

22NRM06 ADMIT

Characterisation of AC and DC MV instrument transformers in extended frequency range up to 150 kHz

METROLOGY
PARTNERSHIP

EURAMET

ADMIT
AC & DC
High
Frequency
Instrument
Transformers

Project aims, challenges and work plan overview

Mario Luiso, Università degli Studi della Campania «Luigi Vanvitelli»

22NRM06 ADMIT - Workshop

Torino, 21 June 2023

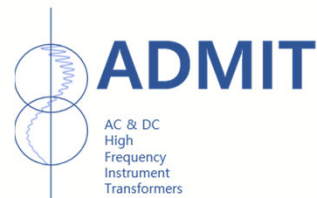


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Acknowledgement

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Standardization Needs

- Standardization needs from IEC TC38 sent to STAIR EMPIR and published on EURAMET website

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Home > Calls > Call 2021 - Normative

Previous Calls

Call 2021 - Green Deal

Call 2021 - Normative

Call for Needs (stage 1) Orientation Stage 1 Submit Warning Call for Proposals (stage 2) Working Meetings Questions

Connections Budget Stage 2 Submit Virtual Review Conference

The CEN/CENELEC priority research topics can be found below:

- [Specifications for non-conventional d.c. substation and performance assessment of non-conventional subs.](#)
- [Characterization of Instrument Transformers for AC and DC grids up to 36 kV and up to 150 kHz](#)**
- [Mechanical data \(P, F, etc.\) for physical contacts between moving machinery or its parts with persons](#)

Version 7 – 8 July 2020
 Gee : http://ftp.cenelec.eu/CN/ResearchInnovation/STAIR/STAIR-EMPIR-needs/EMPIR_responseform.docx



RESEARCH AND STANDARDISATION

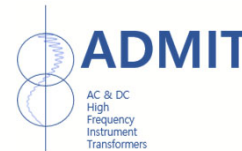
RESPONSE FORM for Standardisation groups

Opportunity for standardisation to contribute to the *European Partnership on Metrology EPM* under Horizon Europe

Objective: to collect standardization needs and suggestions to develop research projects in testing and measurements for the upcoming European Partnership on Metrology (EPM) calls in 2021

Deadline for the consultation: 11 December 2020.

Source of the identified need (identification of TC, WG, etc, incl. title)	<input type="checkbox"/> CEN/TC 0/WG 0 / <input type="checkbox"/> CLC/TC 0/WG 0 <input type="checkbox"/> ISO/TC 0/SC 0 / WG 0 / <input checked="" type="checkbox"/> IEC/TC 38/SC 0 / WG 0 <input type="checkbox"/> Other, namely <i>Identification, Title</i>
European entity responsible for submission of the need	CEN/CLC TC 38 <i>Instrument Transformers</i>
Person that can be contacted for more detail	Filippo Frugoni filippo@frugoni.it +39 049 5384606 <i>Italy</i>
Title:	Characterization of Instrument Transformers for AC and DC grids up to 36 kV and up to 150 kHz
Unaddressed need	Feasible measurement methods and instrumentation for accurate characterization of Instrument Transformers used to measure disturbances up to 150kHz in Medium Voltage AC and DC grids



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Unaddressed standardization needs

- IEC TC 38 asked for scientific research to address the specific standardization need

Currently
no standard fully covers this topic!!

- Traceable measurement methods and instrumentation for accurate characterization of **Instrument Transformers** used to measure disturbances up to **150 kHz** in **Medium Voltage AC** and **DC** grids

Measurement and industrial needs

- **Switching power converters**, both generators and loads
 - Switching frequencies
 - Low voltage $\sim 1\text{MHz}$ @ $\sim 1\text{W}$ & 230V
 - Medium voltage $\sim 10\text{kHz}$ @ $\sim 100\text{kW}$ & 10kV
- Switching behaviour originates harmonics of the switching fundamental tone ($\sim 10\text{kHz}$) up to hundreds of kilohertz
- These tones are not synchronous with the power frequency ($50/60\text{ Hz}$)

CAUSES

- Interfere with Power Line Communication -> Failure of grid automation and meter reading
- High Frequency -> Increase Losses -> Reduce Equipment Life -> **More Economical Losses**
- Couple with control system of inverters -> Possible local blackouts

PROBLEMS!!

Over 9 kHz....

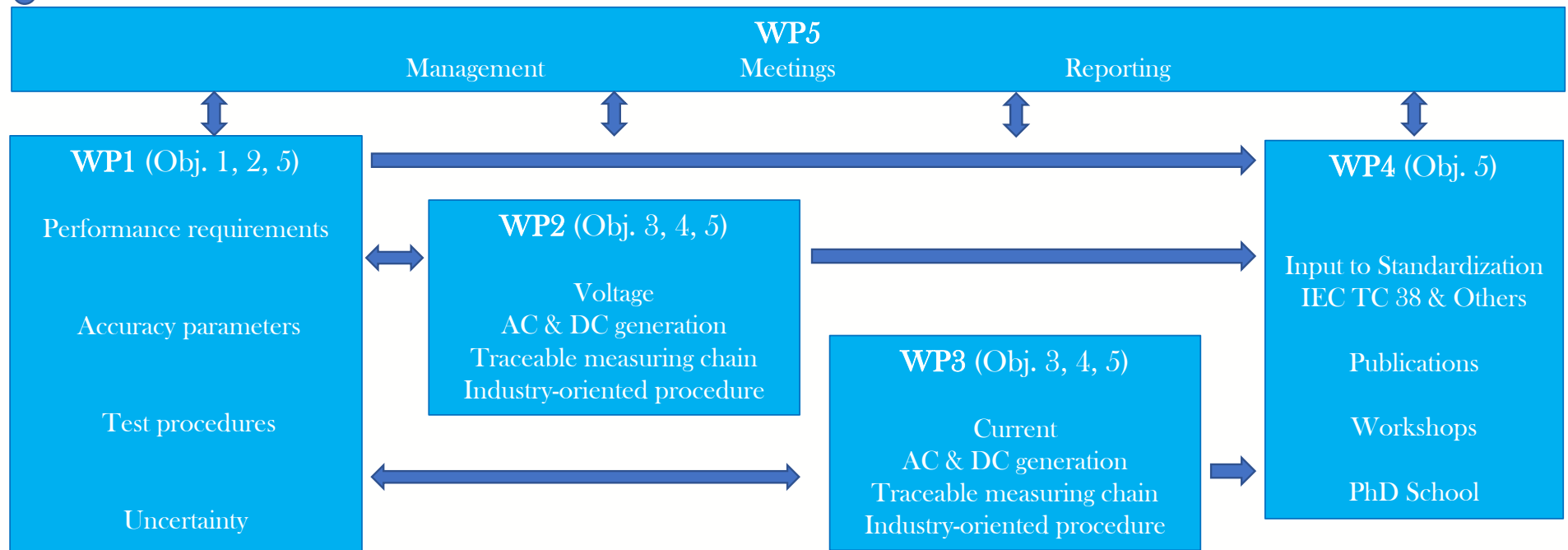
- To avoid disasters, it is of vital importance to measure emissions, at least up to 150 kHz, in LV but also in MV grids
- ITs are necessary for these kinds of measurements
- Recently, an Italian DSO required LPITs up to 800 kHz!!
- Currently, NO ONE around the world is able to verify IT accuracy up to so high frequency

NEEDS!!

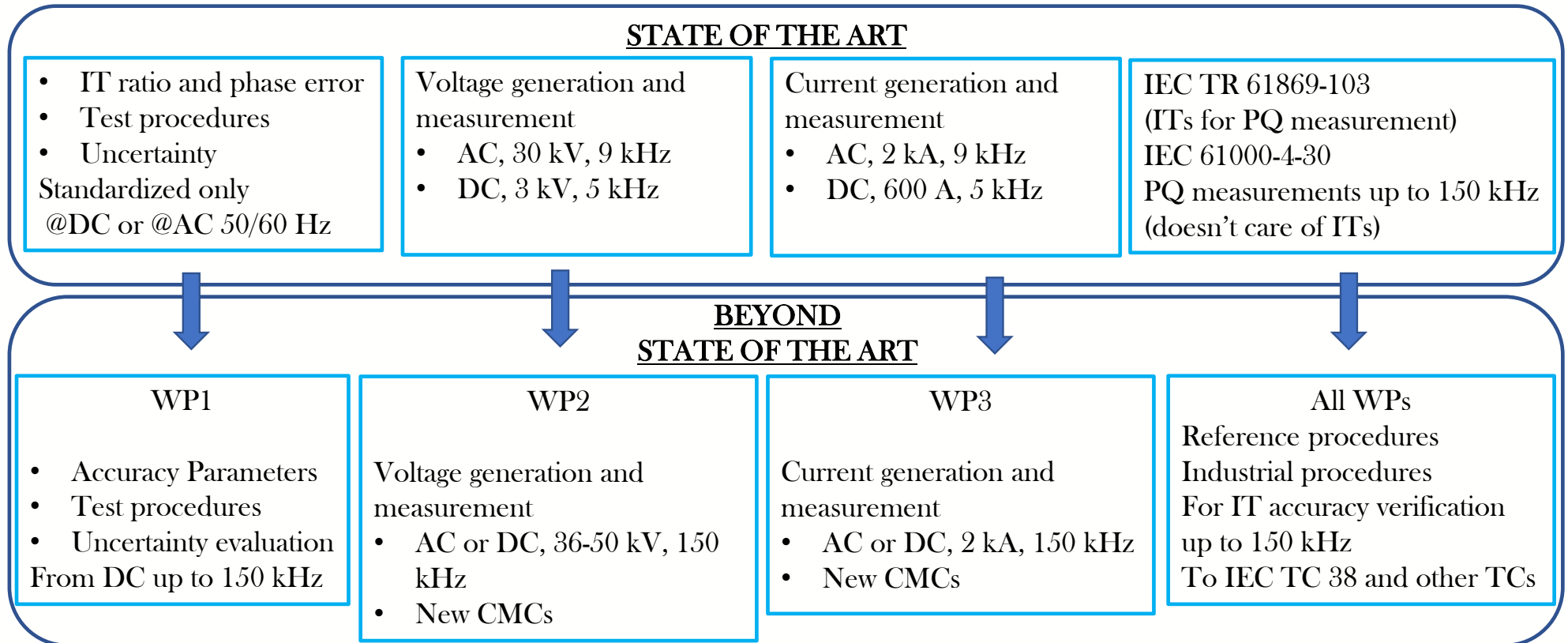
Aim & Objectives - Work Packages Structure

AIM

Accuracy parameters, test procedures, current and voltage generation systems and traceable measuring chains to support standardization on IT accuracy verification up to 150 kHz



Excellence and Progress beyond the state of the art



Impact

Industry & Society

- **IT manufacturers:** improve their products thanks to the accurate knowledge of their performance, certified HF ITs
- **Grid operators:** accurate knowledge of their grid operation up to 150 kHz also at MV level
- **Instrument manufacturers:** HF-ready measuring instruments for MV grids
- **Power converter manufacturers:** accurate performance measurement also at MV level
- **Notified bodies:** appropriate testing procedures
- **Energy regulators:** HF «compatibility levels» can be defined and accurately measured

Science

- **Metrology:** new services, measurement techniques and CMC entries
- **Scientific community:** journal papers and presentations to boost research on future energy grids

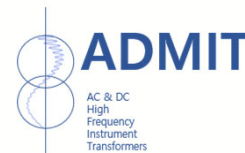
Standardization & EU policy

- **Standardization bodies:** new standards on ITs and HF disturbance measurements
- **Europe:** Market leader on IT and energy-related products and services



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