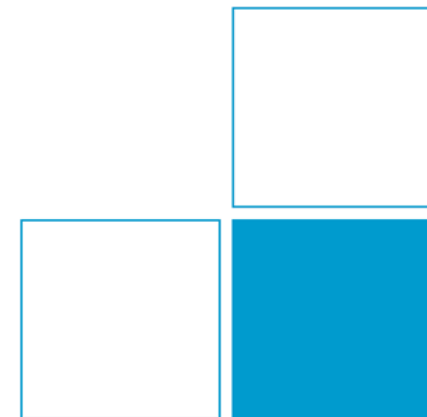


## WP3: New services for non-conventional voltage and current sensors

Enrico Mohns (PTB)

Metrology For Future Smart Grid Technologies  
Haarlem, 19th April 2017



# 1. Motivation

*(2013) → non-conventional instrument transformers exist, but no calibration service (including traceability) in Europe available*

## WP3 of FutureGrid:




*" Testing and calibration of non-conventional sensors "*

- Development of calibration facilities for
  - validating sensors with analogue output
  - validating sensors with digital output incl. SAMUs
  - validating test sets for testing of n.c. sensors
- Launch calibration services and CMC entries (internationally recognized)
- Supporting work (practice guides, papers...)

## 2. Collaboration with Stakeholders

### Support of the research in WP3 of FutureGrid:

- Zera (Test sets for voltage / current sensors)
- Schniewindt (SV generator; SAMU; SV Viewer)
- Zelisko (MV voltage sensor)
- ABB Switzerland (calibration of a test set for ABB's FOCS)
- LEM (set of new series of Rogowski Coils)

 Physikalisch-Technische Bundesanstalt Braunschweig und Berlin Nationales Metrologieinstitut	
 Kalibrierschein Calibration Certificate	
Gegenstand: Object:	Spannungssensor mit T-Stecker
Hersteller: Manufacturer:	Zelisko GmbH Beethovenstrasse 43 - 45 A-2340 Modling
Typ: Type:	SMVS UW1001
Kennnummer: Serial No.:	1693
Auftraggeber: Applicant:	Zelisko GmbH Beethovenstrasse 43 - 45 A-2340 Modling
Anzahl der Seiten: Number of pages:	7
Geschäftszeichen: Reference No.:	14003178
Kalibrierzeichen: Calibration mark:	26090 PTB 15 / 26091 PTB 15
Datum der Kalibrierung: Date of calibration:	30.04.2015
Im Auftrag On behalf of PTB	Braunschweig, 2015-05-06 Im Auftrag On behalf of PTB
 Enrico Mohns	 Gunter Roessle
	

# 3. Calibration systems for analogue n.c. sensors

(VSL, TUBITAK, PTB)

Based on precise (modular) setups:

- ADC's, IVD's, CT's + Shunt
- Power Amplifiers
- Instrumentation amplifier



Based on commercial test sets...

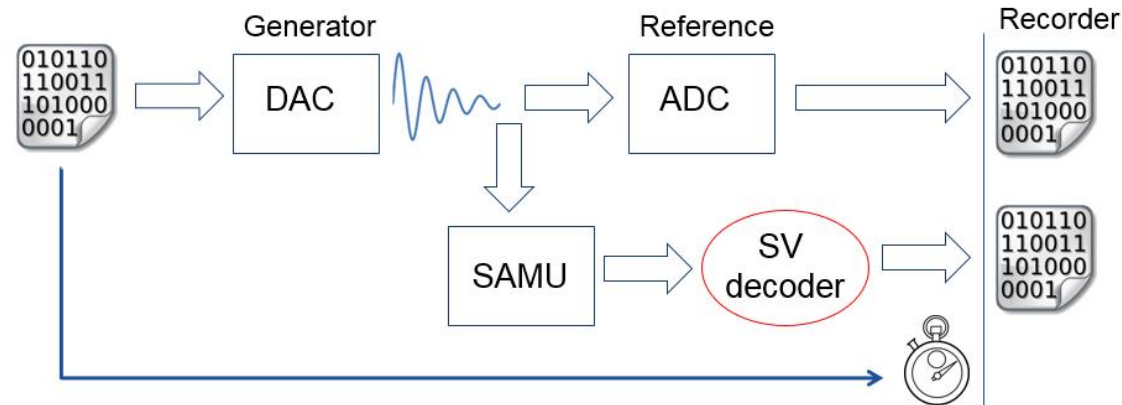


# 3. Calibration systems for digital n.c. sensors

(METAS, PTB, VSL, TUD)

Based on precise (modular) setups:

- Frequency link to atomic clocks
- ADC's, IVD's, CT's + Shunt
- SV Decoder Software



Based on commercial test sets...



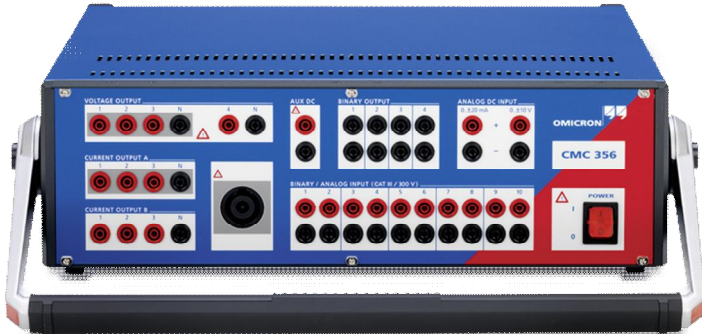
# 3. Calibration systems for n.c. test sets

(PTB, METAS, VSL, TUBITAK)

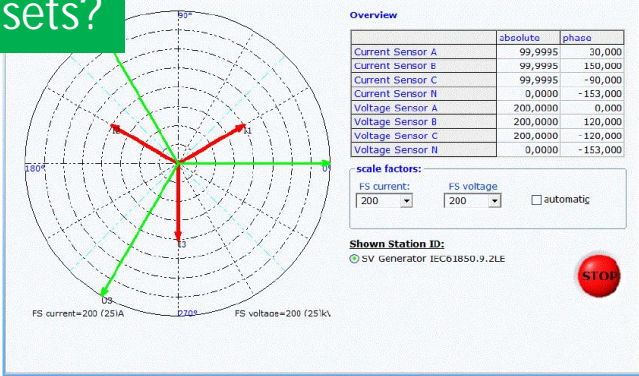
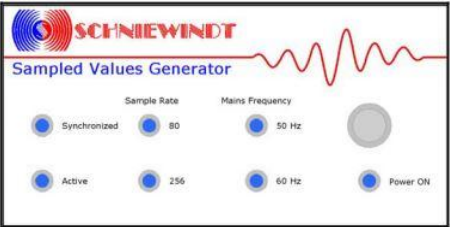
Testing of n.c. sensors for measuring purposes



Testing of n.c. sensors for protection purposes



How to calibrate such "mixed signal" test sets?



# 4. Supporting work

(TUD's activities)

- Analyses of the frequency response of selected non-conventional sensors (all completed)
  - Influence of magnitude and multifrequency signals (D3.4.3)
  - Influence of electric and magnetic stray fields (D3.4.4)
- Analysing the transmission behaviour of digital non-conventional sensors on magnitude and multifrequency signals (D3.2.5) (finished in May)
- Investigating the requirements of A/D converters within sensors to determine important power quality parameters (D3.4.6) (completed)
- Good practice guide on the installation of non-conventional sensors in order to ensure a high accuracy (D3.4.5) (finished in May)

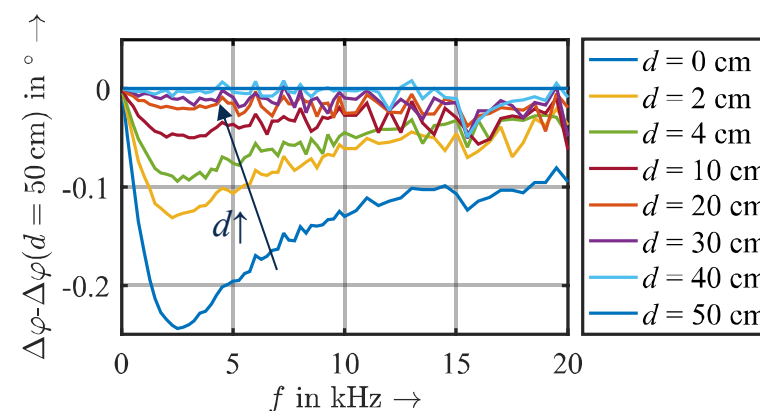
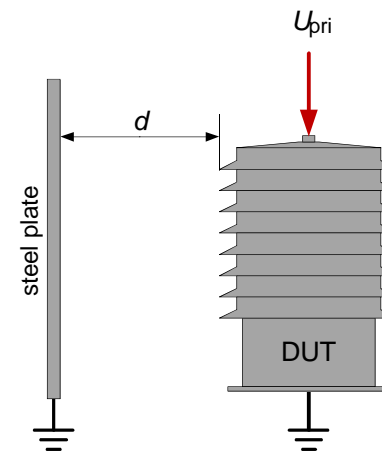


# 4. Supporting work

(TUD's activities)

## Influence of electric stray fields at a resistive divider

- Resistive 10 kV divider was analysed
- Frequency response was determined at different positions of a grounded steel plate
- At rated frequency, there is no noticeable influence of the distance  $d$  on ratio error and phase displacement
- Influence increases with rising frequency and decreasing distance  $d$
- Phase displacement of divider have a peak at approx. 2.5 kHz





## Before the technical presentations start...

- à *This WP3 handled the urgently required traceability for the “testing of non-conventional sensors”*
- à *Considering the whole instrumentation chain, several open issues remain*

*(2017 à ): A follow-up project will be submitted:*

*“Metrology for the next-generation  
digital substation instrumentation”*

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Stand: 04/17		