

Proficiency testing for in-house measuring laboratories – Results and Evaluation

Proficiency testing scheme Metals on filters July/August 2023

Summary of laboratory test results

Sample 1

| Unit | Cobalt | | Copper | | Indium | | Lead | | Manganese | |
|--------|------------|---------|------------|---------|------------|----------|------------|---------|------------|---------|
| | µg absolut | Z score | µg absolut | Z score | µg absolut | Z score | µg absolut | Z score | µg absolut | Z score |
| 1 | 9,76 | -0,05 | 11,70 | -0,24 | < 0,50 | | 24,10 | -0,12 | 6,01 | 0,13 |
| 5 | 10,28 | 0,48 | 12,87 | 0,73 | 0,40 | 0,62 | 26,16 | 0,73 | 6,60 | 1,13 |
| 13 | 9,30 | -0,52 | 11,40 | -0,49 | 0,38 | 0,06 | 21,90 | -1,02 | 5,76 | -0,29 |
| 33 | 9,53 | -0,28 | 11,95 | -0,03 | 0,39 | 0,20 | 25,20 | 0,33 | 5,90 | -0,06 |
| 42 | 10,02 | 0,22 | 11,95 | -0,03 | 0,39 | 0,33 | 23,77 | -0,25 | 6,09 | 0,27 |
| 54 | 10,30 | 0,50 | 12,80 | 0,68 | 0,38 | 0,09 | 24,03 | -0,15 | 6,27 | 0,57 |
| 68 | 10,30 | 0,50 | 12,80 | 0,68 | | | 23,80 | -0,24 | 6,25 | 0,53 |
| 70 | 9,06 | -0,76 | 11,90 | -0,07 | | | 22,96 | -0,59 | 4,75 | -1,99 |
| 71 | 10,51 | 0,72 | 12,30 | 0,26 | | | 25,67 | 0,52 | 6,10 | 0,28 |
| 80 | 10,50 | 0,71 | 13,40 | 1,18 | 0,37 | -0,18 | 27,70 | 1,36 | 6,41 | 0,80 |
| 84 | 9,38 | -0,44 | 12,00 | 0,01 | | | 23,50 | -0,36 | 5,68 | -0,43 |
| 90 | 9,55 | -0,26 | 11,63 | -0,30 | 0,35 | -0,73 | 23,02 | -0,56 | 5,74 | -0,32 |
| 92 | 9,68 | -0,13 | 11,50 | -0,40 | 0,39 | 0,33 | 25,00 | 0,25 | 5,96 | 0,05 |
| 95 | 10,12 | 0,32 | 12,68 | 0,58 | 0,37 | -0,23 | 24,40 | 0,00 | 6,20 | 0,45 |
| 106 | 9,71 | -0,10 | 12,14 | 0,13 | 0,39 | 0,33 | 24,60 | 0,09 | 5,90 | -0,06 |
| 111 | 10,12 | 0,32 | 12,72 | 0,61 | 0,39 | 0,20 | 25,42 | 0,42 | 6,22 | 0,49 |
| 116 | 9,99 | 0,19 | 12,50 | 0,43 | 0,43 | 1,33 | 24,70 | 0,13 | 6,44 | 0,86 |
| 129 | 9,51 | -0,30 | 12,16 | 0,15 | | | 26,67 | 0,93 | 6,50 | 0,96 |
| 154 | 9,11 | -0,71 | 10,98 | -0,84 | 0,35 | -0,71 | 22,40 | -0,82 | 5,47 | -0,77 |
| 177 | 11,10 | 1,32 | 11,70 | -0,24 | 0,10 | -7,35 BE | 23,30 | -0,45 | 4,70 | -2,08 E |
| 197 | 9,39 | -0,43 | 10,90 | -0,91 | 0,35 | -0,71 | 22,50 | -0,77 | 5,49 | -0,75 |
| 206 | 8,45 | -1,38 | 9,95 | -1,70 | 0,34 | -1,00 | 23,80 | -0,24 | 5,32 | -1,03 |
| 243 | 10,29 | 0,49 | 12,95 | 0,81 | | | 26,22 | 0,75 | 6,61 | 1,14 |
| 252 | 9,97 | 0,16 | 12,26 | 0,23 | 0,38 | 0,06 | 24,81 | 0,17 | 5,97 | 0,06 |
| 267 | 9,30 | -0,52 | 11,80 | -0,15 | | | 23,50 | -0,36 | 5,70 | -0,39 |
| 294 | 9,79 | -0,02 | 10,67 | -1,10 | | | 25,00 | 0,25 | 6,20 | 0,45 |
| - | - | -- | - | -- | - | -- | - | -- | - | -- |
| Method | ISO 5725-2 | | ISO 5725-2 | | ISO 5725-2 | | ISO 5725-2 | | ISO 5725-2 | |

| | Cobalt Z score | Copper Z score | Indium Z score | Lead Z score | Manganese Z score |
|--|----------------|----------------|----------------|--------------|-------------------|
| Assessment | Z <=2,00 | Z <=2,00 | Z <=2,00 | Z <=2,00 | Z <=2,00 |
| No. of laboratories that submitted results | 26 | 26 | 18 | 26 | 26 |
| Mean | 9,81 | 11,98 | 0,38 | 24,39 | 5,93 |
| Reprod. s.d. | 0,56 | 0,79 | 0,02 | 1,40 | 0,49 |
| Rel. reproducibility s.d. | 5,73 % | 6,57 % | 5,88 % | 5,73 % | 8,33 % |
| Reference value | 10,08 | 13,01 | 0,37 | 25,80 | 6,19 |
| Target s.d. | 0,98 | 1,20 | 0,04 | 2,44 | 0,59 |
| Rel. target s.d. | 10,00 % | 10,00 % | 10,00 % | 10,00 % | 10,00 % |
| Lower limit of tolerance | 7,85 | 9,59 | 0,30 | 19,51 | 4,75 |
| Upper limit of tolerance | 11,77 | 14,38 | 0,45 | 29,27 | 7,12 |
| Type B outliers | | | 1 | | |
| No. of laboratories after elimination of outliers type A-D and F (without laboratories that only gave states but no measured values) | 26 | 26 | 16 | 26 | 26 |
| 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 | | | | | |

| | Nickel Z score | Zinc Z score |
|------|----------------|--------------|
| Unit | µg absolut | µg absolut |
| 1 | 12,90 -0,26 | 99,00 0,75 |
| 5 | 14,12 0,66 | 96,79 0,51 |
| 13 | 12,40 -0,64 | 93,70 0,18 |
| 33 | 12,88 -0,27 | 90,60 -0,16 |
| 42 | 12,95 -0,22 | 93,68 0,18 |
| 54 | 14,25 0,76 | 90,00 -0,22 |

| | Nickel | Z score | Zinc | Z score |
|--|------------|----------|------------|----------|
| 68 | 14,25 | 0,76 | 97,45 | 0,59 |
| 70 | 12,44 | -0,61 | 82,63 | -1,02 |
| 71 | 35,55 | 16,85 BE | 95,11 | 0,33 |
| 80 | 14,30 | 0,80 | 107,00 | 1,62 |
| 84 | 12,90 | -0,26 | 88,80 | -0,35 |
| 90 | 12,34 | -0,68 | 88,11 | -0,43 |
| 92 | 12,80 | -0,33 | 77,00 | -1,64 |
| 95 | 13,73 | 0,37 | 89,50 | -0,28 |
| 106 | 13,11 | -0,10 | 93,17 | 0,12 |
| 111 | 14,28 | 0,78 | 99,11 | 0,77 |
| 116 | 13,60 | 0,27 | 98,90 | 0,74 |
| 129 | 14,70 | 1,10 | 90,47 | -0,17 |
| 154 | 12,31 | -0,70 | 81,94 | -1,10 |
| 177 | 20,00 | 5,10 BE | 45,50 | -5,06 BE |
| 197 | 12,20 | -0,79 | 87,40 | -0,51 |
| 206 | 11,70 | -1,16 | 84,80 | -0,79 |
| 243 | 14,05 | 0,61 | 96,56 | 0,49 |
| 252 | 13,26 | 0,01 | 94,99 | 0,32 |
| 267 | 13,10 | -0,11 | 88,50 | -0,39 |
| 294 | 18,28 | 3,80 BE | 96,10 | 0,44 |
| - | - | -- | - | -- |
| Method | ISO 5725-2 | | ISO 5725-2 | |
| Assessment | Z <=2,00 | | Z <=2,00 | |
| No. of laboratories that submitted results | 26 | | 26 | |
| Mean | 13,24 | | 92,05 | |
| Reprod. s.d. | 0,83 | | 6,54 | |
| Rel. reproducibility s.d. | 6,30 % | | 7,11 % | |
| Reference value | 13,88 | | 98,90 | |
| Target s.d. | 1,32 | | 9,21 | |
| Rel. target s.d. | 10,00 % | | 10,00 % | |
| Lower limit of tolerance | 10,59 | | 73,64 | |
| Upper limit of tolerance | 15,89 | | 110,46 | |
| Type B outliers | 3 | | 1 | |
| No. of laboratories after elimination of | 23 | | 25 | |

Nickel Z score

Zinc Z score

outliers type A-D and F (w ithout
laboratories that only gave states but no
measured values)

Summary of laboratory test results

Sample 2

| Unit | Cobalt Z score | | Copper Z score | | Indium Z score | | Lead Z score | | Manganese Z score | |
|--------|----------------|----------|----------------|-------|----------------|----------|--------------|----------|-------------------|-------|
| | µg absolut | | µg absolut | | µg absolut | | µg absolut | | µg absolut | |
| 1 | 3,73 | -0,30 | 24,10 | -0,37 | 2,51 | -0,83 | 61,10 | -0,44 | 25,00 | -0,08 |
| 5 | 4,02 | 0,46 | 26,09 | 0,42 | 2,99 | 0,92 | 66,19 | 0,36 | 27,17 | 0,78 |
| 13 | 3,66 | -0,48 | 24,00 | -0,41 | 2,73 | -0,03 | 68,40 | 0,70 | 24,00 | -0,48 |
| 33 | 3,80 | -0,12 | 25,28 | 0,10 | 2,80 | 0,23 | 66,20 | 0,36 | 25,25 | 0,02 |
| 42 | 3,82 | -0,07 | 24,53 | -0,20 | 2,93 | 0,70 | 63,03 | -0,14 | 25,29 | 0,04 |
| 54 | 4,04 | 0,51 | 26,20 | 0,47 | 2,57 | -0,61 | 62,00 | -0,30 | 25,70 | 0,20 |
| 68 | 4,00 | 0,40 | 25,70 | 0,27 | | | 60,60 | -0,52 | 25,80 | 0,24 |
| 70 | 3,81 | -0,09 | 25,23 | 0,08 | | | 60,59 | -0,52 | 24,40 | -0,32 |
| 71 | 3,94 | 0,24 | 25,78 | 0,30 | | | 65,95 | 0,32 | 25,75 | 0,22 |
| 80 | 4,05 | 0,53 | 29,20 | 1,66 | 2,80 | 0,23 | 71,90 | 1,25 | 28,70 | 1,39 |
| 84 | 3,79 | -0,14 | 25,70 | 0,27 | | | 62,60 | -0,21 | 24,00 | -0,48 |
| 90 | 3,79 | -0,14 | 24,19 | -0,34 | 2,68 | -0,21 | 66,41 | 0,39 | 25,09 | -0,04 |
| 92 | 3,86 | 0,04 | 24,50 | -0,21 | 2,88 | 0,52 | 64,10 | 0,03 | 26,20 | 0,40 |
| 95 | 3,92 | 0,19 | 25,05 | 0,00 | 2,52 | -0,80 | 61,17 | -0,43 | 24,64 | -0,22 |
| 106 | 3,73 | -0,30 | 24,50 | -0,21 | 2,69 | -0,17 | 65,89 | 0,31 | 24,08 | -0,44 |
| 111 | 4,14 | 0,78 | 27,71 | 1,07 | 2,88 | 0,51 | 68,43 | 0,71 | 27,07 | 0,74 |
| 116 | 3,94 | 0,25 | 26,20 | 0,47 | 3,03 | 1,07 | 65,70 | 0,28 | 26,30 | 0,44 |
| 129 | 3,63 | -0,56 | 25,84 | 0,32 | | | 64,73 | 0,13 | 27,21 | 0,80 |
| 154 | 3,54 | -0,79 | 21,95 | -1,23 | 2,50 | -0,87 | 56,21 | -1,21 | 22,45 | -1,09 |
| 177 | 2,80 | -2,72 BE | 24,30 | -0,29 | 0,80 | -7,08 BE | 45,80 | -2,83 BE | 21,20 | -1,59 |
| 197 | 3,63 | -0,56 | 23,80 | -0,49 | 2,63 | -0,39 | 58,10 | -0,91 | 23,00 | -0,87 |
| 206 | 3,53 | -0,82 | 21,80 | -1,29 | 2,63 | -0,39 | 65,20 | 0,20 | 24,30 | -0,36 |
| 243 | 4,09 | 0,64 | 26,83 | 0,72 | | | 68,87 | 0,77 | 27,87 | 1,06 |
| 252 | 3,90 | 0,14 | 26,05 | 0,41 | 2,77 | 0,12 | 64,99 | 0,17 | 25,02 | -0,07 |
| 267 | 3,80 | -0,12 | 24,50 | -0,21 | | | 60,10 | -0,60 | 24,30 | -0,36 |
| 294 | 3,97 | 0,32 | 21,85 | -1,27 | | | 59,44 | -0,70 | 25,40 | 0,08 |
| - | - | -- | - | -- | - | -- | - | -- | - | -- |
| Method | ISO 5725-2 | | ISO 5725-2 | | ISO 5725-2 | | ISO 5725-2 | | ISO 5725-2 | |

| | Cobalt | Z score | Copper | Z score | Indium | Z score | Lead | Z score | Manganese | Z score |
|--|------------|---------|------------|---------|----------|---------|----------|---------|-----------|---------|
| Assessment | Z <=2,00 | | Z <=2,00 | | Z <=2,00 | | Z <=2,00 | | Z <=2,00 | |
| No. of laboratories that submitted results | 26 | | 26 | | 18 | | 26 | | 26 | |
| Mean | 3,85 | | 25,03 | | 2,74 | | 63,92 | | 25,20 | |
| Reprod. s.d. | 0,17 | | 1,68 | | 0,17 | | 3,72 | | 1,66 | |
| Rel. reproducibility s.d. | 4,40 % | | 6,72 % | | 6,11 % | | 5,82 % | | 6,60 % | |
| Reference value | 4,03 | | 27,61 | | 2,95 | | 69,40 | | 26,00 | |
| Target s.d. | 0,38 | | 2,50 | | 0,27 | | 6,39 | | 2,52 | |
| Rel. target s.d. | 10,00 % | | 10,00 % | | 10,00 % | | 10,00 % | | 10,00 % | |
| Lower limit of tolerance | 3,08 | | 20,03 | | 2,19 | | 51,13 | | 20,16 | |
| Upper limit of tolerance | 4,61 | | 30,04 | | 3,28 | | 76,70 | | 30,24 | |
| Type B outliers | 1 | | | | 1 | | 1 | | | |
| No. of laboratories after elimination of outliers type A-D and F (without laboratories that only gave states but no measured values) | 25 | | 26 | | 17 | | 25 | | 26 | |
| 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 | | | | | | | | | | |
| | Nickel | Z score | Zinc | Z score | | | | | | |
| Unit | µg absolut | | µg absolut | | | | | | | |
| 1 | 6,12 | -0,48 | 24,70 | -0,35 | | | | | | |
| 5 | 6,57 | 0,22 | 26,50 | 0,35 | | | | | | |
| 13 | 5,84 | -0,91 | 25,70 | 0,04 | | | | | | |
| 33 | 6,33 | -0,15 | 25,85 | 0,10 | | | | | | |
| 42 | 6,04 | -0,60 | 24,40 | -0,47 | | | | | | |
| 54 | 6,09 | -0,53 | 26,00 | 0,16 | | | | | | |

| | Nickel | Z score | Zinc | Z score |
|--|------------|---------|------------|----------|
| 68 | 6,75 | 0,50 | 27,35 | 0,68 |
| 70 | 7,65 | 1,90 | 23,83 | -0,69 |
| 71 | 6,66 | 0,36 | 26,81 | 0,47 |
| 80 | 6,79 | 0,56 | 29,70 | 1,60 |
| 84 | 6,29 | -0,21 | 26,20 | 0,23 |
| 90 | 6,08 | -0,54 | 24,29 | -0,51 |
| 92 | 6,28 | -0,23 | 21,90 | -1,44 |
| 95 | 6,37 | -0,10 | 24,11 | -0,58 |
| 106 | 6,13 | -0,46 | 24,96 | -0,25 |
| 111 | 6,95 | 0,82 | 27,14 | 0,60 |
| 116 | 6,61 | 0,28 | 27,70 | 0,82 |
| 129 | 7,00 | 0,89 | 26,73 | 0,44 |
| 154 | 5,79 | -0,99 | 22,11 | -1,36 |
| 177 | 7,80 | 2,13 E | 13,10 | -4,88 BE |
| 197 | 5,98 | -0,70 | 23,50 | -0,82 |
| 206 | 6,02 | -0,63 | 24,60 | -0,39 |
| 243 | 6,75 | 0,51 | 27,53 | 0,76 |
| 252 | 6,42 | -0,01 | 27,55 | 0,76 |
| 267 | 6,20 | -0,35 | 25,20 | -0,16 |
| 294 | 5,61 | -1,27 | 41,40 | 6,17 BE |
| - | - | -- | - | -- |
| Method | ISO 5725-2 | | ISO 5725-2 | |
| Assessment | Z <=2,00 | | Z <=2,00 | |
| No. of laboratories that submitted results | 26 | | 26 | |
| Mean | 6,43 | | 25,60 | |
| Reprod. s.d. | 0,52 | | 1,86 | |
| Rel. reproducibility s.d. | 8,17 % | | 7,26 % | |
| Reference value | 6,85 | | 29,60 | |
| Target s.d. | 0,64 | | 2,56 | |
| Rel. target s.d. | 10,00 % | | 10,00 % | |
| Lower limit of tolerance | 5,14 | | 20,48 | |
| Upper limit of tolerance | 7,71 | | 30,72 | |
| Type B outliers | | | 2 | |
| No. of laboratories after elimination of | 26 | | 24 | |

Nickel Z score

Zinc Z score

outliers type A-D and F (w ithout
laboratories that only gave states but no
measured values)

Summary of laboratory test results

Sample 3

| | Chromium Z score | | Cobalt Z score | | Copper Z score | | Indium Z score | | Lead Z score | |
|--------|------------------|----------|----------------|----------|----------------|-------|----------------|----------|--------------|-------|
| Unit | µg absolut | | µg absolut | | µg absolut | | µg absolut | | µg absolut | |
| 1 | 2,16 | -0,31 | 0,66 | -0,34 | 2,54 | -0,27 | 0,57 | -1,68 | 97,50 | 0,12 |
| 5 | 2,64 | 1,83 B | 0,72 | 0,48 | 2,73 | 0,46 | 0,76 | 1,10 | 101,45 | 0,53 |
| 13 | 2,15 | -0,35 | 0,68 | -0,10 | 2,32 | -1,11 | 0,68 | -0,05 | 104,00 | 0,79 |
| 33 | 2,19 | -0,17 | 0,65 | -0,55 | 2,60 | -0,04 | 0,68 | -0,11 | 96,40 | 0,00 |
| 42 | 2,16 | -0,31 | 0,66 | -0,39 | 2,54 | -0,27 | 0,70 | 0,21 | 87,87 | -0,88 |
| 54 | 2,34 | 0,50 | 0,71 | 0,31 | 2,73 | 0,46 | 0,66 | -0,31 | 90,50 | -0,61 |
| 68 | 2,30 | 0,32 | 0,70 | 0,19 | 2,70 | 0,35 | | | 90,75 | -0,58 |
| 70 | 2,16 | -0,31 | 0,61 | -1,09 | 2,55 | -0,23 | | | 94,73 | -0,17 |
| 71 | 2,18 | -0,23 | 0,67 | -0,28 | 2,65 | 0,16 | | | 98,02 | 0,17 |
| 80 | 2,27 | 0,19 | 0,70 | 0,20 | 2,94 | 1,27 | 0,68 | -0,07 | 107,60 | 1,17 |
| 84 | 2,17 | -0,26 | 0,65 | -0,51 | 2,54 | -0,27 | | | 94,80 | -0,16 |
| 90 | 2,05 | -0,80 | 0,65 | -0,54 | 2,46 | -0,57 | 0,62 | -0,96 | 98,08 | 0,18 |
| 92 | 2,31 | 0,37 | 0,68 | -0,12 | 2,60 | -0,04 | 0,72 | 0,55 | 97,40 | 0,11 |
| 95 | 7,65 | 24,32 BE | 0,72 | 0,42 | 2,71 | 0,40 | 0,71 | 0,30 | 91,84 | -0,47 |
| 106 | 2,18 | -0,22 | 0,68 | -0,10 | 2,67 | 0,23 | 0,68 | -0,08 | 93,08 | -0,34 |
| 111 | 2,50 | 1,22 | 0,74 | 0,83 | 2,98 | 1,42 | 0,72 | 0,47 | 100,99 | 0,48 |
| 116 | 2,33 | 0,46 | 0,68 | -0,16 | 2,68 | 0,27 | 0,79 | 1,52 | 89,50 | -0,71 |
| 129 | 4,44 | 9,93 BE | 0,44 | -3,60 BE | 2,45 | -0,61 | | | 96,00 | -0,04 |
| 154 | 2,12 | -0,48 | 0,66 | -0,39 | 2,48 | -0,52 | 0,66 | -0,37 | 89,38 | -0,72 |
| 177 | 3,60 | 6,16 BE | 0,80 | 1,64 | 2,80 | 0,73 | 0,20 | -7,08 BE | 114,00 | 1,83 |
| 197 | 2,16 | -0,31 | 0,62 | -1,00 | 2,35 | -1,00 | 0,64 | -0,65 | 88,50 | -0,82 |
| 206 | 2,18 | -0,22 | 0,64 | -0,68 | 2,42 | -0,73 | 0,70 | 0,21 | 101,00 | 0,48 |
| 243 | 2,45 | 1,00 | 0,74 | 0,76 | 2,76 | 0,57 | | | 105,24 | 0,92 |
| 252 | 2,23 | 0,01 | 0,72 | 0,48 | 2,73 | 0,46 | 0,68 | -0,08 | 93,37 | -0,31 |
| 267 | 2,20 | -0,13 | 0,70 | 0,19 | 2,50 | -0,42 | | | 90,50 | -0,61 |
| 294 | 5,42 | 14,33 BE | 0,74 | 0,77 | 2,42 | -0,72 | | | 92,80 | -0,37 |
| - | - | -- | - | -- | - | -- | - | -- | - | -- |
| Method | ISO 5725-2 | | ISO 5725-2 | | ISO 5725-2 | | ISO 5725-2 | | ISO 5725-2 | |

| | Chromium | Z score | Cobalt | Z score | Copper | Z score | Indium | Z score | Lead | Z score |
|--|----------|---------|----------|---------|----------|---------|----------|---------|----------|---------|
| Assessment | Z <=2,00 | | Z <=2,00 | | Z <=2,00 | | Z <=2,00 | | Z <=2,00 | |
| No. of laboratories that submitted results | 26 | | 26 | | 26 | | 18 | | 26 | |
| Mean | 2,23 | | 0,69 | | 2,61 | | 0,69 | | 96,36 | |
| Reprod. s.d. | 0,11 | | 0,04 | | 0,17 | | 0,05 | | 6,45 | |
| Rel. reproducibility s.d. | 4,93 % | | 6,29 % | | 6,40 % | | 7,36 % | | 6,69 % | |
| Reference value | 2,37 | | 0,70 | | 2,94 | | 0,69 | | 100,90 | |
| Target s.d. | 0,22 | | 0,07 | | 0,26 | | 0,07 | | 9,64 | |
| Rel. target s.d. | 10,00 % | | 10,00 % | | 10,00 % | | 10,00 % | | 10,00 % | |
| Lower limit of tolerance | 1,78 | | 0,55 | | 2,09 | | 0,55 | | 77,09 | |
| Upper limit of tolerance | 2,67 | | 0,82 | | 3,13 | | 0,82 | | 115,63 | |
| Type B outliers | 5 | | 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 | | 25 | | 26 | | 17 | | 26 | |
| 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 | | | | | | | | | | |

| | Manganese | Z score | Nickel | Z score | Zinc | Z score |
|------|------------|---------|------------|---------|------------|---------|
| Unit | µg absolut | | µg absolut | | µg absolut | |
| 1 | 10,80 | 0,00 | 4,41 | -0,09 | 62,10 | -0,42 |
| 5 | 12,03 | 1,14 | 4,76 | 0,70 | 68,86 | 0,62 |
| 13 | 10,70 | -0,09 | 4,24 | -0,47 | 74,10 | 1,43 |
| 33 | 10,45 | -0,33 | 4,30 | -0,34 | 62,70 | -0,33 |
| 42 | 10,62 | -0,17 | 4,23 | -0,50 | 61,26 | -0,55 |
| 54 | 11,00 | 0,18 | 4,23 | -0,50 | 60,40 | -0,68 |

| | Manganese | Z score | Nickel | Z score | Zinc | Z score |
|--|------------|---------|------------|---------|------------|----------|
| 68 | 11,05 | 0,23 | 4,70 | 0,56 | 67,80 | 0,46 |
| 70 | 9,68 | -1,04 | 4,10 | -0,79 | 56,61 | -1,27 |
| 71 | 10,77 | -0,03 | 4,65 | 0,45 | 66,20 | 0,21 |
| 80 | 11,30 | 0,46 | 4,72 | 0,61 | 73,40 | 1,32 |
| 84 | 10,10 | -0,65 | 4,36 | -0,20 | 62,50 | -0,36 |
| 90 | 10,18 | -0,58 | 4,11 | -0,76 | 63,34 | -0,23 |
| 92 | 11,00 | 0,18 | 4,46 | 0,02 | 54,90 | -1,53 |
| 95 | 11,03 | 0,21 | 6,55 | 4,73 BE | 62,23 | -0,40 |
| 106 | 10,69 | -0,10 | 4,47 | 0,04 | 63,19 | -0,25 |
| 111 | 11,65 | 0,78 | 4,87 | 0,95 | 69,94 | 0,79 |
| 116 | 11,30 | 0,46 | 4,55 | 0,22 | 71,30 | 1,00 |
| 129 | 11,49 | 0,64 | 5,63 | 2,65 BE | 64,47 | -0,05 |
| 154 | 10,31 | -0,46 | 4,32 | -0,29 | 61,51 | -0,51 |
| 177 | 9,10 | -1,58 | 6,00 | 3,48 BE | 32,80 | -4,94 BE |
| 197 | 9,68 | -1,04 | 4,03 | -0,94 | 61,40 | -0,53 |
| 206 | 10,60 | -0,19 | 4,40 | -0,11 | 64,80 | 0,00 |
| 243 | 12,43 | 1,50 | 4,92 | 1,06 | 70,42 | 0,86 |
| 252 | 10,79 | -0,01 | 4,61 | 0,36 | 66,92 | 0,32 |
| 267 | 10,60 | -0,19 | 4,40 | -0,11 | 63,60 | -0,19 |
| 294 | 11,52 | 0,66 | 4,52 | 0,15 | 66,70 | 0,29 |
| - | - | -- | - | -- | - | -- |
| 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 | 26 | | 26 | | 26 | |
| Mean | 10,80 | | 4,45 | | 64,83 | |
| Reprod. s.d. | 0,73 | | 0,25 | | 4,77 | |
| Rel. reproducibility s.d. | 6,76 % | | 5,51 % | | 7,35 % | |
| Reference value | 11,13 | | 4,87 | | 71,70 | |
| Target s.d. | 1,08 | | 0,45 | | 6,48 | |
| Rel. target s.d. | 10,00 % | | 10,00 % | | 10,00 % | |
| Lower limit of tolerance | 8,64 | | 3,56 | | 51,86 | |
| Upper limit of tolerance | 12,96 | | 5,34 | | 77,79 | |
| Type B outliers | | | 3 | | 1 | |
| No. of laboratories after elimination of | 26 | | 23 | | 25 | |

Manganese Z score

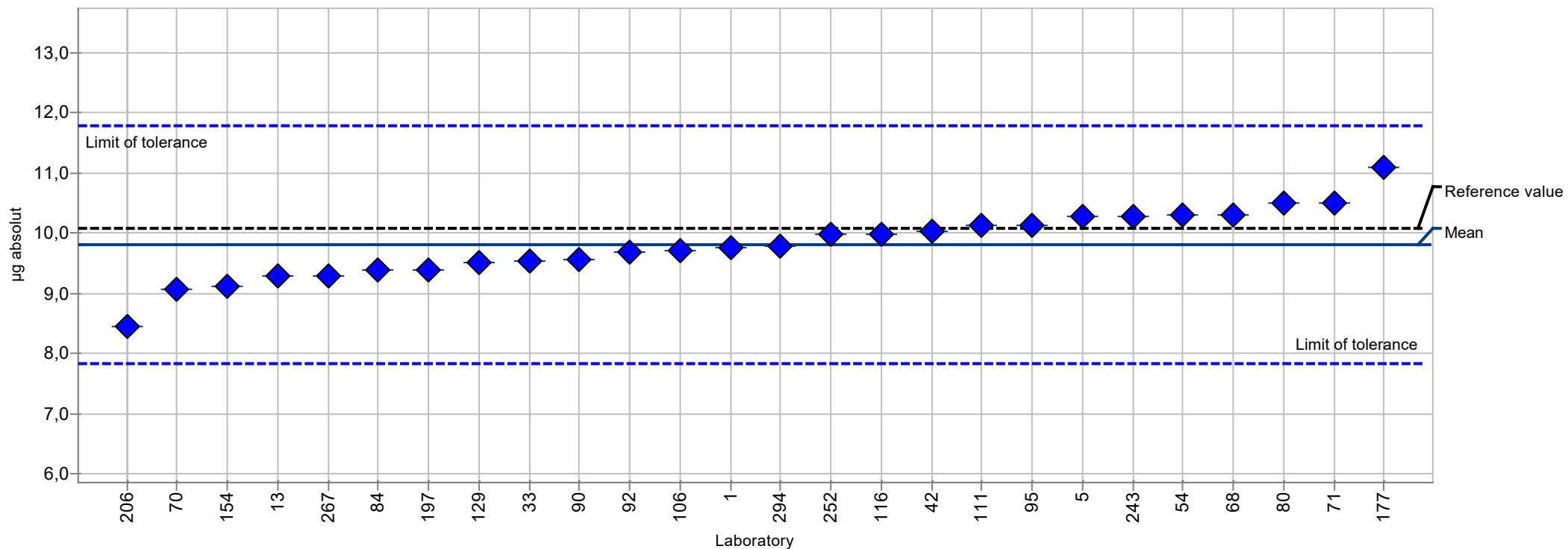
Nickel Z score

Zinc Z score

outliers type A-D and F (w ithout
laboratories that only gave states but no
measured values)

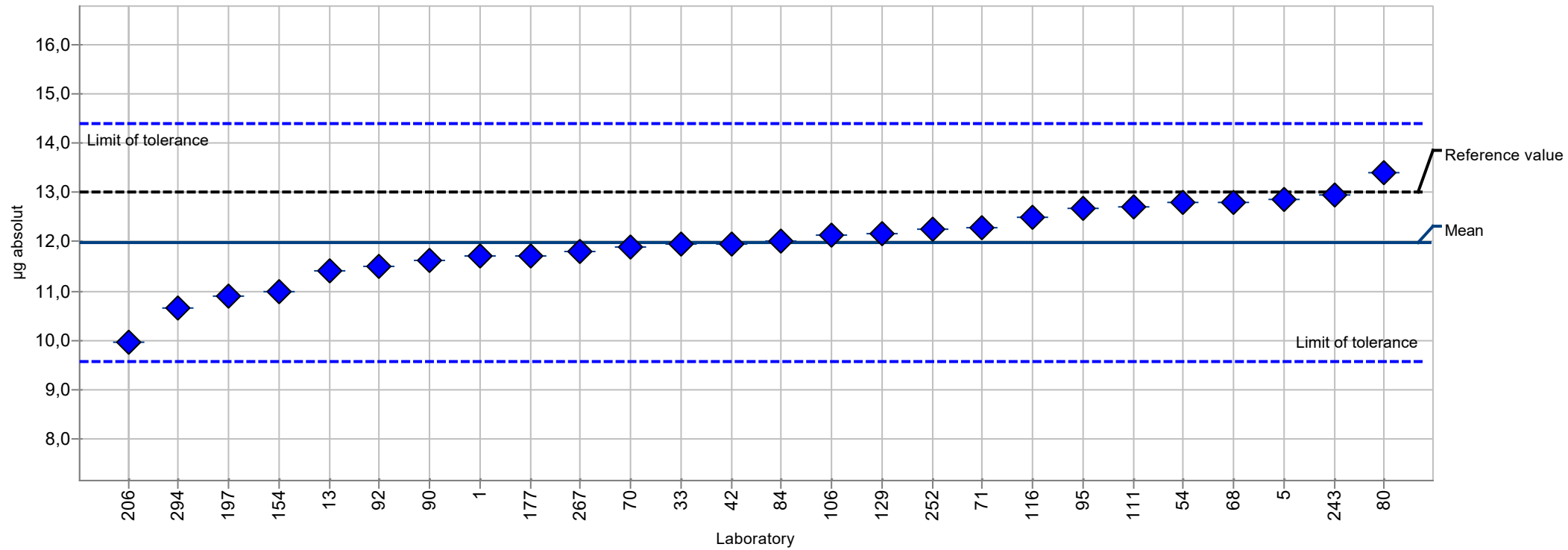
Summary results

| | | | |
|---|-------------------|----------------------------|---|
| Measurand: | Cobalt | Mean: | 9,81 µg absolut |
| Sample: | 1 | Reprod. s.d.: | 0,56 µg absolut |
| Method: | ISO 5725-2 | Rel.reprod. s.d.: | 5,73% |
| Rel.target s.d.: | 10,00% | Reference value: | 10,08 µg absolut |
| Number of laboratories in calculation: | 26 | Range of tolerance: | 7,85 - 11,77 µg absolut (Z-Score <= 2,00) |



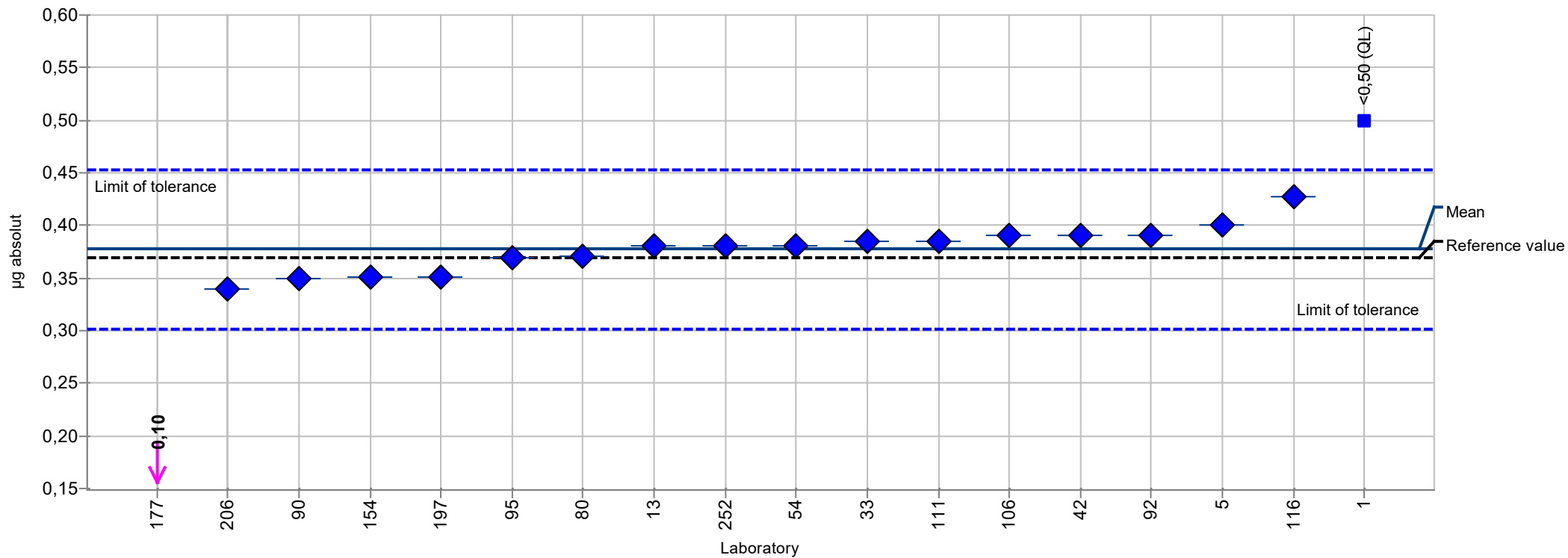
Summary results

| | | | |
|--|------------|---------------------|---|
| Measurand: | Copper | Mean: | 11,98 µg absolut |
| Sample: | 1 | Reprod. s.d.: | 0,79 µg absolut |
| Method: | ISO 5725-2 | Rel.reprod. s.d.: | 6,57% |
| Rel.target s.d.: | 10,00% | Reference value: | 13,01 µg absolut |
| Number of laboratories in calculation: | 26 | Range of tolerance: | 9,59 - 14,38 µg absolut (Z-Score <= 2,00) |



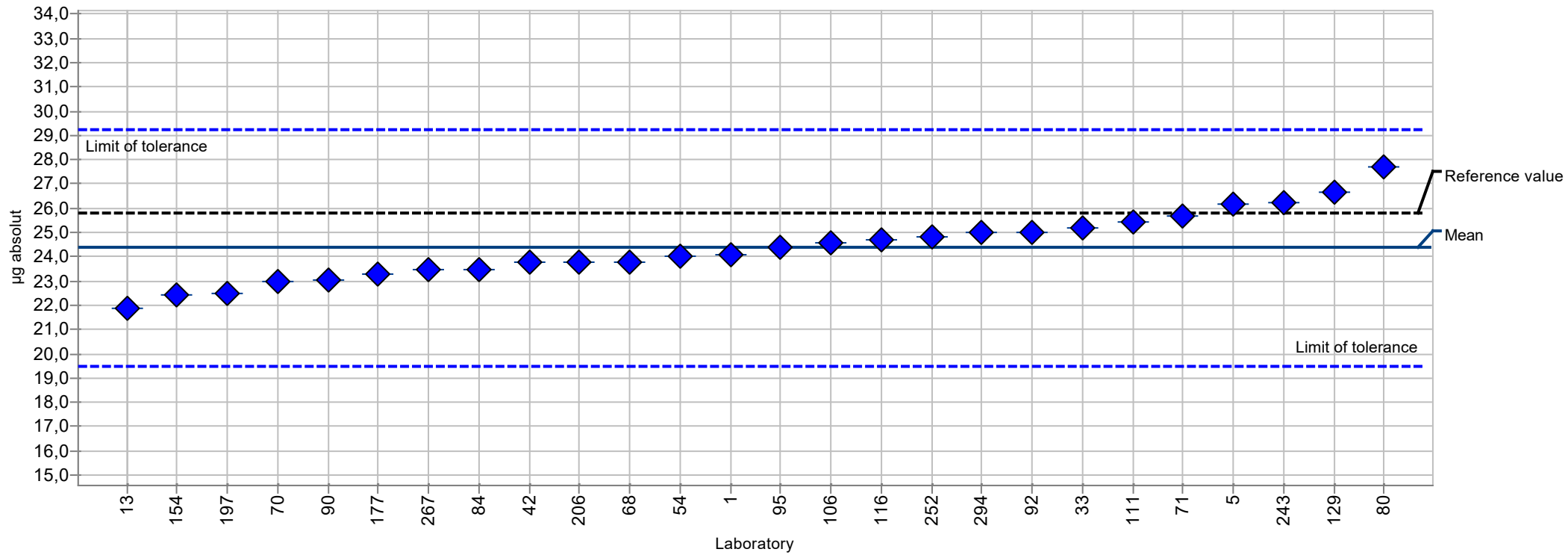
Summary results

| | | | |
|--|------------|----------------------------|---|
| Measurand: | Indium | Mean: | 0,38 µg absolut |
| Sample: | 1 | Reprod. s.d.: | 0,02 µg absolut |
| Method: | ISO 5725-2 | Rel.reprod. s.d.: | 5,88% |
| Rel.target s.d.: | 10,00% | Reference value: | 0,37 µg absolut |
| Number of laboratories in calculation + outliers: | 17 | Range of tolerance: | 0,30 - 0,45 µg absolut ($ Z\text{-Score} \leq 2,00$) |



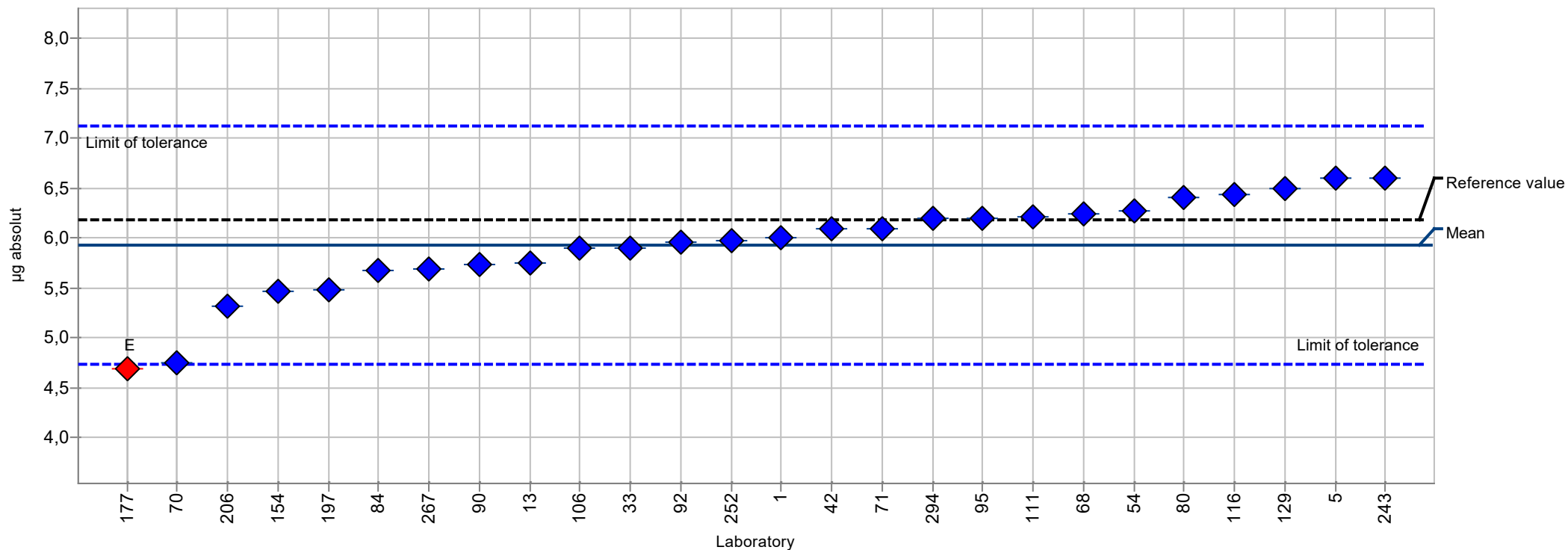
Summary results

| | | | |
|---|------------|----------------------------|---|
| Measurand: | Lead | Mean: | 24,39 µg absolut |
| Sample: | 1 | Reprod. s.d.: | 1,40 µg absolut |
| Method: | ISO 5725-2 | Rel.reprod. s.d.: | 5,73% |
| Rel.target s.d.: | 10,00% | Reference value: | 25,80 µg absolut |
| Number of laboratories in calculation: | 26 | Range of tolerance: | 19,51 - 29,27 µg absolut ($ Z\text{-Score} \leq 2,00$) |



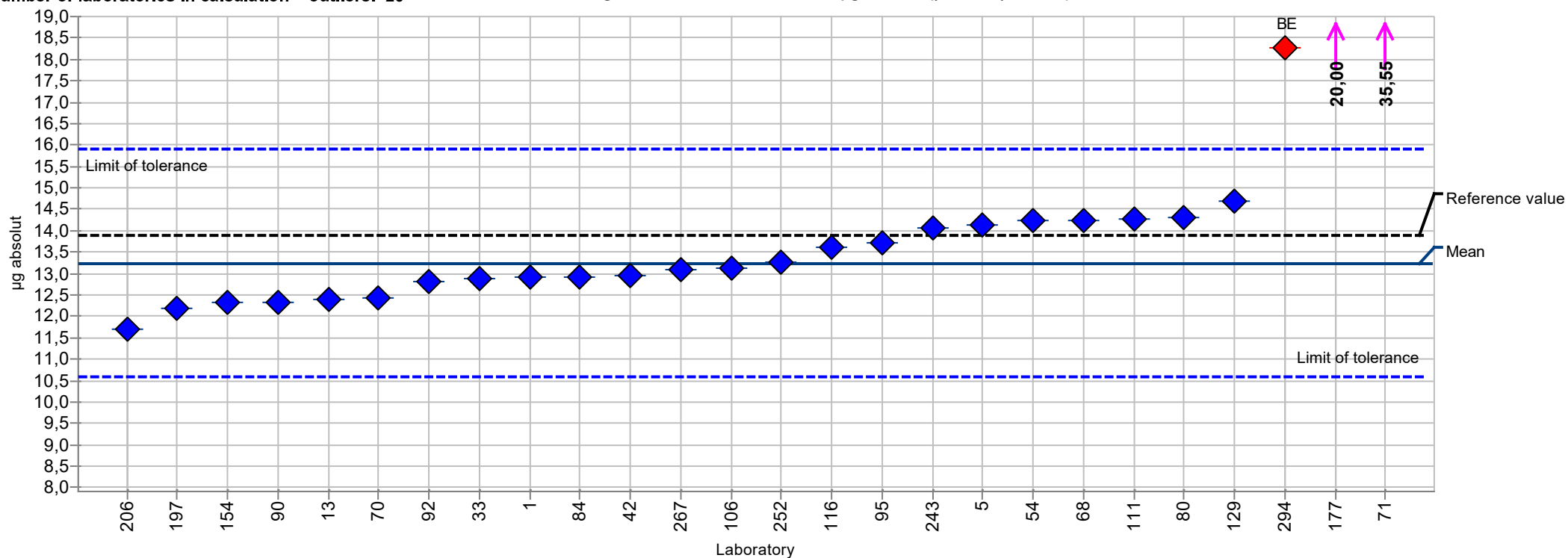
Summary results

| | | | |
|---|-------------------|----------------------------|--|
| Measurand: | Manganese | Mean: | 5,93 µg absolut |
| Sample: | 1 | Reprod. s.d.: | 0,49 µg absolut |
| Method: | ISO 5725-2 | Rel.reprod. s.d.: | 8,33% |
| Rel.target s.d.: | 10,00% | Reference value: | 6,19 µg absolut |
| Number of laboratories in calculation: | 26 | Range of tolerance: | 4,75 - 7,12 µg absolut (Z-Score ≤ 2,00) |



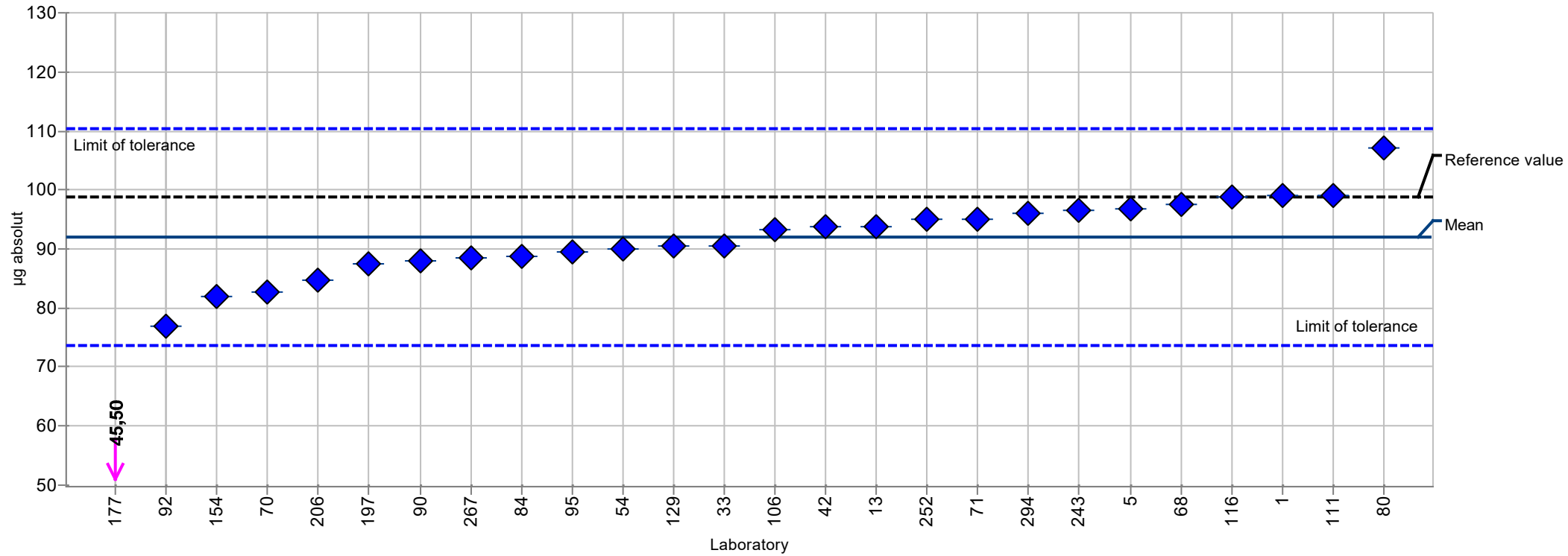
Summary results

| | | | |
|--|------------|---|------------------|
| Measurand: | Nickel | Mean: | 13,24 µg absolut |
| Sample: | 1 | Reprod. s.d.: | 0,83 µg absolut |
| Method: | ISO 5725-2 | Rel.reprod. s.d.: | 6,30% |
| Rel.target s.d.: | 10,00% | Reference value: | 13,88 µg absolut |
| Number of laboratories in calculation + outliers: 26 | | Range of tolerance: 10,59 - 15,89 µg absolut ($ Z\text{-Score} \leq 2,00$) | |



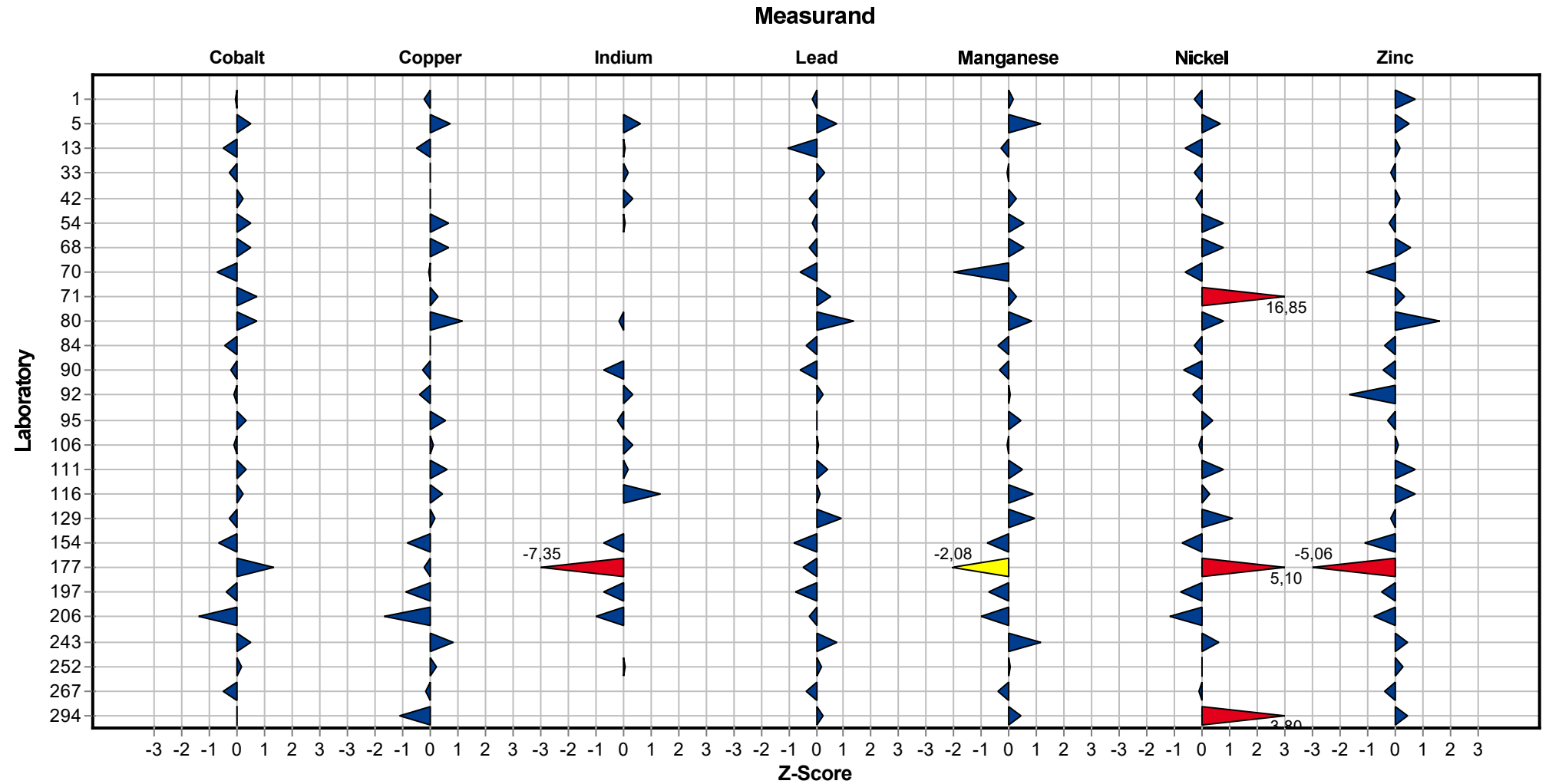
Summary results

| | | | |
|---|-------------------|---|-------------------------|
| Measurand: | Zinc | Mean: | 92,05 µg absolut |
| Sample: | 1 | Reprod. s.d.: | 6,54 µg absolut |
| Method: | ISO 5725-2 | Rel.reprod. s.d.: | 7,11% |
| Rel.target s.d.: | 10,00% | Reference value: | 98,90 µg absolut |
| Number of laboratories in calculation + outliers: 26 | | Range of tolerance: 73,64 - 110,46 µg absolut (Z-Score <= 2,00) | |



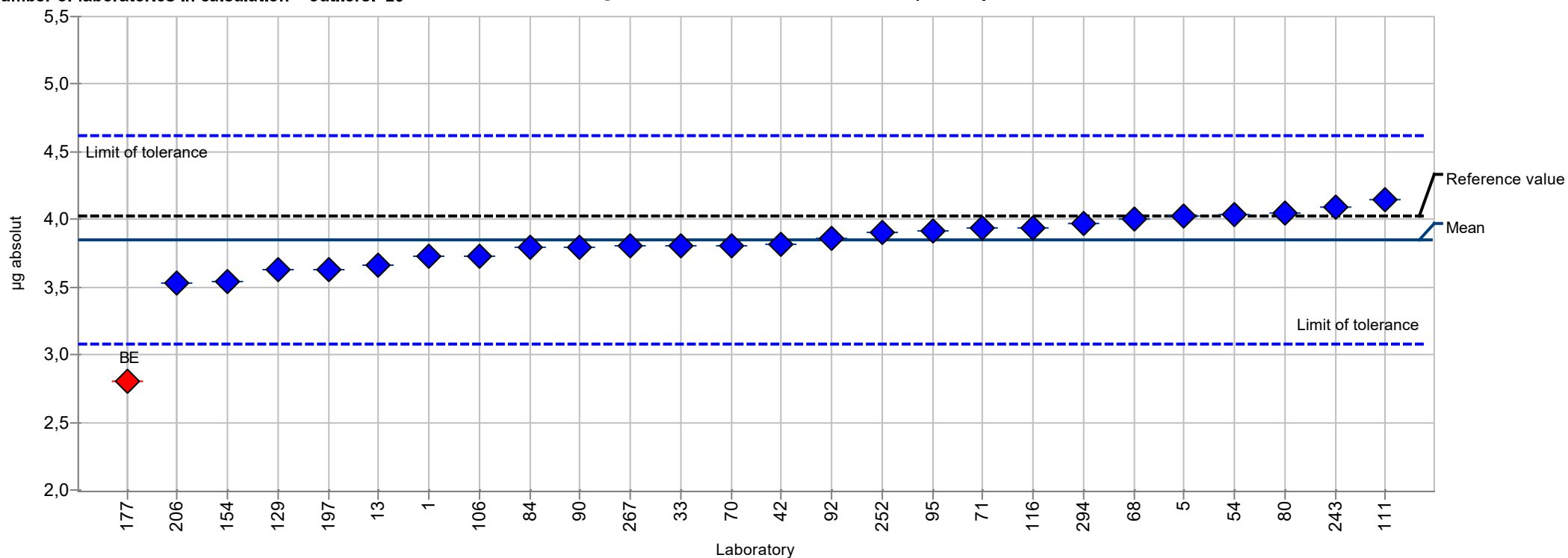
Sample chart of Z-scores

Sample 1



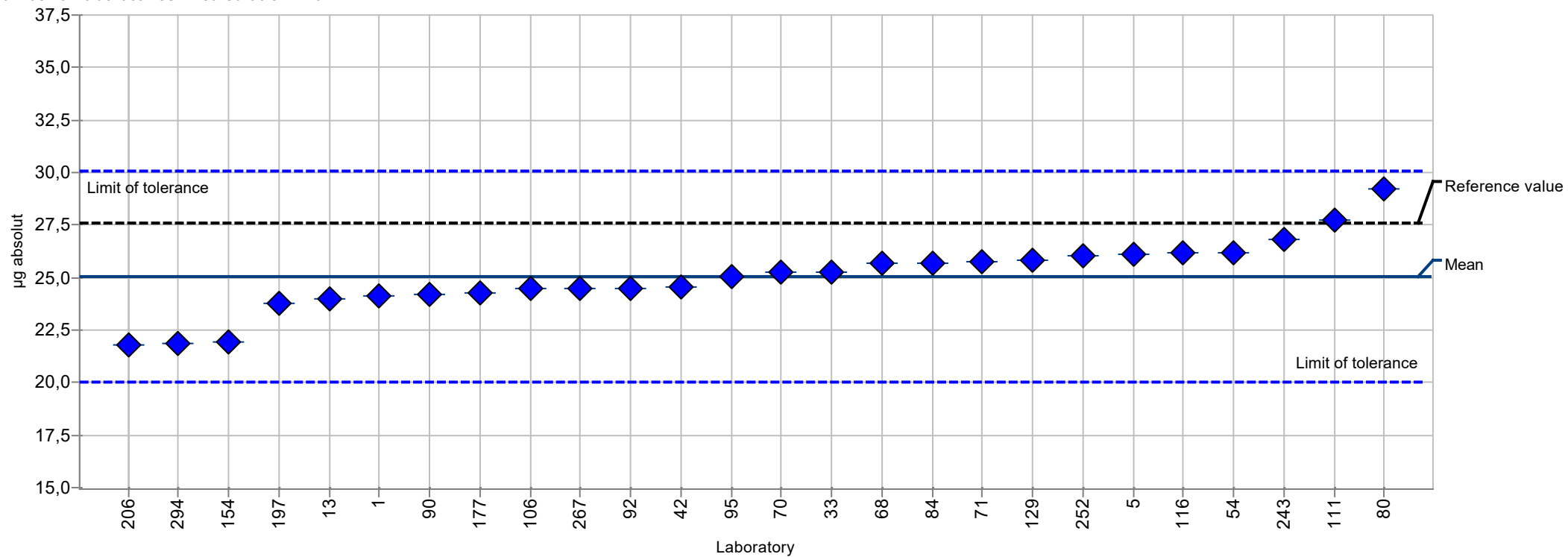
Summary results

| | | | |
|--|-------------------|----------------------------|--|
| Measurand: | Cobalt | Mean: | 3,85 µg absolut |
| Sample: | 2 | Reprod. s.d.: | 0,17 µg absolut |
| Method: | ISO 5725-2 | Rel.reprod. s.d.: | 4,40% |
| Rel.target s.d.: | 10,00% | Reference value: | 4,03 µg absolut |
| Number of laboratories in calculation + outliers: | 26 | Range of tolerance: | 3,08 - 4,61 µg absolut (Z-Score ≤ 2,00) |



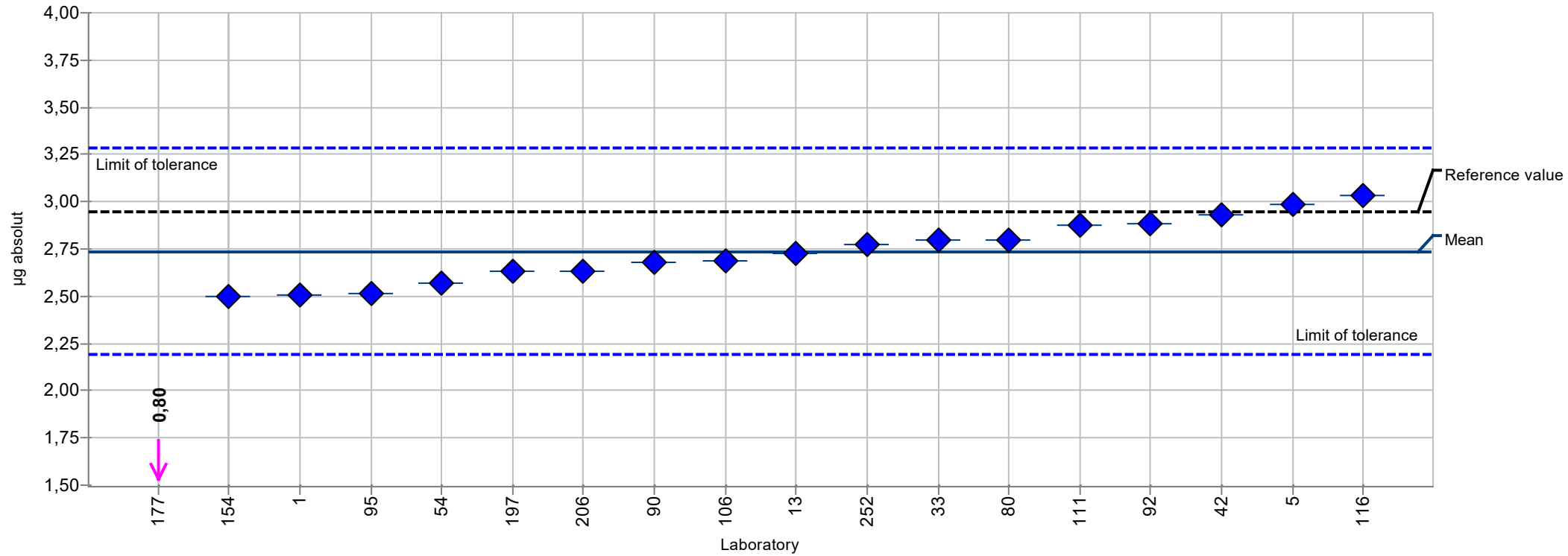
Summary results

| | | | |
|---|-------------------|----------------------------|--|
| Measurand: | Copper | Mean: | 25,03 µg absolut |
| Sample: | 2 | Reprod. s.d.: | 1,68 µg absolut |
| Method: | ISO 5725-2 | Rel.reprod. s.d.: | 6,72% |
| Rel.target s.d.: | 10,00% | Reference value: | 27,61 µg absolut |
| Number of laboratories in calculation: | 26 | Range of tolerance: | 20,03 - 30,04 µg absolut (Z-Score <= 2,00) |



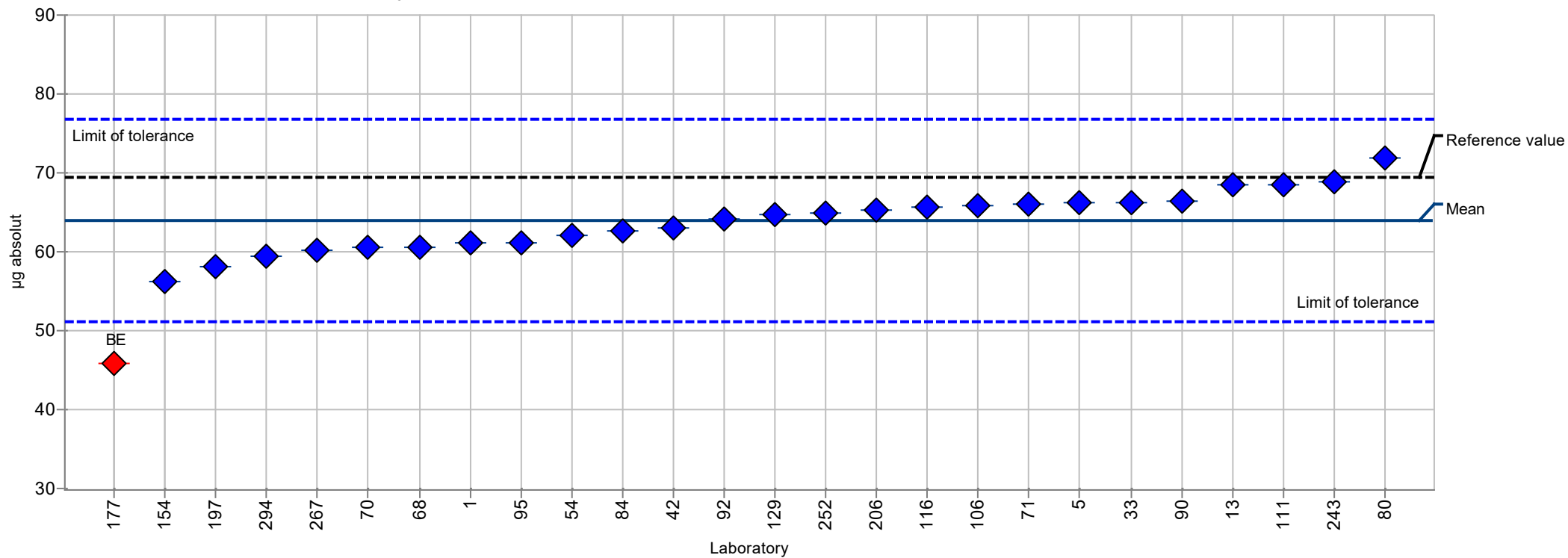
Summary results

| | | | |
|---|------------|---------------------|---|
| Measurand: | Indium | Mean: | 2,74 µg absolut |
| Sample: | 2 | Reprod. s.d.: | 0,17 µg absolut |
| Method: | ISO 5725-2 | Rel.reprod. s.d.: | 6,11% |
| Rel.target s.d.: | 10,00% | Reference value: | 2,95 µg absolut |
| Number of laboratories in calculation + outliers: | 18 | Range of tolerance: | 2,19 - 3,28 µg absolut ($ Z\text{-Score} \leq 2,00$) |



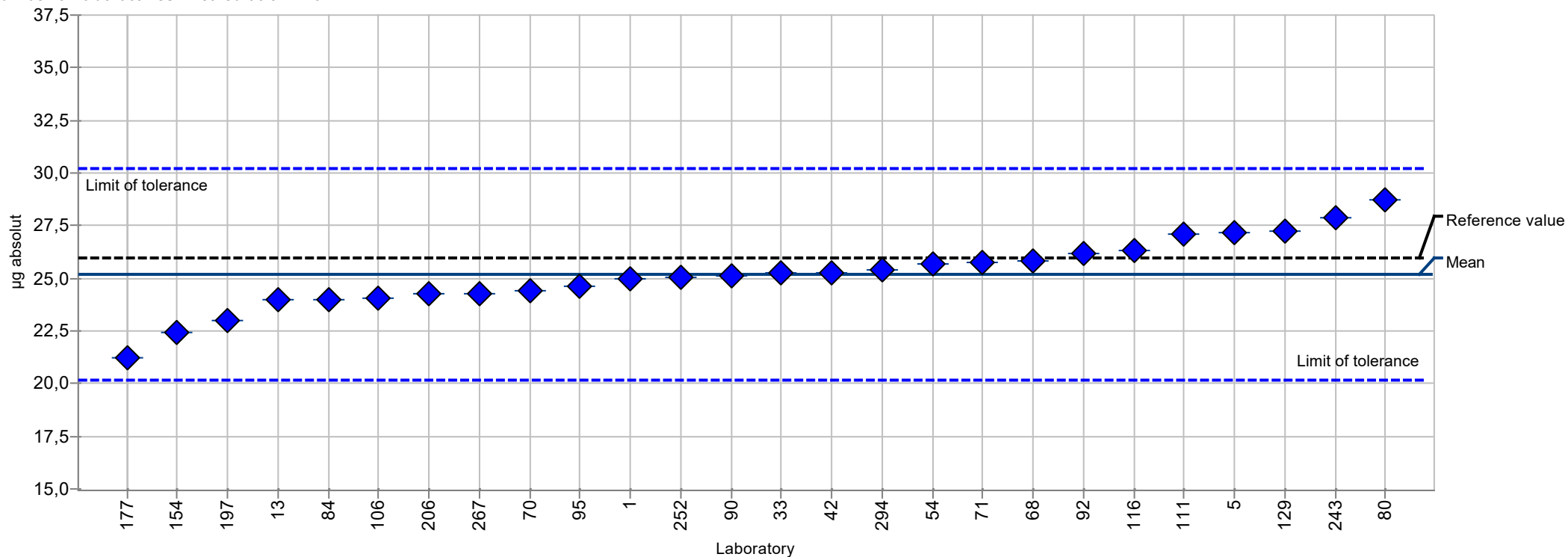
Summary results

| | | | |
|--|-------------------|----------------------------|--|
| Measurand: | Lead | Mean: | 63,92 µg absolut |
| Sample: | 2 | Reprod. s.d.: | 3,72 µg absolut |
| Method: | ISO 5725-2 | Rel.reprod. s.d.: | 5,82% |
| Rel.target s.d.: | 10,00% | Reference value: | 69,40 µg absolut |
| Number of laboratories in calculation + outliers: | 26 | Range of tolerance: | 51,13 - 76,70 µg absolut (Z-Score <= 2,00) |



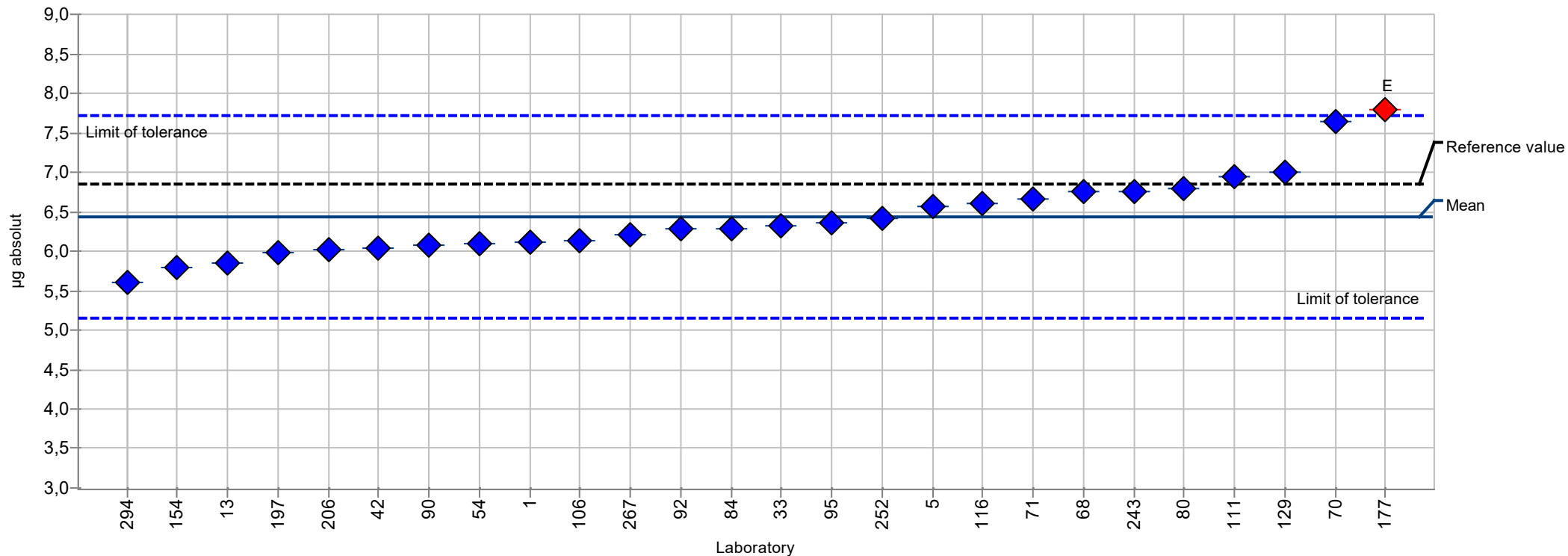
Summary results

| | | | |
|---|-------------------|----------------------------|--|
| Measurand: | Manganese | Mean: | 25,20 µg absolut |
| Sample: | 2 | Reprod. s.d.: | 1,66 µg absolut |
| Method: | ISO 5725-2 | Rel.reprod. s.d.: | 6,60% |
| Rel.target s.d.: | 10,00% | Reference value: | 26,00 µg absolut |
| Number of laboratories in calculation: | 26 | Range of tolerance: | 20,16 - 30,24 µg absolut (Z-Score <= 2,00) |



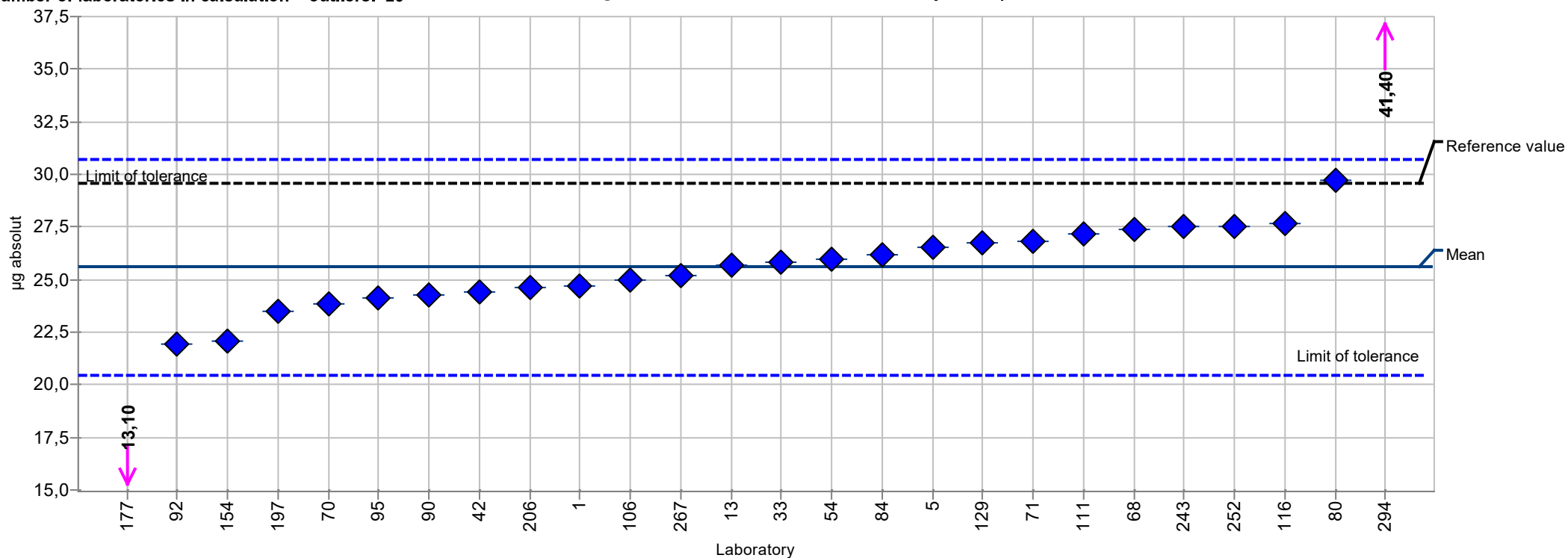
Summary results

| | | | |
|--|------------|---------------------|---|
| Measurand: | Nickel | Mean: | 6,43 µg absolut |
| Sample: | 2 | Reprod. s.d.: | 0,52 µg absolut |
| Method: | ISO 5725-2 | Rel.reprod. s.d.: | 8,17% |
| Rel.target s.d.: | 10,00% | Reference value: | 6,85 µg absolut |
| Number of laboratories in calculation: | 26 | Range of tolerance: | 5,14 - 7,71 µg absolut ($ Z\text{-Score} \leq 2,00$) |



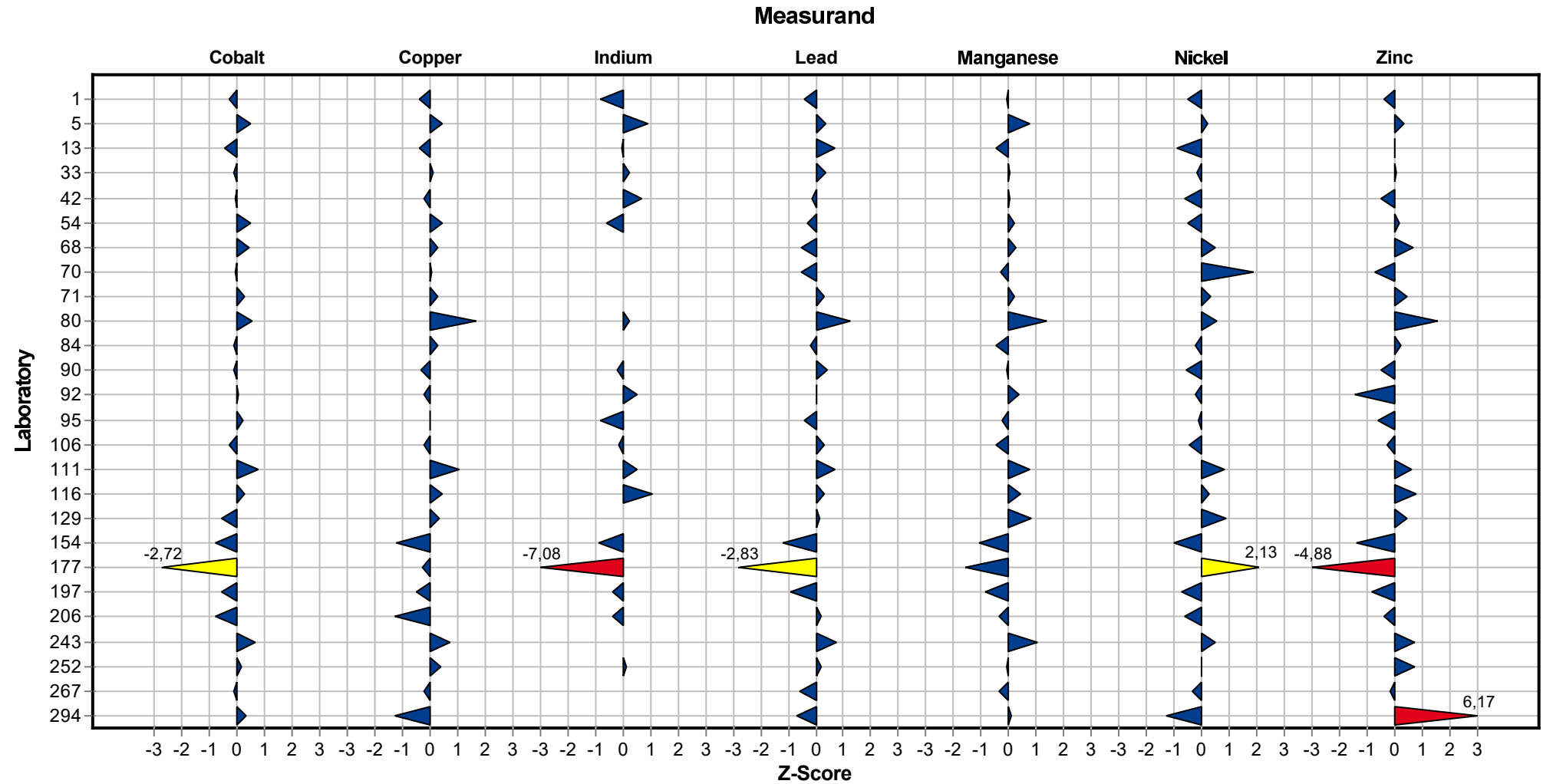
Summary results

| | | | |
|--|------------|----------------------------|---|
| Measurand: | Zinc | Mean: | 25,60 µg absolut |
| Sample: | 2 | Reprod. s.d.: | 1,86 µg absolut |
| Method: | ISO 5725-2 | Rel.reprod. s.d.: | 7,26% |
| Rel.target s.d.: | 10,00% | Reference value: | 29,60 µg absolut |
| Number of laboratories in calculation + outliers: | 26 | Range of tolerance: | 20,48 - 30,72 µg absolut ($ Z\text{-Score} \leq 2,00$) |



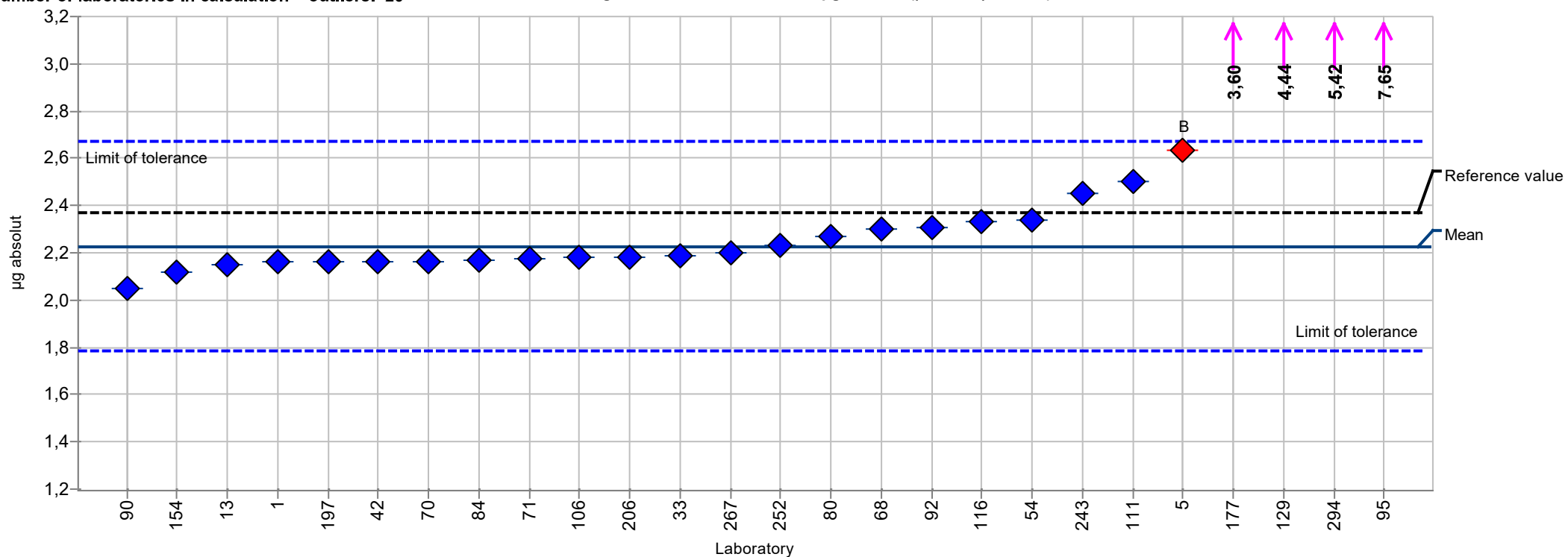
Sample chart of Z-scores

Sample 2



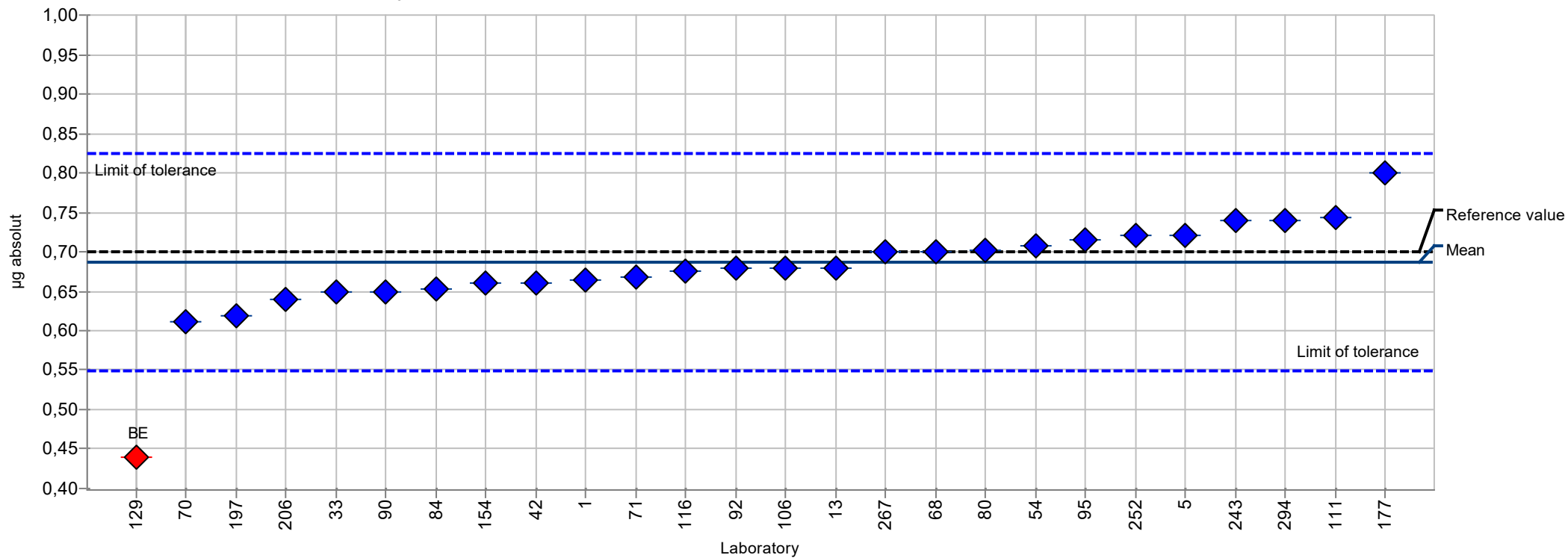
Summary results

| | | | |
|---|------------|---------------------|---|
| Measurand: | Chromium | Mean: | 2,23 µg absolut |
| Sample: | 3 | Reprod. s.d.: | 0,11 µg absolut |
| Method: | ISO 5725-2 | Rel.reprod. s.d.: | 4,93% |
| Rel.target s.d.: | 10,00% | Reference value: | 2,37 µg absolut |
| Number of laboratories in calculation + outliers: | 26 | Range of tolerance: | 1,78 - 2,67 µg absolut ($ Z\text{-Score} \leq 2,00$) |



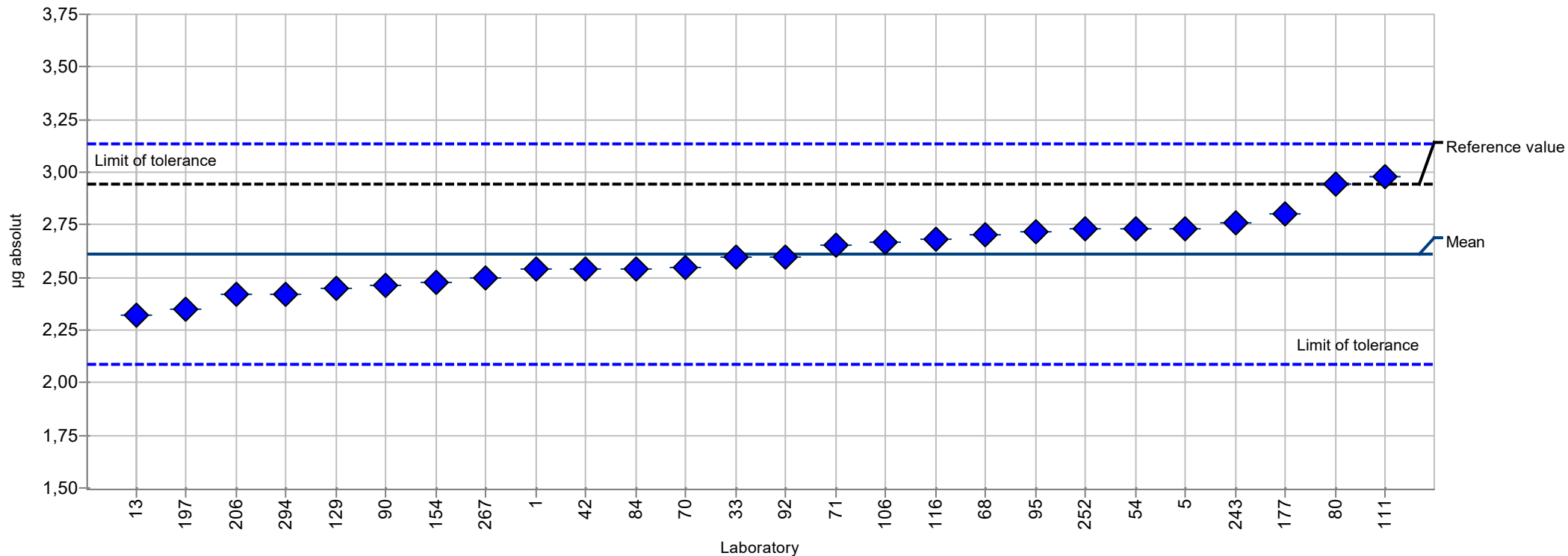
Summary results

| | | | |
|--|-------------------|----------------------------|--|
| Measurand: | Cobalt | Mean: | 0,69 µg absolut |
| Sample: | 3 | Reprod. s.d.: | 0,04 µg absolut |
| Method: | ISO 5725-2 | Rel.reprod. s.d.: | 6,29% |
| Rel.target s.d.: | 10,00% | Reference value: | 0,70 µg absolut |
| Number of laboratories in calculation + outliers: | 26 | Range of tolerance: | 0,55 - 0,82 µg absolut (Z-Score <= 2,00) |



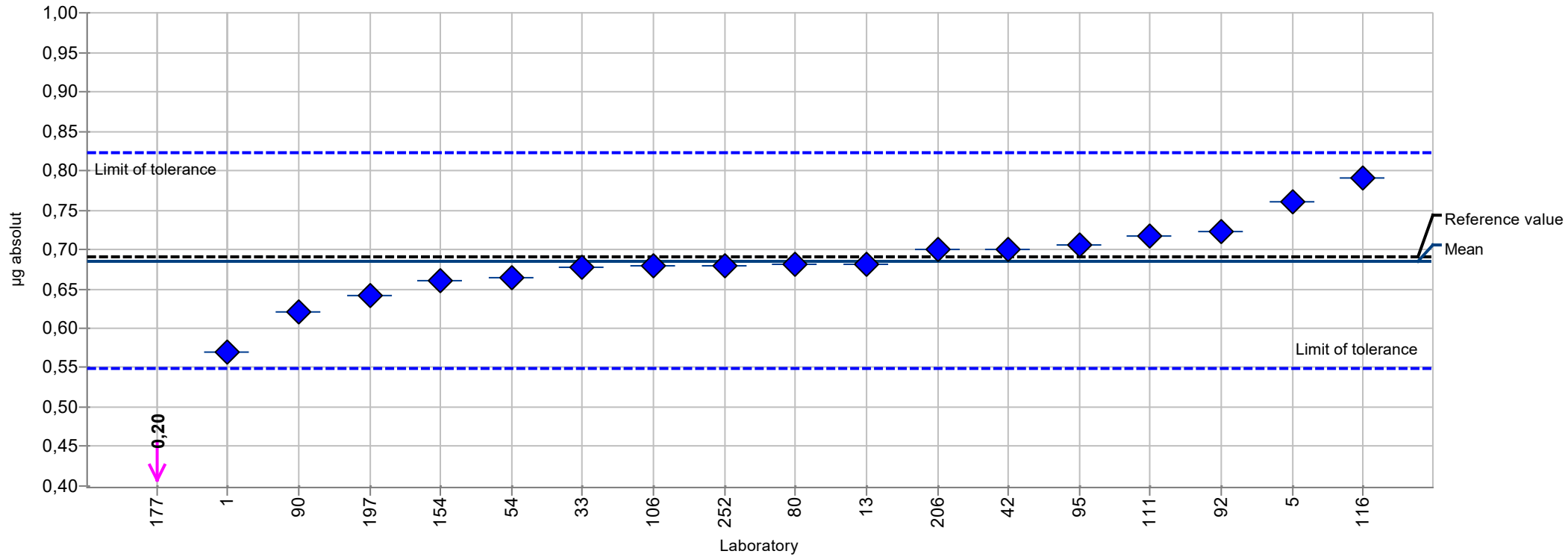
Summary results

| | | | |
|---|-------------------|----------------------------|--|
| Measurand: | Copper | Mean: | 2,61 µg absolut |
| Sample: | 3 | Reprod. s.d.: | 0,17 µg absolut |
| Method: | ISO 5725-2 | Rel.reprod. s.d.: | 6,40% |
| Rel.target s.d.: | 10,00% | Reference value: | 2,94 µg absolut |
| Number of laboratories in calculation: | 26 | Range of tolerance: | 2,09 - 3,13 µg absolut (Z-Score <= 2,00) |



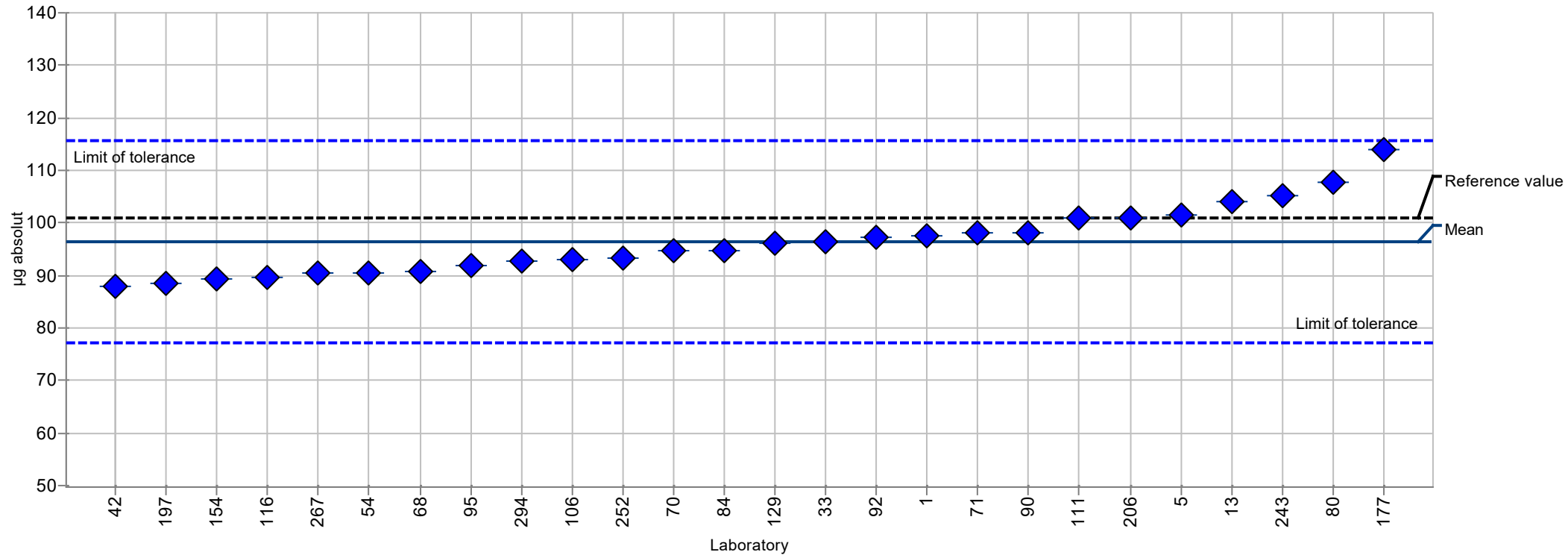
Summary results

| | | | |
|--|------------|----------------------------|---|
| Measurand: | Indium | Mean: | 0,69 µg absolut |
| Sample: | 3 | Reprod. s.d.: | 0,05 µg absolut |
| Method: | ISO 5725-2 | Rel.reprod. s.d.: | 7,36% |
| Rel.target s.d.: | 10,00% | Reference value: | 0,69 µg absolut |
| Number of laboratories in calculation + outliers: | 18 | Range of tolerance: | 0,55 - 0,82 µg absolut ($ Z\text{-Score} \leq 2,00$) |



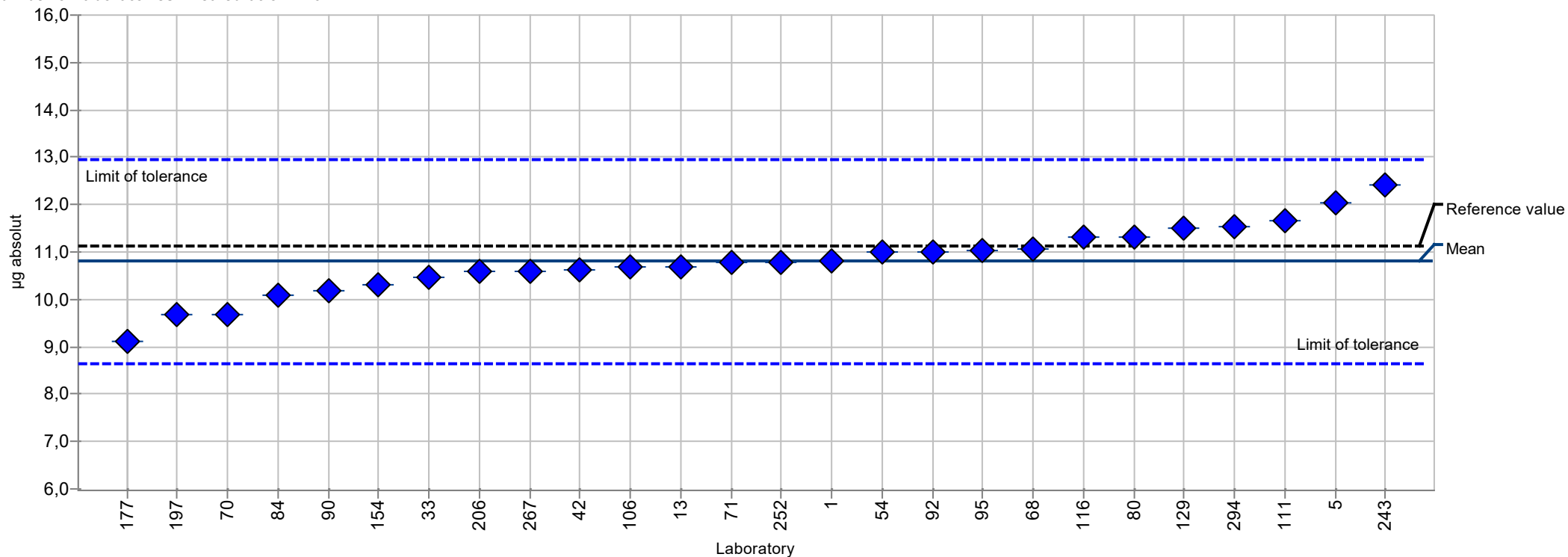
Summary results

| | | | |
|---|-------------------|----------------------------|---|
| Measurand: | Lead | Mean: | 96,36 µg absolut |
| Sample: | 3 | Reprod. s.d.: | 6,45 µg absolut |
| Method: | ISO 5725-2 | Rel.reprod. s.d.: | 6,69% |
| Rel.target s.d.: | 10,00% | Reference value: | 100,90 µg absolut |
| Number of laboratories in calculation: | 26 | Range of tolerance: | 77,09 - 115,63 µg absolut (Z-Score ≤ 2,00) |



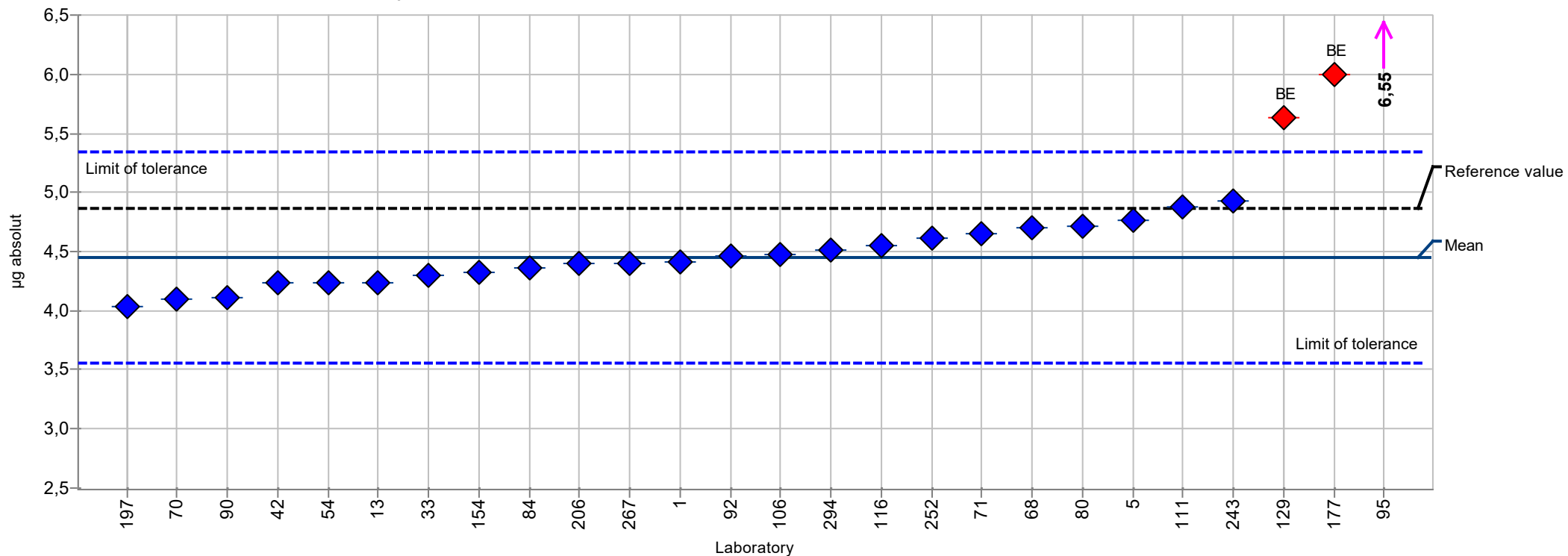
Summary results

| | | | |
|---|-------------------|----------------------------|---|
| Measurand: | Manganese | Mean: | 10,80 µg absolut |
| Sample: | 3 | Reprod. s.d.: | 0,73 µg absolut |
| Method: | ISO 5725-2 | Rel.reprod. s.d.: | 6,76% |
| Rel.target s.d.: | 10,00% | Reference value: | 11,13 µg absolut |
| Number of laboratories in calculation: | 26 | Range of tolerance: | 8,64 - 12,96 µg absolut (Z-Score <= 2,00) |



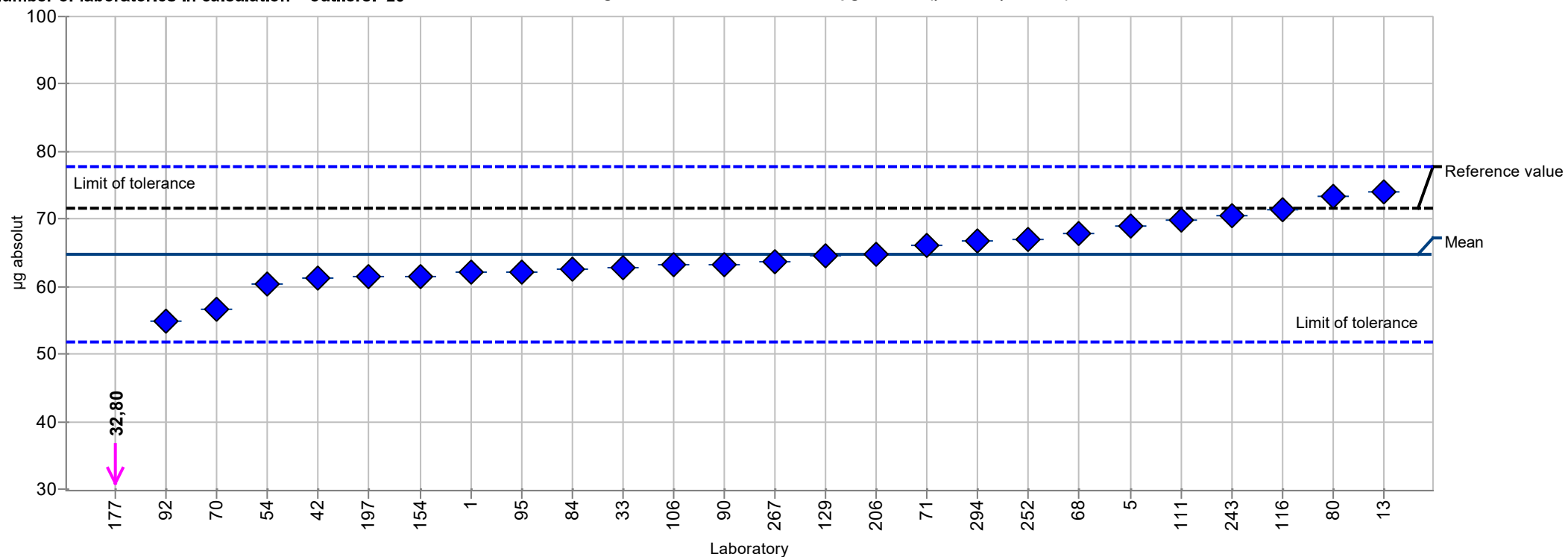
Summary results

| | | | |
|--|-------------------|----------------------------|--|
| Measurand: | Nickel | Mean: | 4,45 µg absolut |
| Sample: | 3 | Reprod. s.d.: | 0,25 µg absolut |
| Method: | ISO 5725-2 | Rel.reprod. s.d.: | 5,51% |
| Rel.target s.d.: | 10,00% | Reference value: | 4,87 µg absolut |
| Number of laboratories in calculation + outliers: | 26 | Range of tolerance: | 3,56 - 5,34 µg absolut (Z-Score ≤ 2,00) |



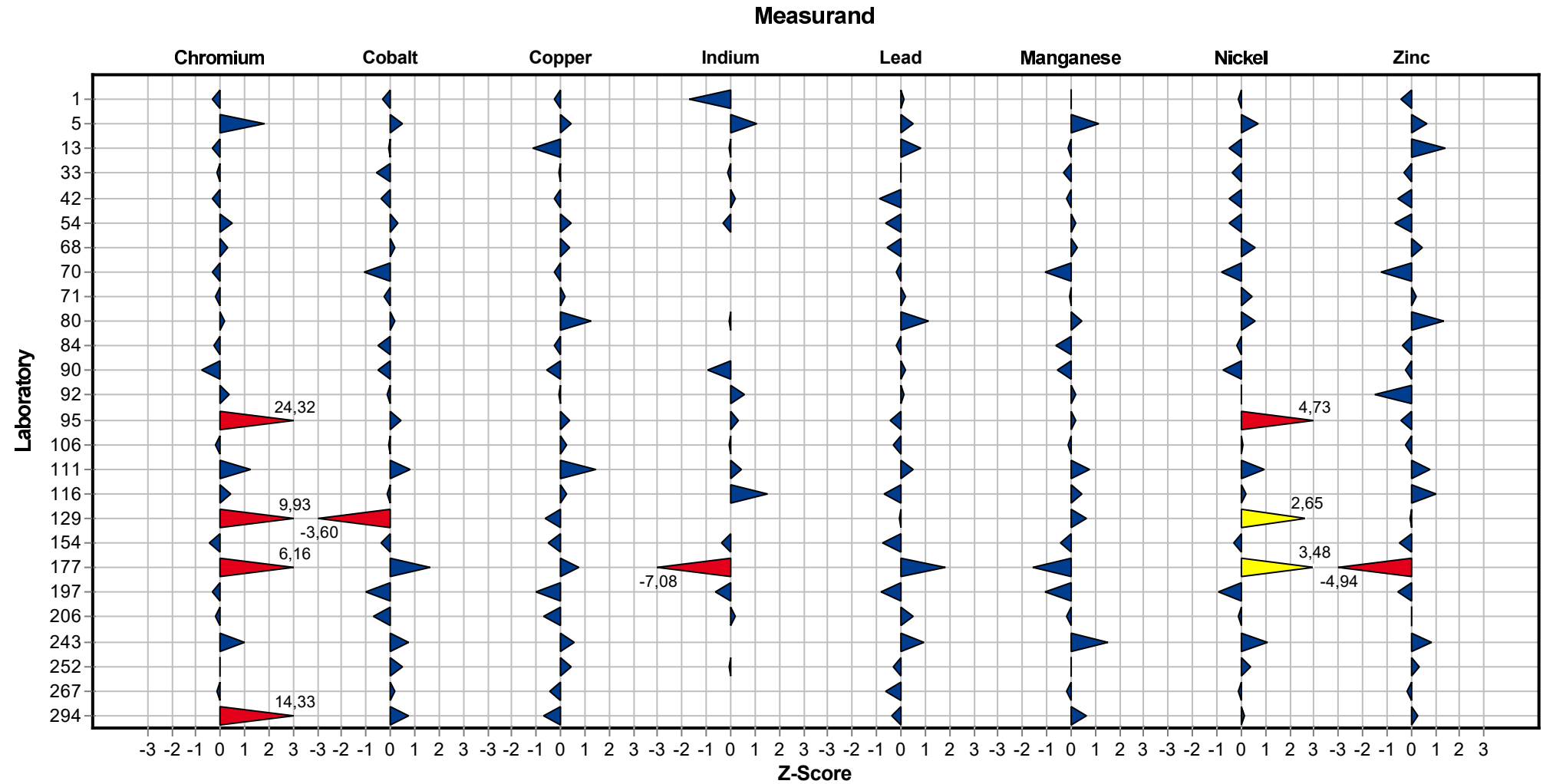
Summary results

| | | | |
|---|------------|---------------------|---|
| Measurand: | Zinc | Mean: | 64,83 µg absolut |
| Sample: | 3 | Reprod. s.d.: | 4,77 µg absolut |
| Method: | ISO 5725-2 | Rel.reprod. s.d.: | 7,35% |
| Rel.target s.d.: | 10,00% | Reference value: | 71,70 µg absolut |
| Number of laboratories in calculation + outliers: | 26 | Range of tolerance: | 51,86 - 77,79 µg absolut ($ Z\text{-Score} \leq 2,00$) |



Sample chart of Z-scores

Sample 3



Questions and Answers

| Participant | Pulping method |
|-------------|---|
| 1 | NIOSH 7302 |
| 5 | |
| 13 | Hotplate digestion with nitric acid |
| 33 | IFA-Arbeitsmappe, Blatt 6015 |
| 42 | Mikrowellendruckaufschluss nach IFA-Arbeitsmappe (Blatt 6015) |
| 54 | IFA-Arbeitsmappe, Blatt 6015, offener Aufschluss 6,67 ml HNO ₃ und 3,33 ml HCl, 2 h bei 120 °C Rückfluss, auf definiertes Volumen aufgefüllt |
| 68 | Offener Aufschluss |
| 70 | IFA-Arbeitsmappe, Blatt 6015 |
| 71 | nach BIA |
| 80 | NIOSH 7300:2003-03 |
| 84 | BGI 6015, 2018-11, Gesamt |
| 90 | Mikrowellendigestion method with an Anton-Paar Multiwave 3000 |
| 92 | Mikrowellendruckaufschluss |
| 95 | IFA Blatt 6015 |
| 106 | Lösung in 65 % Salpetersäure |
| 111 | IFA 6015, Mikrowelle |
| 116 | Offener Standardaufschluss nach IFA-Arbeitsmappe, Blatt 6015 |
| 129 | IFA Arbeitsmappe Blatt 6015 |
| 154 | HF/HNO ₃ Mikrowelle |
| 177 | Mikrowellenaufschluss in Anlehnung an IFA 6015 |
| 197 | IFA 6015 |
| 206 | |
| 243 | Mikrowellendruckaufschluss nach IFA-Arbeitsmappe, Blatt 6015 |
| 252 | Angelehnt an IFA-Arbeitsmappe (Blatt 6015)-Standardmikrowellendruckaufschluss |
| 267 | Mikrowellendigestion |
| 294 | IFA 6015, offener Aufschluss |

| Participant | Acid concentration | Mixing ratio |
|-------------|---|--------------|
| 1 | 37 % HNO ₃ // 30 % H ₂ O ₂ | 3:2 |

Proficiency testing scheme Metals 2023

| Participant | Acid concentration | Mixing ratio |
|-------------|---|--|
| 13 | 67% nitric acid | 5ml nitric acid and 5ml milliQ |
| 33 | Salpetersäure: 65, Salzsäure: 25% | 2 Teile Salpeters. + 1 Teil Salzs. |
| 42 | 69% Salpetersäure | 10 ml HNO3 |
| 54 | HNO3 (> 69 %), HCl (25 %) | 6,67 ml HNO3 (2 Anteile) , 3,33 ml HCl (1 Anteil) |
| 68 | 2.5ml HCl 37% + 5.0ml HNO3 65% | 1:2 |
| 70 | 69% | 10 ml Salpetersäure auf 25ml |
| 71 | HNO3 65%ig ; HCL 30%ig | 2:1 |
| 80 | HNO3 65%, HClO4 70% | 4:1 |
| 84 | HNO3 65 %, HCl 25 % | 2:1 |
| 90 | 10 ml HNO3 65% ultra-pure | Ramp : 15 min - Pressure rate : 0.5 bar/s - Hold time : 45 min - Electrical power : 1100 W |
| 92 | 65% | |
| 95 | 65%ige Salpetersäure | |
| 106 | 65 % Salpetersäure | 0,5 ml 65 % Salpetersäure |
| 111 | 65% Salpetersäure | 10 ml Salpetersäure |
| 116 | HNO3 65%, HCl 30% | 2:1 |
| 129 | 65% -ige Salpetersäure, 30% - ige Salzsäure | 2 Teile Salpetersäure, 1 Teil Salzsäure |
| 154 | 38% HF; 65% HNO3 | 1:3 |
| 177 | HNO3 65% | keine Mischung |
| 197 | 65% HNO3 / 25% HCl | 2:1 |
| 206 | HCl 32%, HNO3 65%, H2O2 30% | HNO3, HCl, H2O2, H2O (1:1:1:1) |
| 243 | Salpetersäure 65% | 10 ml Salpetersäure |
| 252 | entsprechend IFA-Arbeitsmappe | 10 ml HNO3 |
| 267 | HNO3 65% , (suprapure) | |
| 294 | Salpetersäure 69%, Salzsäure 35 % | Salpetersäure/Salzsäure 2:1 |

| Participant | Time of pulping |
|-------------|--|
| 1 | 0,33 |
| 13 | 2 hours |
| 33 | 2 |
| 42 | 15 min auf 220°C, Haltezeit 45 min bei 220°C |
| 54 | 2 h |
| 68 | 2 |

Proficiency testing scheme Metals 2023

| Participant | Time of pulping |
|-------------|-----------------|
|-------------|-----------------|

| | |
|-----|--|
| 70 | 3h, davon 2h Abkühlphase |
| 71 | 2h |
| 80 | ca. 60 Min |
| 84 | 2 h |
| 90 | 60 min |
| 92 | 45 |
| 95 | 1 |
| 106 | 2 h |
| 111 | 15 min Rampe, Haltezeit 60 min bei 200 °C (statt Haltezeit 45 min bei 240 °C gemäß IFA 6015) |
| 116 | 2 |
| 129 | 2 |
| 154 | 1 |
| 177 | 1 h |
| 197 | 2 |
| 206 | 1 |
| 243 | 1 h |
| 252 | 1h |
| 294 | 3 h |

| Participant | Reagent volume | Equipment |
|-------------|----------------|-----------|
|-------------|----------------|-----------|

| | | |
|----|-------|---------------------------|
| 1 | 15 | geschlossen - Mikrow elle |
| 13 | 25 | Under reflux |
| 33 | 25 | Rückfluss |
| 42 | 25 | geschlossen (Mikrow elle) |
| 54 | 25 ml | unter Rückfluss |
| 68 | 50 | offen |
| 70 | 25 ml | geschlossen |
| 71 | 25 mL | offen |
| 80 | 25 ml | offen |
| 84 | 20 ml | unter Rückfluss |
| 90 | 50ml | Closed |
| 92 | 50 | geschlossen |

Proficiency testing scheme Metals 2023

| Participant | Reagent volume | Equipment |
|-------------|--|---|
| 95 | 50 | geschlossen (Mikrow ellenaufschluss) |
| 106 | 16,25 ml | geschlossen |
| 111 | 25 | geschlossen (Mikrow elle) |
| 116 | 20 | offen |
| 129 | 20 | unter Rückfluss |
| 154 | 50 | geschlossen |
| 177 | 25 ml | Mikrow elle |
| 197 | 20ml | offen |
| 206 | Aufschluss (9 ml Aufschlusslösung + 1ml interner Standard), 1:10 Verdünnung, Messung | Mikrow ellendruckaufschluss |
| 243 | 50 ml | geschlossen |
| 252 | 50 ml | Mikrow ellendruckaufschluss (geschlossen) |
| 294 | 50 mL | unter Rückfluss |

| Participant | Methode für Cobalt (AAS/flame, | Method for lead | Method for zinc |
|-------------|--------------------------------------|--------------------------------------|--------------------------------------|
| 1 | OES | OES | OES |
| 5 | ICP/OES | ICP/OES | ICP/OES |
| 13 | ICP-MS | ICP-OES | ICP-OES |
| 33 | ICP-MS | ICP-MS | ICP-MS |
| 42 | ICP/MS | ICP/MS | ICP/MS |
| 54 | ICP-MS, DIN EN ISO 17294-2:2017-01 | ICP-MS, DIN EN ISO 17294-2:2017-01 | ICP-MS, DIN EN ISO 17294-2:2017-01 |
| 68 | ICP/OES | ICP/OES | ICP/OES |
| 70 | ICP/OES | ICP/OES | ICP/OES |
| 71 | ICP-OES | ICP-OES | ICP-OES |
| 80 | ICP-OES | ICP-OES | ICP-OES |
| 84 | ICP-MS, DIN EN ISO 17294-2 (2017-01) | ICP-MS, DIN EN ISO 17294-2 (2017-01) | ICP-MS, DIN EN ISO 17294-2 (2017-01) |
| 90 | ICP-MS | ICP-MS | ICP-MS |
| 92 | DIN EN ISO 17294-2 | DIN EN ISO 17294-2 | DIN EN ISO 17294-2 |
| 95 | ICP-MS | ICP-MS | ICP-MS |
| 106 | ICP-MS | ICP-MS | ICP-MS |
| 111 | ICP-MS | ICP-MS | ICP-MS |
| 116 | ICP-MS | ICP-MS | ICP-MS |
| 129 | ICP | AAS/Flamme | AAS/Flamme |

Proficiency testing scheme Metals 2023

| Participant | Methode für Cobalt (AAS/flame, | Method for lead | Method for zinc |
|-------------|--------------------------------|------------------|-----------------|
| 154 | ICP-MS | ICP-MS | ICP-MS |
| 177 | AAS Graphitrohr | AAS Graphitrohr | ICP-OES |
| 197 | ICP-MS | ICP-MS | ICP-MS |
| 206 | ICP-MS | ICP-MS | ICP-MS |
| 243 | ICP-MS | ICP-MS | ICP-MS |
| 252 | ICP-MS | ICP-MS | ICP-MS |
| 267 | ICP-MS | ICP-MS | ICP-MS |
| 294 | i.A. IFA 8095, ET-AAS | IFA 6310, ET-AAS | IFA 8985, F-AAS |

| Participant | Method for copper | Method for nickel | Method for indium |
|-------------|--------------------------------------|--------------------------------------|------------------------------------|
| 1 | OES | OES | OES |
| 5 | ICP/OES | ICP/OES | ICP/OES |
| 13 | ICP-MS | ICP-MS | ICP-MS |
| 33 | ICP-MS | ICP-MS | ICP-MS |
| 42 | ICP/MS | ICP/MS | ICP/MS |
| 54 | ICP-MS, DIN EN ISO 17294-2:2017-01 | ICP-MS, DIN EN ISO 17294-2:2017-01 | ICP-MS, DIN EN ISO 17294-2:2017-01 |
| 68 | ICP/OES | ICP/OES | - |
| 70 | ICP/OES | ICP/OES | |
| 71 | ICP-OES | ICP-OES | |
| 80 | ICP-OES | ICP-OES | ICP-OES |
| 84 | ICP-MS, DIN EN ISO 17294-2 (2017-01) | ICP-MS, DIN EN ISO 17294-2 (2017-01) | nicht untersucht |
| 90 | ICP-MS | ICP-MS | ICP-MS |
| 92 | DIN EN ISO 17294-2 | DIN EN ISO 17294-2 | DIN EN ISO 17294-2 |
| 95 | ICP-MS | ICP-MS | ICP-MS |
| 106 | ICP-MS | ICP-MS | ICP-MS |
| 111 | ICP-MS | ICP-MS | ICP-MS |
| 116 | ICP-MS | ICP-MS | ICP-MS |
| 129 | AAS/Flamme | AAS/Flamme | |
| 154 | ICP-MS | ICP-MS | ICP-MS |
| 177 | ICP-OES | AAS Graphitrohr | AAS Graphitrohr |
| 197 | ICP-MS | ICP-MS | ICP-MS |
| 206 | ICP-MS | ICP-MS | ICP-MS |

Proficiency testing scheme Metals 2023

| Participant | Method for copper | Method for nickel | Method for indium |
|-------------|-------------------|-------------------|-------------------|
| 243 | ICP-MS | ICP-MS | ICP-MS |
| 252 | ICP-MS | ICP-MS | ICP-MS |
| 267 | ICP-MS | ICP-MS | not analysed |
| 294 | IFA 7755, ET-AAS | IFA 8095, ET-AAS | |

| Participant | Method for manganese | Methode für Chrom |
|-------------|--------------------------------------|--------------------------------------|
| 1 | OES | OES |
| 5 | ICP/OES | ICP/OES |
| 13 | ICP-MS | ICP-MS |
| 33 | ICP-MS | ICP-MS |
| 42 | ICP/MS | ICP/MS |
| 54 | ICP-MS, DIN EN ISO 17294-2:2017-01 | ICP-MS, DIN EN ISO 17294-2:2017-01 |
| 68 | ICP/OES | ICP/OES |
| 70 | ICP/OES | ICP/OES |
| 71 | ICP-OES | ICP-OES |
| 80 | ICP-OES | ICP-OES |
| 84 | ICP-MS, DIN EN ISO 17294-2 (2017-01) | ICP-MS, DIN EN ISO 17294-2 (2017-01) |
| 90 | ICP-MS | ICP-MS |
| 92 | DIN EN ISO 17294-2 | DIN EN ISO 17294-2 |
| 95 | ICP-MS | ICP-MS |
| 106 | ICP-MS | ICP-MS |
| 111 | ICP-MS | ICP-MS |
| 116 | ICP-MS | ICP-MS |
| 129 | AAS/Flamme | AAS/Flamme |
| 154 | ICP-MS | ICP-MS |
| 177 | ICP-OES | AAS Graphitrohr |
| 197 | ICP-MS | ICP-MS |
| 206 | ICP-MS | ICP-MS |
| 243 | ICP-MS | ICP-MS |
| 252 | ICP-MS | ICP-MS |
| 267 | ICP-MS | ICP-MS |
| 294 | ET-AAS | ET-AAS |