



FINAL REPORT ON THE RESULTS OF PRECISION EXPERIMENT

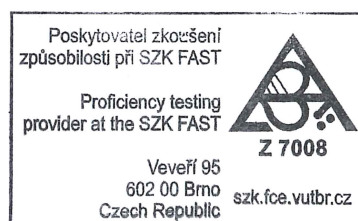
Proficiency Testing Program Mortar, Cement and Fine-grained Cement Composites ZMC 2019/1

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1 Introduction and Important Contacts

In the year 2019, the Proficiency Testing Provider at the SZK FAST (PT Provider) initiated the Proficiency Testing Program (PTP) designated ZMC 2019/1 whose aim was to verify and assess the conformity of test results across laboratories when testing mortar, cement and fine-grained cement composites.

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

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The subjects of proficiency testing were the following testing procedures:

1. EN 196-1 – Strength [1]
2. EN 196-2 (art. 4.4.1) – Determination of loss on ignition [2]
3. EN 196-2 (art. 4.4.2) – Determination of sulphate content [2]
4. EN 196-2 (art. 4.4.3) – Determination of the residue insoluble in hydrochloric acid and sodium carbonate [2]
5. EN 196-2 (art. 4.4.4) – Determination of the residue insoluble in hydrochloric acid and potassium hydroxide [2]
6. EN 196-2 (art. 4.4.5) – Determination of sulphite content [2]
7. EN 196-3 – Setting time, Soundness[3]
8. EN 196-10 – Determination of the water-soluble chromium (Cr^{6+}) [4]
9. EN 1015-1 – Granularity [5]
10. EN 1015-3 – Consistency [6]
11. EN 1015-6 – Density of fresh mortar [7]
12. EN 1015-10 – Density of hardened mortar [8]
13. EN 1015-11 – Strength [9]
14. EN 1015-12 – Adhesion [10]
15. EN 1015-18 – Capillary absorption coefficient (C_m) [11]
16. EN 1015-19 – Water vapor flow [12]
17. EN 13892-2 – Determination of flexural and compressive strength [13]
18. EN 12004-2 (art. 8.1) – Open time [14]
19. EN 12004-2 (art. 8.2) – Slippage [14]
20. EN 12004-2 (art. 8.3.3.2) – Adhesion [14]
21. EN 12004-2 (art. 8.3.3.3) – Adhesion [14]

22. EN 196-2 (art. 4.4.6) – Determination of manganese content [2]

Testing procedures No **1, 3, 7, 10, 12, 13, 14, 15, 18 and 20** were open. The other methods were not been open due to the lack of participants (interested laboratories).

The specimens were taken from the same production with the same production date. The test results from individual PTP participants were compared via a method involving the statistical analysis of all their results in a manner complying with ISO 5725-2 [15] and with EN ISO/IEC 17043 [16]. The outcome is the present final report summarizing the results of the interlaboratory comparison, including statistical evaluation.

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

Table 1: Participation of individual laboratories in the PTP (tests designated according to part 1)

ID/Part	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21
4bcf20	X	-	-	-	-	-	X	-	-	-	-	-	-	-	-	-	-	-	-	-	-
aa3e07	-	-	-	-	-	-	-	-	-	X	-	-	X	-	-	-	-	-	-	-	-
ab93aa	-	-	-	-	-	-	-	-	-	-	-	-	X	-	-	-	-	-	-	-	-
f0d7ff	-	-	-	-	-	-	-	-	-	-	-	-	X	-	-	-	-	-	-	-	-
1a9bd8	X	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
43b61e	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	X	-	X	-
baba84	X	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
605eff	-	-	X	-	-	-	X	-	-	-	-	-	-	-	-	-	-	X	-	X	-
2f16d8	-	-	-	-	-	-	-	-	-	X	-	-	-	X	X	-	-	-	-	-	-
663aa5	-	-	-	-	-	-	-	-	-	-	-	-	X	-	-	-	-	X	-	-	-
3a3d88	-	-	-	-	-	-	-	-	-	-	-	-	-	X	-	-	-	-	-	-	-
8d740f	X	-	-	-	-	-	X	-	-	-	-	-	-	-	-	-	-	-	-	-	-
4a1546	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	X	-
e81c7c	-	-	-	-	-	-	-	-	-	X	-	X	-	X	X	-	-	-	-	-	-
4992f9	-	-	-	-	-	-	-	-	-	-	-	-	X	-	-	-	-	-	-	-	-
13d063	-	-	-	-	-	-	-	-	-	-	-	-	X	-	-	-	-	-	-	-	-
db7c2e	X	-	-	-	-	-	-	-	-	-	-	-	X	-	-	-	-	-	-	-	-
3276e6	X	-	X	-	-	-	X	-	-	-	-	-	X	-	-	-	-	-	-	-	-
110bd9	-	-	-	-	-	-	-	-	-	-	-	-	X	-	-	-	-	-	-	-	-
d9a0c9	-	-	-	-	-	-	-	-	-	-	-	-	-	X	-	-	-	-	-	-	-
004e7b	-	-	-	-	-	-	-	-	-	-	-	-	-	-	X	-	-	-	-	-	-
4d31e1	-	-	-	-	-	-	-	-	-	-	-	X	-	X	-	-	-	-	-	-	-
fdec0f	-	-	X	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
112b14	-	-	-	-	-	-	-	-	-	-	-	-	X	-	-	-	-	-	-	-	-
bfc43d	X	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
4ee571	-	-	-	-	-	-	-	-	-	-	-	-	X	-	-	-	-	-	-	-	-
e56f66	X	-	-	-	-	-	-	-	-	-	-	X	X	-	-	-	-	-	-	X	-
35d72a	-	-	-	-	-	-	-	-	-	-	-	-	-	X	-	-	-	X	-	-	-
de9190	X	-	X	-	-	-	X	-	-	-	-	X	X	-	-	-	-	-	-	-	-
e79d89	X	-	-	-	-	-	X	-	-	X	-	X	-	-	-	-	-	-	-	-	-
n	10	0	4	0	0	0	5	0	0	4	0	5	13	6	3	0	0	4	0	4	0

Table 2: List of participants (laboratories) – the order in the table does not correspond to the identification number in Table 1

Laboratory	Address	Accreditation No.
"ЦЕНТЪР ЗА ИЗПИТВАНЕ И ЕВРОПЕЙСКА СЕРТИФИКАЦИЯ" ЕООД/Center for Testing and European Certification Ltd.	2, Industrialna str., Stara Zagora, 6000, Bulgaria	No 252 ЛИ
AG Institut d.o.o. Novi Sad	dr Djordja Joanovica 4, Novi Sad, 21000, Republika Srbija	01-457
BETOTECH, s.r.o. - pracoviště Beroun	Beroun 660, Beroun, 26601, Česká republika	1195
BETOTECH, s.r.o. - pracoviště Ostrava	Beroun 660, BEROUN, 266 01, Česká republika	1195.2
CMR Center Materials Research snc	Via Zamenhof 589, Vicenza, 36100, Italy	-
Christos Shiathas	Aglantzias Light Industrial Area, No. 10, Nicosia, 2108, NICOSIA	L001
Christos Shiathas	Aglantzias Light Industrial Area, No. 10, Nicosia, 2108, Nicosia	-
Itecons - Instituto de Investigação e Desenvolvimento Tecnológico para a Construção, Energia, Ambiente e Sustentabilidade	Rua Pedro Hispano - Pinhal de Marrocos, Coimbra, 3030-289, Portugal	L0446
Ivan Kozhuharov	108 Besarabia street, Sofia, 1517, Bulgaria	-
Laboratoire Central des Travaux Publics - LCTP	1, rue Kaddour RAHIM- HUSSEIN DEY, ALGER, 16040, ALGERIE	-
Lithuanian Energy Institute	Breslaujos str. 3, Kaunas, LT-44403, Lithuania	LA.01.06
QUALIFORM SLOVAKIA s.r.o. , Pracoviško 02 Svit	Pasienková 9 D, Bratislava, 82106, Slovenská republika	154/S-301
QUALIFORM SLOVAKIA s.r.o. - organizační složka	Lesní 693, Bílovice nad Svitavou, 66401, 28311060	S-301
STACHEMA Bratislava a.s.	Železničná 714/180, Rovinka, 900 41, Slovenská republika	S-275
Stachema CZ s.r.o., Zkušební laboratoř, Pracoviště 2	Hasičská 1, Zibohlavy, Kolín, 28002, Česká republika	L 1433
TIQU-Tiroler Qualitätszentrum für Umwelt, Bau und Rohstoffe GmbH	Gewerbestraße 4, Ötztal-Bahnhof, 6430, Austria/Tirol	-
TPA EOOD CTC SOFIA	Rezbarska str. № 7, SOFIA, 1510, BULGARIA	-
Technický a zkušební ústav Praha, s.p., Centrální laboratoř, zkušebna 0500 Předměřice nad Labem	Průmyslová 283, Předměřice n.L., 503 02, Česká republika	1018.3
Technický a zkušební ústav stavební Praha, s. p., pobočka České Budějovice	Nemanická 441, České Budějovice, 370 10, Česká republika	1018.3
Technický a zkušební ústav stavební Praha, s.p.	Tolstého 447, Teplice, 415 03, Česká republika	L 1018.3
Technický a zkušební ústav stavební Praha, s.p. - pobočka Praha	Prosecká 811/76a, Praha 9 - Prosek, 190 00, Česká republika	1018.3

Laboratory	Address	Accreditation No.
Technický a zkušební ústav stavební Praha, s.p. Centrální laboratoř - zkušebna Plzeň	Zahradní 15, Plzeň, 326 00, Česká republika	1018.3
Technický a zkušební ústav stavební Praha, s.p., pobočka 0700 Ostrava	U Studia 14, Ostrava, 700 30, Česká republika	1018.3
Technický a zkušební ústav stavební Praha, s.p., pobočka Brno	Hněvkovského 77, Brno, 617 00, Česká republika	1018.3
Testing Laboratory "LABKONSULT PLUS" Ltd.	kompl.Mladost-1, bl.43/vh.3/app.41, Sofia, 1784, BULGARIA	-
Universiteit Gent (Labormatorium Magnel voor Betononderzoek)	Technologiepark - Zwijnaarde 60, Zwijnaarde (Ghent), 9052, Belgium	220-TEST
Vysoké učení technické v Brně, Fakulta stavební, Akreditovaná zkušební laboratoř při ÚTHD FAST VUT v Brně	Veveří 331/95, Brno, 60200, Česká republika	L1396
Zkušební laboratoř Kloknerova ústavu	Šolínova 7, Praha 6 - Dejvice, 16608, Česká republika	1061
ÉMI Építésügyi Minőségellenőrző Innovációs Nonprofit Kft.	Dózsa György út 26., Szentendre, 2000, Hungary	NAH-1-1110/2018
Ředitelství silnic a dálnic ČR	Rebešovická 40, Brno-Chrlice, 643 00, Česká republika	1072

2 Procedures used in the Statistical Analysis of Laboratory Results

The statistical analysis is based on the following steps:

1. Evaluation of intralaboratory variabilities by Cochran's C test: If 5% or 1% critical value is exceeded, the effect of the individual observations is first considered. If the results indicate that high participant variability is caused by a single observation, this value is excluded from the experiment, but the participant is not excluded as outlying. By overcoming 1% of the critical value, the participant's results can be marked as outlying and excluded from the experiment.
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.
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.

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 Mortar, Cement and Fine-grained Cement Composites (PT Program) organized by the PT Provider at the SZK FAST. 30 participants (laboratories) took part in the PT Program. The program focused on ordinary standardized testing of mortar, cement, fine-grained cement composites. The test results are evaluated separately for each testing procedure examined. An evaluation of statistical characteristics is included in the Appendix, as well as test results and graphic presentations. Testing methods can be found in part 1 of this report.

Table 4: Evaluation of overall performance and outliers.

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

ID / Method	1	3	7	10	12	13	14	15	18	20
4bcf20	✓	-	X	-	-	-	-	-	-	-
aa3e07	-	-	-	✓	-	✓	-	-	-	-
ab93aa	-	-	-	-	-	✓	-	-	-	-
f0d7ff	-	-	-	-	-	✓	-	-	-	-
1a9bd8	✓	-	-	-	-	-	-	-	-	-
43b61e	-	-	-	-	-	-	-	-	✓	✓
baba84	✓	-	-	-	-	-	-	-	-	-
605eff	-	✓	✓	-	-	-	-	-	✓	✓
2f16d8	-	-	-	✓	-	-	✓	✓	-	-
663aa5	-	-	-	-	-	✓	-	-	✓	-
3a3d88	-	-	-	-	-	-	✓	-	-	-
8d740f	✓	-	✓	-	-	-	-	-	-	-
4a1546	-	-	-	-	-	-	-	-	-	✓
e81c7c	-	-	-	✓	✓	-	✓	✓	-	-
4992f9	-	-	-	-	-	✓	-	-	-	-
13d063	-	-	-	-	-	✓	-	-	-	-
db7c2e	✓	-	-	-	-	✓	-	-	-	-
3276e6	✓	✓	X	-	-	✓	-	-	-	-
110bd9	-	-	-	-	-	✓	-	-	-	-
d9a0c9	-	-	-	-	-	-	✓	-	-	-
004e7b	-	-	-	-	-	-	-	✓	-	-
4d31e1	-	-	-	-	✓	-	✓	-	-	-
fdec0f	-	✓	-	-	-	-	-	-	-	-
112b14	-	-	-	-	-	✓	-	-	-	-
bfc43d	✓	-	-	-	-	-	-	-	-	-
4ee571	-	-	-	-	-	✓	-	-	-	-
e56f66	✓	-	-	-	✓	✓	-	-	-	✓
35d72a	-	-	-	-	-	-	✓	-	✓	-
de9190	?	✓	✓	-	✓	?	-	-	-	-
e79d89	✓	-	✓	✓	X	-	-	-	-	-

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- [5] EN 1015-1. *Methods of test for mortar for masonry - Part 1: Determination of particle size distribution (by sieve analysis)*. 1999.
- [6] EN 1015-3. *Methods of test for mortar for masonry - Part 3: Determination of consistence of fresh mortar (by flow table)*. 2000.
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- [11] EN 1015-18. *Methods of test for mortar for masonry - Part 18: Determination of water absorption coefficient due to capillarity action of hardened mortar*. 2003.
- [12] EN 1015-19. *Methods of test for mortar for masonry - Part 19: Determination of water vapour permeability of hardened rendering and plastering mortars*. 1999.
- [13] EN 13892-2. *Methods of test for screed materials - Part 2: Determination of flexural and compressive strength*. 2003.
- [14] EN 12004-2. *Adhesives for ceramic tiles - Part 2: Test methods*. 2017.
- [15] 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*. 1997.
- [16] EN ISO/IEC 17043. *Conformity assessment - General requirements for proficiency testing*. 2010.

1 Appendix – EN 196-1 – Strength

1.1 Flexural Strength after 2 days of ageing

1.1.1 Test results

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

ID	Test results [N/mm ²]			u_X [N/mm ²]	\bar{x} [N/mm ²]	s_0 [N/mm ²]	V_X [%]
4bcf20	4.0	3.5	-	0.2	3.8	0.33	8.67
baba84	4.2	4.3	3.9	0.4	4.1	0.21	5.04
bfc43d	4.4	4.3	4.5	-	4.4	0.1	2.27
e56f66	5.1	5.3	4.7	-	5.0	0.31	6.07
8d740f	4.8	5.6	5.4	1.2	5.3	0.42	7.91
3276e6	5.2	5.4	5.2	0.2	5.3	0.12	2.19
e79d89	5.4	5.7	5.3	0.5	5.5	0.21	3.81
de9190	7.3	6.8	6.2	0.6	6.8	0.55	8.14

1.1.2 The Numerical Procedure for Determining Outliers

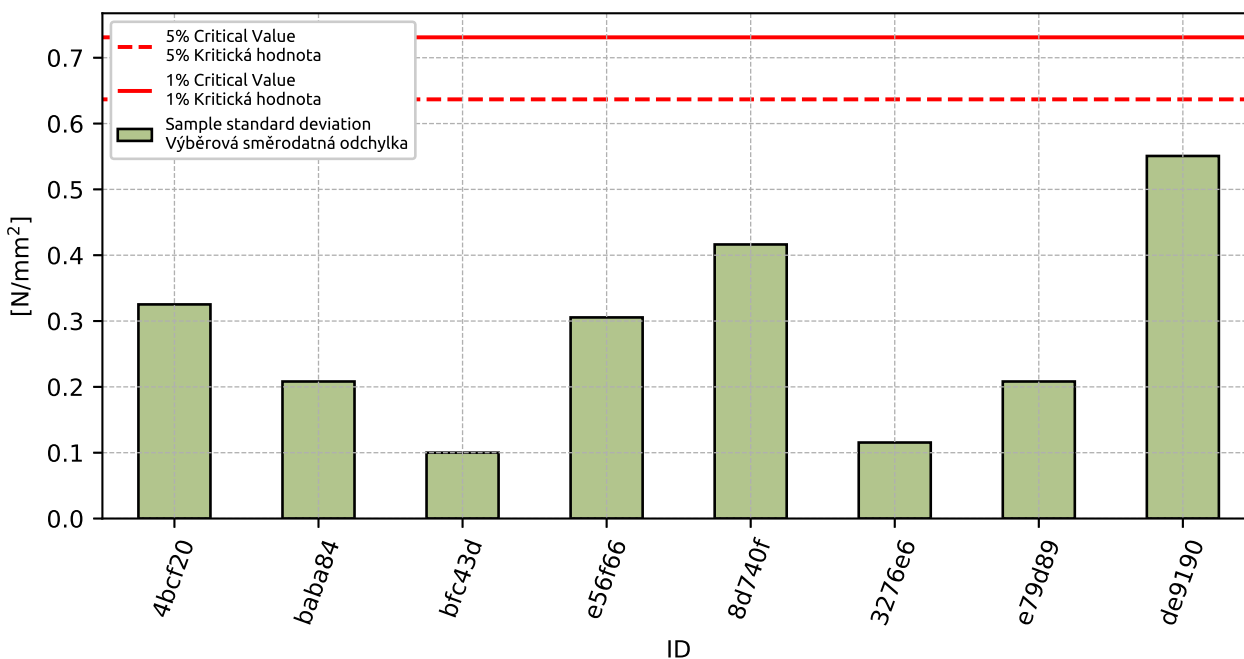


Figure 1: Cochran's test - sample standard deviations

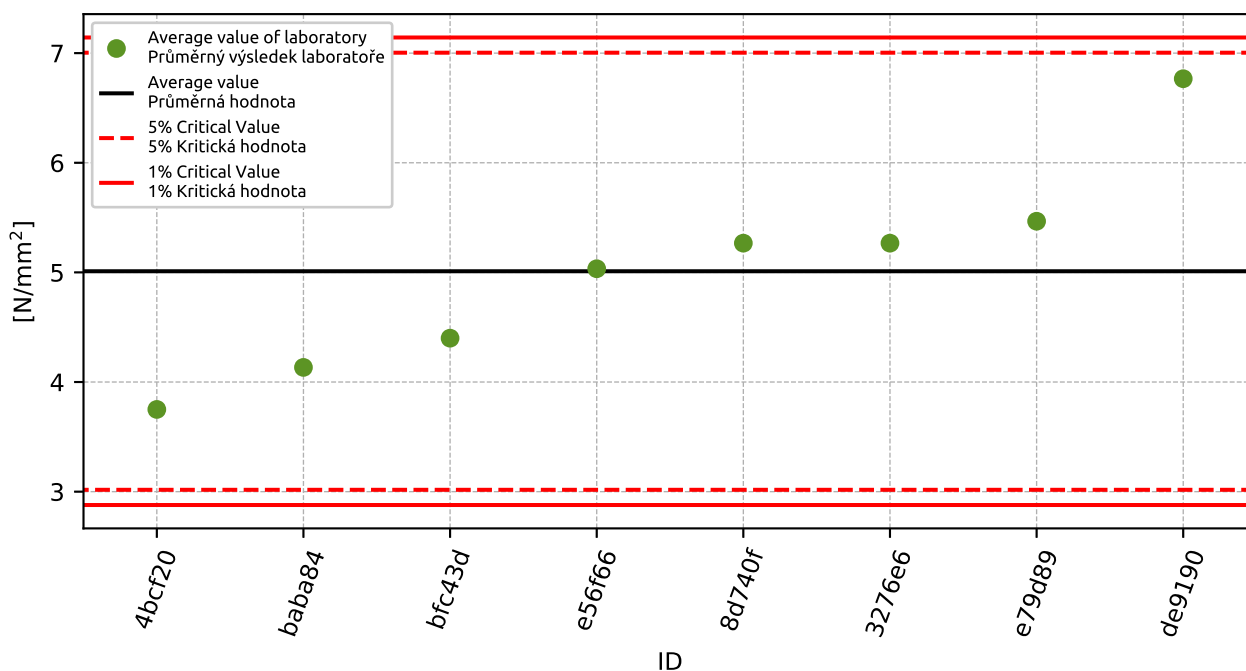


Figure 2: **Grubbs' test** - average values

1.1.3 Mandel's Statistics

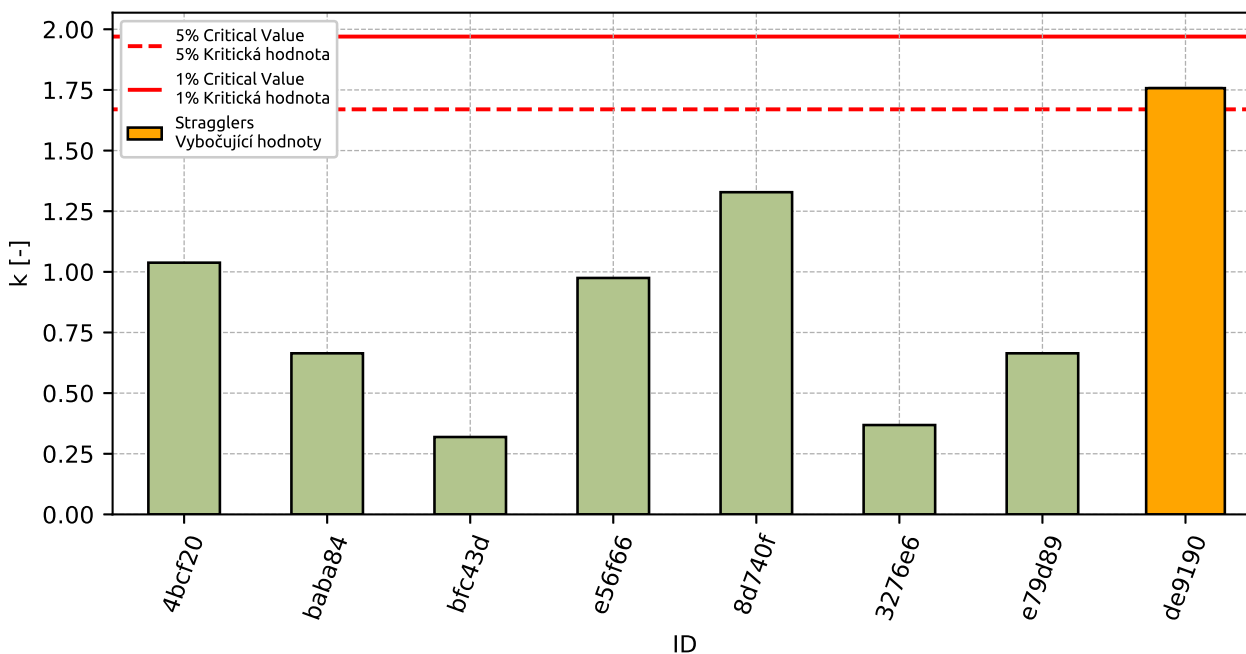


Figure 3: Intralaboratory Consistency Statistic

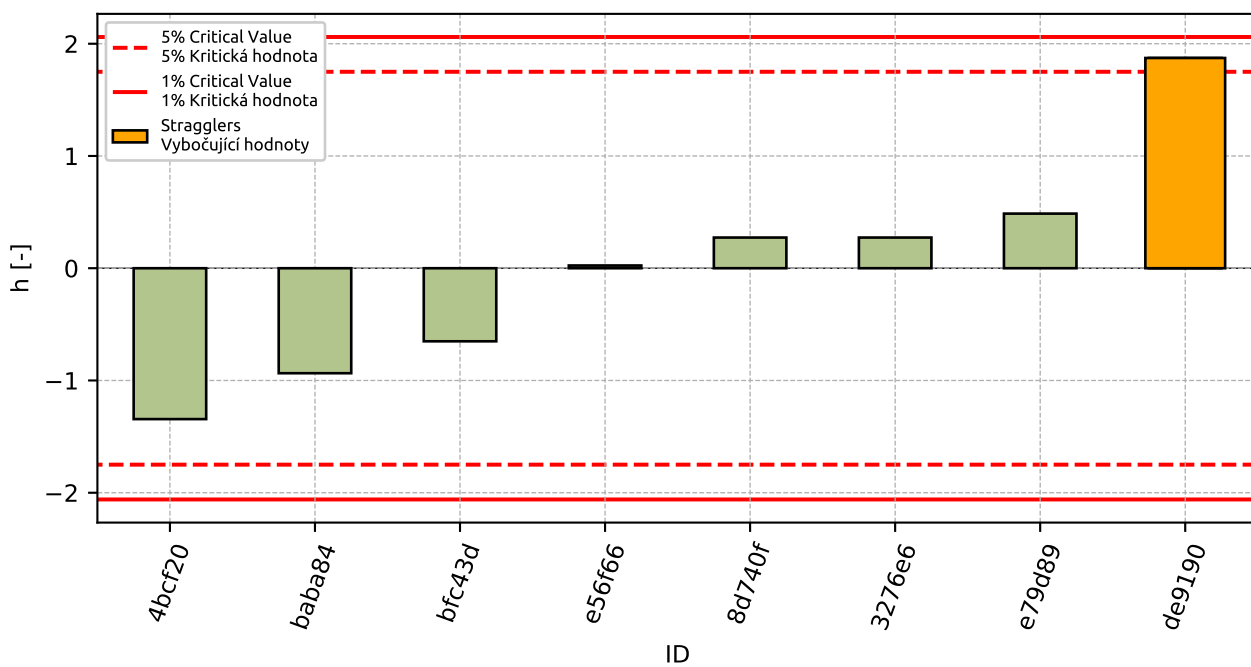


Figure 4: Interlaboratory Consistency Statistic

1.1.4 Descriptive statistics

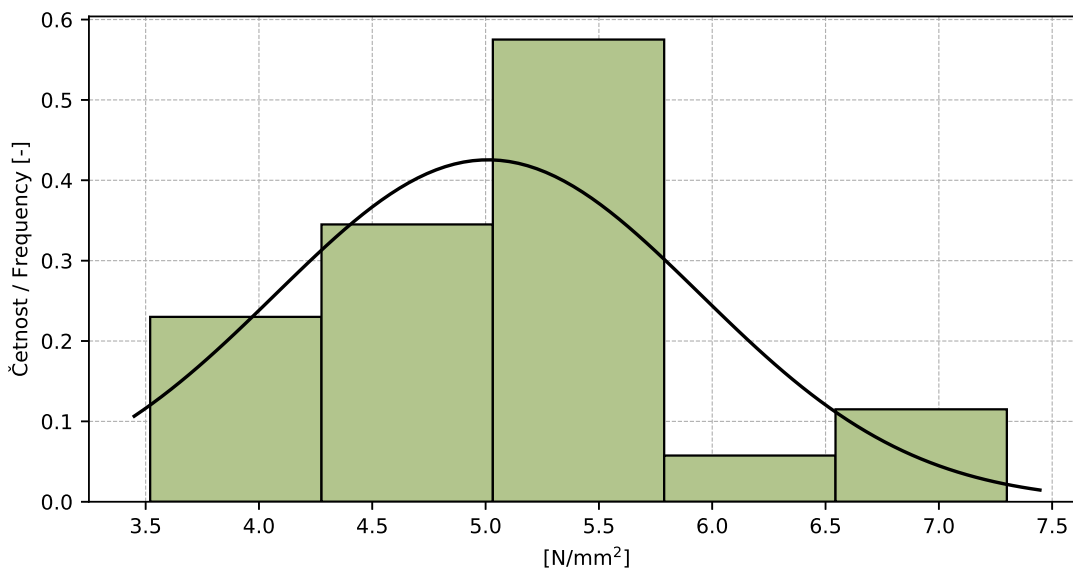


Figure 5: Histogram of all test results

Table 5: Descriptive statistics

Characteristics	[N/mm ²]
Průměrná hodnota / Average value – \bar{x}	5.0
Výběrová směrodatná odchylka / Sample standard deviation – s	0.94
Vztažná hodnota / Assigned value – x^*	5.0
Robustní směrodatná odchylka / Robust standard deviation – s^*	0.95
Nejistota měření vztažné hodnoty / Measurement uncertainty of assigned value – u_X	0.42
Mezilaboratorní sm. odch. / Interlaboratory standard deviation – s_L	0.92
Směrodatná odchylka opakovatelnosti / Repeatability standard deviation – s_r	0.31
Směrodatná odchylka reprodukovatelnosti / Reproducibility standard deviation – s_R	0.97
Opakovatelnost / Repeatability – r	0.9
Reprodukovatelnost / Reproducibility – R	2.7

1.1.5 Evaluation of Performance Statistics

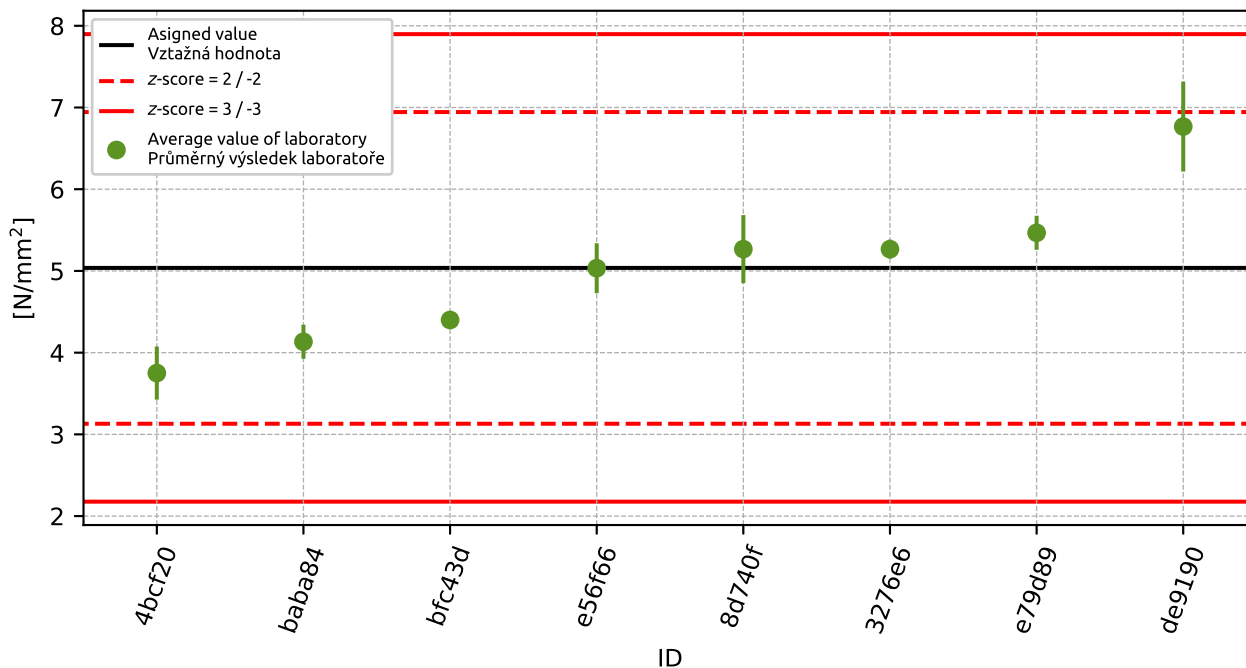


Figure 6: Average values and sample standard deviations

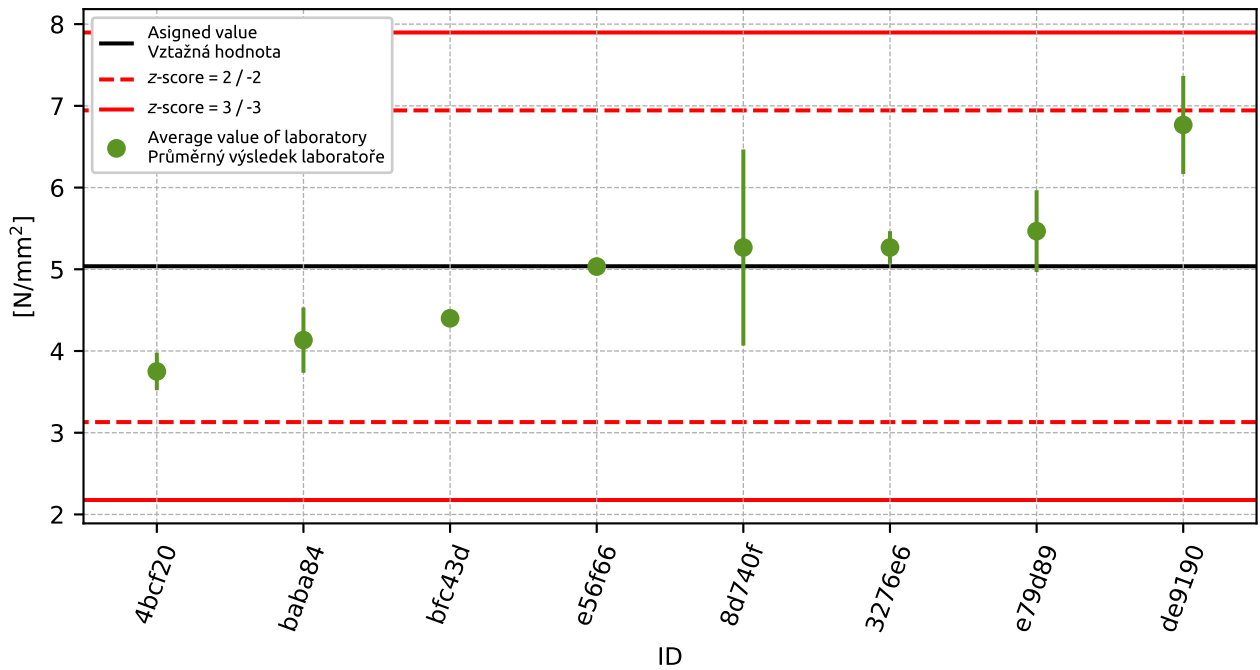


Figure 7: Average values and extended uncertainties of measurement

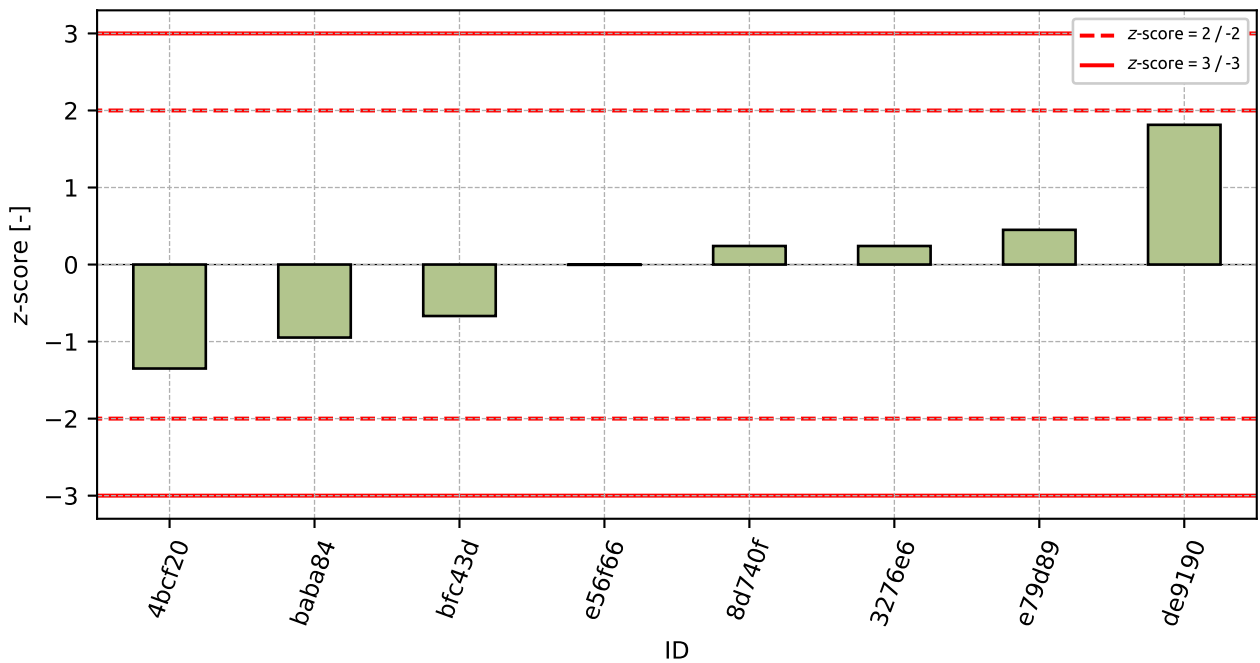
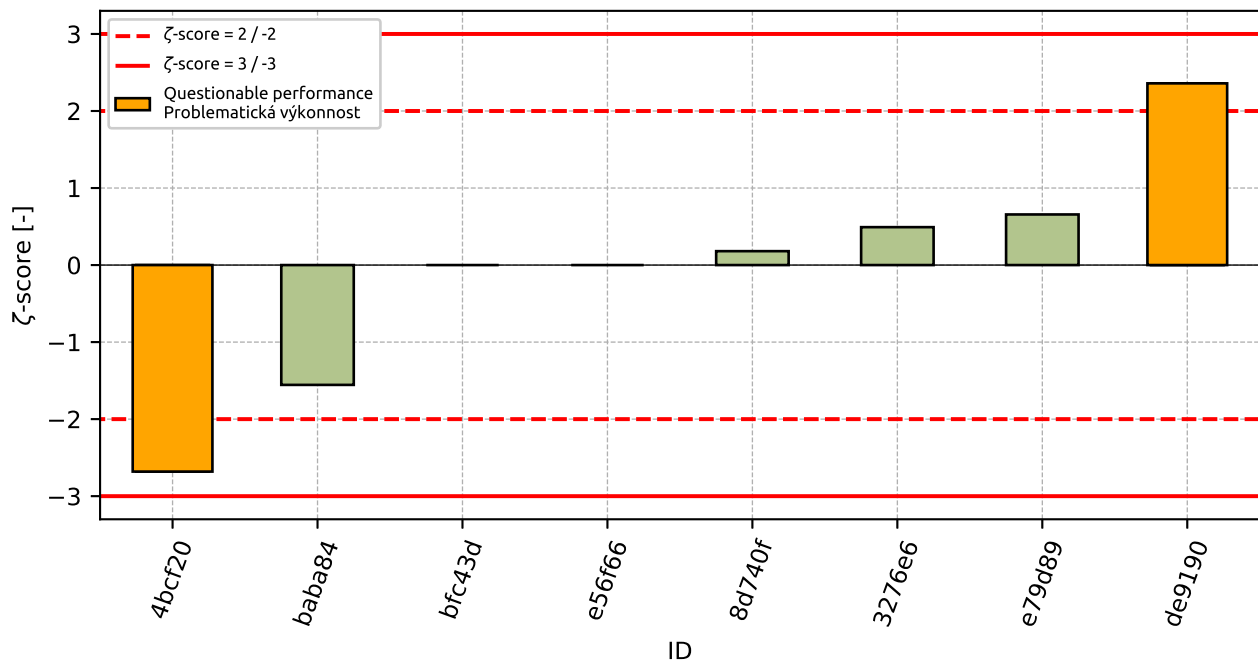


Figure 8: z-score

Figure 9: ζ -scoreTable 6: z-score and ζ -score

ID	z-score [-]	ζ -score [-]
4bcf20	-1.35	-2.68
baba84	-0.95	-1.56
bfc43d	-0.67	-
e56f66	-0.0	-
8d740f	0.24	0.18
3276e6	0.24	0.49
e79d89	0.45	0.66
de9190	1.81	2.36

1.2 Compressive Strength after 2 days of ageing

1.2.1 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 [N/mm ²]						u_x	\bar{x}	s_0	V_x
							[N/mm ²]	[N/mm ²]	[N/mm ²]	[%]
baba84	20.1	20.0	18.7	20.2	19.4	18.1	2.0	19.4	0.86	4.41
db7c2e	24.3	23.7	24.4	24.0	24.0	24.1	3.0	24.1	0.25	1.03
8d740f	25.2	24.7	25.1	25.2	24.7	24.9	1.5	25.0	0.23	0.94
3276e6	25.2	24.7	25.3	24.9	25.3	25.1	0.3	25.1	0.24	0.96
bfc43d	26.6	23.9	25.4	24.7	24.9	26.0	-	25.2	0.96	3.82
e79d89	25.3	25.6	25.3	25.3	25.6	26.9	1.3	25.7	0.62	2.42
4bcf20	26.2	27.5	25.6	25.6	25.0	26.9	0.4	26.1	0.92	3.52
e56f66	27.0	28.4	25.0	22.8	28.4	25.5	-	26.2	2.18	8.33
de9190	28.4	30.0	30.2	30.9	28.2	27.9	1.2	29.3	1.25	4.28

1.2.2 The Numerical Procedure for Determining Outliers

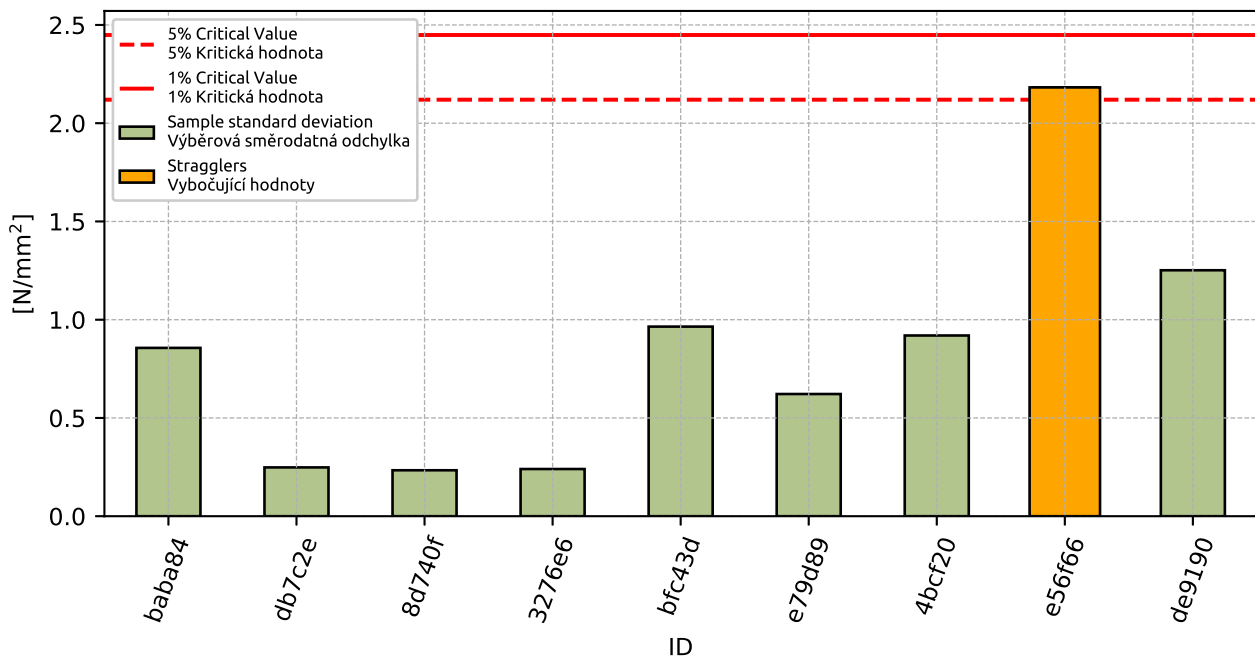


Figure 10: Cochran's test - sample standard deviations

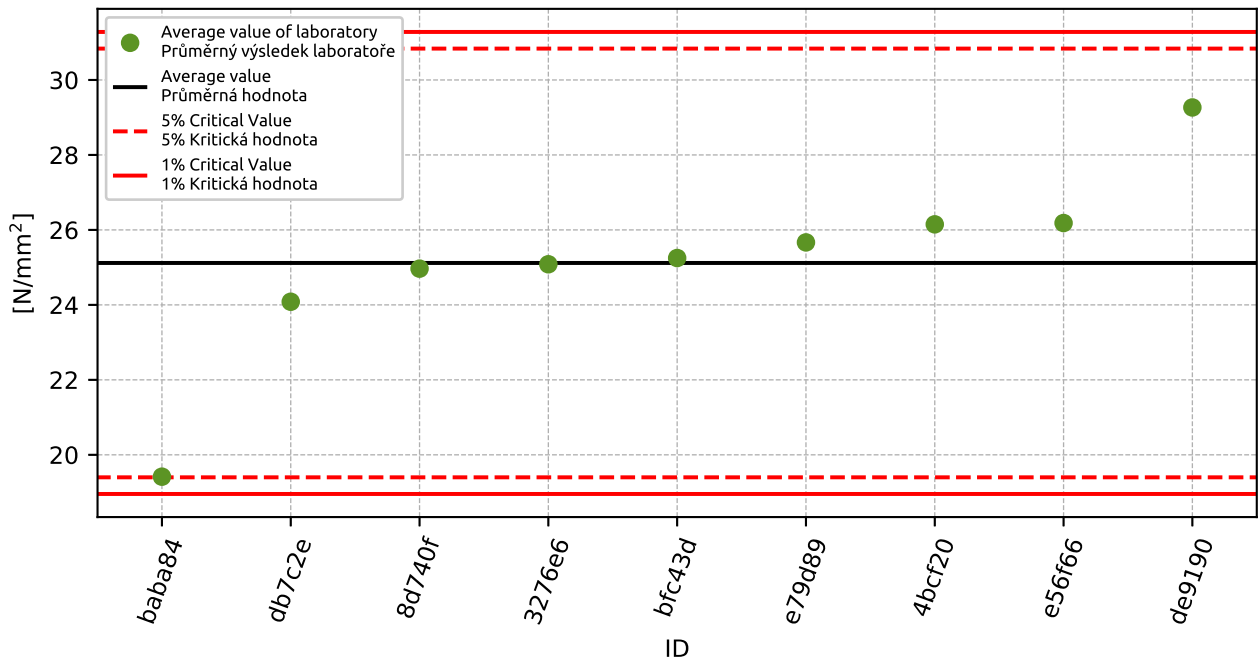


Figure 11: **Grubbs' test** - average values

1.2.3 Mandel's Statistics

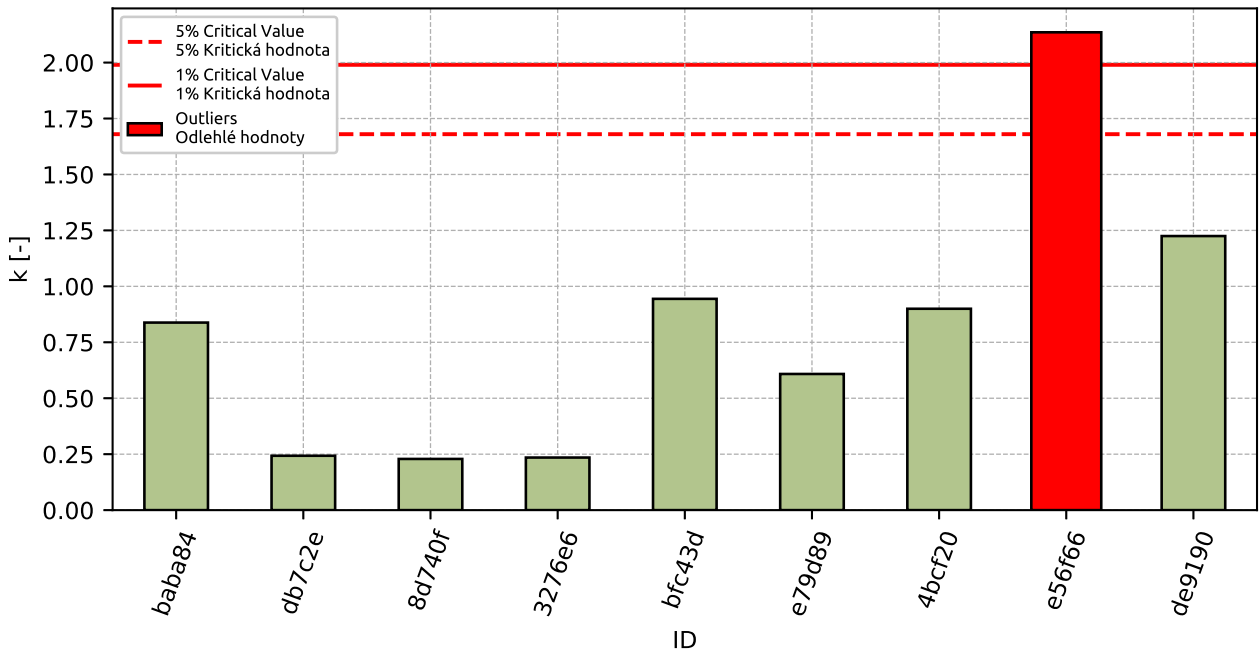


Figure 12: Intralaboratory Consistency Statistic

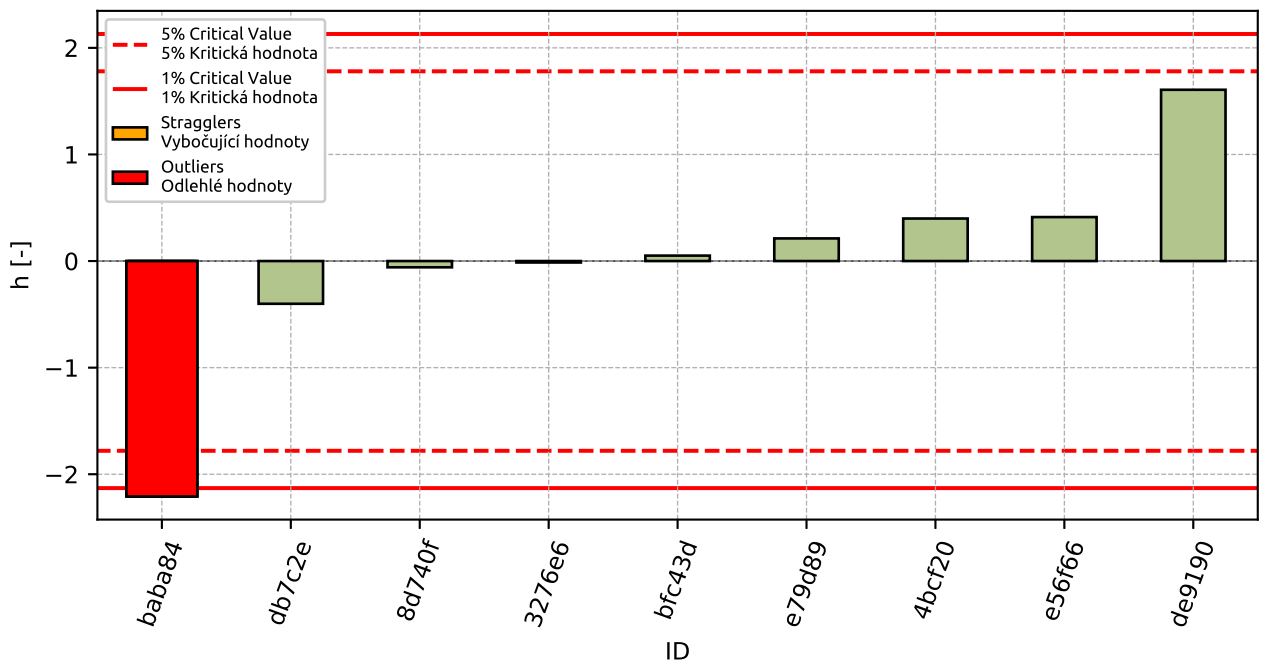


Figure 13: Interlaboratory Consistency Statistic

1.2.4 Descriptive statistics

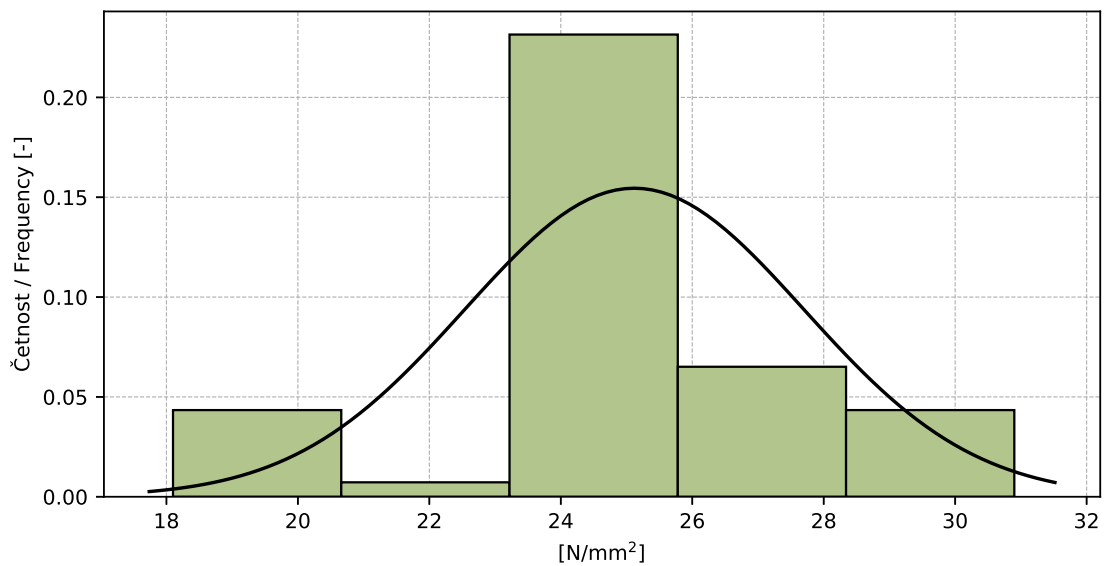


Figure 14: Histogram of all test results

Table 8: Descriptive statistics

Characteristics	[N/mm ²]
Průměrná hodnota / Average value – \bar{x}	25.1
Výběrová směrodatná odchylka / Sample standard deviation – s	2.58
Vztažná hodnota / Assigned value – x^*	25.5
Robustní směrodatná odchylka / Robust standard deviation – s^*	1.8
Nejistota měření vztažné hodnoty / Measurement uncertainty of assigned value – u_X	0.75
p -hodnota testu normality / p -value of normality test	0.042 [-]
Mezilaboratorní sm. odch. / Interlaboratory standard deviation – s_L	2.55
Směrodatná odchylka opakovatelnosti / Repeatability standard deviation – s_r	1.02
Směrodatná odchylka reprodukovatelnosti / Reproducibility standard deviation – s_R	2.75
Opakovatelnost / Repeatability – r	2.9
Reprodukovatelnost / Reproducibility – R	7.7

1.2.5 Evaluation of Performance Statistics

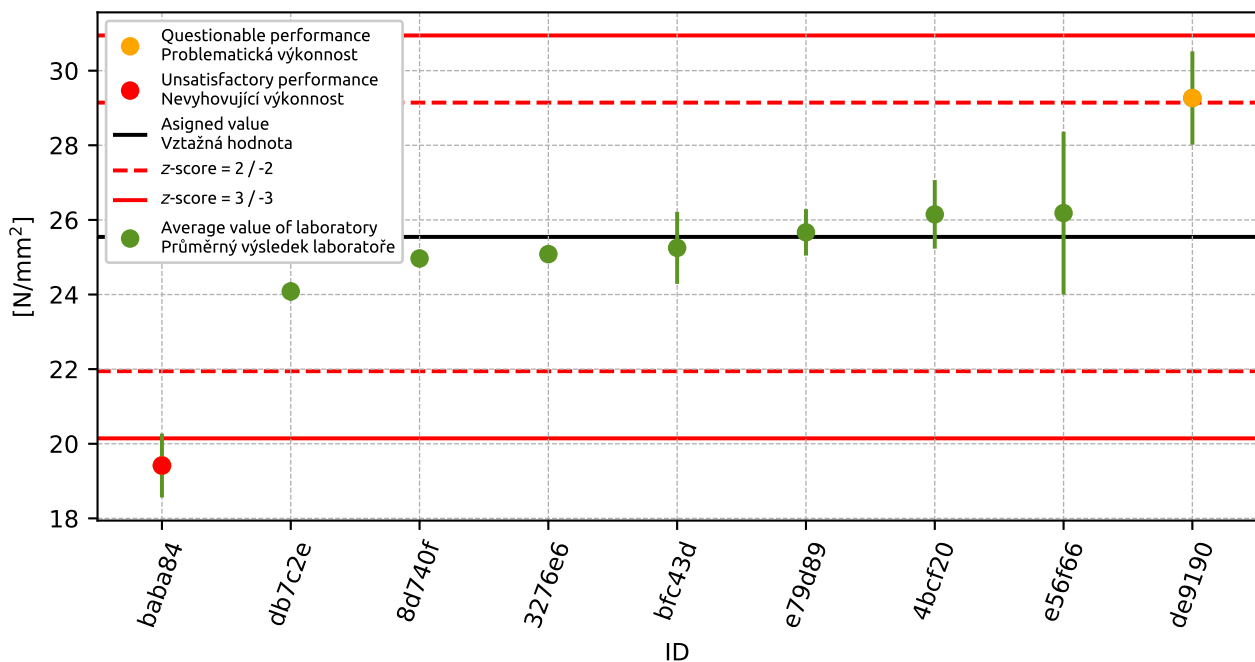


Figure 15: Average values and sample standard deviations

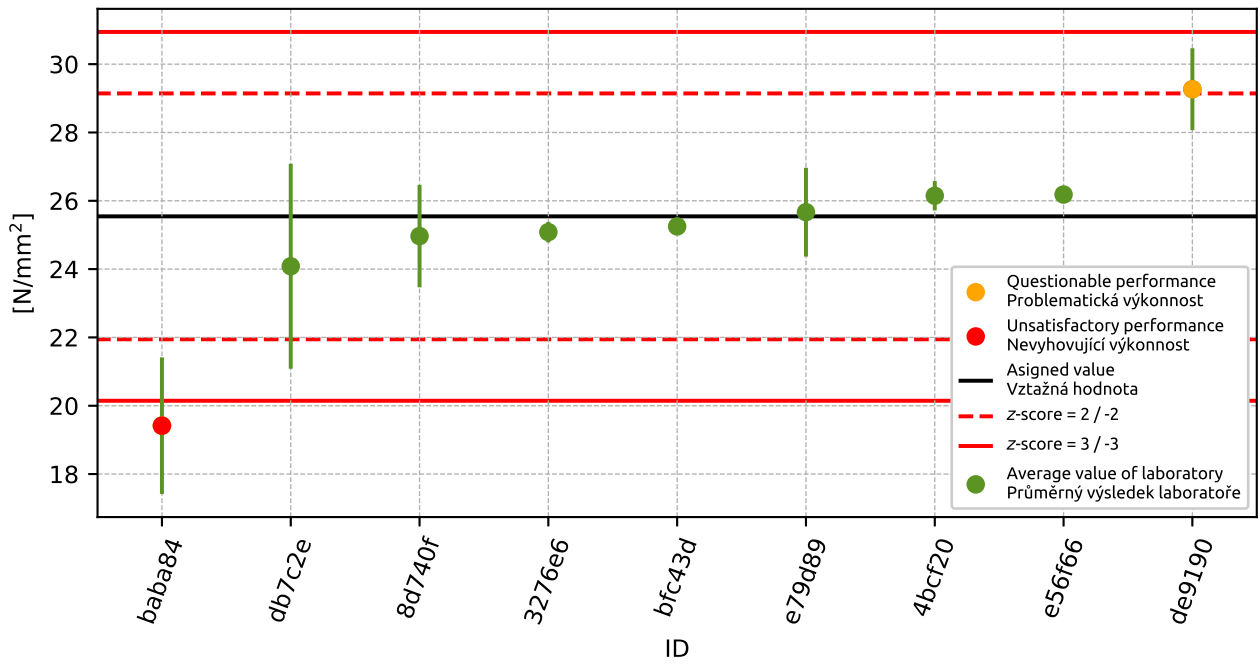


Figure 16: Average values and extended uncertainties of measurement

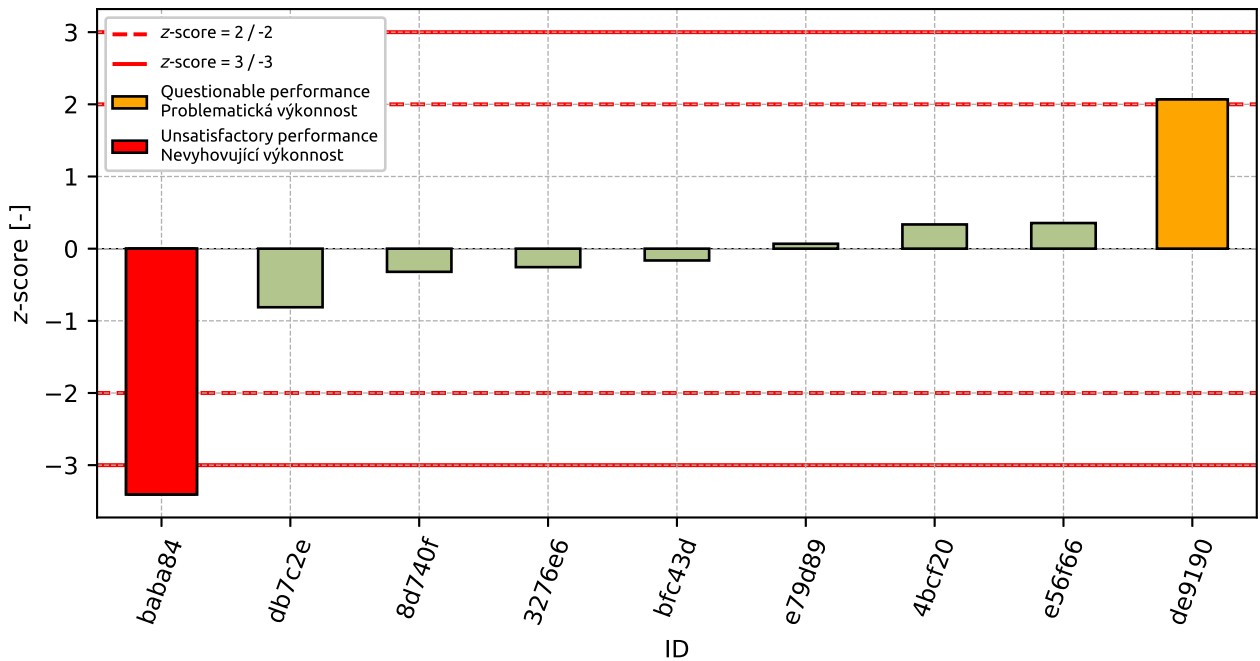
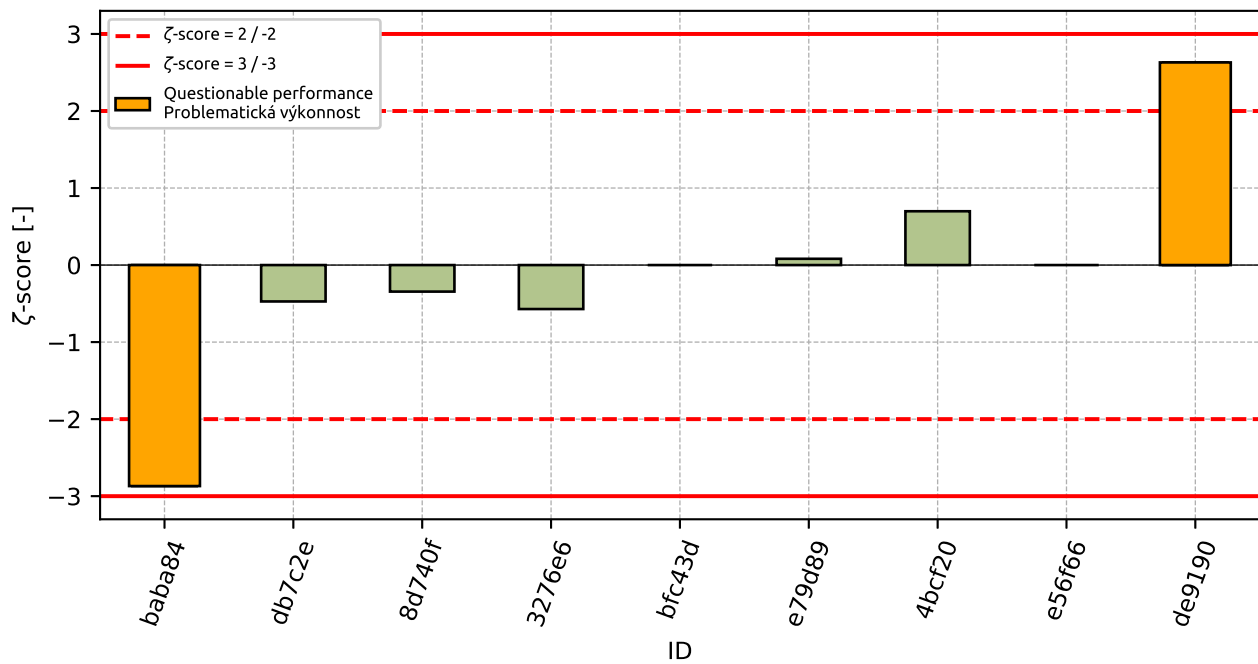


Figure 17: z-score

Figure 18: ζ -scoreTable 9: z-score and ζ -score

ID	z-score [-]	ζ -score [-]
baba84	-3.4	-2.87
db7c2e	-0.81	-0.47
8d740f	-0.32	-0.34
3276e6	-0.26	-0.57
bfc43d	-0.16	-
e79d89	0.07	0.08
4bcf20	0.34	0.7
e56f66	0.36	-
de9190	2.07	2.63

1.3 Flexural Strength after 7 days of ageing

1.3.1 Test results

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

ID	Test results			u_x	\bar{x}	s_0	V_x
	[N/mm ²]						
8d740f	6.0	6.8	6.3	1.1	6.4	0.4	6.35
baba84	6.6	6.3	6.6	0.5	6.5	0.17	2.66
bfc43d	6.7	6.9	6.6	-	6.7	0.15	2.27
3276e6	7.9	6.8	6.6	0.2	7.1	0.7	9.86
e79d89	7.9	7.7	7.9	0.5	7.8	0.12	1.47
e56f66	8.5	8.4	7.7	-	8.2	0.44	5.32
de9190	9.4	8.8	7.5	0.8	8.6	0.97	11.34
4bcf20	8.4	9.8	8.0	0.6	8.8	0.97	11.12

1.3.2 The Numerical Procedure for Determining Outliers

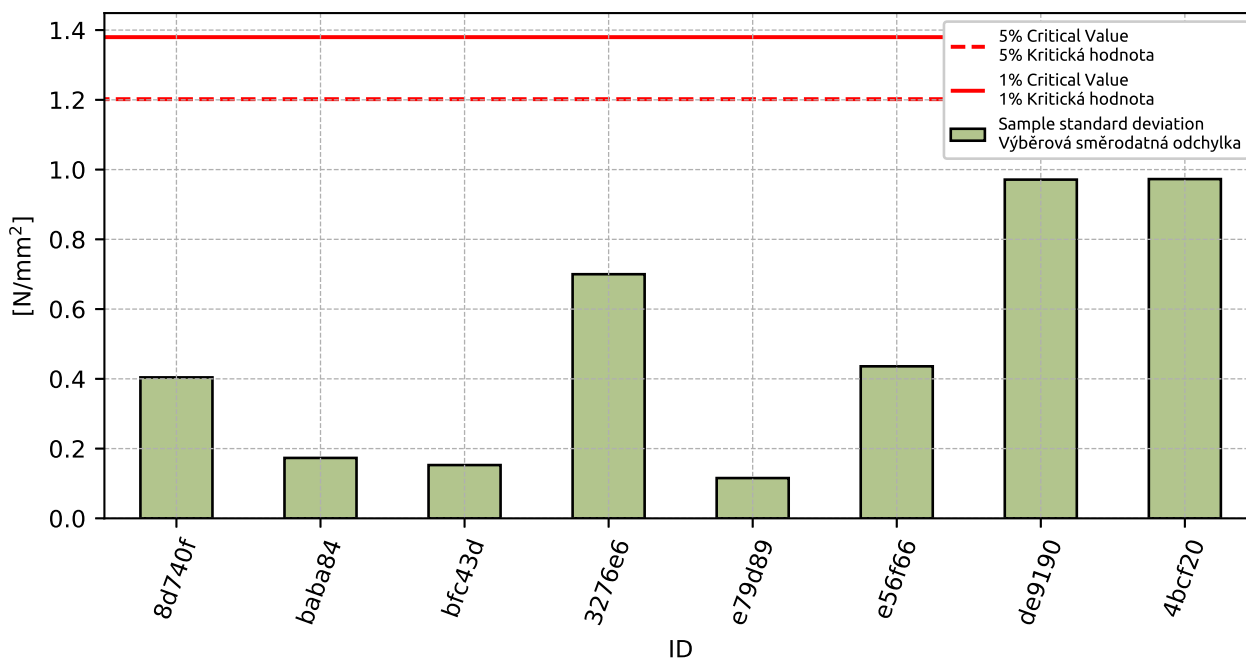


Figure 19: Cochran's test - sample standard deviations

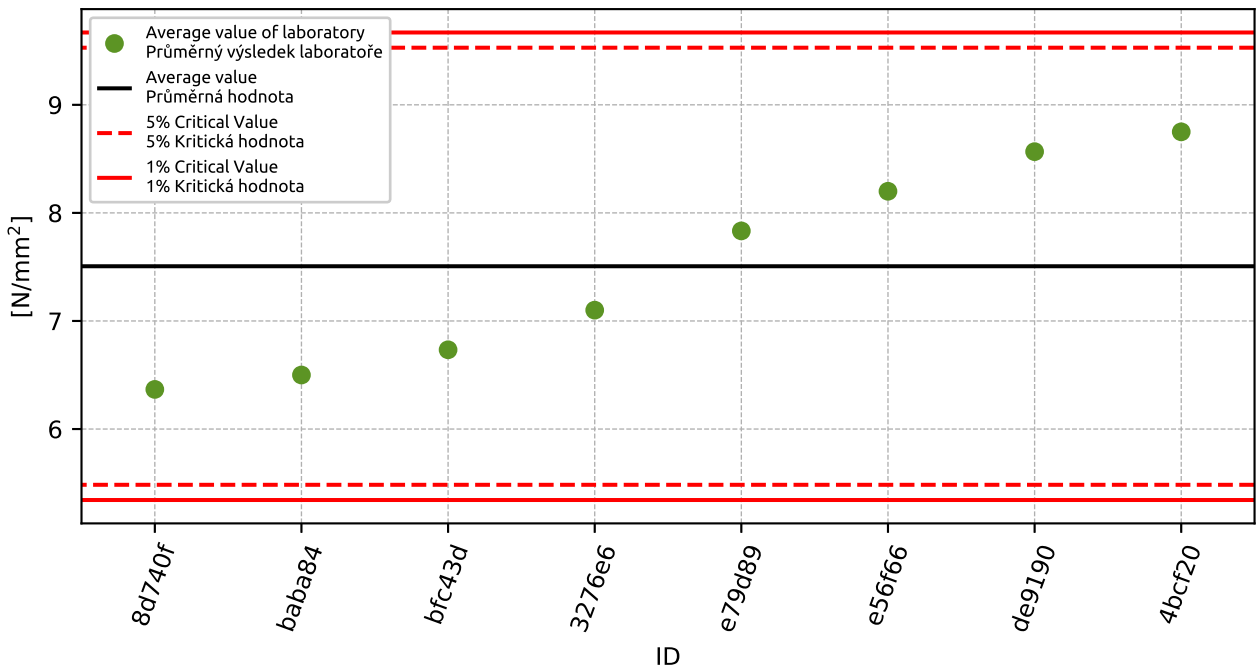


Figure 20: **Grubbs' test** - average values

1.3.3 Mandel's Statistics

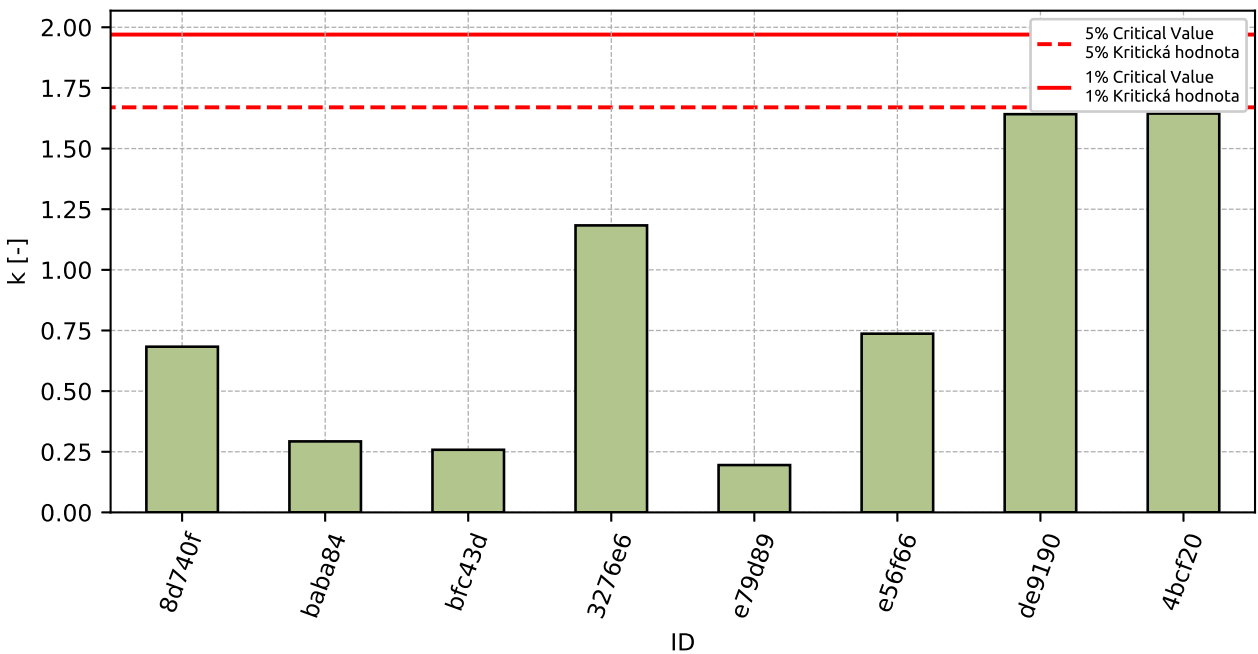


Figure 21: Intralaboratory Consistency Statistic

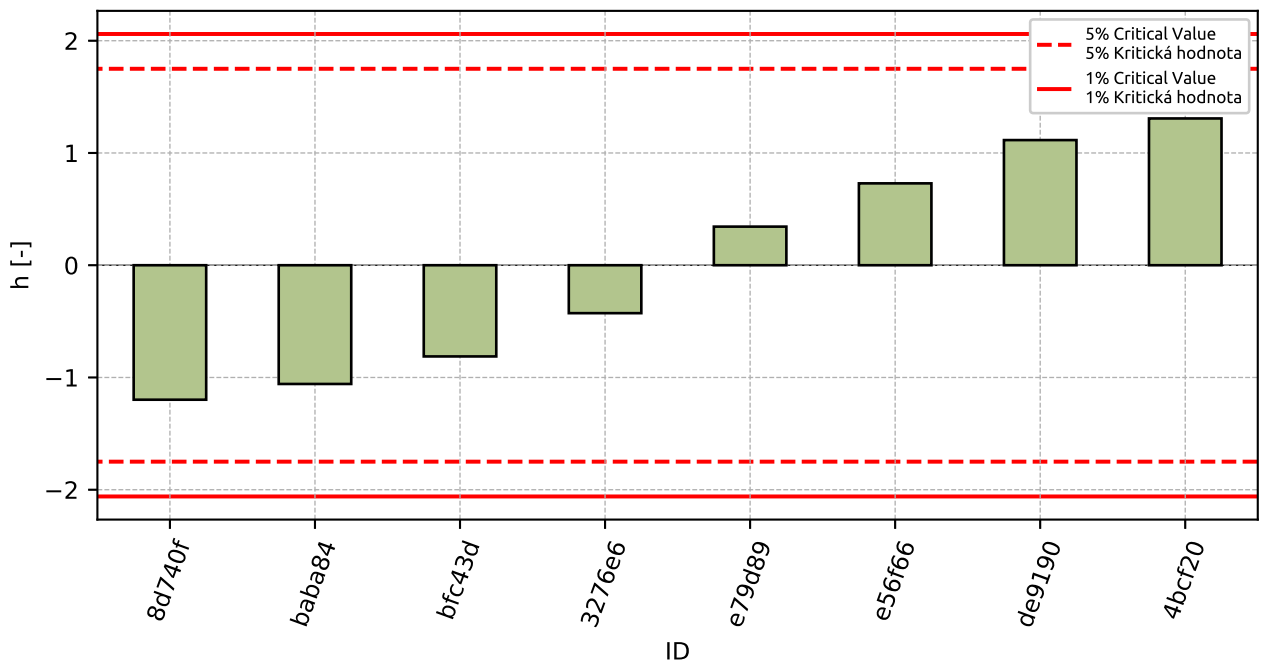


Figure 22: Interlaboratory Consistency Statistic

1.3.4 Descriptive statistics

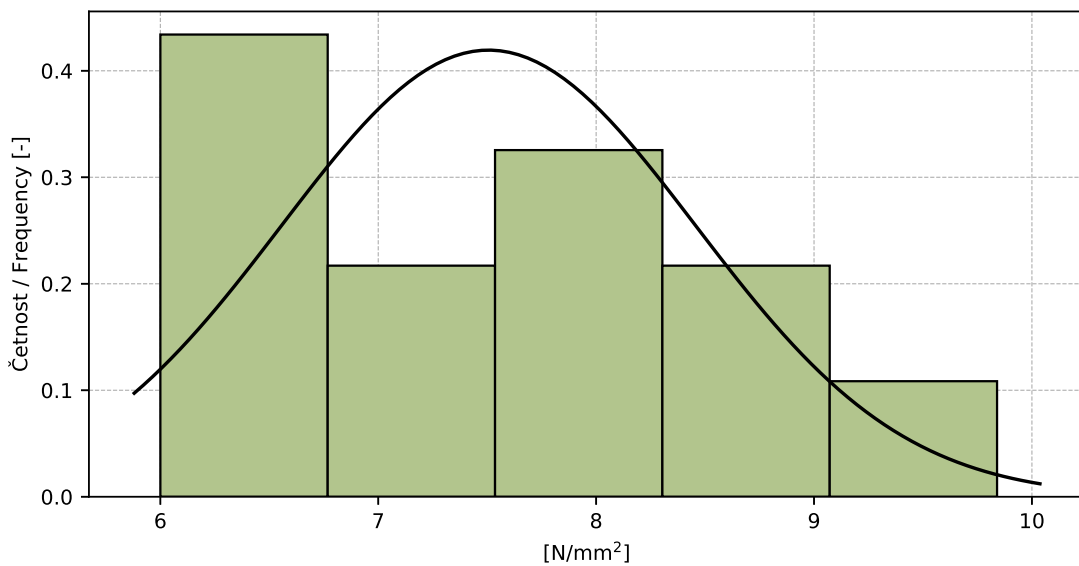


Figure 23: Histogram of all test results

Table 11: Descriptive statistics

Characteristics	[N/mm ²]
Průměrná hodnota / Average value – \bar{x}	7.5
Výběrová směrodatná odchylka / Sample standard deviation – s	0.95
Vztažná hodnota / Assigned value – x^*	7.5
Robustní směrodatná odchylka / Robust standard deviation – s^*	1.01
Nejistota měření vztažné hodnoty / Measurement uncertainty of assigned value – u_X	0.45
p -hodnota testu normality / p -value of normality test	0.444 [-]
Mezilaboratorní sm. odch. / Interlaboratory standard deviation – s_L	0.89
Směrodatná odchylka opakovatelnosti / Repeatability standard deviation – s_r	0.59
Směrodatná odchylka reprodukovatelnosti / Reproducibility standard deviation – s_R	1.07
Opakovatelnost / Repeatability – r	1.7
Reprodukovatelnost / Reproducibility – R	3.0

1.3.5 Evaluation of Performance Statistics

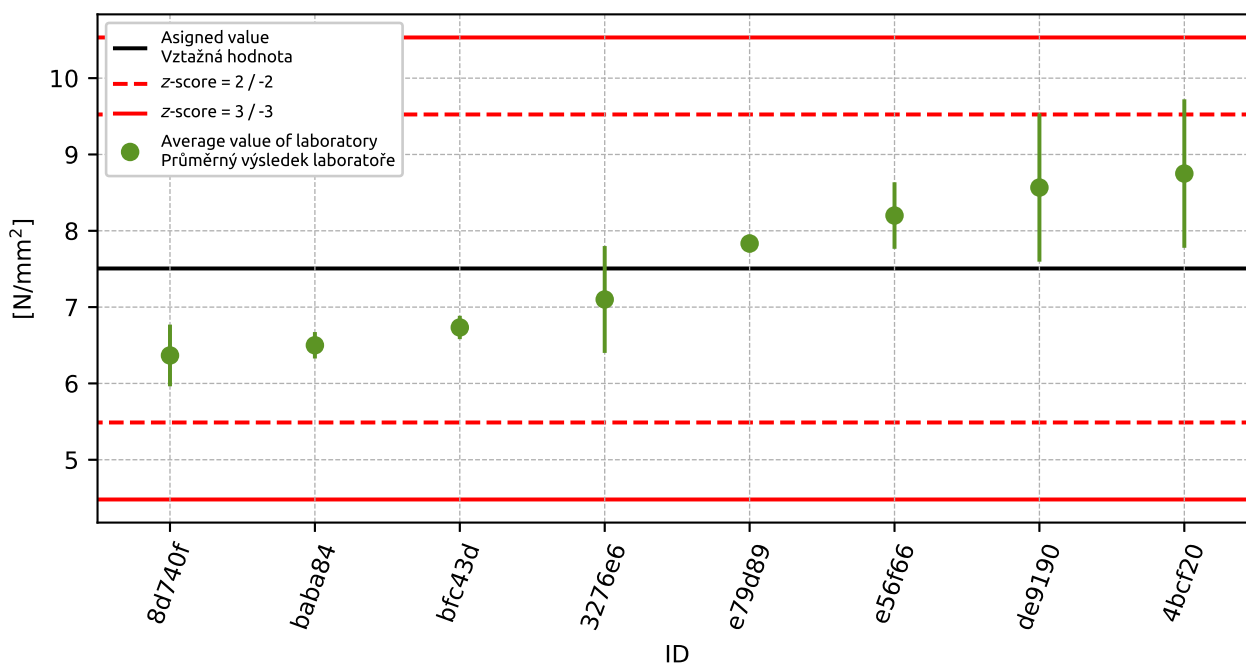


Figure 24: Average values and sample standard deviations

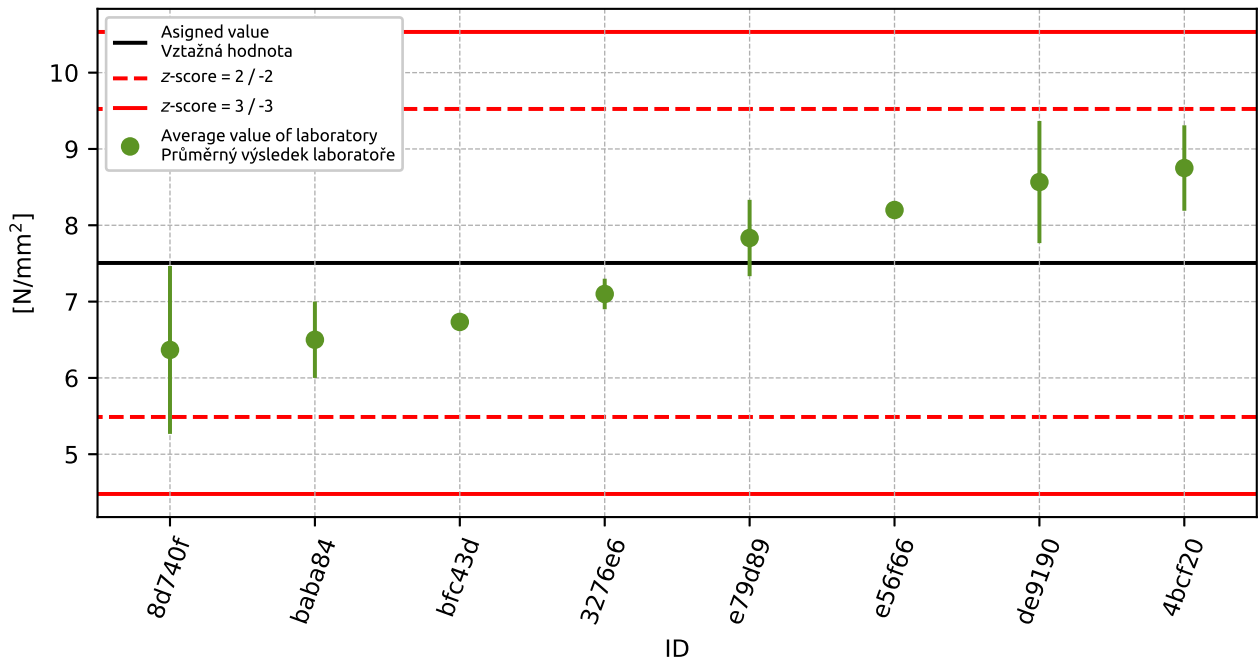


Figure 25: Average values and extended uncertainties of measurement

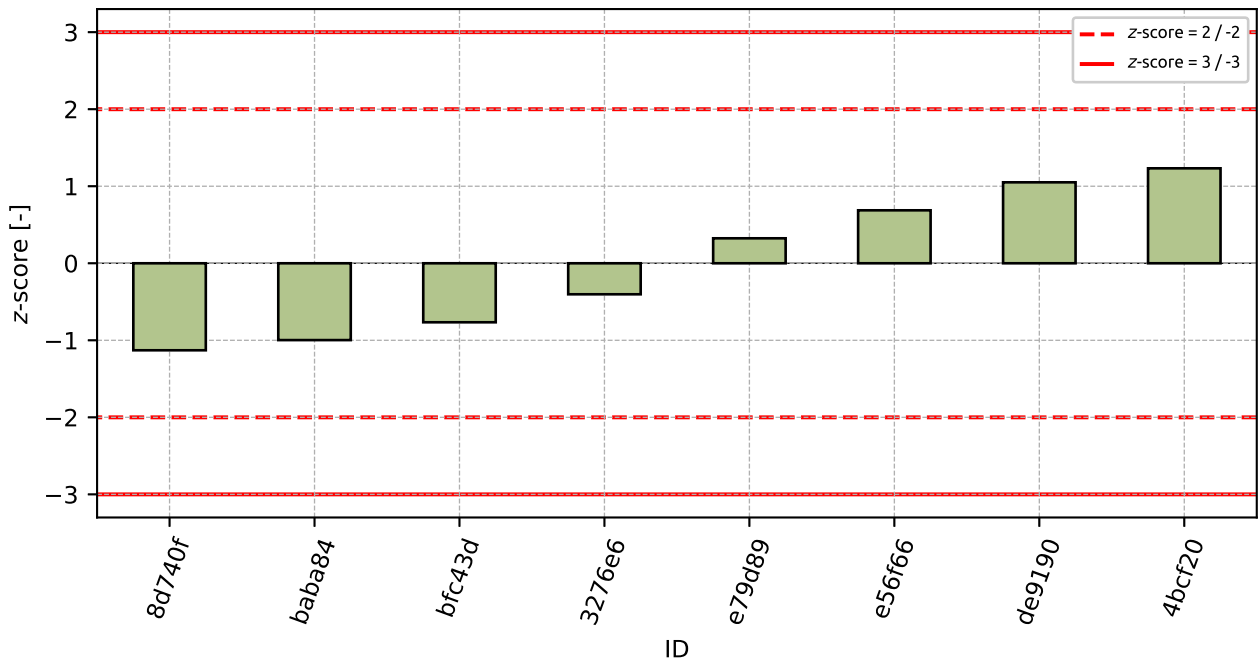


Figure 26: z-score

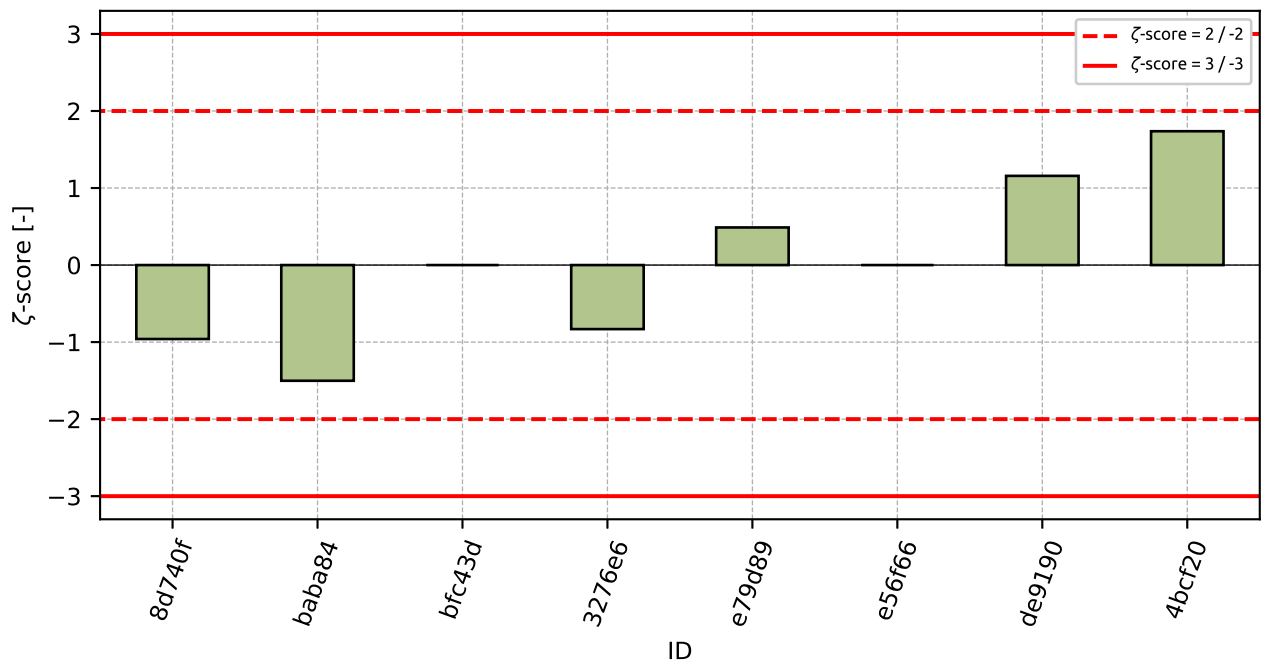


Figure 27: z-score

Table 12: z-score and z-score

ID	z-score [-]	z-score [-]
8d740f	-1.13	-0.96
baba84	-1.0	-1.5
bfc43d	-0.77	-
3276e6	-0.4	-0.83
e79d89	0.32	0.49
e56f66	0.69	-
de9190	1.05	1.16
4bcf20	1.23	1.74

1.4 Compressive Strength after 7 days of ageing

1.4.1 Test results

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

ID	Test results [N/mm ²]						u_x [N/mm ²]	\bar{x} [N/mm ²]	s_0 [N/mm ²]	V_x [%]
	baba84	36.7	29.2	36.0	34.5	34.5	37.2	3.0	34.7	2.91
4bcf20	31.2	33.1	38.8	36.2	35.0	36.9	1.1	35.2	2.7	7.67
e79d89	36.3	36.6	36.6	37.5	36.4	37.6	1.3	36.8	0.57	1.54
3276e6	39.5	39.0	40.7	38.0	39.5	41.8	1.0	39.8	1.33	3.35
bfc43d	41.3	39.0	40.9	41.9	40.2	39.8	-	40.5	1.06	2.61
db7c2e	39.4	41.7	41.8	43.2	42.7	40.6	3.0	41.6	1.39	3.34
e56f66	42.0	43.4	40.9	41.4	42.8	40.0	-	41.8	1.25	2.99
8d740f	42.1	41.8	42.6	42.8	42.7	42.5	2.5	42.4	0.39	0.91
de9190	50.2	51.9	52.2	51.2	52.0	50.9	1.1	51.4	0.77	1.5

1.4.2 The Numerical Procedure for Determining Outliers

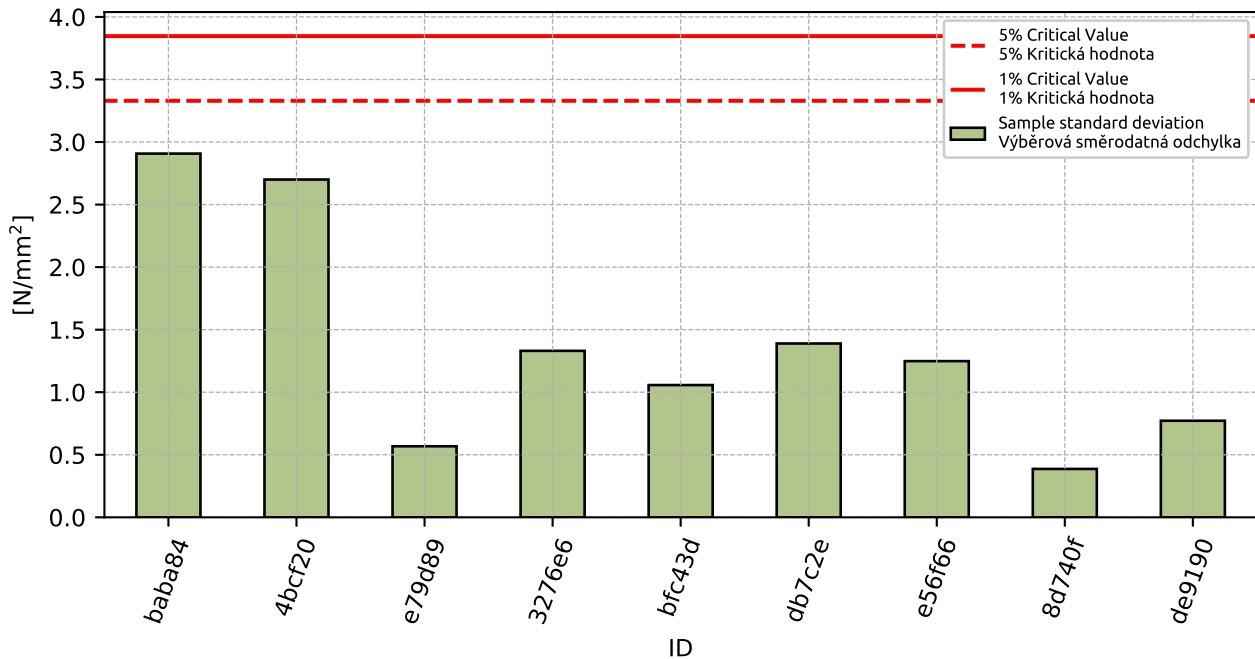


Figure 28: **Cochran's test** - sample standard deviations

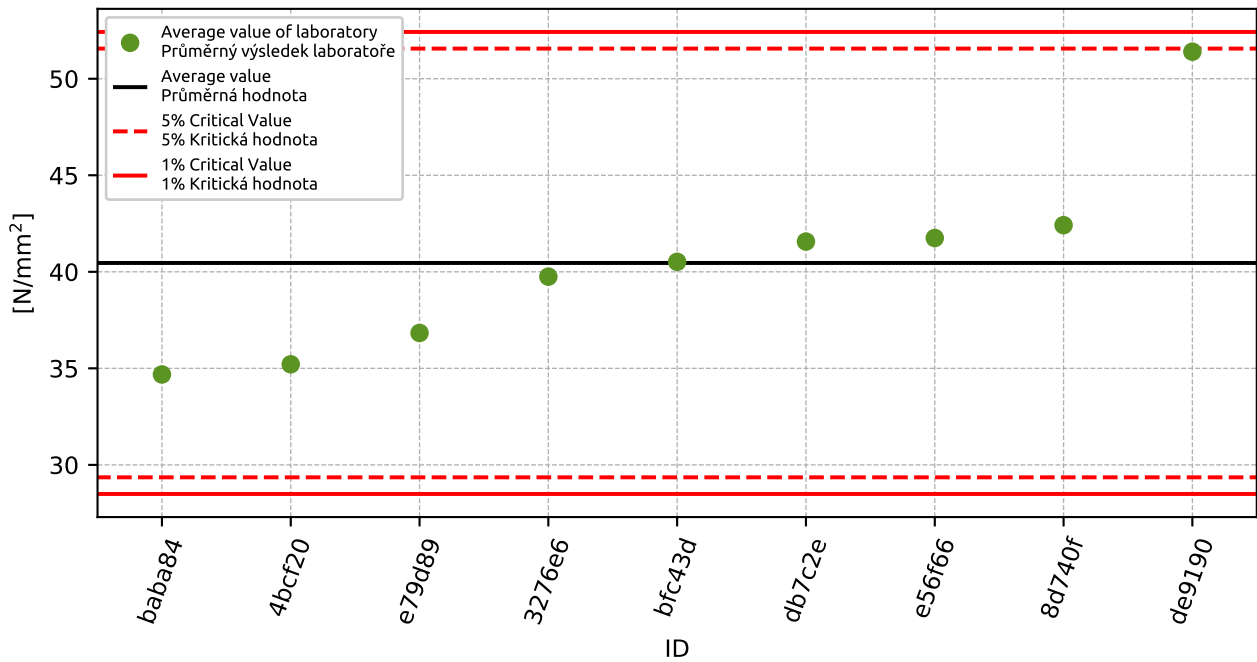


Figure 29: **Grubbs' test** - average values

1.4.3 Mandel's Statistics

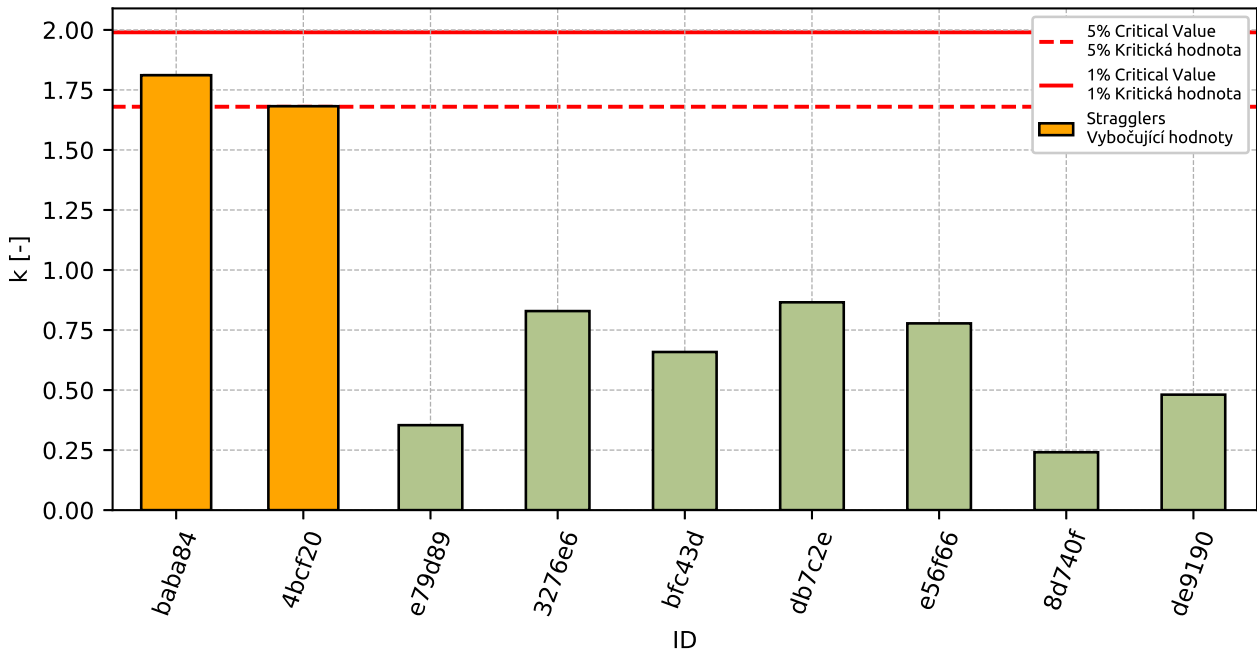


Figure 30: Intralaboratory Consistency Statistic

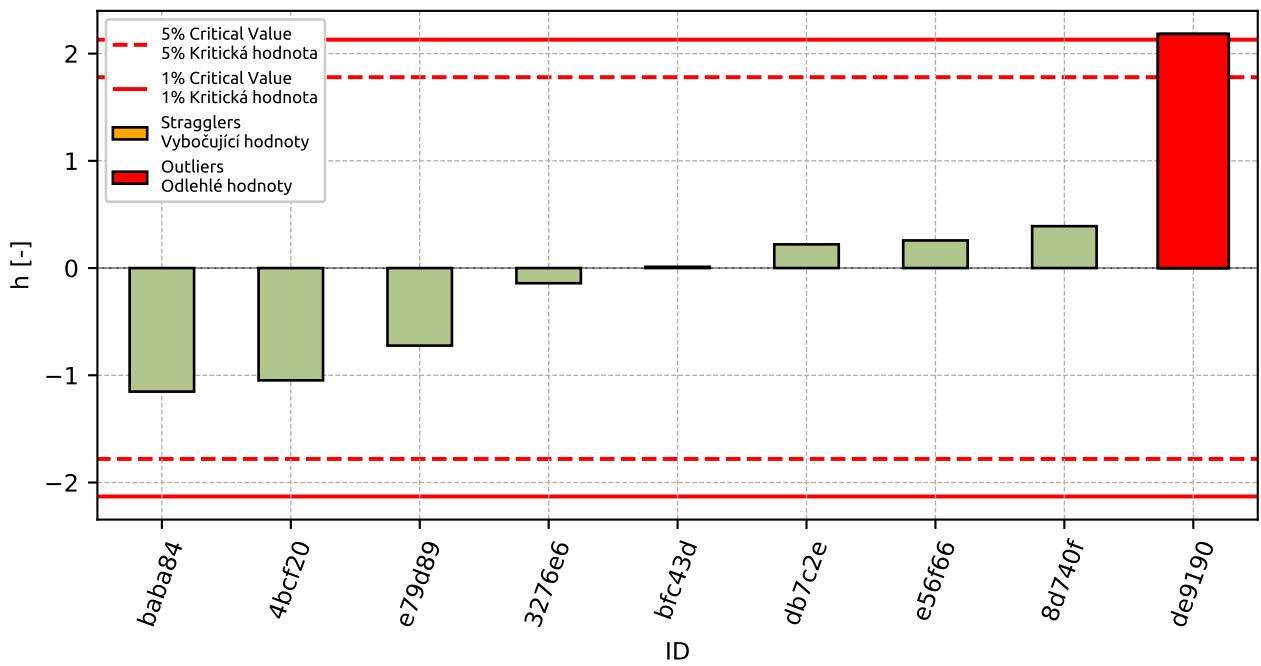


Figure 31: Interlaboratory Consistency Statistic

1.4.4 Descriptive statistics

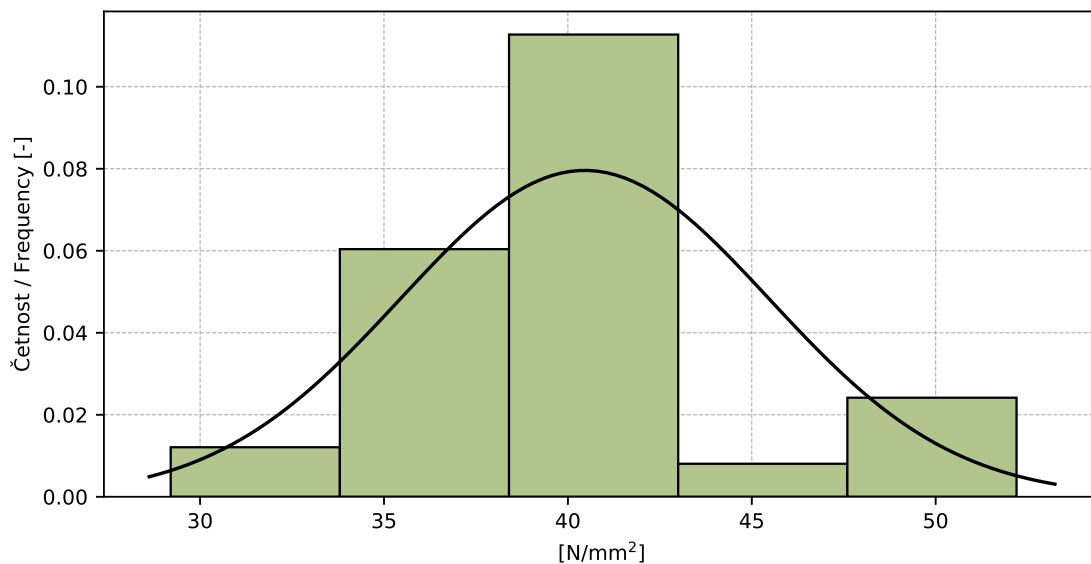


Figure 32: Histogram of all test results

Table 14: Descriptive statistics

Characteristics	[N/mm ²]
Průměrná hodnota / Average value – \bar{x}	40.5
Výběrová směrodatná odchylka / Sample standard deviation – s	5.01
Vztažná hodnota / Assigned value – x^*	40.8
Robustní směrodatná odchylka / Robust standard deviation – s^*	4.99
Nejistota měření vztažné hodnoty / Measurement uncertainty of assigned value – u_X	2.08
p -hodnota testu normality / p -value of normality test	0.048 [-]
Mezilaboratorní sm. odch. / Interlaboratory standard deviation – s_L	4.97
Směrodatná odchylka opakovatelnosti / Repeatability standard deviation – s_r	1.61
Směrodatná odchylka reprodukovatelnosti / Reproducibility standard deviation – s_R	5.22
Opakovatelnost / Repeatability – r	4.5
Reprodukovatelnost / Reproducibility – R	14.6

1.4.5 Evaluation of Performance Statistics

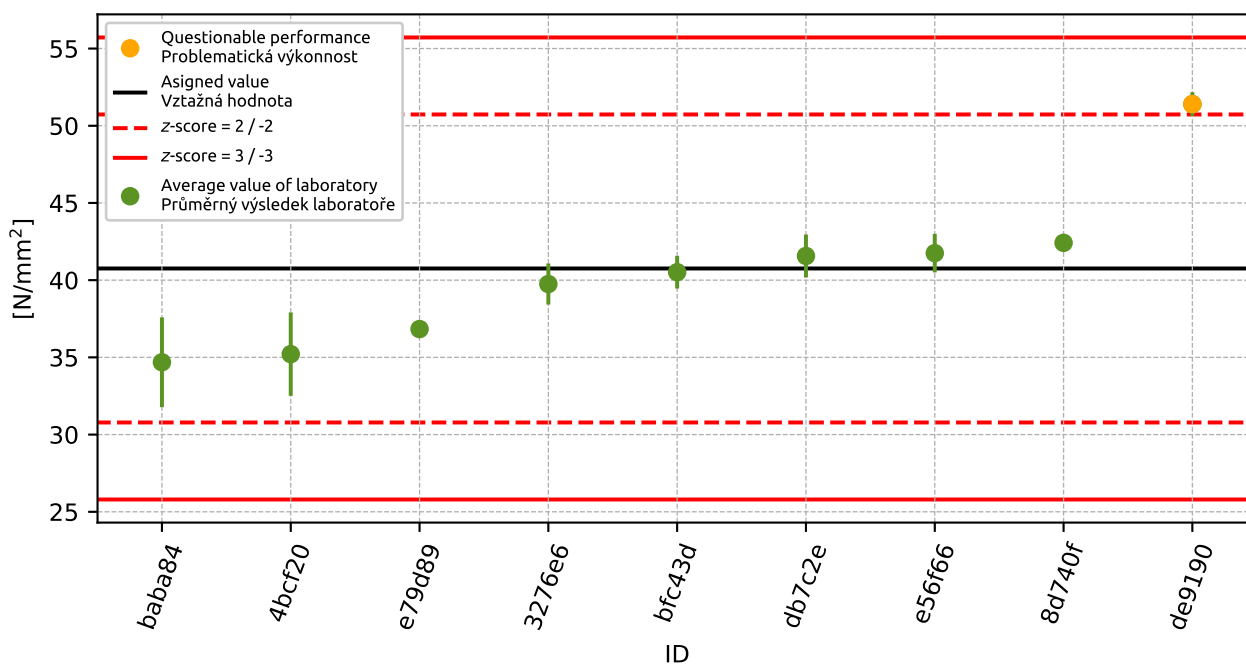


Figure 33: Average values and sample standard deviations

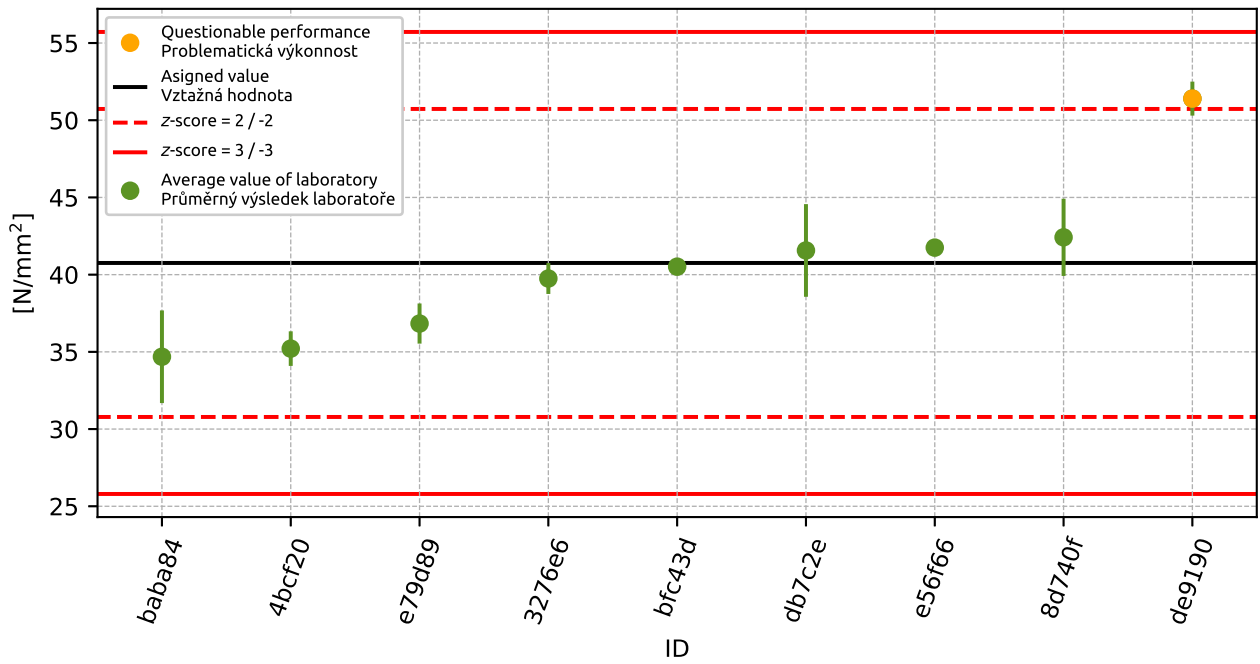


Figure 34: Average values and extended uncertainties of measurement

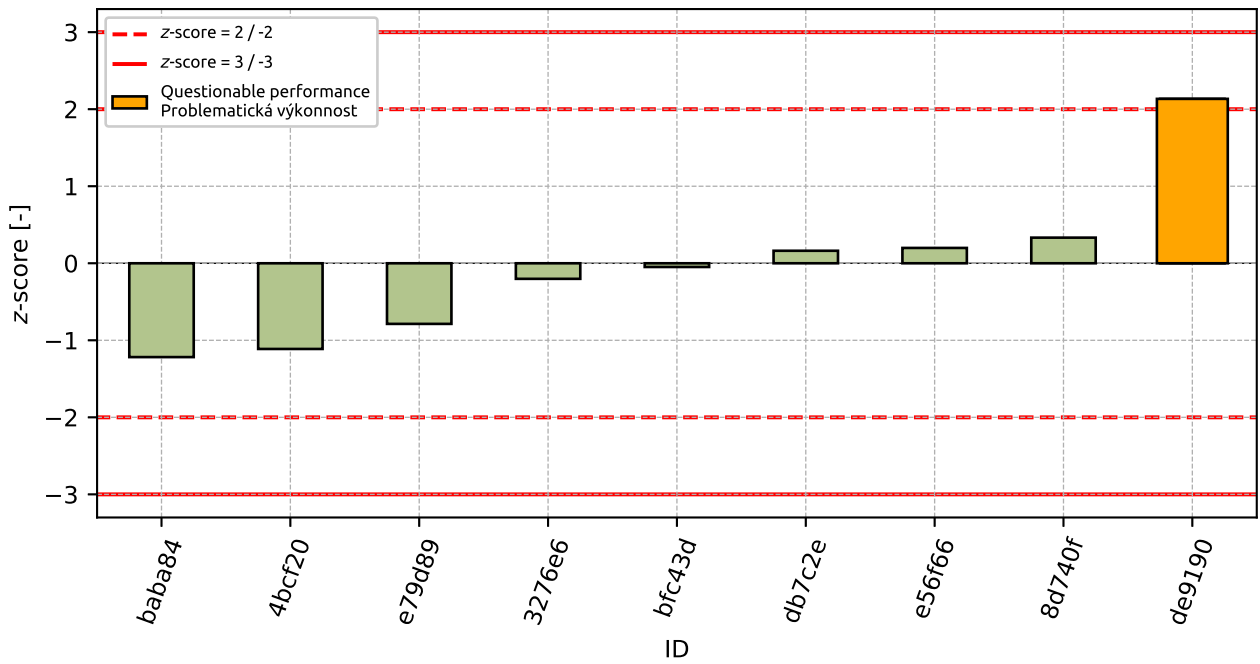
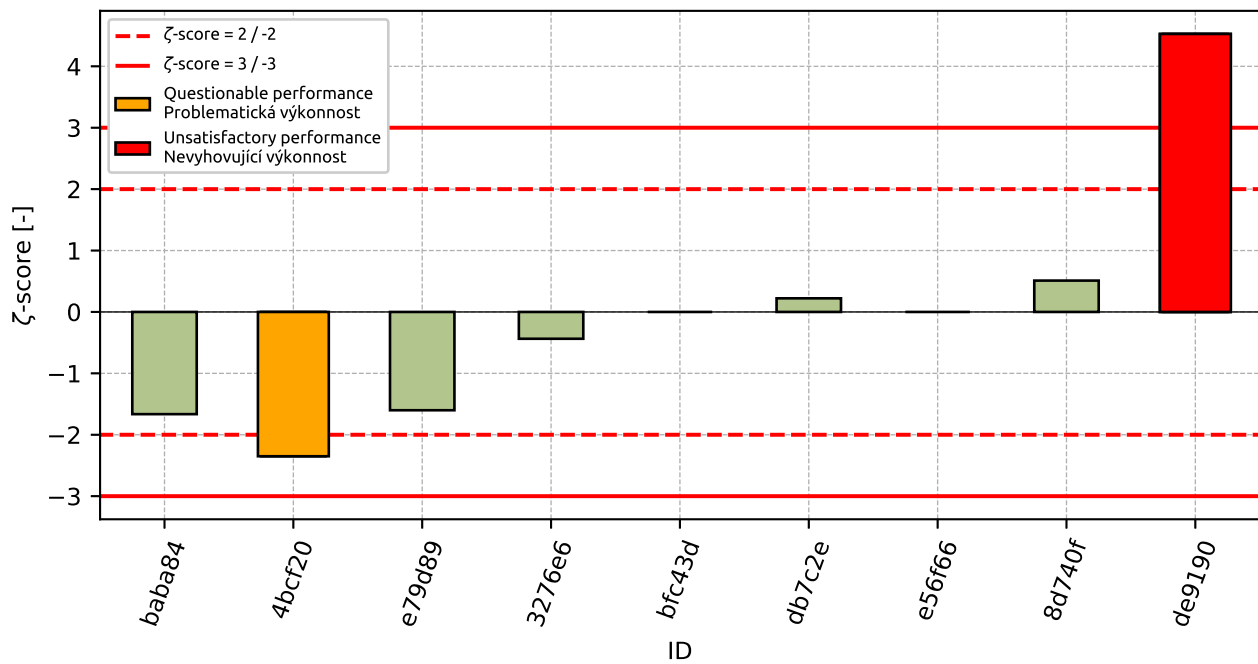


Figure 35: z-score

Figure 36: ζ -scoreTable 15: z-score and ζ -score

ID	z-score [-]	ζ -score [-]
baba84	-1.22	-1.66
4bcf20	-1.11	-2.35
e79d89	-0.79	-1.6
3276e6	-0.2	-0.44
bfc43d	-0.05	-
db7c2e	0.16	0.22
e56f66	0.2	-
8d740f	0.33	0.51
de9190	2.13	4.53

1.5 Flexural Strength after 28 days of ageing

1.5.1 Test results

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

ID	Test results			u_x [N/mm ²]	\bar{x} [N/mm ²]	s_0 [N/mm ²]	V_x [%]
	[N/mm ²]	[N/mm ²]	[N/mm ²]				
3276e6	8.0	8.3	7.9	0.2	8.1	0.21	2.58
bfc43d	8.1	8.1	8.5	-	8.2	0.23	2.8
baba84	8.3	8.3	8.4	0.5	8.3	0.06	0.69
8d740f	8.4	8.1	8.8	1.0	8.4	0.35	4.16
e56f66	9.2	8.9	8.1	-	8.7	0.57	6.51
1a9bd8	9.2	8.7	9.0	0.9	8.9	0.23	2.6
e79d89	9.0	8.9	9.1	0.4	9.0	0.1	1.11
4bcf20	9.6	9.8	9.8	0.1	9.8	0.13	1.36
de9190	11.9	12.2	11.3	0.7	11.8	0.46	3.88

1.5.2 The Numerical Procedure for Determining Outliers

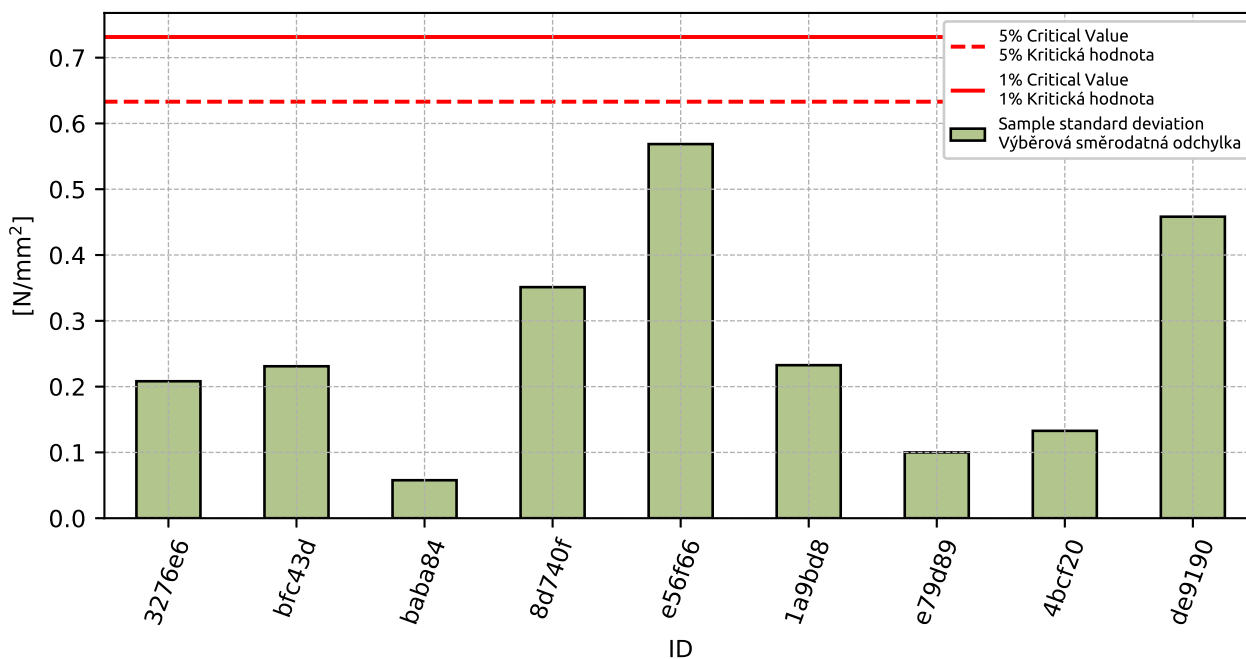


Figure 37: **Cochran's test** - sample standard deviations

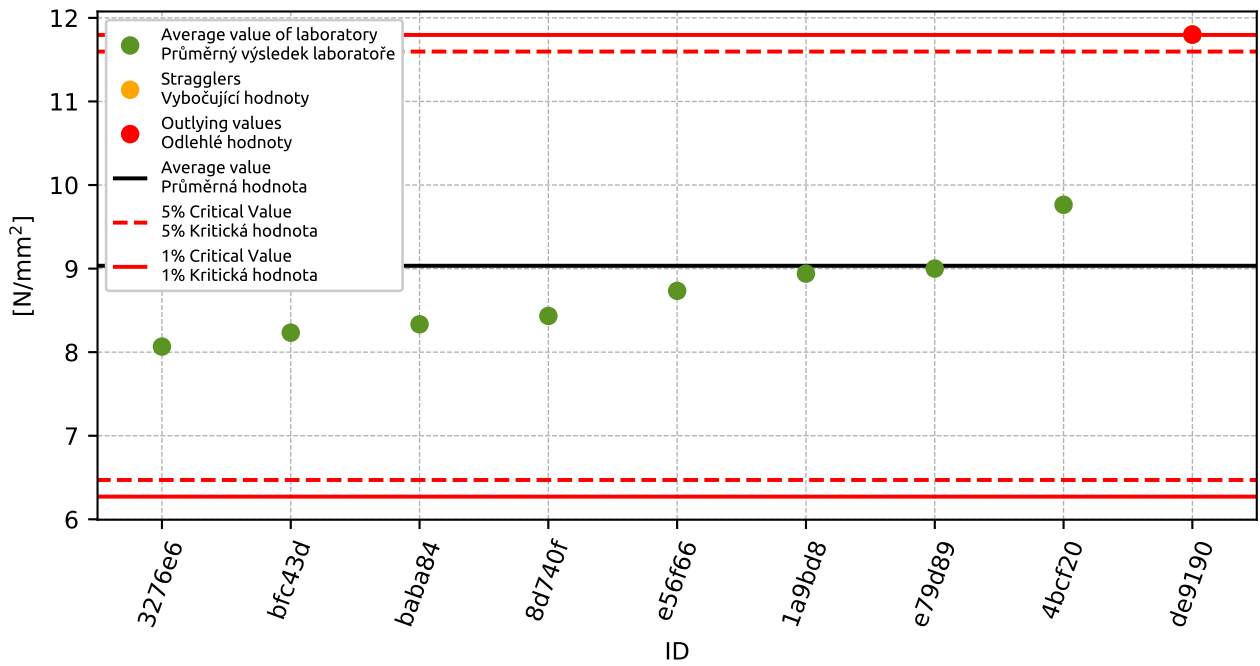


Figure 38: **Grubbs' test** - average values

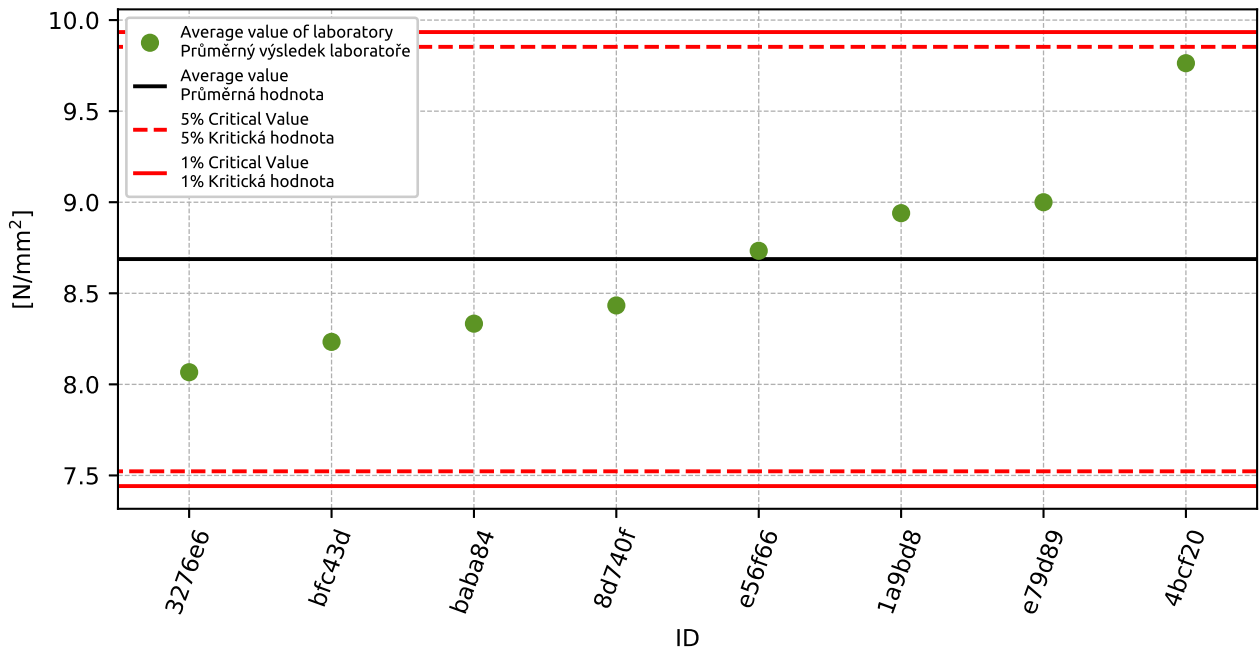


Figure 39: **Grubbs' test** - average values without outliers

1.5.3 Mandel's Statistics

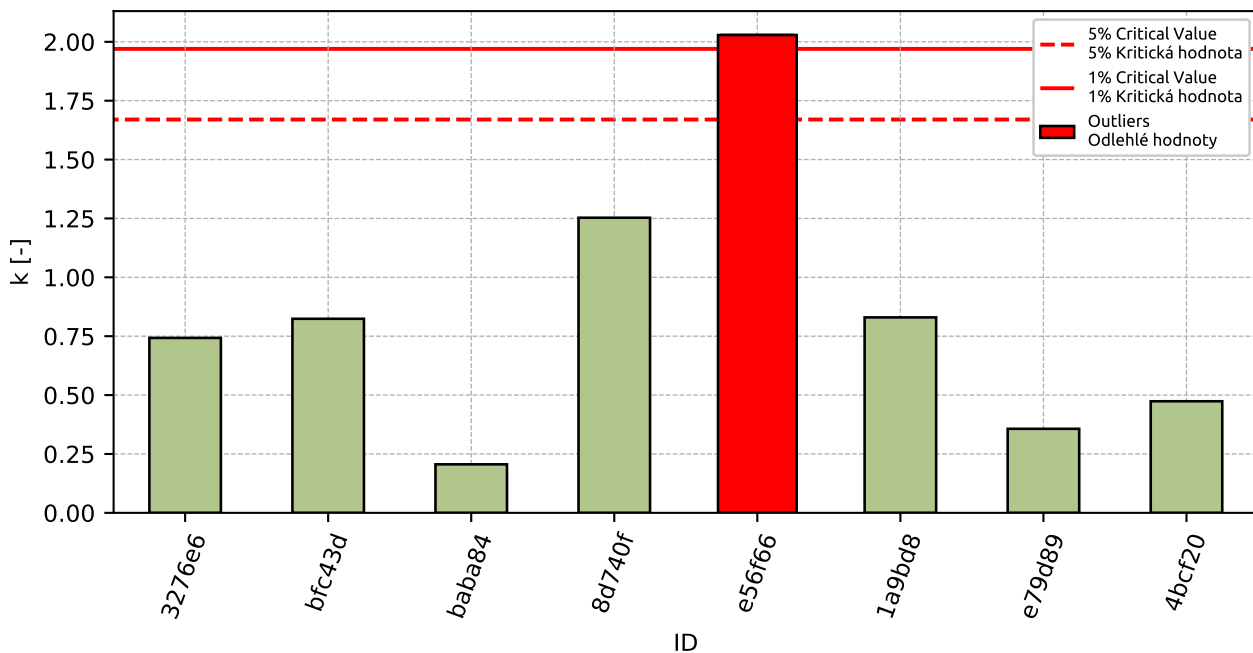


Figure 40: Intralaboratory Consistency Statistic

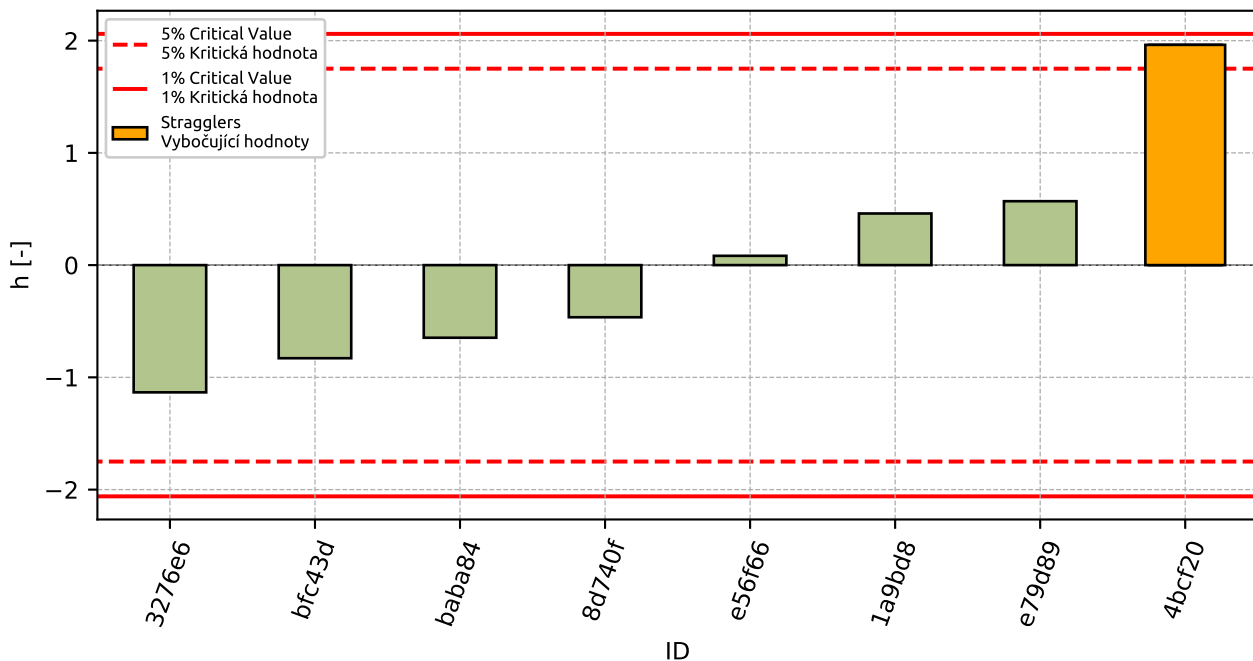


Figure 41: Interlaboratory Consistency Statistic

1.5.4 Descriptive statistics

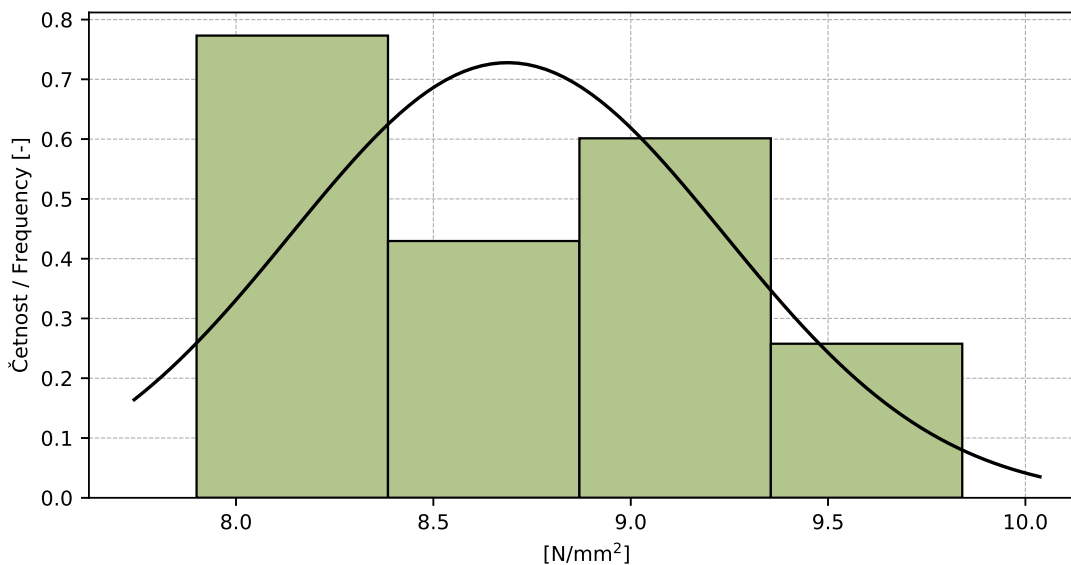


Figure 42: Histogram of all test results

Table 17: Descriptive statistics

Characteristics	[N/mm ²]
Průměrná hodnota / Average value – \bar{x}	8.7
Výběrová směrodatná odchylka / Sample standard deviation – s	0.55
Vztažná hodnota / Assigned value – x^*	8.7
Robustní směrodatná odchylka / Robust standard deviation – s^*	0.58
Nejistota měření vztažné hodnoty / Measurement uncertainty of assigned value – u_X	0.26
p -hodnota testu normality / p -value of normality test	0.383 [-]
Mezilaboratorní sm. odch. / Interlaboratory standard deviation – s_L	0.52
Směrodatná odchylka opakovatelnosti / Repeatability standard deviation – s_r	0.28
Směrodatná odchylka reprodukovatelnosti / Reproducibility standard deviation – s_R	0.59
Opakovatelnost / Repeatability – r	0.8
Reprodukovatelnost / Reproducibility – R	1.7

1.5.5 Evaluation of Performance Statistics

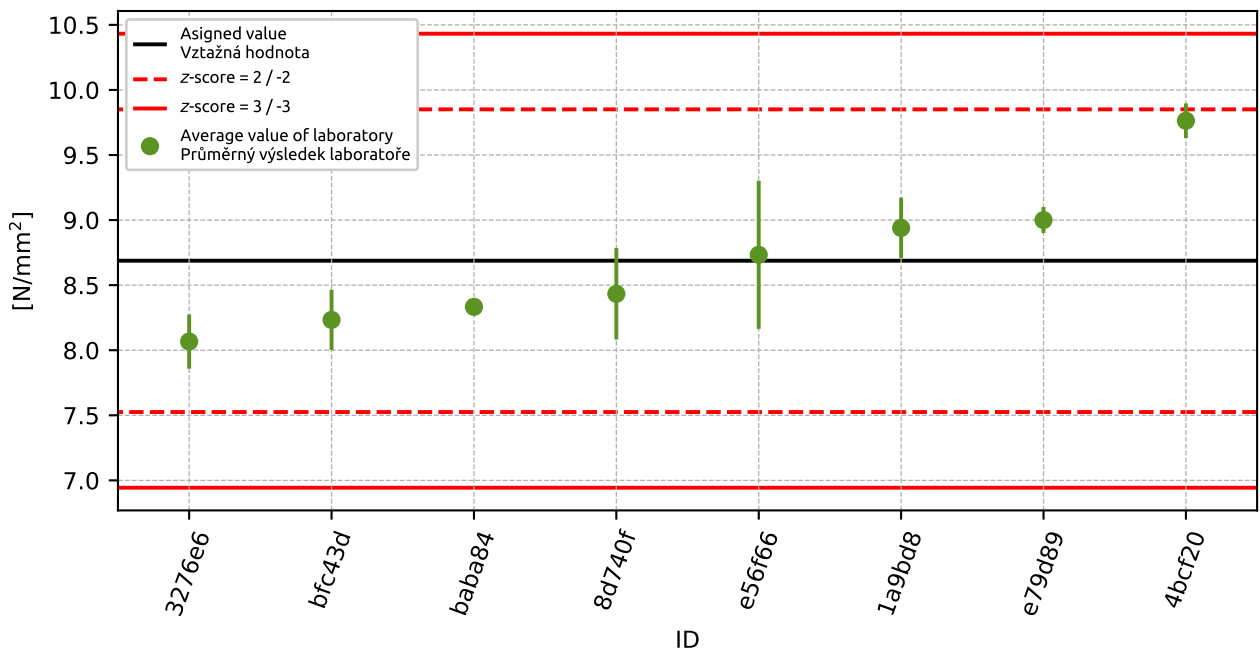


Figure 43: Average values and sample standard deviations

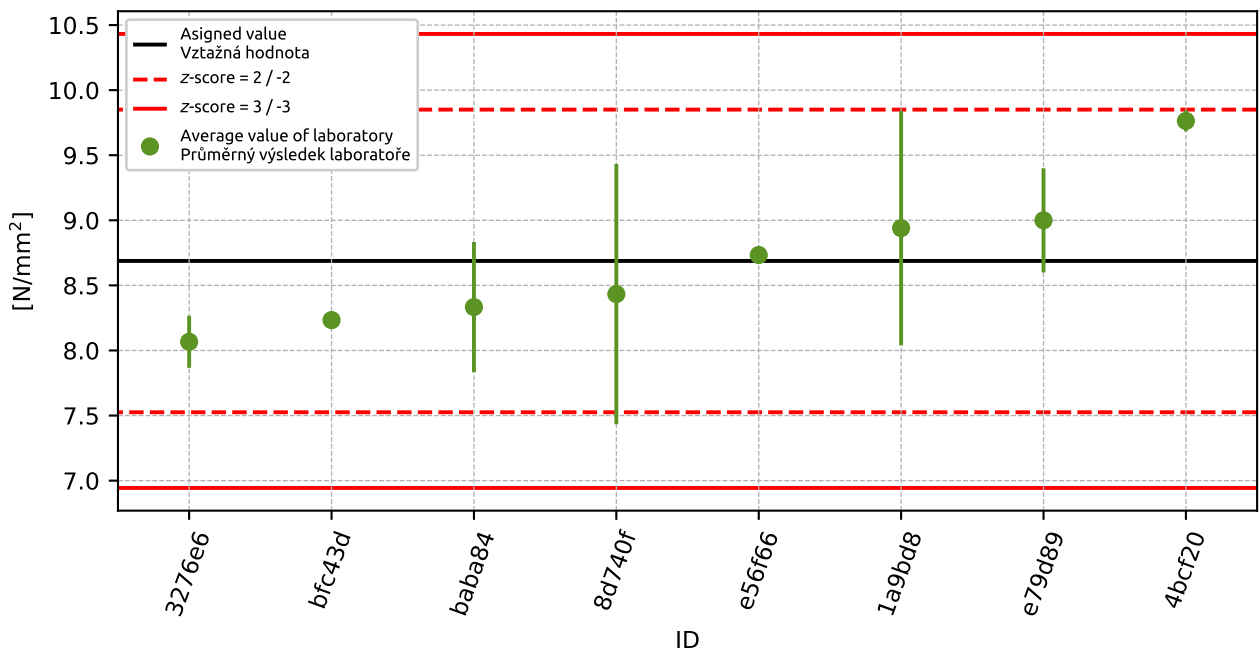


Figure 44: Average values and extended uncertainties of measurement

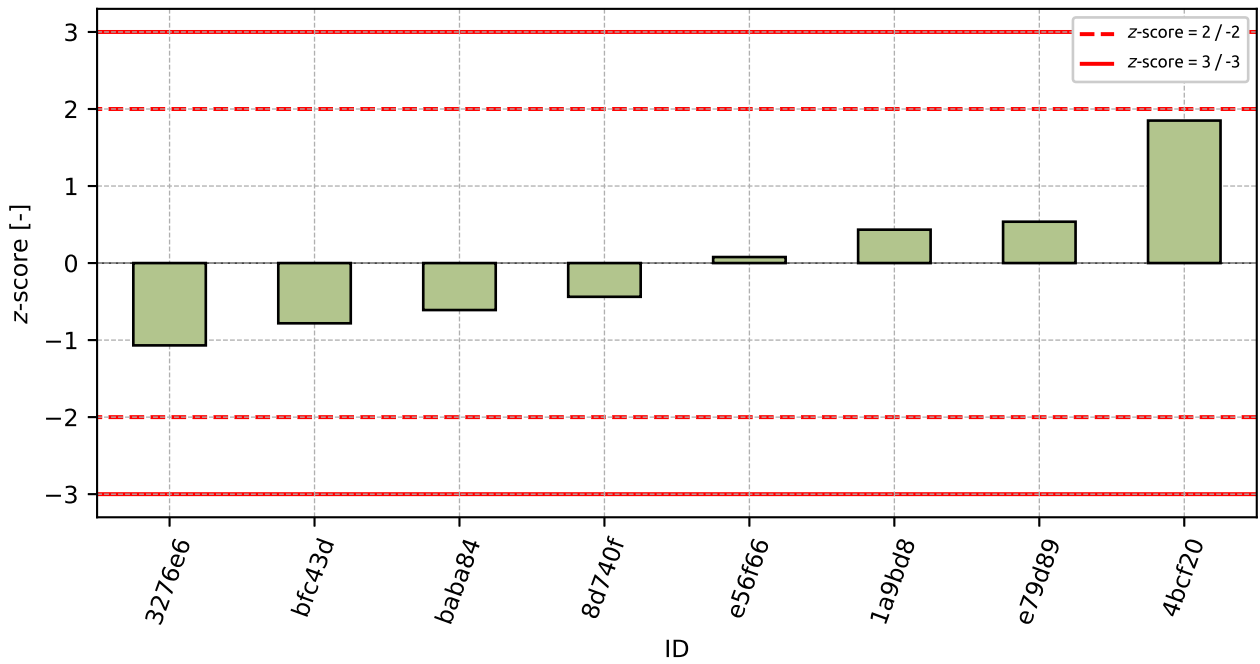


Figure 45: z-score

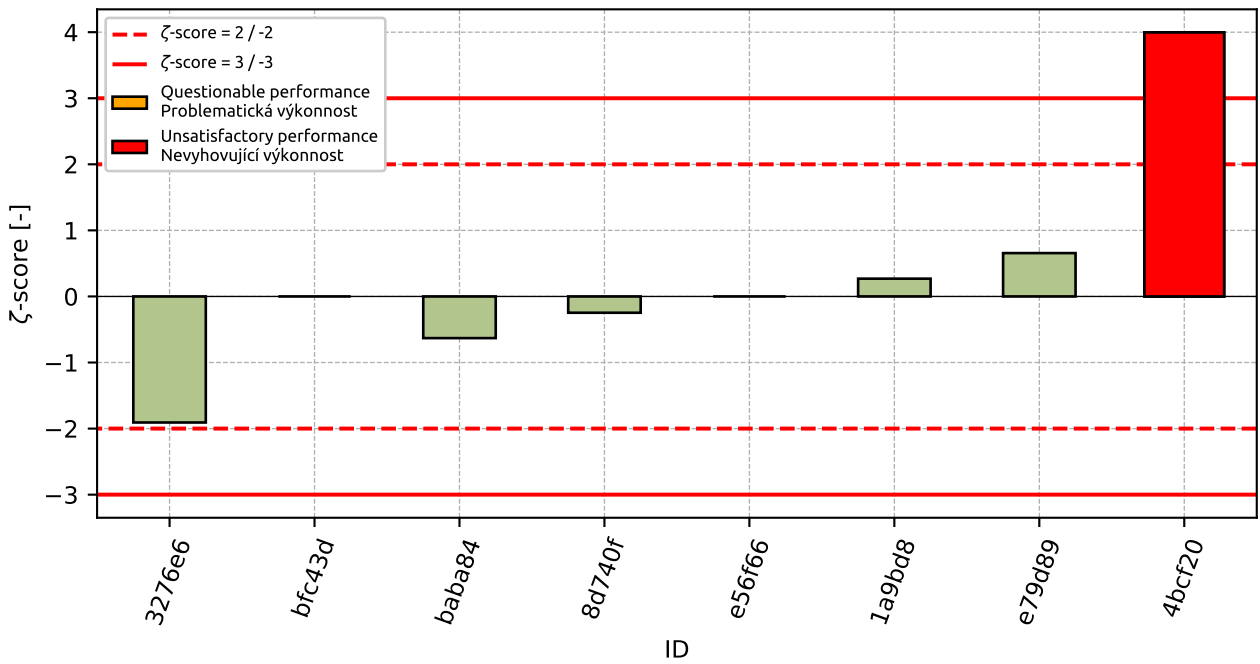


Figure 46: ζ-score

Table 18: z-score and ζ -score

ID	z-score [-]	ζ -score [-]
3276e6	-1.07	-1.91
bfc43d	-0.78	-
baba84	-0.61	-0.63
8d740f	-0.44	-0.25
e56f66	0.08	-
1a9bd8	0.43	0.27
e79d89	0.54	0.66
4bcf20	1.85	4.0

1.6 Compressive Strength after 28 days of ageing

1.6.1 Test results

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

ID	Test results [N/mm ²]						u_x [N/mm ²]	\bar{x} [N/mm ²]	s_0 [N/mm ²]	V_x [%]
4bcf20	48.8	47.5	47.5	45.6	44.4	48.1	0.7	47.0	1.65	3.51
3276e6	48.6	48.7	47.8	46.5	47.0	47.7	1.0	47.7	0.87	1.81
e79d89	49.4	52.5	49.1	53.5	49.4	51.3	2.5	50.9	1.86	3.65
db7c2e	51.2	51.6	48.8	50.0	53.1	52.9	3.0	51.3	1.66	3.24
e56f66	50.7	53.3	52.3	48.3	53.3	52.9	-	51.8	1.97	3.8
8d740f	53.5	53.9	54.5	54.5	55.0	53.8	3.0	54.2	0.56	1.03
bfc43d	54.6	53.7	56.8	53.7	55.0	57.0	-	55.1	1.46	2.65
1a9bd8	54.8	56.8	54.0	54.5	55.6	56.0	2.7	55.3	1.03	1.86
baba84	55.5	54.8	53.6	55.2	57.4	56.4	3.0	55.5	1.31	2.36
de9190	58.2	59.0	58.4	57.6	58.9	59.5	1.1	58.6	0.67	1.15

1.6.2 The Numerical Procedure for Determining Outliers

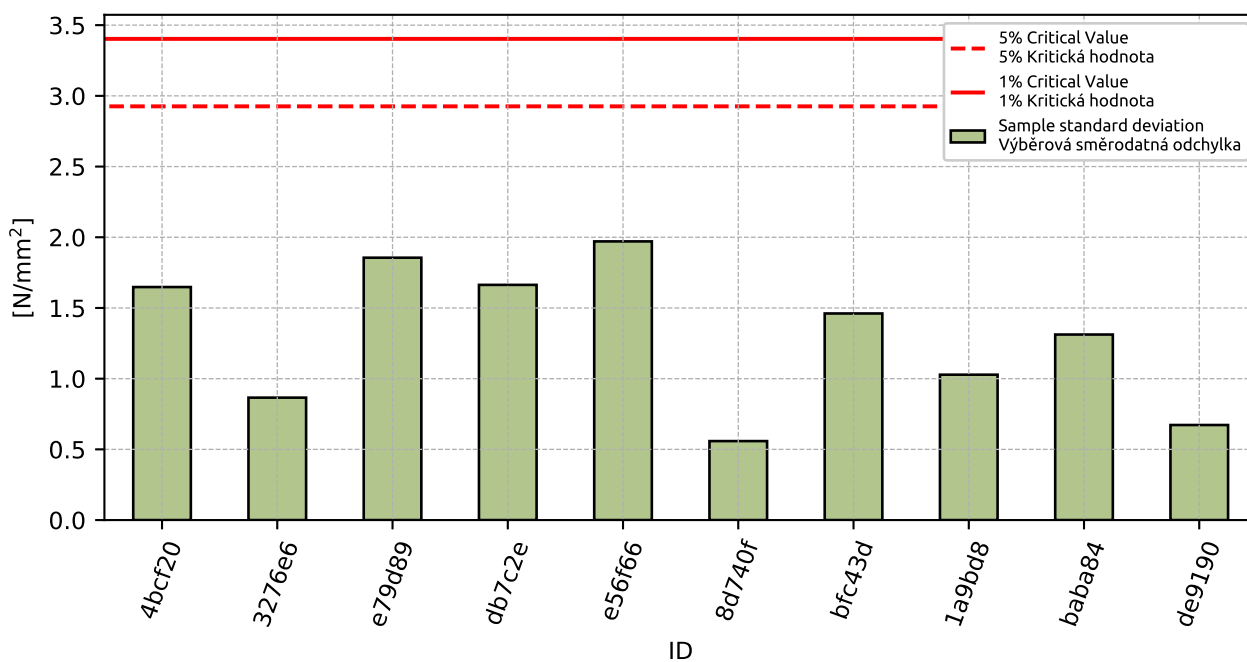


Figure 47: Cochran's test - sample standard deviations

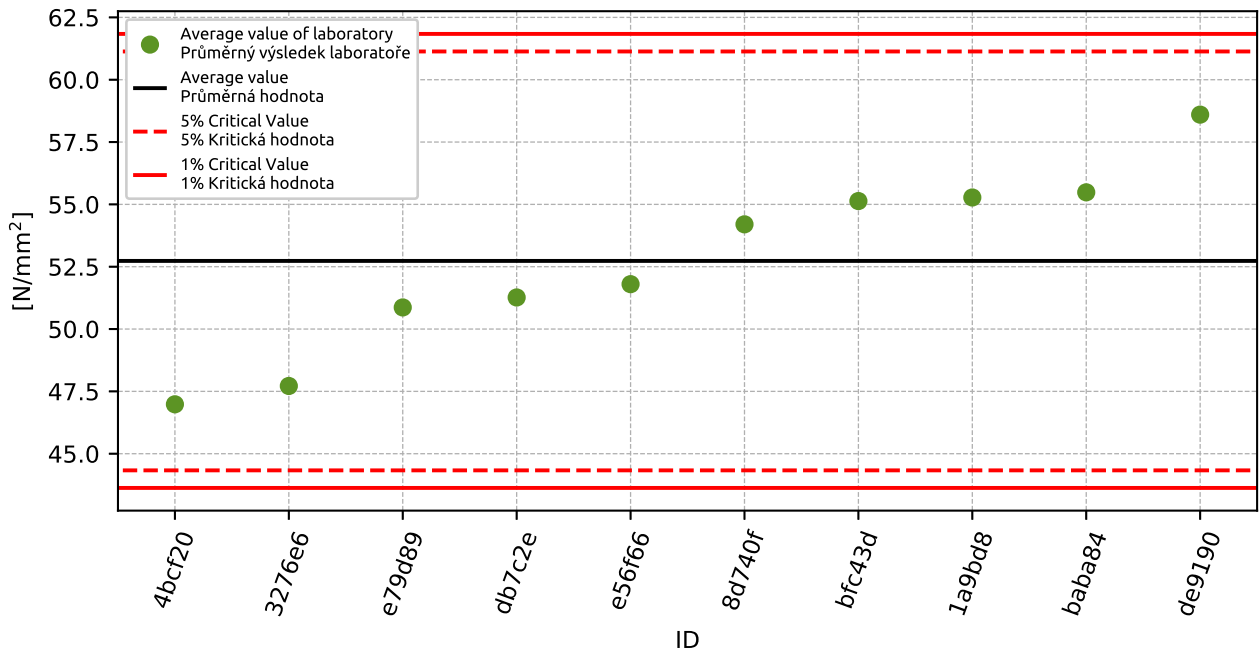


Figure 48: **Grubbs' test** - average values

1.6.3 Mandel's Statistics

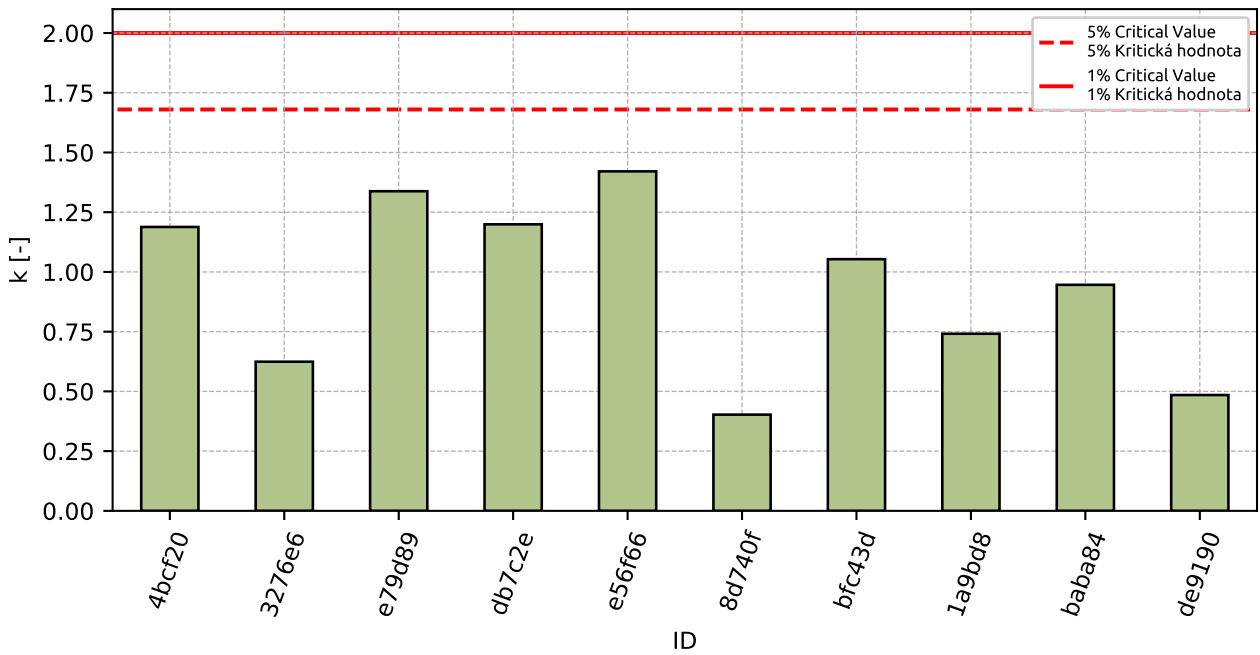


Figure 49: Intralaboratory Consistency Statistic

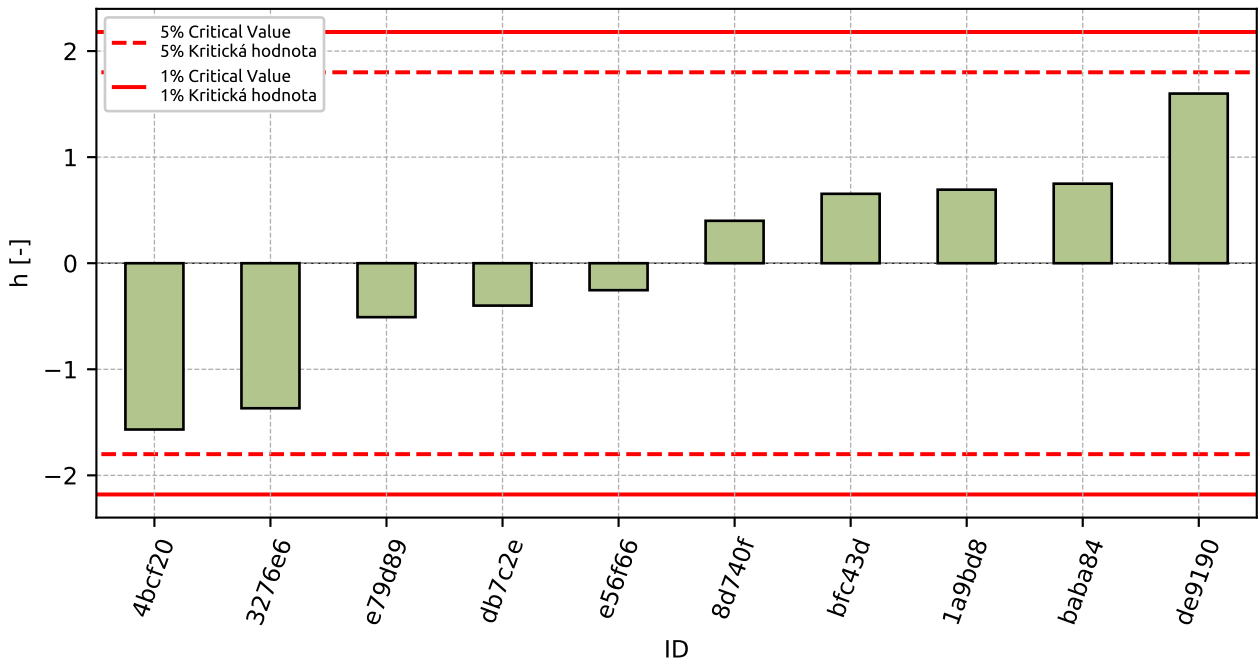


Figure 50: Interlaboratory Consistency Statistic

1.6.4 Descriptive statistics

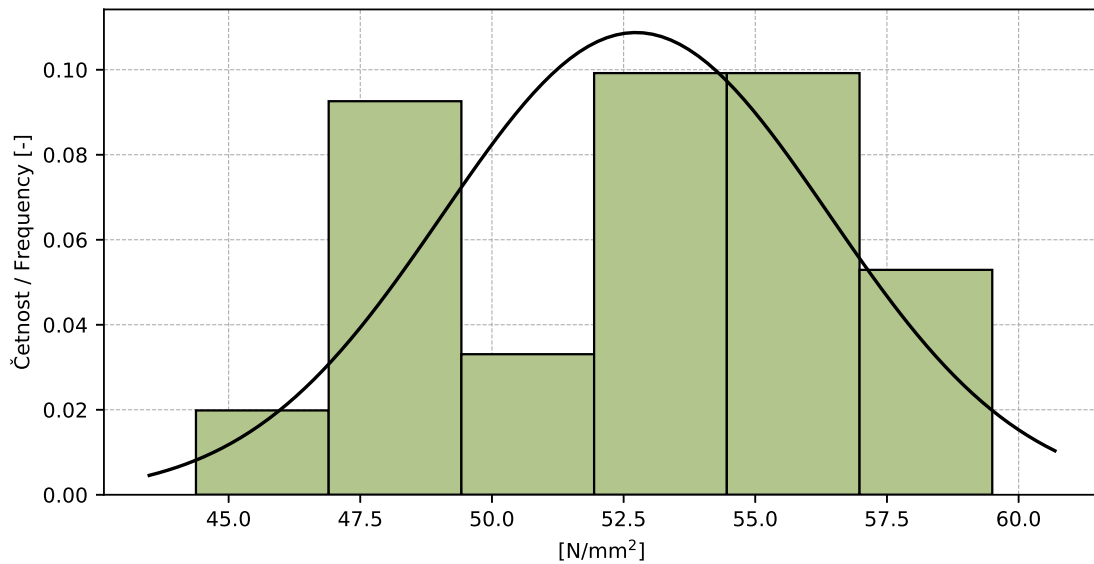


Figure 51: Histogram of all test results

Table 20: Descriptive statistics

Characteristics	[N/mm ²]
Průměrná hodnota / Average value – \bar{x}	52.7
Výběrová směrodatná odchylka / Sample standard deviation – s	3.67
Vztažná hodnota / Assigned value – x^*	52.9
Robustní směrodatná odchylka / Robust standard deviation – s^*	3.69
Nejistota měření vztažné hodnoty / Measurement uncertainty of assigned value – u_X	1.46
p -hodnota testu normality / p -value of normality test	0.148 [-]
Mezilaboratorní sm. odch. / Interlaboratory standard deviation – s_L	3.62
Směrodatná odchylka opakovatelnosti / Repeatability standard deviation – s_r	1.39
Směrodatná odchylka reprodukovatelnosti / Reproducibility standard deviation – s_R	3.88
Opakovatelnost / Repeatability – r	3.9
Reprodukovatelnost / Reproducibility – R	10.9

1.6.5 Evaluation of Performance Statistics

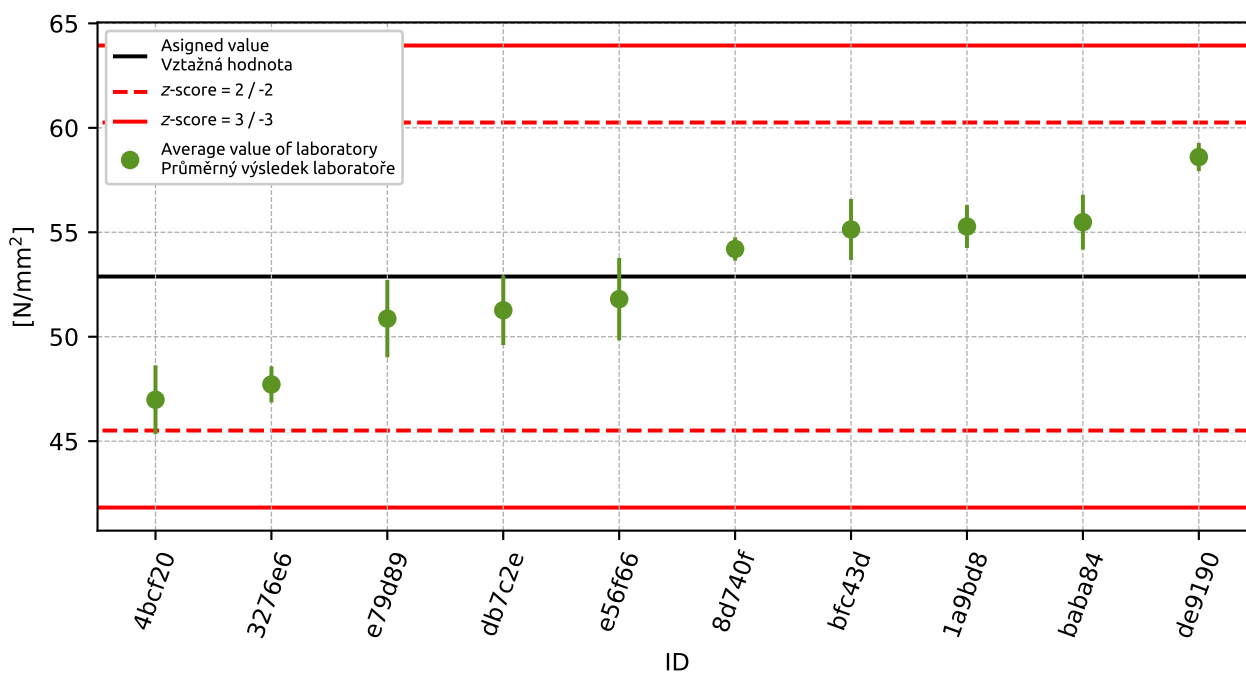


Figure 52: Average values and sample standard deviations

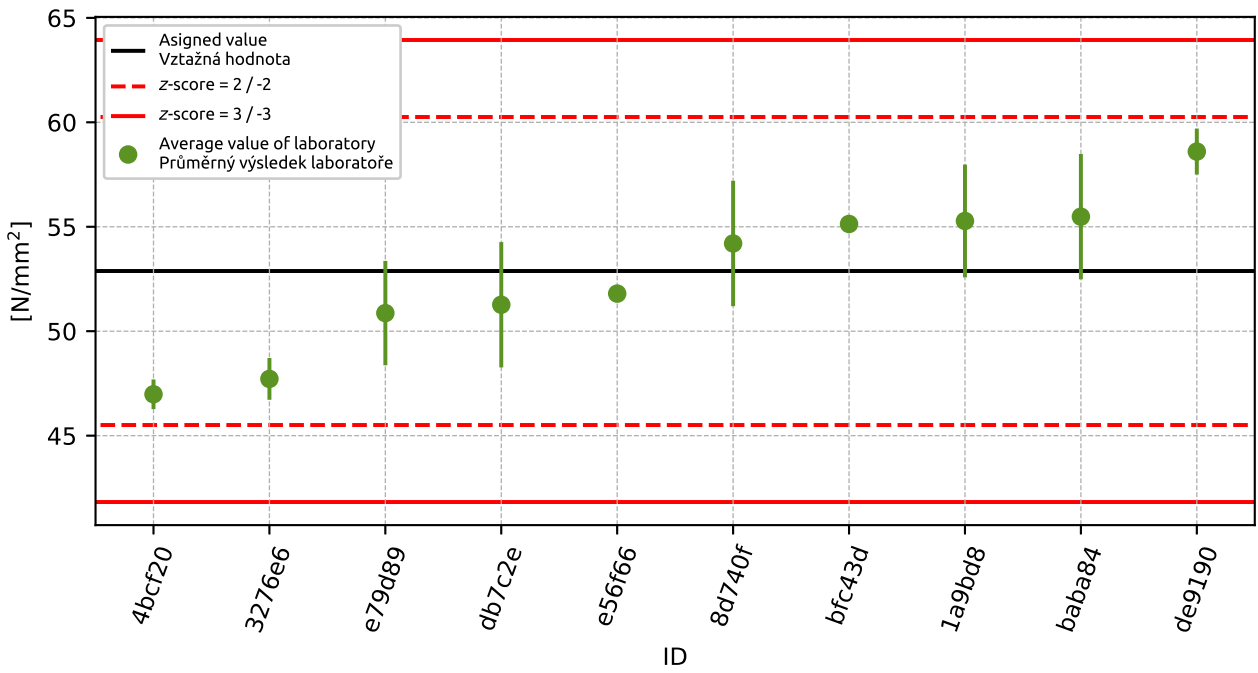


Figure 53: Average values and extended uncertainties of measurement

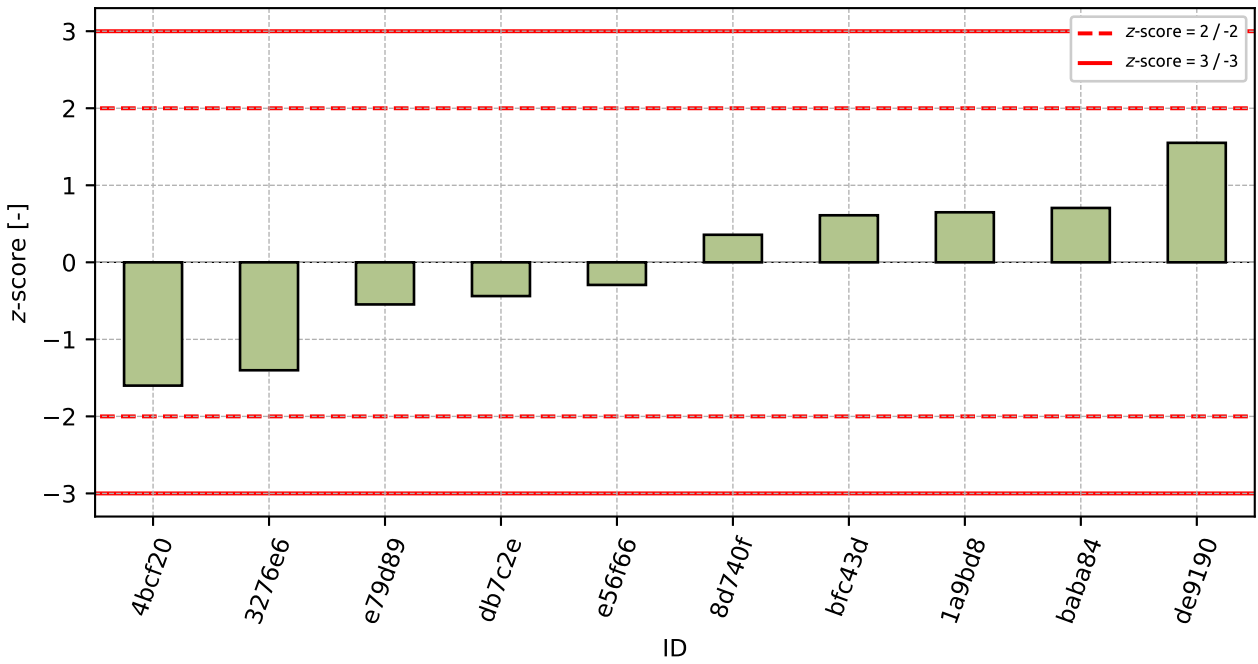
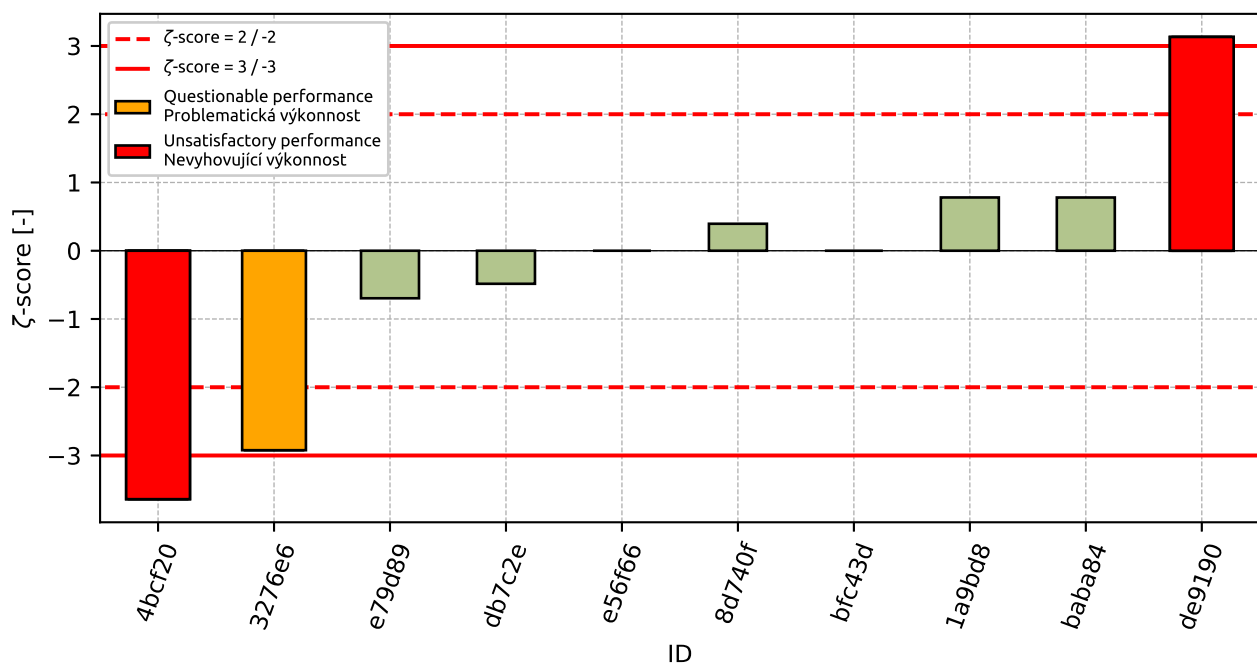


Figure 54: z-score

Figure 55: ζ -scoreTable 21: z-score and ζ -score

ID	z-score [-]	ζ -score [-]
4bcf20	-1.6	-3.64
3276e6	-1.4	-2.92
e79d89	-0.55	-0.7
db7c2e	-0.44	-0.48
e56f66	-0.29	-
8d740f	0.36	0.4
bfc43d	0.61	-
1a9bd8	0.65	0.78
baba84	0.71	0.78
de9190	1.55	3.13

2 Appendix – EN 196-2 (art. 4.4.1) – Determination of loss on ignition

This part of the PT program was not open due to the lack of participants.

3 Appendix – EN 196-2 (art. 4.4.2) – Determination of sulphate content

3.0.1 Test results

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

ID	Test results			u_x [%]	\bar{x} [%]	s_0 [%]	V_x [%]
	[%]	[%]	[%]				
3276e6	2.7	3.0	2.8	0.2	2.8	0.15	5.21
de9190	3.0	3.0	3.0	0.3	3.0	0.01	0.33
fdec0f	3.0	-	-	0.2	3.0	0.0	0.0
605eff	3.1	3.0	3.4	0.3	3.2	0.21	6.57

3.0.2 The Numerical Procedure for Determining Outliers

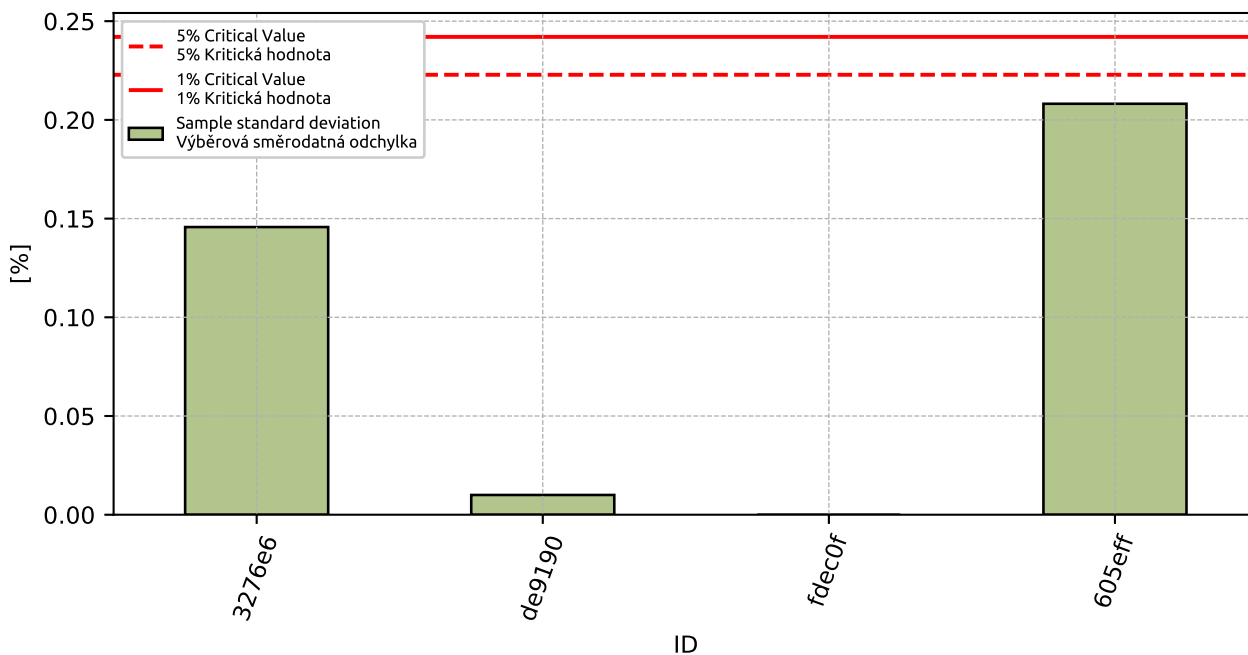


Figure 56: Cochran's test - sample standard deviations

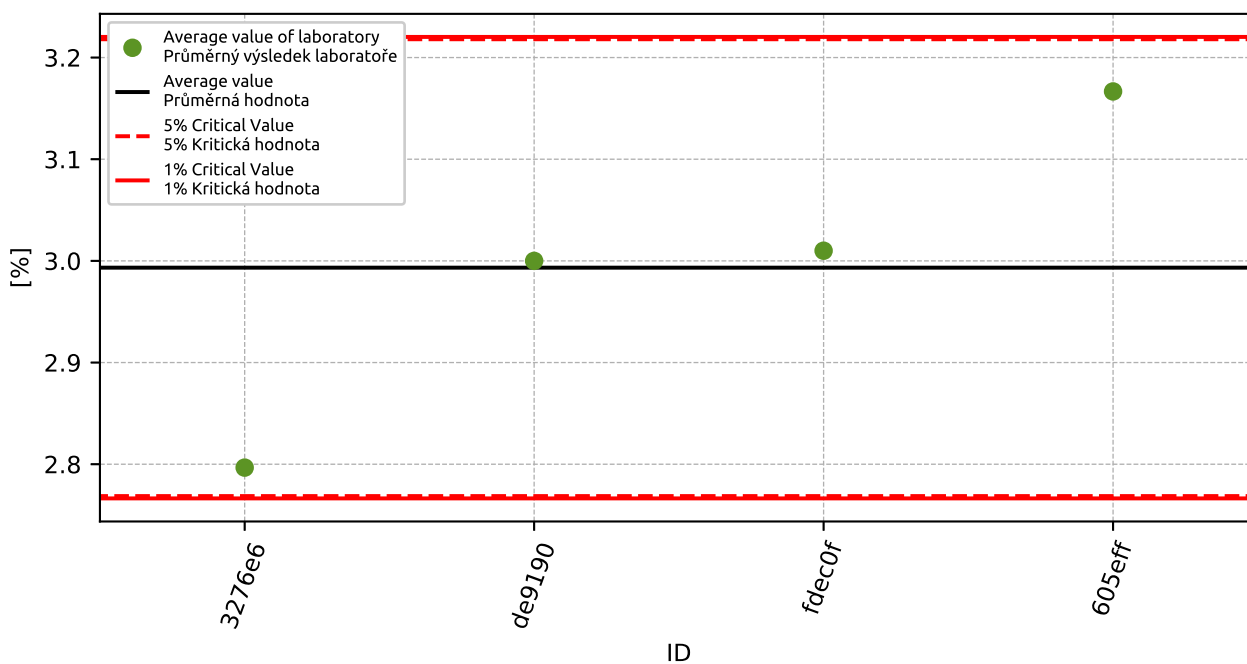


Figure 57: **Grubbs' test** - average values

3.0.3 Mandel's Statistics

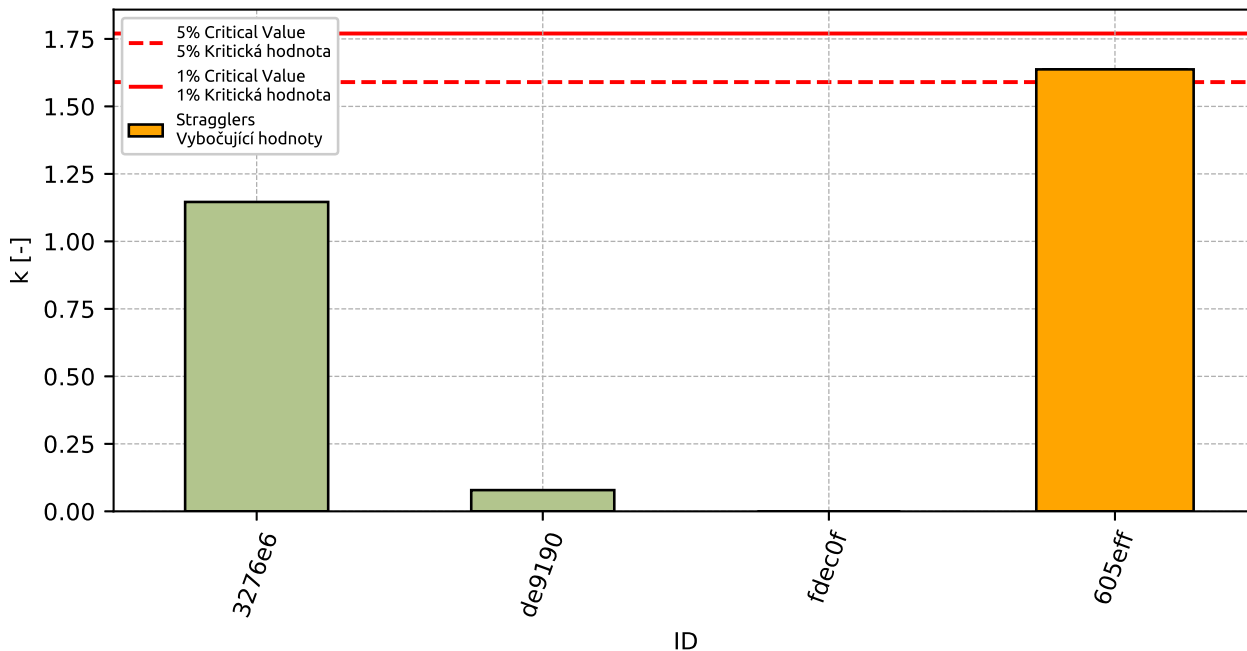


Figure 58: Intralaboratory Consistency Statistic

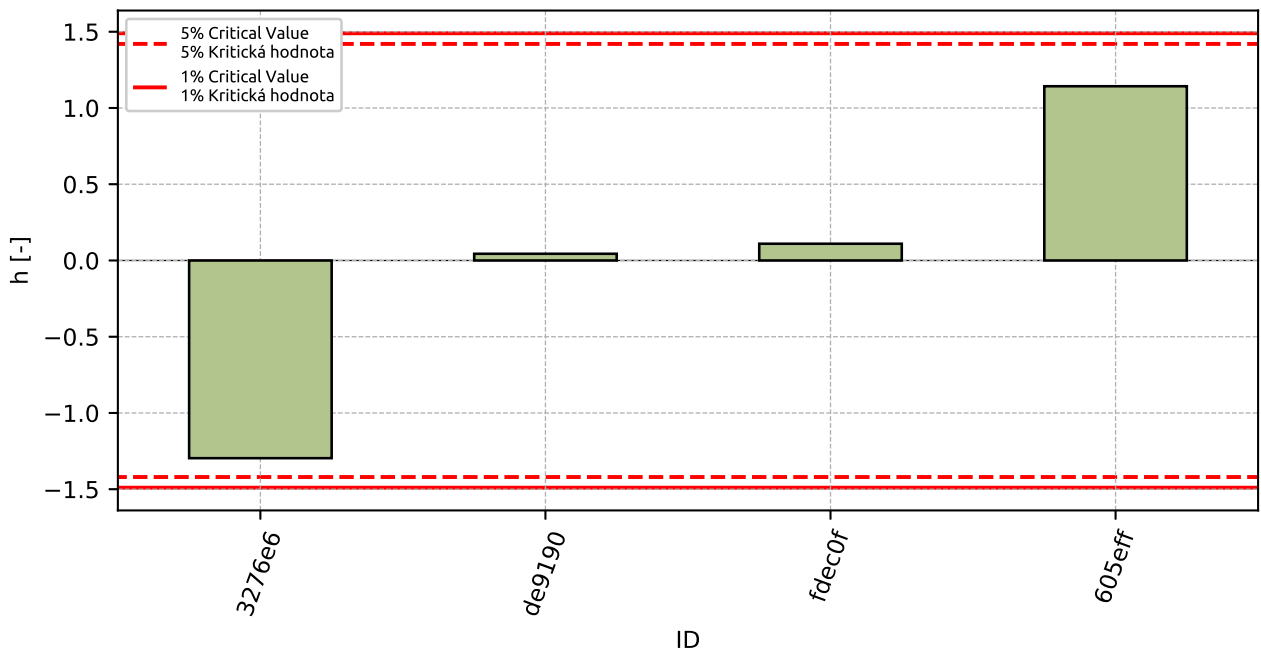


Figure 59: Interlaboratory Consistency Statistic

3.0.4 Descriptive statistics

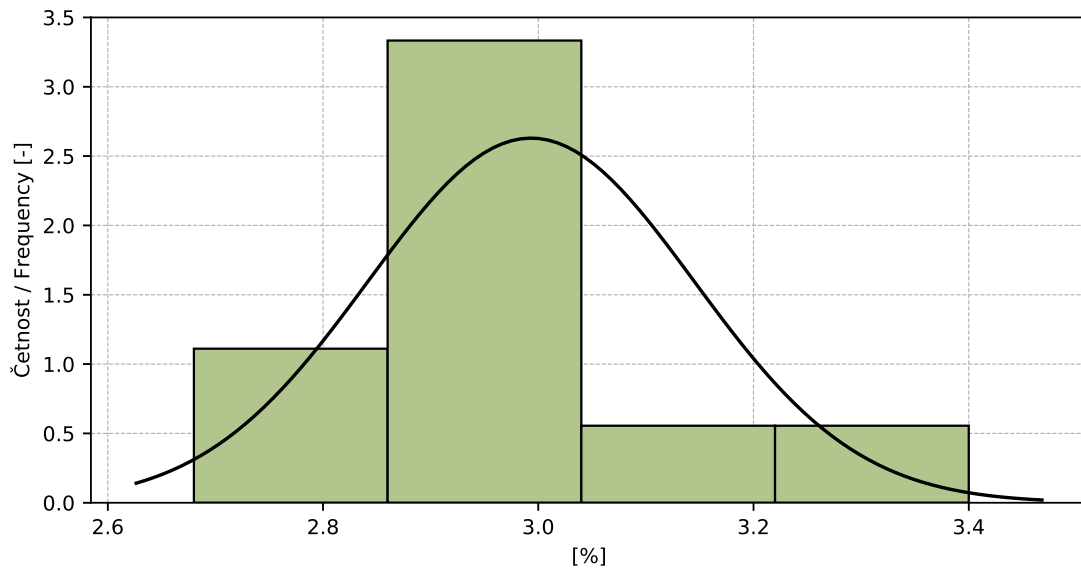


Figure 60: Histogram of all test results

Table 23: Descriptive statistics

Characteristics	[%]
Průměrná hodnota / Average value – \bar{x}	3.0
Výběrová směrodatná odchylka / Sample standard deviation – s	0.15
Vztažná hodnota / Assigned value – x^*	3.0
Robustní směrodatná odchylka / Robust standard deviation – s^*	0.14
Nejistota měření vztažné hodnoty / Measurement uncertainty of assigned value – u_X	0.09
Mezilaboratorní sm. odch. / Interlaboratory standard deviation – s_L	0.13
Směrodatná odchylka opakovatelnosti / Repeatability standard deviation – s_r	0.13
Směrodatná odchylka reprodukovatelnosti / Reproducibility standard deviation – s_R	0.18
Opakovatelnost / Repeatability – r	0.4
Reprodukovatelnost / Reproducibility – R	0.5

3.0.5 Evaluation of Performance Statistics

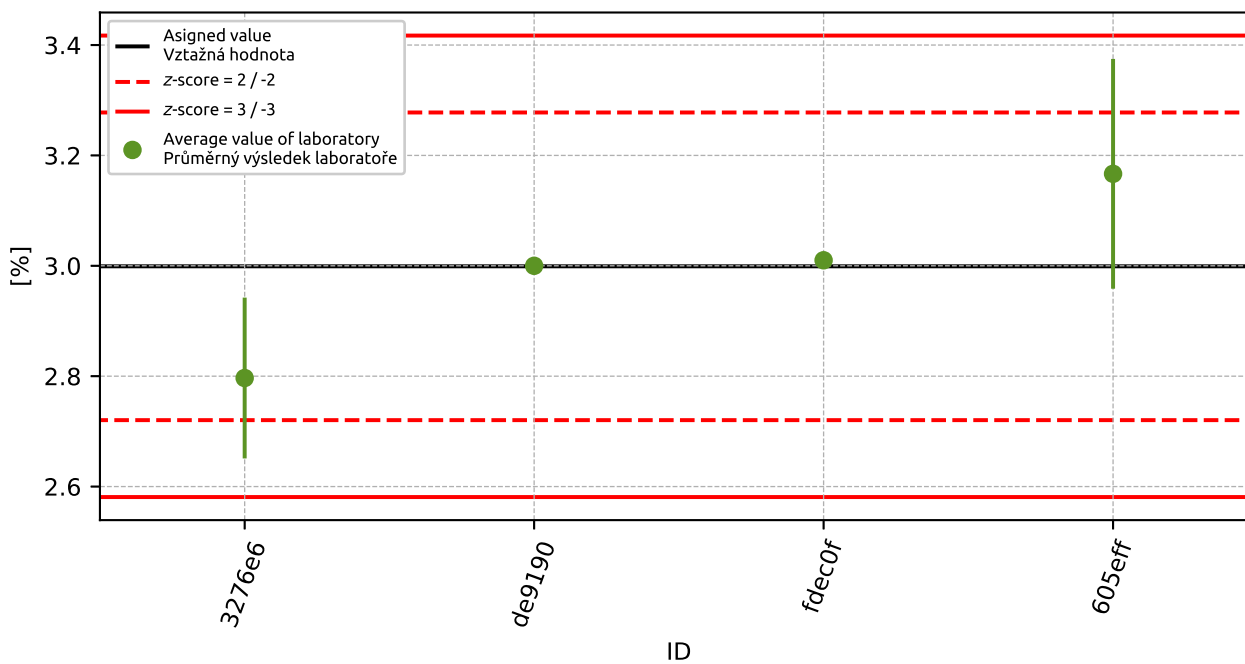


Figure 61: Average values and sample standard deviations

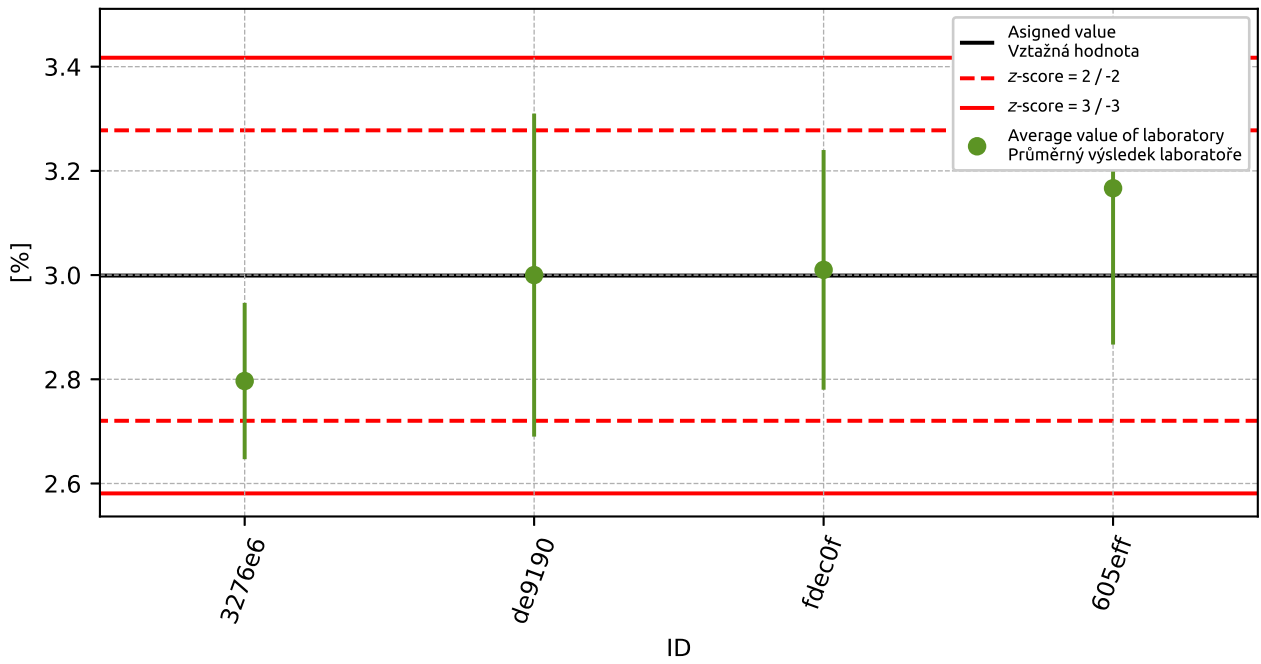


Figure 62: Average values and extended uncertainties of measurement

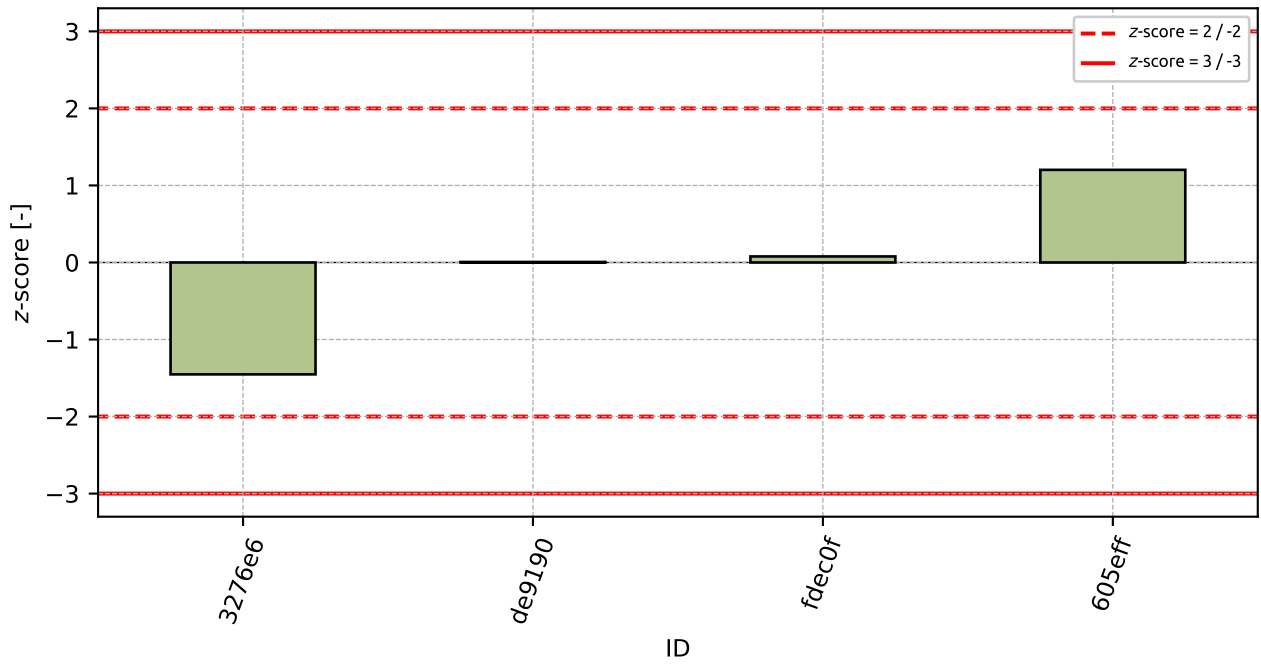


Figure 63: z-score

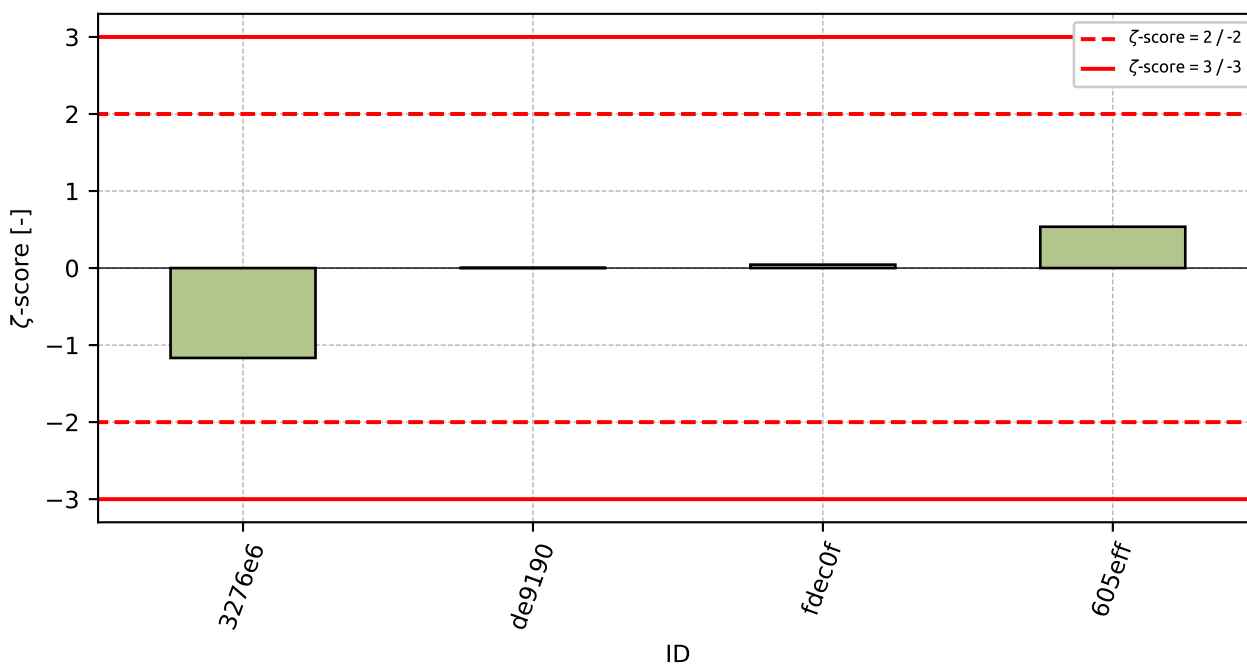


Figure 64: z-score

Table 24: z-score and zeta-score

ID	z-score [-]	zeta-score [-]
3276e6	-1.45	-1.17
de9190	0.01	0.0
fdec0f	0.08	0.04
605eff	1.2	0.54

4 Appendix – EN 196-2 (art. 4.4.3) – Determination of the residue insoluble in hydrochloric acid and sodium carbonate

This part of the PT program was not open due to the lack of participants.

5 Appendix – EN 196-2 (art. 4.4.4) – Determination of the residue insoluble in hydrochloric acid and potassium hydroxide

This part of the PT program was not open due to the lack of participants.

6 Appendix – EN 196-2 (art. 4.4.5) – Determination of sulphite content

This part of the PT program was not open due to the lack of participants.

7 Appendix – EN 196-3 – Setting time, Soundness

7.1 Initial setting time

7.1.1 Test results

Table 25: 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 [min.]			u_x [min.]	\bar{x} [min.]	s_0 [min.]	V_x [%]
3276e6	130	140	130	10	133.0	5.8	4.33
e79d89	135	140	145	15	140.0	5.0	3.57
8d740f	195	180	190	20	188.0	7.6	4.06
4bcf20	205	210	220	4	212.0	7.6	3.61
de9190	208	217	220	7	215.0	6.2	2.9
605eff	215	215	218	10	216.0	1.7	0.8

7.1.2 The Numerical Procedure for Determining Outliers

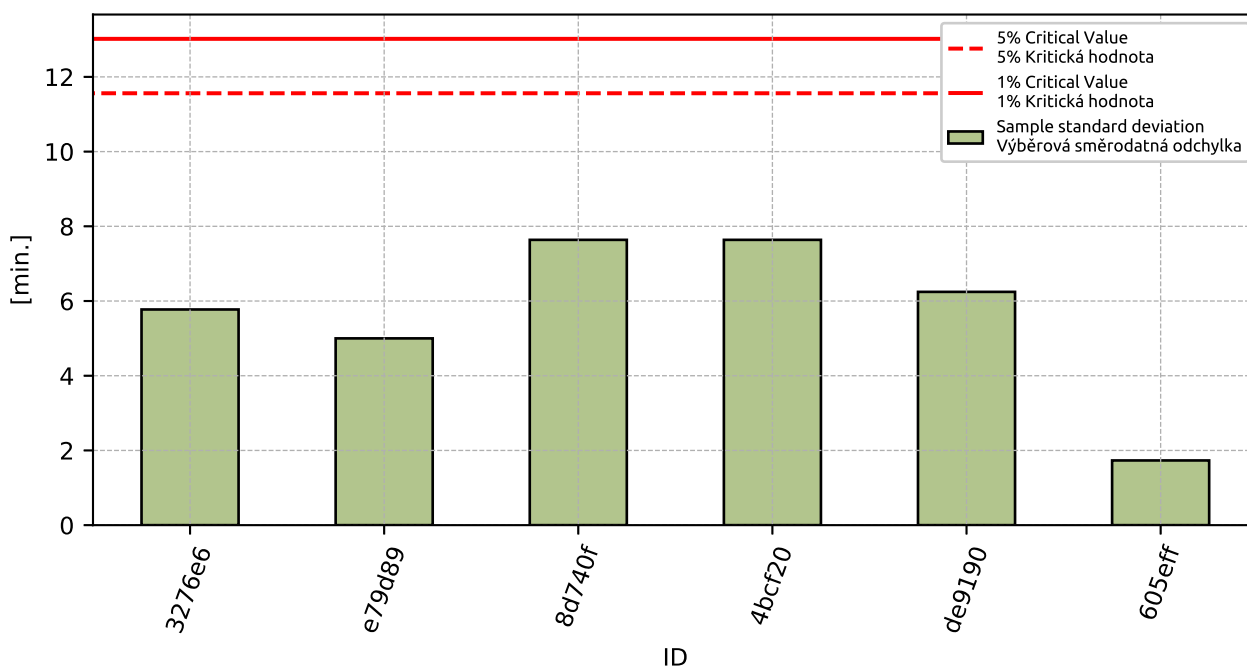


Figure 65: **Cochran's test** - sample standard deviations

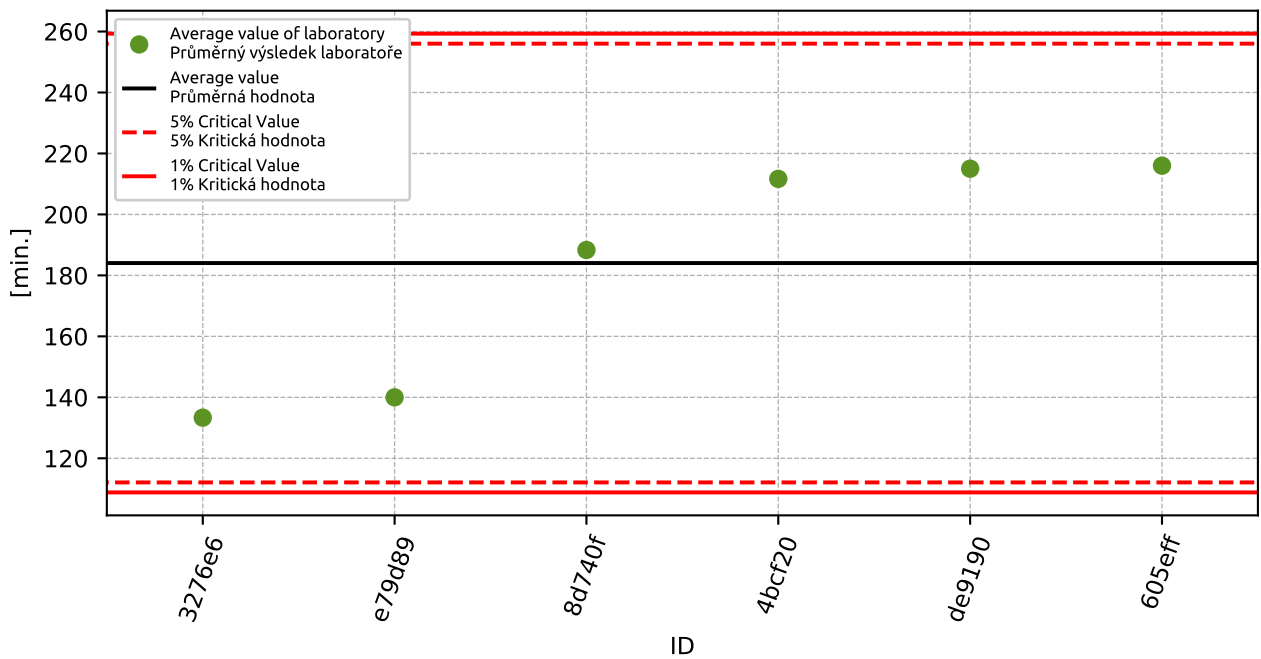


Figure 66: **Grubbs' test** - average values

7.1.3 Mandel's Statistics

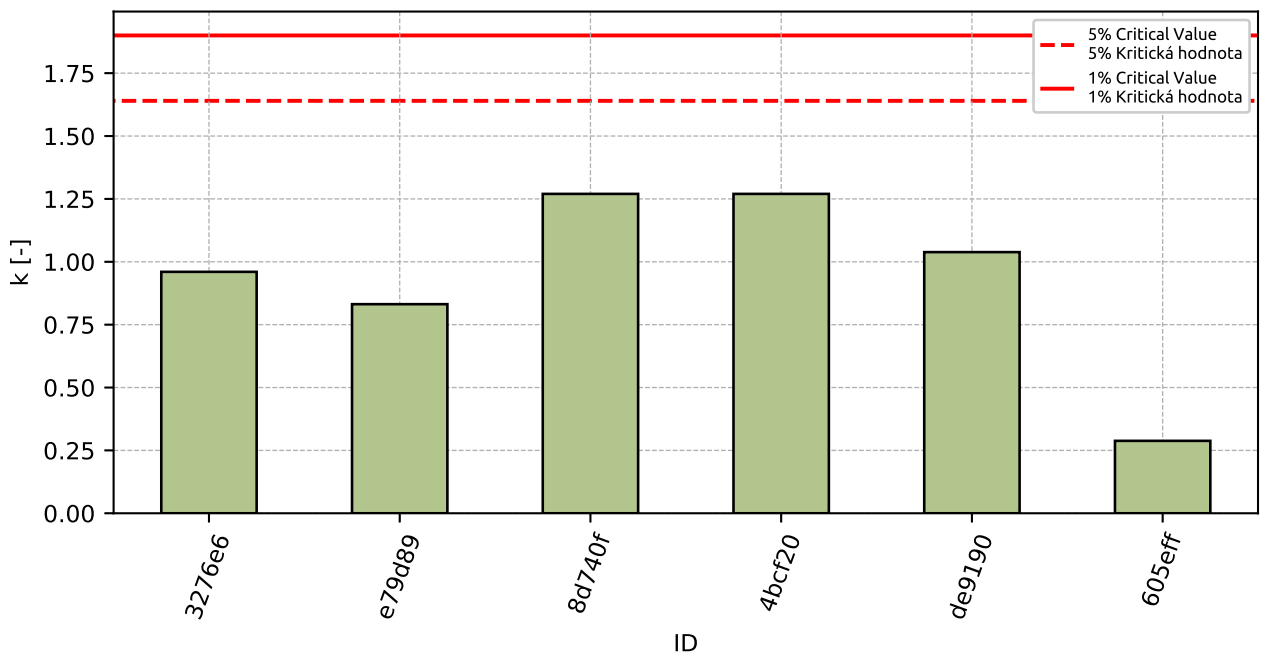


Figure 67: Intralaboratory Consistency Statistic

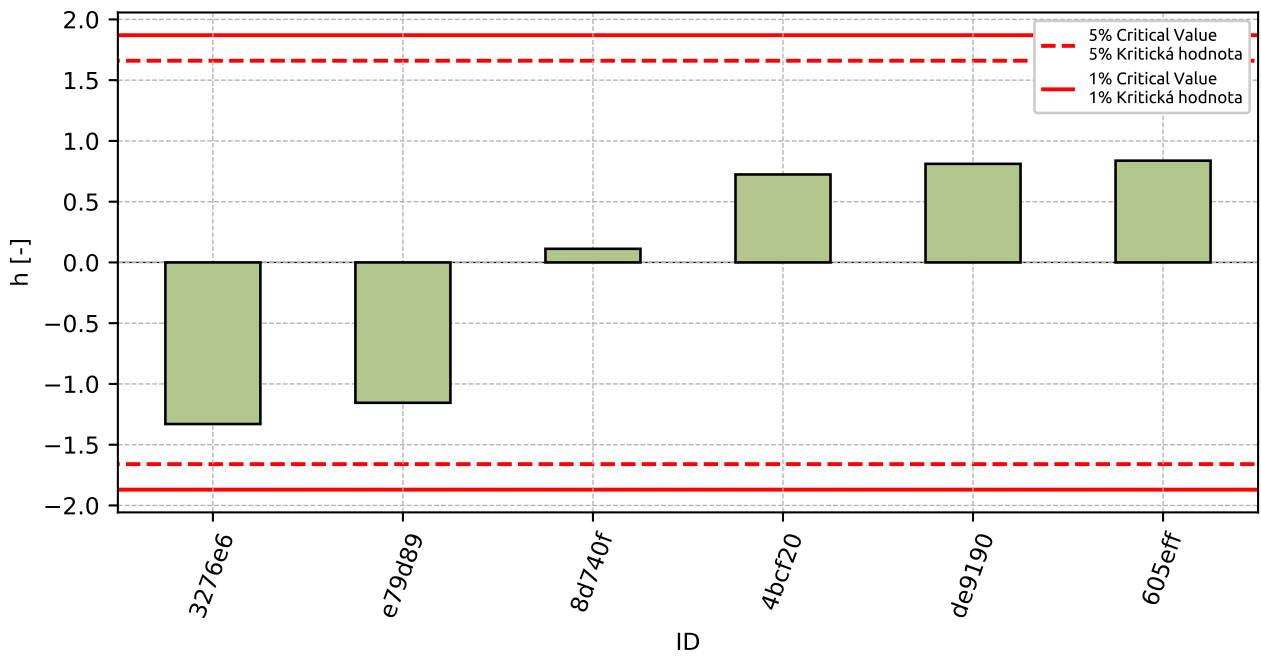


Figure 68: Interlaboratory Consistency Statistic

7.1.4 Descriptive statistics

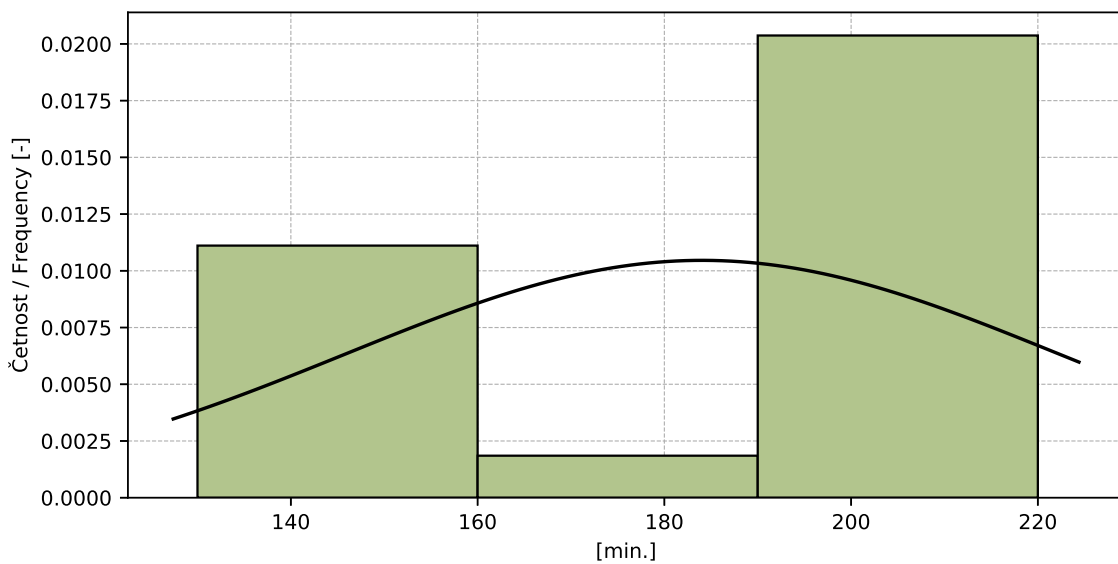


Figure 69: Histogram of all test results

Table 26: Descriptive statistics

Characteristics	[min.]
Průměrná hodnota / Average value – \bar{x}	184.0
Výběrová směrodatná odchylka / Sample standard deviation – s	38.1
Vztažná hodnota / Assigned value – x^*	194.0
Robustní směrodatná odchylka / Robust standard deviation – s^*	24.9
Nejistota měření vztažné hodnoty / Measurement uncertainty of assigned value – u_X	12.7
p -hodnota testu normality / p -value of normality test	0.019 [-]
Mezilaboratorní sm. odch. / Interlaboratory standard deviation – s_L	38.0
Směrodatná odchylka opakovatelnosti / Repeatability standard deviation – s_r	6.0
Směrodatná odchylka reprodukovatelnosti / Reproducibility standard deviation – s_R	38.5
Opakovatelnost / Repeatability – r	17.0
Reprodukovatelnost / Reproducibility – R	108.0

7.1.5 Evaluation of Performance Statistics

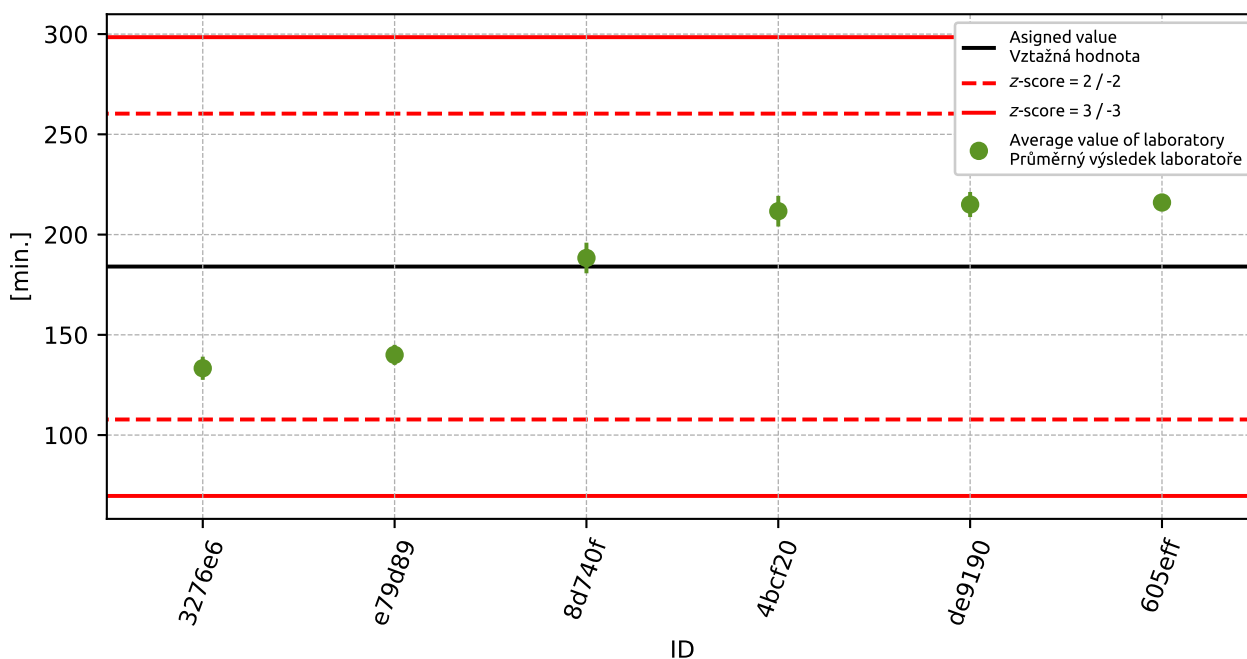


Figure 70: Average values and sample standard deviations

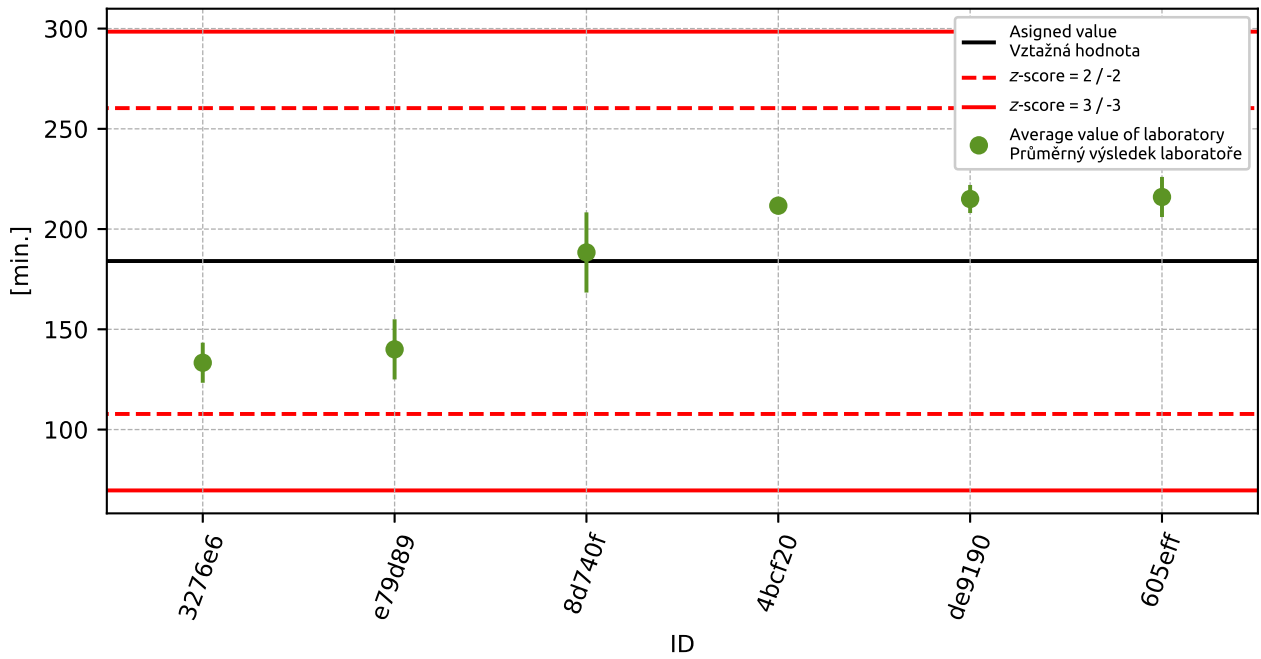


Figure 71: Average values and extended uncertainties of measurement

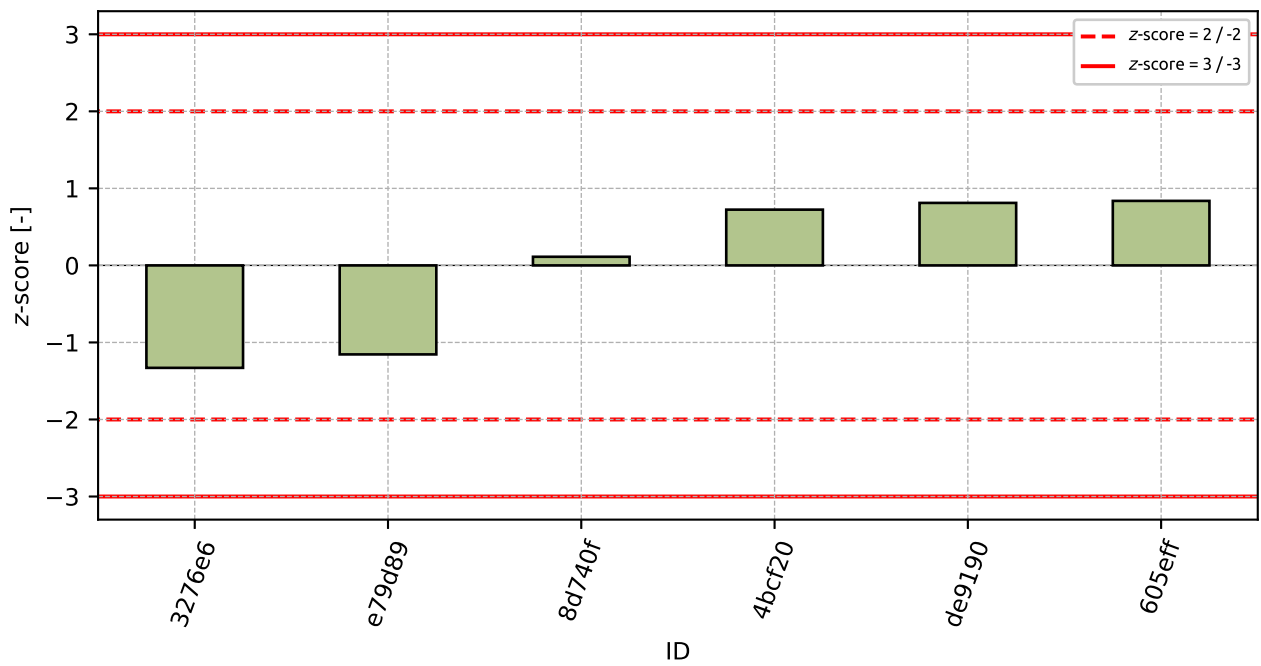
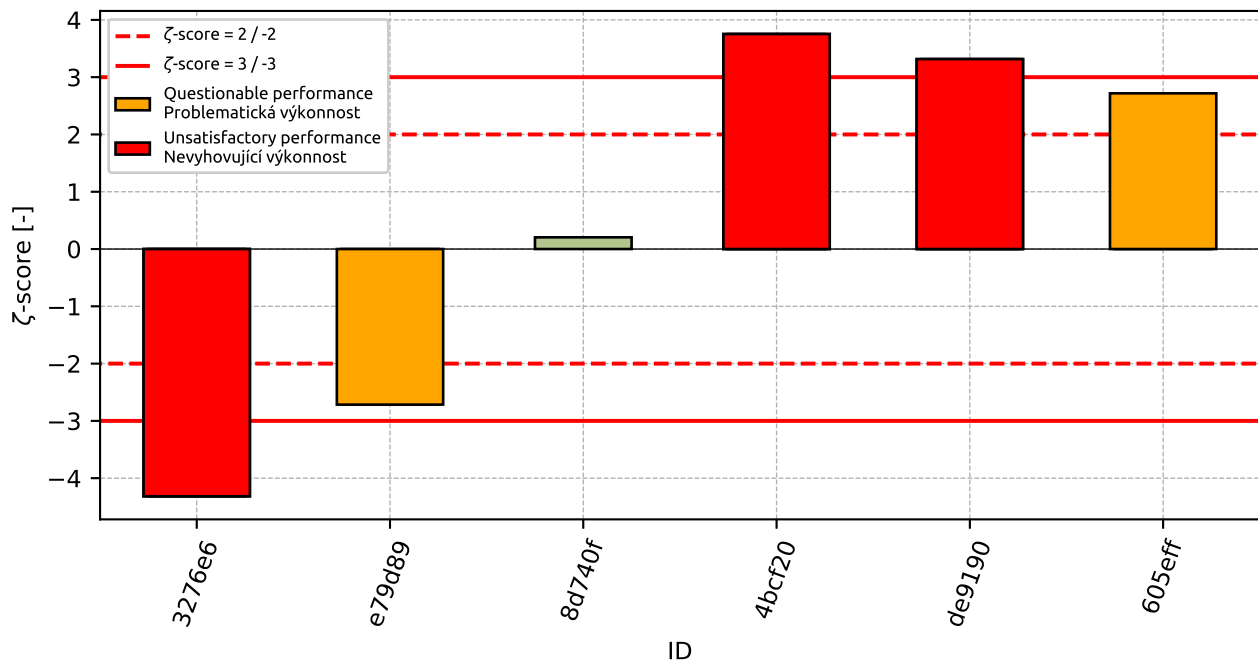


Figure 72: z-score

Figure 73: ζ -scoreTable 27: z-score and ζ -score

ID	z-score [-]	ζ -score [-]
3276e6	-1.33	-4.32
e79d89	-1.16	-2.72
8d740f	0.11	0.2
4bcf20	0.72	3.75
de9190	0.81	3.31
605eff	0.84	2.72

7.2 Final setting time

7.2.1 Test results

Table 28: 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 [min.]			u_x [min.]	\bar{x} [min.]	s_0 [min.]	V_x [%]
3276e6	230	230	225	10	228	2.9	1.26
4bcf20	265	265	270	5	267	2.9	1.08
605eff	280	275	275	10	277	2.9	1.04
8d740f	285	275	270	21	277	7.6	2.76
e79d89	270	280	280	20	277	5.8	2.09
de9190	269	280	285	9	278	8.2	2.94

7.2.2 The Numerical Procedure for Determining Outliers

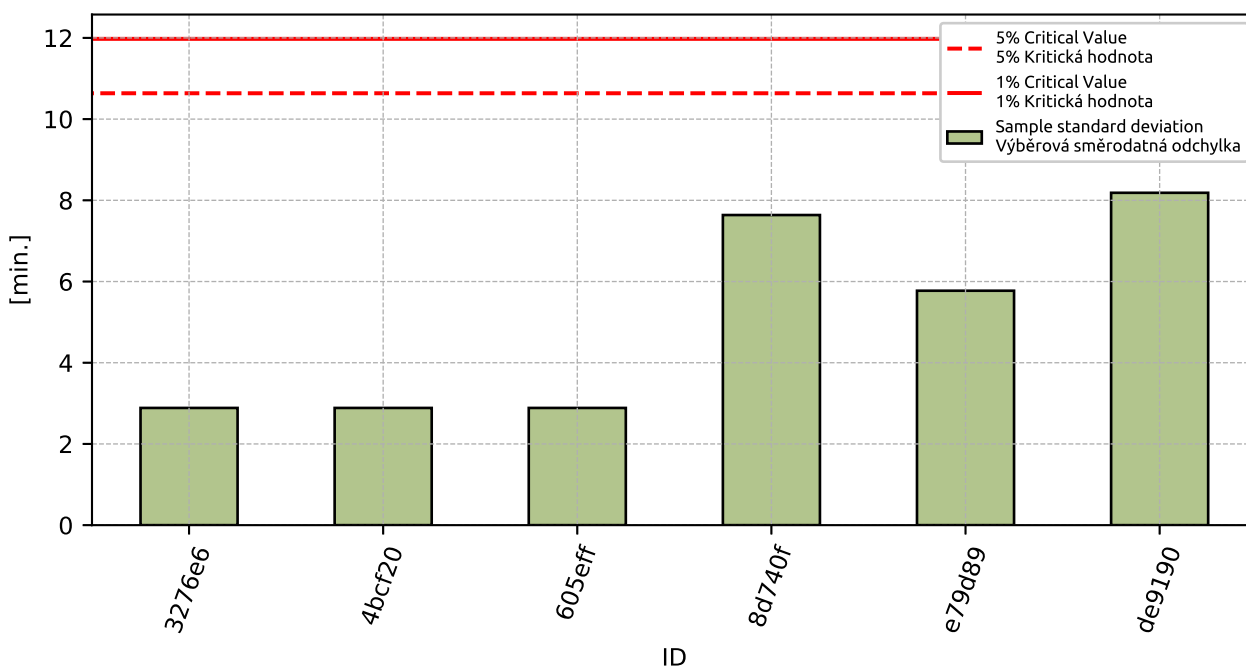


Figure 74: **Cochran's test** - sample standard deviations

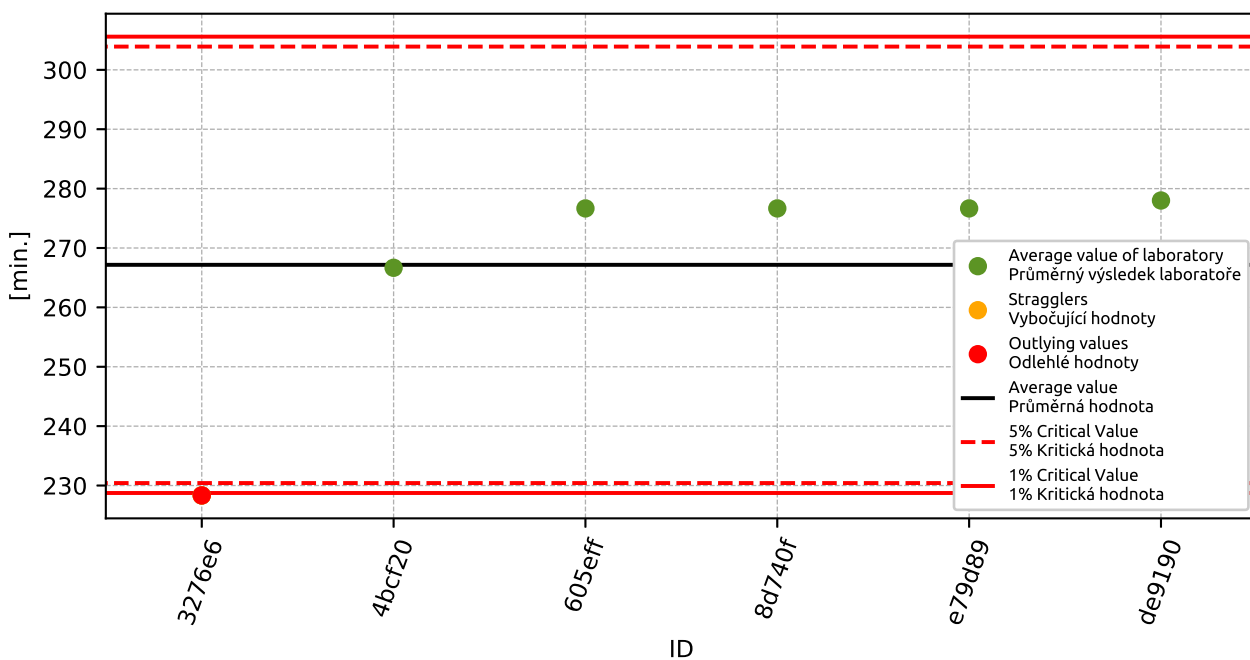


Figure 75: **Grubbs' test** - average values

7.2.3 Mandel's Statistics

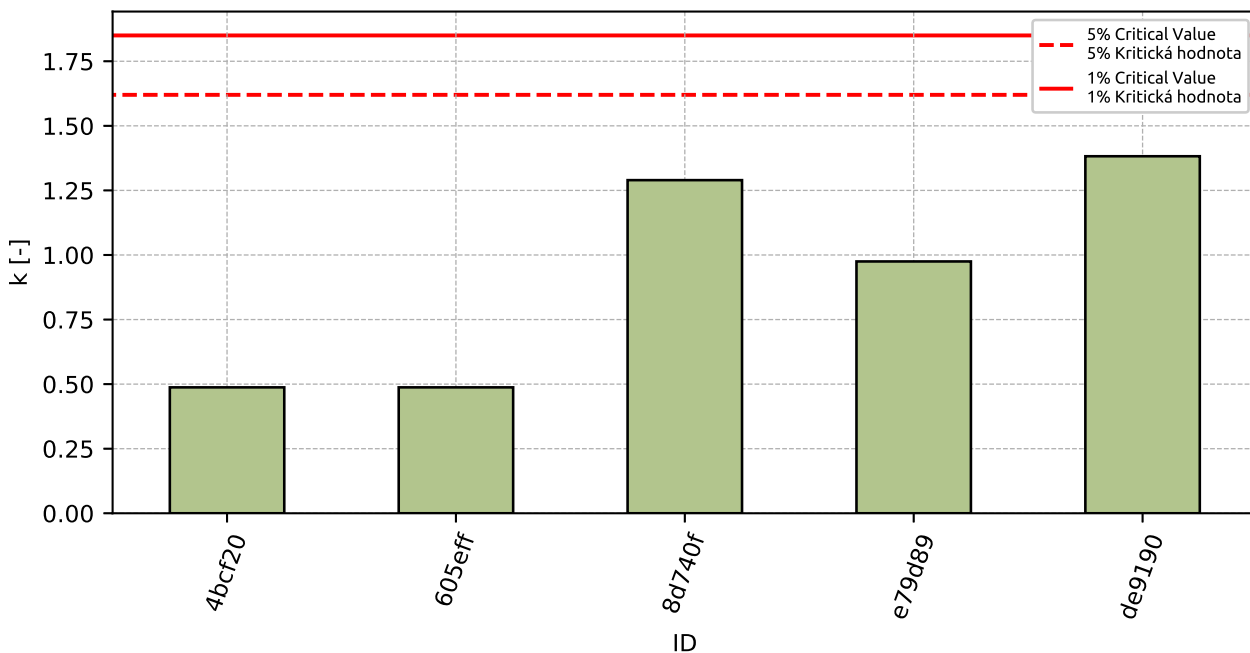


Figure 76: Intralaboratory Consistency Statistic

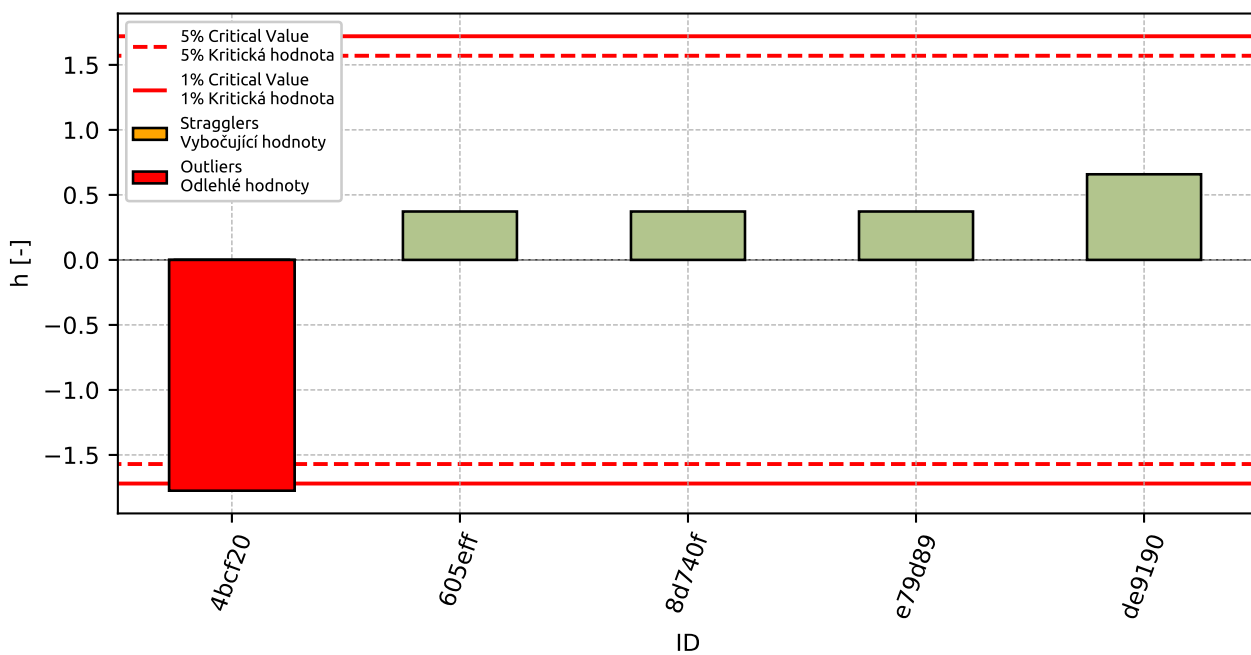


Figure 77: Interlaboratory Consistency Statistic

7.2.4 Descriptive statistics

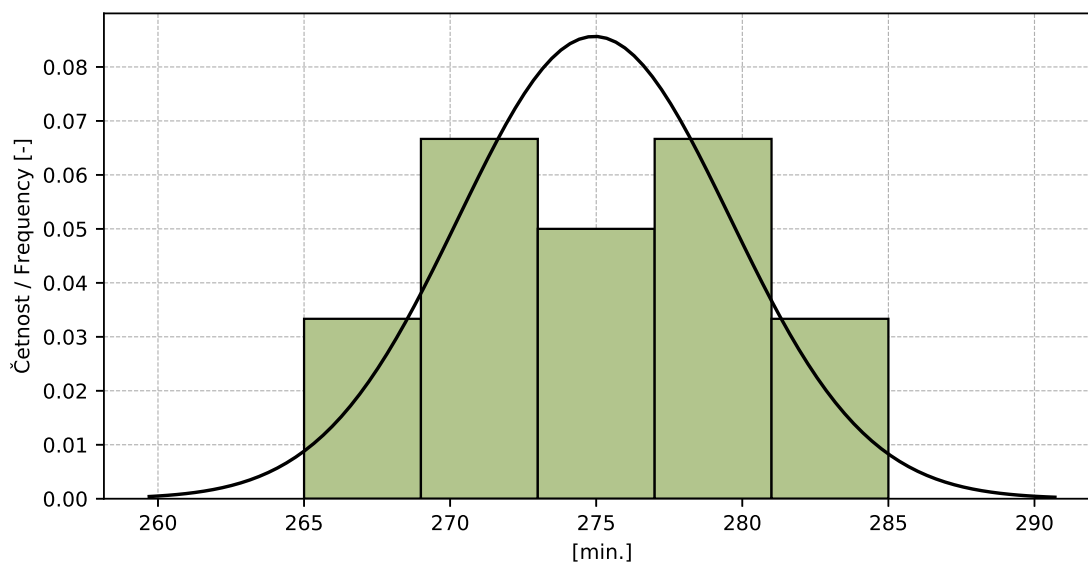


Figure 78: Histogram of all test results

Table 29: Descriptive statistics

Characteristics	[min.]
Průměrná hodnota / Average value – \bar{x}	275.0
Výběrová směrodatná odchylka / Sample standard deviation – s	4.7
Vztažná hodnota / Assigned value – x^*	277.0
Robustní směrodatná odchylka / Robust standard deviation – s^*	0.6
Nejistota měření vztažné hodnoty / Measurement uncertainty of assigned value – u_X	0.3
p -hodnota testu normality / p -value of normality test	0.46 [-]
Mezilaboratorní sm. odch. / Interlaboratory standard deviation – s_L	3.2
Směrodatná odchylka opakovatelnosti / Repeatability standard deviation – s_r	5.9
Směrodatná odchylka reprodukovatelnosti / Reproducibility standard deviation – s_R	6.7
Opakovatelnost / Repeatability – r	17.0
Reprodukovatelnost / Reproducibility – R	19.0

7.2.5 Evaluation of Performance Statistics

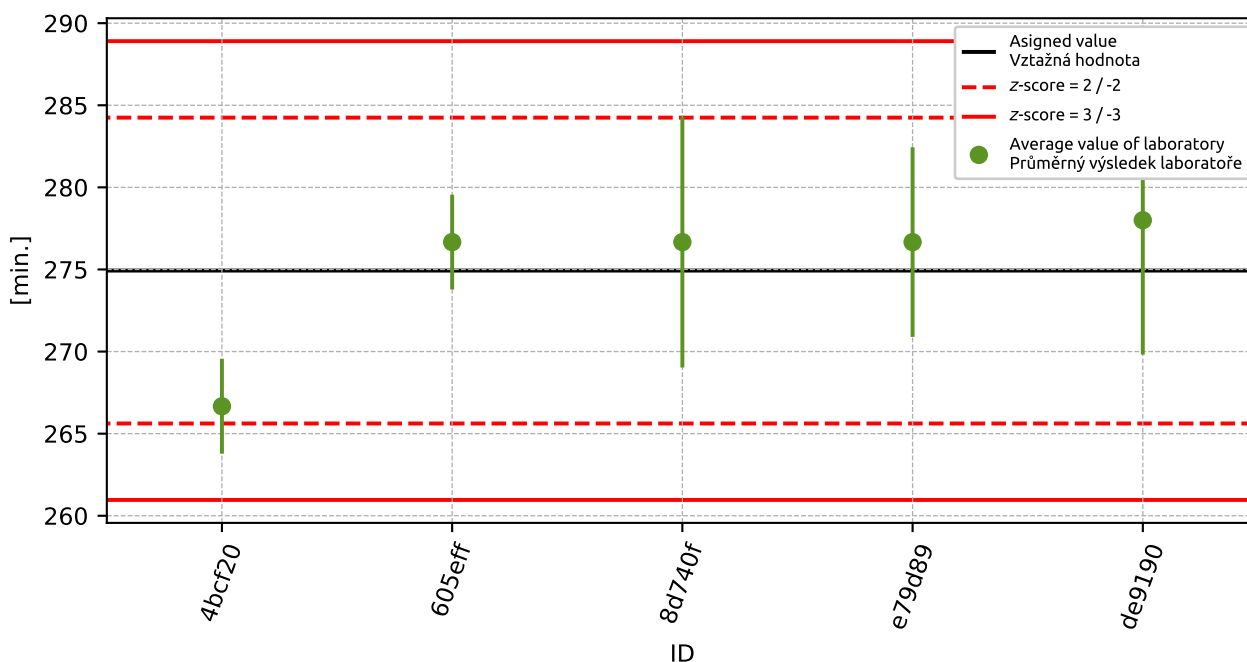


Figure 79: Average values and sample standard deviations

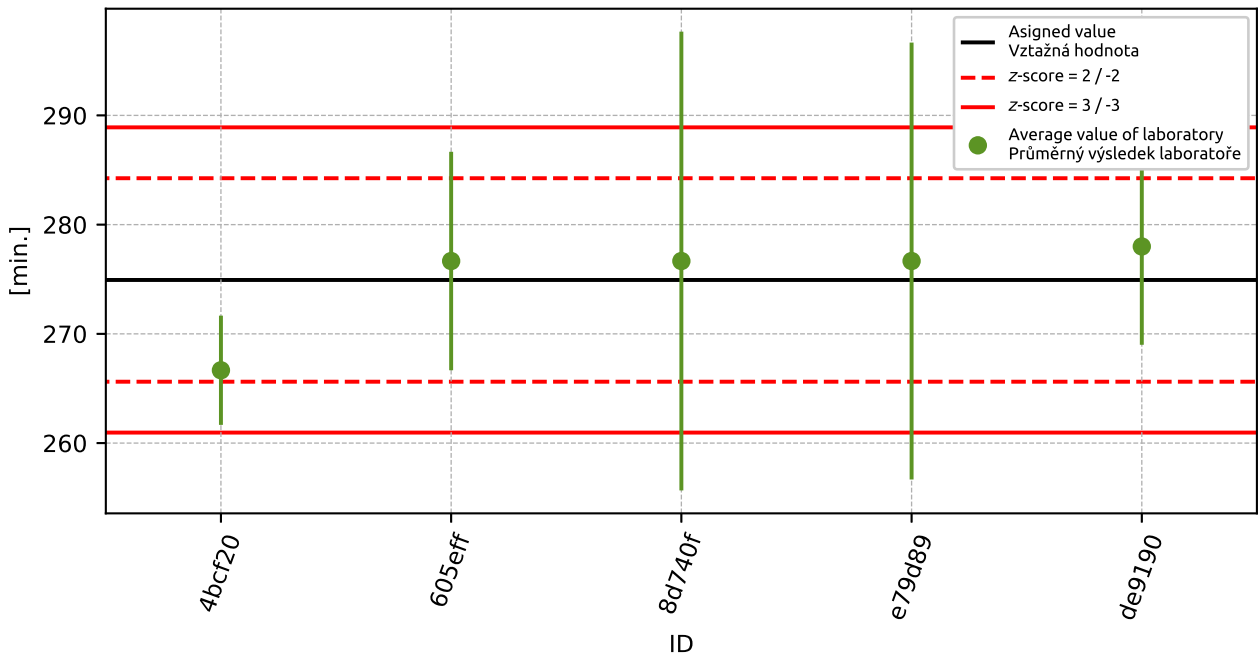


Figure 80: Average values and extended uncertainties of measurement

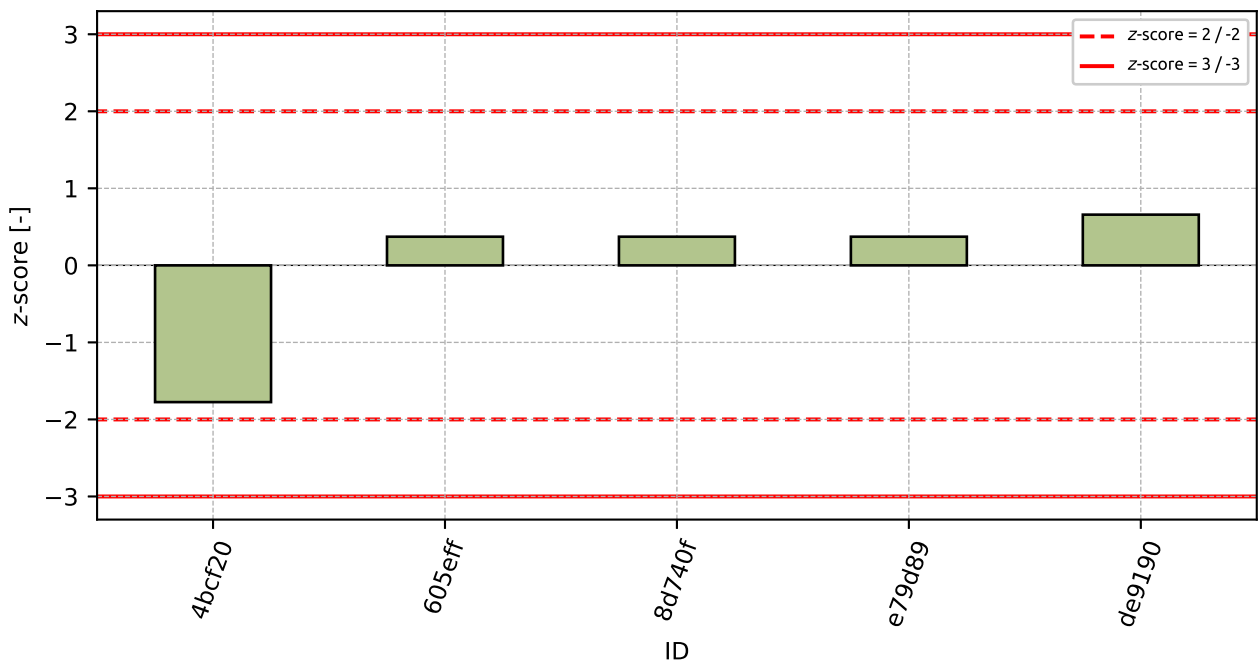


Figure 81: z-score

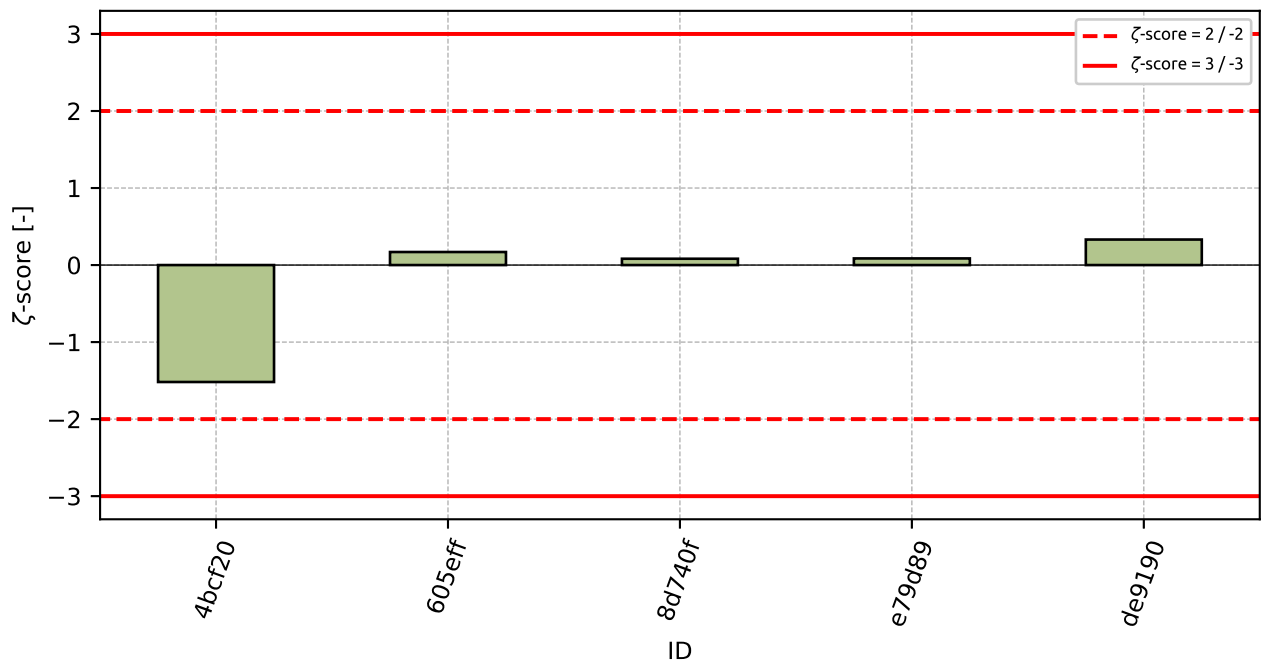


Figure 82: ζ -score

Table 30: z-score and ζ -score

ID	z-score [-]	ζ -score [-]
4bcf20	-1.78	-1.52
605eff	0.37	0.17
8d740f	0.37	0.08
e79d89	0.37	0.09
de9190	0.66	0.33

7.3 Soundness

7.3.1 Test results

Table 31: Test results - ordered by average value. Outliers are marked by red color. u_x - extended uncertainty of measurement; \bar{x} - average value; s_0 - sample standard deviation; V_x - variation coefficient

ID	Test results [mm]			u_x [mm]	\bar{x} [mm]	s_0 [mm]	V_x [%]
e79d89	0.3	0.4	0.3	0.1	0.3	0.06	17.32
605eff	0.4	0.4	0.5	0.2	0.4	0.06	13.32
8d740f	1.0	1.0	0.5	0.5	0.8	0.29	34.64
de9190	0.8	0.8	0.9	0.1	0.8	0.06	6.93
3276e6	2.0	2.0	1.0	1.0	1.7	0.58	34.64
4bcf20	4.0	8.0	6.0	0.1	6.0	2.0	33.33

7.3.2 The Numerical Procedure for Determining Outliers

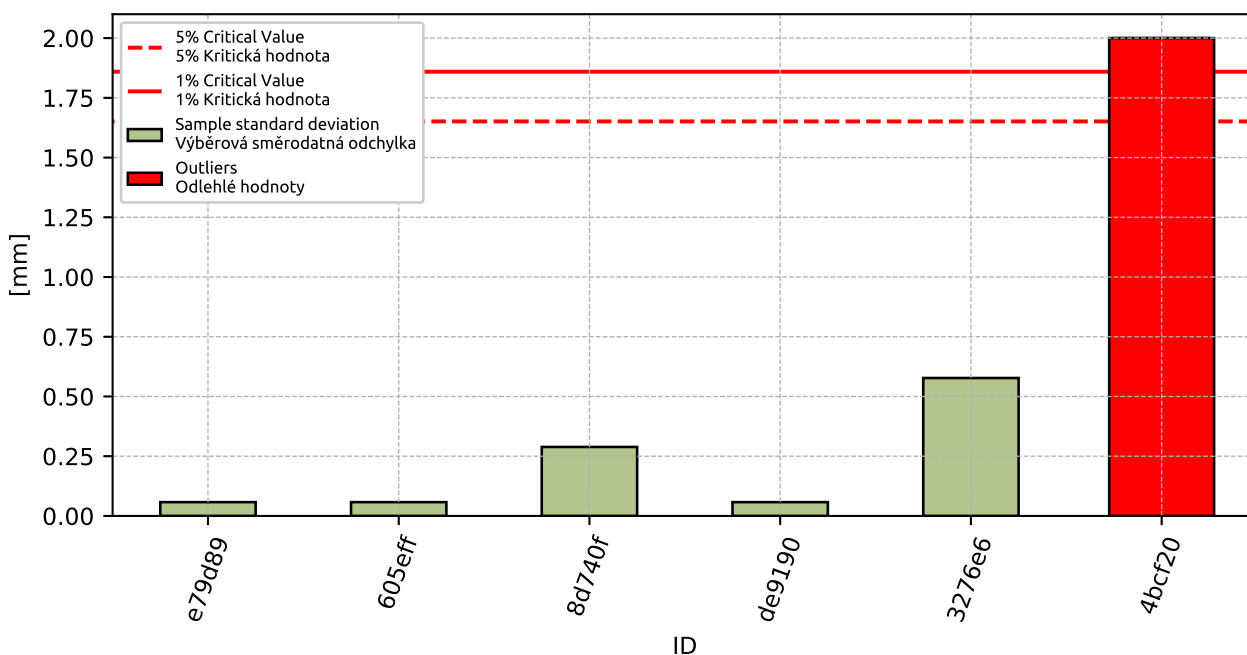


Figure 83: Cochran's test - sample standard deviations

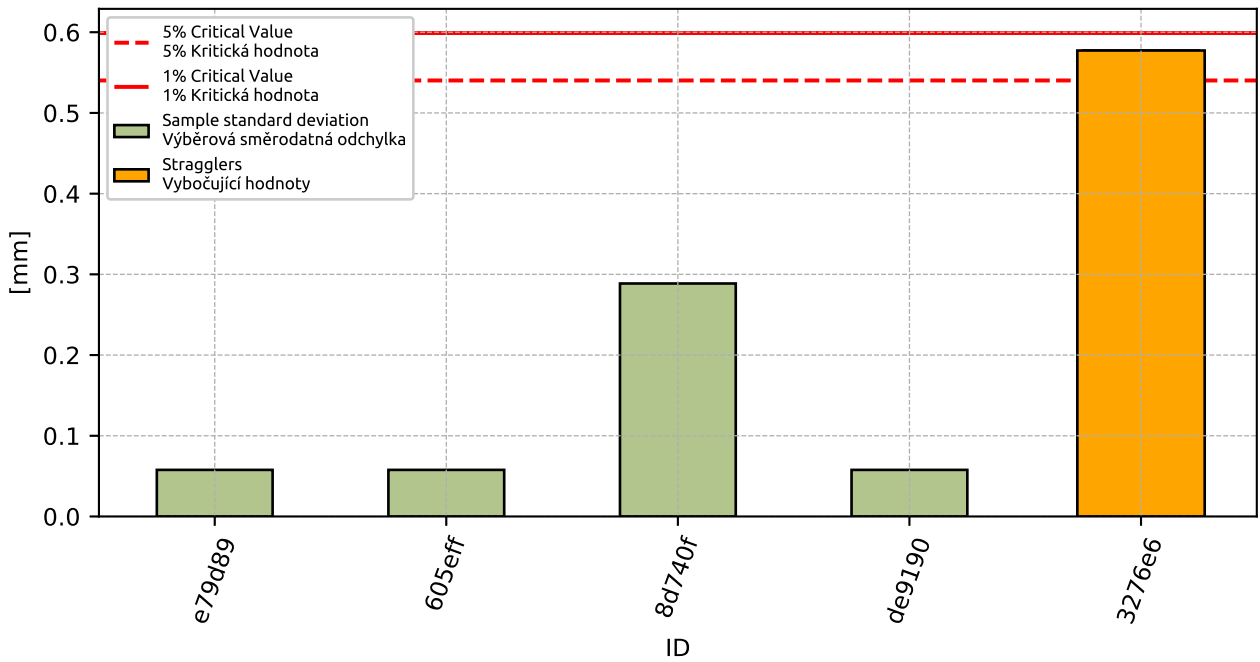


Figure 84: **Cochran's test** - sample standard deviations without outliers

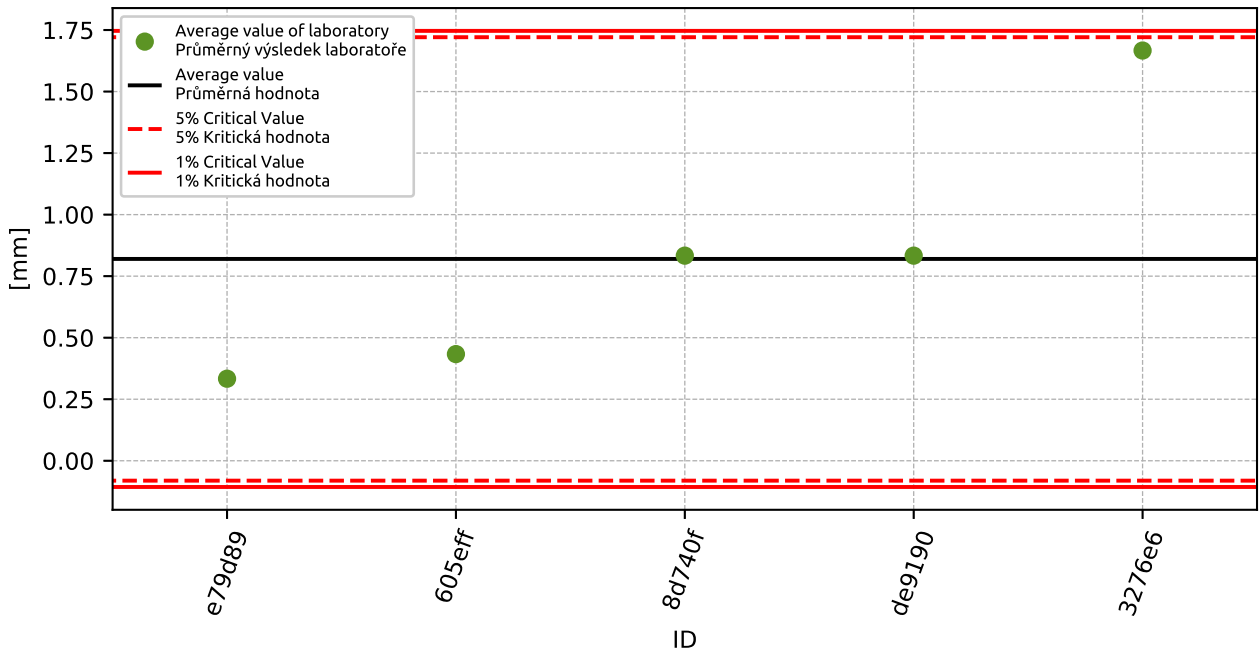


Figure 85: **Grubbs' test** - average values

7.3.3 Mandel's Statistics

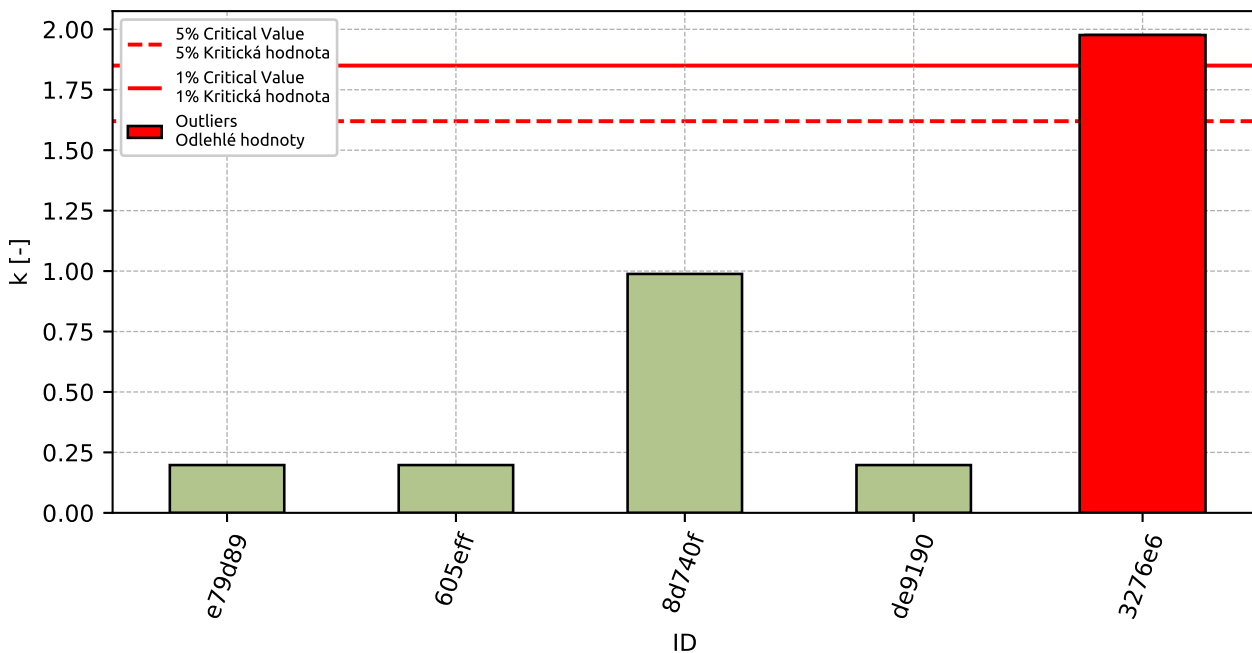


Figure 86: Intralaboratory Consistency Statistic

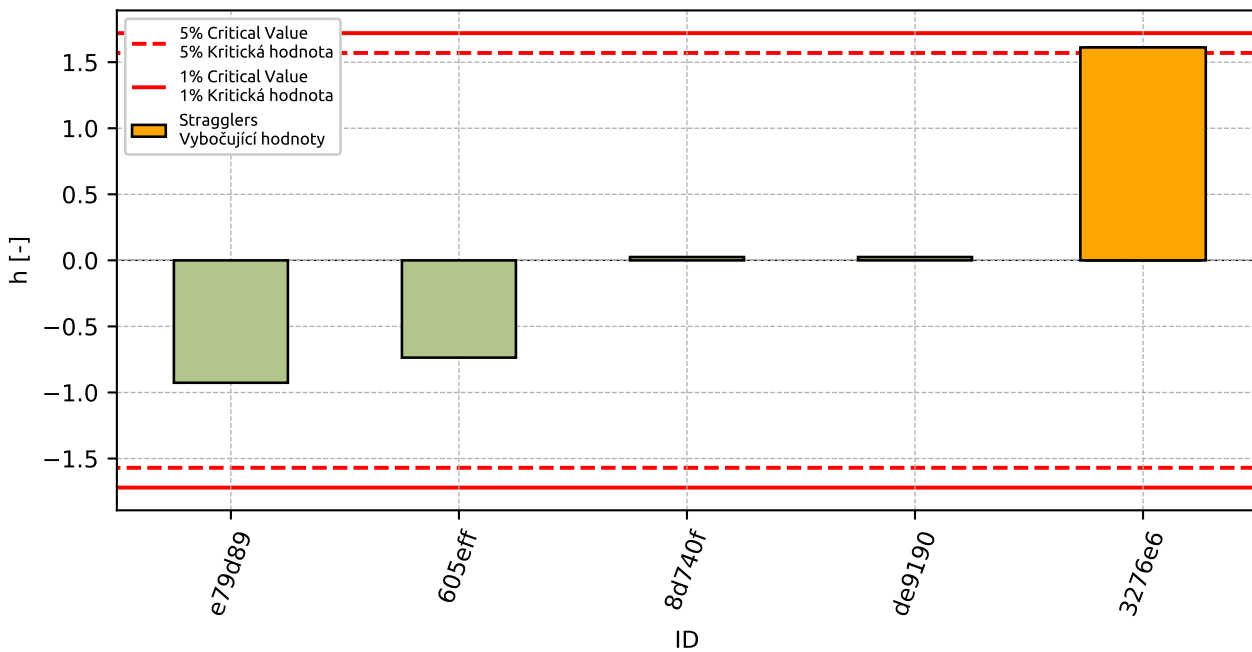


Figure 87: Interlaboratory Consistency Statistic

7.3.4 Descriptive statistics

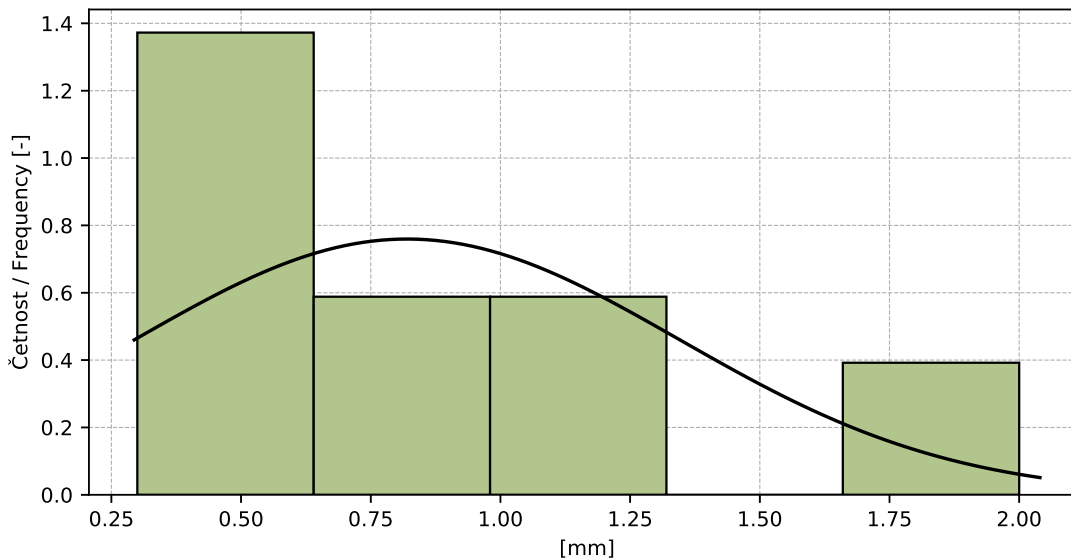


Figure 88: Histogram of all test results

Table 32: Descriptive statistics

Characteristics	[mm]
Průměrná hodnota / Average value – \bar{x}	0.8
Výběrová směrodatná odchylka / Sample standard deviation – s	0.53
Vztažná hodnota / Assigned value – x^*	0.8
Robustní směrodatná odchylka / Robust standard deviation – s^*	0.53
Nejistota měření vztažné hodnoty / Measurement uncertainty of assigned value – u_X	0.3
p -hodnota testu normality / p -value of normality test	0.032 [-]
Mezilaboratorní sm. odch. / Interlaboratory standard deviation – s_L	0.5
Směrodatná odchylka opakovatelnosti / Repeatability standard deviation – s_r	0.29
Směrodatná odchylka reprodukovatelnosti / Reproducibility standard deviation – s_R	0.58
Opakovatelnost / Repeatability – r	0.8
Reprodukovatelnost / Reproducibility – R	1.6

7.3.5 Evaluation of Performance Statistics

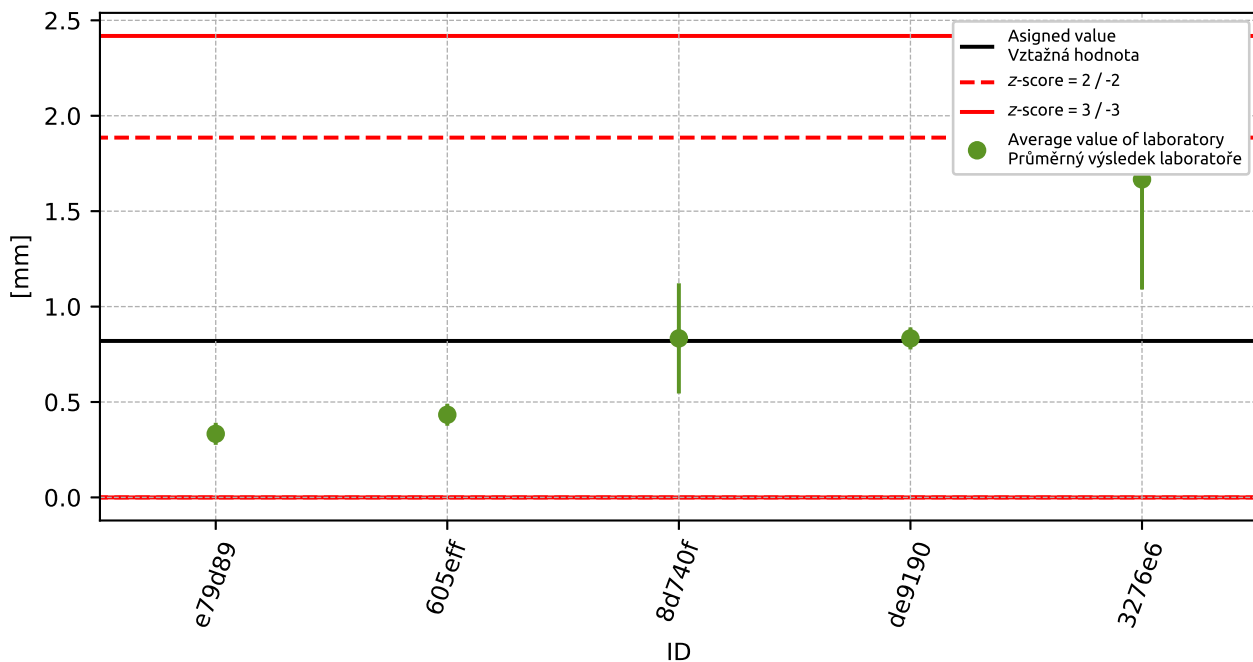


Figure 89: Average values and sample standard deviations

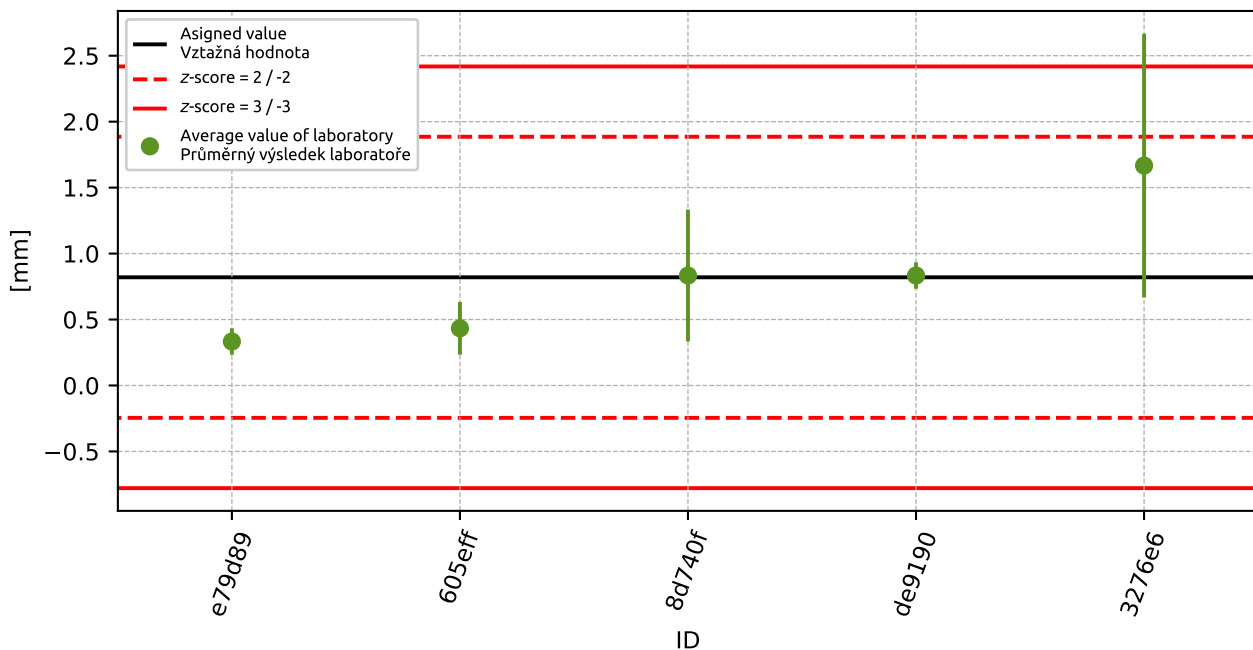


Figure 90: Average values and extended uncertainties of measurement

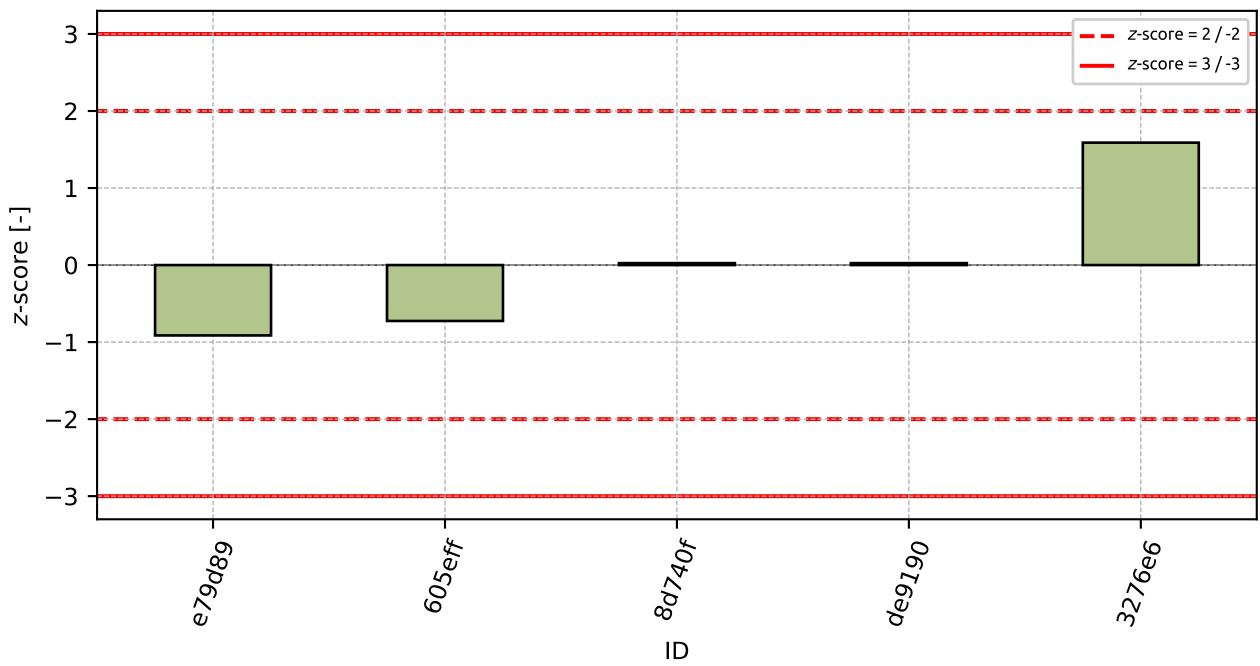


Figure 91: z-score

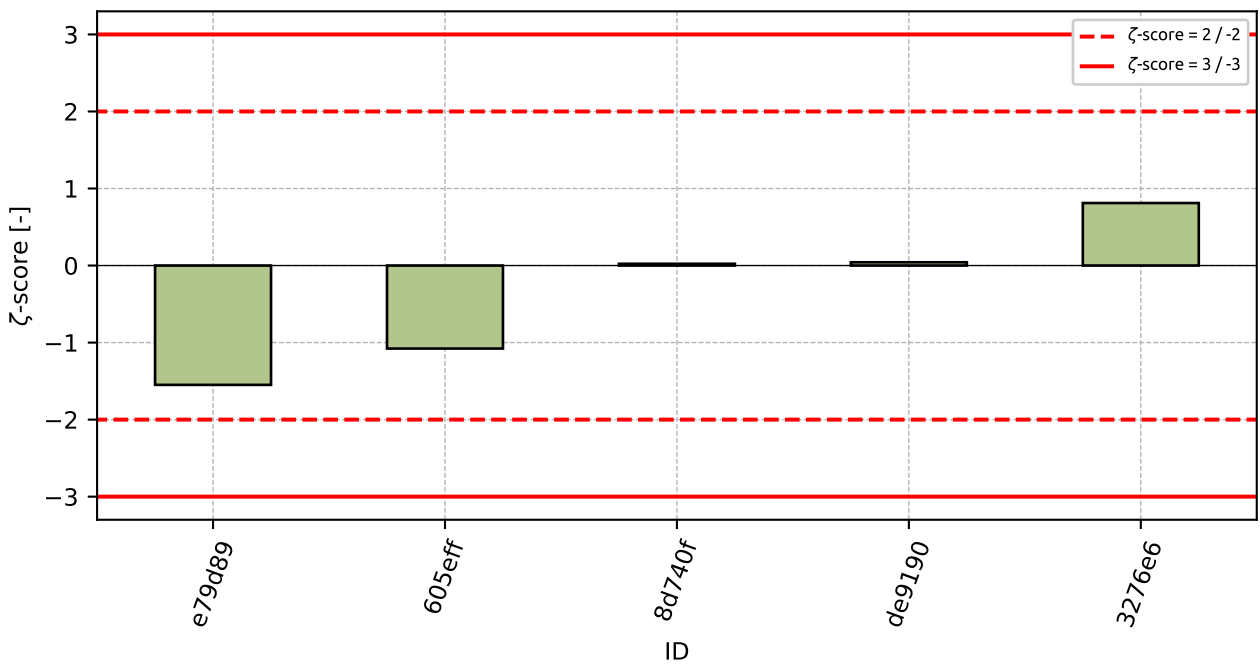


Figure 92: zeta-score

Table 33: z-score and ζ -score

ID	z-score [-]	ζ -score [-]
e79d89	-0.91	-1.55
605eff	-0.73	-1.08
8d740f	0.03	0.02
de9190	0.03	0.04
3276e6	1.59	0.81

8 Appendix – EN 196-10 – Determination of the water-soluble chromium (Cr^{6+})

This part of the PT program was not open due to the lack of participants.

9 Appendix – EN 1015-1 – Granularity

This part of the PT program was not open due to the lack of participants.

10 Appendix – EN 1015-3 – Consistency

10.1 Test results

Table 34: 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 [mm]	\bar{x} [mm]	s_0 [mm]	V_x [%]
	[mm]	[mm]	[mm]				
aa3e07	168.0	168.0	169.0	4.0	168.3	0.58	0.34
2f16d8	171.4	170.0	174.3	1.6	171.9	2.19	1.28
e79d89	182.0	182.0	183.0	3.0	182.3	0.58	0.32
e81c7c	192.0	192.0	192.0	-	192.0	0.0	0.0

10.2 The Numerical Procedure for Determining Outliers

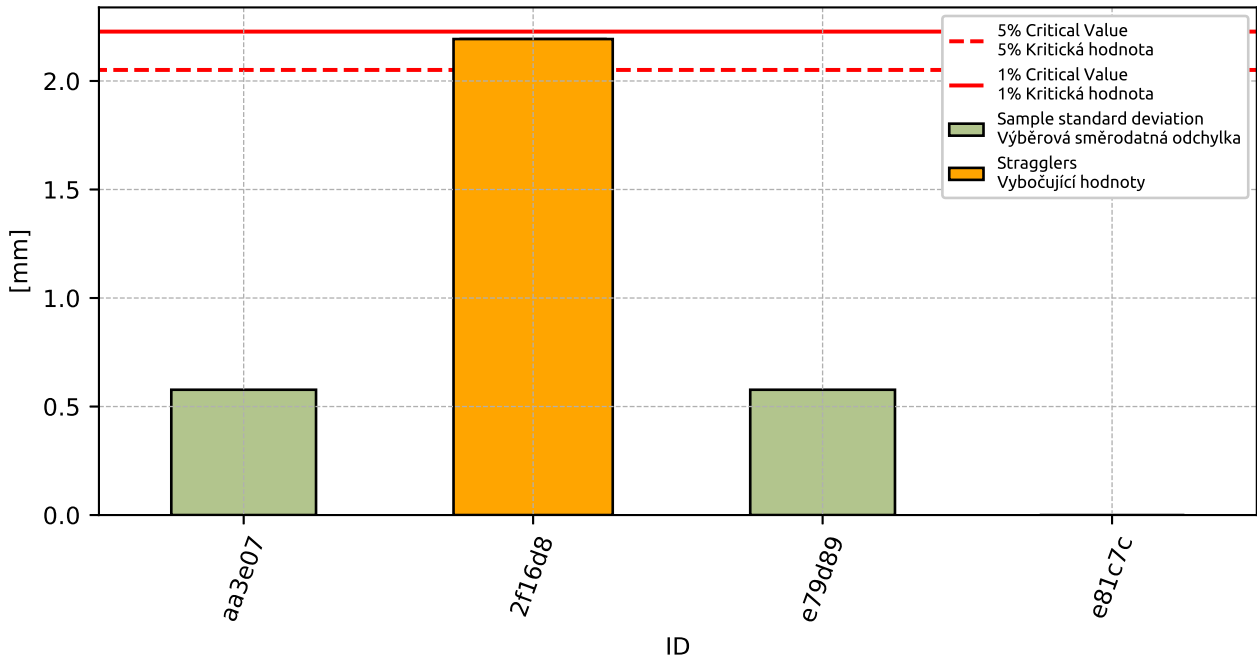


Figure 93: **Cochran's test** - sample standard deviations

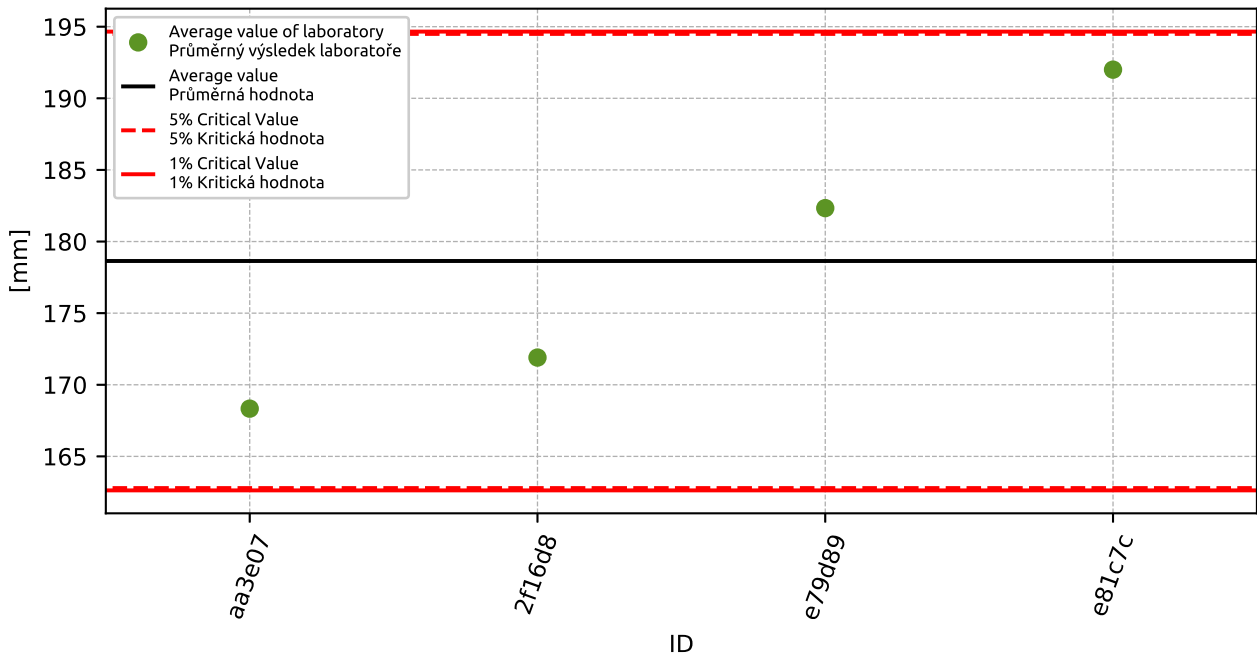


Figure 94: **Grubbs' test** - average values

10.3 Mandel's Statistics

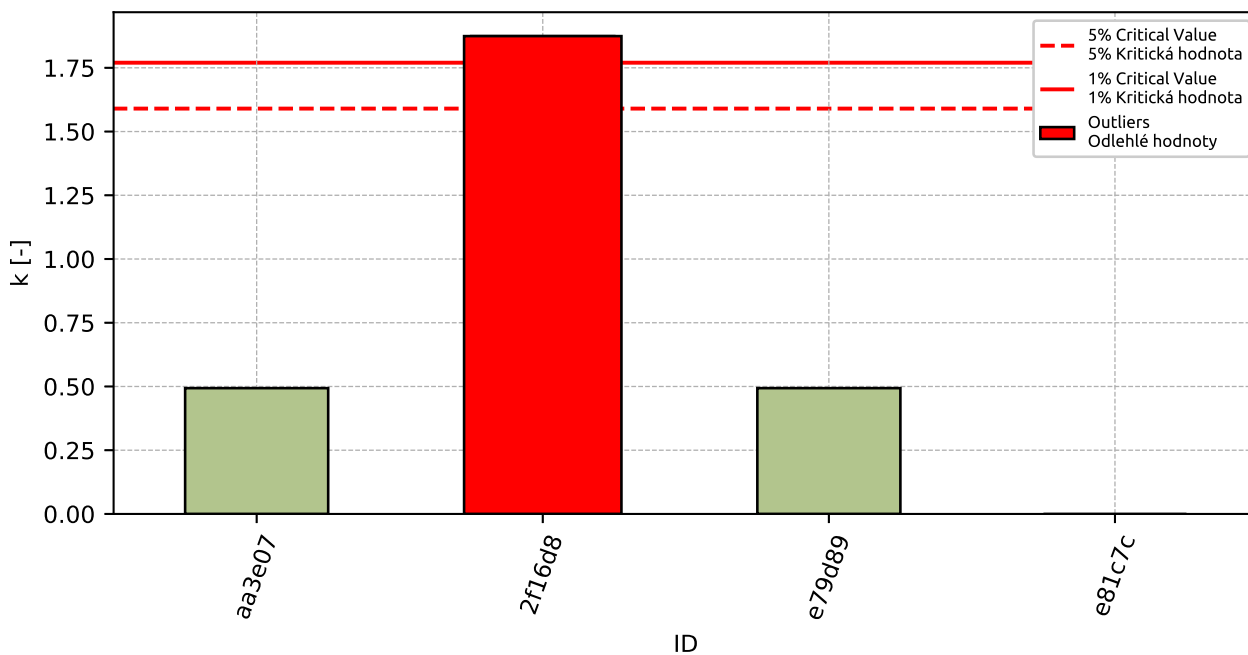


Figure 95: Intralaboratory Consistency Statistic

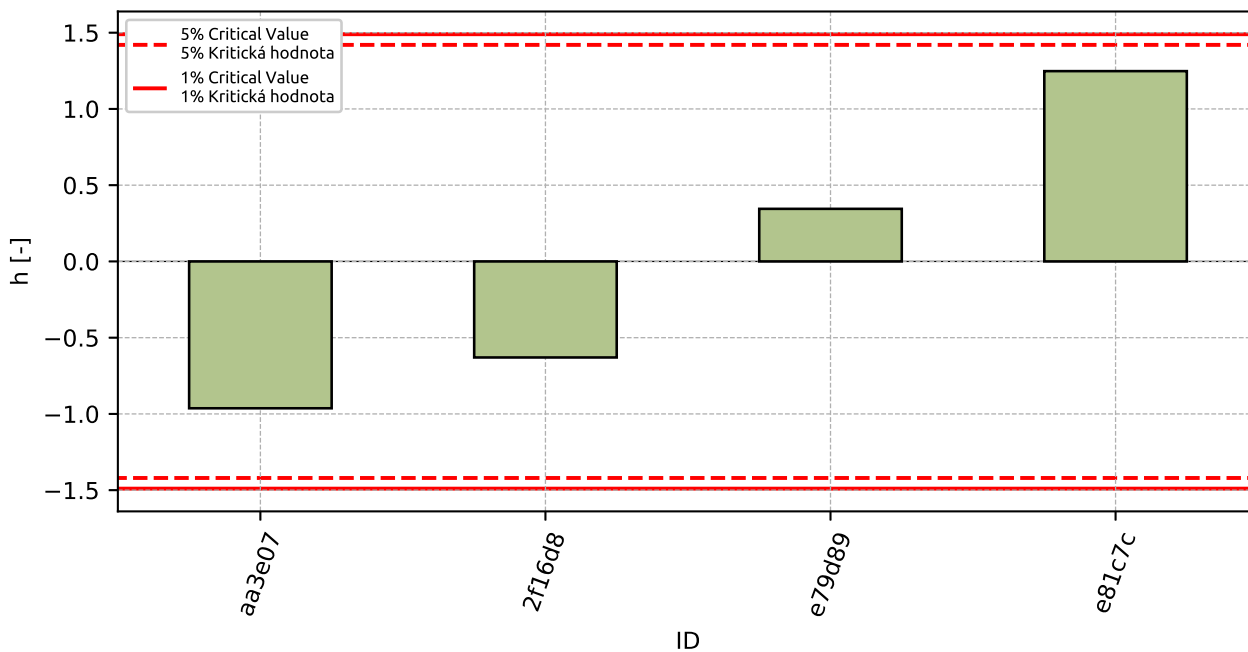


Figure 96: Interlaboratory Consistency Statistic

10.4 Descriptive statistics

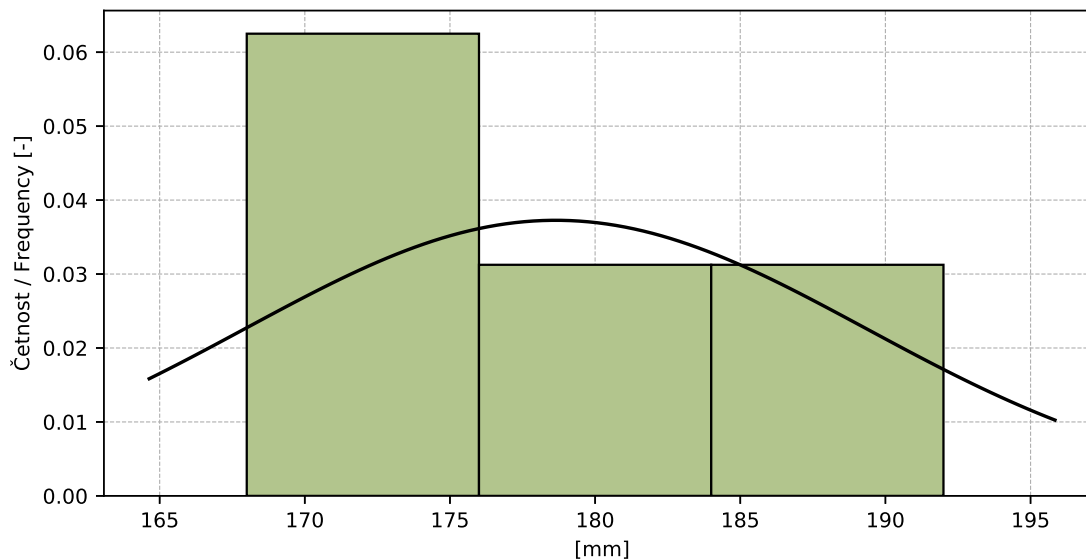


Figure 97: Histogram of all test results

Table 35: Descriptive statistics

Characteristics	[mm]
Průměrná hodnota / Average value – \bar{x}	178.6
Výběrová směrodatná odchylka / Sample standard deviation – s	10.7
Vztažná hodnota / Assigned value – x^*	178.6
Robustní směrodatná odchylka / Robust standard deviation – s^*	10.51
Nejistota měření vztažné hodnoty / Measurement uncertainty of assigned value – u_X	6.57
p -hodnota testu normality / p -value of normality test	0.169 [-]
Mezilaboratorní sm. odch. / Interlaboratory standard deviation – s_L	10.68
Směrodatná odchylka opakovatelnosti / Repeatability standard deviation – s_r	1.17
Směrodatná odchylka reprodukovatelnosti / Reproducibility standard deviation – s_R	10.75
Opakovatelnost / Repeatability – r	3.3
Reprodukovatelnost / Reproducibility – R	30.1

10.5 Evaluation of Performance Statistics

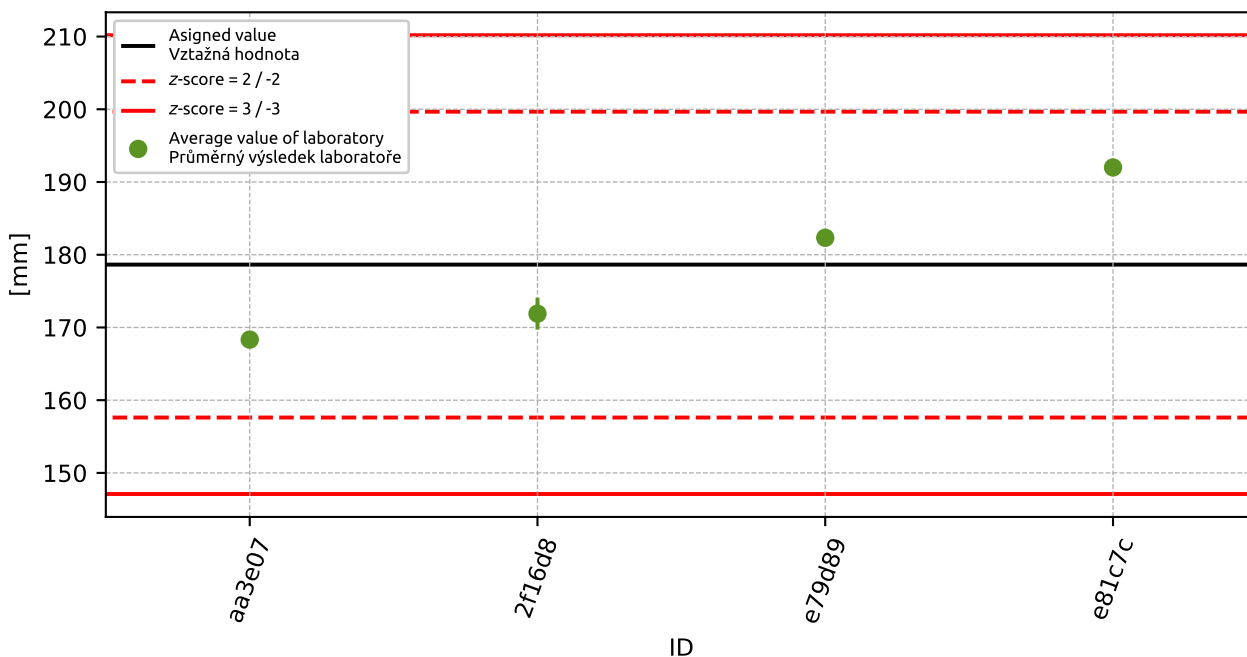


Figure 98: Average values and sample standard deviations

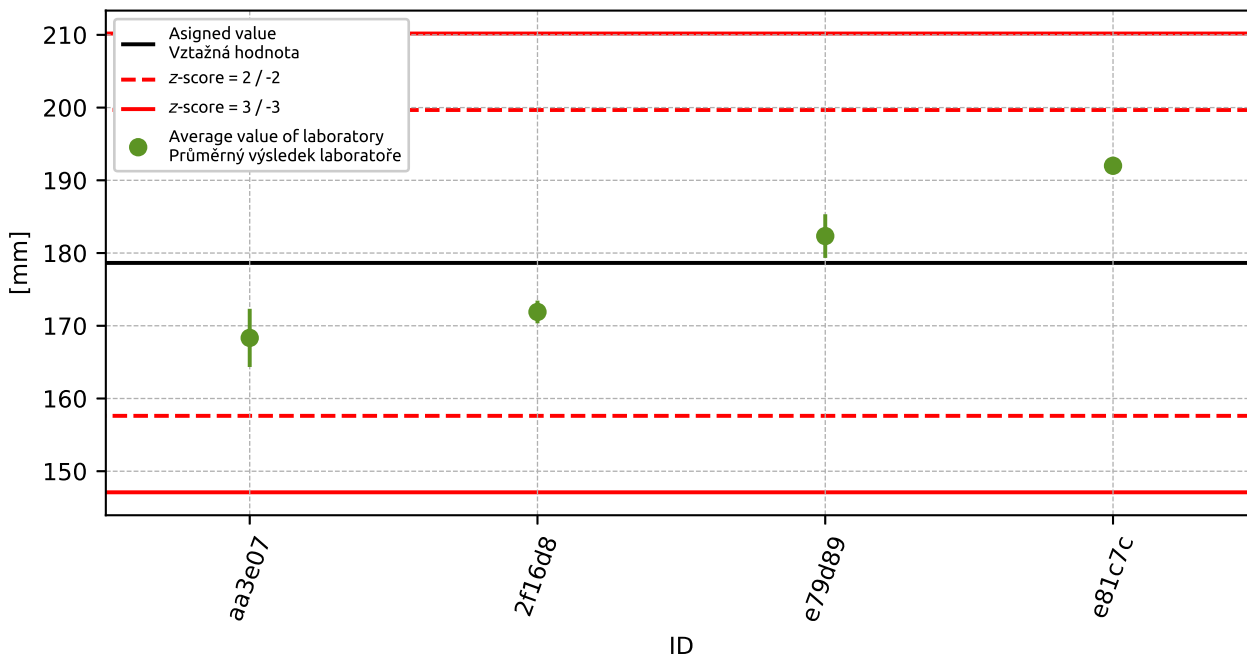


Figure 99: Average values and extended uncertainties of measurement

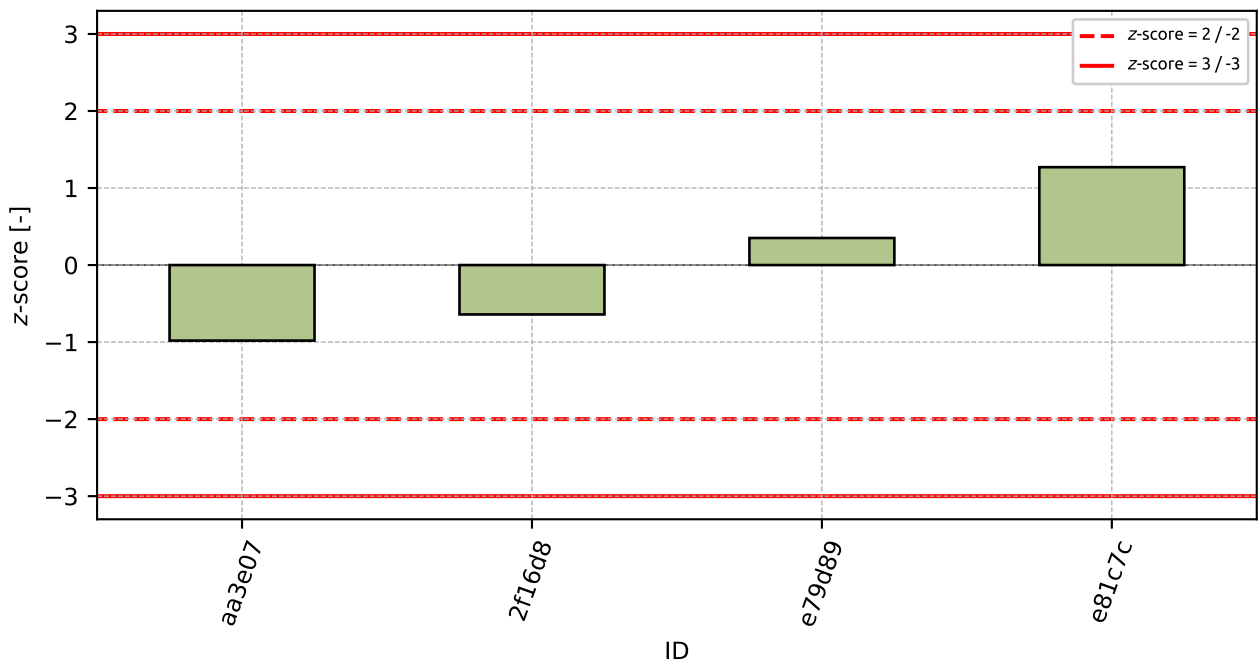


Figure 100: z-score

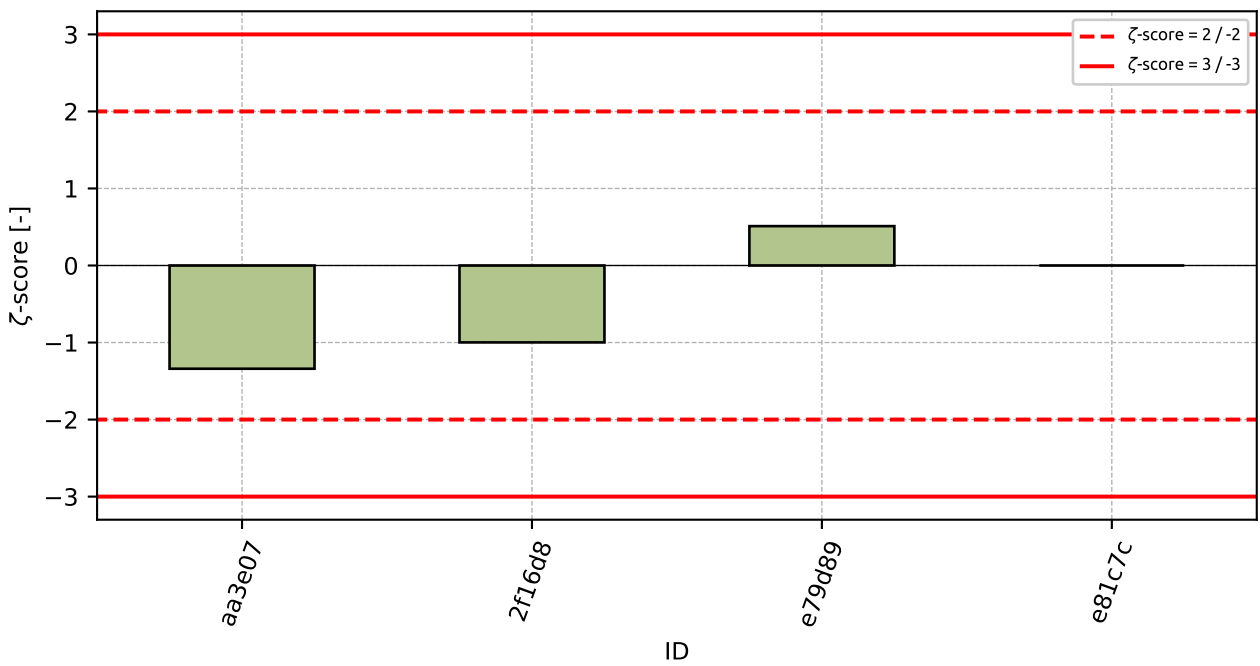


Figure 101: zeta-score

Table 36: z-score and ζ -score

ID	z-score [-]	ζ -score [-]
aa3e07	-0.98	-1.34
2f16d8	-0.64	-1.0
e79d89	0.35	0.51
e81c7c	1.27	-

11 Appendix – EN 1015-6 – Density of fresh mortar

This part of the PT program was not open due to the lack of participants.

12 Appendix – EN 1015-10 – Density of hardened mortar

12.1 Test results

Table 37: 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 [kg/m ³]	\bar{x} [kg/m ³]	s_0 [kg/m ³]	V_X [%]
	[kg/m ³]						
4d31e1	1890	1890	1900	15.0	1893.3	5.77	0.3
de9190	1901	1900	1905	4.0	1902.0	2.65	0.14
e56f66	1906	1914	1927	-	1915.7	10.6	0.55
e81c7c	1930	1930	1930	-	1930.0	0.0	0.0
e79d89	2110	2110	2120	30.0	2113.3	5.77	0.27

12.2 The Numerical Procedure for Determining Outliers

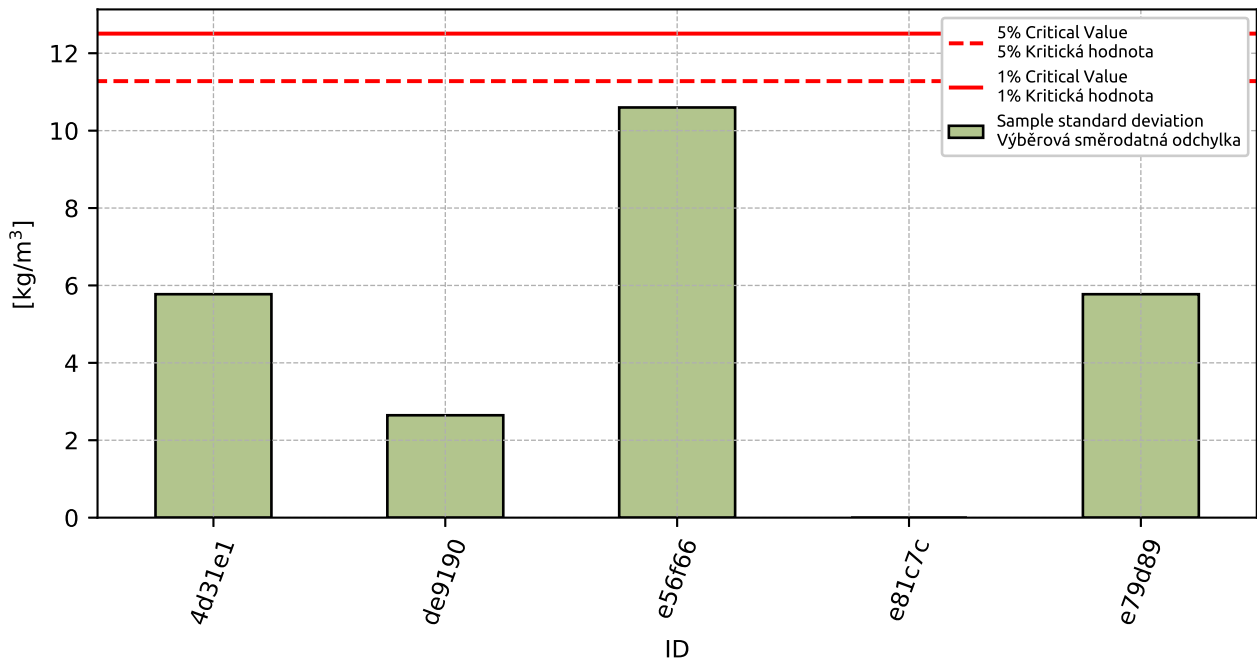


Figure 102: **Cochran's test** - sample standard deviations

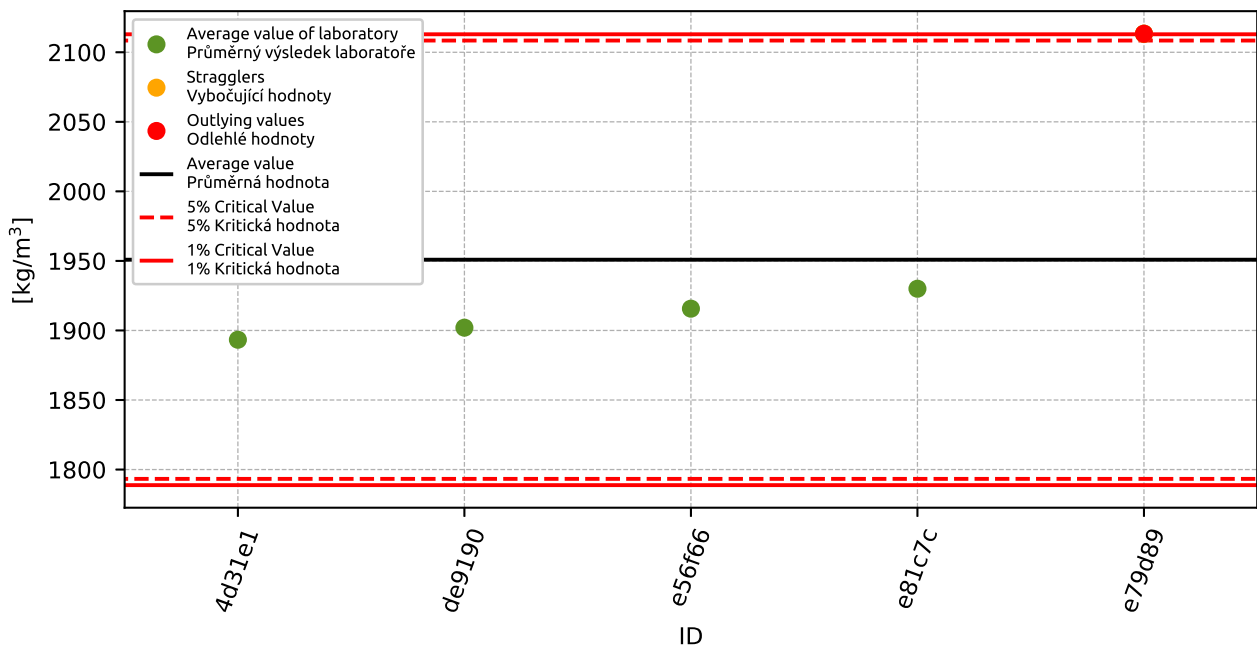


Figure 103: **Grubbs' test** - average values

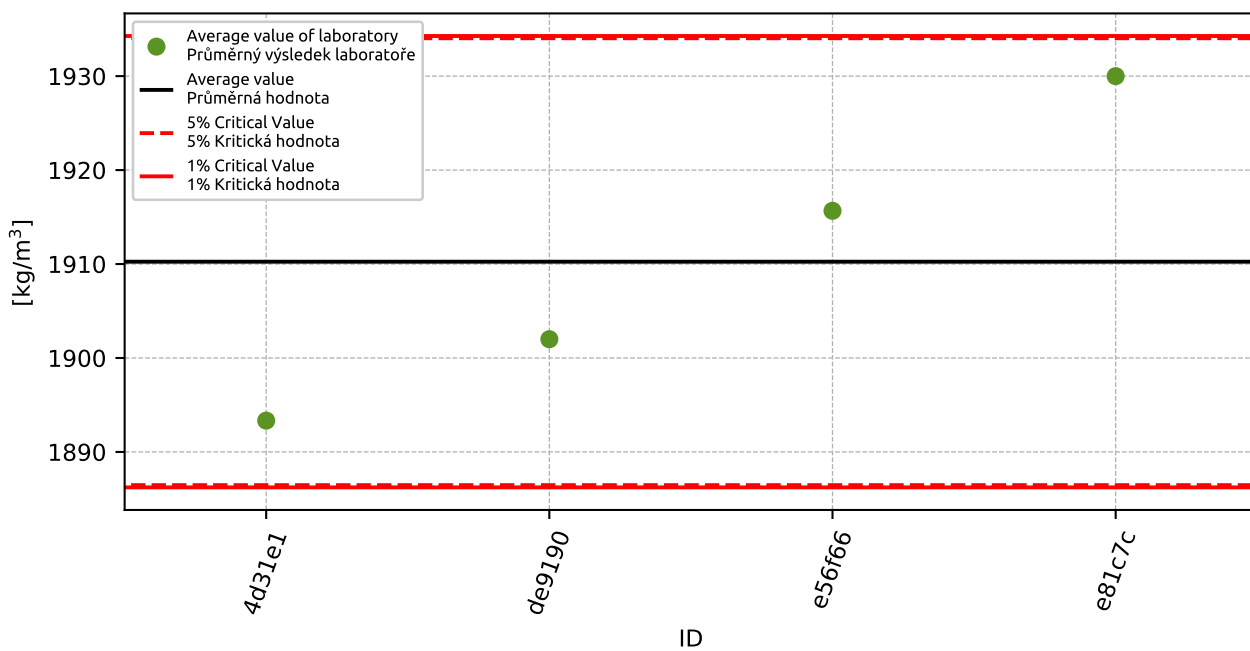


Figure 104: **Grubbs' test** - average values without outliers

12.3 Mandel's Statistics

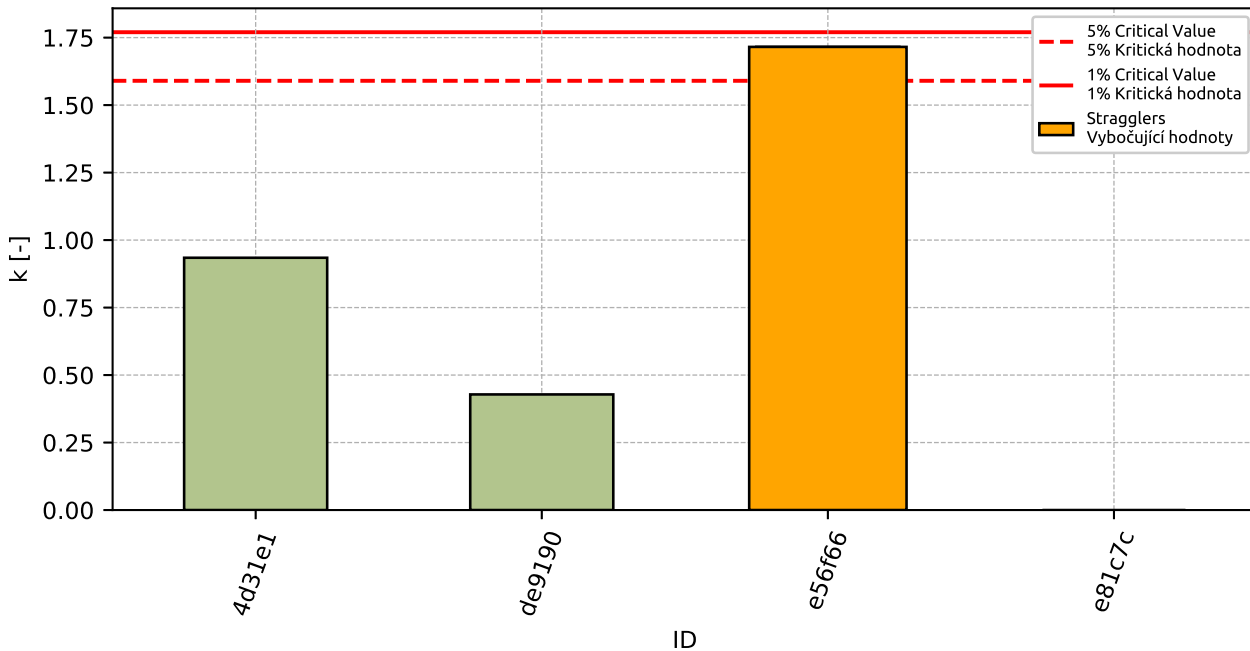


Figure 105: Intralaboratory Consistency Statistic

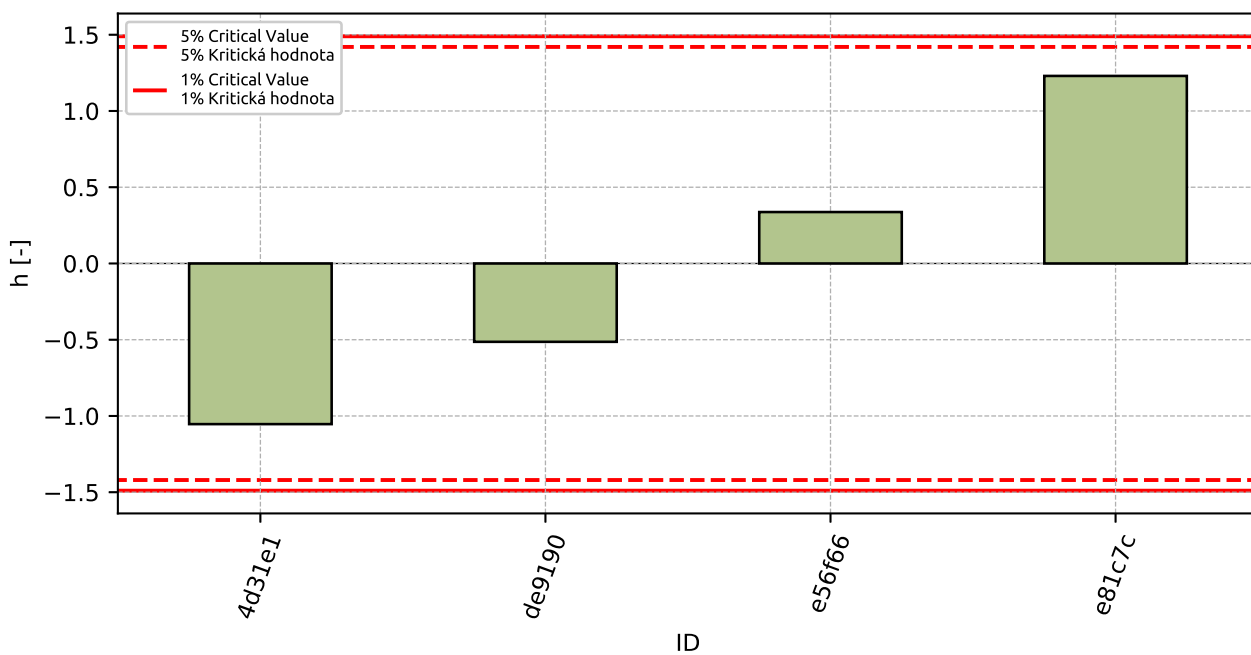


Figure 106: Interlaboratory Consistency Statistic

12.4 Descriptive statistics

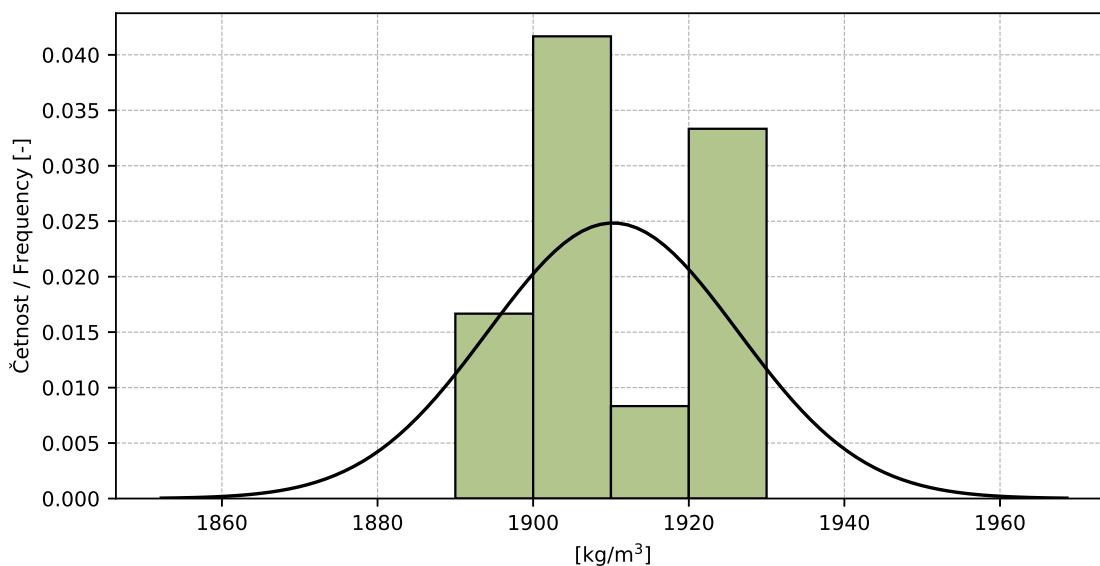


Figure 107: Histogram of all test results

Table 38: Descriptive statistics

Characteristics	[kg/m ³]
Průměrná hodnota / Average value – \bar{x}	1910.2
Výběrová směrodatná odchylka / Sample standard deviation – s	16.06
Vztažná hodnota / Assigned value – x^*	1910.2
Robustní směrodatná odchylka / Robust standard deviation – s^*	15.77
Nejistota měření vztažné hodnoty / Measurement uncertainty of assigned value – u_X	9.86
p -hodnota testu normality / p -value of normality test	0.217 [-]
Mezilaboratorní sm. odch. / Interlaboratory standard deviation – s_L	15.66
Směrodatná odchylka opakovatelnosti / Repeatability standard deviation – s_r	6.18
Směrodatná odchylka reprodukovatelnosti / Reproducibility standard deviation – s_R	16.83
Opakovatelnost / Repeatability – r	17.3
Reprodukovatelnost / Reproducibility – R	47.1

12.5 Evaluation of Performance Statistics

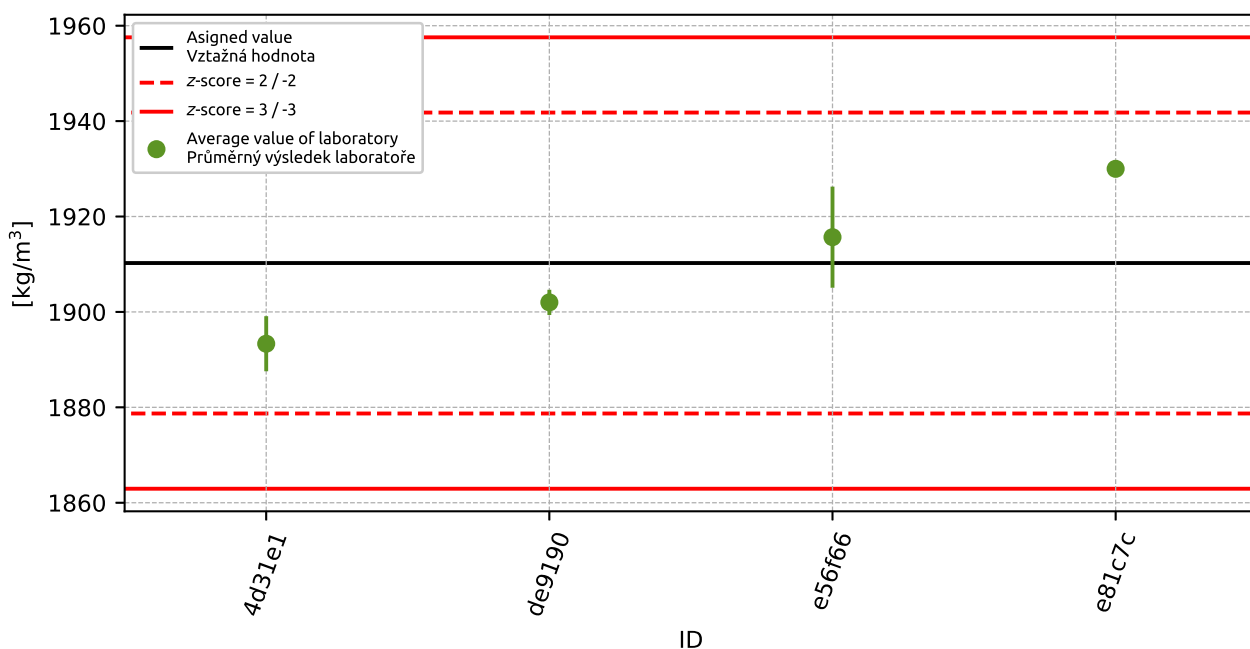


Figure 108: Average values and sample standard deviations

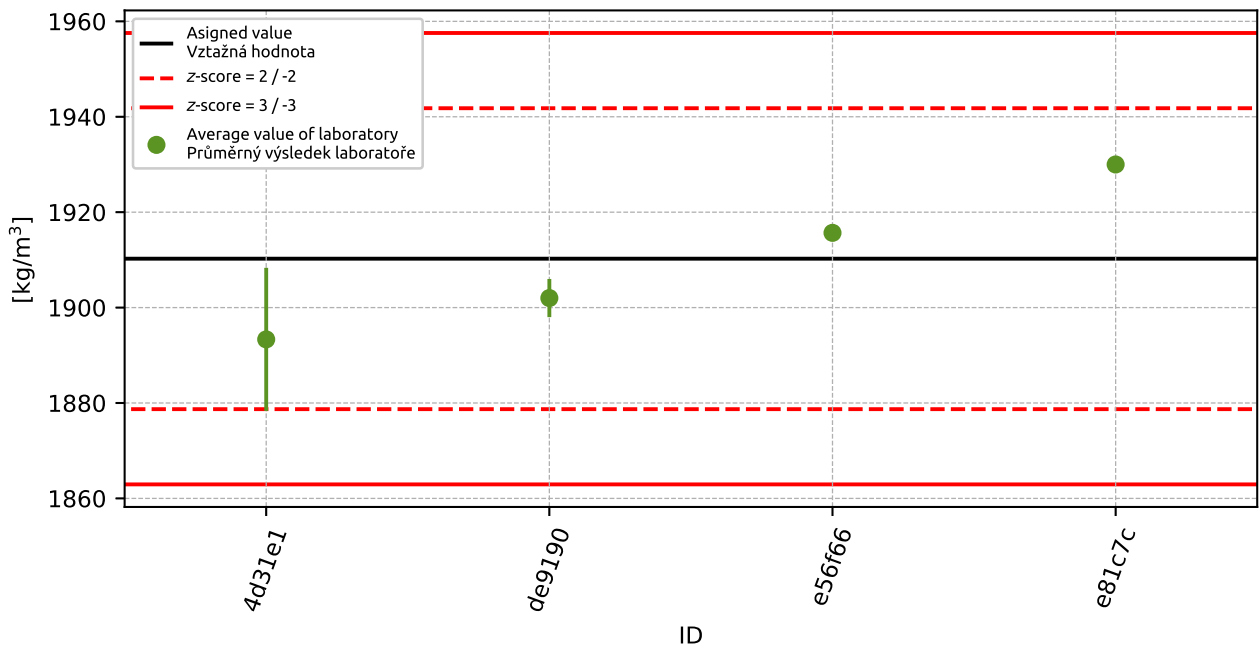


Figure 109: Average values and extended uncertainties of measurement

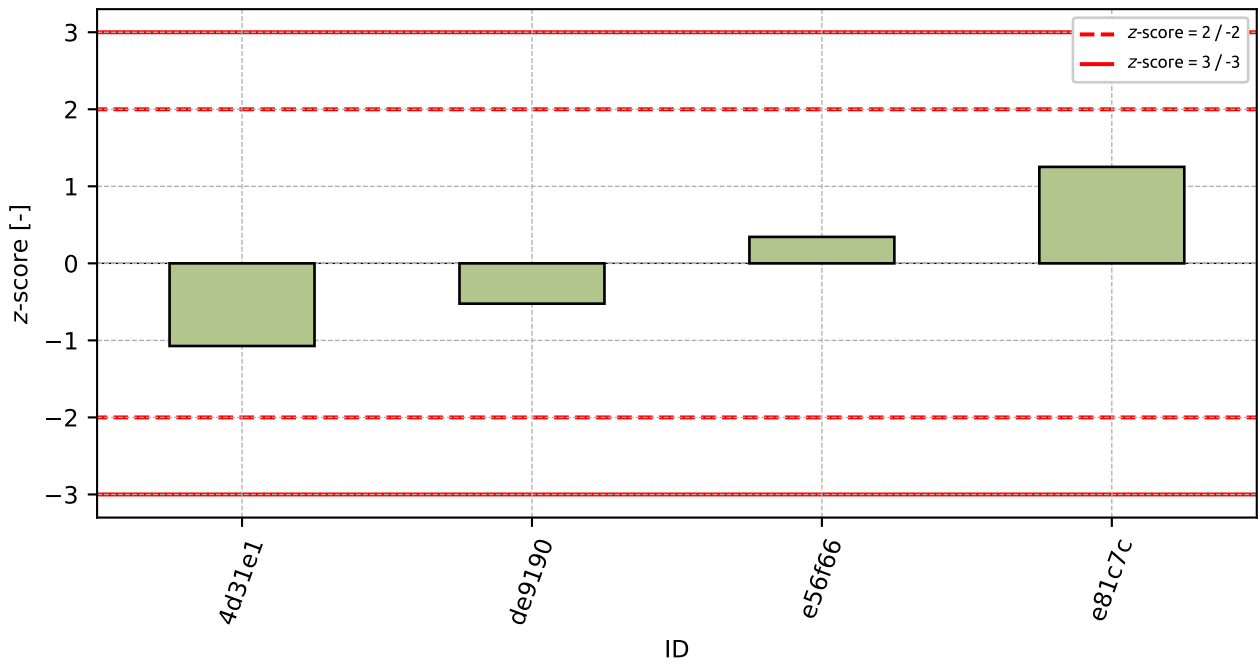


Figure 110: z-score

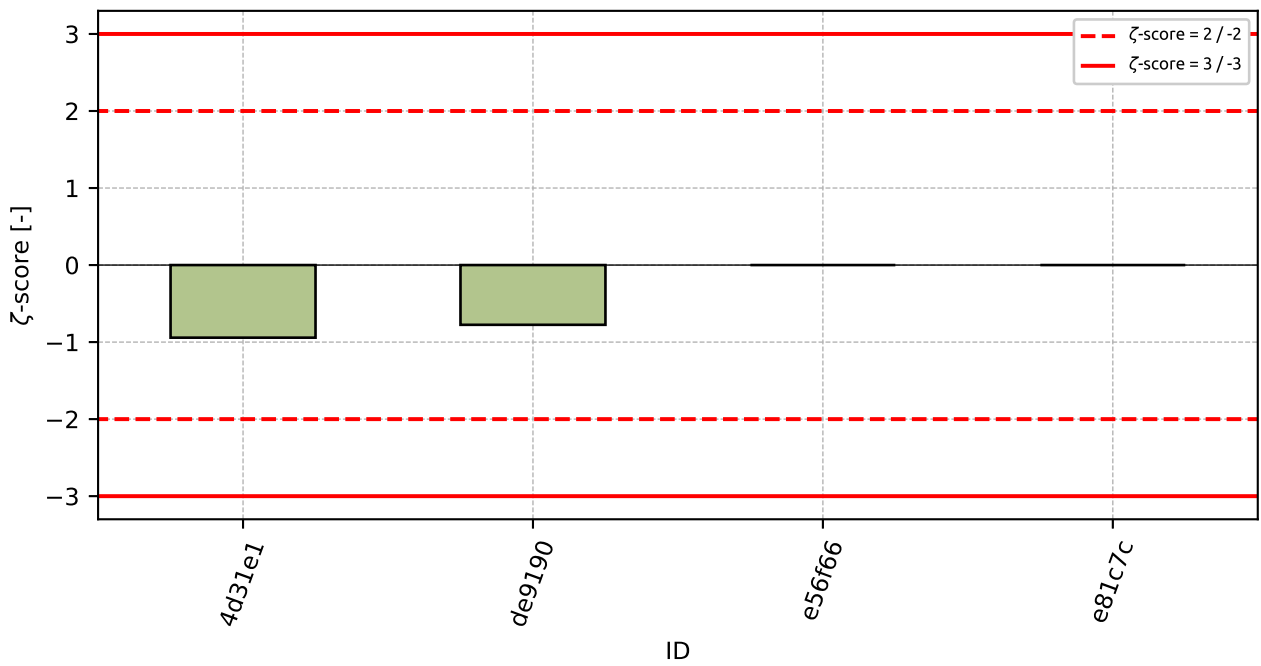


Figure 111: z-score

Table 39: z-score and z-score

ID	z-score [-]	z-score [-]
4d31e1	-1.07	-0.94
de9190	-0.52	-0.78
e56f66	0.34	-
e81c7c	1.25	-

13 Appendix – EN 1015-11 – Strength

13.1 Flexural Strength

13.1.1 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 [N/mm ²]			u_x [N/mm ²]	\bar{x} [N/mm ²]	s_0 [N/mm ²]	V_x [%]
663aa5	1.9	2.0	2.0	0.0	2.0	0.04	2.07
112b14	2.6	2.6	2.4	0.1	2.6	0.1	4.06
f0d7ff	3.3	3.0	3.3	0.5	3.2	0.17	5.41
110bd9	3.8	3.5	3.4	0.1	3.6	0.18	5.08
e56f66	3.9	3.3	4.2	-	3.8	0.46	12.06
13d063	3.7	3.8	3.9	0.4	3.8	0.06	1.58
ab93aa	3.8	3.9	4.0	0.2	3.9	0.1	2.56
3276e6	4.1	3.9	4.3	0.2	4.1	0.2	4.88
4992f9	4.8	4.7	4.7	0.1	4.7	0.03	0.61
4ee571	5.8	5.9	5.3	1.0	5.7	0.32	5.67
aa3e07	5.8	5.5	5.8	0.2	5.7	0.2	3.52
de9190	7.5	7.3	7.7	0.3	7.5	0.2	2.67

13.1.2 The Numerical Procedure for Determining Outliers

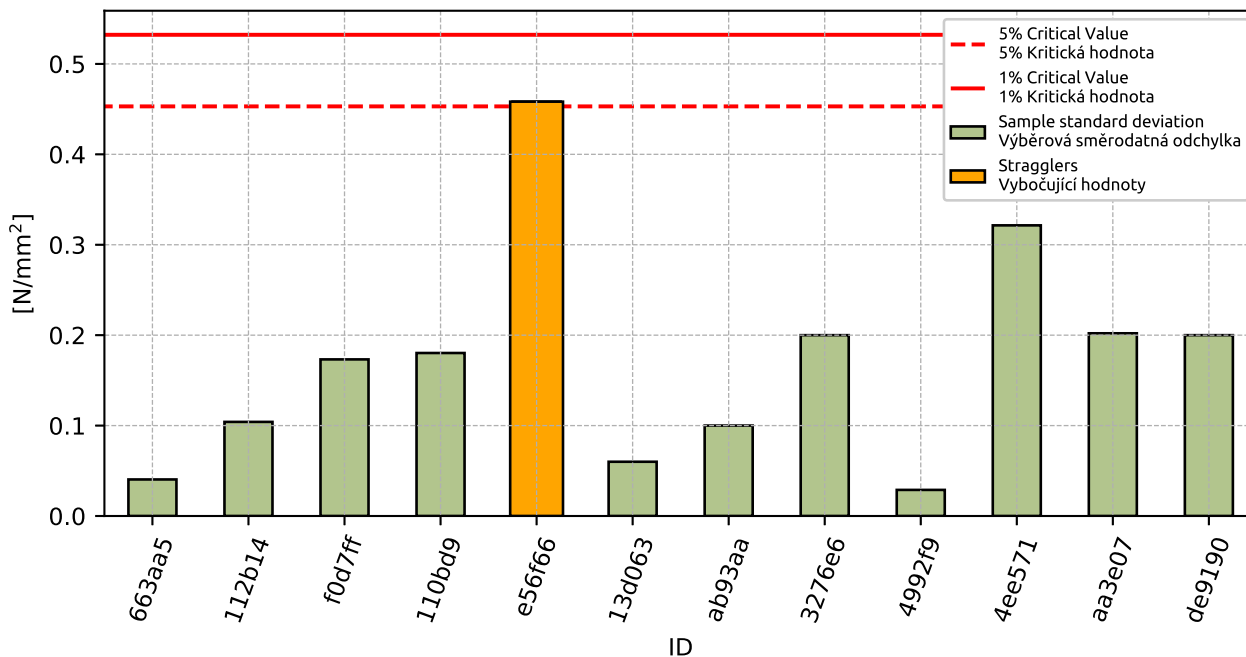


Figure 112: Cochran's test - sample standard deviations

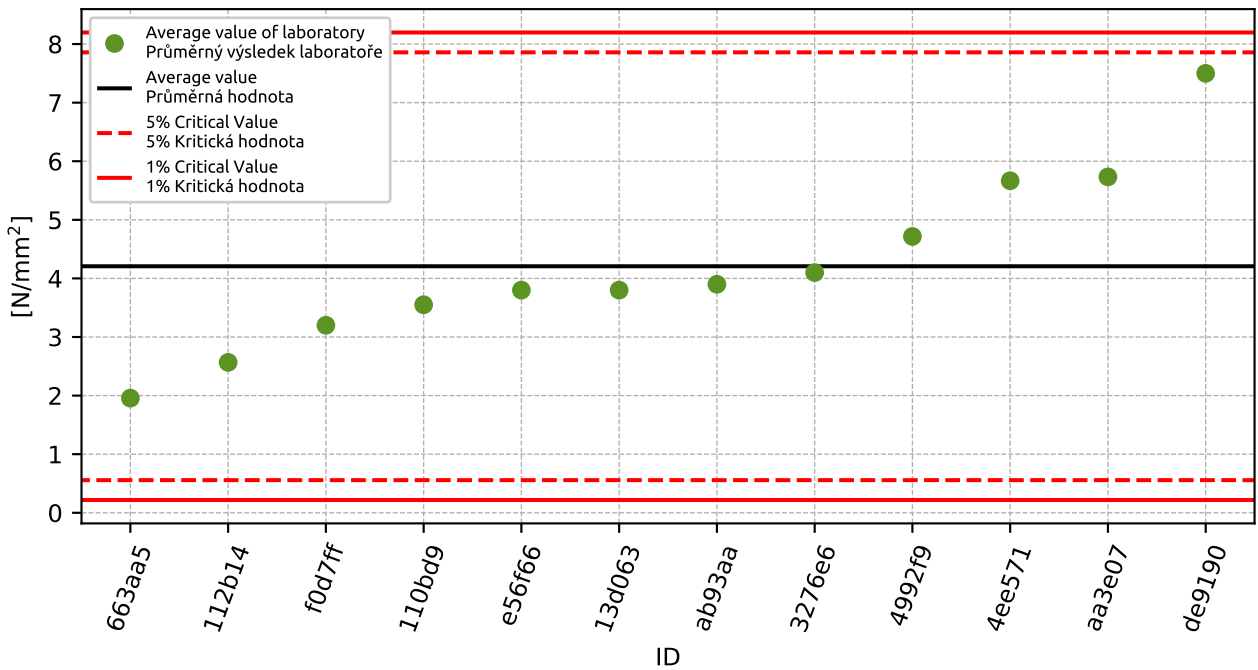


Figure 113: Grubbs' test - average values

13.1.3 Mandel's Statistics

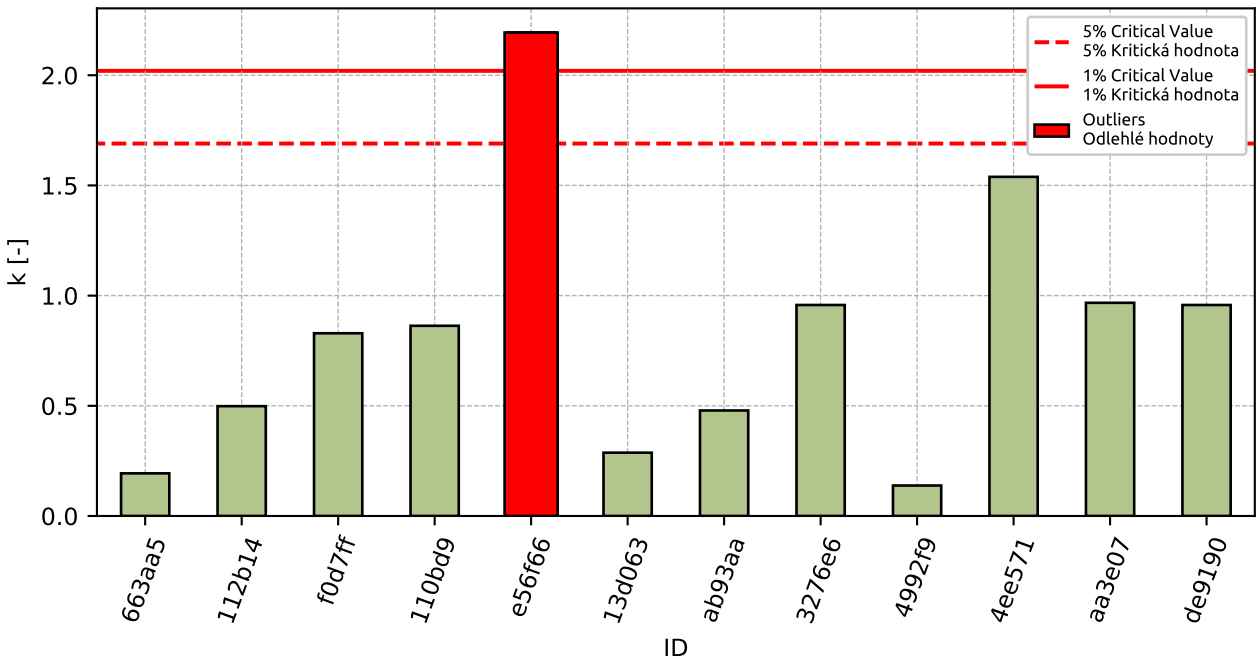


Figure 114: Intralaboratory Consistency Statistic

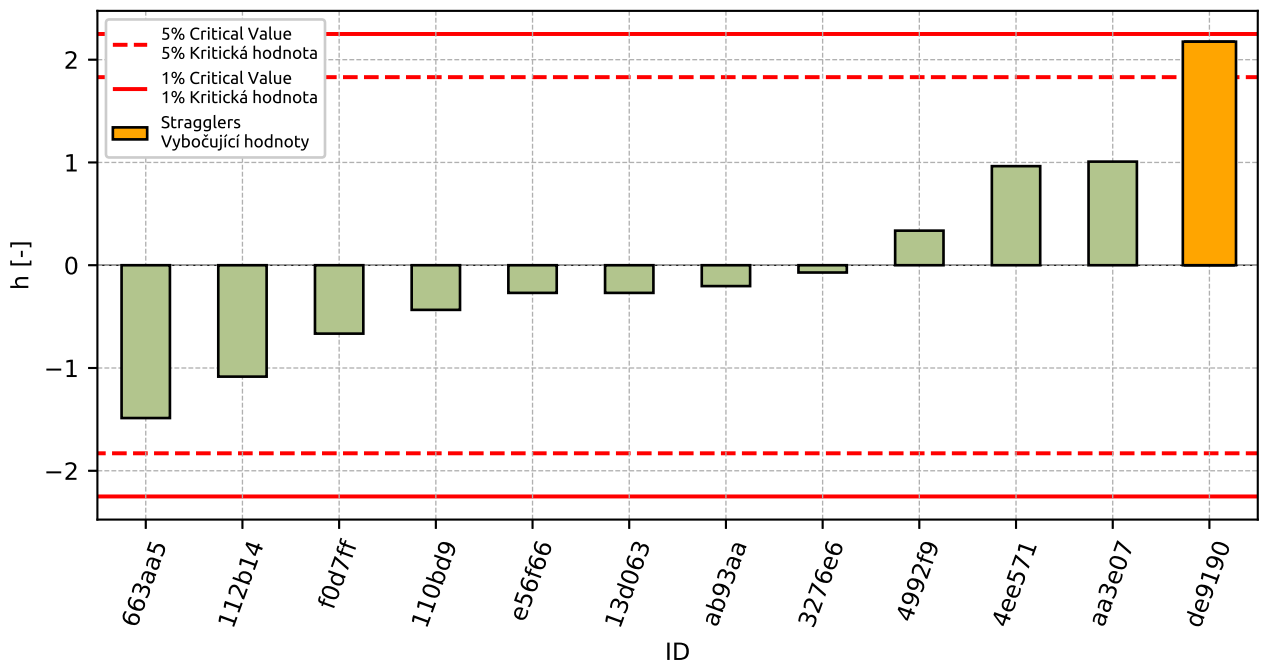


Figure 115: Interlaboratory Consistency Statistic

13.1.4 Descriptive statistics

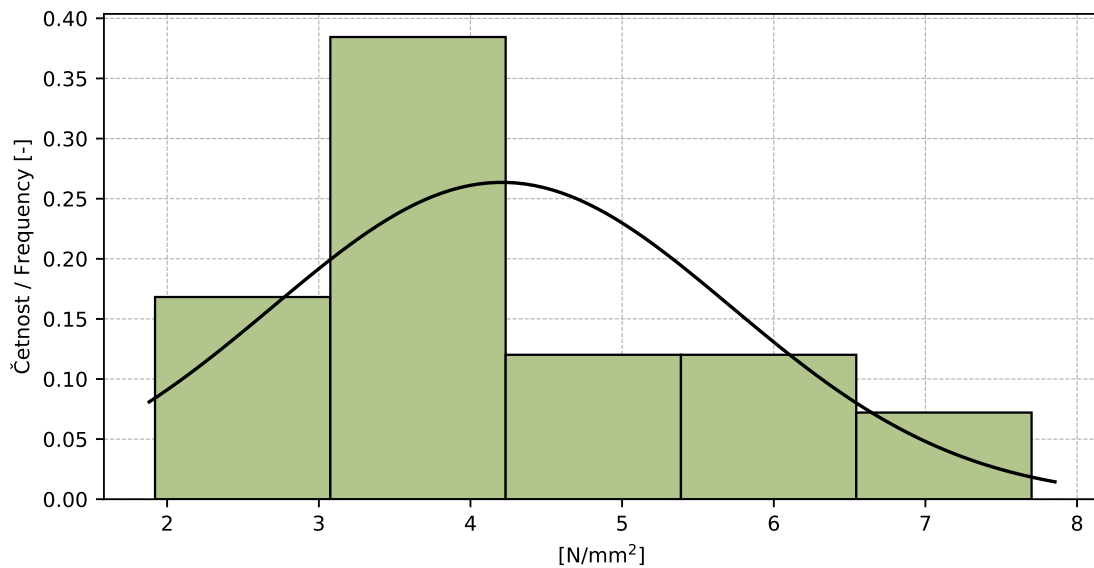


Figure 116: Histogram of all test results

Table 41: Descriptive statistics

Characteristics	[N/mm ²]
Průměrná hodnota / Average value – \bar{x}	4.2
Výběrová směrodatná odchylka / Sample standard deviation – s	1.51
Vztažná hodnota / Assigned value – x^*	4.2
Robustní směrodatná odchylka / Robust standard deviation – s^*	1.58
Nejistota měření vztažné hodnoty / Measurement uncertainty of assigned value – u_X	0.57
p -hodnota testu normality / p -value of normality test	0.168 [-]
Mezilaboratorní sm. odch. / Interlaboratory standard deviation – s_L	1.51
Směrodatná odchylka opakovatelnosti / Repeatability standard deviation – s_r	0.21
Směrodatná odchylka reprodukovatelnosti / Reproducibility standard deviation – s_R	1.52
Opakovatelnost / Repeatability – r	0.6
Reprodukovatelnost / Reproducibility – R	4.3

13.1.5 Evaluation of Performance Statistics

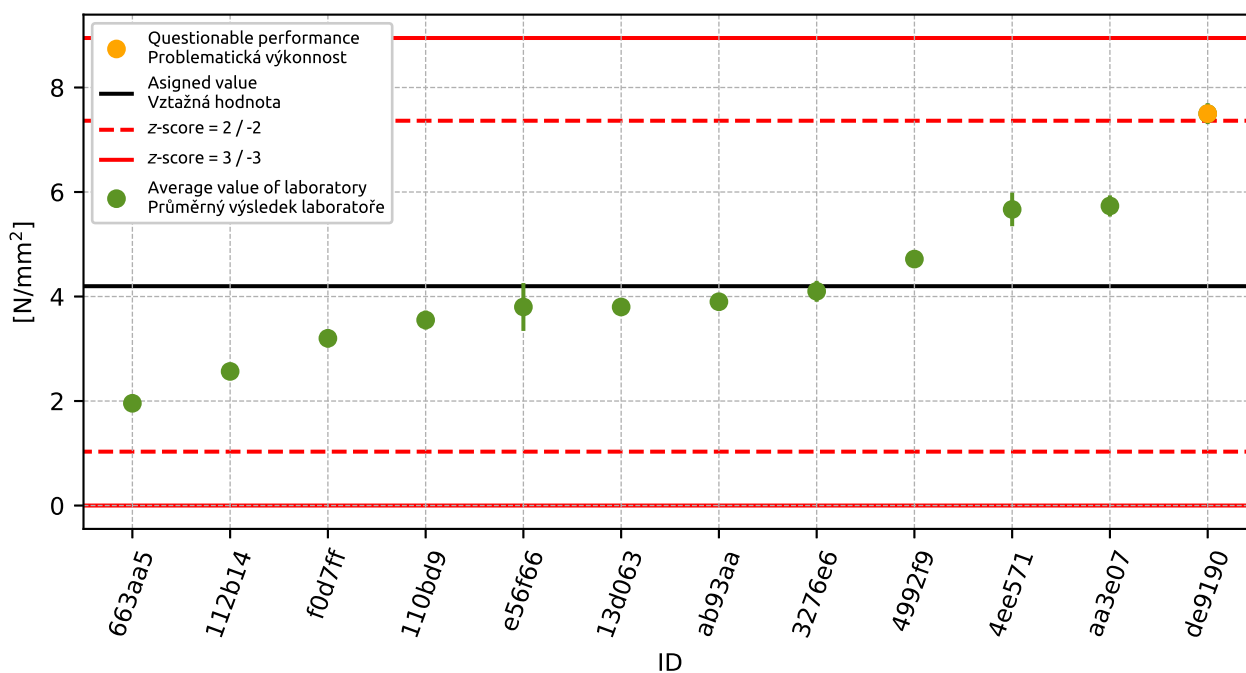


Figure 117: Average values and sample standard deviations

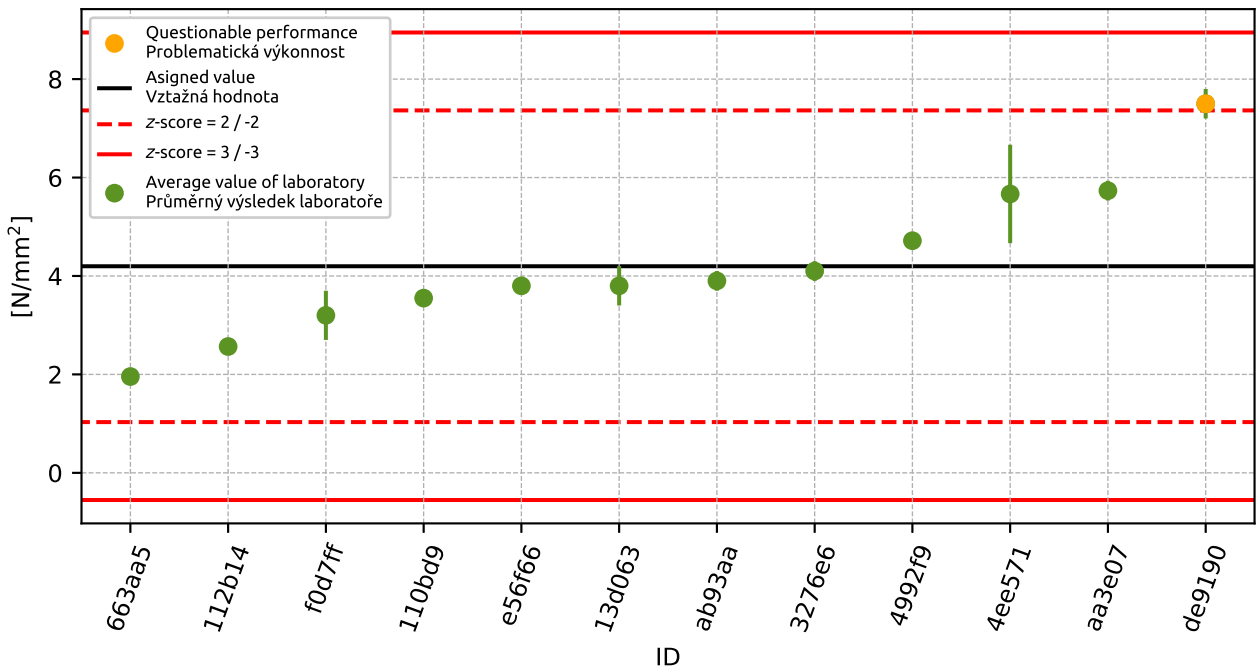


Figure 118: Average values and extended uncertainties of measurement

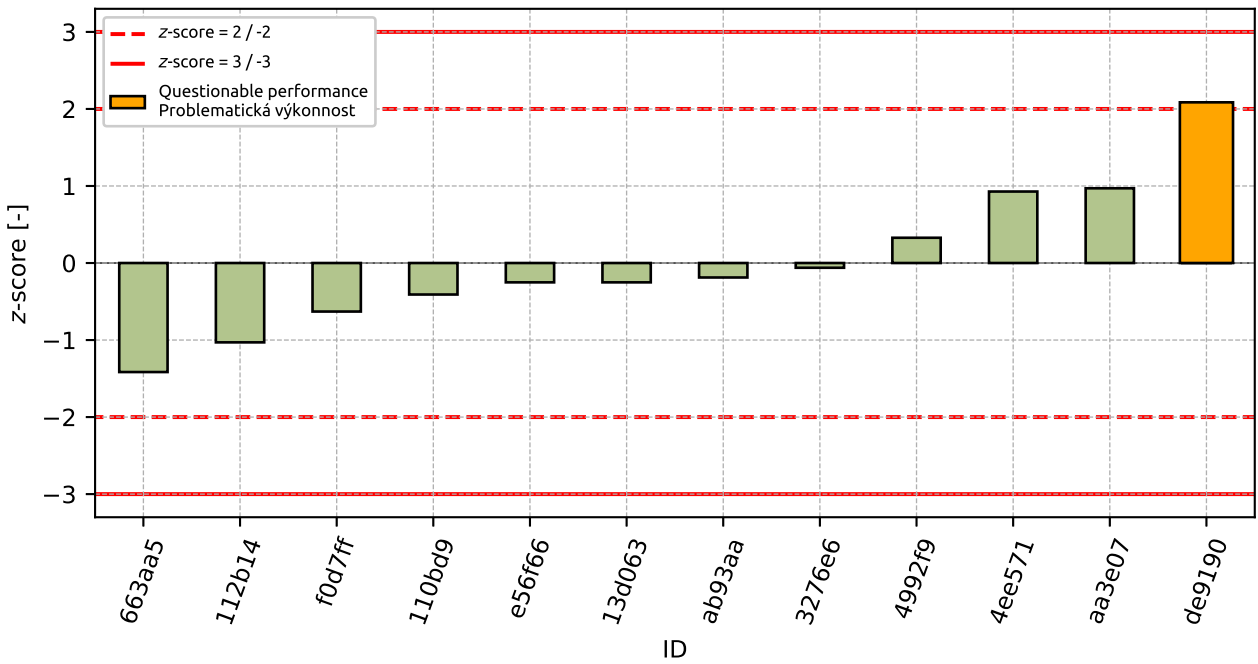
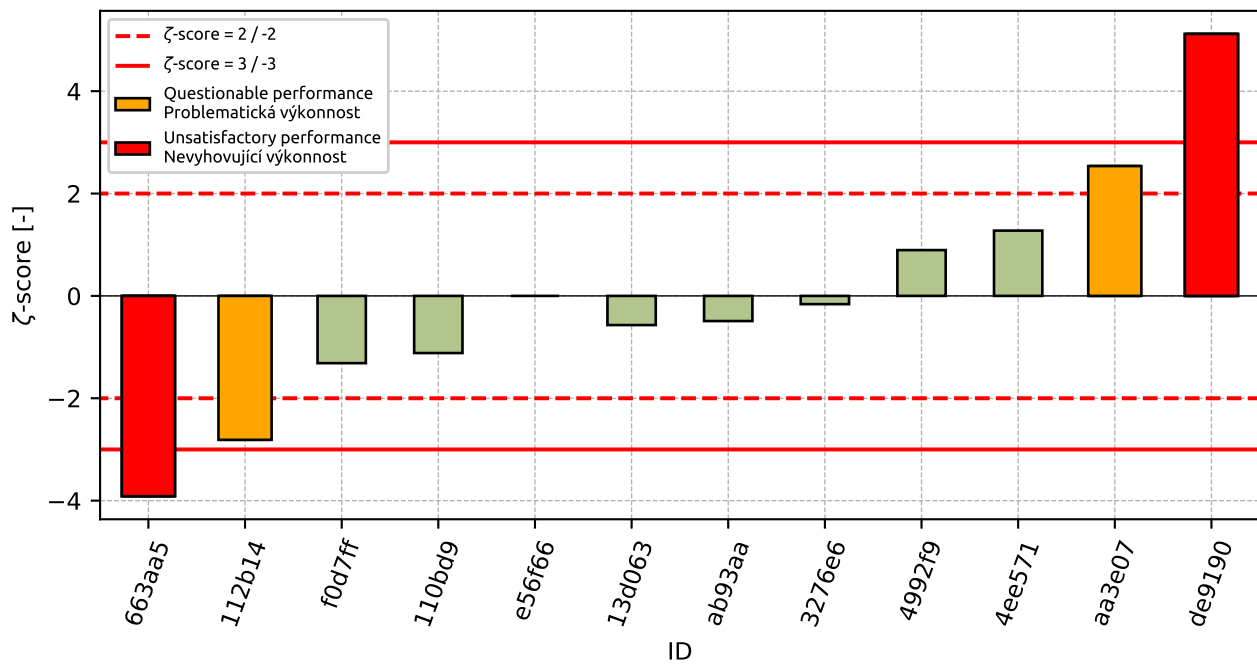


Figure 119: z-score

Figure 120: ζ -scoreTable 42: z-score and ζ -score

ID	z-score [-]	ζ -score [-]
663aa5	-1.42	-3.91
112b14	-1.03	-2.81
f0d7ff	-0.63	-1.31
110bd9	-0.41	-1.12
e56f66	-0.25	-
13d063	-0.25	-0.57
ab93aa	-0.19	-0.49
3276e6	-0.06	-0.16
4992f9	0.33	0.9
4ee571	0.93	1.28
aa3e07	0.97	2.54
de9190	2.09	5.12

13.2 Compressive Strength

13.2.1 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 [N/mm ²]	\bar{x} [N/mm ²]	s_0 [N/mm ²]	V_x [%]
	[N/mm ²]									
663aa5	7.8	7.8	7.6	7.5	7.7	7.5	0.1	7.7	0.11	1.47
db7c2e	9.8	9.0	9.0	8.6	8.8	8.2	0.7	8.9	0.5	5.62
112b14	10.0	9.8	9.7	9.7	9.8	9.8	0.7	9.8	0.09	0.96
de9190	10.9	11.1	11.5	10.7	10.7	11.7	0.5	11.1	0.42	3.78
4992f9	13.2	13.2	13.4	13.8	13.3	12.5	0.2	13.2	0.42	3.14
f0d7ff	13.9	13.0	13.7	13.2	13.3	13.2	0.7	13.4	0.34	2.56
110bd9	13.5	13.6	13.1	13.4	13.4	13.6	0.1	13.4	0.2	1.48
ab93aa	13.4	13.6	13.3	13.6	13.4	13.5	0.2	13.5	0.09	0.69
13d063	13.4	13.4	14.3	14.2	14.3	14.4	2.0	14.0	0.46	3.28
3276e6	13.7	14.3	13.8	13.9	13.6	14.9	0.2	14.0	0.49	3.48
e56f66	15.4	15.0	15.4	15.5	15.2	15.6	-	15.4	0.24	1.56
aa3e07	18.4	19.0	19.0	19.8	20.2	19.0	0.5	19.2	0.65	3.39
4ee571	19.9	19.6	19.3	20.5	20.3	19.8	0.5	19.9	0.44	2.22

13.2.2 The Numerical Procedure for Determining Outliers

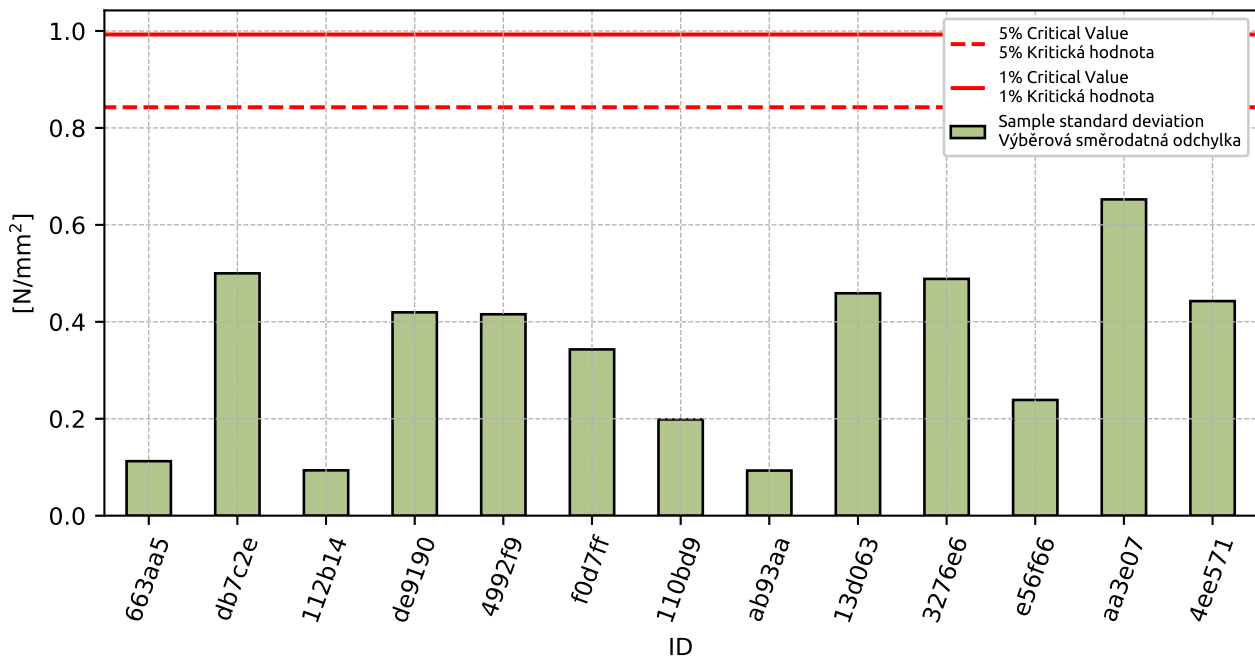


Figure 121: **Cochran's test** - sample standard deviations

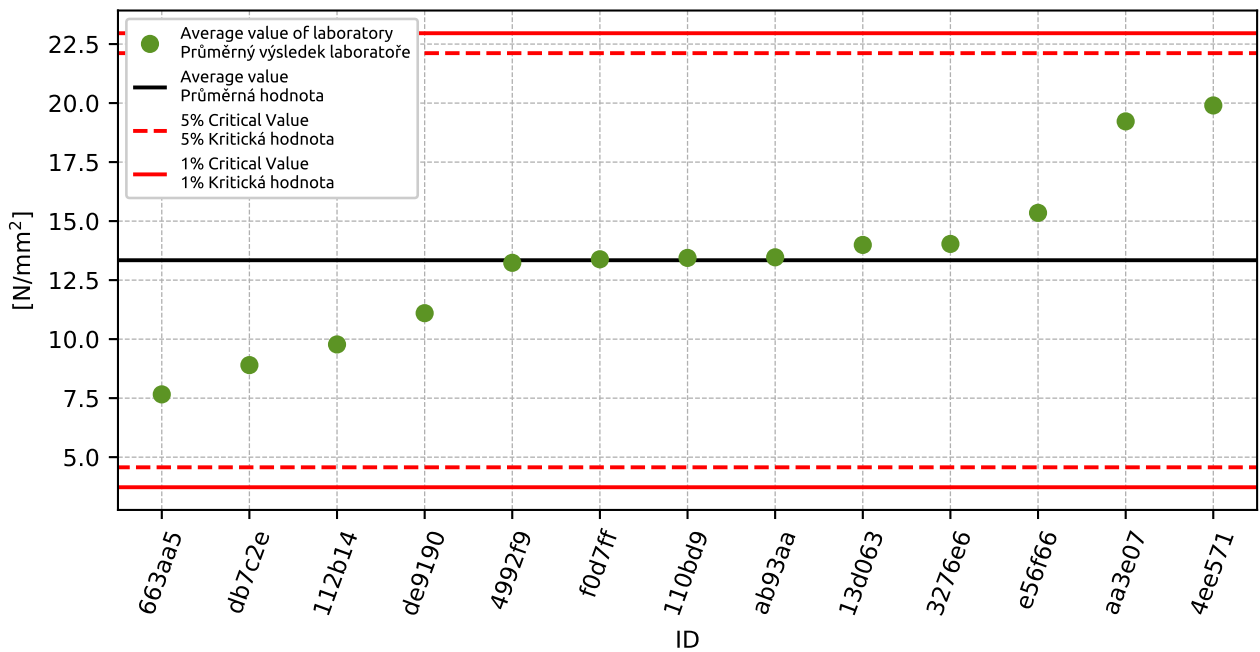


Figure 122: Grubbs' test - average values

13.2.3 Mandel's Statistics

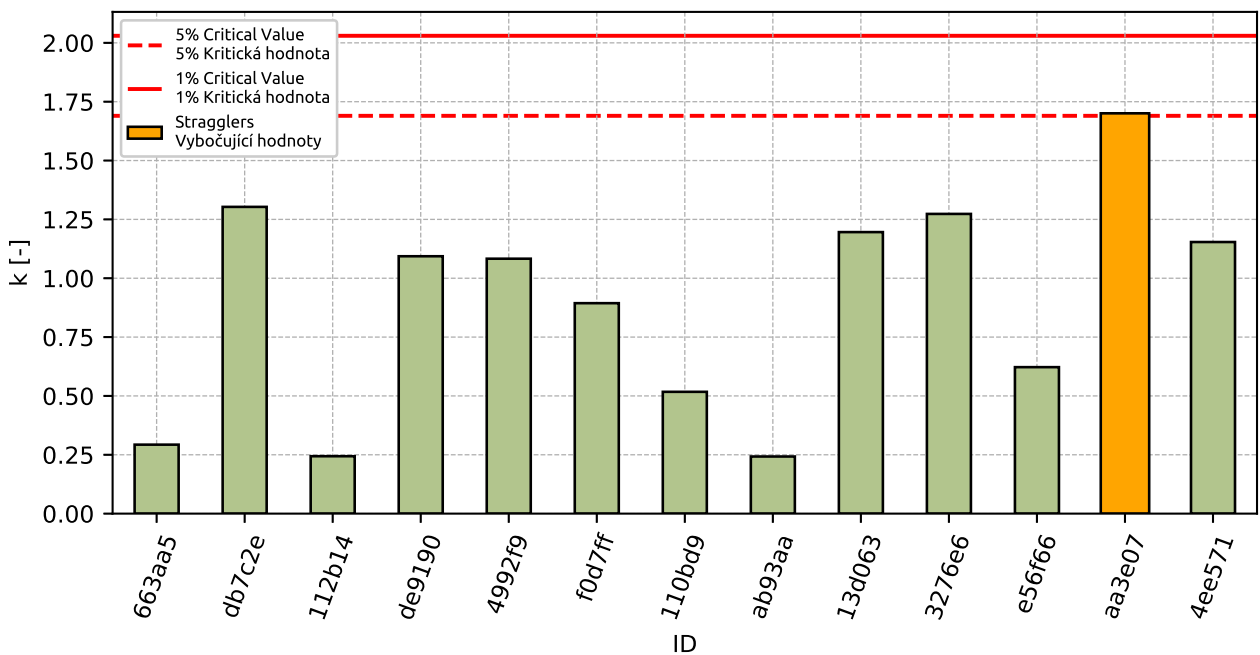


Figure 123: Intralaboratory Consistency Statistic

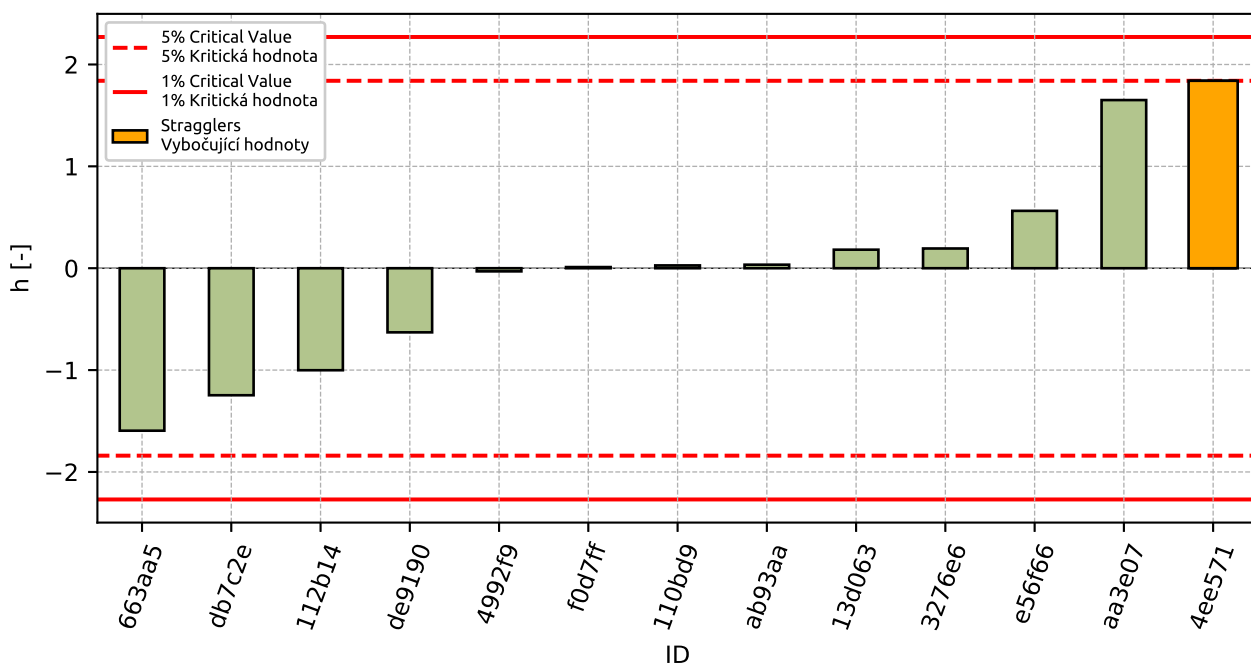


Figure 124: Interlaboratory Consistency Statistic

13.2.4 Descriptive statistics

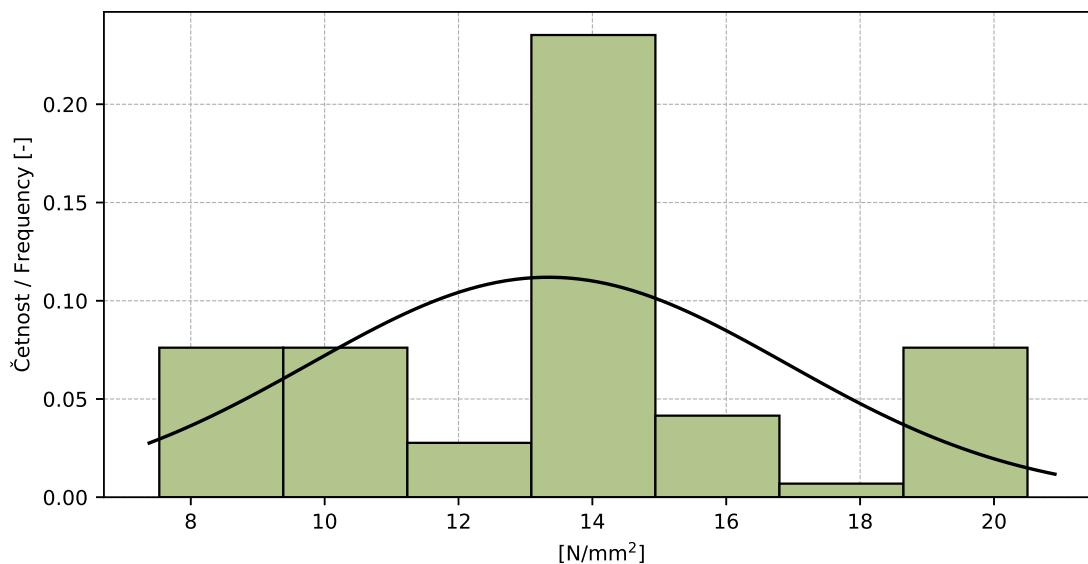


Figure 125: Histogram of all test results

Table 44: Descriptive statistics

Characteristics	[N/mm ²]
Průměrná hodnota / Average value – \bar{x}	13.3
Výběrová směrodatná odchylka / Sample standard deviation – s	3.56
Vztažná hodnota / Assigned value – x^*	13.4
Robustní směrodatná odchylka / Robust standard deviation – s^*	3.43
Nejistota měření vztažné hodnoty / Measurement uncertainty of assigned value – u_X	1.19
p -hodnota testu normality / p -value of normality test	0.416 [-]
Mezilaboratorní sm. odch. / Interlaboratory standard deviation – s_L	3.56
Směrodatná odchylka opakovatelnosti / Repeatability standard deviation – s_r	0.38
Směrodatná odchylka reprodukovatelnosti / Reproducibility standard deviation – s_R	3.58
Opakovatelnost / Repeatability – r	1.1
Reprodukovatelnost / Reproducibility – R	10.0

13.2.5 Evaluation of Performance Statistics

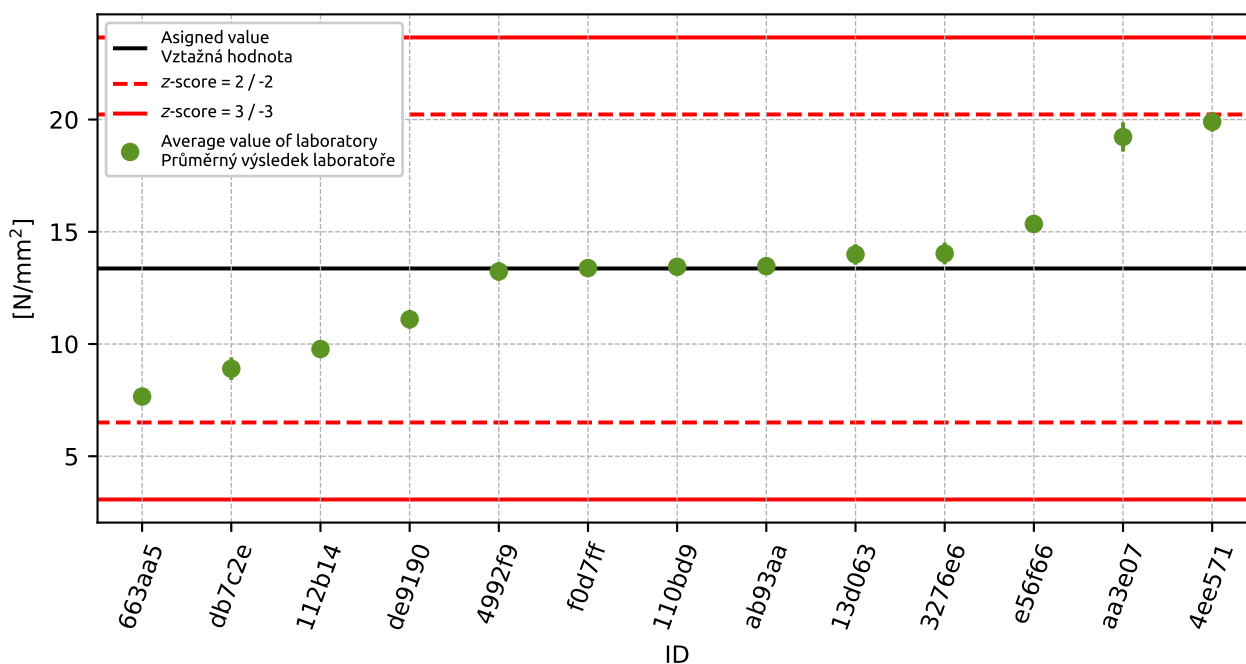


Figure 126: Average values and sample standard deviations

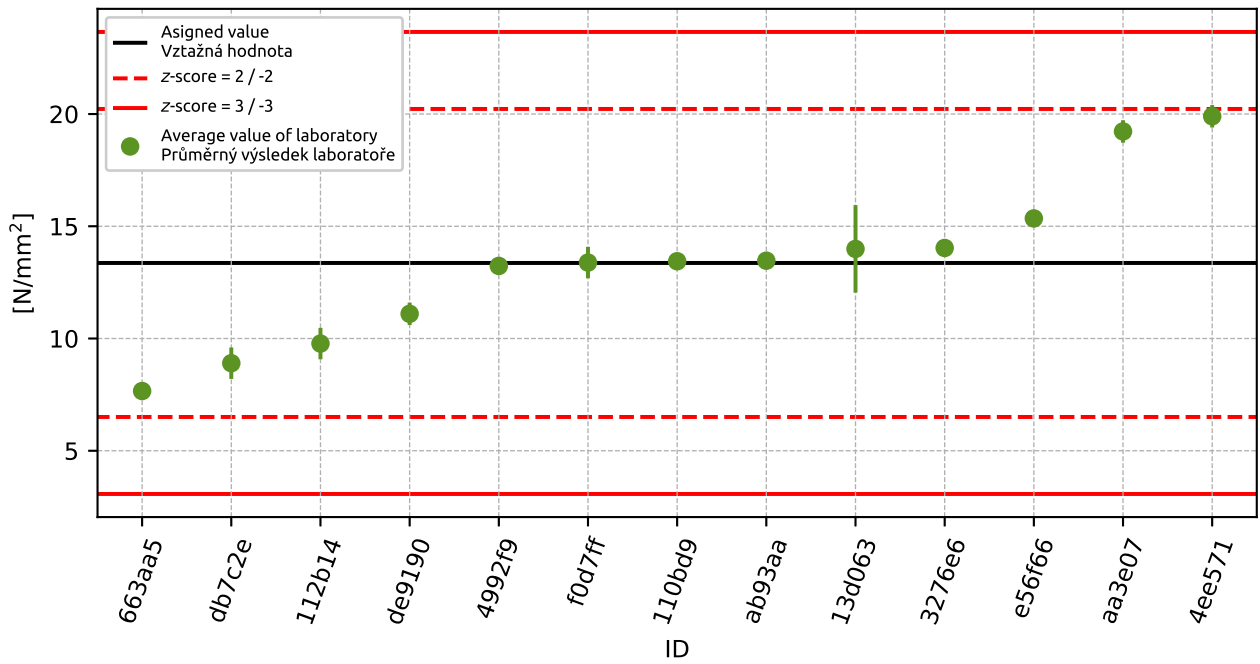


Figure 127: Average values and extended uncertainties of measurement

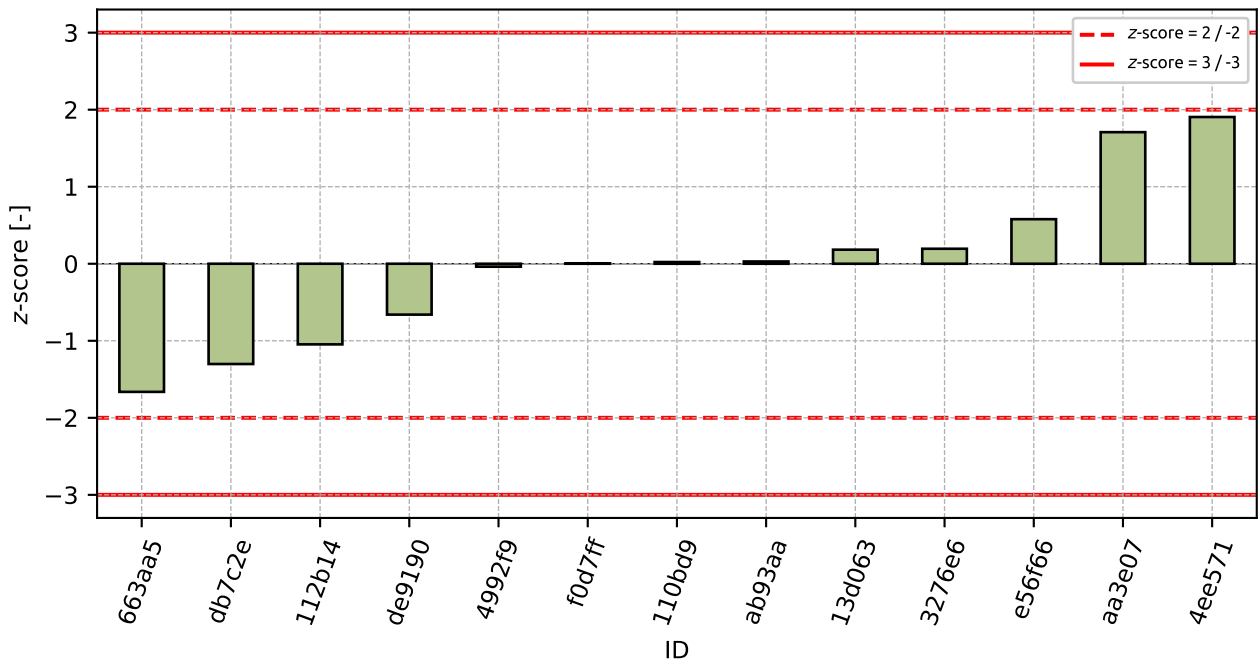
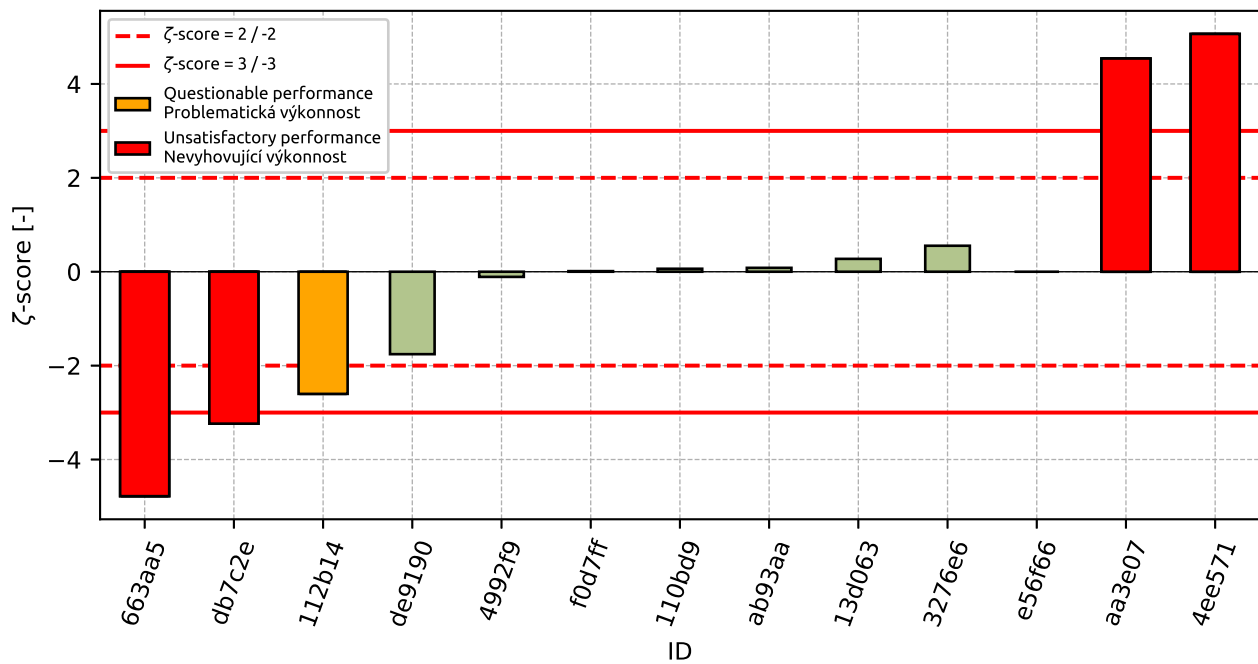


Figure 128: z-score

Figure 129: ζ -scoreTable 45: z-score and ζ -score

ID	z-score [-]	ζ -score [-]
663aa5	-1.66	-4.78
db7c2e	-1.3	-3.24
112b14	-1.05	-2.6
de9190	-0.66	-1.76
4992f9	-0.04	-0.11
f0d7ff	0.01	0.01
110bd9	0.02	0.06
ab93aa	0.03	0.08
13d063	0.18	0.27
3276e6	0.19	0.55
e56f66	0.58	-
aa3e07	1.71	4.54
4ee571	1.9	5.06

14 Appendix – EN 1015-12 – Adhesion

14.1 Test results

Table 46: Test results - ordered by average value. Outliers are marked by red color. u_x - extended uncertainty of measurement; \bar{x} - average value; s_0 - sample standard deviation; V_x - variation coefficient

ID	Test results [N/mm ²]			u_x [N/mm ²]	\bar{x} [N/mm ²]	s_0 [N/mm ²]	V_x [%]
e81c7c	0.3	0.3	0.3	-	0.3	0.04	11.58
d9a0c9	0.4	0.6	0.4	-	0.4	0.1	21.91
4d31e1	0.5	0.4	0.5	0.2	0.5	0.06	12.37
35d72a	1.0	1.0	1.0	0.0	1.0	0.03	2.84
2f16d8	1.1	1.2	1.0	0.3	1.1	0.1	9.09
3a3d88	2.6	2.7	2.8	-	2.7	0.05	1.85

14.2 The Numerical Procedure for Determining Outliers

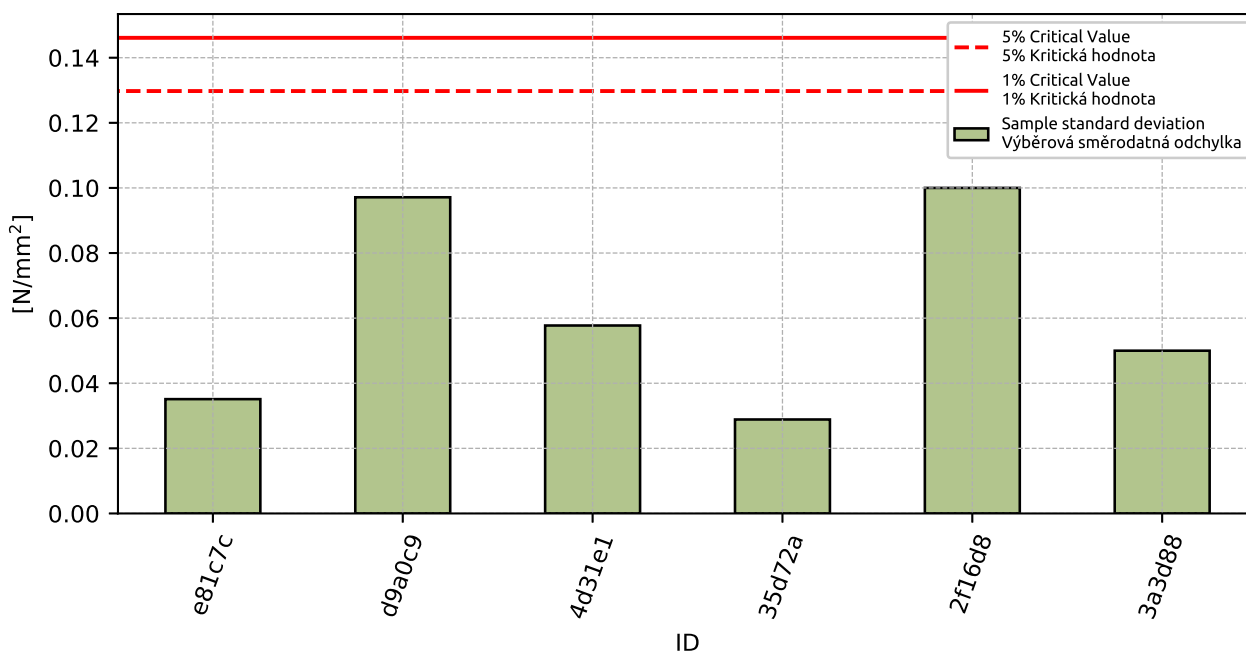


Figure 130: Cochran's test - sample standard deviations

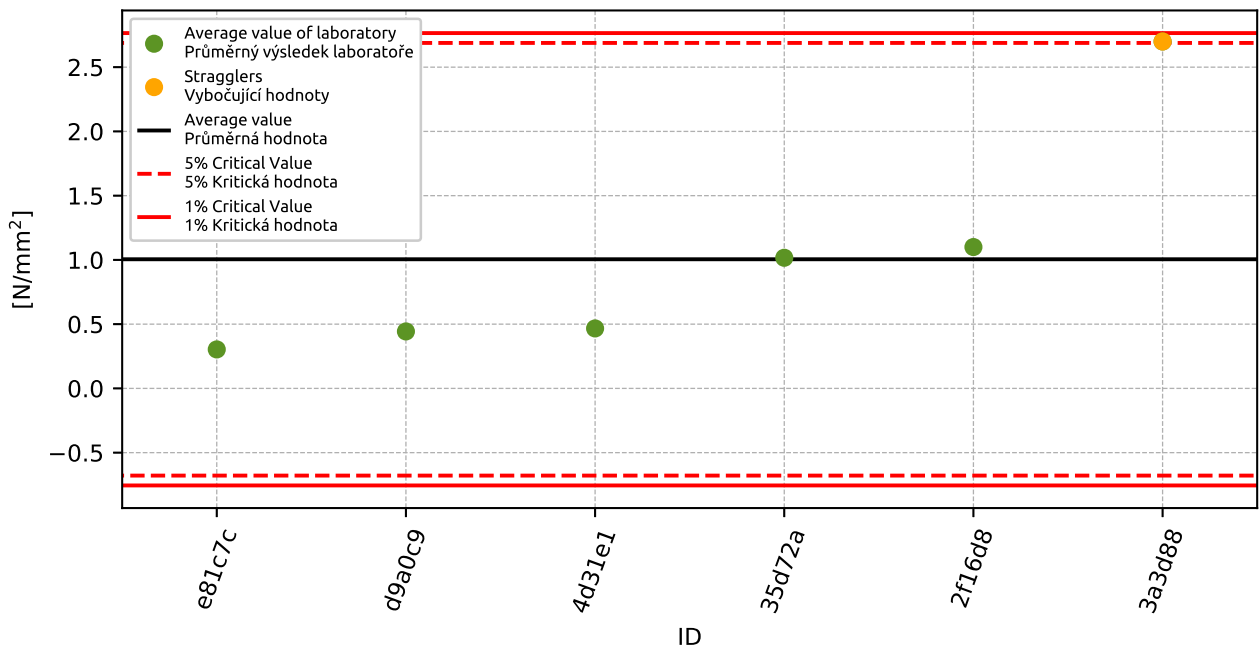


Figure 131: **Grubbs' test** - average values

14.3 Mandel's Statistics

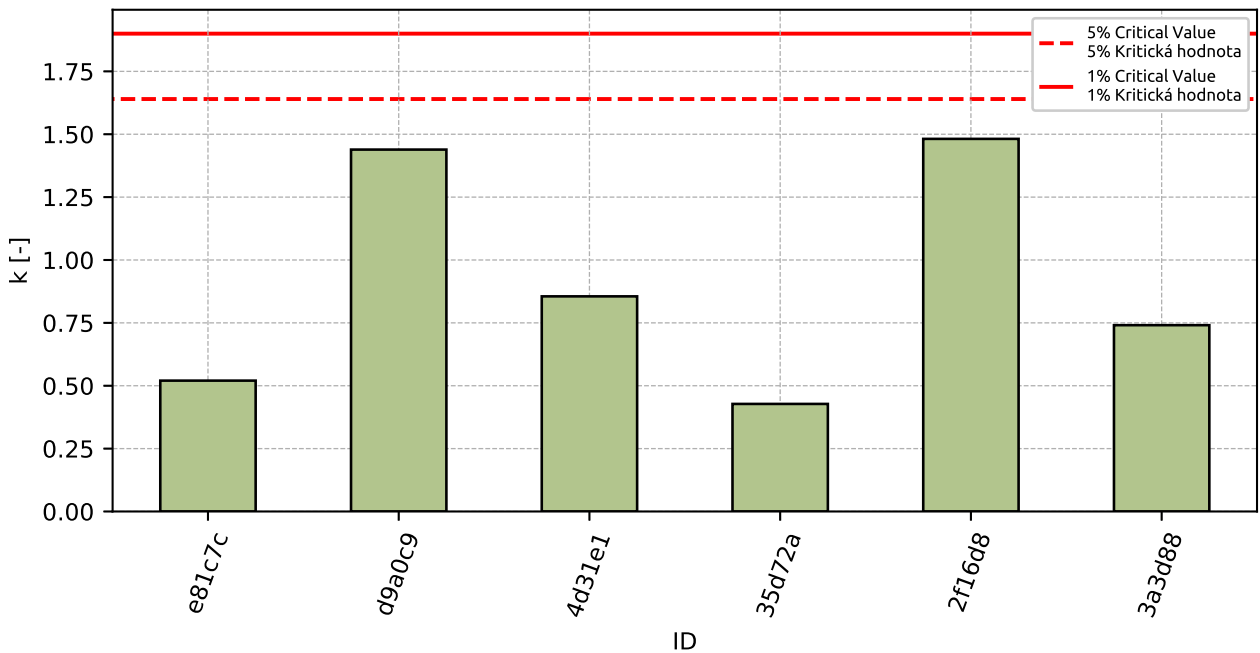


Figure 132: Intralaboratory Consistency Statistic

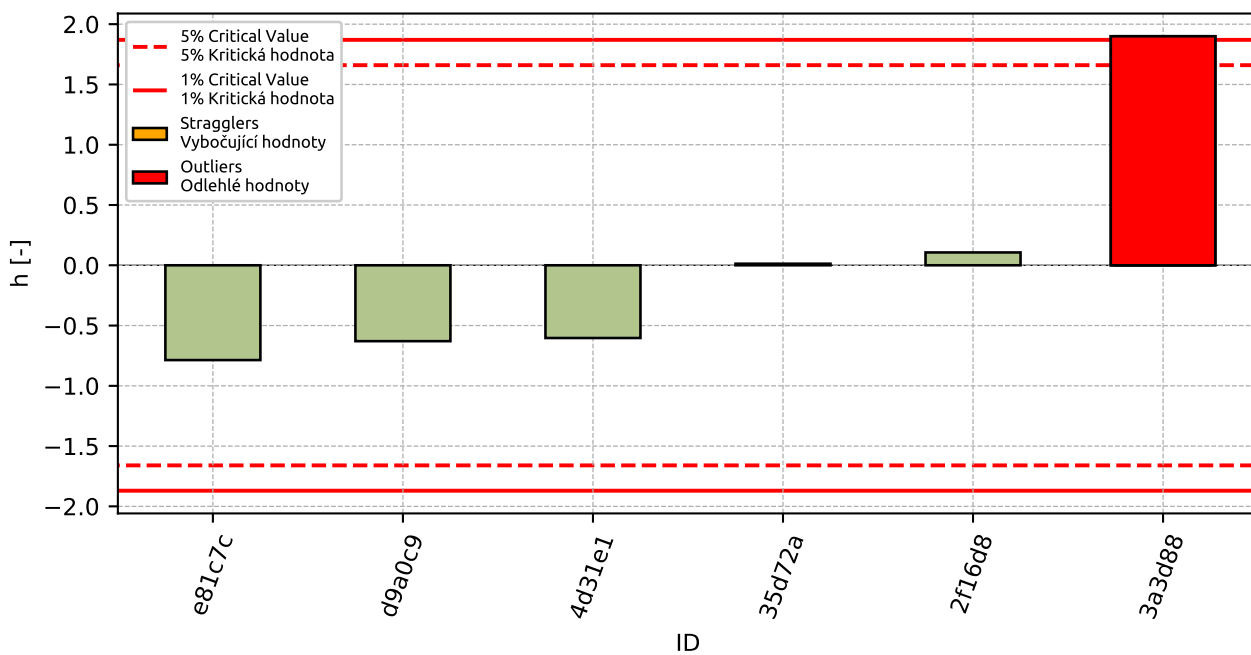


Figure 133: Interlaboratory Consistency Statistic

14.4 Descriptive statistics

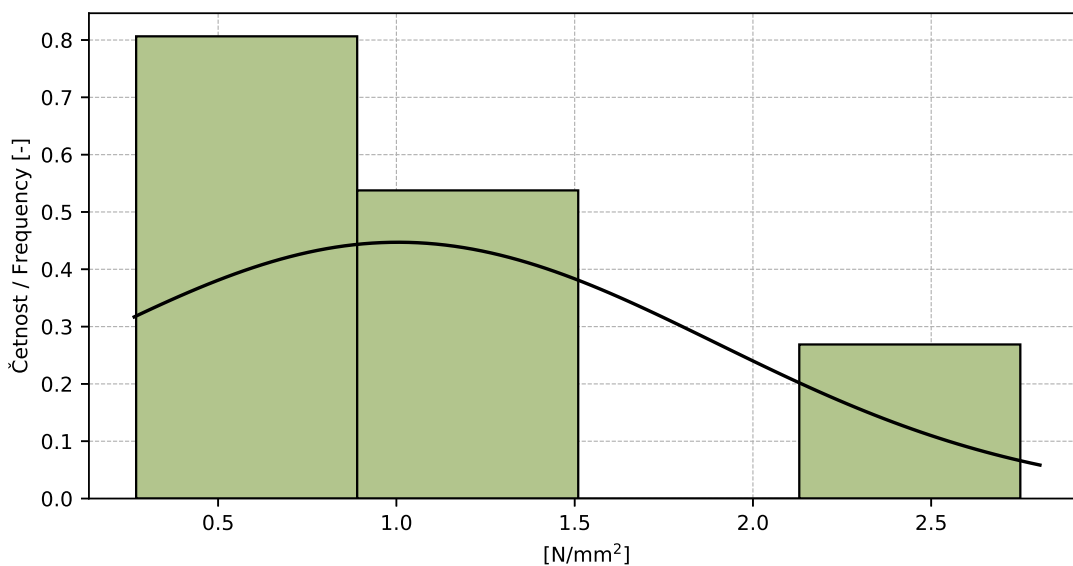


Figure 134: Histogram of all test results

Table 47: Descriptive statistics

Characteristics	[N/mm ²]
Průměrná hodnota / Average value – \bar{x}	1.0
Výběrová směrodatná odchylka / Sample standard deviation – s	0.89
Vztažná hodnota / Assigned value – x^*	1.0
Robustní směrodatná odchylka / Robust standard deviation – s^*	0.92
Nejistota měření vztažné hodnoty / Measurement uncertainty of assigned value – u_X	0.47
p -hodnota testu normality / p -value of normality test	0.031 [-]
Mezilaboratorní sm. odch. / Interlaboratory standard deviation – s_L	0.89
Směrodatná odchylka opakovatelnosti / Repeatability standard deviation – s_r	0.07
Směrodatná odchylka reprodukovatelnosti / Reproducibility standard deviation – s_R	0.89
Opakovatelnost / Repeatability – r	0.2
Reprodukovatelnost / Reproducibility – R	2.5

14.5 Evaluation of Performance Statistics

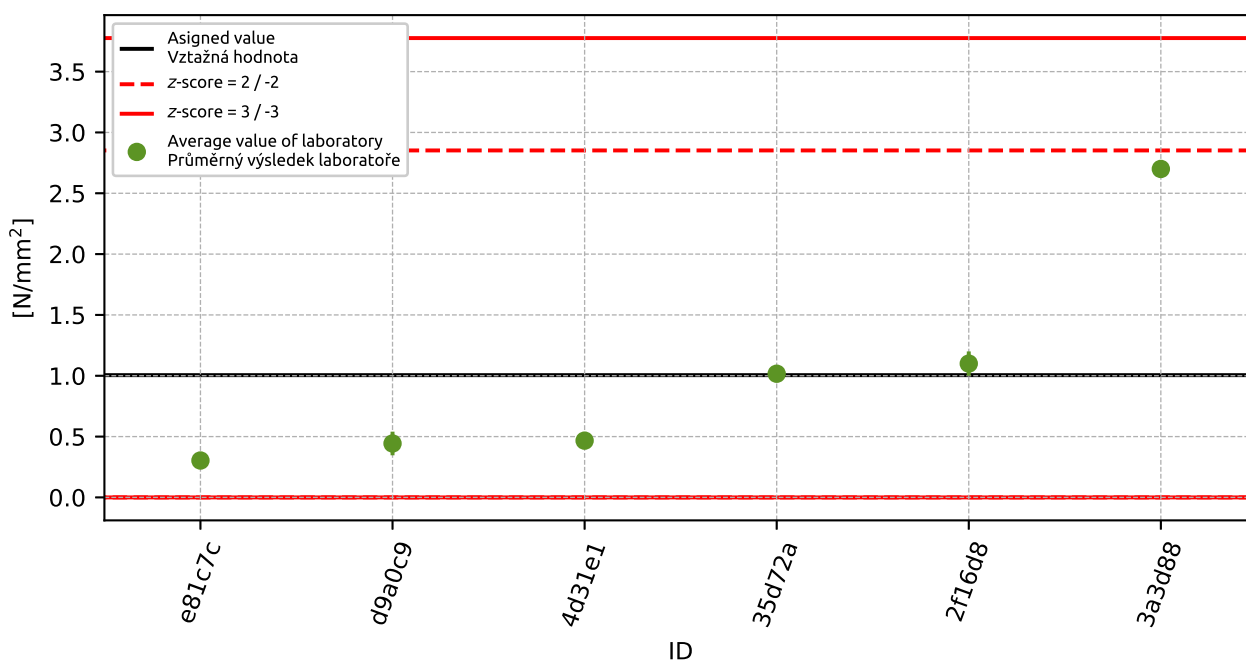


Figure 135: Average values and sample standard deviations

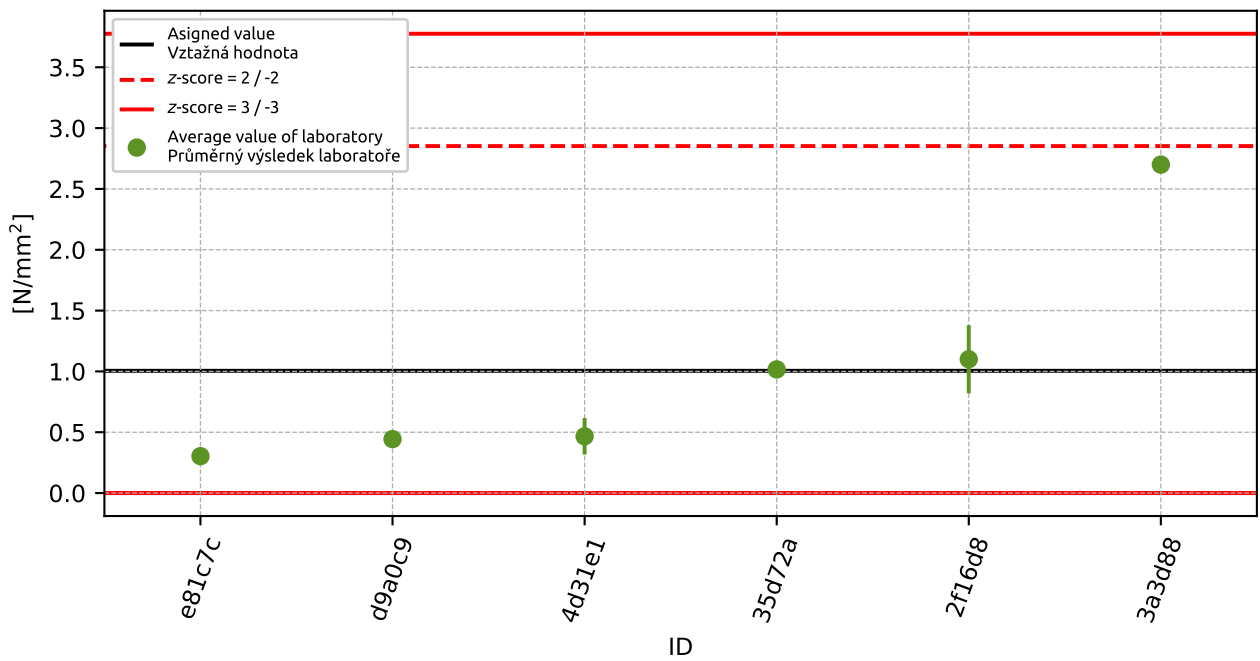


Figure 136: Average values and extended uncertainties of measurement

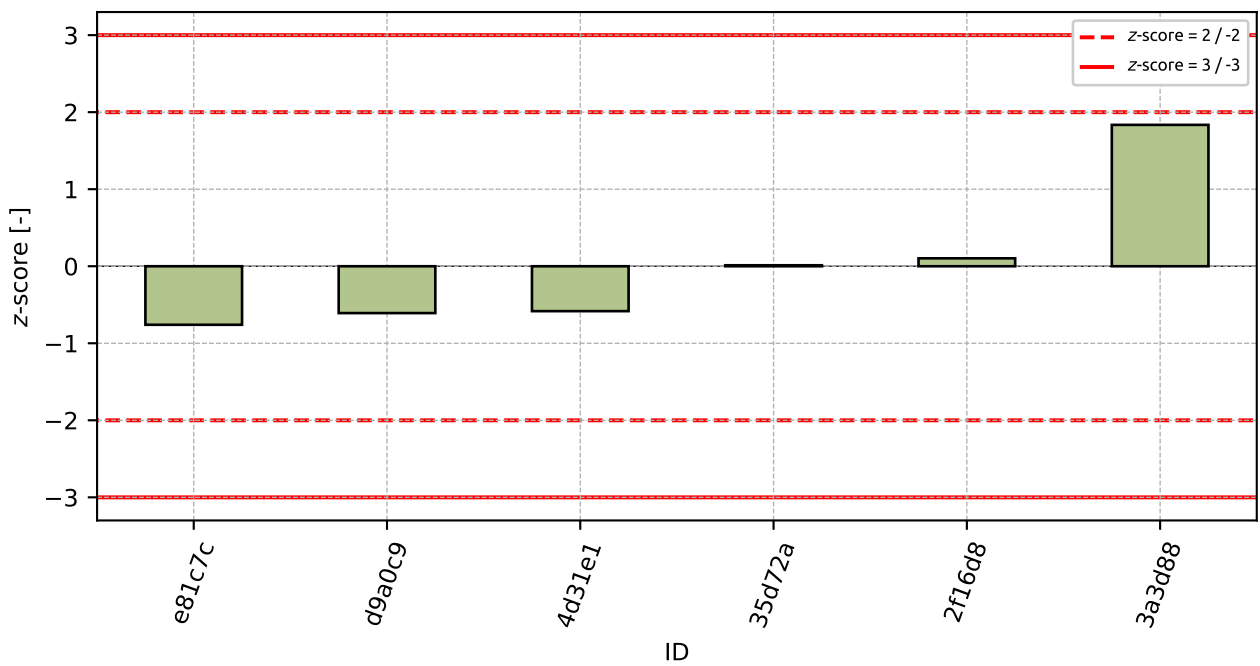


Figure 137: z-score

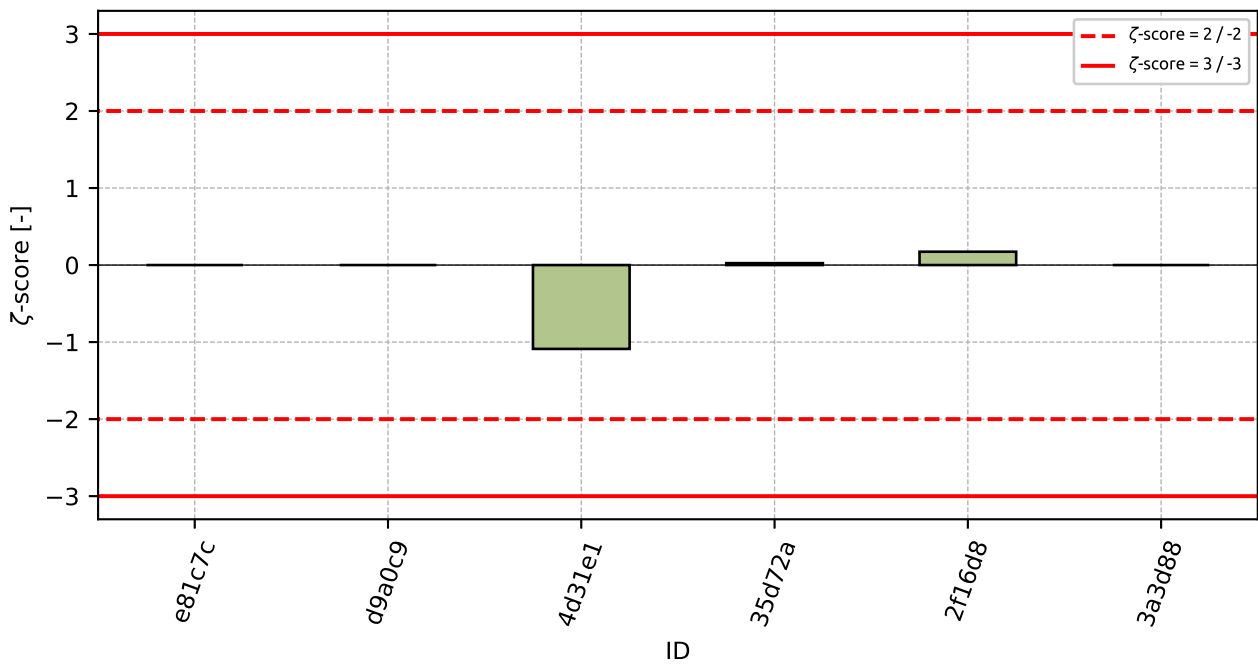


Figure 138: z-score

Table 48: z-score and z-score

ID	z-score [-]	z-score [-]
e81c7c	-0.76	-
d9a0c9	-0.61	-
4d31e1	-0.58	-1.09
35d72a	0.01	0.02
2f16d8	0.1	0.17
3a3d88	1.84	-

15 Appendix – EN 1015-18 – Capillary absorption coefficient (C_m)

15.1 Test results

Table 49: 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 [kg/(m ² · √min)]	\bar{x} [kg/(m ² · √min)]	s_0 [kg/(m ² · √min)]	V_x [%]
	[kg/(m ² · √min)]	[kg/(m ² · √min)]	[kg/(m ² · √min)]				
004e7b	0.34	0.33	0.35	0.0	0.34	0.01	2.94
2f16d8	0.6	0.6	0.6	0.04	0.6	0.0	0.0
e81c7c	0.9	0.85	0.9	-	0.88	0.028999999999999998	3.27

15.2 The Numerical Procedure for Determining Outliers

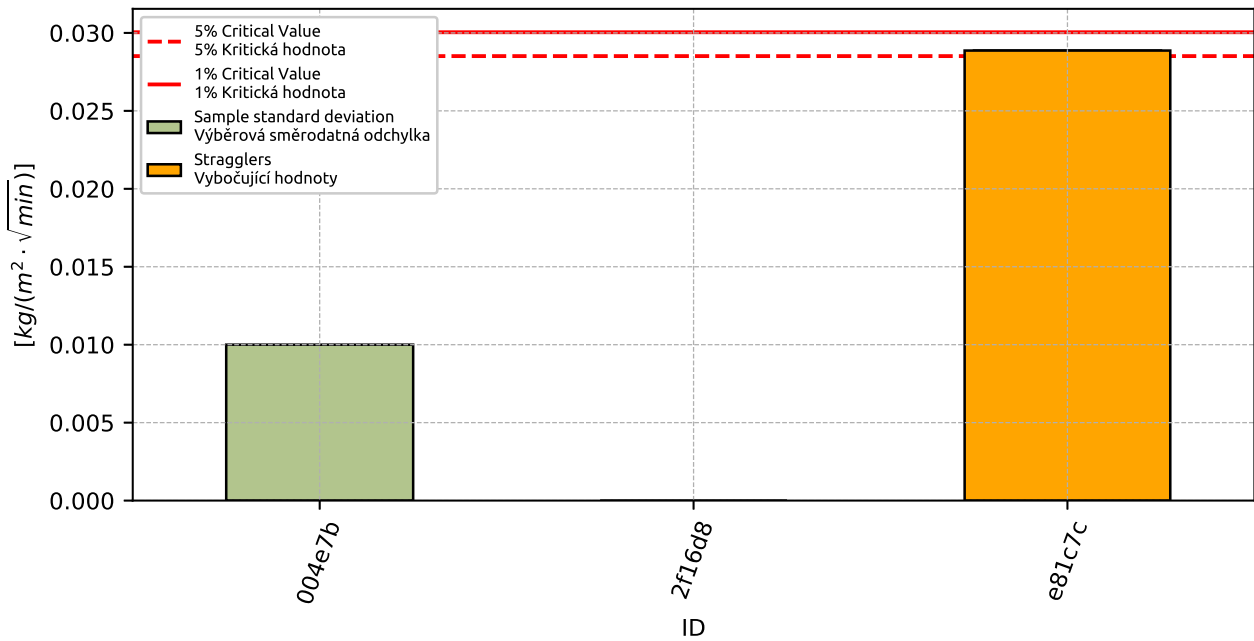


Figure 139: **Cochran's test** - sample standard deviations

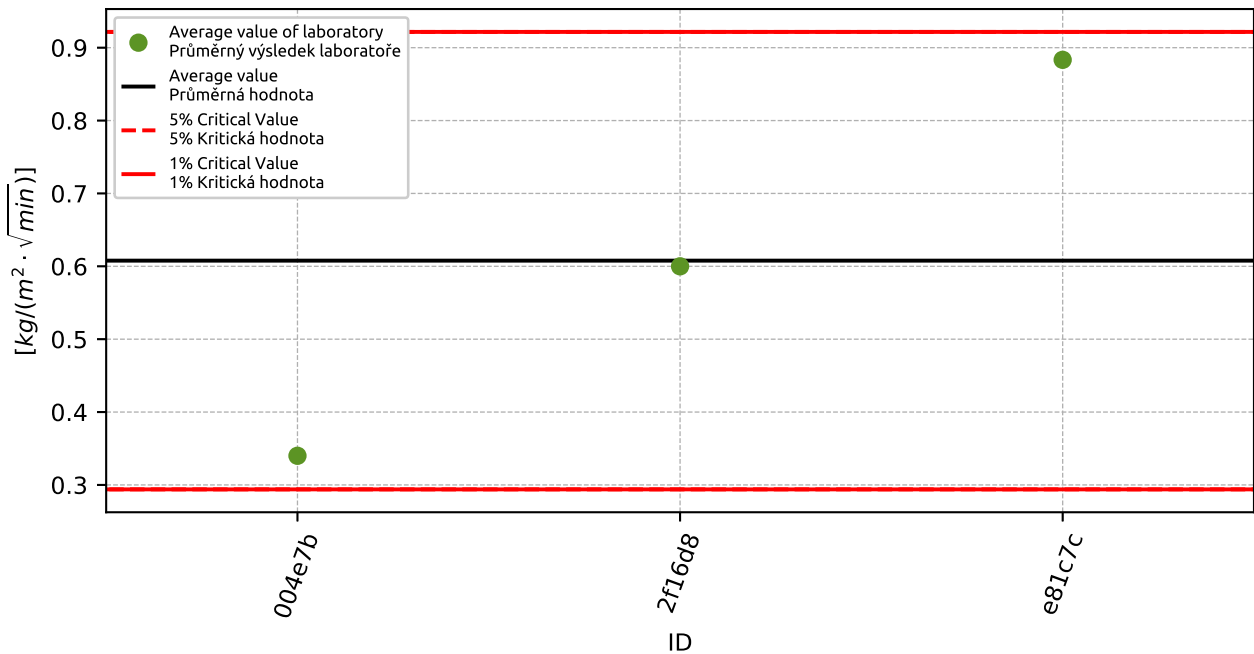


Figure 140: **Grubbs' test** - average values

15.3 Mandel's Statistics

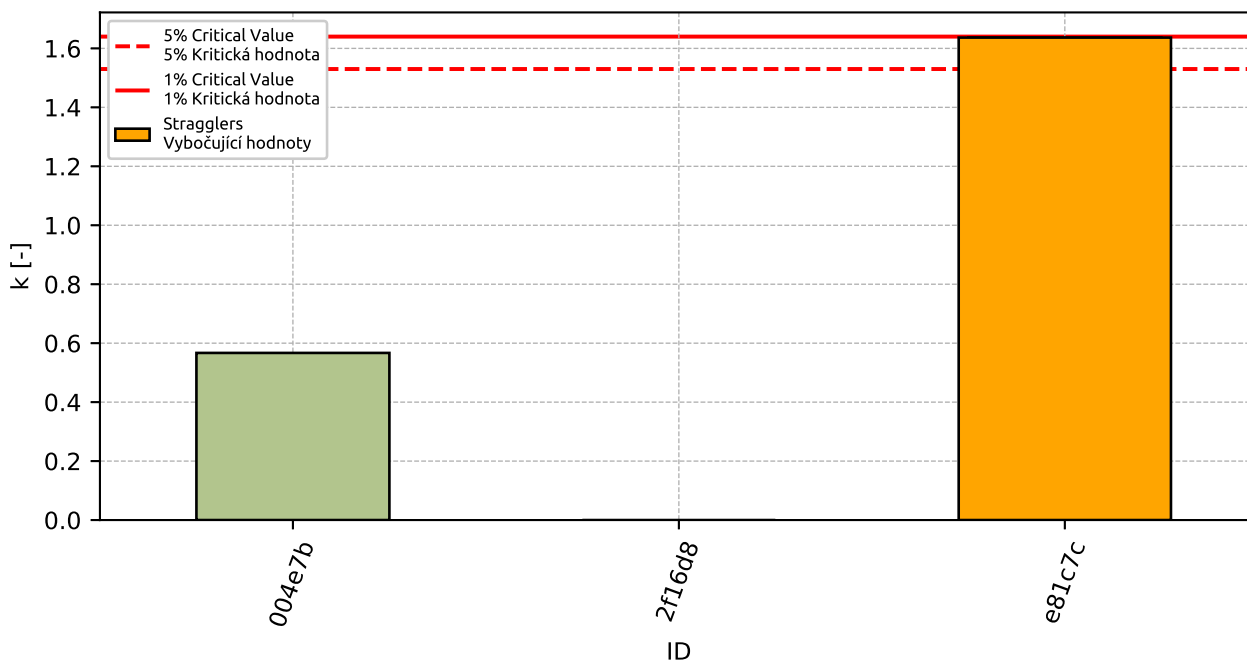


Figure 141: Intralaboratory Consistency Statistic

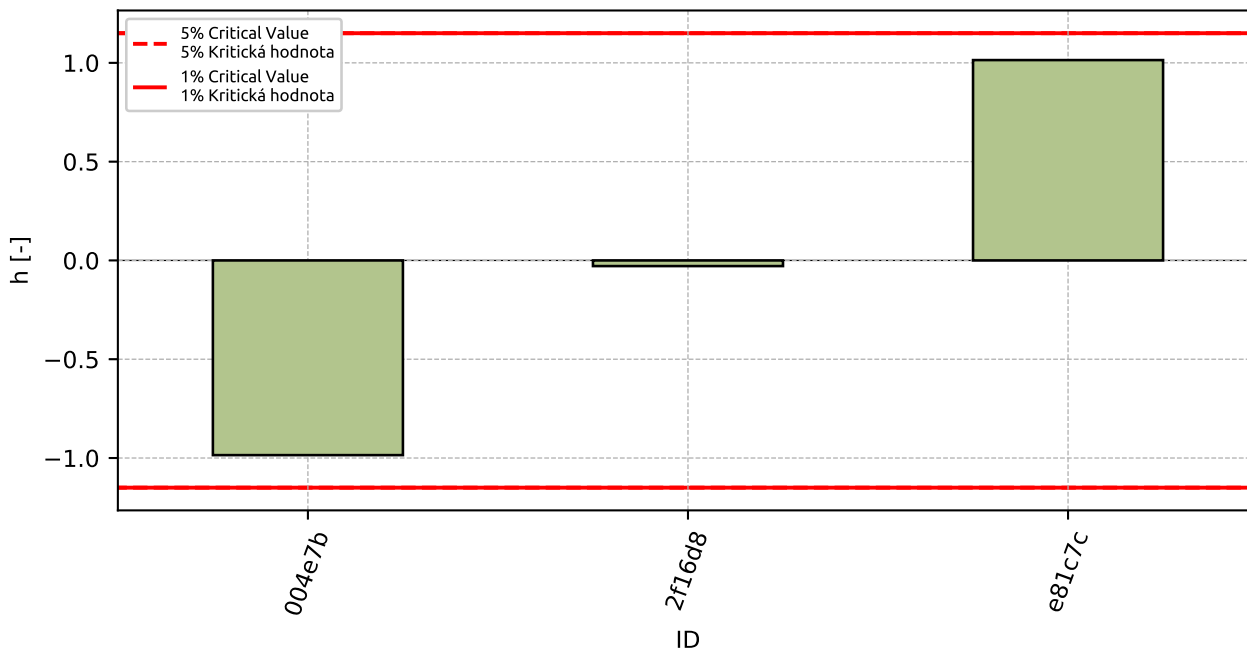


Figure 142: Interlaboratory Consistency Statistic

15.4 Descriptive statistics

Table 50: Descriptive statistics

Characteristics	[kg/(m ² · √min)]
Průměrná hodnota / Average value – \bar{x}	0.61
Výběrová směrodatná odchylka / Sample standard deviation – s	0.272
Vztažná hodnota / Assigned value – x^*	0.61
Robustní směrodatná odchylka / Robust standard deviation – s^*	0.272
Nejistota měření vztažné hodnoty / Measurement uncertainty of assigned value – u_X	0.521
p -hodnota testu normality / p -value of normality test	0.333 [-]
Mezilaboratorní sm. odch. / Interlaboratory standard deviation – s_L	0.272
Směrodatná odchylka opakovatelnosti / Repeatability standard deviation – s_r	0.018
Směrodatná odchylka reprodukovatelnosti / Reproducibility standard deviation – s_R	0.272
Opakovatelnost / Repeatability – r	0.05
Reprodukovatelnost / Reproducibility – R	0.76

15.5 Evaluation of Performance Statistics

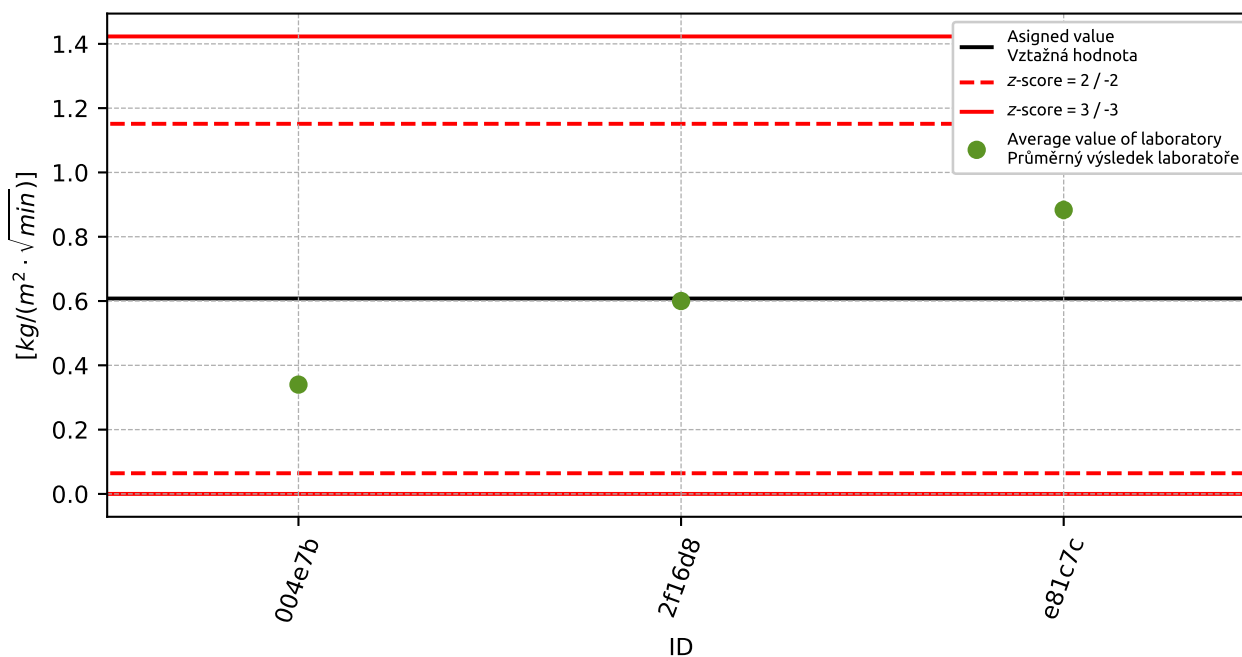


Figure 143: Average values and sample standard deviations

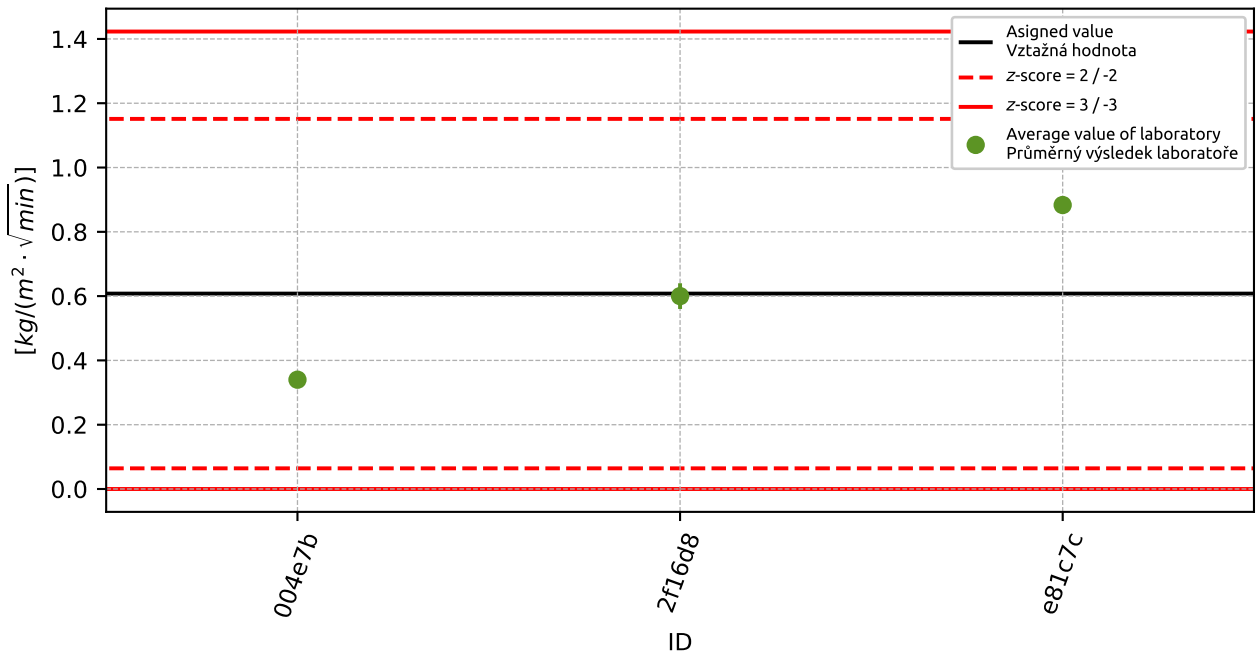


Figure 144: Average values and extended uncertainties of measurement

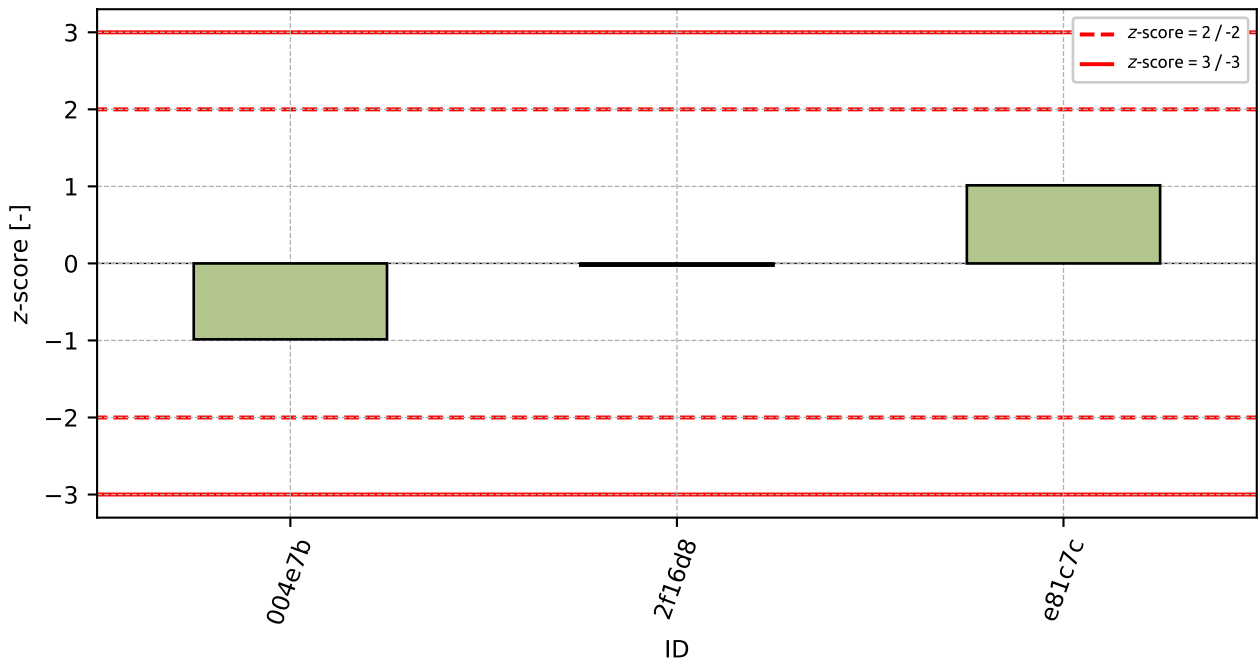
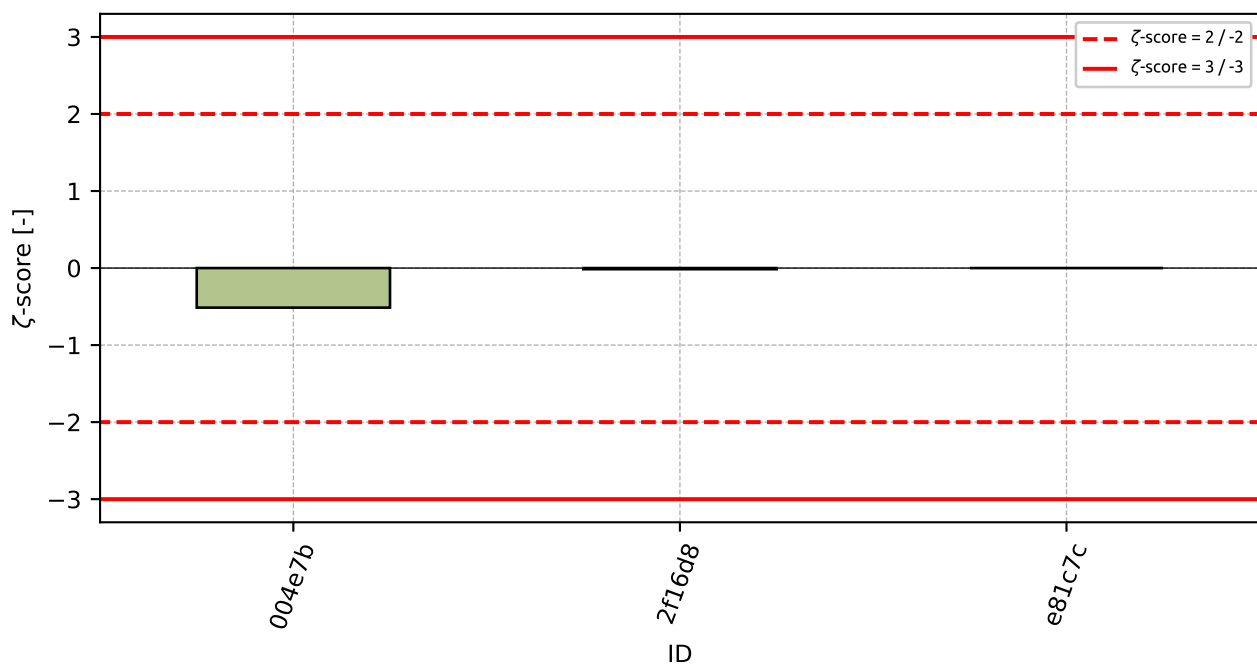


Figure 145: z-score

Figure 146: ζ -scoreTable 51: z-score and ζ -score

ID	z-score [-]	ζ -score [-]
004e7b	-0.99	-0.51
2f16d8	-0.03	-0.01
e81c7c	1.01	-

16 Appendix – EN 1015-19 – Water vapor flow

This part of the PT program was not open due to the lack of participants.

17 Appendix – EN 13892-2 – Determination of flexural and compressive strength

This part of the PT program was not open due to the lack of participants.

18 Appendix – EN 12004-2 (art. 8.1) – Open time

18.1 10 min.

18.1.1 Test results

Table 52: 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 [N/mm ²]	\bar{x} [N/mm ²]	s_0 [N/mm ²]	V_x [%]
	[N/mm ²]													
605eff	0.7	0.8	0.7	0.8	0.7	0.7	0.7	0.8	0.7	0.7	0.0	0.7	0.03	3.49
663aa5	0.9	0.8	1.1	1.2	0.7	0.7	0.6	1.1	1.1	1.2	0.2	0.9	0.23	24.16
35d72a	1.0	1.0	0.9	0.9	0.9	1.0	0.8	1.0	1.0	1.0	0.1	1.0	0.07	7.44
43b61e	1.1	1.0	1.1	1.1	1.0	1.0	0.9	0.9	1.0	0.8	0.1	1.0	0.1	10.1

18.1.2 The Numerical Procedure for Determining Outliers

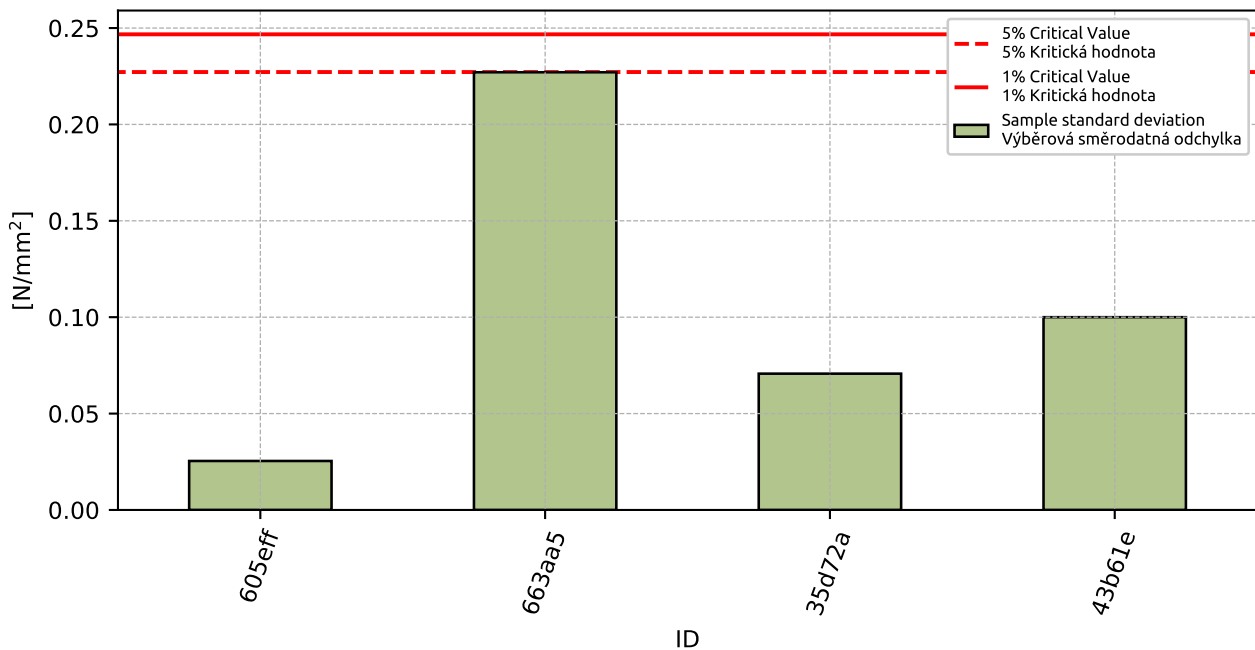


Figure 147: Cochran's test - sample standard deviations

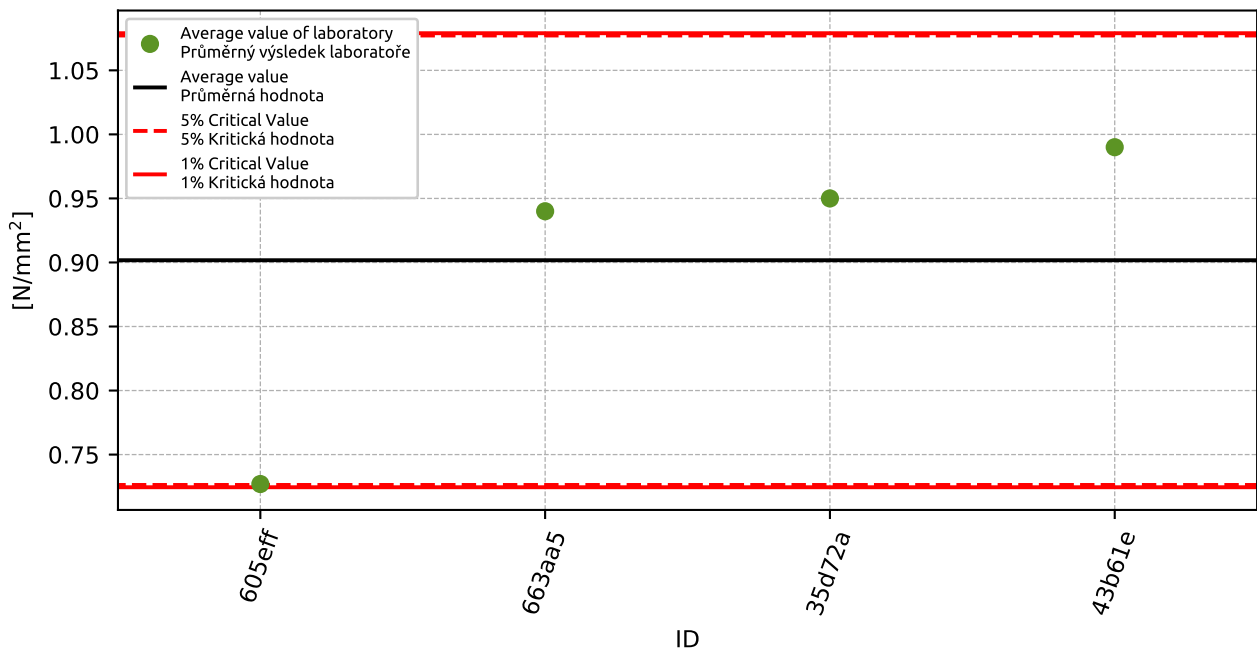


Figure 148: **Grubbs' test** - average values

18.1.3 Mandel's Statistics

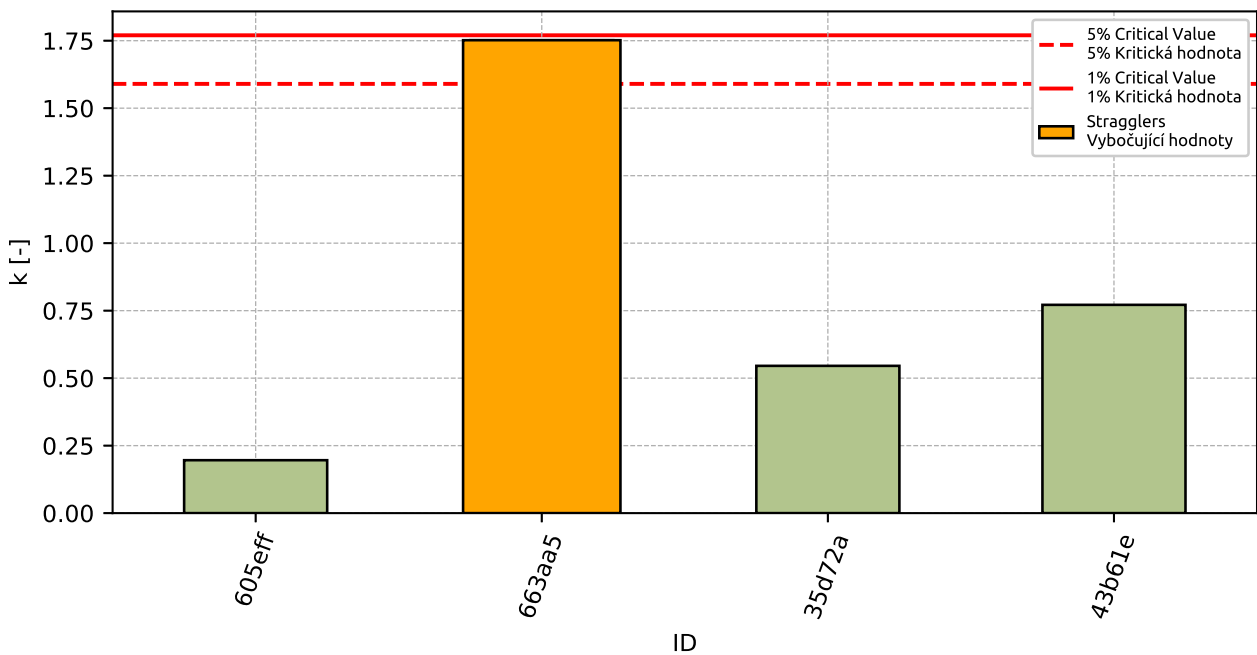


Figure 149: Intralaboratory Consistency Statistic

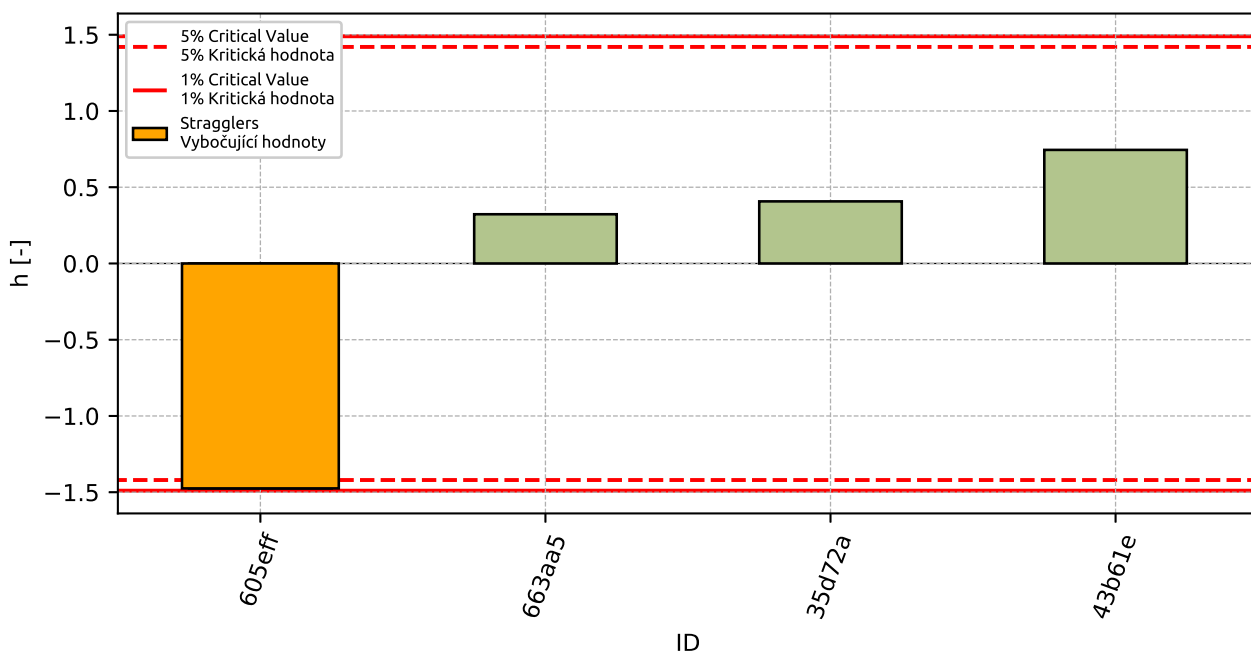


Figure 150: Interlaboratory Consistency Statistic

18.1.4 Descriptive statistics

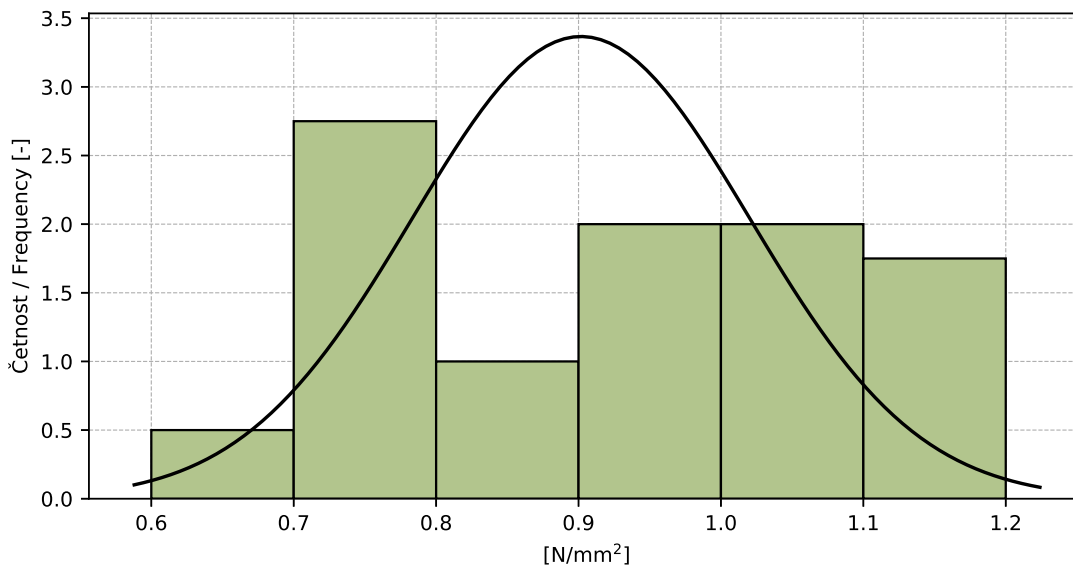


Figure 151: Histogram of all test results

Table 53: Descriptive statistics

Characteristics	[N/mm ²]
Průměrná hodnota / Average value – \bar{x}	0.9
Výběrová směrodatná odchylka / Sample standard deviation – s	0.12
Vztažná hodnota / Assigned value – x^*	0.9
Robustní směrodatná odchylka / Robust standard deviation – s^*	0.04
Nejistota měření vztažné hodnoty / Measurement uncertainty of assigned value – u_X	0.03
p -hodnota testu normality / p -value of normality test	0.042 [-]
Mezilaboratorní sm. odch. / Interlaboratory standard deviation – s_L	0.11
Směrodatná odchylka opakovatelnosti / Repeatability standard deviation – s_r	0.13
Směrodatná odchylka reprodukovatelnosti / Reproducibility standard deviation – s_R	0.17
Opakovatelnost / Repeatability – r	0.4
Reprodukovatelnost / Reproducibility – R	0.5

18.1.5 Evaluation of Performance Statistics

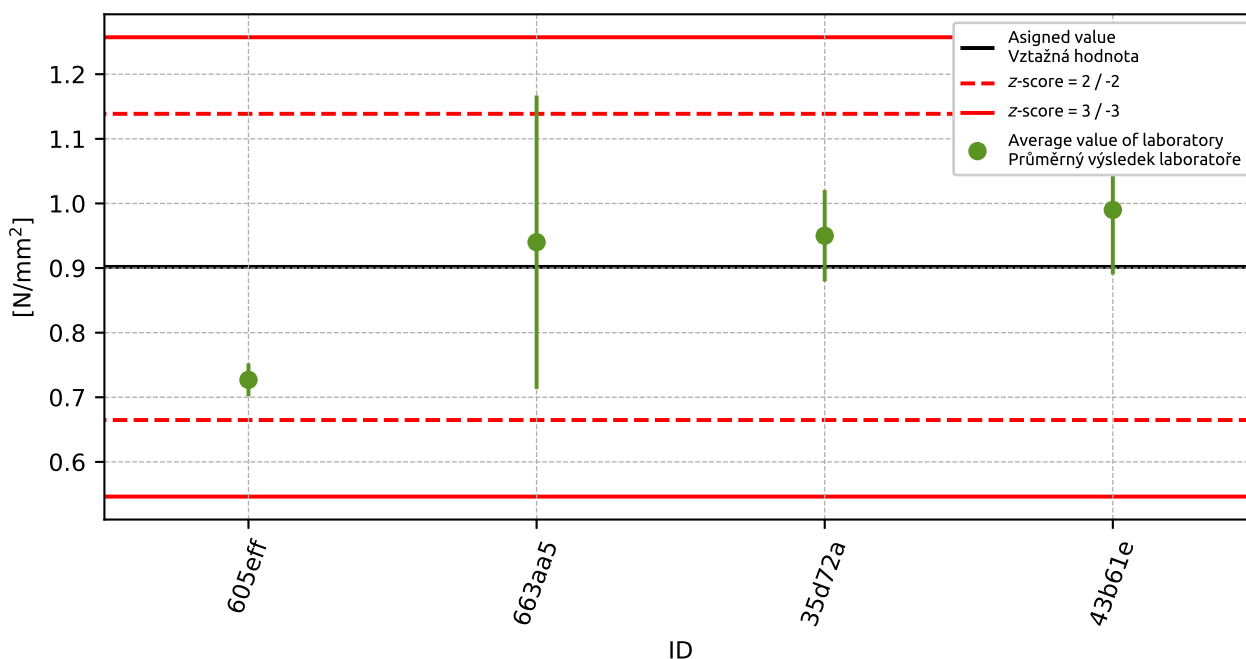


Figure 152: Average values and sample standard deviations

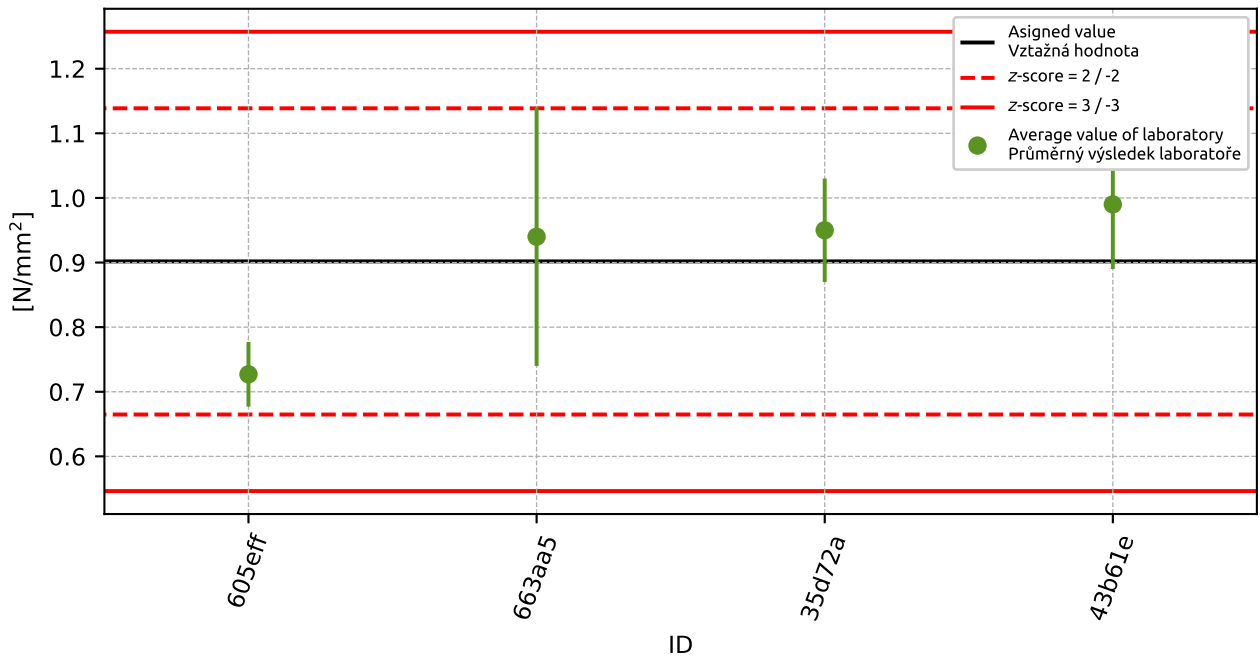


Figure 153: Average values and extended uncertainties of measurement

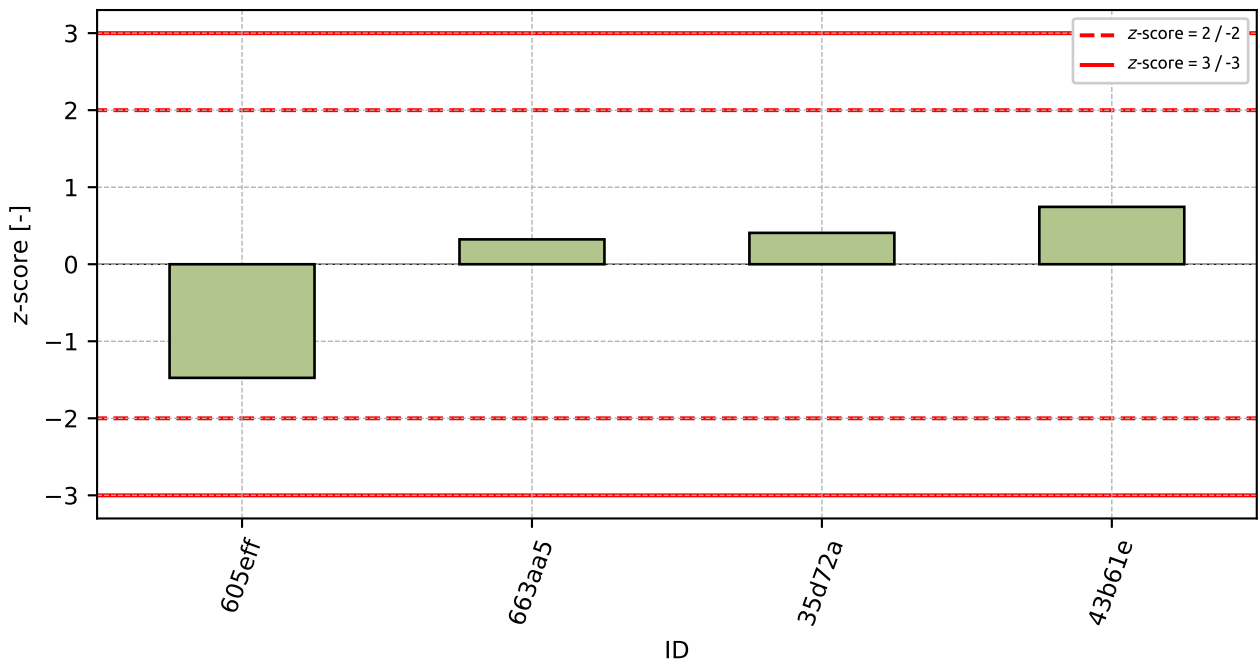


Figure 154: z-score

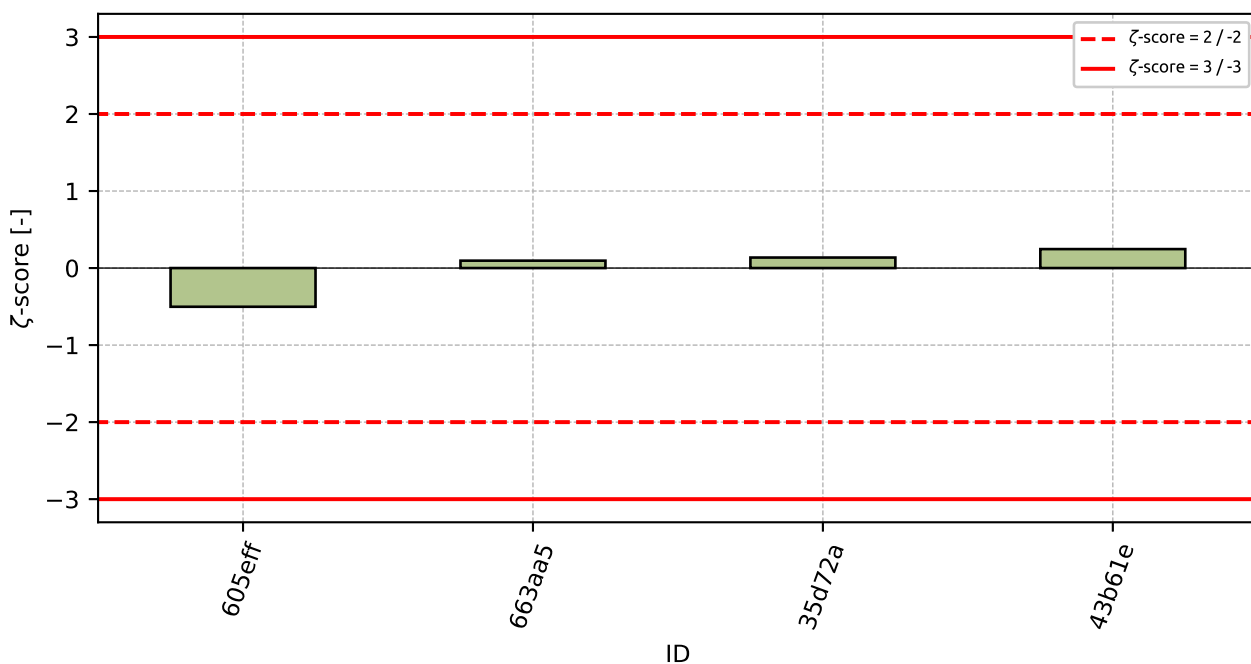


Figure 155: z-score

Table 54: z-score and z-score

ID	z-score [-]	z-score [-]
605eff	-1.47	-0.5
663aa5	0.32	0.1
35d72a	0.41	0.14
43b61e	0.74	0.25

18.2 30 min.

18.2.1 Test results

Table 55: 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
	[N/mm ²]										[N/mm ²]	[N/mm ²]	[N/mm ²]	[%]
663aa5	0.4	0.4	0.2	0.2	0.4	0.2	0.3	0.1	0.3	0.2	0.1	0.3	0.11	39.24
43b61e	0.3	0.3	0.4	0.4	0.5	0.3	0.4	0.3	0.4	0.4	0.0	0.4	0.07	18.97
605eff	0.6	0.6	0.6	0.6	0.6	0.7	0.6	0.6	0.6	0.6	0.0	0.6	0.02	2.6
35d72a	0.5	0.7	0.8	0.7	0.8	0.6	0.6	0.7	0.8	0.9	0.1	0.7	0.12	16.86

18.2.2 The Numerical Procedure for Determining Outliers

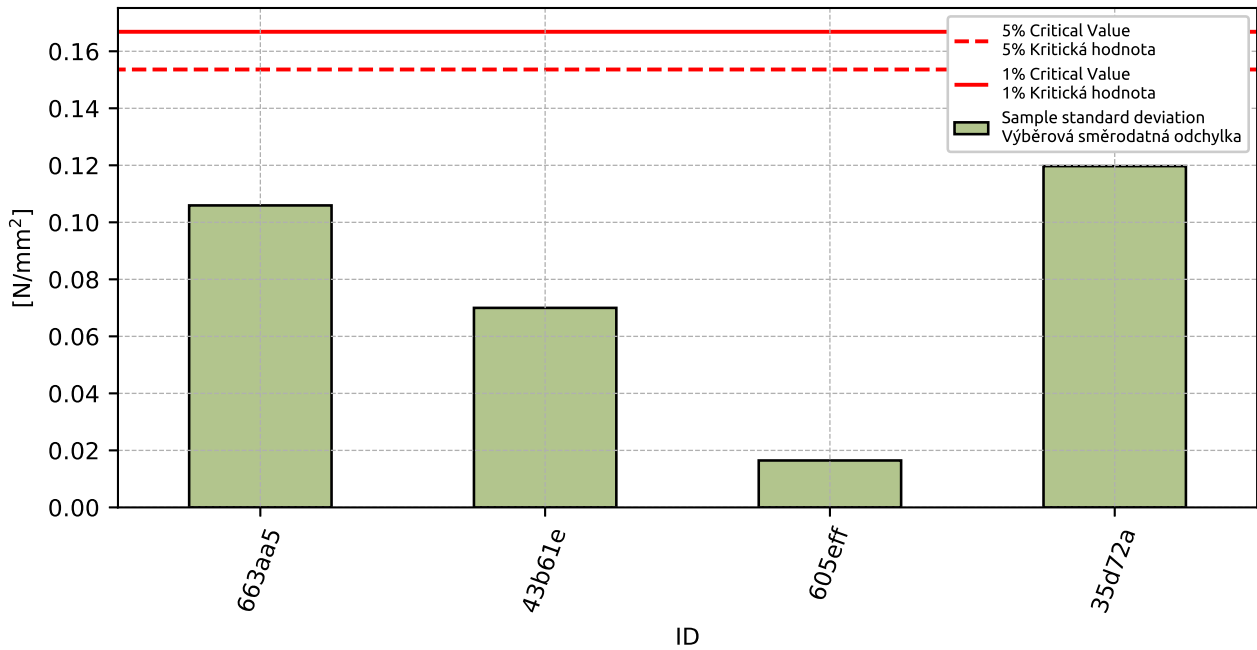


Figure 156: **Cochran's test** - sample standard deviations

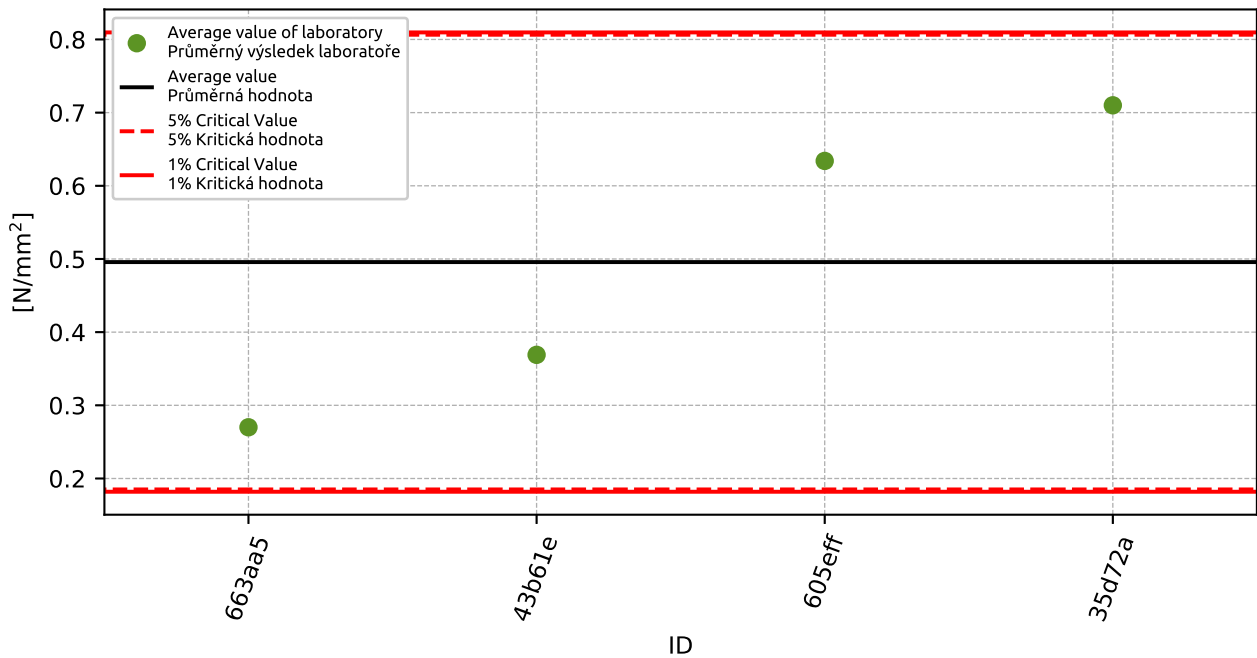


Figure 157: **Grubbs' test** - average values

18.2.3 Mandel's Statistics

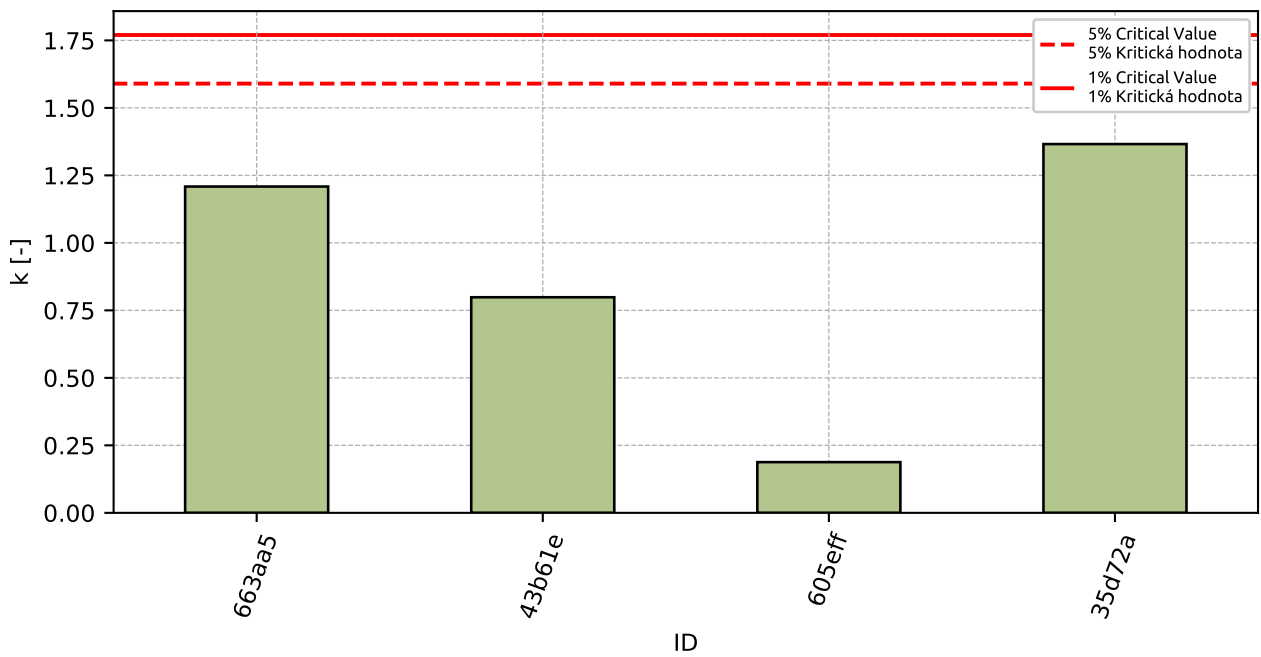


Figure 158: Intralaboratory Consistency Statistic

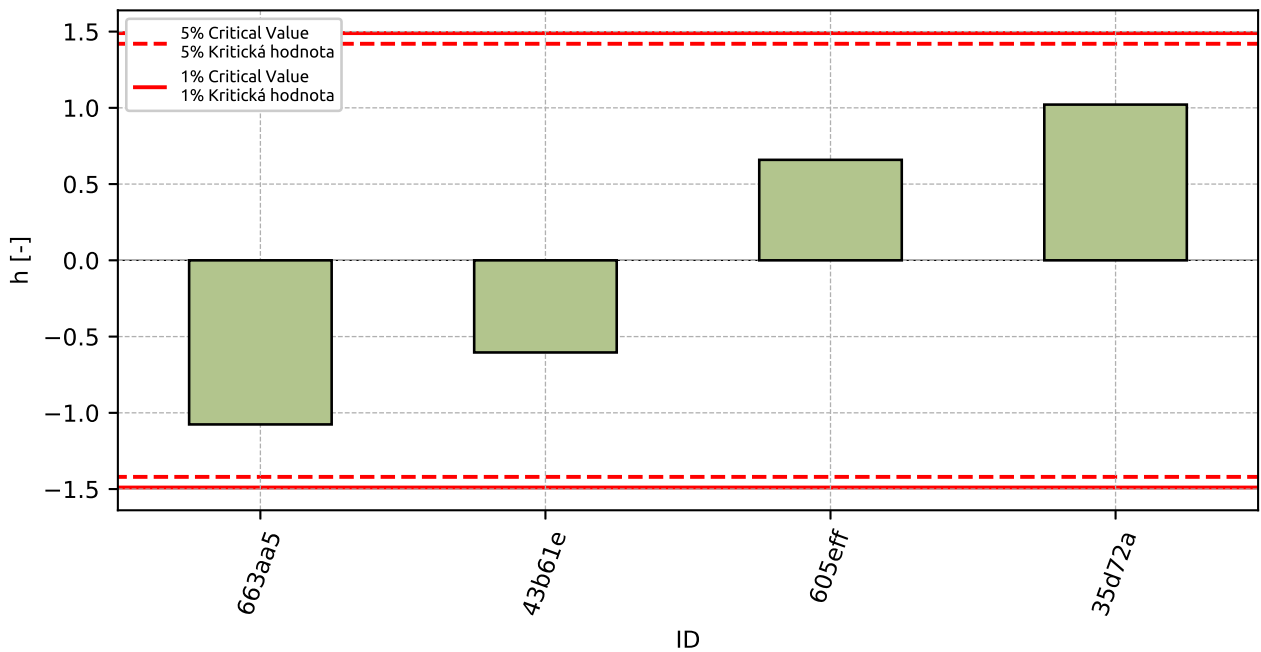


Figure 159: Interlaboratory Consistency Statistic

18.2.4 Descriptive statistics

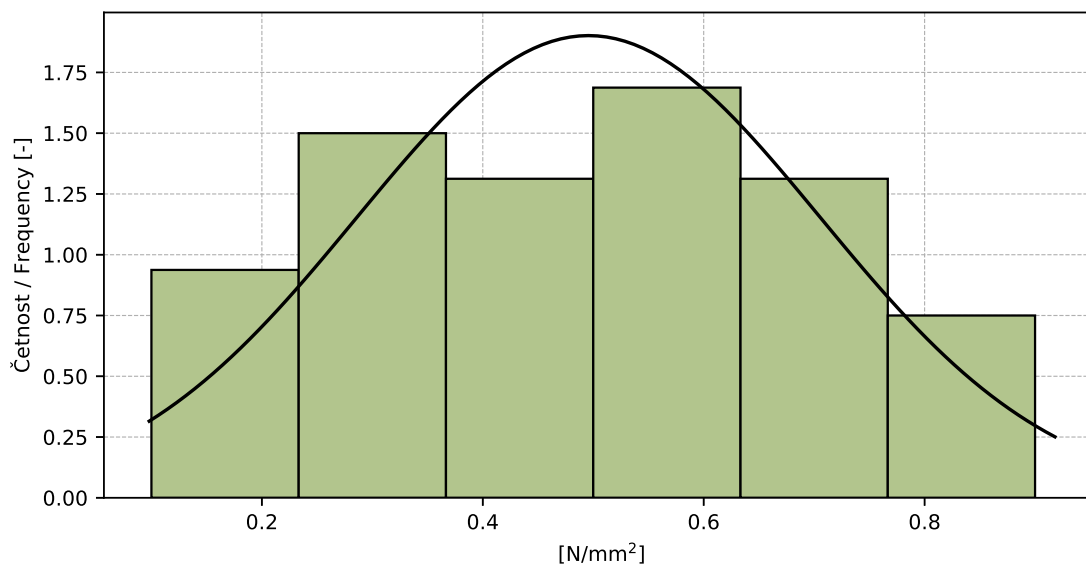


Figure 160: Histogram of all test results

Table 56: Descriptive statistics

Characteristics	[N/mm ²]
Průměrná hodnota / Average value – \bar{x}	0.5
Výběrová směrodatná odchylka / Sample standard deviation – s	0.21
Vztažná hodnota / Assigned value – x^*	0.5
Robustní směrodatná odchylka / Robust standard deviation – s^*	0.21
Nejistota měření vztažné hodnoty / Measurement uncertainty of assigned value – u_X	0.46
p -hodnota testu normality / p -value of normality test	0.134 [-]
Mezilaboratorní sm. odch. / Interlaboratory standard deviation – s_L	0.21
Směrodatná odchylka opakovatelnosti / Repeatability standard deviation – s_r	0.09
Směrodatná odchylka reprodukovatelnosti / Reproducibility standard deviation – s_R	0.23
Opakovatelnost / Repeatability – r	0.2
Reprodukovatelnost / Reproducibility – R	0.6

18.2.5 Evaluation of Performance Statistics

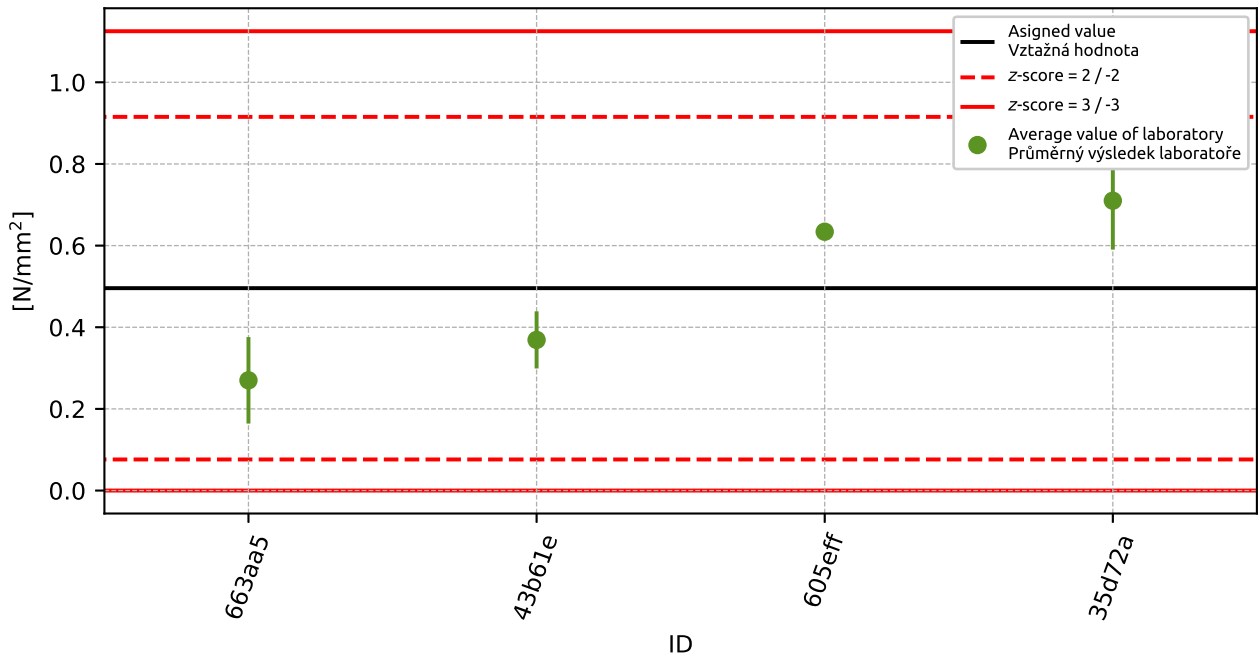


Figure 161: Average values and sample standard deviations

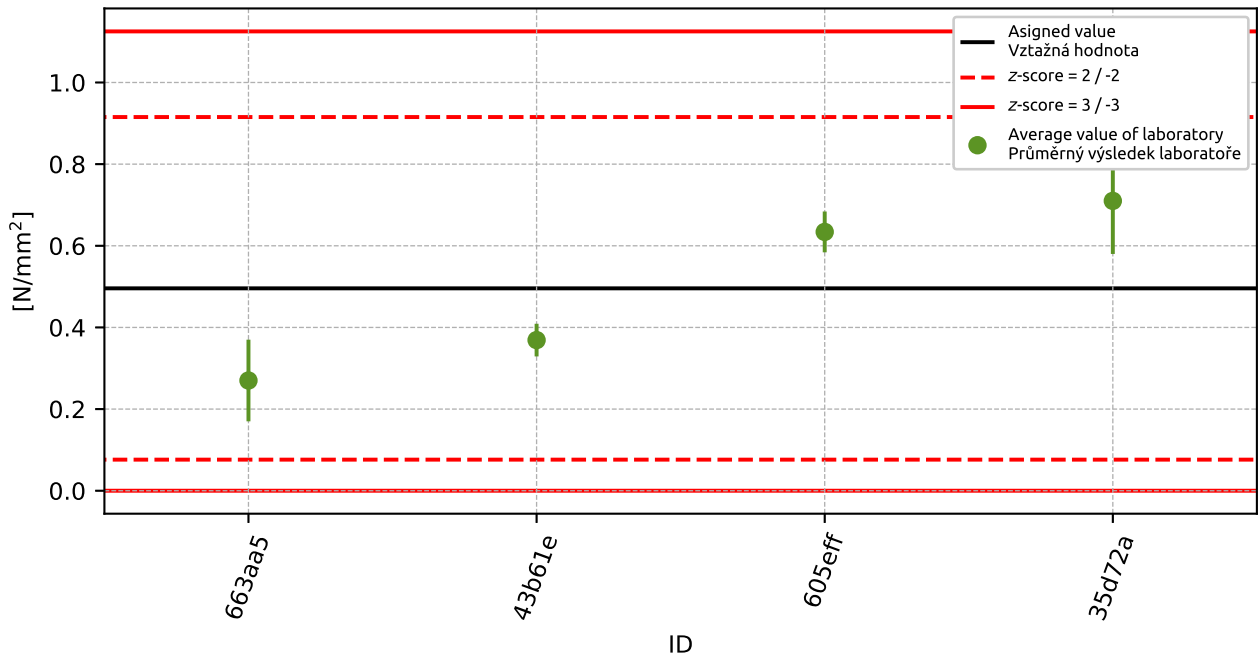


Figure 162: Average values and extended uncertainties of measurement

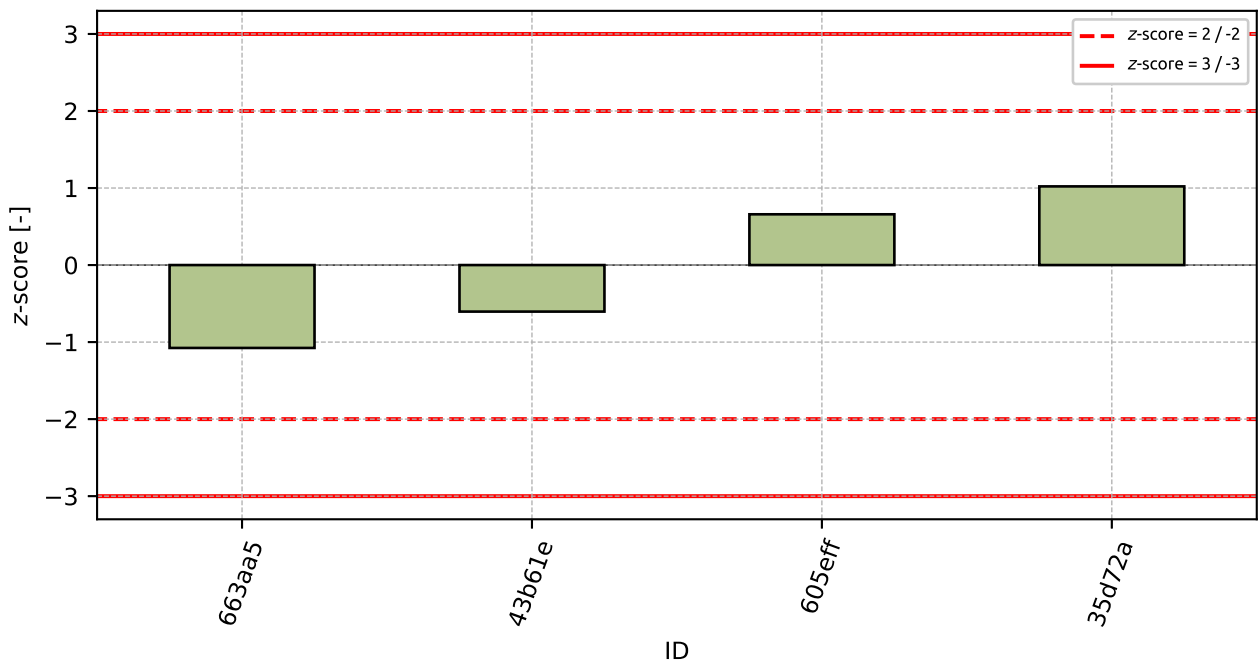


Figure 163: z-score

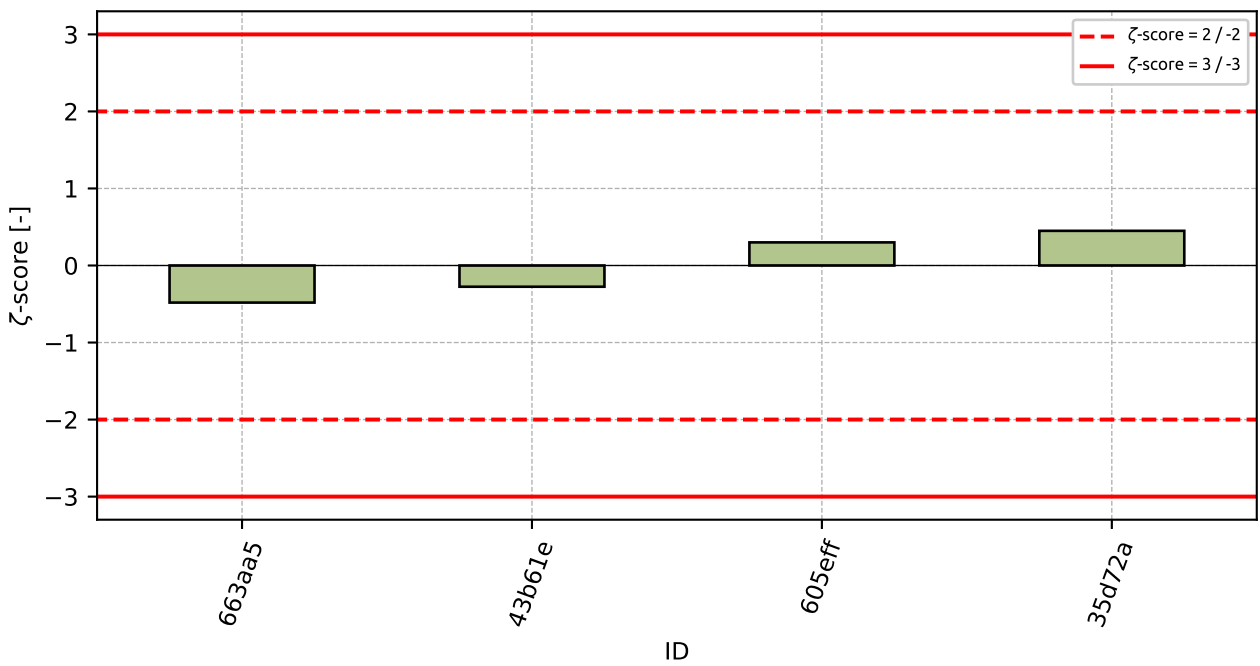


Figure 164: zeta-score

Table 57: z-score and ζ -score

ID	z-score [-]	ζ -score [-]
663aa5	-1.08	-0.48
43b61e	-0.6	-0.28
605eff	0.66	0.3
35d72a	1.02	0.45

19 Appendix – EN 12004-2 (art. 8.2) – Slippage

This part of the PT program was not open due to the lack of participants.

20 Appendix – EN 12004-2 (art. 8.3.3.2) – Adhesion

20.1 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 [N/mm ²]										u_x [N/mm ²]	\bar{x} [N/mm ²]	s_0 [N/mm ²]	V_x [%]
43b61e	0.2	0.3	0.2	0.3	0.2	0.2	0.2	0.3	0.2	0.2	0.0	0.2	0.05	22.55
605eff	0.7	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.0	0.8	0.02	2.0
4a1546	1.1	1.3	0.7	1.1	0.8	1.0	0.8	0.7	0.7	0.9	0.1	0.9	0.21	22.85

20.2 The Numerical Procedure for Determining Outliers

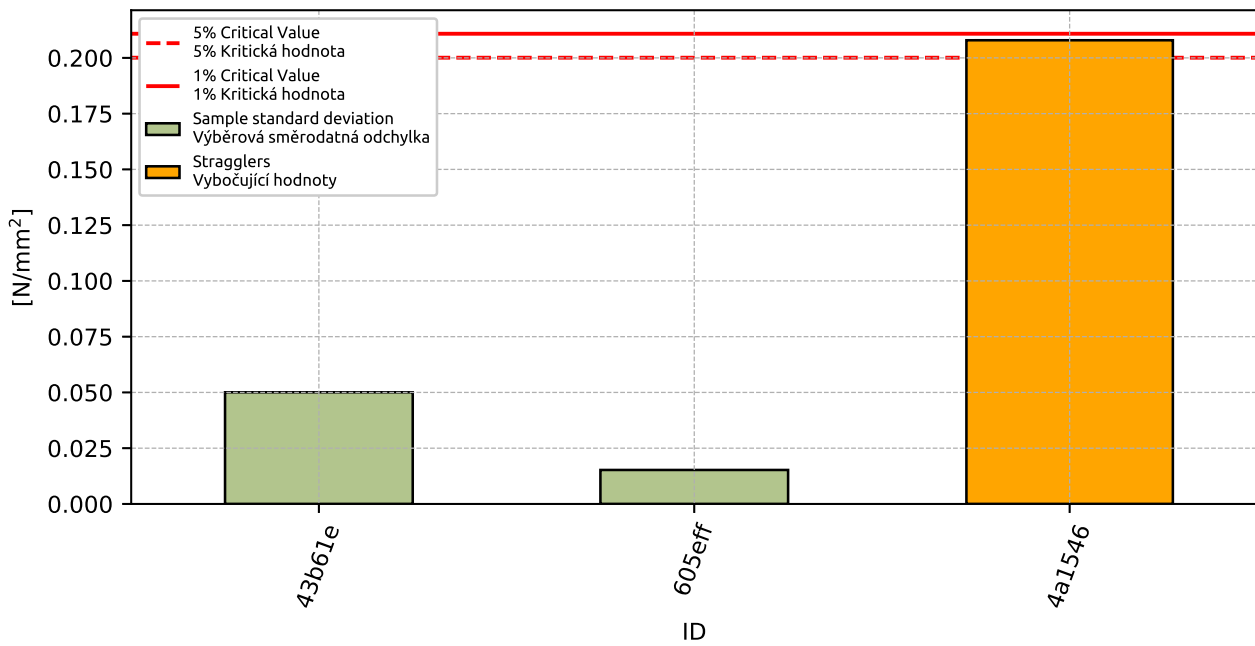


Figure 165: Cochran's test - sample standard deviations

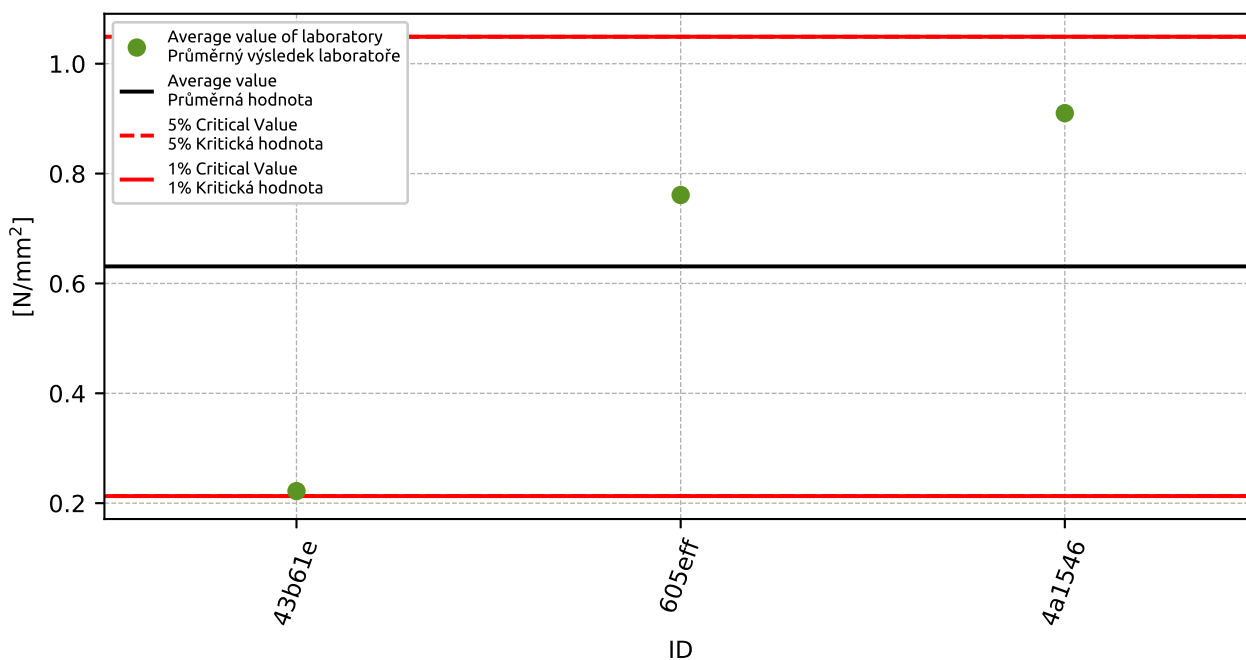


Figure 166: **Grubbs' test** - average values

20.3 Mandel's Statistics

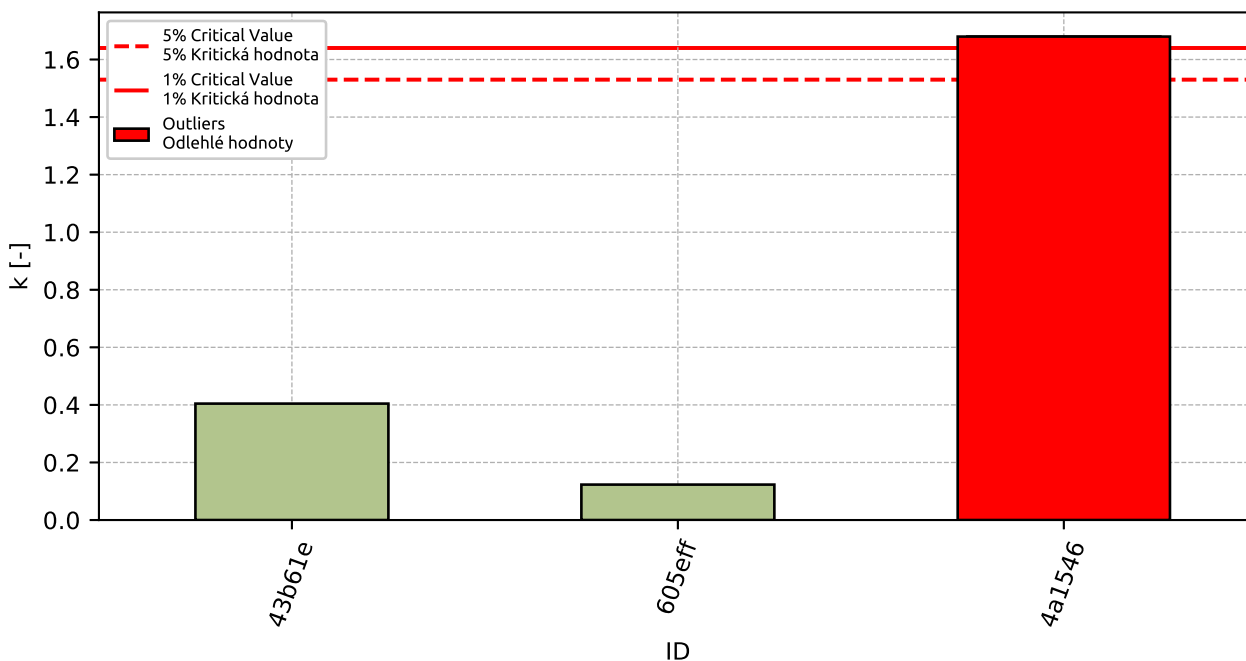


Figure 167: Intralaboratory Consistency Statistic

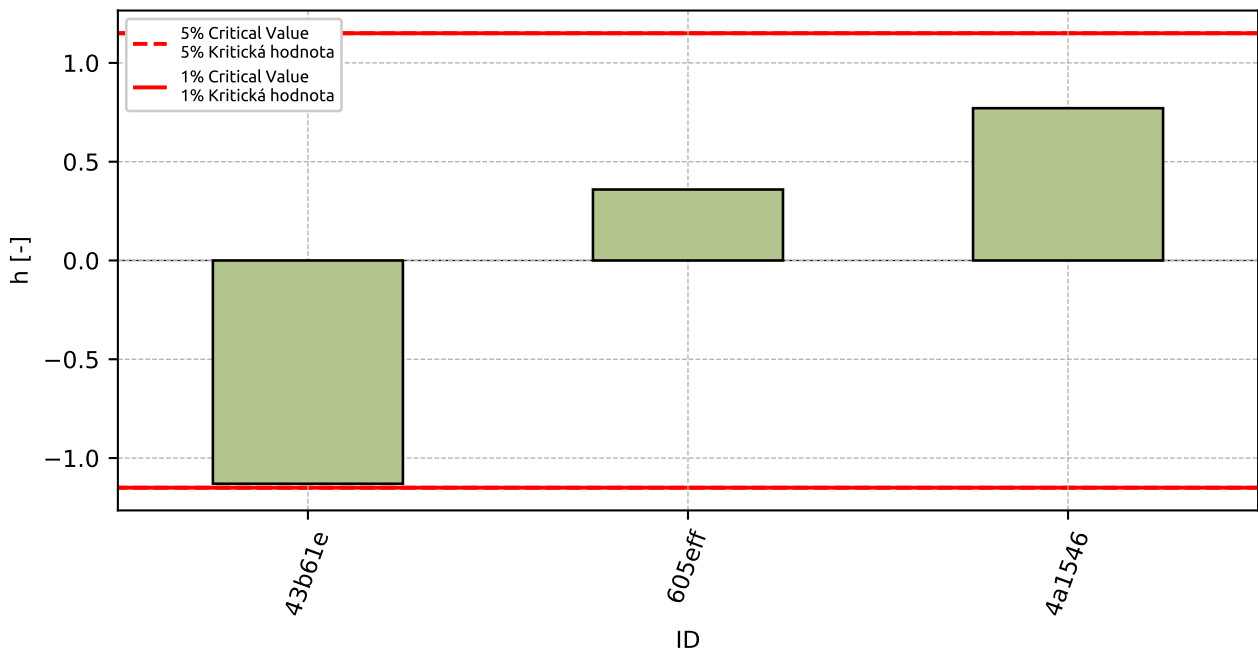


Figure 168: Interlaboratory Consistency Statistic

20.4 Descriptive statistics

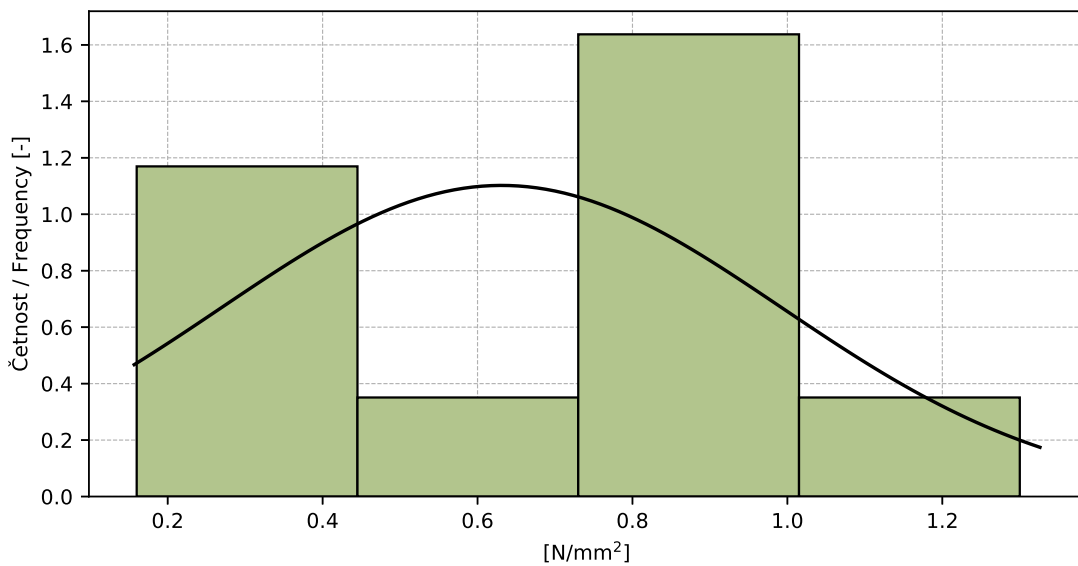


Figure 169: Histogram of all test results

Table 59: Descriptive statistics

Characteristics	[N/mm ²]
Průměrná hodnota / Average value – \bar{x}	0.6
Výběrová směrodatná odchylka / Sample standard deviation – s	0.36
Vztažná hodnota / Assigned value – x^*	0.6
Robustní směrodatná odchylka / Robust standard deviation – s^*	0.36
Nejistota měření vztažné hodnoty / Measurement uncertainty of assigned value – u_X	0.6
p -hodnota testu normality / p -value of normality test	0.346 [-]
Mezilaboratorní sm. odch. / Interlaboratory standard deviation – s_L	0.36
Směrodatná odchylka opakovatelnosti / Repeatability standard deviation – s_r	0.12
Směrodatná odchylka reprodukovatelnosti / Reproducibility standard deviation – s_R	0.38
Opakovatelnost / Repeatability – r	0.3
Reprodukovatelnost / Reproducibility – R	1.1

20.5 Evaluation of Performance Statistics

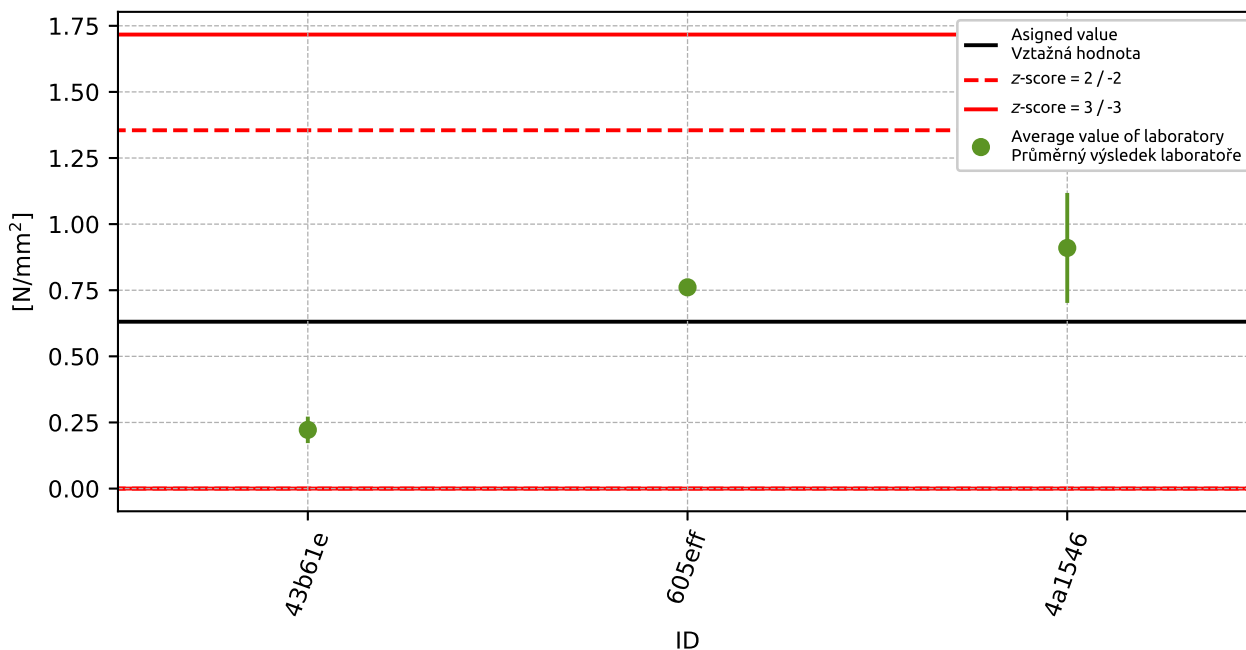


Figure 170: Average values and sample standard deviations

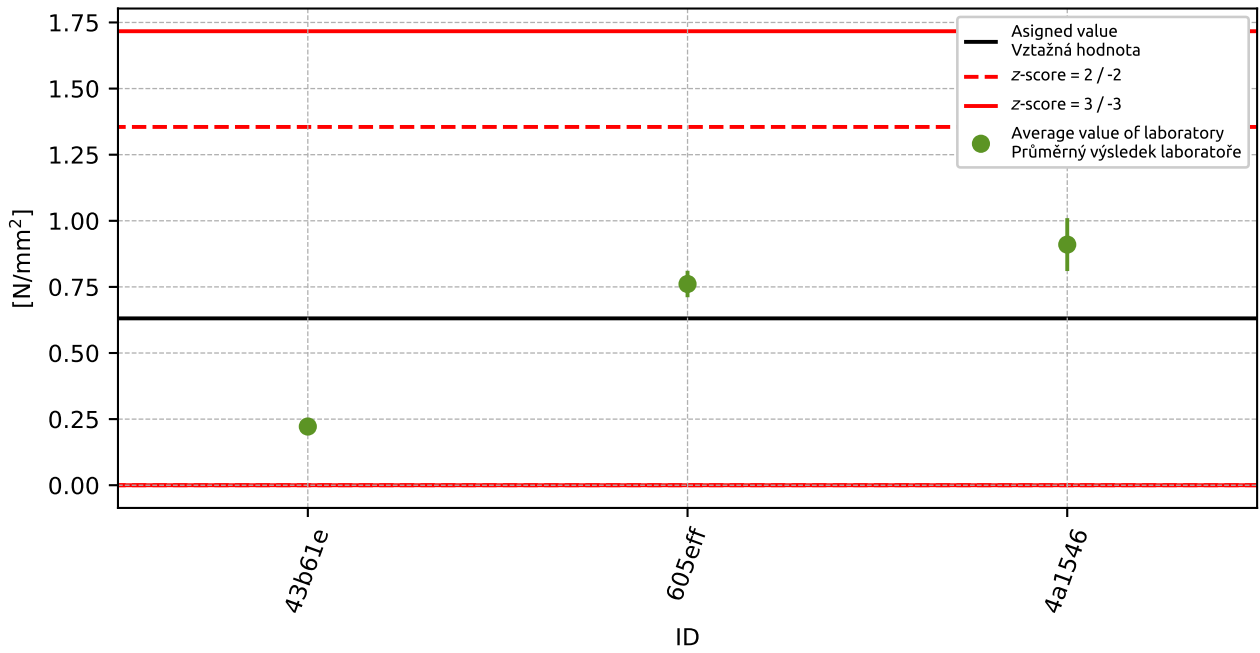


Figure 171: Average values and extended uncertainties of measurement

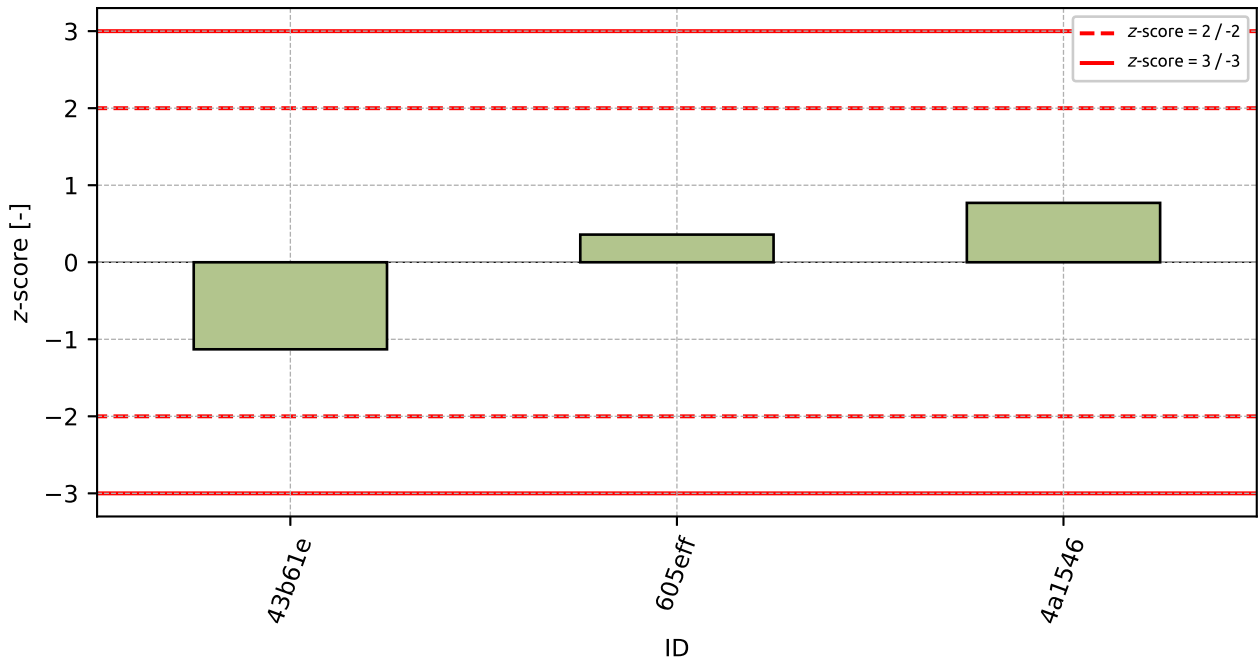
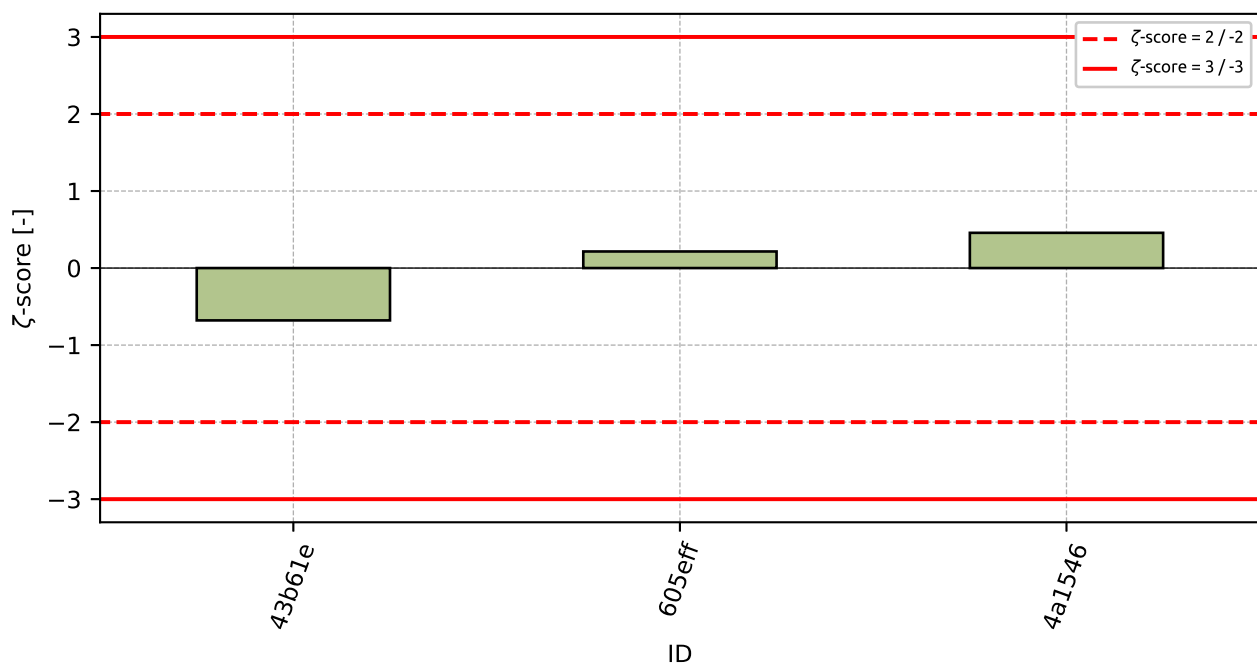


Figure 172: z-score

Figure 173: ζ -scoreTable 60: z-score and ζ -score

ID	z-score [-]	ζ -score [-]
43b61e	-1.13	-0.68
605eff	0.36	0.22
4a1546	0.77	0.46

21 Appendix – EN 12004-2 (art. 8.3.3.3) – Adhesion

This part of the PT program was not open due to the lack of participants.

22 Appendix – EN 196-2 (art. 4.4.6) – Determination of manganese content

This part of the PT program was not open due to the lack of participants.