IFA
Institut für Arbeitsschutz der
Deutschen Gesetzlichen Unfallversicherung

Round-robin tests for

in-house measuring laboratories

Institut für Arbeitsschutz der Deutschen Gesetzlichen Unfallversicherung (IFA)
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Results and Evaluation

Round-robin test

„Organic substances with thermodesorption 2015“

Summary of laboratory means

	n-Butyl acetate	Z score	n-Heptane	Z score	Toluene	Z score	n-Octane	Z score	p-Xylene	Z score
Unit	µg/m³		µg/m³		µg/m³		µg/m³		µg/m³	
11			10,55	-8,79 BE	9,05	-8,76 BE	47,30	-5,63 BE	13,75	-7,36 BE
23	73,00	-1,11	71,50	-1,79	65,50	-1,05	93,00	-1,41	49,00	-0,61
24	81,15	-0,11	95,21	0,94	85,04	1,63	111,96	0,34	55,01	0,55
30	77,40	-0,57	89,50	0,28	78,95	0,79	112,05	0,35	52,35	0,04
44	101,34	2,35 E	107,44	2,34 E	87,50	1,96	129,51	1,96	57,66	1,06
55	78,95	-0,38	90,70	0,42	78,30	0,70	105,55	-0,25	53,95	0,34
60					61,25	-1,63			54,30	0,41
88	90,00	0,97	124,50	4,30 FE	87,00	1,89	140,50	2,98 CE	55,50	0,64
116	88,00	0,72	94,00	0,80	93,00	2,71 E	122,00	1,27	63,00	2,08 E
151	76,25	-0,71	91,20	0,48	76,50	0,46	103,55	-0,44	51,55	-0,12
170	79,00	-0,37	84,50	-0,29	55,50	-2,41 E	108,00	-0,03	50,00	-0,41
172	83,00	0,11	78,00	-1,04	68,00	-0,70	105,00	-0,30	47,00	-0,99
184	75,00	-0,86	74,00	-1,50	72,50	-0,09	97,50	-1,00	52,50	0,07
209	98,50	2,00 E	83,50	-0,41	72,00	-0,16	107,50	-0,07	54,00	0,35
230	77,50	-0,56	97,00	1,14	61,50	-1,59	119,50	1,04	48,00	-0,80
503	72,90	-1,12	78,10	-1,03	68,00	-0,70	99,55	-0,81	42,80	-1,79
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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	14		15		16		15		16	
Mean	82,07		87,05		73,15		108,28		52,16	
Reproducibility s.d.	10,55		10,93		11,19		10,92		4,68	
Rel. reproducibility s.d.	12,86 %		12,56 %		15,29 %		10,08 %		8,98 %	
Reference value	70,80		78,20		73,90		105,50		50,80	
Target s.d.	8,21		8,70		7,31		10,83		5,22	
Rel. target s.d.:	10,00 %		10,00 %		10,00 %		10,00 %		10,00 %	
Lower limit of tolerance	65,66		69,64		58,52		86,62		41,73	

	n-Butyl acetate	Z score	n-Heptane	Z score	Toluene	Z score	n-Octane	Z score	p-Xylene	Z score
Upper limit of tolerance	98,49		104,46		87,78		129,93		62,59	
Type E outliers	3		6		7		4		3	
Type F outliers			1							
No. of laboratories after elimination of outliers type A-D and F (without laboratories that only gave states but no measured values)	14		13		15		13		15	

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|>3,5	

	Ethylbenzene	Z score	1,2,4-Trimethylbenzene	Z score	2-Ethoxyethyl acetate	Z score	4-Methyl-2-Pentanone	Z score
Unit	µg/m³		µg/m³		µg/m³		µg/m³	
11	560,50	97,08 CE						
23	47,50	-0,93	35,50	-0,85	74,00	0,35	81,50	-1,44
24	52,51	0,03	42,34	0,91	69,33	-0,30	100,14	0,52
30	52,05	-0,06	39,45	0,17	73,40	0,26	99,00	0,40
44	58,34	1,15	44,23	1,40	79,43	1,11	104,49	0,98
55	52,95	0,12	40,70	0,49	71,75	0,03	92,20	-0,31
60	51,50	-0,16	39,85	0,27				
88	58,00	1,08	38,00	-0,21	65,00	-0,91	126,50	3,29 E
116	63,00	2,04 E	54,00	3,92 BE	79,00	1,05	106,00	1,14
151	52,80	0,09	39,75	0,24	62,10	-1,32	91,55	-0,38
170	49,00	-0,64	37,00	-0,46	65,00	-0,91	96,50	0,14
172	50,00	-0,45	35,00	-0,98	62,00	-1,33	104,00	0,93
184	51,00	-0,26	42,00	0,82	65,50	-0,84	86,50	-0,91
209	56,00	0,70	40,50	0,44 C	87,50	2,24 CE	111,50	1,72

	Ethylbenzene	Z score	1,2,4-Trimethylbenzene	Z score	2-Ethoxyethyl acetate	Z score	4-Methyl-2-Pentanone	Z score
230	50,00	-0,45	36,50	-0,59	89,50	2,52 E	82,50	-1,33
503	44,75	-1,45	33,95	-1,25	32,95	-5,39 BE	62,35	-3,45 E
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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	16		15		14		14	
Mean	52,34		38,80		71,51		95,17	
Reproducibility s.d.	4,63		3,20		8,96		16,33	
Rel. reproducibility s.d.	8,85 %		8,26 %		12,53 %		17,15 %	
Reference value	50,00		39,20		63,00		92,60	
Target s.d.	5,23		3,88		7,15		9,52	
Rel. target s.d.:	10,00 %		10,00 %		10,00 %		10,00 %	
Lower limit of tolerance	41,88		31,04		57,21		76,14	
Upper limit of tolerance	62,81		46,56		85,81		114,21	
Type E outliers	3		1		5		4	
No. of laboratories after elimination of outliers type A-D and F (without laboratories that only gave states but no measured values)	15		13		12		14	

	Cumol	Z score
Unit	µg/m³	
11	18,90	-5,19 BE
23	37,00	-0,58
24	41,74	0,63
30	41,30	0,51
44	43,27	1,01
55	39,25	-0,01
60	38,65	-0,16
88	33,00	-1,60
116	45,00	1,46
151	38,20	-0,28

	Cumol	Z score
170	37,50	-0,45
172	39,00	-0,07
184	42,50	0,82
209	42,00	0,69
230	35,50	-0,96
503	55,10	4,03 FE
–	–	– –
Method	ISO 5725-2	
Assessment	|Z|<=2,00	
No. of laboratories that submitted results	16	
Mean	39,28	
Reproducibility s.d.	3,42	
Rel. reproducibility s.d.	8,72 %	
Reference value	39,00	
Target s.d.	3,93	
Rel. target s.d.:	10,00 %	
Lower limit of tolerance	31,43	
Upper limit of tolerance	47,14	
Type E outliers	5	
Type F outliers	1	
No. of laboratories after elimination of outliers type A-D and F (without laboratories that only gave states but no measured values)	14	

Summary of laboratory means

	n-Butyl acetate	Z score	n-Heptane	Z score	Toluene	Z score	n-Octane	Z score	p-Xylene	Z score
Unit	µg/m³		µg/m³		µg/m³		µg/m³		µg/m³	
11	49,70	-5,94 BE	46,55	-2,57 E	65,90	-1,32	78,60	0,65	65,70	-0,35
23	110,00	-1,02	53,00	-1,54	66,00	-1,30	63,50	-1,39	65,50	-0,38
24	120,81	-0,14	67,84	0,83	82,66	0,89	73,45	-0,04	70,56	0,37
30	122,50	0,00	70,30	1,23	83,35	0,98	78,40	0,63	72,30	0,62
44	153,98	2,57 E	83,11	3,27 E	90,63	1,94 C	89,85	2,18 E	76,91	1,30 C
55	118,55	-0,32	71,60	1,43	81,55	0,75	73,50	-0,04	72,55	0,66
60					68,95	-0,91			72,60	0,67
88	142,00	1,59	99,50	5,89 FE	90,50	1,93	90,50	2,27 E	76,00	1,17
116	138,00	1,26	70,00	1,18	91,00	1,99	79,00	0,71	80,00	1,75
151	120,10	-0,20	69,85	1,15	80,55	0,61	70,75	-0,41	70,00	0,29
170	121,00	-0,12	62,50	-0,02	66,50	-1,24 C	73,50	-0,04	71,50	0,51
172	120,00	-0,21	59,00	-0,58	77,00	0,15	69,00	-0,65	59,00	-1,33
184	92,00	-2,49 E	44,00	-2,97 E	64,00	-1,57	56,50	-2,34 E	60,00	-1,18
209	142,50	1,63 C	59,50	-0,50	68,00	-1,04 C	68,50	-0,71	68,00	-0,01 C
230	123,50	0,08	53,50	-1,46	36,00	-5,26 BE	71,00	-0,38	62,00	-0,89
503	115,85	-0,54	61,15	-0,24	70,65	-0,69	70,60	-0,43	57,80	-1,51
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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	15		15		16		15		16	
Mean	122,51		62,62		75,88		73,77		68,06	
Reproducibility s.d.	17,15		10,85		9,59		9,91		6,47	
Rel. reproducibility s.d.	14,00 %		17,33 %		12,64 %		13,43 %		9,51 %	
Reference value	110,10		60,20		77,40		72,30		69,40	
Target s.d.	12,25		6,26		7,59		7,38		6,81	
Rel. target s.d.:	10,00 %		10,00 %		10,00 %		10,00 %		10,00 %	
Lower limit of tolerance	98,01		50,10		60,71		59,02		54,45	

	n-Butyl acetate	Z score	n-Heptane	Z score	Toluene	Z score	n-Octane	Z score	p-Xylene	Z score
Upper limit of tolerance	147,01		75,15		91,06		88,53		81,67	
Type E outliers	7		7		5		3			
Type F outliers			1							
No. of laboratories after elimination of outliers type A-D and F (without laboratories that only gave states but no measured values)	13		14		12		15		14	

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|>3,5	

	Ethylbenzene	Z score	1,2,4-Trimethylbenzene	Z score	2-Ethoxyethyl acetate	Z score	4-Methyl-2-Pentanone	Z score
Unit	µg/m³		µg/m³		µg/m³		µg/m³	
11	315,50	22,05 CE	149,00	1,30	31,30	-7,79 FE	46,60	-5,41 FE
23	88,00	-1,06	115,00	-1,28	155,00	0,92	86,50	-1,49
24	96,22	-0,23	133,58	0,13	142,33	0,03	105,32	0,37
30	102,80	0,44	142,20	0,79	163,20	1,50 F	110,90	0,91
44	111,42	1,32	150,16	1,39	160,25	1,29 C	114,77	1,30
55	100,10	0,17	137,60	0,44	148,40	0,46	101,25	-0,04
60	99,75	0,13	137,20	0,41				
88	112,00	1,38	115,00	-1,28	72,50	-4,89 FE	130,50	2,84 E
116	113,00	1,48	167,00	2,67 E	153,00	0,78	113,00	1,12
151	104,40	0,60	136,50	0,35	133,55	-0,59	100,90	-0,07
170	101,00	0,26	140,50	0,66	135,00	-0,49	101,50	-0,01
172	90,00	-0,86	116,00	-1,20	130,00	-0,84	110,00	0,83
184	82,00	-1,67	118,00	-1,05	111,00	-2,18 CE	77,50	-2,37 E
209	101,00	0,26 C	117,00	-1,12	178,50	2,58 CE	113,50	1,17

	Ethylbenzene	Z score	1,2,4-Trimethylbenzene	Z score	2-Ethoxyethyl acetate	Z score	4-Methyl-2-Pentanone	Z score
230	93,50	-0,50	125,50	-0,48	138,00	-0,28	100,00	-0,16
503	86,10	-1,25	119,60	-0,93	74,75	-4,73 FE	68,60	-3,25 E
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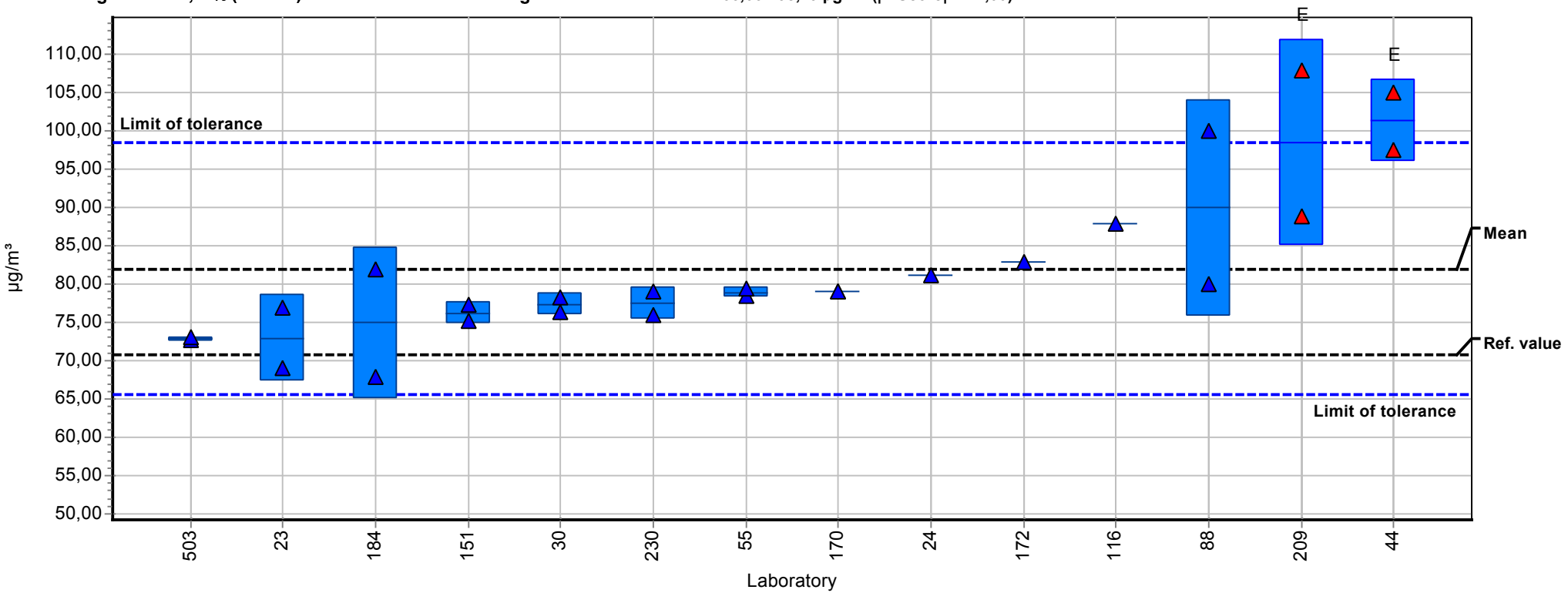
Method	ISO 5725-2		ISO 5725-2		ISO 5725-2		ISO 5725-2	
Assessment	|Z|<=2,00		|Z|<=2,00		|Z|<=2,00		|Z|<=2,00	
No. of laboratories that submitted results	16		16		15		15	
Mean	98,45		131,83		141,94		101,61	
Reproducibility s.d.	10,06		14,94		9,53		17,73	
Rel. reproducibility s.d.	10,21 %		11,34 %		6,71 %		17,45 %	
Reference value	98,70		134,00		141,20		103,50	
Target s.d.	9,85		13,18		14,19		10,16	
Rel. target s.d.:	10,00 %		10,00 %		10,00 %		10,00 %	
Lower limit of tolerance	78,76		105,46		113,55		81,29	
Upper limit of tolerance	118,15		158,20		170,33		121,93	
Type E outliers	2		2		8		7	
Type F outliers					4		1	
No. of laboratories after elimination of outliers type A-D and F (without laboratories that only gave states but no measured values)	14		16		8		14	

	Cumol	Z score
Unit	µg/m³	
11	131,50	1,29
23	110,00	-0,55
24	114,26	-0,19
30	129,95	1,16
44	130,82	1,24
55	118,00	0,14
60	109,70	-0,58
88	86,50	-2,57 E
116	132,00	1,34

	Cumol	Z score	
151	117,75	0,11	
170	128,00	0,99	
172	111,00	-0,47	
184	105,00	-0,98	
209	127,00	0,91	C
230	109,50	-0,60	
503	166,25	4,28	BE
–	–	– –	
Method	ISO 5725-2		
Assessment	|Z|<=2,00		
No. of laboratories that submitted results	16		
Mean	116,43		
Reproducibility s.d.	13,69		
Rel. reproducibility s.d.	11,76 %		
Reference value	121,60		
Target s.d.	11,64		
Rel. target s.d.:	10,00 %		
Lower limit of tolerance	93,14		
Upper limit of tolerance	139,71		
Type E outliers	5		
No. of laboratories after elimination of outliers type A-D and F (without laboratories that only gave states but no measured values)	14		

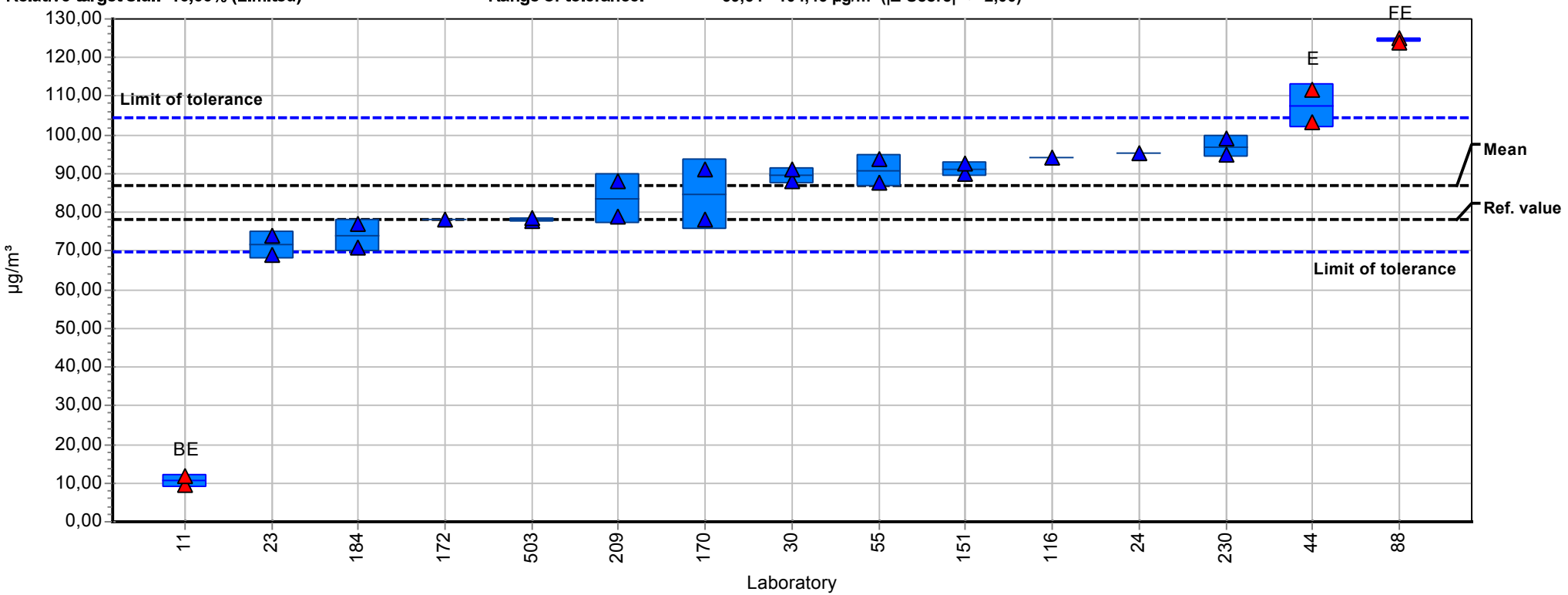
Summary results

Measurand:	n-Butyl acetate	**Mean:**	82,07 µg/m³
Sample:	1	**Reproducibility s.d.:**	10,55 µg/m³
Method:	ISO 5725-2	**Relative reproducibility s.d.:**	12,86%
No. of laboratories:	14	**Reference value:**	70,80 µg/m³
Relative target s.d.:	10,00% (Limited)	**Range of tolerance:**	65,66 - 98,49 µg/m³ (|Z-Score| <= 2,00)



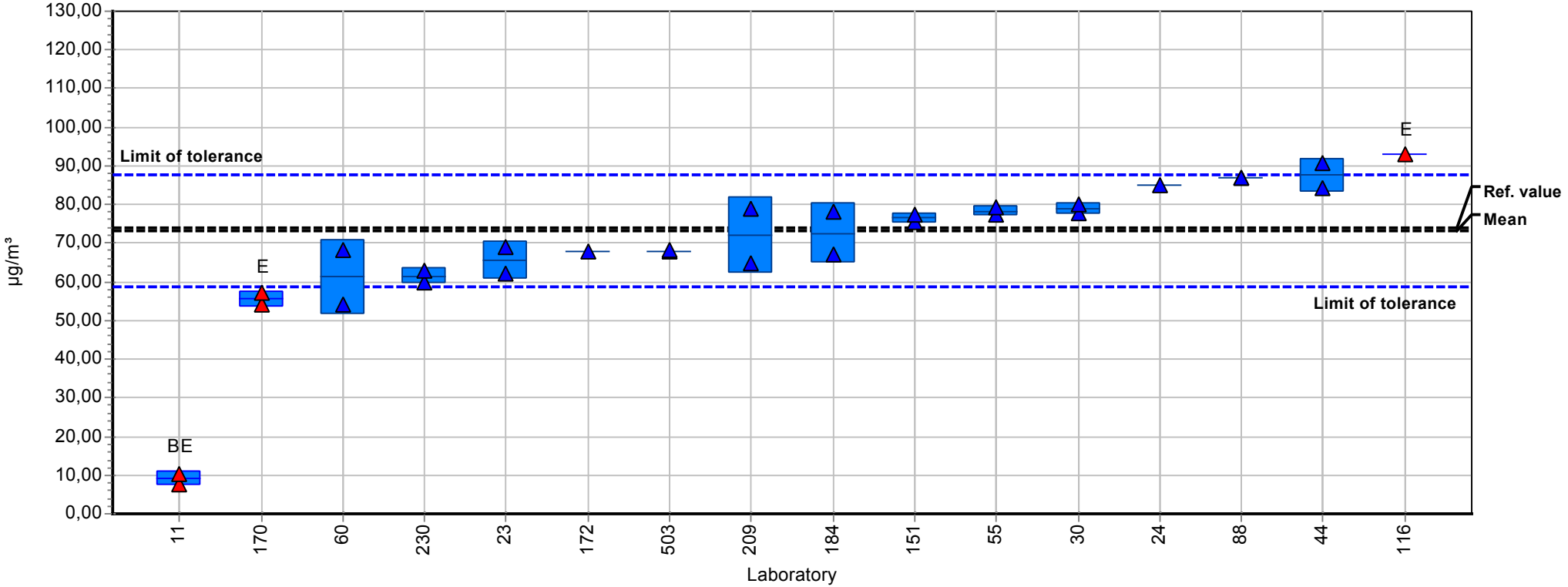
Summary results

Measurand:	n-Heptane	**Mean:**	87,05 µg/m³
Sample:	1	**Reproducibility s.d.:**	10,93 µg/m³
Method:	ISO 5725-2	**Relative reproducibility s.d.:**	12,56%
No. of laboratories:	13	**Reference value:**	78,20 µg/m³
Relative target s.d.:	10,00% (Limited)	**Range of tolerance:**	69,64 - 104,46 µg/m³ (|Z-Score| <= 2,00)



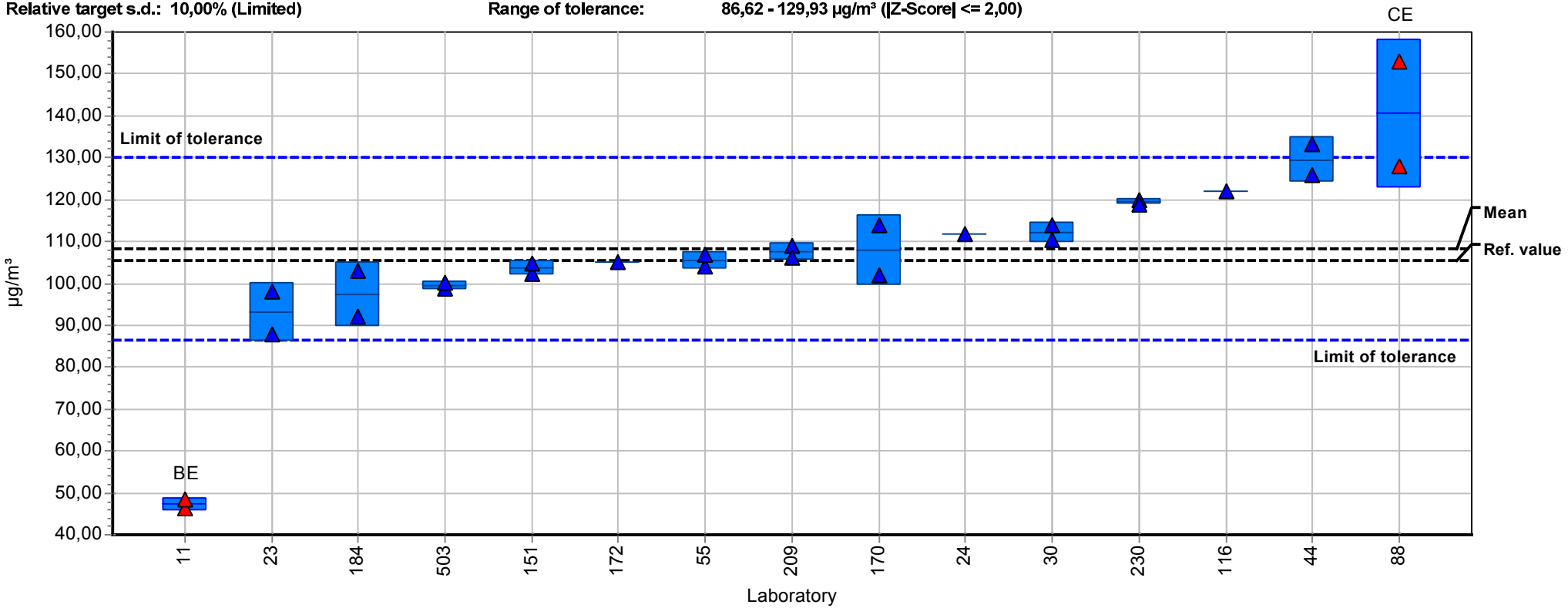
Summary results

Measurand:	**Toluene**	**Mean:**	**73,15 µg/m³**
Sample:	**1**	**Reproducibility s.d.:**	**11,19 µg/m³**
Method:	**ISO 5725-2**	**Relative reproducibility s.d.:**	**15,29%**
No. of laboratories:	**15**	**Reference value:**	**73,90 µg/m³**
Relative target s.d.:	**10,00% (Limited)**	**Range of tolerance:**	**58,52 - 87,78 µg/m³ (|Z-Score| <= 2,00)**



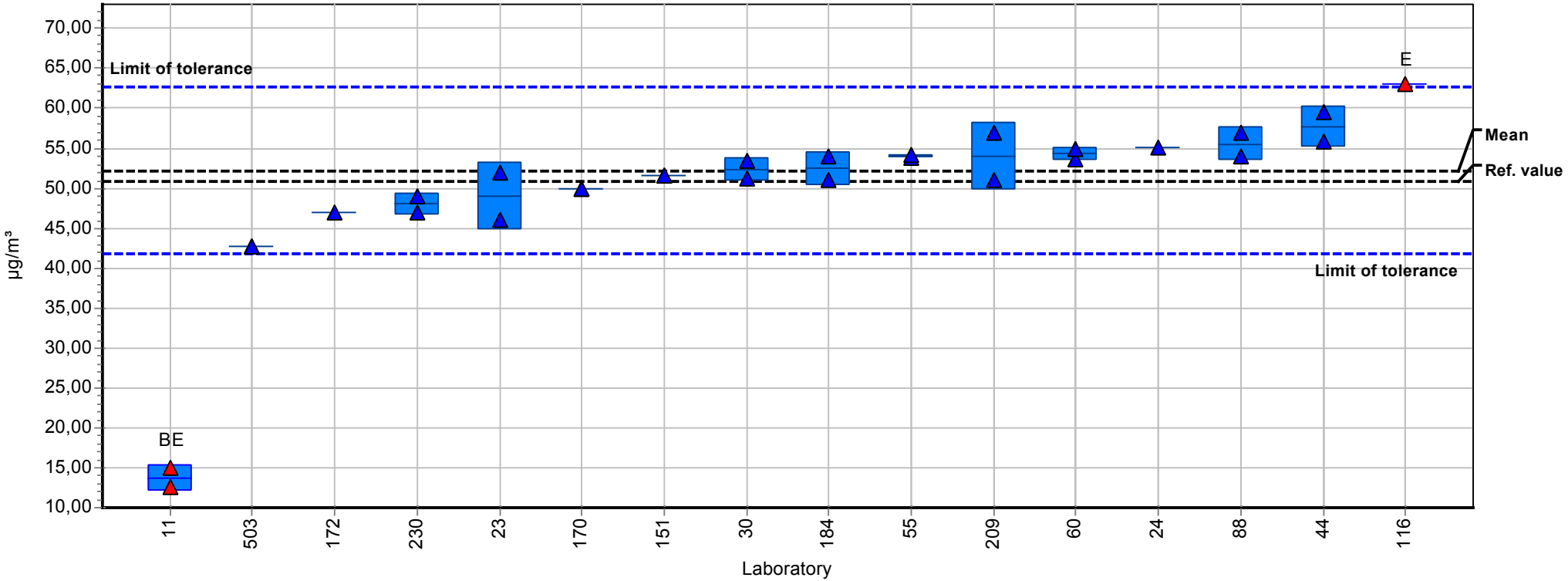
Summary results

Measurand:	n-Octane	**Mean:**	108,28 µg/m³
Sample:	1	**Reproducibility s.d.:**	10,92 µg/m³
Method:	ISO 5725-2	**Relative reproducibility s.d.:**	10,08%
No. of laboratories:	13	**Reference value:**	105,50 µg/m³
Relative target s.d.:	10,00% (Limited)	**Range of tolerance:**	86,62 - 129,93 µg/m³ (|Z-Score| <= 2,00)



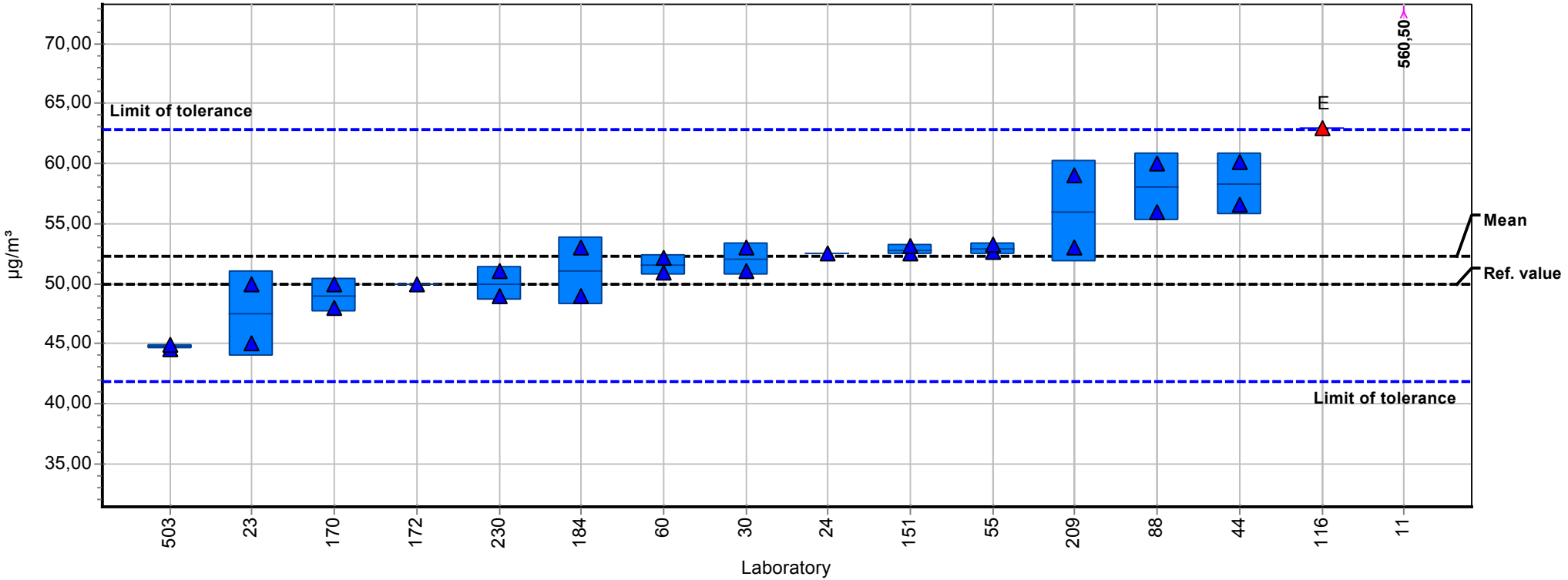
Summary results

Measurand:	p-Xylene	**Mean:**	52,16 µg/m³
Sample:	1	**Reproducibility s.d.:**	4,68 µg/m³
Method:	ISO 5725-2	**Relative reproducibility s.d.:**	8,98%
No. of laboratories:	15	**Reference value:**	50,80 µg/m³
Relative target s.d.:	10,00% (Limited)	**Range of tolerance:**	41,73 - 62,59 µg/m³ (|Z-Score| <= 2,00)



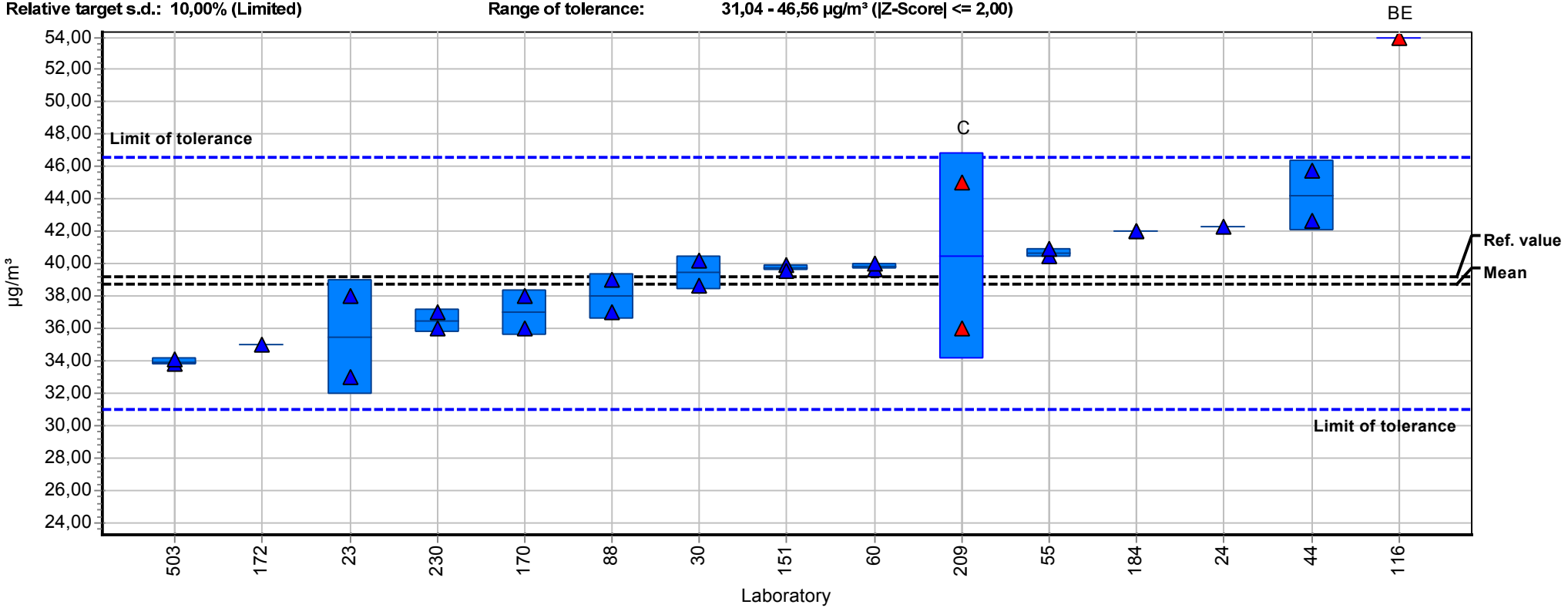
Summary results

Measurand:	Ethylbenzene	**Mean:**	52,34 µg/m³
Sample:	1	**Reproducibility s.d.:**	4,63 µg/m³
Method:	ISO 5725-2	**Relative reproducibility s.d.:**	8,85%
No. of laboratories:	15	**Reference value:**	50,00 µg/m³
Relative target s.d.:	10,00% (Limited)	**Range of tolerance:**	41,88 - 62,81 µg/m³ (|Z-Score| <= 2,00)



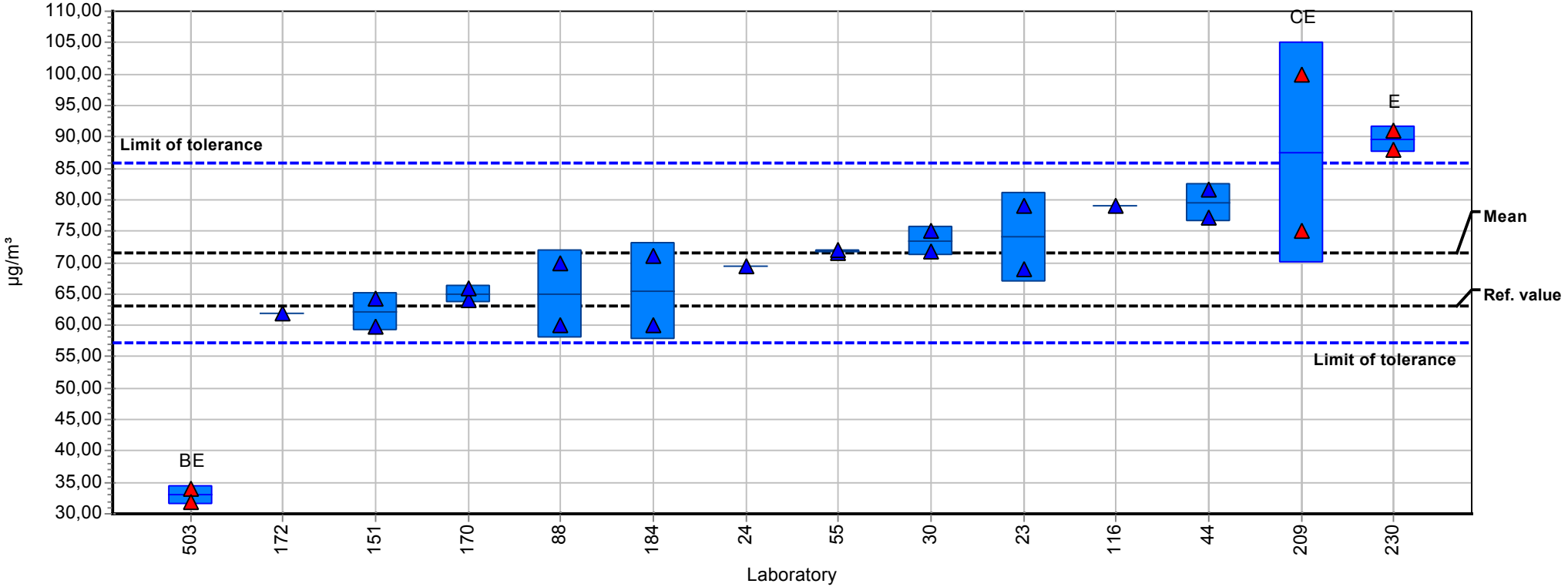
Summary results

Measurand:	1,2,4-Trimethylbenzene	**Mean:**	38,80 µg/m³
Sample:	1	**Reproducibility s.d.:**	3,20 µg/m³
Method:	ISO 5725-2	**Relative reproducibility s.d.:**	8,26%
No. of laboratories:	13	**Reference value:**	39,20 µg/m³
Relative target s.d.:	10,00% (Limited)	**Range of tolerance:**	31,04 - 46,56 µg/m³ (|Z-Score| <= 2,00)



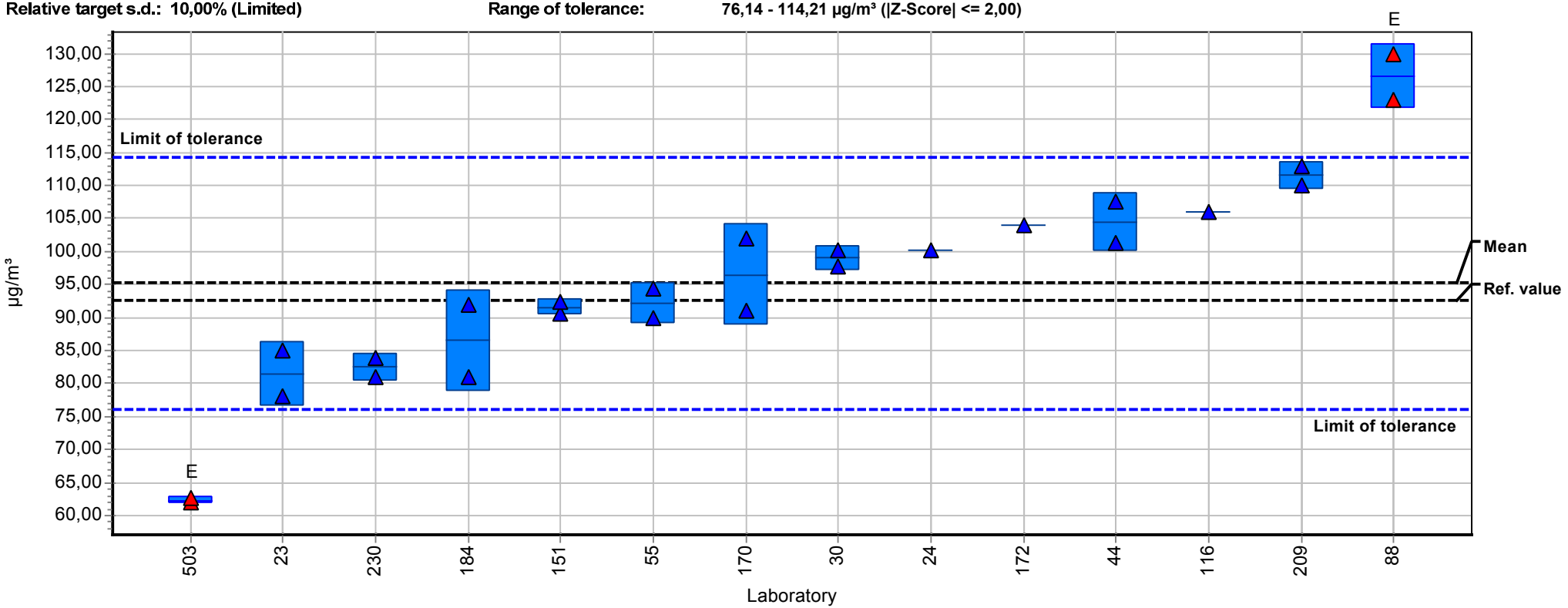
Summary results

Measurand:	**2-Ethoxyethyl acetate**	**Mean:**	**71,51 µg/m³**
Sample:	**1**	**Reproducibility s.d.:**	**8,96 µg/m³**
Method:	**ISO 5725-2**	**Relative reproducibility s.d.:**	**12,53%**
No. of laboratories:	**12**	**Reference value:**	**63,00 µg/m³**
Relative target s.d.:	**10,00% (Limited)**	**Range of tolerance:**	**57,21 - 85,81 µg/m³ (|Z-Score| <= 2,00)**



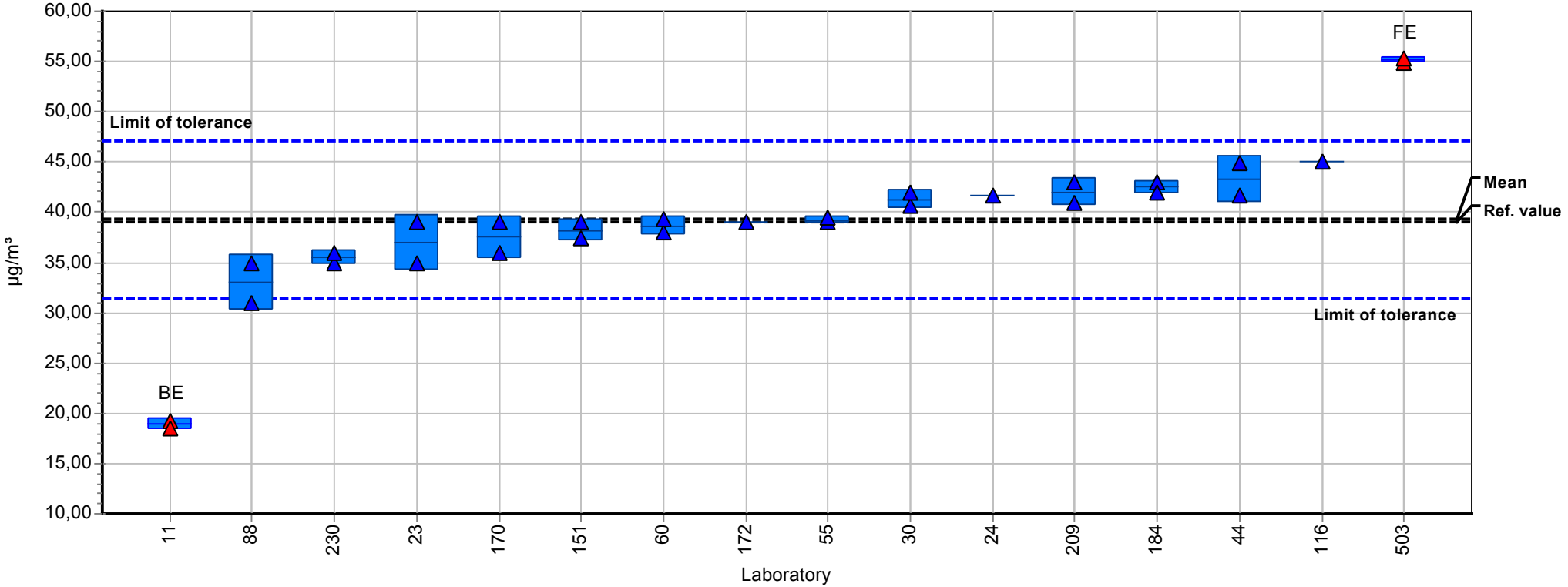
Summary results

Measurand:	**4-Methyl-2-Pentanone**	**Mean:**	**95,17 µg/m³**
Sample:	**1**	**Reproducibility s.d.:**	**16,33 µg/m³**
Method:	**ISO 5725-2**	**Relative reproducibility s.d.:**	**17,15%**
No. of laboratories:	**14**	**Reference value:**	**92,60 µg/m³**
Relative target s.d.:	**10,00% (Limited)**	**Range of tolerance:**	**76,14 - 114,21 µg/m³ (|Z-Score| <= 2,00)**



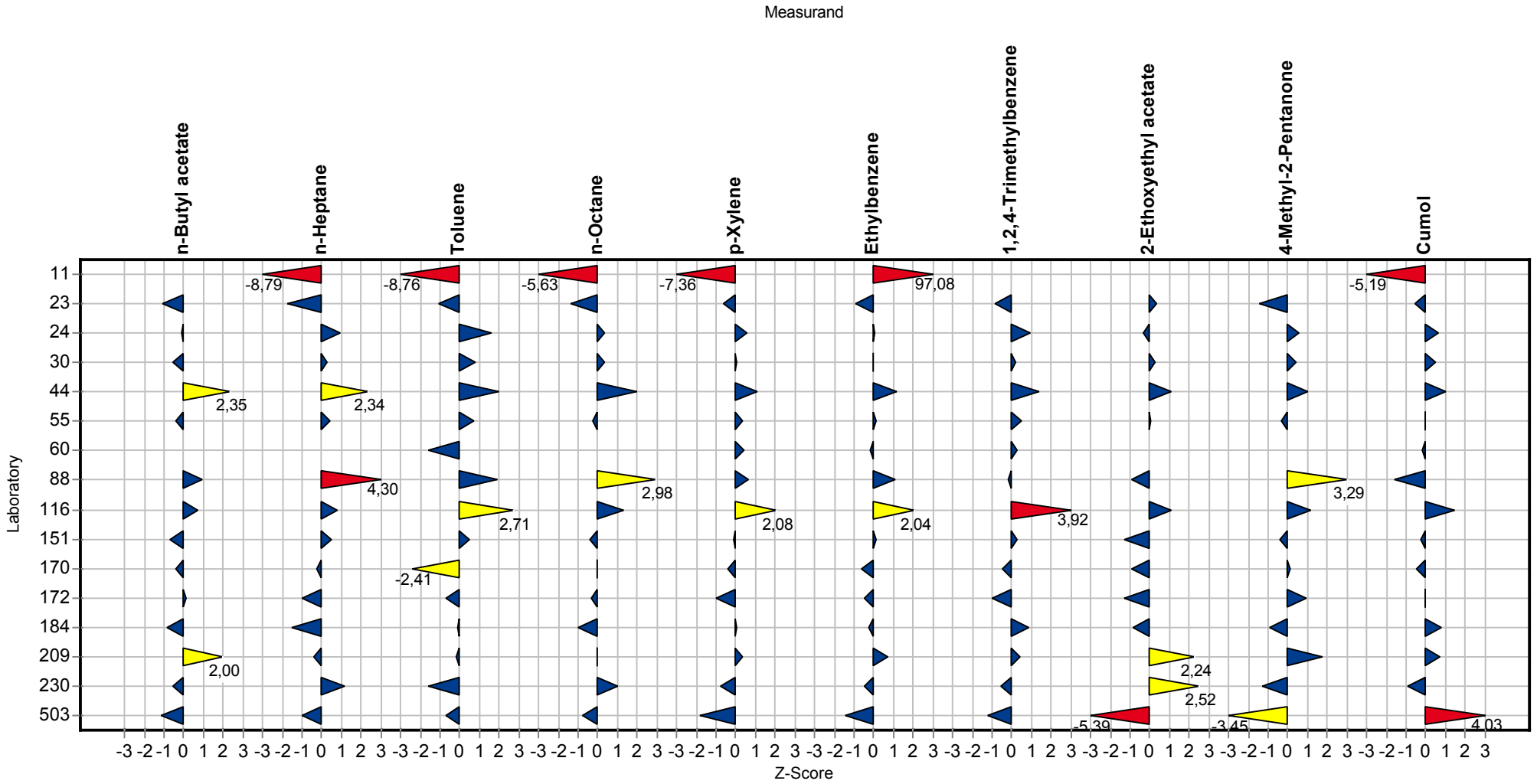
Summary results

Measurand:	**Cumol**	**Mean:**	**39,28 µg/m³**
Sample:	**1**	**Reproducibility s.d.:**	**3,42 µg/m³**
Method:	**ISO 5725-2**	**Relative reproducibility s.d.:**	**8,72%**
No. of laboratories:	**14**	**Reference value:**	**39,00 µg/m³**
Relative target s.d.:	**10,00% (Limited)**	**Range of tolerance:**	**31,43 - 47,14 µg/m³ (|Z-Score| <= 2,00)**



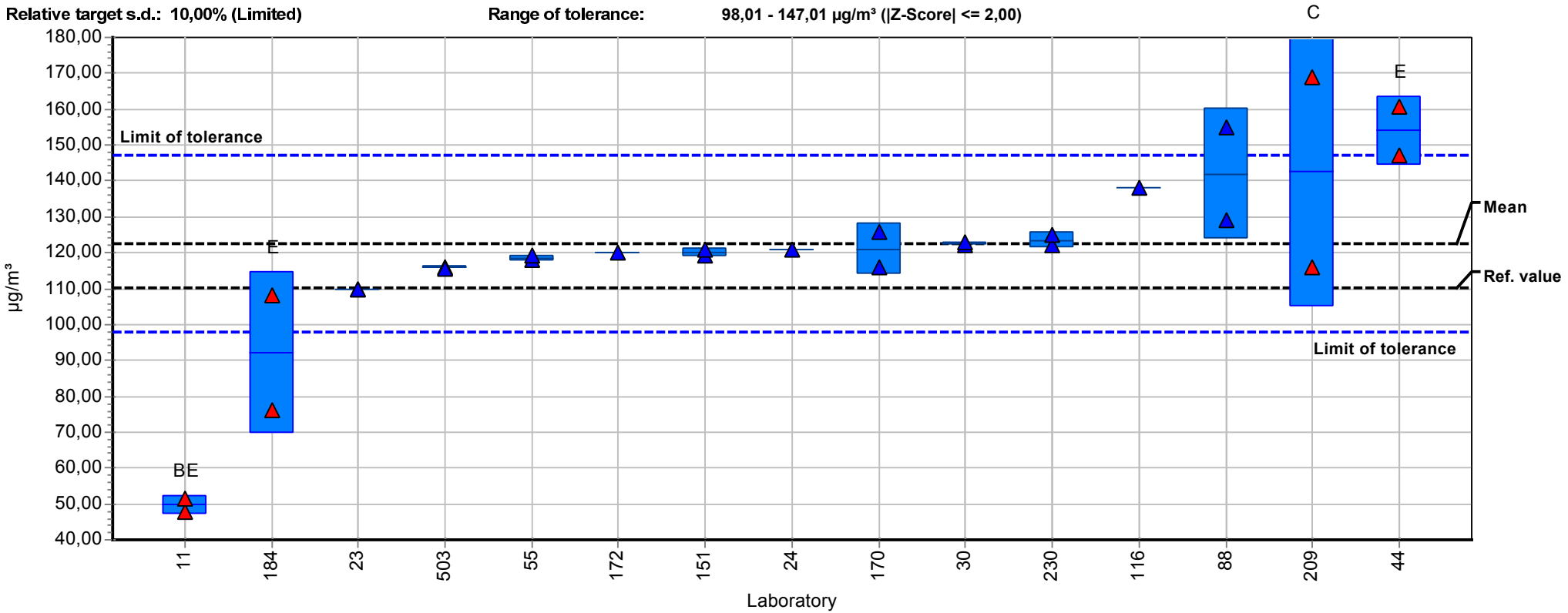
Sample chart of Z-Scores

Sample 1



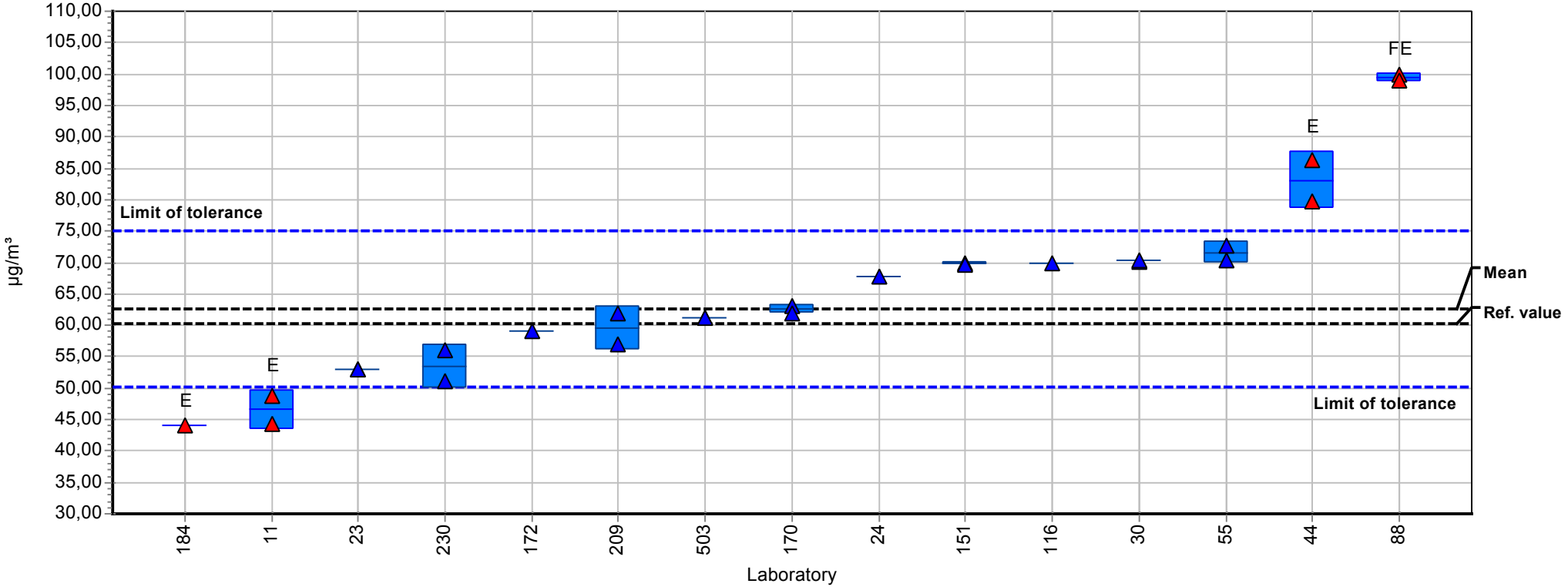
Summary results

Measurand:	**n-Butyl acetate**	**Mean:**	**122,51 µg/m³**
Sample:	**2**	**Reproducibility s.d.:**	**17,15 µg/m³**
Method:	**ISO 5725-2**	**Relative reproducibility s.d.:**	**14,00%**
No. of laboratories:	**13**	**Reference value:**	**110,10 µg/m³**
Relative target s.d.:	**10,00% (Limited)**	**Range of tolerance:**	**98,01 - 147,01 µg/m³ (|Z-Score| <= 2,00)**



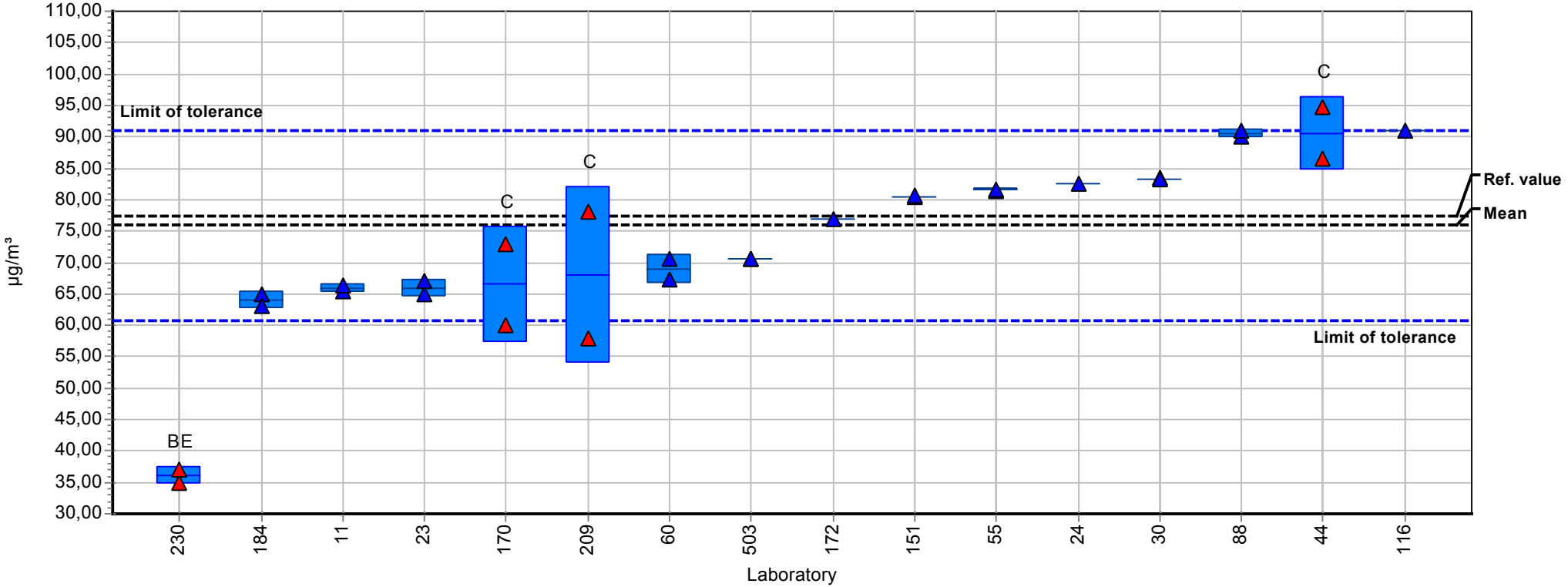
Summary results

Measurand:	n-Heptane	**Mean:**	62,62 µg/m³
Sample:	2	**Reproducibility s.d.:**	10,85 µg/m³
Method:	ISO 5725-2	**Relative reproducibility s.d.:**	17,33%
No. of laboratories:	14	**Reference value:**	60,20 µg/m³
Relative target s.d.:	10,00% (Limited)	**Range of tolerance:**	50,10 - 75,15 µg/m³ (|Z-Score| <= 2,00)



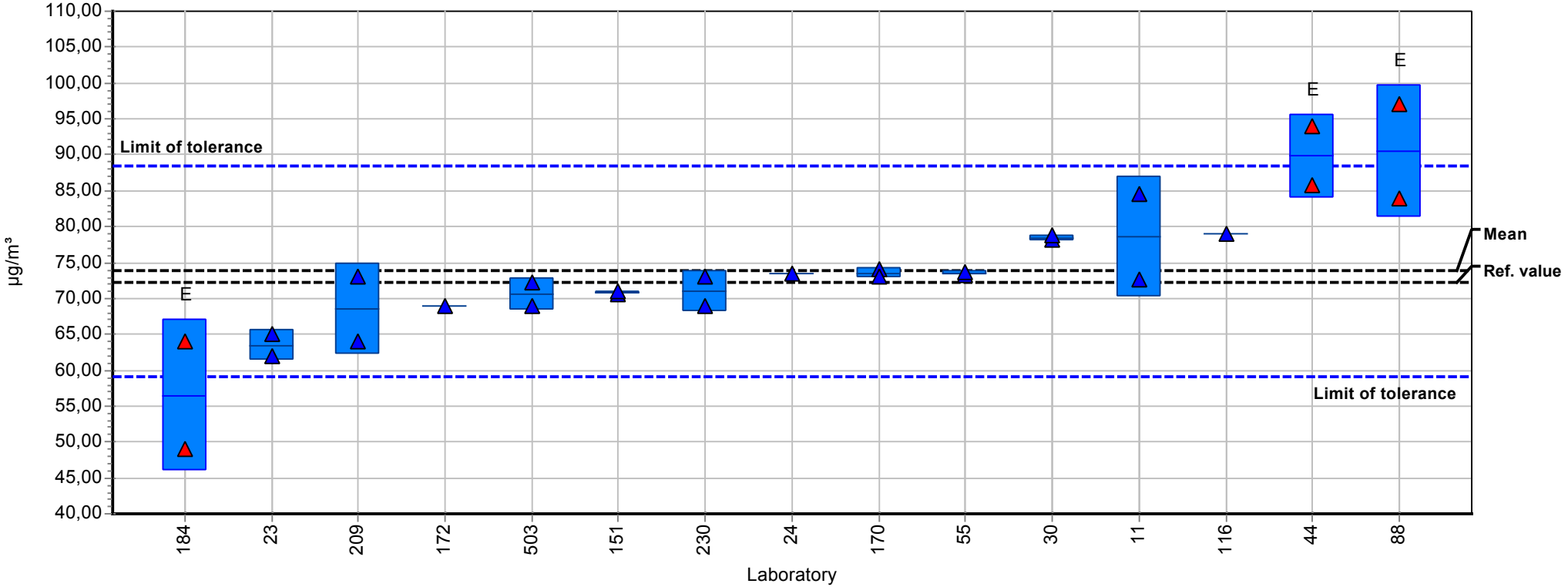
Summary results

Measurand:	**Toluene**	**Mean:**	**75,88 µg/m³**
Sample:	**2**	**Reproducibility s.d.:**	**9,59 µg/m³**
Method:	**ISO 5725-2**	**Relative reproducibility s.d.:**	**12,64%**
No. of laboratories:	**12**	**Reference value:**	**77,40 µg/m³**
Relative target s.d.:	**10,00% (Limited)**	**Range of tolerance:**	**60,71 - 91,06 µg/m³ (|Z-Score| <= 2,00)**



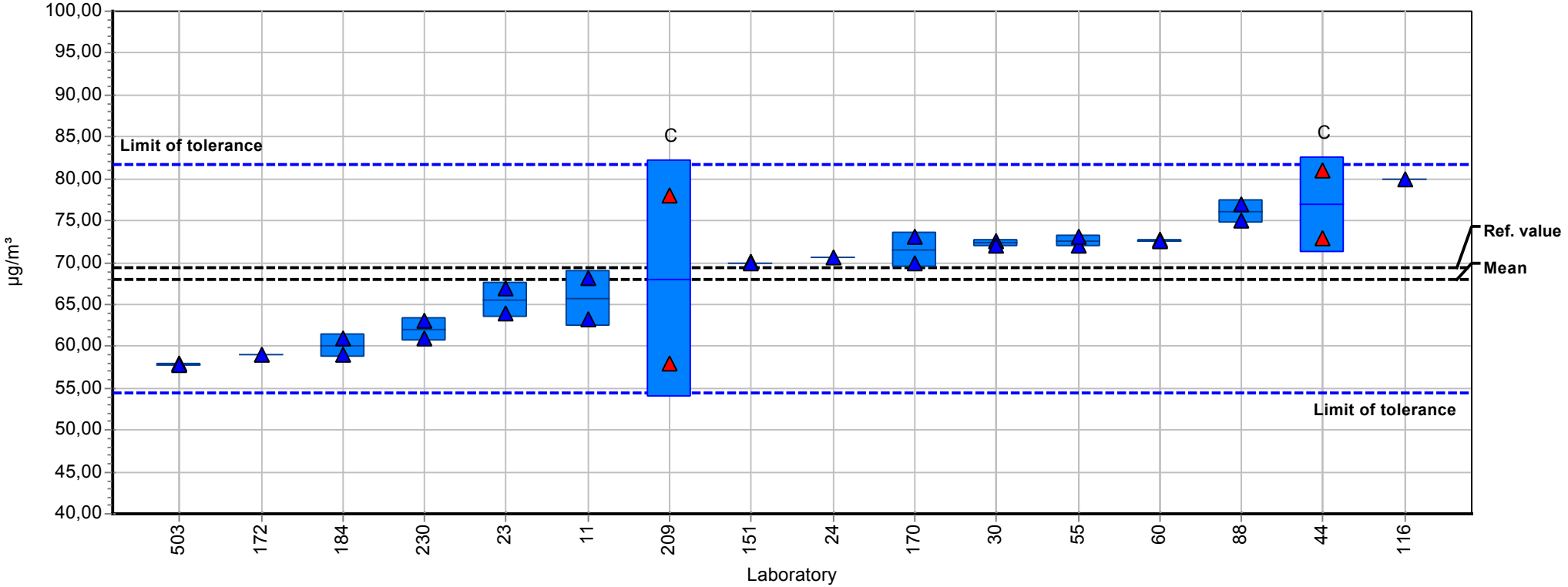
Summary results

Measurand:	n-Octane	**Mean:**	73,77 µg/m³
Sample:	2	**Reproducibility s.d.:**	9,91 µg/m³
Method:	ISO 5725-2	**Relative reproducibility s.d.:**	13,43%
No. of laboratories:	15	**Reference value:**	72,30 µg/m³
Relative target s.d.:	10,00% (Limited)	**Range of tolerance:**	59,02 - 88,53 µg/m³ (|Z-Score| <= 2,00)



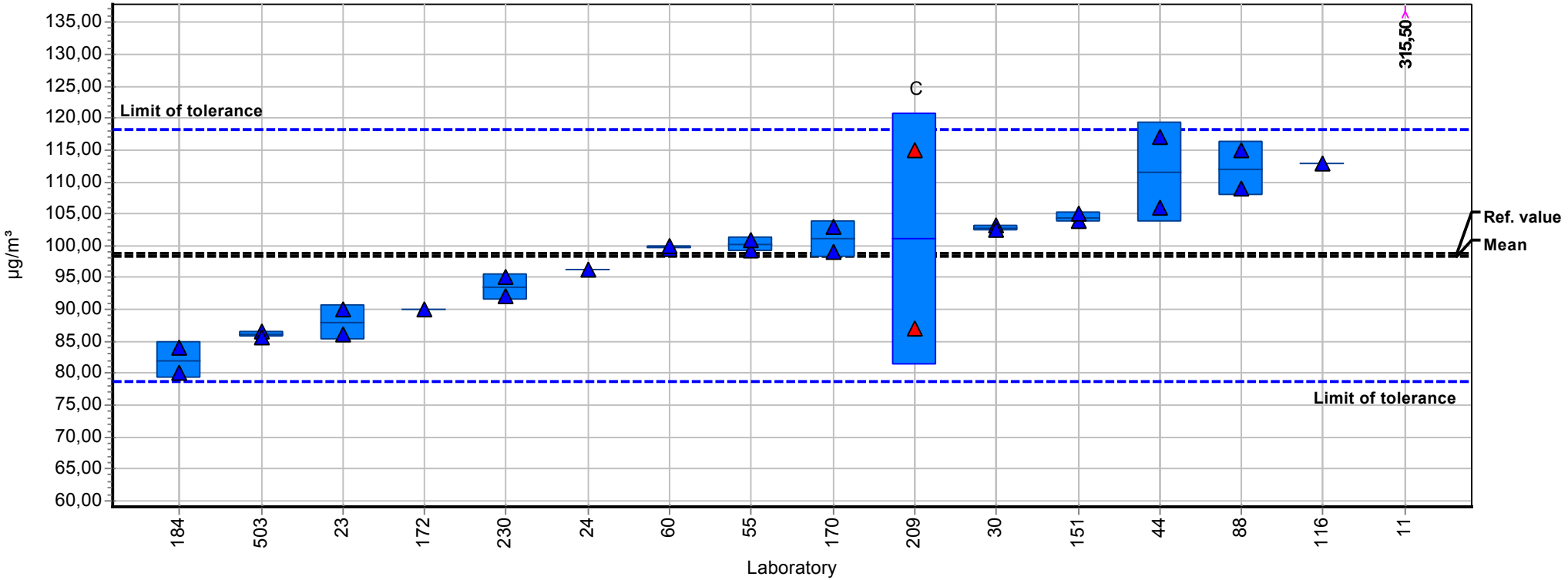
Summary results

Measurand:	p-Xylene	**Mean:**	68,06 µg/m³
Sample:	2	**Reproducibility s.d.:**	6,47 µg/m³
Method:	ISO 5725-2	**Relative reproducibility s.d.:**	9,51%
No. of laboratories:	14	**Reference value:**	69,40 µg/m³
Relative target s.d.:	10,00% (Limited)	**Range of tolerance:**	54,45 - 81,67 µg/m³ (|Z-Score| <= 2,00)



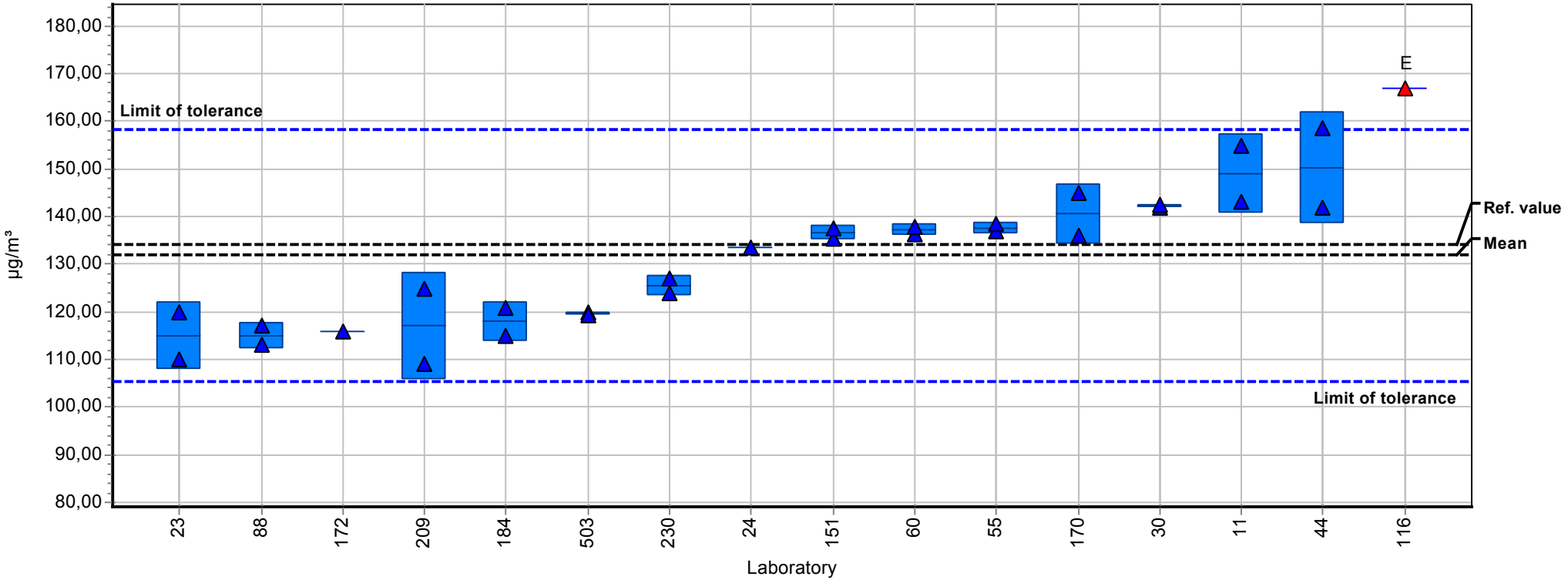
Summary results

Measurand:	Ethylbenzene	**Mean:**	98,45 µg/m³
Sample:	2	**Reproducibility s.d.:**	10,06 µg/m³
Method:	ISO 5725-2	**Relative reproducibility s.d.:**	10,21%
No. of laboratories:	14	**Reference value:**	98,70 µg/m³
Relative target s.d.:	10,00% (Limited)	**Range of tolerance:**	78,76 - 118,15 µg/m³ (|Z-Score| <= 2,00)



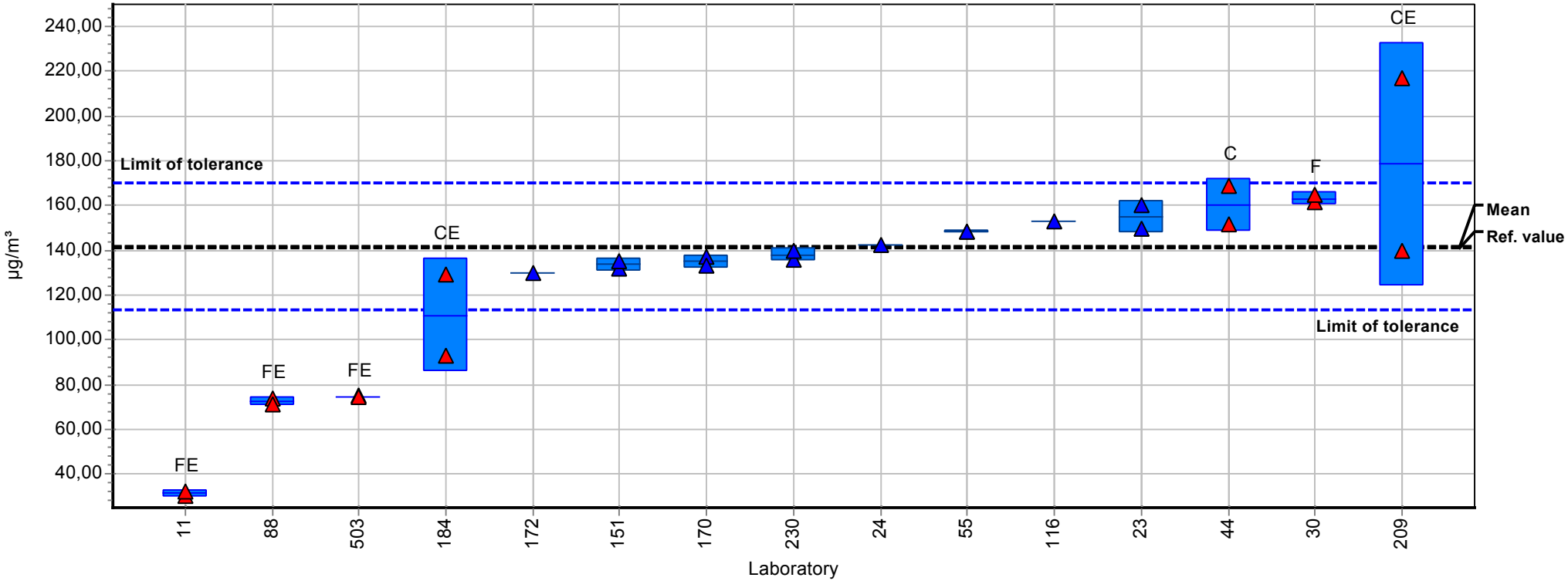
Summary results

Measurand:	1,2,4-Trimethylbenzene	**Mean:**	131,83 µg/m³
Sample:	2	**Reproducibility s.d.:**	14,94 µg/m³
Method:	ISO 5725-2	**Relative reproducibility s.d.:**	11,34%
No. of laboratories:	16	**Reference value:**	134,00 µg/m³
Relative target s.d.:	10,00% (Limited)	**Range of tolerance:**	105,46 - 158,20 µg/m³ (|Z-Score| <= 2,00)



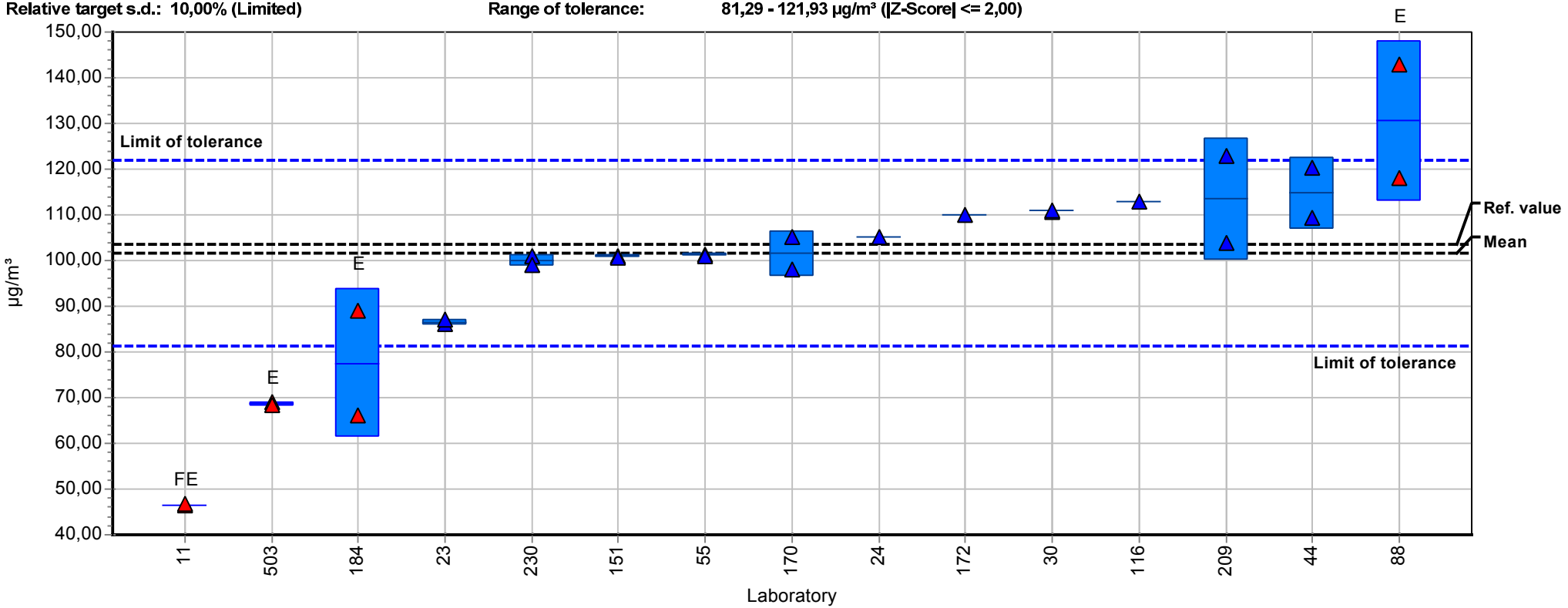
Summary results

Measurand:	2-Ethoxyethyl acetate	**Mean:**	141,94 µg/m³
Sample:	2	**Reproducibility s.d.:**	9,53 µg/m³
Method:	ISO 5725-2	**Relative reproducibility s.d.:**	6,71%
No. of laboratories:	8	**Reference value:**	141,20 µg/m³
Relative target s.d.:	10,00% (Limited)	**Range of tolerance:**	113,55 - 170,33 µg/m³ (|Z-Score| <= 2,00)



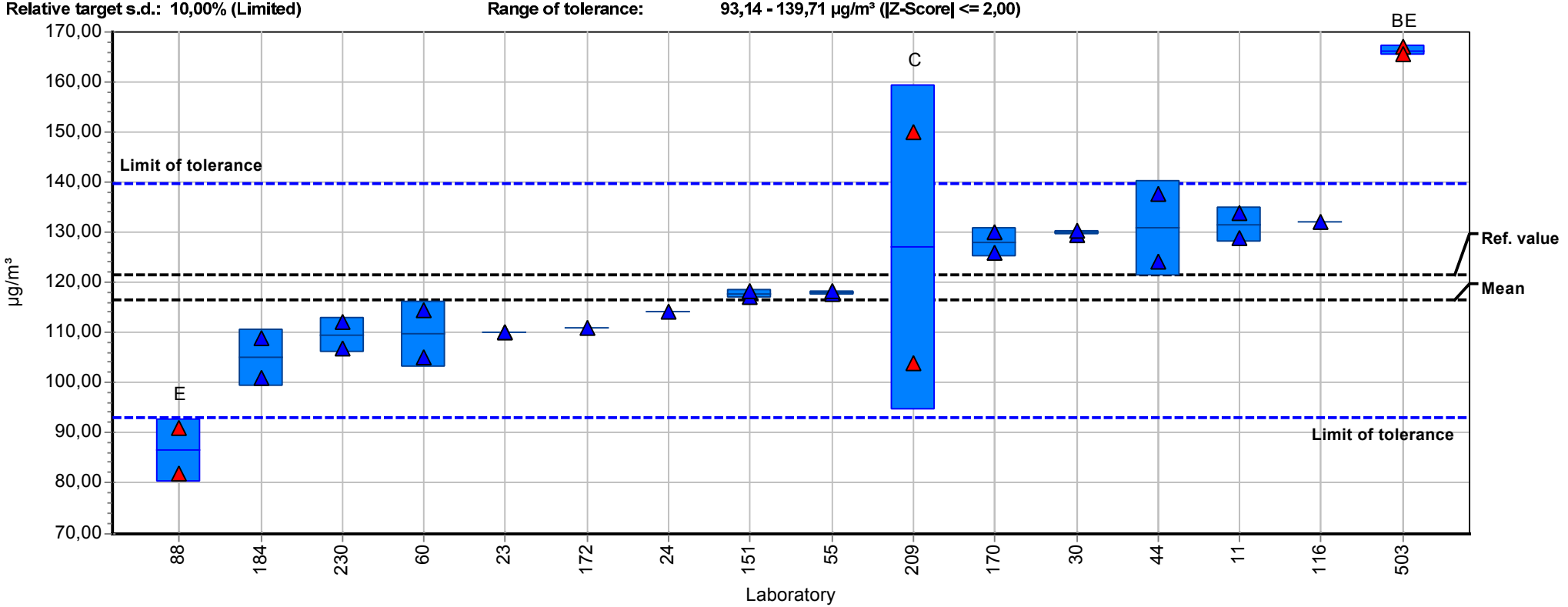
Summary results

Measurand:	4-Methyl-2-Pentanone	**Mean:**	101,61 µg/m³
Sample:	2	**Reproducibility s.d.:**	17,73 µg/m³
Method:	ISO 5725-2	**Relative reproducibility s.d.:**	17,45%
No. of laboratories:	14	**Reference value:**	103,50 µg/m³
Relative target s.d.:	10,00% (Limited)	**Range of tolerance:**	81,29 - 121,93 µg/m³ (|Z-Score| <= 2,00)



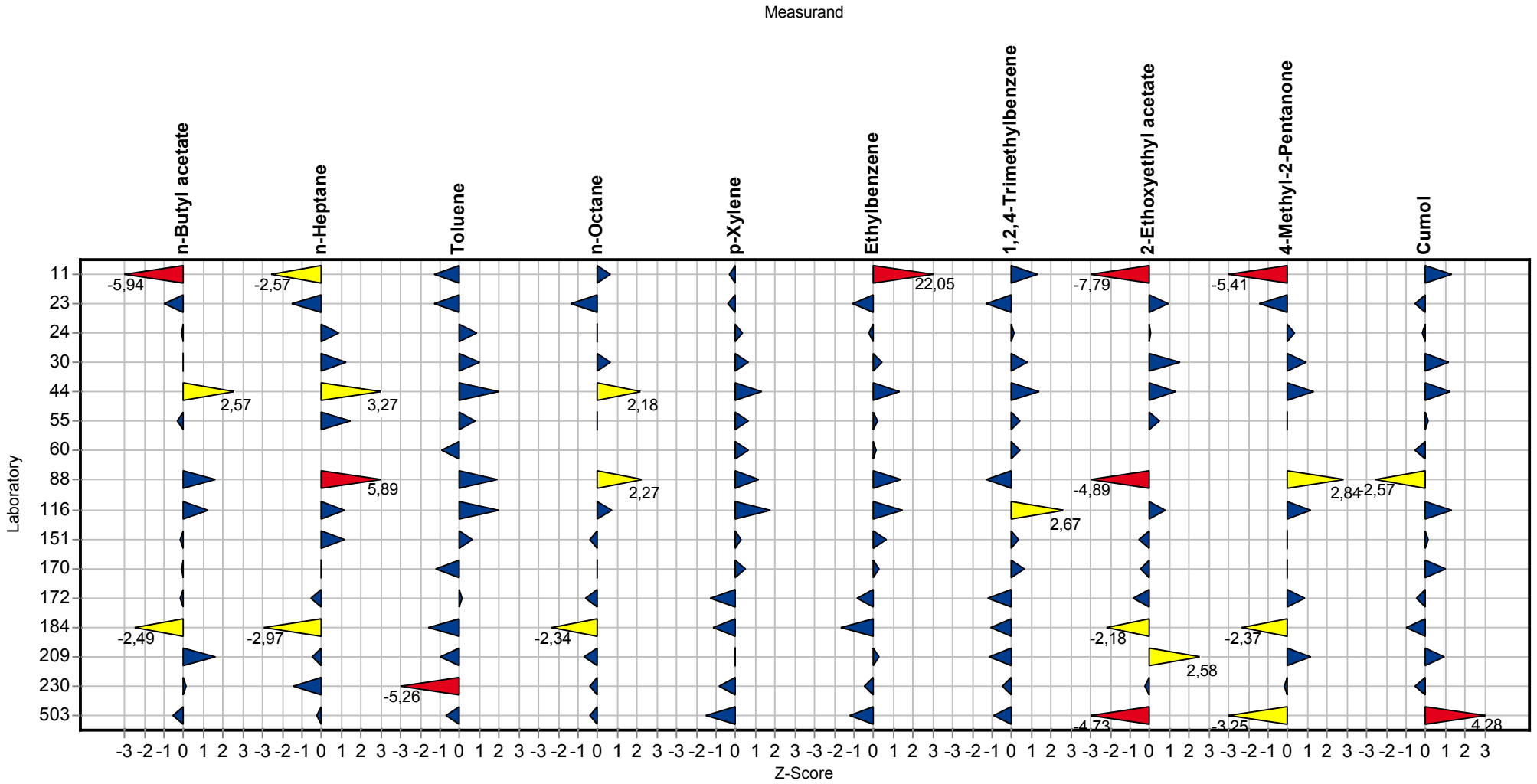
Summary results

Measurand:	Cumol	**Mean:**	116,43 µg/m³
Sample:	2	**Reproducibility s.d.:**	13,69 µg/m³
Method:	ISO 5725-2	**Relative reproducibility s.d.:**	11,76%
No. of laboratories:	14	**Reference value:**	121,60 µg/m³
Relative target s.d.:	10,00% (Limited)	**Range of tolerance:**	93,14 - 139,71 µg/m³ (|Z-Score| <= 2,00)



Sample chart of Z-Scores

Sample 2



Questions and Answers

Participant	Kind of tube	Sampling pump	Volume flow	Volume flow measurement	Sampling time
11	tenax ta	/	/	/	/
23	Tenax TA	GSA SG 350; Gilian LFS-113DC	100 mL/min	Definer 220-M	50 min
24	Gertsel Tenax TA	Desaga GS 301	0,1-0,2 L/min	Desaga GS 301	20-40 min
30	Tenax TA	-	-	-	-
44	Tenax TA	Gilian	100ml/min	Gilian	40min
55	Tenax TA	/	/	/	/
88	Tenax TA	/	/	/	/
116	TENAX TA	Gilian LFS 113	0,1 l/min	BIOS Defender	
151	Tenax TA				
170	Tenax TA	Gilian GilAir plus	100 mL/min	Bios Defender 530	20 bis 50 Minuten
172	Tenax	FLEC-Pumpe	0,1 l/min		30 min
184	Perkin-Elmer, Tenax	GSA SG 5100	0,05 l/min	Rotameter + digital	60 min
209	Tenax TA	GilAir, GSA2500	1.5 - 1.8 l/min	TSI 4100	15 - 20 min
230	Tenax TA	Fa. Holbach, BIVOC 2	0,15 m/l min	TSI, Modell 4100	20 Minuten
503	tenax	---	---	---	---

Participant	Analytical method	thermodesorber	Desorption temperature	Desorption flow	Desorption time
11	YES	PERKIN ELMER ATD650	280	30	15
23	Ja	Perkin Elmer ATD 400	295 °C	50	15 min
24	DIN ISO 16000-6	Gerstel TDS 2	280°C	43 ml/min	10min
30	ISO 16000-6	Perkim Elmer TD 650	260°C	50 ml/min	15 min
44	No	PE ATD650	280	50	5
55	Yes	Unity Markes	300	25	10
88	NO (ISO 16000-6)	Ultra TD (Markes)	280°C	20	15
151	Yes	Perkin Elmer Turbomatrix 650	280	100	10
170	Nein	Gerstel TDS	30 °C - 280 °C; 40 K/min	38	7 Min Haltezeit
172	Ja	Shimadzu TD 20	280 °C	60	15
184	ja	Turbomatrix ATD, Perkin-Elmer	280°C	50 ml/min	10 min
209	(1) DIN ISO 16000-6 (2) DIN EN ISO 16.000-6:2012-11				

Participant	Analytical method	thermodesorber	Desorption temperature	Desorption flow	Desorption time
230	DIN EN 16000-6	TDS 3, Fa. Gerstel	40°C bis 260°C	30 ml/min	5 Minuten
503	No	Markes	300°C	50 ml/min	5 min

Participant	Cyro trap	Carrier gas	Flow rate	Analytical column
11	-30/300	HELIUM	25PSI	5% PHENYL 95% Methylsiloxane
23	-27 °C und 295 °C	Helium	45	RXi-SIL-5ms Säulenlänge:60m;Säuleninnendurchmesser 0,25 mm; Filmdicke 0,1µm
24	-150°C / 280°C	Helium	1,3ml/min	Agilent Ultra 2
30	-30°C/280°C	He	1 ml/min	Rxi 5MS 60 m x 0.25 mm id x 0.25 µm df
44	-30 degree to 290 degree	Helium	1.5	DB-5 MS
55	10°C; max heating rate to 350°C	He	1.5	Rxi-5Sil-MS 60m x 0.25 mm ID x 1.0 µm
88	5°C (up to 280°C)	Helium	20	DSQ II (Thermo Scientific) - 95 % dimethylpolysiloxane, 5 % diphenylpolysiloxane
151	-30 and 300	Helium	1.2	50m BP1
170	-150 °C; 15 K/s auf 280 °C	Helium	1,2	DB-5MS; 50 m*0,2 mm*0,33 µm
172	-15/280 °C	TD: Stickstoff, GC: Helium	Programm	Restek RCI 5 Sil MS
184	-30°C auf 290°C	Helium	1 ml/min	RTX200, Restek
230	- 30°C - 10K/min auf 280°C	Helium	0,6 ml/min	Optima 1 MS Accent , MN, 60 m
503	-10°C / 305°C	He	1	HP-1MS

Participant	Data evaluation	Detector	Recovery rate
11	MS	MS	
23	substanzspezifisch kalibriert mit Vergleichsstandards	MS (Shimadzu GC/MS 2010)	Ja
24	2-Punkt-Kalibrierung externer Standards	Agilent MSD 5973	ja
30	identification by MS and quantification by FID	Agilent GC 7890A with MS 5975C	no
44	internal standard method	MSD	No
55	calibration curve 9 points and internal standard; MS identification m/z + retention time	MS Agilent	
88	using the actual response factor for each compound	Mass spectrometer	No
151	External standards, twin colum RTs	FID	No
170	substanzspezifisch / GC-MS Datenbank Nist11	MS 5973N	nein
172	Interne Standards mit RRF zu den mitgeführten externen Standards, externe Standards	Massenspektrometer	ja
184	Kalibrierung mit internem Standard	MSD	nein

Participant	Data evaluation	Detector	Recovery rate
230	Referenzstandards bekannter Konzentration, mit eigener Belegung. Identifizierung RT und MS,	MS	nein
503	target	MS	no

Participant	date of analysis
11	23/06/15
23	28.05.15
24	03.-17.06.2015
30	01/06/2015
44	20150706
55	03/06/2015
88	04 and 11/06/2015
151	9th July 2015
170	11.06.2015
172	02.06.2015
184	22.05.15-05.06.15
230	01.06.2015
503	03/06/15

Blank values RRT VOC with sampling 2/2015

blank 1, 20 May 2015

µg/m³

Lab	1,2,4-Trimethyl-benzene	Ethyl-benzene	p-Xylene	n-Octane	Toluene	n-Heptane	n-Butyl acetate	Cumol	4-Methyl -2- pentanone	2-Ethoxy ethylacetate
11	60,8	560,0	60,10	141,00	66,80	61,00	19,30	58,80	31,20	16,40
23	< 1,00	<1,0	<1,0	<1,0	2,00	<1,0	<1,0	<1,0	<1,0	<1,0
24	0	0	0	0	0	0	0	0	0	0
30	<2,0	<2,0	<1,0	<2,0	<1,0	<2,0	<2,0	<2,0	<2,0	<2,0
44	0	0	0	0	0	0	0	0	0	0
55	<1,0	<1,0	<1,0	<1,0	<1,0	<1,0	<1,0	<1,0	<1,0	<1,0
60	<2,5	<2,5	<2,5	<2,5	<2,5	<2,5	<2,5	<2,5	<2,5	<2,5
88	2,00	0	2,00	-1,00	0	-2,00	0	5,00	-3,00	2,00
116	2,00	3,00	7,00	<1,0	2,00	1,00	2,00	<1,0	<1,0	<1,0
151	2,50	0	0	0	0	0	0,20	0	0	0
170	<1,0	<1,0	<1,0	<1,0	<1,0	<1,0	<1,0	<1,0	<1,0	<1,0
172	< 1,30	< 1,30	< 1,30	< 1,30	< 2,70	< 1,30	< 2,70	< 1,30	< 2,70	< 1,70
184	<1,0	<1,0	<1,0	<1,0	<1,0	<1,0	<1,0	<1,0	<1,0	<1,0
209	0	0	0	0	0	0	0	0	0	0
230	<2,0	<2,0	<2,0	<2,0	<2,0	4,00	<2,0	<2,0	<2,0	4,00
503	<2,5	<2,5	<2,5	<2,5	<2,5	<2,5	<2,5	<2,5	<2,5	<2,5
IFA	<5,0	<5,0	<5,0	<5,0	<5,0	<5,0	<5,0	<10,0	<10,0	<10,0

blank 2, 21 May 2015

µg/m³

Lab	1,2,4-Trimethyl-benzene	Ethyl-benzene	p-Xylene	n-Octane	Toluene	n-Heptane	n-Butyl acetate	Cumol	4-Methyl -2- pentanone	2-Ethoxy ethylacetate
11	246,61	2752,9	77,05	319,00	42,50	70,50		128,1	2,88	
23	<1,0	<1,0	<1,0	<1,0	<1,0	<1,0	<1,0	<1,0	<1,0	<1,0
24	0	0	0	0	0	0	0	0	0	0
30	<2,0	<2,0	<1,0	<2,0	<1,0	<2,0	<2,0	<2,0	<2,0	<2,0
44	0	0	0	0	0	0	0	0	0	0
55	<1,0	<1,0	<1,0	<1,0	<1,0	<1,0	<1,0	<1,0	<1,0	<1,0
60	<2,5	<2,5	<2,5	<2,5	<2,5	<2,5	<2,5	<2,5	<2,5	<2,5
88	3,00	0	2,00	-1,00	0	-1,00	0	5,00	-3,00	4,00
116	2,00	2,00	4,00	< 1,0	2,00	1,00	2,00	< 1,0	< 1,0	<1,0
151	1,30	0	0	0,20	0	0	0,30	0	0	0
170	<1,0	<1,0	<1,0	<1,0	<1,0	<1,0	<1,0	<1,0	<1,0	<1,0
172	< 1,30	< 1,30	< 1,30	< 1,30	< 2,70	< 1,30	< 2,70	< 1,30	< 2,70	< 1,70
184	<1,0	<1,0	<1,0	<1,0	<1,0	<1,0	<1,0	<1,0	<1,0	<1,0
209	0	0	0	0	0	0	0	0	0	0
230	<2,0	<2,0	<2,0	<2,0	<2,0	12,00	<2,0	<2,0	2,00	<2,0
503	<2,50	<2,5	<2,5	<2,5	<2,5	<2,5	<2,5	<2,5	<2,5	<2,5
IFA	<5,0	<5,0	<5,0	<5,0	<5,0	<5,0	<5,0	<10,00	<10,00	<10,00