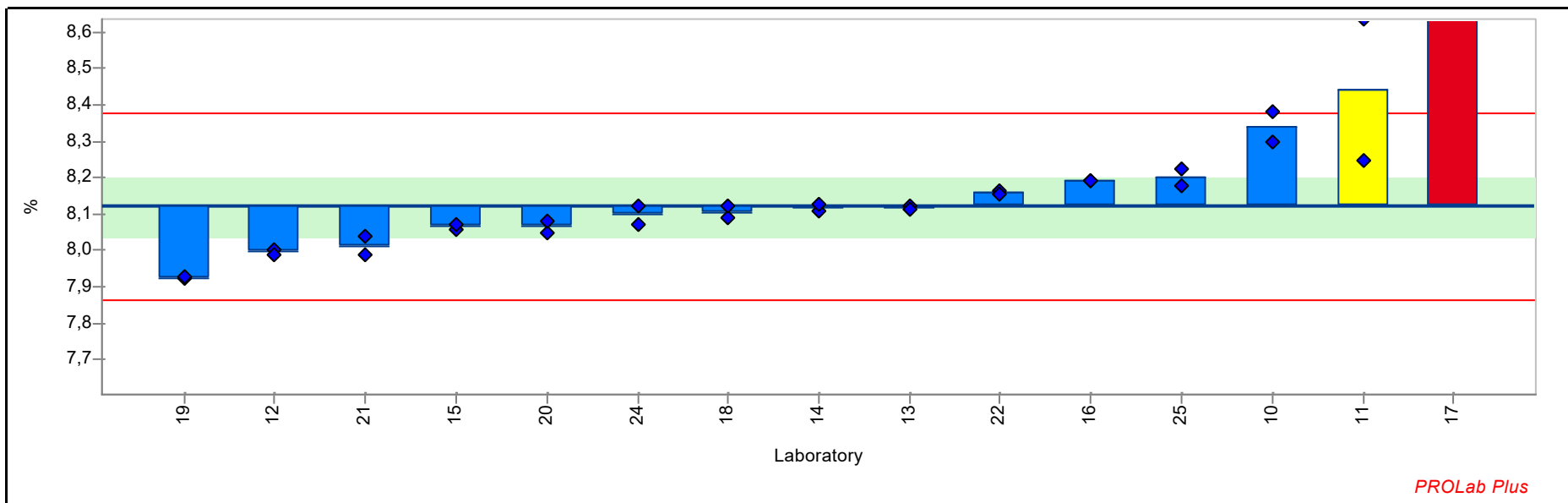
$ z  \leq 2.0$	indicates "satisfactory" performance = generates no signal
$2.0 <  z  < 3.0$	indicates "questionable" performance = generates a warning signal
$ z  \geq 3.0$	indicates "unsatisfactory" performance = generates an action signal

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

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**Summary results**

**Sample:** FLX-1001 **Reproducibility s.d.:** 0,129 %  
**Measurand:** Al<sub>2</sub>O<sub>3</sub> **Repeatability s.d.:** 0,025 %  
**Mean ± U(Mean):** 8,120 ± 0,080 % **Range of tolerance:** 7,862 - 8,377 % (|z-score| ≤ 2,000)  
**No. of laboratories:** 14 **Statistical method:** Q/Hampel



Lab code	Lab mean	s.d.	z-score	Conc. 1	Conc. 2	Accreditation	Analytical method	Comment
10	8,341	0,059	1,717	8,383	8,299	ISO 17025	XRF (fusion)	ISO 29581-2 2010
11	8,441	0,272	2,490	8,633	8,248		XRF (fusion)	ISO 29581-2 2010
12	7,995	0,008	-0,966	8,001	7,990		XRF (fusion)	ISO DIN 51001 2003
13	8,119	0,006	-0,007	8,123	8,115	ISO 17025	XRF (fusion)	
14	8,117	0,013	-0,023	8,108	8,126	ISO 17025	XRF (fusion)	ISO 29581-2 2010
15	8,064	0,008	-0,430	8,059	8,070	ISO 17025	XRF (fusion)	

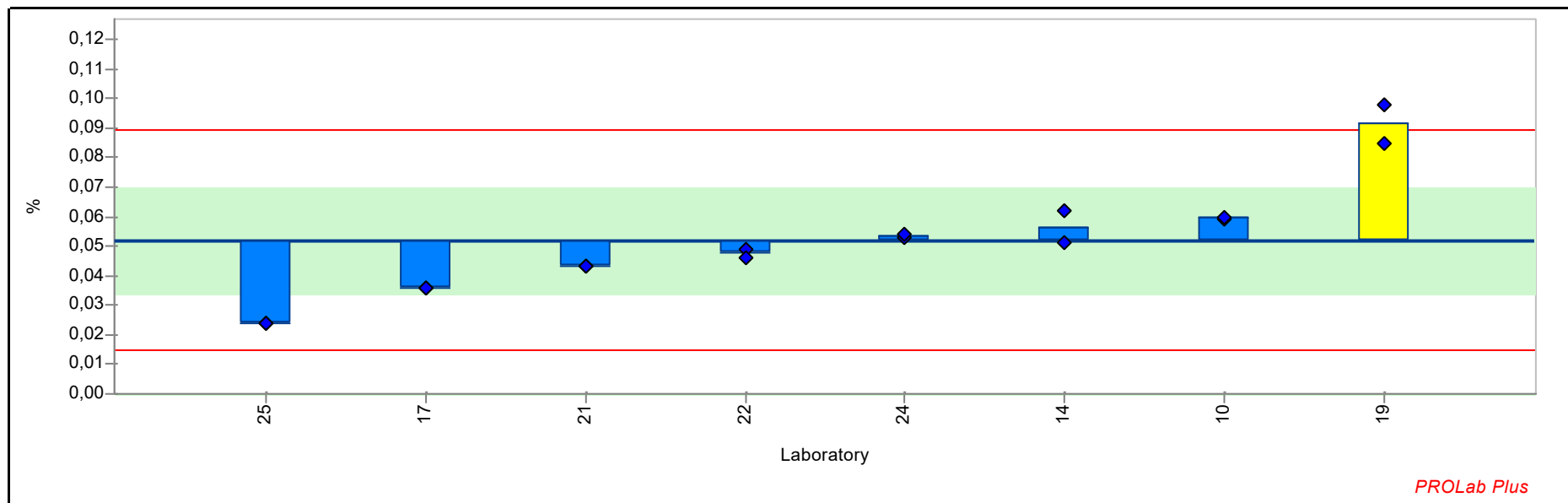
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Lab code	Lab mean	s.d.	z-score	Conc. 1	Conc. 2	Accreditation	Analytical method	Comment
16	8,190	0,000	0,544	8,190	8,190		XRF (fusion)	
17	8,684	0,001	4,382	8,683	8,685		XRF (pressed pellet) - information only	DIN EN 196-2
18	8,105	0,021	-0,116	8,090	8,120		XRF (fusion)	ISO 29581-2 2010
19	7,924	0,003	-1,522	7,922	7,926		XRF (fusion)	
20	8,065	0,021	-0,427	8,050	8,080		XRF (fusion)	DIN EN 196-2
21	8,014	0,033	-0,827	8,037	7,990	ISO 17025	Other Method	ASTM C1301
22	8,159	0,004	0,304	8,162	8,156		XRF (fusion)	ISO 29581-2 2010
24	8,097	0,038	-0,178	8,124	8,070		XRF (fusion)	ISO 29581-2 2010
25	8,200	0,035	0,626	8,225	8,176	ISO 17025	XRF (fusion)	ISO DIN 51001 2003



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**Sample:** FLX-1001 **Reproducibility s.d.:** 0,019 %  
**Measurand:** BaO (information only) **Repeatability s.d.:** 0,002 %  
**Mean ± U(Mean):** 0,052 ± 0,018 % **Range of tolerance:** 0,015 - 0,089 % (|z-score| ≤ 2,000)  
**No. of laboratories:** 7 **Statistical method:** Q/Hampel

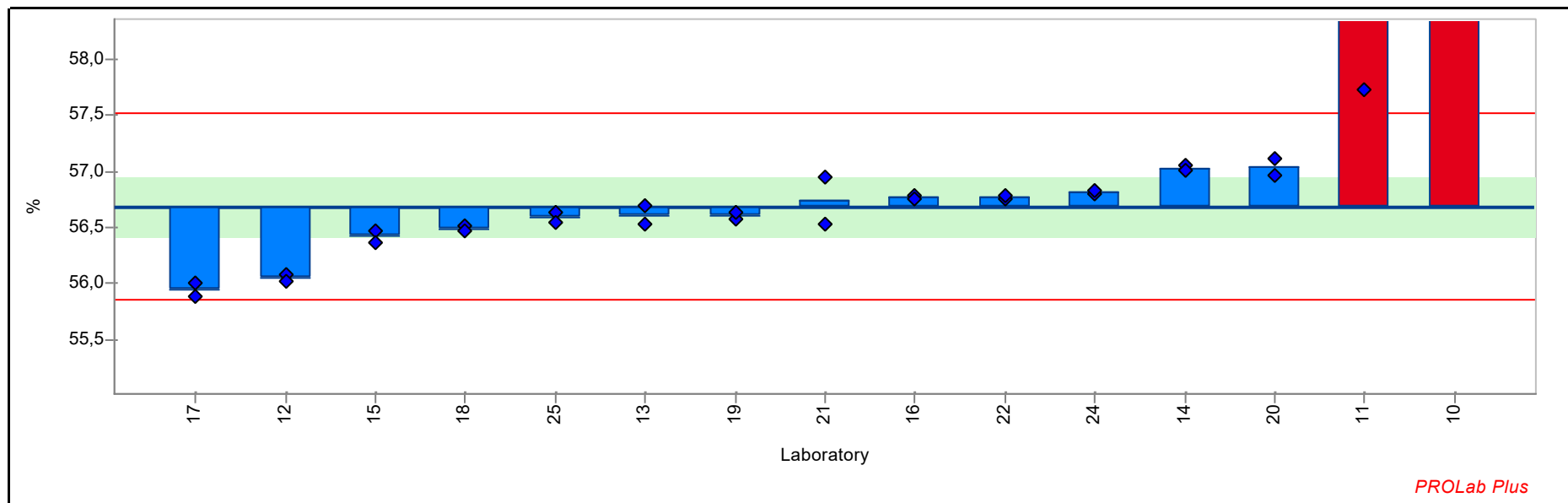


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Lab code	Lab mean	s.d.	z-score	Conc. 1	Conc. 2	Accreditation	Analytical method	Comment
10	0,059	0,001	0,400	0,059	0,060		XRF (fusion)	ISO 29581-2 2010
14	0,056	0,008	0,240	0,062	0,051	ISO 17025	XRF (fusion)	ISO DIN 51001 2003
17	0,036	0,000	-0,856	0,036	0,036		XRF (pressed pellet) - information only	DIN EN 196-2
19	0,091	0,009	2,111	0,098	0,085		XRF (fusion)	
21	0,043	0,000	-0,482	0,043	0,043		Other Method	
22	0,048	0,002	-0,241	0,049	0,046		XRF (fusion)	ISO DIN 51001 2003
24	0,053	0,001	0,080	0,053	0,054		XRF (fusion)	ISO DIN 51001 2003
25	0,024	0,000	-1,497	0,024	0,024	ISO 17025	XRF (fusion)	ISO DIN 51001 2003

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**Sample:** FLX-1001 **Reproducibility s.d.:** 0,418 %  
**Measurand:** CaO **Repeatability s.d.:** 0,069 %  
**Mean ± U(Mean):** 56,688 ± 0,256 % **Range of tolerance:** 55,852 - 57,523 % (|z-score| ≤ 2,000)  
**No. of laboratories:** 14 **Statistical method:** Q/Hampel



Lab code	Lab mean	s.d.	z-score	Conc. 1	Conc. 2	Accreditation	Analytical method	Comment
10	58,424	0,048	4,158	58,458	58,390	ISO 17025	XRF (fusion)	ISO 29581-2 2010
11	58,408	0,962	4,120	59,088	57,728		XRF (fusion)	ISO 29581-2 2010
12	56,046	0,043	-1,535	56,077	56,016		XRF (fusion)	ISO DIN 51001 2003
13	56,608	0,116	-0,191	56,526	56,690	ISO 17025	XRF (fusion)	
14	57,029	0,036	0,816	57,054	57,003	ISO 17025	XRF (fusion)	ISO 29581-2 2010
15	56,419	0,071	-0,642	56,470	56,369	ISO 17025	XRF (fusion)	
16	56,772	0,018	0,203	56,785	56,760		XRF (fusion)	
17	55,945	0,081	-1,779	55,887	56,002		XRF (pressed pellet) - information only	DIN EN 196-2

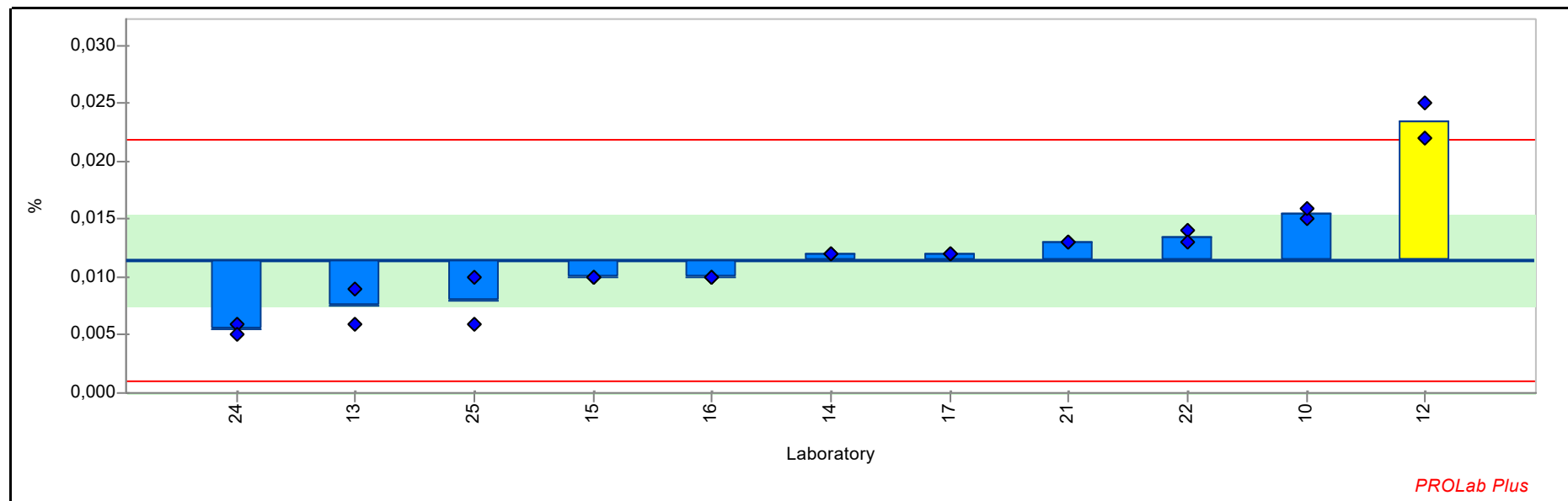
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Lab code	Lab mean	s.d.	z-score	Conc. 1	Conc. 2	Accreditation	Analytical method	Comment
18	56,490	0,028	-0,473	56,510	56,470		XRF (fusion)	ISO 29581-2 2010
19	56,609	0,045	-0,188	56,577	56,641		XRF (fusion)	
20	57,040	0,113	0,844	56,960	57,120		XRF (fusion)	DIN EN 196-2
21	56,745	0,298	0,137	56,956	56,534	ISO 17025	Other Method	ASTM C1301
22	56,772	0,018	0,203	56,760	56,785		XRF (fusion)	ISO 29581-2 2010
24	56,813	0,025	0,300	56,795	56,831		XRF (fusion)	ISO 29581-2 2010
25	56,591	0,073	-0,233	56,642	56,539	ISO 17025	XRF (fusion)	ISO DIN 51001 2003

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**Sample:** FLX-1001 **Reproducibility s.d.:** 0,005 %  
**Measurand:** Cr2O3 **Repeatability s.d.:** 0,002 %  
**Mean ± U(Mean):** 0,011 ± 0,004 % **Range of tolerance:** 0,001 - 0,022 % (|z-score| ≤ 2,000)  
**No. of laboratories:** 10 **Statistical method:** Q/Hampel



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Lab code	Lab mean	s.d.	z-score	Conc. 1	Conc. 2	Accreditation	Analytical method	Comment
10	0,015	0,001	0,780	0,015	0,016	ISO 17025	XRF (fusion)	ISO 29581-2 2010
12	0,024	0,002	2,312	0,022	0,025	ISO 17025	XRF (fusion)	ISO DIN 51001 2003
13	0,007	0,002	-0,752	0,006	0,009	ISO 17025	XRF (fusion)	
14	0,012	0,000	0,110	0,012	0,012	ISO 17025	XRF (fusion)	ISO 29581-2 2010
15	0,010	0,000	-0,273	0,010	0,010	ISO 17025	XRF (fusion)	
16	0,010	0,000	-0,273	0,010	0,010		XRF (fusion)	
17	0,012	0,000	0,110	0,012	0,012		XRF (pressed pellet) - information only	DIN EN 196-2
21	0,013	0,000	0,301	0,013	0,013		Other Method	

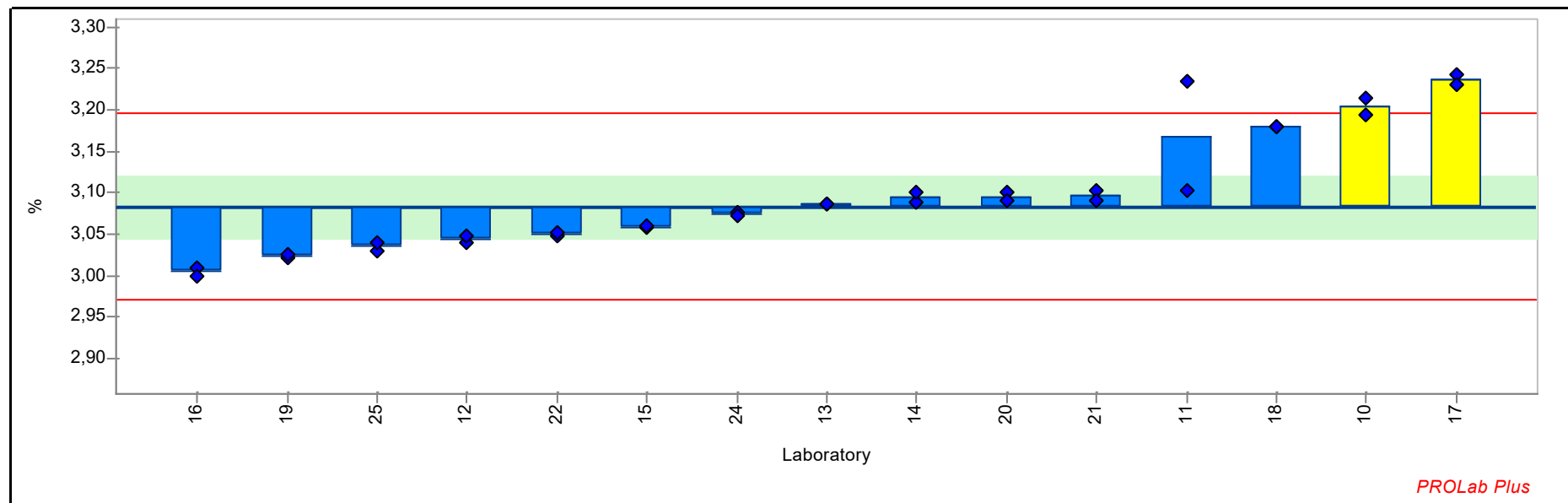
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Lab code	Lab mean	s.d.	z-score	Conc. 1	Conc. 2	Accreditation	Analytical method	Comment
22	0,013	0,001	0,397	0,014	0,013		XRF (fusion)	ISO 29581-2 2010
24	0,005	0,001	-1,135	0,006	0,005		XRF (fusion)	ISO 29581-2 2011
25	0,008	0,003	-0,656	0,010	0,006	ISO 17025	XRF (fusion)	ISO DIN 51001 2003

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**Sample:** FLX-1001 **Reproducibility s.d.:** 0,057 %  
**Measurand:** Fe2O3 **Repeatability s.d.:** 0,009 %  
**Mean ± U(Mean):** 3,083 ± 0,038 % **Range of tolerance:** 2,970 - 3,197 % (|z-score| ≤ 2,000)  
**No. of laboratories:** 14 **Statistical method:** Q/Hampel



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Lab code	Lab mean	s.d.	z-score	Conc. 1	Conc. 2	Accreditation	Analytical method	Comment
10	3,204	0,013	2,141	3,214	3,195	ISO 17025	XRF (fusion)	ISO 29581-2 2010
11	3,168	0,094	1,505	3,235	3,102		XRF (fusion)	ISO 29581-2 2010
12	3,043	0,006	-0,703	3,039	3,048		XRF (fusion)	ISO DIN 51001 2003
13	3,087	0,001	0,057	3,087	3,086	ISO 17025	XRF (fusion)	
14	3,094	0,008	0,189	3,088	3,100	ISO 17025	XRF (fusion)	ISO 29581-2 2010
15	3,058	0,001	-0,447	3,057	3,059	ISO 17025	XRF (fusion)	
16	3,005	0,007	-1,383	3,010	3,000		XRF (fusion)	
17	3,236	0,009	2,706	3,243	3,230		XRF (pressed pellet) - information only	DIN EN 196-2

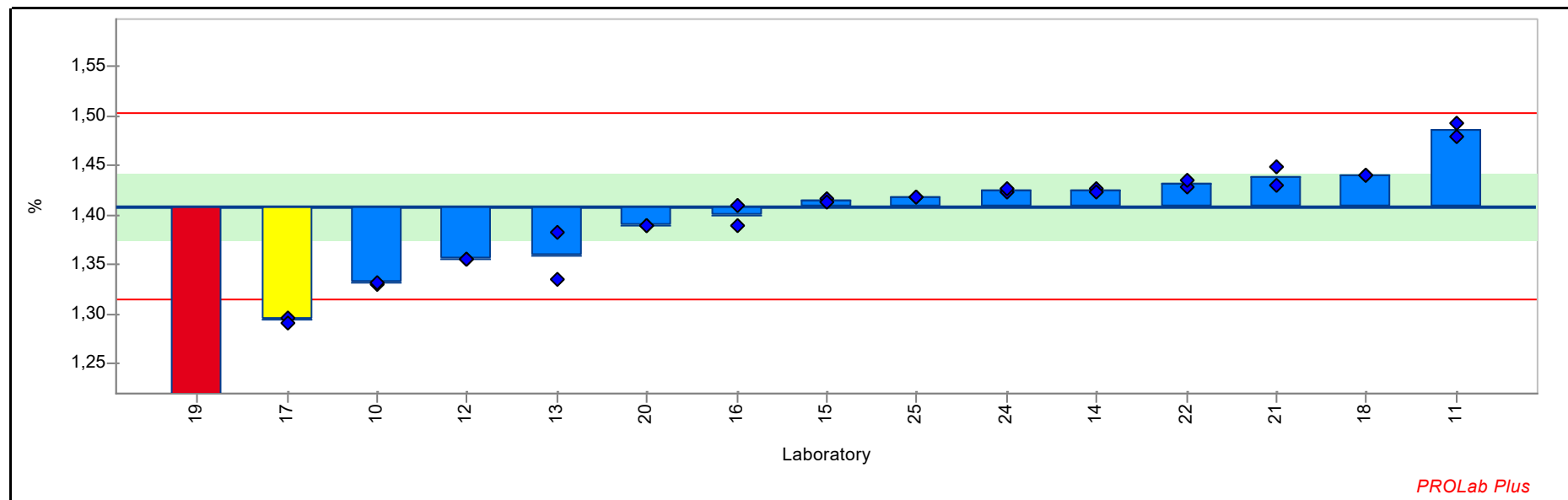
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Lab code	Lab mean	s.d.	z-score	Conc. 1	Conc. 2	Accreditation	Analytical method	Comment
18	3,180	0,000	1,708	3,180	3,180		XRF (fusion)	ISO 29581-2 2010
19	3,023	0,002	-1,056	3,022	3,025		XRF (fusion)	
20	3,095	0,007	0,207	3,100	3,090		XRF (fusion)	DIN EN 196-2
21	3,096	0,009	0,233	3,103	3,090	ISO 17025	Other Method	ASTM C1301
22	3,050	0,002	-0,597	3,048	3,051		XRF (fusion)	ISO 29581-2 2010
24	3,075	0,003	-0,147	3,077	3,073		XRF (fusion)	ISO 29581-2 2012
25	3,035	0,007	-0,853	3,030	3,040	ISO 17025	XRF (fusion)	ISO DIN 51001 2003

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**Sample:** FLX-1001 **Reproducibility s.d.:** 0,047 %  
**Measurand:** K2O **Repeatability s.d.:** 0,004 %  
**Mean ± U(Mean):** 1,409 ± 0,032 % **Range of tolerance:** 1,315 - 1,503 % (|z-score| ≤ 2,000)  
**No. of laboratories:** 14 **Statistical method:** Q/Hampel



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Lab code	Lab mean	s.d.	z-score	Conc. 1	Conc. 2	Accreditation	Analytical method	Comment
10	1,332	0,001	-1,641	1,331	1,332	ISO 17025	XRF (fusion)	ISO 29581-2 2010
11	1,486	0,009	1,641	1,493	1,480		XRF (fusion)	ISO 29581-2 2010
12	1,356	0,001	-1,132	1,355	1,356		XRF (fusion)	ISO DIN 51001 2003
13	1,358	0,033	-1,069	1,382	1,335	ISO 17025	XRF (fusion)	
14	1,425	0,001	0,339	1,426	1,424	ISO 17025	XRF (fusion)	ISO 29581-2 2010
15	1,415	0,001	0,127	1,416	1,414	ISO 17025	XRF (fusion)	
16	1,400	0,014	-0,191	1,390	1,410		XRF (fusion)	
17	1,294	0,004	-2,424	1,297	1,292		XRF (pressed pellet) - information only	DIN EN 196-2

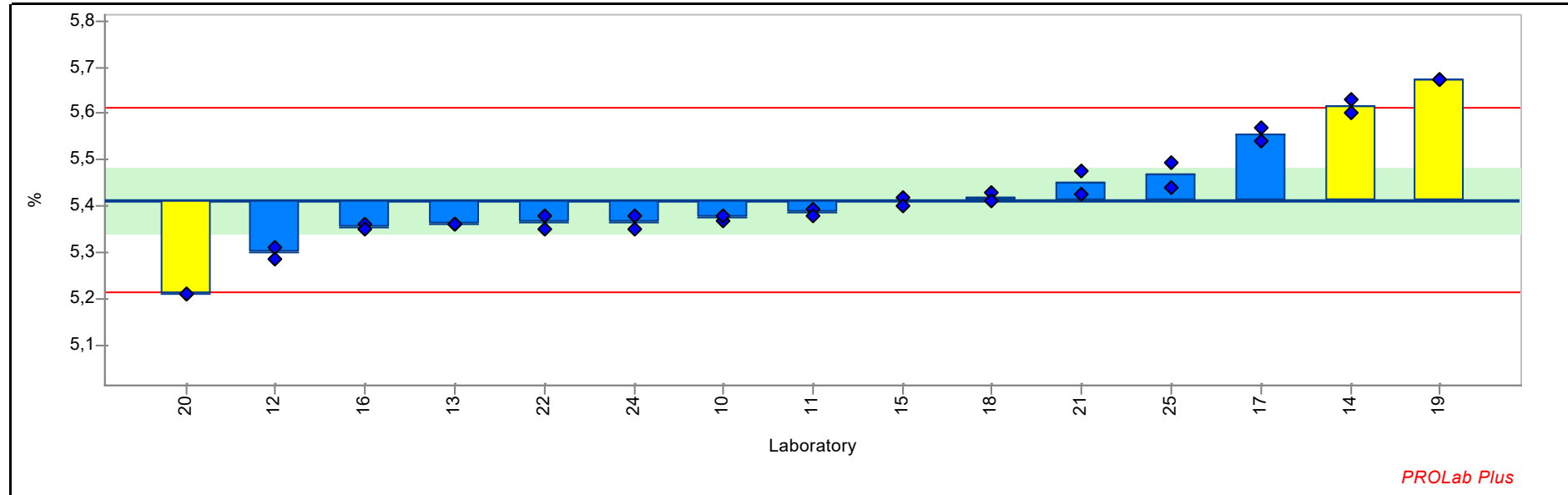


**RV\_2020\_01\_Cement**

Lab code	Lab mean	s.d.	z-score	Conc. 1	Conc. 2	Accreditation	Analytical method	Comment
18	1,440	0,000	0,656	1,440	1,440		XRF (fusion)	ISO 29581-2 2010
19	1,136	0,004	-5,779	1,139	1,133		XRF (fusion)	
20	1,390	0,000	-0,402	1,390	1,390		XRF (fusion)	DIN EN 196-2
21	1,440	0,012	0,646	1,431	1,448	ISO 17025	Other Method	ASTM C1301
22	1,432	0,004	0,487	1,429	1,435		XRF (fusion)	ISO 29581-2 2010
24	1,425	0,002	0,328	1,423	1,426		XRF (fusion)	ISO 29581-2 2013
25	1,419	0,000	0,212	1,419	1,419	ISO 17025	XRF (fusion)	ISO DIN 51001 2003

RV\_2020\_01\_Cement

**Sample:** FLX-1001 **Reproducibility s.d.:** 0,100 %  
**Measurand:** Loss on Ignition **Repeatability s.d.:** 0,023 %  
**Mean ± U(Mean):** 5,413 ± 0,072 % **Range of tolerance:** 5,213 - 5,613 % (|z-score| ≤ 2,000)  
**No. of laboratories:** 15 **Statistical method:** Q/Hampel



PROLab Plus

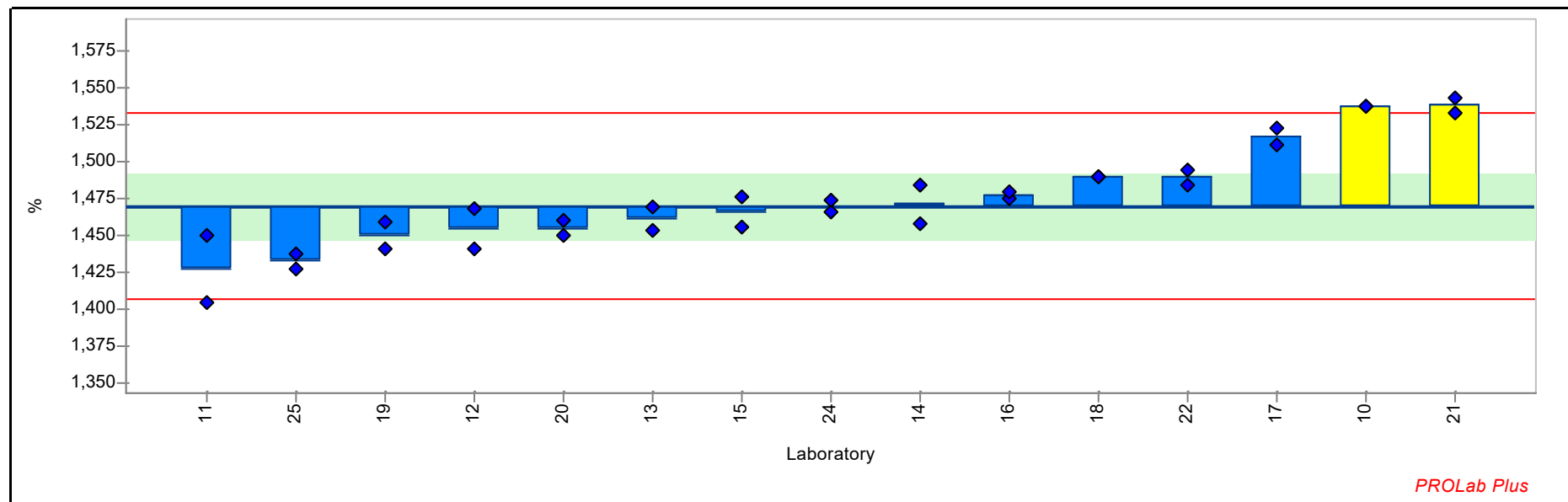
Lab code	Lab mean	s.d.	z-score	Conc. 1	Conc. 2	Accreditation	Analytical method	Comment
10	5,375	0,007	-0,384	5,370	5,380	ISO 17025	Other Method	LOI @ 950°C
11	5,386	0,009	-0,269	5,393	5,380		Other Method	LOI @ 950°C
12	5,299	0,018	-1,144	5,312	5,286		Other Method	LOI @ 950°C
13	5,361	0,001	-0,524	5,360	5,362	ISO 17025	Other Method	LOI @ 950°C
14	5,615	0,021	2,016	5,600	5,630	ISO 17025	Other Method	LOI @ 950°C
15	5,410	0,014	-0,034	5,420	5,400	ISO 17025	Other Method	LOI @ 950°C
16	5,356	0,008	-0,574	5,362	5,350		Other Method	LOI @ 950°C
17	5,555	0,021	1,416	5,540	5,570		Other Method	LOI @ 950°C

**RV\_2020\_01\_Cement**

Lab code	Lab mean	s.d.	z-score	Conc. 1	Conc. 2	Accreditation	Analytical method	Comment
18	5,420	0,014	0,066	5,430	5,410		Other Method	LOI @ 950°C
19	5,674	0,000	2,606	5,674	5,674		Other Method	LOI @ 950°C
20	5,210	0,000	-2,034	5,210	5,210		Other Method	LOI @ 950°C
21	5,450	0,036	0,371	5,476	5,425	ISO 17025	Other Method	LOI @ 950°C
22	5,365	0,021	-0,484	5,350	5,380		Other Method	LOI @ 950°C
24	5,365	0,021	-0,484	5,350	5,380		Other Method	LOI @ 950°C
25	5,468	0,038	0,546	5,495	5,441	ISO 17025	Other Method	LOI @ 950°C

RV\_2020\_01\_Cement

**Sample:** FLX-1001 **Reproducibility s.d.:** 0,032 %  
**Measurand:** MgO **Repeatability s.d.:** 0,012 %  
**Mean ± U(Mean):** 1,470 ± 0,022 % **Range of tolerance:** 1,407 - 1,534 % (|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
10	1,538	0,000	2,138	1,538	1,538	ISO 17025	XRF (fusion)	ISO 29581-2 2010
11	1,427	0,032	-1,347	1,450	1,405		XRF (fusion)	ISO 29581-2 2010
12	1,454	0,019	-0,496	1,468	1,441		XRF (fusion)	ISO DIN 51001 2003
13	1,462	0,011	-0,259	1,470	1,454	ISO 17025	XRF (fusion)	
14	1,472	0,019	0,040	1,485	1,458	ISO 17025	XRF (fusion)	ISO 29581-2 2010
15	1,466	0,015	-0,117	1,477	1,456	ISO 17025	XRF (fusion)	
16	1,478	0,004	0,230	1,475	1,480		XRF (fusion)	
17	1,518	0,008	1,491	1,523	1,512		XRF (pressed pellet) - information only	DIN EN 196-2

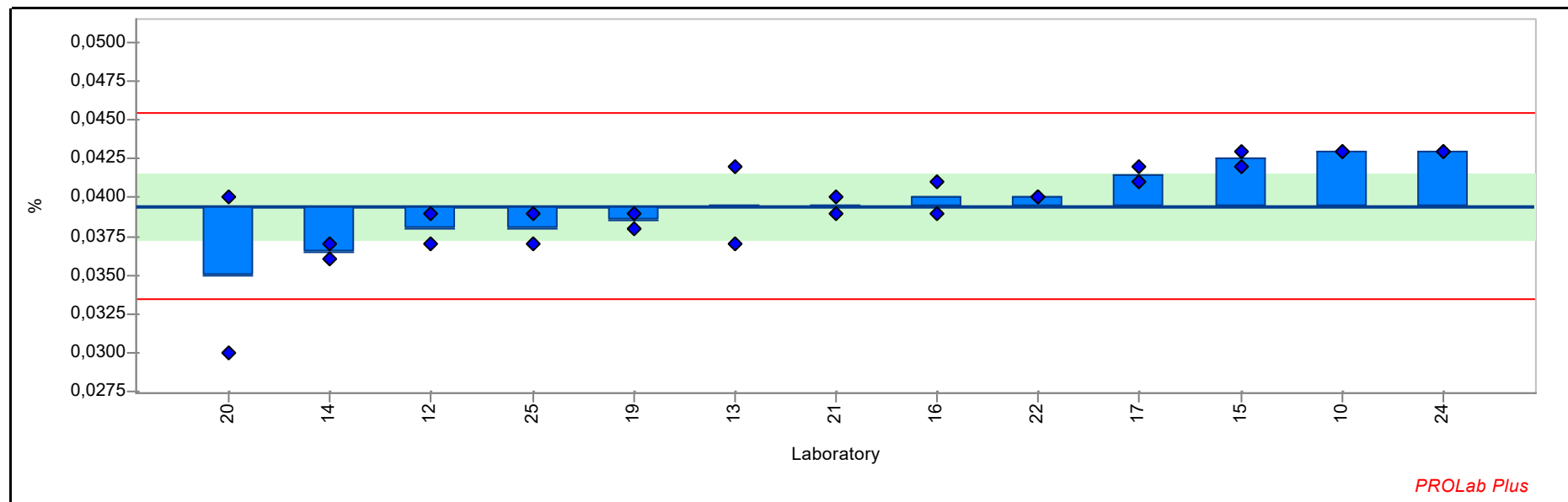
**RV\_2020\_01\_Cement**

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Lab code	Lab mean	s.d.	z-score	Conc. 1	Conc. 2	Accreditation	Analytical method	Comment
18	1,490	0,000	0,624	1,490	1,490		XRF (fusion)	ISO 29581-2 2010
19	1,450	0,013	-0,638	1,459	1,441		XRF (fusion)	
20	1,455	0,007	-0,480	1,450	1,460		XRF (fusion)	DIN EN 196-2
21	1,538	0,008	2,154	1,544	1,533	ISO 17025	Other Method	ASTM C1301
22	1,490	0,007	0,624	1,495	1,485		XRF (fusion)	ISO 29581-2 2010
24	1,470	0,006	-0,007	1,466	1,474		XRF (fusion)	ISO 29581-2 2014
25	1,433	0,007	-1,174	1,438	1,428	ISO 17025	XRF (fusion)	ISO DIN 51001 2003

RV\_2020\_01\_Cement

**Sample:** FLX-1001 **Reproducibility s.d.:** 0,003 %  
**Measurand:** Mn2O3 **Repeatability s.d.:** 0,001 %  
**Mean ± U(Mean):** 0,039 ± 0,002 % **Range of tolerance:** 0,033 - 0,045 % (|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
10	0,043	0,000	1,175	0,043	0,043	ISO 17025	XRF (fusion)	ISO 29581-2 2010
12	0,038	0,001	-0,484	0,037	0,039		XRF (fusion)	ISO DIN 51001 2003
13	0,040	0,004	0,014	0,042	0,037	ISO 17025	XRF (fusion)	
14	0,036	0,001	-0,982	0,036	0,037	ISO 17025	XRF (fusion)	ISO 29581-2 2010
15	0,042	0,001	1,009	0,043	0,042	ISO 17025	XRF (fusion)	
16	0,040	0,001	0,180	0,039	0,041		XRF (fusion)	
17	0,042	0,001	0,677	0,042	0,041		XRF (pressed pellet) - information only	DIN EN 196-2
19	0,038	0,001	-0,318	0,038	0,039		XRF (fusion)	

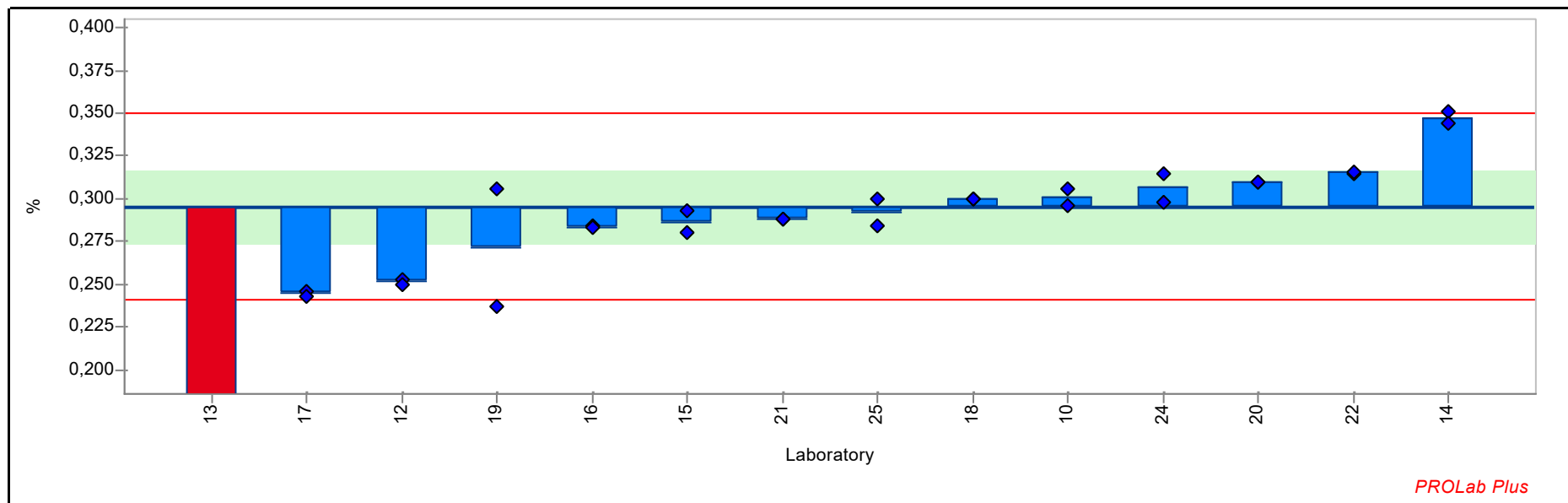
**RV\_2020\_01\_Cement**

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Lab code	Lab mean	s.d.	z-score	Conc. 1	Conc. 2	Accreditation	Analytical method	Comment
20	0,035	0,007	-1,479	0,030	0,040		XRF (fusion)	DIN EN 196-2
21	0,040	0,001	0,014	0,039	0,040	ISO 17025	Other Method	ASTM C1301
22	0,040	0,000	0,180	0,040	0,040		XRF (fusion)	ISO 29581-2 2010
24	0,043	0,000	1,175	0,043	0,043		XRF (fusion)	ISO 29581-2 2015
25	0,038	0,001	-0,484	0,039	0,037	ISO 17025	XRF (fusion)	ISO DIN 51001 2003

RV\_2020\_01\_Cement

**Sample:** FLX-1001 **Reproducibility s.d.:** 0,027 %  
**Measurand:** Na2O **Repeatability s.d.:** 0,007 %  
**Mean ± U(Mean):** 0,295 ± 0,021 % **Range of tolerance:** 0,241 - 0,350 % (|z-score| ≤ 2,000)  
**No. of laboratories:** 13 **Statistical method:** Q/Hampel



Lab code	Lab mean	s.d.	z-score	Conc. 1	Conc. 2	Accreditation	Analytical method	Comment
10	0,301	0,007	0,203	0,296	0,306	ISO 17025	XRF (fusion)	ISO 29581-2 2010
12	0,252	0,002	-1,604	0,253	0,250		XRF (fusion)	ISO DIN 51001 2003
13	0,143	0,004	-5,545	0,141	0,146	ISO 17025	XRF (fusion)	
14	0,347	0,005	1,899	0,351	0,344	ISO 17025	XRF (fusion)	ISO 29581-2 2010
15	0,286	0,009	-0,327	0,280	0,293	ISO 17025	XRF (fusion)	
16	0,283	0,001	-0,436	0,284	0,283		XRF (fusion)	
17	0,244	0,002	-1,859	0,246	0,243		XRF (pressed pellet) - information only	DIN EN 196-2
18	0,300	0,000	0,166	0,300	0,300		XRF (fusion)	ISO 29581-2 2010



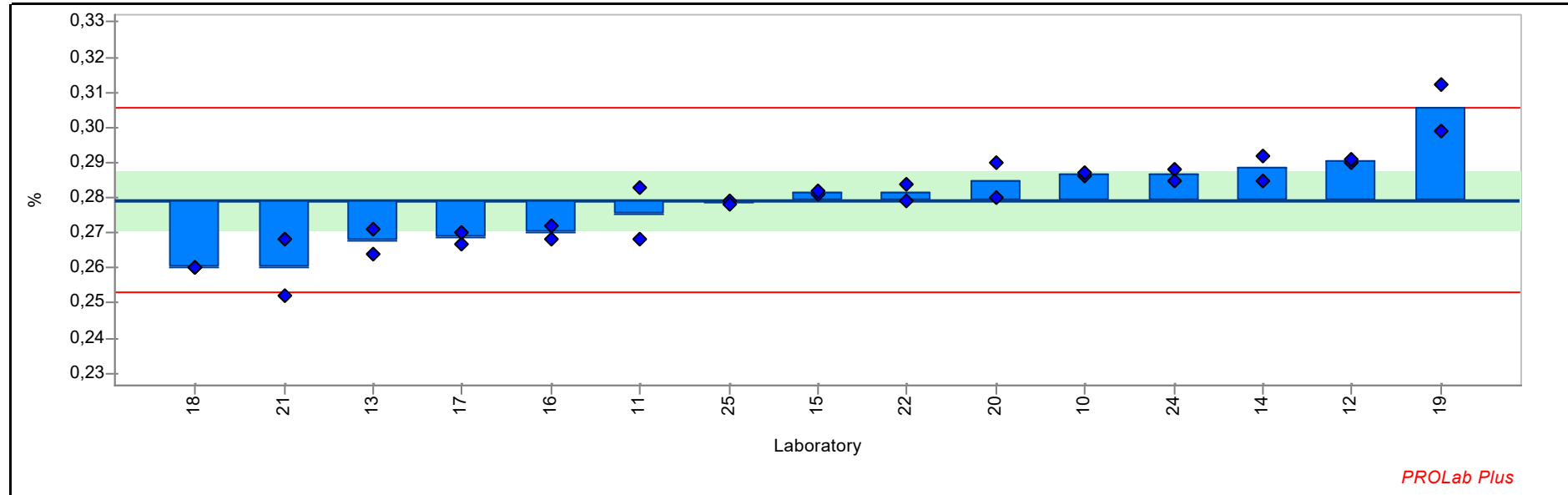
**RV\_2020\_01\_Cement**

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Lab code	Lab mean	s.d.	z-score	Conc. 1	Conc. 2	Accreditation	Analytical method	Comment
19	0,271	0,049	-0,874	0,306	0,237		XRF (fusion)	
20	0,310	0,000	0,531	0,310	0,310		XRF (fusion)	DIN EN 196-2
21	0,288	0,000	-0,272	0,288	0,288	ISO 17025	Other Method	ASTM C1301
22	0,316	0,001	0,732	0,315	0,316		XRF (fusion)	ISO 29581-2 2010
24	0,306	0,012	0,403	0,298	0,315		XRF (fusion)	ISO 29581-2 2016
25	0,292	0,011	-0,126	0,300	0,284	ISO 17025	XRF (fusion)	ISO DIN 51001 2003

RV\_2020\_01\_Cement

**Sample:** FLX-1001 **Reproducibility s.d.:** 0,013 %  
**Measurand:** P2O5 **Repeatability s.d.:** 0,005 %  
**Mean ± U(Mean):** 0,279 ± 0,009 % **Range of tolerance:** 0,253 - 0,306 % (|z-score| ≤ 2,000)  
**No. of laboratories:** 14 **Statistical method:** Q/Hampel



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Lab code	Lab mean	s.d.	z-score	Conc. 1	Conc. 2	Accreditation	Analytical method	Comment
10	0,286	0,001	0,543	0,286	0,287	ISO 17025	XRF (fusion)	ISO 29581-2 2010
11	0,275	0,011	-0,290	0,283	0,268		XRF (fusion)	ISO 29581-2 2010
12	0,290	0,001	0,847	0,290	0,291		XRF (fusion)	ISO DIN 51001 2003
13	0,268	0,005	-0,897	0,271	0,264	ISO 17025	XRF (fusion)	
14	0,288	0,005	0,695	0,292	0,285	ISO 17025	XRF (fusion)	ISO DIN 51001 2003
15	0,281	0,001	0,164	0,281	0,282	ISO 17025	XRF (fusion)	
16	0,270	0,003	-0,707	0,268	0,272		XRF (fusion)	
17	0,269	0,002	-0,821	0,267	0,270		XRF (pressed pellet) - information only	DIN EN 196-2

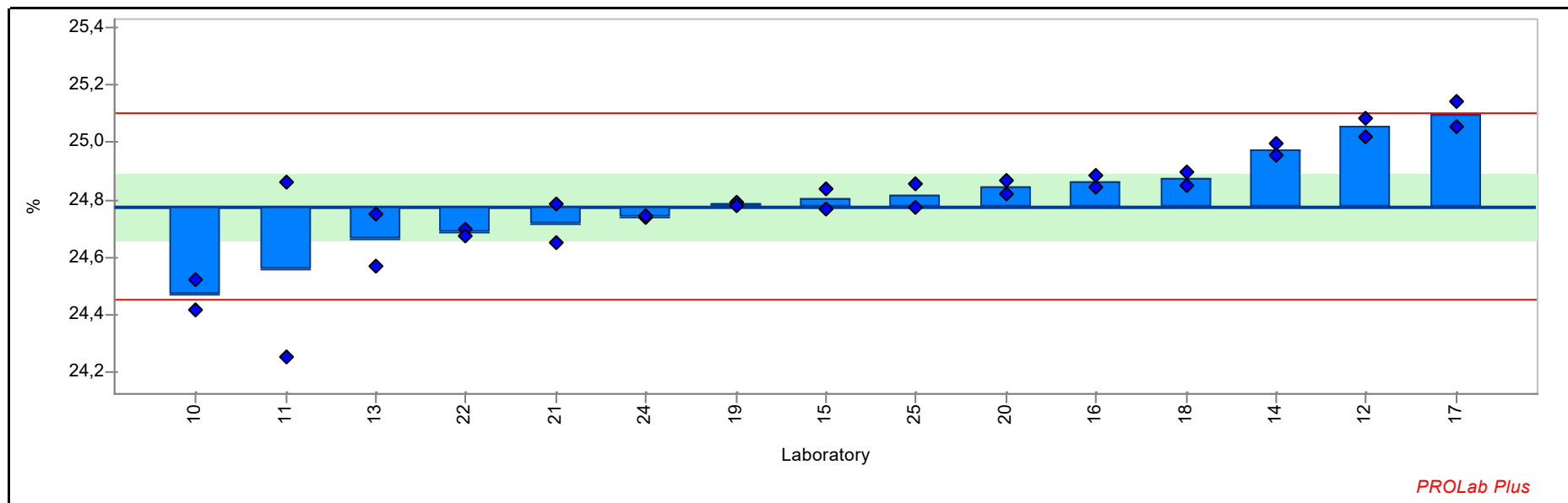
**RV\_2020\_01\_Cement**

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Lab code	Lab mean	s.d.	z-score	Conc. 1	Conc. 2	Accreditation	Analytical method	Comment
18	0,260	0,000	-1,465	0,260	0,260		XRF (fusion)	ISO 29581-2 2010
19	0,305	0,009	1,984	0,312	0,299		XRF (fusion)	
20	0,285	0,007	0,430	0,290	0,280		XRF (fusion)	DIN EN 196-2
21	0,260	0,011	-1,465	0,268	0,252	ISO 17025	Other Method	ASTM C1301
22	0,281	0,004	0,164	0,284	0,279		XRF (fusion)	ISO 29581-2 2010
24	0,286	0,002	0,543	0,288	0,285		XRF (fusion)	ISO 29581-2 2017
25	0,279	0,001	-0,063	0,279	0,278	ISO 17025	XRF (fusion)	ISO DIN 51001 2003

RV\_2020\_01\_Cement

**Sample:** FLX-1001 **Reproducibility s.d.:** 0,163 %  
**Measurand:** SiO2 **Repeatability s.d.:** 0,064 %  
**Mean ± U(Mean):** 24,777 ± 0,117 % **Range of tolerance:** 24,451 - 25,104 % (|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
10	24,472	0,075	-1,873	24,525	24,419	ISO 17025	XRF (fusion)	ISO 29581-2 2010
11	24,558	0,433	-1,345	24,864	24,252		XRF (fusion)	ISO 29581-2 2010
12	25,054	0,047	1,695	25,021	25,087		XRF (fusion)	ISO DIN 51001 2003
13	24,660	0,132	-0,717	24,754	24,567	ISO 17025	XRF (fusion)	
14	24,974	0,030	1,205	24,995	24,953	ISO 17025	XRF (fusion)	ISO 29581-2 2010
15	24,803	0,050	0,160	24,839	24,768	ISO 17025	XRF (fusion)	
16	24,865	0,028	0,537	24,845	24,885		XRF (fusion)	
17	25,099	0,062	1,968	25,142	25,055		XRF (pressed pellet) - information only	DIN EN 196-2

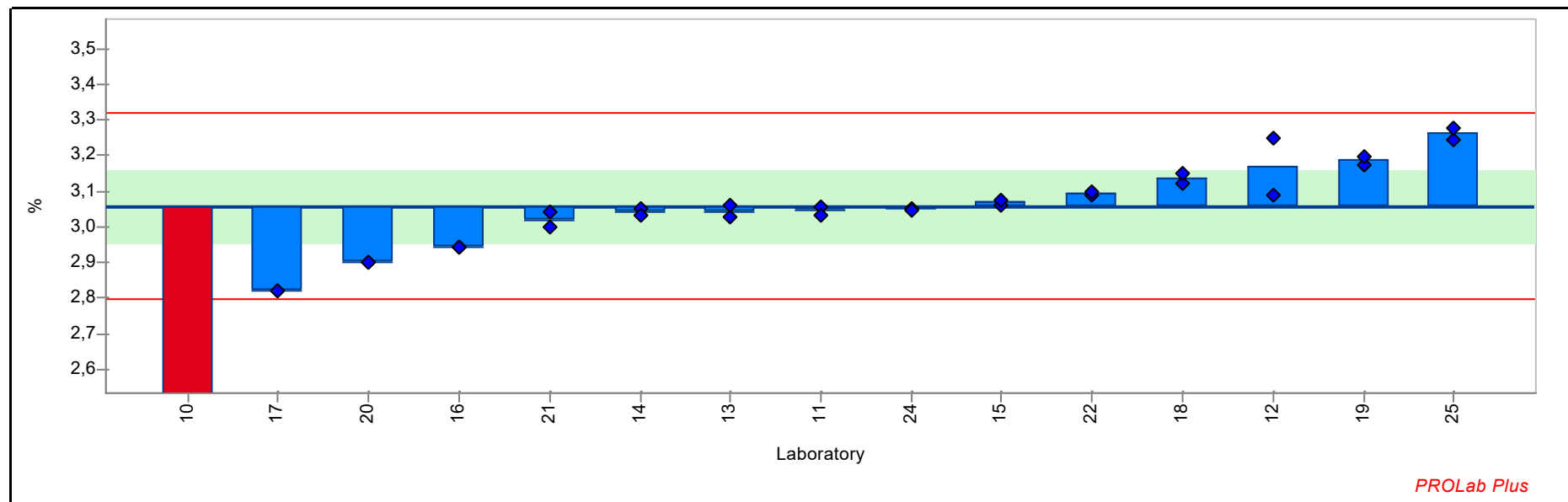
**RV\_2020\_01\_Cement**

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Lab code	Lab mean	s.d.	z-score	Conc. 1	Conc. 2	Accreditation	Analytical method	Comment
18	24,875	0,035	0,598	24,900	24,850		XRF (fusion)	ISO 29581-2 2010
19	24,787	0,012	0,055	24,795	24,778		XRF (fusion)	
20	24,845	0,035	0,414	24,820	24,870		XRF (fusion)	DIN EN 196-2
21	24,717	0,095	-0,371	24,650	24,784	ISO 17025	Other Method	ASTM C1301
22	24,688	0,018	-0,552	24,700	24,675		XRF (fusion)	ISO 29581-2 2010
24	24,741	0,006	-0,220	24,737	24,746		XRF (fusion)	ISO 29581-2 2018
25	24,816	0,061	0,236	24,859	24,773	ISO 17025	XRF (fusion)	ISO DIN 51001 2003

RV\_2020\_01\_Cement

**Sample:** FLX-1001 **Reproducibility s.d.:** 0,131 %  
**Measurand:** SO3 **Repeatability s.d.:** 0,024 %  
**Mean ± U(Mean):** 3,058 ± 0,102 % **Range of tolerance:** 2,796 - 3,321 % (|z-score| ≤ 2,000)  
**No. of laboratories:** 15 **Statistical method:** Q/Hampel



PROLab Plus

Lab code	Lab mean	s.d.	z-score	Conc. 1	Conc. 2	Accreditation	Analytical method	Comment
10	2,200	0,023	-6,539	2,216	2,184	ISO 17025	XRF (fusion)	ISO 29581-2 2010
11	3,045	0,018	-0,102	3,058	3,032		XRF (fusion)	ISO 29581-2 2010
12	3,170	0,114	0,855	3,090	3,251		XRF (fusion)	ISO DIN 51001 2003
13	3,044	0,024	-0,109	3,027	3,061	ISO 17025	XRF (fusion)	
14	3,042	0,014	-0,124	3,052	3,032	ISO 17025	XRF (fusion)	ISO 29581-2 2010
15	3,068	0,013	0,074	3,059	3,077	ISO 17025	XRF (fusion)	
16	2,945	0,000	-0,863	2,945	2,945		XRF (fusion)	
17	2,820	0,000	-1,816	2,820	2,820		Other Method	Wet chemical analysis

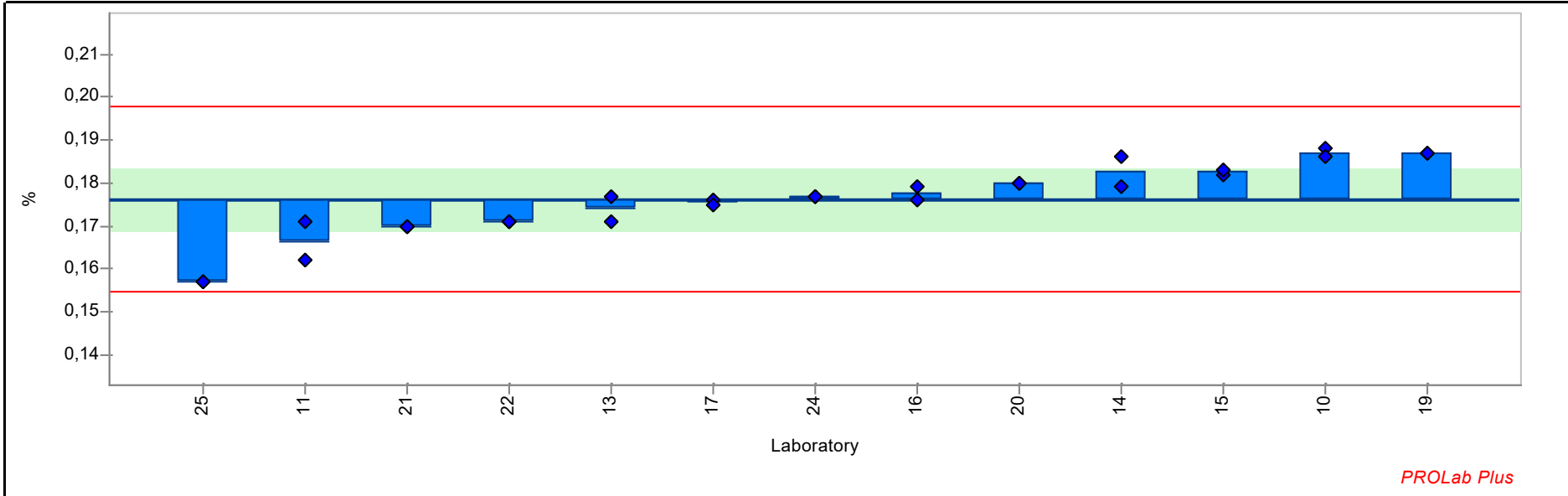
**RV\_2020\_01\_Cement**

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Lab code	Lab mean	s.d.	z-score	Conc. 1	Conc. 2	Accreditation	Analytical method	Comment
18	3,135	0,021	0,584	3,120	3,150			
19	3,186	0,014	0,973	3,176	3,196		XRF (fusion)	
20	2,900	0,000	-1,206	2,900	2,900		Other Method	SO3 gravimetrisch
21	3,020	0,031	-0,292	2,998	3,042	ISO 17025	Other Method	ASTM C1301
22	3,096	0,006	0,283	3,091	3,100		XRF (fusion)	ISO 29581-2 2010
24	3,049	0,006	-0,071	3,053	3,045		XRF (fusion)	ISO 29581-2 2019
25	3,261	0,023	1,548	3,245	3,278	ISO 17025	Other Method	DIN EN ISO 15350 2010

RV\_2020\_01\_Cement

**Sample:** FLX-1001 **Reproducibility s.d.:** 0,011 %  
**Measurand:** SrO **Repeatability s.d.:** 0,003 %  
**Mean ± U(Mean):** 0,176 ± 0,007 % **Range of tolerance:** 0,155 - 0,198 % (|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
10	0,187	0,001	0,993	0,188	0,186	ISO 17025	XRF (fusion)	ISO 29581-2 2010
11	0,167	0,006	-0,901	0,162	0,171		XRF (fusion)	ISO 29581-2 2010
13	0,174	0,004	-0,208	0,171	0,177	ISO 17025	XRF (fusion)	
14	0,182	0,005	0,577	0,186	0,179	ISO 17025	XRF (fusion)	ISO 29581-2 2010
15	0,182	0,001	0,577	0,182	0,183	ISO 17025	XRF (fusion)	
16	0,177	0,002	0,115	0,179	0,176		XRF (fusion)	
17	0,175	0,001	-0,069	0,176	0,175		XRF (pressed pellet) - information only	DIN EN 196-2
19	0,187	0,000	0,993	0,187	0,187		XRF (fusion)	



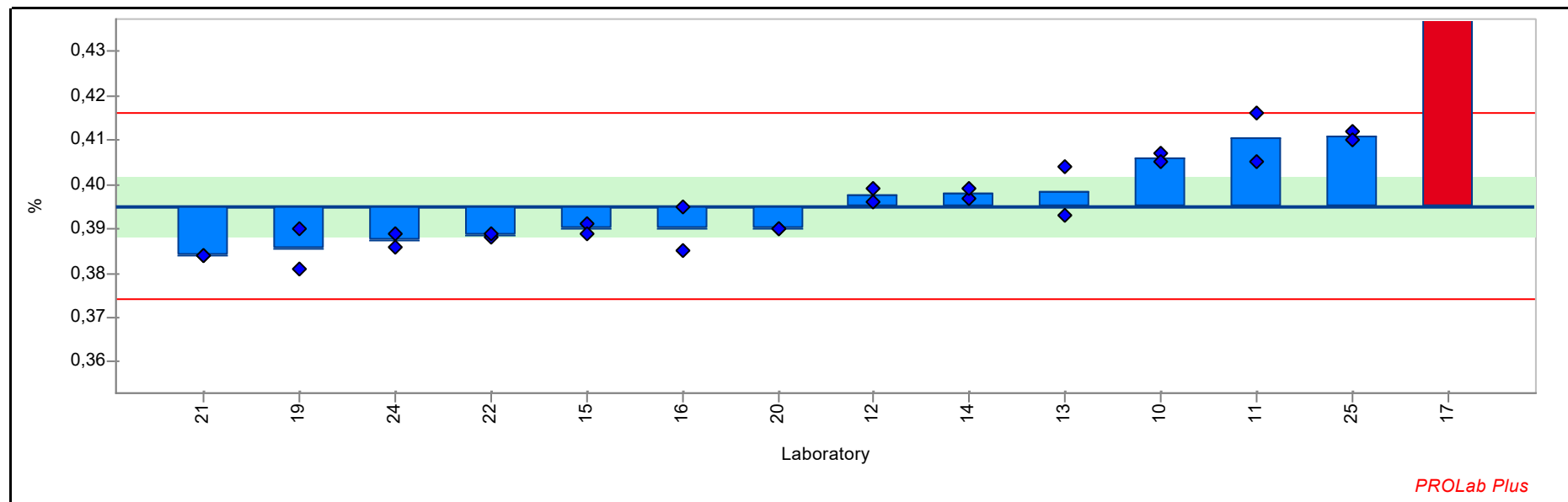
**RV\_2020\_01\_Cement**

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Lab code	Lab mean	s.d.	z-score	Conc. 1	Conc. 2	Accreditation	Analytical method	Comment
20	0,180	0,000	0,346	0,180	0,180		XRF (fusion)	DIN EN 196-2
21	0,170	0,000	-0,577	0,170	0,170	ISO 17025	Other Method	ASTM C1301
22	0,171	0,000	-0,485	0,171	0,171		XRF (fusion)	ISO 29581-2 2010
24	0,177	0,000	0,069	0,177	0,177		XRF (fusion)	ISO 29581-2 2020
25	0,157	0,000	-1,778	0,157	0,157	ISO 17025	XRF (fusion)	ISO DIN 51001 2003

RV\_2020\_01\_Cement

**Sample:** FLX-1001 **Reproducibility s.d.:** 0,011 %  
**Measurand:** TiO2 **Repeatability s.d.:** 0,003 %  
**Mean ± U(Mean):** 0,395 ± 0,006 % **Range of tolerance:** 0,374 - 0,416 % (|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
10	0,406	0,001	1,029	0,407	0,405	ISO 17025	XRF (fusion)	ISO 29581-2 2010
11	0,410	0,008	1,456	0,416	0,405		XRF (fusion)	ISO 29581-2 2010
12	0,398	0,002	0,223	0,399	0,396		XRF (fusion)	ISO DIN 51001 2003
13	0,399	0,008	0,318	0,404	0,393	ISO 17025	XRF (fusion)	
14	0,398	0,001	0,270	0,397	0,399	ISO 17025	XRF (fusion)	ISO 29581-2 2010
15	0,390	0,001	-0,489	0,391	0,389	ISO 17025	XRF (fusion)	
16	0,390	0,007	-0,489	0,395	0,385		XRF (fusion)	
17	0,443	0,003	4,540	0,441	0,445		XRF (pressed pellet) - information only	DIN EN 196-2

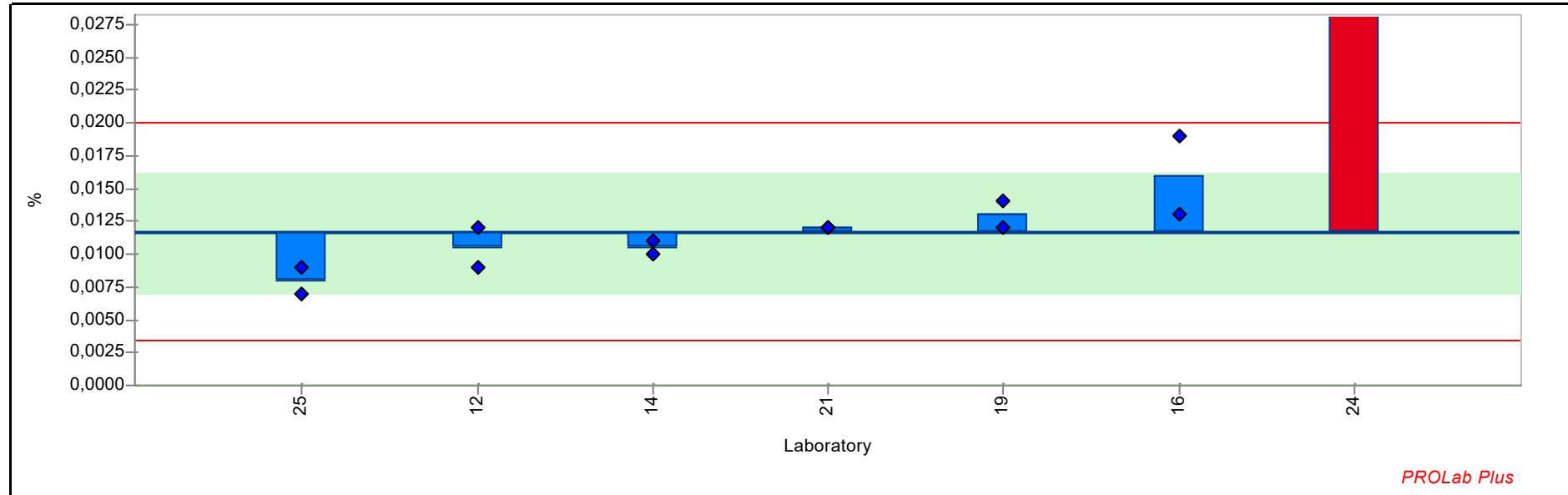
**RV\_2020\_01\_Cement**

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Lab code	Lab mean	s.d.	z-score	Conc. 1	Conc. 2	Accreditation	Analytical method	Comment
19	0,386	0,006	-0,916	0,381	0,390		XRF (fusion)	
20	0,390	0,000	-0,489	0,390	0,390		XRF (fusion)	DIN EN 196-2
21	0,384	0,000	-1,058	0,384	0,384	ISO 17025	Other Method	ASTM C1301
22	0,389	0,001	-0,631	0,388	0,389		XRF (fusion)	ISO 29581-2 2010
24	0,388	0,002	-0,726	0,389	0,386		XRF (fusion)	ISO 29581-2 2021
25	0,411	0,001	1,504	0,412	0,410	ISO 17025	XRF (fusion)	ISO DIN 51001 2003

RV\_2020\_01\_Cement

**Sample:** FLX-1001 **Reproducibility s.d.:** 0,004 %  
**Measurand:** V2O5 (information only) **Repeatability s.d.:** 0,002 %  
**Mean ± U(Mean):** 0,012 ± 0,005 % **Range of tolerance:** 0,003 - 0,020 % (|z-score| ≤ 2,000)  
**No. of laboratories:** 7 **Statistical method:** Q/Hampel

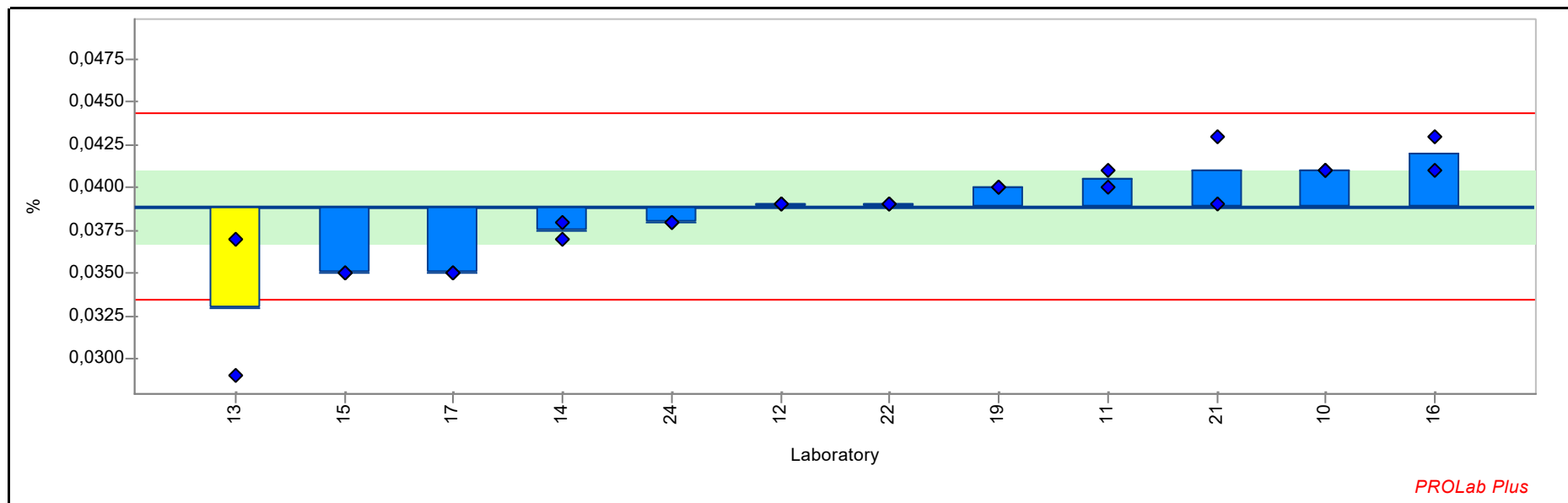


PROLab Plus

Lab code	Lab mean	s.d.	z-score	Conc. 1	Conc. 2	Accreditation	Analytical method	Comment
12	0,010	0,002	-0,282	0,009	0,012		XRF (fusion)	ISO DIN 51001 2003
14	0,010	0,001	-0,282	0,010	0,011	ISO 17025	XRF (fusion)	ISO DIN 51001 2003
16	0,016	0,004	1,046	0,013	0,019		XRF (fusion)	
19	0,013	0,001	0,322	0,014	0,012		XRF (fusion)	
21	0,012	0,000	0,080	0,012	0,012		Other Method	
24	0,069	0,000	13,840	0,069	0,069		XRF (fusion)	ISO DIN 51001 2003
25	0,008	0,001	-0,885	0,007	0,009	ISO 17025	XRF (fusion)	ISO DIN 51001 2003

RV\_2020\_01\_Cement

**Sample:** FLX-1001 **Reproducibility s.d.:** 0,003 %  
**Measurand:** ZnO **Repeatability s.d.:** 0,001 %  
**Mean ± U(Mean):** 0,039 ± 0,002 % **Range of tolerance:** 0,033 - 0,044 % (|z-score| ≤ 2,000)  
**No. of laboratories:** 11 **Statistical method:** Q/Hampel



PROLab Plus

Lab code	Lab mean	s.d.	z-score	Conc. 1	Conc. 2	Accreditation	Analytical method	Comment
10	0,041	0,000	0,772	0,041	0,041	ISO 17025	XRF (fusion)	ISO 29581-2 2010
11	0,041	0,001	0,589	0,040	0,041		XRF (fusion)	ISO 29581-2 2010
12	0,039	0,000	0,040	0,039	0,039		XRF (fusion)	ISO DIN 51001 2003
13	0,033	0,006	-2,154	0,029	0,037	ISO 17025	XRF (fusion)	
14	0,037	0,001	-0,508	0,038	0,037	ISO 17025	XRF (fusion)	ISO 29581-2 2010
15	0,035	0,000	-1,422	0,035	0,035	ISO 17025	XRF (fusion)	
16	0,042	0,001	1,137	0,043	0,041		XRF (fusion)	
17	0,035	0,000	-1,422	0,035	0,035		XRF (pressed pellet) - information only	DIN EN 196-2

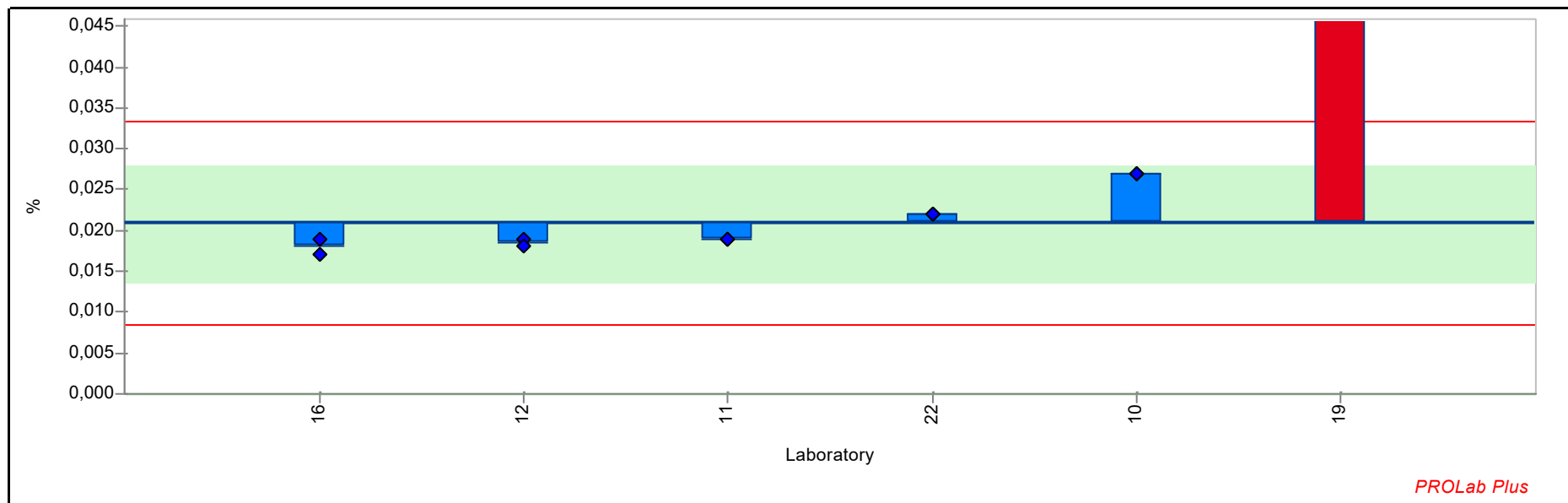
**RV\_2020\_01\_Cement**

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Lab code	Lab mean	s.d.	z-score	Conc. 1	Conc. 2	Accreditation	Analytical method	Comment
19	0,040	0,000	0,406	0,040	0,040		XRF (fusion)	
21	0,041	0,003	0,772	0,043	0,039	ISO 17025	Other Method	ASTM C1301
22	0,039	0,000	0,040	0,039	0,039		XRF (fusion)	ISO 29581-2 2010
24	0,038	0,000	-0,325	0,038	0,038		XRF (fusion)	ISO 29581-2 2010

RV\_2020\_01\_Cement

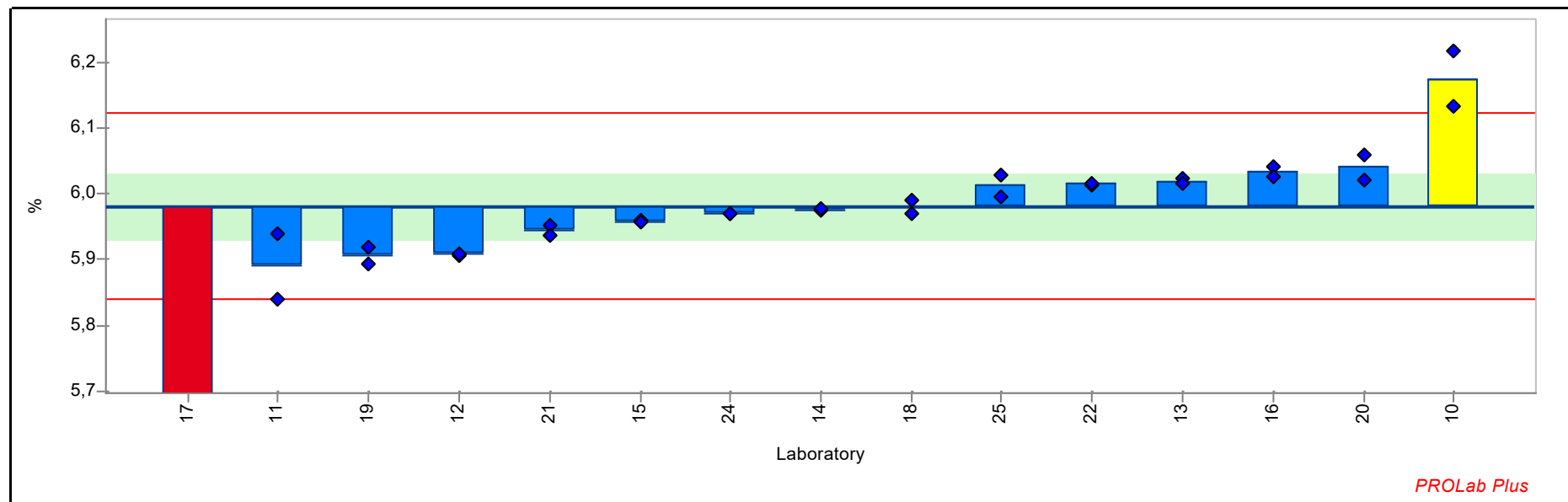
**Sample:** FLX-1001 **Reproducibility s.d.:** 0,006 %  
**Measurand:** ZrO2 (information only) **Repeatability s.d.:** 0,001 %  
**Mean ± U(Mean):** 0,021 ± 0,007 % **Range of tolerance:** 0,008 - 0,033 % (|z-score| ≤ 2,000)  
**No. of laboratories:** 6 **Statistical method:** Q/Hampel



Lab code	Lab mean	s.d.	z-score	Conc. 1	Conc. 2	Accreditation	Analytical method	Comment
10	0,027	0,000	0,977	0,027	0,027		XRF (fusion)	ISO 29581-2 2010
11	0,019	0,000	-0,304	0,019	0,019		XRF (fusion)	Lab calibration method
12	0,018	0,001	-0,385	0,019	0,018		XRF (fusion)	ISO DIN 51001 2003
16	0,018	0,001	-0,465	0,019	0,017		XRF (fusion)	
19	0,049	0,000	4,503	0,049	0,049		XRF (fusion)	
22	0,022	0,000	0,176	0,022	0,022		XRF (fusion)	ISO DIN 51001 2003

RV\_2020\_01\_Cement

**Sample:** FLX-1002 **Reproducibility s.d.:** 0,071 %  
**Measurand:** Al<sub>2</sub>O<sub>3</sub> **Repeatability s.d.:** 0,016 %  
**Mean ± U(Mean):** 5,981 ± 0,050 % **Range of tolerance:** 5,839 - 6,123 % (|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
10	6,175	0,058	2,726	6,134	6,216	ISO 17025	XRF (fusion)	ISO 29581-2 2010
11	5,891	0,070	-1,279	5,841	5,940		XRF (fusion)	ISO 29581-2 2010
12	5,908	0,001	-1,033	5,907	5,909		XRF (fusion)	ISO DIN 51001 2003
13	6,019	0,006	0,530	6,023	6,015	ISO 17025	XRF (fusion)	
14	5,976	0,002	-0,082	5,974	5,977	ISO 17025	XRF (fusion)	ISO 29581-2 2010
15	5,957	0,002	-0,336	5,959	5,956	ISO 17025	XRF (fusion)	
16	6,033	0,011	0,720	6,040	6,025		XRF (fusion)	
17	5,676	0,004	-4,298	5,673	5,679		XRF (pressed pellet) - information only	DIN EN 196-2

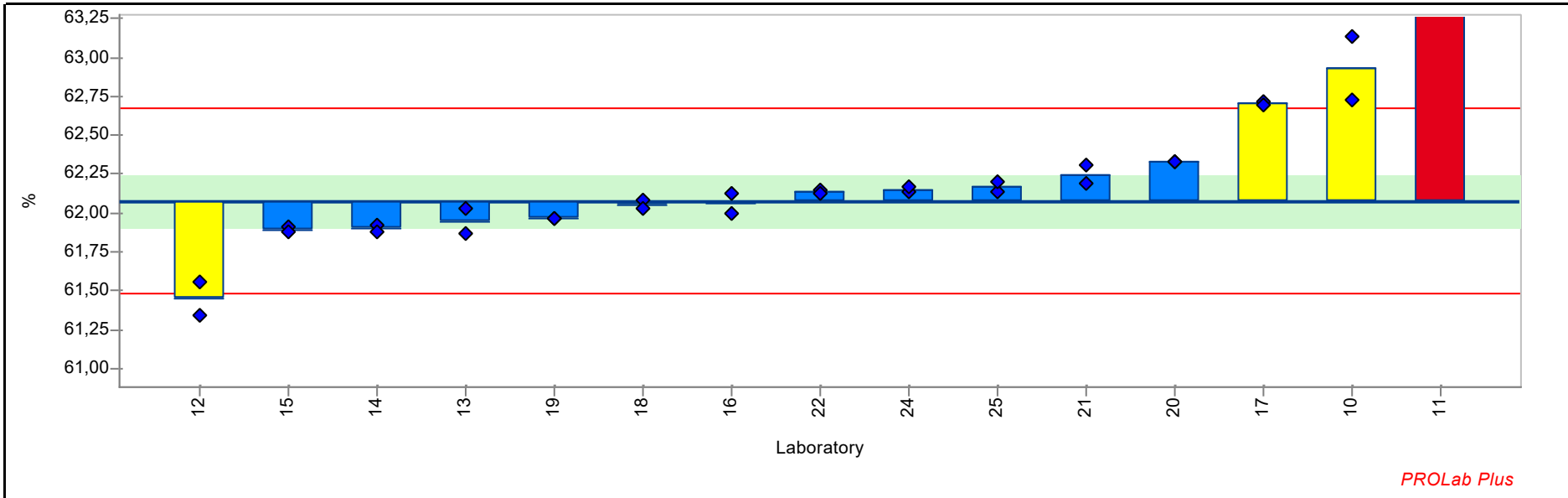


**RV\_2020\_01\_Cement**

Lab code	Lab mean	s.d.	z-score	Conc. 1	Conc. 2	Accreditation	Analytical method	Comment
18	5,980	0,014	-0,019	5,990	5,970		XRF (fusion)	ISO 29581-2 2010
19	5,907	0,018	-1,047	5,920	5,894		XRF (fusion)	
20	6,040	0,028	0,826	6,060	6,020		XRF (fusion)	DIN EN 196-2
21	5,944	0,011	-0,533	5,951	5,936	ISO 17025	Other Method	ASTM C1301
22	6,015	0,003	0,474	6,013	6,017		XRF (fusion)	ISO 29581-2 2010
24	5,970	0,001	-0,153	5,971	5,970		XRF (fusion)	ISO 29581-2 2010
25	6,012	0,024	0,431	6,029	5,995	ISO 17025	XRF (fusion)	ISO DIN 51001 2003

RV\_2020\_01\_Cement

**Sample:** FLX-1002 **Reproducibility s.d.:** 0,299 %  
**Measurand:** CaO **Repeatability s.d.:** 0,064 %  
**Mean ± U(Mean):** 62,078 ± 0,170 % **Range of tolerance:** 61,480 - 62,676 % (|z-score| <= 2,000)  
**No. of laboratories:** 14 **Statistical method:** Q/Hampel



Lab code	Lab mean	s.d.	z-score	Conc. 1	Conc. 2	Accreditation	Analytical method	Comment
10	62,930	0,284	2,848	63,130	62,729	ISO 17025	XRF (fusion)	ISO 29581-2 2010
11	63,730	0,202	5,526	63,588	63,873		XRF (fusion)	ISO 29581-2 2010
12	61,454	0,152	-2,085	61,562	61,347		XRF (fusion)	ISO DIN 51001 2003
13	61,947	0,116	-0,438	61,865	62,029	ISO 17025	XRF (fusion)	
14	61,902	0,030	-0,589	61,923	61,881	ISO 17025	XRF (fusion)	ISO 29581-2 2010
15	61,895	0,025	-0,612	61,913	61,877	ISO 17025	XRF (fusion)	
16	62,063	0,088	-0,052	62,125	62,000		XRF (fusion)	
17	62,705	0,016	2,097	62,716	62,694		XRF (pressed pellet) - information only	DIN EN 196-2

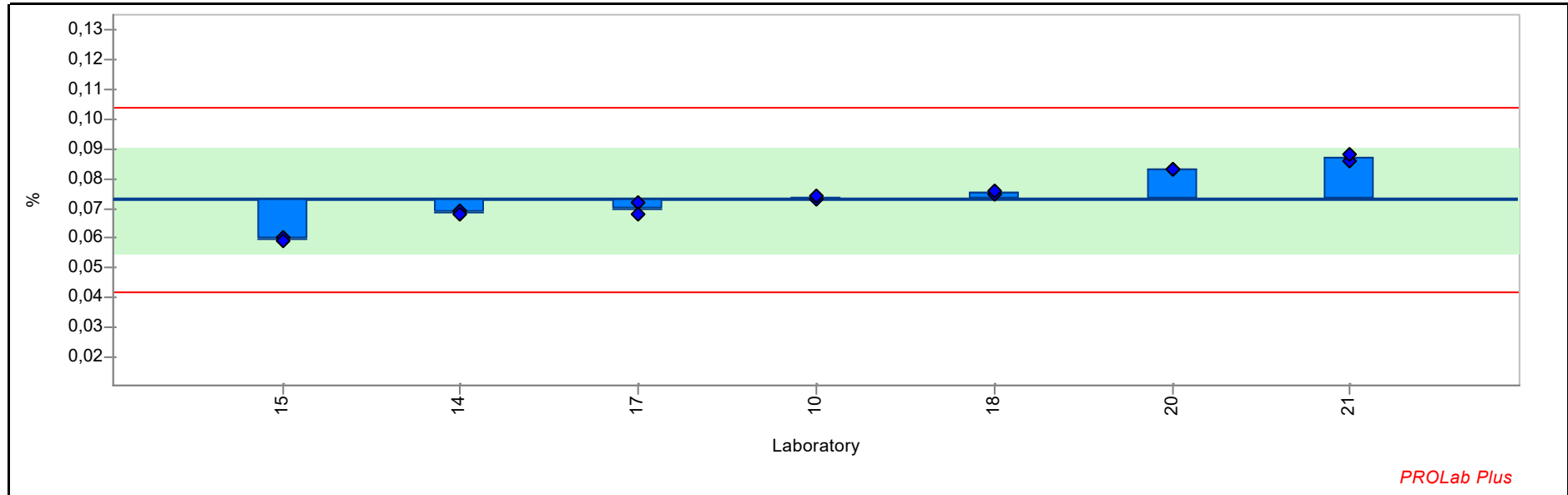
**RV\_2020\_01\_Cement**

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Lab code	Lab mean	s.d.	z-score	Conc. 1	Conc. 2	Accreditation	Analytical method	Comment
18	62,055	0,035	-0,077	62,080	62,030		XRF (fusion)	ISO 29581-2 2010
19	61,962	0,003	-0,388	61,964	61,960		XRF (fusion)	
20	62,330	0,000	0,843	62,330	62,330		XRF (fusion)	DIN EN 196-2
21	62,248	0,079	0,569	62,192	62,304	ISO 17025	Other Method	ASTM C1301
22	62,138	0,018	0,199	62,150	62,125		XRF (fusion)	ISO 29581-2 2010
24	62,150	0,021	0,241	62,135	62,165		XRF (fusion)	ISO 29581-2 2011
25	62,169	0,047	0,304	62,136	62,202	ISO 17025	XRF (fusion)	ISO DIN 51001 2003

RV\_2020\_01\_Cement

**Sample:** FLX-1002                      **Reproducibility s.d.:** 0,016 %  
**Measurand:** CI (information only)      **Repeatability s.d.:** 0,001 %  
**Mean ± U(Mean):** 0,073 ± 0,017 %      **Range of tolerance:** 0,042 - 0,104 % (|z-score| ≤ 2,000)  
**No. of laboratories:** 5                      **Statistical method:** Q/Hampel

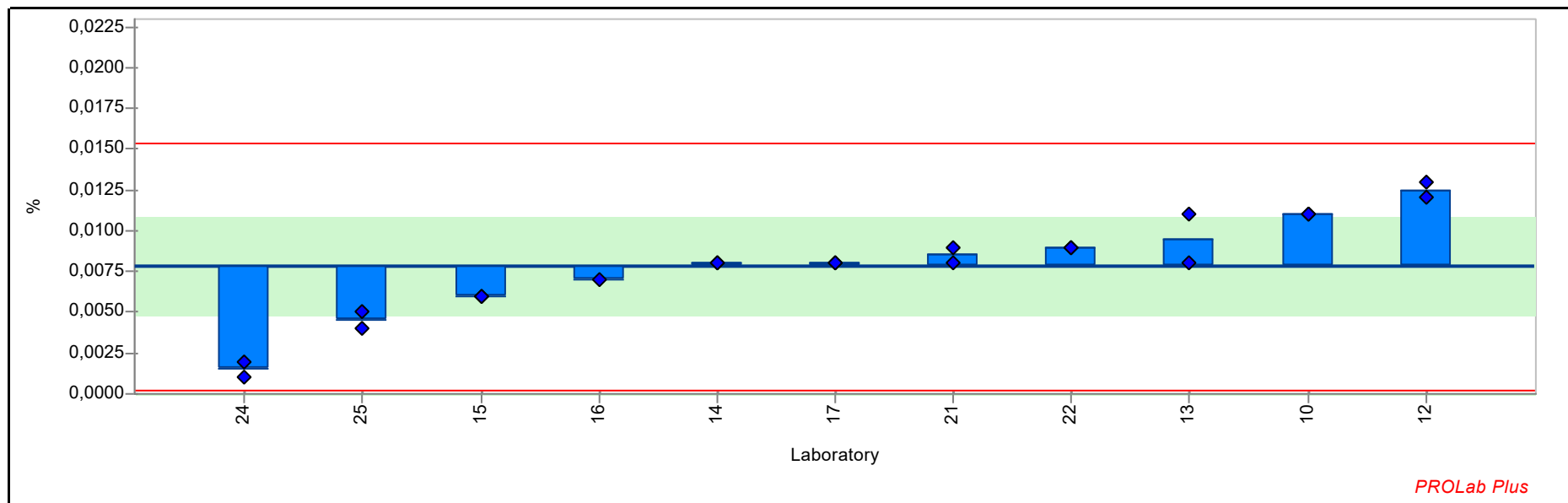


PROLab Plus

Lab code	Lab mean	s.d.	z-score	Conc. 1	Conc. 2	Accreditation	Analytical method	Comment
10	0,073	0,001	0,045	0,073	0,074		Other Method	DIN EN 10304-2
14	0,069	0,001	-0,277	0,069	0,068	ISO 17025	XRF (fusion)	ISO DIN 51001 2003
15	0,059	0,001	-0,856	0,060	0,059	ISO 17025	Other Method	
17	0,070	0,003	-0,180	0,072	0,068		XRF (pressed pellet) - information only	DIN EN 196-2
18	0,075	0,001	0,174	0,075	0,076		Other Method	DIN EN 196-2
20	0,083	0,000	0,657	0,083	0,083		XRF (pressed pellet) - information only	DIN EN 196-2
21	0,087	0,001	0,914	0,086	0,088		Other Method	DIN EN 196-2

RV\_2020\_01\_Cement

**Sample:** FLX-1002 **Reproducibility s.d.:** 0,004 %  
**Measurand:** Cr2O3 **Repeatability s.d.:** 0,001 %  
**Mean ± U(Mean):** 0,008 ± 0,003 % **Range of tolerance:** 0,000 - 0,015 % (|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
10	0,011	0,000	0,841	0,011	0,011	ISO 17025	XRF (fusion)	ISO 29581-2 2010
12	0,013	0,001	1,237	0,013	0,012		XRF (fusion)	ISO DIN 51001 2003
13	0,009	0,002	0,445	0,008	0,011	ISO 17025	XRF (fusion)	
14	0,008	0,000	0,049	0,008	0,008	ISO 17025	XRF (fusion)	ISO 29581-2 2010
15	0,006	0,000	-0,478	0,006	0,006	ISO 17025	XRF (fusion)	
16	<0,00Z		-0,215	<0,002	0,007		XRF (fusion)	
17	0,008	0,000	0,049	0,008	0,008		XRF (pressed pellet) - information only	DIN EN 196-2
21	0,009	0,001	0,181	0,008	0,009		Other Method	

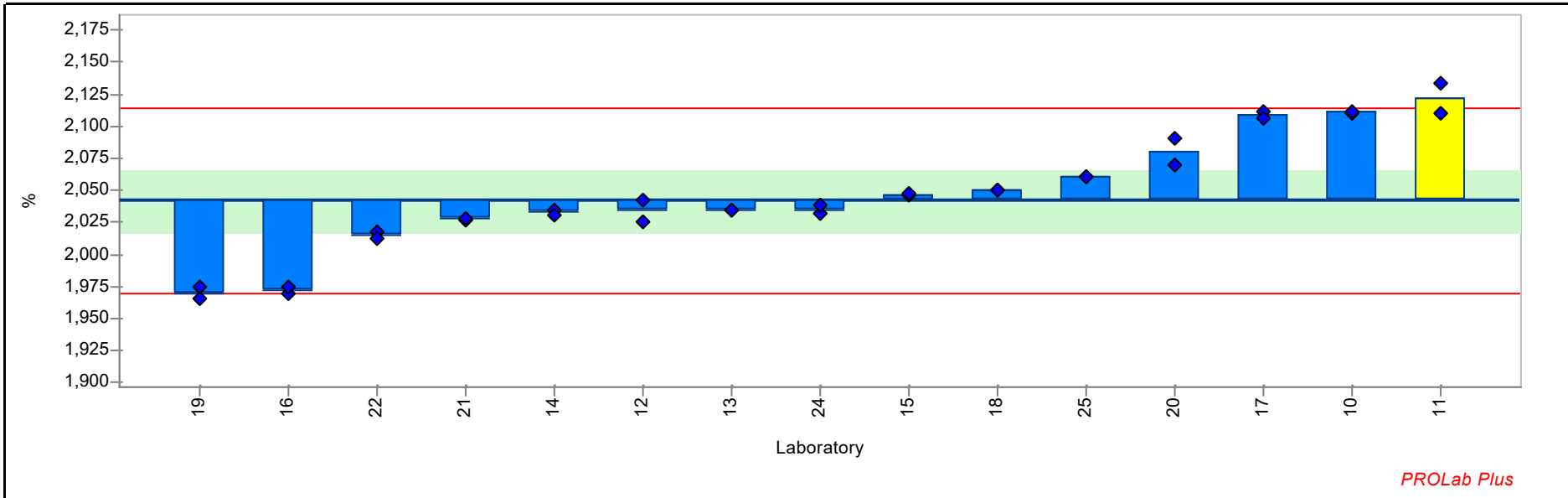
**RV\_2020\_01\_Cement**

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Lab code	Lab mean	s.d.	z-score	Conc. 1	Conc. 2	Accreditation	Analytical method	Comment
22	0,009	0,000	0,313	0,009	0,009		XRF (fusion)	ISO 29581-2 2010
24	0,002	0,001	-1,666	0,001	0,002		XRF (fusion)	ISO 29581-2 2012
25	0,005	0,001	-0,874	0,004	0,005	ISO 17025	XRF (fusion)	ISO DIN 51001 2003

RV\_2020\_01\_Cement

**Sample:** FLX-1002 **Reproducibility s.d.:** 0,036 %  
**Measurand:** Fe2O3 **Repeatability s.d.:** 0,004 %  
**Mean ± U(Mean):** 2,042 ± 0,024 % **Range of tolerance:** 1,969 - 2,114 % (|z-score| ≤ 2,000)  
**No. of laboratories:** 14 **Statistical method:** Q/Hampel



Lab code	Lab mean	s.d.	z-score	Conc. 1	Conc. 2	Accreditation	Analytical method	Comment
10	2,111	0,001	1,907	2,110	2,112	ISO 17025	XRF (fusion)	ISO 29581-2 2010
11	2,122	0,017	2,210	2,134	2,110		XRF (fusion)	ISO 29581-2 2010
12	2,034	0,012	-0,200	2,043	2,026		XRF (fusion)	ISO DIN 51001 2003
13	2,034	0,001	-0,200	2,035	2,034	ISO 17025	XRF (fusion)	
14	2,033	0,003	-0,241	2,035	2,031	ISO 17025	XRF (fusion)	ISO 29581-2 2010
15	2,046	0,001	0,131	2,046	2,047	ISO 17025	XRF (fusion)	
16	1,973	0,004	-1,907	1,970	1,975		XRF (fusion)	
17	2,109	0,004	1,852	2,112	2,106		XRF (pressed pellet) - information only	DIN EN 196-2

**RV\_2020\_01\_Cement**

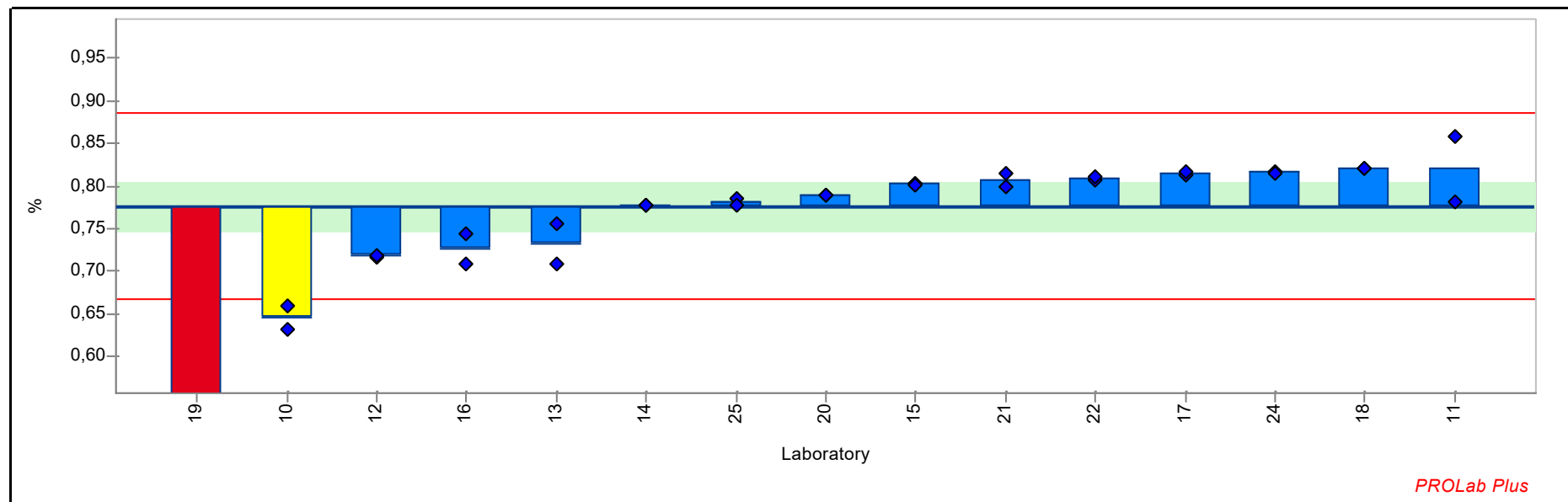
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Lab code	Lab mean	s.d.	z-score	Conc. 1	Conc. 2	Accreditation	Analytical method	Comment
18	2,050	0,000	0,227	2,050	2,050		XRF (fusion)	ISO 29581-2 2010
19	1,970	0,007	-1,976	1,965	1,975		XRF (fusion)	
20	2,080	0,014	1,053	2,070	2,090		XRF (fusion)	DIN EN 196-2
21	2,027	0,001	-0,392	2,027	2,028	ISO 17025	Other Method	ASTM C1301
22	2,015	0,004	-0,723	2,018	2,013		XRF (fusion)	ISO 29581-2 2010
24	2,035	0,004	-0,186	2,032	2,038		XRF (fusion)	ISO 29581-2 2013
25	2,061	0,000	0,530	2,061	2,061	ISO 17025	XRF (fusion)	ISO DIN 51001 2003



RV\_2020\_01\_Cement

**Sample:** FLX-1002 **Reproducibility s.d.:** 0,055 %  
**Measurand:** K2O **Repeatability s.d.:** 0,007 %  
**Mean ± U(Mean):** 0,777 ± 0,028 % **Range of tolerance:** 0,667 - 0,886 % (|z-score| ≤ 2,000)  
**No. of laboratories:** 14 **Statistical method:** Q/Hampel



Lab code	Lab mean	s.d.	z-score	Conc. 1	Conc. 2	Accreditation	Analytical method	Comment
10	0,647	0,019	-2,375	0,660	0,633	ISO 17025	XRF (fusion)	ISO 29581-2 2010
11	0,820	0,054	0,793	0,858	0,782		XRF (fusion)	ISO 29581-2 2010
12	0,718	0,001	-1,069	0,717	0,719		XRF (fusion)	ISO DIN 51001 2003
13	0,732	0,033	-0,823	0,755	0,708	ISO 17025	XRF (fusion)	
14	0,778	0,000	0,026	0,778	0,778	ISO 17025	XRF (fusion)	ISO 29581-2 2010
15	0,803	0,001	0,483	0,804	0,802	ISO 17025	XRF (fusion)	
16	0,726	0,026	-0,914	0,745	0,708		XRF (fusion)	
17	0,815	0,004	0,693	0,812	0,817		XRF (pressed pellet) - information only	DIN EN 196-2

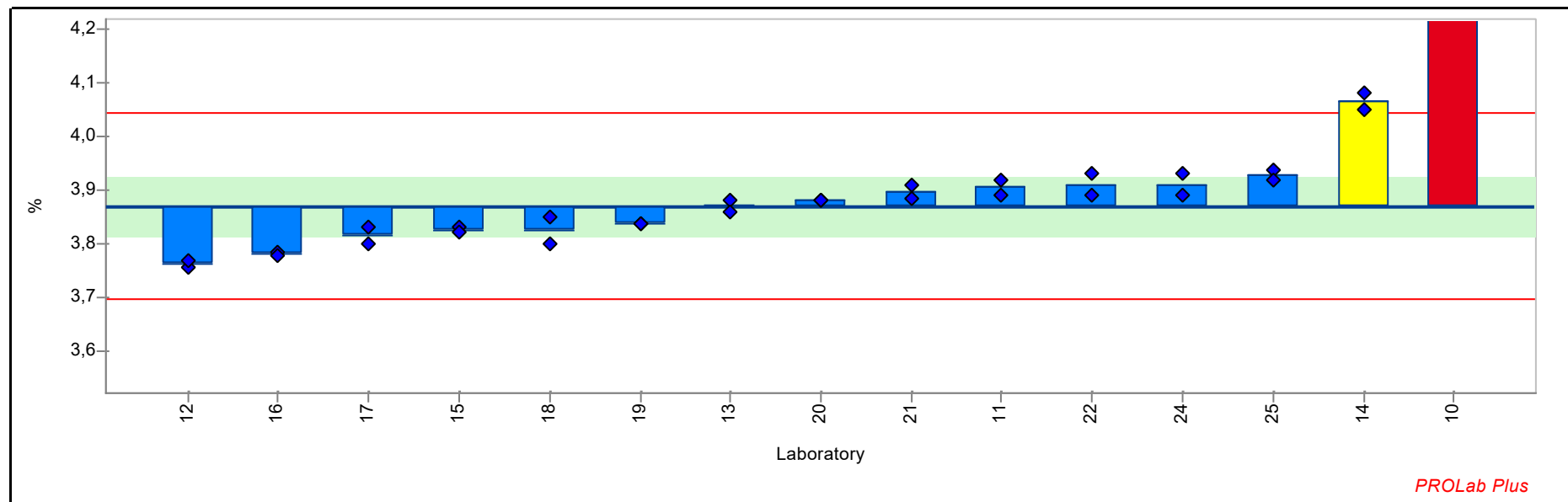
**RV\_2020\_01\_Cement**

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Lab code	Lab mean	s.d.	z-score	Conc. 1	Conc. 2	Accreditation	Analytical method	Comment
18	0,820	0,000	0,793	0,820	0,820		XRF (fusion)	ISO 29581-2 2010
19	0,499	0,004	-5,068	0,502	0,496		XRF (fusion)	
20	0,790	0,000	0,245	0,790	0,790		XRF (fusion)	DIN EN 196-2
21	0,807	0,011	0,556	0,815	0,799	ISO 17025	Other Method	ASTM C1301
22	0,810	0,002	0,601	0,808	0,811		XRF (fusion)	ISO 29581-2 2010
24	0,816	0,001	0,720	0,817	0,815		XRF (fusion)	ISO 29581-2 2014
25	0,782	0,006	0,090	0,786	0,777	ISO 17025	XRF (fusion)	ISO DIN 51001 2003

RV\_2020\_01\_Cement

**Sample:** FLX-1002 **Reproducibility s.d.:** 0,087 %  
**Measurand:** Loss on Ignition **Repeatability s.d.:** 0,021 %  
**Mean ± U(Mean):** 3,870 ± 0,056 % **Range of tolerance:** 3,695 - 4,044 % (|z-score| ≤ 2,000)  
**No. of laboratories:** 15 **Statistical method:** Q/Hampel



PROLab Plus

Lab code	Lab mean	s.d.	z-score	Conc. 1	Conc. 2	Accreditation	Analytical method	Comment
10	4,230	0,000	4,138	4,230	4,230	ISO 17025	Other Method	LOI @ 950°C
11	3,905	0,020	0,407	3,891	3,919		Other Method	LOI @ 950°C
12	3,761	0,011	-1,240	3,754	3,769		Other Method	LOI @ 950°C
13	3,870	0,014	0,006	3,880	3,860	ISO 17025	Other Method	LOI @ 950°C
14	4,065	0,021	2,244	4,080	4,050	ISO 17025	Other Method	LOI @ 950°C
15	3,825	0,007	-0,511	3,830	3,820	ISO 17025	Other Method	LOI @ 950°C
16	3,780	0,004	-1,028	3,783	3,777		Other Method	LOI @ 950°C
17	3,815	0,021	-0,626	3,830	3,800		Other Method	LOI @ 950°C

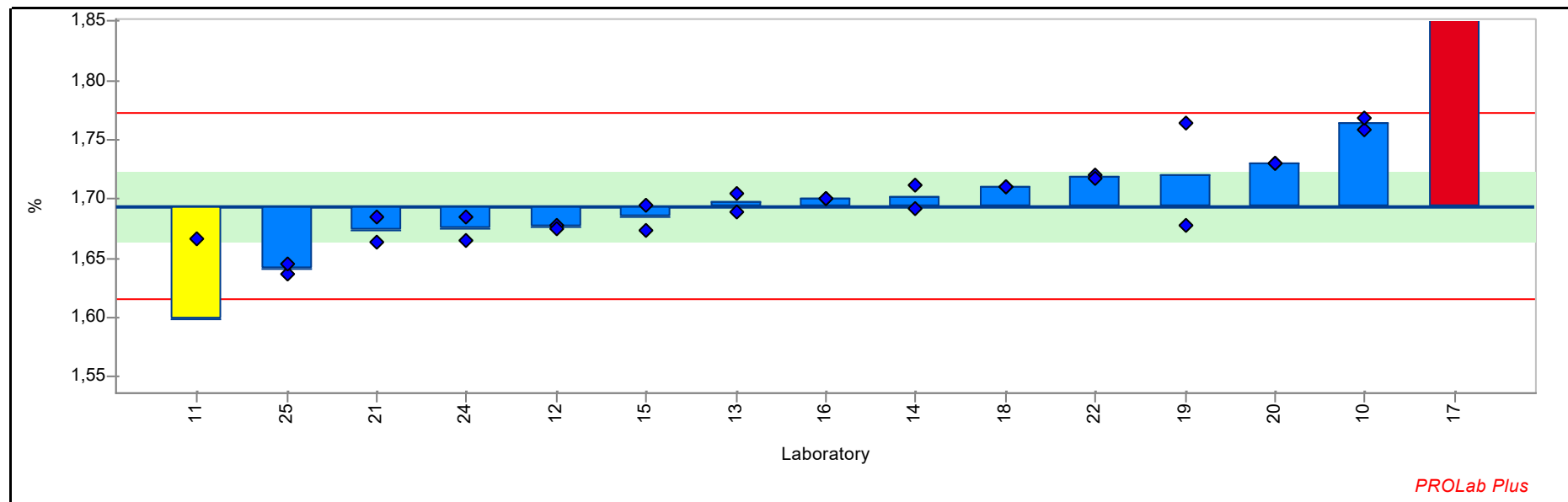
**RV\_2020\_01\_Cement**

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Lab code	Lab mean	s.d.	z-score	Conc. 1	Conc. 2	Accreditation	Analytical method	Comment
18	3,825	0,035	-0,511	3,850	3,800		Other Method	LOI @ 950°C
19	3,837	0,000	-0,373	3,837	3,837		Other Method	LOI @ 950°C
20	3,880	0,000	0,120	3,880	3,880		Other Method	LOI @ 950°C
21	3,896	0,016	0,310	3,885	3,908	ISO 17025	Other Method	LOI @ 950°C
22	3,910	0,028	0,465	3,890	3,930		Other Method	LOI @ 950°C
24	3,910	0,028	0,465	3,890	3,930		Other Method	LOI @ 950°C
25	3,926	0,013	0,654	3,936	3,917	ISO 17025	Other Method	LOI @ 950°C

RV\_2020\_01\_Cement

**Sample:** FLX-1002 **Reproducibility s.d.:** 0,039 %  
**Measurand:** MgO **Repeatability s.d.:** 0,016 %  
**Mean ± U(Mean):** 1,694 ± 0,029 % **Range of tolerance:** 1,615 - 1,773 % (|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
10	1,764	0,006	1,761	1,759	1,768	ISO 17025	XRF (fusion)	ISO 29581-2 2010
11	1,599	0,095	-2,404	1,666	1,532		XRF (fusion)	ISO 29581-2 2010
12	1,676	0,001	-0,455	1,677	1,675		XRF (fusion)	ISO DIN 51001 2003
13	1,697	0,011	0,077	1,705	1,689	ISO 17025	XRF (fusion)	
14	1,702	0,013	0,191	1,711	1,692	ISO 17025	XRF (fusion)	ISO 29581-2 2010
15	1,684	0,015	-0,239	1,674	1,695	ISO 17025	XRF (fusion)	
16	1,700	0,000	0,153	1,700	1,700		XRF (fusion)	
17	1,885	0,001	4,837	1,884	1,886		XRF (pressed pellet) - information only	DIN EN 196-2

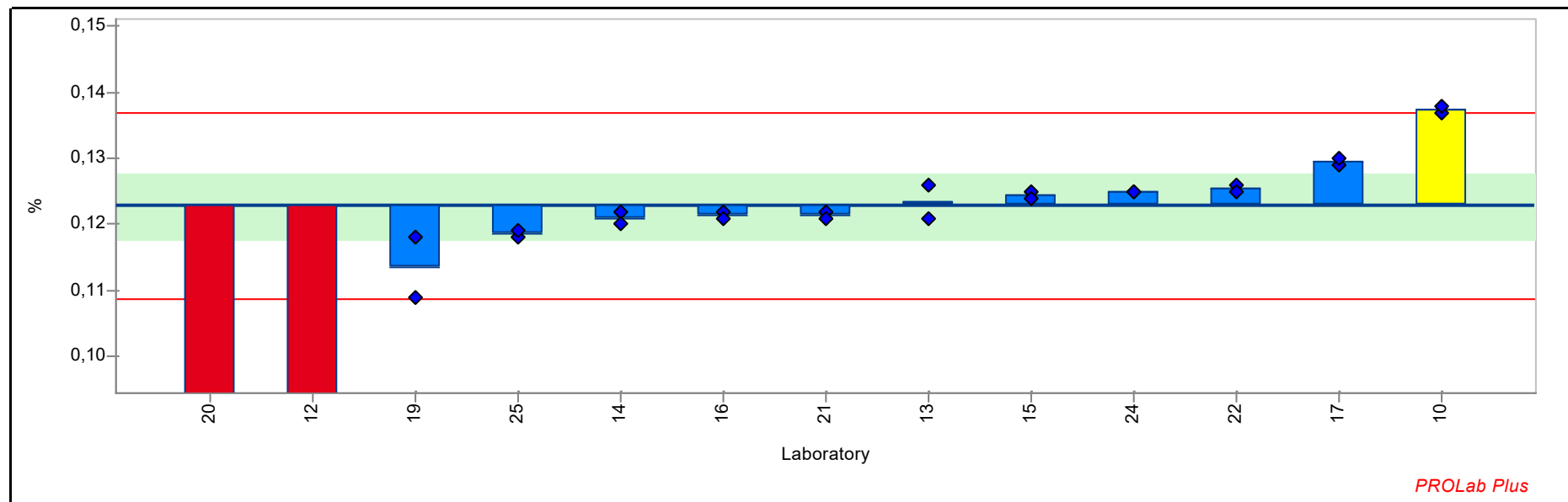
**RV\_2020\_01\_Cement**

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Lab code	Lab mean	s.d.	z-score	Conc. 1	Conc. 2	Accreditation	Analytical method	Comment
18	1,710	0,000	0,406	1,710	1,710		XRF (fusion)	ISO 29581-2 2010
19	1,720	0,062	0,672	1,677	1,764		XRF (fusion)	
20	1,730	0,000	0,913	1,730	1,730		XRF (fusion)	DIN EN 196-2
21	1,674	0,016	-0,505	1,663	1,685	ISO 17025	Other Method	ASTM C1301
22	1,719	0,002	0,621	1,720	1,717		XRF (fusion)	ISO 29581-2 2010
24	1,675	0,014	-0,480	1,685	1,665		XRF (fusion)	ISO 29581-2 2015
25	1,640	0,006	-1,354	1,636	1,645	ISO 17025	XRF (fusion)	ISO DIN 51001 2003

RV\_2020\_01\_Cement

**Sample:** FLX-1002 **Reproducibility s.d.:** 0,007 %  
**Measurand:** Mn2O3 **Repeatability s.d.:** 0,001 %  
**Mean ± U(Mean):** 0,123 ± 0,005 % **Range of tolerance:** 0,109 - 0,137 % (|z-score| ≤ 2,000)  
**No. of laboratories:** 12 **Statistical method:** Q/Hampel



PROLab Plus

Lab code	Lab mean	s.d.	z-score	Conc. 1	Conc. 2	Accreditation	Analytical method	Comment
10	0,138	0,001	2,077	0,137	0,138	ISO 17025	XRF (fusion)	ISO 29581-2 2010
12	0,067	0,002	-7,947	0,068	0,065		XRF (fusion)	ISO DIN 51001 2003
13	0,123	0,004	0,100	0,126	0,121	ISO 17025	XRF (fusion)	
14	0,121	0,001	-0,253	0,122	0,120	ISO 17025	XRF (fusion)	ISO 29581-2 2010
15	0,125	0,001	0,241	0,125	0,124	ISO 17025	XRF (fusion)	
16	0,121	0,001	-0,182	0,122	0,121		XRF (fusion)	
17	0,130	0,001	0,947	0,129	0,130		XRF (pressed pellet) - information only	DIN EN 196-2
19	0,113	0,006	-1,312	0,118	0,109		XRF (fusion)	

**RV\_2020\_01\_Cement**

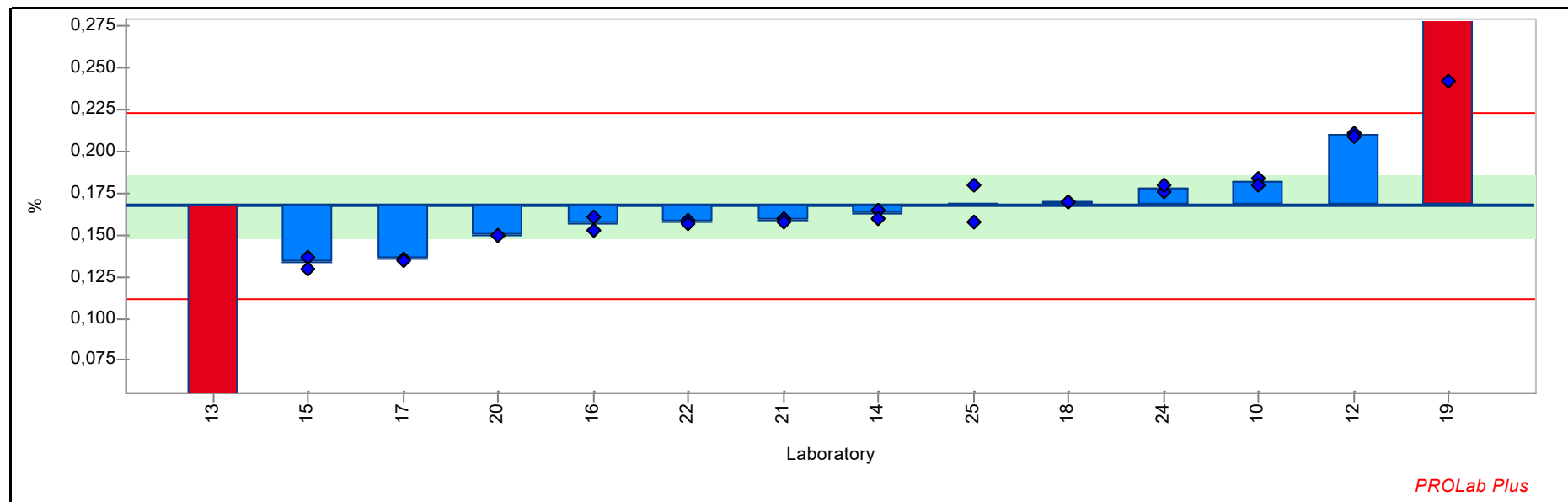
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Lab code	Lab mean	s.d.	z-score	Conc. 1	Conc. 2	Accreditation	Analytical method	Comment
20	0,060	0,000	-8,865	0,060	0,060		XRF (fusion)	DIN EN 196-2
21	0,121	0,001	-0,182	0,122	0,121	ISO 17025	Other Method	ASTM C1301
22	0,126	0,001	0,382	0,126	0,125		XRF (fusion)	ISO 29581-2 2010
24	0,125	0,000	0,312	0,125	0,125		XRF (fusion)	ISO 29581-2 2016
25	0,118	0,001	-0,606	0,118	0,119	ISO 17025	XRF (fusion)	ISO DIN 51001 2003



RV\_2020\_01\_Cement

**Sample:** FLX-1002 **Reproducibility s.d.:** 0,028 %  
**Measurand:** Na2O **Repeatability s.d.:** 0,004 %  
**Mean ± U(Mean):** 0,167 ± 0,018 % **Range of tolerance:** 0,111 - 0,223 % (|z-score| ≤ 2,000)  
**No. of laboratories:** 13 **Statistical method:** Q/Hampel



PROLab Plus

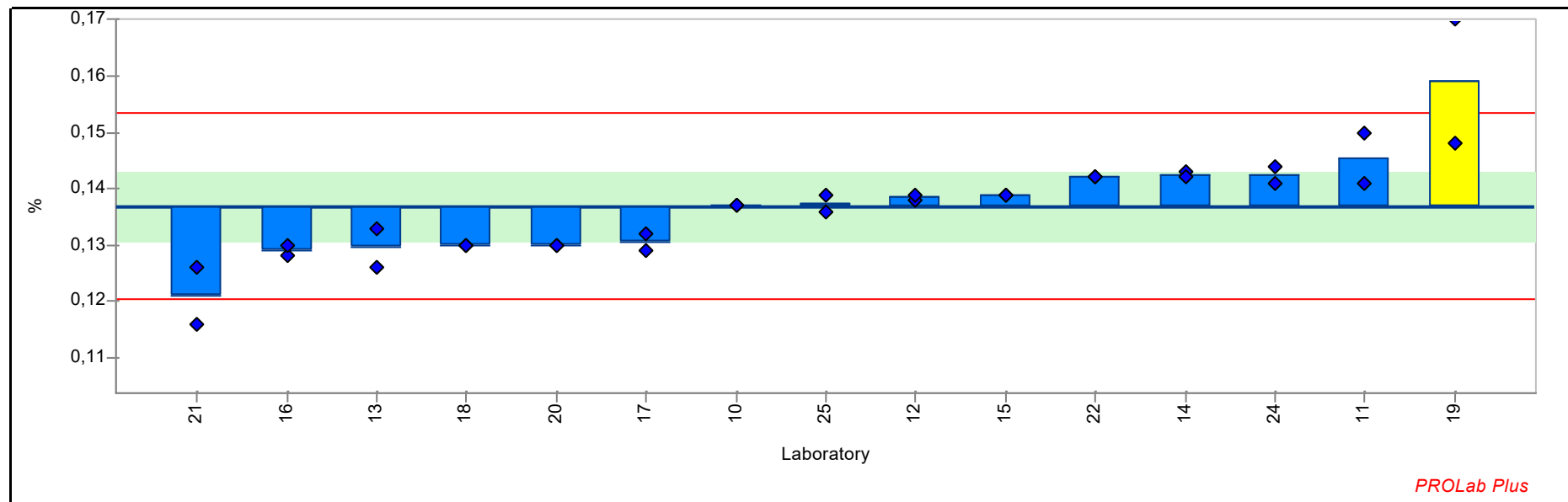
Lab code	Lab mean	s.d.	z-score	Conc. 1	Conc. 2	Accreditation	Analytical method	Comment
10	0,182	0,003	0,524	0,184	0,180	ISO 17025	XRF (fusion)	ISO 29581-2 2010
12	0,210	0,001	1,523	0,211	0,209		XRF (fusion)	ISO DIN 51001 2003
13	0,007	0,002	-5,707	0,009	0,006	ISO 17025	XRF (fusion)	
14	0,163	0,004	-0,173	0,165	0,160	ISO 17025	XRF (fusion)	ISO 29581-2 2010
15	0,134	0,005	-1,208	0,130	0,137	ISO 17025	XRF (fusion)	
16	0,157	0,006	-0,369	0,153	0,161		XRF (fusion)	
17	0,136	0,001	-1,137	0,136	0,135		XRF (pressed pellet) - information only	DIN EN 196-2
18	0,170	0,000	0,095	0,170	0,170		XRF (fusion)	ISO 29581-2 2010

**RV\_2020\_01\_Cement**

Lab code	Lab mean	s.d.	z-score	Conc. 1	Conc. 2	Accreditation	Analytical method	Comment
19	0,281	0,055	4,058	0,242	0,320		XRF (fusion)	
20	0,150	0,000	-0,619	0,150	0,150		XRF (fusion)	DIN EN 196-2
21	0,159	0,001	-0,298	0,160	0,158	ISO 17025	Other Method	ASTM C1301
22	0,158	0,001	-0,333	0,159	0,157		XRF (fusion)	ISO 29581-2 2010
24	0,178	0,003	0,381	0,176	0,180		XRF (fusion)	ISO 29581-2 2017
25	0,169	0,016	0,059	0,158	0,180	ISO 17025	XRF (fusion)	ISO DIN 51001 2003

RV\_2020\_01\_Cement

**Sample:** FLX-1002 **Reproducibility s.d.:** 0,008 %  
**Measurand:** P2O5 **Repeatability s.d.:** 0,003 %  
**Mean ± U(Mean):** 0,137 ± 0,006 % **Range of tolerance:** 0,120 - 0,154 % (|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
10	0,137	0,000	0,010	0,137	0,137	ISO 17025	XRF (fusion)	ISO 29581-2 2010
11	0,145	0,006	1,034	0,141	0,150		XRF (fusion)	ISO 29581-2 2010
12	0,139	0,001	0,191	0,138	0,139		XRF (fusion)	ISO DIN 51001 2003
13	0,130	0,005	-0,893	0,133	0,126	ISO 17025	XRF (fusion)	
14	0,142	0,001	0,673	0,143	0,142	ISO 17025	XRF (fusion)	ISO 29581-2 2010
15	0,139	0,000	0,251	0,139	0,139	ISO 17025	XRF (fusion)	
16	0,129	0,001	-0,954	0,128	0,130		XRF (fusion)	
17	0,131	0,002	-0,773	0,132	0,129		XRF (pressed pellet) - information only	DIN EN 196-2

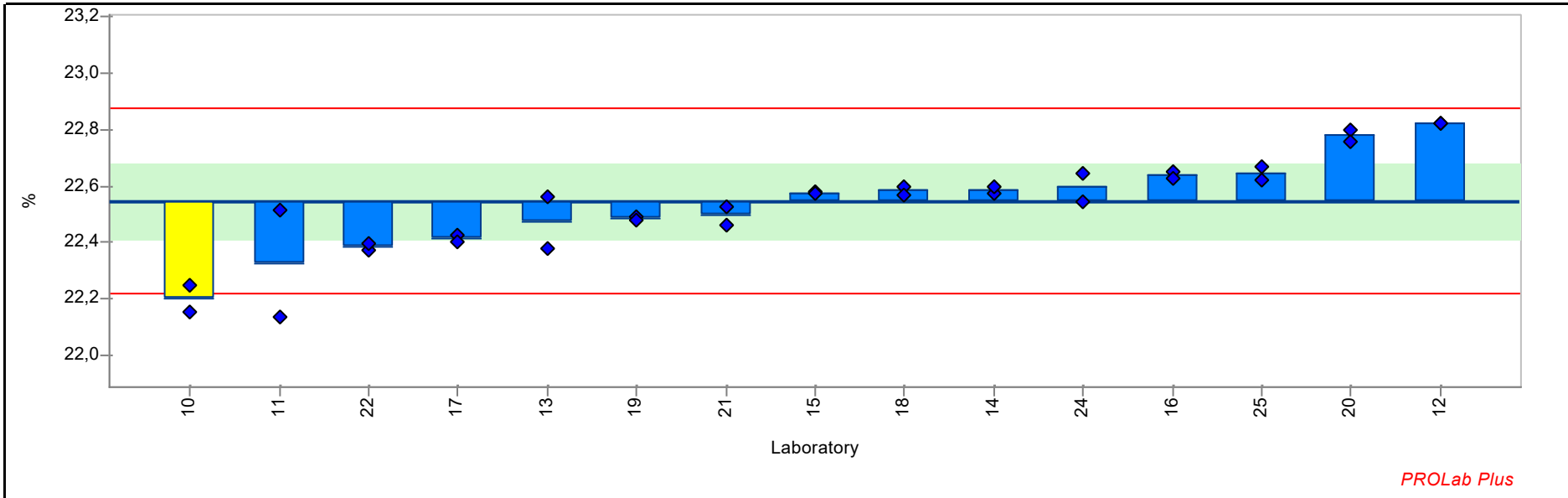
**RV\_2020\_01\_Cement**

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Lab code	Lab mean	s.d.	z-score	Conc. 1	Conc. 2	Accreditation	Analytical method	Comment
18	0,130	0,000	-0,833	0,130	0,130		XRF (fusion)	ISO 29581-2 2010
19	0,159	0,016	2,660	0,170	0,148		XRF (fusion)	
20	0,130	0,000	-0,833	0,130	0,130		XRF (fusion)	DIN EN 196-2
21	0,121	0,007	-1,917	0,126	0,116	ISO 17025	Other Method	ASTM C1301
22	0,142	0,000	0,612	0,142	0,142		XRF (fusion)	ISO 29581-2 2010
24	0,142	0,002	0,673	0,144	0,141		XRF (fusion)	ISO 29581-2 2018
25	0,138	0,002	0,070	0,136	0,139	ISO 17025	XRF (fusion)	ISO DIN 51001 2003

RV\_2020\_01\_Cement

**Sample:** FLX-1002 **Reproducibility s.d.:** 0,165 %  
**Measurand:** SiO2 **Repeatability s.d.:** 0,037 %  
**Mean ± U(Mean):** 22,547 ± 0,134 % **Range of tolerance:** 22,217 - 22,878 % (|z-score| ≤ 2,000)  
**No. of laboratories:** 14 **Statistical method:** Q/Hampel



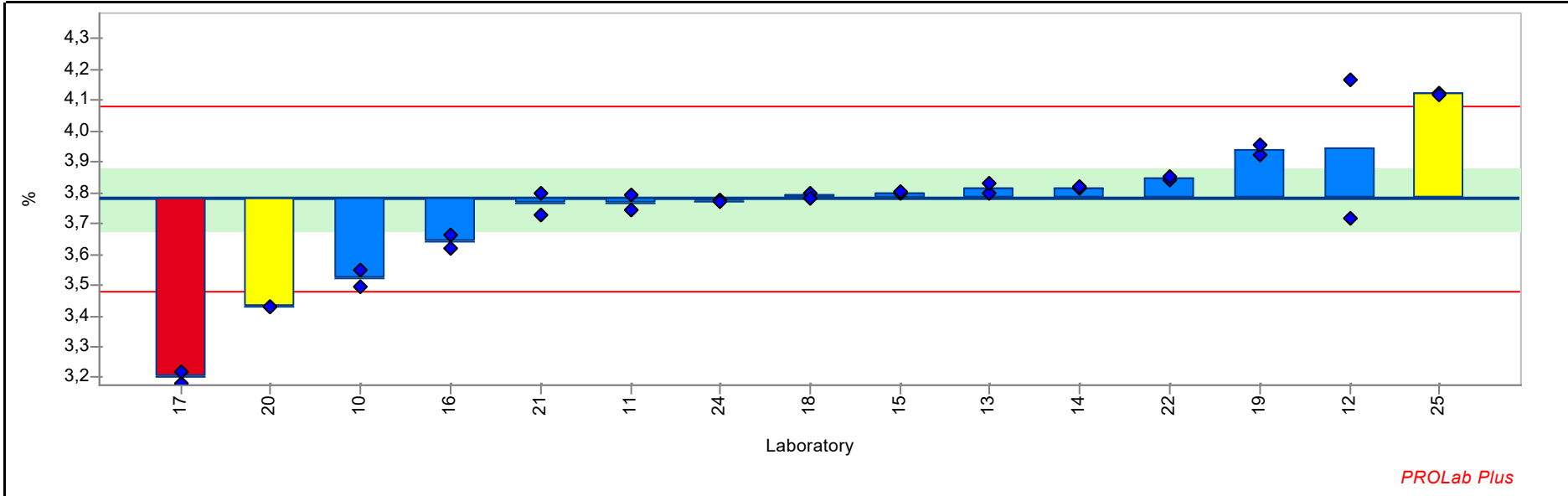
Lab code	Lab mean	s.d.	z-score	Conc. 1	Conc. 2	Accreditation	Analytical method	Comment
10	22,201	0,068	-2,095	22,153	22,249	ISO 17025	XRF (fusion)	ISO 29581-2 2010
11	22,326	0,267	-1,339	22,515	22,137		XRF (fusion)	ISO 29581-2 2010
12	22,822	0,001	1,661	22,821	22,823		XRF (fusion)	ISO DIN 51001 2003
13	22,471	0,132	-0,459	22,565	22,378	ISO 17025	XRF (fusion)	
14	22,587	0,015	0,237	22,576	22,597	ISO 17025	XRF (fusion)	ISO 29581-2 2010
15	22,576	0,006	0,176	22,581	22,572	ISO 17025	XRF (fusion)	
16	22,640	0,014	0,560	22,650	22,630		XRF (fusion)	
17	22,413	0,014	-0,813	22,423	22,403		XRF (pressed pellet) - information only	DIN EN 196-2

**RV\_2020\_01\_Cement**

Lab code	Lab mean	s.d.	z-score	Conc. 1	Conc. 2	Accreditation	Analytical method	Comment
18	22,585	0,021	0,228	22,600	22,570		XRF (fusion)	ISO 29581-2 2010
19	22,485	0,007	-0,377	22,490	22,480		XRF (fusion)	
20	22,780	0,028	1,407	22,800	22,760		XRF (fusion)	DIN EN 196-2
21	22,495	0,048	-0,317	22,529	22,461	ISO 17025	Other Method	ASTM C1301
22	22,385	0,014	-0,982	22,375	22,395		XRF (fusion)	ISO 29581-2 2010
24	22,595	0,071	0,288	22,545	22,645		XRF (fusion)	ISO 29581-2 2019
25	22,643	0,034	0,578	22,619	22,667	ISO 17025	XRF (fusion)	ISO DIN 51001 2003

RV\_2020\_01\_Cement

**Sample:** FLX-1002 **Reproducibility s.d.:** 0,151 %  
**Measurand:** SO3 **Repeatability s.d.:** 0,033 %  
**Mean ± U(Mean):** 3,779 ± 0,102 % **Range of tolerance:** 3,477 - 4,081 % (|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
10	3,521	0,040	-1,710	3,493	3,549	ISO 17025	XRF (fusion)	ISO 29581-2 2010
11	3,768	0,035	-0,073	3,743	3,793		XRF (fusion)	ISO 29581-2 2010
12	3,942	0,320	1,080	3,716	4,168		XRF (fusion)	ISO DIN 51001 2003
13	3,814	0,024	0,232	3,797	3,831	ISO 17025	XRF (fusion)	
14	3,817	0,004	0,248	3,814	3,819	ISO 17025	XRF (fusion)	ISO 29581-2 2010
15	3,800	0,003	0,139	3,798	3,802	ISO 17025	XRF (fusion)	
16	3,643	0,032	-0,905	3,665	3,620		XRF (fusion)	
17	3,200	0,028	-3,837	3,180	3,220		Other Method	Wet chemical analysis

**RV\_2020\_01\_Cement**

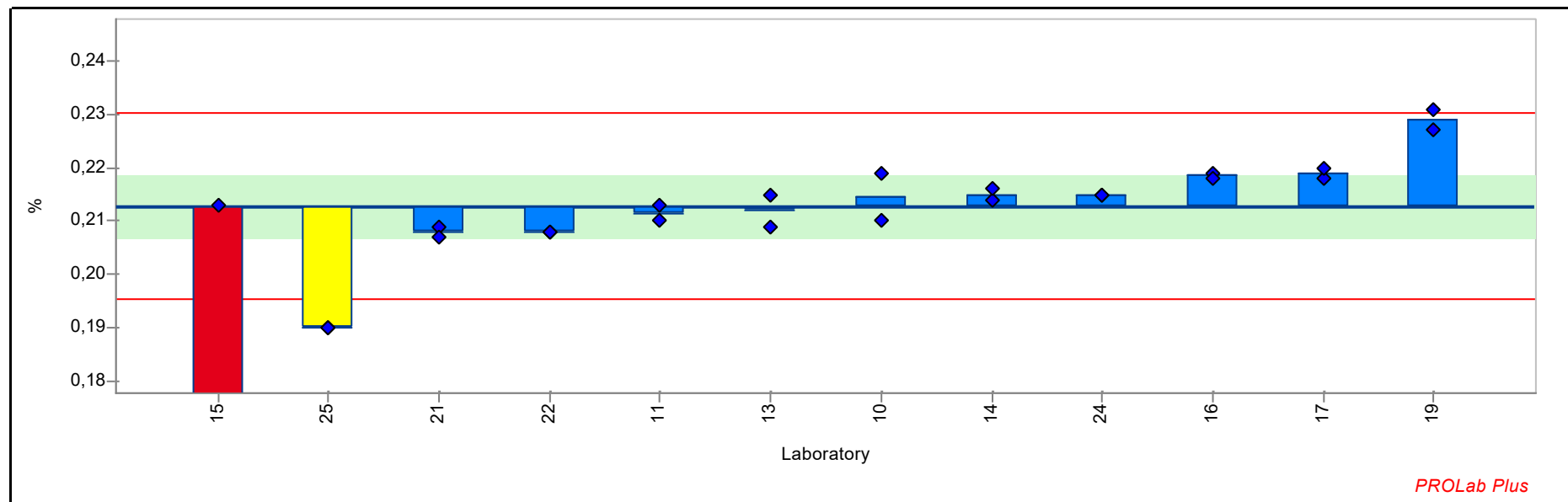
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Lab code	Lab mean	s.d.	z-score	Conc. 1	Conc. 2	Accreditation	Analytical method	Comment
18	3,790	0,014	0,072	3,800	3,780		XRF (fusion)	ISO 29581-2 2010
19	3,939	0,023	1,063	3,923	3,956		XRF (fusion)	
20	3,430	0,000	-2,313	3,430	3,430		Other Method	SO3 gravimetrisch
21	3,763	0,048	-0,106	3,797	3,729	ISO 17025	Other Method	ASTM C1301
22	3,848	0,006	0,457	3,844	3,852		XRF (fusion)	ISO 29581-2 2010
24	3,772	0,005	-0,043	3,776	3,769		XRF (fusion)	ISO 29581-2 2020
25	4,121	0,004	2,269	4,124	4,119	ISO 17025	Other Method	DIN EN ISO 15350 2010



RV\_2020\_01\_Cement

**Sample:** FLX-1002 **Reproducibility s.d.:** 0,009 %  
**Measurand:** SrO **Repeatability s.d.:** 0,003 %  
**Mean ± U(Mean):** 0,213 ± 0,006 % **Range of tolerance:** 0,195 - 0,230 % (|z-score| ≤ 2,000)  
**No. of laboratories:** 11 **Statistical method:** Q/Hampel



Lab code	Lab mean	s.d.	z-score	Conc. 1	Conc. 2	Accreditation	Analytical method	Comment
10	0,214	0,006	0,193	0,219	0,210	ISO 17025	XRF (fusion)	ISO 29581-2 2010
11	0,211	0,002	-0,150	0,213	0,210		XRF (fusion)	ISO 29581-2 2010
13	0,212	0,004	-0,093	0,209	0,215	ISO 17025	XRF (fusion)	
14	0,215	0,001	0,250	0,214	0,216	ISO 17025	XRF (fusion)	ISO 29581-2 2010
15	0,168	0,063	-5,067	0,213	0,124	ISO 17025	XRF (fusion)	
16	0,219	0,001	0,650	0,219	0,218		XRF (fusion)	
17	0,219	0,001	0,708	0,218	0,220		XRF (pressed pellet) - information only	DIN EN 196-2
19	0,229	0,003	1,851	0,231	0,227		XRF (fusion)	

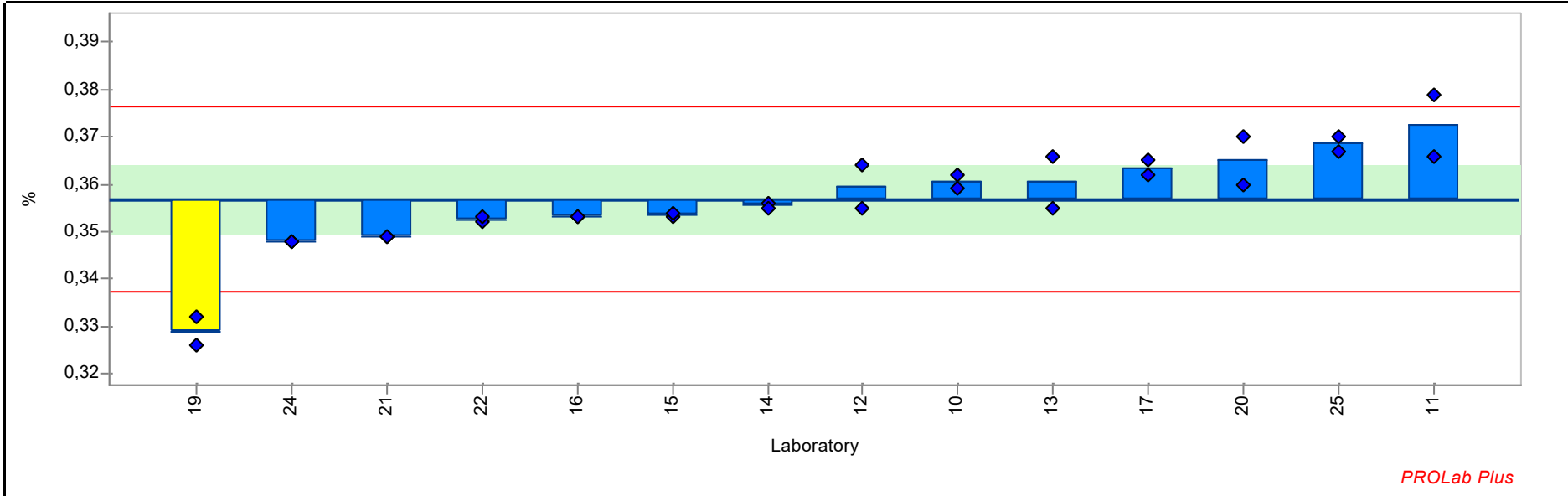
**RV\_2020\_01\_Cement**

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Lab code	Lab mean	s.d.	z-score	Conc. 1	Conc. 2	Accreditation	Analytical method	Comment
21	0,208	0,001	-0,550	0,209	0,207	ISO 17025	Other Method	ASTM C1301
22	0,208	0,000	-0,550	0,208	0,208		XRF (fusion)	ISO 29581-2 2010
24	0,215	0,000	0,250	0,215	0,215		XRF (fusion)	ISO 29581-2 2021
25	0,190	0,000	-2,609	0,190	0,190	ISO 17025	XRF (fusion)	ISO DIN 51001 2003

RV\_2020\_01\_Cement

**Sample:** FLX-1002 **Reproducibility s.d.:** 0,010 %  
**Measurand:** TiO2 **Repeatability s.d.:** 0,004 %  
**Mean ± U(Mean):** 0,357 ± 0,007 % **Range of tolerance:** 0,337 - 0,377 % (|z-score| ≤ 2,000)  
**No. of laboratories:** 13 **Statistical method:** Q/Hampel



Lab code	Lab mean	s.d.	z-score	Conc. 1	Conc. 2	Accreditation	Analytical method	Comment
10	0,360	0,002	0,370	0,359	0,362	ISO 17025	XRF (fusion)	ISO 29581-2 2010
11	0,372	0,009	1,592	0,366	0,379		XRF (fusion)	ISO 29581-2 2010
12	0,359	0,006	0,268	0,355	0,364		XRF (fusion)	ISO DIN 51001 2003
13	0,360	0,008	0,370	0,366	0,355	ISO 17025	XRF (fusion)	
14	0,355	0,001	-0,139	0,356	0,355	ISO 17025	XRF (fusion)	ISO 29581-2 2010
15	0,353	0,001	-0,342	0,353	0,354	ISO 17025	XRF (fusion)	
16	0,353	0,000	-0,393	0,353	0,353		XRF (fusion)	
17	0,363	0,002	0,676	0,365	0,362		XRF (pressed pellet) - information only	DIN EN 196-2

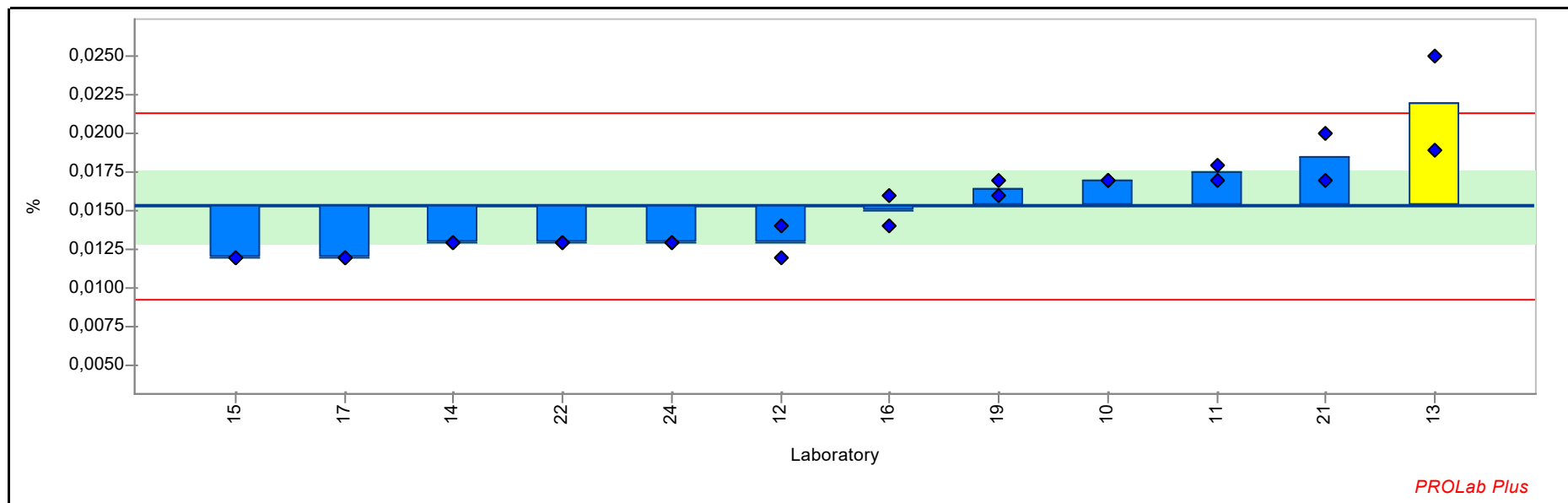
**RV\_2020\_01\_Cement**

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Lab code	Lab mean	s.d.	z-score	Conc. 1	Conc. 2	Accreditation	Analytical method	Comment
19	0,329	0,004	-2,837	0,332	0,326		XRF (fusion)	
20	0,365	0,007	0,828	0,370	0,360		XRF (fusion)	DIN EN 196-2
21	0,349	0,000	-0,801	0,349	0,349	ISO 17025	Other Method	ASTM C1301
22	0,352	0,001	-0,444	0,352	0,353		XRF (fusion)	ISO 29581-2 2010
24	0,348	0,000	-0,902	0,348	0,348		XRF (fusion)	ISO 29581-2 2022
25	0,368	0,002	1,185	0,367	0,370	ISO 17025	XRF (fusion)	ISO DIN 51001 2003

RV\_2020\_01\_Cement

**Sample:** FLX-1002 **Reproducibility s.d.:** 0,003 %  
**Measurand:** ZnO **Repeatability s.d.:** 0,001 %  
**Mean ± U(Mean):** 0,015 ± 0,002 % **Range of tolerance:** 0,009 - 0,021 % (|z-score| ≤ 2,000)  
**No. of laboratories:** 11 **Statistical method:** Q/Hampel



Lab code	Lab mean	s.d.	z-score	Conc. 1	Conc. 2	Accreditation	Analytical method	Comment
10	0,017	0,000	0,558	0,017	0,017	ISO 17025	XRF (fusion)	ISO 29581-2 2010
11	0,018	0,001	0,723	0,017	0,018		XRF (fusion)	ISO 29581-2 2010
12	0,013	0,001	-0,759	0,014	0,012		XRF (fusion)	ISO DIN 51001 2003
13	0,022	0,004	2,205	0,019	0,025	ISO 17025	XRF (fusion)	
14	0,013	0,000	-0,759	0,013	0,013	ISO 17025	XRF (fusion)	ISO 29581-2 2010
15	0,012	0,000	-1,089	0,012	0,012	ISO 17025	XRF (fusion)	
16	0,015	0,001	-0,101	0,014	0,016		XRF (fusion)	
17	0,012	0,000	-1,089	0,012	0,012		XRF (pressed pellet) - information only	DIN EN 196-2

**RV\_2020\_01\_Cement**

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Lab code	Lab mean	s.d.	z-score	Conc. 1	Conc. 2	Accreditation	Analytical method	Comment
19	0,017	0,001	0,393	0,017	0,016		XRF (fusion)	
21	0,019	0,002	1,052	0,020	0,017	ISO 17025	Other Method	ASTM C1301
22	0,013	0,000	-0,759	0,013	0,013		XRF (fusion)	ISO 29581-2 2010
24	0,013	0,000	-0,759	0,013	0,013		XRF (fusion)	ISO 29581-2 2023

Ring test RV\_2020\_01\_Cement

## Survey of scores

Lab code	Al2O3	BaO	CaO	Cr2O3	Fe2O3	K2O	LOI	MgO	Mn2O3	Na2O	P2O5	SiO2	SO3	SrO	TiO2	V2O5	ZnO	ZrO2
10	1,717	0,400	4,158	0,780	2,141	-1,641	-0,384	2,138	1,175	0,203	0,543	-1,873	-6,539	0,993	1,029		0,772	0,977
11	2,490		4,120		1,505	1,641	-0,269	-1,347			-0,290	-1,345	-0,102	-0,901	1,456		0,589	-0,304
12	-0,966		-1,535	2,312	-0,703	-1,132	-1,144	-0,496	-0,484	-1,604	0,847	1,695	0,855		0,223	-0,282	0,040	-0,385
13	-0,007		-0,191	-0,752	0,057	-1,069	-0,524	-0,259	0,014	-5,545	-0,897	-0,717	-0,109	-0,208	0,318			-2,154
14	-0,023	0,240	0,816	0,110	0,189	0,339	2,016	0,040	-0,982	1,899	0,695	1,205	-0,124	0,577	0,270	-0,282		-0,508
15	-0,430		-0,642	-0,273	-0,447	0,127	-0,034	-0,117	1,009	-0,327	0,164	0,160	0,074	0,577	-0,489			-1,422
16	0,544		0,203	-0,273	-1,383	-0,191	-0,574	0,230	0,180	-0,436	-0,707	0,537	-0,863	0,115	-0,489	1,046	1,137	-0,465
17	4,382	-0,856	-1,779	0,110	2,706	-2,424	1,416	1,491	0,677	-1,859	-0,821	1,968	-1,816	-0,069	4,540			-1,422
18	-0,116		-0,473		1,708	0,656	0,066	0,624		0,166	-1,465	0,598	0,584					
19	-1,522	2,111	-0,188		-1,056	-5,779	2,606	-0,638	-0,318	-0,874	1,984	0,055	0,973	0,993	-0,916	0,322	0,406	4,503
20	-0,427		0,844		0,207	-0,402	-2,034	-0,480	-1,479	0,531	0,430	0,414	-1,206	0,346	-0,489			
21	-0,827	-0,482	0,137	0,301	0,233	0,646	0,371	2,154	0,014	-0,272	-1,465	-0,371	-0,292	-0,577	-1,058	0,080	0,772	
22	0,304	-0,241	0,203	0,397	-0,597	0,487	-0,484	0,624	0,180	0,732	0,164	-0,552	0,283	-0,485	-0,631		0,040	0,176
24	-0,178	0,080	0,300	-1,135	-0,147	0,328	-0,484	-0,007	1,175	0,403	0,543	-0,220	-0,071	0,069	-0,726	13,840	-0,325	
25	0,626	-1,497	-0,233	-0,656	-0,853	0,212	0,546	-1,174	-0,484	-0,126	-0,063	0,236	1,548	-1,778	1,504	-0,885		

Ring test RV\_2020\_01\_Cement

## Survey of scores

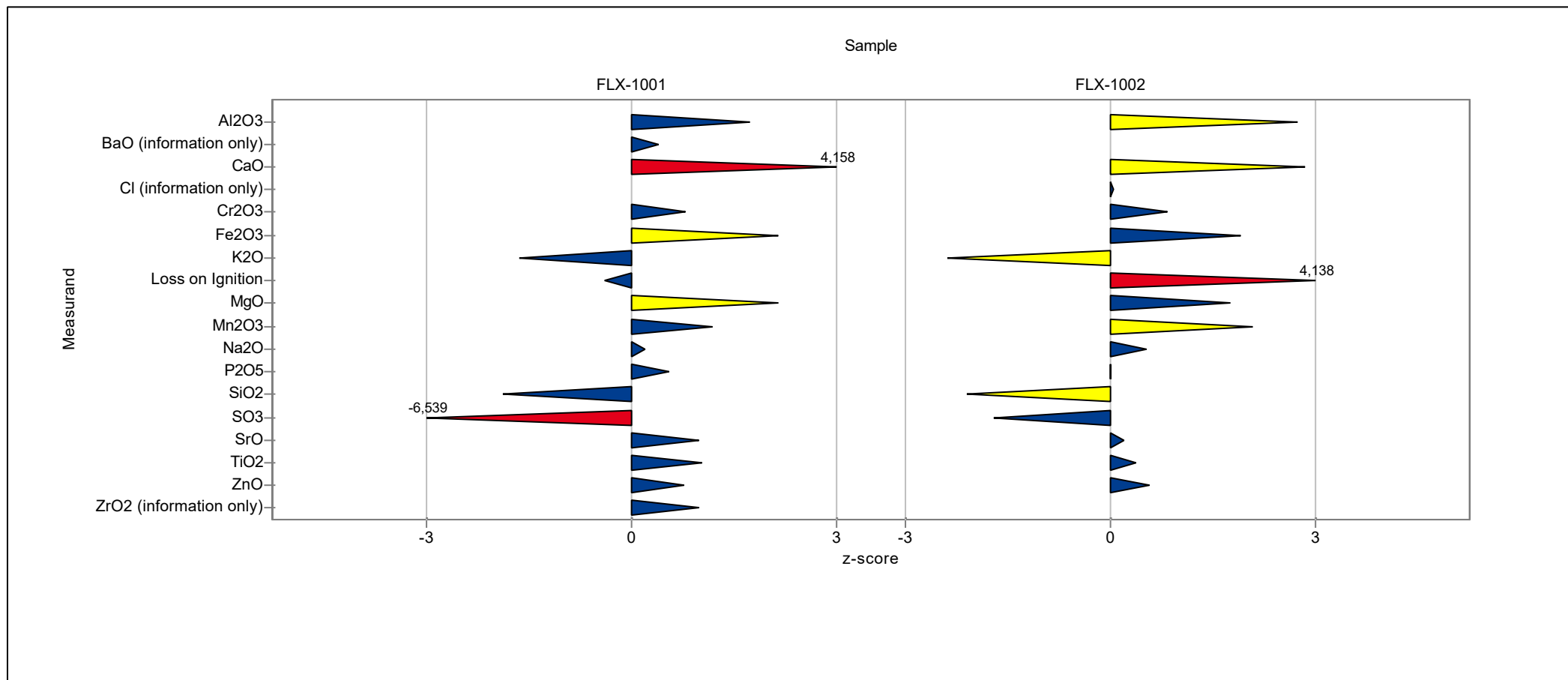
Lab code	Al2O3	CaO	Cl	Cr2O3	Fe2O3	K2O	LOI	MgO	Mn2O3	Na2O	P2O5	SiO2	SO3	SrO	TiO2	ZnO
10	2,726	2,848	0,045	0,841	1,907	-2,375	4,138	1,761	2,077	0,524	0,010	-2,095	-1,710	0,193	0,370	0,558
11	-1,279	5,526			2,210	0,793	0,407	-2,404			1,034	-1,339	-0,073	-0,150	1,592	0,723
12	-1,033	-2,085		1,237	-0,200	-1,069	-1,240	-0,455	-7,947	1,523	0,191	1,661	1,080		0,268	-0,759
13	0,530	-0,438		0,445	-0,200	-0,823	0,006	0,077	0,100	-5,707	-0,893	-0,459	0,232	-0,093	0,370	2,205
14	-0,082	-0,589	-0,277	0,049	-0,241	0,026	2,244	0,191	-0,253	-0,173	0,673	0,237	0,248	0,250	-0,139	-0,759
15	-0,336	-0,612	-0,856	-0,478	0,131	0,483	-0,511	-0,239	0,241	-1,208	0,251	0,176	0,139	-5,067	-0,342	-1,089
16	0,720	-0,052		-0,215	-1,907	-0,914	-1,028	0,153	-0,182	-0,369	-0,954	0,560	-0,905	0,650	-0,393	-0,101
17	-4,298	2,097	-0,180	0,049	1,852	0,693	-0,626	4,837	0,947	-1,137	-0,773	-0,813	-3,837	0,708	0,676	-1,089
18	-0,019	-0,077	0,174		0,227	0,793	-0,511	0,406		0,095	-0,833	0,228	0,072			
19	-1,047	-0,388			-1,976	-5,068	-0,373	0,672	-1,312	4,058	2,660	-0,377	1,063	1,851	-2,837	0,393
20	0,826	0,843	0,657		1,053	0,245	0,120	0,913	-8,865	-0,619	-0,833	1,407	-2,313		0,828	
21	-0,533	0,569	0,914	0,181	-0,392	0,556	0,310	-0,505	-0,182	-0,298	-1,917	-0,317	-0,106	-0,550	-0,801	1,052
22	0,474	0,199		0,313	-0,723	0,601	0,465	0,621	0,382	-0,333	0,612	-0,982	0,457	-0,550	-0,444	-0,759
24	-0,153	0,241		-1,666	-0,186	0,720	0,465	-0,480	0,312	0,381	0,673	0,288	-0,043	0,250	-0,902	-0,759
25	0,431	0,304		-0,874	0,530	0,090	0,654	-1,354	-0,606	0,059	0,070	0,578	2,269	-2,609	1,185	



RV\_2020\_01\_Cement

# Laboratory chart of z-scores

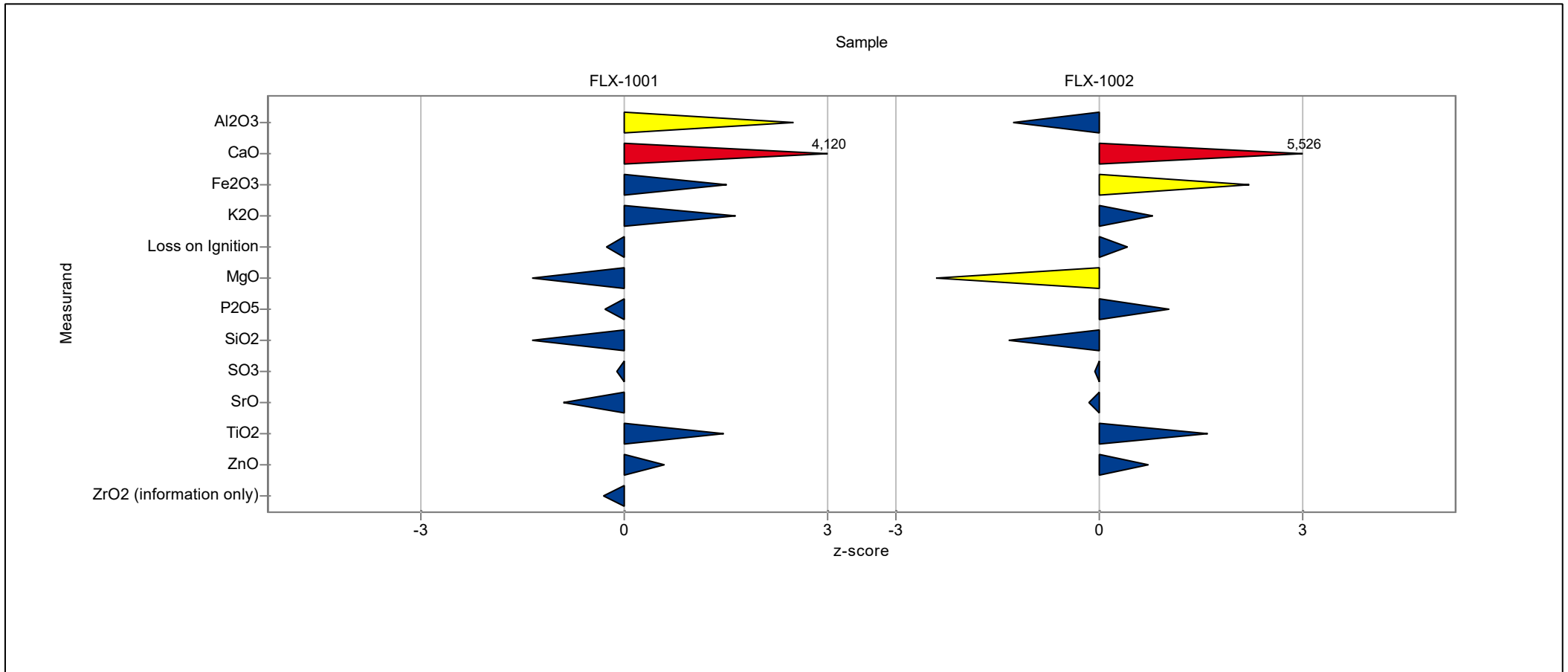
Laboratory: 10



RV\_2020\_01\_Cement

# Laboratory chart of z-scores

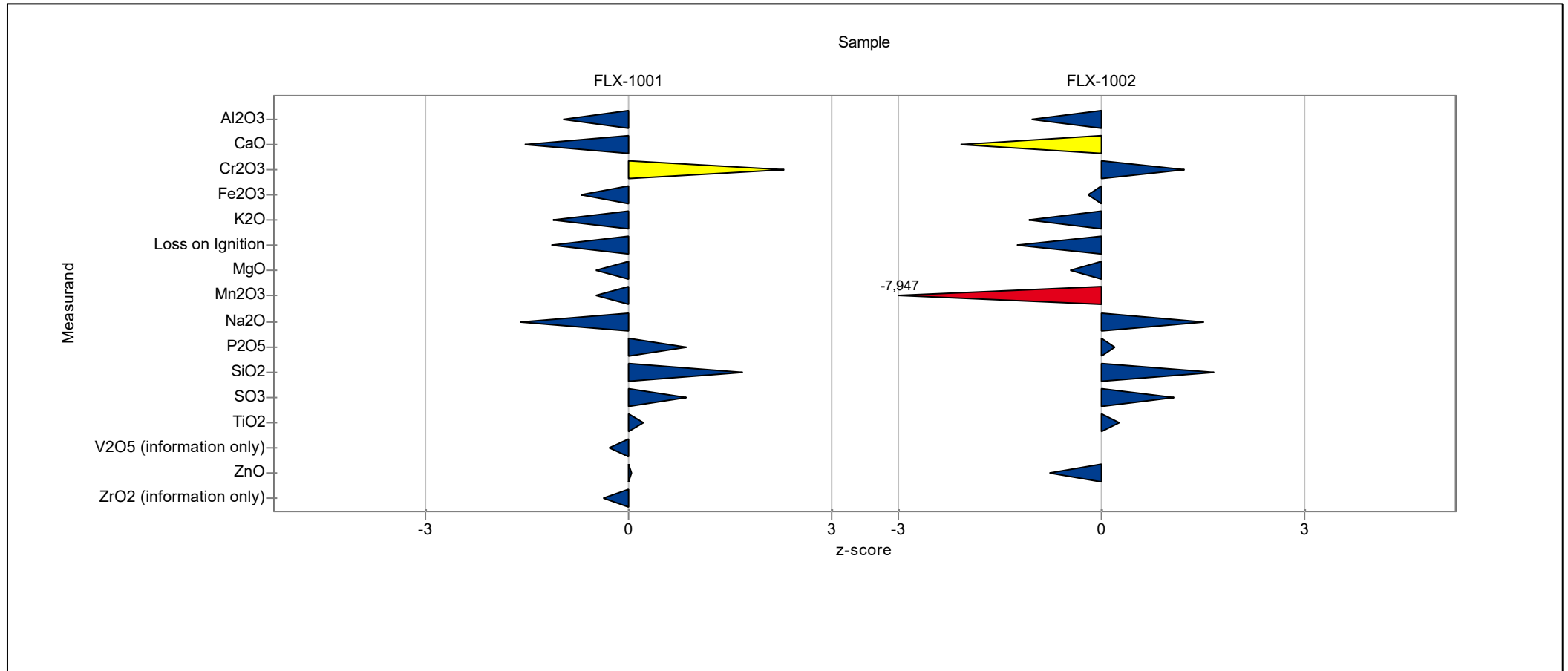
Laboratory: 11



RV\_2020\_01\_Cement

# Laboratory chart of z-scores

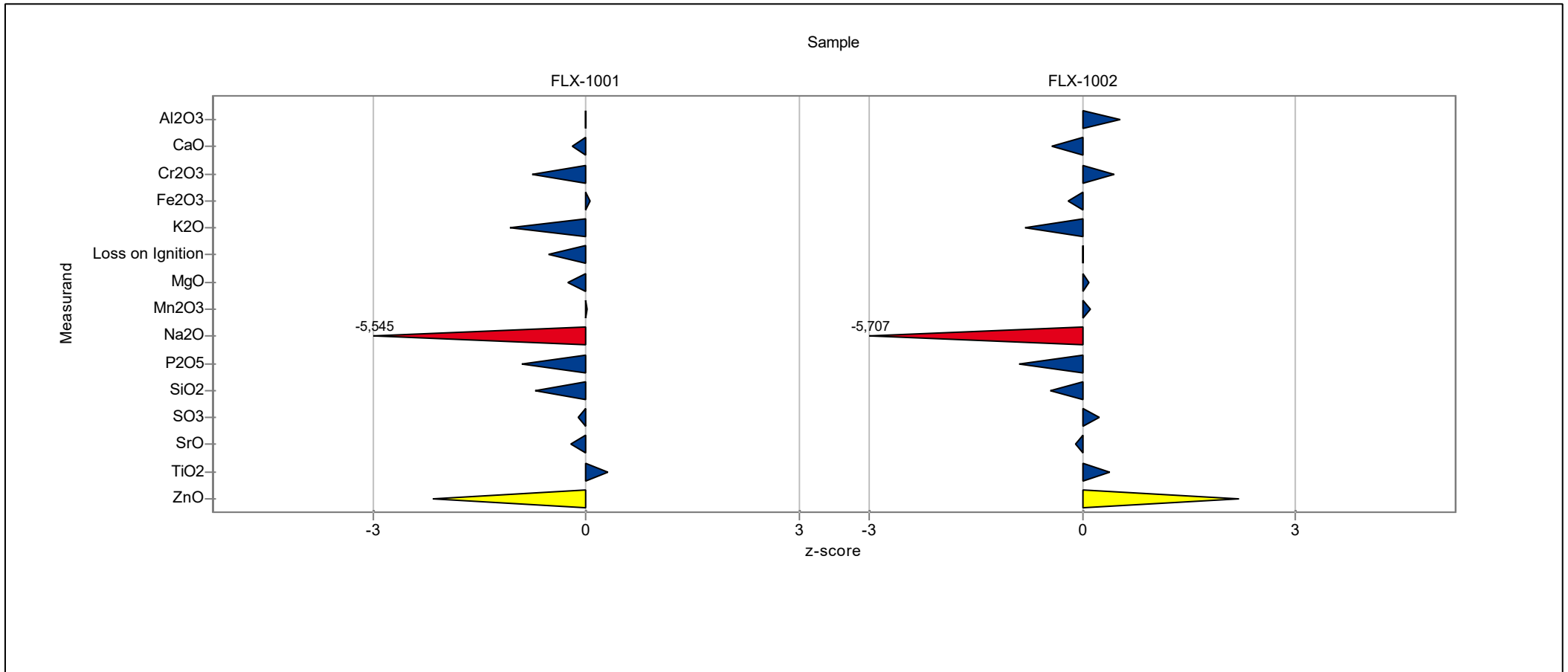
Laboratory: 12



RV\_2020\_01\_Cement

# Laboratory chart of z-scores

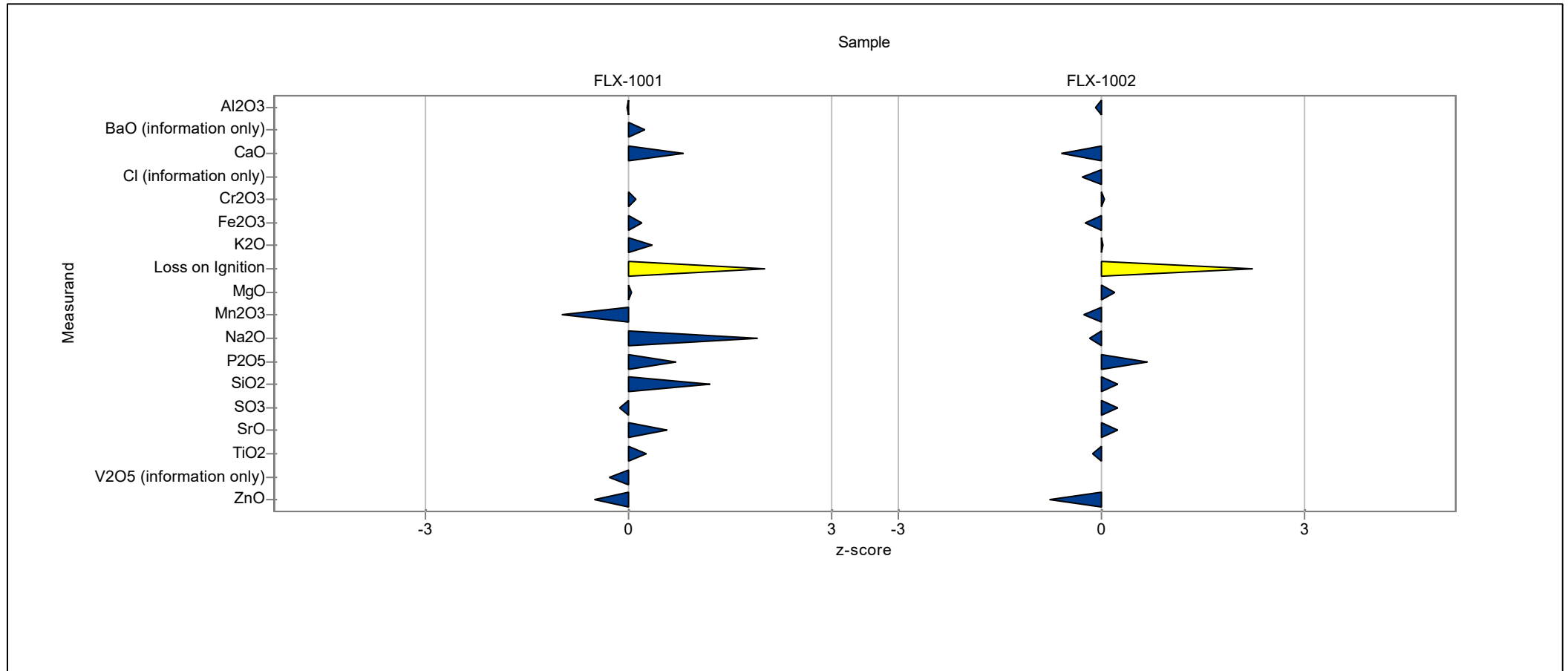
Laboratory: 13



RV\_2020\_01\_Cement

## Laboratory chart of z-scores

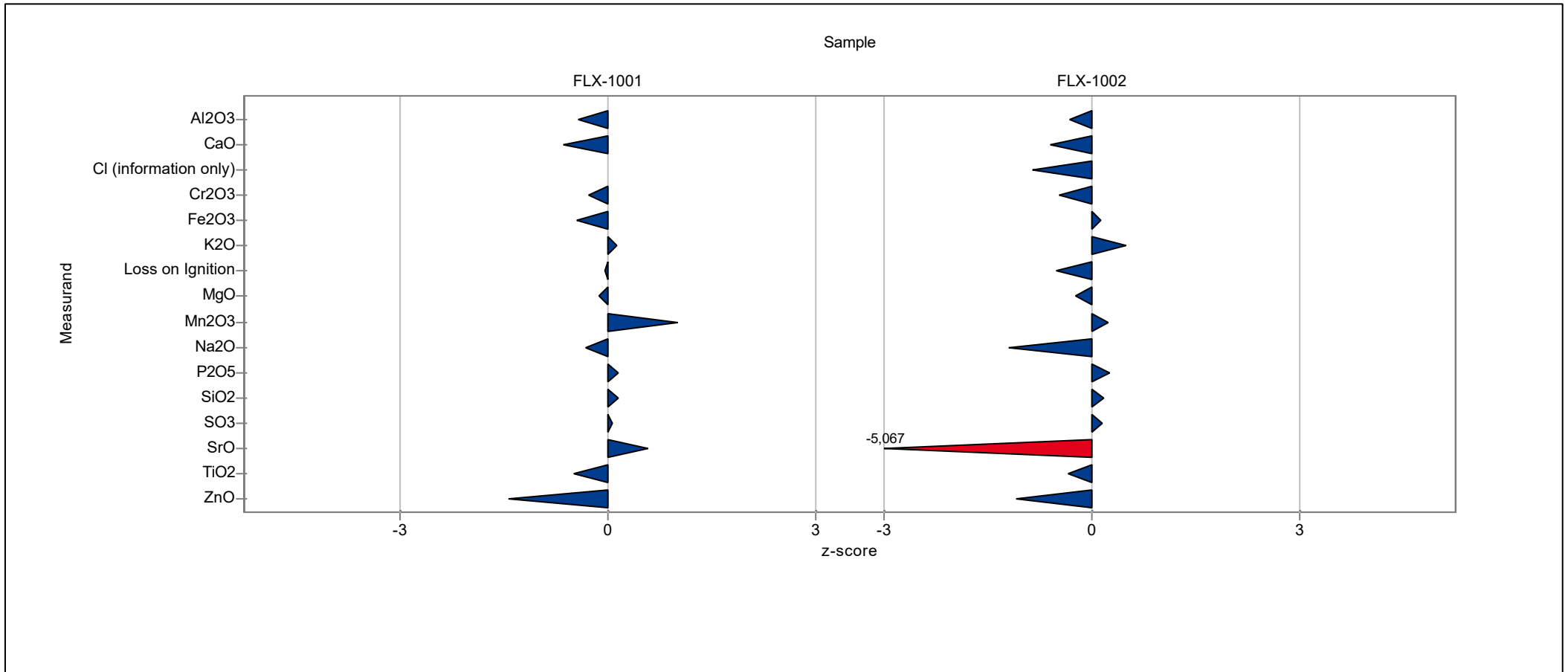
Laboratory: 14



RV\_2020\_01\_Cement

# Laboratory chart of z-scores

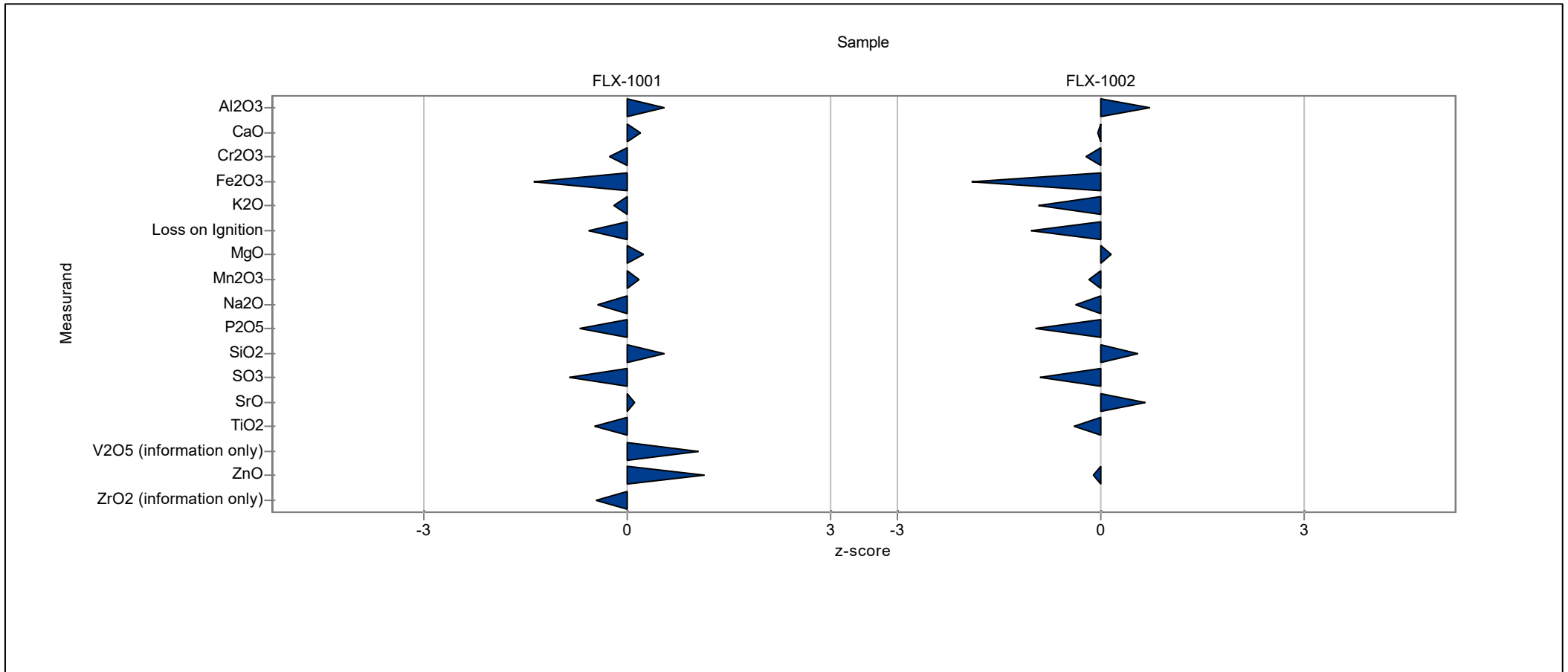
Laboratory: 15



RV\_2020\_01\_Cement

# Laboratory chart of z-scores

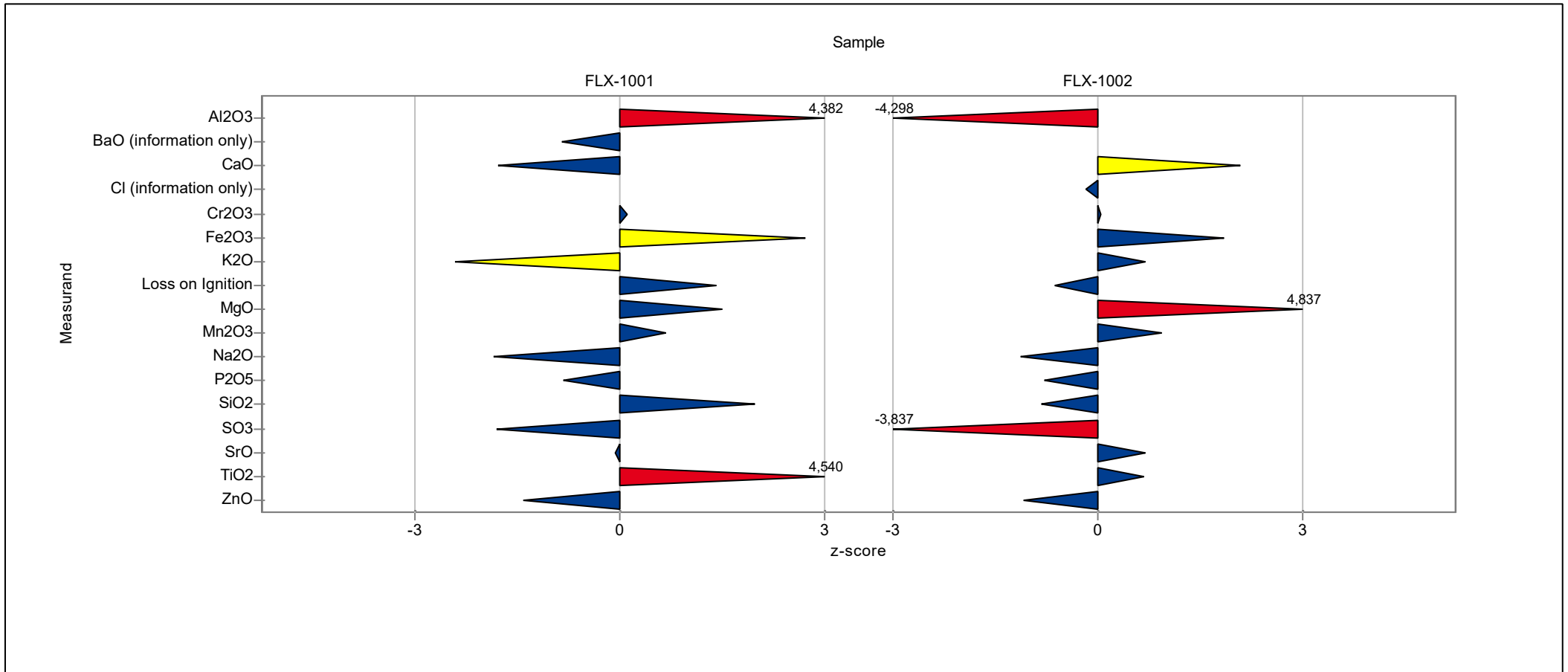
Laboratory: 16



RV\_2020\_01\_Cement

# Laboratory chart of z-scores

Laboratory: 17

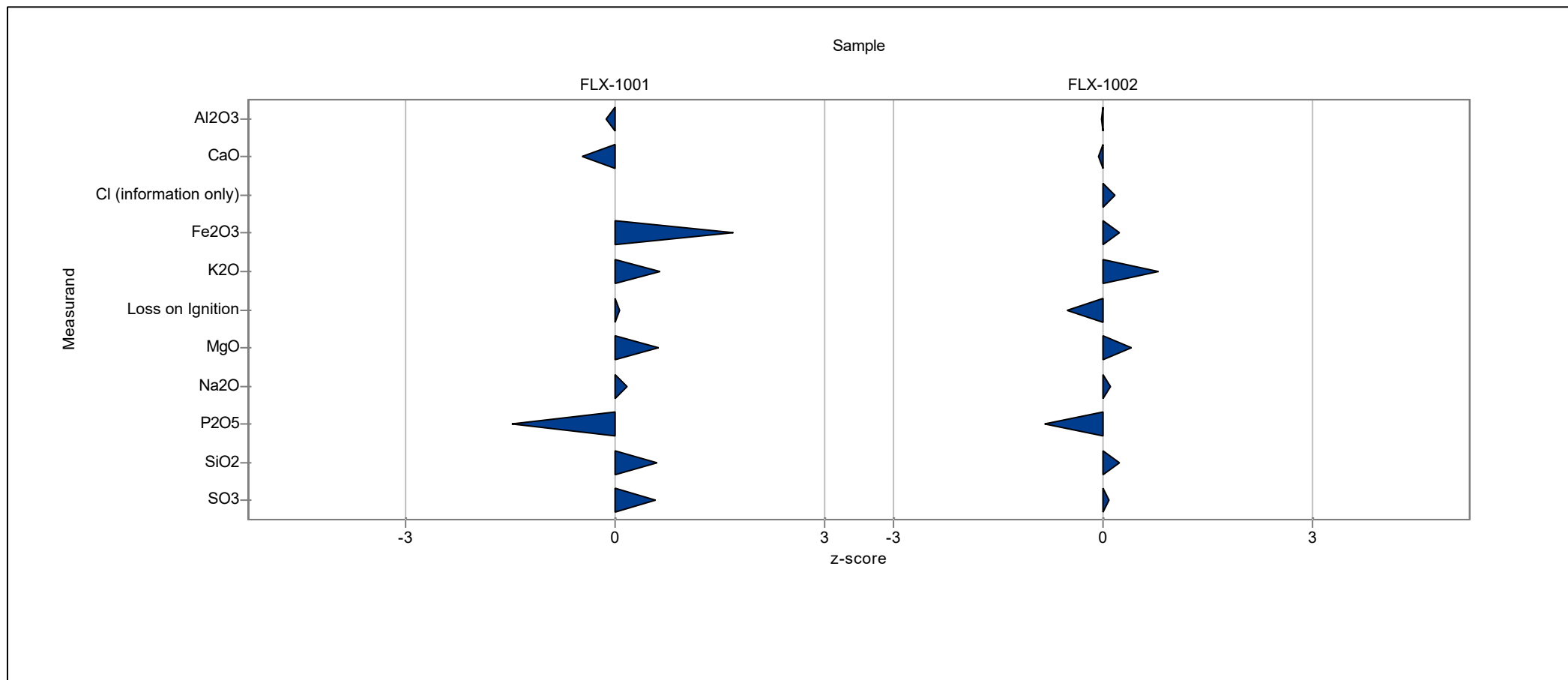




RV\_2020\_01\_Cement

## Laboratory chart of z-scores

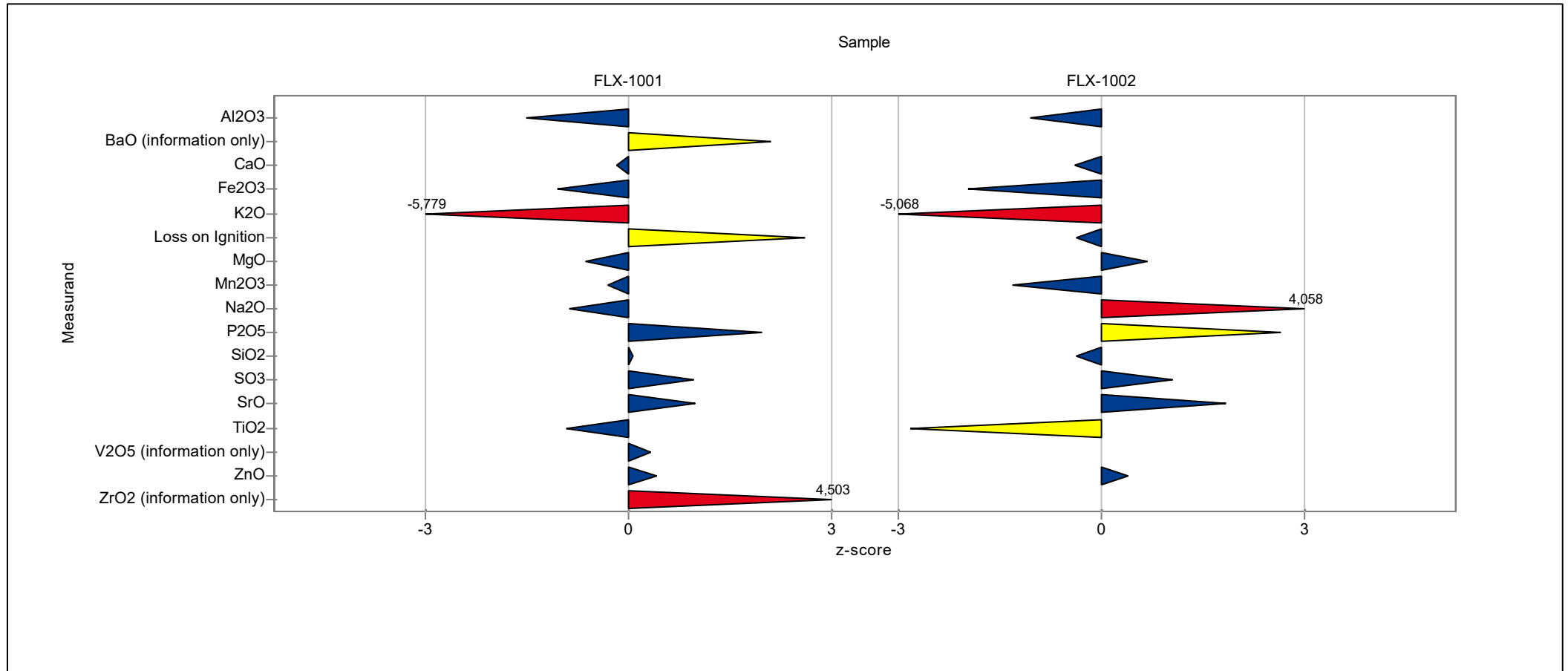
Laboratory: 18



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# Laboratory chart of z-scores

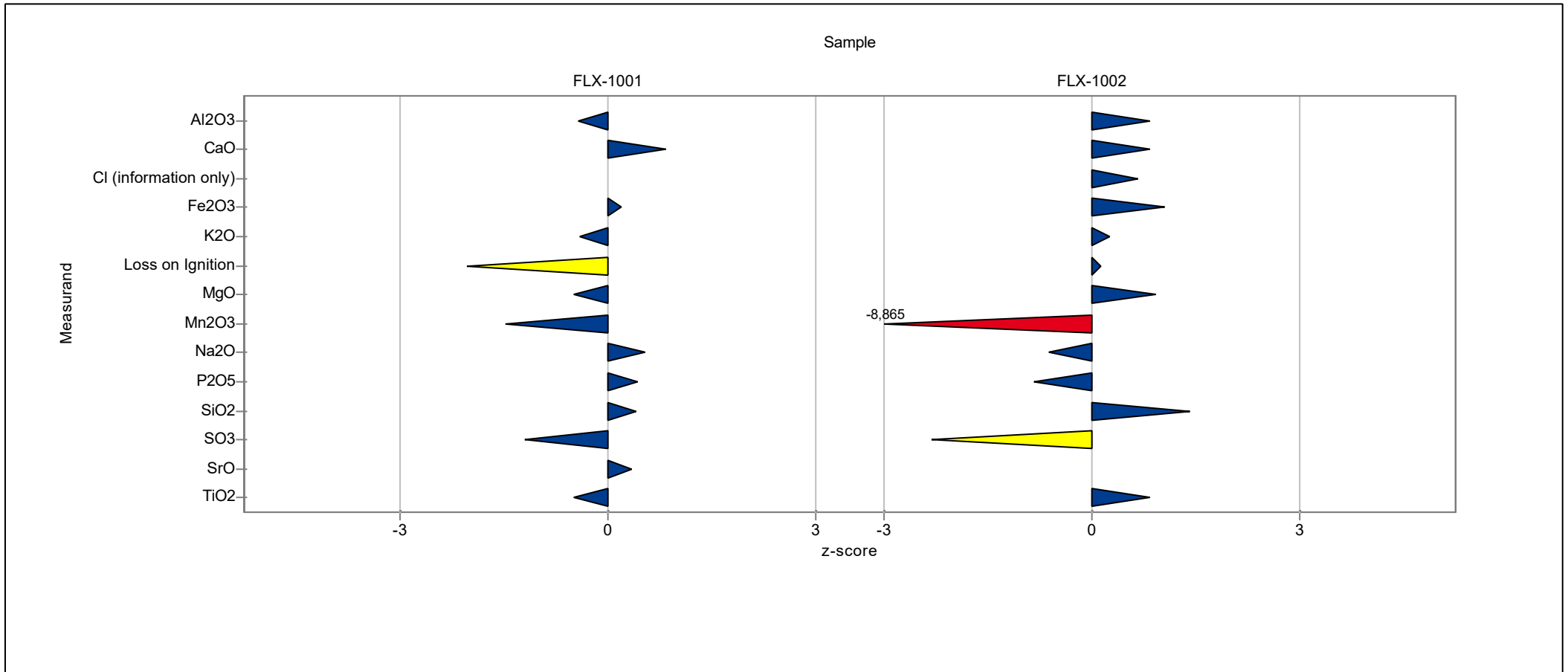
Laboratory: 19



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# Laboratory chart of z-scores

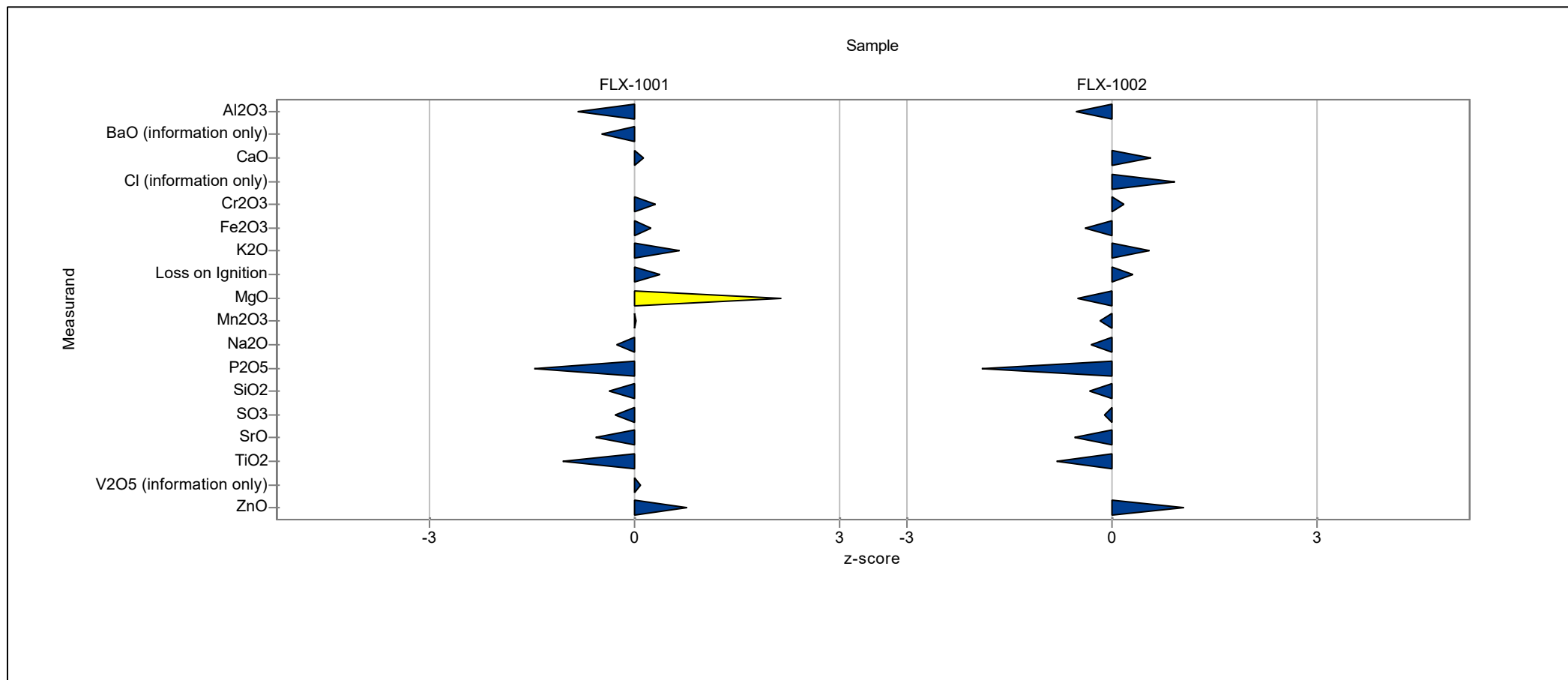
Laboratory: 20



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## Laboratory chart of z-scores

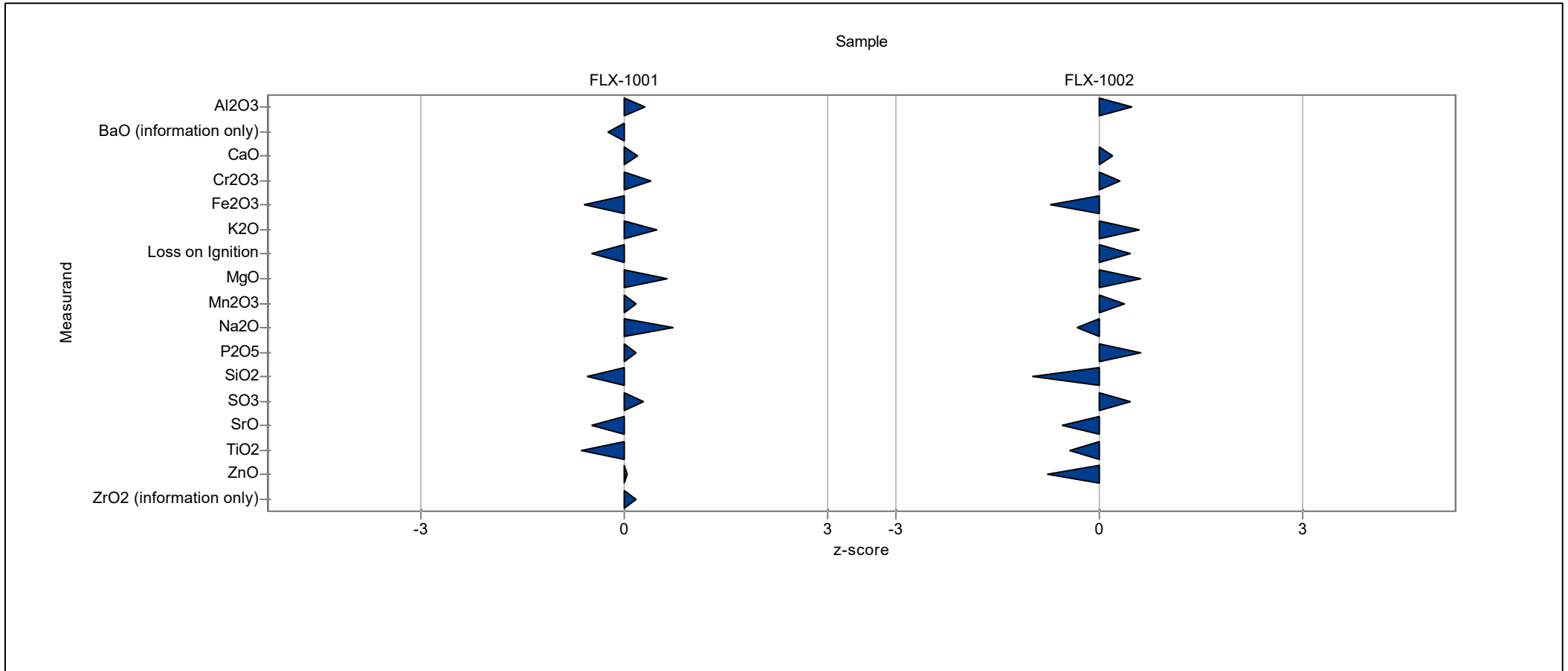
Laboratory: 21



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# Laboratory chart of z-scores

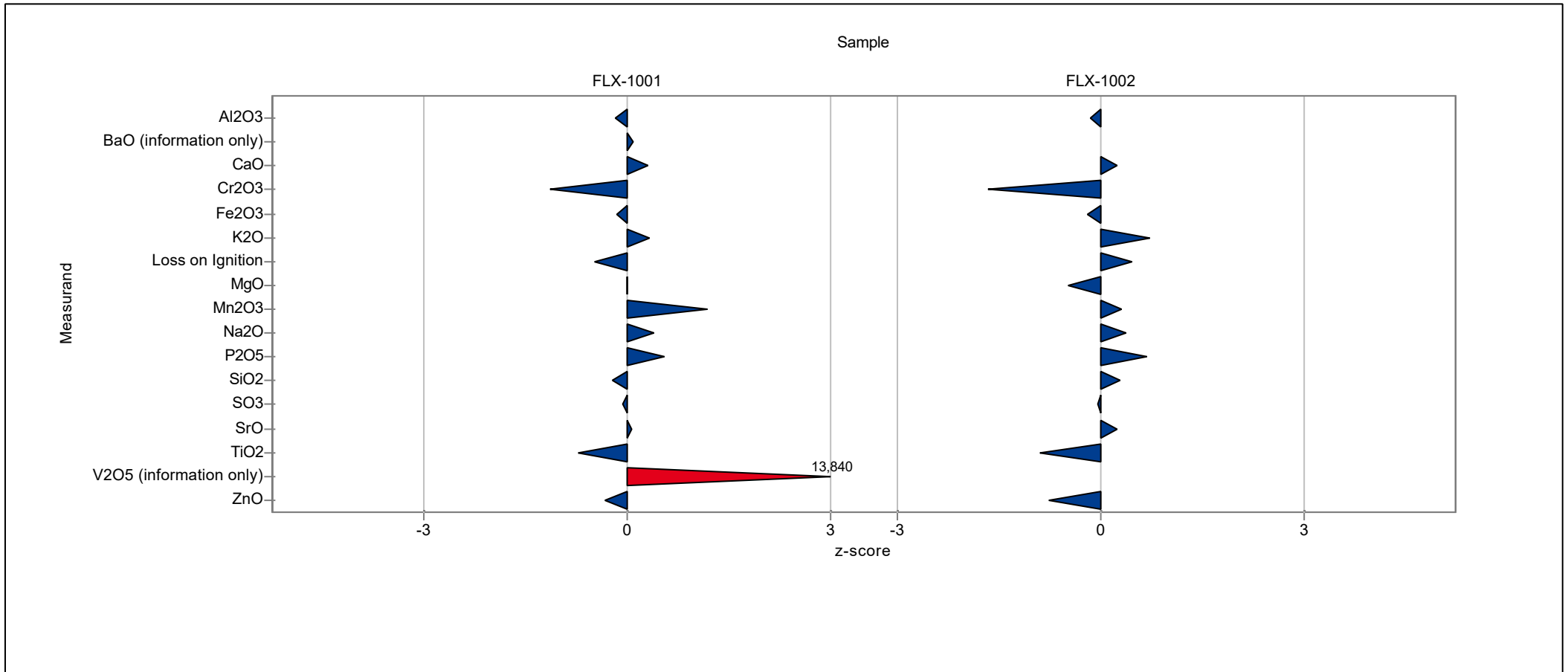
Laboratory: 22



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# Laboratory chart of z-scores

Laboratory: 24



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# Laboratory chart of z-scores

Laboratory: 25

