BRNO UNIVERSITY OF TECHNOLOGY

FACULTY OF CIVIL ENGINEERING
institute of building testing

ilac-MRA

Z 7008

FINAL REPORT ON THE RESULTS OF PRECISION EXPERIMENT

Proficiency Testing Program
Testing of Asphalt Products
ZAP 2026/1

Brno University of Technology
Proficiency testing provider at the SZK FAST
Veveří 95, Brno 602 00
Czech Republic

www.szk.fce.vutbr.cz
www.ptprovider.cz

Date: August 20, 2026

Poskytovatel zkoušení způsobilosti při SZK FAST
Proficiency testing provider at the SZK FAST
Z 7008
Veveří 95
602 00 Brno
Czech Republic
szk.fce.vutbr.cz

Assoc. Prof. Ing. Tomáš Vymazal, Ph.D.
Head of the PT Provider, PTP coordinator

Ing. Petr Misák, Ph.D.
Coordinator of PTP results assessment

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1 Introduction and Important Contacts

At the beginning of 2026, the Proficiency Testing Provider at SZK FAST (PoZZ) launched a Proficiency Testing Programme (PrZZ), designated ZAP 2026/1, to verify and assess the consistency of asphalt products test results. The assessment of the results of the proficiency testing programme was carried out by a committee consisting of the following PT Provider employees:

Head of the PT Provider, PTP coordinator

Assoc. Prof. Tomáš Vymazal, Ph.D.
Brno University of Technology
Faculty of Civil Engineering
Institute of Building Testing
Veveří 95, Brno 602 00
Czech Republic
Tel.: +420 603 313 337
Email: Tomas.Vymazal@vut.cz

Coordinator of PTP result assessment PTP

Ing. Petr Misák, Ph.D.
Brno University of Technology
Faculty of Civil Engineering
Institute of Building Testing
Veveří 95, Brno 602 00
Czech Republic
Tel.: +420 774 980 255
Email: Petr.Misak@vut.cz

The subjects of proficiency testing were the following testing procedures:

1. EN 1426 Determination of needle penetration of bitumen and bituminous binders [1],
2. EN 1427 Determination of the softening point of bitumen and bituminous binders – Ring and Ball method [2],
3. EN 13398 Determination of elastic recovery (RE) of modified bitumen [3],
4. EN 12593 Determination of the Fraass breaking point (T) [4],
5. EN 1429 Determination of residue on sieving of bituminous emulsions and storage stability [5],
6. EN 12697□1 Determination of soluble binder content [6],
7. EN 12697□2+A1 Determination of particle size distribution [7],
8. EN 12697□5 Determination of maximum density [8],
9. EN 12697□6 Determination of bulk density of bituminous specimens [9],
10. EN 12697□8 Determination of void characteristics of bituminous mixtures [10],
11. EN 12697□12, EN 12697□23 ITSR – Resistance to water sensitivity expressed as Indirect Tensile Strength Ratio – Method A [11, 12],
12. EN 12697□18 Determination of binder drainage – Clause 5 – Beaker method [13],
13. EN 12697□20 Determination of hardness number on cube or Marshall specimens – Penetration by pin after 60 min [14],
14. EN 12697□22+A1 Wheel tracking test – Small□size device, Procedure B in air [15],
15. ČSN 73 6161 Determination of adhesion of bituminous binders to aggregates – Dry aggregate test [16].

Test procedures 3, 5 and 15 were not opened due to low interest of participants.

The supplier, SQZ, s. r. o., was responsible for the preparation of testing samples for the PTP. The supplier also ensured the homogeneity and stability of the testing samples, which were distributed among the PTP participants in such a way that their properties could not be affected.

The test results from individual PTP participants were compared via a method involving the statistical analysis of all their results in a manner complying with ISO 5725-2 [17] and with EN ISO/IEC 17043 [18]. The outcome is the present final report summarizing the results of the interlaboratory comparison, including statistical evaluation.

52 laboratories took part in PTP. In order to maintain the anonymity of the PTP, each laboratory was given an identification number that will be used henceforth in this document. An integral part of the present final report is a Certificate of Participation in the Proficiency Testing Program. It is unique for each participant and includes the participant's ID used in this report. The following chart shows the participation of laboratories in individual parts of the PTP.

Table 1: Participation of individual laboratories in the PTP

ID/Method	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
3ad904	-	-	-	-	-	-	-	-	X	-	-	-	-	-	-
1bbfc6	X	X	-	-	-	-	-	-	X	-	-	-	-	-	-
e41b09	-	-	-	-	-	-	-	-	-	-	-	-	-	X	-
c0263e	-	-	-	-	-	-	-	-	-	X	-	-	-	-	-
ed79a8	X	X	-	-	-	X	X	X	X	X	X	-	-	-	-
163a74	X	X	-	-	-	X	X	X	X	X	X	-	-	X	-
f8b2f6	X	X	-	-	-	-	-	-	-	-	-	X	-	-	-
61062e	-	-	-	-	-	X	X	X	X	X	-	-	-	-	-
013bae	-	-	-	-	-	X	X	X	X	X	-	-	-	-	-
6055e8	-	-	-	-	-	X	X	X	X	X	-	-	-	-	-
0e7e1b	X	X	-	-	-	X	X	X	-	X	-	-	-	-	-
ecde28	-	X	-	X	-	-	-	-	-	-	-	-	-	-	-
5e2f75	-	-	-	X	-	-	-	-	-	-	-	X	-	-	-
c7f8b5	-	-	-	-	-	-	-	-	-	-	-	-	X	-	-
53be5a	-	-	-	-	-	X	X	X	X	X	X	-	X	-	-
67d099	-	-	-	-	-	-	-	X	X	X	-	-	-	-	-
88c528	-	-	-	-	-	-	-	-	-	-	-	X	-	-	-
5164dd	-	-	-	-	-	-	-	-	-	-	-	X	-	-	-
8c31a2	X	-	-	-	-	-	-	-	-	-	-	-	-	-	-
c3f7c8	X	X	-	-	-	-	-	-	-	-	-	-	-	-	-
6aa9bb	-	X	-	-	-	-	-	-	-	-	-	-	-	-	-
85afc0	-	-	-	-	-	-	-	-	X	-	-	-	-	-	-
76139e	X	-	-	-	-	-	-	-	-	-	-	-	-	-	-
b40e75	-	-	-	-	-	X	X	-	-	-	X	-	-	-	-
e3b5b2	-	-	-	-	-	-	-	X	X	X	-	-	-	-	-
c32a3e	-	-	-	-	-	-	-	-	-	-	X	X	-	X	-
b66afc	-	-	-	-	-	-	X	X	X	-	-	-	-	-	-
d7c042	X	X	-	X	-	X	X	X	X	X	-	X	-	X	-
f9181c	-	-	-	-	-	-	X	-	-	-	-	-	-	-	-
b1b84e	-	-	-	X	-	-	-	-	-	-	-	X	X	-	-
1c9da5	-	-	-	-	-	X	X	X	X	X	X	X	-	-	-
6e1552	X	X	-	-	-	-	-	-	-	-	-	-	-	-	-
e5354a	-	X	-	-	-	-	-	-	-	-	-	-	-	-	-
cec3ca	X	X	-	-	-	X	X	X	X	-	X	X	-	X	-
5649f1	-	-	-	-	-	X	X	X	X	X	-	-	-	-	-
cd6080	-	-	-	-	-	-	-	X	X	X	-	-	-	-	-
71ec09	-	-	-	-	-	-	-	-	-	-	-	-	X	-	-
b008c1	-	-	-	-	-	-	-	-	-	-	-	-	-	X	-
56ba54	-	-	-	-	-	-	-	-	-	-	X	-	-	-	-

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ID/Method	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
d77529	-	-	-	-	-	-	-	-	-	X	-	-	-	-	-
60506a	-	-	-	-	-	-	-	-	-	X	-	-	-	-	-
e9b0c7	-	-	-	-	-	-	-	-	-	X	-	-	-	-	-
beef10	-	-	-	-	-	-	-	-	-	X	-	-	-	-	-
99a0db	-	-	-	-	-	-	-	-	-	-	-	X	-	-	-
a415c6	-	-	-	-	-	-	-	-	-	-	-	X	-	-	-
712769	-	-	-	-	-	-	-	-	-	-	-	X	-	-	-
89a7ea	-	-	-	-	-	-	-	-	-	-	-	X	-	-	-
4c459a	-	-	-	-	-	X	X	X	X	X	-	X	-	-	-
5e2a9a	-	-	-	-	-	X	X	X	X	X	-	X	-	-	-
ca9a2f	-	-	-	-	-	-	-	-	-	-	X	-	-	-	-
8b137c	-	-	-	-	-	X	X	X	X	X	-	-	-	X	-
146b0f	-	-	-	-	-	X	X	X	X	X	-	-	-	-	-

Table 2: List of participants (laboratories) – the order in the table does not correspond to the identification number in previous table

Laboratory	Address	Accreditation number
AB "HISK"	S. Kerbedžio g. 7, Panevėžys, LT-35104, Lithuania	LA.01.070
AG Institut DOO Novi Sad, Sektor za laboratorijska ispitivanja - Laboratorija Beograd	Put novosadskog partizanskog odreda 1a, Novi Sad, 21000, Serbia	01-457
AIK-INŽENJERING doo Banovići	Begov potok bb, Banovići, 75290, Bosna i Hercegovina	LI-128-01
Asphalt Pavement Institute APIAN doo - Beograd	VRANJSKA 29/65, Beograd, 11050, Serbia	ATS-01/565
Bouwkundig Labo BL	Langendonkstraat 2, Sint-Joris, 8730, Belgium	-
C.N.A.I.R prin CESTRIN	BD. IULIU MANIU, NR. 401A, SECTOR 6, BUCURESTI, 061101, ROMANIA	LI220/19.09.2025
CSS d.o.o.	Savska cesta 144a, Zagreb, 10000, Croatia	1106
D.O.O. Geomehanika	Dobropoljska 21, Belgrade, 011, Serbia	-
GEOTEST SHPK	Aurostrada TIRANE -DURRES, KM 2-MEZEZ, KASHAR, TIRANE - ALBANIA, TIRANE, 1051, ALBANIA	-
Generalna Dyrekcja Dróg Krajowych i Autostrad Oddział w Szczecinie	Al. Bohaterów Warszawy 33, Szczecin, 70-340, Poland	AB 1529
Geohidroinzenering DOO Skopje	1606 No.8, Gjorce Petrov, Skopje, Skopje, 1000, N Macedonija	LT-096
Institut pro testování a certifikaci, a.s.	třída Tomáše Bati 299, Louky, Zlín, 76302, Česká republika	1007.1

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Laboratory	Address	Accreditation number
Institut za građevinarstvo, građevinske materijale i nemetale d.o.o.	Kojšino 29, Tuzla, 75000, BiH	04-01
LABORATOIRE DES TRAVAUX PUBLICS DU SUD	Zone des activités Bouhraoua- PB 332 GHARDAIA, GHARDAIA, 47000, Algérie	-
LEPL Levan Samkharauli National Forensic Bureau (NFB)	84 Chavchavadze Avenue, Tbilisi, 0162, Georgia	225 84 84
LPM - LABORATORIO PROVE MATERIALI di impresa bacchi srl	via don giuseppe dossetti 19, carpiano (mi), 20074, italy	01205
LT356410314	R. Kalantos street 85a, Kaunas, 45293, Lietuva	LA.01.002
Laboratorijski putni centar doo Novi Sad	Boška Petrovića 3, Novi Sad, 21000, Srbija	01-531
MTS Ltd	19 Kernanstown Ind Est, Carlow, R93 PY67, Ireland	120T
Národná diaľničná spoločnosť a.s.	Dúbravská cesta 14, Bratislava, 84104, Slovensko	456/S-328
QUALIFORM SLOVAKIA s.r.o. - pracovisko Bratislava	Pasienková 9 D, Bratislava, 821 06, Slovenská republika	S-301
SQZ, s.r.o. - organizačná zložka Bratislava, Pracovisko Banská Bystrica	Mlynské Nivy 68, Bratislava, 82105, Slovensko	S-376
SQZ, s.r.o. - organizačná zložka Bratislava, Pracovisko Bratislava	Mlynské Nivy 68, Bratislava, 82105, Slovensko	S-376
SQZ, s.r.o. - organizačná zložka Bratislava, Pracovisko Bratislava	Mlynské Nivy 68, Bratislava, 82105, Slovensko	S-376
SQZ, s.r.o. - organizačná zložka Bratislava, Pracovisko Bratislava	Mlynské Nivy 68, Bratislava, 82105, Slovensko	S-376
SQZ, s.r.o. - organizačná zložka Bratislava, Pracovisko Bratislava	Mlynské Nivy 68, Bratislava, 82105, Slovensko	S-376
SQZ, s.r.o. - organizačná zložka Bratislava, Pracovisko Bratislava	Mlynské Nivy 68, Bratislava, 82105, Slovensko	S-376
SQZ, s.r.o. - organizačná zložka Bratislava, Pracovisko Prešov	Mlynské Nivy 68, Bratislava, 82105, Slovensko	S-376
SQZ, s.r.o. - organizačná zložka Bratislava, Pracovisko Žilina	Mlynské Nivy 68, Bratislava, 82105, Slovensko	S-376
SQZ, s.r.o. - organizačná zložka Bratislava, pracovisko Banská Bystrica	Mlynské Nivy 68, Bratislava, 82105, Slovensko	S-376
SQZ, s.r.o. - organizačná zložka Bratislava, pracovisko Dubnica nad Váhom	Mlynské Nivy 68, Bratislava, 82105, Slovensko	-
SQZ, s.r.o. - organizačná zložka Bratislava, pracovisko Nové Zámky	Mlynské Nivy 68, Bratislava, 82105, Slovensko	-
SQZ, s.r.o. - organizačná zložka Bratislava, pracovisko Prešov	Mlynské Nivy 68, Bratislava, 82105, Slovensko	S-376
SQZ, s.r.o. - organizačná zložka Bratislava, pracovisko Žilina	Mlynské Nivy 68, Bratislava, 82105, Slovensko	S-376

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Laboratory	Address	Accreditation number
SQZ, s.r.o., Laboratoře SQZ - pracoviště č. 1 - Olomouc	U místní dráhy 939/5, Olomouc, 77900, Česká republika	1135.1
SQZ, s.r.o., Laboratoře SQZ - pracoviště č. 14 - České Budějovice	U místní dráhy 939/5, Olomouc, 77900, Česká republika	1135.1
SQZ, s.r.o., Laboratoře SQZ - pracoviště č. 2 - Chotýšany	U místní dráhy 939/5, Olomouc, 77900, Česká republika	1135.1
SQZ, s.r.o., Laboratoře SQZ - pracoviště č. 5 - Kařez	U místní dráhy 939/5, Olomouc, 77900, Česká republika	1135.1
SQZ, s.r.o., Laboratoře SQZ - pracoviště č. 6 - Louny	U místní dráhy 939/5, Olomouc, 77900, Česká republika	1135.1
SQZ, s.r.o., Laboratoře SQZ - pracoviště č. 9 - Srch	U místní dráhy 939/5, Olomouc, 77900, Česká republika	1135.1
Slovenská správa ciest	Dúbravská cesta 1152/3, Bratislava - Karlova Ves, 841 04, Slovenská republika	181/S-322
TESScontrol, s. r. o., organizačná zloška, TESScontrol - Zkušební laboratoř Pardubice, Fáblovka 405, 533 52 Pardubice	efakturycz@tesscontrol.sk, Znojmo, 669 02, Česká republika	-
TRA EOOD CTC BURGAS	Rezbarska str. №7, SOFIA, 1510, BULGARIA	-
TRA EOOD CTC KREPOST	Rezbarska str. №7, SOFIA, 1510, BULGARIA	-
TRA EOOD CTC SOFIA	Rezbarska str. №7, SOFIA, 1510, BULGARIA	-
VIAKONTROL, spol. s r.o.	Bulharská 70, Bratislava, 82104, Slovenská republika	1263
VIALAB CZ s.r.o. CL01 Krč	U Michelského lesa 1581/2, Praha 4, 140 00, Česká republika	L 1112
VIALAB CZ s.r.o. - CL03 Herink	U Michelského lesa 1581/2, Praha 4, 140 00, Česká republika	L 1112
VIALAB CZ s.r.o. - CL05 Kolín	U Michelského lesa 1581/2, Praha 4, 140 00, Česká republika	L 1112
VIALAB CZ s.r.o. - CL08 Plačice	Piletická 498, Hradec Králové, 503 41, Česká republika	L 1112
Ředitelství silnic a dálnic s. p.	Čerčanská 2023/12, Praha 4 - Krč, 140 00, Česká republika	1072
Ředitelství silnic a dálnic s. p., Samostatné oddělení zkušebnictví Praha, Laboratoř Praha	Čerčanská 2023/12, Praha, 140 00, Česká republika	1734

2 Procedures used in the Statistical Analysis of Laboratory Results

The statistical analysis is based on the following steps:

1. Evaluation of intralaboratory variabilities by Cochran's C test: If 5% or 1% critical value is exceeded, the effect of the individual observations is first considered. If the results indicate that high participant variability is caused by a single observation, this value is excluded from the experiment, but the participant is not excluded as outlying. By overcoming 1% of the critical value, the participant's results can be marked as outlying and excluded from the experiment (symbol **X**).
2. The numerical critical evaluation of the test results using Grubbs' test: By overcoming 1% critical value, the participant's results can be marked as outlying and excluded from the experiment (symbol **X**).
3. Graphical determination of the consistency of laboratories (Mandel's statistics): The exceedance of the critical values of Mandel's statistics does not indicate that the results of the laboratories concerned are wrong; it only suggests minor inconsistencies.
4. Evaluation of descriptive statistics and, if possible, taking into account the number of observations, the repeatability and reproducibility.
5. Evaluation of the assigned value.
6. The performance evaluation: The most significant outcome of the PT Program is the so-called z-score and ζ-score (zeta-score). These characteristics assess the performance of individual participants by comparing it with the assigned value and measurement uncertainties. z-score and ζ-score are compared with limit values. The resulting ζ-score values are not taken into account during the final evaluation of the performance of participants as they are to a considerable degree dependent on the values of the measurement uncertainties of the assessed institutions. The following scales are applied for the z-score values:
   - $|z\text{-score}| < 2 \Rightarrow$ shows that the laboratory performance is **satisfactory** and generates no signal – ✓.
   - $2 \leq |z\text{-score}| < 3 \Rightarrow$ shows that the laboratory performance is **questionable** and generates an action signal – **?**.
   - $|z\text{-score}| \geq 3 \Rightarrow$ shows that the laboratory performance is **unsatisfactory** and generates an action signal – **!**.

Procedures used in the statistical analysis of proficiency testing programs can be found here: http://ptprovider.cz/?lang=en.

3 Conclusions of the Statistical Analysis

The present report summarizes the results of the Proficiency Testing Program ZAP 2026/1 (PT Program) organized by the PT Provider at the SZK FAST. 52 participants (laboratories) took part in the PT Program. The PT program focused on ordinary standardized testing of asphalt products. The test results are evaluated separately for each testing procedure examined. An evaluation of statistical characteristics is included in the Appendix, as well as test results and graphic presentations. In some cases, overcoming the critical values of the Cochran test due to incorrect rounding of test results by laboratories was not taken into account. Testing methods can be found in part 1 of this report.

The evaluation of test No. 7 (ČSN EN 933-1 Determination of particle size distribution – Sieving method) is presented separately in part 3.1.

3.1 EN 12697-2 – Sieving method

The results of this test were assessed as a multi-level experiment, where each of the levels was formed by the aperture sizes of the individual sieves. At each level, a separate evaluation of the statistical characteristics, exclusion of outliers and evaluation of the performance of the participants was carried out. The test results, together with the graphic presentation and the evaluated statistical characteristics, are given in Appendix 7. The results of the participants were assessed as outlying, questionable or unsatisfactory only in cases where the critical values were exceeded **at at least four levels of the experiment**. In those cases where the test results across laboratories showed no variability, they were not evaluated.

The assigned value and its uncertainty were determined on the basis of Algorithm A (ISO 13528 [19]). The evaluation of the performance and outliers of the participants for the individual sieves is given in Table 3.

✓ – satisfactory performance; ? – questionable performance; ! – unsatisfactory performance, X – outlier

Table 3: Evaluation of participants performance for individual sieves – ČSN EN 12697-2+A1

ID	11.2 mm	8 mm	5.6 mm	4 mm	2 mm	1 mm	0.5 mm	0.25 mm	0.125 mm	0.063 mm	Overall
013bae	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
0e7e1b	✓	✓	✓	✓	✓	✓	?	✓	✓	✓	✓
146b0f	✓	✓	-	✓	✓	-	-	-	✓	✓	✓
163a74	✓	✓	✓	✓	✓	✓	?	✓	✓	✓	✓
1c9da5	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
4c459a	✓	✓	✓	✓	✓	✓	✓	?	?	✓	✓
53be5a	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
5649f1	X	✓	-	✓	✓	✓	-	-	✓	✓	✓
5e2a9a	✓	✓	✓	✓	✓	?	✓	✓	?	✓	✓
6055e8	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
61062e	✓	?	✓	✓	✓	✓	✓	✓	✓	✓	✓
8b137c	✓	✓	✓	✓	✓	?	X	✓	✓	✓	✓
b40e75	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
b66afc	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓

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ID	11.2 mm	8 mm	5.6 mm	4 mm	2 mm	1 mm	0.5 mm	0.25 mm	0.125 mm	0.063 mm	Overall
cec3ca	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
d7c042	✓	✓	✓	✓	✓	✓	✓	✓	✓	?	✓
ed79a8	✓	✓	-	?	✓	✓	✓	✓	✓	✓	✓
f9181c	✓	✓	✓	✓	✓	✓	✓	✓	✓	X	✓

3.2 Overall Summary of the Performance of Participants

Table 4: Evaluation of overall performance and outliers.
✓ – satisfactory performance; ? – questionable performance; ! – unsatisfactory performance, X – outlier

Table 4: Evaluation of participants performance

ID / Method	1	2	4	6	7	8	9	10	11	12	13	14
013bae	-	-	-	✓	✓	✓	✓	✓	-	-	-	-
0e7e1b	✓	✓	-	✓	✓	?	-	✓	-	-	-	-
146b0f	-	-	-	?	✓	✓	✓	✓	-	-	-	-
163a74	✓	✓	-	✓	✓	✓	?	✓	✓	-	-	✓
1bbfc6	✓	✓	-	-	-	-	✓	-	-	-	-	-
1c9da5	-	-	-	✓	✓	✓	✓	✓	✓	✓	-	-
4c459a	-	-	-	✓	✓	✓	✓	✓	-	✓	-	-
5164dd	-	-	-	-	-	-	-	-	-	?	-	-
53be5a	-	-	-	✓	✓	✓	?	✓	✓	-	✓	-
5649f1	-	-	-	✓	✓	✓	✓	✓	-	-	-	-
56ba54	-	-	-	-	-	-	-	-	✓	-	-	-
5e2a9a	-	-	-	✓	✓	✓	✓	✓	-	✓	-	-
5e2f75	-	-	✓	-	-	-	-	-	-	✓	-	-
60506a	-	-	-	-	-	-	-	✓	-	-	-	-
6055e8	-	-	-	✓	✓	✓	✓	✓	-	-	-	-
61062e	-	-	-	✓	✓	✓	✓	✓	-	-	-	-
67d099	-	-	-	-	-	✓	X	X	-	-	-	-
6aa9bb	-	✓	-	-	-	-	-	-	-	-	-	-
6e1552	✓	✓	-	-	-	-	-	-	-	-	-	-
712769	-	-	-	-	-	-	-	-	-	✓	-	-
71ec09	-	-	-	-	-	-	-	-	-	-	✓	-
76139e	✓	-	-	-	-	-	-	-	-	-	-	-
85afc0	-	-	-	-	-	-	✓	-	-	-	-	-
88c528	-	-	-	-	-	-	-	-	-	✓	-	-
89a7ea	-	-	-	-	-	-	-	-	-	✓	-	-

Continued on next page

Continued from previous page

ID / Method	1	2	4	6	7	8	9	10	11	12	13	14
8b137c	-	-	-	✓	✓	✓	✓	✓	-	-	-	✓
8c31a2	✓	-	-	-	-	-	-	-	-	-	-	-
99a0db	-	-	-	-	-	-	-	-	-	✓	-	-
a415c6	-	-	-	-	-	-	-	-	-	✓	-	-
b008c1	-	-	-	-	-	-	-	-	-	-	-	✓
b1b84e	-	-	✓	-	-	-	-	-	-	✓	✓	-
b40e75	-	-	-	✓	✓	-	-	-	✓	-	-	-
b66afc	-	-	-	-	✓	✓	✓	-	-	-	-	-
beef10	-	-	-	-	-	-	-	✓	-	-	-	-
c0263e	-	-	-	-	-	-	-	✓	-	-	-	-
c32a3e	-	-	-	-	-	-	-	-	✓	✓	-	✓
c3f7c8	✓	✓	-	-	-	-	-	-	-	-	-	-
c7f8b5	-	-	-	-	-	-	-	-	-	-	✓	-
ca9a2f	-	-	-	-	-	-	-	-	✓	-	-	-
cd6080	-	-	-	-	-	✓	✓	✓	-	-	-	-
cec3ca	✓	✓	-	✓	✓	✓	✓	-	✓	✓	-	✓
d77529	-	-	-	-	-	-	-	✓	-	-	-	-
d7c042	✓	✓	✓	X	✓	✓	✓	✓	-	✓	-	✓
e3b5b2	-	-	-	-	-	✓	✓	✓	-	-	-	-
e41b09	-	-	-	-	-	-	-	-	-	-	-	✓
e5354a	-	?	-	-	-	-	-	-	-	-	-	-
e9b0c7	-	-	-	-	-	-	-	✓	-	-	-	-
ecde28	-	✓	✓	-	-	-	-	-	-	-	-	-
ed79a8	?	✓	-	✓	✓	✓	X	?	✓	-	-	-
f8b2f6	✓	✓	-	-	-	-	-	-	-	✓	-	-
f9181c	-	-	-	-	✓	-	-	-	-	-	-	-

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[1] EN 1426. *Bitumen and Bituminous Binders - Determination of Needle Penetration*. 2024.

[2] EN 1427. *Bitumen and Bituminous Binders - Determination of the Softening Point - Ring and Ball Method*. 2015.

[3] EN 13398. *Bitumen and Bituminous Binders - Determination of the Elastic Recovery of Modified Bitumen*. 2018.

[4] EN 12593. *Bitumen and Bituminous Binders - Determination of the Fraass Breaking Point*. 2015.

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[6] EN 12697-1. *Bituminous mixtures - Test methods - Part 1: Soluble binder content*. 2020.

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[13] EN 12697-18. *Bituminous mixtures - Test methods - Part 18: Binder drainage*. 2018.

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[18] EN ISO/IEC 17043. *Conformity assessment - General requirements for proficiency testing*. 2010.

[19] ISO 13 528. *Statistical methods for use in proficiency testing by interlaboratory comparisons*. 2022.

1 Appendix – EN 1426 Determination of needle penetration

1.1 Test results

Table 5: Test results – ordered by average value. Outliers are marked by red color. Columns 1–6 are individual determinations; u_X – extended uncertainty of measurement; $\bar{x}$ – average value; s_0 – sample standard deviation; V_X – variation coefficient

ID	1 [0.1 mm]	2 [0.1 mm]	3 [0.1 mm]	4 [0.1 mm]	5 [0.1 mm]	6 [0.1 mm]	u_X [0.1 mm]	$\bar{x}$ [0.1 mm]	s_0 [0.1 mm]	V_X [%]
f8b2f6	50	50	50	50	50	50	-	50	0.0	0.00
1bbfc6	51	50	50	51	50	51	0.1	50	0.5	1.08
c3f7c8	50	51	52	51	52	52	0.5	51	0.8	1.59
163a74	51	51	52	52	51	52	-	52	0.5	1.06
0e7e1b	52	52	52	52	52	52	-	52	0.0	0.00
cec3ca	53	52	53	54	53	53	-	53	0.6	1.19
76139e	53	54	54	54	55	55	2.0	54	0.8	1.39
6e1552	56	56	56	56	57	56	2.0	56	0.4	0.73
d7c042	56	57	58	56	56	57	3.0	57	0.8	1.44
8c31a2	59	60	60	57	55	56	5.1	58	2.1	3.70
ed79a8	65	64	65	64	63	64	2.0	64	0.8	1.17

1.2 The Numerical Procedure for Determining Outliers

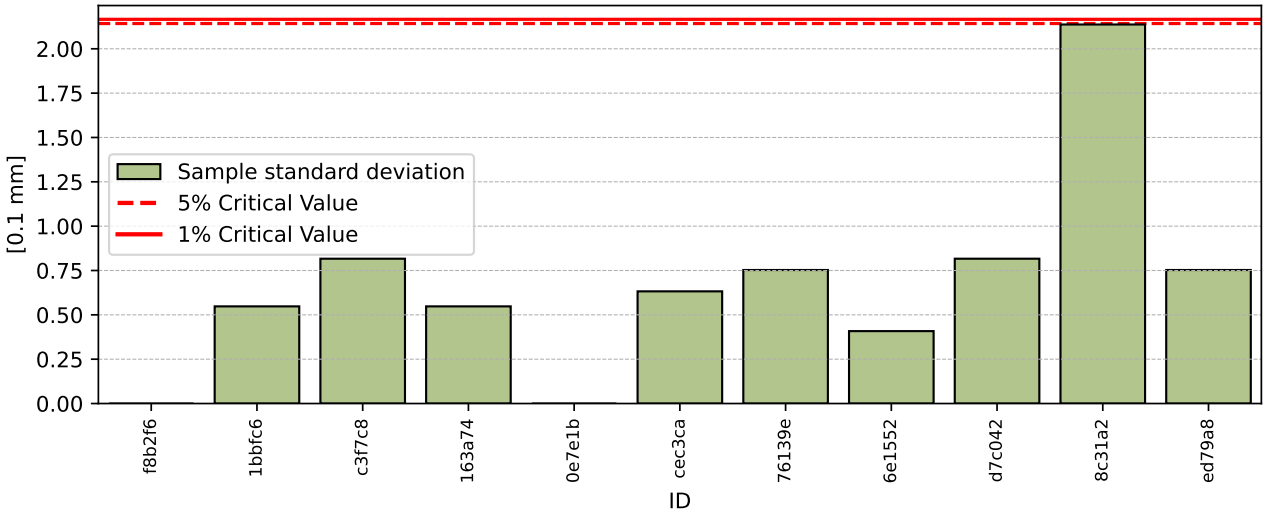

Figure 1: **Cochran's test** - sample standard deviations

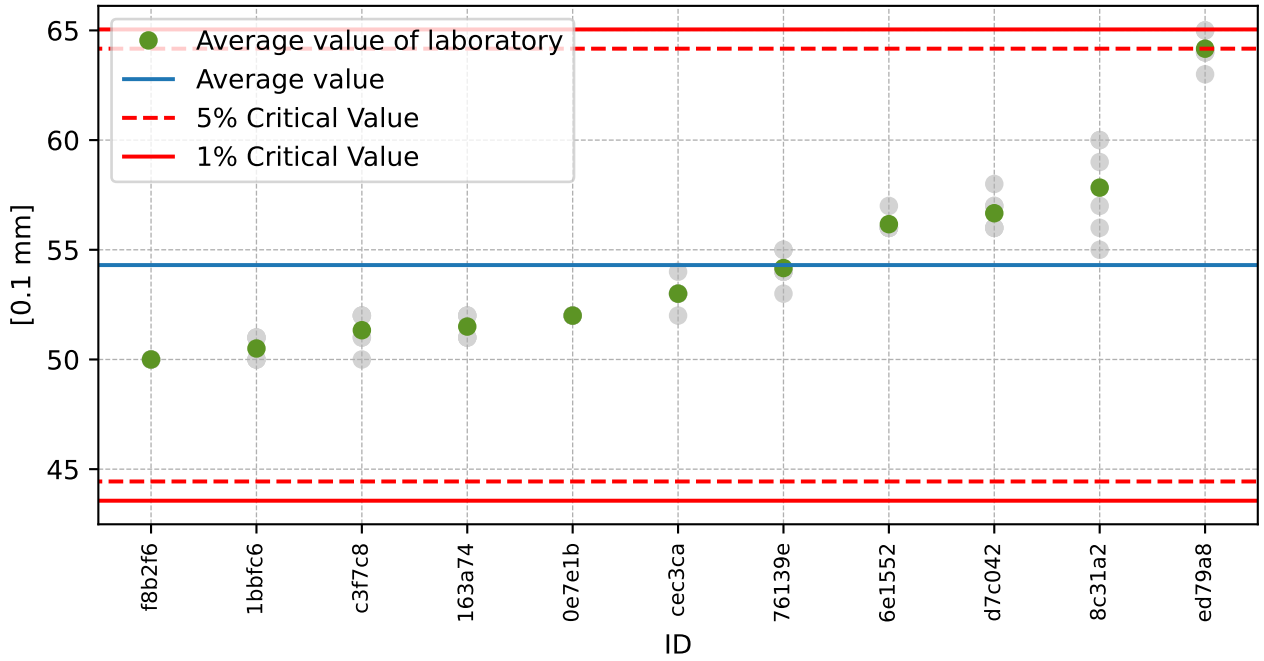

Figure 2: **Grubbs' test** - average values

1.3 Mandel's Statistics

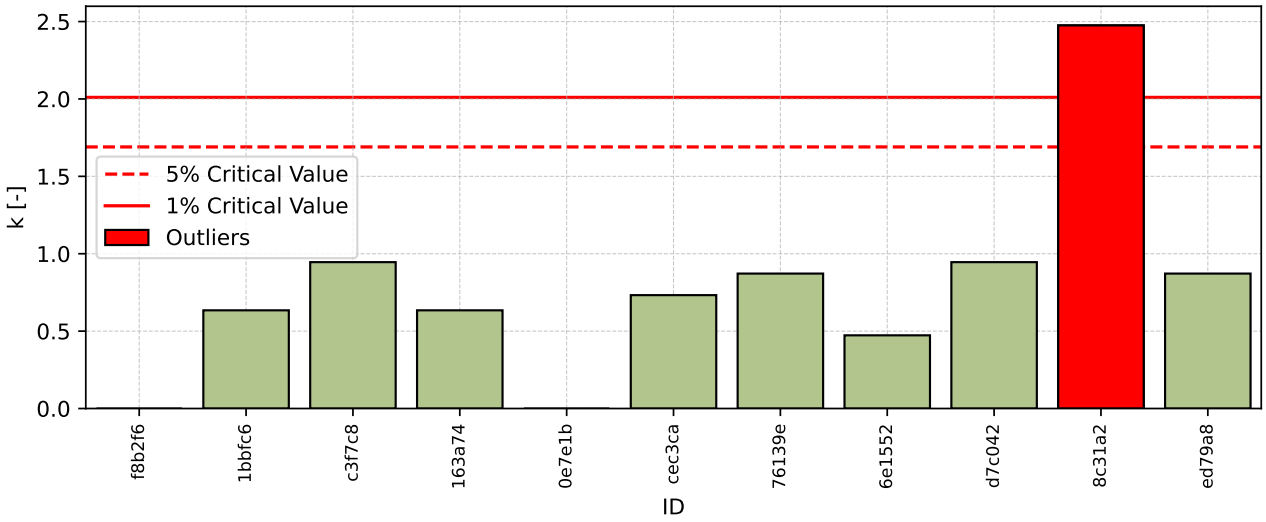

Figure 3: Intralaboratory Consistency Statistic

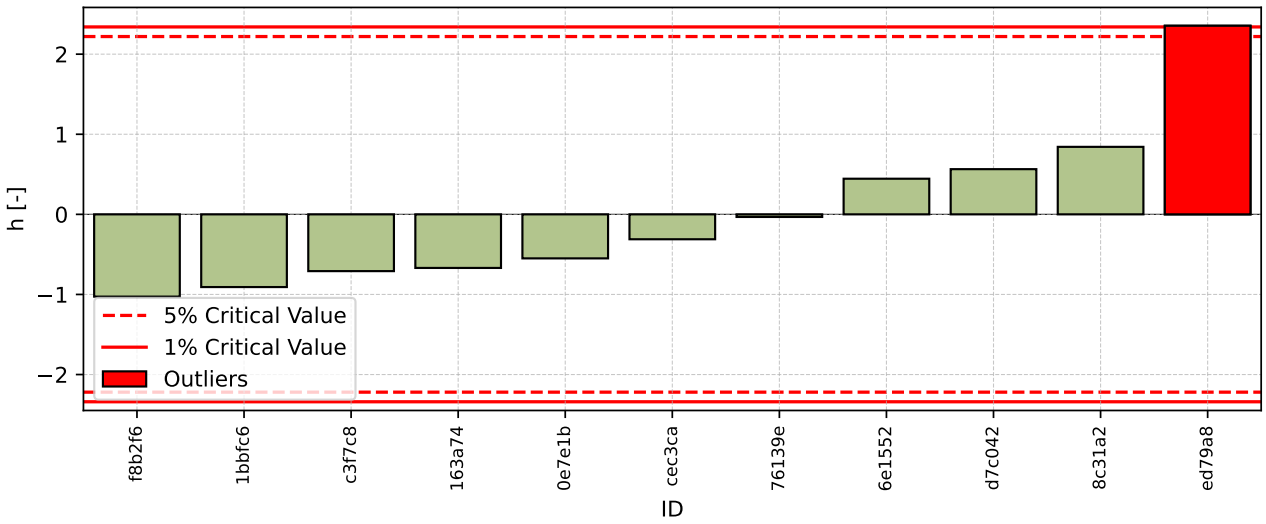

Figure 4: Interlaboratory Consistency Statistic

1.4 Descriptive statistics

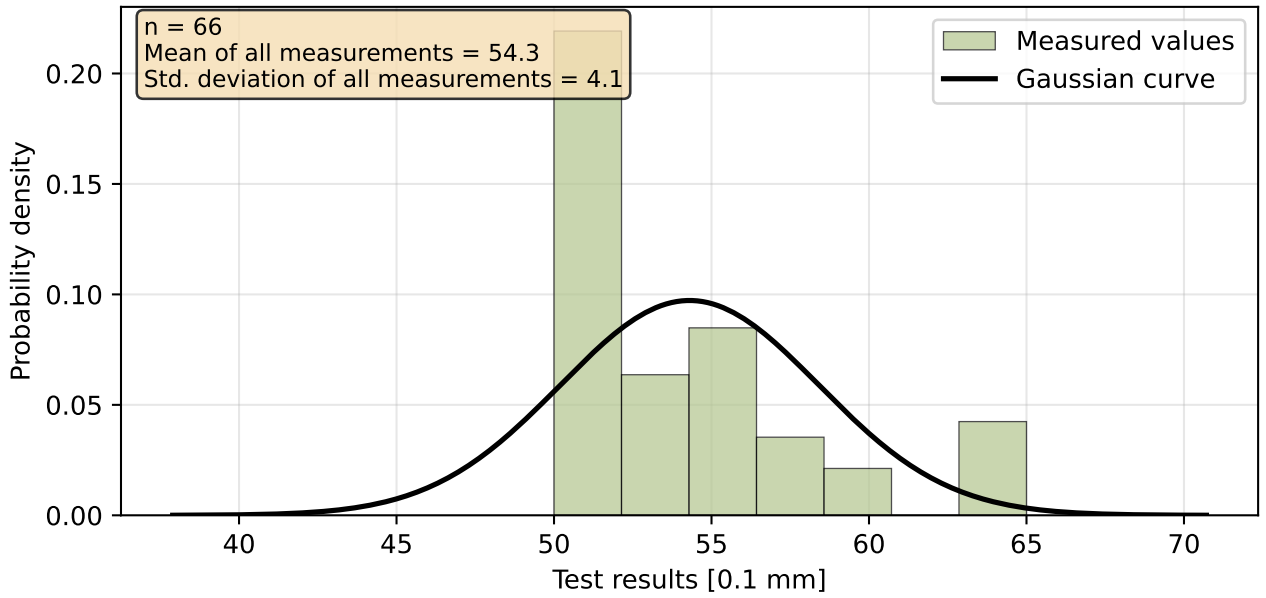

Figure 5: Histogram of all test results

Table 6: Descriptive statistics

Characteristics	[0.1 mm]
Average value – $\bar{x}$	54.3
Sample standard deviation – s	4.2
Assigned value – x^*	54.3
Robust standard deviation – s^*	4.2
Measurement uncertainty of assigned value – u_X	1.3
p-value of normality test [-]	< 0.001
Interlaboratory standard deviation – s_L	4.2
Repeatability standard deviation – s_r	0.9
Reproducibility standard deviation – s_R	4.3
Repeatability – r	2.4
Reproducibility – R	11.9

1.5 Evaluation of Performance Statistics

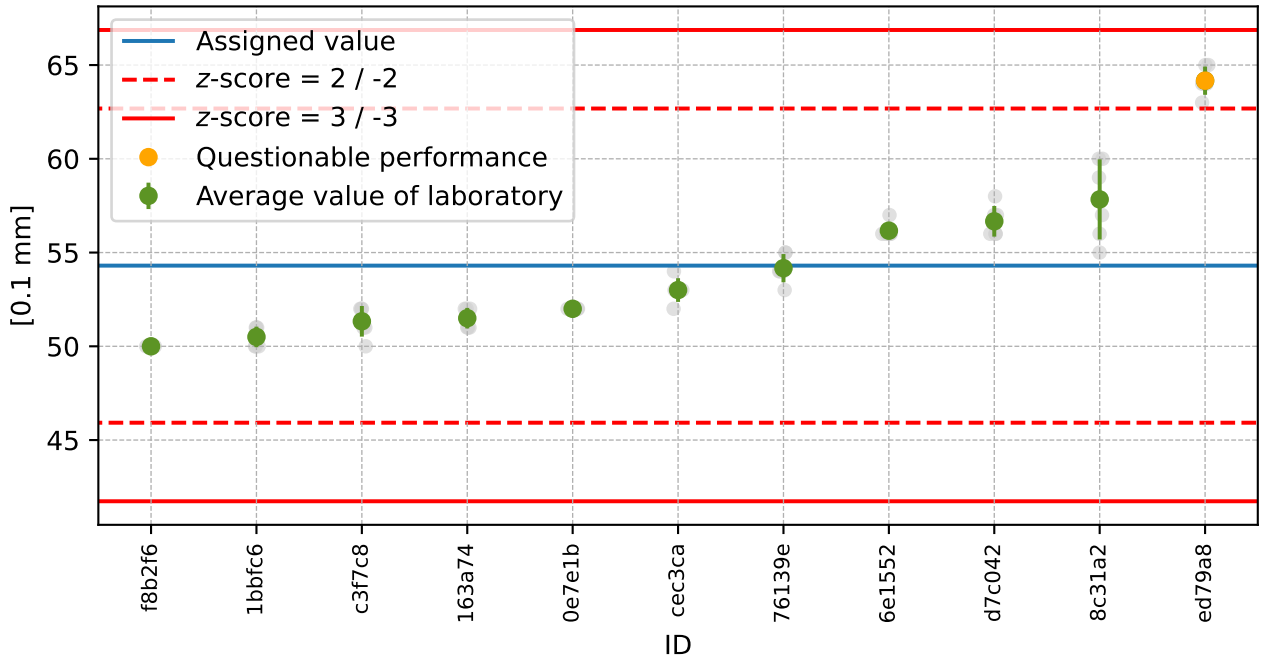

Figure 6: Average values and sample standard deviations

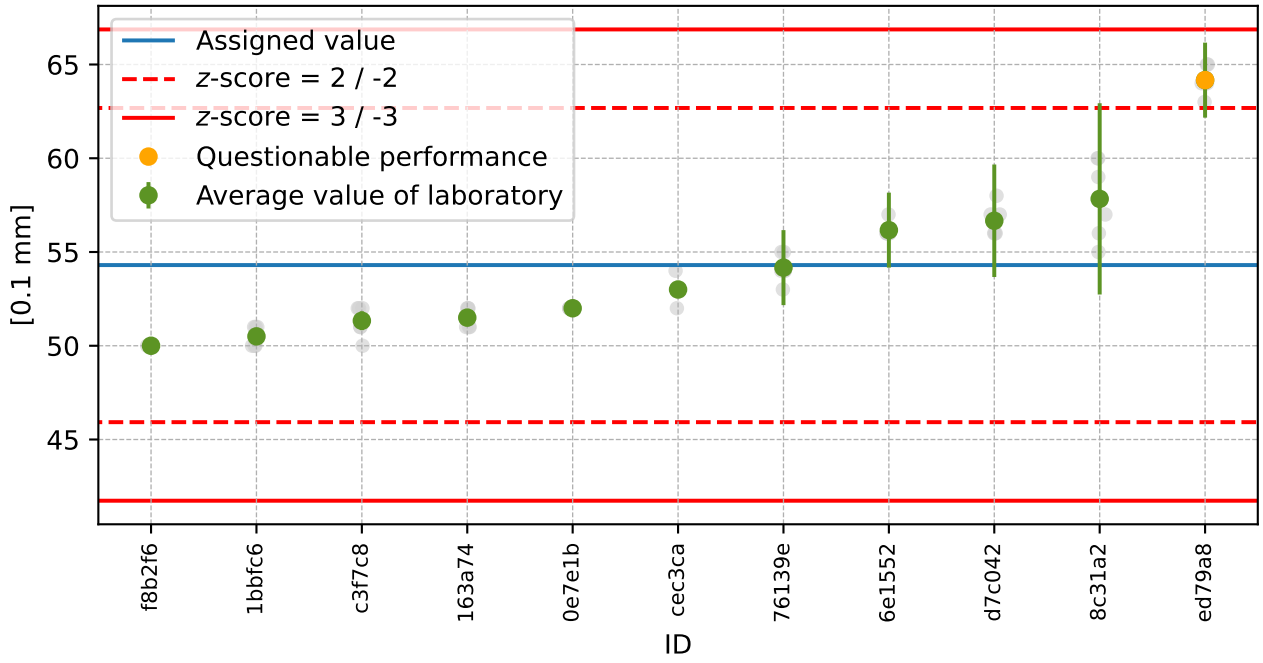

Figure 7: Average values and extended uncertainties of measurement

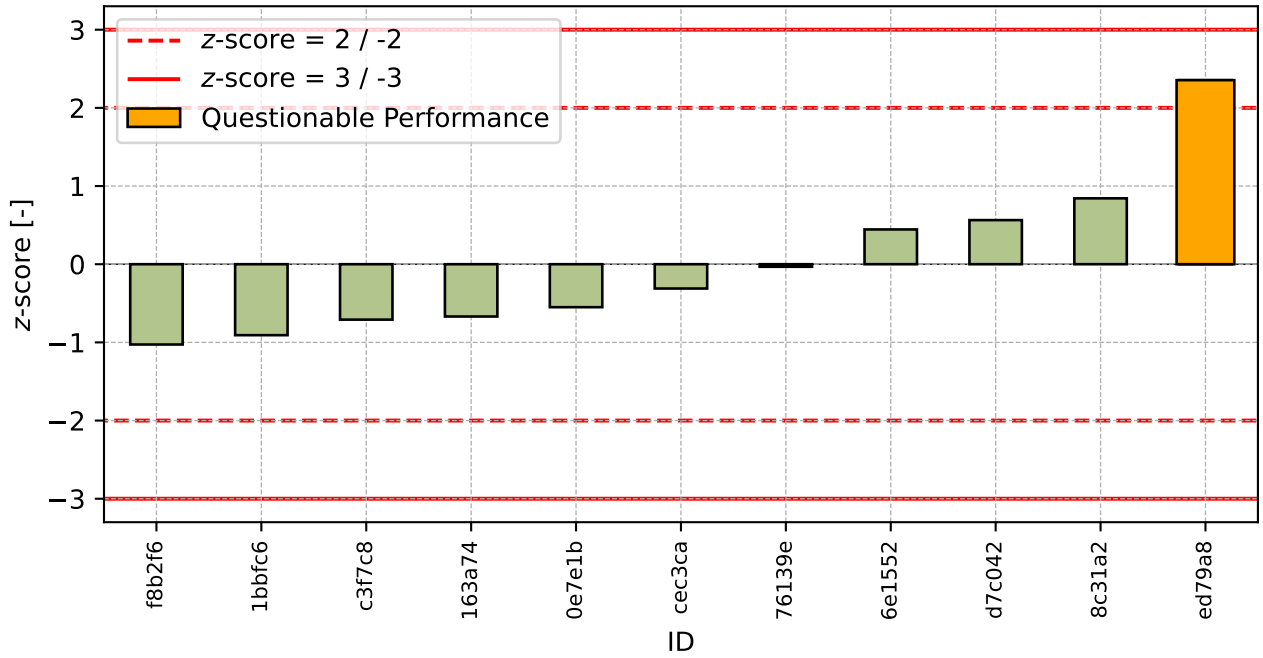

Figure 8: z-score

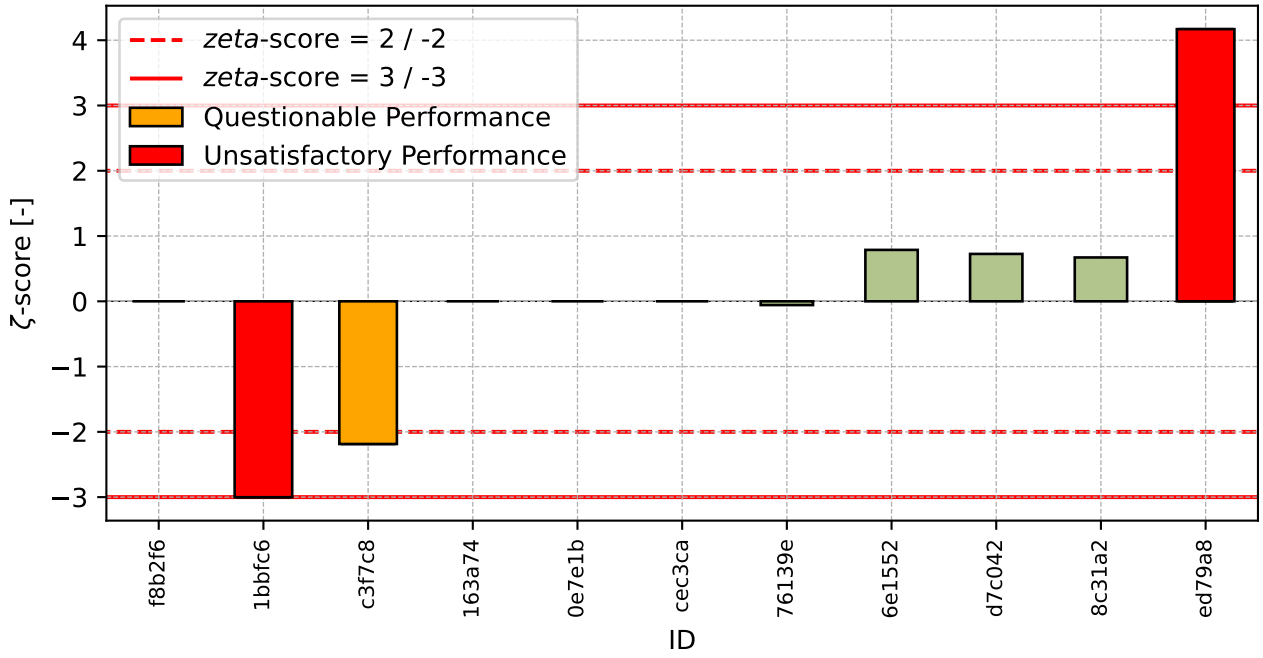

Figure 9: ζ-score

Table 7: z-score and ζ-score

ID	z-score [-]	ζ-score [-]
f8b2f6	-1.03	-
1bbfc6	-0.91	-3.00
c3f7c8	-0.71	-2.19
163a74	-0.67	-
0e7e1b	-0.55	-
cec3ca	-0.31	-
76139e	-0.03	-0.06
6e1552	0.44	0.79
d7c042	0.56	0.73
8c31a2	0.84	0.67
ed79a8	2.35	4.17

2 Appendix – EN 1427 Determination of the softening point – Ring and Ball method

2.1 Test results

Table 8: Test results – ordered by average value. Outliers are marked by red color. Columns 1–2 are individual determinations; u_X – extended uncertainty of measurement; $\bar{x}$ – average value; s_0 – sample standard deviation; V_X – variation coefficient

ID	1 [°C]	2 [°C]	u_X [°C]	$\bar{x}$ [°C]	s_0 [°C]	V_X [%]
e5354a	46.5	46.6	0.16	46.5	0.07	0.15
d7c042	48.2	48.2	2.00	48.2	0.00	0.00
ecde28	48.2	48.4	0.30	48.3	0.14	0.29
6e1552	48.6	48.5	1.40	48.5	0.07	0.15
f8b2f6	48.9	48.9	-	48.9	0.00	0.00
163a74	49.2	49.2	-	49.2	0.00	0.00
6aa9bb	49.2	49.2	0.40	49.2	0.00	0.00
cec3ca	49.2	49.3	-	49.2	0.07	0.14
0e7e1b	49.3	49.3	-	49.3	0.00	0.00
c3f7c8	49.4	50.0	0.20	49.7	0.42	0.85
ed79a8	51.2	50.8	1.00	51.0	0.28	0.55
1bbfc6	51.4	51.7	0.50	51.5	0.21	0.41

2.2 The Numerical Procedure for Determining Outliers

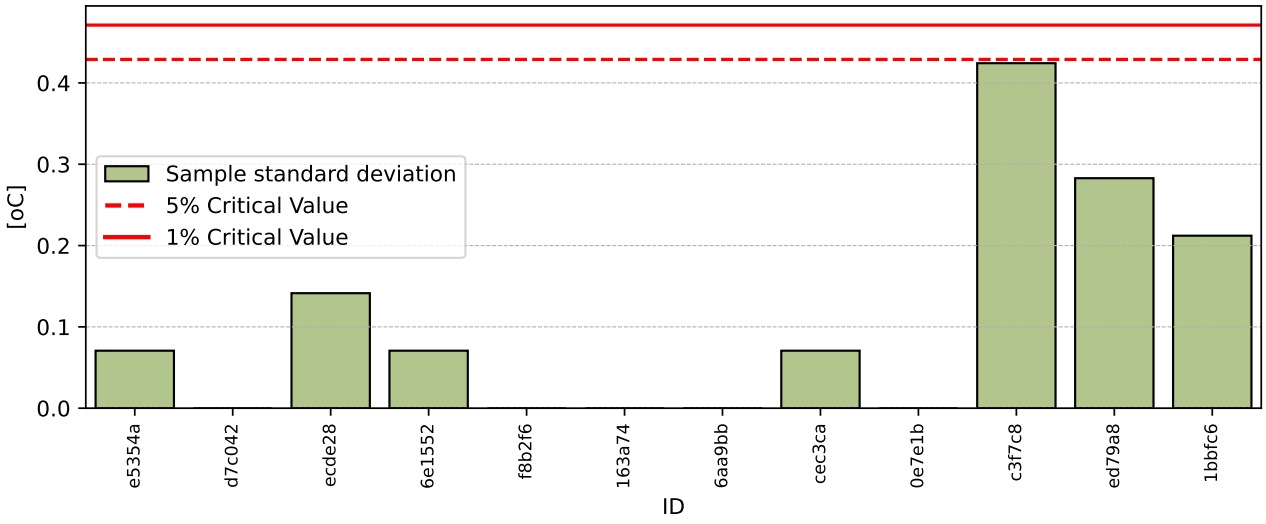

Figure 10: **Cochran's test** - sample standard deviations

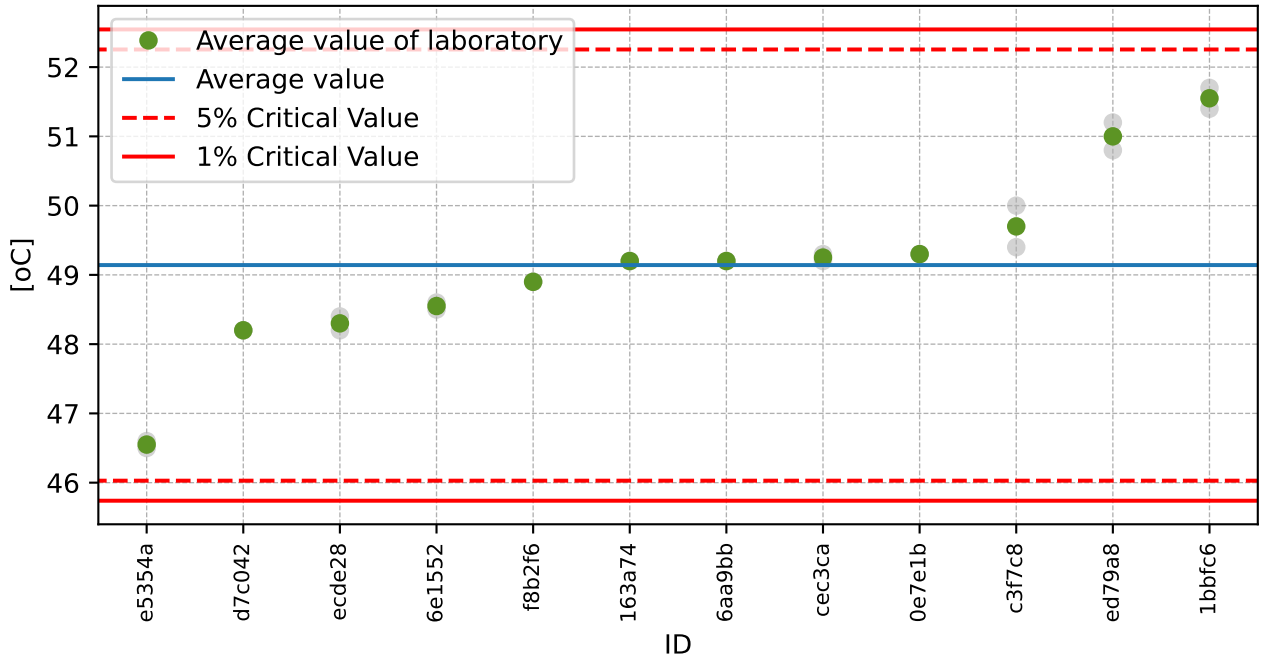

Figure 11: **Grubbs' test** - average values

2.3 Mandel's Statistics

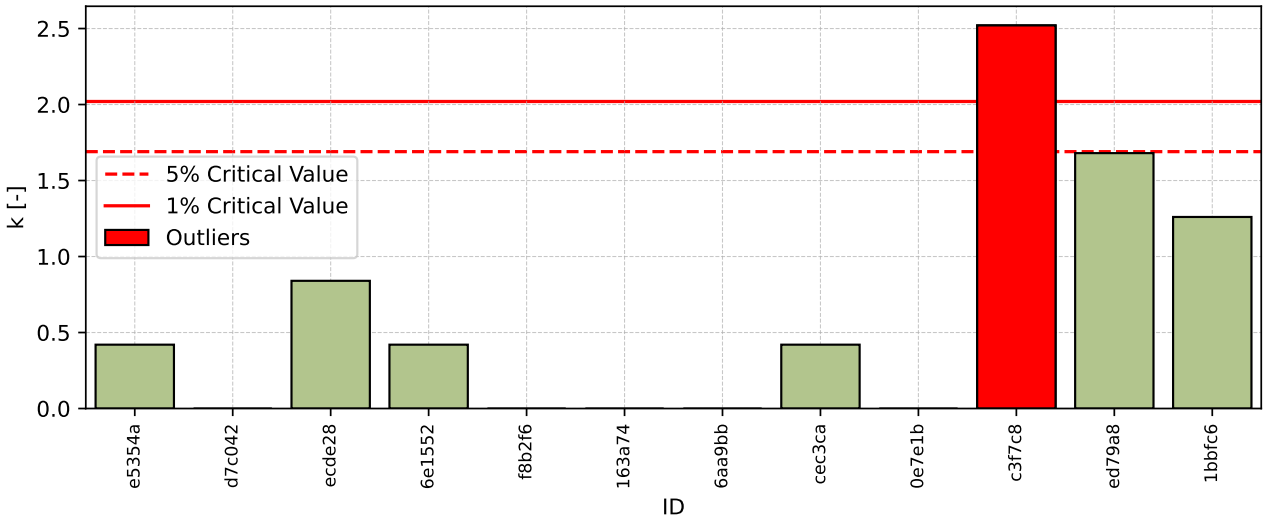

Figure 12: Intralaboratory Consistency Statistic

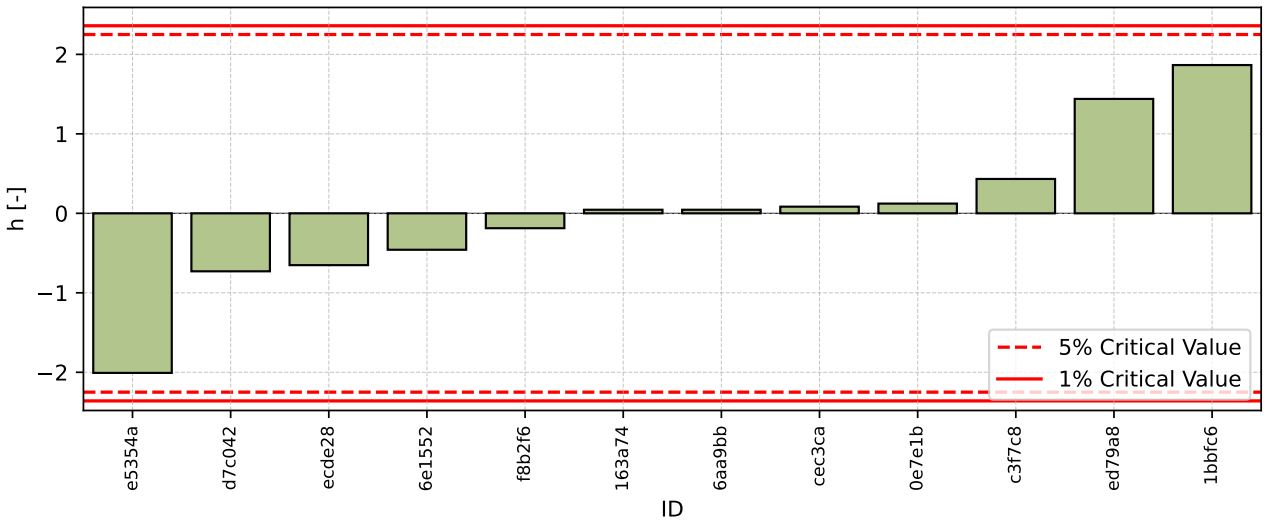

Figure 13: Interlaboratory Consistency Statistic

2.4 Descriptive statistics

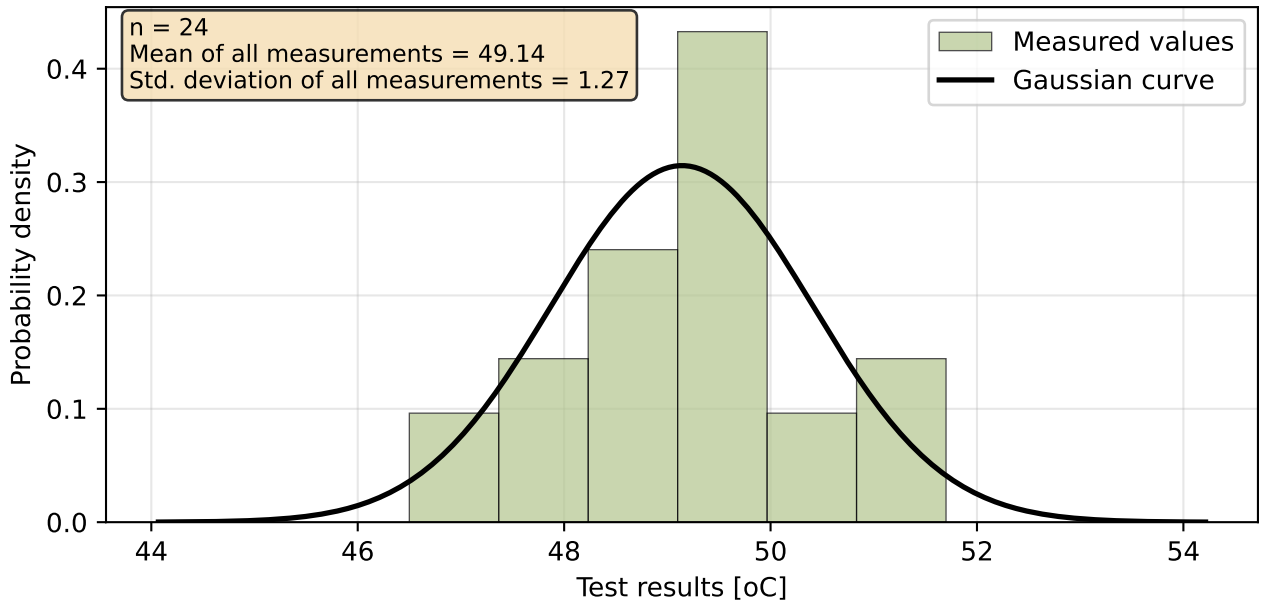

Figure 14: Histogram of all test results

Table 9: Descriptive statistics

Characteristics	[°C]
Average value – $\bar{x}$	49.14
Sample standard deviation – s	1.29
Assigned value – x^*	49.14
Robust standard deviation – s^*	1.29
Measurement uncertainty of assigned value – u_X	0.37
p-value of normality test [-]	0.069
Interlaboratory standard deviation – s_L	1.29
Repeatability standard deviation – s_r	0.17
Reproducibility standard deviation – s_R	1.30
Repeatability – r	0.47
Reproducibility – R	3.63

2.5 Evaluation of Performance Statistics

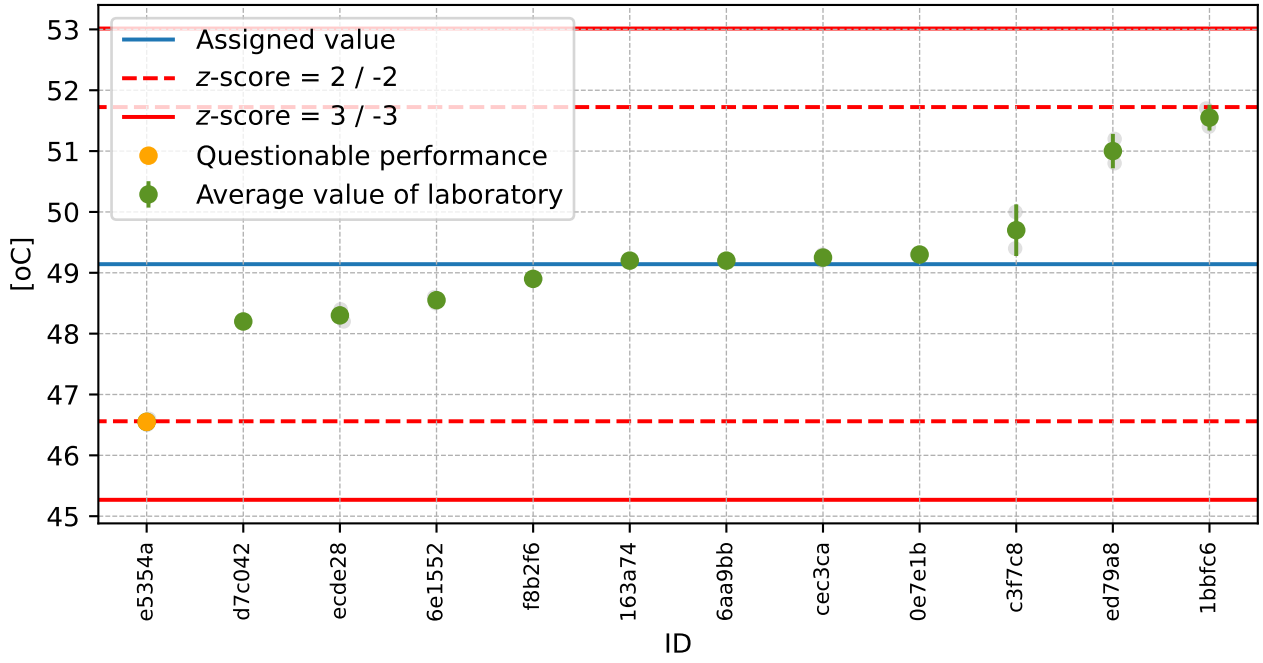

Figure 15: Average values and sample standard deviations

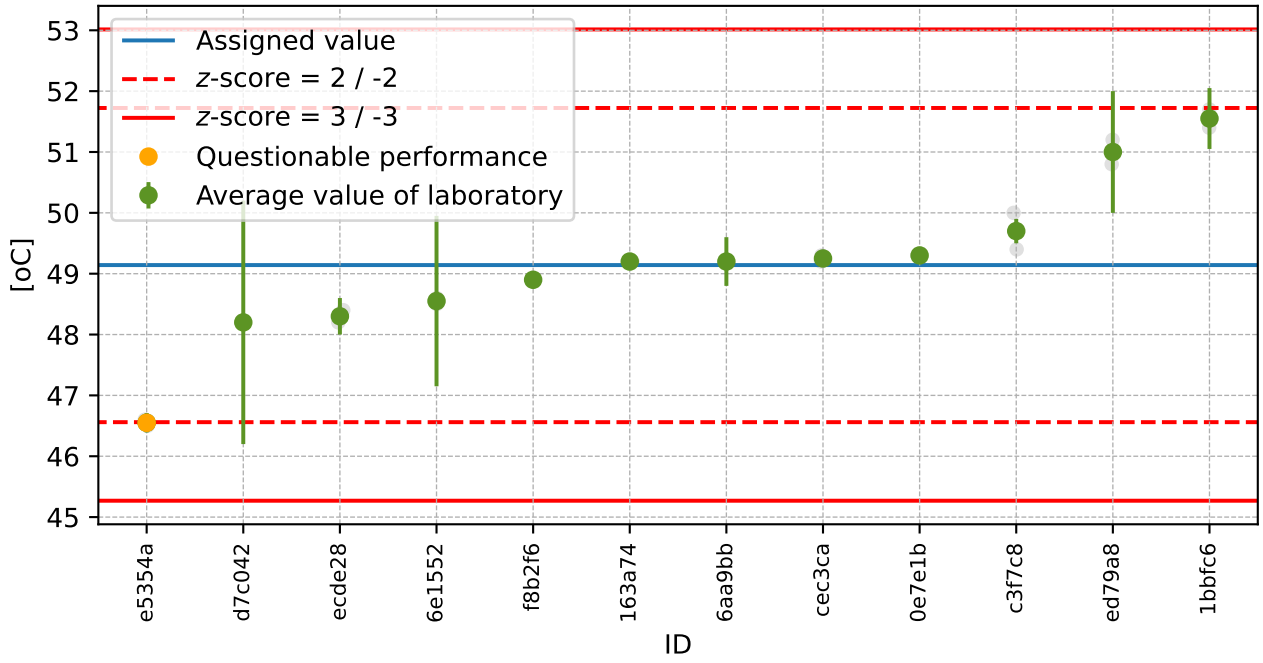

Figure 16: Average values and extended uncertainties of measurement

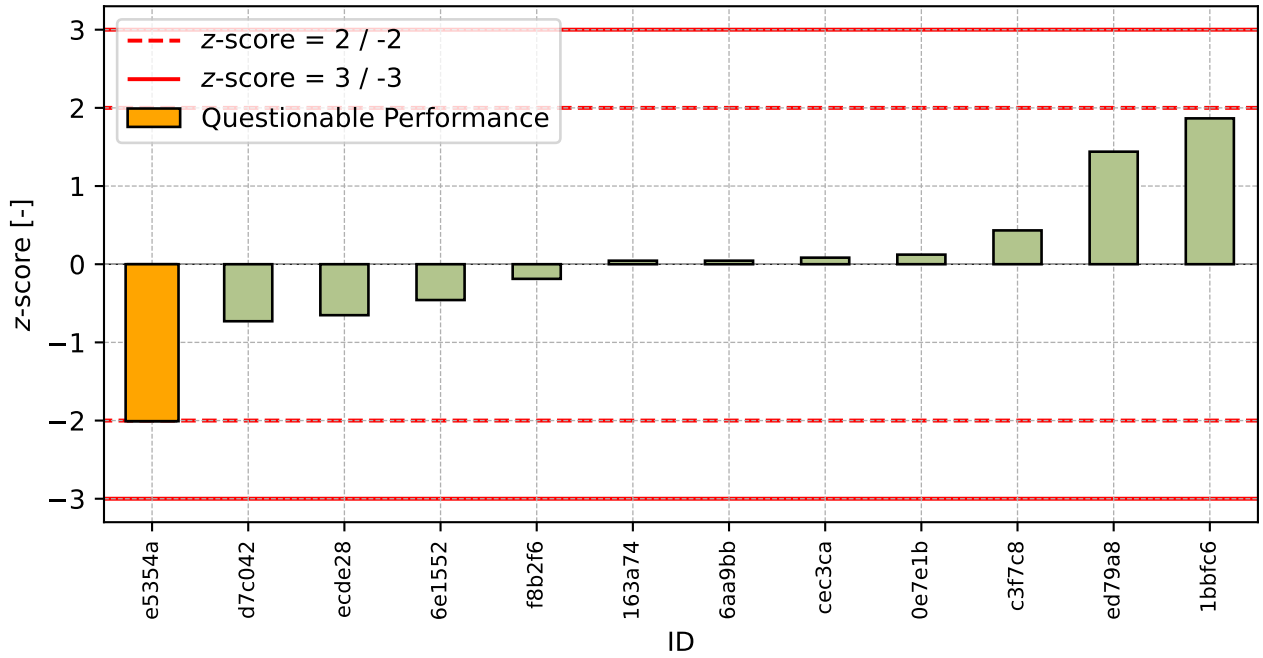

Figure 17: z-score

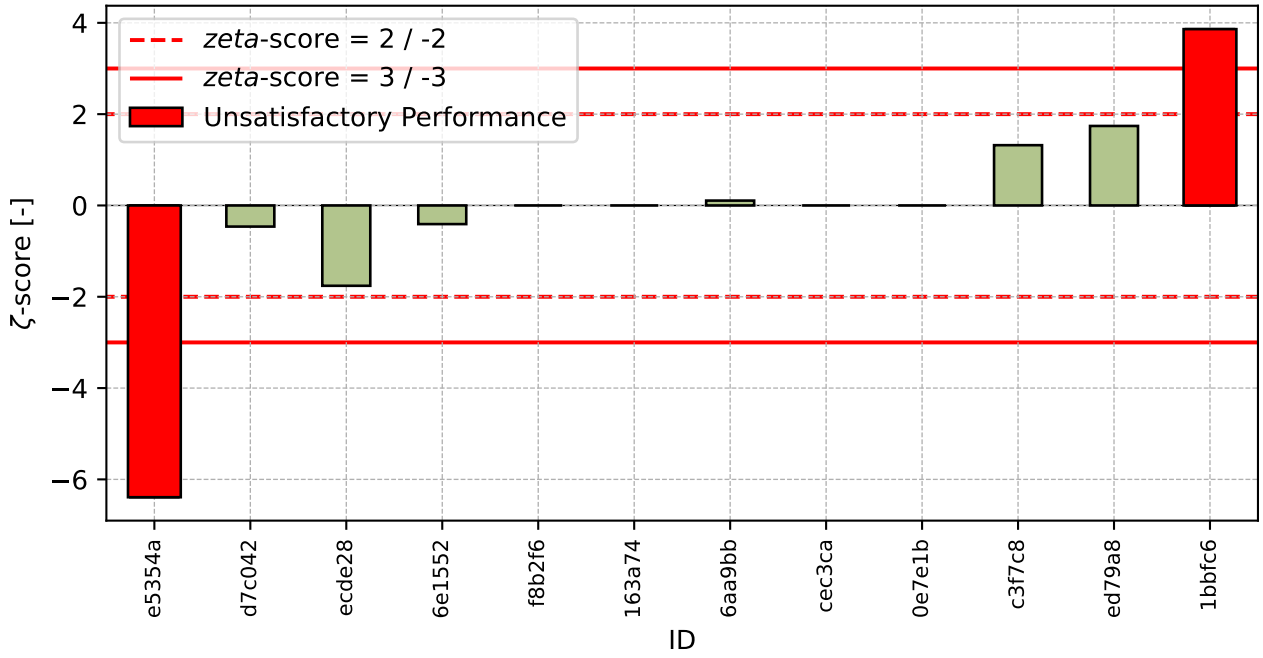

Figure 18: ζ-score

Table 10: z-score and ζ-score

ID	z-score [-]	ζ-score [-]
e5354a	-2.01	-6.39
d7c042	-0.73	-0.46
ecde28	-0.65	-1.76
6e1552	-0.46	-0.41
f8b2f6	-0.19	-
163a74	0.05	-
6aa9bb	0.05	0.11
cec3ca	0.08	-
0e7e1b	0.12	-
c3f7c8	0.43	1.32
ed79a8	1.44	1.74
1bbfc6	1.87	3.86

3 Appendix – EN 13398 Determination of elastic recovery of modified bitumen (RE)

This part of the PT programme was not opened due to low interest from laboratories.

4 Appendix – EN 12593 Determination of the Fraass breaking point (T)

4.1 Test results

Table 11: Test results – ordered by average value. Outliers are marked by red color. Columns 1–2 are individual determinations; u_X – extended uncertainty of measurement; $\bar{x}$ – average value; s_0 – sample standard deviation; V_X – variation coefficient

ID	1 [°C]	2 [°C]	u_X [°C]	$\bar{x}$ [°C]	s_0 [°C]	V_X [%]
5e2f75	-14	-	2.6	-14	-	-
b1b84e	-13	-14	2.0	-14	0.7	-5.24
d7c042	-13	-	3.0	-13	-	-
ecde28	-8	-7	2.0	-8	0.7	-9.43

4.2 The Numerical Procedure for Determining Outliers

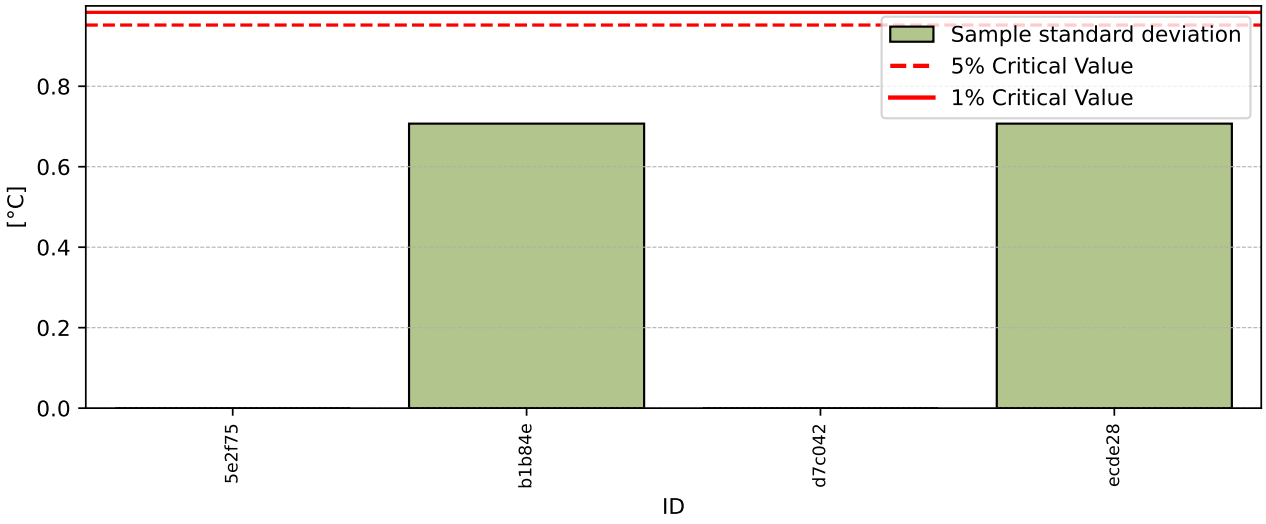

Figure 19: **Cochran's test** - sample standard deviations

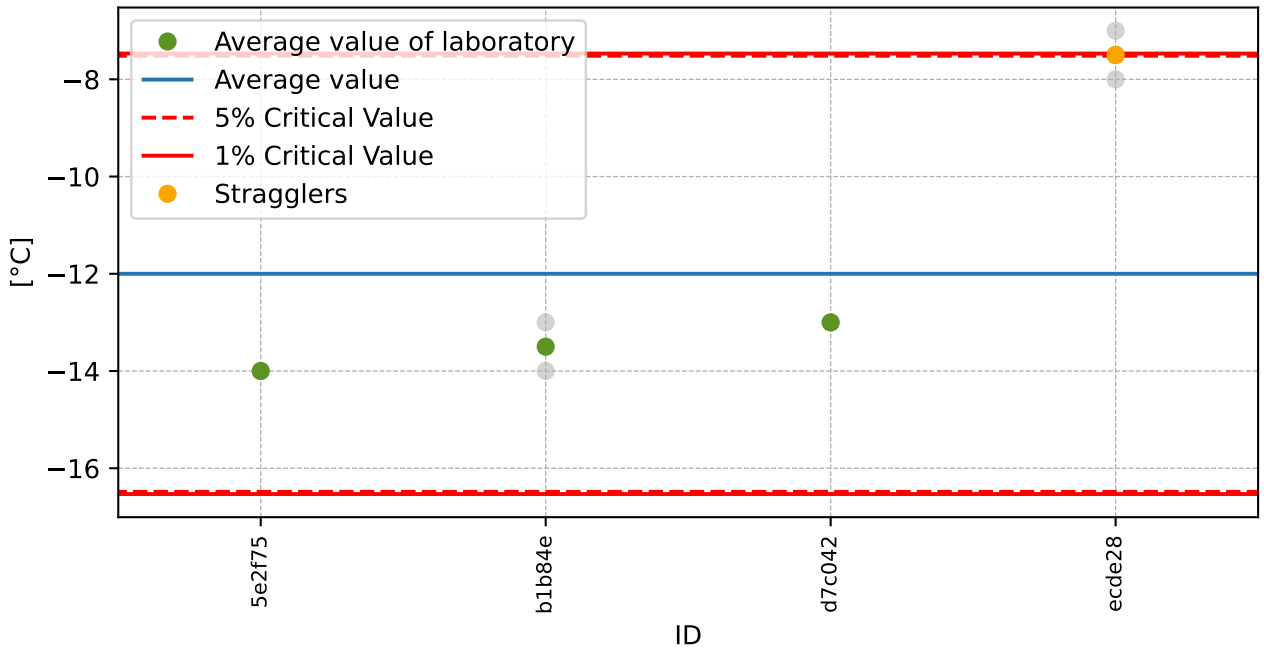

Figure 20: **Grubbs' test** - average values

4.3 Mandel's Statistics

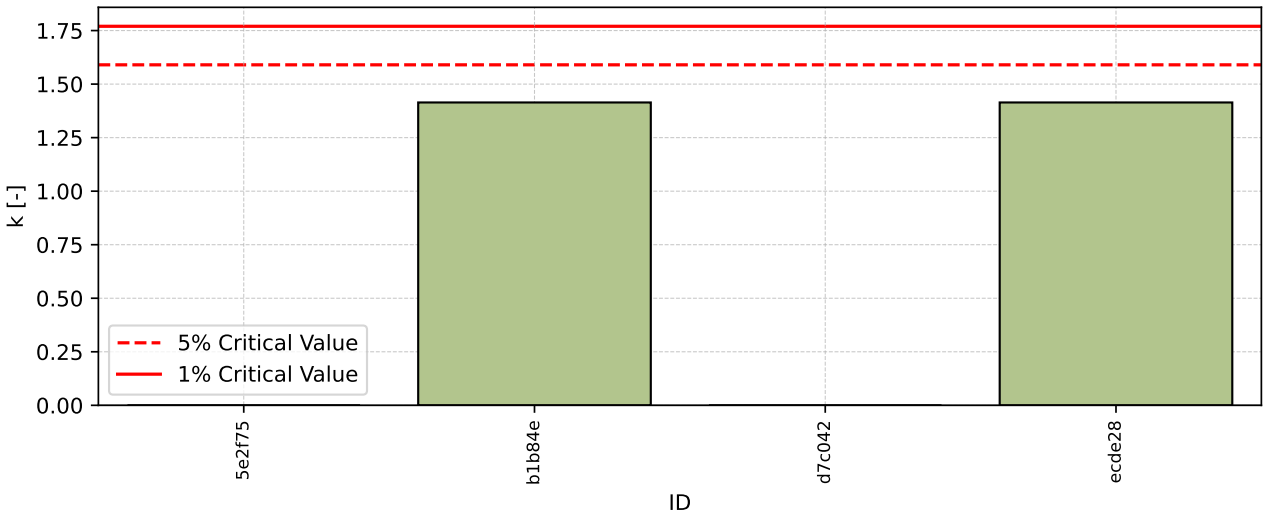

Figure 21: Intralaboratory Consistency Statistic

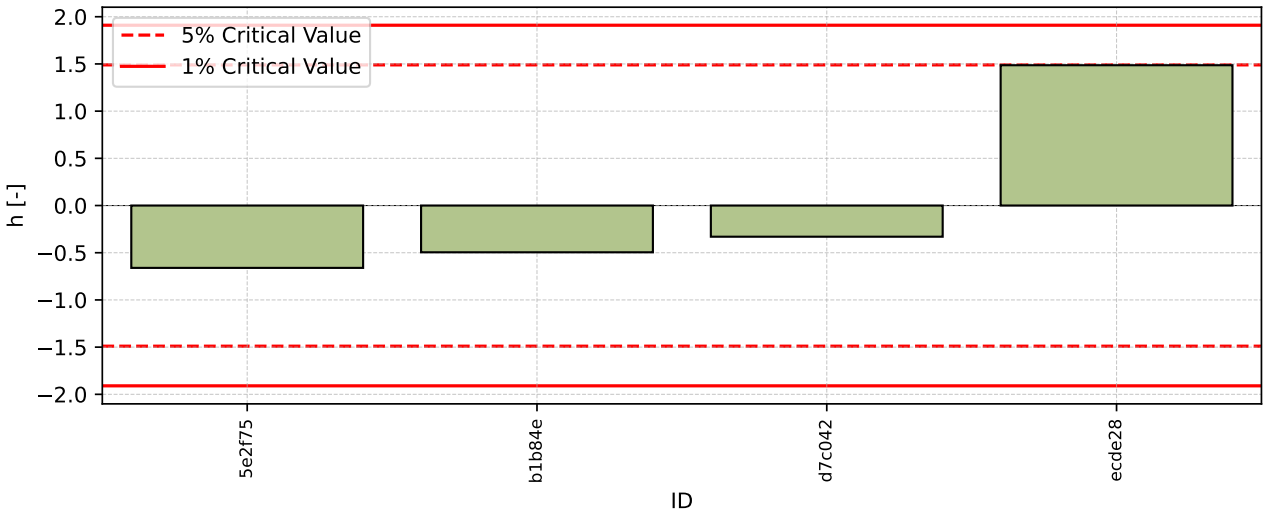

Figure 22: Interlaboratory Consistency Statistic

4.4 Descriptive statistics

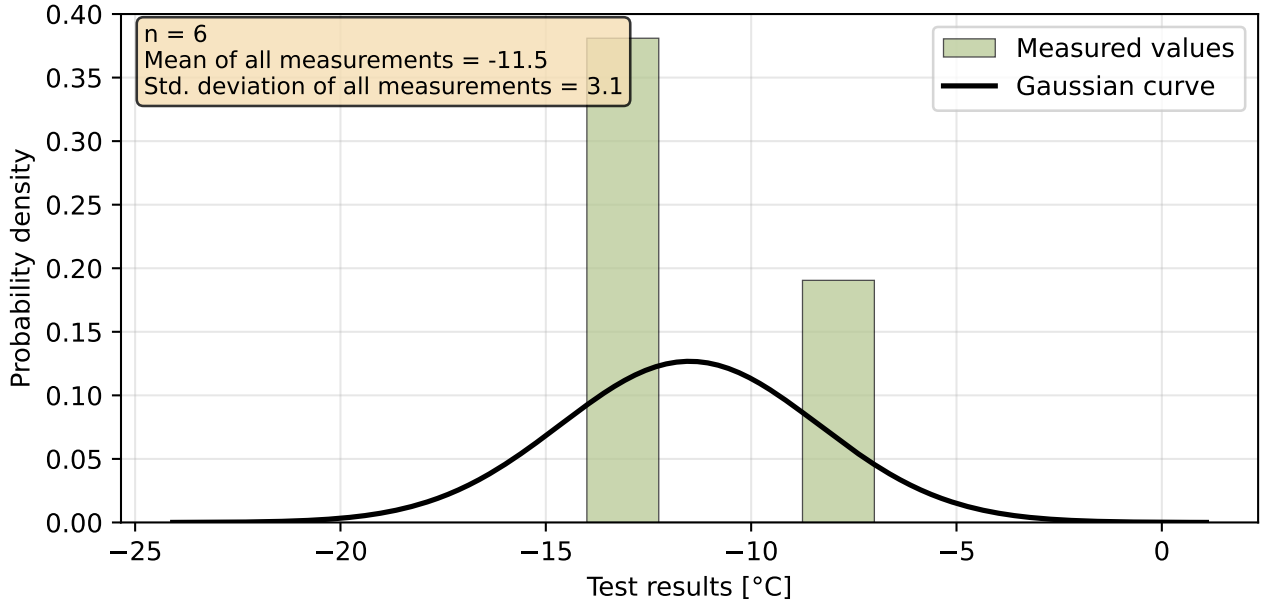

Figure 23: Histogram of all test results

Table 12: Descriptive statistics

Characteristics	[°C]
Average value – $\bar{x}$	-12.0
Sample standard deviation – s	3.0
Assigned value – x^*	-12.0
Robust standard deviation – s^*	3.0
Measurement uncertainty of assigned value – u_X	1.5
p-value of normality test [-]	0.033
Interlaboratory standard deviation – s_L	3.0
Repeatability standard deviation – s_r	0.5
Reproducibility standard deviation – s_R	3.0
Repeatability – r	1.4
Reproducibility – R	8.5

4.5 Evaluation of Performance Statistics

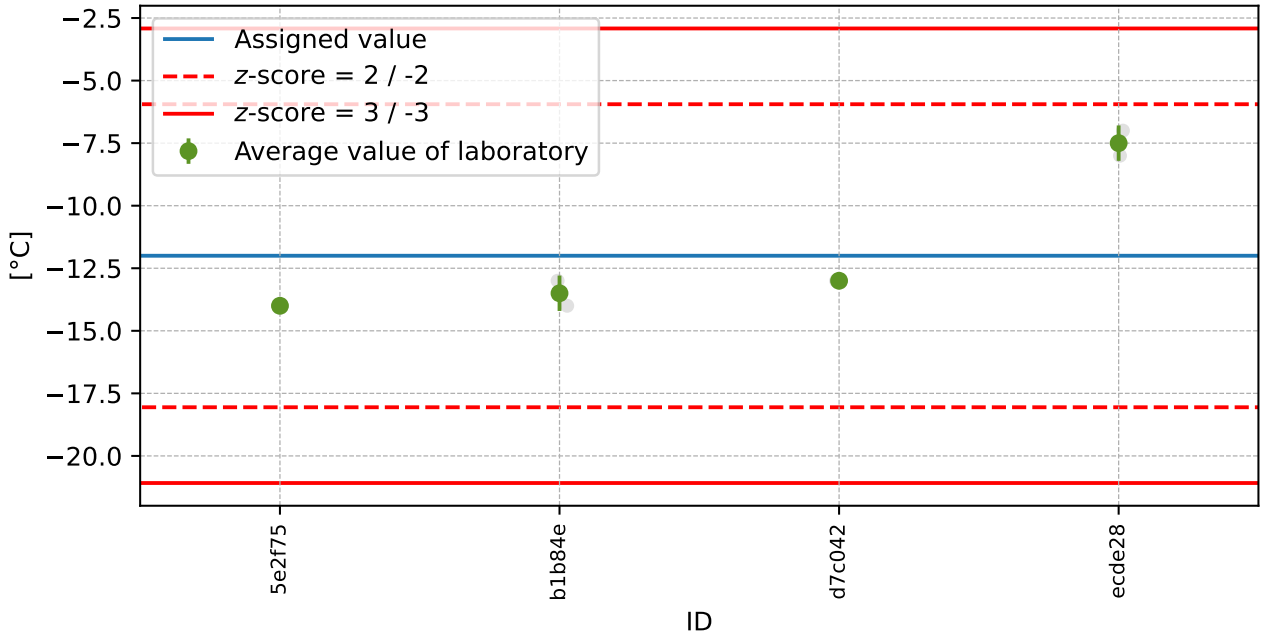

Figure 24: Average values and sample standard deviations

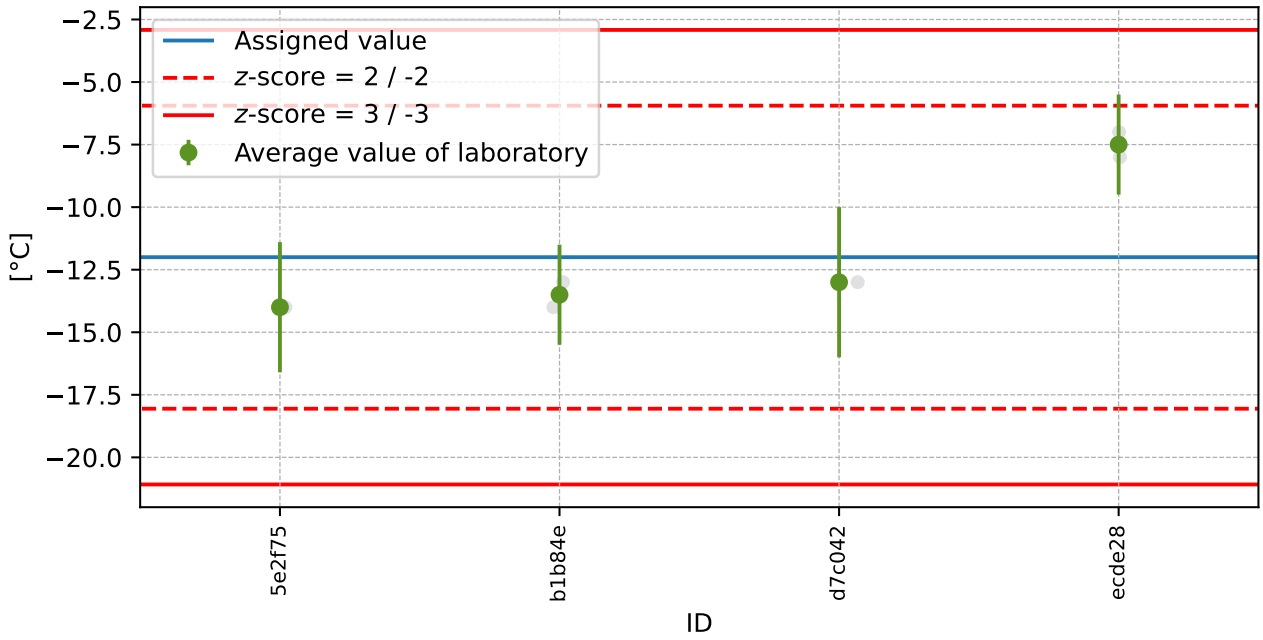

Figure 25: Average values and extended uncertainties of measurement

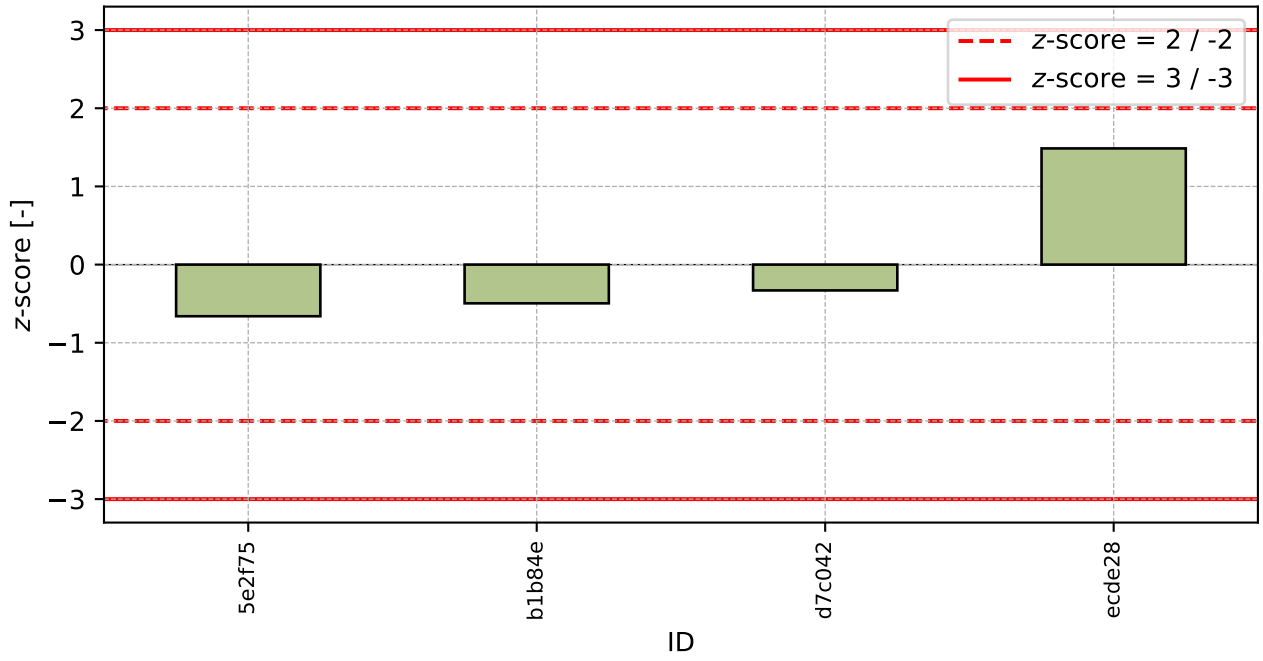

Figure 26: z-score

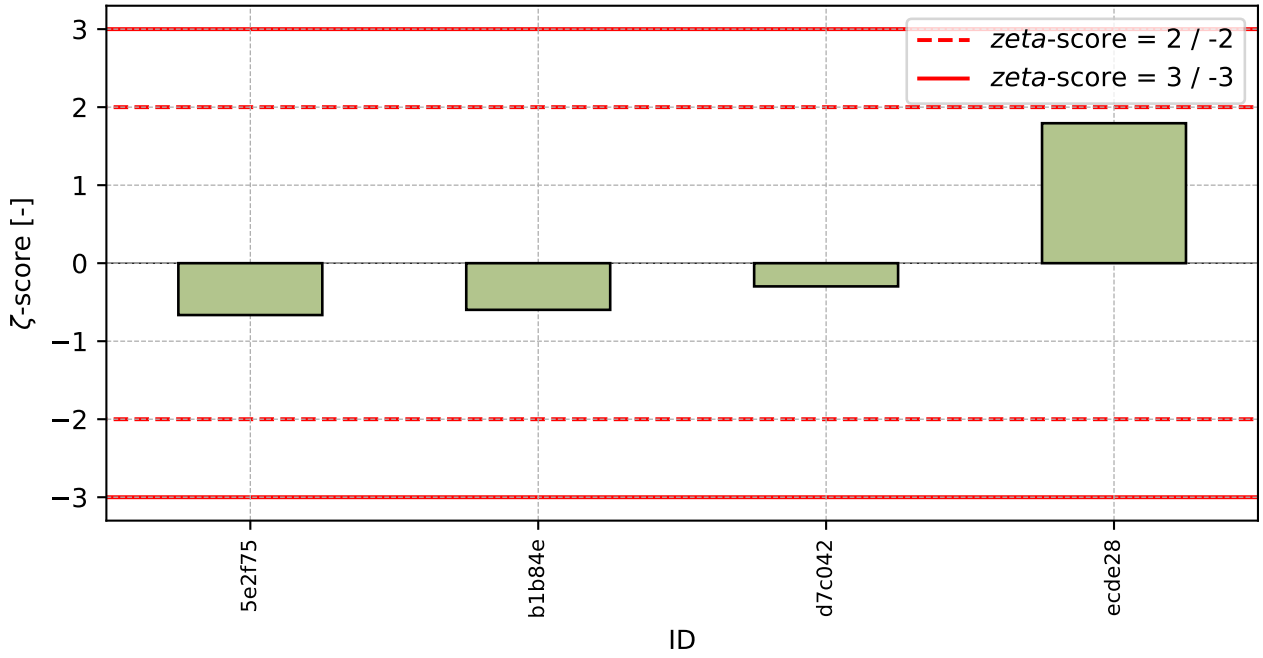

Figure 27: ζ-score

Table 13: z-score and ζ-score

ID	z-score [-]	ζ-score [-]
5e2f75	-0.66	-0.66
b1b84e	-0.50	-0.60
d7c042	-0.33	-0.30
ecde28	1.49	1.79

5 Appendix – EN 1429 Determination of residue on sieving of bituminous emulsions and storage stability

This part of the PT programme was not opened due to low interest from laboratories.

6 Appendix – EN 12697-1 Determination of soluble binder content

6.1 Test results

Table 14: Test results – ordered by average value. Outliers are marked by red color. u_X – extended uncertainty of measurement.

ID	Result [%]	u_X [%]
6055e8	5.2	-
5649f1	5.2	-
ed79a8	5.3	0.10
61062e	5.3	-
013bae	5.3	-
53be5a	5.3	0.40
163a74	5.4	-
0e7e1b	5.4	-
b40e75	5.4	0.30
4c459a	5.4	-
5e2a9a	5.4	-
8b137c	5.4	-
1c9da5	5.5	-
cec3ca	5.5	-
146b0f	5.7	0.20
d7c042	6.0	0.90

6.2 The Numerical Procedure for Determining Outliers

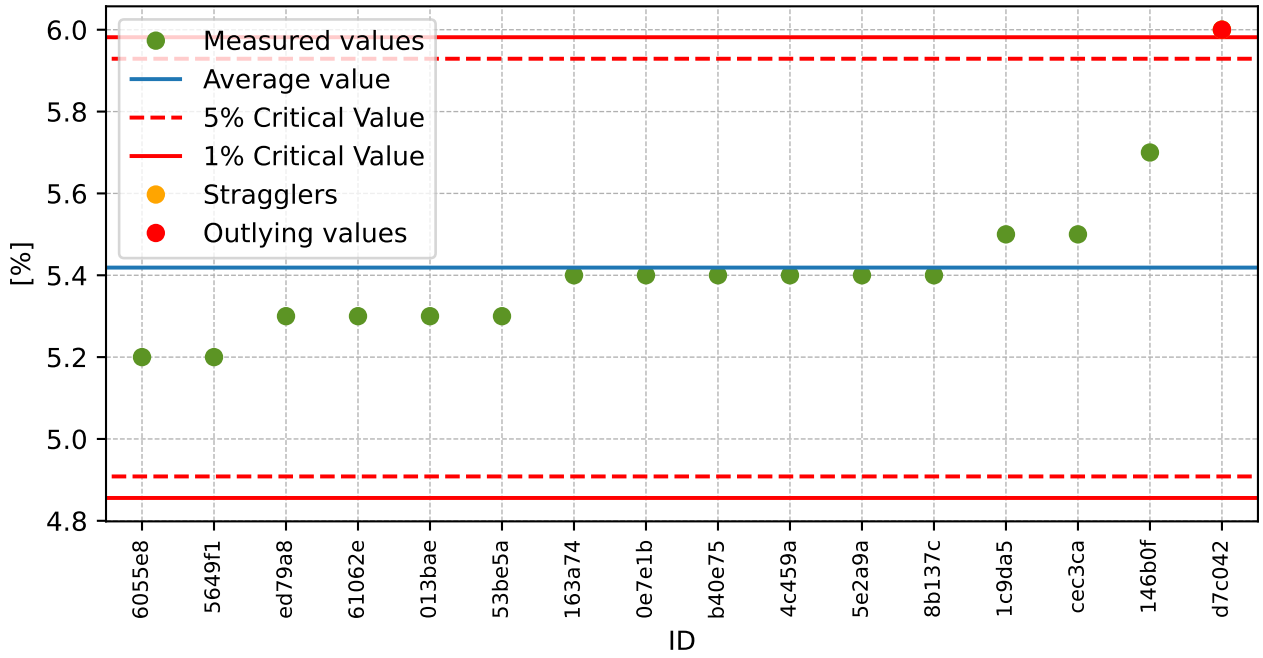

Figure 28: **Grubbs' test** - average values

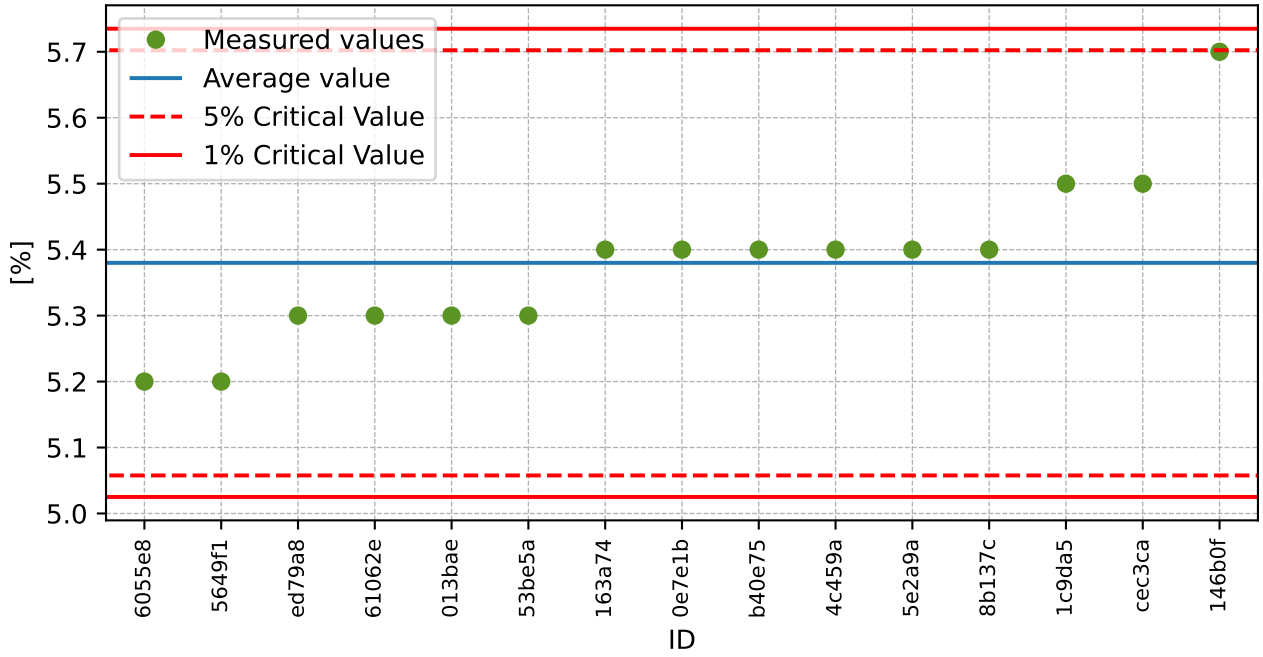

Figure 29: **Grubbs' test** - average values without outliers

6.3 Mandel's Statistics

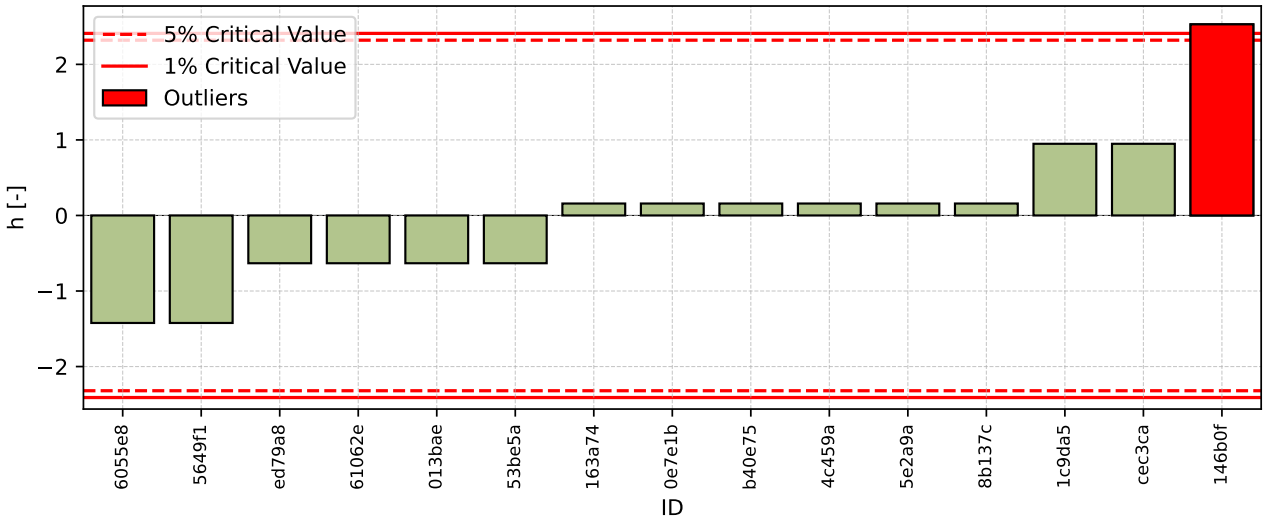

Figure 30: Interlaboratory Consistency Statistic

6.4 Descriptive statistics

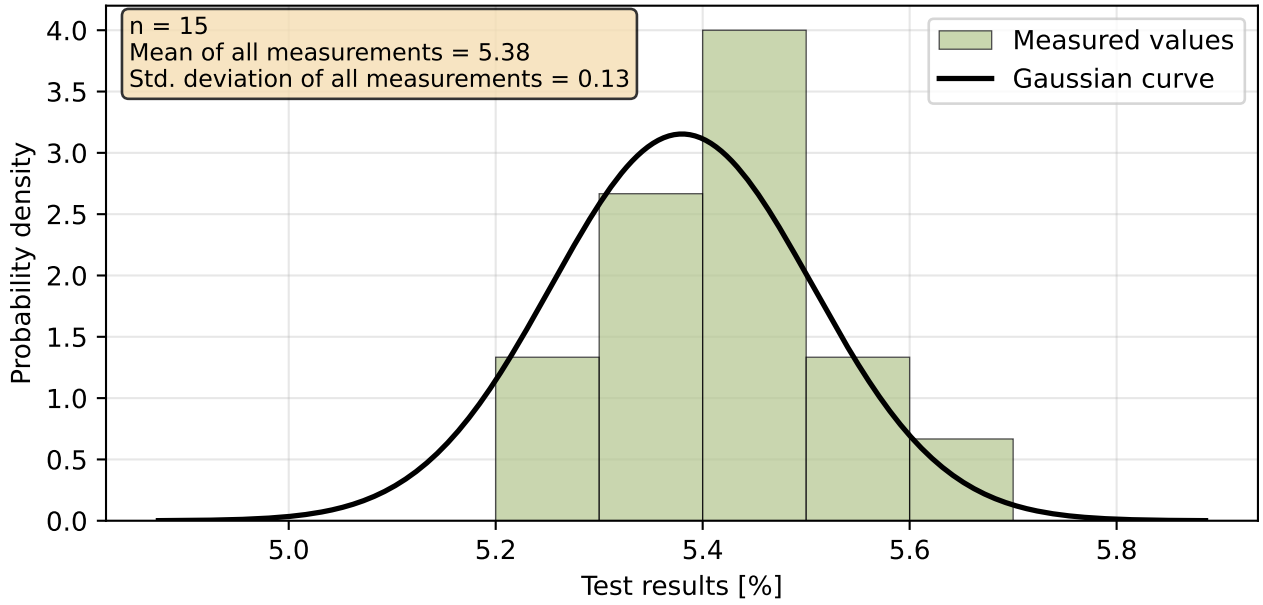

Figure 31: Histogram of all test results

Table 15: Descriptive statistics

Characteristics	[%]
Average value – $\bar{x}$	5.38
Sample standard deviation – s	0.13
Assigned value – x^*	5.38
Robust standard deviation – s^*	0.13
Measurement uncertainty of assigned value – u_X	0.03
p-value of normality test [-]	0.079

6.5 Evaluation of Performance Statistics

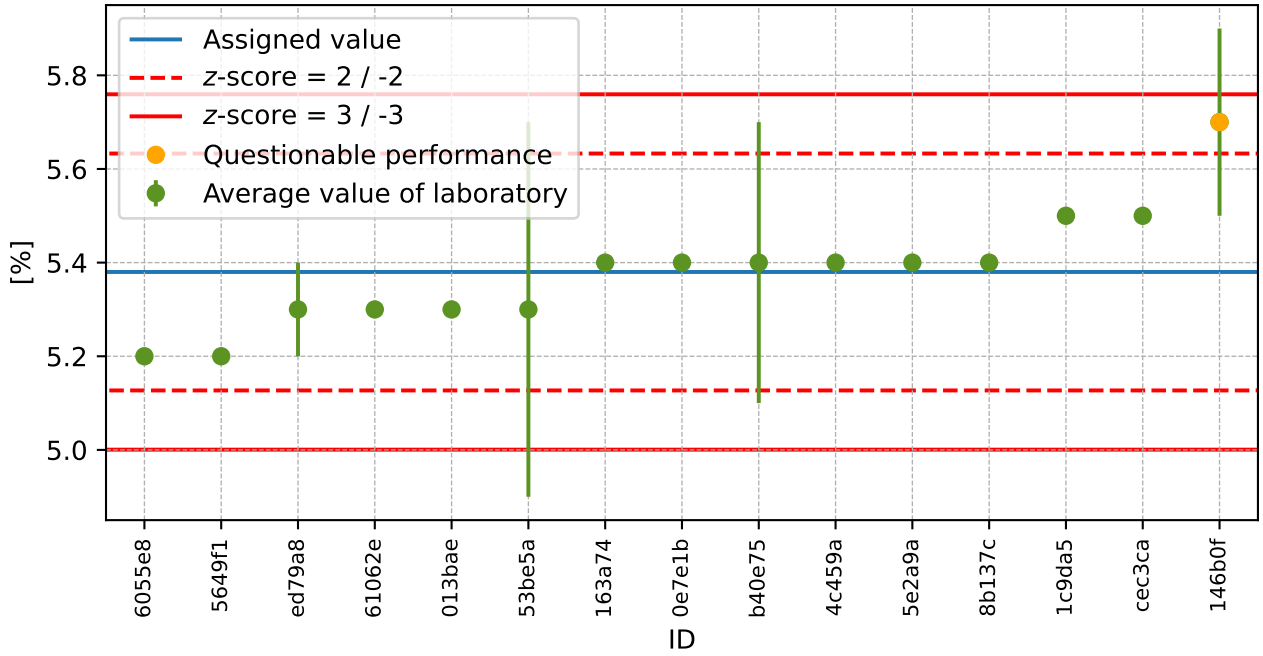

Figure 32: Average values and extended uncertainties of measurement

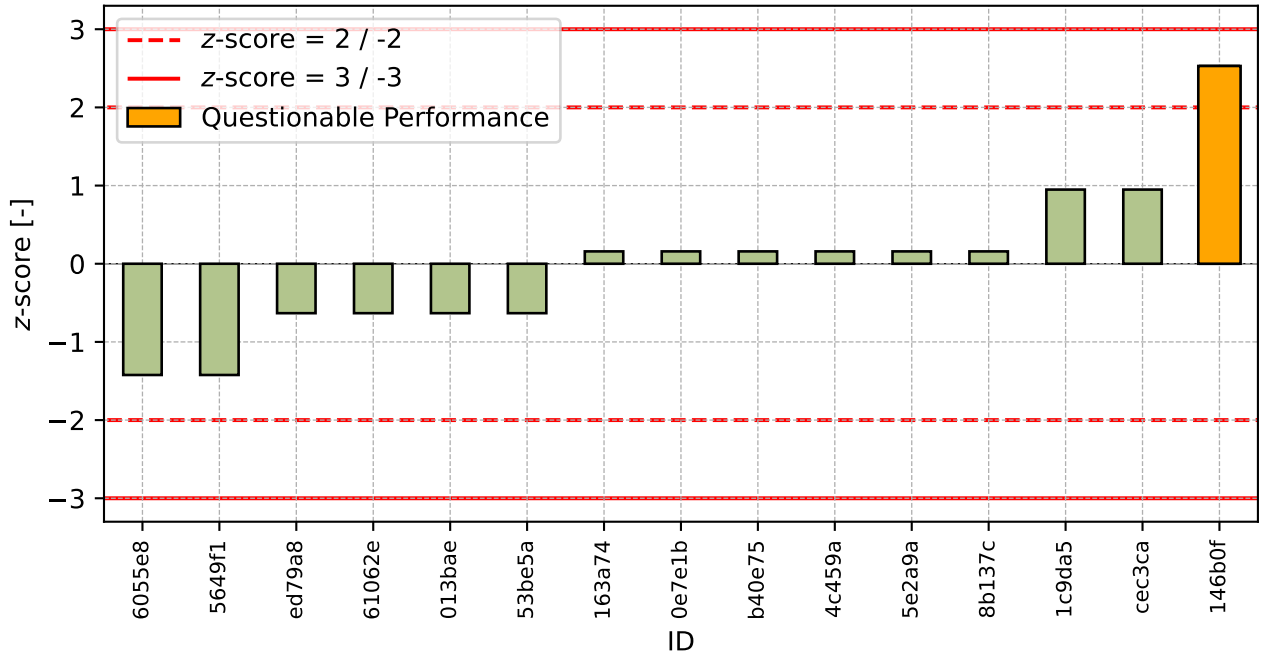

Figure 33: z-score

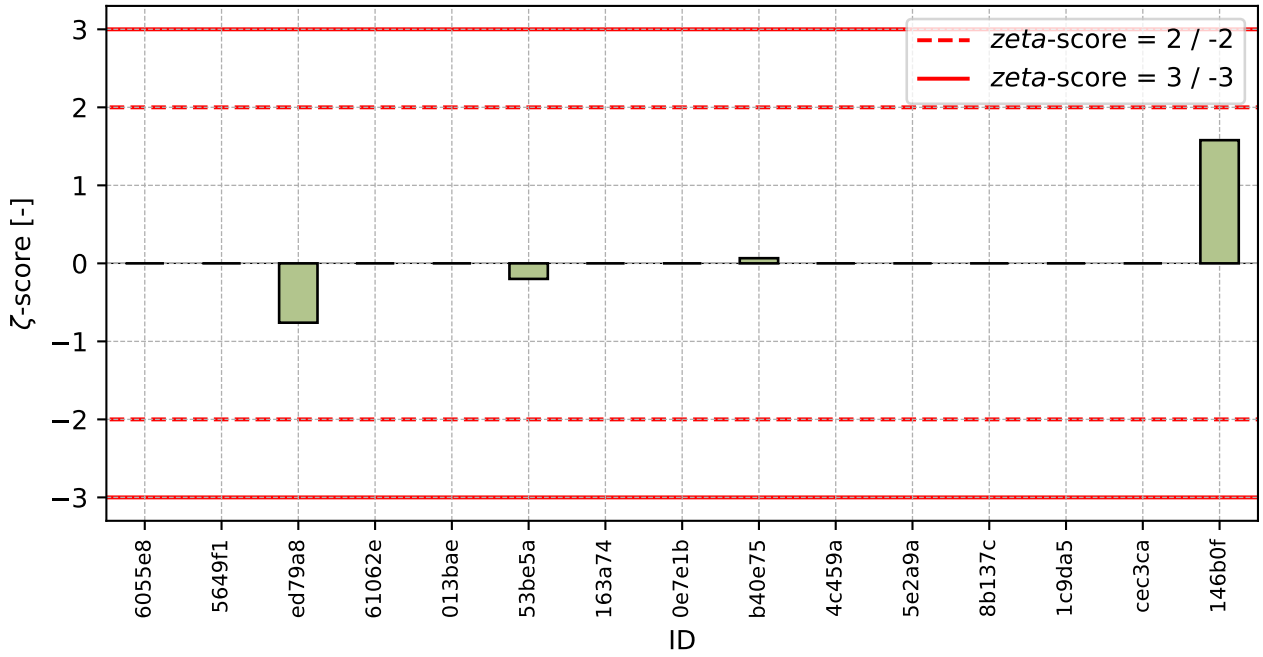

Figure 34: ζ-score

Table 16: z-score and ζ-score

ID	z-score [-]	ζ-score [-]
6055e8	-1.42	-
5649f1	-1.42	-
ed79a8	-0.63	-0.76
61062e	-0.63	-
013bae	-0.63	-
53be5a	-0.63	-0.20
163a74	0.16	-
0e7e1b	0.16	-
b40e75	0.16	0.07
4c459a	0.16	-
5e2a9a	0.16	-
8b137c	0.16	-
1c9da5	0.95	-
cec3ca	0.95	-
146b0f	2.53	1.58

7 Appendix – EN 12697-2+A1 Determination of particle size distribution

7.1 11.2 mm

7.1.1 Test results

Table 17: Test results – ordered by average value. Outliers are marked by red color. u_X – extended uncertainty of measurement.

ID	Result [% m/m]	u_X [% m/m]
5649f1	96.7	-
163a74	99.0	-
61062e	99.0	-
013bae	99.0	-
6055e8	99.0	-
0e7e1b	99.0	-
53be5a	99.0	7.30
8b137c	99.0	-
d7c042	99.0	5.00
f9181c	99.0	1.20
1c9da5	99.0	-
4c459a	99.0	-
b66afc	99.2	-
cec3ca	99.3	-
b40e75	99.9	1.70
ed79a8	100.0	0.60
5e2a9a	100.0	-
146b0f	100.0	-

7.1.2 The Numerical Procedure for Determining Outliers

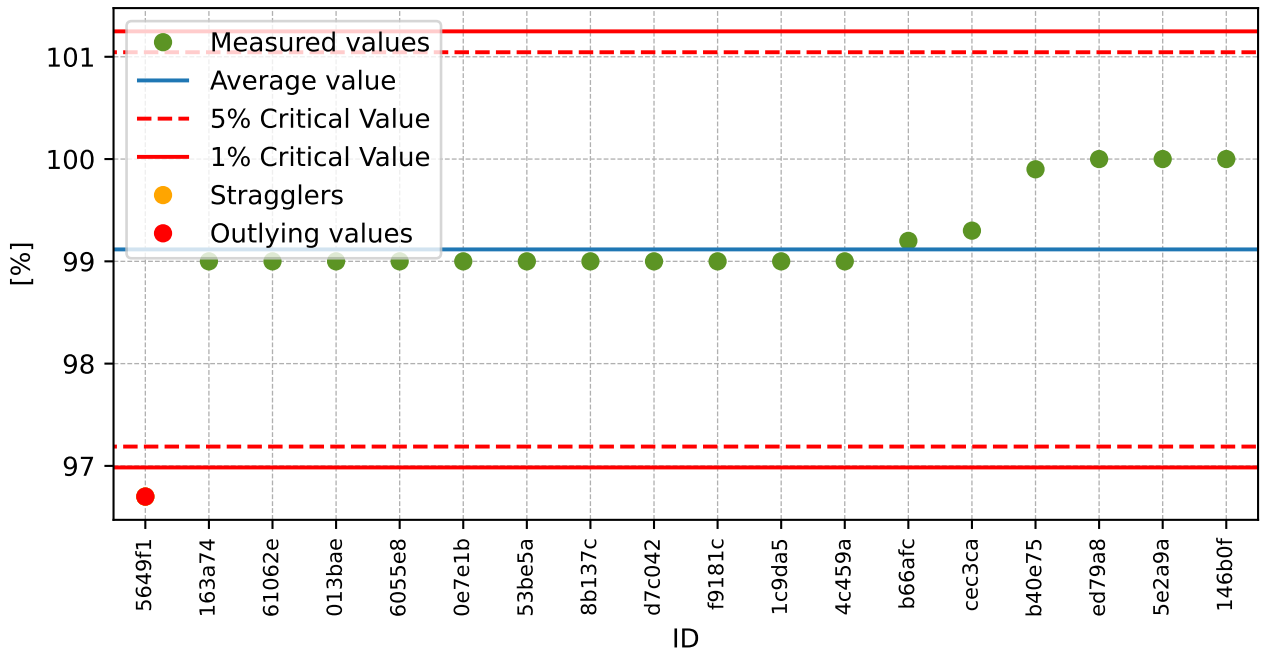

Figure 35: **Grubbs' test** - average values

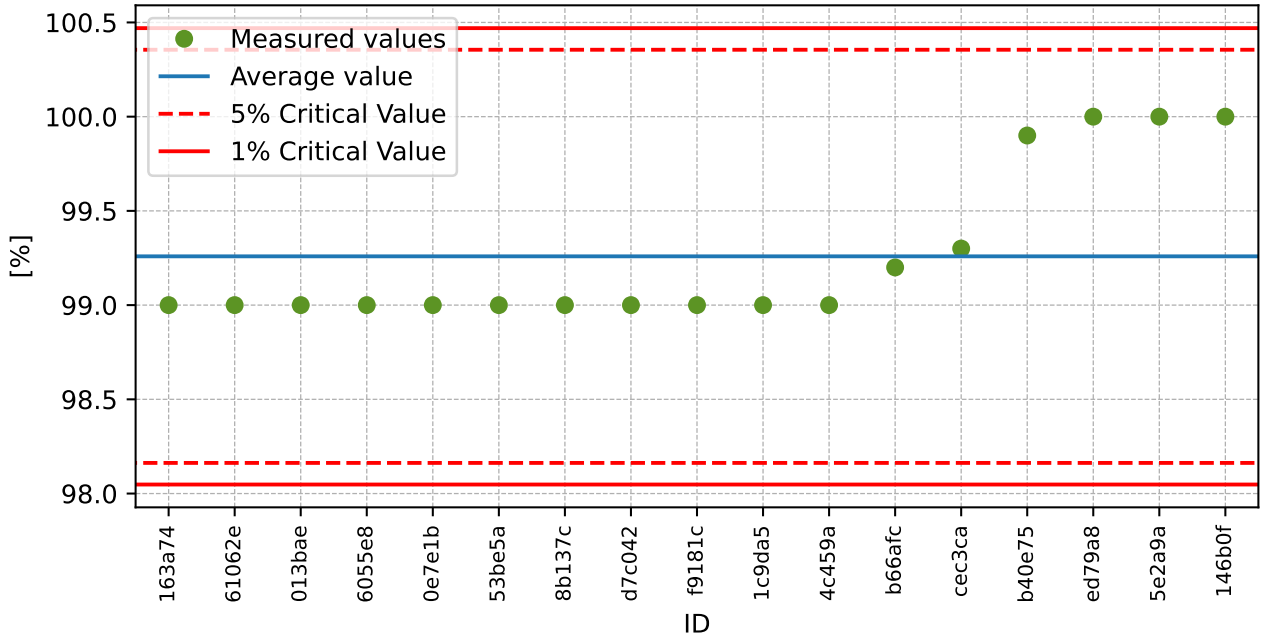

Figure 36: **Grubbs' test** - average values without outliers

7.1.3 Mandel's Statistics

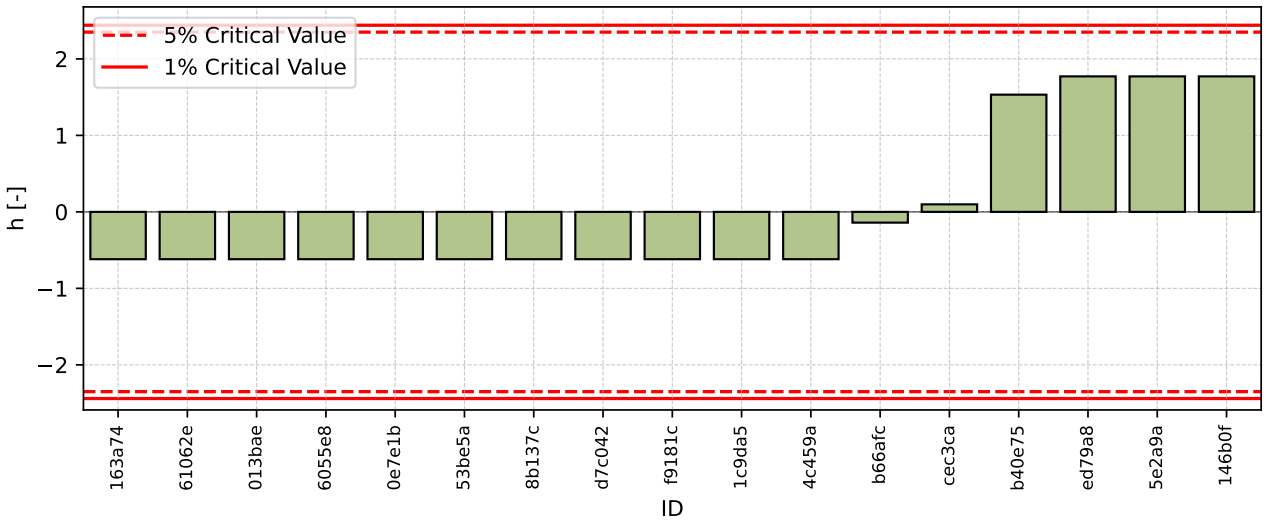

Figure 37: Interlaboratory Consistency Statistic

7.1.4 Descriptive statistics

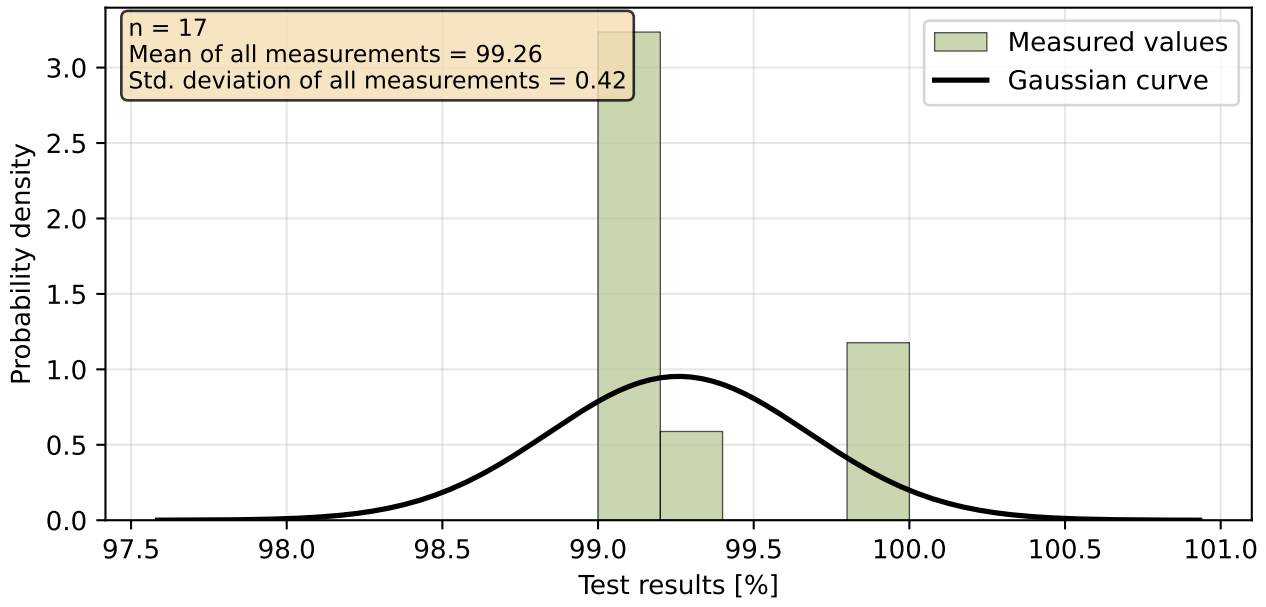

Figure 38: Histogram of all test results

Table 18: Descriptive statistics

Characteristics	[% m/m]
Average value – $\bar{x}$	99.26
Sample standard deviation – s	0.42
Assigned value – x^*	99.26
Robust standard deviation – s^*	0.42
Measurement uncertainty of assigned value – u_X	0.10
p-value of normality test [-]	< 0.001

7.1.5 Evaluation of Performance Statistics

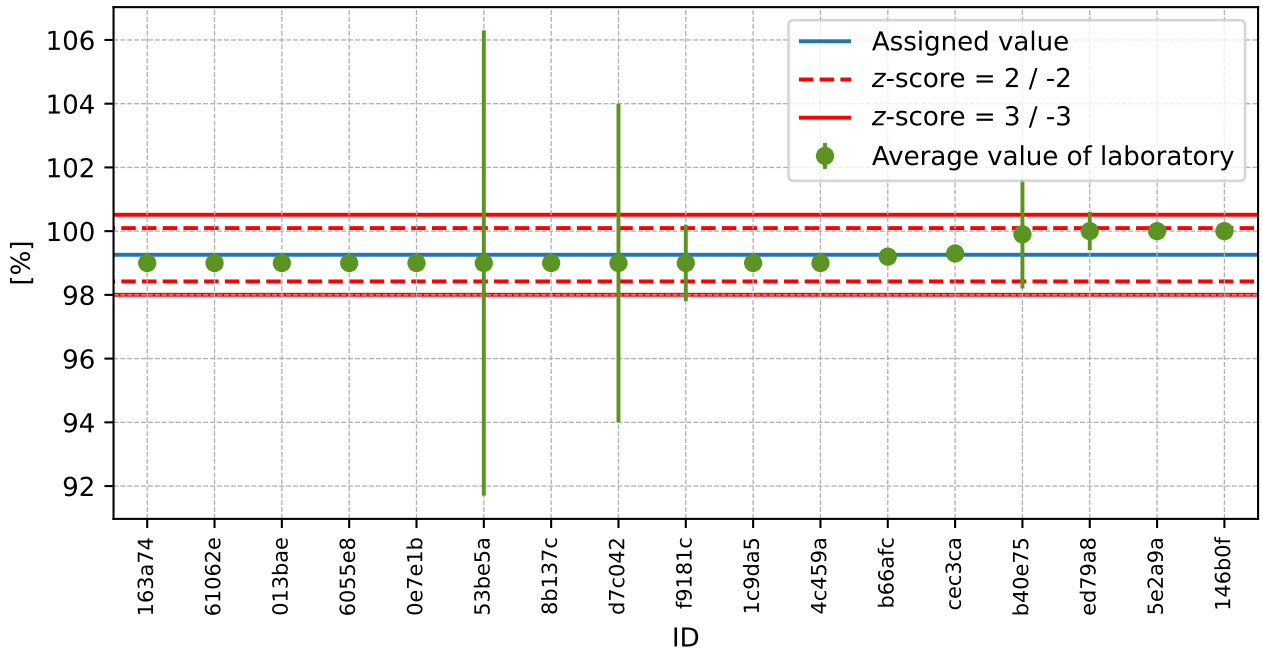

Figure 39: Average values and extended uncertainties of measurement

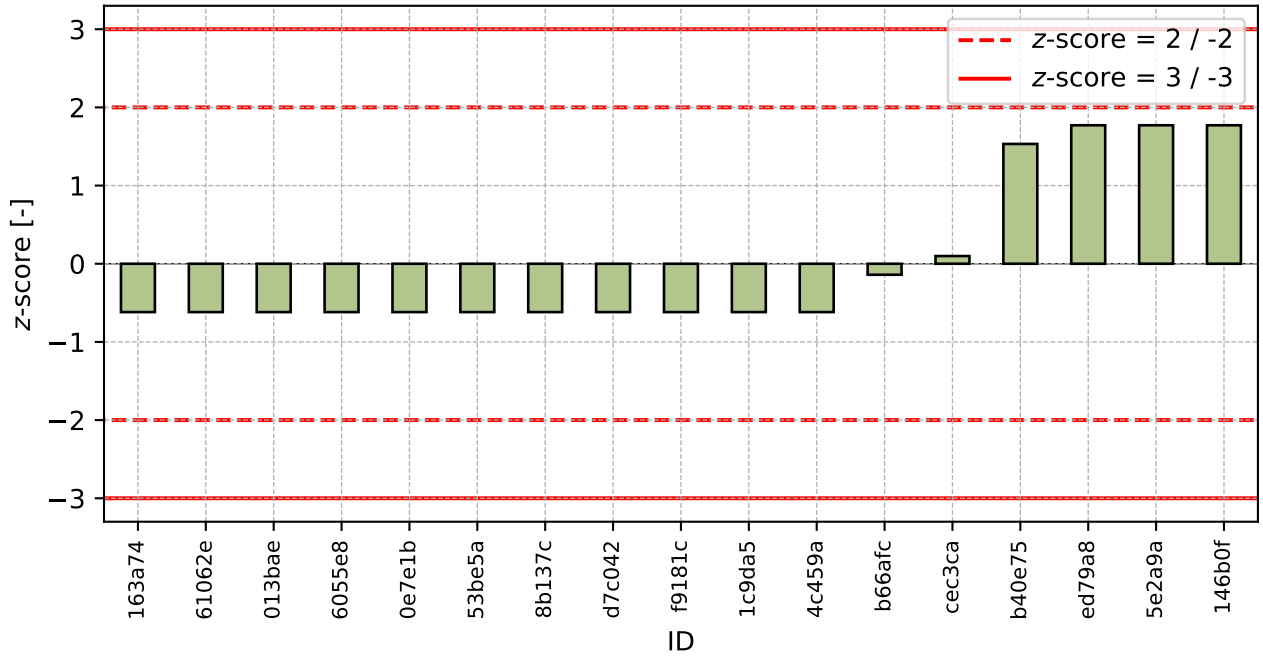

Figure 40: z-score

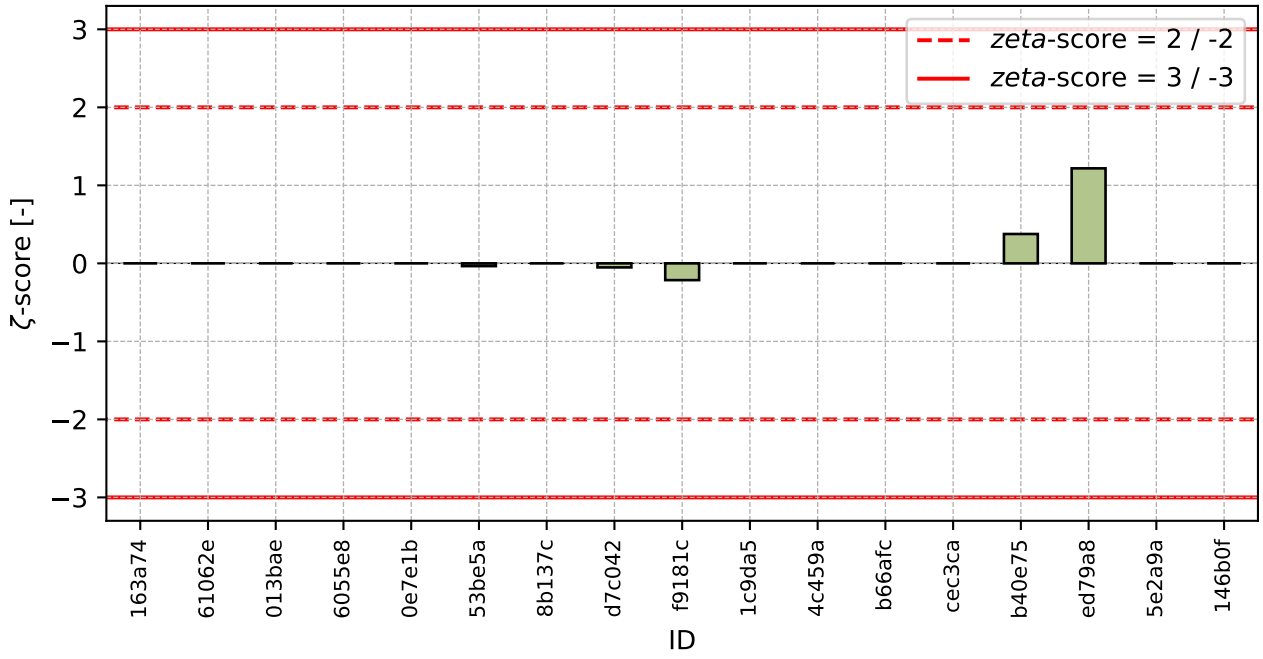

Figure 41: ζ-score

Table 19: z-score and ζ-score

ID	z-score [-]	ζ-score [-]
163a74	-0.62	-
61062e	-0.62	-
013bae	-0.62	-
6055e8	-0.62	-
0e7e1b	-0.62	-
53be5a	-0.62	-0.04
8b137c	-0.62	-
d7c042	-0.62	-0.05
f9181c	-0.62	-0.21
1c9da5	-0.62	-
4c459a	-0.62	-
b66afc	-0.14	-
cec3ca	0.10	-
b40e75	1.53	0.38
ed79a8	1.77	1.22
5e2a9a	1.77	-
146b0f	1.77	-

7.2 8 mm

7.2.1 Test results

Table 20: Test results – ordered by average value. Outliers are marked by red color. u_X – extended uncertainty of measurement.

ID	Result [% m/m]	u_X [% m/m]
61062e	82.0	-
1c9da5	84.0	-
5649f1	84.1	-
b66afc	86.5	-
cec3ca	86.8	-
f9181c	87.0	1.20
ed79a8	87.0	0.60
013bae	88.0	-
d7c042	89.0	4.50
6055e8	89.0	-
5e2a9a	89.0	-
53be5a	89.0	6.70
4c459a	90.0	-
8b137c	91.0	-
b40e75	91.2	1.70
0e7e1b	92.0	-
163a74	92.0	-
146b0f	93.0	-

7.2.2 The Numerical Procedure for Determining Outliers

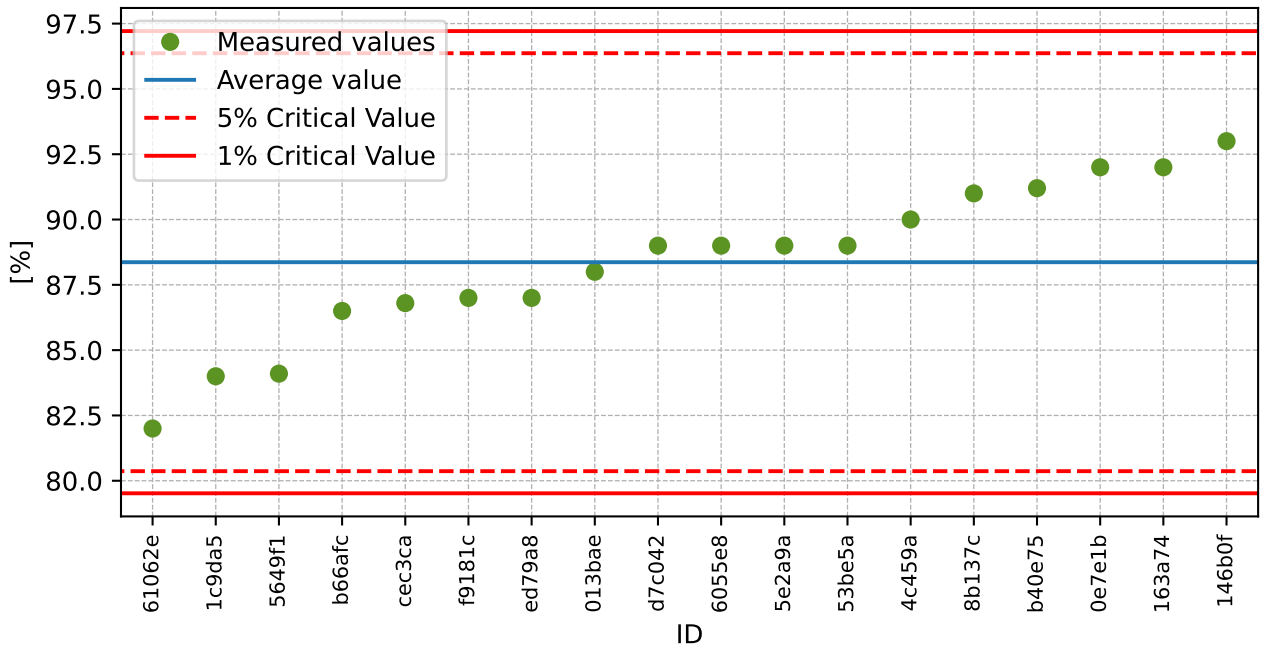

Figure 42: **Grubbs' test** - average values

7.2.3 Mandel's Statistics

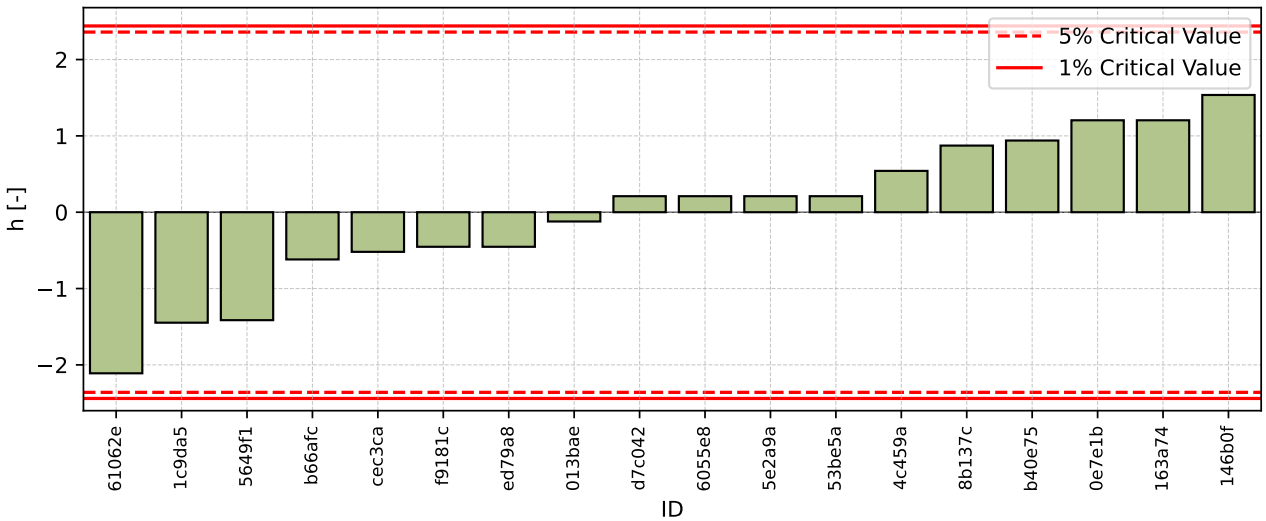

Figure 43: Interlaboratory Consistency Statistic

7.2.4 Descriptive statistics

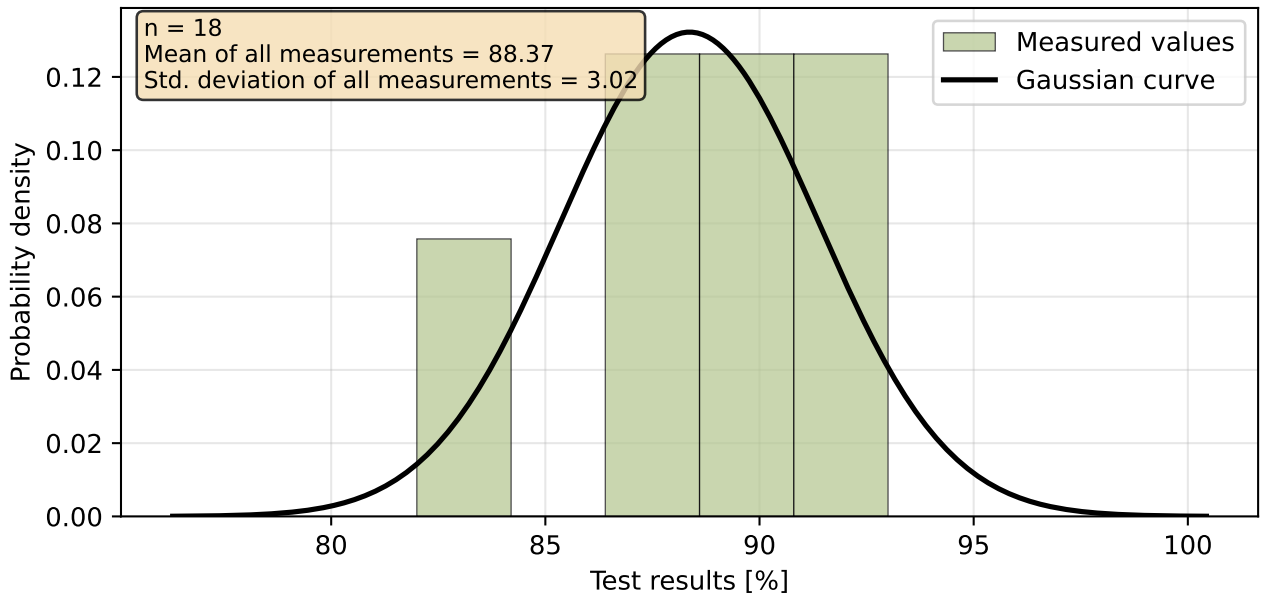

Figure 44: Histogram of all test results

Table 21: Descriptive statistics

Characteristics	**[% m/m]**
Average value – $\bar{x}$	88.37
Sample standard deviation – s	3.02
Assigned value – x^*	88.37
Robust standard deviation – s^*	3.02
Measurement uncertainty of assigned value – u_X	0.71
p-value of normality test [-]	0.601

7.2.5 Evaluation of Performance Statistics

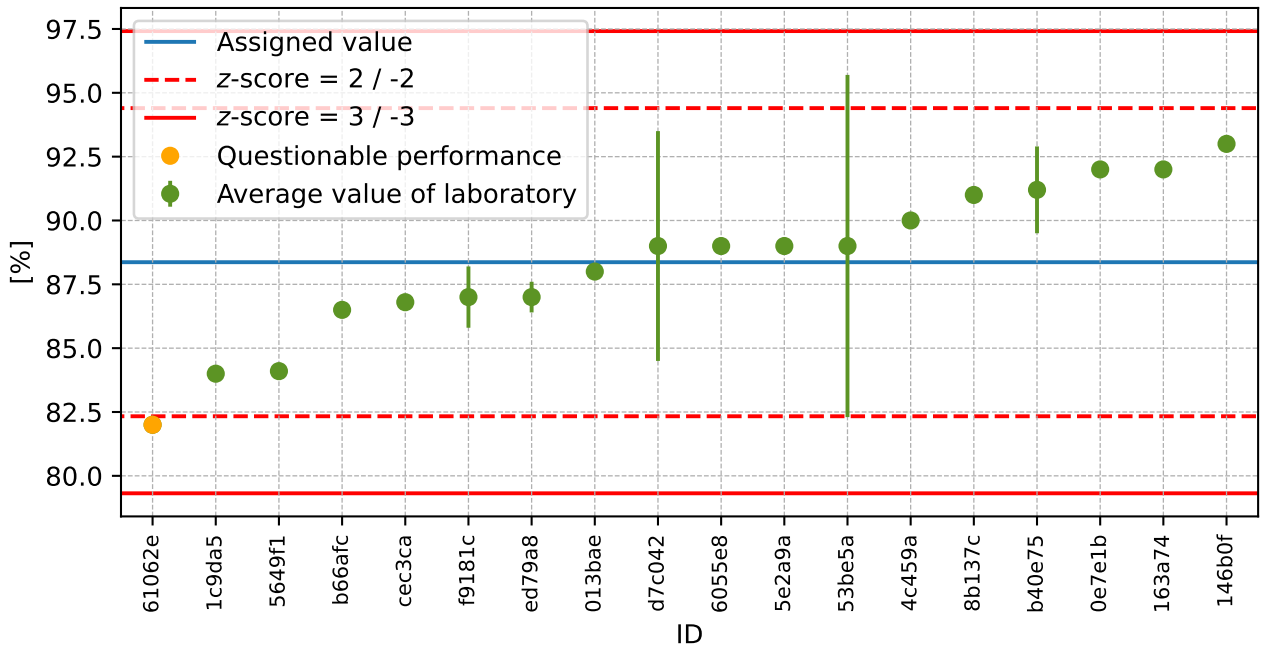

Figure 45: Average values and extended uncertainties of measurement

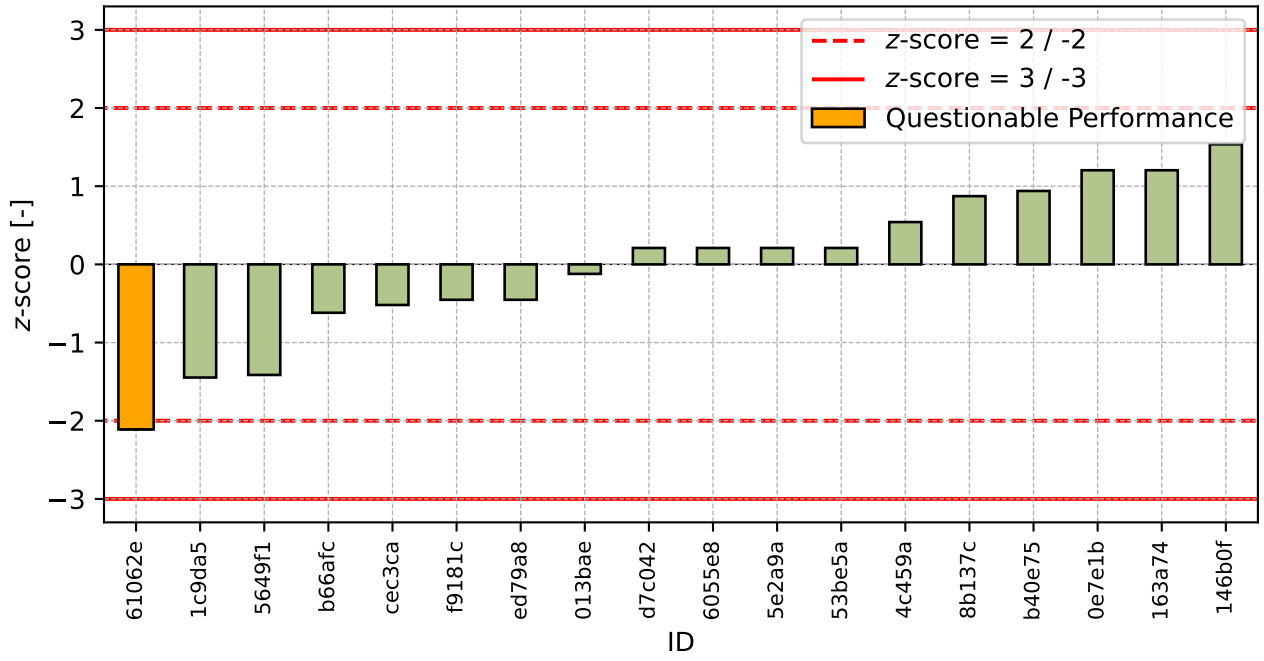

Figure 46: z-score

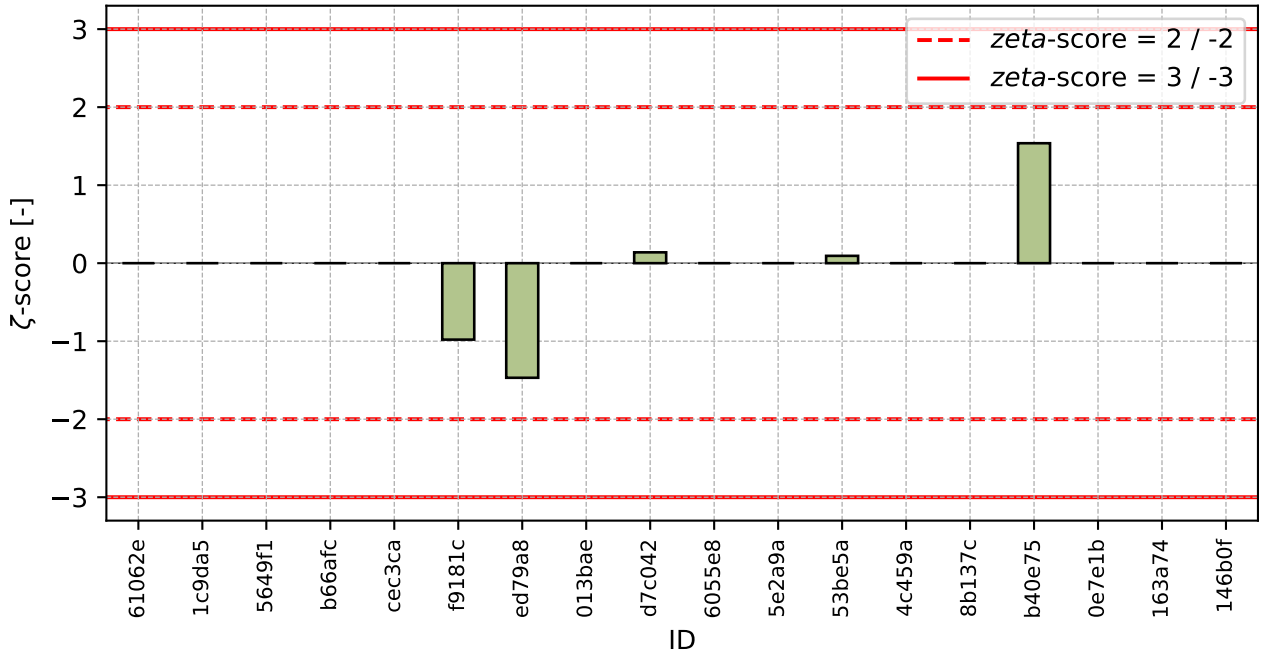

Figure 47: ζ-score

Table 22: z-score and ζ-score

ID	z-score [-]	ζ-score [-]
61062e	-2.11	-
1c9da5	-1.45	-
5649f1	-1.41	-
b66afc	-0.62	-
cec3ca	-0.52	-
f9181c	-0.45	-0.98
ed79a8	-0.45	-1.47
013bae	-0.12	-
d7c042	0.21	0.14
6055e8	0.21	-
5e2a9a	0.21	-
53be5a	0.21	0.09
4c459a	0.54	-
8b137c	0.87	-
b40e75	0.94	1.54
0e7e1b	1.20	-
163a74	1.20	-
146b0f	1.54	-

7.3 5.6 mm

7.3.1 Test results

Table 23: Test results – ordered by average value. Outliers are marked by red color. u_X – extended uncertainty of measurement.

ID	Result [% m/m]	u_X [% m/m]
4c459a	51.0	-
1c9da5	52.0	-
5e2a9a	53.0	-
f9181c	54.0	1.40
cec3ca	54.5	-
b66afc	55.2	-
6055e8	57.0	-
53be5a	58.0	7.10
013bae	59.0	-
61062e	60.0	-
b40e75	60.0	1.70
d7c042	61.0	3.10
163a74	62.0	-
0e7e1b	62.0	-
8b137c	64.0	-

7.3.2 The Numerical Procedure for Determining Outliers

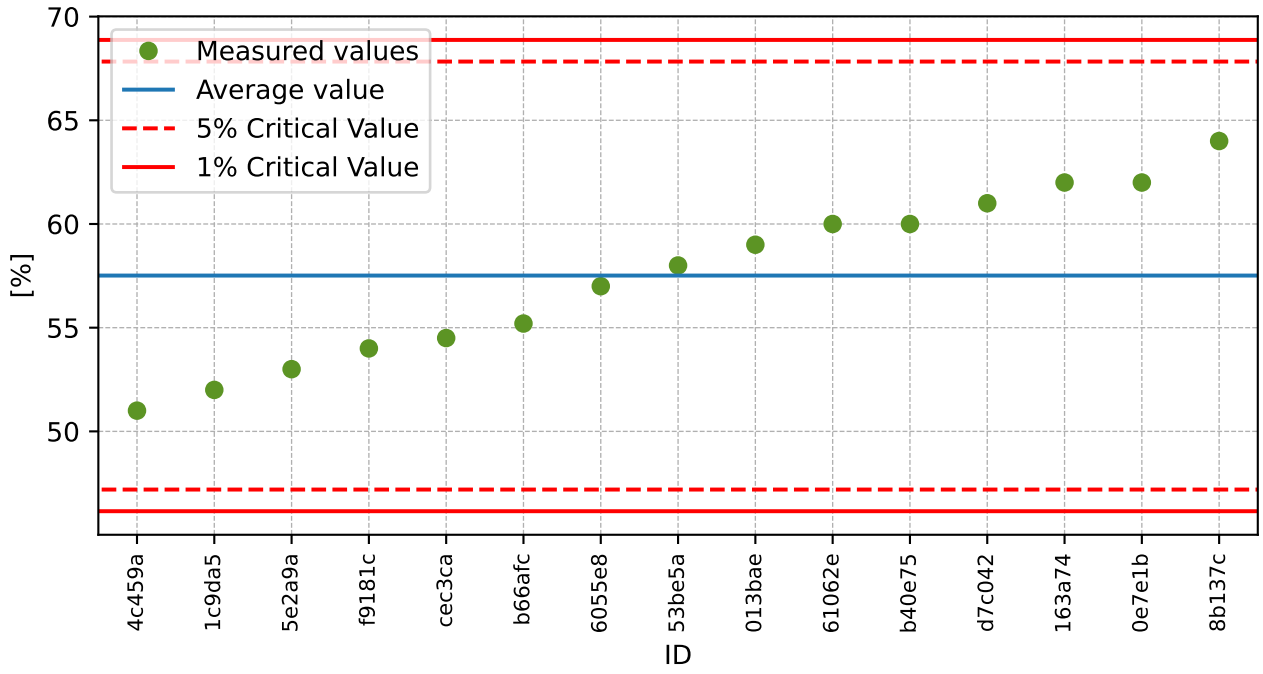

Figure 48: **Grubbs' test** - average values

7.3.3 Mandel's Statistics

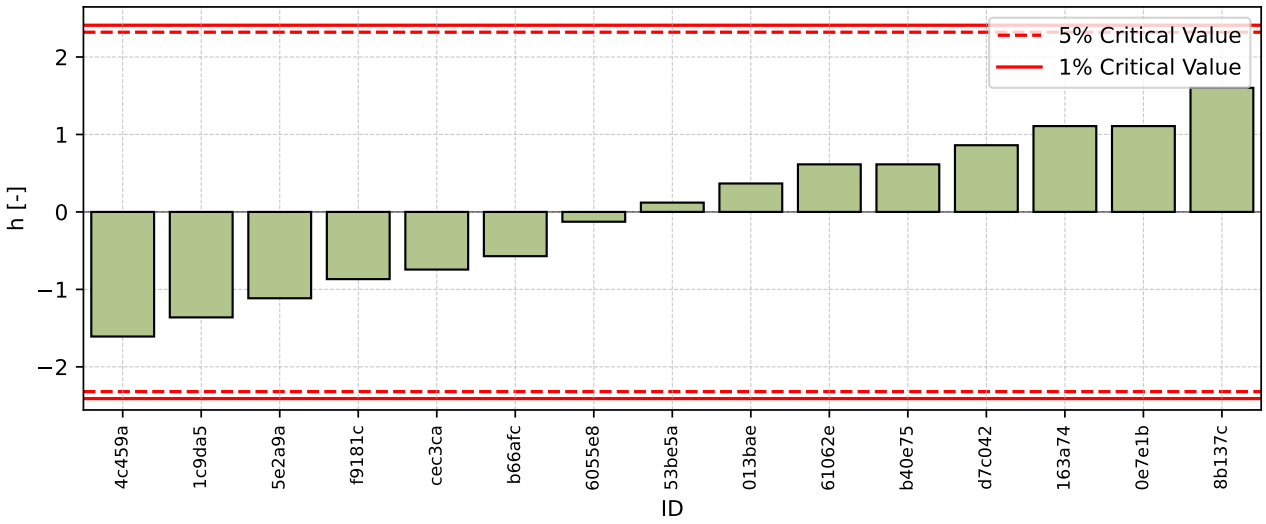

Figure 49: Interlaboratory Consistency Statistic

7.3.4 Descriptive statistics

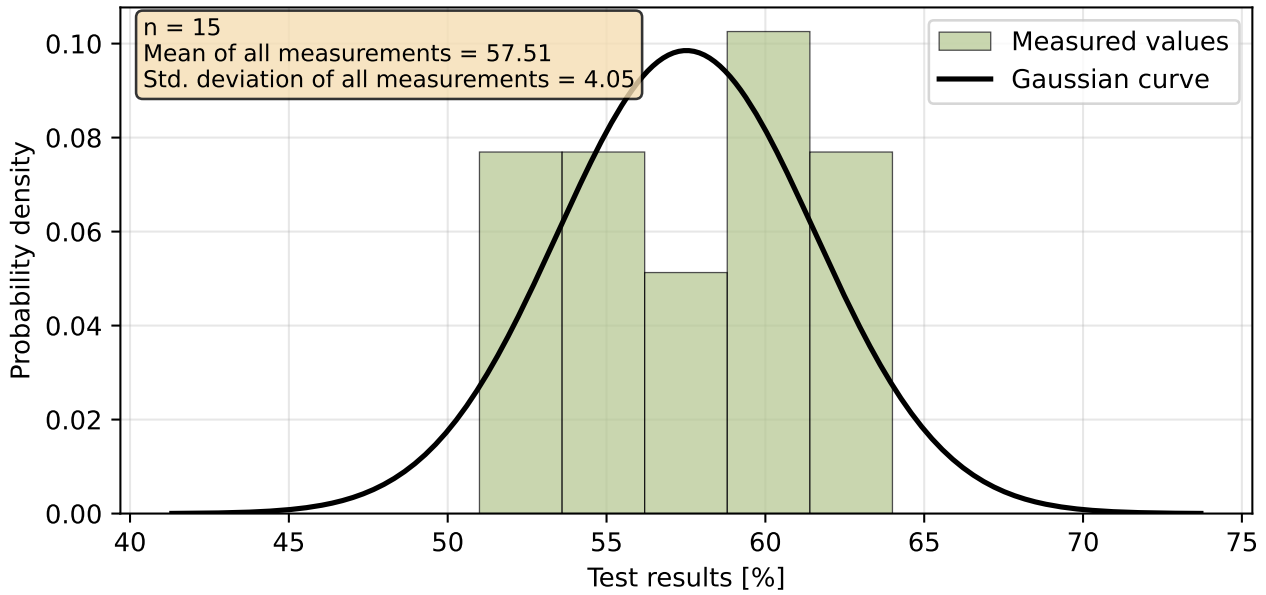

Figure 50: Histogram of all test results

Table 24: Descriptive statistics

Characteristics	[% m/m]
Average value – $\bar{x}$	57.51
Sample standard deviation – s	4.05
Assigned value – x^*	57.51
Robust standard deviation – s^*	4.05
Measurement uncertainty of assigned value – u_X	1.05
p-value of normality test [-]	0.627

7.3.5 Evaluation of Performance Statistics

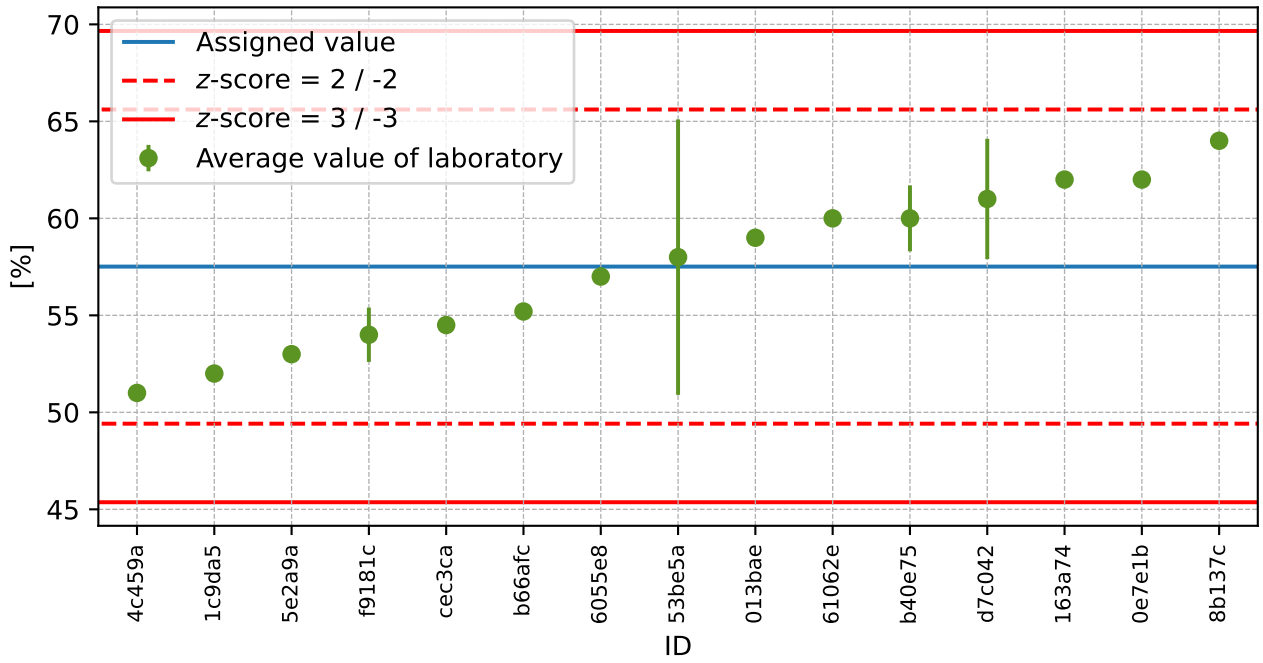

Figure 51: Average values and extended uncertainties of measurement

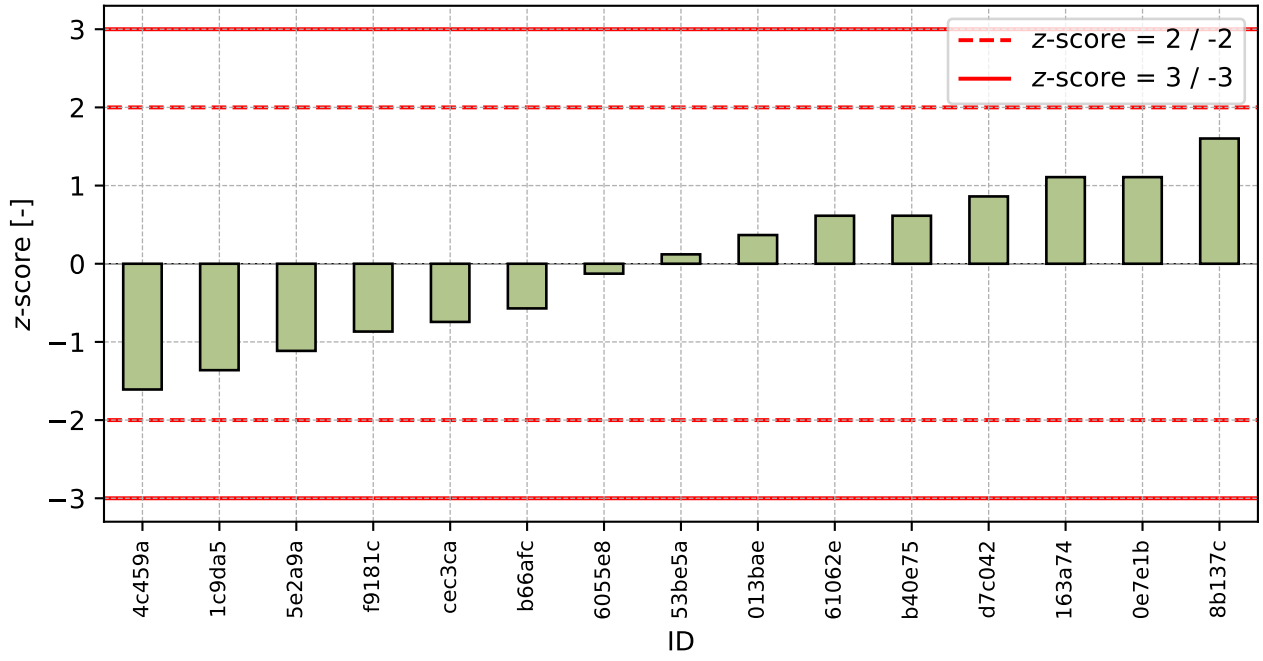

Figure 52: z-score

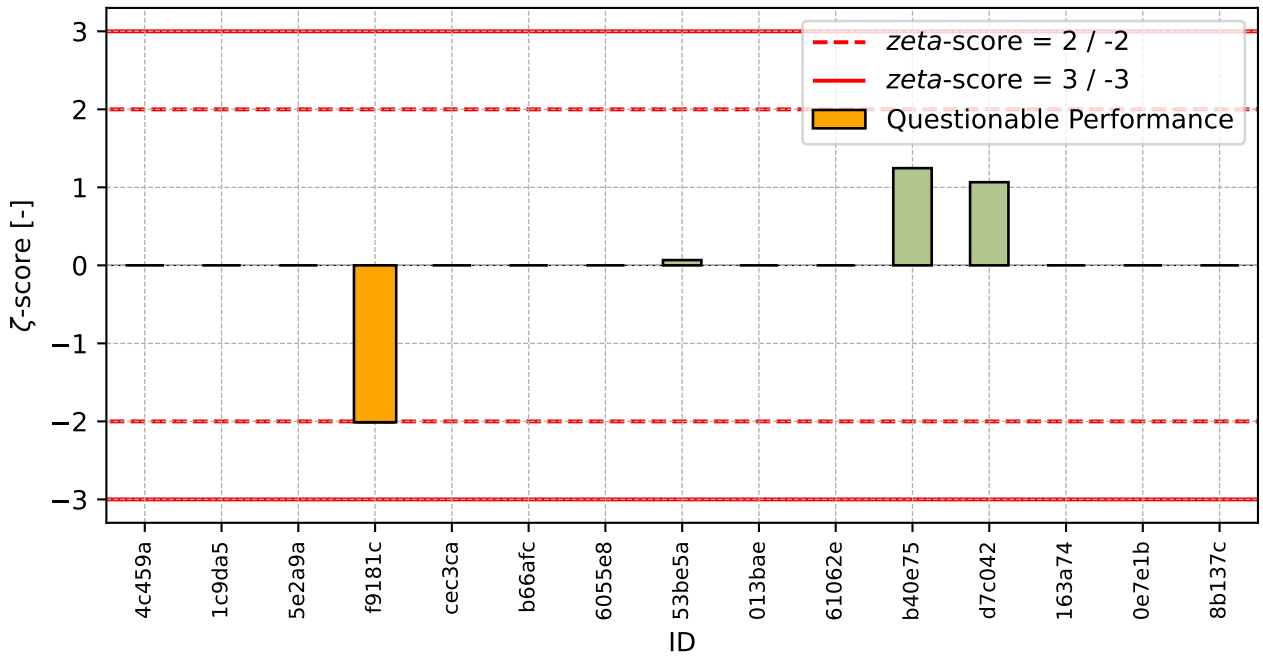

Figure 53: ζ-score

Table 25: z-score and ζ-score

ID	z-score [-]	ζ-score [-]
4c459a	-1.61	-
1c9da5	-1.36	-
5e2a9a	-1.11	-
f9181c	-0.87	-2.01
cec3ca	-0.74	-
b66afc	-0.57	-
6055e8	-0.13	-
53be5a	0.12	0.07
013bae	0.37	-
61062e	0.61	-
b40e75	0.61	1.25
d7c042	0.86	1.07
163a74	1.11	-
0e7e1b	1.11	-
8b137c	1.60	-

7.4 4 mm

7.4.1 Test results

Table 26: Test results – ordered by average value. Outliers are marked by red color. u_X – extended uncertainty of measurement.

ID	Result [% m/m]	u_X [% m/m]
ed79a8	37.0	0.60
1c9da5	38.0	-
5649f1	39.5	-
cec3ca	40.7	-
5e2a9a	41.0	-
6055e8	41.0	-
f9181c	41.0	1.40
b40e75	41.7	1.70
4c459a	42.0	-
53be5a	42.0	6.90
b66afc	42.5	-
013bae	43.0	-
61062e	43.0	-
0e7e1b	44.0	-
163a74	44.0	-
d7c042	44.0	3.50
146b0f	46.0	-
8b137c	47.0	-

7.4.2 The Numerical Procedure for Determining Outliers

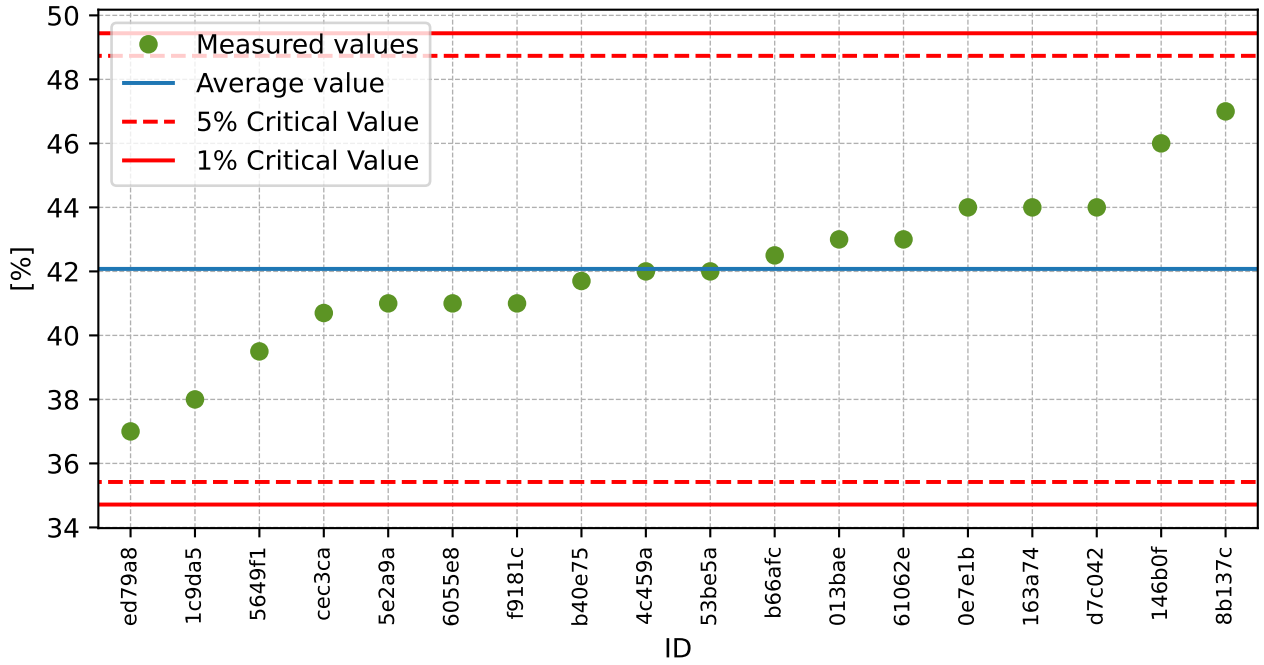

Figure 54: **Grubbs' test** - average values

7.4.3 Mandel's Statistics

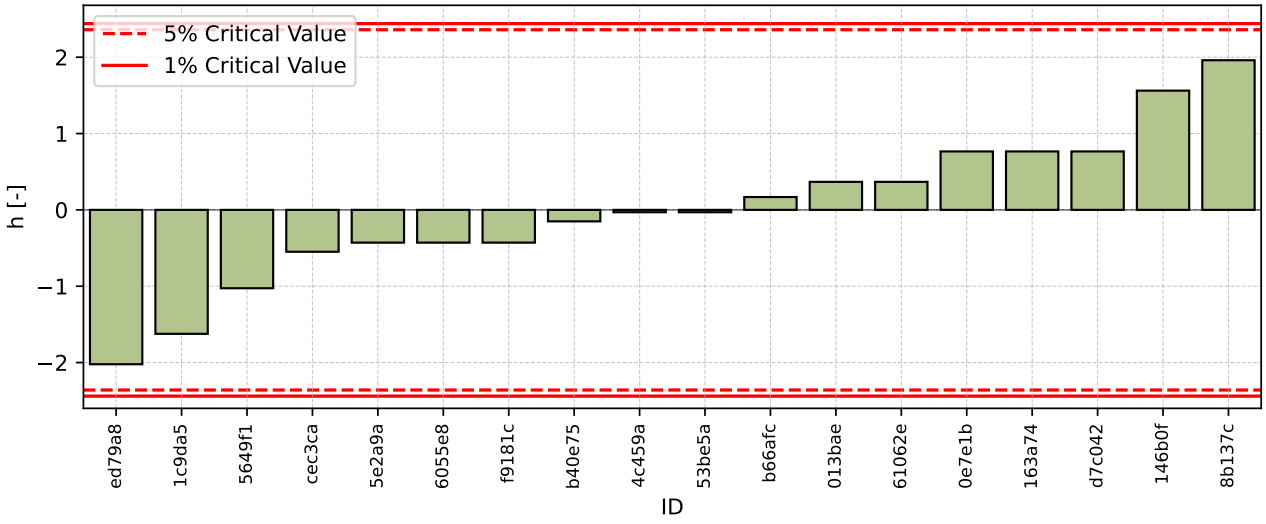

Figure 55: Interlaboratory Consistency Statistic

7.4.4 Descriptive statistics

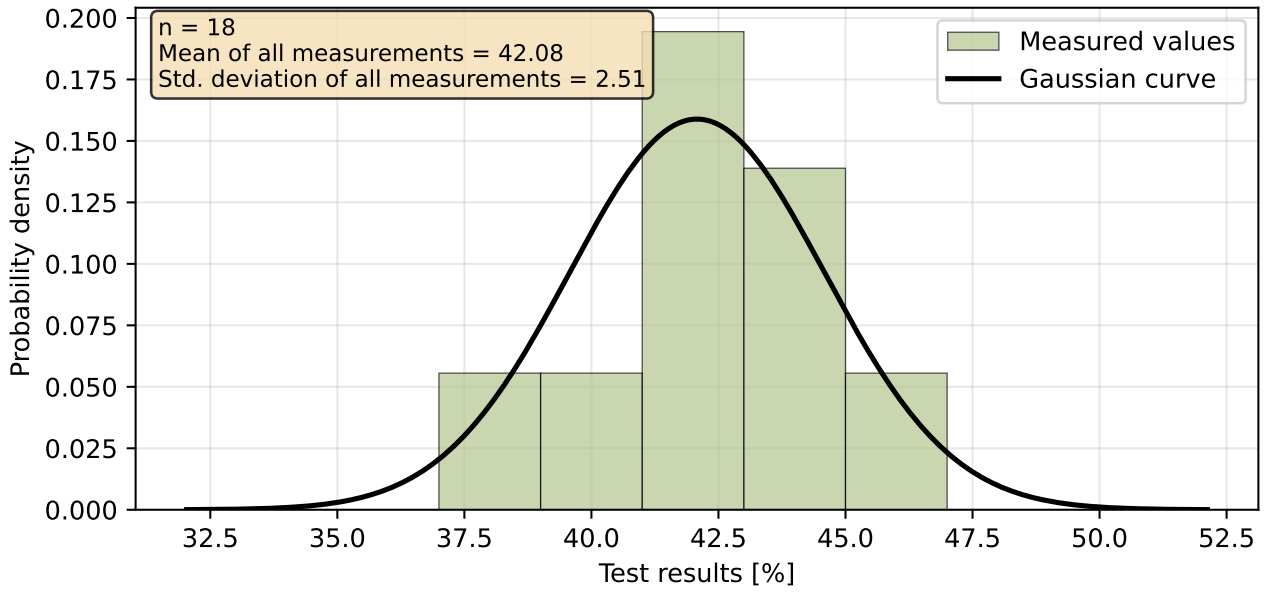

Figure 56: Histogram of all test results

Table 27: Descriptive statistics

Characteristics	**[% m/m]**
Average value – $\bar{x}$	42.08
Sample standard deviation – s	2.51
Assigned value – x^*	42.08
Robust standard deviation – s^*	2.51
Measurement uncertainty of assigned value – u_X	0.59
p-value of normality test [-]	0.905

7.4.5 Evaluation of Performance Statistics

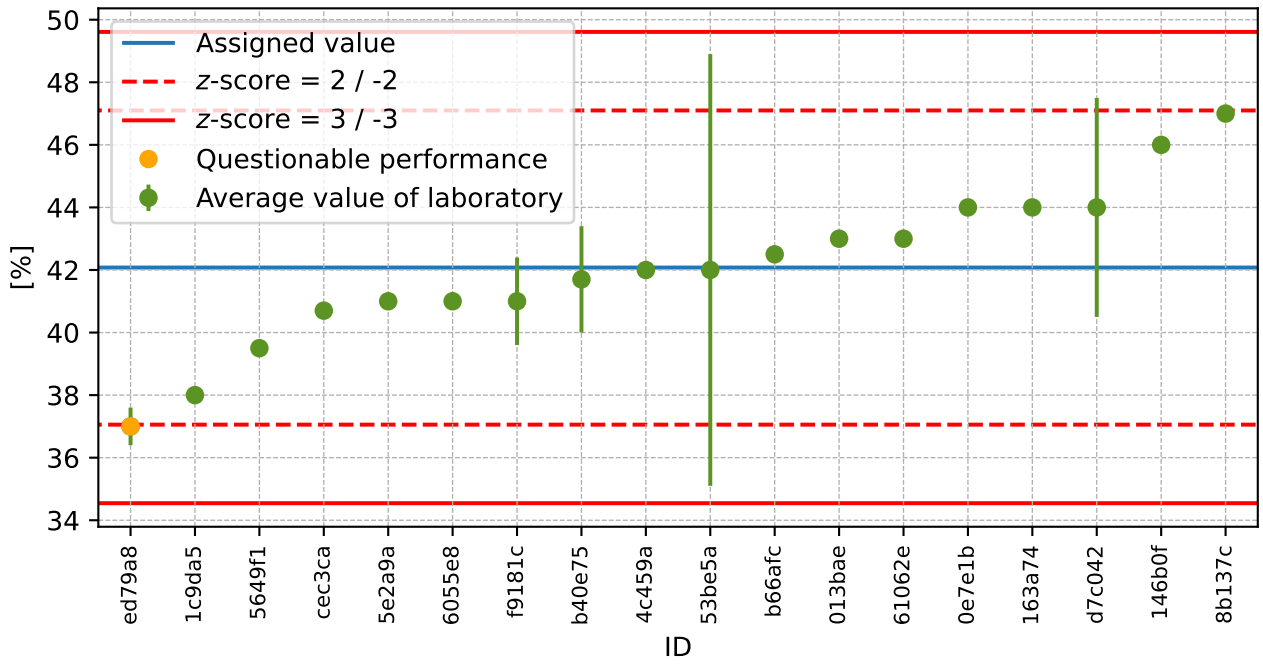

Figure 57: Average values and extended uncertainties of measurement

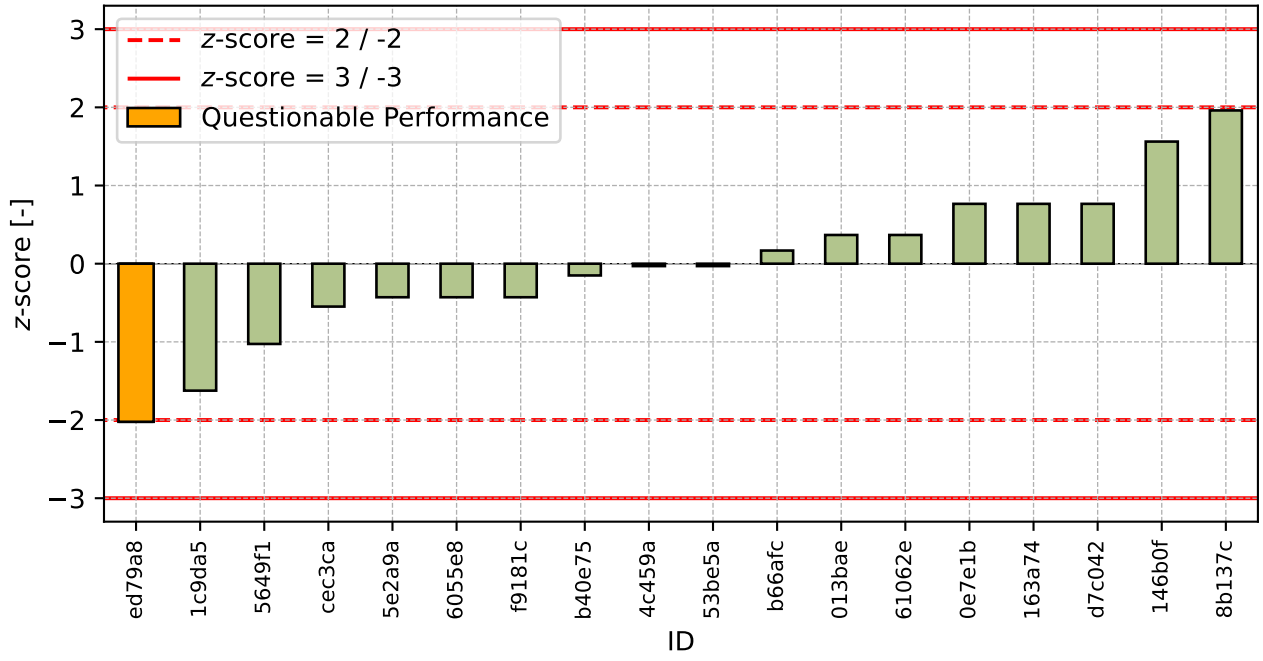

Figure 58: z-score

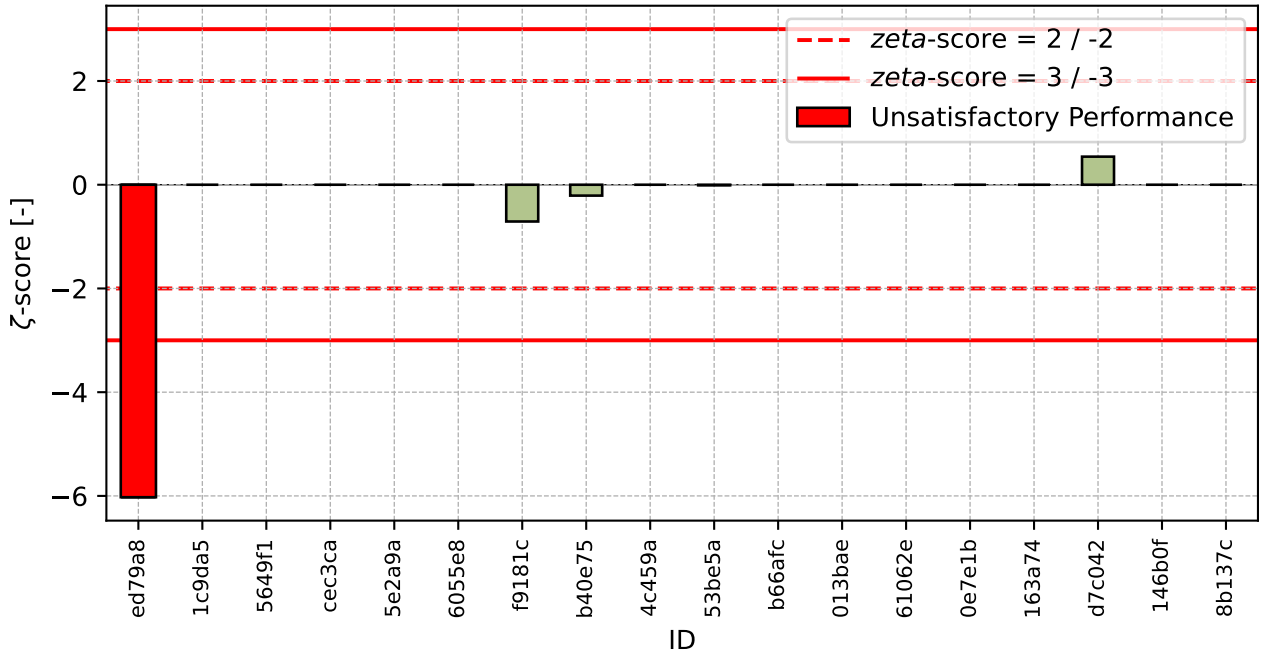

Figure 59: ζ-score

Table 28: z-score and ζ-score

ID	z-score [-]	ζ-score [-]
ed79a8	-2.02	-6.03
1c9da5	-1.62	-
5649f1	-1.03	-
cec3ca	-0.55	-
5e2a9a	-0.43	-
6055e8	-0.43	-
f9181c	-0.43	-0.71
b40e75	-0.15	-0.21
4c459a	-0.03	-
53be5a	-0.03	-0.01
b66afc	0.17	-
013bae	0.37	-
61062e	0.37	-
0e7e1b	0.77	-
163a74	0.77	-
d7c042	0.77	0.54
146b0f	1.56	-
8b137c	1.96	-

7.5 2 mm

7.5.1 Test results

Table 29: Test results – ordered by average value. Outliers are marked by red color. u_X – extended uncertainty of measurement.

ID	Result [% m/m]	u_X [% m/m]
ed79a8	29.0	0.60
5649f1	29.8	-
6055e8	30.0	-
f9181c	30.0	1.40
1c9da5	30.0	-
cec3ca	30.5	-
013bae	31.0	-
53be5a	31.0	6.70
5e2a9a	31.0	-
4c459a	31.0	-
b40e75	31.6	1.70
61062e	32.0	-
163a74	33.0	-
0e7e1b	33.0	-
d7c042	33.0	2.60
b66afc	33.1	-
8b137c	34.0	-
146b0f	34.0	-

7.5.2 The Numerical Procedure for Determining Outliers

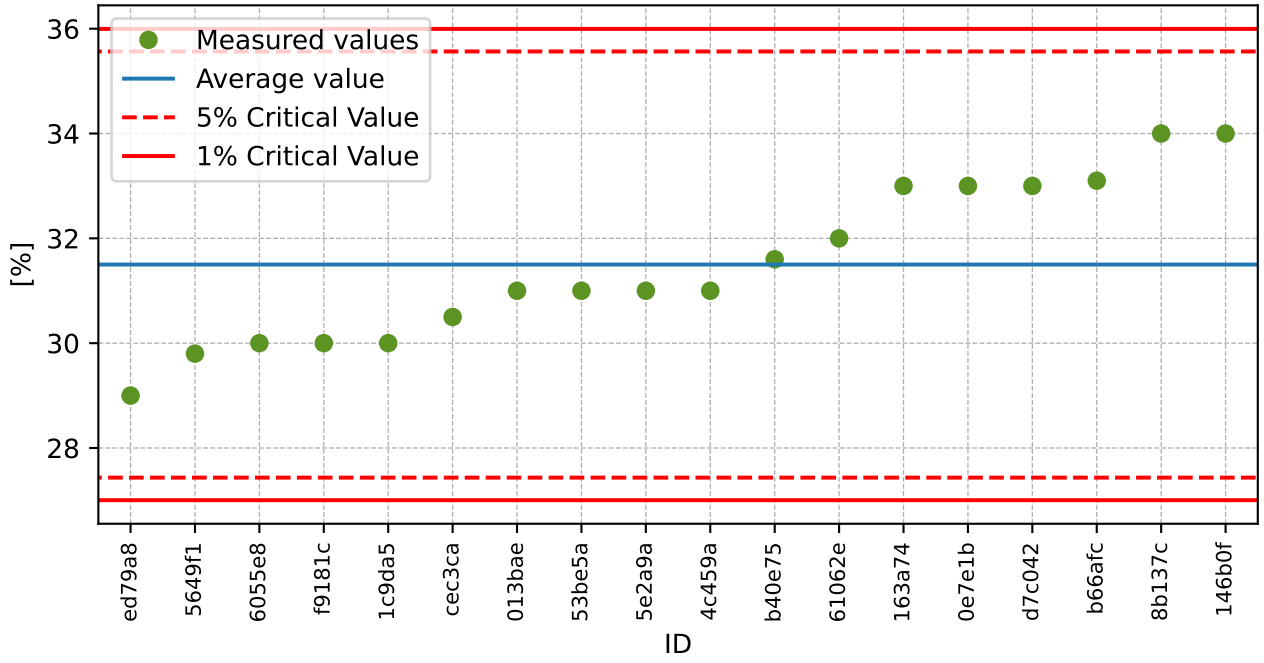

Figure 60: **Grubbs' test** - average values

7.5.3 Mandel's Statistics

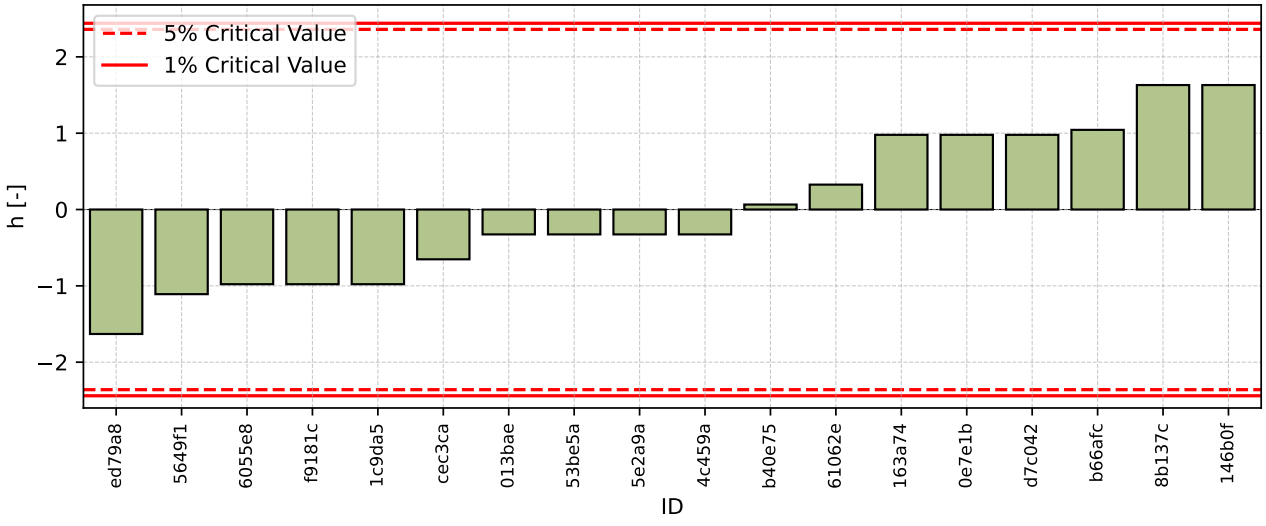

Figure 61: Interlaboratory Consistency Statistic

7.5.4 Descriptive statistics

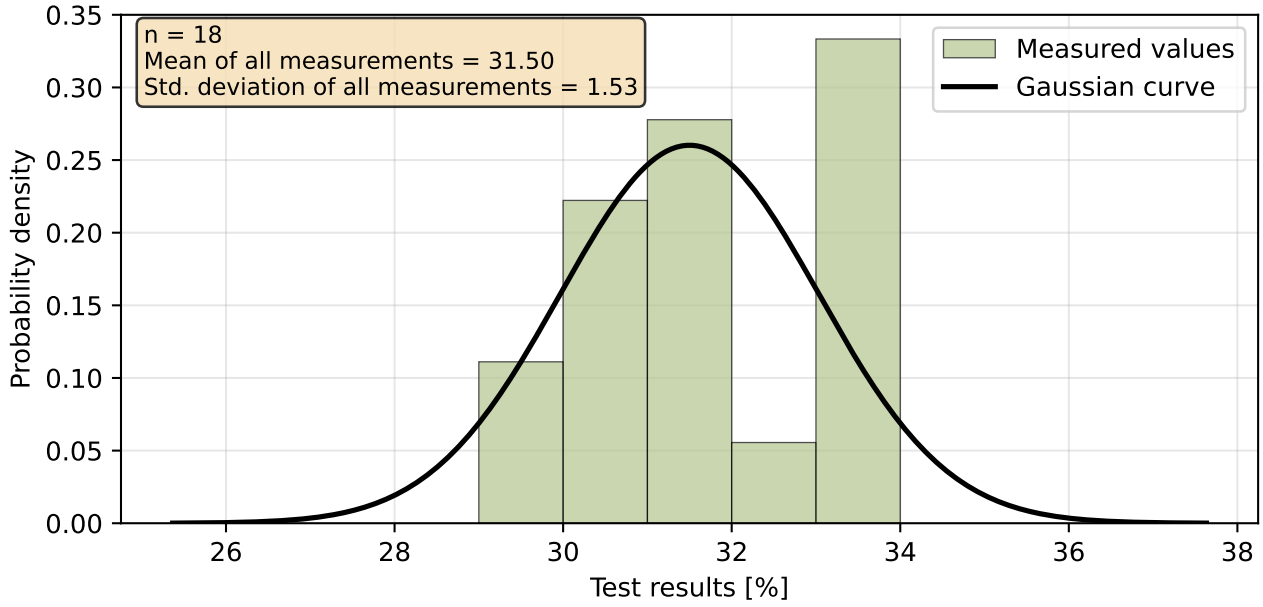

Figure 62: Histogram of all test results

Table 30: Descriptive statistics

Characteristics	**[% m/m]**
Average value – $\bar{x}$	31.50
Sample standard deviation – s	1.53
Assigned value – x^*	31.50
Robust standard deviation – s^*	1.53
Measurement uncertainty of assigned value – u_X	0.36
p-value of normality test [-]	0.198

7.5.5 Evaluation of Performance Statistics

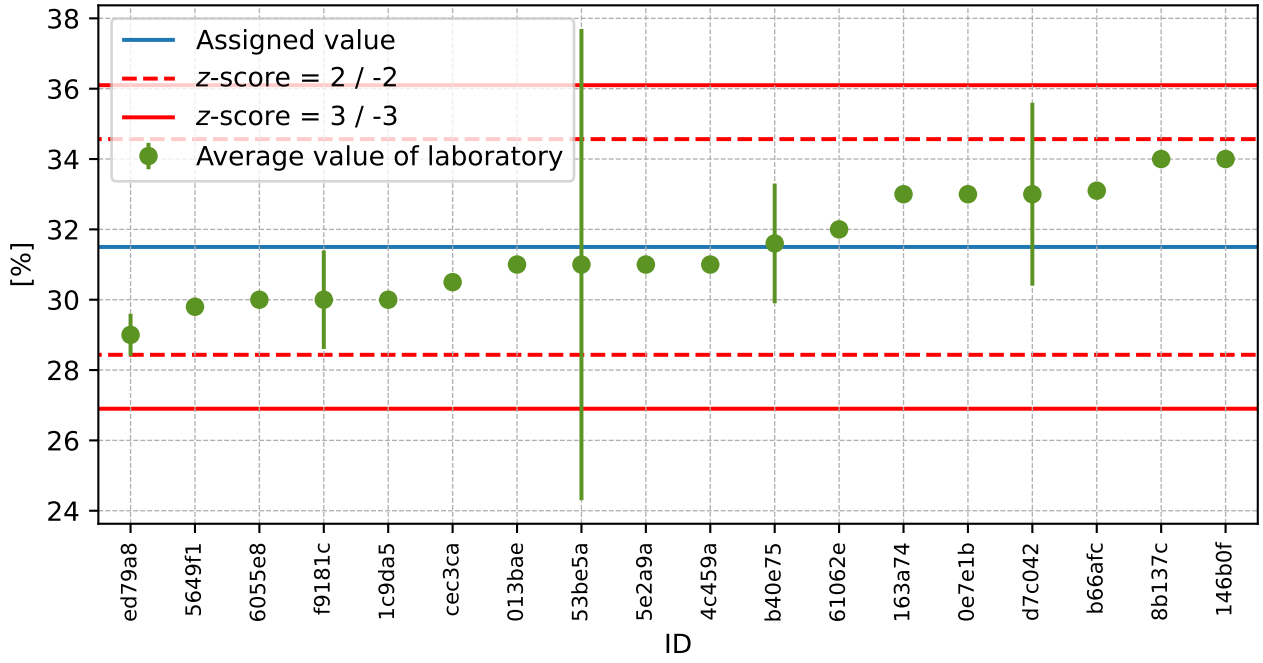

Figure 63: Average values and extended uncertainties of measurement

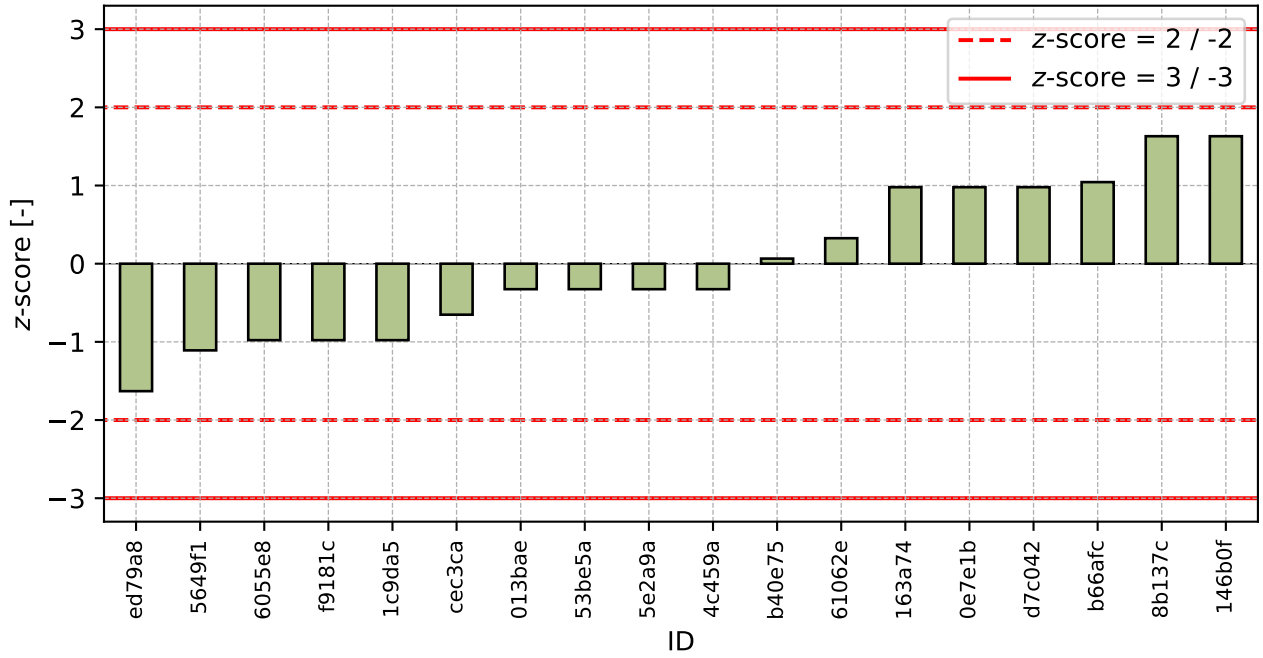

Figure 64: z-score

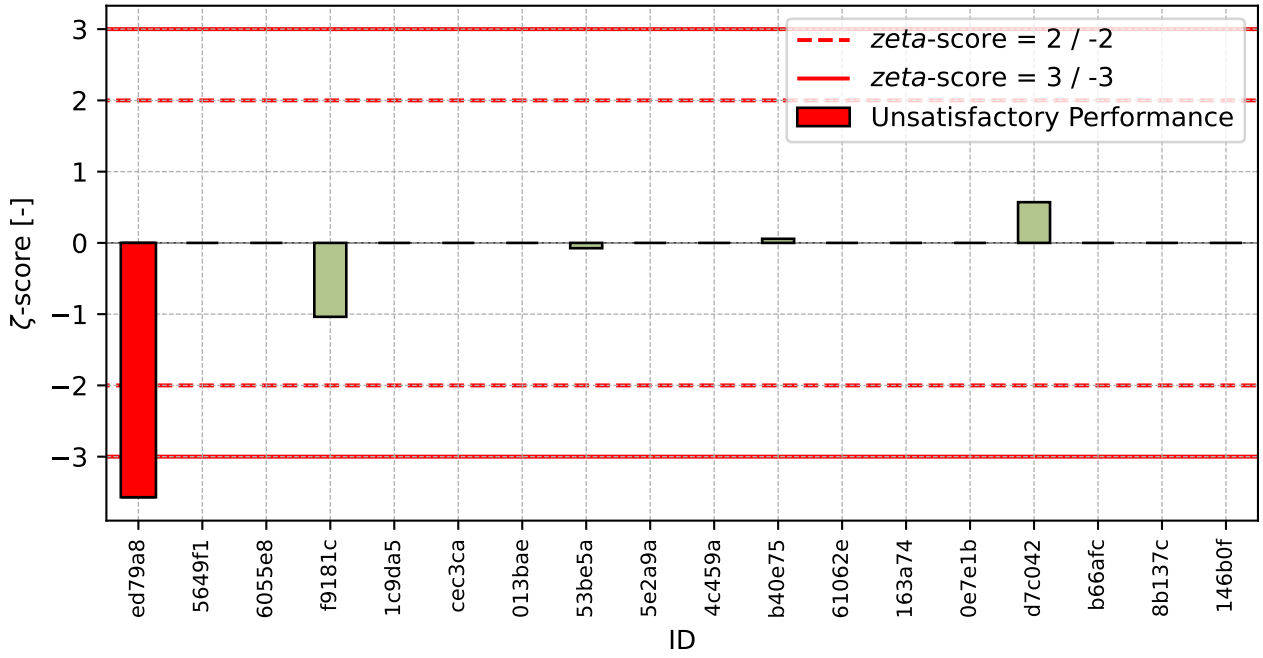

Figure 65: ζ-score

Table 31: z-score and ζ-score

ID	z-score [-]	ζ-score [-]
ed79a8	-1.63	-3.57
5649f1	-1.11	-
6055e8	-0.98	-
f9181c	-0.98	-1.04
1c9da5	-0.98	-
cec3ca	-0.65	-
013bae	-0.33	-
53be5a	-0.33	-0.07
5e2a9a	-0.33	-
4c459a	-0.33	-
b40e75	0.07	0.06
61062e	0.33	-
163a74	0.98	-
0e7e1b	0.98	-
d7c042	0.98	0.57
b66afc	1.04	-
8b137c	1.63	-
146b0f	1.63	-

7.6 1 mm

7.6.1 Test results

Table 32: Test results – ordered by average value. Outliers are marked by red color. u_X – extended uncertainty of measurement.

ID	Result [% m/m]	u_X [% m/m]
5e2a9a	20.0	-
4c459a	21.0	-
5649f1	21.7	-
ed79a8	22.0	0.60
6055e8	22.0	-
f9181c	22.0	1.70
1c9da5	22.0	-
cec3ca	22.6	-
b40e75	22.8	1.70
163a74	23.0	-
61062e	23.0	-
013bae	23.0	-
0e7e1b	23.0	-
53be5a	23.0	6.20
d7c042	23.0	2.50
b66afc	23.3	-
8b137c	25.0	-

7.6.2 The Numerical Procedure for Determining Outliers

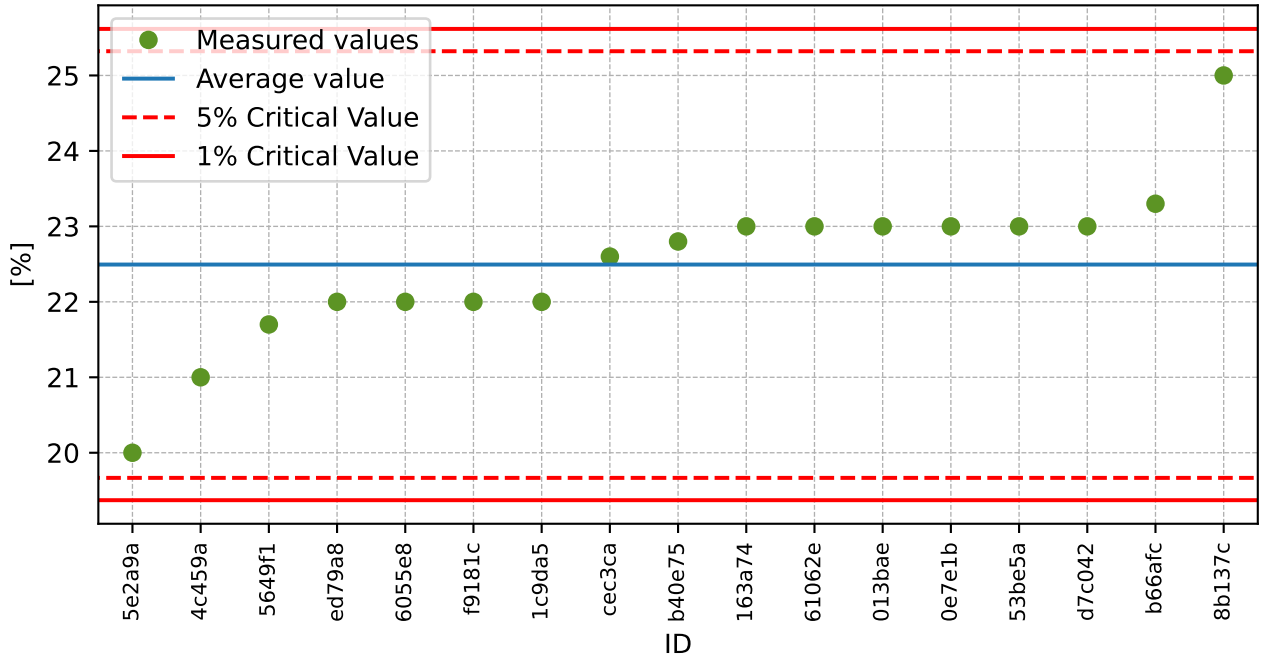

Figure 66: **Grubbs' test** - average values

7.6.3 Mandel's Statistics

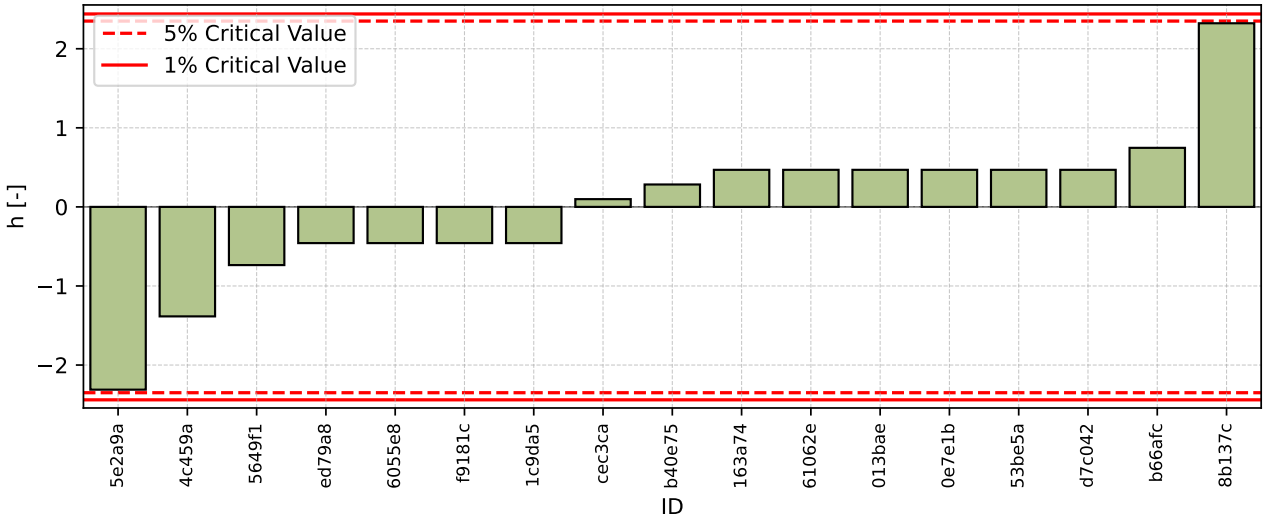

Figure 67: Interlaboratory Consistency Statistic

7.6.4 Descriptive statistics

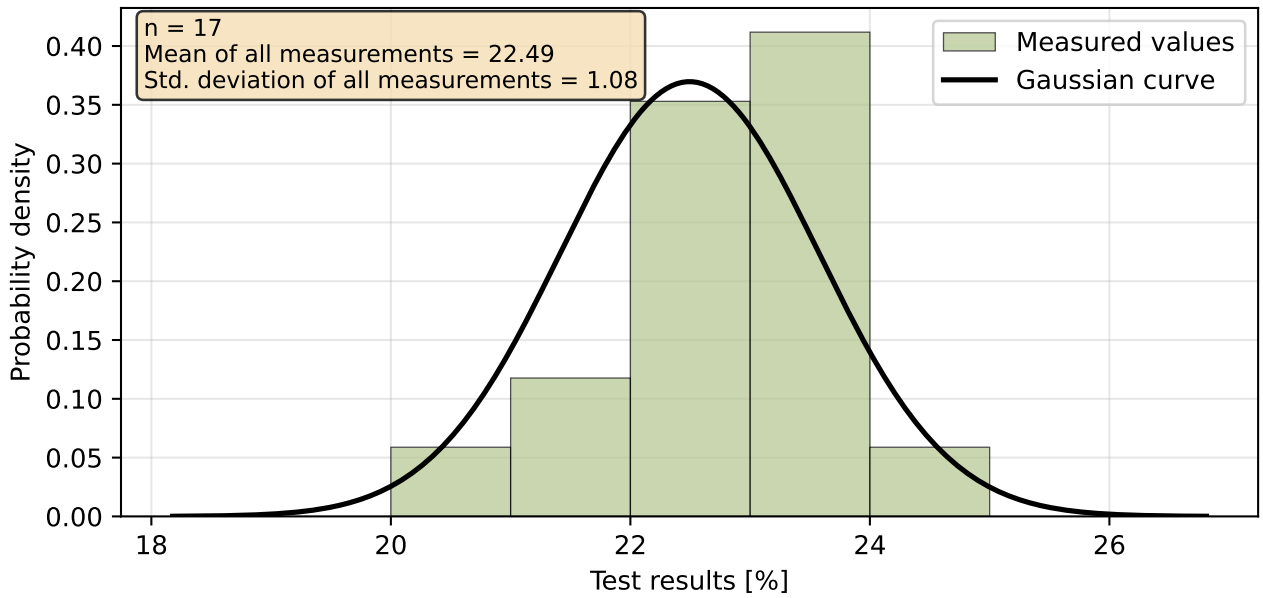

Figure 68: Histogram of all test results

Table 33: Descriptive statistics

Characteristics	**[% m/m]**
Average value – $\bar{x}$	22.49
Sample standard deviation – s	1.08
Assigned value – x^*	22.49
Robust standard deviation – s^*	1.08
Measurement uncertainty of assigned value – u_X	0.26
p-value of normality test [-]	0.098

7.6.5 Evaluation of Performance Statistics

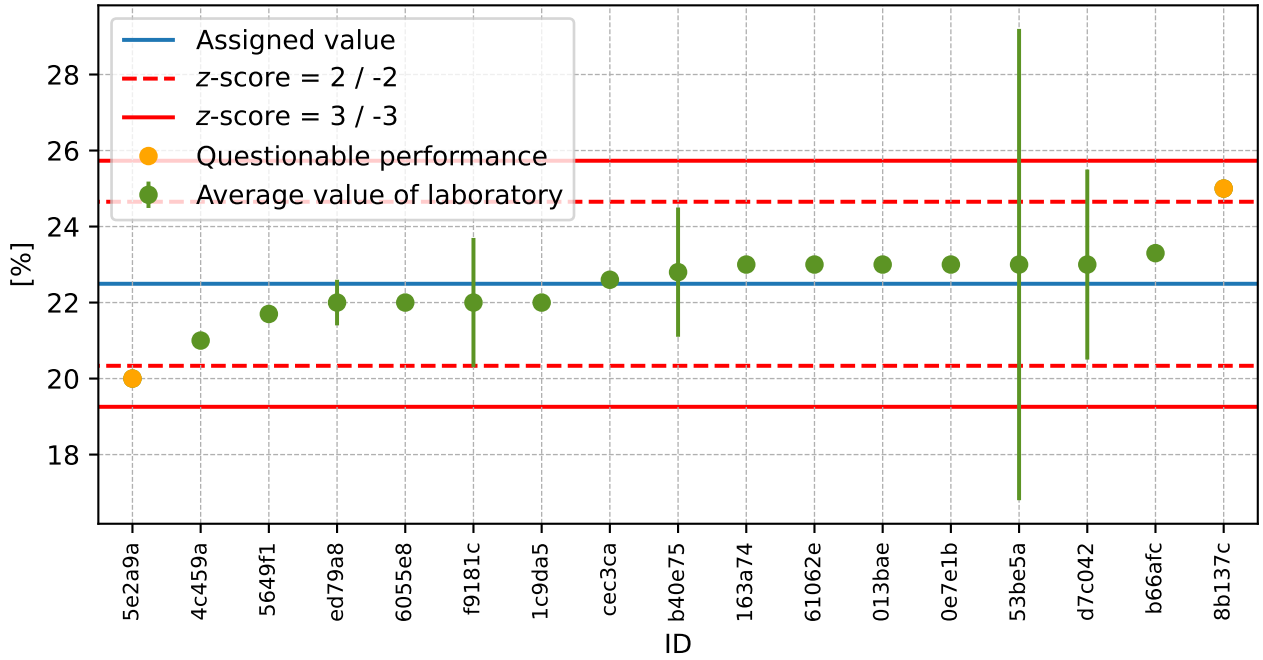

Figure 69: Average values and extended uncertainties of measurement

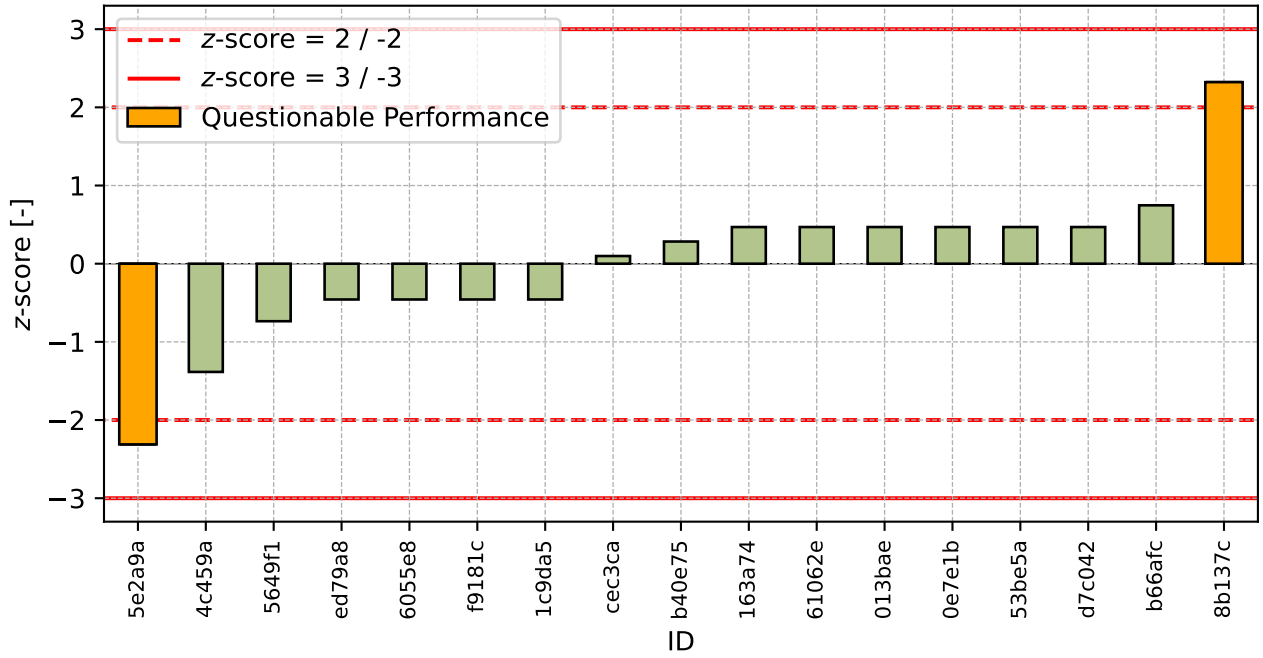

Figure 70: z-score

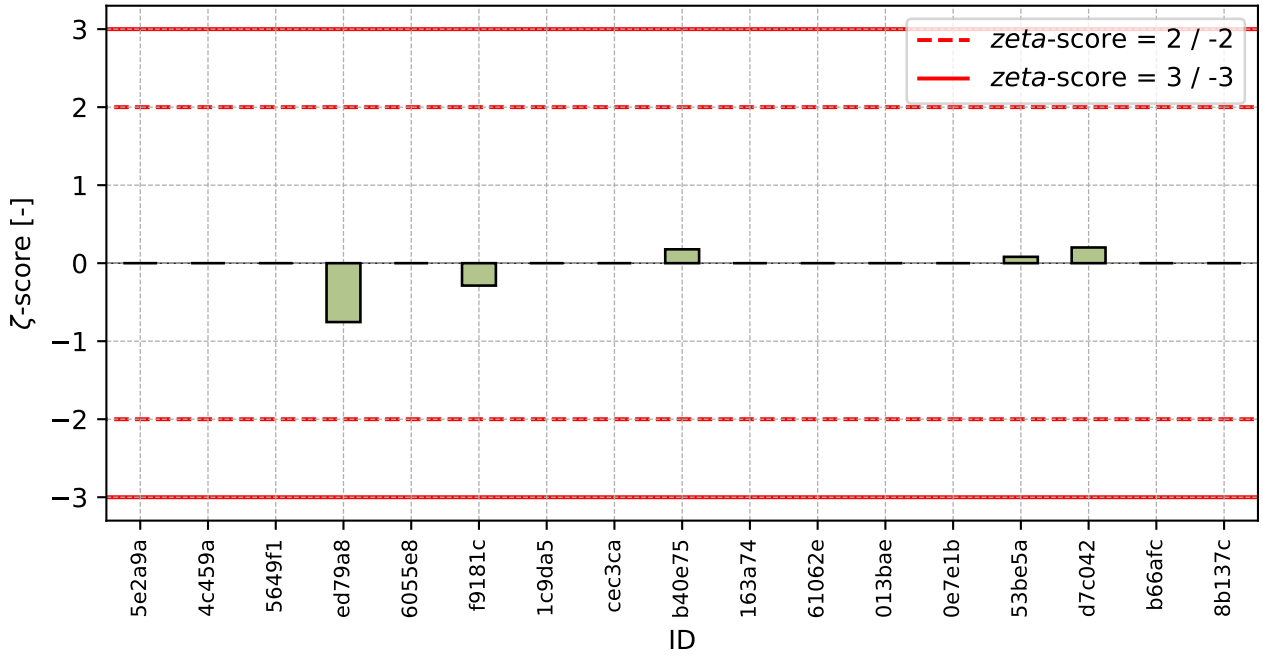

Figure 71: ζ-score

Table 34: z-score and ζ-score

ID	z-score [-]	ζ-score [-]
5e2a9a	-2.31	-
4c459a	-1.38	-
5649f1	-0.74	-
ed79a8	-0.46	-0.75
6055e8	-0.46	-
f9181c	-0.46	-0.29
1c9da5	-0.46	-
cec3ca	0.10	-
b40e75	0.28	0.18
163a74	0.47	-
61062e	0.47	-
013bae	0.47	-
0e7e1b	0.47	-
53be5a	0.47	0.08
d7c042	0.47	0.20
b66afc	0.75	-
8b137c	2.32	-

7.7 0.5 mm

7.7.1 Test results

Table 35: Test results – ordered by average value. Outliers are marked by red color. u_X – extended uncertainty of measurement.

ID	Result [% m/m]	u_X [% m/m]
ed79a8	16.0	0.60
61062e	16.0	-
013bae	16.0	-
6055e8	16.0	-
53be5a	16.0	6.00
b66afc	16.0	-
d7c042	16.0	1.80
f9181c	16.0	2.10
1c9da5	16.0	-
4c459a	16.0	-
5e2a9a	16.0	-
b40e75	16.2	1.70
cec3ca	16.5	-
163a74	17.0	-
0e7e1b	17.0	-
8b137c	18.0	-

7.7.2 The Numerical Procedure for Determining Outliers

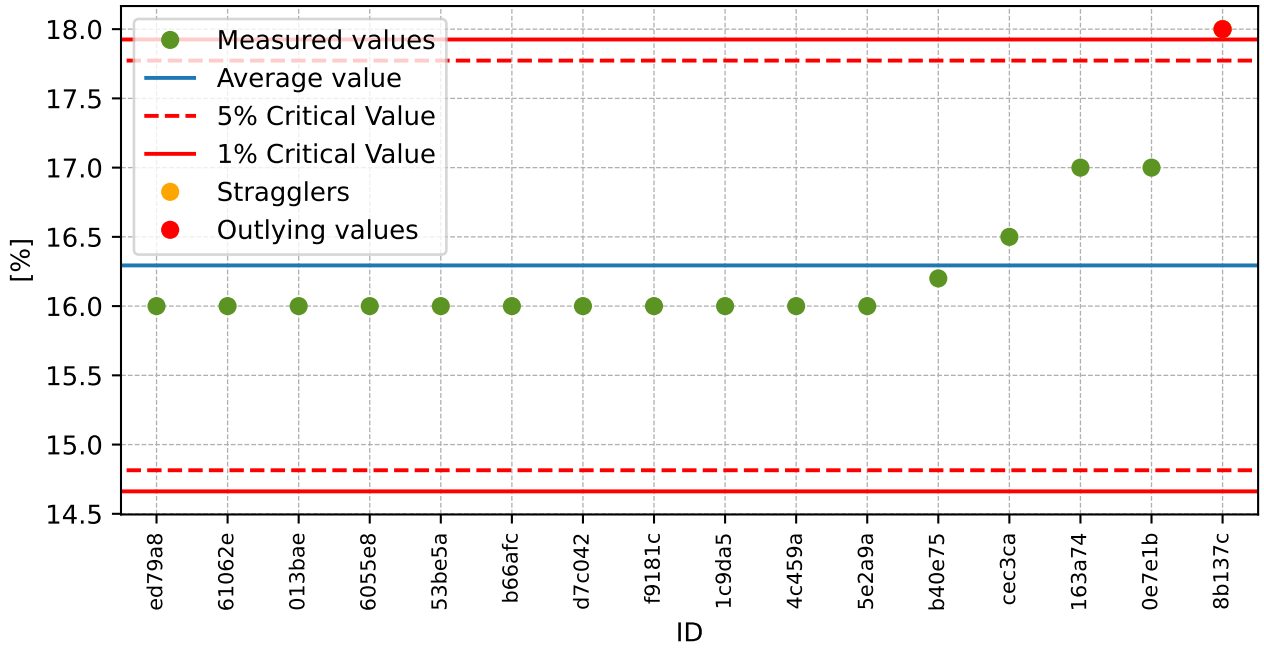

Figure 72: **Grubbs' test** - average values

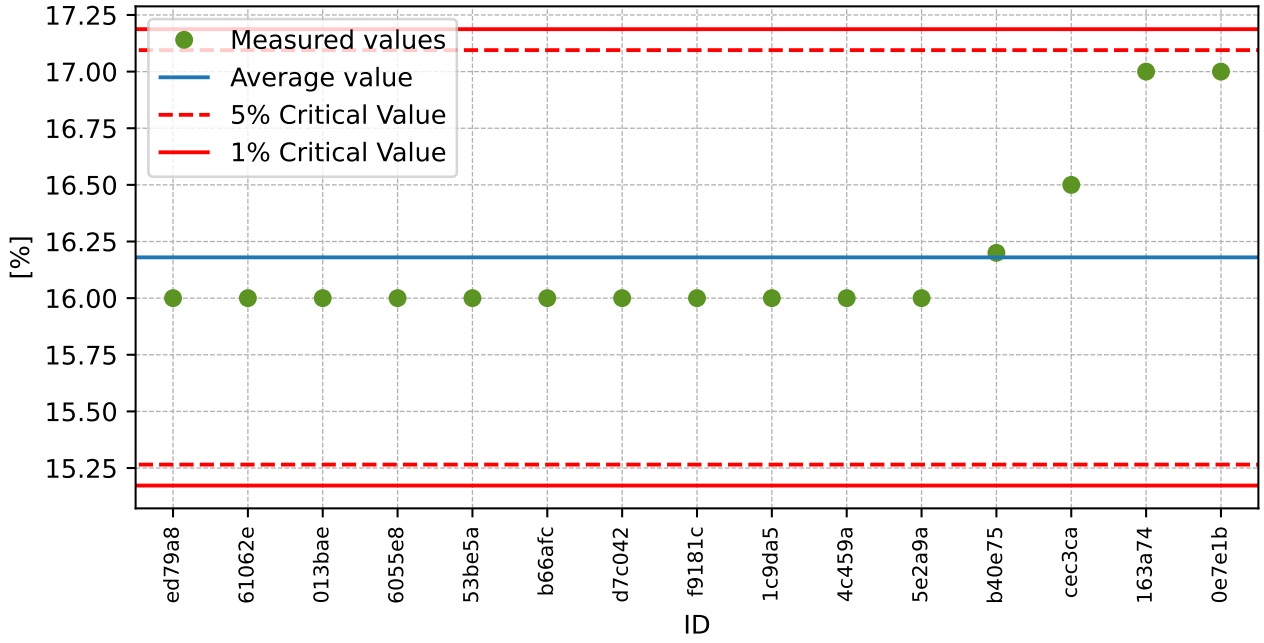

Figure 73: **Grubbs' test** - average values without outliers

7.7.3 Mandel's Statistics

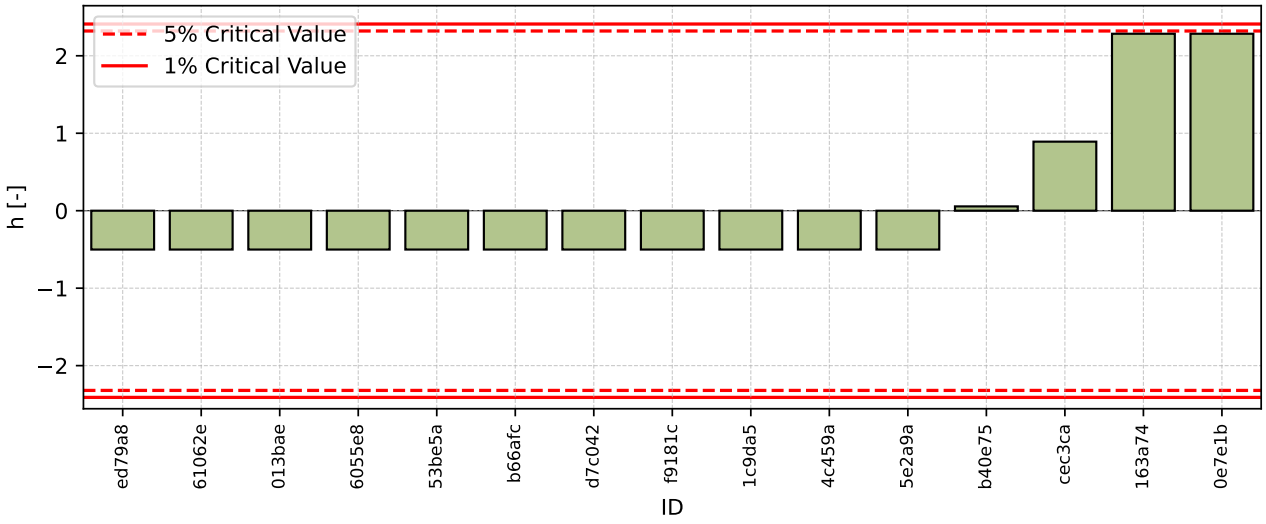

Figure 74: Interlaboratory Consistency Statistic

7.7.4 Descriptive statistics

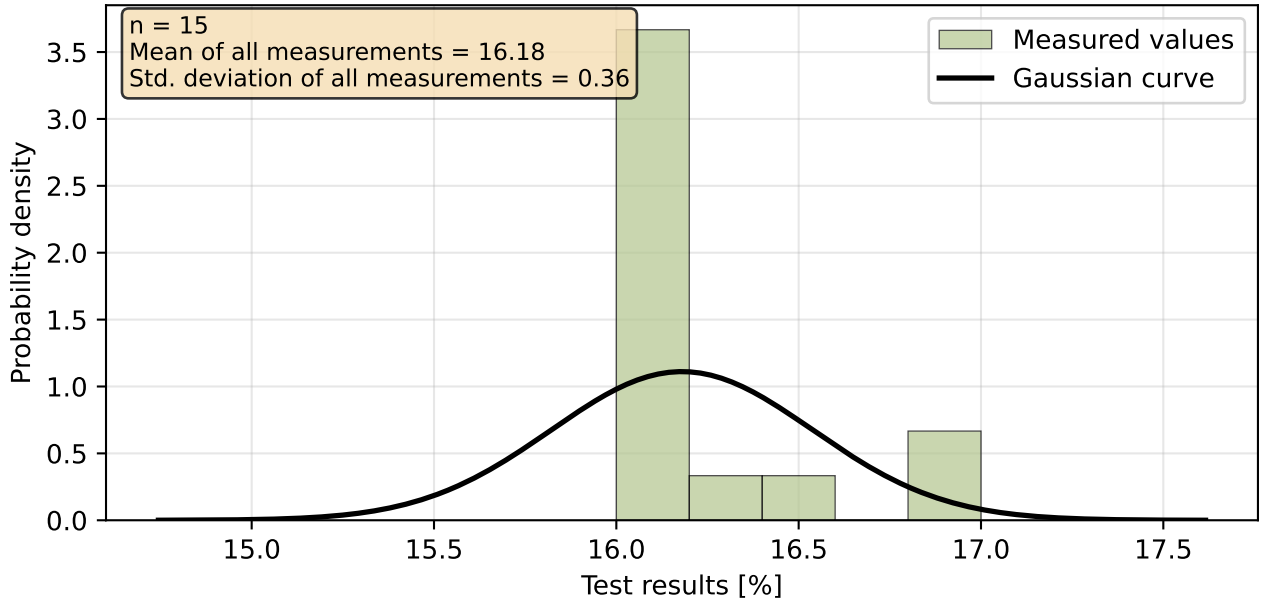

Figure 75: Histogram of all test results

Table 36: Descriptive statistics

Characteristics	**[% m/m]**
Average value – $\bar{x}$	16.18
Sample standard deviation – s	0.36
Assigned value – x^*	16.18
Robust standard deviation – s^*	0.36
Measurement uncertainty of assigned value – u_X	0.09
p-value of normality test [-]	< 0.001

7.7.5 Evaluation of Performance Statistics

Figure 76: Average values and extended uncertainties of measurement

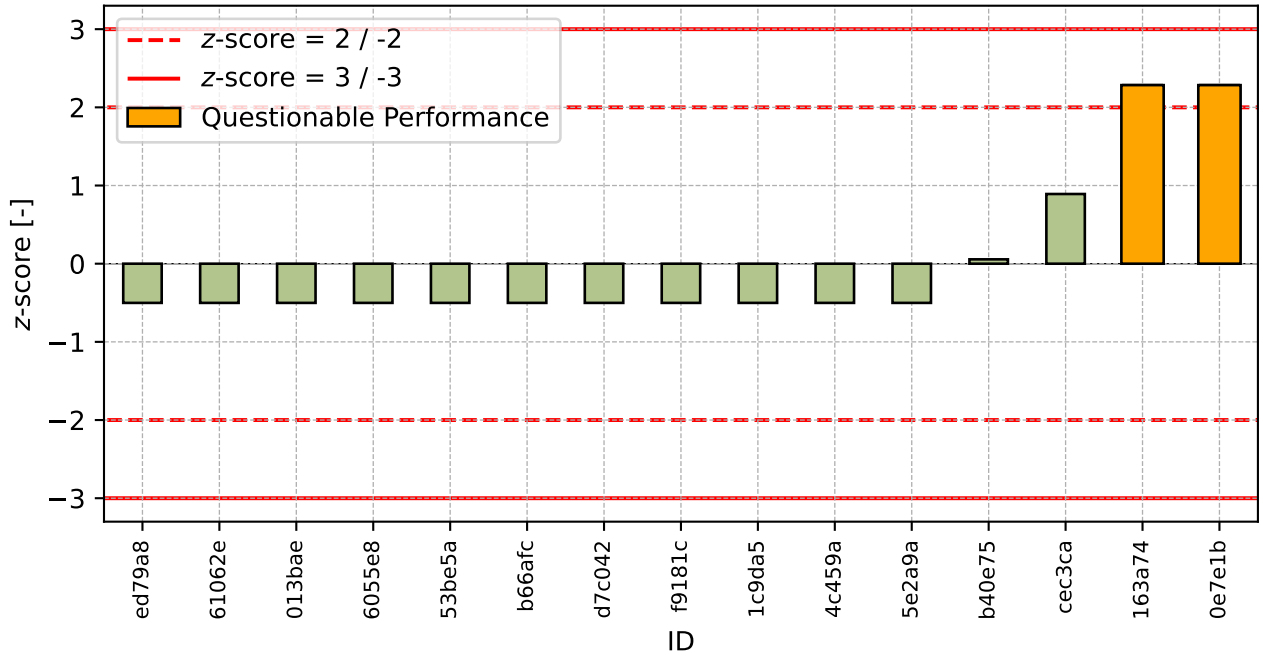

Figure 77: z-score

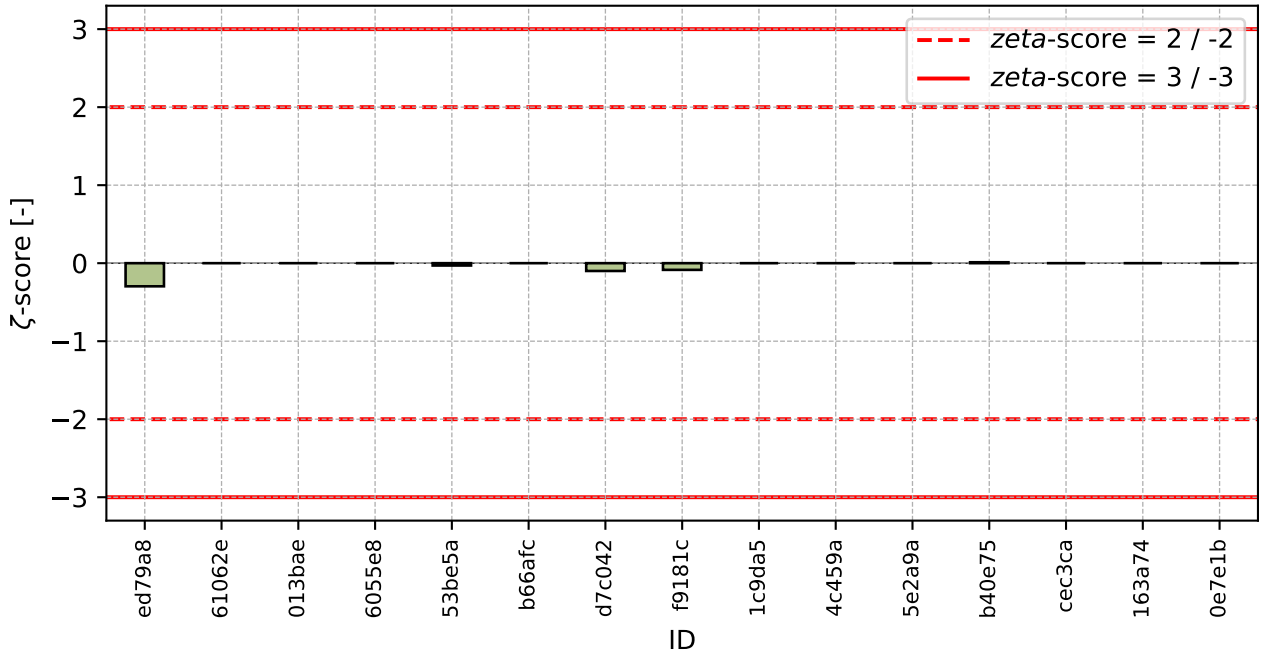

Figure 78: ζ-score

Table 37: z-score and ζ-score

ID	z-score [-]	ζ-score [-]
ed79a8	-0.50	-0.30
61062e	-0.50	-
013bae	-0.50	-
6055e8	-0.50	-
53be5a	-0.50	-0.03
b66afc	-0.50	-
d7c042	-0.50	-0.10
f9181c	-0.50	-0.09
1c9da5	-0.50	-
4c459a	-0.50	-
5e2a9a	-0.50	-
b40e75	0.06	0.01
cec3ca	0.89	-
163a74	2.28	-
0e7e1b	2.28	-

7.8 0.25 mm

7.8.1 Test results

Table 38: Test results – ordered by average value. Outliers are marked by red color. u_X – extended uncertainty of measurement.

ID	Result [% m/m]	u_X [% m/m]
f9181c	10.0	2.20
1c9da5	10.0	-
b66afc	10.1	-
b40e75	10.8	1.70
ed79a8	11.0	0.60
163a74	11.0	-
61062e	11.0	-
013bae	11.0	-
6055e8	11.0	-
0e7e1b	11.0	-
53be5a	11.0	5.70
d7c042	11.0	1.90
cec3ca	11.1	-
5e2a9a	12.0	-
8b137c	12.0	-
4c459a	13.0	-

7.8.2 The Numerical Procedure for Determining Outliers

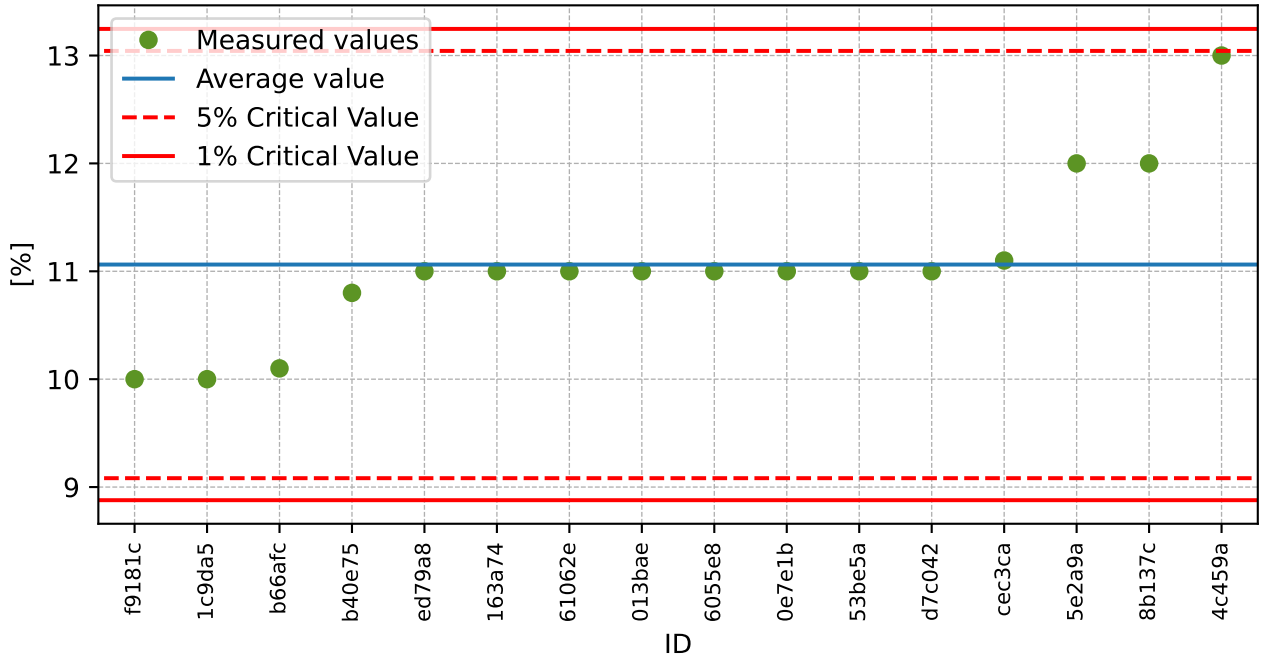

Figure 79: **Grubbs' test** - average values

7.8.3 Mandel's Statistics

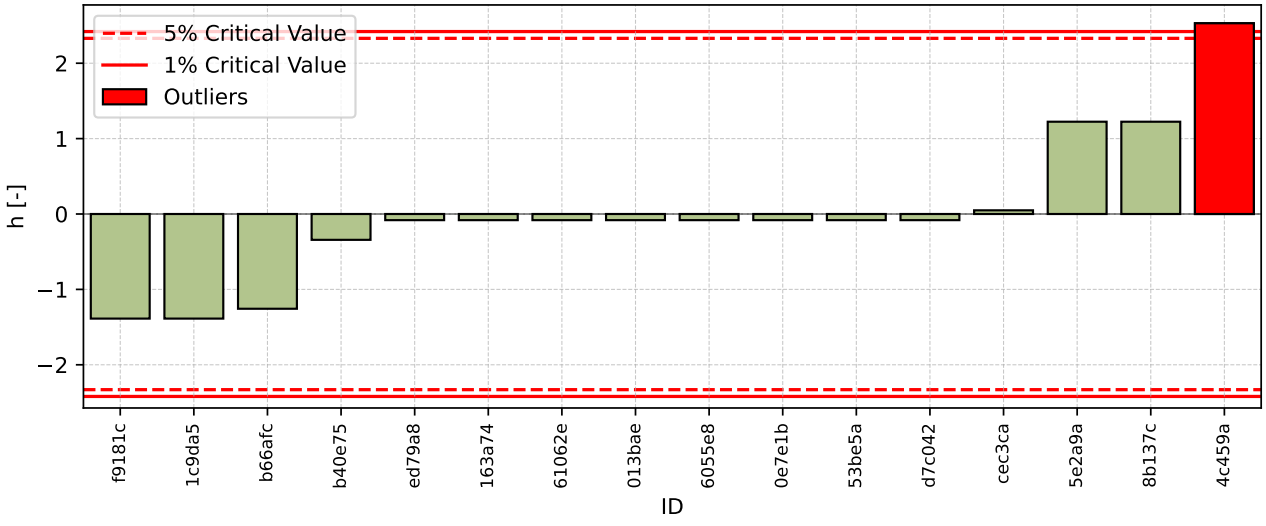

Figure 80: Interlaboratory Consistency Statistic

7.8.4 Descriptive statistics

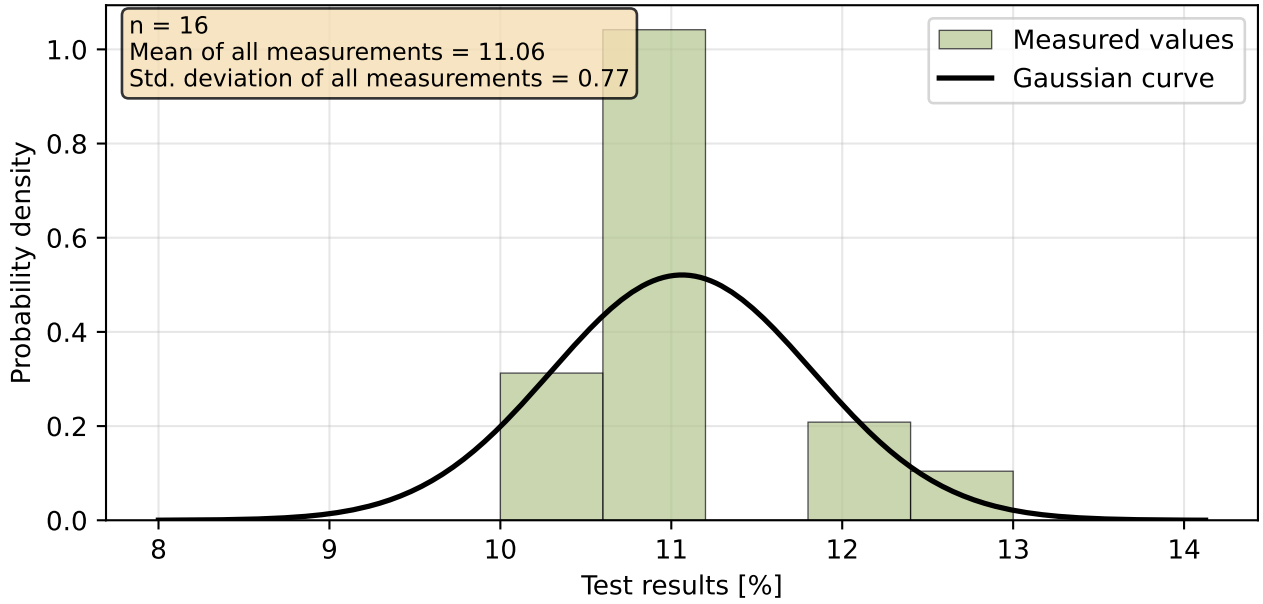

Figure 81: Histogram of all test results

Table 39: Descriptive statistics

Characteristics	[% m/m]
Average value – $\bar{x}$	11.06
Sample standard deviation – s	0.77
Assigned value – x^*	11.06
Robust standard deviation – s^*	0.77
Measurement uncertainty of assigned value – u_X	0.19
p-value of normality test [-]	0.008

7.8.5 Evaluation of Performance Statistics

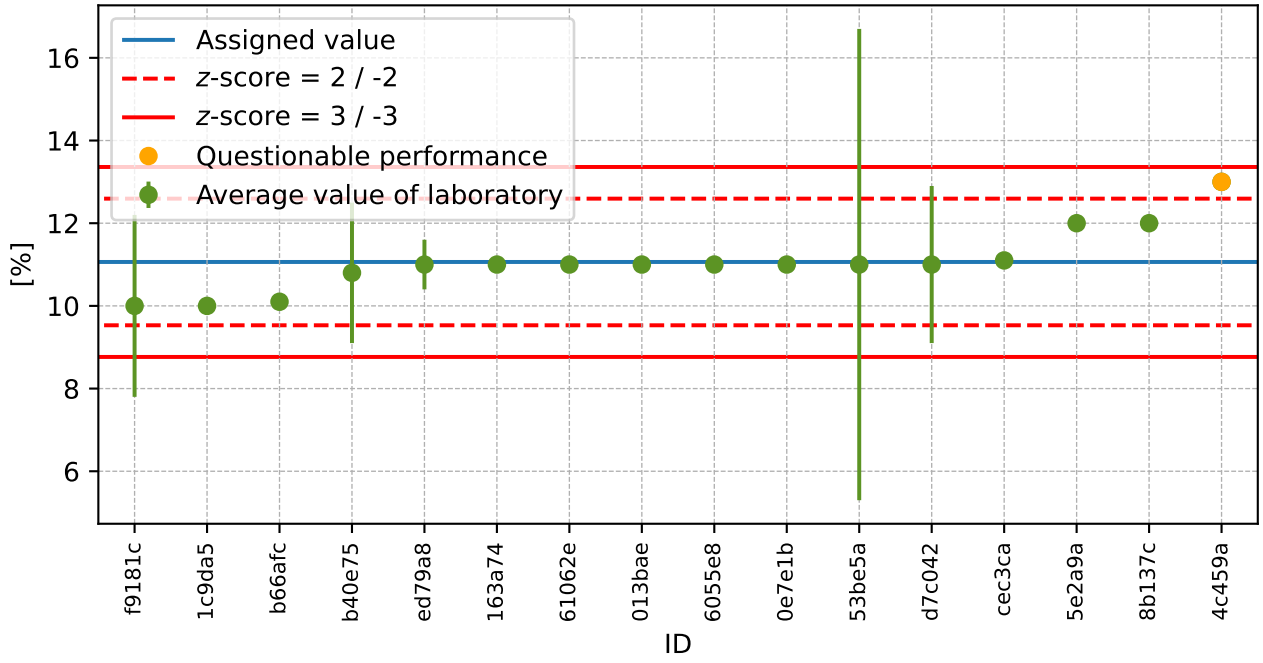

Figure 82: Average values and extended uncertainties of measurement

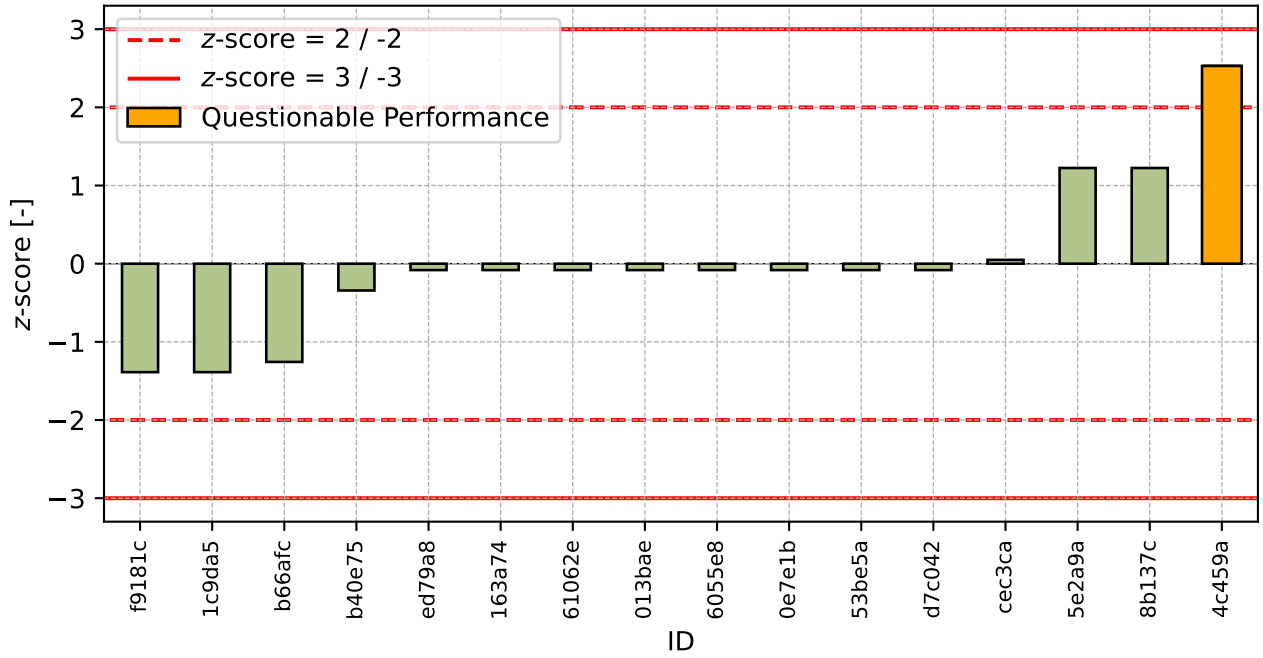

Figure 83: z-score

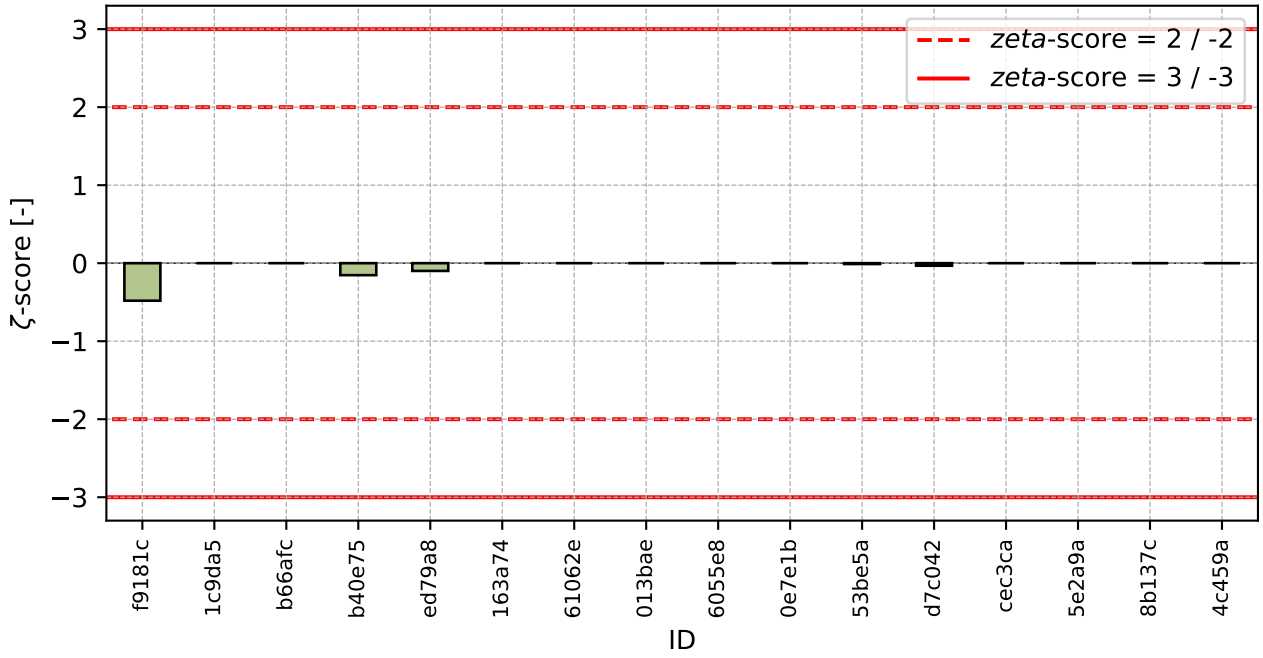

Figure 84: ζ-score

Table 40: z-score and ζ-score

ID	z-score [-]	ζ-score [-]
f9181c	-1.39	-0.48
1c9da5	-1.39	-
b66afc	-1.26	-
b40e75	-0.34	-0.15
ed79a8	-0.08	-0.10
163a74	-0.08	-
61062e	-0.08	-
013bae	-0.08	-
6055e8	-0.08	-
0e7e1b	-0.08	-
53be5a	-0.08	-0.01
d7c042	-0.08	-0.03
cec3ca	0.05	-
5e2a9a	1.22	-
8b137c	1.22	-
4c459a	2.53	-

7.9 0.125 mm

7.9.1 Test results

Table 41: Test results – ordered by average value. Outliers are marked by red color. u_X – extended uncertainty of measurement.

ID	Result [% m/m]	u_X [% m/m]
b66afc	6.8	-
1c9da5	7.0	-
f9181c	7.0	2.60
d7c042	7.0	1.80
53be5a	7.0	8.40
ed79a8	7.0	0.60
146b0f	7.0	-
b40e75	7.4	1.70
5649f1	7.4	-
cec3ca	7.5	-
6055e8	8.0	-
8b137c	8.0	-
013bae	8.0	-
61062e	8.0	-
163a74	8.0	-
0e7e1b	8.0	-
4c459a	9.0	-
5e2a9a	9.0	-

7.9.2 The Numerical Procedure for Determining Outliers

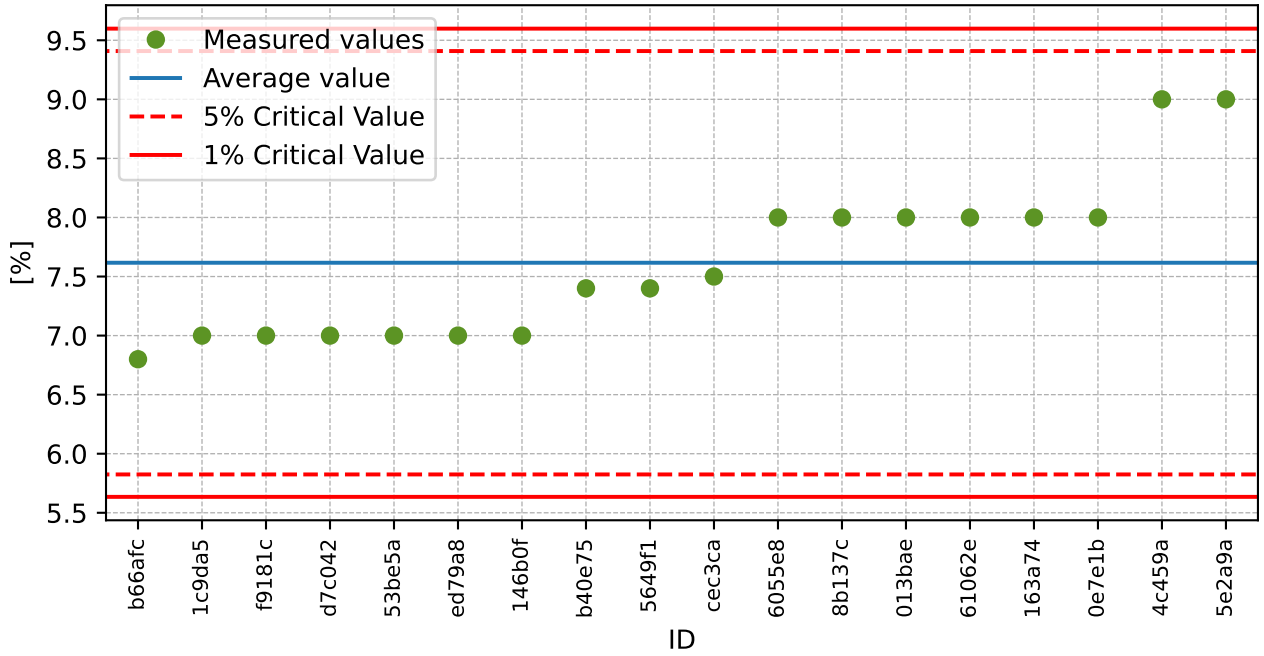

Figure 85: **Grubbs' test** - average values

7.9.3 Mandel's Statistics

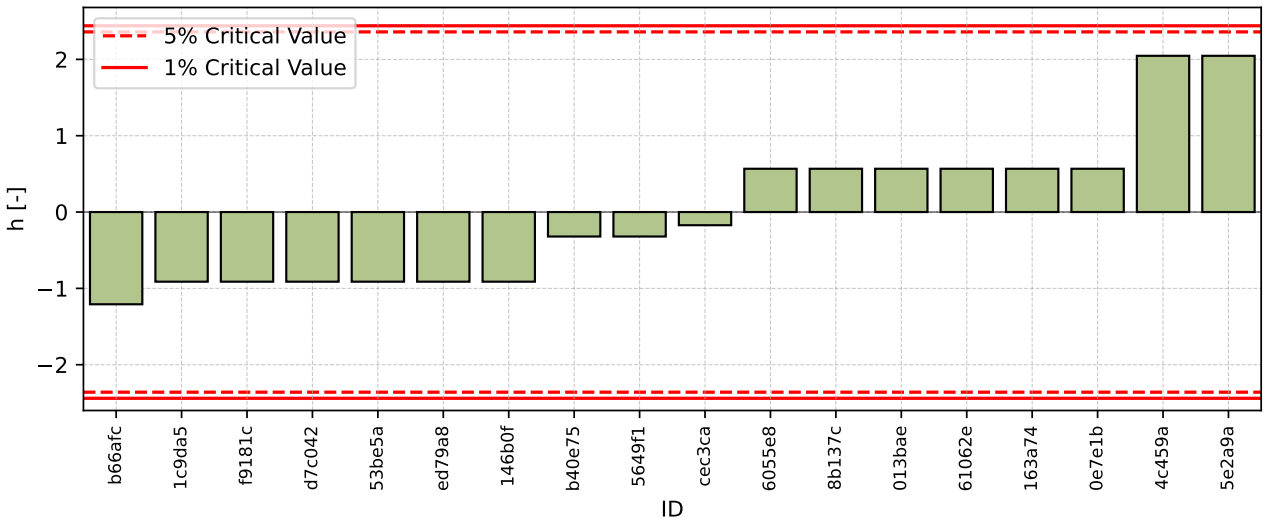

Figure 86: Interlaboratory Consistency Statistic

7.9.4 Descriptive statistics

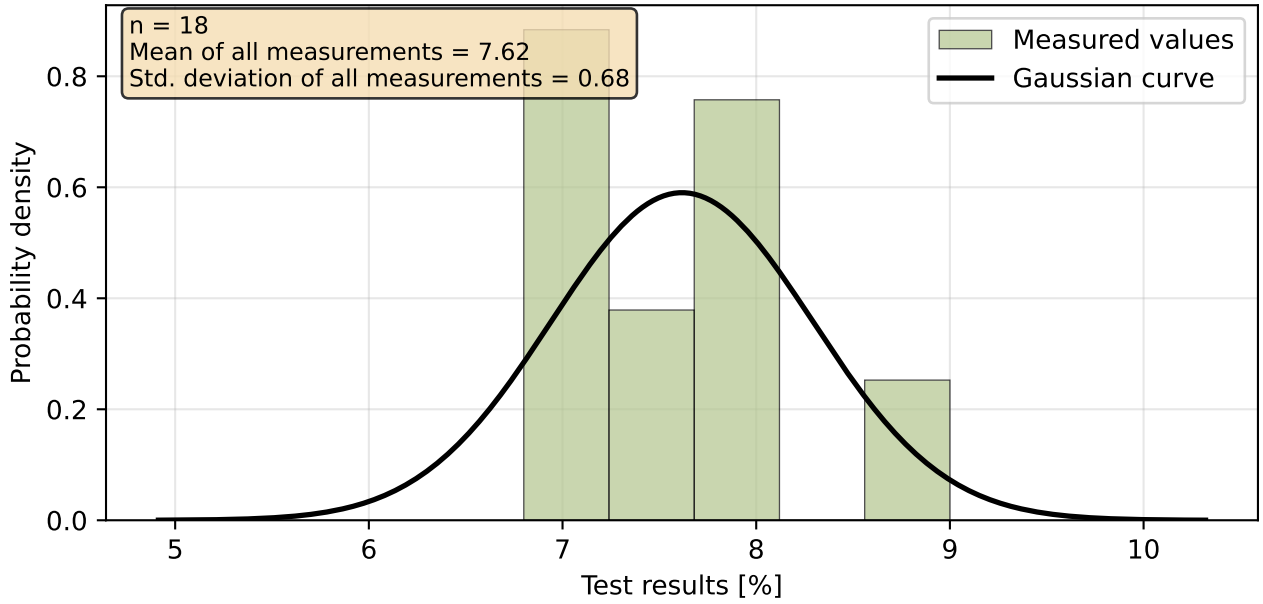

Figure 87: Histogram of all test results

Table 42: Descriptive statistics

Characteristics	**[% m/m]**
Average value – $\bar{x}$	7.62
Sample standard deviation – s	0.68
Assigned value – x^*	7.62
Robust standard deviation – s^*	0.68
Measurement uncertainty of assigned value – u_X	0.16
p-value of normality test [-]	0.010

7.9.5 Evaluation of Performance Statistics

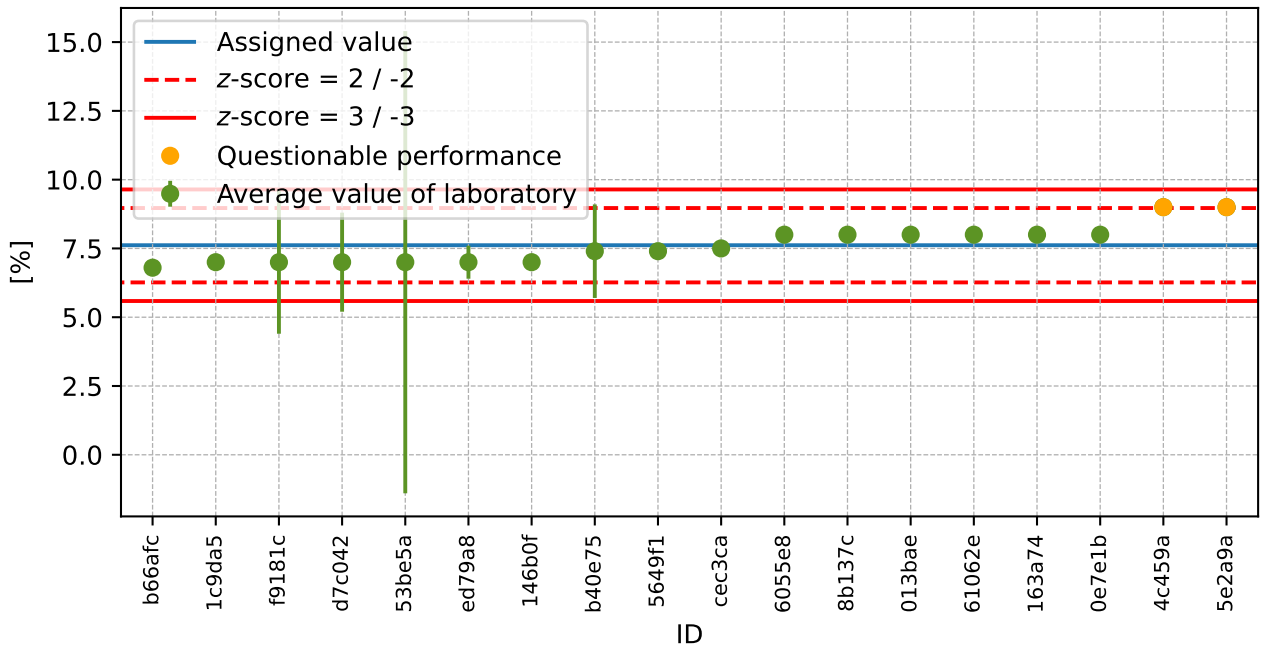

Figure 88: Average values and extended uncertainties of measurement

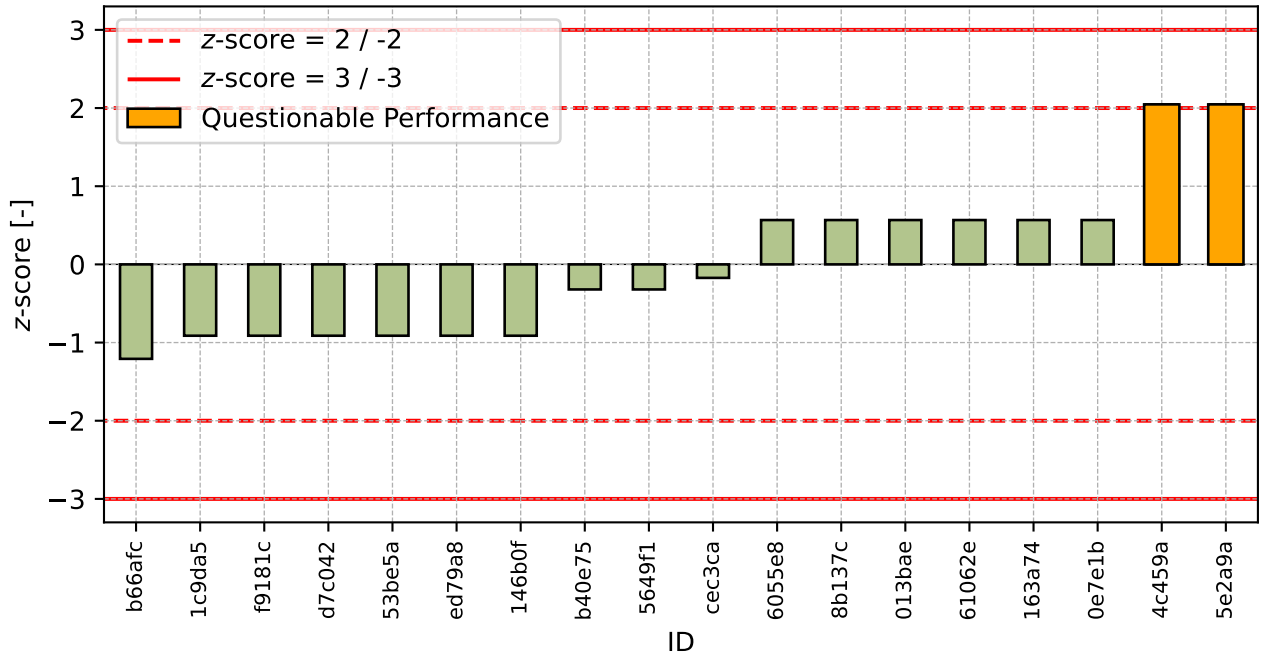

Figure 89: z-score

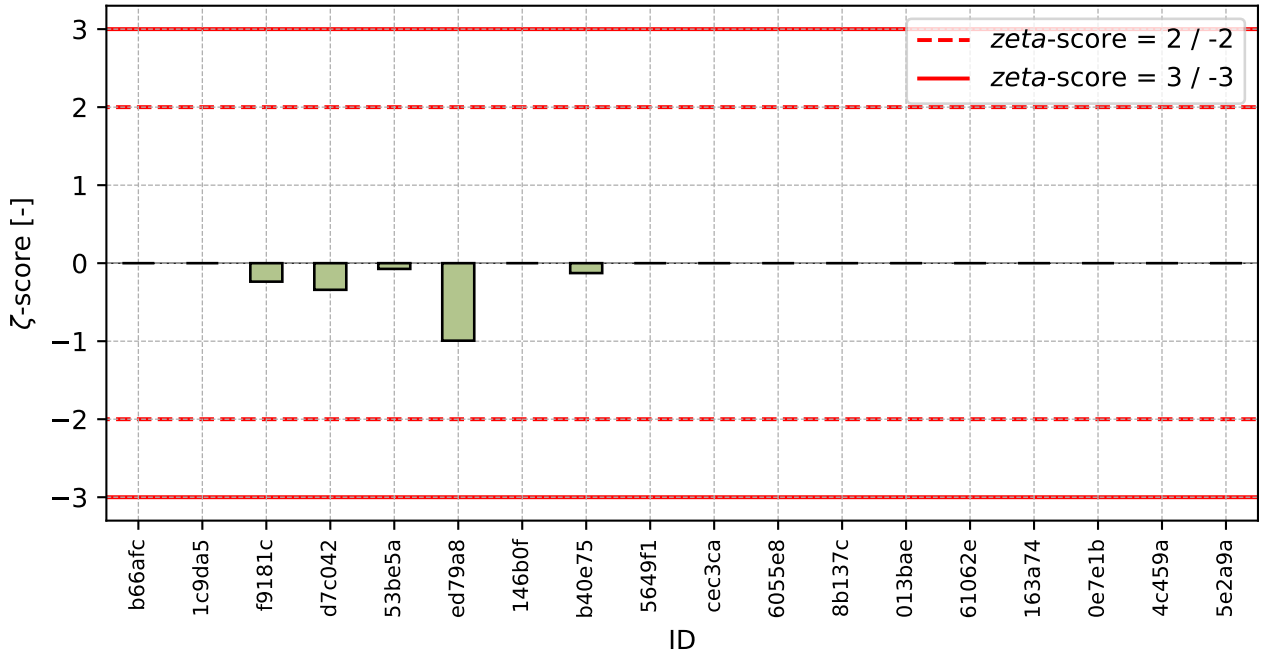

Figure 90: ζ-score

Table 43: z-score and ζ-score

ID	z-score [-]	ζ-score [-]
b66afc	-1.21	-
1c9da5	-0.91	-
f9181c	-0.91	-0.24
d7c042	-0.91	-0.34
53be5a	-0.91	-0.07
ed79a8	-0.91	-0.99
146b0f	-0.91	-
b40e75	-0.32	-0.13
5649f1	-0.32	-
cec3ca	-0.17	-
6055e8	0.57	-
8b137c	0.57	-
013bae	0.57	-
61062e	0.57	-
163a74	0.57	-
0e7e1b	0.57	-
4c459a	2.05	-
5e2a9a	2.05	-

7.10 0.063 mm

7.10.1 Test results

Table 44: Test results – ordered by average value. Outliers are marked by red color. u_X – extended uncertainty of measurement.

ID	Result [% m/m]	u_X [% m/m]
f9181c	3.4	2.80
d7c042	4.3	1.20
b66afc	5.1	-
1c9da5	5.2	-
5e2a9a	5.3	-
cec3ca	5.4	-
ed79a8	5.4	0.60
b40e75	5.5	1.70
53be5a	5.7	7.00
013bae	5.8	-
5649f1	5.8	-
4c459a	5.8	-
0e7e1b	5.9	-
163a74	5.9	-
8b137c	6.0	-
146b0f	6.0	-
6055e8	6.1	-
61062e	6.1	-

7.10.2 The Numerical Procedure for Determining Outliers

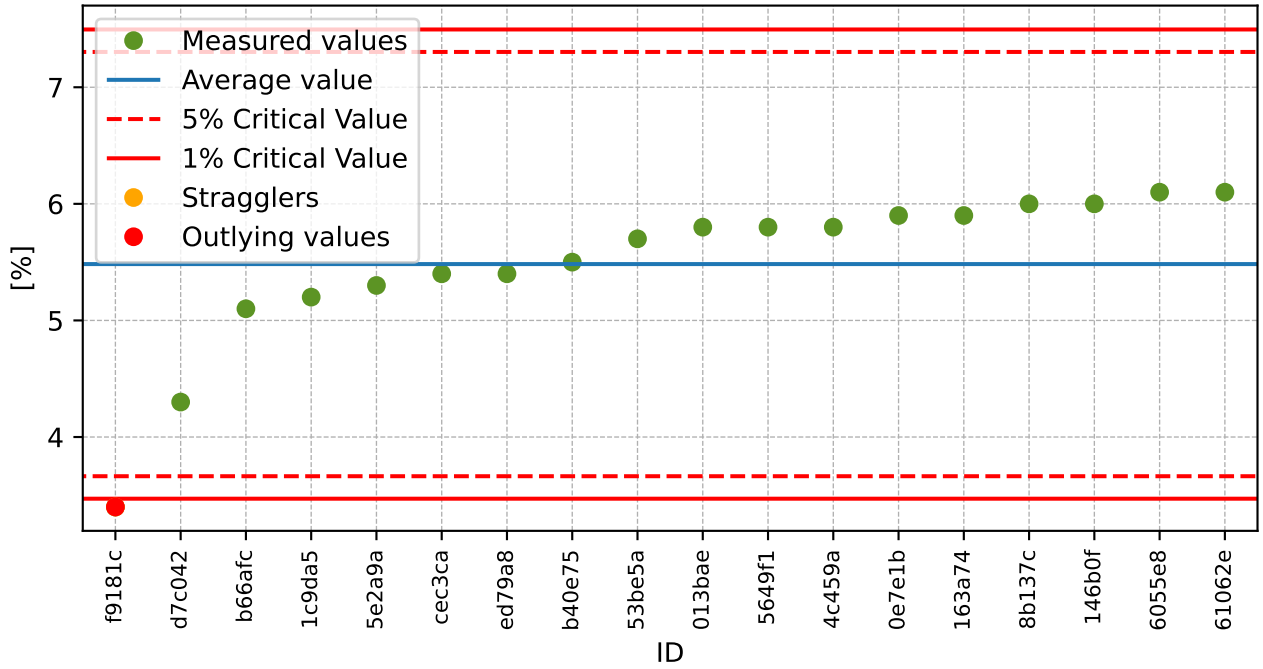

Figure 91: **Grubbs' test** - average values

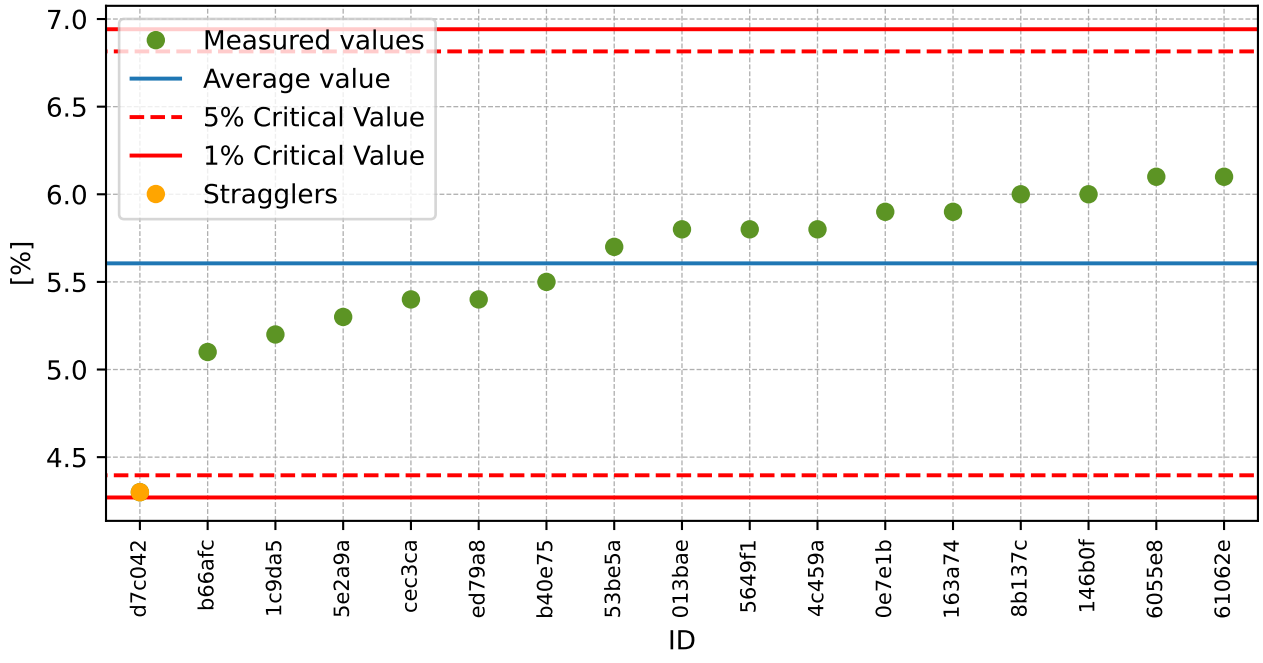

Figure 92: **Grubbs' test** - average values without outliers

7.10.3 Mandel's Statistics

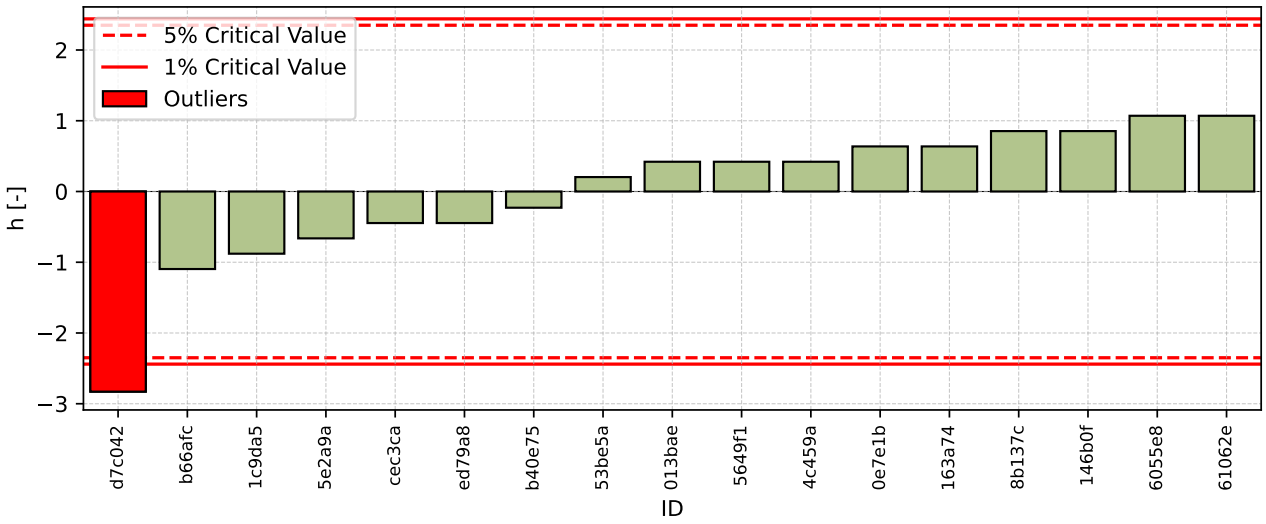

Figure 93: Interlaboratory Consistency Statistic

7.10.4 Descriptive statistics

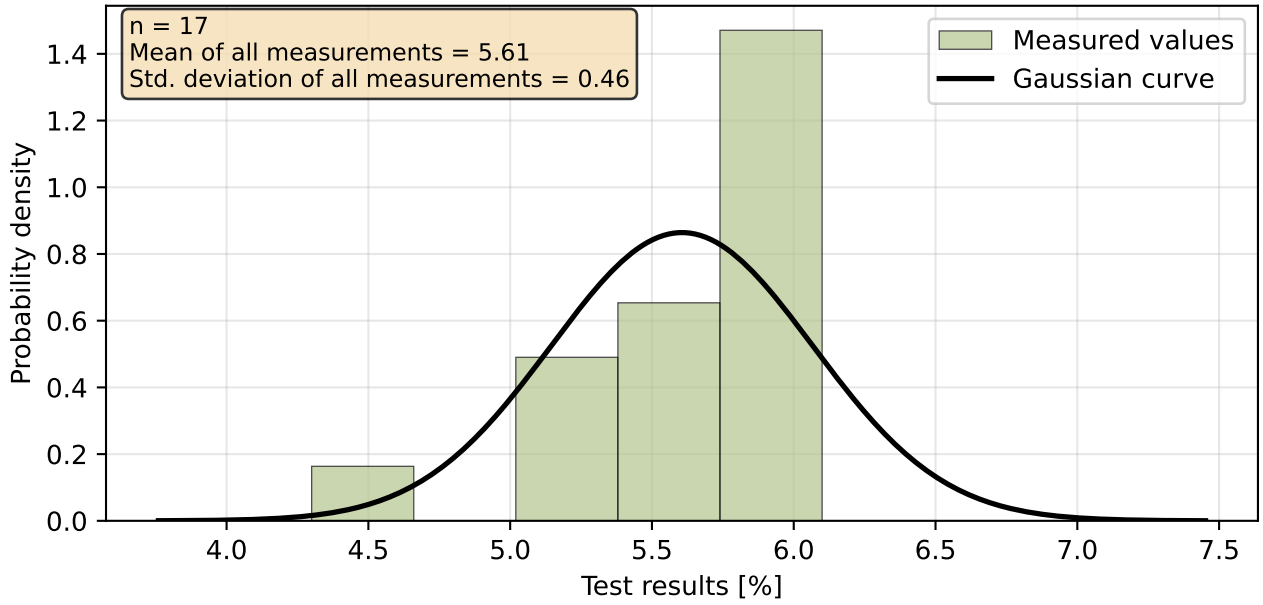

Figure 94: Histogram of all test results

Table 45: Descriptive statistics

Characteristics	[% m/m]
Average value – $\bar{x}$	5.61
Sample standard deviation – s	0.46
Assigned value – x^*	5.61
Robust standard deviation – s^*	0.46
Measurement uncertainty of assigned value – u_X	0.11
p-value of normality test [-]	0.021

7.10.5 Evaluation of Performance Statistics

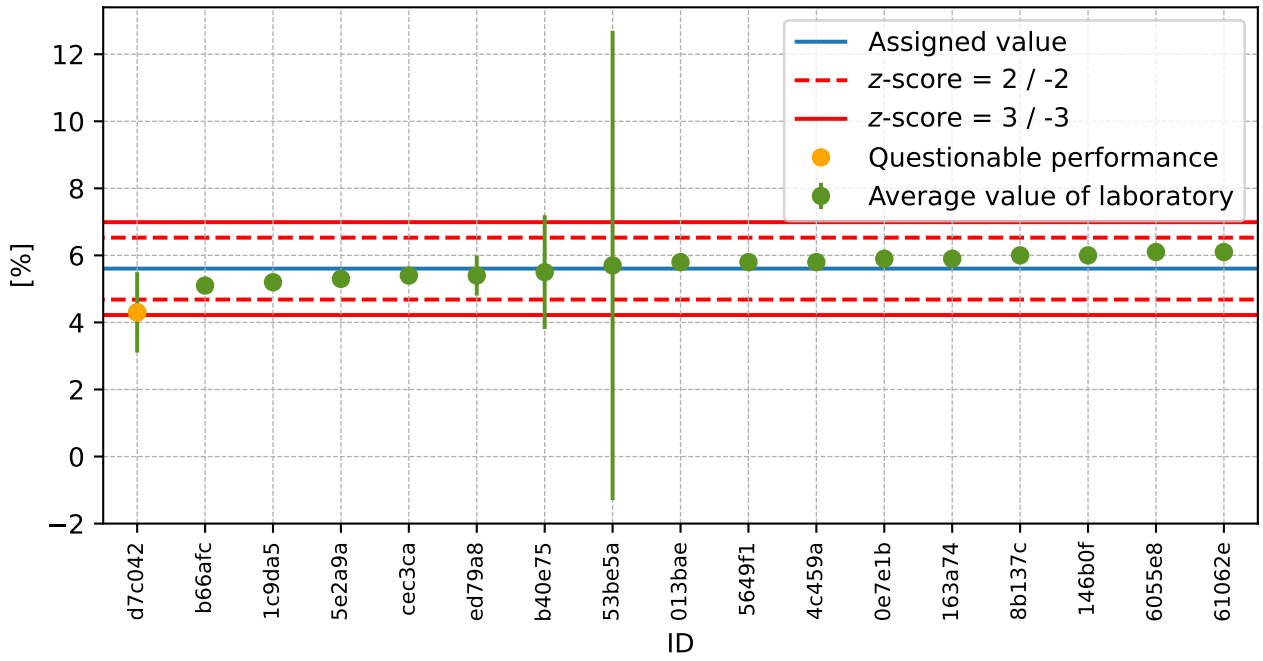

Figure 95: Average values and extended uncertainties of measurement

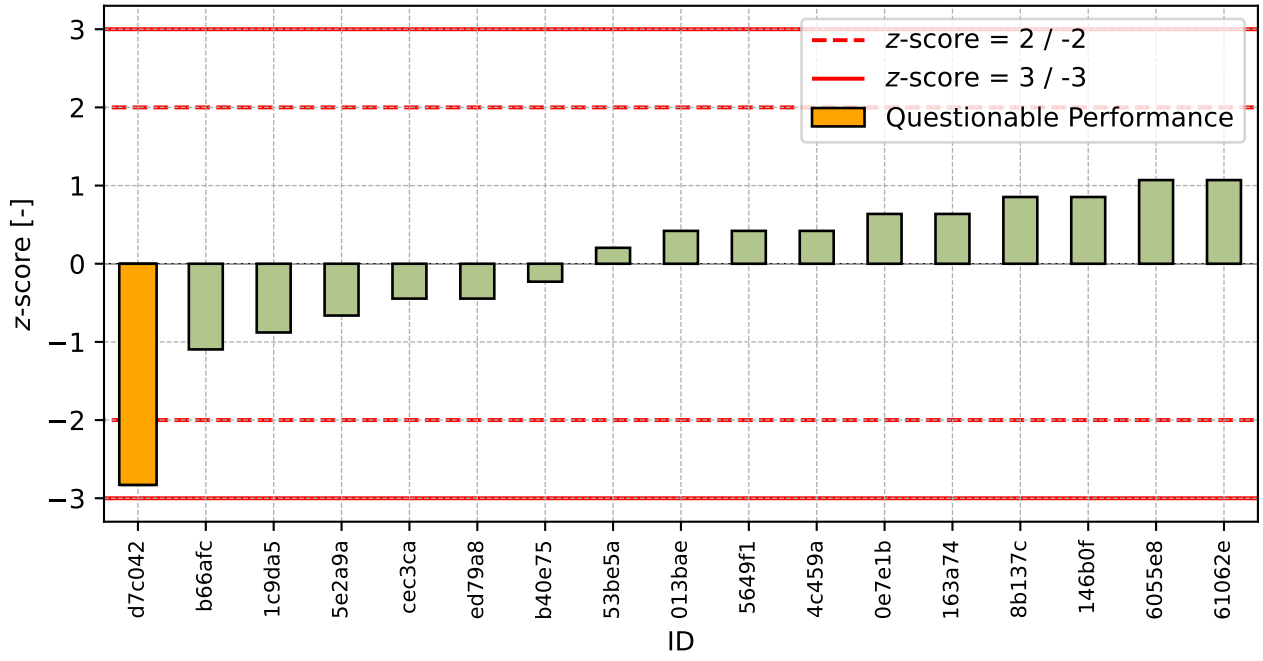

Figure 96: z-score

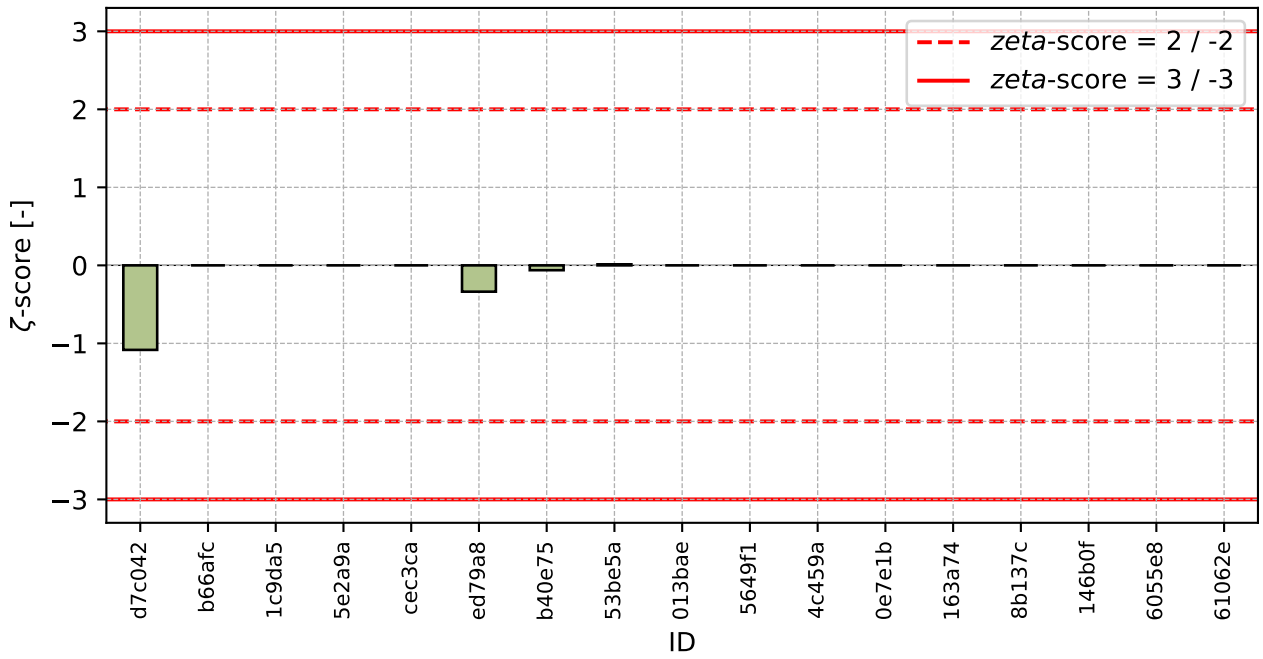

Figure 97: ζ-score

Table 46: z-score and ζ-score

ID	z-score [-]	ζ-score [-]
d7c042	-2.83	-1.08
b66afc	-1.10	-
1c9da5	-0.88	-
5e2a9a	-0.66	-
cec3ca	-0.45	-
ed79a8	-0.45	-0.34
b40e75	-0.23	-0.06
53be5a	0.20	0.01
013bae	0.42	-
5649f1	0.42	-
4c459a	0.42	-
0e7e1b	0.64	-
163a74	0.64	-
8b137c	0.85	-
146b0f	0.85	-
6055e8	1.07	-
61062e	1.07	-

8 Appendix – EN 12697-5 Determination of maximum density

8.1 Test results

Table 47: Test results – ordered by average value. Outliers are marked by red color. Columns 1–2 are individual determinations; u_X – extended uncertainty of measurement; $\bar{x}$ – average value; s_0 – sample standard deviation; V_X – variation coefficient

ID	1 [Mg/m³]	2 [Mg/m³]	u_X [Mg/m³]	$\bar{x}$ [Mg/m³]	s_0 [Mg/m³]	V_X [%]
0e7e1b	2.457	2.247	-	2.352	0.1485	6.31
5649f1	2.416	2.422	-	2.419	0.0042	0.18
d7c042	2.433	2.433	0.2190	2.433	0.0000	0.00
ed79a8	2.451	2.444	-	2.447	0.0049	0.20
6055e8	2.448	2.450	-	2.449	0.0014	0.06
61062e	2.450	2.450	-	2.450	0.0000	0.00
53be5a	2.452	2.448	0.0080	2.450	0.0028	0.12
013bae	2.452	2.453	-	2.452	0.0007	0.03
5e2a9a	2.453	2.458	-	2.455	0.0035	0.14
163a74	2.455	2.457	-	2.456	0.0014	0.06
4c459a	2.456	2.459	-	2.458	0.0021	0.09
8b137c	2.457	2.459	-	2.458	0.0014	0.06
cd6080	2.465	2.467	0.0150	2.466	0.0014	0.06
146b0f	2.468	2.466	0.0120	2.467	0.0014	0.06
e3b5b2	2.469	2.472	0.0100	2.470	0.0021	0.09
1c9da5	2.472	2.475	-	2.474	0.0021	0.09
cec3ca	2.472	2.475	-	2.474	0.0021	0.09
b66afc	2.472	2.475	-	2.474	0.0021	0.09
67d099	2.489	2.484	0.0160	2.486	0.0035	0.14

8.2 The Numerical Procedure for Determining Outliers

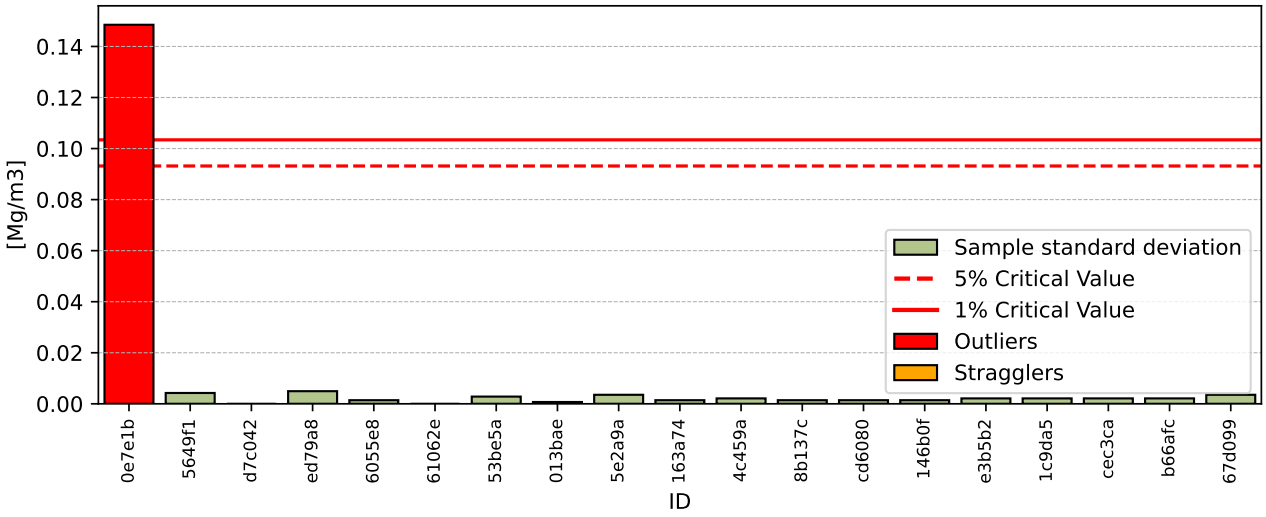

Figure 98: **Cochran's test** - sample standard deviations

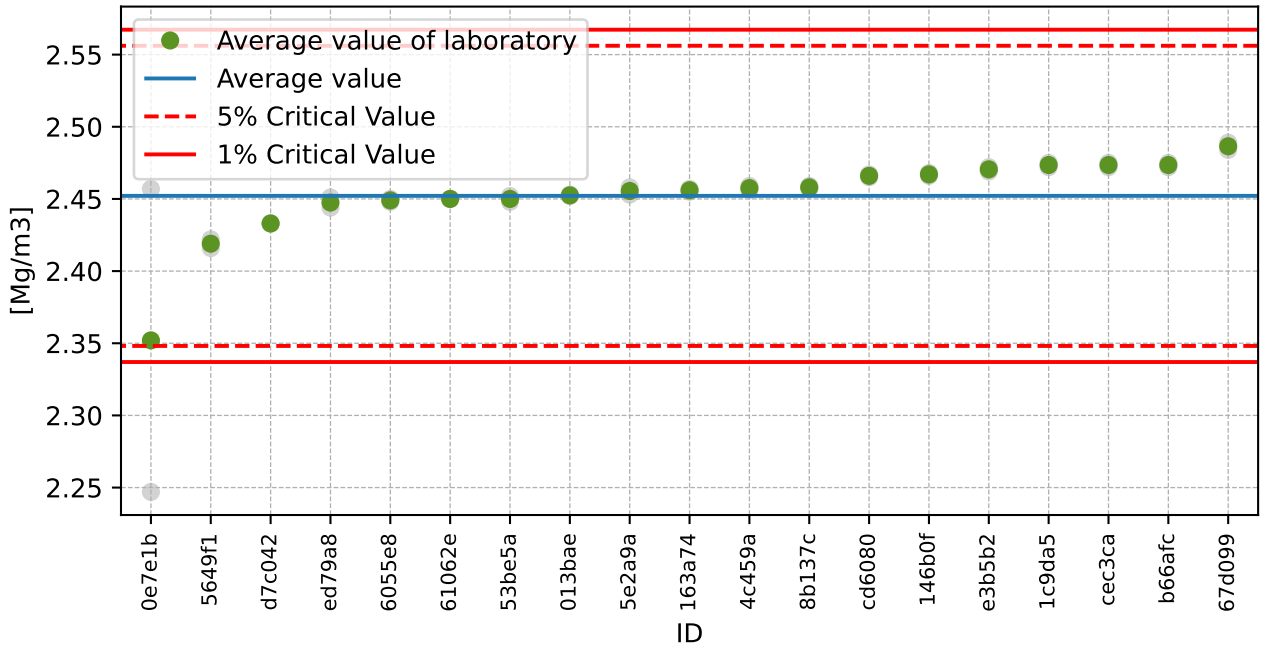

Figure 99: **Grubbs' test** - average values

8.3 Mandel's Statistics

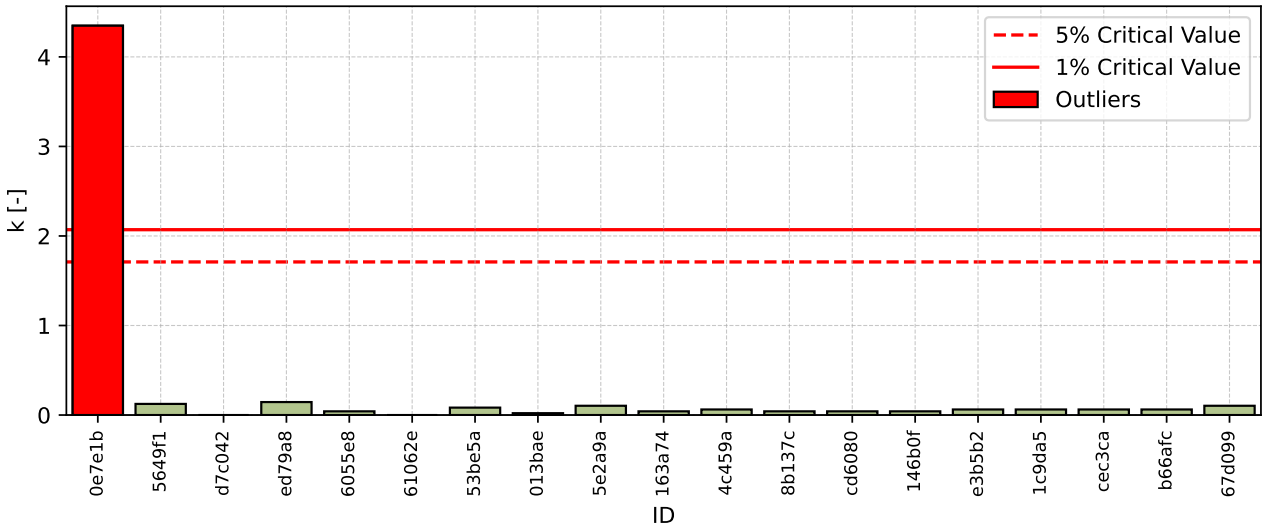

Figure 100: Intralaboratory Consistency Statistic

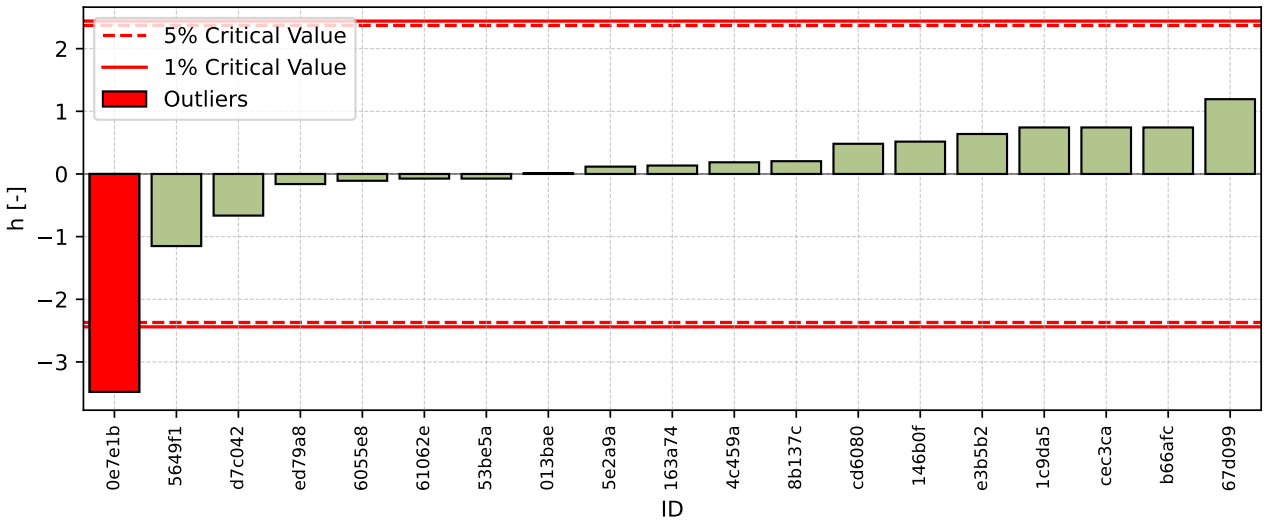

Figure 101: Interlaboratory Consistency Statistic

8.4 Descriptive statistics

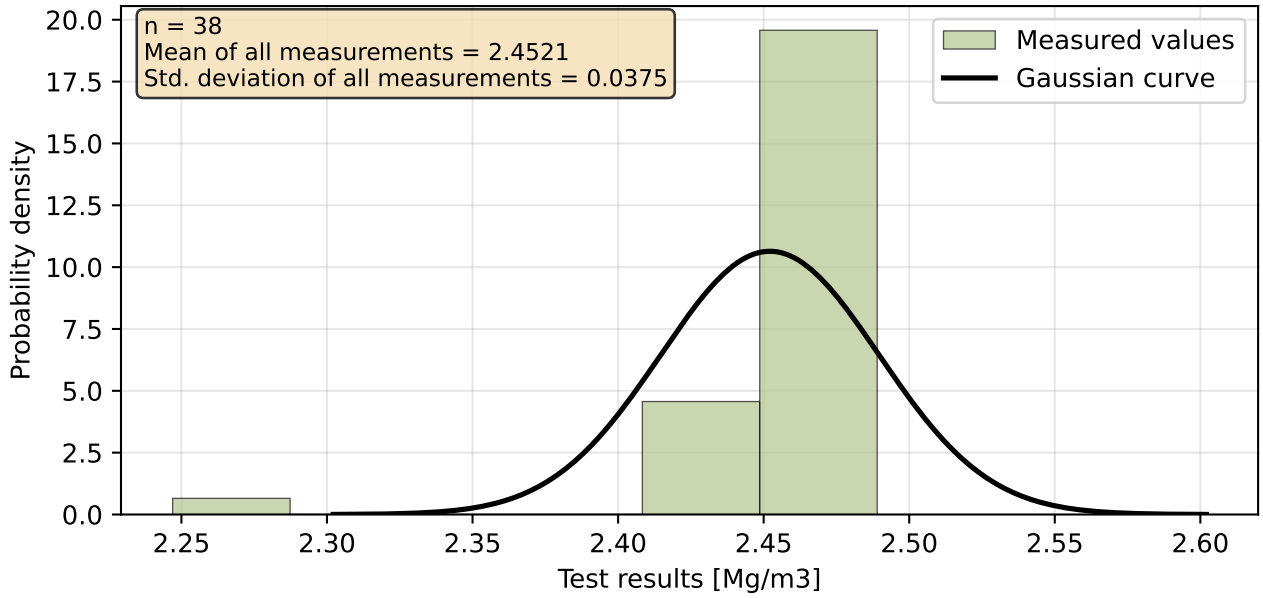

Figure 102: Histogram of all test results

Table 48: Descriptive statistics

Characteristics	**[Mg/m^3]**
Average value – $\bar{x}$	2.4521
Sample standard deviation – s	0.0288
Assigned value – x^*	2.4521
Robust standard deviation – s^*	0.0388
Measurement uncertainty of assigned value – u_X	0.0089
p-value of normality test [-]	< 0.001
Interlaboratory standard deviation – s_L	0.0157
Repeatability standard deviation – s_r	0.0342
Reproducibility standard deviation – s_R	0.0376
Repeatability – r	0.0956
Reproducibility – R	0.1052

8.5 Evaluation of Performance Statistics

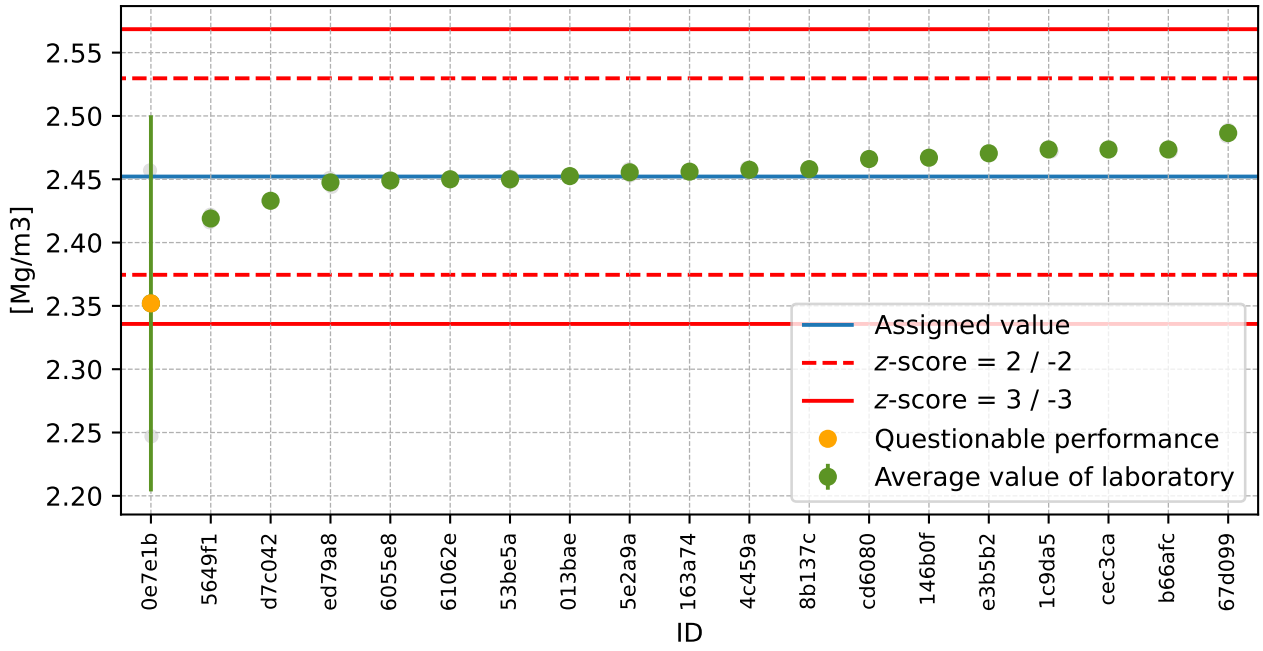

Figure 103: Average values and sample standard deviations

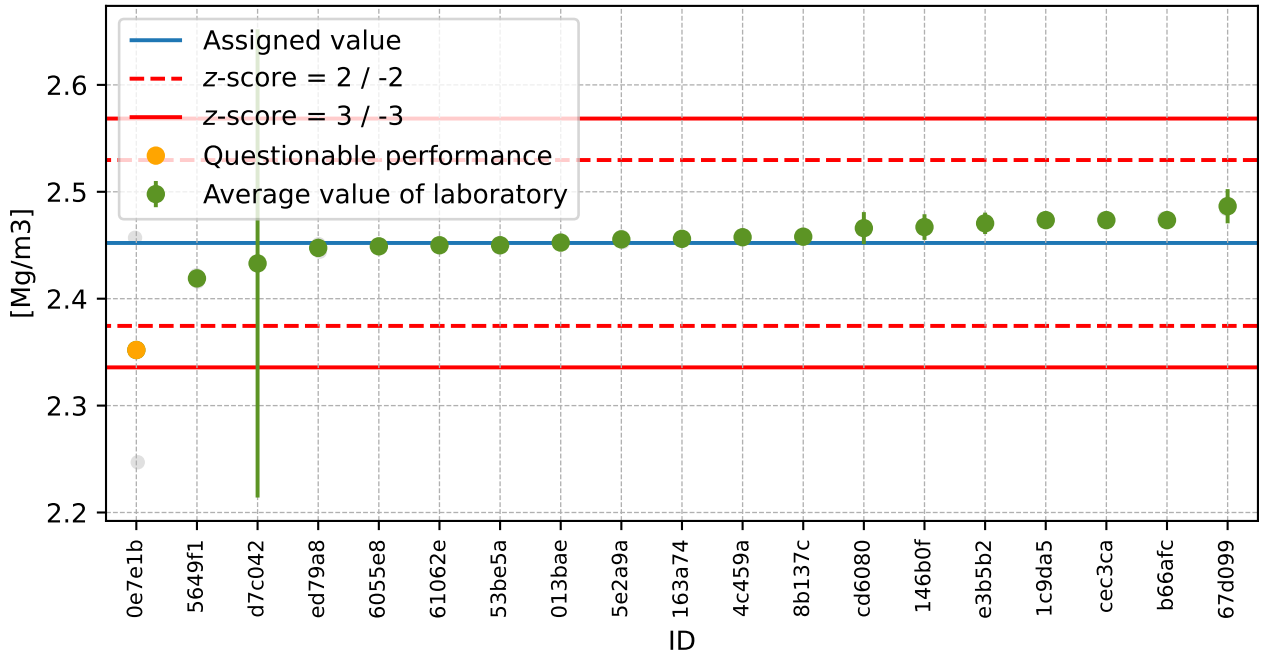

Figure 104: Average values and extended uncertainties of measurement

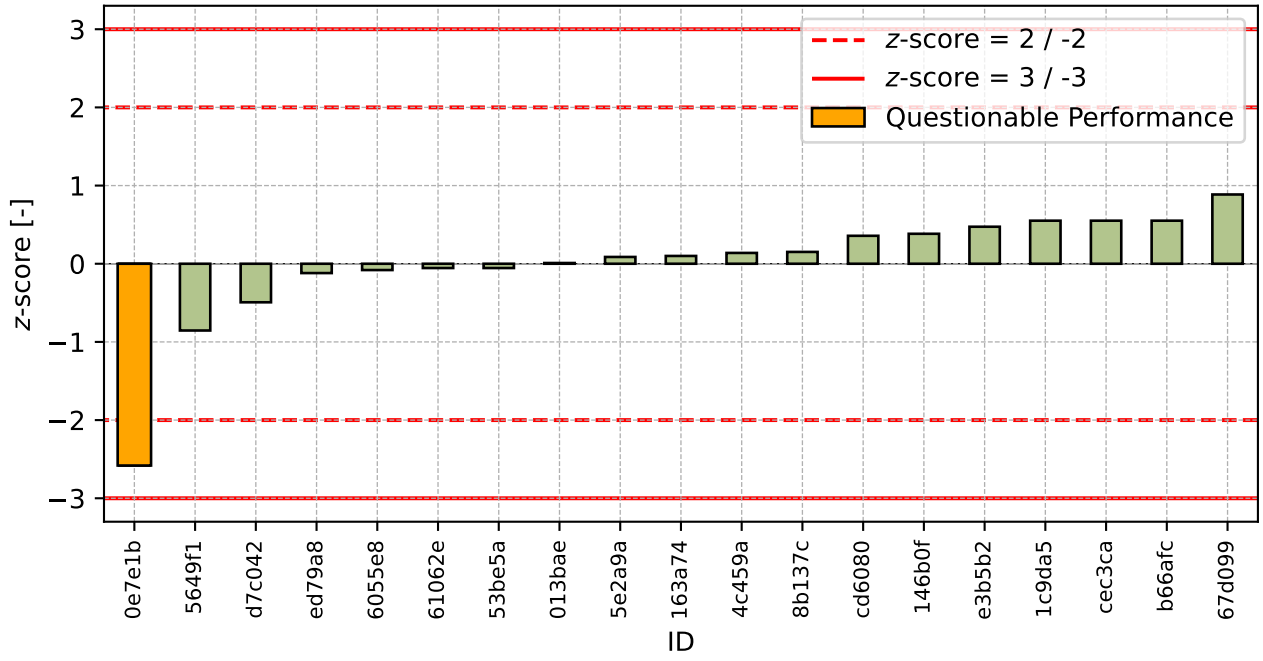

Figure 105: z-score

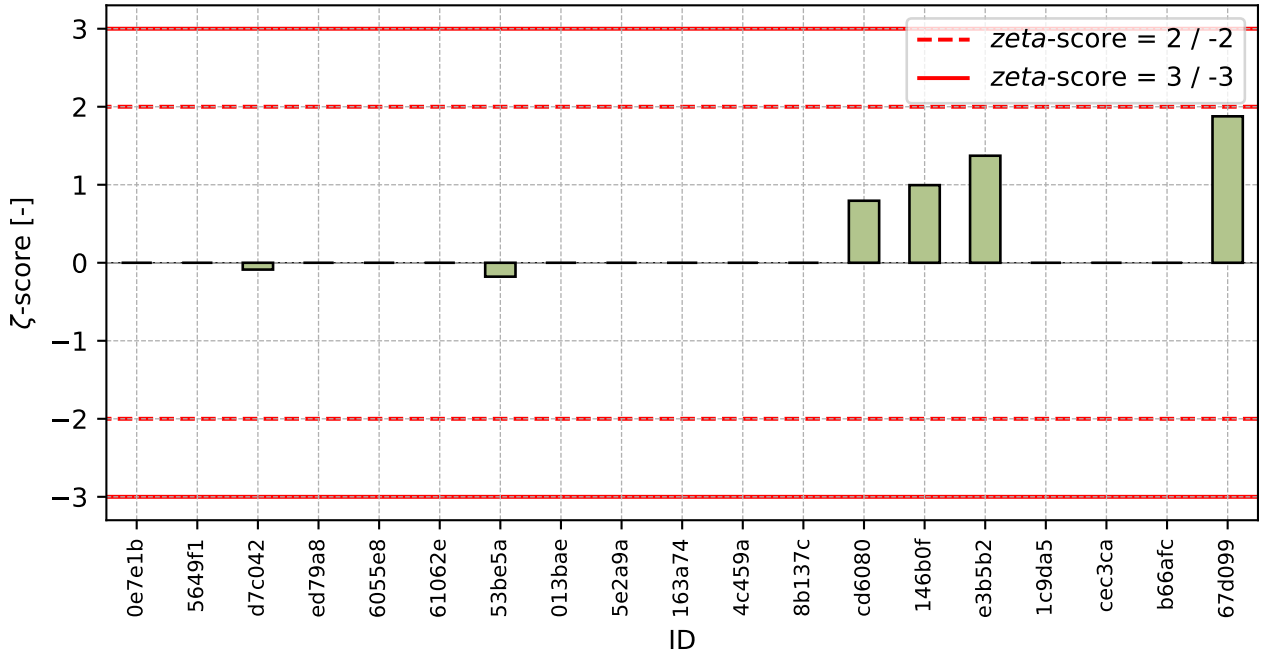

Figure 106: ζ-score

Table 49: z-score and ζ-score

ID	z-score [-]	ζ-score [-]
0e7e1b	-2.58	-
5649f1	-0.85	-
d7c042	-0.49	-0.09
ed79a8	-0.12	-
6055e8	-0.08	-
61062e	-0.05	-
53be5a	-0.05	-0.18
013bae	0.01	-
5e2a9a	0.09	-
163a74	0.10	-
4c459a	0.14	-
8b137c	0.15	-
cd6080	0.36	0.80
146b0f	0.38	1.00
e3b5b2	0.47	1.37
1c9da5	0.55	-
cec3ca	0.55	-
b66afc	0.55	-
67d099	0.89	1.88

9 Appendix – EN 12697-6 Determination of bulk density of bituminous specimens

9.1 Test results

Table 50: Test results – ordered by average value. Outliers are marked by red color. u_X – extended uncertainty of measurement.

ID	Result [Mg/m^3]	u_X [Mg/m^3]
67d099	2.080	0.0380
ed79a8	2.173	-
163a74	2.270	-
8b137c	2.283	-
1bbfc6	2.291	0.0050
6055e8	2.294	-
013bae	2.296	-
4c459a	2.297	-
61062e	2.298	-
b66afc	2.301	-
85afc0	2.302	0.0160
1c9da5	2.302	-
cec3ca	2.303	-
cd6080	2.304	0.0140
5649f1	2.307	-
5e2a9a	2.307	-
d7c042	2.311	0.2080
e3b5b2	2.315	0.0100
146b0f	2.315	0.0150
53be5a	2.330	0.0080
3ad904	2.458	0.0027

9.2 The Numerical Procedure for Determining Outliers

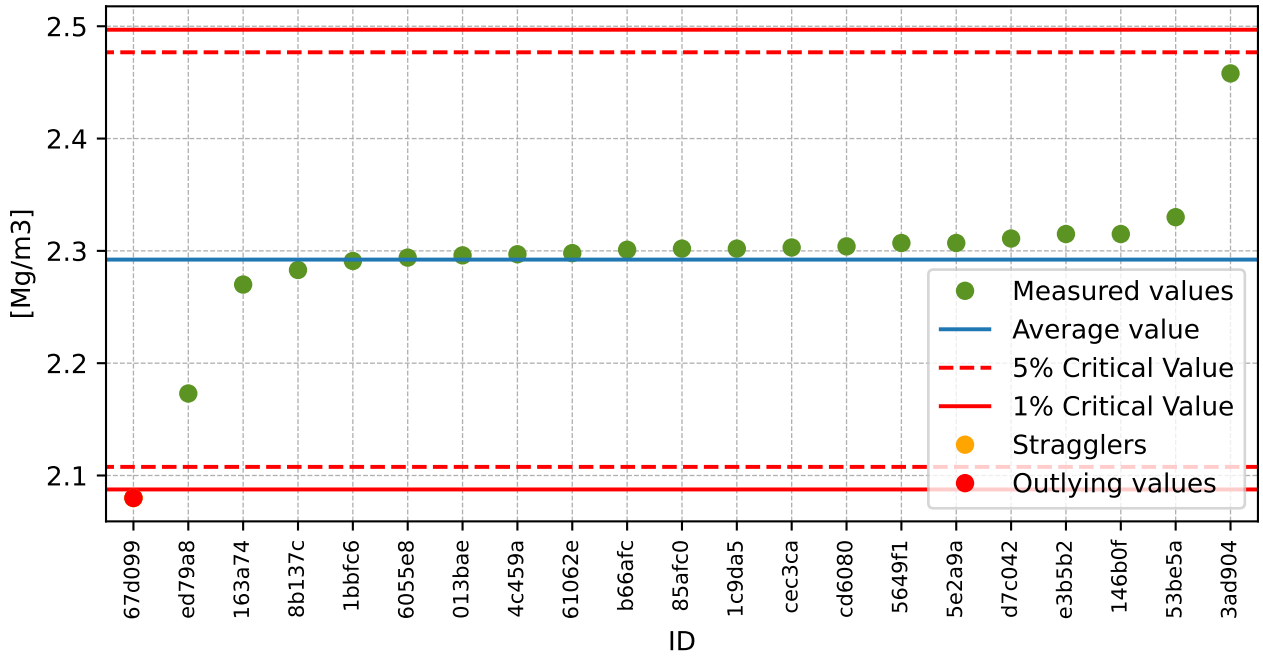

Figure 107: **Grubbs' test** - average values

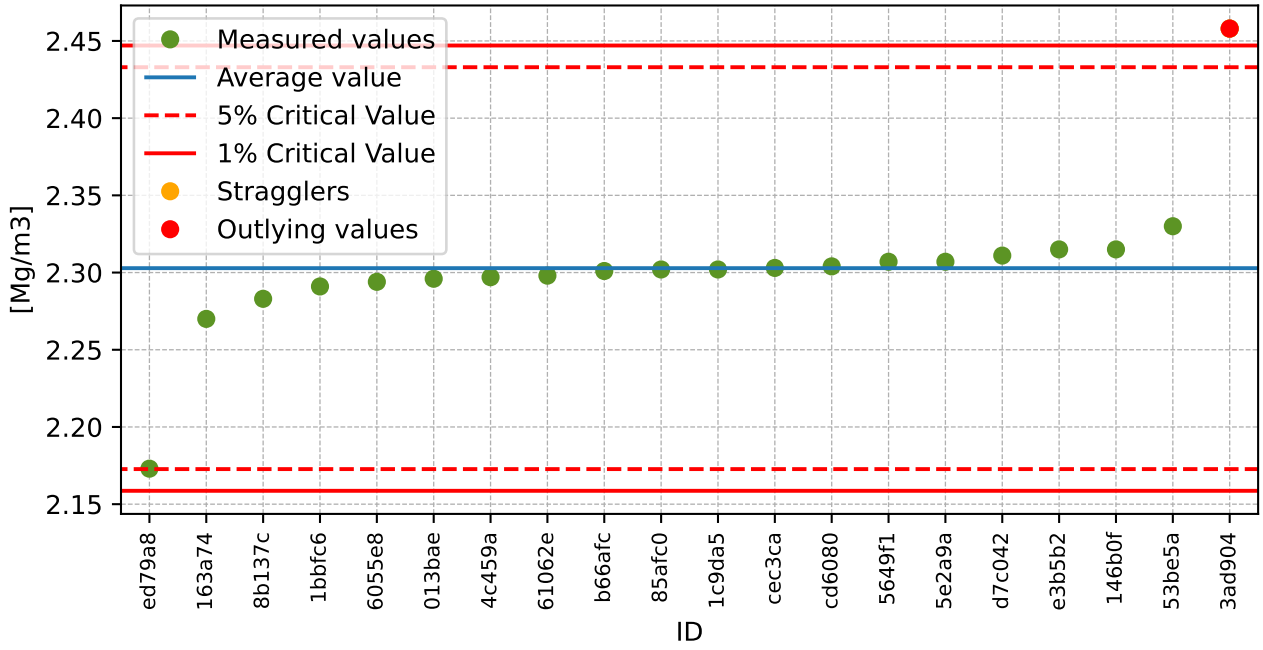

Figure 108: **Grubbs' test** - average values without outliers

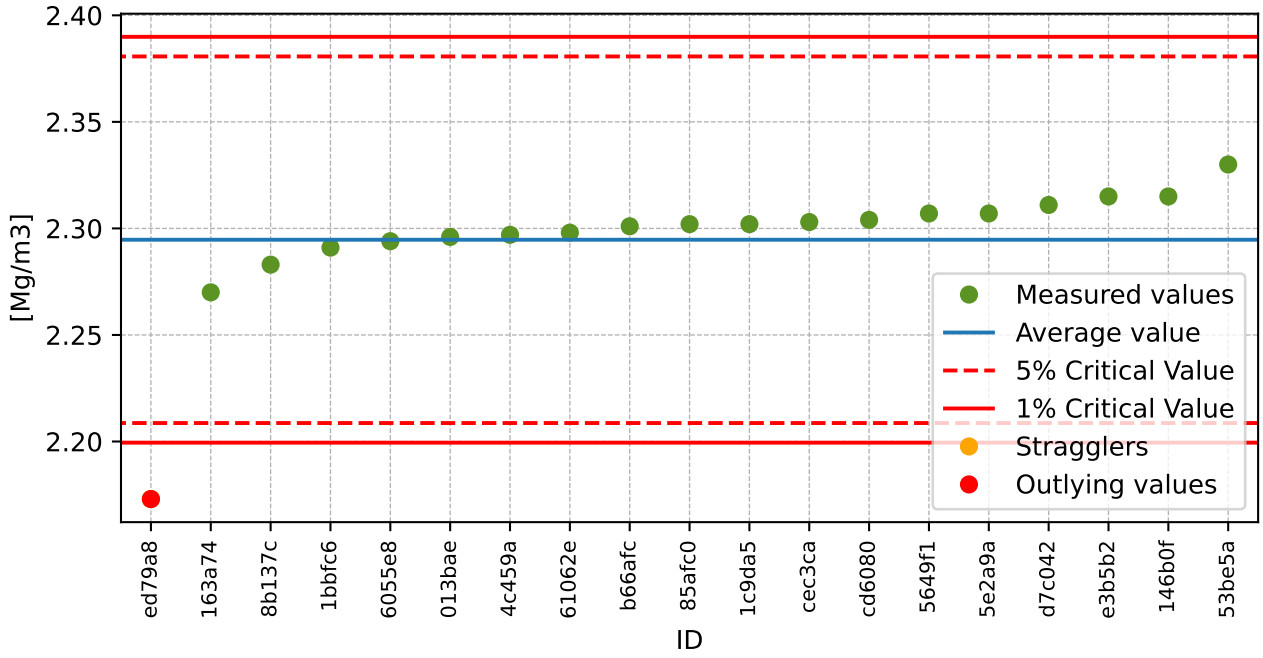

Figure 109: **Grubbs' test** - average values without outliers

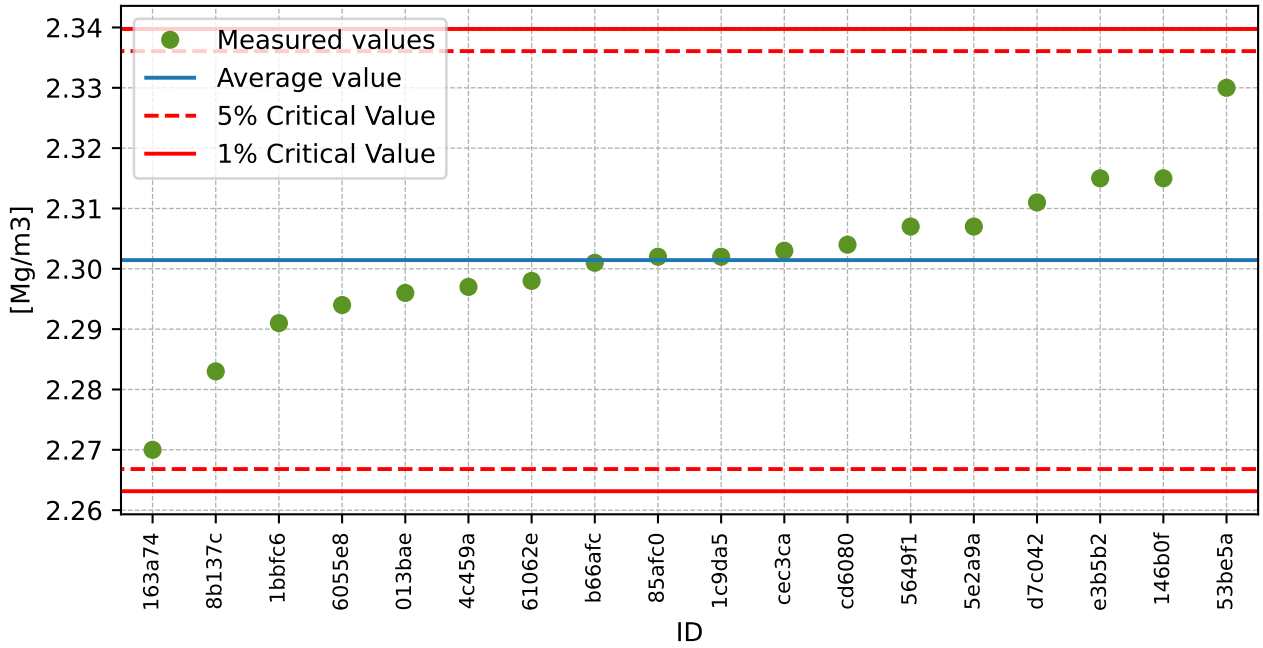

Figure 110: **Grubbs' test** - average values without outliers

9.3 Mandel's Statistics

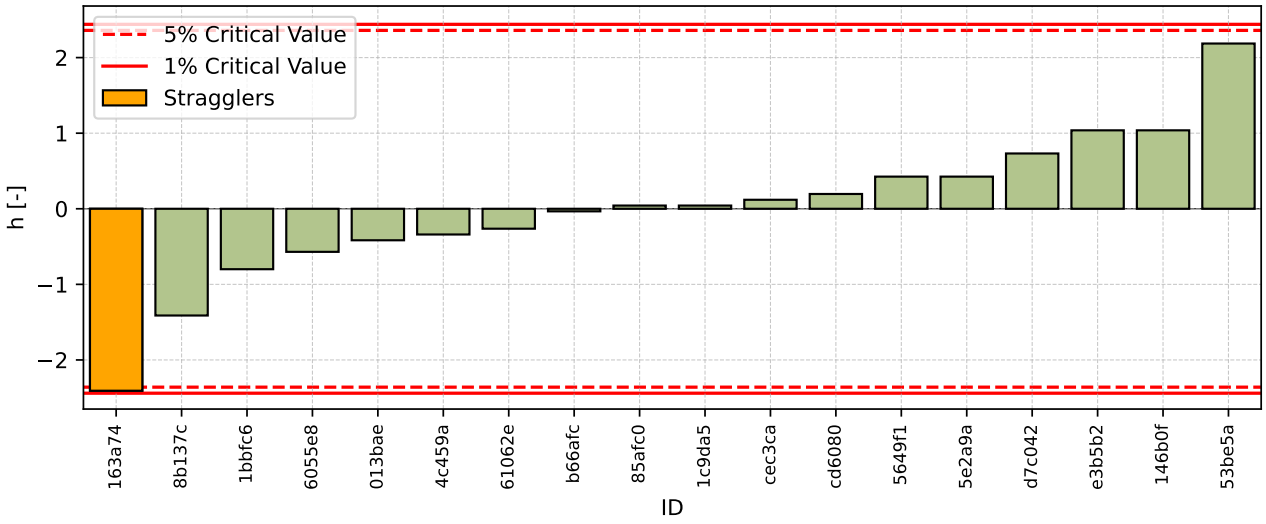

Figure 111: Interlaboratory Consistency Statistic

9.4 Descriptive statistics

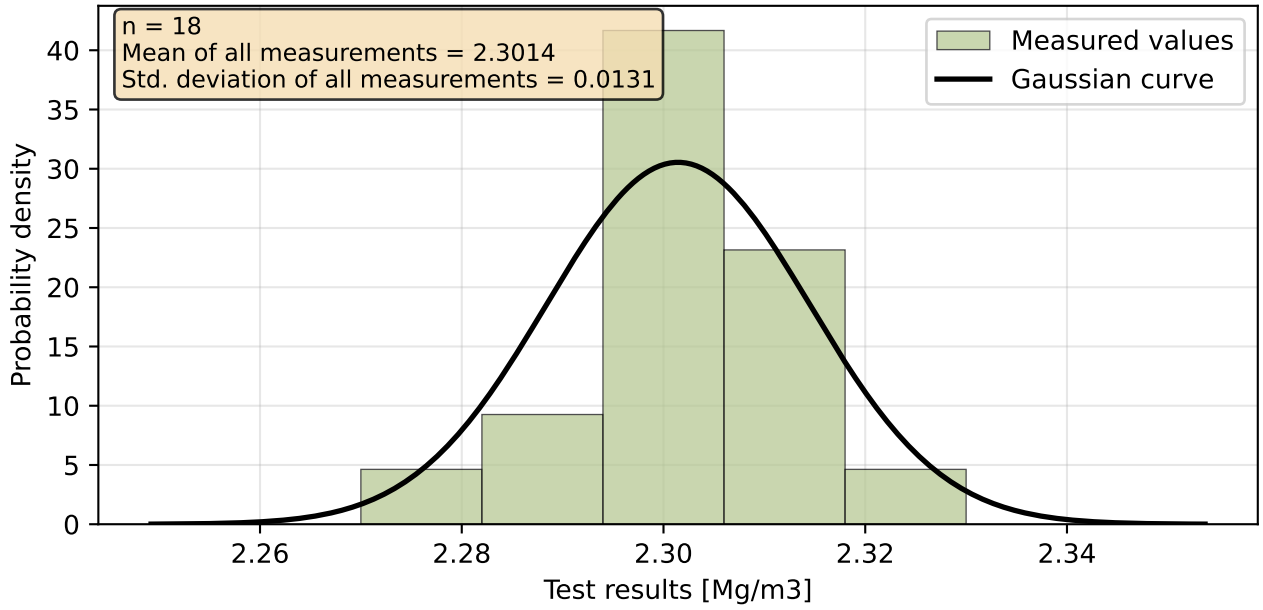

Figure 112: Histogram of all test results

Table 51: Descriptive statistics

Characteristics	[Mg/m^3]
Average value – $\bar{x}$	2.3014
Sample standard deviation – s	0.0131
Assigned value – x^*	2.3014
Robust standard deviation – s^*	0.0131
Measurement uncertainty of assigned value – u_X	0.0031
p-value of normality test [-]	0.652

9.5 Evaluation of Performance Statistics

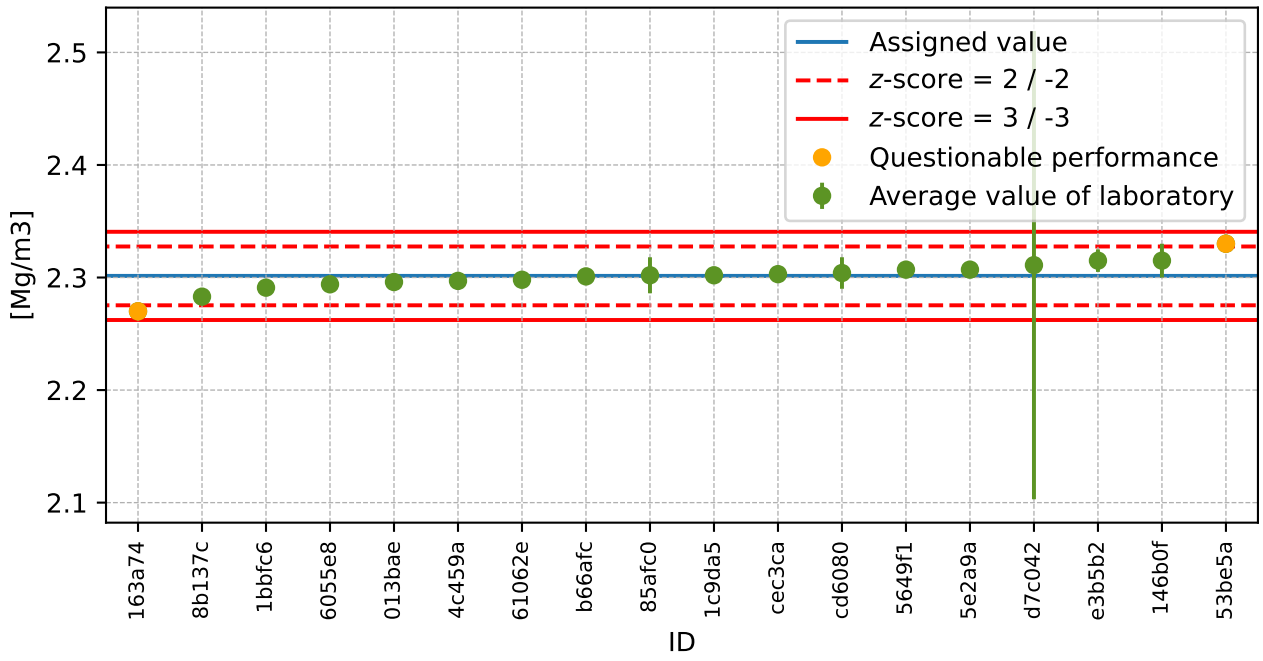

Figure 113: Average values and extended uncertainties of measurement

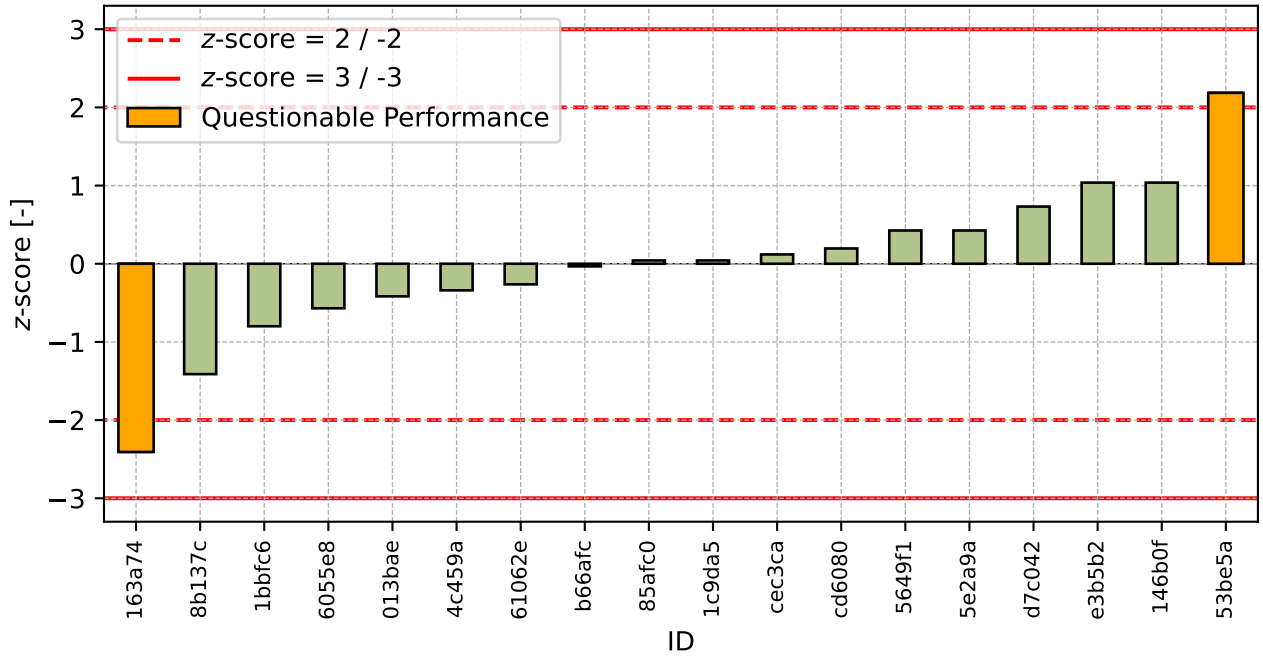

Figure 114: z-score

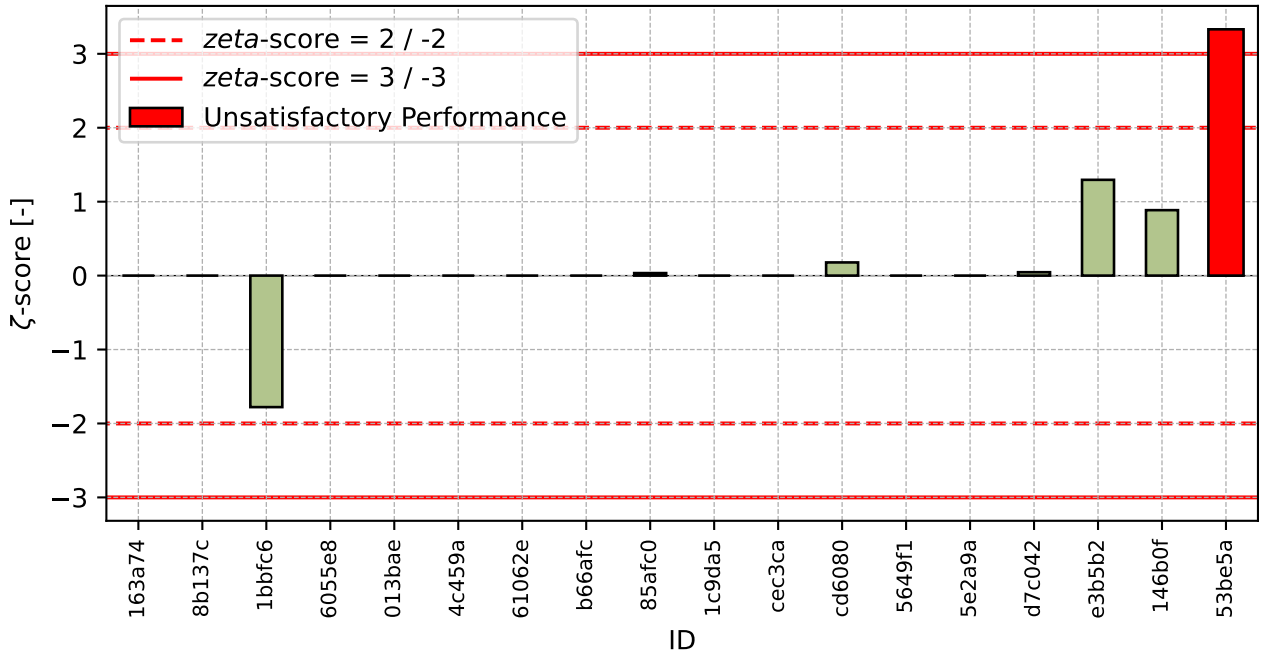

Figure 115: ζ-score

Table 52: z-score and ζ-score

ID	z-score [-]	ζ-score [-]
163a74	-2.41	-
8b137c	-1.41	-
1bbfc6	-0.80	-1.78
6055e8	-0.57	-
013bae	-0.42	-
4c459a	-0.34	-
61062e	-0.26	-
b66afc	-0.03	-
85afc0	0.04	0.03
1c9da5	0.04	-
cec3ca	0.12	-
cd6080	0.20	0.18
5649f1	0.43	-
5e2a9a	0.43	-
d7c042	0.73	0.05
e3b5b2	1.04	1.30
146b0f	1.04	0.89
53be5a	2.19	3.33

10 Appendix – EN 12697-8 Determination of void characteristics of bituminous mixtures

10.1 Test results

Table 53: Test results – ordered by average value. Outliers are marked by red color. u_X – extended uncertainty of measurement.

ID	Result [%]	u_X [%]
0e7e1b	2.3	-
6055e8	2.3	-
5649f1	4.6	-
53be5a	4.9	0.30
c0263e	5.0	0.30
d7c042	5.1	1.30
beef10	5.2	-
60506a	5.5	-
d77529	5.9	-
5e2a9a	6.0	-
e9b0c7	6.1	-
61062e	6.2	-
146b0f	6.2	0.20
e3b5b2	6.3	0.40
013bae	6.4	-
4c459a	6.5	-
cd6080	6.6	0.30
1c9da5	6.9	-
8b137c	7.1	-
163a74	7.4	-
ed79a8	11.2	0.50
67d099	16.1	1.56

10.2 The Numerical Procedure for Determining Outliers

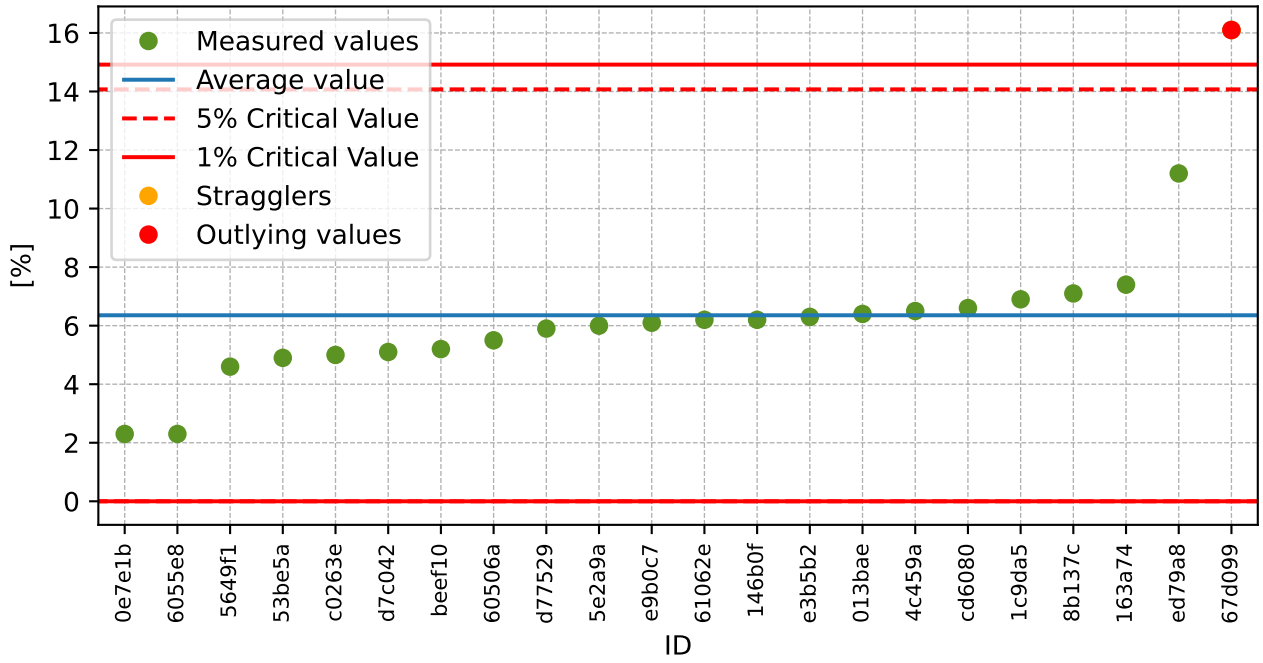

Figure 116: **Grubbs' test** - average values

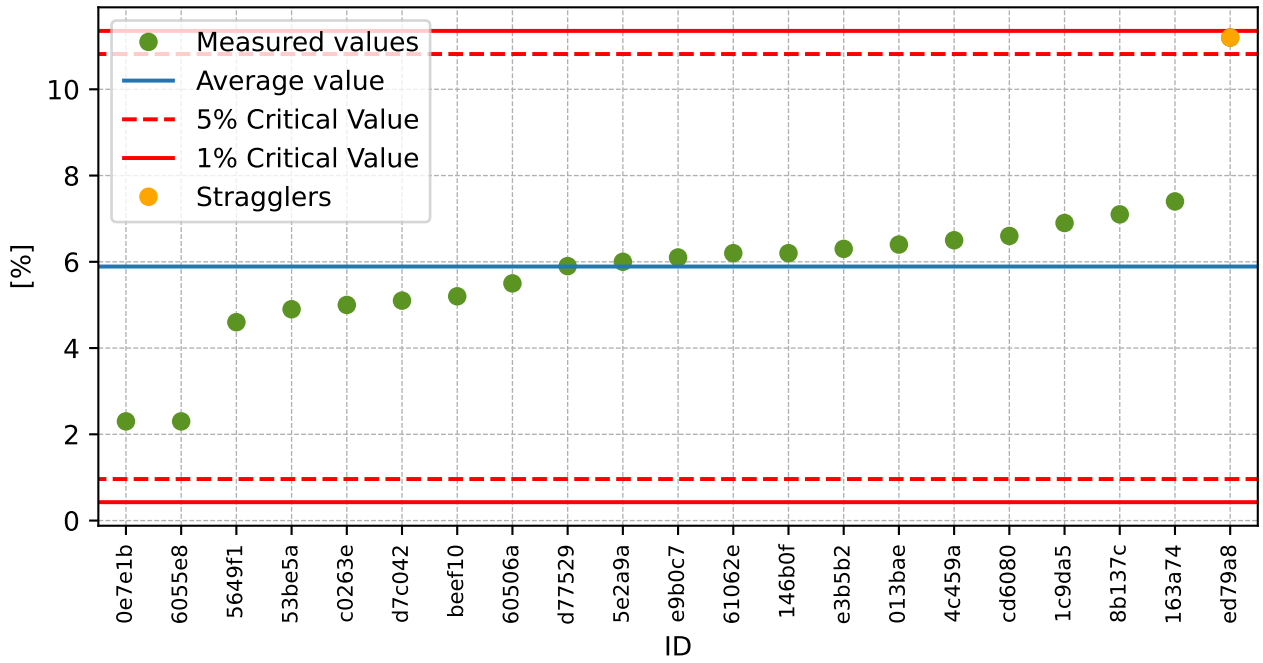

Figure 117: **Grubbs' test** - average values without outliers

10.3 Mandel's Statistics

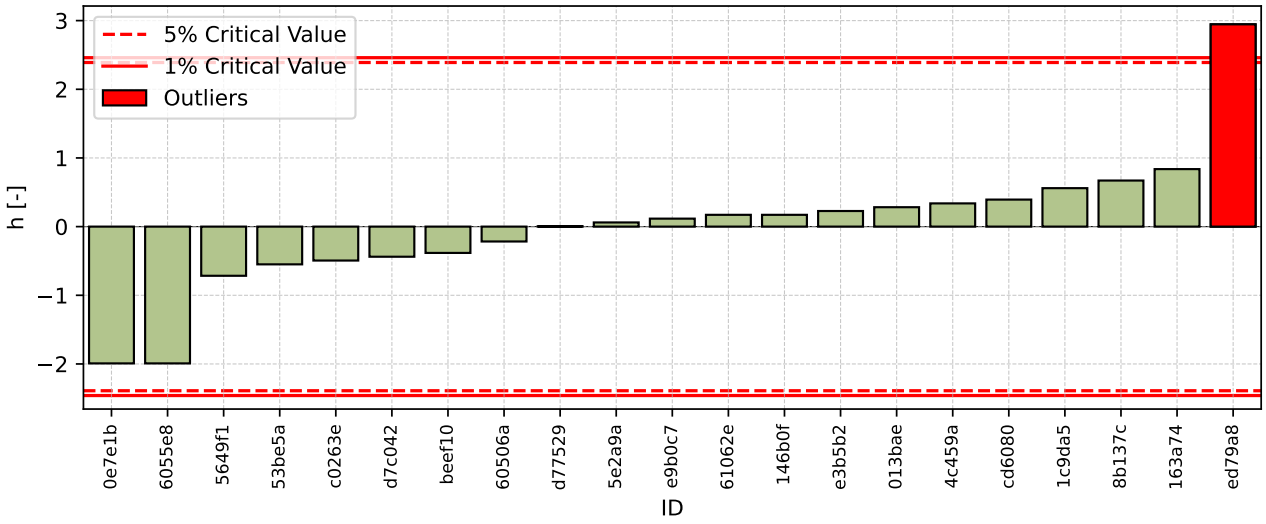

Figure 118: Interlaboratory Consistency Statistic

10.4 Descriptive statistics

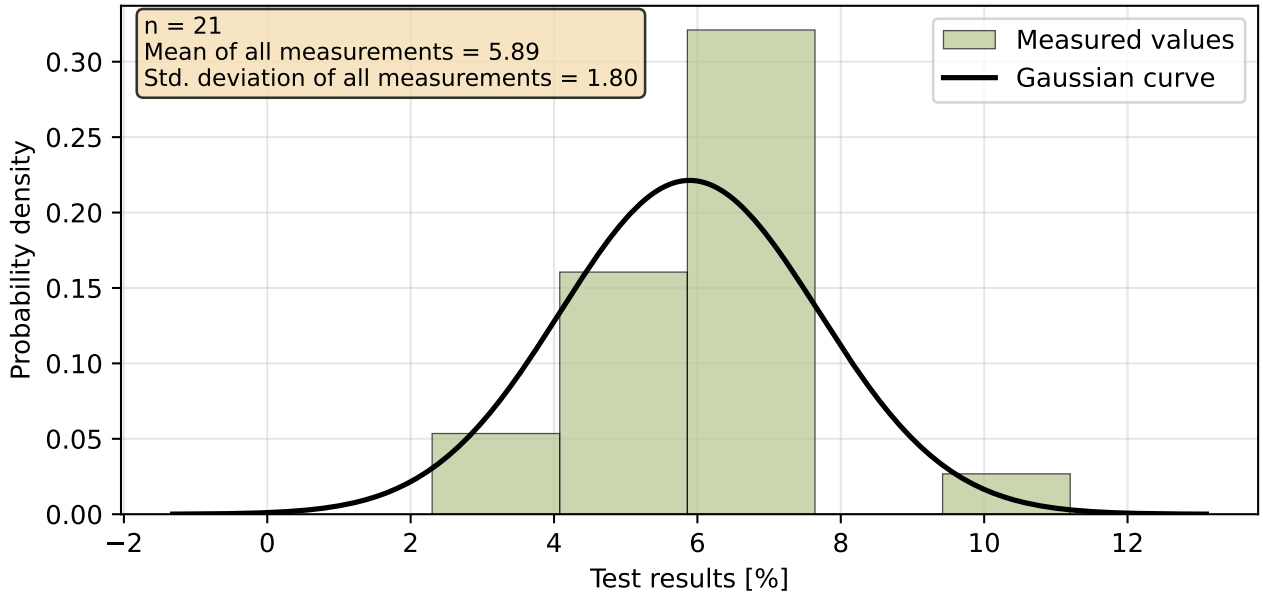

Figure 119: Histogram of all test results

Table 54: Descriptive statistics

Characteristics	[%]
Average value – $\bar{x}$	5.89
Sample standard deviation – s	1.80
Assigned value – x^*	5.89
Robust standard deviation – s^*	1.80
Measurement uncertainty of assigned value – u_X	0.39
p-value of normality test [-]	0.010

10.5 Evaluation of Performance Statistics

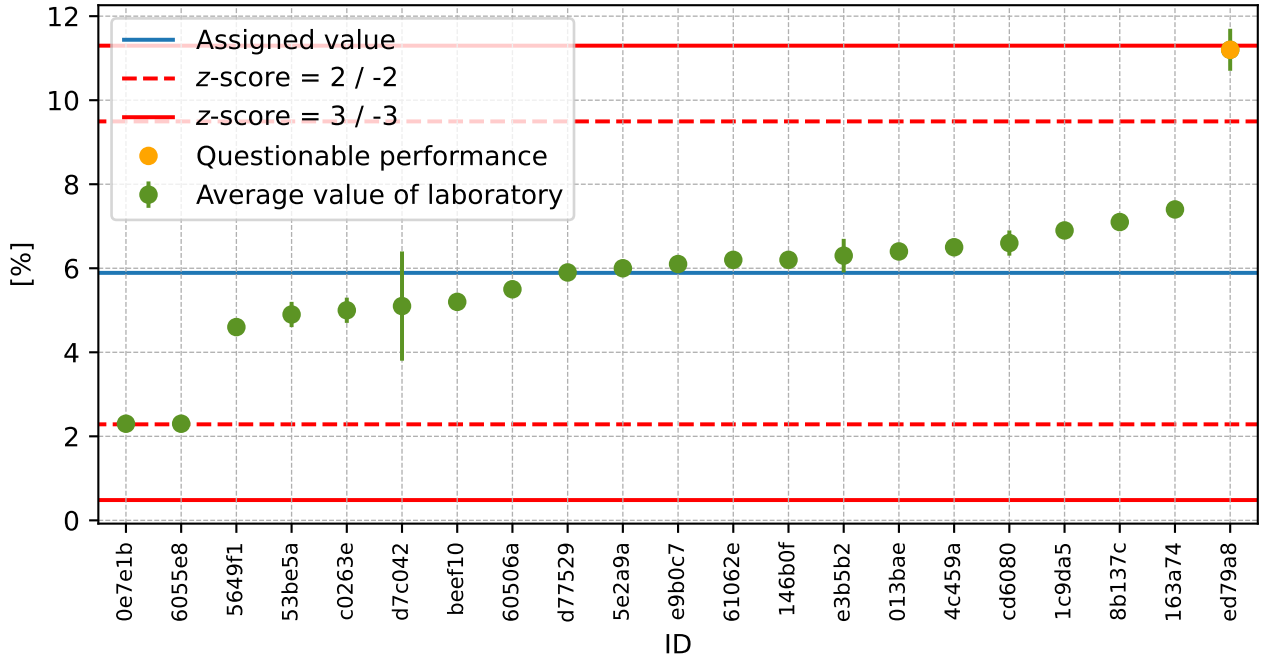

Figure 120: Average values and extended uncertainties of measurement

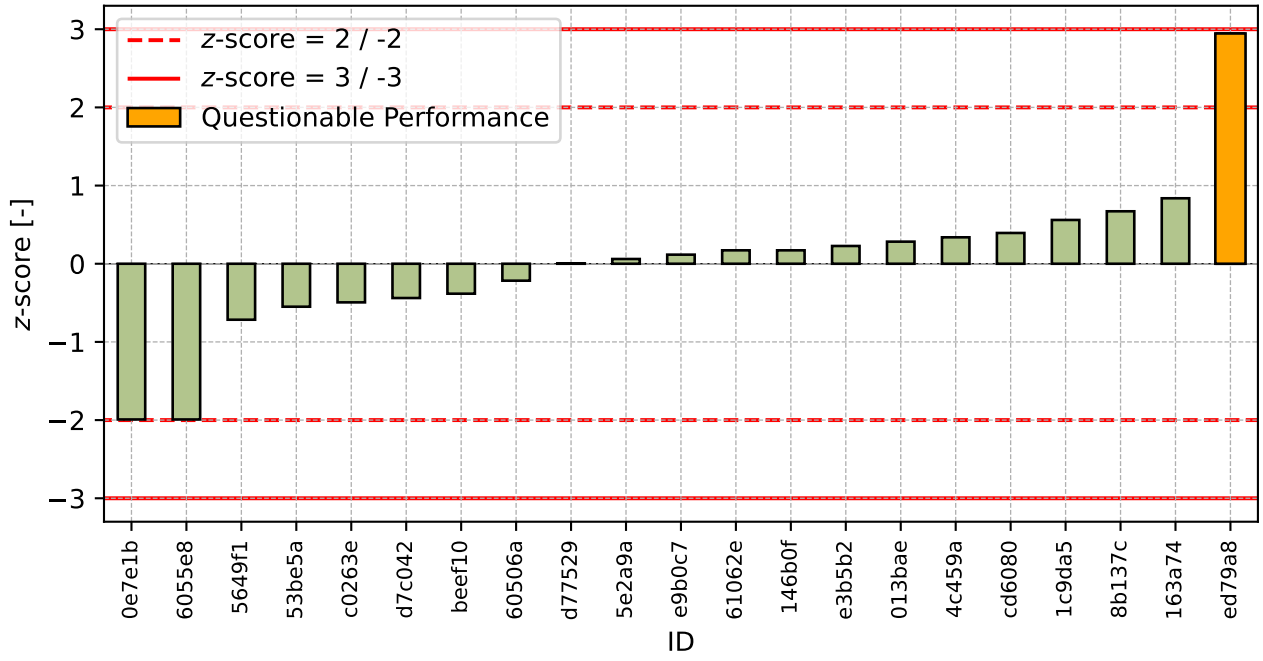

Figure 121: z-score

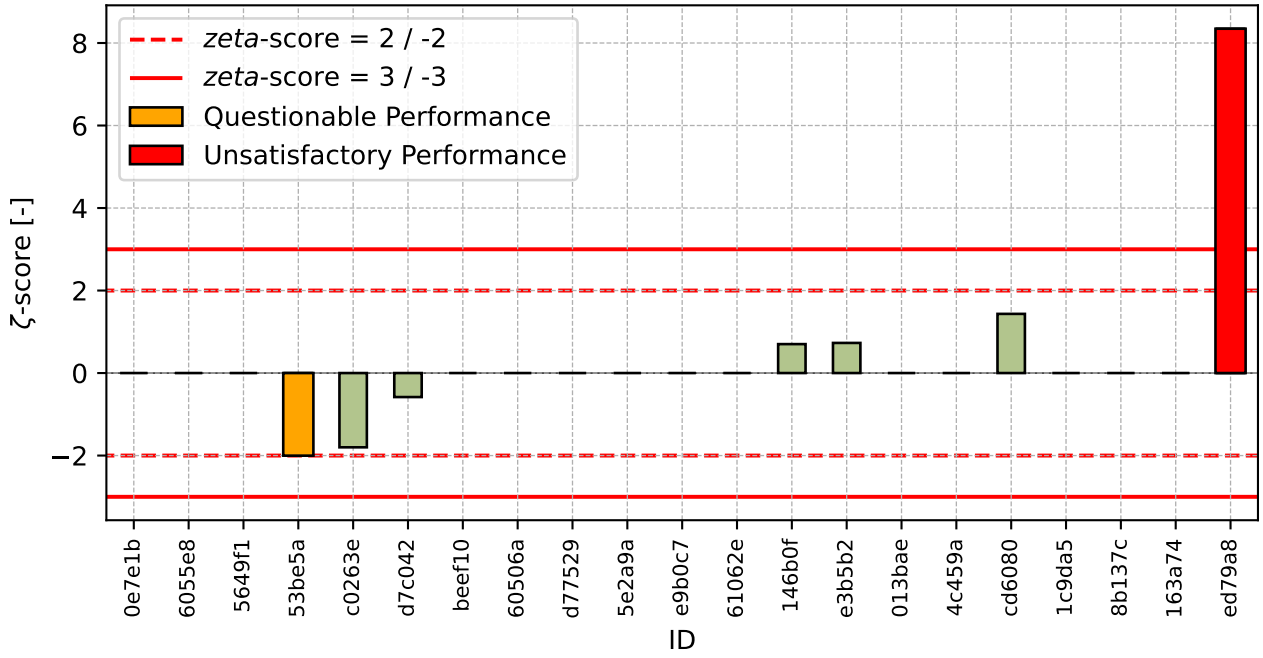

Figure 122: ζ-score

Table 55: z-score and ζ-score

ID	z-score [-]	ζ-score [-]
0e7e1b	-1.99	-
6055e8	-1.99	-
5649f1	-0.72	-
53be5a	-0.55	-2.00
c0263e	-0.49	-1.80
d7c042	-0.44	-0.58
beef10	-0.38	-
60506a	-0.22	-
d77529	0.01	-
5e2a9a	0.06	-
e9b0c7	0.12	-
61062e	0.17	-
146b0f	0.17	0.70
e3b5b2	0.23	0.73
013bae	0.28	-
4c459a	0.34	-
cd6080	0.39	1.43
1c9da5	0.56	-
8b137c	0.67	-
163a74	0.84	-
ed79a8	2.95	8.35

11 Appendix – EN 12697-12, -23 ITSR – Resistance to water sensitivity (Method A)

11.1 Mean indirect tensile strength of dry specimens (ITSd)

11.1.1 Test results

Table 56: Test results – ordered by average value. Outliers are marked by red color. u_X – extended uncertainty of measurement.

ID	Result [%]	u_X [%]
ed79a8	669	80.0
53be5a	850	198.0
ca9a2f	1073	-
1c9da5	1234	-
cec3ca	1403	-
c32a3e	1430	7.0
56ba54	1475	-
163a74	1486	-
b40e75	1498	59.9

11.1.2 The Numerical Procedure for Determining Outliers

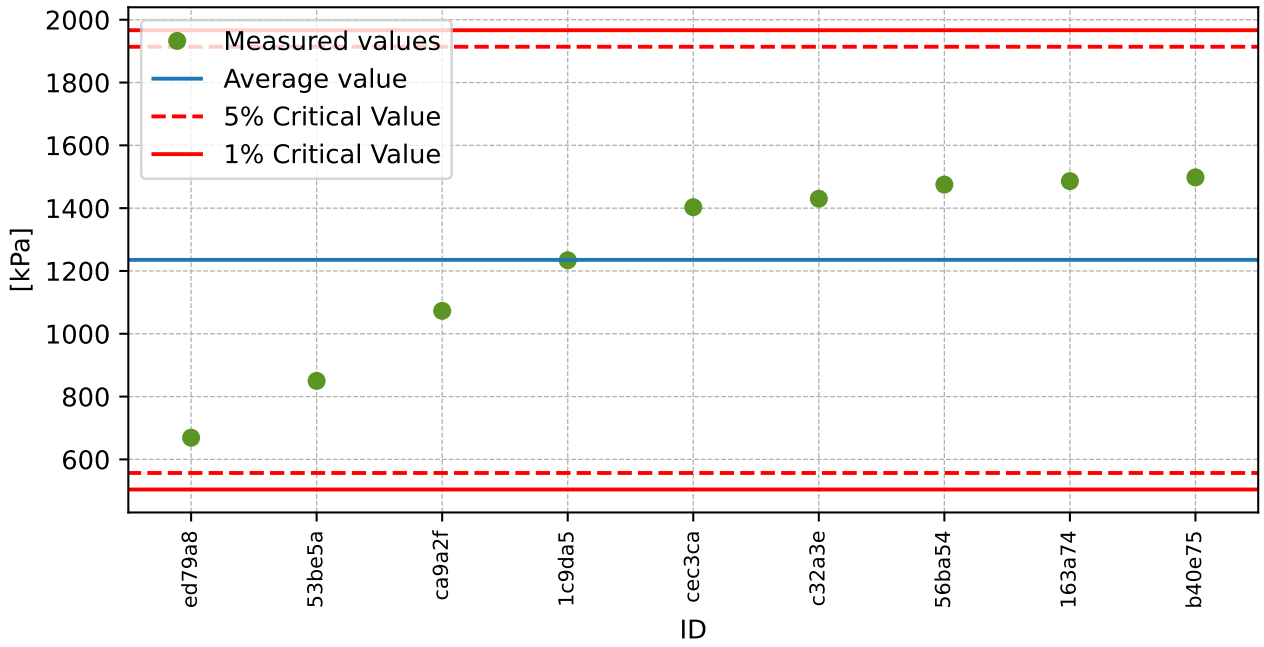

Figure 123: **Grubbs' test** - average values

11.1.3 Mandel's Statistics

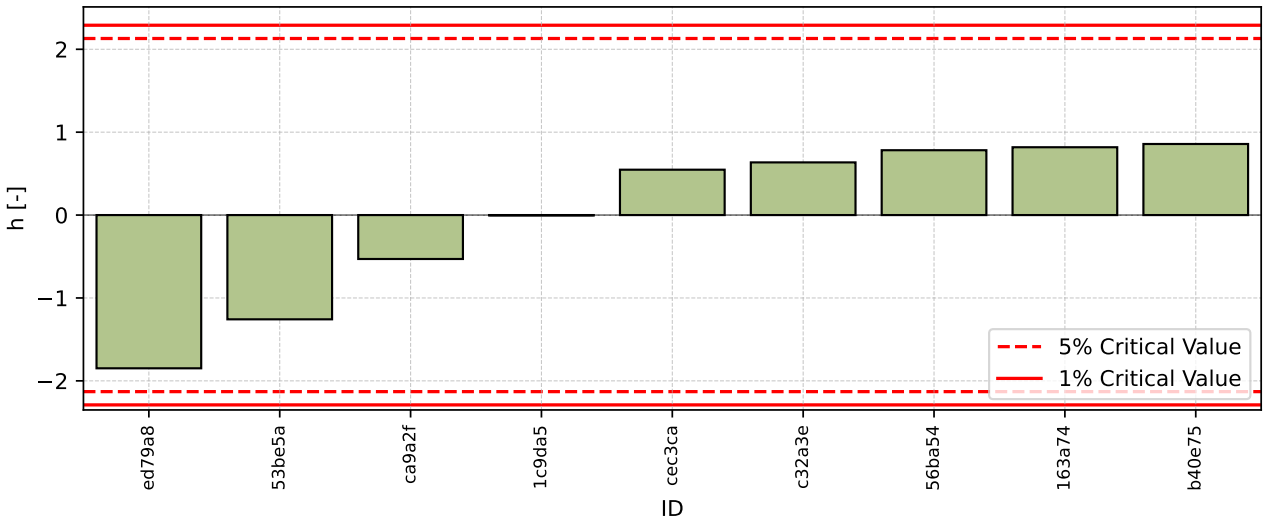

Figure 124: Interlaboratory Consistency Statistic

11.1.4 Descriptive statistics

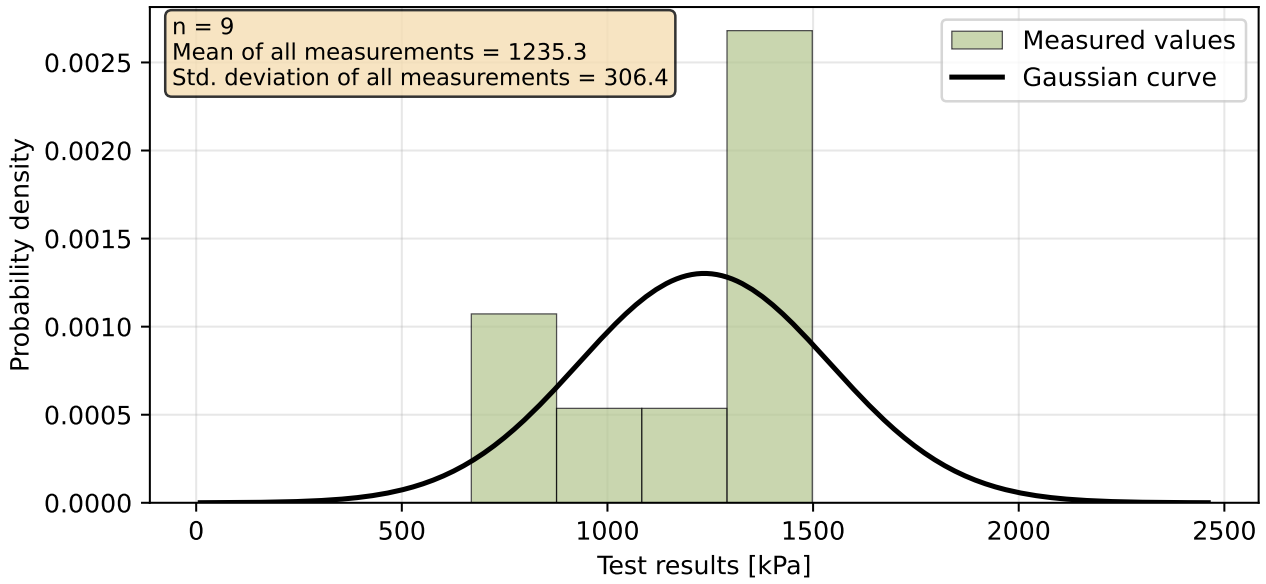

Figure 125: Histogram of all test results

Table 57: Descriptive statistics

Characteristics	[%]
Average value – $\bar{x}$	1235.3
Sample standard deviation – s	306.4
Assigned value – x^*	1235.3
Robust standard deviation – s^*	306.4
Measurement uncertainty of assigned value – u_X	102.1
p-value of normality test [-]	0.053

11.1.5 Evaluation of Performance Statistics

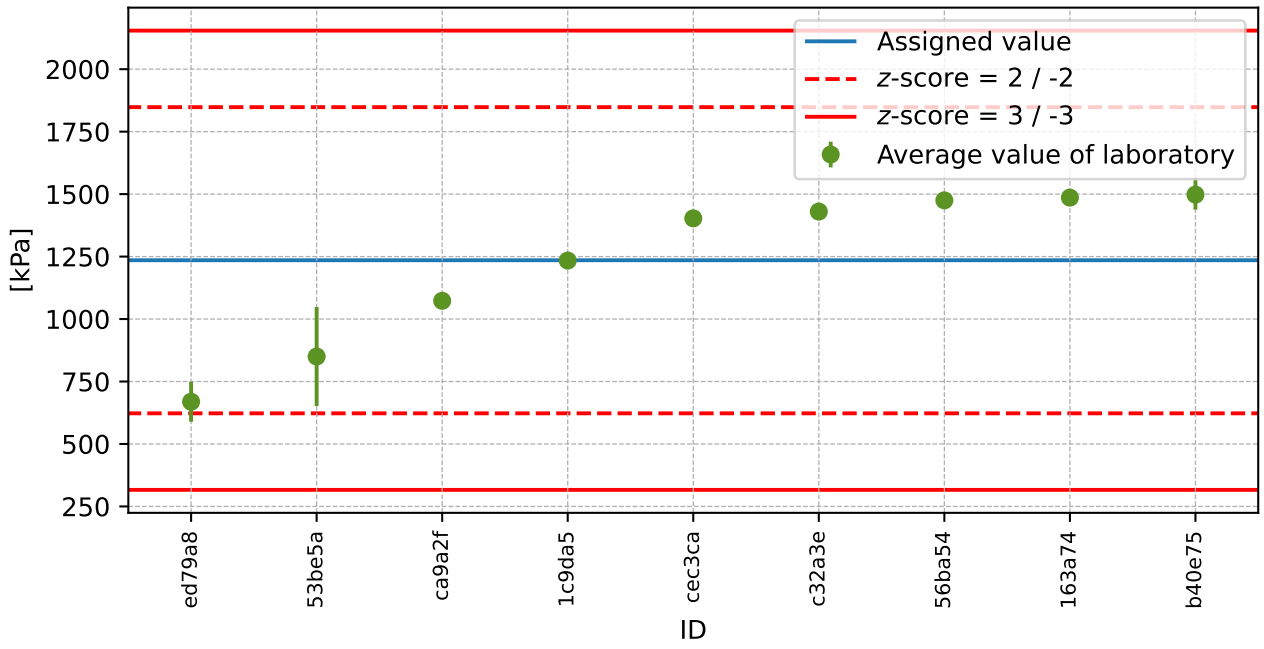

Figure 126: Average values and extended uncertainties of measurement

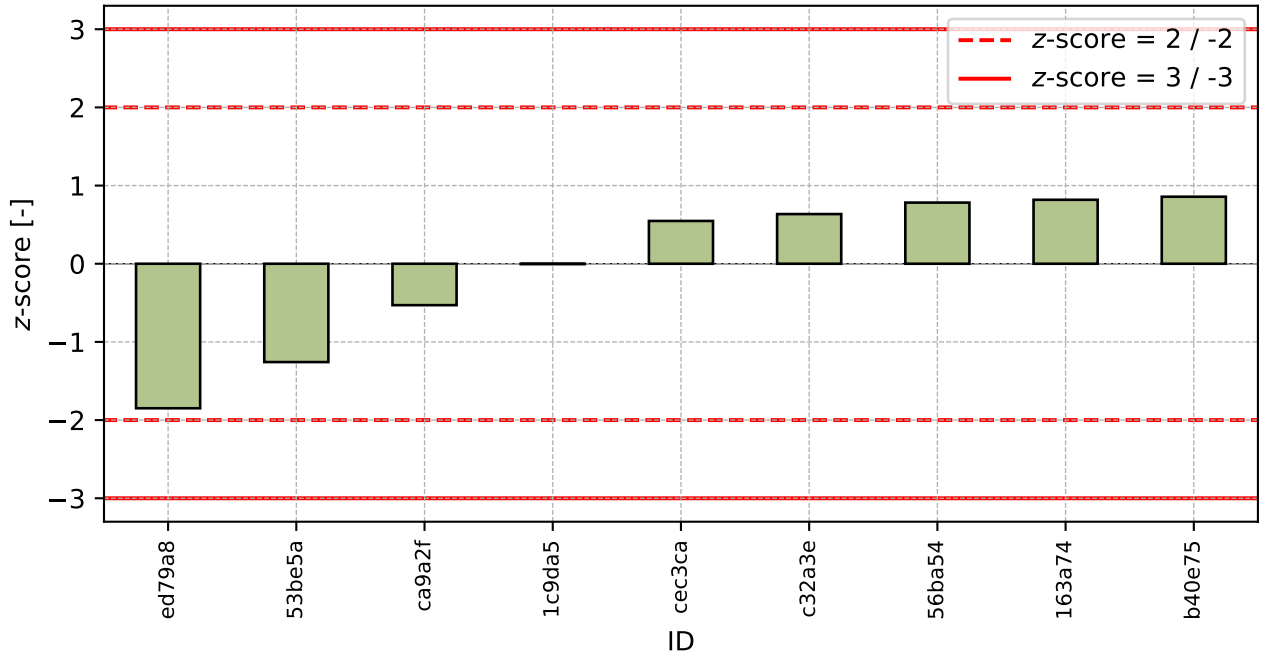

Figure 127: z-score

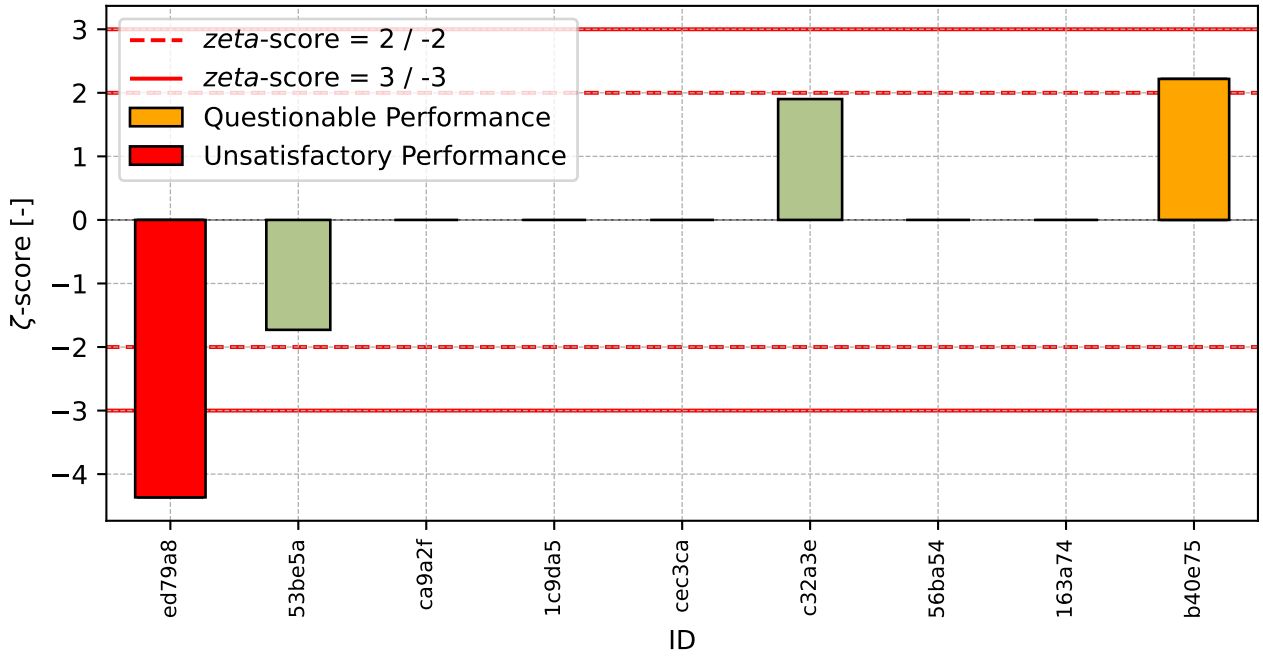

Figure 128: ζ-score

Table 58: z-score and ζ-score

ID	z-score [-]	ζ-score [-]
ed79a8	-1.85	-4.37
53be5a	-1.26	-1.73
ca9a2f	-0.53	-
1c9da5	-0.00	-
cec3ca	0.55	-
c32a3e	0.64	1.90
56ba54	0.78	-
163a74	0.82	-
b40e75	0.86	2.22

11.2 Mean indirect tensile strength of wet specimens (ITSw)

11.2.1 Test results

Table 59: Test results – ordered by average value. Outliers are marked by red color. u_X – extended uncertainty of measurement.

ID	Result [kPa]	u_X [kPa]
ed79a8	529	80.0
53be5a	723	198.0
ca9a2f	906	-
cec3ca	1231	-
c32a3e	1250	7.0
b40e75	1283	51.3
56ba54	1348	-
163a74	1352	-
1c9da5	1414	-

11.2.2 The Numerical Procedure for Determining Outliers

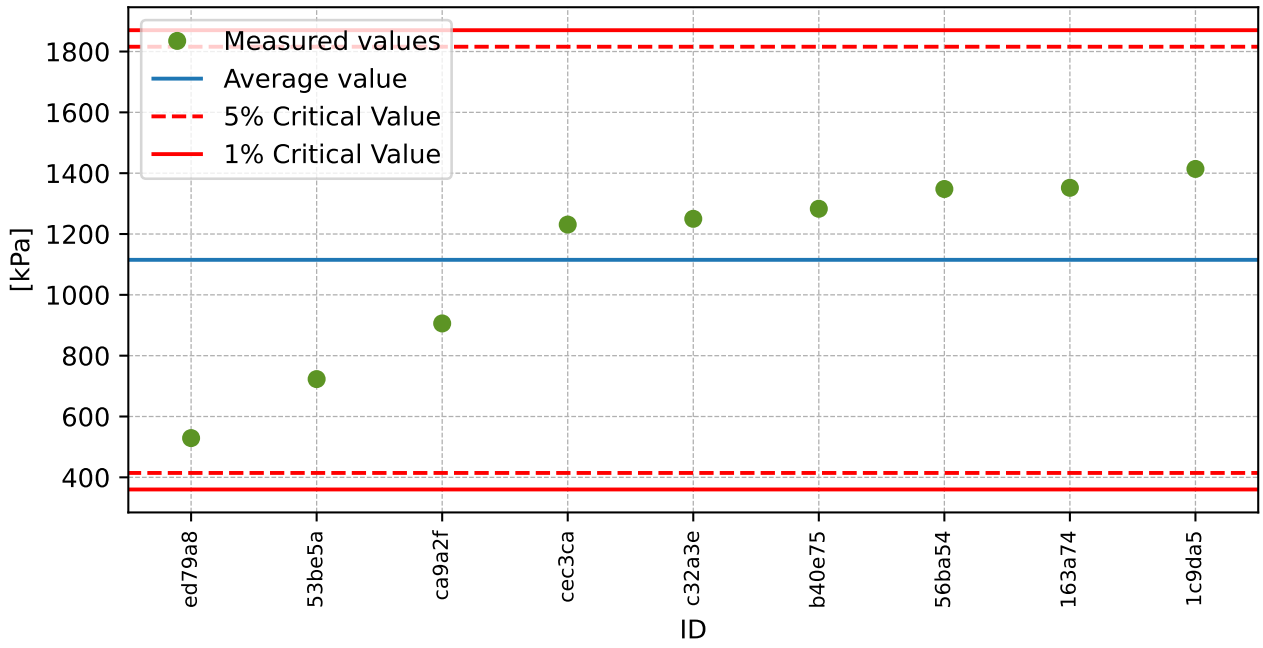

Figure 129: **Grubbs' test** - average values

11.2.3 Mandel's Statistics

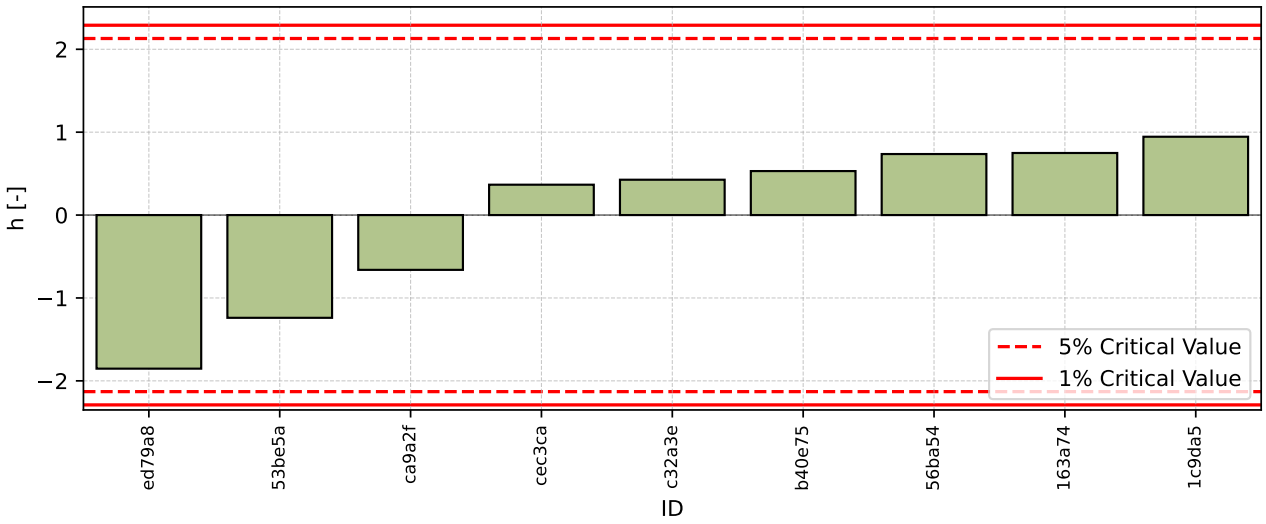

Figure 130: Interlaboratory Consistency Statistic

11.2.4 Descriptive statistics

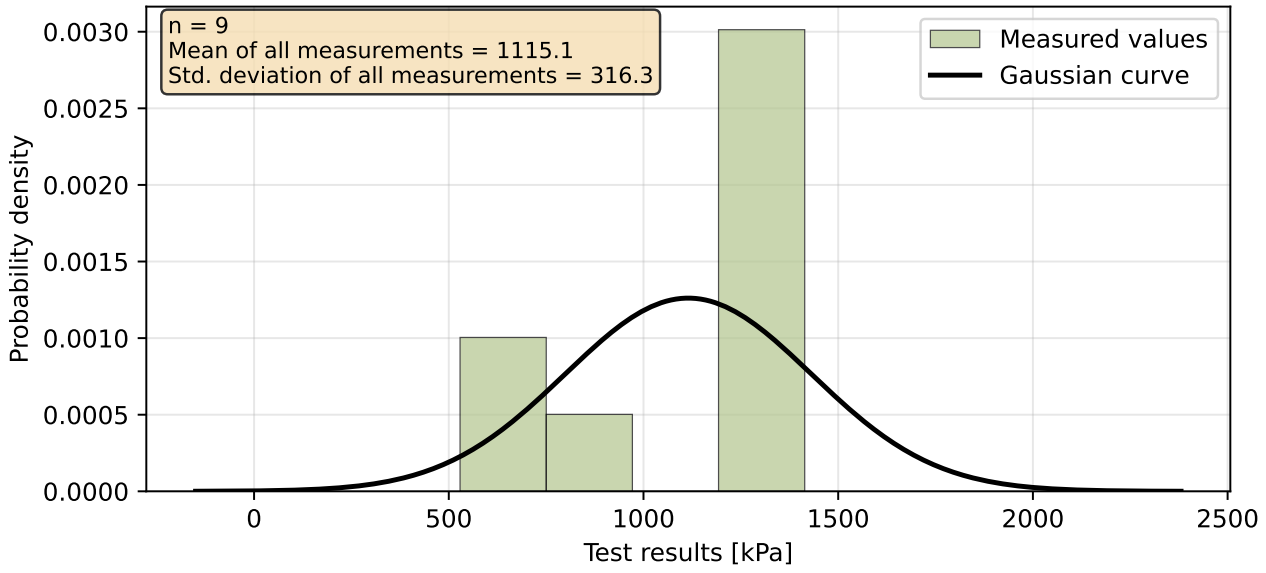

Figure 131: Histogram of all test results

Table 60: Descriptive statistics

Characteristics	[kPa]
Average value – $\bar{x}$	1115.1
Sample standard deviation – s	316.3
Assigned value – x^*	1115.1
Robust standard deviation – s^*	316.3
Measurement uncertainty of assigned value – u_X	105.4
p-value of normality test [-]	0.051

11.2.5 Evaluation of Performance Statistics

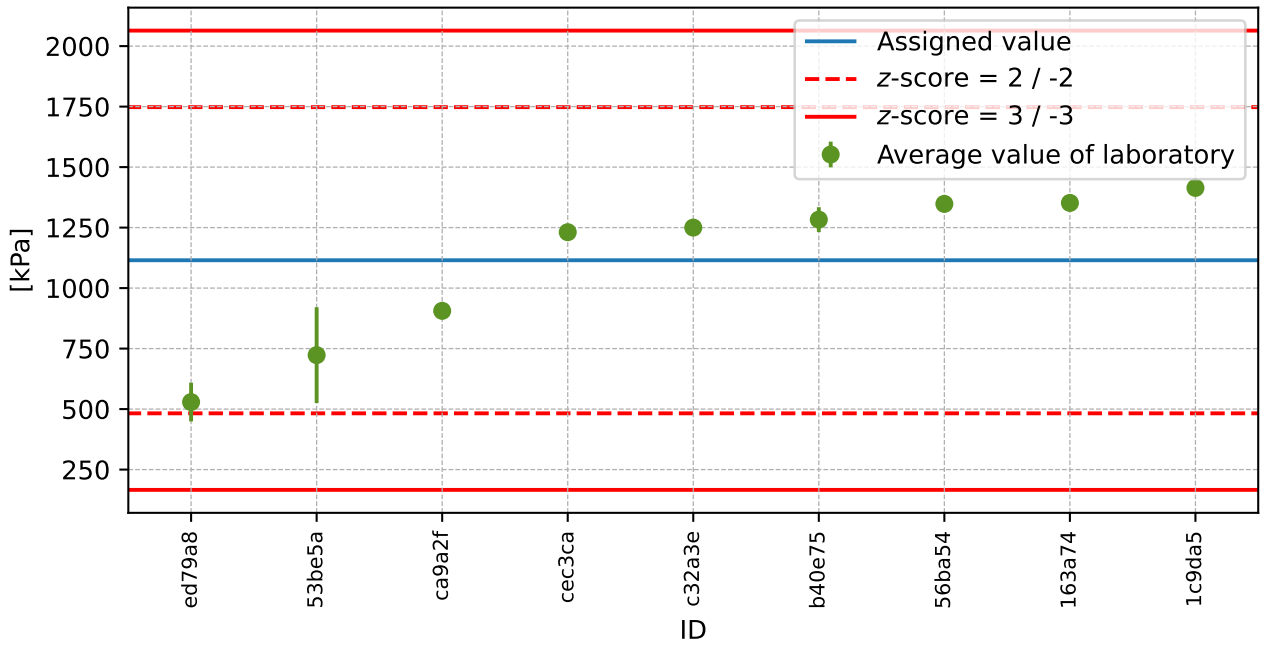

Figure 132: Average values and extended uncertainties of measurement

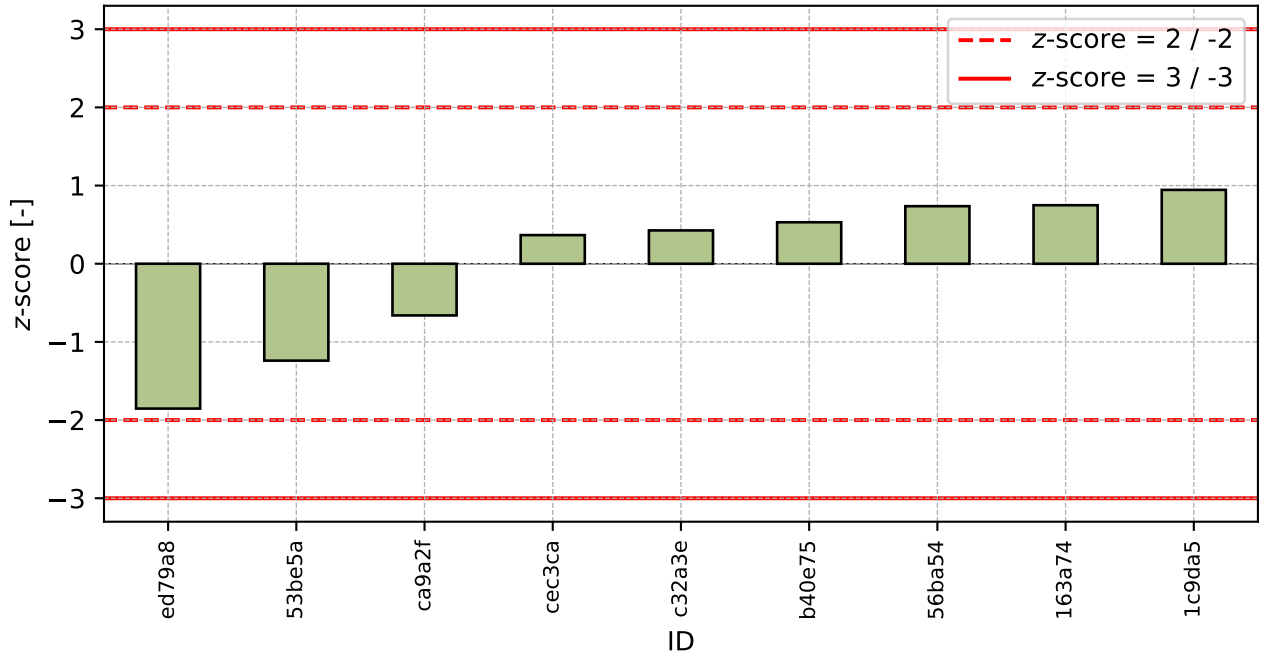

Figure 133: z-score

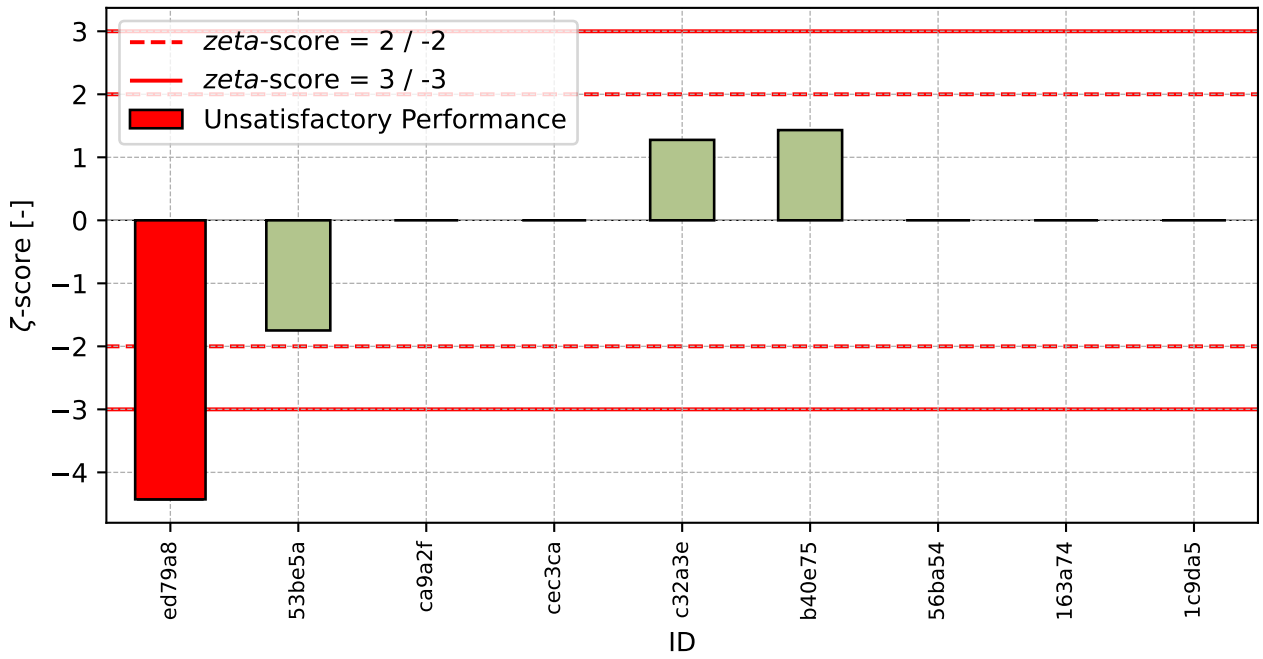

Figure 134: ζ-score

Table 61: z-score and ζ-score

ID	z-score [-]	ζ-score [-]
ed79a8	-1.85	-4.43
53be5a	-1.24	-1.75
ca9a2f	-0.66	-
cec3ca	0.37	-
c32a3e	0.43	1.28
b40e75	0.53	1.43
56ba54	0.74	-
163a74	0.75	-
1c9da5	0.94	-

11.3 ITSR

11.3.1 Test results

Table 62: Test results – ordered by average value. Outliers are marked by red color. u_X – extended uncertainty of measurement.

ID	Result [%]	u_X [%]
ed79a8	79.1	-
ca9a2f	84.0	-
53be5a	85.1	5.40
b40e75	85.7	8.30
1c9da5	87.3	-
c32a3e	87.4	0.40
cec3ca	87.7	-
163a74	91.0	-
56ba54	91.0	-

11.3.2 The Numerical Procedure for Determining Outliers

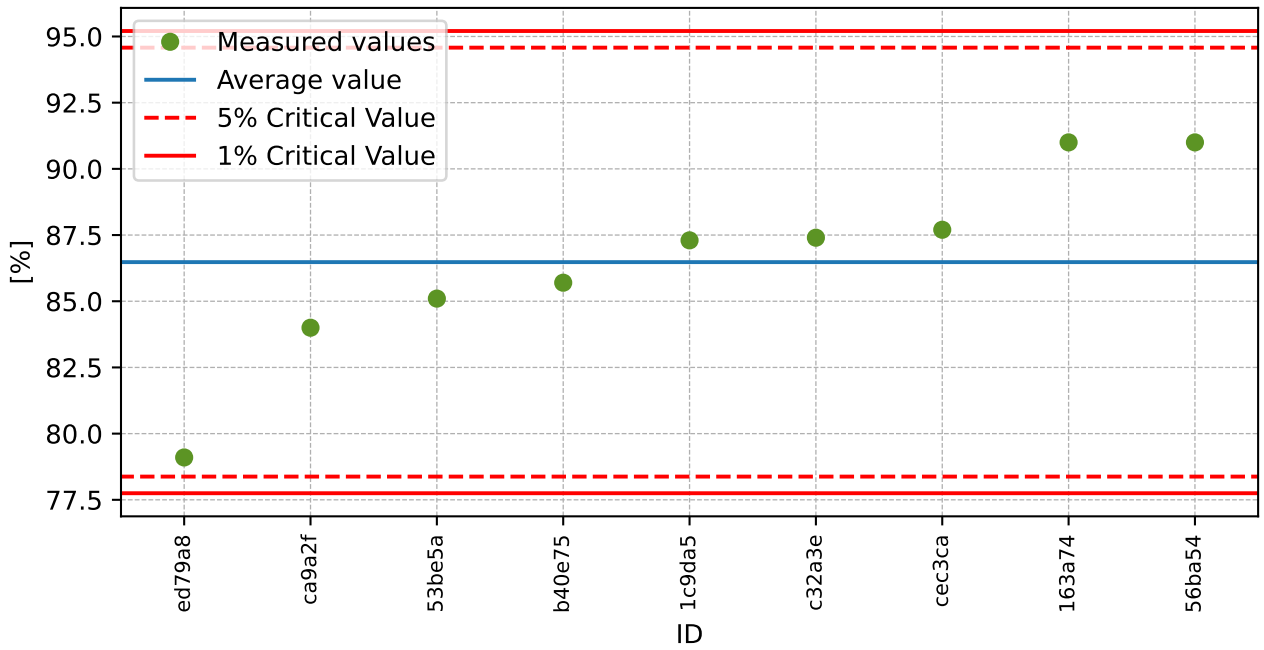

Figure 135: **Grubbs' test** - average values

11.3.3 Mandel's Statistics

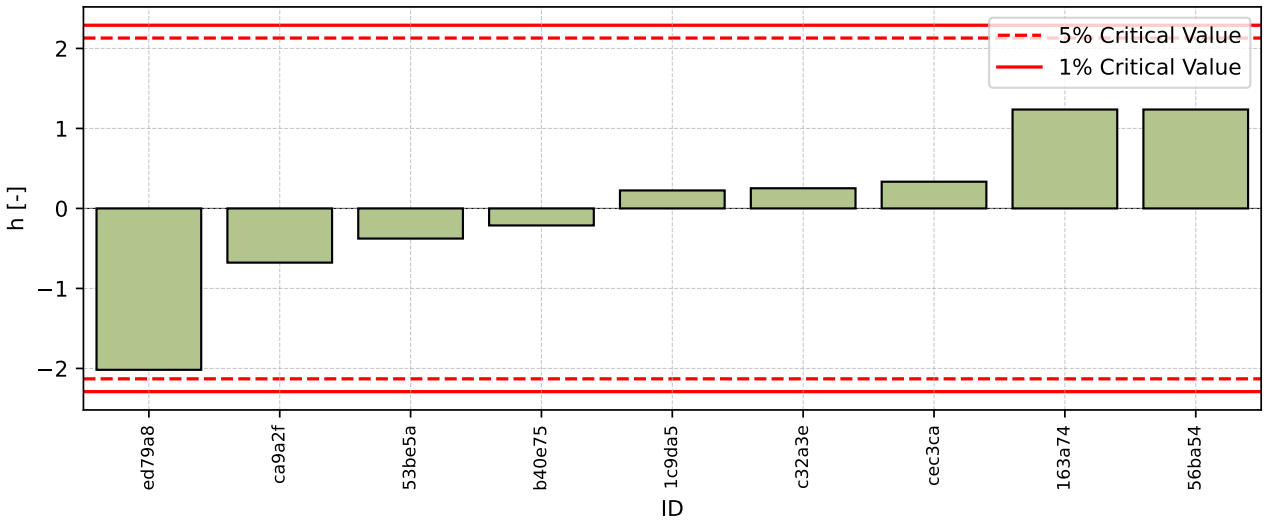

Figure 136: Interlaboratory Consistency Statistic

11.3.4 Descriptive statistics

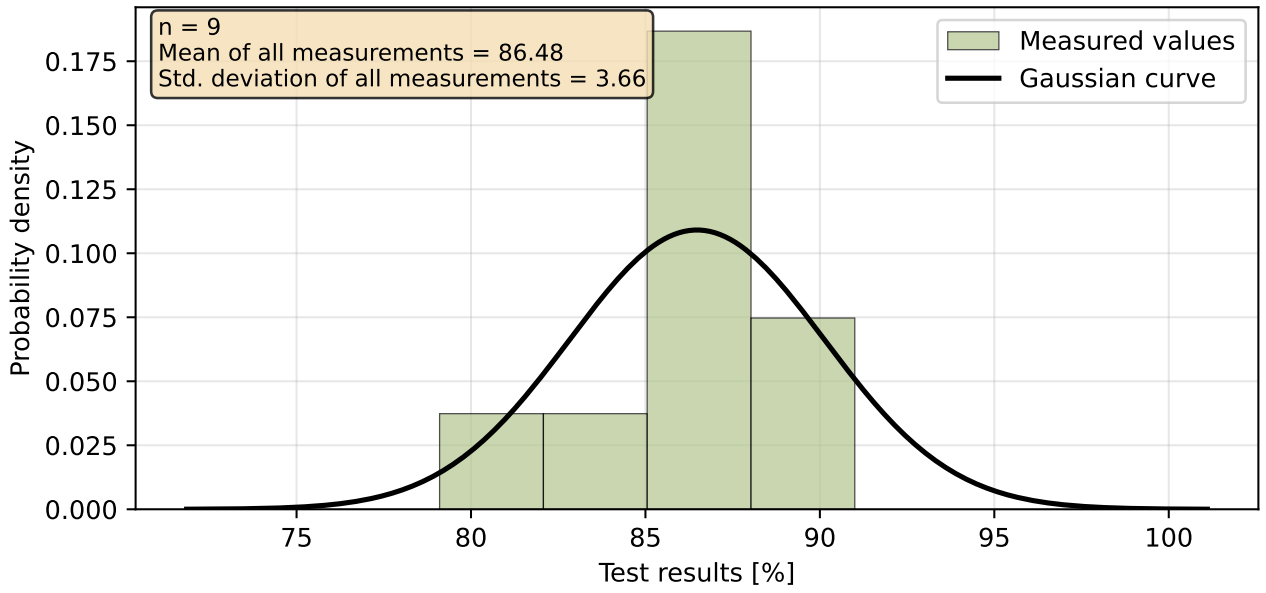

Figure 137: Histogram of all test results

Table 63: Descriptive statistics

Characteristics	[%]
Average value – $\bar{x}$	86.48
Sample standard deviation – s	3.66
Assigned value – x^*	86.48
Robust standard deviation – s^*	3.66
Measurement uncertainty of assigned value – u_X	1.22
p-value of normality test [-]	0.441

11.3.5 Evaluation of Performance Statistics

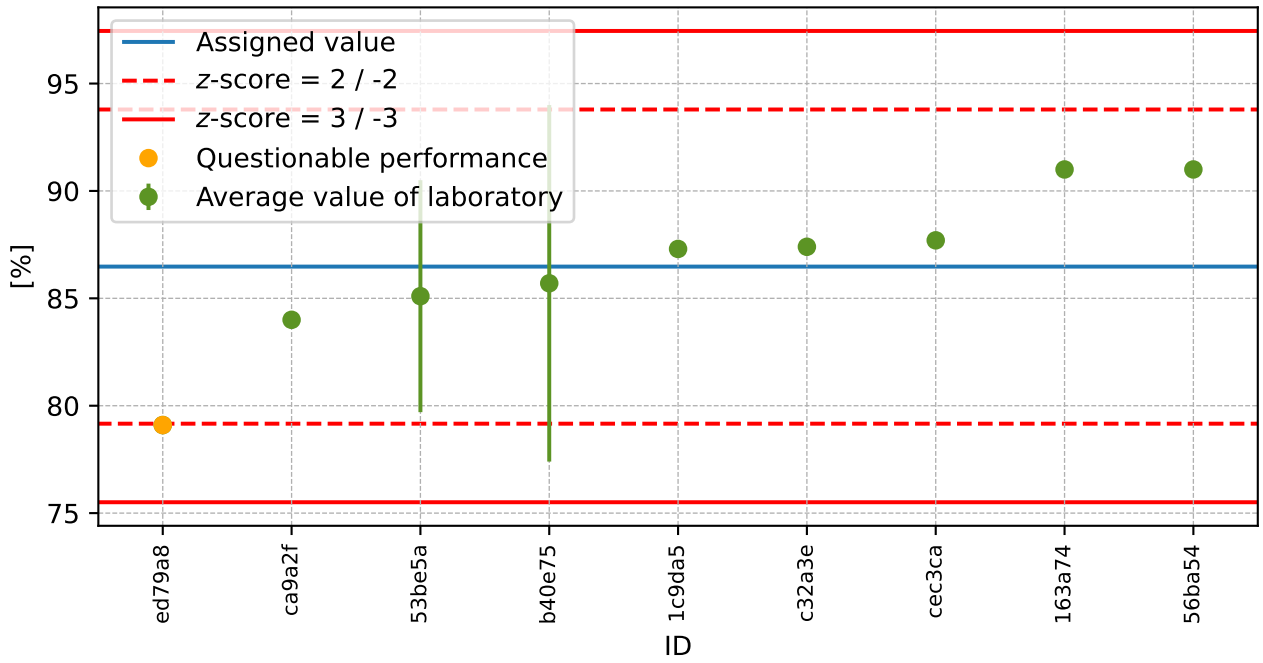

Figure 138: Average values and extended uncertainties of measurement

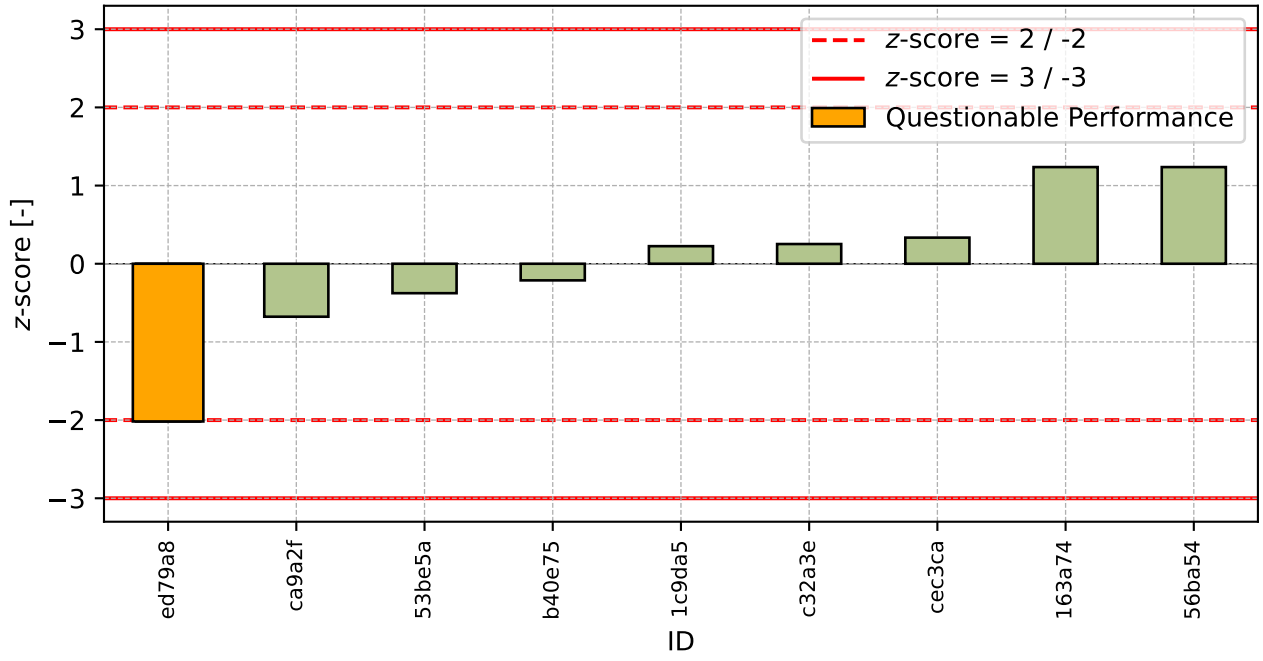

Figure 139: z-score

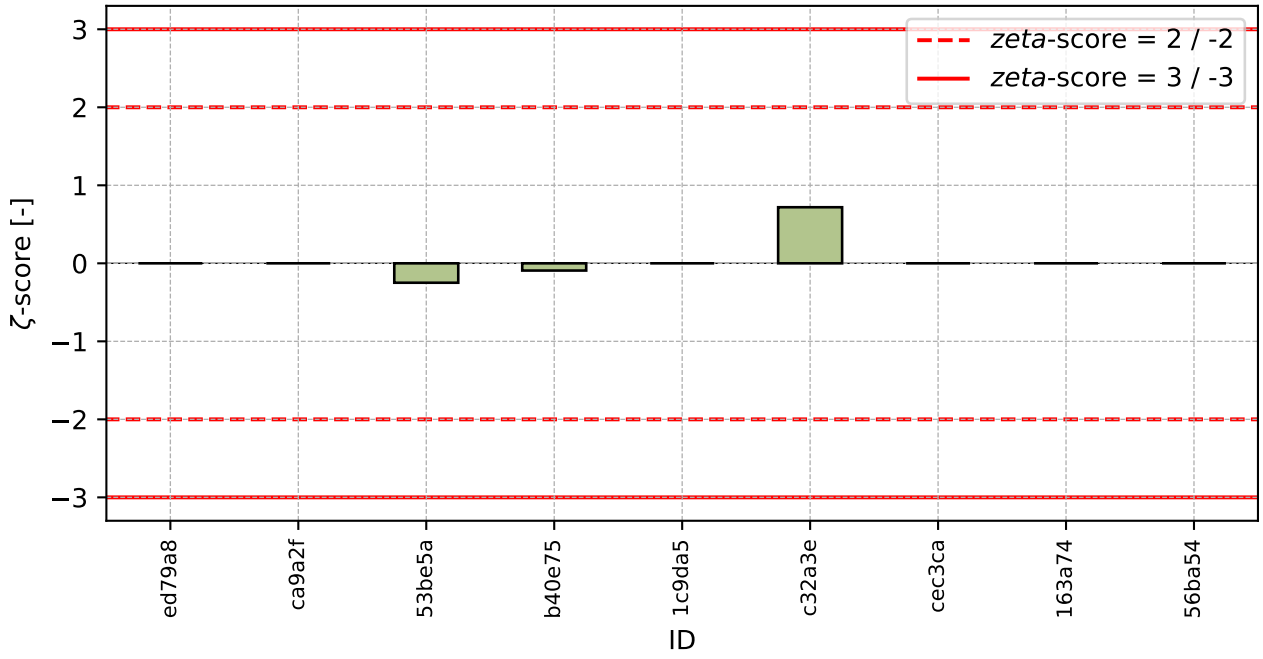

Figure 140: ζ-score

Table 64: z-score and ζ-score

ID	z-score [-]	ζ-score [-]
ed79a8	-2.02	-
ca9a2f	-0.68	-
53be5a	-0.38	-0.25
b40e75	-0.21	-0.09
1c9da5	0.22	-
c32a3e	0.25	0.72
cec3ca	0.33	-
163a74	1.24	-
56ba54	1.24	-

12 Appendix – EN 12697-18 Determination of binder drainage – Beaker method

12.1 Test results

Table 65: Test results – ordered by average value. Outliers are marked by red color. Columns 1–2 are individual determinations; u_X – extended uncertainty of measurement; $\bar{x}$ – average value; s_0 – sample standard deviation; V_X – variation coefficient

ID	1 [%]	2 [%]	u_X [%]	$\bar{x}$ [%]	s_0 [%]	V_X [%]
d7c042	0.10	0.10	0.030	0.10	0.000	0.00
b1b84e	0.11	0.10	0.050	0.11	0.007	6.73
712769	0.20	0.10	-	0.15	0.071	47.14
1c9da5	0.19	0.20	-	0.20	0.007	3.63
f8b2f6	0.20	0.20	-	0.20	0.000	0.00
5e2f75	0.24	0.16	0.400	0.20	0.057	28.28
c32a3e	0.19	0.21	0.030	0.20	0.014	7.07
cec3ca	0.20	0.20	-	0.20	0.000	0.00
a415c6	0.20	0.20	-	0.20	0.000	0.00
89a7ea	0.20	0.20	-	0.20	0.000	0.00
4c459a	0.20	0.20	-	0.20	0.000	0.00
5e2a9a	0.20	0.20	-	0.20	0.000	0.00
88c528	0.25	0.22	0.400	0.23	0.021	9.03
99a0db	0.30	0.30	-	0.30	0.000	0.00
5164dd	0.33	0.33	0.400	0.33	0.000	0.00

12.2 The Numerical Procedure for Determining Outliers

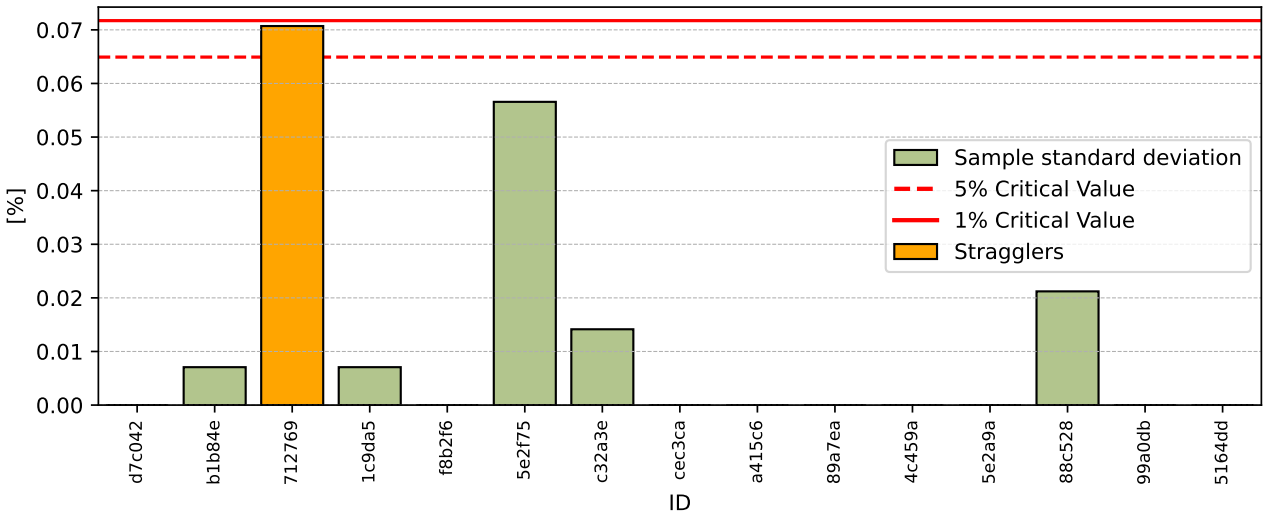

Figure 141: **Cochran's test** - sample standard deviations

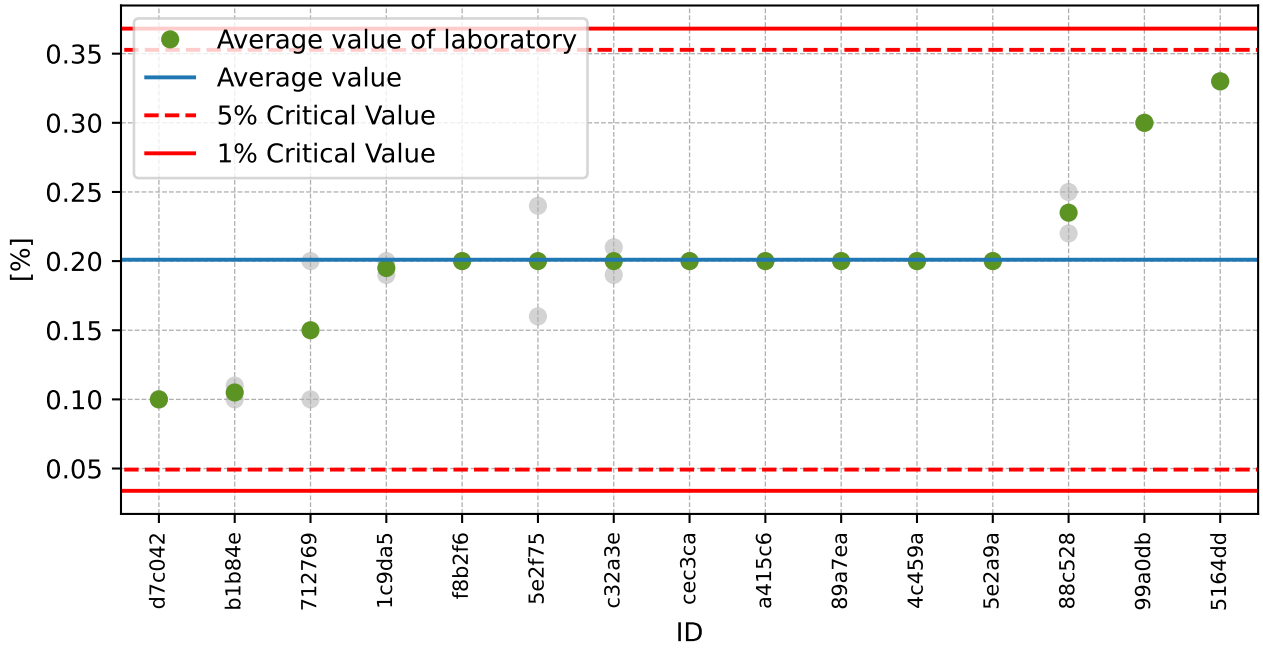

Figure 142: **Grubbs' test** - average values

12.3 Mandel's Statistics

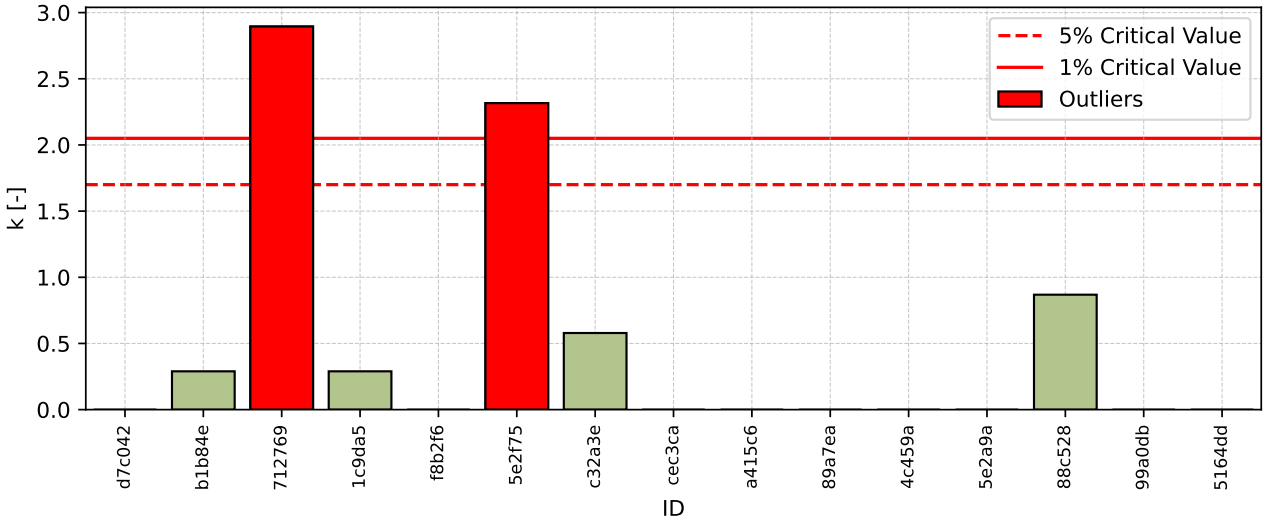

Figure 143: Intralaboratory Consistency Statistic

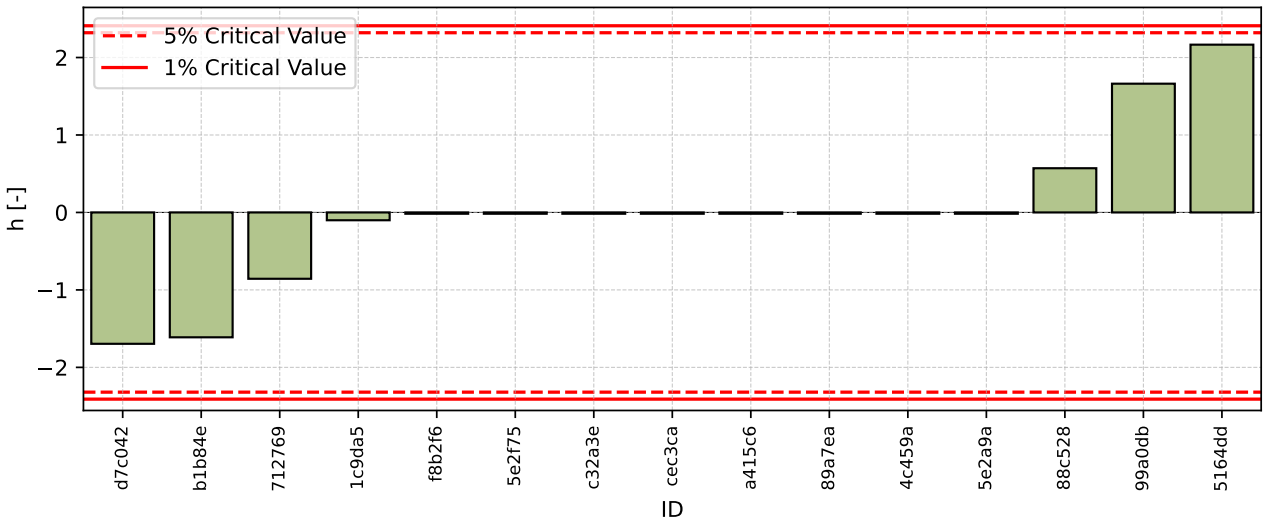

Figure 144: Interlaboratory Consistency Statistic

12.4 Descriptive statistics

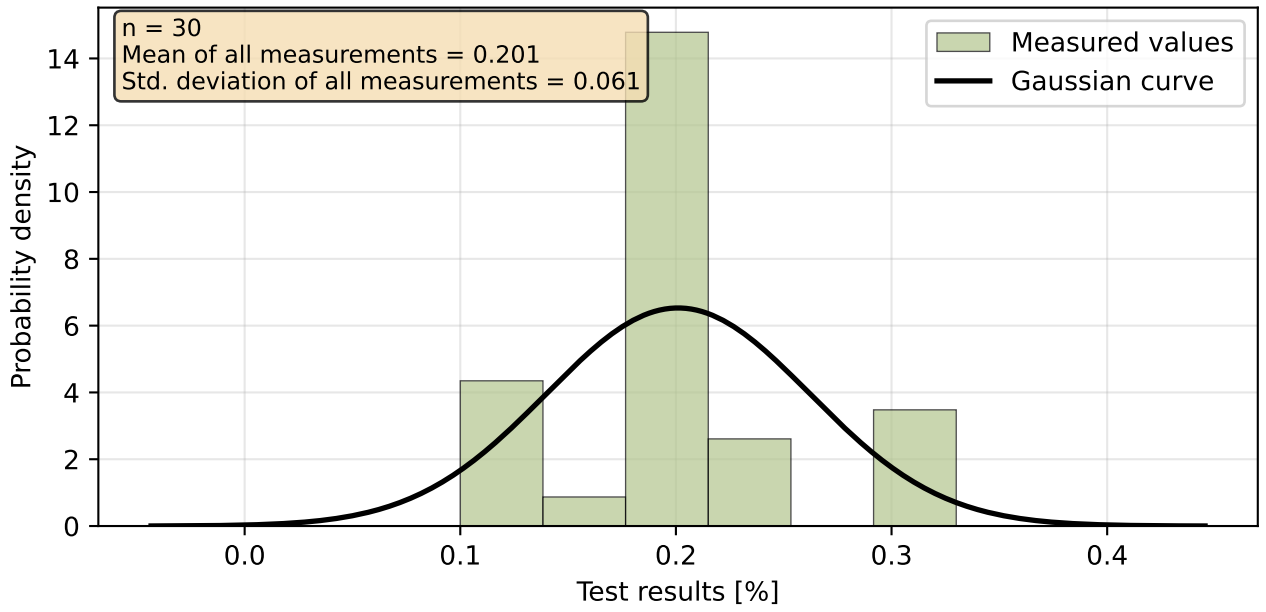

Figure 145: Histogram of all test results

Table 66: Descriptive statistics

Characteristics	[%]
Average value – $\bar{x}$	0.201
Sample standard deviation – s	0.060
Assigned value – x^*	0.201
Robust standard deviation – s^*	0.060
Measurement uncertainty of assigned value – u_X	0.015
p-value of normality test [-]	$<$ 0.001
Interlaboratory standard deviation – s_L	0.057
Repeatability standard deviation – s_r	0.024
Reproducibility standard deviation – s_R	0.062
Repeatability – r	0.068
Reproducibility – R	0.174

12.5 Evaluation of Performance Statistics

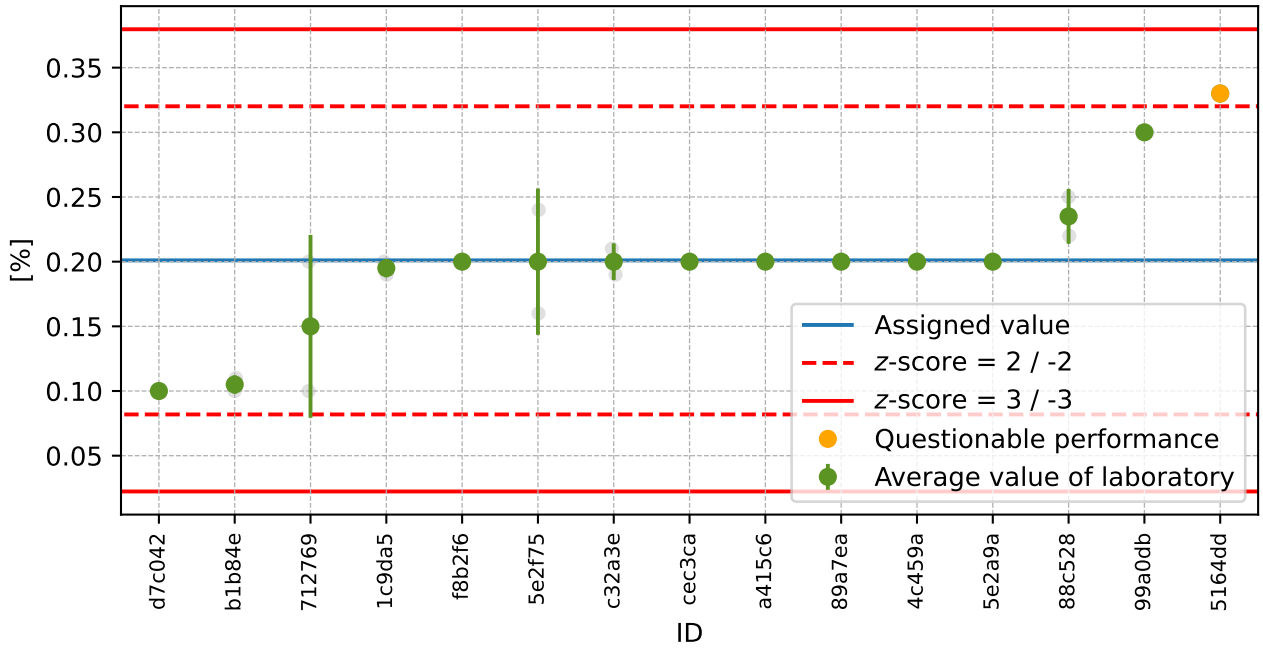

Figure 146: Average values and sample standard deviations

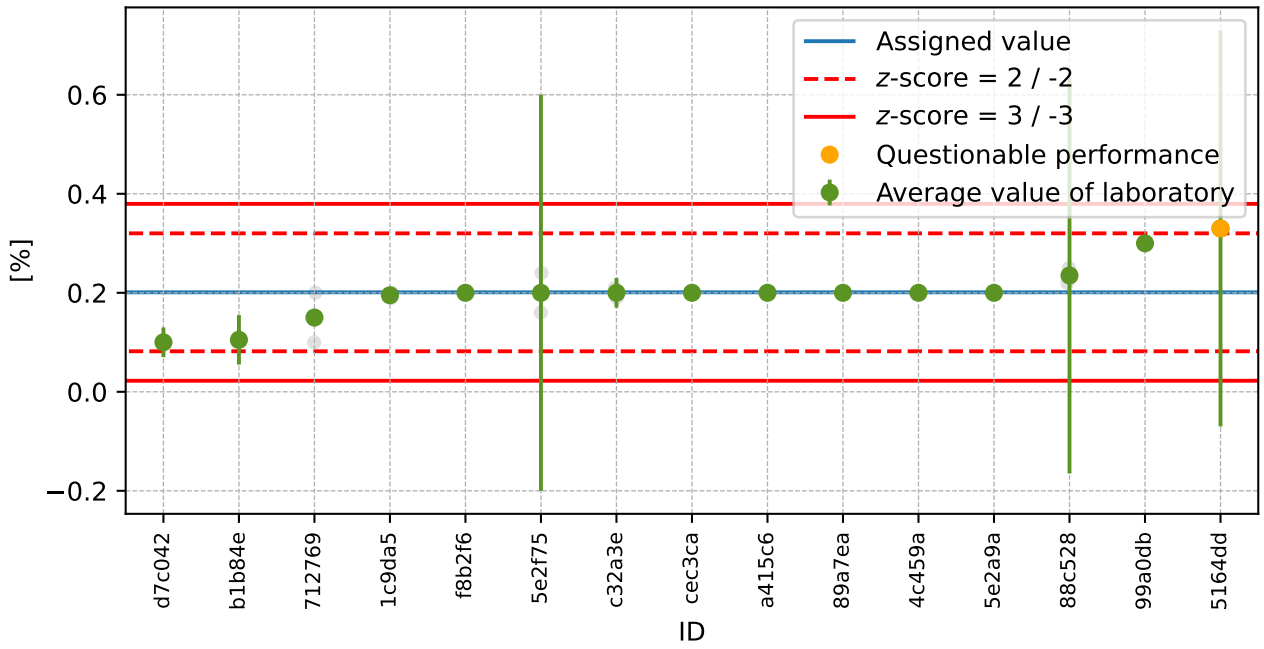

Figure 147: Average values and extended uncertainties of measurement

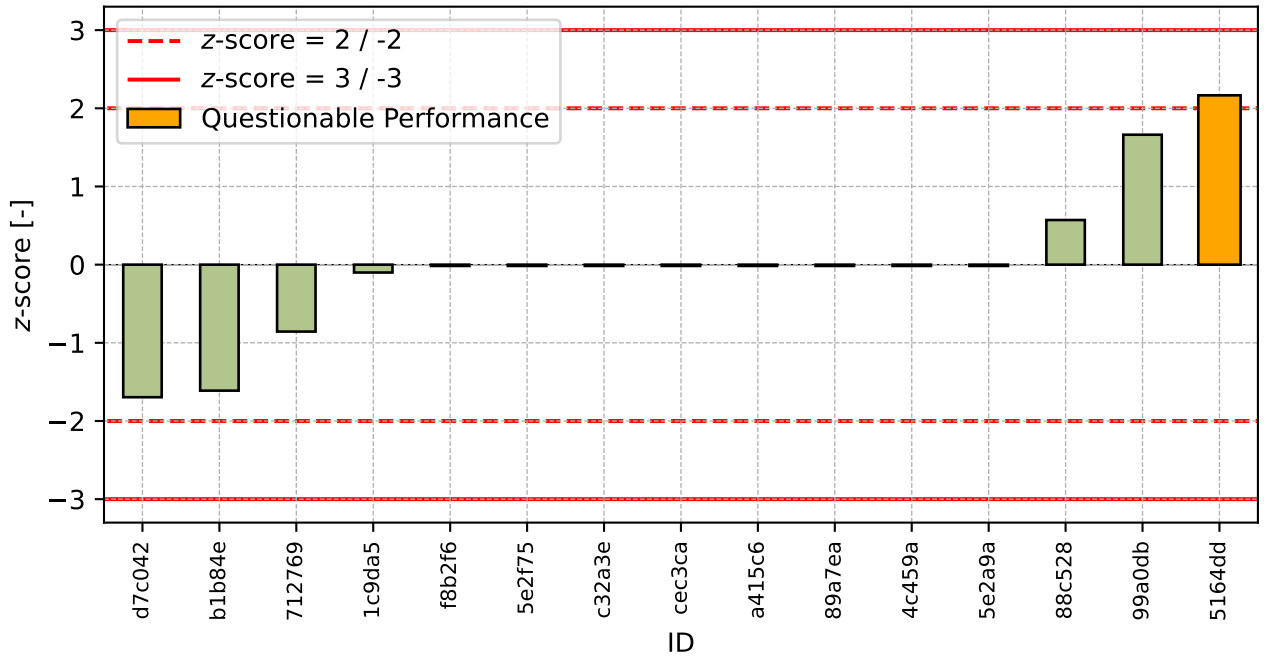

Figure 148: z-score

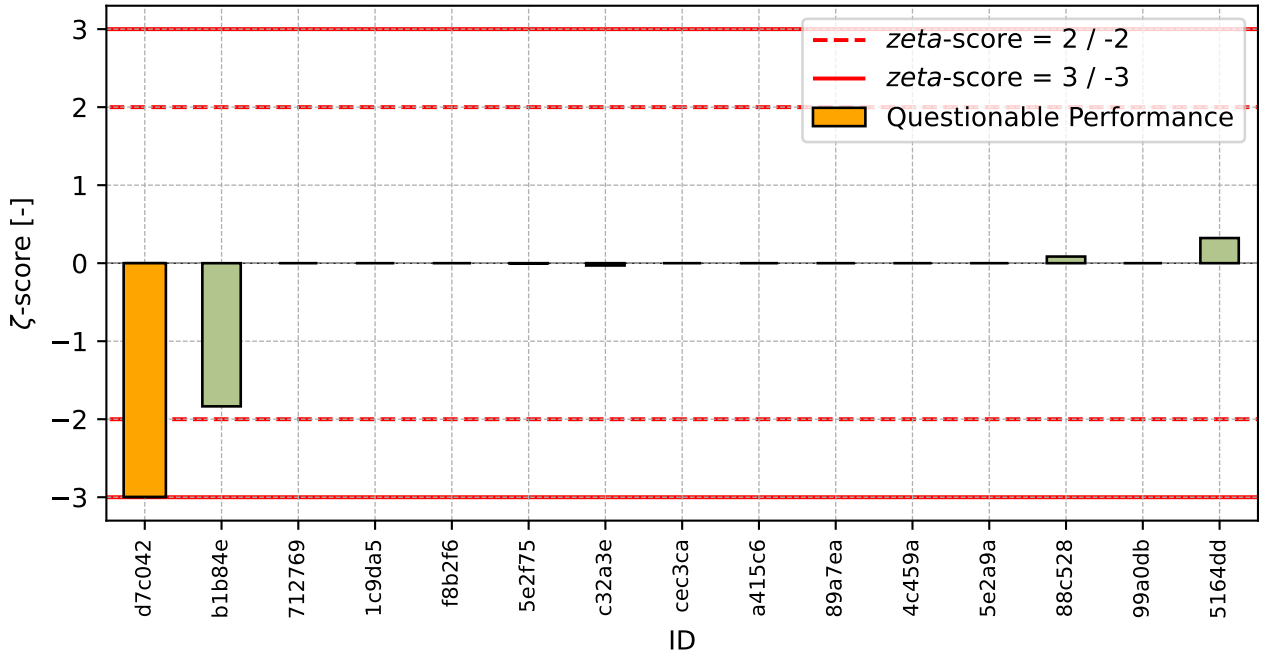

Figure 149: ζ-score

Table 67: z-score and ζ-score

ID	z-score [-]	ζ-score [-]
d7c042	-1.70	-3.00
b1b84e	-1.61	-1.84
712769	-0.86	-
1c9da5	-0.10	-
f8b2f6	-0.02	-
5e2f75	-0.02	-0.00
c32a3e	-0.02	-0.03
cec3ca	-0.02	-
a415c6	-0.02	-
89a7ea	-0.02	-
4c459a	-0.02	-
5e2a9a	-0.02	-
88c528	0.57	0.08
99a0db	1.66	-
5164dd	2.17	0.32

13 Appendix – EN 12697-20 Penetration by pin after 60 min

13.1 Test results

Table 68: Test results – ordered by average value. Outliers are marked by red color. Columns 1–2 are individual determinations; u_X – extended uncertainty of measurement; $\bar{x}$ – average value; s_0 – sample standard deviation; V_X – variation coefficient

ID	1 [mm]	2 [mm]	u_X [mm]	$\bar{x}$ [mm]	s_0 [mm]	V_X [%]
53be5a	0.23	0.21	0.100	0.22	0.014	6.43
b1b84e	0.99	0.97	0.080	0.98	0.014	1.44
c7f8b5	0.92	1.15	-	1.03	0.163	15.71
71ec09	1.87	1.94	-	1.91	0.049	2.60

13.2 The Numerical Procedure for Determining Outliers

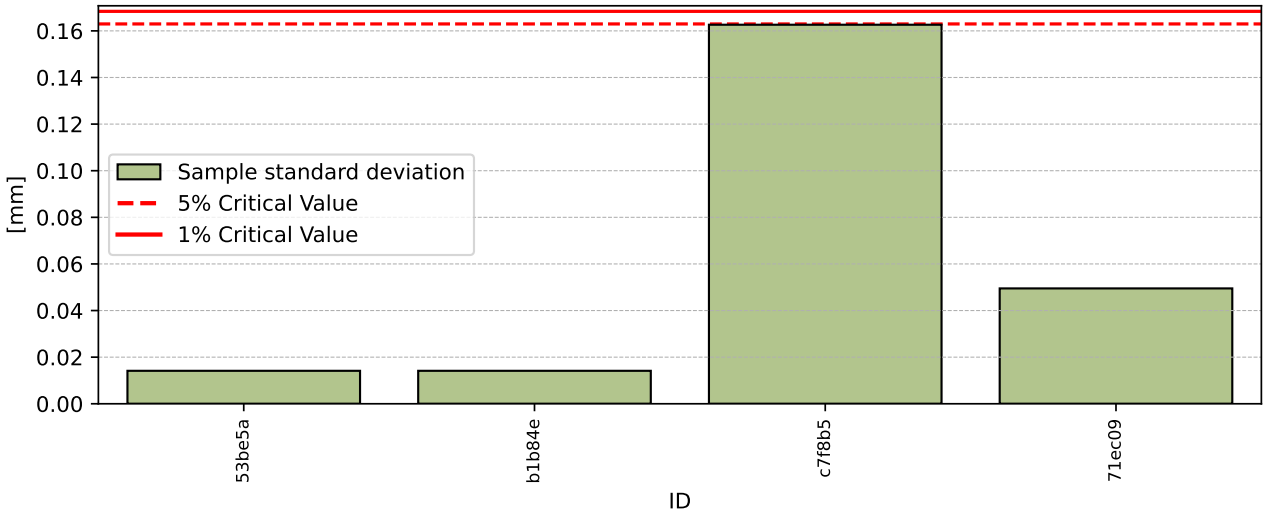

Figure 150: **Cochran's test** - sample standard deviations

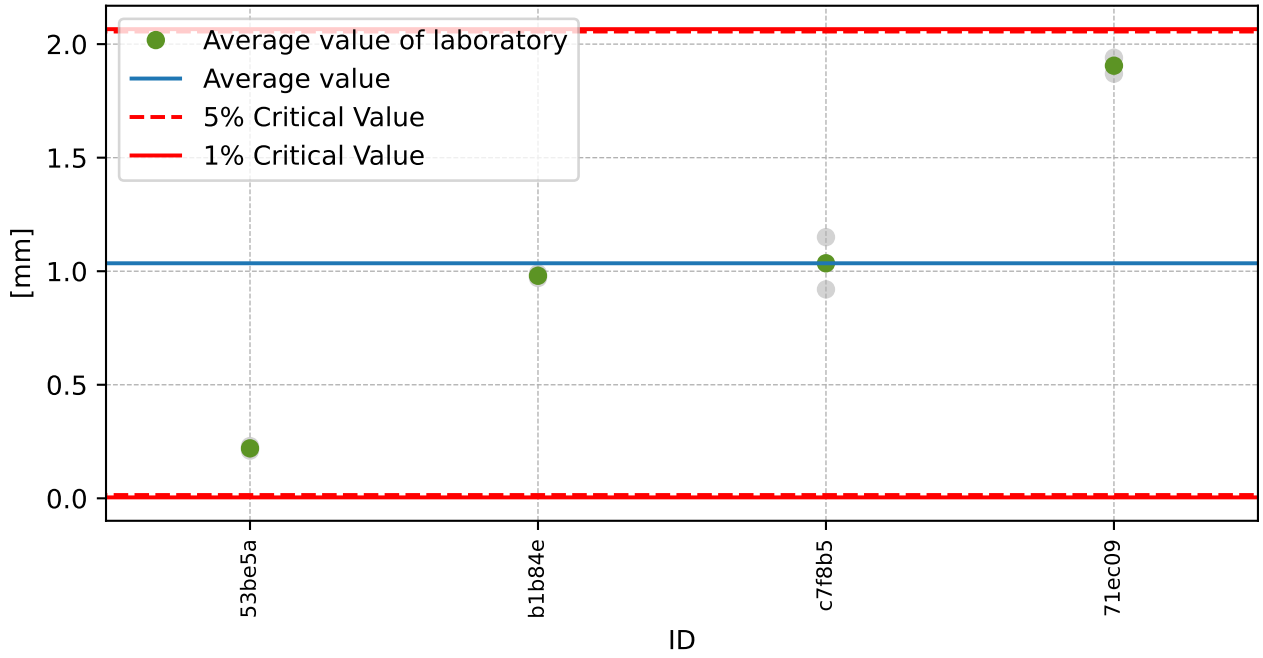

Figure 151: **Grubbs' test** - average values

13.3 Mandel's Statistics

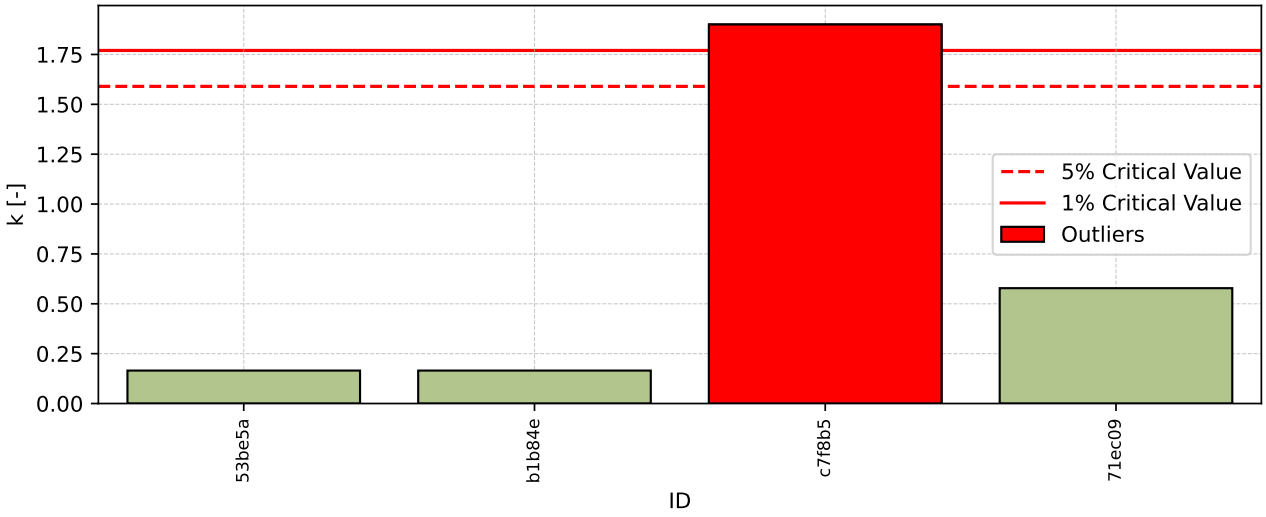

Figure 152: Intralaboratory Consistency Statistic

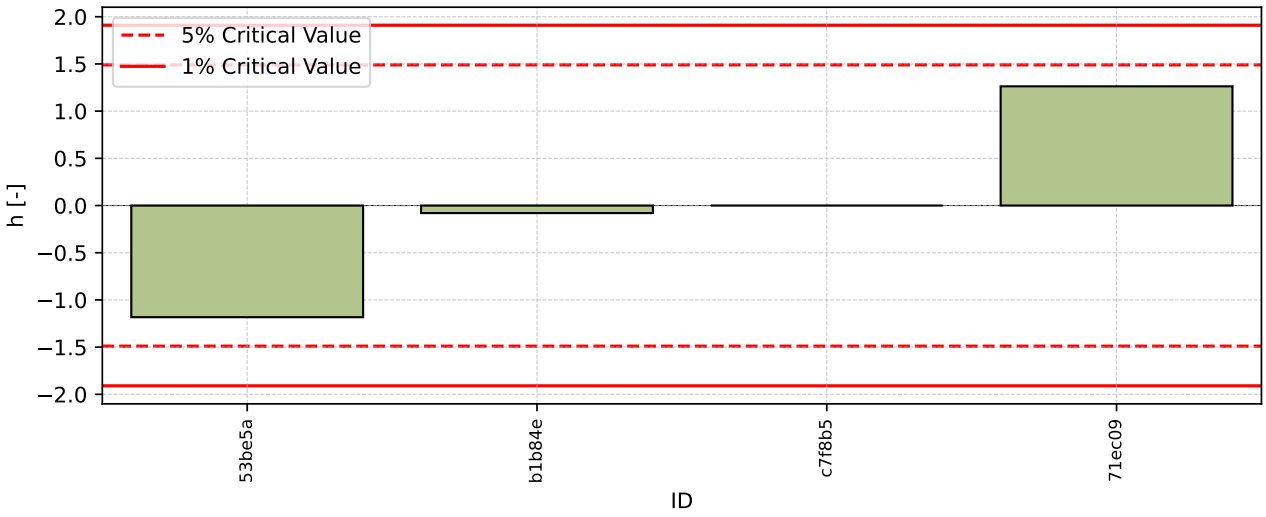

Figure 153: Interlaboratory Consistency Statistic

13.4 Descriptive statistics

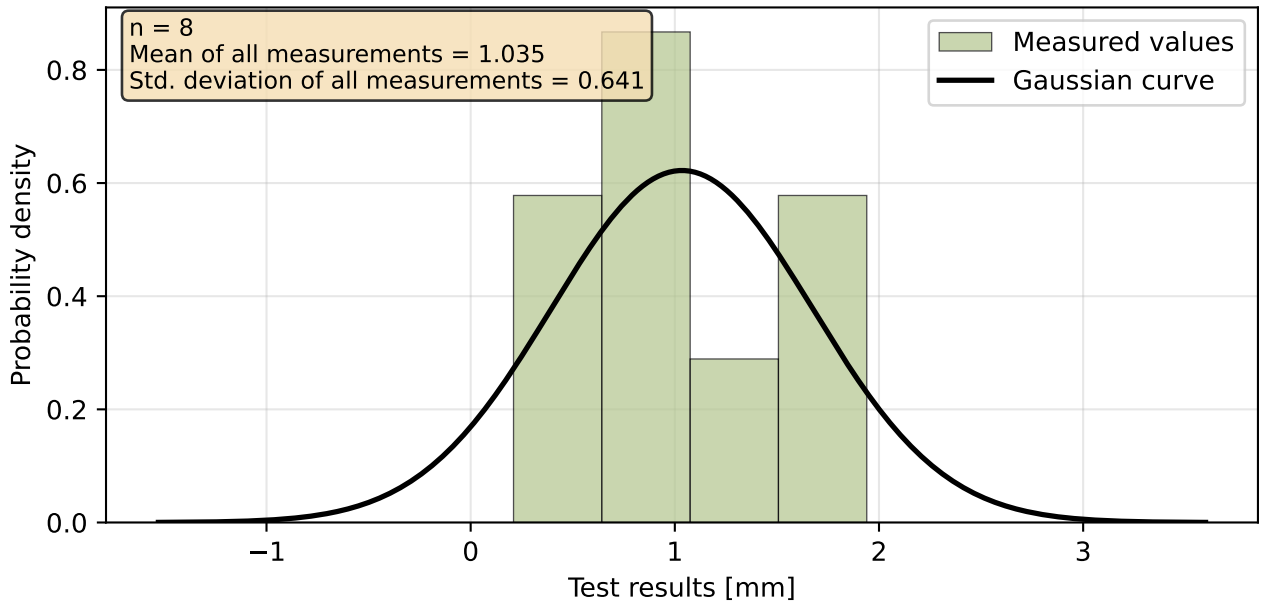

Figure 154: Histogram of all test results

Table 69: Descriptive statistics

Characteristics	[mm]
Average value – $\bar{x}$	1.035
Sample standard deviation – s	0.689
Assigned value – x^*	1.035
Robust standard deviation – s^*	0.689
Measurement uncertainty of assigned value – u_X	0.344
p-value of normality test [-]	0.273
Interlaboratory standard deviation – s_L	0.686
Repeatability standard deviation – s_r	0.086
Reproducibility standard deviation – s_R	0.692
Repeatability – r	0.240
Reproducibility – R	1.937

13.5 Evaluation of Performance Statistics

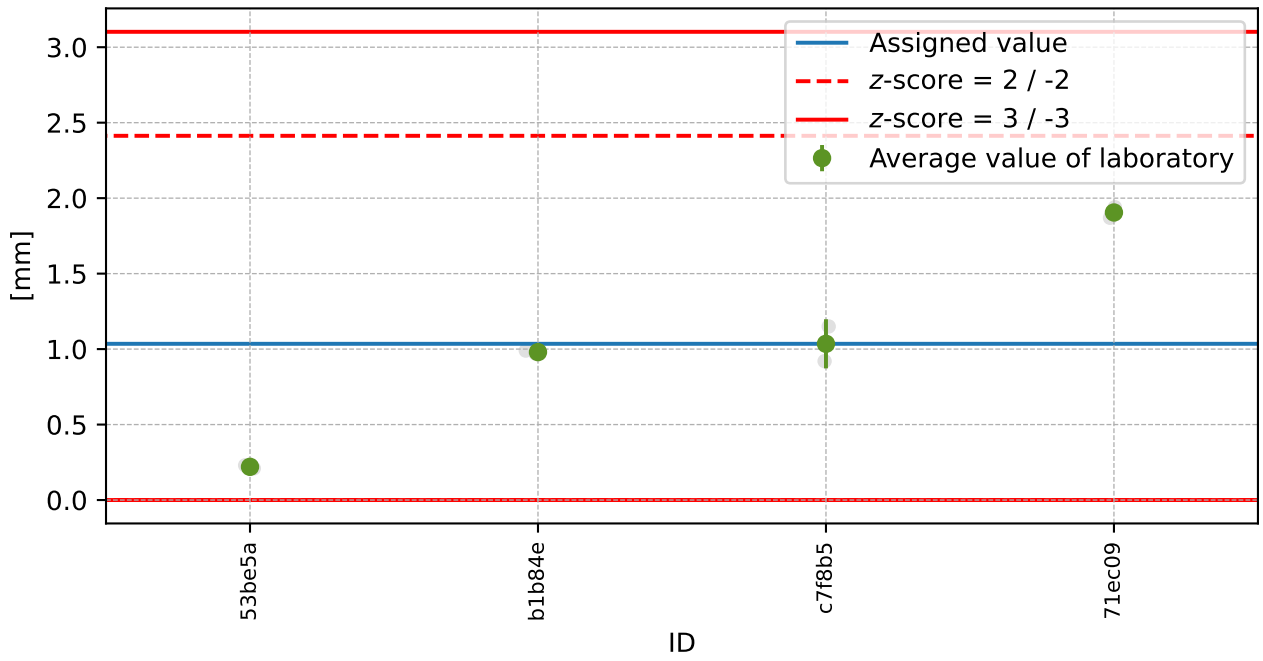

Figure 155: Average values and sample standard deviations

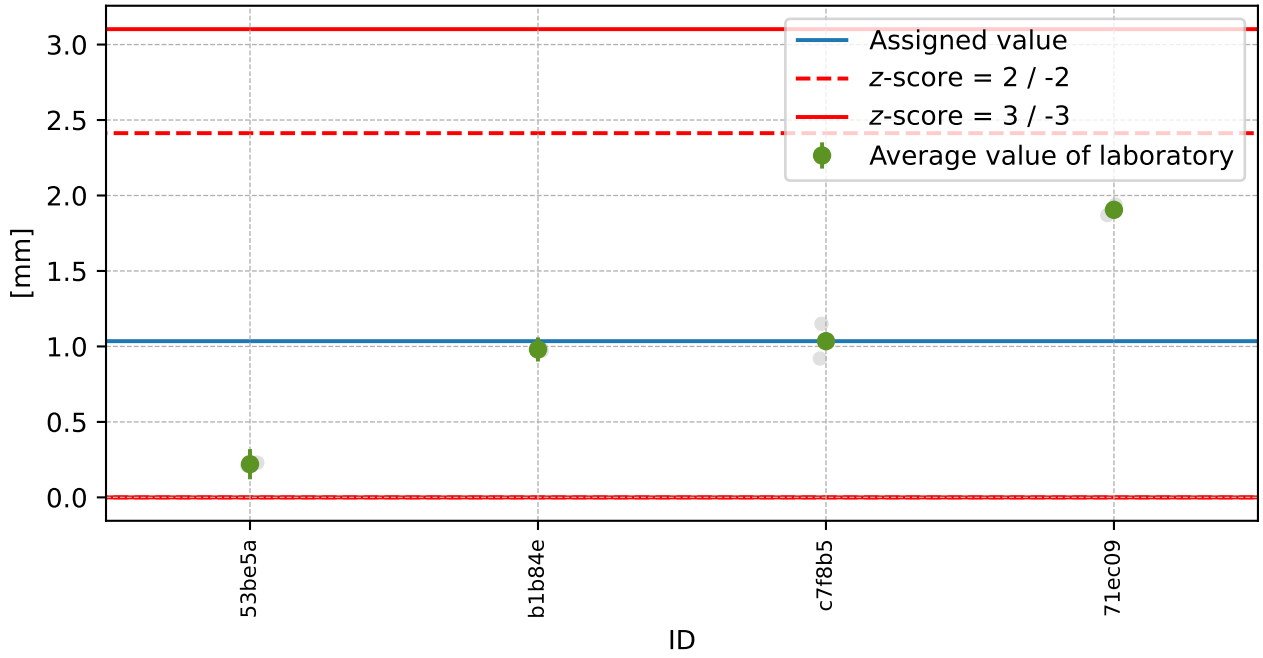

Figure 156: Average values and extended uncertainties of measurement

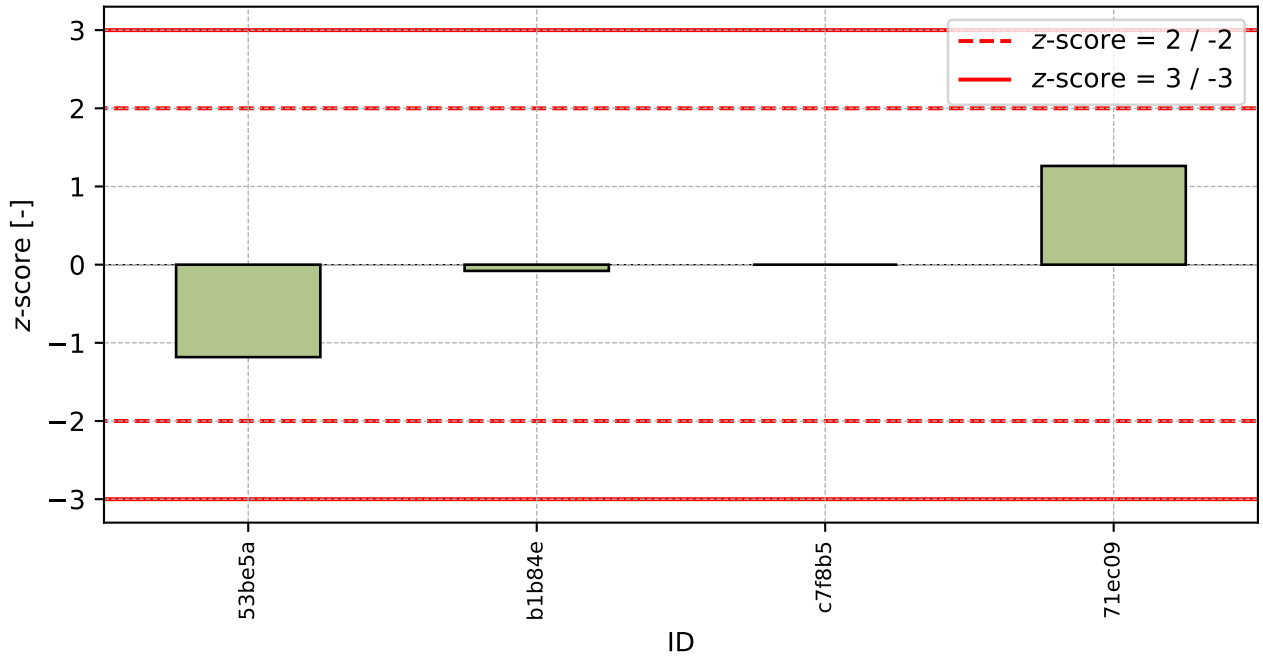

Figure 157: z-score

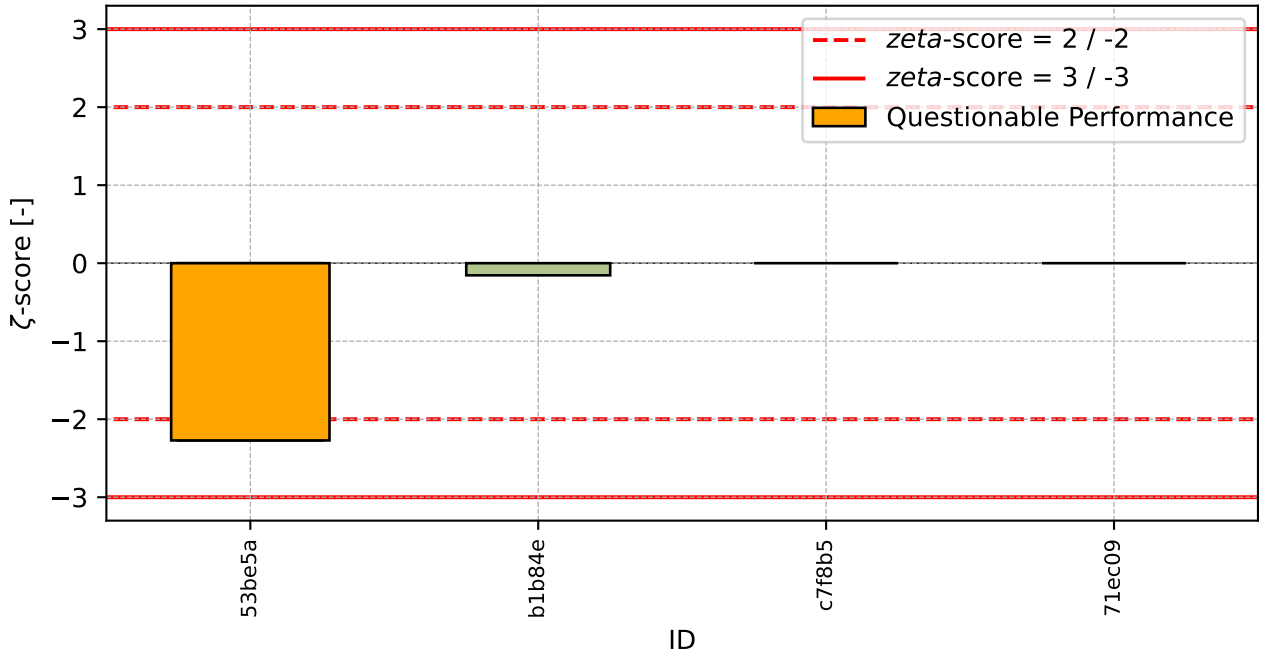

Figure 158: ζ-score

Table 70: z-score and ζ-score

ID	z-score [-]	ζ-score [-]
53be5a	-1.18	-2.27
b1b84e	-0.08	-0.16
c7f8b5	0.00	-
71ec09	1.26	-

14 Appendix – EN 12697-22+A1 Wheel tracking test – Procedure B in air

14.1 Wheel tracking

14.1.1 Test results

Table 71: Test results – ordered by average value. Outliers are marked by red color. Columns 1–2 are individual determinations; u_X – extended uncertainty of measurement; $\bar{x}$ – average value; s_0 – sample standard deviation; V_X – variation coefficient

ID	1	2	u_X	$\bar{x}$	s_0	V_X
	[mm/1000 cycles]	[mm/1000 cycles]	[mm/1000 cycles]	[mm/1000 cycles]	[mm/1000 cycles]	[%]
b008c1	0.019	0.021	-	0.020	0.0014	7.07
8b137c	0.020	0.020	-	0.020	0.0000	0.00
c32a3e	0.030	0.020	0.0080	0.025	0.0071	28.28
cec3ca	0.020	0.030	-	0.025	0.0071	28.28
d7c042	0.030	0.030	0.0060	0.030	0.0000	0.00
e41b09	0.040	0.060	0.0200	0.050	0.0141	28.28
163a74	0.950	0.940	-	0.945	0.0071	0.75

14.1.2 The Numerical Procedure for Determining Outliers

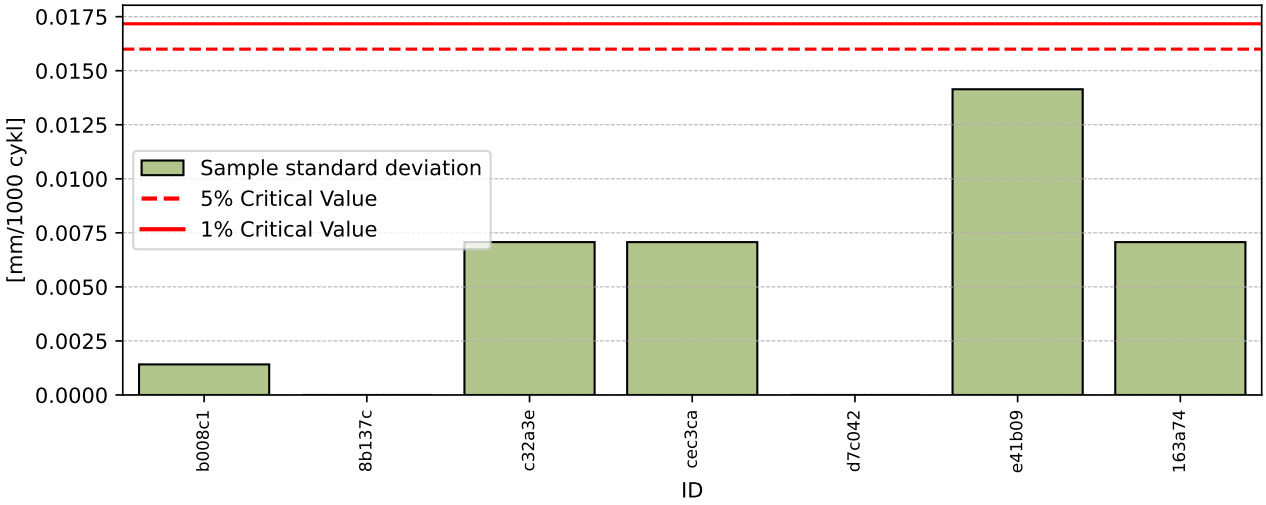

Figure 159: **Cochran's test** - sample standard deviations

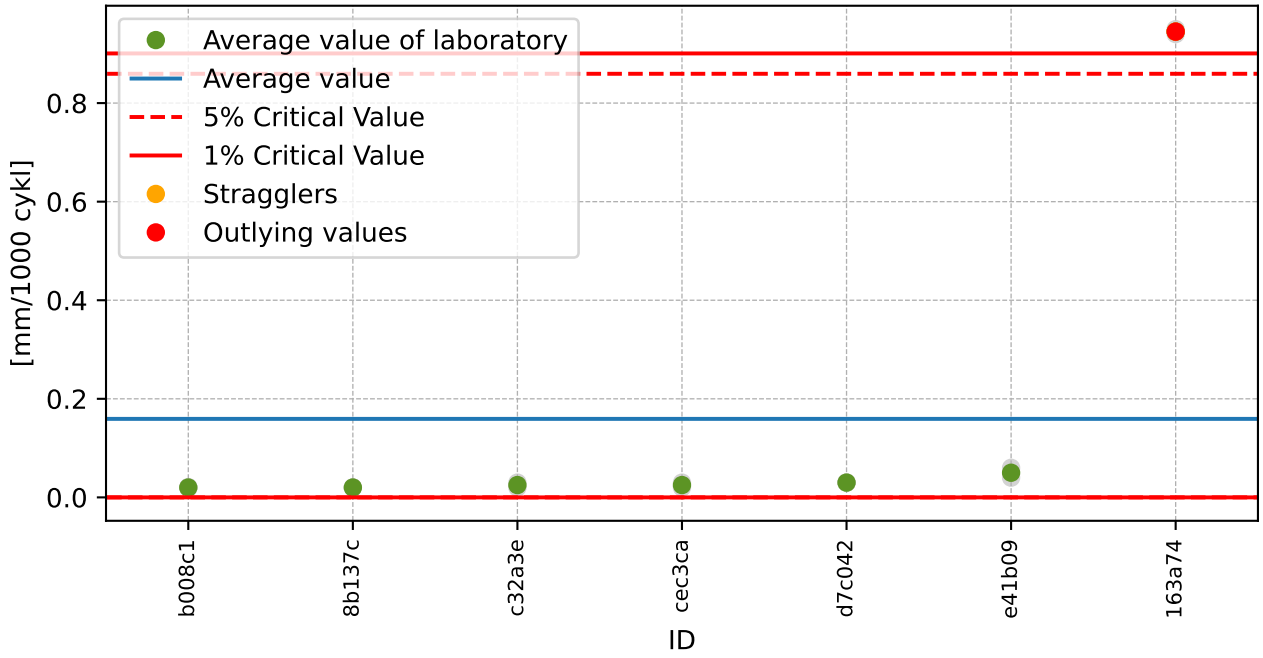

Figure 160: **Grubbs' test** - average values

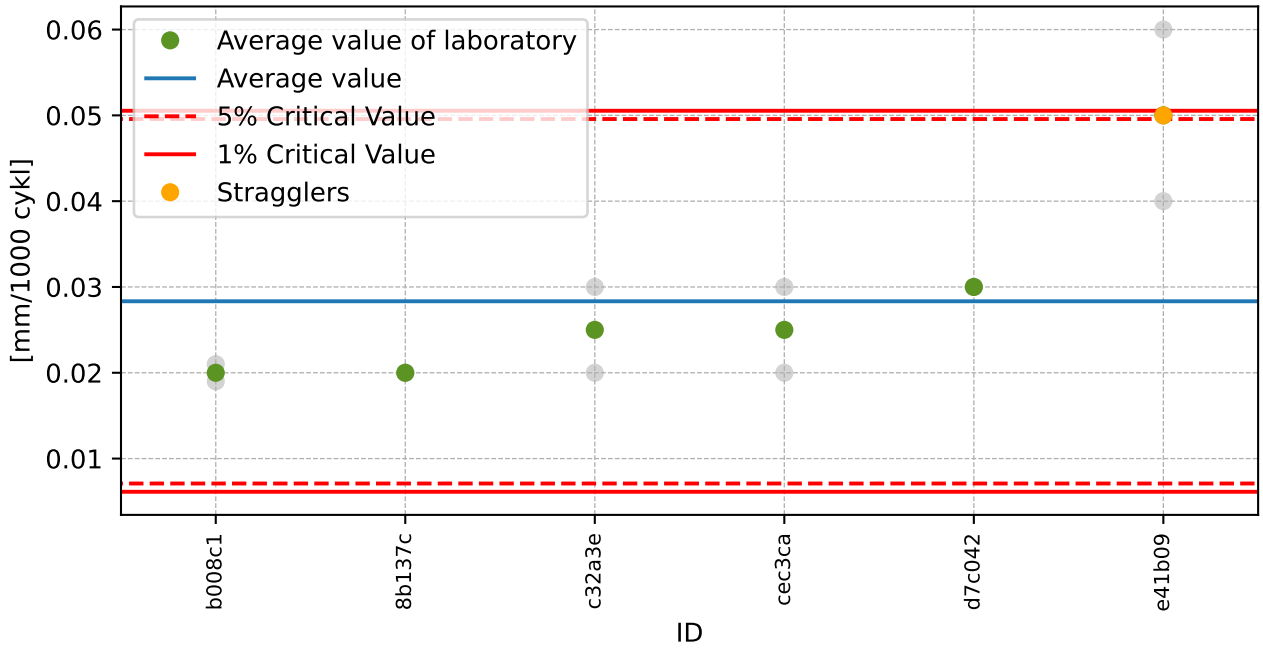

Figure 161: **Grubbs' test** - average values without outliers

14.1.3 Mandel's Statistics

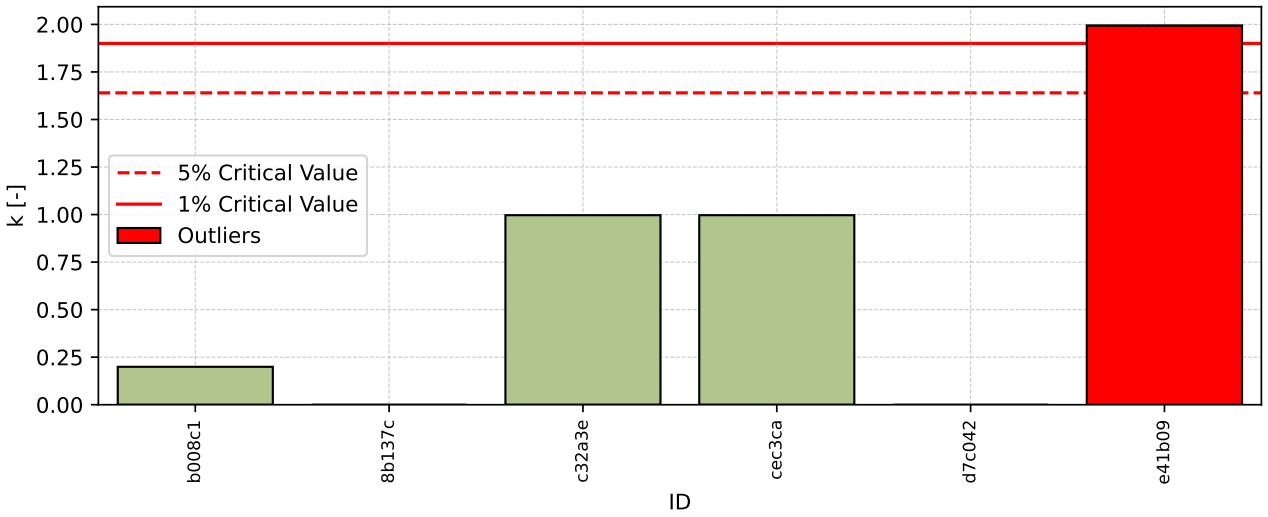

Figure 162: Intralaboratory Consistency Statistic

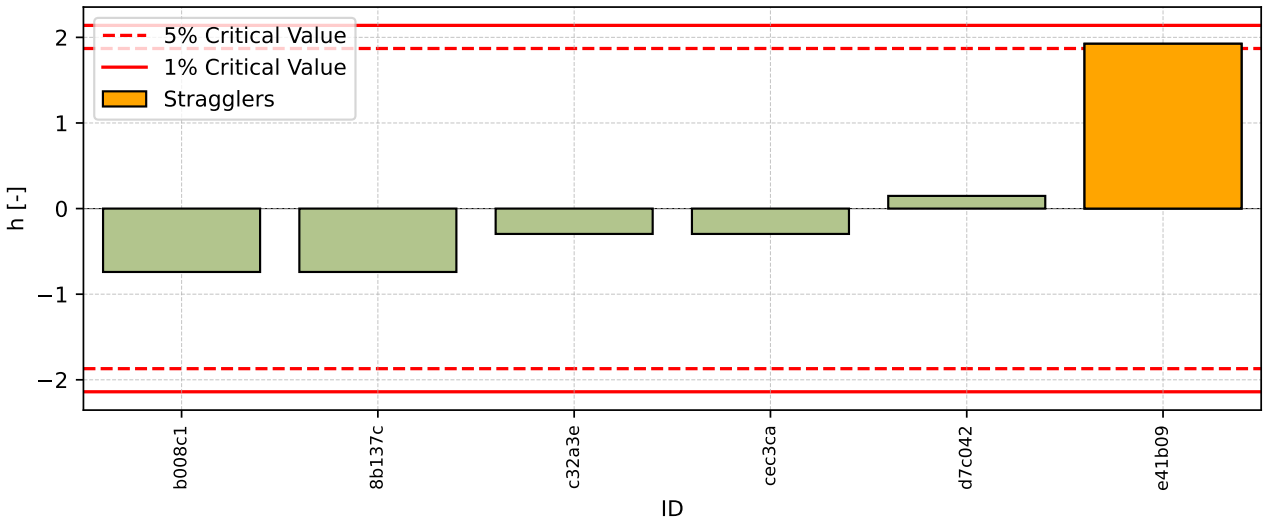

Figure 163: Interlaboratory Consistency Statistic

14.1.4 Descriptive statistics

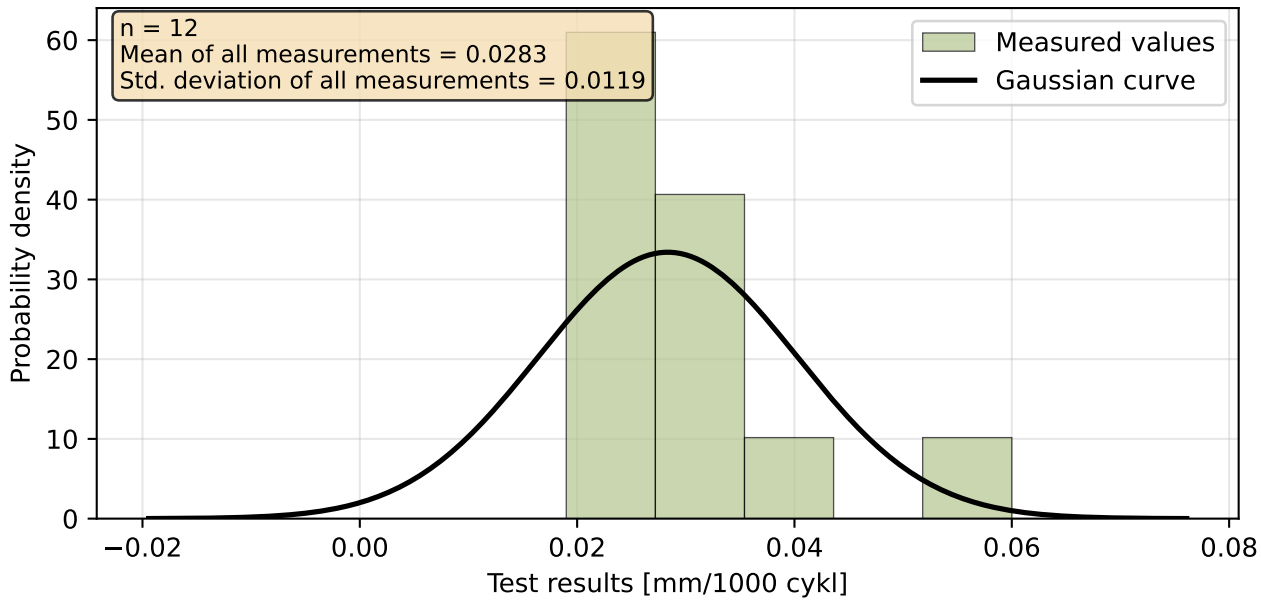

Figure 164: Histogram of all test results

Table 72: Descriptive statistics

Characteristics	[mm/1000 cycles]
Average value – $\bar{x}$	0.0283
Sample standard deviation – s	0.0113
Assigned value – x^*	0.0283
Robust standard deviation – s^*	0.0113
Measurement uncertainty of assigned value – u_X	0.0046
p-value of normality test [-]	0.002

14.1.5 Evaluation of Performance Statistics

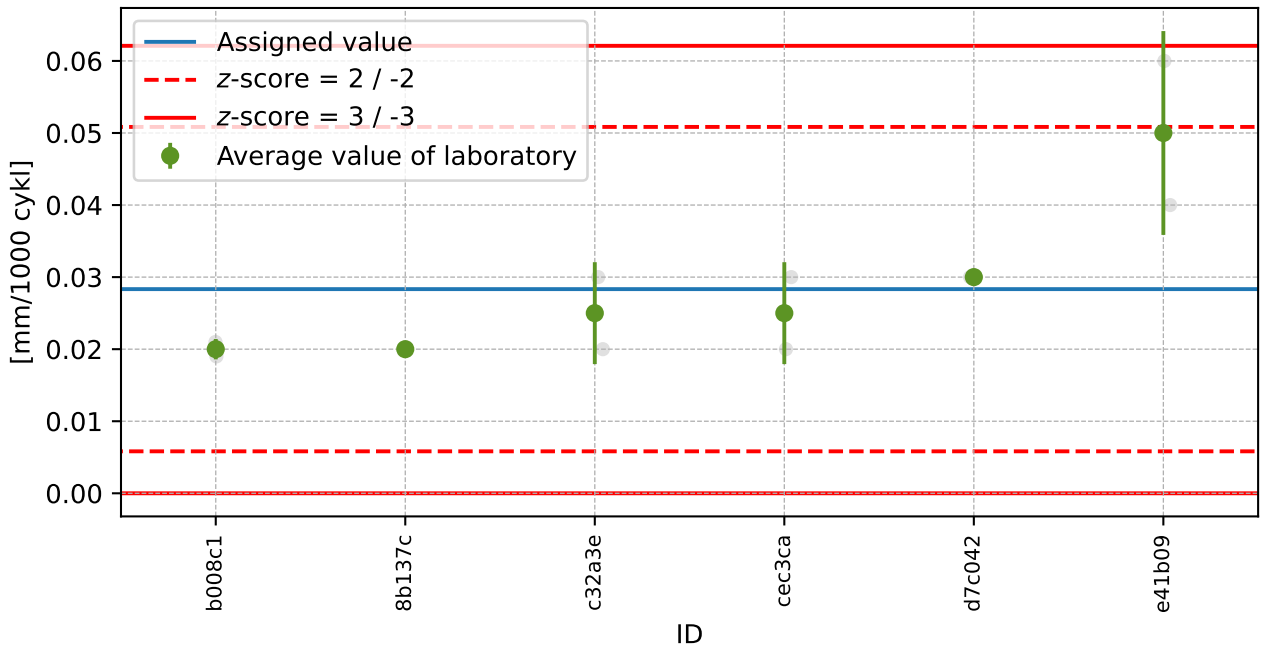

Figure 165: Average values and sample standard deviations

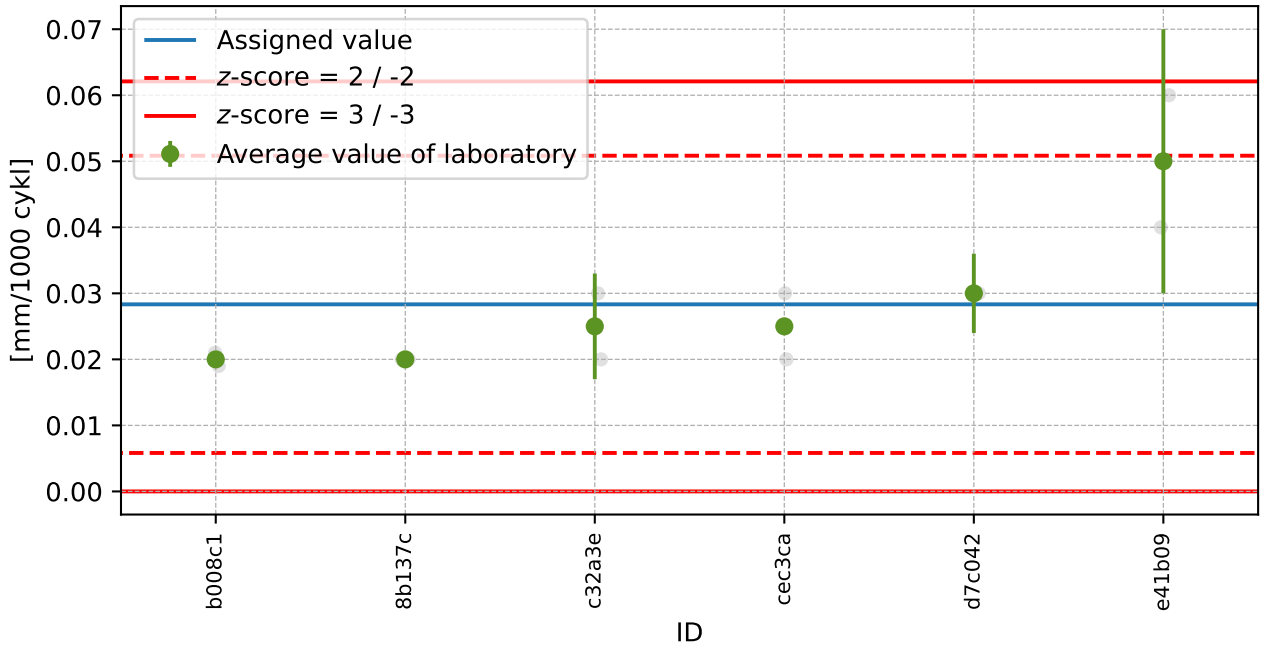

Figure 166: Average values and extended uncertainties of measurement

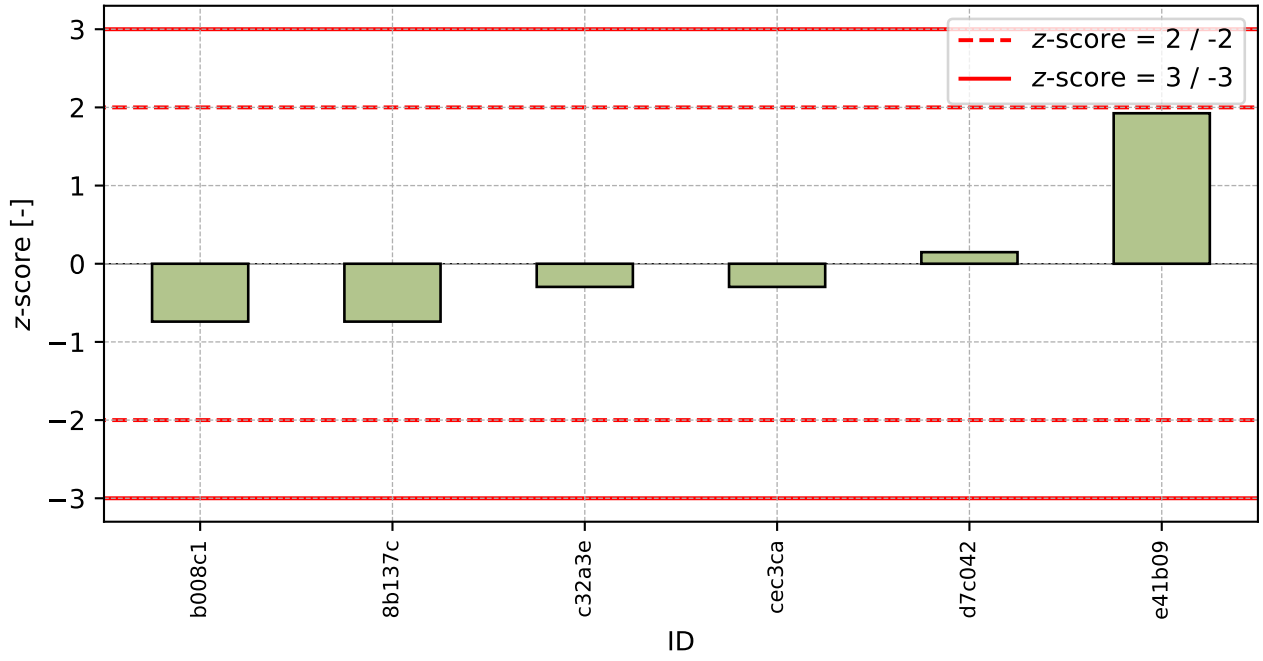

Figure 167: z-score

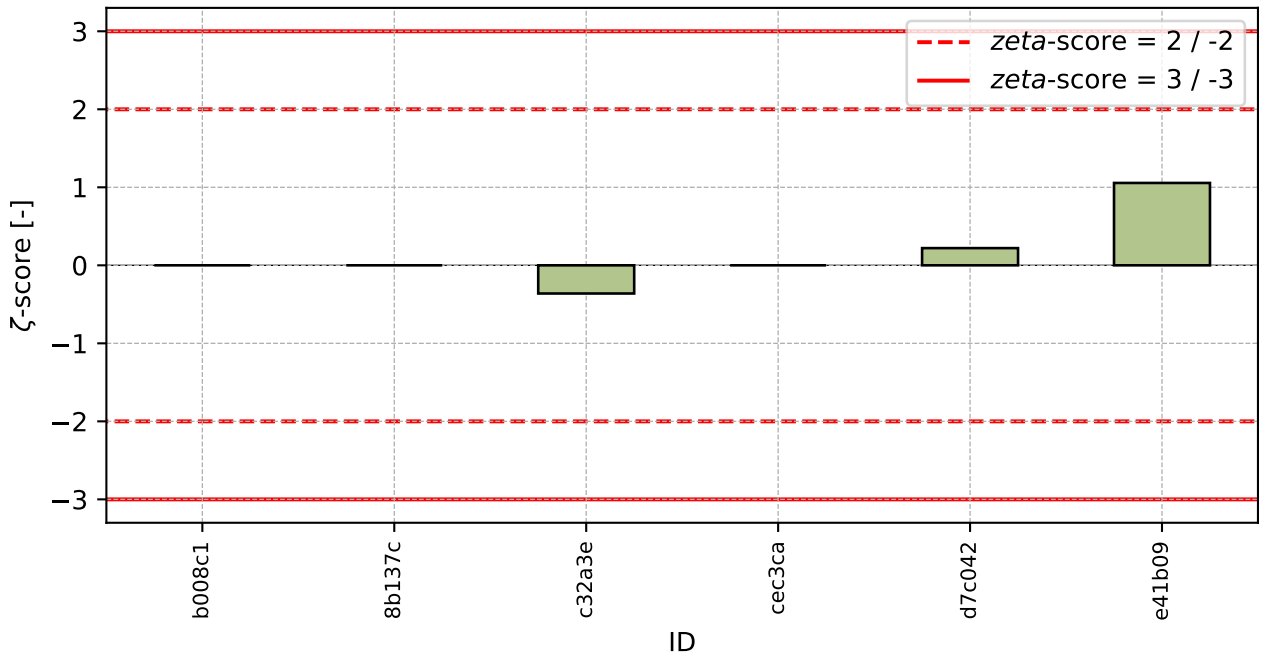

Figure 168: ζ-score

Table 73: z-score and ζ-score

ID	z-score [-]	ζ-score [-]
b008c1	-0.74	-
8b137c	-0.74	-
c32a3e	-0.30	-0.36
cec3ca	-0.30	-
d7c042	0.15	0.22
e41b09	1.93	1.06

14.2 Wheel tracking test – small-size device, Procedure B in air

14.2.1 Test results

Table 74: Test results – ordered by average value. Outliers are marked by red color. Columns 1–2 are individual determinations; u_X – extended uncertainty of measurement; $\bar{x}$ – average value; s_0 – sample standard deviation; V_X – variation coefficient

ID	1 [%]	2 [%]	u_X [%]	$\bar{x}$ [%]	s_0 [%]	V_X [%]
163a74	2.3	2.3	-	2.3	0.00	0.00
b008c1	2.3	2.3	-	2.3	0.00	0.00
8b137c	2.5	2.7	-	2.6	0.14	5.44
cec3ca	3.1	3.2	-	3.2	0.07	2.24
c32a3e	3.3	3.2	0.08	3.2	0.07	2.18
d7c042	4.0	3.8	0.80	3.9	0.14	3.63
e41b09	4.0	4.5	0.05	4.2	0.35	8.32

14.2.2 The Numerical Procedure for Determining Outliers

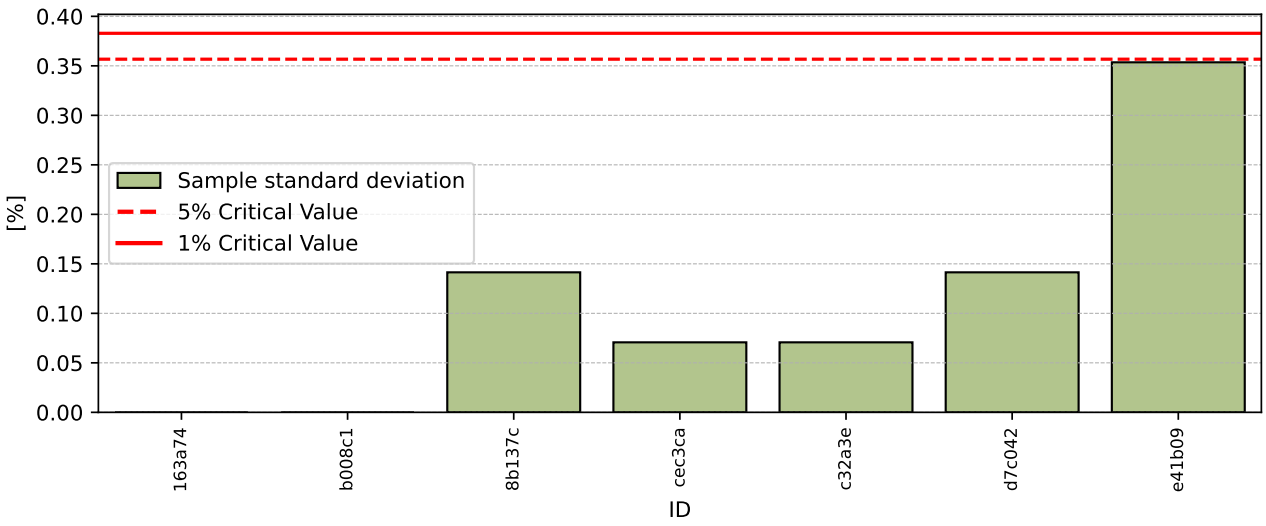

Figure 169: **Cochran's test** - sample standard deviations

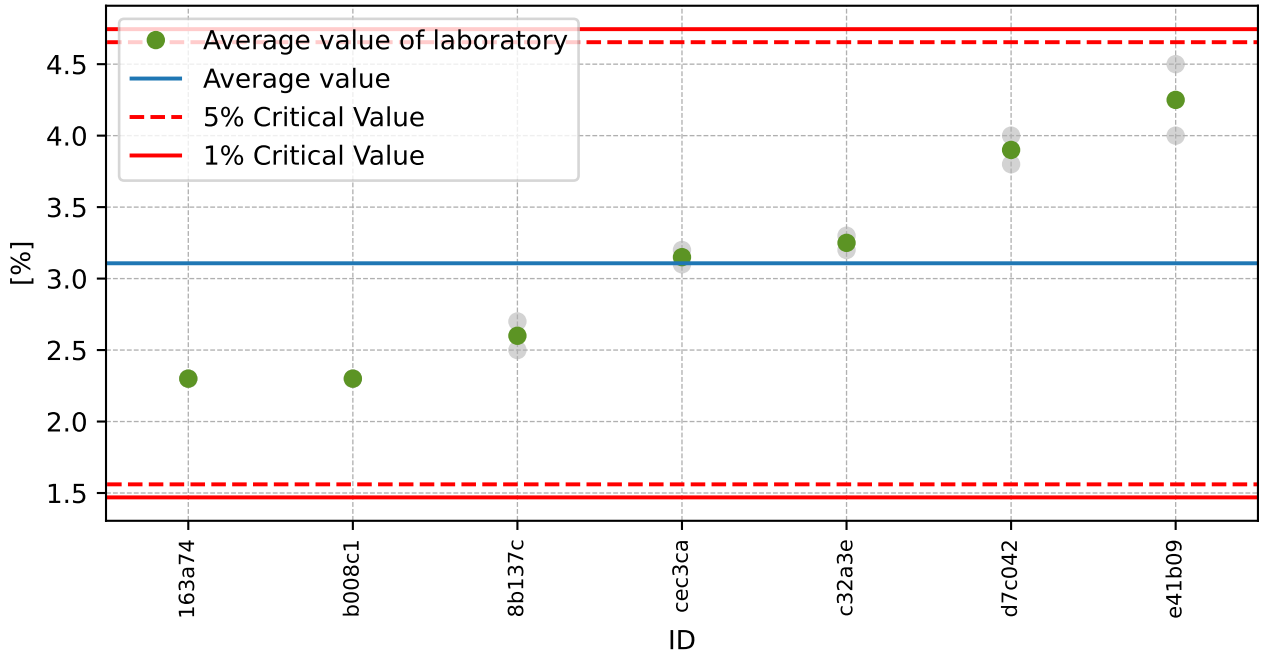

Figure 170: **Grubbs' test** - average values

14.2.3 Mandel's Statistics

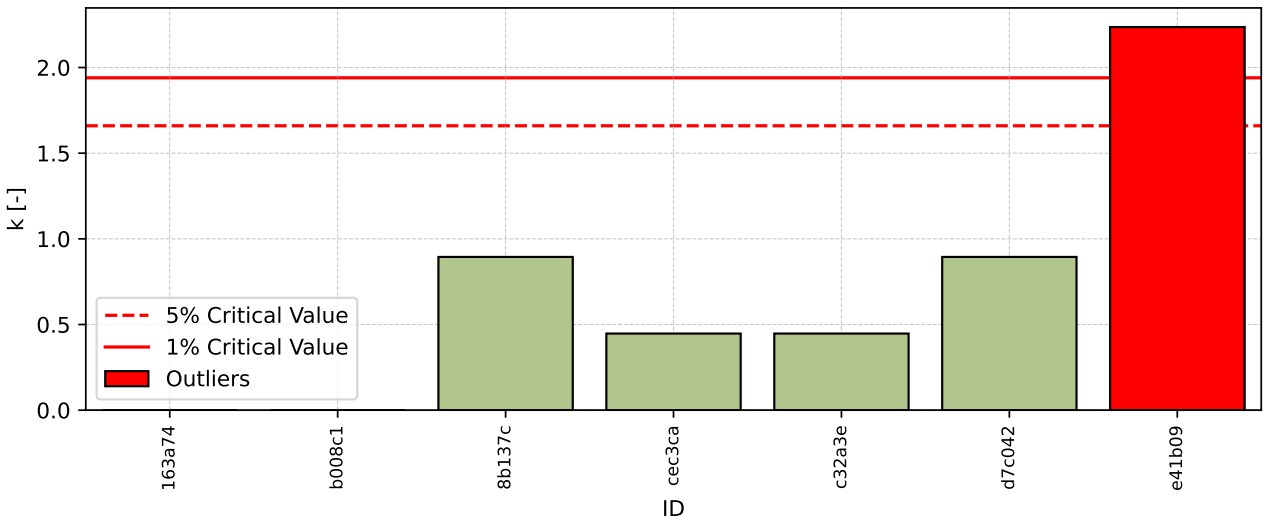

Figure 171: Intralaboratory Consistency Statistic

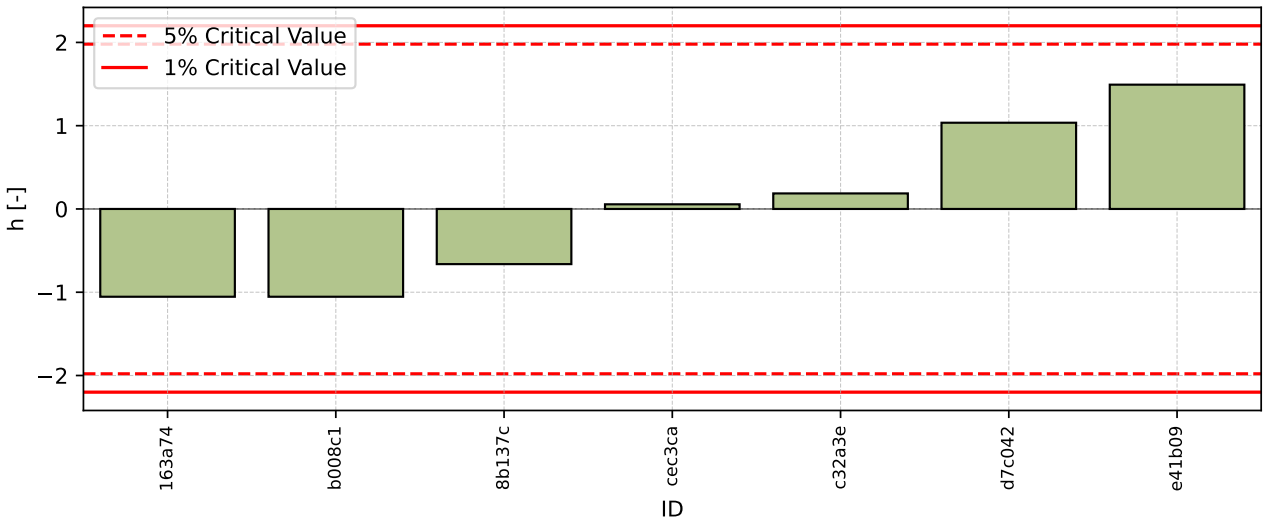

Figure 172: Interlaboratory Consistency Statistic

14.2.4 Descriptive statistics

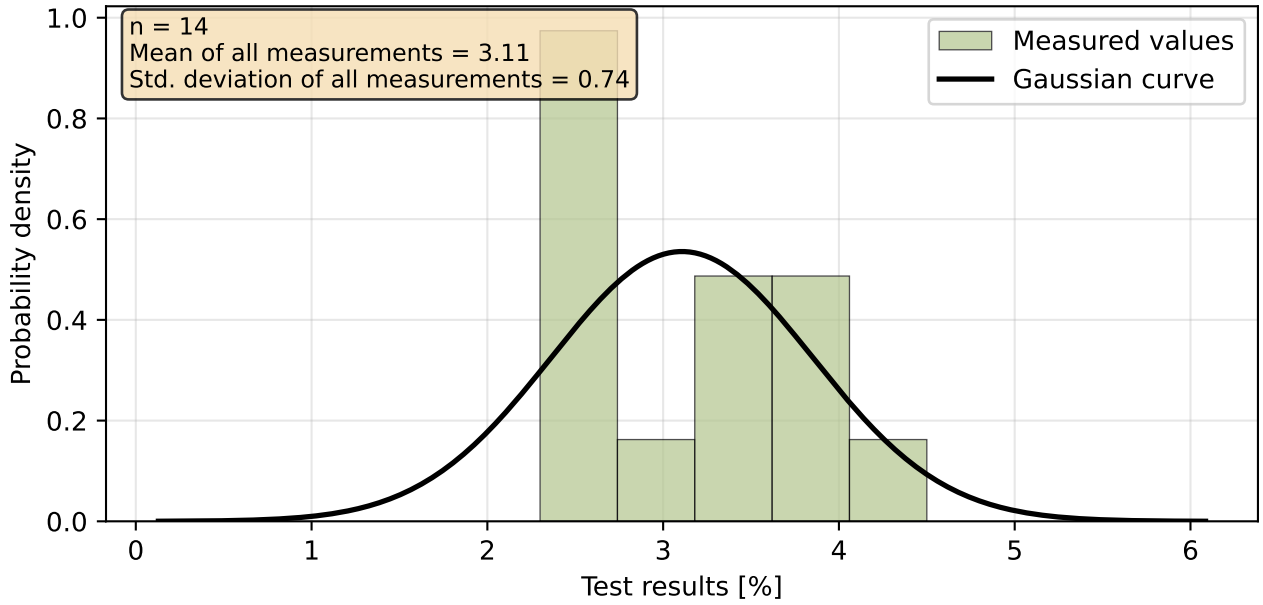

Figure 173: Histogram of all test results

Table 75: Descriptive statistics

Characteristics	[%]
Average value – $\bar{x}$	3.11
Sample standard deviation – s	0.77
Assigned value – x^*	3.11
Robust standard deviation – s^*	0.77
Measurement uncertainty of assigned value – u_X	0.29
p-value of normality test [-]	0.108
Interlaboratory standard deviation – s_L	0.76
Repeatability standard deviation – s_r	0.16
Reproducibility standard deviation – s_R	0.77
Repeatability – r	0.44
Reproducibility – R	2.17

14.2.5 Evaluation of Performance Statistics

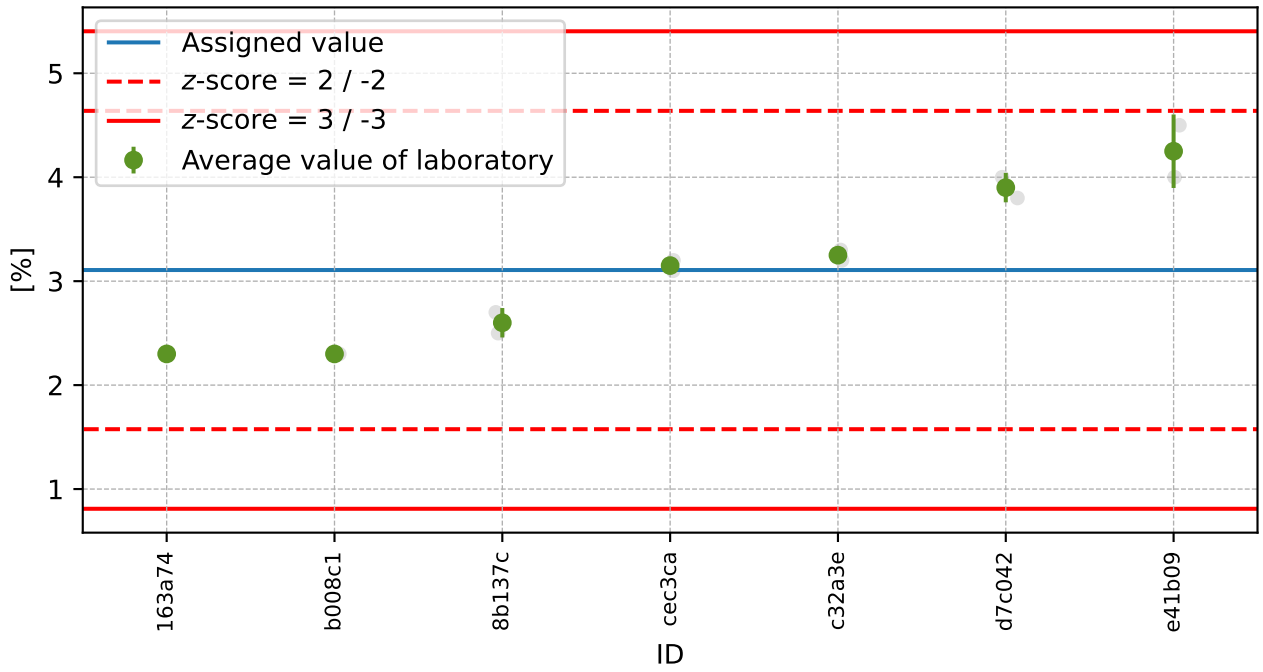

Figure 174: Average values and sample standard deviations

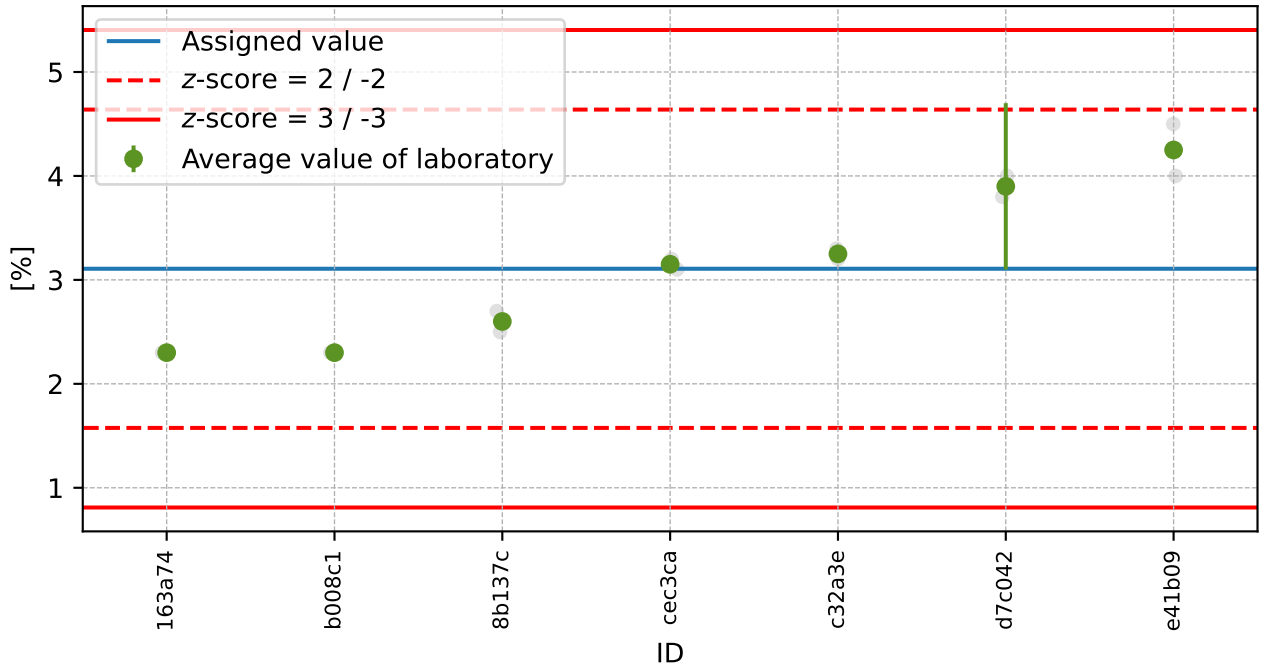

Figure 175: Average values and extended uncertainties of measurement

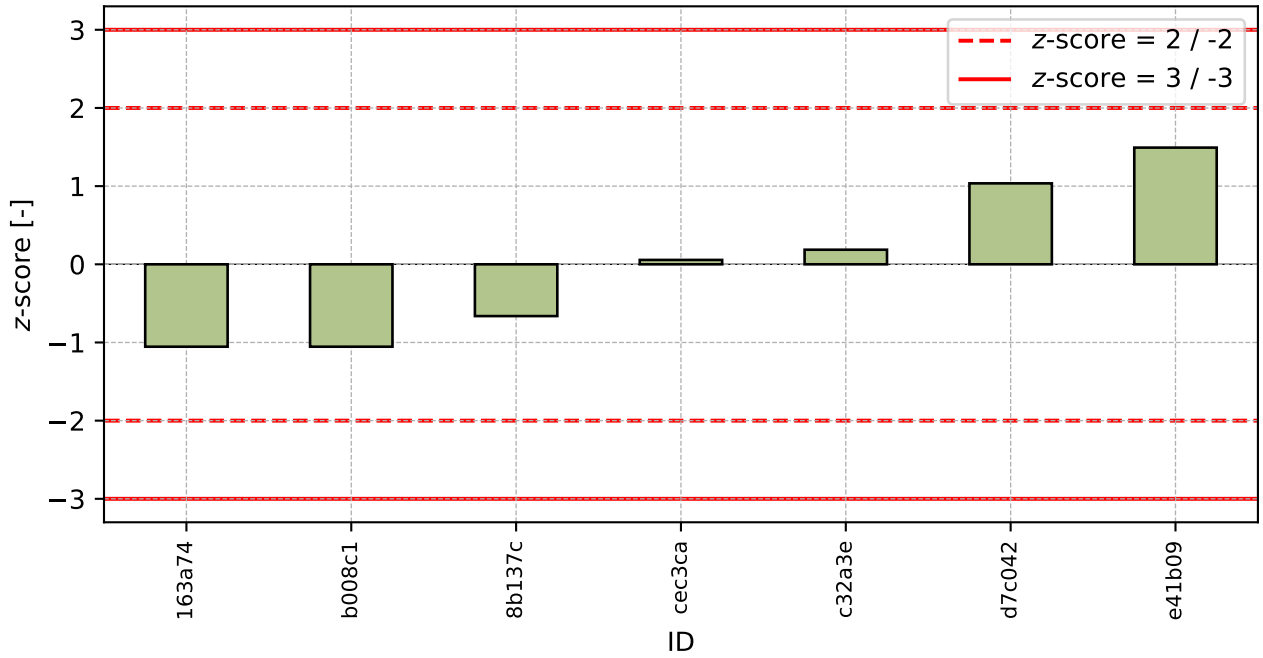

Figure 176: z-score

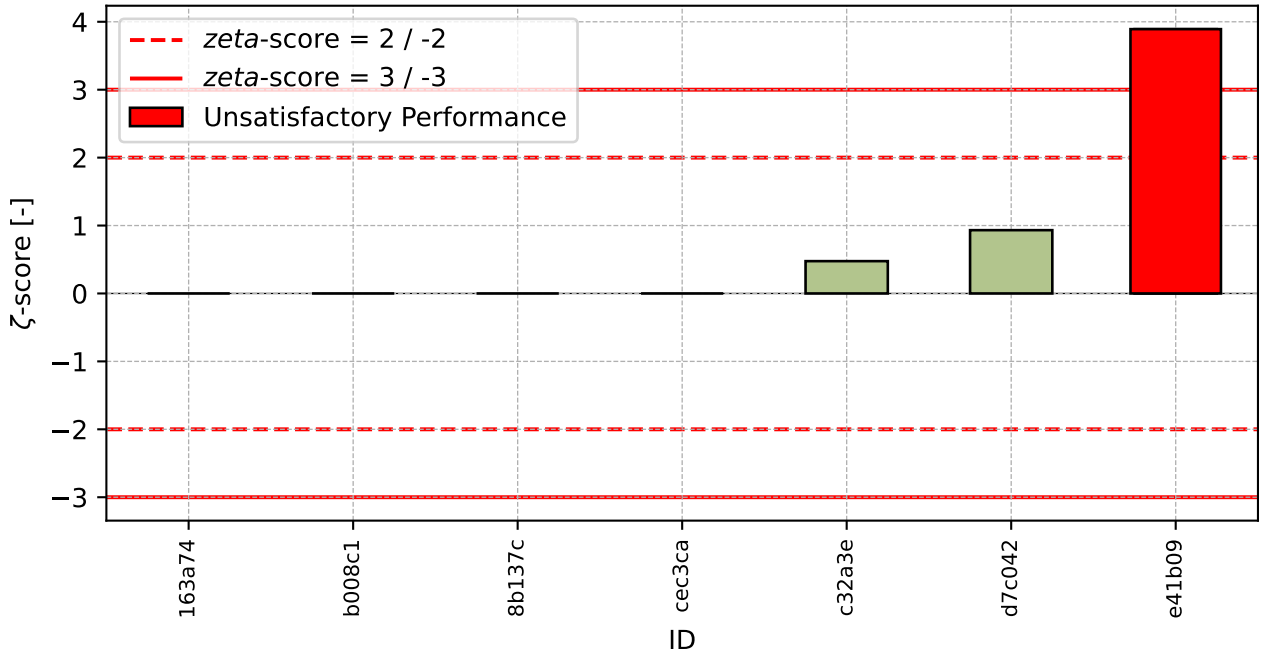

Figure 177: ζ-score

Table 76: z-score and ζ-score

ID	z-score [-]	ζ-score [-]
163a74	-1.05	-
b008c1	-1.05	-
8b137c	-0.66	-
cec3ca	0.06	-
c32a3e	0.19	0.48
d7c042	1.04	0.93
e41b09	1.49	3.89

15 Appendix – ČSN 73 6161 Adhesion of bituminous binders to aggregates

This part of the PT programme was not opened due to low interest from laboratories.