Summary of laboratory means

Measurand hydrochloric acid

Laboratory	sample 1	Z score	sample 2	Z score	sample 3	Z score
Unit	mg/m³		mg/m³		mg/m³	
–	–	– –	–	– –	–	– –
12	0,938	0,10	2,899	0,04	5,031	0,05
15	0,780	-1,60	2,880	-0,02	4,220	-1,57
26	0,850	-0,85	2,650	-0,82	4,370	-1,27
68	1,040	1,19	3,070	0,64	6,090	2,16 E
78	0,952	0,25	2,900	0,05	5,250	0,49
82	0,948	0,20	3,389	1,74	5,544	1,07
110	1,370	4,75 FE	2,570	-1,10	3,520	-2,97 E
111	0,983	0,58	2,900	0,05	5,430	0,84
131	1,005	0,82	3,000	0,39	5,300	0,59
135	0,972	0,46	3,010	0,43	5,318	0,62
143	1,156	2,44 E	3,254	1,27	6,728	3,44 E
149	1,268	3,65 E	3,400	1,78	7,484	4,95 FE
163	0,710	-2,36 E	2,803	-0,29	5,256	0,50
177	1,011	0,88	2,883	-0,01	6,757	3,50 E
178	0,737	-2,07 E	2,460	-1,48	3,980	-2,05 E
195	0,800	-1,39	3,090	0,71	3,580	-2,85 E
196	1,040	1,19	3,030	0,50	5,070	0,13
197	0,736	-2,08 E	2,150	-2,55 E	4,960	-0,09
224	0,892	-0,40	2,751	-0,47	4,725	-0,56
266	0,790	-1,50	2,630	-0,89	3,700	-2,61 E
269	0,973	0,47	2,890	0,01	5,310	0,61
–	–	– –	–	– –	–	– –
Assessment	|Z|<=2,00		|Z|<=2,00		|Z|<=2,00	
Mean	0,929		2,886		5,007	
Reproducibility s.d.	0,145		0,296		0,923	
Rel. reproducibility s.d.	15,60 %		10,24 %		18,43 %	
Reference value	0,990		3,040		5,330	
Target s.d.	0,093		0,289		0,501	
Rel. target s.d.	10,00 %		10,00 %		10,00 %	
Lower limit of tolerance	0,743		2,309		4,006	
Upper limit of tolerance	1,115		3,463		6,008	
Type E outliers	6		1		8	
Type F outliers	1		0		1	
No. of laboratories after elimination of outliers type A-D and F (without laboratories that only gave states but no measured values)	20		21		20	

Explanation of outlier types

A: Single outlier

B: Differing laboratory mean

C: excessive laboratory s.d.

D: Excluded manually

E: score outside tolerance limits

F: |Score|>3,5

Summary of laboratory means

Measurand nitric acid

Laboratory	sample 1	Z score	sample 2	Z score	sample 3	Z score
Unit	mg/m³		mg/m³		mg/m³	
–	–	– –	–	– –	–	– –
12	0,790	0,38	2,301	0,24	4,381	-0,74
15	0,739	-0,29	2,240	-0,04	4,390	-0,72
26	0,690	-0,93	2,210	-0,17	4,340	-0,83
68	0,850	1,17	2,440	0,85	5,120	0,82
78	0,894	1,75	2,400	0,68	5,750	2,15 E
82	0,863	1,34	2,349	0,45	5,334	1,27
110	0,723	-0,50	2,170	-0,35	3,950	-1,65
111	0,833	0,95	2,320	0,32	5,160	0,90
131	0,829	0,89	2,348	0,44	4,824	0,19
135	0,675	-1,13	2,017	-1,03	4,221	-1,08
143	0,812	0,67	2,366	0,52	5,152	0,89
149	0,835	0,97	2,370	0,54	5,181	0,95
163	0,547	-2,81 E	2,093	-0,69	4,327	-0,86
177	0,819	0,76	2,359	0,49	5,431	1,48
178	0,681	-1,05	1,986	-1,17	4,280	-0,96
195	0,790	0,38	2,900	2,90 E	4,230	-1,06
196	0,874	1,49	2,390	0,63	5,200	0,99
197	0,438	-4,24 FE	1,640	-2,71 E	5,140	0,86
224	0,493	-3,52 E	2,052	-0,87	4,051	-1,44
266	0,710	-0,67	2,120	-0,57	4,160	-1,21
269	0,772	0,15	2,140	-0,48	4,750	0,04
–	–	– –	–	– –	–	– –
Assessment	|Z|<=2,00		|Z|<=2,00		|Z|<=2,00	
Mean	0,761		2,248		4,732	
Reproducibility s.d.	0,106		0,241		0,533	
Rel. reproducibility s.d.	13,91 %		10,73 %		11,25 %	
Reference value	0,820		2,370		4,940	
Target s.d.	0,076		0,225		0,473	
Rel. target s.d.	10,00 %		10,00 %		10,00 %	
Lower limit of tolerance	0,609		1,799		3,786	
Upper limit of tolerance	0,913		2,698		5,678	
Type E outliers	3		2		1	
Type F outliers	1		0		0	
No. of laboratories after elimination of outliers type A-D and F (without laboratories that only gave states but no measured values)	20		21		21	

Explanation of outlier types

A: Single outlier

B: Differing laboratory mean

C: excessive laboratory s.d.

D: Excluded manually

E: score outside tolerance limits

F: |Score|>3,5

Summary of laboratory means

Measurand phosphoric acid

Laboratory	sample 1	Z score	sample 2	Z score	sample 3	Z score
Unit	mg/m³		mg/m³		mg/m³	
–	–	– –	–	– –	–	– –
12	0,162	-1,58	0,603	-1,02	2,379	-0,65
15						
26	0,190	-0,12	0,700	0,42	2,680	0,54
68	0,200	0,40	0,710	0,57	2,600	0,22
78	0,207	0,76	0,702	0,45	2,540	-0,01
82	0,196	0,19	0,653	-0,28	2,430	-0,45
110	0,205	0,66	0,712	0,60	2,600	0,22
111	0,200	0,40	0,683	0,17	2,550	0,03
131	0,198	0,30	0,682	0,15	2,580	0,14
135	0,186	-0,33	0,618	-0,80	2,431	-0,44
143						
149						
163	0,190	-0,12	0,632	-0,59	2,669	0,49
177	0,201	0,45	0,630	-0,62	2,530	-0,05
178	0,210	0,92	0,697	0,37	2,580	0,14
195	0,280	4,56 BE	1,200	7,86 BE	5,210	10,48 BE
196	0,196	0,19	0,690	0,27	2,500	-0,17
197	0,189	-0,17	0,687	0,23	2,640	0,38
224	0,158	-1,78	0,665	-0,10	2,441	-0,40
266	0,190	-0,12	0,670	-0,03	2,590	0,18
269	0,191	-0,07	0,687	0,23	2,500	-0,17
–	–	– –	–	– –	–	– –
Assessment	|Z|<=2,00		|Z|<=2,00		|Z|<=2,00	
Mean	0,192		0,672		2,544	
Reproducibility s.d.	0,014		0,033		0,087	
Rel. reproducibility s.d.	7,25 %		4,97 %		3,43 %	
Reference value	0,197		0,703		2,570	
Target s.d.	0,019		0,067		0,254	
Rel. target s.d.	10,00 %		10,00 %		10,00 %	
Lower limit of tolerance	0,154		0,537		2,035	
Upper limit of tolerance	0,231		0,806		3,052	
Type E outliers	1		1		1	
Type F outliers	0		0		0	
No. of laboratories after elimination of outliers type A-D and F (without laboratories that only gave states but no measured values)	17		17		17	

Explanation of outlier types

A: Single outlier

B: Differing laboratory mean

C: excessive laboratory s.d.

D: Excluded manually

E: score outside tolerance limits

F: |Score|>3,5

Summary of laboratory means

Measurand sulfuric acid

Laboratory	sample 1	Z score	sample 2	Z score	sample 3	Z score
Unit	mg/m³		mg/m³		mg/m³	
–	–	– –	–	– –	–	– –
12	0,145	-0,53	0,021	-3,21 E	0,112	-1,02
15						
26	0,160	0,45	0,050	6,16 BE	0,130	0,42
68	0,150	-0,20	0,030	-0,30	0,120	-0,38
78	0,158	0,32	0,034	0,89	0,123	-0,14
82	0,156	0,19	0,037	1,96	0,127	0,18
110	0,173	1,30	0,061	9,71 BE	0,151	2,10 E
111	0,155	0,13	0,032	0,41	0,127	0,18
131	0,151	-0,13	0,026	-1,60	0,129	0,34
135	0,149	-0,26	0,033	0,66	0,120	-0,38
143						
149						
163	0,143	-0,66	0,032	0,34	0,116	-0,70
177	0,164	0,72	0,035	1,31	0,128	0,26
178	0,144	-0,59	0,028	-0,95	0,113	-0,94
195	0,170	1,11	0,030	-0,30	0,130	0,42
196	0,149	-0,26	0,036	1,70	0,121	-0,30
197	0,155	0,13	0,034	0,99	0,136	0,90
224	0,142	-0,72	0,025	-1,92	0,123	-0,14
266	0,150	-0,20	0,032	0,34	0,120	-0,38
269	0,141	-0,79	0,030	-0,30	0,120	-0,38
–	–	– –	–	– –	–	– –
Assessment	|Z|<=2,00		|Z|<=2,00		|Z|<=2,00	
Mean	0,153		0,031		0,125	
Reproducibility s.d.	0,009		0,004		0,009	
Rel. reproducibility s.d.	6,07 %		13,86 %		7,27 %	
Reference value	0,162		0,034		0,128	
Target s.d.	0,015		0,003		0,012	
Rel. target s.d.	10,00 %		10,00 %		10,00 %	
Lower limit of tolerance	0,122		0,025		0,100	
Upper limit of tolerance	0,184		0,037		0,150	
Type E outliers	0		3		1	
Type F outliers	0		0		0	
No. of laboratories after elimination of outliers type A-D and F (without laboratories that only gave states but no measured values)	18		16		18	

Explanation of outlier types

A: Single outlier

B: Differing laboratory mean

C: excessive laboratory s.d.

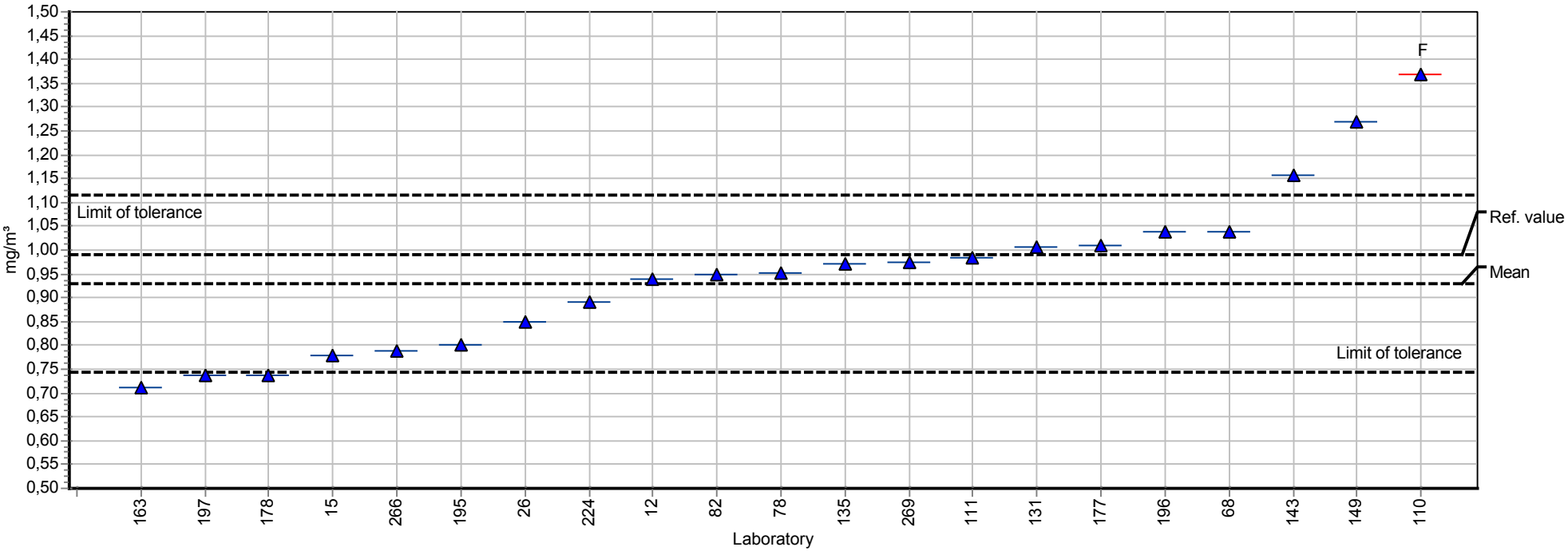
D: Excluded manually

E: score outside tolerance limits

F: |Score|>3,5

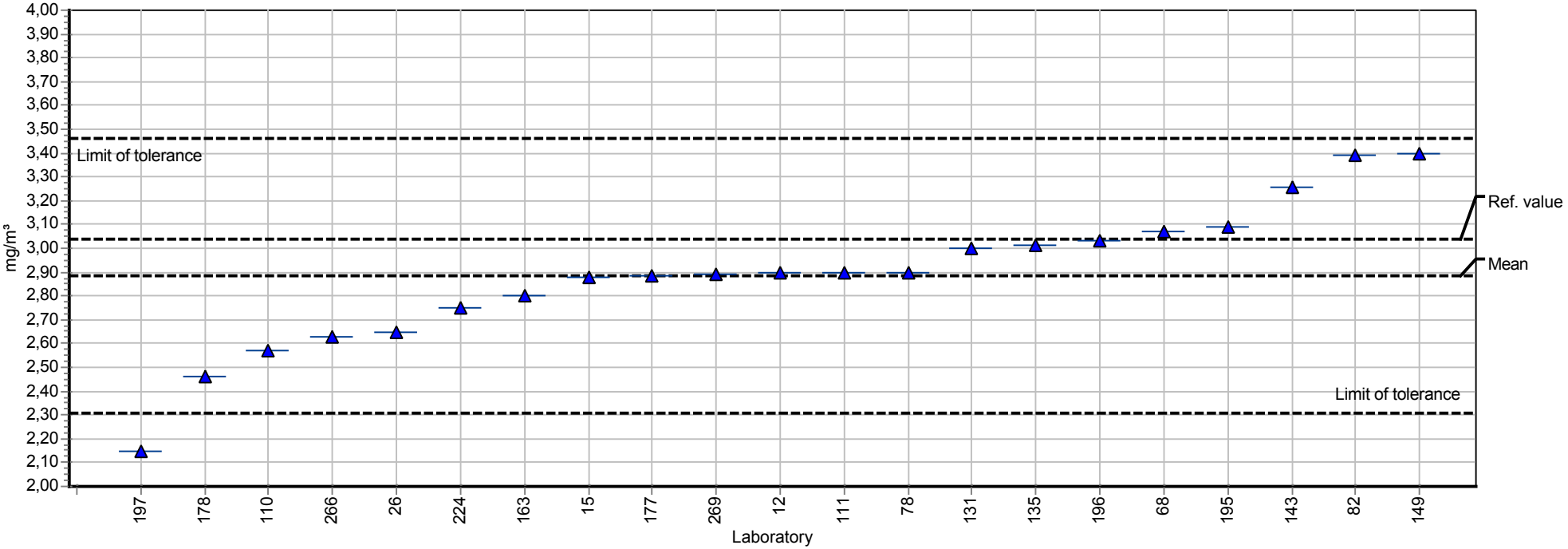
Summary results

Measurand:	**hydrochloric acid**	**Mean:**	**0,929 mg/m³**
Sample:	**sample 1**	**Reproducibility s.d.:**	**0,145 mg/m³**
Method:	**ISO 5725**	**Rel. reproducibility s.d.:**	**15,60%**
No. of laboratories:	**20**	**Reference value:**	**0,990 mg/m³**
		Tolerance limits:	**0,743 - 1,115 mg/m³ (|Z score| < 2,00)**



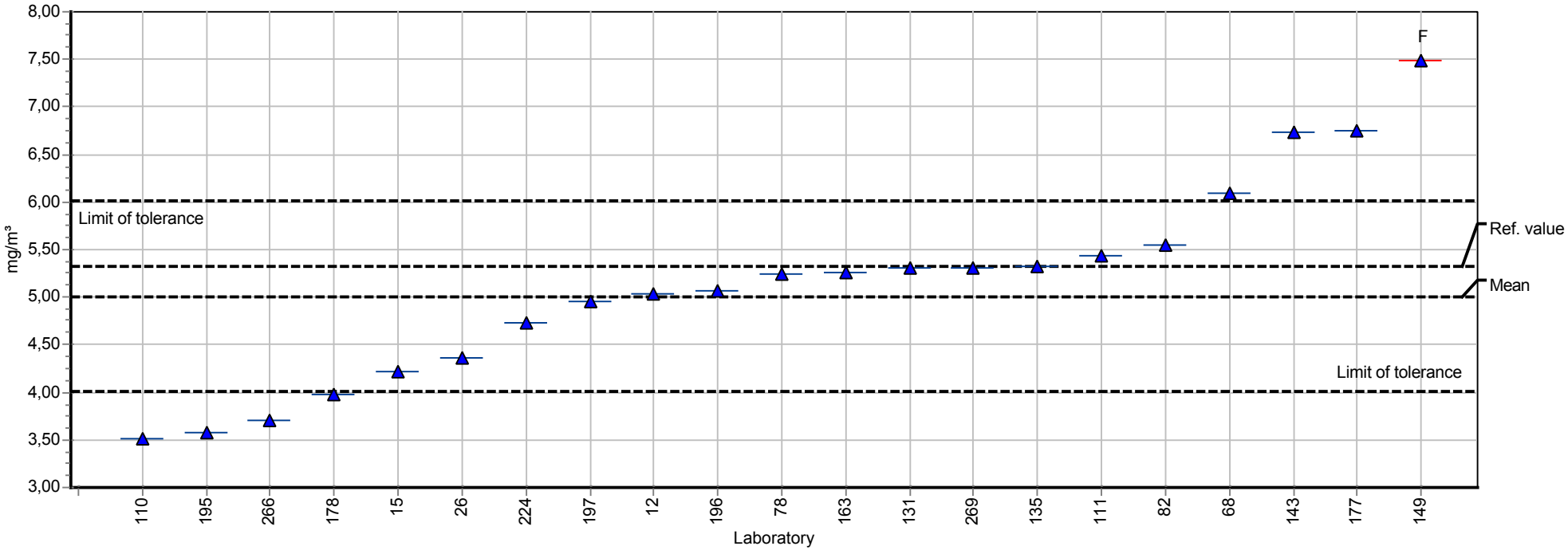
Summary results

Measurand:	**hydrochloric acid**	**Mean:**	**2,886 mg/m³**
Sample:	**sample 2**	**Reproducibility s.d.:**	**0,296 mg/m³**
Method:	**ISO 5725**	**Rel. reproducibility s.d.:**	**10,24%**
No. of laboratories:	**21**	**Reference value:**	**3,040 mg/m³**
		Tolerance limits:	**2,309 - 3,463 mg/m³ (|Z score| < 2,00)**



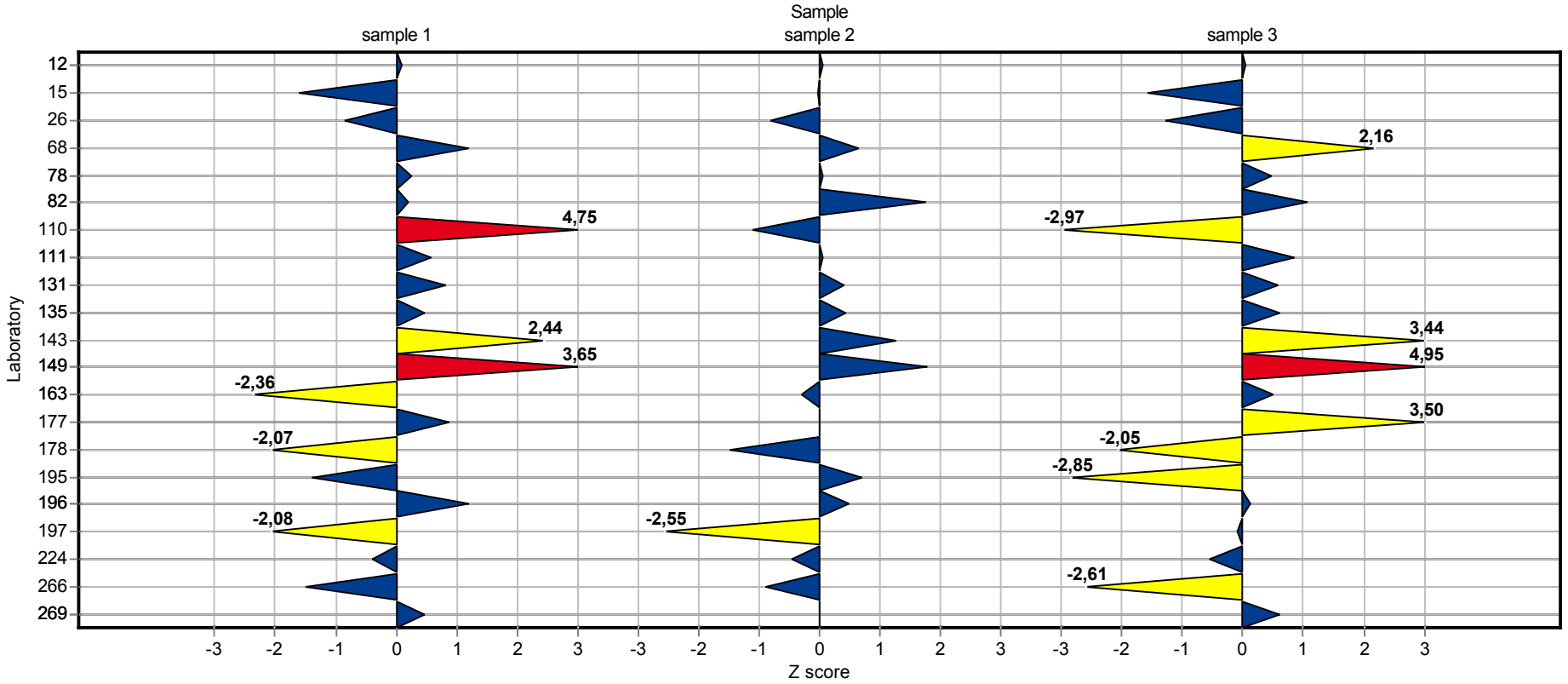
Summary results

Measurand:	**hydrochloric acid**	**Mean:**	**5,007 mg/m³**
Sample:	**sample 3**	**Reproducibility s.d.:**	**0,923 mg/m³**
Method:	**ISO 5725**	**Rel. reproducibility s.d.:**	**18,43%**
No. of laboratories:	**20**	**Reference value:**	**5,330 mg/m³**
		Tolerance limits:	**4,006 - 6,008 mg/m³ (|Z score| < 2,00)**



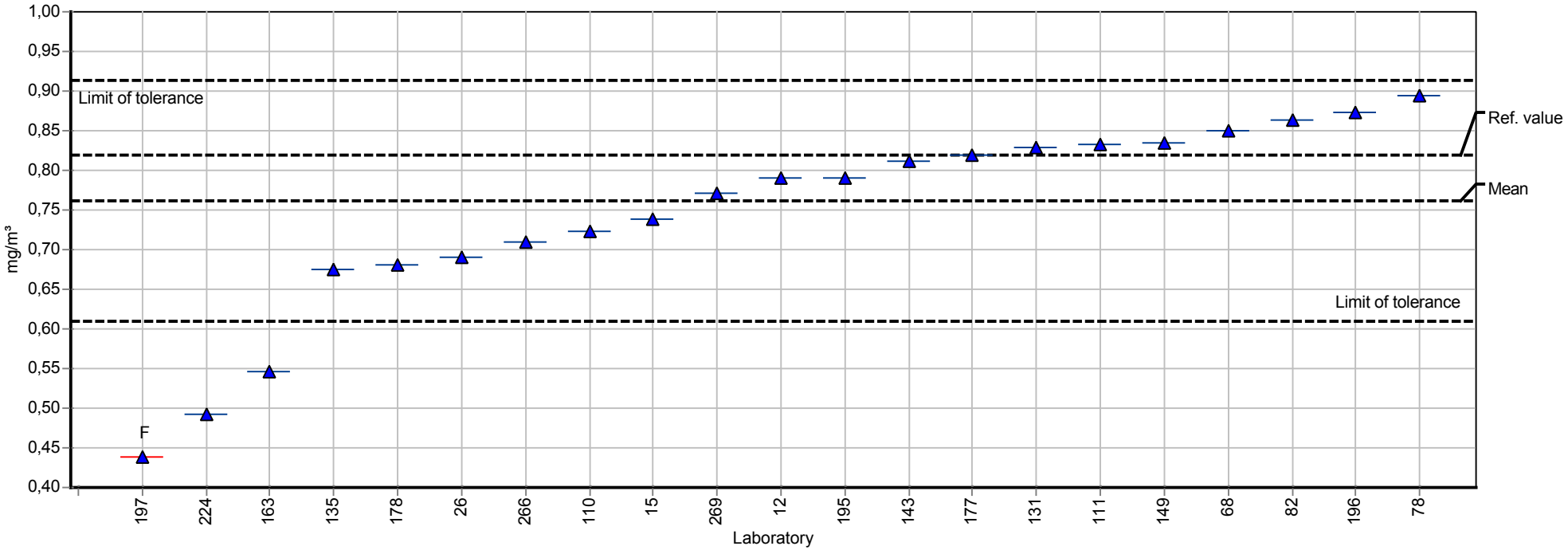
Analyte chart of Z scores

Measurand: hydrochloric acid



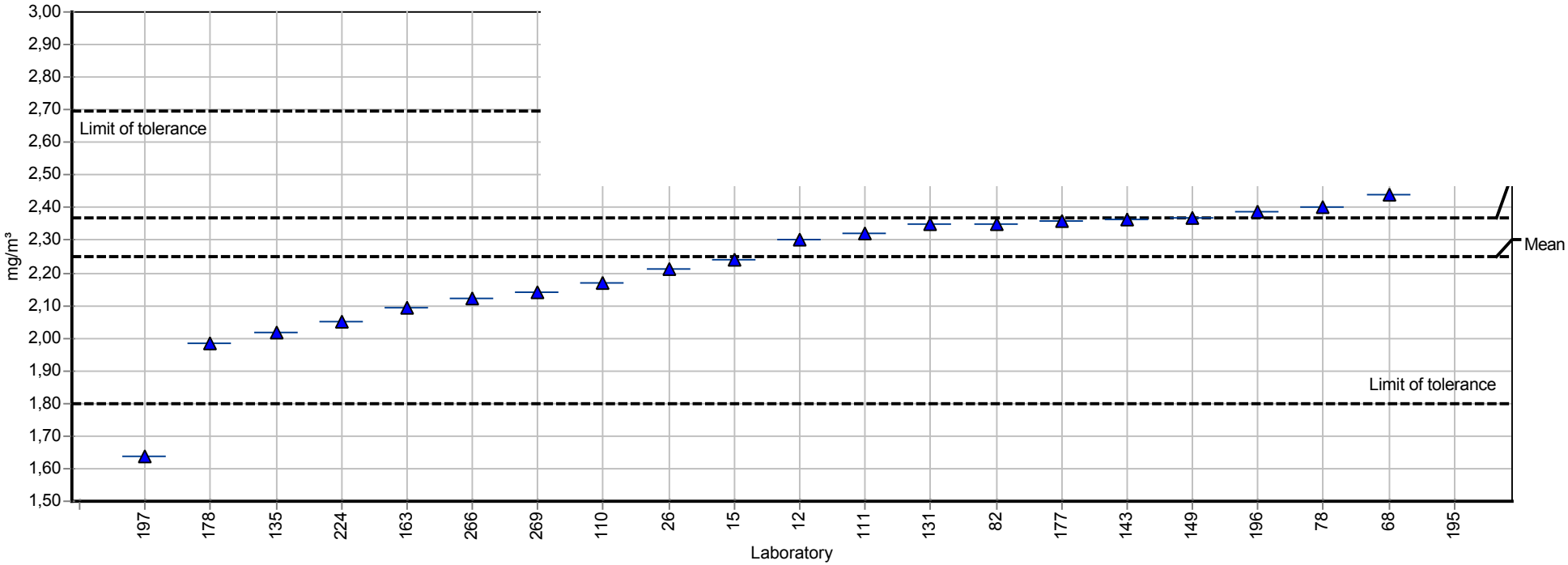
Summary results

Measurand:	**nitric acid**	**Mean:**	**0,761 mg/m³**
Sample:	**sample 1**	**Reproducibility s.d.:**	**0,106 mg/m³**
Method:	**ISO 5725**	**Rel. reproducibility s.d.:**	**13,91%**
No. of laboratories:	**20**	**Reference value:**	**0,820 mg/m³**
		Tolerance limits:	**0,609 - 0,913 mg/m³ (|Z score| < 2,00)**



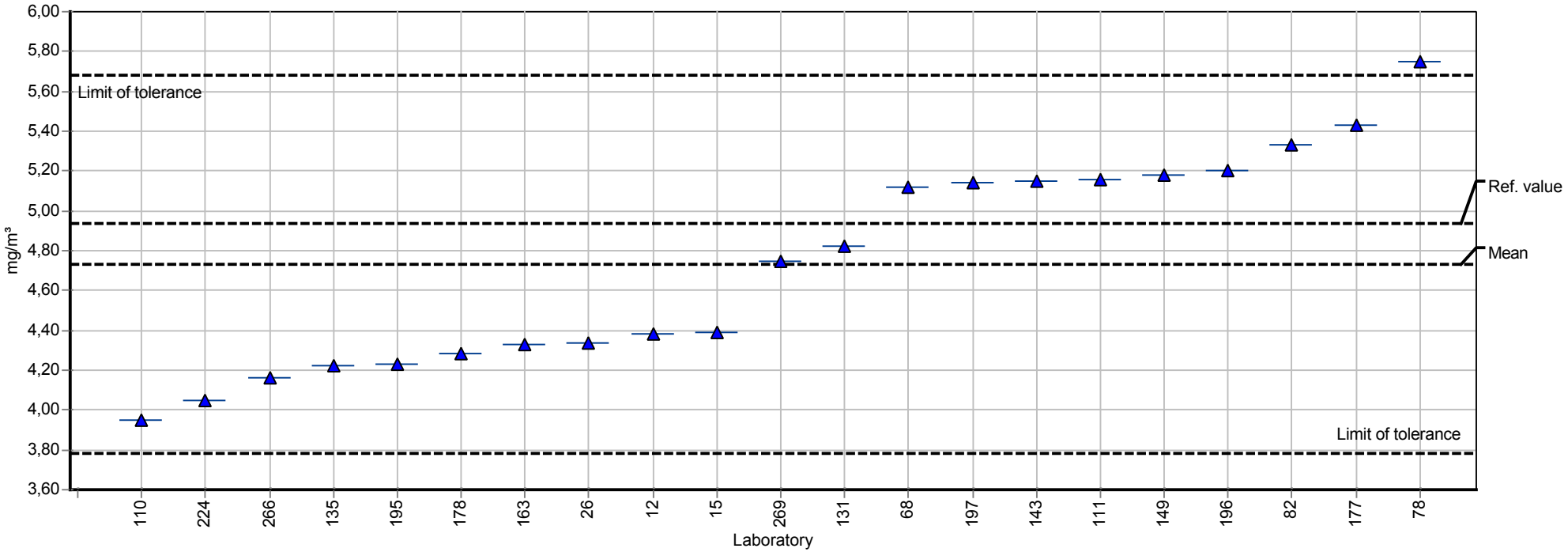
Summary results

Measurand:	**nitric acid**	**Mear**
Sample:	**sample 2**	**Repr**
Method:	**ISO 5725**	**Rel.**
No. of laboratories:	**21**	**Refe**
		Tole



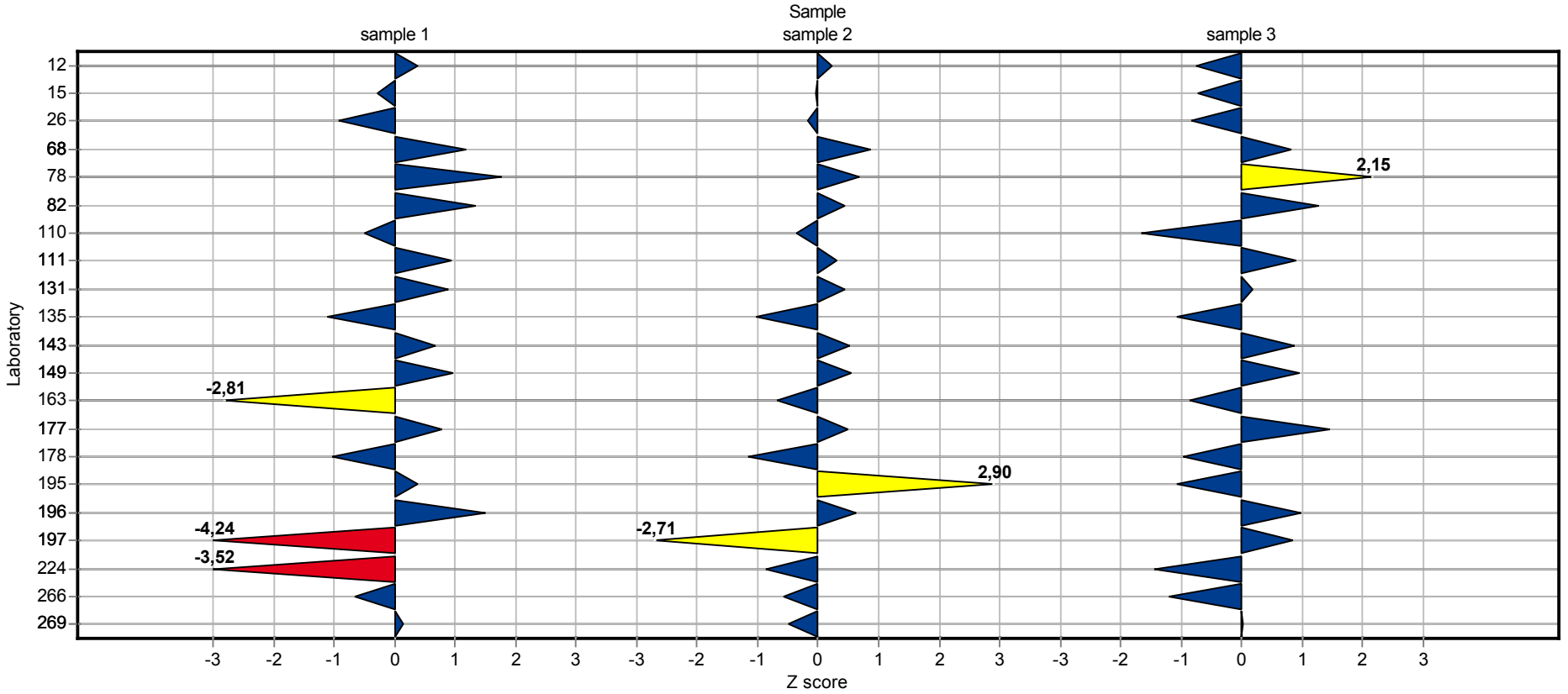
Summary results

Measurand:	**nitric acid**	**Mean:**	**4,732 mg/m³**
Sample:	**sample 3**	**Reproducibility s.d.:**	**0,533 mg/m³**
Method:	**ISO 5725**	**Rel. reproducibility s.d.:**	**11,25%**
No. of laboratories:	**21**	**Reference value:**	**4,940 mg/m³**
		Tolerance limits:	**3,786 - 5,678 mg/m³ (|Z score| < 2,00)**



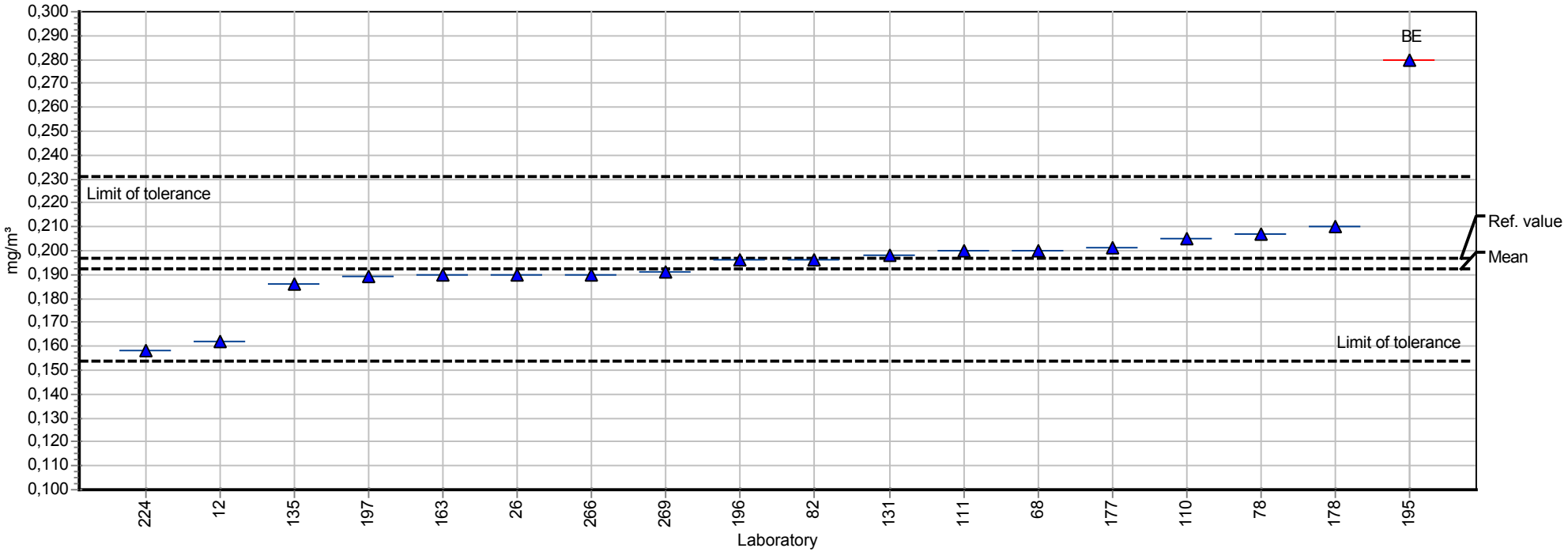
Analyte chart of Z scores

Measurand: nitric acid



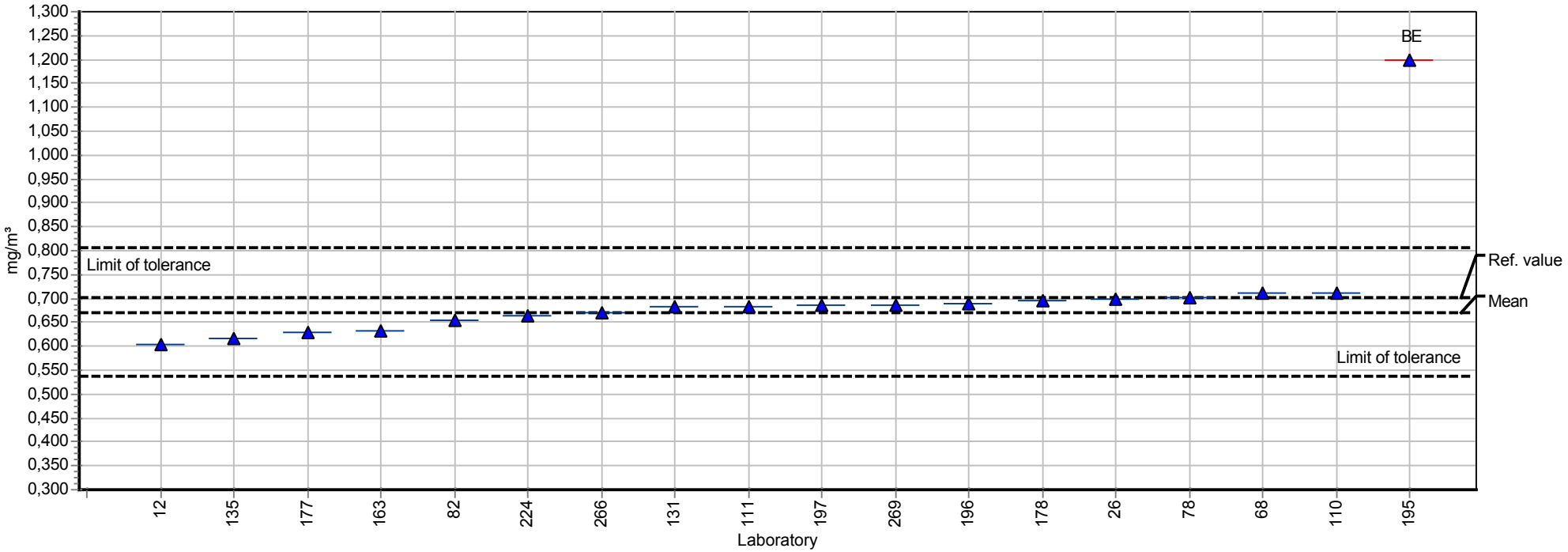
Summary results

Measurand:	**phosphoric acid**	**Mean:**	**0,192 mg/m³**
Sample:	**sample 1**	**Reproducibility s.d.:**	**0,014 mg/m³**
Method:	**ISO 5725**	**Rel. reproducibility s.d.:**	**7,25%**
No. of laboratories:	**17**	**Reference value:**	**0,197 mg/m³**
		Tolerance limits:	**0,154 - 0,231 mg/m³ (|Z score| < 2,00)**



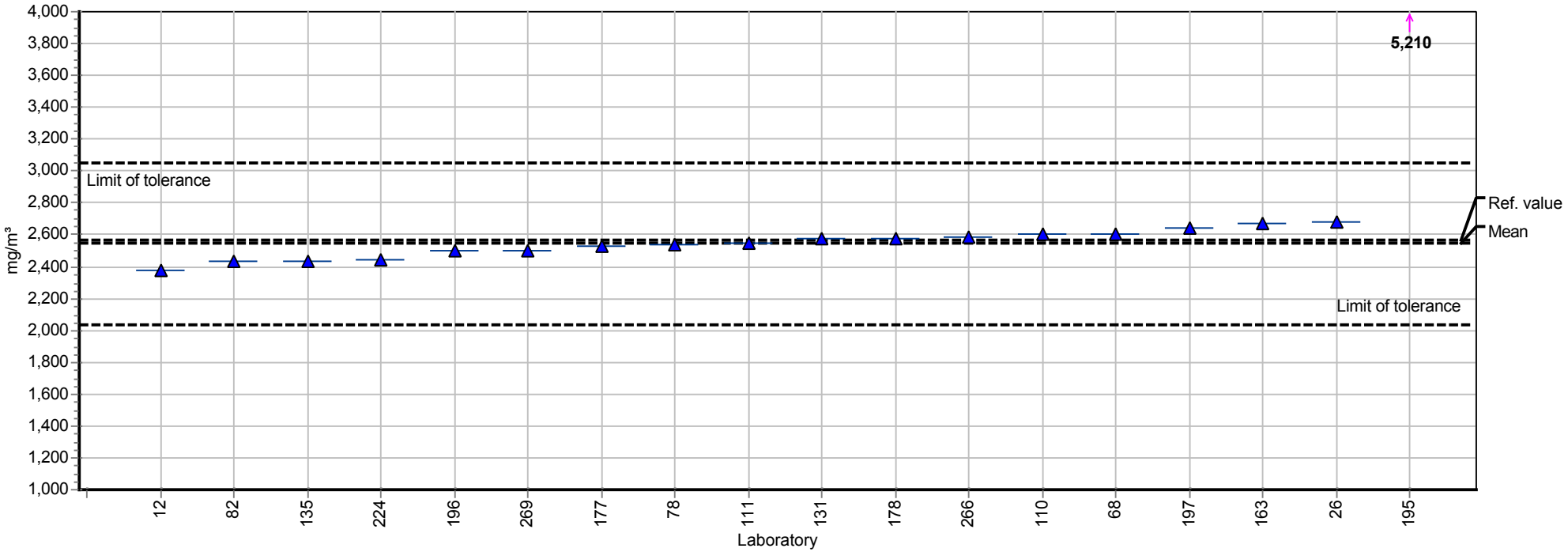
Summary results

Measurand:	**phosphoric acid**	**Mean:**	**0,672 mg/m³**
Sample:	**sample 2**	**Reproducibility s.d.:**	**0,033 mg/m³**
Method:	**ISO 5725**	**Rel. reproducibility s.d.:**	**4,97%**
No. of laboratories:	**17**	**Reference value:**	**0,703 mg/m³**
		Tolerance limits:	**0,537 - 0,806 mg/m³ (|Z score| < 2,00)**



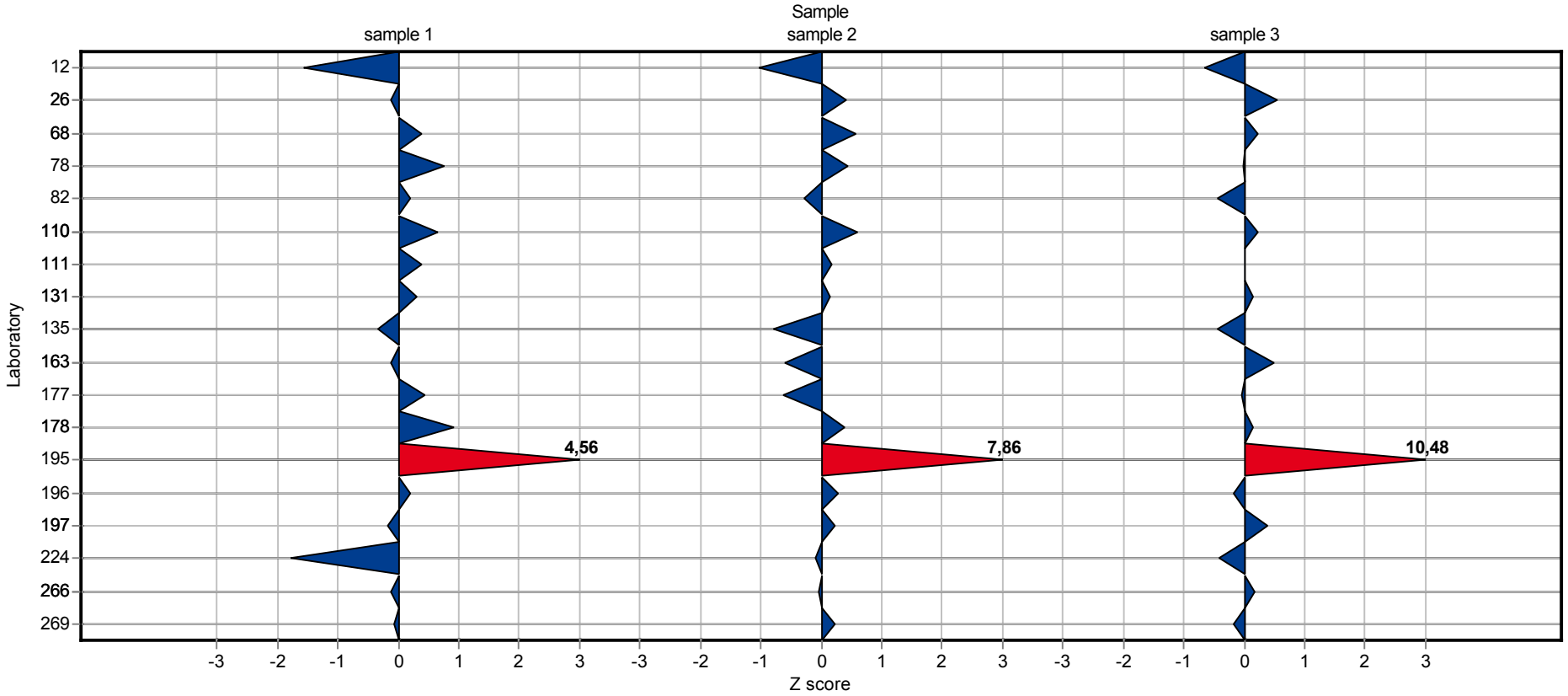
Summary results

Measurand:	**phosphoric acid**	**Mean:**	**2,544 mg/m³**
Sample:	**sample 3**	**Reproducibility s.d.:**	**0,087 mg/m³**
Method:	**ISO 5725**	**Rel. reproducibility s.d.:**	**3,43%**
No. of laboratories:	**17**	**Reference value:**	**2,570 mg/m³**
		Tolerance limits:	**2,035 - 3,052 mg/m³ (|Z score| < 2,00)**



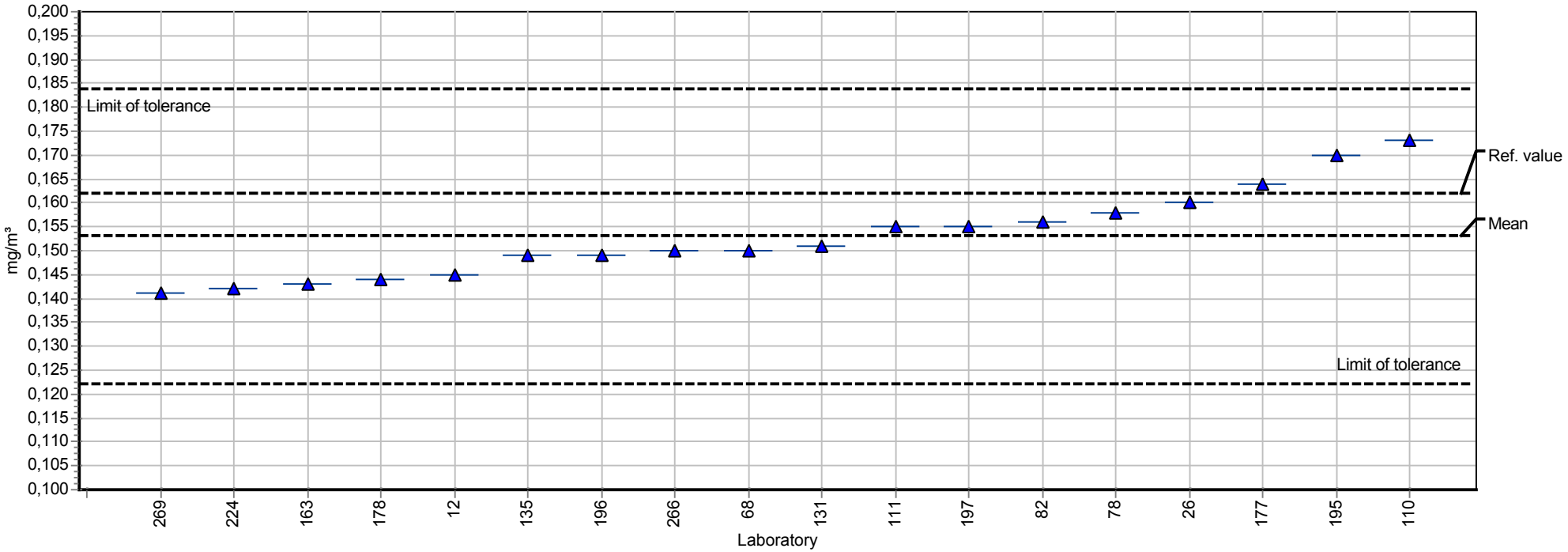
Analyte chart of Z scores

Measurand: phosphoric acid



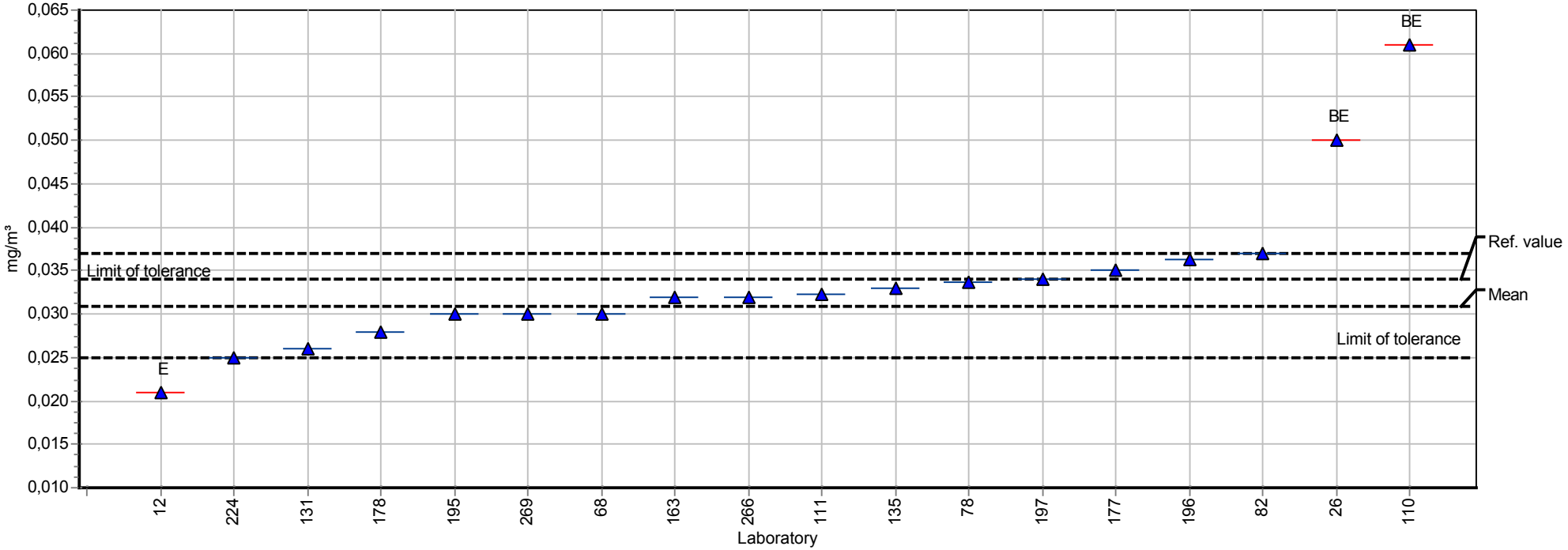
Summary results

Measurand:	**sulfuric acid**	**Mean:**	**0,153 mg/m³**
Sample:	**sample 1**	**Reproducibility s.d.:**	**0,009 mg/m³**
Method:	**ISO 5725**	**Rel. reproducibility s.d.:**	**6,07%**
No. of laboratories:	**18**	**Reference value:**	**0,162 mg/m³**
		Tolerance limits:	**0,122 - 0,184 mg/m³ (|Z score| < 2,00)**



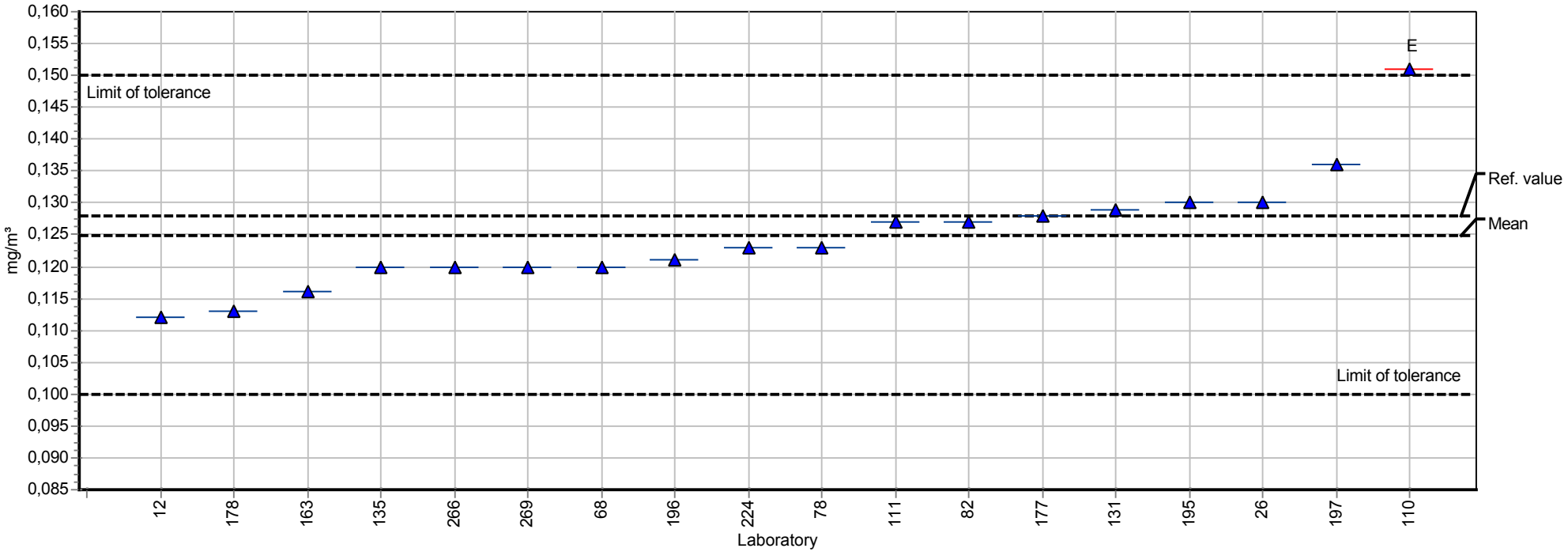
Summary results

Measurand:	**sulfuric acid**	**Mean:**	**0,031 mg/m³**
Sample:	**sample 2**	**Reproducibility s.d.:**	**0,004 mg/m³**
Method:	**ISO 5725**	**Rel. reproducibility s.d.:**	**13,86%**
No. of laboratories:	**16**	**Reference value:**	**0,034 mg/m³**
		Tolerance limits:	**0,025 - 0,037 mg/m³ (|Z score| < 2,00)**



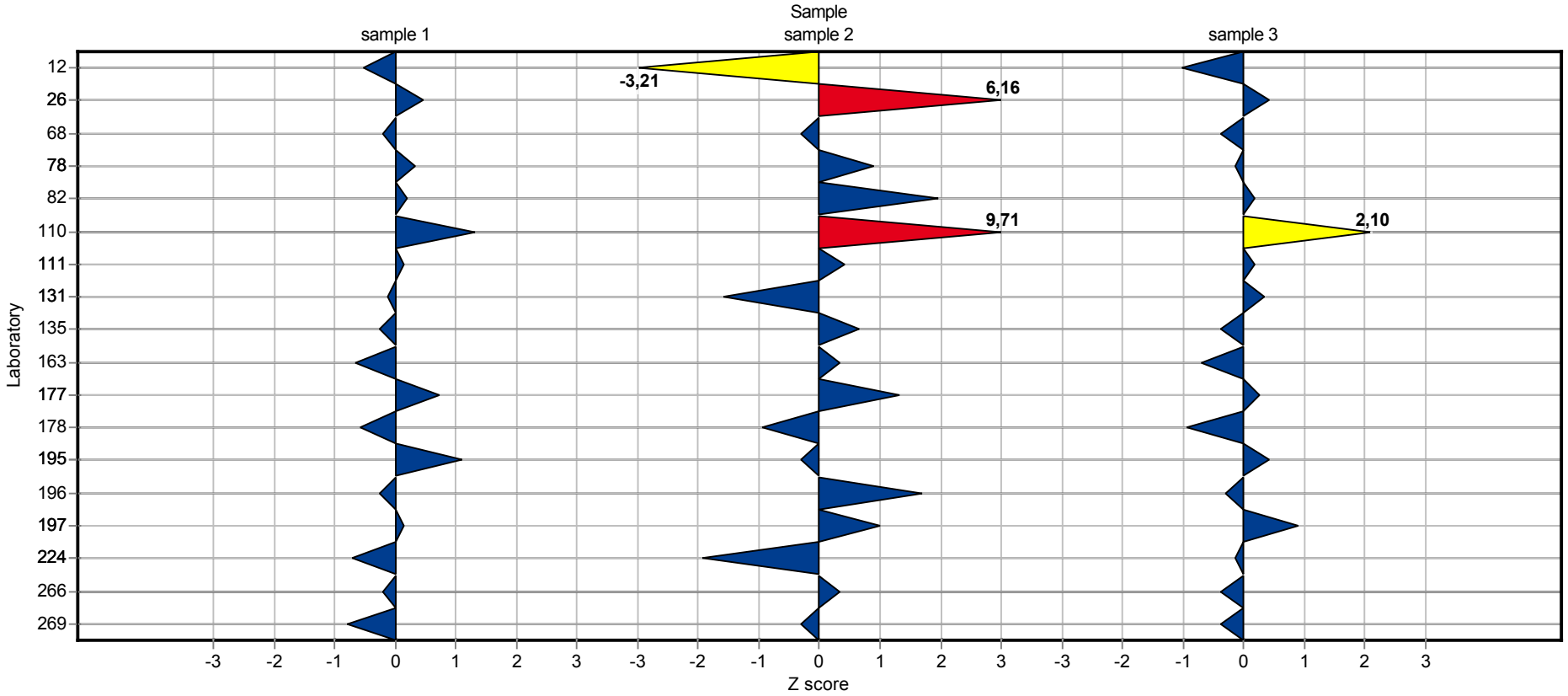
Summary results

Measurand:	**sulfuric acid**	**Mean:**	**0,125 mg/m³**
Sample:	**sample 3**	**Reproducibility s.d.:**	**0,009 mg/m³**
Method:	**ISO 5725**	**Rel. reproducibility s.d.:**	**7,27%**
No. of laboratories:	**18**	**Reference value:**	**0,128 mg/m³**
		Tolerance limits:	**0,100 - 0,150 mg/m³ (|Z score| < 2,00)**



Analyte chart of Z scores

Measurand: sulfuric acid



Questions and Answers

Participant	sample set
12	QF-Filter
15	only Orbo 53
26	Quarzfilter
68	2: Orbo 53/Quarzfaserfilter
82	2
110	Orbo 53 / Quarzfilter
111	2
131	Orbo53/Quartz fibre filters
135	3
143	Only orbo 53
149	Only Orbo 53
163	2
177	2
178	2
195	Orbo 53 / quartz fibre filter
196	2
197	3
224	
266	Tubes and quartz fibre filters
269	Filter

Participant	desorption solution
12	1,2 mmol Na2CO3 / 4,0 mmol NaHCO3 - 20 ml
15	deionized water, 10mL
26	Natriumhydrogencarbonat/ Natriumcarbonat, 30ml
68	Lösung: 17ml 0.1m NaHCO3 und 18ml 0.1m Na2CO3/1L H2O // Orbo: 10ml Volumen. Filter: 2ml resp. 1ml auf 10ml Volumen
82	3,2 mmol Natriumcarbonat 1 mmol Natriumhydrogencarbonat, je Kammer 25 mL, gesamte Desorptionslösung der Filter auf 25 mL aufgefüllt
110	8,0 mmol Na2CO3 + 1,0 mmol NaHCO3, 50ml Vol.

Participant	desorption solution
111	2,7 mM Natriumcarbonat / 0,3 mM Natriumhydrogencarbonat
131	DI water, 5ml for tubes (and 5 ml for filters)
135	Wasser, 10 mL
143	10 mM Na2CO3, 10 ml
149	10 mM Sodium Carbonate, 10 mL
163	Na2CO3 3,1 mM/NaHCO3 0,35 mM. 10 ml
177	12 mmol KOH
178	12 mM NaCO3+ 5 mM NaHCO3, 10 ml
195	Carbonate/Bicarbonate 5 mL
196	Milli-Q Water
197	IC-Eluent, 10 ml
224	Water-SML
266	Na2CO3 2,7 mM / NaHCO3 0,3 mM
269	Schwefelsäure und Phosphorsäure: Desorptionslösung erhalten / Salzsäure und Salpetersäure: gemäß BGIA 6172 (10 ml Reinstwasser)

Participant	time of desorption
12	15 Minuten Ultraschall
15	10 minutes
26	30 Minuten
68	Orbo: 10 Min. Dampfbad // Filter: nichts
82	20 Min Ultraschall
110	15 Minuten
111	15 min im Ultraschallbad
131	tubes 150 min+shaking, filters 30 min in ultrasonic bath
135	15 Minuten im Ultraschallbad anschließend 30 Minuten stehen lassen
143	10 minutes
149	10 minutes
163	10 min. waterbath
177	60 min Ultraschallbad
178	15 min - ultrasonic bath
195	30 min
196	one hour

Participant	time of desorption
197	15 min U-Bad
224	30 Min
266	30 min in a water bath
269	Schwefelsäure und Phosphorsäure: 15 Minuten im Ultraschallbad, 30 Minuten ruhen / Salzsäure und Salpetersäure: 15 Minuten im Ultraschallbad, 30 Minuten ruhen

Participant	filtration
12	Ja
15	yes
26	nein
68	Nein
82	Ja, Ultrafiltrationszelle, zusatz zu Methrom 838 Advanced Sample Processor, Filtration direkt vor der Messung
110	Orbo 53 - nein / Quarzfilter - ja
111	nein
131	yes
135	Ja
143	no
149	No
163	yes
177	nein
178	yes
195	yes
196	Yes
197	Ja
224	no
266	yes (for impregnated filters)
269	ja (Regeneratcellulose 0,45 µm / Chromafil RC-45/25)

Participant	wavelength	injection volume
12		20 µl
15	N/A	50 µL
26	keine	7000
68	Leitfähigkeitsmesszelle	25 ul

Participant	wavelength	injection volume
82	210 nm	100 µL
110	-	10 µl
111		5
131		10 µl
135	-	10
143		100 µl
149		100
163	n/a	50
177		50
178	-	75 µl
195	---	200
196	NA	50
197	ohne	50
224	-	25 µl
266		50 µL
269	Phosphorsäure: 880 nm / Salzsäure, Salpetersäure und Schwefelsäure: Suppressed Conductivity	50 µl

Participant	kind of injection
12	Autosampler
15	autosampler
26	Autosampler
68	Autosampler
82	Autosampler, Methrom 838 Advanced Sample Processor
110	Autosampler
111	Autosampler
131	autosampler
135	Autosampler
143	autosampler
149	Autosampler
163	manual / autosampler
177	Autosampler
178	Autosampler

Participant	kind of injection
195	autosampler
196	autosampler
197	Autosampler
224	full loop
266	autosampler
269	Schleife

Participant	Ion Chromatographic System
12	Metrohm IC 790 / Supressor / Leitfähigkeitsdetektor
15	Dionex ICS-2000, conductivity detection
26	IC kompakt Methrom
68	System DX-120, Leitfähigkeitsmesszelle, ASRS ULTRA II 4mm, Anionen-Supressor sowie Reagent-Free System von Dionex
82	Metrohm 861 Advanced Compact IC
110	Dionex ICS 900
111	Dionex ICS-90 mit Leitfähigkeitsdetektor
131	Dionex ICS 2500: GP50gradient pump, EG 50 Eluent generator, ASRS 300+ CRD200 (2mm), ED 50 conductivity detector
135	ICS 2100 mit Leitfähigkeitsdetektor
143	DIONEX ICS 1000
149	ICS-1000 Ion Chromatography System
163	quaternary pump, mabile phase generator, conductivity meter.
177	Dionex ICS 2000
178	Dionex 120. Detection: Conductivity
195	Dionex ICS 3000
196	Conductivity
197	Dionex ICS 1100, Leitfähigkeitsdetektor
224	ICS-3000 Dionex
266	Dionex ICS-2000, isocratic pump, conductivity detector
269	Dionex

Participant	analytical column	mobile phase
12	Metrosep ASupp4	1,2 mmol Na2CO3 / 4,0 mmol NaHCO3
15	IonPac AG18 Guard Column 4mm x 50mm, IonPac AS18 Analytical	39 mM KOH

Participant	analytical column	mobile phase
26	Asup 4	siehe 2
68	IonPac AS18 von Dionex, Dimensionen: 4x250mm	Wasser
82	Mertosept A-Supp 5-250	3,2 mmol Natriumcarbonat 1 mmol Natriumhydrogencarbonat
110	AG14A / AS14A	8,0 mmol Na2CO3 + 1,0 mmol NaHCO3
111	AS22; 2*250mm	4,5 mM Natriumcarbonat / 1,4 mM Natriumhydrogencarbonat
131	Dionex AS11-HC separator column (2x250mm) and guard column (2x50mm)	gradient 1-30 mM KOH
135	AS 18	23 mM KOH
143	AS9-HC 4x250 mm	10 mM Na2CO3 solution
149	AS9-HC 4X25 mm	10 mM Sodium Carbonate
163	AS11HC, 4 x 250 mm	KOH 21 mM, gradient
177	AS15 2mm	12-48mmol KOH
178	IonPac AS9 HC; 4x250mm	12 mM Naco3 + 5 mM NaHCO3
195	Dionex AS14 4 x 250 mm	Carbonate/Bicarbonate
196	Dionex AS14A	1.0mM NaHCO3 / 8.0mM Na2CO3
197	AS 22, 250	1,4mmol/l NaHCO3, 4,5 mmol/l Na2CO3
224	AS-II HC	30 mM OH´
266	AS12A, 4mm	2,7 mM Na2CO3 / 0,3 mM NaHCO3
269	IonPac AS9-HC	Natriumhydrogencarbonat (1,5 mmol/l) / Natriuncarbonat (8 mmol/l)

Participant	flow rate	date of analysis
12	1 ml/min	20.03.2012
15	1 mL/min	
26	1,5	12.04.2012
68	1 ml/min	27.3.2012
82	0,7 mL/ Minute	24.-27.04.2012
110	1,10 ml/min	26. & 27. Mrz 2012
111	0,3	16.04.2012
131	0,38 ml/min	28-30.3.2012
135	0,25	10.04.2012
143	1 ml/min	09.04.2012
149	1 mL/min	19.03.2012
163	1 ml/min	09/05/12 10/05/12

Ringversuch Inorganic acids 2012

Participant	flow rate	date of analysis
177	0,3	18.04.2012
178	1ml/min	23/04/2012
195	1.2	11/4/12
196	1	3/23/12, 3/24/12, 3/27/12
197	1,2 ml/min	siehe Messwerte
224	0,38 ml/min	14/05/12
266	1,5 mL/min	19/04/2012
269	Salzsäure, Salpetersäure, Schwefelsäure: 1 ml/min	21. bis 29.03.2012