

TC-AUV 2019 Report

Stephen Robinson

CCAUV12, BIPM
26 – 27 September 2019

- TC-AUV
 - Report of general activities
- Highlights
- Emerging metrology challenges

Overview of TC-AUV



- Chair of TC-AUV
 - Stephen Robinson, NPL
- Members: 24
- Sub-committees:
 - **SC-A: Sound in Air**
 - **SC-U: Ultrasound & Underwater acoustics**
 - **SC-V: Vibration & acceleration**
- Working Group
 - CMC review
- TC-AUV Meeting:
 - April 4-5, 2019
 - PTB, Braunschweig, Germany
 - Guest delegates:
 - COOMET (x2)



Delegates at 2019 meeting of TC-AUV at PTB, Braunschweig, Germany

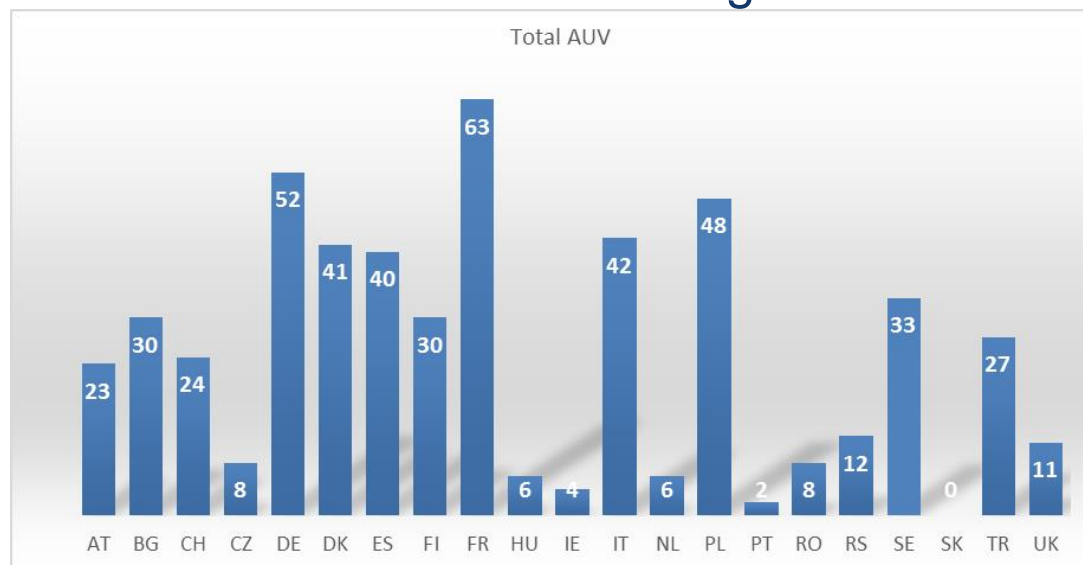
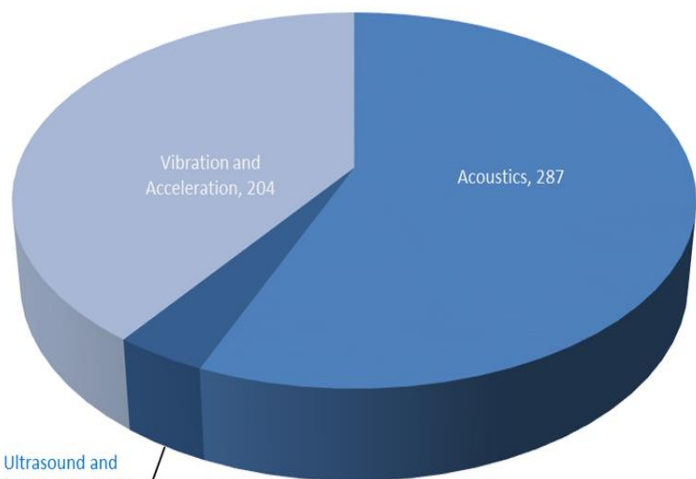
SC Convenors:

- SC-A; Erling Sandemann-Olsen (DPLA)
- SC-U: Gianni Durando (INRIM)
- SC-V: Thomas Bruns (PTB)
 - new SC-V convenor in 2019

General activities - CMCs



- 20 EURAMET NMIs & DIs have a total of 510 CMC entries on BIPM KCDB
- CMC review – BIM (Bulgaria)
 - Vibration CMCs for BIM currently under review with action plan agreed regarding future acceptance
- CMCs re-submitted in the 2018-2019 period:
 - Germany, Turkey, with Serbia, France, Poland and Austria in progress.
- Overall, number of CMCs is not excessive - situation is manageable.



General activities



- EURAMET provides inputs to world metrology
 - Provides role in CCAUV and its working groups

Capacity Building

- Tanasko surveyed interest in training courses in air acoustics and vibration
- Responses from TR, UK, PO, RS, EE, GR, MK, ES, IE, BG, MD
- Two courses being run in June at GUM

EURAMET Training Course on Acoustics measurements

Registration closed - this training course is fully booked.

Objective

The training course aims to improve the knowledge of the less experienced laboratory staff in EURAMET NMIs/DIs in the field of the calibration and testing of measuring devices used in acoustic metrology.

The training will include lectures concerning the devices used in acoustic metrology and methods of their calibration and testing, practical exercises in laboratories and estimation of measurement uncertainties.

The training will comprise a mixture of 2 days lectures and 3 days of practical sessions.

Who should attend

EURAMET NMI/DI staff dealing with calibration and testing of measuring devices used in acoustics, requiring extension of knowledge and experience.

Participants are expected to have basic knowledge in acoustic metrology.

EVENT INFORMATION

DATE

2019-06-10 to 2019-06-14

LOCATION

GUM, Warszawa, Poland

CATEGORIES

Capacity Building
Technical Training

Share the Event

Current comparisons:

- Two EURAMET comparisons (A-K5 now finished)
- Four CCAUV comparisons ongoing (W-K2, V-K4, V-K5 and A.K6)

AUV interest in possible future EMNs

- Environmental pollution monitoring...
- Medical imaging...

Concept

European Metrology Networks (EMN)



Overall objective

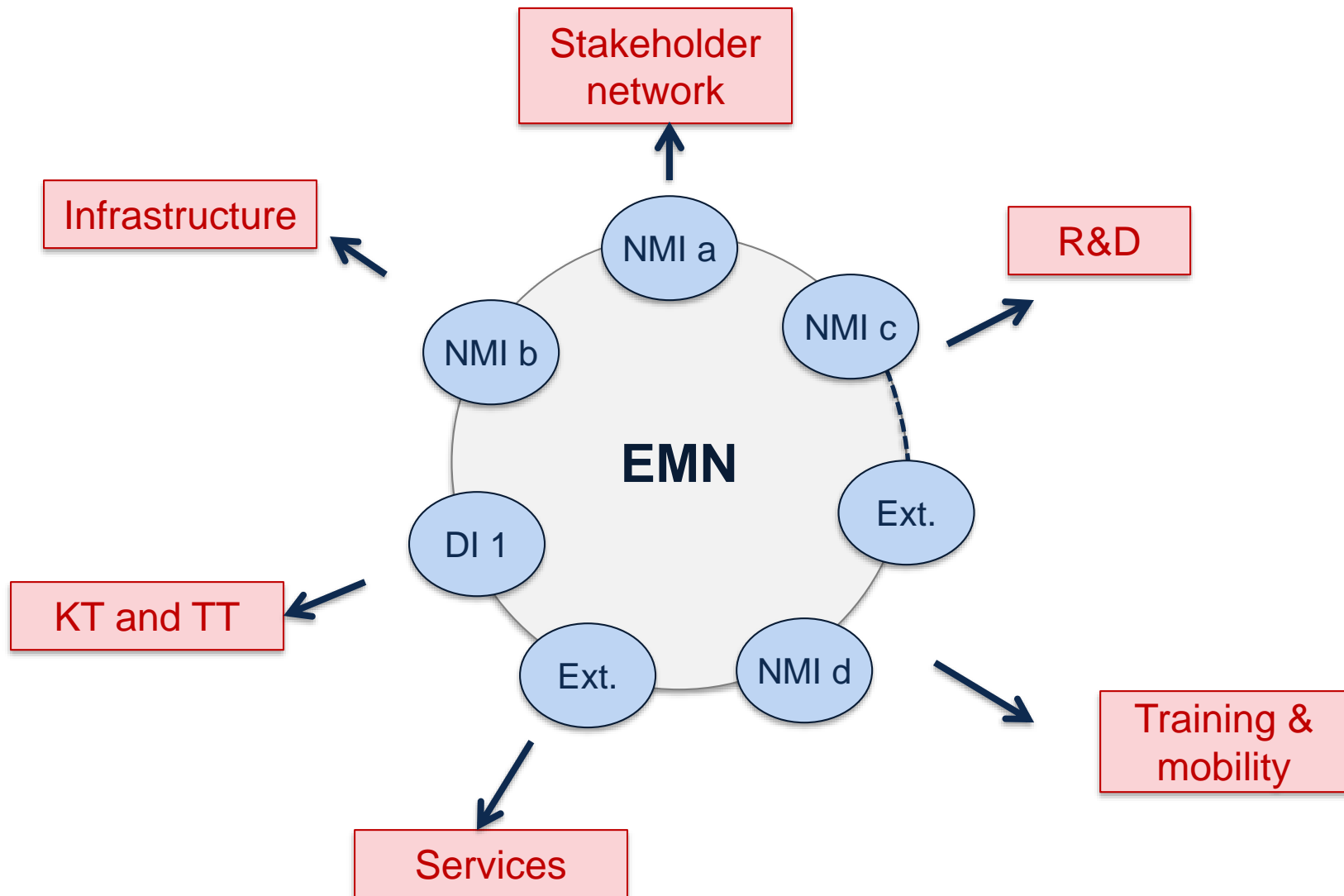
The overall objective is to create sustainable structures in areas of strategic importance for the future of European metrology by:

- Creating and disseminating knowledge
- Gaining international leadership and recognition
- Building coordinated infrastructure.

“Strategic importance” means that an EMN needs to cover a field which:

- is of relevance at the European level and has a high potential impact,
- is too wide to handle for individual players
- needs capabilities and/or tools beyond the ones which are already established at NMIs and DIs.

European Metrology Networks (EMN)



Characteristics of EMNs



European metrology networks:

- cover an area of major strategic importance, with European dimension;
- consist of core network of NMIs/DIs with a clear commitment to contribute to the network;
- establish close links to a wider stakeholder community;
- strive for scientific excellence;
- plan the activities based on a strategic agenda;
- establish a knowledge, technology transfer and promotion plan;
- plan for sustainable structures;
- develop common activities:
 - AUV interest in possible future EMNs
 - Environmental pollution monitoring...
 - Medical imaging...

Recent EMPIR projects

15HLT03 EARS II

Metrology for modern hearing assessment and protecting public health from emerging noise sources

May 2016 – April 2019

Project lead: Christian Koch (PTB)

15PRT02 UNAC-LOW

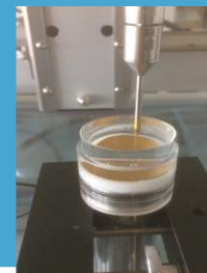
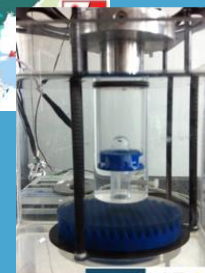
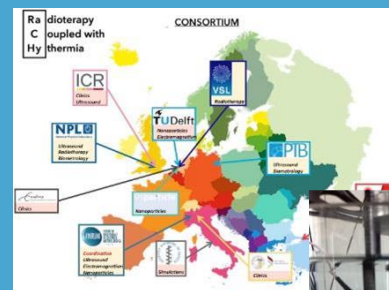
Underwater acoustic calibration standards for frequencies below 1 kHz

May 2016 – April 2019

18HLT06 RaCHy Project

June 2019 – May 2021

- Aim: to provide a reliable metrology framework for the evaluation of radiation-based therapies coupled with hyperthermia induced by Therapeutic Ultrasound (TUS), conventional Electromagnetic Radiation (EMR), magnetic nano-particles (MNPs).



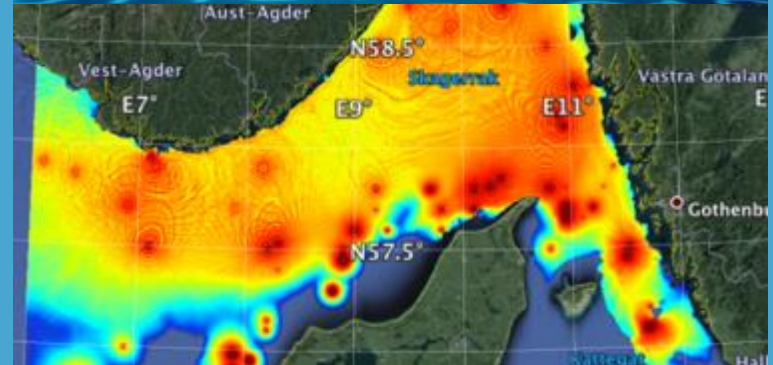


**Acoustics, Ultrasound
and Vibration**

Thank you

TC-AUV

Emerging metrology
challenges



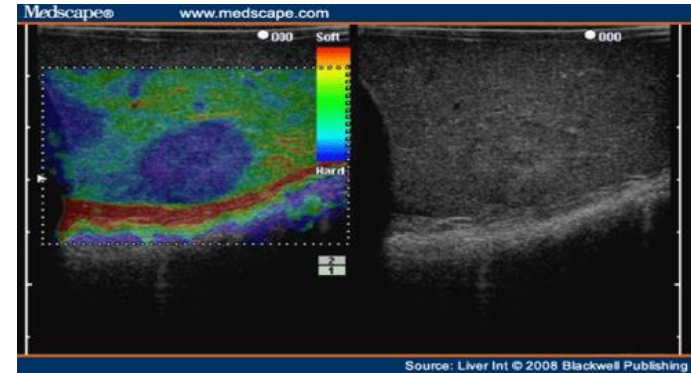
Very low frequency traceability

- International sensor networks
 - Seismic, infrasonic climate studies, nuclear weapons test ban monitoring, tsunami detection
- **But:** no calibration, no traceability, little QA
- Need for:
 - Development of calibration and traceability strategies, methods, devices - build up traceability infrastructure
 - Demonstration of impact on climate and marine environment monitoring, both disaster warnings and for forecasting of environmental variables
- Example stakeholders
- CTBTO
 - traceability badly needed for global sensor network for vibration, hydroacoustics, infrasound
 - traceability request made through CCAUV & CGPM
- Renewable energy
 - traceability for VLF sound emitted by land-based wind turbines and during offshore construction



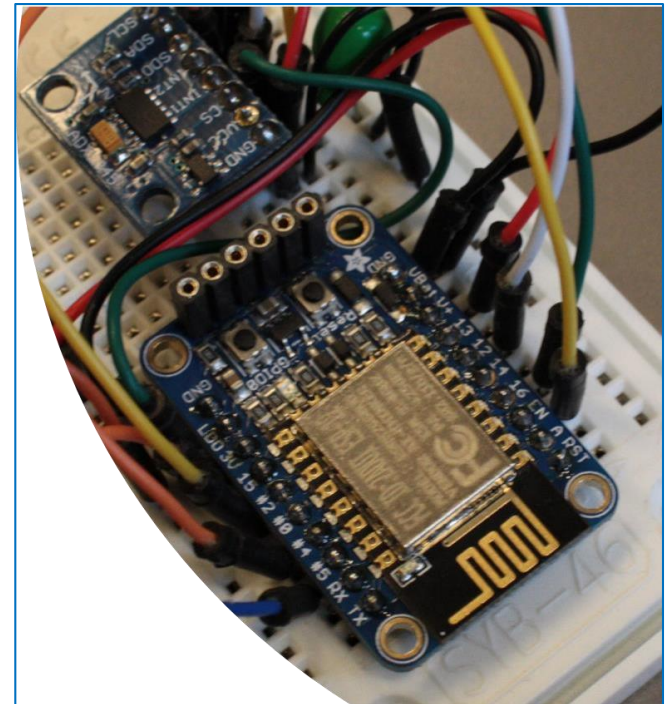
Quantitative acoustic imaging

- Medical ultrasound and marine acoustics
- Ability to relate image to physical properties
- Important for:
 - comparison between images (before and after)
 - classification of image features



Digital sensors and sensor networks

- Sensors play vital part in AUV metrology and applications
 - Increasingly the transducers have digital outputs and are distributed in networks
 - Devices are often embedded into their surroundings and cannot be separated for calibration (no access to analogue signals)
- Work in TC-AUV to examine the issues in preparation for more pre-normative work
- EMPIR 17IND12 Met4FoF (06/18 – 05/21)
 - Metrology for the Factory of the Future





**Acoustics, Ultrasound
and Vibration**

Thank you

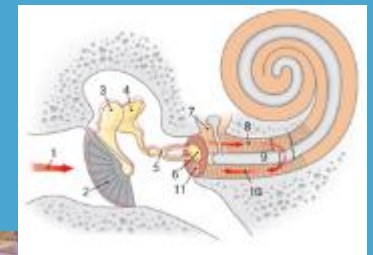
15HLT03 EARS II

Metrology for modern hearing assessment and protecting public health from emerging noise sources

May 2016 – April 2019

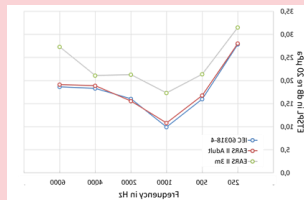
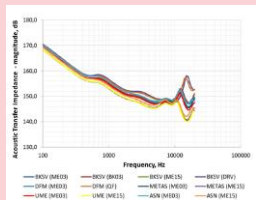
Project lead: Christian Koch (PTB)

- New ear simulator and calibration strategies for improved audiometric diagnosis and new born screening
- Impact of infra- and ultrasound on humans
- Perceptual mechanisms of infra- and ultrasound
- Qualitative and quantitative characterisation of emerging sound in the public and at workplaces

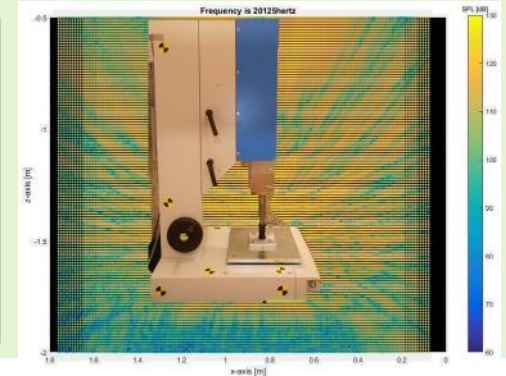


EARS II Achievements

- **New ear simulator**
- new specifications set
- international comparison of transfer impedance measurement
- first set of normative data for application in audiological practice
- new idea for an improved definition of hearing threshold transfer values

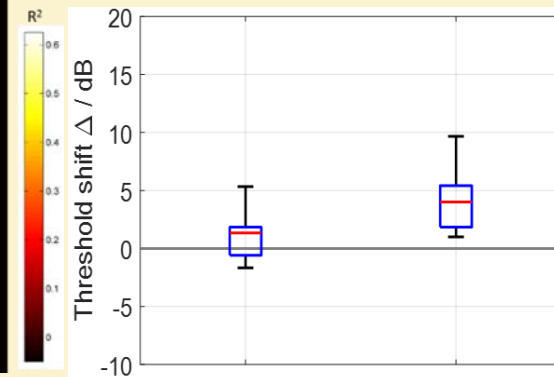
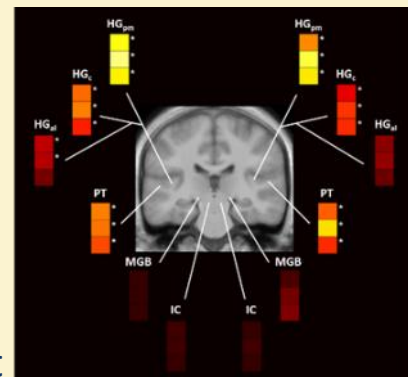


- **Ultrasound at workplaces**
- study for long-time exposure with questionnaires and fMRI-scans showed significant correlations
- New practical measurement methods for ultrasound exposure at workplaces developed
- Successfully tested at real workplaces: Coca Cola, Ferrero



Infrasound Perception

- level, loudness, unpleasantness tested
- subjectively (questionnaires) and objectively (fMRT) investigated
- model of cochlea for LF hearing developed
- combination of sound and infrasound
- audible sound “disturbs” the infrasound but not vice versa!



15PRT02 UNAC-LOW

Underwater acoustic calibration standards for frequencies below 1 kHz

May 2016 – April 2019

TUBITAK – MAM (TR), NPL (UK), DFM (DK), FOI (SE), CNR & ISPRA (IT)
Project lead: TUBITAK-MAM (A. Biber)

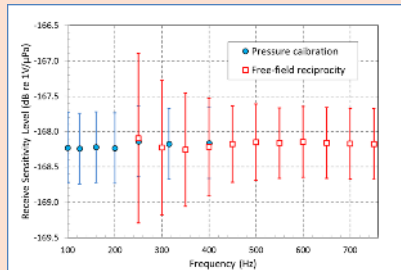
Develop traceable measurement capabilities for calibration of **hydrophones** and **autonomous sound recorders** and systems

Develop a coherent strategy for long-term operation of the developed measurement capabilities

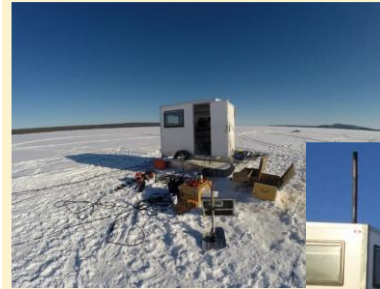


UNAC-LOW Achievements

- **LF hydrophone calibration**
- New pressure calibration capability in Turkey and Denmark
- Extended UK free-field calibration & new UK laser pistonphone standard
- Round-robin comparison (TR, UK, SE)



- **Autonomous recorder calibration**
- Comparison of calibration methods
- Field trials organised in Rome and at Hornavan, Lapland, Sweden
- New calibration services offered



- **Outputs**
- Publications (3 journal, 6 conferences)
- New calibration services offered by partners
- Contributions to IEC and ISO standards (new work Item in IEC TC87)
- Input to revision of TC-AUV road maps and coordinated strategy
- Traceability & support provided to EU MSFD monitoring projects (JOMOPANS, QUIETMED)

18HLT06 RaCHy Project

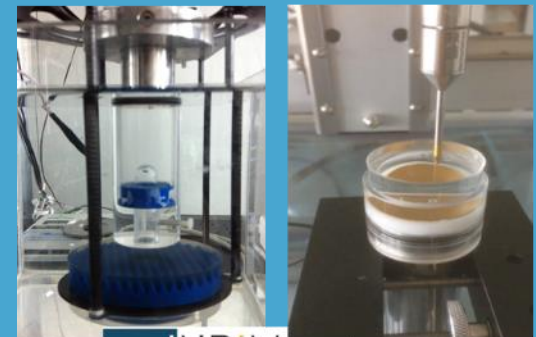
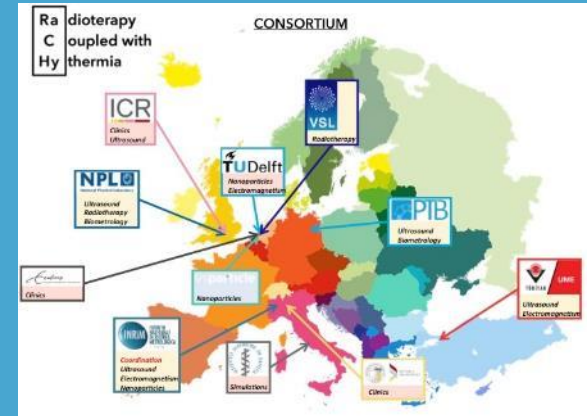
June 2019 – May 2021

- Aim: to provide a reliable metrology framework for the evaluation of a class of radiation-based therapies coupled with hyperthermia induced by Therapeutic Ultrasound (TUS), conventional Electromagnetic Radiation (EMR), magnetic nano-particles (MNPs).

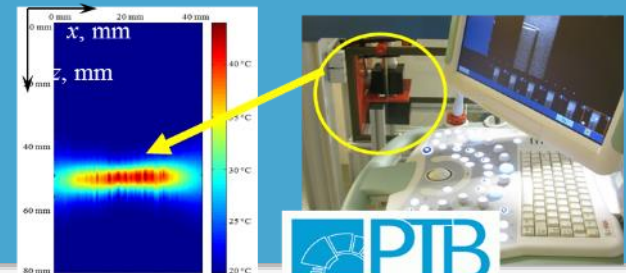
Since hyperthermia causes radio-sensitization and inhibition of recovery from radiation damage, its combination with radiotherapy creates a potent combination for treating human tumours

WP1: Heat delivery systems for hyperthermia treatments

WP2: Temperature exposure evaluation



INRiM
ISTITUTO NAZIONALE
DI RICERCA METROLOGICA



PTB
Physikalisch-Technische Bundesanstalt
Braunschweig und Berlin



**Acoustics, Ultrasound
and Vibration**

Thank you