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
Strength and Durability of Hardened Concrete
ZZB 2025/1

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

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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

In the year 2025, the Proficiency Testing Provider at the SZK FAST (PT Provider) initiated the Proficiency Testing Program (PTP) designated ZZB 2025/1 whose aim was to verify and assess the conformity of test results across laboratories when testing hardened concrete.

The assessment of the results of the Proficiency Testing Program was carried out by a committee consisting of the following PT Provider employees:

Head of the PT Provider, PTP coordinator

Assoc. Prof. Ing. 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 PrZZ

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 12390-3** – Compressive strength of test specimens [1].
2. **EN 12390-7** – Density of hardened concrete [2].
3. **EN 12390-8** – Depth of penetration of water under pressure [3].
4. **EN 480-11** – Determination of air void characteristics in hardened concrete [4].
5. **ČSN 73 1322** – Determination of frost resistance of concrete [5].
6. **ČSN 73 1324** – Determination of grindability of concrete [6].
7. **ČSN 73 1326** – Resistance of cement concrete surface to water and defrosting chemicals – Method A [7].
8. **ČSN 73 1326** – Resistance of cement concrete surface to water and defrosting chemicals – Method C [7].
9. **CEN/TS 12390-9** – Freeze-thaw resistance – Scaling [8].

Testing procedures 4, 5, 6, 8 and 9 were not open due to low interest from laboratories.

The supplier, BETOTECH s. r. o., was responsible for the preparation of hardened concrete for the PTP. Fresh concrete for the preparation of test samples was taken from one production batch prepared in accordance with methods stipulated in EN 206 [9]. Fresh concrete was poured into test moulds, which were always of the same type, and after removal from the moulds the test specimens were placed under identical conditions in storage rooms complying with the requirements for individual specifications.

The specimens were taken from the same production with the same production date. 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 [10] and with EN ISO/IEC 17043 [11]. The outcome is the present final report summarizing the results of the interlaboratory comparison, including statistical evaluation.

51 laboratories took part in the program. 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
89b0e1	X	X	-	-	-	-	-	-	-
109b42	X	-	-	-	-	-	-	-	-
ca6b29	X	X	-	-	-	-	X	-	-
dcb7e1	-	-	X	-	-	-	X	-	-
d12b02	-	-	X	-	-	-	X	-	-
b11cae	-	-	X	-	-	-	X	-	-
a6b6ad	-	-	-	-	-	-	X	-	-
2f4bcb	-	-	X	-	-	-	X	-	-
35569a	-	-	X	-	-	-	-	-	-
00b6c2	X	X	X	-	-	-	-	-	-
b57771	X	X	X	-	-	-	X	-	-
a7bbbf	X	X	-	-	-	-	-	-	-
4670d7	X	X	-	-	-	-	-	-	-
e67c75	X	X	-	-	-	-	-	-	-
94cbe6	X	X	-	-	-	-	-	-	-
20a6e1	X	-	-	-	-	-	-	-	-
c92264	X	X	-	-	-	-	-	-	-
2fe8b4	-	-	X	-	-	-	-	-	-
baf4d7	X	X	X	-	-	-	-	-	-
18bcb8	X	X	-	-	-	-	-	-	-
f55e78	X	X	-	-	-	-	-	-	-
bccd4c	X	X	X	-	-	-	X	-	-
9251ae	-	-	X	-	-	-	-	-	-
504c49	X	-	-	-	-	-	-	-	-
43bde6	X	X	X	-	-	-	X	-	-
409e27	X	-	-	-	-	-	-	-	-
d671a6	X	-	-	-	-	-	X	-	-
a57a34	X	X	-	-	-	-	-	-	-
fb994e	X	X	-	-	-	-	X	-	-
19410e	X	X	X	-	-	-	X	-	-
05561a	X	-	X	-	-	-	-	-	-
ab1d71	-	-	X	-	-	-	-	-	-
aa384e	-	-	X	-	-	-	-	-	-
47c8a6	-	-	X	-	-	-	-	-	-
de3f77	-	-	X	-	-	-	-	-	-
225a59	X	X	X	-	-	-	-	-	-
9730f4	-	-	X	-	-	-	-	-	-
576e51	X	X	-	-	-	-	-	-	-
677e70	-	-	X	-	-	-	X	-	-
9b210b	X	X	X	-	-	-	X	-	-
f070fb	-	-	X	-	-	-	X	-	-
bfd33c	X	-	-	-	-	-	-	-	-
b28848	X	-	-	-	-	-	-	-	-
2637ed	X	X	-	-	-	-	-	-	-

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ID/Method	1	2	3	4	5	6	7	8	9
3aab6e	X	X	X	-	-	-	-	-	-
907d3f	X	-	-	-	-	-	-	-	-
5b49d4	X	-	-	-	-	-	-	-	-
5b96a9	-	X	-	-	-	-	-	-	-
a72404	-	-	X	-	-	-	-	-	-
05342b	X	X	X	-	-	-	-	-	-
307ab4	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
Apros d.o.o.	Občinska cesta 10, Maribor, 2000, Slovenija	-
BETOTECH, s.r.o. - pracoviště Brno	Beroun 660, Beroun, 26601, Česká republika	1195.3
BOKU Wien, Institut fuer Konstruktiven Ingenieurbau	Peter-Jordan-Str. 82, Vienna, 1190, Austria	P0252
BetónRacio, s.r.o., Skúšobné laboratórium, Pracovisko Lietavská Lúčka	Skladová 2, Trnava, 917 00, Slovenská republika	S-320
BetónRacio, s.r.o., Skúšobné laboratórium, Pracovisko Trnava	Skladová 2, Trnava, 917 00, Slovenská republika	S-320
BetónRacio, s.r.o., Skúšobné laboratórium, Pracovisko Veľký Šariš	Skladová 2, Trnava, 917 00, Slovenská republika	S-320
CIRM doo, Belgrade	Stevana Markovica 8/1, Belgrade, 11080, Serbia	-
CONSULTEST s.r.o. - pracoviště Znojmo	Medkova 974/4, Brno, 62700, Česká republika	1211
CONTROL-VHS-SK, s.r.o.	Kamenná 14, Žilina, 010 01, Slovenská republika	437/S-317
CS-BETON s.r.o.	Velké Žernoseky 184, Litoměřice, 412 01, Česká republika	1500
Cement Hranice, akciová společnost - Betonářská laboratoř	Bělotínská 288, Hranice I - Město, 75301, Česká republika	1284
Cemex Czech Republic s.r.o.	Plzeňská 3217/16, Praha 5, 15000, Česká republika	1302
Central Materials Laboratory	Canna Road, Tabuan Jaya, Kuching, 93350, Sarawak, Malaysia	-
Centrální laboratoř COLAS CZ, a.s. - pracoviště Znojmo	Rubeška 215/1, Praha, 19000, Česká republika	1780
Centrální laboratoř COLAS CZ, a.s. - pracoviště Západ	Rubeška 215/1, Praha, 19000, Česká republika	1780
EDAFOMICHANIKI S.A.	19 EMMANUEL PAPADAKI, NEO IRAKLEIO, 14121, GREECE	1269

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Laboratory	Address	Accreditation number
Holcim Česko, a.s.	Čížkovice 27, Čížkovice, 41112, Česká republika	1426
Horský s.r.o.	Klánovická 286/12, Praha, 198 00, Česká republika	1207
Innovation Hub/PPC S.A. PPC LABORATORIES, INSPECTION AND CERTIFICATION SINGLE MEMBER S.A.	Leontariou 9, Kantza Pallini, 15351, Athens Greece	-
Institut pro testování a certifikaci, a.s.	třída Tomáše Bati 299, Louky, Zlín, 76302, Česká republika	1007.1
Institut technologie a testování betonu, s.r.o., Zkušební laboratoř ITTB Brno	Medkova 974/4, Brno, 62700, Česká republika	L1778
JKV TEST s.r.o.	Suhrady 148/4, Vřesina, 747 20, Česká republika	1294
KORIDORI SRBIJE LTD.	Kralja Petra 21, Belgrade, 11000, Srbija	-
KTU Building Materials and Structures Research Centre	Studentu st. 48-276, Kaunas, LT-51367, Lithuania	LA.01.29
Kilsaran Concrete Unlimited Company	Piercetown, Dunboyne, Co.Meath, A86 W820, Ireland	241T
Kilsaran Concrete Unlimited Company	Piercetown, Dunboyne, Co.Meath, A86 W820, Ireland	241T
Kiwa GmbH	Finkenweg 7, Gersthofen, 86368, Germany	D-PL-11217-01-01
Laboratorium Drogowe Szczecin Sp. z o.o.	Tama Pomorzańska 13L, Szczecin, 70-030, Poland	AB1806
MBS CZ-SK s.r.o.	F.V.Veselého 2760/7, Praha 9, 193 00, Česká republika	1495
MIRTEC S.A., THIVA BRANCH	76th km of Athens-Lamia National Road (Ritsona exit), Schimatari, Voeotia, 32009, Greece	-
Northern Regional Laboratory	Lot 7130, Block 1, Lambir Land District, Jalan Miri Bypass, Miri, 98000, Sarawak, Malaysia	-
Národná diaľničná spoločnosť a.s.	Dúbravská cesta 14, Bratislava, 84104, Slovensko	456/S-328
Panevėžio statybos trestas AB	P. Puzino 1, Panevėžys, 35113, Panevezys	LA.01.022
Sibotec	Industriepark Oost 6, Beernem, 8730, Belgium	-
TESScontrol, s. r. o. Oblastné Laboratórium Bratislava, Laboratórium Bratislava	Ľubochnianska 1/A, 831 04 Bratislava, Bratislava, 831 04, Slovenská republika	S-375
TESScontrol, s. r. o. Oblastné Laboratórium Bratislava, Laboratórium Prešov	Laboratórium Prešov, Petrovianska 4, 080 05 Prešov, Pešov, 080 05, Slovenská republika	S-375

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Laboratory	Address	Accreditation number
TESScontrol, s. r. o., Oblastné Laboratórium Zvolen, Laboratórium Zvolen	Hronská 3211/1, 960 93 Zvolen, Zvolen, 960 93, Slovenská republika	S-375
TESScontrol, s. r. o., organizačná zloška, TESScontrol - Zkušební laboratoř Znojmo	Brněnská 3797/29, 669 02 Znojmo, Znojmo, 669 02, Česká republika	L-1793
TESTAV-LAB s.r.o.	Chodská 7, Liberec 3, 466 02, Česká republika	1180
TITAN CEMENT COMPANY S.A.	22A HALKIDOS STREET, ATHENS, 111 43, Greece	-
TPA Spoločnosť pre zabezpečenie kvality a inovácie s.r.o. - pracovisko Geča	Areál STRABAG ul. Priemyselná, Geča, 04410, Česká republika	211/S-176
TZÚS Praha, s.p.	Nemanická 441/8, České Budějovice, 37010, Česká republika	-
Technick a zkušební ústav stavební Praha, s.p. Pobočka Plzeň	Prosecká 811/76a, Praha 9 - Prosek, 190 00, Česká republika	1018.3
Technický a zkušební ústav Praha, s.p., Centrální laboratoř, zkušebna 0500 Předměřice nad Labem	Průmyslová 283, Předměřice nad Labem, 503 02, Česká republika	1018.3
Technický a zkušební ústav stavební Praha, s.p. - pracoviště Ostrava	U Studia 14, Ostrava - Zábřeh, 700 30, Česká republika	1018.3
Technický a zkušební ústav stavební Praha, s.p. - pracoviště Praha	Prosecká 811/76a, Praha 9, 19000, Česká republika	1018.3
Technický a zkušební ústav stavební Praha, s.p. - pracoviště Teplice	Tolstého 447, Teplice, 41503, Česká republika	1018.3
UAB Testlita	Jankiškių str. 39, Vilnius, LT-02300, Lithuania	LA.01.013
VUHU a.s.	tř. Budovatelů 2830/3, Most, 43401, Česká republika	1078
Výzkumný ústav pozemních staveb - Certifikační společnost, s.r.o.	Pražská 16/810, Praha - Hostivař, 10200, Česká republika	1234
Ředitelství silnic a dálnic s. p.	Čerčanská 2023/12, Praha 4 - Krč, 140 00, Česká republika	1072

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 Strength and Durability of Hardened Concrete (PT Program) organized by the PT Provider at the SZK FAST. 51 participants (laboratories) took part in the PT Program. The program focused on ordinary standardized testing of hardened concrete with emphasis on its strength and durability. 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. Testing methods can be found in part 1 of this report. Table 3 shows the evaluation of the laboratory performance according to EN ISO/IEC 17043 [11].

Test procedure 7 was evaluated as a multilevel experiment. The level of the experiment was always composed of the number of freeze-thaw cycles. Laboratory performance was marked other than satisfactory only when critical z-score values were exceeded at two or more experiment levels.

Table 3: Evaluation of overall performance and outliers.
✓ – satisfactory performance; ? – questionable performance; ! – unsatisfactory performance; X – outlier;

ID / Method	1	2	3	4	5	6	7	8	9
89b0e1	✓	✓	-	-	-	-	-	-	-
109b42	✓	-	-	-	-	-	-	-	-
ca6b29	✓	✓	-	-	-	-	✓	-	-
dcb7e1	-	-	✓	-	-	-	✓	-	-
d12b02	-	-	✓	-	-	-	✓	-	-
b11cae	-	-	✓	-	-	-	✓	-	-
a6b6ad	-	-	-	-	-	-	✓	-	-
2f4bcb	-	-	✓	-	-	-	?	-	-
35569a	-	-	✓	-	-	-	-	-	-
00b6c2	!	✓	✓	-	-	-	-	-	-
b57771	✓	✓	✓	-	-	-	✓	-	-
a7bbbf	✓	✓	-	-	-	-	-	-	-
4670d7	✓	✓	-	-	-	-	-	-	-
e67c75	✓	✓	-	-	-	-	-	-	-
94cbe6	✓	✓	-	-	-	-	-	-	-
20a6e1	✓	-	-	-	-	-	-	-	-
c92264	✓	✓	-	-	-	-	-	-	-
2fe8b4	-	-	✓	-	-	-	-	-	-
baf4d7	✓	✓	✓	-	-	-	-	-	-
18bcb8	✓	✓	-	-	-	-	-	-	-
f55e78	✓	✓	-	-	-	-	-	-	-
bccd4c	✓	✓	✓	-	-	-	✓	-	-
9251ae	-	-	✓	-	-	-	-	-	-
504c49	?	-	-	-	-	-	-	-	-
43bde6	✓	✓	✓	-	-	-	✓	-	-

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ID / Method	1	2	3	4	5	6	7	8	9
409e27	✓	-	-	-	-	-	-	-	-
d671a6	✓	-	-	-	-	-	✓	-	-
a57a34	✓	✓	-	-	-	-	-	-	-
fb994e	✓	✓	-	-	-	-	?	-	-
19410e	✓	✓	✓	-	-	-	✓	-	-
05561a	✓	-	✓	-	-	-	-	-	-
ab1d71	-	-	✓	-	-	-	-	-	-
aa384e	-	-	✓	-	-	-	-	-	-
47c8a6	-	-	✓	-	-	-	-	-	-
de3f77	-	-	✓	-	-	-	-	-	-
225a59	✓	✓	✓	-	-	-	-	-	-
9730f4	-	-	✓	-	-	-	-	-	-
576e51	✓	✓	-	-	-	-	-	-	-
677e70	-	-	✓	-	-	-	✓	-	-
9b210b	✓	✓	✓	-	-	-	✓	-	-
f070fb	-	-	✓	-	-	-	✓	-	-
bfd33c	✓	-	-	-	-	-	-	-	-
b28848	✓	-	-	-	-	-	-	-	-
2637ed	✓	✓	-	-	-	-	-	-	-
3aab6e	✓	✓	✓	-	-	-	-	-	-
907d3f	✓	-	-	-	-	-	-	-	-
5b49d4	✓	-	-	-	-	-	-	-	-
5b96a9	-	✓	-	-	-	-	-	-	-
a72404	-	-	✓	-	-	-	-	-	-
05342b	?	✓	✓	-	-	-	-	-	-
307ab4	✓	✓	✓	-	-	-	✓	-	-

References

[1] EN 12390-3. *Testing hardened concrete - Part 3: Compressive strength of test specimens*. 2020.

[2] EN 12390-7. *Testing hardened concrete - Part 7: Density of hardened concrete*. 2020.

[3] EN 12390-8. *Testing hardened concrete - Part 8: Depth of penetration of water under pressure*. 2020.

[4] EN 480-11. *Admixtures for concrete, mortar and grout - Test methods - Part 11: Determination of air void characteristics in hardened concrete*. 2006.

[5] ČSN 73 1322. *Determination of frost resistance of concrete*. 2003.

[6] ČSN 73 1324. *Determination of grindability of concrete*. 2003.

[7] ČSN 73 1326. *Resistance of cement concrete surface to water and defrosting chemicals*. 2003.

[8] CEN/TS 12390-9. *Testing hardened concrete - Part 9: Freeze-thaw resistance - Scaling*. 2007.

[9] EN 206:2013+A2:2021. *Concrete - Specification, performance, production and conformity*. 2021.

[10] ISO 5725-2. *Accuracy (trueness and precision) of measurement methods and results - Part 2: Basic method for the determination of repeatability and reproducibility of a standard measurement method*. 2019.

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

1 Appendix – EN 12390-3 – Compressive strength of test specimens

1.1 Test results

Table 4: Test results - ordered by average value. Outliers are marked by red color. u_X - extended uncertainty of measurement; $\bar{x}$ - average value; s_0 - sample standard deviation; V_X - variation coefficient

ID	Test results [N/mm^2]			u_X [N/mm^2]	$\bar{x}$ [N/mm^2]	s_0 [N/mm^2]	V_X [%]
bfd33c	49.0	45.3	50.6	2.6	48.3	2.72	5.63
5b49d4	49.7	47.6	48.4	-	48.6	1.06	2.18
20a6e1	47.8	50.5	49.0	1.5	49.1	1.35	2.76
d671a6	48.8	49.8	49.4	-	49.3	0.5	1.02
b28848	48.9	49.6	49.7	0.4	49.4	0.44	0.88
109b42	50.0	47.8	50.6	1.0	49.5	1.47	2.98
89b0e1	51.2	51.1	49.7	1.0	50.7	0.84	1.66
409e27	50.8	52.0	50.0	1.0	50.9	1.01	1.98
c92264	49.6	51.2	52.5	0.6	51.1	1.47	2.87
bccd4c	51.3	51.8	50.3	2.5	51.1	0.76	1.49
43bde6	53.5	47.6	52.7	2.9	51.3	3.2	6.24
4670d7	50.3	52.0	51.8	-	51.4	0.93	1.81
907d3f	53.1	52.1	49.0	-	51.4	2.14	4.16
19410e	48.9	54.0	51.3	3.6	51.4	2.55	4.96
f55e78	50.9	52.5	51.7	0.5	51.7	0.8	1.55
ca6b29	52.7	52.4	50.8	0.1	52.0	1.0	1.93
3aab6e	49.7	53.9	52.6	0.4	52.1	2.15	4.13
307ab4	51.5	52.9	52.1	2.4	52.2	0.7	1.35
576e51	52.9	53.5	50.3	3.8	52.2	1.7	3.26
a57a34	52.4	53.6	51.1	1.0	52.4	1.25	2.39
baf4d7	52.5	52.2	52.7	2.5	52.5	0.25	0.48
18bcb8	50.4	54.0	53.0	0.5	52.5	1.86	3.54
94cbe6	53.2	50.5	54.2	-	52.6	1.91	3.64
a7bbbf	52.3	53.2	53.2	4.0	52.9	0.52	0.98
e67c75	53.3	51.4	54.0	-	52.9	1.35	2.54
fb994e	53.6	52.6	52.6	2.3	52.9	0.58	1.09
225a59	53.1	53.2	53.2	0.3	53.2	0.06	0.11
05561a	52.9	53.1	54.1	0.8	53.4	0.64	1.2
2637ed	53.5	53.6	54.5	1.6	53.9	0.55	1.02
9b210b	54.4	54.3	55.3	-	54.7	0.55	1.01
b57771	53.9	56.1	55.6	4.0	55.2	1.15	2.09
504c49	57.3	55.6	56.4	1.1	56.4	0.85	1.51
05342b	56.4	57.6	59.4	7.5	57.8	1.51	2.61
00b6c2	58.5	59.0	58.0	2.9	58.5	0.5	0.85

1.2 The Numerical Procedure for Determining Outliers

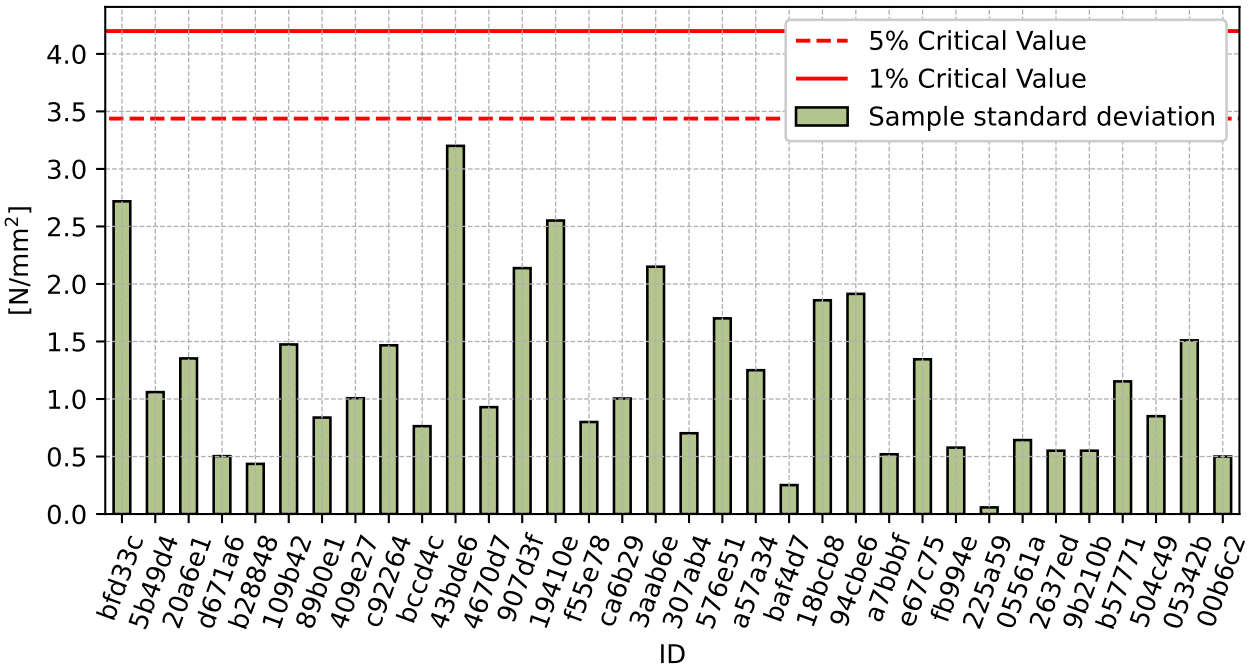

Figure 1: **Cochran's test** - sample standard deviations

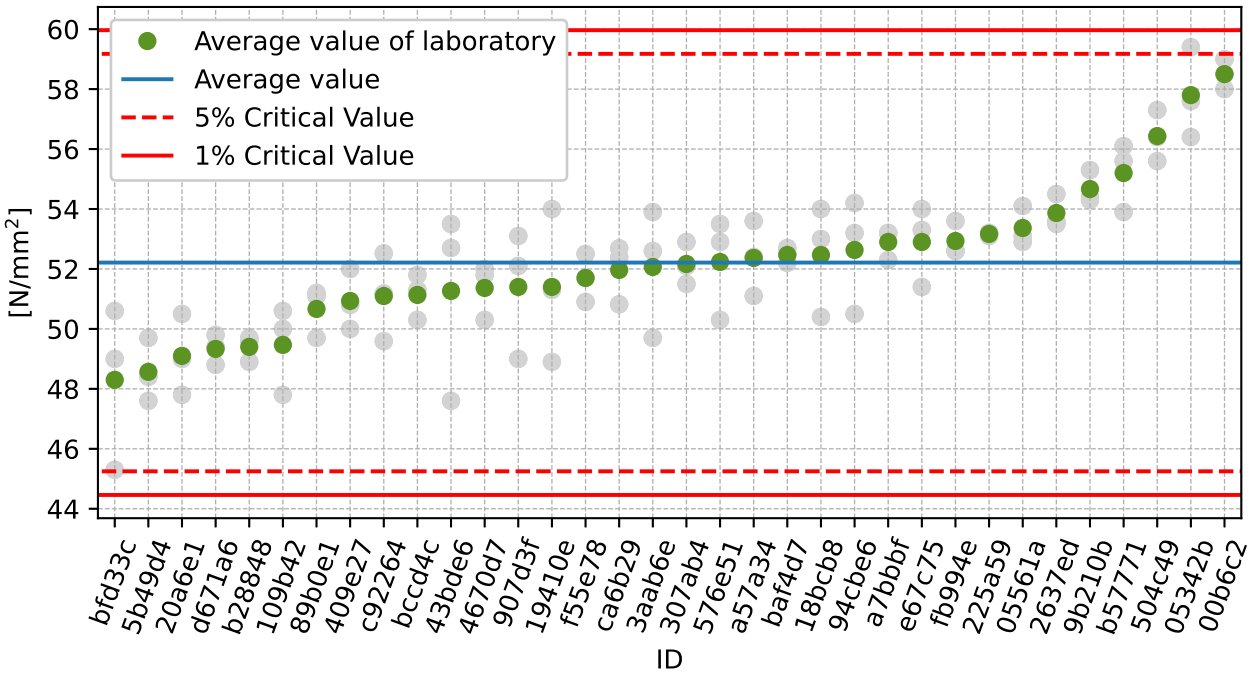

Figure 2: **Grubbs' test** - average values

1.3 Mandel's Statistics

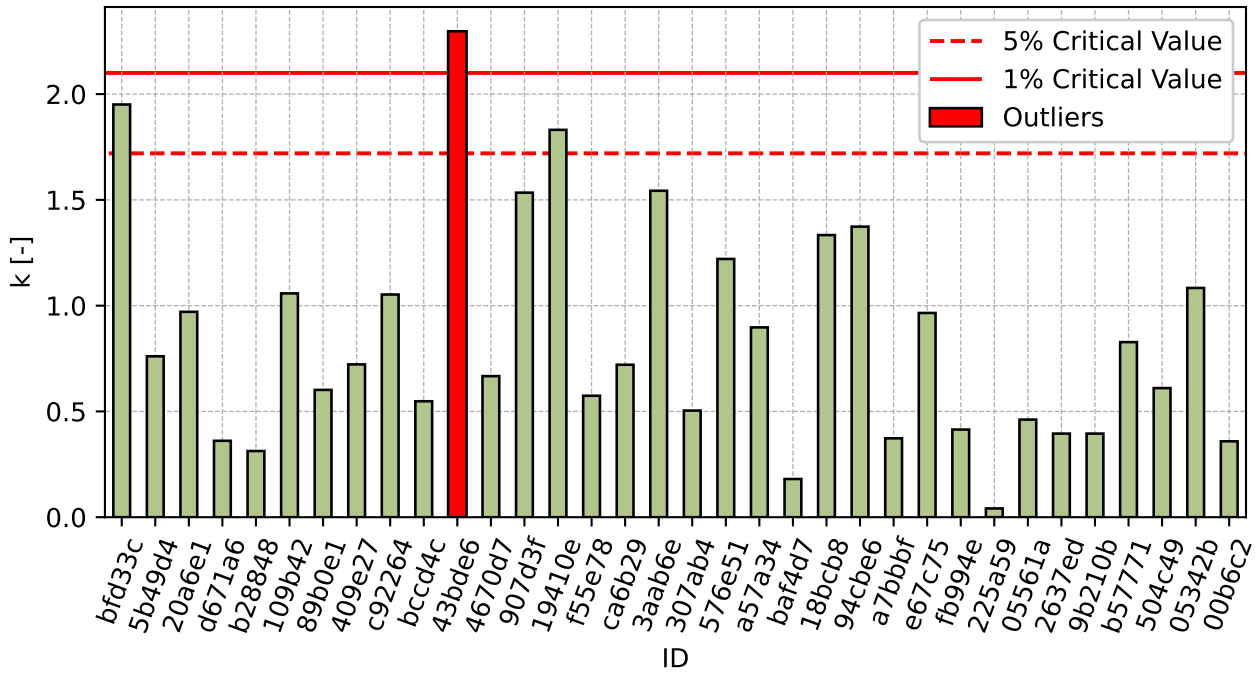

Figure 3: Intralaboratory Consistency Statistic

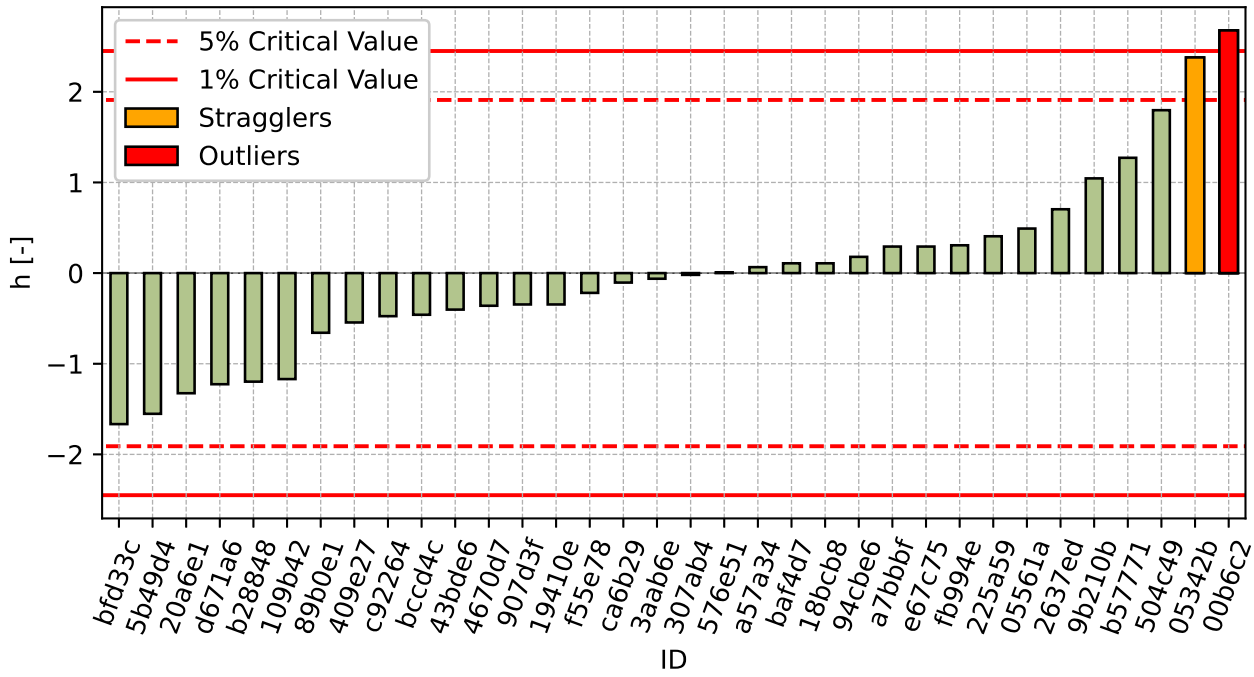

Figure 4: Interlaboratory Consistency Statistic

1.4 Descriptive statistics

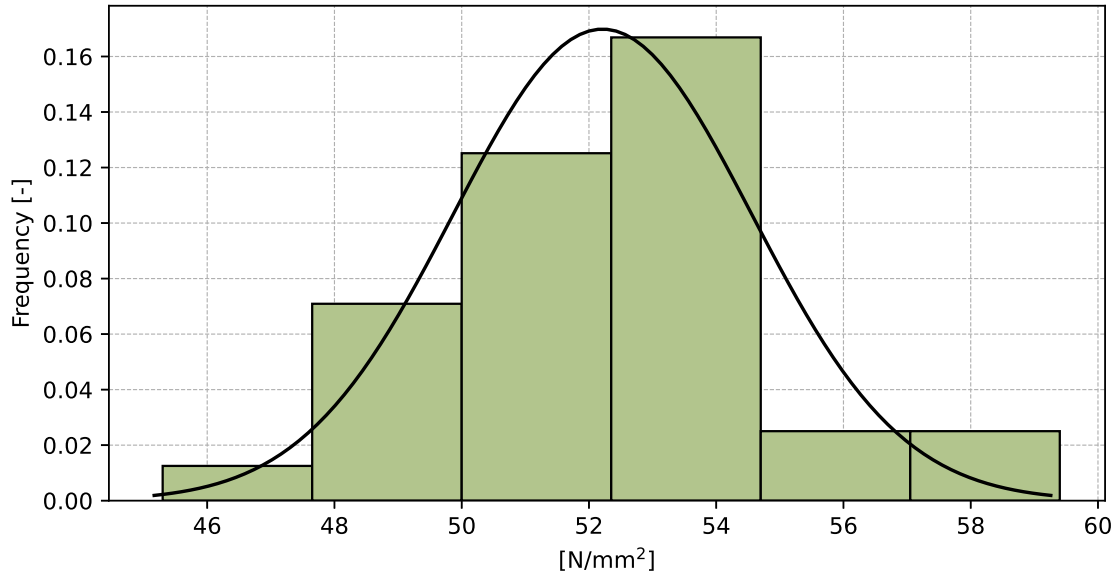

Figure 5: Histogram of all test results

Table 5: Descriptive statistics

Characteristics	**[N/mm²]**
Average value – $\bar{x}$	52.2
Sample standard deviation – s	2.35
Asigned value – x^*	52.2
Robust standard deviation – s^*	2.01
Measurement uncertainty of asigned value – u_X	0.43
p-value of normality test	0.092 [-]
Interlaboratory standard deviation – s_L	2.21
Repeatability standard deviation – s_r	1.39
Reproducibility standard deviation – s_R	2.61
Repeatability – r	3.9
Reproducibility – R	7.3

1.5 Evaluation of Performance Statistics

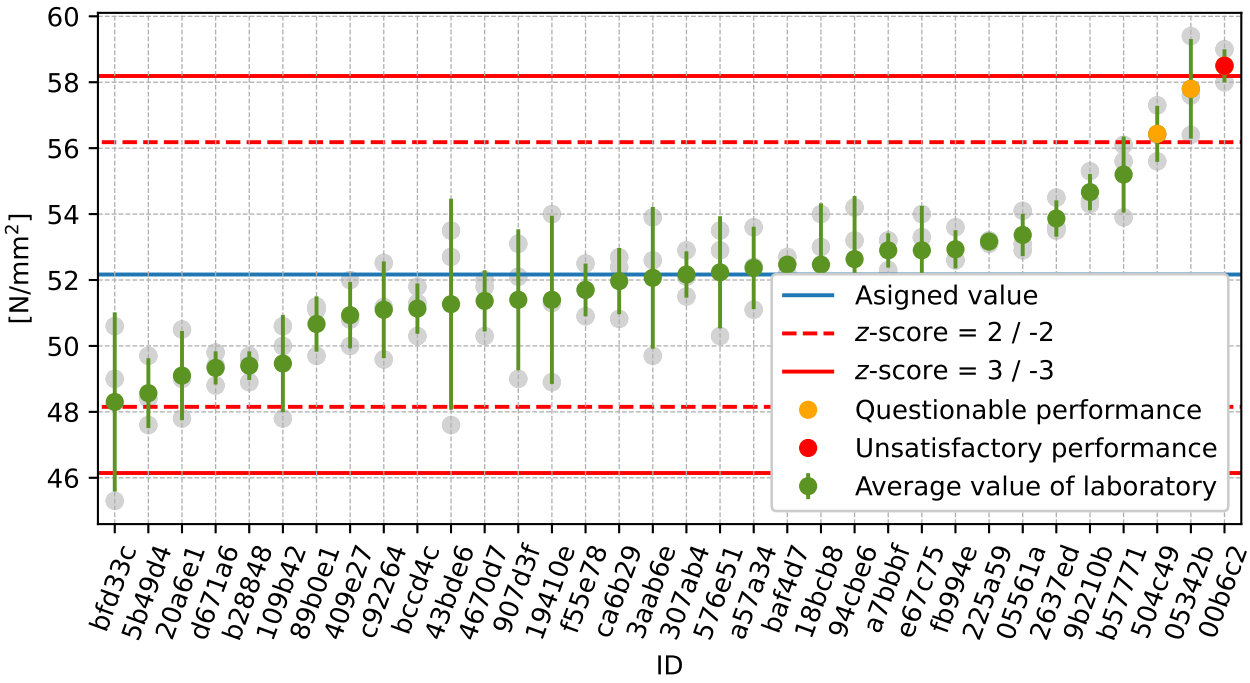

Figure 6: Average values and sample standard deviations

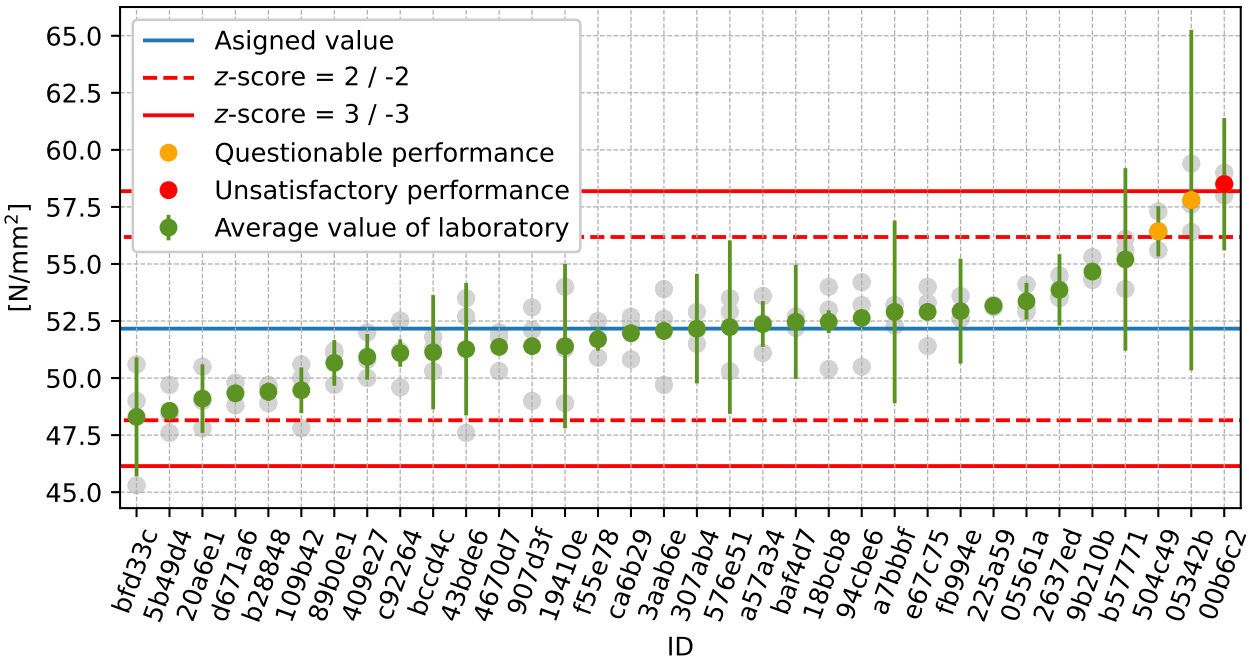

Figure 7: Average values and extended uncertainties of measurement

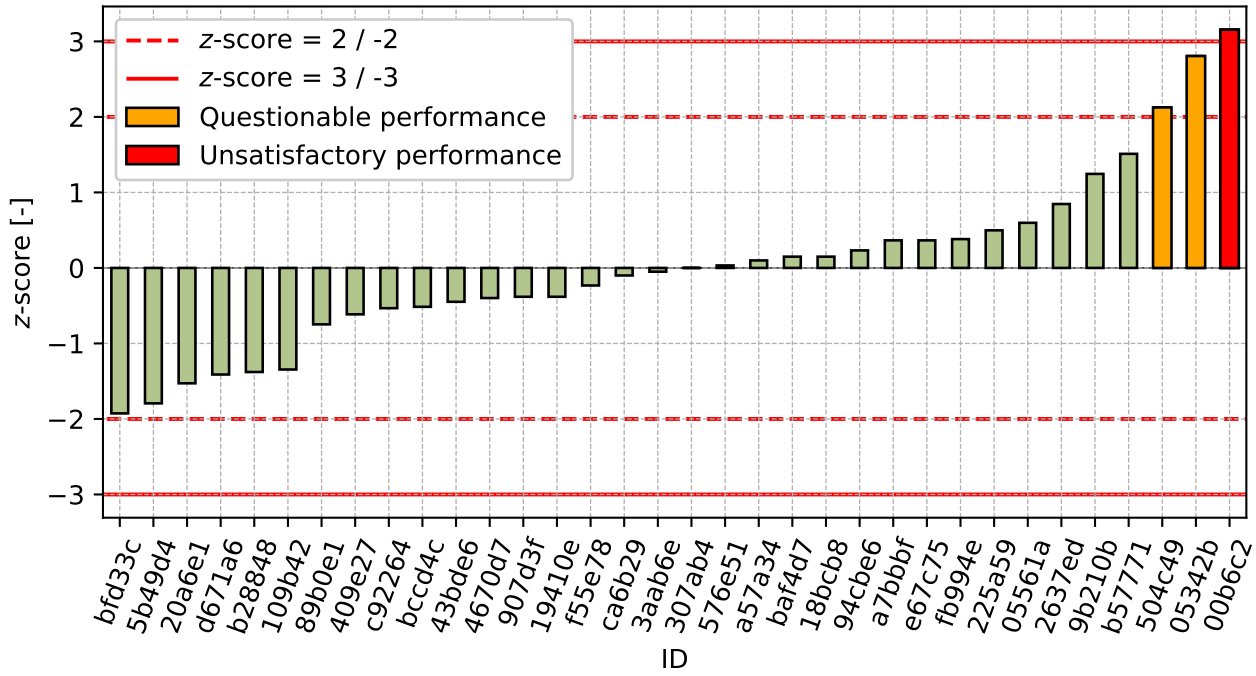

Figure 8: z-score

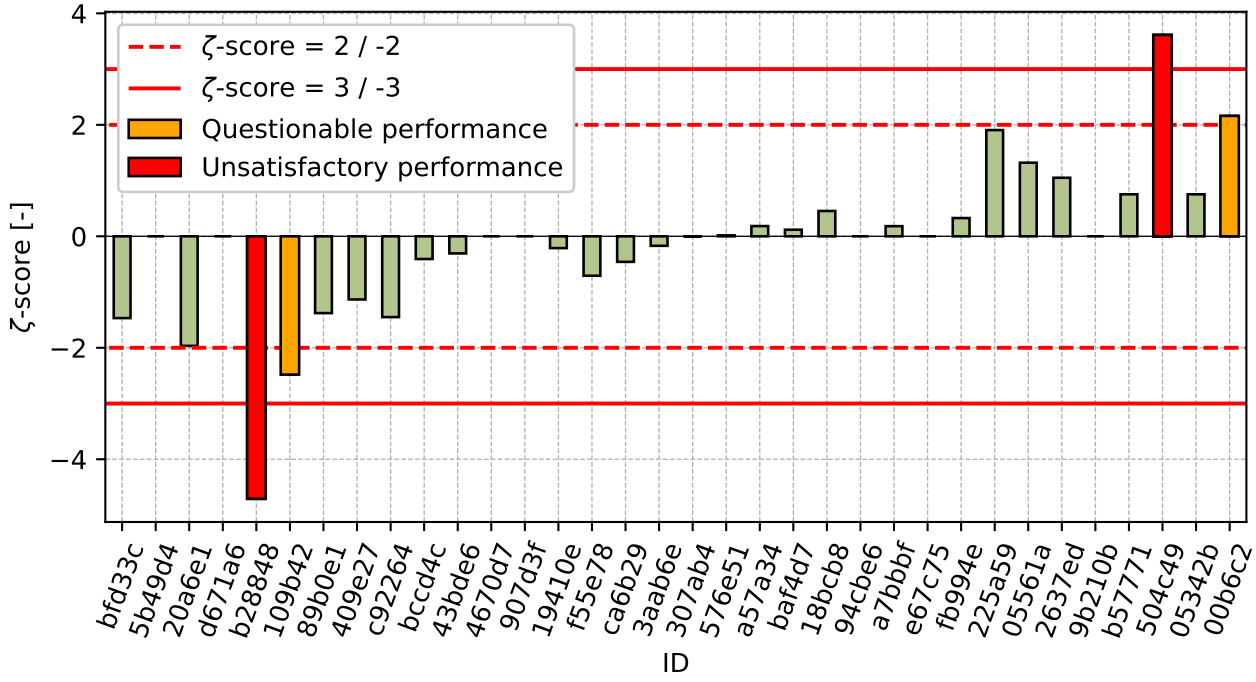

Figure 9: ζ-score

Table 6: z-score and ζ-score

ID	z-score [-]	ζ-score [-]
bfd33c	-1.93	-1.47
5b49d4	-1.79	-
20a6e1	-1.53	-1.97
d671a6	-1.41	-
b28848	-1.38	-4.71
109b42	-1.35	-2.48
89b0e1	-0.75	-1.38
409e27	-0.61	-1.13
c92264	-0.53	-1.45
bccd4c	-0.51	-0.41
43bde6	-0.45	-0.31
4670d7	-0.40	-
907d3f	-0.38	-
19410e	-0.38	-0.21
f55e78	-0.23	-0.71
ca6b29	-0.10	-0.46
3aab6e	-0.05	-0.17
307ab4	-0.00	-0.00
576e51	0.03	0.02
a57a34	0.10	0.18
baf4d7	0.15	0.12
18bcb8	0.15	0.45
94cbe6	0.23	-
a7bbbf	0.37	0.18
e67c75	0.37	-
fb994e	0.38	0.33
225a59	0.50	1.91
05561a	0.60	1.32
2637ed	0.85	1.05
9b210b	1.25	-
b57771	1.51	0.75
504c49	2.13	3.61
05342b	2.81	0.75
00b6c2	3.15	2.16

2 Appendix – EN 12390-7 – Density of hardened concrete

2.1 Test results

Table 7: Test results - ordered by average value. Outliers are marked by red color. u_X - extended uncertainty of measurement; $\bar{x}$ - average value; s_0 - sample standard deviation; V_X - variation coefficient

ID	Test results [kg/m³]			u_X [kg/m³]	$\bar{x}$ [kg/m³]	s_0 [kg/m³]	V_X [%]
a7bbbf	2280	2280	2280	15	2280	0	0
f55e78	2290	2280	2280	10	2283	5.8	0.25
bccd4c	2300	2290	2290	40	2293	5.8	0.25
94cbe6	2310	2280	2290	-	2293	15.3	0.67
4670d7	2300	2300	2280	-	2293	11.5	0.5
307ab4	2290	2300	2290	6	2293	5.8	0.25
e67c75	2300	2290	2300	-	2297	5.8	0.25
576e51	2300	2290	2300	20	2297	5.8	0.25
05342b	2298	2301	2300	25	2300	1.5	0.07
18bcb8	2300	2320	2290	10	2303	15.3	0.66
a57a34	2290	2310	2310	32	2303	11.5	0.5
2637ed	2300	2310	2310	21	2307	5.8	0.25
b57771	2310	2310	2300	15	2307	5.8	0.25
89b0e1	2316	2305	2308	100	2310	5.7	0.25
c92264	2310	2318	2310	0	2313	4.6	0.2
9b210b	2330	2300	2310	-	2313	15.3	0.66
43bde6	2310	2310	2320	20	2313	5.8	0.25
5b96a9	2316	2317	2313	2	2315	2.1	09
fb994e	2330	2320	2300	20	2317	15.3	0.66
3aab6e	2316	2319	2326	8	2320	5.1	0.22
baf4d7	2320	2330	2320	30	2323	5.8	0.25
225a59	2320	2330	2330	13	2327	5.8	0.25
00b6c2	2320	2350	2320	70	2330	17.3	0.74
19410e	2340	2330	2330	90	2333	5.8	0.25
ca6b29	2339	2330	2341	-	2337	5.9	0.25

2.2 The Numerical Procedure for Determining Outliers

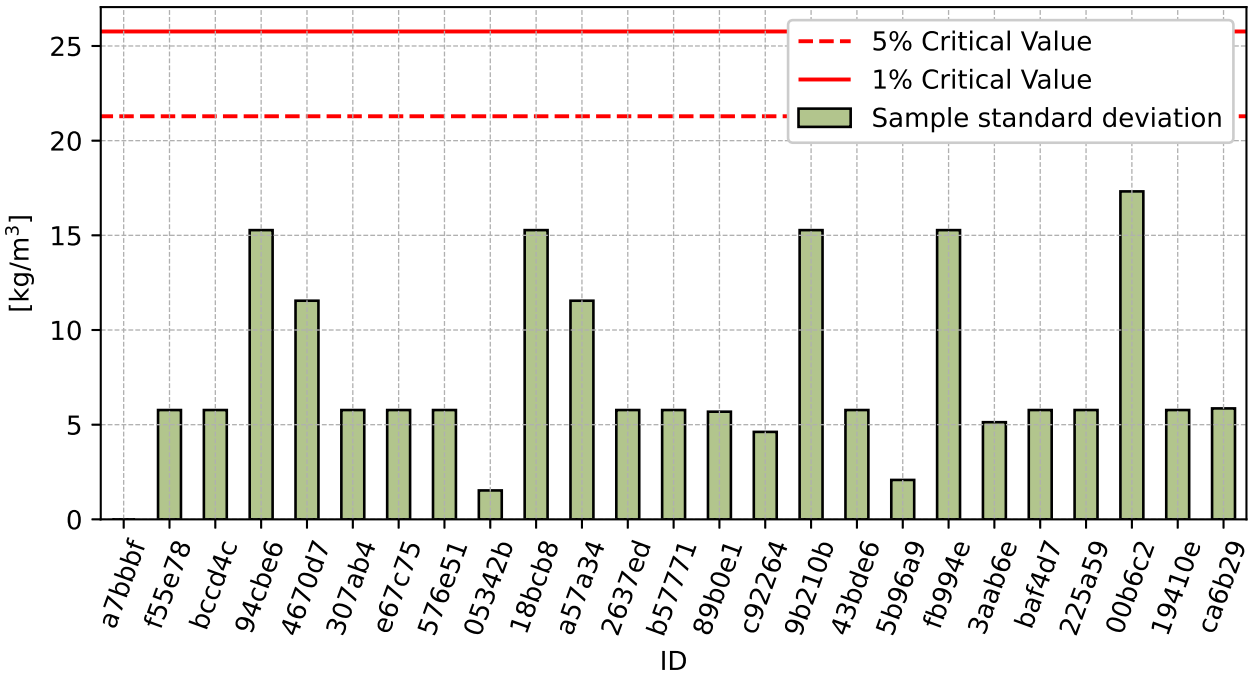

Figure 10: **Cochran's test** - sample standard deviations

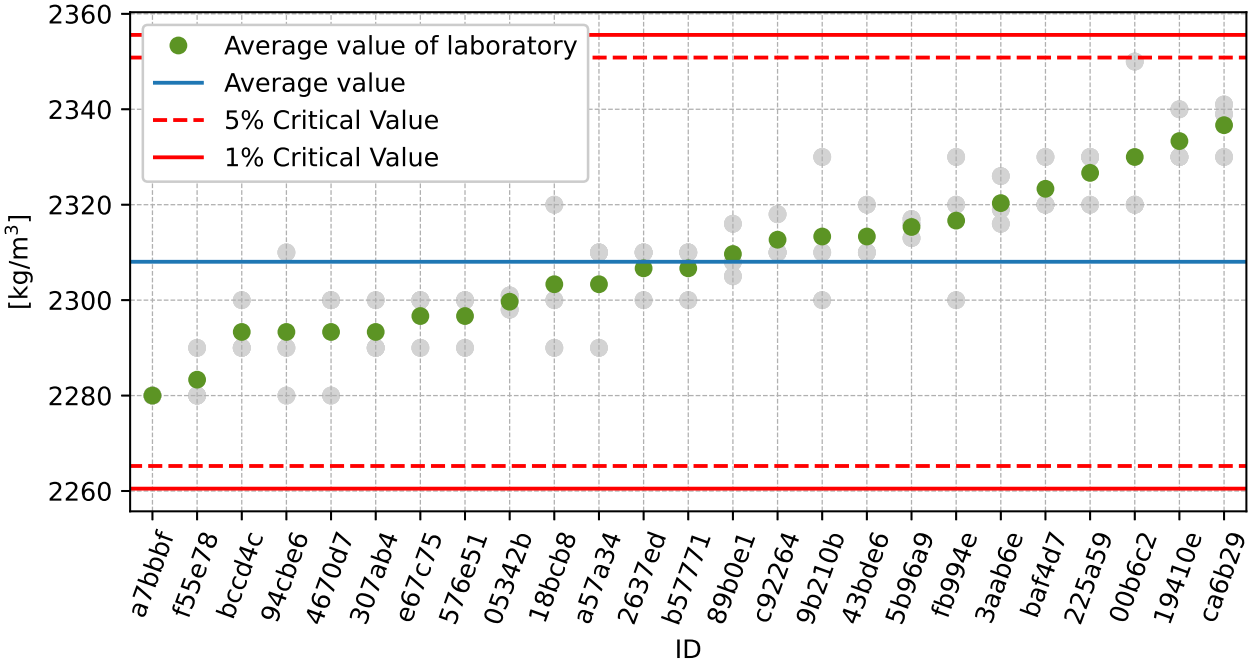

Figure 11: **Grubbs' test** - average values

2.3 Mandel's Statistics

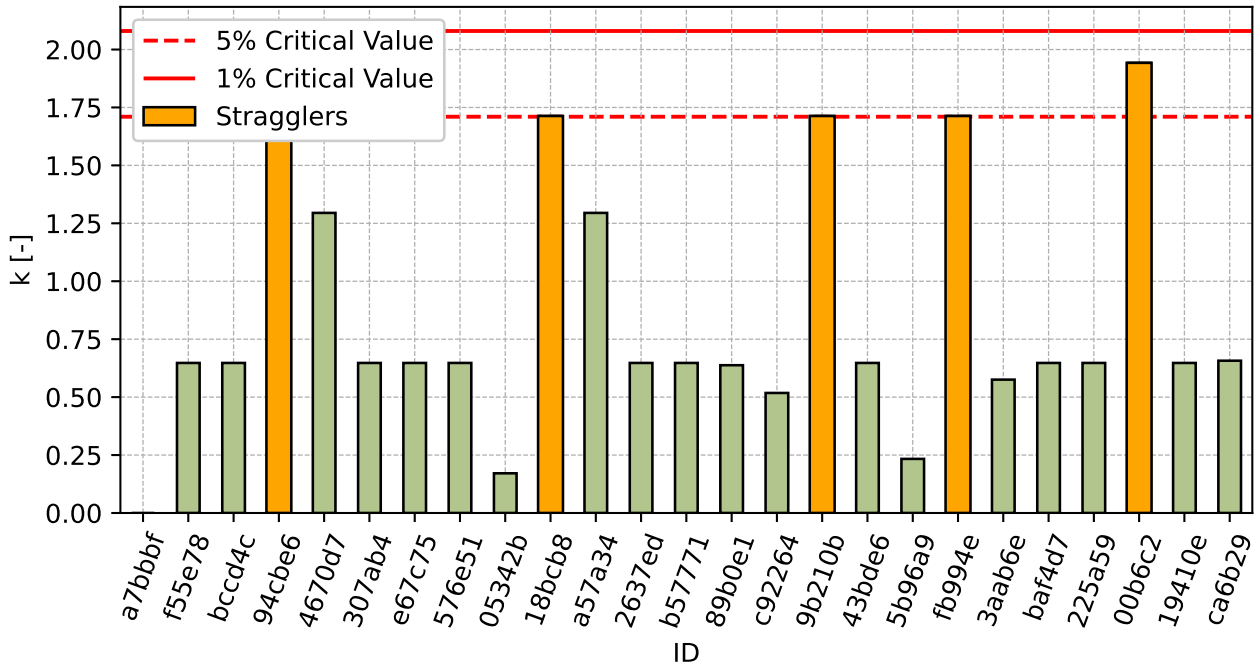

Figure 12: Intralaboratory Consistency Statistic

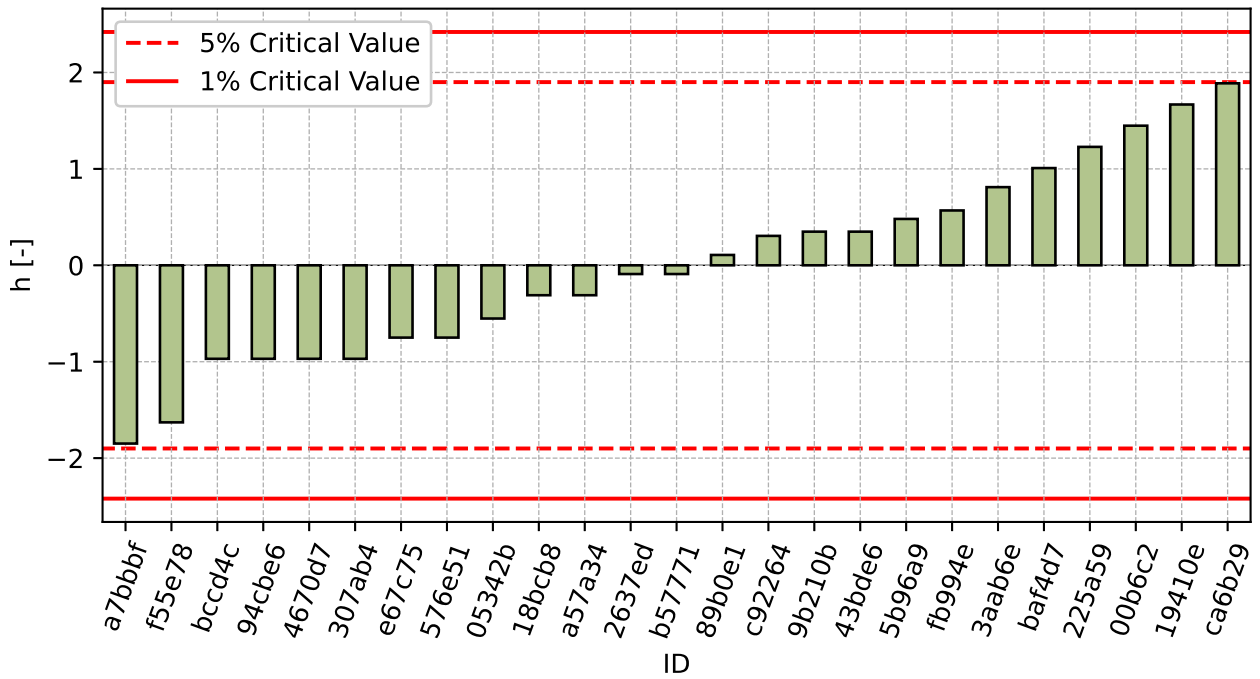

Figure 13: Interlaboratory Consistency Statistic

2.4 Descriptive statistics

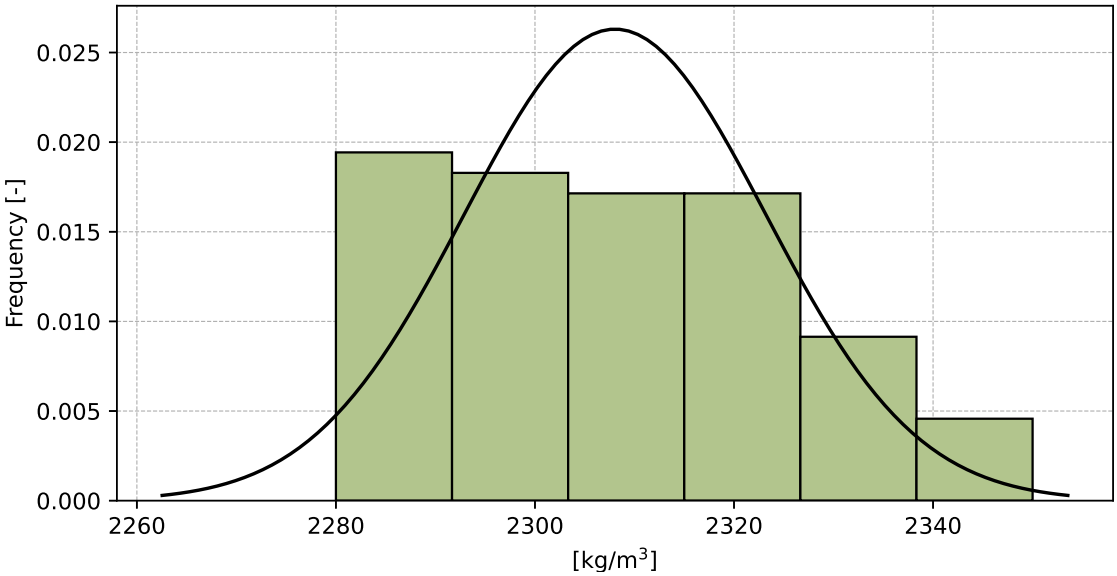

Figure 14: Histogram of all test results

Table 8: Descriptive statistics

Characteristics	**[kg/m³]**
Average value – $\bar{x}$	2308
Sample standard deviation – s	15.2
Asigned value – x^*	2308
Robust standard deviation – s^*	16.0
Measurement uncertainty of asigned value – u_X	4.0
p-value of normality test	0.038 [-]
Interlaboratory standard deviation – s_L	14.3
Repeatability standard deviation – s_r	8.9
Reproducibility standard deviation – s_R	16.8
Repeatability – r	25
Reproducibility – R	47

2.5 Evaluation of Performance Statistics

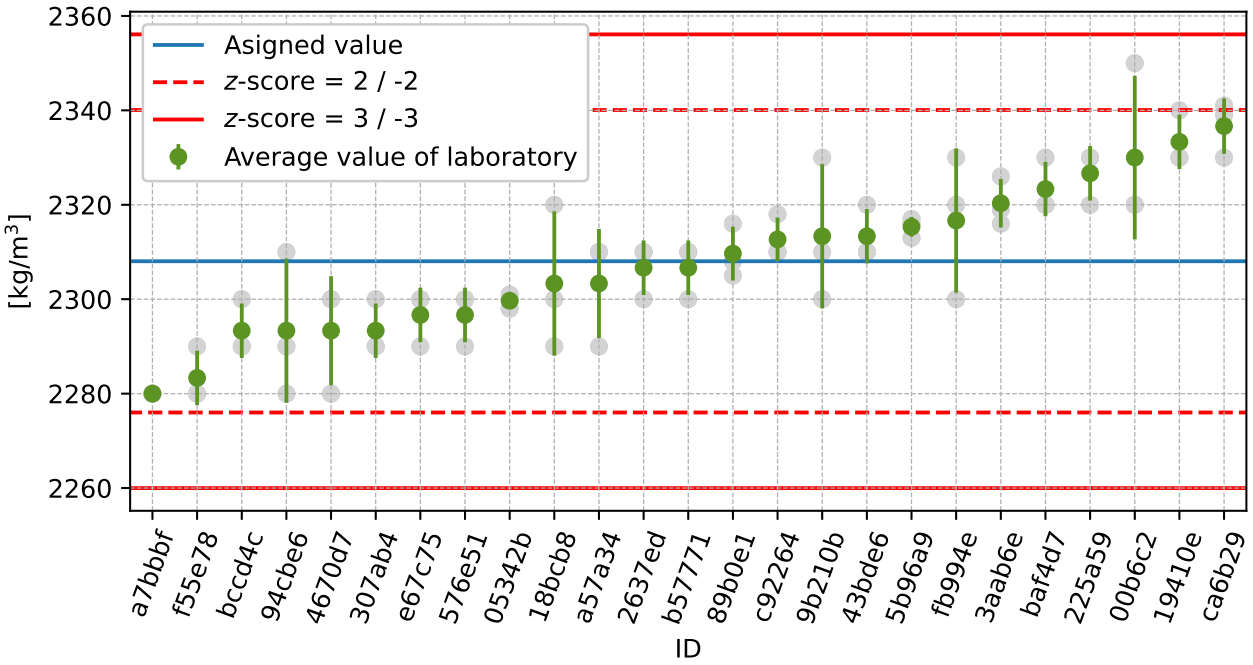

Figure 15: Average values and sample standard deviations

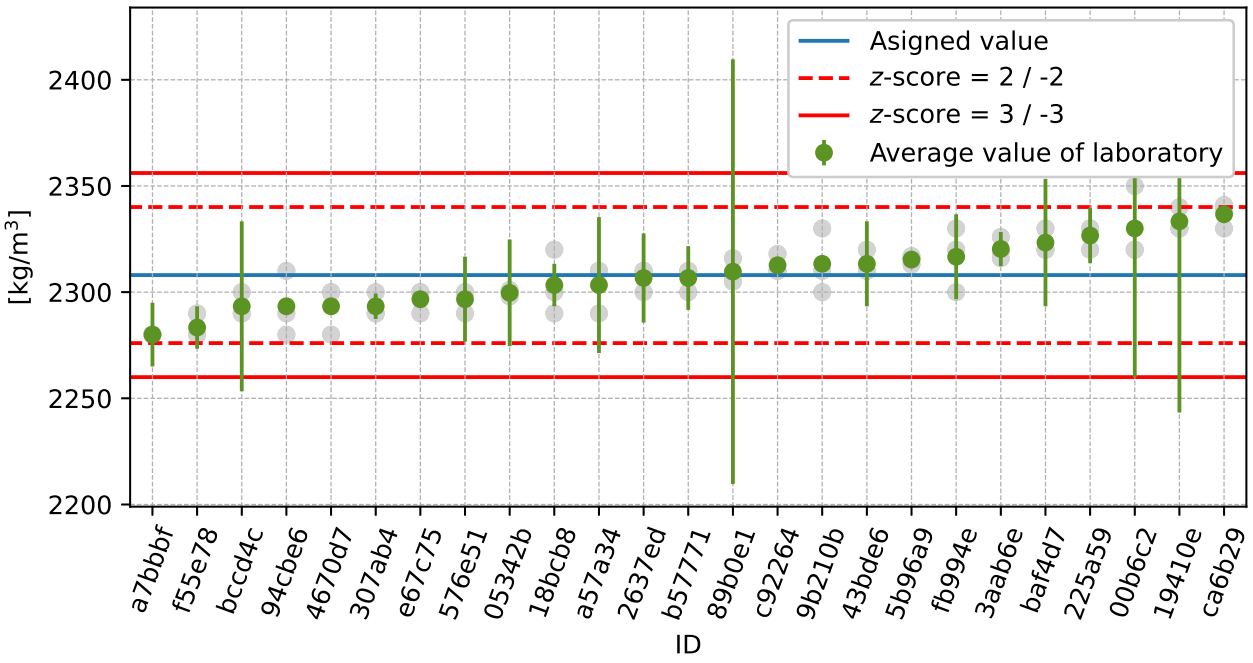

Figure 16: Average values and extended uncertainties of measurement

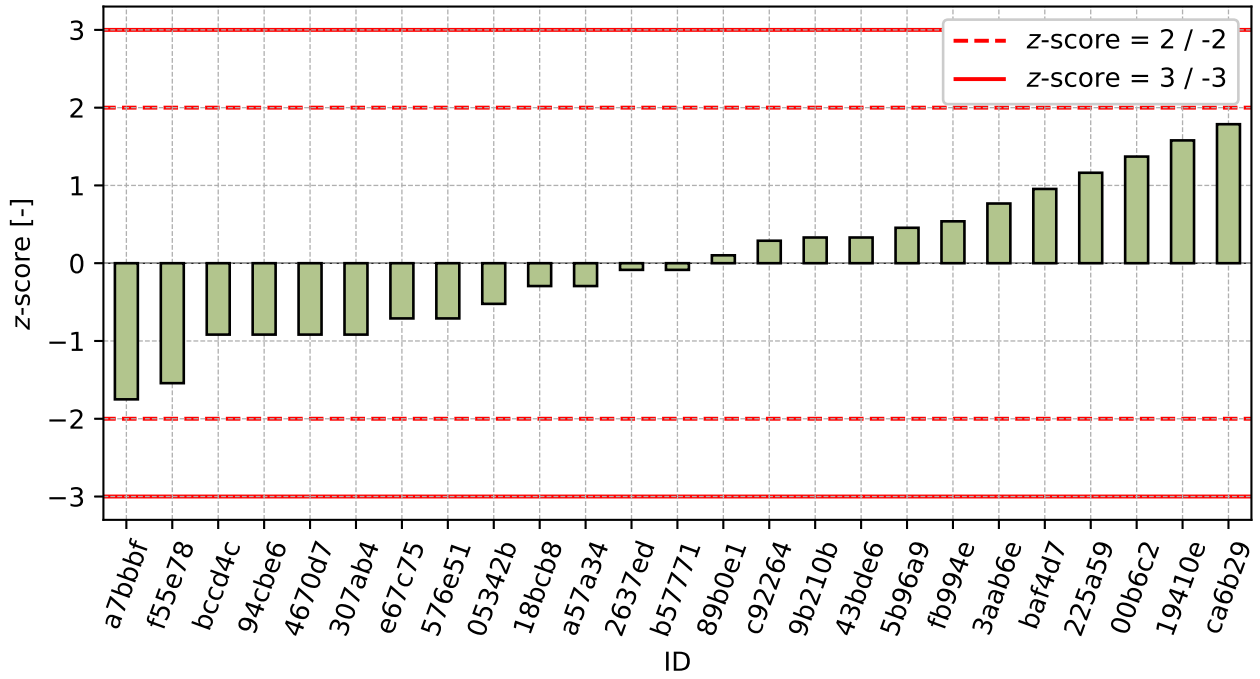

Figure 17: z-score

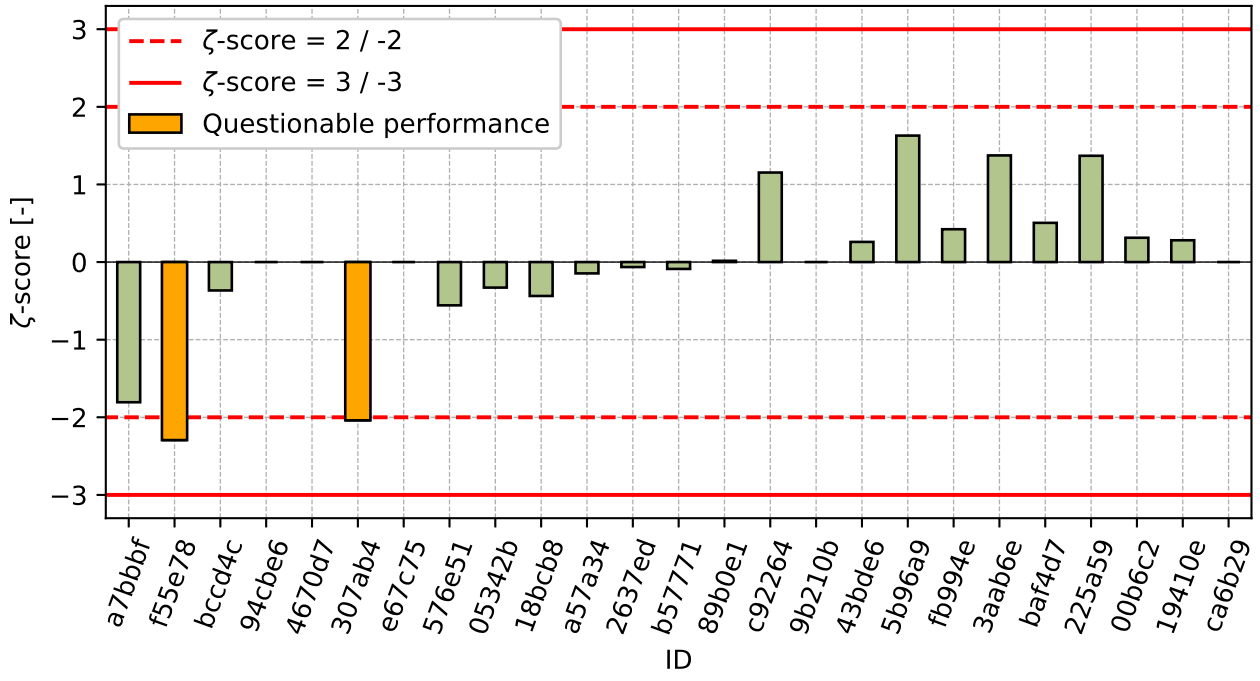

Figure 18: ζ-score

Table 9: z-score and ζ-score

ID	z-score [-]	ζ-score [-]
a7bbbf	-1.75	-1.81
f55e78	-1.54	-2.29
bccd4c	-0.92	-0.37
94cbe6	-0.92	-
4670d7	-0.92	-
307ab4	-0.92	-2.04
e67c75	-0.71	-
576e51	-0.71	-0.56
05342b	-0.52	-0.33
18bcb8	-0.29	-0.44
a57a34	-0.29	-0.15
2637ed	-0.09	-0.06
b57771	-0.09	-0.09
89b0e1	0.10	0.02
c92264	0.29	1.15
9b210b	0.33	-
43bde6	0.33	0.26
5b96a9	0.46	1.63
fb994e	0.54	0.42
3aab6e	0.77	1.37
baf4d7	0.95	0.51
225a59	1.16	1.37
00b6c2	1.37	0.31
19410e	1.58	0.28
ca6b29	1.79	-

3 Appendix – EN 12390-8 – Depth of penetration of water under pressure

3.1 Test results

Table 10: Test results - ordered by average value. Outliers are marked by red color. u_X - extended uncertainty of measurement; $\bar{x}$ - average value; s_0 - sample standard deviation; V_X - variation coefficient

ID	Test results [mm]			u_X [mm]	$\bar{x}$ [mm]	s_0 [mm]	V_X [%]
19410e	7	5	5	2	6	1.2	20.38
35569a	6	6	7	-	6	0.6	9.12
f070fb	5	9	9	4	8	2.3	30.12
43bde6	6	10	10	2	9	2.3	26.65
baf4d7	13	9	5	4	9	4	44.44
225a59	10	9	8	3	9	1	11.11
2f4bcb	12	10	8	-	10	2	20
9251ae	11	9	10	2	10	1.1	11
2fe8b4	13	15	5	2	11	5.3	48.1
00b6c2	12	13	10	1	12	1.5	13.09
b11cae	14	12	14	-	13	1.2	8.66
a72404	20	7	13	1	13	6.5	48.8
3aab6e	18	12	11	1	14	3.8	27.7
bccd4c	9	16	17	3	14	4.4	31.13
05561a	15	14	13	1	14	1	7.14
677e70	13	16	14	1	14	1.5	10.66
b57771	15	20	10	10	15	5	33.33
05342b	14	15	16	1	15	1	6.67
d12b02	14	16	15	-	15	1	6.67
ab1d71	12	19	16	1	16	3.5	22.42
aa384e	11	19	17	3	16	4.2	26.57
47c8a6	15	17	16	-	16	1	6.25
9730f4	15	17	16	2	16	1	6.25
307ab4	23	16	21	2	20	3.6	18.03
dcb7e1	19	22	20	2	20	1.5	7.51
9b210b	22	19	20	-	20	1.5	7.51
de3f77	20	25	21	2	22	2.6	123

3.2 The Numerical Procedure for Determining Outliers

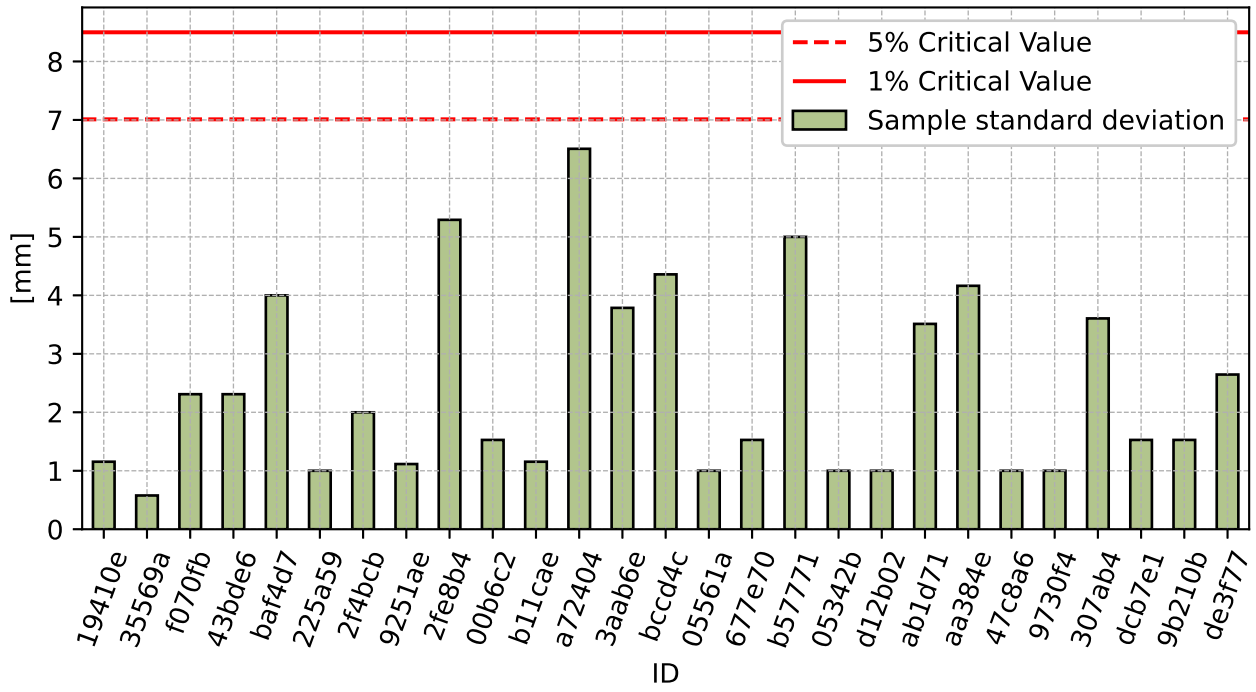

Figure 19: **Cochran's test** - sample standard deviations

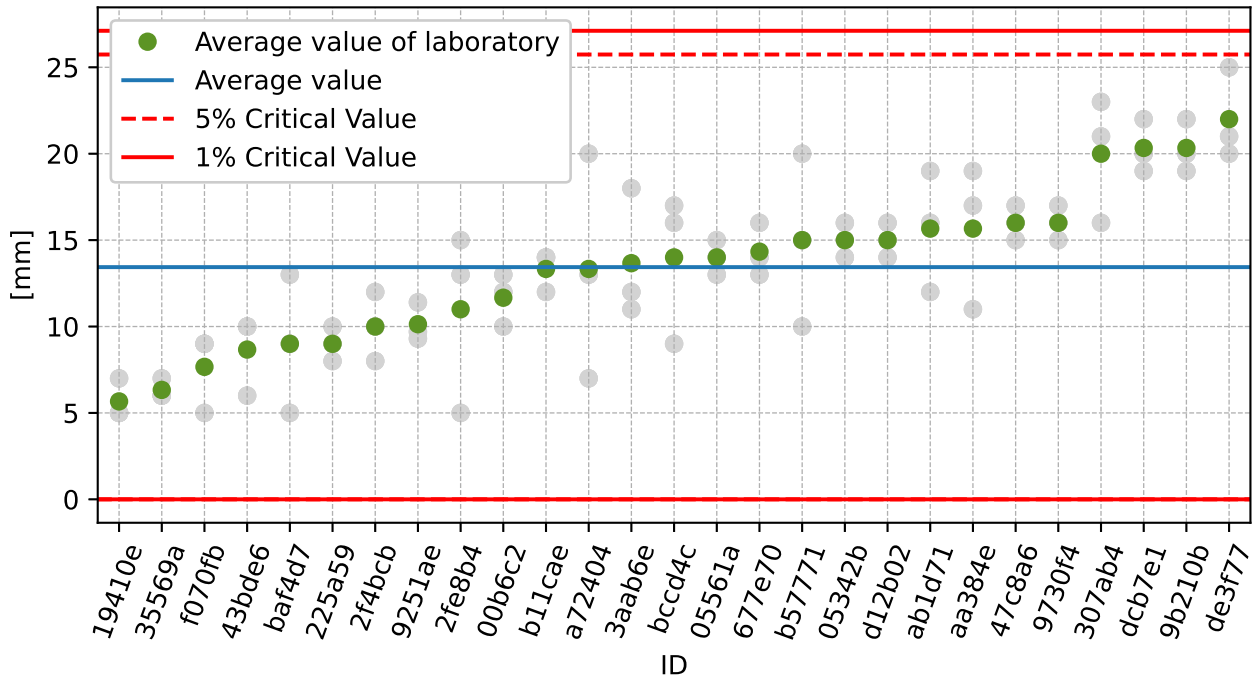

Figure 20: **Grubbs' test** - average values

3.3 Mandel's Statistics

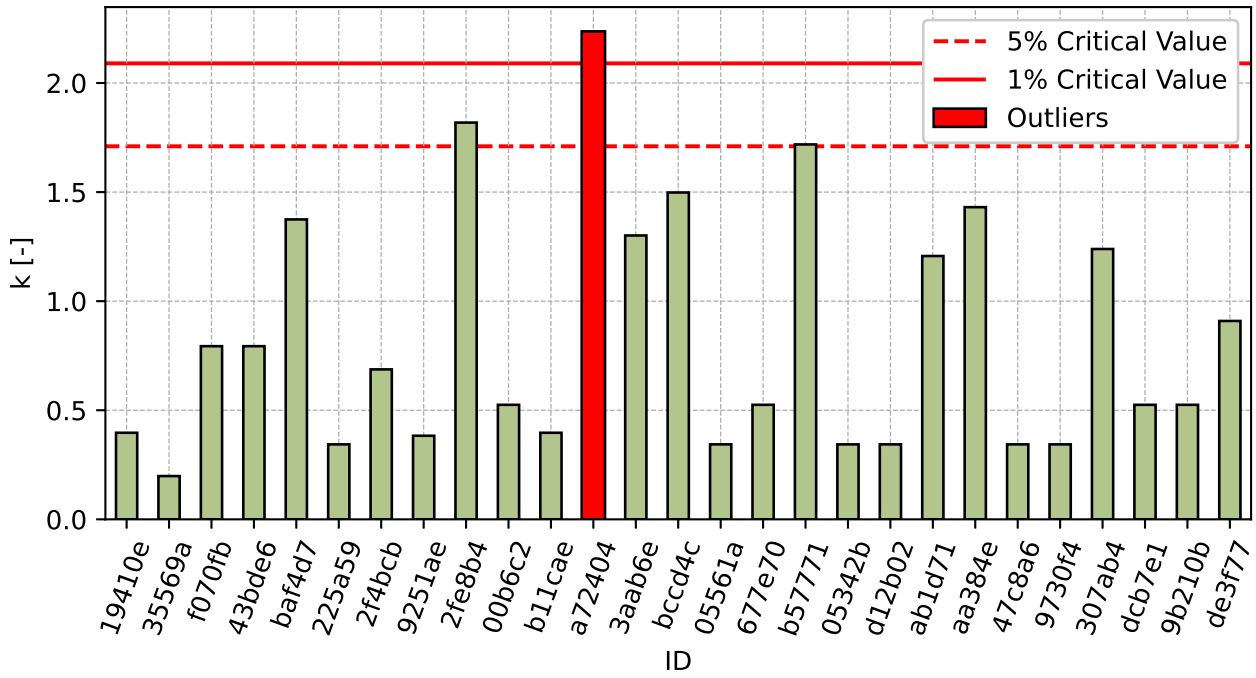

Figure 21: Intralaboratory Consistency Statistic

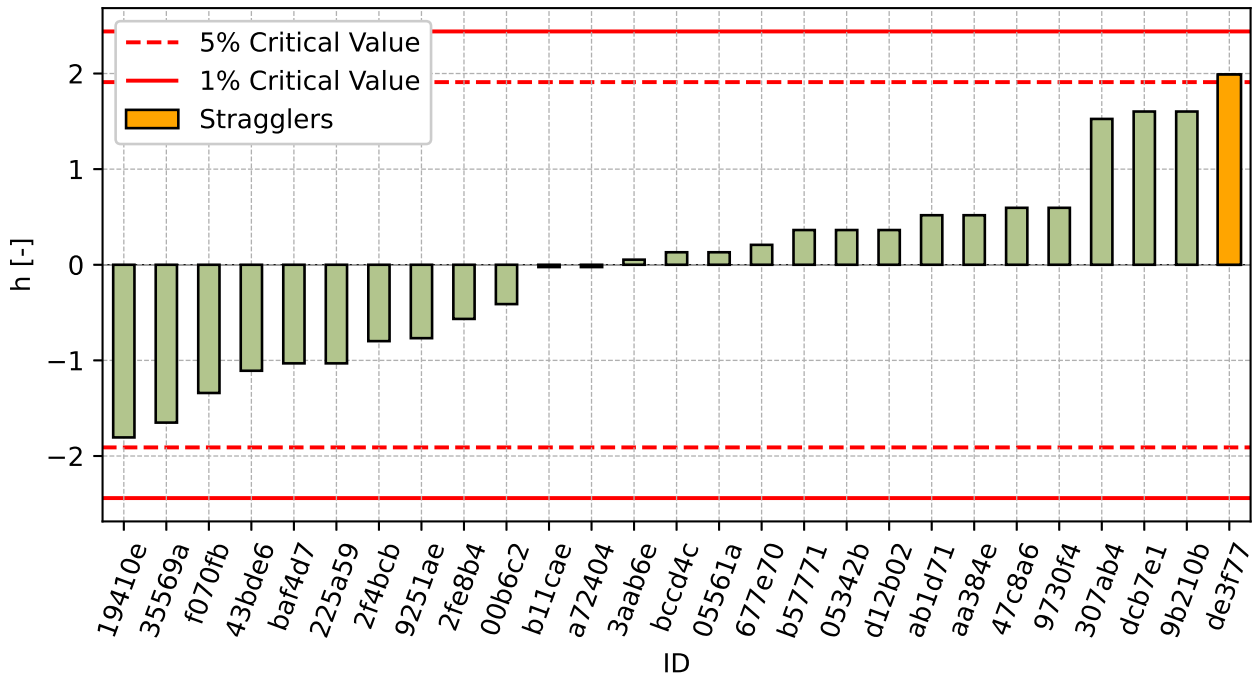

Figure 22: Interlaboratory Consistency Statistic

3.4 Descriptive statistics

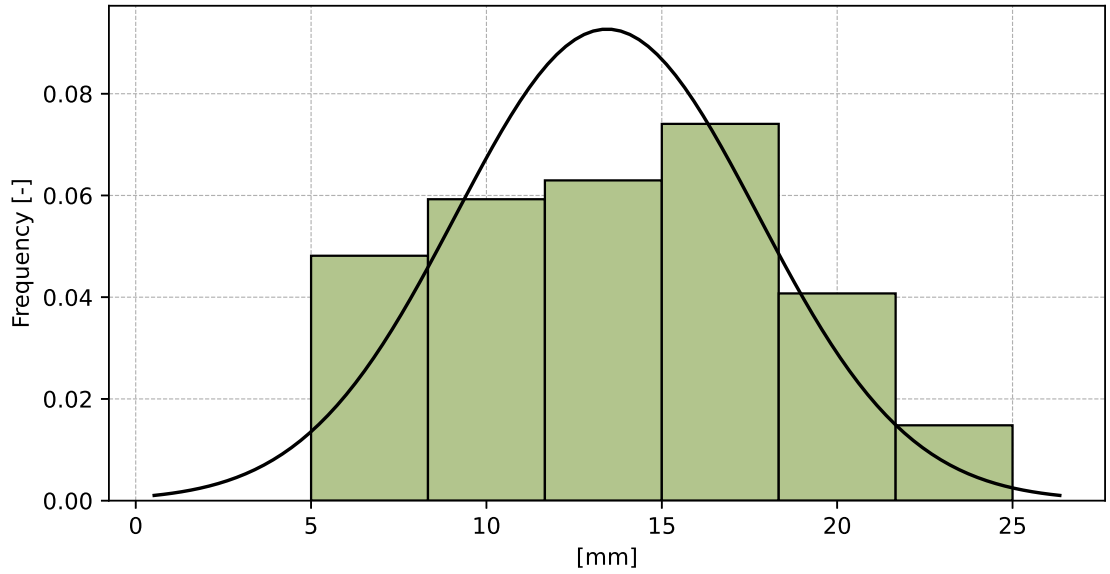

Figure 23: Histogram of all test results

Table 11: Descriptive statistics

Characteristics	[mm]
Average value – $\bar{x}$	13
Sample standard deviation – s	4.3
Asigned value – x^*	14
Robust standard deviation – s^*	4.2
Measurement uncertainty of asigned value – u_X	1.0
p-value of normality test	0.172 [-]
Interlaboratory standard deviation – s_L	4.0
Repeatability standard deviation – s_r	2.9
Reproducibility standard deviation – s_R	4.9
Repeatability – r	8
Reproducibility – R	14

3.5 Evaluation of Performance Statistics

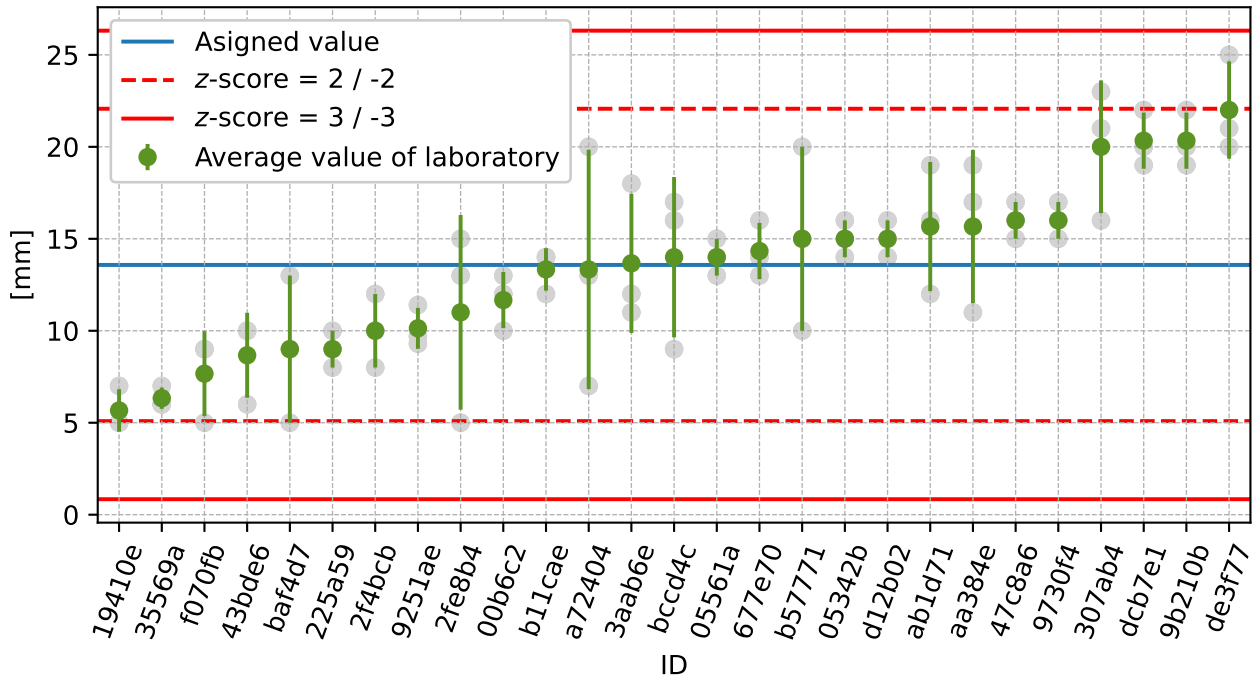

Figure 24: Average values and sample standard deviations

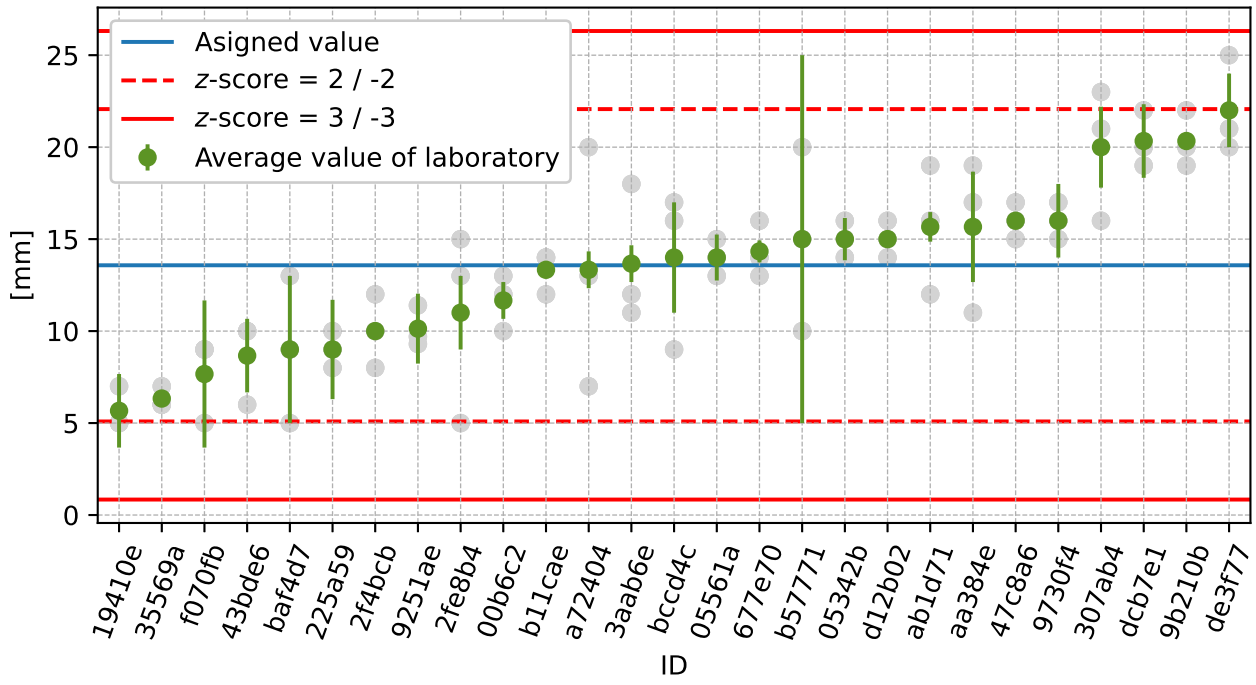

Figure 25: Average values and extended uncertainties of measurement

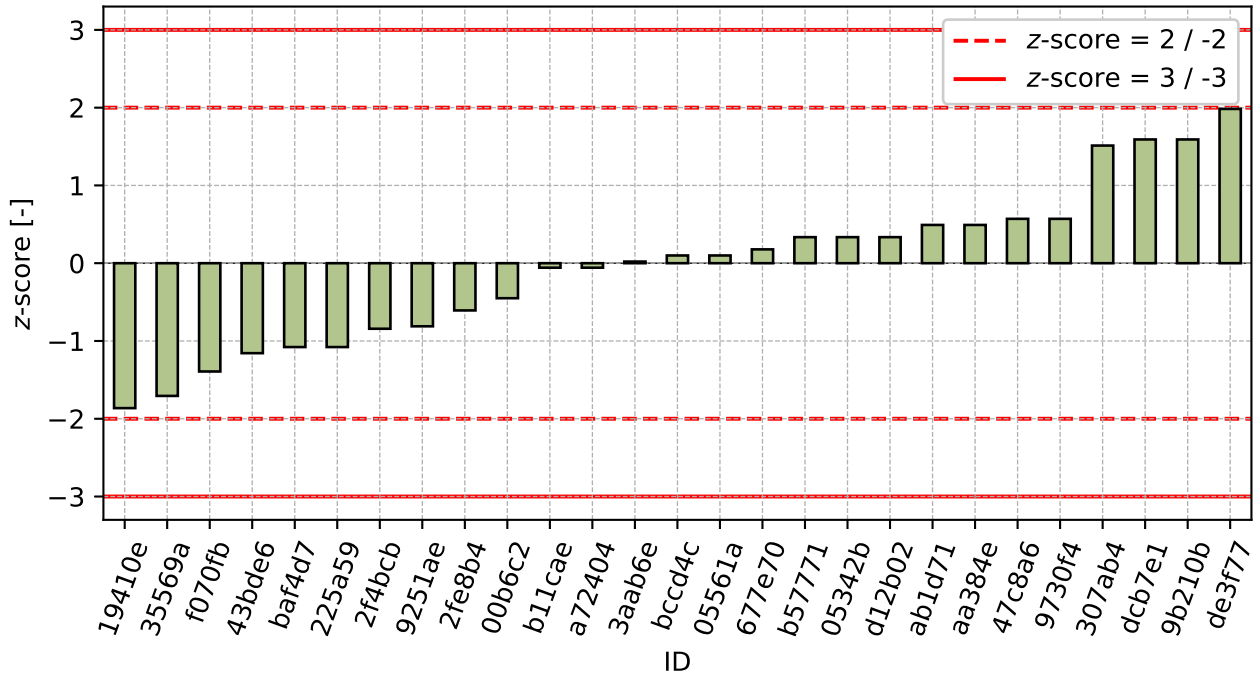

Figure 26: z-score

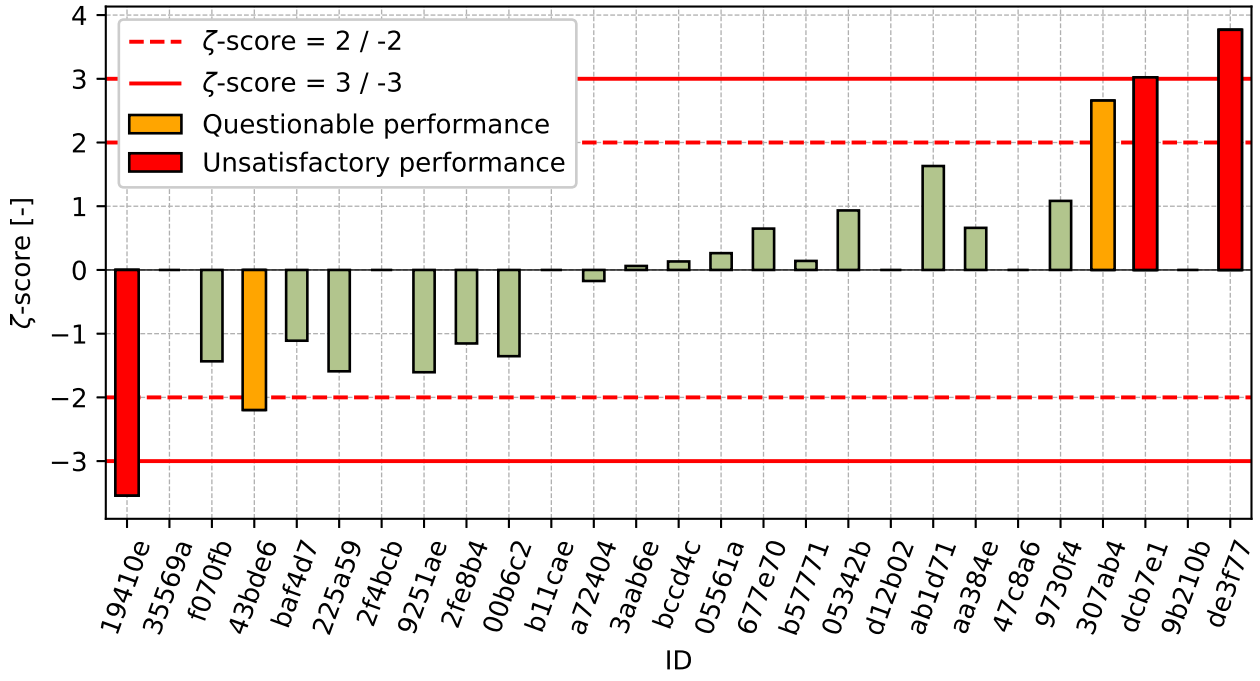

Figure 27: ζ-score

Table 12: z-score and ζ-score

ID	z-score [-]	ζ-score [-]
19410e	-1.86	-3.54
35569a	-1.71	-
f070fb	-1.39	-1.43
43bde6	-1.16	-2.20
baf4d7	-1.08	-1.11
225a59	-1.08	-1.59
2f4bcb	-0.84	-
9251ae	-0.81	-1.61
2fe8b4	-0.61	-1.15
00b6c2	-0.45	-1.35
b11cae	-0.06	-
a72404	-0.06	-0.17
3aab6e	0.02	0.06
bccd4c	0.10	0.13
05561a	0.10	0.26
677e70	0.18	0.65
b57771	0.33	0.14
05342b	0.33	0.93
d12b02	0.33	-
ab1d71	0.49	1.63
aa384e	0.49	0.66
47c8a6	0.57	-
9730f4	0.57	1.08
307ab4	1.51	2.66
dcb7e1	1.59	3.02
9b210b	1.59	-
de3f77	1.98	3.77

4 Appendix – EN 480-11 – Determination of air void characteristics in hardened concrete

This part of PT program was not open due to low number of participants.

5 Appendix – ČSN 73 1322 – Determination of frost resistance of concrete

This part of PT program was not open due to low number of participants.

6 Appendix – ČSN 73 1324 – Determination of grindability of concrete

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

7 Appendix – ČSN 73 1326 – Resistance of cement concrete surface to water and defrosting chemicals – Method A

7.1 25 cycles

7.1.1 Test results

Table 13: Test results - ordered by average value. Outliers are marked by red color. u_X - extended uncertainty of measurement; $\bar{x}$ - average value; s_0 - sample standard deviation; V_X - variation coefficient

ID	Test results [g/m^2]			u_X [g/m^2]	$\bar{x}$ [g/m^2]	s_0 [g/m^2]	V_X [%]
bccd4c	48.4	36.2	40.0	-	41.5	6.24	15.03
b57771	51.8	58.7	58.3	10.0	56.3	3.87	6.88
307ab4	47.8	89.8	52.5	14.0	63.4	23.01	36.32
19410e	74.5	52.2	66.3	13.0	64.3	11.28	17.53
43bde6	73.6	77.2	62.3	3.1	71.0	7.77	10.94
b11cae	88.9	84.4	48.9	-	74.1	21.91	29.58
9b210b	74.6	89.7	78.4	-	80.9	7.85	9.71
a6b6ad	116.2	116.1	81.5	-	104.6	20.01	19.13
d671a6	105.6	116.8	101.5	-	108.0	7.92	7.34
dcb7e1	145.0	70.0	113.0	49.0	109.3	37.63	34.42
d12b02	136.1	125.6	104.8	-	122.2	15.93	13.04
ca6b29	118.4	115.4	149.8	20.0	127.9	19.05	14.9
f070fb	190.4	99.3	189.8	75.0	159.8	52.42	32.8
2f4bcb	155.7	194.3	257.8	-	202.6	51.55	25.45
fb994e	278.4	333.3	215.7	16.6	275.8	58.84	21.34
677e70	327.8	387.0	256.7	1.9	323.8	65.24	20.15

7.1.2 The Numerical Procedure for Determining Outliers

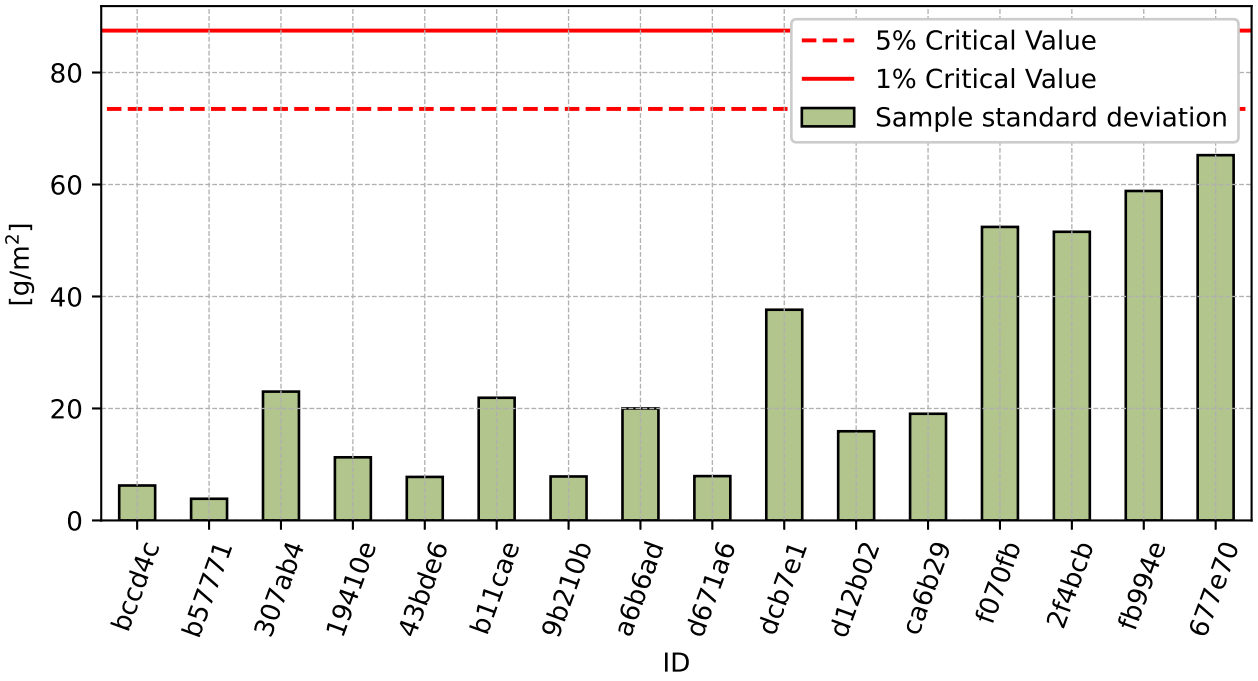

Figure 28: **Cochran's test** - sample standard deviations

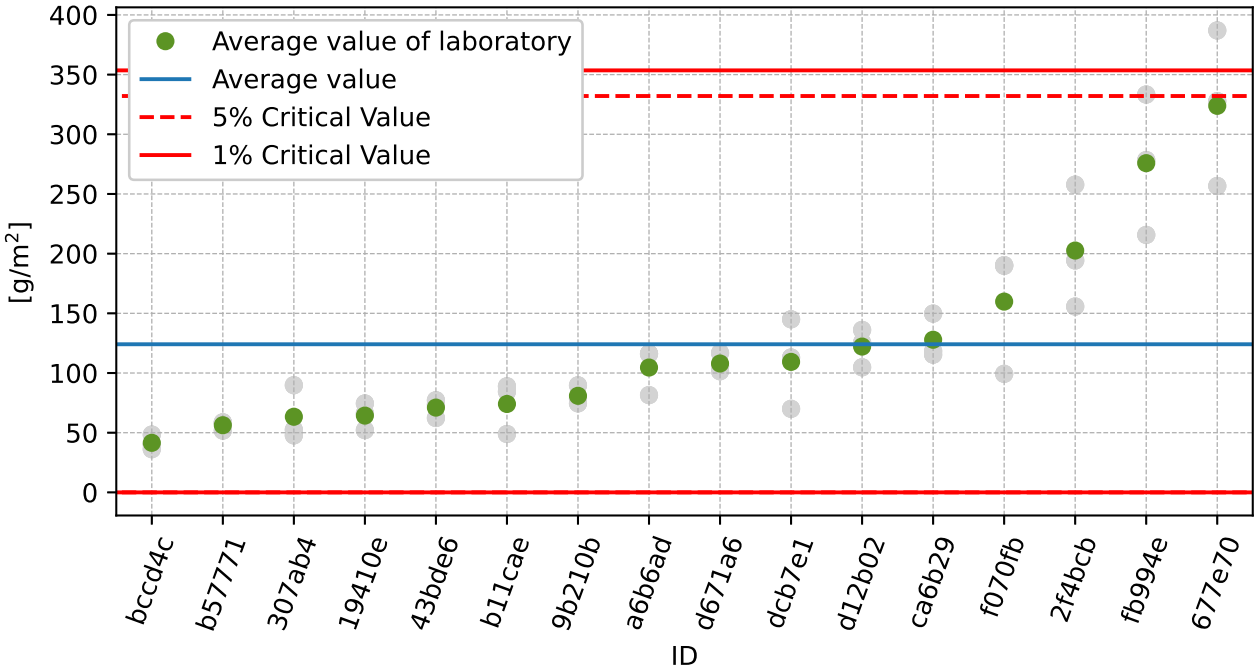

Figure 29: **Grubbs' test** - average values

7.1.3 Mandel's Statistics

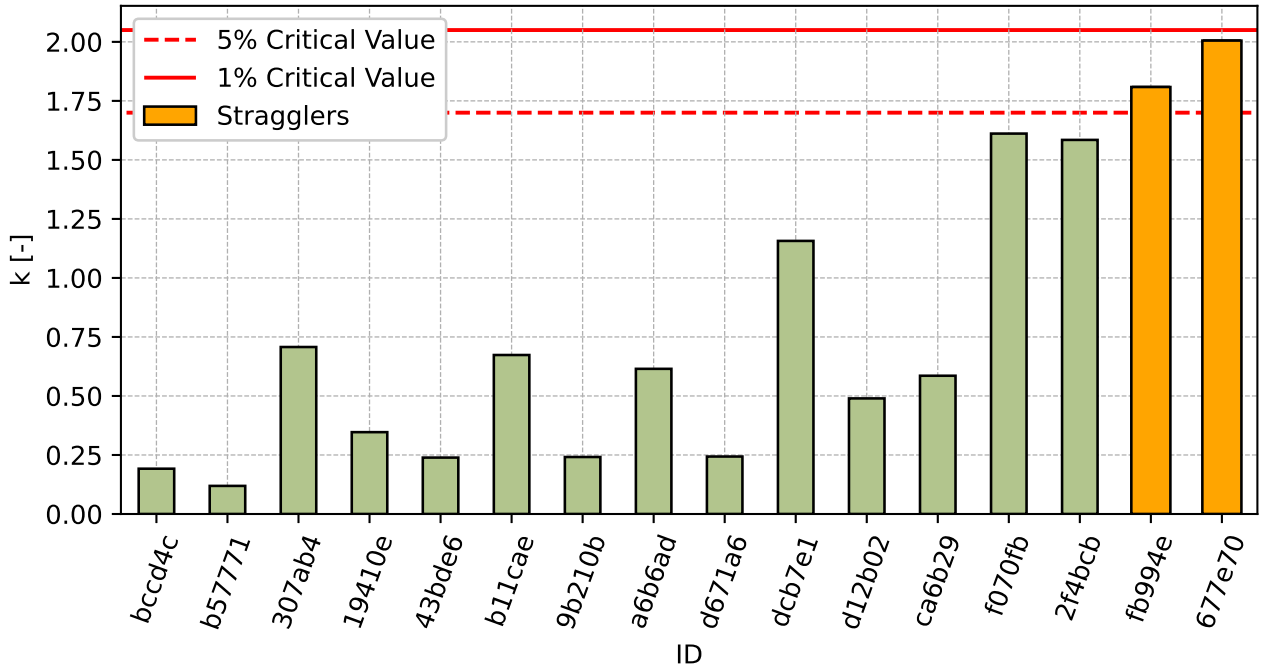

Figure 30: Intralaboratory Consistency Statistic

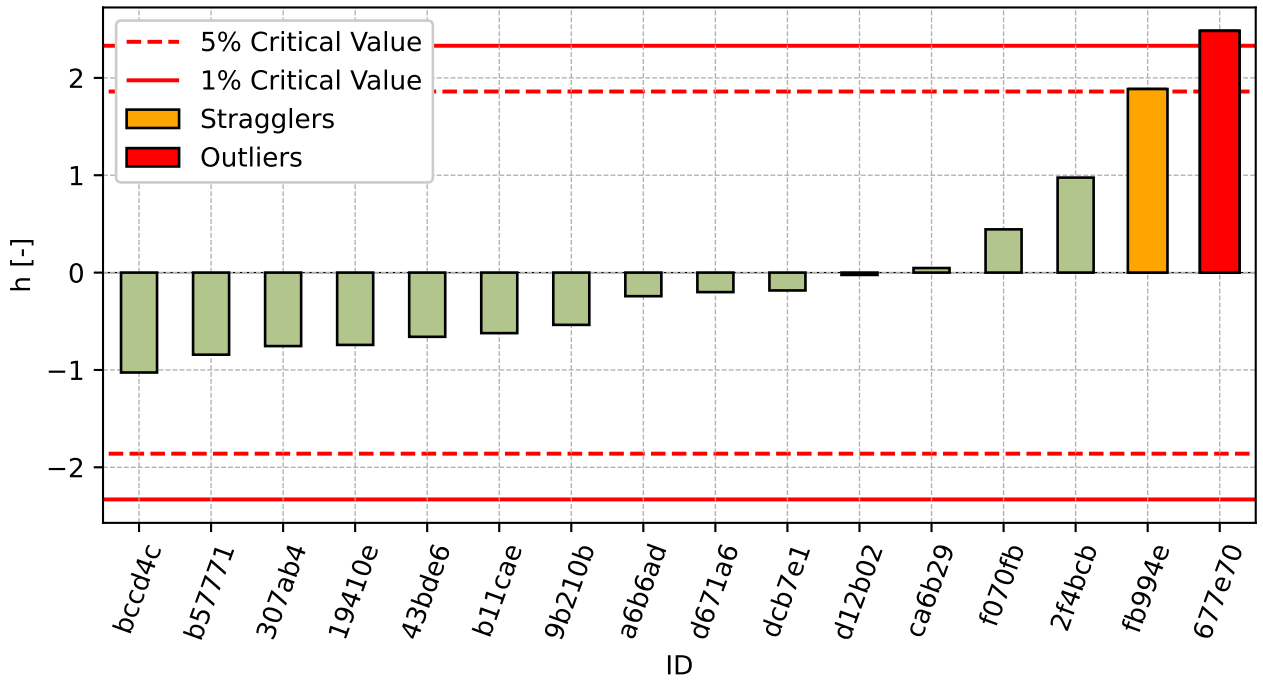

Figure 31: Interlaboratory Consistency Statistic

7.1.4 Descriptive statistics

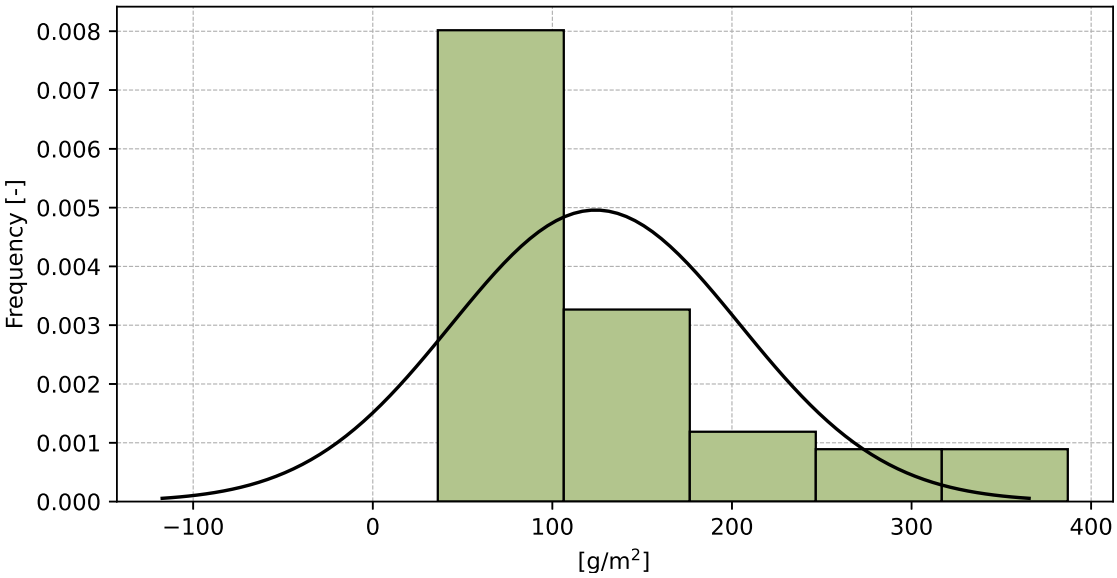

Figure 32: Histogram of all test results

Table 14: Descriptive statistics

Characteristics	[g/m²]
Average value – $\bar{x}$	124.1
Sample standard deviation – s	80.45
Asigned value – x^*	118.2
Robust standard deviation – s^*	78.47
Measurement uncertainty of asigned value – u_X	24.52
p-value of normality test	0.0 [-]
Interlaboratory standard deviation – s_L	78.23
Repeatability standard deviation – s_r	32.53
Reproducibility standard deviation – s_R	84.72
Repeatability – r	91.1
Reproducibility – R	237.2

7.1.5 Evaluation of Performance Statistics

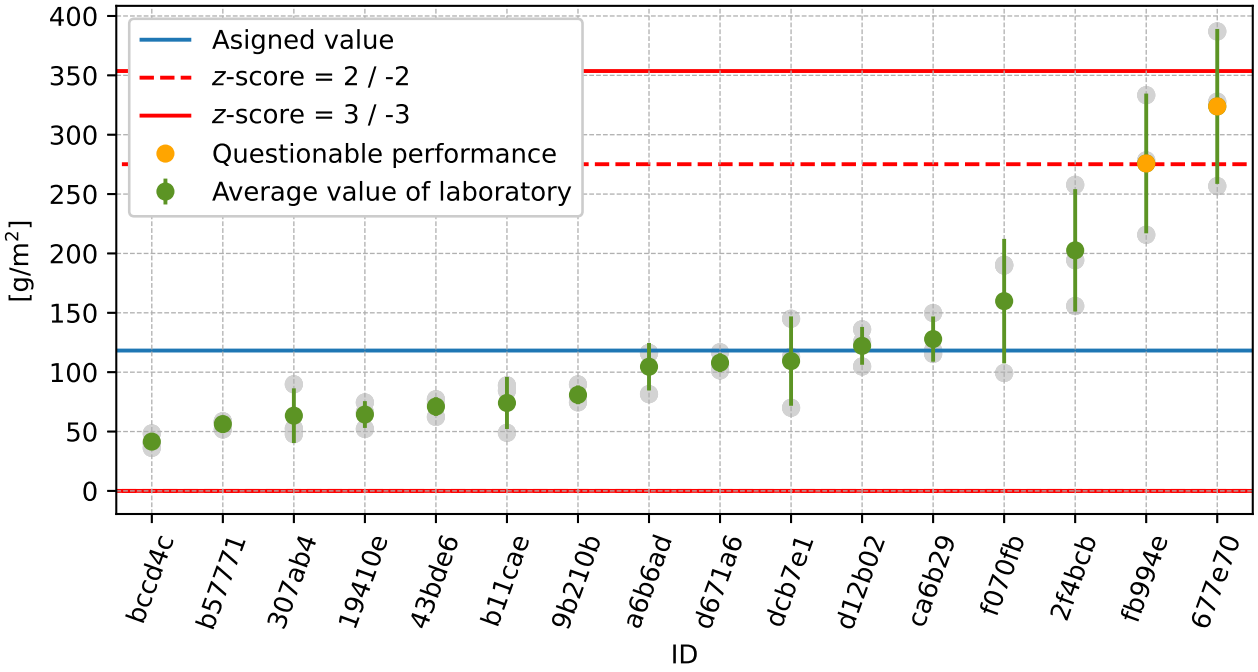

Figure 33: Average values and sample standard deviations

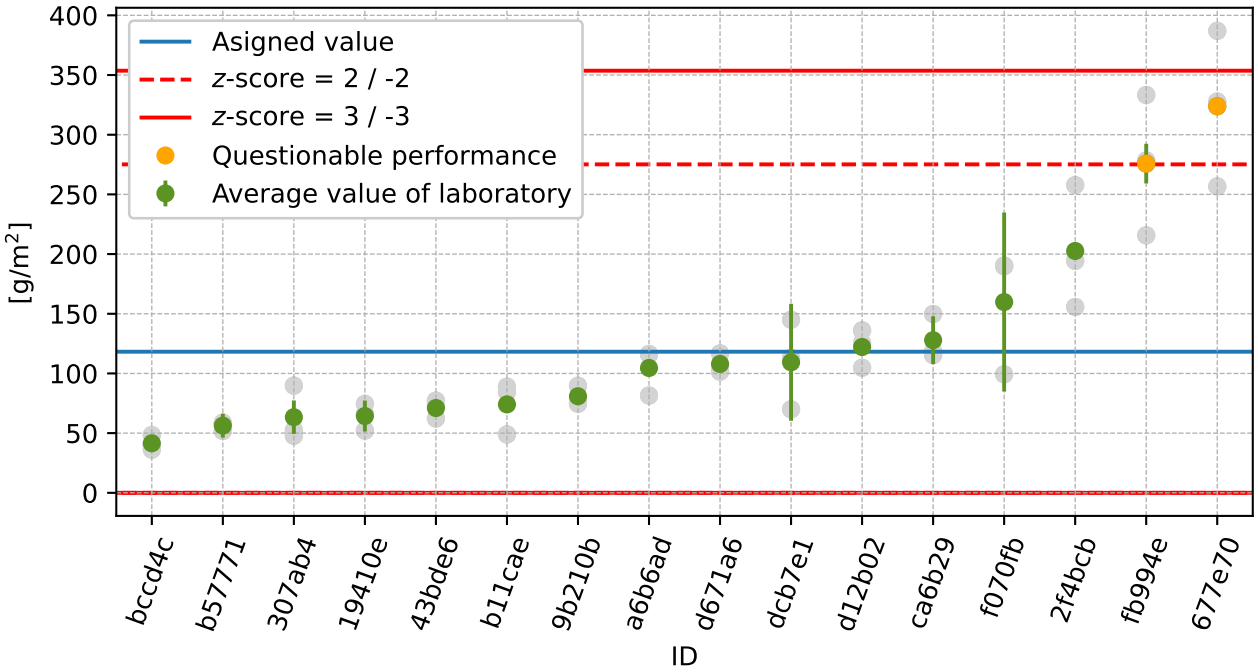

Figure 34: Average values and extended uncertainties of measurement

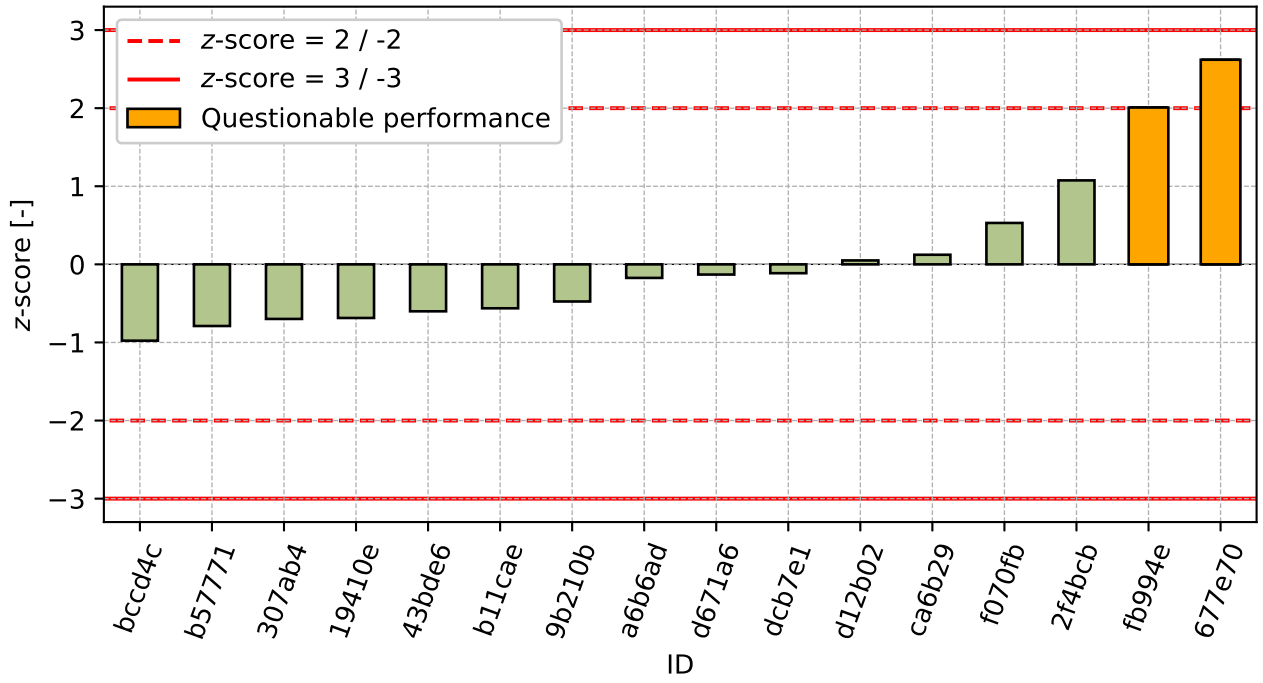

Figure 35: z-score

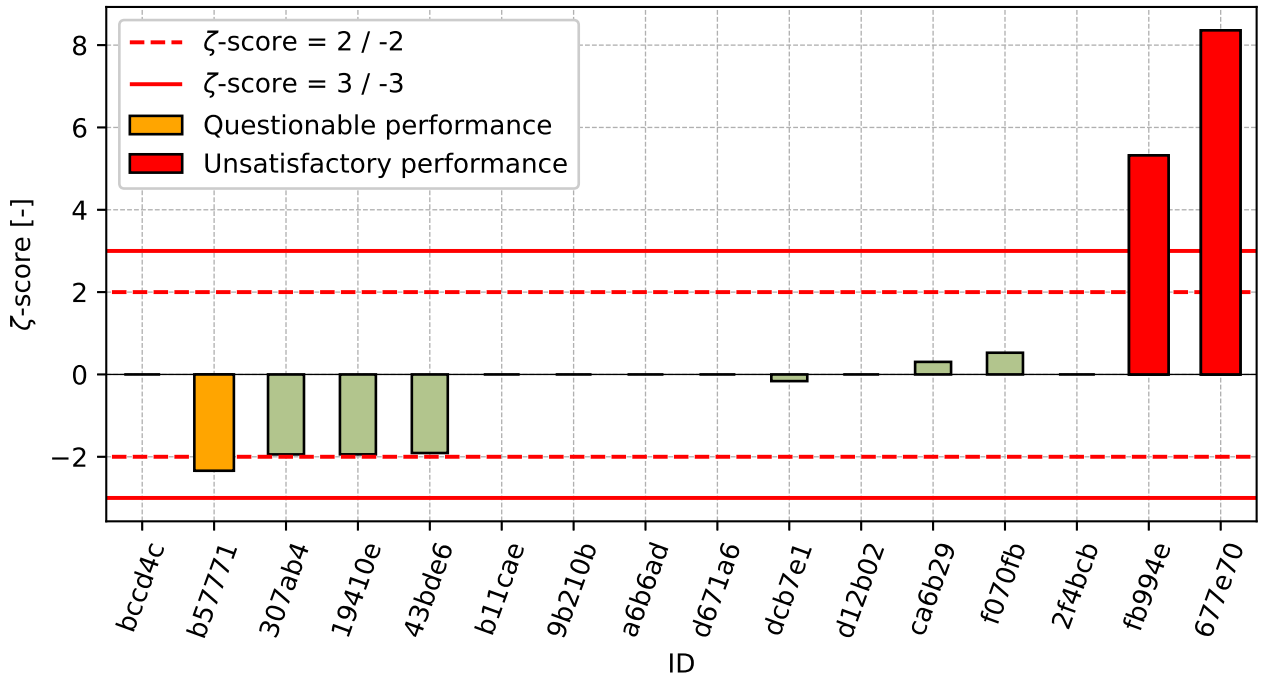

Figure 36: ζ-score

Table 15: z-score and ζ-score

ID	z-score [-]	ζ-score [-]
bccd4c	-0.98	-
b57771	-0.79	-2.34
307ab4	-0.70	-1.94
19410e	-0.69	-1.94
43bde6	-0.60	-1.91
b11cae	-0.56	-
9b210b	-0.48	-
a6b6ad	-0.17	-
d671a6	-0.13	-
dcb7e1	-0.11	-0.16
d12b02	0.05	-
ca6b29	0.12	0.31
f070fb	0.53	0.53
2f4bcb	1.08	-
fb994e	2.01	5.32
677e70	2.62	8.36

7.2 50 cycles

7.2.1 Test results

Table 16: Test results - ordered by average value. Outliers are marked by red color. u_X - extended uncertainty of measurement; $\bar{x}$ - average value; s_0 - sample standard deviation; V_X - variation coefficient

ID	Test results [g/m^2]			u_X [g/m^2]	$\bar{x}$ [g/m^2]	s_0 [g/m^2]	V_X [%]
ca6b29	81.6	96.5	84.0	20.0	87.4	8.0	9.16
307ab4	116.5	131.4	86.7	25.0	111.5	22.76	20.41
b57771	103.6	130.1	115.9	10.0	116.5	13.26	11.38
19410e	151.8	104.3	132.5	28.0	129.5	23.89	18.44
bccd4c	149.3	120.7	132.0	-	134.0	14.4	10.75
9b210b	133.5	152.1	133.3	-	139.6	10.8	7.73
43bde6	147.2	196.9	128.4	7.9	157.5	35.39	22.47
b11cae	186.8	186.5	106.7	-	160.0	46.16	28.85
a6b6ad	207.6	207.9	143.9	-	186.5	36.86	19.77
d12b02	215.3	251.5	189.2	-	218.7	31.29	14.31
d671a6	258.1	245.4	207.0	-	236.8	26.61	11.23
dcb7e1	340.0	156.0	269.0	122.0	255.0	92.8	36.39
677e70	261.5	367.5	186.7	1.6	271.9	90.85	33.41
2f4bcb	329.1	375.3	480.0	-	394.8	77.32	19.58
f070fb	441.7	335.3	555.9	145.5	444.3	110.32	24.83
fb994e	502.0	580.4	368.6	29.0	483.7	107.08	22.14

7.2.2 The Numerical Procedure for Determining Outliers

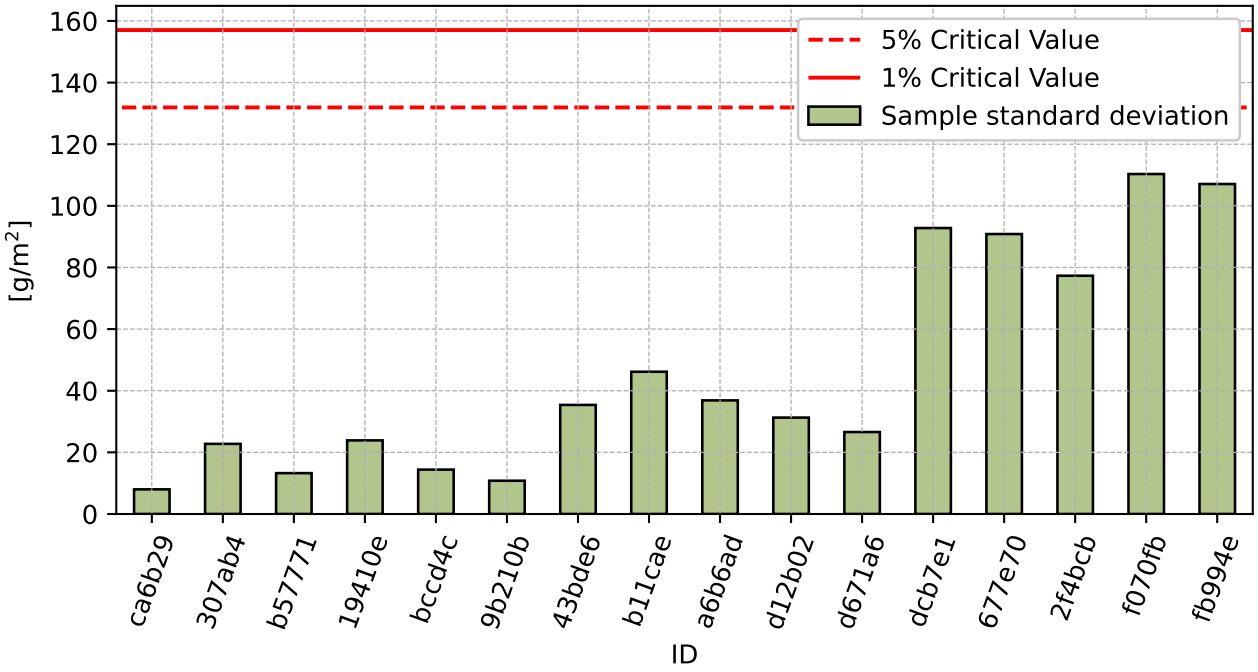

Figure 37: **Cochran's test** - sample standard deviations

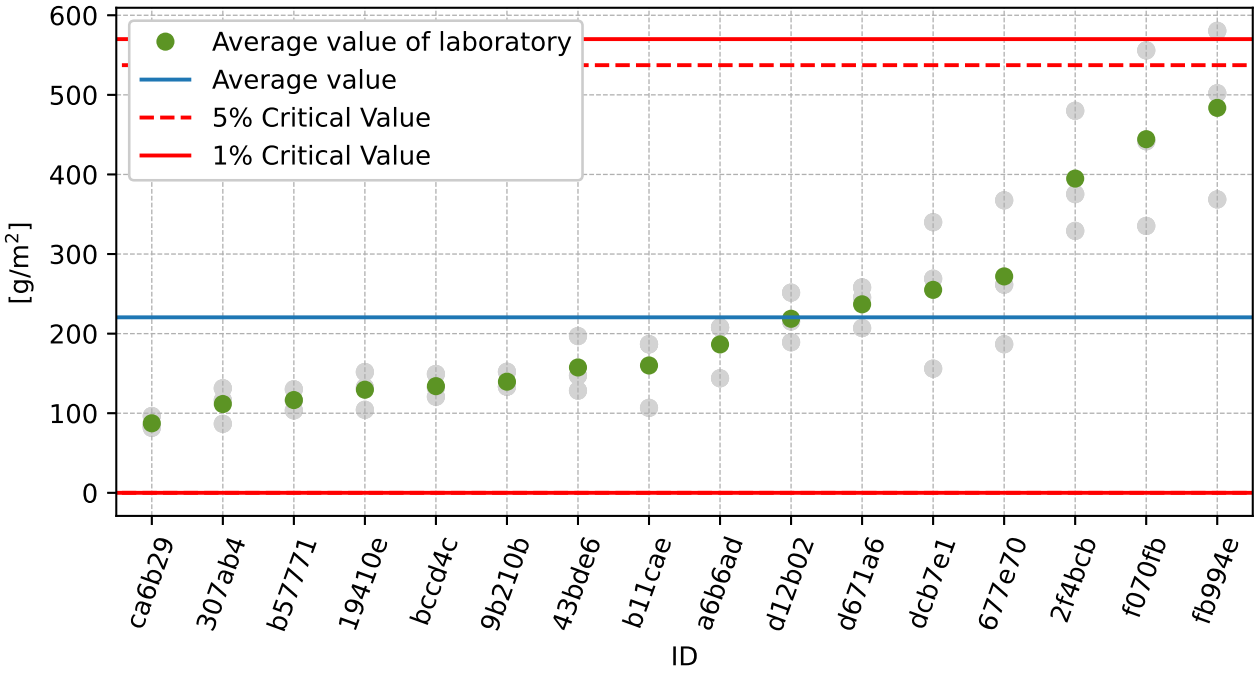

Figure 38: **Grubbs' test** - average values

7.2.3 Mandel's Statistics

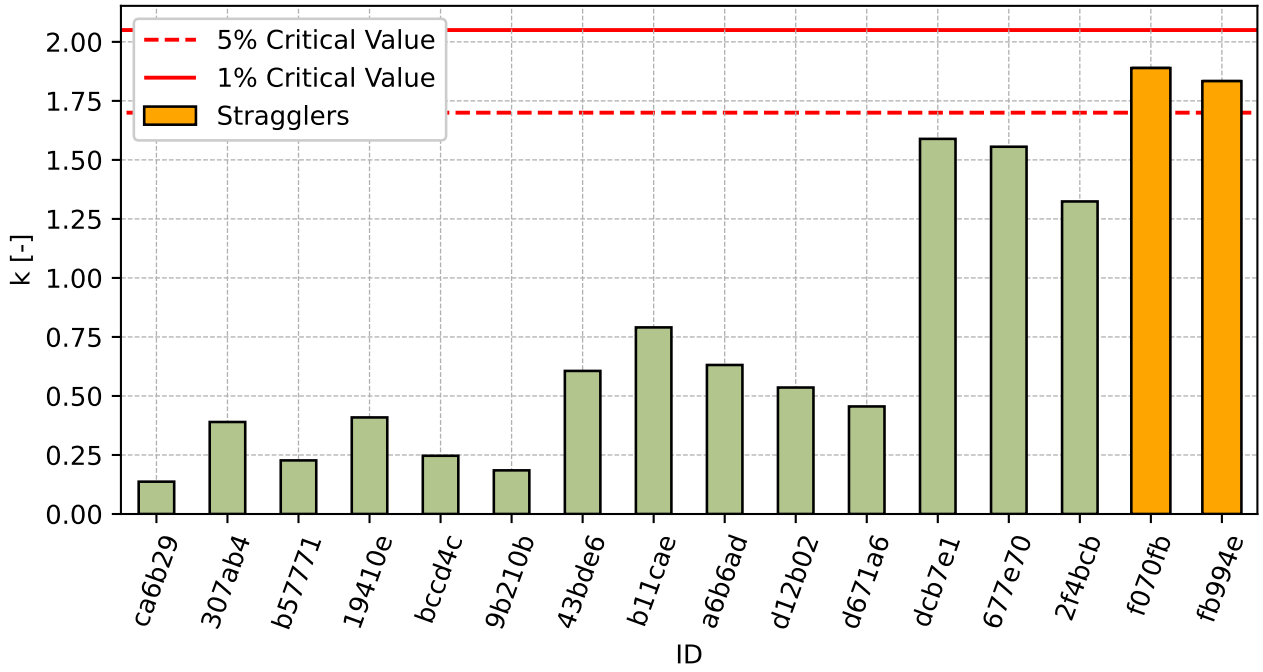

Figure 39: Intralaboratory Consistency Statistic

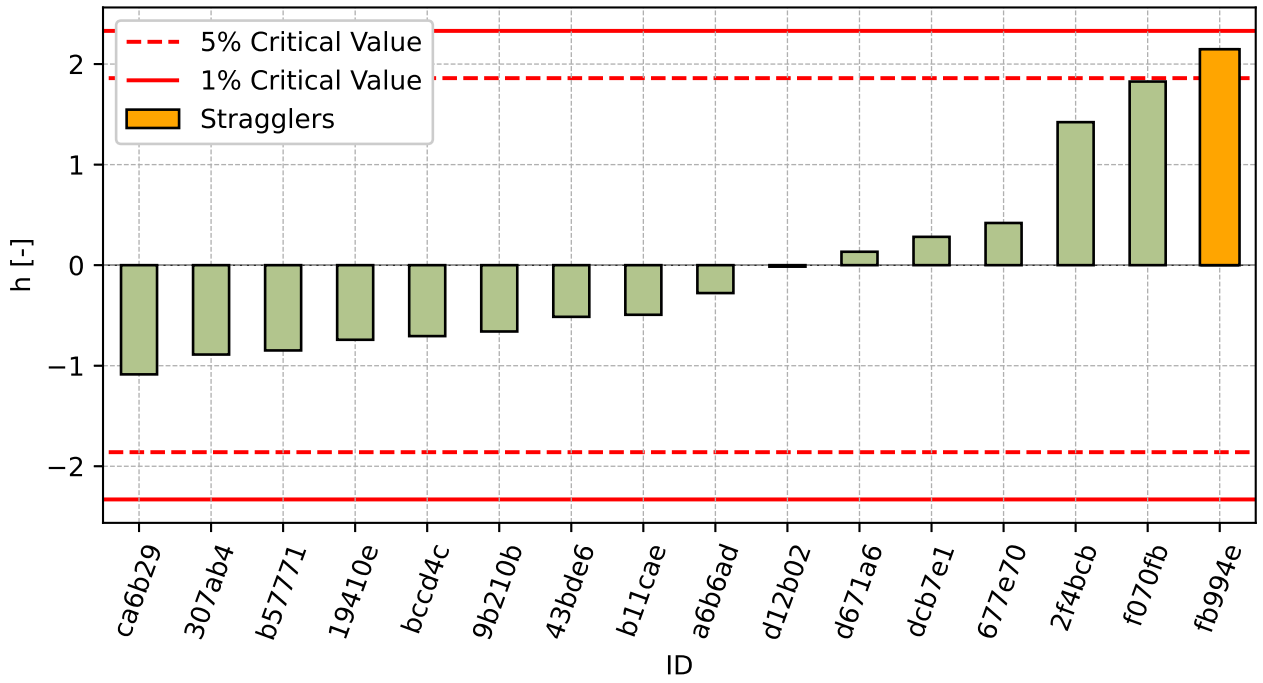

Figure 40: Interlaboratory Consistency Statistic

7.2.4 Descriptive statistics

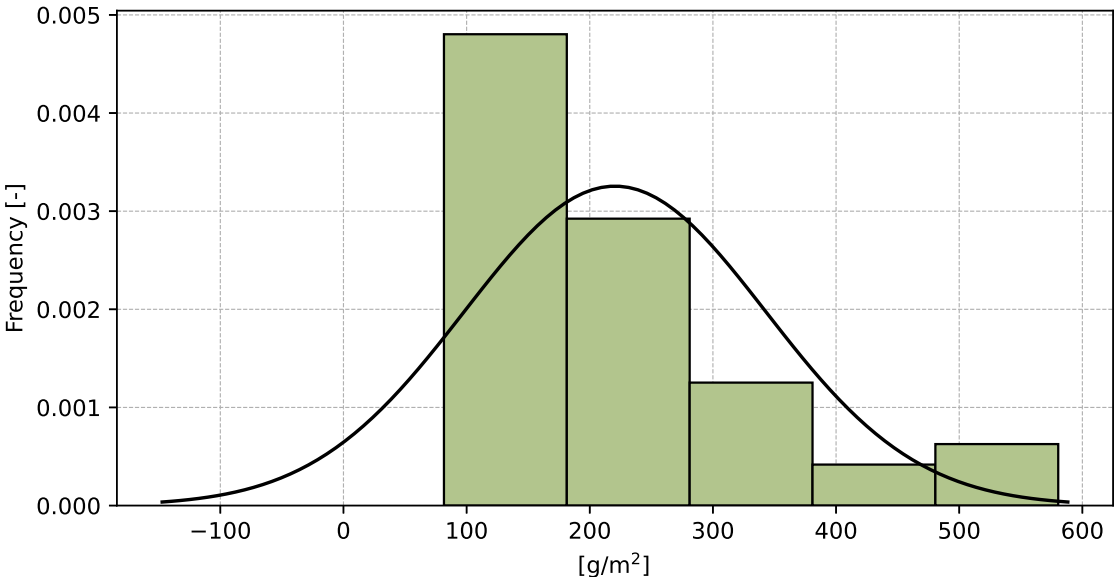

Figure 41: Histogram of all test results

Table 17: Descriptive statistics

Characteristics	**[g/m²]**
Average value – $\bar{x}$	220.5
Sample standard deviation – s	122.56
Asigned value – x^*	206.2
Robust standard deviation – s^*	111.91
Measurement uncertainty of asigned value – u_X	34.97
p-value of normality test	0.0 [-]
Interlaboratory standard deviation – s_L	117.83
Repeatability standard deviation – s_r	58.4
Reproducibility standard deviation – s_R	131.51
Repeatability – r	163.5
Reproducibility – R	368.2

7.2.5 Evaluation of Performance Statistics

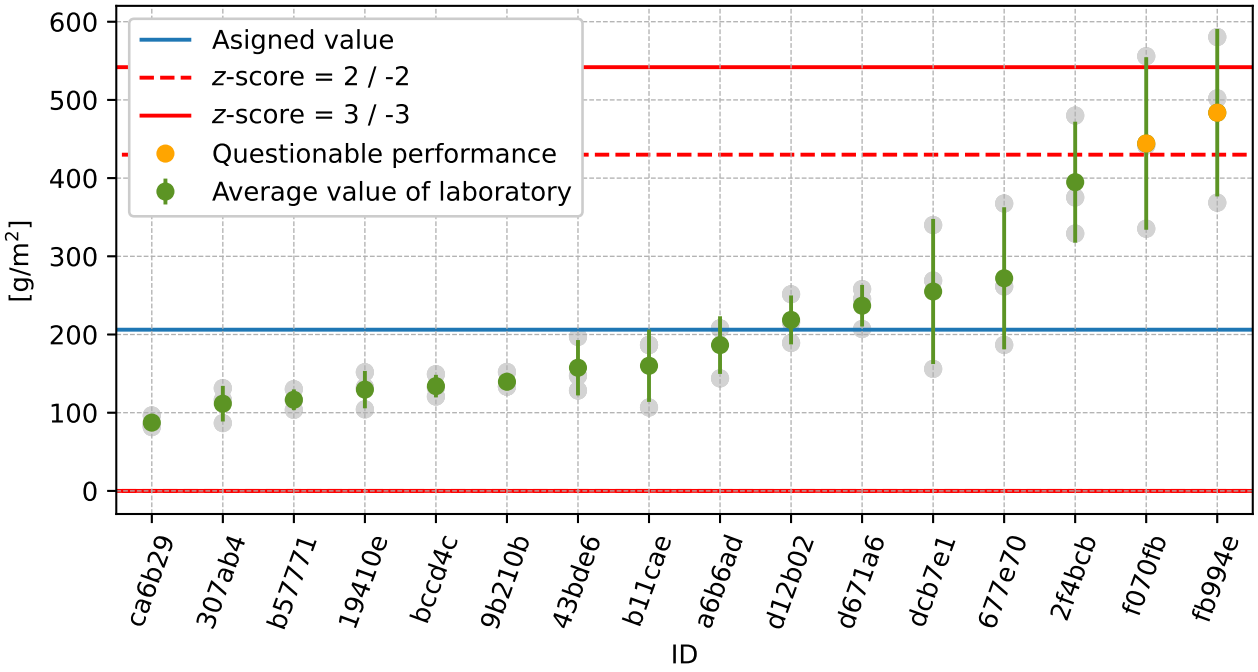

Figure 42: Average values and sample standard deviations

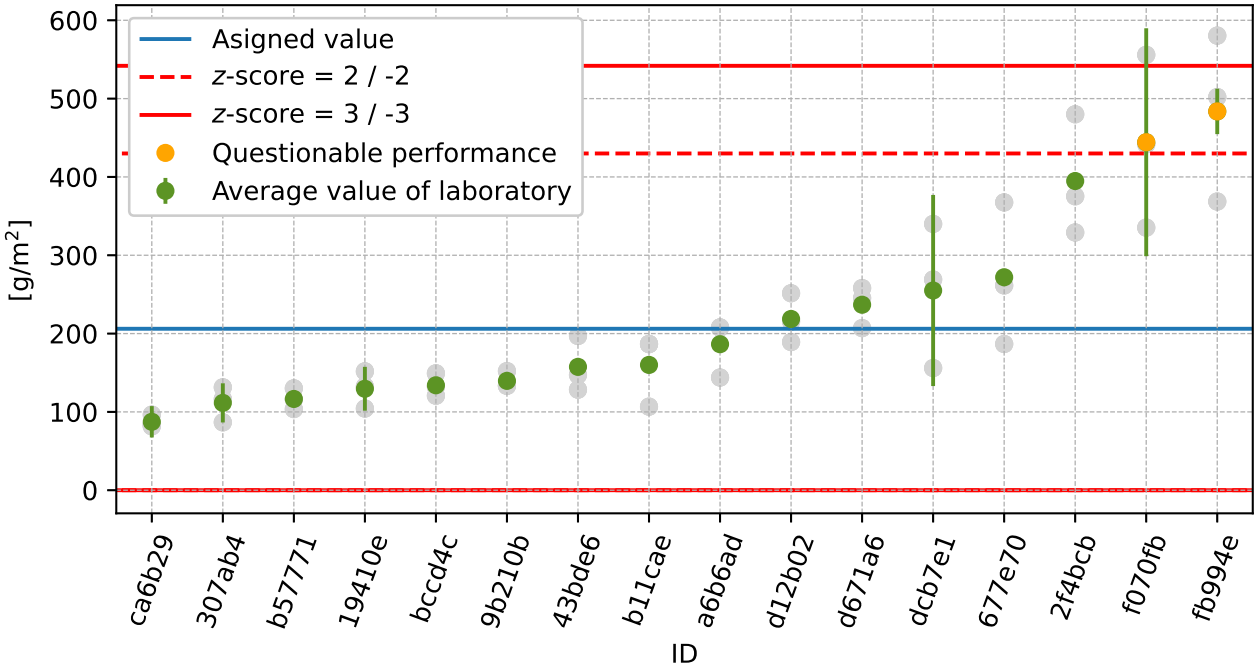

Figure 43: Average values and extended uncertainties of measurement

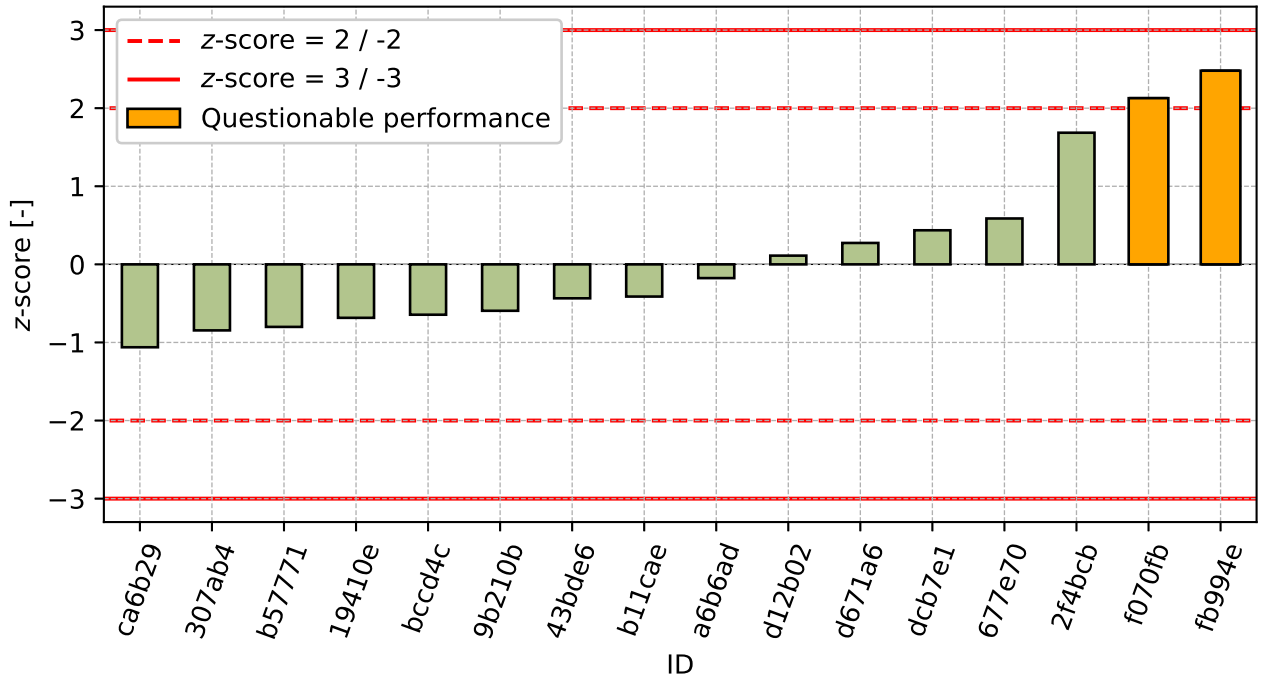

Figure 44: z-score

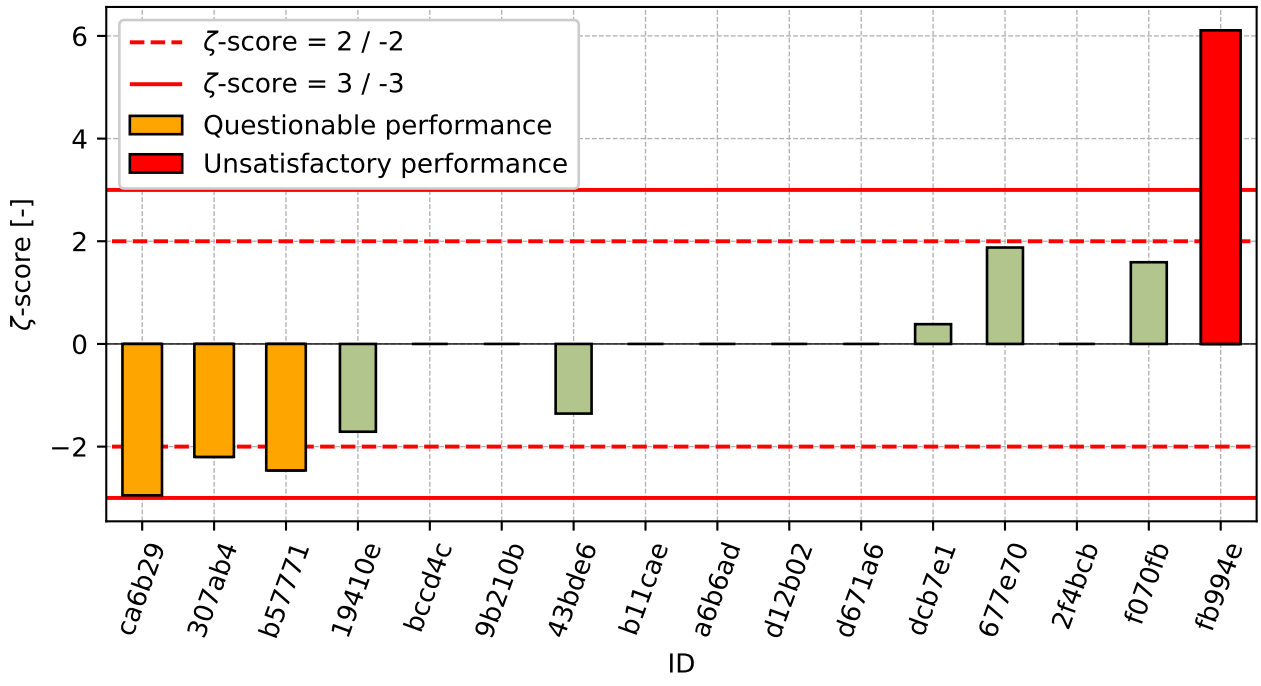

Figure 45: ζ-score

Table 18: z-score and ζ-score

ID	z-score [-]	ζ-score [-]
ca6b29	-1.06	-2.95
307ab4	-0.85	-2.20
b57771	-0.80	-2.46
19410e	-0.68	-1.71
bccd4c	-0.64	-
9b210b	-0.59	-
43bde6	-0.43	-1.36
b11cae	-0.41	-
a6b6ad	-0.18	-
d12b02	0.11	-
d671a6	0.27	-
dcb7e1	0.44	0.38
677e70	0.59	1.88
2f4bcb	1.69	-
f070fb	2.13	1.59
fb994e	2.48	6.11

7.3 75 cycles

7.3.1 Test results

Table 19: Test results - ordered by average value. Outliers are marked by red color. u_X - extended uncertainty of measurement; $\bar{x}$ - average value; s_0 - sample standard deviation; V_X - variation coefficient

ID	Test results [g/m^2]			u_X [g/m^2]	$\bar{x}$ [g/m^2]	s_0 [g/m^2]	V_X [%]
307ab4	95.3	98.8	61.2	19.0	85.1	20.77	24.41
ca6b29	80.3	127.2	78.2	20.0	95.2	27.7	29.09
b57771	170.1	203.6	179.2	10.0	184.3	17.32	9.4
9b210b	188.5	198.9	192.1	-	193.2	5.28	2.73
b11cae	289.1	262.0	164.4	-	238.5	65.59	27.5
19410e	237.3	225.5	260.4	23.0	241.1	17.75	7.36
bccd4c	258.2	209.2	256.1	-	241.2	27.7	11.49
43bde6	220.8	347.5	210.1	13.9	259.5	76.43	29.46
a6b6ad	297.6	314.3	206.3	-	272.7	58.14	21.32
677e70	323.9	238.5	268.3	1.7	276.9	43.34	15.65
d12b02	274.8	374.0	253.5	-	300.8	64.31	21.38
d671a6	367.6	358.3	281.2	-	335.7	47.43	14.13
dcb7e1	547.0	262.0	460.0	192.0	423.0	146.06	34.53
f070fb	597.1	483.3	738.6	167.5	606.3	127.9	21.09
2f4bcb	555.9	653.4	720.0	-	643.1	82.53	12.83
fb994e	725.5	823.5	529.4	41.6	692.8	149.75	21.62

7.3.2 The Numerical Procedure for Determining Outliers

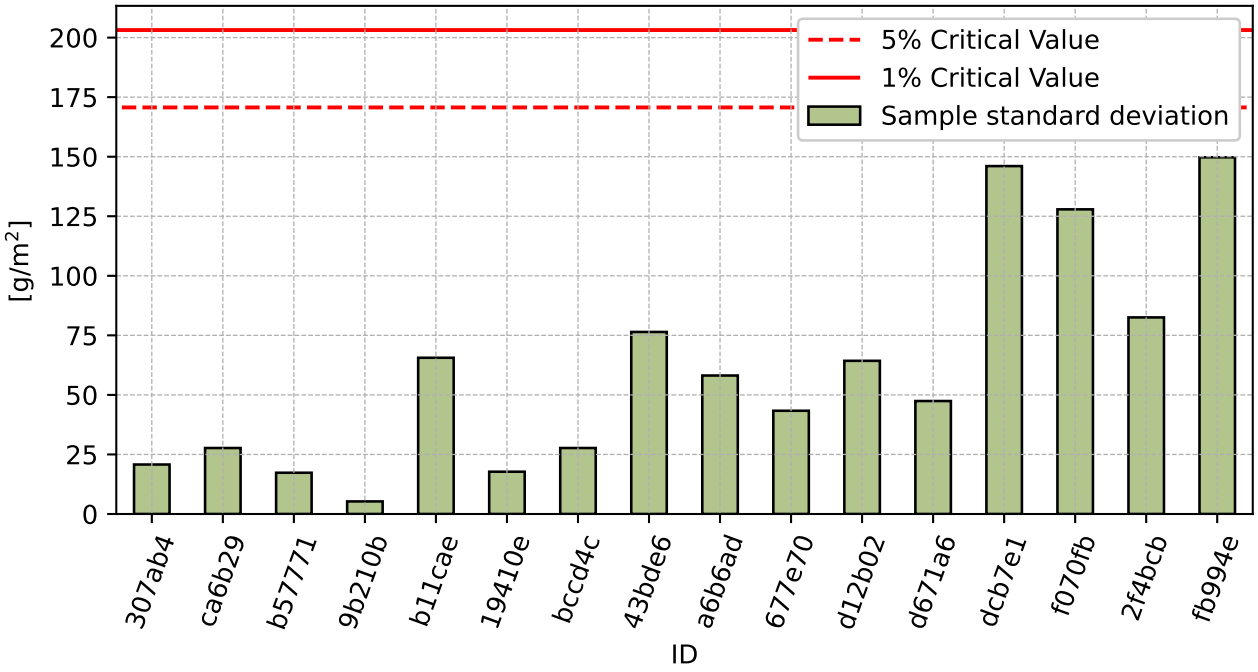

Figure 46: **Cochran's test** - sample standard deviations

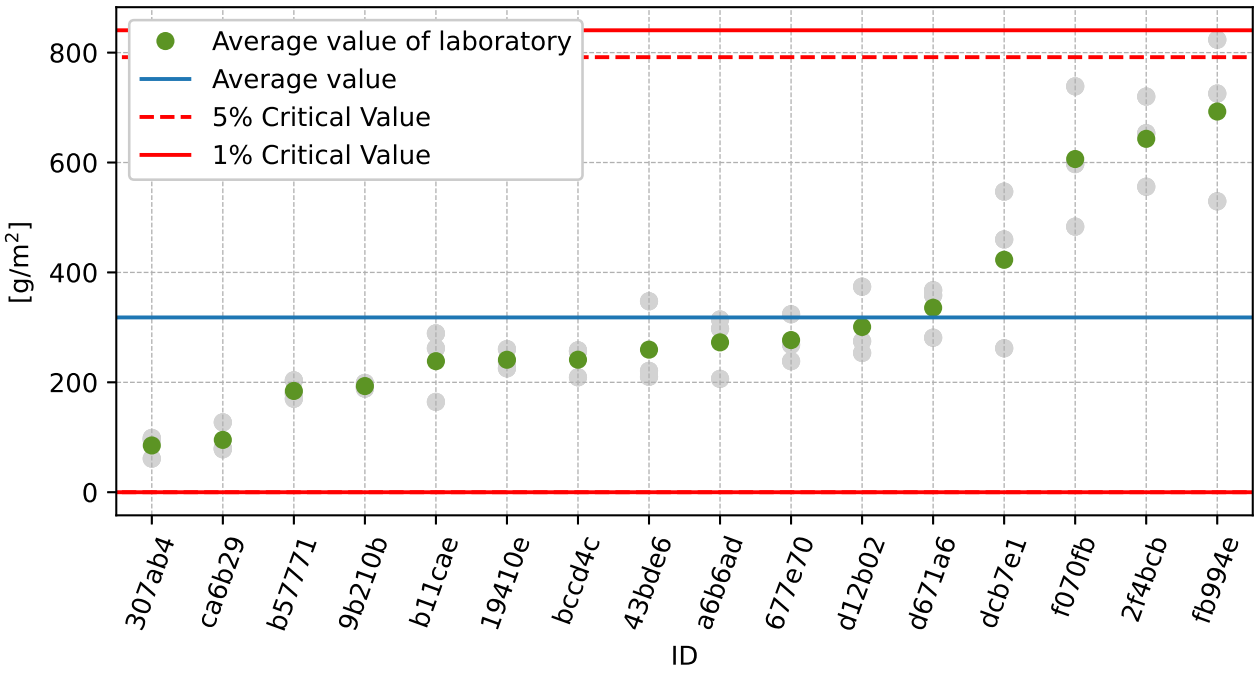

Figure 47: **Grubbs' test** - average values

7.3.3 Mandel's Statistics

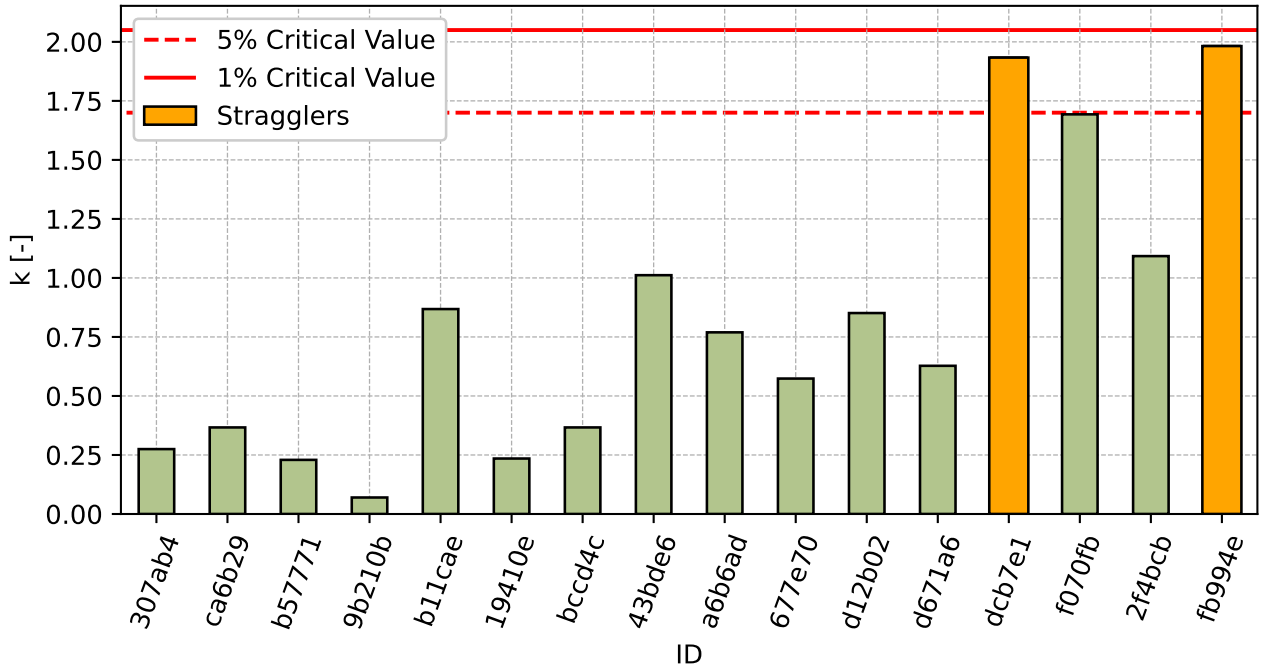

Figure 48: Intralaboratory Consistency Statistic

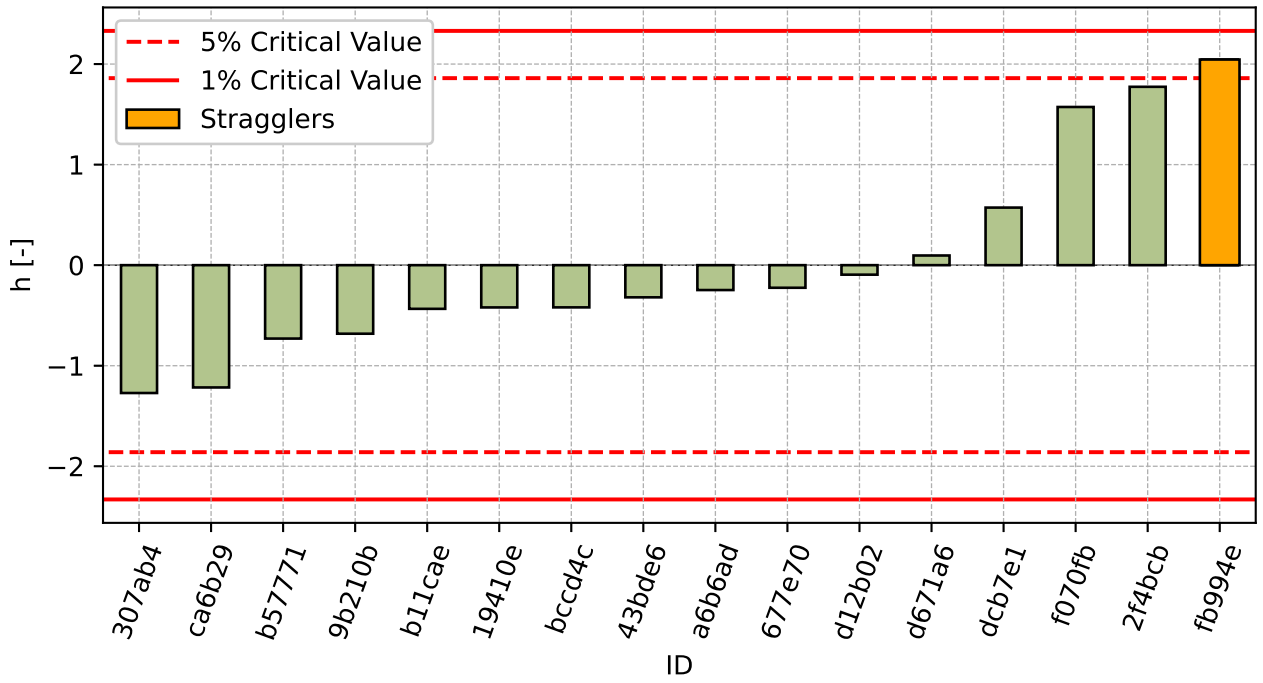

Figure 49: Interlaboratory Consistency Statistic

7.3.4 Descriptive statistics

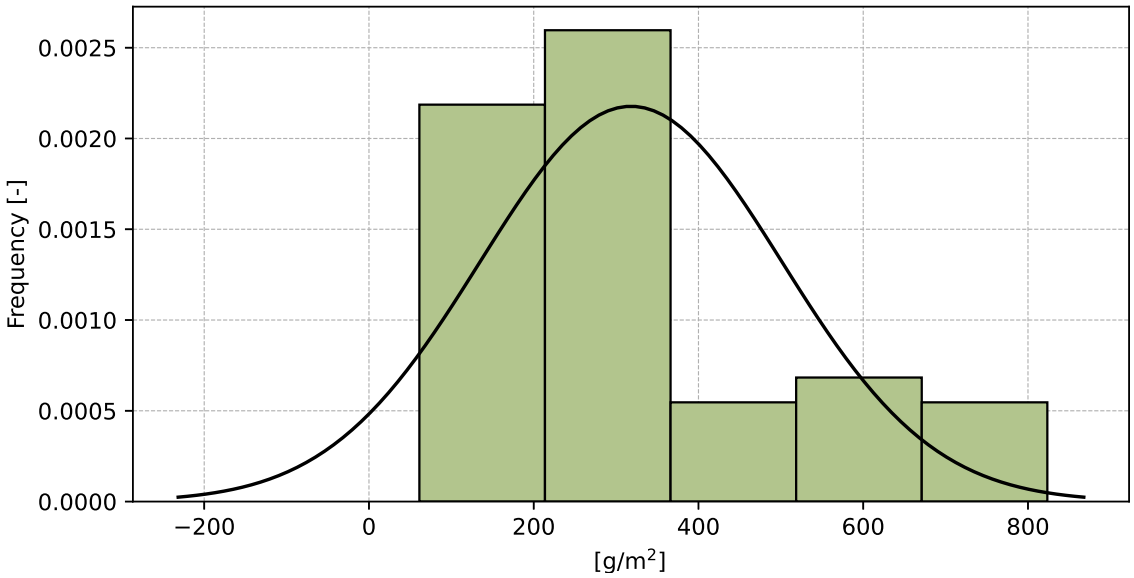

Figure 50: Histogram of all test results

Table 20: Descriptive statistics

Characteristics	[g/m²]
Average value – $\bar{x}$	318.1
Sample standard deviation – s	183.22
Asigned value – x^*	295.2
Robust standard deviation – s^*	158.84
Measurement uncertainty of asigned value – u_X	49.64
p-value of normality test	0.0 [-]
Interlaboratory standard deviation – s_L	177.96
Repeatability standard deviation – s_r	75.55
Reproducibility standard deviation – s_R	193.33
Repeatability – r	211.5
Reproducibility – R	541.3

7.3.5 Evaluation of Performance Statistics

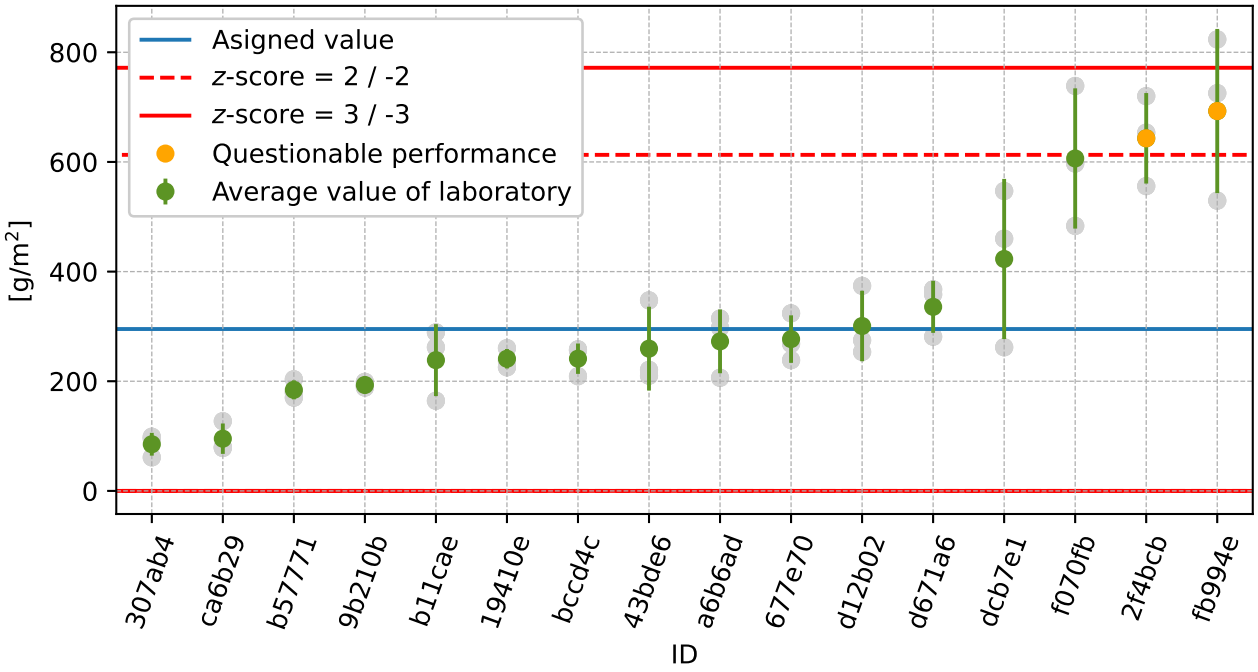

Figure 51: Average values and sample standard deviations

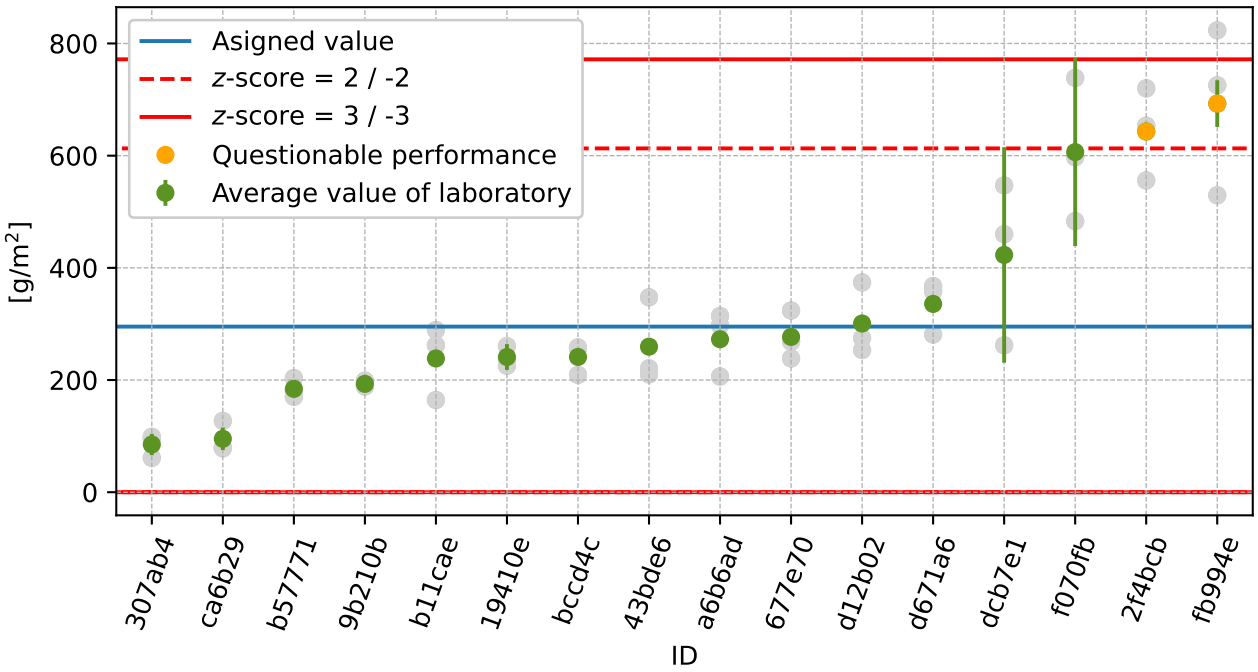

Figure 52: Average values and extended uncertainties of measurement

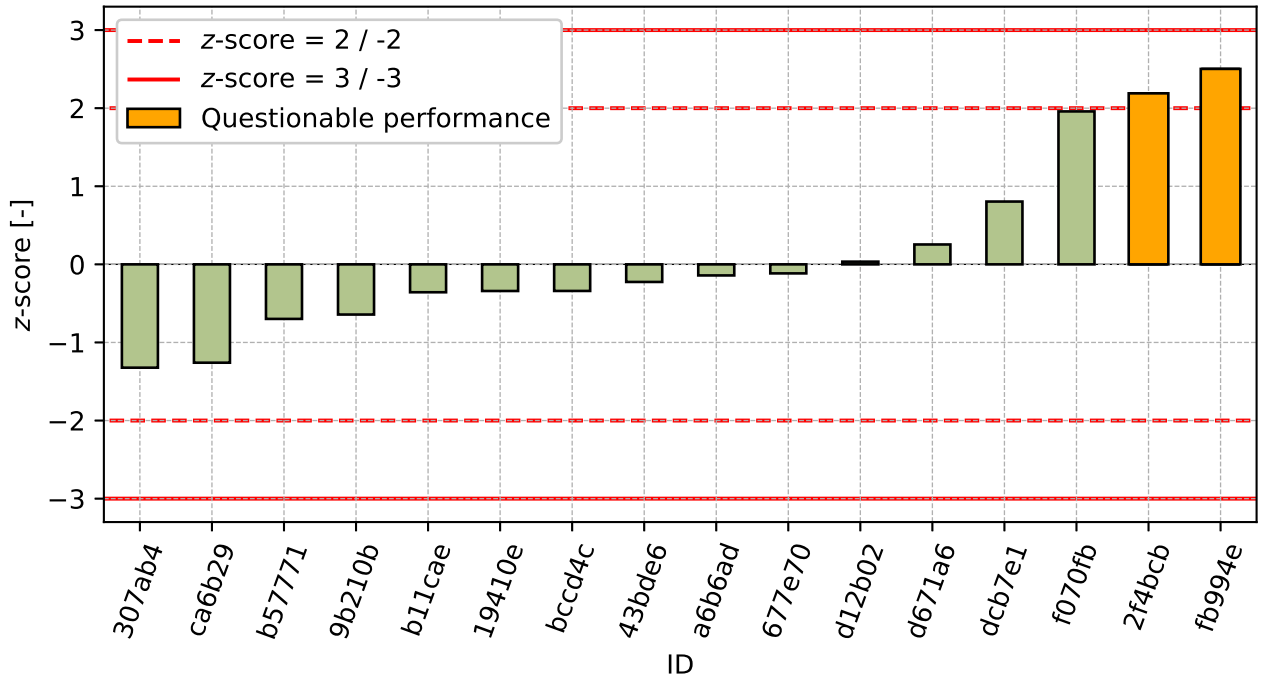

Figure 53: z-score

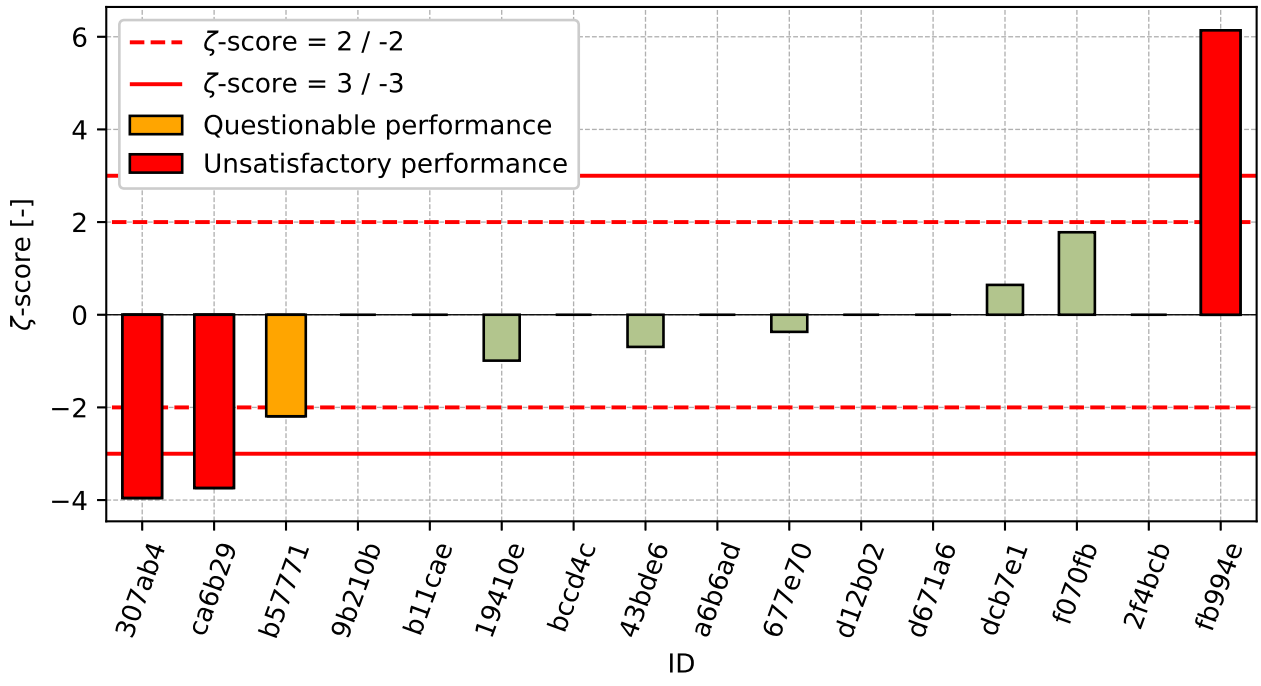

Figure 54: ζ-score

Table 21: z-score and ζ-score

ID	z-score [-]	ζ-score [-]
307ab4	-1.32	-3.95
ca6b29	-1.26	-3.74
b57771	-0.70	-2.19
9b210b	-0.64	-
b11cae	-0.36	-
19410e	-0.34	-0.99
bccd4c	-0.34	-
43bde6	-0.23	-0.69
a6b6ad	-0.14	-
677e70	-0.12	-0.37
d12b02	0.03	-
d671a6	0.25	-
dcb7e1	0.80	0.64
f070fb	1.96	1.78
2f4bcb	2.19	-
fb994e	2.50	6.14

7.4 100 cycles

7.4.1 Test results

Table 22: Test results - ordered by average value. Outliers are marked by red color. u_X - extended uncertainty of measurement; $\bar{x}$ - average value; s_0 - sample standard deviation; V_X - variation coefficient

ID	Test results [g/m^2]			u_X [g/m^2]	$\bar{x}$ [g/m^2]	s_0 [g/m^2]	V_X [%]
ca6b29	88.2	146.1	69.3	20.0	101.2	40.02	39.54
307ab4	122.4	113.3	85.9	24.0	107.2	19.0	17.72
9b210b	247.4	237.9	235.2	-	240.2	6.41	2.67
b57771	235.0	267.7	282.3	10.0	261.7	24.22	9.26
677e70	331.7	312.7	283.9	1.9	309.4	24.07	7.78
b11cae	404.7	350.9	231.1	-	328.9	88.87	27.02
a6b6ad	416.5	426.9	259.0	-	367.5	94.08	25.6
43bde6	298.3	532.8	319.0	21.4	383.4	129.83	33.86
19410e	337.0	377.0	441.0	63.0	385.0	52.46	13.63
d12b02	350.5	484.6	333.4	-	389.5	82.8	21.26
bccd4c	419.6	329.8	424.1	-	391.2	53.19	13.6
d671a6	477.1	479.0	355.4	-	437.2	70.82	16.2
dcb7e1	809.0	429.0	705.0	258.0	647.7	196.38	30.32
f070fb	745.1	619.6	896.6	181.0	753.8	138.7	18.4
2f4bcb	765.0	962.5	982.2	-	903.2	120.12	13.3
fb994e	1000.0	1051.0	698.0	55.0	916.3	190.79	20.82

7.4.2 The Numerical Procedure for Determining Outliers

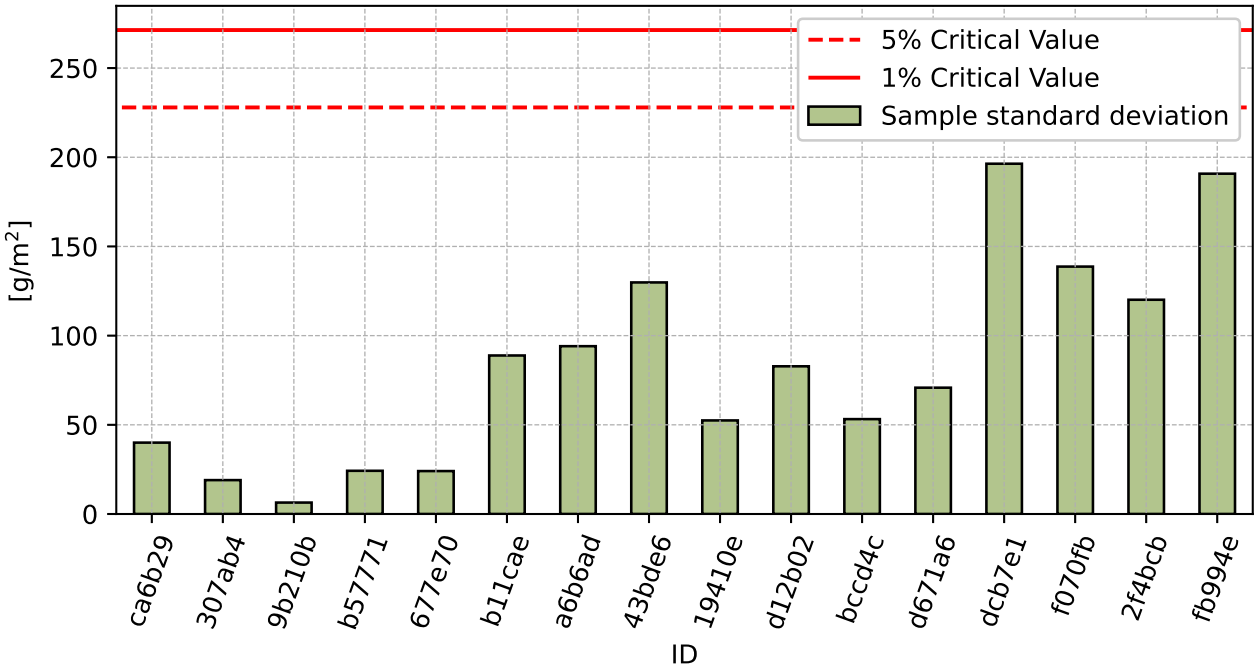

Figure 55: **Cochran's test** - sample standard deviations

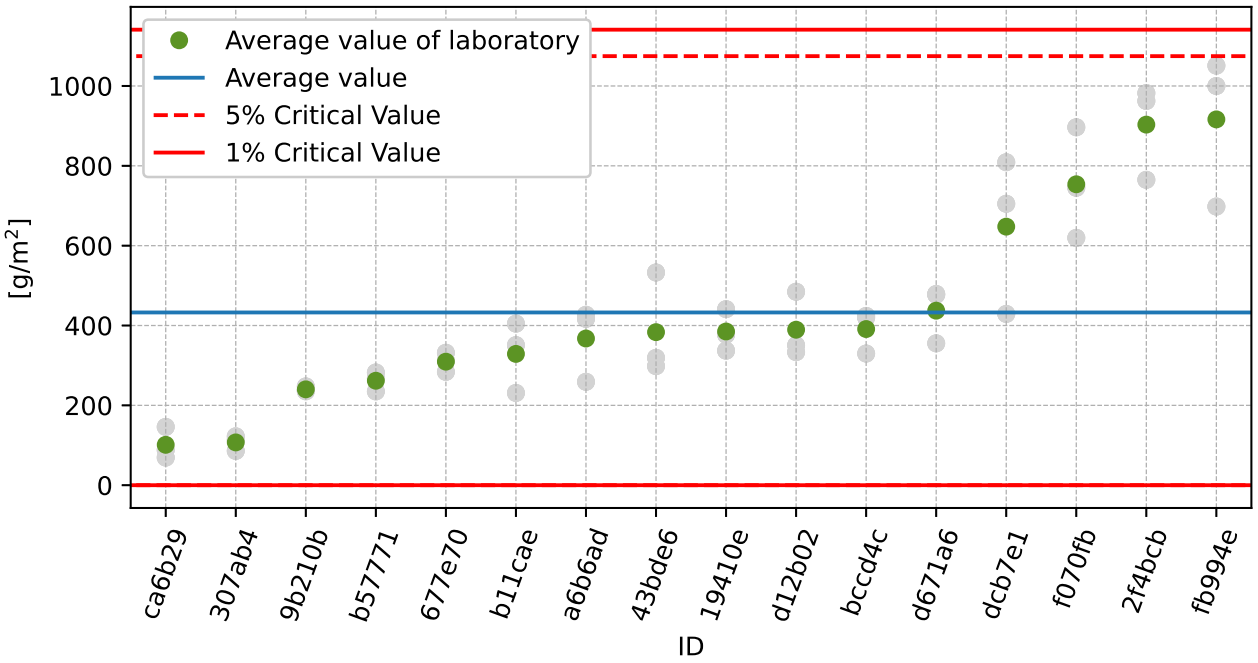

Figure 56: **Grubbs' test** - average values

7.4.3 Mandel's Statistics

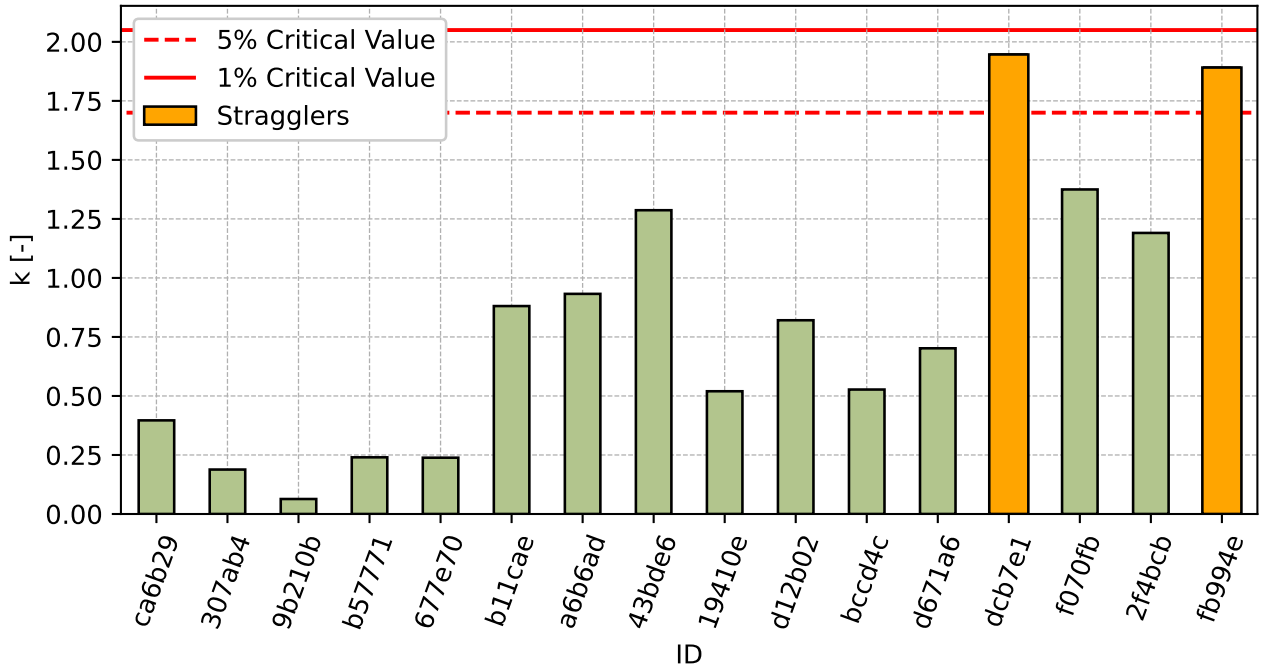

Figure 57: Intralaboratory Consistency Statistic

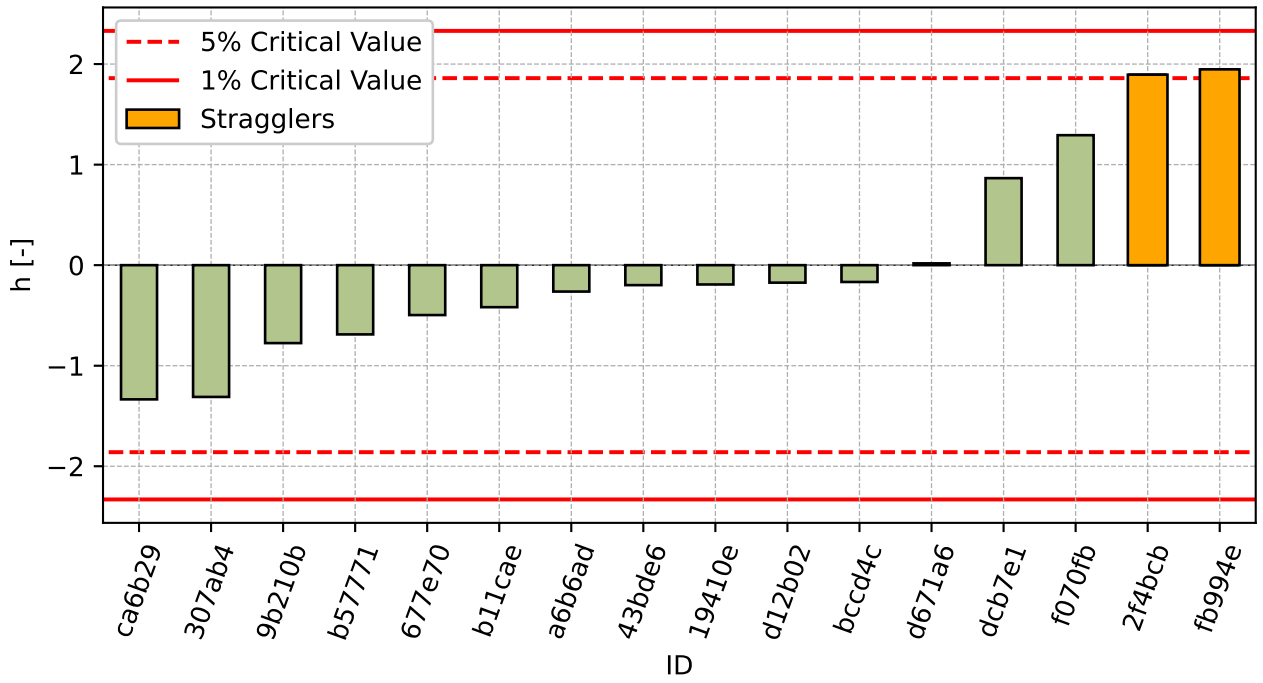

Figure 58: Interlaboratory Consistency Statistic

7.4.4 Descriptive statistics

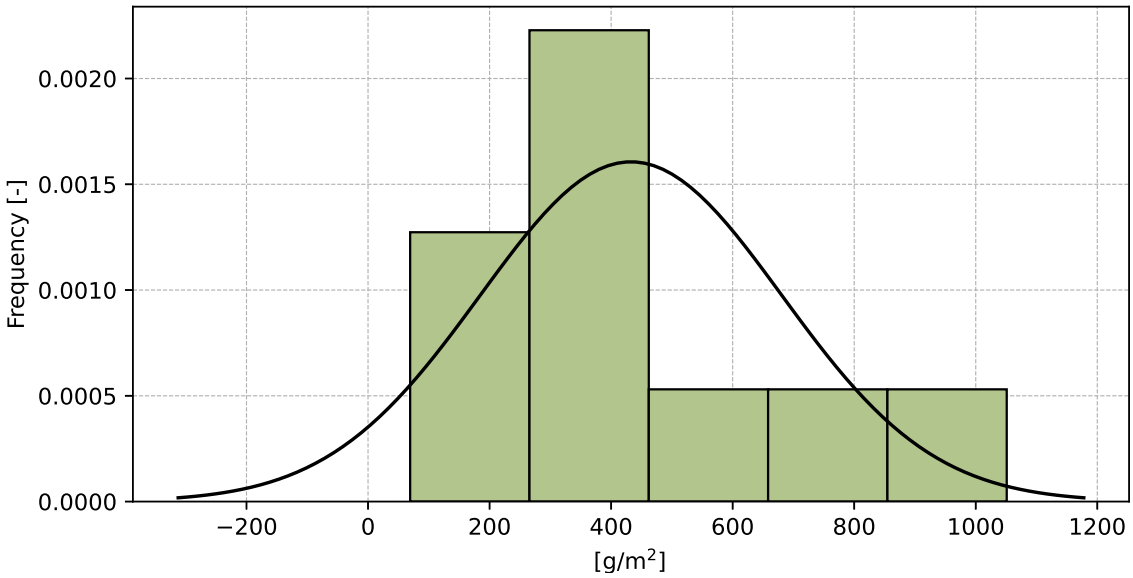

Figure 59: Histogram of all test results

Table 23: Descriptive statistics

Characteristics	[g/m²]
Average value – $\bar{x}$	432.7
Sample standard deviation – s	248.37
Asigned value – x^*	409.4
Robust standard deviation – s^*	212.39
Measurement uncertainty of asigned value – u_X	66.37
p-value of normality test	0.001 [-]
Interlaboratory standard deviation – s_L	241.44
Repeatability standard deviation – s_r	100.89
Reproducibility standard deviation – s_R	261.67
Repeatability – r	282.5
Reproducibility – R	732.7

7.4.5 Evaluation of Performance Statistics

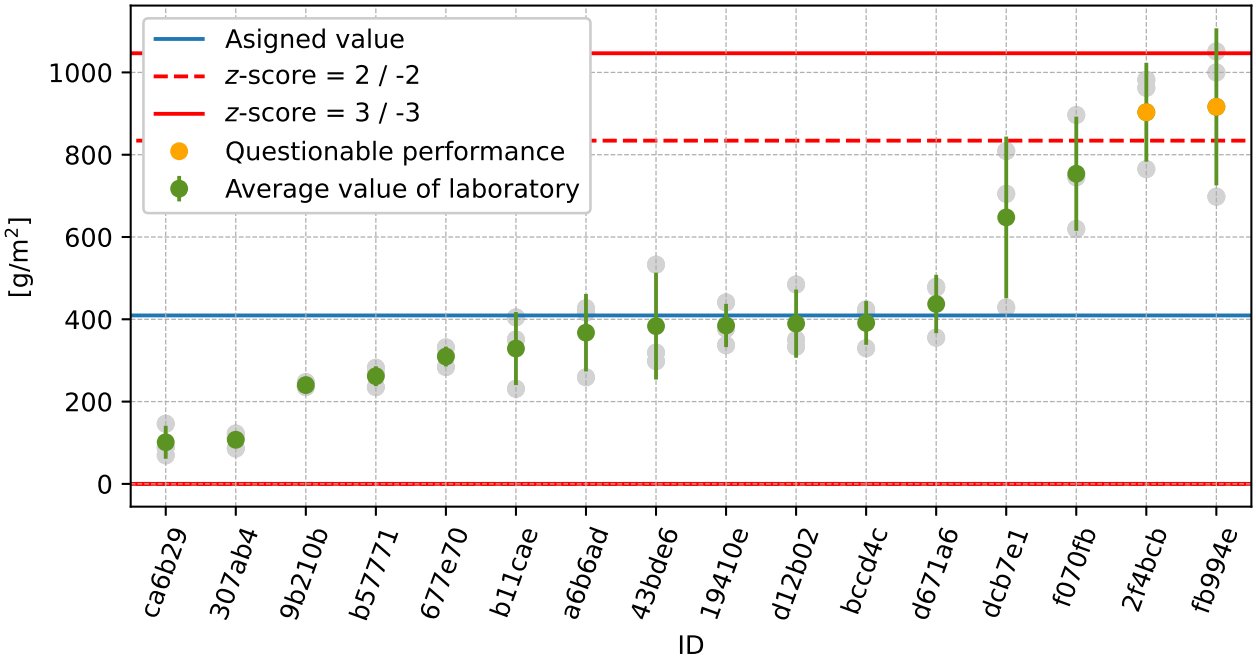

Figure 60: Average values and sample standard deviations

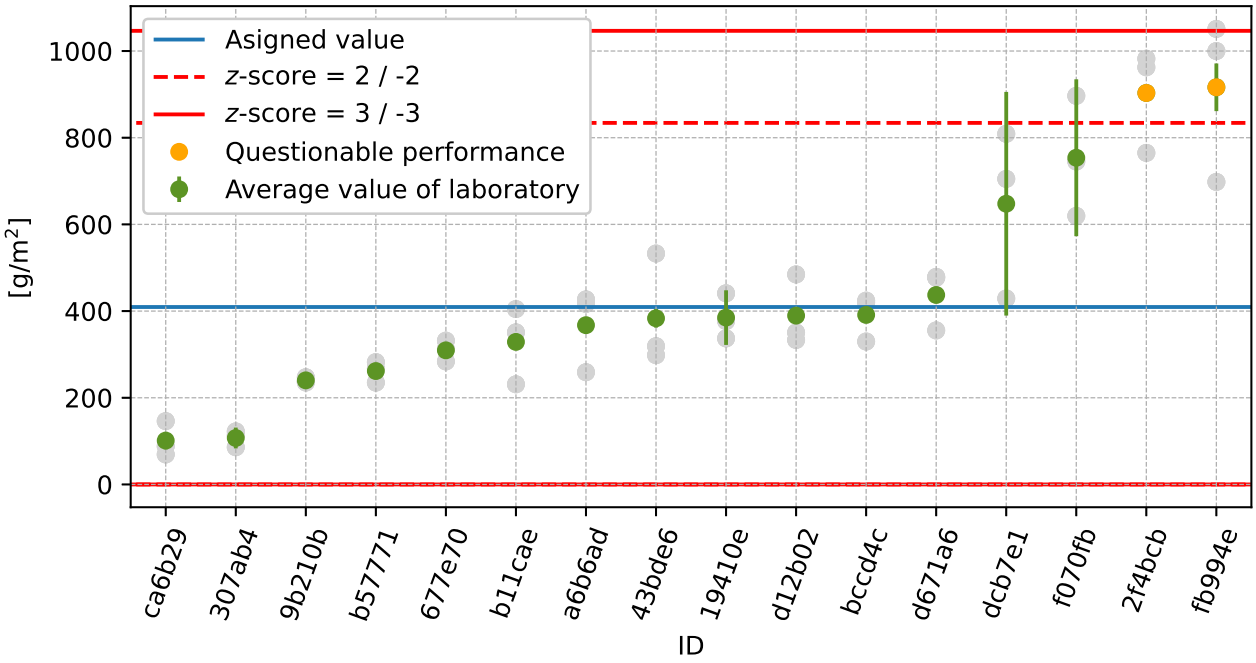

Figure 61: Average values and extended uncertainties of measurement

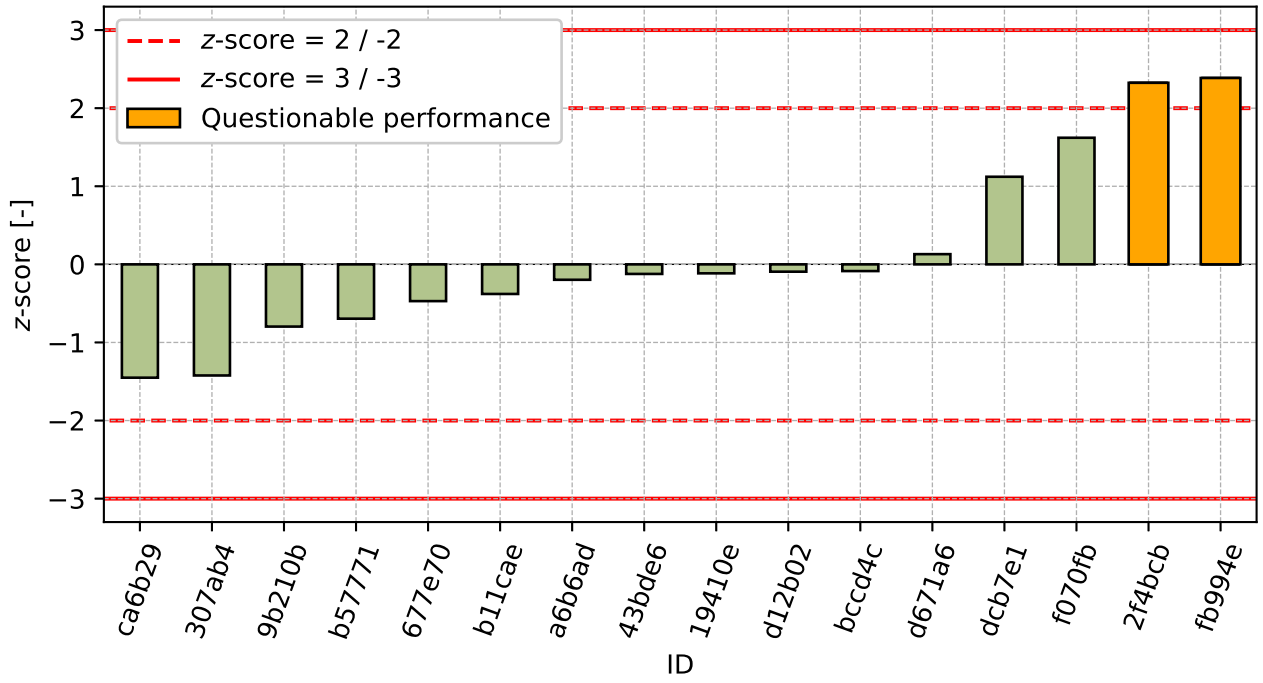

Figure 62: z-score

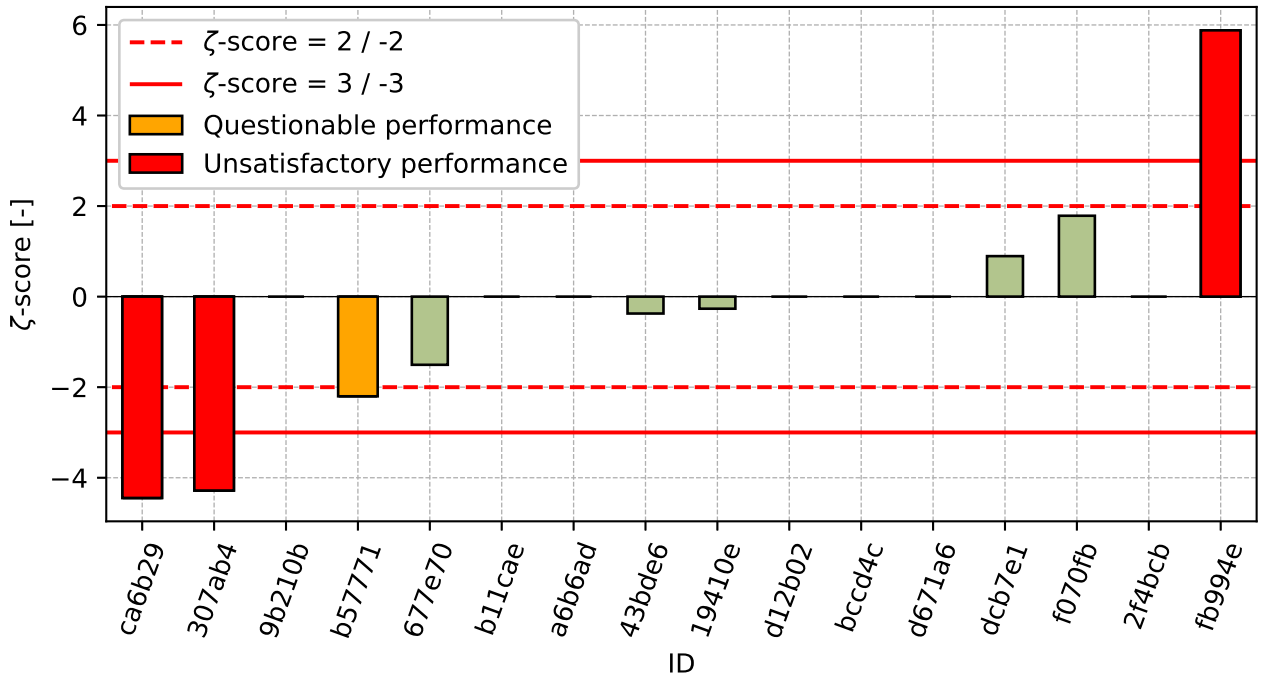

Figure 63: ζ-score

Table 24: z-score and ζ-score

ID	z-score [-]	ζ-score [-]
ca6b29	-1.45	-4.45
307ab4	-1.42	-4.28
9b210b	-0.80	-
b57771	-0.70	-2.20
677e70	-0.47	-1.51
b11cae	-0.38	-
a6b6ad	-0.20	-
43bde6	-0.12	-0.37
19410e	-0.11	-0.27
d12b02	-0.09	-
bccd4c	-0.09	-
d671a6	0.13	-
dcb7e1	1.12	0.89
f070fb	1.62	1.79
2f4bcb	2.33	-
fb994e	2.39	5.88

8 Appendix – ČSN 73 1326 – Resistance of cement concrete surface to water and defrosting chemicals – Method C

9 Appendix – CEN/TS 12390-9 – Freeze-thaw resistance – Scaling

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