

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

10 September 2024

Summary of laboratory test results

Sample 1

Laboratory	1-Butanol	Z score	1,2,4-Trimetylbenzene	Z score	4-Methyl-2-pentanone	Z score	Benzene	Z score	Cumene	Z score
Unit	µg/m³		µg/m³		µg/m³		µg/m³		µg/m³	
18	58,9	-4,77 FE	14,3	-4,86 FE	31,0	-3,87 FE	22,2	-5,95 BE	24,1	-4,89 FE
24	151,7	3,46 FE	31,8	1,45	53,9	0,67	58,3	0,64	50,8	0,76
40					43,8	-1,34	60,5	1,03		
59	129,0	1,45	30,3	0,89	53,5	0,59	56,4	0,29	48,0	0,17
76	197,0	7,48 BE	41,0	4,74 FE	75,0	4,84 FE	62,5	1,40	60,5	2,82 E
97	77,0	-3,17 E	17,5	-3,71 FE	35,0	-3,07 E	34,0	-3,86 BE	30,5	-3,53 E
116	126,0	1,18	31,8	1,42	67,5	3,35 E	49,8	-0,91	52,9	1,21
134	111,0	-0,15	31,3	1,25	68,8	3,63 E	51,8	-0,55	53,3	1,29
137	120,0	0,65	22,5	-1,91	43,5	-1,39	61,0	1,13		
171	98,5	-1,26	38,2	3,73 FE	43,2	-1,45	47,4	-1,35	58,4	2,38 E
206	129,3	1,47	23,7	-1,48	50,7	0,03	49,0	-1,05	39,2	-1,69
217	110,0	-0,24	30,0	0,78	54,0	0,69	51,0	-0,70	51,0	0,81
218	117,5	0,43	26,5	-0,47	47,0	-0,70	56,0	0,21	42,0	-1,10
233	90,1	-2,00 E	26,9	-0,34	53,2	0,52	54,3	-0,10	46,2	-0,20
240	119,7	0,62	27,2	-0,22	56,5	1,18	51,8	-0,55	44,0	-0,67
247	124,0	1,00	30,7	1,04	52,6	0,41	55,0	0,03	48,9	0,37
248	125,0	1,09	31,0	1,14	58,0	1,48	59,0	0,76	54,0	1,45
265	118,0	0,47	29,0	0,43	47,0	-0,70	48,0	-1,24	48,0	0,17
267			29,0	0,43			58,5	0,66	49,4	0,47
286	96,2	-1,46	23,8	-1,44	43,8	-1,33	42,9	-2,18 E	39,0	-1,73
294	116,5	0,34	26,8	-0,38	51,3	0,14	53,9	-0,17	44,3	-0,62
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Method	ISO 5725-2		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		Z <=2,00	
No. of laboratories that submitted results	19		20		20		21		19	
Mean	112,7		27,8		50,5		54,8		47,2	
Reprod. s.d.	15,8		3,2		9,1		5,4		8,1	
Rel. reproducibility s.d.	14,03 %		11,42 %		17,92 %		9,80 %		17,07 %	
Reference value	120,9		26,5		44,4		50,5		44,3	

Laboratory	1-Butanol Z score	1,2,4-Trimethylbenzene Z score	4-Methyl-2-pentanone Z score	Benzene Z score	Cumene Z score
Target s.d.	11,3	2,8	5,1	5,5	4,7
Rel. target s.d.	10,00 %	10,00 %	10,00 %	10,00 %	10,00 %
Lower limit of tolerance	90,2	22,3	40,4	43,9	37,7
Upper limit of tolerance	135,2	33,4	60,6	65,8	56,6
Type B outliers	1			2	
Type C outliers					
Type F outliers	2	4	2		1
No. of laboratories after elimination of outliers type A-D and F (without laboratories that only gave states but no measured values)	16	16	18	19	18
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	m-Xylene	Z score	n-Butylacetate	Z score	n-Octane	Z score	Propylbenzene	Z score	Toluene	Z score
Unit	µg/m³		µg/m³		µg/m³		µg/m³		µg/m³	
18	22,1	-4,80 FE	52,5	-3,39 E	34,2	-4,86 FE	38,7	-5,19 FE	17,9	-3,65 BE
24	44,5	0,87	87,4	1,00	68,9	0,31	85,9	0,77	28,3	0,03
40	34,3	-1,63	76,1	-0,42	57,5	-1,40	70,2	-1,19	26,1	-0,74
59	45,4	1,09	84,0	0,58	67,0	0,03	78,8	-0,11	30,4	0,78
76	47,0	1,48	95,0	1,97	92,0	3,77 FE	116,0	4,59 FE	35,0	2,42 E
97	28,0	-3,16 E	45,0	-4,33 FE	47,5	-2,89 E	44,5	-4,42 FE	58,0	10,58 CE
116	45,7	1,15	111,0	3,98 FE	71,9	0,76	83,8	0,52	28,2	0,01
134	46,0	1,22	113,0	4,23 FE	74,2	1,10	85,5	0,73	28,0	-0,07
137	34,5	-1,58	62,0	-2,19 E	59,0	-1,17	105,0	3,17 E	23,5	-1,66
171	48,6	1,87	56,3	-2,91 E	73,2	0,96	84,1	0,55	27,0	-0,42
206	27,3	-3,33 E	86,3	0,87	59,9	-1,03	70,8	-1,12	9,4	-6,67 BE
217	48,0	1,72	66,0	-1,69	79,0	1,82	77,0	-0,34	28,0	-0,07
218	45,5	1,11	77,0	-0,30	87,0	3,02 E	71,0	-1,09	28,5	0,11
233	41,2	0,07	84,6	0,65	69,1	0,34			26,4	-0,64
240	46,2	1,28	88,9	1,20	68,8	0,30	73,3	-0,80	29,4	0,43
247	45,9	1,21	83,7	0,54	67,8	0,15	79,1	-0,08	30,4	0,78
248	47,0	1,48	91,0	1,46	70,0	0,48	81,0	0,16	33,0	1,71
265	44,0	0,74	90,0	1,34	70,0	0,48	77,0	-0,34	26,0	-0,78
267	45,0	1,00	87,0	0,96	69,3	0,38	85,5	0,73	29,9	0,59
286	36,0	-1,21	67,6	-1,49	56,0	-1,62	65,9	-1,73	24,9	-1,17
294	40,0	-0,24	83,1	0,47	66,8	0,00	75,5	-0,52	25,4	-0,99
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Method	ISO 5725-2		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		Z <=2,00	
No. of laboratories that submitted results	21		21		21		20		21	
Mean	40,9		79,4		66,8		79,7		28,2	
Reprod. s.d.	7,1		12,1		9,9		10,2		3,1	
Rel. reproducibility s.d.	17,30 %		15,21 %		14,80 %		12,79 %		10,99 %	
Reference value	40,8		78,7		73,1		76,1		28,6	
Target s.d.	4,1		7,9		6,7		8,0		2,8	
Rel. target s.d.	10,00 %		10,00 %		10,00 %		10,00 %		10,00 %	
Lower limit of tolerance	32,8		63,5		53,5		63,8		22,6	
Upper limit of tolerance	49,1		95,3		80,2		95,7		33,8	
Type B outliers									2	

Laboratory	m-Xylene	Z score	n-Butylacetate	Z score	n-Octane	Z score	Propylbenzene	Z score	Toluene	Z score
Type C outliers									1	
Type F outliers	1		3		2		3			
No. of laboratories after elimination of outliers type A-D and F (without laboratories that only gave states but no measured values)	20		18		19		17		18	

Summary of laboratory test results

Sample 2

Laboratory	1-Butanol	Z score	1,2,4-Trimetylbenzene	Z score	4-Methyl-2-pentanone	Z score	Benzene	Z score	Cumene	Z score
Unit	µg/m³		µg/m³		µg/m³		µg/m³		µg/m³	
18	29,9	-2,15 E	48,4	-3,28 E	40,4	-3,26 FE	15,3	-5,78 FE	30,2	-4,53 FE
24	45,4	1,92	78,7	0,92	65,3	0,89	41,7	1,50	57,4	0,40
40			61,6	-1,45	56,9	-0,50	44,9	2,39 E		
59	43,8	1,51	73,3	0,17	66,1	1,02	38,3	0,55	55,8	0,11
76	68,0	7,86 BE	107,0	4,85 FE	93,0	5,51 FE	42,5	1,73	70,5	2,77 E
97	28,0	-2,65 E	45,5	-3,68 FE	43,0	-2,83 E	23,5	-3,52 E	36,5	-3,39 E
116	42,6	1,19	91,6	2,72 E	83,3	3,90 E	35,5	-0,20	58,6	0,61
134	37,8	-0,09	94,4	3,11 E	87,3	4,57 FE	36,0	-0,05	64,8	1,75
137	37,5	-0,15	59,0	-1,81	53,5	-1,08	42,0	1,59		
171	21,9	-4,25 FE	94,2	3,08 E	44,8	-2,53 E	27,4	-2,44 E	61,8	1,19
206	38,7	0,16	65,0	-0,98	61,7	0,29	29,8	-1,78	50,1	-0,93
217	36,0	-0,55	70,0	-0,28	61,0	0,17	33,0	-0,90	56,0	0,14
218	39,0	0,24	70,5	-0,21	59,0	-0,16	38,0	0,48	51,0	-0,76
233	30,1	-2,10 E	68,4	-0,50	64,8	0,81	37,0	0,20	53,1	-0,37
240	41,6	0,92	66,1	-0,82	68,4	1,41	34,6	-0,45	51,8	-0,62
247	43,5	1,42	75,0	0,41	66,0	1,01	38,5	0,62	56,6	0,25
248	48,0	2,60 E	78,0	0,83	70,0	1,67	41,0	1,31	62,0	1,23
265	34,0	-1,07	79,0	0,97	62,0	0,34	34,0	-0,62	60,0	0,87
267			74,5	0,34			38,8	0,69	56,5	0,22
286	30,7	-1,94	60,1	-1,66	49,0	-1,83	25,6	-2,94 E	44,3	-1,98
294	41,3	0,84	69,5	-0,35	62,0	0,34	35,8	-0,12	51,8	-0,63
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Method	ISO 5725-2		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		Z <=2,00	
No. of laboratories that submitted results	19		21		20		21		19	
Mean	38,1		72,0		60,0		36,2		55,2	
Reprod. s.d.	5,7		11,7		9,3		6,0		8,5	
Rel. reproducibility s.d.	15,01 %		16,27 %		15,49 %		16,68 %		15,32 %	
Reference value	39,4		65,5		55,8		32,1		48,8	

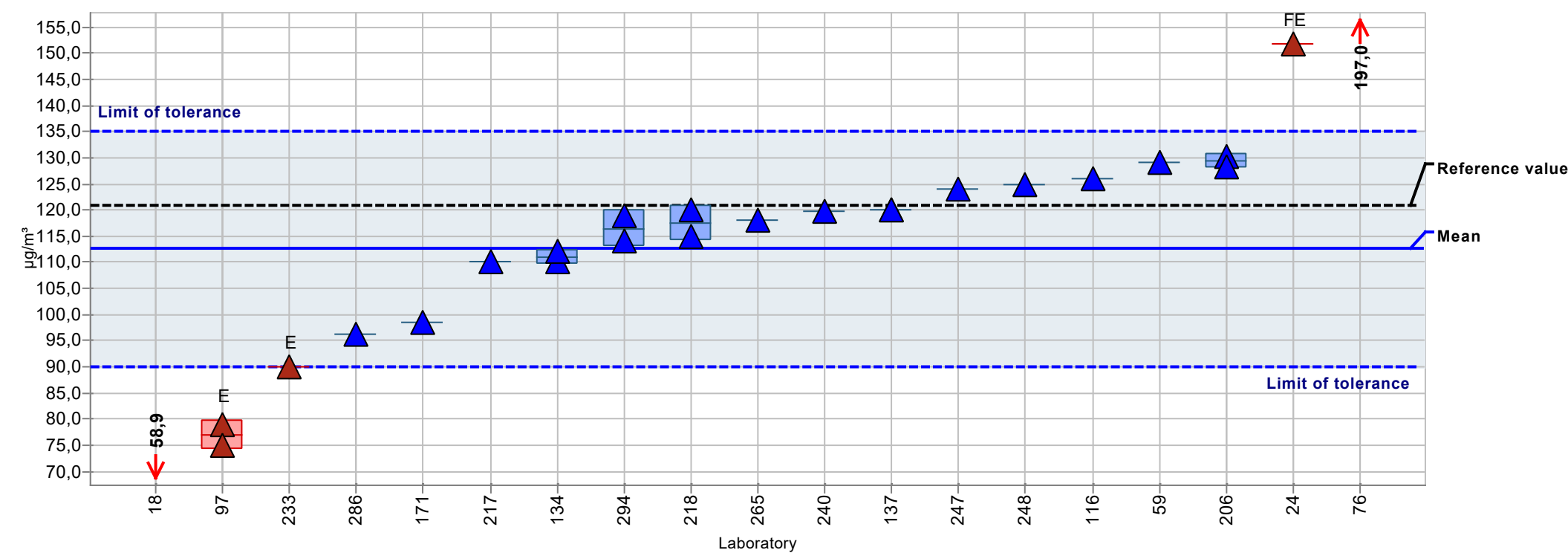
Laboratory	1-Butanol Z score	1,2,4-Trimethylbenzene Z score	4-Methyl-2-pentanone Z score	Benzene Z score	Cumene Z score
Target s.d.	3,8	7,2	6,0	3,6	5,5
Rel. target s.d.	10,00 %	10,00 %	10,00 %	10,00 %	10,00 %
Lower limit of tolerance	30,5	57,6	48,0	29,0	44,2
Upper limit of tolerance	45,7	86,4	72,0	43,5	66,3
Type B outliers	1				
Type C outliers					
Type F outliers	1	2	3	1	1
No. of laboratories after elimination of outliers type A-D and F (without laboratories that only gave states but no measured values)	17	19	17	20	18
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	m-Xylene	Z score	n-Butylacetate	Z score	n-Octane	Z score	Propylbenzene	Z score	Toluene	Z score
Unit	µg/m³		µg/m³		µg/m³		µg/m³		µg/m³	
18	60,4	-3,81 FE	20,7	-4,23 FE	63,3	-4,77 FE	14,0	-4,85 FE	74,6	-4,04 BE
24	101,2	0,38	37,6	0,49	118,2	-0,24	29,0	0,67	126,0	0,06
40	101,3	0,38	35,3	-0,15	114,4	-0,55			129,5	0,34
59	99,4	0,19	38,0	0,61	124,5	0,29	29,1	0,71	120,0	-0,41
76	145,0	4,86 FE	41,0	1,44	157,5	3,01 E	32,0	1,78	157,5	2,59 E
97	69,0	-2,93 E	20,5	-4,28 FE	86,0	-2,90 E	15,0	-4,48 FE	91,0	-2,73 CE
116	121,0	2,40 E	41,8	1,67	127,0	0,49	29,7	0,95	141,0	1,27
134	124,5	2,76 E	44,2	2,33 CE	129,5	0,70	29,4	0,81	143,5	1,47
137	82,0	-1,59	26,5	-2,61 E	105,0	-1,33	66,5	14,48 BE	110,0	-1,21
171	108,0	1,07	19,1	-4,67 FE	113,0	-0,66	28,0	0,31	105,0	-1,61
206	70,3	-2,79 E	36,8	0,28	123,4	0,19	21,1	-2,25 E	50,4	-5,97 BE
217	110,0	1,28	28,0	-2,19 E	130,0	0,74	23,0	-1,53	120,0	-0,41
218	109,5	1,22	33,5	-0,66	154,5	2,76 E	24,5	-0,98	119,5	-0,45
233	96,0	-0,16	35,4	-0,13	119,3	-0,15			120,0	-0,41
240	104,5	0,71	39,8	1,10	114,3	-0,56	26,4	-0,28	118,5	-0,53
247	101,0	0,35	38,1	0,63	126,0	0,41	29,5	0,86	121,0	-0,33
248	91,0	-0,67	33,0	-0,80	120,0	-0,09	29,0	0,68	130,0	0,39
265	108,0	1,07	41,0	1,44	114,0	-0,58	28,0	0,31	121,0	-0,33
267	104,5	0,71	37,0	0,33	118,8	-0,19	28,4	0,46	130,2	0,40
286	81,7	-1,63	29,5	-1,77	92,4	-2,37 E	21,8	-1,97	107,0	-1,45
294	94,0	-0,36	37,8	0,53	115,0	-0,50	25,8	-0,52	112,0	-1,05
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Method	ISO 5725-2		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		Z ≤2,00	
No. of laboratories that submitted results	21		21		21		19		21	
Mean	97,6		35,9		121,0		27,2		125,1	
Reprod. s.d.	16,1		4,4		18,3		3,3		14,2	
Rel. reproducibility s.d.	16,49 %		12,38 %		15,08 %		12,13 %		11,38 %	
Reference value	90,5		32,8		120,5		24,7		118,1	
Target s.d.	9,8		3,6		12,1		2,7		12,5	
Rel. target s.d.	10,00 %		10,00 %		10,00 %		10,00 %		10,00 %	
Lower limit of tolerance	78,0		28,7		96,8		21,7		100,1	
Upper limit of tolerance	117,1		43,0		145,3		32,6		150,2	
Type B outliers							1		2	

Laboratory	m-Xylene	Z score	n-Butylacetate	Z score	n-Octane	Z score	Propylbenzene	Z score	Toluene	Z score
Type C outliers			1						1	
Type F outliers	2		3		1		2			
No. of laboratories after elimination of outliers type A-D and F (without laboratories that only gave states but no measured values)	19		17		20		16		18	

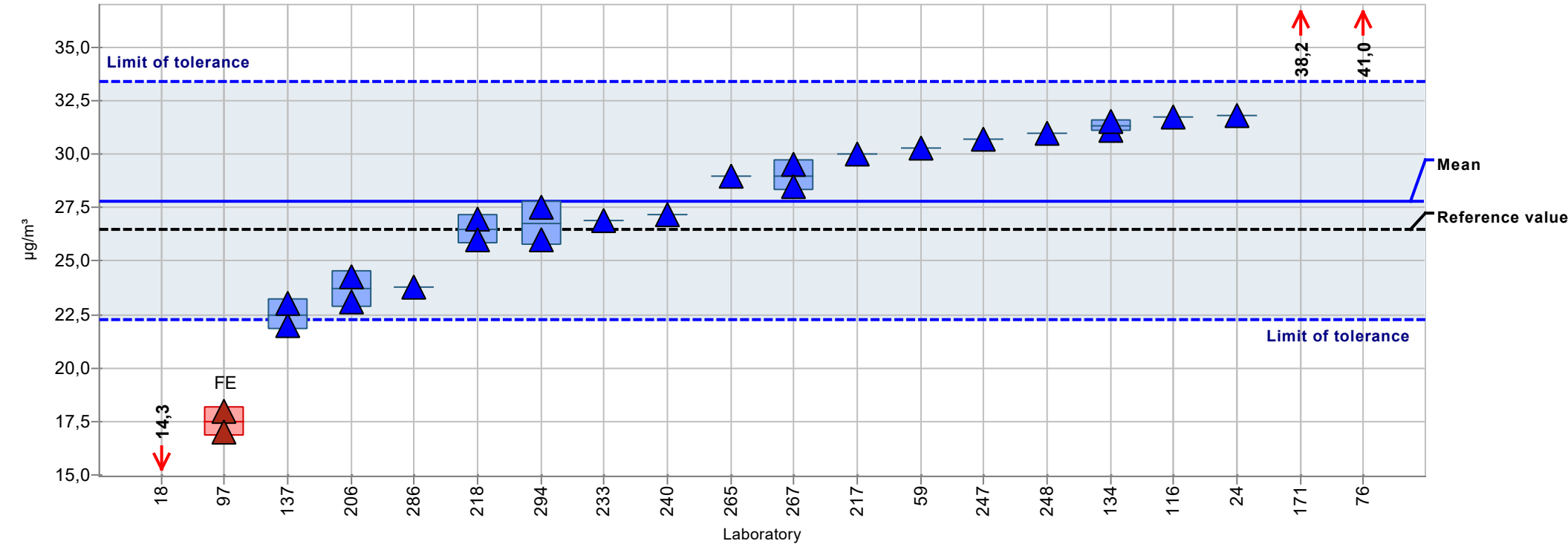
Summary results

Sample:	Sample 1	Mean:	112,7 µg/m³
Measurand:	1-Butanol	Reprod. s.d.:	15,8 µg/m³
Method:	ISO 5725-2	Rel.reprod. s.d.:	14,03%
Rel.target s.d.:	10,00%	Reference value:	120,9 µg/m³
Number of laboratories in calculation + outliers: 19		Range of tolerance:	90,2 - 135,2 µg/m³ (Z-Score <= 2,00)



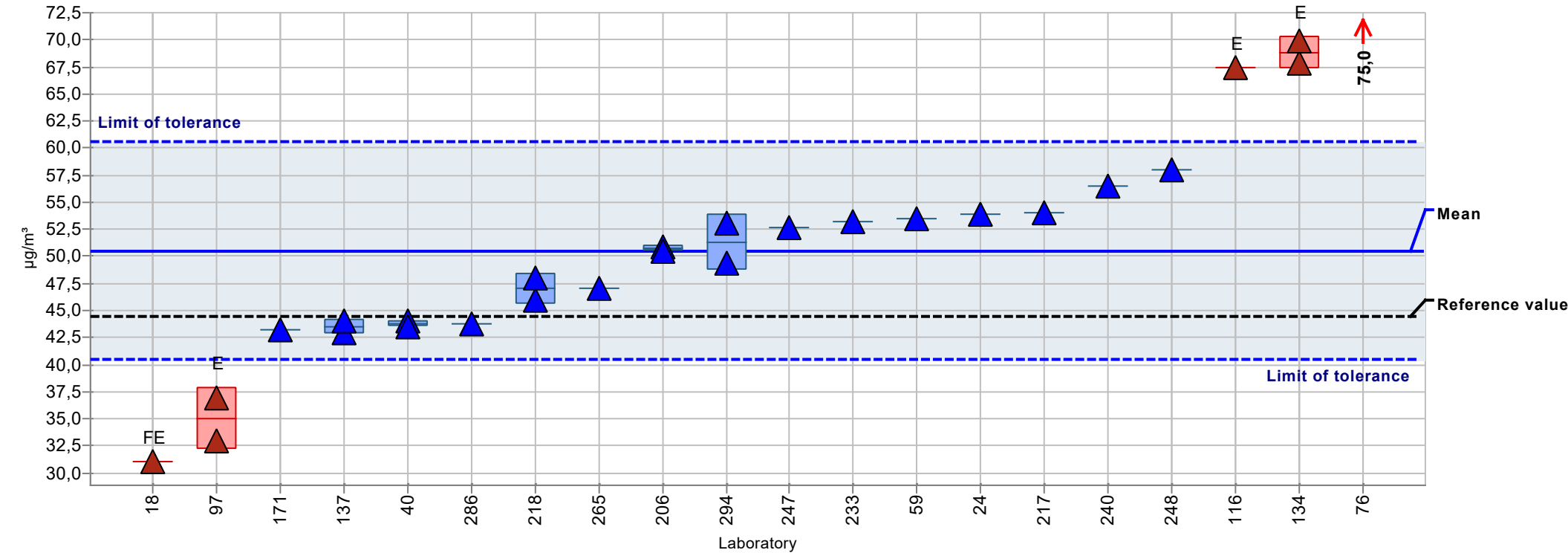
Summary results

Sample:	Sample 1	Mean:	27,8 µg/m³
Measurand:	1,2,4-Trimethylbenzene	Reprod. s.d.:	3,2 µg/m³
Method:	ISO 5725-2	Rel.reprod. s.d.:	11,42%
Rel.target s.d.:	10,00%	Reference value:	26,5 µg/m³
Number of laboratories in calculation + outliers: 20		Range of tolerance:	22,3 - 33,4 µg/m³ (Z-Score <= 2,00)



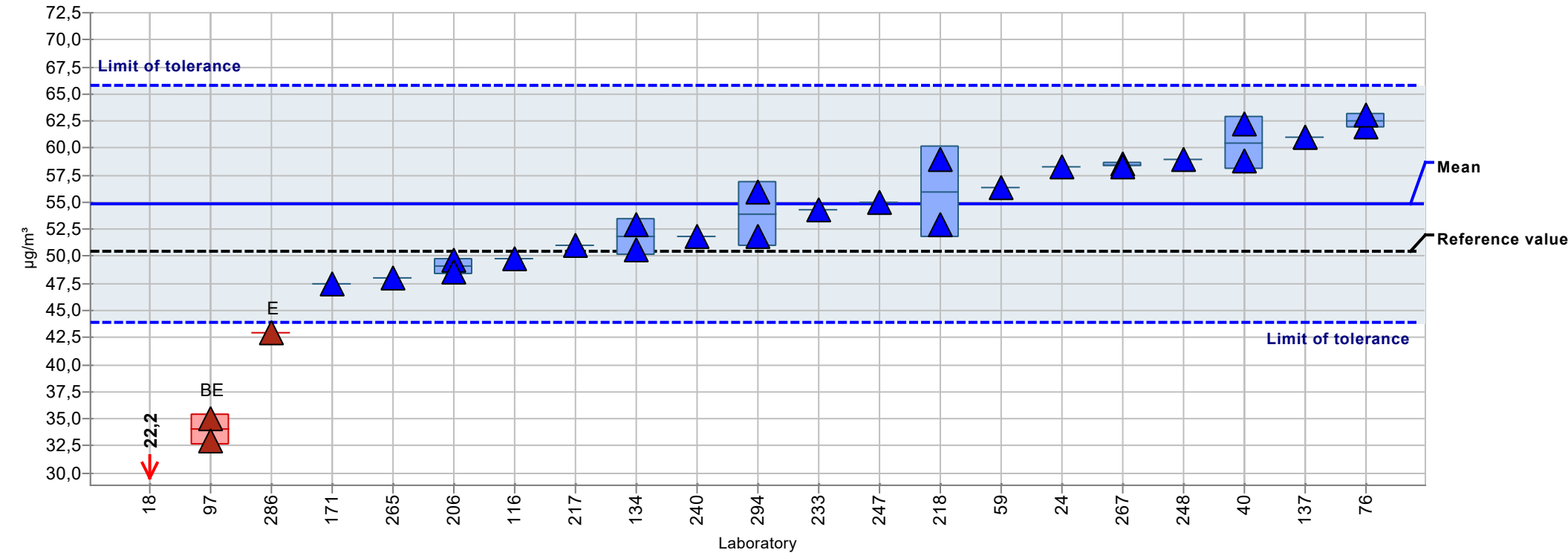
Summary results

Sample:	Sample 1	Mean:	50,5 µg/m³
Measurand:	4-Methyl-2-pentanone	Reprod. s.d.:	9,1 µg/m³
Method:	ISO 5725-2	Rel.reprod. s.d.:	17,92%
Rel.target s.d.:	10,00%	Reference value:	44,4 µg/m³
Number of laboratories in calculation+ outliers: 20		Range of tolerance:	40,4 - 60,6 µg/m³ (Z-Score <= 2,00)



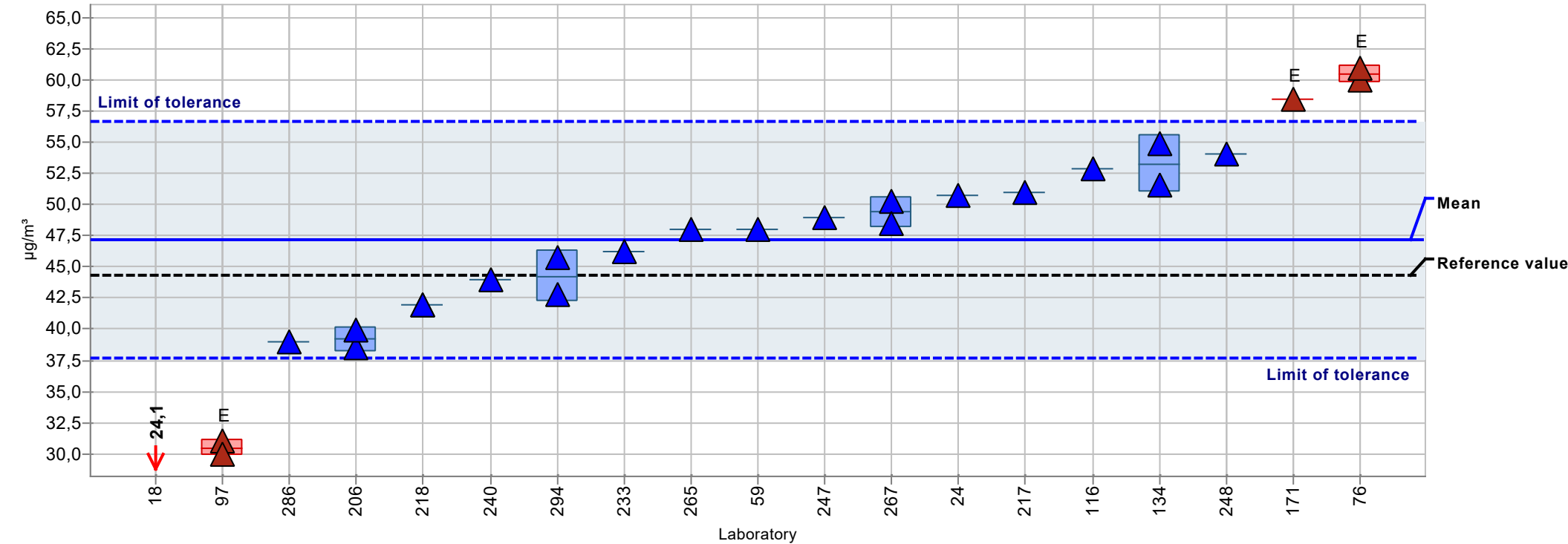
Summary results

Sample:	Sample 1	Mean:	54,8 µg/m³
Measurand:	Benzene	Reprod. s.d.:	5,4 µg/m³
Method:	ISO 5725-2	Rel.reprod. s.d.:	9,80%
Rel.target s.d.:	10,00%	Reference value:	50,5 µg/m³
Number of laboratories in calculation + outliers: 21		Range of tolerance:	43,9 - 65,8 µg/m³ (Z-Score <= 2,00)



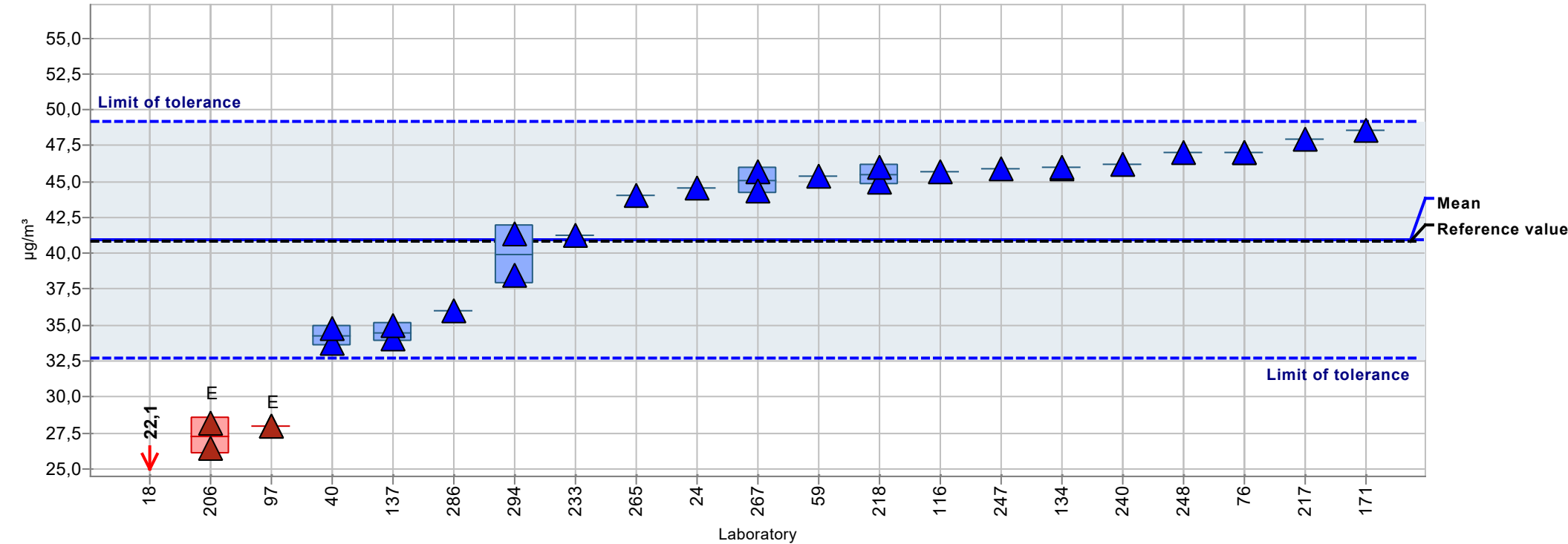
Summary results

Sample:	Sample 1	Mean:	47,2 µg/m³
Measurand:	Cumene	Reprod. s.d.:	8,1 µg/m³
Method:	ISO 5725-2	Rel.reprod. s.d.:	17,07%
Rel.target s.d.:	10,00%	Reference value:	44,3 µg/m³
Number of laboratories in calculation+ outliers: 19		Range of tolerance:	37,7 - 56,6 µg/m³ (Z-Score <= 2,00)



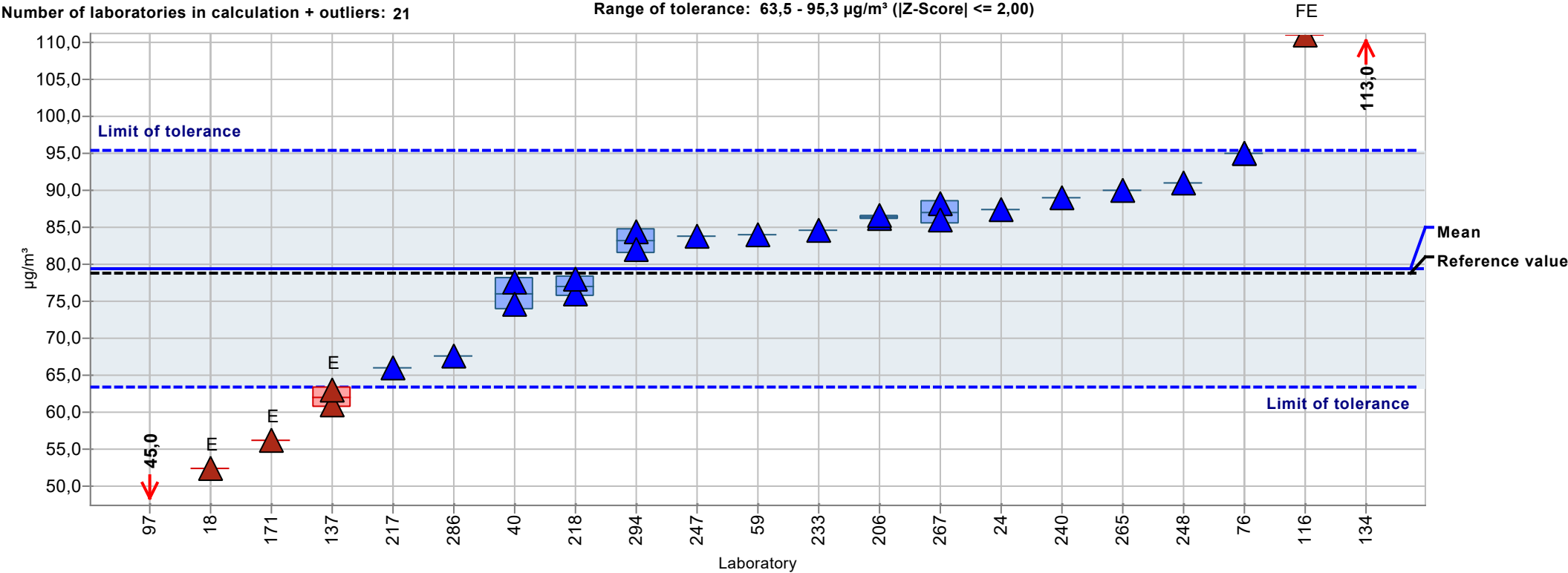
Summary results

Sample:	Sample 1	Mean:	40,9 µg/m³
Measurand:	m-Xylene	Reprod. s.d.:	7,1 µg/m³
Method:	ISO 5725-2	Rel.reprod. s.d.:	17,30%
Rel.target s.d.:	10,00%	Reference value:	40,8 µg/m³
Number of laboratories in calculation+ outliers: 21		Range of tolerance:	32,8 - 49,1 µg/m³ (Z-Score <= 2,00)



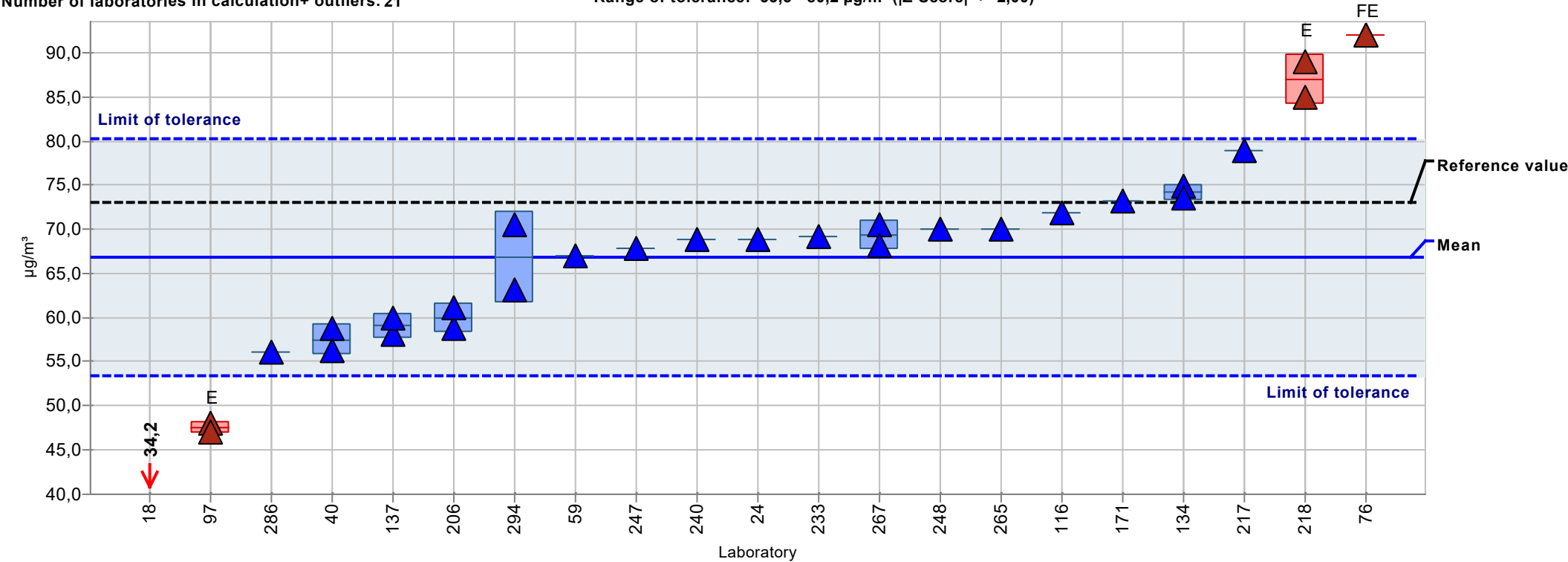
Summary results

Sample:	Sample 1	Mean:	79,4 µg/m³
Measurand:	n-Butylacetate	Reprod. s.d.:	12,1 µg/m³
Method:	ISO 5725-2	Rel.reprod. s.d.:	15,21%
Rel.target s.d.:	10,00%	Reference value:	78,7 µg/m³
Number of laboratories in calculation + outliers: 21		Range of tolerance:	63,5 - 95,3 µg/m³ (Z-Score <= 2,00)



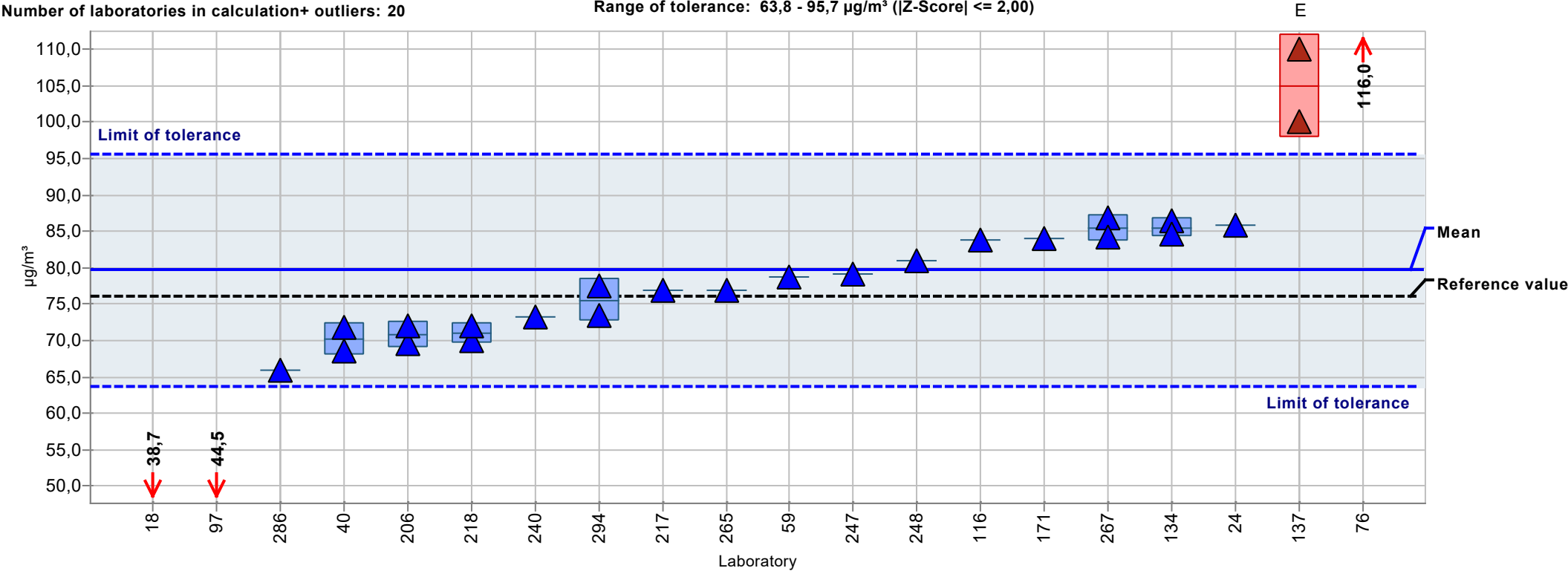
Summary results

Sample:	Sample 1	Mean:	66,8 µg/m³
Measurand:	n-Octane	Reprod. s.d.:	9,9 µg/m³
Method:	ISO 5725-2	Rel.reprod. s.d.:	14,80%
Rel.target s.d.:	10,00%	Reference value:	73,1 µg/m³
Number of laboratories in calculation+ outliers: 21		Range of tolerance:	53,5 - 80,2 µg/m³ (Z-Score <= 2,00)



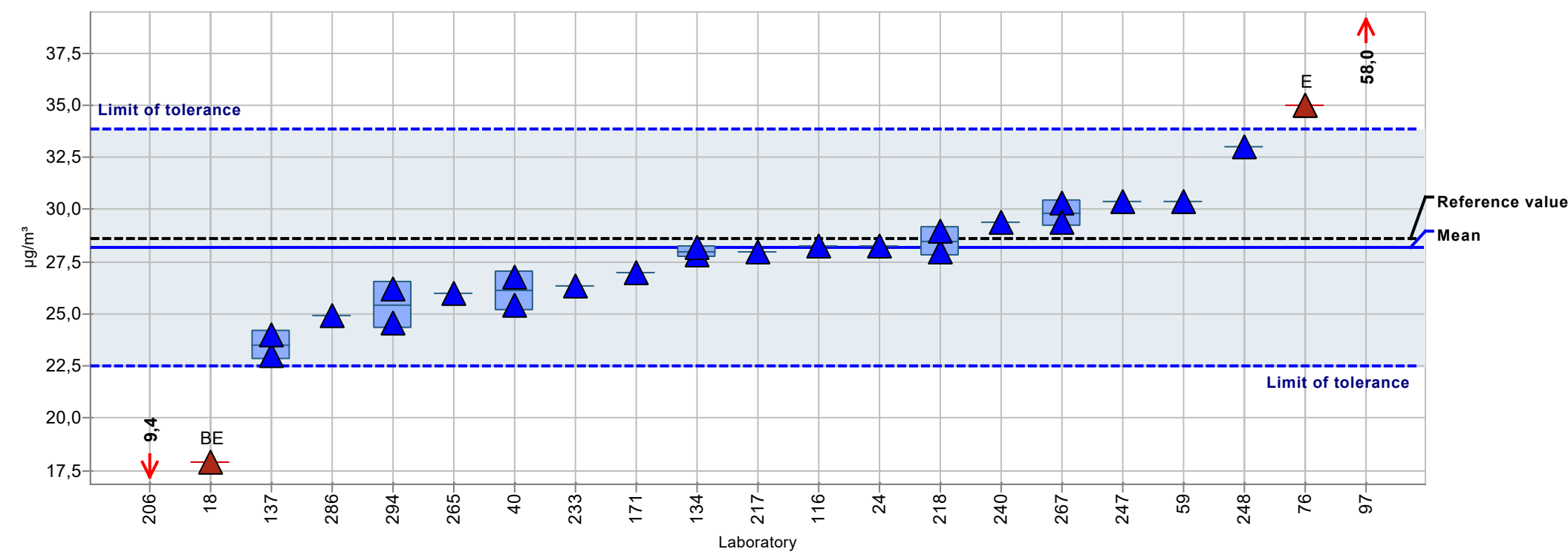
Summary results

Sample:	Sample 1	Mean:	79,7 µg/m³
Measurand:	Propylbenzene	Reprod. s.d.:	10,2 µg/m³
Method:	ISO 5725-2	Rel.reprod. s.d.:	12,79%
Rel.target s.d.:	10,00%	Reference value:	76,1 µg/m³
Number of laboratories in calculation+ outliers: 20		Range of tolerance:	63,8 - 95,7 µg/m³ (Z-Score <= 2,00)



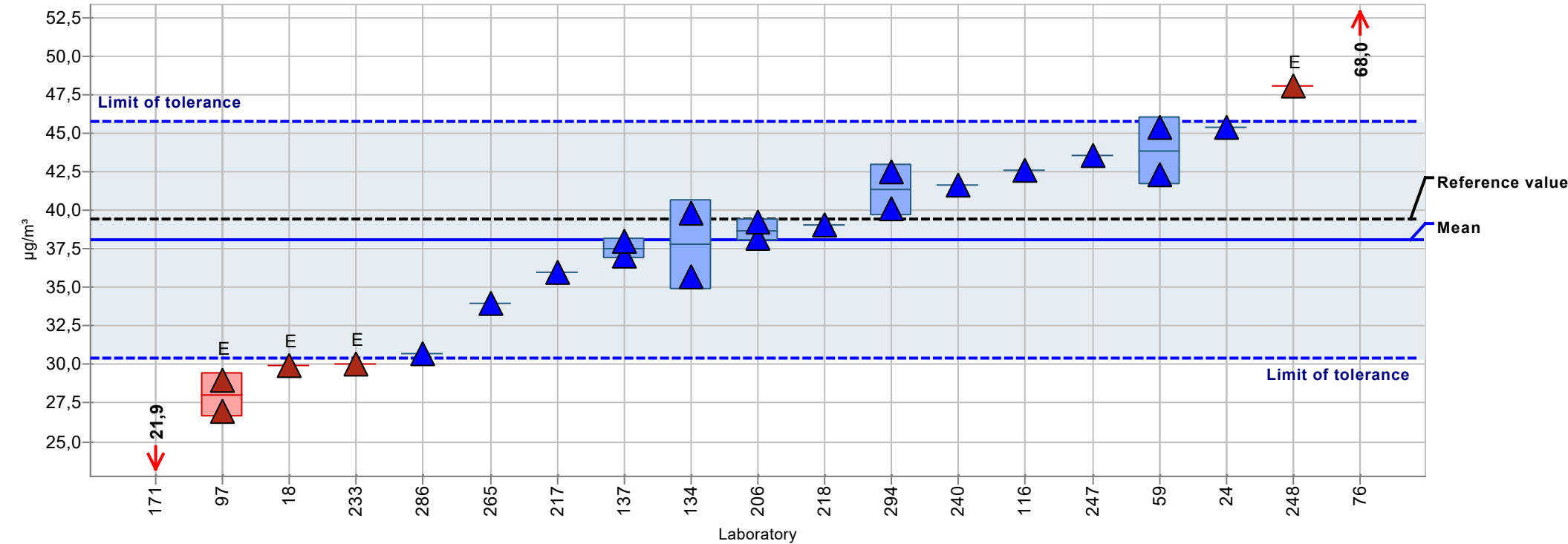
Summary results

Sample:	Sample 1	Mean:	28,2 µg/m³
Measurand:	Toluene	Reprod. s.d.:	3,1 µg/m³
Method:	ISO 5725-2	Rel.reprod. s.d.:	10,99%
Rel.target s.d.:	10,00%	Reference value:	28,6 µg/m³
Number of laboratories in calculation + outliers: 21		Range of tolerance:	22,6 - 33,8 µg/m³ (Z-Score <= 2,00)



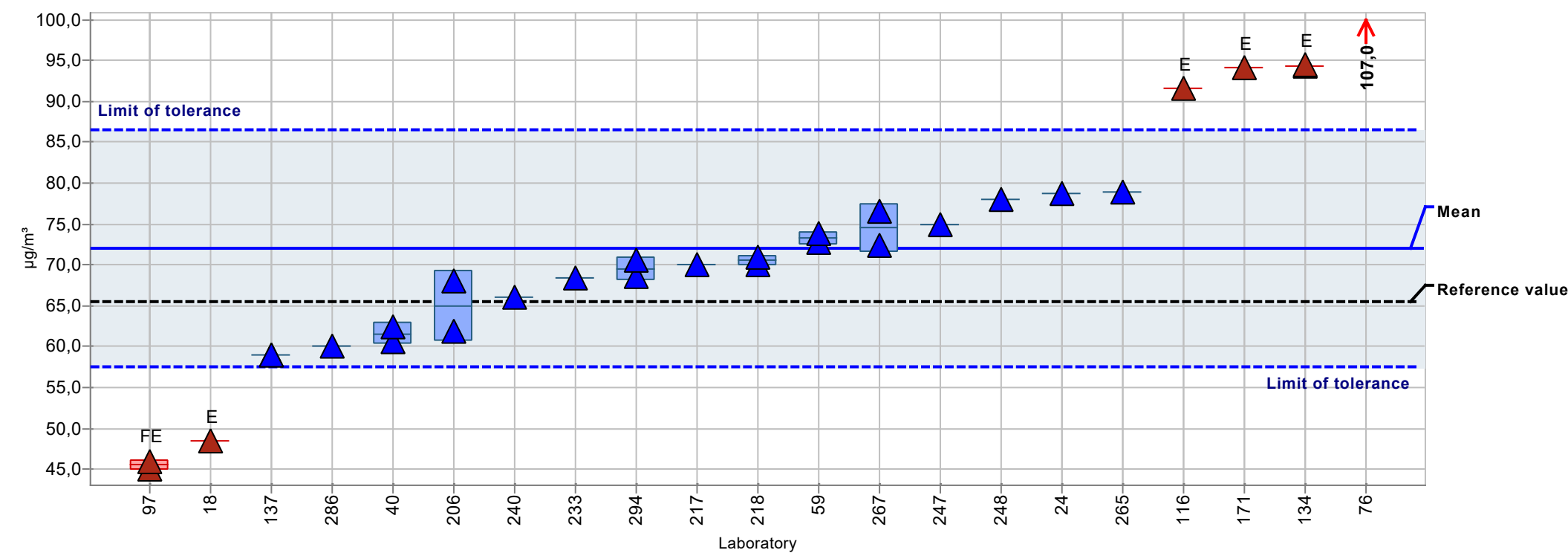
Summary results

Sample:	Sample 2	Mean:	38,1 µg/m³
Measurand:	1-Butanol	Reprod. s.d.:	5,7 µg/m³
Method:	ISO 5725-2	Rel.reprod. s.d.:	15,01%
Rel.target s.d.:	10,00%	Reference value:	39,4 µg/m³
Number of laboratories in calculation + outliers: 19		Range of tolerance:	30,5 - 45,7 µg/m³ (Z-Score <= 2,00)



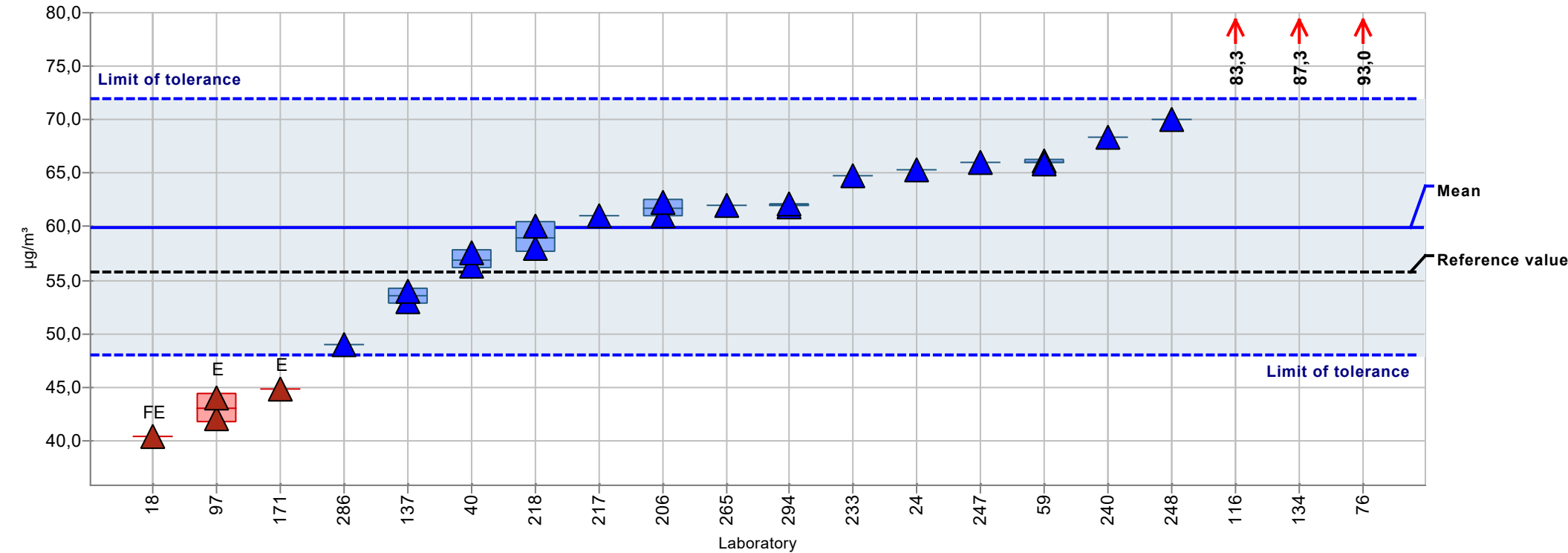
Summary results

Sample:	Sample 2	Mean:	72,0 µg/m³
Measurand:	1,2,4-Trimethylbenzene	Reprod. s.d.:	11,7 µg/m³
Method:	ISO 5725-2	Rel.reprod. s.d.:	16,27%
Rel.target s.d.:	10,00%	Reference value:	65,5 µg/m³
Number of laboratories in calculation + outliers:21		Range of tolerance:	57,6 - 86,4 µg/m³ (Z-Score <= 2,00)



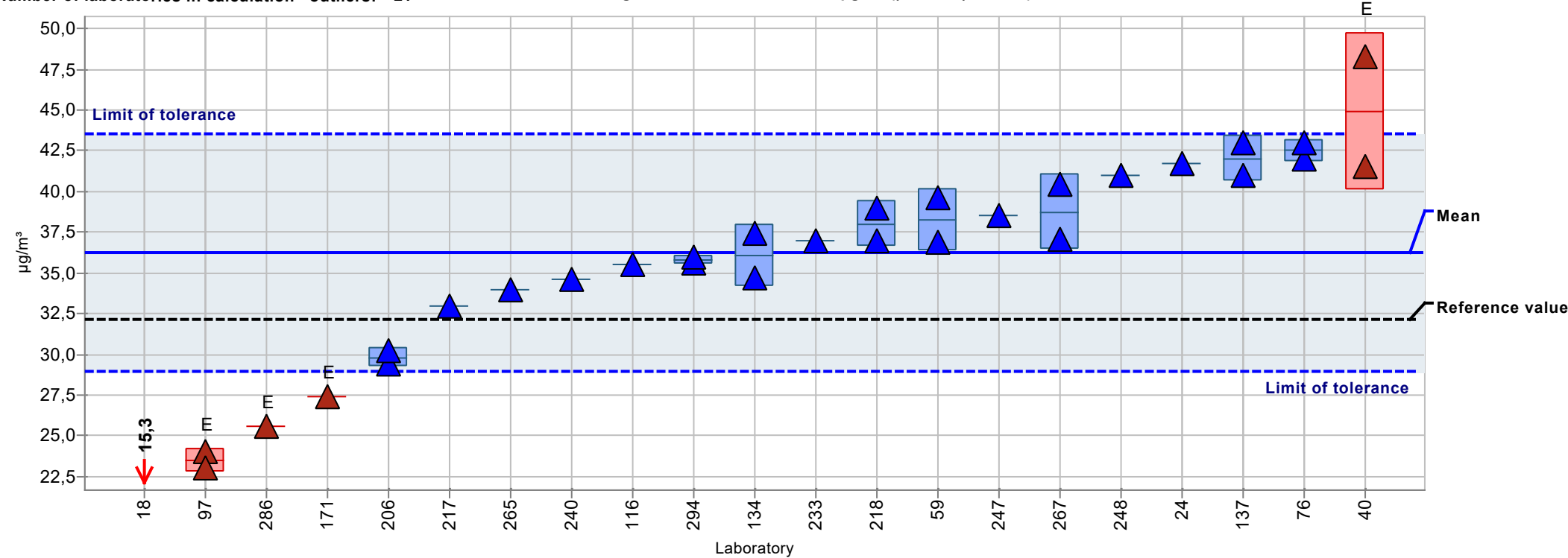
Summary results

Sample:	Sample 2	Mean:	60,0 µg/m³
Measurand:	4-Methyl-2-pentanone	Reprod. s.d.:	9,3 µg/m³
Method:	ISO 5725-2	Rel.reprod. s.d.:	15,49%
Rel.target s.d.:	10,00%	Reference value:	55,8 µg/m³
Number of laboratories in calculation+ outliers: 20		Range of tolerance:	48,0 - 72,0 µg/m³ (Z-Score <= 2,00)



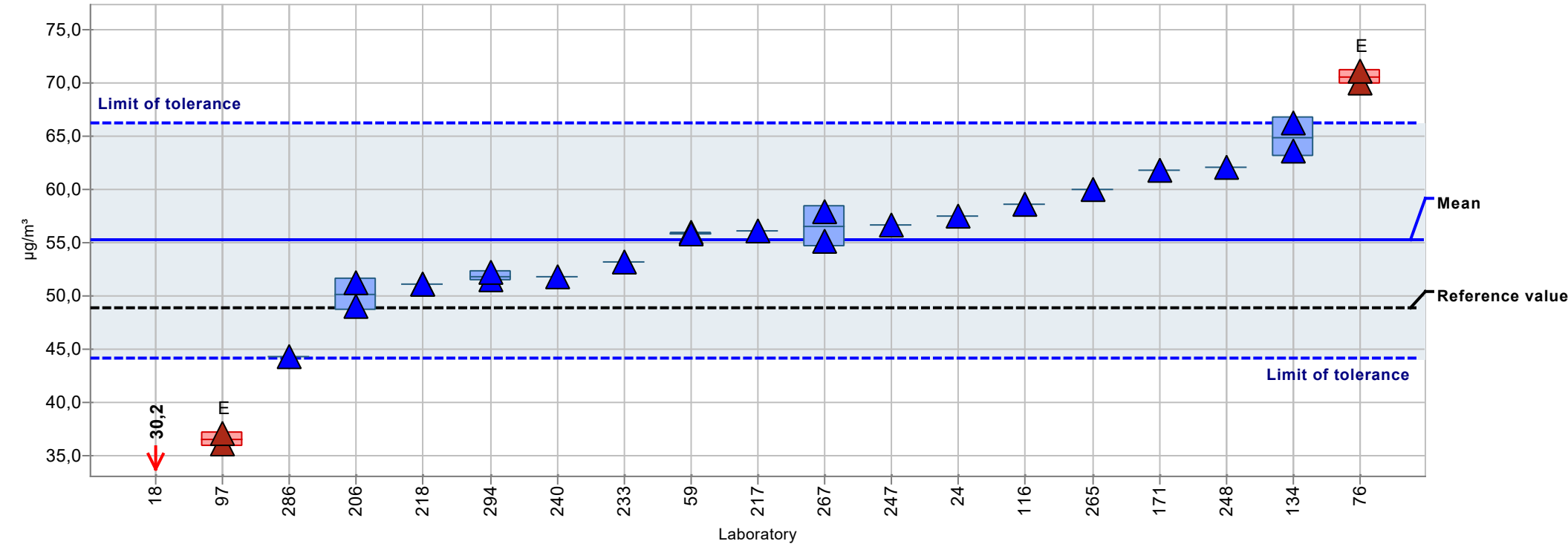
Summary results

Sample:	Sample 2	Mean:	36,2 µg/m³
Measurand:	Benzene	Reprod. s.d.:	6,0 µg/m³
Method:	ISO 5725-2	Rel.reprod. s.d.:	16,68%
Rel.target s.d.:	10,00%	Reference value:	32,1 µg/m³
Number of laboratories in calculation+ outliers:	21	Range of tolerance:	29,0 - 43,5 µg/m³ (Z-Score <= 2,00)



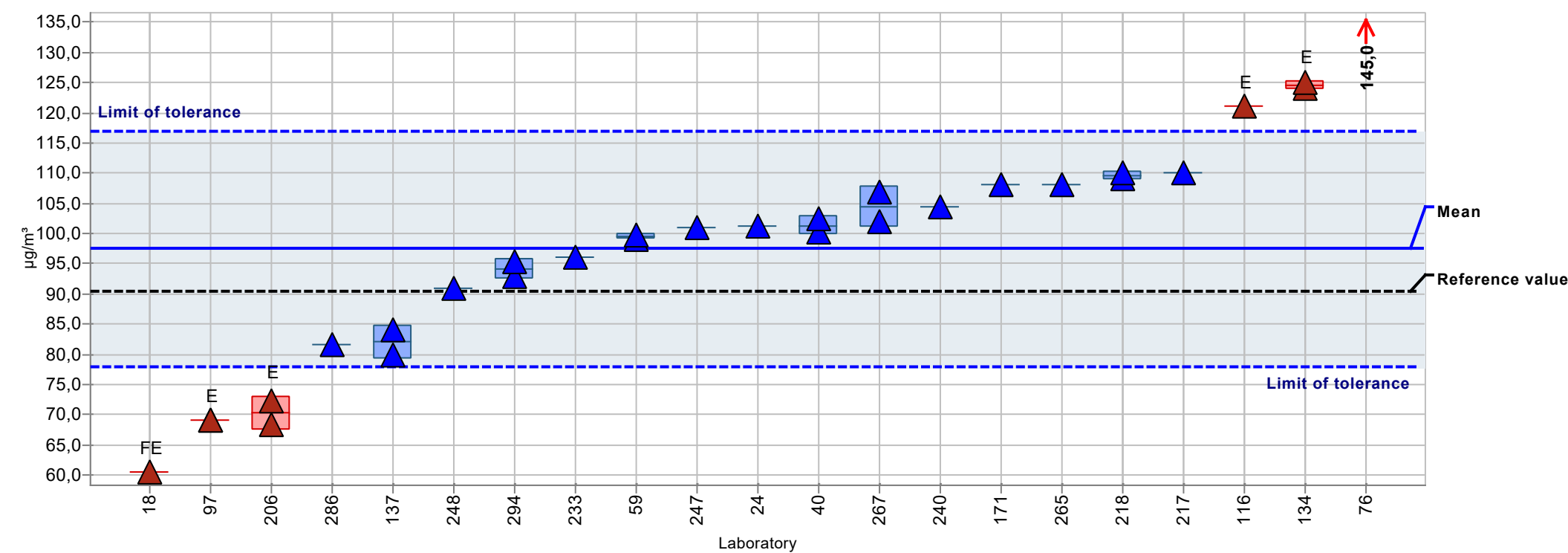
Summary results

Sample:	Sample 2	Mean:	55,2 µg/m³
Measurand:	Cumene	Reprod. s.d.:	8,5 µg/m³
Method:	ISO 5725-2	Rel.reprod. s.d.:	15,32%
Rel.target s.d.:	10,00%	Reference value:	48,8 µg/m³
Number of laboratories in calculation+ outliers:	19	Range of tolerance:	44,2 - 66,3 µg/m³ (Z-Score <= 2,00)



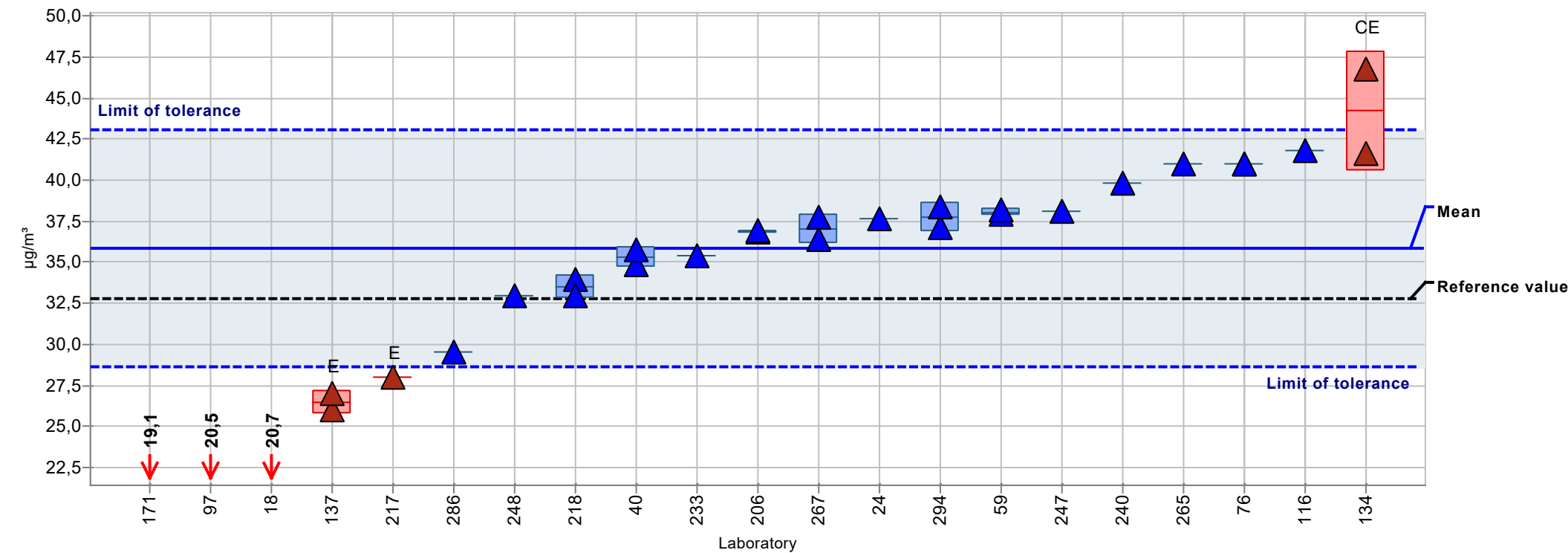
Summary results

Sample:	Sample 2	Mean:	97,6 µg/m³
Measurand:	m-Xylene	Reprod. s.d.:	16,1 µg/m³
Method:	ISO 5725-2	Rel.reprod. s.d.:	16,49%
Rel.target s.d.:	10,00%	Reference value:	90,5 µg/m³
Number of laboratories in calculation+ outliers: 21		Range of tolerance:	78,0 - 117,1 µg/m³ (Z-Score <= 2,00)



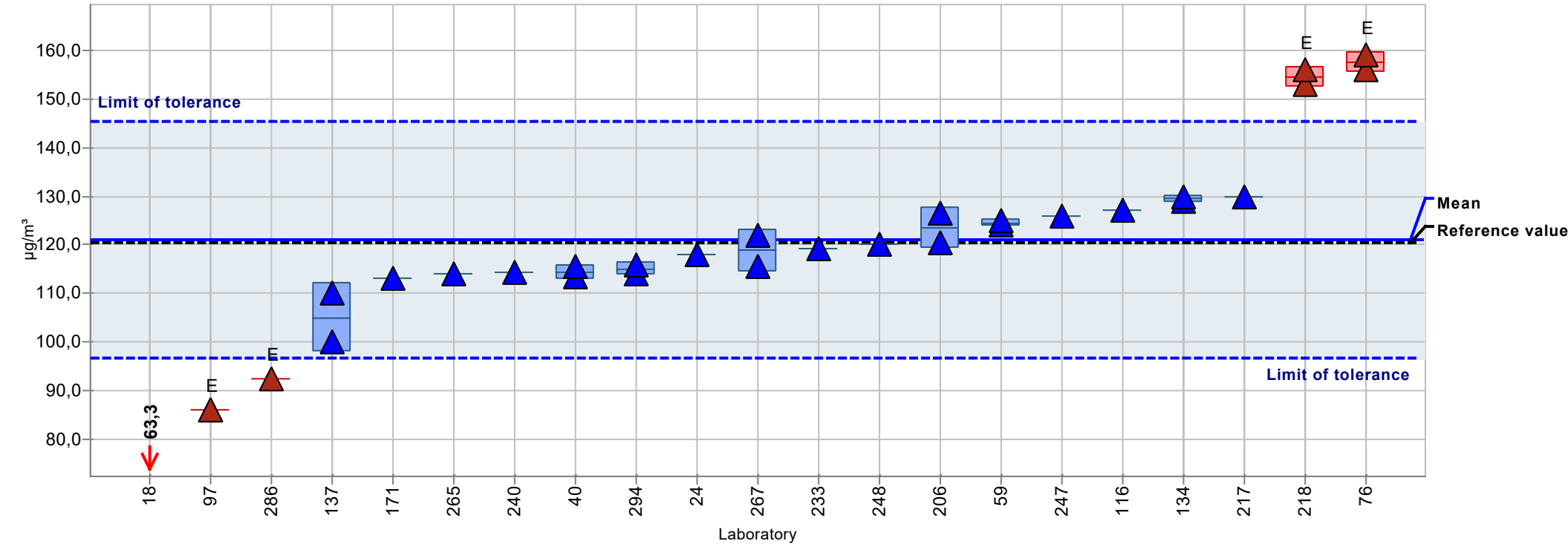
Summary results

Sample:	Sample 2	Mean:	35,9 µg/m³
Measurand:	n-Butylacetate	Reprod. s.d.:	4,4 µg/m³
Method:	ISO 5725-2	Rel.reprod. s.d.:	12,38%
Rel.target s.d.:	10,00%	Reference value:	32,8 µg/m³
Number of laboratories in calculation + outliers: 21		Range of tolerance:	28,7 - 43,0 µg/m³ (Z-Score <= 2,00)



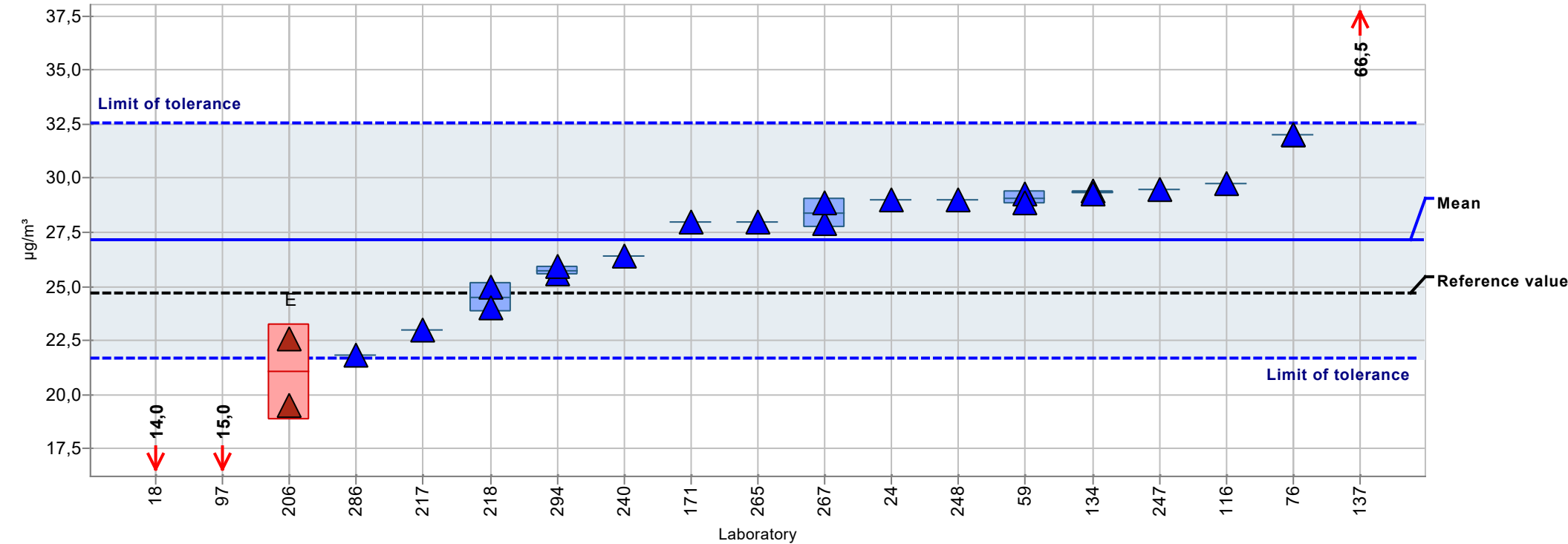
Summary results

Sample:	Sample 2	Mean:	121,0 µg/m³
Measurand:	n-Octane	Reprod. s.d.:	18,3 µg/m³
Method:	ISO 5725-2	Rel.reprod. s.d.:	15,08%
Rel.target s.d.:	10,00%	Reference value:	120,5 µg/m³
Number of laboratories in calculation + outliers: 21		Range of tolerance:	96,8 - 145,3 µg/m³ (Z-Score <= 2,00)



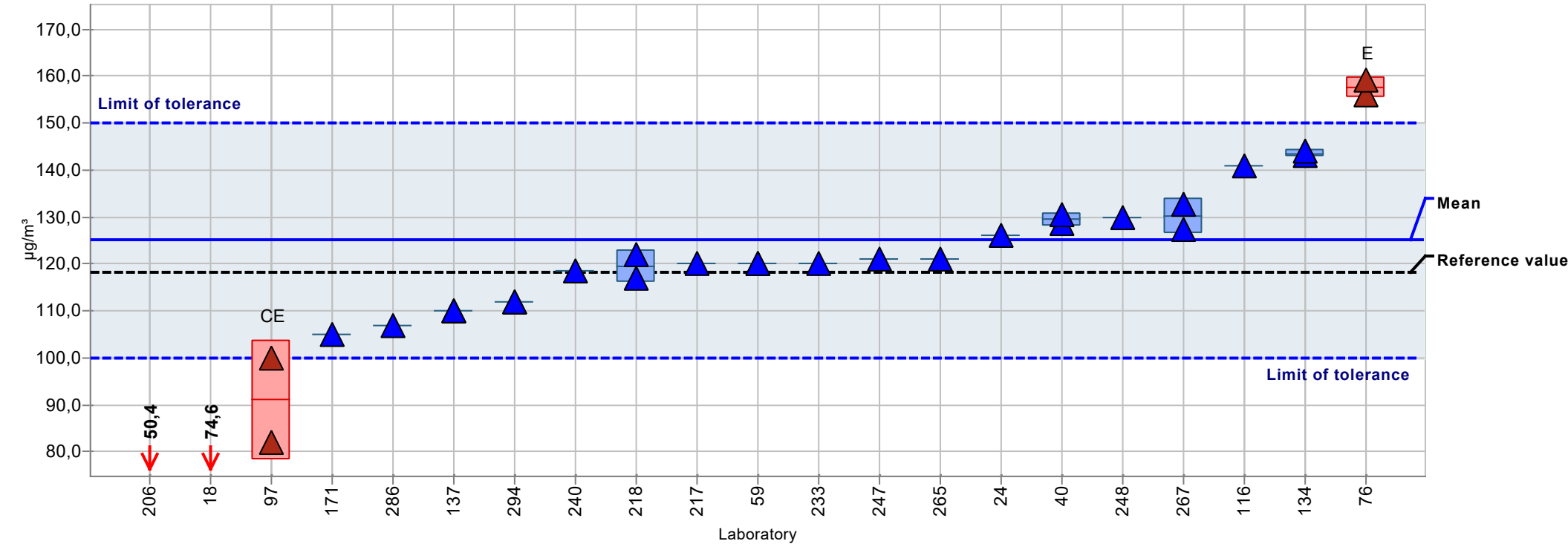
Summary results

Sample:	Sample 2	Mean:	27,2 µg/m³
Measurand:	Propylbenzene	Reprod. s.d.:	3,3 µg/m³
Method:	ISO 5725-2	Rel.reprod. s.d.:	12,13%
Rel.target s.d.:	10,00%	Reference value:	24,7 µg/m³
Number of laboratories in calculation + outliers: 19		Range of tolerance:	21,7 - 32,6 µg/m³ (Z-Score <= 2,00)



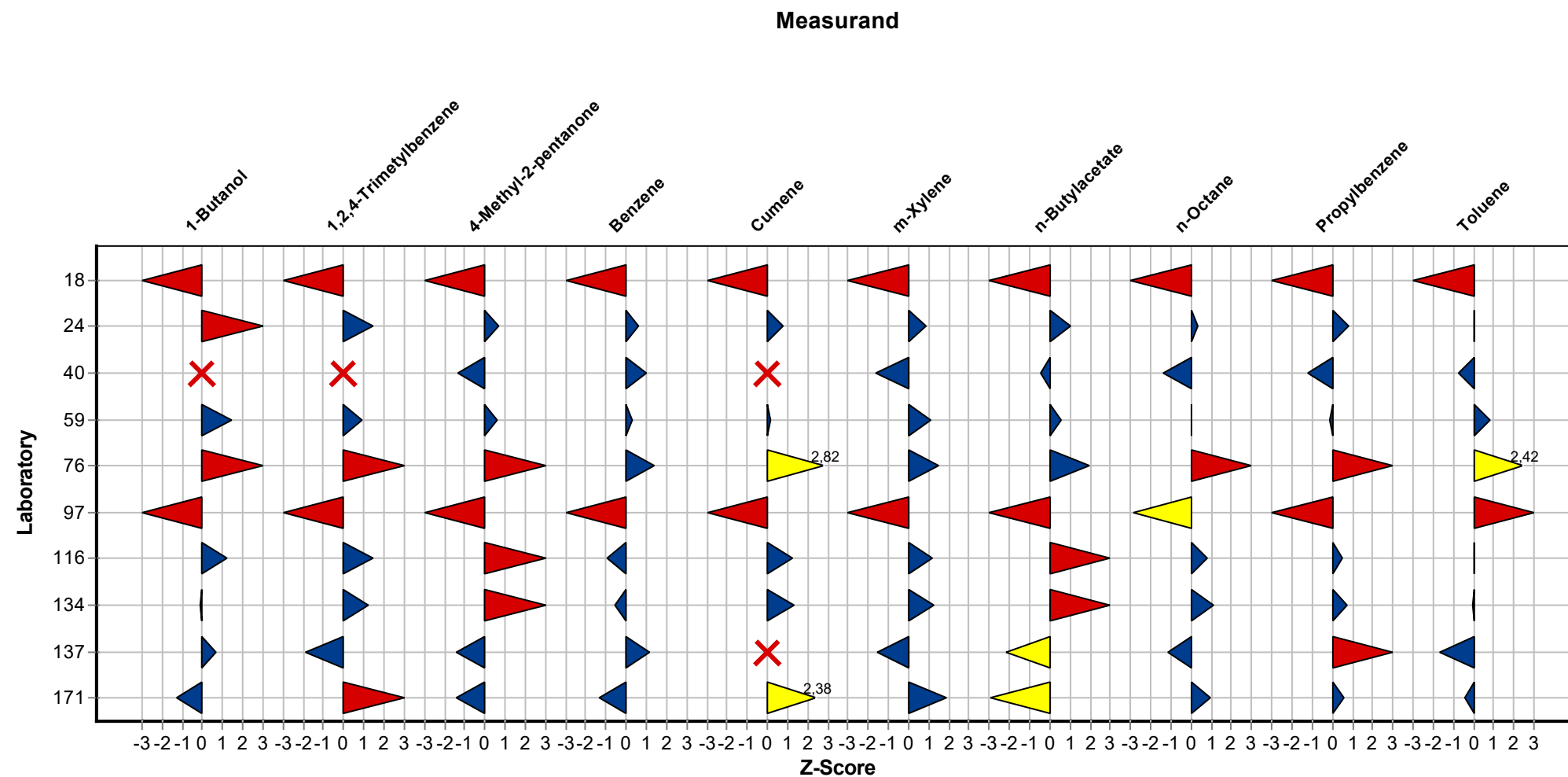
Summary results

Sample:	Sample 2	Mean:	125,1 µg/m³
Measurand:	Toluene	Reprod. s.d.:	14,2 µg/m³
Method:	ISO 5725-2	Rel.reprod. s.d.:	11,38%
Rel.target s.d.:	10,00%	Reference value:	118,1 µg/m³
Number of laboratories in calculation + outliers: 21		Range of tolerance:	100,1 - 150,2 µg/m³ (Z-Score <= 2,00)



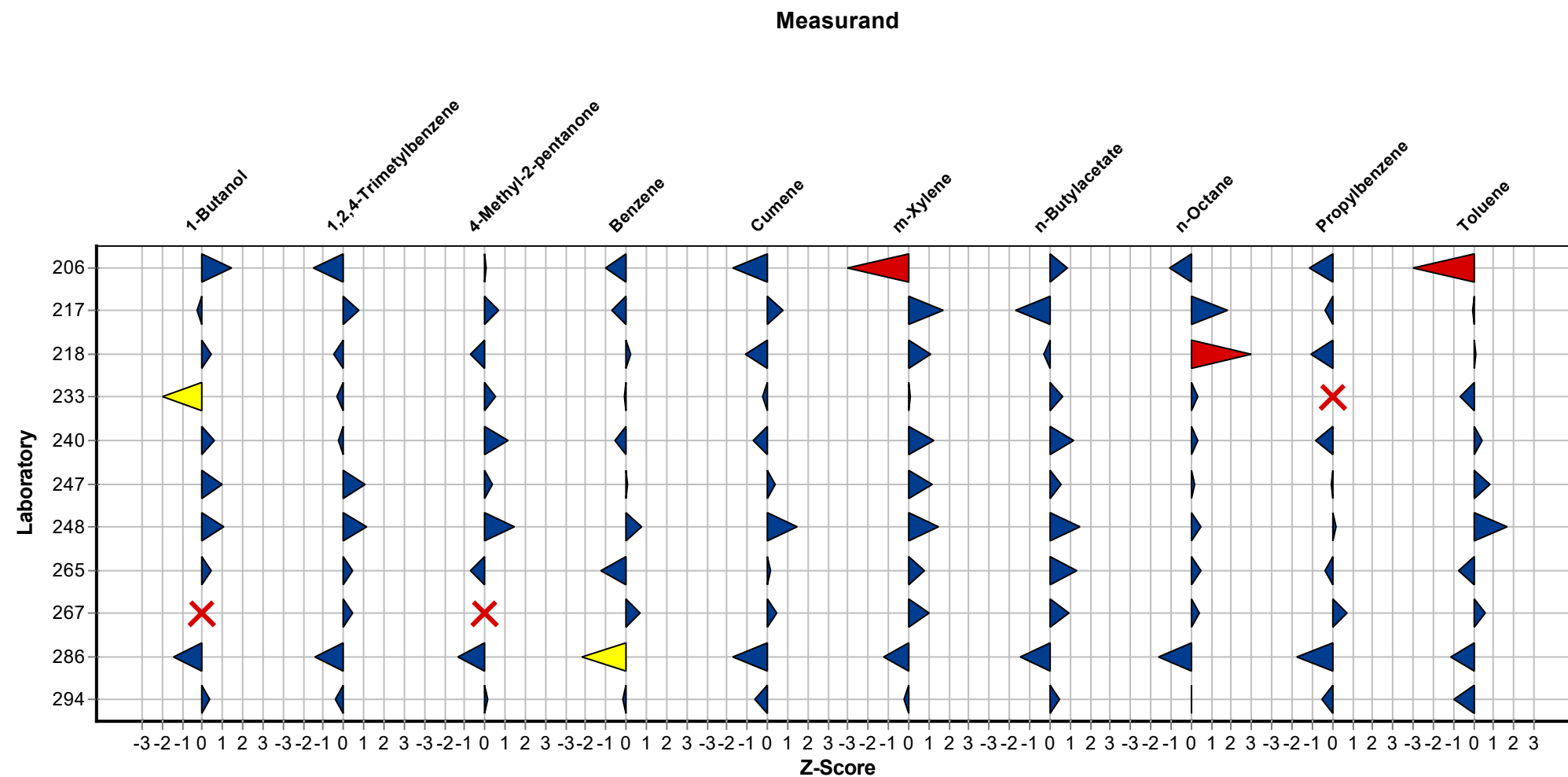
Sample chart of Z-scores

Sample Sample 1



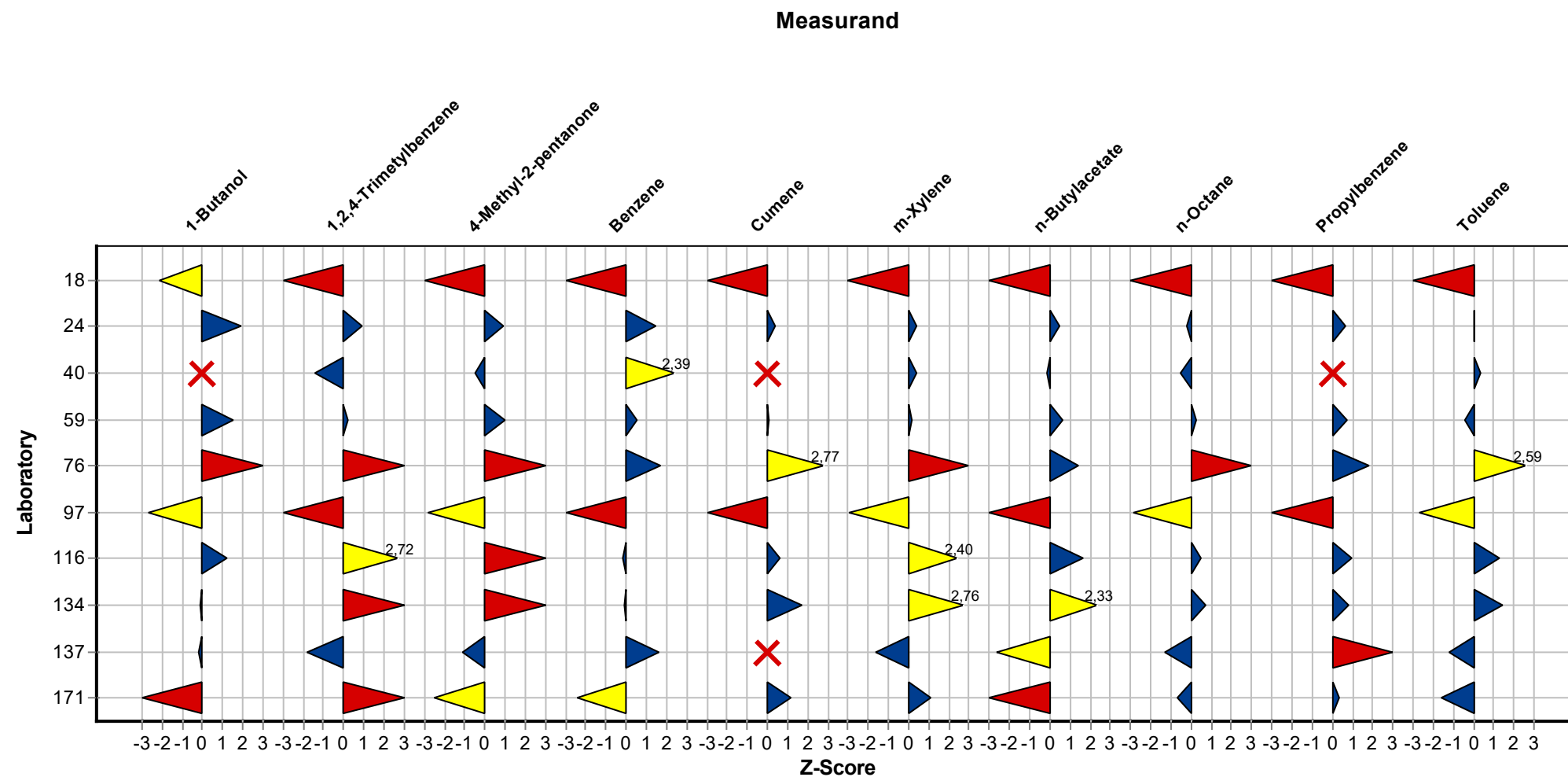
Sample chart of Z-scores

Sample Sample 1



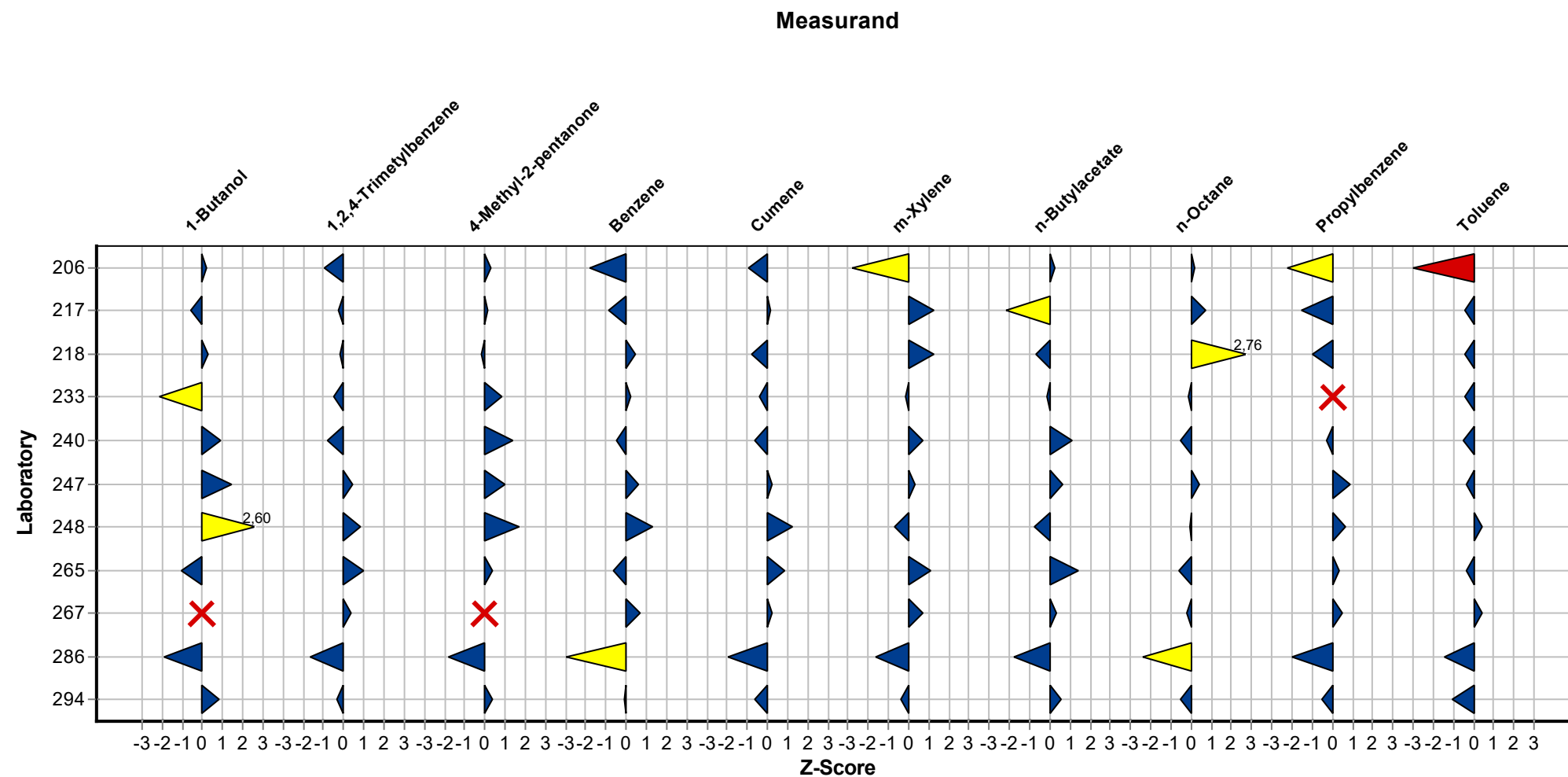
Sample chart of Z-scores

Sample Sample 2



Sample chart of Z-scores

Sample Sample 2



Summary of laboratory test results

Sample Blank value

Laboratory	1-Butanol	1,2,4-Trimethylbenzene	4-Methyl-2-pentanone	Benzene	Cumene	m-Xylene	n-Butylacetate	n-Octane	Propyl benzene	Toluene
Unit	µg/m³	µg/m³	µg/m³	µg/m³	µg/m³	µg/m³	µg/m³	µg/m³	µg/m³	µg/m³
18						0,7				1,7
24	0,0	0,4	0,0	2,3	0,0	0,9	0,0	0,5	0,0	0,0
40		0,0	0,0	4,2		0,0	0,0	0,0	0,0	3,1
59	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0
76	< 2,0	< 2,0	< 2,0	< 2,0	< 2,0	< 2,0	< 2,0	< 2,0	< 2,0	< 2,0
97	< 1,0	< 1,0	1,0	< 1,0	< 1,0	< 1,0	< 1,0	< 1,0	< 1,0	8,5
116	2,8	0,8	< 0,5	< 0,5	< 0,5	1,6	1,3	< 0,5	< 0,5	1,7
134	0,8	< 0,5	< 0,5	< 0,5	< 0,5	< 0,5	< 0,5	< 0,5	< 0,5	< 0,5
171	< 1,0	< 1,0	< 1,0	< 2,0	< 1,0	< 1,0	< 1,0	< 1,0	< 1,0	< 1,0
218	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0
240	< 0,5	0,6	< 0,5	< 0,5	< 0,5	1,5	1,1	< 0,5	< 0,5	< 0,5
248	< 1,0	2,0	< 1,0	< 1,0	< 1,0	4,0	< 1,0	< 1,0	< 1,0	3,0
265	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0
267		< 1,7		< 1,7	< 1,7	< 1,7	< 1,7	< 1,7	< 1,7	< 1,7
286	< 2,0	< 2,0	< 2,0	< 2,0	< 2,0	< 2,0	< 2,0	< 2,0	< 2,0	< 2,0
294	< 2,0	< 2,0	< 2,0	< 2,0	< 2,0	< 2,0	< 2,0	< 2,0	< 2,0	< 2,0
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No. of laboratories that submitted results	13	15	14	15	14	16	15	15	15	16

Questions and Answers

Participant	Sample carrier	Sampling pump	Volume flow
24	Gerstel Tenax TA	BiVOC2V2	0,1 - 0,2 mL/min
40	Metallröhrchen mit Tenax von Markes	Gilian LFS-113DC	50 mL/min
59	TDS-Tenax Sigma A	BiVOC V2	0.1
76	Edelstahl, Tenax TA, Supelco	Holbach BiVOC2	0,1 l/min
97	Tenax TA, diverse Hersteller	Holbach BiVOC2, GSA SG350ex	0,1 l/min
116	Tenax TA Supelco	Gilian	0,1L/min
134	Tenax TA (Supelco	Airchecksampler 224-PCXR8	0,1l/min
137	Tenax, SUPELCO	M1: BiVOC2; M2: Gilian GilAir Plus	0,1 L/min
171	Tenax TD tube	GilAir plus	0.2 l/m
206	Tenax TA, CAMSCO	SKC 224-PCEX8	100 ml/Min
217	TENAX	Gilair Plus	160 ml/min
218	Edelstahlröhrchen 3,5", TenaxTA, Markes International	SKC Pocket Pump Touch	75-160 mL/min
233	Tenax TA von Markes	DESAGA GS301 und Gilian GilAir Plus	0,1 L/min
240	Tenax TA, 60/80 mesh, FA Supelco	SKC AirCheck TOUCH, Model 220-500TC	120 mL/min
247	Tenax TA	BiVOC2v2 2-kanlaig Fa. Holbach GmbH	0,1L/min
248	Tenax TA Röhrchen	GSA SG 350	ca. 80 mL/min
265	Tenax TA	BiVOC V2	0,1 L/min
267	Stainless Steel tubes filled with Tenax TA (ref. C1-AXXX-5003, Markes International)	Gilian GilAir plus	125mL/min
286	Tenax TA	LFS 113 (ex) von Sensidyne	Messung 1: 60 ml/min ; Messung 2: 52 ml/min
294	TENAX TA	Gilian GilAir PLUS	0,065 L/min

Participant	Volume flow measurement	Sampling time	Analytical method	Thermal desorber
24	BiVOC2V2	10-40 Min	DIN ISO 16000-6	Gerstel TD 3.5+
40	Drycal DC Lite	52	Hausmethode, angelehnt an DIN ISO 16000-6	Markes - TD-100xr
59	BiVOC V2	30	DIN ISO 16000-6	
76	Holbach BiVOC2 (intern)	30 min	DIN EN ISO 16000-6	Perkin Elmer TurboMatrix 650
97	Defender 510L	30 Minuten	DIN ISO 16000-6	Markes TD100-xr
116	Defender	20-40	DIN ISO 16000-6	TD30R (Shimadzu)
134	Flowmeter 35810 MLW (Analyt MTC)	30min, 20min	DIN ISO 16000-6	TD30R (Shimadzu)
137	Trockenkolbenkalibrator Defender 520	40	DIN ISO 16000-6	
171	TSI 4100 Series	25	DIN ISO 16000-6 :2011	
206	BIOS Defender 510	20 Min	16000-6	Perkin Elmer ATD

Volatile organic compounds -VOC- with thermal desorption with own sampling 2024

Participant	Volume flow measurement	Sampling time	Analytical method	Thermal desorber
217	TSI 4146	ca. 31-32	16000-6	
218	Analyt-MTC, 35809MLWB	15 - 30 min	DIN ISO 16000-6:2022-03	Markes TD-100
233	Aalborg GFM17	20	DIN 16000-6	Markes TD100-xr
240	red-y compact series by vögtlin	25	DIN ISO 16000-6	Shimadzu TD30-R
247	Flowmeter Bronkhorst Mättig GmbH	30 min	DIN ISO 16000-6	Gerstel TD 3.5+
248	SKC Gilibrator 3, Messzelle bis 450 mL/min	ca. 30 Minuten	DIN ISO 16000-6:2022-03	Markes Unity TD100
265	Massenflussmesser von Bronkhorst	20	DIN ISO 16000-6	Shimadzu TD30
267	Gilian Gilibrator 3	25	ISO 16000-6	Markes Unity-xr
286	Gilibrator II Volumenstrom Kalibrator von Sensidyne	Messung 1: 60 Minuten ; Messung 2: 30 Minuten	DIN ISO 16000-6	Perkin Elmer TurboMatrix 650
294	Rotameter, Rota Yokogawa	30	DIN ISO 16000-6	Turbomatrix 650, Perkin Elmer

Participant	Desorption temperature	Cryo trap
24	260°C	-150°C / 280°C
40	250°C	10°C Kühlfalltemperatur, maximale Heiztemperatur sind 280 °C
76	280°C	-30°C, 280°C
97	-	-
116	250°C	-20°C/250°C
134	250°C	-20°C/250°C
206	260°C	-30°C - 270°C
218	300 °C	-5 °C / 320 °C
233	280°C	-10°C auf 320°C
240	270 °C	-20 °C auf 270 °C
247	270°C	-30°C / 270°C
248	330°C	-25°C und 300°C
265	290 °C	-17 °C / 290 °C
267	280°C	-5°C -300°C
286	270°C	-20°C / 290°C
294	280°C	-30°C auf 290°C

Participant	Gas chromatograph (GC)	Carrier gas	Carrier gas flow
24	Agilent GC 7890 B	Helium	1,3 mL/min
40	7890B	He	2,25
59	HP-5-MS	Helium	
76	Agilent GC/MS 7890A/5975C Triple-Axis	Helium	12,21 ml/min

Volatile organic compounds -VOC- w ith thermodesorption with own sampling 2024

Participant	Gas chromatograph (GC)	Carrier gas	Carrier gas flow
97	SHIMADZU-GC-2010 Plus	Helium	-
116	GCMS-QP2020 (Shimadzu)	Helium	1,2
134	GCMS-QP2020 (Shimadzu)	Helium	1,2
171	HP-6890-GCMS_17-5975		
206	Agilent 8790	Helium	1,2 ml/Min
217	GC-MS (MARKES TD100-xr, Shimadzu GC-MS QP 2010 Ultra bzw. Shimadzu GC-MS-QP2020, 60 m Säule		
218	Agilent 7890A	Helium	1,4 mL/min (Säulenfluss)
233	Agilent GC 7890A	Helium	1,5 mL/min
240	Shimadzu GC-2010	Helium	1,86
247	Agilent 7890 B	Helium	1,2
248		Helium	1,2 mL/min
265	Shimadzu QP2020	Helium	2,46 ml/min
267	Agilent 8890	Helium	1,77mL/min
286	Agilent 7890A	Helium	1,5
294	Agilent 6890N	Helium	1 ml/min

Participant	Analytical column	Detector
24	Agilent Ultra 2	Agilent MSD 5977B
40	Rxi-1ms 60m 0,25 mmID, 1µm	MS
59		EI
76	Agilent J&W Scientific 30 m HP 5 (0,25 mm / 0,25 µm)	MS
97	OPTIMA 5 MS Accent MN	SHIMADZU GCMS-QP2020
116	Rtx-5MS 30m, 0,25mmID, 1µmFD (Restek)	Massenspektrometer/FID
134	Rtx-5MS 30m, 0,25mmID, 1µmFD (Restek)	Massenspektrometer/FID
206	Restek Rtx-5	MS
218	DB-5 MS/UI	Agilent 5975C
233	HP-5ms 5%Phenyl	Agilent 5975C MSD
240	TG-5MS (60m x 0,25 mm x 0,25 µm)	Massenspektrometer
247	Optima 5 MS	MSD 5977 B, Agilent
248	DB 5	MS Agilent 5975
265	Agilent VF-5MS	MS
267	HP Innowax 60m x 0.32mm x 0.5µm, Agilent Technologies (ref: 19091M-216)	Mass spectrometer (scan mode for acquisition)
286	RTX-200	MSD
294	Restek RTX200	MSD

Volatile organic compounds -VOC- with thermodesorption with own sampling 2024

Participant	Data evaluation	Recovery rate	Date of Analysis
24	Quantifizierung mittels 2 Punkt Kalibrierung mit externem Standard, Identifikation über Retentionszeit und Massenspektren	nein	11.10. + 14.10.2024
40	MS, interne Standard Methode	nein	16.09.2024
59	Retentionszeiten und computergestützter Vergl. aufgenommener Massenspektren mit Biblio		1.10.2024
76	Quantifizierung über externe Standards, Identifizierung über Datenbank und Retentionszeiten der externen Standards	Nein	23.09.2024
97	mit externen Standards	nein	16.09.2024
116	MS: interne Standardmethode	nein	17.10.2024
134	Identifizierung über Retentionszeit und Target/Qualifier, Kalibrierung substanzspezifisch MS: interne Standardmethode, FID externe Standardmethode	nein	24.9.2024
137			20.09.2024
171			21.09.2024-30.09.2024
206	externe Standards, MS	ja	September
217			2.10.2024
218	Externe Kalibrierung SCAN/SIM	Nein	02.10.2024
233	Quantifizierung über externe 6-Punkt-Kalibrierung mit ISTD, Identifikation mit MS und Retentionszeit	nein	13.9.-24.10.2024
240	Quantifiziert durch 5 Punkt Kalibrierung (TIC und spezifische Massenspur), Identifiziert anhand der Retentionszeit und des MS-Spektrums	nein	11.09.2024
247	stoffspezifisch: Vergleichsspektrum + Retentionszeit	nein	01.10.2024
248	EIC Originalreferenzen, eigene und kommerzielle Bibliotheken	nein	16.09.2024
265	über stoffspezifische Kalibration	nein	13.09.2024 - 16.09.2024
267	Acquisition in scan mode, quantification with one m/z quantifier and confirmation of identification with specific qualifiers and their ratio	No	23/09/2024
286	Externer Standard / Massenspektren- und Retentionszeit-Vergleich	Ja	13.09.2024
294	Kalibrierung mit internem standard	nicht berücksichtigt	04.10.2024- 09.10.2024