Ultra Fast DC Fault Detection and Protection

Closing the gap towards a safe LVDC system

Fedor Boendermaker

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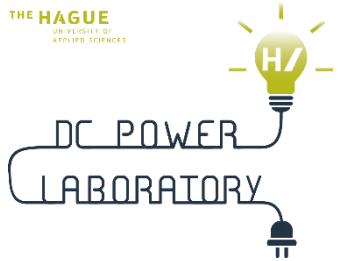


Achtergrond

Afbeelding: Sumanley xulx, Pixabay

Afbeelding: ATAG

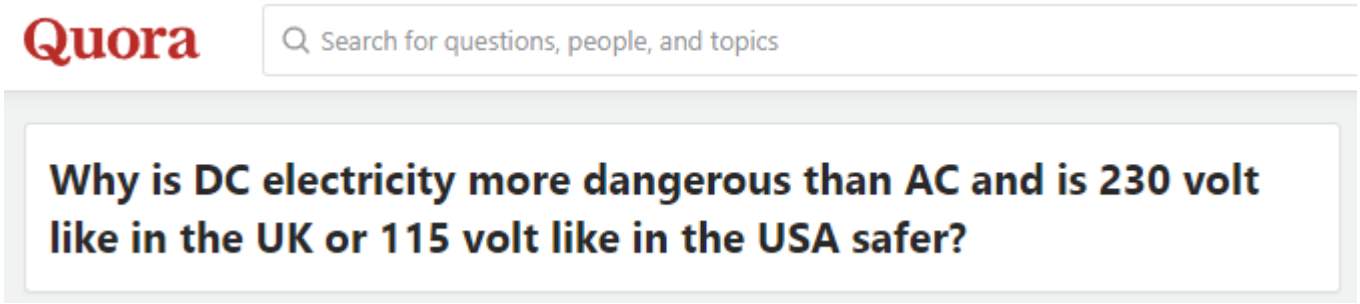
ATAG BENELUX

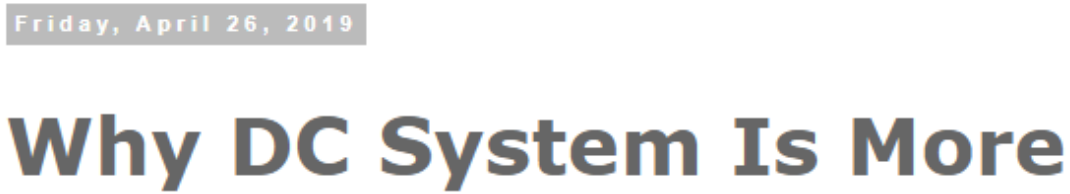
Power Electronics & Energy Storage event
POWER ELECTRONICS
ENERGY STORAGE
27 juni 2023 | 1931 Congrescentrum 's-Hertogenbosch

THE HAGUE UNIVERSITY OF APPLIED SCIENCES

DC POWER LABORATORY

Het probleem



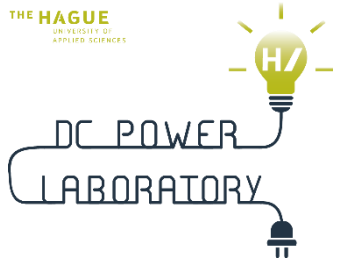


Afbeeldingen:
https://www.quora.com/Why-is-DC-electricity-more-dangerous-than-AC-and-is-230-volt-like-in-the-UK-or-115-volt-like-in-the-USA-safer
https://www.wazipoint.com/2018/03/why-dc-system-is-more-dangerous-than-ac.html
https://www.chegg.com/homework-help/questions-and-answers/question-41-1-point-dc-current-dangerous-alternating-current-true-false-question-42-1-poin-q98170347

Het doel

Ontwerpen van een beveiligingssysteem voor gelijkspanning:

- Aantonen dat DC net zo veilig of veiliger kan zijn dan AC
- Aantonen welke limieten een DC beveiligingssysteem kent
- In kaart brengen hoe apparaten en beveiligingsmaatregelen op elkaar afgestemd kunnen worden.

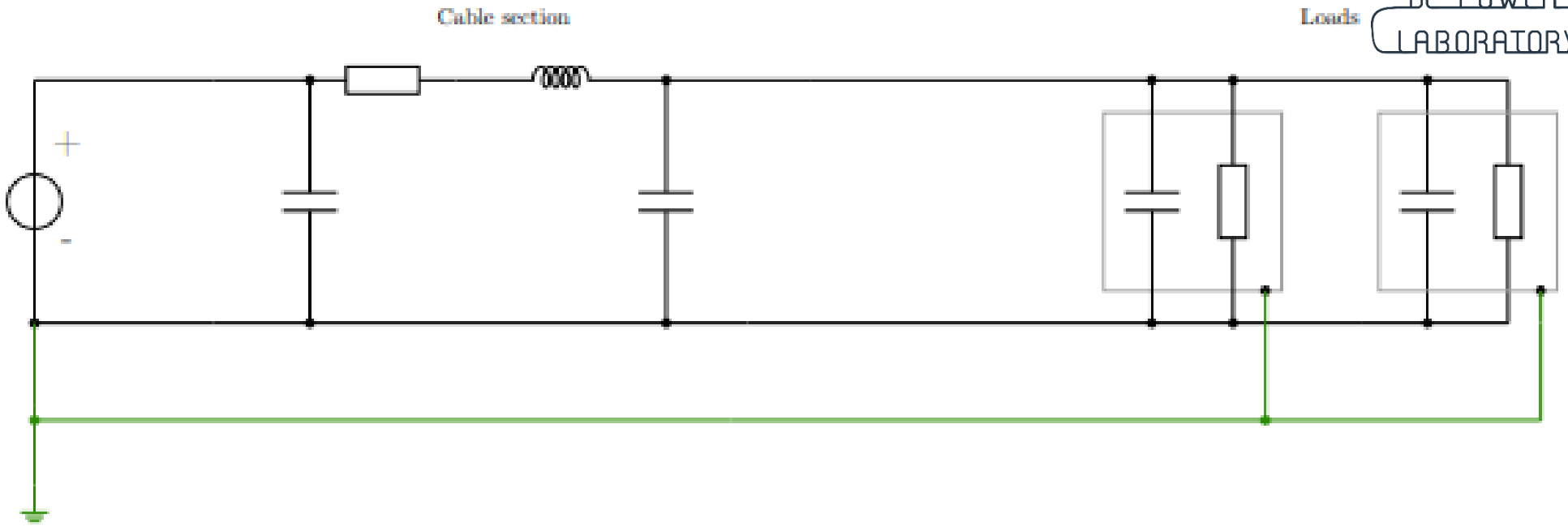


LVDC

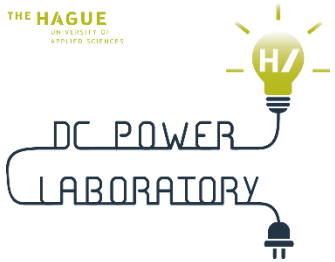
120 – 500 VDC

Unipolar

16A



Type fouten

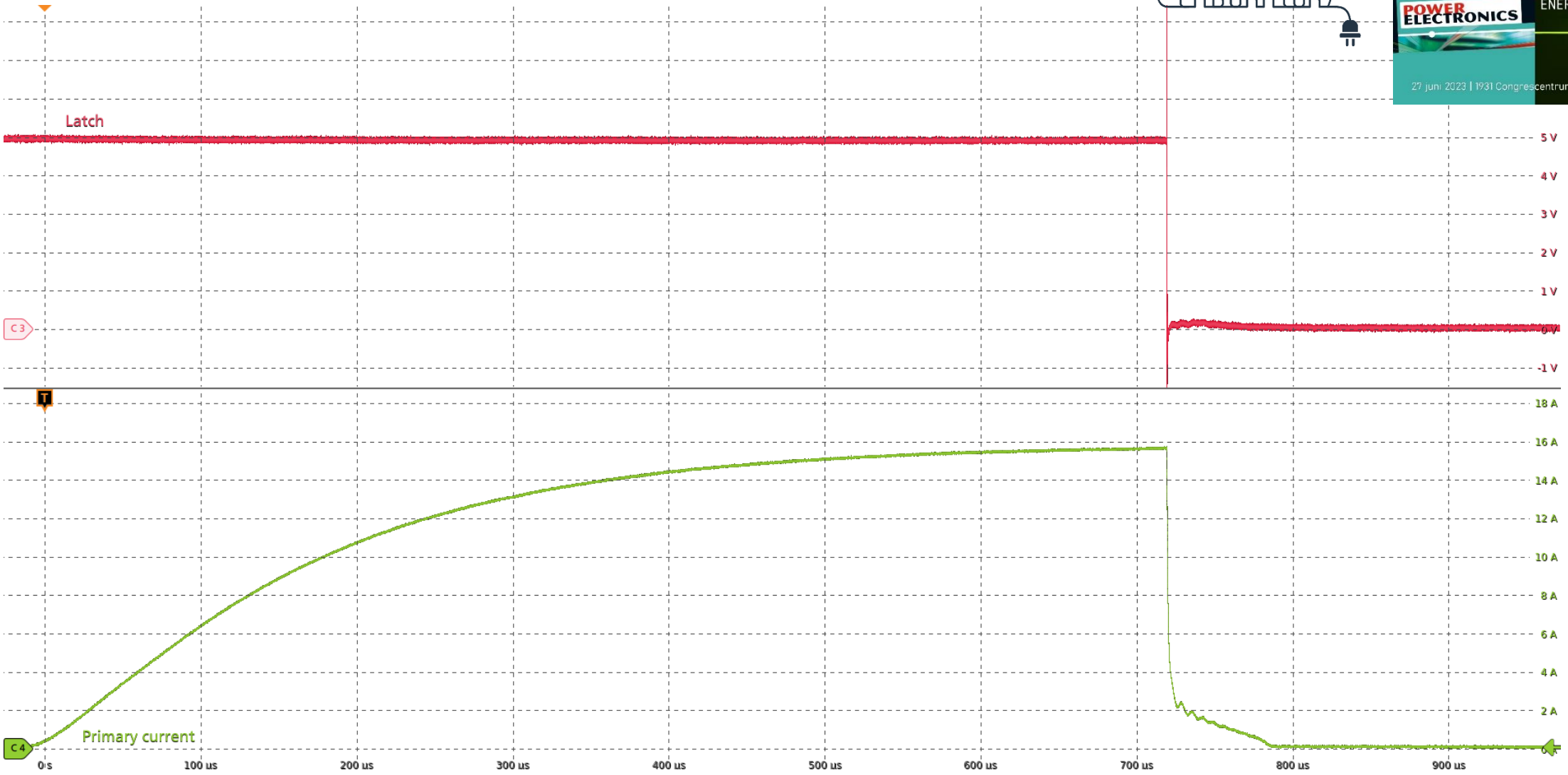


- Overbelasting
- Kortsluiting
- Elektrische schok

Overbelasting

Afbeelding: Wikipedia (https://fr.m.wikipedia.org/wiki/Fichier:Fuse_symbol_Europe.svg)

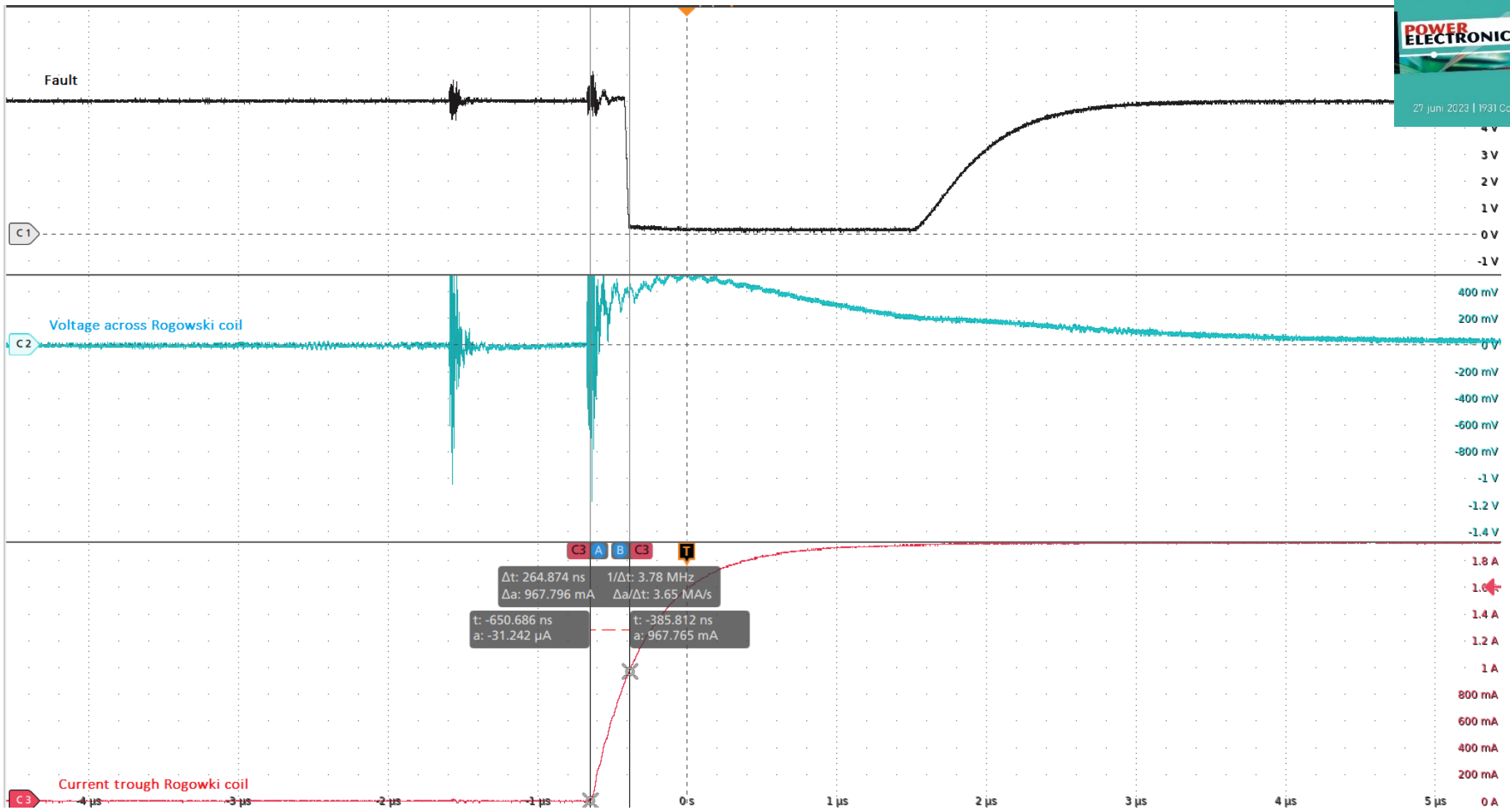
Overbelasting



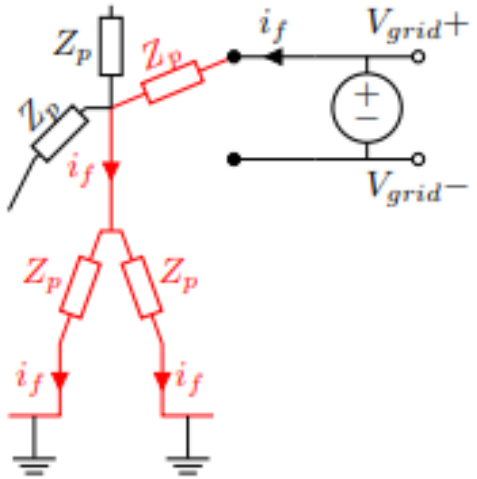
Kortsluiting

- Lage impedantie tussen de spanningsvoerende geleider en nul.
- Hele hoge stromen in een hele korte tijd.
- Gaat vaak gepaard met vonkbogen.
- Di/Dt detectie.

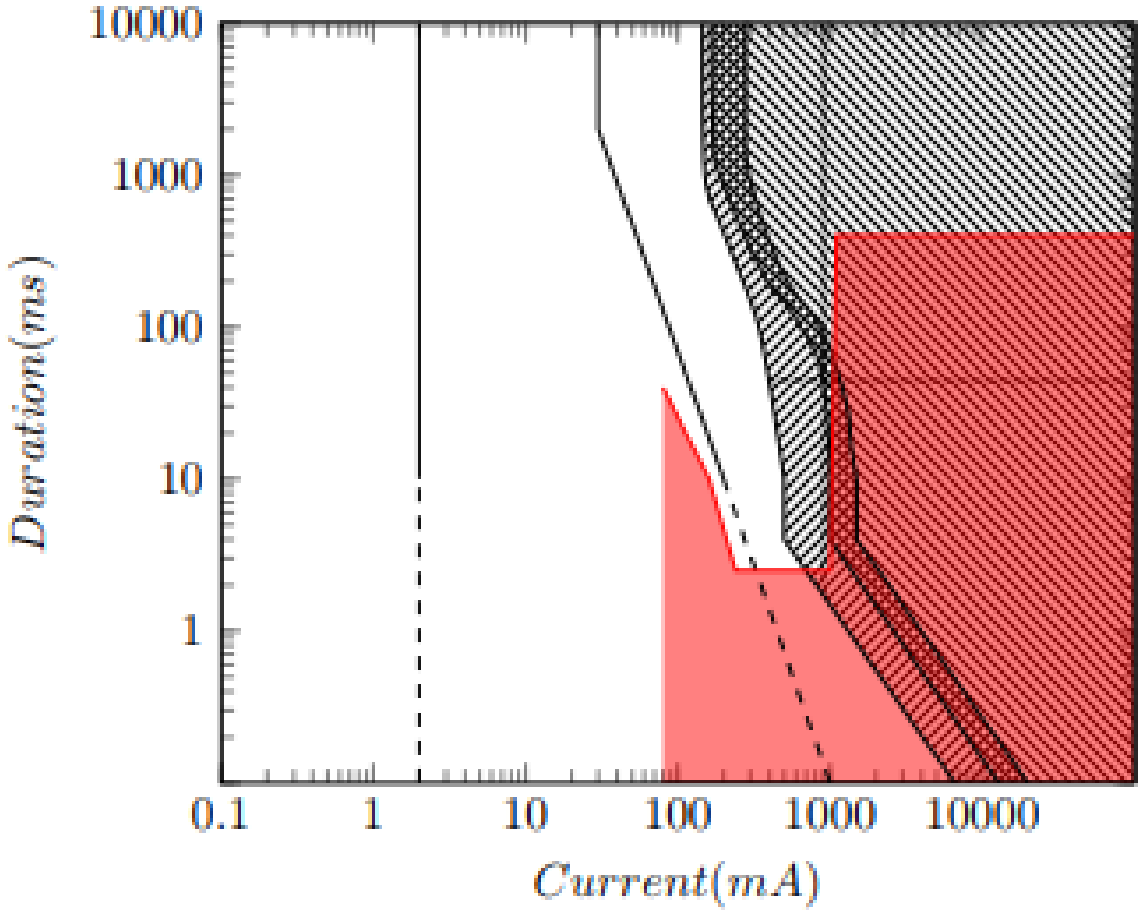
Kortsluiting

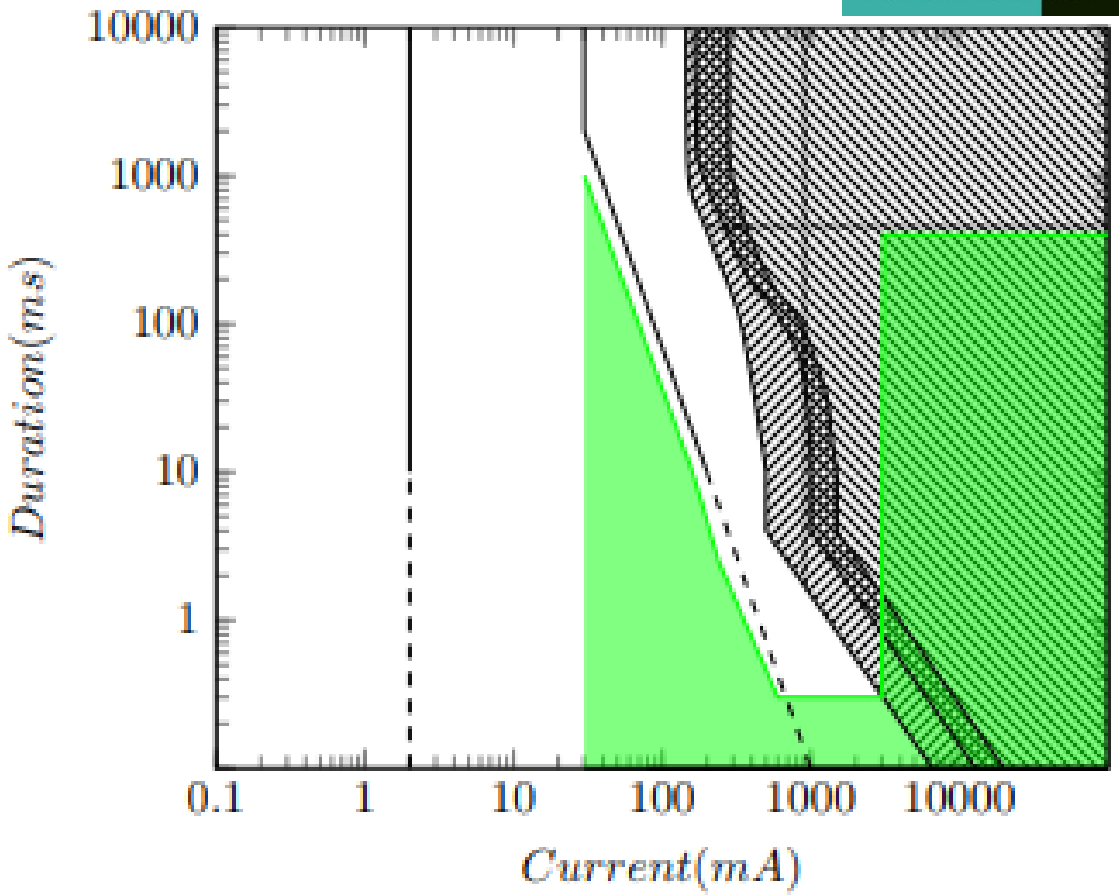


Elektrische schok / Aardlek

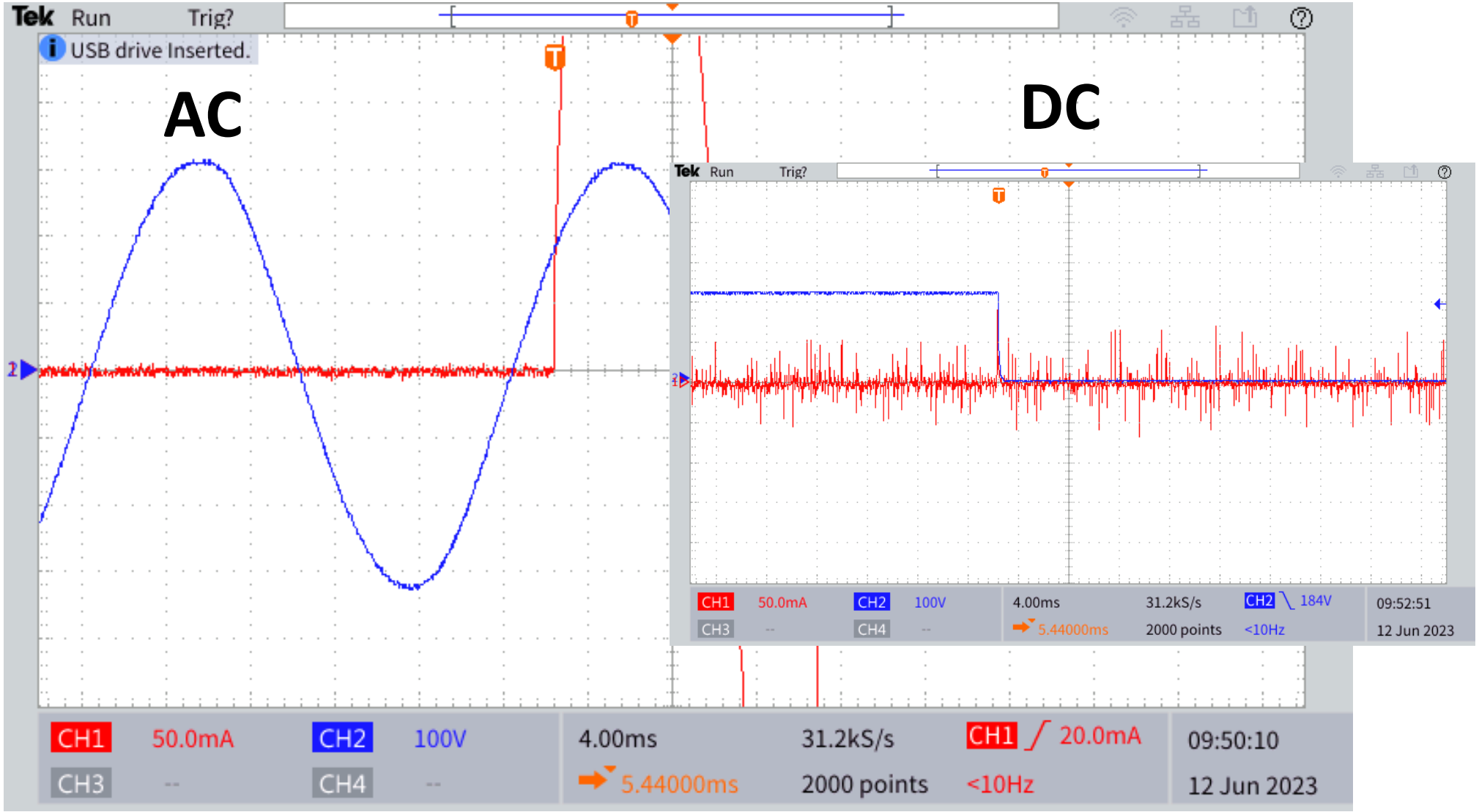


Elektrische schok





Elektrische schok



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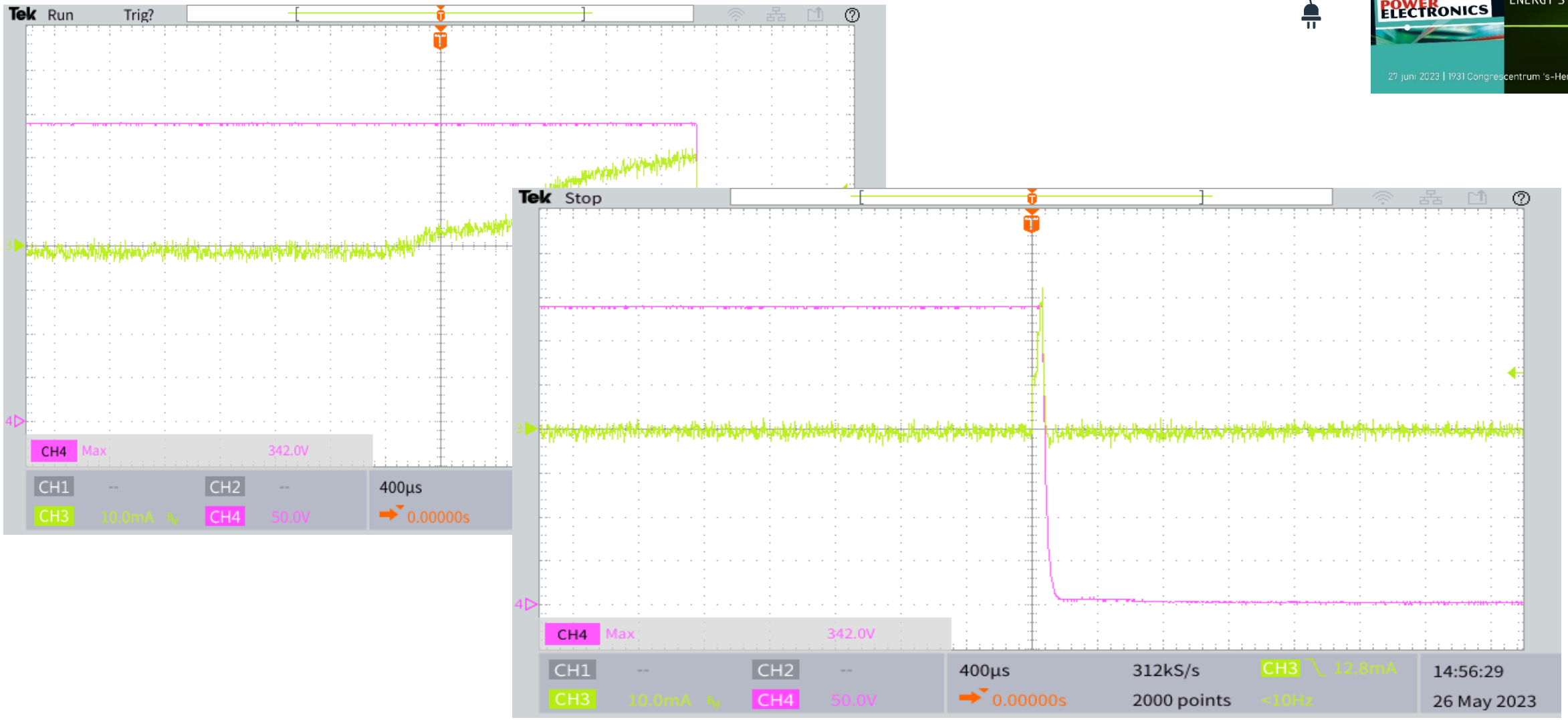

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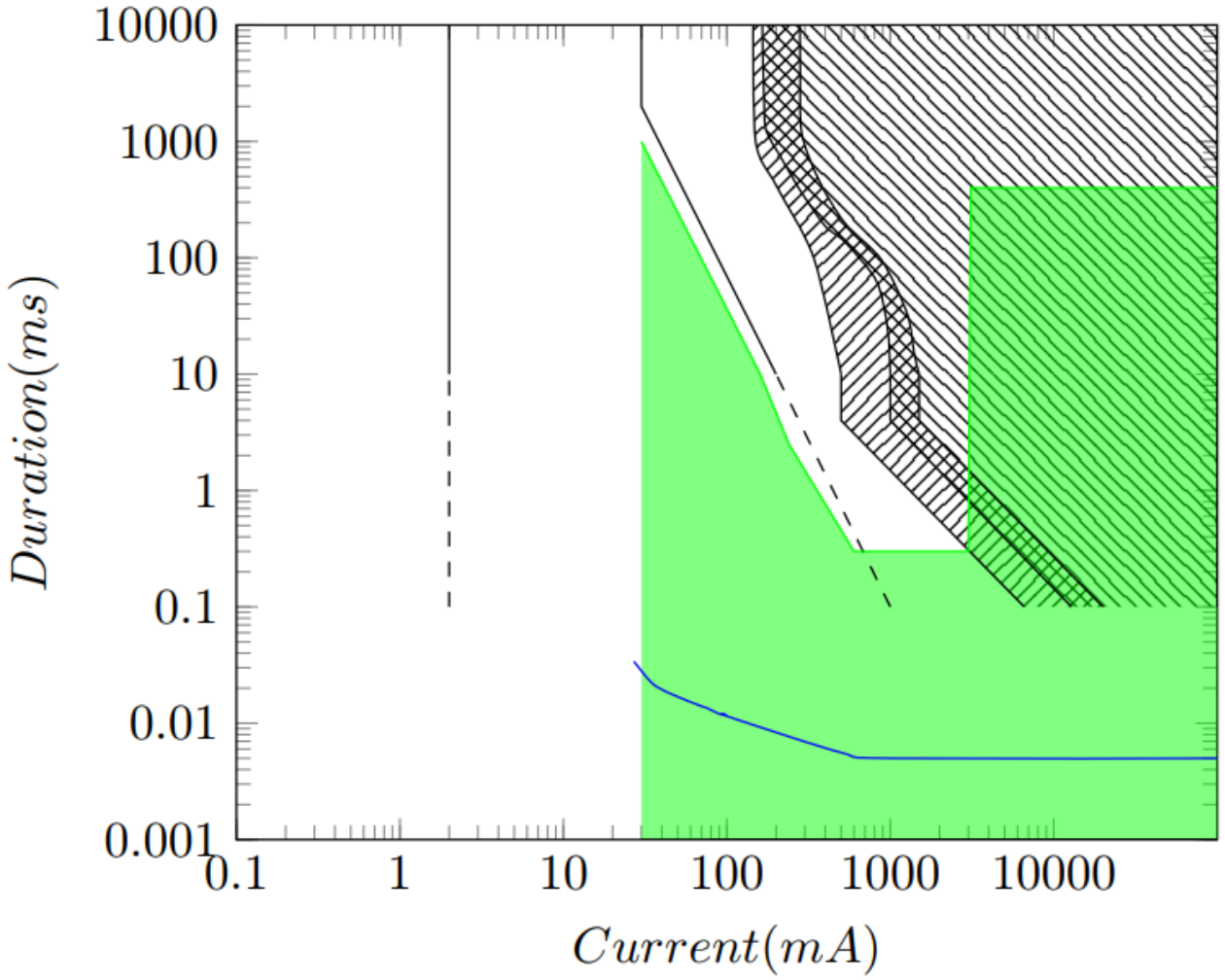
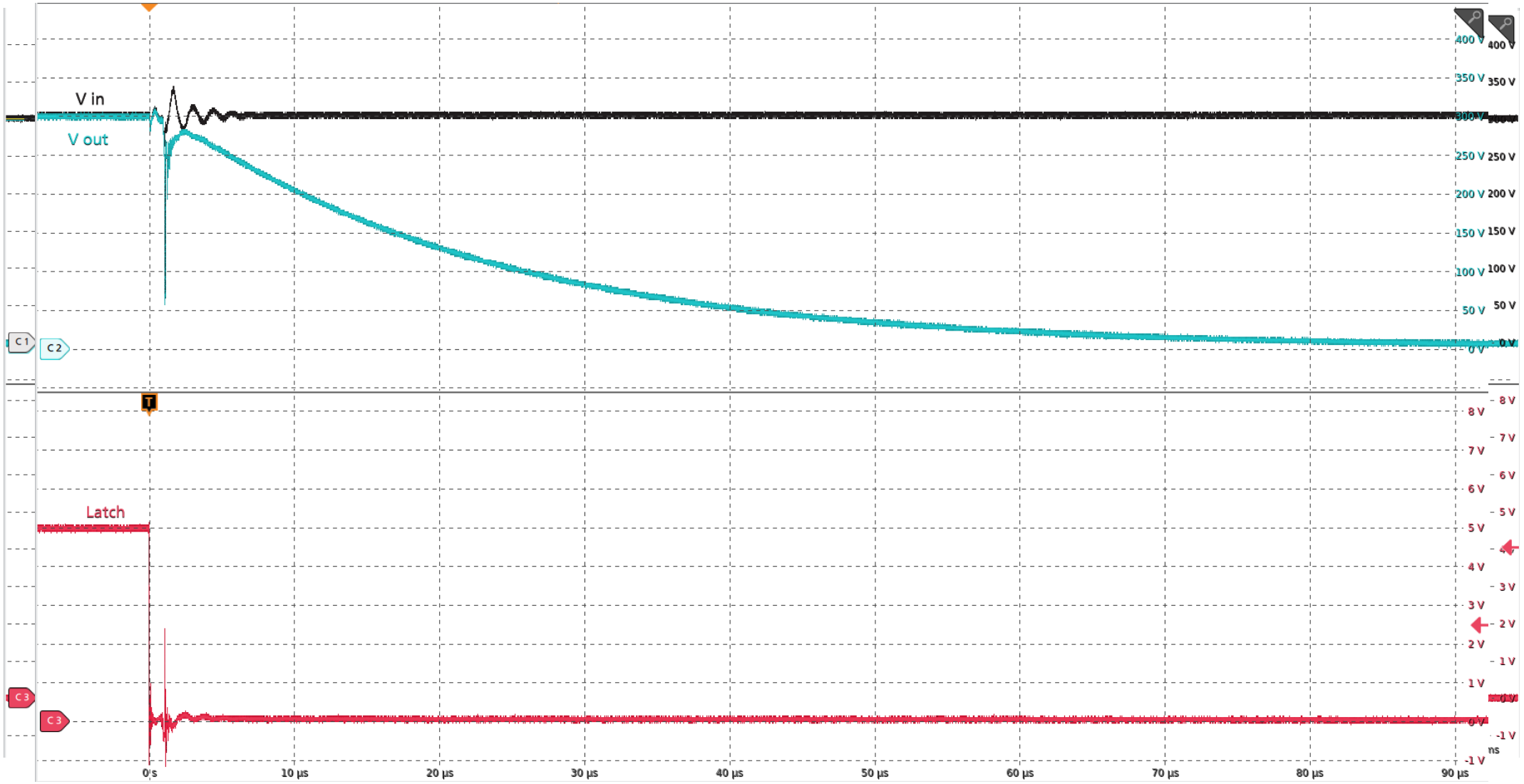


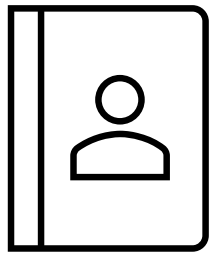
Solid state breaker



Conclusie

Voltage range	120 - 500 VDC	
Current range	-16 - 16 A	Detection of faults only applies to positive currents
Di/Dt Trip level	1 MA/s	Within 1 microsecond
RCD Trip level	30 mA	Within 35 microseconds
Maximum discharge capacity	420 uF	Within 1 millisecond at 350 VDC
Maximum precharge capacity	8 uF	25 millisecond precharge duration

Vragen



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Stand 14

Zou ik mijn eigen systeem aan durven raken?