

Recent Research Activities in Power and Power Quality Measurements at CMI

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3-PHASE WIDEBAND SAMPLING WATTMETER

Measurement Set-up

Set-up includes:

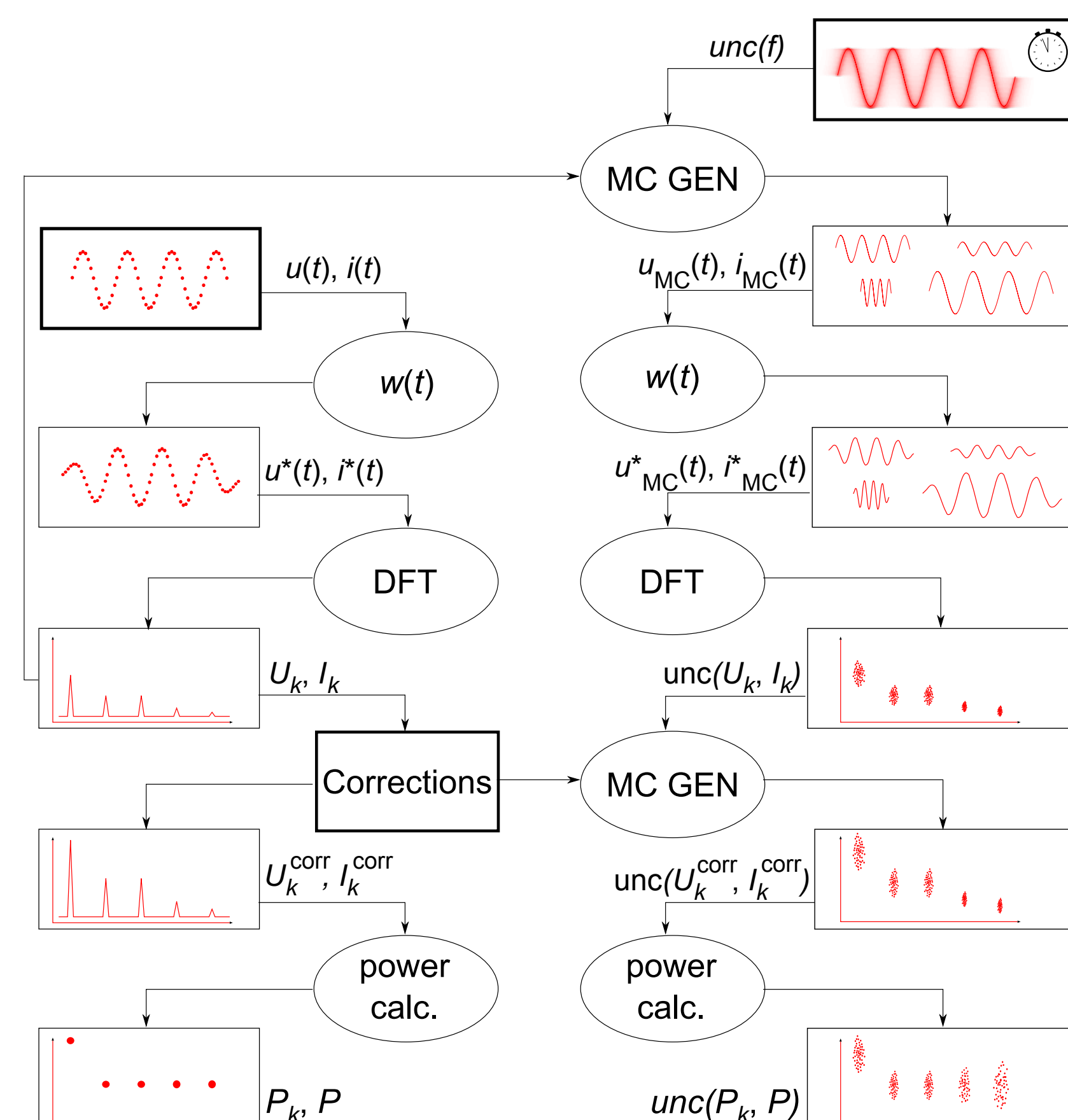
- 3x NI 5922 (wideband sampling cards)
- 3x set of voltage dividers 120 V - 240 V
- 3x set of current shunts 30 mA - 20 A
- External clock

Data processing:

- window function + FFT to get voltage amplitudes and phases for all six channels
- add the corrections of sampling cards
- calculate the current values for three channels
- add the corrections of current shunts and voltage dividers
- calculate power

Uncertainty: Monte Carlo method

Data processing algorithm



Comparison with SP DSWM

Each phase of 3PSWM compared with 1-phase SP DSWM. Measurement: direct generation of 0.6 V for voltage and current channel (without dividers and shunts), at frequency 60 Hz, 88 period sampled.

Measured error (3PSWM - DSWM) of single phases:

Phase of 3PSWM	Ser. N. of NI5922	Voltage Channel	Current Channel
1-phase	F22D5B	4,2 ppm	-11 ppm
2-phase	EF3F4F	-28 ppm	-70 ppm
3-phase	F22060	-103 ppm	-344 ppm

3-phase: possible troubles with sampling card F22060.

IMPLEMENTATION OF IEC 62586-2 IN POWER QUALITY MEASUREMENT

IEC 62586-2 contains many **new** tests for power quality measurements. Not all of them can be implemented using Fluke 6100A.

CMI developed measurement system for:

test A 4.1.1 Check $U_{rms}(1/2)$ are independently synchronized on each channel on zero crossing.

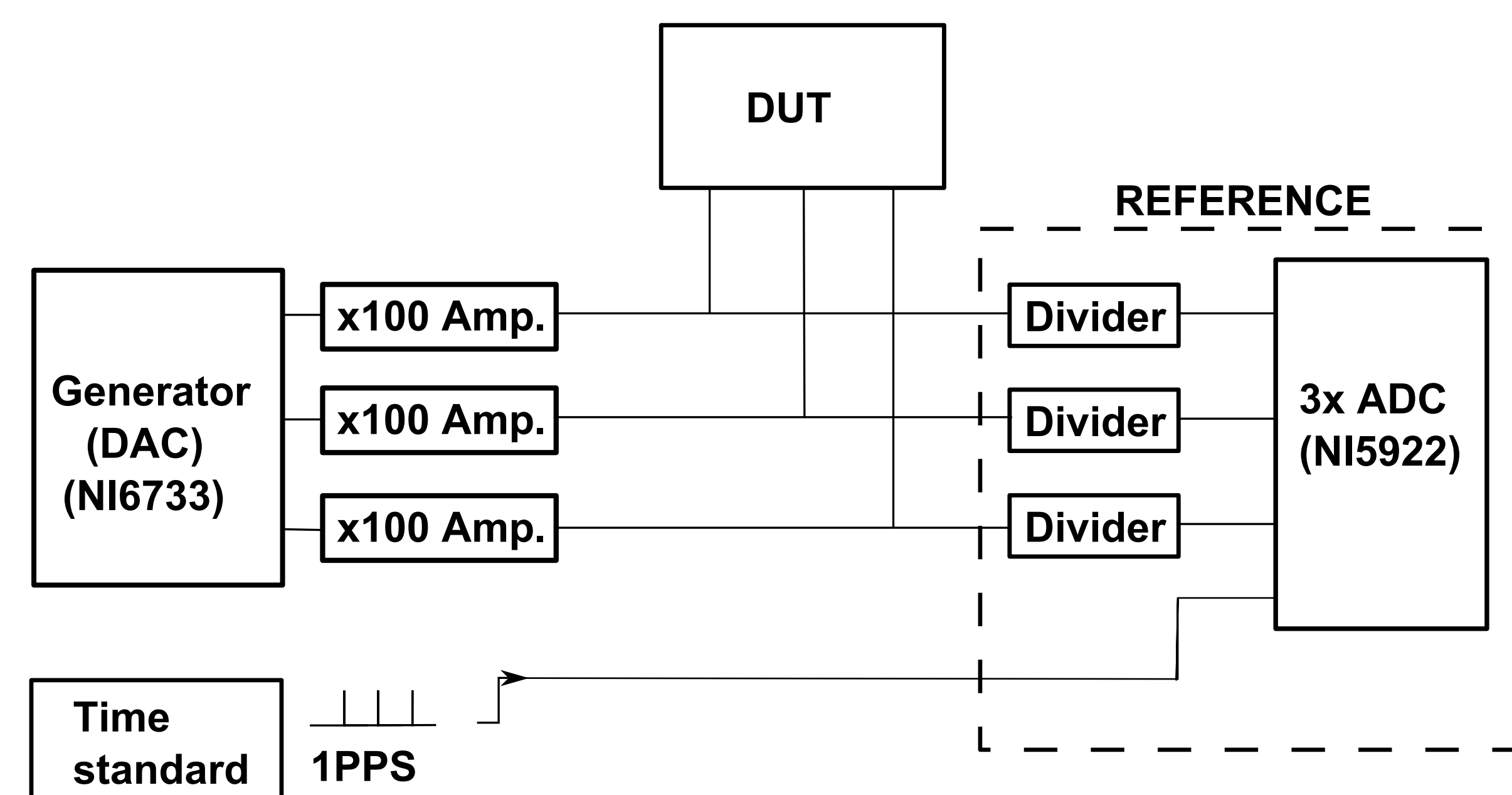
test A 4.2.1 Check that dips and interruptions are detected in polyphase system by applying a single test with a 3 phase non synchronous disturbance that contains both a dip and an interruption.

test A 4.3.1 Check that swells are detected in polyphase system by applying a single test with a 3 phase non synchronous swell injection.

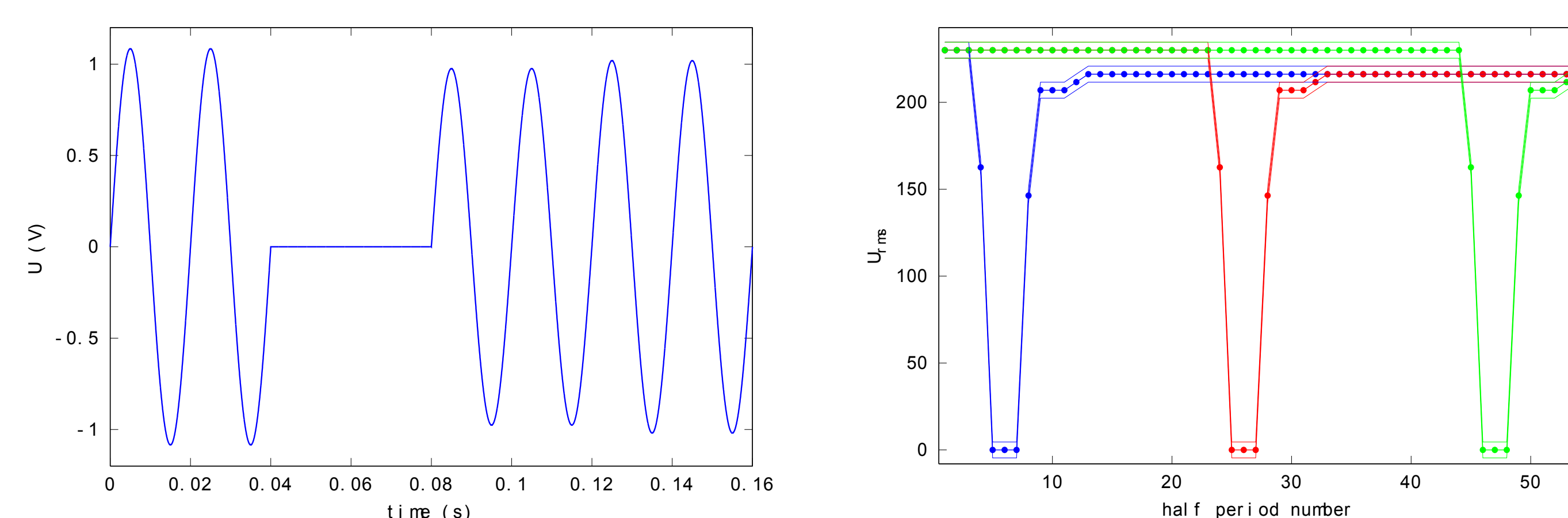
test A 6.1.1 Check that 10/12- cycle measurements intervals are gapless and non-overlapping (voltage harmonics).

test A 7.1.1 Check that 10/12- cycle measurements intervals are gapless and non-overlapping (voltage interharmonics).

3-Phase Measurement Set-up



Example of test signal and expected result for one phase to test A4.1.1



EMRP AND EMPIR ACTIVITIES

EMRP Smart Grids II.

CMI is active in WP4 A transducer Measurement Framework in Support of PMUs/PQ in:

Task 4.1 Optimization and Application of Non-Invasive Current Transducers

- analysis of air-gap and split-core CT
- developing of methods for reducing errors and improving frequency behaviour of CT

Task 4.3 Transducer-Response Correction Algorithms and Uncertainty Propagation

- developing of SW model to evaluate uncertainty of PMU/PQ parameters using MC method
- writing of report describing the simulations
- apply the model to evaluate uncertainty propagation and sensitivity analysis on measured PMU/PQ parameters
- developing of simplified approximated analytical expressions linking output uncertainties (with input quantities and uncertainties) to be implemented in embedded SW for PMU/PQ parameter evaluation.

EMPIR Call 2015

CMI in Research Potential Call submitted PRT called

Joined Development of Complex Power and Power Quality measurements.

Co-authors: MIKES, SP, INRIM, SIQ, CEM, IMBH, HMI, Metroserf.

Waiting for committee decision.

Abstract: Increasing demands in power and PQ measurements have caused strong metrology research effort in this area. Several NMIs have developed power and PQ measurement systems based on the sampling technics however the most of NMIs still have not finished this task. Joined effort in this field will give possibility to develop a new system for sampled power and PQ measurements based on the knowledge of well experienced NMIs, which will be embraced by less experienced NMIs and will remain open for every institute/company/university. The knowledge transfer between NMIs/DIs in this field give a research potential in power and PQ measurements for every participating NMI/DI.