PREPAREDNESS

Metrology for mobile detection of ionising radiation following a nuclear or radiological incident.

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

Non-governmental dosimetry networks - metrological validation of measurement data

Miloš Živanović[1], Viacheslav Morosh[2], Nikola Kržanović[1], Giorgia Iurlaro[3], Steven Bell[4], Marco Sangiorgi[5], Gordana Pantelić[1], Olivera Ciraj Bjelac[1], Miloš Đaletić[1], Luciano Sperandio[3], Sotiris Ioannidis[4]

1) VINS, 2) PTB, 3) ENEA, 4) NPL, 5) JRC

Miloš Živanović
milosz@vinca.rs

Preparedness project

• Work package 3 within 16ENV04 Preparedness project studies the non-governmental dosimetry networks

• Detailed information on existing networks is gathered, including methods of data processing, mapping and online data transfer

• 16 types of dosimeters used in non-governmental networks (MINN) are acquired and a study of metrological properties is conducted

• New dosimetry systems are developed

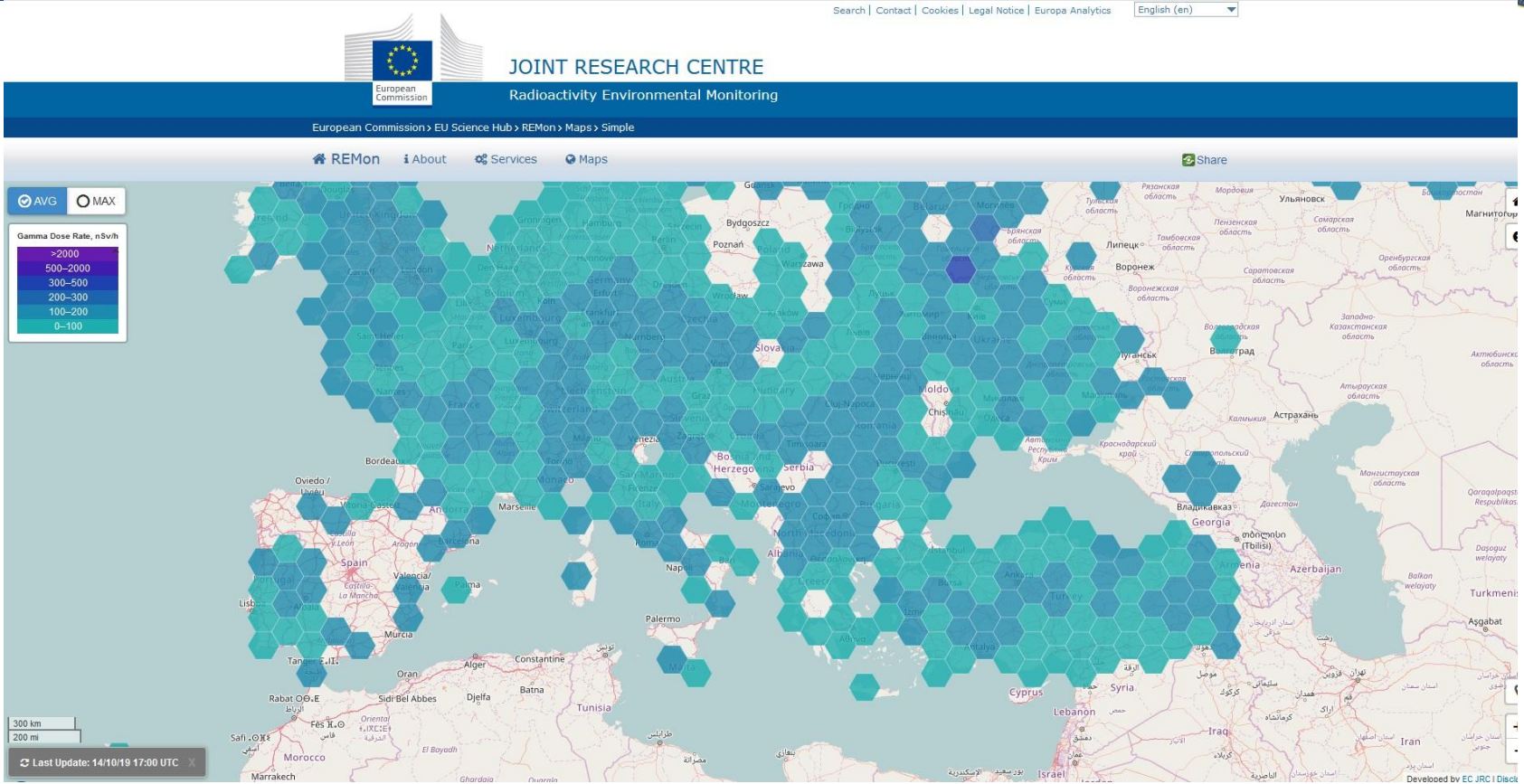
Dosimetry networks

• Dosemeters, spectrometers and other detectors are spread across the territory and communicate data in real time to the server

• The data from radiation networks allow for better emergency response

• Official, governmental radiation networks are established in most countries

Dosimetry networks - EURDEP



Dosimetry networks

• In addition to official networks, there are also non-governmental networks

• Non-governmental networks are networks run by private individuals, companies or other subjects

• Non-governmental networks for ionising radiation are not regulated

Dosimetry networks

• Non-governmental networks for ionizing radiation monitoring are in expansion, especially since the Fukushima accident

• In 2020, anybody can buy a dosimeter, upload the data, create a website or publish data on Facebook

• In many places, density of non-governmental networks is higher than the density of official networks

Dosimetry networks

- Non-governmental networks data is in most cases not validated

- Most of the users are laymen, with no background in radiation protection

- In some networks, users are allowed to upload data manually

- A malicious individual could intentionally upload fake data

Dosimetry networks

• Data provided by non-governmental networks have a potential to cause unwarranted panic, but also to be used by official authorities for decision making

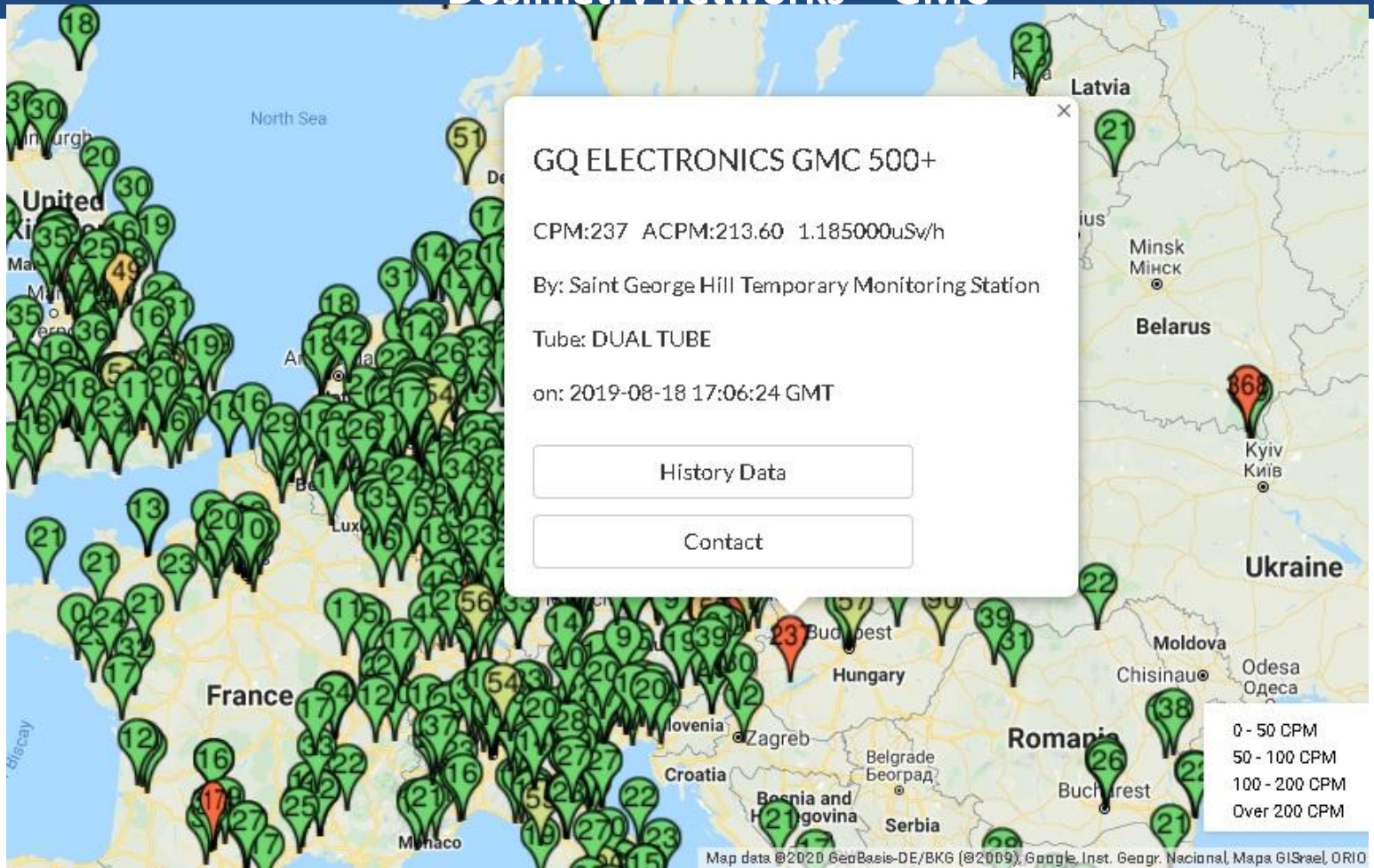
• In preparedness project, the accent was on metrological properties of the devices, but research on other aspects is needed

Dosimetry networks

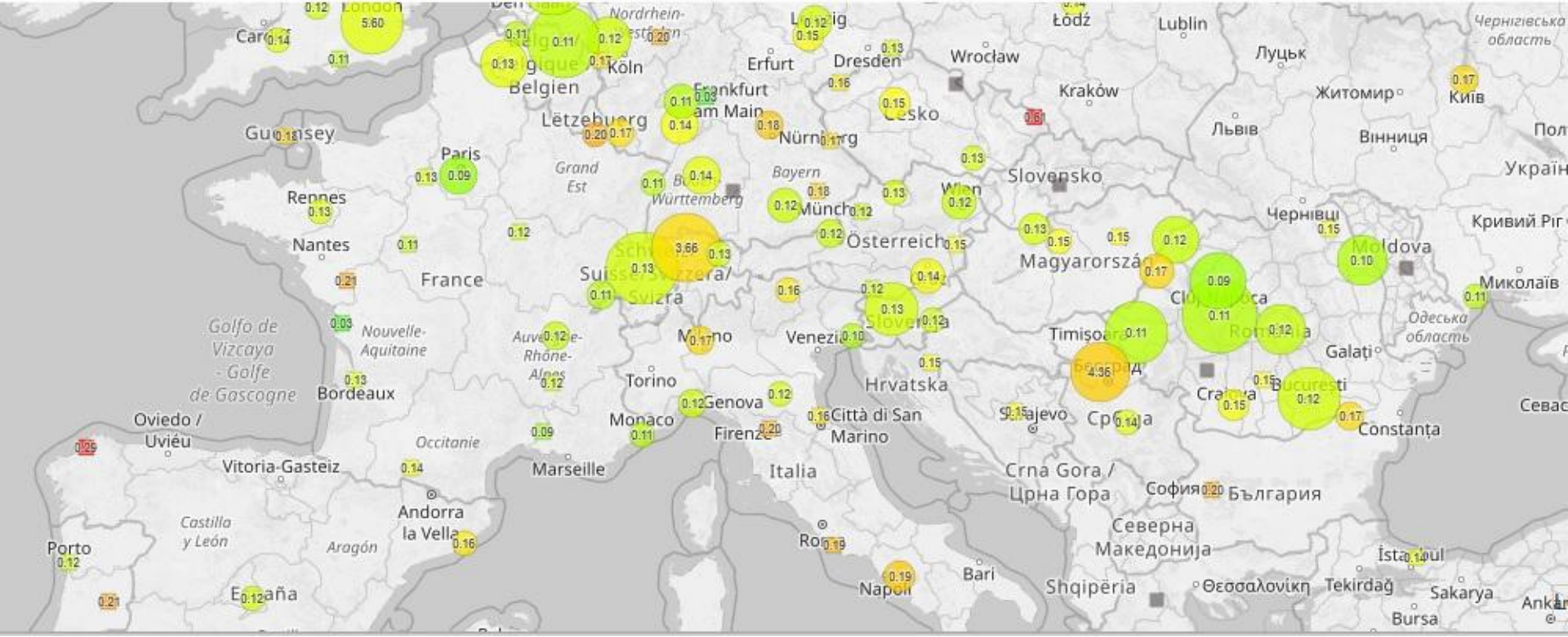
• Some of the non-governmental networks with operational measurement stations in Europe:

http://www.gmcmap.com/
http://www.radmon.org/
http://radioactiveathome.org/map/
http://www.uradmonitor.com/
http://safecast.org/tilemap

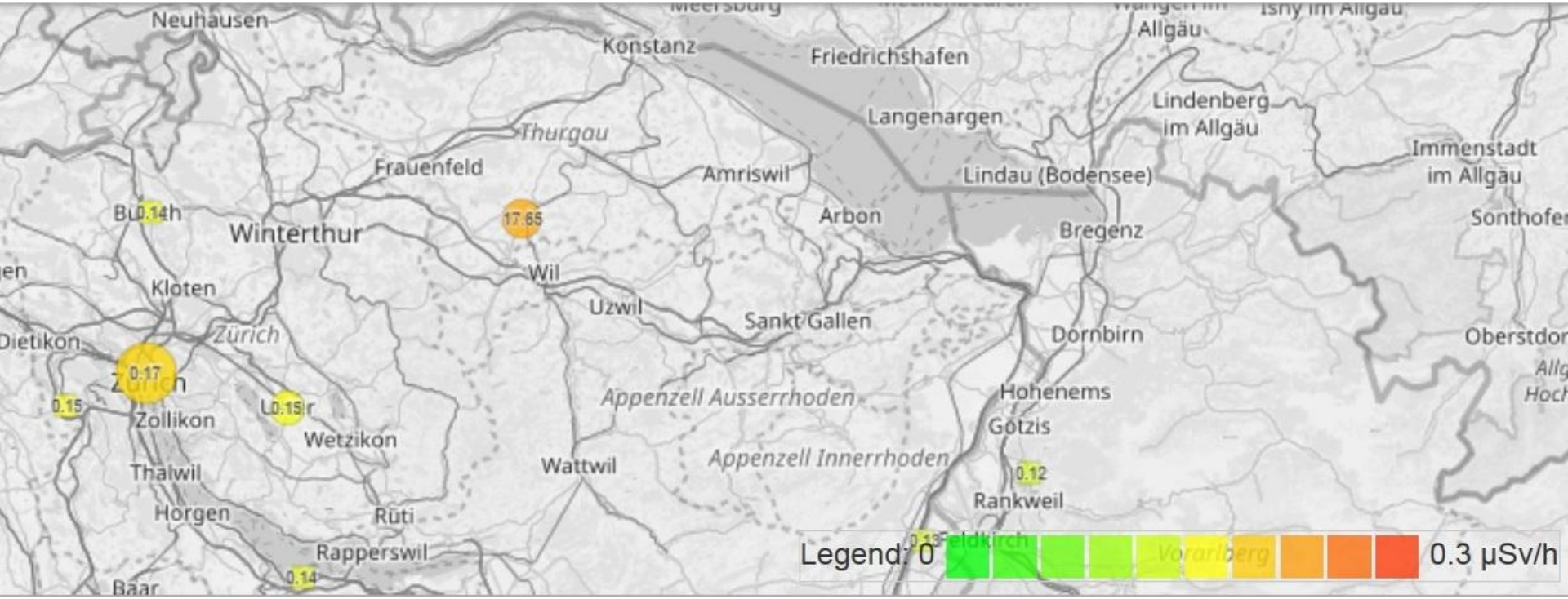
Dosimetry networks - GMC



Dosimetry networks - uRad



Dosimetry networks - uRad



Overview

Sensor

Radiation

Time interval

14 Oct 2019

Visualization

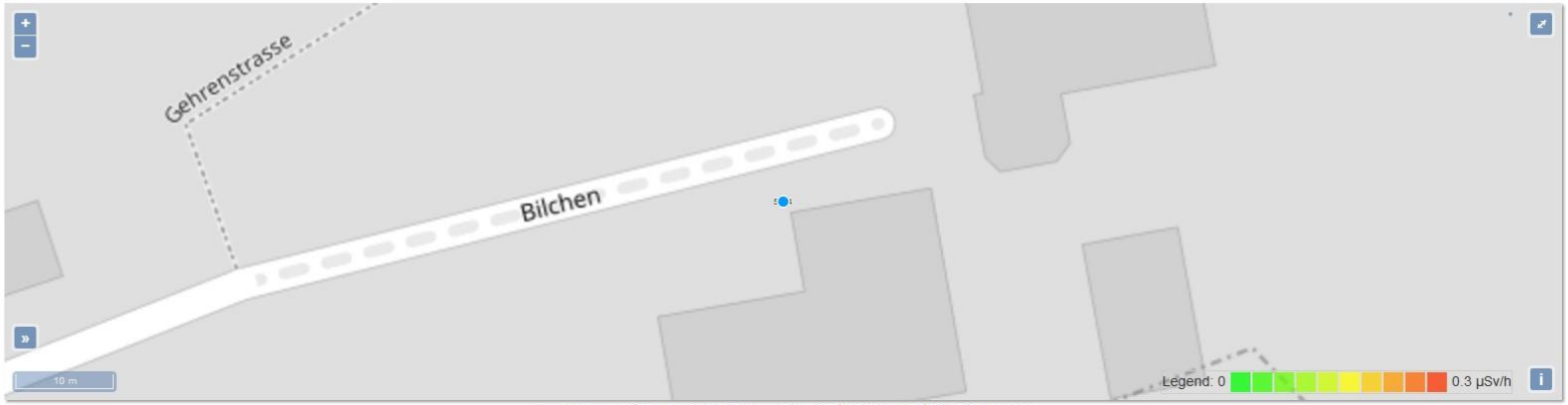
- Simple
- Gradient
- Heatmap
- Clusters

Show offline **Automated refresh**

History (mobile units only)

Status

Ready



Map shows real time **Radiation** global data. Use the left menu to change sensor.

History

Model A3

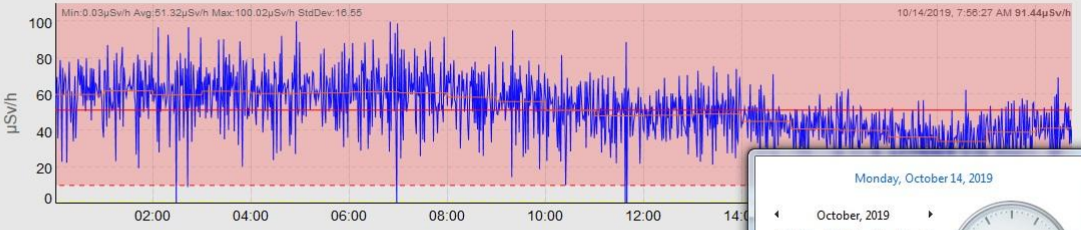
SW: 126 **HW:** 105

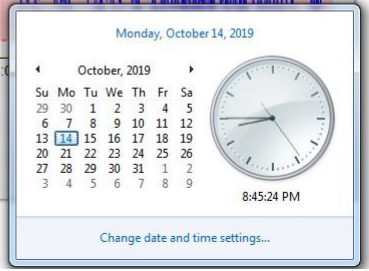
Fixed unit

Unit 8200008E online

in Affeltrangen, CH, joined on 22-Aug-2017

Uptime: 1159860s
Last data: 14-Oct-2019 20:45
Altitude: 515.21 m
Detailed view






tere Bahnhofstrasse
Bilchen
5.54
0.16
Bezirk Münchwilen

MINN testing

- 16 types of MINNs were sourced and commissioned by 4 partners

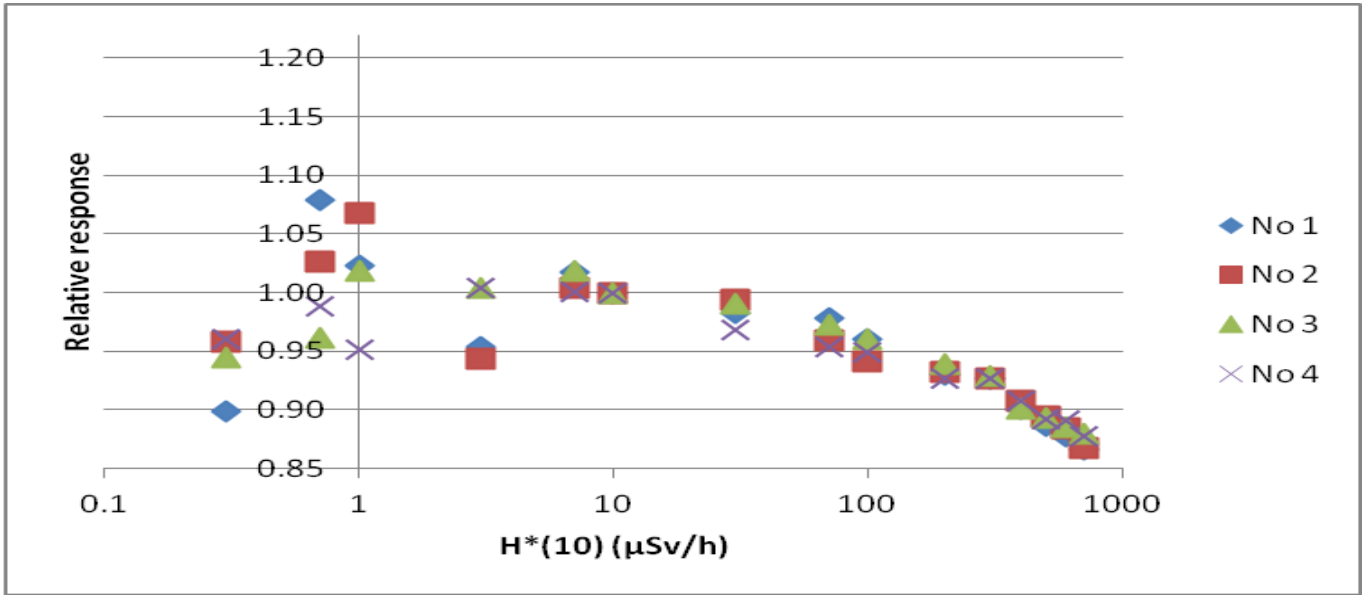
Sourced by	Manufacturer	Type
PTB	GAMMA-SCOUT GmbH	GammaScout (LND 712)
PTB	GQ Electronics	GMC 600 (SBT 11A)
PTB	Safecast	BGeigie Nano (LND 7317)
PTB	uRADMonitor	Urad Modell A (SBM 20)
NPL	International Medcom	IMI Inspector Alert V2 (LND-7317)
NPL	International Medcom	Rad100 (LND-712)
NPL	uRad	A3 (SI-29BG)
NPL	MyGeiger	ver. 3 PRO (SBM-20)
ENEA	Quarta	QuartaRAD RD1212-BT Detector
ENEA	GQ Electronics	Plus GQ Electronics GMC-300E Plus
ENEA	MAZUR Instrument	PRM-7000 Geiger Counter
ENEA	S.E. International,INC	SEINTL Monitor 200 Detector
VINS	GQ Electronics	GMC-320 Plus
VINS	GQ Electronics	GMC-500 Plus
VINS	Magnasci	uRADMonitor model KIT1

MINN testing

- Different tests were performed on the MINNs:
  - linearity test
  - energy dependence
  - inherent background determination
  - response to secondary cosmic radiation
  - plume simulation
  - tests in climate chamber

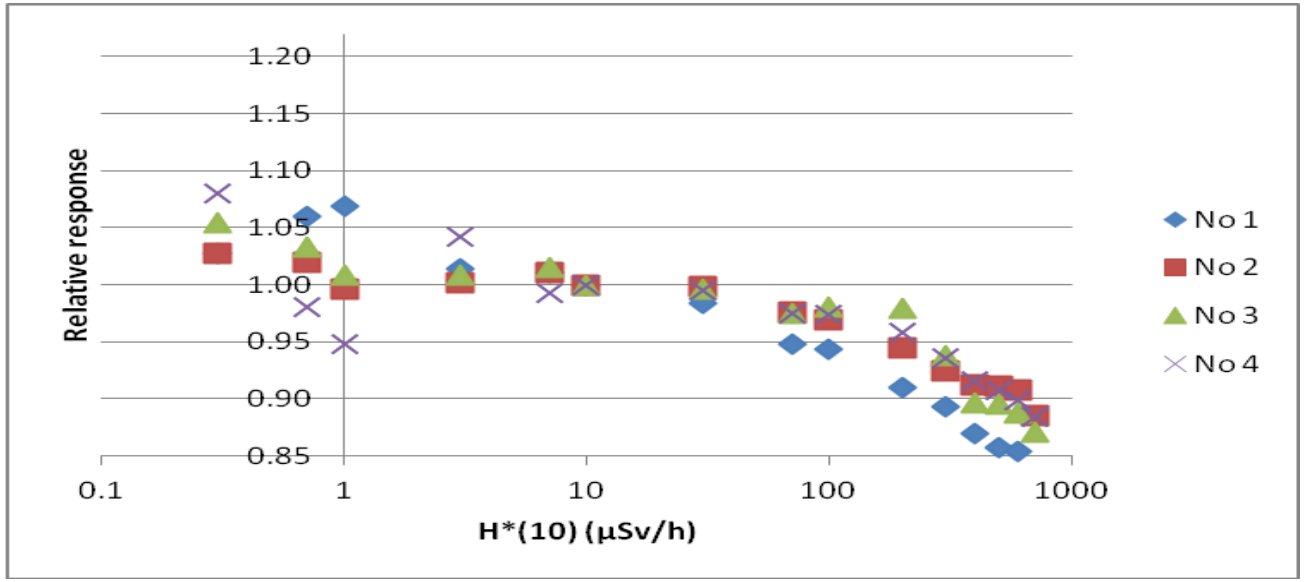
MINN testing

Dosimeter type 1 linearity



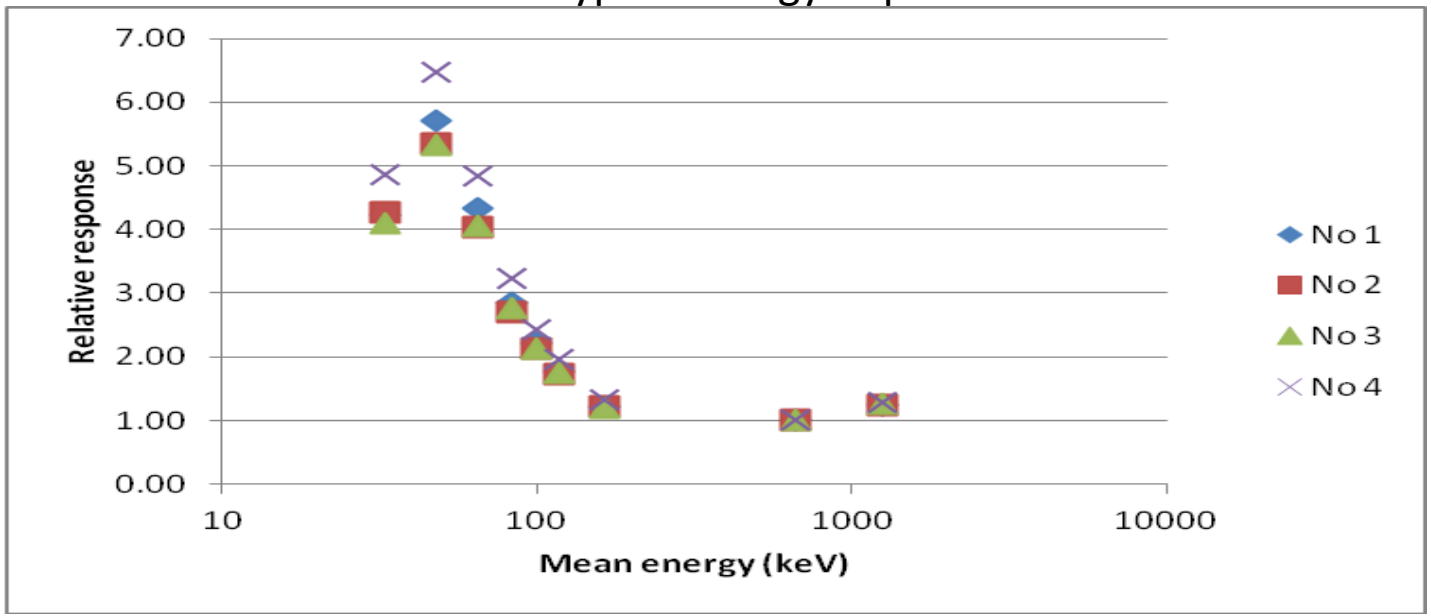
MINN testing

Dosimeter type 2 linearity



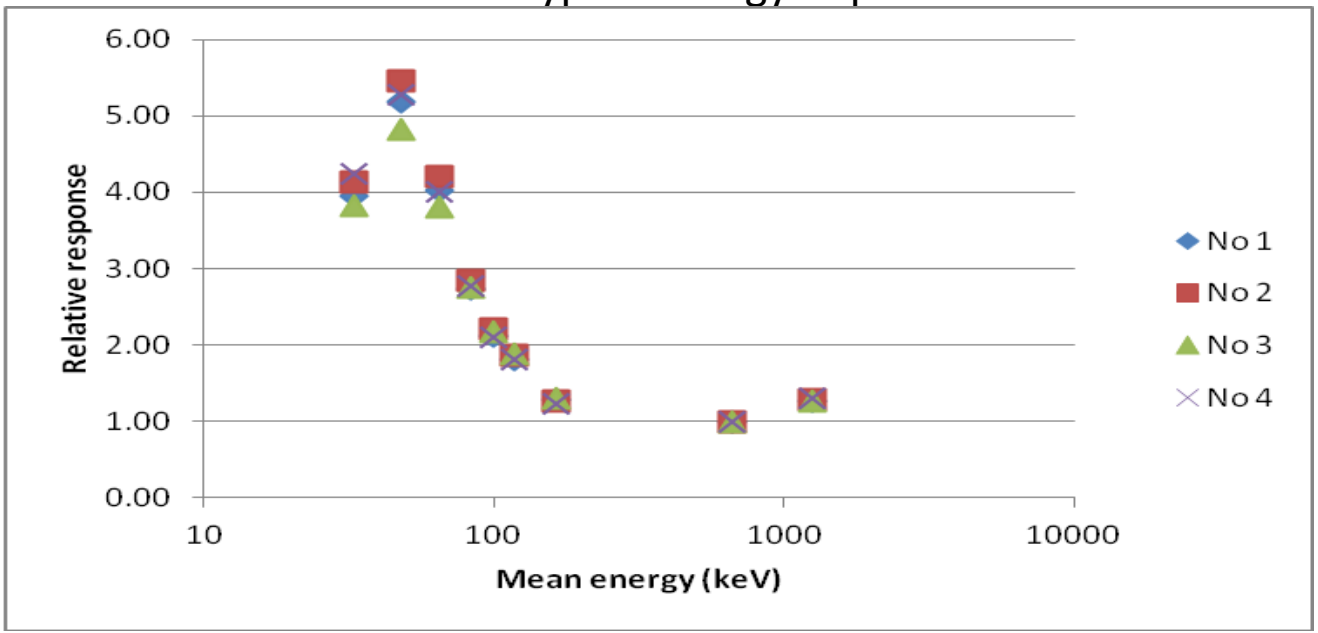
MINN testing

Dosimeter type 1 energy dependence



MINN testing

Dosimeter type 2 energy dependence

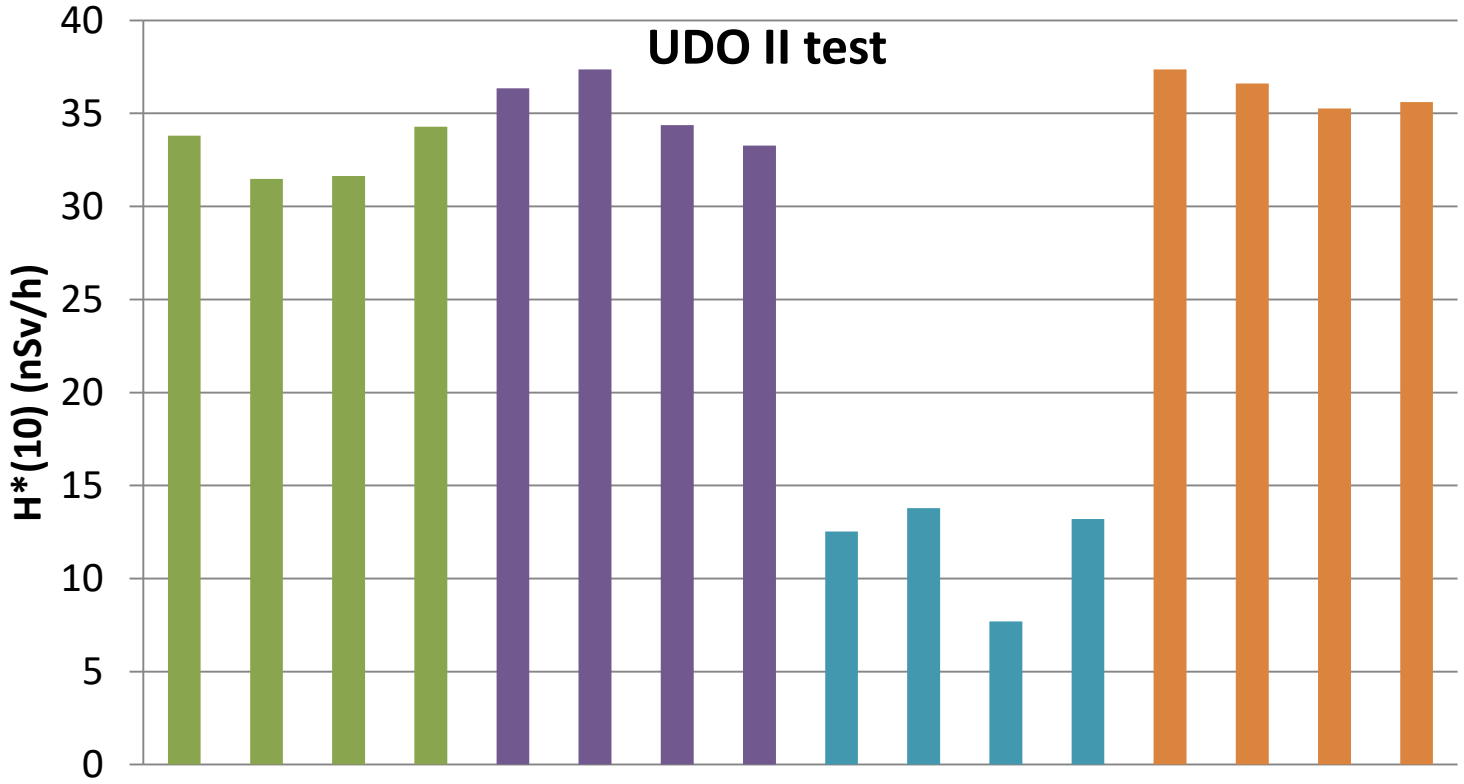


MINN testing

UDO II test

- Dosimeters are positioned in an underground laboratory in a salt mine
- Reference value of H*(10) is 1.5 nSv/h
- Inherent background of dosimeters is determined

MINN testing



MINN testing

Lake test

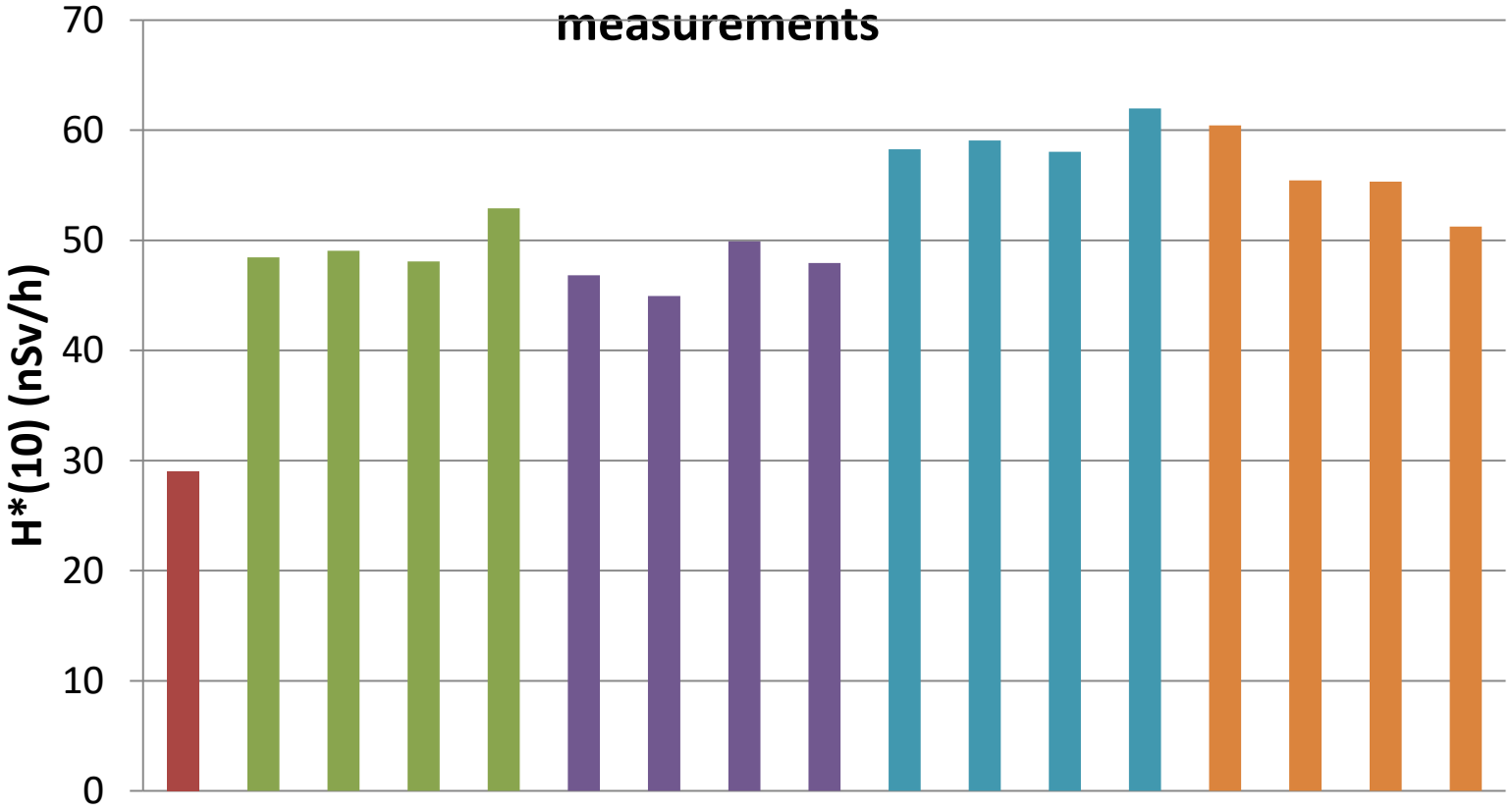
- Dosimeters are positioned on a floating platform on a lake
- Background consists almost exclusively from cosmic radiation
- Response to cosmic radiation is determined

MINN testing


acer

MINN testing

Lake test – inherent background was subtracted from MINN measurements



MINN testing

Plume simulation

- Dosimeters are positioned at the perimeter of a circle centred at the source holder

- In the first step, background is measured by all the devices

- 6 sources are sequentially exposed (30 minutes each)

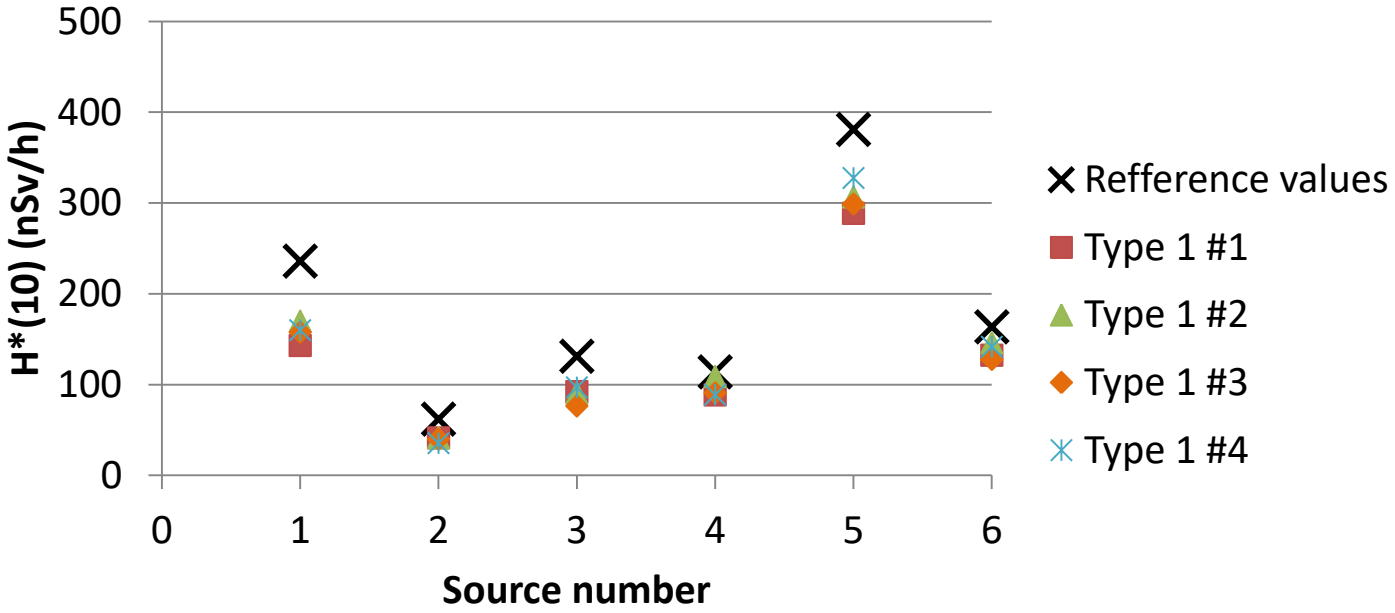
- At the end, background is measured again

- Response of dosimeters to small changes of H*(10) is determined

MINN testing

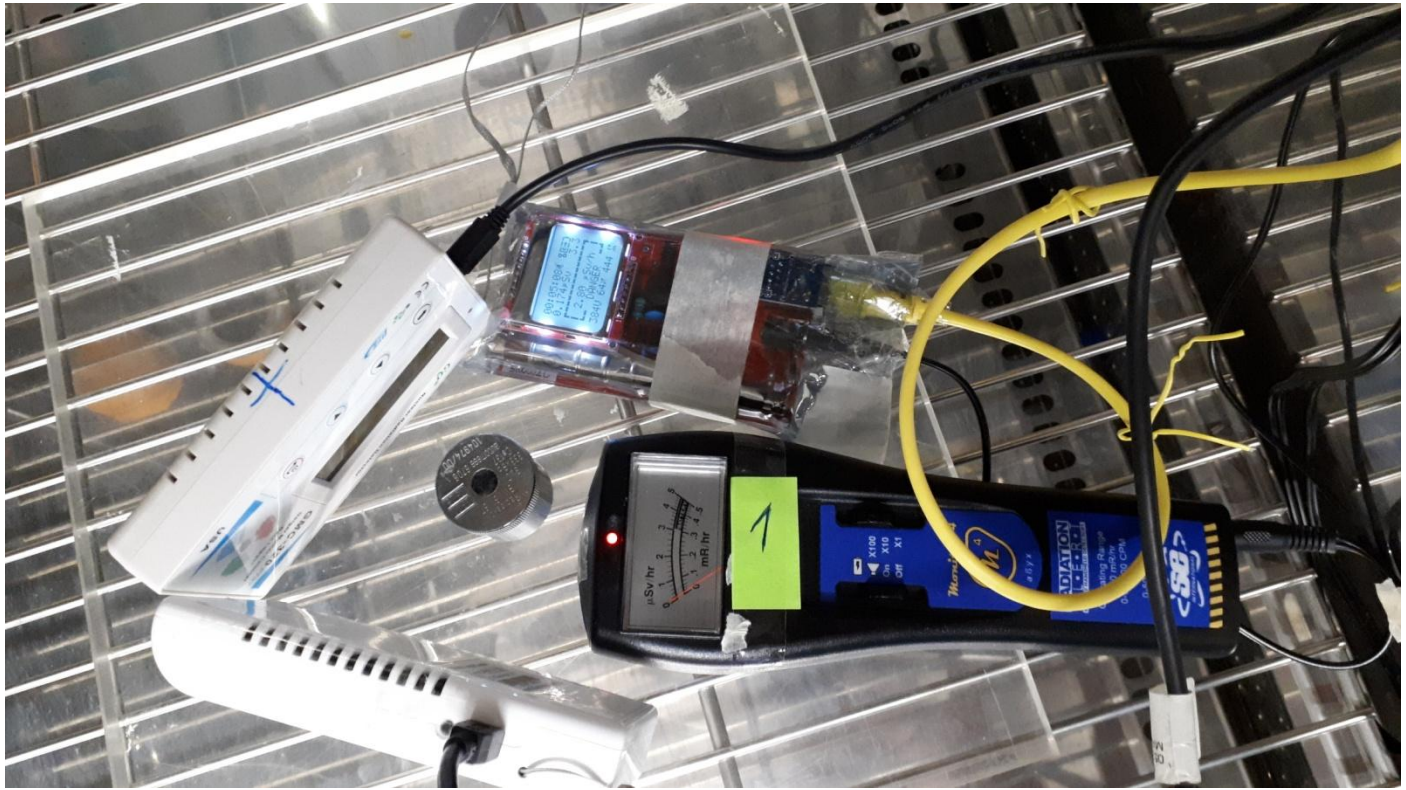
- Plume simulation (Sources 1-3 are Cs-137, 4 and 6 are Co-60, 5 is Ra-226)

*background was subtracted from source measurements



MINN testing

- Climate chamber



Climate chamber tests

- normal conditions: +20 °C and 65% RH
- cold and dry: -20 °C and 0% RH
- warm: +50 °C and 50% RH
- humid: 30 °C and 95% RH
- normal conditions again

MINN testing

Climate chamber tests – 4 types commissioned by VINS

- normal conditions: +20 °C and 65% RH - all instruments are OK
- cold and dry: -20 °C and 0% RH – all instruments show increas of response (up to 10 %)
- warm: +50 °C and 50% RH – 2 types show 0 indication, two are OK
- humid: 30 °C and 95% RH – all instruments are OK
- normal conditions again – all instruments are OK, none are damaged

MINN testing

(Preliminary) conclusions

- Studied types of MINNs do not meet all the criteria set by relevant standards

- Energy dependence represents the most serious problem

- However, many dosimeters used by professionals have comparable characteristics, and GM tubes are used even in some early warning networks

MINN testing

(Preliminary) conclusions

- MINNs are sensitive to small changes of doserate
- Some of the MINNs fail in very warm weather
- Can we use the data from non-governmental networks?


tere Bahnhofstrasse
Bilchen
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Thank you for your attention!