



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



traceRadon: New results and open questions for research

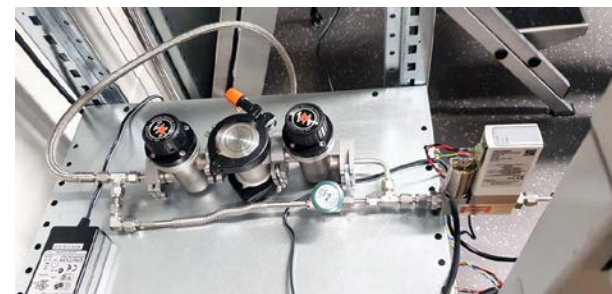
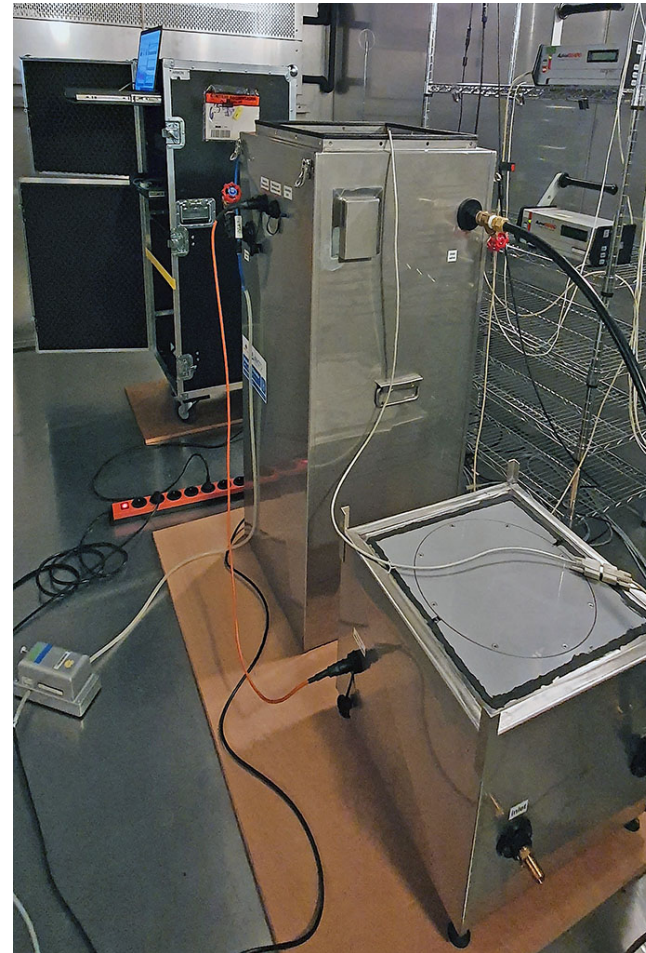
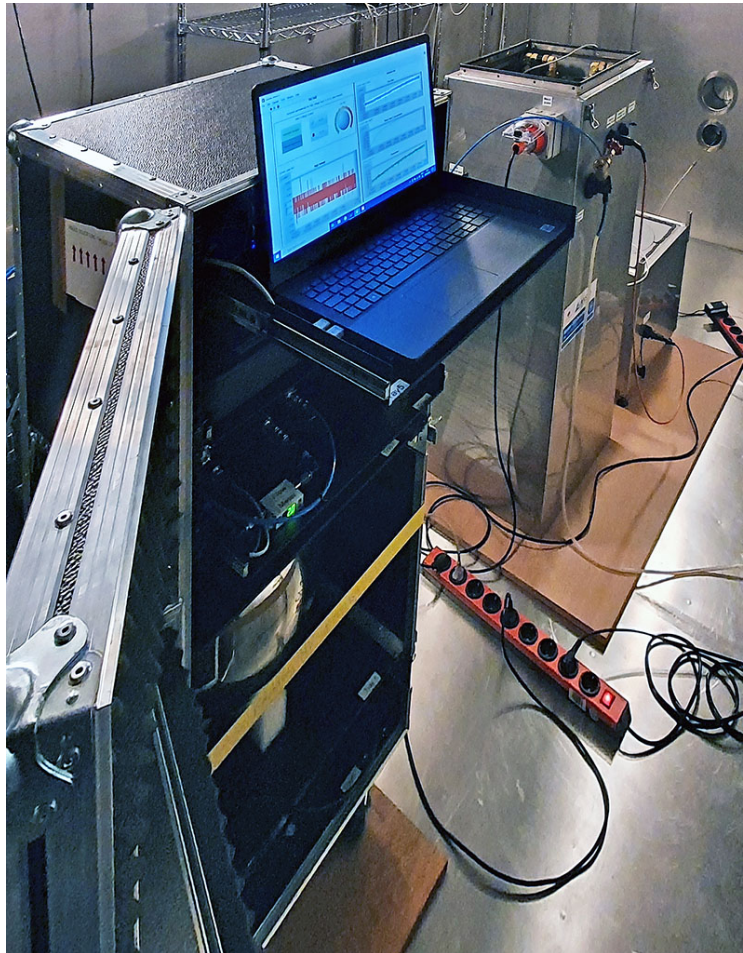
EMPIR 19ENV01 traceRadon

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.



ARMON v2.0 and ANSTO 200 L in 20 m³ climate chamber

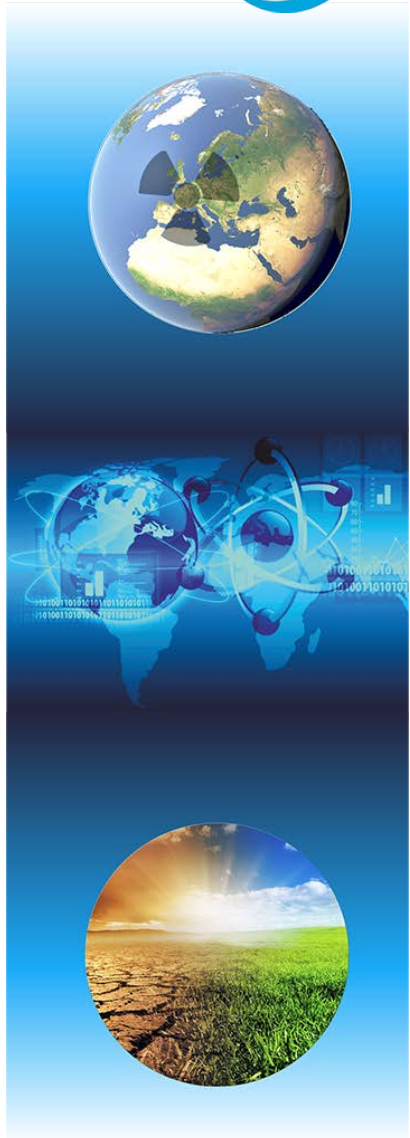


ARMON v2.0 and ANSTO 200 L in 20 m³ climate chamber

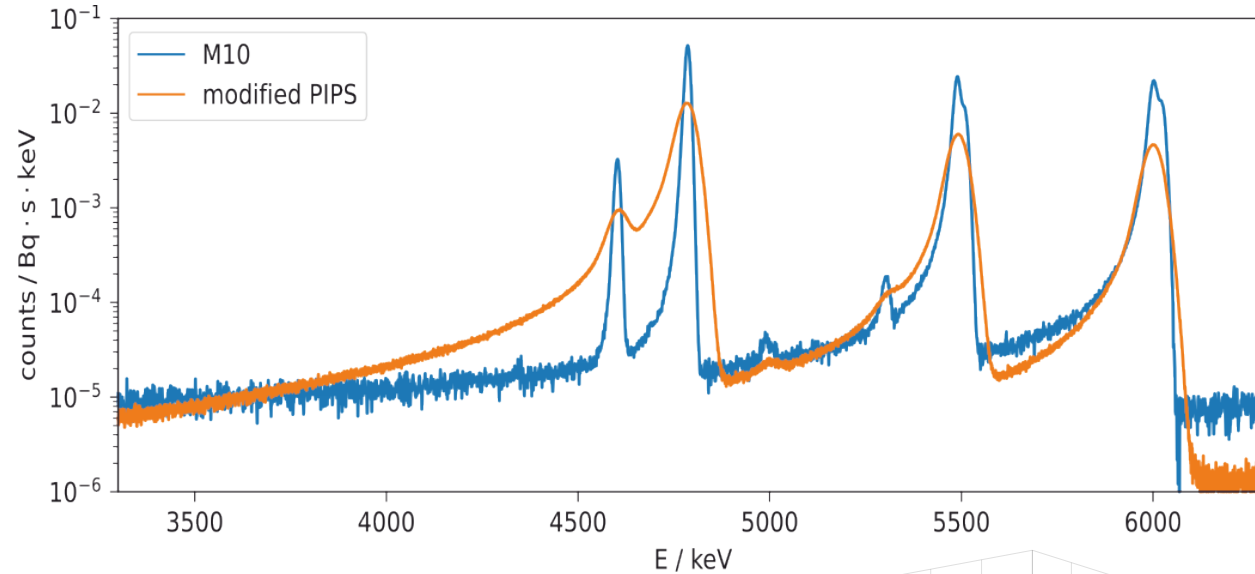
Discrepancy with 3. ion implanted ²²⁶Ra source: 2018-1121




➔ Re-characterisation of source: 2018-1121

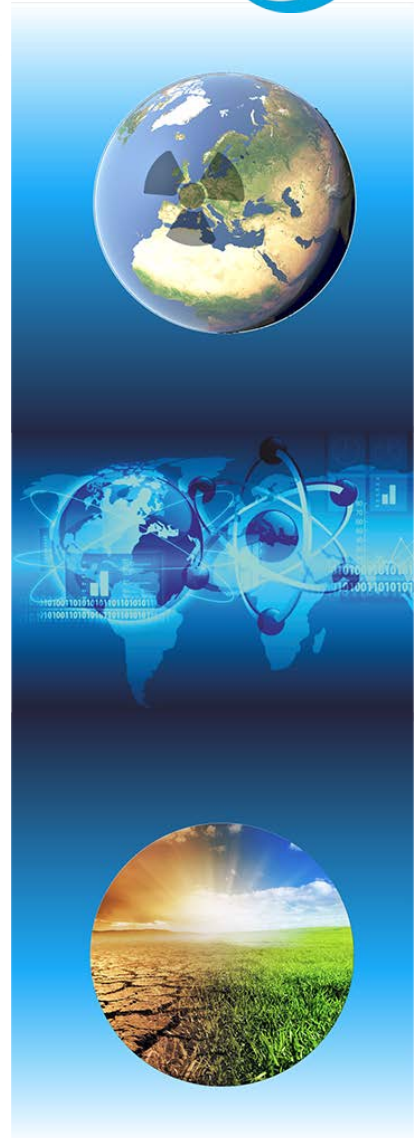
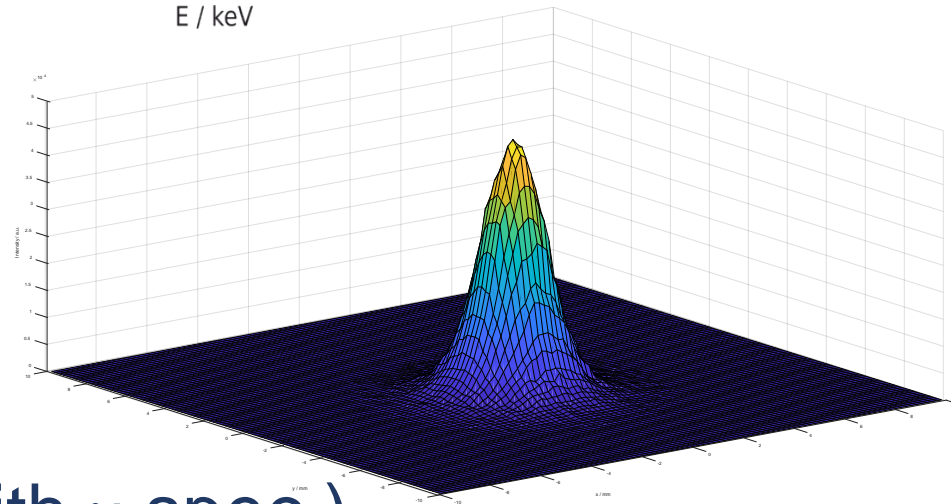


α -spectrometry:

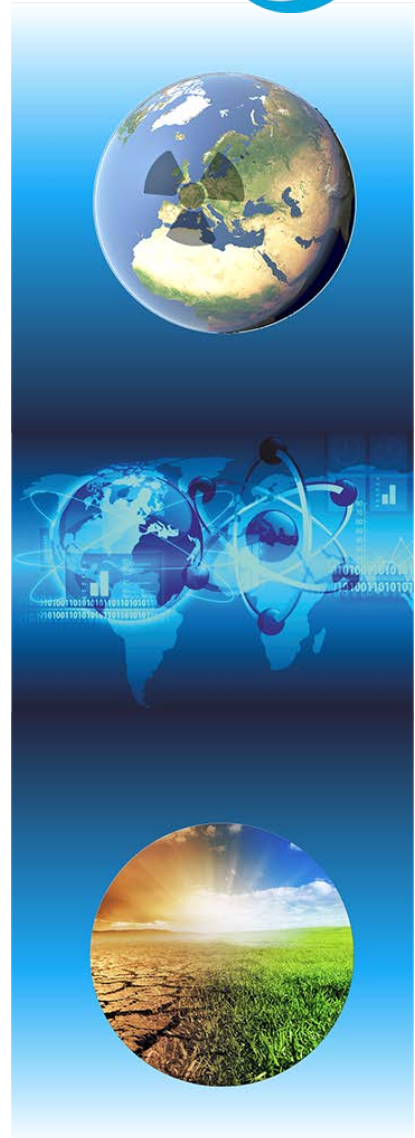
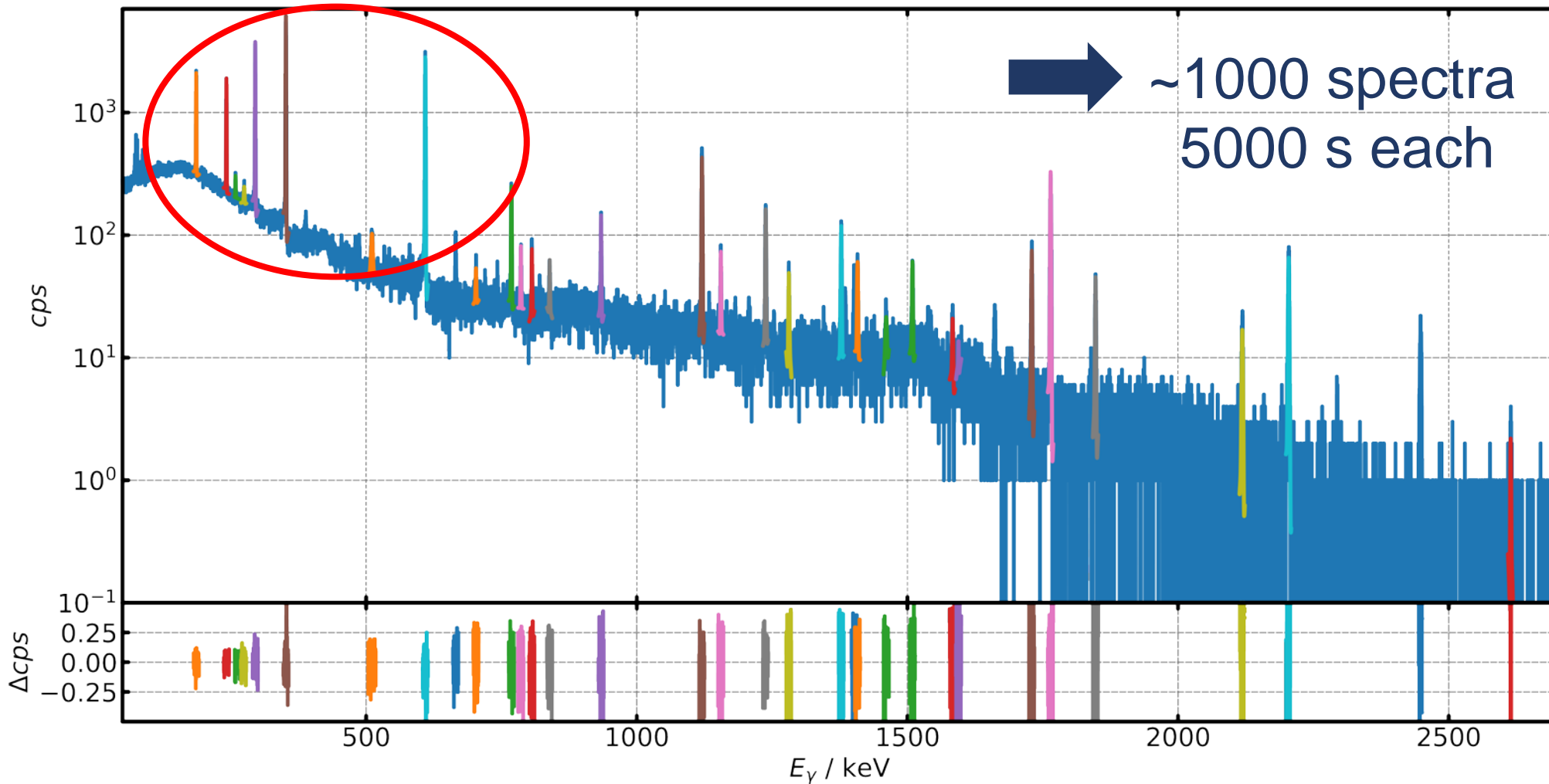


auto radiography:

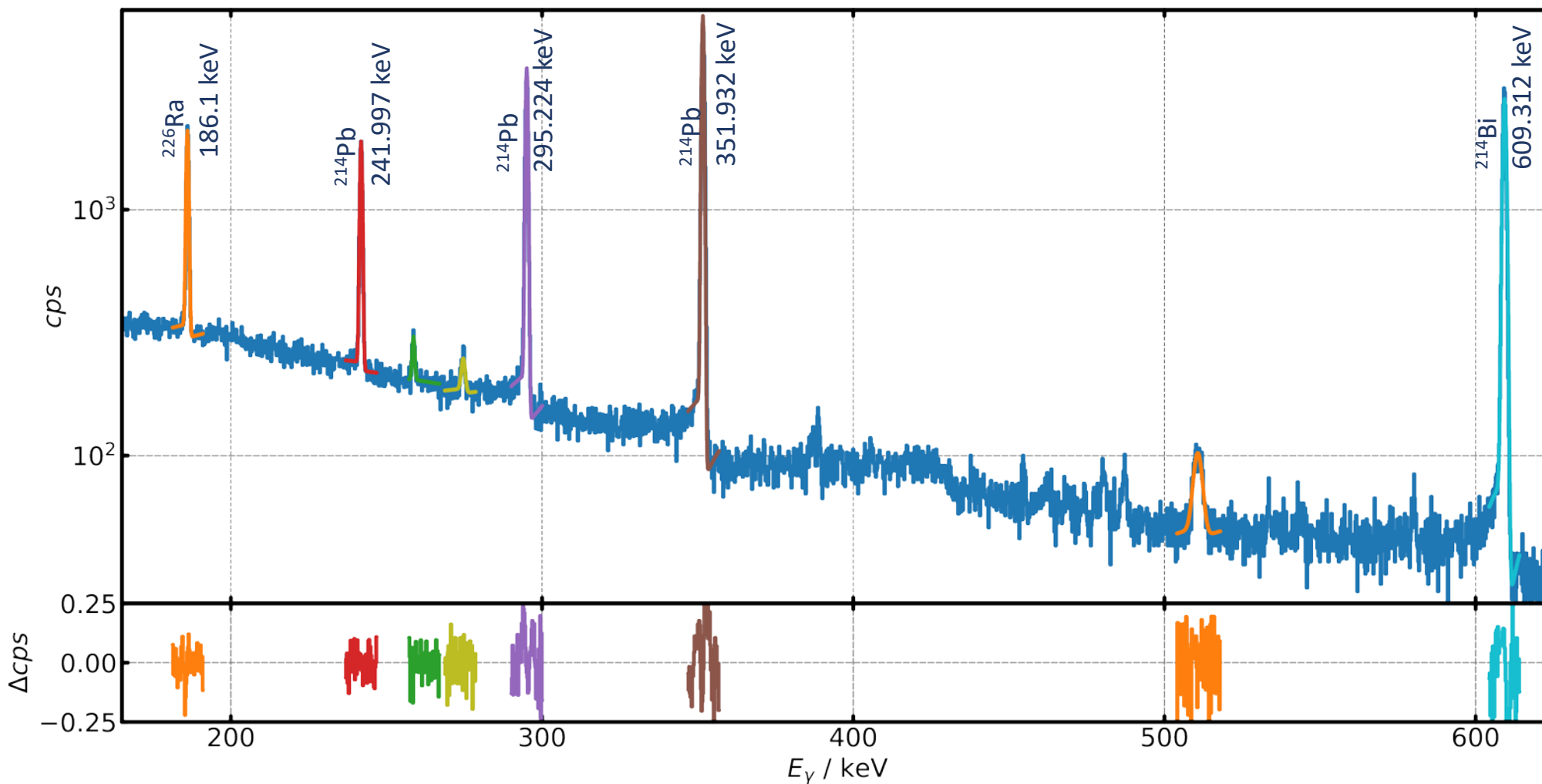
 activity of 2018-1121:
 $A(^{226}\text{Ra}) = 1104.1(63) \text{ Bq}$
 (unchanged, confirmed with γ -spec.)



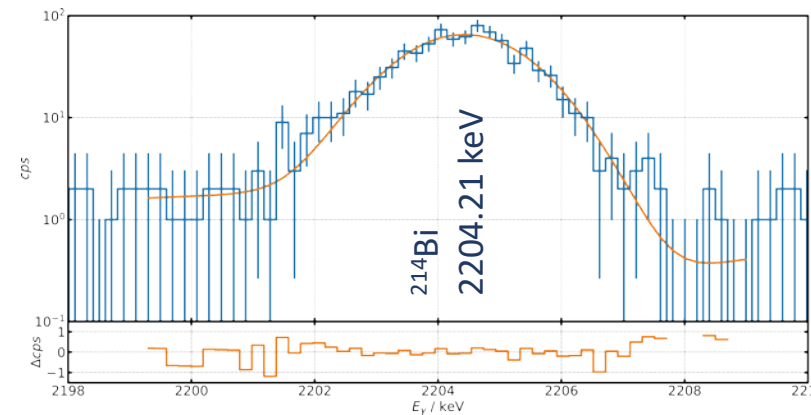
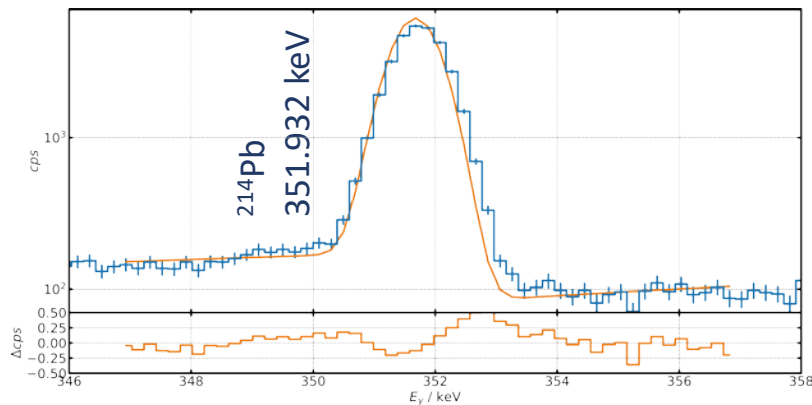
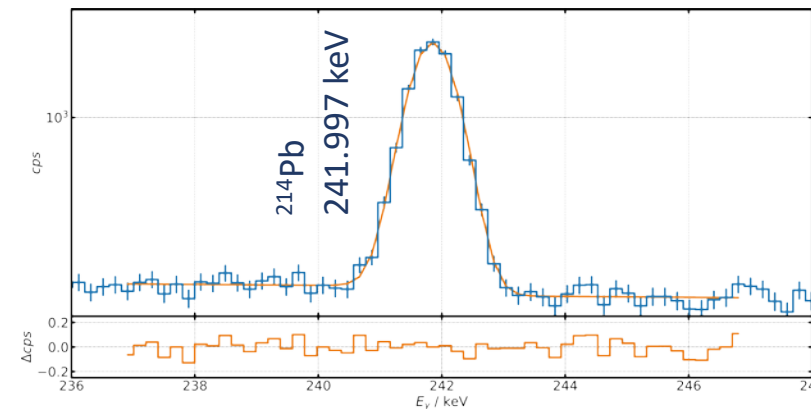
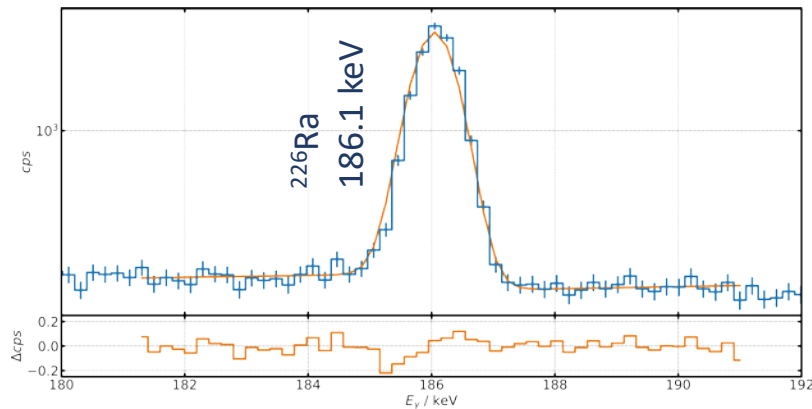
Emanation: determination via γ -spectrometry (HPGe)

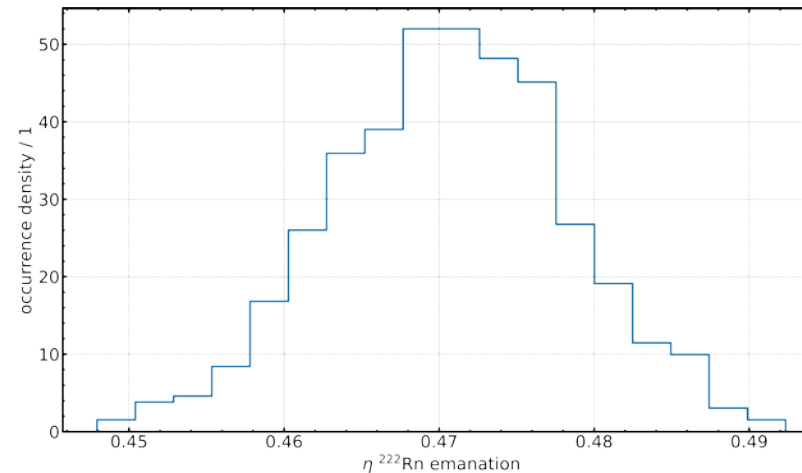
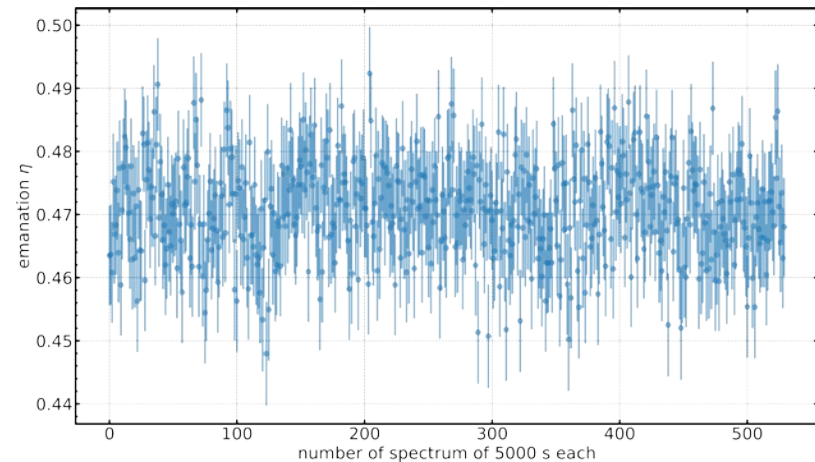
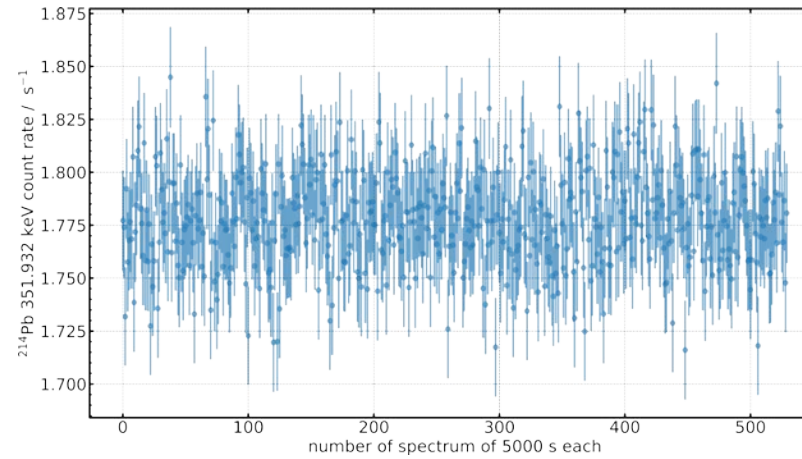
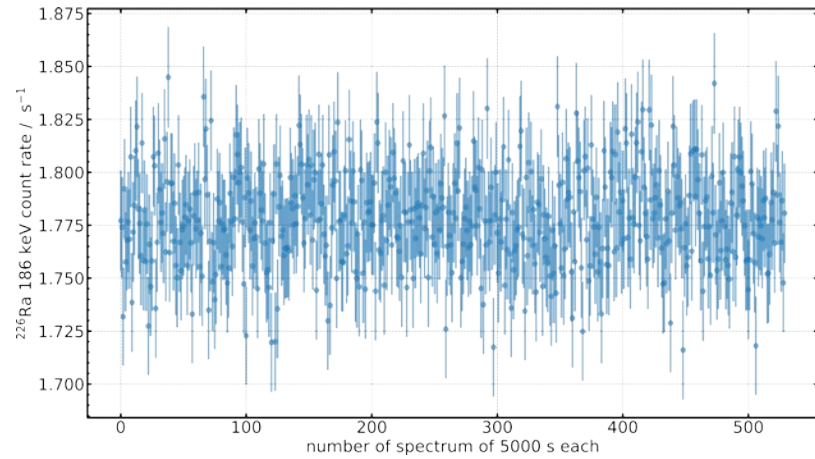


Emanation: determination via γ -spectrometry (HPGe)

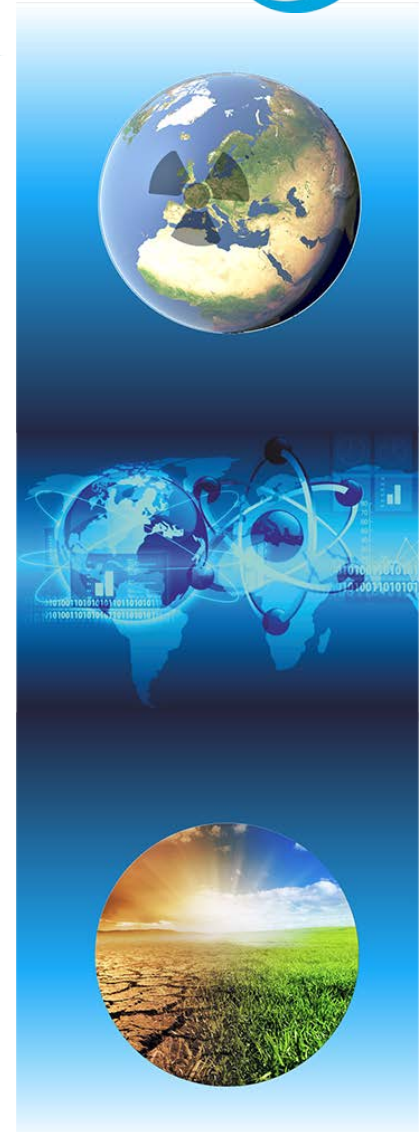


Emanation: determination via γ -spectrometry (HPGe)

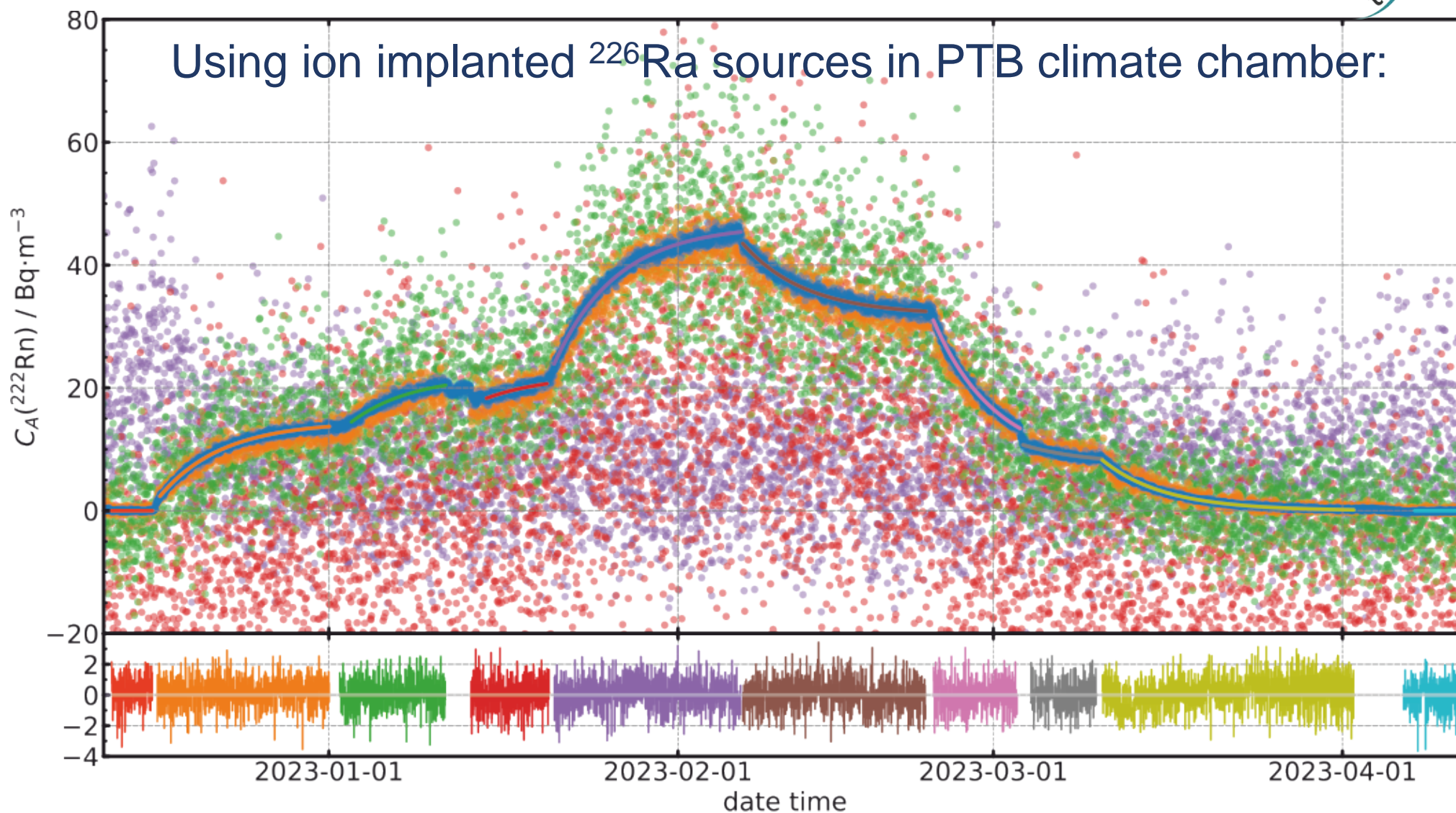


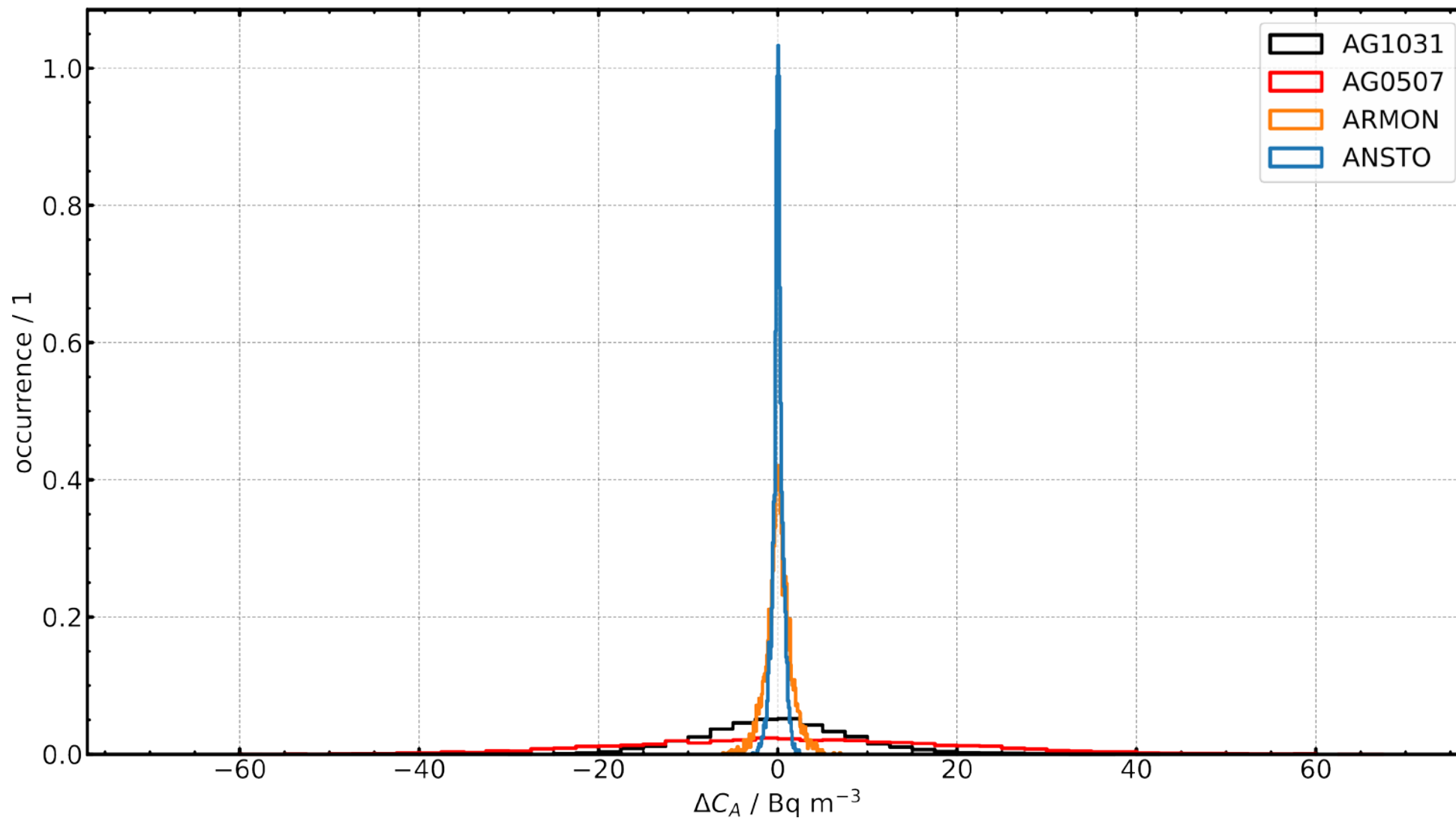


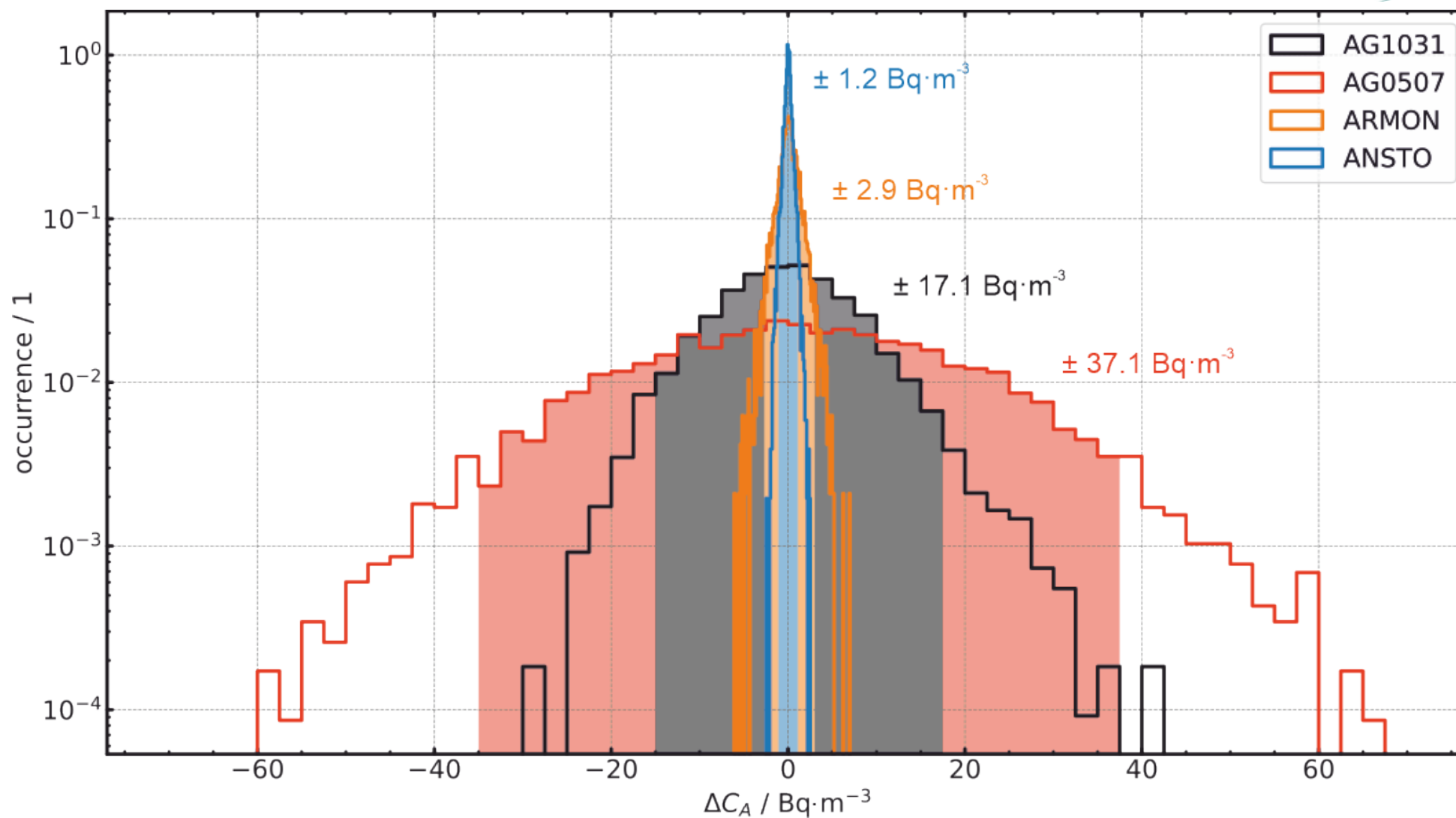
➔ emanation: $\eta = 0.467(9)$ (was $\eta = 0.340(4)$ before)

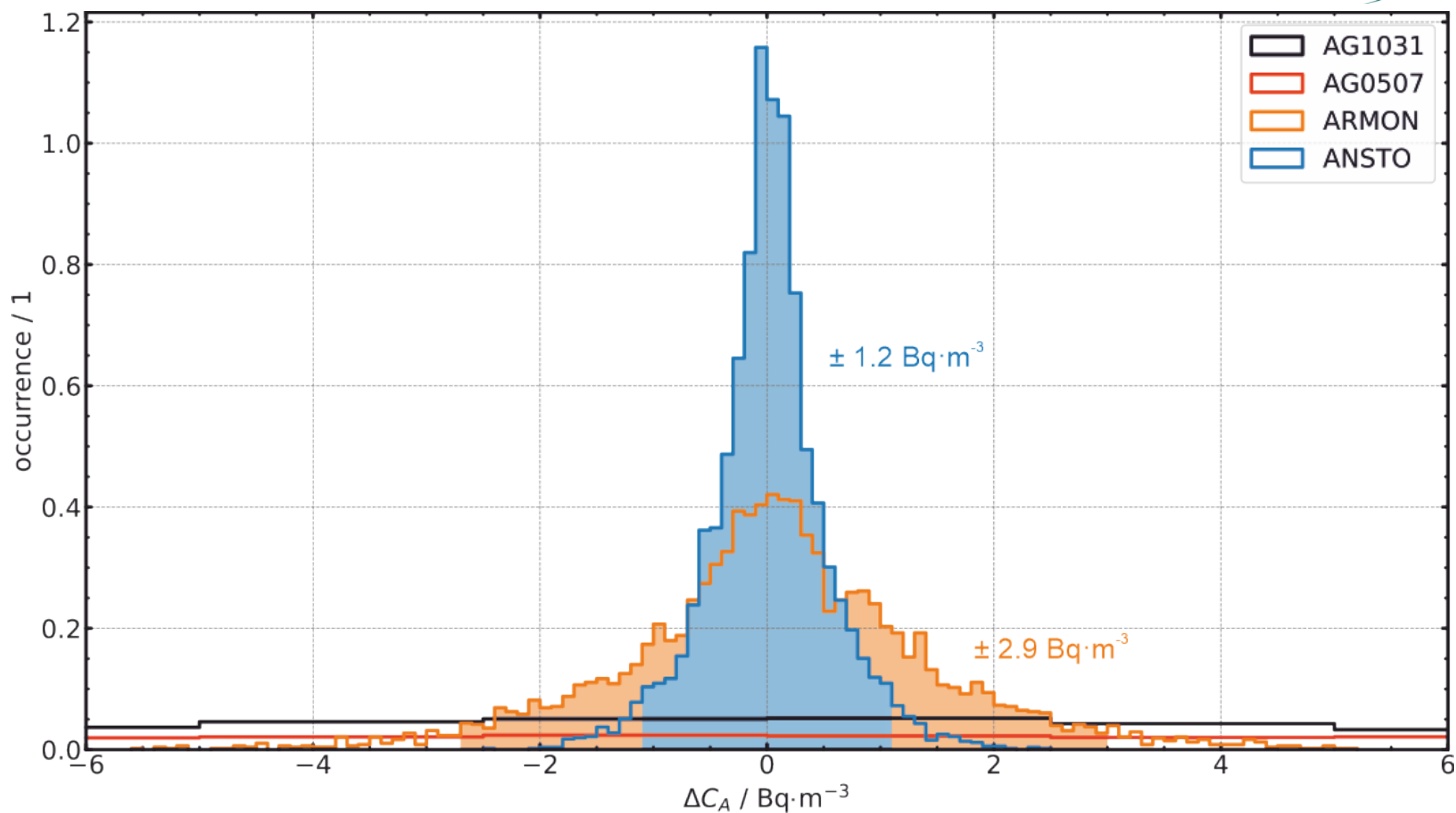


Using ion implanted ^{226}Ra sources in PTB climate chamber:









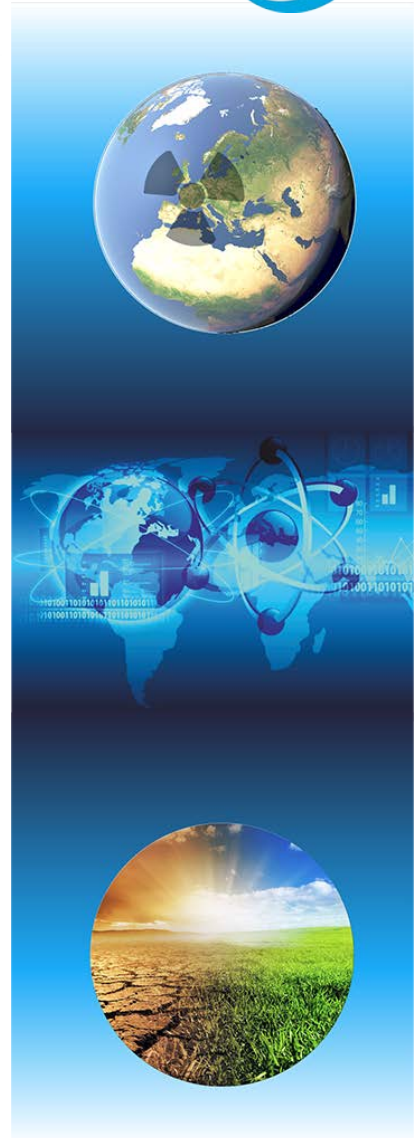
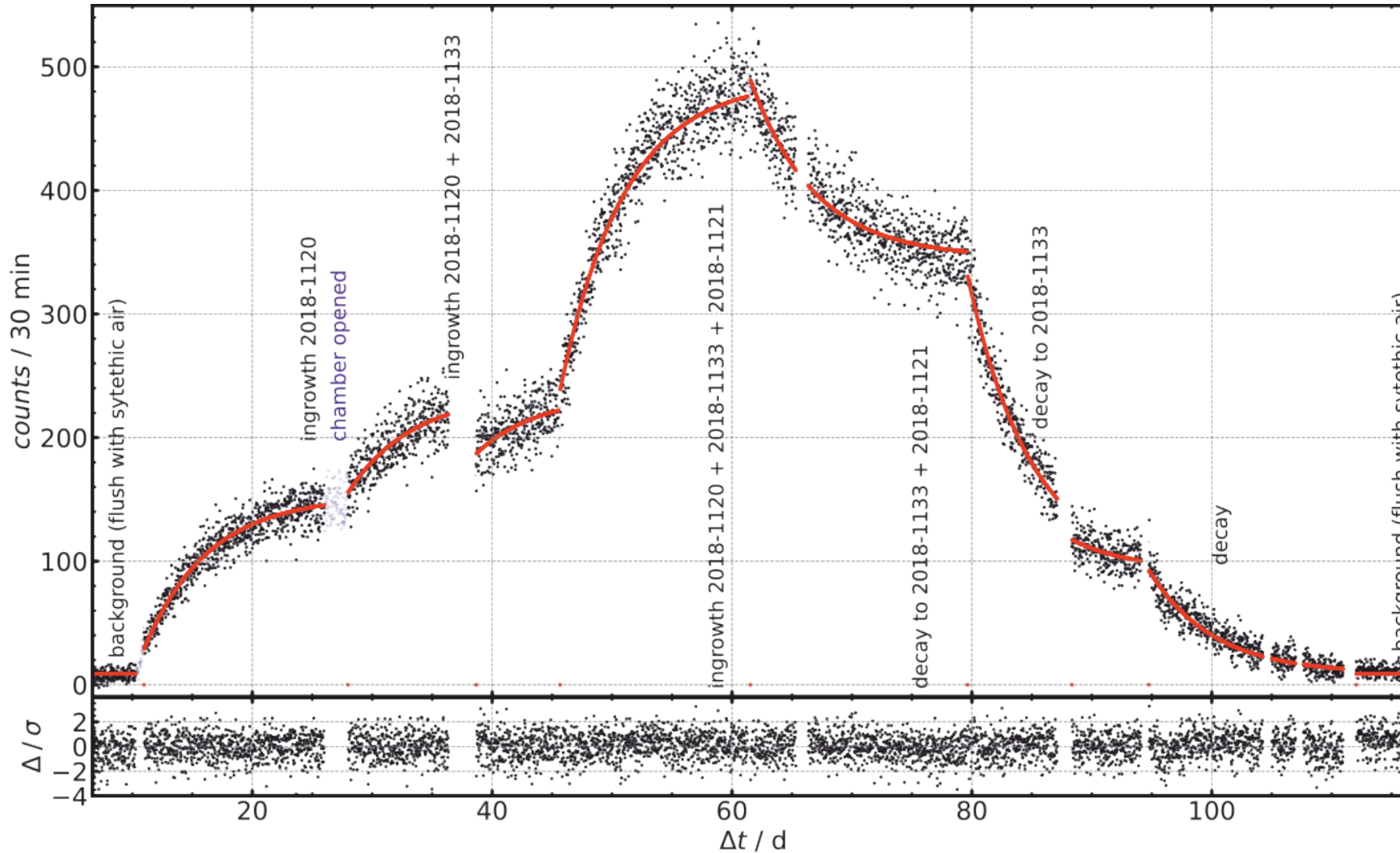
2019

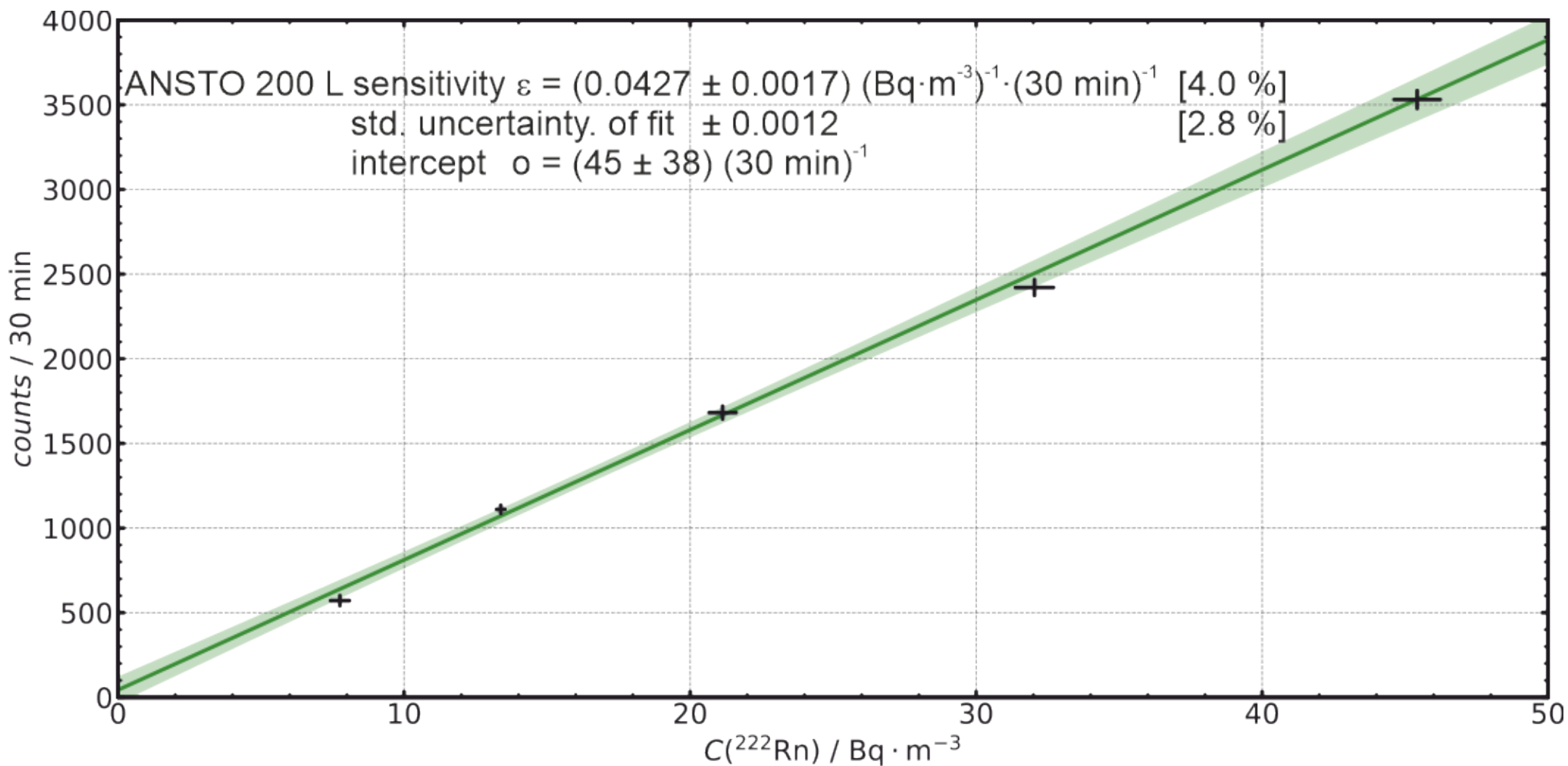
C in Bq·m ⁻³	u(C) in Bq·m ⁻³	calibration factor k in s·Bq·m ⁻³	sensitivity k _c in 1/(s·Bq·m ⁻³)	intrinsic background in the chamber ΔM ₀ in s ⁻¹
7.76	0.13	26.0 ± 0.5	0.0385 ± 0.0013	0.03107 ± 0.00015
13.38	0.16			
18.09	0.17			
21.14	0.23			

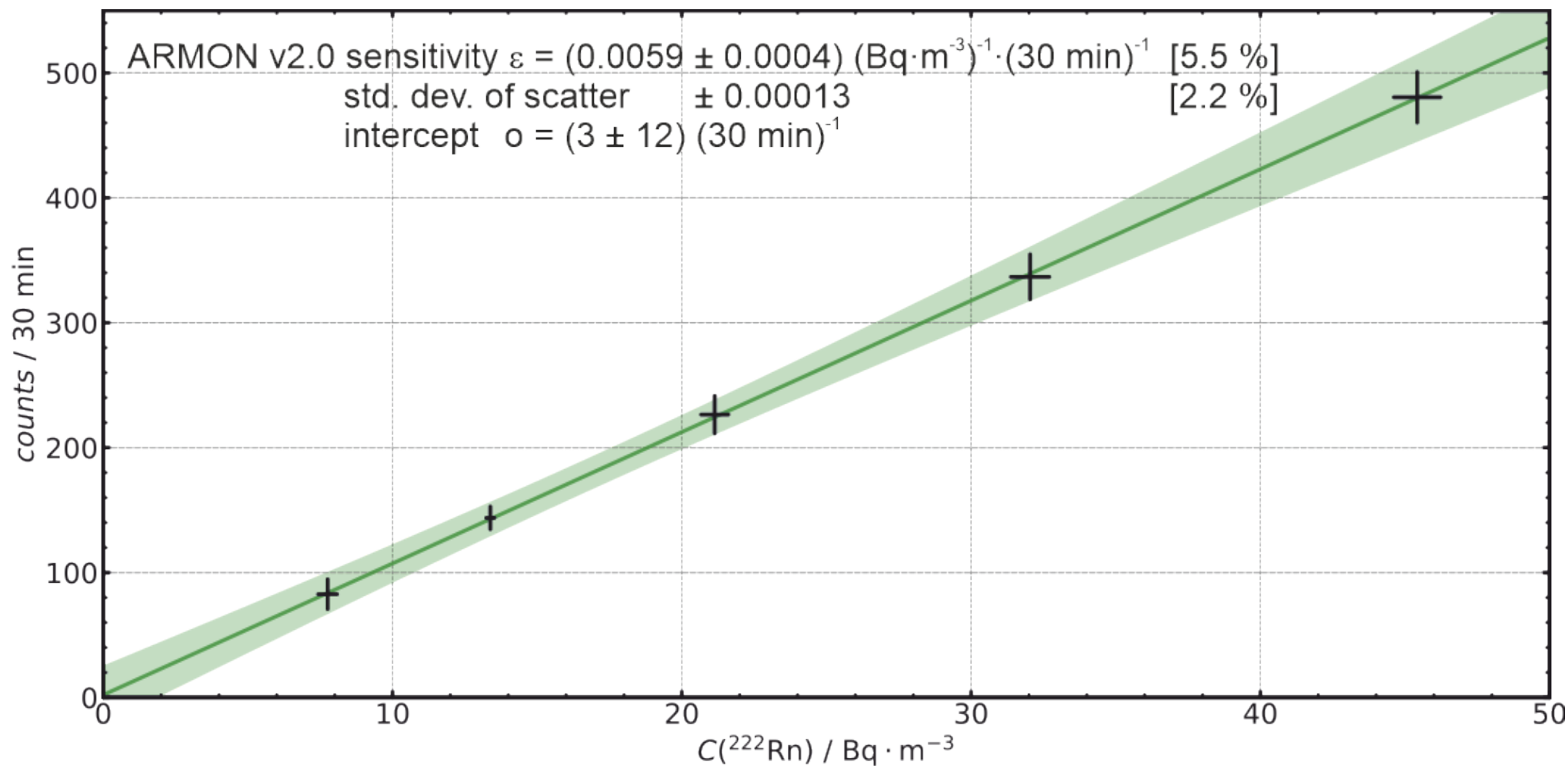
2023 – with changed Th delay volume and traveling

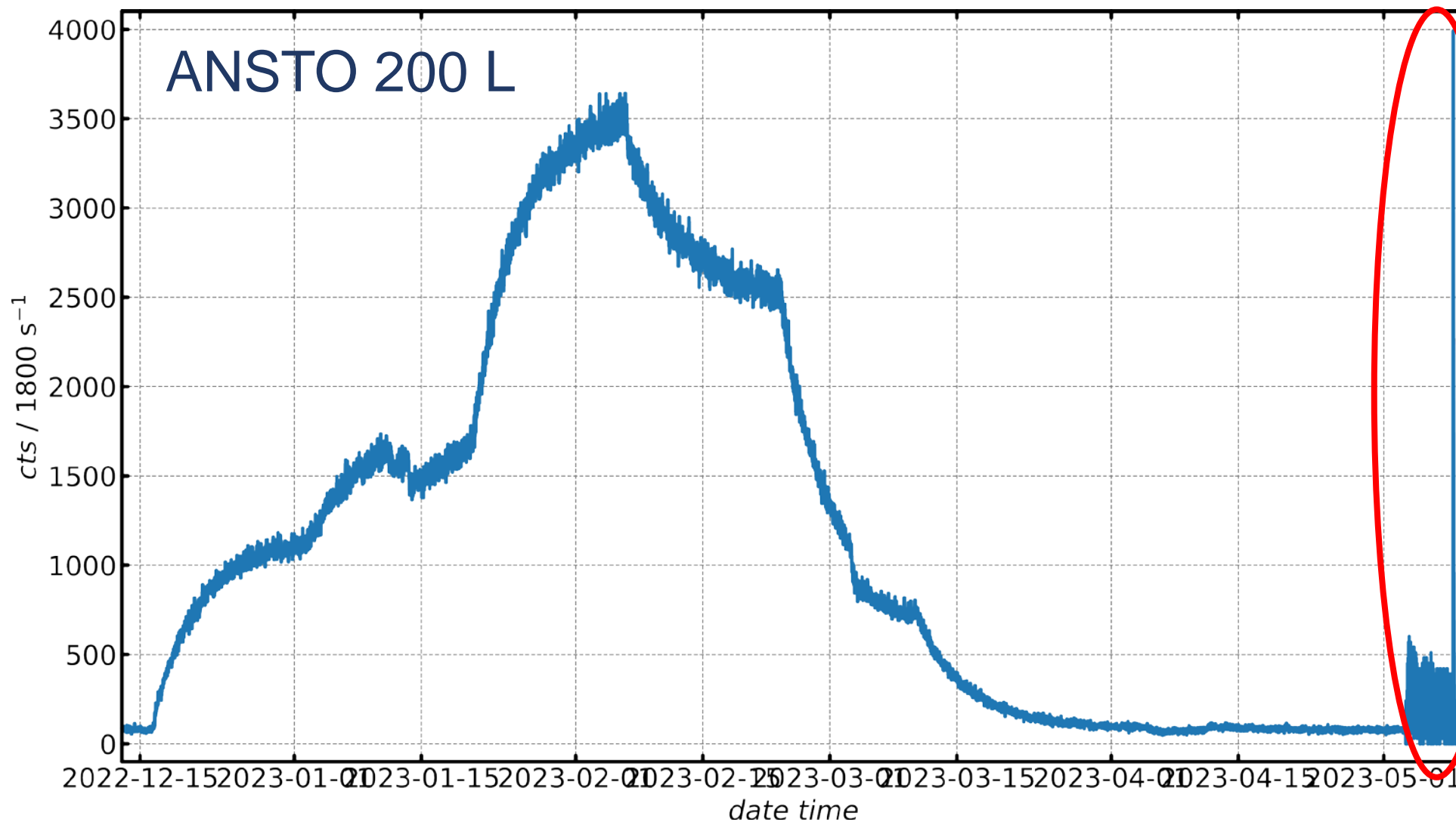
7.76	0.13	23.4 ± 0.9	0.0427 ± 0.0017	0.04313 ± 0.00018
13.38	0.16			
18.09	0.17			
21.14	0.23			

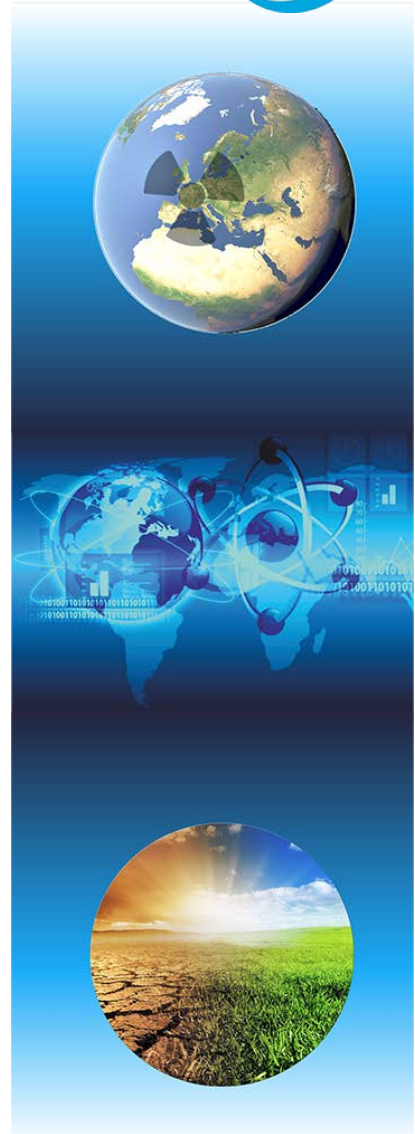
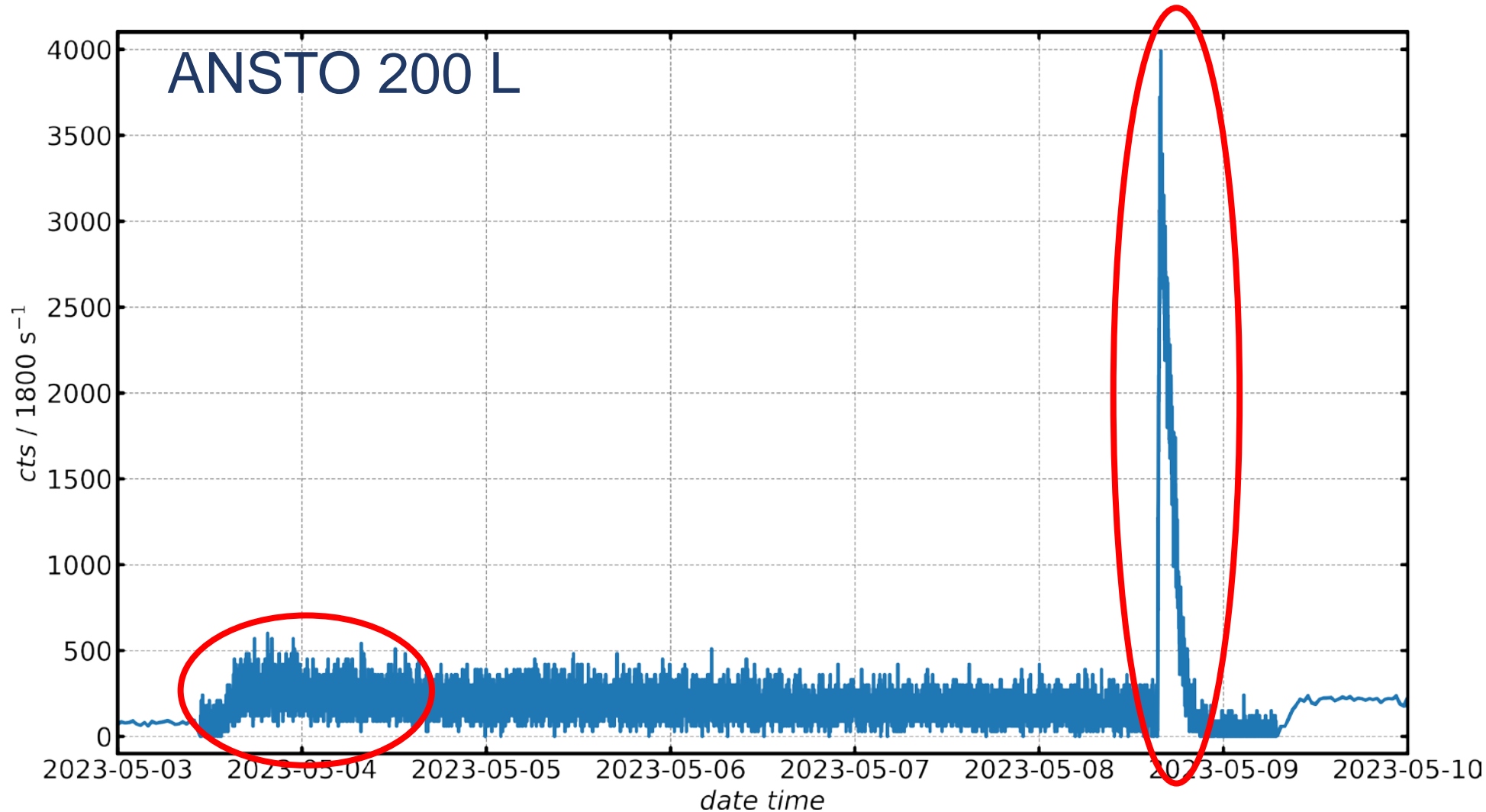


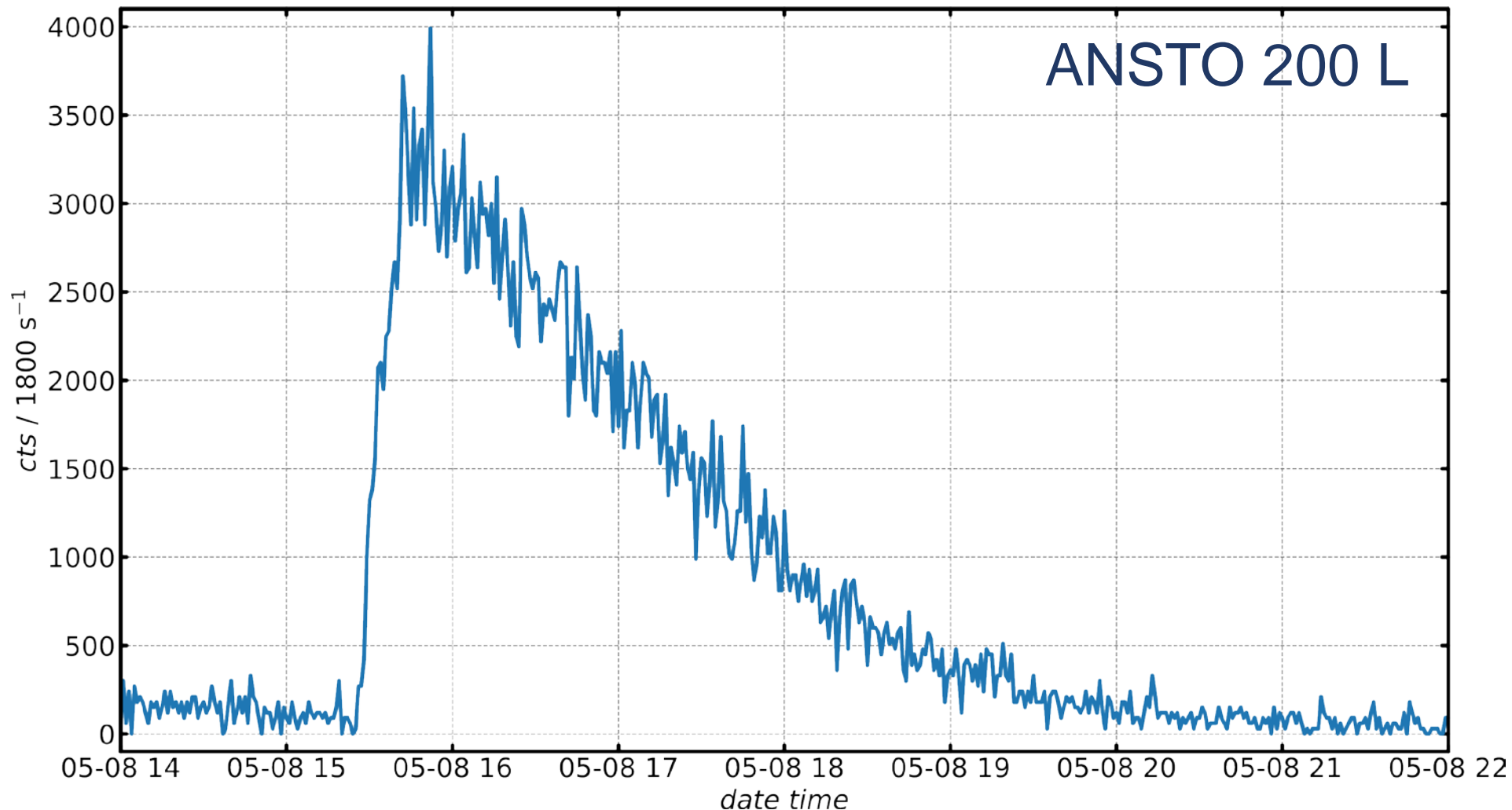


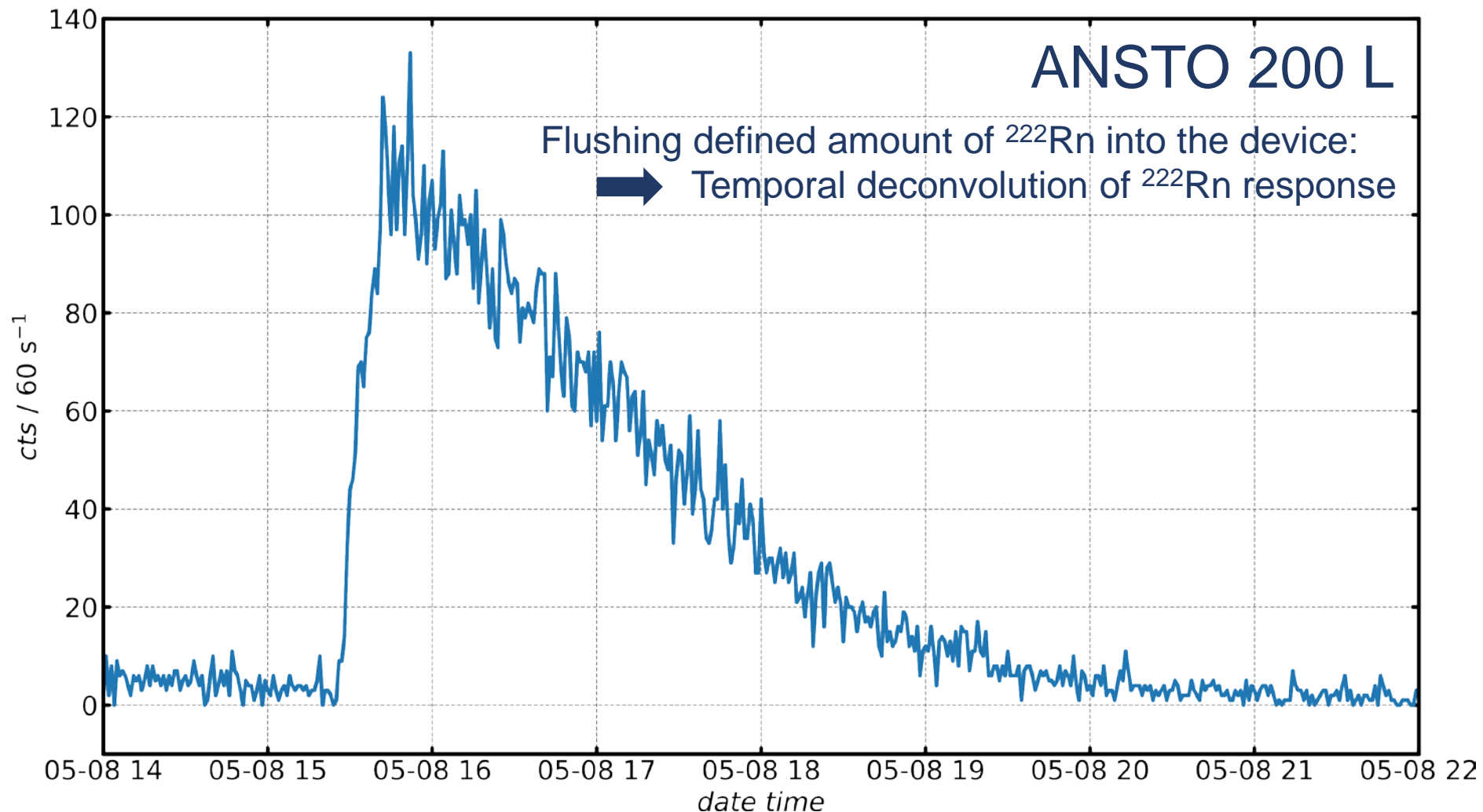


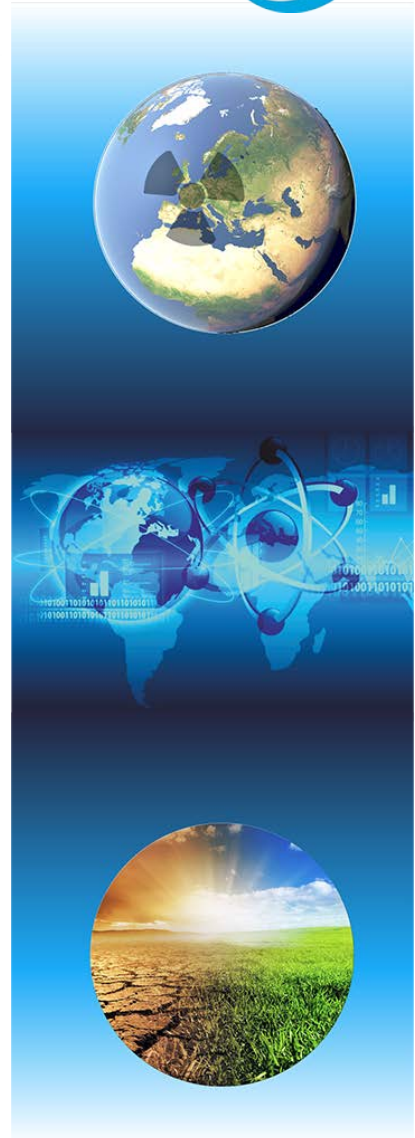
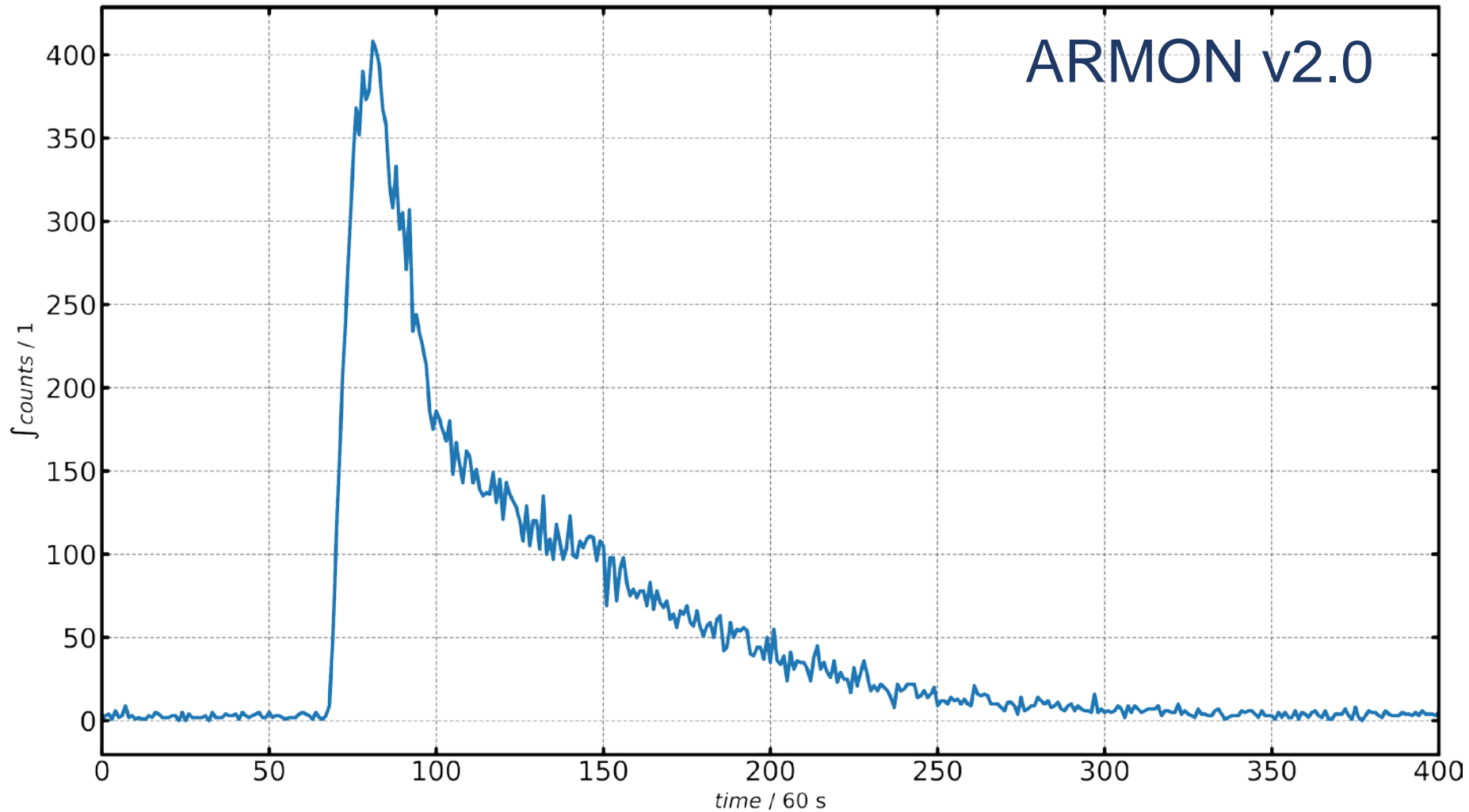


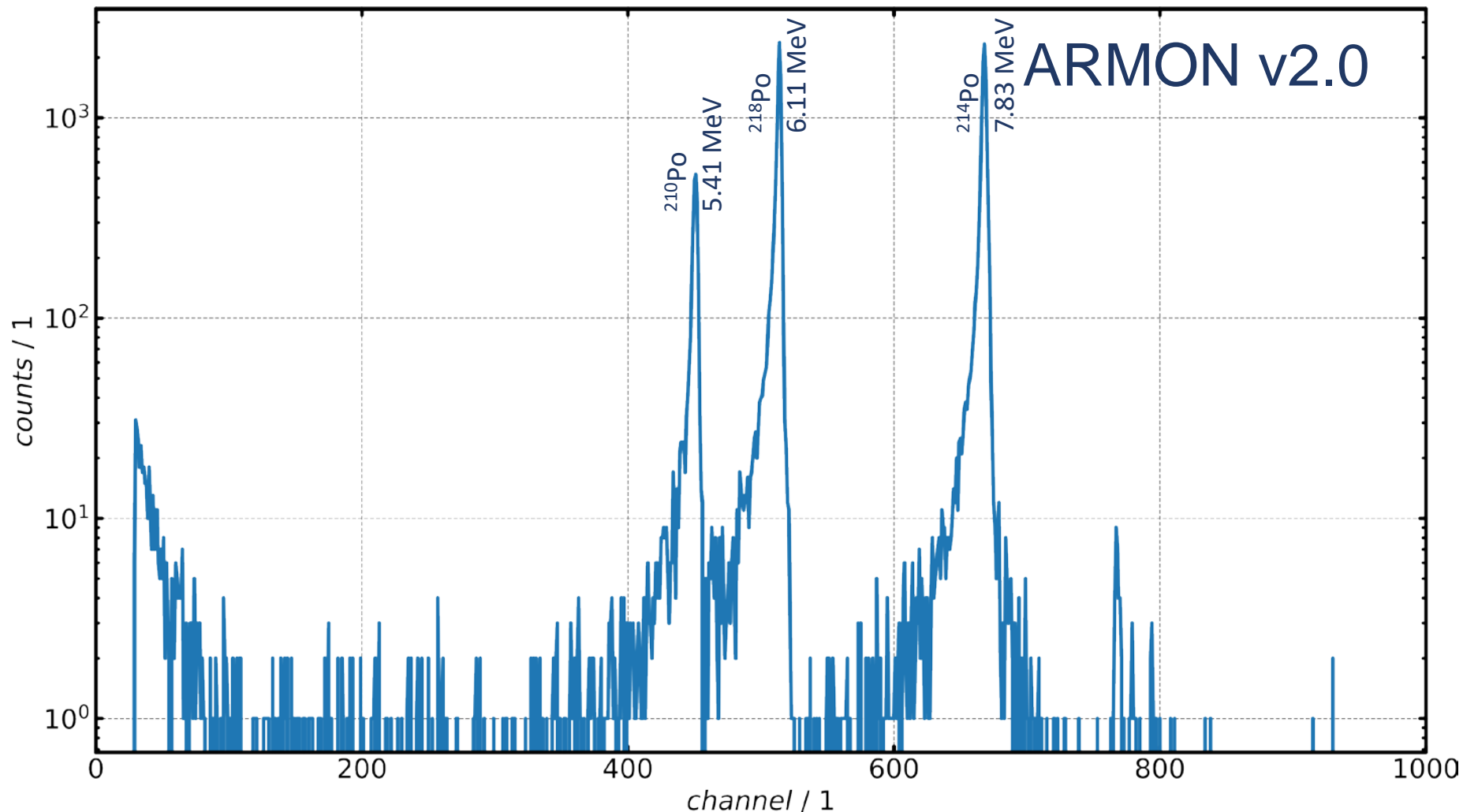




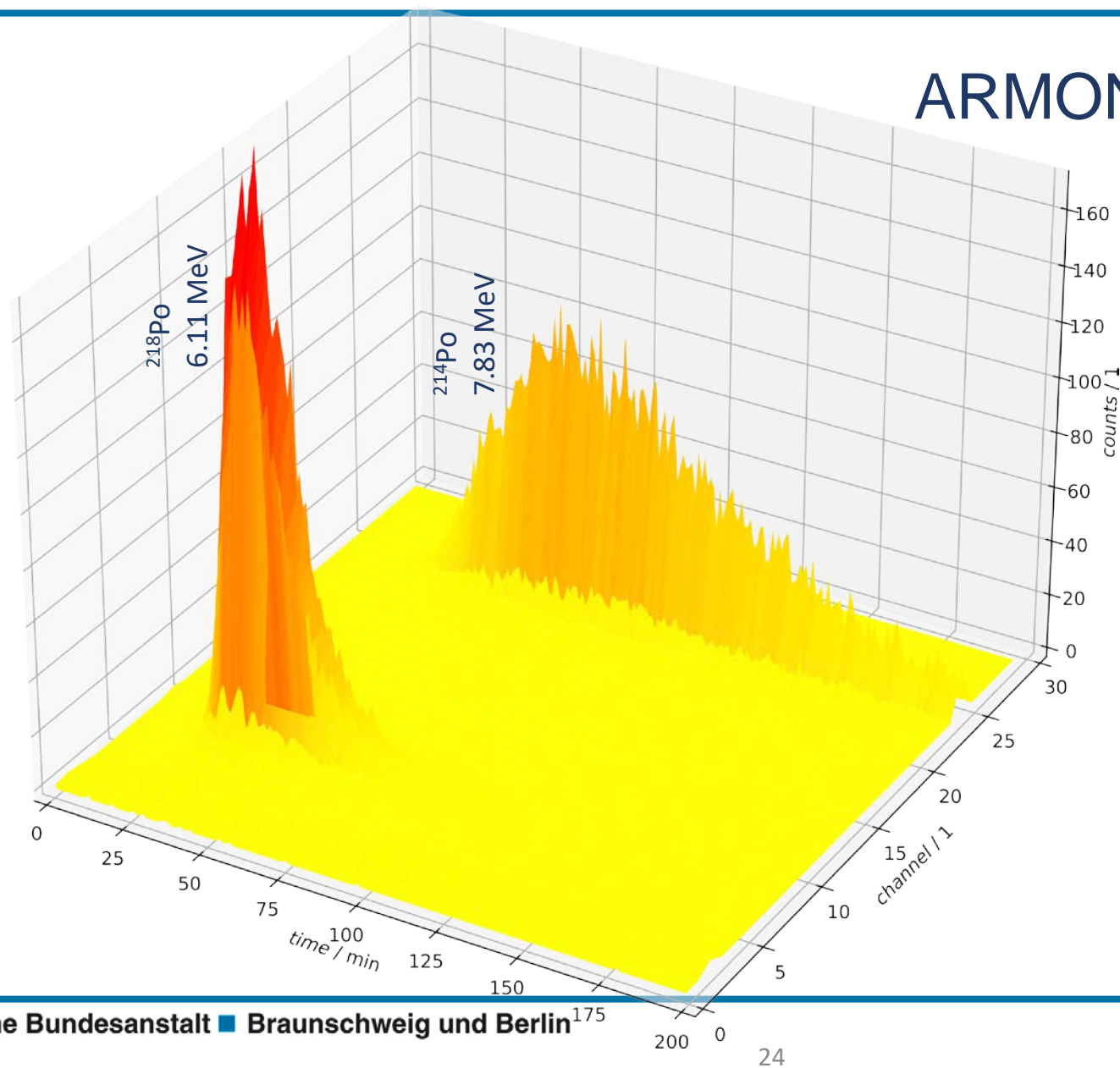


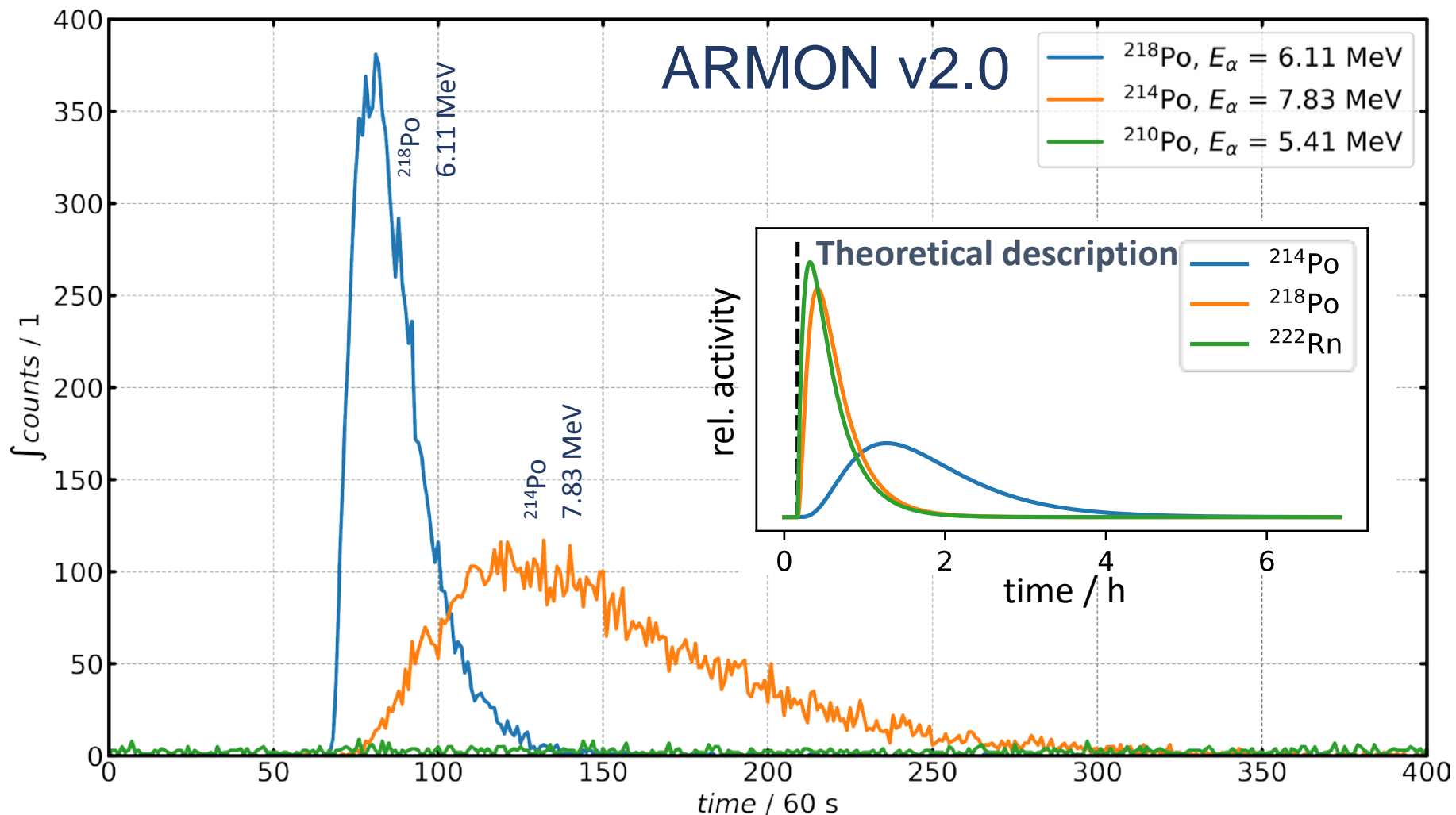






ARMON v2.0





- ^{222}Rn emanation sources from MBq to few Bq are feasible
- **Wishlist: mass separated ion implanted IRSD with soft landing**
- Puls calibration at detectors in field feasible
 - but evaluation and comparison still to come
- **ARMON detector will be commercialised by Radonova (license agreement UPC-Radonova)**



➤ EPM PRT_IND_IONZ_APP78 ➡ i20 probably SRT ➡ 5th July '23

➤ Objectives:

1. To develop new concepts and methods for **sensors detecting radon activity concentration** with lowered response time, increased sensitivity and reduced uncertainty. Build the sensors **cost effective** and material saving through **advanced manufacturing** using industrial production by SMEs.
2. To develop **traceable, in-situ operando calibration procedures** for these sensors with less than 10 % uncertainty at an activity concentration level of 50 Bq·m⁻³ allowing for response time and dynamic linearity testing.
3. To develop a **quality assured network**, fit-for-purpose consisting of these sensors for big buildings in **future cities**. Making use of developing standards as **artificial intelligence, IoT** and **digital twins**. Implementing digital SI to facilitate collaborative research, development as well as self-sustaining expendability.
4. To develop an extension of the sensor network, including other existing and developing sensor networks and to develop **intelligent data analysis** and assimilation methods to optimize the use of **energy, air quality management** and **radiation protection**.

➤ Interested? ➡ Email: Tanita.Balle@PTB.de, Stefan.Roettger@PTB.de





... to the traceRadon-project partners:



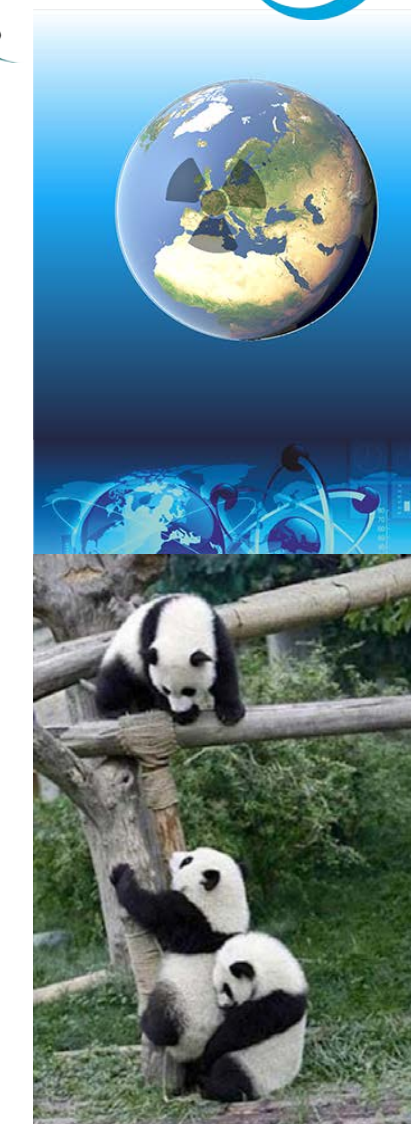
... to the traceRadon-project collaborators:



... to the traceRadon-project Stakeholder Committee, Stakeholders, MSU, EURAMET,

... and for your attention!

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