# Research needs on radon and NORM – General discussion

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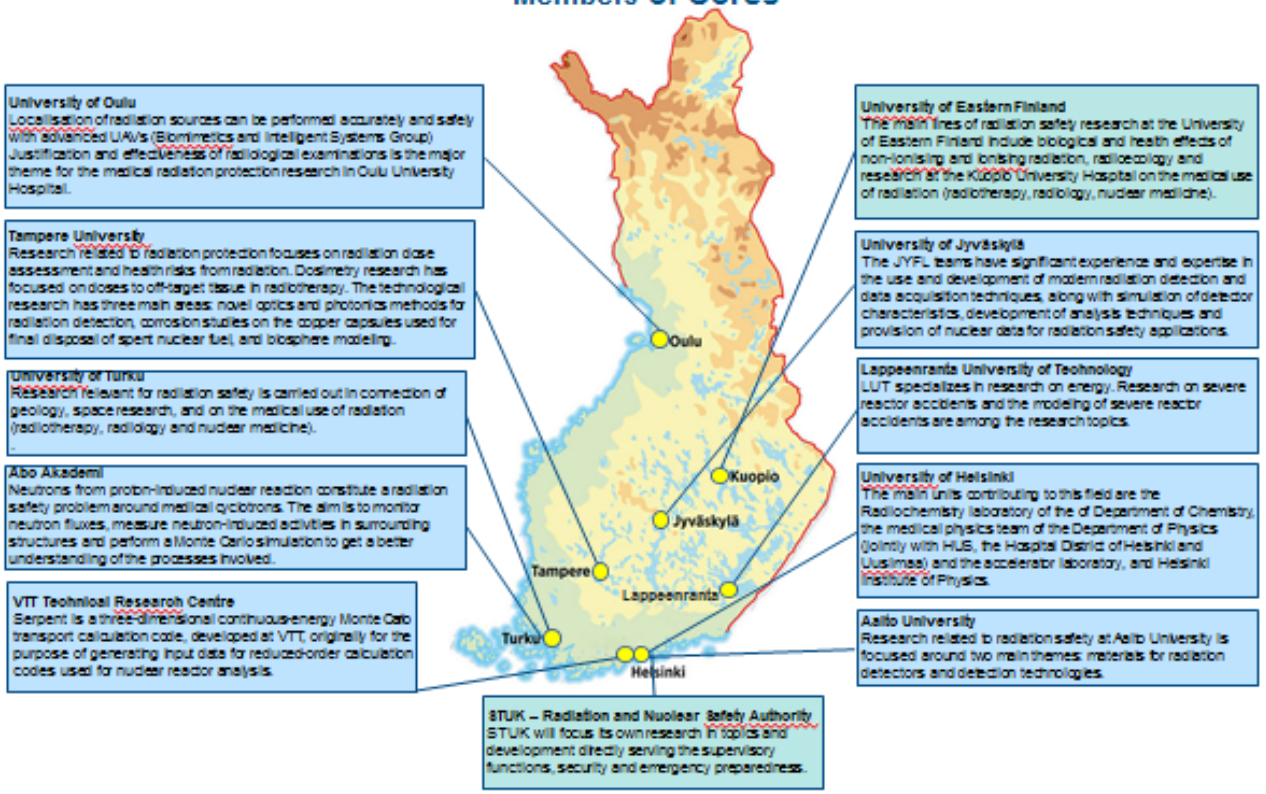
# Cores – National programme and Consortium for radiation safety research

Cores

## Introduction

Cores, Finnish Consortium for Radiation Safety Research, is strengthening the cooperation between research institutions and universities. By joining forces, STUK and the universities aim to secure the continuity of the radiation safety research in Finland. This ensures that Finland maintains the national competence and that the Finnish research retains its high level position within international research community.

## Members of Cores



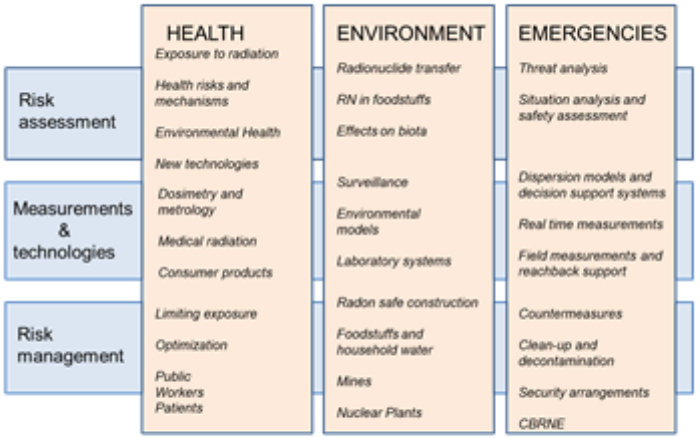
# Cores

Consortium for Radiation Safety Research

## Roadmap 2018 - 2022

- To engage new partners, universities as well as research institutes
- To organise activities fostering the cooperation – joint symposia and working groups
- To disseminate of Cores' aims and achievements via Cores newsletters and the website
- To foster education and training and promoting the joint use of infrastructures and databases
- To promote national and international funding for radiation sciences and links with the European radiation protection research platforms

## Programme framework




## Links to European RP Programme

MELODI Multidisciplinary European Low Dose Initiative

EUROPEAN RADIOECOLOGY ALLIANCE

EMPIR EURAMET

The EMPIR initiative is co-funded by the European Union's Horizon 2020 research and innovation programme and the EMPIR Participating States

EURADOS

EURAMED European Alliance for Medical Radiation Protection Research

NERIS

## Cores consortium

Aalto-yliopisto Aalto-universitetet Aalto University

University of Eastern Finland

Jyväskylän yliopisto

Åbo Akademi

Oulun yliopisto

Turun yliopisto University of Turku

Tampereen yliopisto

LUT Lappeenranta University of Technology

VTT

stuk

*Coordinator of Cores: Sisko Salomaa, STUK*

# ALLIANCE

EUROPEAN RADIOECOLOGY ALLIANCE

## Challenges

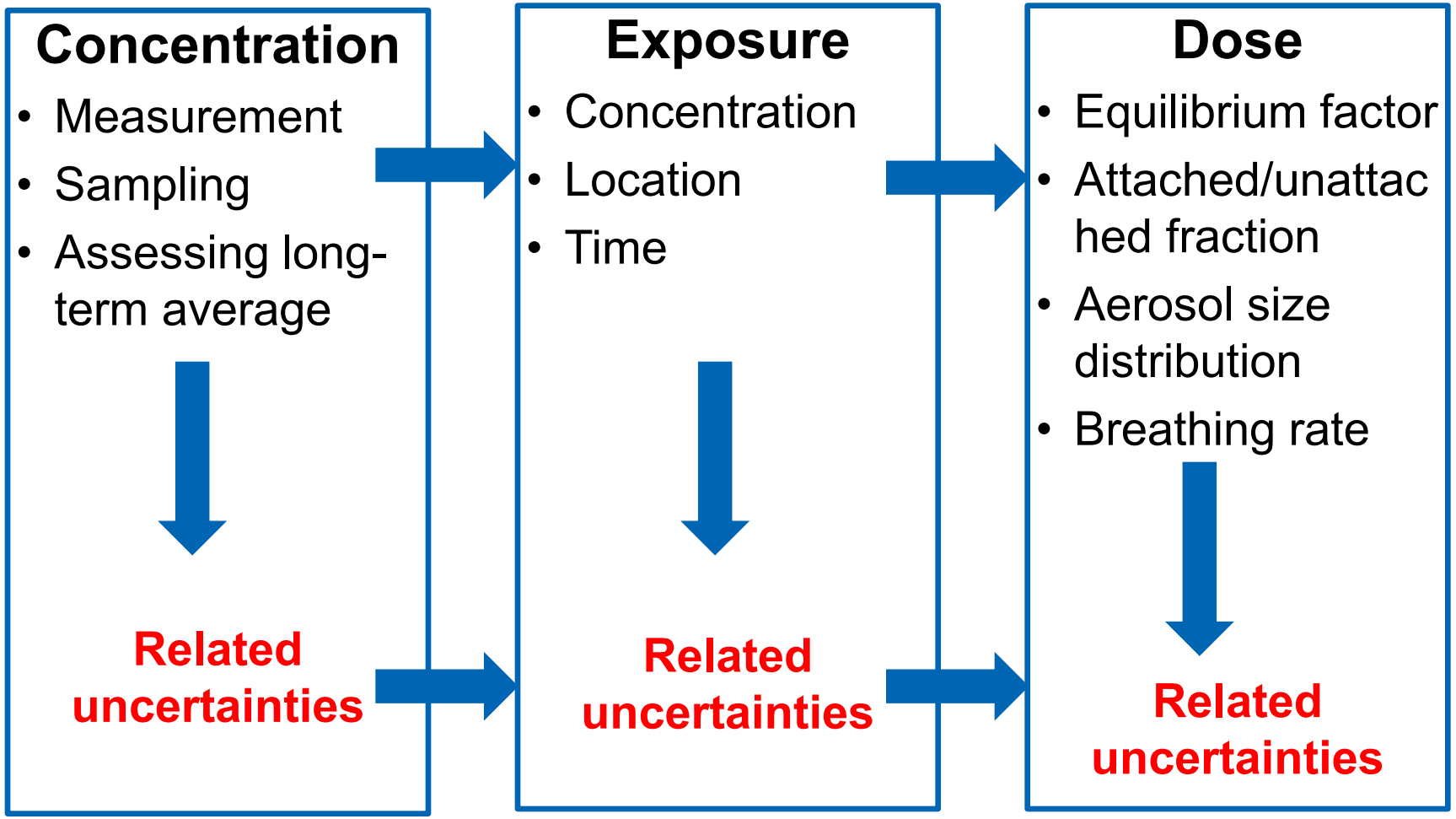
- To predict human and wildlife exposure in a robust way by **quantifying key processes that influence radionuclide transfers and exposure**
- To determine ecological consequences under realistic exposure conditions
- To improve human and environmental protection by integrating radioecology

Hinton et al. J Environ Radioact. 2013 Jan; 115:73-82

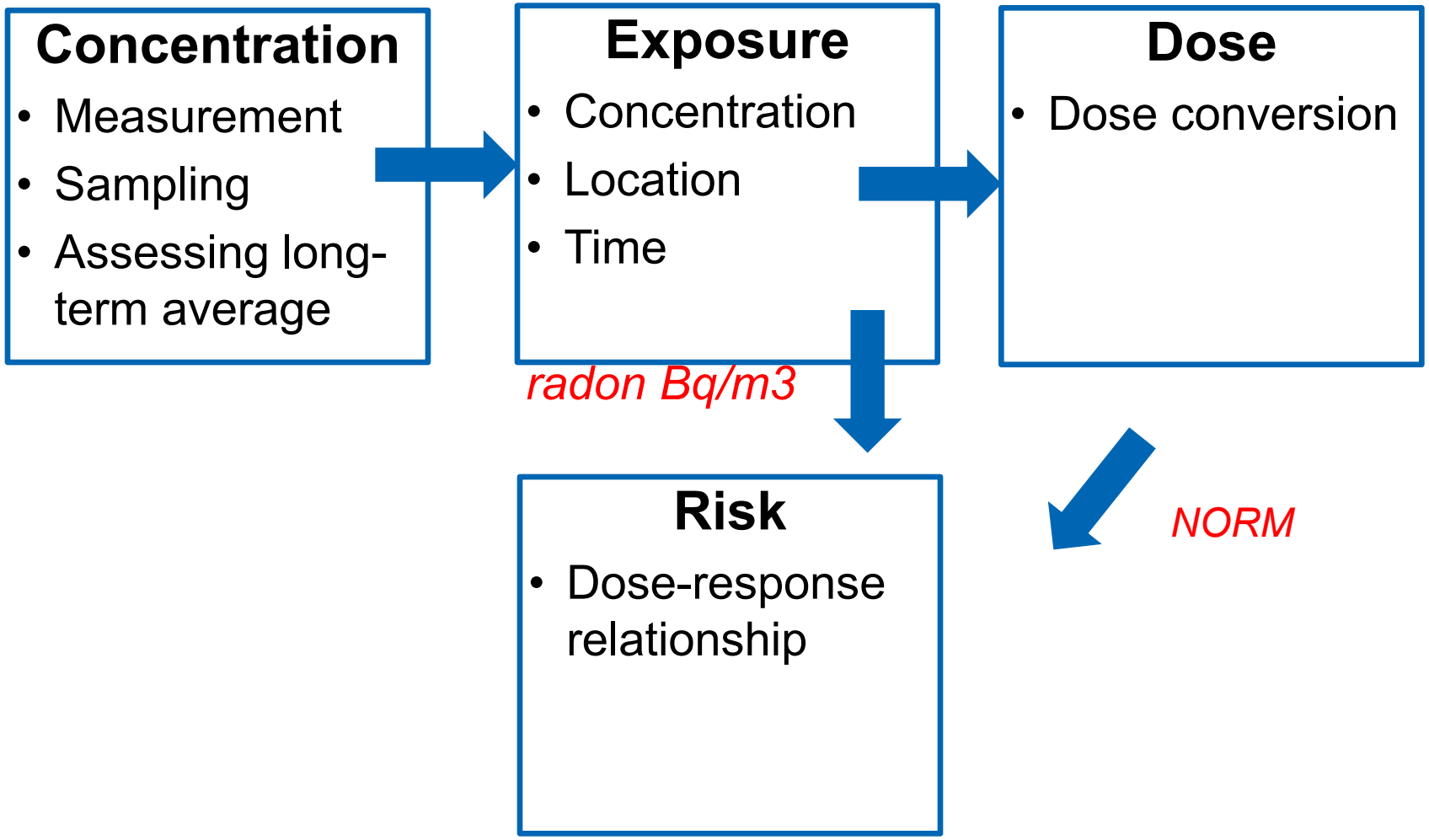
## Long-term (!) Roadmaps

- Marine Radioecology
- Human Foodchain
- **Naturally Occurring Radioactive Materials (NORM)**
- Atmospheric Radionuclides in Transfer Processes
- Transgenerational Effects and Species Radiosensitivity

# Concentration → Exposure → Dose



# Risk assessment / dose assessment



# Research needs on Exposure

- Reducing uncertainties in the determination of radon and other NORM concentrations to cover different types of exposure scenarios
  - Detection uncertainty (instrument) 10–20 %
  - Sampling uncertainty (variations) 40–50 %
  - Thoron interference 0–20 %
- Providing improved measurement techniques of radon and thoron progeny
- Establishing sampling strategies that take into account the spatial and temporal variability of radon and other NORM concentrations
- Improving exposure assessment to support epidemiological studies and public health actions
  - Probabilistic models ?
- Identifying and characterising the sources of radon and other NORM and the bio-geochemical processes involved in their transport and transfer in the atmospheric, terrestrial and aquatic ecosystems
- To improve modelling of radon and other NORM transport and transfer at various spatial scales

# Research needs on Dosimetry

- To generate new knowledge related to the role of spatial dose distribution in radiation risk and to explore how it can be considered in the system of radiation protection (inhomogeneous deposition; alpha emitters)

- Assessing the uncertainties affecting dosimetric calculations
- Quantification of the effect of smoking on absorbed doses
- Identifying specific groups potentially more sensitive to radon exposure than the general public
  - individual anatomic features or physiological conditions
  - people with lung diseases, children…
- Characterization of the spatial dose distribution in the lungs
- Quantification of the spatial dose distribution within the bronchial epithelial cells

# Research needs – Effects and risks

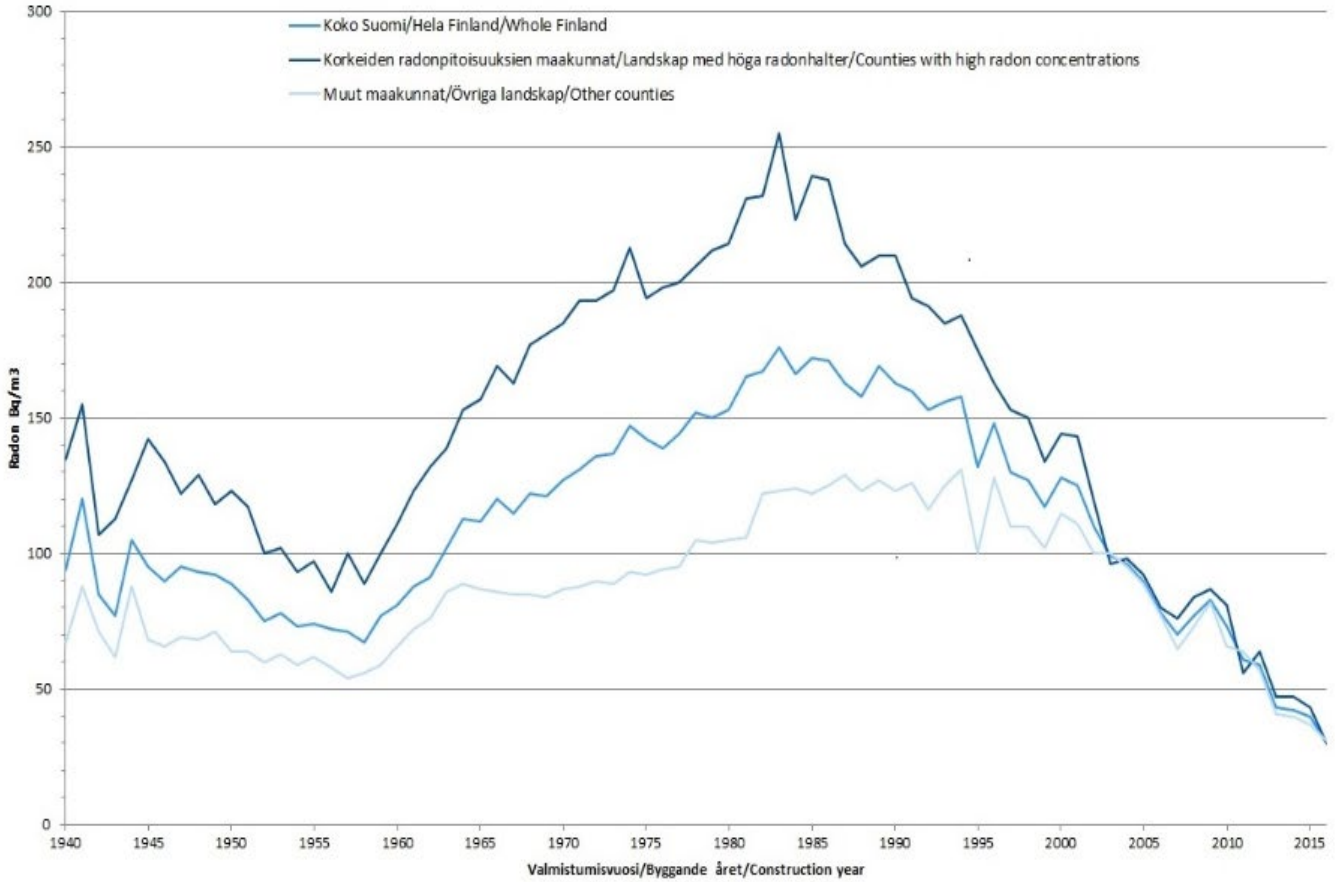
- Interaction between radon and smoking in lung cancer
- Studies on radon risks other than lung cancer among adults
- Studies on the association of radon and childhood leukemia and brain cancer
- Uncertainties in radon risk assessment due to thoron
- Risks from radon and NORM in drinking water
- Mechanisms of radiation action in the disease processes
- Various sources of uncertainties in lung cancer risk inference
- Effects and mechanisms of action of combined exposures to radon or NORM and other stressors relevant of true exposure situations (eg. radon and smoking/diesel exhaust/chemicals)
- Assessment of combined toxicity and cumulative risk

# Research needs - Mitigation

- Improving and optimising radiation protection of workers, the general public and the environment
- Improvement of radon mitigation systems efficiency and sustainability; case radon:
  - radon entry pathways and overall efficiency of radon control systems
  - modification and optimisation of ventilation systems performance
  - application of radon-resistant construction techniques and materials
  - utilization of continuous radon monitors for control of active operation elements of preventive measures and corrective actions.
- Development of NORM residues/waste final treatment strategies
  – site specific preventive actions and mitigation methods
  – specific NORM involving industries, technological processes, legacy sites and environmental conditions.

# Radon prevention

- New houses are often built radon safe



# Research need on radon and NORM

- Euratom work programme 2019-2020:

  *"…lifting key uncertainties about the risks from low-dose radiation and resolving challenges these uncertainties pose for the implementation of Directive Euratom 2013/59.*

  *"In particular it should address people's exposures to **radon** in terms of **risk assessment** and **mitigation**"*

# STUK

## THE RADIATION AND NUCLEAR SAFETY AUTHORITY'S STRATEGY FOR 2018–2022


### TARGETS RELATED TO STUK'S RESOURCES

1. THE HAPPIEST CIVIL SERVANTS IN THE WORLD
2. ABILITY TO UNDERSTAND COMPLEX ENTITIES
3. COST-AWARE OPERATIONS

### EFFECTIVENESS TARGETS

4. RISK-INFORMED AND COMMENSURABLE OVERSIGHT
5. FLEXIBLE AND EFFICIENT WORKING METHODS
6. EFFECTIVE NATIONAL RADIATION SAFETY RESEARCH

### SOCIETAL TARGETS

7. EMPHASISING THE RESPONSIBILITY OF THE OPERATORS
8. PEOPLE UNDERSTAND THE RISKS OF RADIATION
9. SOCIETY IS RESILIENT TO DISTURBANCES

### OUR VALUES:

- EXPERTISE
- OPENNESS
- COURAGE
- CO-OPERATION

# General discussion

Thank you for your input to research on radon and NORM!

STUK will use the knowledge to identify research needs, develop the national programme and also to fund some research

Collaboration with the universities in the Cores network and European RP research platforms