EMPIR EURAMET
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Introduction to HIT Project

Metrology for Humidity at High Temperatures and Transient Conditions

Workshop at INRIM, Torino, Italy

12 July 2018

HIT

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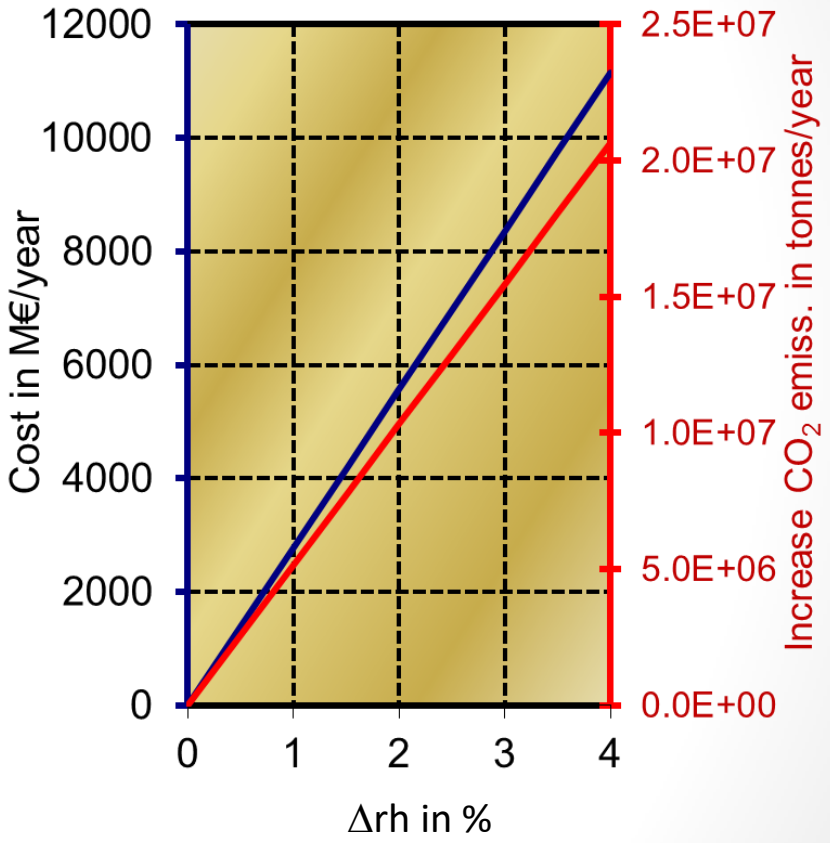
Industrial humidity measurements and impact on the climate

- Heating and evaporating water require significantly more energy than many other liquids.
- Drying = evaporating water
- In 2012, the annual energy consumption in Europe was about 2 x 10^7 GWh
  - It's estimated the 15 % of this is consumed in drying processes
- More reliable humidity measurement in drying
  - less over-drying
  - reduced energy consumption



Humidity and product quality (1/2)

- In many applications humidity is measured in-line for determining the dryness of material flow in a process:
  - Paper mills
  - Wood (kiln) driers
  - Raw material dryers
  - Polymer industry

[www.bigondry.com]

- Material properties and final product quality is highly dependent on the dryness
- E.g. in food production, the most important moisture-related parameter is water activity:
  - Water activity = equilibrium relative humidity on scale 0 to 1

Humidity and product quality (2/2)

- Storage conditions are important, e.g. in production of pharmaceuticals and various bio-products
  - Effect on product quality and shelf life

[www. pharmamicroresources.com]

[www.pharmaguideline.com]

- Environmental tests are vital for ensuring and improving characteristics of e.g. electronic components and products
  - Operation and safety in various conditions
  - New materials and features

[www.cmenvirosystems.com]

Traceability challenges in humidity measurements

- Relative humidity measurements at high temperatures (> 100 °C)
  - Humidity sensors are only calibrated at lower temperatures: How representative are the calibration results?
  - Humidity realisations (national standards) are limited to lower temperature range
  - How to estimate measurement uncertainty (e.g. effect of thermal radiation)?
- Humidity measurements in non-static conditions
  - Fast transients in e.g. baking control
  - Humidity ramps in e.g. electronic testing
  - Non-static spatial inhomogeneity in e.g. product storages
- Traceable in-line water activity measurement
  - E.g. in food and feed production

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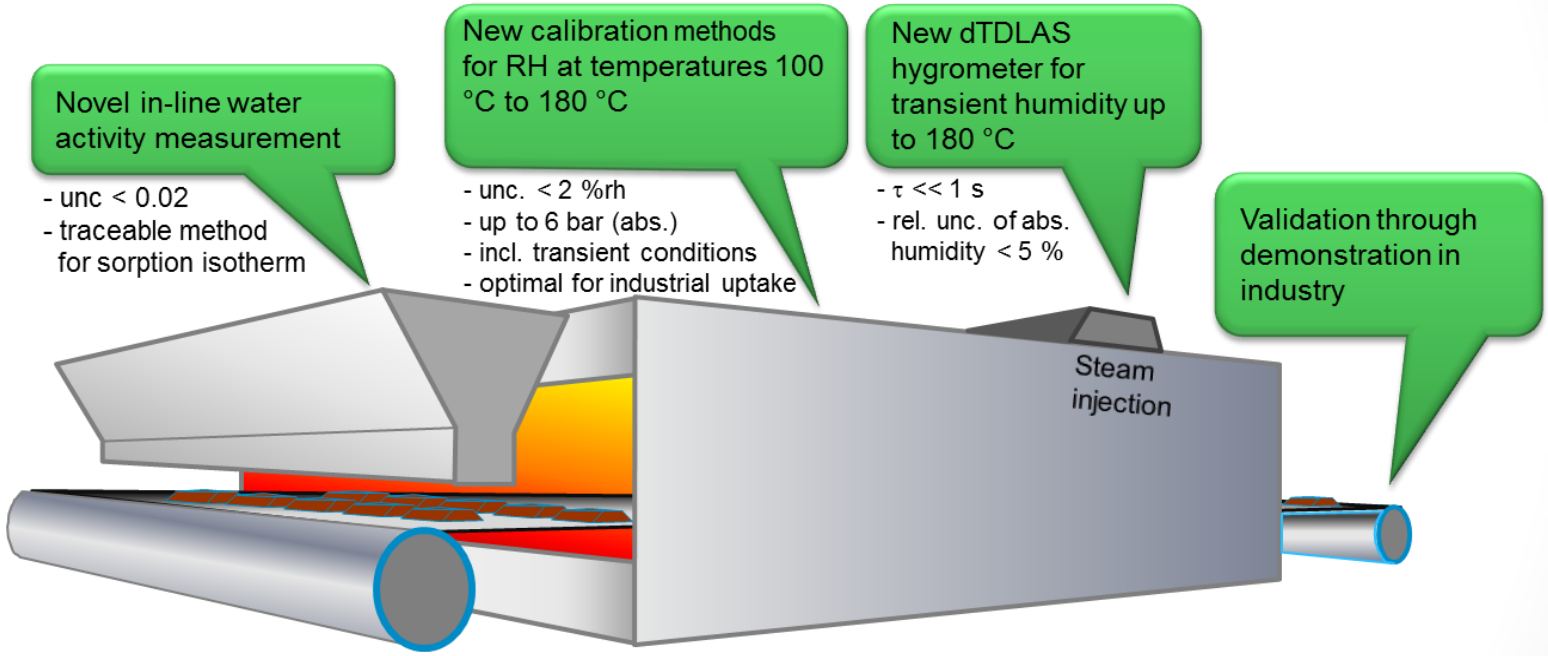
EMPIR 14IND11 HIT

"Metrology for Humidity at High Temperatures and Transient Conditions"



New measurement approach for microbiological sample storage
- influence of microbiological processe on humidity gradients and transients
- unc. < 2 %rh

New approach for maintenance of equipment
- dynamic humidity measurement
- unc. < 2 %rh
- calibr. time reduced by 50 %
- new field calibrator

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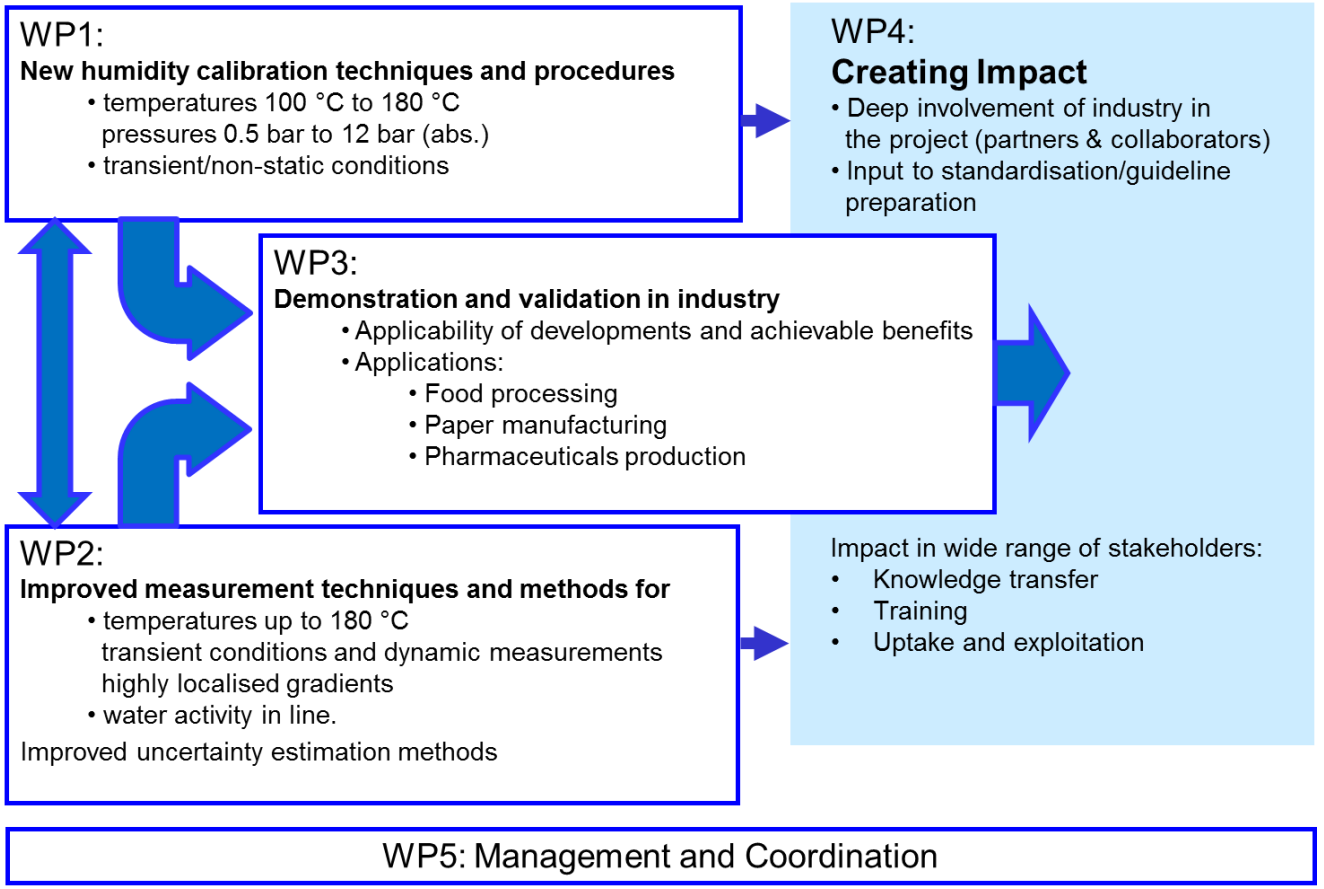
HIT: Implementation



ALL DEVELOPMENTS ARE DEMONSTRATED IN INDUSTRY:

brovind · ctcpa · FrieslandCampina · lek a Sandoz company · ORION · GP Georgia-Pacific

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- CETIAT, France
- DELTA, Denmark
- DTI, Denmark
- INRIM, Italy
- PTB, Germany
- UL, Slovenia
- VSL, Netherlands
- CNR, Italy
- GBV, Italy
- IH, The Netherlands
- Michell Bv, The Netherlands
- TU-DA, Germany
- UNICLAM, Italy
- Vaisala, Finland

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