IFA
Institut für Arbeitsschutz der
Deutschen Gesetzlichen Unfallversicherung

Proficiency testing for in-house and external measuring stations - results and evaluation

Proficiency testing scheme

Volatile organic compounds (VOC) with thermal desorption with own sampling

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Summary of laboratory means

Sample 1

Laboratory	1,2,3-Trimethylbenzene	Z score	4-Methyl-2-pentanone	Z score	alpha-Pinene	Z score	Benzene	Z score
Unit	µg/m³		µg/m³		µg/m³		µg/m³	
23	46.5	0.42	95.0	0.36	104.0	1.97	27.5	0.66
24	49.4	1.08	107.8	1.76	93.1	0.72	32.3	2.51 E
26	37.5	-1.59	75.0	-1.82	78.5	-0.97	22.0	-1.47
36	42.5	-0.47	88.2	-0.38	78.2	-1.00	23.2	-0.99
61	36.0	-1.93	73.0	-2.04 E	76.0	-1.25	21.0	-1.86
76	57.5	2.89 E	106.0	1.56	93.5	0.76	30.5	1.82
84	40.5	-0.92	90.0	-0.19	87.5	0.07	24.0	-0.70
97	40.5	-0.92	76.0	-1.71	75.0	-1.37	23.0	-1.09
135	44.5	-0.02	100.2	0.93	98.0	1.28	26.4	0.21
143	40.5	-0.91	90.2	-0.17	75.9	-1.27	22.4	-1.32
158	48.0	0.77	93.3	0.18	84.8	-0.24	25.0	-0.32
215	49.5	1.10	116.1	2.65 E			26.8	0.37
230	43.2	-0.30	92.9	0.13	115.0	3.23 E	47.8	8.54 BE
233	42.7	-0.43	98.8	0.77	102.6	1.81	27.0	0.46
250	37.0	-1.71	76.0	-1.71	70.0	-1.94	22.0	-1.47
265	49.0	0.99	103.0	1.23	83.0	-0.45	27.0	0.46
267	50.1	1.23			94.7	0.89	30.1	1.68
285	52.1	1.68	101.5	1.07	84.2	-0.30	28.3	0.97
297	41.0	-0.81 C	74.5	-1.88	71.0	-1.83	21.5	-1.67
300							30.8	1.94
304	44.7	0.02	100.0	0.91	96.0	1.04	28.9	1.18
317	39.0	-1.26	81.0	-1.17	75.0	-1.37	23.0	-1.09
344	36.0	-1.93	74.0	-1.93	67.0	-2.29 E	21.0	-1.86
–	–	– –	–	– –	–	– –	–	– –
Method	ISO 5725-2		ISO 5725-2		ISO 5725-2		ISO 5725-2	
Assessment	|Z|<=2.00		|Z|<=2.00		|Z|<=2.00		|Z|<=2.00	
No. of laboratories that submitted results	22		21		21		23	
Mean	44.6		91.7		86.9		25.8	

Laboratory	1,2,3-Trimethylbenzene	Z score	4-Methyl-2-pentanone	Z score	alpha-Pinene	Z score	Benzene	Z score
Reprod. s.d.	5.8		12.8		12.9		3.5	
Rel. reproducibility s.d.	12.93 %		13.96 %		14.89 %		13.45 %	
Reference value	46.6		98.4		89.5		26.2	
Target s.d.	4.5		9.2		8.7		2.6	
Rel. target s.d.	10.00 %		10.00 %		10.00 %		10.00 %	
Lower limit of tolerance	35.7		73.4		69.5		20.6	
Upper limit of tolerance	53.5		110.1		104.3		31.0	
Type B outliers							1	
Type C outliers	1							
No. of laboratories after elimination of outliers type A-D and F (without laboratories that only gave states but no measured values)	21		21		21		22	
Explanation of outlier types								
A: Single outlier	Grubbs							
B: Differing laboratory mean	Grubbs							
C: Excessive laboratory s.d.	Cochran							
D: Excluded manually								
E: mean outside tolerance limits								
F: |Z-Score|>3.50								

Laboratory	Cumene	Z score	o-Xylene	Z score	Toluene	Z score
Unit	µg/m³		µg/m³		µg/m³	
23	66.5	0.48	43.0	0.39	55.0	0.29
24	70.1	1.05	46.3	1.18	59.4	1.12
26	56.5	-1.09	35.0	-1.55	47.0	-1.20
36	55.2	-1.29	36.2	-1.24	47.5	-1.11
61	55.0	-1.33	33.0	-2.03 E	45.0	-1.58
76	68.5	0.80	45.0	0.87	61.5	1.51
84	60.0	-0.54	42.0	0.14	50.5	-0.55
97	64.5	0.17	35.5	-1.43	43.5	-1.86
135	65.2	0.29	43.0	0.40	54.5	0.19
143	58.5	-0.78	38.8	-0.63	49.9	-0.66
158	63.7	0.04	43.7	0.55	53.0	-0.09
215	72.7	1.45	46.2	1.16	58.6	0.97
230	60.2	-0.50	40.8	-0.16	64.5	2.07 E
233	63.7	0.04	42.9	0.36	55.1	0.31
250	56.0	-1.17	35.0	-1.55	48.0	-1.02
265	70.0	1.04	43.0	0.39	58.0	0.85
267	75.0	1.82	47.2	1.41	61.6	1.53
285	66.8	0.54	46.4	1.20	54.8	0.25
297	65.5	0.33 C	36.0	-1.30 C	44.0	-1.77
300					54.0	0.12
304	89.7	4.14 BE	47.8	1.53	61.7	1.54
317	58.0	-0.86	36.0	-1.30	49.0	-0.83
344	54.0	-1.49	34.0	-1.79	46.0	-1.39
–	–	– –	–	– –	–	– –
Method	ISO 5725-2		ISO 5725-2		ISO 5725-2	
Assessment	|Z|<=2.00		|Z|<=2.00		|Z|<=2.00	
No. of laboratories that submitted results	22		22		23	
Mean	63.4		41.4		53.4	
Reprod. s.d.	6.3		4.8		6.5	
Rel. reproducibility s.d.	9.92 %		11.53 %		12.18 %	
Reference value	67.2		42.6		54.3	
Target s.d.	6.3		4.1		5.3	
Rel. target s.d.	10.00 %		10.00 %		10.00 %	
Lower limit of tolerance	50.7		33.1		42.7	

Laboratory	Cumene	Z score	o-Xylene	Z score	Toluene	Z score
Upper limit of tolerance	76.1		49.7		64.1	
Type B outliers	1					
Type C outliers	1		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		23	

Summary of laboratory means

Sample 2

Laboratory	1,2,3-Trimethylbenzene	Z score	4-Methyl-2-pentanone	Z score	alpha-Pinene	Z score	Benzene	Z score
Unit	µg/m³		µg/m³		µg/m³		µg/m³	
23	32.5	0.80	50.5	0.44	139	1.98	69.0	0.74
24	34.8	1.55	57.9	1.96	128	1.07	78.9	2.28 E
26	25.5	-1.52	39.5	-1.84	100	-1.38	55.0	-1.44
36	28.8	-0.44	45.2	-0.65	105	-0.93	57.8	-1.01
61	25.0	-1.69	38.0	-2.15 E	100	-1.38	54.0	-1.59
76	36.5	2.13 E	54.5	1.26	124	0.73	76.5	1.91
84	27.5	-0.86	46.0	-0.49	116	-0.04	59.0	-0.81
97	27.5	-0.86	40.0	-1.73	100	-1.33 C	57.0	-1.13
135	30.6	0.17	53.7	1.10	133	1.47	68.0	0.59
143	26.4	-1.21	46.9	-0.31	106	-0.89	59.3	-0.77
158	32.0	0.65	47.6	-0.17	113	-0.22	60.5	-0.57
215	33.0	0.99	57.5	1.88			69.3	0.79
230	29.6	-0.16	51.2	0.58	128	0.99	112.0	7.44 BE
233	30.2	0.04	52.9	0.93	131	1.29	65.6	0.21
250	25.0	-1.69	40.0	-1.73	93	-1.98	55.0	-1.44
265	33.0	0.97	57.0	1.78	112	-0.34	69.0	0.74
267	33.0	0.95			125	0.75	74.7	1.63
285	36.4	2.10 E	55.4	1.45	106	-0.86 C	61.0	-0.51
297	27.0	-1.02	39.0	-1.94	94	-1.90	53.0	-1.75
300							73.5	1.45
304	30.1	0.02	51.4	0.61	129	1.11	72.1	1.22
317	26.0	-1.36	41.0	-1.53	96	-1.72	56.0	-1.28
344	25.0	-1.69	40.0	-1.73	88	-2.41 E	52.0	-1.90
–	–	– –	–	– –	–	– –	–	– –
Method	ISO 5725-2		ISO 5725-2		ISO 5725-2		ISO 5725-2	
Assessment	|Z|<=2.00		|Z|<=2.00		|Z|<=2.00		|Z|<=2.00	
No. of laboratories that submitted results	22		21		21		23	
Mean	30.1		48.4		116		64.2	

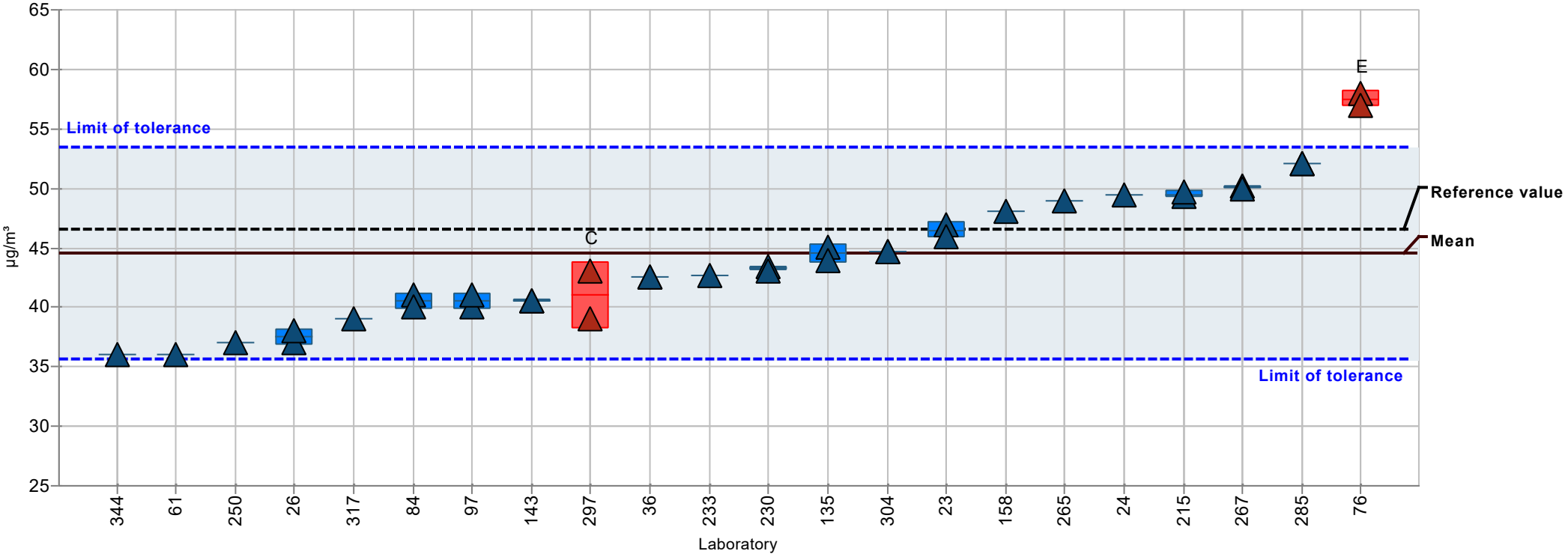
Laboratory	1,2,3-Trimethylbenzene	Z score	4-Methyl-2-pentanone	Z score	alpha-Pinene	Z score	Benzene	Z score
Reprod. s.d.	3.7		6.6		15		8.2	
Rel. reproducibility s.d.	12.24 %		13.62 %		13.14 %		12.81 %	
Reference value	31.8		51.3		122		67.6	
Target s.d.	3.0		4.8		12		6.4	
Rel. target s.d.	10.00 %		10.00 %		10.00 %		10.00 %	
Lower limit of tolerance	24.1		38.7		93		51.4	
Upper limit of tolerance	36.1		58.1		139		77.1	
Type B outliers							1	
Type C outliers					2			
No. of laboratories after elimination of outliers type A-D and F (without laboratories that only gave states but no measured values)	22		21		19		22	
Explanation of outlier types								
A: Single outlier	Grubbs							
B: Differing laboratory mean	Grubbs							
C: Excessive laboratory s.d.	Cochran							
D: Excluded manually								
E: mean outside tolerance limits								
F: |Z-Score|>3.50								

Laboratory	Cumene	Z score	o-Xylene	Z score	Toluene	Z score
Unit	µg/m³		µg/m³		µg/m³	
23	33.5	0.74	63.5	0.46	84.5	0.32
24	35.6	1.41	70.9	1.68	94.7	1.55
26	28.0	-1.02	50.5	-1.68	71.0	-1.33
36	27.2	-1.26	52.8	-1.31	71.0	-1.33
61	27.0	-1.34	49.0	-1.93	70.0	-1.45
76	32.5	0.42	66.5	0.96	94.0	1.48
84	28.5	-0.86	61.5	0.13	76.5	-0.66
97	32.0	0.26	52.0	-1.43	66.5	-1.88
135	32.2	0.33	65.9	0.86 C	88.5	0.80 C
143	27.4	-1.21	57.5	-0.52	78.0	-0.48
158	32.0	0.26	63.3	0.42	79.5	-0.29
215	34.8	1.18	68.8	1.33	91.3	1.15
230	29.4	-0.57	67.1	1.05	98.5	2.02 E
233	32.2	0.33	63.1	0.40	85.0	0.38
250	28.0	-1.02	50.0	-1.76	72.0	-1.21
265	34.0	0.90	63.0	0.38	88.0	0.74
267	35.8	1.48	68.5	1.29	92.8	1.32
285	34.7	1.13	66.4	0.94	84.0	0.25
297	31.0	-0.06	52.0	-1.43	66.0	-1.94
300					82.2	0.03
304	49.4	5.84 BE	70.3	1.59	94.8	1.57
317	29.0	-0.70	51.0	-1.60	72.0	-1.21
344	28.0	-1.02	50.0	-1.76	70.0	-1.45
–	–	– –	–	– –	–	– –
Method	ISO 5725-2		ISO 5725-2		ISO 5725-2	
Assessment	|Z|<=2.00		|Z|<=2.00		|Z|<=2.00	
No. of laboratories that submitted results	22		22		23	
Mean	31.2		60.7		81.9	
Reprod. s.d.	3.0		7.7		10.4	
Rel. reproducibility s.d.	9.73 %		12.64 %		12.72 %	
Reference value	32.9		63.8		84.3	
Target s.d.	3.1		6.1		8.2	
Rel. target s.d.	10.00 %		10.00 %		10.00 %	
Lower limit of tolerance	24.9		48.6		65.5	

Laboratory	Cumene	Z score	o-Xylene	Z score	Toluene	Z score
Upper limit of tolerance	37.4		72.8		98.3	
Type B outliers	1					
Type C outliers			1		1	
No. of laboratories after elimination of outliers type A-D and F (without laboratories that only gave states but no measured values)	21		21		22	

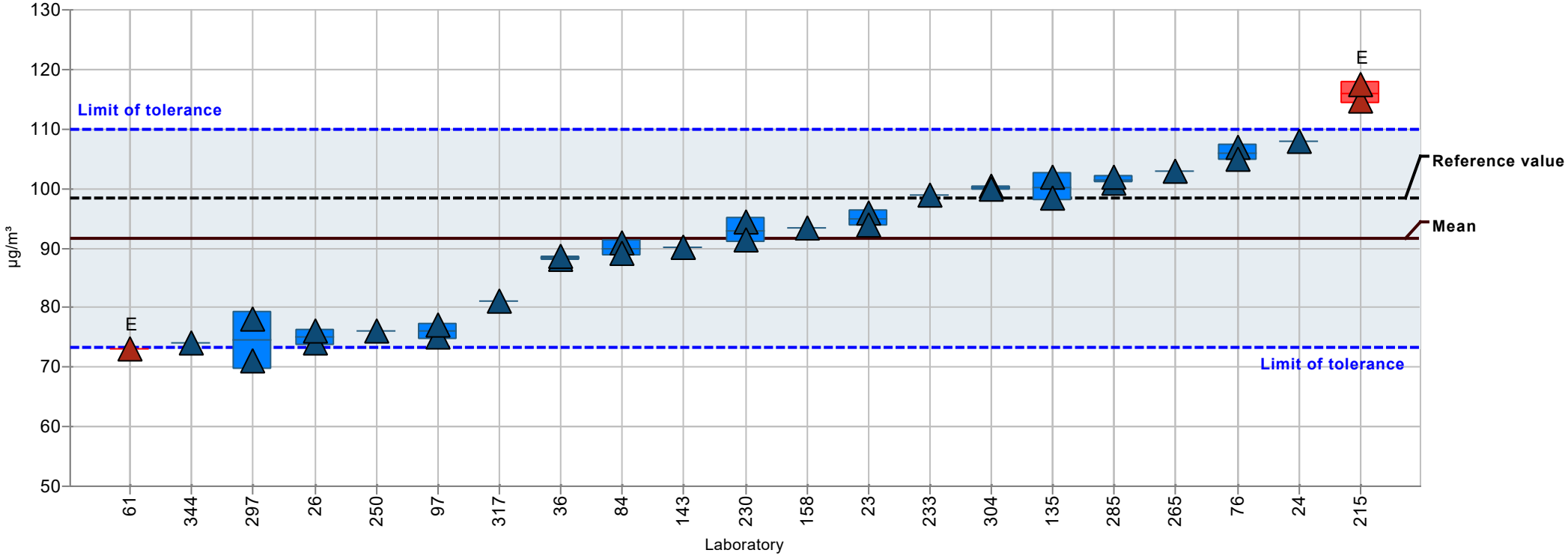
Summary results

Sample:	**1**	**Mean:**	**44.6 µg/m³**
Measurand:	**1,2,3-Trimethylbenzene**	**Reprod. s.d.:**	**5.8 µg/m³**
Method:	**ISO 5725-2**	**Rel.reprod. s.d.:**	**12.93%**
Rel.target s.d.:	**10.00%**	**Reference value:**	**46.6 µg/m³**
Number of laboratories in calculation + outliers:	**22**	**Range of tolerance:**	**35.7 - 53.5 µg/m³ (|Z-Score| <= 2.00)**



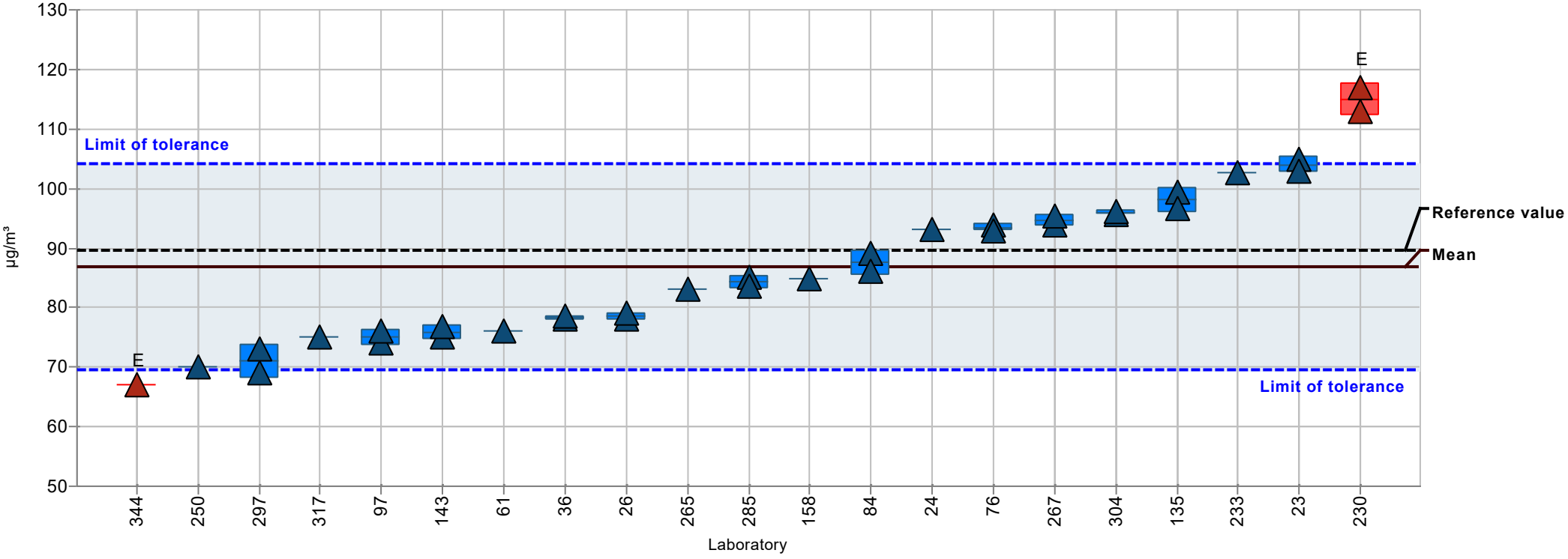
Summary results

Sample:	**1**	**Mean:**	**91.7 µg/m³**
Measurand:	**4-Methyl-2-pentanone**	**Reprod. s.d.:**	**12.8 µg/m³**
Method:	**ISO 5725-2**	**Rel.reprod. s.d.:**	**13.96%**
Rel.target s.d.:	**10.00%**	**Reference value:**	**98.4 µg/m³**
Number of laboratories in calculation + outliers:	**21**	**Range of tolerance:**	**73.4 - 110.1 µg/m³ (|Z-Score| <= 2.00)**



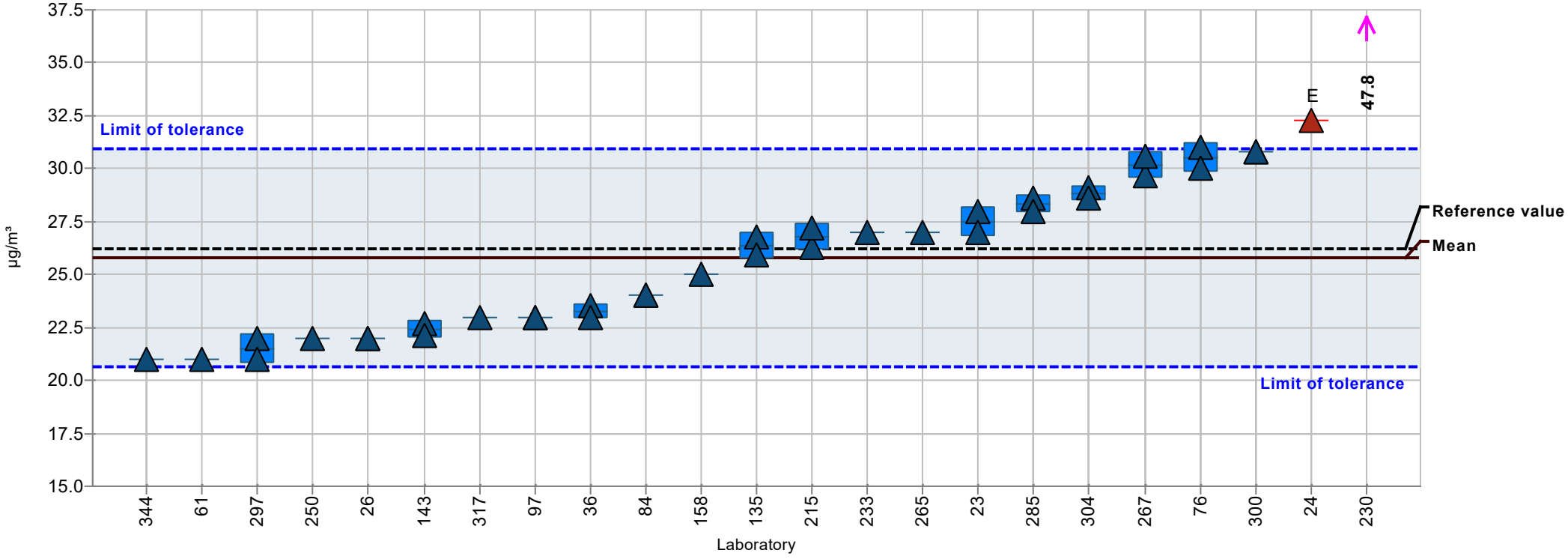
Summary results

Sample:	**1**	**Mean:**	**86.9 µg/m³**
Measurand:	**alpha-Pinene**	**Reprod. s.d.:**	**12.9 µg/m³**
Method:	**ISO 5725-2**	**Rel.reprod. s.d.:**	**14.89%**
Rel.target s.d.:	**10.00%**	**Reference value:**	**89.5 µg/m³**
Number of laboratories in calculation + outliers:	**21**	**Range of tolerance:**	**69.5 - 104.3 µg/m³ (|Z-Score| <= 2.00)**



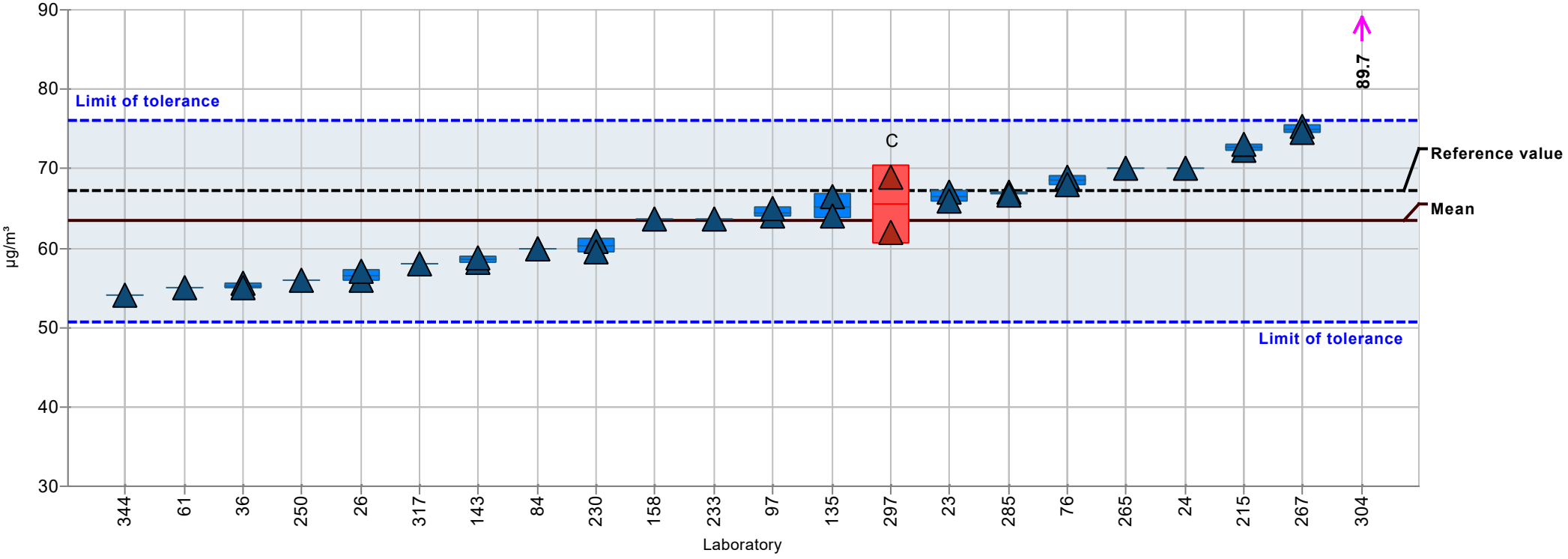
Summary results

Sample:	**1**	**Mean:**	**25.8 µg/m³**
Measurand:	**Benzene**	**Reprod. s.d.:**	**3.5 µg/m³**
Method:	**ISO 5725-2**	**Rel.reprod. s.d.:**	**13.45%**
Rel.target s.d.:	**10.00%**	**Reference value:**	**26.2 µg/m³**
Number of laboratories in calculation + outliers:	**23**	**Range of tolerance:**	**20.6 - 31.0 µg/m³ (|Z-Score| <= 2.00)**



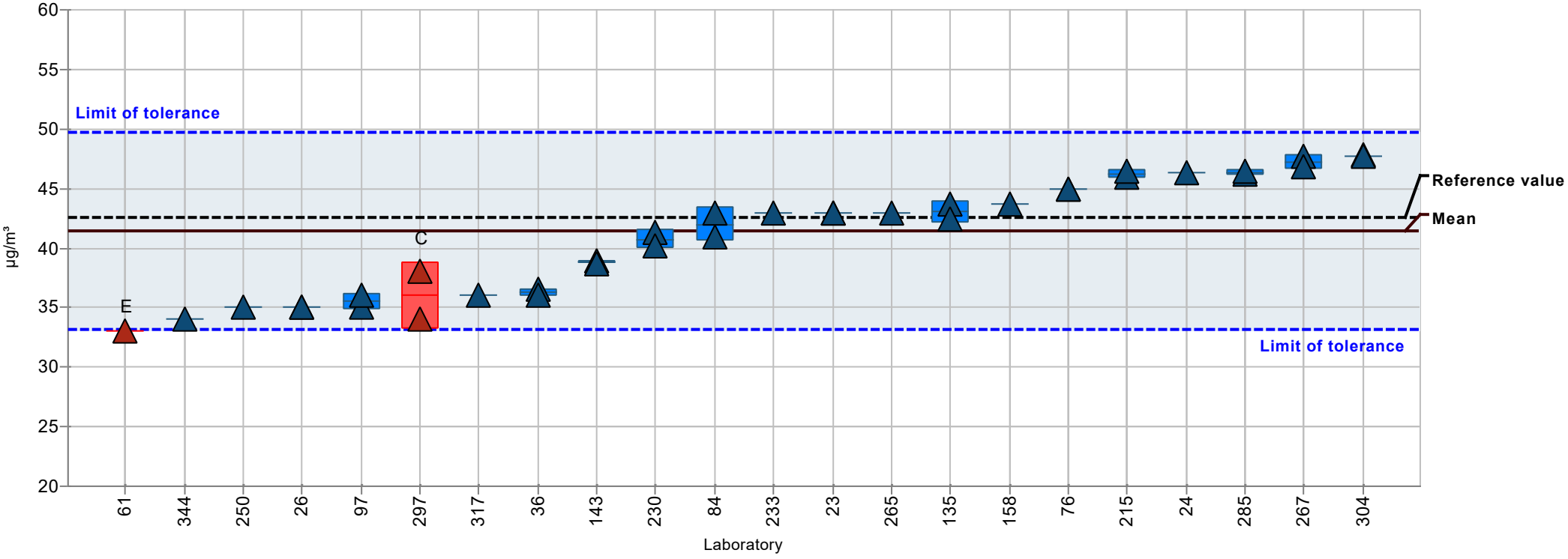
Summary results

Sample:	**1**	**Mean:**	**63.4 µg/m³**
Measurand:	**Cumene**	**Reprod. s.d.:**	**6.3 µg/m³**
Method:	**ISO 5725-2**	**Rel.reprod. s.d.:**	**9.92%**
Rel.target s.d.:	**10.00%**	**Reference value:**	**67.2 µg/m³**
Number of laboratories in calculation + outliers:	**22**	**Range of tolerance:**	**50.7 - 76.1 µg/m³ (|Z-Score| <= 2.00)**



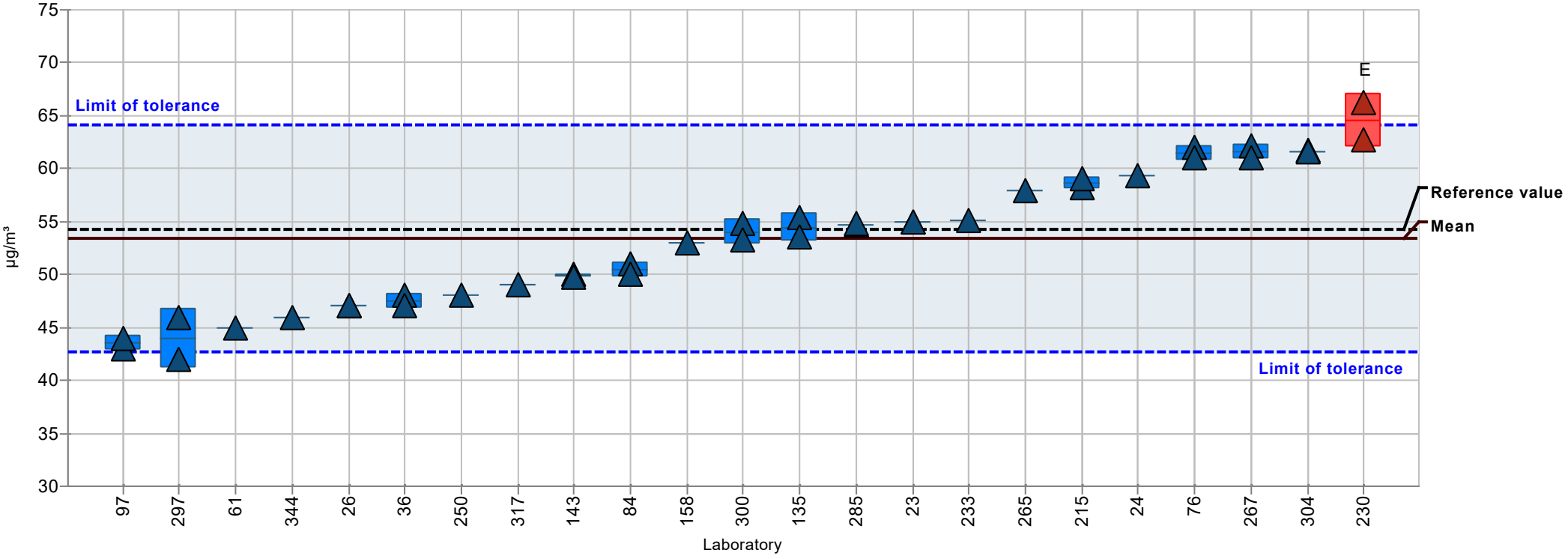
Summary results

Sample:	**1**	**Mean:**	**41.4 µg/m³**
Measurand:	**o-Xylene**	**Reprod. s.d.:**	**4.8 µg/m³**
Method:	**ISO 5725-2**	**Rel.reprod. s.d.:**	**11.53%**
Rel.target s.d.:	**10.00%**	**Reference value:**	**42.6 µg/m³**
Number of laboratories in calculation + outliers:	**22**	**Range of tolerance:**	**33.1 - 49.7 µg/m³ (|Z-Score| <= 2.00)**



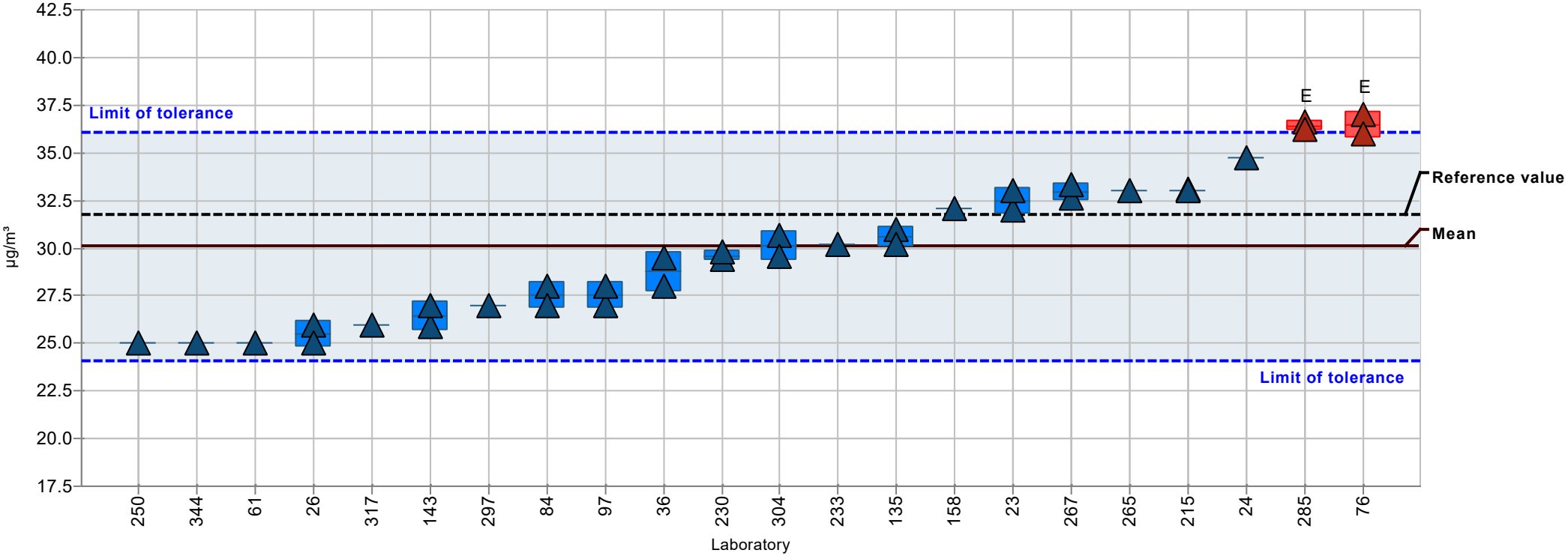
Summary results

Sample:	**1**	**Mean:**	**53.4 µg/m³**
Measurand:	**Toluene**	**Reprod. s.d.:**	**6.5 µg/m³**
Method:	**ISO 5725-2**	**Rel.reprod. s.d.:**	**12.18%**
Rel.target s.d.:	**10.00%**	**Reference value:**	**54.3 µg/m³**
Number of laboratories in calculation + outliers:	**23**	**Range of tolerance:**	**42.7 - 64.1 µg/m³ (|Z-Score| <= 2.00)**



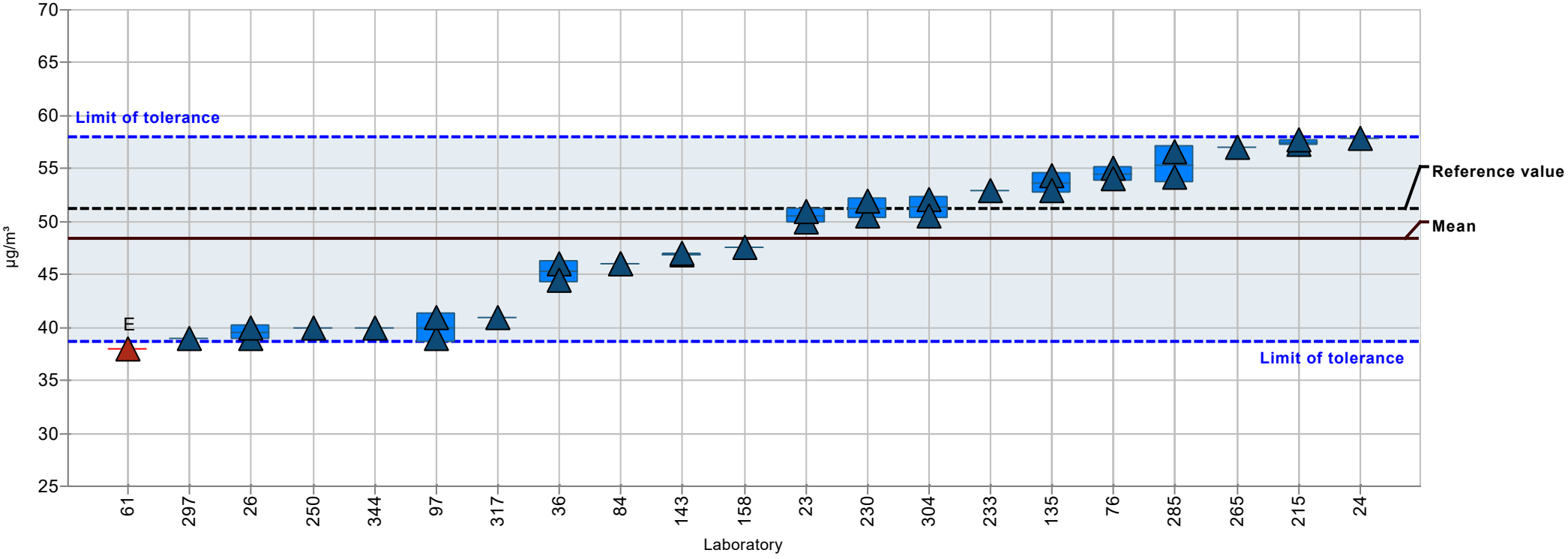
Summary results

Sample:	**2**	**Mean:**	**30.1 µg/m³**
Measurand:	**1,2,3-Trimethylbenzene**	**Reprod. s.d.:**	**3.7 µg/m³**
Method:	**ISO 5725-2**	**Rel.reprod. s.d.:**	**12.24%**
Rel.target s.d.:	**10.00%**	**Reference value:**	**31.8 µg/m³**
Number of laboratories in calculation + outliers:	**22**	**Range of tolerance:**	**24.1 - 36.1 µg/m³ (|Z-Score| <= 2.00)**



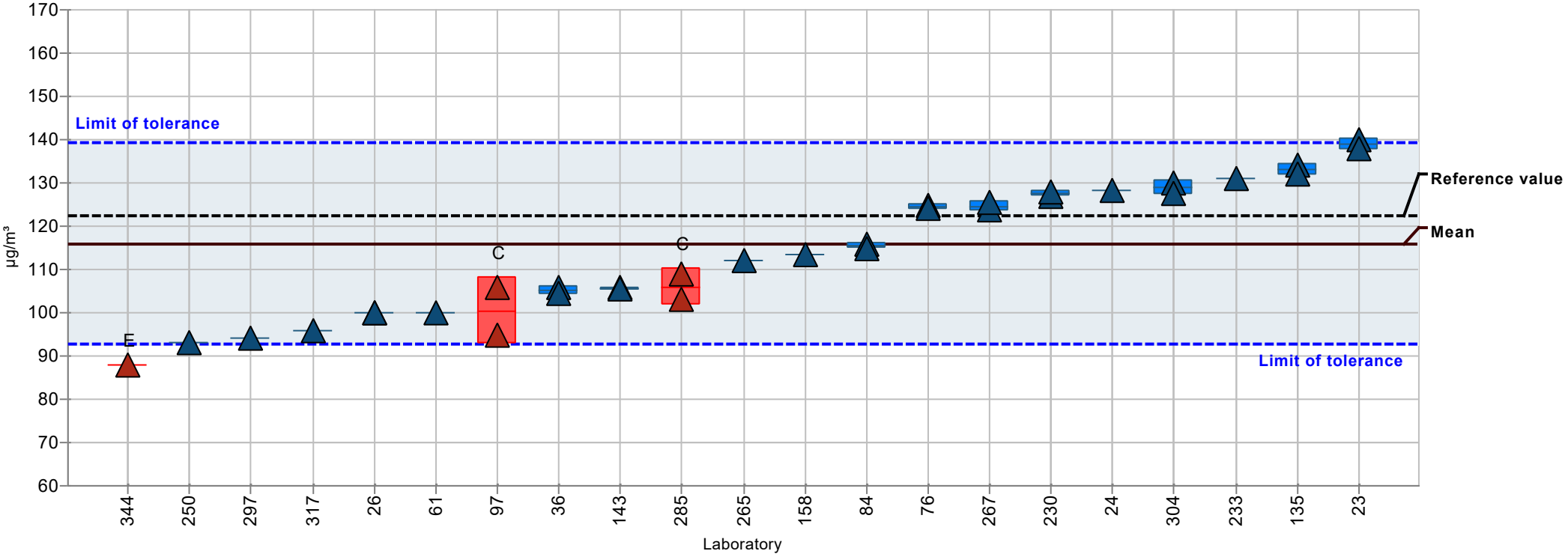
Summary results

Sample:	**2**	**Mean:**	**48.4 µg/m³**
Measurand:	**4-Methyl-2-pentanone**	**Reprod. s.d.:**	**6.6 µg/m³**
Method:	**ISO 5725-2**	**Rel.reprod. s.d.:**	**13.62%**
Rel.target s.d.:	**10.00%**	**Reference value:**	**51.3 µg/m³**
Number of laboratories in calculation + outliers:	**21**	**Range of tolerance:**	**38.7 - 58.1 µg/m³ (|Z-Score| <= 2.00)**



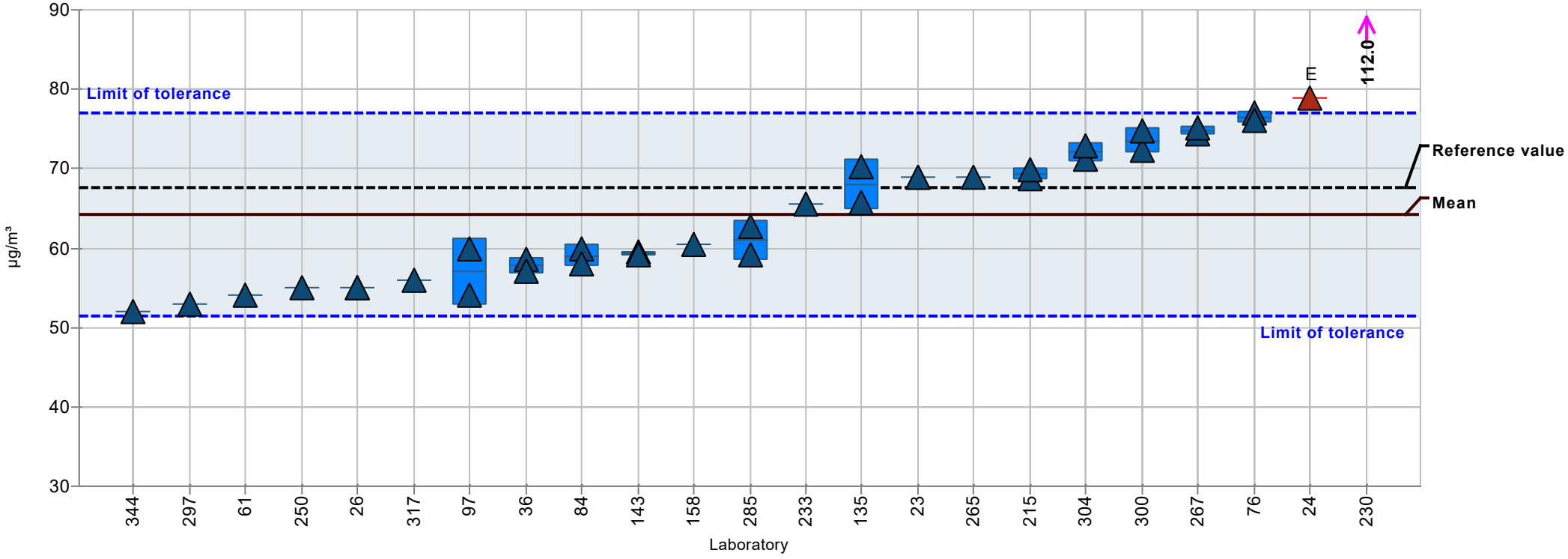
Summary results

Sample:	**2**	**Mean:**	**116 µg/m³**
Measurand:	**alpha-Pinene**	**Reprod. s.d.:**	**15 µg/m³**
Method:	**ISO 5725-2**	**Rel.reprod. s.d.:**	**13.14%**
Rel.target s.d.:	**10.00%**	**Reference value:**	**122 µg/m³**
Number of laboratories in calculation + outliers:	**21**	**Range of tolerance:**	**93 - 139 µg/m³ (|Z-Score| <= 2.00)**



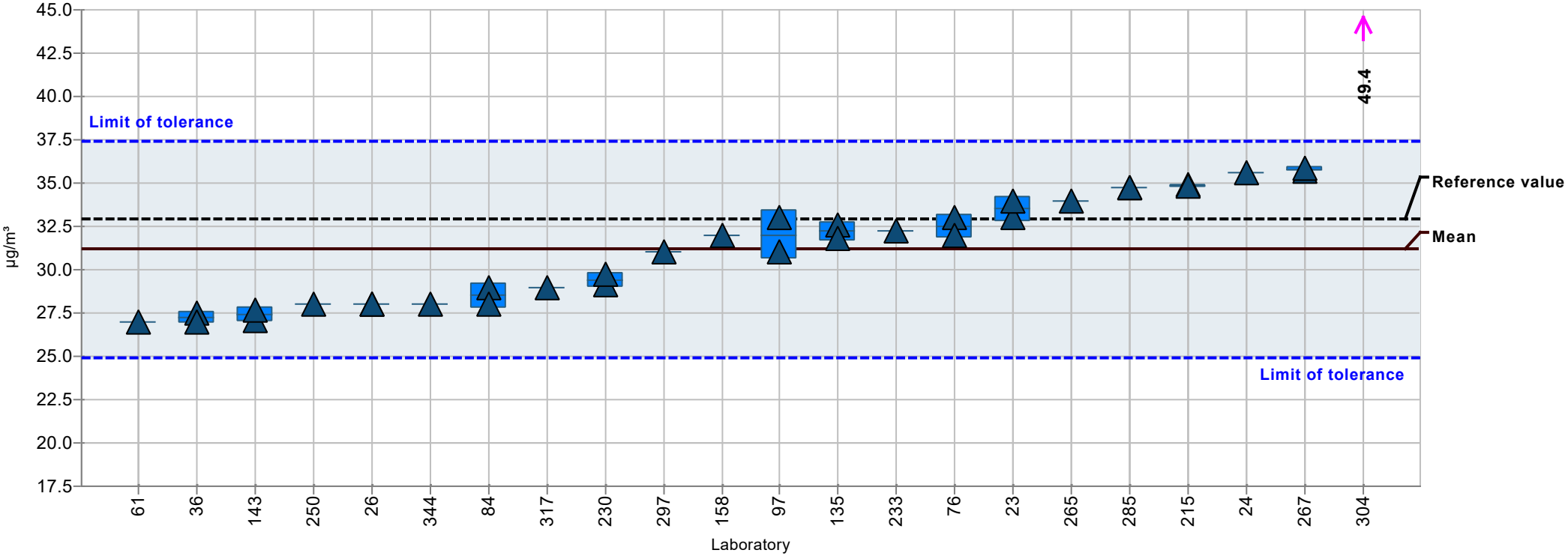
Summary results

Sample:	**2**	**Mean:**	**64.2 µg/m³**
Measurand:	**Benzene**	**Reprod. s.d.:**	**8.2 µg/m³**
Method:	**ISO 5725-2**	**Rel.reprod. s.d.:**	**12.81%**
Rel.target s.d.:	**10.00%**	**Reference value:**	**67.6 µg/m³**
Number of laboratories in calculation + outliers:	**23**	**Range of tolerance:**	**51.4 - 77.1 µg/m³ (|Z-Score| <= 2.00)**



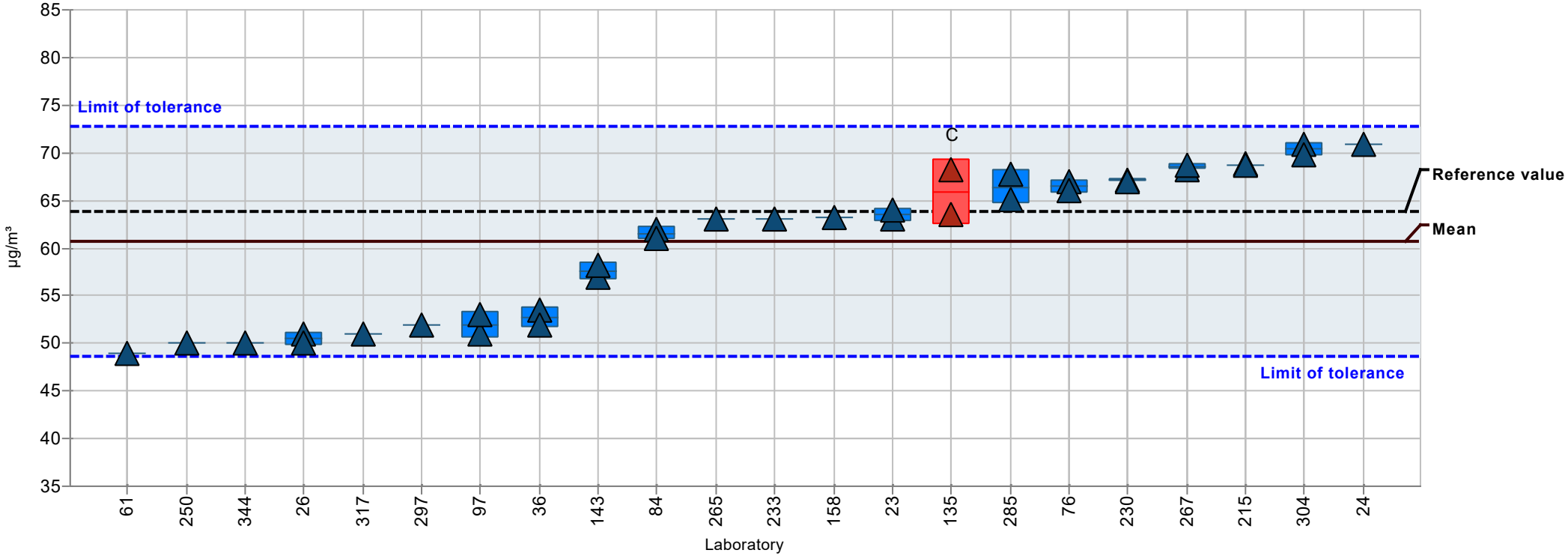
Summary results

Sample:	**2**	**Mean:**	**31.2 µg/m³**
Measurand:	**Cumene**	**Reprod. s.d.:**	**3.0 µg/m³**
Method:	**ISO 5725-2**	**Rel.reprod. s.d.:**	**9.73%**
Rel.target s.d.:	**10.00%**	**Reference value:**	**32.9 µg/m³**
Number of laboratories in calculation + outliers:	**22**	**Range of tolerance:**	**24.9 - 37.4 µg/m³ (|Z-Score| <= 2.00)**



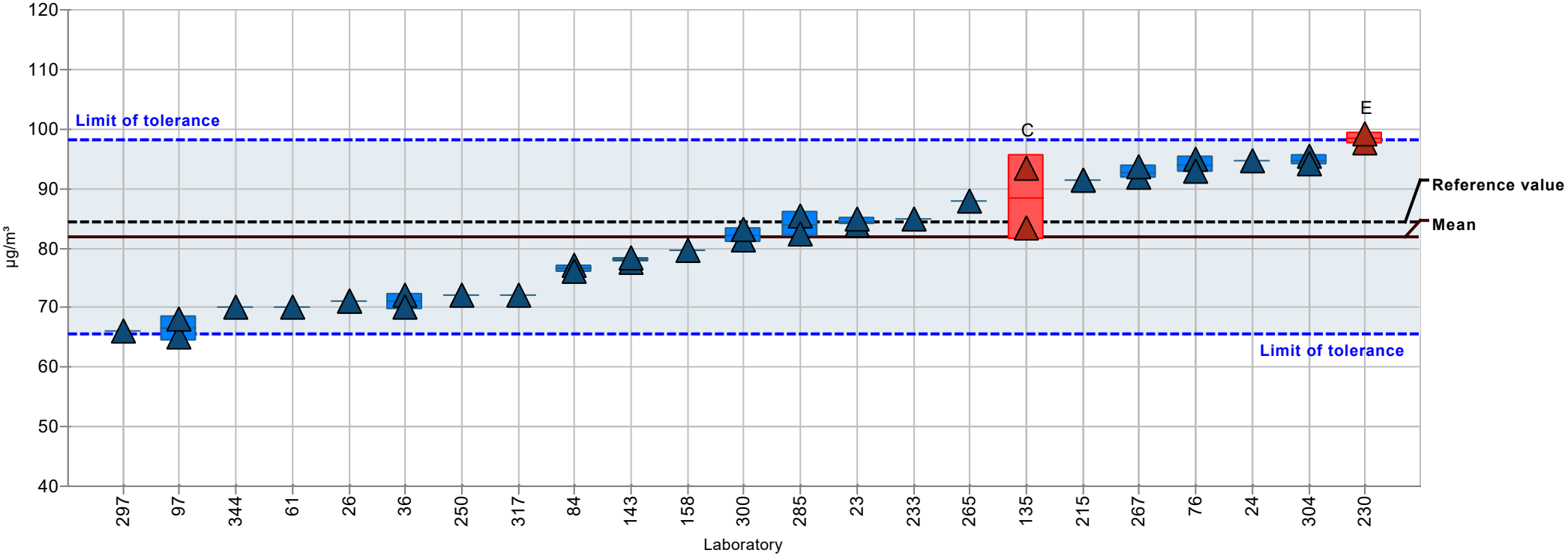
Summary results

Sample:	**2**	**Mean:**	**60.7 µg/m³**
Measurand:	**o-Xylene**	**Reprod. s.d.:**	**7.7 µg/m³**
Method:	**ISO 5725-2**	**Rel.reprod. s.d.:**	**12.64%**
Rel.target s.d.:	**10.00%**	**Reference value:**	**63.8 µg/m³**
Number of laboratories in calculation + outliers:	**22**	**Range of tolerance:**	**48.6 - 72.8 µg/m³ (|Z-Score| <= 2.00)**



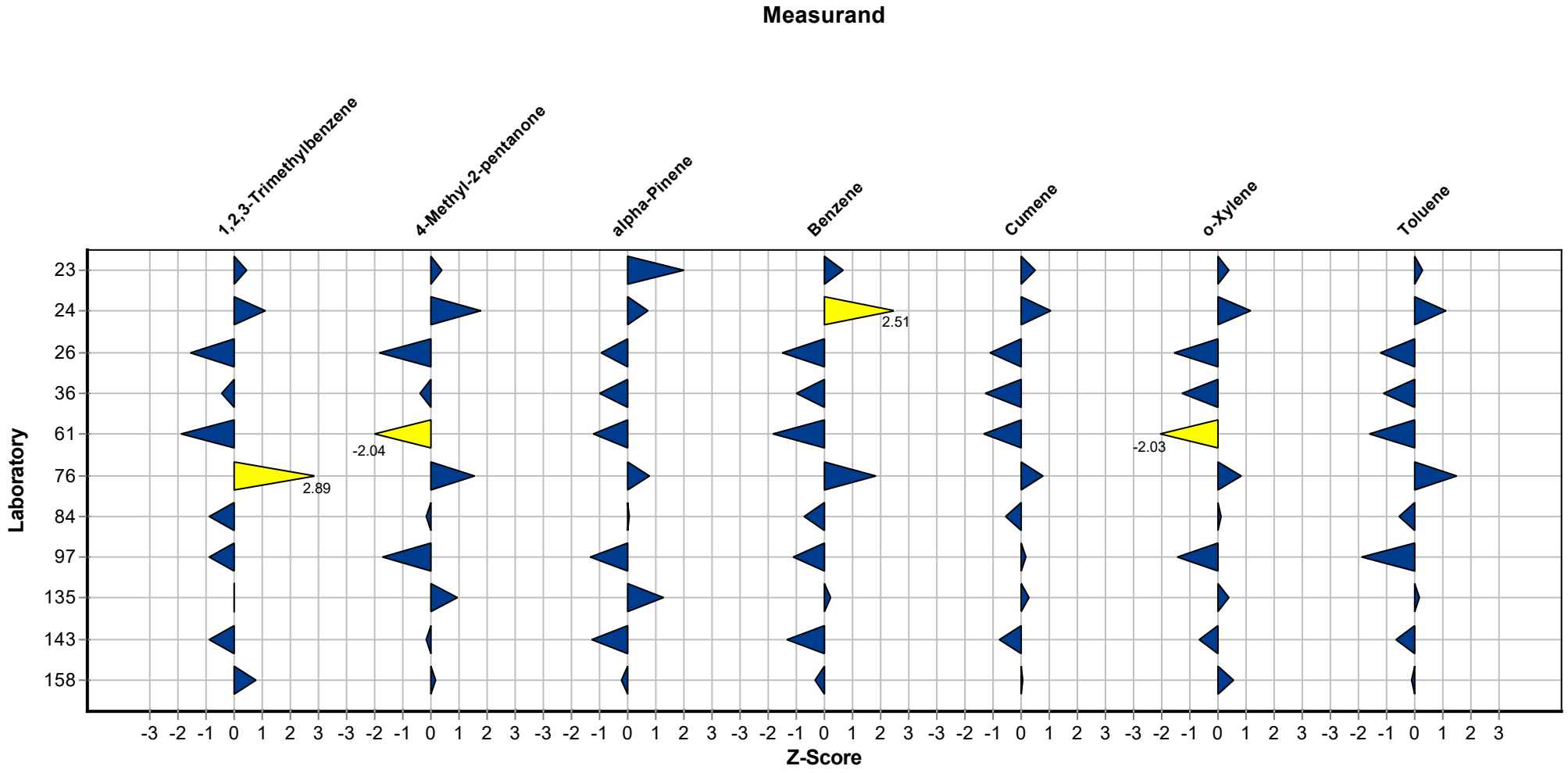
Summary results

Sample:	**2**	**Mean:**	**81.9 µg/m³**
Measurand:	**Toluene**	**Reprod. s.d.:**	**10.4 µg/m³**
Method:	**ISO 5725-2**	**Rel.reprod. s.d.:**	**12.72%**
Rel.target s.d.:	**10.00%**	**Reference value:**	**84.3 µg/m³**
Number of laboratories in calculation + outliers:	**23**	**Range of tolerance:**	**65.5 - 98.3 µg/m³ (|Z-Score| <= 2.00)**



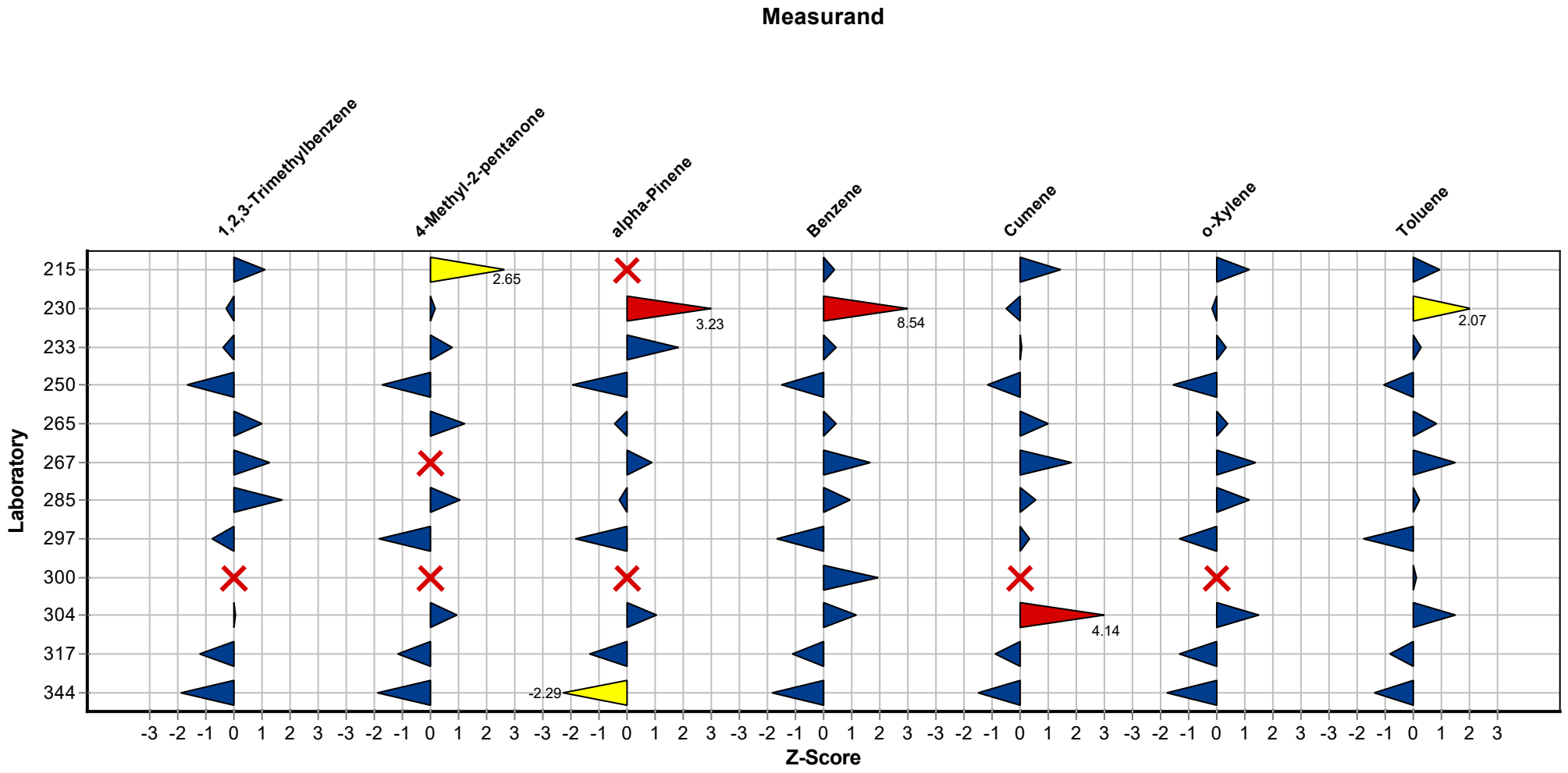
Sample chart of Z-scores

Sample 1



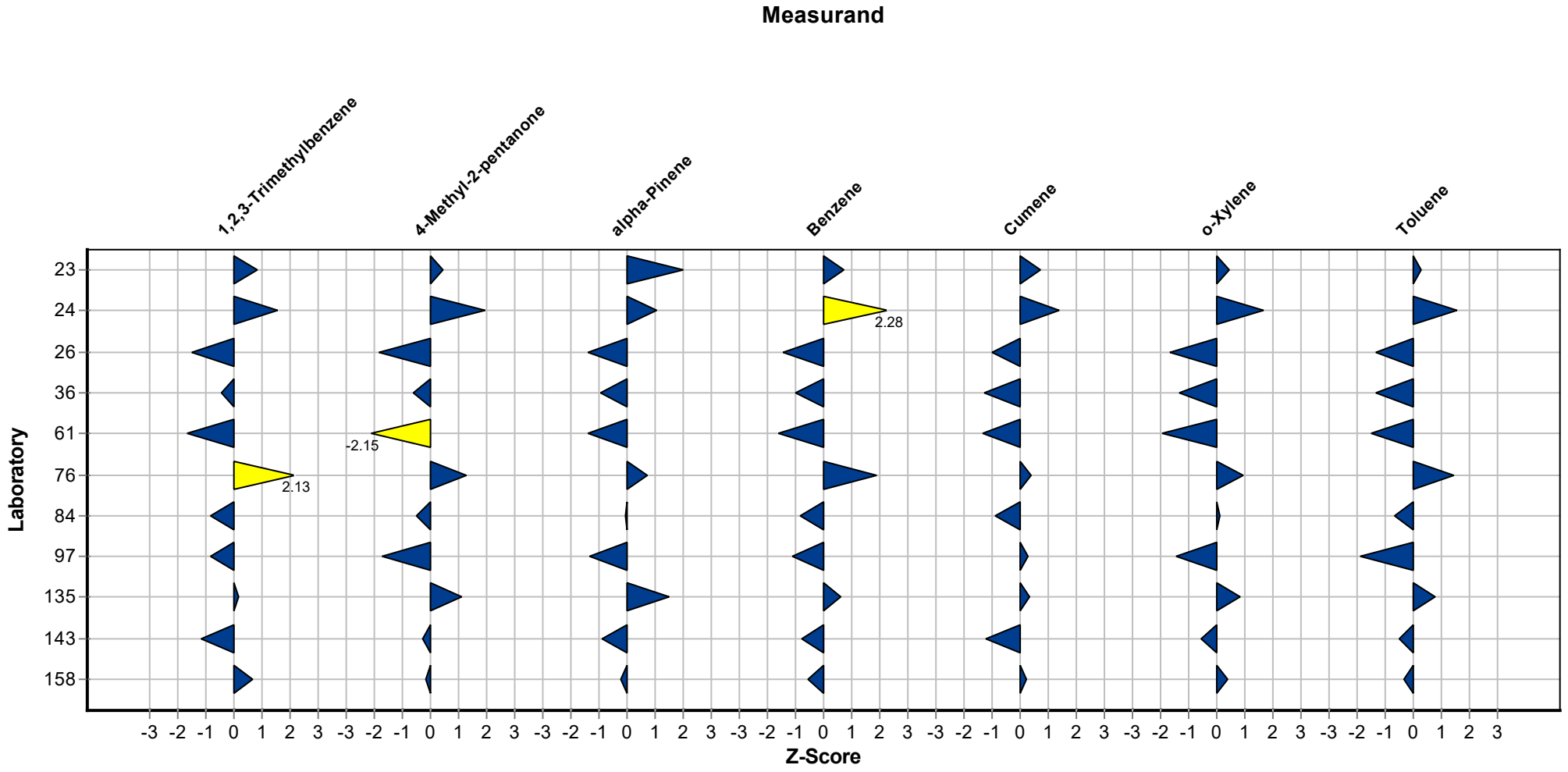
Sample chart of Z-scores

Sample 1



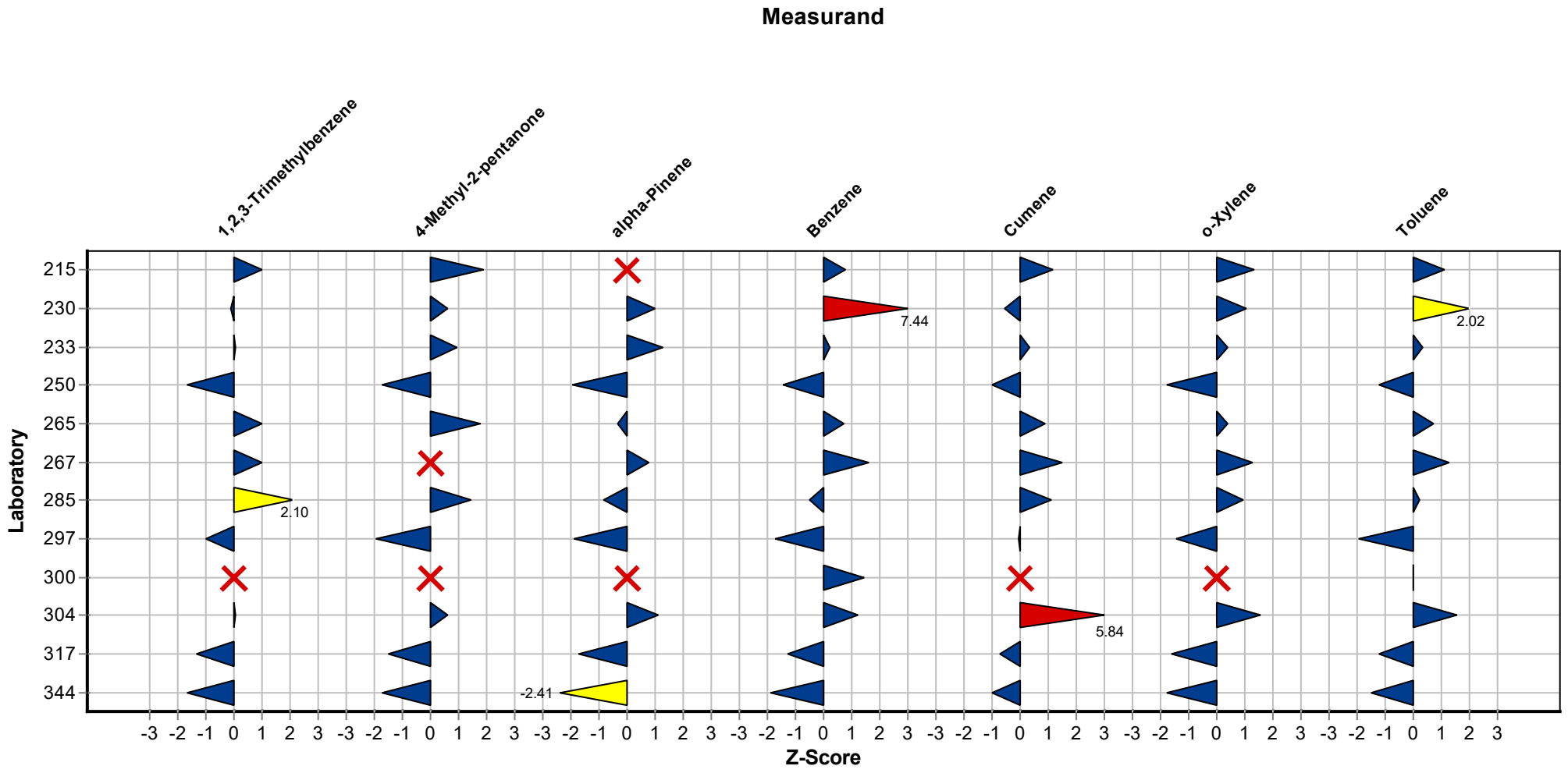
Sample chart of Z-scores

Sample 2



Sample chart of Z-scores

Sample 2



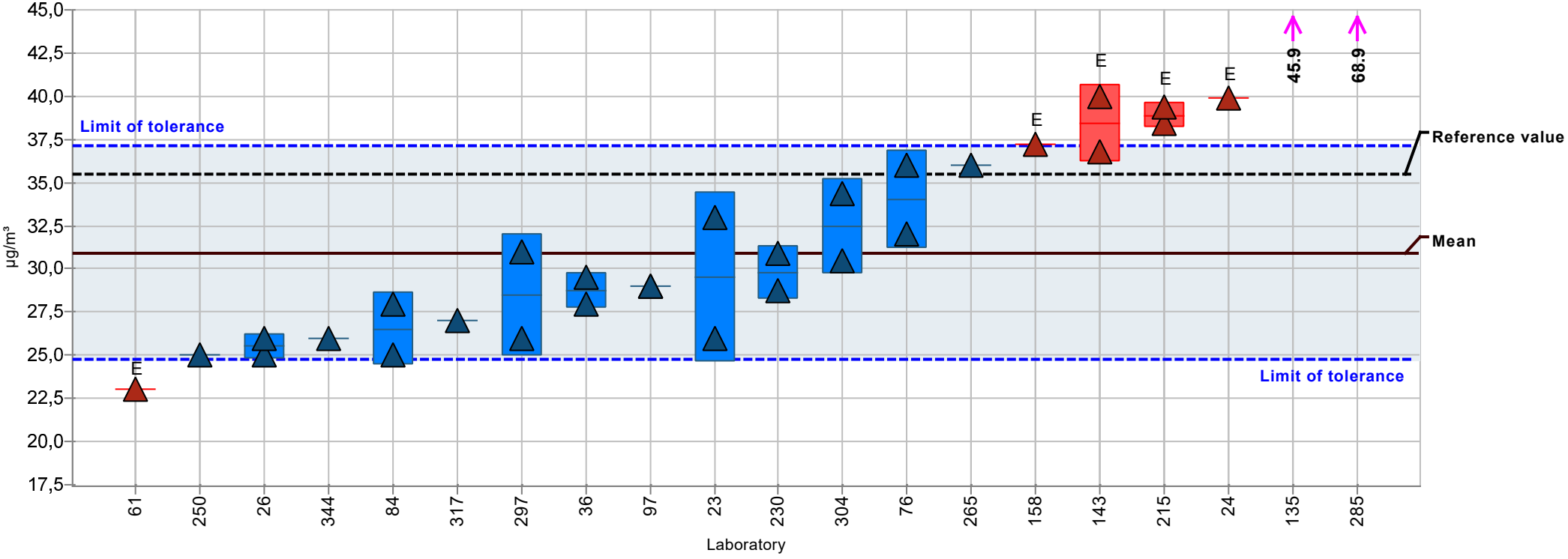
Summary of laboratory test results

Sample System blank value

Laboratory	1,2,3-Trimethylbenzene	Score	4-Methyl-2-pentanone	Score	alpha-Pinene	Score	Benzene	Score	Cumene	Score	o-Xylene	Score	Toluene	Score
Unit	µg/m³		µg/m³		µg/m³		µg/m³		µg/m³		µg/m³		µg/m³	
23	0.000		0.000		0.000		0.00		0		0.00		0.00	
24	0.000		0.000		0.000		2.70		0		1.02		0.96	
26	< 2.000		< 2.000		< 2.000		< 2.00		< 2.0		< 2.00		< 2.00	
36	0.000		0.000		0.000		0.00		0		0.00		0.00	
61	0.000		0.000		0.000		0.00		0		0.00		0.00	
76	< 2.000		< 2.000		< 2.000		< 2.00		< 2.0		< 2.00		< 2.00	
97	< 1.000		< 1.000		< 1.000		< 1.00		< 1.0		< 1.00		< 1.00	
135	< 2.000		< 2.000		< 2.000		< 2.00		< 2.0		< 2.00		< 2.00	
143	< 0.500		< 1.500		< 0.500		< 0.50		< 0.50		< 0.50		< 0.50	
158	0.080		0.090		0.200		0.04		0		0.09		0.39	
215	0.000		0.000				0.00		0		0.00		0.00	
230	< 1.000		< 2.000		< 2.000		< 1.00		< 1.0		< 1.00		< 1.00	
250	< 1.000		< 1.000		< 1.000		< 1.00		< 1.0		< 1.00		< 1.00	
265	0.000		0.000		0.000		0.00		0		0.00		0.00	
267	< 1.600				< 1.600		< 1.60		< 1.6		< 1.60		< 1.60	
285	< 0.500		< 0.500		< 0.500		< 0.50		< 0.50		0.73		1.40	
297	< 1.000		< 1.000		< 1.000		< 1.00		< 1.0		< 1.00		< 1.00	
304	0.000		0.000		0.000		0.00		0		0.00		0.00	
317	< 1.000		< 1.000		< 1.000		< 1.00		< 1.0		< 1.00		< 1.00	
344	< 1.000		< 1.000		< 1.000		< 1.00		< 1.0		< 1.00		< 1.00	
–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
No. of laboratories that submitted results	20		19		19		20		20		20		20	

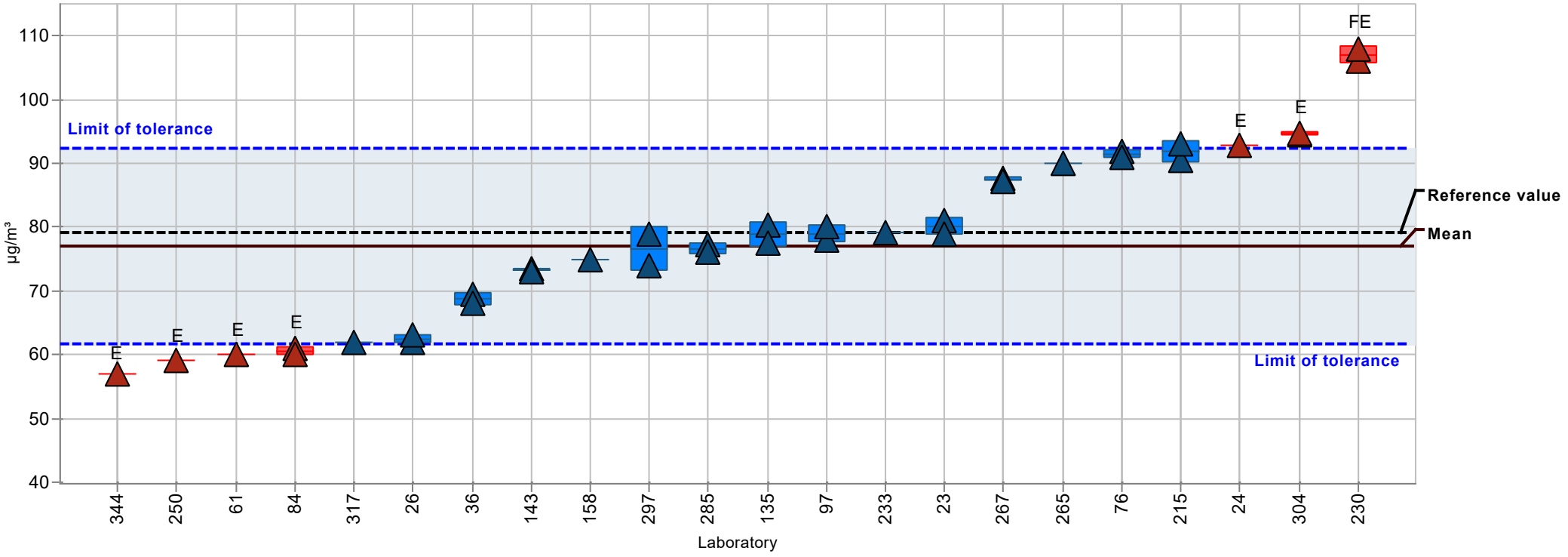
Summary results

Sample:	1	**Mean:**	30.9 µg/m³
Measurand:	2-Ethoxyethanol	**Reprod. s.d.:**	5.2 µg/m³
Method:	ISO 5725-2	**Rel.reprod. s.d.:**	16.86%
Rel.target s.d.:	10.00%	**Reference value:**	35.5 µg/m³
Number of laboratories in calculation + outliers:	20	**Range of tolerance:**	24.7 - 37.1 µg/m³ (|Z-Score| <= 2.00)



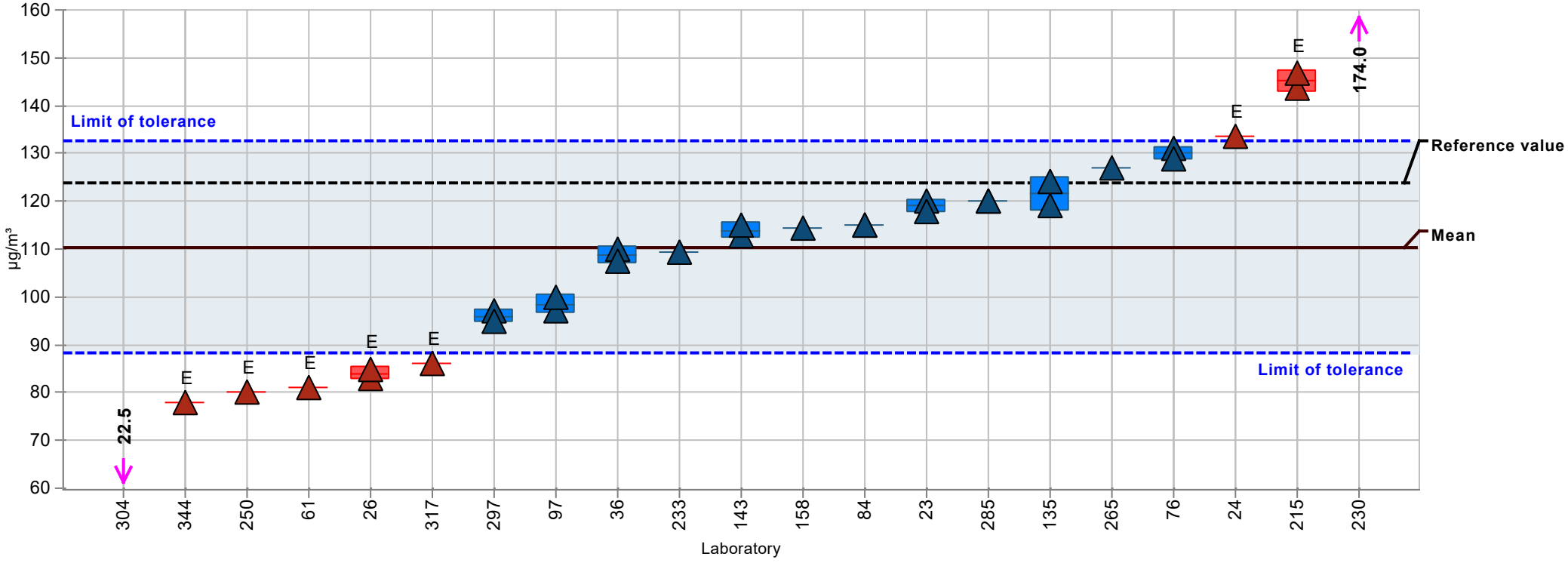
Summary results

Sample:	1	**Mean:**	77.0 µg/m³
Measurand:	n-Heptane	**Reprod. s.d.:**	11.9 µg/m³
Method:	ISO 5725-2	**Rel.reprod. s.d.:**	15.43%
Rel.target s.d.:	10.00%	**Reference value:**	79.1 µg/m³
Number of laboratories in calculation + outlier:	22	**Range of tolerance:**	61.6 - 92.4 µg/m³ (|Z-Score| <= 2.00)



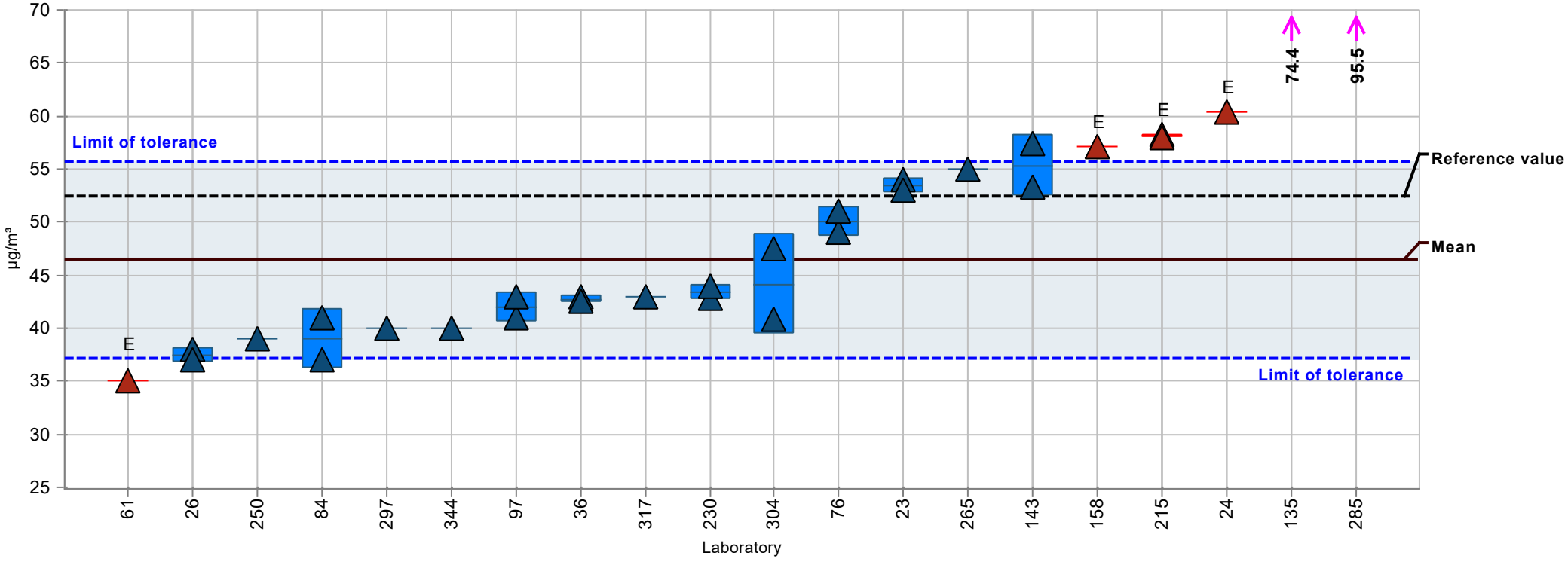
Summary results

Sample:	1	**Mean:**	110 µg/m³
Measurand:	Ethyl acetate	**Reprod. s.d.:**	19 µg/m³
Method:	ISO 5725-2	**Rel.reprod. s.d.:**	17.23%
Rel.target s.d.:	10.00%	**Reference value:**	124 µg/m³
Number of laboratories in calculation + outliers:	21	**Range of tolerance:**	88 - 133 µg/m³ (|Z-Score| <= 2.00)



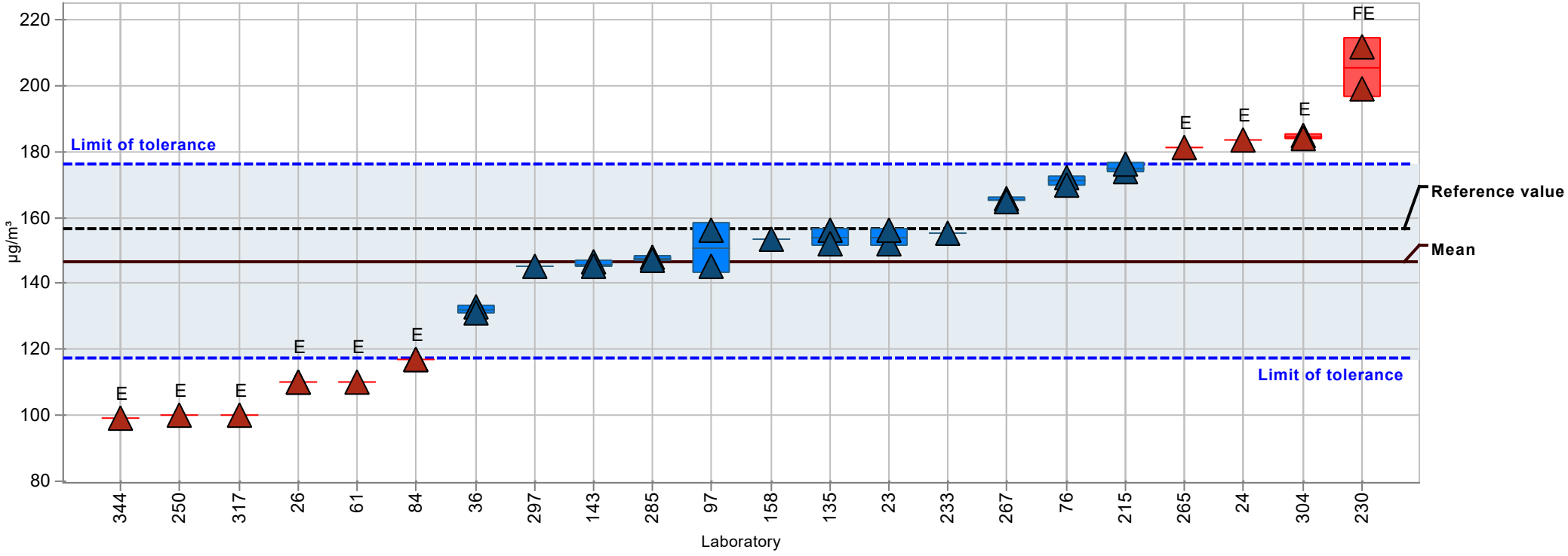
Summary results

Sample:	**2**	**Mean:**	**46.5 µg/m³**
Measurand:	**2-Ethoxyethanol**	**Reprod. s.d.:**	**7.9 µg/m³**
Method:	**ISO 5725-2**	**Rel.reprod. s.d.:**	**16.92%**
Rel.target s.d.:	**10.00%**	**Reference value:**	**52.5 µg/m³**
Number of laboratories in calculation + outliers:	**20**	**Range of tolerance:**	**37.2 - 55.8 µg/m³ (|Z-Score| <= 2,00)**



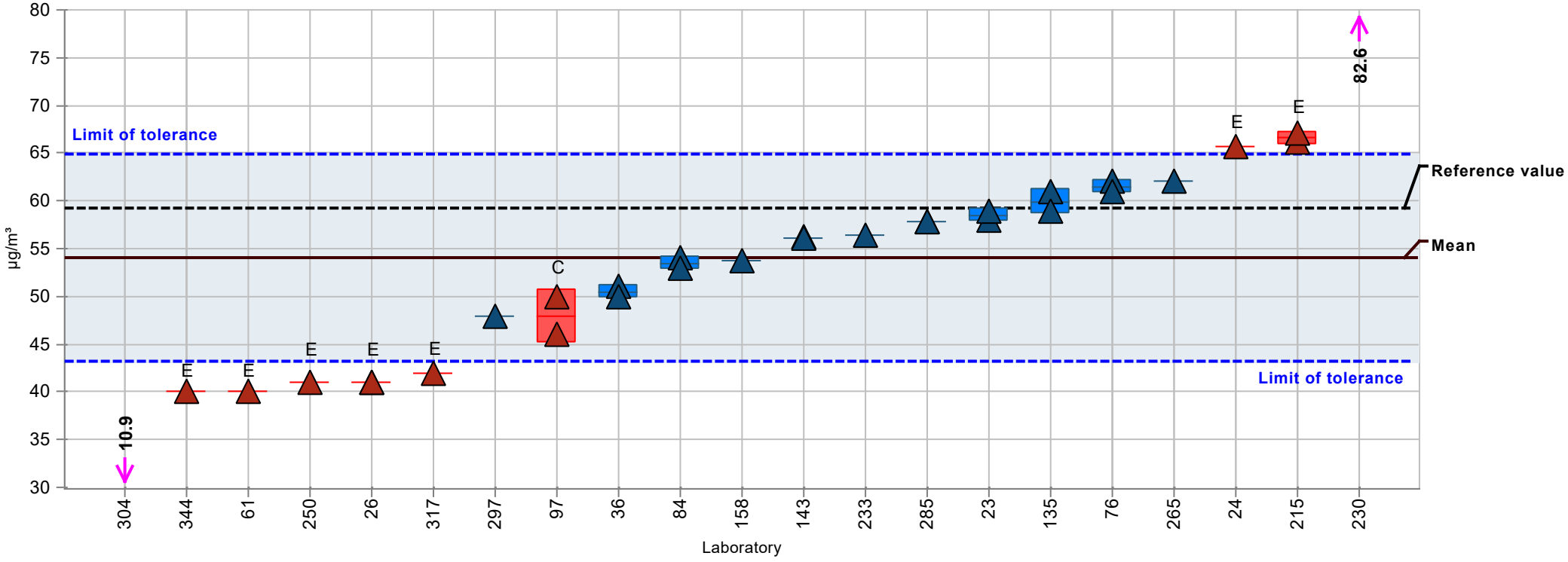
Summary results

Sample:	**2**	**Mean:**	**147 µg/m³**
Measurand:	**n-Heptane**	**Reprod. s.d.:**	**27 µg/m³**
Method:	**ISO 5725-2**	**Rel.reprod. s.d.:**	**18.17%**
Rel.target s.d.:	**10.00%**	**Reference value:**	**156 µg/m³**
Number of laboratories in calculation + outliers:	**22**	**Range of tolerance:**	**117 - 176 µg/m³ (|Z-Score| <= 2.00)**



Summary results

Sample:	2	**Mean:**	54.1 µg/m³
Measurand:	Ethyl acetate	**Reprod. s.d.:**	8.6 µg/m³
Method:	ISO 5725-2	**Rel.reprod. s.d.:**	15.99%
Rel.target s.d.:	10.00%	**Reference value:**	59.3 µg/m³
Number of laboratories in calculation + outliers:	21	**Range of tolerance:**	43.3 - 64.9 µg/m³ (|Z-Score| <= 2.00)



Questions and Answers

Participant	Sample carrier	Sampling pump	Flow rate	Flow rate measurement
23	Tenax TA	LFS-113DC	0,067 L/min	Gilibrator
24	Gerstel Tenax TA	BiVOC2V2	0,1 L/min	BiVOC2V2
26	Markes, TENAX, Edelstahlröhrchen	Sensidyne GilAir Plus	0,09 l/min	
36	Tenax Supelco	BiVOC V2	0.1 L/min	Mesa_Labs_Defender_200-510M
61	Tenaxröhrchen	Bivoc2	0.1	Bivoc2
76	Tenax	BiVOC2 der Fa. Umweltanalytik Holbach GmbH	100 ml/min	BiVOC2 der Fa. Umweltanalytik Holbach GmbH
84	Tenax TA und Carbopack X	GSA SG350	0,2 L/min bzw. 0,1 L/min	TSI 4146
97	Tenax, diverse Hersteller	GSA SG350ex, Holbach BiVOC2	0,1 l/min	Defender 510L
135	Tenax TA Supelco	Holbach BIVOC2 V2	80 ml/min	Integrierter Massenflussmesser der Probenahmepumpe
143	Tenax TA, Markes	Gil Air Plus	0,2 / 0,1 L/min	Analyt-MTC 0-1L
158	Tenax TA	LFS	0,066 ml/min	DryCal
215	Tenax TA	Bivoc-2	0,2 Nl/min	Bubble-Meter
230	Tenax TA, Firma Gerstel	BIVOC, Fa Holbach	0,15 ml/min	TSI 4140 F
233	Tenax TA von Markes	DESAGA GS 301 und Gilian GilAirPlus	0,1 L/min	Aalborg GFM17
265	Tenax TA	BiVOC V2	0,1 L/min	Massenflussmesser von Bronkhorst
267	Stainless Steel tubes filled with Tenax TA (Markes International)	Gilian GilAir plus	125mL/min	Gilian Gilibraltor 3
285	Tenax TA (Supelco)	SKC 224-PCXR8	0,1 L/min	BIOS Defender 510-M
297	Tenax-Röhrchen Perkin-Elmer	BiVOC2, für Probe 2: Gilair Plus	0,2 l/min	TSI 4146
300	Dräger Aktivkohle, Typ NIOSH (50)	Gilian GilAir Plus	500 mL/min	Gilibrator 2
304	Tenax TA	BiVOC2v2 (Umweltanalytik Holbach GmbH)	0.1 NL/min	x

Participant	Sampling time	Analytical method	Thermal desorber	Desorption temperature tubes	Desorption flow	Desorption time
23	30 min	DIN ISO 16000-6	Shimadzu TD-30R	250 °C	60 ml/min	5 min
24	20 min	DIN ISO 16000-6	Gerstel TD 3.5+	260°C	43 ml/min	10 min
26	30	DIN EN ISO 16000-6	Markes TD100-xr	280	50	10
36	30 Minuten	DIN ISO 16000-6	Gerstel TD 3.5.+	260°C		
61	30	DIN ISO 16000-6	Markes TD100xr			
76	30	DIN ISO 16000-6	Perkin Elmer ATD 650	280°C	1	15
84	10 bzw. 20 min	DIN ISO 16000-6 (2022-03)	Shimadzu TD20, 240 °C	240 °C	110 mL/min	12 min
97	30	DIN ISO 16000-6	Markes TD100-xr	keine Angabe durch Labor	keine Angabe durch Labor	keine Angabe durch Labor
135	43,75	DIN ISO 16000-6	Perkin Elmer TurboMatrix 650	270°C	29	17
143	10 / 5 min.	DIN ISO 16000-6	Markes TD100-xr	250°C	20 mL/min	20 min.

Participant	Sampling time	Analytical method	Thermal desorber	Desorption temperature tubes	Desorption flow	Desorption time
158	30	DIN ISO 16000-6	Markes TD 100	280 °C	75 ml/min	8 min
215	5-10	DIN ISO 16000-6	TD-30R	300	60	10
230	20 min	DIN ISO 16000-6	TDS 3, Fa Gerstel	40°C - 260°C	30,0	5 min
233	20	DIN 16000-6	Markes TD100-xr	280°C		10
265	20	DIN ISO 16000-6	Shimadzu TD30	290 °C	60	15
267	25	ISO 16000-6	Markes Unity-xr	280°C	40	15
285	40 min, 50 min	DIN ISO 16000-6	TD30R (Shimadzu)	250°C	60	5
297	15	16000-6	MARKES	280°C	1,4	10 Minuten
300		IFA Arbeitsmappe	keine Thermodesorbtion, Desorbtion mit CS2	-	-	-
304	20 min (2 Liter) & 40 min (4L)	DIN ISO 16000-6	Shimadzu TD30-R	270 °C	70 mL/min	10 min

Participant	Focussing temperature	Carrier gas	Carrier gas flow	Analytical column
23	- 18 °C	Helium	Column Flow 2,42 ml/min und Total Flow 33,1 ml/min	Rxi 5 Sil ms
24	-40°C	Helium	1,3 ml/min	Agilent Ultra 2
26	-25 °C	Helium	0,5	Restek, Rxi-5Sil MS
36		Helium	1,2	Optima 5 MS
61				5 % Phenyl-/95 % Methyl-Polysiloxan-Kapillarsäule
76	-30°C	Helium	12,2	Agilent J&W Scientific DB-5
84	-20 °C	Helium	110 mL/min	Agilent MS-5 (60m*0,25mm/0,25µm)
97	keine Angabe durch Labor	Helium	keine Angabe durch das Labor	OPTIMA 5 MS Accent MN
135	-20°C	Helium	1,5	Restek Rxi-5ms
143	-10°C	Helium	20 mL/min	DB 624 UI
158	10 °C	Helium	1 ml/min	Resteck RTX-1 60m, ID 0,25 x 1µm
215	0°C	Helium	4,8	VF-5ms
230	-30°C	Helium	0,6 ml/min	Restek Rxi 1ms, 60m
233	20°C	Helium	1,5 mL/min	HP-5ms 5%Phenyl
265	-17 °C	Helium	2,46 ml/min	Agilent VF-5MS
267	-5°C	Helium	1.77mL/min	HP Innowax 60m x 0.32mm x 0.5um, Agilent Technologies (ref: 19091M-216)
285	-20°C	Helium	1,2	Rtx-5MS 30m, 0,25mmID, 1µmFD (Restek)
297	-10°C	Helium	1,4	GC-Coulumn Optima 5 MS accent 1,00 µl
300	-	Stickstoff	1 mL/min	DB-WAX, 60m x 0,250mm, 0,25 µm
304	-25 °C	Helium	1.69 mL/min	Optima-624 (Macherey-Nagel)

Participant	Detector	Data evaluation
23	MS Shimadzu QP 2020	Quantifizierung über Vergleichstandards (substanzspezifisch)
24	Agilent MSD 5977B	2-Punktkalibrierung externer Standards
26	MS	einkalibrierte Substanzen
36	MSD 5977 B, Agilent	stoffspezifisch, Vergleichsspektrum+Retentionszeit
61	Agilent MS 5977A	Mittels internem Standard
76	MS	externer Standard
84	MS-Detektor Shimadzu QP-2010 Ultra	Identifizierung über externe Standards und NIST05 Bibliothek, Quantifizierung über externe Standardreihen,
97	SHIMADZU GCMS-QP2020	externe Standards
135	MSD	
143	Single Quadrupol Agilent 5977 E MSD	
158	MSD Agilent 5978C	ISTD
215	MS QP 2020NX	substanzspezifische Kalibrierung + SIM&SCAN, mit internen Std.
230	MS	Referenzstandards, eigene Belegung, Retentionszeit, MS
233	Agilent 5975C MSD	Quantifizierung über externe 6-Punkt Kalibrierung mit ISTD, Identifikation mit MS und Retentionszeit
265	MS	über stoffspezifische Kalibration
267	Mass spectrometer (scan mode for acquisition)	Acquisition in scan mode, quantification with one m/z quantifier and confirmation of identification with specific qualifiers and their ratio
285	Massenspektromer, FID	Identifizierung über Retentionszeit und Target/Qualifier, Kalibrierung substanzspezifisch, MS: interne Standardmethode, FID: externe Standardmethode
297	GC-MS QP2020 Shimadzu AG	externer Standard, externer Standard
300	FID	interner Standard, Retentionszeiten, Absicherung über zwei Säulen unterschiedlicher Polaritäten
304	Shimadzu GCMS-QP2020 NX	Interner Standard (Toluol-d8)

Participant	Recovery rate	Date of analysis
23	nein	10.06.2025
24	nein	07.07. + 08.07.2025
26	ja	11.06.2025
36	Nein	19.06.205
61	Ja	13.06.2025 -20.06.2025
76	Nein	17.06.2025
84	nein (IS Toluol-d8 und Naphthalin-d8)	Hauptproben: 24.06.2025, Rückstellproben: 25.06.2025
97	nein	06.06.2025
135	ja	17.06.2025
143	nein	5.-11.6.25
158	Es wurden Kontrollstandards eingesetzt	05.06. - 12.06.2025
215	nein	06.06.2025
230	nein	ab dem 16.06.2025

Participant	Recovery rate	Date of analysis
233	nein	23.6.2025-10.07.2025
265	nein	16.06.2025
267	Nein	05.06.2025
285	nein	20.06.2025
300	ja	11.06.2025
304	Nein	04.06.2025