

# **Trustworthy virtual experiments and** digital twins (ViDiT) - vidit.ptb.de

# Aim of the project

To develop methods and tools that enable ensuring the reliability and trustworthiness of virtual experiments and digital twins in metrology.

# Specific needs

- Traceability in metrological applications, where virtual experiments / digital twins are used
- Validation procedures for metrology systems with embedded virtual experiments / digital twins
- Transferability of the developed methods to a large variety of industrial applications



# **Target groups**

- Metrological and scientific communities
- End users in all industry sectors, where virtual experiments / digital twins are used,

e.g.

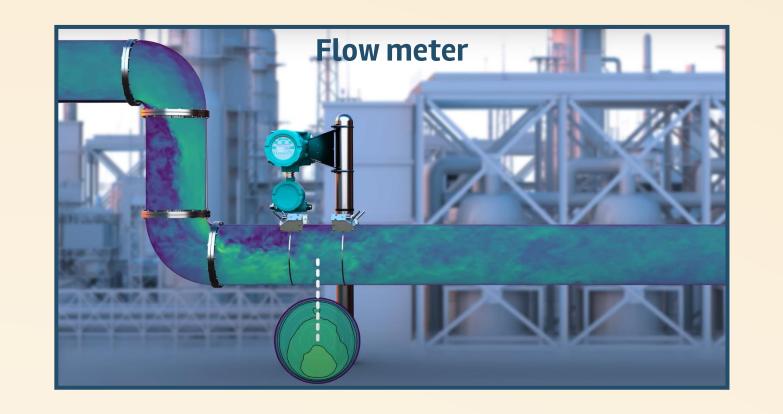
- Optical industry
- Flow meter manufacturers
- Material processing companies

# Scientific objectives









#### WP1: Uncertainty evaluation for virtual experiments

- JCGM:GUM-compliant uncertainty • evaluation
- Bayesian methods
  - Application of the developed methods to 3 use cases

#### WP2: Uncertainty evaluation for digital twins

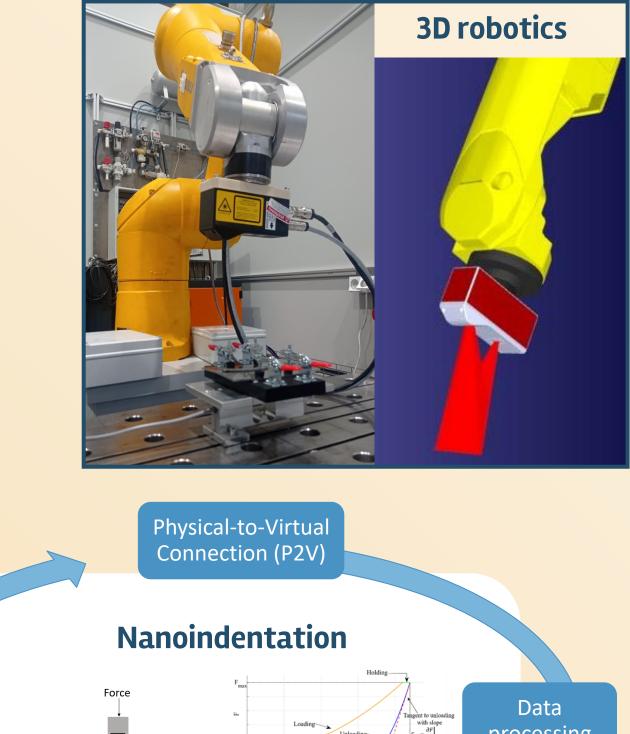
- Extension of uncertainty evaluation to digital twins
- Inclusion of feedback loop in uncertainty evaluation
- Application to 4 use cases

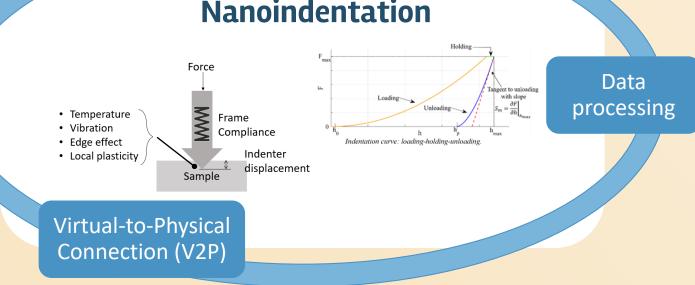
WP3: Validation of virtual experiments and digital twins + surrogate models

- Development of validation methods for all applications of WP1+2
- Guidelines for validation of virtual experiments / digital twins
- Validation procedures for virtual experiments / digital twins that include surrogate models

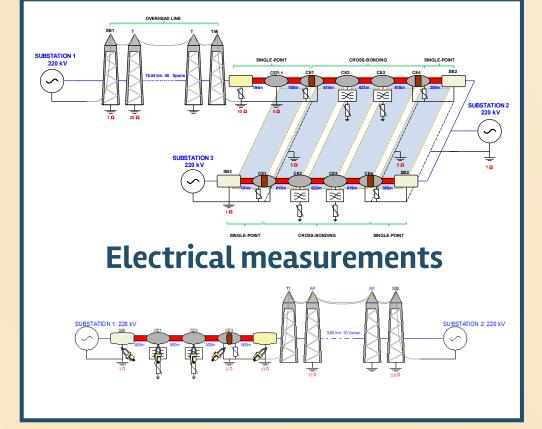
WP4: Industrial

case studies









- 12 industrial case studies related to the applications of WP1+2+3
- Transfer of developed methods into real industrial environments
- All industrial participants involved

# Pathway to impact

### **Expected results**

- Good practice guides on
  - uncertainty evaluation for virtual experiments / digital twins
  - procedures for validation
- **Open-access software repository** • including a FAIR data set for each use case
- User's guide
- **Report on practical applicability** of developed methods

### **Dissemination**: Open-access publications, training material, reports to standards committees

**DCE** measures

#### **Communication**: Project website, stakeholder workshops, newsletters

**Exploitation**: Guidelines and software allow uptake of methods by stakeholders. Training material supports them.

### Outcomes

- **Traceability** in several metrological applications, where virtual experiments / digital twins are used
- Validation procedures for using virtual experiments / digital twins in traceable measurement chains
- **Transfer** of developed methods to case studies from industry

### Impacts

- Scientific: New uncertainty evaluation methods, new validation routines
- **Economic / Technological:** More accurate and resource saving production and testing, lower production times and costs
- Societal:

Better security because of less failure in material, less waste, savings in energy

## Consortium

#### Internal



### External





### 8 National Metrology Institutes:

PTB (Germany, coordinator, WP1 leader), FFII (Spain), GUM (Poland), INTI (Argentina), LNE (France, WP4 leader), TUBITAK (Turkey), VSL (Netherlands, WP3 leader), VTT (Finland, WP5 leader)

• 5 universities + 2 research centres:

ENSPS (France), IDEKO (Spain), PK (Poland), POLITO (Italy, WP2 leader), TEKNIKER (Spain), UNIPD (Italy), UPM (Spain)

#### • 6 companies:

DUI (Netherlands), FLEXIM (Germany), GEOMNIA (France), KROHNE (Germany), Mahr (Germany), SICK (Germany)







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