Test Report

Document No.	C3001262	Copy No.	1	Number of pages	41

Apparatus	Bayonet Fuse Holder
Designation	not specified
Serial Number	No.1; No.2; No.3 (assigned by CESI)
Manufacturer	THS Industria e Comercio Ltda. Rua Sargento Francisco Rodrigues da Rosa, 534 Cajuru do Sul - 18.105-008 Sorocaba – Brazil
Client	THS Industria e Comercio Ltda. Rua Sargento Francisco Rodrigues da Rosa, 534 Cajuru do Sul - 18.105-008 Sorocaba - Brazil
Tested for	---
Date(s) of tests	January 27, 2023
Tested by	CESI S.p.A. Via Rubattino, 54 20134 Milano – Italy
Test performed	Dielectric tests: - Lightning impulse voltage test; - Power-frequency voltage test.

The apparatus, constructed in accordance with the description, drawings and photographs incorporated in this document has been subjected to the series of proving tests in accordance with:

Client's requests

The results are shown in the record of proving tests and the oscillograms attached hereto. The ratings assigned by the Manufacturer are listed on the ratings page.
The document applies only to the apparatus tested. The responsibility for conformity of any apparatus having the same designations with that tested rests with the Manufacturer.

January 27, 2023

Date	Del Giorgio Carlo C3001262 2969 AUT Test Engineer in charge	The Manager - Verhoeven Bas C3001262 3482248 APP Approved by

Notes

STL-Member

CESI Group members are founder members of the SHORT-CIRCUIT TESTING LIAISON (STL) which has been established in 1969. STL is a forum for voluntary international cooperation of testing organizations.

CESI Group Test Documents description

STL Type Test Certificate of .....

Issued for type tests of high voltage products (> 1 kV_{ac}; > 1,5 kV_{dc}), which have successfully been carried out in full compliance with the relevant specifications or standards and STL Guides valid at the time of the test. The STL Type Test Certificate consists of documents unequivocally identifying the test object and describes all conditions under which the tests were conducted. It gives evidence of the unobjectionable behavior of the test object during the tests in line with the normative documents applied as well as of the results of successful testing.

Type Test Certificate of .....

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Test Certificate of (complete / selected) Type Tests

Issued if type tests of low voltage products (< 1 kV_{ac}; < 1,5 kV_{dc}) requested by the relevant product standard were passed. For these tests the equipment under test must be clearly identified by technical description, drawings, and additional specifications.

Certificate of Design Verification

Issued for passed design verification tests according to IEC 61439. For these tests the equipment under test must be clearly identified by technical description, drawings, and additional specifications.

Type Test Report

Issued for high and low voltage products if parts of selected type tests have been passed; those shall be carried out in full compliance with the relevant standards but (for high voltage products) do not fulfill all STL requirements for issuing a Type Test Certificate. For these tests the equipment under test must be clearly identified by technical description, drawings, and additional specifications.

Test Report

Issued for all other tests on high and low voltage products which have been carried out according to specifications, standards and/or client instructions

On-Site Test Record

Issued as a record of results acquired during the on-site tests / measurements

Test Award

Can be additionally issued for all named types of test documents above if the tests to be referenced were passed

Tests witnessed by:

Identification of the object: not requested

Test evaluation

IEC / Sub-clause	Test	Test result
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The decision rule in conformity assessment is based on the simple acceptance method according to ILAC-G8: 09/2019.		

Revision No.	Date	Reference	List of modifications and reasons
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The data necessary to permit repetition of the tests are contained in the document marked: -----

The reported expanded uncertainties are determined in accordance with the Publication JCGM 100 “Evaluation of measurement data - Guide to the expression of uncertainty in measurement” and are based on a standard uncertainty multiplied by a coverage factor k = 2, which for a normal distribution provides a level of confidence of approximately 95 %.

Peak voltage (impulse tests)	± 3,0 %		
Voltage a.c., d.c. (dielectric tests)	± 3,0 %		
Peak current (impulse tests)	± 3,0 %		
Time parameters (impulse tests)	± 10 %		
Time parameters (a.c., d.c. dielectric tests)	± 1,5 %		
Partial discharge measurement	up to 10 pC: ± 1,0 pC	above 10 pC: ± 10 %	
Atmospheric conditions:			
Temperature; Pressure; Absolute humidity;	± 1,0 °C;	± 2,0 hPa;	± 1 g/m^3

Laboratory information

Receipt date of the sample	January 27, 2023 (the apparatus under test has been verified as received)
Test location	CESI S.p.A. - Via Rubattino 54 - 20134 Milan - Italy
CESI testing team	Mr M. Folchini – Mr N. Venezia – Mr L. Francesco
Test laboratory	P180 (100 kJ)
ODV	7000006419

Rated characteristics of the tested object assigned by the Client

Bayonet Fuse Holder	
Manufacturer	THS Industria e Comercio Ltda.
Type	not specified
Serial No.	1 – 2 – 3 (assigned by CESI)
Voltage (U_r)	35 kV
Lightning impulse withstand voltage	150 kV_{peak}
Power-frequency withstand voltage	80 kV_{rms}
Frequency	not specified
Current	not specified

Test requirements, development and results

Dielectric test are to be performed on three test samples as provided by the Client, according to the following instructions and specifications:
Power frequency withstand voltage test at 80 kV;
Lightning impulse withstand voltage test (three successive impulse of both positive and negative polarity at 150 kV).

Each sample in turn was placed inside a plastic tank containing about 40 litres of mineral oil having 89,7 kV of dielectric breakdown voltage at power frequency, measured according to IEC 60156 (electrode gap = 2 mm).

The tests were performed applying the voltage on the terminals with the metallic layer of the cap connected to the earth (see photo No.9 and No.10).

NOTE: the client did not provide the fuse cartridges therefore, the test laboratory connect, by means a copper wire, the metallic side of the internal insulating piece with the external terminals (see photo No.7 and No.8)

Lightning impulse voltage test

For each test condition, the bayonet fuse holder was submitted to three voltage applications of positive polarity and three voltage applications of negative polarity at the required voltage of 150 kV.
The waveform of the impulses was the standard 1,2/50 μs impulse voltage in accordance with IEC 60060.

No flashover or breakdown occurred during the test.
Therefore **the test is PASSED.**

Power-frequency voltage test

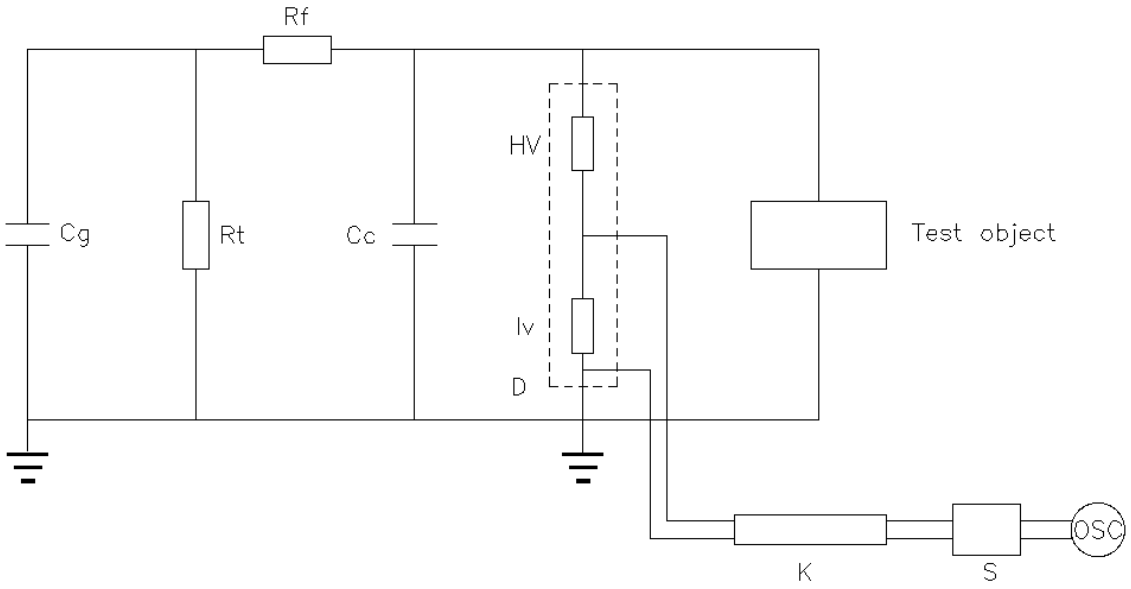
The test was performed with a single-phase alternating voltage in accordance with IEC 60060, at the required voltage of 80 kV_{rms}. The duration of each test application was 60 s.

The voltage waveshape was comply with the requirements of IEC 60060-1 subclause 6.2.1.1:
It was approximate to a sinusoid with the difference of the magnitudes of the positive and negative peak values less than 2 %. The ratio of peak to r.m.s. values was equals √2 within ±5 %.

No flashover or breakdown occurred during the test.
Therefore **the test is PASSED.**

Circuit A0002

Impulse generator



No. of stages: 2
C_g: 250 nF
R_t: 240 Ω (2//200 Ω + 1x140 Ω)
R_f: 380 Ω (2x140 Ω + 1x60 Ω + 1x40 Ω)
C_C: ---- nF (not used)

Voltage measuring system CESI No. 9792
D - divider PASSONI & VILLA type RC series CESI No.06700; scale factor 2910
HV - high voltage capacitance 600 pF
lv - low voltage unit CESI No.06704 (C=1620 nF; R_s=0,147 Ω)
K - coaxial cable
S - attenuation and termination unit CESI No. 14924 (not used)
OSC - digital oscilloscope LECROY HDO6034; CESI No.58202
Data acquisition and calculation software for impulse waveshape PANDA rel. 8.3 January 2021

	Measured waveshape		
	polarity	time μs	oscillogram No.
front	positive	1,21	1
tail		48,1	2

	Check of the test circuit		
	Charging voltage V_c	Measured voltage V_m	η $V_m / (V_c \cdot n_{stages})$
polarity	kV/stage	kV	
positive	62,7	119,7	0,955

Additional measurements:
Atmospheric conditions Data logger E+E ELEKTRONIK type HUMLOG 20 CESI No.58065
Correction factor Software Fattori UR REL rel 3.1 January 2016

Lightning impulse voltage test

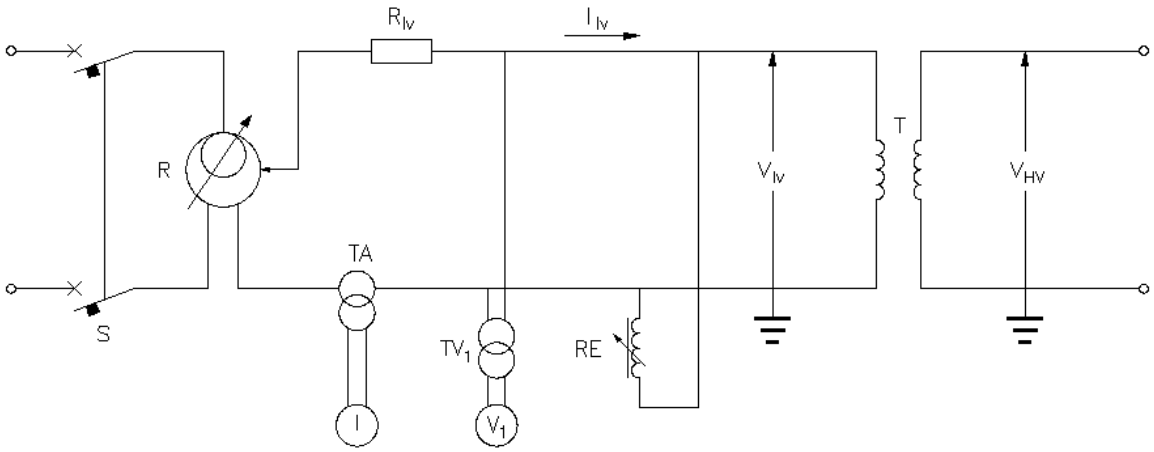
Test object: Bayonet Fuse Holder
Test circuit: A0002
Arrangement: see photographs from No.7 to No.14

Atmospheric conditions and correction factor			
b	t	h	K_t
kPa	°C	g / m^3	
100,01	14,9	4,7	1,000

Date: January 27, 2023

test sample No.	polarity	impulse generator charging voltage kV/stage	voltage required U (*) kV_{peak}	voltage applied U x K_t kV_{peak}	A: (o) withstand (x) flashover B: oscillogram No. C: peak voltage [kV] D: time to discharge (µs)			
1	positive	78,5	150,0	150,0	A	o	o	o
					B	03	04	05
					C	149,8	149,5	149,9
					D			
	negative	78,3	150,0	150,0	A	o	o	o
					B	06	07	08
					C	150,0	150,1	150,2
					D			
2	positive	78,8	150,0	150,0	A	o	o	o
					B	10	11	12
					C	149,8	149,9	149,8
					D			
	negative	78,4	150,0	150,0	A	o	o	o
					B	13	14	15
					C	150,1	149,9	150,0
					D			
3	positive	78,7	150,0	150,0	A	o	o	o
					B	17	18	19
					C	150,0	149,8	149,8
					D			
	negative	78,3	150,0	150,0	A	o	o	o
					B	20	21	22
					C	150,0	149,7	150,0
					D			

Circuit A0058



R - regulation group PIVI composed by:
- single-phase voltage converter PIVI; power 210 kVA; voltage 380 V/0÷610 V
- booster transformer PIVI; power 200 kVA; voltage 600 V /6 kV

R_{lv} - protection resistor TELEMA; R= 2 Ω

TA - current transformer type CGS; ratio 50 A/5 A; CESI No.33277

I - direct reading digital ammeter

TV_1 - voltage transformer type ALSTOM; ratio 6 kV/100 V; CESI No.33276

V_1 - digital voltmeter FLUKE type 8842A; CESI No.05735

RE - variable reactor (not used)

T - booster transformer CGE mod. KOC; secondary winding power 700 kVA; voltage 6 kV /350 kV; ratio 58,33

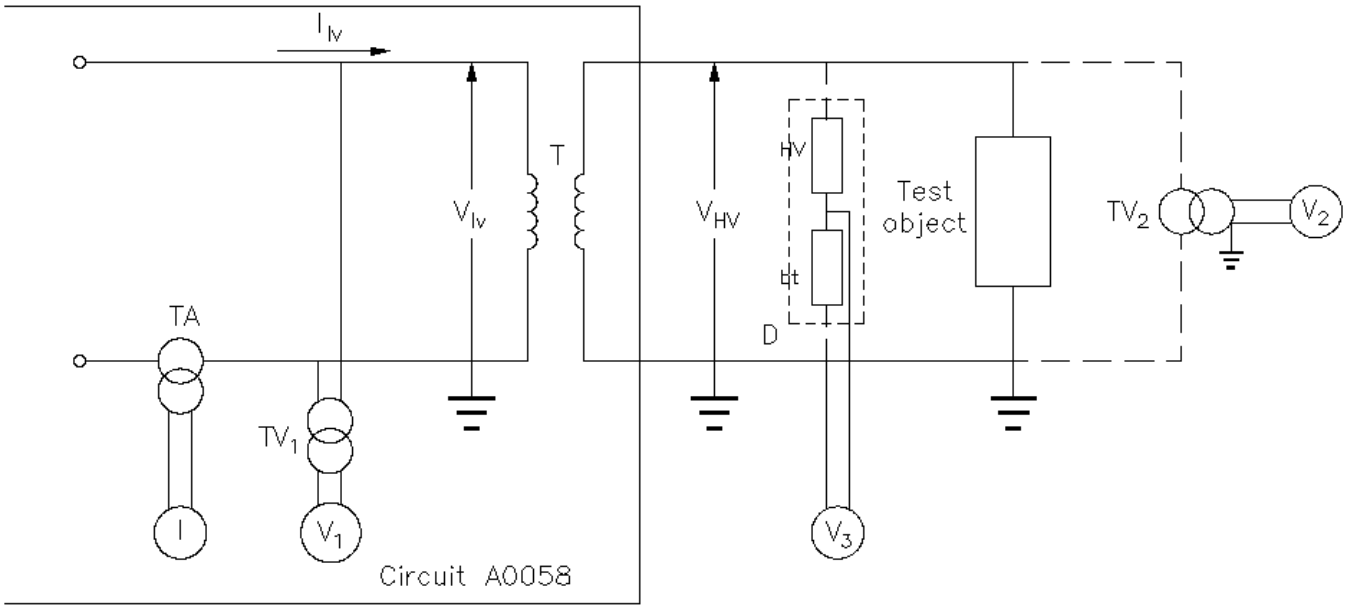
Additional measurements:

Atmospheric conditions	Data logger E+E ELEKTRONIK type HUMLOG 20 CESI No.58065
Correction factor	Software Fattori UR REL rel 3.1 January 2016
Time duration	Stopwatch CDC ELETTROMECCANICA type TDN46, CESI No.38203

Tripping of the circuit breaker S

I_N	k_{TA}	setting of instantaneous tripping			setting of time delayed tripping		
		s_1	$s_1 \bullet k_{TA} \bullet I_N$	t_1	s_2	$s_2 \bullet k_{TA} \bullet I_N$	t_2
A	A/A		A	s		A	s
5	10	1	50	0,05	0,5	25	0,05

Circuit A0059



TA - current transformer type CGS; ratio 50 A/5 A; CESI No.33277
I - direct reading digital ammeter
TV_1 - voltage transformer type ALSTOM; ratio 6 kV/100 V; CESI No.33276
V_1 - digital voltmeter FLUKE type 8842A; CESI No.05735

D - divider PASSONI & VILLA type RC series CESI No. 6700; scale factor $k_D = 2930$
HV - high voltage capacitance 600 pF
lv - low voltage unit CESI No. 6704
K - coaxial cable
S - attenuation and termination unit CESI No. 14924
V_3 - digital voltmeter AGILENT type 34401A; CESI No.55077

TV_2 - voltage transformer (not used)
V_2 - digital voltmeter (not used)

Functional check of the test circuit Date: January 27, 2023

Low voltage				High voltage				k_t
				k_2 = ----		k_D = 2930		
V_1	V_{lv}	I	I_{lv}	V_2	V_{HV}	V_3	V_{HV}	V_{HV} / V_1
V	V	A	A	V	kV	V_{peak}	kV_{peak}	ktheo = 3500
22,161	1329,7	--	1,0	--	--	26,464	77,54	3499

Power-frequency voltage test

Test object: Bayonet Fuse Holder

Test circuit: A0058 – A0059

Arrangement: see photographs from No.7 to No.14

Atmospheric conditions and correction factor			
b	t	h	K_t
kPa	°C	g / m^3	
100,01	14,9	4,7	1,000

Date: January 27, 2023

Test sample No.	Voltage required U kV_{rms}	Voltage applied U x K_t kV_{rms}	Test voltage V_3 V_{rms}	Test voltage $V_{HV} = k_D V_3$ (k_D = 2930) kV_{rms}	Test duration s	Test result	Oscillogram No.	Notes
1	80,0	80,0	56,57	80,0	60	withstand	9	the oscillogram show the last 200 ms of the test duration
2	80,0	80,0	56,57	80,0	60	withstand	16	
3	80,0	80,0	56,57	80,0	60	withstand	23	

The voltage waveshape was comply with the requirements of IEC 60060-1 subclause 6.2.1.1:
It was approximate to a sinusoid with the difference of the magnitudes of the positive and negative peak values less than 2 %.
The ratio of peak to r.m.s. values was equals √2 within ±5 %.

Photograph of the test object

Photo no. 1

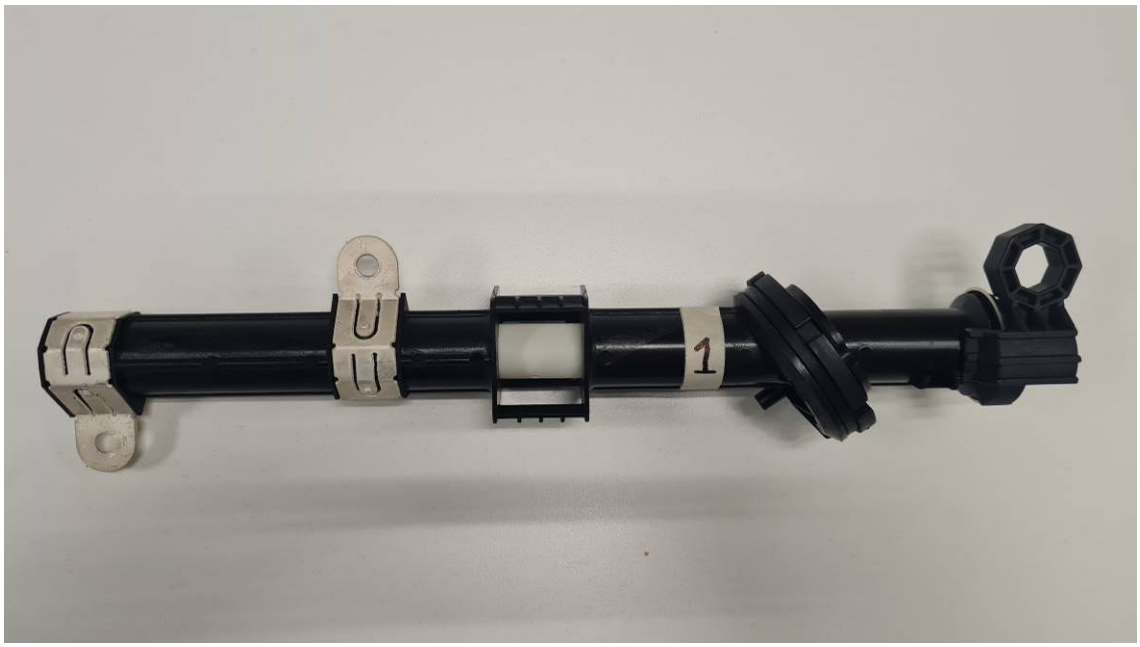


Photo no. 2

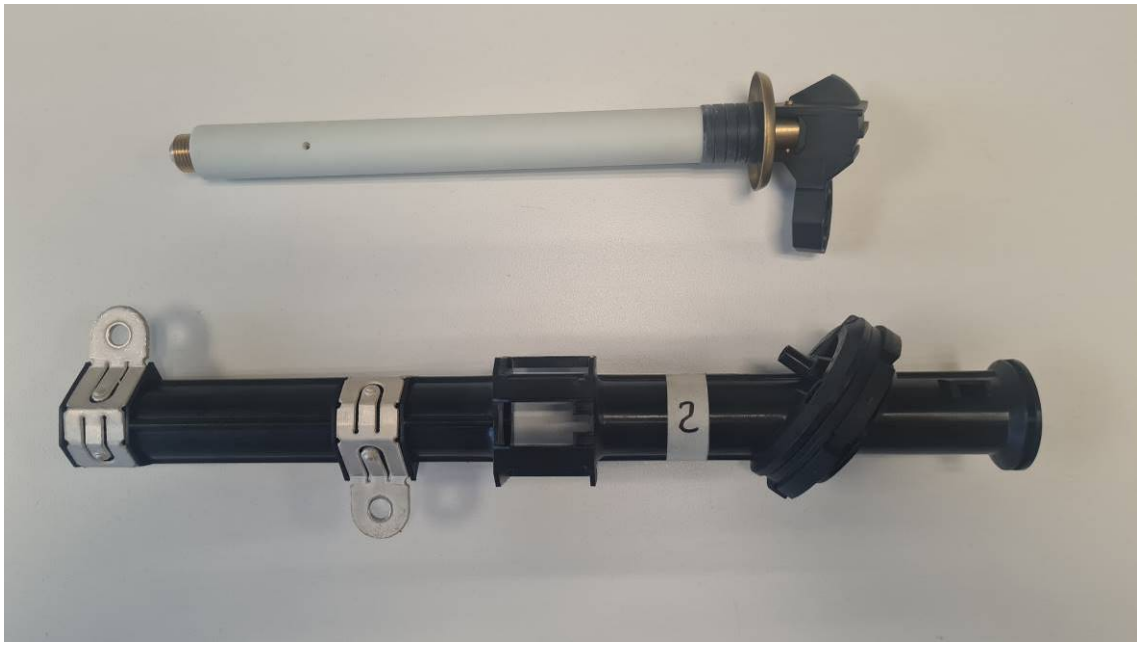


Photo no. 3

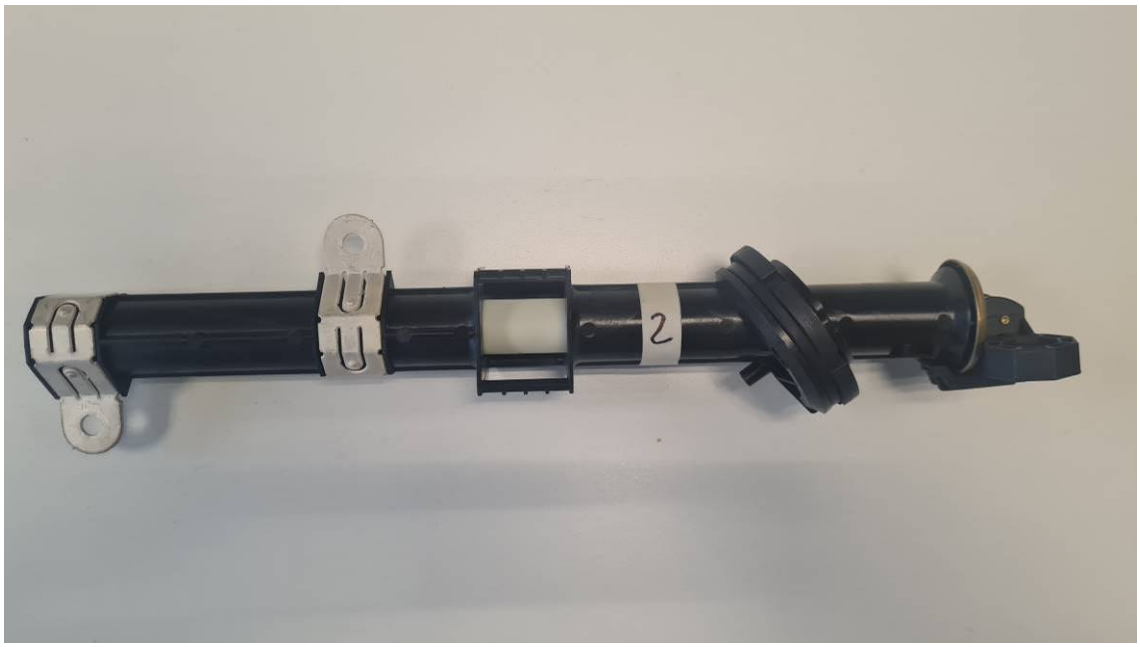


Photo no. 4

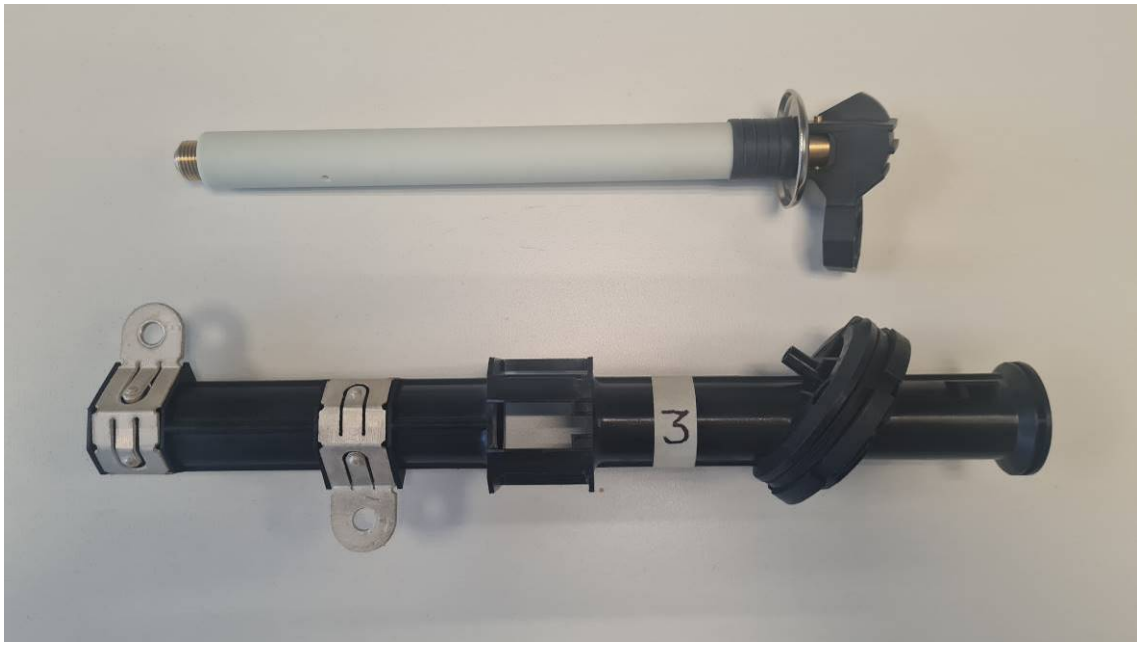


Photo no. 5

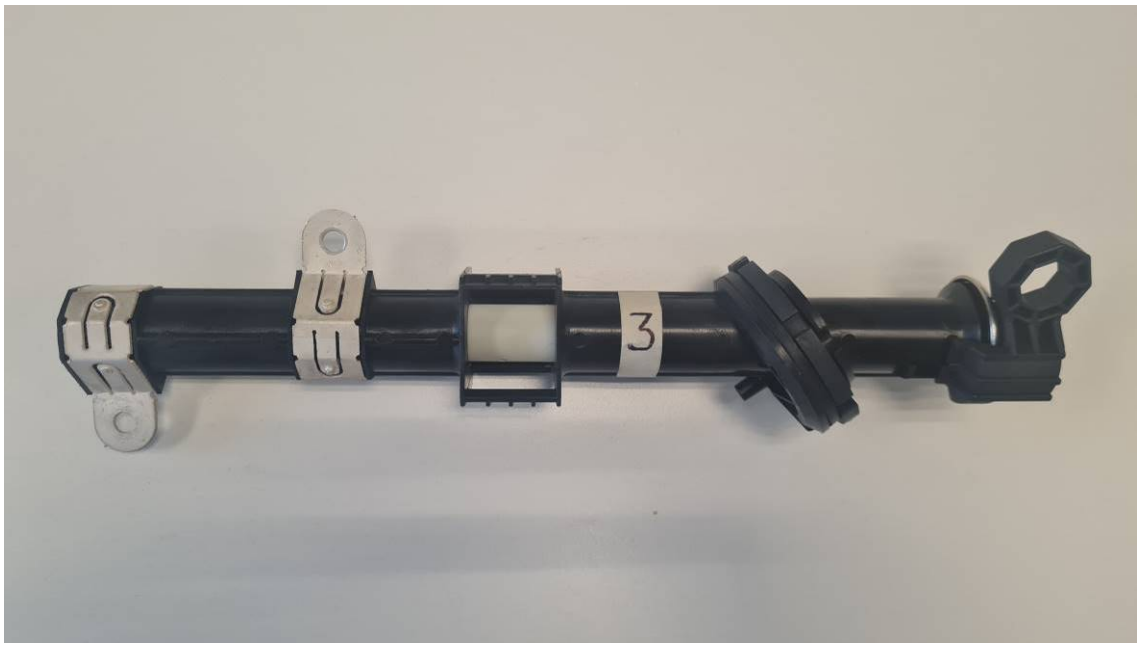


Photo no. 6

Photograph of the test arrangement

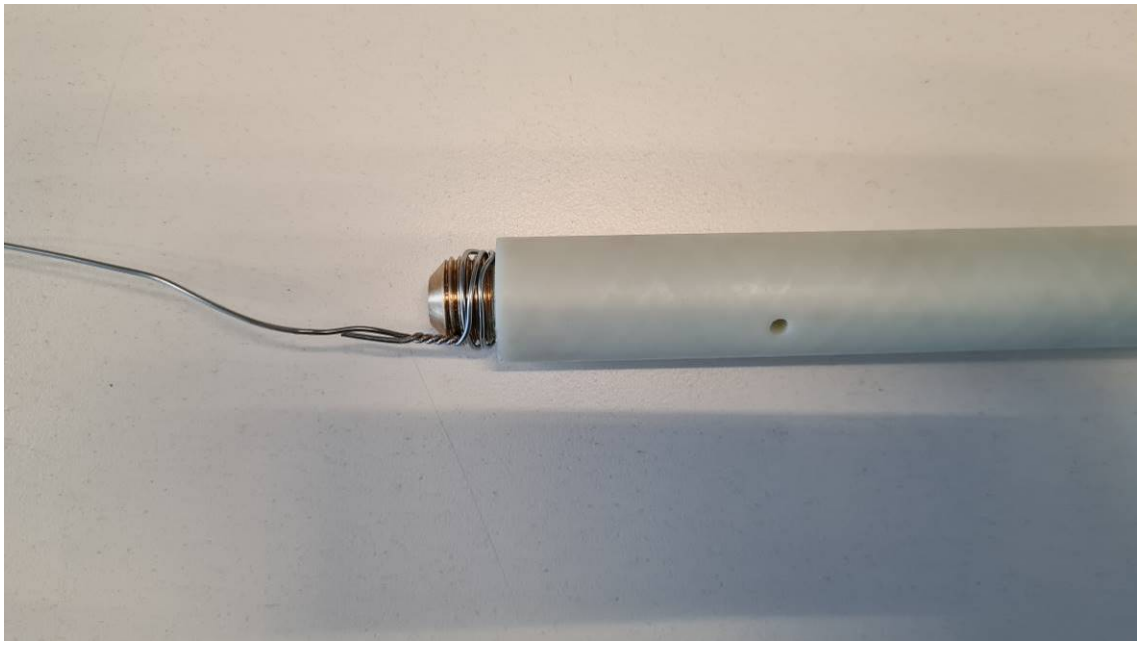
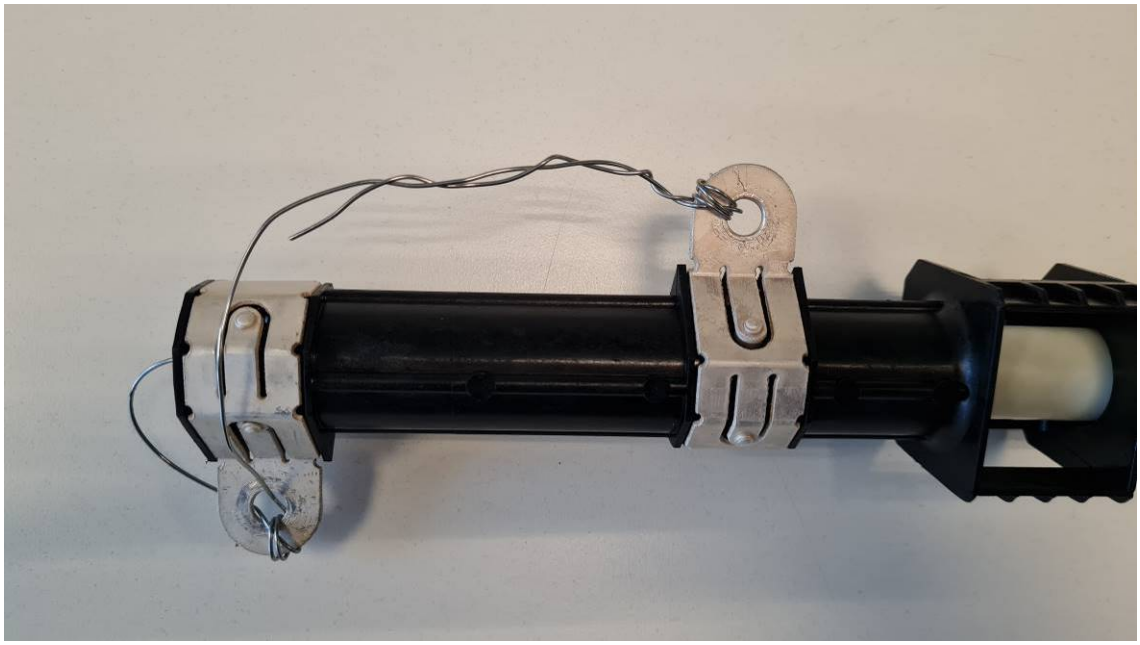


Photo no. 7



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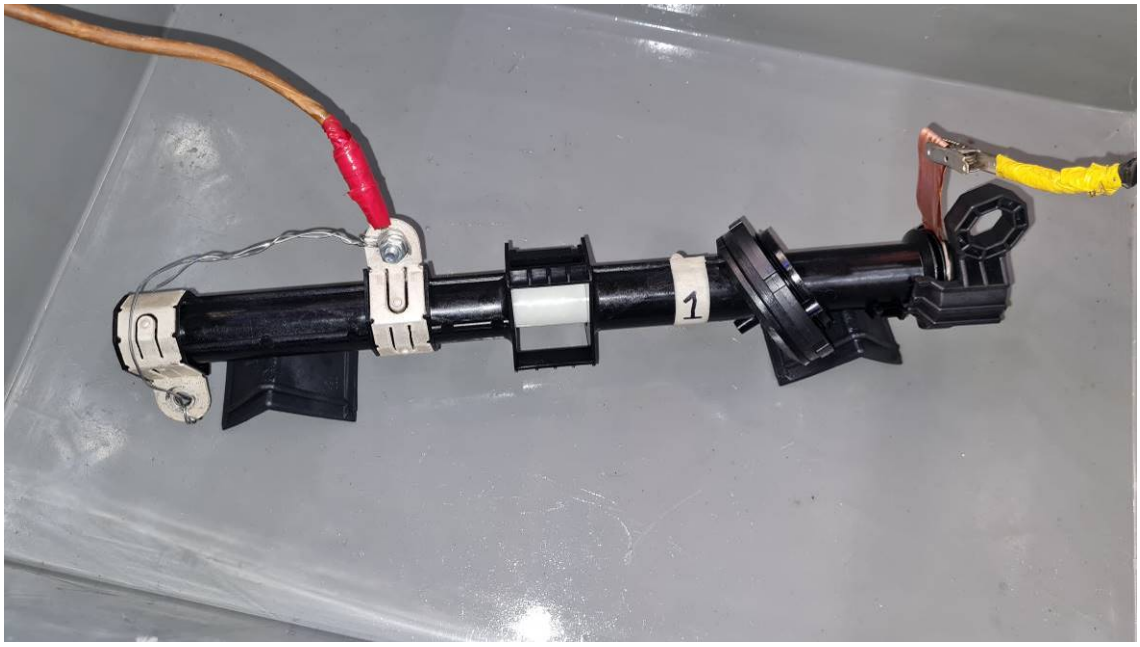


Photo no. 9

Photo no. 10

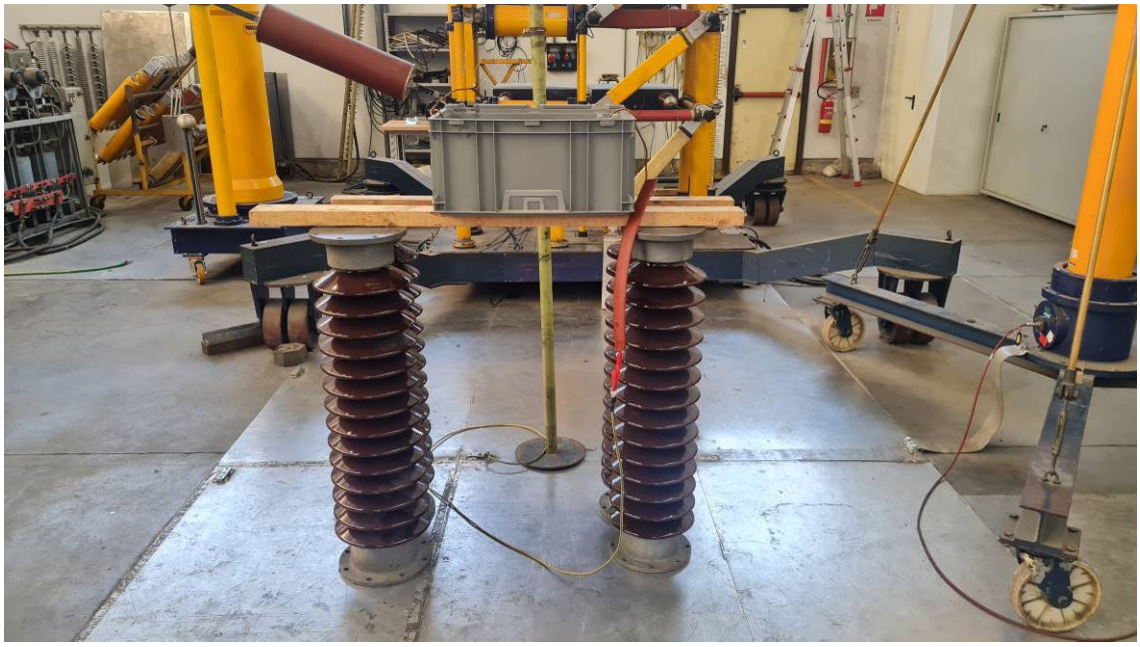


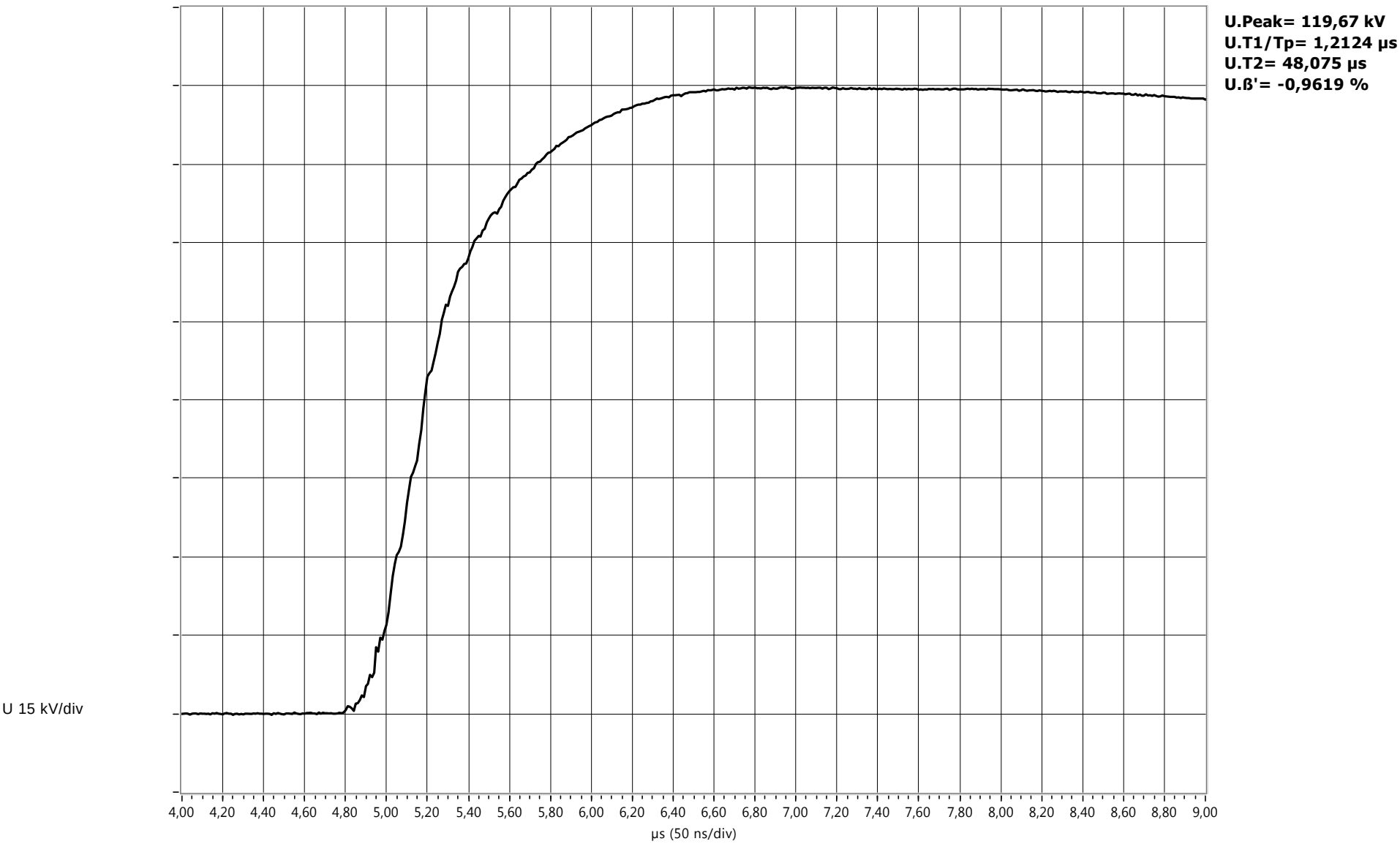
Photo no. 11

Photo no. 12

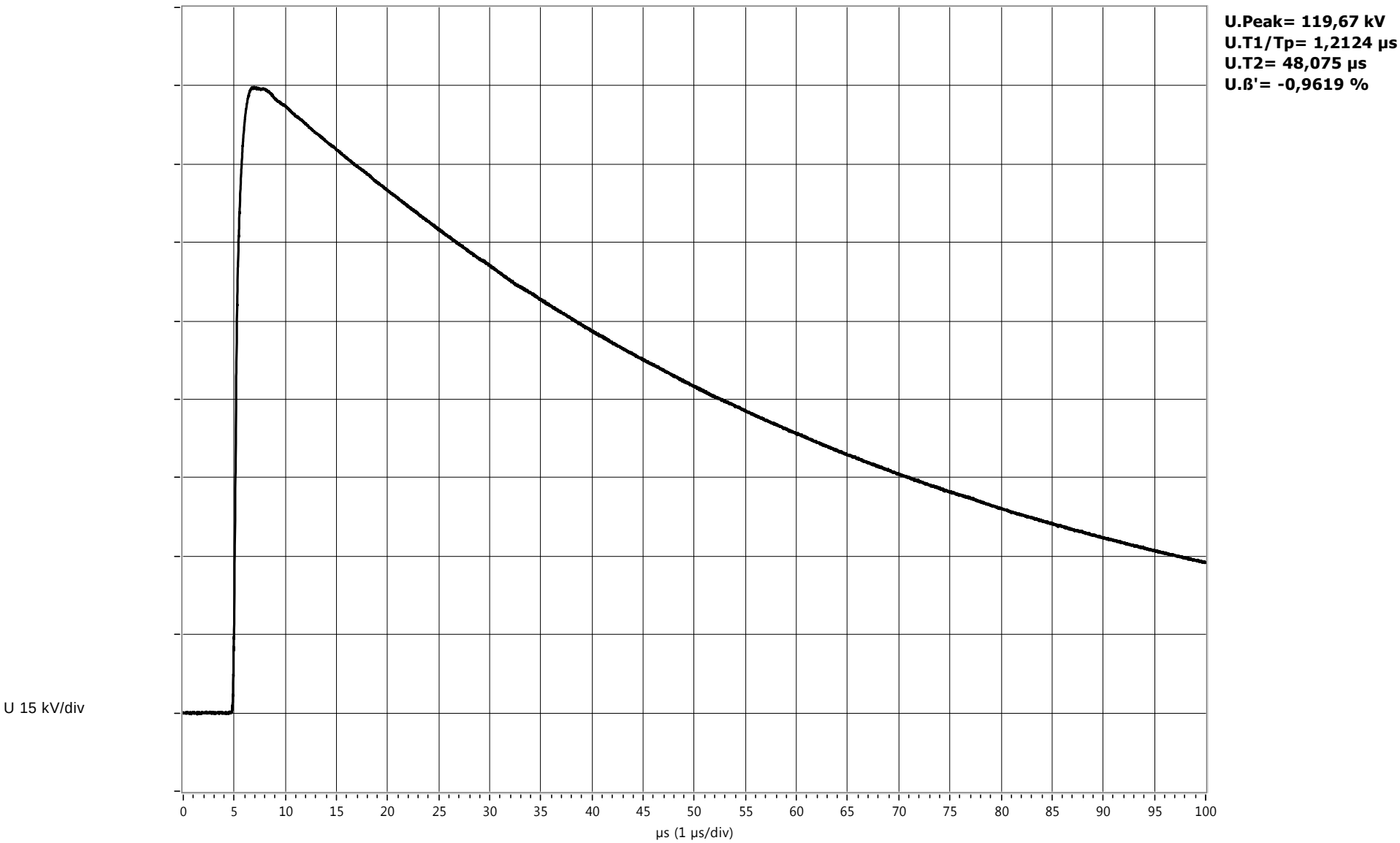
Photo no. 13

Photo no. 14

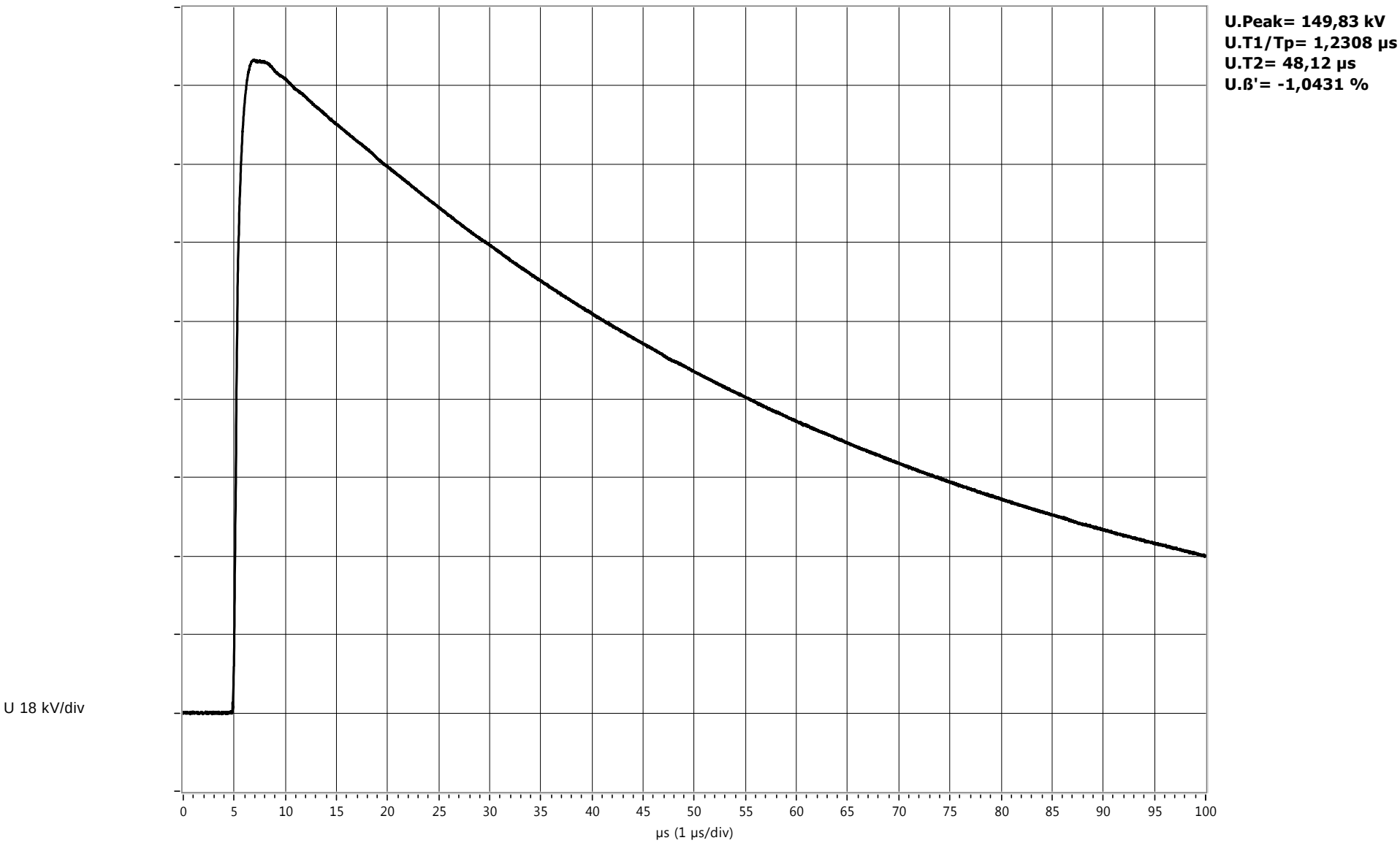
END OF THE DOCUMENT



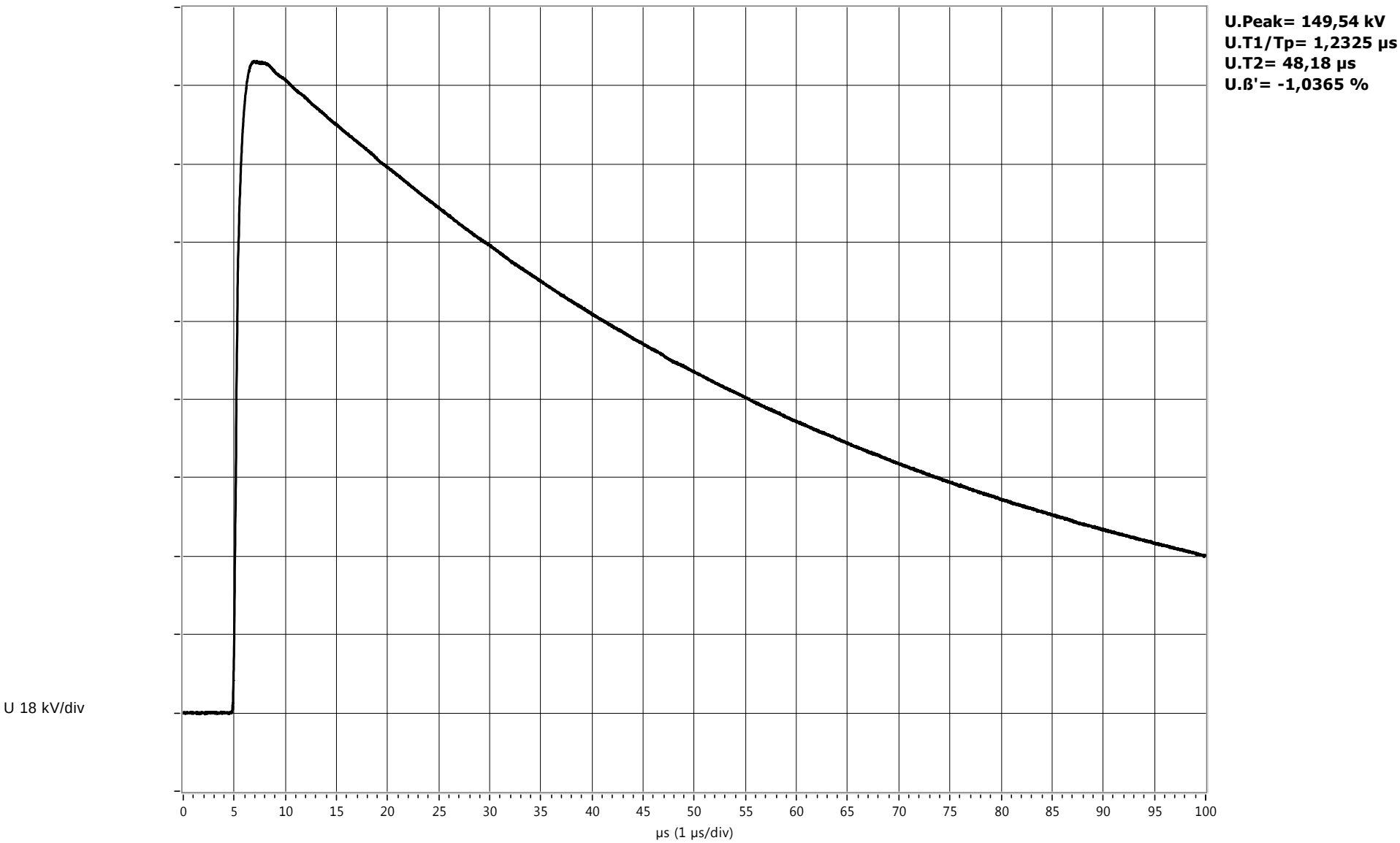
CESI P180 **C3001262** , Oscill. No. **0001**



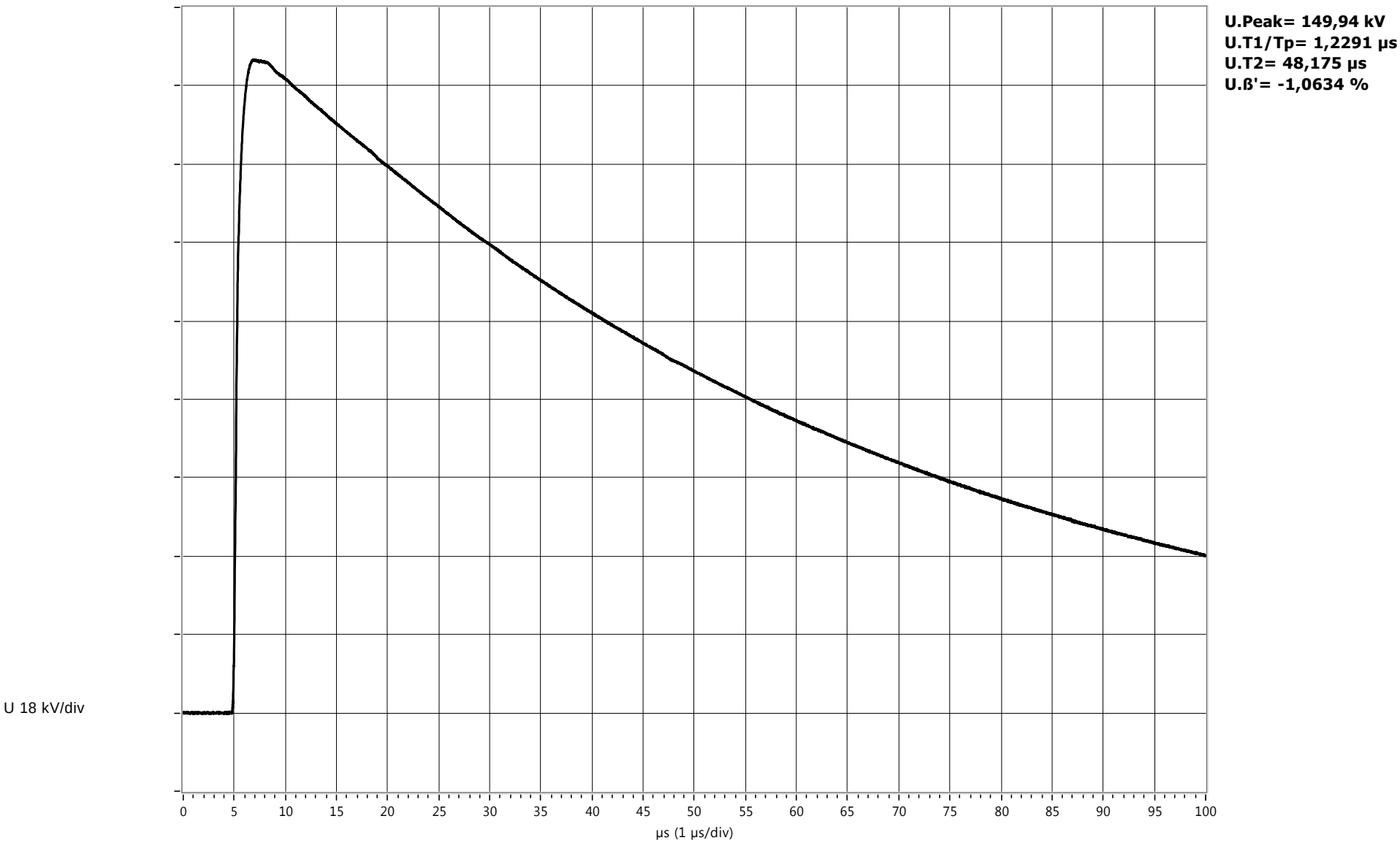
CESI P180 **C3001262** , Oscill. No. **0002**



CESI P180 **C3001262** , Oscill. No. **0003**

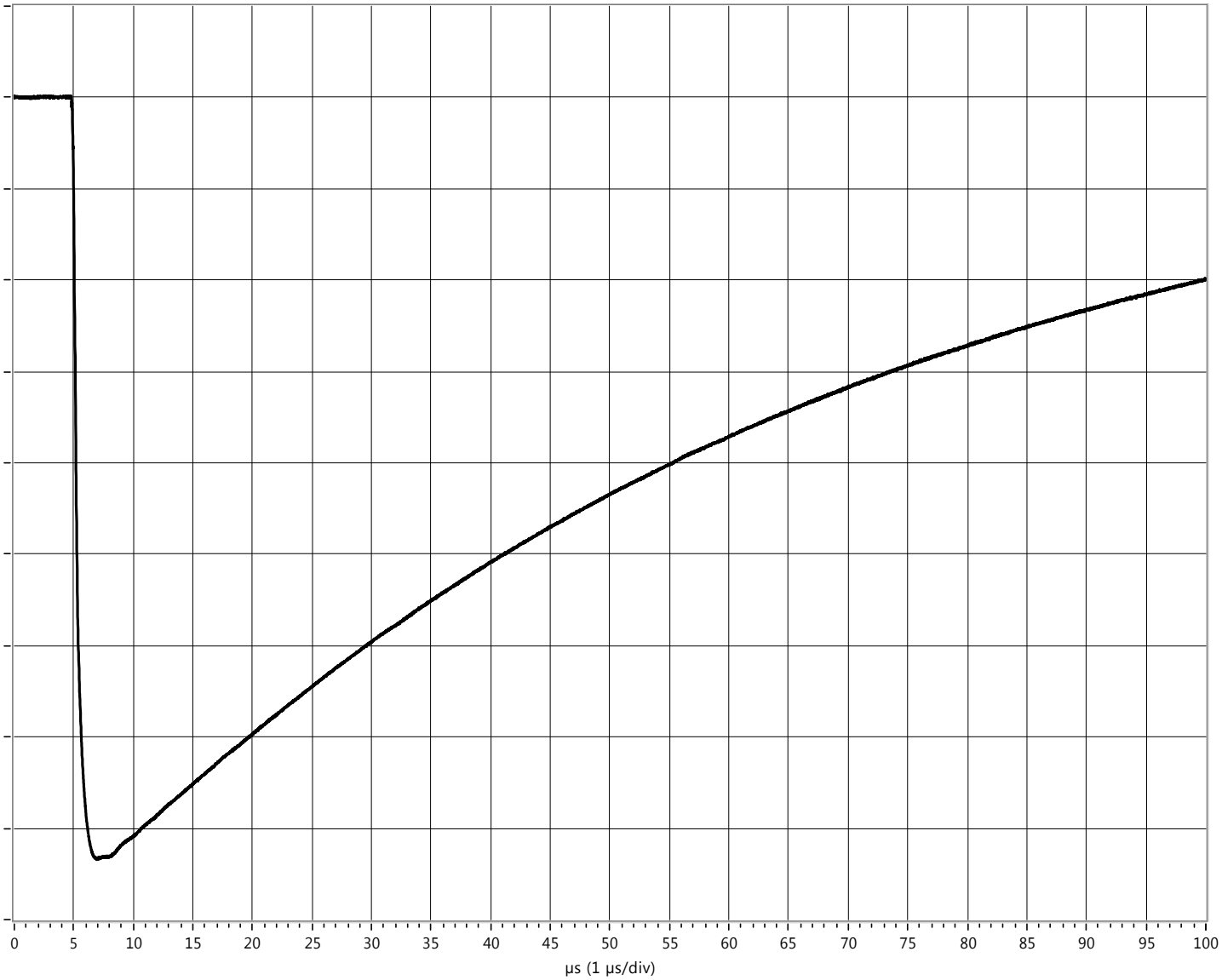


CESI P180 **C3001262** , Oscill. No. **0004**



CESI P180 **C3001262** , Oscill. No. **0005**

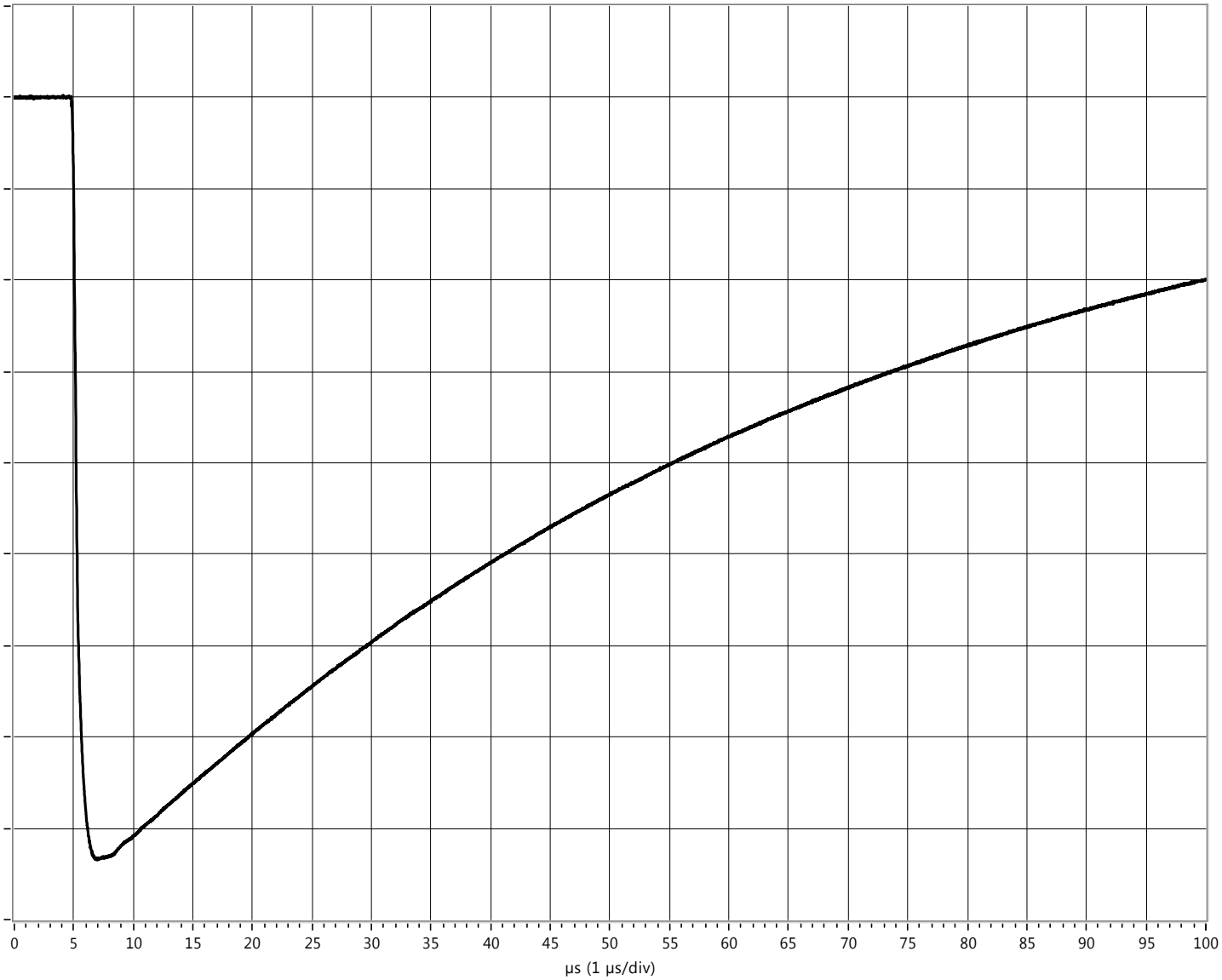
U 18 kV/div



U.Peak= 149,99 kV
U.T1/Tp= 1,2291 µs
U.T2= 47,985 µs
U.ß'= -1,0097 %

CESI P180 **C3001262** , Oscill. No. **0006**

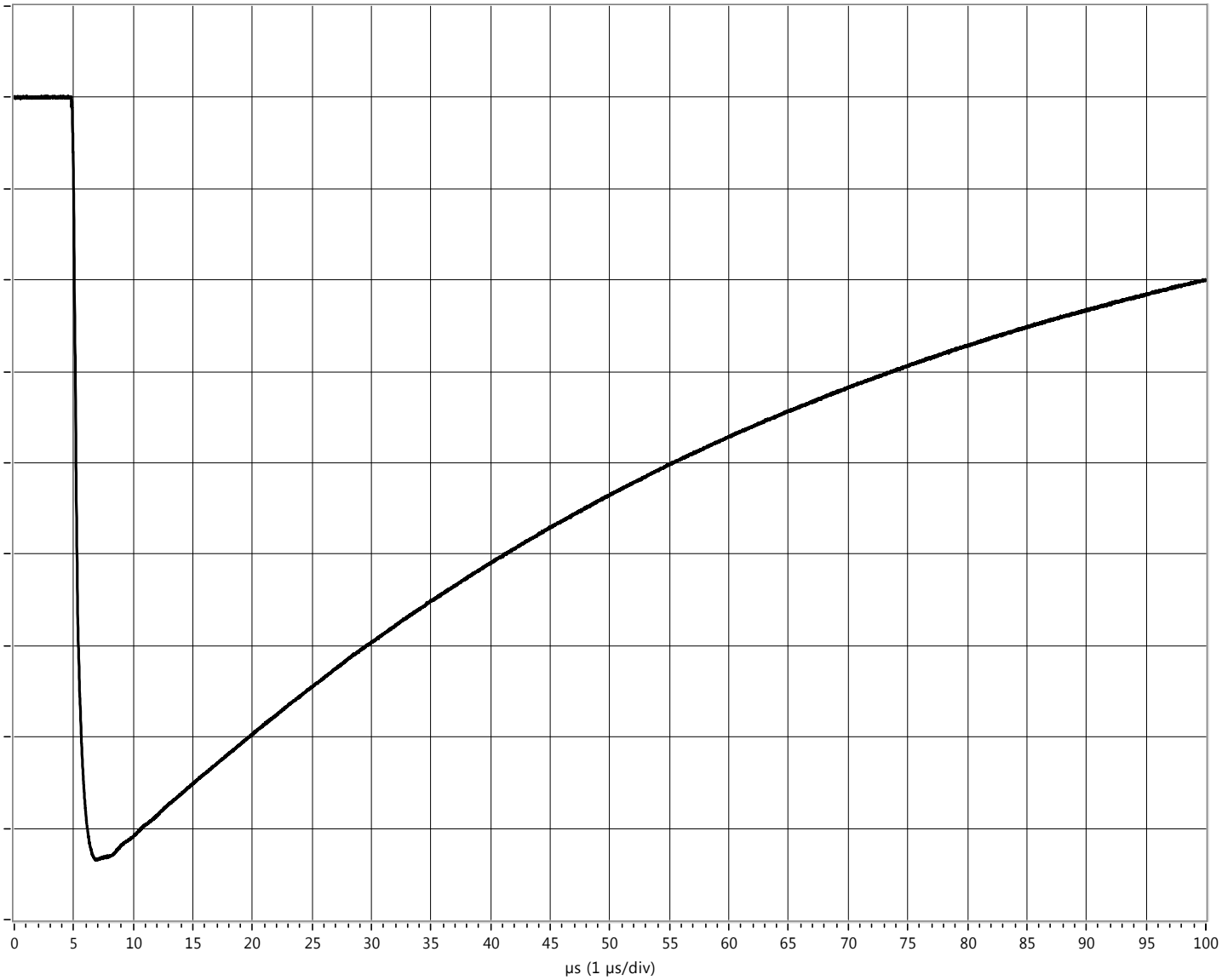
U 18 kV/div



U.Peak= 150,08 kV
U.T1/Tp= 1,2341 µs
U.T2= 47,99 µs
U.ß'= -0,9223 %

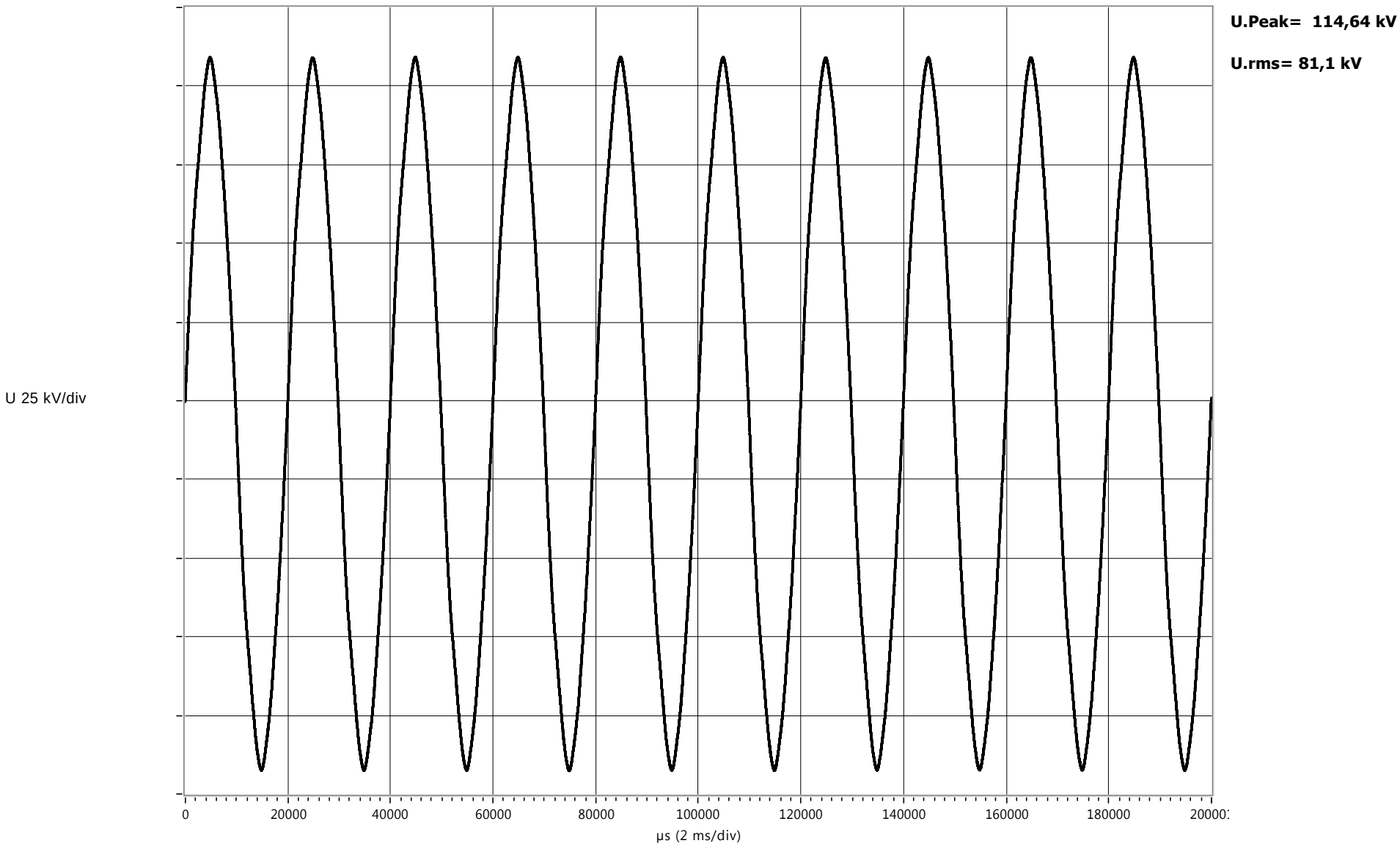
CESI P180 **C3001262** , Oscill. No. **0007**

U 18 kV/div

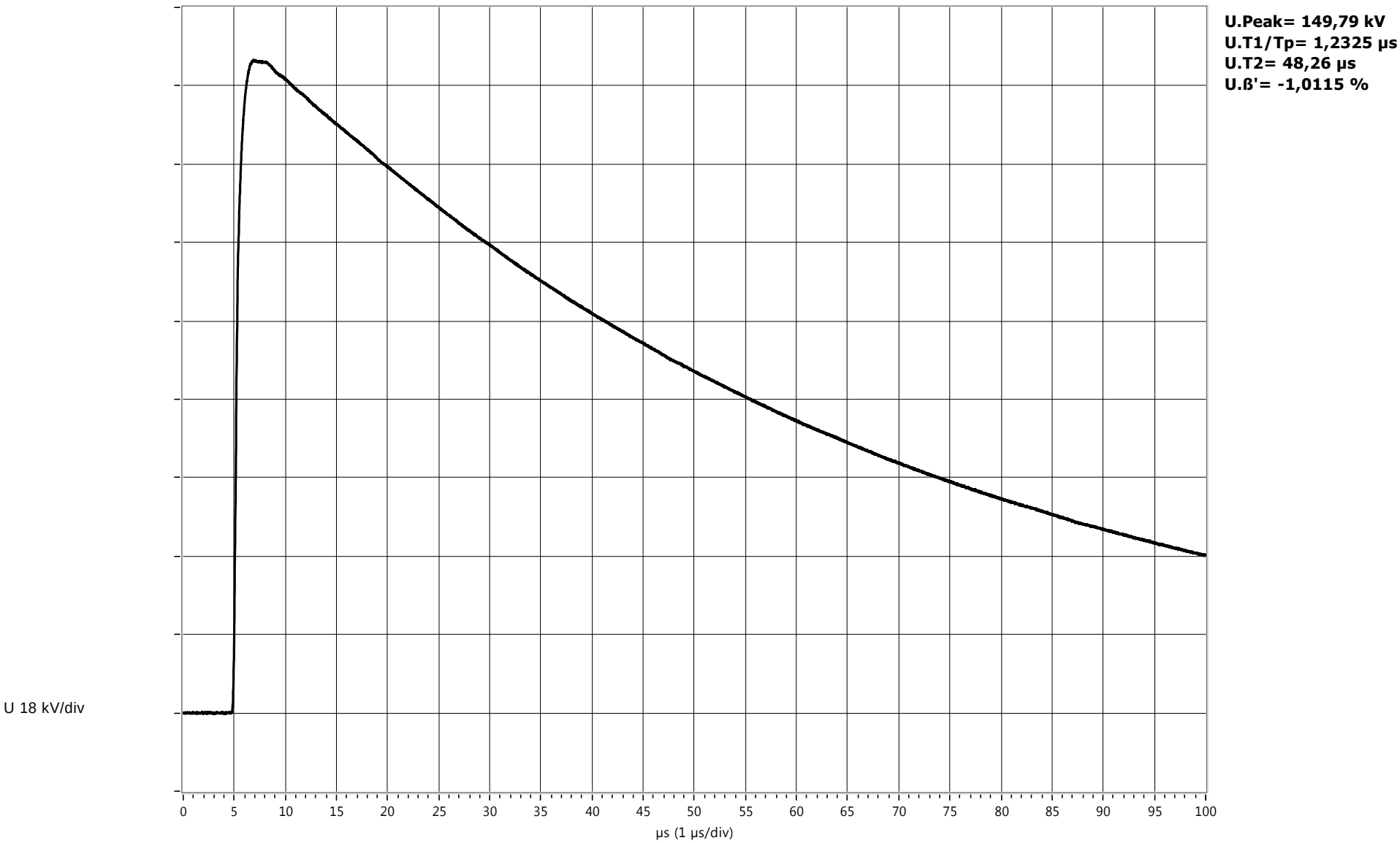


U.Peak= 150,15 kV
U.T1/Tp= 1,2241 µs
U.T2= 47,975 µs
U.ß'= -0,9499 %

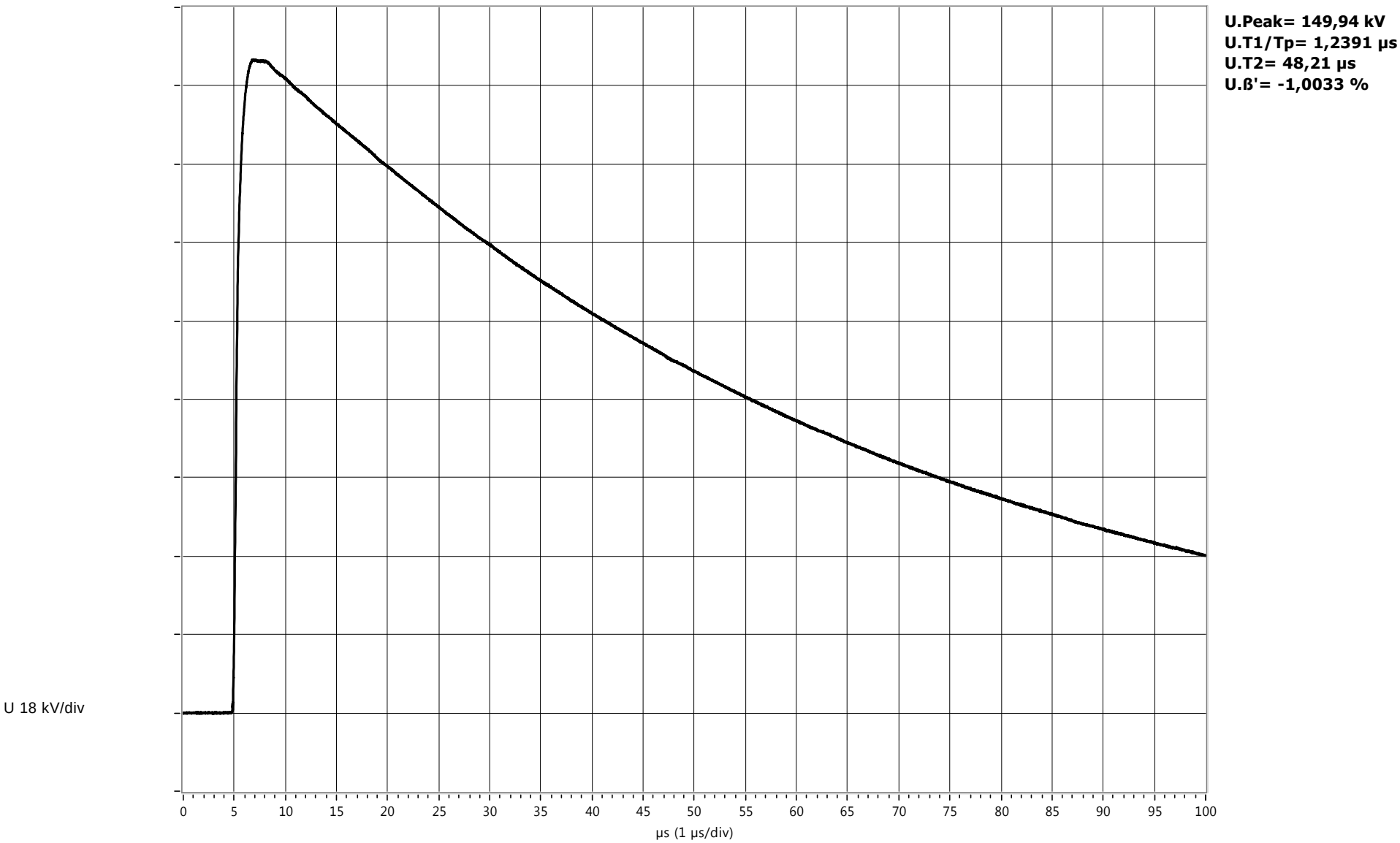
CESI P180 **C3001262** , Oscill. No. **0008**



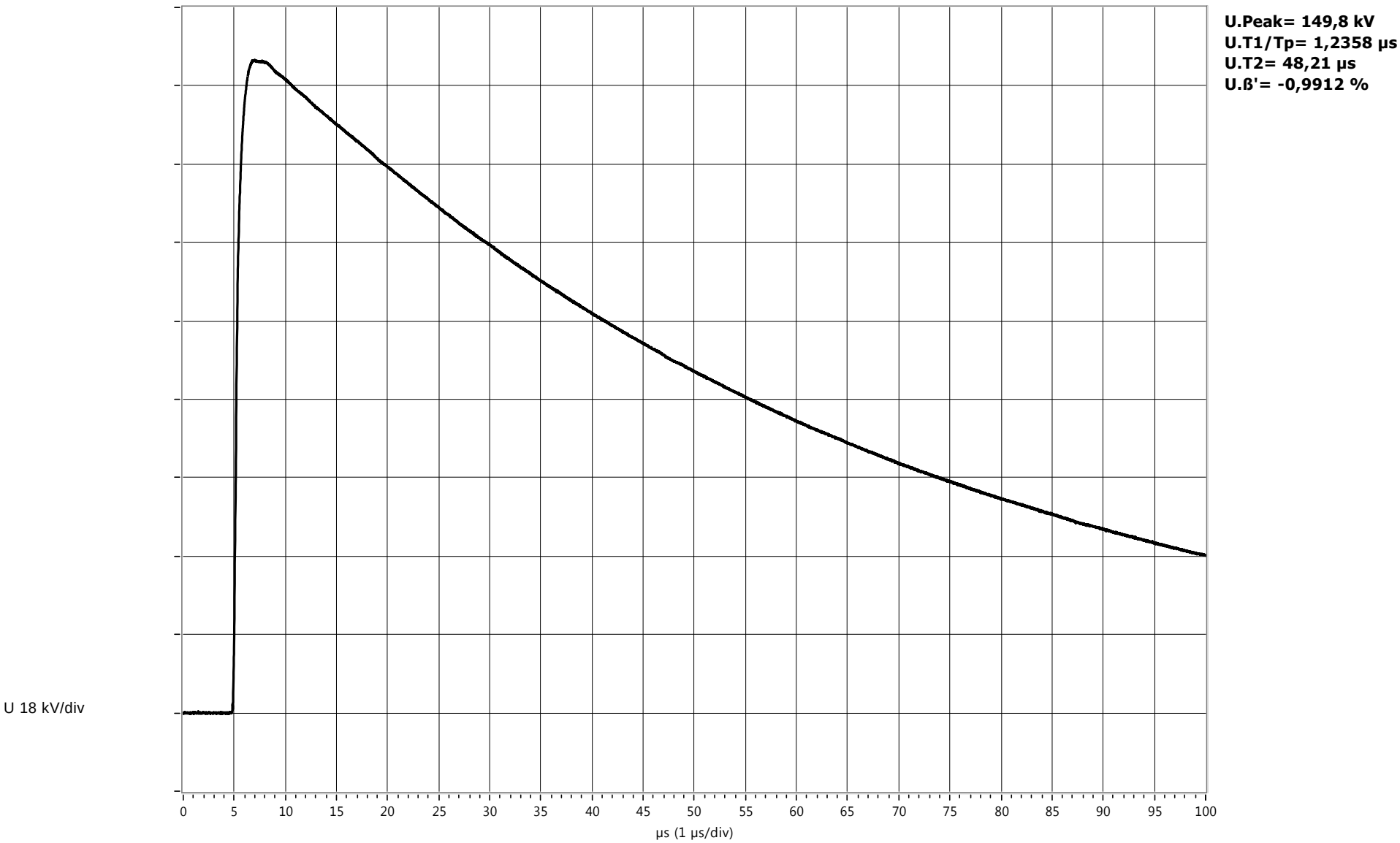
CESI P180 **C3001262** , Oscill. No. **0009**



CESI P180 **C3001262** , Oscill. No. **0010**

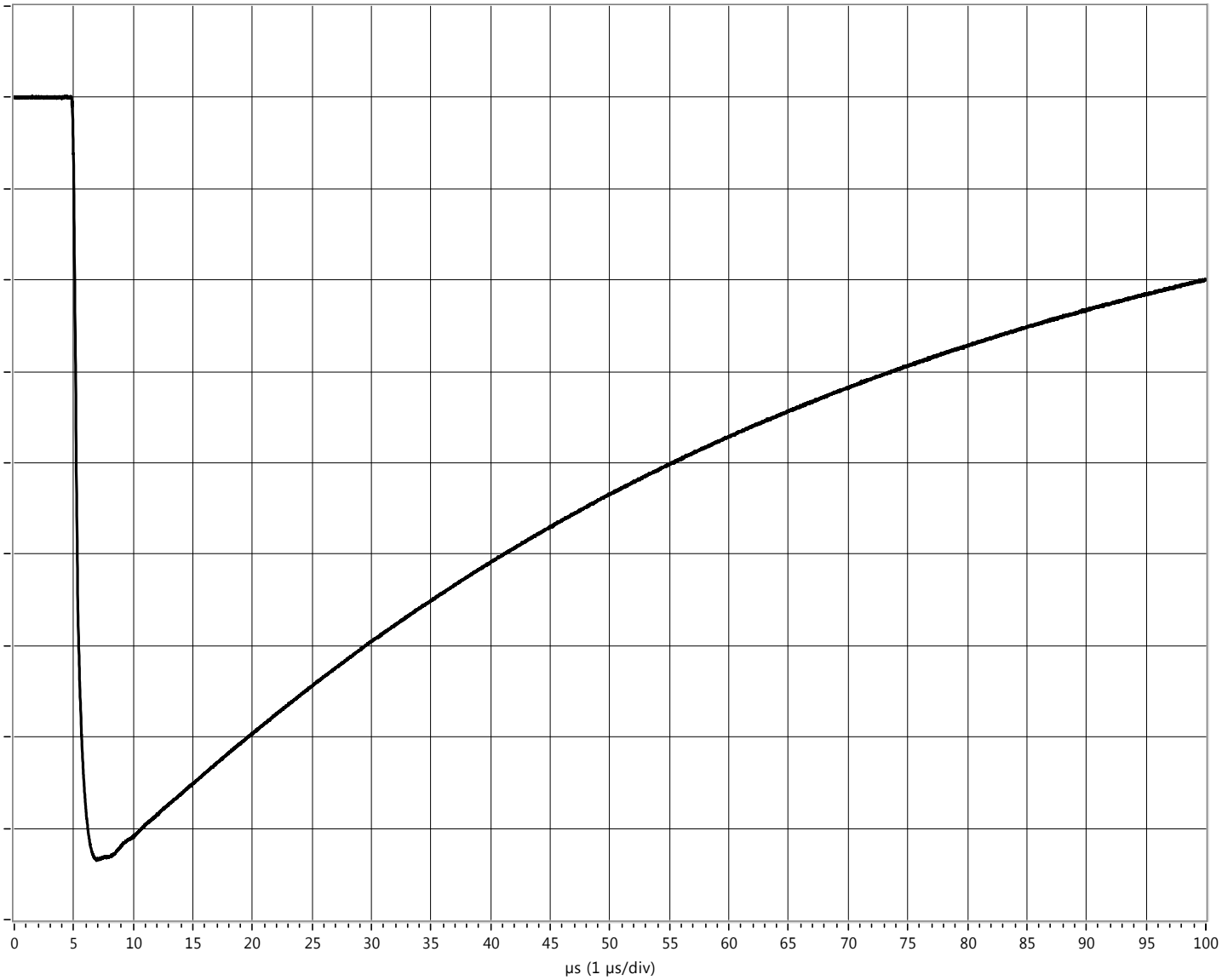


CESI P180 **C3001262** , Oscill. No. **0011**



CESI P180 **C3001262** , Oscill. No. **0012**

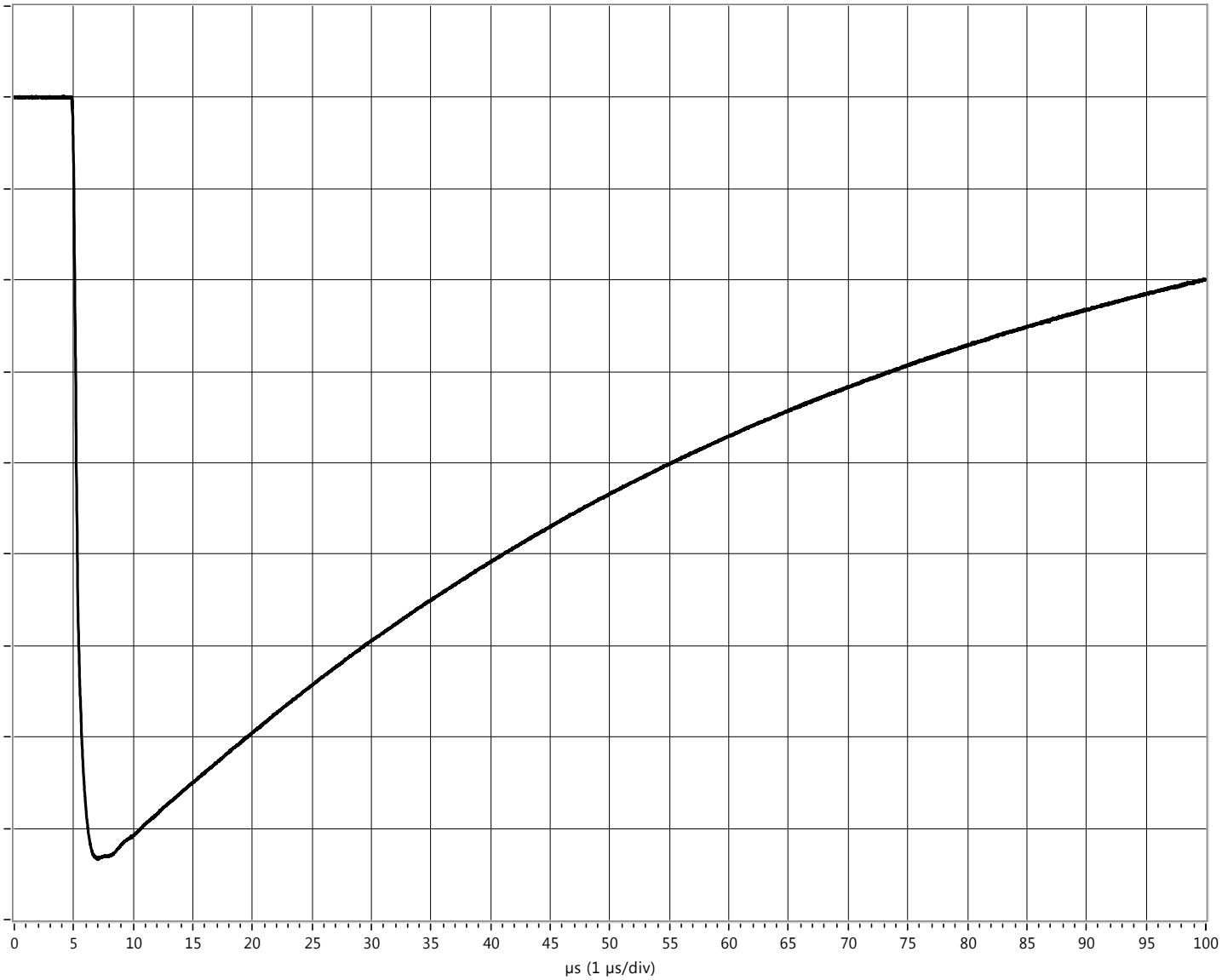
U 18 kV/div



U.Peak= 150,11 kV
U.T1/Tp= 1,2325 µs
U.T2= 47,88 µs
U.ß'= -0,8122 %

CESI P180 **C3001262** , Oscill. No. **0013**

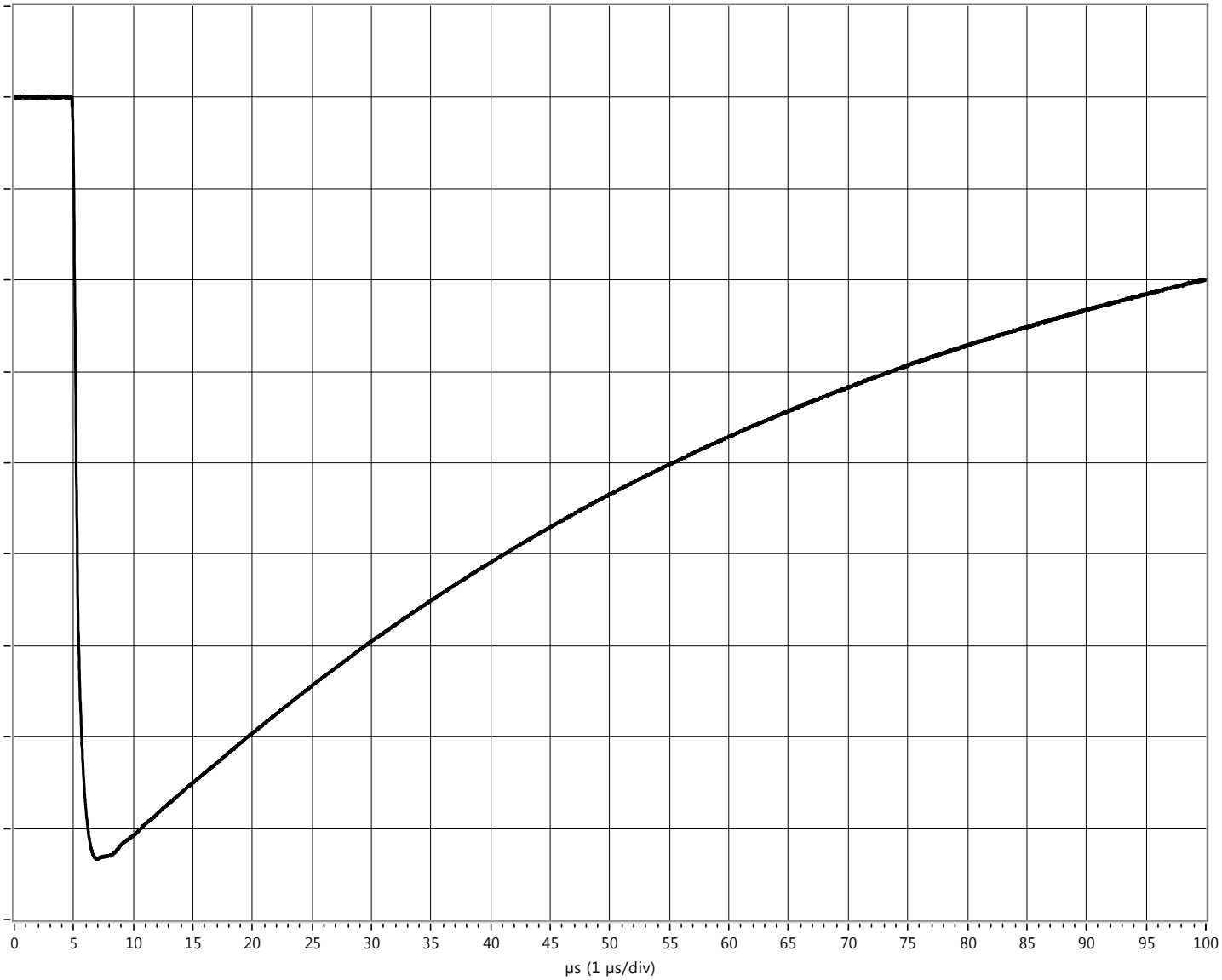
U 18 kV/div



U.Peak= 149,94 kV
U.T1/Tp= 1,2308 µs
U.T2= 47,89 µs
U.ß'= -0,8092 %

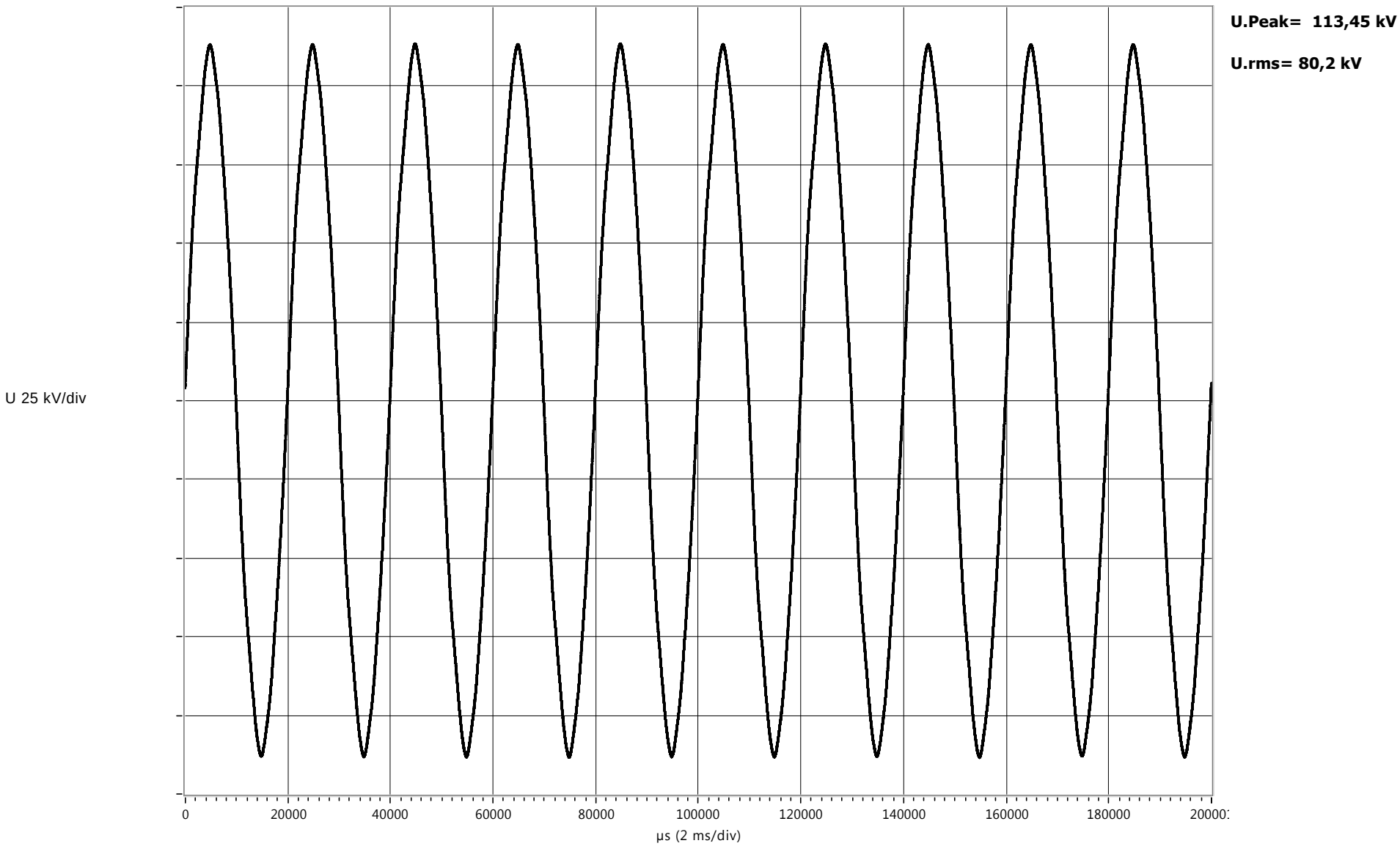
CESI P180 **C3001262** , Oscill. No. **0014**

U 18 kV/div

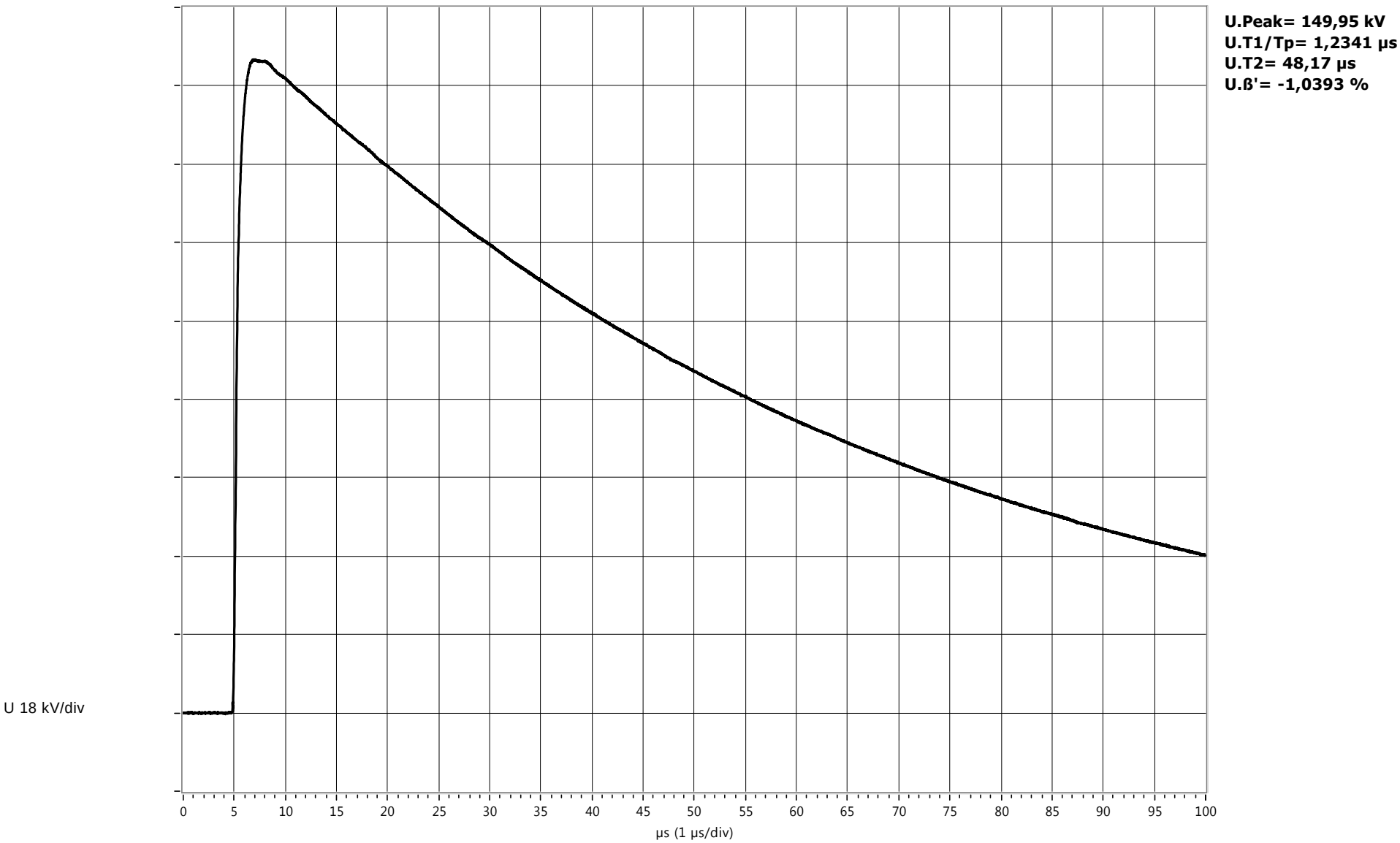


U.Peak= 149,96 kV
U.T1/Tp= 1,2258 µs
U.T2= 47,95 µs
U.ß'= -0,8926 %

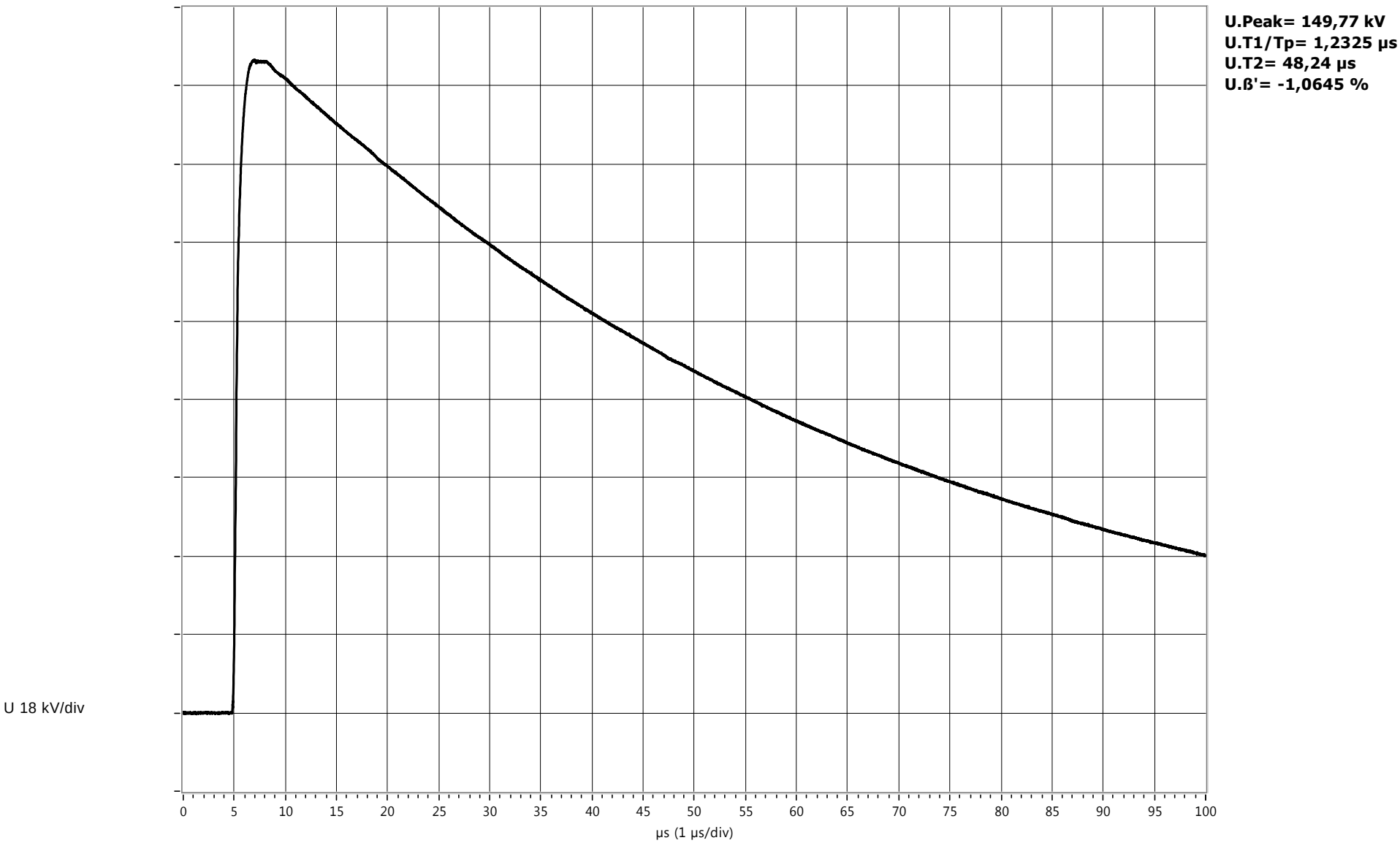
CESI P180 **C3001262** , Oscill. No. **0015**



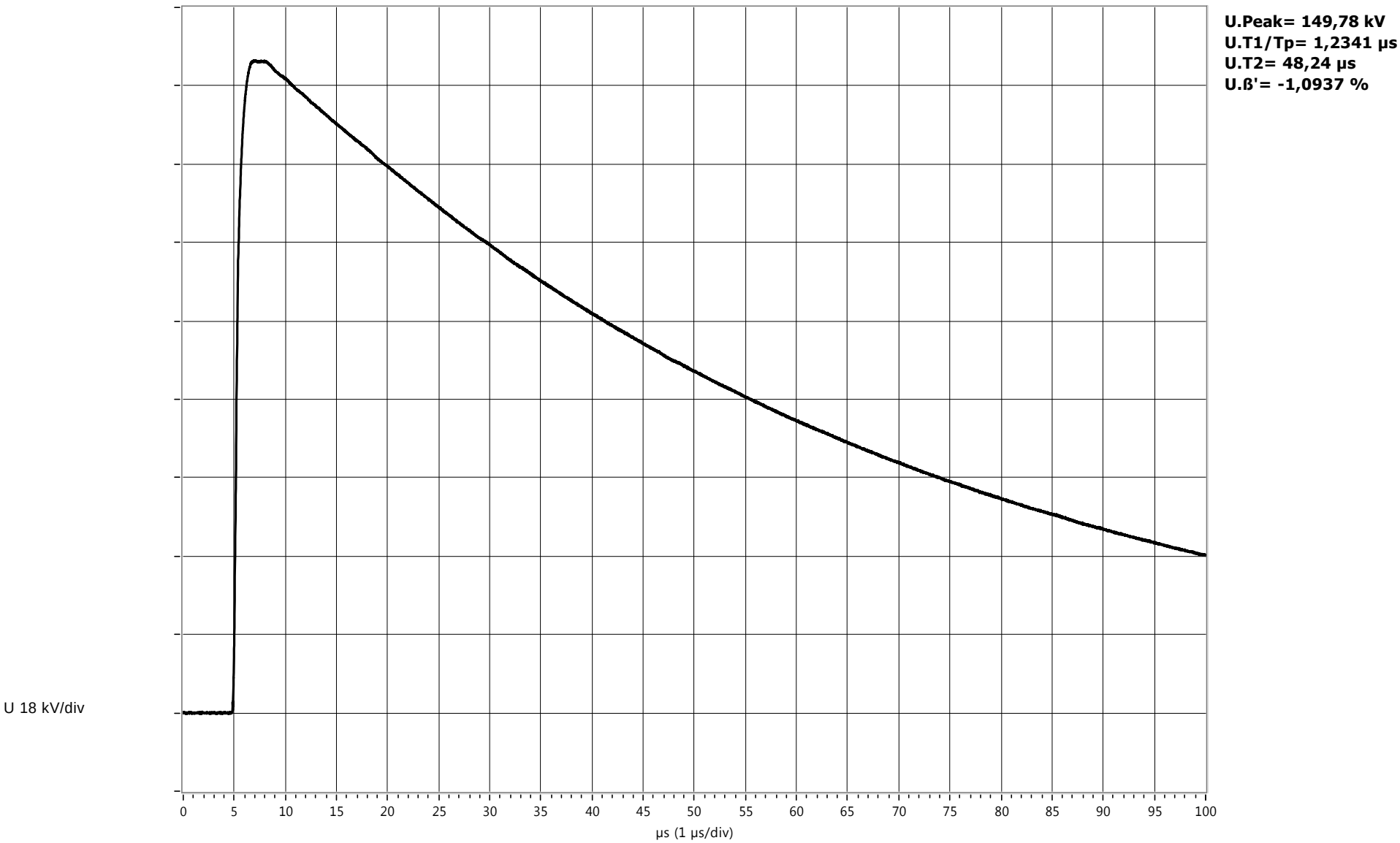
CESI P180 **C3001262** , Oscill. No. **0016**



CESI P180 **C3001262** , Oscill. No. **0017**

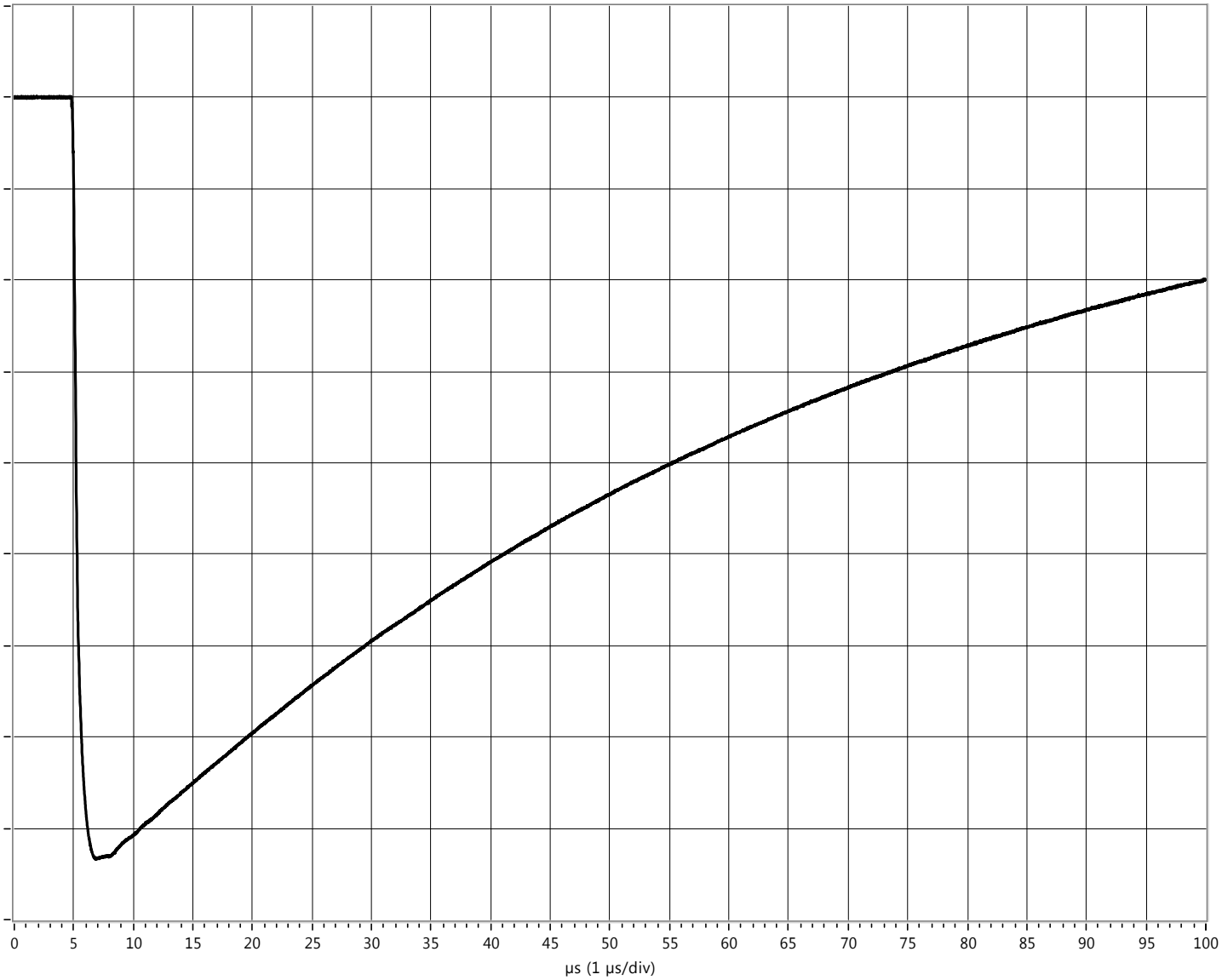


CESI P180 **C3001262** , Oscill. No. **0018**



CESI P180 **C3001262** , Oscill. No. **0019**

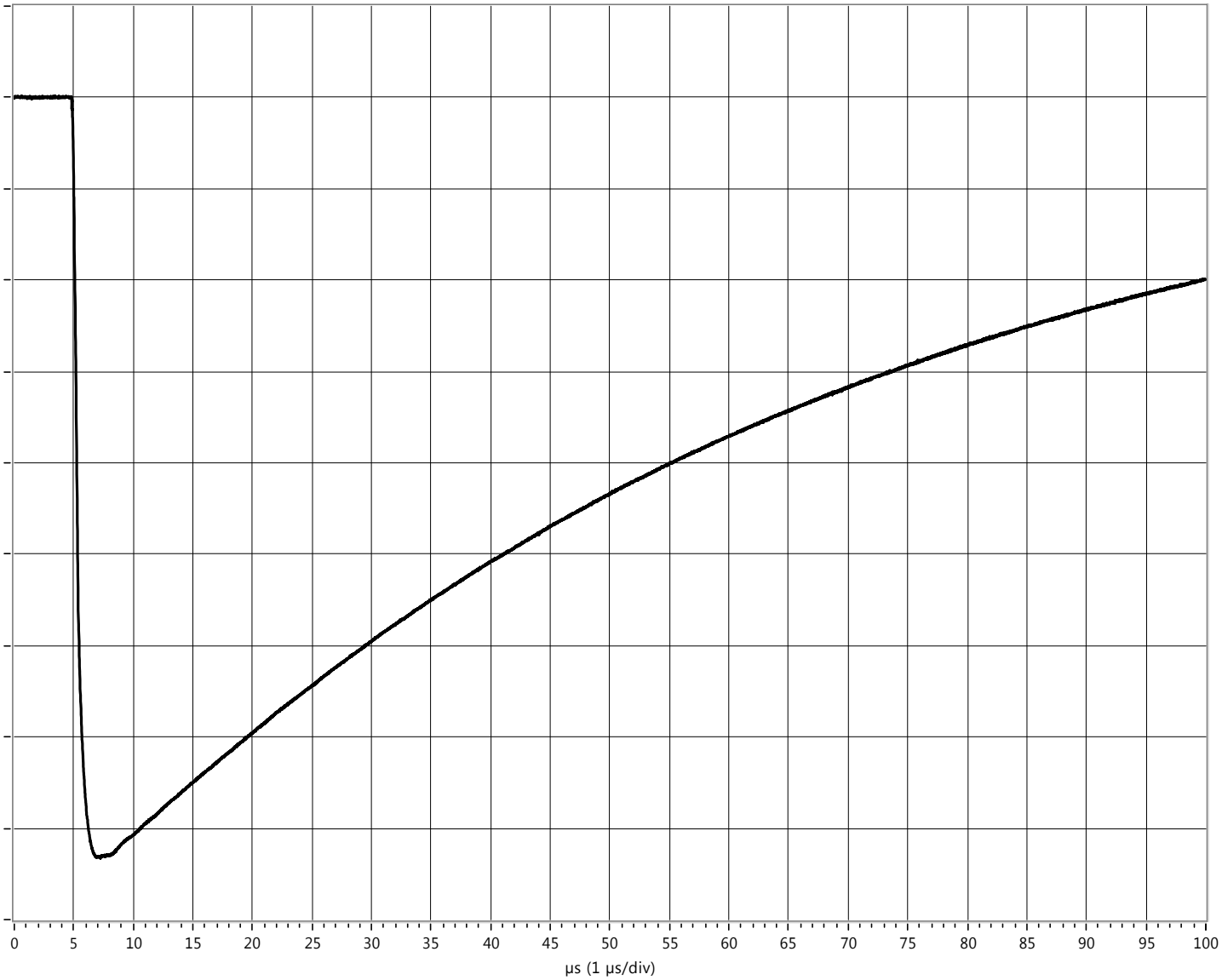
U 18 kV/div



U.Peak= 149,96 kV
U.T1/Tp= 1,2291 µs
U.T2= 47,925 µs
U.ß'= -0,8718 %

CESI P180 **C3001262** , Oscill. No. **0020**

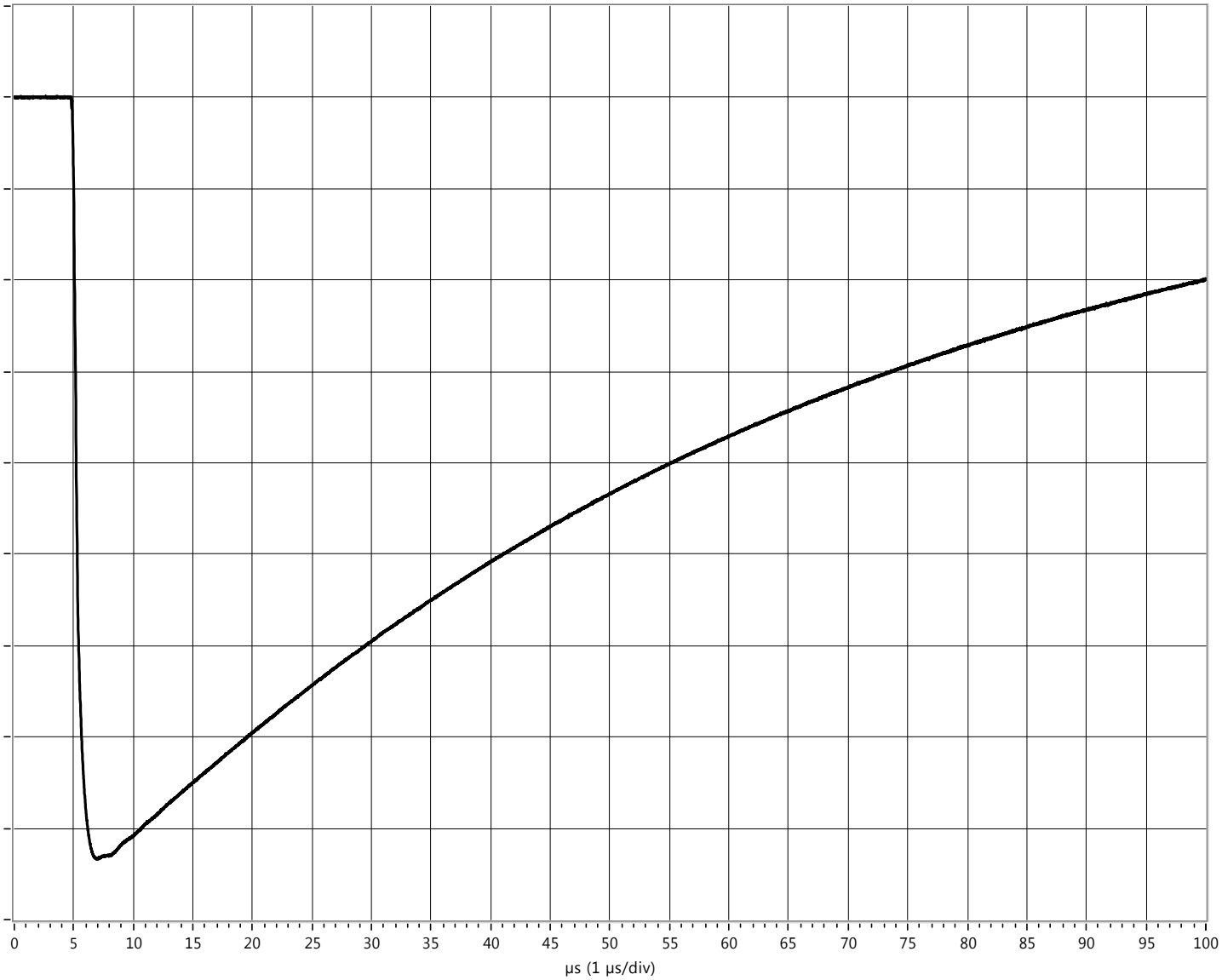
U 18 kV/div



U.Peak= 149,71 kV
U.T1/Tp= 1,2408 µs
U.T2= 47,94 µs
U.ß'= -0,8919 %

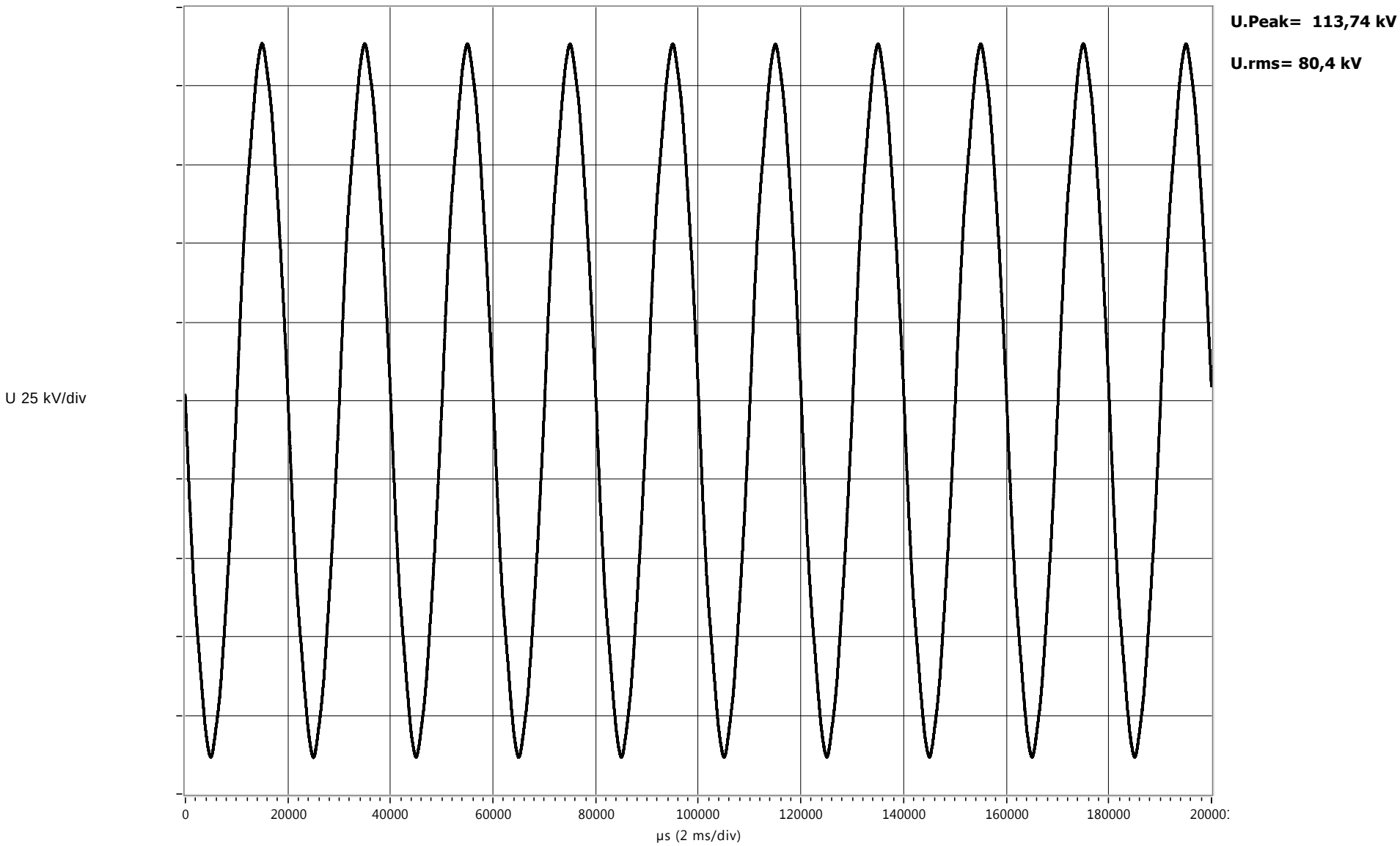
CESI P180 **C3001262** , Oscill. No. **0021**

U 18 kV/div



U.Peak= 149,96 kV
U.T1/Tp= 1,2341 µs
U.T2= 47,85 µs
U.ß'= -0,878 %

CESI P180 **C3001262** , Oscill. No. **0022**



CESI P180 **C3001262** , Oscill. No. **0023**