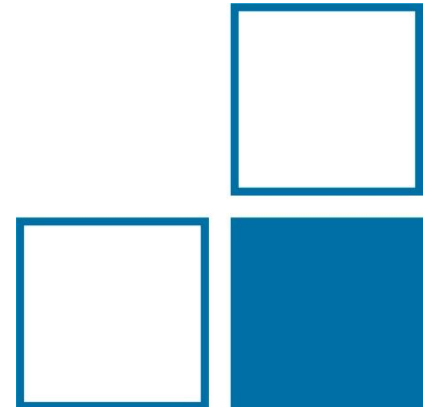


HV-com²

Support for standardisation of high voltage testing with composite and combined wave shapes

Dr. Johann Meisner

Instrument Transformers and High Voltage Metrology



Introduction

„State of art“ and „needs“

Project „HV-com²“

Low Voltage

High Voltage

Validation

Conclusion

Introduction

„State of art“ and „needs“

Project „HV-com²“

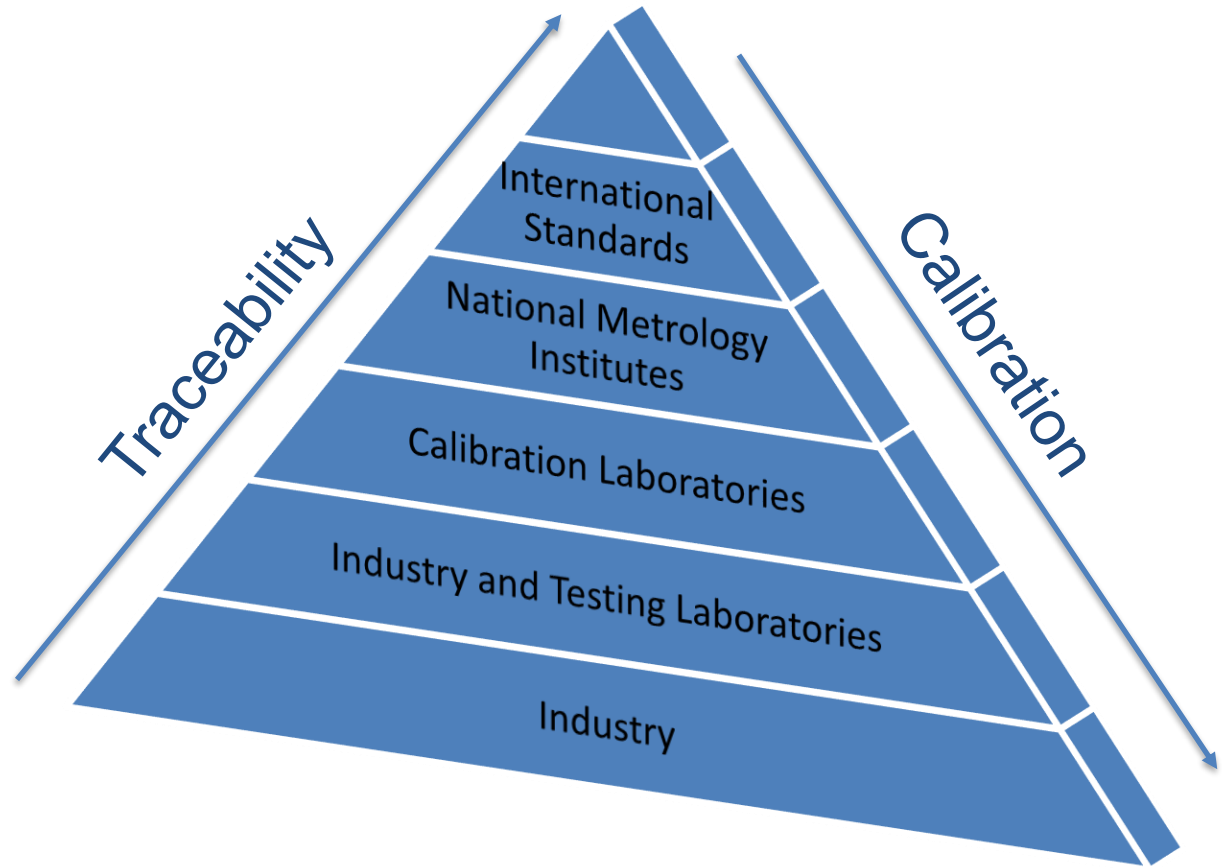
Low Voltage

High Voltage

Validation

Conclusion

- Need for methods and research
- Need for capabilities and facilities
- Need for calibration and accreditation
- Need for calibration
- Need for testing



Introduction

„State of art“ and „needs“

Project „HV-com²“

Low Voltage

High Voltage

Validation

Conclusion

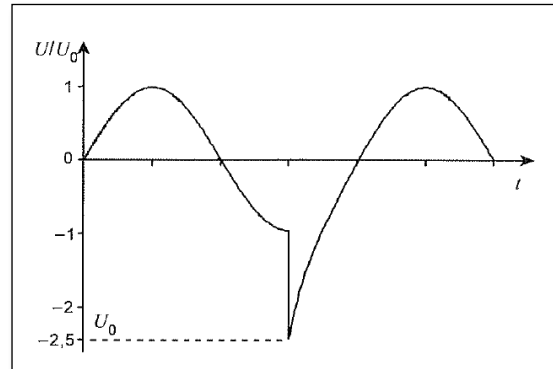
PTB Combined and composite wave shapes

HVAC
or
HVDC

Combined or
Composite
Wave Shape

Lightning Impulse
or
Switching Impulse

IEC 60060 – 1 High-voltage test techniques
- Part 1: General definitions and test requirements
→ Review started!



-Describes the circuits for composite and combined tests
-Gives no requirements for test voltage
-Does not deal with time parameters

For whom and for what?

- GIS testing
- Cabel testing
- Transformer testing
- ...

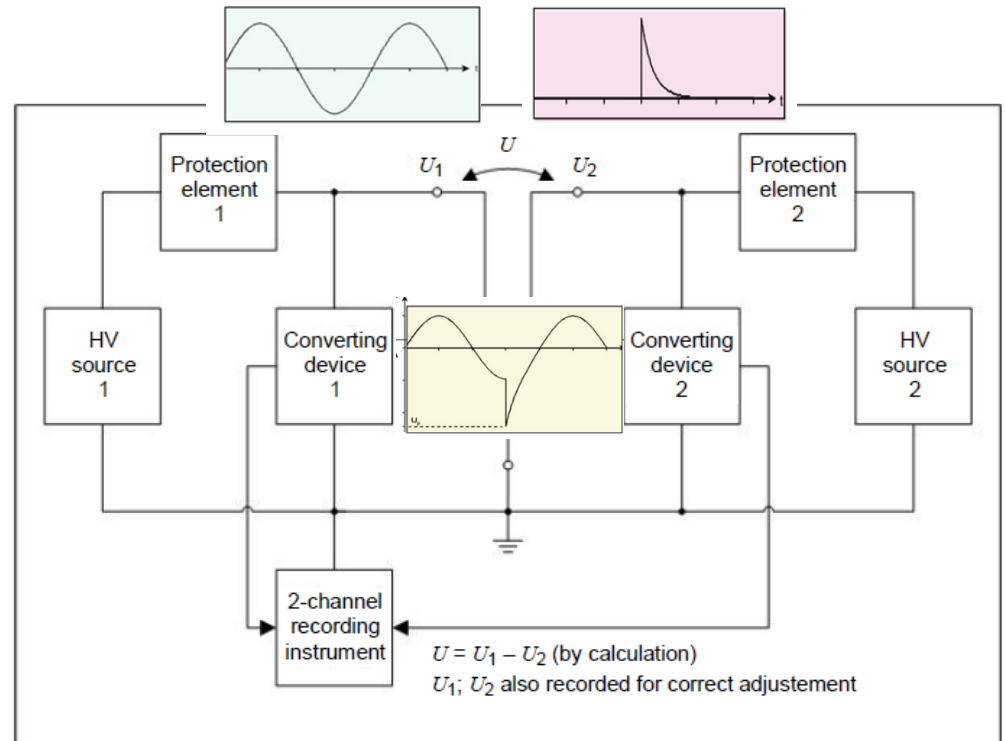


<https://global-sei.com/power-cable-business/products/hvdc/>

<https://www.energate-messenger.de/news/163845/zwei-konverter-fuer-eine-hgve-leitung>

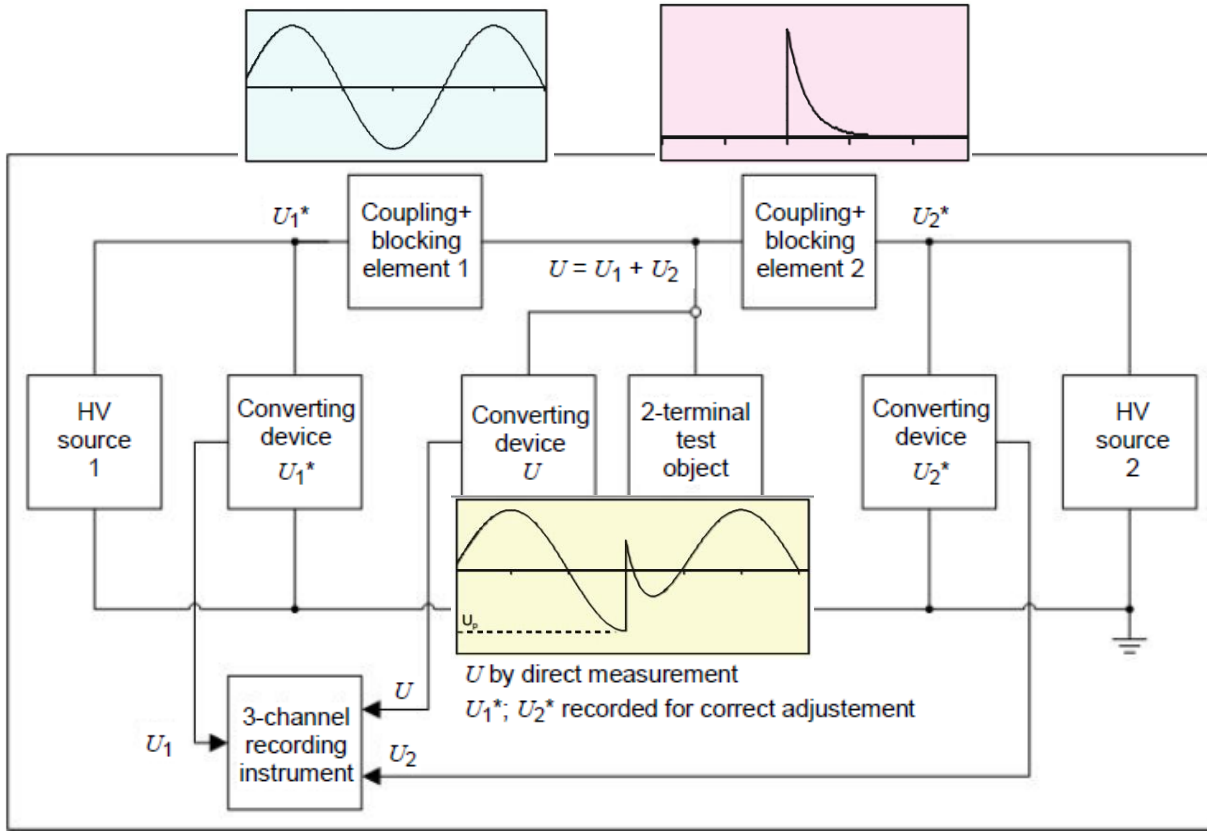
https://www.zfk.de/fileadmin/Bilderdatenbank_NEU/Technik/Energie_gasolierte_Schaltanlage_c_ABB.jpg

- Blocking elements for protection
- Different measuring devices
- Calculation of combined voltage



IEC 2219/10

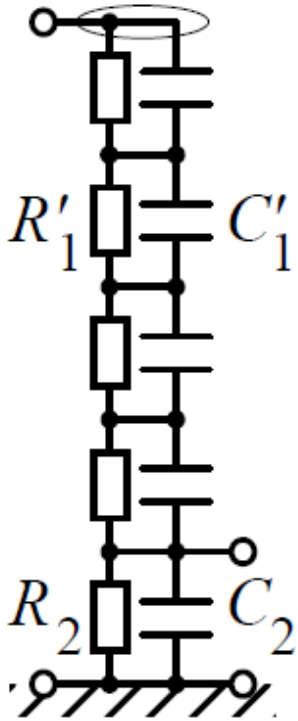
PTB Composite voltage test



IEC 2222/10

- Blocking elements for protection
- One measuring devices
- Real measurement of composite voltage

Universal R-C-Divider



A. Küchler, „Hochspannungstechnik“

- Testing Dividers/Systems with HVAC, HVDC and Impulses separately
 - HVAC scale factor $\rightarrow 998$
 - HVDC scale factor $\rightarrow 1002$
 - Impulse scale factor $\rightarrow 987$
- Customers must choose scale factor for composite wave shapes themselves
- There are no reference dividers
- There are no calibration services

Introduction

„State of art“ and „needs“

Project „HV-com²“

Low Voltage

High Voltage

Validation

Conclusion

EMPIR



The EMPIR initiative is co-funded by the European Union's Horizon 2020 research and innovation programme and the EMPIR Participating States



**Support for standardisation of high voltage testing with
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19NRM07 HV-com²

<https://www.ptb.de/empir2020/hv-com2/home/>

PTB Research Project „HV-com²“



<https://simple.wikipedia.org/wiki/Europe>

Introduction

„State of art“ and „needs“

Project „HV-com²“

Low Voltage

High Voltage

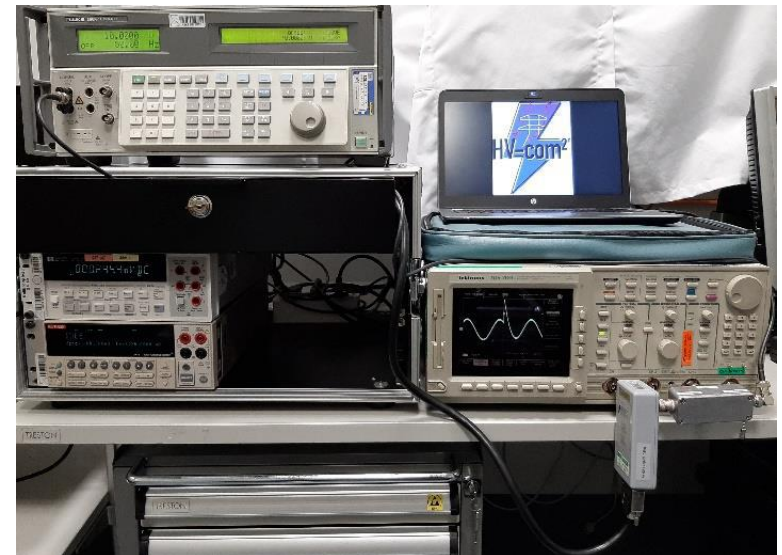
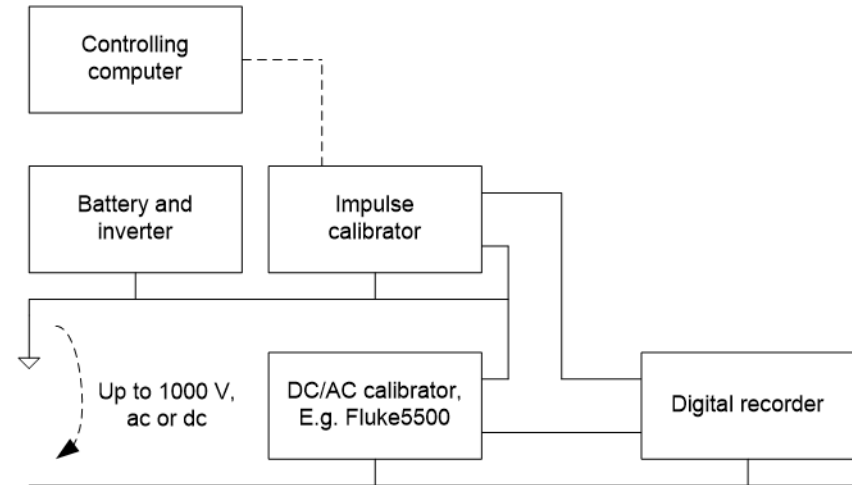
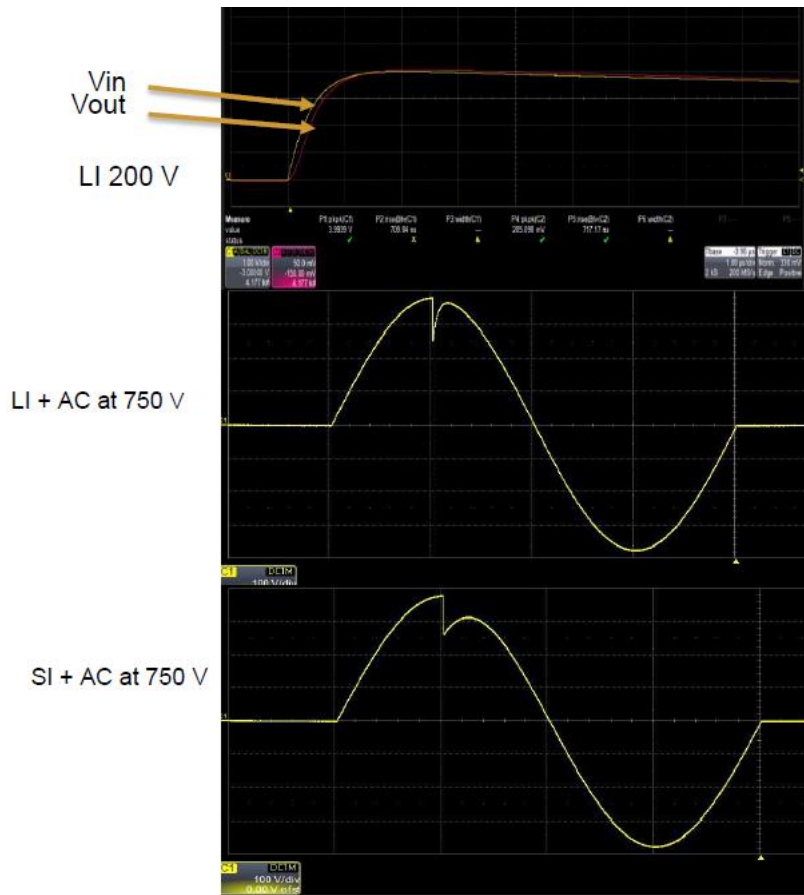
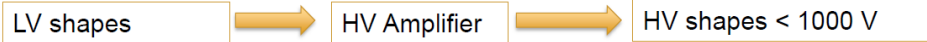
Validation

Conclusion

- Parameter for superimposed wave shapes
- LV generators
- LV measurement instruments (transient recorders)
- Software for superimposed wave shapes
- Comparison of different digitizers and generators

- Recommendation for standardisation in TC 42
 - IEC 60060 series
 - IEC 61083 series

PTB Low voltage generators



Introduction

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Project „HV-com²“

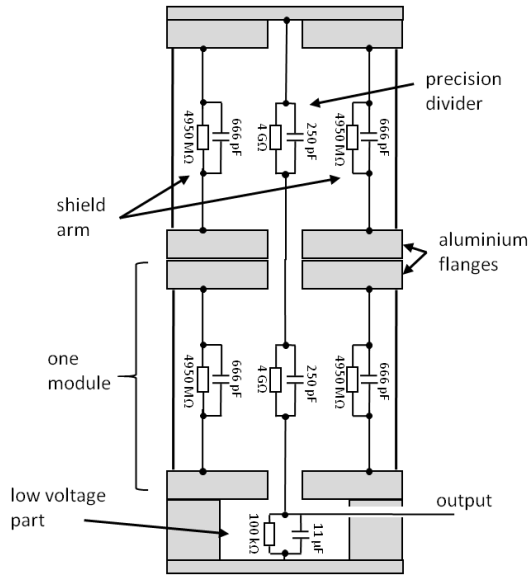
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High Voltage

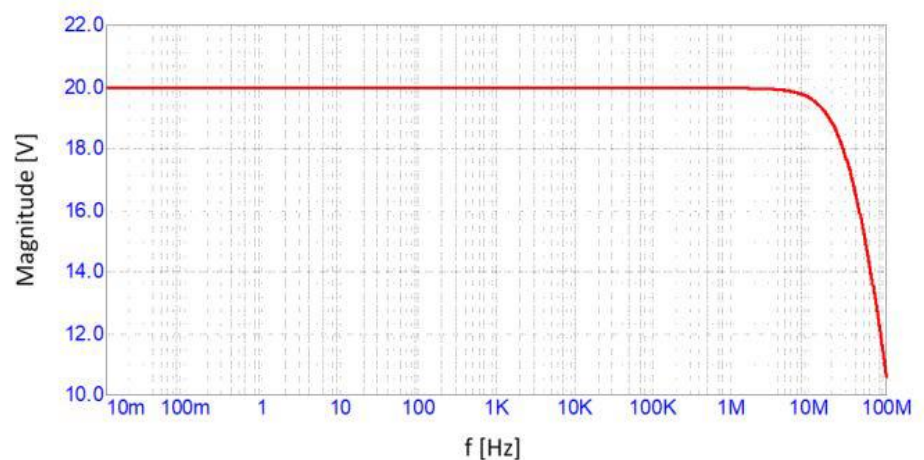
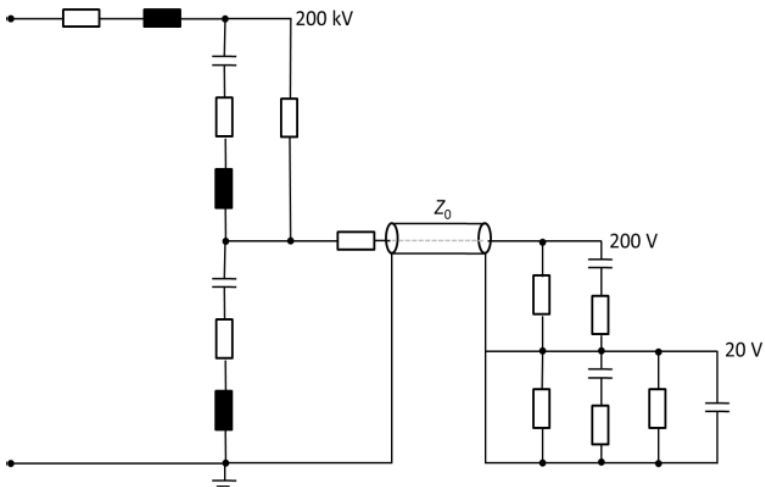
Validation

Conclusion

PTB WP 2: Traceable reference systems



- Modular reference divider
 - 200 kV modules
 - 400 kV modules
 - At least 4 NMIs
- Setup of the circuits
- Determine the uncertainty (<2%)
- Comparison of NMIs new references



Introduction

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Project „HV-com²“

Low Voltage

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Validation

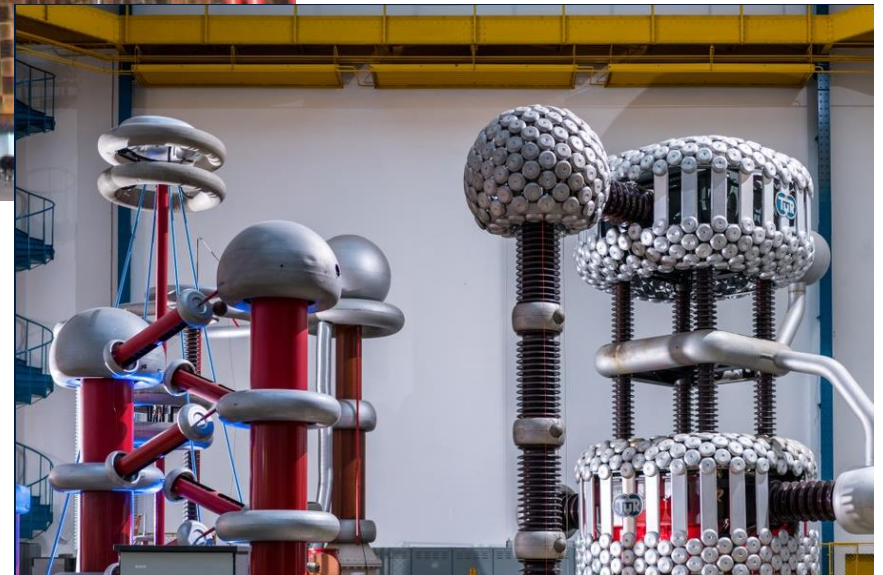
Conclusion

PTB WP 3: Approved measuring systems

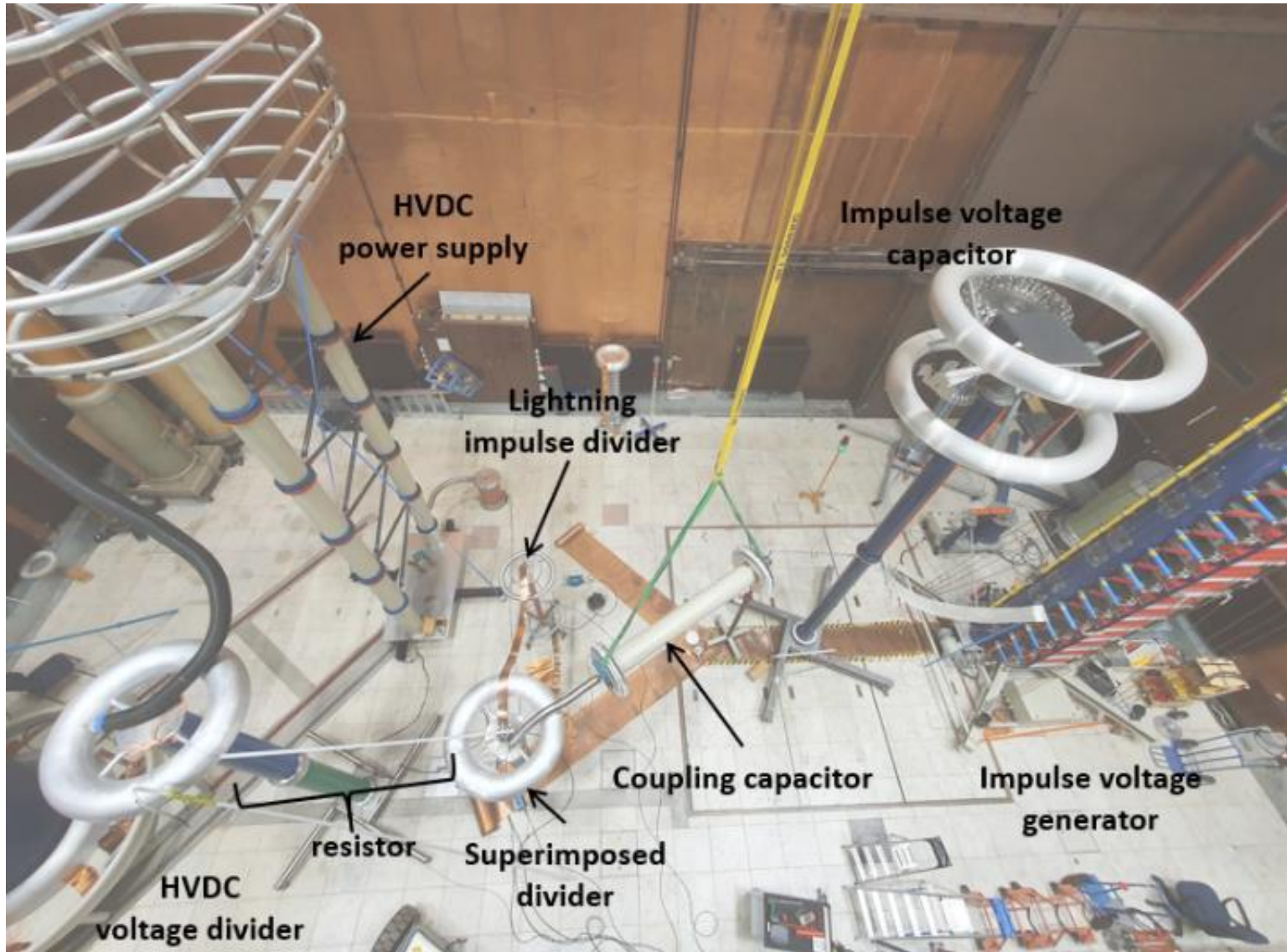
- Comparison Measurements at TU Graz and TU Dresden



<https://www.tugraz.at/institute/hsp/>



<https://tu-dresden.de/ing/elektrotechnik/ieeh/das-institut#intro>



Introduction

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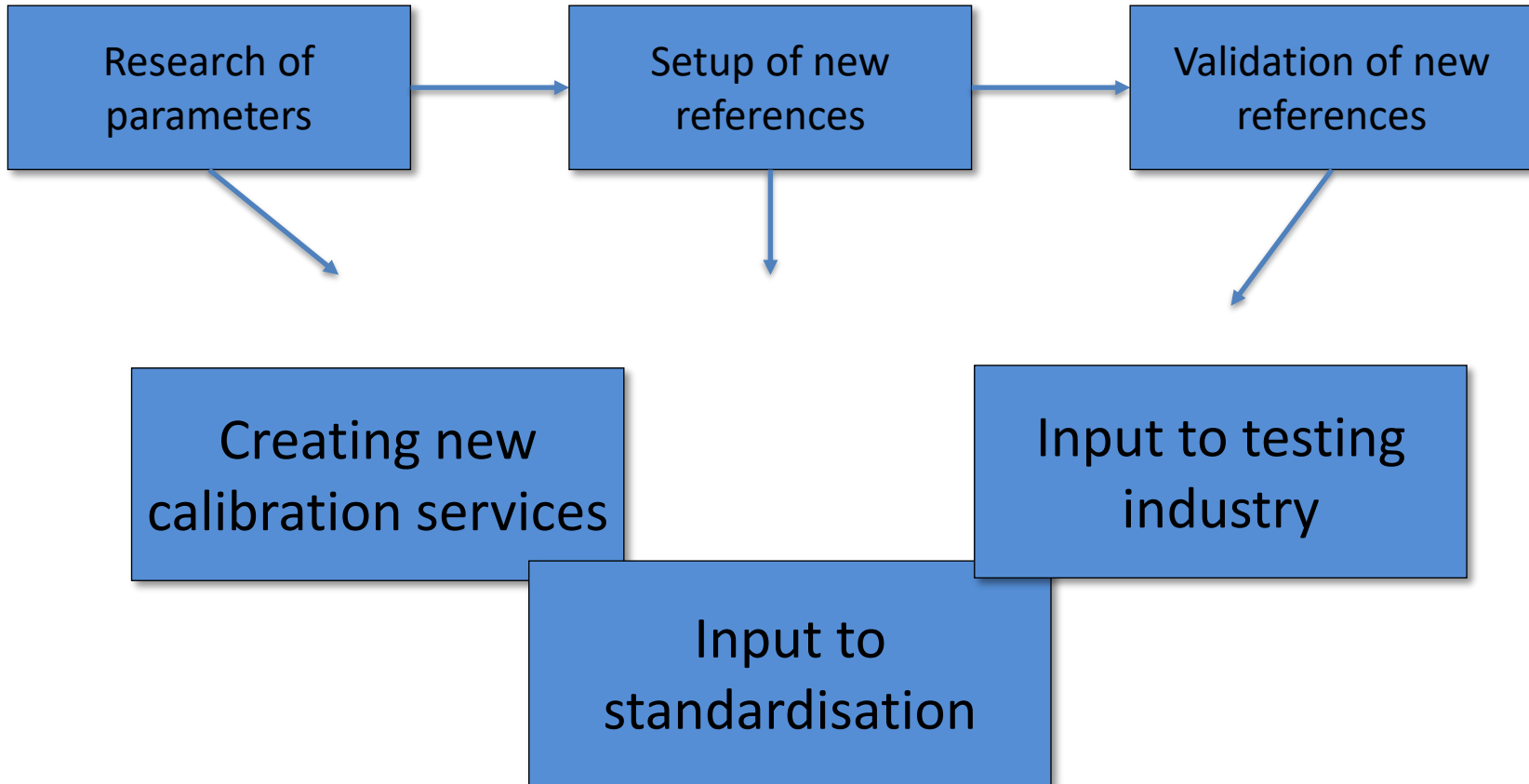
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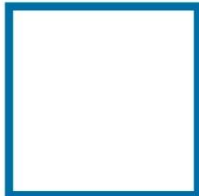


**Support for standardisation of high voltage testing with
composite and combined wave shapes
19NRM07 HV-com²**



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