

# DIG AC: Workpackage 4: Validation of new traceability chain

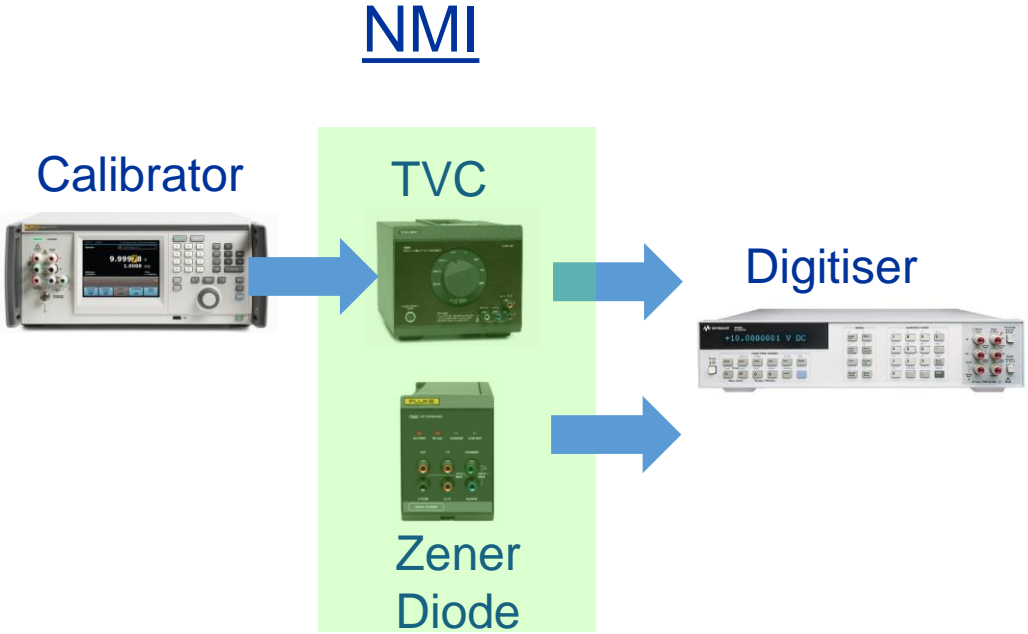
## Final Meeting, CEM, May 2022



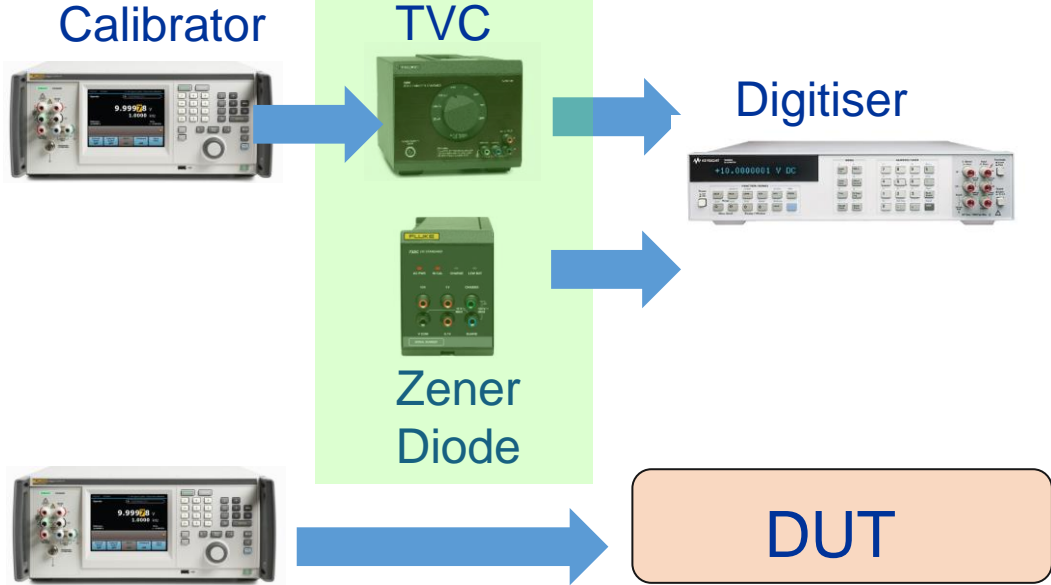
# Digital traceability chain for AC voltage

up to 1 V, 10 Hz to 1 MHz

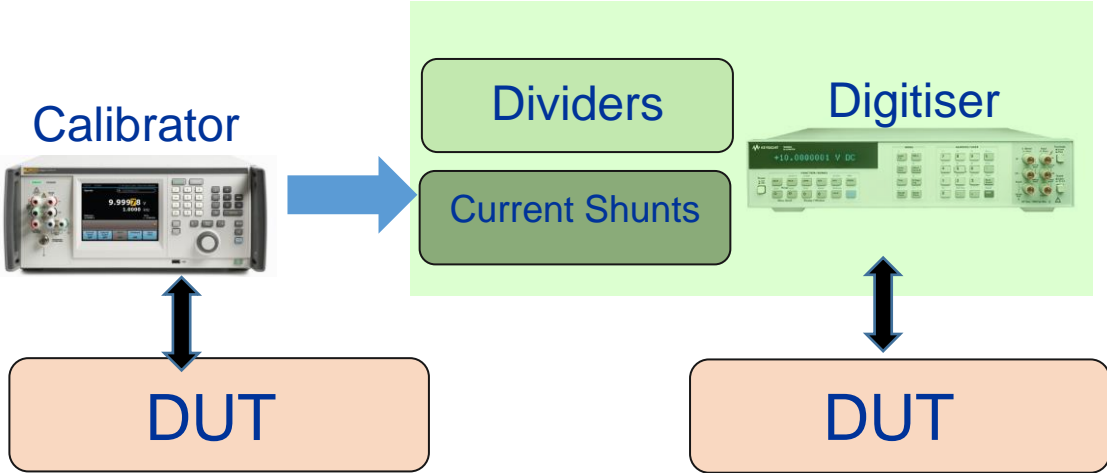
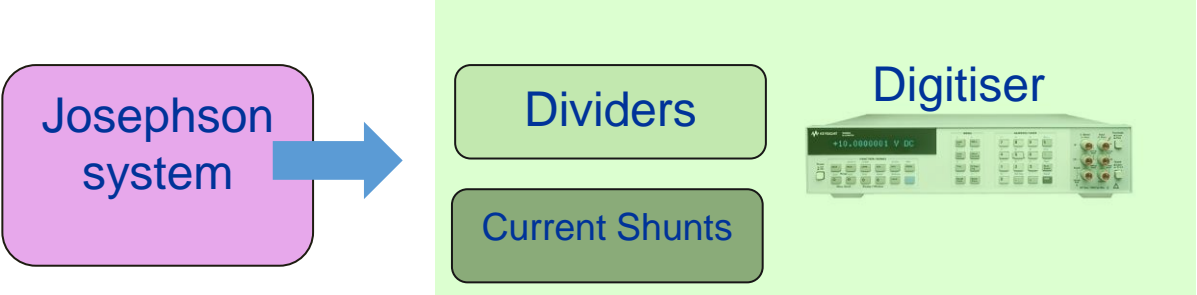
Existing



Calibration Lab / customer



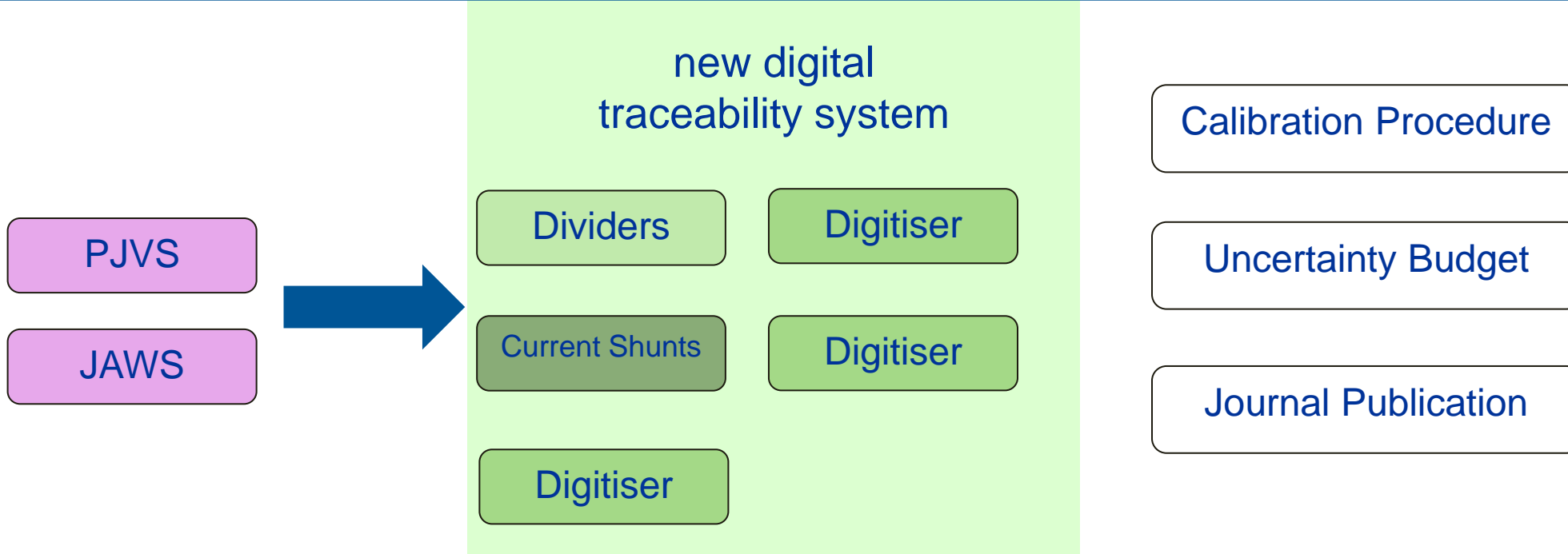
Future



Items sent to NMI for calibration

# WP4 Overview

## Task 4.1 Validation



## Task 4.2 TVC comparison



## Task 4.3 Future intercomparison



# WP4 Task 4.1 Validation against Josephson standards

Digitizer Characterization: PTB, NPL, TUBITAK, CEM, CMI

Static gain

Dynamic gain

Linearity

Static gain thermal drift

# WP4 Task 4.1 Validation against Josephson standards

## Voltage Dividers: INRIM, Metroser

Resistive dividers  
Inductive dividers

# **WP4 Task 4.1 Validation against Josephson standards**

Current Shunts: CEM, FER, PTB

Multi-tone waveforms: CEM, PTB

# WP4 Task 4.1 Validation against Josephson standards

Uncertainties and algorithm validation: CMI

THD example

# WP4 Task 4.1 Validation against Josephson standards

A method for using Josephson voltage standards for direct characterisation of high performance digitizers to establish AC voltage and current traceability to SI

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## Abstract.

A method for traceability to SI for ac voltage and current based on high performance digitizers is presented. In contrast to the existing thermal-based methods, the proposed method utilizes direct traceability to quantum based waveforms via the use of Josephson voltage systems. This allows not only a simplification of the traceability chain and reduced measurement times but also offers the potential for analysis of the ac voltage and current waveform spectral content, a feature which is

## Deliverable 5: submit journal publication

*IOP Measurement Science and Technology (Precision measurements and metrology)*

### Tasks:

- Review abstract / conclusion
- Check combination and conclusion of sections
- Add missing references
- Formatting of figures
- Typos / latex unit errors / hyphens etc.



# WP4 Task 4.2 Comparison with thermal methods



17RPT03 DIG-AC

A digital traceability chain for AC voltage and current

GUM

**Report A4.2.3 on assessment the advantages and disadvantages of applying digitisers in the measurement traceability chain in the context of the future quantum AC voltage standard acquisition.**

# WP4 Task 4.2 Comparison with thermal methods

17RPT03 DIG-AC

A digital traceability chain for  
AC voltage and current

Report on Comparison of the Thermal and  
Quantum/Digital Calibration Methods

TÜBİTAK UME

TUBITAK

# WP4 Task 4.3 Protocol for a future intercomparison

## Deliverable D6: Protocol Document

17RPT03 DIG-AC

Activity A4.3.1: Report



Task 4.3: Protocol for a future intercomparison

**Activity A4.3.1: Definition of a protocol for a future intercomparison**

**Partners**

(TUBITAK, FER, CEM, CMI, GUM, Metroserf, PTB, INRIM, IPQ, JV, NPL, UMA)

# WP4 Progress Reporting

May 2022

EMPIR

Month	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36						
Activities	Jun-18	Jul-18	Aug-18	Sep-18	Oct-18	Nov-18	Dec-18	Jan-19	Feb-19	Mar-19	Apr-19	May-19	Jun-19	Jul-19	Aug-19	Sep-19	Oct-19	Nov-19	Dec-19	Jan-20	Feb-20	Mar-20	Apr-20	May-20	Jun-20	Jul-20	Aug-20	Sep-20	Oct-20	Nov-20	Dec-20	Jan-21	Feb-21	Mar-21	Apr-21	May-21						
	WP 4																																									
	Task 4.1																																									
4.1.1	Validation Measurements																																									
4.1.2	Validation Measurements																																									
4.1.3	Validation Measurements																																									
4.1.4																																										
4.1.5																																										
4.1.6																																										
4.1.7																																										
	Task 4.2																																									
4.2.1	TVC comparison																																									
4.2.2	TVC comparison																																									
4.2.3																																										
4.2.4																																										
	Task 4.3																																									
4.3.1	Task 4.3																																									
4.3.2	Task 4.3																																									

**D5:** Submit publication: validation of system

**Report:** advantages / disadvantages of using digitizers

**Report:** comparison thermal / quantum methods

**D6:** Protocol