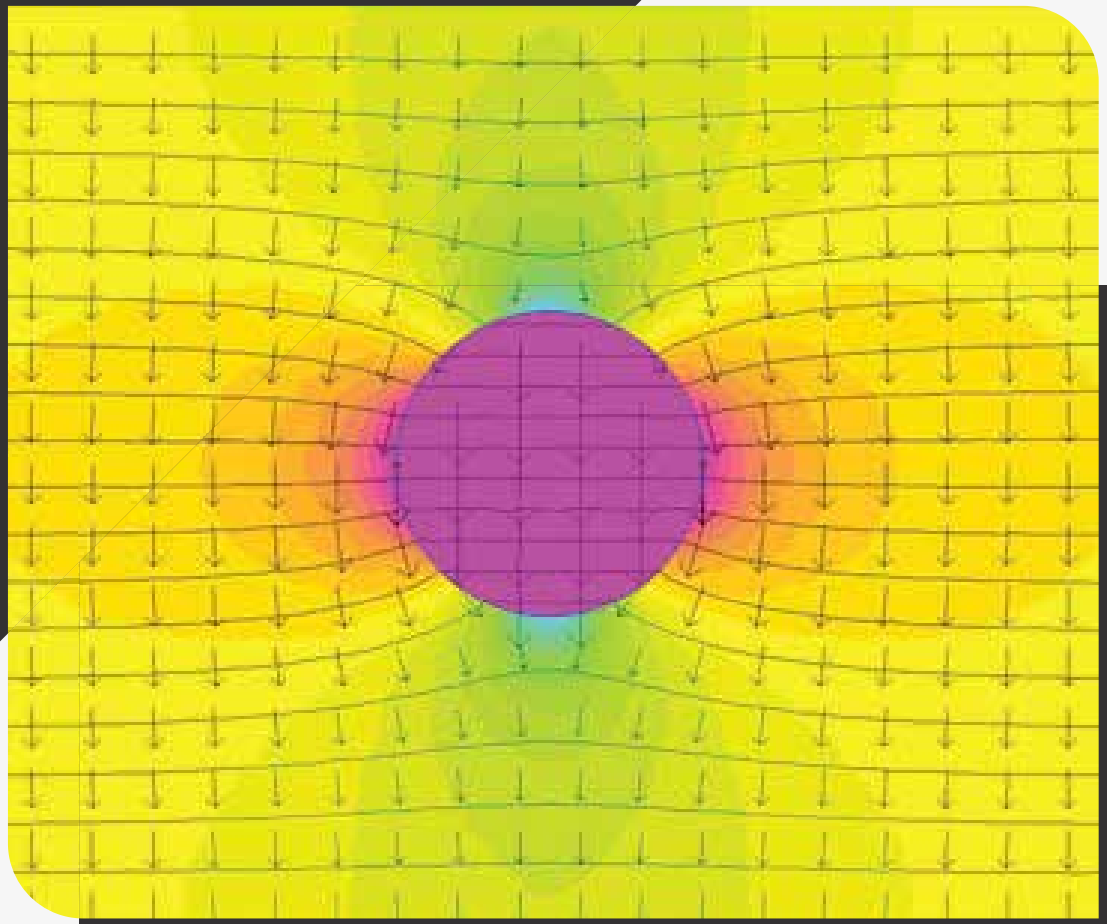
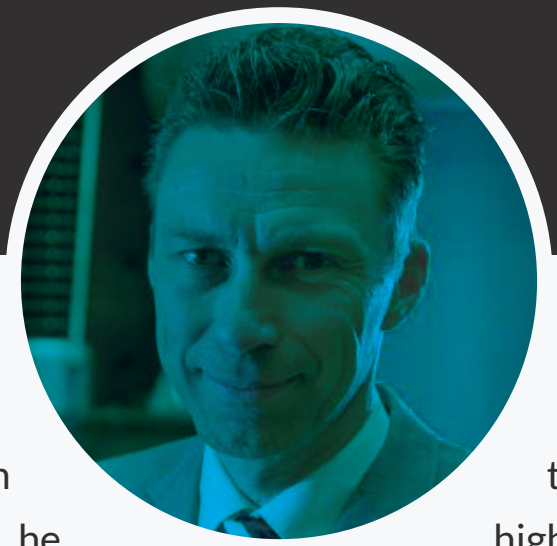


TRANSFORMER ACADEMY

COURSE AUTHOR: STEFAN TENBOHLEN

# PARTIAL DISCHARGE MEASUREMENT FOR POWER TRANSFORMERS COURSE

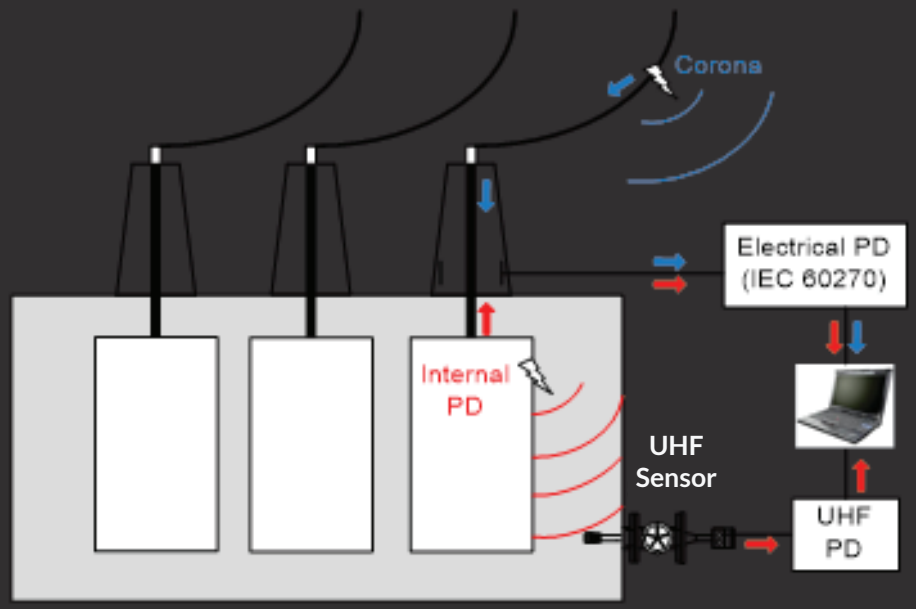
# STEFAN TENBOHLEN

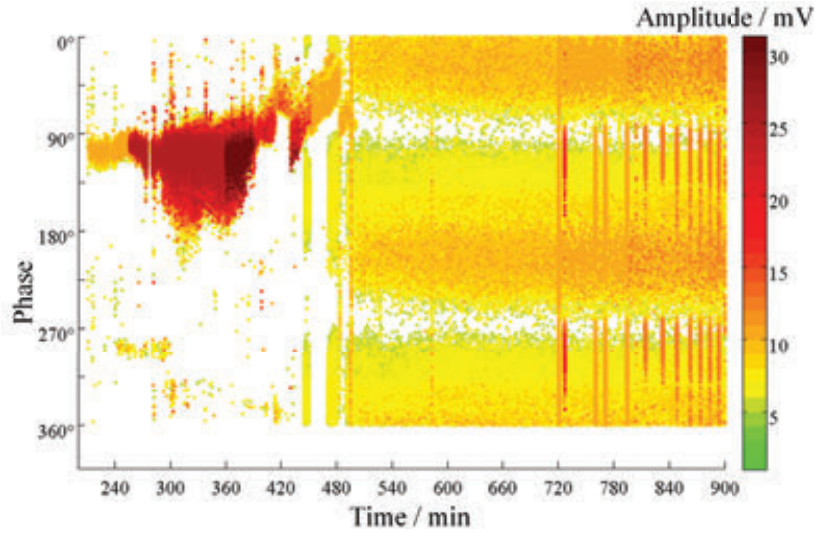


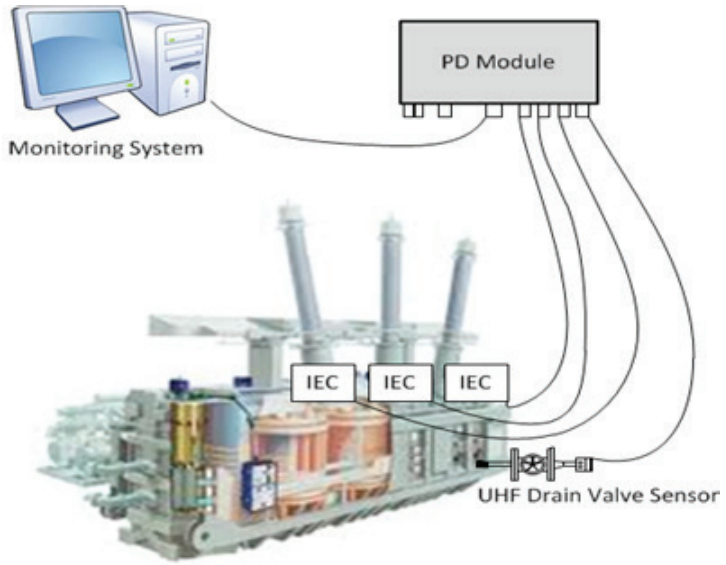
Stefan Tenbohlen received his diploma and PhD in Engineering from the Technical University of Aachen, Germany, in 1992 and 1997, respectively. In 1997, he joined ALSTOM Schorch Transformatoren GmbH, Mönchengladbach, Germany, where he was responsible for basic research and product development. From 2002 - 2004, he was the Head of the Electrical and Mechanical Design Department. In 2004, he was appointed Professor and Head of the Institute of Power Transmission and High Voltage Technology of the University of Stuttgart, Germany. In this position, his main research fields are high voltage technique, power transmission, and electromagnetic compatibility (EMC). Prof. Tenbohlen holds several patents and has published more than 500 papers. He is a member of the IEEE, CIGRÉ, German committees of A2 (power transformers, D1 (emerging technologies), C4 (system technical performance), several international working groups.

# WHAT MAKES THIS COURSE UNIQUE AND ITS INTENDED AUDIENCE

*The main difference between this course and many others that exist in the web market today is the detailed description of fundamentals and the neutral and multivendor presentation of PD measurement techniques.*

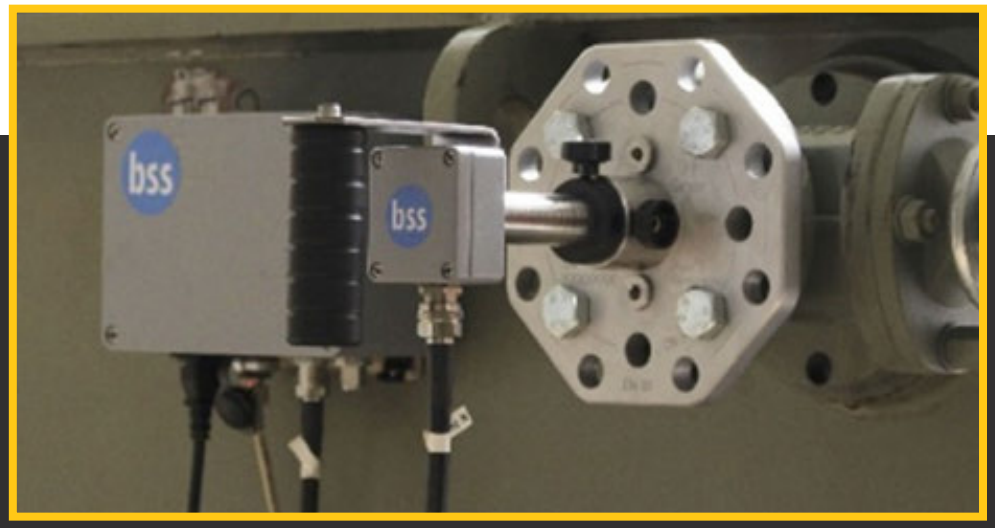


# THE COURSE IS INTENDED FOR:

- → Utility engineers, both young and senior, especially those responsible for condition assessment and maintenance of power transformers
- → Manufacturers of transformers, transformer components, monitoring systems, sensors, etc.
- → Students and anyone wishing to understand the scientific foundation of PD measurement
- → Anyone interested in a deeper awareness of partial discharge measurement and interpretation
- → Staff who are responsible for transformers and want them to be more operational and efficient



# INTRODUCTORY / BASIC LEVEL

## LESSON 1: BASICS OF PARTIAL DISCHARGES I

- Description of PD phenomena
- Effects of PD
- PD quantities
- Equivalent circuit of PD
- Measurement setup PD acc. IEC 60270

## LESSON 2: BASICS OF PARTIAL DISCHARGES II

- Calibration of the measurement setup
- Influence of PD location on the apparent charge
- PD signal processing and visualization
- PD test procedure
- Noise suppression

# INTERMEDIATE LEVEL

## LESSON 1: UHF PD MEASUREMENT

- Principle of measurement
- Types of sensors for UHF PD measurement
- Calibration of UHF sensors and the measurement system
- Installation of UHF sensors

## LESSON 2: ONSITE MEASUREMENT OF PD

- Noises
- Excitation of transformer
- Synchronous multiterminal PD measurement
- Monitoring of PD
- Acoustic measurement of PD
- Localization of PD

# MASTER'S LEVEL

## LESSON 1: ADVANCED INTERPRETATION OF PD MEASUREMENTS

- Interpretation of PRPD pattern
- Use of artificial intelligence

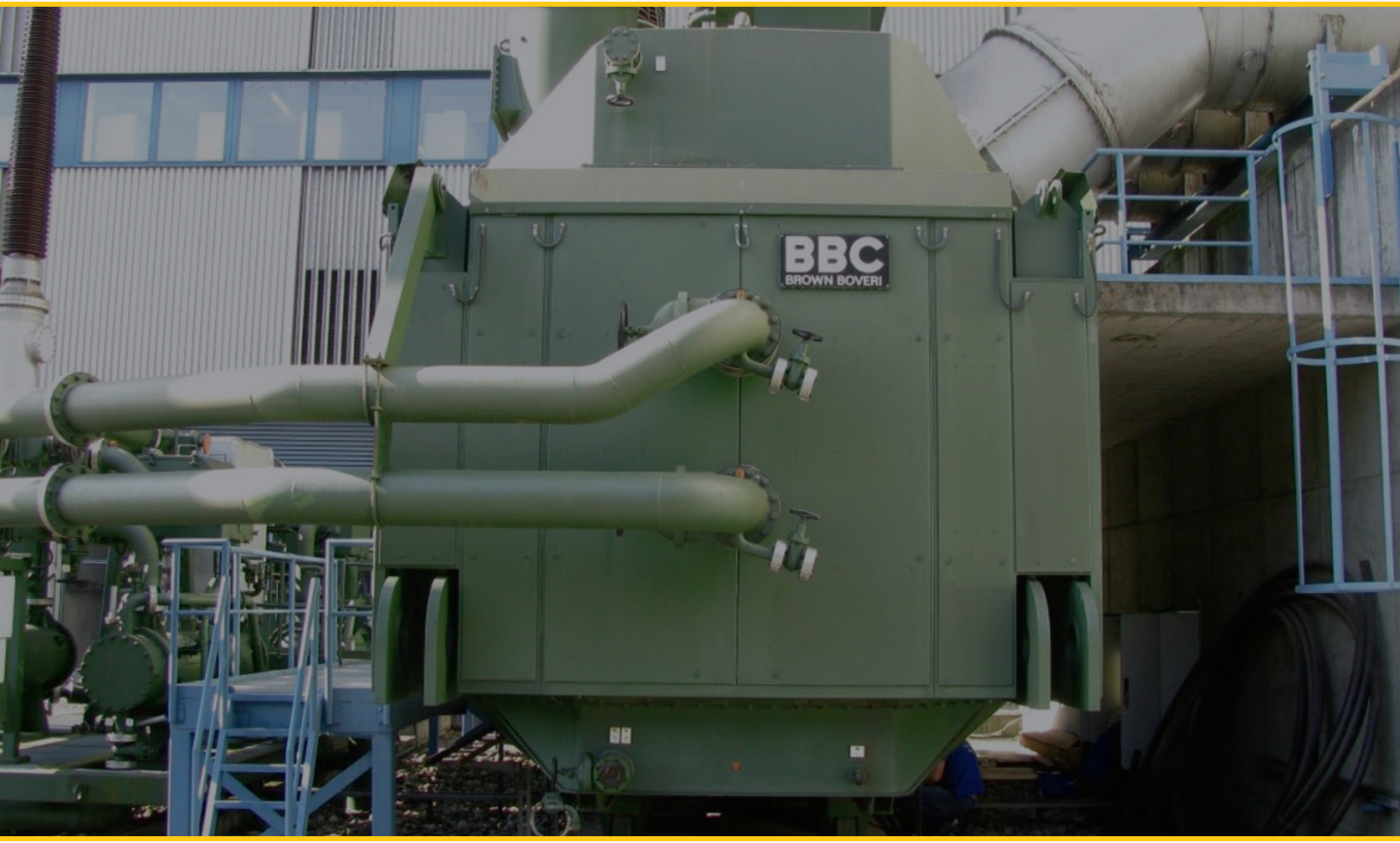
## LESSON 2: PLACEMENT OF UHF-SENSORS IN POWER TRANSFORMERS

- Principle of UHF measurement technique
- Types of UHF sensors
- Experimental setup
- Simulation model
- Placement of UHF sensors

# MASTER'S LEVEL

## LESSON 3: CALIBRATION OF ELECTRICAL AND ELECTROMAGNETIC PD MEASUREMENTS

- Measurement system calibration - ensuring repeatability and comparability for PD measurements with systems and techniques from different manufacturers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Thank you!