

Date: 10/12/2021

INPUT DATA

Data sheet	DBL123456
Pulse frequency	8 kHz
Filter	no Filter
Customer machine ID	
Description	Demo Data
Upload date	10/12/2021, 12:11:30

DATA SETS

Data set	Name
1	Data_21-09-2020_at_08-24-40
10	Data_21-09-2020_at_15-09-21
11	Data_22-09-2020_at_07-33-33
12	Data_22-09-2020_at_11-01-50
13	Data_23-09-2020_at_13-17-04
14	Data_23-09-2020_at_13-59-39
2	Data_21-09-2020_at_08-24-41
3	Data_21-09-2020_at_08-31-01
4	Data_21-09-2020_at_08-31-02
5	Data_21-09-2020_at_08-31-03
6	Data_21-09-2020_at_08-55-47
7	Data_21-09-2020_at_14-50-22
8	Data_21-09-2020_at_14-50-30
9	Data_21-09-2020_at_14-51-17

SUMMARY

Data set	e+a stress index			Maximum voltage peak in V			Maximum peak-peak voltage in V		
	U	V	W	U	V	W	U	V	W
1	0.005	2.372	1.904	1056	1466	1447	1358	1835	1806
10	0.010	2.732	2.336	1055	1493	1464	1333	1788	1760
11	0.008	2.790	2.410	1049	1470	1446	1334	1834	1793
12	0.010	2.743	2.412	1066	1476	1458	1350	1812	1783
13	0.012	2.955	2.530	1084	1515	1499	1329	1808	1776
14	0.009	2.775	2.446	1075	1495	1472	1356	1854	1825
2	0.005	2.363	1.905	1056	1466	1440	1363	1832	1804
3	0.006	2.420	2.052	1064	1477	1451	1346	1846	1817
4	0.006	2.416	2.043	1067	1490	1466	1360	1866	1834
5	0.005	2.377	2.009	1080	1501	1476	1366	1875	1846
6	0.010	2.734	2.369	1063	1508	1477	1347	1843	1810
7	0.009	2.751	2.347	1057	1492	1470	1330	1806	1778
8	0.009	2.789	2.373	1056	1480	1463	1330	1807	1779



SUMMARY (continued)

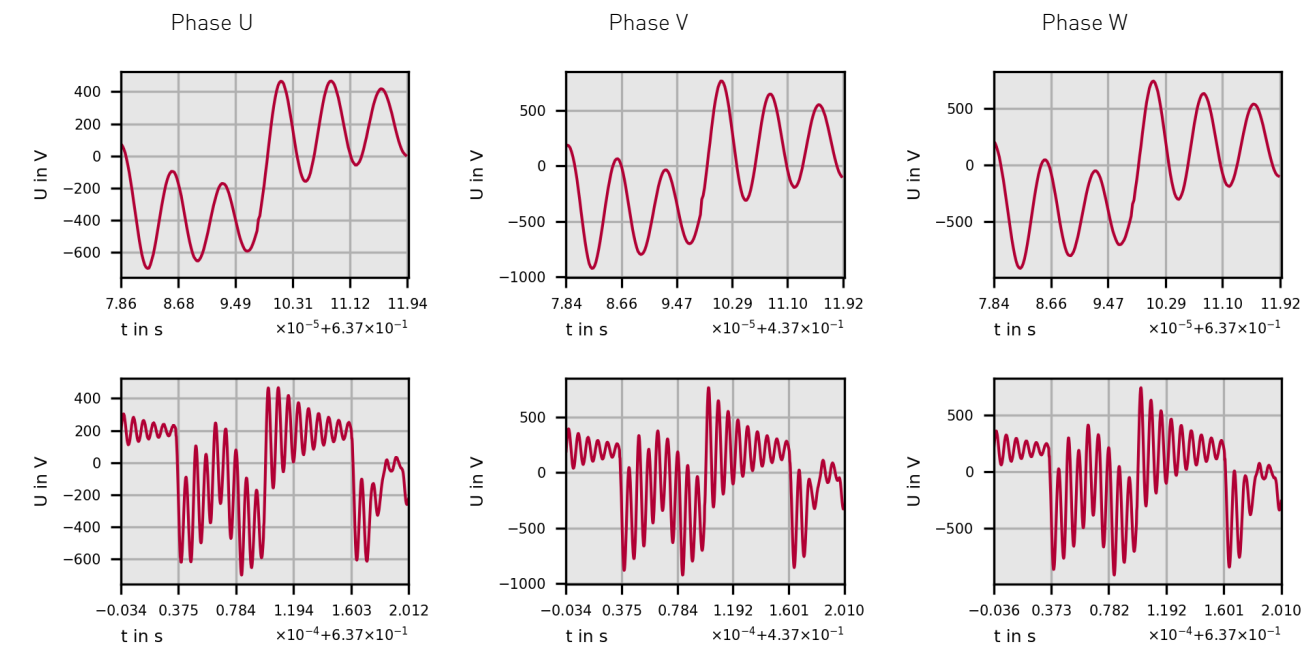
Data set	e+a stress index			Maximum voltage peak in V			Maximum peak-peak voltage in V		
	U	V	W	U	V	W	U	V	W
9	0.009	2.743	2.339	1061	1485	1465	1329	1804	1775

DISCLAIMER

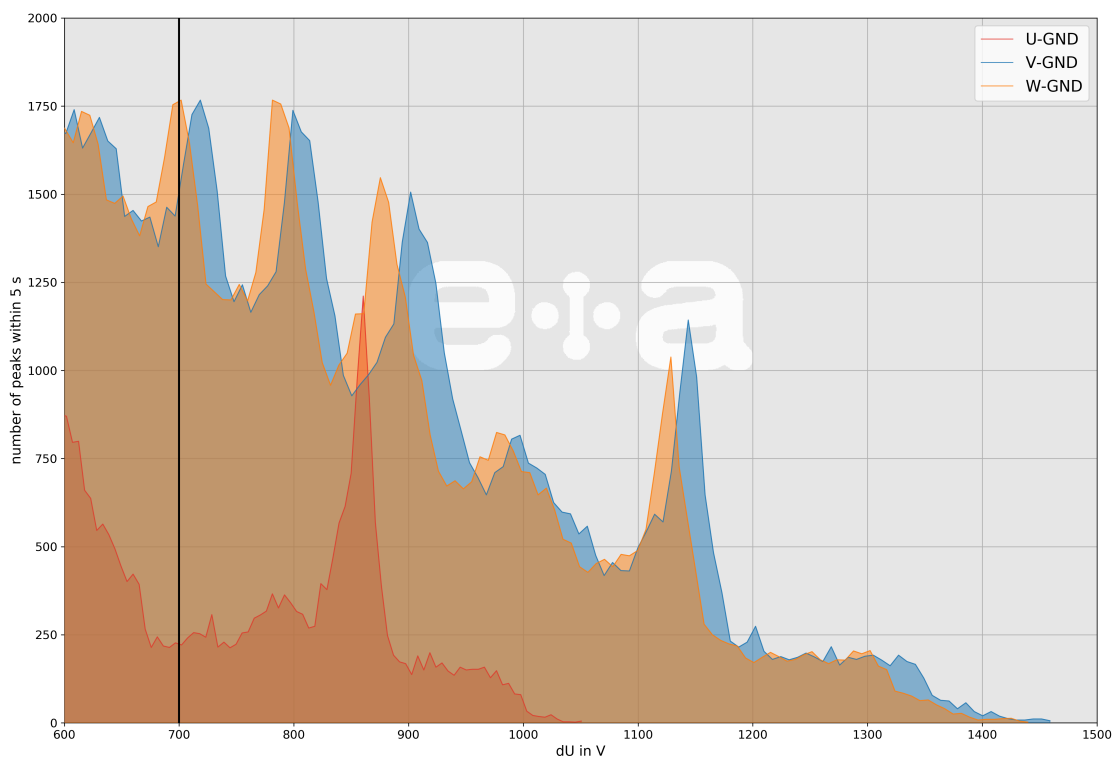
The analysis is based on measurements that have not been performed by e+a.
All warranties related to the provided analysis result, either expressed or implied, including without limitation any warranties of merchantability or fitness for a particular purpose or for approvals, are expressly excluded and disclaimed.

ANALYSIS DATA SET "Data_21-09-2020_at_08-24-40"

Maximum voltage peak

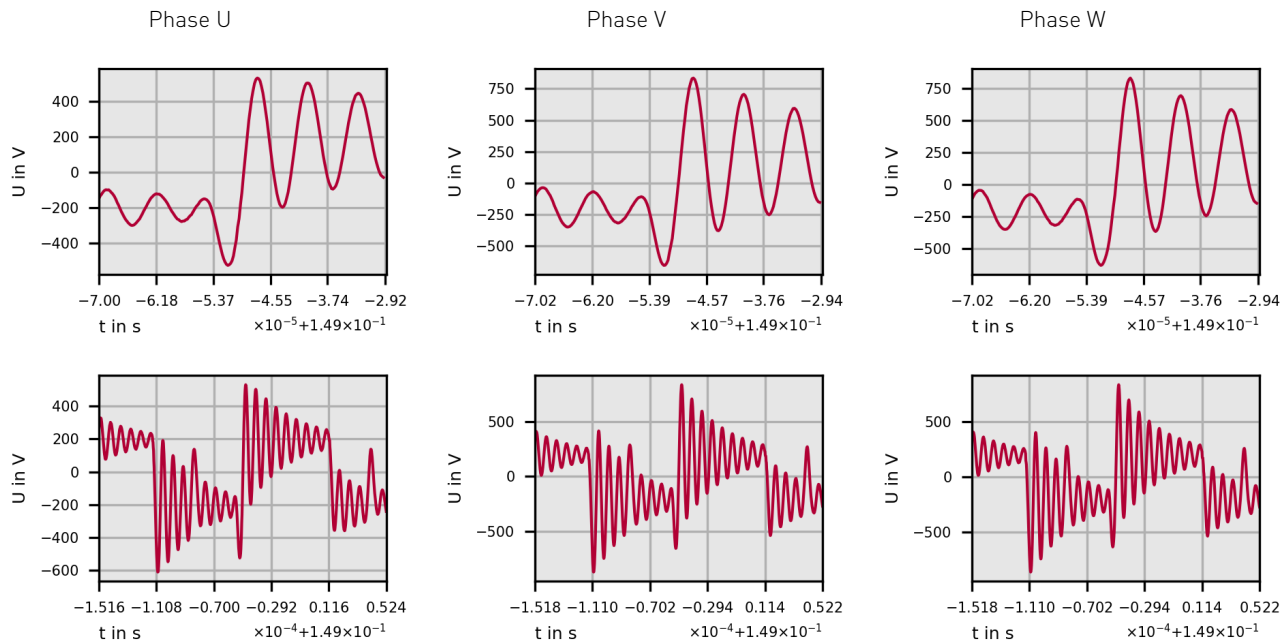


Voltage peak distribution

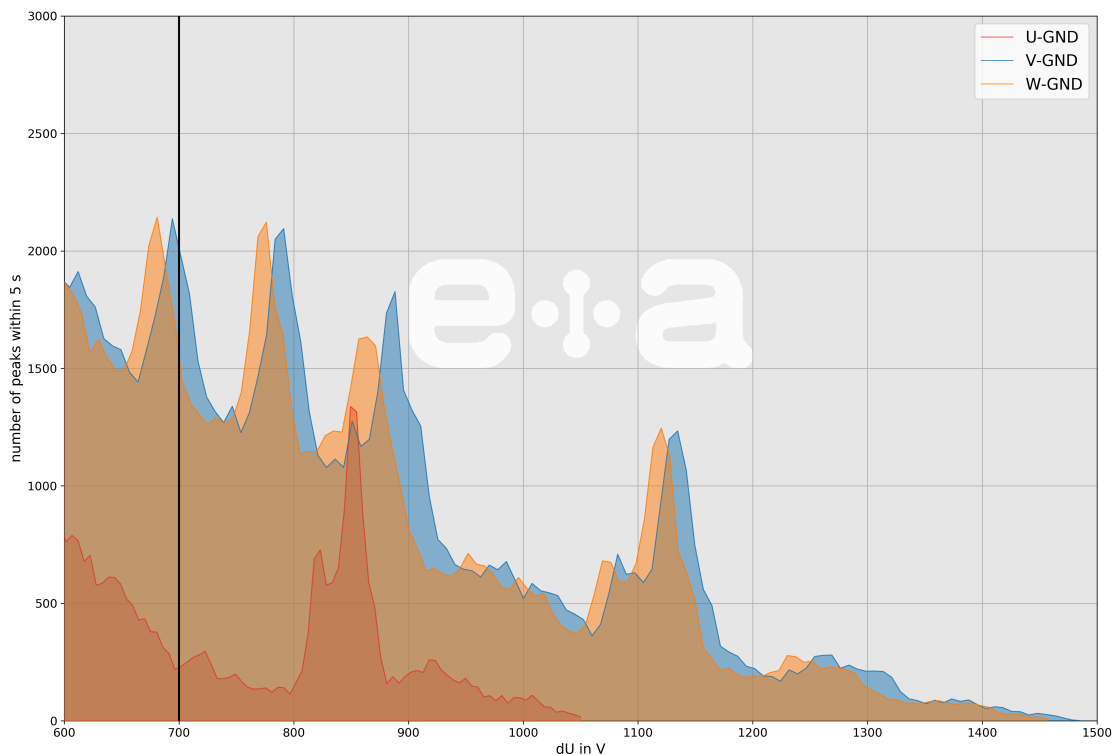


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Maximum voltage peak

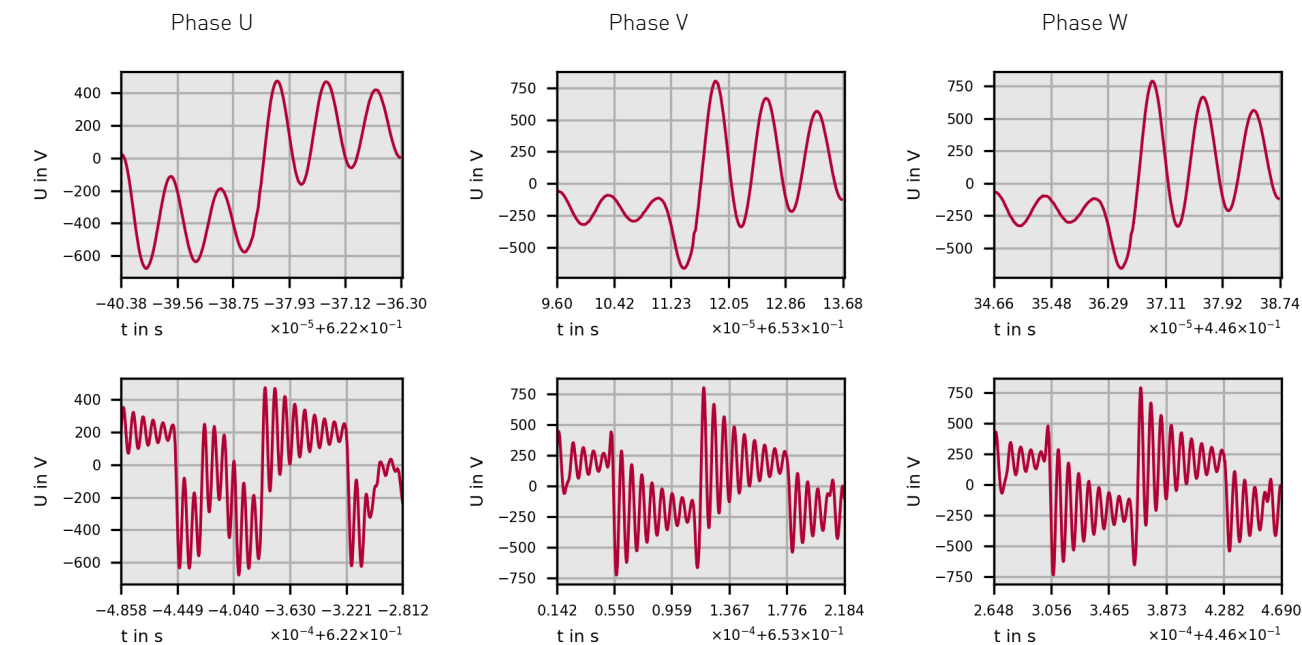


Voltage peak distribution

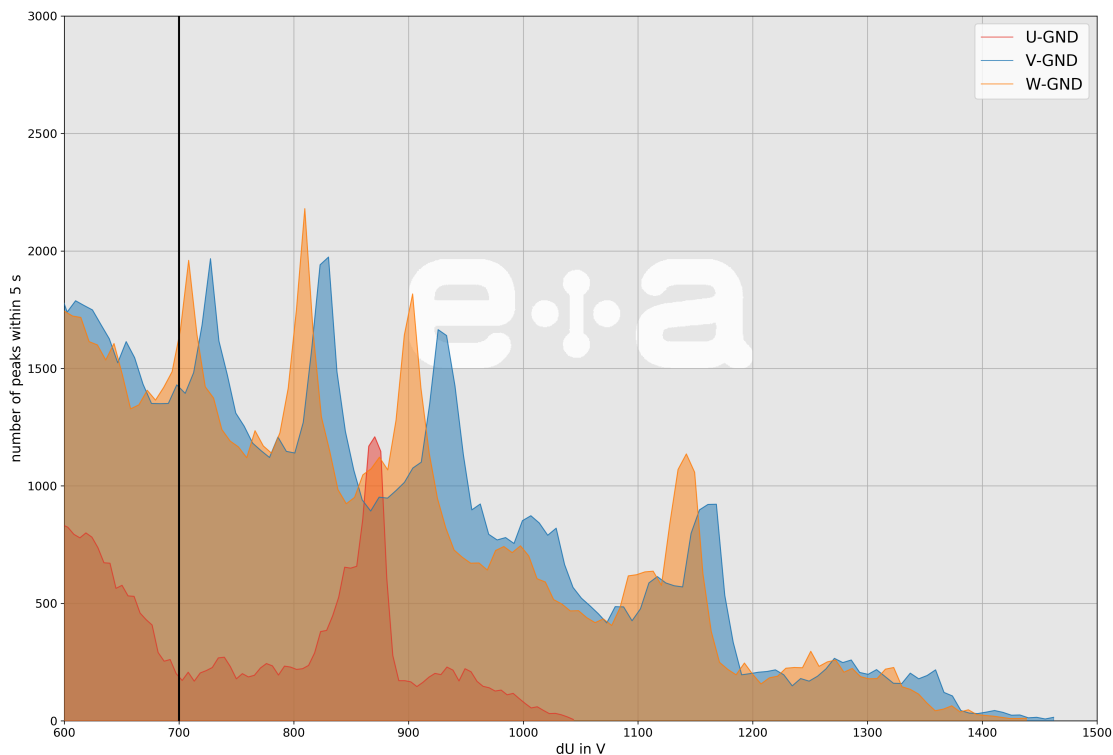


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Maximum voltage peak

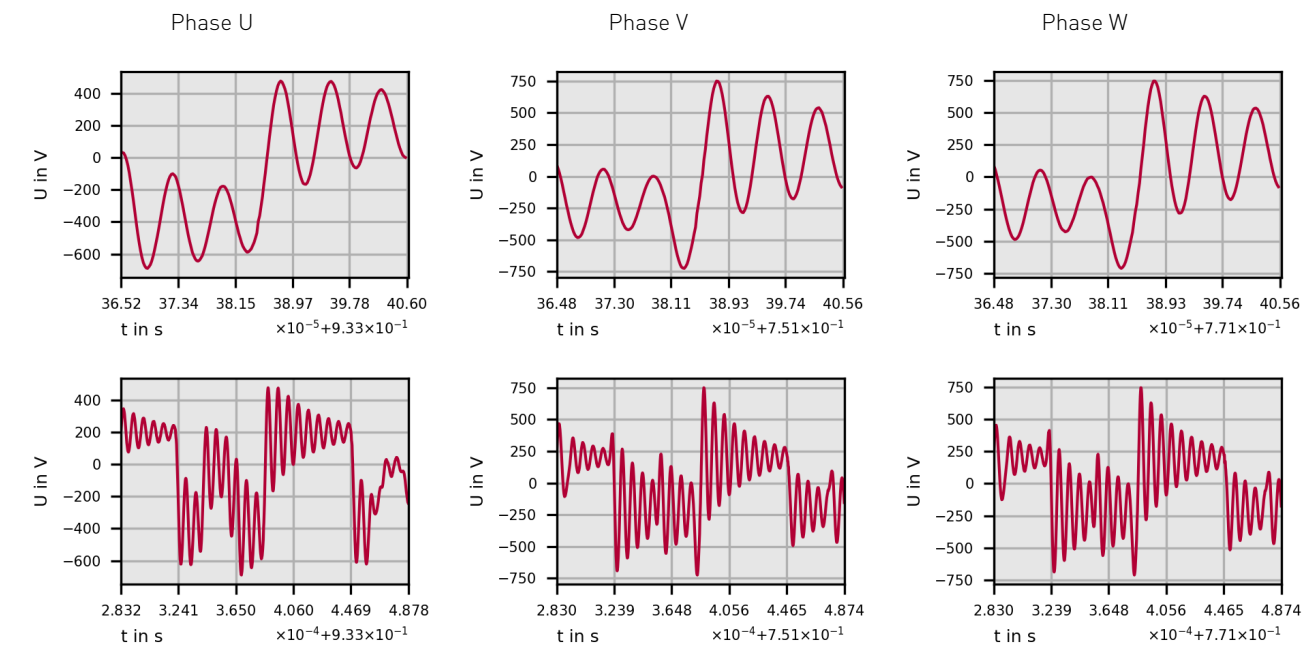


Voltage peak distribution

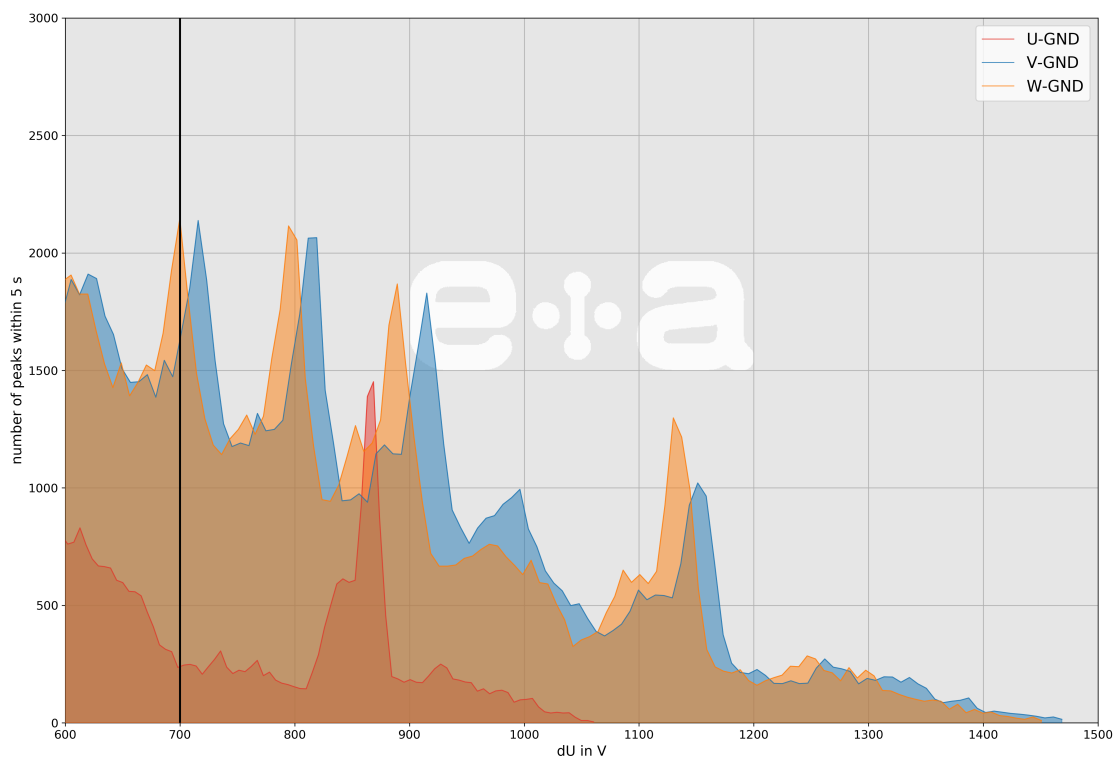


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Maximum voltage peak

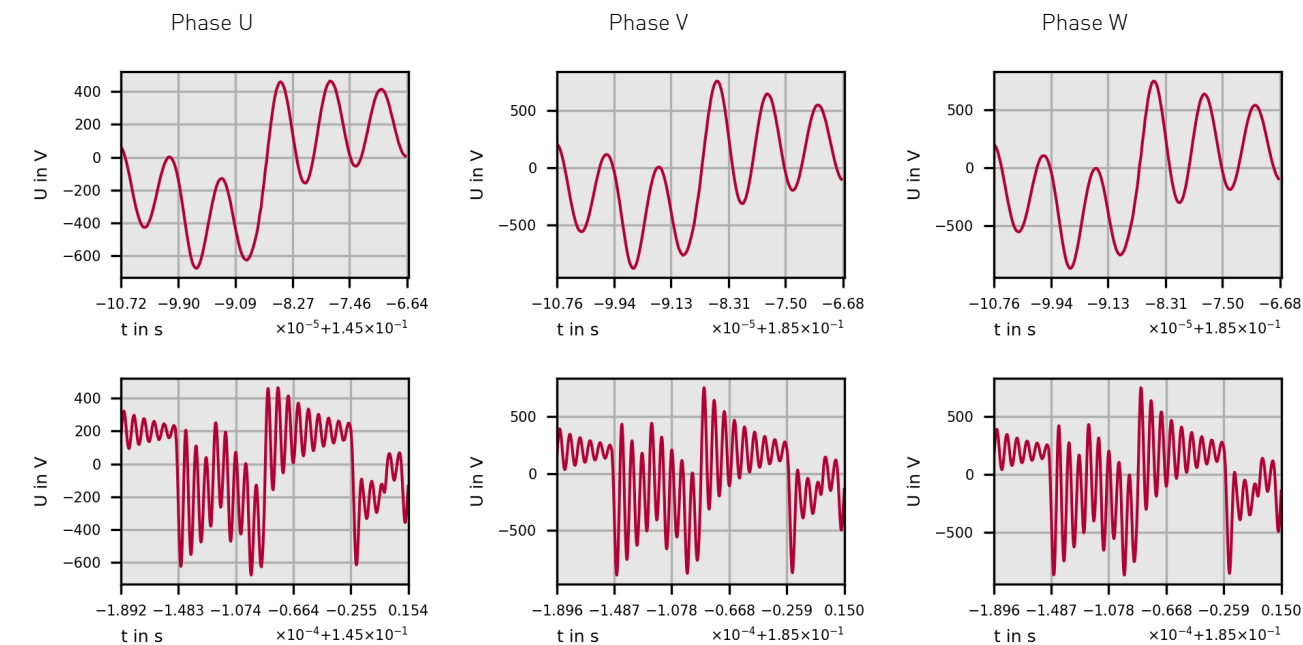


Voltage peak distribution

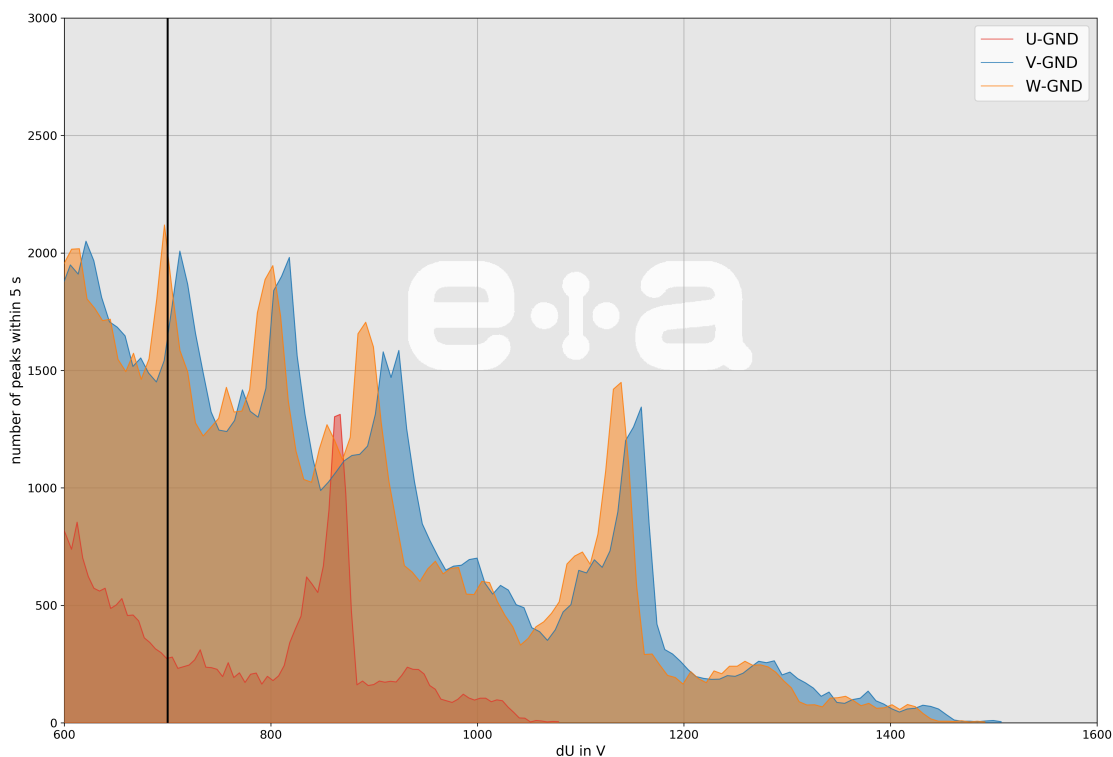


ANALYSIS DATA SET "Data_23-09-2020_at_13-17-04"

Maximum voltage peak

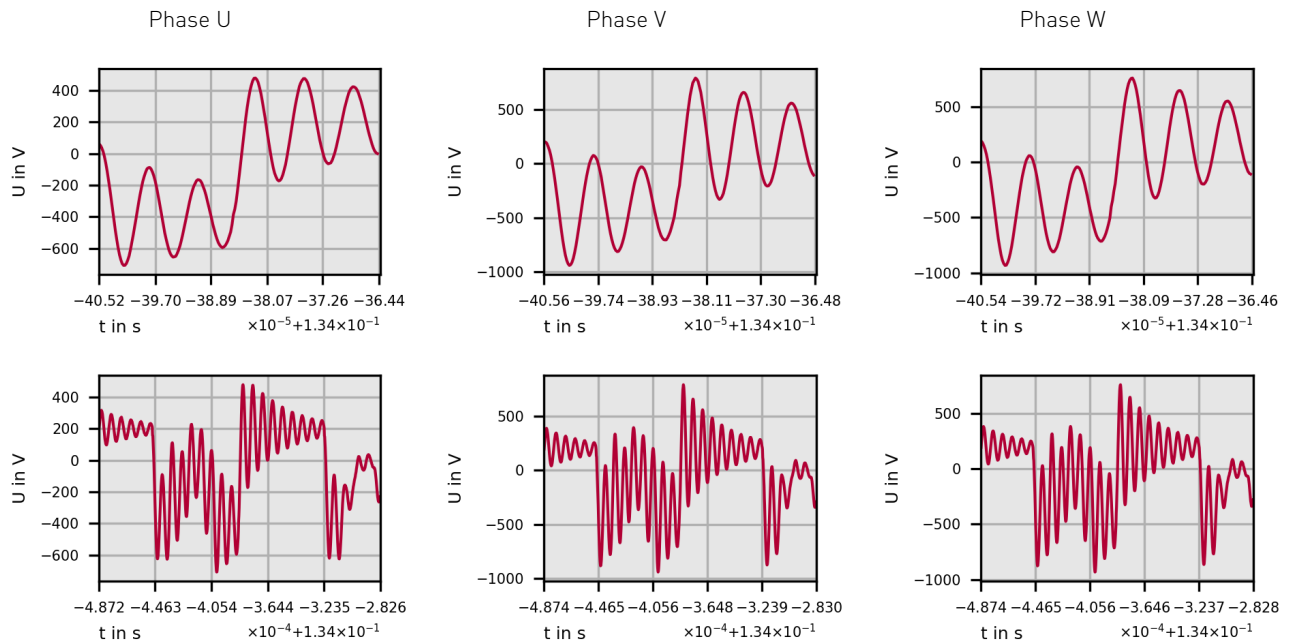


Voltage peak distribution

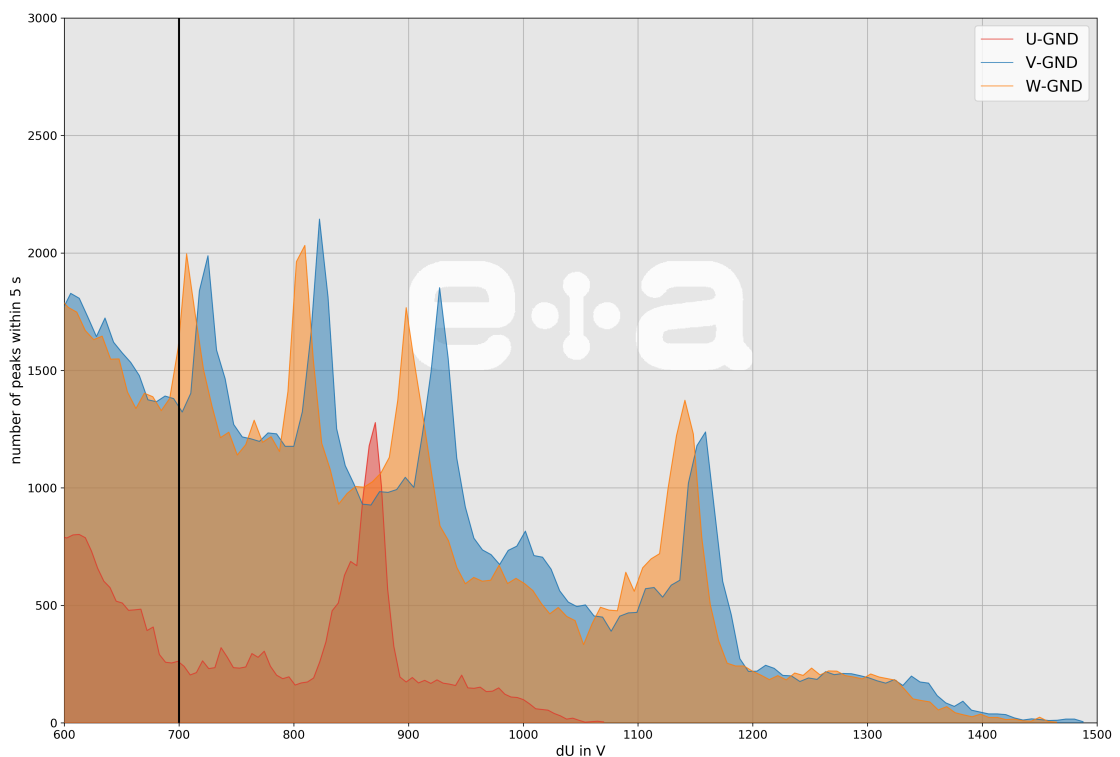


ANALYSIS DATA SET "Data_23-09-2020_at_13-59-39"

Maximum voltage peak

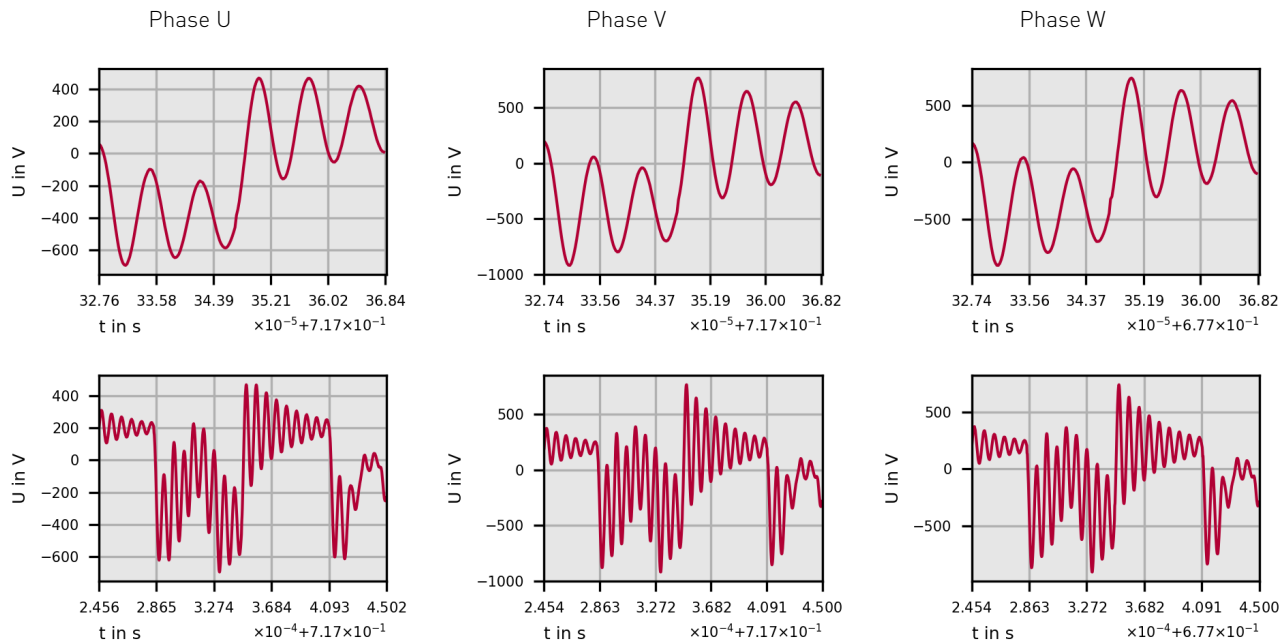


Voltage peak distribution

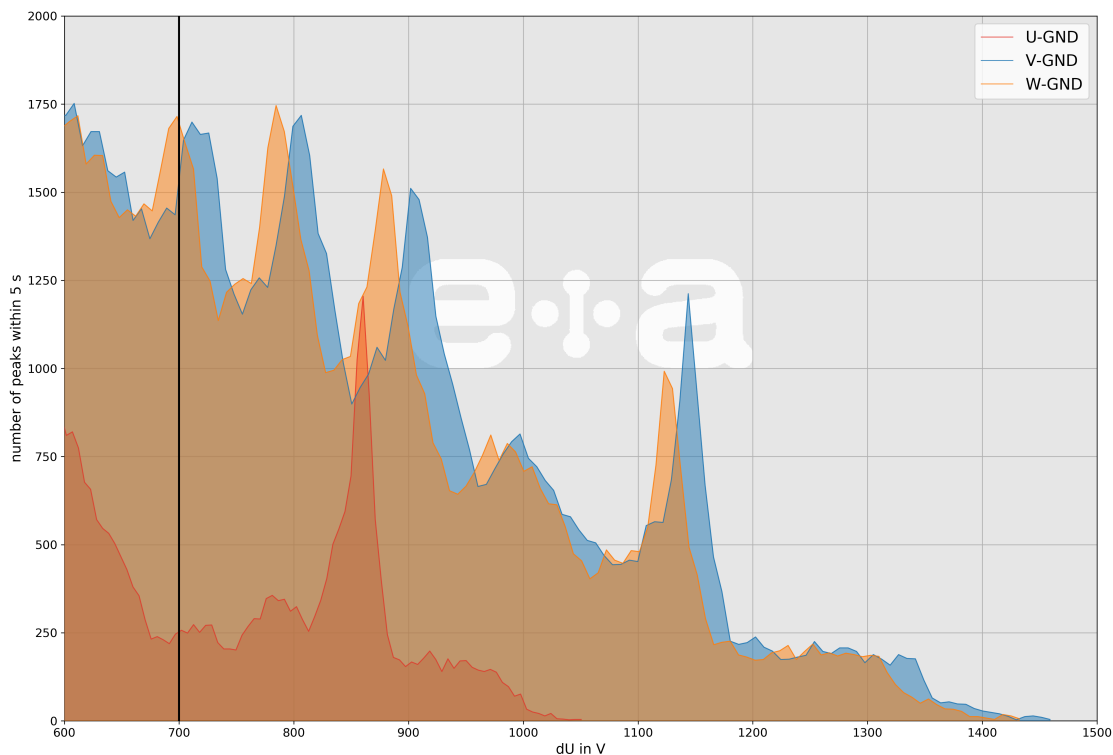


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Maximum voltage peak

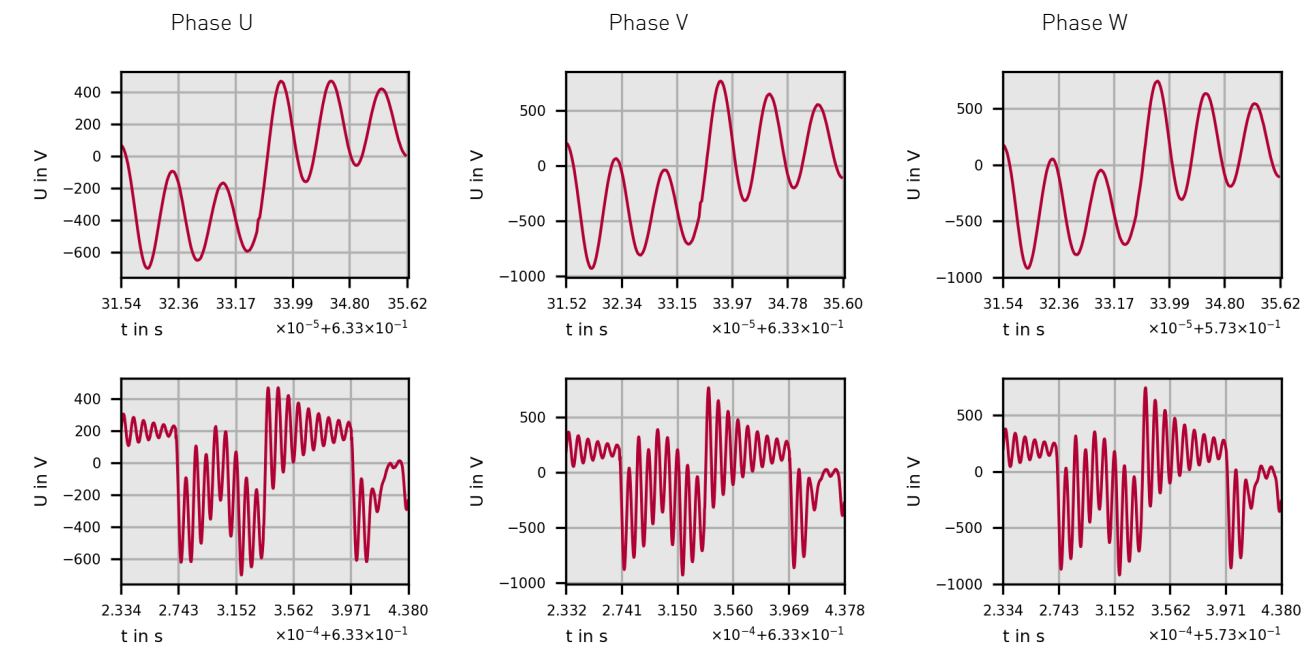


Voltage peak distribution

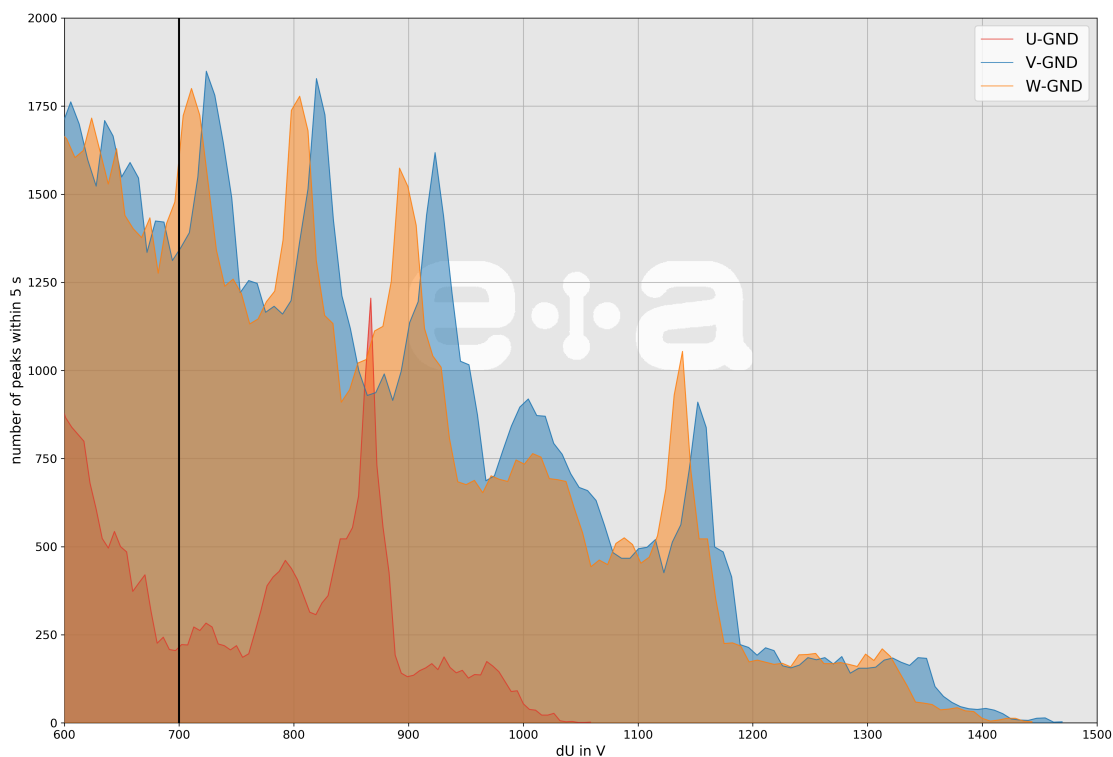


ANALYSIS DATA SET "Data_21-09-2020_at_08-31-01"

Maximum voltage peak

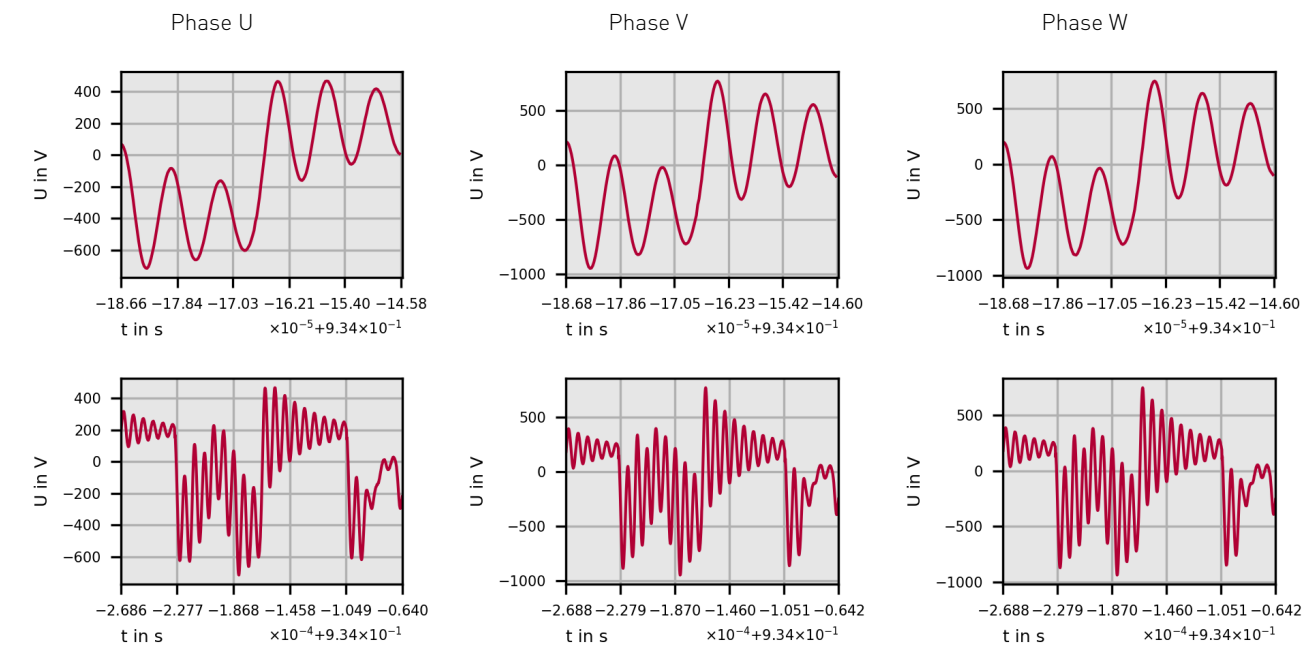


Voltage peak distribution

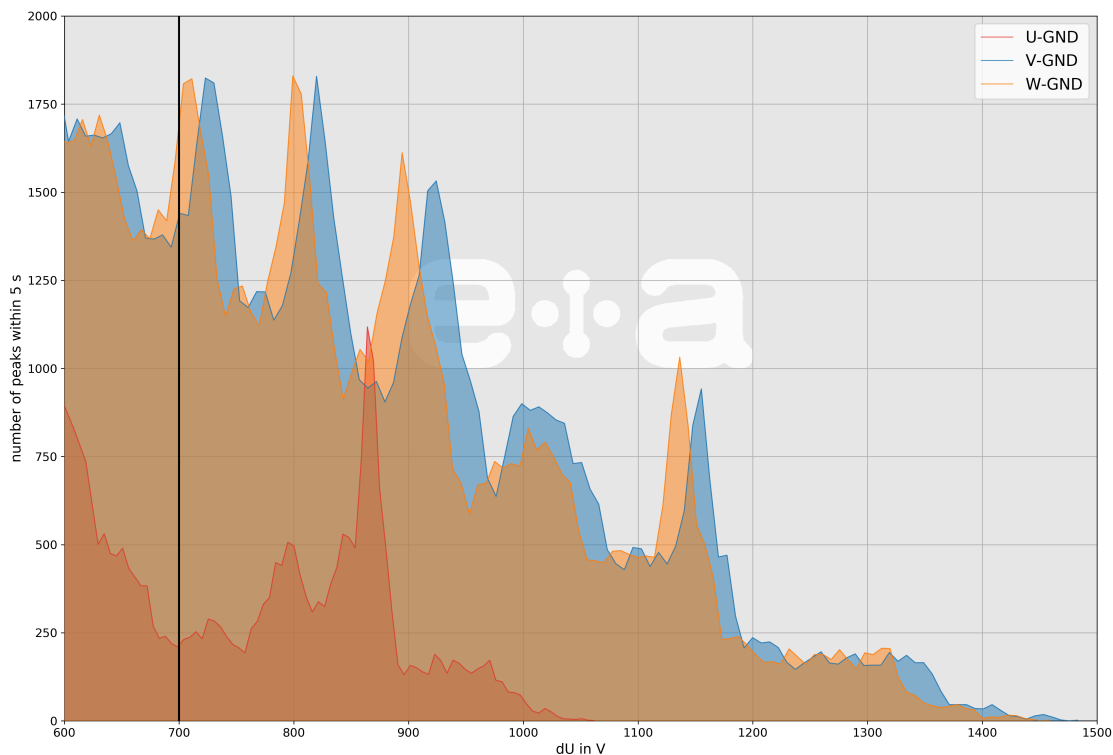


ANALYSIS DATA SET "Data_21-09-2020_at_08-31-02"

Maximum voltage peak

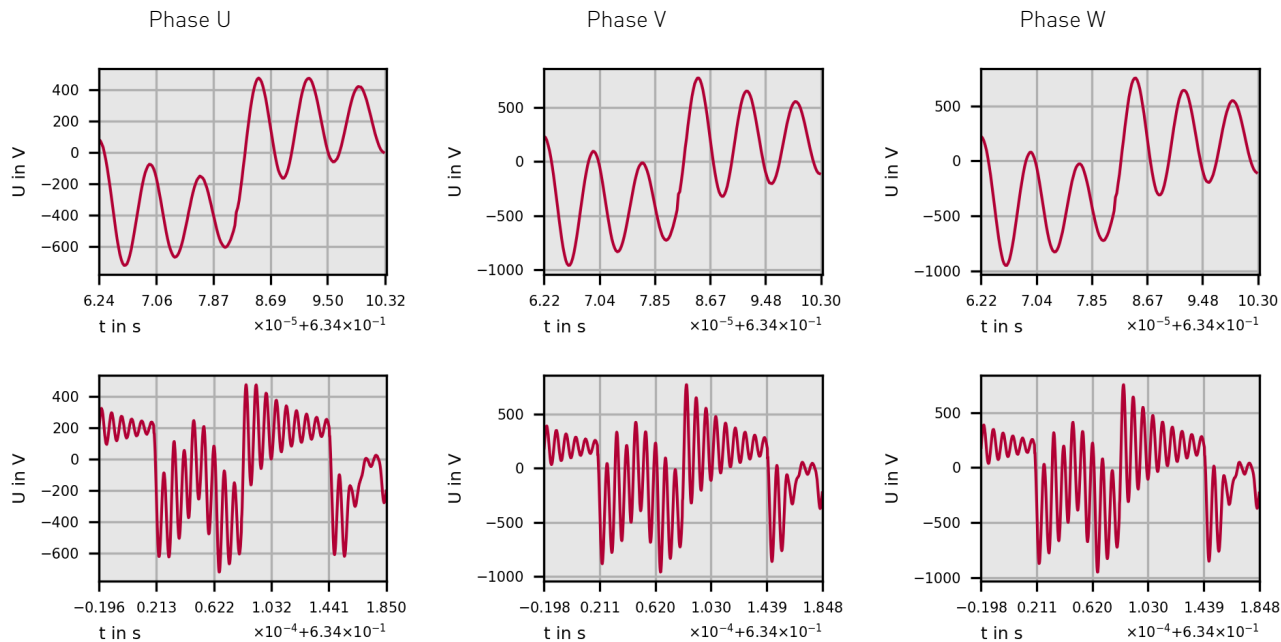


Voltage peak distribution

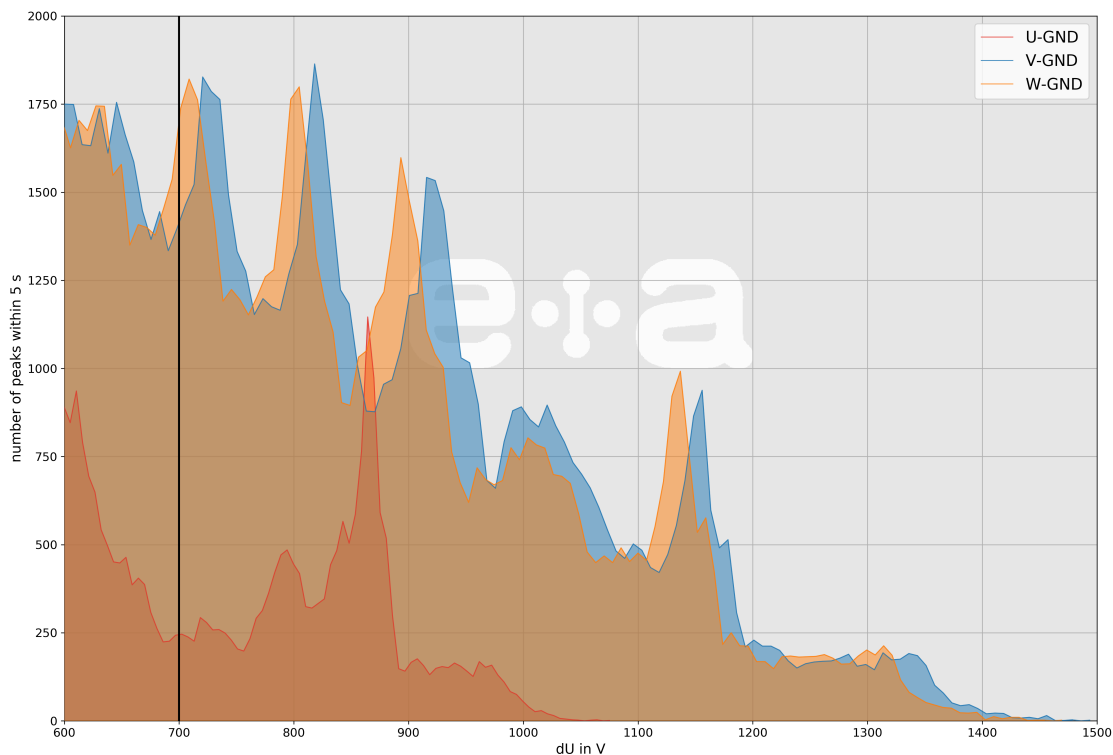


ANALYSIS DATA SET "Data_21-09-2020_at_08-31-03"

Maximum voltage peak

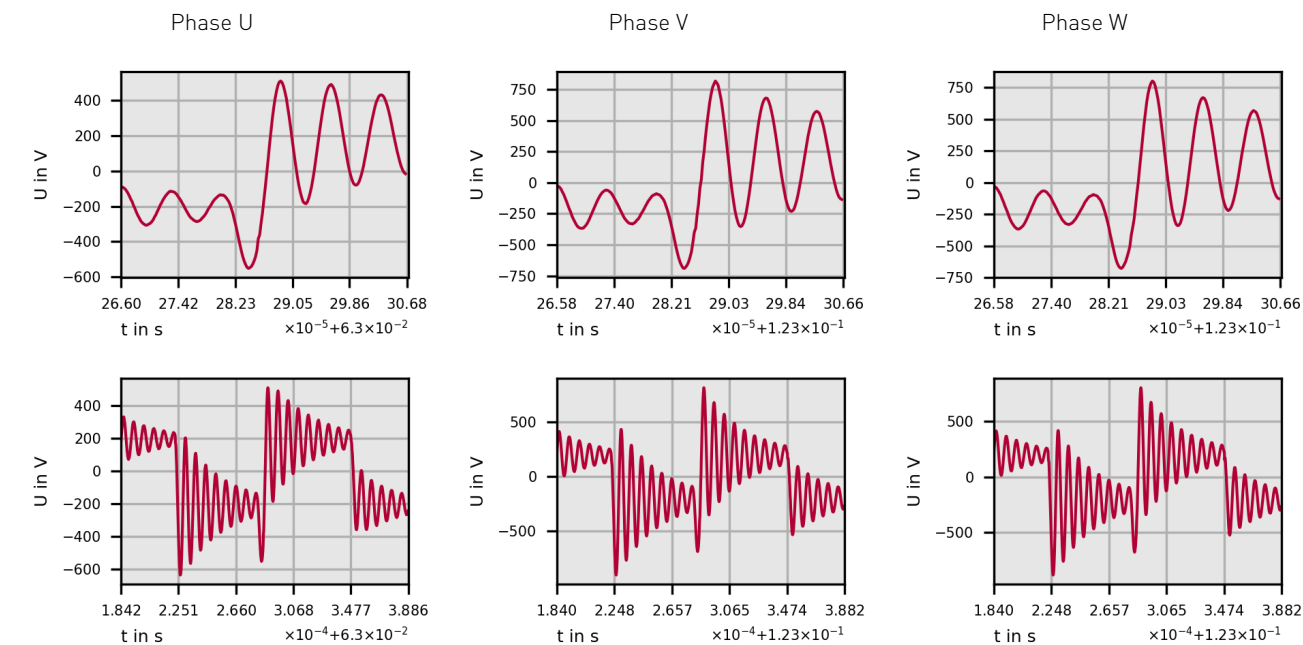


Voltage peak distribution

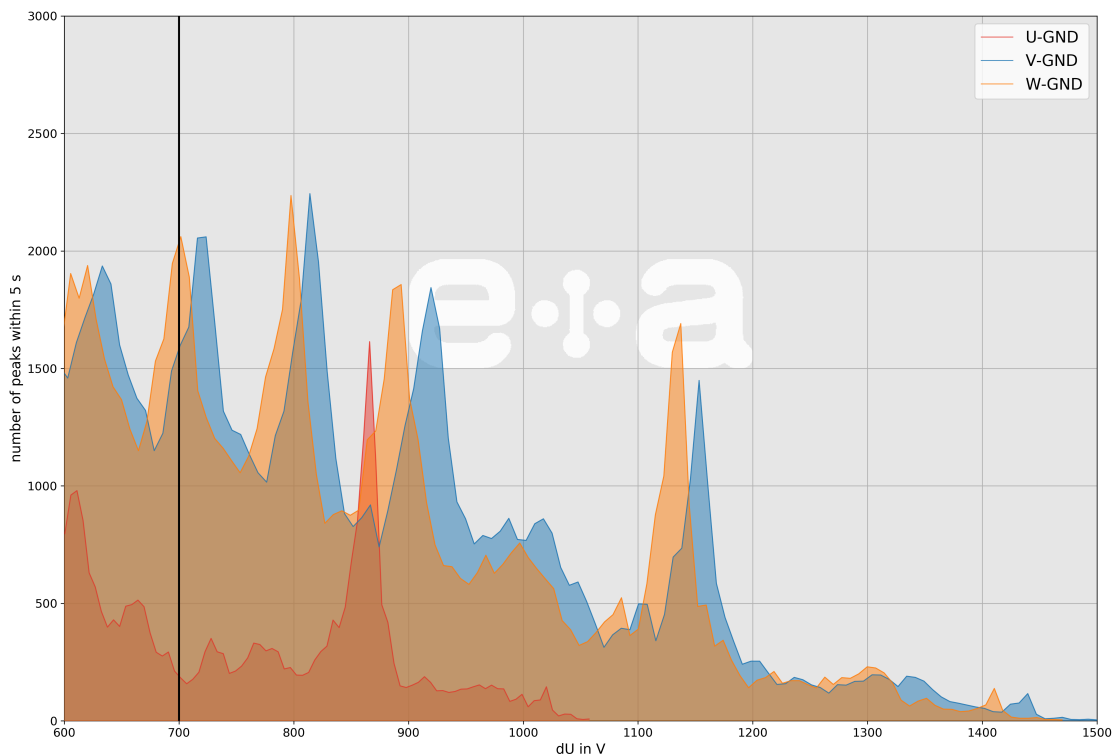


ANALYSIS DATA SET "Data_21-09-2020_at_08-55-47"

Maximum voltage peak

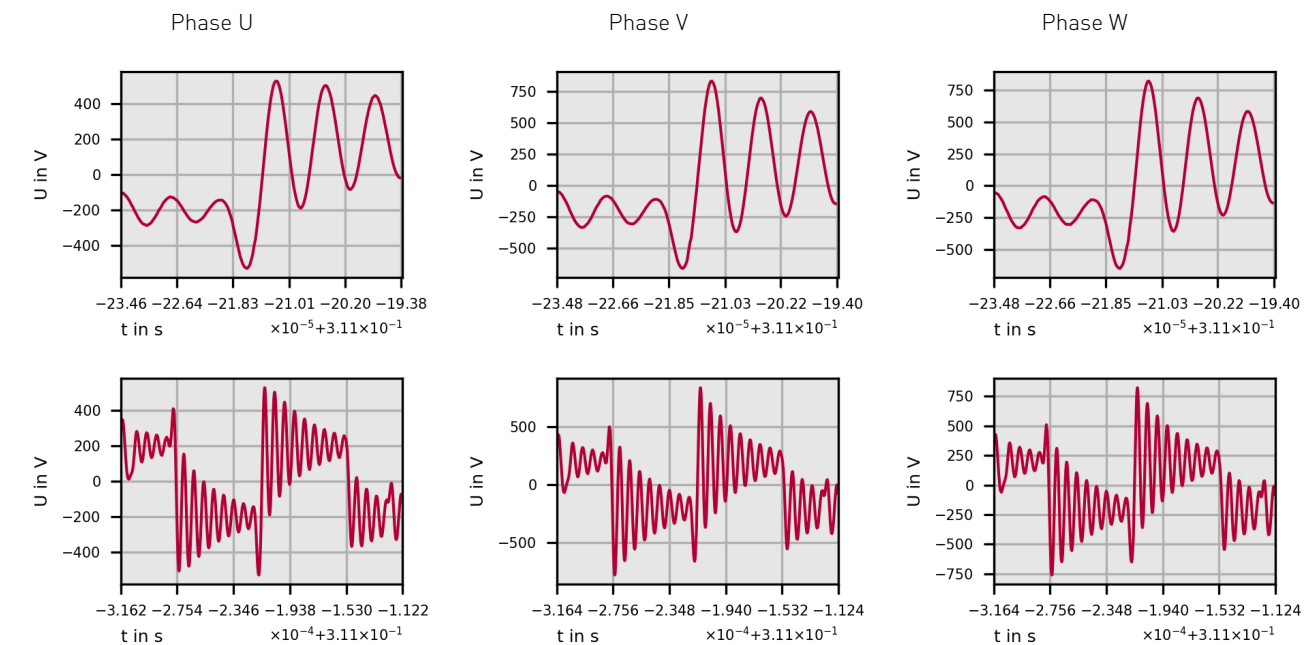


Voltage peak distribution

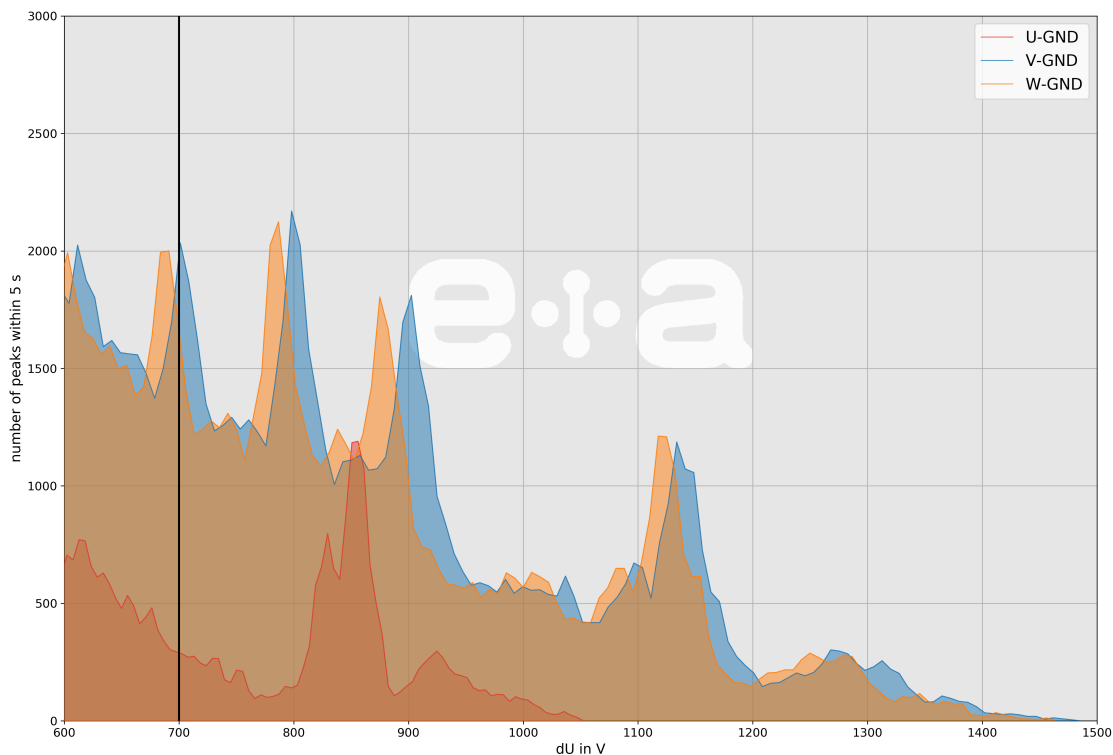


ANALYSIS DATA SET "Data_21-09-2020_at_14-50-22"

Maximum voltage peak

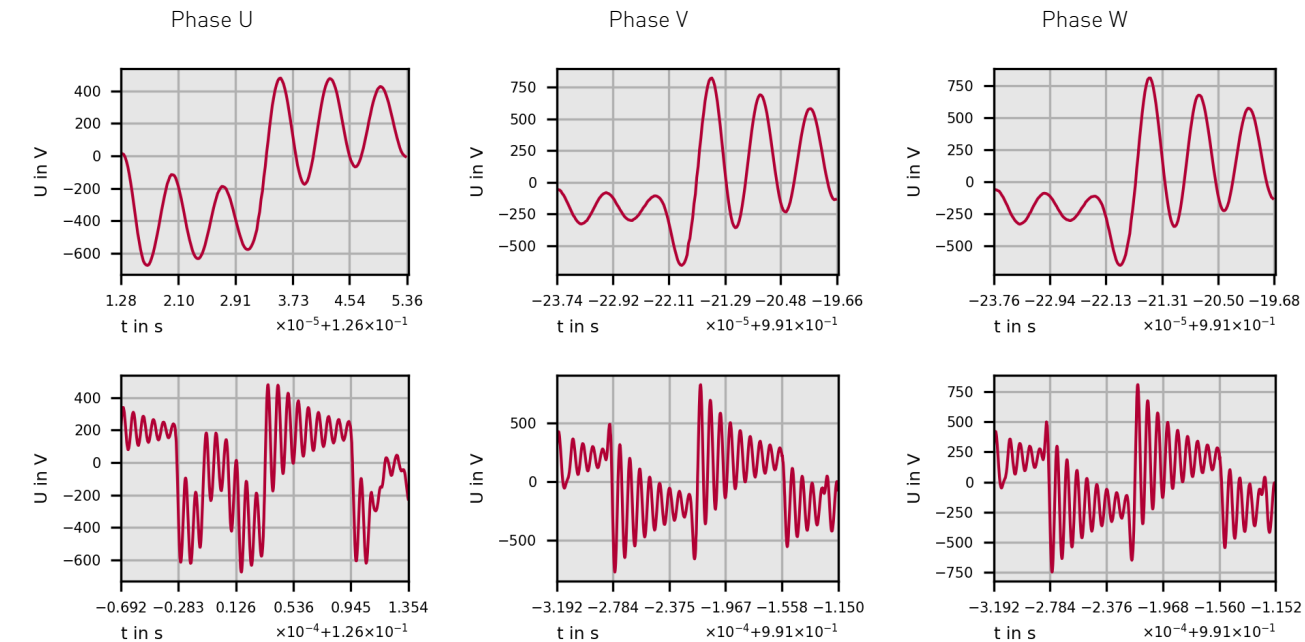


Voltage peak distribution

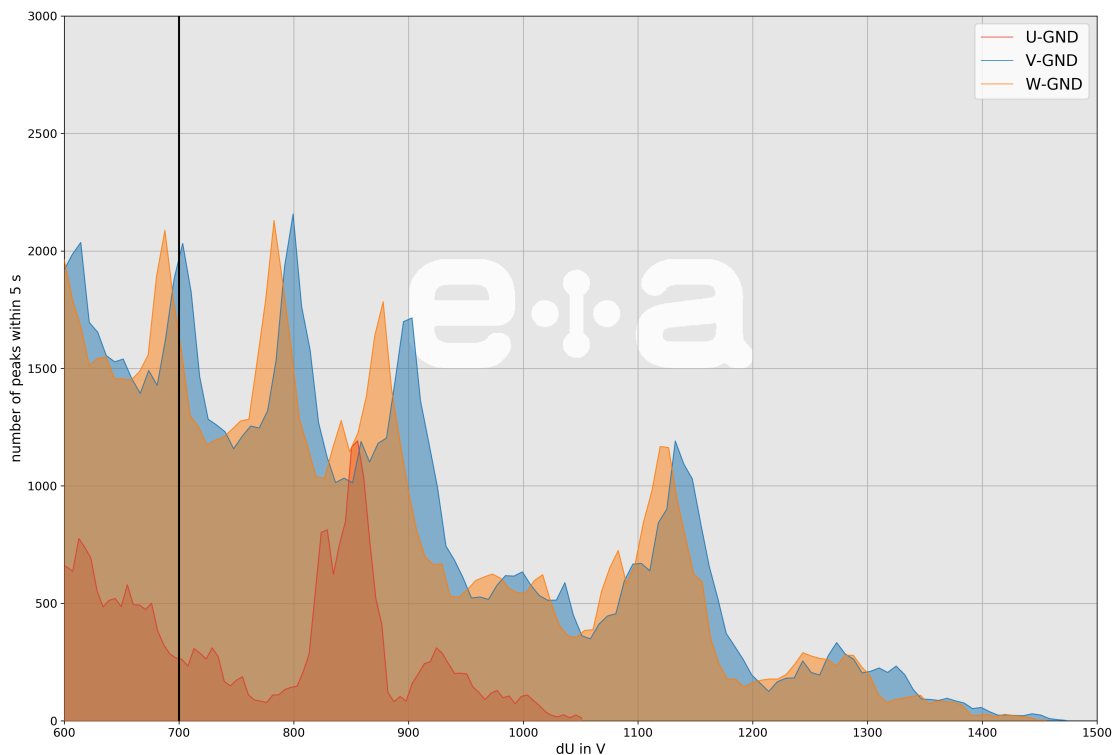


ANALYSIS DATA SET "Data_21-09-2020_at_14-50-30"

Maximum voltage peak

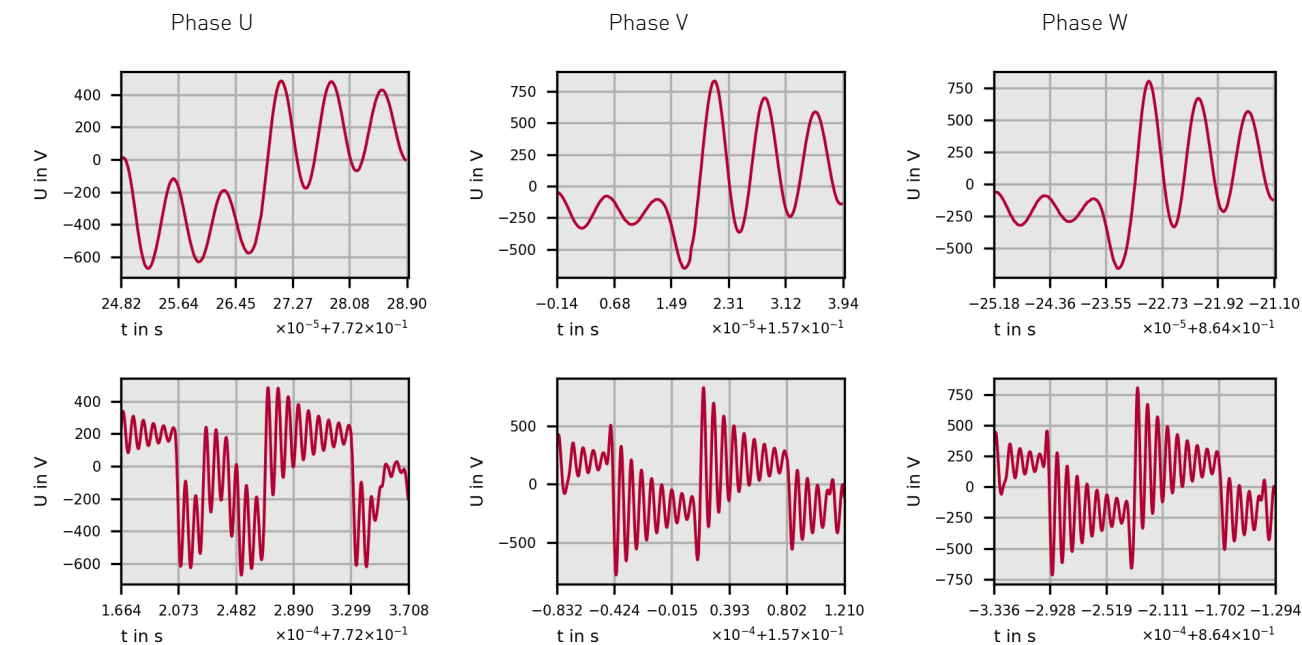


Voltage peak distribution

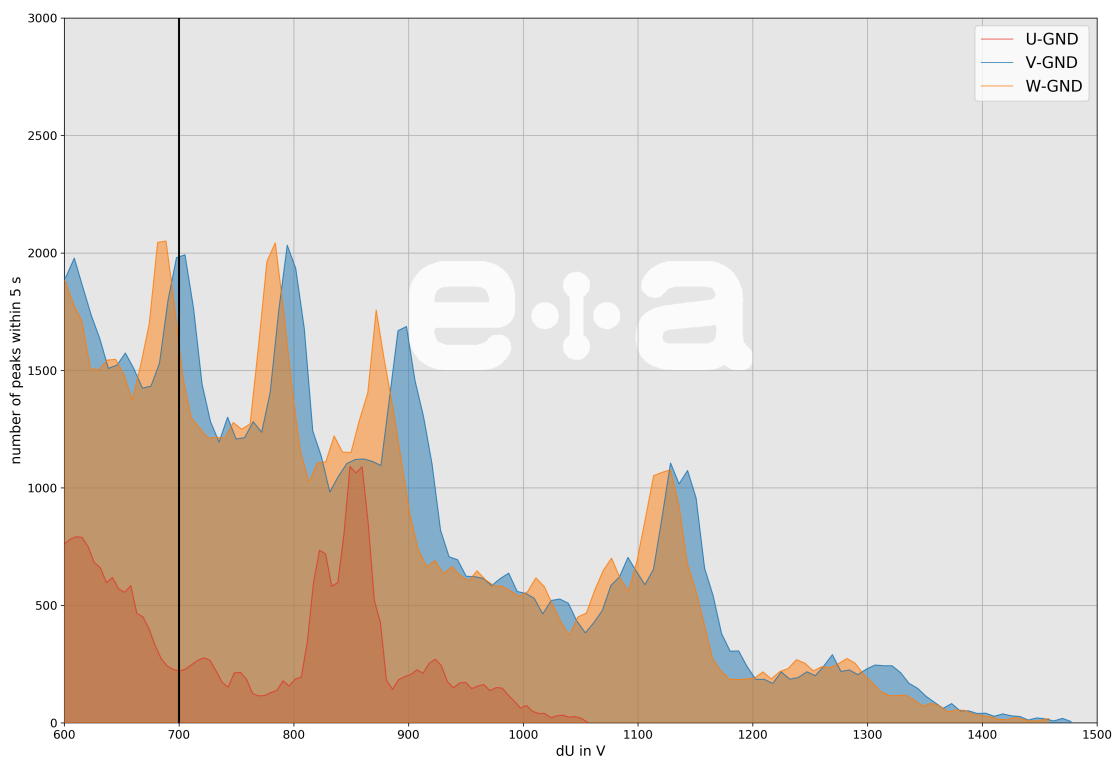


ANALYSIS DATA SET "Data_21-09-2020_at_14-51-17"

Maximum voltage peak



Voltage peak distribution



BRIEF TECHNICAL INFORMATION

e+a Stress Index



Date: 08/10/2020

Version: 1.1

1 Introduction

Besides thermal ageing of insulation systems as considered in standards, also relevant electrical ageing effects caused by today's common use of PWM converters with fast switching power semiconductors have an impact on insulation systems. Although these effects, originating from voltage peaks of switching operations in power semiconductors, have already been investigated in several scientific research studies since the nineties, binding test and evaluation methods have not been developed so far. The e+a stress index evaluates and summarizes all voltage peaks in the period under consideration with respect to step height and peak rise time. The goal of the e+a stress index is to:

- determine a summarizing stress value,
- predict the probability of a premature failure.

2 Measuring Signal

By default, e+a records voltage characteristics of U-Gnd, V-Gnd and W-Gnd over a period of 5 s. All recorded voltage steps are analysed individually. Figure 1 shows a sample voltage step.

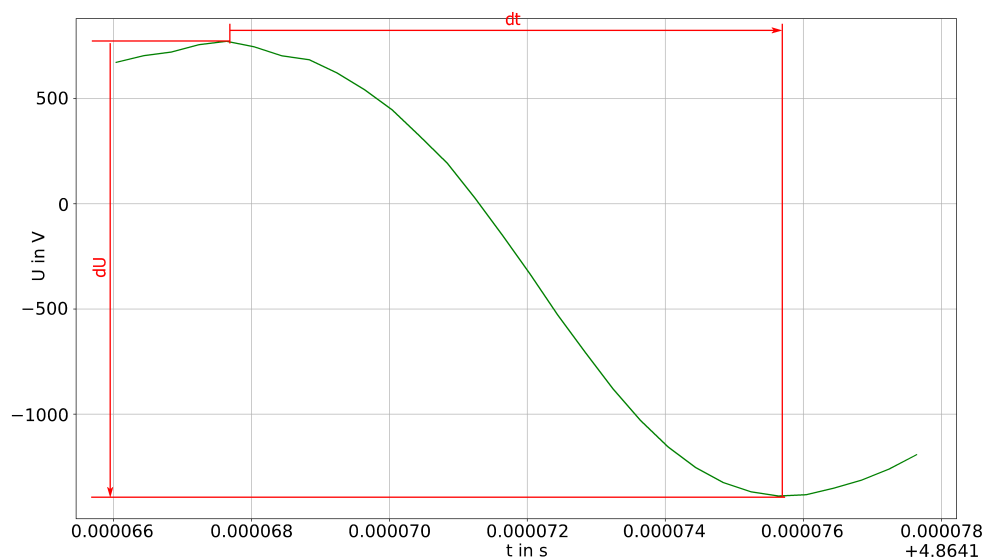


Figure 1: Sample voltage step

BRIEF TECHNICAL INFORMATION

e+a Stress Index



3 Calculation

Presently, the e+a stress index considers three important influencing factors:

- dU height of voltage step,
- dt peak rise time,
- n number of voltage steps,

leading to:

$$A_{e+a-load} = \frac{\sum_{i=0}^n f_{load}(dU_i, dt_i)}{A_{e+a-norm}}$$

The function f_{load} calculates a stress value for each voltage step. For

$$y = f_{Belastung}(dU_i, dt_i) \mid 0V < dU < 4000V \cap dt = \text{const.}$$

the resulting characteristics is shown in Figure 2.

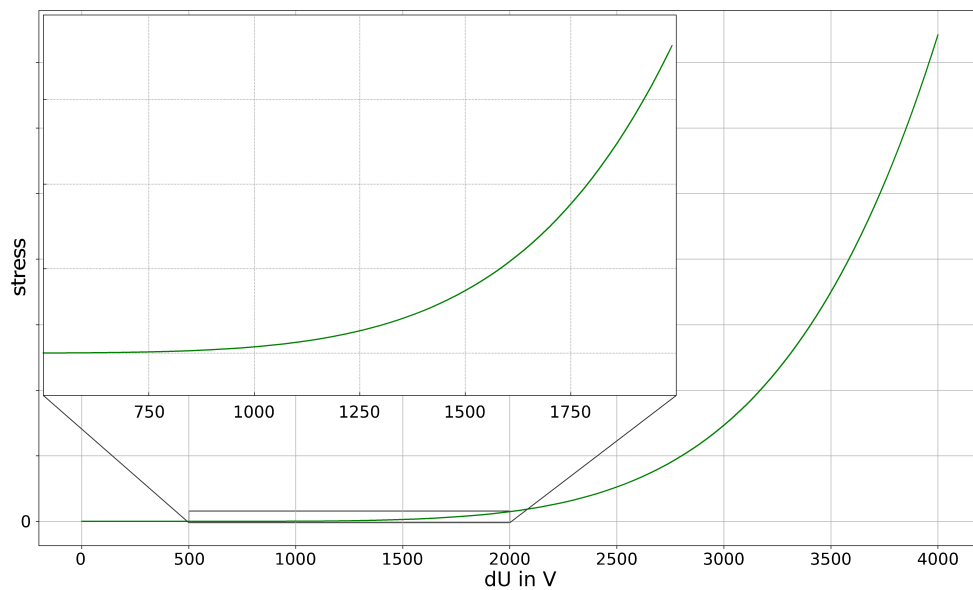


Figure 2: Influence of voltage step height on stress index

BRIEF TECHNICAL INFORMATION

e+a Stress Index



4 Evaluation

e+a evaluates the stress index according to Figure 3 as follows:

- green no premature failure of insulation system expected
- yellow elevated failure risk
- red extremely elevated failure risk

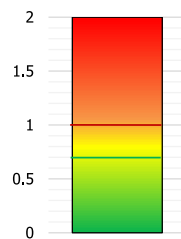


Figure 3: Scale for stress index

The evaluation is based on experiences with previous failures. Since the stress index is dependent on the operating point, the residence time at the respective operating point is another important aspect. According to today's state of knowledge, it is not possible to predict the operating time after which a failure caused by voltage peaks is to be expected for certain operating parameters. There exists no data base to predict the time to failure in dependency on the stress index.

The limits given in this info sheet are preliminary. e+a reserves the right to modify the limits based on new empirical values.