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
Soil Testing
ZZ 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

Date: January 28, 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

Contents

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 ZZ 2025/1 whose aim was to verify and assess the conformity of test results across laboratories when testing soils.

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

doc. 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 ISO 17892-1 Geotechnical investigation and testing - Laboratory testing of soil - Part 1: Determination of water content [1],
2. EN ISO 17892-3 Geotechnical investigation and testing - Laboratory testing of soil - Part 3: Determination of particle density [2],
3. EN ISO 17892-4 Geotechnical investigation and testing - Laboratory testing of soil - Part 4: Determination of particle size distribution, art. 5.2 (Sieving) [3],
4. EN ISO 17892-4 Geotechnical investigation and testing - Laboratory testing of soil - Part 4: Determination of particle size distribution, art. 5.3 (Densimetric analysis),
5. EN ISO 17892-5 Geotechnical investigation and testing - Laboratory testing of soil - Part 5: Incremental loading oedometer test [4],
6. EN ISO 17892-7 Geotechnical investigation and testing - Laboratory testing of soil - Part 7: Unconfined compression test [5],
7. CEN ISO/TS 17892-10 Geotechnical investigation and testing - Laboratory testing of soil - Part 10: Direct shear tests [6],
8. EN ISO 17892-12 Geotechnical investigation and testing - Laboratory testing of soil - Part 12: Determination of liquid and plastic limits, art. 5.3 [7],
9. EN ISO 17892-12 Geotechnical investigation and testing - Laboratory testing of soil - Part 12: Determination of liquid and plastic limits, art. 5.4 [7],
10. EN 13286-2 Unbound and hydraulically bound mixtures - Part 2: Test methods for laboratory reference density and water content -Proctor compaction [8],
11. EN 13286-47 Unbound and hydraulically bound mixtures - Part 47: Test method for the determination of California Bearing ratio, immediate bearing index and linear swelling [9].

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.

83 laboratories from Europe 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	10	11
03aaf7	X	X	X	X	X	X	X	-	X	-	-
040aa6	X	X	X	-	-	-	-	X	X	-	-
0c7288	X	X	X	X	X	X	X	X	-	X	X
1039e8	X	X	X	X	X	X	X	X	X	X	X
12ba1b	X	-	X	X	-	-	-	-	X	-	-
140974	-	-	-	-	-	-	-	X	-	X	-
1413f1	X	-	X	-	-	-	-	X	-	-	-
17a1ac	-	-	-	-	-	-	-	-	-	X	-
21a0a0	X	X	X	X	X	X	X	X	X	X	X
227aa1	X	X	X	-	-	-	X	X	-	-	-
249582	-	-	-	-	-	-	X	-	-	-	-
24fb24	X	-	-	X	-	-	-	-	-	-	-
250d39	-	-	-	X	-	X	X	-	-	X	X
281c65	X	-	X	-	X	X	-	-	X	X	-
28b09e	X	-	X	-	-	-	-	X	-	-	-
3e1a74	-	-	X	-	-	X	-	-	-	X	X
415768	X	X	X	-	-	-	-	-	-	-	-
45e944	X	X	X	X	X	X	X	X	-	X	X
492fa2	-	X	-	X	-	-	-	-	-	-	-
4c2c6b	-	-	-	-	-	-	-	-	-	X	X
4cd4b5	X	-	-	-	-	-	-	-	-	X	X
4d5dd5	X	X	X	-	-	-	-	X	-	-	X
4d7590	X	-	-	-	-	-	-	-	-	X	-
4e83fc	X	X	X	X	X	-	X	X	-	X	X
52a5b8	X	X	X	X	X	X	X	X	-	-	-
557fe3	X	X	X	X	X	X	X	X	X	X	X
5671c5	X	X	X	X	X	X	X	X	X	X	X
5685e9	X	-	X	X	-	-	-	-	X	X	-
571743	X	X	-	-	-	-	-	X	-	-	-
57335f	X	X	X	-	X	-	-	X	-	-	-
57b55b	X	-	X	-	-	-	-	-	-	-	-
5880d9	X	-	X	X	-	X	-	X	X	-	X
5fd06d	-	-	-	-	X	X	X	-	-	X	-
61afff	X	-	X	X	-	-	-	X	X	-	X
655e79	-	-	-	-	X	X	X	X	-	-	-
666c8c	X	-	X	-	-	-	-	X	-	-	-
66c346	-	-	X	X	-	-	-	X	-	-	-
6977b1	-	X	-	X	-	-	X	X	-	-	-
6fb891	X	-	-	X	-	-	-	-	-	-	-
716bbc	X	-	X	-	-	-	-	X	-	X	X
728dee	-	-	-	-	-	-	-	-	-	X	-

Continued on next page

Continued from previous page

ID/Method	1	2	3	4	5	6	7	8	9	10	11
732ca5	X	-	-	-	-	-	-	-	-	X	-
754c28	-	X	X	X	X	X	X	-	X	X	X
777120	X	-	X	-	-	-	-	X	-	-	-
79cfdb	X	X	X	X	X	X	X	-	X	X	X
8527ec	X	X	X	X	X	X	X	X	-	X	X
85b84f	X	X	X	X	X	-	X	X	X	X	-
88de8c	X	-	X	X	-	-	-	X	-	X	X
8b2244	-	X	X	-	-	-	-	X	X	-	-
93ae6b	-	X	X	X	-	-	-	X	X	-	-
970f8d	X	X	-	-	X	X	X	-	-	-	-
9b9c90	-	-	-	-	-	-	-	X	X	X	-
a030ff	-	X	-	-	X	-	-	-	-	-	-
a4ee29	X	-	-	-	-	-	-	-	-	X	-
a65624	X	-	X	X	-	-	-	X	-	-	-
a703dc	-	-	-	-	-	-	-	-	-	X	X
a75067	-	-	-	-	-	-	-	-	-	X	-
a8d257	X	X	X	X	X	X	X	X	X	-	-
aed0c0	-	-	-	-	-	-	-	-	-	X	-
afb2e8	X	-	X	X	-	-	-	-	X	X	X
afb515	-	-	-	-	-	-	-	X	-	-	X
b13ae1	X	-	-	-	-	-	-	-	-	-	-
b3d1e7	X	-	X	X	-	-	-	-	X	X	X
b5135e	X	X	X	X	X	X	X	X	X	X	X
b66921	X	-	X	-	-	-	-	-	-	X	X
b7fb96	X	-	-	-	-	-	-	-	-	X	-
c6a8b7	X	-	X	-	-	-	-	-	-	X	-
cc7ae6	X	-	-	-	-	-	-	-	-	-	-
d143aa	X	-	X	-	-	-	-	-	-	-	-
d27b5f	-	-	X	X	-	-	-	-	X	-	X
d64e09	-	-	-	-	-	-	-	-	-	X	-
d9e3e1	-	-	-	-	X	X	X	-	-	-	-
e01a62	X	-	-	X	-	-	-	X	-	-	-
e53ac1	X	-	-	-	-	-	-	-	-	-	-
f2f2df	-	-	-	-	-	-	X	-	-	-	X
f39782	-	-	-	-	X	X	X	-	-	-	-
fa43b2	X	X	X	X	-	-	-	-	X	X	-
fb5cad	X	-	X	-	-	-	-	-	X	-	-
fc43ce	-	-	-	-	-	X	-	-	-	-	X
fce388	X	X	-	-	-	-	-	-	-	-	-
fd7eff	X	X	X	X	X	-	X	-	X	X	X
465bb7	-	-	X	X	-	-	-	-	-	-	-
989943	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
4G consite s.r.o.	Šlikova 406/29, Praha 6, 16900, Česká republika	1518
AG-UNS ARHITEKTONSKO-GRAĐEVINS INSTITUT DOO NOVI SAD	Put Novosadskog Partizanskog Odreda 1a, Novi Sad, 21000, Republic of Serbia	01-457
AG-UNS ARHITEKTONSKO-GRAĐEVINSKI INSTITUT DOO NOVI SAD - Belgrade	Put Novosadskog Partizanskog Odreda 1a, Novi Sad, 21000, Republic of Serbia	01-457
ALFA TEST ANGELOU KONSTANTINA LTD	End of Stratou Str., Christoupoli, Spata, 19004, Attiki, Greece	-
ALS Czech Republic s.r.o.	Na Harfě 336/9, Praha 9, 19000, Česká republika	-
AS "Celuprojekts"	Murjanu 7A, Riga, LV1024, Latvia	LATAK-T-520
AZ Consult, spol. s r.o.	Klíšská 1334/12, Ústí nad Labem, 400 01, Česká republika	L1740
AZ GEO, s.r.o.	Ocelářská 2969/12, Ostrava-Vítkovice, 70300, Česká republika	1768
Asphalt pavement institute - Apian DOO Beograd	Vranjska 29/65, Belgrade, 11000, Serbia	-
BHP	Unit 4 New Road Enterprise Centre, Limerick, V94P9X4, Co. Limerick	5T
Banat Inzenjering LBI DOO	Makedonska 15, Zrenjanin, 23000, Republic of Seriba	01-540
Bautechnische Versuch- und Forschungsanstalt	Alpenstr. 157, Salzburg, 5020, Austria	-
Bechtel ENKA UK Limited Ogranak Beograd	Jasički put 52 đ, Kruševac, 37000, Serbia	-
C.S.R. SRL CENTRO SVILUPPO RICERCHE - Andrea Todesco	Via Mestrina 46x, Noale, 30033, Venice (Italy)	-
C.S.R. SRL CENTRO SVILUPPO RICERCHE - Cristian Frizzarin	Via Mestrina 46x, Noale, 30033, Venice (Italy)	-
CDDI s.r.o. Vysoké Mýto	Vraclavská 163, Vysoké Mýto, 56601, Česká republika	-
CESILAB SRL	via 9 novembre 1989, 9, Turbigo (MI), 20029, ITALY	-
D.o.o. Geomehanika	Dobropoljska 21, Belgarde, 11000, Serbia	-
DSP a.s.	Kostěnice 111, Kostěnice, 530 02, Česká republika	1782
DTQ	Stjepana Tomića 3, Sarajevo, 71000, Bosnia and Herzegovi	-
Danucem Slovensko a.s., Skúšobné laboratórium Bratislava	Pestovateľská 2, Bratislava, 821 04, Slovenská republika	426/S-313
EDAFOMICHANIKI S.A.	19 EMMANUEL PAPADAKI, NEO IRAKLEIO, 14121, Greece	1269

Continued on next page

Continued from previous page

Laboratory	Address	Accreditation number
Eurofins Umwelt Österreich GmbH & Co. KG	Palmersstraße 2, Wiener Neudorf, 2351, Austria	ID 0071
G.U.B. Ingenieur AG	Katharinenstraße 11, Zwickau, 08056, Germany	D-PL-18082-01-00
GEMATEST spol. s.r.o.	Dr. Janského 954, Černošice, 25228, Česká republika	1291
GEOINGKOMPLEX (ГЕОИНЖКОМПЛЕКС)	shartava street #43d, Tbilisi, 0160, Tbilisi	GAC-TL-0352
GEOPET Teplice s.r.o.	Tolstého 451, Teplice, 415 01, Česká republika	1812
GEOPUT DOO BEOGRAD	Tome Rosandića 2, Belgrade (Beograd), 11010, Serbia (Srbija)	01-290
GEOtest, a.s.	Šmahova 1244/112, Brno, 627 00, Česká republika	1271
Geo-Test d.o.o.	Vojina Đurašinovića Kostje 11, Beograd, 11060, Serbia	01-466
Geoengineering LLC	15a Tamarashvili Street, Tbilisi, 0177, Georgia	-
Geolab d.o.o,Sarajevo	Mustafe Bajića 19, Sarajevo, 71 000, Bosna i Hercegovina	-
Geotech d.o.o.	Ciottina 21, Rijeka, 51000, Croatia	1717
Group Van Vooren	Industriepark Rosteyne 1, zelzate, 9060, België	BELAC B-296
Institut za građevinarstvo, građevinske materijale i nemetale d.o.o. Tuzla	Kojšino 29, Tuzla, 75000, BiH	LI - 04 -01
Institute IMS, Laboratory for Roads and Geotechnics	Bulevar vojvode Mišića 43, Belgrade, 11000, Serbia	01-138
KIRKITADZE AND COMPANY (LLC)	Tbilisi, Pekini 27, Tbilisi, 0160, Georgia	-
Koridori Srbije d.o.o.	Kralja Petra 21, Beograd, 11000, REPUBLIKA SRBIJA	-
LABORATORIUM DROGOWE SZCZECIN SP. Z O.O.	Tama Pomorzańska 13L, Szczecin, 70-030, Polska	AB1806
Laboratorijski putni centar doo Novi Sad	Abadzijska 32 - Veternik, Veternik, 21203, Srbija	01-531
Lithuanian geology survey under ministry of environment	S. Konarskio 35, Vilnius, 03123, Lithuania	LA.215-01
anonymous	anonymous	-
Materialversuchsanstalt Strass GmbH	Oberdorf 103, Strass im Zillertal, 6261, Austria	0455
Mattest (Ireland) Limited - Cork	Unit 18, University Hall Industrial Park, Sarsfield Road, Wilton, Cork, T12 EV20, Cork - Ireland	-
Mattest (Ireland) Limited - Dublin	Unit 2, Northwest Business Park, Ballycoolin, Dublin, D15 EF1H, Dublin - Ireland	-
Mining Institute Ltd. Belgrade	Batajnicki drum br.2, Zemun / Beograd, 11080, Serbia	-

Continued on next page

Continued from previous page

Laboratory	Address	Accreditation number
Mining and Metallurgy Institute Bor	Albert Ajnstajn 1, Bor, 19210, Serbia	01-308, ATS Serbia
NORD COMAT SHPK	Street "Muhamet Deliu", Building of the company "Dodaj", 1st floor, near "Fresku" restaurant, Dajt„ Tirana, 1062, Albania	LT 063
Národná diaľničná spoločnosť a.s.	Domkárska 9 (Stredisko správy a údržby diaľnic SSÚD 2 Bratislava), Bratislava, 82105, Slovensko	456/S-328
PPC Inspectra S.A.	Leontariou 9, Kantza Pallini, 15351, Athens Greece	-
PUDIS a.s.	Podbabská 1014/20, Praha 6, 160 00, Česká republika	1762
QCONTROL s.r.o., odštěpný závod - pracoviště Olomouc	Lesní 693, Bílovice nad Svitavou, 66401, Česká republika	1737
QCONTROL s.r.o., odštěpný závod - pracoviště Praha	Lesní 693, Bílovice nad Svitavou, 66401, Česká republika	1737
Rina Consulting - GET	Via Renata Bianchi 38, Genova, 16152, Italy	-
S.C. GEOSTUD S.R.L.	Sângerului, Bucharest, 014617, Other	-
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. - pracoviště Bílý Kámen	939/5 U místní dráhy, Olomouc, 779 00, Česká republika	1135.1
Sotiropoulos and Associates LAB LP	PATISION 46, ATHENS, 10682, GREECE	-
Stichting Technisch Centrum voor de Keramische Industrie (TCKI)	Florijnweg 6, Velp, 6883 JP, Netherlands	L254
Structum, d.o.o.	Tovarniška cesta 26, Ajdovščina, 5270, Slovenia	-
Structural Soils Ltd - Bristol	Structural Soils Ltd, Unit 1A Princess Street, Bristol, BS3 4AG, Bristol	-
Structural Soils Ltd - Castleford	Luke Fisher, Structural Soils Ltd, The Potteries, Pottery Street, Castleford, WF10 1NJ, West Yorkshire	-
Structural Soils Ltd - Hertfordshire	Sharon Cairns, Structural Soils Ltd, 18 Frogmore Road, Hemel Hempstead, HP3 9RT, Hertfordshire	-
Sweco Lietuva UAB	Ozo str. 12A-1, Vilnius, 08200, Lithuania	-
TEPVERAM s.r.o.	Třibřichy 13, Třibřichy, 537 01, Česká republika	1759
TESScontrol, s. r. o., organizačná zloška, TESScontrol - Zkušební laboratoř Znojmo	efakturycz@tesscontrol.sk, Znojmo, 669 02, Česká republika	L-1793

Continued on next page

Continued from previous page

Laboratory	Address	Accreditation number
TPA ČR, s.r.o.	Vrbenská 1821/31, České Budějovice, 37006, Česká republika	1181
TPA ČR, s.r.o.	Vrbenská 1821/31, České Budějovice, 370 06, Česká republika	1181
TPA ČR, s.r.o. pracoviště č.4 Olomouc, Tovární 731, 783 53 Velká Bystřice	Vrbenská 1821/31, České Budějovice, 370 06, Česká republika	1181
TRANSLAB LABORATORIUM	Oeverstraat 21, Lokeren, 9160, Belgium	-
UAB "Rapasta"	Gedinimo g. 47-217, Kaunas, 44239, Kaunas	LA.243-01
UAB Gruntira	Žiogupio 37D, Palanga, LT-00177, Lietuva	-
VUHU a.s.	tř. Budovatelů 2830/3, Most, 43401, Česká republika	1078
Vlaamse Overheid - afdeling Geotechiek	Technologiepark-Zwijnaarde 68, Gent, 9052, België	-
WSB Labor-GmbH	Gewerbestraße 3, Mautern an der Donau, 3512, Austria	-
i2 Analytical Limited Sp. z o.o. Oddział w Polsce	Pionierów 39, Ruda Śląska, 41-711, Polska	-
Ústav stavebního zkušebnictví s.r.o.	Jiřího Potůčka 115, Pardubice, 53009, Česká republika	1115
ČVUT Kloknerův ústav	Šolínova, 7, Praha 6, 16608, Česká republika	1061
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
Περιφέρεια Βορείου Αιγαίου – Διεύθυνση Τεχνικών Έργων Π.Ε. Λέσβου, Τμήμα Εργαστηρίων	El. BENIZELOU 35, MYTILENE, 81132, GREECE	-
"HIDROZAVOD DTD" AD	Petra Drapsina 56, Novi Sad, 21000, Srbija	01-405

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 ZZ 2025/1(PT Program) organized by the PT Provider at the SZK FAST. 83 participants (laboratories) took part in the PT Program. The program focused on ordinary standardized testing of soil. 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.

The testing methods 3 and 4 were evaluated as a multilevel experiment. Laboratory performance was classified as problematic or unsatisfactory if critical values were exceeded on at least four levels of the experiment.

Table 4: 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	10	11
03aaf7	✓	✓	✓	✓	?	✓	✓	-	✓	-	-
040aa6	✓	✓	✓	-	-	-	-	✓	✓	-	-
0c7288	✓	✓	✓	✓	✓	?	✓	✓	-	✓	✓
1039e8	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
12ba1b	✓	-	✓	✓	-	-	-	-	✓	-	-
140974	-	-	-	-	-	-	-	✓	-	✓	-
1413f1	✓	-	✓	-	-	-	-	✓	-	-	-
17a1ac	-	-	-	-	-	-	-	-	-	X	-
21a0a0	✓	✓	✓	✓	?	✓	✓	✓	✓	✓	✓
227aa1	✓	✓	✓	-	-	-	?	✓	-	-	-
249582	-	-	-	-	-	-	✓	-	-	-	-
24fb24	✓	-	-	X	-	-	-	-	-	-	-
250d39	-	-	-	✓	-	✓	✓	-	-	✓	✓
281c65	✓	-	✓	-	✓	✓	-	-	-	✓	-
28b09e	✓	-	✓	-	-	-	-	✓	-	-	-
3e1a74	-	-	✓	-	-	✓	-	-	-	✓	?
415768	✓	✓	✓	-	-	-	-	-	-	-	-
45e944	✓	✓	✓	✓	✓	✓	?	✓	-	✓	✓
492fa2	-	✓	-	✓	-	-	-	-	-	-	-
4c2c6b	-	-	-	-	-	-	-	-	-	✓	✓
4cd4b5	✓	-	-	-	-	-	-	-	-	✓	✓
4d5dd5	✓	✓	✓	-	-	-	-	✓	-	-	✓
4d7590	✓	-	-	-	-	-	-	-	-	✓	-
4e83fc	?	✓	✓	✓	✓	-	✓	?	-	✓	✓
52a5b8	✓	✓	X	✓	✓	✓	✓	✓	-	-	-
557fe3	✓	✓	✓	✓	✓	X	✓	✓	✓	✓	✓
5671c5	✓	✓	✓	✓	✓	?	✓	✓	✓	✓	✓

Continued on next page

Continued from previous page

ID / Method	1	2	3	4	5	6	7	8	9	10	11
5685e9	✓	-	✓	✓	-	-	-	-	✓	✓	-
571743	✓	✓	-	-	-	-	-	✓	-	-	-
57335f	✓	✓	✓	-	✓	-	-	✓	-	-	-
57b55b	✓	-	✓	-	-	-	-	-	-	-	-
5880d9	✓	-	✓	✓	-	✓	-	✓	✓	-	✓
5fd06d	-	-	-	-	✓	✓	✓	-	-	?	-
61afff	✓	-	✓	✓	-	-	-	✓	✓	-	✓
655e79	-	-	-	-	✓	✓	✓	✓	-	-	-
666c8c	✓	-	✓	-	-	-	-	✓	-	-	-
66c346	-	-	✓	?	-	-	-	✓	-	-	-
6977b1	-	✓	-	✓	-	-	✓	?	-	-	-
6fb891	✓	-	-	✓	-	-	-	-	-	-	-
716bbc	✓	-	✓	-	-	-	-	✓	-	✓	✓
728dee	-	-	-	-	-	-	-	-	-	✓	-
732ca5	✓	-	-	-	-	-	-	-	-	✓	-
754c28	-	✓	✓	✓	?	✓	✓	-	✓	?	✓
777120	✓	-	X	-	-	-	-	?	-	-	-
79cfdb	✓	✓	✓	✓	✓	✓	✓	-	✓	?	✓
8527ec	✓	✓	✓	✓	✓	✓	✓	✓	-	✓	✓
85b84f	✓	✓	✓	✓	✓	-	✓	✓	✓	✓	-
88de8c	✓	-	✓	✓	-	-	-	✓	-	✓	?
8b2244	-	✓	✓	-	-	-	-	✓	✓	-	-
93ae6b	-	✓	✓	✓	-	-	-	✓	✓	-	-
970f8d	✓	✓	-	-	✓	✓	✓	-	-	-	-
9b9c90	-	-	-	-	-	-	-	✓	✓	✓	-
a030ff	-	✓	-	-	✓	-	-	-	-	-	-
a4ee29	✓	-	-	-	-	-	-	-	-	✓	-
a65624	✓	-	X	✓	-	-	-	✓	-	-	-
a703dc	-	-	-	-	-	-	-	-	-	✓	✓
a75067	-	-	-	-	-	-	-	-	-	✓	-
a8d257	✓	✓	✓	✓	✓	✓	✓	✓	✓	-	-
aed0c0	-	-	-	-	-	-	-	-	-	✓	-
afb2e8	✓	-	✓	?	-	-	-	-	✓	X	✓
afb515	-	-	-	-	-	-	-	✓	-	-	✓
b13ae1	✓	-	-	-	-	-	-	-	-	-	-
b3d1e7	✓	-	✓	✓	-	-	-	-	!	✓	✓
b5135e	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓

Continued on next page

Continued from previous page

ID / Method	1	2	3	4	5	6	7	8	9	10	11
b66921	✓	-	✓	-	-	-	-	-	-	✓	✓
b7fb96	✓	-	-	-	-	-	-	-	-	✓	-
c6a8b7	✓	-	?	-	-	-	-	-	-	X	-
cc7ae6	✓	-	-	-	-	-	-	-	-	-	-
d143aa	✓	-	✓	-	-	-	-	-	-	-	-
d27b5f	-	-	✓	✓	-	-	-	-	✓	-	✓
d64e09	-	-	-	-	-	-	-	-	-	✓	-
d9e3e1	-	-	-	-	✓	✓	✓	-	-	-	-
e01a62	✓	-	-	✓	-	-	-	?	-	-	-
e53ac1	✓	-	-	-	-	-	-	-	-	-	-
f2f2df	-	-	-	-	-	-	✓	-	-	-	✓
f39782	-	-	-	-	✓	✓	✓	-	-	-	-
fa43b2	✓	✓	✓	✓	-	-	-	-	✓	✓	-
fb5cad	✓	-	✓	-	-	-	-	-	✓	-	-
fc43ce	-	-	-	-	-	✓	-	-	-	-	✓
fce388	✓	✓	-	-	-	-	-	-	-	-	-
fd7eff	✓	✓	✓	✓	✓	-	✓	-	✓	✓	✓
465bb7	-	-	✓	X	-	-	-	-	-	-	-
989943	X	-	✓	-	-	-	-	-	-	-	-

References

[1] EN ISO 17892-1. *Geotechnical investigation and testing - Laboratory testing of soil - Part 1: Determination of water content*. 2015.

[2] EN ISO 17892-3. *Geotechnical investigation and testing - Laboratory testing of soil - Part 3: Determination of particle density*. 2016.

[3] EN ISO 17892-4. *Geotechnical investigation and testing - Laboratory testing of soil - Part 4: Determination of particle size distribution*. 2017.

[4] EN ISO 17892-5. *Geotechnical investigation and testing - Laboratory testing of soil - Part 5: Incremental loading oedometer test*. 2017.

[5] EN ISO 17892-7. *Geotechnical investigation and testing - Laboratory testing of soil - Part 7: Unconfined compression test*. 2018.

[6] EN ISO 17892-10. *Geotechnical investigation and testing - Laboratory testing of soil - Part 10: Direct shear tests*. 2018.

[7] EN ISO 17892-12. *Geotechnical investigation and testing - Laboratory testing of soil - Part 12: Determination of liquid and plastic limits*. 2018.

[8] EN 13286-2. *Unbound and hydraulically bound mixtures - Part 2: Test methods for laboratory reference density and water content - Proctor compaction*. 2011.

[9] EN 13286-47. *Unbound and hydraulically bound mixtures - Part 47: Test method for the determination of California Bearing ratio, immediate bearing index and linear swelling*. 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 ISO 17892-1 – Water content

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 [%]			u_X [%]	$\bar{x}$ [%]	s_0 [%]	V_X [%]
4e83fc	3.3	3.3	3.5	0.05	3.4	0.12	3.43
6fb891	3.5	3.5	3.5	0.02	3.5	0.00	0.00
415768	3.5	3.5	3.5	1.09	3.5	0.00	0.00
777120	3.5	3.5	3.8	-	3.6	0.17	4.81
b3d1e7	3.6	3.6	3.6	-	3.6	0.00	0.00
281c65	3.6	3.6	3.7	-	3.6	0.06	1.59
227aa1	3.4	4.0	3.6	-	3.7	0.31	8.33
970f8d	3.7	3.7	3.6	-	3.7	0.06	1.57
57b55b	3.7	3.7	3.7	0.25	3.7	0.00	0.00
b13ae1	3.7	3.7	3.7	0.90	3.7	0.00	0.00
a4ee29	3.6	3.7	3.8	0.10	3.7	0.10	2.70
12ba1b	3.6	3.7	3.8	2.00	3.7	0.10	2.70
8527ec	3.8	3.7	3.8	0.20	3.8	0.06	1.53
88de8c	3.7	3.8	3.8	0.10	3.8	0.06	1.53
61afff	3.7	3.8	3.8	-	3.8	0.06	1.53
fd7eff	3.8	3.7	3.8	-	3.8	0.06	1.53
b66921	3.8	3.8	3.7	0.20	3.8	0.06	1.53
a65624	3.7	3.9	3.8	0.08	3.8	0.10	2.63
040aa6	3.8	3.8	3.8	0.19	3.8	0.00	0.00
57335f	3.8	3.8	3.8	0.05	3.8	0.00	0.00
a8d257	3.8	3.8	3.8	1.30	3.8	0.00	0.00
fce388	3.8	3.8	3.8	0.01	3.8	0.00	0.00
85b84f	3.8	3.7	3.9	-	3.8	0.10	2.63
b5135e	3.8	3.7	3.9	-	3.8	0.10	2.63
cc7ae6	3.9	3.8	3.8	0.24	3.8	0.06	1.51
5671c5	3.9	3.8	3.8	-	3.8	0.06	1.51
e53ac1	3.8	3.8	3.9	-	3.8	0.06	1.51
716bbc	4.1	3.6	3.8	0.10	3.8	0.25	6.57
52a5b8	3.9	3.8	3.8	-	3.8	0.06	1.51
afb2e8	3.8	3.8	3.9	-	3.8	0.06	1.51
4d7590	4.0	3.7	3.8	0.14	3.8	0.15	3.98
1413f1	3.9	3.9	3.8	0.80	3.9	0.06	1.49
c6a8b7	3.8	3.9	3.9	0.10	3.9	0.06	1.49
1039e8	3.9	3.9	3.9	-	3.9	0.00	0.00
28b09e	3.9	3.9	3.9	0.10	3.9	0.00	0.00
666c8c	3.8	4.0	3.9	0.10	3.9	0.10	2.56
79cfdb	3.9	3.9	3.9	0.10	3.9	0.00	0.00
d143aa	3.9	3.9	3.9	0.78	3.9	0.00	0.00
03aaf7	3.9	3.9	3.9	0.01	3.9	0.00	0.00

Continued on next page

Continued from previous page

ID	Test results [%]			u_X [%]	$\bar{x}$ [%]	s_0 [%]	V_X [%]
571743	3.9	3.9	4.0	0.07	3.9	0.06	1.47
21a0a0	4.0	4.0	3.9	-	4.0	0.06	1.46
fb5cad	4.0	4.0	4.0	0.10	4.0	0.00	0.00
5685e9	4.0	4.0	4.0	0.36	4.0	0.00	0.00
24fb24	4.0	4.0	4.0	0.15	4.0	0.00	0.00
557fe3	4.0	4.0	4.1	0.30	4.0	0.06	1.43
4d5dd5	4.0	4.0	4.1	-	4.0	0.06	1.43
e01a62	4.1	4.0	4.2	0.20	4.1	0.10	2.44
732ca5	4.0	4.1	4.2	0.50	4.1	0.10	2.44
0c7288	4.2	4.2	4.1	0.06	4.2	0.06	1.39
5880d9	4.2	4.1	4.2	-	4.2	0.06	1.39
fa43b2	4.2	4.2	4.1	0.50	4.2	0.06	1.39
45e944	4.2	4.1	4.3	-	4.2	0.10	2.38
b7fb96	4.2	4.2	4.3	0.50	4.2	0.06	1.36
4cd4b5	4.2	4.2	4.3	0.08	4.2	0.06	1.36
989943	36.5	34.8	33.8	10.00	35.0	1.37	3.90

1.2 The Numerical Procedure for Determining Outliers

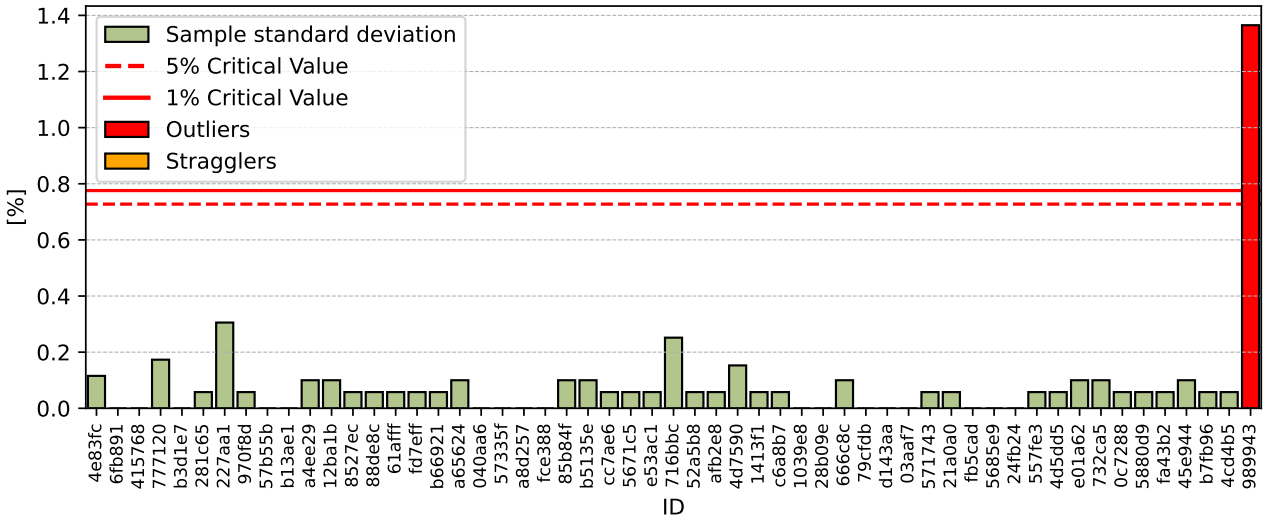

Figure 1: **Cochran's test** - sample standard deviations

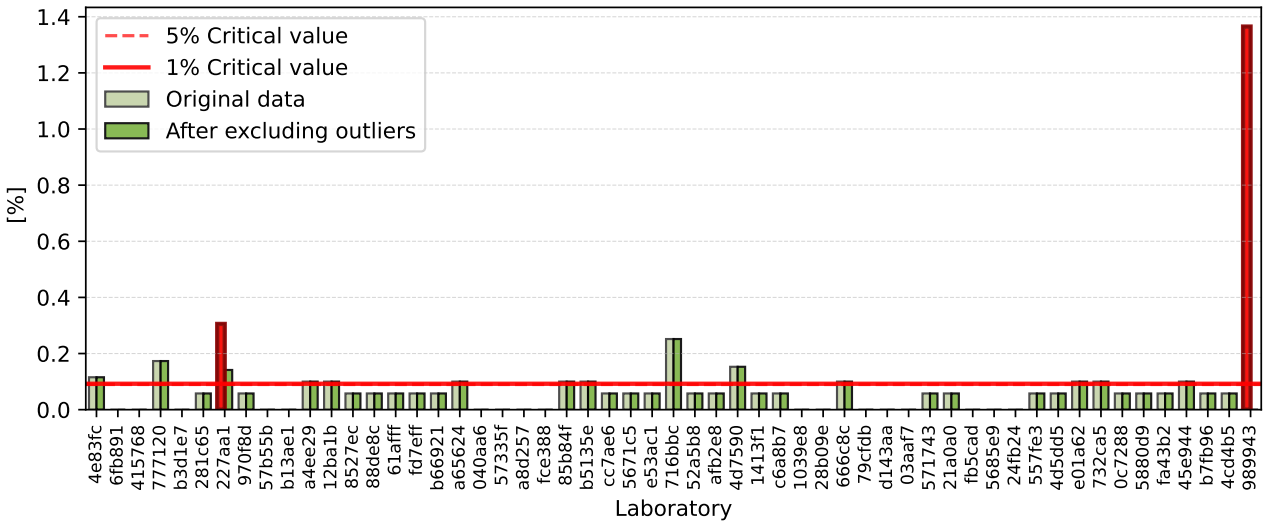

Figure 2: **Cochran's test** - sample standard deviations without outliers

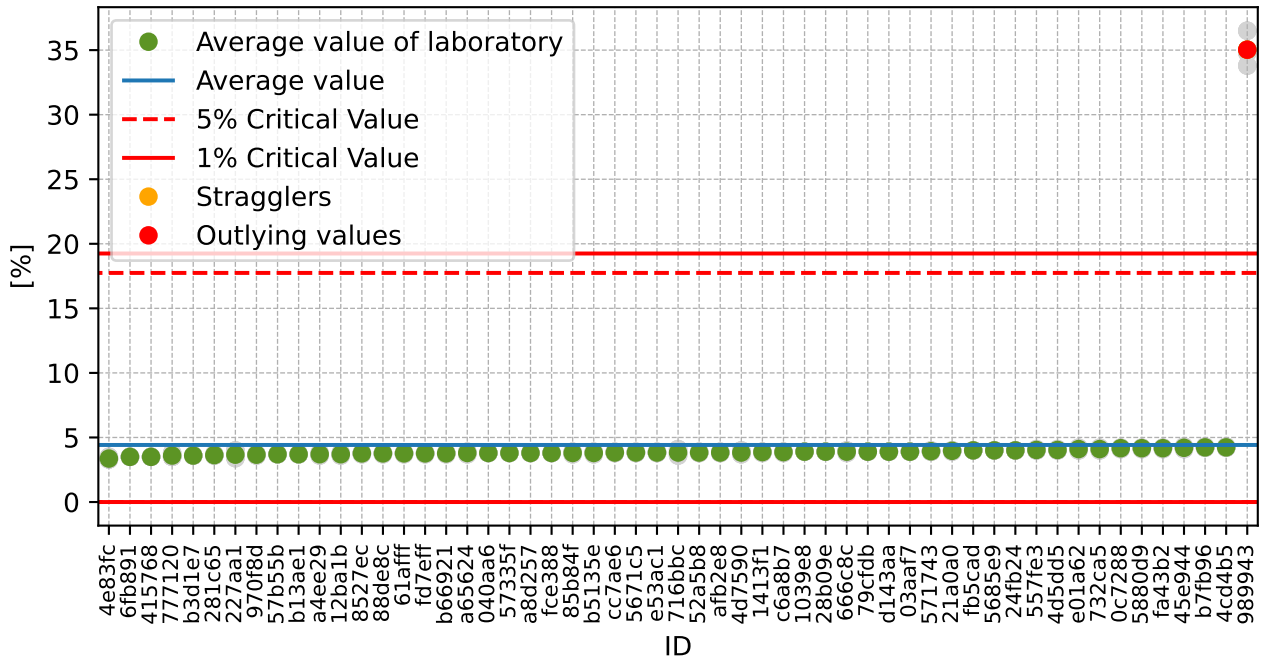

Figure 3: **Grubbs' test** - average values

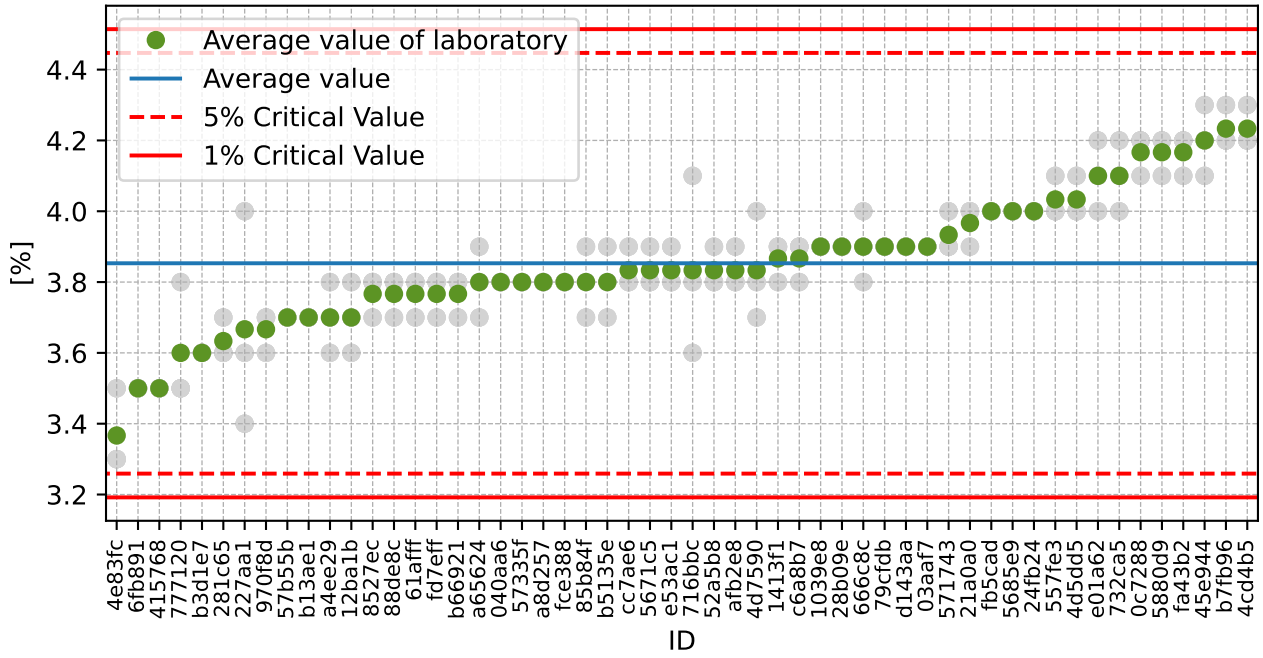

Figure 4: **Grubbs' test** - average values without outliers

1.3 Mandel's Statistics

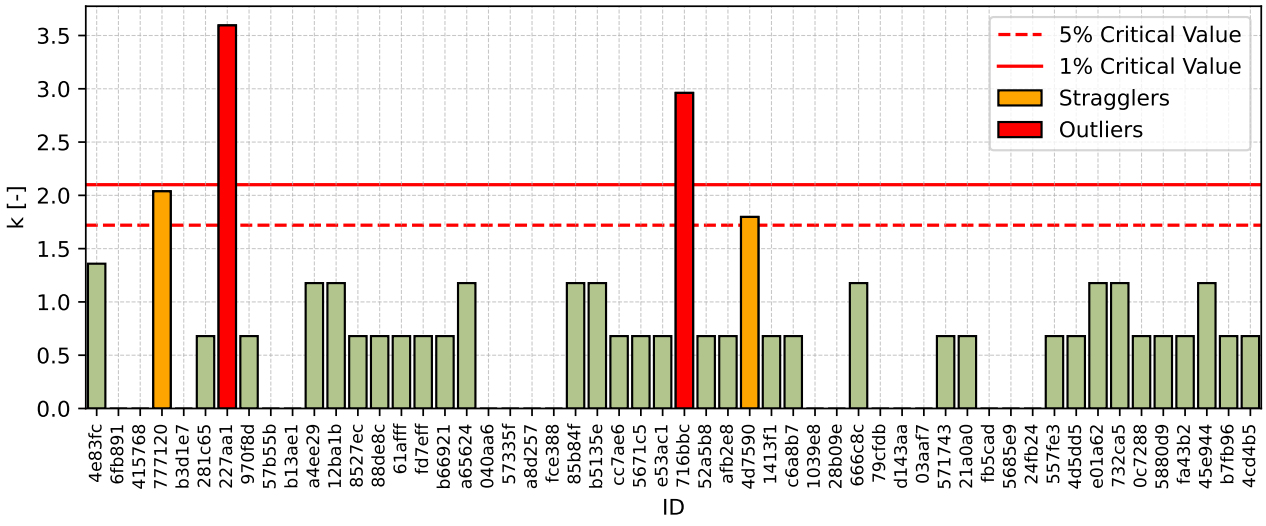

Figure 5: Intralaboratory Consistency Statistic

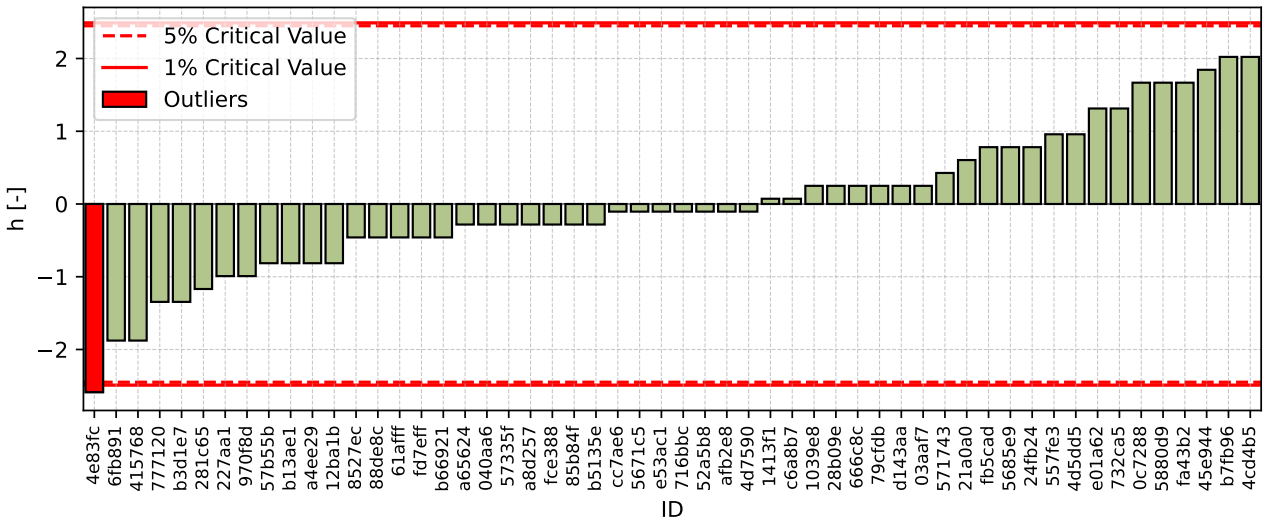

Figure 6: Interlaboratory Consistency Statistic

1.4 Descriptive statistics

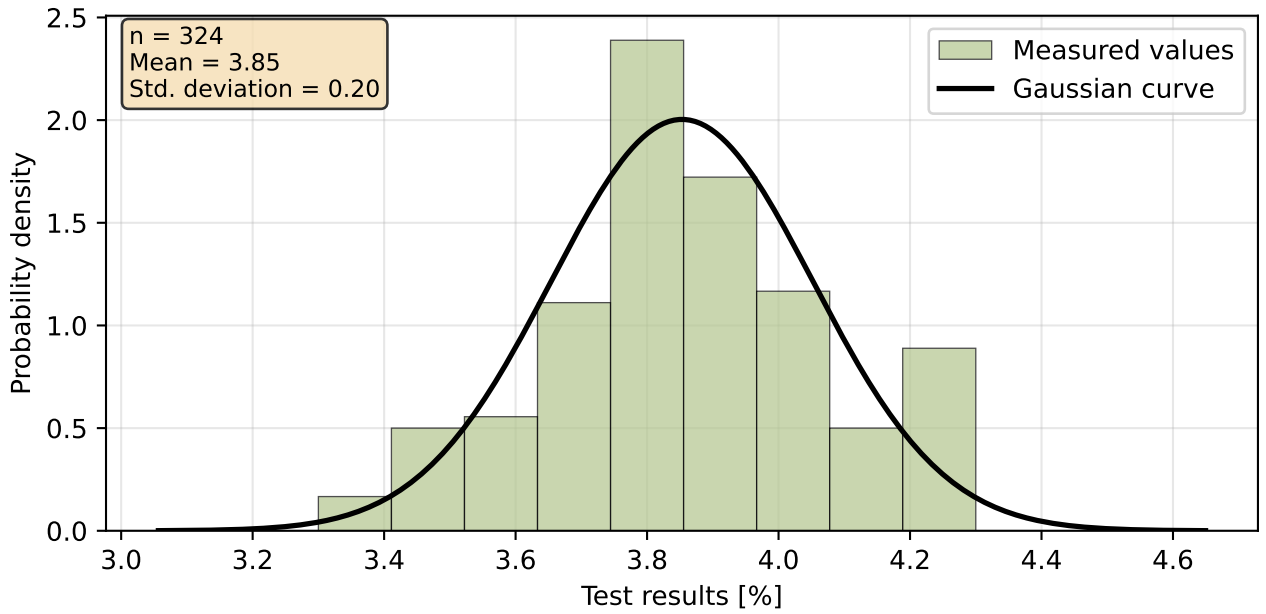

Figure 7: Histogram of all test results

Table 5: Descriptive statistics

Characteristics	[%]
Average value – $\bar{x}$	3.9
Sample standard deviation – s	0.19
Asigned value – x^*	3.9
Robust standard deviation – s^*	0.22
Measurement uncertainty of asigned value – u_X	0.03
p-value of normality test	0.001 [-]

1.5 Evaluation of Performance Statistics

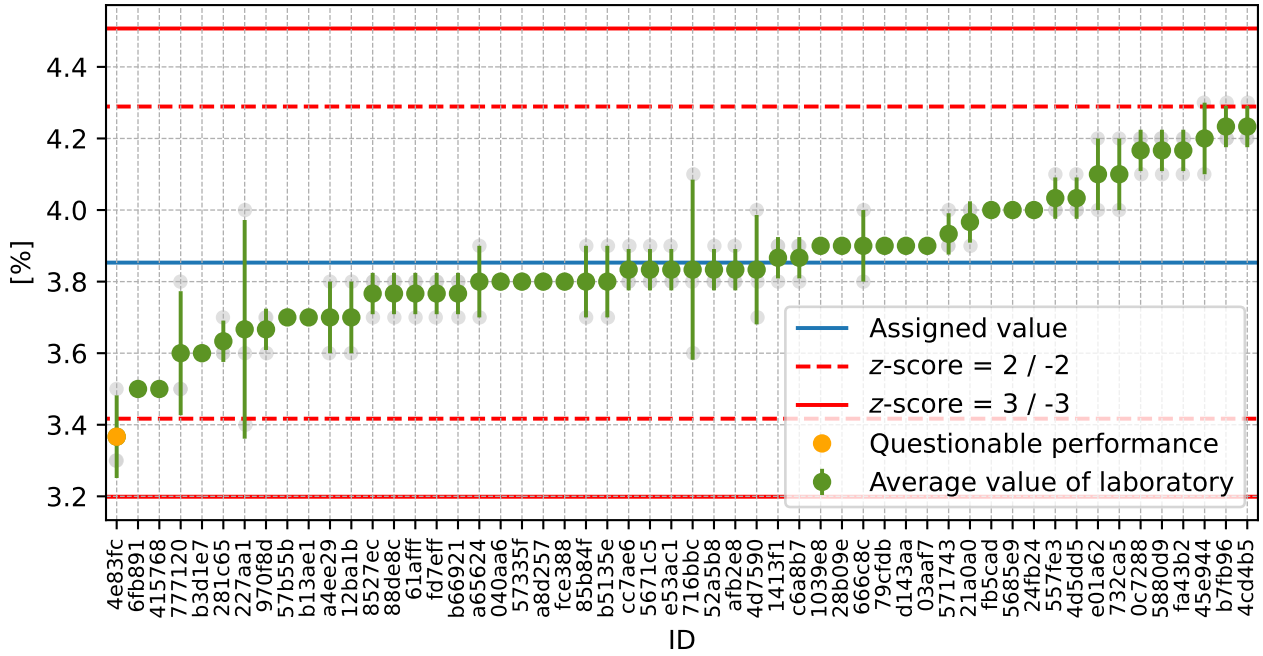

Figure 8: Average values and sample standard deviations

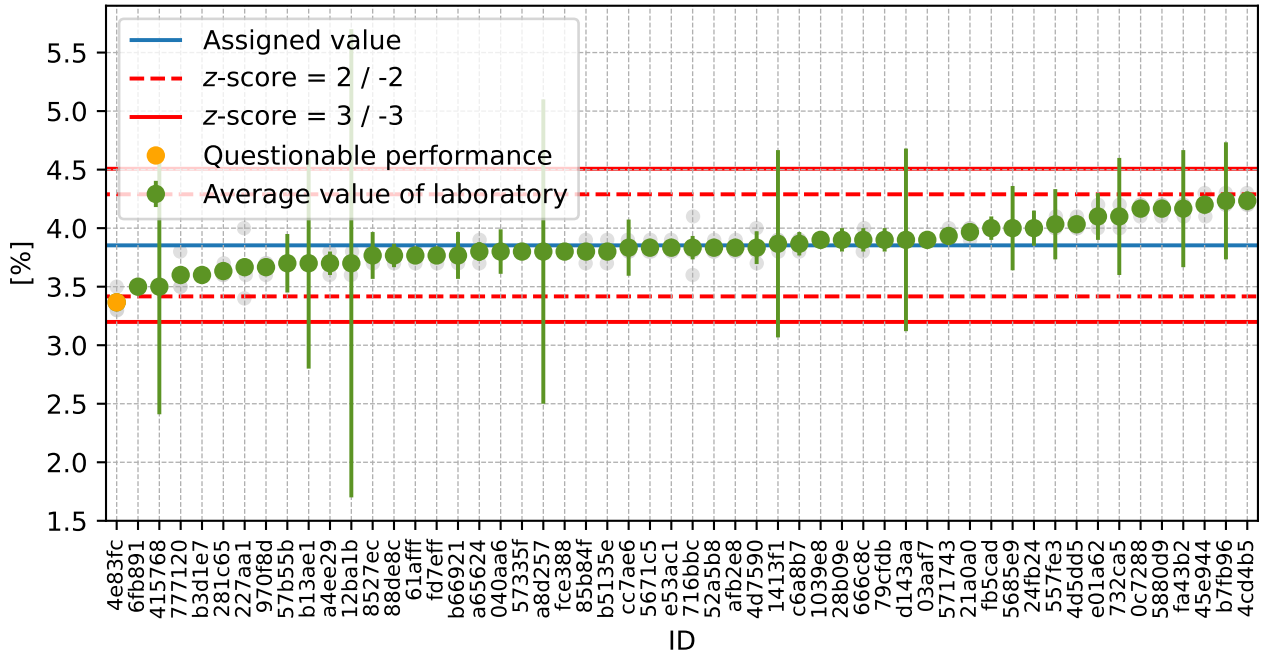

Figure 9: Average values and extended uncertainties of measurement

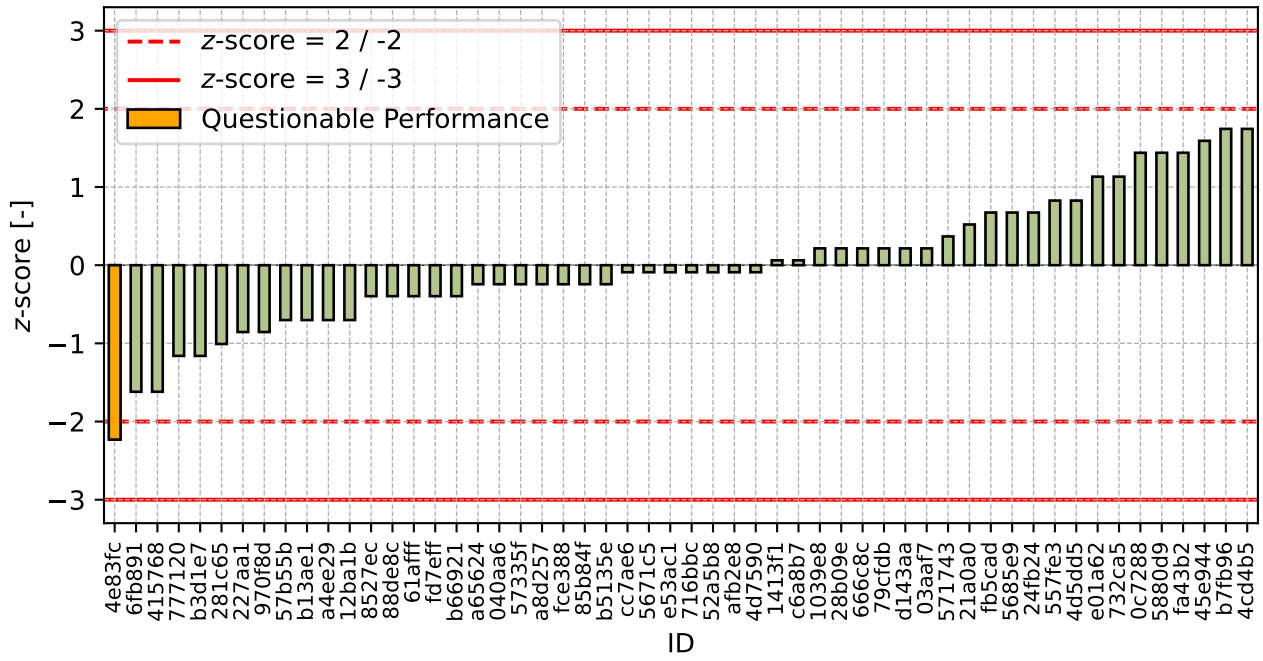

Figure 10: z-score

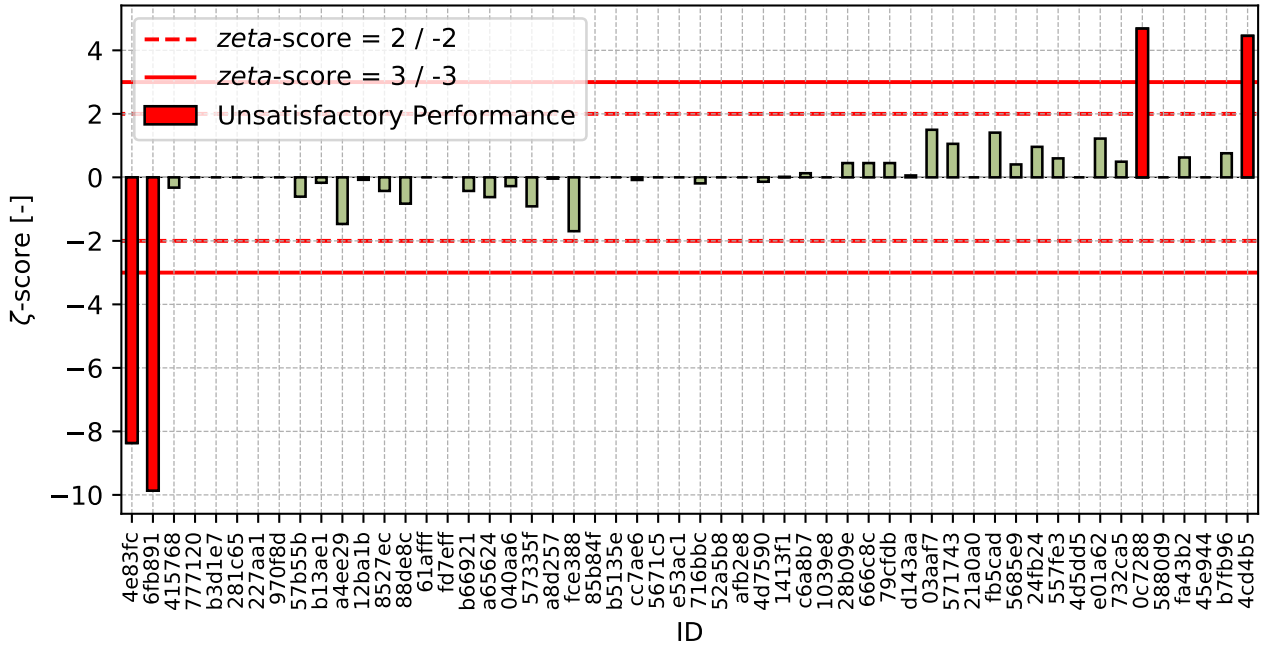

Figure 11: ζ-score

Table 6: z-score and ζ-score

ID	z-score [-]	ζ-score [-]
4e83fc	-2.23	-8.37
6fb891	-1.62	-9.87
415768	-1.62	-0.32
777120	-1.16	-
b3d1e7	-1.16	-
281c65	-1.01	-
227aa1	-0.85	-
970f8d	-0.85	-
57b55b	-0.7	-0.61
b13ae1	-0.7	-0.17
a4ee29	-0.7	-1.47
12ba1b	-0.7	-0.08
8527ec	-0.4	-0.43
88de8c	-0.4	-0.83
61afff	-0.4	-
fd7eff	-0.4	-
b66921	-0.4	-0.43
a65624	-0.24	-0.62
040aa6	-0.24	-0.28
57335f	-0.24	-0.91
a8d257	-0.24	-0.04
fce388	-0.24	-1.7
85b84f	-0.24	-
b5135e	-0.24	-
cc7ae6	-0.09	-0.08

Continued on next page

Continued from previous page

ID	z-score [-]	ζ-score [-]
5671c5	-0.09	-
e53ac1	-0.09	-
716bbc	-0.09	-0.19
52a5b8	-0.09	-
afb2e8	-0.09	-
4d7590	-0.09	-0.14
1413f1	0.06	0.02
c6a8b7	0.06	0.13
1039e8	0.22	-
28b09e	0.22	0.45
666c8c	0.22	0.45
79cfdb	0.22	0.45
d143aa	0.22	0.06
03aaf7	0.22	1.5
571743	0.37	1.06
21a0a0	0.52	-
fb5cad	0.67	1.41
5685e9	0.67	0.41
24fb24	0.67	0.96
557fe3	0.83	0.6
4d5dd5	0.83	-
e01a62	1.13	1.22
732ca5	1.13	0.49
0c7288	1.44	4.68
5880d9	1.44	-
fa43b2	1.44	0.63
45e944	1.59	-
b7fb96	1.74	0.76
4cd4b5	1.74	4.46

2 Appendix – EN ISO 17892-3 – Particle density

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 [Mg/m^3]			u_X [Mg/m^3]	$\bar{x}$ [Mg/m^3]	s_0 [Mg/m^3]	V_X [%]
227aa1	2.60	2.60	2.60	-	2.60	0.000	0.00
0c7288	2.62	2.62	2.61	0.050	2.62	0.006	0.22
52a5b8	2.62	2.61	2.63	-	2.62	0.010	0.38
fa43b2	2.62	2.63	2.63	0.104	2.63	0.006	0.22
6977b1	2.63	2.64	2.63	0.010	2.63	0.006	0.22
4d5dd5	2.63	2.64	2.63	-	2.63	0.006	0.22
45e944	2.63	2.64	2.64	-	2.64	0.006	0.22
4e83fc	2.64	2.64	2.64	0.050	2.64	0.000	0.00
8527ec	2.65	2.63	2.65	0.040	2.64	0.012	0.44
754c28	2.67	2.64	2.63	0.040	2.65	0.021	0.79
85b84f	2.65	2.64	2.66	-	2.65	0.010	0.38
57335f	2.65	2.66	2.65	0.050	2.65	0.006	0.22
557fe3	2.64	2.66	2.66	0.040	2.65	0.012	0.44
492fa2	2.66	2.67	2.65	-	2.66	0.010	0.38
1039e8	2.66	2.66	2.66	-	2.66	0.000	0.00
b5135e	2.66	2.67	2.68	-	2.67	0.010	0.37
79cfdb	2.67	2.67	2.67	0.010	2.67	0.000	0.00
040aa6	2.67	2.68	2.67	0.010	2.67	0.006	0.22
8b2244	2.67	2.67	2.68	-	2.67	0.006	0.22
fd7eff	2.68	2.67	2.67	-	2.67	0.006	0.22
5671c5	2.68	2.69	2.69	-	2.69	0.006	0.21
970f8d	2.69	2.69	2.69	-	2.69	0.000	0.00
21a0a0	2.69	2.69	2.69	-	2.69	0.000	0.00
a8d257	2.68	2.69	2.70	0.046	2.69	0.010	0.37
03aaf7	2.69	2.69	2.70	0.028	2.69	0.006	0.21
93ae6b	2.69	2.70	2.70	0.010	2.70	0.006	0.21
a030ff	2.71	2.71	2.72	0.025	2.71	0.006	0.21
415768	2.72	2.73	2.73	0.767	2.73	0.006	0.21
fce388	2.74	2.72	2.73	0.010	2.73	0.010	0.37
571743	2.74	2.75	2.74	0.010	2.74	0.006	0.21

2.2 The Numerical Procedure for Determining Outliers

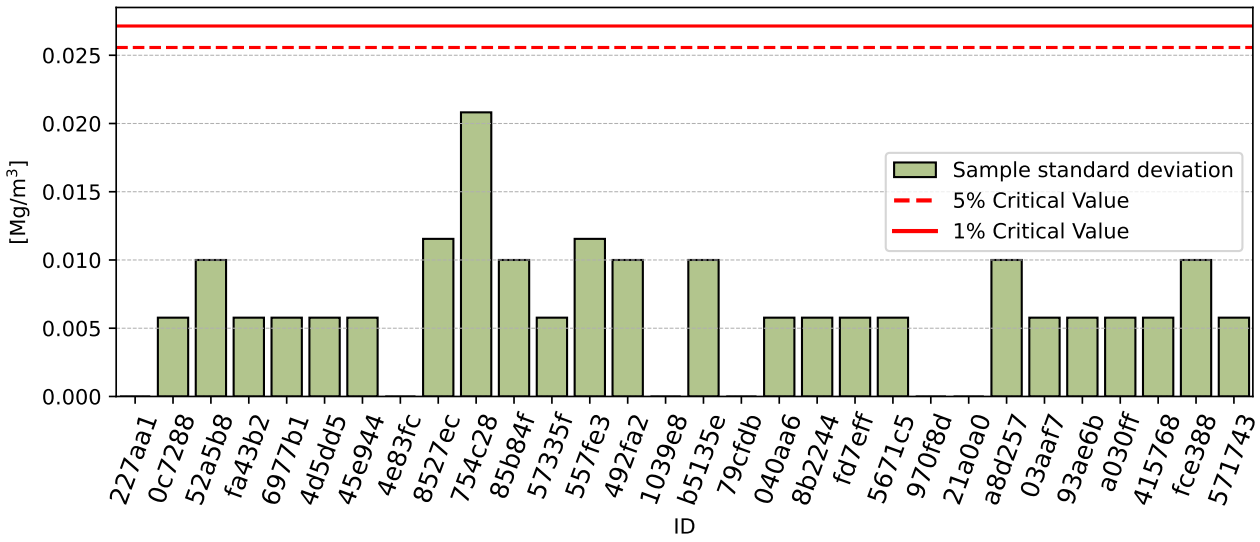

Figure 12: **Cochran's test** - sample standard deviations

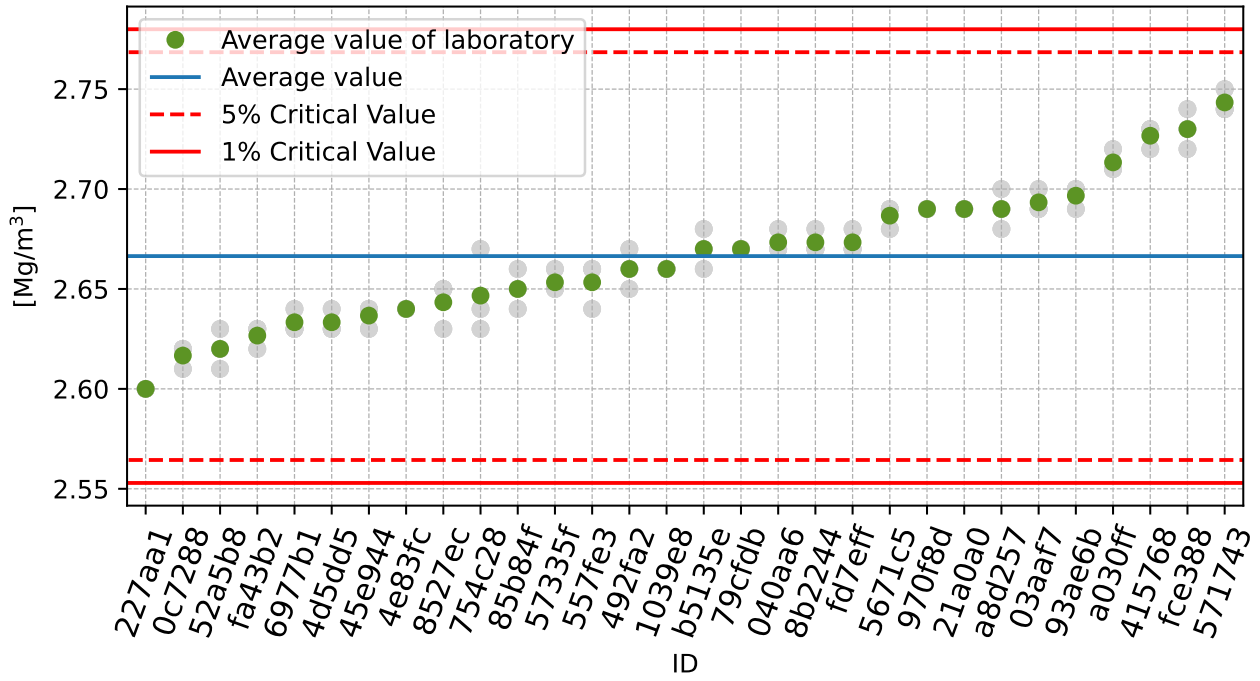

Figure 13: **Grubbs' test** - average values

2.3 Mandel's Statistics

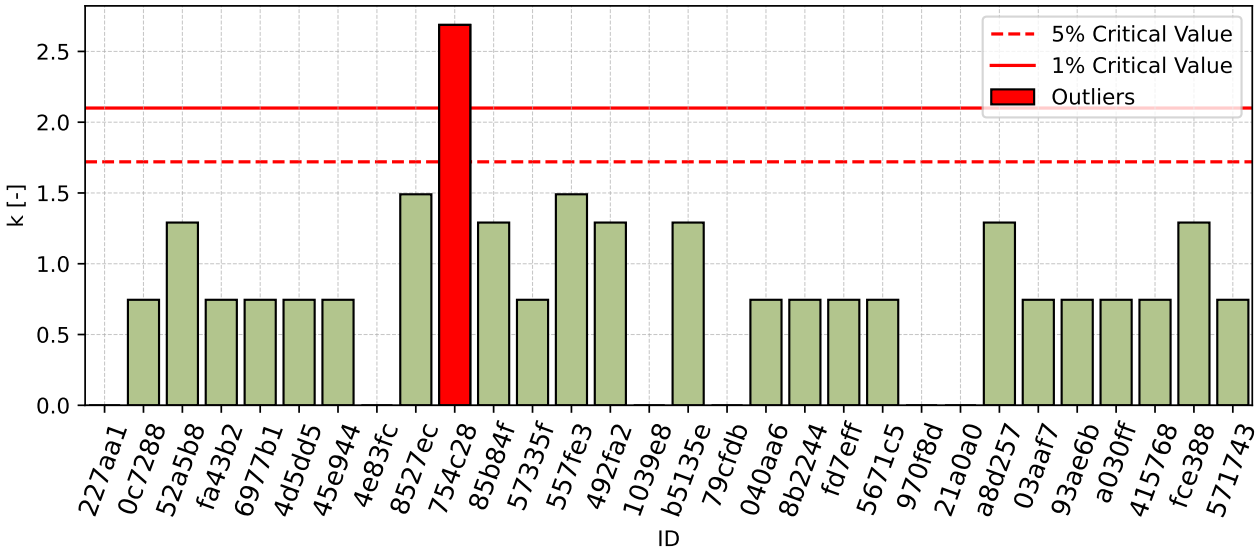

Figure 14: Intralaboratory Consistency Statistic

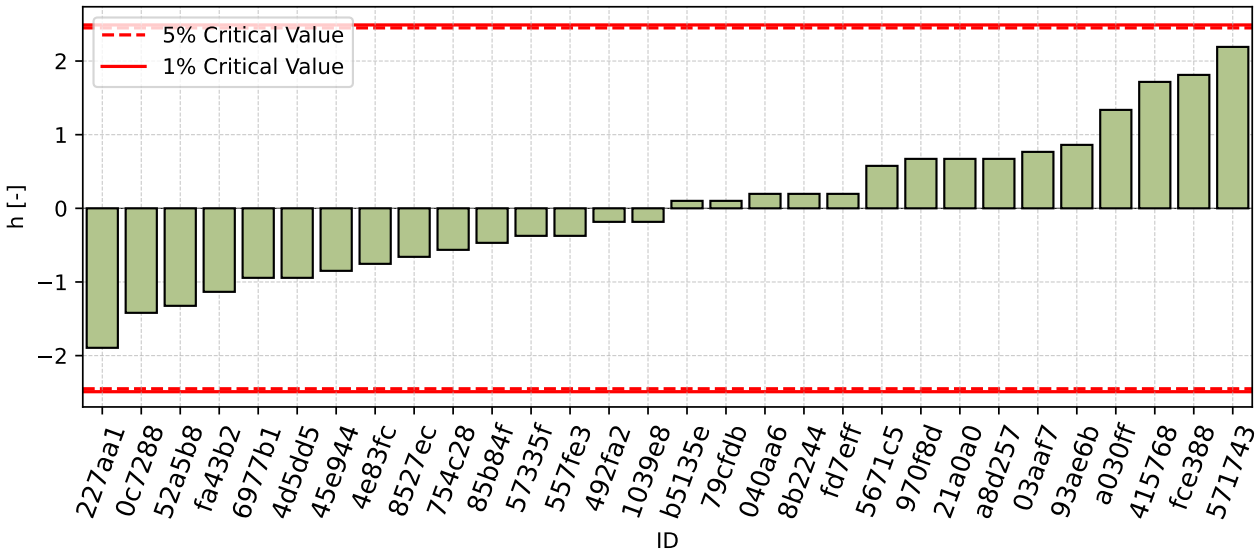

Figure 15: Interlaboratory Consistency Statistic

2.4 Descriptive statistics

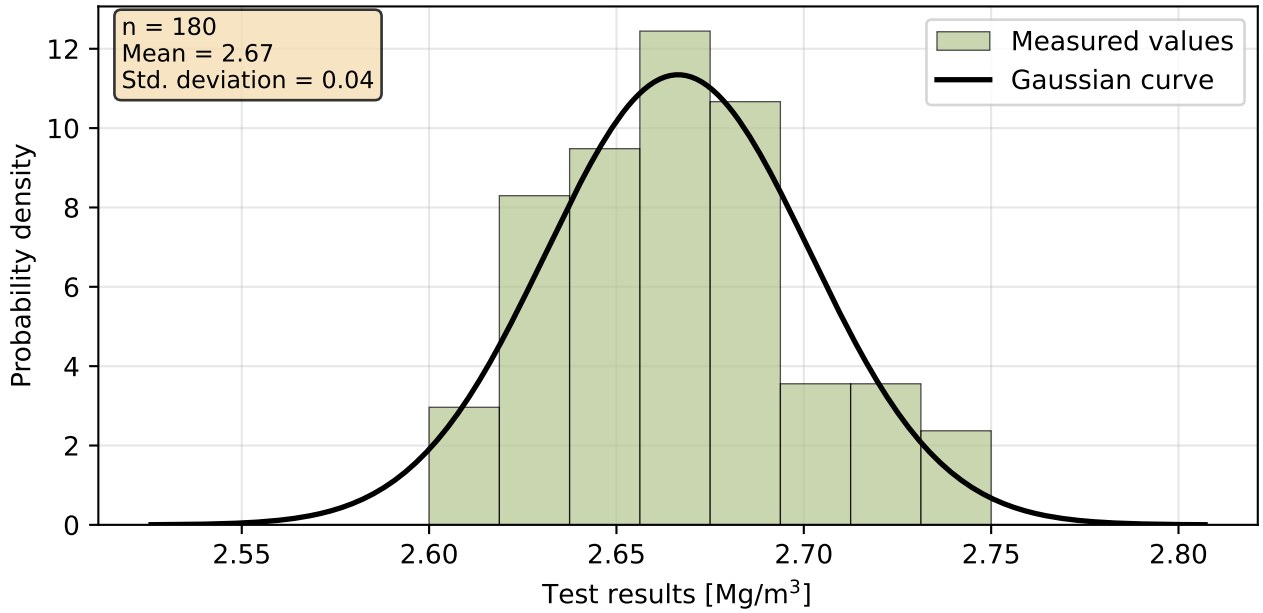

Figure 16: Histogram of all test results

Table 8: Descriptive statistics

Characteristics	**[Mg/m^3]**
Average value – $\bar{x}$	2.67
Sample standard deviation – s	0.035
Asigned value – x^*	2.67
Robust standard deviation – s^*	0.045
Measurement uncertainty of asigned value – u_X	0.008
p-value of normality test	0.067 [-]
Interlaboratory standard deviation – s_L	0.035
Repeatability standard deviation – s_r	0.008
Reproducibility standard deviation – s_R	0.036
Repeatability – r	0.02
Reproducibility – R	0.1

2.5 Evaluation of Performance Statistics

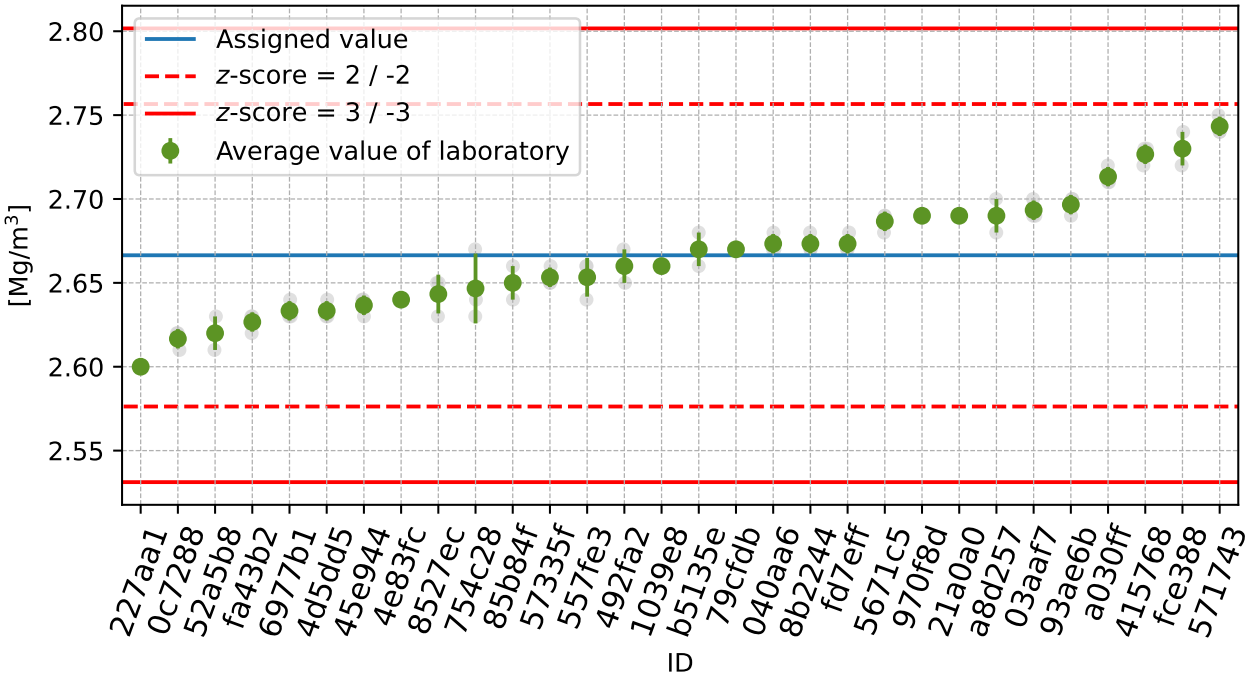

Figure 17: Average values and sample standard deviations

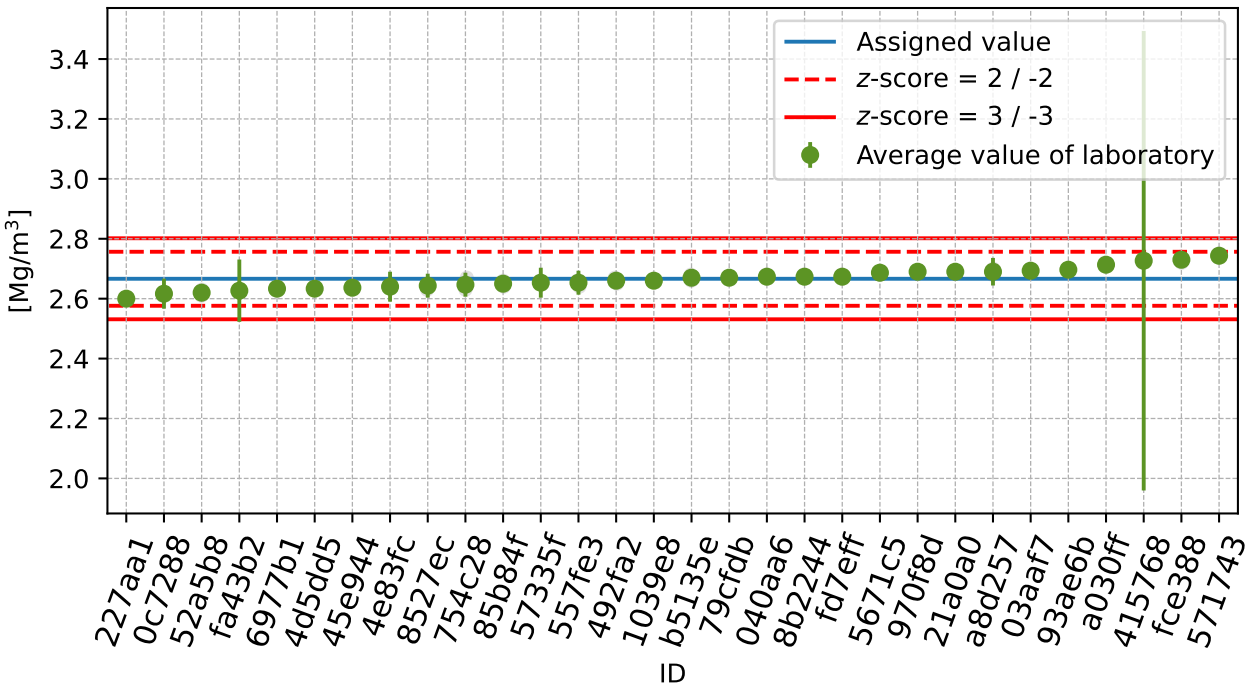

Figure 18: Average values and extended uncertainties of measurement

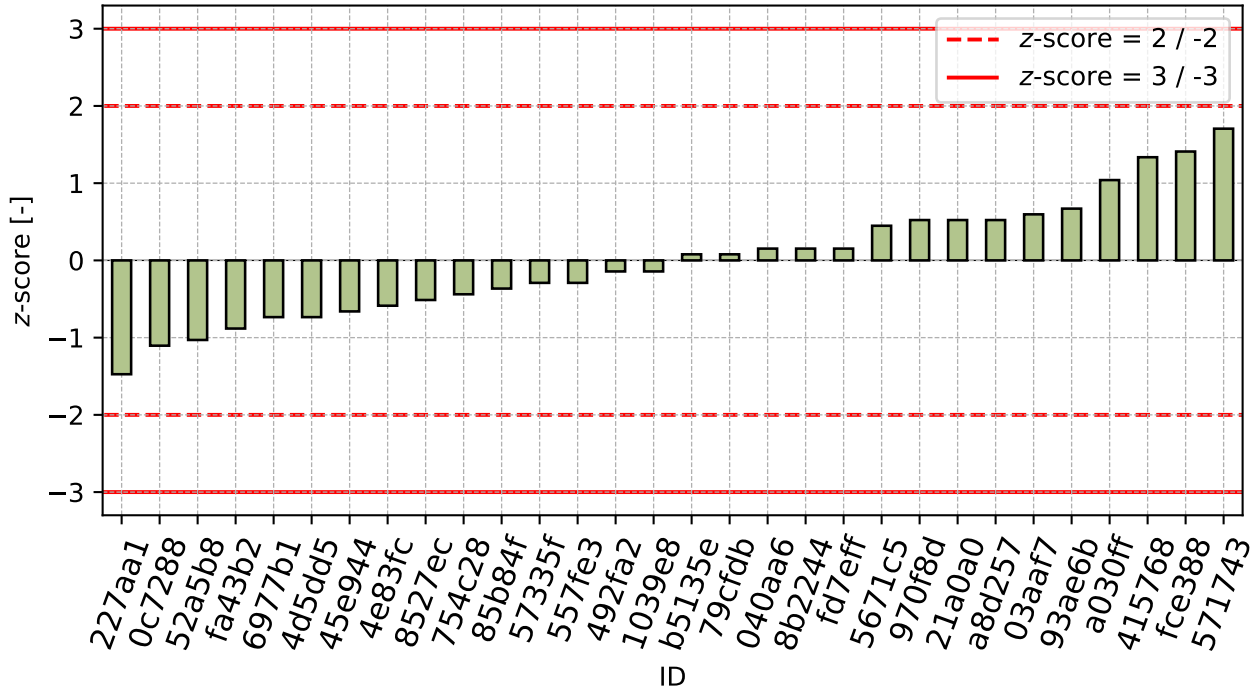

Figure 19: z-score

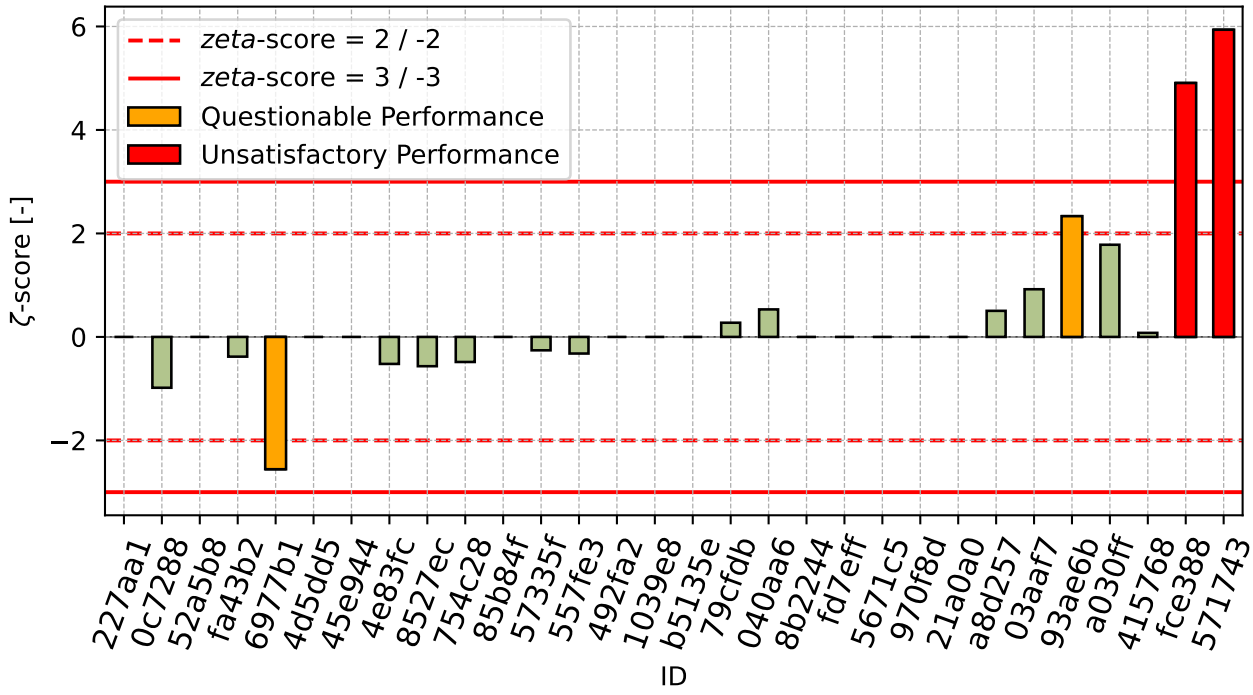

Figure 20: ζ-score

Table 9: z-score and ζ-score

ID	z-score [-]	ζ-score [-]
227aa1	-1.47	-
0c7288	-1.1	-0.98
52a5b8	-1.03	-
fa43b2	-0.88	-0.38
6977b1	-0.73	-2.56
4d5dd5	-0.73	-
45e944	-0.66	-
4e83fc	-0.59	-0.52
8527ec	-0.51	-0.57
754c28	-0.44	-0.48
85b84f	-0.36	-
57335f	-0.29	-0.26
557fe3	-0.29	-0.32
492fa2	-0.14	-
1039e8	-0.14	-
b5135e	0.08	-
79cfdb	0.08	0.27
040aa6	0.15	0.53
8b2244	0.15	-
fd7eff	0.15	-
5671c5	0.45	-
970f8d	0.52	-
21a0a0	0.52	-
a8d257	0.52	0.5
03aaf7	0.6	0.92
93ae6b	0.67	2.33
a030ff	1.04	1.78
415768	1.34	0.08
fce388	1.41	4.91
571743	1.71	5.94

3 Appendix – EN ISO 17892-4 – Particle size distribution, art. 5.2 (Sieving)

Table 10: Test results - sieve pass [%]; outlying values are marked in red

ID	8 mm	4 mm	2 mm	1 mm	0.50 mm	0.25 mm	0.125 mm	0.063 mm
03aaf7	100	95	87	61	35	11	2	0.6
040aa6	100	96	84	61	33	11	3	1.5
0c7288	-	-	87	-	-	-	-	2
1039e8	100	95	84	60	31	8	1	0.4
12ba1b	100	96	84	60	34	11	3	1.5
1413f1	100	95	83	62	34	11	3	1.6
21a0a0	100	95	82	59	31	8	1	0.6
227aa1	100	93	84	70	29	29	4	1
281c65	100	95	82	58	31	9	1	0.2
28b09e	100	96	84	60	29	7	1	0
3e1a74	100	95	82	59	32	10	3	1.8
415768	-	-	78	54	30	8	-	-
45e944	100	96	84	60	38	8	1	0.2
465bb7	100	96	84	61	34	11	3	1.2
4d5dd5	100	96	84	62	33	10	2	1.1
4e83fc	-	-	81	-	-	-	-	2
52a5b8	97	94	89	83	79	76	71	66.7
557fe3	100	96	84	61	33	13	4	2.2
5671c5	100	93	81	58	30	8	1	0.1
5685e9	100	95	82	59	28	5	0	0.1
57335f	-	-	85	-	-	-	-	2
57b55b	100	96	84	61	32	11	3	1.5
5880d9	100	95	81	57	30	8	2	0.9
61afff	100	94	84	58	30	9	2	1.2
666c8c	100	96	85	59	30	7	1	0
66c346	100	96	84	61	34	11	3	2
716bbc	100	96	84	60	33	10	2	-
754c28	100	96	85	62	34	11	3	1.3
777120	85	82	78	72	69	65	63	59.2
79cfdb	100	95	83	59	31	8	1	0.3
8527ec	-	-	85	-	-	-	-	2
85b84f	100	96	84	60	32	10	4	2.4
88de8c	100	95	82	59	32	10	2	1.2
8b2244	100	95	82	58	31	10	4	2.7
93ae6b	100	96	84	61	35	11	3	1.6
989943	99	96	83	60	32	5	-	-
a65624	100	100	99	98	96	95	94	90.1
a8d257	-	96	86	64	38	15	3	1.5
afb2e8	100	95	82	60	33	11	3	1.4
b3d1e7	100	94	82	59	32	11	3	1.6

Pokračování na další straně

Pokračování z předchozí strany

ID	8 mm	4 mm	2 mm	1 mm	0.50 mm	0.25 mm	0.125 mm	0.063 mm
b5135e	100	95	82	59	31	8	1	0.2
b66921	100	96	84	62	34	11	3	1.3
c6a8b7	100	96	85	63	38	17	9	8.3
d143aa	99	95	81	57	27	7	1	0
d27b5f	100	96	82	59	34	13	4	2.4
fa43b2	100	95	82	59	33	10	2	0.5
fb5cad	100	95	82	59	32	8	1	0.4
fd7eff	100	96	83	59	31	9	2	0.9

Table 12: Grubbs test results

Characteristic	8 mm	4 mm	2 mm	1 mm	0.50 mm	0.25 mm	0.125 mm	0.063 mm
G_{min}	0.203	0.050	0.131	0.047	0.049	0.006	0.067	0.124
G_{max}	6.180	5.674	5.093	5.051	4.621	4.418	4.413	4.618
$G_{0.05}$	3.057	3.067	3.112	3.076	3.076	3.076	3.057	3.085
$G_{0.01}$	3.404	3.415	3.464	3.425	3.425	3.425	3.404	3.435

Table 13: Grubbs test results - iteration 2 (after removal of outlying values)

Characteristic	8 mm	4 mm	2 mm	1 mm	0.50 mm	0.25 mm	0.125 mm	0.063 mm
G_{min}	0.239	0.395	0.137	0.041	0.025	0.002	0.112	0.109
G_{max}	5.647	4.212	2.836	4.862	4.829	4.691	4.611	4.786
$G_{0.05}$	3.047	3.057	3.103	3.067	3.067	3.067	3.047	3.076
$G_{0.01}$	3.392	3.404	3.455	3.415	3.415	3.415	3.392	3.425

Table 14: Grubbs test results - iteration 3 (after removal of outlying values)

Characteristic	8 mm	4 mm	2 mm	1 mm	0.50 mm	0.25 mm	0.125 mm	0.063 mm
G_{min}	0.227	0.387	0.137	0.095	0.027	0.057	0.005	0.003
G_{max}	4.304	2.827	2.836	3.896	5.813	5.781	6.091	6.334
$G_{0.05}$	3.036	3.047	3.103	3.057	3.057	3.057	3.036	3.067
$G_{0.01}$	3.381	3.392	3.455	3.404	3.404	3.404	3.381	3.415

Table 15: Grubbs test results - iteration 4 (after removal of outlying values)

Characteristic	8 mm	4 mm	2 mm	1 mm	0.50 mm	0.25 mm	0.125 mm	0.063 mm
G_{min}	0.160	0.387	0.137	0.000	0.119	0.058	0.284	0.020
G_{max}	6.085	2.827	2.836	4.170	2.318	4.936	4.275	5.205
$G_{0.05}$	3.025	3.047	3.103	3.047	3.047	3.047	3.025	3.057
$G_{0.01}$	3.369	3.392	3.455	3.392	3.392	3.392	3.369	3.404

Table 16: Grubbs test results - iteration 5 (after removal of outlying values)

Characteristic	8 mm	4 mm	2 mm	1 mm	0.50 mm	0.25 mm	0.125 mm	0.063 mm
G_{min}	-	0.387	0.137	0.138	0.119	0.106	0.238	0.057
G_{max}	-	2.827	2.836	3.180	2.318	3.070	2.044	2.002
$G_{0.05}$	3.014	3.047	3.103	3.036	3.047	3.036	3.014	3.047
$G_{0.01}$	3.356	3.392	3.455	3.381	3.392	3.381	3.356	3.392

Table 17: Grubbs test results - iteration 6 (after removal of outlying values)

Characteristic	8 mm	4 mm	2 mm	1 mm	0.50 mm	0.25 mm	0.125 mm	0.063 mm
G_{min}	-	0.387	0.137	0.065	0.119	0.210	0.238	0.057
G_{max}	-	2.827	2.836	2.614	2.318	2.620	2.044	2.002
$G_{0.05}$	3.014	3.047	3.103	3.025	3.047	3.025	3.014	3.047
$G_{0.01}$	3.356	3.392	3.455	3.369	3.392	3.369	3.356	3.392

Table 18: Z-score - values from non-outlying data; values > 2 are marked in orange, > 3 in red

ID	8 mm	4 mm	2 mm	1 mm	0.50 mm	0.25 mm	0.125 mm	0.063 mm
03aaf7	0.000	-0.387	1.845	0.703	1.100	0.692	-0.238	-0.721
040aa6	0.000	0.833	0.358	0.703	0.287	0.692	0.665	0.446
0c7288	-	-	1.845	-	-	-	-	1.094
1039e8	0.000	-0.387	0.358	0.065	-0.525	-0.754	-1.141	-0.981
12ba1b	0.000	0.833	0.358	0.065	0.693	0.692	0.665	0.446
1413f1	0.000	-0.387	-0.137	1.340	0.693	0.692	0.665	0.576
21a0a0	0.000	-0.387	-0.632	-0.572	-0.525	-0.754	-1.141	-0.721
227aa1	0.000	-2.827	0.358	X	-1.337	X	1.568	-0.202
281c65	0.000	-0.387	-0.632	-1.209	-0.525	-0.272	-1.141	-1.240
28b09e	0.000	0.833	0.358	0.065	-1.337	-1.236	-1.141	-1.499
3e1a74	0.000	-0.387	-0.632	-0.572	-0.119	0.210	0.665	0.835
415768	-	-	-2.614	X	-0.931	-0.754	-	-
45e944	0.000	0.833	0.358	0.065	2.318	-0.754	-1.141	-1.240
465bb7	0.000	0.833	0.358	0.703	0.693	0.692	0.665	0.057
4d5dd5	0.000	0.833	0.358	1.340	0.287	0.210	-0.238	-0.073
4e83fc	-	-	-1.128	-	-	-	-	1.094
52a5b8	X	-1.607	2.836	X	X	X	X	X
557fe3	0.000	0.833	0.358	0.703	0.287	1.656	1.568	1.354
5671c5	0.000	-2.827	-1.128	-1.209	-0.931	-0.754	-1.141	-1.370
5685e9	0.000	-0.387	-0.632	-0.572	-1.743	-2.200	-2.044	-1.370
57335f	-	-	0.854	-	-	-	-	1.094
57b55b	0.000	0.833	0.358	0.703	-0.119	0.692	0.665	0.446
5880d9	0.000	-0.387	-1.128	-1.846	-0.931	-0.754	-0.238	-0.332

Pokračování na další straně

Pokračování z předchozí strany

ID	8 mm	4 mm	2 mm	1 mm	0.50 mm	0.25 mm	0.125 mm	0.063 mm
61afff	0.000	-1.607	0.358	-1.209	-0.931	-0.272	-0.238	0.057
666c8c	0.000	0.833	0.854	-0.572	-0.931	-1.236	-1.141	-1.499
66c346	0.000	0.833	0.358	0.703	0.693	0.692	0.665	1.094
716bbc	0.000	0.833	0.358	0.065	0.287	0.210	-0.238	-
754c28	0.000	0.833	0.854	1.340	0.693	0.692	0.665	0.187
777120	X	X	-2.614	X	X	X	X	X
79cfdb	0.000	-0.387	-0.137	-0.572	-0.525	-0.754	-1.141	-1.110
8527ec	-	-	0.854	-	-	-	-	1.094
85b84f	0.000	0.833	0.358	0.065	-0.119	0.210	1.568	1.613
88de8c	0.000	-0.387	-0.632	-0.572	-0.119	0.210	-0.238	0.057
8b2244	0.000	-0.387	-0.632	-1.209	-0.525	0.210	1.568	2.002
93ae6b	0.000	0.833	0.358	0.703	1.100	0.692	0.665	0.576
989943	X	0.833	-0.137	0.065	-0.119	-2.200	-	-
a65624	0.000	X	X	X	X	X	X	X
a8d257	-	0.833	1.349	2.614	2.318	2.620	0.665	0.446
afb2e8	0.000	-0.387	-0.632	0.065	0.287	0.692	0.665	0.316
b3d1e7	0.000	-1.607	-0.632	-0.572	-0.119	0.692	0.665	0.576
b5135e	0.000	-0.387	-0.632	-0.572	-0.525	-0.754	-1.141	-1.240
b66921	0.000	0.833	0.358	1.340	0.693	0.692	0.665	0.187
c6a8b7	0.000	0.833	0.854	1.977	2.318	X	X	X
d143aa	X	-0.387	-1.128	-1.846	-2.150	-1.236	-1.141	-1.499
d27b5f	0.000	0.833	-0.632	-0.572	0.693	1.656	1.568	1.613
fa43b2	0.000	-0.387	-0.632	-0.572	0.287	0.210	-0.238	-0.851
fb5cad	0.000	-0.387	-0.632	-0.572	-0.119	-0.754	-1.141	-0.981
fd7eff	0.000	0.833	-0.137	-0.572	-0.525	-0.272	-0.238	-0.332

4 Appendix – EN ISO 17892-4 – Particle size distributionn, art. 5.3 (Densimetric analysis)

Table 20: Test results - sieve pass [%]; outlying values are marked in red

ID	0.050 mm	0.020 mm	0.010 mm	0.005 mm	0.002 mm
03aaf7	84	55	37	26	18
0c7288	94	48	39	32	24
1039e8	84	51	36	28	22
12ba1b	96	62	40	28	18
21a0a0	82	55	38	38	22
24fb24	90	85	70	50	27
250d39	85	51	32	19	7
45e944	80	54	39	27	22
465bb7	8	25	22	13	14
492fa2	80	53	38	27	21
4e83fc	84	54	39	27	17
52a5b8	84	56	39	30	21
557fe3	85	58	38	28	18
5671c5	88	61	38	26	16
5685e9	84	57	39	29	18
5880d9	84	56	38	28	22
61afff	85	54	38	28	21
66c346	100	70	49	37	29
6977b1	76	57	40	31	24
6fb891	76	56	34	19	7
754c28	82	56	40	29	21
79cfdb	88	58	37	26	17
8527ec	83	54	39	27	20
85b84f	84	52	36	26	16
88de8c	94	62	43	30	19
93ae6b	82	50	38	27	23
a65624	91	79	39	22	12
a8d257	64	47	35	25	13
afb2e8	86	72	64	46	29
b3d1e7	81	62	47	33	23
b5135e	84	52	36	27	21
d27b5f	92	64	54	33	26
e01a62	-	62	-	21	15
fa43b2	73	50	32	21	11
fd7eff	69	48	32	27	24

Table 22: Grubbs test results

Characteristic	0.050 mm	0.020 mm	0.010 mm	0.005 mm	0.002 mm
G_{min}	0.012	0.026	0.017	0.045	0.069
G_{max}	4.953	3.176	3.472	3.138	2.304
$G_{0.05}$	2.965	2.978	2.965	2.978	2.978
$G_{0.01}$	3.301	3.316	3.301	3.316	3.316

Table 23: Grubbs test results - iteration 2 (after removal of outlying values)

Characteristic	0.050 mm	0.020 mm	0.010 mm	0.005 mm	0.002 mm
G_{min}	0.008	0.038	0.009	0.055	0.069
G_{max}	2.740	3.231	3.599	3.118	2.304
$G_{0.05}$	2.952	2.965	2.952	2.965	2.978
$G_{0.01}$	3.286	3.301	3.286	3.301	3.316

Table 24: Grubbs test results - iteration 3 (after removal of outlying values)

Characteristic	0.050 mm	0.020 mm	0.010 mm	0.005 mm	0.002 mm
G_{min}	0.008	0.021	0.029	0.024	0.069
G_{max}	2.740	3.142	2.991	2.836	2.304
$G_{0.05}$	2.952	2.952	2.938	2.952	2.978
$G_{0.01}$	3.286	3.286	3.270	3.286	3.316

Table 25: Grubbs test results - iteration 4 (after removal of outlying values)

Characteristic	0.050 mm	0.020 mm	0.010 mm	0.005 mm	0.002 mm
G_{min}	0.008	0.026	0.070	0.024	0.069
G_{max}	2.740	2.679	3.331	2.836	2.304
$G_{0.05}$	2.952	2.938	2.924	2.952	2.978
$G_{0.01}$	3.286	3.270	3.253	3.286	3.316

Table 26: Grubbs test results - iteration 5 (after removal of outlying values)

Characteristic	0.050 mm	0.020 mm	0.010 mm	0.005 mm	0.002 mm
G_{min}	0.008	0.026	0.045	0.024	0.069
G_{max}	2.740	2.679	2.946	2.836	2.304
$G_{0.05}$	2.952	2.938	2.908	2.952	2.978
$G_{0.01}$	3.286	3.270	3.236	3.286	3.316

Table 27: Grubbs test results - iteration 6 (after removal of outlying values)

Characteristic	0.050 mm	0.020 mm	0.010 mm	0.005 mm	0.002 mm
G_{min}	0.008	0.026	0.067	0.024	0.069
G_{max}	2.740	2.679	2.961	2.836	2.304
$G_{0.05}$	2.952	2.938	2.893	2.952	2.978
$G_{0.01}$	3.286	3.270	3.218	3.286	3.316

Table 28: Grubbs test results - iteration 7 (after removal of outlying values)

Characteristic	0.050 mm	0.020 mm	0.010 mm	0.005 mm	0.002 mm
G_{min}	0.008	0.026	0.178	0.024	0.069
G_{max}	2.740	2.679	2.127	2.836	2.304
$G_{0.05}$	2.952	2.938	2.876	2.952	2.978
$G_{0.01}$	3.286	3.270	3.199	3.286	3.316

Table 29: Z-score - values from non-outlying data; values > 2 are marked in orange, > 3 in red

ID	0.050 mm	0.020 mm	0.010 mm	0.005 mm	0.002 mm
03aaf7	-0.008	-0.196	-0.178	-0.225	-0.255
0c7288	1.357	-1.379	0.590	0.980	0.862
1039e8	-0.008	-0.872	-0.563	0.176	0.490
12ba1b	1.630	0.988	0.974	0.176	-0.255
21a0a0	-0.281	-0.196	0.206	2.185	0.490
24fb24	0.811	X	X	X	1.421
250d39	0.128	-0.872	-2.099	-1.631	-2.304
45e944	-0.555	-0.365	0.590	-0.024	0.490
465bb7	X	X	X	-2.836	-1.000
492fa2	-0.555	-0.534	0.206	-0.024	0.303
4e83fc	-0.008	-0.365	0.590	-0.024	-0.442
52a5b8	-0.008	-0.026	0.590	0.578	0.303
557fe3	0.128	0.312	0.206	0.176	-0.255
5671c5	0.538	0.819	0.206	-0.225	-0.628
5685e9	-0.008	0.143	0.590	0.377	-0.255
5880d9	-0.008	-0.026	0.206	0.176	0.490
61afff	0.128	-0.365	0.206	0.176	0.303
66c346	2.177	2.341	X	1.984	1.793
6977b1	-1.101	0.143	0.974	0.779	0.862
6fb891	-1.101	-0.026	-1.331	-1.631	-2.304
754c28	-0.281	-0.026	0.974	0.377	0.303
79cfdb	0.538	0.312	-0.178	-0.225	-0.442
8527ec	-0.145	-0.365	0.590	-0.024	0.117

Pokračování na další straně

Pokračování z předchozí strany

ID	0.050 mm	0.020 mm	0.010 mm	0.005 mm	0.002 mm
85b84f	-0.008	-0.703	-0.563	-0.225	-0.628
88de8c	1.357	0.988	2.127	0.578	-0.069
93ae6b	-0.281	-1.041	0.206	-0.024	0.676
a65624	0.948	X	0.590	-1.028	-1.373
a8d257	-2.740	-1.548	-0.947	-0.426	-1.187
afb2e8	0.265	2.679	X	X	1.793
b3d1e7	-0.418	0.988	X	1.181	0.676
b5135e	-0.008	-0.703	-0.563	-0.024	0.303
d27b5f	1.084	1.326	X	1.181	1.235
e01a62	-	0.988	-	-1.229	-0.814
fa43b2	-1.510	-1.041	-2.099	-1.229	-1.559
fd7eff	-2.057	-1.379	-2.099	-0.024	0.862

5 Appendix – EN ISO 17892-5 – Incremental loading oedometer test

5.1 50 – 100 kPa

5.1.1 Test results

Table 31: Test results - ordered by average value. Outliers are marked by red color. u_X - extended uncertainty of measurement.

ID	Test results [MPa]	u_X [MPa]
754c28	0.59	0.100
557fe3	4.30	1.100
79cfdb	5.10	0.400
d9e3e1	5.46	0.470
45e944	5.59	-
281c65	5.59	-
85b84f	5.94	-
a030ff	6.70	-
655e79	6.89	-
5fd06d	7.00	1.200
4e83fc	7.14	-
1039e8	7.55	-
f39782	7.60	-
fd7eff	8.19	-
52a5b8	8.26	-
a8d257	8.27	0.330
970f8d	9.50	-
57335f	10.10	0.500
b5135e	11.01	-
21a0a0	11.03	-
5671c5	11.87	-
0c7288	12.82	2.630
8527ec	13.00	0.200
03aaf7	14.90	2.900

5.1.2 The Numerical Procedure for Determining Outliers

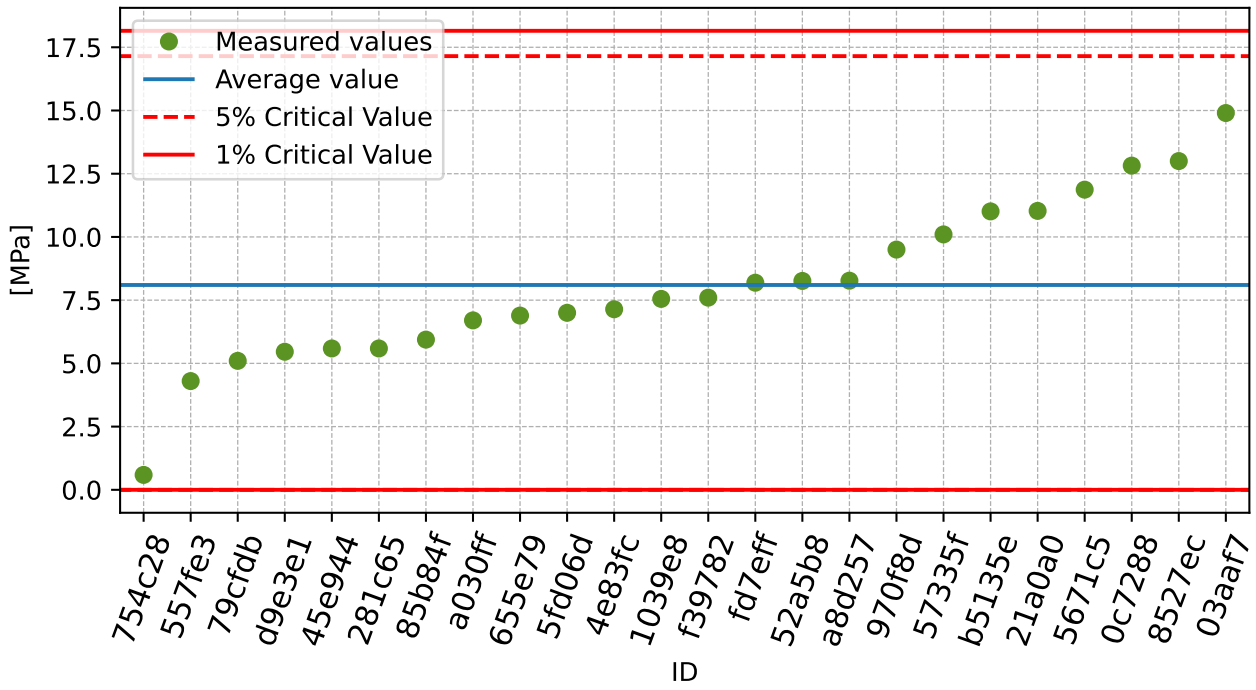

Figure 21: **Grubbs' test** - average values

5.1.3 Mandel's Statistics

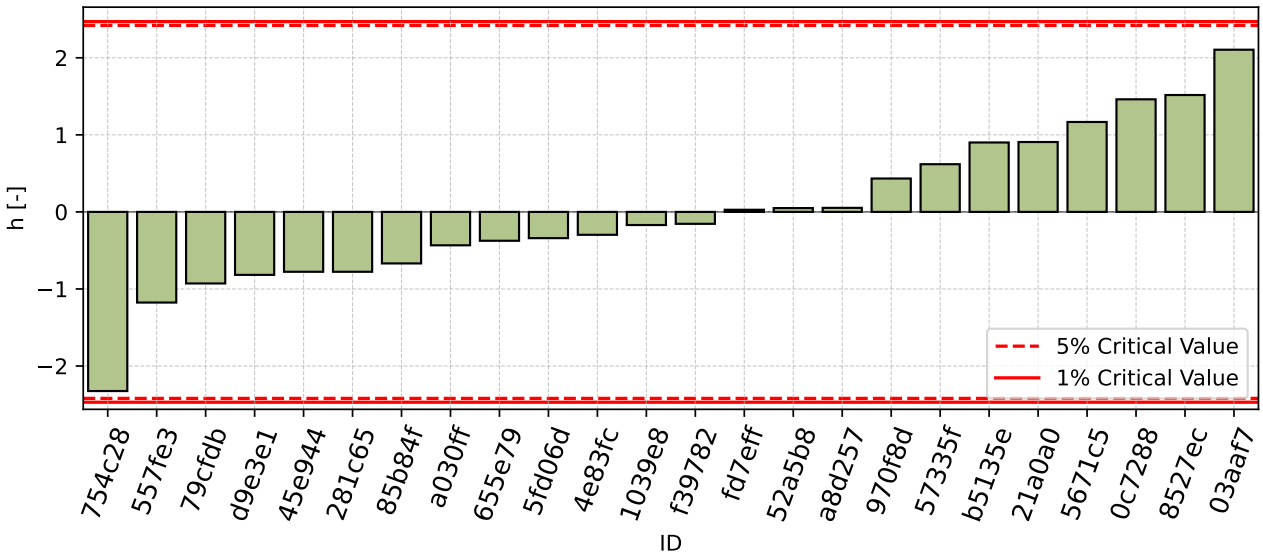

Figure 22: Interlaboratory Consistency Statistic

5.1.4 Descriptive statistics

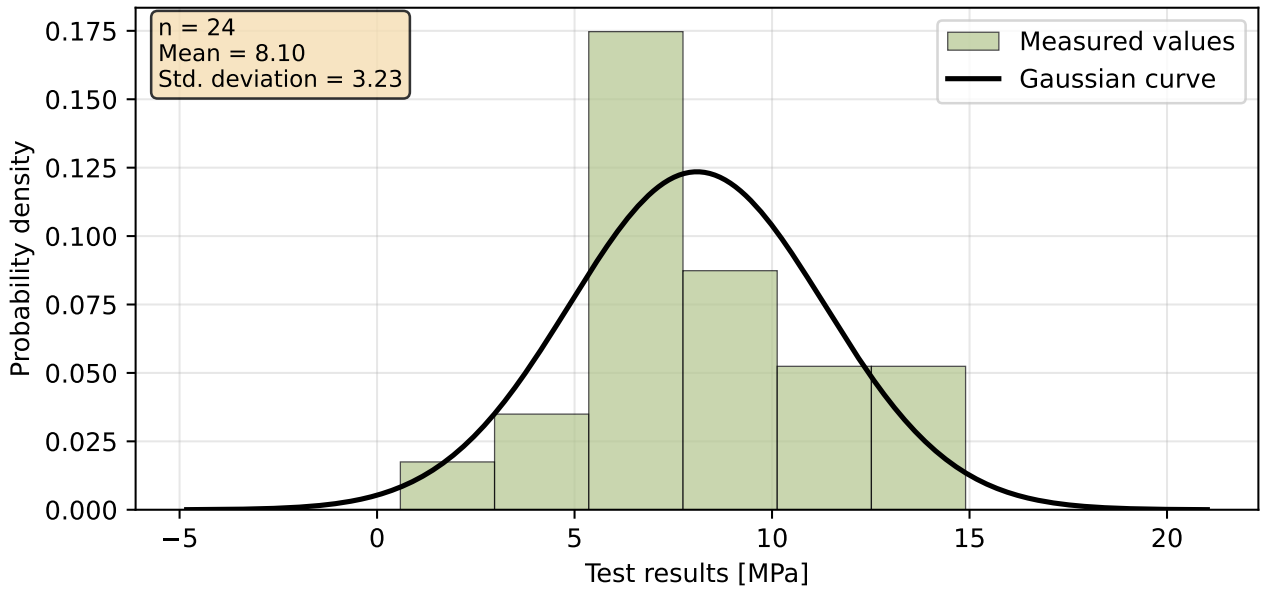

Figure 23: Histogram of all test results

Table 32: Descriptive statistics

Characteristics	[MPa]
Average value – $\bar{x}$	8.1
Sample standard deviation – s	3.23
Asigned value – x^*	8.1
Robust standard deviation – s^*	3.23
Measurement uncertainty of asigned value – u_X	0.659
p-value of normality test	0.724 [-]

5.1.5 Evaluation of Performance Statistics

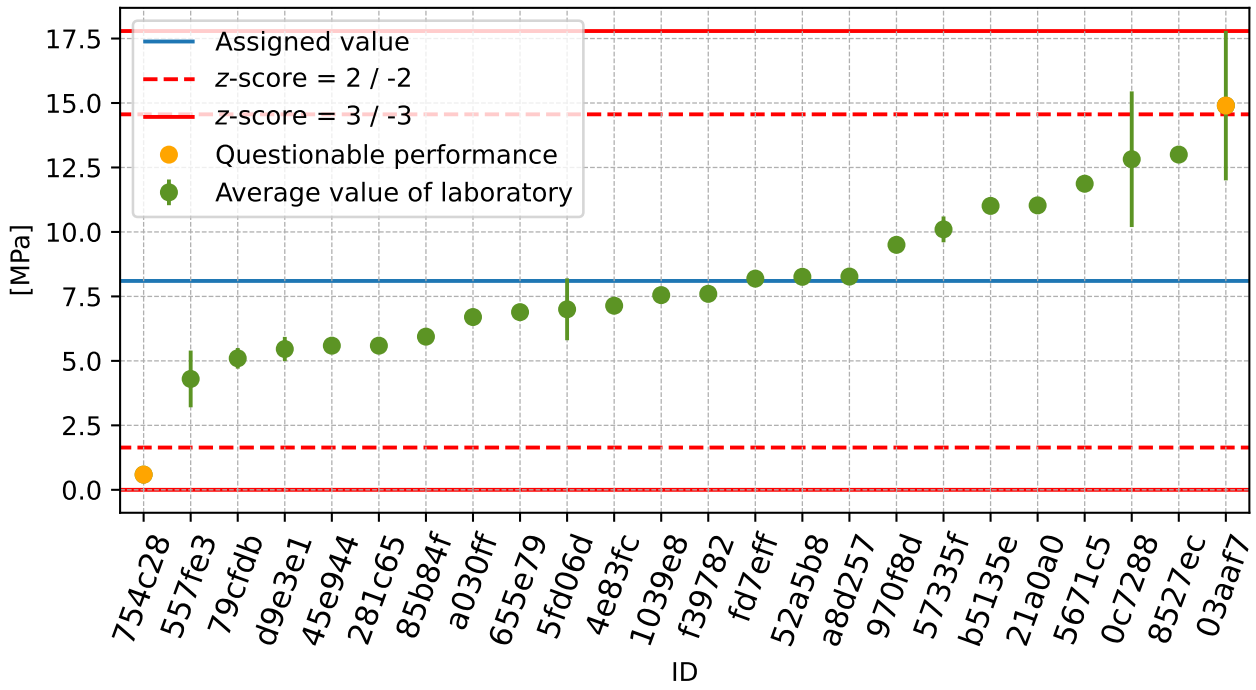

Figure 24: Average values and extended uncertainties of measurement

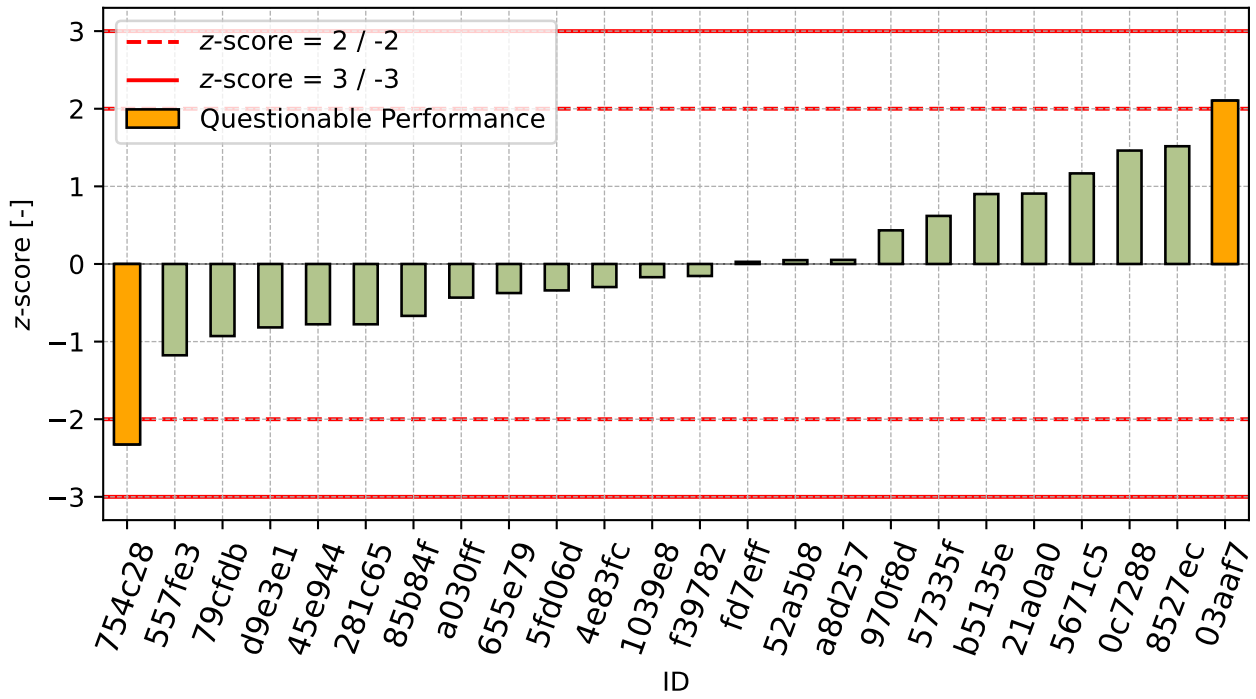

Figure 25: z-score

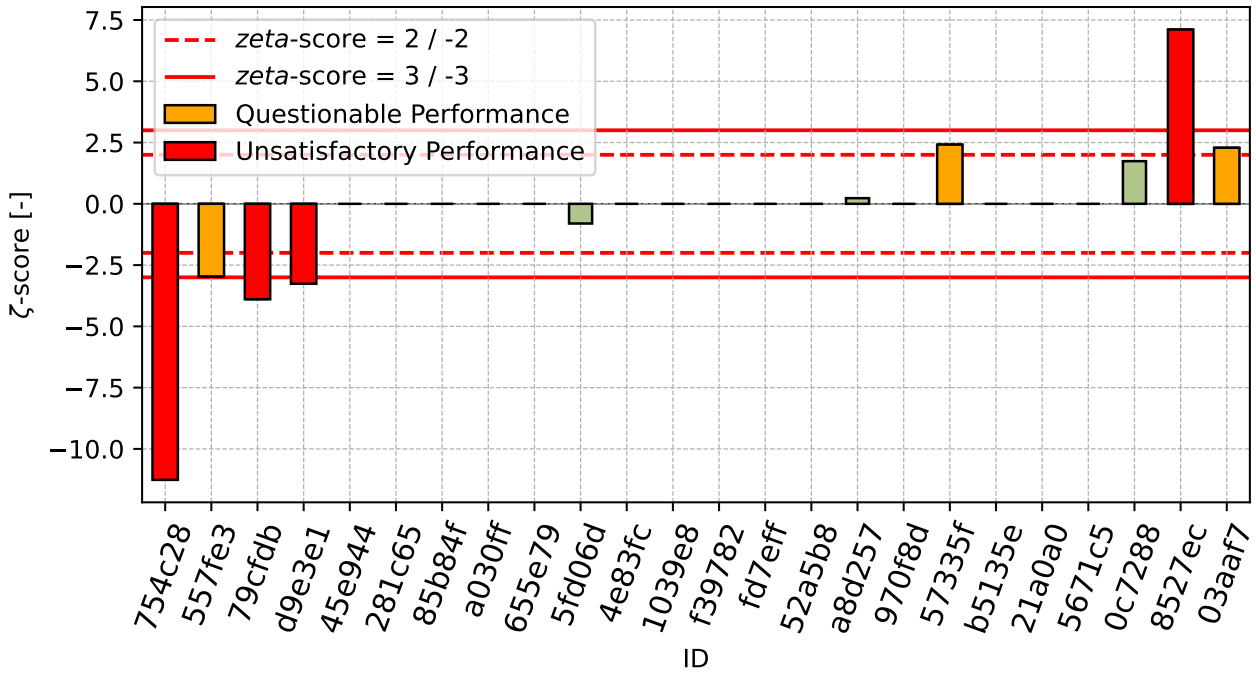

Figure 26: ζ-score

Table 33: z-score and ζ-score

ID	z-score [-]	ζ-score [-]
754c28	-2.32	-11.26
557fe3	-1.18	-2.96
79cfdb	-0.93	-3.89
d9e3e1	-0.82	-3.26
45e944	-0.78	-
281c65	-0.78	-
85b84f	-0.67	-
a030ff	-0.43	-
655e79	-0.37	-
5fd06d	-0.34	-0.8
4e83fc	-0.3	-
1039e8	-0.17	-
f39782	-0.15	-
fd7eff	0.03	-
52a5b8	0.05	-
a8d257	0.05	0.23
970f8d	0.43	-
57335f	0.62	2.42
b5135e	0.9	-
21a0a0	0.91	-
5671c5	1.17	-
0c7288	1.46	1.74

Continued on next page

Continued from previous page

ID	z-score [-]	ζ-score [-]
8527ec	1.52	7.11
03aaf7	2.11	2.29

5.2 100 – 200 kPa

5.2.1 Test results

Table 34: Test results - ordered by average value. Outliers are marked by red color. u_X - extended uncertainty of measurement.

ID	Test results [MPa]	u_X [MPa]
557fe3	5.00	0.500
45e944	5.70	-
79cfdb	6.30	0.300
754c28	7.81	1.000
a8d257	7.84	0.520
4e83fc	8.33	-
85b84f	8.44	-
281c65	8.82	-
1039e8	9.14	-
d9e3e1	9.30	0.430
a030ff	9.60	-
52a5b8	9.84	-
5fd06d	10.00	0.500
f39782	10.10	-
57335f	11.24	0.560
655e79	11.24	-
970f8d	11.40	-
8527ec	11.70	0.200
b5135e	12.26	-
5671c5	12.63	-
0c7288	13.33	2.730
03aaf7	13.40	1.200
fd7eff	14.05	-
21a0a0	16.48	-

5.2.2 The Numerical Procedure for Determining Outliers

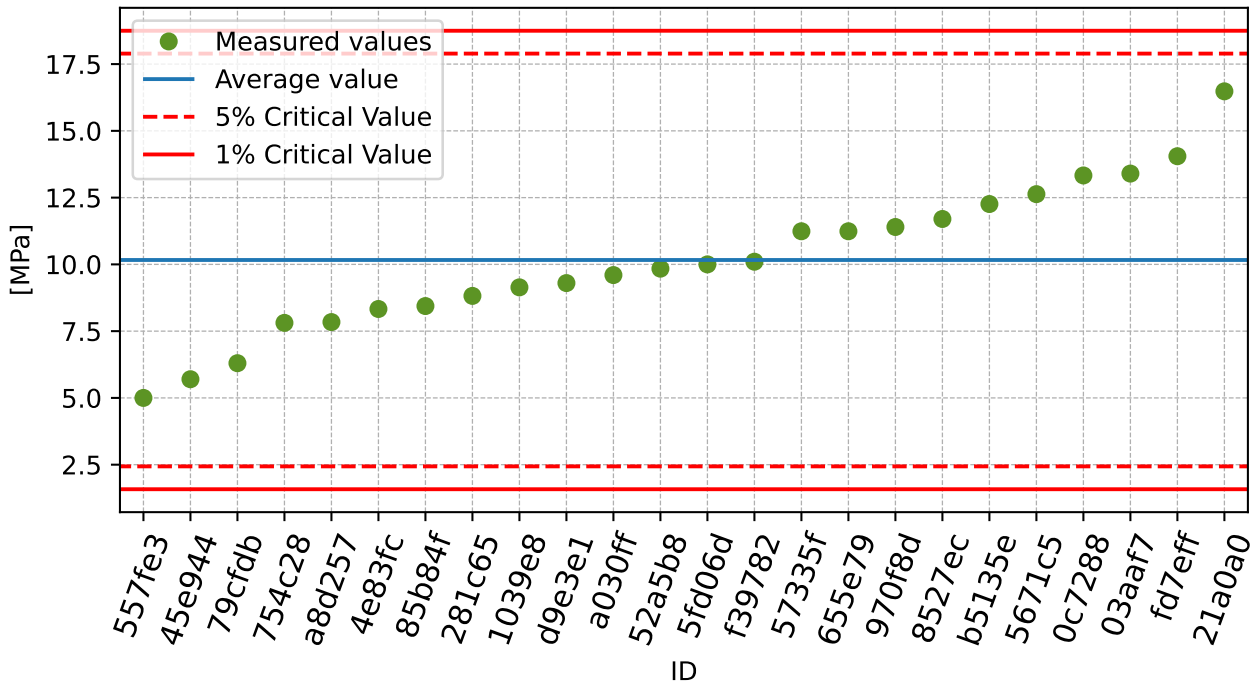

Figure 27: **Grubbs' test** - average values

5.2.3 Mandel's Statistics

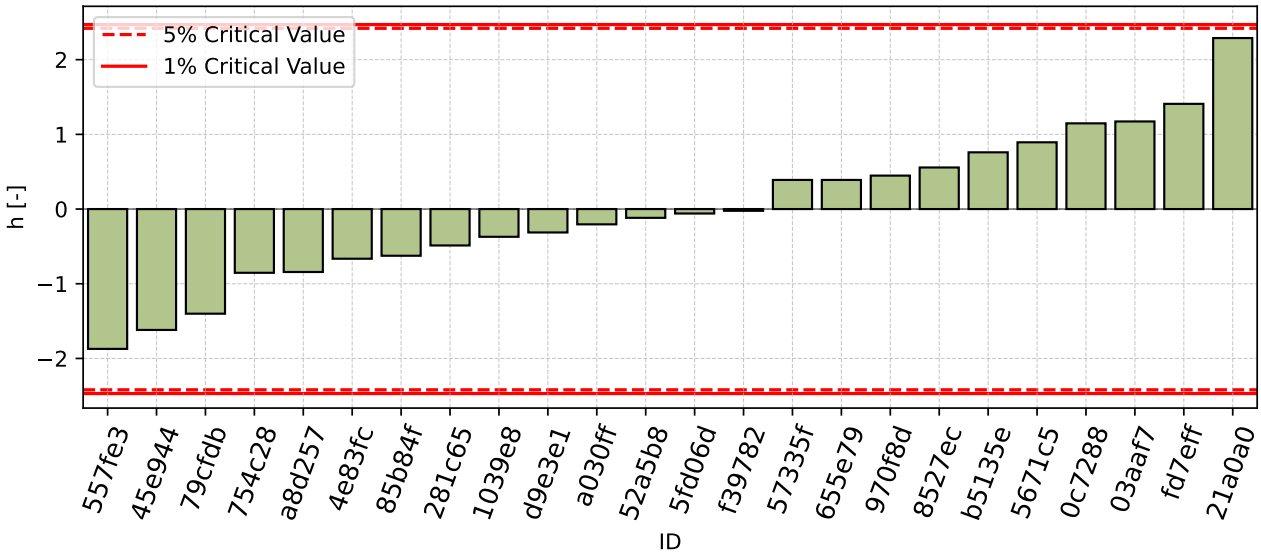

Figure 28: Interlaboratory Consistency Statistic

5.2.4 Descriptive statistics

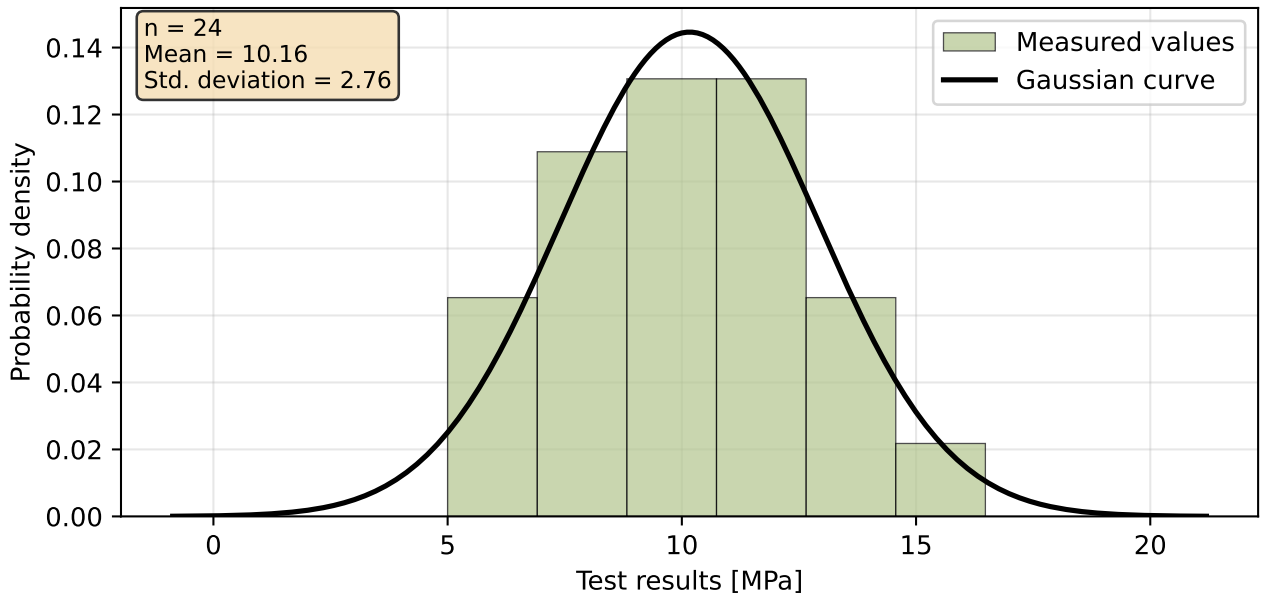

Figure 29: Histogram of all test results

Table 35: Descriptive statistics

Characteristics	**[MPa]**
Average value – $\bar{x}$	10.16
Sample standard deviation – s	2.759
Asigned value – x^*	10.16
Robust standard deviation – s^*	2.759
Measurement uncertainty of asigned value – u_X	0.563
p-value of normality test	0.989 [-]

5.2.5 Evaluation of Performance Statistics

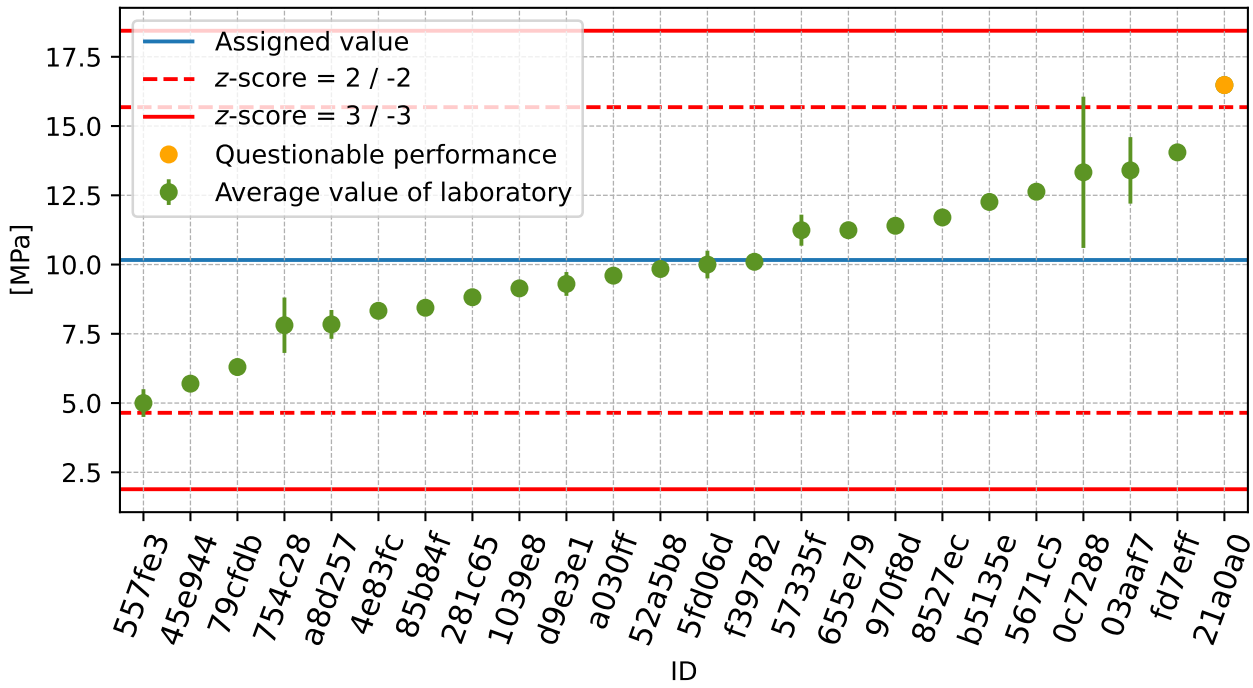

Figure 30: Average values and extended uncertainties of measurement

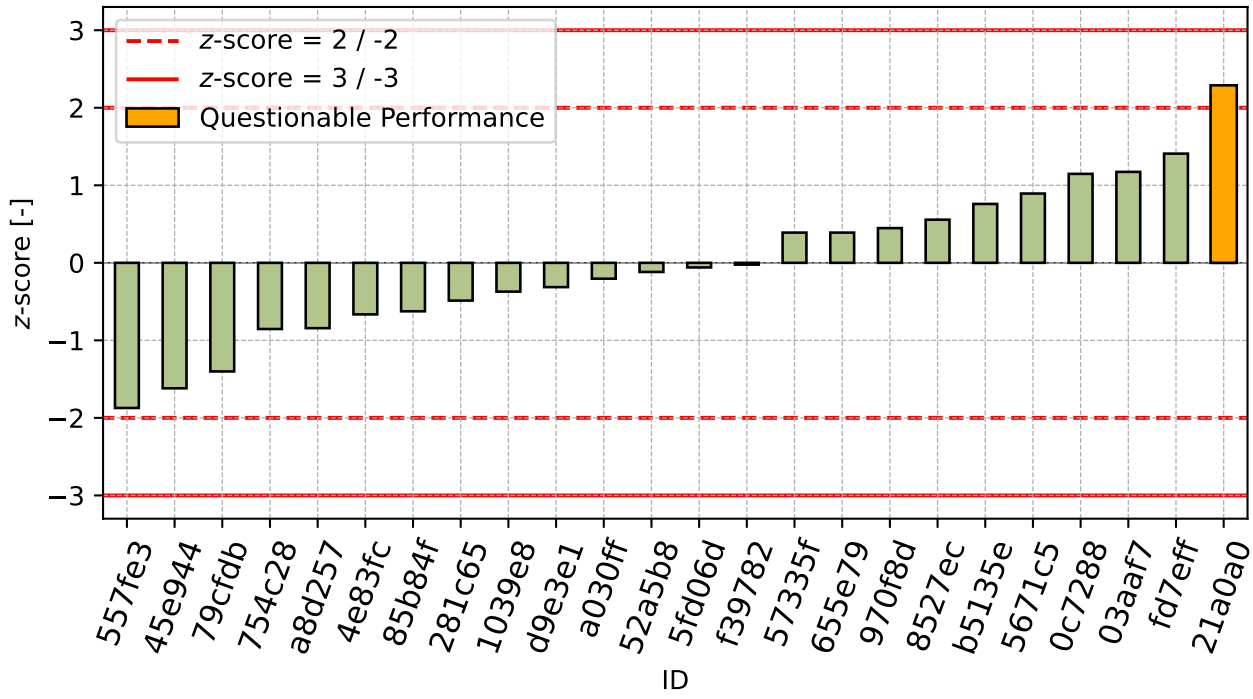

Figure 31: z-score

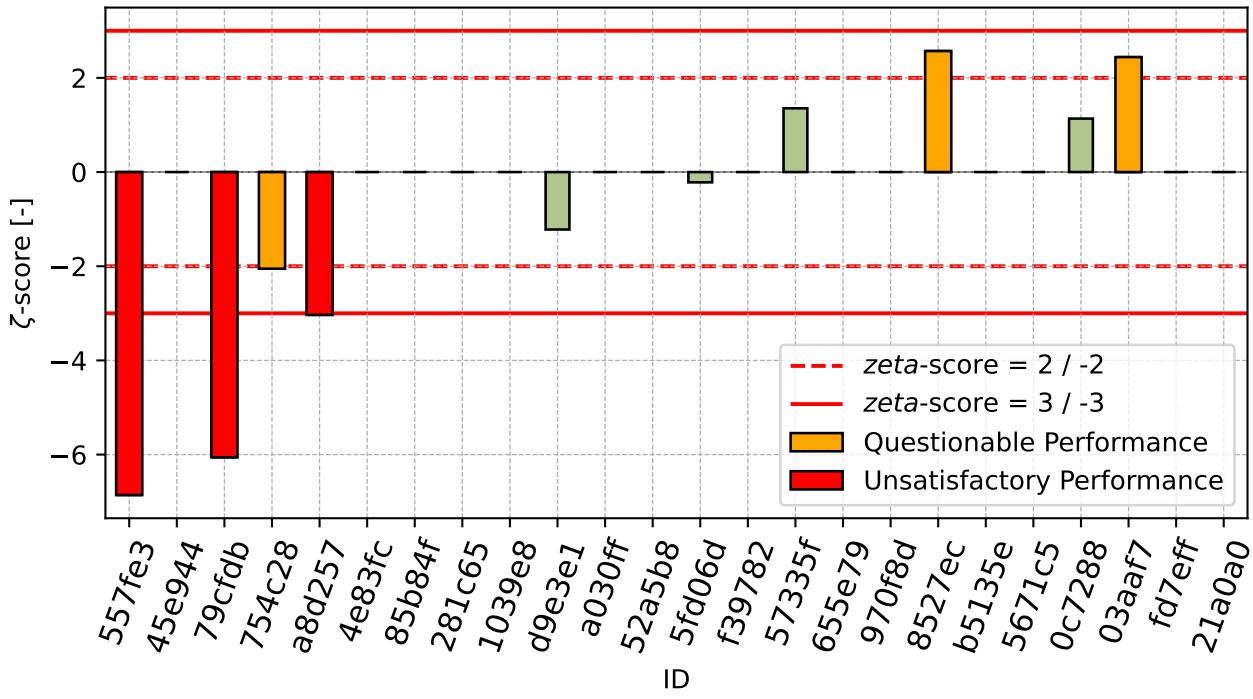

Figure 32: ζ-score

Table 36: z-score and ζ-score

ID	z-score [-]	ζ-score [-]
557fe3	-1.87	-6.86
45e944	-1.62	-
79cfdb	-1.4	-6.06
754c28	-0.85	-2.05
a8d257	-0.84	-3.03
4e83fc	-0.67	-
85b84f	-0.63	-
281c65	-0.49	-
1039e8	-0.37	-
d9e3e1	-0.31	-1.22
a030ff	-0.2	-
52a5b8	-0.12	-
5fd06d	-0.06	-0.22
f39782	-0.02	-
57335f	0.39	1.35
655e79	0.39	-
970f8d	0.45	-
8527ec	0.56	2.57
b5135e	0.76	-
5671c5	0.89	-
0c7288	1.15	1.14
03aaf7	1.17	2.44

Continued on next page

Continued from previous page

ID	z-score [-]	ζ-score [-]
fd7eff	1.41	-
21a0a0	2.29	-

5.3 200 – 400 kPa

5.3.1 Test results

Table 37: Test results - ordered by average value. Outliers are marked by red color. u_X - extended uncertainty of measurement.

ID	Test results [MPa]	u_X [MPa]
557fe3	7.90	0.800
79cfdb	8.70	0.300
45e944	10.67	-
85b84f	10.71	-
281c65	10.76	-
a8d257	11.91	0.530
4e83fc	12.50	-
8527ec	13.30	0.200
754c28	13.42	1.000
a030ff	13.60	-
1039e8	13.89	-
f39782	14.20	-
655e79	14.87	-
5fd06d	15.00	0.500
b5135e	15.35	-
52a5b8	15.59	-
d9e3e1	15.87	0.590
0c7288	16.13	3.310
970f8d	16.50	-
5671c5	17.07	-
03aaf7	20.40	1.500
57335f	21.28	1.060
fd7eff	22.36	-
21a0a0	23.12	-

5.3.2 The Numerical Procedure for Determining Outliers

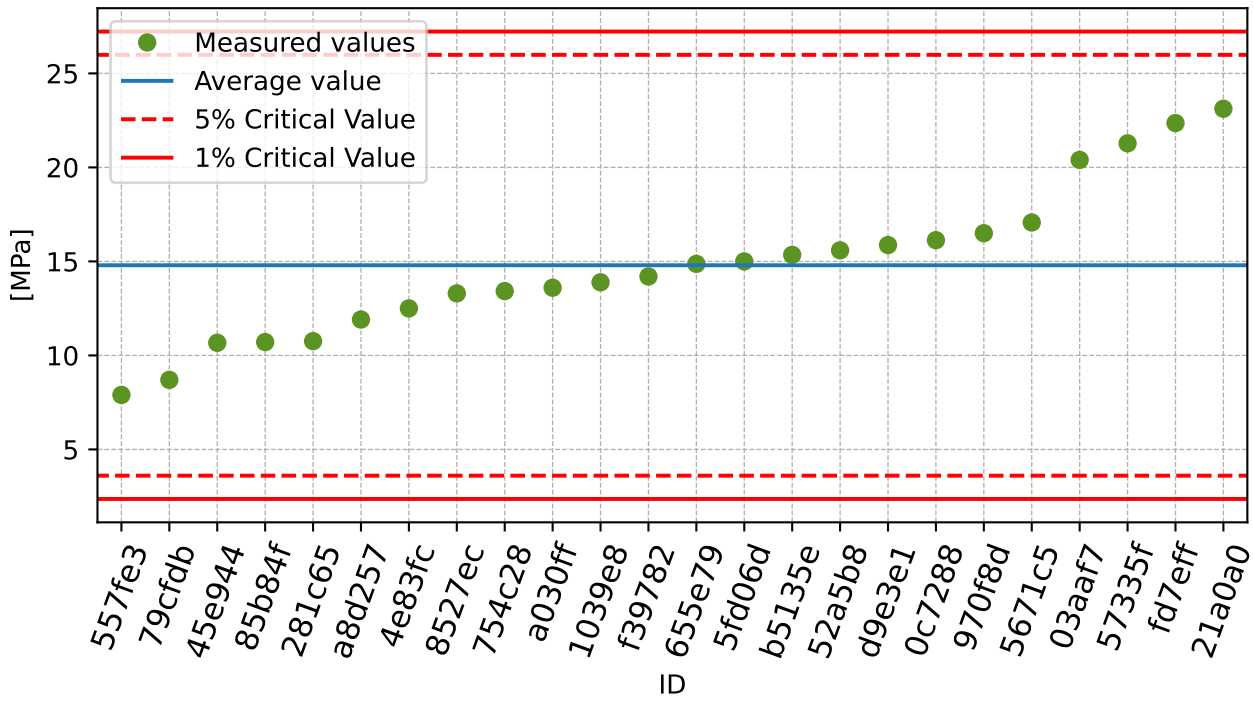

Figure 33: **Grubbs' test** - average values

5.3.3 Mandel's Statistics

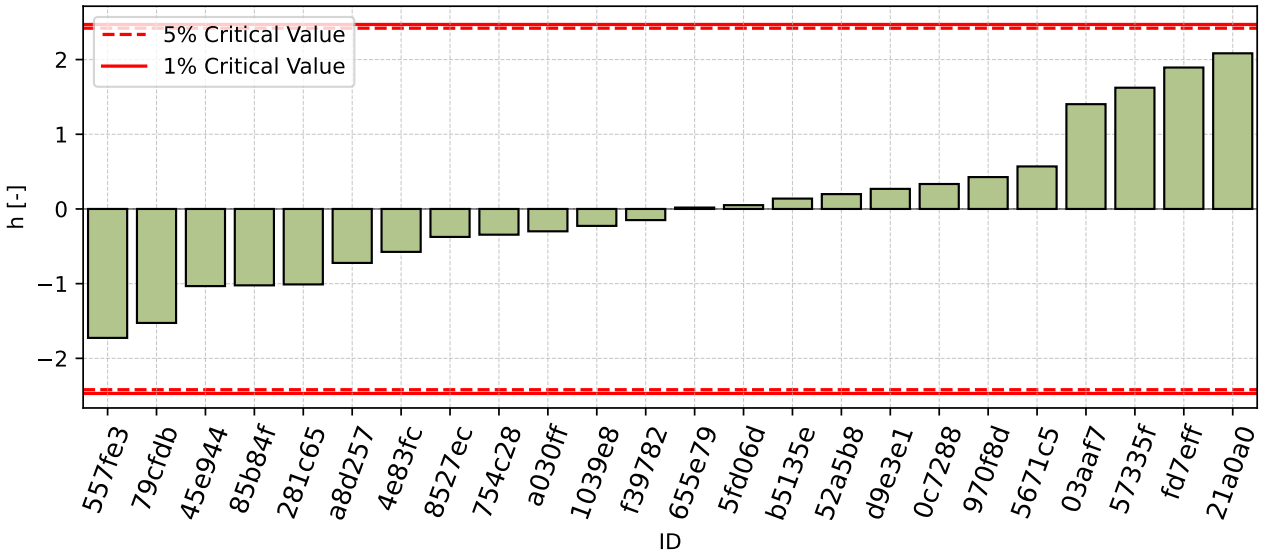

Figure 34: Interlaboratory Consistency Statistic

5.3.4 Descriptive statistics

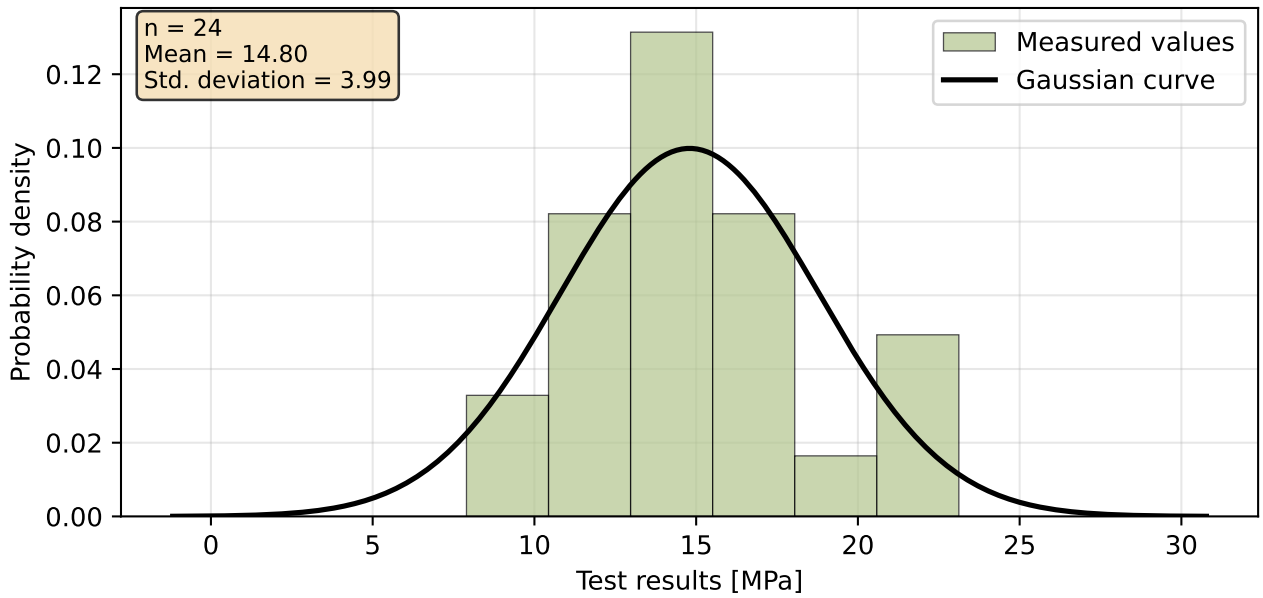

Figure 35: Histogram of all test results

Table 38: Descriptive statistics

Characteristics	**[MPa]**
Average value – $\bar{x}$	14.8
Sample standard deviation – s	3.995
Asigned value – x^*	14.8
Robust standard deviation – s^*	3.995
Measurement uncertainty of asigned value – u_X	0.815
p-value of normality test	0.334 [-]

5.3.5 Evaluation of Performance Statistics

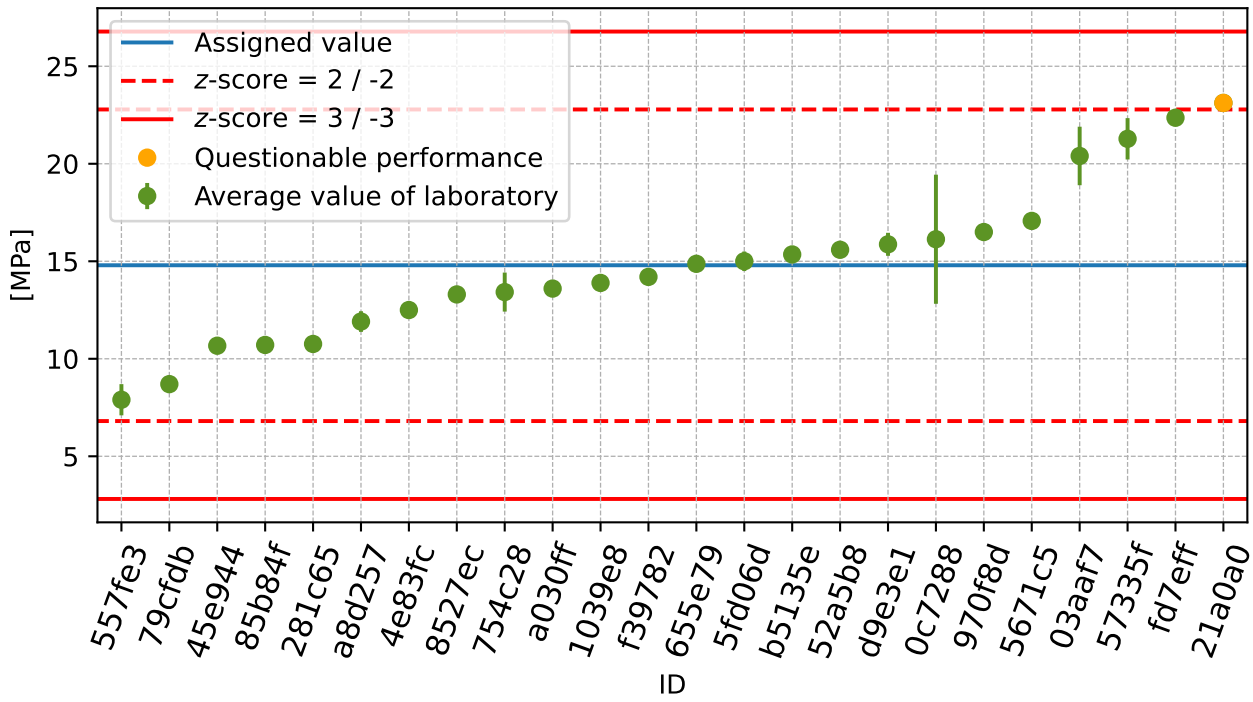

Figure 36: Average values and extended uncertainties of measurement

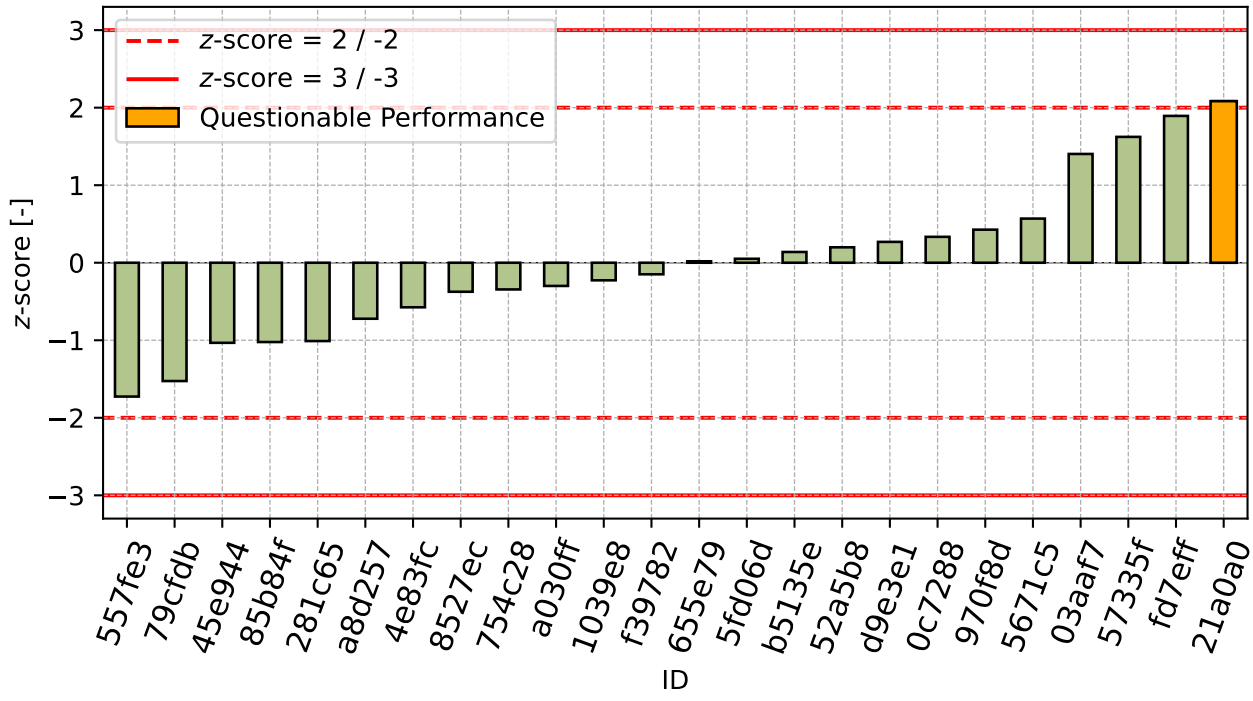

Figure 37: z-score

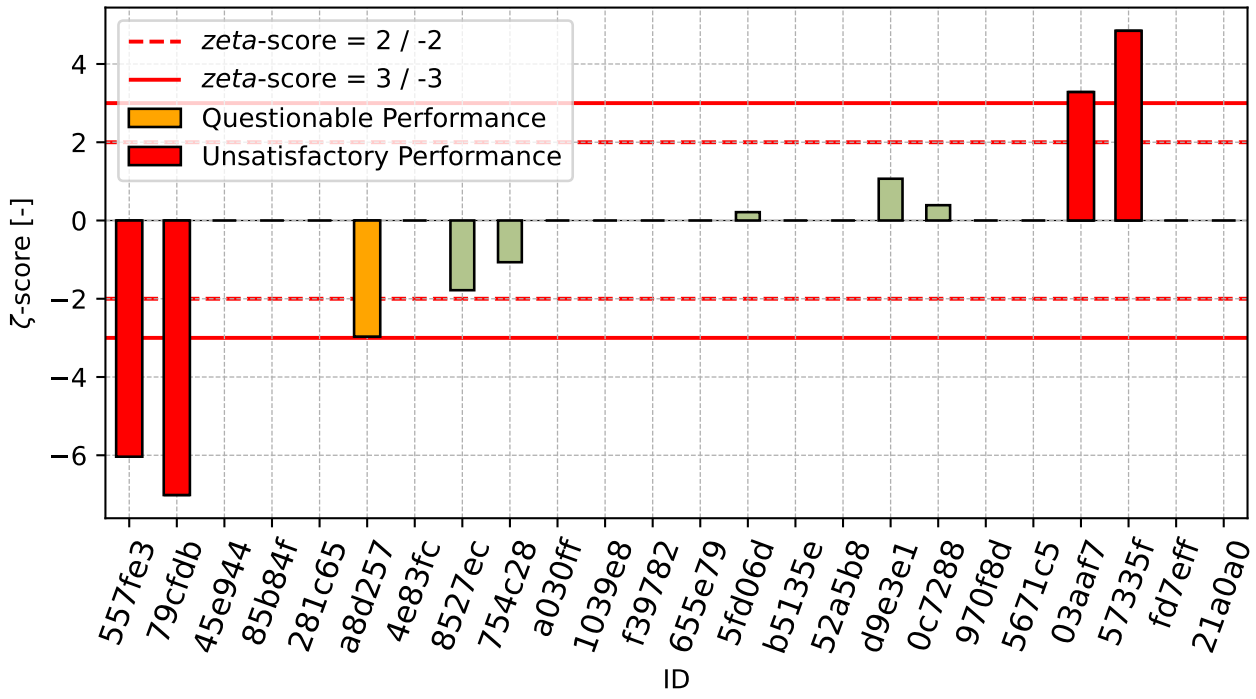

Figure 38: ζ-score

Table 39: z-score and ζ-score

ID	z-score [-]	ζ-score [-]
557fe3	-1.73	-6.04
79cfdb	-1.53	-7.02
45e944	-1.03	-
85b84f	-1.02	-
281c65	-1.01	-
a8d257	-0.72	-2.97
4e83fc	-0.57	-
8527ec	-0.37	-1.78
754c28	-0.34	-1.07
a030ff	-0.3	-
1039e8	-0.23	-
f39782	-0.15	-
655e79	0.02	-
5fd06d	0.05	0.21
b5135e	0.14	-
52a5b8	0.2	-
d9e3e1	0.27	1.07
0c7288	0.33	0.39
970f8d	0.43	-
5671c5	0.57	-
03aaf7	1.4	3.28
57335f	1.62	4.85

Continued on next page

Continued from previous page

ID	z-score [-]	ζ-score [-]
fd7eff	1.89	-
21a0a0	2.08	-

6 Appendix – EN ISO 17892-7 – Unconfined compressive strength, Strain at failure

6.1 Unconfined compressive strength

6.1.1 Test results

Table 40: 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 [MPa]				u_X [MPa]	$\bar{x}$ [MPa]	s_0 [MPa]	V_X [%]
754c28	0.139	0.133	0.134	0.136	0.0200	0.136	0.0026	1.95
52a5b8	0.130	0.152	0.154	0.133	-	0.142	0.0125	8.79
655e79	0.166	0.169	0.161	0.160	-	0.164	0.0042	2.59
5fd06d	0.199	0.160	0.179	0.200	0.0200	0.184	0.0190	10.29
3e1a74	0.196	0.168	0.192	0.189	0.0050	0.186	0.0125	6.71
a8d257	0.191	0.185	0.190	0.186	0.0022	0.188	0.0029	1.57
21a0a0	0.191	0.189	0.202	0.194	-	0.194	0.0057	2.95
557fe3	0.182	0.188	0.200	0.210	0.0150	0.195	0.0125	6.41
281c65	0.198	0.206	0.195	0.200	-	0.200	0.0046	2.33
8527ec	0.192	0.212	0.206	0.193	0.0400	0.201	0.0098	4.90
d9e3e1	0.210	0.183	0.212	0.211	0.0200	0.204	0.0140	6.87
5671c5	0.212	0.208	0.201	0.198	-	0.205	0.0064	3.12
1039e8	0.205	0.200	0.216	0.207	-	0.207	0.0067	3.23
79cfdb	0.185	0.188	0.219	0.243	0.0100	0.209	0.0275	13.19
b5135e	0.200	0.223	0.215	0.208	-	0.211	0.0098	4.64
03aaf7	0.225	0.230	0.178	0.230	0.0510	0.216	0.0253	11.72
45e944	0.228	0.199	0.223	0.219	-	0.217	0.0127	5.85
fc43ce	0.223	0.220	0.247	0.247	0.0700	0.234	0.0148	6.31
250d39	0.244	-	-	-	0.0016	0.244	0.0000	0.00
f39782	0.262	0.233	0.248	0.251	-	0.248	0.0120	4.81
5880d9	0.290	0.258	0.261	0.247	-	0.264	0.0183	6.95
970f8d	0.275	0.265	0.286	0.271	-	0.274	0.0088	3.23
0c7288	0.290	0.320	0.290	0.390	0.0480	0.323	0.0472	14.63

6.1.2 The Numerical Procedure for Determining Outliers

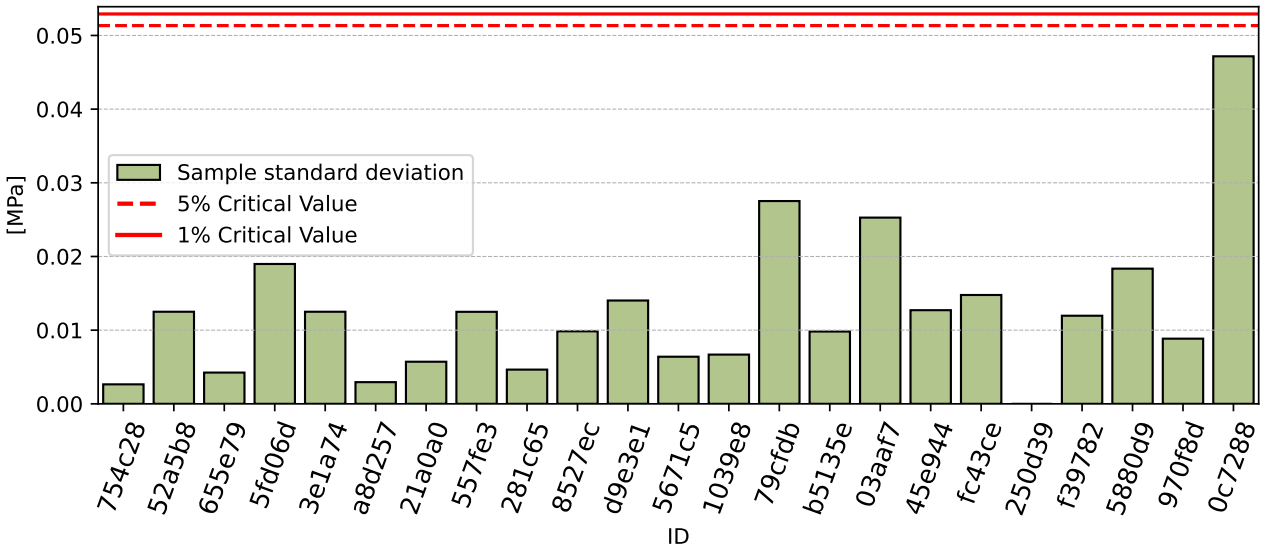

Figure 39: **Cochran's test** - sample standard deviations

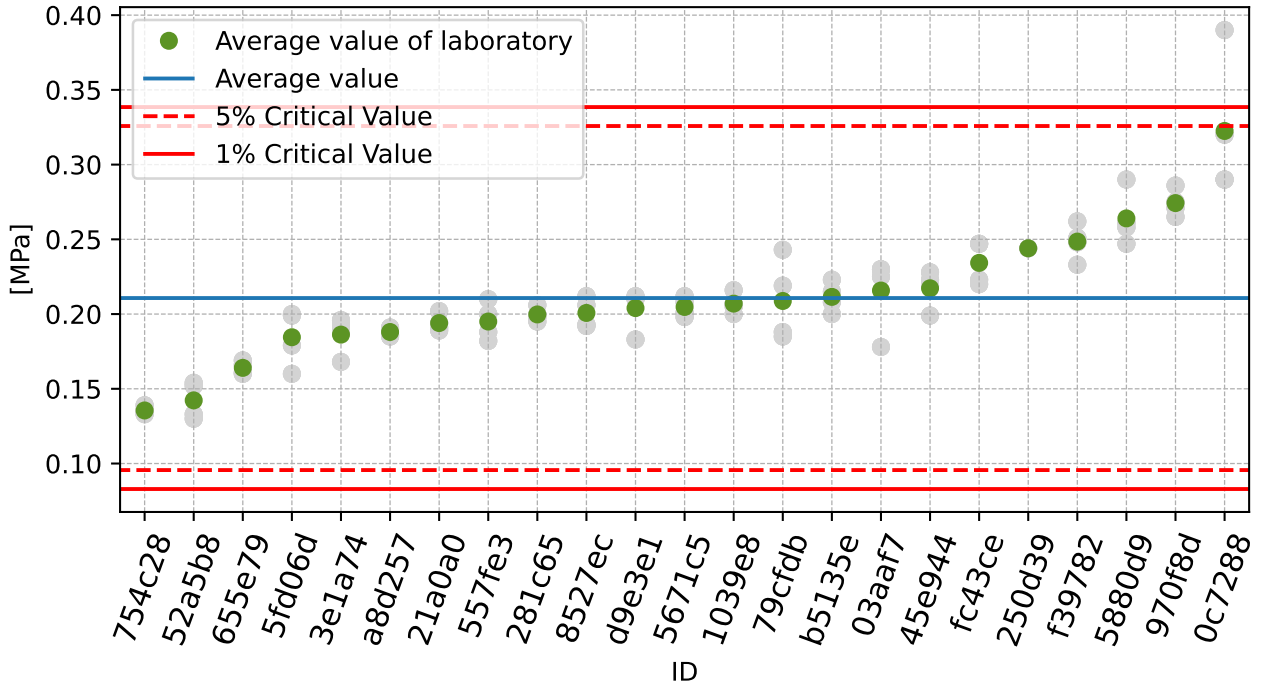

Figure 40: **Grubbs' test** - average values

6.1.3 Mandel's Statistics

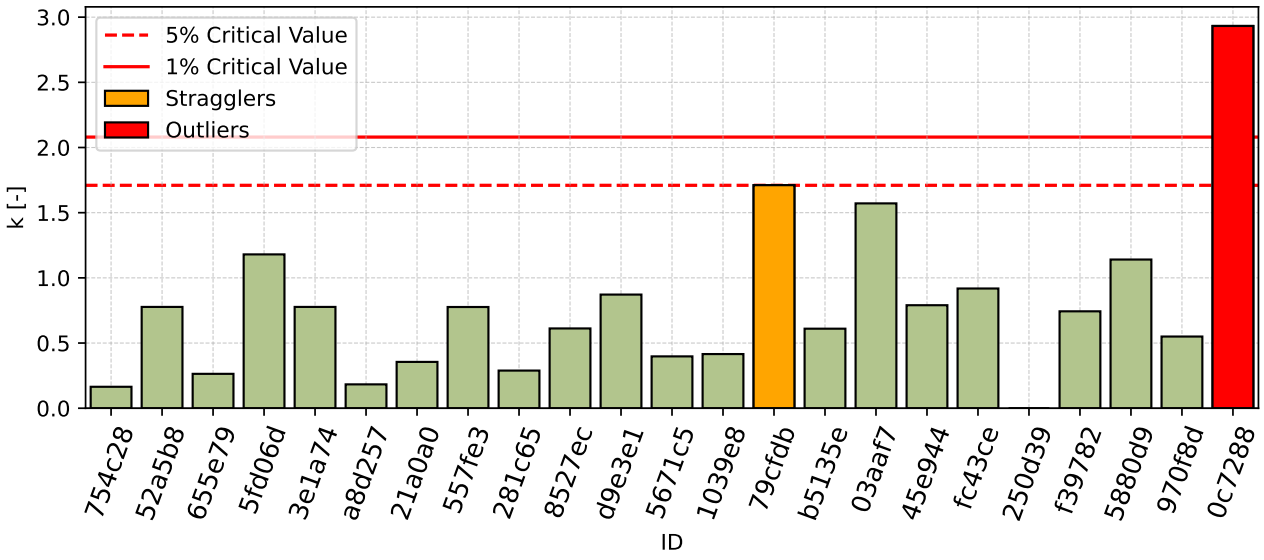

Figure 41: Intralaboratory Consistency Statistic

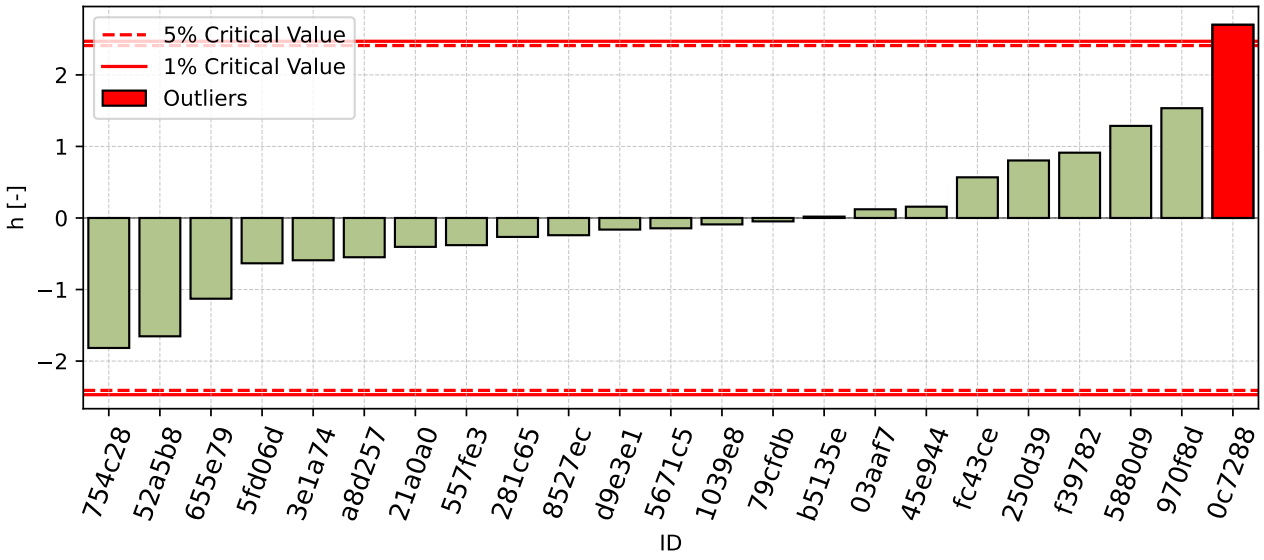

Figure 42: Interlaboratory Consistency Statistic

6.1.4 Descriptive statistics

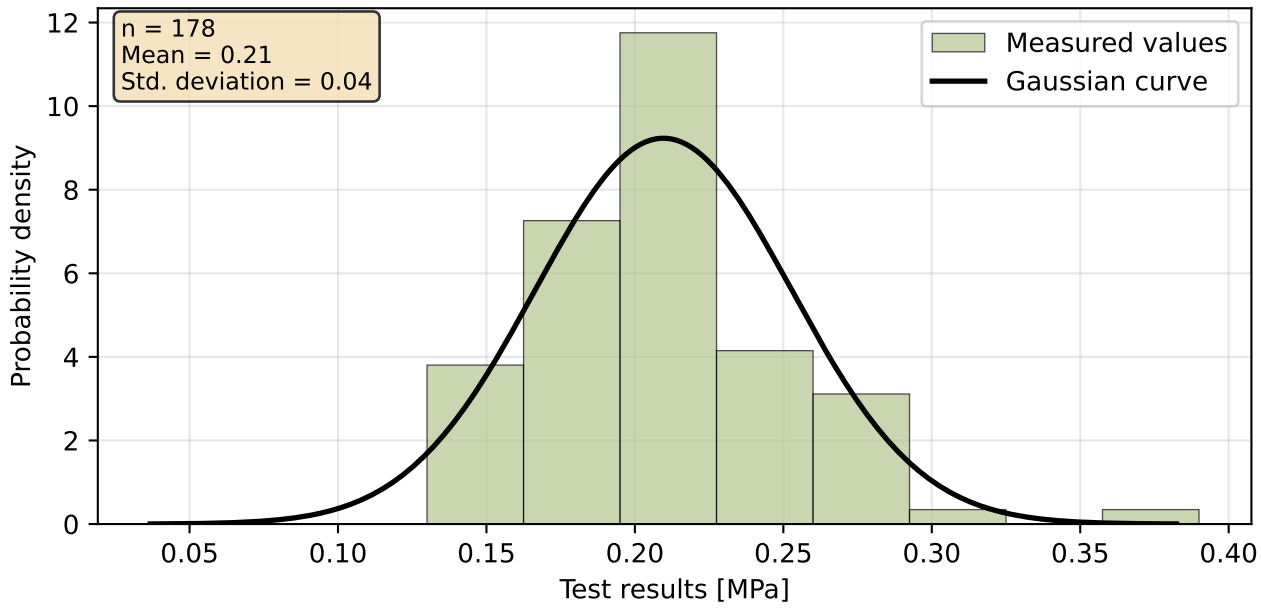

Figure 43: Histogram of all test results

Table 41: Descriptive statistics

Characteristics	[MPa]
Average value – $\bar{x}$	0.211
Sample standard deviation – s	0.0414
Asigned value – x^*	0.211
Robust standard deviation – s^*	0.0414
Measurement uncertainty of asigned value – u_X	0.0086
p-value of normality test	0.0 [-]
Interlaboratory standard deviation – s_L	0.0406
Repeatability standard deviation – s_r	0.0161
Reproducibility standard deviation – s_R	0.0437
Repeatability – r	0.045
Reproducibility – R	0.122

6.1.5 Evaluation of Performance Statistics

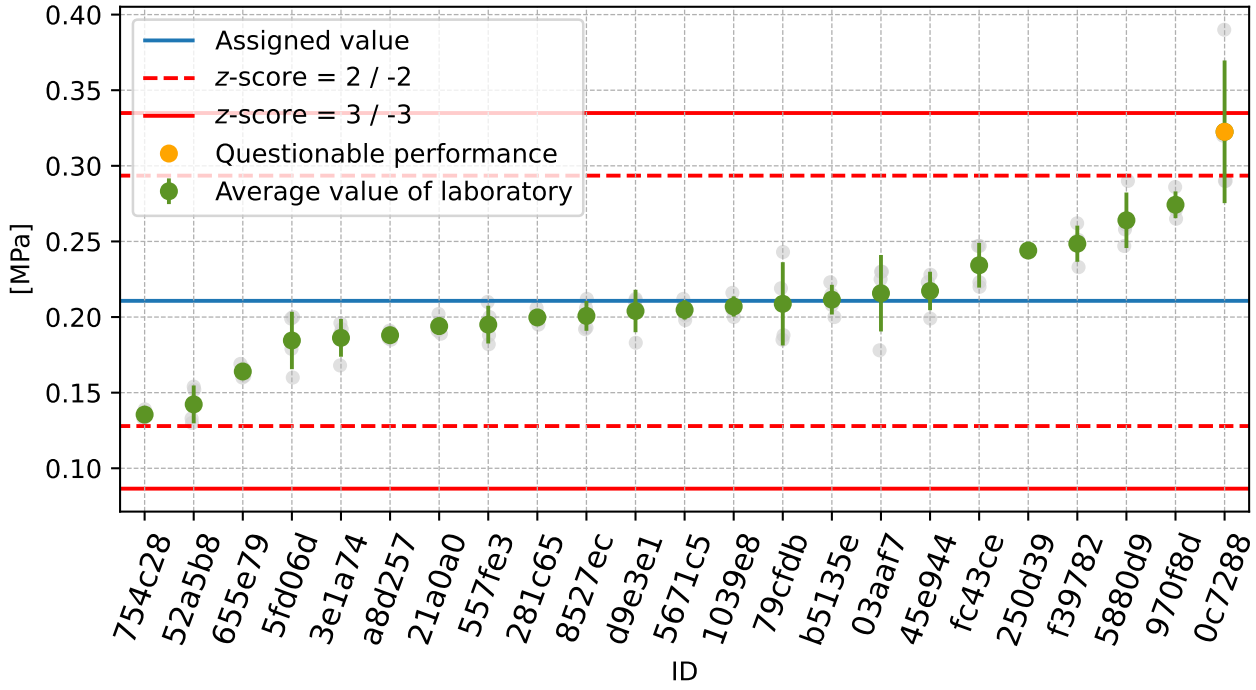

Figure 44: Average values and sample standard deviations

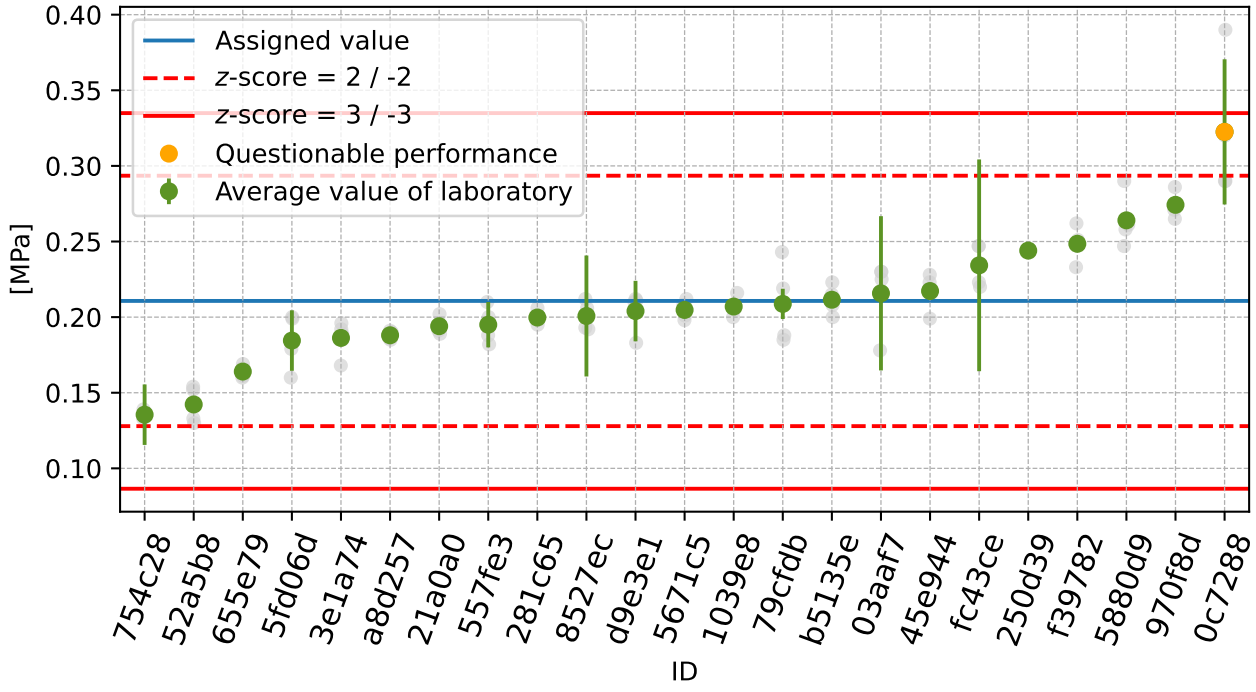

Figure 45: Average values and extended uncertainties of measurement

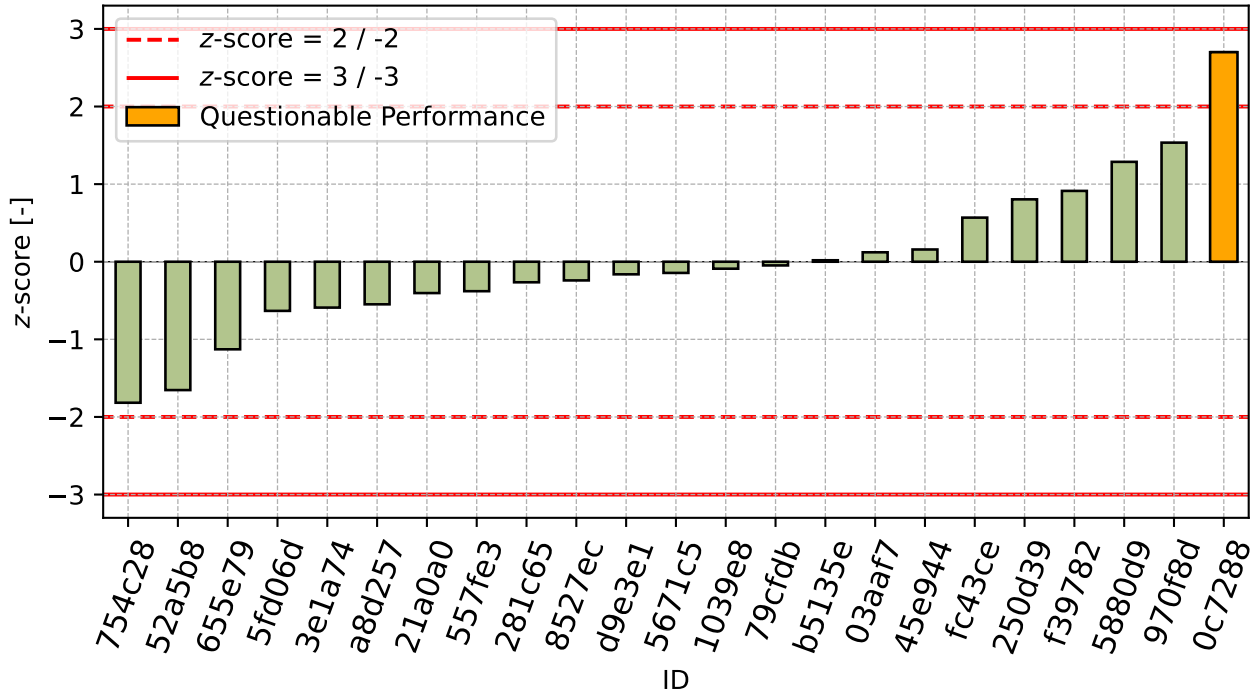

Figure 46: z-score

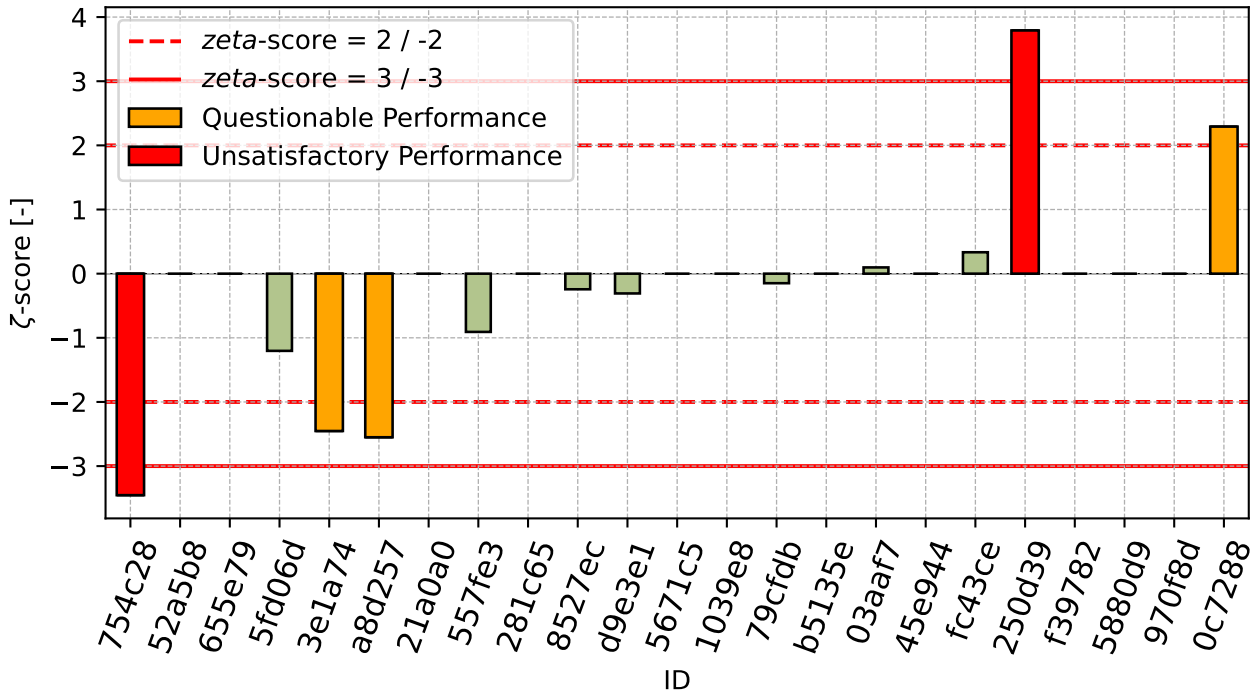

Figure 47: ζ-score

Table 42: z-score and ζ-score

ID	z-score [-]	ζ-score [-]
754c28	-1.82	-3.45
52a5b8	-1.65	-
655e79	-1.13	-
5fd06d	-0.63	-1.2
3e1a74	-0.59	-2.45
a8d257	-0.55	-2.55
21a0a0	-0.4	-
557fe3	-0.38	-0.91
281c65	-0.26	-
8527ec	-0.24	-0.24
d9e3e1	-0.16	-0.31
5671c5	-0.14	-
1039e8	-0.09	-
79cfdb	-0.05	-0.15
b5135e	0.02	-
03aaf7	0.12	0.1
45e944	0.16	-
fc43ce	0.57	0.33
250d39	0.8	3.79
f39782	0.91	-
5880d9	1.29	-
970f8d	1.53	-
0c7288	2.7	2.29

6.2 Strain at failure

6.2.1 Test results

Table 43: 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 [%]				u_X [%]	$\bar{x}$ [%]	s_0 [%]	V_X [%]
8527ec	2.3	2.3	2.2	2.3	0.04	2.3	0.05	2.20
250d39	3.2	-	-	-	0.02	3.2	0.00	0.00
5880d9	3.5	3.7	2.8	3.2	-	3.3	0.39	11.87
79cfdb	3.6	4.3	3.5	1.9	0.60	3.3	1.01	30.51
281c65	3.0	3.2	4.2	3.4	-	3.5	0.53	15.25
655e79	3.7	3.6	3.7	3.7	-	3.7	0.05	1.36
0c7288	2.8	3.6	3.9	4.5	-	3.7	0.71	19.11
970f8d	3.9	3.5	3.8	3.7	-	3.7	0.17	4.58
52a5b8	2.8	3.2	3.2	6.6	-	3.9	1.78	44.98
21a0a0	4.1	3.9	3.8	4.2	-	4.0	0.18	4.56
5fd06d	2.8	4.5	5.5	4.3	1.10	4.3	1.11	26.07
3e1a74	5.1	3.6	4.8	4.0	1.00	4.4	0.69	15.88
45e944	4.7	4.8	4.6	4.4	-	4.6	0.17	3.69
754c28	4.8	4.6	5.3	4.6	0.80	4.8	0.33	6.85
b5135e	4.9	4.7	5.0	5.0	-	4.9	0.14	2.89
1039e8	5.1	5.2	4.8	5.0	-	5.0	0.17	3.40
03aaf7	4.6	4.4	5.6	5.8	1.37	5.1	0.70	13.77
a8d257	6.2	5.5	6.0	4.4	1.05	5.5	0.81	14.58
fc43ce	2.3	4.7	8.7	7.3	1.44	5.8	2.83	49.30
f39782	6.1	5.8	5.9	6.0	-	5.9	0.13	2.17
d9e3e1	6.5	7.2	8.4	7.0	0.64	7.3	0.81	11.08
5671c5	7.4	7.4	7.9	7.6	-	7.6	0.24	3.12
557fe3	10.8	10.3	9.5	10.1	0.10	10.2	0.54	5.28

6.2.2 The Numerical Procedure for Determining Outliers

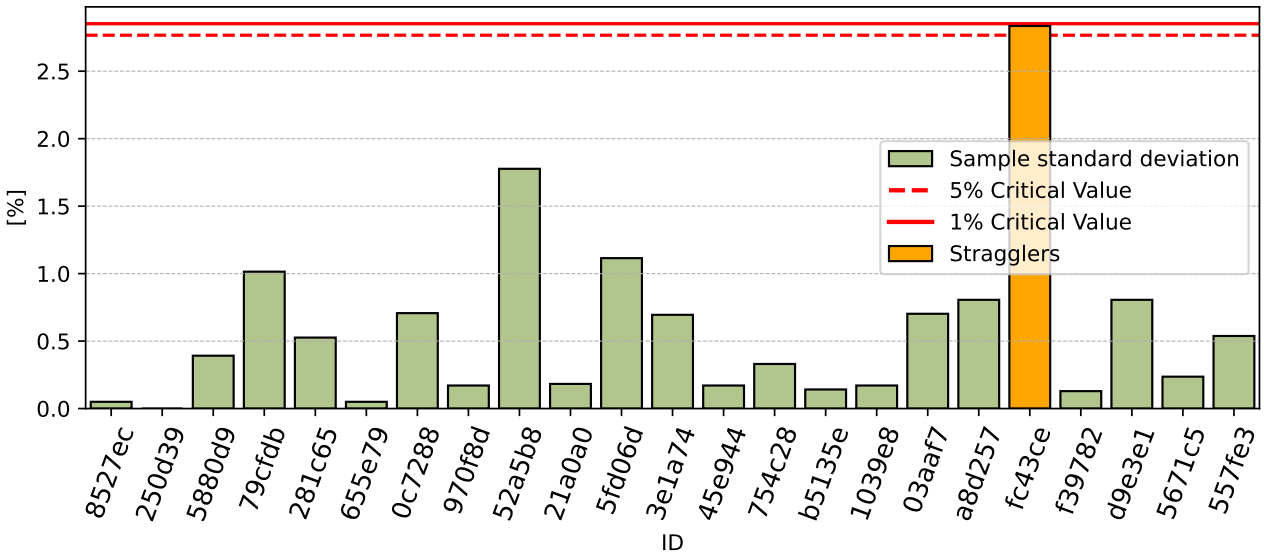

Figure 48: **Cochran's test** - sample standard deviations

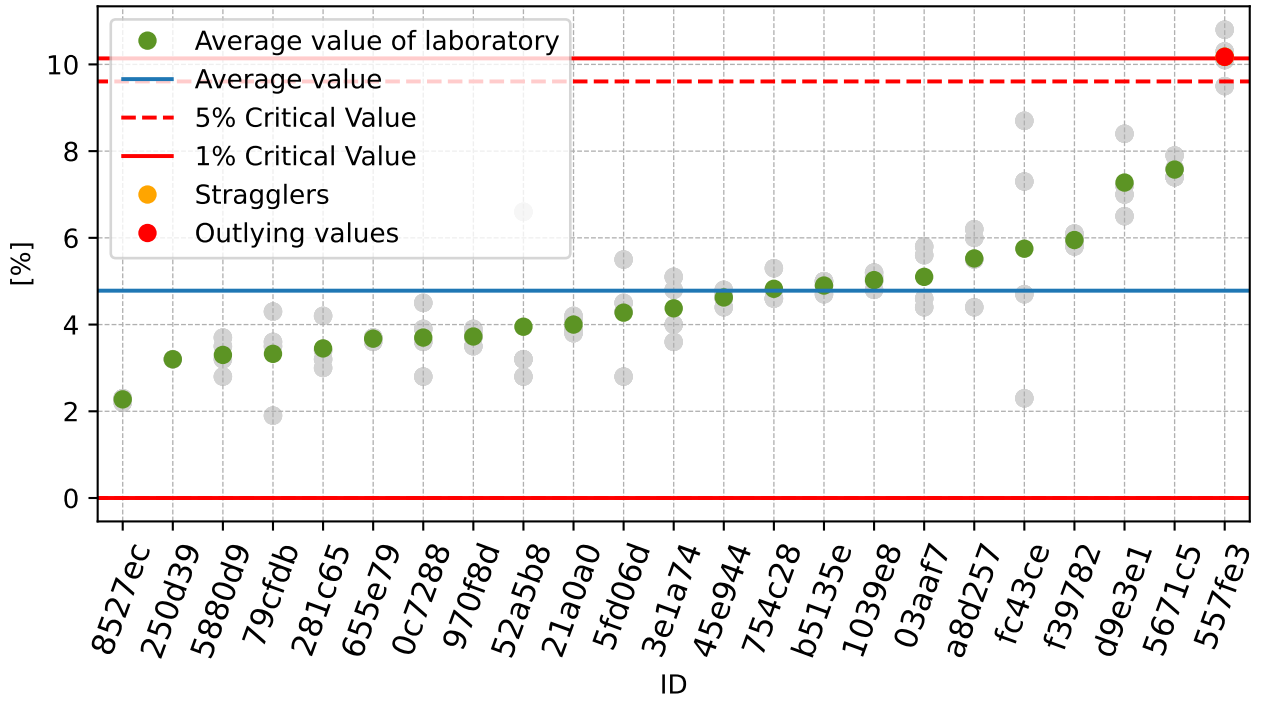

Figure 49: **Grubbs' test** - average values

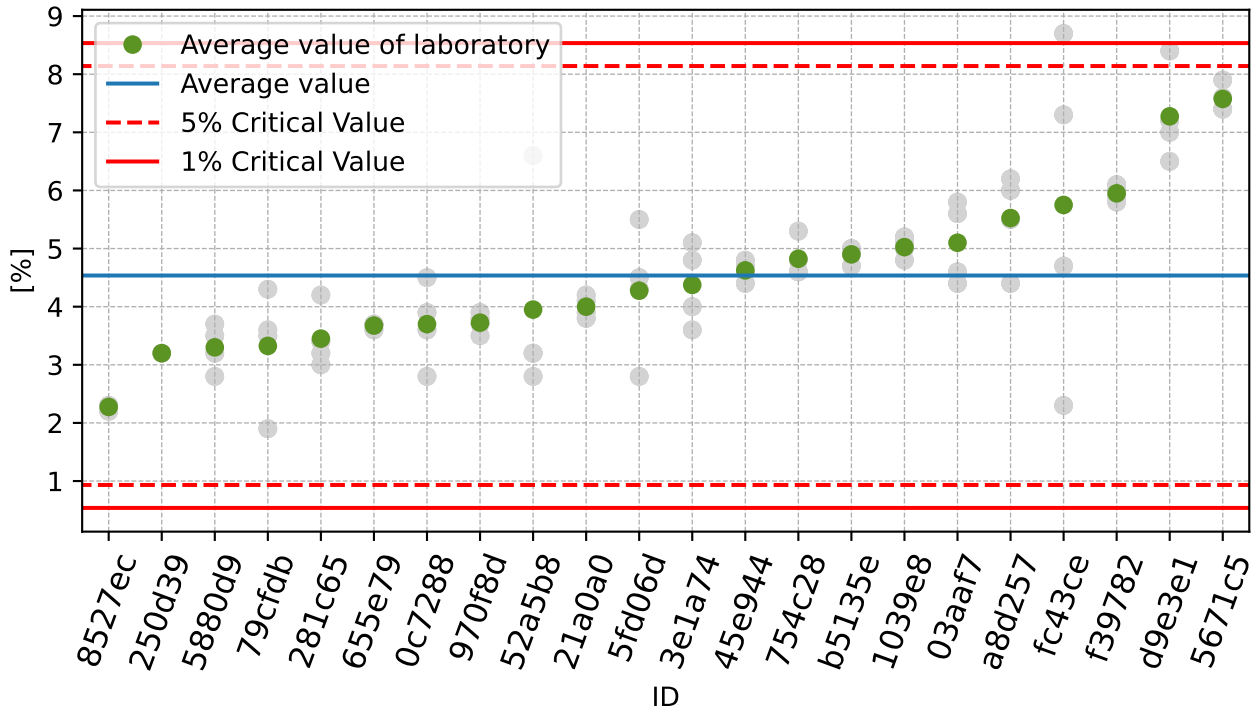

Figure 50: **Grubbs' test** - average values without outliers

6.2.3 Mandel's Statistics

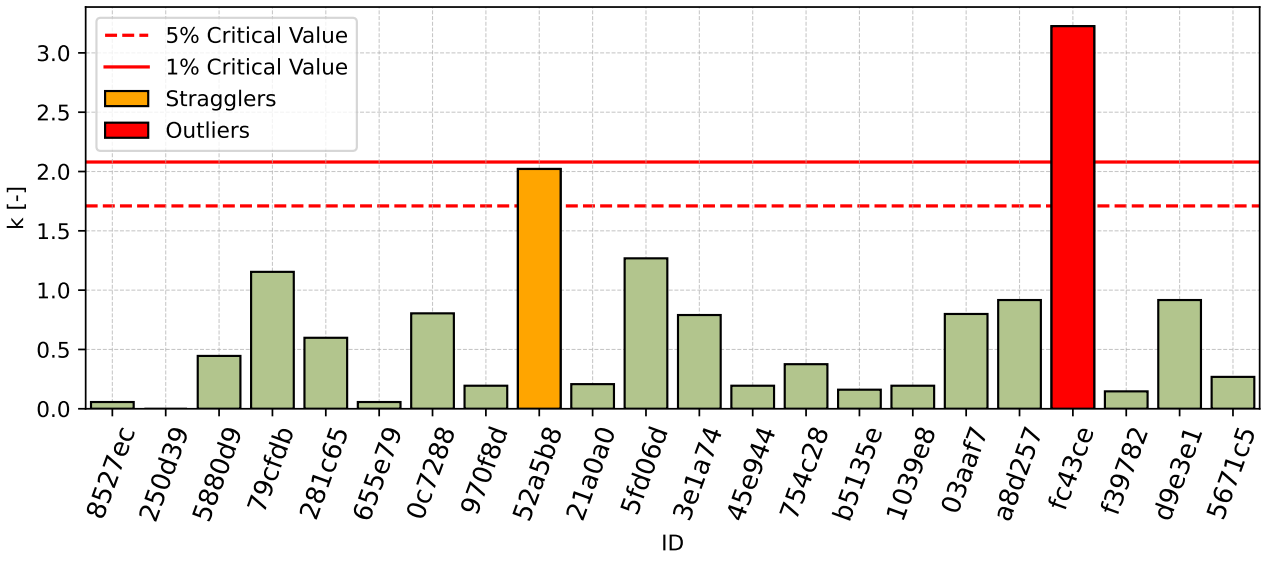

Figure 51: Intralaboratory Consistency Statistic

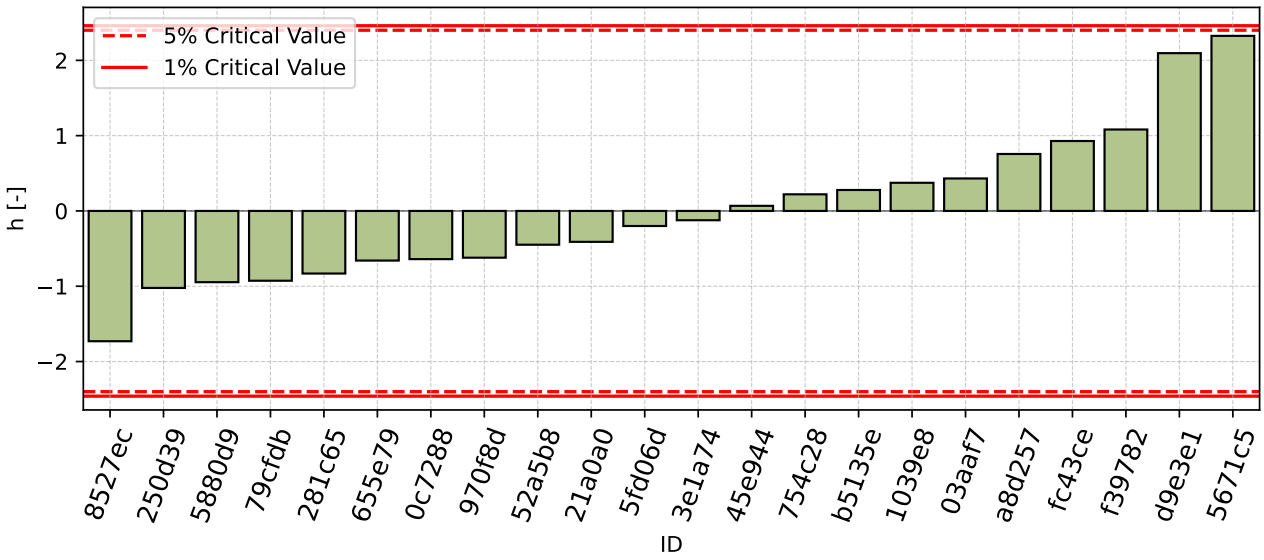

Figure 52: Interlaboratory Consistency Statistic

6.2.4 Descriptive statistics

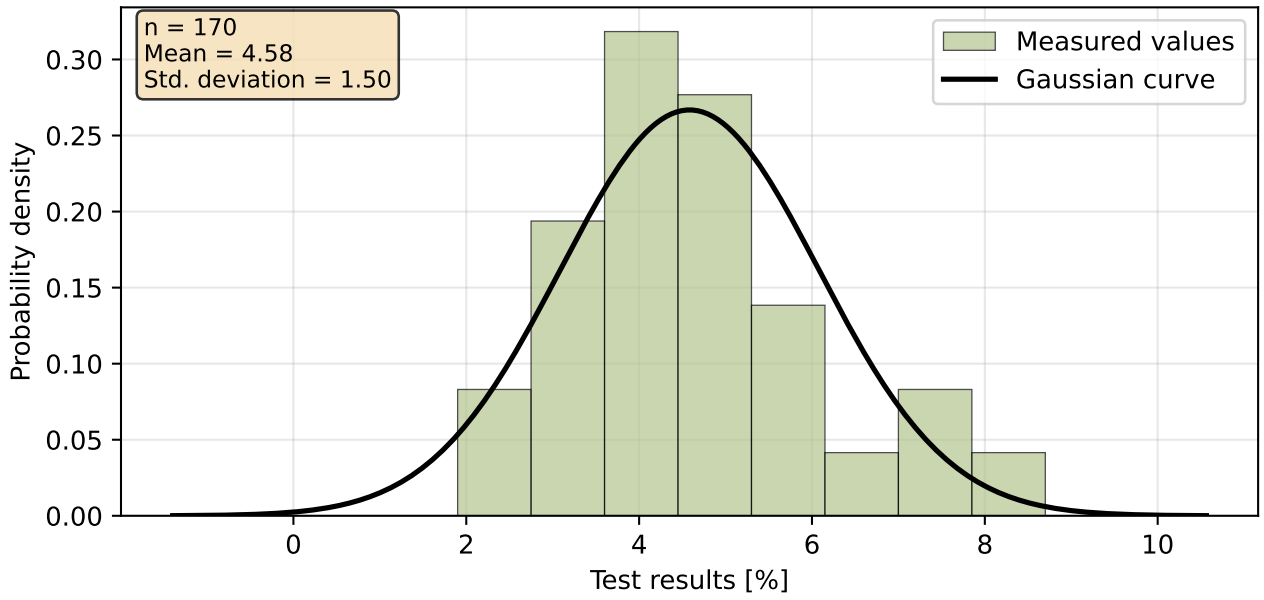

Figure 53: Histogram of all test results

Table 44: Descriptive statistics

Characteristics	[%]
Average value – $\bar{x}$	4.5
Sample standard deviation – s	1.31
Asigned value – x^*	4.5
Robust standard deviation – s^*	1.38
Measurement uncertainty of asigned value – u_X	0.29
p-value of normality test	0.009 [-]

6.2.5 Evaluation of Performance Statistics

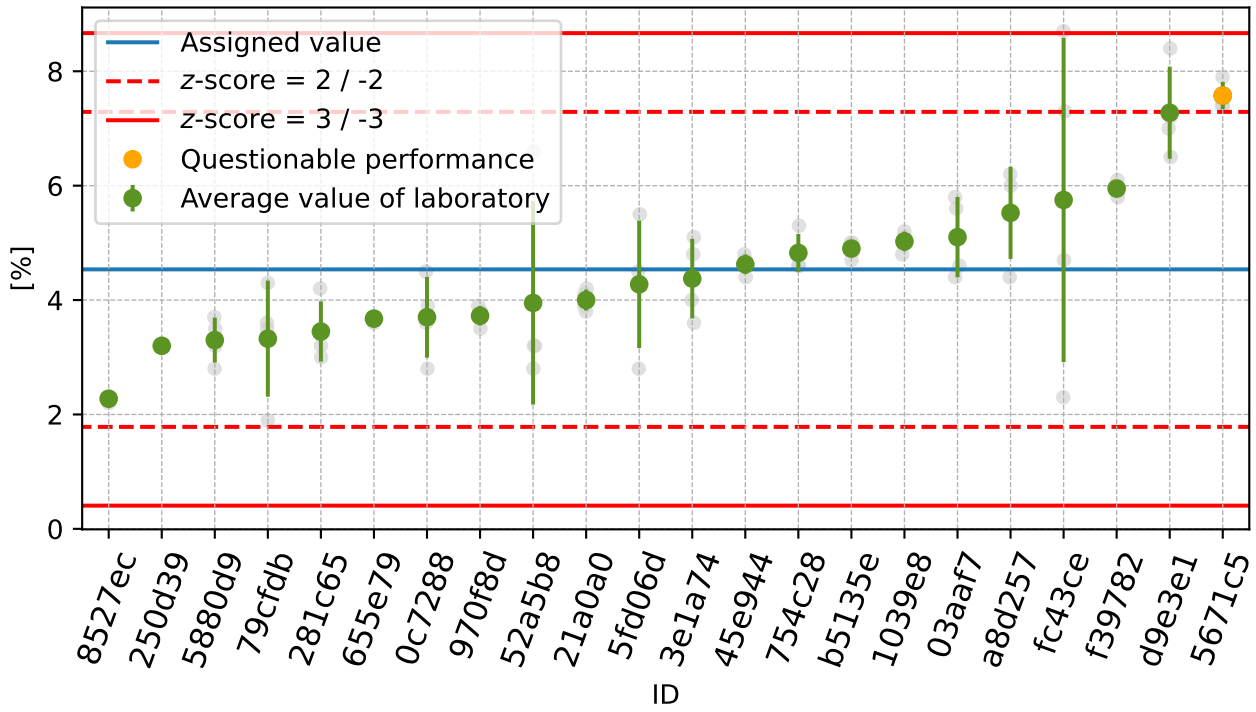

Figure 54: Average values and sample standard deviations

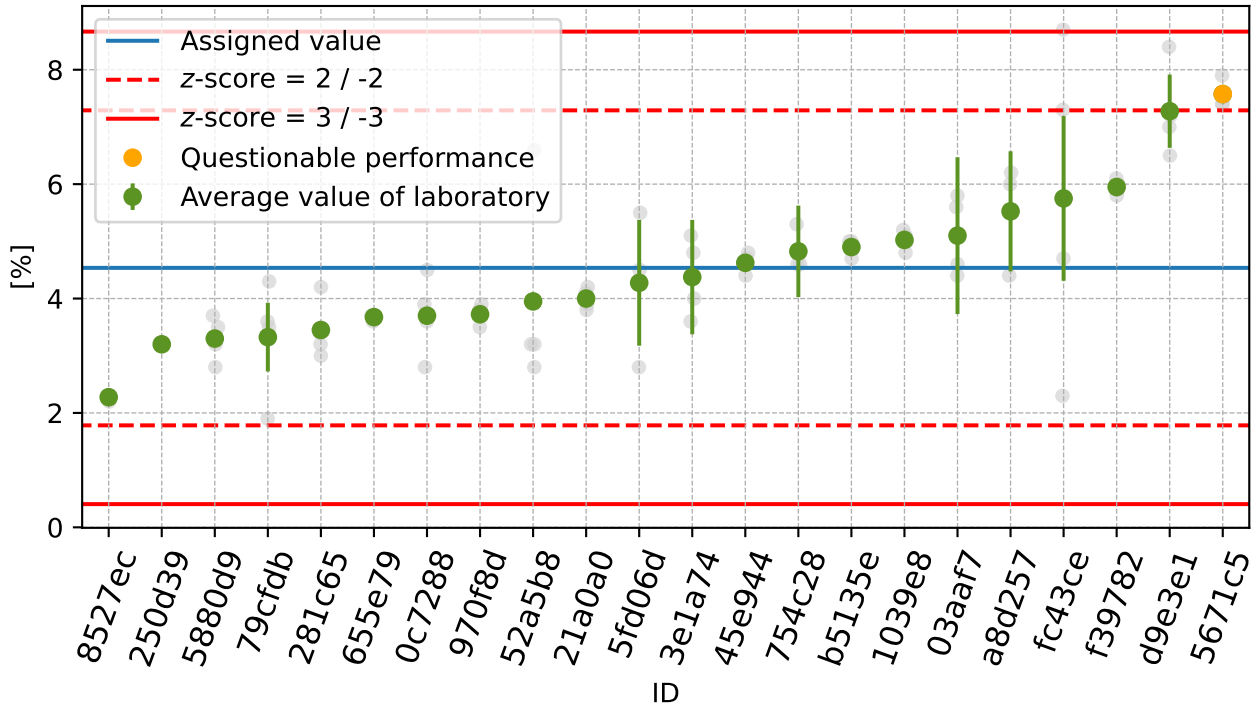

Figure 55: Average values and extended uncertainties of measurement

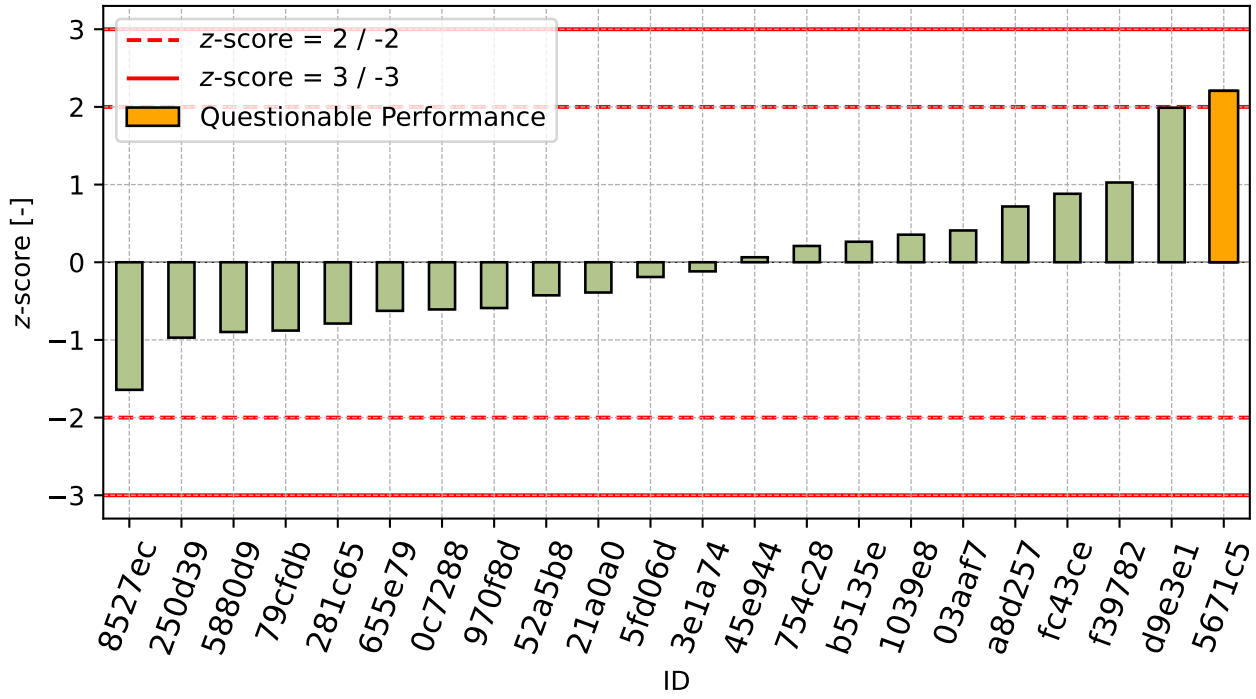

Figure 56: z-score

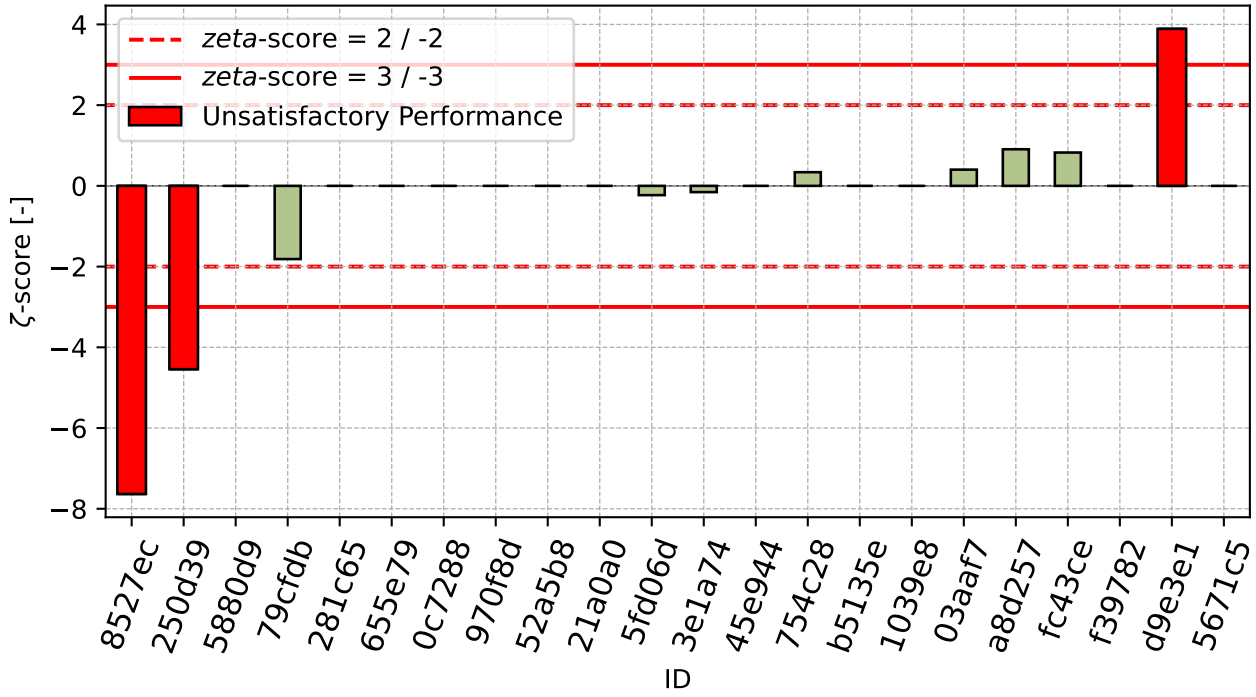

Figure 57: ζ-score

Table 45: z-score and ζ-score

ID	z-score [-]	ζ-score [-]
8527ec	-1.64	-7.63
250d39	-0.97	-4.54
5880d9	-0.9	-
79cfdb	-0.88	-1.81
281c65	-0.79	-
655e79	-0.63	-
0c7288	-0.61	-
970f8d	-0.59	-
52a5b8	-0.43	-
21a0a0	-0.39	-
5fd06d	-0.19	-0.23
3e1a74	-0.12	-0.15
45e944	0.06	-
754c28	0.21	0.34
b5135e	0.26	-
1039e8	0.35	-
03aaf7	0.41	0.4
a8d257	0.72	0.91
fc43ce	0.88	0.83
f39782	1.03	-
d9e3e1	1.99	3.89
5671c5	2.21	-

7 Appendix – CEN ISO/TS 17892-10 – Effective shear parameters

7.1 50 kPa

7.1.1 Test results

Table 46: Test results - ordered by average value. Outliers are marked by red color. u_X - extended uncertainty of measurement.

ID	Test results [kPa]	u_X [kPa]
754c28	33.0	6.00
8527ec	35.0	0.10
5671c5	35.1	-
85b84f	40.0	-
6977b1	40.0	1.00
970f8d	40.4	-
655e79	41.5	-
227aa1	41.5	-
557fe3	41.7	5.00
250d39	42.0	0.50
0c7288	44.0	3.10
21a0a0	45.0	-
4e83fc	46.0	3.22
249582	46.0	3.27
d9e3e1	47.6	4.80
b5135e	48.0	-
79cfdb	48.2	-
52a5b8	48.9	-
f39782	49.0	-
f2f2df	49.0	-
5fd06d	51.0	6.00
1039e8	52.0	-
fd7eff	53.3	-
a8d257	55.0	4.50
03aaf7	56.0	0.23
45e944	65.2	-

7.1.2 The Numerical Procedure for Determining Outliers

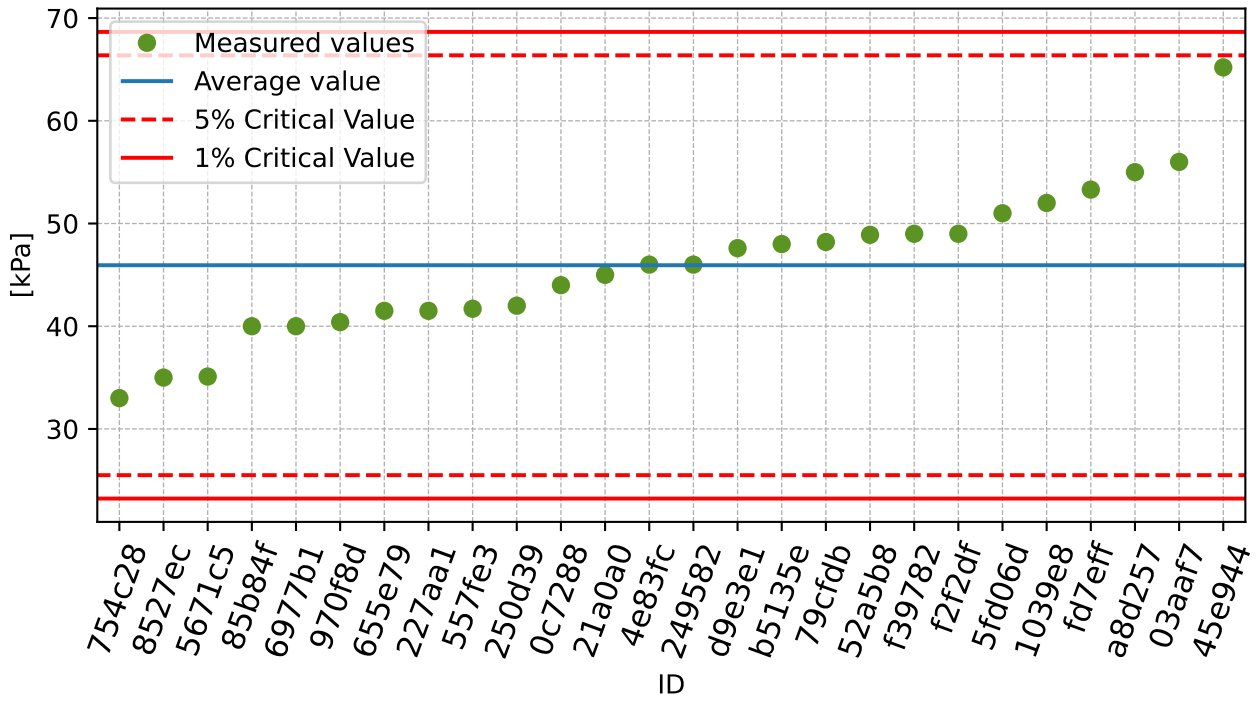

Figure 58: **Grubbs' test** - average values

7.1.3 Mandel's Statistics

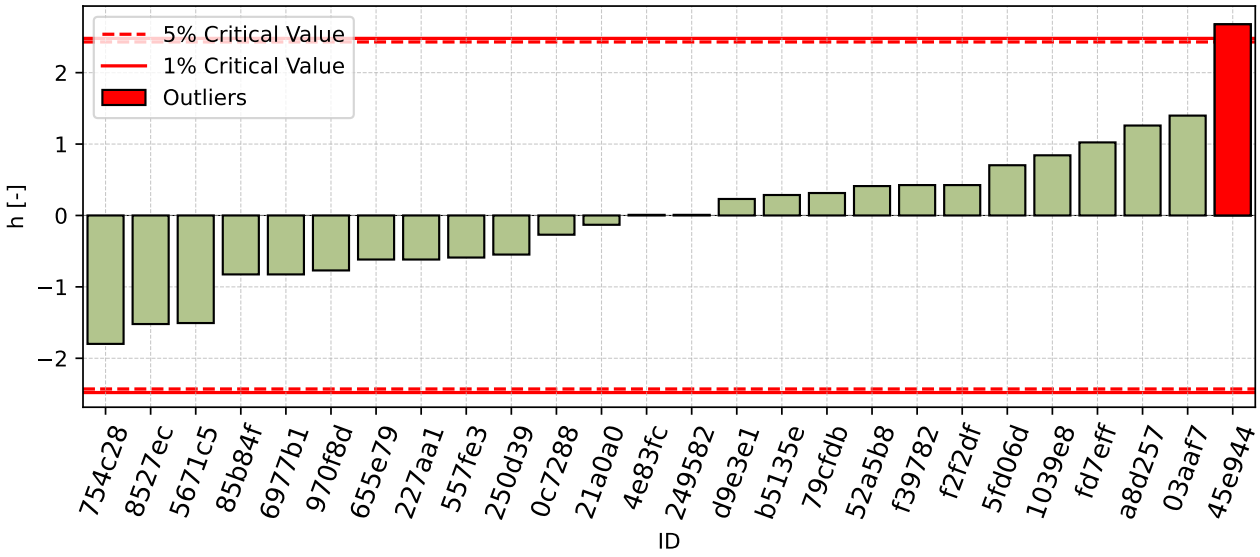

Figure 59: Interlaboratory Consistency Statistic

7.1.4 Descriptive statistics

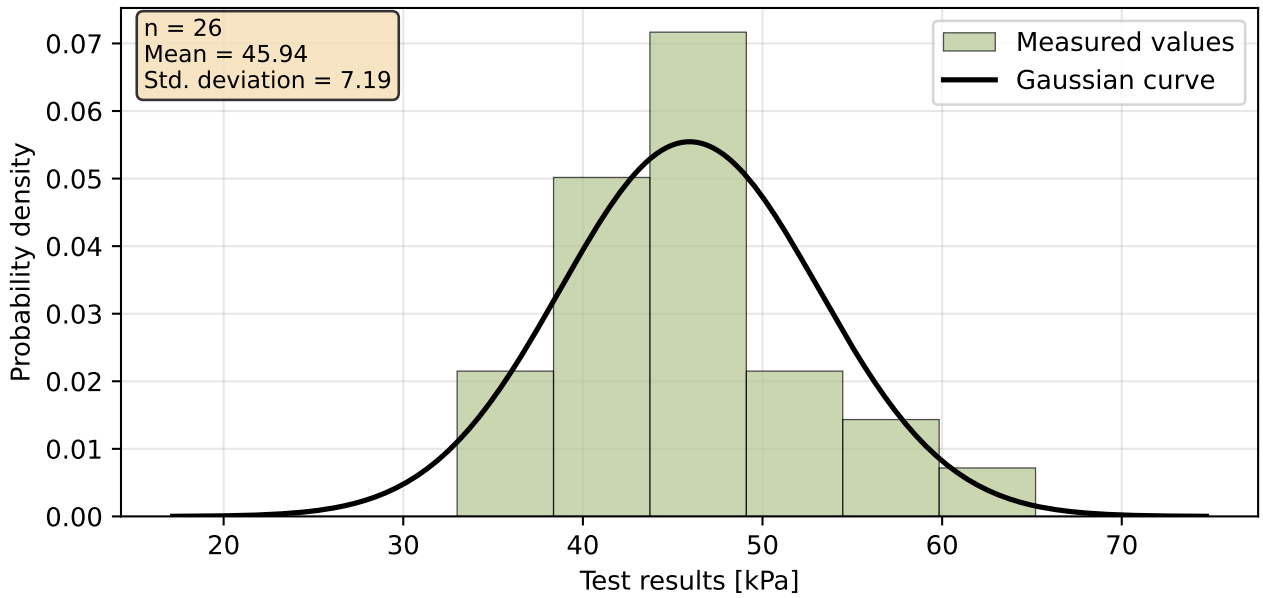

Figure 60: Histogram of all test results

Table 47: Descriptive statistics

Characteristics	**[kPa]**
Average value – $\bar{x}$	45.9
Sample standard deviation – s	7.19
Asigned value – x^*	45.9
Robust standard deviation – s^*	7.19
Measurement uncertainty of asigned value – u_X	1.41
p-value of normality test	0.66 [-]

7.1.5 Evaluation of Performance Statistics

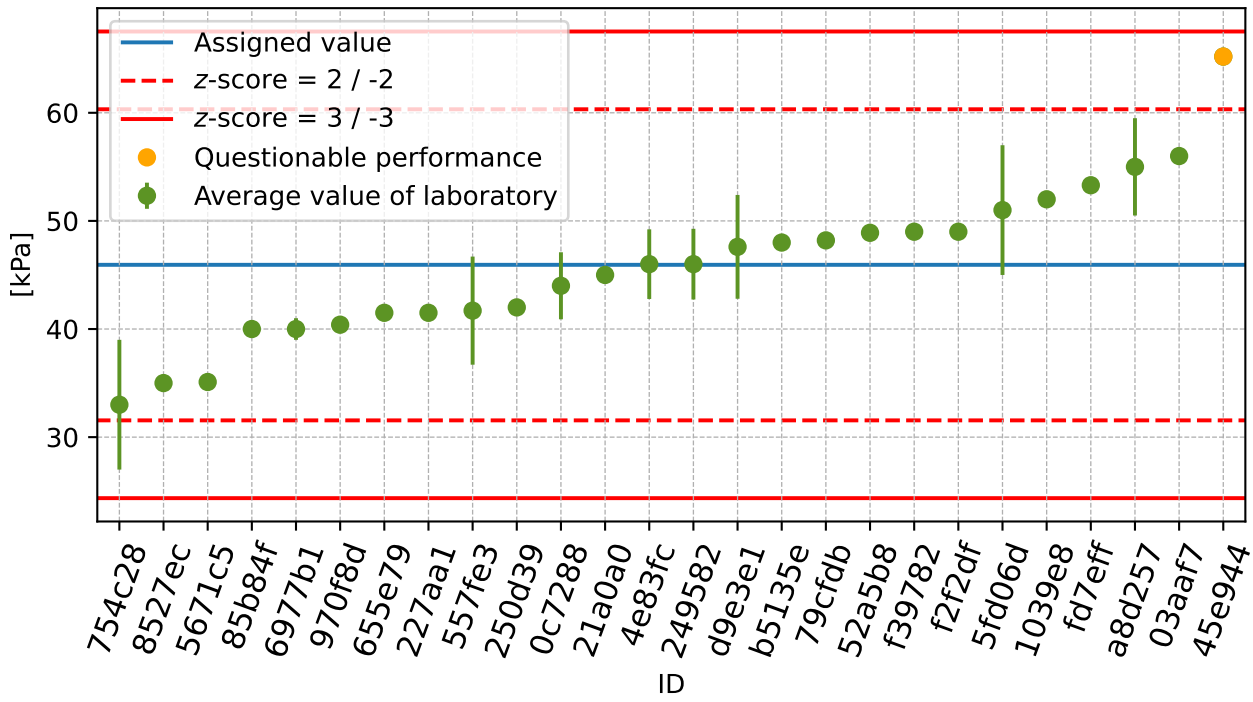

Figure 61: Average values and extended uncertainties of measurement

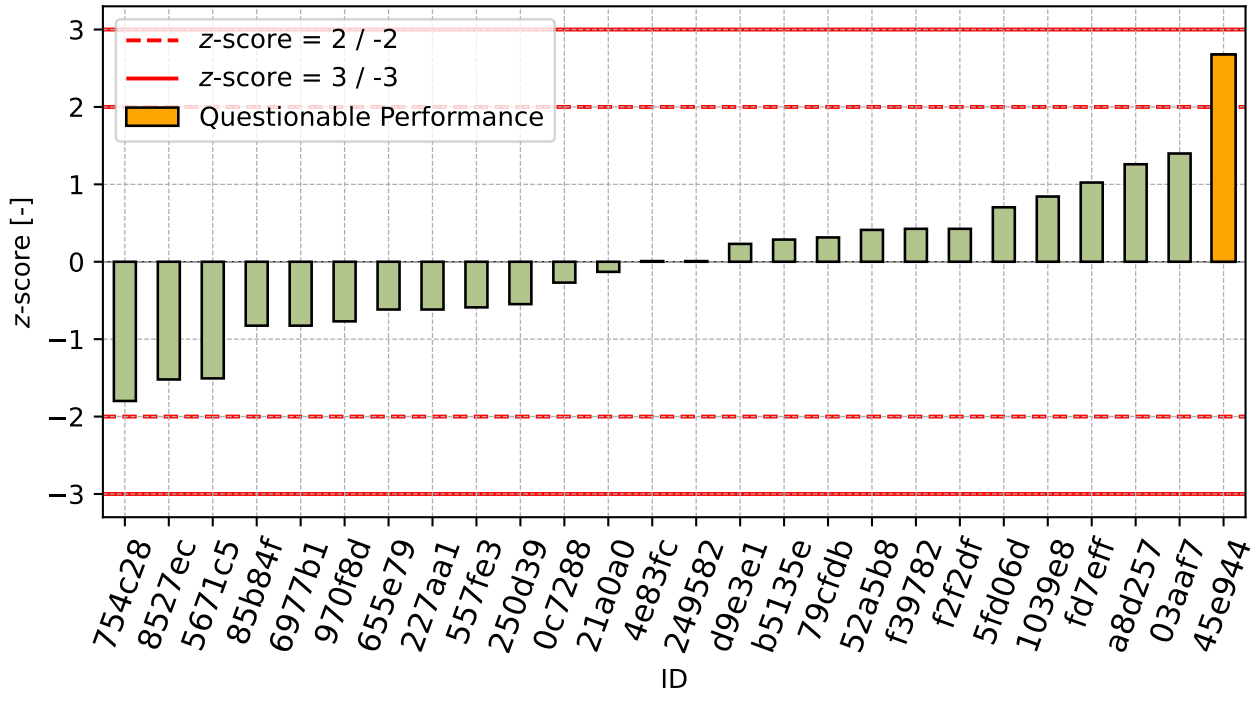

Figure 62: z-score

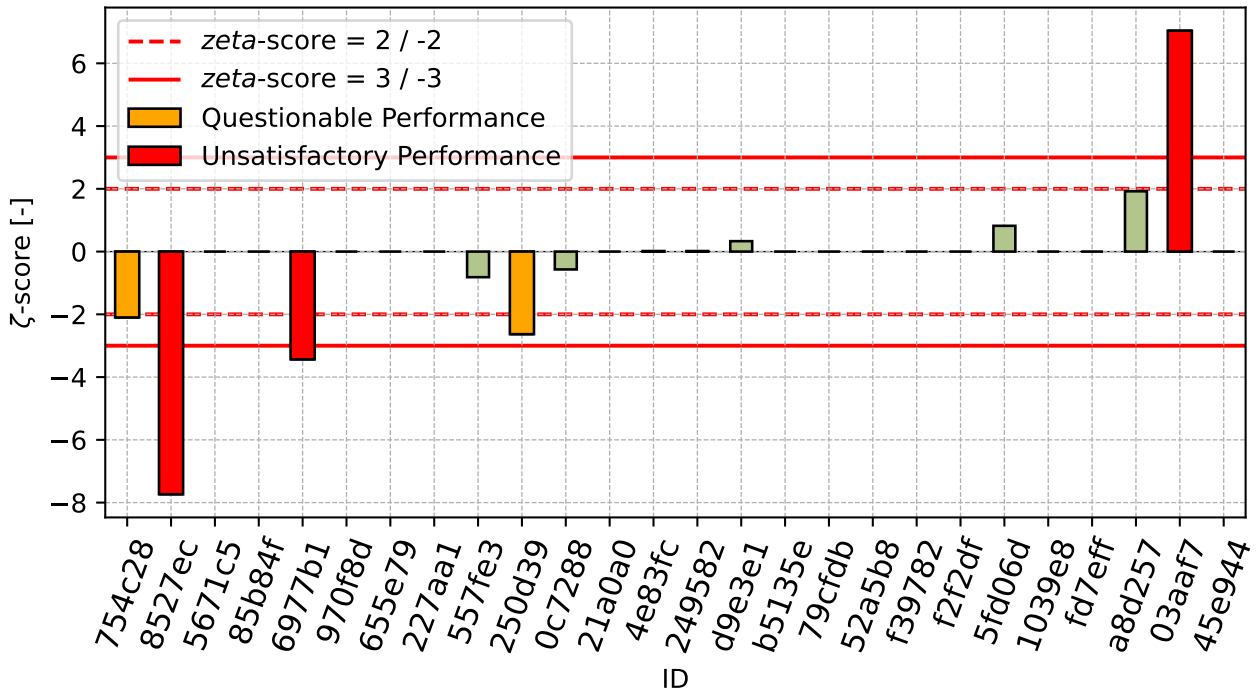

Figure 63: ζ-score

Table 48: z-score and ζ-score

ID	z-score [-]	ζ-score [-]
754c28	-1.8	-2.1
8527ec	-1.52	-7.73
5671c5	-1.51	-
85b84f	-0.83	-
6977b1	-0.83	-3.43
970f8d	-0.77	-
655e79	-0.62	-
227aa1	-0.62	-
557fe3	-0.59	-0.82
250d39	-0.55	-2.63
0c7288	-0.27	-0.57
21a0a0	-0.13	-
4e83fc	0.01	0.02
249582	0.01	0.02
d9e3e1	0.23	0.33
b5135e	0.29	-
79cfdb	0.31	-
52a5b8	0.41	-
f39782	0.43	-
f2f2df	0.43	-
5fd06d	0.7	0.82
1039e8	0.84	-
fd7eff	1.02	-

Continued on next page

Continued from previous page

ID	z-score [-]	ζ-score [-]
a8d257	1.26	1.92
03aaf7	1.4	7.04
45e944	2.68	-

7.2 100 kPa

7.2.1 Test results

Table 49: Test results - ordered by average value. Outliers are marked by red color. u_X - extended uncertainty of measurement.

ID	Test results [kPa]	u_X [kPa]
227aa1	52.1	-
250d39	65.0	0.78
655e79	71.5	-
0c7288	72.0	5.00
85b84f	73.0	-
4e83fc	73.0	5.11
5671c5	74.9	-
970f8d	76.7	-
f2f2df	78.0	-
8527ec	78.1	0.10
b5135e	79.0	-
52a5b8	79.5	-
d9e3e1	82.8	3.02
f39782	83.0	-
03aaf7	83.0	0.55
5fd06d	83.0	8.00
557fe3	83.6	5.00
754c28	85.0	6.00
6977b1	89.0	1.00
79cfdb	91.0	-
1039e8	91.1	-
fd7eff	93.2	-
a8d257	94.0	4.50
249582	96.0	6.82
21a0a0	98.0	-
45e944	111.9	-

7.2.2 The Numerical Procedure for Determining Outliers

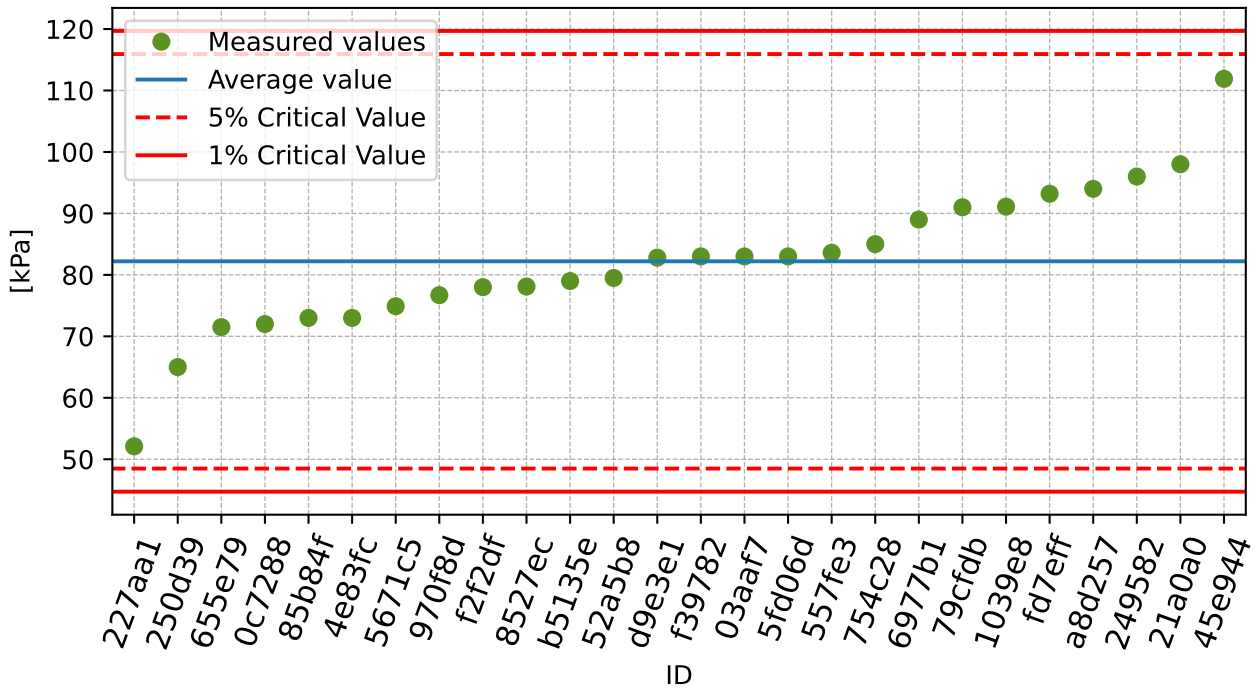

Figure 64: **Grubbs' test** - average values

7.2.3 Mandel's Statistics

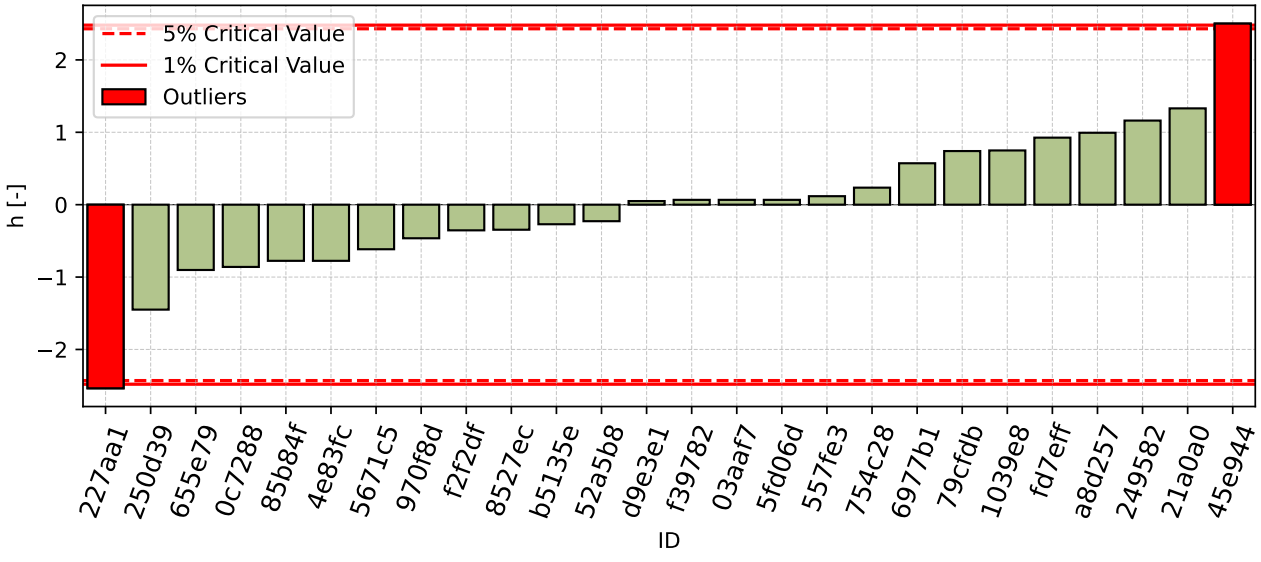

Figure 65: Interlaboratory Consistency Statistic

7.2.4 Descriptive statistics

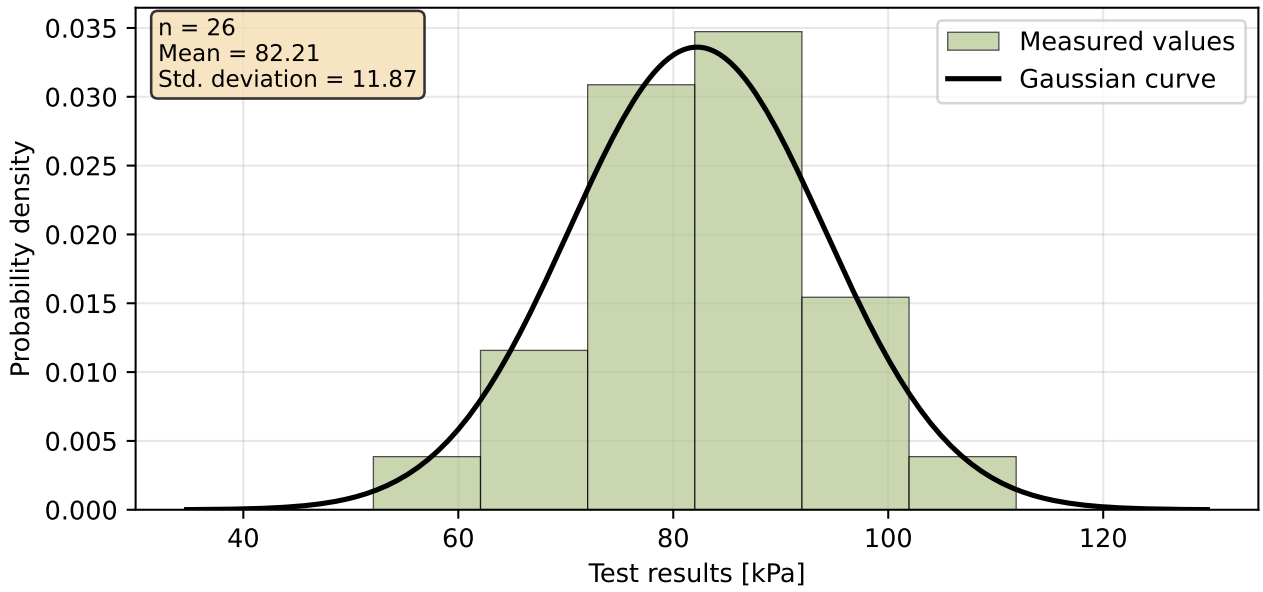

Figure 66: Histogram of all test results

Table 50: Descriptive statistics

Characteristics	**[kPa]**
Average value – $\bar{x}$	82.2
Sample standard deviation – s	11.87
Asigned value – x^*	82.2
Robust standard deviation – s^*	11.87
Measurement uncertainty of asigned value – u_X	2.33
p-value of normality test	0.709 [-]

7.2.5 Evaluation of Performance Statistics

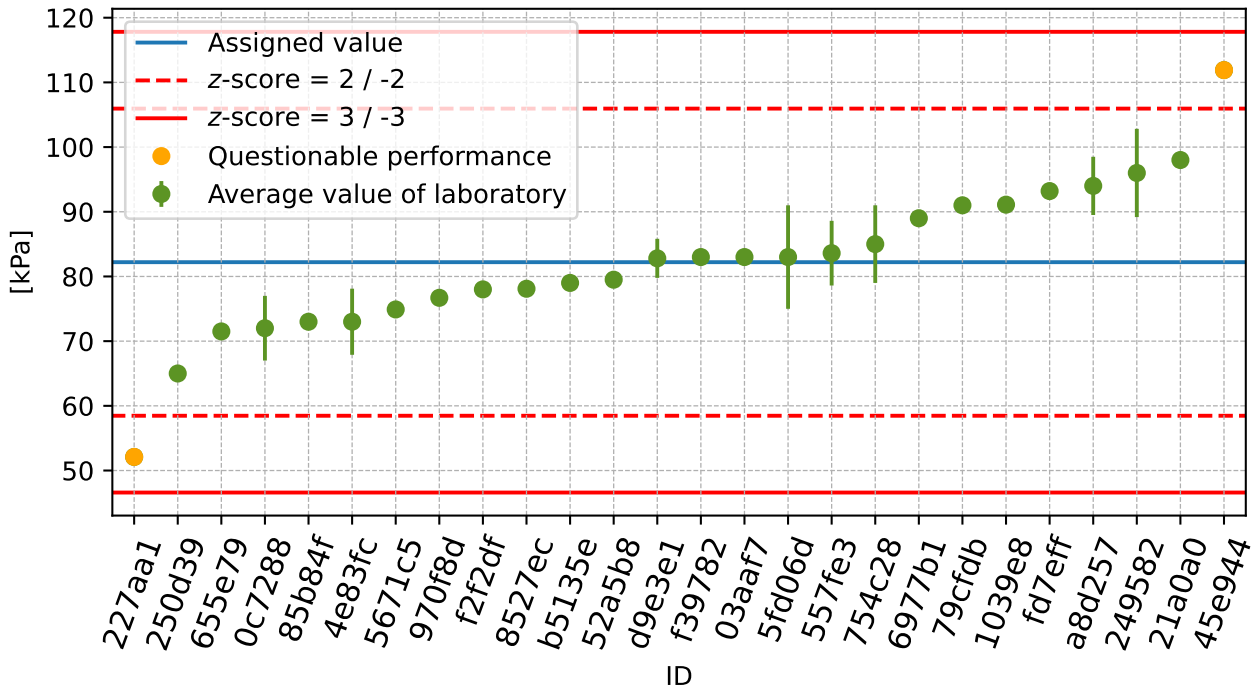

Figure 67: Average values and extended uncertainties of measurement

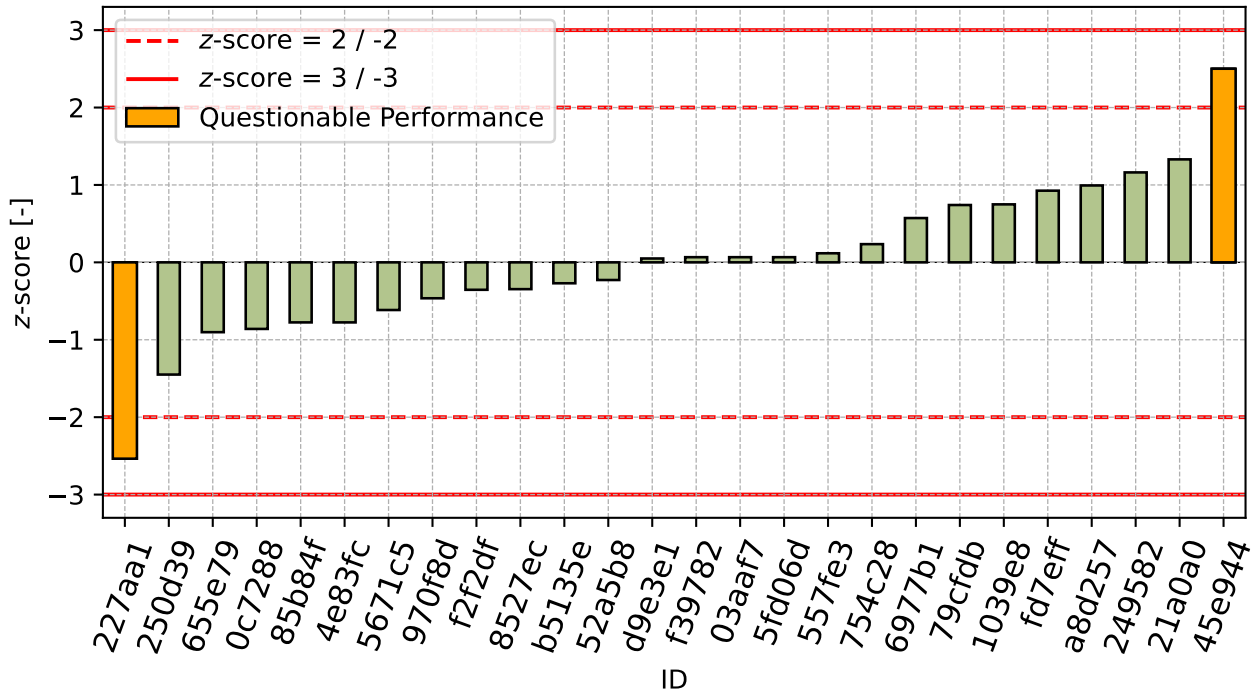

Figure 68: z-score

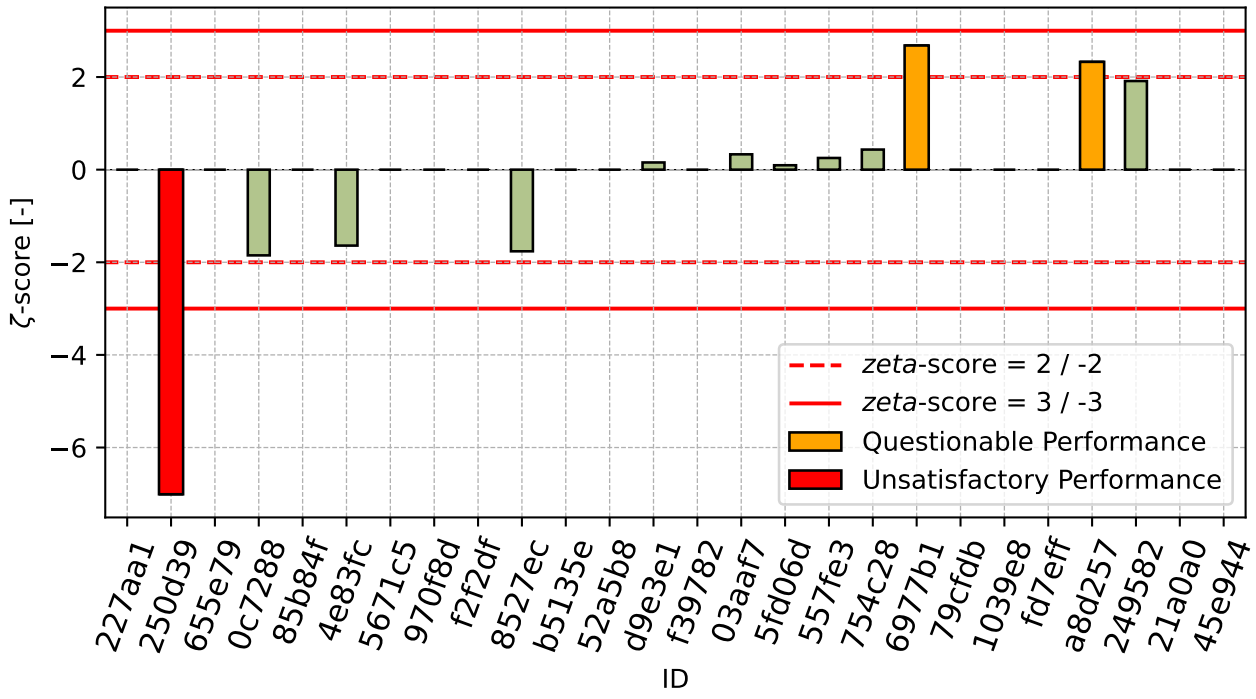

Figure 69: ζ-score

Table 51: z-score and ζ-score

ID	z-score [-]	ζ-score [-]
227aa1	-2.54	-
250d39	-1.45	-7.01
655e79	-0.9	-
0c7288	-0.86	-1.85
85b84f	-0.78	-
4e83fc	-0.78	-1.64
5671c5	-0.62	-
970f8d	-0.46	-
f2f2df	-0.35	-
8527ec	-0.35	-1.76
b5135e	-0.27	-
52a5b8	-0.23	-
d9e3e1	0.05	0.16
f39782	0.07	-
03aaf7	0.07	0.33
5fd06d	0.07	0.1
557fe3	0.12	0.25
754c28	0.24	0.43
6977b1	0.57	2.68
79cfdb	0.74	-
1039e8	0.75	-
fd7eff	0.93	-
a8d257	0.99	2.33

Continued on next page

Continued from previous page

ID	z-score [-]	ζ-score [-]
249582	1.16	1.91
21a0a0	1.33	-
45e944	2.5	-

7.3 200 kPa

7.3.1 Test results

Table 52: Test results - ordered by average value. Outliers are marked by red color. u_X - extended uncertainty of measurement.

ID	Test results [kPa]	u_X [kPa]
227aa1	106.5	-
655e79	118.4	-
85b84f	134.0	-
8527ec	135.1	0.10
250d39	138.0	1.66
f2f2df	141.0	-
d9e3e1	142.3	10.50
6977b1	144.0	1.00
4e83fc	144.0	10.08
557fe3	144.5	5.00
5fd06d	146.0	4.00
03aaf7	147.0	0.14
970f8d	147.8	-
754c28	148.1	8.00
52a5b8	148.4	-
f39782	149.0	-
79cfdb	149.0	-
5671c5	149.8	-
0c7288	151.0	10.50
249582	152.0	10.79
b5135e	158.0	-
fd7eff	159.1	-
1039e8	167.2	-
a8d257	169.0	7.50
45e944	170.1	-
21a0a0	175.0	-

7.3.2 The Numerical Procedure for Determining Outliers

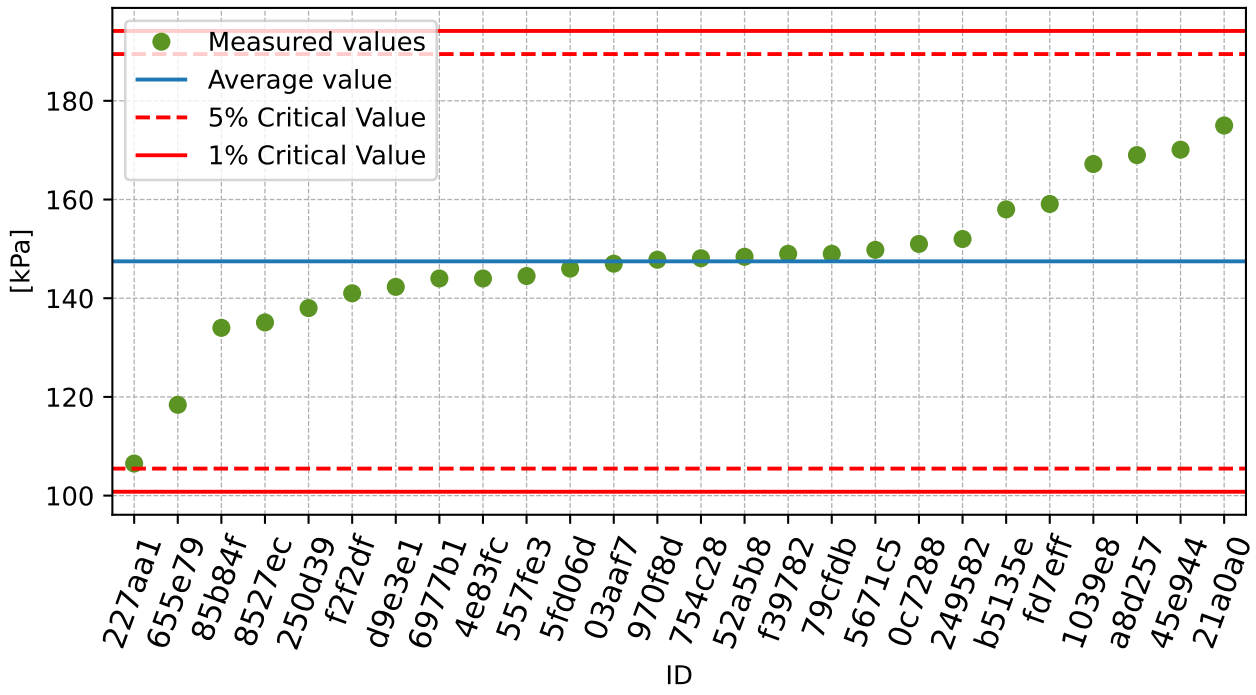

Figure 70: **Grubbs' test** - average values

7.3.3 Mandel's Statistics

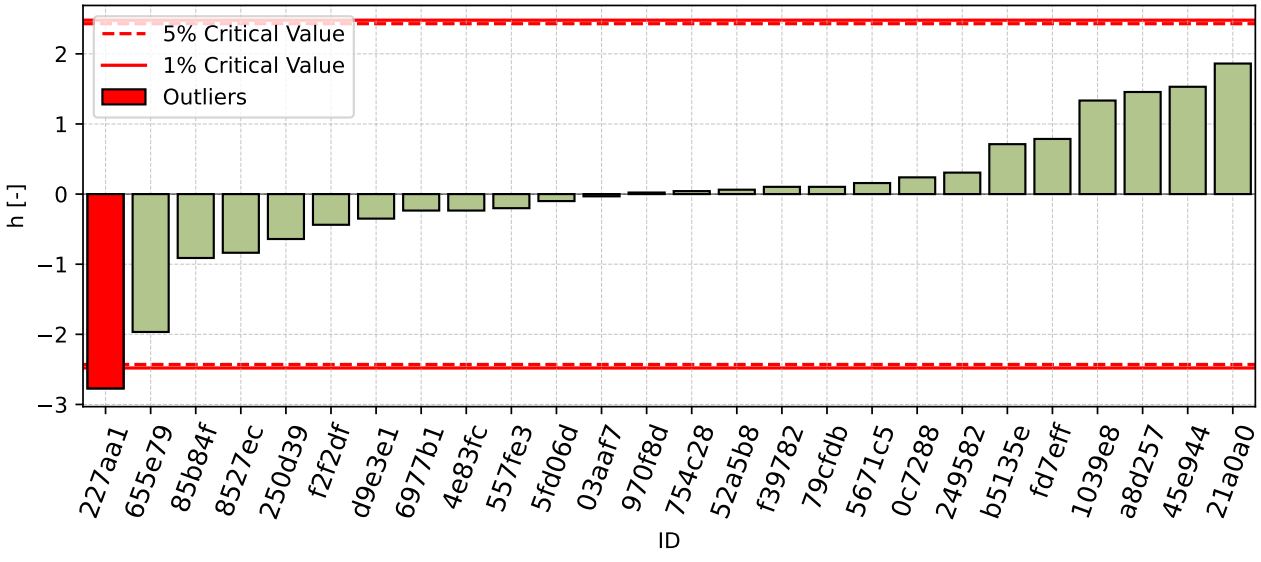

Figure 71: Interlaboratory Consistency Statistic

7.3.4 Descriptive statistics

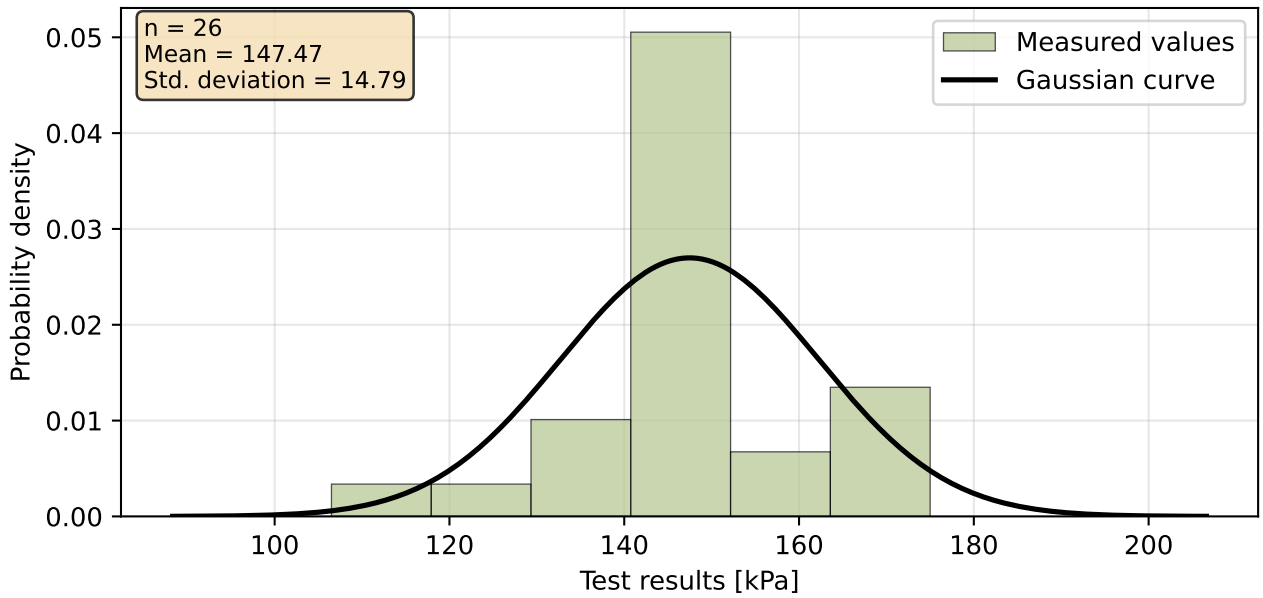

Figure 72: Histogram of all test results

Table 53: Descriptive statistics

Characteristics	**[kPa]**
Average value – $\bar{x}$	147.5
Sample standard deviation – s	14.79
Asigned value – x^*	147.5
Robust standard deviation – s^*	14.79
Measurement uncertainty of asigned value – u_X	2.9
p-value of normality test	0.073 [-]

7.3.5 Evaluation of Performance Statistics

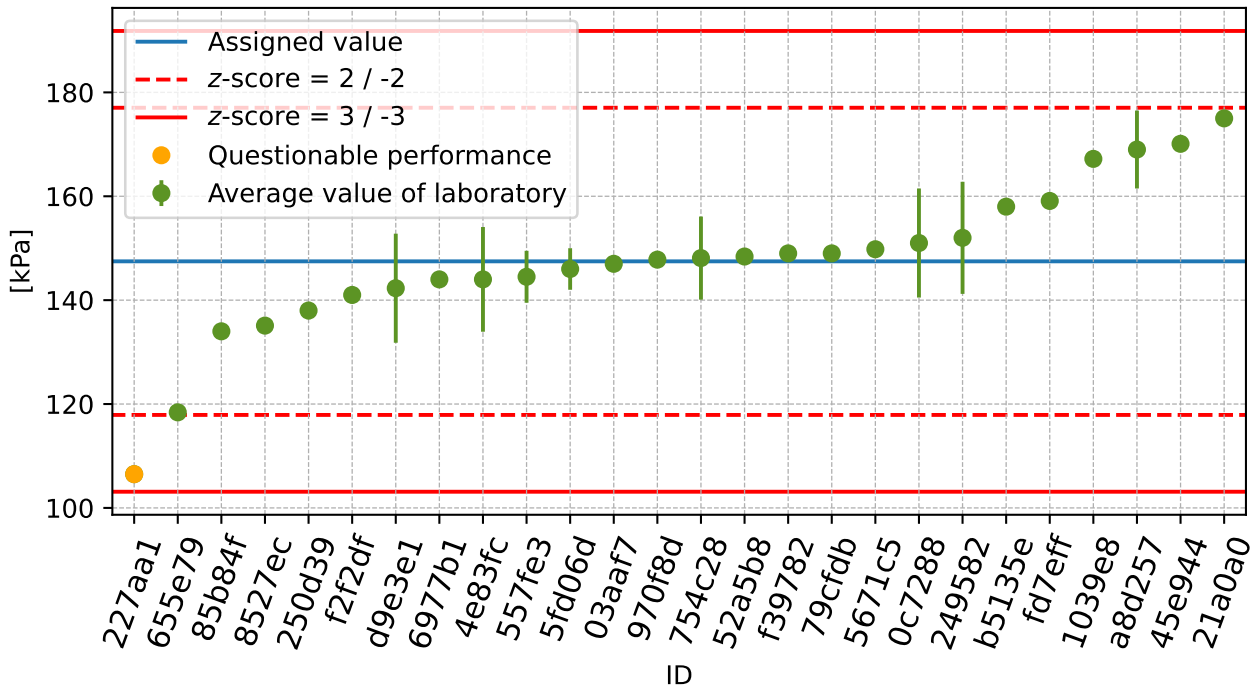

Figure 73: Average values and extended uncertainties of measurement

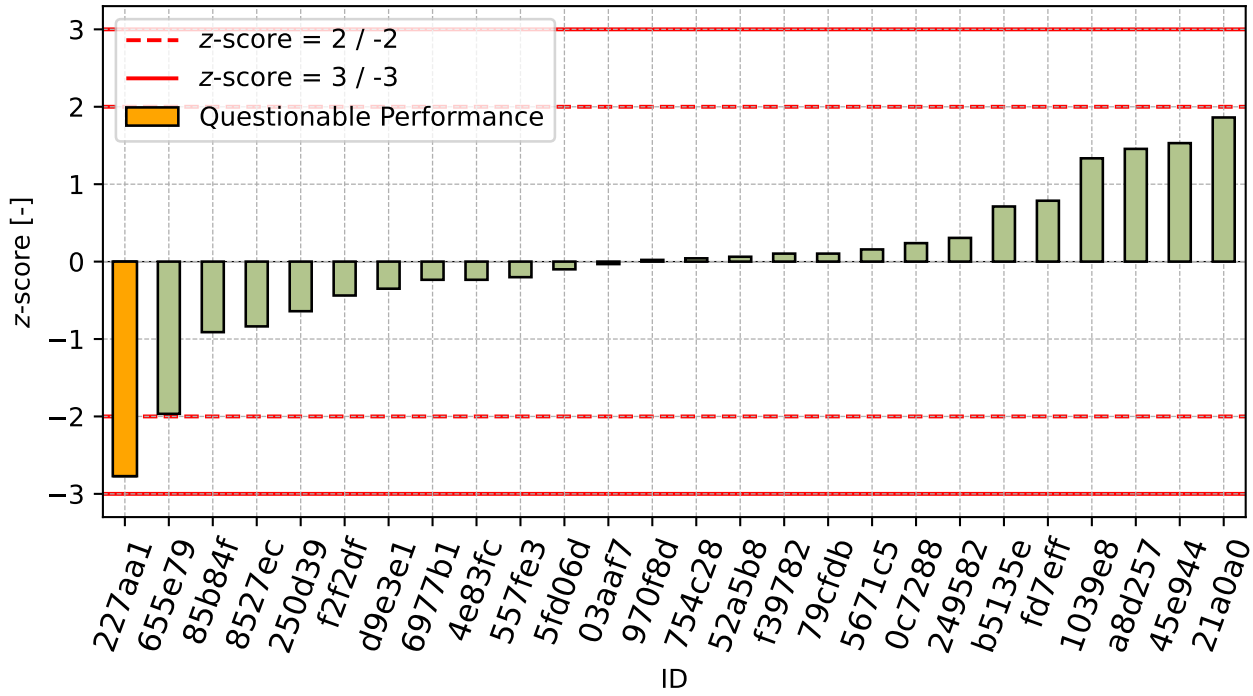

Figure 74: z-score

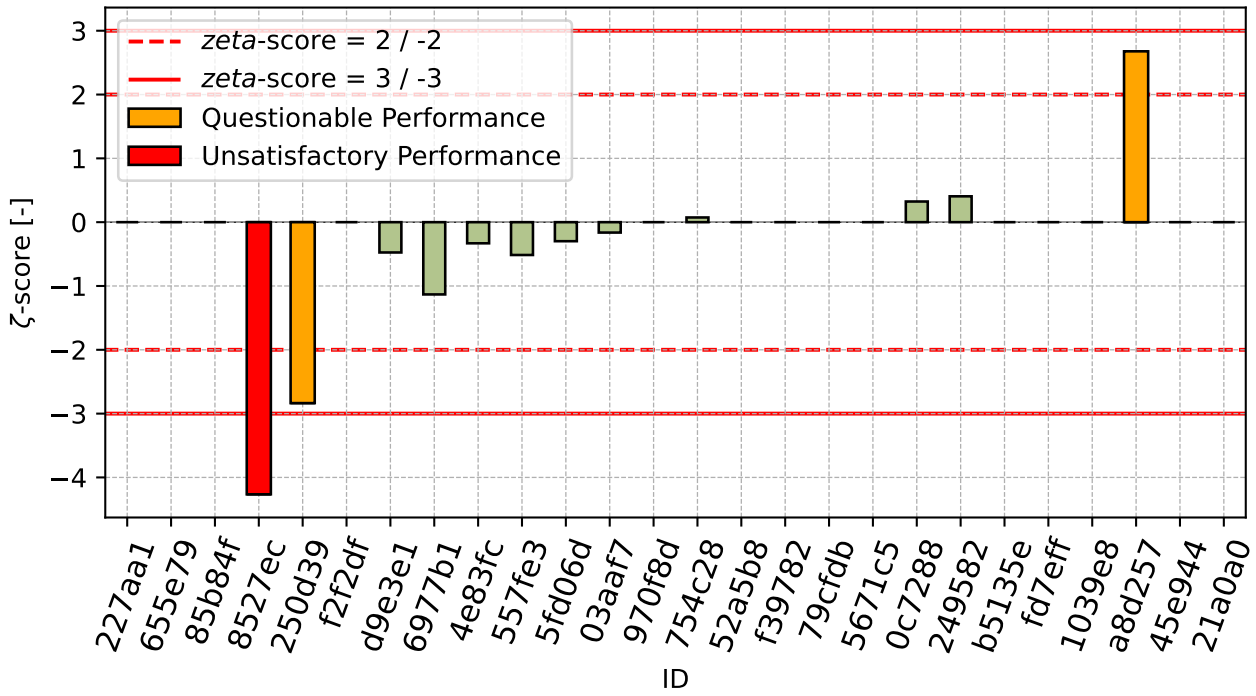

Figure 75: ζ-score

Table 54: z-score and ζ-score

ID	z-score [-]	ζ-score [-]
227aa1	-2.77	-
655e79	-1.97	-
85b84f	-0.91	-
8527ec	-0.84	-4.26
250d39	-0.64	-2.84
f2f2df	-0.44	-
d9e3e1	-0.35	-0.47
6977b1	-0.23	-1.13
4e83fc	-0.23	-0.33
557fe3	-0.2	-0.51
5fd06d	-0.1	-0.3
03aaf7	-0.03	-0.16
970f8d	0.02	-
754c28	0.04	0.07
52a5b8	0.06	-
f39782	0.1	-
79cfdb	0.1	-
5671c5	0.16	-
0c7288	0.24	0.32
249582	0.31	0.41
b5135e	0.71	-
fd7eff	0.79	-
1039e8	1.33	-

Continued on next page

Continued from previous page

ID	z-score [-]	ζ-score [-]
a8d257	1.46	2.68
45e944	1.53	-
21a0a0	1.86	-

7.4 400 kPa

7.4.1 Test results

Table 55: Test results - ordered by average value. Outliers are marked by red color. u_X - extended uncertainty of measurement.

ID	Test results [kPa]	u_X [kPa]
227aa1	196.8	-
655e79	219.9	-
557fe3	230.5	7.10
85b84f	238.0	-
8527ec	244.7	0.10
f39782	260.0	-
249582	263.0	18.67
5671c5	268.2	-
970f8d	270.4	-
79cfdb	272.3	-
d9e3e1	277.2	32.02
03aaf7	280.0	0.11
f2f2df	281.0	-
250d39	282.0	3.38
21a0a0	284.0	-
0c7288	286.0	20.00
4e83fc	286.0	20.02
b5135e	290.0	-
52a5b8	290.4	-
1039e8	290.6	-
a8d257	295.0	7.50
5fd06d	296.0	2.00
45e944	296.8	-
754c28	302.0	10.00
fd7eff	305.3	-
6977b1	306.0	1.00

7.4.2 The Numerical Procedure for Determining Outliers

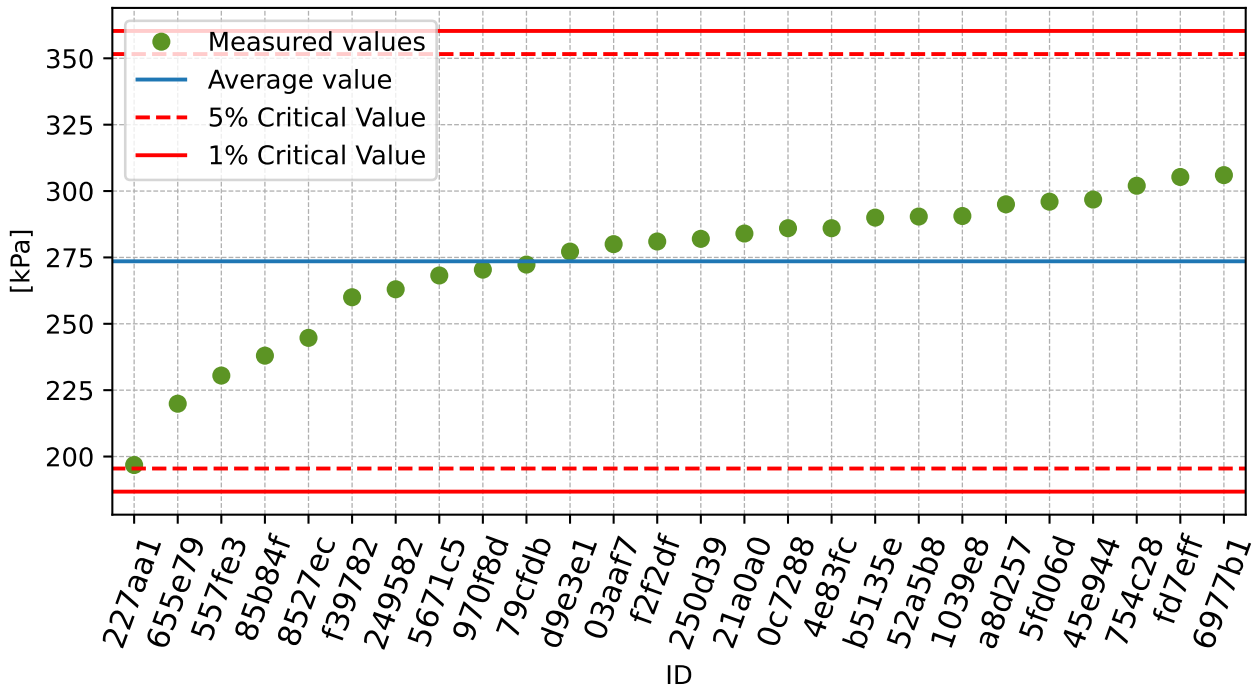

Figure 76: **Grubbs' test** - average values

7.4.3 Mandel's Statistics

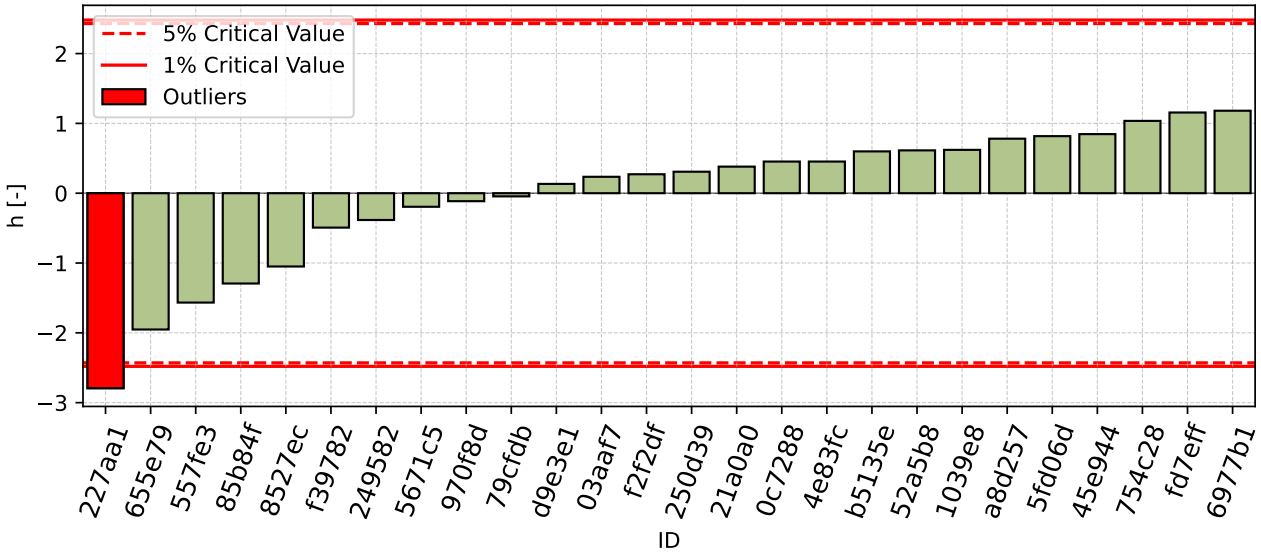

Figure 77: Interlaboratory Consistency Statistic

7.4.4 Descriptive statistics

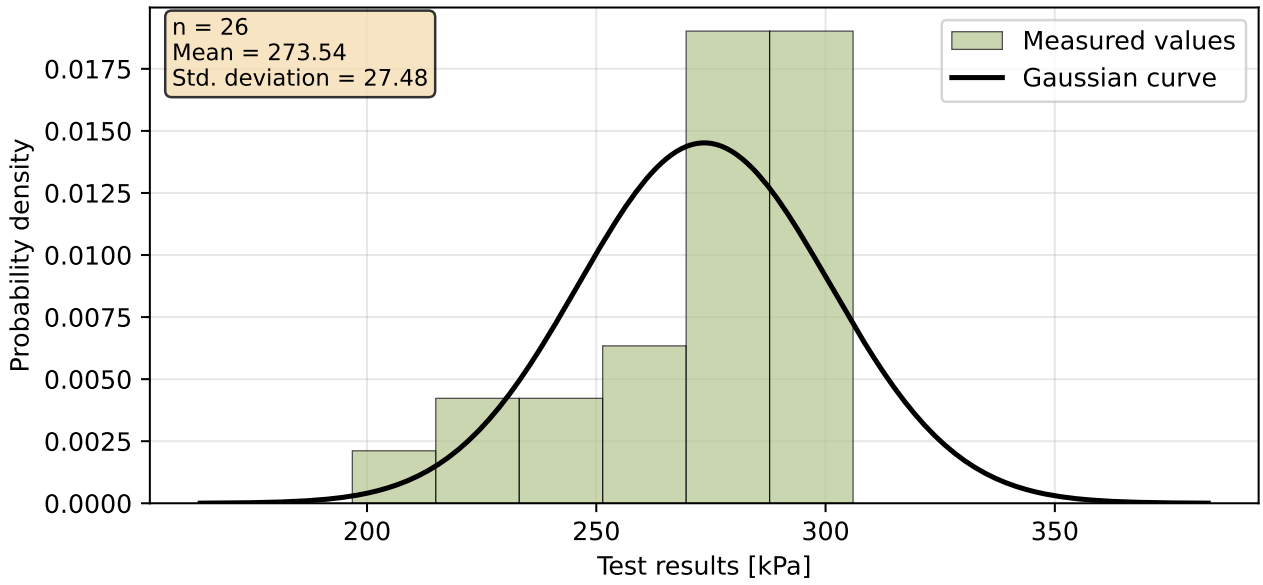

Figure 78: Histogram of all test results

Table 56: Descriptive statistics

Characteristics	**[kPa]**
Average value – $\bar{x}$	273.5
Sample standard deviation – s	27.48
Asigned value – x^*	273.5
Robust standard deviation – s^*	27.48
Measurement uncertainty of asigned value – u_X	5.39
p-value of normality test	0.006 [-]

7.4.5 Evaluation of Performance Statistics

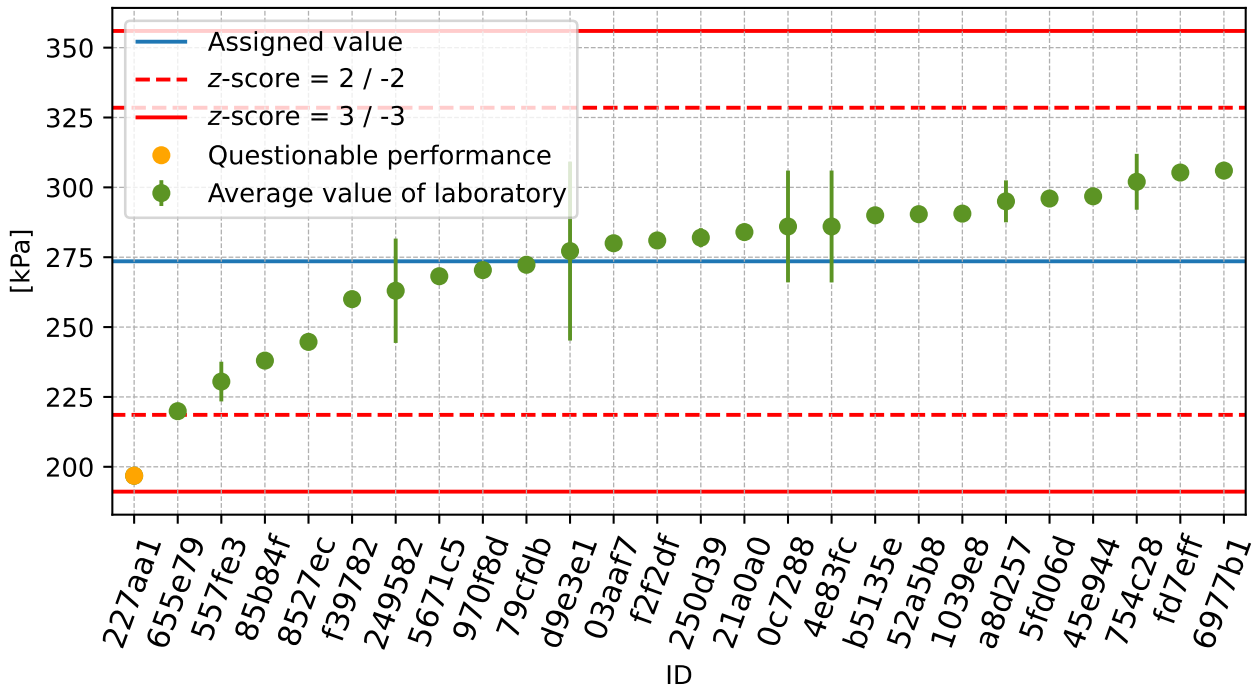

Figure 79: Average values and extended uncertainties of measurement

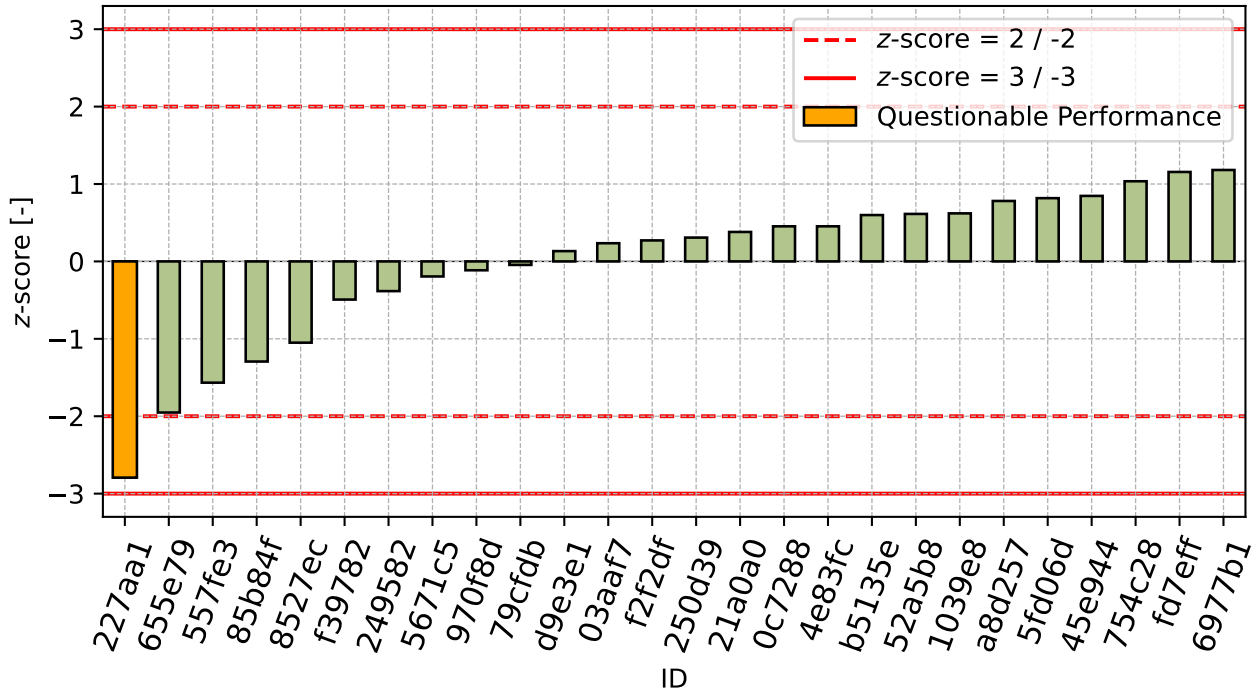

Figure 80: z-score

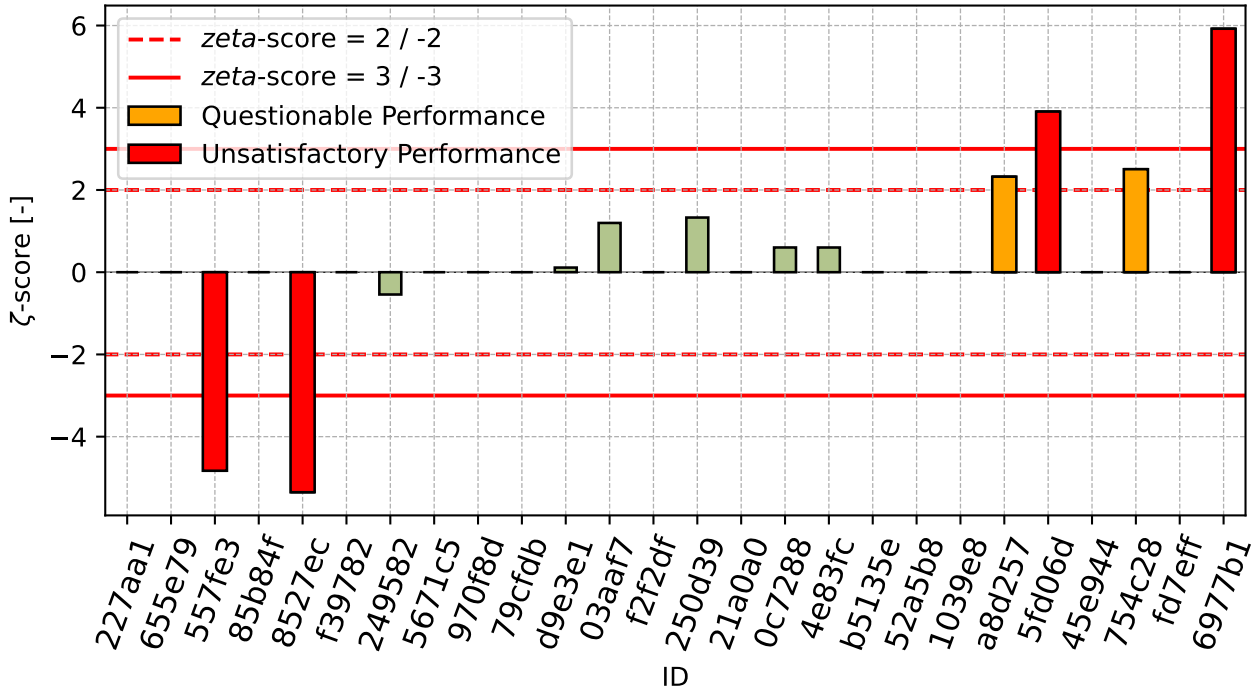

Figure 81: ζ-score

Table 57: z-score and ζ-score

ID	z-score [-]	ζ-score [-]
227aa1	-2.79	-
655e79	-1.95	-
557fe3	-1.57	-4.83
85b84f	-1.29	-
8527ec	-1.05	-5.35
f39782	-0.49	-
249582	-0.38	-0.54
5671c5	-0.19	-
970f8d	-0.11	-
79cfdb	-0.05	-
d9e3e1	0.13	0.11
03aaf7	0.24	1.2
f2f2df	0.27	-
250d39	0.31	1.33
21a0a0	0.38	-
0c7288	0.45	0.6
4e83fc	0.45	0.6
b5135e	0.6	-
52a5b8	0.61	-
1039e8	0.62	-
a8d257	0.78	2.32
5fd06d	0.82	3.91
45e944	0.85	-

Continued on next page

Continued from previous page

ID	z-score [-]	ζ-score [-]
754c28	1.04	2.51
fd7eff	1.16	-
6977b1	1.18	5.92

8 Appendix – EN ISO 17892-12, art. 5.3 – Atterberg limits

8.1 Liquid limit

8.1.1 Test results

Table 58: 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 [%]			u_X [%]	$\bar{x}$ [%]	s_0 [%]	V_X [%]
e01a62	30.0	30.0	29.0	2.00	29.7	0.58	1.95
716bbc	31.1	31.6	32.0	0.20	31.6	0.45	1.43
88de8c	32.2	32.2	32.4	4.80	32.3	0.12	0.36
66c346	32.5	32.5	32.5	-	32.5	0.00	0.00
777120	33.0	33.0	32.0	-	32.7	0.58	1.77
afb515	32.7	34.0	32.5	-	33.1	0.81	2.46
5880d9	33.1	33.1	33.1	-	33.1	0.00	0.00
45e944	33.8	32.8	33.2	-	33.3	0.50	1.51
655e79	33.7	33.9	34.0	-	33.9	0.15	0.45
140974	33.6	33.5	34.5	0.32	33.9	0.55	1.63
5671c5	34.0	33.8	34.1	-	34.0	0.15	0.45
1413f1	32.1	34.0	35.9	1.50	34.0	1.90	5.59
4d5dd5	34.0	33.8	34.2	-	34.0	0.20	0.59
21a0a0	34.1	33.8	34.2	-	34.0	0.21	0.61
b5135e	34.0	35.0	34.0	-	34.3	0.58	1.68
a8d257	34.0	35.0	34.0	0.80	34.3	0.58	1.68
571743	34.8	34.9	34.0	1.10	34.6	0.49	1.43
61afff	34.4	34.6	34.7	-	34.6	0.15	0.44
a65624	36.2	34.0	33.7	1.80	34.6	1.37	3.94
1039e8	34.9	35.0	35.0	-	35.0	0.06	0.17
93ae6b	35.0	36.0	35.0	0.70	35.3	0.58	1.63
9b9c90	35.1	36.0	35.4	2.08	35.5	0.46	1.29
4e83fc	36.0	35.0	36.0	0.36	35.7	0.58	1.62
666c8c	36.0	37.0	36.0	1.00	36.3	0.58	1.59
28b09e	36.0	36.0	37.0	1.00	36.3	0.58	1.59
6977b1	37.0	36.4	38.2	1.60	37.2	0.92	2.46
0c7288	37.0	37.0	38.0	0.37	37.3	0.58	1.55
57335f	38.0	37.0	38.0	0.38	37.7	0.58	1.53
52a5b8	37.6	38.0	38.1	-	37.9	0.26	0.70
557fe3	37.9	38.3	38.0	2.00	38.1	0.21	0.55
8527ec	39.0	38.0	38.0	1.30	38.3	0.58	1.51
227aa1	39.0	39.0	39.0	-	39.0	0.00	0.00

8.1.2 The Numerical Procedure for Determining Outliers

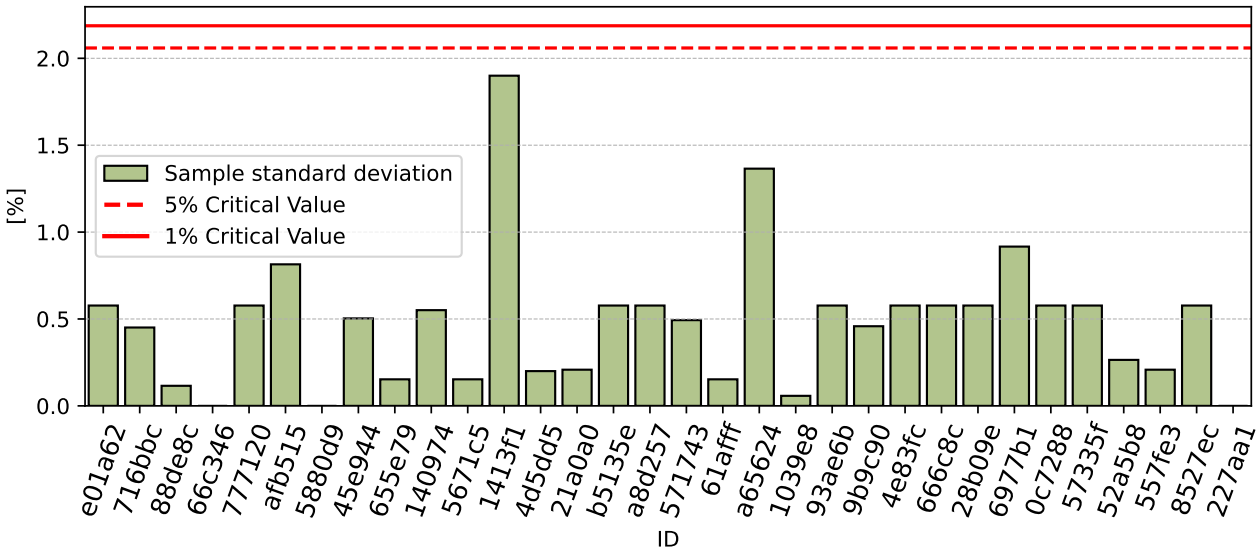

Figure 82: **Cochran's test** - sample standard deviations

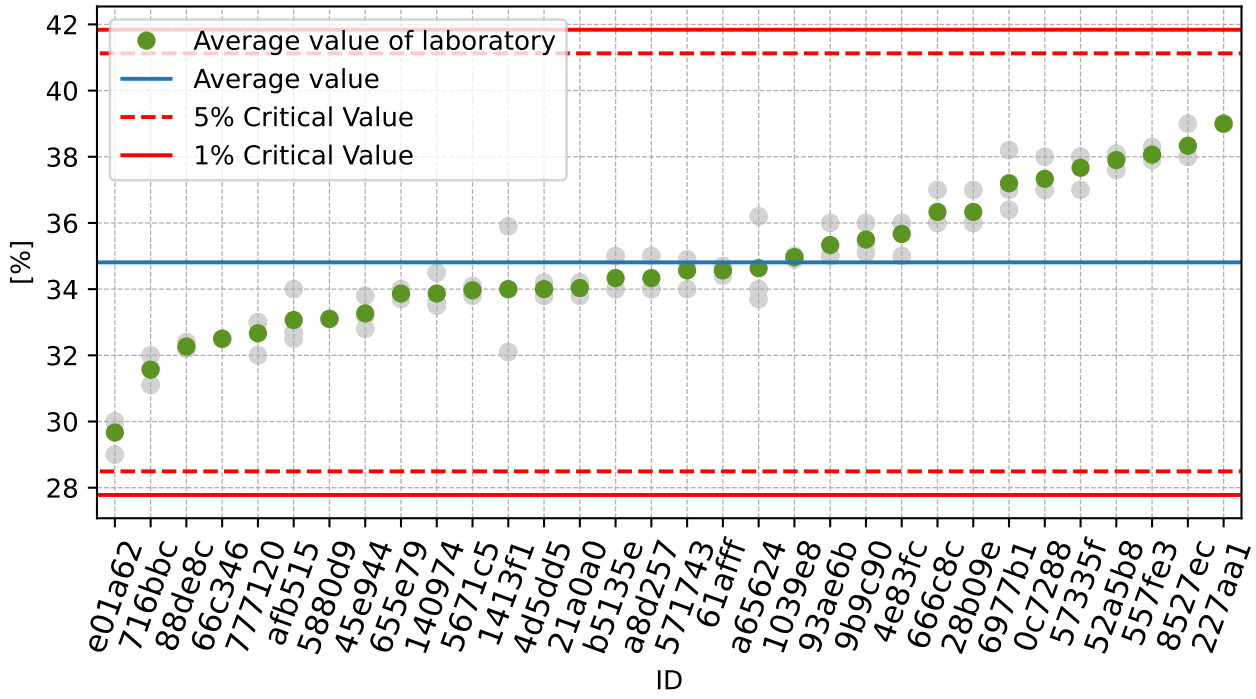

Figure 83: **Grubbs' test** - average values

8.1.3 Mandel's Statistics

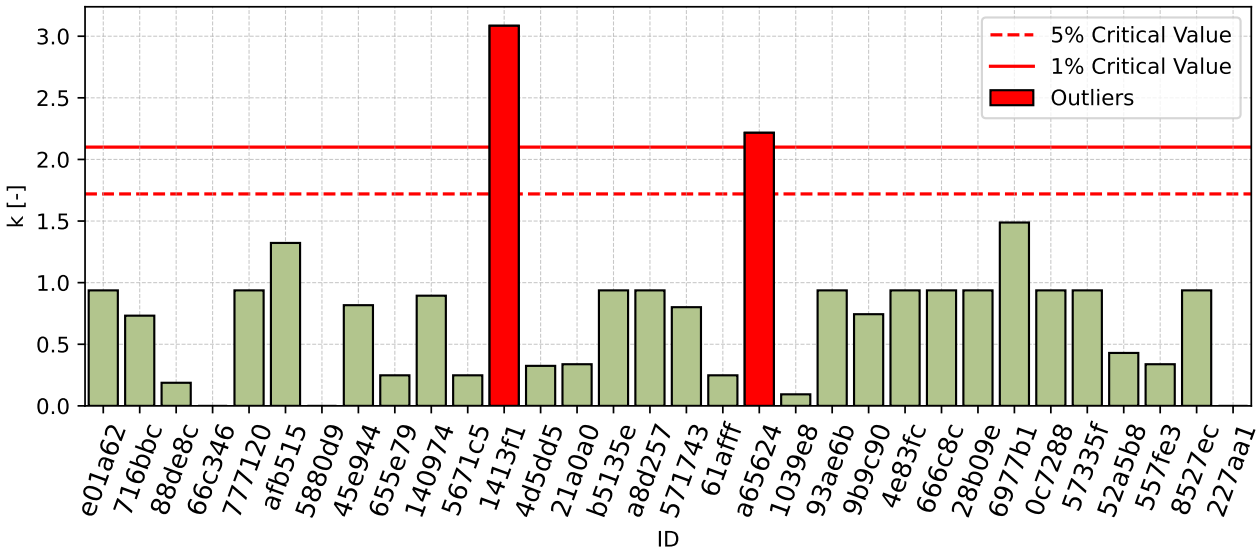

Figure 84: Intralaboratory Consistency Statistic

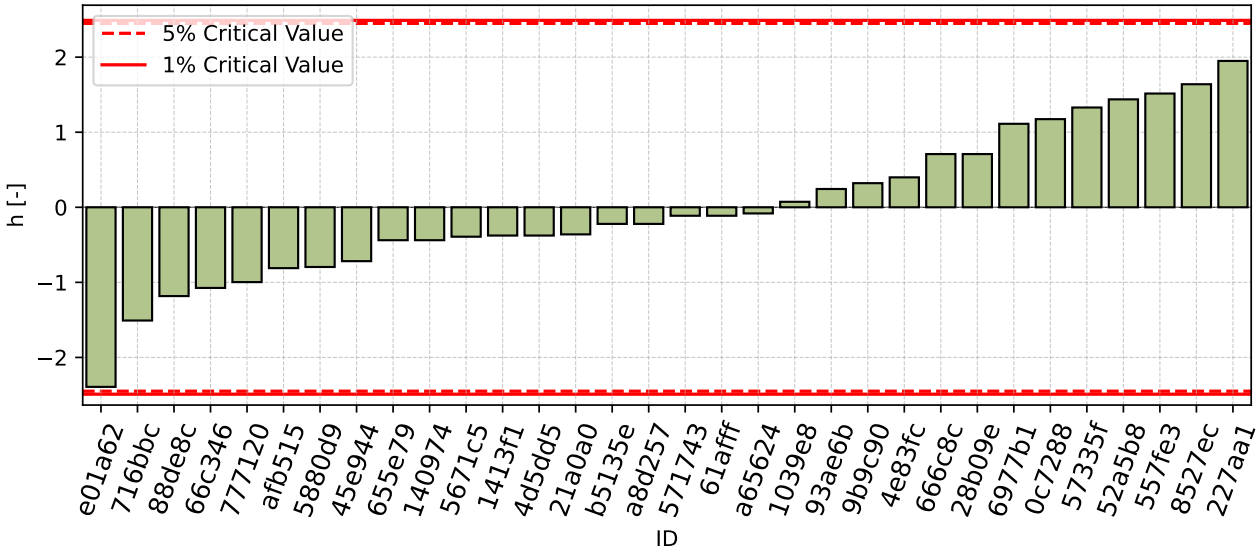

Figure 85: Interlaboratory Consistency Statistic

8.1.4 Descriptive statistics

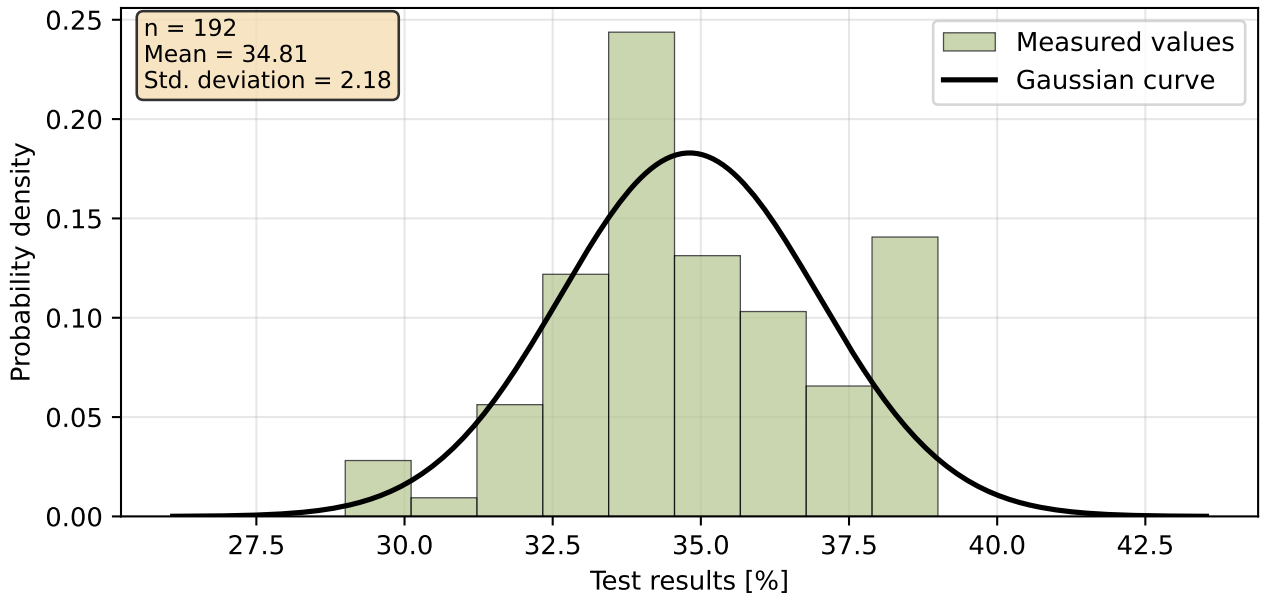

Figure 86: Histogram of all test results

Table 59: Descriptive statistics

Characteristics	**[%]**
Average value – $\bar{x}$	34.8
Sample standard deviation – s	2.15
Asigned value – x^*	34.8
Robust standard deviation – s^*	2.15
Measurement uncertainty of asigned value – u_X	0.38
p-value of normality test	0.033 [-]
Interlaboratory standard deviation – s_L	2.12
Repeatability standard deviation – s_r	0.62
Reproducibility standard deviation – s_R	2.21
Repeatability – r	1.7
Reproducibility – R	6.2

8.1.5 Evaluation of Performance Statistics

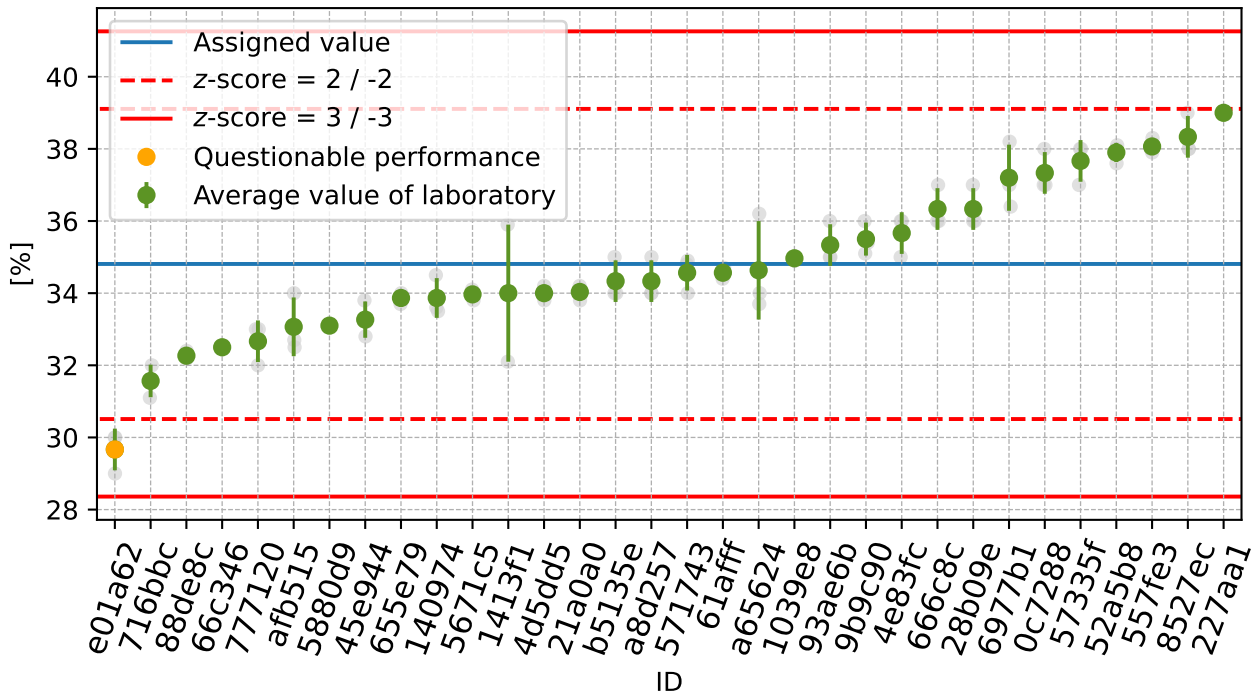

Figure 87: Average values and sample standard deviations

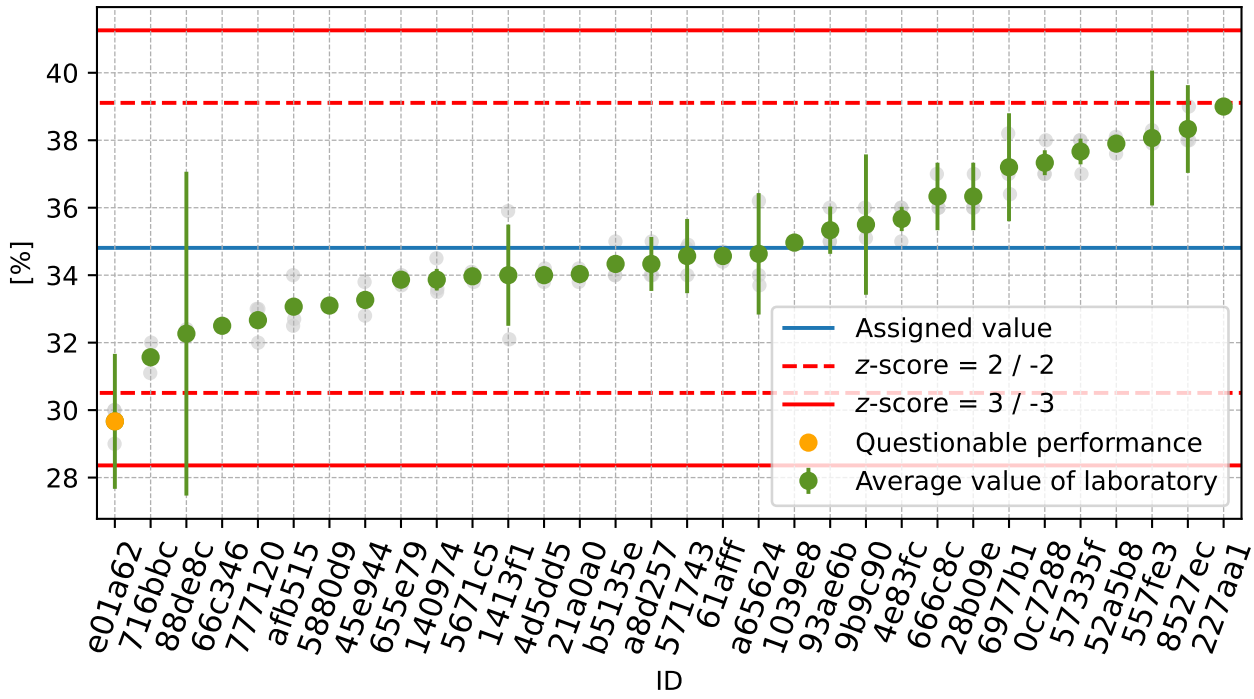

Figure 88: Average values and extended uncertainties of measurement

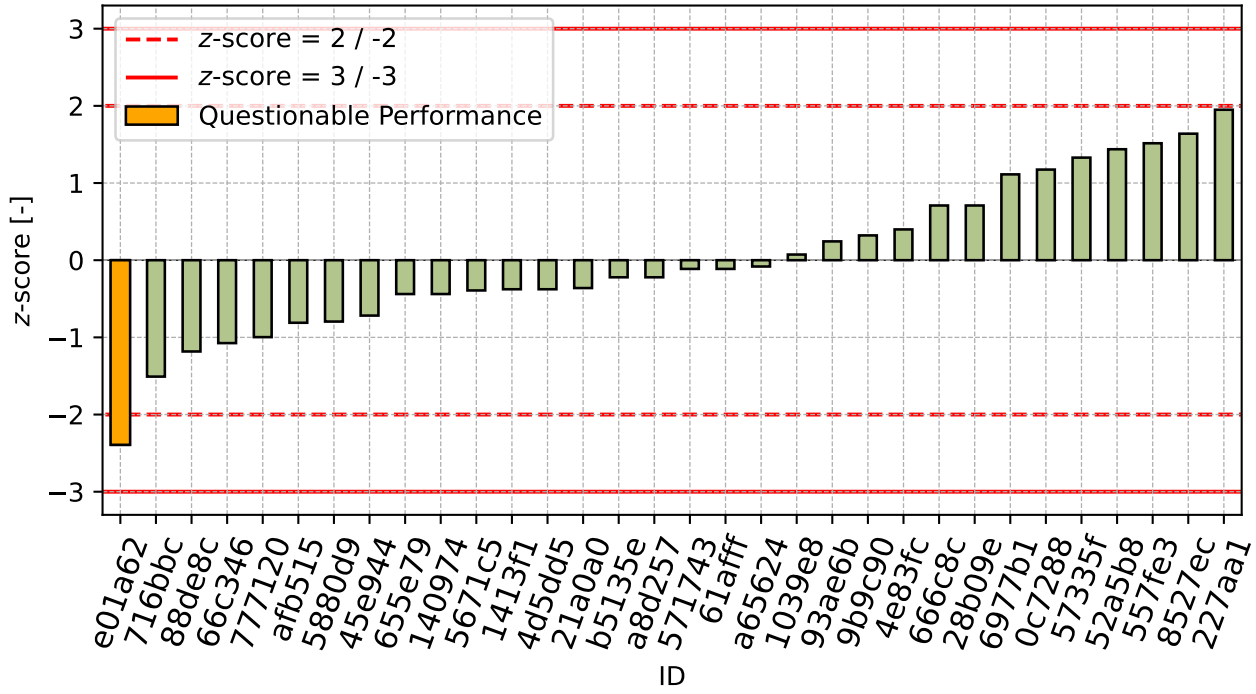

Figure 89: z-score

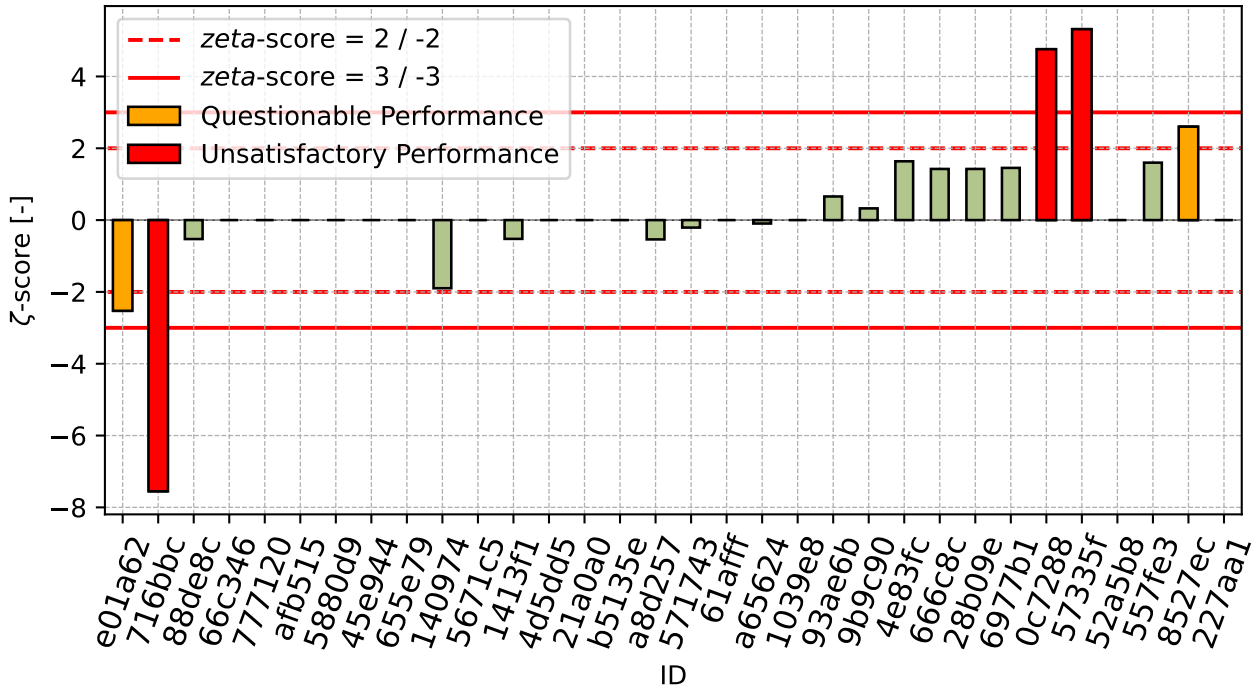

Figure 90: ζ-score

Table 60: z-score and ζ-score

ID	z-score [-]	ζ-score [-]
e01a62	-2.39	-2.53
716bbc	-1.51	-7.55
88de8c	-1.18	-0.53
66c346	-1.07	-
777120	-1.0	-
afb515	-0.81	-
5880d9	-0.8	-
45e944	-0.72	-
655e79	-0.44	-
140974	-0.44	-1.9
5671c5	-0.39	-
1413f1	-0.38	-0.52
4d5dd5	-0.38	-
21a0a0	-0.36	-
b5135e	-0.22	-
a8d257	-0.22	-0.54
571743	-0.11	-0.21
61afff	-0.11	-
a65624	-0.08	-0.1
1039e8	0.07	-
93ae6b	0.24	0.66
9b9c90	0.32	0.33
4e83fc	0.4	1.64
666c8c	0.71	1.42
28b09e	0.71	1.42
6977b1	1.11	1.45
0c7288	1.17	4.76
57335f	1.33	5.32
52a5b8	1.44	-
557fe3	1.52	1.6
8527ec	1.64	2.6
227aa1	1.95	-

8.2 Plastic limit

8.2.1 Test results

Table 61: 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 [%]			u_X [%]	$\bar{x}$ [%]	s_0 [%]	V_X [%]
6977b1	17.3	17.4	17.1	1.50	17.3	0.15	0.88
5671c5	19.0	18.9	19.1	-	19.0	0.10	0.53
227aa1	20.0	20.0	20.0	-	20.0	0.00	0.00
e01a62	21.0	19.0	20.0	2.00	20.0	1.00	5.00
1039e8	20.0	20.0	20.0	-	20.0	0.00	0.00
45e944	20.2	19.8	20.3	-	20.1	0.26	1.32
b5135e	20.0	21.0	20.0	-	20.3	0.58	2.84
a8d257	20.0	20.0	22.0	0.70	20.7	1.15	5.59
716bbc	21.1	20.8	20.5	0.20	20.8	0.30	1.44
140974	20.8	20.7	21.5	0.22	21.0	0.44	2.08
4d5dd5	21.1	21.0	21.3	-	21.1	0.15	0.72
571743	20.5	21.9	21.2	1.40	21.2	0.70	3.30
93ae6b	21.0	21.0	22.0	0.20	21.3	0.58	2.71
666c8c	22.0	22.0	20.0	1.10	21.3	1.15	5.41
8527ec	21.0	22.0	21.0	1.30	21.3	0.58	2.71
85b84f	21.4	21.1	21.7	-	21.4	0.30	1.40
88de8c	20.8	22.0	21.5	1.00	21.4	0.60	2.81
8b2244	21.2	21.5	21.7	-	21.5	0.25	1.17
557fe3	21.4	22.2	21.3	4.00	21.6	0.49	2.28
655e79	21.5	21.7	21.9	-	21.7	0.20	0.92
21a0a0	21.4	22.9	21.5	-	21.9	0.84	3.82
57335f	22.0	22.0	22.0	0.01	22.0	0.00	0.00
28b09e	22.0	22.0	22.0	1.00	22.0	0.00	0.00
61afff	21.9	22.3	22.1	-	22.1	0.20	0.90
0c7288	22.0	22.0	23.0	0.44	22.3	0.58	2.59
040aa6	21.9	22.6	22.8	0.70	22.4	0.47	2.11
52a5b8	22.4	22.6	22.4	-	22.5	0.12	0.51
5880d9	22.5	22.6	22.4	-	22.5	0.10	0.44
9b9c90	22.9	22.9	22.0	1.66	22.6	0.52	2.30
a65624	23.1	23.0	22.1	1.15	22.7	0.55	2.42
1413f1	23.4	23.6	23.8	1.50	23.6	0.20	0.85
afb515	23.6	23.9	24.0	-	23.8	0.21	0.87
777120	25.0	25.0	25.0	-	25.0	0.00	0.00
4e83fc	25.0	25.0	25.0	0.50	25.0	0.00	0.00

8.2.2 The Numerical Procedure for Determining Outliers

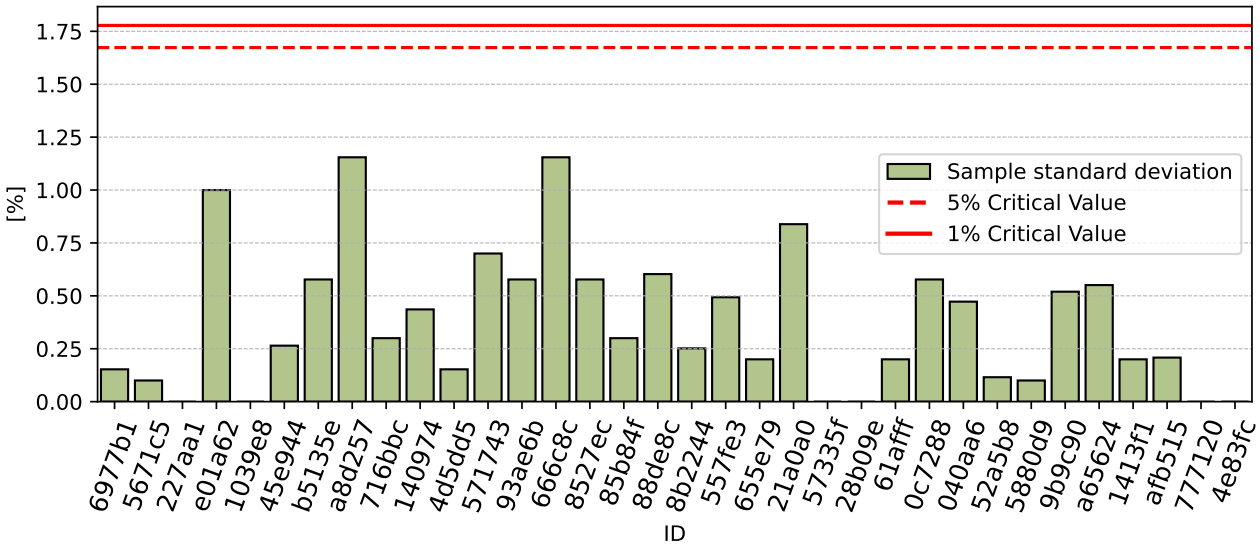

Figure 91: **Cochran's test** - sample standard deviations

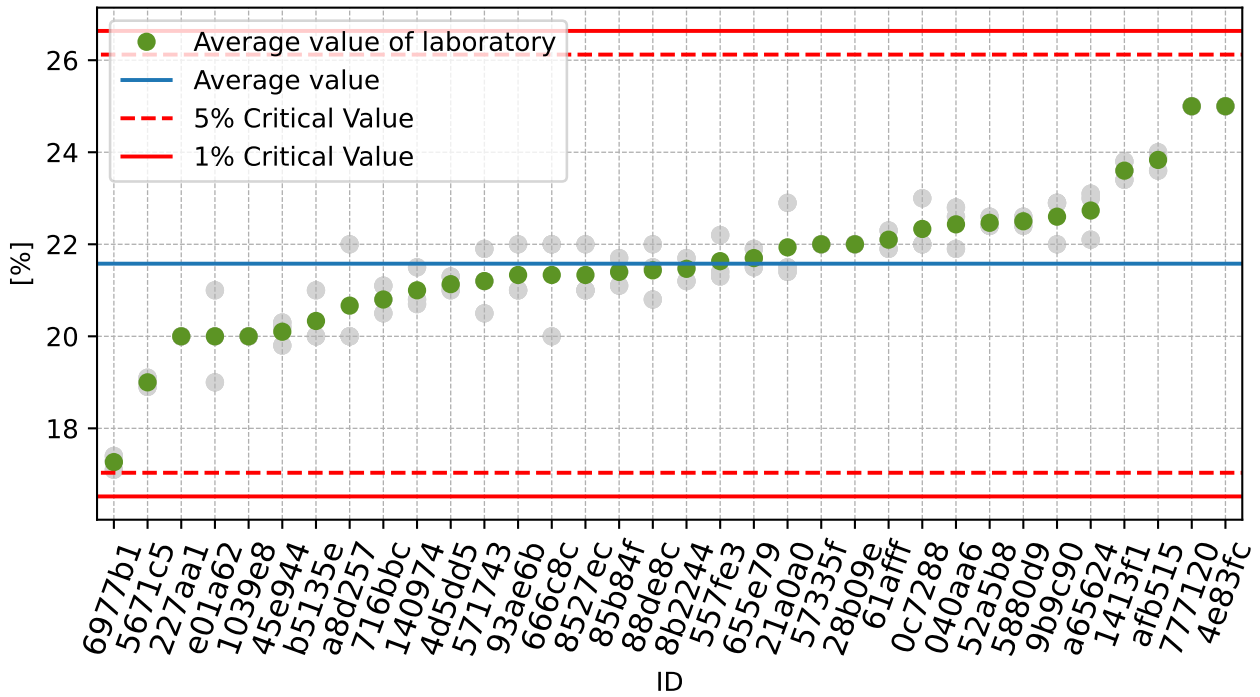

Figure 92: **Grubbs' test** - average values

8.2.3 Mandel's Statistics

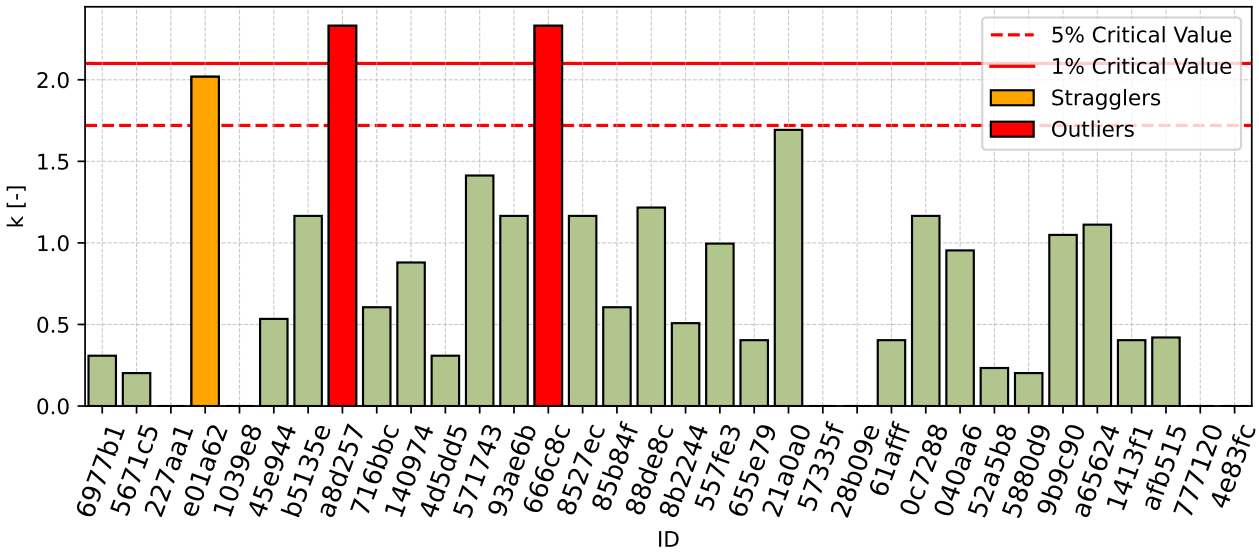

Figure 93: Intralaboratory Consistency Statistic

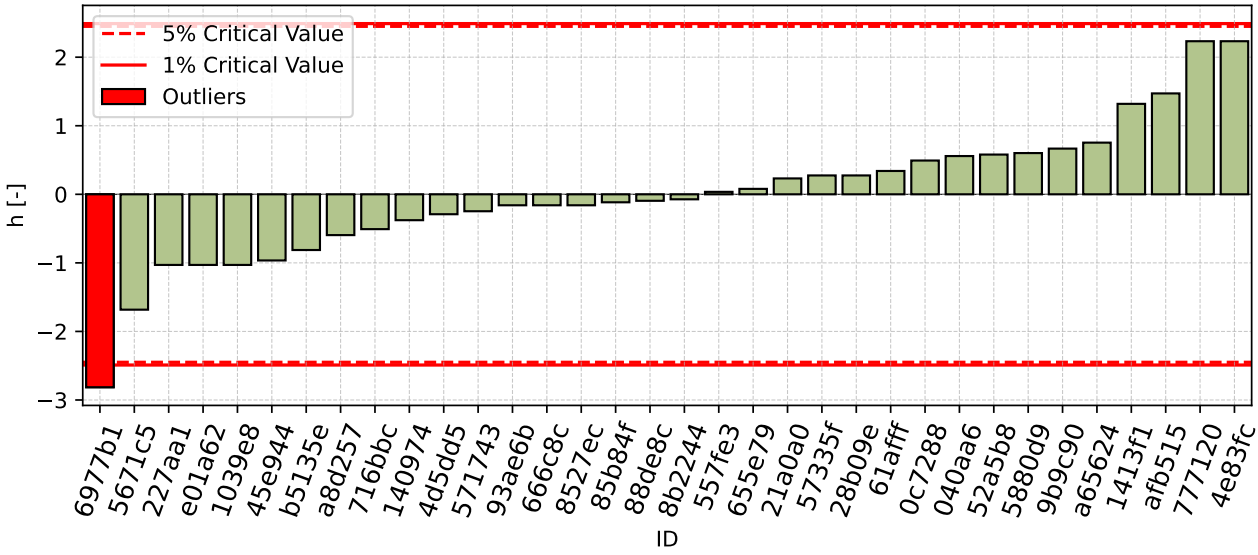

Figure 94: Interlaboratory Consistency Statistic

8.2.4 Descriptive statistics

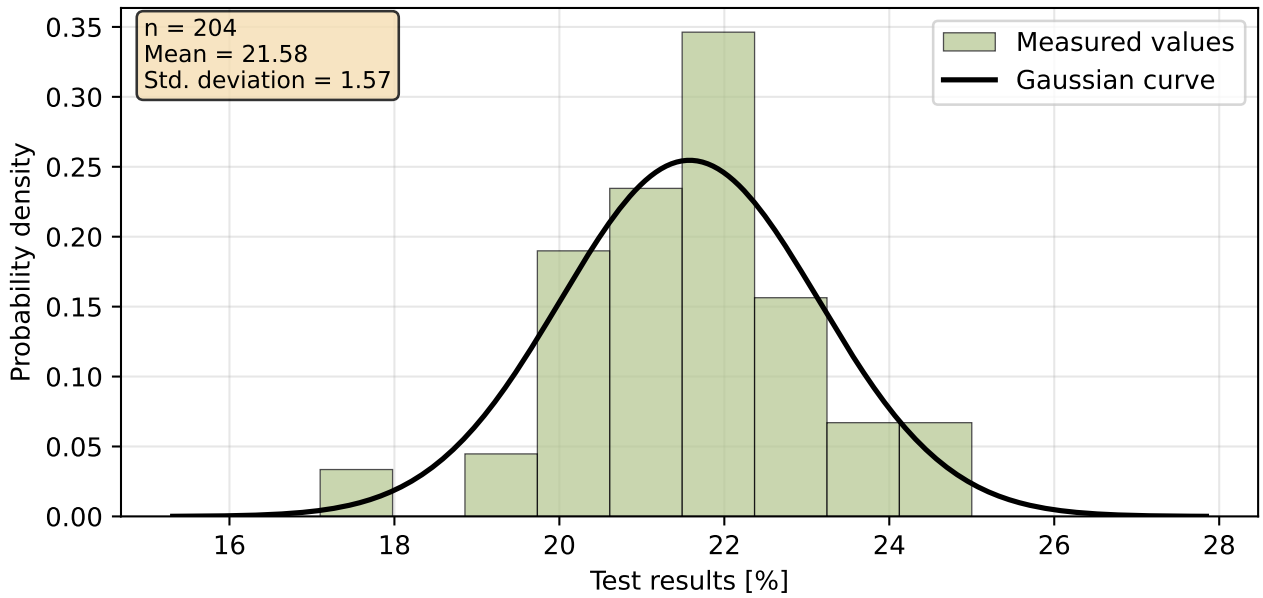

Figure 95: Histogram of all test results

Table 62: Descriptive statistics

Characteristics	**[%]**
Average value – $\bar{x}$	21.6
Sample standard deviation – s	1.53
Asigned value – x^*	21.6
Robust standard deviation – s^*	1.53
Measurement uncertainty of asigned value – u_X	0.26
p-value of normality test	0.007 [-]
Interlaboratory standard deviation – s_L	1.51
Repeatability standard deviation – s_r	0.5
Reproducibility standard deviation – s_R	1.58
Repeatability – r	1.4
Reproducibility – R	4.4

8.2.5 Evaluation of Performance Statistics

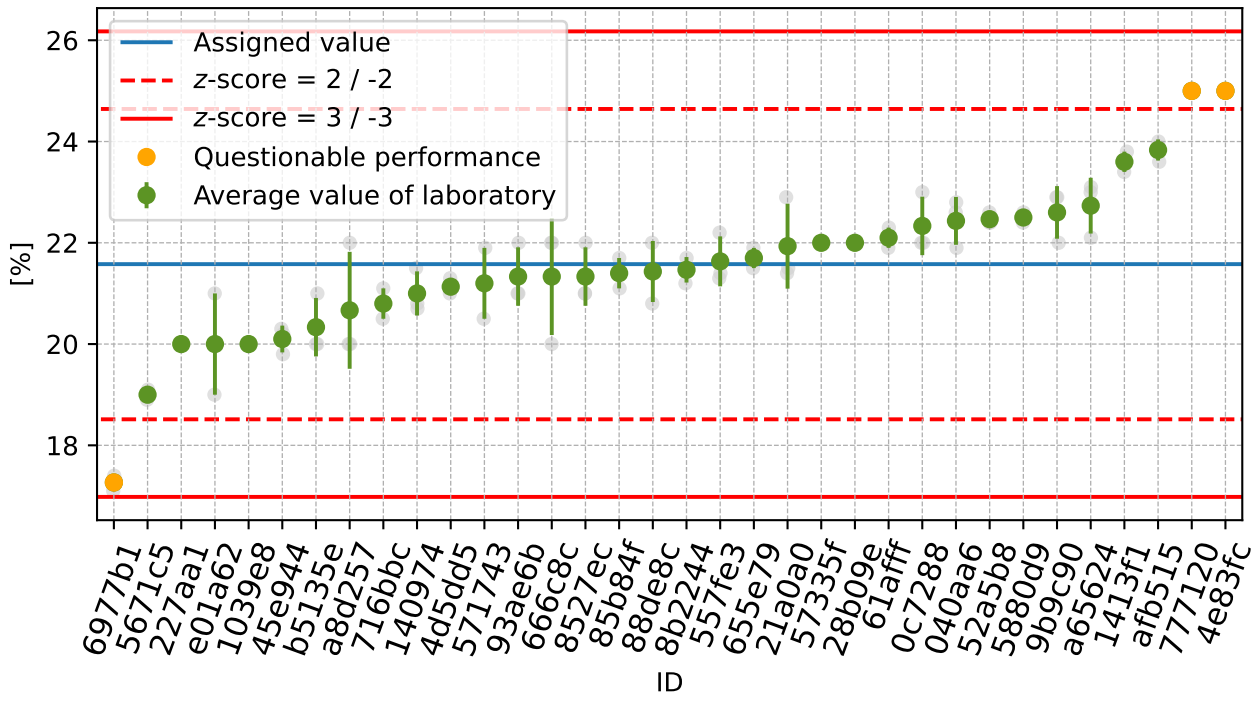

Figure 96: Average values and sample standard deviations

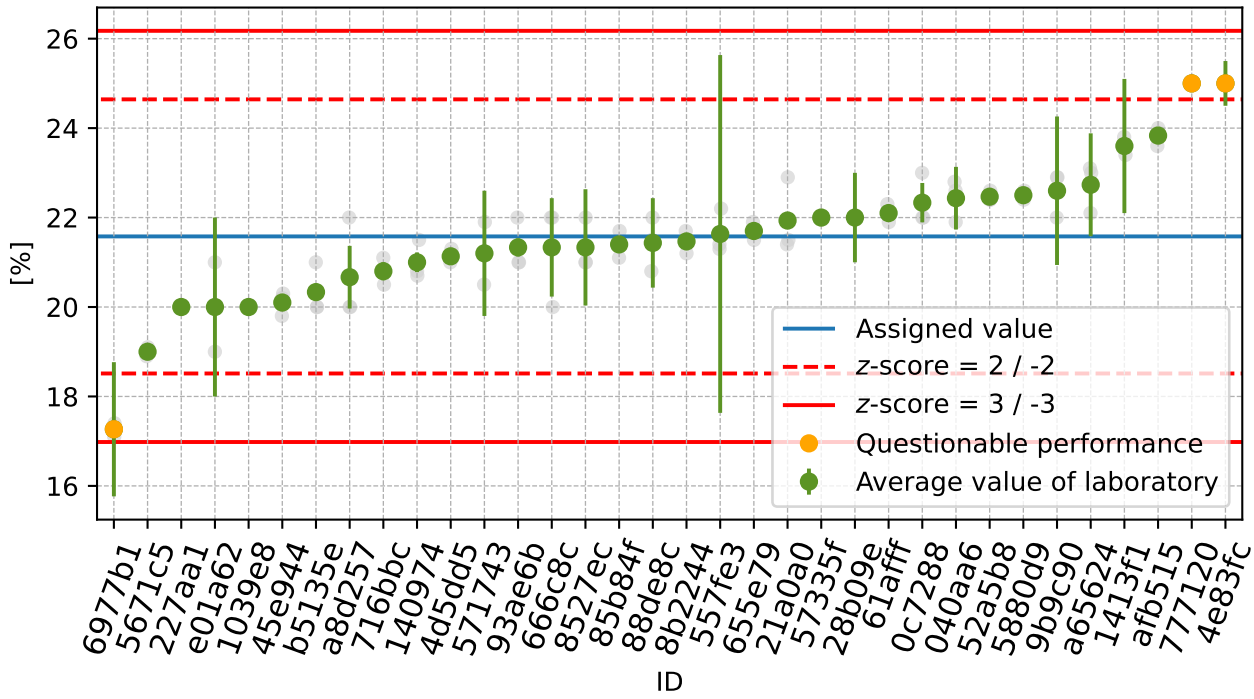

Figure 97: Average values and extended uncertainties of measurement

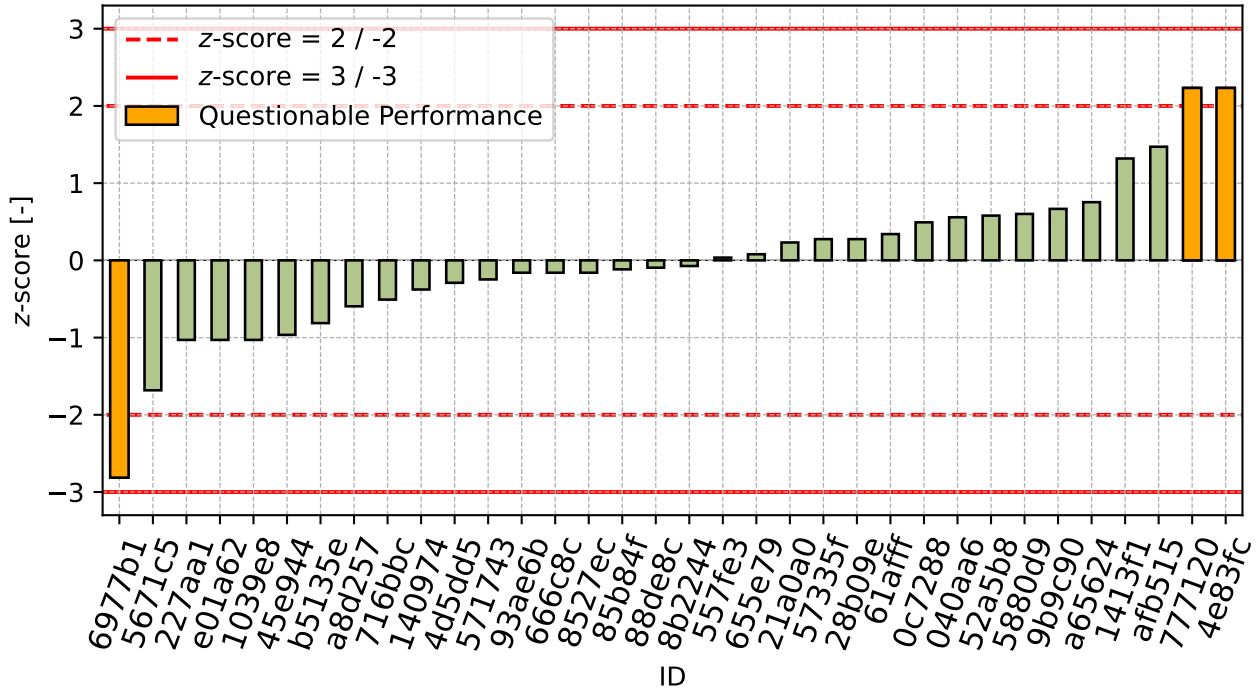

Figure 98: z-score

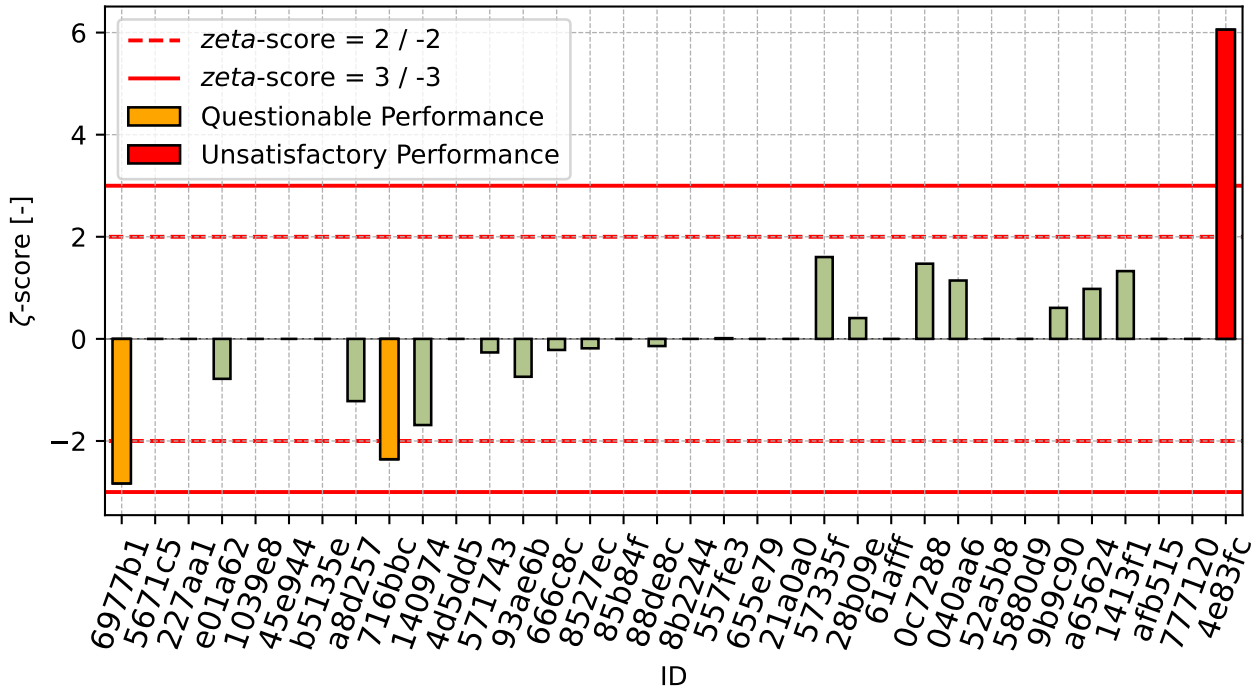

Figure 99: ζ-score

Table 63: z-score and ζ-score

ID	z-score [-]	ζ-score [-]
6977b1	-2.81	-2.83
5671c5	-1.68	-
227aa1	-1.03	-
e01a62	-1.03	-0.78
1039e8	-1.03	-
45e944	-0.96	-
b5135e	-0.81	-
a8d257	-0.6	-1.22
716bbc	-0.51	-2.36
140974	-0.38	-1.69
4d5dd5	-0.29	-
571743	-0.25	-0.27
93ae6b	-0.16	-0.74
666c8c	-0.16	-0.22
8527ec	-0.16	-0.18
85b84f	-0.12	-
88de8c	-0.09	-0.14
8b2244	-0.07	-
557fe3	0.04	0.01
655e79	0.08	-
21a0a0	0.23	-
57335f	0.28	1.6
28b09e	0.28	0.41
61afff	0.34	-
0c7288	0.49	1.47
040aa6	0.56	1.14
52a5b8	0.58	-
5880d9	0.6	-
9b9c90	0.67	0.61
a65624	0.75	0.98
1413f1	1.32	1.33
afb515	1.47	-
777120	2.23	-
4e83fc	2.23	6.06

9 Appendix – EN ISO 17892-12, art. 5.4 – Atterberg limits (Casagrande)

9.1 Test results

Table 64: 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 [%]			u_X [%]	$\bar{x}$ [%]	s_0 [%]	V_X [%]
b3d1e7	26.8	25.9	25.5	-	26.1	0.67	2.55
5880d9	30.1	31.3	29.8	-	30.4	0.79	2.61
8b2244	30.4	30.5	30.3	-	30.4	0.10	0.33
85b84f	30.5	30.1	30.8	-	30.5	0.35	1.15
754c28	30.3	30.1	31.2	3.00	30.5	0.59	1.92
afb2e8	31.4	30.5	30.1	-	30.7	0.67	2.17
9b9c90	31.3	30.8	30.8	1.37	31.0	0.29	0.93
21a0a0	31.6	32.1	31.4	-	31.7	0.36	1.14
fd7eff	31.8	31.7	31.7	-	31.7	0.06	0.18
03aaf7	32.0	32.0	32.0	0.68	32.0	0.00	0.00
79cfdb	32.4	32.1	32.1	0.50	32.2	0.17	0.54
12ba1b	32.1	32.2	32.3	3.00	32.2	0.10	0.31
b5135e	32.0	32.0	33.0	-	32.3	0.58	1.79
93ae6b	33.0	33.0	32.0	1.60	32.7	0.58	1.77
a8d257	34.0	33.0	32.0	0.80	33.0	1.00	3.03
5671c5	33.1	33.0	33.2	-	33.1	0.10	0.30
61afff	33.2	33.4	33.4	-	33.3	0.12	0.35
040aa6	33.0	32.7	34.4	1.70	33.4	0.91	2.72
5685e9	33.5	33.7	33.9	7.20	33.7	0.20	0.59
1039e8	33.8	33.9	34.1	-	33.9	0.15	0.45
d27b5f	36.4	33.9	33.1	8.30	34.5	1.72	4.99
fb5cad	34.8	34.5	34.5	0.43	34.6	0.17	0.50
fa43b2	34.7	35.2	35.3	6.98	35.1	0.32	0.92
557fe3	35.2	36.5	36.7	2.00	36.1	0.81	2.25

9.2 The Numerical Procedure for Determining Outliers

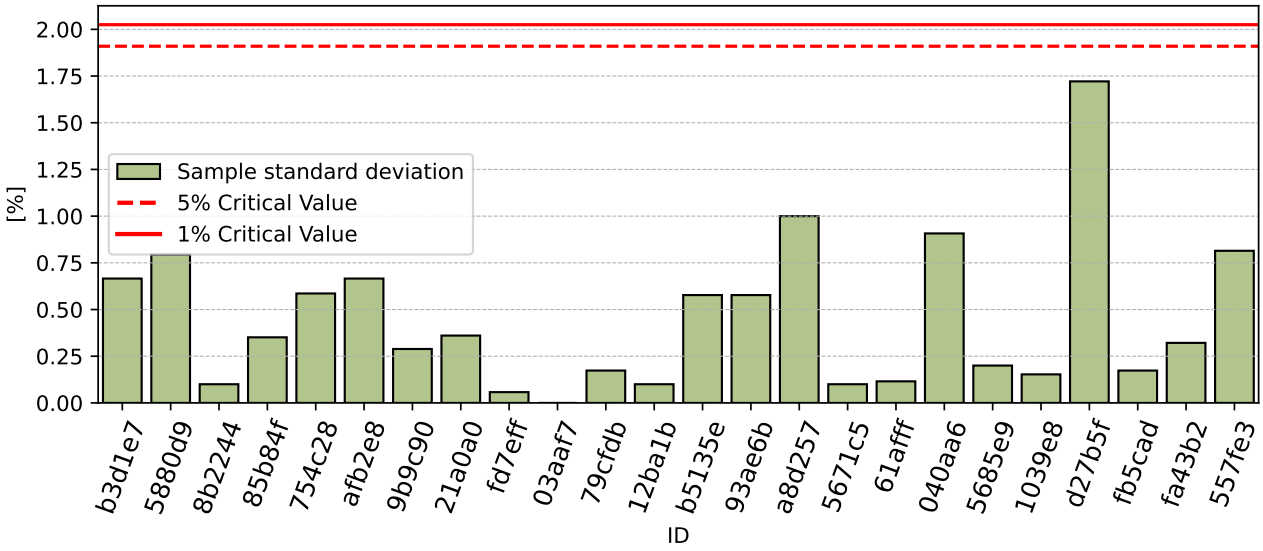

Figure 100: **Cochran's test** - sample standard deviations

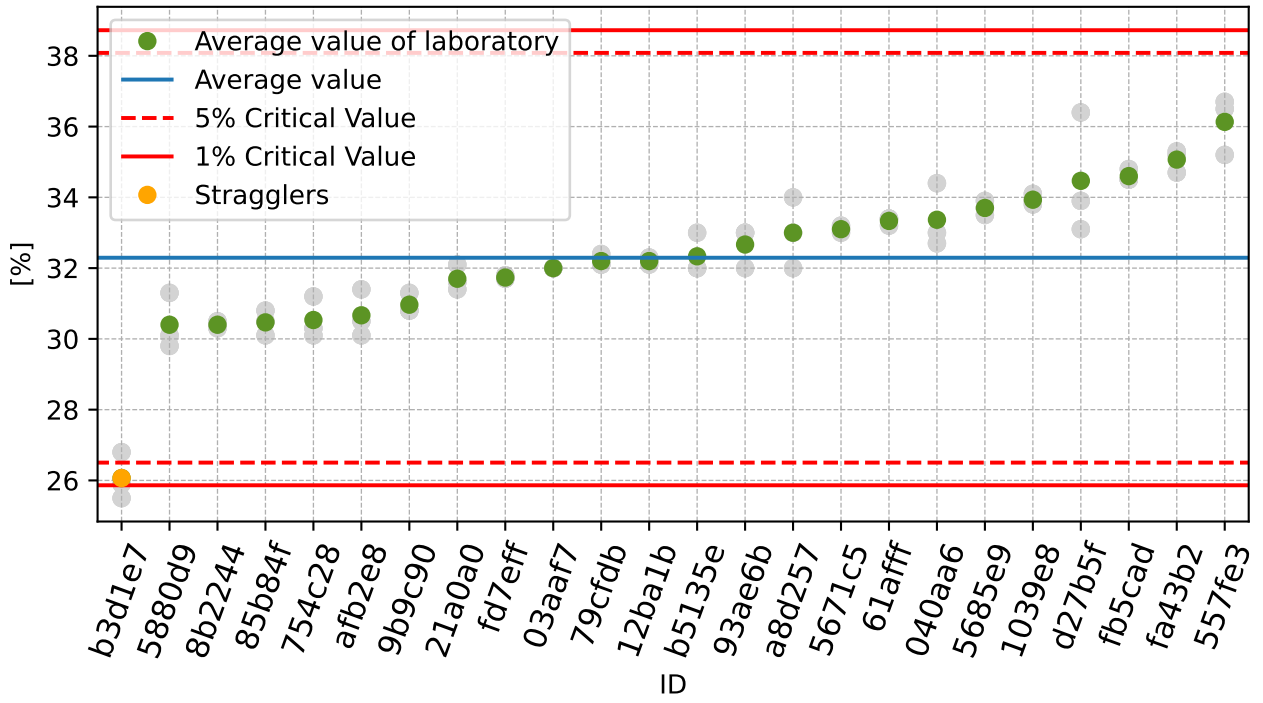

Figure 101: **Grubbs' test** - average values

9.3 Mandel's Statistics

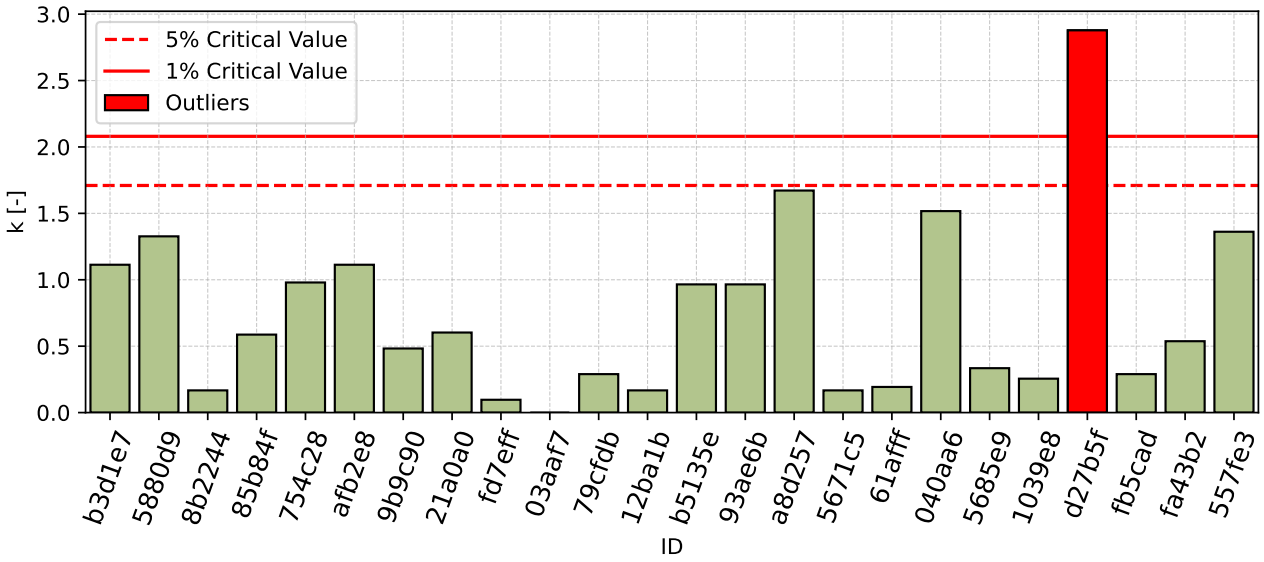

Figure 102: Intralaboratory Consistency Statistic

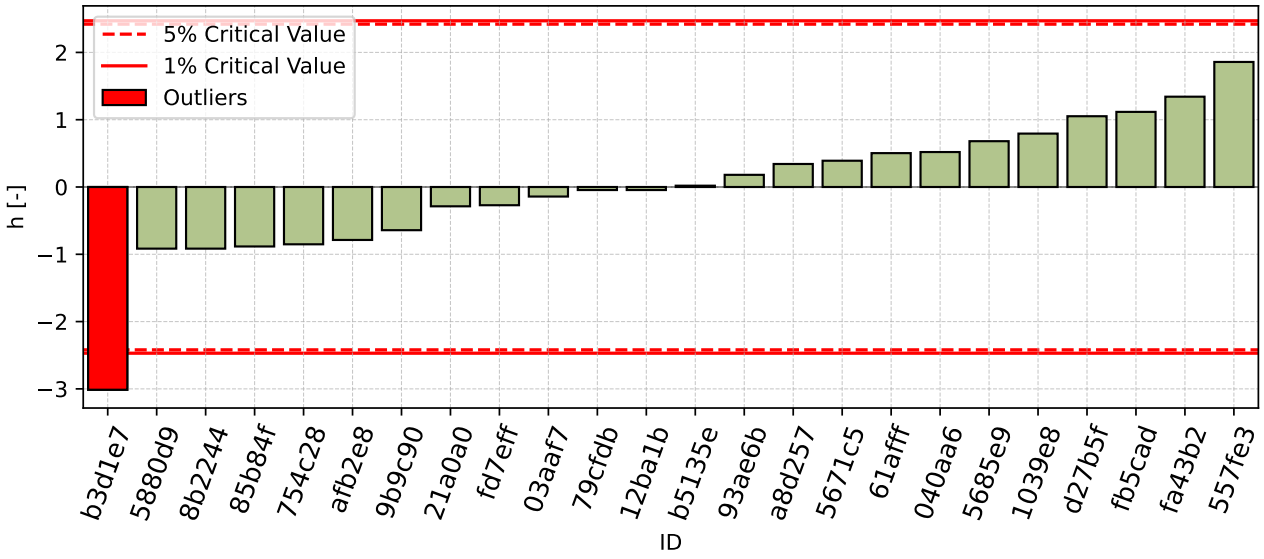

Figure 103: Interlaboratory Consistency Statistic

9.4 Descriptive statistics

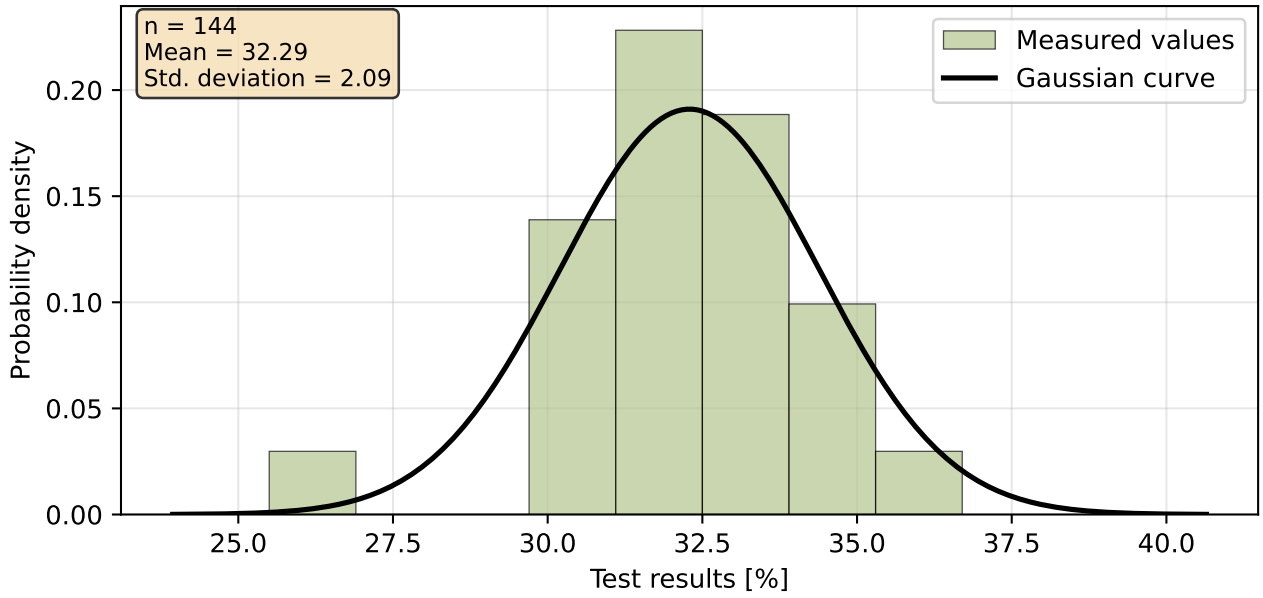

Figure 104: Histogram of all test results

Table 65: Descriptive statistics

Characteristics	[%]
Average value – $\bar{x}$	32.3
Sample standard deviation – s	2.07
Asigned value – x^*	32.3
Robust standard deviation – s^*	2.07
Measurement uncertainty of asigned value – u_X	0.42
p-value of normality test	0.005 [-]
Interlaboratory standard deviation – s_L	2.04
Repeatability standard deviation – s_r	0.6
Reproducibility standard deviation – s_R	2.12
Repeatability – r	1.7
Reproducibility – R	5.9

9.5 Evaluation of Performance Statistics

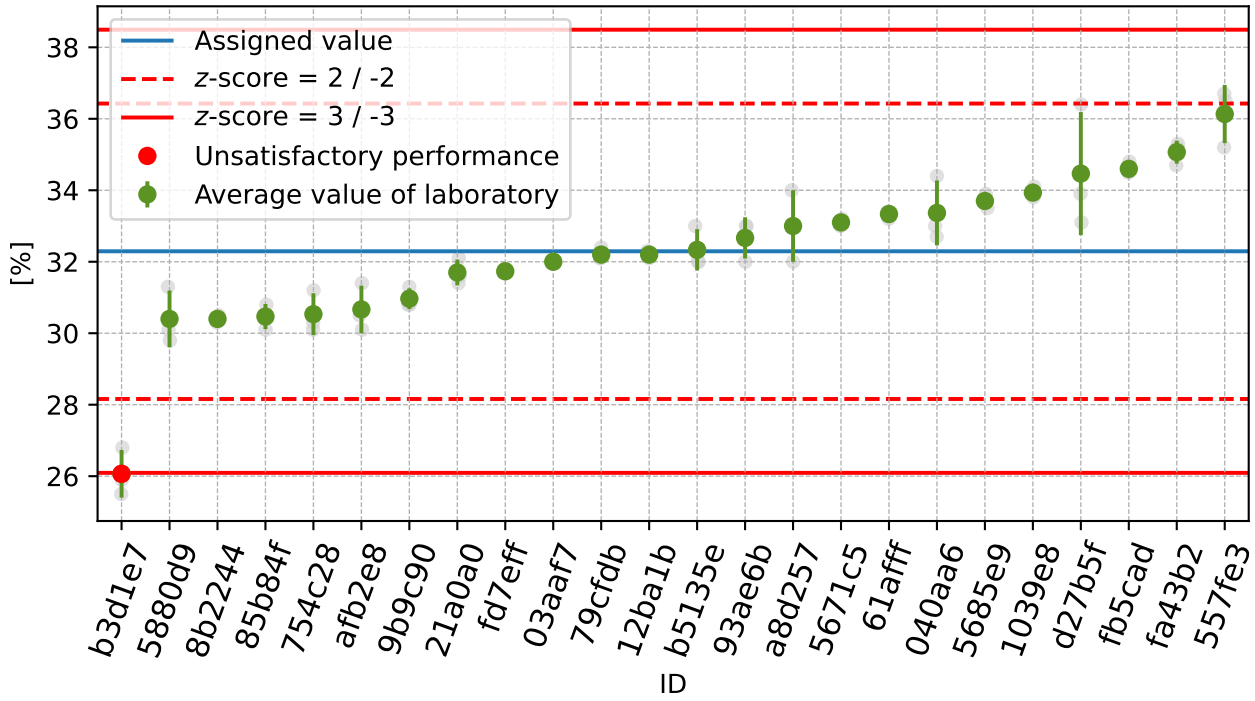

Figure 105: Average values and sample standard deviations

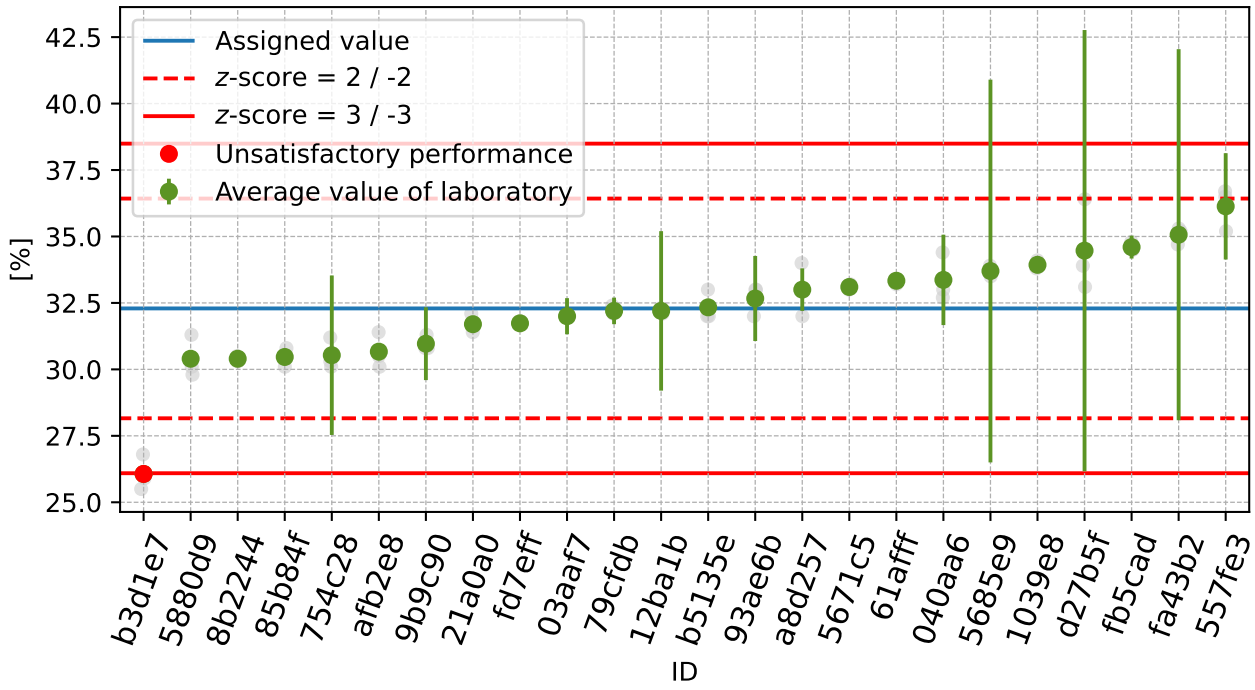

Figure 106: Average values and extended uncertainties of measurement

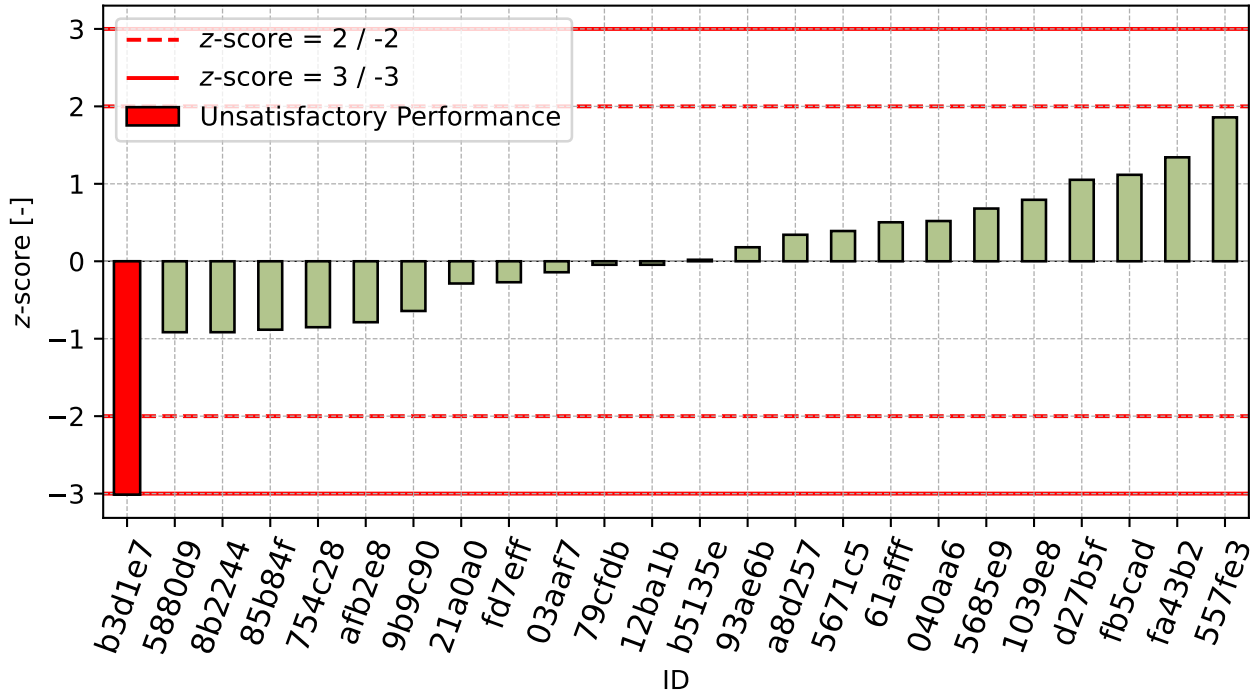

Figure 107: z-score

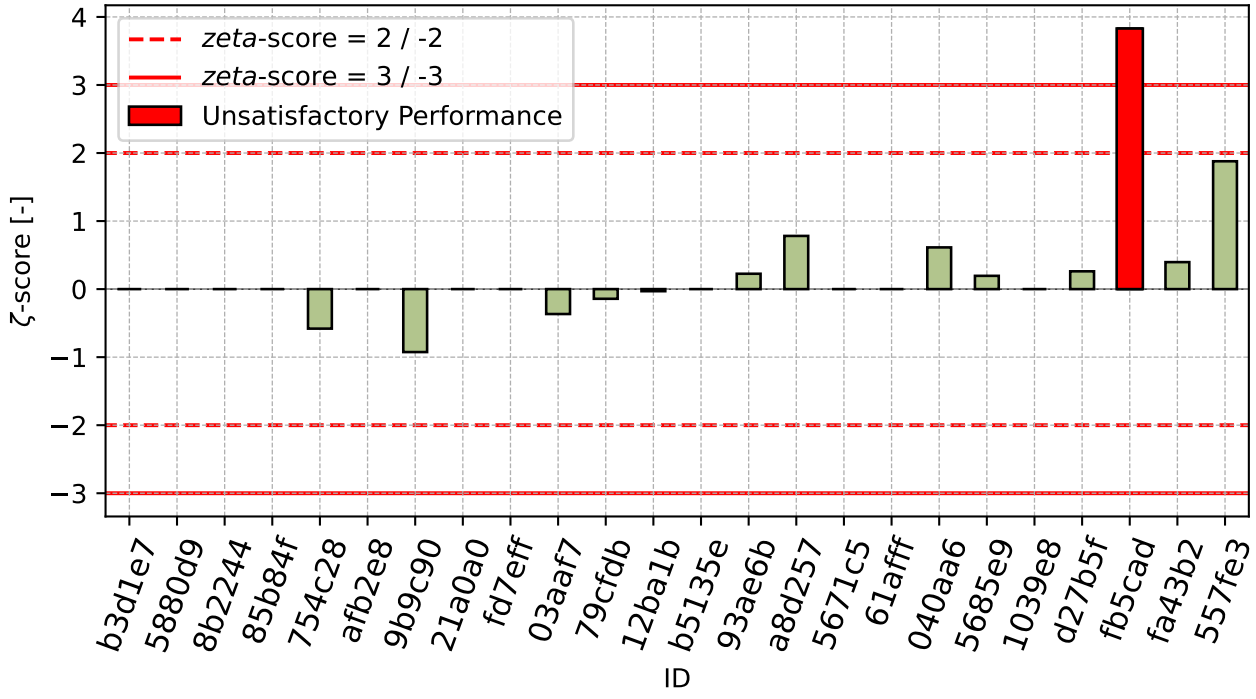

Figure 108: ζ-score

Table 66: z-score and ζ-score

ID	z-score [-]	ζ-score [-]
b3d1e7	-3.01	-
5880d9	-0.92	-
8b2244	-0.92	-
85b84f	-0.88	-
754c28	-0.85	-0.58
afb2e8	-0.79	-
9b9c90	-0.64	-0.93
21a0a0	-0.29	-
fd7eff	-0.27	-
03aaf7	-0.14	-0.37
79cfdb	-0.05	-0.14
12ba1b	-0.05	-0.03
b5135e	0.02	-
93ae6b	0.18	0.23
a8d257	0.34	0.78
5671c5	0.39	-
61afff	0.5	-
040aa6	0.52	0.61
5685e9	0.68	0.2
1039e8	0.79	-
d27b5f	1.05	0.26
fb5cad	1.12	3.83
fa43b2	1.34	0.4
557fe3	1.86	1.88

10 Appendix – EN 13286-2 – Proctor

10.1 Proctor density

10.1.1 Test results

Table 67: Test results - ordered by average value. Outliers are marked by red color. u_X - extended uncertainty of measurement.

ID	Test results [kg/m^3]	u_X [kg/m^3]
79cfdb	1720	10.0
5fd06d	1721	29.0
281c65	1733	-
9b9c90	1736	2.4
250d39	1750	9.0
4cd4b5	1752	35.0
45e944	1754	-
140974	1757	90.0
c6a8b7	1757	-
b66921	1775	32.0
4c2c6b	1780	110.0
4d7590	1780	12.0
732ca5	1783	39.0
b7fb96	1785	39.0
88de8c	1787	18.0
a4ee29	1790	50.0
5671c5	1790	-
4e83fc	1790	4.0
a75067	1799	20.0
728dee	1800	-
b5135e	1800	-
8527ec	1800	14.0
21a0a0	1802	-
716bbc	1806	10.0
aed0c0	1807	-
557fe3	1810	50.0
5685e9	1810	131.0
1039e8	1810	-
0c7288	1810	4.0
fd7eff	1812	-
b3d1e7	1814	-
3e1a74	1823	25.0
fa43b2	1823	55.0
d64e09	1824	20.0
a703dc	1825	20.0
754c28	1830	50.0
85b84f	1841	-
17a1ac	2042	-
afb2e8	2144	-

10.1.2 The Numerical Procedure for Determining Outliers

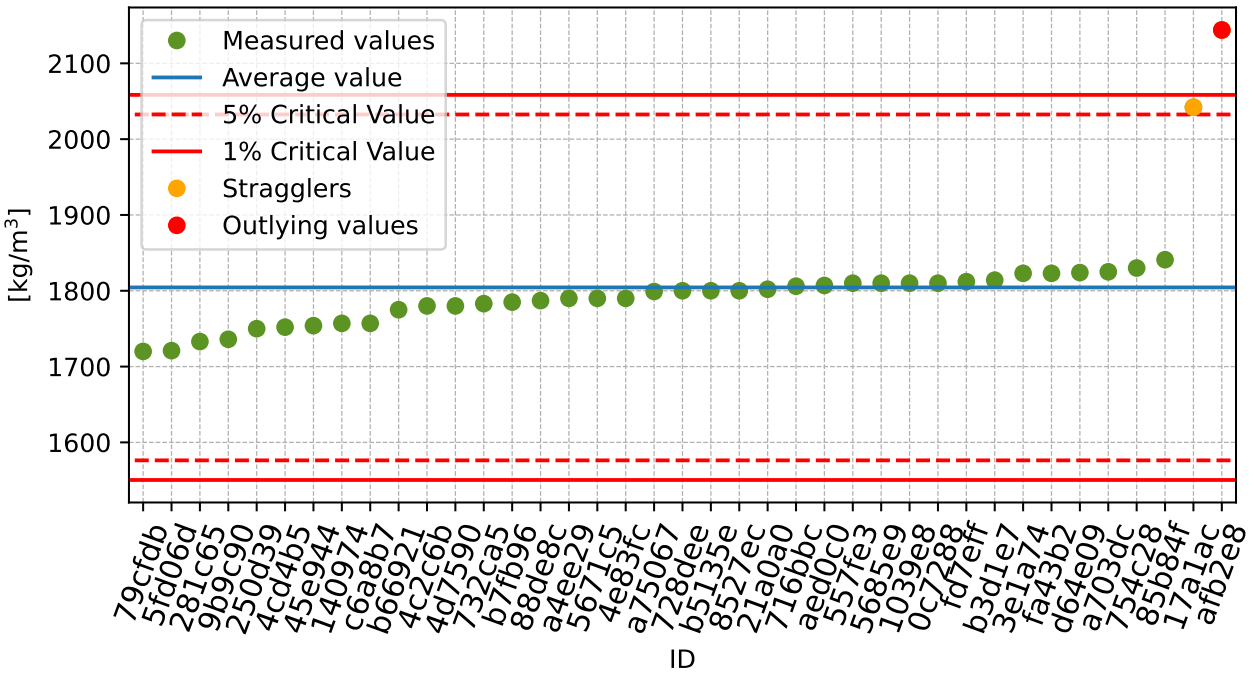

Figure 109: **Grubbs' test** - average values

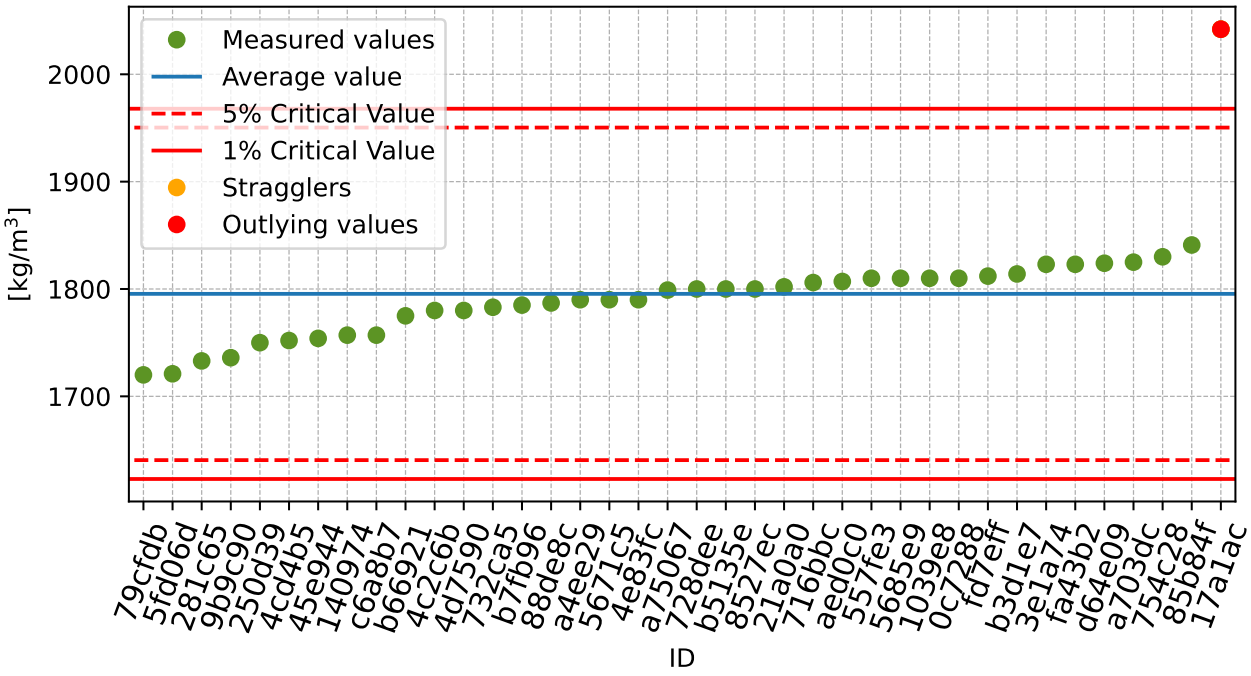

Figure 110: **Grubbs' test** - average values without outliers

10.1.3 Mandel's Statistics

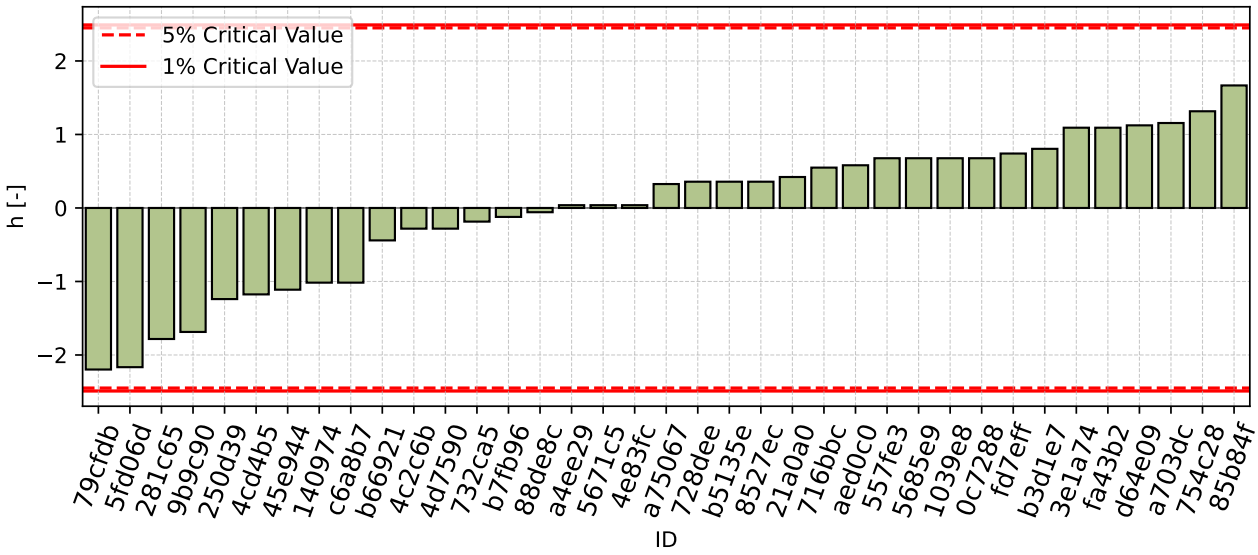

Figure 111: Interlaboratory Consistency Statistic

10.1.4 Descriptive statistics

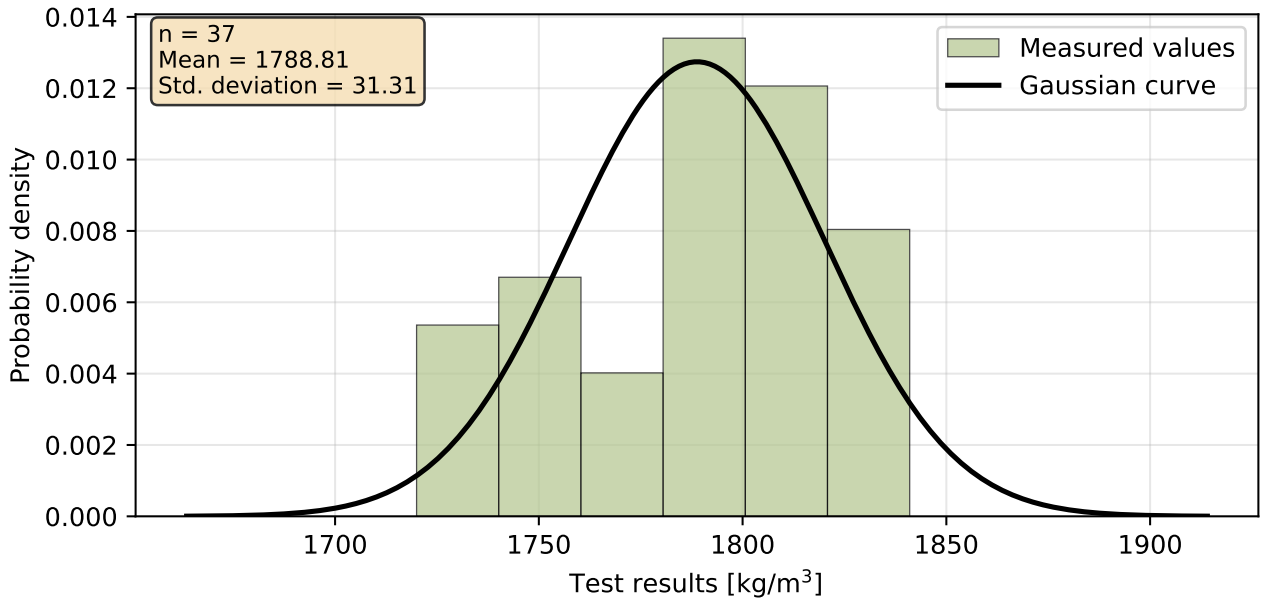

Figure 112: Histogram of all test results

Table 68: Descriptive statistics

Characteristics	[kg/m³]
Average value – $\bar{x}$	1789
Sample standard deviation – s	31.3
Asigned value – x^*	1789
Robust standard deviation – s^*	31.3
Measurement uncertainty of asigned value – u_X	5.1
p-value of normality test	0.042 [-]

10.1.5 Evaluation of Performance Statistics

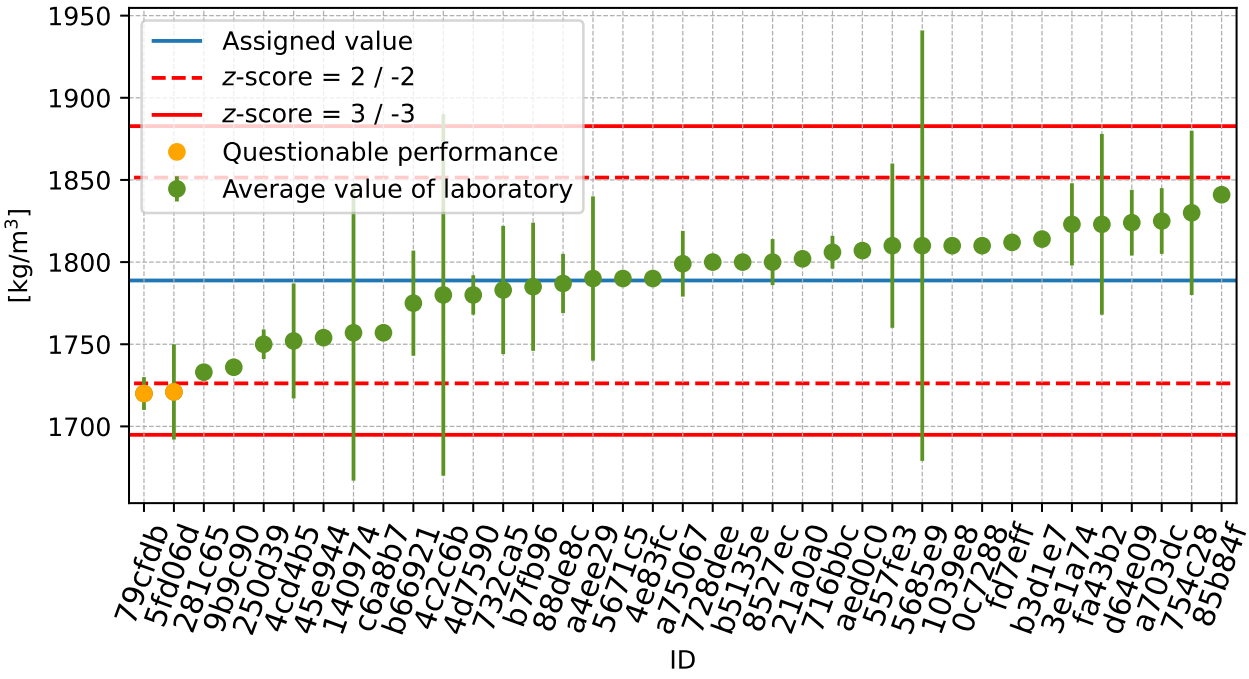

Figure 113: Average values and extended uncertainties of measurement

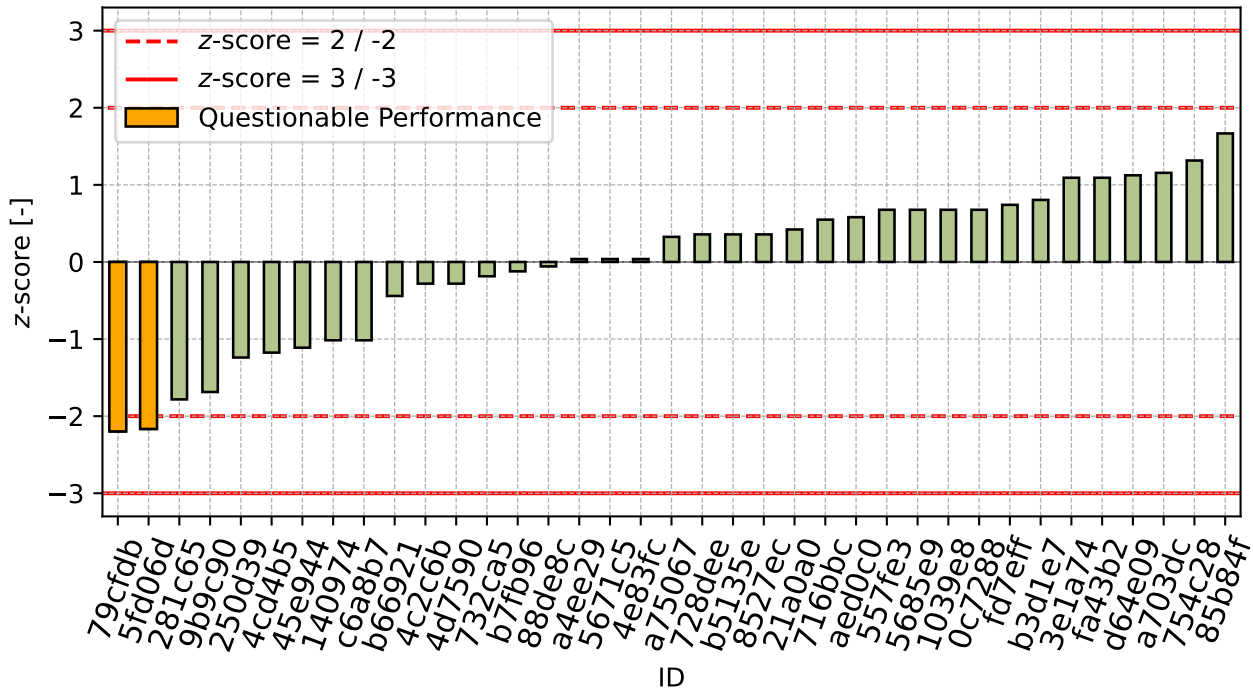

Figure 114: z-score

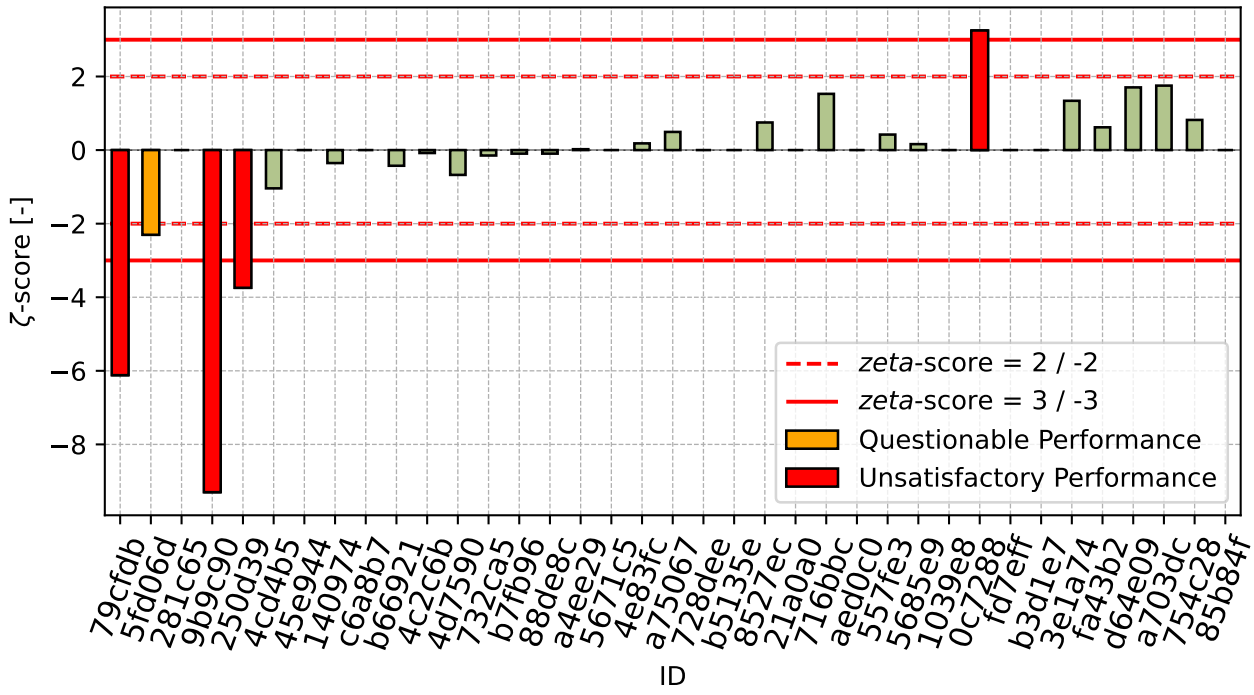

Figure 115: ζ-score

Table 69: z-score and ζ-score

ID	z-score [-]	ζ-score [-]
79cfdb	-2.2	-6.12
5fd06d	-2.17	-2.3
281c65	-1.78	-
9b9c90	-1.69	-9.3
250d39	-1.24	-3.74
4cd4b5	-1.18	-1.04
45e944	-1.11	-
140974	-1.02	-0.35
c6a8b7	-1.02	-
b66921	-0.44	-0.43
4c2c6b	-0.28	-0.08
4d7590	-0.28	-0.67
732ca5	-0.19	-0.15
b7fb96	-0.12	-0.1
88de8c	-0.06	-0.1
a4ee29	0.04	0.02
5671c5	0.04	-
4e83fc	0.04	0.18
a75067	0.33	0.49
728dee	0.36	-
b5135e	0.36	-
8527ec	0.36	0.75
21a0a0	0.42	-
716bbc	0.55	1.53
aed0c0	0.58	-
557fe3	0.68	0.42
5685e9	0.68	0.16
1039e8	0.68	-
0c7288	0.68	3.25
fd7eff	0.74	-
b3d1e7	0.8	-
3e1a74	1.09	1.34
fa43b2	1.09	0.62
d64e09	1.12	1.7
a703dc	1.16	1.75
754c28	1.32	0.82
85b84f	1.67	-

10.2 Optimum water content

10.2.1 Test results

Table 70: Test results - ordered by average value. Outliers are marked by red color. u_X - extended uncertainty of measurement.

ID	Test results [%]	u_X [%]
afb2e8	5.0	-
c6a8b7	10.5	-
754c28	12.0	1.00
728dee	14.0	-
85b84f	14.0	-
0c7288	14.0	0.42
a703dc	14.2	1.00
fd7eff	14.2	-
a75067	14.2	2.00
aed0c0	14.3	-
d64e09	14.5	0.50
a4ee29	14.9	0.50
21a0a0	14.9	-
4e83fc	15.0	0.45
557fe3	15.0	2.00
b3d1e7	15.0	-
3e1a74	15.5	1.00
1039e8	15.5	-
732ca5	15.6	0.70
b5135e	15.6	-
b7fb96	15.7	0.70
716bbc	15.7	0.10
5671c5	15.8	-
5685e9	15.8	2.32
4d7590	15.8	0.11
4c2c6b	16.0	1.00
8527ec	16.0	0.10
88de8c	16.1	1.00
fa43b2	16.1	2.09
79cfdb	16.3	0.20
b66921	16.3	0.50
281c65	16.4	-
45e944	16.5	-
140974	16.6	1.70
5fd06d	17.0	1.30
250d39	17.0	0.60
17a1ac	17.6	-
4cd4b5	17.6	0.40
9b9c90	17.8	0.08

10.2.2 The Numerical Procedure for Determining Outliers

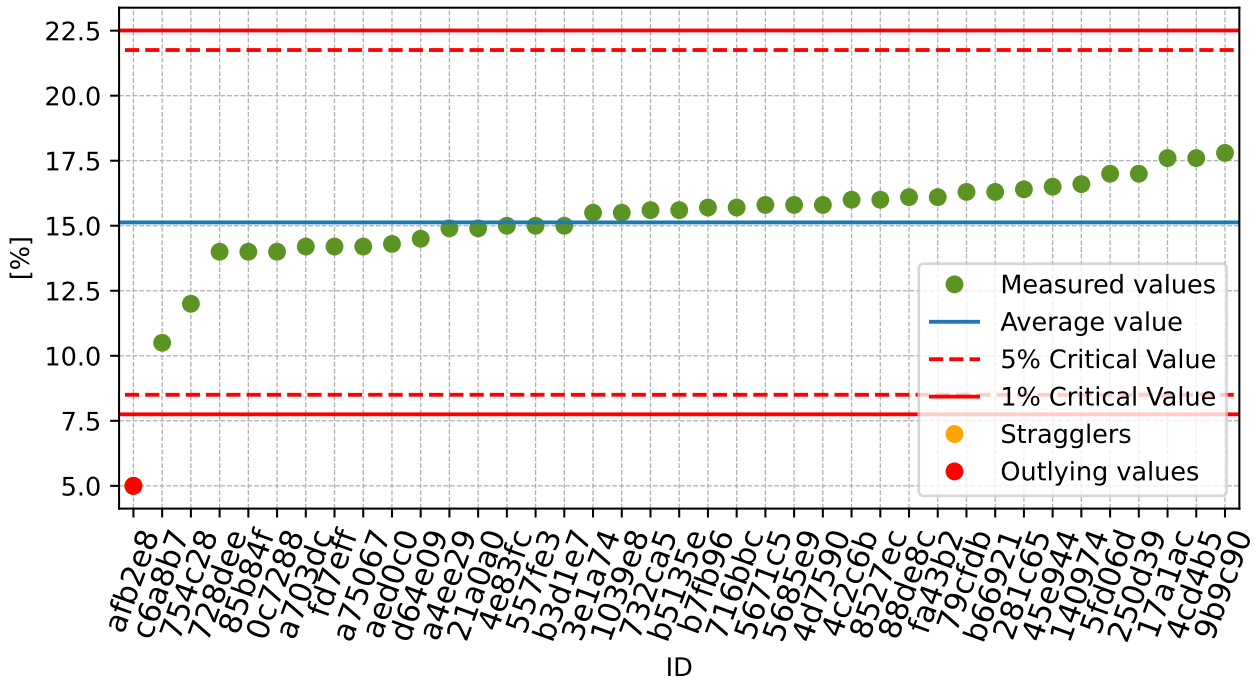

Figure 116: **Grubbs' test** - average values

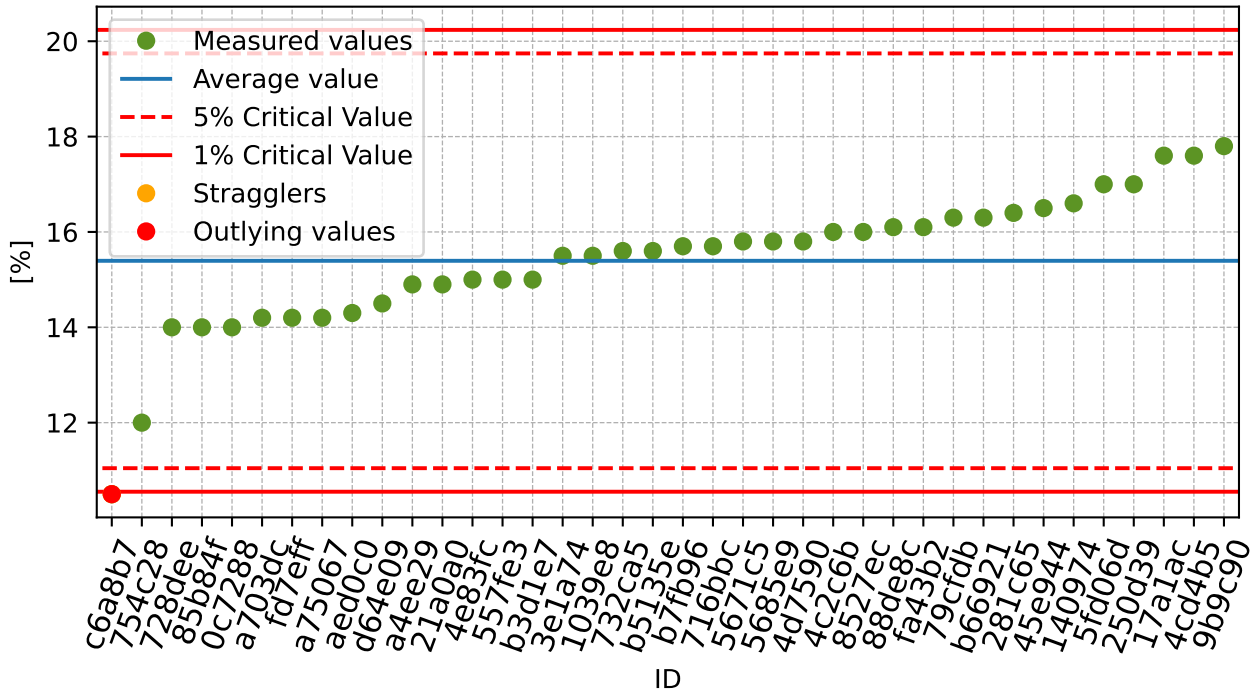

Figure 117: **Grubbs' test** - average values without outliers

10.2.3 Mandel's Statistics

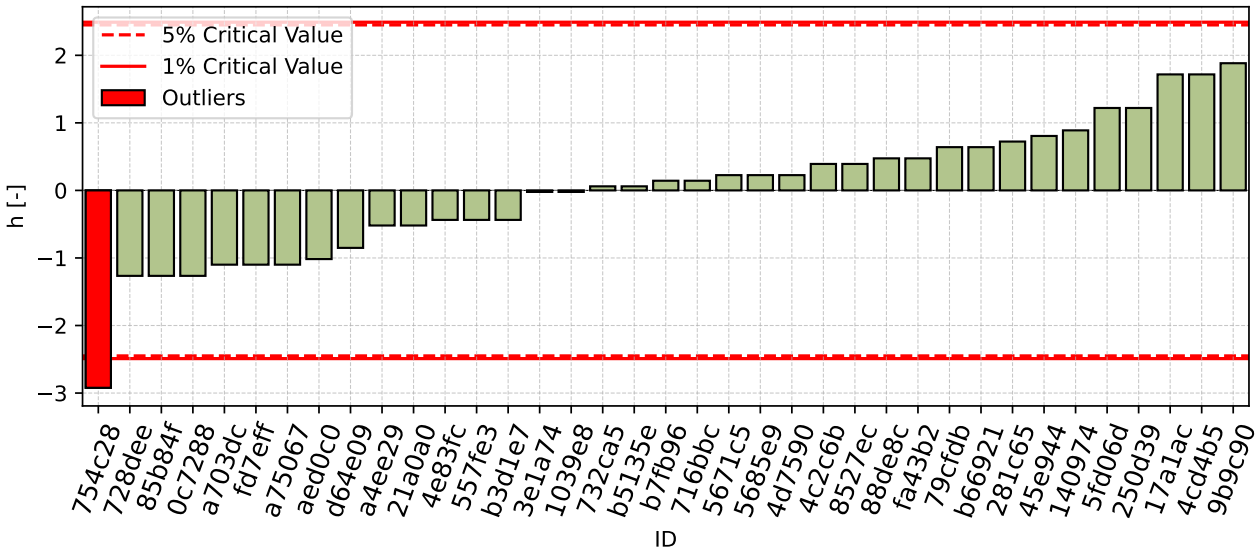

Figure 118: Interlaboratory Consistency Statistic

10.2.4 Descriptive statistics

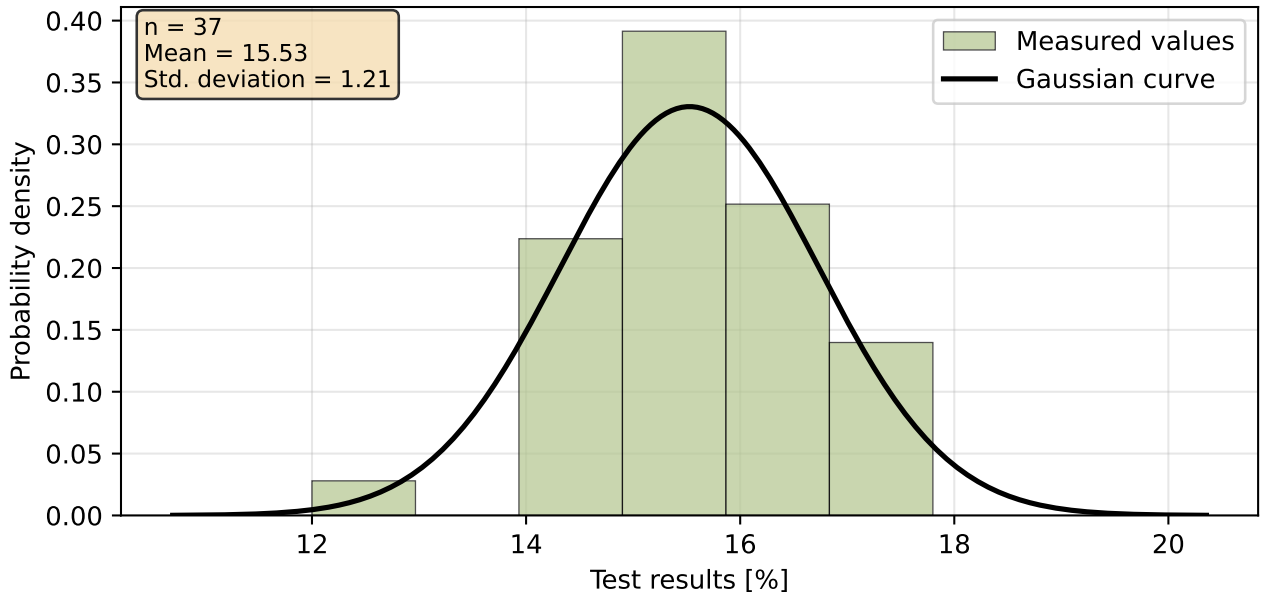

Figure 119: Histogram of all test results

Table 71: Descriptive statistics

Characteristics	[%]
Average value – $\bar{x}$	15.5
Sample standard deviation – s	1.21
Asigned value – x^*	15.5
Robust standard deviation – s^*	1.21
Measurement uncertainty of asigned value – u_X	0.2
p-value of normality test	0.307 [-]

10.2.5 Evaluation of Performance Statistics

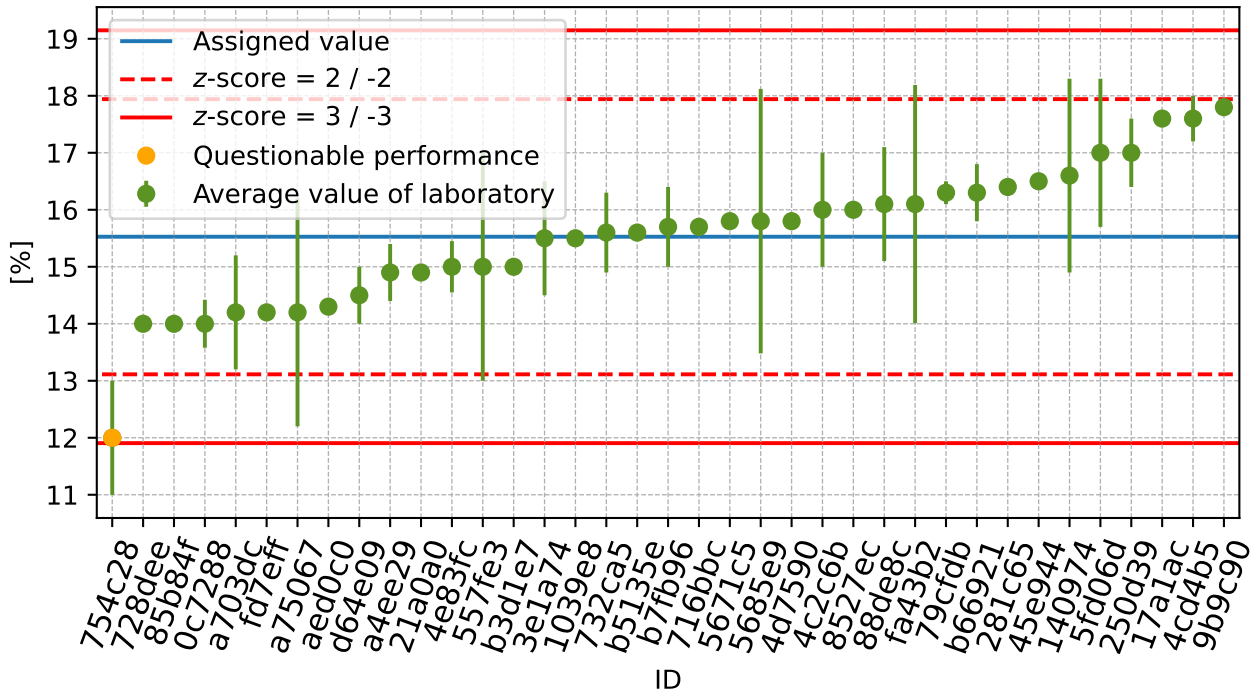

Figure 120: Average values and extended uncertainties of measurement

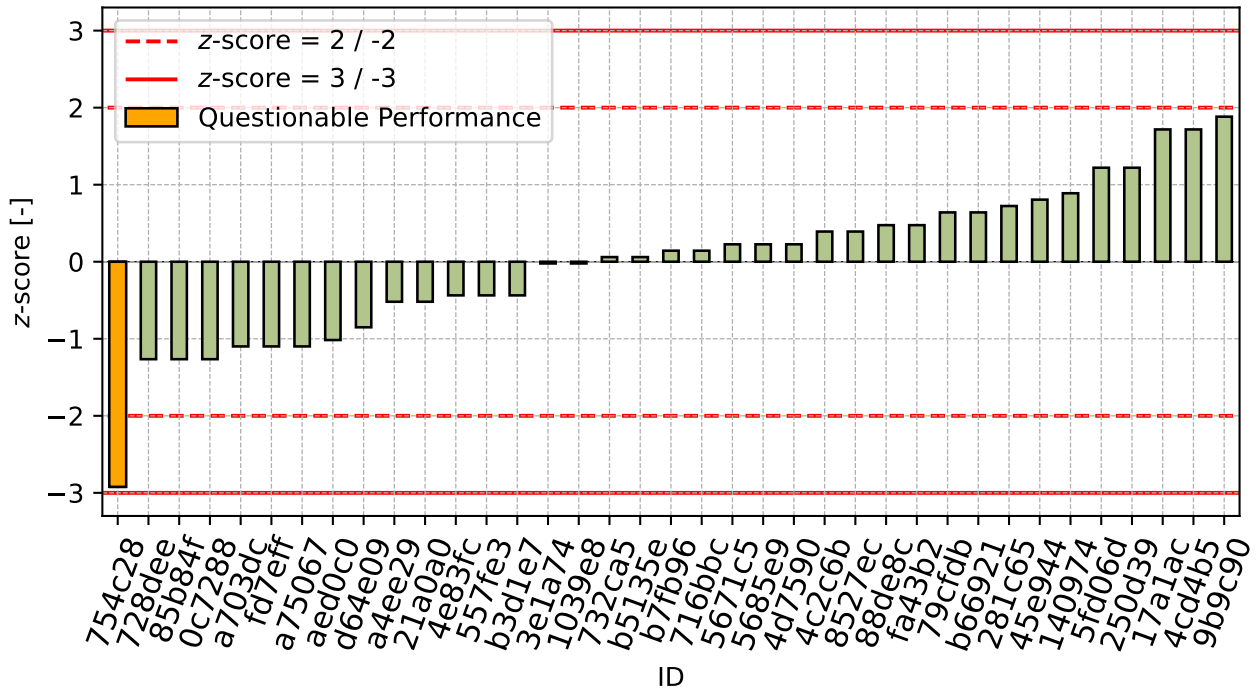

Figure 121: z-score

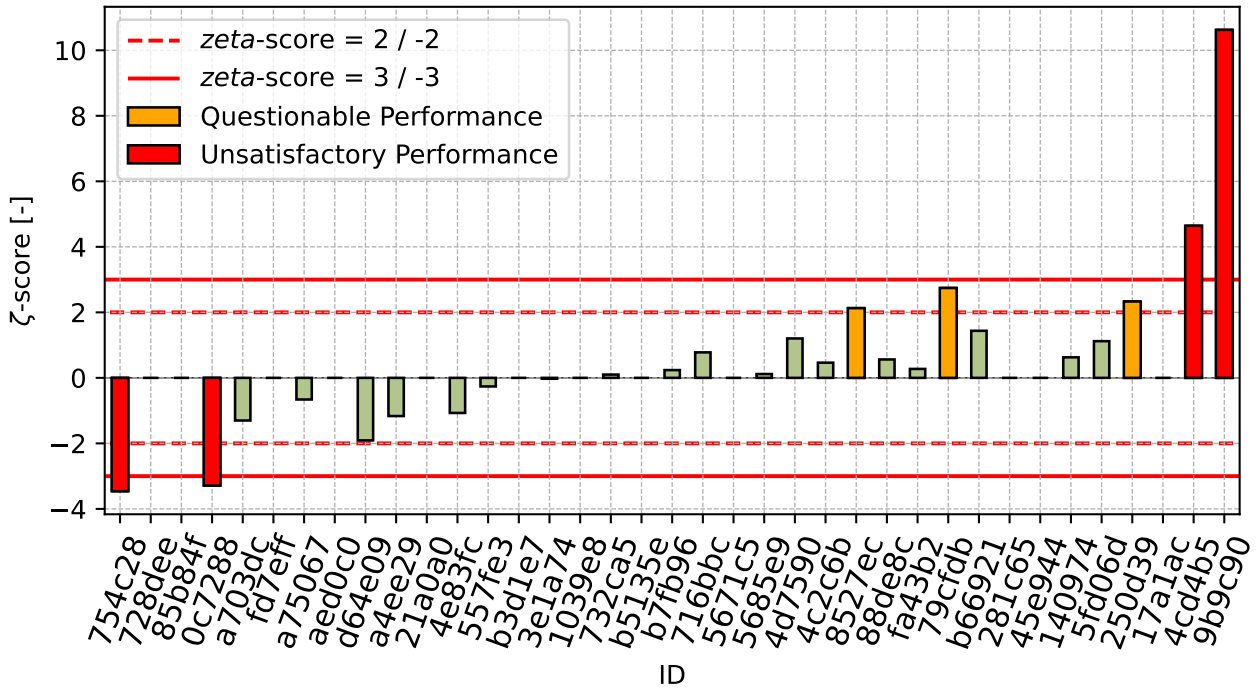

Figure 122: ζ-score

Table 72: z-score and ζ-score

ID	z-score [-]	ζ-score [-]
754c28	-2.92	-3.46
728dee	-1.27	-
85b84f	-1.27	-
0c7288	-1.27	-3.29
a703dc	-1.1	-1.3
fd7eff	-1.1	-
a75067	-1.1	-0.66
aed0c0	-1.02	-
d64e09	-0.85	-1.91
a4ee29	-0.52	-1.17
21a0a0	-0.52	-
4e83fc	-0.44	-1.07
557fe3	-0.44	-0.26
b3d1e7	-0.44	-
3e1a74	-0.02	-0.03
1039e8	-0.02	-
732ca5	0.06	0.1
b5135e	0.06	-
b7fb96	0.14	0.24
716bbc	0.14	0.78
5671c5	0.23	-
5685e9	0.23	0.12
4d7590	0.23	1.2
4c2c6b	0.39	0.46
8527ec	0.39	2.13
88de8c	0.47	0.56
fa43b2	0.47	0.27
79cfdb	0.64	2.74
b66921	0.64	1.44
281c65	0.72	-
45e944	0.81	-
140974	0.89	0.63
5fd06d	1.22	1.12
250d39	1.22	2.33
17a1ac	1.72	-
4cd4b5	1.72	4.64
9b9c90	1.88	10.62

11 Appendix – EN 13286-47 – IBI

11.1 Test results

Table 73: Test results - ordered by average value. Outliers are marked by red color. u_X - extended uncertainty of measurement.

ID	Test results [%]	u_X [%]
557fe3	3.0	3.00
a703dc	4.2	0.50
754c28	4.2	1.00
4d5dd5	5.1	-
d27b5f	5.5	1.90
0c7288	6.0	1.50
afb515	6.3	-
afb2e8	6.5	-
8527ec	8.0	0.10
716bbc	8.3	0.40
1039e8	8.3	-
61afff	8.7	-
5880d9	8.8	-
4cd4b5	9.0	1.40
5671c5	9.0	-
b3d1e7	9.0	-
fd7eff	9.3	-
fc43ce	9.6	16.70
79cfdb	9.7	0.10
b5135e	10.0	-
21a0a0	10.7	-
45e944	11.2	-
4e83fc	12.0	3.60
4c2c6b	13.0	3.00
b66921	14.0	1.50
250d39	14.3	0.50
f2f2df	15.8	-
3e1a74	18.0	1.50
88de8c	18.6	1.30

11.2 The Numerical Procedure for Determining Outliers

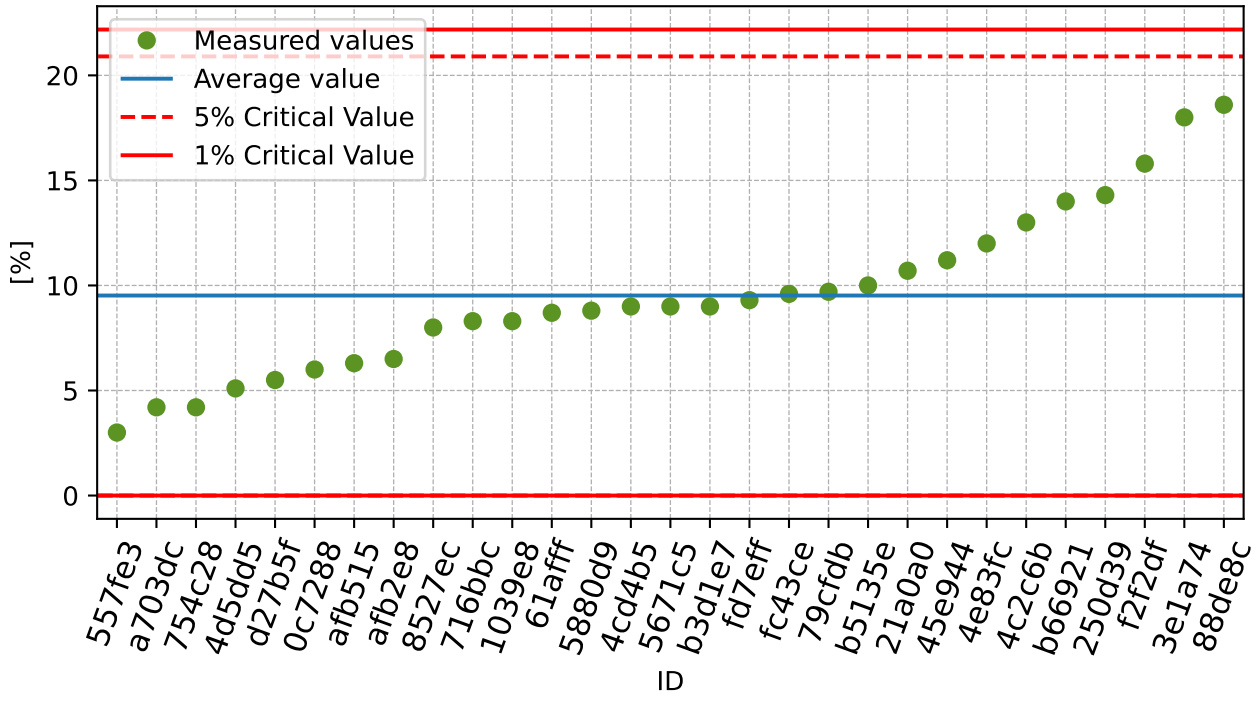

Figure 123: **Grubbs' test** - average values

11.3 Mandel's Statistics

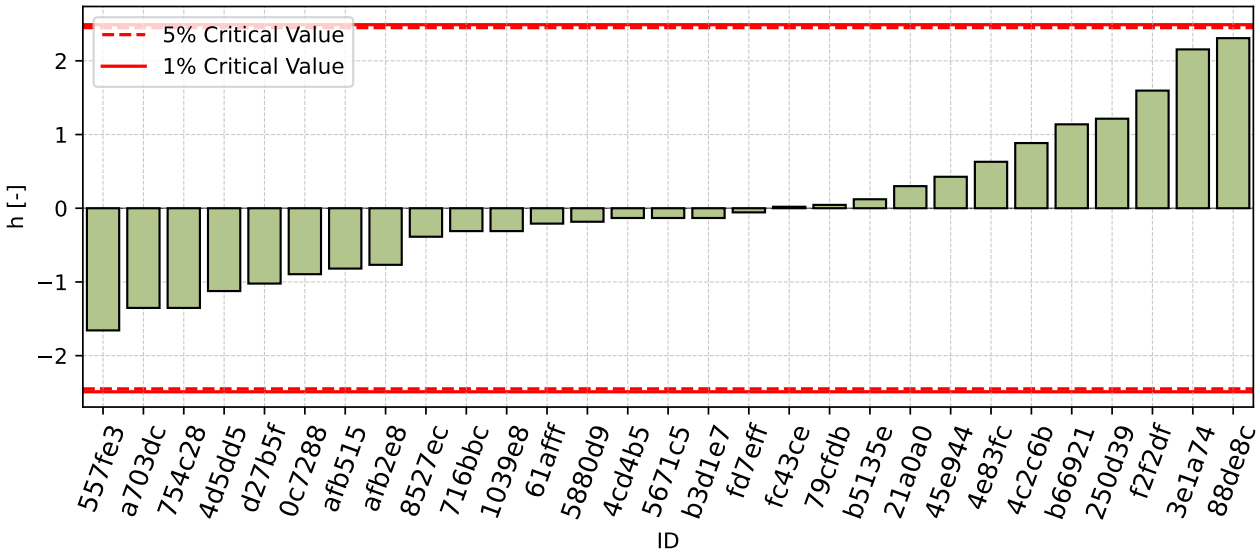

Figure 124: Interlaboratory Consistency Statistic

11.4 Descriptive statistics

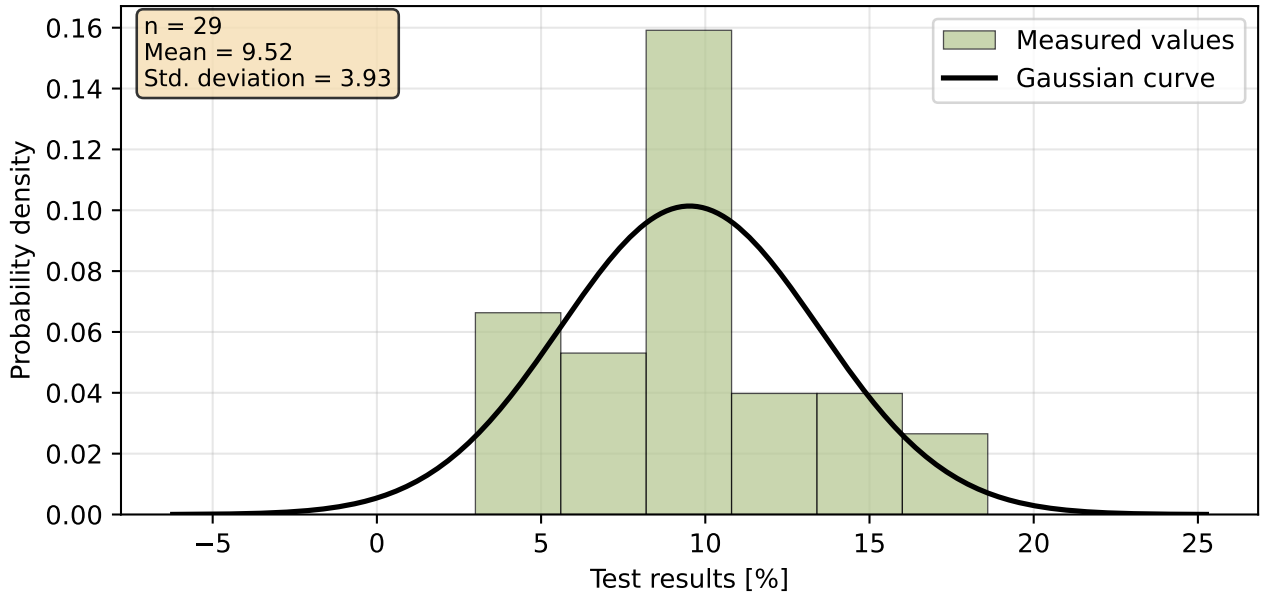

Figure 125: Histogram of all test results

Table 74: Descriptive statistics

Characteristics	[%]
Average value – $\bar{x}$	9.5
Sample standard deviation – s	3.93
Asigned value – x^*	9.5
Robust standard deviation – s^*	3.93
Measurement uncertainty of asigned value – u_X	0.73
p-value of normality test	0.213 [-]

11.5 Evaluation of Performance Statistics

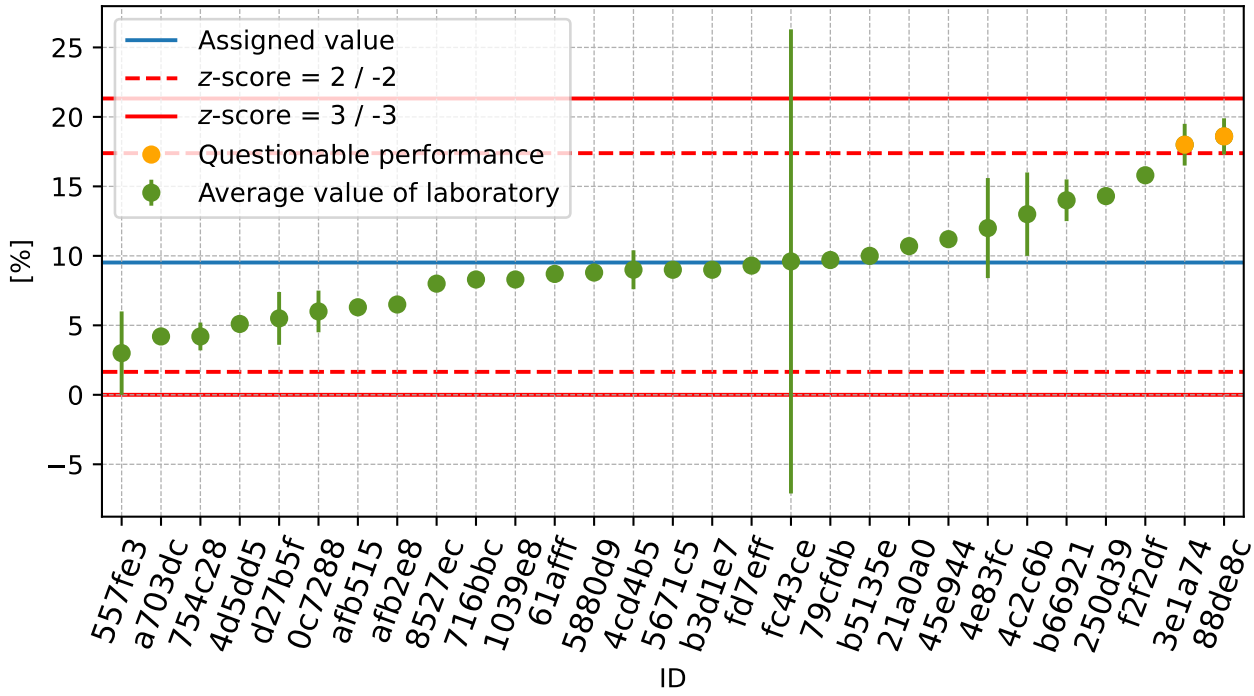

Figure 126: Average values and extended uncertainties of measurement

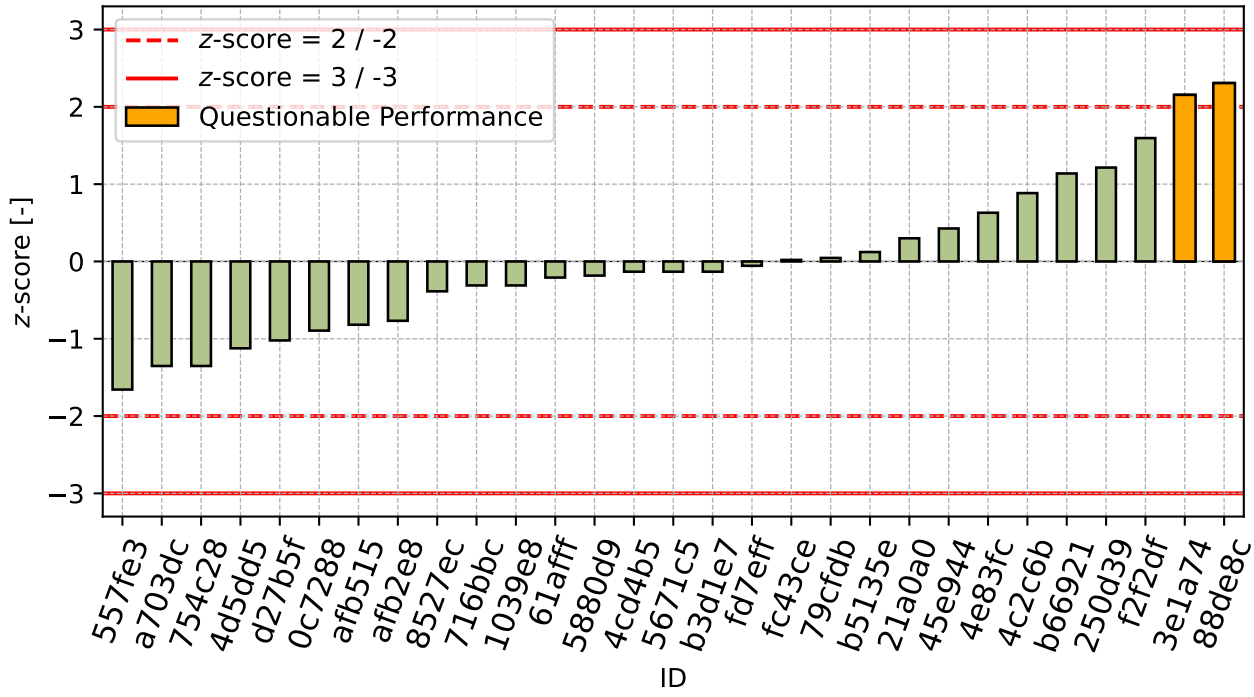

Figure 127: z-score

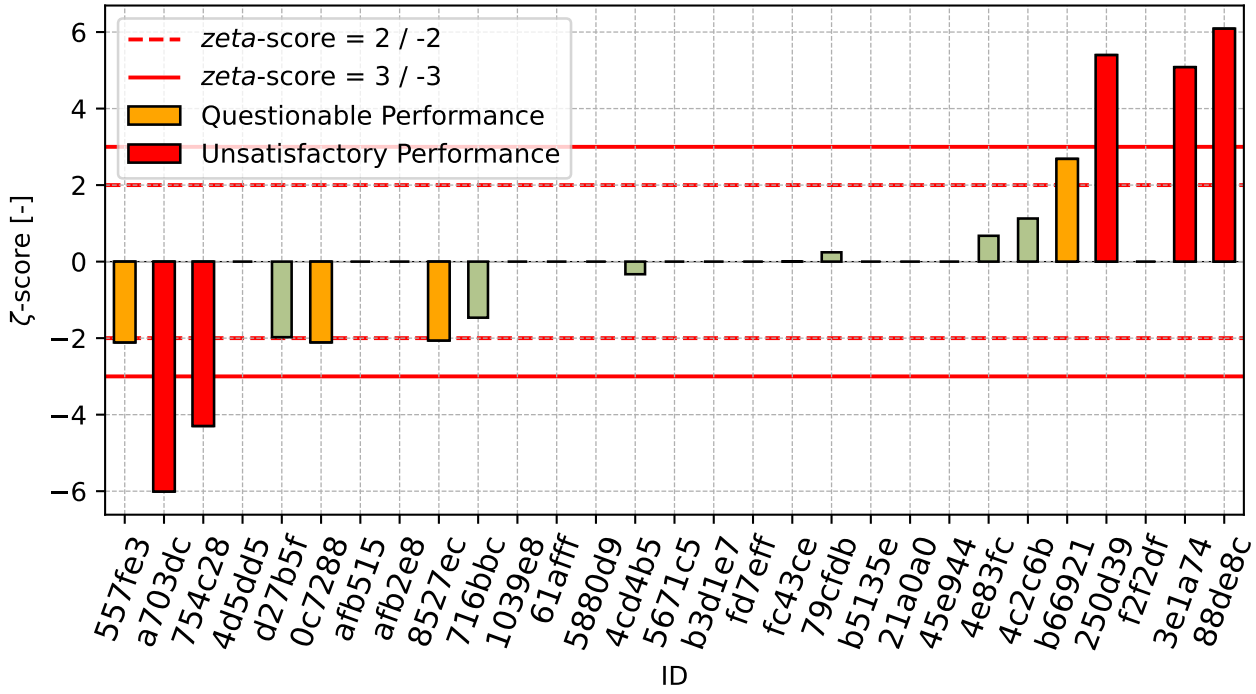

Figure 128: ζ-score

Table 75: z-score and ζ-score

ID	z-score [-]	ζ-score [-]
557fe3	-1.66	-2.11
a703dc	-1.35	-6.01
754c28	-1.35	-4.3
4d5dd5	-1.12	-
d27b5f	-1.02	-1.98
0c7288	-0.89	-2.11
afb515	-0.82	-
afb2e8	-0.77	-
8527ec	-0.39	-2.06
716bbc	-0.31	-1.47
1039e8	-0.31	-
61afff	-0.21	-
5880d9	-0.18	-
4cd4b5	-0.13	-0.33
5671c5	-0.13	-
b3d1e7	-0.13	-
fd7eff	-0.06	-
fc43ce	0.02	0.0
79cfdb	0.05	0.24
b5135e	0.12	-
21a0a0	0.3	-
45e944	0.43	-
4e83fc	0.63	0.67
4c2c6b	0.88	1.13

Continued on next page

Continued from previous page

ID	z-score [-]	ζ-score [-]
b66921	1.14	2.68
250d39	1.21	5.4
f2f2df	1.6	-
3e1a74	2.16	5.08
88de8c	2.31	6.09