

# FLUXANA®

XRF Application Solutions

RV-2019-02

## Final Proficiency Test Report for Cement

FLX-RV-2019-02-Sample01,  
FLX-RV-2019-02-Sample02



Bedburg-Hau, June 03, 2020

**Coordinator of PT**

Charlotte Winkels-Herding

**Statistics and Report**

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# FLUXANA®

## XRF Application Solutions

### RV-2019-02

Sample 01	Al <sub>2</sub> O <sub>3</sub>	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>	Na <sub>2</sub> O
Unit	%	%	%	%	%	%	%	%	%
No. of laboratories	13	13	9	12	13	13	13	10	12
Mean m	7,766	54,283	0,005	1,199	0,670	2,164	3,600	0,187	0,178
Reproducibility standard deviation s <sub>R</sub>	0,155	0,639	0,003	0,051	0,064	0,251	0,064	0,006	0,029
Repeatability standard deviation s <sub>r</sub>	0,019	0,088	0,001	0,007	0,010	0,019	0,008	0,001	0,005
Robust standard deviation s*	0,178	0,607	0,003	0,048	0,071	0,261	0,064	0,006	0,031
Uncertainty U (s*)	0,123	0,421	0,003	0,034	0,049	0,181	0,045	0,005	0,022
Uncertainty U (s <sub>R</sub> )	0,107	0,443	0,003	0,037	0,044	0,174	0,044	0,005	0,021
Mean - 2*s <sub>R</sub>	7,455	53,005	-0,001	1,097	0,541	1,663	3,471	0,174	0,120
Mean + 2*s <sub>R</sub>	8,076	55,562	0,011	1,301	0,799	2,666	3,729	0,200	0,235
	P <sub>2</sub> O <sub>5</sub>	SiO <sub>2</sub>	SO <sub>3</sub>	SrO	TiO <sub>2</sub>	ZnO	Sulfate	Sulfide	
Unit	%	%	%	%	%	%	%	%	
No. of laboratories	11	13	12	9	11	8	4	4	
Mean m	0,084	26,907	4,432	0,129	0,600	0,009	0,520	3,421	
Reproducibility standard deviation s <sub>R</sub>	0,009	0,366	0,187	0,009	0,032	0,004	0,316	0,153	
Repeatability standard deviation s <sub>r</sub>	0,004	0,031	0,037	0,002	0,002	0,001	0,005	0,019	
Robust standard deviation s*	0,008	0,367	0,206	0,010	0,032	0,004	0,316	0,094	
Uncertainty U (s*)	0,006	0,255	0,163	0,008	0,024	0,004	0,395	0,118	
Uncertainty U (s <sub>R</sub> )	0,007	0,254	0,135	0,008	0,024	0,004	0,395	0,191	
Mean - 2*s <sub>R</sub>	0,066	26,175	4,059	0,112	0,537	0,001	-0,112	3,115	
Mean + 2*s <sub>R</sub>	0,102	27,639	4,806	0,146	0,663	0,018	1,153	3,727	

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

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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Sample 02	Al <sub>2</sub> O <sub>3</sub>	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>	Na <sub>2</sub> O
Unit	%	%	%	%	%	%	%	%	%
No. of laboratories	13	13	9	12	13	13	13	10	12
Mean m	7,772	57,073	0,009	3,238	1,261	6,093	1,416	0,039	0,272
Reproducibility standard deviation s <sub>R</sub>	0,187	0,362	0,003	0,078	0,084	0,500	0,037	0,005	0,038
Repeatability standard deviation s <sub>r</sub>	0,021	0,053	0,001	0,010	0,010	0,009	0,011	0,001	0,008
Robust standard deviation s*	0,179	0,312	0,002	0,080	0,075	0,497	0,041	0,004	0,037
Uncertainty U (s*)	0,124	0,216	0,002	0,058	0,052	0,345	0,028	0,003	0,026
Uncertainty U (s <sub>R</sub> )	0,130	0,251	0,003	0,056	0,058	0,347	0,026	0,004	0,027
Mean - 2*s <sub>R</sub>	7,398	56,349	0,003	3,083	1,092	5,092	1,342	0,029	0,196
Mean + 2*s <sub>R</sub>	8,146	57,796	0,015	3,393	1,429	7,094	1,490	0,050	0,348
	P <sub>2</sub> O <sub>5</sub>	SiO <sub>2</sub>	SO <sub>3</sub>	SrO	TiO <sub>2</sub>	ZnO	Sulfate	Sulfide	
Unit	%	%	%	%	%	%	%	%	
No. of laboratories	11	13	12	10	11	9	4	4	
Mean m	0,160	25,263	2,521	0,170	0,365	0,039	0,031	2,627	
Reproducibility standard deviation s <sub>R</sub>	0,012	0,563	0,125	0,008	0,020	0,005	0,047	0,183	
Repeatability standard deviation s <sub>r</sub>	0,002	0,044	0,021	0,002	0,003	0,002	0,002	0,024	
Robust standard deviation s*	0,011	0,598	0,113	0,009	0,014	0,005	0,051	0,176	
Uncertainty U (s*)	0,009	0,415	0,085	0,007	0,010	0,004	0,064	0,221	
Uncertainty U (s <sub>R</sub> )	0,009	0,390	0,090	0,006	0,015	0,004	0,059	0,229	
Mean - 2*s <sub>R</sub>	0,136	24,138	2,271	0,153	0,324	0,029	-0,063	2,260	
Mean + 2*s <sub>R</sub>	0,184	26,388	2,771	0,187	0,405	0,049	0,126	2,994	

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

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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### Introduction

X-ray fluorescence analysis is a frequently used technique for the analysis of oxidic materials.

However, for the calibration of XRF instruments, dedicated standard material is needed. 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 the German DAKKS according to DIN EN ISO/IEC 17025:2005 for the test laboratory in Bedburg-Hau.

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

All evaluations are performed in agreement with DIN EN ISO/IEC 17043:2010, DIN EN ISO 17034:2017 and ISO Guide 35:2017.

### 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.

**RV-2019-02****Participants**

Chemische Fabrik Budenheim KG	Germany
CMS Cement Industries Sdn Bhd	Malaysia
CRH Lab Sp z o o	Poland
Dyckerhoff GmbH	Germany
Holcim (Schweiz) AG, Zentral-Labor	Switzerland
Horn & Co. Analytics	Germany
Lafarge Cement S.A.	Poland
Nebraska Department of Transportation	USA
SGS Institut Fresenius GmbH	Germany
Sharrcem Sh. P. K. - Titan Group	Kosovë/Albania
Thyssen Krupp Steel EUROPE AG	Germany
Voestalpine Texas	USA
X-ray Minerals Services Ltd	United Kingdom



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## Statistical Evaluation used for this PT

### Calculation of Mean $m$

The mean  $m$  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.

### 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 13528:2015)

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

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



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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:

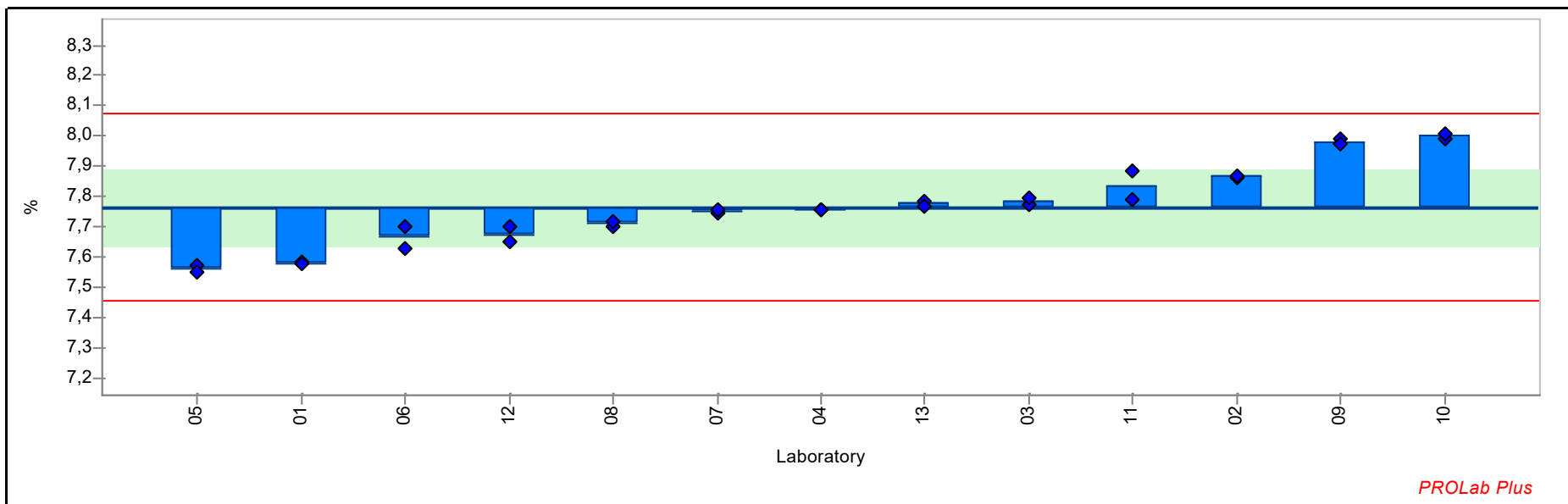
$ z  \leq 2.0$	indicates "satisfactory" performance = generates no signal
$2.0 <  z  < 3.0$	indicates "questionable" performance = generates a warning signal
$ z  \geq 3.0$	indicates "unsatisfactory" performance = generates an action signal

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.

RV-2019-02 Cement (Sulfate and Sulfide)

Summary results

**Sample:** FLX-RV-Sample01      **Reprod. s.d.:** 0,155 %  
**Measurand:** Al<sub>2</sub>O<sub>3</sub>      **Repeat. s.d.:** 0,019 %  
**Mean ± U(Mean):** 7,766 ± 0,123 %      **Range of tolerance:** 7,455 - 8,076 % (|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
01	7,581	0,006	-1,190	7,585	7,577	ISO 17025	Other Method	ICP
02	7,867	0,004	0,656	7,865	7,870	ISO 17025	XRF (fusion)	DIN 51001 2003-08
03	7,785	0,014	0,124	7,775	7,795	no accreditation	XRF (fusion)	
04	7,758	0,004	-0,053	7,760	7,755	ISO 17025	XRF (fusion)	DIN 51001 2003-08
05	7,563	0,018	-1,306	7,576	7,550	no accreditation	XRF (fusion)	
06	7,665	0,047	-0,646	7,699	7,632	ISO 17025	XRF (fusion)	



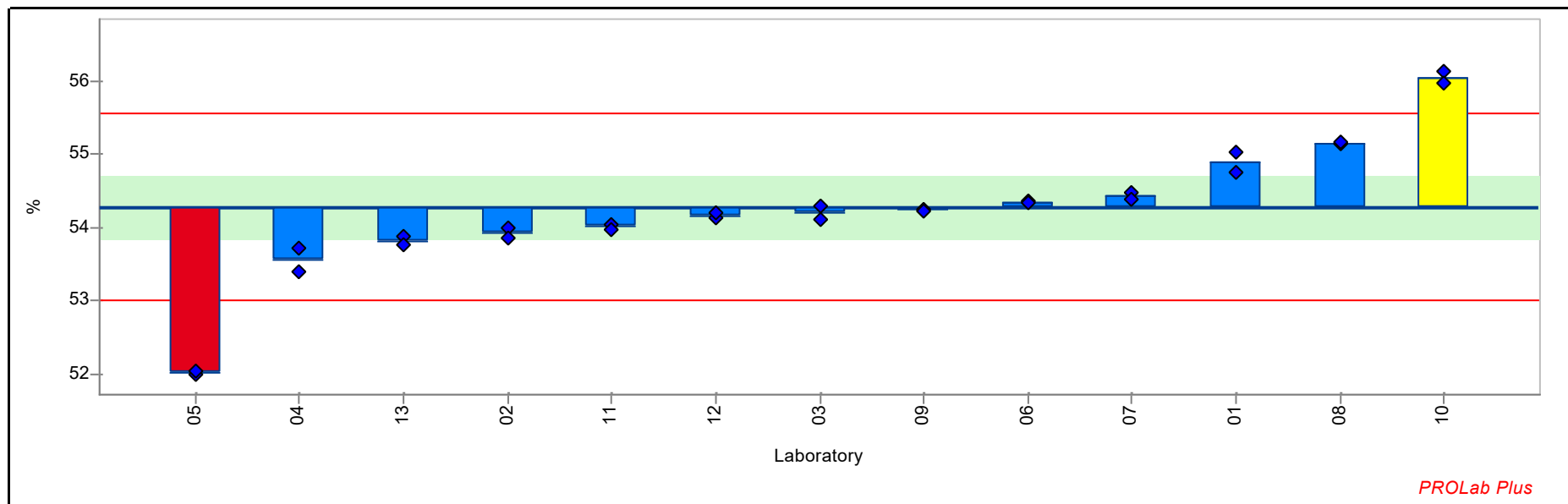
**RV-2019-02 Cement (Sulfate and Sulfide)**

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Lab code	Lab mean	s.d.	z-score	Conc. 1	Conc. 2	Accreditation	Analytical method	Comment
07	7,752	0,005	-0,091	7,748	7,755	no accreditation	XRF (fusion)	EN-196-2 2013
08	7,711	0,011	-0,352	7,703	7,719	ISO 17025	XRF (fusion)	DIN 51001 2003-08
09	7,982	0,014	1,394	7,992	7,972	no accreditation	XRF (fusion)	
10	8,000	0,014	1,510	7,990	8,010	no accreditation	XRF (fusion)	ISO 29581-2 2010-02
11	7,838	0,067	0,463	7,885	7,790	no accreditation	XRF (fusion)	PN-EN ISO 12677
12	7,676	0,035	-0,575	7,652	7,701	no accreditation	XRF (fusion)	
13	7,777	0,011	0,076	7,785	7,770	ISO 17025	XRF (fusion)	

**RV-2019-02 Cement (Sulfate and Sulfide)**

**Sample:** FLX-RV-Sample01      **Reprod. s.d.:** 0,639 %  
**Measurand:** CaO      **Repeat. s.d.:** 0,088 %  
**Mean ± U(Mean):** 54,283 ± 0,421 %      **Range of tolerance:** 53,005 - 55,562 % (|z-score| ≤ 2,000)  
**No. of laboratories:** 13      **Statistical method:** Q/Hampel



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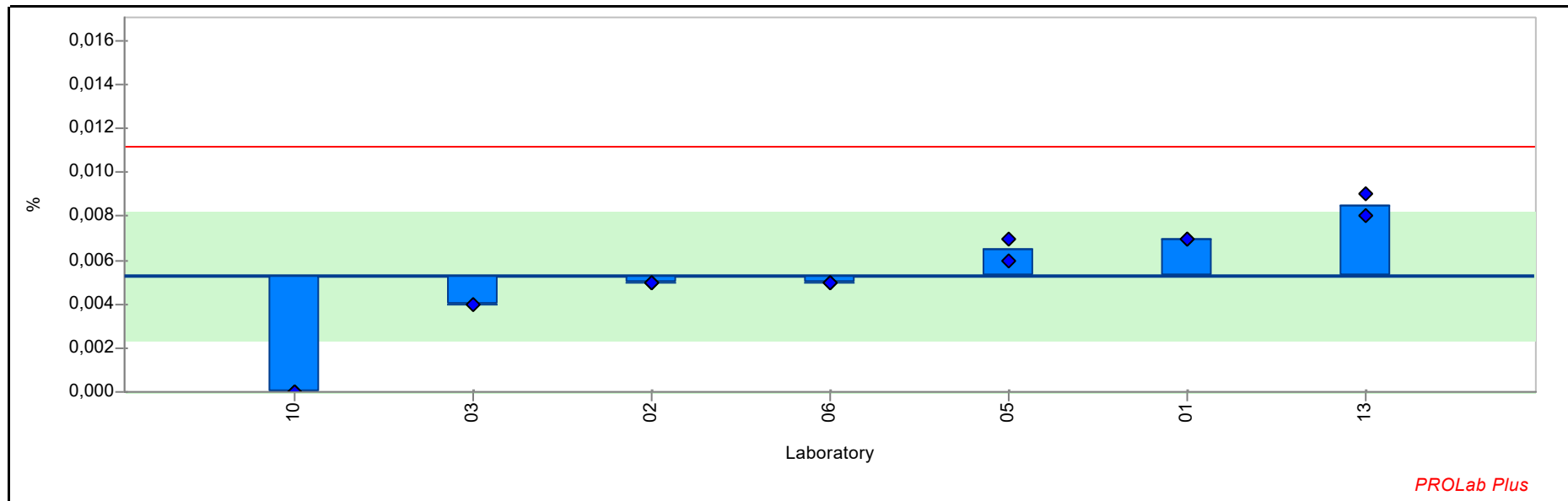
Lab code	Lab mean	s.d.	z-score	Conc. 1	Conc. 2	Accreditation	Analytical method	Comment
01	54,899	0,194	0,963	55,036	54,762	ISO 17025	Other Method	ICP
02	53,932	0,088	-0,549	53,995	53,870	ISO 17025	XRF (fusion)	DIN 51001 2003-08
03	54,197	0,124	-0,134	54,110	54,285	no accreditation	XRF (fusion)	
04	53,567	0,223	-1,120	53,725	53,410	ISO 17025	XRF (fusion)	DIN 51001 2003-08
05	52,020	0,034	-3,541	51,996	52,044	no accreditation	XRF (fusion)	
06	54,348	0,023	0,101	54,364	54,332	ISO 17025	XRF (fusion)	
07	54,438	0,059	0,242	54,480	54,396	no accreditation	XRF (fusion)	EN-196-2 2013
08	55,152	0,027	1,359	55,133	55,171	ISO 17025	XRF (fusion)	DIN 51001 2003-08

**RV-2019-02 Cement (Sulfate and Sulfide)**

Lab code	Lab mean	s.d.	z-score	Conc. 1	Conc. 2	Accreditation	Analytical method	Comment
09	54,245	0,015	-0,059	54,256	54,235	no accreditation	XRF (fusion)	
10	56,045	0,106	2,756	56,120	55,970	no accreditation	XRF (fusion)	ISO 29581-2 2010-02
11	54,010	0,042	-0,429	54,039	53,980	no accreditation	XRF (fusion)	PN-EN ISO 12677
12	54,165	0,052	-0,186	54,128	54,201	no accreditation	XRF (fusion)	
13	53,817	0,079	-0,730	53,873	53,761	ISO 17025	XRF (fusion)	

**RV-2019-02 Cement (Sulfate and Sulfide)**

**Sample:** FLX-RV-Sample01      **Reprod. s.d.** 0,003 %  
**Measurand:** Cr2O3      **Repeat. s.d.** 0,001 %  
**Mean ± U(Mean):** 0,005 ± 0,003 %      **Range of tolerance:** -0,001 - 0,011 % (|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
01	0,007	0,000	0,589	0,007	0,007	ISO 17025	Other Method	ICP
02	0,005	0,000	-0,089	0,005	0,005	ISO 17025	XRF (fusion)	DIN 51001 2003-08
03	0,004		-0,428	0,004	<0,002	no accreditation	XRF (fusion)	
04	<0,010			<0,010	<0,010	ISO 17025	XRF (fusion)	DIN 51001 2003-08
05	0,007	0,001	0,419	0,006	0,007	no accreditation	XRF (fusion)	
06	0,005	0,000	-0,089	0,005	0,005	ISO 17025	XRF (fusion)	
10	0,000	0,000	-1,783	0,000	0,000	no accreditation	XRF (fusion)	ISO 29581-2 2010-02
12	<0,010			<0,010	<0,010	no accreditation	XRF (fusion)	

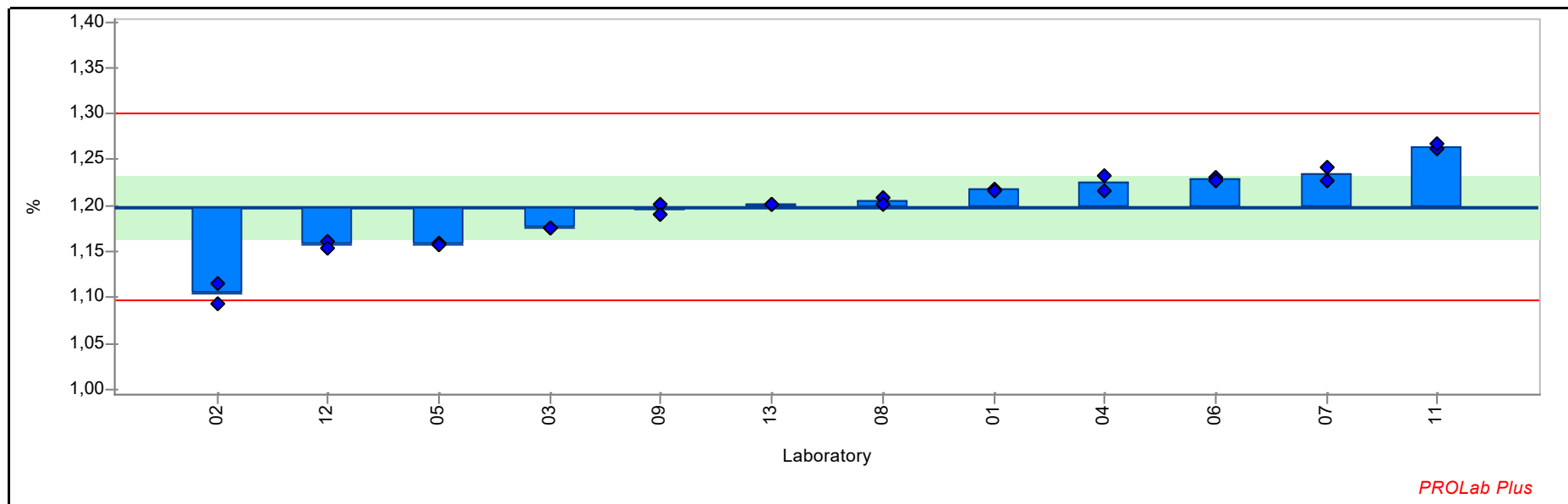
**RV-2019-02 Cement (Sulfate and Sulfide)**

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Lab code	Lab mean	s.d.	z-score	Conc. 1	Conc. 2	Accreditation	Analytical method	Comment
13	0,009	0,001	1,097	0,009	0,008	ISO 17025	XRF (fusion)	

**RV-2019-02 Cement (Sulfate and Sulfide)**

**Sample:** FLX-RV-Sample01      **Reprod. s.d.:** 0,051 %  
**Measurand:** Fe2O3      **Repeat. s.d.:** 0,007 %  
**Mean ± U(Mean):** 1,199 ± 0,034 %      **Range of tolerance:** 1,097 - 1,301 % (|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	1,218	0,001	0,368	1,218	1,217	ISO 17025	Other Method	ICP
02	1,105	0,015	-1,846	1,115	1,094	ISO 17025	XRF (fusion)	DIN 51001 2003-08
03	1,175	0,000	-0,465	1,175	1,175	no accreditation	XRF (fusion)	
04	1,224	0,011	0,505	1,232	1,217	ISO 17025	XRF (fusion)	DIN 51001 2003-08
05	1,158	0,001	-0,798	1,159	1,157	no accreditation	XRF (fusion)	
06	1,230	0,002	0,603	1,231	1,228	ISO 17025	XRF (fusion)	
07	1,235	0,009	0,701	1,241	1,228	no accreditation	XRF (fusion)	EN-196-2 2013
08	1,204	0,005	0,113	1,208	1,201	ISO 17025	XRF (fusion)	DIN 51001 2003-08

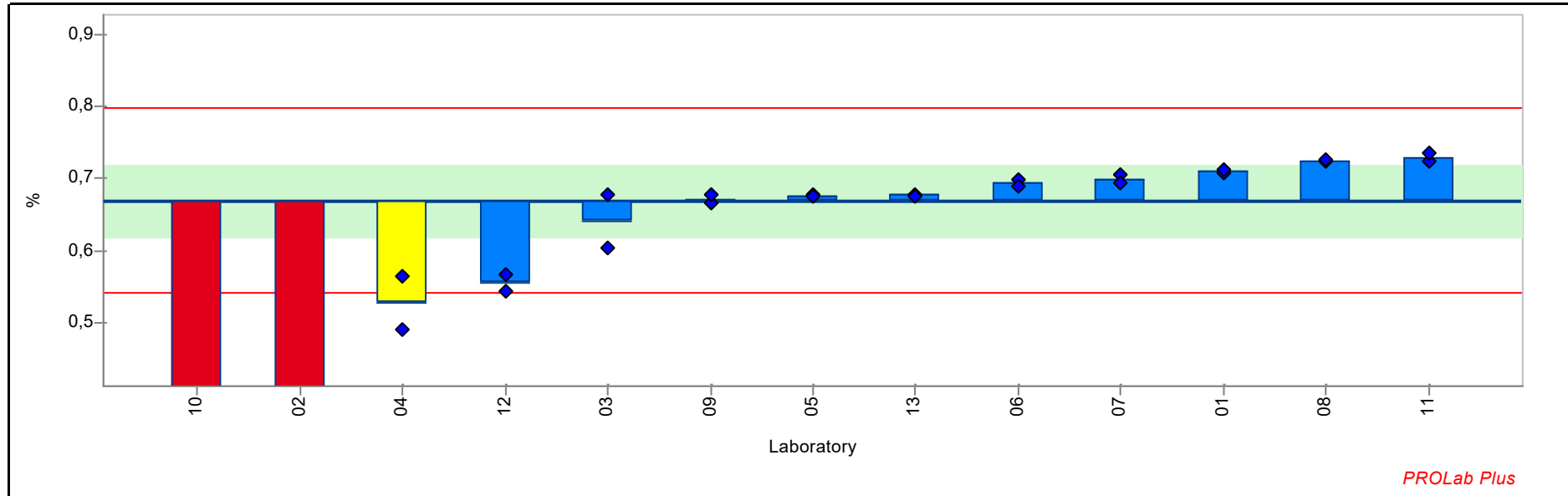
**RV-2019-02 Cement (Sulfate and Sulfide)**

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Lab code	Lab mean	s.d.	z-score	Conc. 1	Conc. 2	Accreditation	Analytical method	Comment
09	1,196	0,007	-0,053	1,201	1,191	no accreditation	XRF (fusion)	
11	1,264	0,004	1,289	1,262	1,267	no accreditation	XRF (fusion)	PN-EN ISO 12677
12	1,157	0,006	-0,817	1,161	1,153	no accreditation	XRF (fusion)	
13	1,202	0,001	0,054	1,202	1,201	ISO 17025	XRF (fusion)	

**RV-2019-02 Cement (Sulfate and Sulfide)**

**Sample:** FLX-RV-Sample01      **Reprod. s.d.** 0,064 %  
**Measurand:** K2O      **Repeat. s.d.** 0,010 %  
**Mean ± U(Mean):** 0,670 ± 0,049 %      **Range of tolerance:** 0,541 - 0,799 % (|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	0,710	0,004	0,616	0,707	0,712	ISO 17025	Other Method	ICP
02	0,313	0,004	-5,558	0,315	0,310	ISO 17025	XRF (fusion)	DIN 51001 2003-08
03	0,640	0,052	-0,465	0,677	0,603	no accreditation	XRF (fusion)	
04	0,527	0,053	-2,214	0,490	0,565	ISO 17025	XRF (fusion)	DIN 51001 2003-08
05	0,677	0,002	0,103	0,678	0,675	no accreditation	XRF (fusion)	
06	0,694	0,006	0,367	0,698	0,689	ISO 17025	XRF (fusion)	
07	0,699	0,008	0,453	0,705	0,693	no accreditation	XRF (fusion)	EN-196-2 2013
08	0,725	0,003	0,857	0,723	0,727	ISO 17025	XRF (fusion)	DIN 51001 2003-08

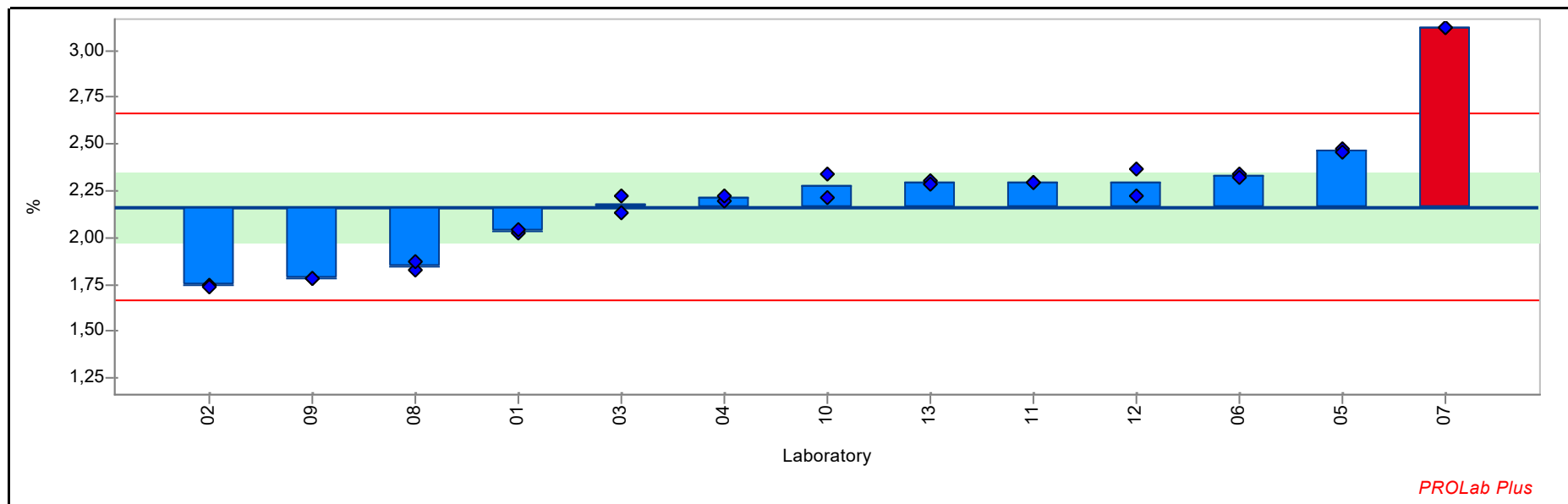


**RV-2019-02 Cement (Sulfate and Sulfide)**

Lab code	Lab mean	s.d.	z-score	Conc. 1	Conc. 2	Accreditation	Analytical method	Comment
09	0,672	0,007	0,033	0,667	0,677	no accreditation	XRF (fusion)	
10	0,268	0,071	-6,250	0,218	0,318	no accreditation	XRF (fusion)	ISO 29581-2 2010-02
11	0,730	0,008	0,927	0,724	0,735	no accreditation	XRF (fusion)	PN-EN ISO 12677
12	0,556	0,016	-1,763	0,568	0,545	no accreditation	XRF (fusion)	
13	0,677	0,001	0,110	0,678	0,676	ISO 17025	XRF (fusion)	

**RV-2019-02 Cement (Sulfate and Sulfide)**

**Sample:** FLX-RV-Sample01      **Reprod. s.d.** 0,251 %  
**Measurand:** Loss on Ignition      **Repeat. s.d.** 0,019 %  
**Mean ± U(Mean):** 2,164 ± 0,181 %      **Range of tolerance:** 1,663 - 2,666 % (|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
01	2,032	0,012	-0,530	2,023	2,040	ISO 17025	Other Method	LOI @ 950°C
02	1,743	0,003	-1,680	1,745	1,741	ISO 17025	Other Method	LOI @ 950°C
03	2,178	0,067	0,052	2,130	2,225	no accreditation	Other Method	LOI @ 950°C
04	2,210	0,014	0,181	2,200	2,220	ISO 17025	Other Method	LOI @ 950°C
05	2,466	0,016	1,204	2,478	2,455	no accreditation	Other Method	LOI @ 950°C
06	2,330	0,014	0,660	2,340	2,320	ISO 17025	Other Method	LOI @ 950°C
07	3,124	0,000	3,825	3,124	3,124	no accreditation	Other Method	LOI @ 950°C
08	1,847	0,033	-1,268	1,823	1,870	ISO 17025	XRF (fusion)	LOI @ 950°C

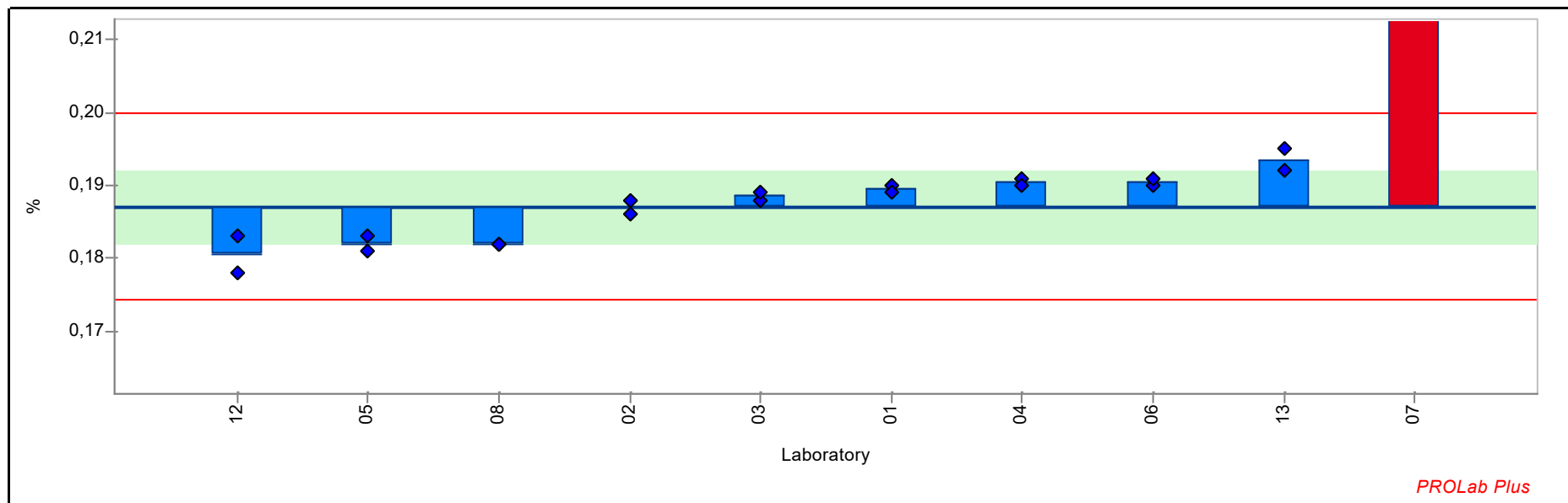
**RV-2019-02 Cement (Sulfate and Sulfide)**

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Lab code	Lab mean	s.d.	z-score	Conc. 1	Conc. 2	Accreditation	Analytical method	Comment
09	1,780	0,000	-1,533	1,780	1,780	no accreditation	Other Method	LOI @ 950°C
10	2,275	0,092	0,441	2,210	2,340	no accreditation	XRF (fusion)	LOI @ 950°C
11	2,298	0,001	0,530	2,297	2,298	no accreditation	Other Method	LOI @ 950°C
12	2,298	0,101	0,534	2,370	2,227	no accreditation	Other Method	LOI @ 950°C
13	2,295	0,007	0,520	2,300	2,290	ISO 17025	Other Method	LOI @ 950°C

**RV-2019-02 Cement (Sulfate and Sulfide)**

**Sample:** FLX-RV-Sample01      **Reprod. s.d.** 0,006 %  
**Measurand:** Mn2O3      **Repeat. s.d** 0,001 %  
**Mean ± U(Mean):** 0,187 ± 0,005 %      **Range of tolerance:** 0,174 - 0,200 % (|z-score| <= 2,000)  
**No. of laboratories:** 10      **Statistical method** Q/Hampel



PROLab Plus

Lab code	Lab mean	s.d.	z-score	Conc. 1	Conc. 2	Accreditation	Analytical method	Comment
01	0,190	0,001	0,371	0,190	0,189	ISO 17025	Other Method	ICP
02	0,187	0,001	-0,017	0,188	0,186	ISO 17025	XRF (fusion)	DIN 51001 2003-08
03	0,189	0,001	0,216	0,188	0,189	no accreditation	XRF (fusion)	
04	0,191	0,001	0,527	0,191	0,190	ISO 17025	XRF (fusion)	DIN 51001 2003-08
05	0,182	0,001	-0,795	0,181	0,183	no accreditation	XRF (fusion)	
06	0,191	0,001	0,527	0,190	0,191	ISO 17025	XRF (fusion)	
07	0,323	0,001	21,052	0,323	0,322	no accreditation	XRF (fusion)	EN-196-2 2013
08	0,182	0,000	-0,795	0,182	0,182	ISO 17025	XRF (fusion)	DIN 51001 2003-08

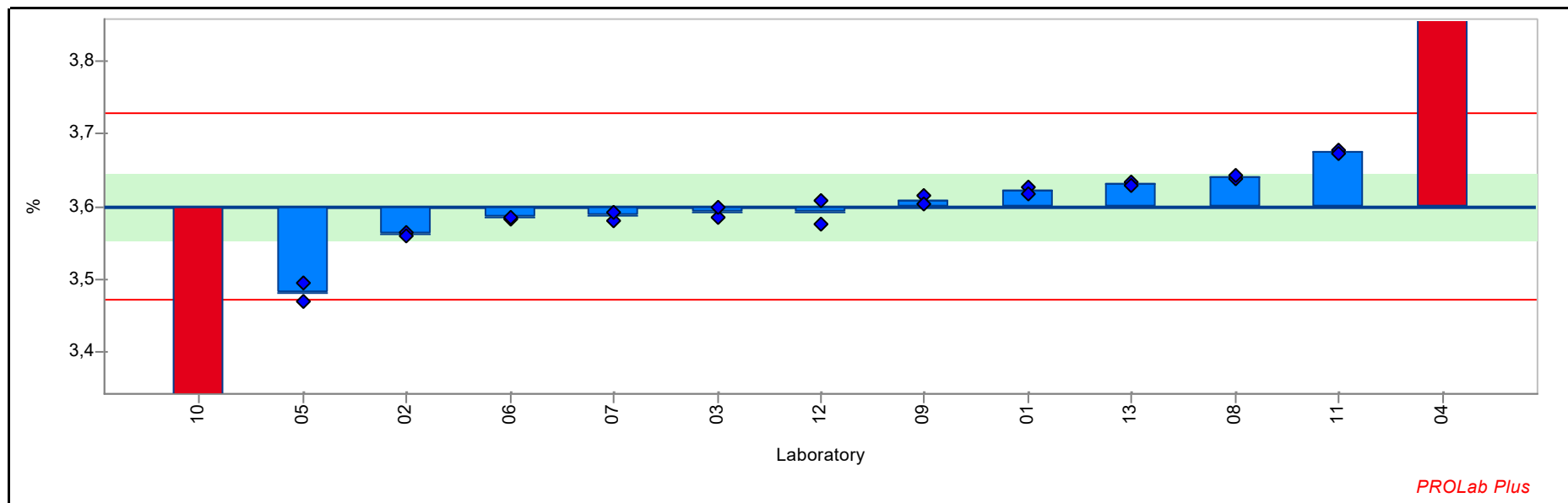
**RV-2019-02 Cement (Sulfate and Sulfide)**

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Lab code	Lab mean	s.d.	z-score	Conc. 1	Conc. 2	Accreditation	Analytical method	Comment
12	0,180	0,004	-1,028	0,178	0,183	no accreditation	XRF (fusion)	
13	0,194	0,002	0,993	0,192	0,195	ISO 17025	XRF (fusion)	

RV-2019-02 Cement (Sulfate and Sulfide)

**Sample:** FLX-RV-Sample01      **Reprod. s.d.** 0,064 %  
**Measurand:** MgO      **Repeat. s.d** 0,008 %  
**Mean ± U(Mean):** 3,600 ± 0,045 %      **Range of tolerance:** 3,471 - 3,729 % (|z-score| <= 2,000)  
**No. of laboratories:** 13      **Statistical method** Q/Hampel



PROLab Plus

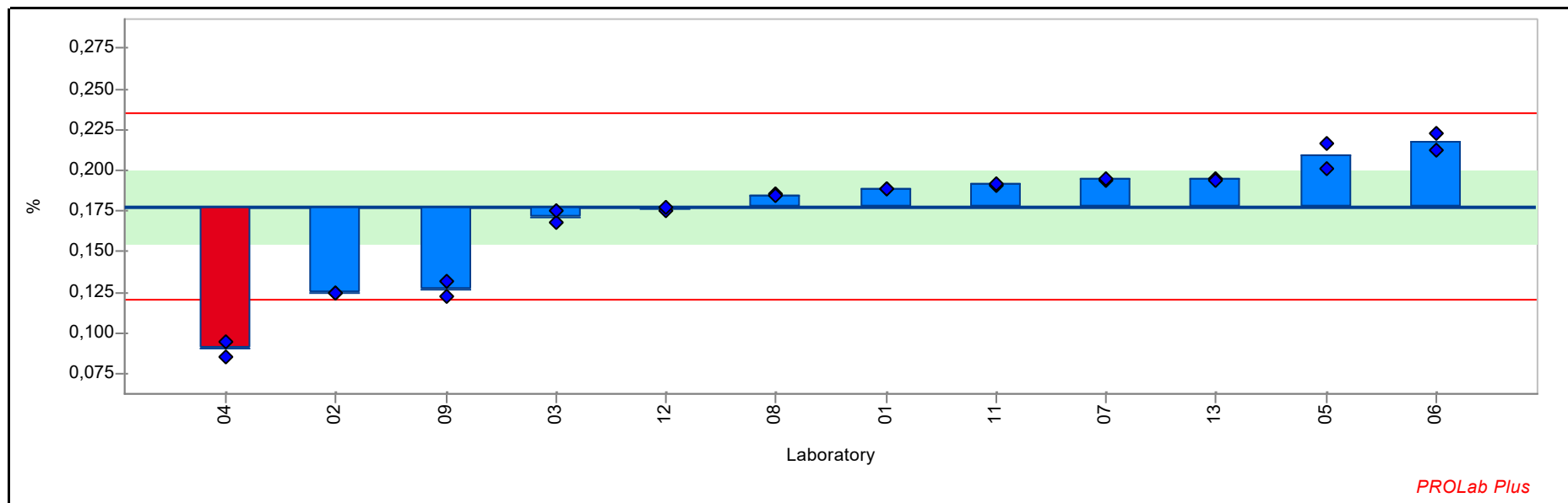
Lab code	Lab mean	s.d.	z-score	Conc. 1	Conc. 2	Accreditation	Analytical method	Comment
01	3,622	0,006	0,342	3,626	3,618	ISO 17025	Other Method	ICP
02	3,563	0,004	-0,583	3,565	3,560	ISO 17025	XRF (fusion)	DIN 51001 2003-08
03	3,593	0,011	-0,117	3,585	3,600	no accreditation	XRF (fusion)	
04	3,888	0,004	4,467	3,890	3,885	ISO 17025	XRF (fusion)	DIN 51001 2003-08
05	3,482	0,018	-1,841	3,494	3,469	no accreditation	XRF (fusion)	
06	3,584	0,003	-0,249	3,582	3,586	ISO 17025	XRF (fusion)	
07	3,587	0,008	-0,210	3,581	3,592	no accreditation	XRF (fusion)	EN-196-2 2013
08	3,639	0,004	0,614	3,637	3,642	ISO 17025	XRF (fusion)	DIN 51001 2003-08

**RV-2019-02 Cement (Sulfate and Sulfide)**

Lab code	Lab mean	s.d.	z-score	Conc. 1	Conc. 2	Accreditation	Analytical method	Comment
09	3,609	0,007	0,140	3,614	3,604	no accreditation	XRF (fusion)	
10	3,206	0,062	-6,122	3,250	3,162	no accreditation	XRF (fusion)	ISO 29581-2 2010-02
11	3,675	0,004	1,173	3,678	3,673	no accreditation	XRF (fusion)	PN-EN ISO 12677
12	3,593	0,023	-0,117	3,576	3,609	no accreditation	XRF (fusion)	
13	3,631	0,004	0,474	3,633	3,628	ISO 17025	XRF (fusion)	

**RV-2019-02 Cement (Sulfate and Sulfide)**

**Sample:** FLX-RV-Sample01      **Reprod. s.d.** 0,029 %  
**Measurand:** Na2O      **Repeat. s.d** 0,005 %  
**Mean ± U(Mean):** 0,178 ± 0,022 %      **Range of tolerance:** 0,120 - 0,235 % (|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	0,189	0,000	0,389	0,189	0,189	ISO 17025	Other Method	ICP
02	0,125	0,000	-1,832	0,125	0,125	ISO 17025	XRF (fusion)	DIN 51001 2003-08
03	0,171	0,005	-0,219	0,168	0,175	no accreditation	XRF (fusion)	
04	0,090	0,007	-3,047	0,095	0,085	ISO 17025	XRF (fusion)	DIN 51001 2003-08
05	0,209	0,011	1,083	0,217	0,201	no accreditation	XRF (fusion)	
06	0,217	0,008	1,378	0,223	0,212	ISO 17025	XRF (fusion)	
07	0,195	0,001	0,580	0,194	0,195	no accreditation	XRF (fusion)	EN-196-2 2013
08	0,185	0,001	0,250	0,186	0,184	ISO 17025	XRF (fusion)	DIN 51001 2003-08



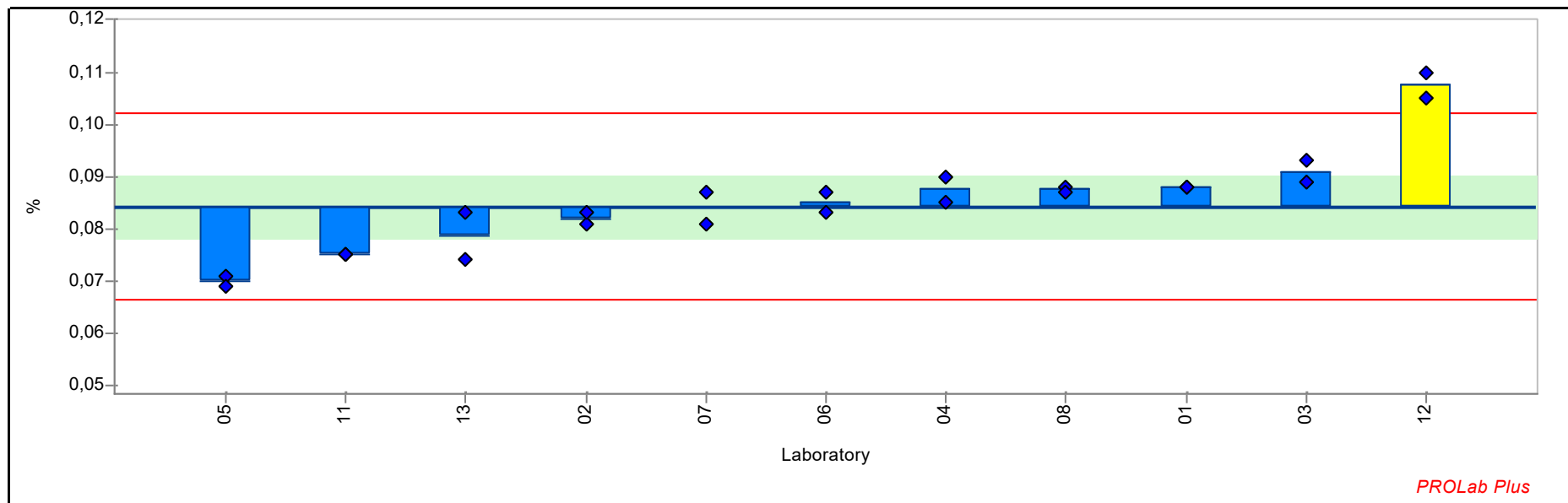
**RV-2019-02 Cement (Sulfate and Sulfide)**

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Lab code	Lab mean	s.d.	z-score	Conc. 1	Conc. 2	Accreditation	Analytical method	Comment
09	0,127	0,007	-1,763	0,132	0,122	no accreditation	XRF (fusion)	
11	0,192	0,001	0,476	0,191	0,192	no accreditation	XRF (fusion)	PN-EN ISO 12677
12	0,176	0,001	-0,062	0,175	0,177	no accreditation	XRF (fusion)	
13	0,195	0,001	0,580	0,195	0,194	ISO 17025	XRF (fusion)	

**RV-2019-02 Cement (Sulfate and Sulfide)**

**Sample:** FLX-RV-Sample01      **Reprod. s.d.:** 0,009 %  
**Measurand:** P2O5      **Repeat. s.d.:** 0,004 %  
**Mean ± U(Mean):** 0,084 ± 0,006 %      **Range of tolerance:** 0,066 - 0,102 % (|z-score| <= 2,000)  
**No. of laboratories:** 11      **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	0,088	0,000	0,415	0,088	0,088	ISO 17025	Other Method	ICP
02	0,082	0,001	-0,254	0,081	0,083	ISO 17025	XRF (fusion)	DIN 51001 2003-08
03	0,091	0,003	0,750	0,089	0,093	no accreditation	XRF (fusion)	
04	0,087	0,004	0,359	0,090	0,085	ISO 17025	XRF (fusion)	DIN 51001 2003-08
05	0,070	0,001	-1,592	0,071	0,069	no accreditation	XRF (fusion)	
06	0,085	0,003	0,081	0,083	0,087	ISO 17025	XRF (fusion)	
07	0,084	0,004	-0,031	0,081	0,087	no accreditation	XRF (fusion)	EN-196-2 2013
08	0,087	0,001	0,359	0,088	0,087	ISO 17025	XRF (fusion)	DIN 51001 2003-08

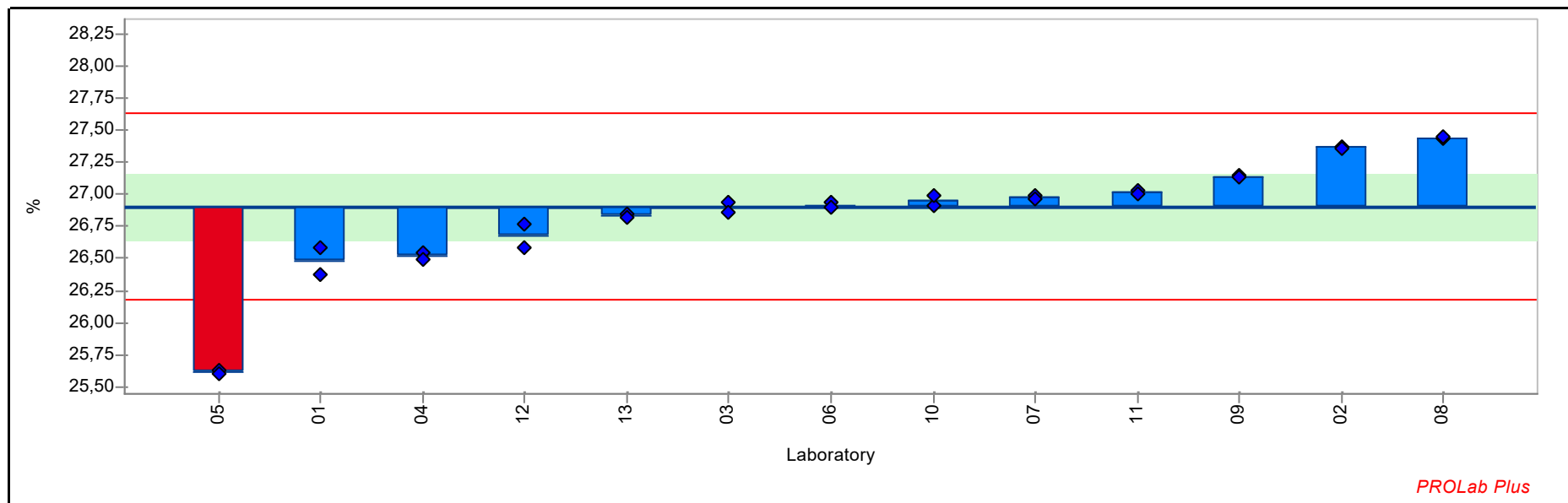
**RV-2019-02 Cement (Sulfate and Sulfide)**

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Lab code	Lab mean	s.d.	z-score	Conc. 1	Conc. 2	Accreditation	Analytical method	Comment
11	0,075	0,000	-1,035	0,075	0,075	no accreditation	XRF (fusion)	PN-EN ISO 12677
12	0,107	0,004	2,589	0,105	0,110	no accreditation	XRF (fusion)	
13	0,079	0,006	-0,644	0,083	0,074	ISO 17025	XRF (fusion)	

**RV-2019-02 Cement (Sulfate and Sulfide)**

**Sample:** FLX-RV-Sample01      **Reprod. s.d.** 0,366 %  
**Measurand:** SiO2      **Repeat. s.d.** 0,031 %  
**Mean ± U(Mean):** 26,907 ± 0,255 %      **Range of tolerance:** 26,175 - 27,639 % (|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
01	26,483	0,148	-1,156	26,588	26,379	ISO 17025	Other Method	ICP
02	27,370	0,007	1,265	27,375	27,365	ISO 17025	XRF (fusion)	DIN 51001 2003-08
03	26,900	0,057	-0,019	26,940	26,860	no accreditation	XRF (fusion)	
04	26,520	0,042	-1,056	26,550	26,490	ISO 17025	XRF (fusion)	DIN 51001 2003-08
05	25,616	0,016	-3,525	25,627	25,605	no accreditation	XRF (fusion)	
06	26,919	0,026	0,032	26,937	26,900	ISO 17025	XRF (fusion)	
07	26,980	0,016	0,200	26,991	26,969	no accreditation	XRF (fusion)	EN-196-2 2013
08	27,443	0,012	1,463	27,434	27,451	ISO 17025	XRF (fusion)	DIN 51001 2003-08

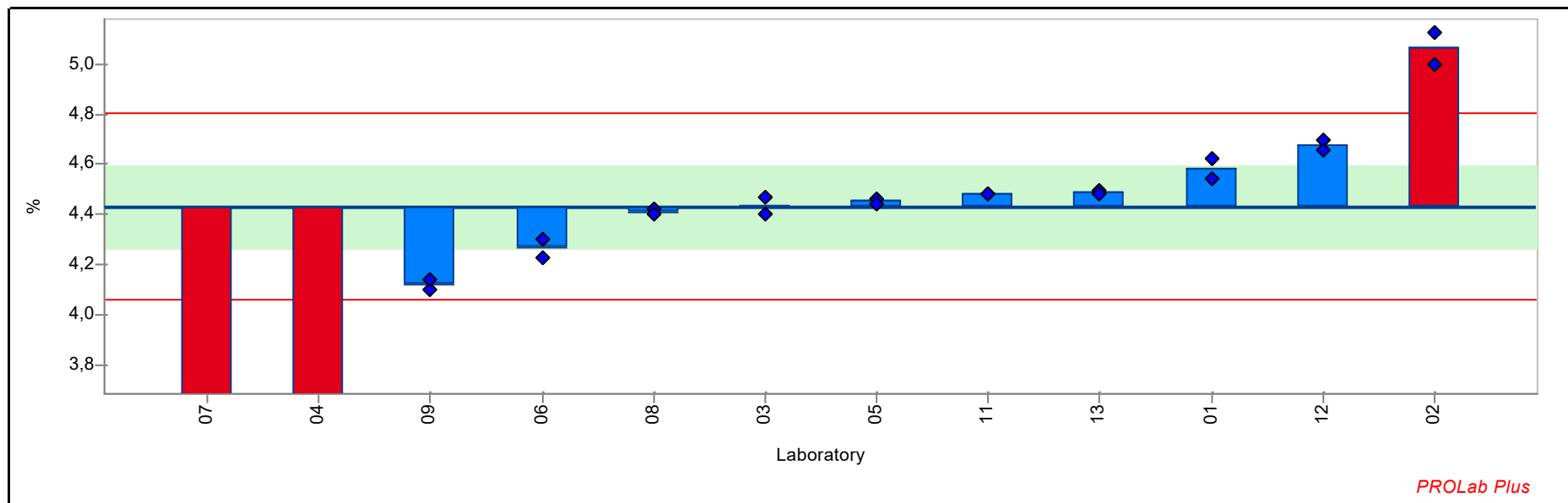
**RV-2019-02 Cement (Sulfate and Sulfide)**

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Lab code	Lab mean	s.d.	z-score	Conc. 1	Conc. 2	Accreditation	Analytical method	Comment
09	27,143	0,014	0,645	27,153	27,133	no accreditation	XRF (fusion)	
10	26,950	0,057	0,118	26,910	26,990	no accreditation	XRF (fusion)	ISO 29581-2 2010-02
11	27,019	0,018	0,306	27,032	27,006	no accreditation	XRF (fusion)	PN-EN ISO 12677
12	26,674	0,134	-0,637	26,768	26,579	no accreditation	XRF (fusion)	
13	26,839	0,021	-0,185	26,854	26,824	ISO 17025	XRF (fusion)	

**RV-2019-02 Cement (Sulfate and Sulfide)**

**Sample:** FLX-RV-Sample01      **Reprod. s.d.:** 0,187 %  
**Measurand:** SO3      **Repeat. s.d.:** 0,037 %  
**Mean ± U(Mean):** 4,432 ± 0,163 %      **Range of tolerance:** 4,059 - 4,806 % (|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
01	4,584	0,053	0,810	4,621	4,546	ISO 17025	Other Method	ICP
02	5,063	0,088	3,374	5,000	5,125	ISO 17025	XRF (fusion)	information only
03	4,438	0,046	0,028	4,470	4,405	no accreditation	XRF (fusion)	
04	3,650	0,000	-4,188	3,650	3,650	ISO 17025	XRF (fusion)	DIN 51001 2003-08
05	4,453	0,011	0,108	4,460	4,445	no accreditation	XRF (fusion)	
06	4,265	0,049	-0,895	4,300	4,230	ISO 17025	Other Method	S -LECO SC-044DR
07	3,381	0,021	-5,625	3,367	3,396	no accreditation	XRF (pressed pellet)	information only
08	4,410	0,013	-0,116	4,420	4,401	ISO 17025	XRF (fusion)	DIN 51001 2003-08

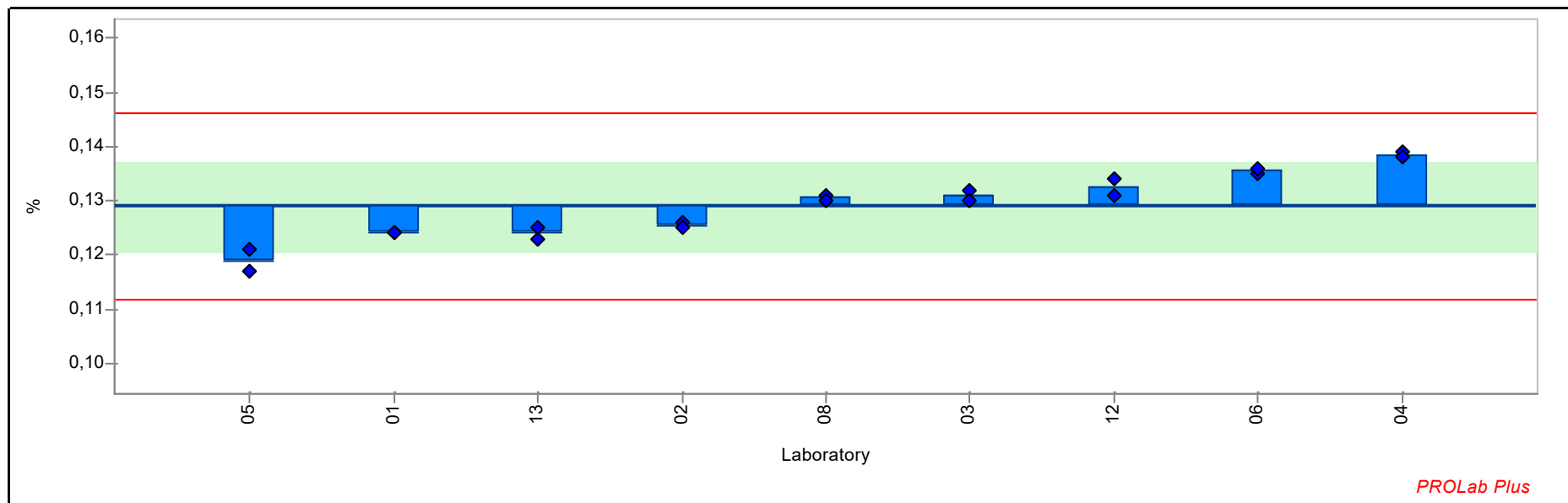
**RV-2019-02 Cement (Sulfate and Sulfide)**

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Lab code	Lab mean	s.d.	z-score	Conc. 1	Conc. 2	Accreditation	Analytical method	Comment
09	4,123	0,029	-1,653	4,103	4,144	no accreditation	XRF (fusion)	
11	4,482	0,003	0,266	4,480	4,484	no accreditation	XRF (fusion)	PN-EN ISO 12677
12	4,675	0,028	1,300	4,695	4,655	no accreditation	XRF (fusion)	
13	4,490	0,009	0,312	4,497	4,484	ISO 17025	XRF (fusion)	

**RV-2019-02 Cement (Sulfate and Sulfide)**

**Sample:** FLX-RV-Sample01      **Reprod. s.d.:** 0,009 %  
**Measurand:** SrO      **Repeat. s.d.:** 0,002 %  
**Mean ± U(Mean):** 0,129 ± 0,008 %      **Range of tolerance:** 0,112 - 0,146 % (|z-score| <= 2,000)  
**No. of laboratories:** 9      **Statistical method:** Q/Hampel



Lab code	Lab mean	s.d.	z-score	Conc. 1	Conc. 2	Accreditation	Analytical method	Comment
01	0,124	0,000	-0,571	0,124	0,124	ISO 17025	Other Method	ICP
02	0,126	0,001	-0,398	0,126	0,125	ISO 17025	XRF (fusion)	DIN 51001 2003-08
03	0,131	0,001	0,238	0,132	0,130	no accreditation	XRF (fusion)	
04	0,139	0,001	1,104	0,139	0,138	ISO 17025	XRF (fusion)	DIN 51001 2003-08
05	0,119	0,003	-1,149	0,117	0,121	no accreditation	XRF (fusion)	
06	0,136	0,001	0,758	0,135	0,136	ISO 17025	XRF (fusion)	
08	0,131	0,001	0,180	0,131	0,130	ISO 17025	XRF (fusion)	DIN 51001 2003-08
12	0,133	0,002	0,411	0,131	0,134	no accreditation	XRF (fusion)	



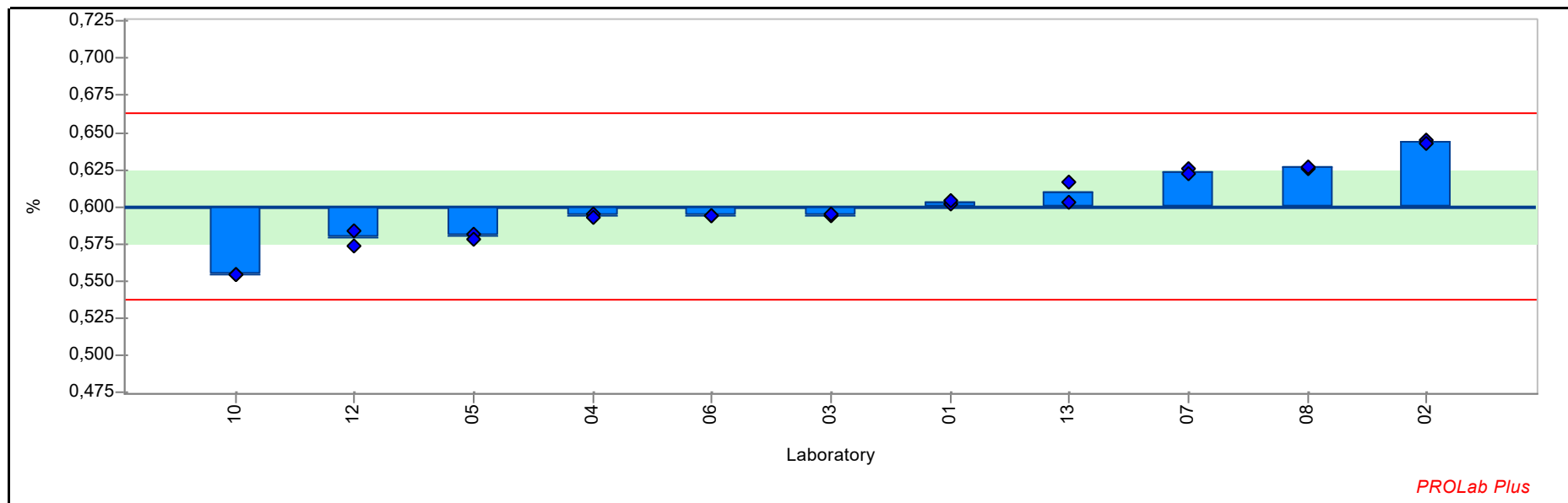
**RV-2019-02 Cement (Sulfate and Sulfide)**

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Lab code	Lab mean	s.d.	z-score	Conc. 1	Conc. 2	Accreditation	Analytical method	Comment
13	0,124	0,001	-0,571	0,123	0,125	ISO 17025	XRF (fusion)	

**RV-2019-02 Cement (Sulfate and Sulfide)**

**Sample:** FLX-RV-Sample01      **Reprod. s.d.:** 0,032 %  
**Measurand:** TiO2      **Repeat. s.d.:** 0,002 %  
**Mean ± U(Mean):** 0,600 ± 0,024 %      **Range of tolerance:** 0,537 - 0,663 % (|z-score| <= 2,000)  
**No. of laboratories:** 11      **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	0,603	0,001	0,085	0,602	0,604	ISO 17025	Other Method	ICP
02	0,644	0,001	1,387	0,645	0,643	ISO 17025	XRF (fusion)	DIN 51001 2003-08
03	0,595	0,001	-0,185	0,594	0,595	no accreditation	XRF (fusion)	
04	0,594	0,001	-0,201	0,595	0,593	ISO 17025	XRF (fusion)	DIN 51001 2003-08
05	0,580	0,003	-0,645	0,582	0,578	no accreditation	XRF (fusion)	
06	0,594	0,000	-0,201	0,594	0,594	ISO 17025	XRF (fusion)	
07	0,624	0,003	0,752	0,626	0,622	no accreditation	XRF (fusion)	EN-196-2 2013
08	0,627	0,001	0,831	0,626	0,627	ISO 17025	XRF (fusion)	DIN 51001 2003-08

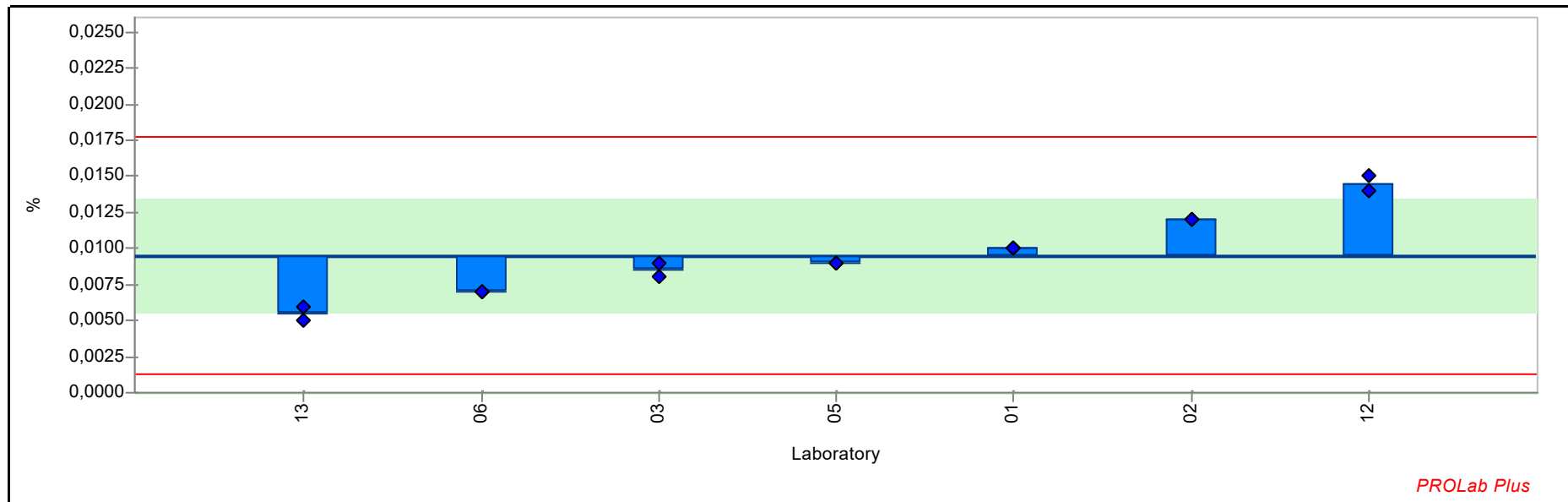
**RV-2019-02 Cement (Sulfate and Sulfide)**

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Lab code	Lab mean	s.d.	z-score	Conc. 1	Conc. 2	Accreditation	Analytical method	Comment
10	0,554	0,001	-1,454	0,555	0,554	no accreditation	XRF (fusion)	ISO 29581-2 2010-02
12	0,579	0,007	-0,677	0,584	0,574	no accreditation	XRF (fusion)	
13	0,610	0,010	0,307	0,617	0,603	ISO 17025	XRF (fusion)	

**RV-2019-02 Cement (Sulfate and Sulfide)**

**Sample:** FLX-RV-Sample01      **Reprod. s.d.** 0,004 %  
**Measurand:** ZnO      **Repeat. s.d.** 0,001 %  
**Mean ± U(Mean):** 0,009 ± 0,004 %      **Range of tolerance:** 0,001 - 0,018 % (|z-score| ≤ 2,000)  
**No. of laboratories:** 7      **Statistical method** Q/Hampel

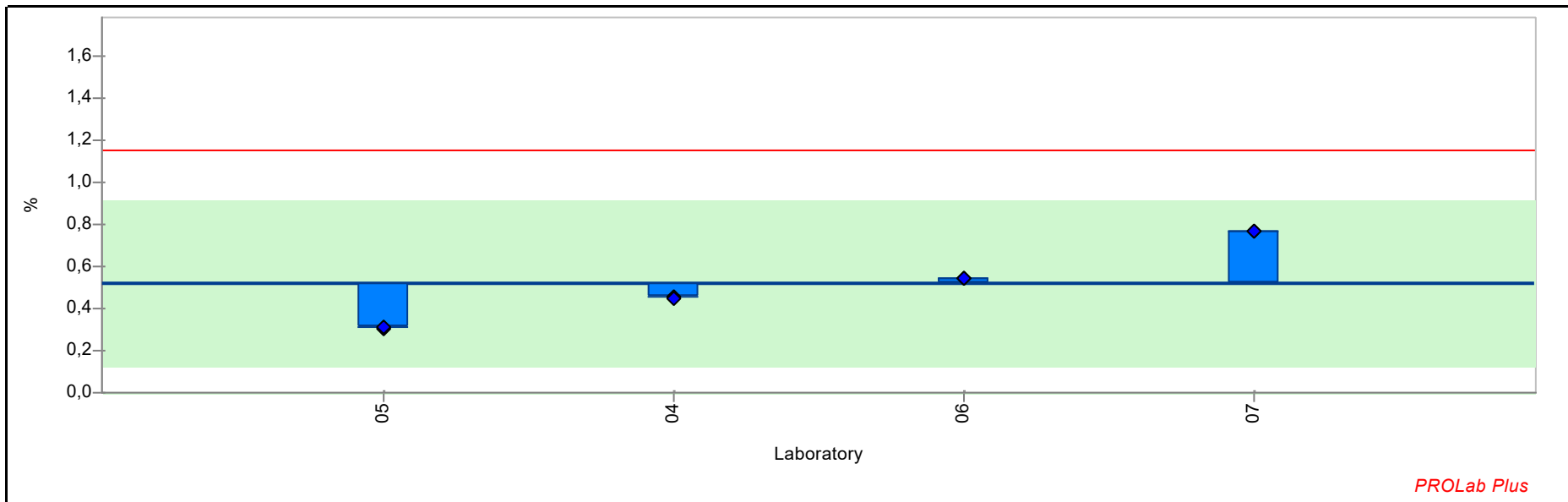


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Lab code	Lab mean	s.d.	z-score	Conc. 1	Conc. 2	Accreditation	Analytical method	Comment
01	0,010	0,000	0,121	0,010	0,010	ISO 17025	Other Method	ICP
02	0,012	0,000	0,605	0,012	0,012	ISO 17025	XRF (fusion)	
03	0,009	0,001	-0,242	0,008	0,009	no accreditation	XRF (fusion)	
04	<0,010			<0,010	<0,010	ISO 17025	XRF (fusion)	DIN 51001 2003-08
05	0,009	0,000	-0,121	0,009	0,009	no accreditation	XRF (fusion)	
06	0,007	0,000	-0,605	0,007	0,007	ISO 17025	XRF (fusion)	
12	0,014	0,001	1,210	0,015	0,014	no accreditation	XRF (fusion)	
13	0,005	0,001	-0,968	0,006	0,005	ISO 17025	XRF (fusion)	

**RV-2019-02 Cement (Sulfate and Sulfide)**

**Sample:** FLX-RV-Sample01      **Reprod. s.d.** 0,316 %  
**Measurand:** Sulfide      **Repeat. s.d** 0,005 %  
**Mean ± U(Mean):** 0,520 ± 0,395 %      **Range of tolerance:** -0,112 - 1,153 % (|z-score| ≤ 2,000)  
**No. of laboratories:** 4      **Statistical method** Q/Hampel

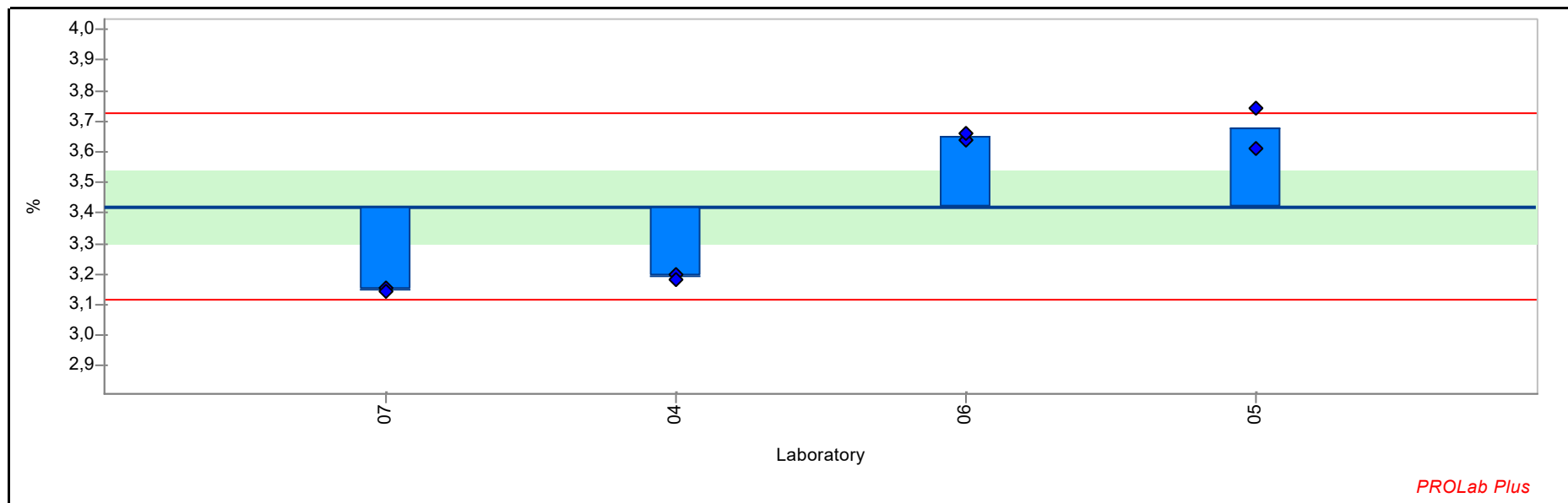


PROLab Plus

Lab code	Lab mean	s.d.	z-score	Conc. 1	Conc. 2	Accreditation	Analytical method	Comment
04	0,454	0,004	-0,209	0,457	0,451	ISO 17025	Other Method	EN-196-2 2013
05	0,311	0,006	-0,660	0,307	0,316	no accreditation	XRF (fusion)	
06	0,545	0,000	0,079	0,545	0,545	no accreditation	Other Method	EN-196-2 2013
07	0,770	0,000	0,790	0,770	0,770	no accreditation	Other Method	EN-196-2 2013

**RV-2019-02 Cement (Sulfate and Sulfide)**

**Sample:** FLX-RV-Sample01      **Reprod. s.d.** 0,153 %  
**Measurand:** Sulfate      **Repeat. s.d** 0,019 %  
**Mean ± U(Mean):** 3,421 ± 0,118 %      **Range of tolerance:** 3,115 - 3,727 % (|z-score| ≤ 2,000)  
**No. of laboratories:** 4      **Statistical method** Q/Hampel

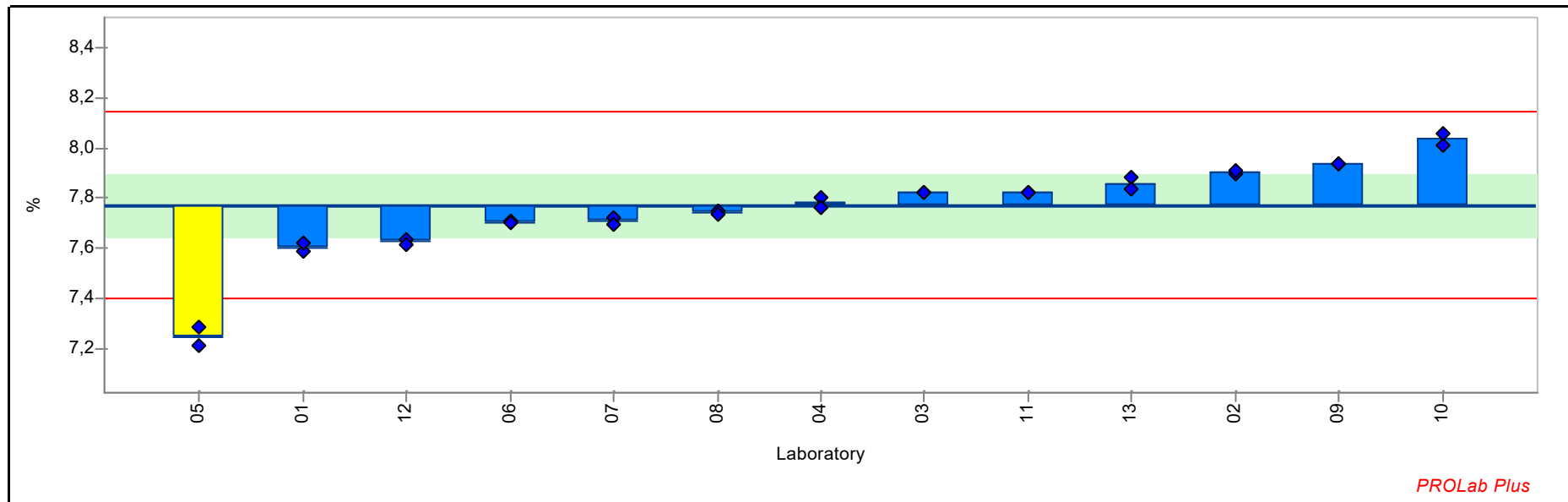


*PROLab Plus*

Lab code	Lab mean	s.d.	z-score	Conc. 1	Conc. 2	Accreditation	Analytical method	Comment
04	3,192	0,011	-1,496	3,200	3,184	ISO 17025	Other Method	EN-196-2 2013
05	3,675	0,095	1,662	3,743	3,608	no accreditation	Other Method	ASTM C114
06	3,650	0,014	1,496	3,640	3,660	no accreditation	Other Method	EN-196-2 2013
07	3,149	0,006	-1,773	3,154	3,145	no accreditation	Other Method	EN-196-2 2013

RV-2019-02 Cement (Sulfate and Sulfide)

**Sample:** FLX-RV-Sample02      **Reprod. s.d.:** 0,187 %  
**Measurand:** Al2O3      **Repeat. s.d.:** 0,021 %  
**Mean ± U(Mean):** 7,772 ± 0,124 %      **Range of tolerance:** 7,398 - 8,146 % (|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
01	7,604	0,027	-0,898	7,585	7,623	ISO 17025	Other Method	ICP
02	7,902	0,011	0,698	7,895	7,910	ISO 17025	XRF (fusion)	DIN 51001 2003-08
03	7,820	0,000	0,257	7,820	7,820	no accreditation	XRF (fusion)	
04	7,782	0,025	0,056	7,800	7,765	ISO 17025	XRF (fusion)	DIN 51001 2003-08
05	7,247	0,051	-2,805	7,283	7,211	no accreditation	XRF (fusion)	
06	7,704	0,001	-0,360	7,705	7,704	ISO 17025	XRF (fusion)	
07	7,710	0,017	-0,331	7,722	7,698	no accreditation	XRF (fusion)	EN-196-2 2013
08	7,744	0,010	-0,149	7,751	7,737	ISO 17025	XRF (fusion)	DIN 51001 2003-08

**RV-2019-02 Cement (Sulfate and Sulfide)**

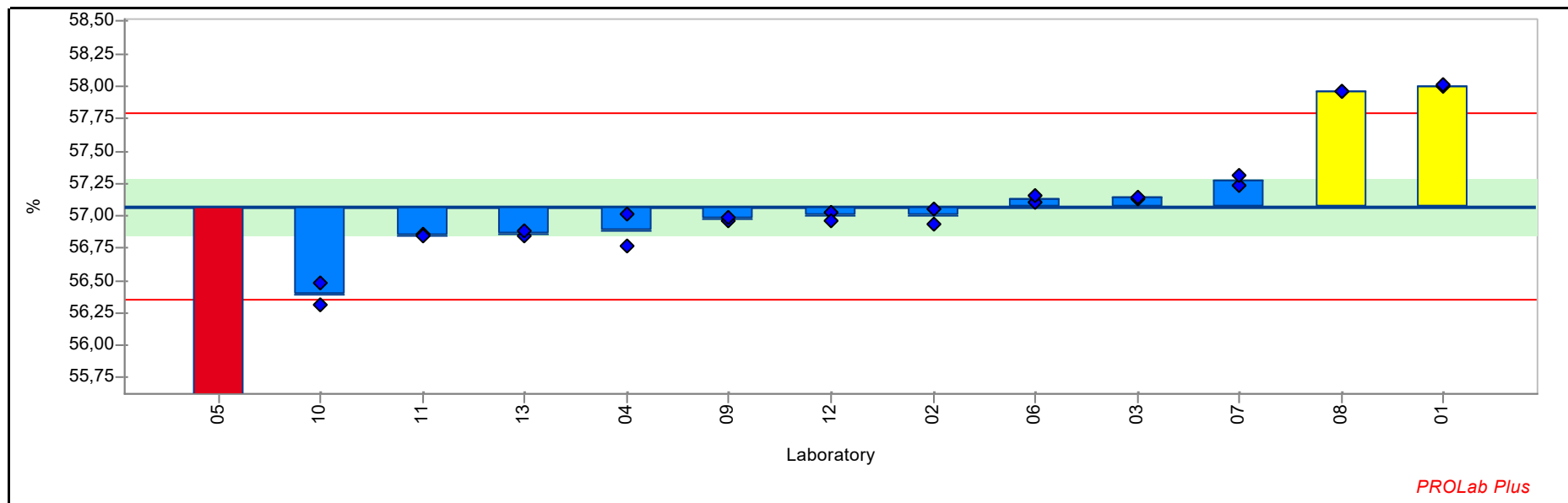
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Lab code	Lab mean	s.d.	z-score	Conc. 1	Conc. 2	Accreditation	Analytical method	Comment
09	7,937	0,000	0,882	7,937	7,937	no accreditation	XRF (fusion)	
10	8,035	0,035	1,406	8,010	8,060	no accreditation	XRF (fusion)	ISO 29581-2 2010-02
11	7,822	0,003	0,268	7,824	7,820	no accreditation	XRF (fusion)	PN-EN ISO 12677
12	7,624	0,012	-0,788	7,633	7,616	no accreditation	XRF (fusion)	
13	7,858	0,033	0,460	7,881	7,835	ISO 17025	XRF (fusion)	



**RV-2019-02 Cement (Sulfate and Sulfide)**

**Sample:** FLX-RV-Sample02      **Reprod. s.d.:** 0,362 %  
**Measurand:** CaO      **Repeat. s.d.:** 0,053 %  
**Mean ± U(Mean):** 57,073 ± 0,216 %      **Range of tolerance:** 56,349 - 57,796 % (|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
01	58,006	0,011	2,581	57,998	58,014	ISO 17025	Other Method	ICP
02	56,998	0,081	-0,208	56,940	57,055	ISO 17025	XRF (fusion)	DIN 51001 2003-08
03	57,138	0,018	0,180	57,125	57,150	no accreditation	XRF (fusion)	
04	56,890	0,170	-0,505	57,010	56,770	ISO 17025	XRF (fusion)	DIN 51001 2003-08
05	52,633	0,069	-12,275	52,584	52,681	no accreditation	XRF (fusion)	
06	57,126	0,036	0,146	57,100	57,151	ISO 17025	XRF (fusion)	
07	57,274	0,057	0,557	57,234	57,314	no accreditation	XRF (fusion)	EN-196-2 2013
08	57,964	0,001	2,464	57,965	57,963	ISO 17025	XRF (fusion)	DIN 51001 2003-08

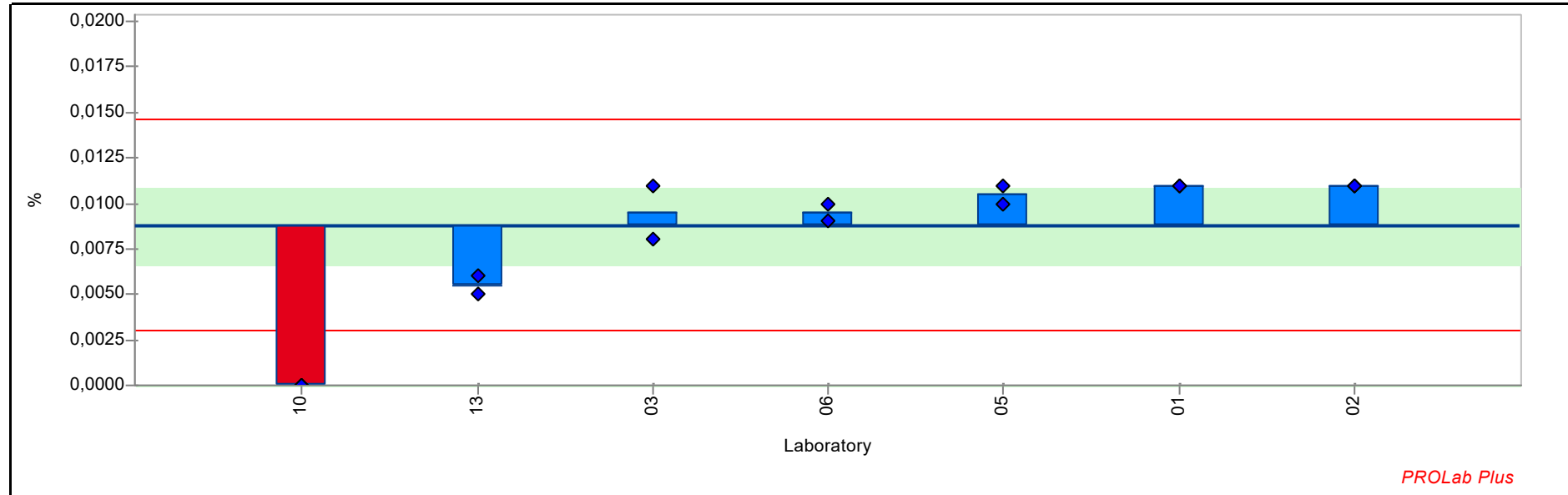
**RV-2019-02 Cement (Sulfate and Sulfide)**

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Lab code	Lab mean	s.d.	z-score	Conc. 1	Conc. 2	Accreditation	Analytical method	Comment
09	56,977	0,015	-0,263	56,967	56,988	no accreditation	XRF (fusion)	
10	56,395	0,120	-1,873	56,480	56,310	no accreditation	XRF (fusion)	ISO 29581-2 2010-02
11	56,850	0,016	-0,615	56,861	56,839	no accreditation	XRF (fusion)	PN-EN ISO 12677
12	56,997	0,045	-0,209	57,029	56,965	no accreditation	XRF (fusion)	
13	56,861	0,025	-0,584	56,844	56,879	ISO 17025	XRF (fusion)	

**RV-2019-02 Cement (Sulfate and Sulfide)**

**Sample:** FLX-RV-Sample02      **Reprod. s.d.** 0,003 %  
**Measurand:** Cr2O3      **Repeat. s.d** 0,001 %  
**Mean ± U(Mean):** 0,009 ± 0,002 %      **Range of tolerance:** 0,003 - 0,015 % (|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
01	0,011	0,000	0,762	0,011	0,011	ISO 17025	Other Method	ICP
02	0,011	0,000	0,762	0,011	0,011	ISO 17025	XRF (fusion)	DIN 51001 2003-08
03	0,009	0,002	0,243	0,011	0,008	no accreditation	XRF (fusion)	
04	<0,010			<0,010	<0,010	ISO 17025	XRF (fusion)	DIN 51001 2003-08
05	0,010	0,001	0,589	0,010	0,011	no accreditation	XRF (fusion)	
06	0,009	0,001	0,243	0,009	0,010	ISO 17025	XRF (fusion)	
10	0,000	0,000	-3,040	0,000	0,000	no accreditation	XRF (fusion)	ISO 29581-2 2010-02
12	<0,010			<0,010	<0,010	no accreditation	XRF (fusion)	

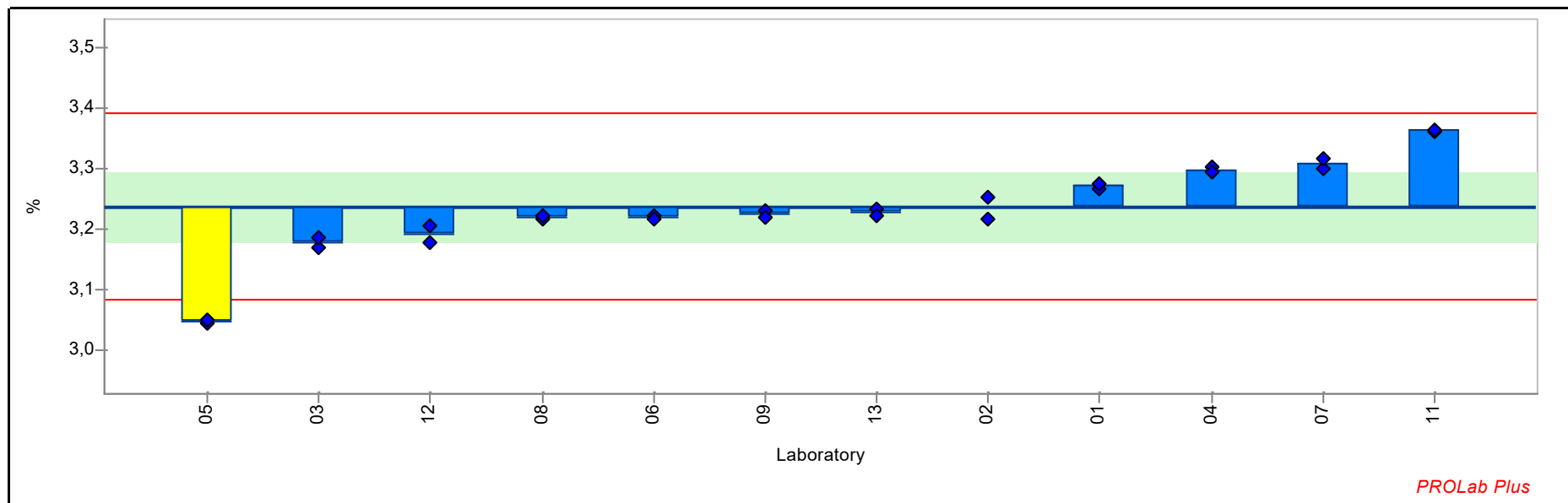
**RV-2019-02 Cement (Sulfate and Sulfide)**

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Lab code	Lab mean	s.d.	z-score	Conc. 1	Conc. 2	Accreditation	Analytical method	Comment
13	0,005	0,001	-1,139	0,006	0,005	ISO 17025	XRF (fusion)	

**RV-2019-02 Cement (Sulfate and Sulfide)**

**Sample:** FLX-RV-Sample02      **Reprod. s.d.:** 0,078 %  
**Measurand:** Fe2O3      **Repeat. s.d.:** 0,010 %  
**Mean ± U(Mean):** 3,238 ± 0,058 %      **Range of tolerance:** 3,083 - 3,393 % (|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
01	3,271	0,006	0,434	3,267	3,276	ISO 17025	Other Method	ICP
02	3,236	0,025	-0,030	3,218	3,253	ISO 17025	XRF (fusion)	DIN 51001 2003-08
03	3,178	0,011	-0,777	3,170	3,185	no accreditation	XRF (fusion)	
04	3,298	0,006	0,776	3,302	3,294	ISO 17025	XRF (fusion)	DIN 51001 2003-08
05	3,046	0,004	-2,466	3,044	3,049	no accreditation	XRF (fusion)	
06	3,220	0,004	-0,229	3,223	3,217	ISO 17025	XRF (fusion)	
07	3,309	0,013	0,918	3,300	3,318	no accreditation	XRF (fusion)	EN-196-2 2013
08	3,220	0,005	-0,236	3,216	3,223	ISO 17025	XRF (fusion)	DIN 51001 2003-08

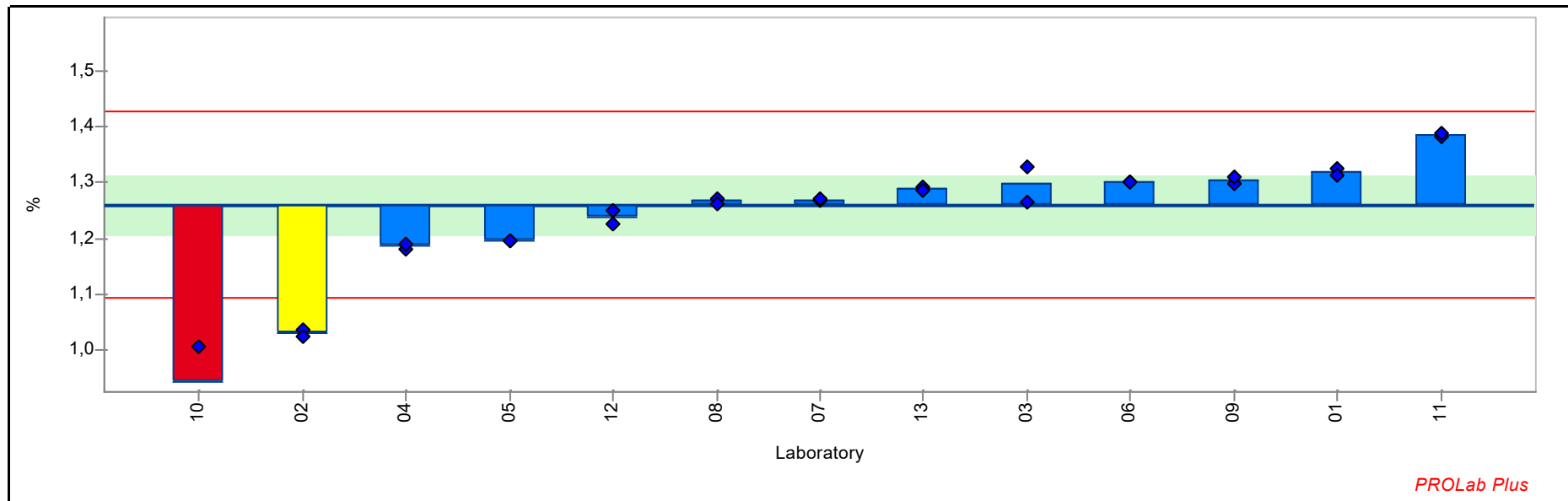
**RV-2019-02 Cement (Sulfate and Sulfide)**

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Lab code	Lab mean	s.d.	z-score	Conc. 1	Conc. 2	Accreditation	Analytical method	Comment
09	3,227	0,008	-0,146	3,232	3,221	no accreditation	XRF (fusion)	
11	3,364	0,002	1,620	3,362	3,365	no accreditation	XRF (fusion)	PN-EN ISO 12677
12	3,192	0,021	-0,590	3,207	3,177	no accreditation	XRF (fusion)	
13	3,228	0,009	-0,120	3,235	3,222	ISO 17025	XRF (fusion)	

RV-2019-02 Cement (Sulfate and Sulfide)

**Sample:** FLX-RV-Sample02      **Reprod. s.d.:** 0,084 %  
**Measurand:** K2O      **Repeat. s.d.:** 0,010 %  
**Mean ± U(Mean):** 1,261 ± 0,052 %      **Range of tolerance:** 1,092 - 1,429 % (|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
01	1,321	0,008	0,711	1,326	1,315	ISO 17025	Other Method	ICP
02	1,029	0,010	-2,746	1,036	1,022	ISO 17025	XRF (fusion)	DIN 51001 2003-08
03	1,297	0,046	0,438	1,330	1,265	no accreditation	XRF (fusion)	
04	1,185	0,007	-0,896	1,180	1,190	ISO 17025	XRF (fusion)	DIN 51001 2003-08
05	1,196	0,002	-0,771	1,194	1,197	no accreditation	XRF (fusion)	
06	1,301	0,001	0,486	1,302	1,301	ISO 17025	XRF (fusion)	
07	1,269	0,004	0,106	1,267	1,272	no accreditation	XRF (fusion)	EN-196-2 2013
08	1,267	0,006	0,076	1,271	1,263	ISO 17025	XRF (fusion)	DIN 51001 2003-08

**RV-2019-02 Cement (Sulfate and Sulfide)**

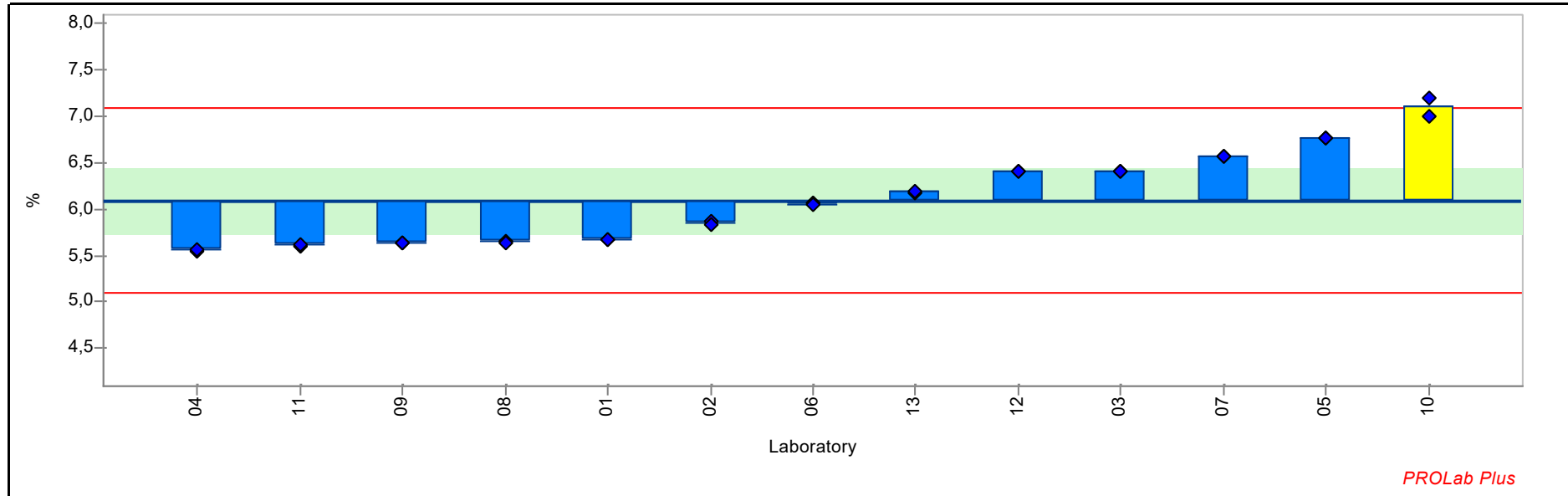
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Lab code	Lab mean	s.d.	z-score	Conc. 1	Conc. 2	Accreditation	Analytical method	Comment
09	1,304	0,008	0,509	1,298	1,309	no accreditation	XRF (fusion)	
10	0,941	0,093	-3,795	0,875	1,006	no accreditation	XRF (fusion)	ISO 29581-2 2010-02
11	1,385	0,004	1,482	1,383	1,388	no accreditation	XRF (fusion)	PN-EN ISO 12677
12	1,238	0,018	-0,262	1,226	1,251	no accreditation	XRF (fusion)	
13	1,288	0,004	0,325	1,291	1,285	ISO 17025	XRF (fusion)	



**RV-2019-02 Cement (Sulfate and Sulfide)**

**Sample:** FLX-RV-Sample02      **Reprod. s.d.** 0,500 %  
**Measurand:** Loss on Ignition      **Repeat. s.d** 0,009 %  
**Mean ± U(Mean):** 6,093 ± 0,345 %      **Range of tolerance:** 5,092 - 7,094 % (|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
01	5,668	0,008	-0,849	5,674	5,662	ISO 17025	Other Method	LOI @ 950°C
02	5,854	0,020	-0,477	5,868	5,840	ISO 17025	Other Method	LOI @ 950°C
03	6,410	0,000	0,634	6,410	6,410	no accreditation	Other Method	LOI @ 950°C
04	5,555	0,021	-1,075	5,540	5,570	ISO 17025	Other Method	LOI @ 950°C
05	6,768	0,001	1,350	6,769	6,768	no accreditation	Other Method	LOI @ 950°C
06	6,055	0,007	-0,075	6,060	6,050	ISO 17025	Other Method	LOI @ 950°C
07	6,572	0,000	0,958	6,572	6,572	no accreditation	Other Method	LOI @ 950°C
08	5,647	0,007	-0,891	5,652	5,642	ISO 17025	XRF (fusion)	LOI @ 950°C

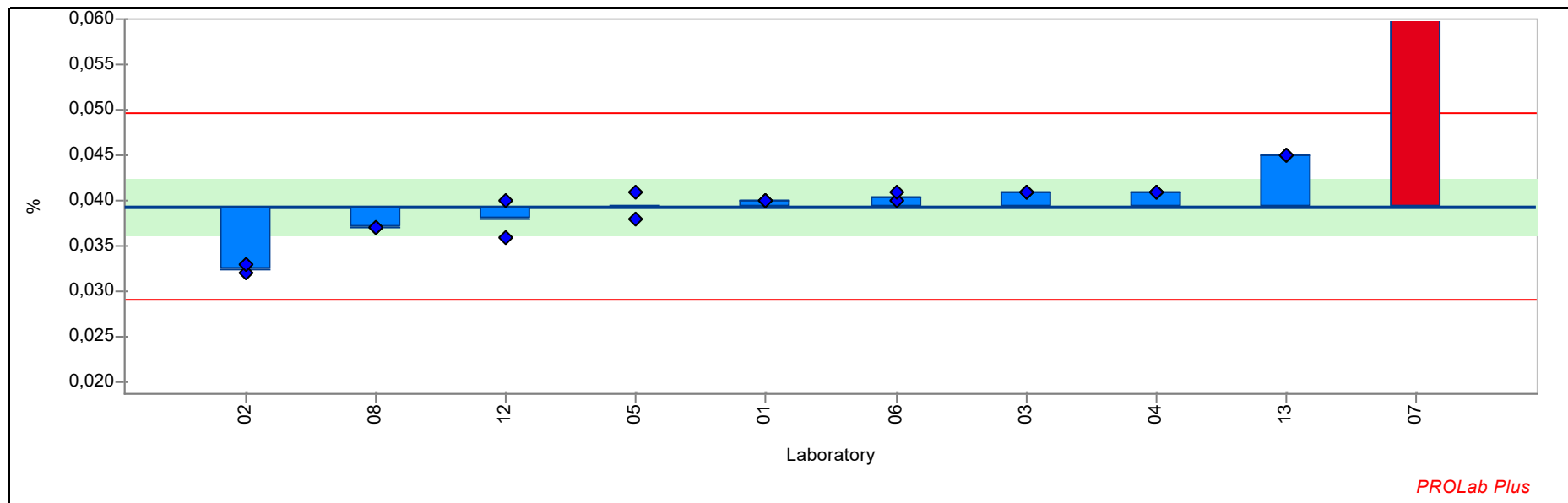
**RV-2019-02 Cement (Sulfate and Sulfide)**

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Lab code	Lab mean	s.d.	z-score	Conc. 1	Conc. 2	Accreditation	Analytical method	Comment
09	5,630	0,000	-0,925	5,630	5,630	no accreditation	Other Method	LOI @ 950°C
10	7,100	0,141	2,013	7,000	7,200	no accreditation	XRF (fusion)	LOI @ 950°C
11	5,611	0,004	-0,964	5,608	5,613	no accreditation	Other Method	LOI @ 950°C
12	6,407	0,011	0,628	6,399	6,415	no accreditation	Other Method	LOI @ 950°C
13	6,185	0,007	0,184	6,180	6,190	ISO 17025	Other Method	LOI @ 950°C

**RV-2019-02 Cement (Sulfate and Sulfide)**

**Sample:** FLX-RV-Sample02      **Reprod. s.d.:** 0,005 %  
**Measurand:** Mn2O3      **Repeat. s.d.:** 0,001 %  
**Mean ± U(Mean):** 0,039 ± 0,003 %      **Range of tolerance:** 0,029 - 0,050 % (|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	0,040	0,000	0,118	0,040	0,040	ISO 17025	Other Method	ICP
02	0,033	0,001	-1,331	0,032	0,033	ISO 17025	XRF (fusion)	DIN 51001 2003-08
03	0,041	0,000	0,311	0,041	0,041	no accreditation	XRF (fusion)	
04	0,041	0,000	0,311	0,041	0,041	ISO 17025	XRF (fusion)	DIN 51001 2003-08
05	0,040	0,002	0,021	0,041	0,038	no accreditation	XRF (fusion)	
06	0,041	0,001	0,215	0,040	0,041	ISO 17025	XRF (fusion)	
07	0,071	0,001	6,109	0,070	0,072	no accreditation	XRF (fusion)	EN-196-2 2013
08	0,037	0,000	-0,462	0,037	0,037	ISO 17025	XRF (fusion)	DIN 51001 2003-08

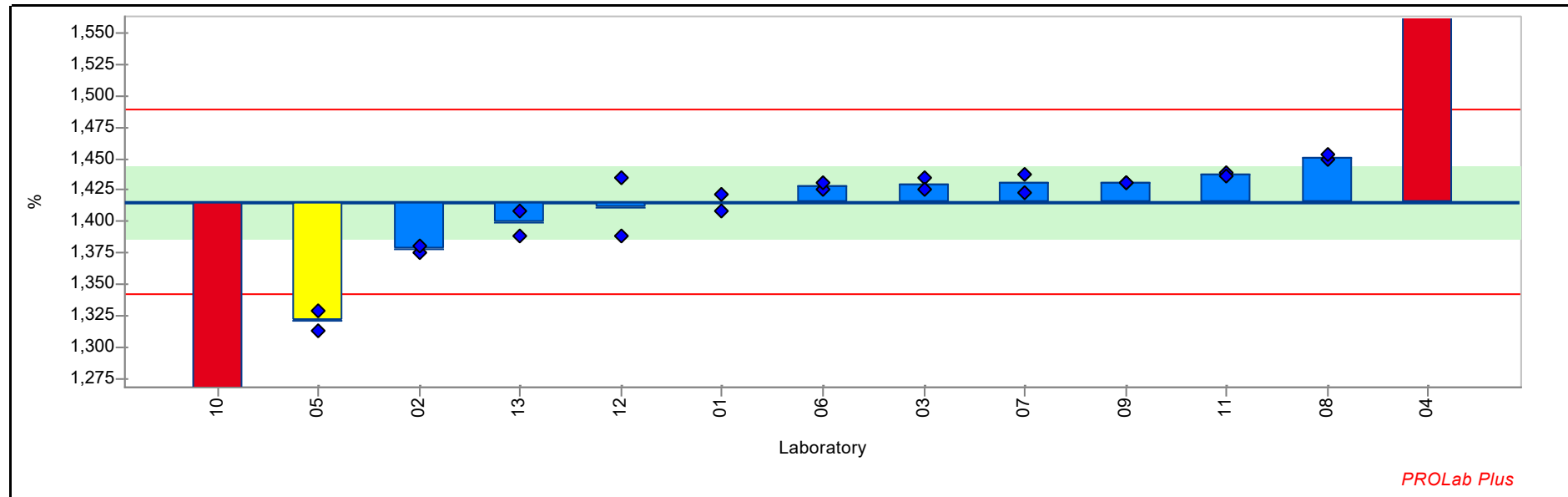
**RV-2019-02 Cement (Sulfate and Sulfide)**

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Lab code	Lab mean	s.d.	z-score	Conc. 1	Conc. 2	Accreditation	Analytical method	Comment
12	0,038	0,003	-0,268	0,036	0,040	no accreditation	XRF (fusion)	
13	0,045	0,000	1,084	0,045	0,045	ISO 17025	XRF (fusion)	

**RV-2019-02 Cement (Sulfate and Sulfide)**

**Sample:** FLX-RV-Sample02      **Reprod. s.d.:** 0,037 %  
**Measurand:** MgO      **Repeat. s.d.:** 0,011 %  
**Mean ± U(Mean):** 1,416 ± 0,028 %      **Range of tolerance:** 1,342 - 1,490 % (|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
01	1,415	0,009	-0,005	1,422	1,409	ISO 17025	Other Method	ICP
02	1,377	0,004	-1,033	1,375	1,380	ISO 17025	XRF (fusion)	DIN 51001 2003-08
03	1,430	0,007	0,387	1,435	1,425	no accreditation	XRF (fusion)	
04	1,637	0,004	5,996	1,635	1,640	ISO 17025	XRF (fusion)	DIN 51001 2003-08
05	1,321	0,011	-2,560	1,313	1,329	no accreditation	XRF (fusion)	
06	1,429	0,004	0,346	1,426	1,431	ISO 17025	XRF (fusion)	
07	1,430	0,011	0,400	1,423	1,438	no accreditation	XRF (fusion)	EN-196-2 2013
08	1,452	0,002	0,968	1,450	1,453	ISO 17025	XRF (fusion)	DIN 51001 2003-08

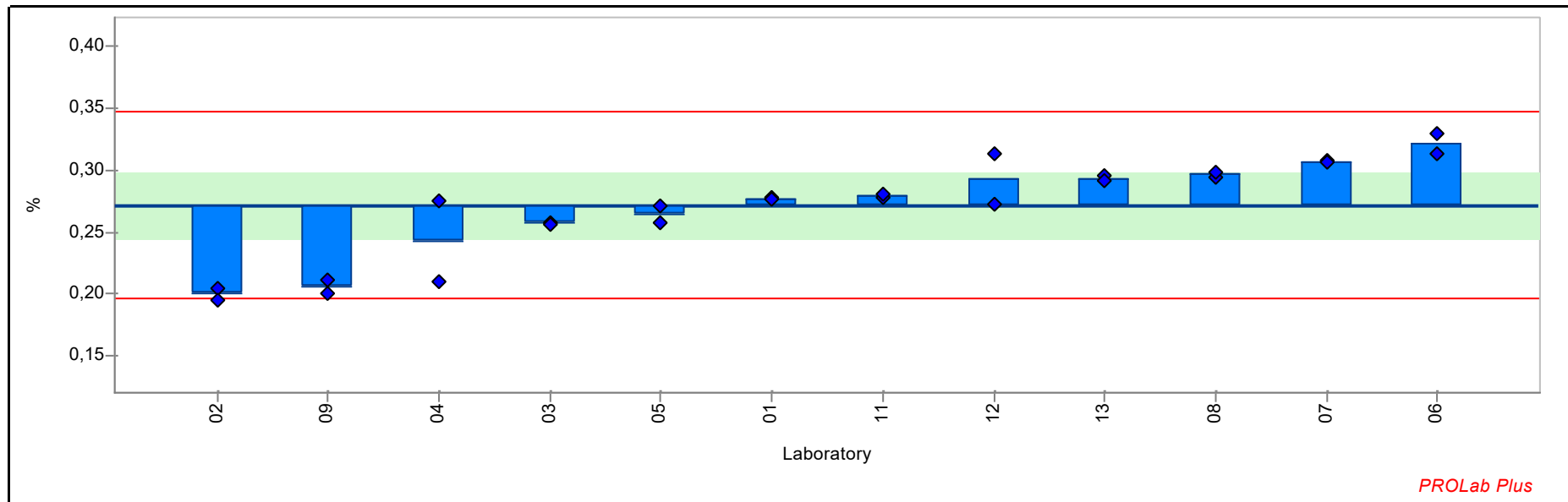
**RV-2019-02 Cement (Sulfate and Sulfide)**

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Lab code	Lab mean	s.d.	z-score	Conc. 1	Conc. 2	Accreditation	Analytical method	Comment
09	1,431	0,000	0,414	1,431	1,431	no accreditation	XRF (fusion)	
10	0,980	0,008	-11,779	0,974	0,986	no accreditation	XRF (fusion)	ISO 29581-2 2010-02
11	1,438	0,002	0,589	1,439	1,436	no accreditation	XRF (fusion)	PN-EN ISO 12677
12	1,411	0,033	-0,114	1,435	1,388	no accreditation	XRF (fusion)	
13	1,399	0,014	-0,452	1,409	1,389	ISO 17025	XRF (fusion)	

**RV-2019-02 Cement (Sulfate and Sulfide)**

**Sample:** FLX-RV-Sample02      **Reprod. s.d.** 0,038 %  
**Measurand:** Na2O      **Repeat. s.d.** 0,008 %  
**Mean ± U(Mean):** 0,272 ± 0,026 %      **Range of tolerance:** 0,196 - 0,348 % (|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	0,277	0,001	0,135	0,278	0,276	ISO 17025	Other Method	ICP
02	0,200	0,007	-1,895	0,205	0,195	ISO 17025	XRF (fusion)	DIN 51001 2003-08
03	0,257	0,001	-0,392	0,258	0,256	no accreditation	XRF (fusion)	
04	0,242	0,046	-0,774	0,275	0,210	ISO 17025	XRF (fusion)	DIN 51001 2003-08
05	0,265	0,009	-0,194	0,271	0,258	no accreditation	XRF (fusion)	
06	0,322	0,012	1,309	0,330	0,313	ISO 17025	XRF (fusion)	
07	0,307	0,001	0,926	0,308	0,306	no accreditation	XRF (fusion)	EN-196-2 2013
08	0,297	0,003	0,663	0,295	0,299	ISO 17025	XRF (fusion)	DIN 51001 2003-08

**RV-2019-02 Cement (Sulfate and Sulfide)**

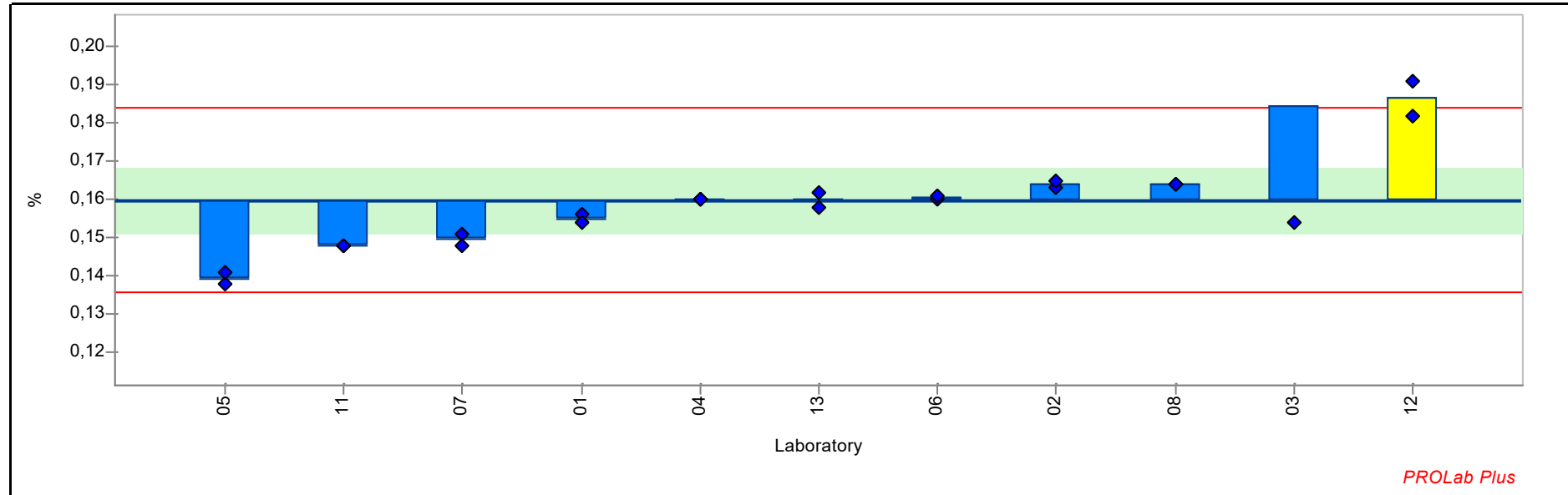
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Lab code	Lab mean	s.d.	z-score	Conc. 1	Conc. 2	Accreditation	Analytical method	Comment
09	0,207	0,008	-1,724	0,212	0,201	no accreditation	XRF (fusion)	
11	0,280	0,002	0,201	0,278	0,281	no accreditation	XRF (fusion)	PN-EN ISO 12677
12	0,293	0,028	0,557	0,313	0,273	no accreditation	XRF (fusion)	
13	0,293	0,004	0,570	0,296	0,291	ISO 17025	XRF (fusion)	



**RV-2019-02 Cement (Sulfate and Sulfide)**

**Sample:** FLX-RV-Sample02      **Reprod. s.d.:** 0,012 %  
**Measurand:** P2O5      **Repeat. s.d.:** 0,002 %  
**Mean ± U(Mean):** 0,160 ± 0,009 %      **Range of tolerance:** 0,136 - 0,184 % (|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
01	0,155	0,001	-0,405	0,156	0,154	ISO 17025	Other Method	ICP
02	0,164	0,001	0,340	0,163	0,165	ISO 17025	XRF (fusion)	DIN 51001 2003-08
03	0,184	0,043	2,000	0,154	0,215	no accreditation	XRF (fusion)	
04	0,160	0,000	0,009	0,160	0,160	ISO 17025	XRF (fusion)	DIN 51001 2003-08
05	0,140	0,002	-1,687	0,138	0,141	no accreditation	XRF (fusion)	
06	0,161	0,001	0,050	0,160	0,161	ISO 17025	XRF (fusion)	
07	0,149	0,002	-0,860	0,151	0,148	no accreditation	XRF (fusion)	EN-196-2 2013
08	0,164	0,000	0,340	0,164	0,164	ISO 17025	XRF (fusion)	DIN 51001 2003-08

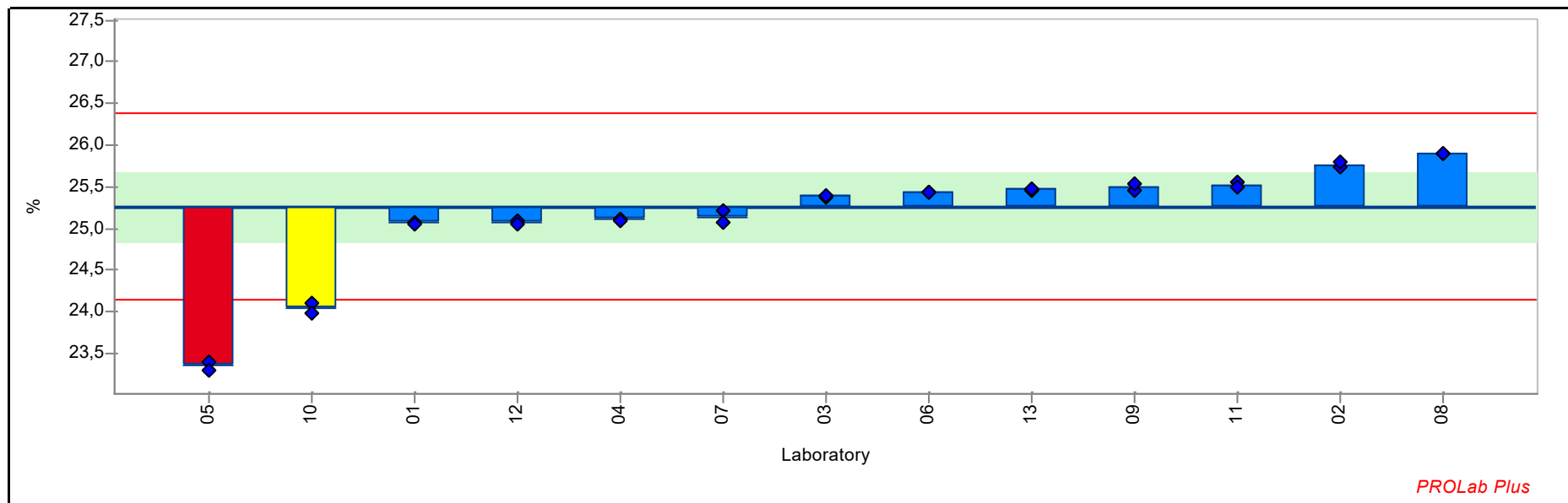
**RV-2019-02 Cement (Sulfate and Sulfide)**

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Lab code	Lab mean	s.d.	z-score	Conc. 1	Conc. 2	Accreditation	Analytical method	Comment
11	0,148	0,000	-0,984	0,148	0,148	no accreditation	XRF (fusion)	PN-EN ISO 12677
12	0,186	0,006	2,201	0,191	0,182	no accreditation	XRF (fusion)	
13	0,160	0,003	0,009	0,162	0,158	ISO 17025	XRF (fusion)	

**RV-2019-02 Cement (Sulfate and Sulfide)**

**Sample:** FLX-RV-Sample02      **Reprod. s.d.:** 0,563 %  
**Measurand:** SiO2      **Repeat. s.d.:** 0,044 %  
**Mean ± U(Mean):** 25,263 ± 0,415 %      **Range of tolerance:** 24,138 - 26,388 % (|z-score| ≤ 2,000)  
**No. of laboratories:** 13      **Statistical method:** Q/Hampel



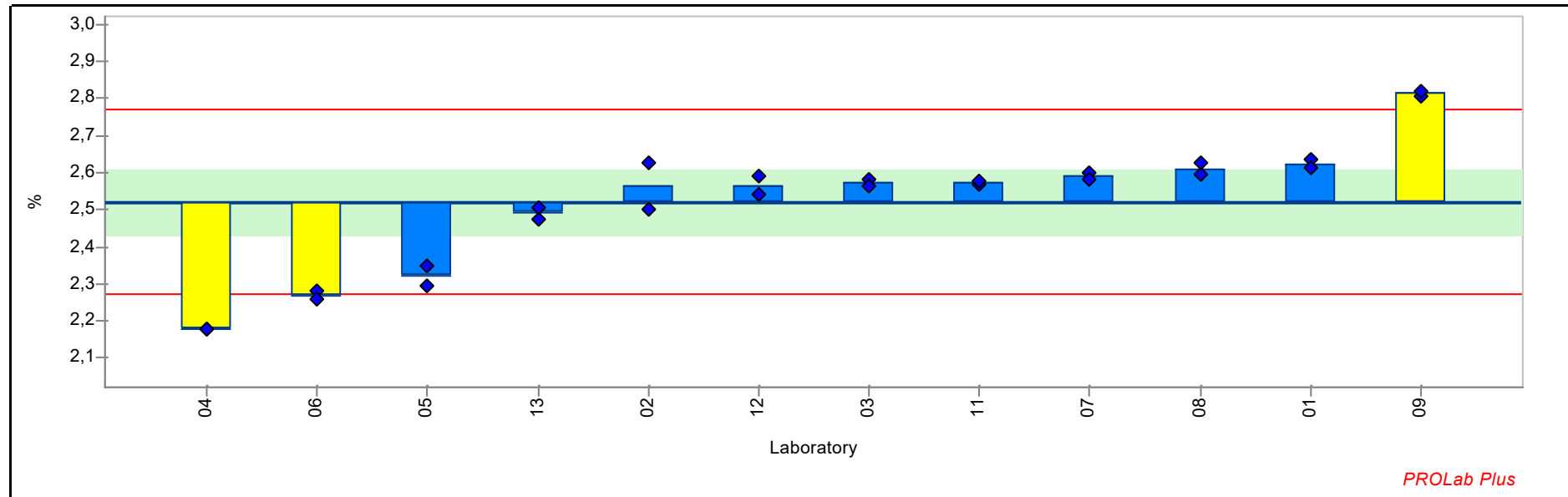
Lab code	Lab mean	s.d.	z-score	Conc. 1	Conc. 2	Accreditation	Analytical method	Comment
01	25,062	0,006	-0,357	25,066	25,058	ISO 17025	Other Method	ICP
02	25,765	0,035	0,892	25,740	25,790	ISO 17025	XRF (fusion)	DIN 51001 2003-08
03	25,390	0,014	0,226	25,380	25,400	no accreditation	XRF (fusion)	
04	25,102	0,025	-0,285	25,120	25,085	ISO 17025	XRF (fusion)	DIN 51001 2003-08
05	23,349	0,081	-3,403	23,406	23,291	no accreditation	XRF (fusion)	
06	25,433	0,003	0,302	25,431	25,435	ISO 17025	XRF (fusion)	
07	25,141	0,094	-0,218	25,207	25,074	no accreditation	XRF (fusion)	EN-196-2 2013
08	25,895	0,006	1,124	25,900	25,891	ISO 17025	XRF (fusion)	DIN 51001 2003-08

**RV-2019-02 Cement (Sulfate and Sulfide)**

Lab code	Lab mean	s.d.	z-score	Conc. 1	Conc. 2	Accreditation	Analytical method	Comment
09	25,495	0,060	0,413	25,453	25,538	no accreditation	XRF (fusion)	
10	24,050	0,085	-2,156	24,110	23,990	no accreditation	XRF (fusion)	ISO 29581-2 2010-02
11	25,523	0,032	0,463	25,546	25,501	no accreditation	XRF (fusion)	PN-EN ISO 12677
12	25,078	0,032	-0,330	25,100	25,055	no accreditation	XRF (fusion)	
13	25,468	0,009	0,365	25,462	25,475	ISO 17025	XRF (fusion)	

RV-2019-02 Cement (Sulfate and Sulfide)

**Sample:** FLX-RV-Sample02      **Reprod. s.d.:** 0,125 %  
**Measurand:** SO3      **Repeat. s.d.:** 0,021 %  
**Mean ± U(Mean):** 2,521 ± 0,085 %      **Range of tolerance:** 2,271 - 2,771 % (|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
01	2,623	0,017	0,814	2,635	2,611	ISO 17025	Other Method	ICP
02	2,563	0,088	0,330	2,500	2,625	ISO 17025	XRF (fusion)	information only
03	2,572	0,011	0,410	2,580	2,565	no accreditation	XRF (fusion)	
04	2,180	0,000	-2,729	2,180	2,180	ISO 17025	XRF (fusion)	DIN 51001 2003-08
05	2,322	0,037	-1,590	2,296	2,349	no accreditation	XRF (fusion)	
06	2,270	0,014	-2,009	2,280	2,260	ISO 17025	Other Method	S -LECO SC-044DR
07	2,590	0,011	0,550	2,598	2,582	no accreditation	XRF (fusion)	EN-196-2 2013
08	2,610	0,021	0,710	2,595	2,625	ISO 17025	XRF (fusion)	DIN 51001 2003-08

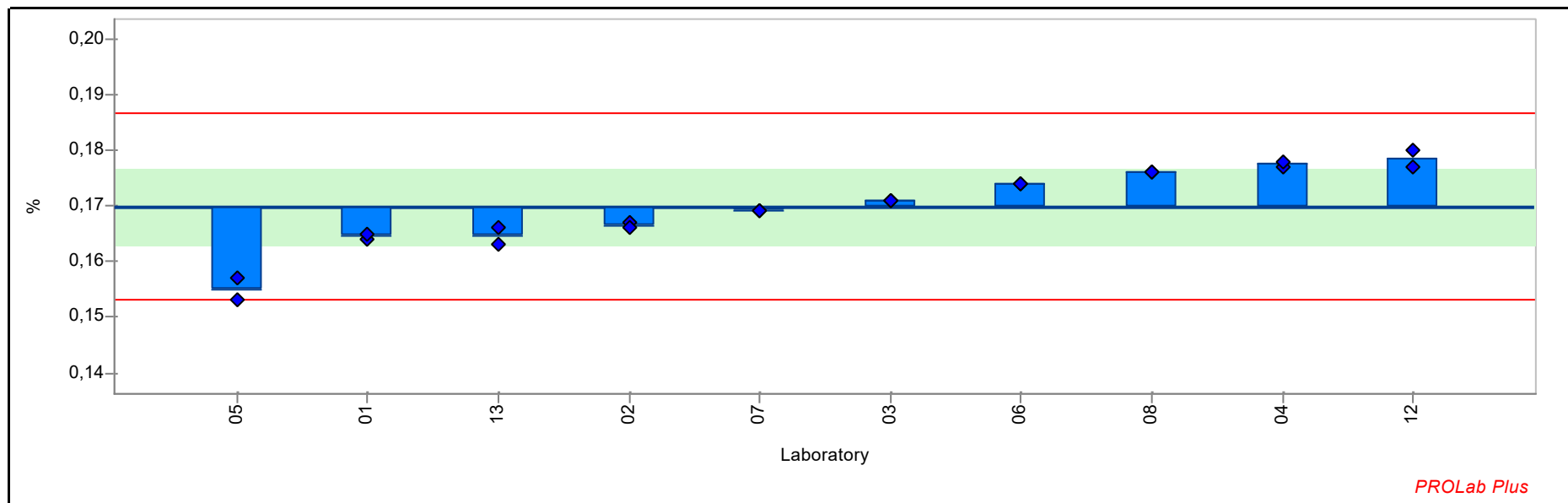
**RV-2019-02 Cement (Sulfate and Sulfide)**

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Lab code	Lab mean	s.d.	z-score	Conc. 1	Conc. 2	Accreditation	Analytical method	Comment
09	2,813	0,008	2,338	2,808	2,819	no accreditation	XRF (fusion)	
11	2,573	0,004	0,414	2,570	2,576	no accreditation	XRF (fusion)	PN-EN ISO 12677
12	2,565	0,034	0,350	2,541	2,589	no accreditation	XRF (fusion)	
13	2,490	0,021	-0,250	2,475	2,505	ISO 17025	XRF (fusion)	

**RV-2019-02 Cement (Sulfate and Sulfide)**

**Sample:** FLX-RV-Sample02      **Reprod. s.d.:** 0,008 %  
**Measurand:** SrO      **Repeat. s.d.:** 0,002 %  
**Mean ± U(Mean):** 0,170 ± 0,007 %      **Range of tolerance:** 0,153 - 0,187 % (|z-score| ≤ 2,000)  
**No. of laboratories:** 10      **Statistical method:** Q/Hampel



PROLab Plus

Lab code	Lab mean	s.d.	z-score	Conc. 1	Conc. 2	Accreditation	Analytical method	Comment
01	0,165	0,001	-0,640	0,164	0,165	ISO 17025	Other Method	ICP
02	0,167	0,001	-0,402	0,167	0,166	ISO 17025	XRF (fusion)	DIN 51001 2003-08
03	0,171	0,000	0,134	0,171	0,171	no accreditation	XRF (fusion)	
04	0,177	0,001	0,907	0,177	0,178	ISO 17025	XRF (fusion)	DIN 51001 2003-08
05	0,155	0,003	-1,771	0,153	0,157	no accreditation	XRF (fusion)	
06	0,174	0,000	0,491	0,174	0,174	ISO 17025	XRF (fusion)	
07	0,169	0,000	-0,104	0,169	0,169	no accreditation	XRF (fusion)	EN-196-2 2013
08	0,176	0,000	0,729	0,176	0,176	ISO 17025	XRF (fusion)	DIN 51001 2003-08

**RV-2019-02 Cement (Sulfate and Sulfide)**

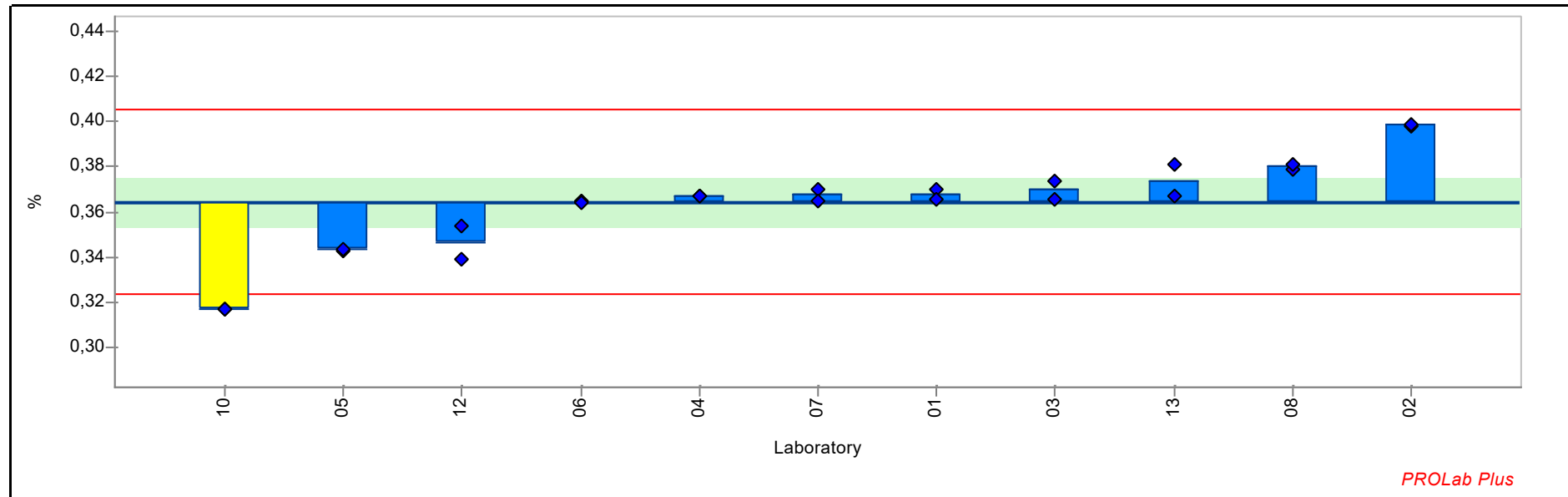
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Lab code	Lab mean	s.d.	z-score	Conc. 1	Conc. 2	Accreditation	Analytical method	Comment
12	0,178	0,002	1,026	0,180	0,177	no accreditation	XRF (fusion)	
13	0,165	0,002	-0,640	0,163	0,166	ISO 17025	XRF (fusion)	



**RV-2019-02 Cement (Sulfate and Sulfide)**

**Sample:** FLX-RV-Sample02      **Reprod. s.d.:** 0,020 %  
**Measurand:** TiO2      **Repeat. s.d.:** 0,003 %  
**Mean ± U(Mean):** 0,365 ± 0,010 %      **Range of tolerance:** 0,324 - 0,405 % (|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
01	0,368	0,003	0,168	0,370	0,366	ISO 17025	Other Method	ICP
02	0,399	0,001	1,660	0,398	0,399	ISO 17025	XRF (fusion)	DIN 51001 2003-08
03	0,370	0,006	0,266	0,374	0,366	no accreditation	XRF (fusion)	
04	0,367	0,000	0,120	0,367	0,367	ISO 17025	XRF (fusion)	DIN 51001 2003-08
05	0,344	0,001	-1,029	0,343	0,344	no accreditation	XRF (fusion)	
06	0,364	0,001	-0,003	0,365	0,364	ISO 17025	XRF (fusion)	
07	0,367	0,004	0,144	0,370	0,365	no accreditation	XRF (fusion)	EN-196-2 2013
08	0,380	0,001	0,755	0,379	0,381	ISO 17025	XRF (fusion)	DIN 51001 2003-08

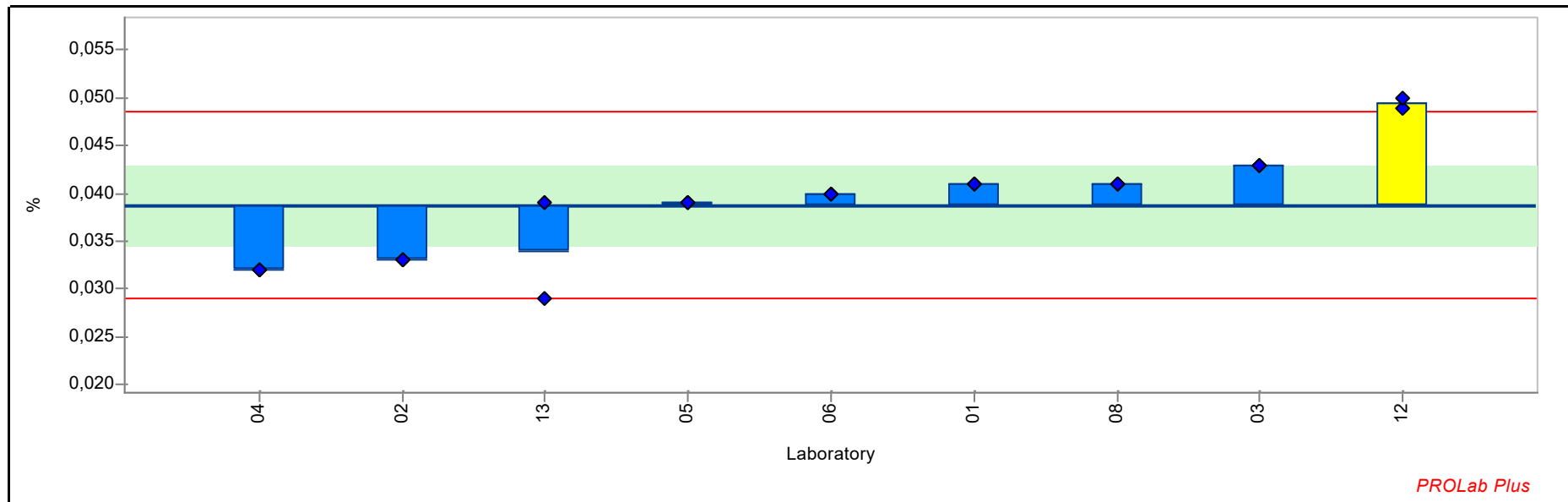
**RV-2019-02 Cement (Sulfate and Sulfide)**

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Lab code	Lab mean	s.d.	z-score	Conc. 1	Conc. 2	Accreditation	Analytical method	Comment
10	0,317	0,000	-2,325	0,317	0,317	no accreditation	XRF (fusion)	ISO 29581-2 2010-02
12	0,347	0,011	-0,883	0,339	0,354	no accreditation	XRF (fusion)	
13	0,374	0,010	0,462	0,381	0,367	ISO 17025	XRF (fusion)	

**RV-2019-02 Cement (Sulfate and Sulfide)**

**Sample:** FLX-RV-Sample02      **Reprod. s.d.** 0,005 %  
**Measurand:** ZnO      **Repeat. s.d.** 0,002 %  
**Mean ± U(Mean):** 0,039 ± 0,004 %      **Range of tolerance:** 0,029 - 0,049 % (|z-score| <= 2,000)  
**No. of laboratories:** 9      **Statistical method** Q/Hampel



PROLab Plus

Lab code	Lab mean	s.d.	z-score	Conc. 1	Conc. 2	Accreditation	Analytical method	Comment
01	0,041	0,000	0,449	0,041	0,041	ISO 17025	Other Method	ICP
02	0,033	0,000	-1,181	0,033	0,033	ISO 17025	XRF (fusion)	
03	0,043	0,000	0,857	0,043	0,043	no accreditation	XRF (fusion)	
04	0,032	0,000	-1,384	0,032	0,032	ISO 17025	XRF (fusion)	DIN 51001 2003-08
05	0,039	0,000	0,042	0,039	0,039	no accreditation	XRF (fusion)	
06	0,040	0,000	0,245	0,040	0,040	ISO 17025	XRF (fusion)	
08	0,041	0,000	0,449	0,041	0,041	ISO 17025	XRF (fusion)	DIN 51001 2003-08
12	0,050	0,001	2,181	0,049	0,050	no accreditation	XRF (fusion)	

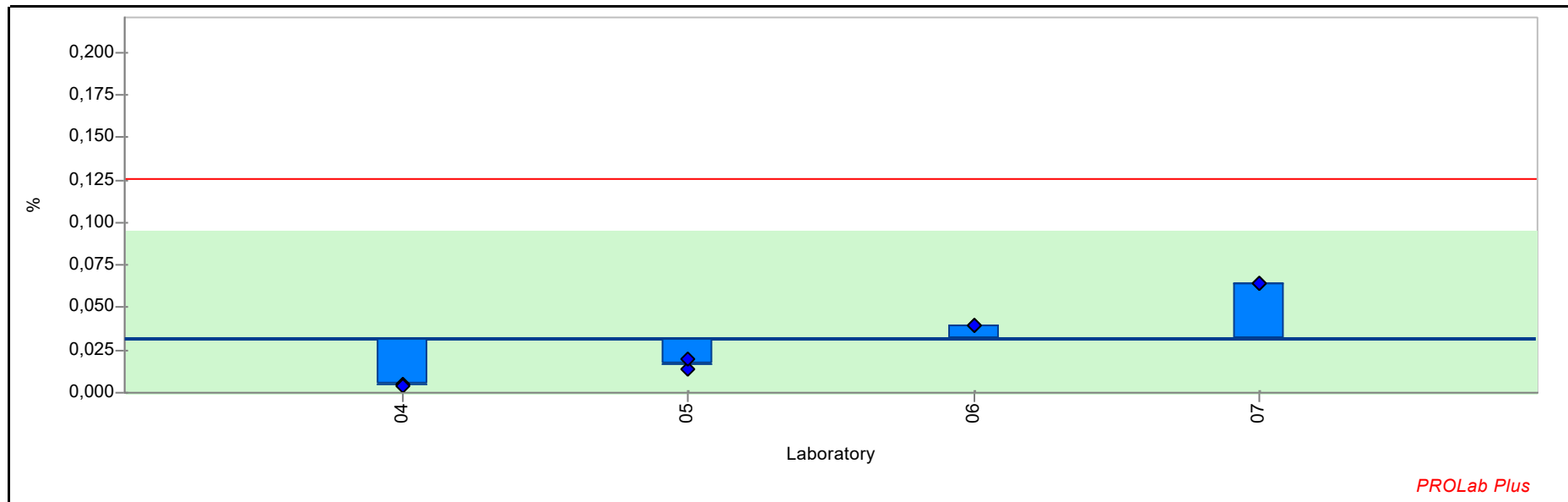
**RV-2019-02 Cement (Sulfate and Sulfide)**

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Lab code	Lab mean	s.d.	z-score	Conc. 1	Conc. 2	Accreditation	Analytical method	Comment
13	0,034	0,007	-0,977	0,029	0,039	ISO 17025	XRF (fusion)	

**RV-2019-02 Cement (Sulfate and Sulfide)**

**Sample:** FLX-RV-Sample02      **Reprod. s.d.:** 0,047 %  
**Measurand:** Sulfide      **Repeat. s.d.:** 0,002 %  
**Mean ± U(Mean):** 0,031 ± 0,064 %      **Range of tolerance:** -0,063 - 0,126 % (|z-score| ≤ 2,000)  
**No. of laboratories:** 4      **Statistical method:** Q/Hampel

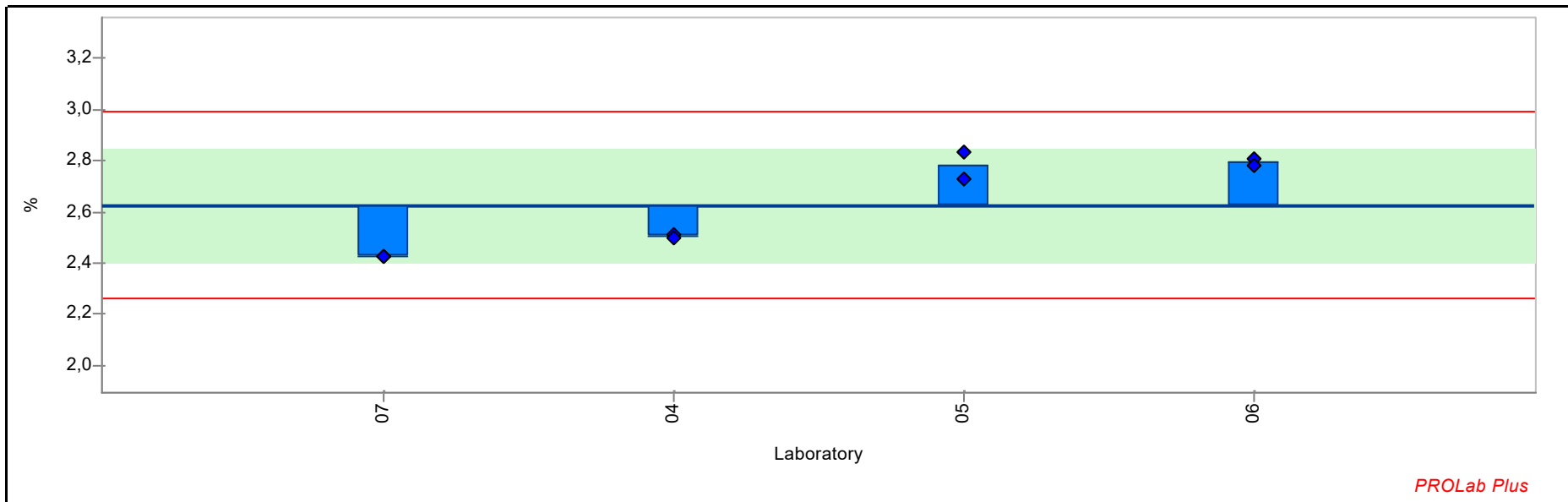


*PROLab Plus*

Lab code	Lab mean	s.d.	z-score	Conc. 1	Conc. 2	Accreditation	Analytical method	Comment
04	0,005	0,001	-0,568	0,005	0,004	ISO 17025	Other Method	EN-196-2 2013
05	0,017	0,004	-0,304	0,014	0,020	no accreditation	XRF (fusion)	
06	0,040	0,000	0,182	0,040	0,040	no accreditation	Other Method	EN-196-2 2013
07	0,064	0,000	0,689	0,064	0,064	no accreditation	Other Method	EN-196-2 2013

**RV-2019-02 Cement (Sulfate and Sulfide)**

**Sample:** FLX-RV-Sample02      **Reprod. s.d.** 0,183 %  
**Measurand:** Sulfate      **Repeat. s.d** 0,024 %  
**Mean ± U(Mean):** 2,627 ± 0,221 %      **Range of tolerance:** 2,260 - 2,994 % (|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
04	2,505	0,006	-0,666	2,509	2,500	ISO 17025	Other Method	EN-196-2 2013
05	2,783	0,077	0,849	2,837	2,728	no accreditation	Other Method	ASTM C114
06	2,795	0,021	0,917	2,810	2,780	no accreditation	Other Method	EN-196-2 2013
07	2,425	0,000	-1,100	2,425	2,425	no accreditation	Other Method	EN-196-2 2013

*RV-2019-02 Cement (Sulfate and Sulfide)***z-scores (per sample)**

Sample: FLX-RV-Sample01

Lab code	Al2O3	CaO	Cr2O3	Fe2O3	K2O	Loss on Ignition	Mn2O3	MgO	Na2O	P2O5	SiO2	SO3	SrO	TiO2	ZnO	Sulfide	Sulfate
01	-1,190	0,963	0,589	0,368	0,616	-0,530	0,371	0,342	0,389	0,415	-1,156	0,810	-0,571	0,085	0,121		
02	0,656	-0,549	-0,089	-1,846	-5,558	-1,680	-0,017	-0,583	-1,832	-0,254	1,265	3,374	-0,398	1,387	0,605		
03	0,124	-0,134	-0,428	-0,465	-0,465	0,052	0,216	-0,117	-0,219	0,750	-0,019	0,028	0,238	-0,185	-0,242		
04	-0,053	-1,120		0,505	-2,214	0,181	0,527	4,467	-3,047	0,359	-1,056	-4,188	1,104	-0,201		-0,209	-1,496
05	-1,306	-3,541	0,419	-0,798	0,103	1,204	-0,795	-1,841	1,083	-1,592	-3,525	0,108	-1,149	-0,645	-0,121	-0,660	1,662
06	-0,646	0,101	-0,089	0,603	0,367	0,660	0,527	-0,249	1,378	0,081	0,032	-0,895	0,758	-0,201	-0,605	0,079	1,496
07	-0,091	0,242		0,701	0,453	3,825	21,052	-0,210	0,580	-0,031	0,200	-5,625		0,752		0,790	-1,773
08	-0,352	1,359		0,113	0,857	-1,268	-0,795	0,614	0,250	0,359	1,463	-0,116	0,180	0,831			
09	1,394	-0,059		-0,053	0,033	-1,533		0,140	-1,763		0,645	-1,653					
10	1,510	2,756	-1,783		-6,250	0,441		-6,122			0,118			-1,454			
11	0,463	-0,429		1,289	0,927	0,530		1,173	0,476	-1,035	0,306	0,266					
12	-0,575	-0,186		-0,817	-1,763	0,534	-1,028	-0,117	-0,062	2,589	-0,637	1,300	0,411	-0,677	1,210		
13	0,076	-0,730	1,097	0,054	0,110	0,520	0,993	0,474	0,580	-0,644	-0,185	0,312	-0,571	0,307	-0,968		

*RV-2019-02 Cement (Sulfate and Sulfide)***z-scores (per sample)**

Sample: FLX-RV-Sample02

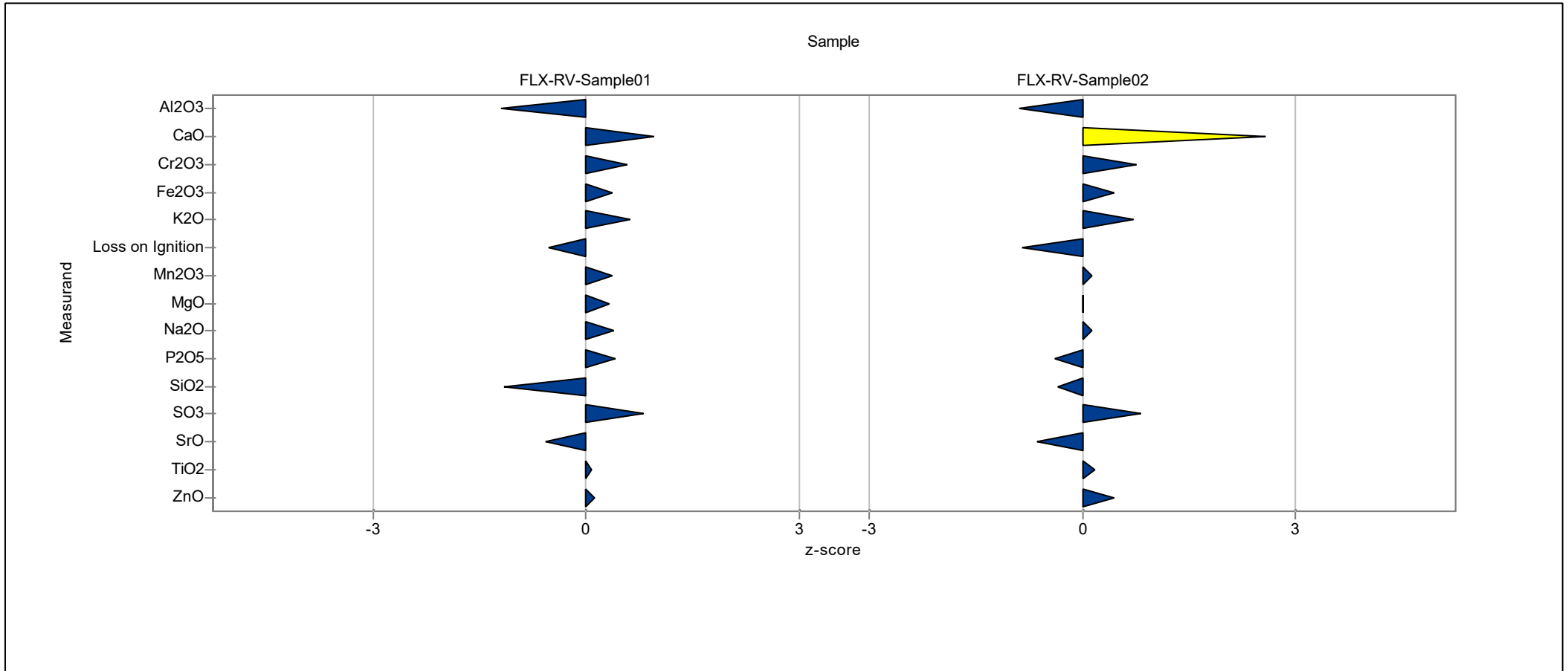
Lab code	Al2O3	CaO	Cr2O3	Fe2O3	K2O	Loss on Ignition	Mn2O3	MgO	Na2O	P2O5	SiO2	SO3	SrO	TiO2	ZnO	Sulfide	Sulfate
01	-0,898	2,581	0,762	0,434	0,711	-0,849	0,118	-0,005	0,135	-0,405	-0,357	0,814	-0,640	0,168	0,449		
02	0,698	-0,208	0,762	-0,030	-2,746	-0,477	-1,331	-1,033	-1,895	0,340	0,892	0,330	-0,402	1,660	-1,181		
03	0,257	0,180	0,243	-0,777	0,438	0,634	0,311	0,387	-0,392	2,000	0,226	0,410	0,134	0,266	0,857		
04	0,056	-0,505		0,776	-0,896	-1,075	0,311	5,996	-0,774	0,009	-0,285	-2,729	0,907	0,120	-1,384	-0,568	-0,666
05	-2,805	-12,275	0,589	-2,466	-0,771	1,350	0,021	-2,560	-0,194	-1,687	-3,403	-1,590	-1,771	-1,029	0,042	-0,304	0,849
06	-0,360	0,146	0,243	-0,229	0,486	-0,075	0,215	0,346	1,309	0,050	0,302	-2,009	0,491	-0,003	0,245	0,182	0,917
07	-0,331	0,557		0,918	0,106	0,958	6,109	0,400	0,926	-0,860	-0,218	0,550	-0,104	0,144		0,689	-1,100
08	-0,149	2,464		-0,236	0,076	-0,891	-0,462	0,968	0,663	0,340	1,124	0,710	0,729	0,755	0,449		
09	0,882	-0,263		-0,146	0,509	-0,925		0,414	-1,724		0,413	2,338					
10	1,406	-1,873	-3,040		-3,795	2,013		-11,779			-2,156			-2,325			
11	0,268	-0,615		1,620	1,482	-0,964		0,589	0,201	-0,984	0,463	0,414					
12	-0,788	-0,209		-0,590	-0,262	0,628	-0,268	-0,114	0,557	2,201	-0,330	0,350	1,026	-0,883	2,181		
13	0,460	-0,584	-1,139	-0,120	0,325	0,184	1,084	-0,452	0,570	0,009	0,365	-0,250	-0,640	0,462	-0,977		



RV-2019-02 Cement (Sulfate and Sulfide)

# Laboratory chart of z-scores

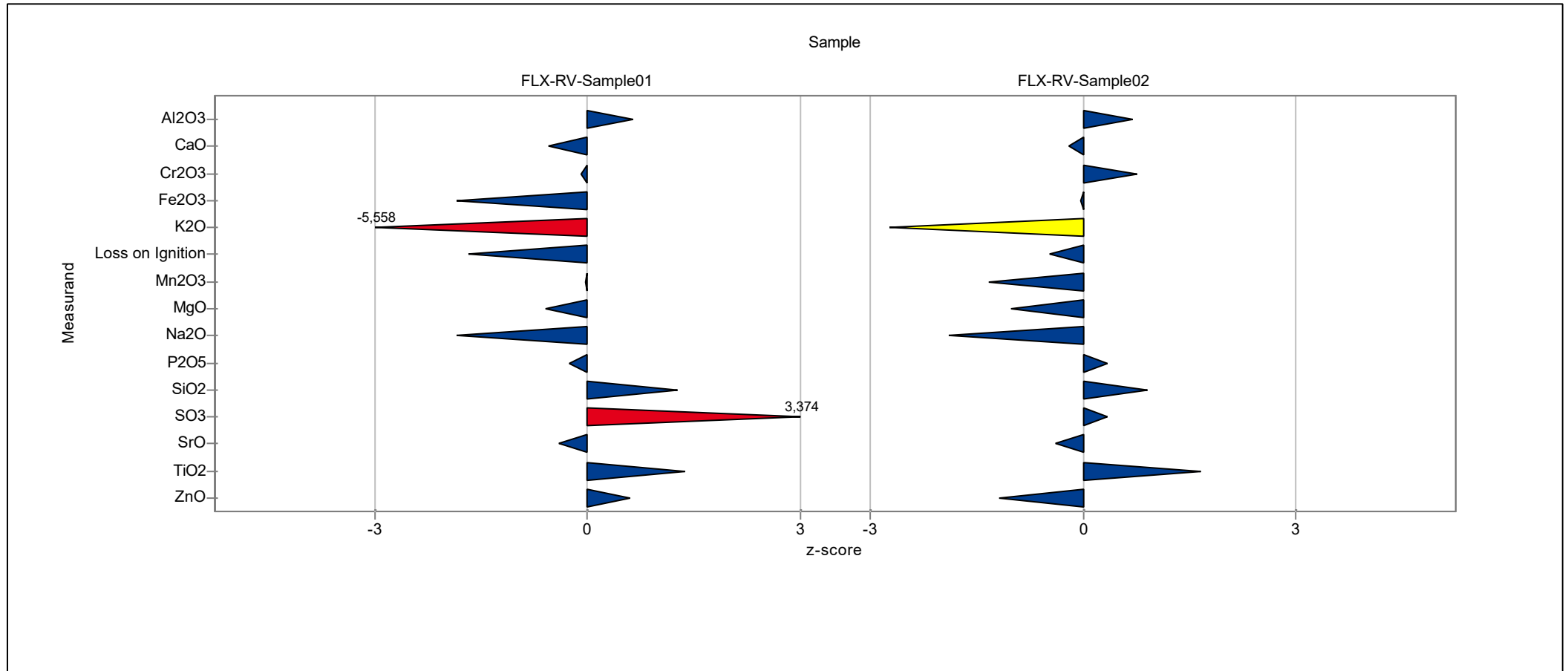
Laboratory: 01



RV-2019-02 Cement (Sulfate and Sulfide)

# Laboratory chart of z-scores

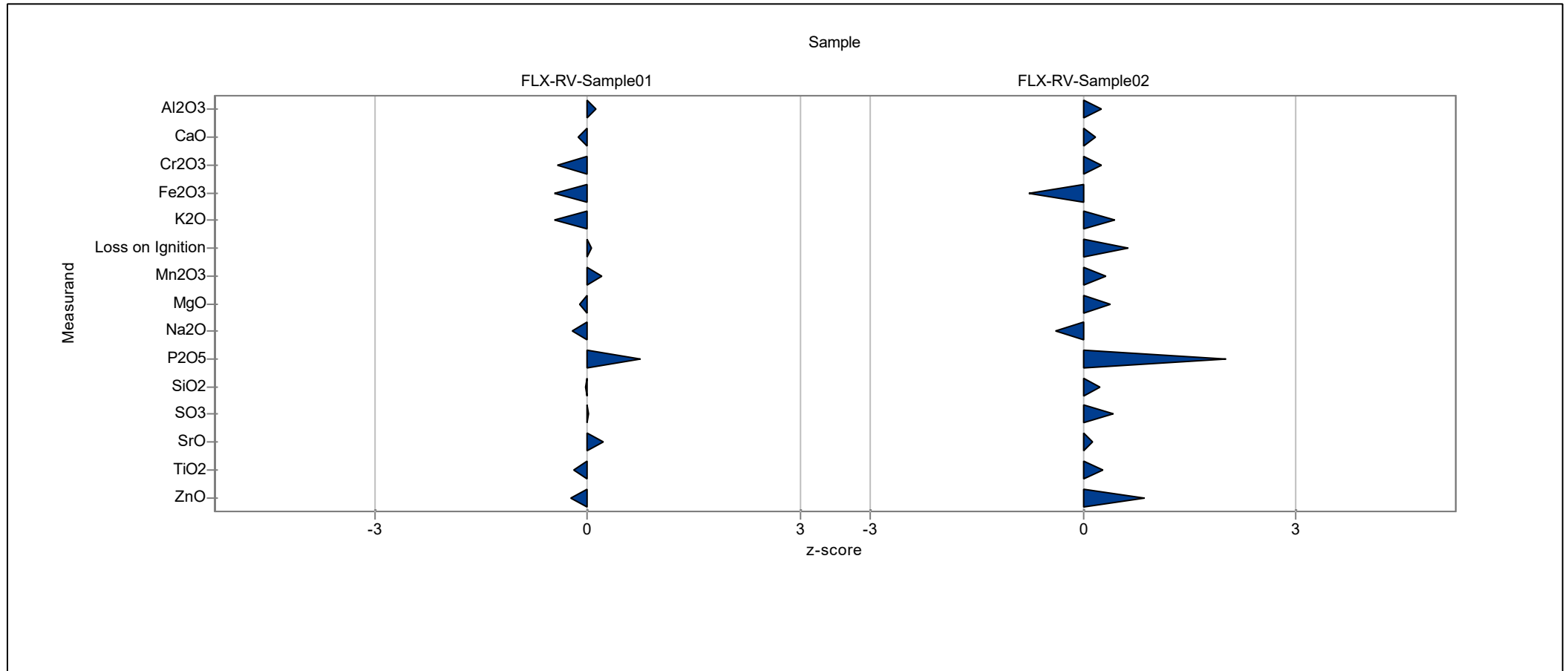
Laboratory: 02



RV-2019-02 Cement (Sulfate and Sulfide)

## Laboratory chart of z-scores

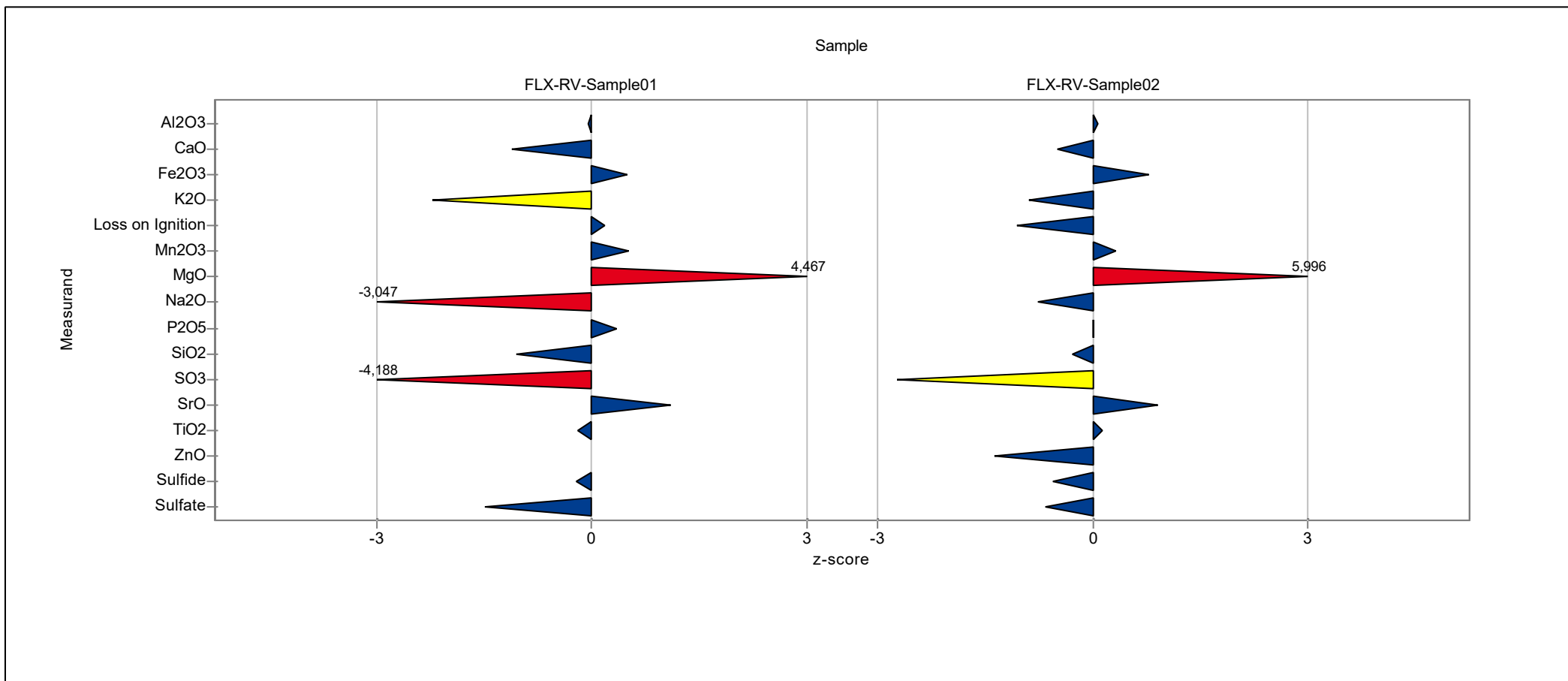
Laboratory: 03



RV-2019-02 Cement (Sulfate and Sulfide)

# Laboratory chart of z-scores

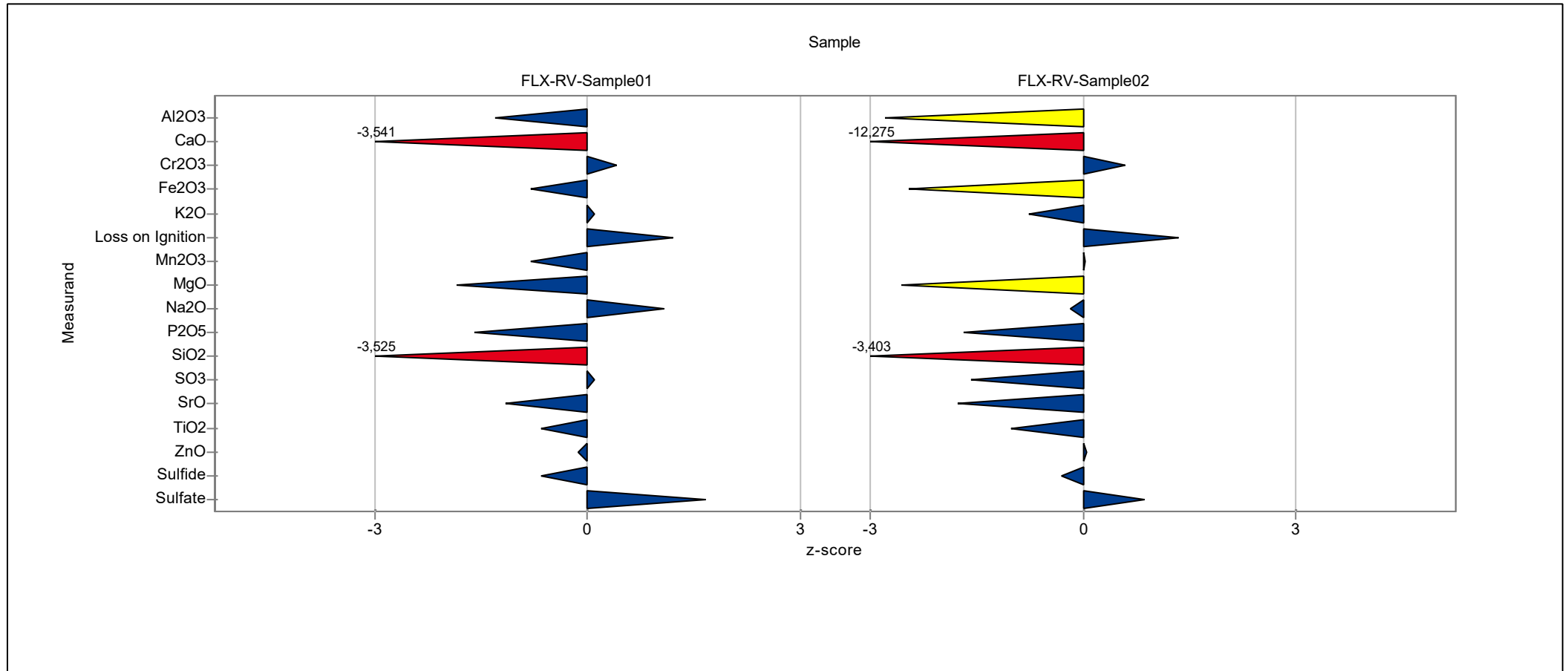
Laboratory: 04



RV-2019-02 Cement (Sulfate and Sulfide)

# Laboratory chart of z-scores

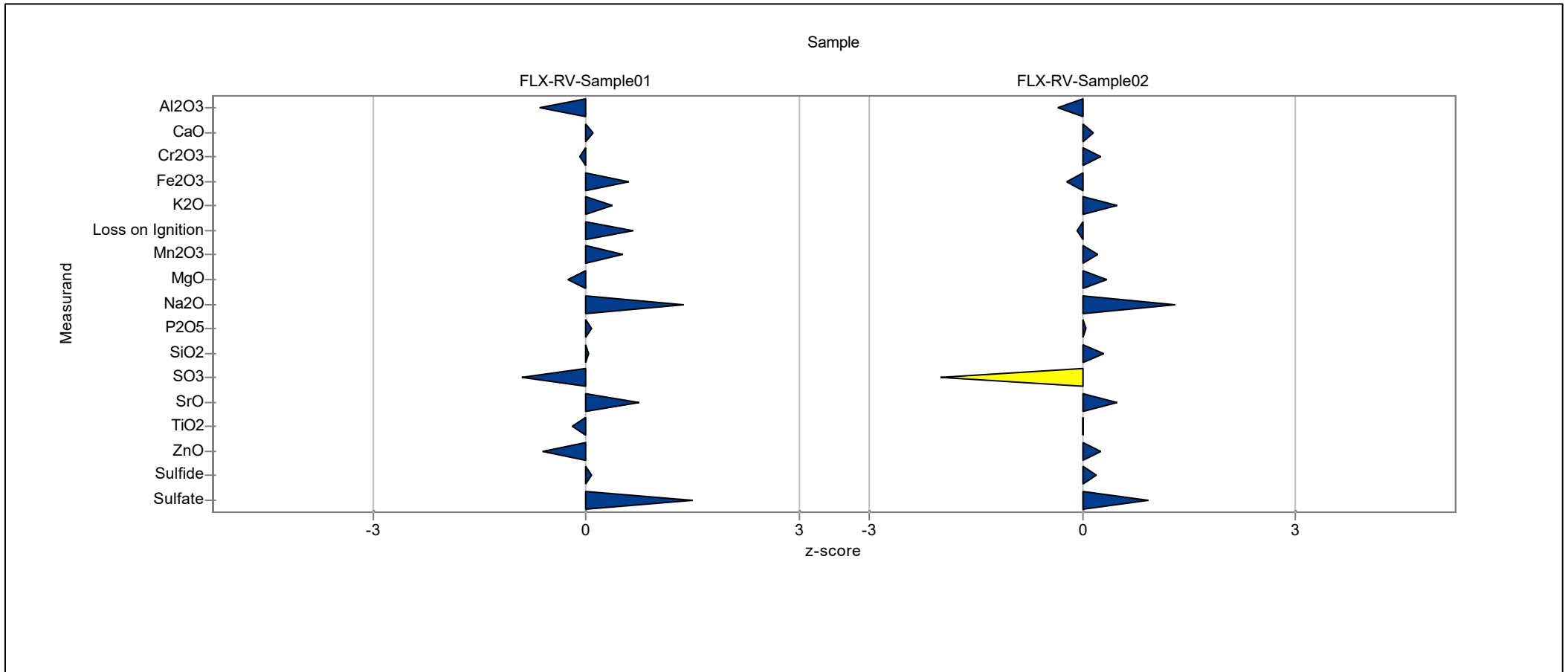
Laboratory: 05



RV-2019-02 Cement (Sulfate and Sulfide)

## Laboratory chart of z-scores

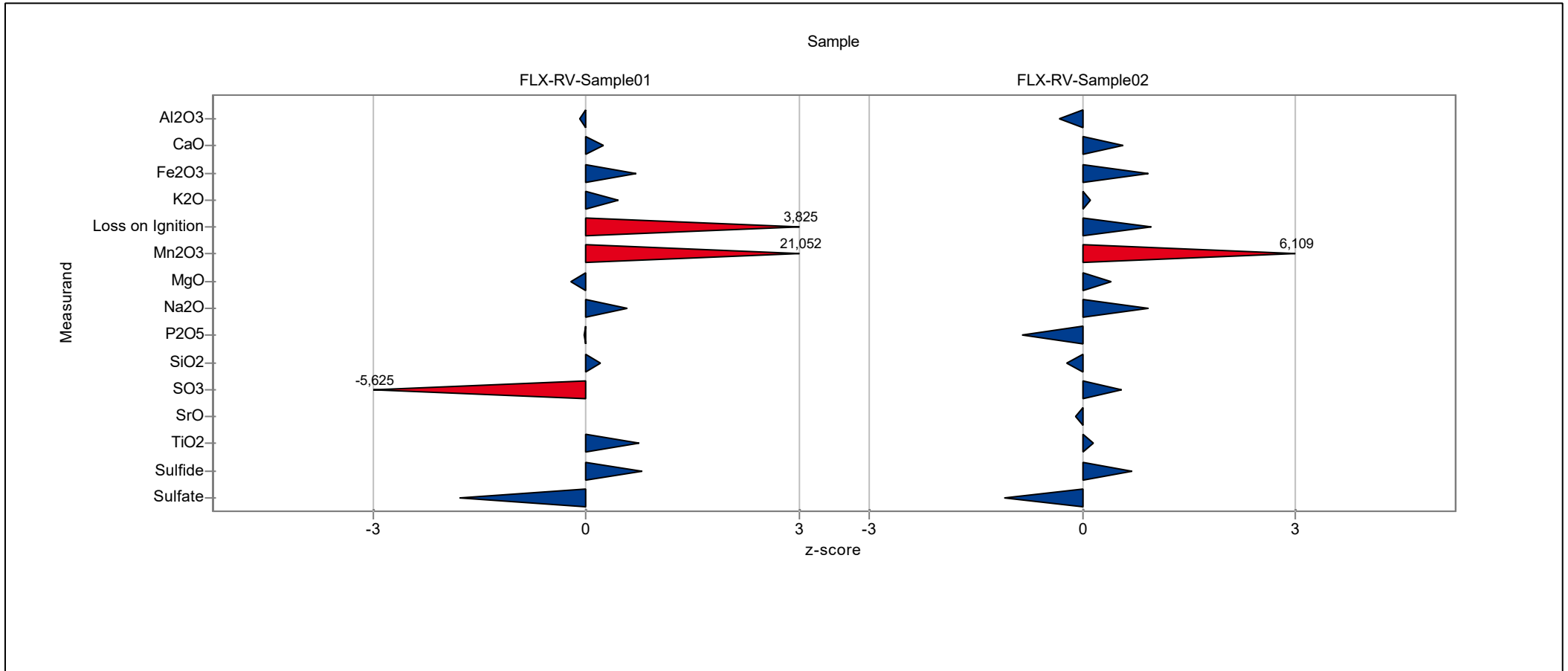
Laboratory: 06



RV-2019-02 Cement (Sulfate and Sulfide)

# Laboratory chart of z-scores

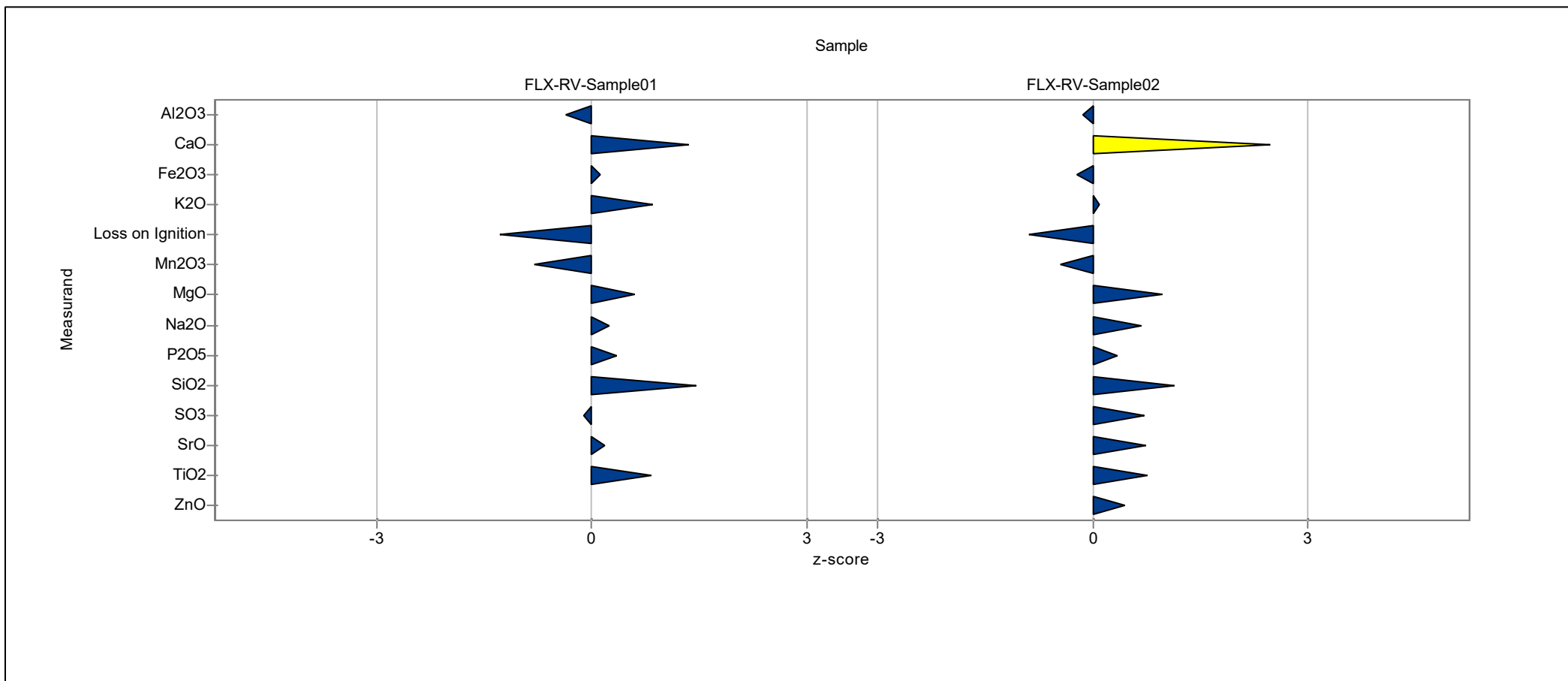
Laboratory: 07



RV-2019-02 Cement (Sulfate and Sulfide)

# Laboratory chart of z-scores

Laboratory: 08

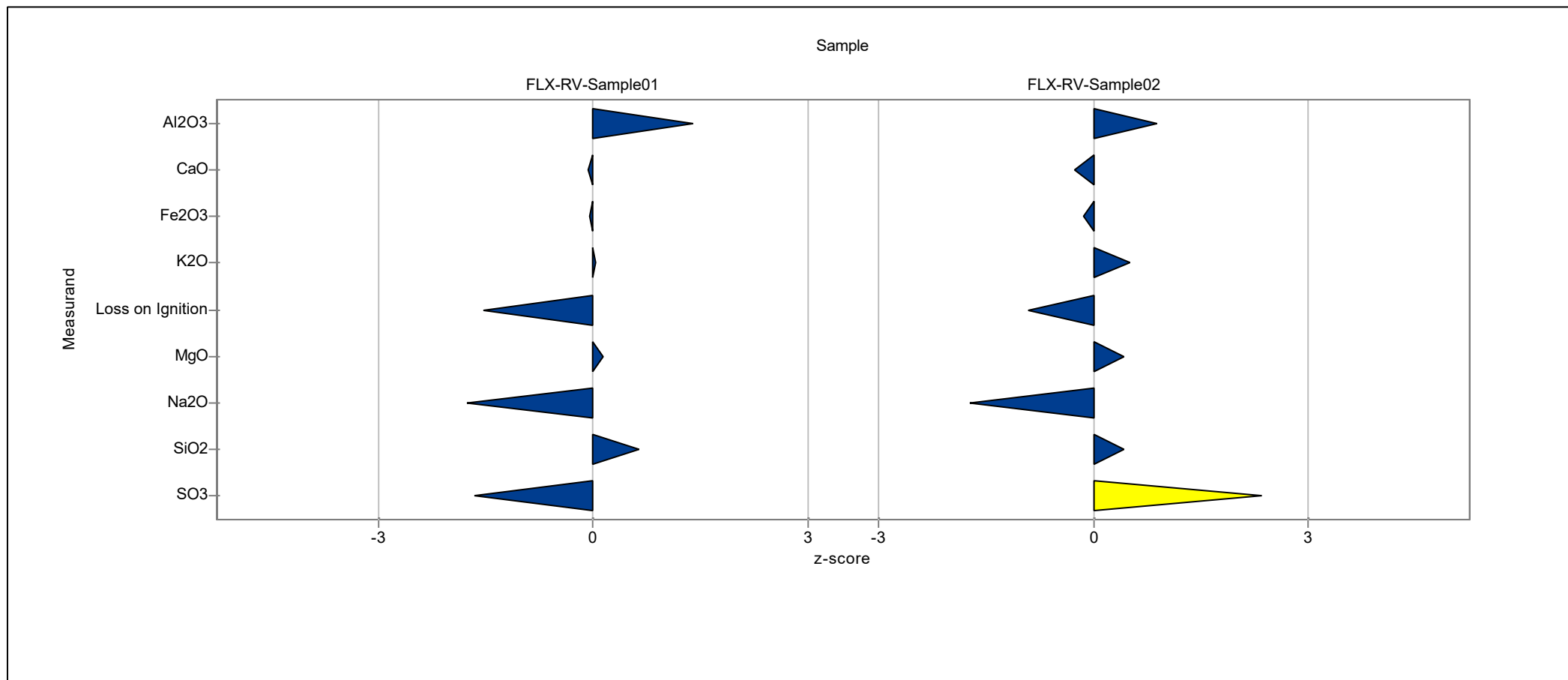




RV-2019-02 Cement (Sulfate and Sulfide)

# Laboratory chart of z-scores

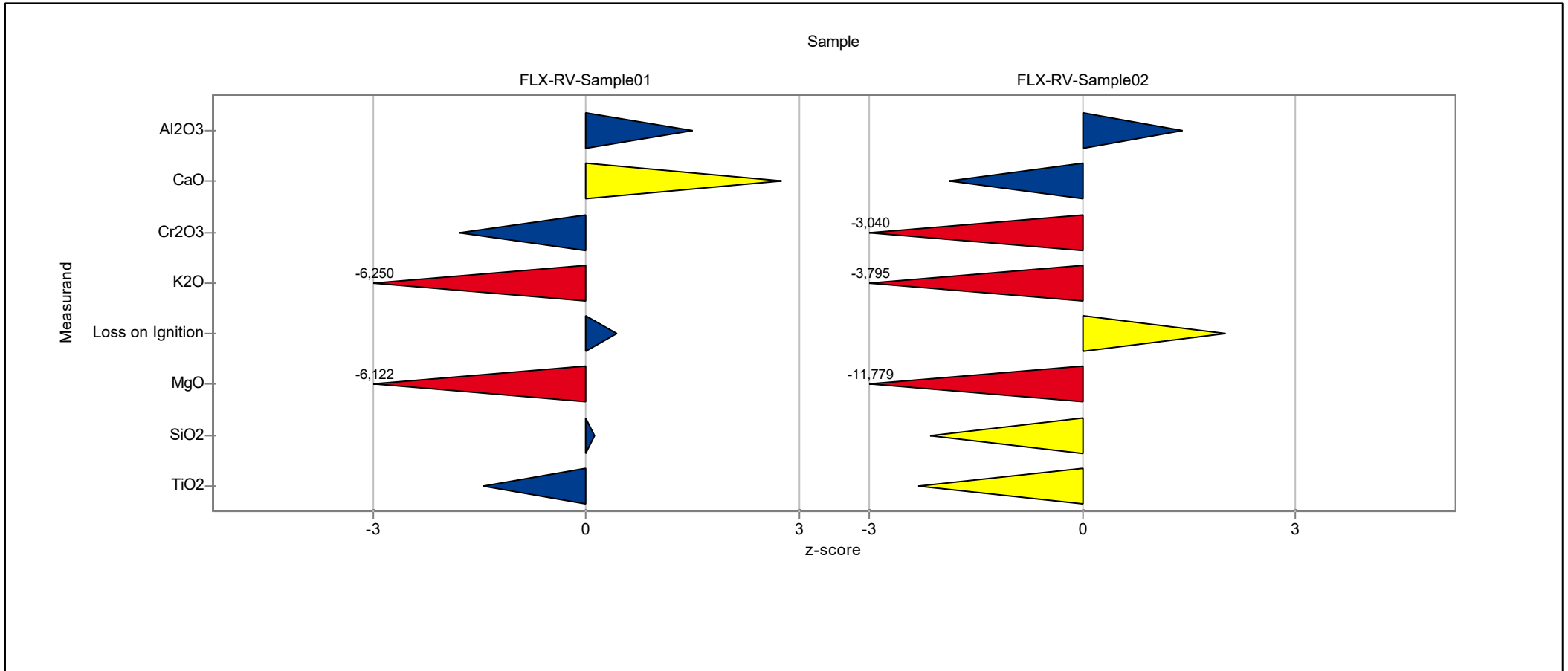
Laboratory: 09



RV-2019-02 Cement (Sulfate and Sulfide)

# Laboratory chart of z-scores

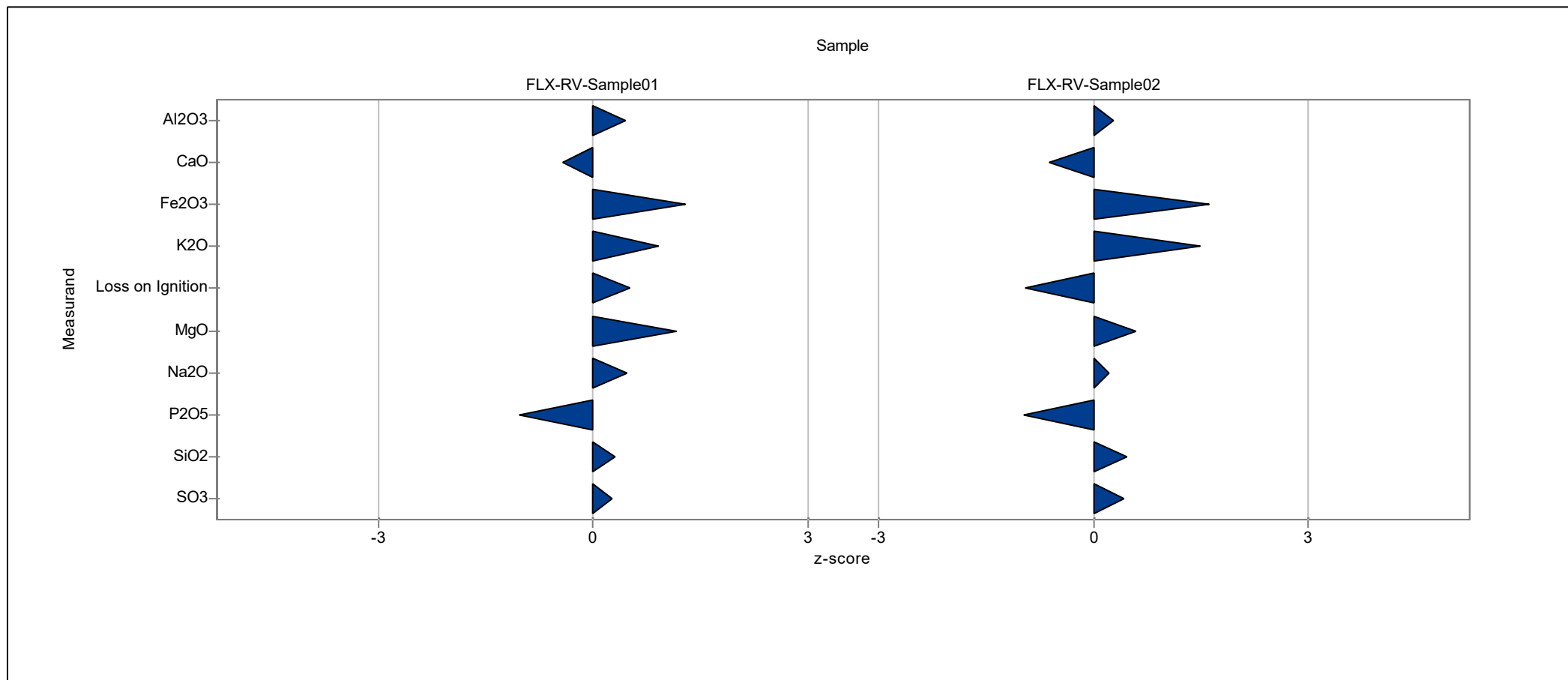
Laboratory: 10



RV-2019-02 Cement (Sulfate and Sulfide)

## Laboratory chart of z-scores

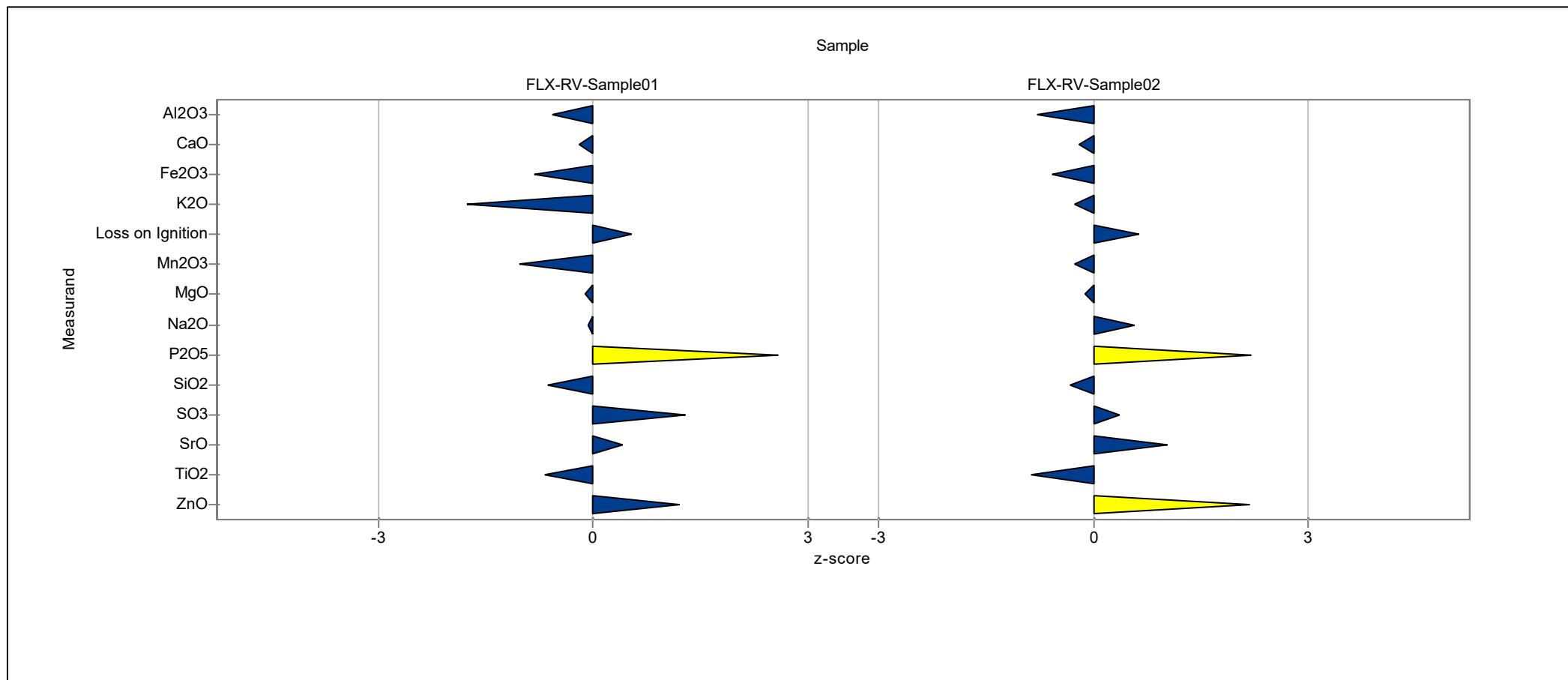
Laboratory: 11



RV-2019-02 Cement (Sulfate and Sulfide)

# Laboratory chart of z-scores

Laboratory: 12



RV-2019-02 Cement (Sulfate and Sulfide)

# Laboratory chart of z-scores

Laboratory: 13

