FXRV-2025-04

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Final Proficiency Test Report for Blackmass (FXRV-2025-04)

FLX-4002

Bedburg-Hau, May 18th 2026

Coordinator of PT
Charlotte Winkels-Herding

Statistics and Report
Dr. Rainer Schramm

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	Al	C	Co	Cu	F	Fe	Li	Mn	Ni	P	S
Unit	%	%	%	%	%	%	%	%	%	%	%
Labs	21	15	21	22	14	19	19	22	21	20	17
Mean m	1,215	19,39	8,674	0,7955	2,113	0,0363	5,223	8,135	26,08	0,2836	0,3798
Repro. s_R	0,248	0,79	0,419	0,0508	0,410	0,0113	0,263	0,368	1,11	0,0495	0,0288
Repeat. s_r	0,009	0,09	0,042	0,0109	0,022	0,0015	0,042	0,043	0,04	0,0045	0,0095
Repro. s*	0,249	0,85	0,400	0,0537	0,413	0,0116	0,265	0,384	1,08	0,0526	0,0267
U (s*)	0,136	0,55	0,218	0,0286	0,276	0,0066	0,152	0,204	0,59	0,0294	0,0162
U (s_R)	0,135	0,51	0,229	0,0271	0,274	0,0065	0,151	0,196	0,60	0,0276	0,0174
Mean-2*s_R	0,720	17,81	7,836	0,6939	1,294	0,0136	4,697	7,399	23,87	0,1847	0,3223
Mean+2*s_R	1,711	20,98	9,512	0,8972	2,933	0,0589	5,748	8,870	28,29	0,3825	0,4373

All values are in mass % and are based on ignited sample material, except for Cl values are based on dried sample material.

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

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Info Only Elements

	N	O	Si
Unit	%	%	%
Labs	5	6	17
Mean m	0,0845	24,57	0,2966
Repro. s_R	0,0263	1,28	0,2174
Repeat. s_r	0,0063	0,19	0,0118
Repro. s*	0,0215	2,01	0,2329
U (s*)	0,0241	2,05	0,1412
U (s_R)	0,0294	1,31	0,1318
Mean-2*s_R	0,0319	22,00	-0,1383
Mean+2*s_R	0,1371	27,14	0,7314

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

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

Participants

Hydrometal	Belgium
Umicore Olen n.v.	Belgium
Umicore SA	Belgium
IC2MP - UMR CNRS 7285	France
Bruker AXS GmbH	Germany
Chemad GmbH	Germany
ChemiLytics GmbH & Co. KG	Germany
cylib GmbH	Germany
Duesenfeld GmbH	Germany
FLUXANA GmbH & Co. KG	Germany
Horn & Co. Analytics GmbH (HUK)	Germany
IME - Metallurgische Prozesstechnik und Metallrecycling	Germany
Institut für Materialprüfung Glörfeld GmbH	Germany
Revierlabor	Germany
revomet GmbH	Germany
Rigaku Europe SE	Germany
Spectro Analytical Instruments GmbH	Germany
TU Clausthal - Institut für Anorganische und Analytische Chemie	Germany
TU Clausthal IGMR/RPT	Germany
Umicore AG & Co. KG	Germany
WRC World Resources Company GmbH	Germany
GVS Cibatech Pvt. Ltd.	India
Rigaku Corporation	Japan
Eurofins EAG Materials Science Netherlands BV	Netherlands
Bruker Singapore Pte. Ltd.	Singapore

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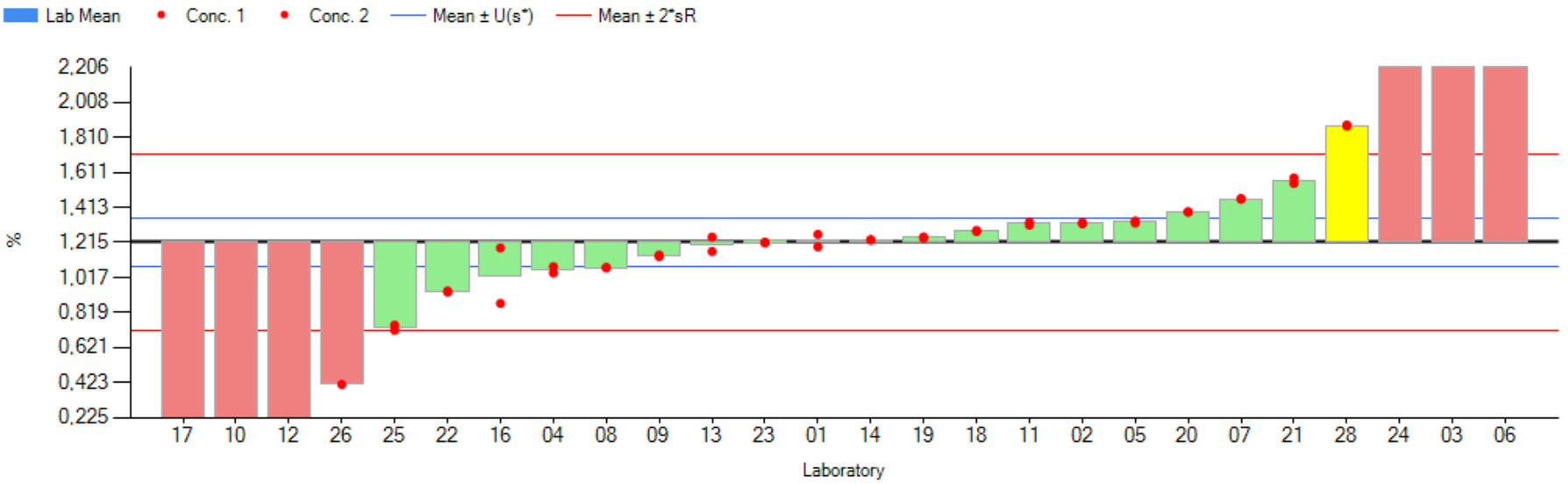
Summary results

Sample:	FLX-4002	**Mean ± U(s*):**	1,215 ± 0,136 %	**Reproducibility s_R:**	0,248 %	**Mean - 2*s_R:**	0,720 % (2 z-score)
Measurand:	**Al**	**Lab. display/calculation:**	26 / 21	**Repeatability s_r:**	0,009 %	**Mean + 2*s_R:**	1,711 % (2 z-score)



Lab code	Conc1	Conc2	Mean	s.d.	z-score	Analytical method	Accreditation	Comment
01	1,261	1,191	1,226	0,050	0,0	ICP-OES	ISO 17025	
02	1,321	1,328	1,325	0,005	0,4	XRF (fusion)	ISO 17025	
03	2,785	2,786	2,785	0,000	6,3	XRF (pressed pellet)	no accreditation	Info only
04	1,043	1,078	1,061	0,025	-0,6	ICP-OES	no accreditation	
05	1,326	1,338	1,332	0,009	0,5	XRF (fusion)	no accreditation	
06	3,179	3,057	3,118	0,086	7,7	XRF (pressed pellet)	no accreditation	Info only

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Lab code	Conc1	Conc2	Mean	s.d.	z-score	Analytical method	Accreditation	Comment
07	1,465	1,460	1,462	0,003	1,0	XRF (fusion)	no accreditation	
08	1,072	1,073	1,073	0,001	-0,6	ICP-OES	no accreditation	
09	1,136	1,144	1,140	0,006	-0,3	XRF (fusion)	no accreditation	
10	0,100	0,090	0,095	0,007	-4,5	ICP-MS	no accreditation	
11	1,314	1,331	1,322	0,012	0,4	ICP-OES	ISO 17025	
12	0,106	0,101	0,104	0,004	-4,5	ICP-OES	no accreditation	
13	1,246	1,164	1,205	0,058	0,0	ICP-OES	no accreditation	Acid digestion on hot plate
14	1,230	1,230	1,230	0,000	0,1	ICP-OES	no accreditation	
16	0,871	1,185	1,028	0,222	-0,8	ICP-OES	ISO 17025	
17	0,068	0,077	0,073	0,007	-4,6	ICP-OES	no accreditation	Aqua regia
18	1,284	1,277	1,281	0,005	0,3	ICP-OES	no accreditation	Pyrosulphate fusion
19	1,240	1,247	1,243	0,005	0,1	ICP-OES	no accreditation	
20	1,387	1,390	1,389	0,002	0,7	XRF (fusion)	no accreditation	
21	1,581	1,550	1,566	0,022	1,4	XRF (fusion)	no accreditation	
22	0,934	0,941	0,937	0,005	-1,1	ICP-OES	no accreditation	
23	1,217	1,213	1,215	0,003	0,0	ICP-OES	no accreditation	
24	2,416	2,577	2,497	0,114	5,2	XRF (pressed pellet)	ISO 17025	Info only
25	0,747	0,719	0,733	0,020	-1,9	ICP-MS	no accreditation	after MW Digestn
26	0,412	0,000	0,412	0,291	-3,2	ICP-MS	ISO 17025	Acid, MW pressure digestion; Info only
28	1,880	1,875	1,878	0,004	2,7	XRF (pressed pellet)	no accreditation	Info only

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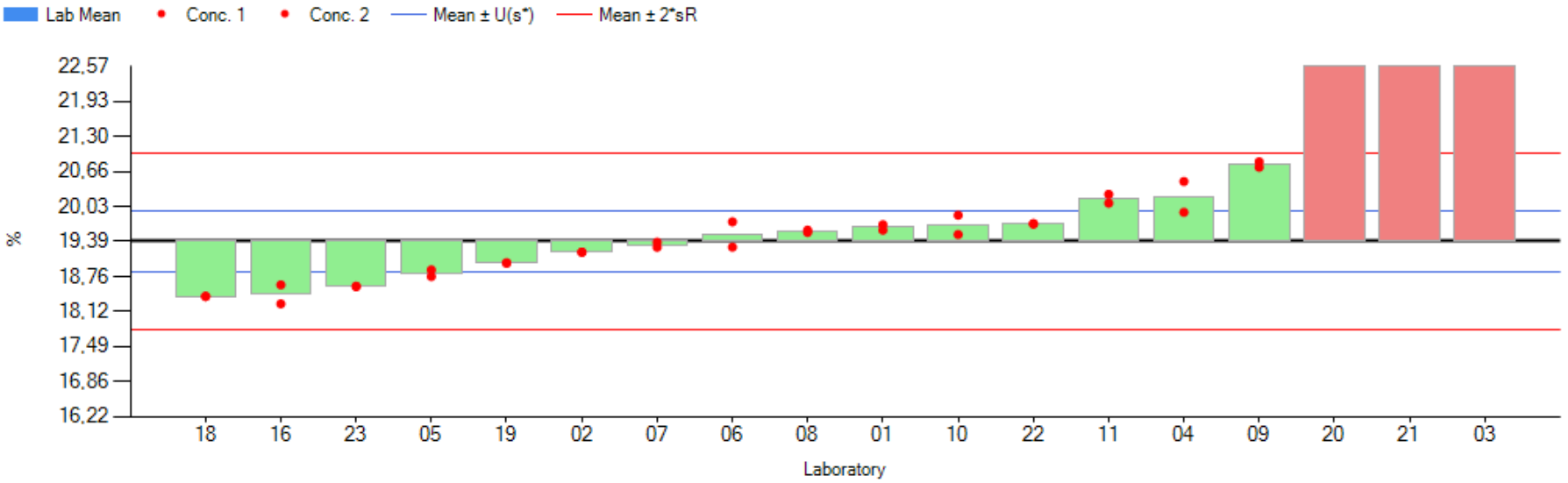
Sample: FLX-4002 **Mean ± U(s*):** 19,39 ± 0,55 % **Reproducibility s_R:** 0,79 % **Mean - 2*s_R:** 17,81 % (2 z-score)
Measurand: C **Lab. display/calculation:** 18 / 15 **Repeatability s_r:** 0,09 % **Mean + 2*s_R:** 20,98 % (2 z-score)



Lab code	Conc1	Conc2	Mean	s.d.	z-score	Analytical method	Accreditation	Comment
01	19,70	19,60	19,65	0,07	0,3	Combustion	ISO 17025	
02	19,20	19,20	19,20	0,00	-0,2	Combustion	no accreditation	
03	50,00	50,00	50,00	0,00	38,6	Other Method	no accreditation	Calculated; Info only
04	20,48	19,92	20,20	0,40	1,0	Combustion	no accreditation	
05	18,76	18,88	18,82	0,08	-0,7	Combustion	no accreditation	
06	19,75	19,29	19,52	0,32	0,2	Combustion	no accreditation	
07	19,38	19,29	19,34	0,06	-0,1	Combustion	no accreditation	
08	19,56	19,60	19,58	0,03	0,2	Combustion	no accreditation	
09	20,84	20,74	20,79	0,07	1,8	Combustion	no accreditation	
10	19,52	19,87	19,70	0,25	0,4	Combustion	no accreditation	

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Lab code	Conc1	Conc2	Mean	s.d.	z-score	Analytical method	Accreditation	Comment
11	20,09	20,25	20,17	0,11	1,0	Combustion	no accreditation	
16	18,61	18,26	18,44	0,24	-1,2	Combustion	ISO 17025	
18	18,40	18,40	18,40	0,00	-1,3	Combustion	no accreditation	IR
19	19,01	19,00	19,01	0,01	-0,5	Combustion	no accreditation	
20	23,99	24,00	24,00	0,01	5,8	Other Method	no accreditation	700°C for 4 hours; Info only
21	25,30	25,30	25,30	0,00	7,4	Other Method	no accreditation	At 600 deg C; Info only
22	19,71	19,72	19,72	0,01	0,4	Combustion	no accreditation	
23	18,58	18,58	18,58	0,00	-1,0	Combustion	no accreditation	

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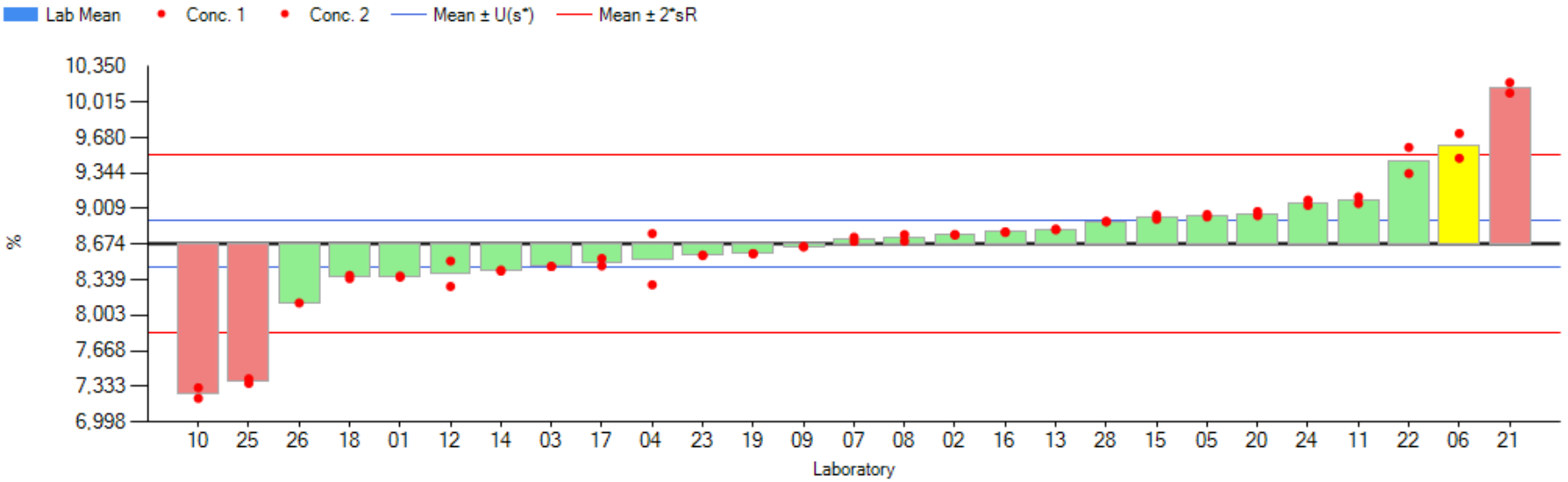
Sample: FLX-4002 **Mean ± U(s*):** 8,674 ± 0,218 % **Reproducibility s_R:** 0,419 % **Mean - 2*s_R:** 7,836 % (2 z-score)
Measurand: Co **Lab. display/calculation:** 27 / 21 **Repeatability s_r:** 0,042 % **Mean + 2*s_R:** 9,512 % (2 z-score)



Lab code	Conc1	Conc2	Mean	s.d.	z-score	Analytical method	Accreditation	Comment
01	8,363	8,374	8,368	0,008	-0,7	ICP-OES	ISO 17025	
02	8,760	8,766	8,763	0,004	0,2	XRF (fusion)	ISO 17025	
03	8,464	8,464	8,464	0,000	-0,5	XRF (pressed pellet)	no accreditation	Info only
04	8,292	8,775	8,533	0,342	-0,3	ICP-OES	no accreditation	
05	8,955	8,932	8,943	0,016	0,6	XRF (fusion)	no accreditation	
06	9,719	9,485	9,602	0,166	2,2	XRF (pressed pellet)	no accreditation	Info only
07	8,700	8,740	8,720	0,028	0,1	ICP-OES	no accreditation	
08	8,702	8,765	8,734	0,044	0,1	ICP-OES	no accreditation	
09	8,654	8,648	8,651	0,004	-0,1	XRF (pressed pellet)	no accreditation	Info only
10	7,320	7,220	7,270	0,071	-3,3	ICP-MS	no accreditation	

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Lab code	Conc1	Conc2	Mean	s.d.	z-score	Analytical method	Accreditation	Comment
11	9,121	9,059	9,090	0,044	1,0	ICP-OES	ISO 17025	
12	8,516	8,275	8,396	0,170	-0,7	ICP-OES	no accreditation	
13	8,817	8,810	8,813	0,005	0,3	ICP-OES	no accreditation	Acid digestion on hot plate
14	8,430	8,420	8,425	0,007	-0,6	ICP-OES	no accreditation	
15	8,910	8,950	8,930	0,028	0,6	ICP-OES	no accreditation	Peroxide digestion
16	8,791	8,786	8,788	0,004	0,3	ICP-OES	ISO 17025	
17	8,470	8,540	8,505	0,050	-0,4	ICP-OES	no accreditation	Aqua regia
18	8,380	8,350	8,365	0,021	-0,7	ICP-OES	no accreditation	Aqua regia
19	8,584	8,587	8,586	0,002	-0,2	ICP-OES	no accreditation	
20	8,983	8,944	8,963	0,028	0,7	XRF (fusion)	no accreditation	
21	10,100	10,200	10,150	0,071	3,5	XRF (fusion)	no accreditation	
22	9,341	9,588	9,464	0,174	1,9	ICP-OES	no accreditation	
23	8,567	8,572	8,569	0,004	-0,2	ICP-OES	no accreditation	
24	9,040	9,090	9,065	0,035	0,9	XRF (pressed pellet)	ISO 17025	Info only
25	7,405	7,361	7,383	0,031	-3,1	ICP-MS	no accreditation	after MW Digestn
26	8,120	0,000	8,120	5,742	-1,3	ICP-MS	ISO 17025	Acid, MW pressure digestion; Info only
28	8,885	8,890	8,888	0,004	0,5	XRF (pressed pellet)	no accreditation	Info only

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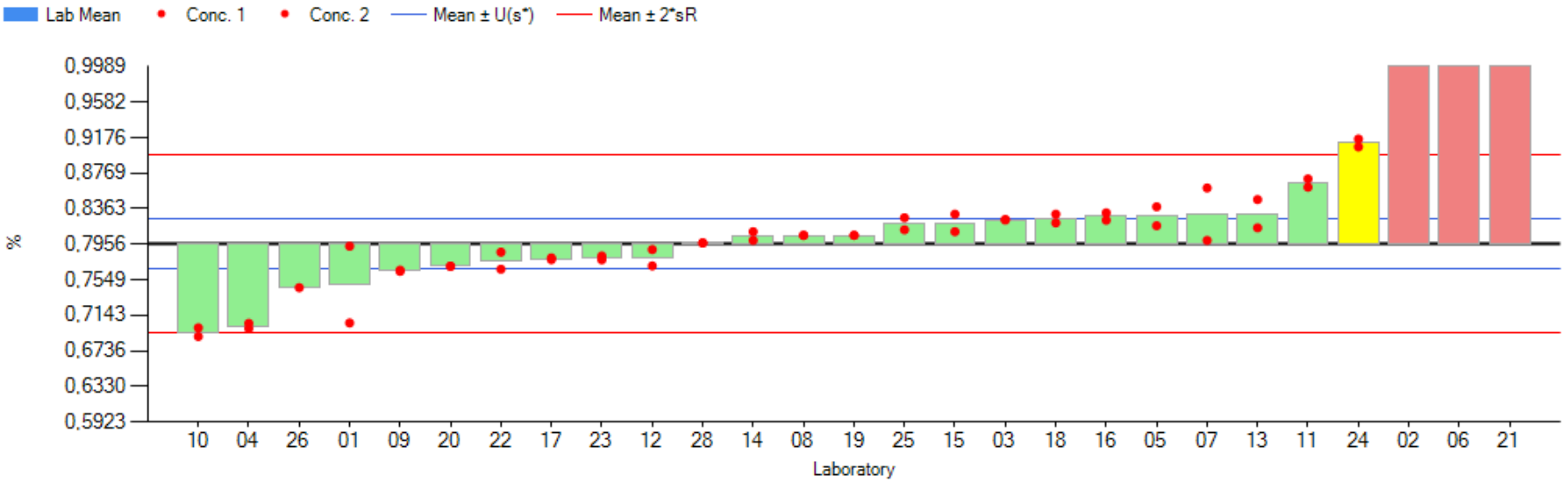
Sample: FLX-4002 **Mean ± U(s*):** 0,7955 ± 0,0286 % **Reproducibility s_R:** 0,0508 % **Mean - 2*s_R:** 0,6939 % (2 z-score)
Measurand: Cu **Lab. display/calculation:** 27 / 22 **Repeatability s_r:** 0,0109 % **Mean + 2*s_R:** 0,8972 % (2 z-score)



Lab code	Conc1	Conc2	Mean	s.d.	z-score	Analytical method	Accreditation	Comment
01	0,7934	0,7056	0,7495	0,0621	-0,9	ICP-OES	ISO 17025	
02	1,0100	1,0200	1,0150	0,0071	4,3	XRF (fusion)	ISO 17025	
03	0,8233	0,8240	0,8237	0,0005	0,6	XRF (pressed pellet)	no accreditation	Info only
04	0,7051	0,6991	0,7021	0,0042	-1,8	ICP-OES	no accreditation	
05	0,8168	0,8385	0,8277	0,0153	0,6	XRF (fusion)	no accreditation	
06	1,1150	1,0980	1,1065	0,0120	6,1	XRF (pressed pellet)	no accreditation	Info only
07	0,8000	0,8600	0,8300	0,0424	0,7	ICP-OES	no accreditation	
08	0,8055	0,8060	0,8057	0,0004	0,2	ICP-OES	no accreditation	
09	0,7659	0,7646	0,7652	0,0009	-0,6	ICP-OES	no accreditation	
10	0,6900	0,7000	0,6950	0,0071	-2,0	ICP-MS	no accreditation	

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Lab code	Conc1	Conc2	Mean	s.d.	z-score	Analytical method	Accreditation	Comment
11	0,8609	0,8704	0,8656	0,0067	1,4	ICP-OES	ISO 17025	
12	0,7895	0,7708	0,7801	0,0132	-0,3	ICP-OES	no accreditation	
13	0,8467	0,8144	0,8306	0,0228	0,7	ICP-OES	no accreditation	Acid digestion on hot plate
14	0,8000	0,8100	0,8050	0,0071	0,2	ICP-OES	no accreditation	
15	0,8300	0,8100	0,8200	0,0141	0,5	ICP-OES	no accreditation	Peroxide digestion
16	0,8231	0,8316	0,8273	0,0060	0,6	ICP-OES	ISO 17025	
17	0,7780	0,7800	0,7790	0,0014	-0,3	ICP-OES	no accreditation	Aqua regia
18	0,8200	0,8300	0,8250	0,0071	0,6	ICP-OES	no accreditation	Aqua regia
19	0,8058	0,8058	0,8058	0,0000	0,2	ICP-OES	no accreditation	
20	0,7704	0,7704	0,7704	0,0000	-0,5	XRF (fusion)	no accreditation	
21	1,1490	1,1230	1,1360	0,0184	6,7	XRF (fusion)	no accreditation	
22	0,7866	0,7670	0,7768	0,0139	-0,4	ICP-OES	no accreditation	
23	0,7822	0,7778	0,7800	0,0031	-0,3	ICP-OES	no accreditation	
24	0,9160	0,9070	0,9115	0,0064	2,3	XRF (pressed pellet)	ISO 17025	Info only
25	0,8121	0,8260	0,8190	0,0098	0,5	ICP-MS	no accreditation	after MW Digestn
26	0,7460	0,0000	0,7460	0,5275	-1,0	ICP-MS	ISO 17025	Acid, MW pressure digestion; Info only
28	0,7969	0,7973	0,7971	0,0003	0,0	XRF (pressed pellet)	no accreditation	Info only

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Sample: FLX-4002 **Mean ± U(s*):** 2,113 ± 0,276 % **Reproducibility s_R:** 0,410 % **Mean - 2*s_R:** 1,294 % (2 z-score)
Measurand: F **Lab. display/calculation:** 20 / 14 **Repeatability s_r:** 0,022 % **Mean + 2*s_R:** 2,933 % (2 z-score)

Lab code	Conc1	Conc2	Mean	s.d.	z-score	Analytical method	Accreditation	Comment
01	2,041	2,084	2,063	0,031	-0,1	Other Method	ISO 17025	HDB. F. EISENHÜTT.LAB. BD3,TL1
02	2,280	2,401	2,341	0,086	0,6	IC	no accreditation	after Peroxide fusion
03	1,776	1,765	1,771	0,008	-0,8	XRF (pressed pellet)	no accreditation	Info only
04	2,231	2,218	2,225	0,009	0,3	IC	no accreditation	
05	2,400	2,405	2,403	0,004	0,7	Wet chemistry	no accreditation	Method is direct potentiometry after pyrohydrolytic separation.
06	2,670	2,410	2,540	0,184	1,0	XRF (pressed pellet)	no accreditation	Info only
07	4,106	4,192	4,149	0,061	5,0	IC	no accreditation	
08	2,250	2,310	2,280	0,042	0,4	IC	no accreditation	
09	2,445	2,435	2,440	0,007	0,8	IC	no accreditation	
11	1,040	1,042	1,041	0,002	-2,6	ISE	ISO 17025	Info only; (<2,00 %)

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Lab code	Conc1	Conc2	Mean	s.d.	z-score	Analytical method	Accreditation	Comment
13	0,860	0,880	0,870	0,014	-3,0	ISE	no accreditation	
16	2,559	2,459	2,509	0,071	1,0	IC	ISO 17025	Combustion
17	0,182	0,185	0,184	0,002	-4,7	IC	no accreditation	IC after water elution
18	0,863	0,887	0,875	0,017	-3,0	IC	no accreditation	HNO3/H2O2
19	2,310	2,300	2,305	0,007	0,5	IC	no accreditation	
21	0,720	0,940	0,830	0,156	-3,1	XRF (fusion)	no accreditation	Info only
22	0,697	0,688	0,692	0,006	-3,5	IC	no accreditation	
23	2,094	2,072	2,083	0,016	-0,1	IC	no accreditation	
24	4,700	4,183	4,442	0,366	5,7	XRF (pressed pellet)	ISO 17025	Info only
28	3,413	3,532	3,473	0,084	3,3	XRF (pressed pellet)	no accreditation	Info only

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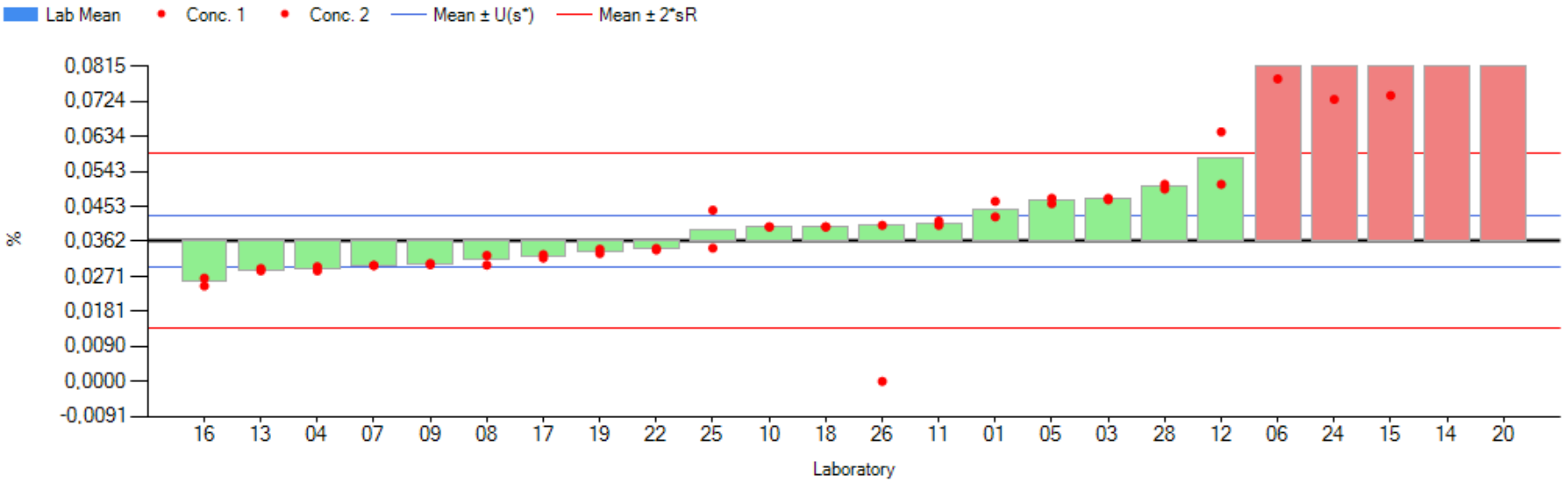
Sample: FLX-4002 **Mean ± U(s*):** 0,0363 ± 0,0066 % **Reproducibility s_R:** 0,0113 % **Mean - 2*s_R:** 0,0136 % (2 z-score)
Measurand: Fe **Lab. display/calculation:** 24 / 19 **Repeatability s_r:** 0,0015 % **Mean + 2*s_R:** 0,0589 % (2 z-score)



Lab code	Conc1	Conc2	Mean	s.d.	z-score	Analytical method	Accreditation	Comment
01	0,0466	0,0426	0,0446	0,0028	0,7	ICP-OES	ISO 17025	
03	0,0474	0,0470	0,0472	0,0003	1,0	XRF (pressed pellet)	no accreditation	Info only
04	0,0286	0,0297	0,0291	0,0008	-0,6	ICP-OES	no accreditation	
05	0,0460	0,0474	0,0467	0,0010	0,9	ICP-OES	no accreditation	
06	0,0848	0,0783	0,0815	0,0046	4,0	XRF (pressed pellet)	no accreditation	Info only
07	0,0300	0,0300	0,0300	0,0000	-0,6	ICP-OES	no accreditation	
08	0,0326	0,0301	0,0313	0,0018	-0,4	ICP-OES	no accreditation	
09	0,0305	0,0302	0,0304	0,0002	-0,5	ICP-OES	no accreditation	
10	0,0400	0,0400	0,0400	0,0000	0,3	ICP-MS	no accreditation	
11	0,0404	0,0415	0,0409	0,0008	0,4	ICP-OES	ISO 17025	

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Lab code	Conc1	Conc2	Mean	s.d.	z-score	Analytical method	Accreditation	Comment
12	0,0646	0,0510	0,0578	0,0096	1,9	ICP-OES	no accreditation	
13	0,0286	0,0292	0,0289	0,0004	-0,7	ICP-OES	no accreditation	Acid digestion on hot plate
14	0,1100	0,1000	0,1050	0,0071	6,1	ICP-OES	no accreditation	
15	0,1050	0,0740	0,0895	0,0219	4,7	ICP-OES	no accreditation	Peroxide digestion
16	0,0247	0,0267	0,0257	0,0014	-0,9	ICP-OES	ISO 17025	
17	0,0328	0,0319	0,0323	0,0006	-0,3	ICP-OES	no accreditation	Aqua regia
18	0,0400	0,0400	0,0400	0,0000	0,3	ICP-OES	no accreditation	Aqua regia
19	0,0342	0,0331	0,0337	0,0008	-0,2	ICP-OES	no accreditation	
20	0,1127	0,1084	0,1106	0,0030	6,6	XRF (fusion)	no accreditation	
22	0,0340	0,0344	0,0342	0,0003	-0,2	ICP-OES	no accreditation	
24	0,0730	0,0950	0,0840	0,0156	4,2	XRF (pressed pellet)	ISO 17025	Info only
25	0,0345	0,0443	0,0394	0,0069	0,3	ICP-MS	no accreditation	after MW Digestn
26	0,0404	0,0000	0,0404	0,0286	0,4	ICP-MS	ISO 17025	Acid, MW pressure digestion; Info only
28	0,0498	0,0510	0,0504	0,0008	1,2	XRF (pressed pellet)	no accreditation	Info only

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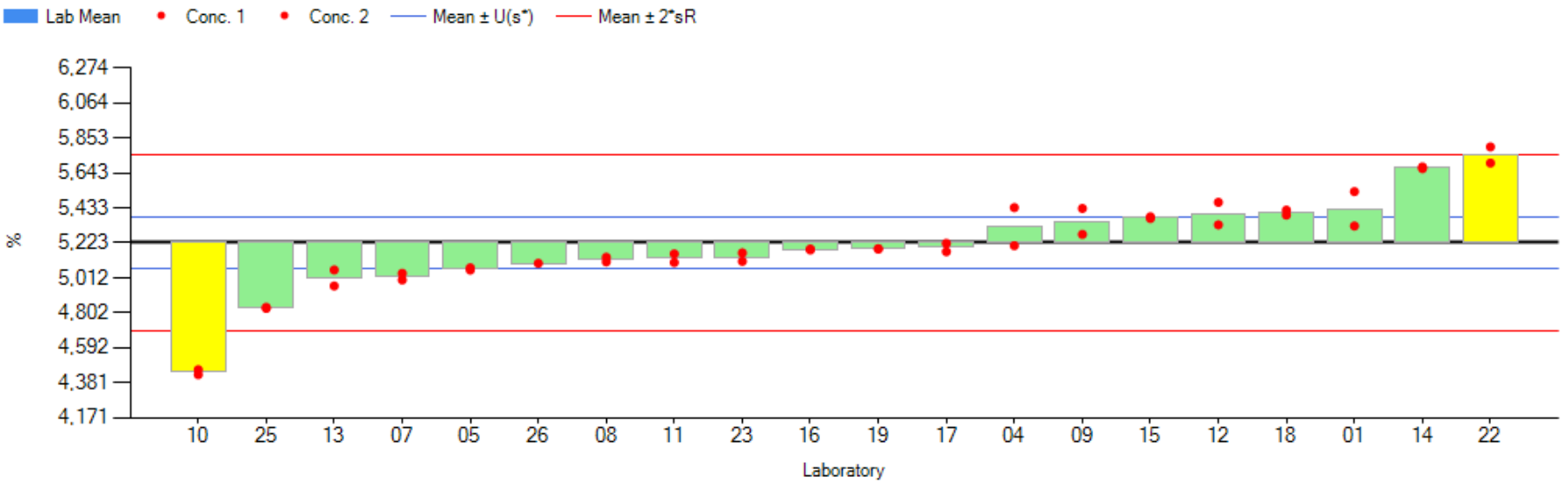
FLUXANA®
XRF Application Solutions

Sample: FLX-4002 **Mean ± U(s*):** 5,223 ± 0,152 % **Reproducibility s_R:** 0,263 % **Mean - 2*s_R:** 4,697 % (2 z-score)
Measurand: Li **Lab. display/calculation:** 20 / 19 **Repeatability s_r:** 0,042 % **Mean + 2*s_R:** 5,748 % (2 z-score)



Lab code	Conc1	Conc2	Mean	s.d.	z-score	Analytical method	Accreditation	Comment
01	5,532	5,325	5,428	0,146	0,8	ICP-OES	ISO 17025	
04	5,206	5,435	5,321	0,162	0,4	ICP-OES	no accreditation	
05	5,073	5,060	5,067	0,010	-0,6	ICP-OES	no accreditation	
07	5,040	5,000	5,020	0,028	-0,8	ICP-OES	no accreditation	
08	5,109	5,136	5,123	0,019	-0,4	ICP-OES	no accreditation	
09	5,430	5,274	5,352	0,110	0,5	ICP-OES	no accreditation	
10	4,460	4,430	4,445	0,021	-3,0	ICP-MS	no accreditation	
11	5,157	5,105	5,131	0,037	-0,3	ICP-OES	ISO 17025	
12	5,467	5,332	5,399	0,096	0,7	ICP-OES	no accreditation	
13	5,060	4,964	5,012	0,068	-0,8	ICP-OES	no accreditation	Acid digestion on hot plate

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Lab code	Conc1	Conc2	Mean	s.d.	z-score	Analytical method	Accreditation	Comment
14	5,680	5,670	5,675	0,007	1,7	ICP-OES	no accreditation	
15	5,370	5,380	5,375	0,007	0,6	ICP-OES	no accreditation	Peroxide digestion
16	5,186	5,181	5,183	0,004	-0,1	ICP-OES	ISO 17025	
17	5,220	5,170	5,195	0,035	-0,1	ICP-OES	no accreditation	Aqua regia
18	5,390	5,420	5,405	0,021	0,7	ICP-OES	no accreditation	Aqua regia
19	5,188	5,186	5,187	0,001	-0,1	ICP-OES	no accreditation	
22	5,801	5,703	5,752	0,069	2,0	ICP-OES	no accreditation	
23	5,163	5,112	5,137	0,036	-0,3	ICP-OES	no accreditation	
25	4,835	4,829	4,832	0,005	-1,5	ICP-MS	no accreditation	after MW Digestn
26	5,100	0,000	5,100	3,606	-0,5	ICP-MS	ISO 17025	Acid, MW pressure digestion; Info only

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FLUXANA®
XRF Application Solutions

Sample: FLX-4002 **Mean ± U(s*):** 8,135 ± 0,204 % **Reproducibility s_R:** 0,368 % **Mean - 2*s_R:** 7,399 % (2 z-score)
Measurand: Mn **Lab. display/calculation:** 27 / 22 **Repeatability s_r:** 0,043 % **Mean + 2*s_R:** 8,870 % (2 z-score)

Lab code	Conc1	Conc2	Mean	s.d.	z-score	Analytical method	Accreditation	Comment
01	8,351	8,392	8,372	0,029	0,6	ICP-OES	ISO 17025	Info only
02	8,270	8,335	8,303	0,046	0,5	XRF (fusion)	ISO 17025	
03	9,029	9,029	9,029	0,000	2,4	XRF (pressed pellet)	no accreditation	Info only
04	7,725	8,130	7,928	0,286	-0,6	ICP-OES	no accreditation	
05	8,456	8,436	8,446	0,014	0,8	XRF (fusion)	no accreditation	
06	9,578	9,764	9,671	0,132	4,2	XRF (pressed pellet)	no accreditation	Info only
07	8,350	8,390	8,370	0,028	0,6	ICP-OES	no accreditation	
08	8,081	8,179	8,130	0,070	0,0	ICP-OES	no accreditation	
09	8,293	8,315	8,304	0,016	0,5	ICP-OES	no accreditation	
10	7,030	7,050	7,040	0,014	-3,0	ICP-MS	no accreditation	

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Lab code	Conc1	Conc2	Mean	s.d.	z-score	Analytical method	Accreditation	Comment
11	7,959	8,029	7,994	0,050	-0,4	ICP-OES	ISO 17025	
12	8,002	7,695	7,849	0,217	-0,8	ICP-OES	no accreditation	
13	8,293	8,168	8,230	0,089	0,3	ICP-OES	no accreditation	Acid digestion on hot plate
14	8,450	8,450	8,450	0,000	0,9	ICP-OES	no accreditation	
15	8,090	8,050	8,070	0,028	-0,2	ICP-OES	no accreditation	Peroxide digestion
16	8,260	8,246	8,253	0,010	0,3	ICP-OES	ISO 17025	
17	7,980	7,960	7,970	0,014	-0,4	ICP-OES	no accreditation	Aqua regia
18	8,210	8,170	8,190	0,028	0,2	ICP-OES	no accreditation	Aqua regia
19	8,113	8,120	8,116	0,005	-0,1	ICP-OES	no accreditation	
20	8,514	8,515	8,514	0,000	1,0	XRF (fusion)	no accreditation	
21	10,630	10,490	10,560	0,099	6,6	XRF (fusion)	no accreditation	
22	8,604	8,663	8,634	0,042	1,4	ICP-OES	no accreditation	
23	8,066	8,064	8,065	0,001	-0,2	ICP-OES	no accreditation	
24	8,389	8,560	8,475	0,121	0,9	XRF (pressed pellet)	ISO 17025	Info only
25	6,816	6,716	6,766	0,071	-3,7	ICP-MS	no accreditation	after MW Digestn
26	7,840	0,000	7,840	5,544	-0,8	ICP-MS	ISO 17025	Acid, MW pressure digestion; Info only
28	8,704	8,698	8,701	0,004	1,5	XRF (pressed pellet)	no accreditation	Info only

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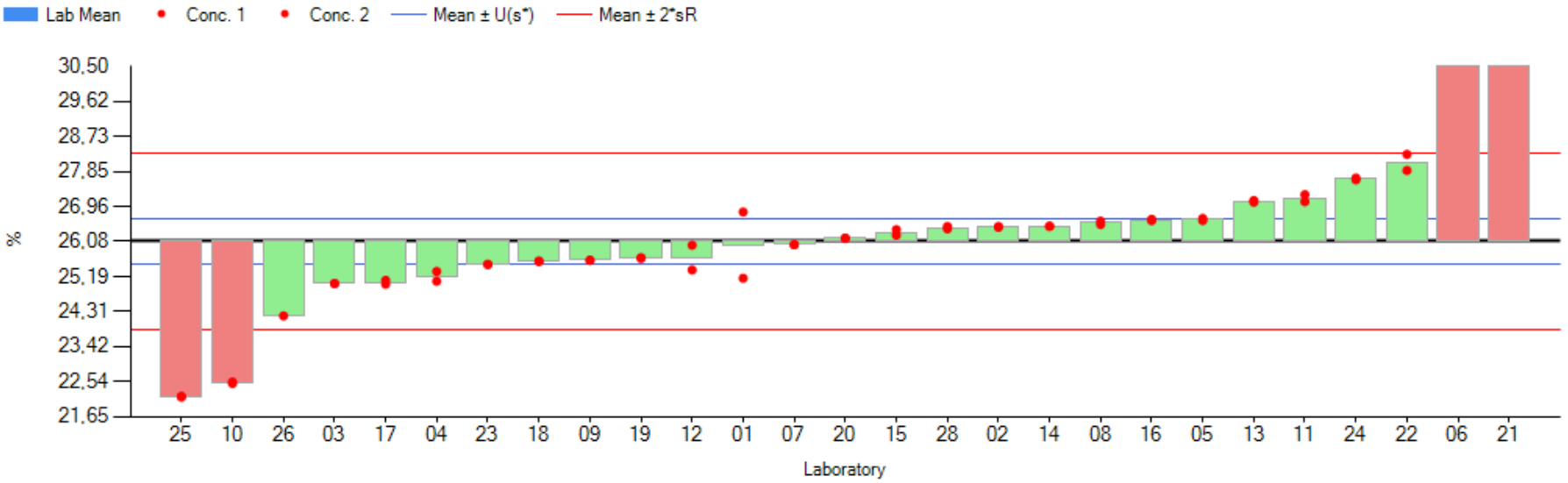
FLUXANA®
XRF Application Solutions

Sample: FLX-4002 **Mean ± U(s*):** 26,08 ± 0,59 % **Reproducibility s_R:** 1,11 % **Mean - 2*s_R:** 23,87 % (2 z-score)
Measurand: Ni **Lab. display/calculation:** 27 / 21 **Repeatability s_r:** 0,04 % **Mean + 2*s_R:** 28,29 % (2 z-score)



Lab code	Conc1	Conc2	Mean	s.d.	z-score	Analytical method	Accreditation	Comment
01	26,83	25,15	25,99	1,18	-0,1	ICP-OES	ISO 17025	
02	26,46	26,44	26,45	0,01	0,3	XRF (fusion)	ISO 17025	
03	25,02	25,02	25,02	0,00	-1,0	XRF (pressed pellet)	no accreditation	Info only
04	25,32	25,08	25,20	0,17	-0,8	ICP-OES	no accreditation	
05	26,67	26,61	26,64	0,04	0,5	XRF (fusion)	no accreditation	
06	30,72	31,23	30,98	0,36	4,4	XRF (pressed pellet)	no accreditation	Info only
07	26,00	26,00	26,00	0,00	-0,1	ICP-OES	no accreditation	
08	26,51	26,60	26,55	0,06	0,4	ICP-OES	no accreditation	
09	25,60	25,61	25,61	0,01	-0,4	XRF (pressed pellet)	no accreditation	Info only
10	22,49	22,53	22,51	0,03	-3,2	ICP-MS	no accreditation	

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Lab code	Conc1	Conc2	Mean	s.d.	z-score	Analytical method	Accreditation	Comment
11	27,26	27,09	27,18	0,13	1,0	ICP-OES	ISO 17025	
12	25,99	25,36	25,67	0,44	-0,4	ICP-OES	no accreditation	
13	27,07	27,12	27,10	0,03	0,9	ICP-OES	no accreditation	Acid digestion on hot plate
14	26,46	26,47	26,47	0,01	0,3	ICP-OES	no accreditation	
15	26,38	26,24	26,31	0,10	0,2	ICP-OES	no accreditation	Peroxide digestion
16	26,64	26,61	26,63	0,03	0,5	ICP-OES	ISO 17025	
17	25,10	25,00	25,05	0,07	-0,9	ICP-OES	no accreditation	Aqua regia
18	25,59	25,57	25,58	0,01	-0,5	ICP-OES	no accreditation	Aqua regia
19	25,65	25,67	25,66	0,01	-0,4	ICP-OES	no accreditation	
20	26,17	26,16	26,16	0,01	0,1	XRF (fusion)	no accreditation	
21	31,37	31,41	31,39	0,03	4,8	XRF (fusion)	no accreditation	
22	28,28	27,88	28,08	0,29	1,8	ICP-OES	no accreditation	
23	25,51	25,50	25,50	0,01	-0,5	ICP-OES	no accreditation	
24	27,64	27,69	27,66	0,03	1,4	XRF (pressed pellet)	ISO 17025	Info only
25	22,15	22,17	22,16	0,02	-3,5	ICP-MS	no accreditation	after MW Digestn
26	24,20	0,00	24,20	17,11	-1,7	ICP-MS	ISO 17025	Acid, MW pressure digestion; Info only
28	26,40	26,46	26,43	0,04	0,3	XRF (pressed pellet)	no accreditation	Info only

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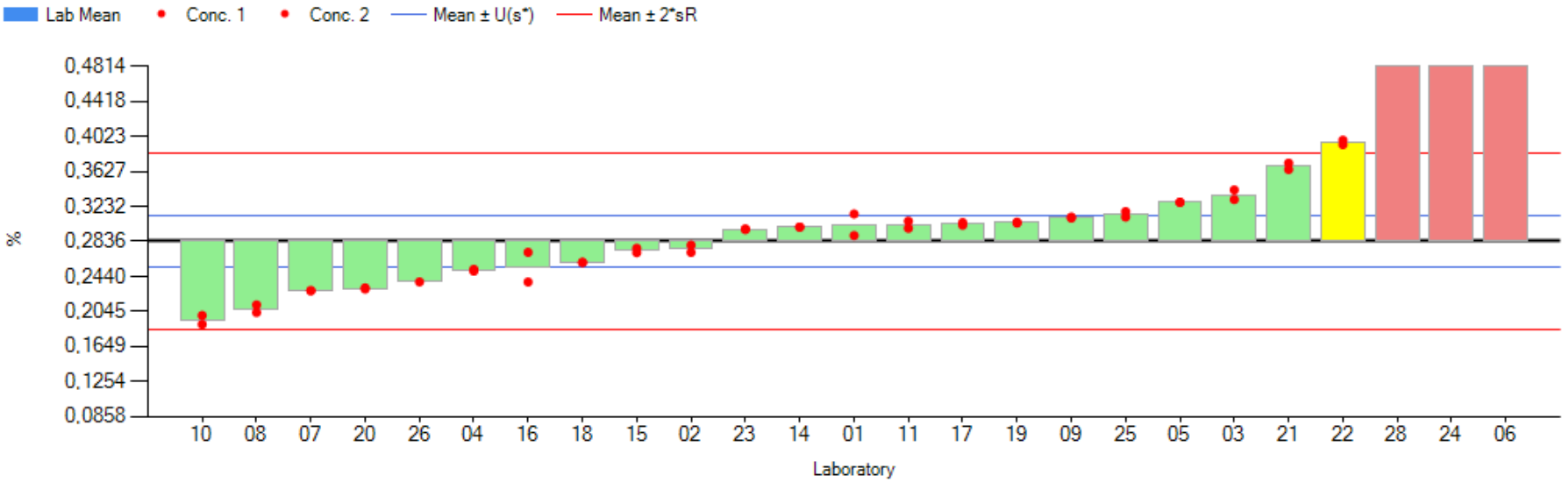
FLUXANA®
XRF Application Solutions

Sample: FLX-4002 **Mean ± U(s*):** 0,2836 ± 0,0294 % **Reproducibility s_R:** 0,0495 % **Mean - 2*s_R:** 0,1847 % (2 z-score)
Measurand: P **Lab. display/calculation:** 25 / 20 **Repeatability s_r:** 0,0045 % **Mean + 2*s_R:** 0,3825 % (2 z-score)



Lab code	Conc1	Conc2	Mean	s.d.	z-score	Analytical method	Accreditation	Comment
01	0,3147	0,2904	0,3026	0,0172	0,4	ICP-OES	ISO 17025	
02	0,2795	0,2713	0,2754	0,0058	-0,2	XRF (fusion)	ISO 17025	
03	0,3310	0,3420	0,3365	0,0078	1,1	XRF (pressed pellet)	no accreditation	Info only
04	0,2522	0,2501	0,2511	0,0015	-0,7	ICP-OES	no accreditation	
05	0,3278	0,3281	0,3280	0,0002	0,9	ICP-OES	no accreditation	
06	0,7390	0,7300	0,7345	0,0064	9,1	XRF (pressed pellet)	no accreditation	Info only
07	0,2280	0,2280	0,2280	0,0000	-1,1	XRF (fusion)	no accreditation	
08	0,2120	0,2033	0,2076	0,0062	-1,5	ICP-OES	no accreditation	
09	0,3101	0,3113	0,3107	0,0008	0,5	ICP-OES	no accreditation	
10	0,2000	0,1900	0,1950	0,0071	-1,8	ICP-MS	no accreditation	

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Lab code	Conc1	Conc2	Mean	s.d.	z-score	Analytical method	Accreditation	Comment
11	0,2985	0,3066	0,3026	0,0057	0,4	ICP-OES	ISO 17025	
14	0,3000	0,3000	0,3000	0,0000	0,3	ICP-OES	no accreditation	
15	0,2760	0,2710	0,2735	0,0035	-0,2	ICP-OES	no accreditation	Peroxide digestion
16	0,2379	0,2714	0,2547	0,0237	-0,6	ICP-OES	ISO 17025	
17	0,3020	0,3050	0,3035	0,0021	0,4	ICP-OES	no accreditation	Aqua regia
18	0,2600	0,2600	0,2600	0,0000	-0,5	ICP-OES	no accreditation	Aqua regia
19	0,3045	0,3055	0,3050	0,0007	0,4	ICP-OES	no accreditation	
20	0,2299	0,2312	0,2305	0,0009	-1,1	XRF (fusion)	no accreditation	
21	0,3723	0,3650	0,3687	0,0052	1,7	XRF (fusion)	no accreditation	
22	0,3982	0,3931	0,3956	0,0036	2,3	ICP-OES	no accreditation	
23	0,2979	0,2971	0,2975	0,0006	0,3	ICP-OES	no accreditation	
24	0,6900	0,7480	0,7190	0,0410	8,8	XRF (pressed pellet)	ISO 17025	Info only
25	0,3113	0,3175	0,3144	0,0044	0,6	ICP-MS	no accreditation	after MW Digestn
26	0,2380	0,0000	0,2380	0,1683	-0,9	ICP-MS	ISO 17025	Acid, MW pressure digestion; Info only
28	0,5991	0,6016	0,6003	0,0018	6,4	XRF (pressed pellet)	no accreditation	Info only

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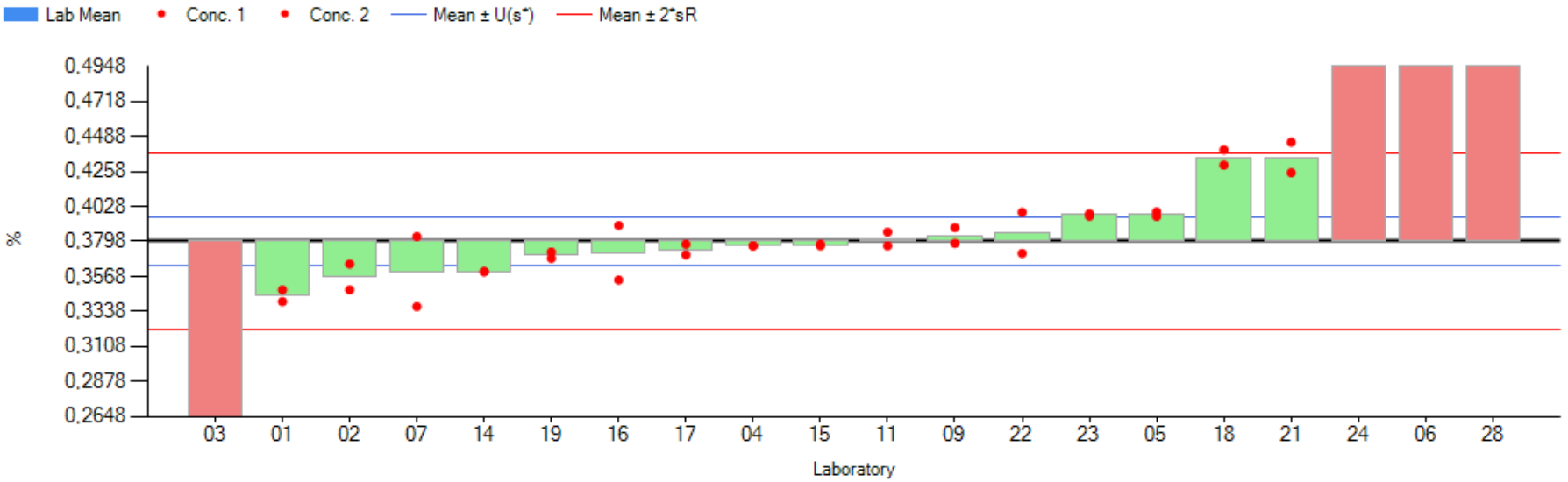
FLUXANA®
XRF Application Solutions

Sample: FLX-4002 **Mean ± U(s*):** 0,3798 ± 0,0162 % **Reproducibility s_R:** 0,0288 % **Mean - 2*s_R:** 0,3223 % (2 z-score)
Measurand: S **Lab. display/calculation:** 20 / 17 **Repeatability s_r:** 0,0095 % **Mean + 2*s_R:** 0,4373 % (2 z-score)



Lab code	Conc1	Conc2	Mean	s.d.	z-score	Analytical method	Accreditation	Comment
01	0,3480	0,3403	0,3441	0,0054	-1,2	Combustion	ISO 17025	Info only
02	0,3480	0,3650	0,3565	0,0120	-0,8	Combustion	no accreditation	
03	0,2450	0,2360	0,2405	0,0064	-4,8	XRF (pressed pellet)	no accreditation	Info only
04	0,3770	0,3770	0,3770	0,0000	-0,1	Combustion	no accreditation	
05	0,3963	0,3993	0,3978	0,0021	0,6	Combustion	no accreditation	
06	0,6242	0,6590	0,6416	0,0246	9,1	Other Method	no accreditation	Combustion, UV detection
07	0,3830	0,3370	0,3600	0,0325	-0,7	Combustion	no accreditation	
09	0,3786	0,3889	0,3838	0,0073	0,1	Combustion	no accreditation	
11	0,3770	0,3860	0,3815	0,0064	0,1	Combustion	no accreditation	
14	0,3600	0,3600	0,3600	0,0000	-0,7	ICP-OES	no accreditation	

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Lab code	Conc1	Conc2	Mean	s.d.	z-score	Analytical method	Accreditation	Comment
15	0,3780	0,3770	0,3775	0,0007	-0,1	ICP-OES	no accreditation	Peroxide digestion
16	0,3903	0,3545	0,3724	0,0253	-0,3	Combustion	ISO 17025	
17	0,3710	0,3780	0,3745	0,0049	-0,2	ICP-OES	no accreditation	Aqua regia
18	0,4400	0,4300	0,4350	0,0071	1,9	ICP-OES	no accreditation	Aqua regia
19	0,3729	0,3687	0,3708	0,0030	-0,3	ICP-OES	no accreditation	
21	0,4450	0,4250	0,4350	0,0141	1,9	XRF (fusion)	no accreditation	
22	0,3720	0,3990	0,3855	0,0191	0,2	Combustion	no accreditation	
23	0,3964	0,3981	0,3972	0,0012	0,6	Combustion	no accreditation	
24	0,6000	0,5940	0,5970	0,0042	7,5	XRF (pressed pellet)	ISO 17025	Info only
28	0,8434	0,8475	0,8455	0,0029	16,2	XRF (pressed pellet)	no accreditation	Info only

FLUXANA®
XRF Application Solutions

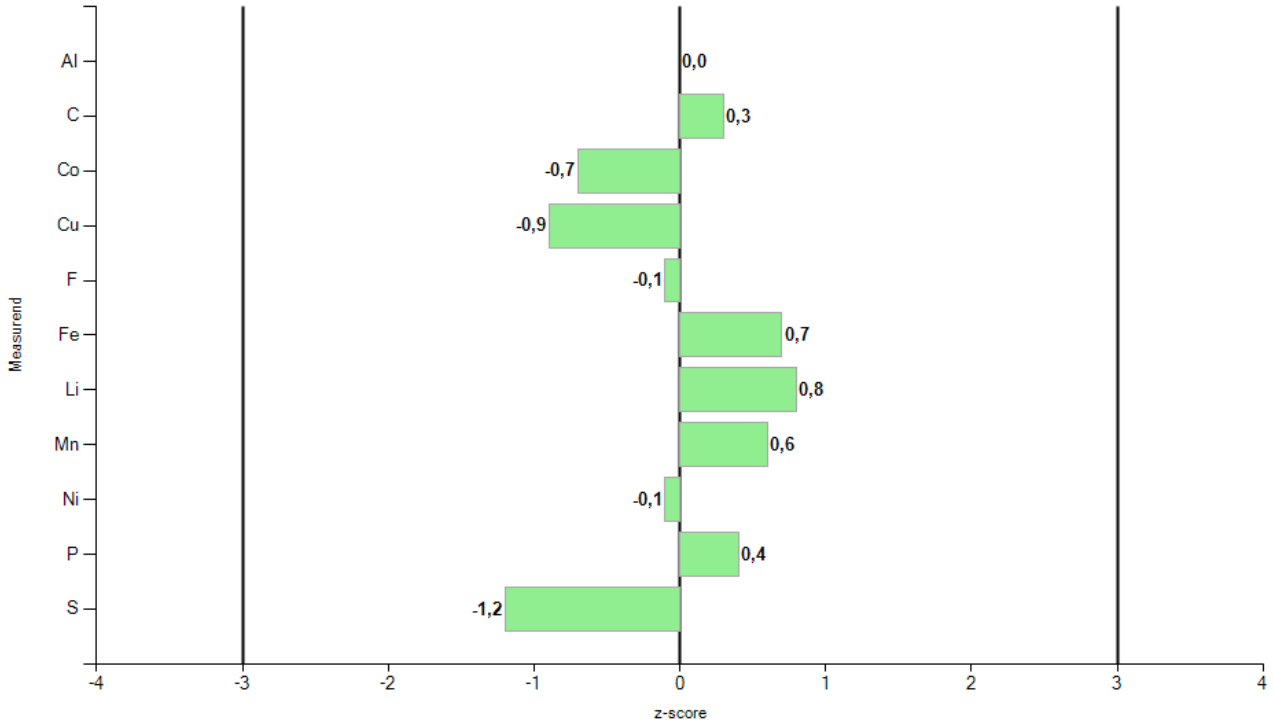
z-scores (per sample)

Sample: FLX-4002

Lab code	Al	C	Co	Cu	F	Fe	Li	Mn	Ni	P	S
01	0,0	0,3	-0,7	-0,9	-0,1	0,7	0,8	0,6	-0,1	0,4	-1,2
02	0,4	-0,2	0,2	4,3	0,6			0,5	0,3	-0,2	-0,8
03	6,3	38,6	-0,5	0,6	-0,8	1,0		2,4	-1,0	1,1	-4,8
04	-0,6	1,0	-0,3	-1,8	0,3	-0,6	0,4	-0,6	-0,8	-0,7	-0,1
05	0,5	-0,7	0,6	0,6	0,7	0,9	-0,6	0,8	0,5	0,9	0,6
06	7,7	0,2	2,2	6,1	1,0	4,0		4,2	4,4	9,1	9,1
07	1,0	-0,1	0,1	0,7	5,0	-0,6	-0,8	0,6	-0,1	-1,1	-0,7
08	-0,6	0,2	0,1	0,2	0,4	-0,4	-0,4	0,0	0,4	-1,5	
09	-0,3	1,8	-0,1	-0,6	0,8	-0,5	0,5	0,5	-0,4	0,5	0,1
10	-4,5	0,4	-3,3	-2,0		0,3	-3,0	-3,0	-3,2	-1,8	
11	0,4	1,0	1,0	1,4	-2,6	0,4	-0,3	-0,4	1,0	0,4	0,1
12	-4,5		-0,7	-0,3		1,9	0,7	-0,8	-0,4		
13	0,0		0,3	0,7	-3,0	-0,7	-0,8	0,3	0,9		
14	0,1		-0,6	0,2		6,1	1,7	0,9	0,3	0,3	-0,7
15			0,6	0,5		4,7	0,6	-0,2	0,2	-0,2	-0,1
16	-0,8	-1,2	0,3	0,6	1,0	-0,9	-0,1	0,3	0,5	-0,6	-0,3
17	-4,6		-0,4	-0,3	-4,7	-0,3	-0,1	-0,4	-0,9	0,4	-0,2
18	0,3	-1,3	-0,7	0,6	-3,0	0,3	0,7	0,2	-0,5	-0,5	1,9
19	0,1	-0,5	-0,2	0,2	0,5	-0,2	-0,1	-0,1	-0,4	0,4	-0,3
20	0,7	5,8	0,7	-0,5		6,6		1,0	0,1	-1,1	
21	1,4	7,4	3,5	6,7	-3,1			6,6	4,8	1,7	1,9
22	-1,1	0,4	1,9	-0,4	-3,5	-0,2	2,0	1,4	1,8	2,3	0,2
23	0,0	-1,0	-0,2	-0,3	-0,1		-0,3	-0,2	-0,5	0,3	0,6
24	5,2		0,9	2,3	5,7	4,2		0,9	1,4	8,8	7,5
25	-1,9		-3,1	0,5		0,3	-1,5	-3,7	-3,5	0,6	
26	-3,2		-1,3	-1,0		0,4	-0,5	-0,8	-1,7	-0,9	
28	2,7		0,5	0,0	3,3	1,2		1,5	0,3	6,4	16,2

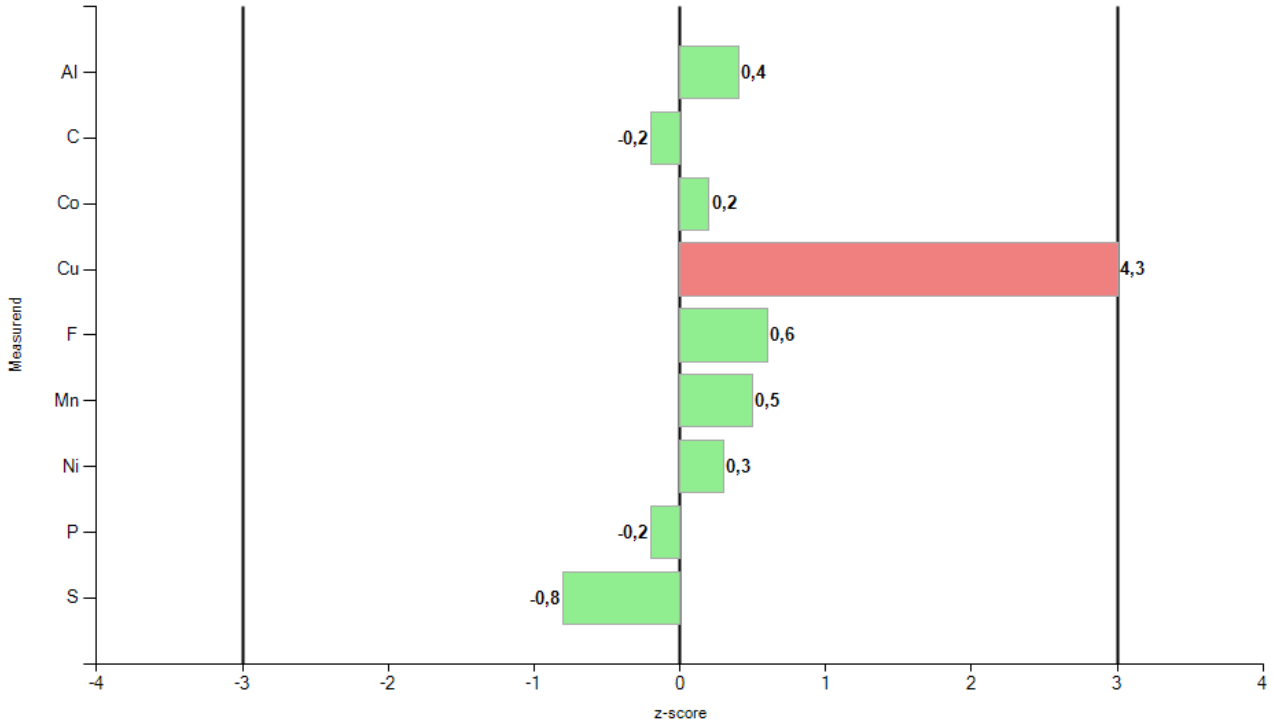
Laboratory chart of z-scores

Laboratory: 01



Laboratory chart of z-scores

Laboratory: 02



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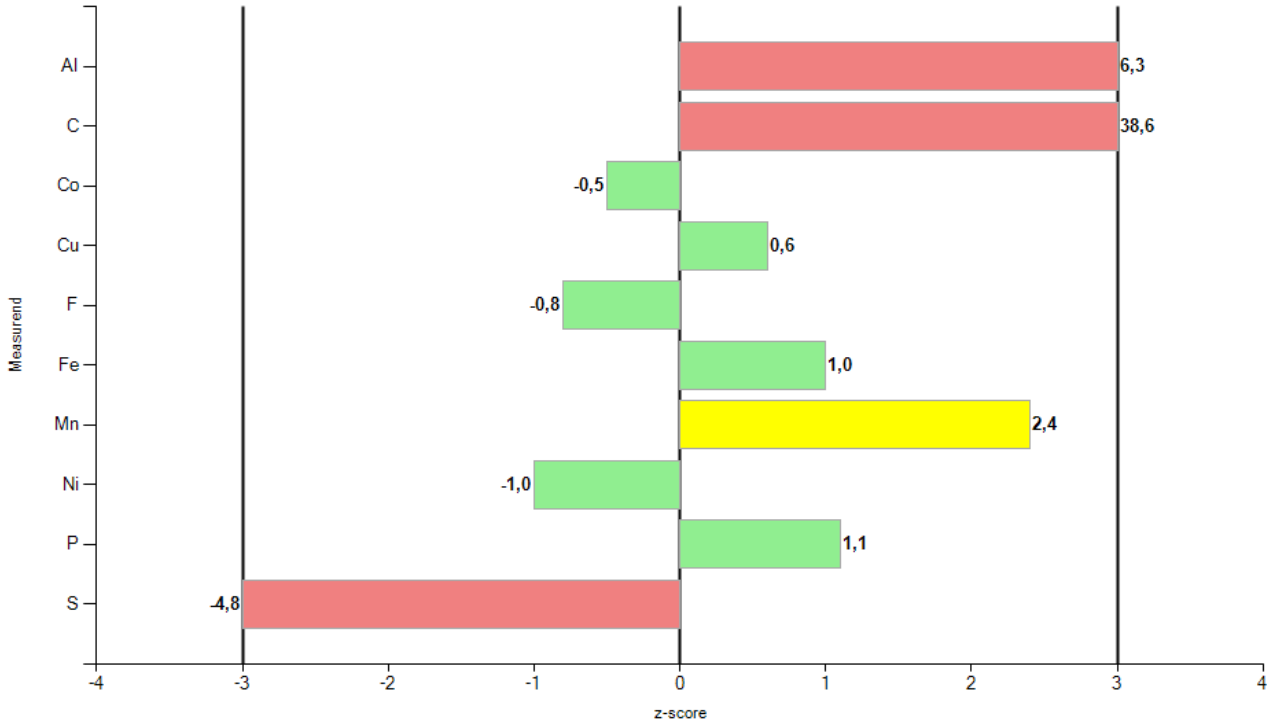
Laboratory: 03



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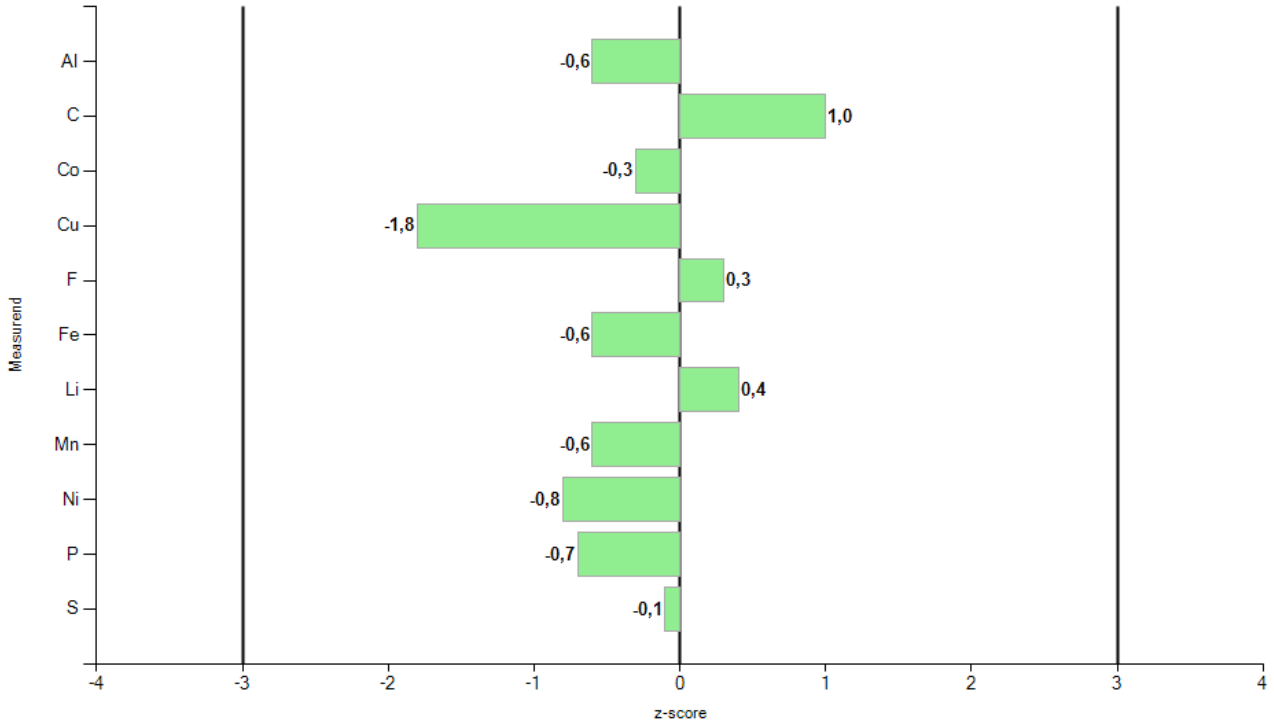
Laboratory: 04



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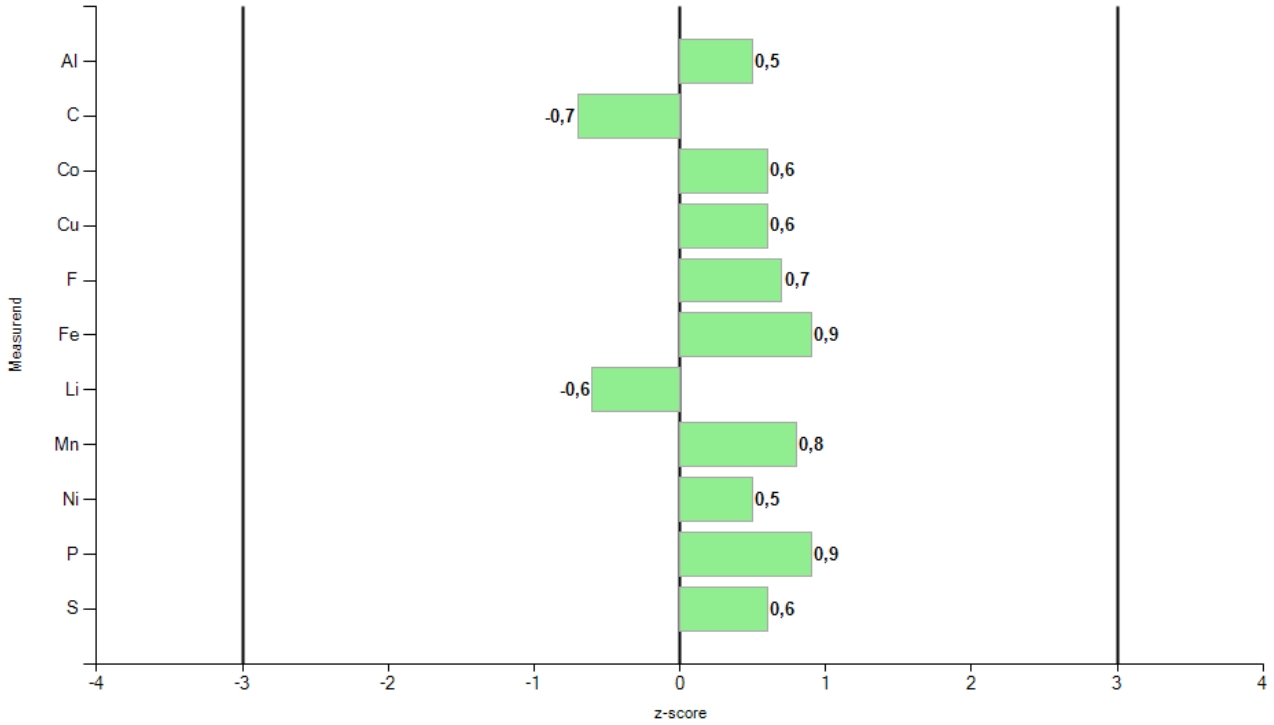
Laboratory: 05



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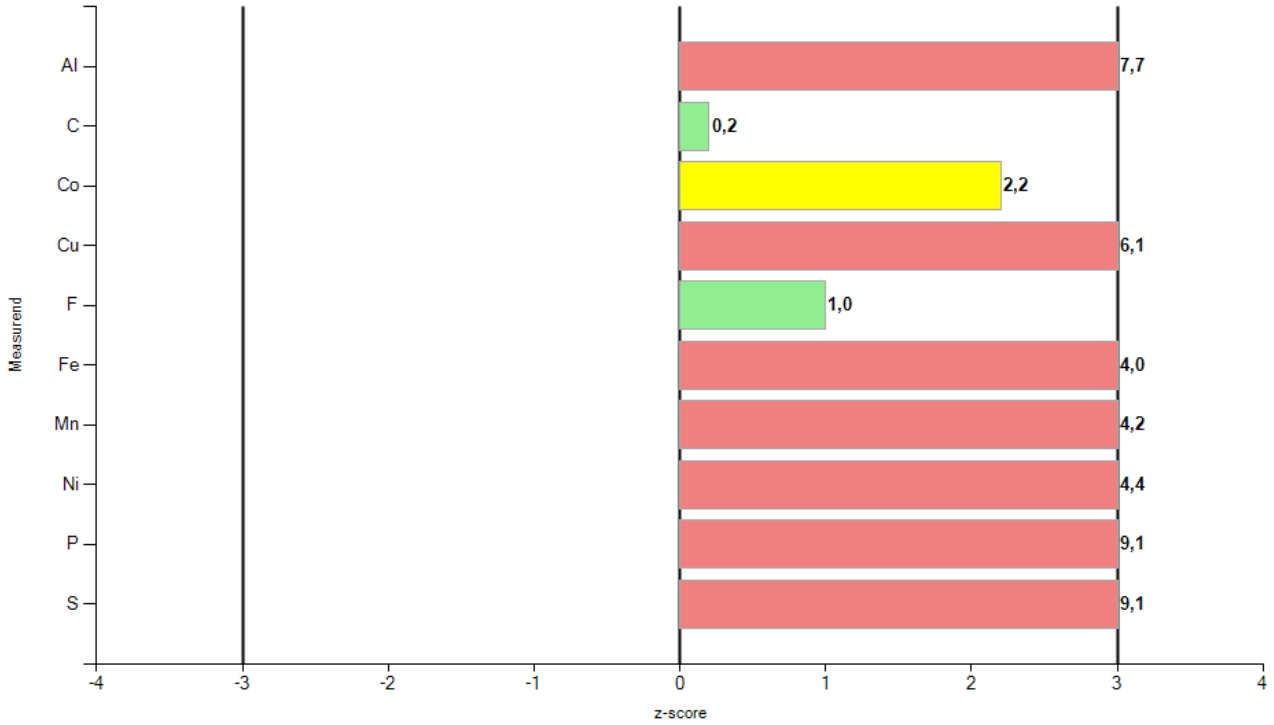
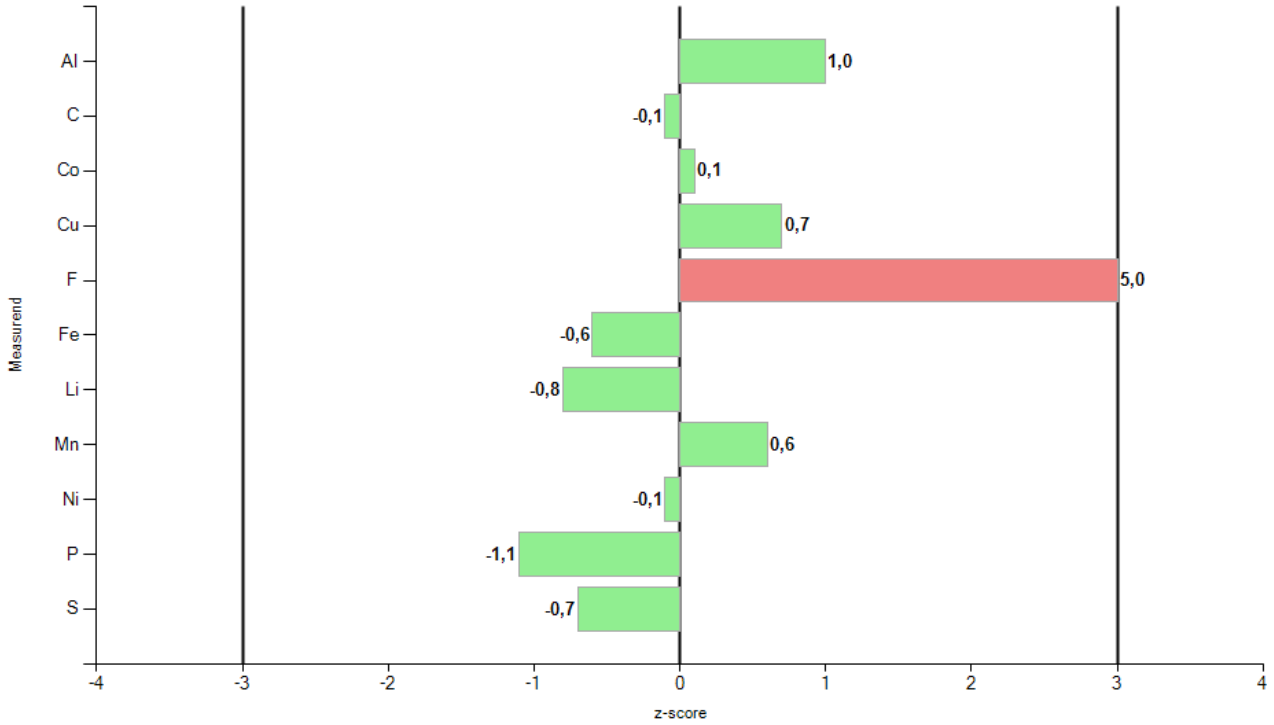
Laboratory: 06



Laboratory chart of z-scores

Laboratory: 07



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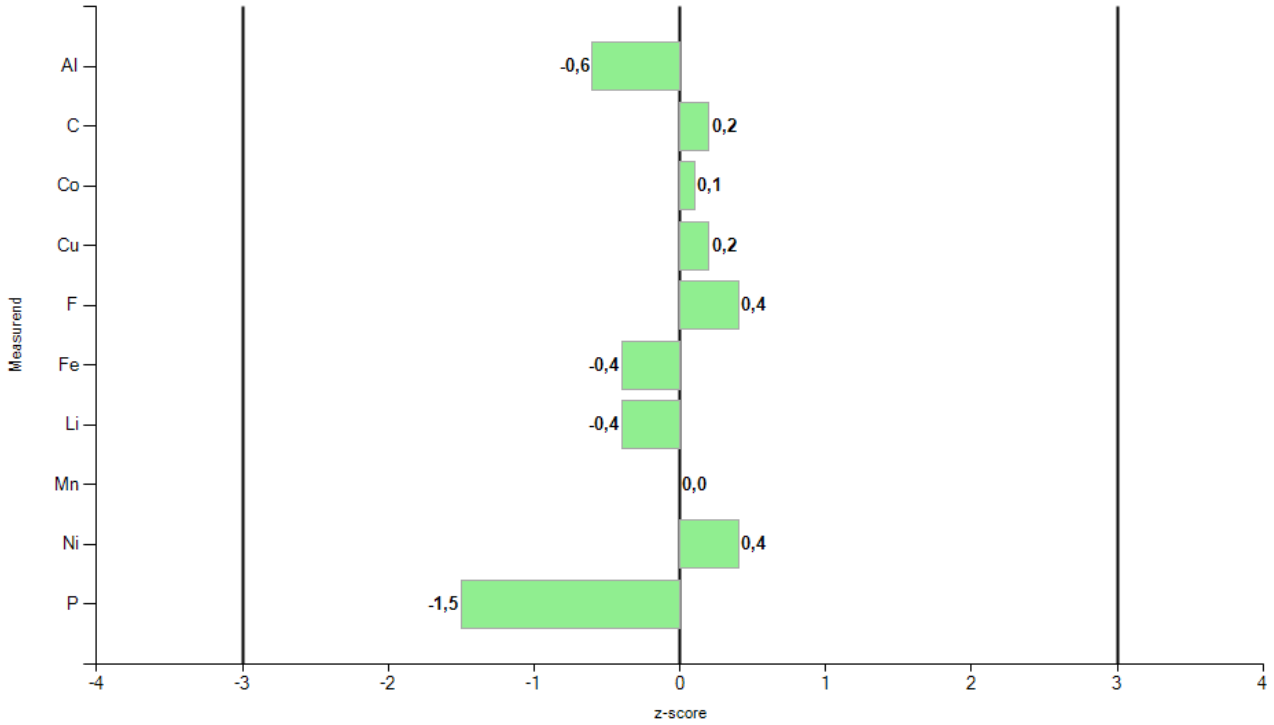
Laboratory: 08



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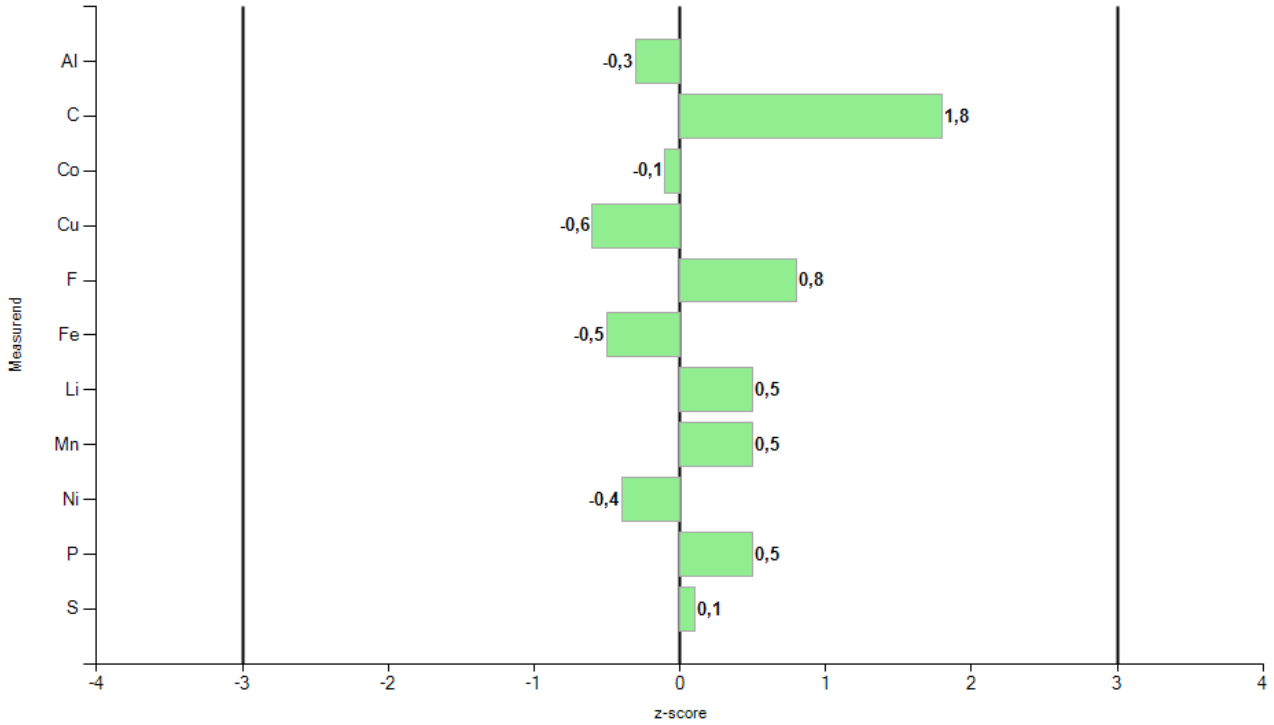
Laboratory: 09



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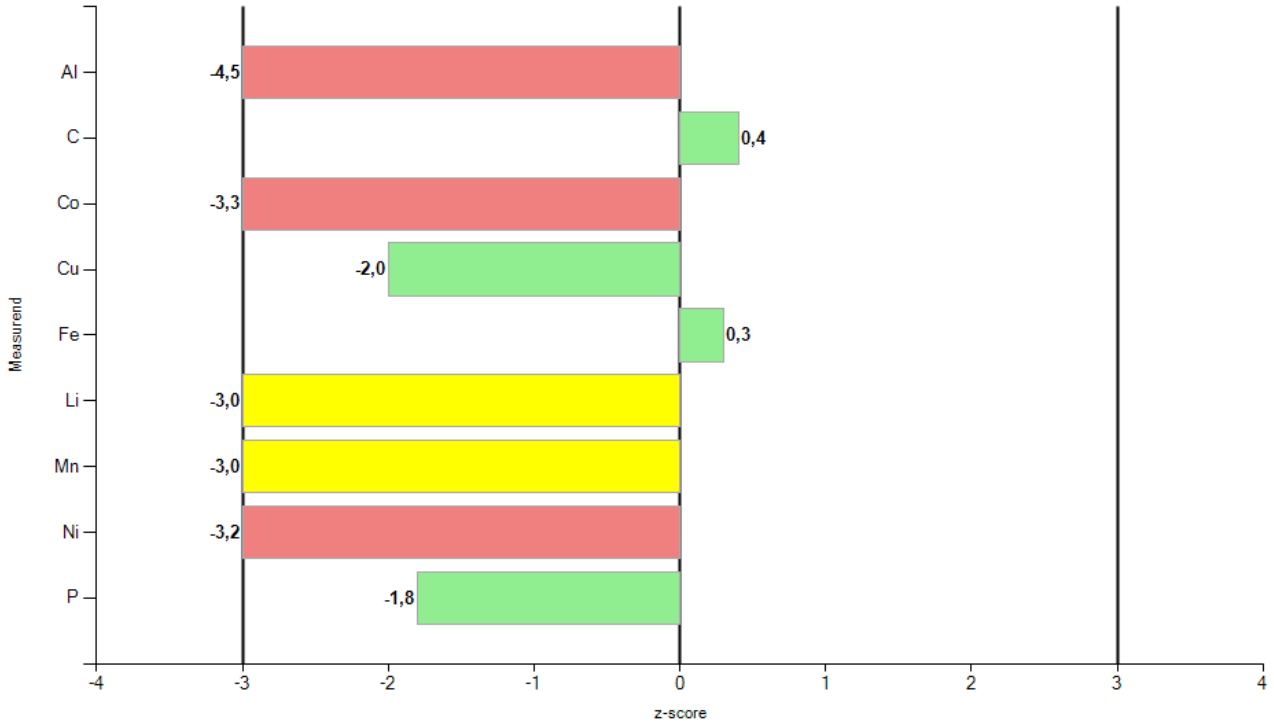
Laboratory: 10



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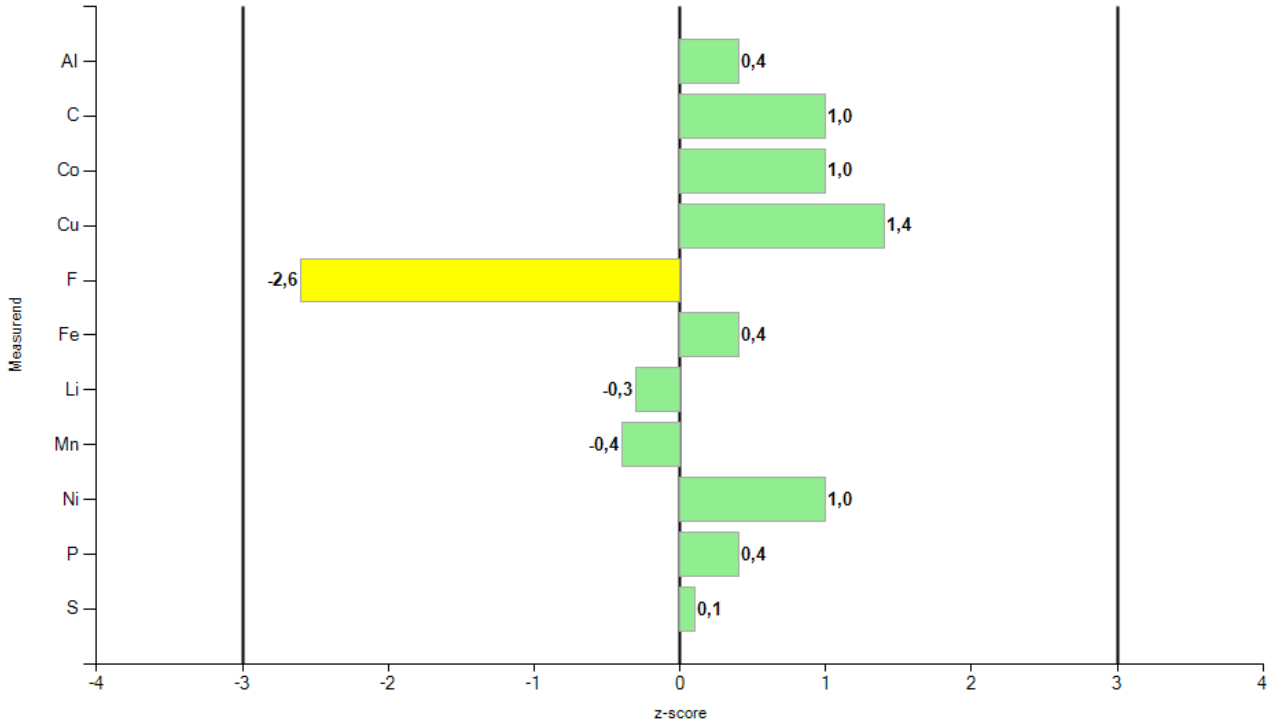
Laboratory chart of z-scores

Laboratory: 11



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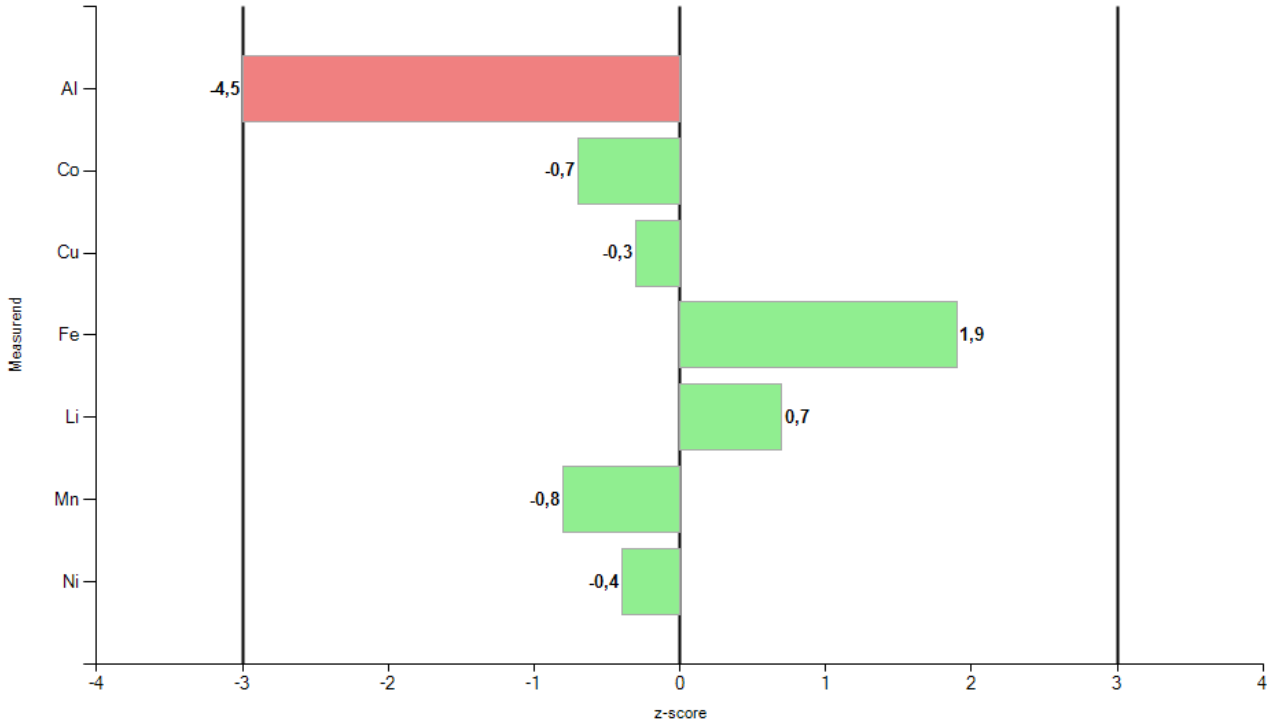
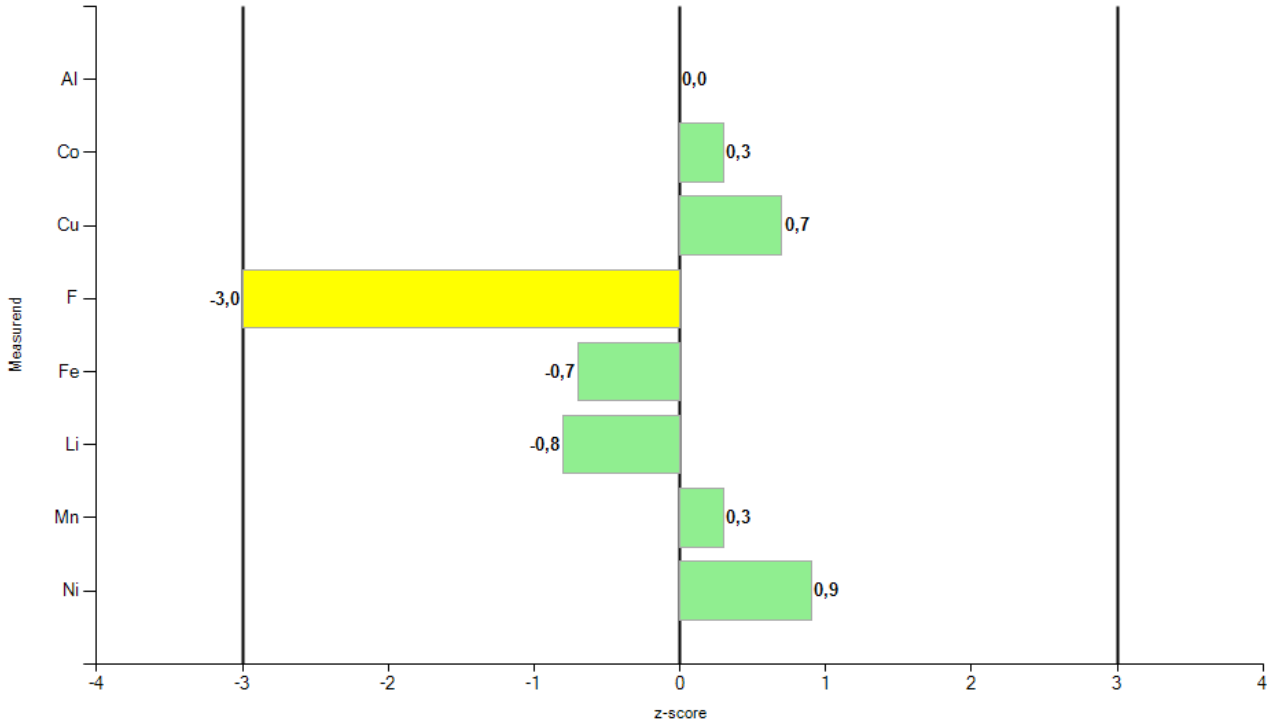
Laboratory: 12



Laboratory chart of z-scores

Laboratory: 13



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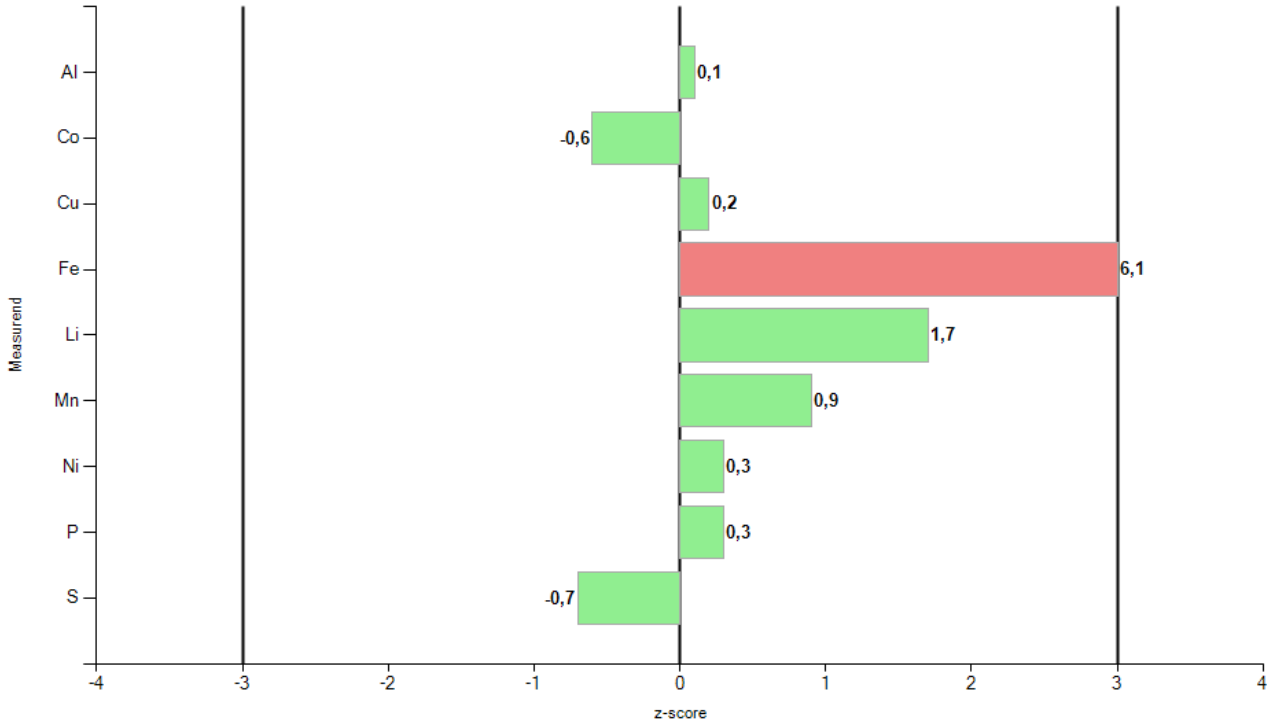
Laboratory: 14



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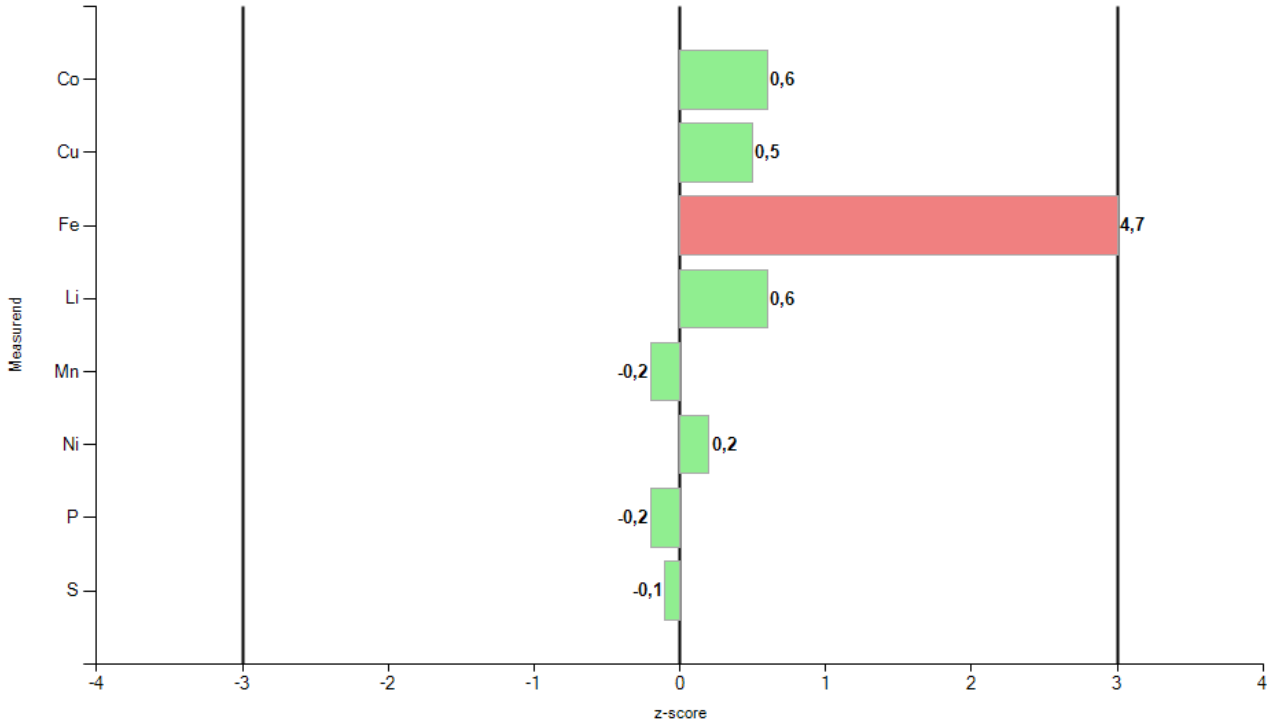
Laboratory: 15



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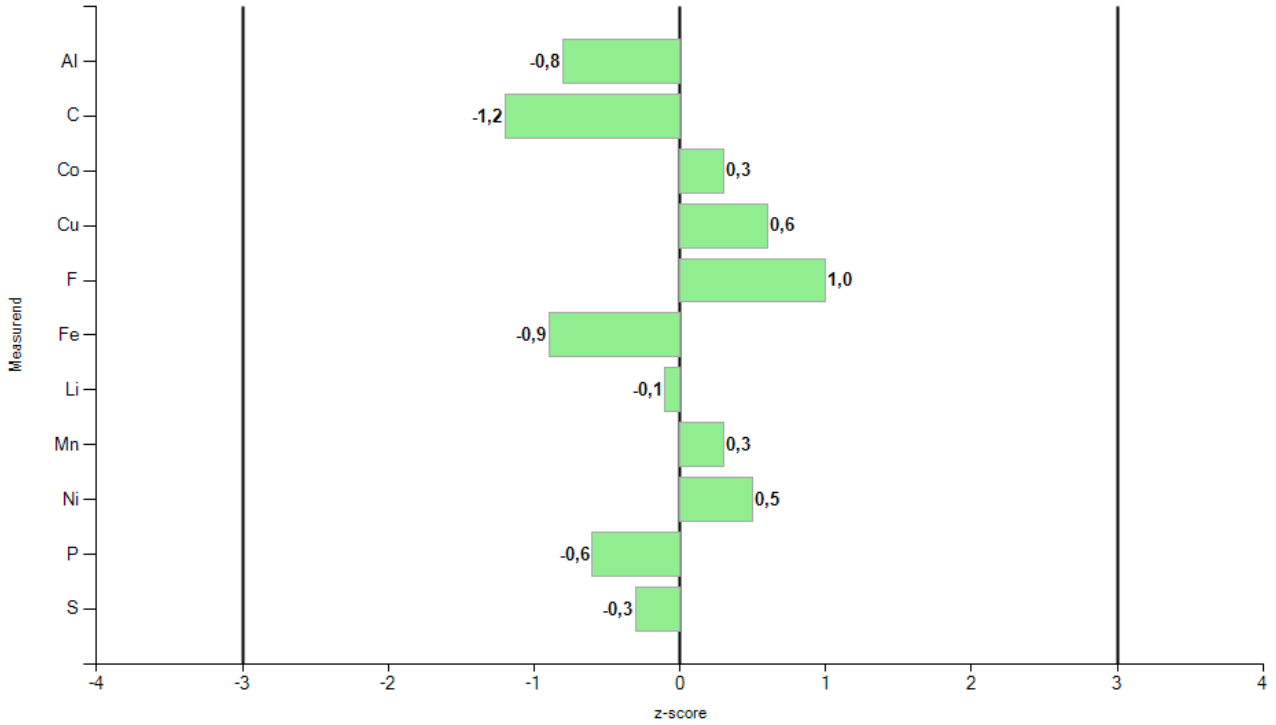
Laboratory: 16



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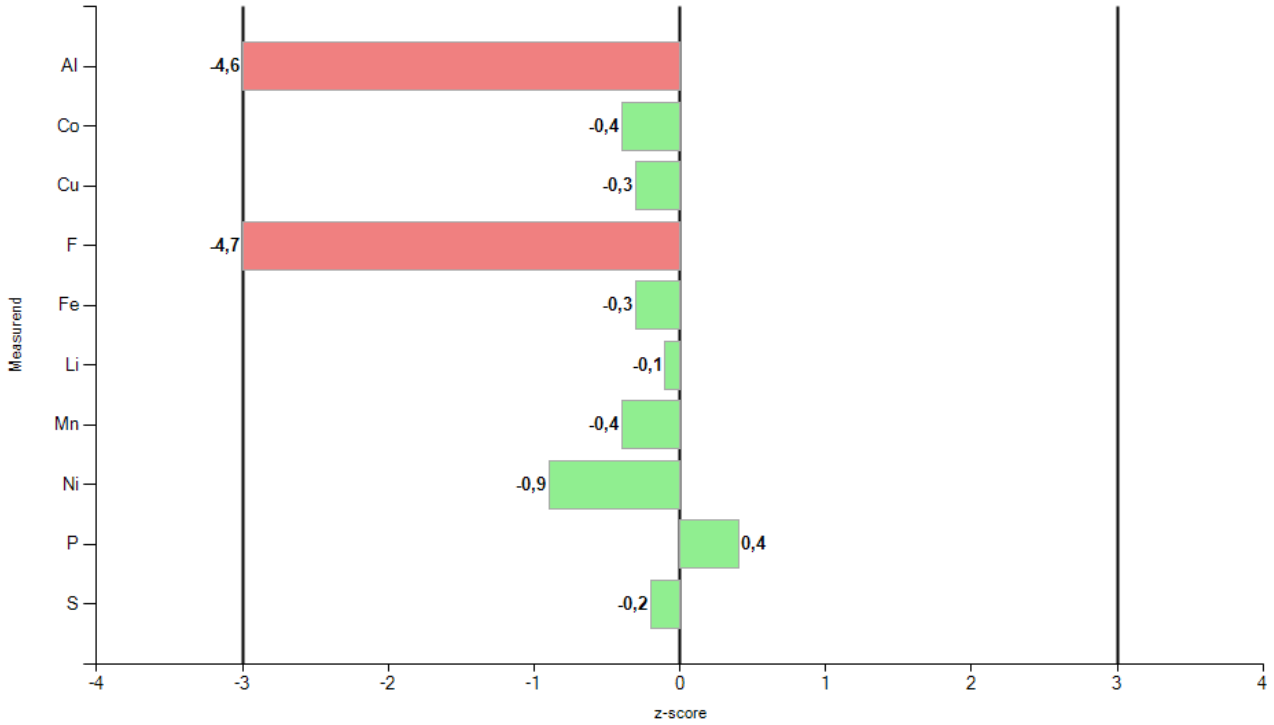
Laboratory: 17



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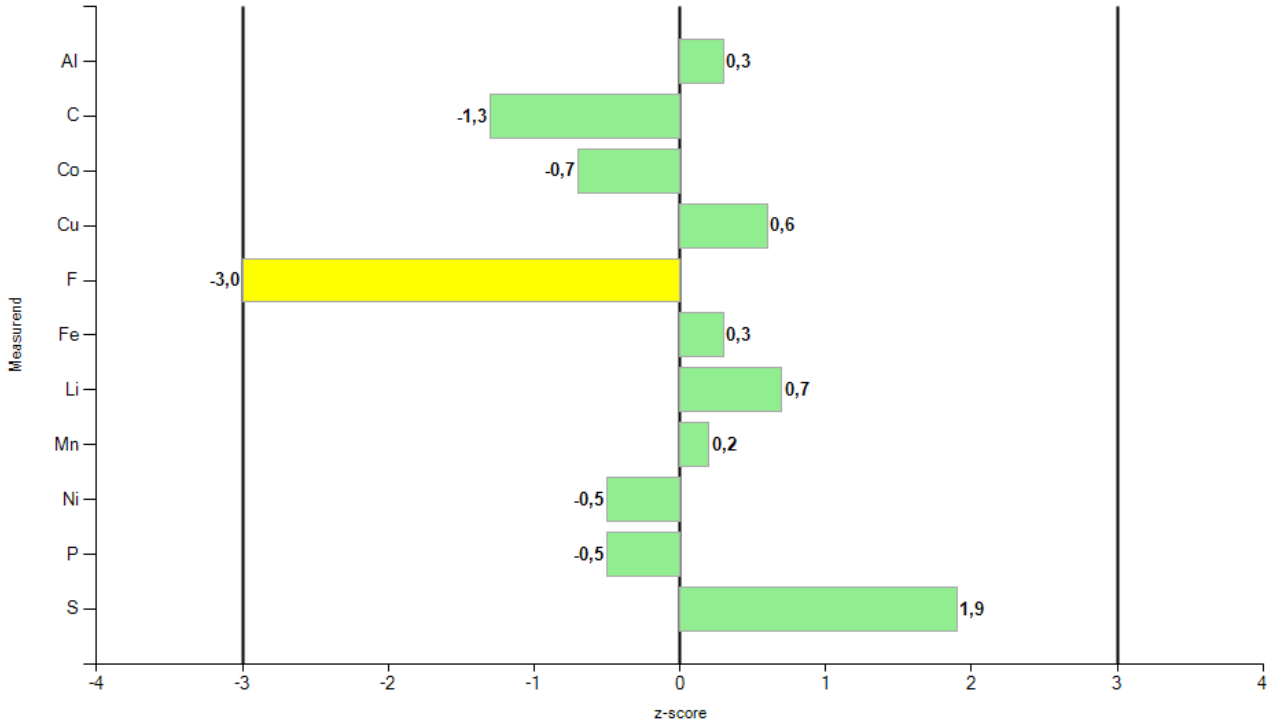
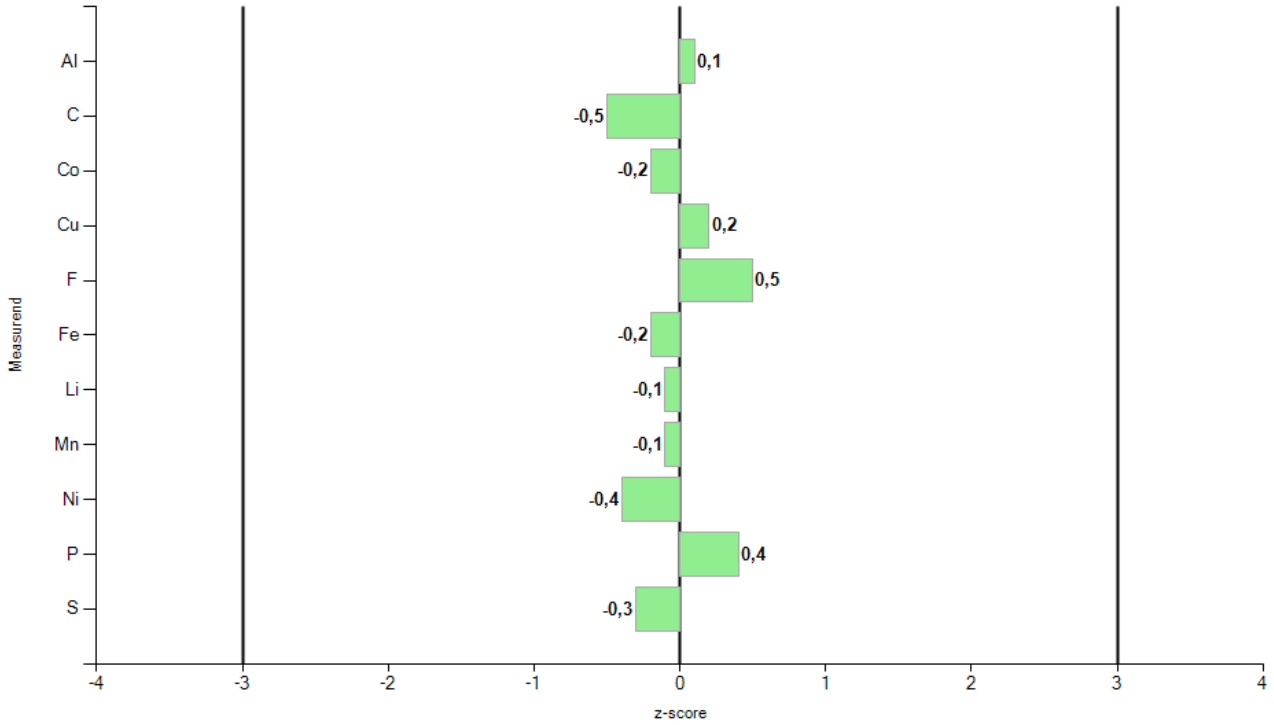
Laboratory chart of z-scores

Laboratory: 18



Laboratory chart of z-scores

Laboratory: 19



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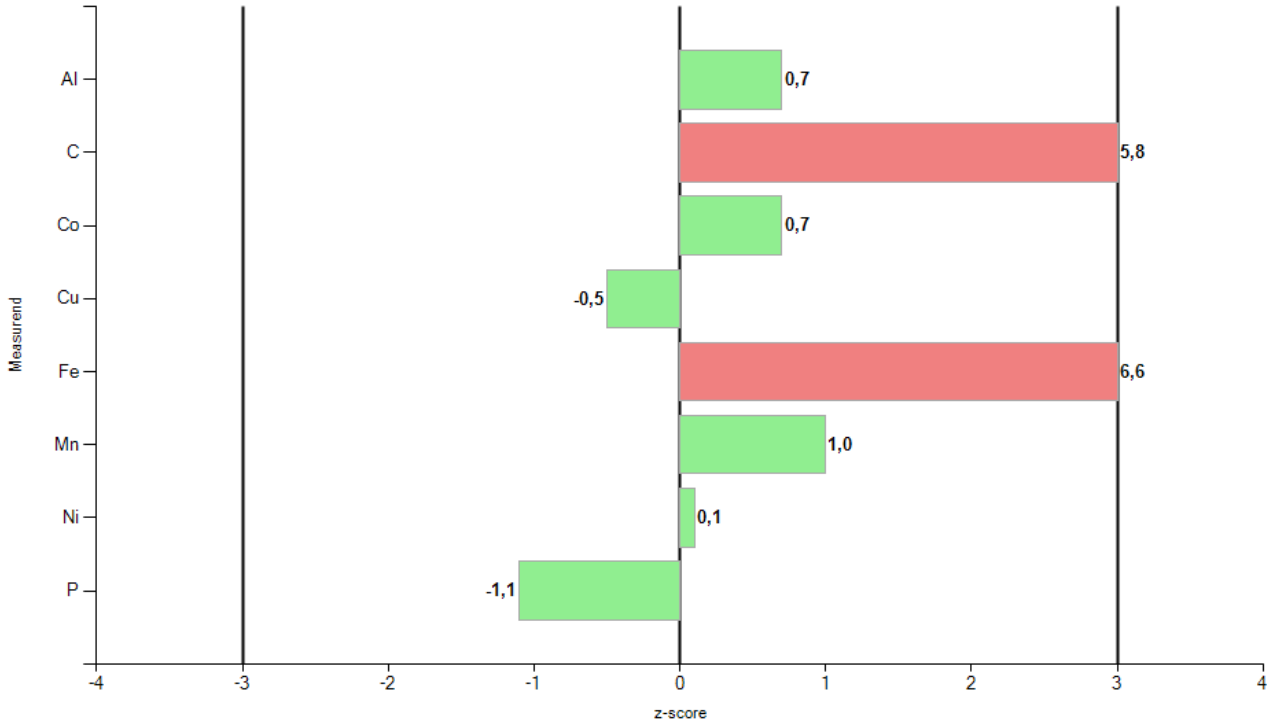

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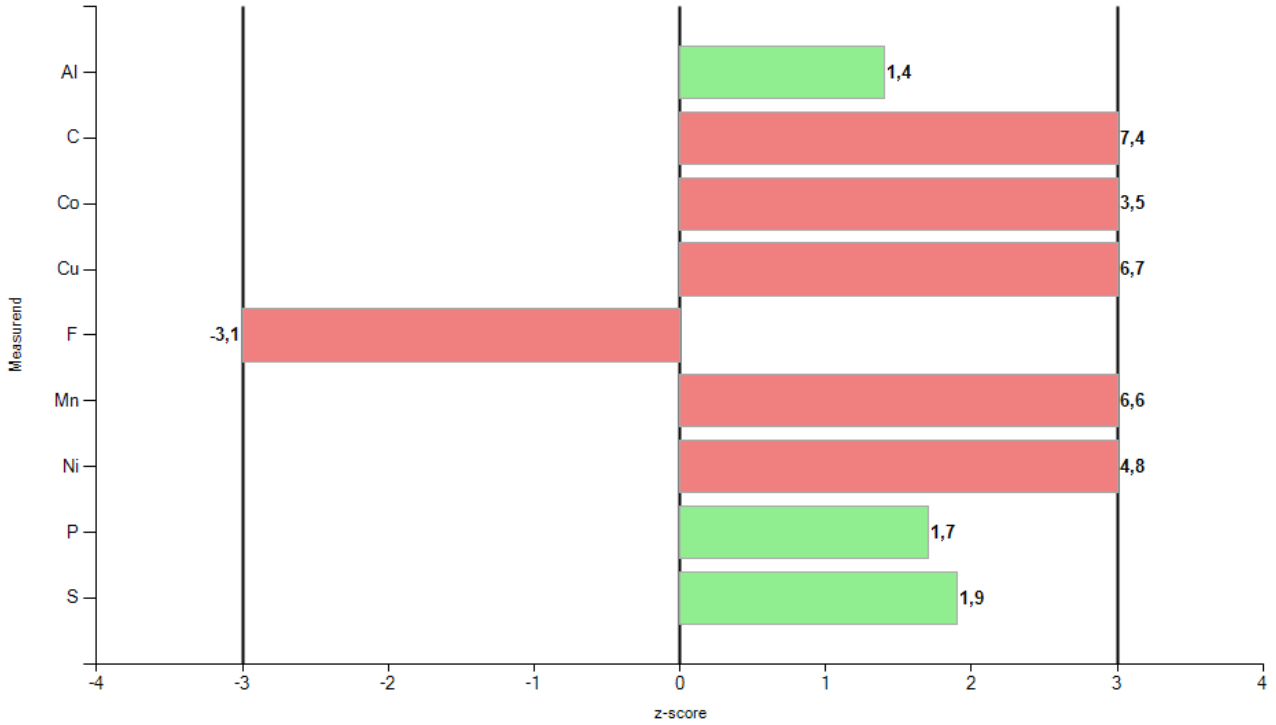

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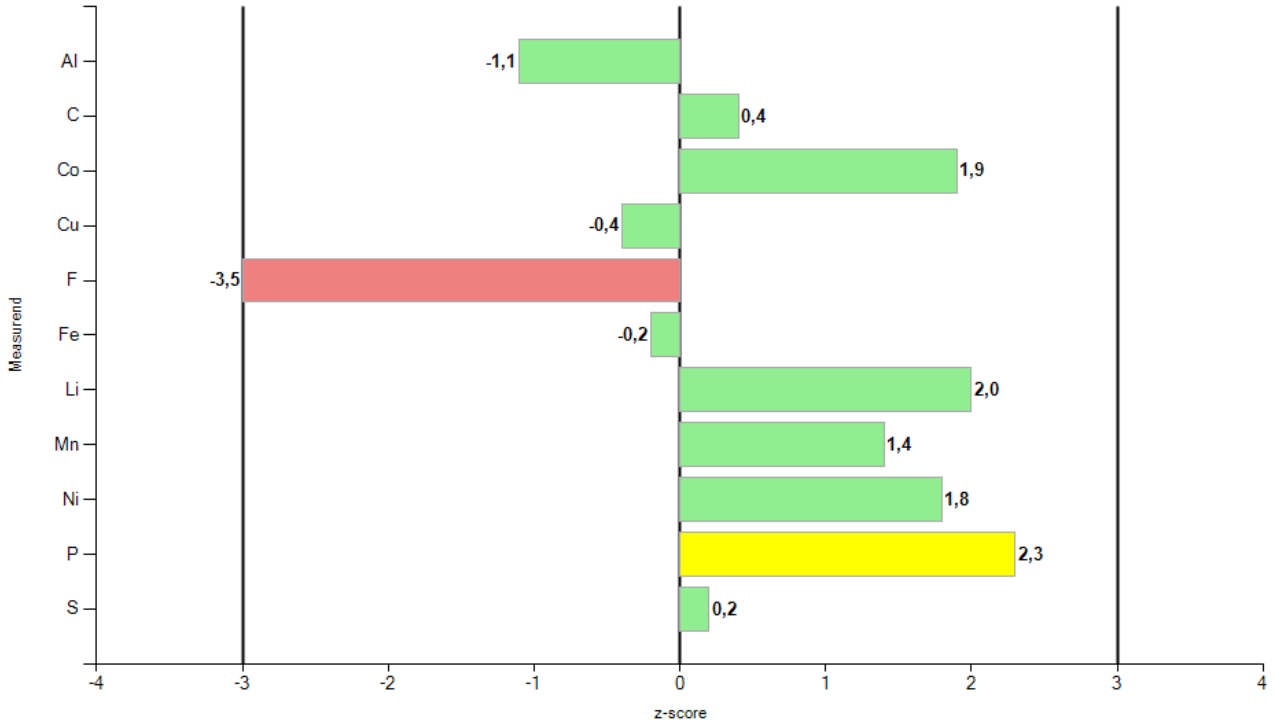
Laboratory: 22



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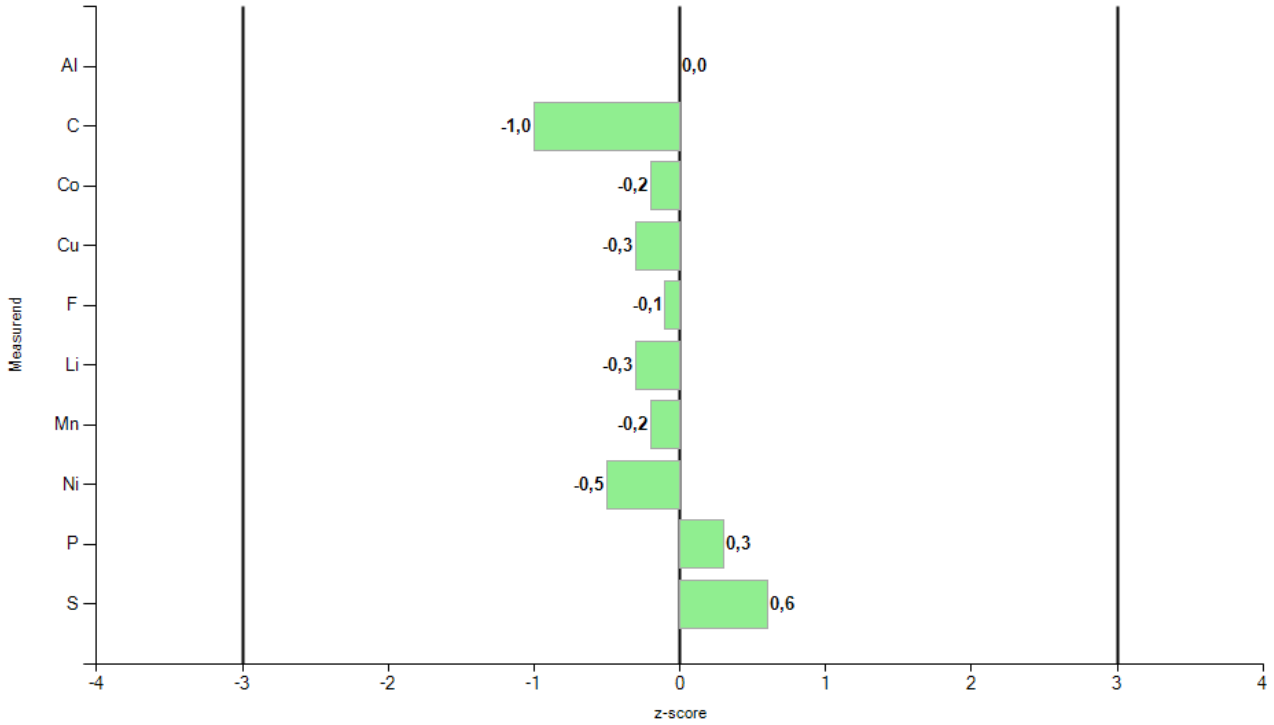
Laboratory: 23



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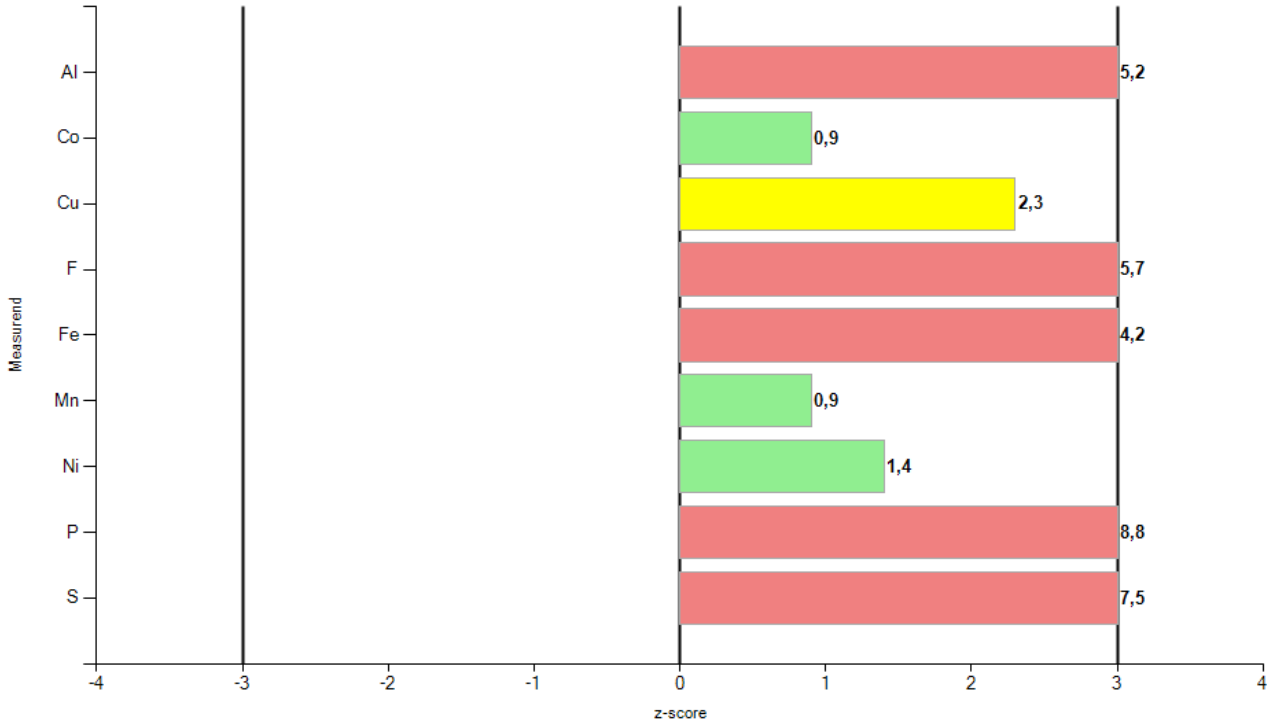
Laboratory: 24



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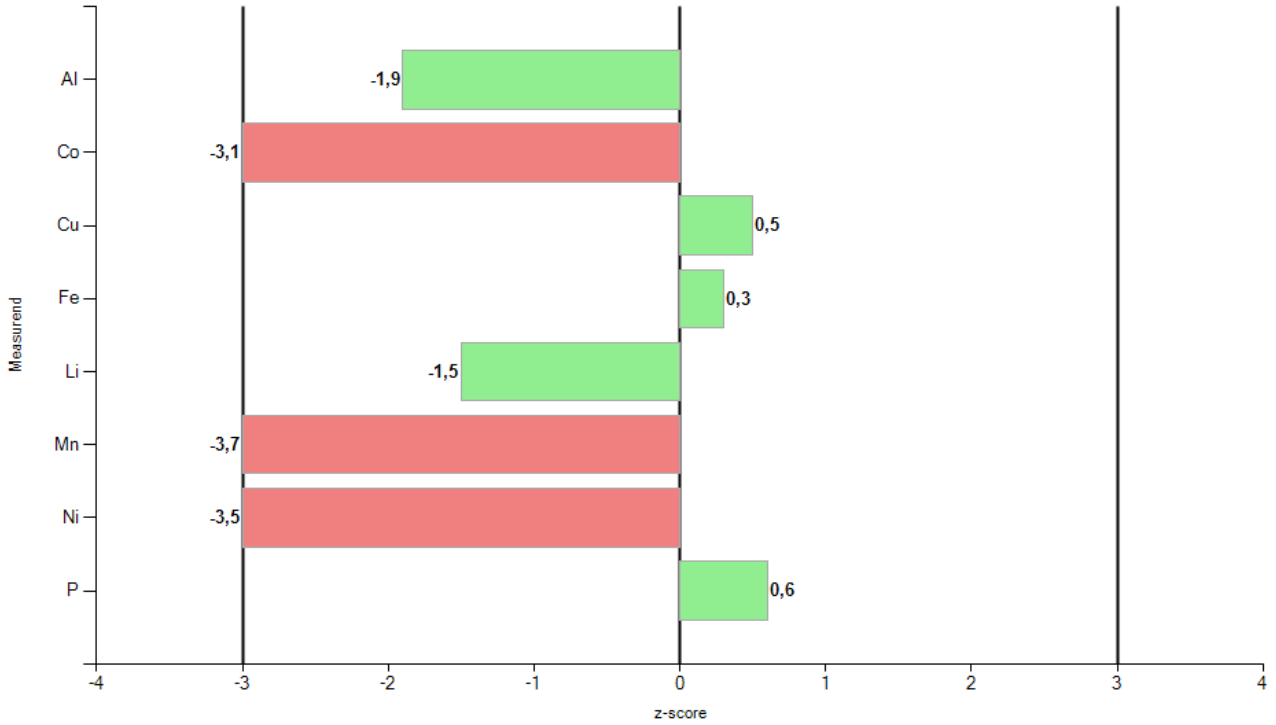

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Laboratory chart of z-scores

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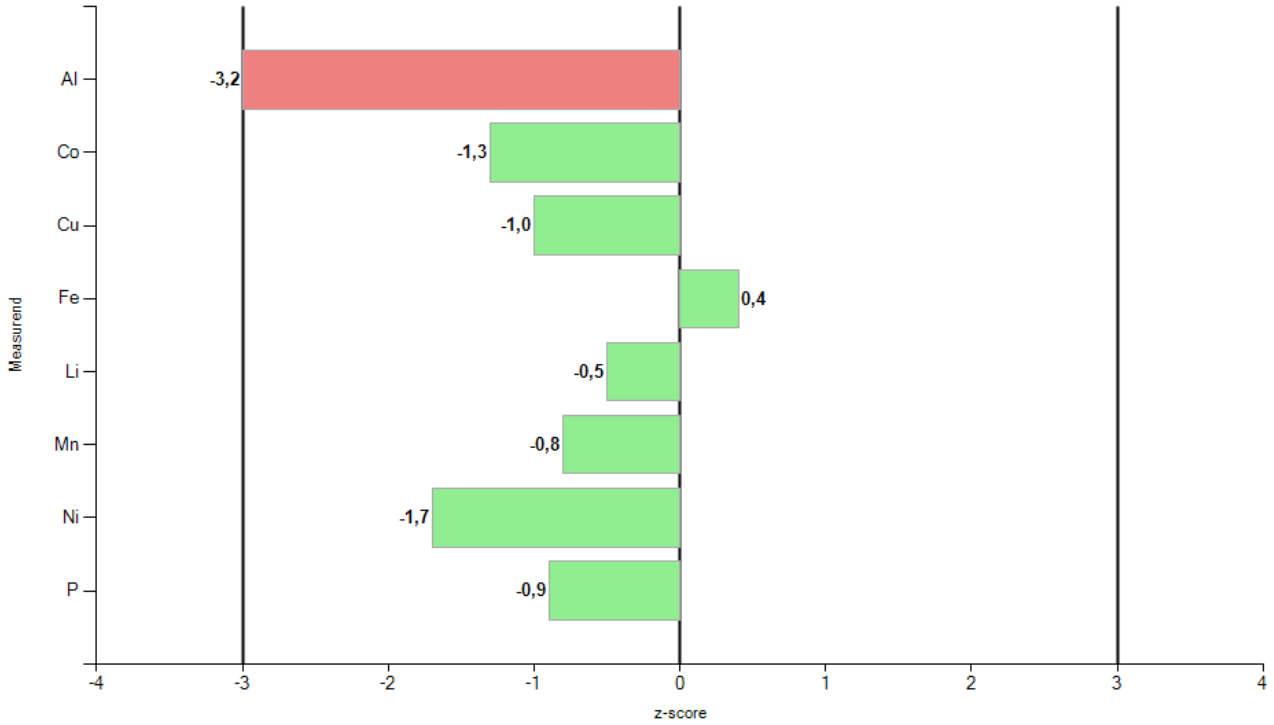

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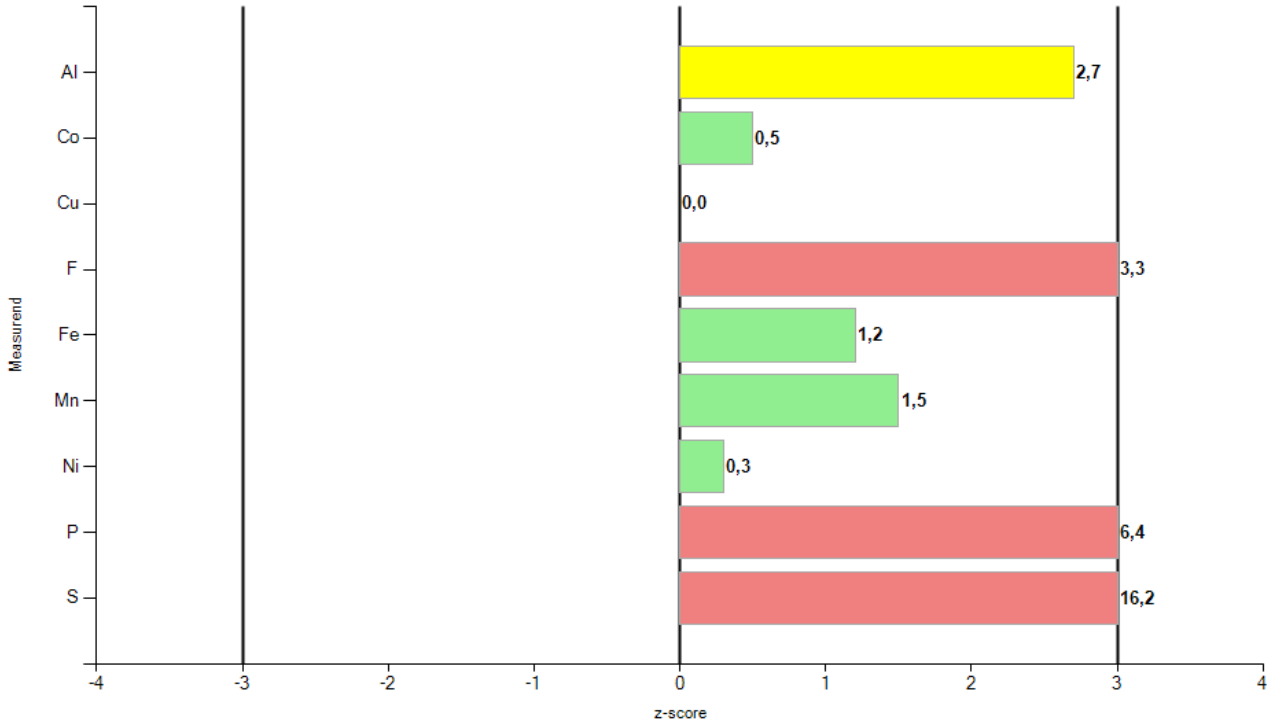
Laboratory: 28



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