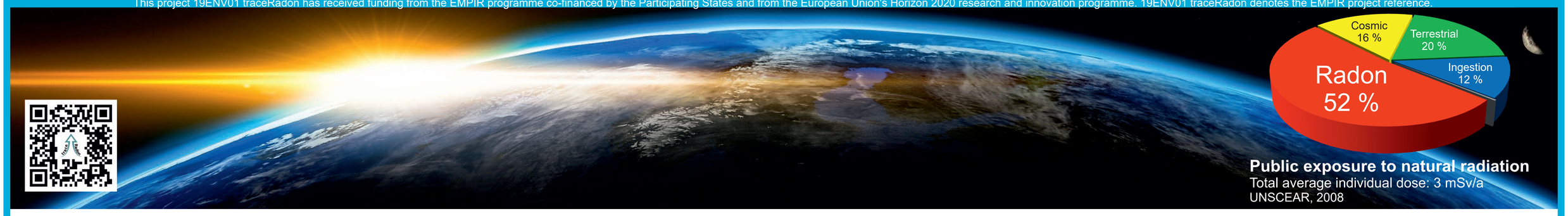
Radon metrology for use in climate change observation and radiation protection at the environmental level - traceRadon

This project 19ENV01 traceRadon has received funding from the EMPIR programme co-financed by the Participating States and from the European Union's Horizon 2020 research and innovation programme. 19ENV01 traceRadon denotes the EMPIR project reference.

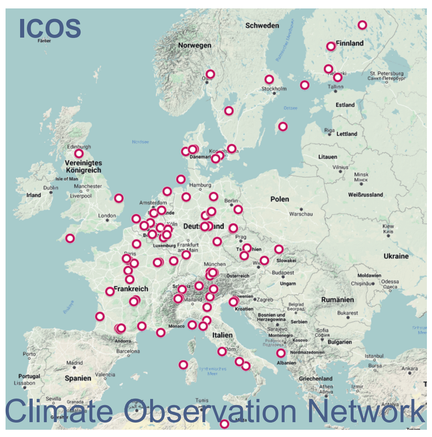


Need:

Climate change is one of the greatest challenges of our time. The temperature rise of the atmosphere of our planet, due to the greenhouse effect, is caused by the increase of GHG.

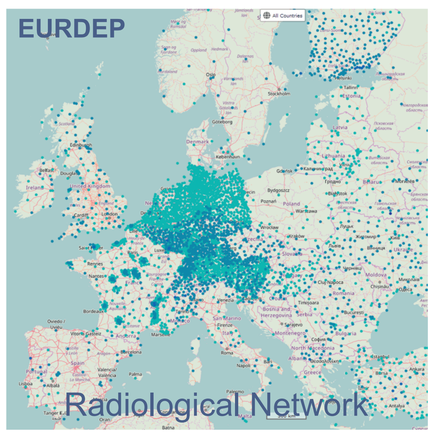
Monitoring of GHG emissions, the dispersion of GHGs and the resulting GHG concentrations in air, is of utmost importance for appropriate climate change mitigation measures. Moreover, Radon and its progeny contribute about **half of the natural radiation dose to the public**. But traceability at the outdoor level is not established.

- Climate research and radiation protection research needs support of traceable low-level outdoor radon measurements according to the needs of **UNFCCC** and the **Council Directive 2013/59/Euratom**.
- Radon and radon flux data is needed to **estimate regional GHG emissions fluxes and radon priority areas (RPA)** but the uncertainties are too large due to missing metrological capabilities.



Objectives: The objectives of this project serve the purpose to establish a metrological base which supports environmental outdoor radon measurements for the use in climate observation and in radiation protection for the public.

- Development of traceable methods for the measurements of outdoor low-level radon activity concentration in air in the range of 1 Bq/m³ to 100 Bq/m³ (WP1)
- To improve radon flux measurements for RPA and to develop standard protocols for radon tracer method to retrieve GHG fluxes (WP2)
- To validate existing radon flux inventories and models with new data from the radiological early warning networks in Europe as well as traceable radon activity concentration and radon flux measurements (WP3)
- To provide dynamic radon and radon flux maps (WP4)
- To facilitate the take up of the technology and measurement infrastructure developed in traceRadon (WP5)



Progress beyond the state of the art:

traceRadon will provide the metrology for the growing radon measurement needs for different purposes that influence all parts of modern society and facilitate the use of this data in industry, scientific communities, standard organisations and all kinds of end users like decision makers or the public.

Impact Knowledge transfer and uptake by: workshops, training course, website, publications and standards **WP5**

Environmental:
- New observables for climate observation and radiation protection
- New real-time data and maps for GHG estimations and RPA
- Direct support of the existing and planned AMN

Social:
- Radiation protection of the public as required by European regulation
- New RPA definition: realtime data for decision makers and the public
- Model improvement: efficient countermeasures on climate change

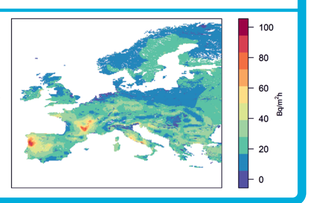
Economic:
- Trigger of development of radon measuring technique worldwide (collaborators from 5 continents)
- Cost-efficient measures in Europe: radiation protection and climate observation
- Support of the EU-ETS by new GHG data

Scientific and technological excellence:
- Merging of big data suppliers like ICOS and EURDEP as well as addition of new observables
- Reduction of uncertainties in GHG estimations
- Validation of radon flux models and inventories for GHG estimations
- Knowledge sharing and capacity building of two large communities

Metrological:
- Traceability for outdoor radon activity concentration measurements
- Traceability for radon flux measurements
- New secondary standards: Sources and instruments
- New and validated data for models used for GHG estimations and risk estimations in radiation protection related to radon
- New standards and protocols

WP4 Radon and radon flux in maps for radiation protection issues

- Identification of RPA
- Quantifying the radon wash-out peak
- Data accessibility and public engagement



WP3 Validation of radon flux models and inventories using radon flux and terrestrial data

- Radon flux maps in GHG and climate change studies
- Inclusion of data from radiological early warning systems
- Validation of radon flux maps using radon flux measurements and outdoor radon activity concentrations

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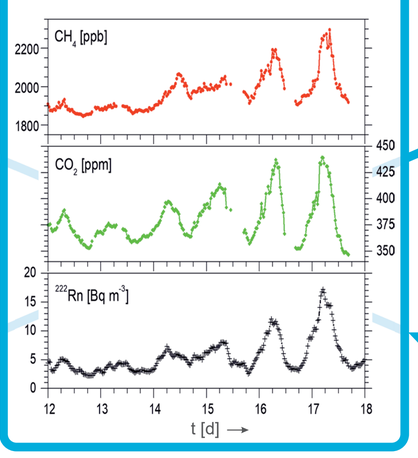
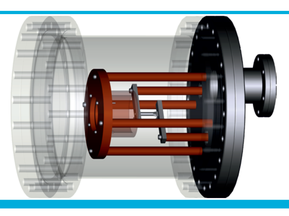


WP1 Traceable measurements of outdoor radon activity concentrations

- Traceable low-level radon sources
- Development of a transfer standard
- Calibration and long-term stability



WP2 Radon flux measurements

- Development of a reference radon flux monitor
- Test under field conditions
- Measurement campaigns
- RTM application

WP6 Management and coordination

Seven leading European NMI/DI in the field of climate observation and ionising radiation. ICOS, JRC and other stakeholders directly involved as traceRadon-partners. Sufficient further external partners with high-level expertise to cover the broad spectrum of two scientific communities. High interest by stakeholder community, expressed by 65 letters of support and a large group of 37 collaborators.

Collaborators: Air Centre (PT), Australian Nuclear Science and Technology Organisation (AU), Bundesamt für Strahlenschutz (DE), Norte Portugal Regional Coordination and Development Commission (PT), Consiglio per la ricerca in agricoltura e l'analisi dell'economia agraria (IT), Instituto de Salud Carlos III (ES), Czech Technical University in Prague (CZ), Environment and Climate Change Canada (CA), Environmental Protection Agency (IE), European Radon Association (EU), European Radiation Dosimetry Group (EU), Integrated Carbon Observation System, European Research Infrastructure Consortium (EU), International Commission on Radiation Units (Int.), iThemba LABS (ZA), Japan Atomic Energy Agency (JP), Ministerio de Sanidad, Consumo y Bienestar Social (ES), Met Office (GB), Max Planck Institute for Biogeochemistry (DE), National Centre for Atmospheric Science (GB), Nuvia (Int.), Politecnico di Milano (IT), Radonova Laboratories AB (SE), Ruprecht-Karls-Universität Heidelberg (DE), Sociedad Española de Protección Radiológica (ES), Slovak Institute of Metrology (SK), Strahlenschutzkommission (DE), Atmospheric Tracer Transport Model Intercomparison Project (Int.), Technische Universität Braunschweig (DE), Umweltbundesamt (DE), Sapienza – Università di Roma (IT), University of Novi Sad (XS), Otto von Guericke Universität Magdebug (DE), World Meteorological Organisation (Int.), Warsaw University of Technology (PL), Uni Siegen (DE).

Radon metrology for use in climate change observation and radiation protection at the environmental level

Conformity

traceRadon entirely addresses, one-to-one, the objectives of the selected research topics, i.e. each objective is addressed by a corresponding work package. It will provide unique metrological support for environmental outdoor radon measurements for the use in climate observation and in radiation protection for the public by creating new traceable observables: radon activity concentration in outdoor air and radon flux. With these new observables the models in climate observation will be improved, uncertainties in greenhouse gas (GHG) observations will be reduced and the inventories of the models will be validated. As a result, dynamic radon and radon flux maps based on up-to-date data will be available for the climate research, emission calculations and for the identification of radon priority areas (RPA).

Need

Radon and its progeny contribute about half of the natural radiation dose to the public. Therefore, reliable information on its day-to-day variability is needed: So, radon protection in Europe is **required in Council Directive 2013/59/EURATOM**. On the other hand, radon is an outstanding tracer for environmental research, e.g. for improving atmospheric transport models, or estimating GHG emissions, improvement of which **is demanded by United Nations Framework Convention on Climate Change (UNFCCC)**. An overlapping need exists between the climate research and the radiation protection communities for traceable low-level outdoor radon measurements in the range of 1 Bq/m³ to 100 Bq/m³ adopted by WMO, WHO, IAEA, ICRU and other international organisations: It results in a demand on actions at a **European level which completely comply with the JRP-objectives**.

Progress beyond the state of the art

The traceRadon partners, including NMI/DI, universities and a specialized private enterprise provide **excellent scientific and technological expertise in climate observation and metrology of ionizing radiation**. The wide range of objectives requires specialists in different but complementary fields and will stimulate interdisciplinary cooperation. Metrologically sound procedures and quantitative methodology for **new observables** for climate observation and radiation protection, **new real-time data and maps for GHG flux estimations and RPA** will directly support all European atmospheric networks and regulatory bodies for radiation protection. This will provide **climate observation and model improvement** which is the basis for efficient countermeasures on climate change as well as **new data for radon risk estimations** in radiation protection. Harmonized **standards and protocols** on radon and radon flux at the environmental level will be available for the first time, covering the urgent need of the growing networks, which are **big data suppliers** in Europe.

Impact

traceRadon already created considerable impact: Two till now completely separate scientific communities started to interact for the first time. Their **joint metrological needs will be addressed in common and directly**: Important end-users joined traceRadon as partners (ICOS-ATC, ICOS-CP, the European Commission Joint Research Centre and regulatory bodies in Europe) and 37 stakeholders expressed their interest to collaborate. Moreover, organisations from four other continents (North America, Australia, Asia, Africa) expressed strong interest as collaborators. The project outcomes will be used as **a model for a global strategy** upgrading climate observation and radiation protection leading to improvement of living conditions worldwide. Thus, environmental, social, economic, scientific/technical and metrological impact will be created (for details see front page and JRP-protocol).

Consortium and management

The consortium comprises 7 leading European NMI/DI in the field of climate observation and ionising radiation. Additionally, 11 external partners, including regulatory bodies, European organisations and universities are directly involved as JRP-partners. Very high interest by stakeholder community has been expressed by 65 letters of support with 34 potential collaborators (from 5 continents in total).
The JRP-Coordinator and all WP-leaders have long-term experience in managing a large consortium and the management will be supported by a PMB and a stakeholder committee of at least 20 members.

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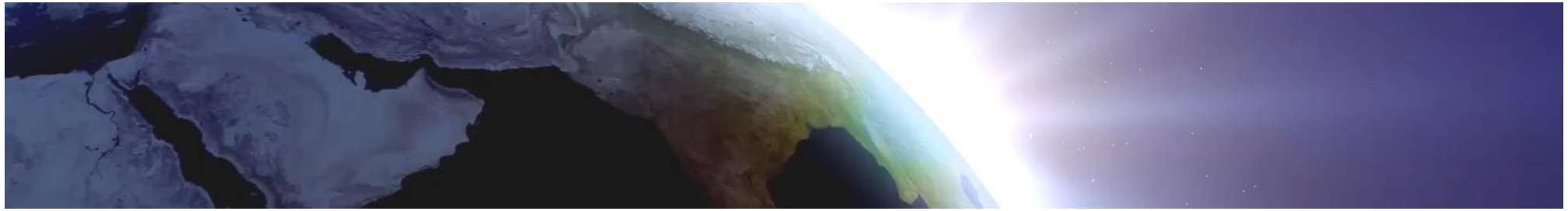
EMPIR
The EMPIR initiative is co-funded by the European Union's Horizon 2020 research and innovation programme and the EMPIR Participating States



Radon metrology for use in climate change observation and radiation protection at the environmental level

EGU Geoscience applications of environmental radioactivity 6.2-173
30th April 2021

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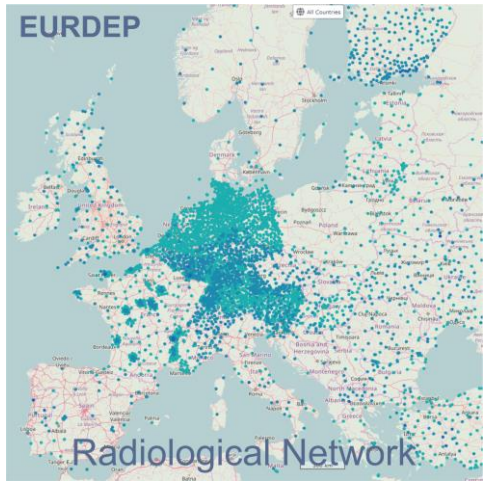
Stefan Röttger, PTB, Ionizing Radiation, Radioactivity, Alpha and Gamma Spectrometry

Combining two communities



Climate change is one of the greatest challenges of our time.

The temperature rise of the atmosphere of our planet, due to the greenhouse effect, is caused by the increase of GHG emissions.

- ICOS: Monitoring of GHG emissions, the dispersion of GHGs and the resulting GHG concentrations in air, is of utmost importance for appropriate climate change mitigation measures.
- EURDEP: Collection and exchange of radiological monitoring data between participating countries of the radiation in the environment.

Both networks could profit from radon measurements at the outdoor level. But **traceability to the SI system** is not established yet.

Stefan Röttger, Annette Röttger, Claudia Grossi, Ute Karstens, Giorgia Cinelli, Chris Rennick
EGU GI6.2-173 2021-04-30

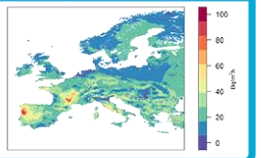
Physikalisch-Technische Bundesanstalt
Braunschweig und Berlin

traceRadon project

Traceability to the SI system

Radon and radon flux in maps for radiation protection issues — WP4

- Identification of RPA
- Quantifying the radon wash-out peak
- Data accessibility and public engagement



Validation of radon flux models and inventories using radon flux and terrestrial data — WP3

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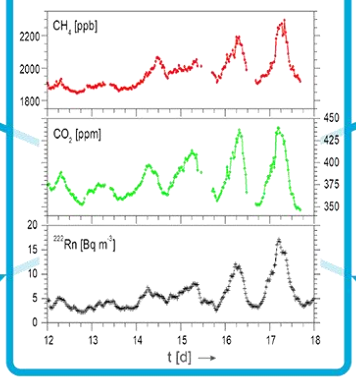
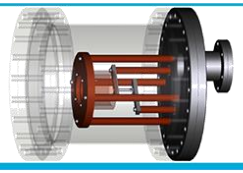


Traceable measurements of outdoor radon activity concentrations — WP1

- Traceable low-level radon sources
- Development of a transfer standard
- Calibration and long-term stability



Radon flux measurements — WP2

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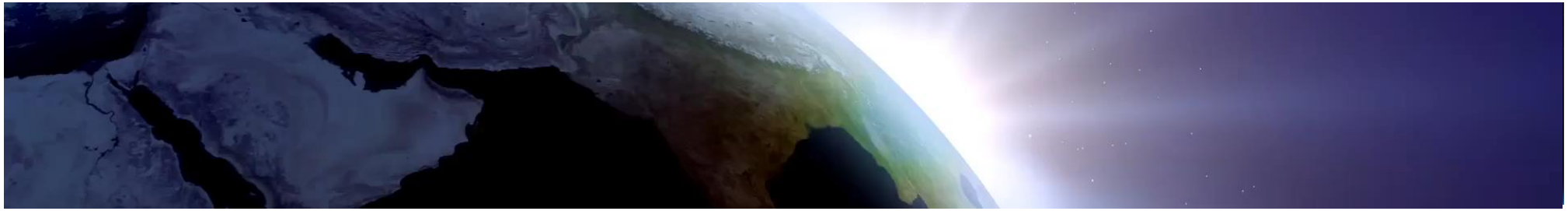
Looking forward for discussion



Thanks to the traceRadon-project partners:

PTB Physikalisch-Technische Bundesanstalt Braunschweig und Berlin; Budapest Főváros Kormányhivatala; Czech Metrology Institute; ENEA Agenzia nazionale per le nuove tecnologie, l'energia e lo sviluppo economico sostenibile; IFIN-HH; NPL National Physical Laboratory; AGES; LOR; ICOS Atmosphere Thematic Centre; ICOS Carbon Portal; INESCTEC; European Commission Joint Research Centre; University of Bristol; UC Universidad de Cantabria; UPC; ideas

- Homepage: http://traceRadon-EMPIR.eu/
- researchgate: https://www.researchgate.net/project/19ENV01-traceRadon
- twitter: @traceRadon ; https://twitter.com/traceradon

This presentation includes material from publications / presentations from partners and collaborators of the EMPIR 19ENV01 traceRadon project.
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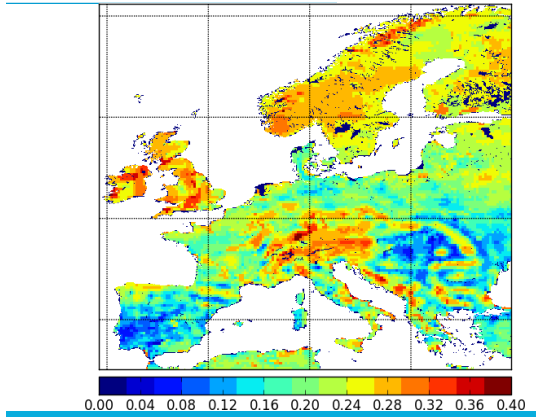
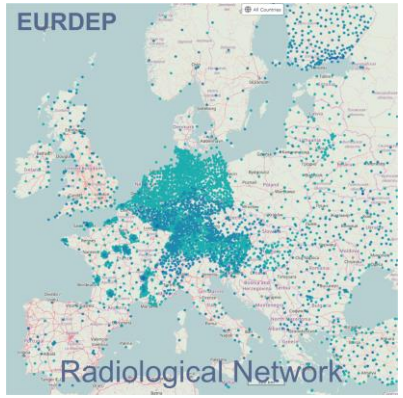
Radon metrology for use in climate change observation and radiation protection at the environmental level

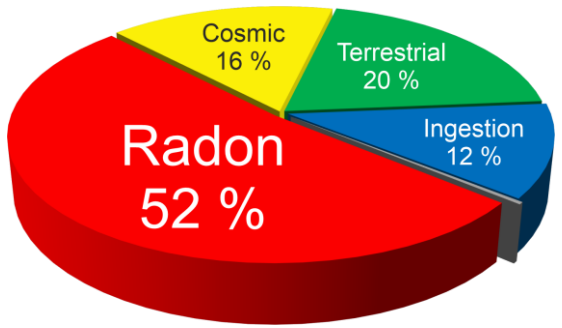
Physikalisch-Technische Bundesanstalt
Braunschweig und Berlin

trace Radon

EURAMET







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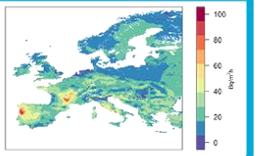

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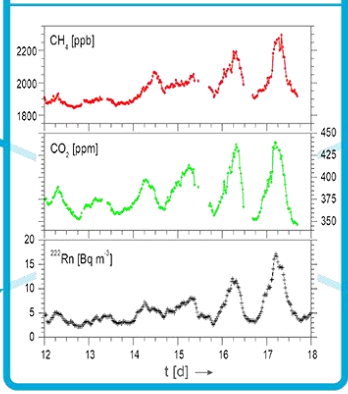

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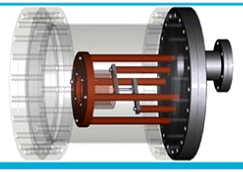

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