

Thermal metrology challenges in Nordic and Baltic countries

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CHALLENGES

In cooperation with industry, the national metrology institutes in Nordic and Baltic countries have identified four main challenges in thermal metrology covering radiation and contact thermometry, and humidity and moisture measurements:

1. Calibration service for radiation thermometers and thermocouples at high temperature beyond 2000 °C

There are many significant initiatives ongoing in Nordic countries related to battery component manufacturing and green steel production. The industry needs calibration services to ensure and prove the reliability of very high temperature measurements.

2. Improved calibration methods for air temperature measurements

Reliable air temperature data in the Northern European region is important for climate modelling and weather forecasting. The meteorology community is keen to improve this data. However, improved accuracy of air temperature measurement is also needed for more optimized energy usage in drying processes, e.g. in wood product manufacturing and concrete production.

3. Metrological tools for sensor networks and thermometry augmented by AI powered simulation

Sensor networks are replacing individual measuring instruments in manufacturing and environmental monitoring. At the same time advanced simulation tools are being introduced to measurement instruments and systems to provide more comprehensive knowledge about thermal conditions than is achievable by physical pointwise temperature sensors. Due to highly sophisticated algorithms, traditional approaches to establish the metrological traceability and to analyse measurement uncertainty are not sufficient in these applications.

4. Humidity and moisture measurements with challenging traceability scenarios

In Nordic and Arctic regions and at high altitudes, humidity measurements are also needed to be performed at very low temperatures. Although high accuracy is very difficult to achieve, instrument manufacturers need high quality reference measurements to support their production. On the other hand, high temperature humidity calibrations are important for ensuring high quality in e.g. testing electronics. Controlling the water content of grain, food products and pharmaceuticals is vital to ensure good quality products and minimize waste in production. Improved methods for soil moisture measurements are needed to enhance the role of soil as a carbon sink and developments in climate observations, weather forecasting, hydrology and agriculture.

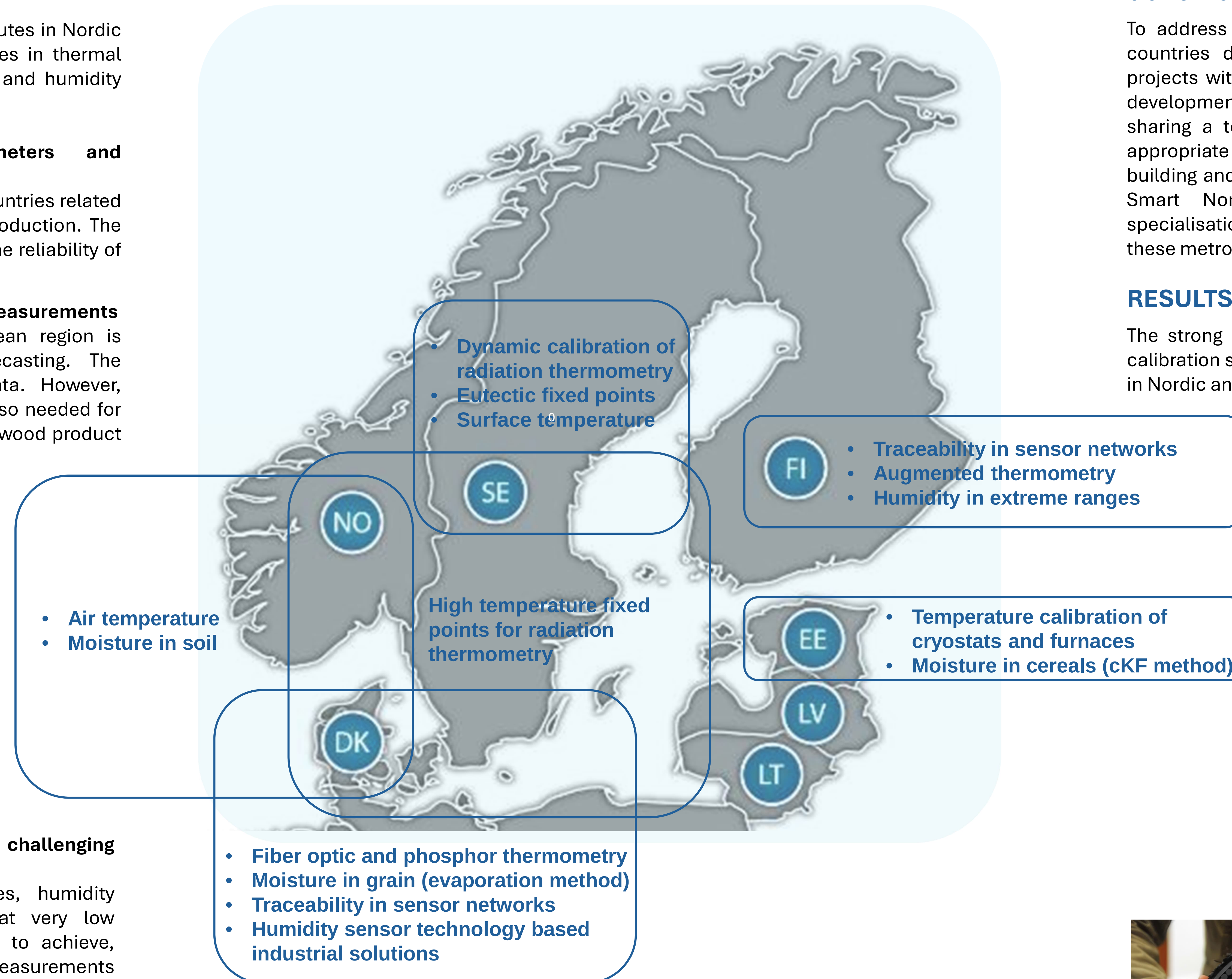


Figure 1 Focus areas of metrology research in Nordic and Baltic countries. Distribution among the NMI/DIs with appropriate overlapping ensure the sustainable and efficient development of the future services.

CONCLUSION Battery component manufacturing and green steel production, climate monitoring in the Northern region, sensor networks, and challenging traceability scenarios in humidity measurements set the main challenges for metrology development in Nordic and Baltic countries. Smart regional collaboration exploiting our diverse expertise will deliver needed new calibration systems, expertise and services.

SOLUTION

To address the challenges, the NMIs and DIs in Nordic and Baltic countries develop their competences and capabilities in research projects within the European Partnership on Metrology and in internal development projects. The resilience of future services is ensured by sharing a topic with several countries but not with all to maintain appropriate efficiency in resourcing. Strategic planning, capacity building and a knowledge transfer tool are/will be used within the EMN Smart North (European metrology network promoting smart specialisation in Northern Europe) to support optimal exploitation of these metrology developments in the whole region.

RESULTS

The strong regional collaboration in metrology research delivers new calibration systems and expertise leading to services needed by industry in Nordic and Baltic countries in the future.

Providing a significant contribution to European research initiatives, we ensure the competitiveness of industry. Working closely with stakeholder in multipartner research projects and customer specific commercial projects ensures efficient uptake of research results

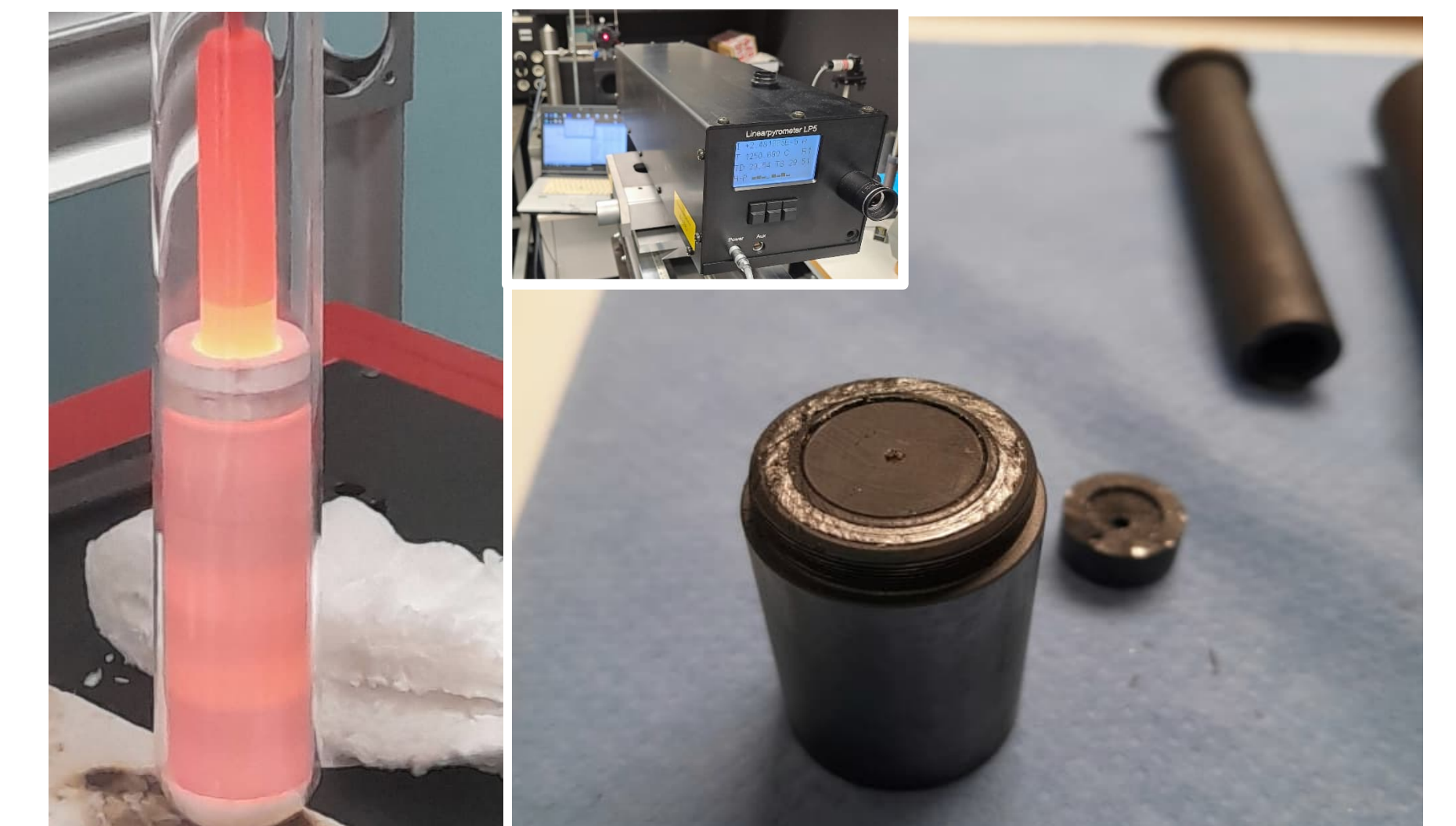


Figure 2 For radiation thermometry, new eutectic fixed point cells and thermometer setups have been developed by JV and DFM while RISE has developed systems for dynamic radiation temperature calibrations.



Figure 3 DTI, JV, RISE are contributing to the development of calibration facilities for fibre-optics thermometry up to 700 °C within INFOTherm project.

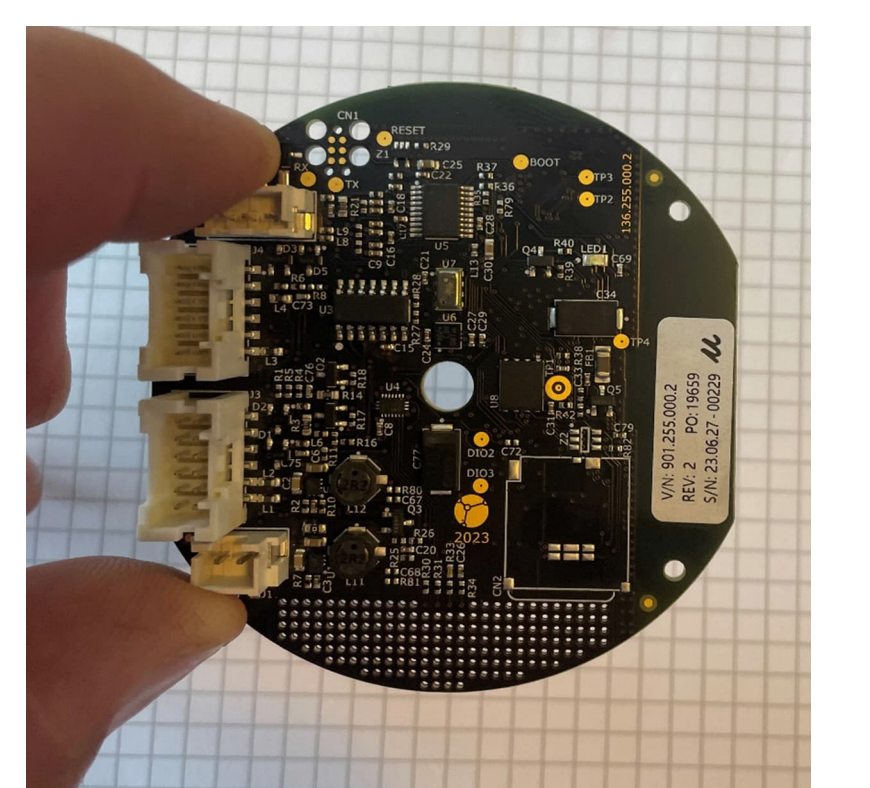


Figure 4 Exploiting the metrology expertise FORCE has developed a Moisture Level Indicator for industrial use.