



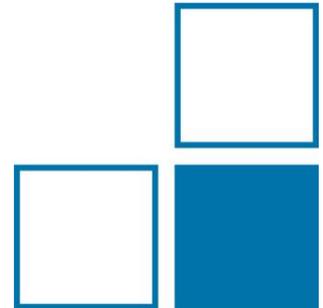
Physikalisch-Technische Bundesanstalt  
Braunschweig and Berlin  
National Metrology Institute

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# Welcome to VirtMet 2025: 2<sup>nd</sup> International Workshop on Metrology for Virtual Measuring Instruments

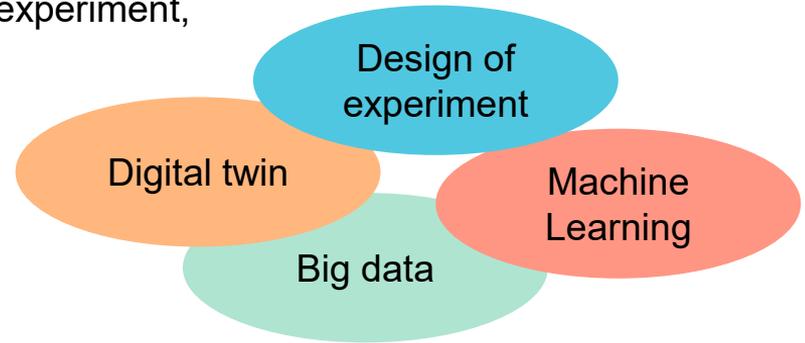
Online Video Conference, 3 – 4 December 2025

Sonja Schmelter, Ines Fortmeier, Daniel Heißelmann



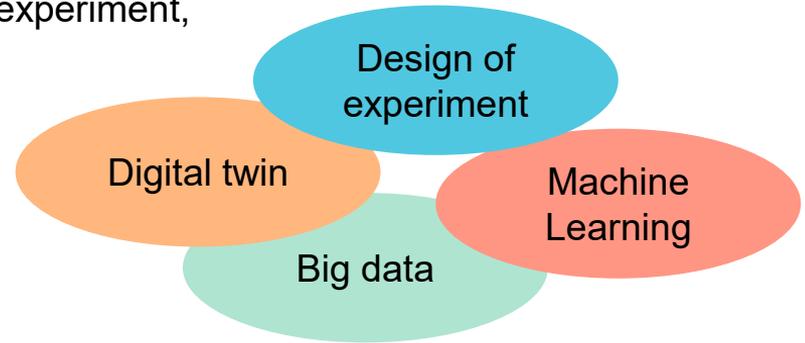
Simulations are used

- to gain a better understanding of a corresponding real experiment,
- to substitute parts of it,
- as an essential component of a real measurement, usually as part of an inverse problem,
- to evaluate measurement uncertainty,
- ...



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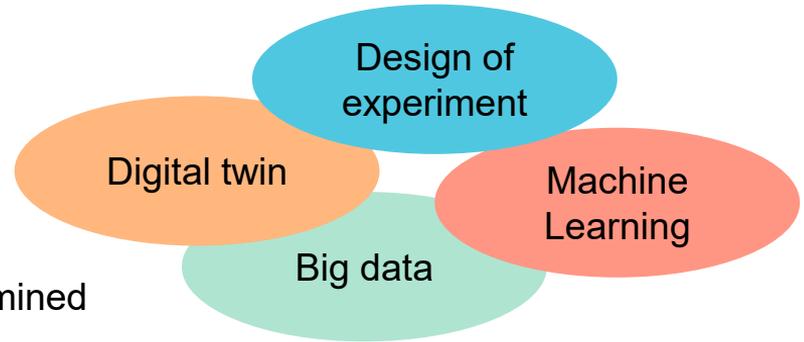


## Overarching questions:

- How to ensure confidence in simulation results?
- How to establish comparability of virtual and real measurements?
- How can virtual experiments be handled for complex measurement systems with large amounts of data?
- How can a realistic measurement uncertainty be determined using simulations?

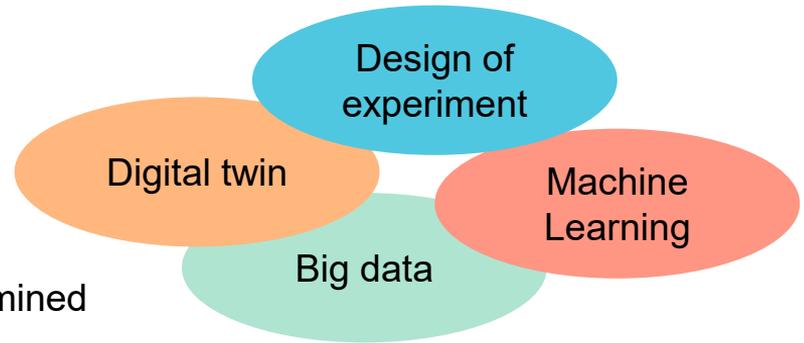
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Within PTB, these issues are discussed within the

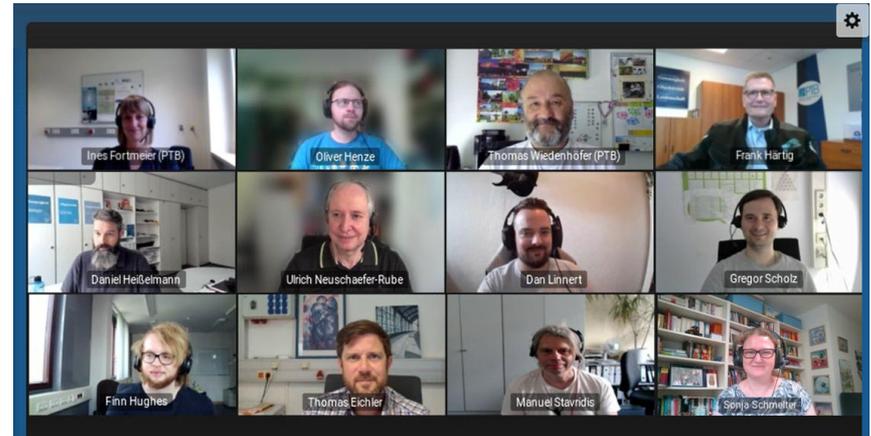
**Competence Center**

**“Metrology for virtual measuring instruments“ (VirtMet)**



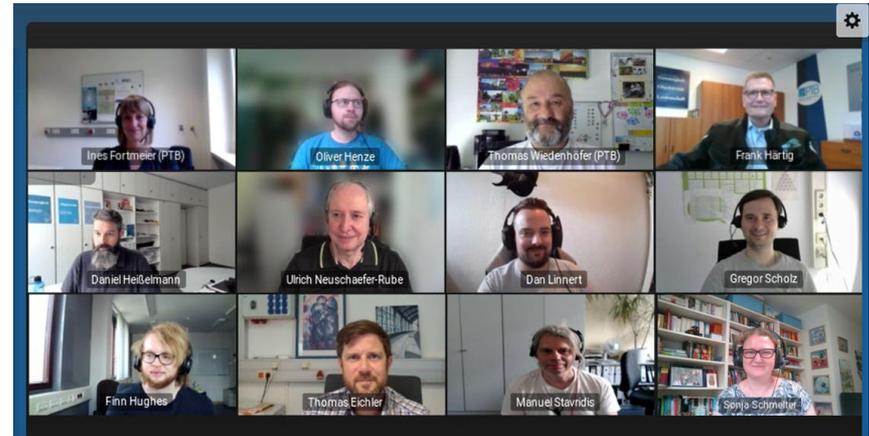
## Who we are...

- About 30 participants from different divisions of PTB:
  - 1 Mechanics and Acoustics
  - 4 Optics
  - 5 Precision Engineering
  - 7 Temperature and Synchrotron Radiation
  - 8 Medical Physics and Metrological Information Technology



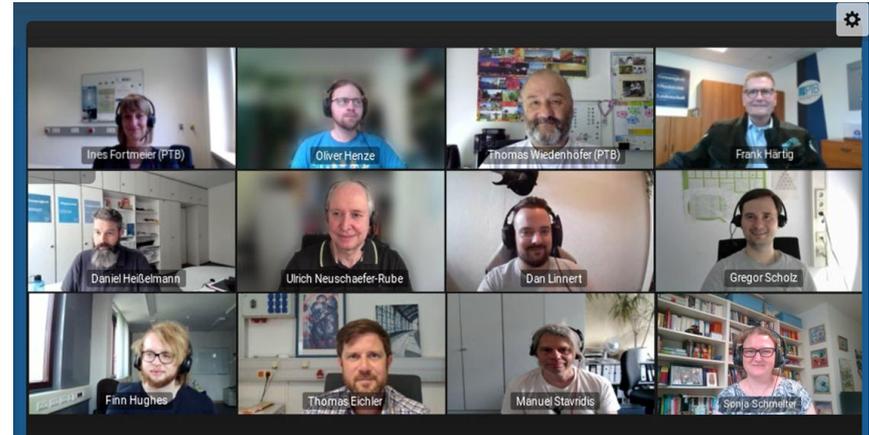
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- Common topic: virtual metrology

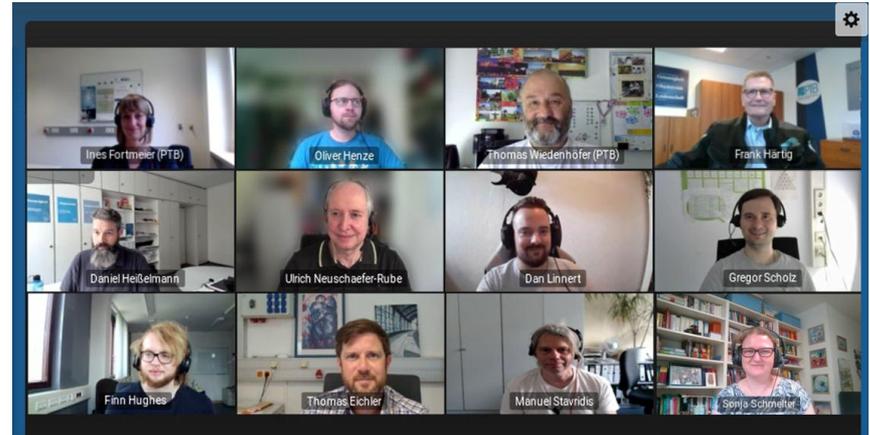


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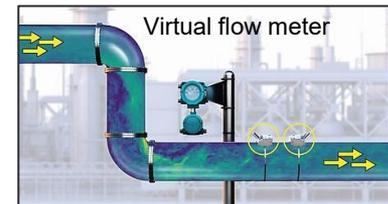
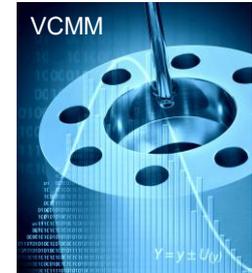
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## What we do...

- Regular meetings (approx. every 4 months)
- Exchange on methods and developments in the individual sub-projects
- Take up overarching issues and work on them in smaller groups



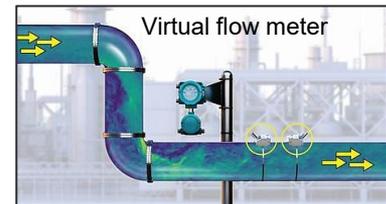
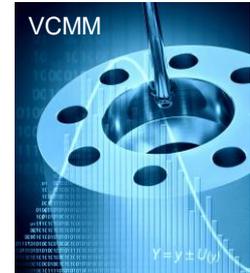
- Virtual Coordinate Measuring Machine (VCMM)
- Tilted-Wave Interferometer (TWI) as an example of hand-in-hand calibration of real and virtual experiments
- Development of a virtual flow meter
- Scatterometry as an example of inverse problems in metrology
- Evaluation of measurement uncertainty using virtual experiments
- Comprehensive traceability for force metrology services
- Traceable industrial 3D roughness and dimensional measurement using optical 3D microscopy and optical distance sensors
- Radiographic simulation for assessing the measurement uncertainty of measurements of geometrical features using X-ray computed tomography



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For further information, please visit

<https://www.ptb.de/cms/en/ptb/competence-centers/virtual-measuring-instruments/competence-centre-virtmet.html>



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National Metrology Institute

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Physikalisch-Technische Bundesanstalt  
National Metrology Institute

Initiation of  
research  
projects



[vidit.ptb.de](http://vidit.ptb.de)



[adam.ptb.de](http://adam.ptb.de)

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Input from  
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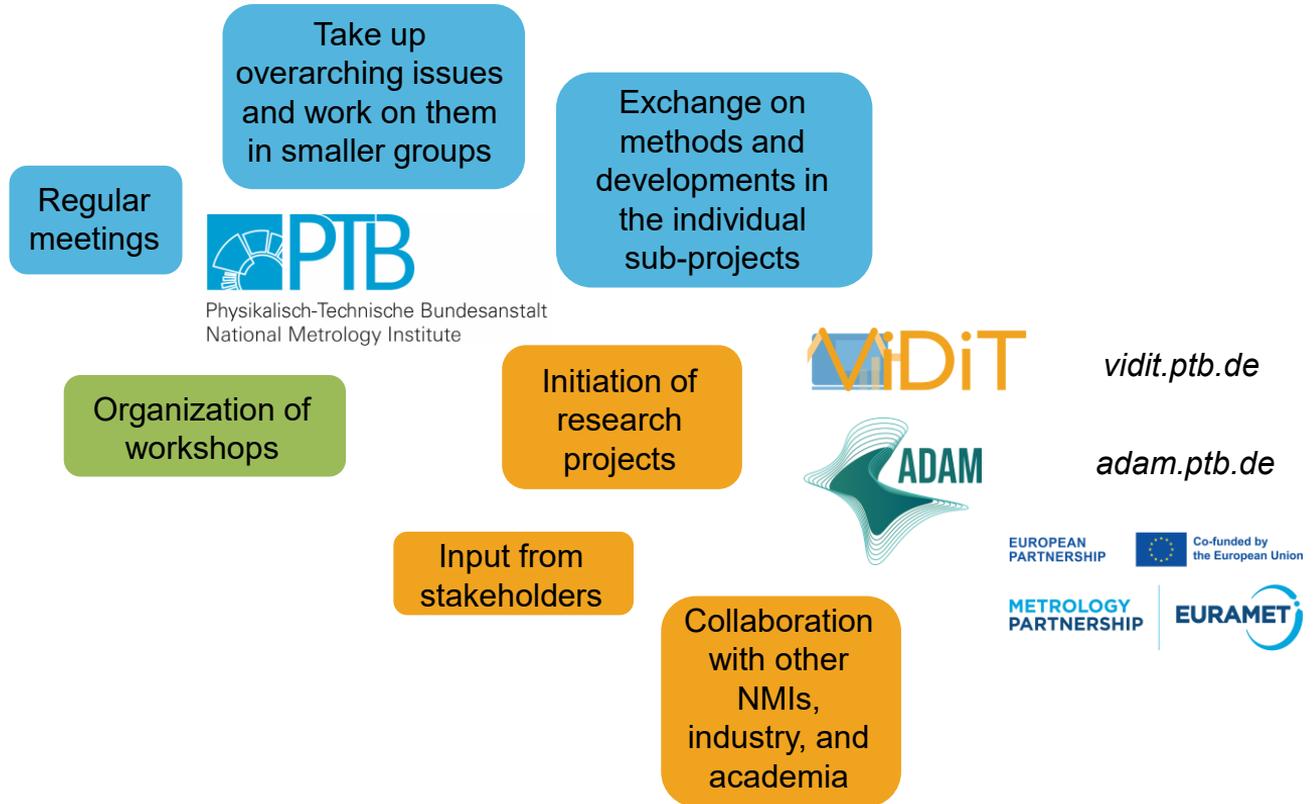
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METROLOGY  
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Physikalisch-Technische Bundesanstalt  
National Metrology Institute

Organization of  
workshops

Initiation of  
research  
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**VirtMess  
2018**

National  
workshop  
“Metrologie für  
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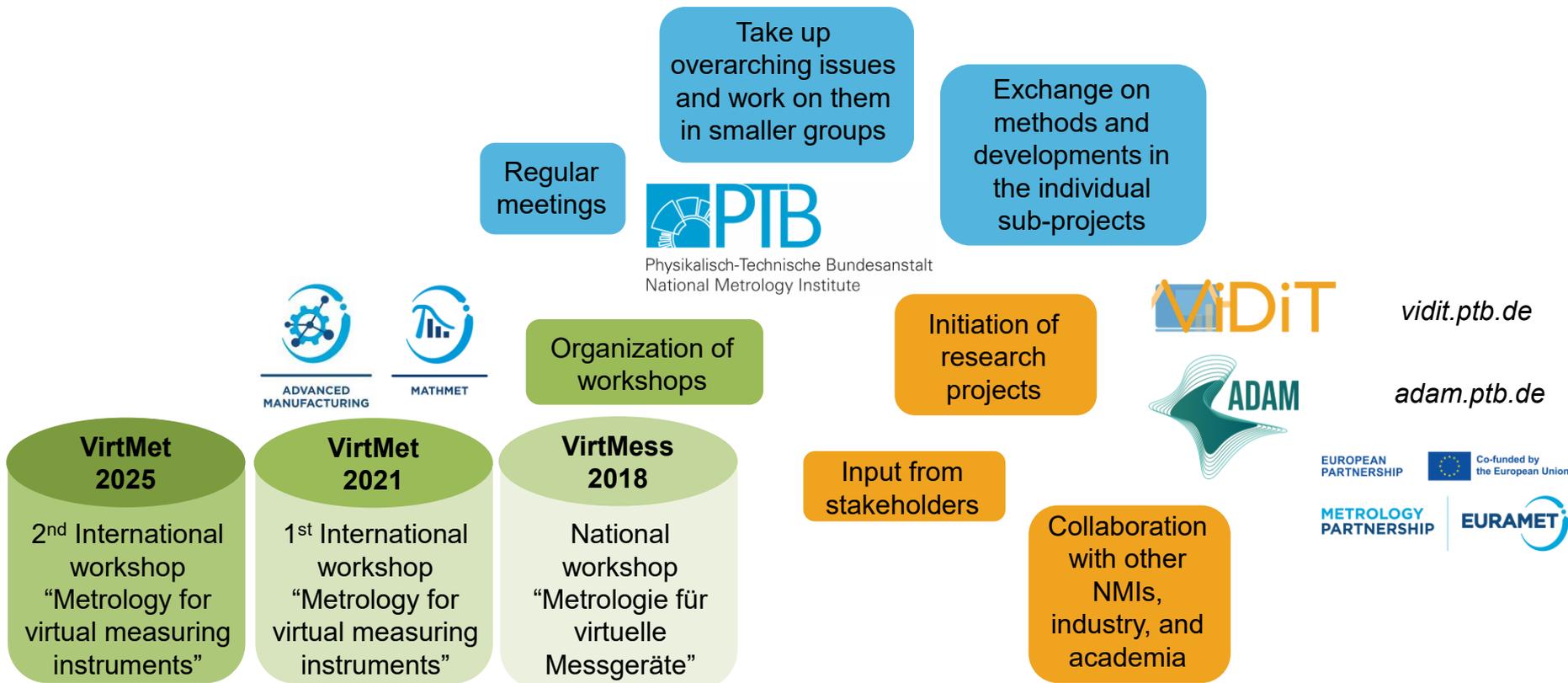
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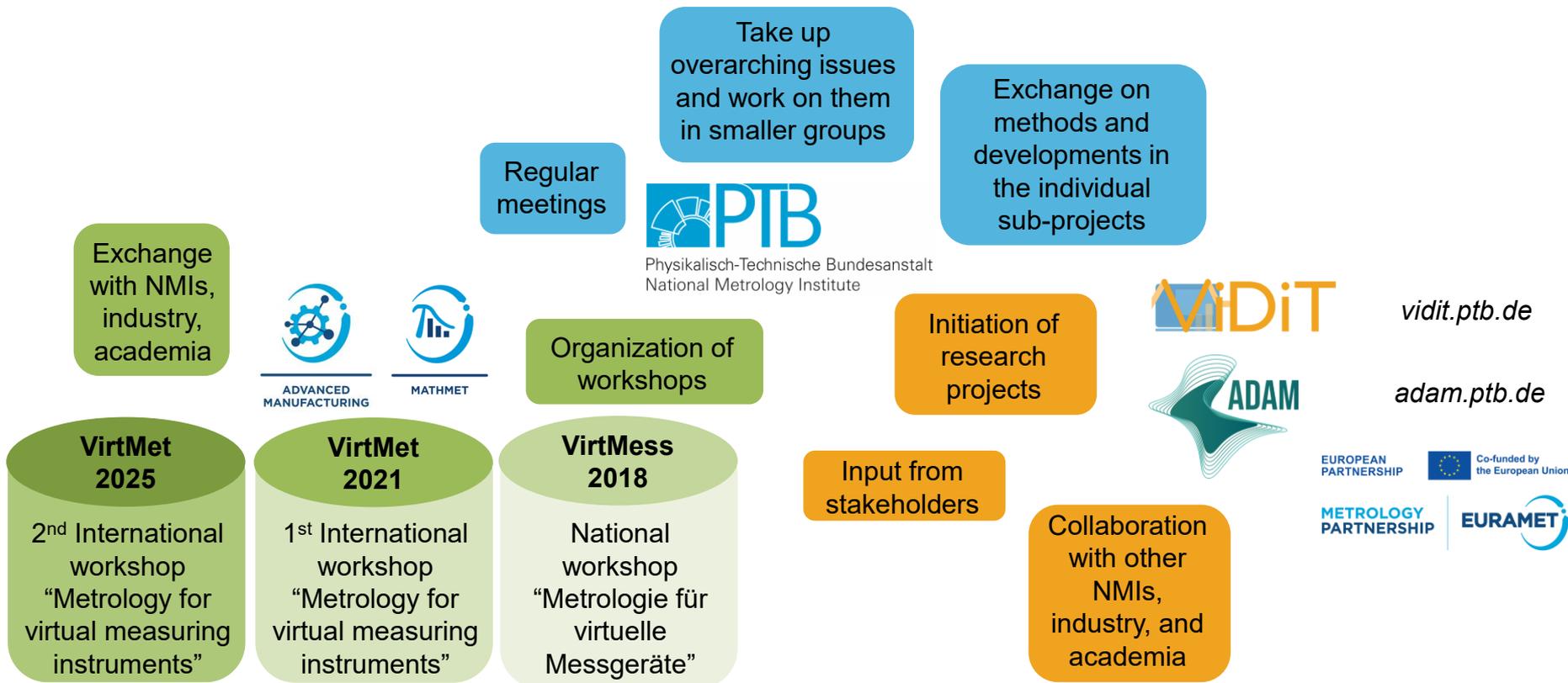
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METROLOGY  
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## 2<sup>nd</sup> International Workshop on Metrology for Virtual Measuring Instruments

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ADVANCED  
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... for the audience:

- Mute when you are not speaking
- Raise your hand and turn on your microphone + camera (if possible) if you have any questions

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## ... for the speakers:

- Stay on schedule with your talk to allow for a short discussion afterwards
  - **Keynote speakers:** 37-40 min. for presentation, 5-8 min. for discussion
  - **Contributed talks:** 15-17 min. for presentation, 3-5 min. for discussion

We will give you a hint after 40/17 minutes

3 December 2025

10:15 – 11:00	<b>Keynote Lecture 1:</b> The use of simulation models in semiconductor optical metrology	Hugo Cramer (ASML)
11:00 – 11:20	Using virtual experiments for improving and evaluating the alignment and the measurement procedure in form measuring interferometry	Gregor Scholz (PTB)
11:20 – 11:40	Uncertainty evaluation using virtual experiments with the example of the tilted-wave interferometer	Manuel Stavridis (PTB)
11:40 – 12:00	Virtual X-Ray Interferometer for Estimation of Systematic Effects in The Determination of The Lattice Parameter of Si-28	Birk Andreas (PTB)
12:00 – 12:10	Discussion	
12:10 – 13:30	Lunch	
13:30 – 14:15	<b>Keynote Lecture 2:</b> Numerical measurement uncertainty estimation for industrial computed tomography - from basic qualified software for X-ray radiographic simulation tools to numerical measurement uncertainty estimation using a virtual CT system	Tino Hausotte (FAU Erlangen-Nürnberg)
14:15 – 14:35	From Design of Experiments to Digital Twins: Machine Learning-Based Uncertainty Evaluation in Coordinate Metrology	Alireza Mollaei Ardestani (Technical University of Denmark)
14:35 – 14:55	Investigation of optical sensors to derive D-MT models for advanced manufacturing applications	Lea-Jean Frömel (PTB)
14:55 – 15:15	A closer look on uncertainty evaluations using Virtual Experiments and VCMMs	Gertjan Kok (VSL)
15:15 – 15:25	Discussion	
15:25 – 15:55	Coffee Break	
15:55 – 16:15	Uncertainty-Aware Multi-Fidelity Surrogate Modelling for Flow Field Predictions in Pipe Systems	Nursen Bayazit (PTB)
16:15 – 16:35	Development of a Digital Counterpart for the Internal Arc Testing	Matias Alberto Aguirre (INTI)
16:35 – 16:55	Automated Anomaly Detection in Quantum Voltage Standards Using Feature-Based Time Series Classification	Guillermo Schneider (INTI)
16:55 – 17:05	Discussion	



## 4 December 2025

10:00 – 10:45	Keynote Lecture 3: VirtMet in the wild: virtual metrology and virtual testing	Louise Wright (NPL)
10:45 – 11:05	Optimizing Phototherapy Efficiency: An Innovative Design for a Narrowband UV Phototherapy Device and the Role of Virtual Measurements	Samaa Faramawy (NIS)
11:05 – 11:25	Simulation-Enhanced Soft Sensors for Industrial-Grade Virtual Sensing: From Concept to Compliance	Piotr Strauch (Siemens AG)
11:25 – 11:45	Simulating Reflectance Transformation Imaging in a virtual environment for Metrology Applications	Samanta Piano (University of Nottingham)
11:45 – 12:05	Digital twin of robotic 3D scanning system: providing metrological traceability	Brahim Ahmed Chekh Oumar (TEKNIKER)
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Competence center VirtMet – [virtmet@ptb.de](mailto:virtmet@ptb.de)

<https://www.ptb.de/cms/en/ptb/competence-centers/virtual-measuring-instruments/competence-centre-virtmet.html>

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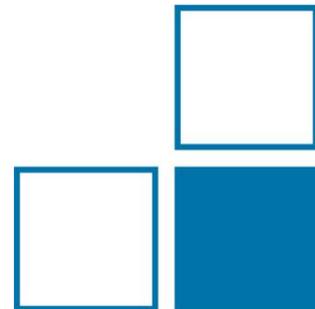
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  - ... as a tool to improve experiments
  - ... for asset/maintenance management

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- Current developments for CT, optics, electronics, ADAS, and VCMM
- Testing and validation of models and model components, also for complex systems
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- Communication, tools and, guidelines

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# Thank you!



Contact: [virtmet@ptb.de](mailto:virtmet@ptb.de)



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