	Main sessions		Round Tables and Research and Innovation Forums		Poster Sessions	
16 June 09:00 - 17:30 hrs	SESSION 2 Power Quality & EMC	SESSION 6 Challenges of DSO Regulation & Competitive Market	RT 1, 2, 3, 4, 5 and 6		SESSION 3 Operation, Control & Protection	SESSION 4 Distributed Energy Resources & Active Demand Integration
			RIF SESSION 1	RIF SESSION 5		
17 June 09:00 - 17:30 hrs	SESSION 1 Network Components	SESSION 5 Planning of Power Distribution Sys-tems	RT 7, 8, 9, 10 and 11		SESSION 2 Power Quality & EMC	SESSION 6 Challenges of DSO Regulation & Competitive Market
			RIF SESSION 3	RIF SESSION 4		
	19:00 hrs: Gala Dinner					
18 June 09:00 - 17:30 hrs	SESSION 3 Operation, Control & Protection	SESSION 4 Distributed Energy Resources & Active Demand Integration	RT 12, 13, 14, 15 and 16		SESSION 1 Network Components	SESSION 5 Planning of Power Distribution Sys-tems
			RIF SESSION 2			

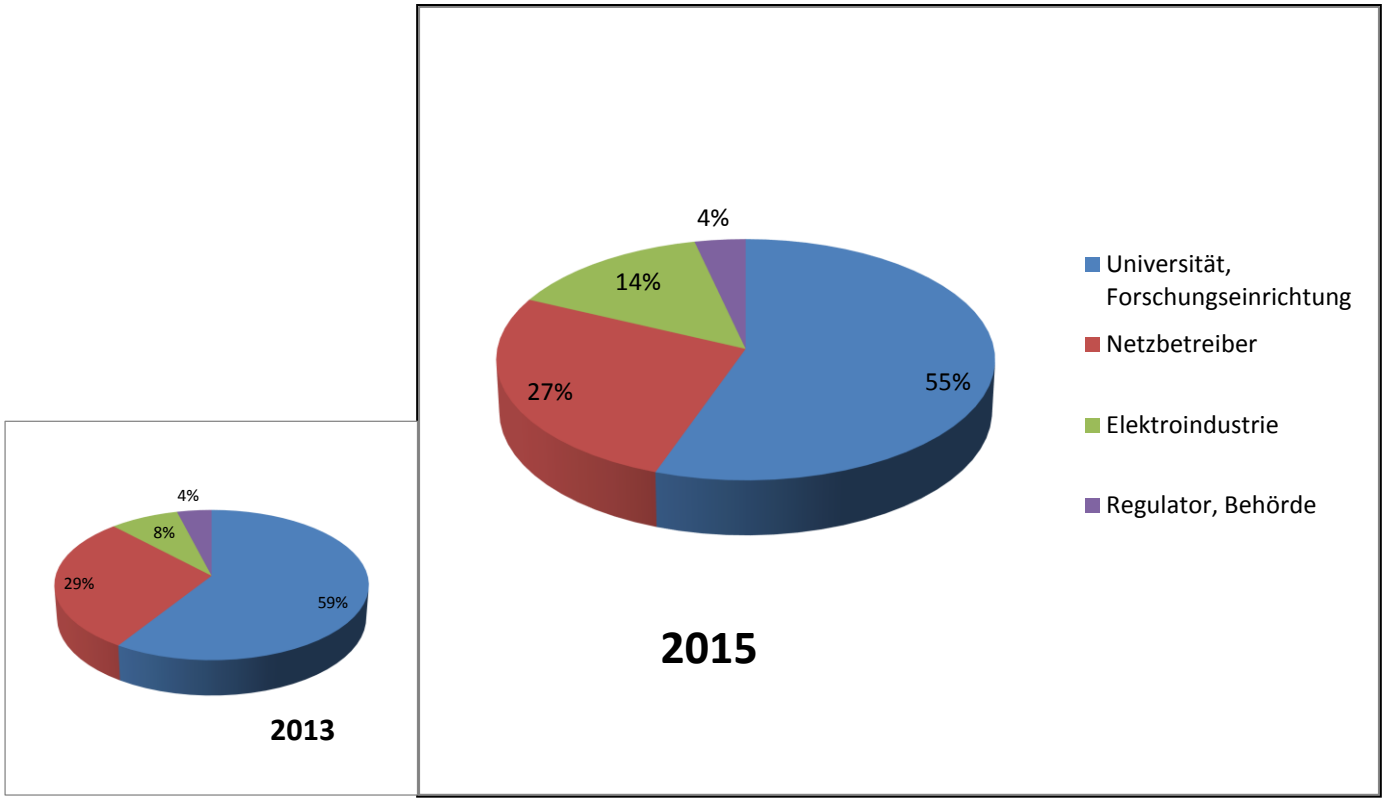
Session 2: Statistik

Eingereichte Kurzfassungen: **215 (158)**

Akzeptierte Beiträge: **137 (112)**

3 österreichische Beiträge

Zahlen von 2013
in Klammer



Session 2: Inhalte

Main Session

Block 1: Electric and magnetic fields, EMC, earthing systems

Block 2: Harmonics

Block 3: Voltage variations

Block 4: Power quality monitoring

Round Table

RT13: Power quality and EMC in the Future Grid (CIGRE/CIRED WG C4.24)

RT15: Reliability Benchmarking - why we should do it? What should be done in future?

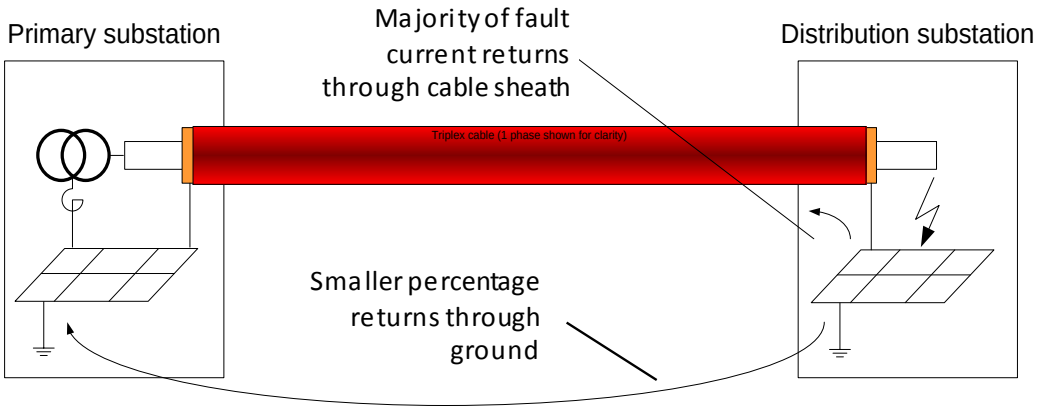
Organisiert von W. Friedl

Research and Innovation Forum (RIF)

0394 A New Design Tool for Distribution Substation Earthing Safety

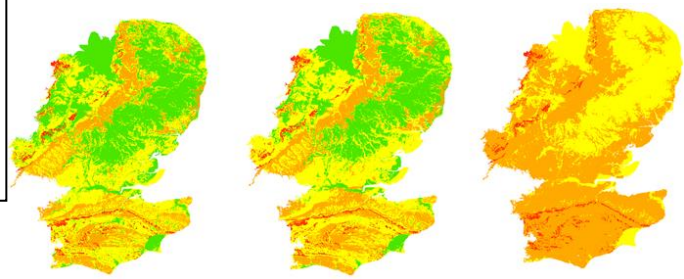
Lyon (France), 15-18 June 2015

- Tool is unique in that it models mutual impedance between phase conductors and sheath(s), as well as self impedance, to accurately calculate ground return current and earth fault current at new substation
- This builds on previous work presented at CIRED in 2011 (0548)
- Removes the need for nomograms or 'C' factors and includes all modern cable types as well as older lead sheath types



Lyon (France), 15-18 June 2015

- The tool links to mapping data to indicate soil type/structure at new site



UK Power Networks Earthing Maps

Lyon (France), 15-18 June 2015

1118 Proof of a Global Earthing System

Summary

- The check of compliance of characteristics and the heavy current injection tests showed that the "Industriepark Hoechst" is safe with respect to touch voltages in case of a medium voltage earth fault
- This result was based on the definition of the global earthing system according IEC 61936-1
- By carrying out heavy current injection tests at a limited number of carefully selected substations it is possible to evaluate the huge number of different MV locations at the whole site
- Considering the conditions at the industrial site the determination of the test circuit impedances showed an additional criteria for evaluation of safety with respect to touch voltages

Stefan Höne, Dr. Ing. Max Reinhard – Germany – Session 2 – No1118

Example "Industriepark Höchst"

- One of Europe's largest chemical and pharmaceutical sites
- Operated by Infraserv GmbH & Co. Höchst KG
- Covers 460 ha with more than 120 production plants, 800 buildings, 72 km of roads, 57 km of railway tracks and 800 km of pipelines
- Production plants are supplied by 10 kV medium voltage networks fed by 110/10 kV transformers
- 110 kV systems feeding the site as well as the 10 kV systems at the industrial site are operated with resonant earthing (arc suppression coils)

Zusammenfassung Block 1

Erdungssysteme:

- **Aktuelle Regeln für Erdungssysteme führen oft zu Überdimensionierung**
- **Einigkeit über die Notwendigkeit von Messungen**
- **Hinweis auf aktuelle Arbeiten der CIGRE/CIRED Arbeitsgruppe B5.35 "Substation earthing system design optimisation through the application of quantified risk analysis" (Co-Convenor L. Fickert)**

Elektrische/magnetische Felder:

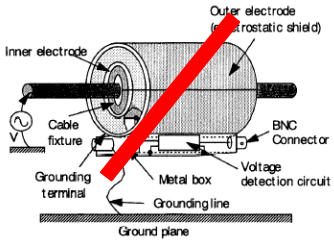
- **Feldemission von Smart Meters mit PLC unkritisch**
- **Generell nachlassendes Interesse**

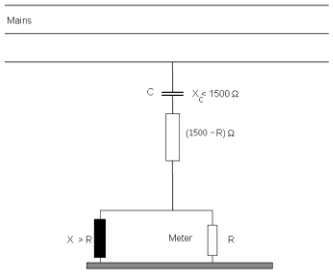
1653 In-situ measurements on HFPQ

Lyon (France), 15-18 June 2015

2 – 150 kHz: In situ Measurement

- Clamp on devices
- Small and easy to handle
- Usable from W to MW
- Sensitivity < 1 mA

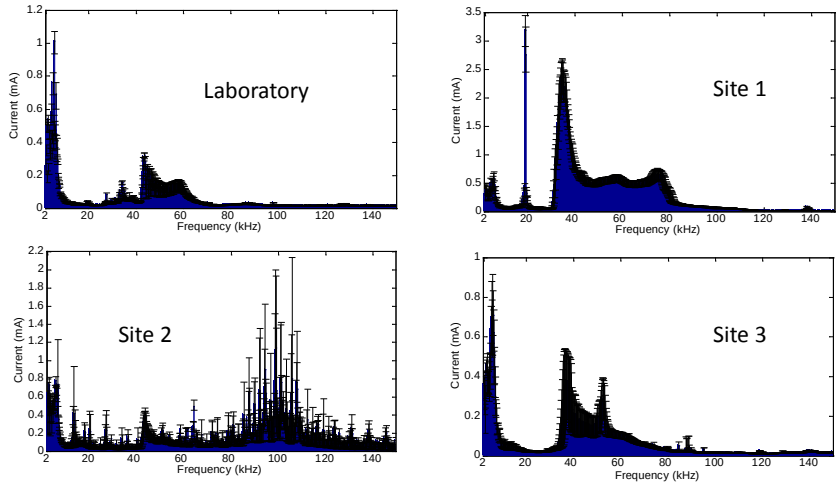




0523 LED lamps in different EMC environments

Lyon (France), 15-18 June 2015

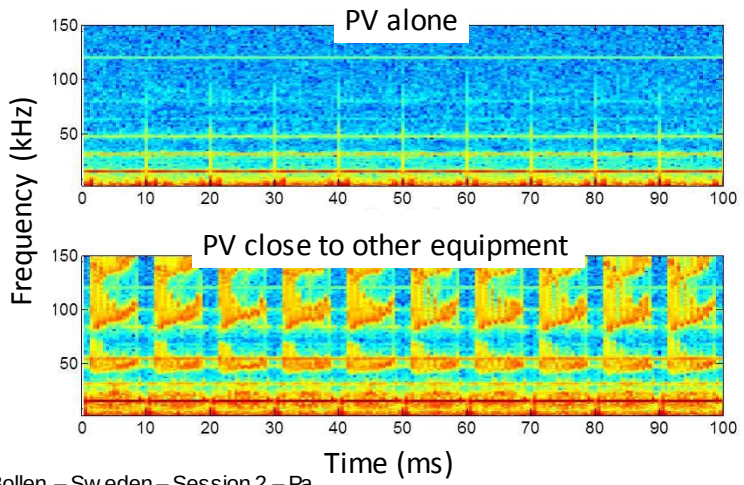
Spectra (2-150 kHz) of the current feeding LED lamp 1 at different sites



0285 Ongoing work in CIGRE working groups on supraharmonics from power-electronic converters

Lyon (France), 15-18 June 2015

Primary and Secondary Emission



Bollen – Sweden – Session 2 – Paper 0285

Zusammenfassung Block 2

Oberschwingungen im Bereich 2-150 kHz:

- Definition von Messmethoden und Messgeräten
- Interaktion der Geräte erschwert die Definition und Erfassung der Oberschwingungsemission
- Mögliche Störung von PLC

PV und Oberschwingungen:

- Kein wesentliches Thema

Elektromobilität und Oberschwingungen

- Diverse Messungen, lineare Überlagerung (gleiche Winkel) soll im Auge behalten werden

0332 Control Algorithms for Voltage Regulated Distribution Transformers (VRDT) – Maximum Grid-Integration of PV and Minimal Wear

CIRED Lyon (France), 15-18 June 2015

Motivation and Goals

Motivation:

- Distributed generation (DG) in LV and MV grids
- Predominantly photovoltaics (PV) in German LV grids
  - Voltage rise in long feeders
  - Overloaded assets
  - Grid extension with new cables
- Voltage Regulated Distribution Transformers (VRDT)
  - Control the voltage in LV grids
  - Mitigate grid reinforcement

Project Goals:

- Assessment of use cases for VRDT
- VRDT laboratory testing
- Field tests in six LV grids
- **New control algorithms**

C. Matrose – Germany – Main Session 2 – Paper 0332

CIRED Lyon (France), 15-18 June 2015

VRDT Concept

Available technology:

- Reactor-type on-load type changer (OLTC)
- Integrated in standard distribution transformer (MV/LV)
- Dimensions remain unchanged
- Can be installed in any secondary substation

Project goal:

- Utilize remote voltage measurements for voltage regulation
  - Develop and test suitable control algorithms
  - Assess the increase in hosting capacity for PV

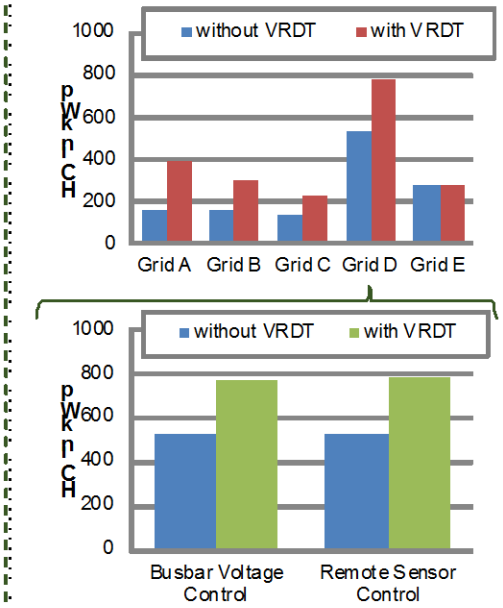
C. Matrose – Germany – Main Session 2 – Paper 0332

0332 Control Algorithms for Voltage Regulated Distribution Transformers (VRDT) – Maximum Grid-Integration of PV and Minimal Wear

CIRED Lyon (France), 15-18 June 2015

Hosting Capacity with VRDT

- Hosting Capacity increased by factor up to 2.4
  - Significant increase for all rural grids (A .. C) and one village (D)
  - No increase for other village (E, voltage is not limiting for HC)
- Hosting capacity limited by
  - Local voltages (no VRDT)
  - Transformer rating (with VRDT)
- HC with RSC / MSC
  - No increase compared to busbar voltage control
  - Increased degree of freedom for DER position



C. Matrose – Germany – Main Session 2 – Paper 0332

0409 A Protocol to Test the Sensitivity of Lighting Equipment to Voltage Fluctuations

CIRED Lyon (France), 15-18 June 2015

Introduction

- Sensitivity to flicker of these new lighting technologies?
  - First studies → **lower sensitivity** to flicker than incandescent lamps
- Final Report of CIGRE C4.108
  - Increase the compatibility levels
    - ✘ WG CIGRE C4.111 : Technological updates in new lamps can involve **diversity in the flicker responses**
  - New reference lamp for the flicker measurement procedure
    - ✘ **Which one?**

✓ **Limit the light fluctuations during the lamps' design process**

WG IEC MT1-TC34 (T. R. 61547-1) → **Immunity Test Protocol**

0409 A Protocol to Test the Sensitivity of Lighting Equipment to Voltage Fluctuations

Lyon (France), 15-18 June 2015

Description of the immunity test protocol

- 1- Apply to the lamp a set of rectangular voltage fluctuations
  - $P_{st} = 1$ (annoyance threshold IEC 61000-4-15)
- 2- Register the illuminance variations produced by the lamp
- 3- Analyze the annoyance by means of an illuminance flickermeter
  - Adapted IEC flickermeter: the illuminance as the input signal
  - If $P_{st}^{LM} > 1$ → Lamp presents a **worse flicker behavior than the incandescent lamp**

Zusammenfassung Block 3

Spannungsband im Verteilnetz:

- **Verbesserte PV-Aufnahmekapazität durch RONT**
- **Bis jetzt keine Probleme mit EV und Spannungsband**

Flicker:

- **Flicker durch Interharmonische – nicht komplett durch Norm abgedeckt**
- **Flicker Immunitätstest für Lampen**
- **Flicker stellt in Praxis kein Limit für die PV-Aufnahmekapazität dar**

Unsymmetrie:

- **Passive Symmetriereinrichtung für (lange) Niederspannungsleitungen**

Dips:

- **Keine neuen Erkentnisse**

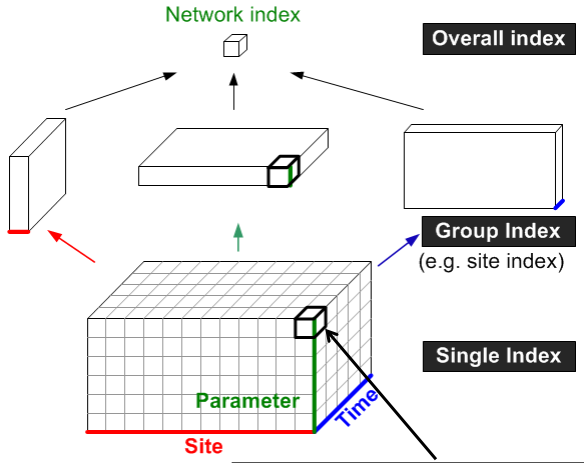
1401 Efficient Power Quality Analysis of Big Data

PQ Index (Aggregation)

Highest level of aggregation

Different levels and variations of aggregation

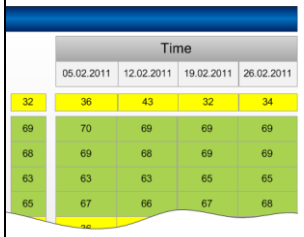
No aggregation



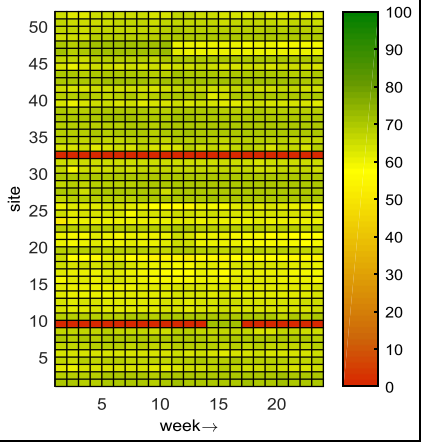
Single index based on 95% quantile of one week data according EN 50160.

Numerical presentation (2)

Index table



Site indices for 50 sites and 23 weeks as colored matrix



- Interactive table for different levels of aggregation
- Easy shift between different views (Site vs. Time; Time vs. PQ parameter; PQ parameter vs. site) by mouse clicking

Zusammenfassung Block 4

PQ Monitoring:

- **Weit verbreitet**
- **Tendenziell keine Verschlechterung der Spannungsqualität**
- **Verwendung von Smart Meters für PQ Monitoring**
- **Datenmanagement (Big data)**

RT13 Will there be more interference in the future grid?

CIRED Lyon (France), 15-18 June 2015

Changes in emission (1)

- new types of equipment
  - solar and wind power
  - electric vehicle chargers
- new versions of existing equipment
- large numbers of small equipment
- smart-grid technology
  - power-line communication
  - grid-size battery storage
  - other schemes (like VVC, feeder reconfiguration)

Math Bollen – Sweden – RT 13 5

RT13 Will there be more interference in the future grid?

CIRED Lyon (France), 15-18 June 2015

Changes in emission (2)

- ”normal harmonics” will remain rather constant
- Increase in other frequencies
  - Supraharmonics
  - Higher-order odd harmonics
  - Interharmonics
- Unbalance due to single-phase equipment
- More voltage variations
- ..

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Ausblick Power Quality

RT13 Will there be more interference in the future grid?

Lyon (France), 15-18 June 2015

Changes in immunity

- Active converters will react differently to voltage dips than passive converters
- Immunity to overvoltages will be different
- LED lamps (and CFL) have different flicker behaviour than incandescent lamps
- New equipment like EV changers
- Power line communication

Math Bollen – Sweden – RT 13

8

Ausblick Power Quality

RT13 Will there be more interference in the future grid?

Lyon (France), 15-18 June 2015

Changes in transfer

- Weaker transmission grid
- Stronger distribution grid
- Cables at transmission level
- Capacitance in the low-voltage grid
- Less damping on consumption side
- Less damping (losses) in the grid

Math Bollen – Sweden – RT 13

9

RT13 Will there be more interference in the future grid?

CIRED Lyon (France), 15-18 June 2015

And the result of all this is ?

- A lot more (types of) disturbances to study
  - increased need for research and studies in PQ
  - keep track of the non-yet-normal harmonics
- New types of interferences will keep us busy
  - Some will require measures, at some locations
  - e.g. voltage variations; unbalance; resonances; ..
- But no indication yet for lots of interference

Math Bollen – Sweden – RT 13

10

Danke für die Aufmerksamkeit