FutureEnergy WP2 @ TU Delft in October 2022

Workshop, 2023-04-26

Jari Hällström et al.

LINEARITY EXTENSION OF UHV CLASS LIGHTNING IMPULSE DIVIDERS UP TO 3000 KV

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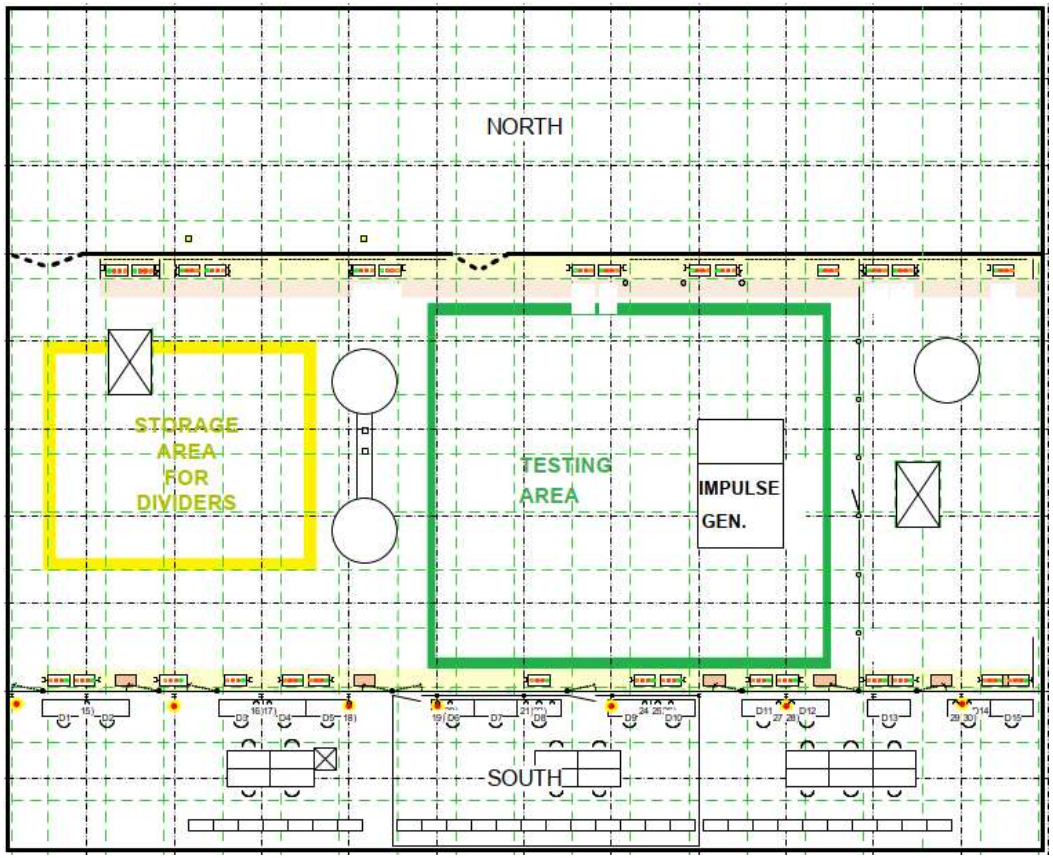
Accepted for oral presentation at ISH 2023, Glasgow, UK

HV lab @TU Delft, from 10th to 28th of October 2022



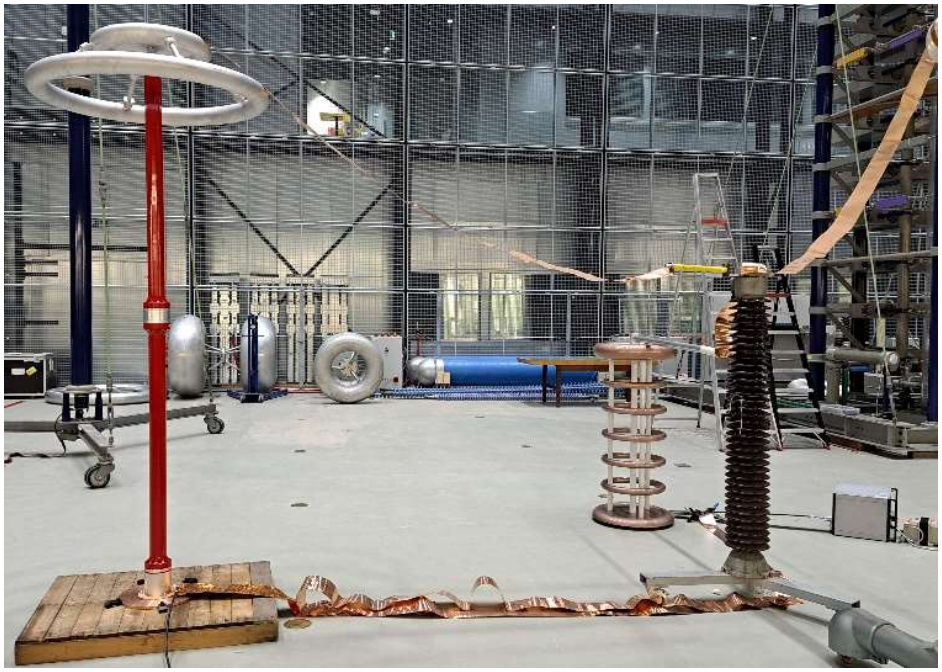
Dividers in the campaign

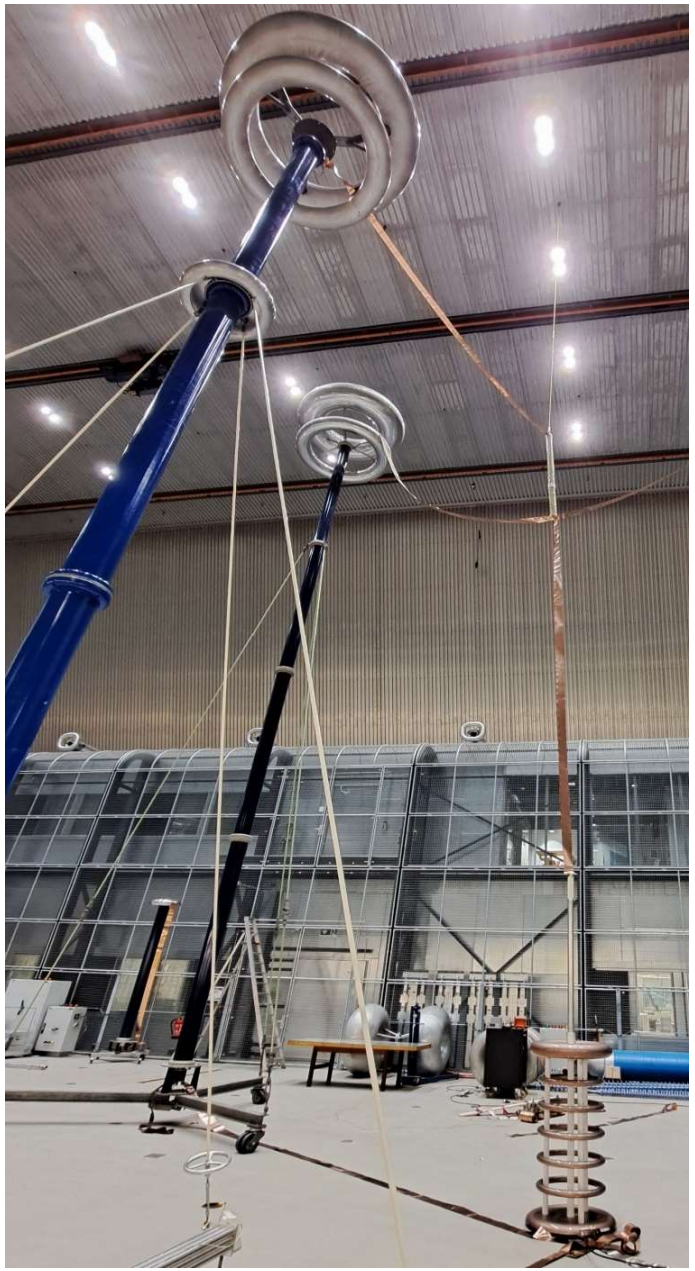
Id.	Type	U_{max}	R_{in}	C_{in}	*Ext. damping resistor*
R400	R	400 kV	10 kΩ	-	250 Ω
R500	R	500 kV	10 kΩ	-	180 Ω
R600	R	600 kV	10 kΩ	-	300 Ω
R1200A	R	1200 kV	10 kΩ	-	330 Ω
R1200B	R	1200 kV	20 kΩ	-	300 Ω
R2000	R	2000 kV	12 kΩ	-	270 Ω
RC1000	RC	1000 kV	370 Ω	600 pF	270 Ω
RCR1200	RCR	1200 kV	180 Ω	700 pF	355 Ω
RC3600	RC	3600 kV	290 Ω	430 pF	820 Ω
RC4000	RC	4000 kV	256 Ω	400 pF	500 Ω

Task 2.3, approximate schedule

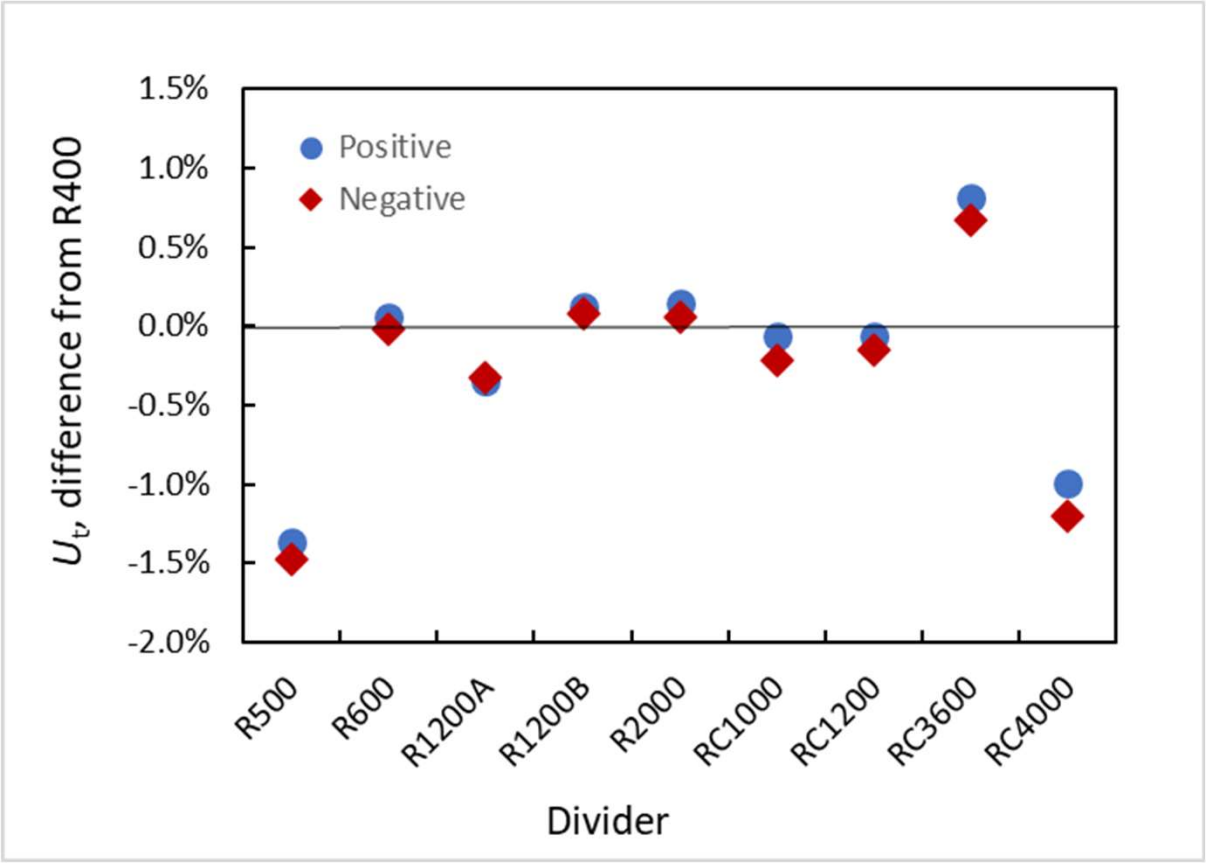
Date		Activity
Mon	10-Oct	Assembly
Tue	11-Oct	Calibrations, 400 kV & step responses, started
Wed	12-Oct	
Thu	13-Oct	
Fri	14-Oct	
Sat	15-Oct	
Sun	16-Oct	
Mon	17-Oct	
Tue	18-Oct	
Wed	19-Oct	Comparisons, 1000 kV – 3000 kV, started
Thu	20-Oct	
Fri	21-Oct	
Sat	22-Oct	
Sun	23-Oct	
Mon	24-Oct	
Tue	25-Oct	FutureEnergy M27 meeting
Wed	26-Oct	Disassembly
Thu	27-Oct	
Fri	28-Oct	

Calibrations @400 kV

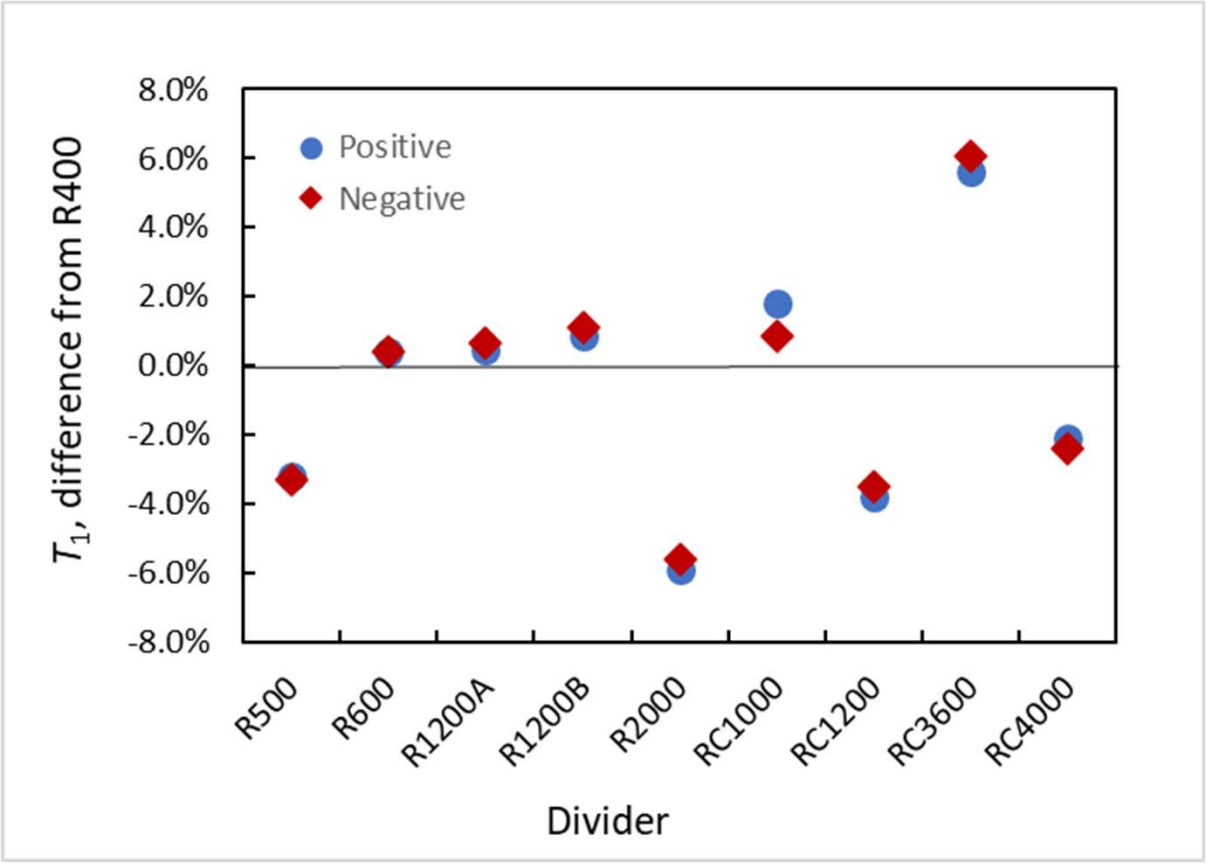




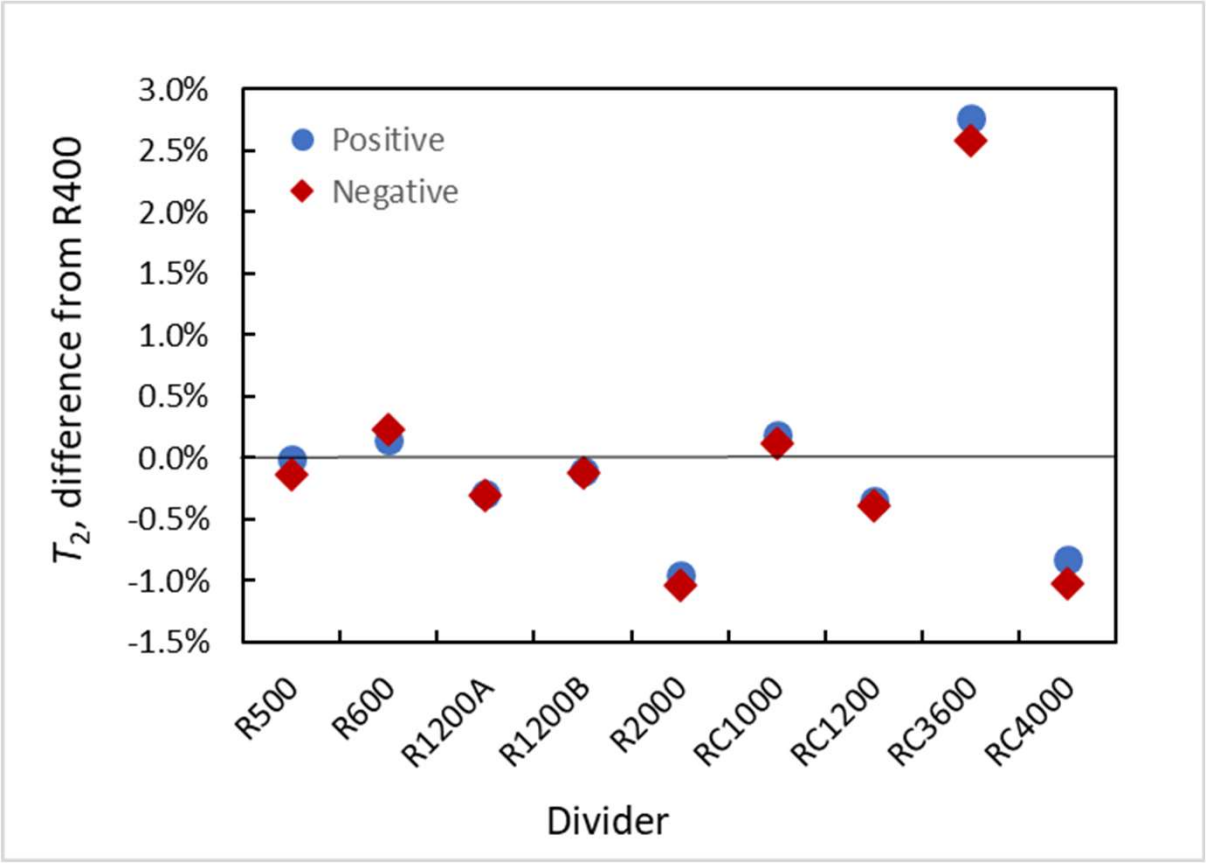
Calibrations @400 kV, U_T



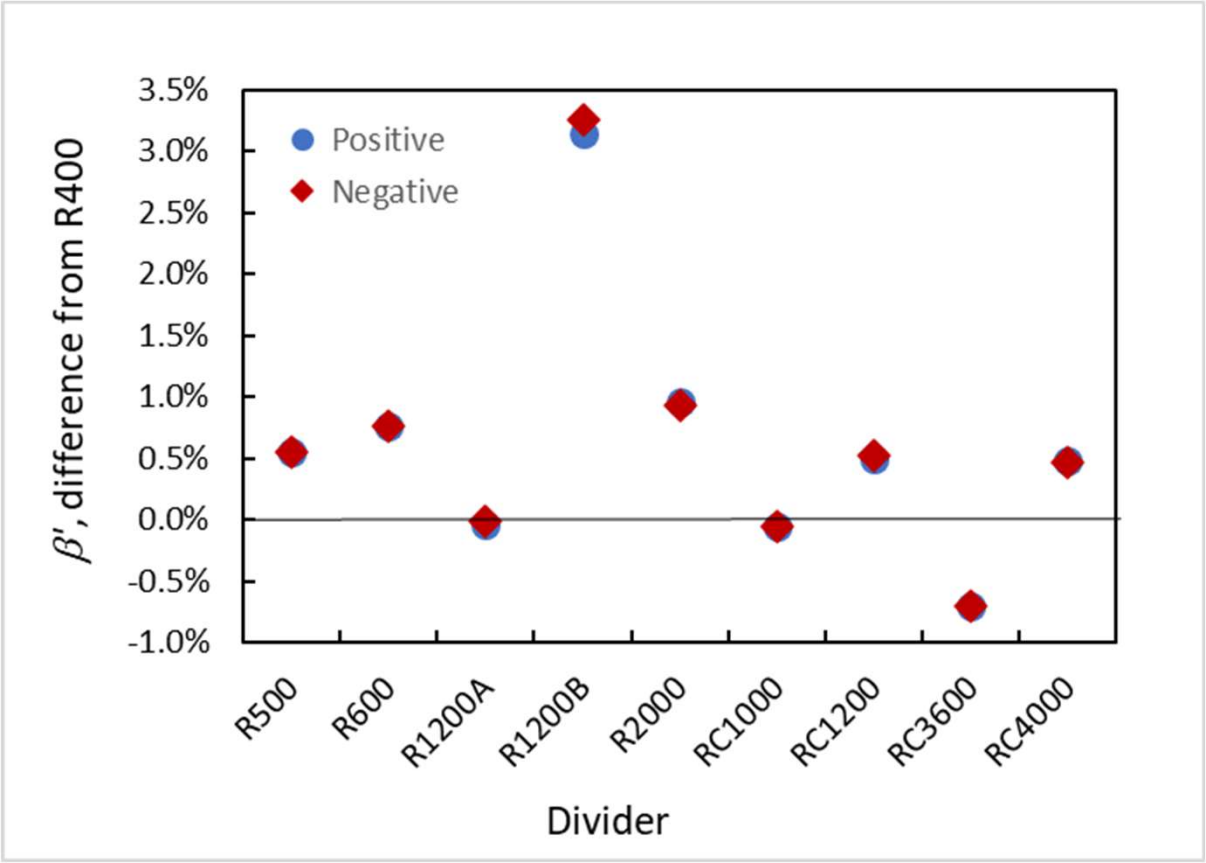
Calibrations @400 kV, T_1



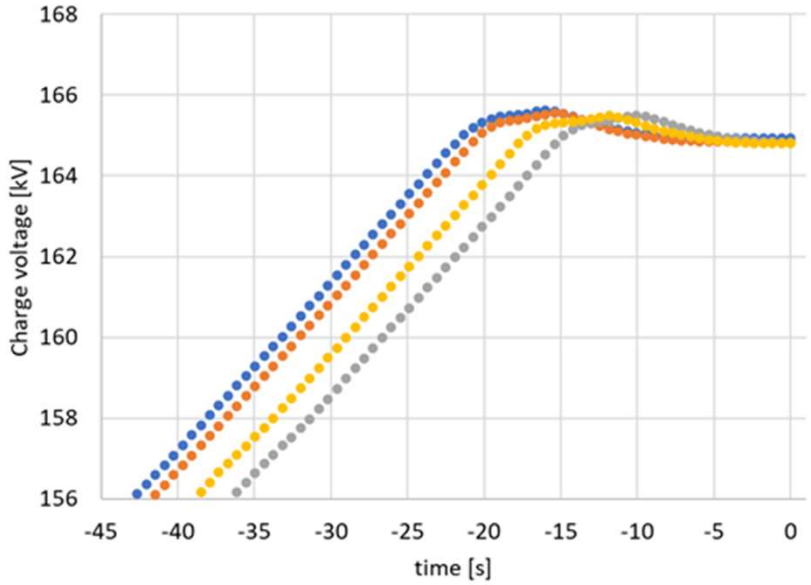
Calibrations @400 kV, T_2



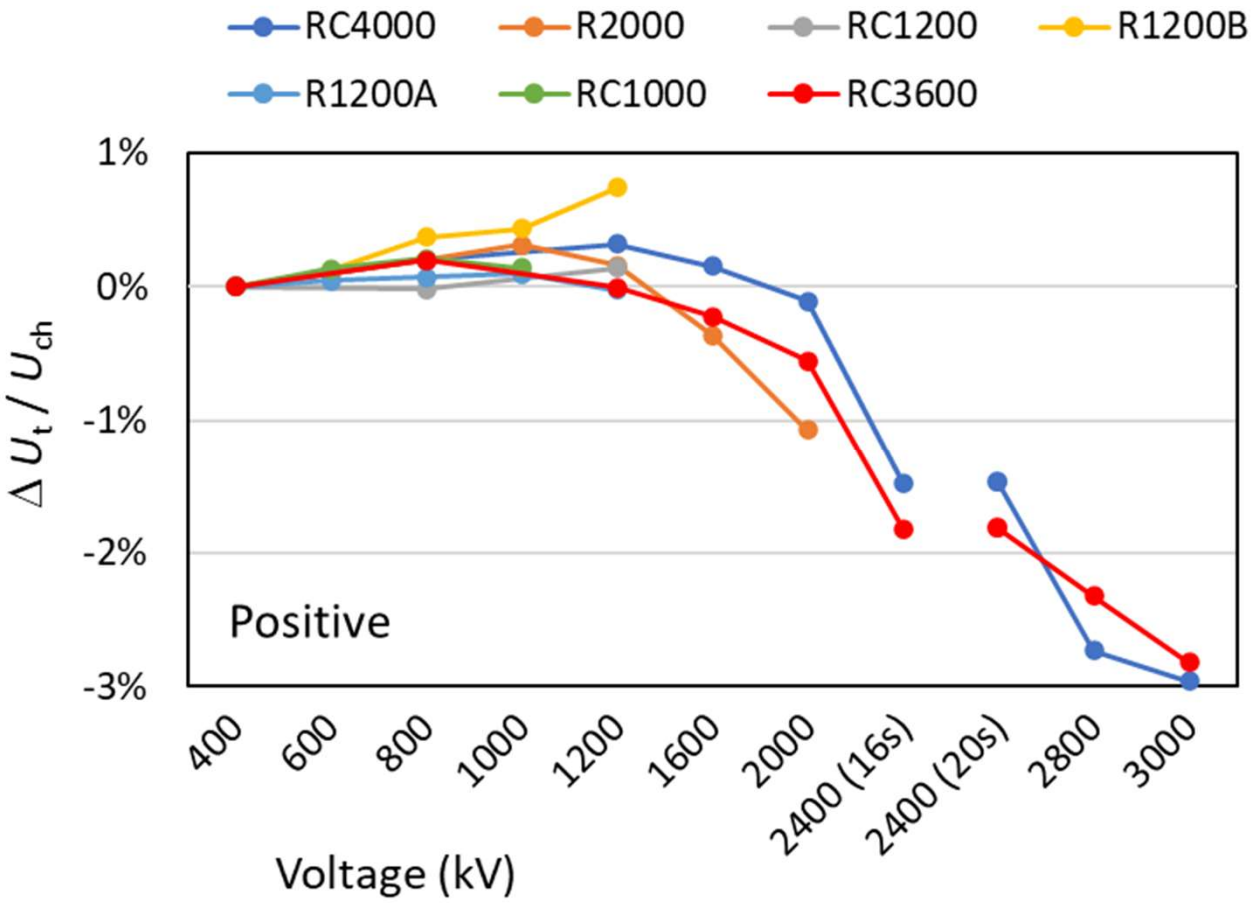
Calibrations @400 kV, β’



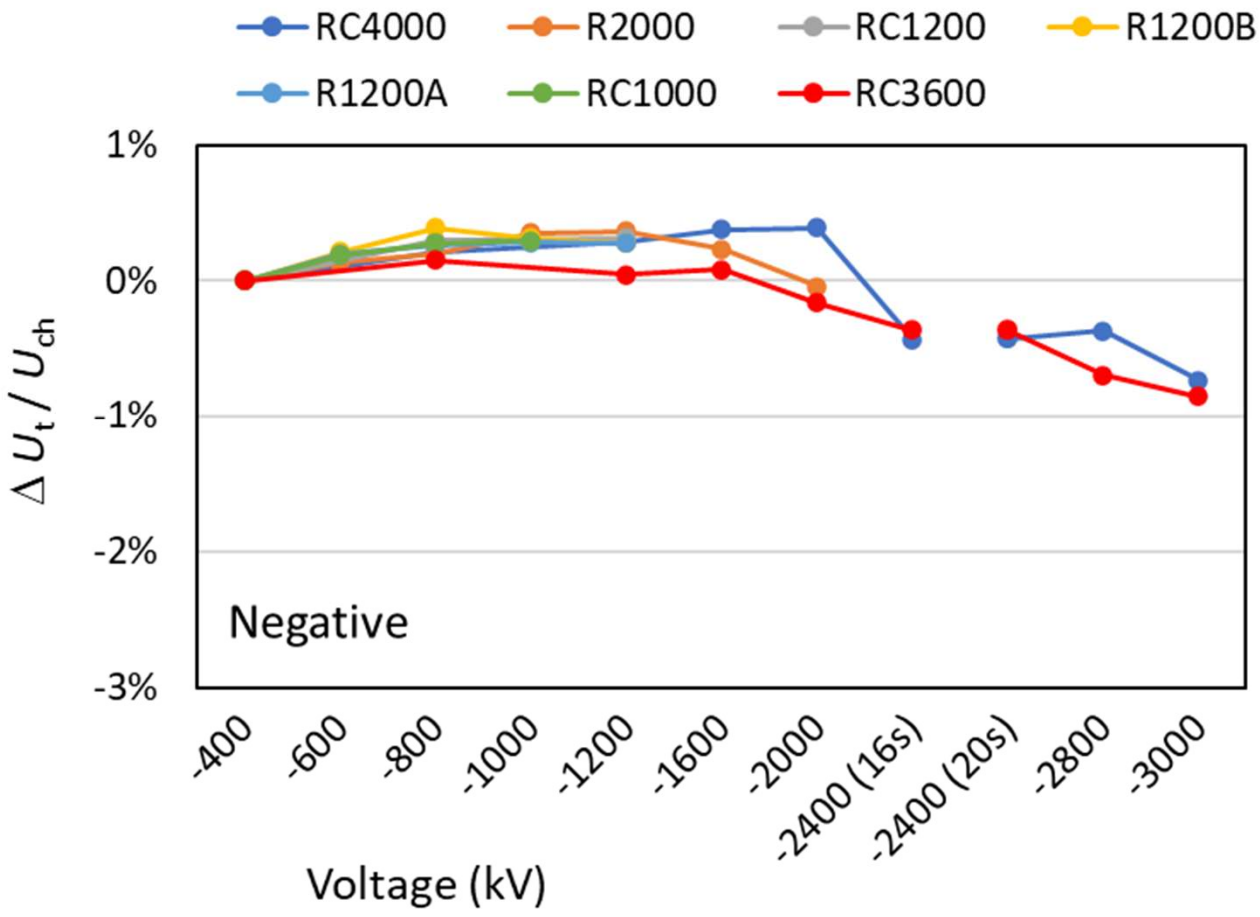
Linearity measurement



Linearity against charging voltage, positive

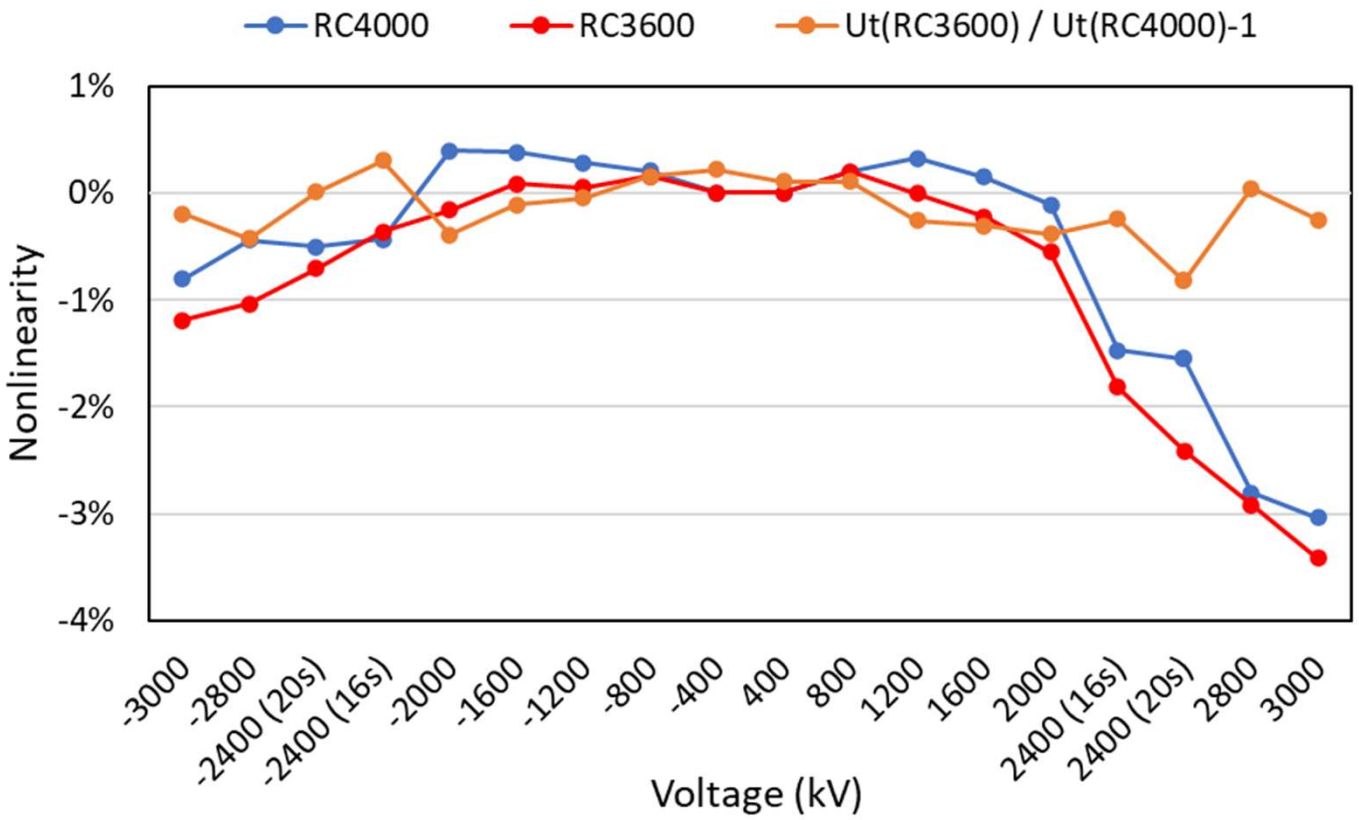


Linearity against charging voltage, negative



TU Delft, 3000 kV setup

Linearity up to 3000 kV



Corona @2000 kV

Conclusions

- The charging voltage method for linear extension relies on a corona-free set-up to achieve 1 % measurement uncertainty as given by the standard [1].
- Working beyond 2 MV on positive polarity puts demands on practically everything to be corona-free, i.e., the divider and generator conditions as well as the HV connections.
- The linearity test against charging voltage of the generator can be used to prove the linearity.
- However, as stated in IEC 60060-2, failure to prove linearity does not necessarily mean that the measuring system is non-linear.

Acknowledgement

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