Project start date and duration: 1 May 2023, 36 months

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Internal Beneficiaries:	External Beneficiaries:	Unfunded Beneficiaries:
1. PTB, Germany	7. ENS Paris-Saclay, France	15. DUI, Netherlands
2. FFII, Spain	8. IDEKO, Spain	16. FLEXIM, Germany
3. GUM, Poland	9. INTI, Argentina	17. GEOMNIA, France
4. LNE, France	10. PK, Poland	18. KROHNE, Germany
5. VSL, Netherlands	11. POLITO, Italy	19. Mahr, Germany
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	13. UNIPD, Italy	21. TUBITAK, Türkiye
	14. UPM, Spain	

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ViDiT

ViDiT (Trustworthy virtual experiments and digital twins) is a European research project within the European Partnership on Metrology programme co-financed from the European Union's Horizon Europe Research and Innovation Programme and by the Participating States. The project has 21 participants consisting of eight National Metrology Institutes, two research centres close to industry, five universities and six companies. The project is coordinated by Physikalisch-Technische Bundesanstalt (PTB).

Why ViDiT?

Virtual experiments and digital twins are key enabling technologies to achieve and realise European strategic policies devoted to sustainability and digitalisation within the complex framework of Industry 4.0 and the European Green Deal. Virtual experiments and digital twins are both simulation models that accurately replicate physical systems and characteristics in a virtual environment. Digital twins further include dynamic updates of the virtual model according to the observed state of its real counterpart. Hence, they consist of two parts, a Physical-to-Virtual connection that models the considered system and a Virtual-to-Physical connection that implements prevention and control strategies to achieve the target accuracy in the physical system.

The use of virtual experiments and digital twins in metrological applications requires uncertainty evaluation methods, as well as reliable validation procedures, to make them fit for purpose, e.g. as substitutes or extensions, to certified measurement devices. This project will develop these methods and procedures to ensure the reliability and trustworthiness of virtual experiments and digital twins in metrology. In addition, this will enable the traceability of modern measurement systems and it will boost and strengthen the European lead in this field. To facilitate the uptake of the developed methods by National Metrology Institutes and industrial stakeholders, three good practice guides will be written, and the applicability of the methods will be demonstrated in twelve case studies covering a variety of industrial metrology applications.

Uncertainty evaluation methods

The combination of virtual data and real measurements is crucial for the digitalisation of industry and metrology. One of the aims of the ViDiT project is to specify what is needed in order to evaluate the uncertainty associated with real measurements when using virtual experiments or digital twins, to assess state-of-the-art uncertainty evaluation methods for this purpose, and to carry out their further development.

Validation procedures

The validation of virtual experiments and digital twins is fundamental for their deployment in industry and metrology because it ensures trust in the results that are obtained. In the ViDiT project, differences between calibrated standards, or measurement data obtained with calibrated instruments, and the corresponding data from the virtual counterpart will be analysed by statistical procedures.

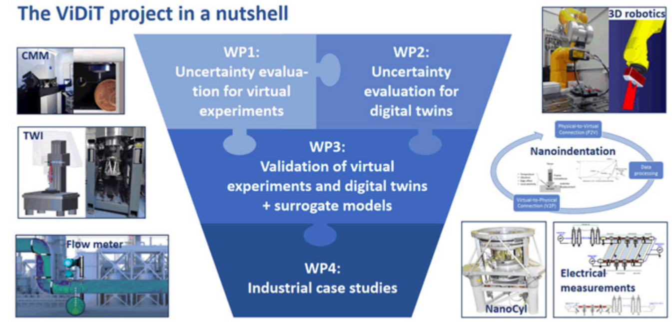
Software

The ViDiT project will provide the implementation of uncertainty evaluation methods for virtual experiments and digital twins in an open access software repository including a FAIR dataset to test and apply the methods provided. Furthermore, the methods will be described in a corresponding user's guide.

Industrial case studies

To ensure the uptake of the developed mathematical and statistical methods and procedures by industry, their practical applicability will be demonstrated in twelve industrial case studies covering six metrological applications: coordinate measurement, optical form measurement, flow measurement, nanoindentation, 3D robotic measurement, electrical measurement.

Our objectives



The overall objective of this project is to develop methods and tools that will ensure the reliability and trustworthiness of virtual experiments and digital twins in metrology in order to support digital transformation within Industry 4.0 and the European Green Deal.

The specific objectives of the project are:

1. To develop methods for evaluating the uncertainty associated with real measurements for three different applications by using the results from corresponding virtual experiments in line with the current state of the art for uncertainty evaluation.

2. To develop methods for uncertainty quantification for digital twins representing complex measurement processes and mechanisms for four different applications, in each case including the effect of dynamic influences on the digital model such as thermal drift or vibrations.

3. To develop approaches for the validation of virtual experiments and digital twins for all applications of objectives 1 and 2, using statistical procedures for the assessment of differences between calibrated standards and corresponding data from their virtual counterpart.

4. To demonstrate the practical applicability of the developed methods, using twelve case studies covering all the metrological applications of objectives 1 and 2.

5. To facilitate the take up of the technology and measurement infrastructure developed in the project by the measurement supply chain, standards developing organisations and end users.