

Neutron Spectrometry at the Canfranc Underground Laboratory

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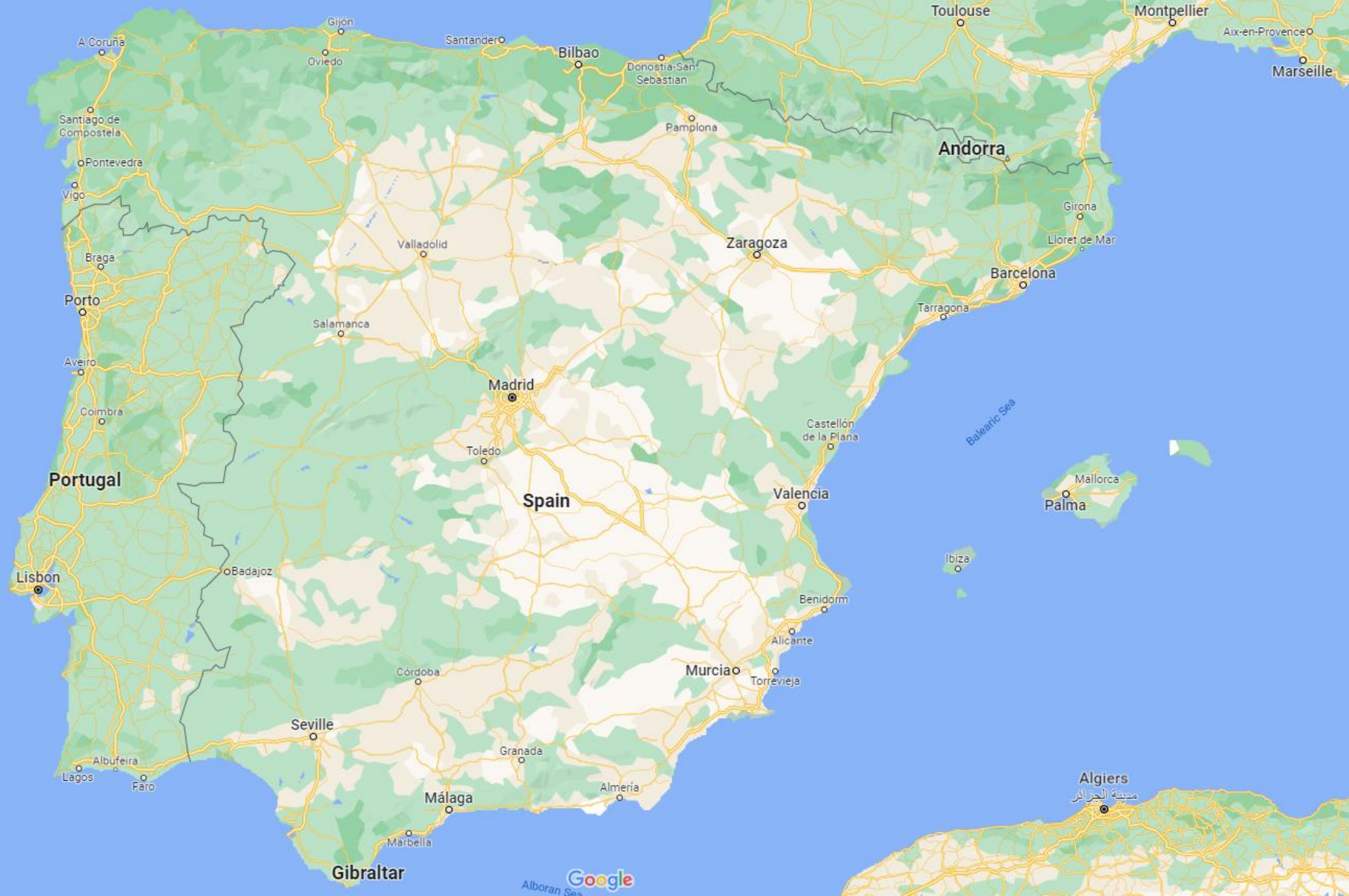


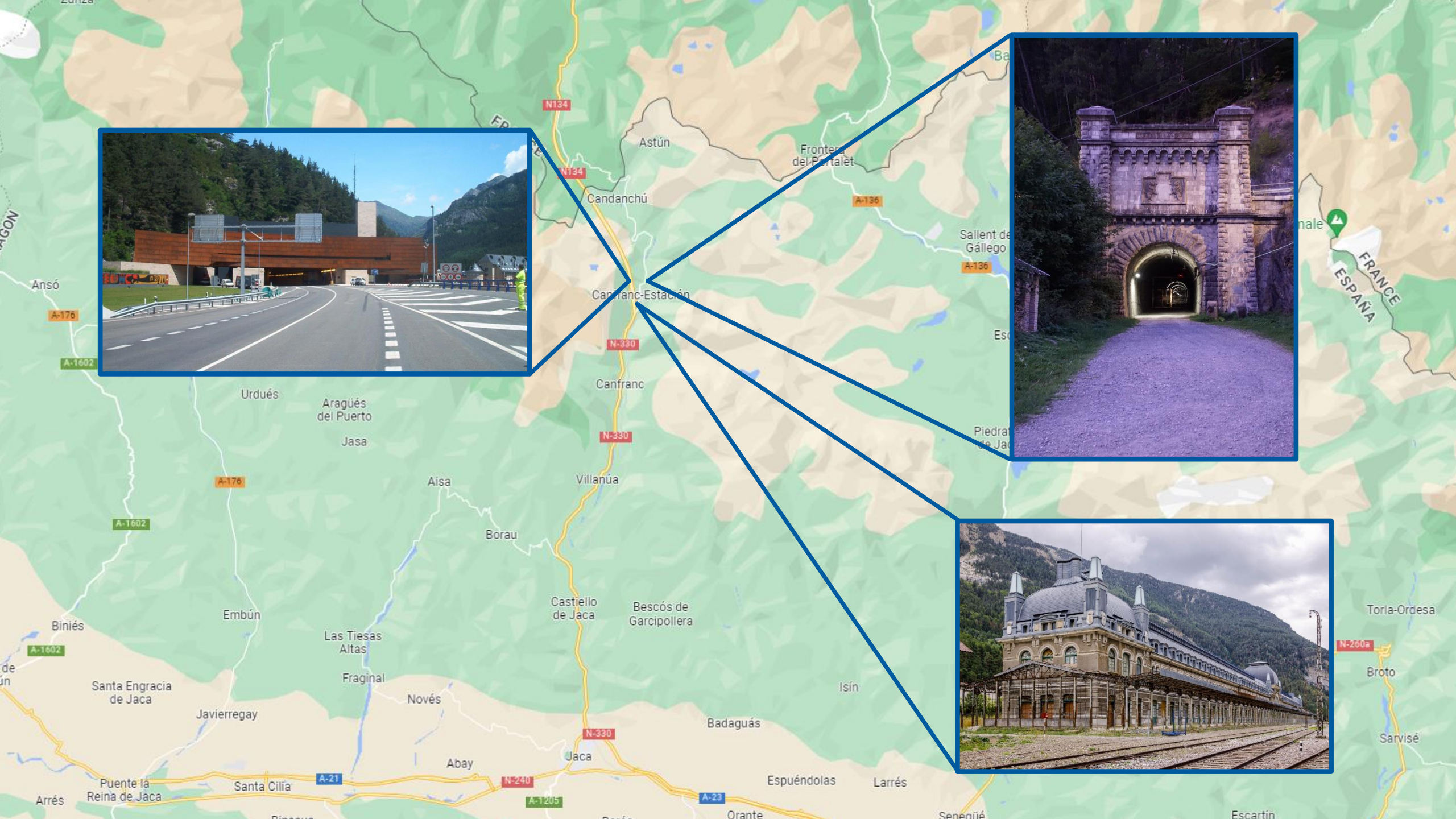
Regular Article - Experimental Physics

Long-term evolution of the neutron rate at the Canfranc Underground Laboratory

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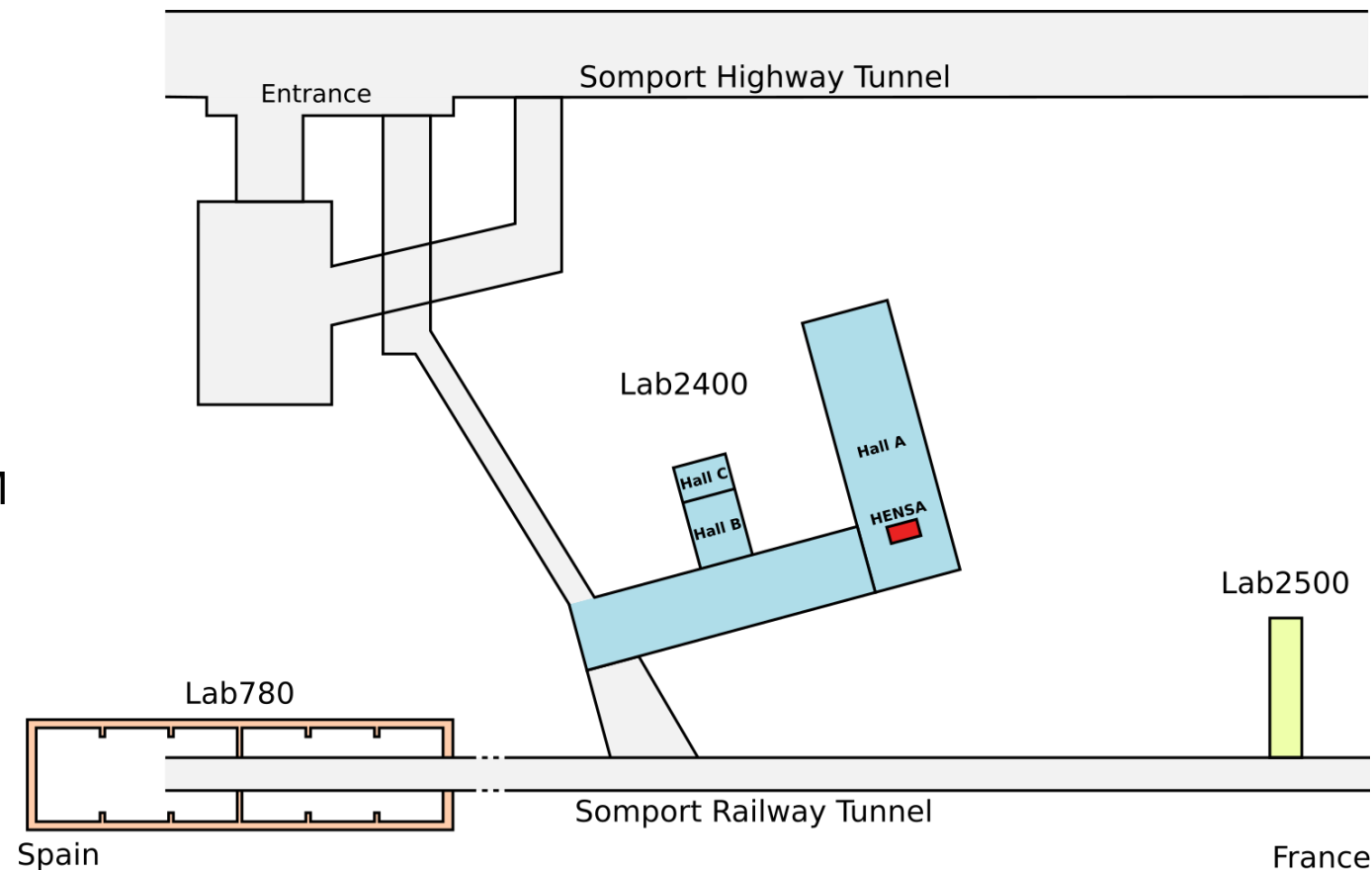






Canfranc Underground Laboratory

- 2,450 m.w.e. rock overburden
 - Boulby (UK) ~ 2,800 m.w.e.
 - Gran Sasso (IT) ~ 3,600 m.w.e.
 - Modane (FR) ~ 4,800 m.w.e.
- Dark Matter: ANAIS, ArDM, TREX-DM
- Neutrino Physics: NEXT, SuperKGd
- Geology: GEODYN



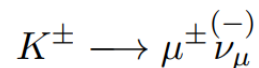
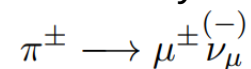
Neutron Background in Underground Laboratories

Cosmic Source

Proton induced shower in atmosphere



Pion/Kaon decay to muons



Electromagnetic/hadronic shower in rock



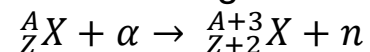
(γ,n)-reactions, spallation processes

Terrestrial Source

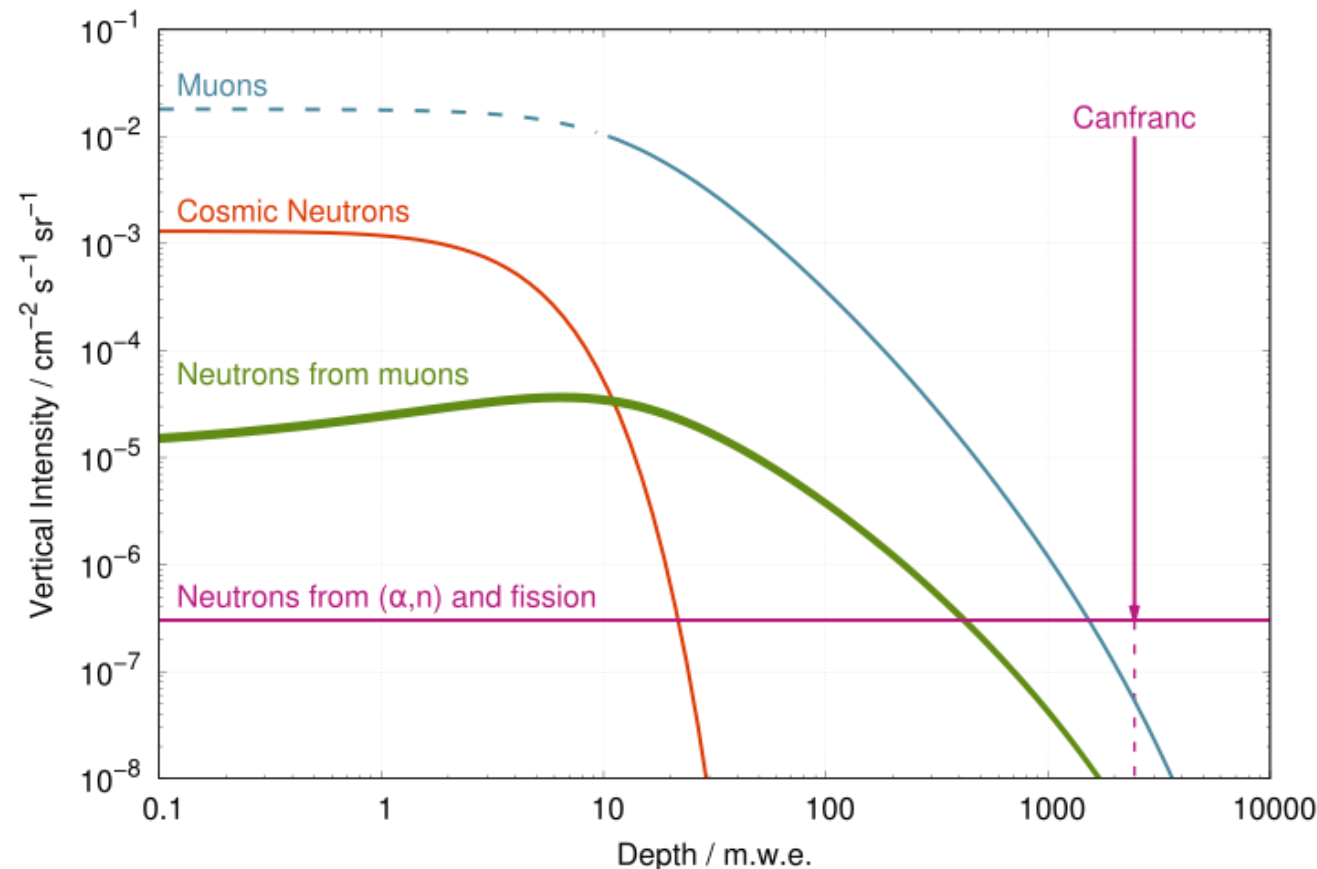
1. (α,n)-reactions
 α from U, Th decay chains



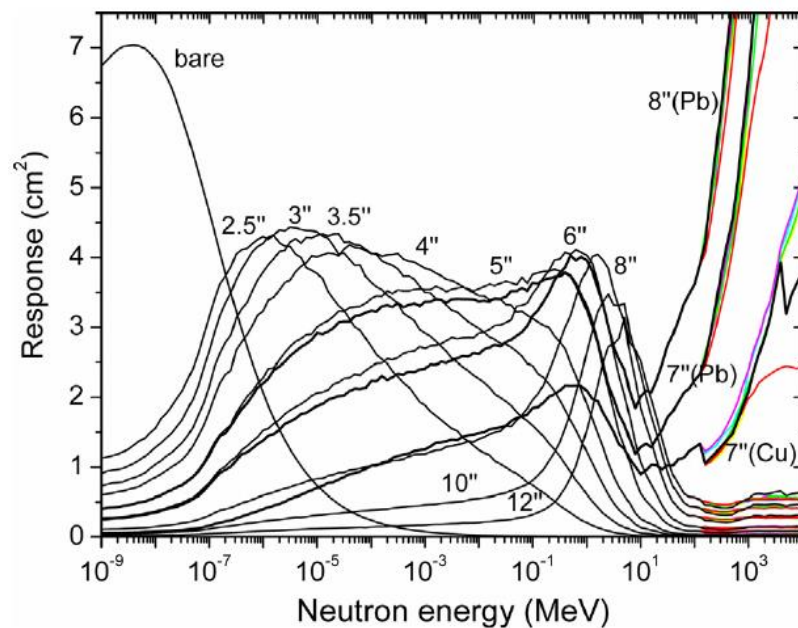
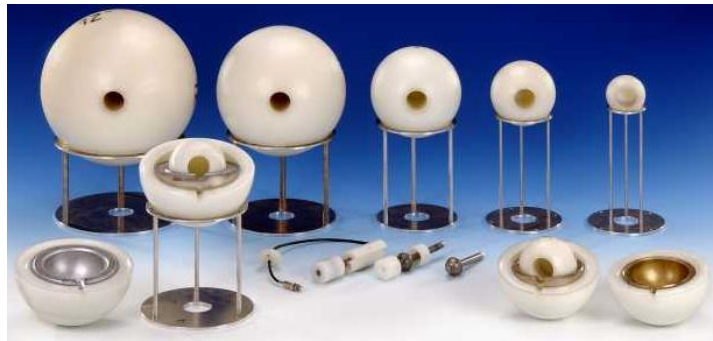
Reactions with light elements



2. Spontaneous fission:
 Decay of ${}^{238}\text{U}$ most important



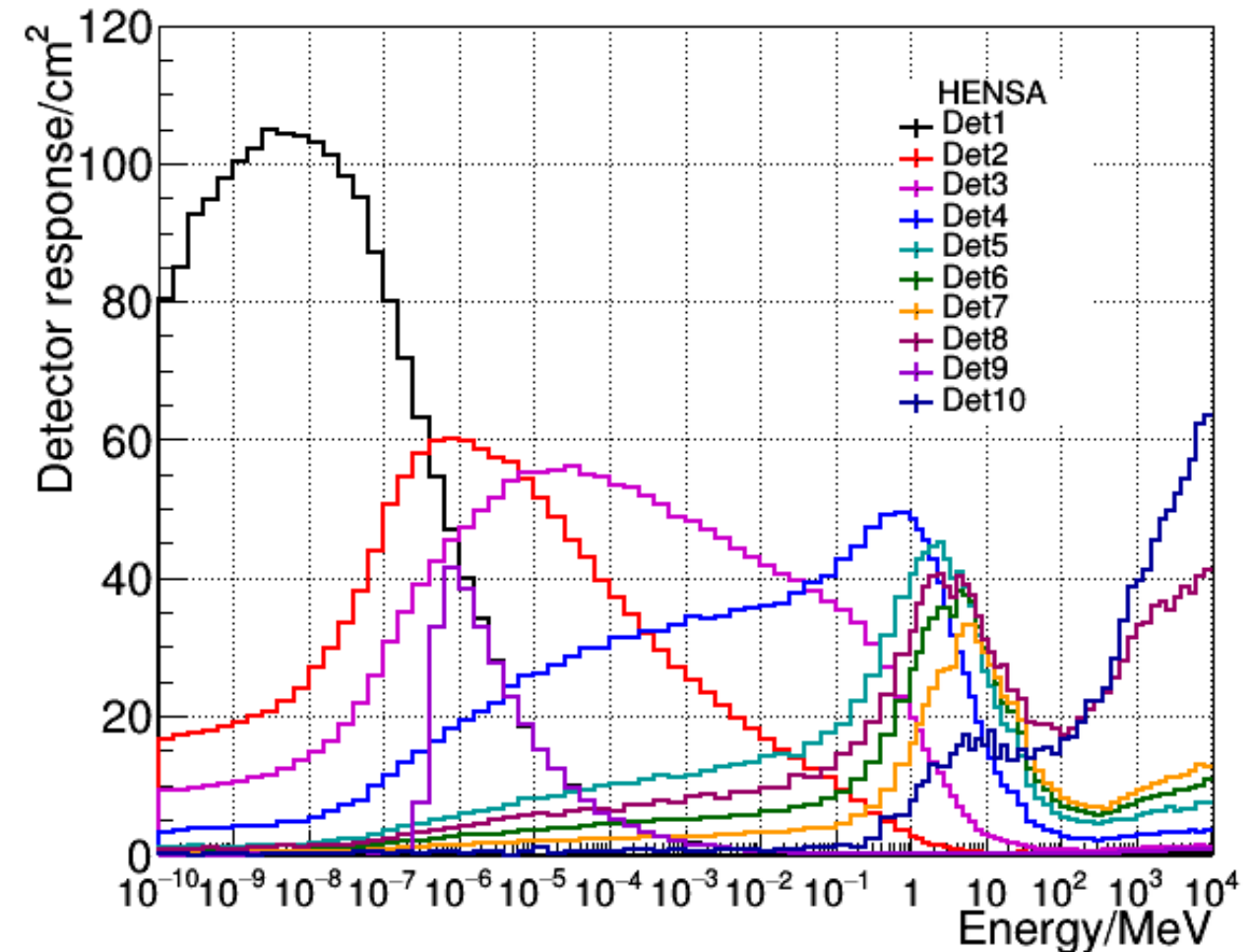
Detection by moderation – Bonner Sphere Approach



Also see poster by Thomas Hensel: „Ambient Neutron Background in the Felsenkeller Underground Laboratory”

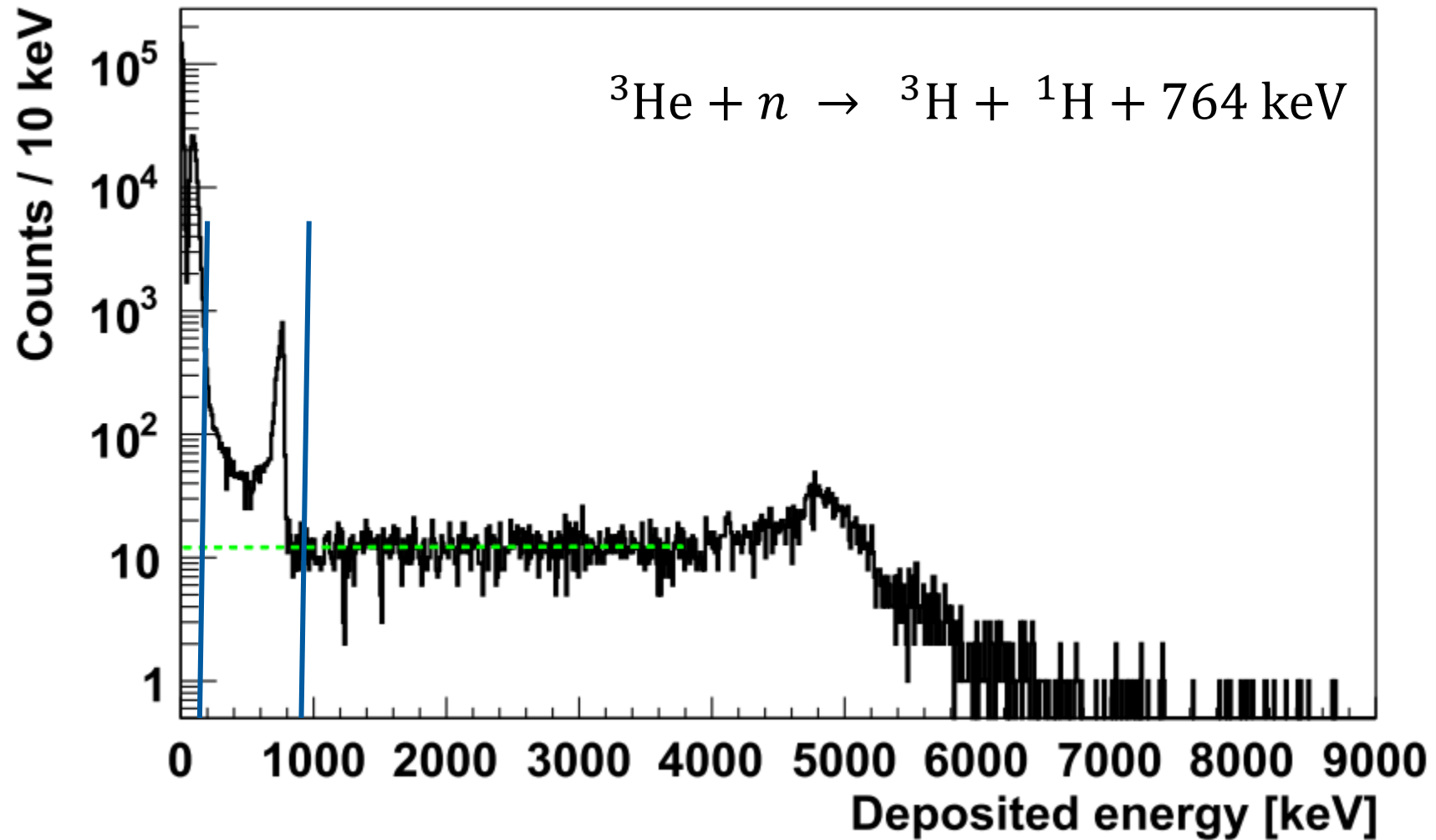
Detection by moderation – Bonner Sphere Approach

Detector name	Material	Dimensions
Det1	Bare (LND-252248)	2.54 cm × 60 cm ³ He tube
Det2	HDPE	4.5 × 4.5 × 70 cm ³
Det3	HDPE	7.0 × 7.0 × 70 cm ³
Det4	HDPE	12.0 × 12.0 × 70 cm ³
Det5	HDPE	18.0 × 18.0 × 70 cm ³
Det6	HDPE	22.5 × 22.5 × 70 cm ³
Det7	HDPE	27.0 × 27.0 × 70 cm ³
Det8	HDPE + Pb	21.0 × 21.0 × 70 cm ³ + 5 mm Pb
Det9	Cd	0.5 mm Cd
Det10	HDPE + Pb + Cd	25.0 × 25.0 × 70 cm ³ + 0.75 mm Cd + 10 mm Pb

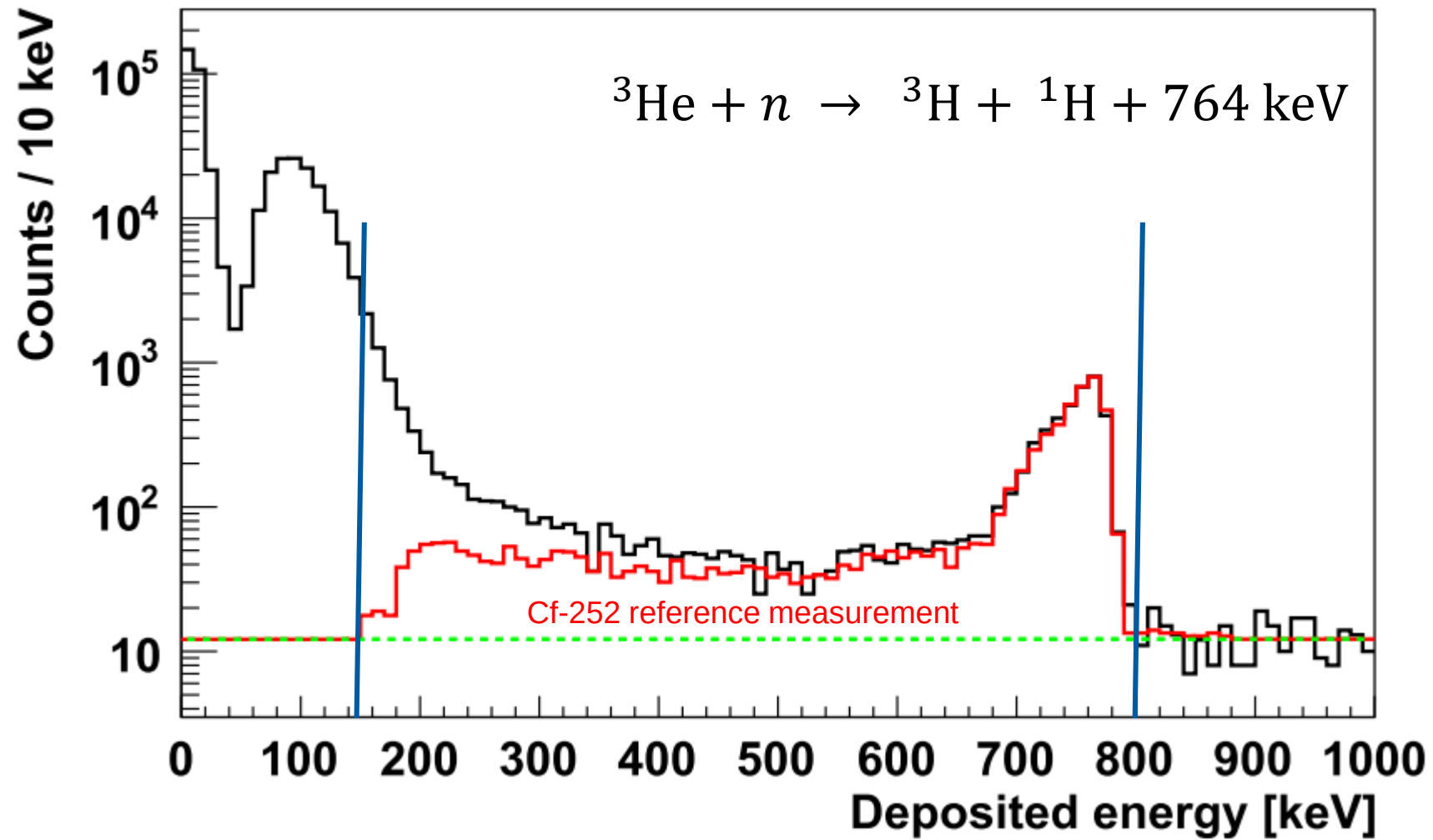


15 times higher neutron response. Underground settings: ~1 count/h.

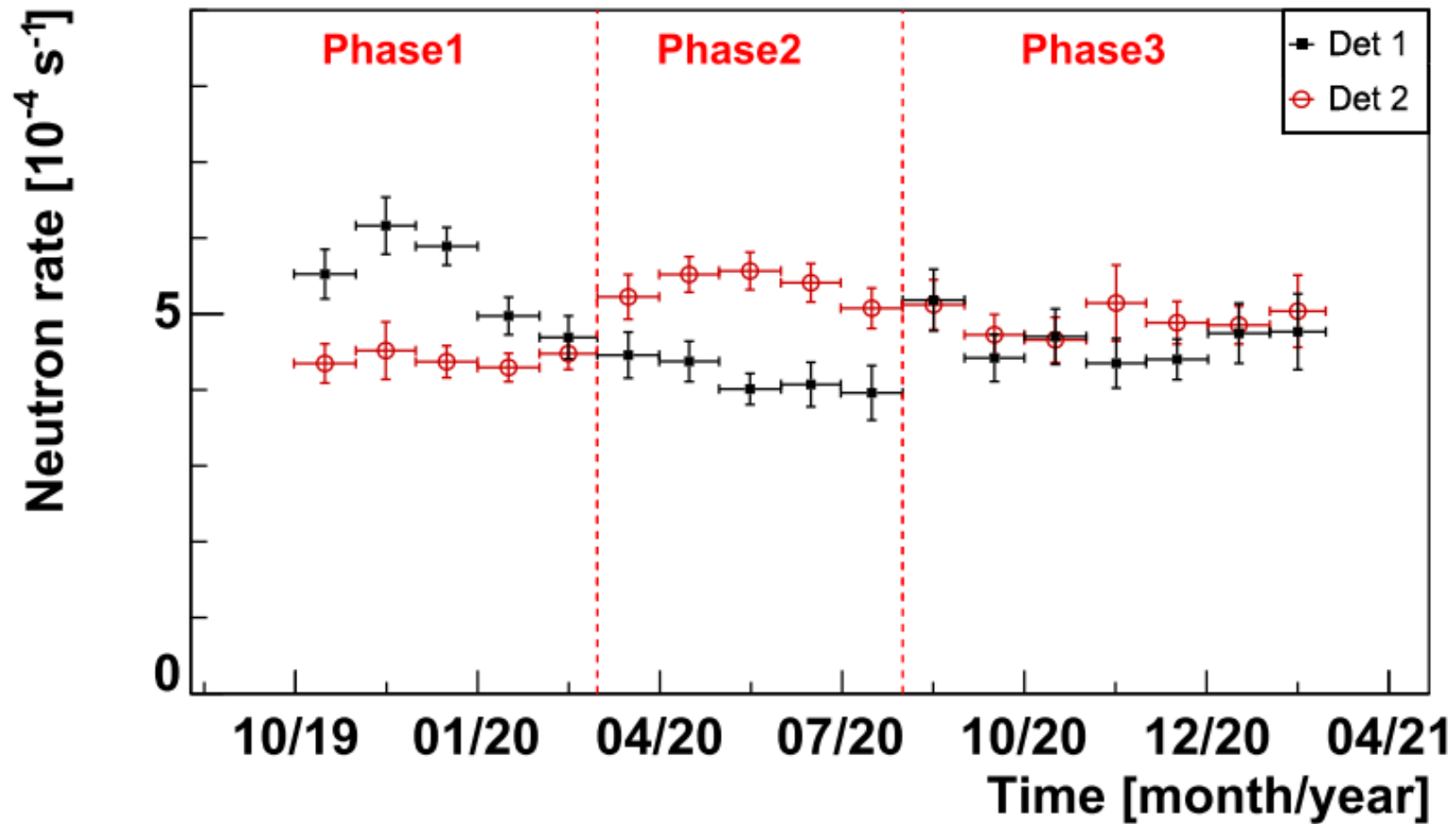
Typical Pulse Height Spectrum – Det1



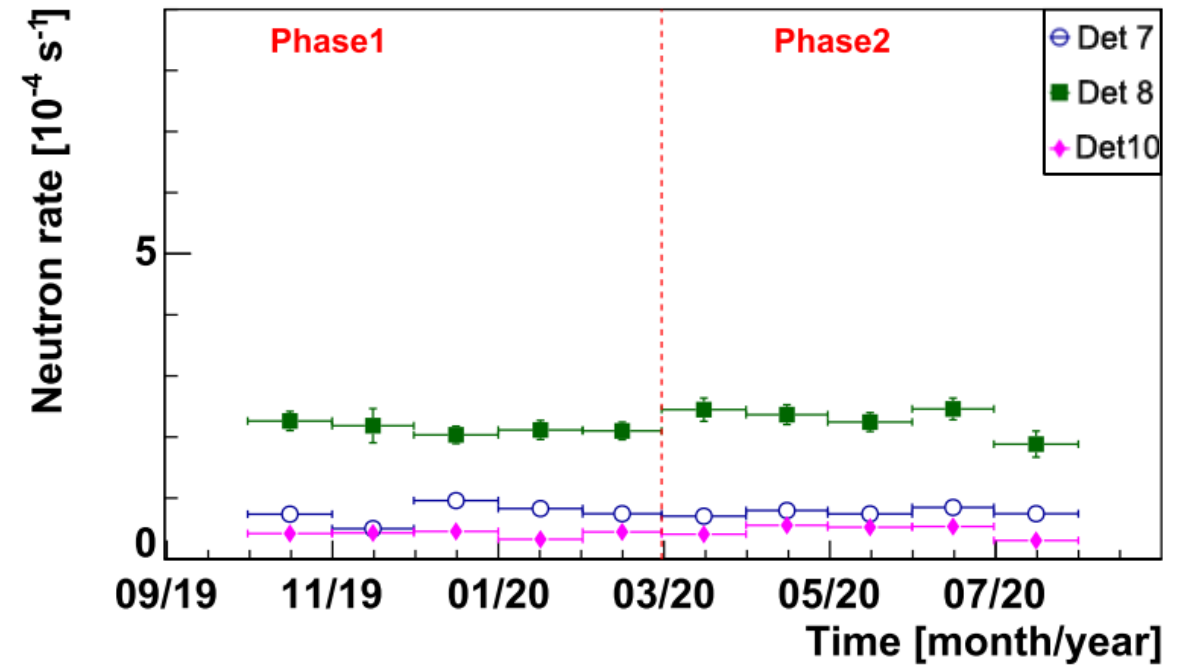
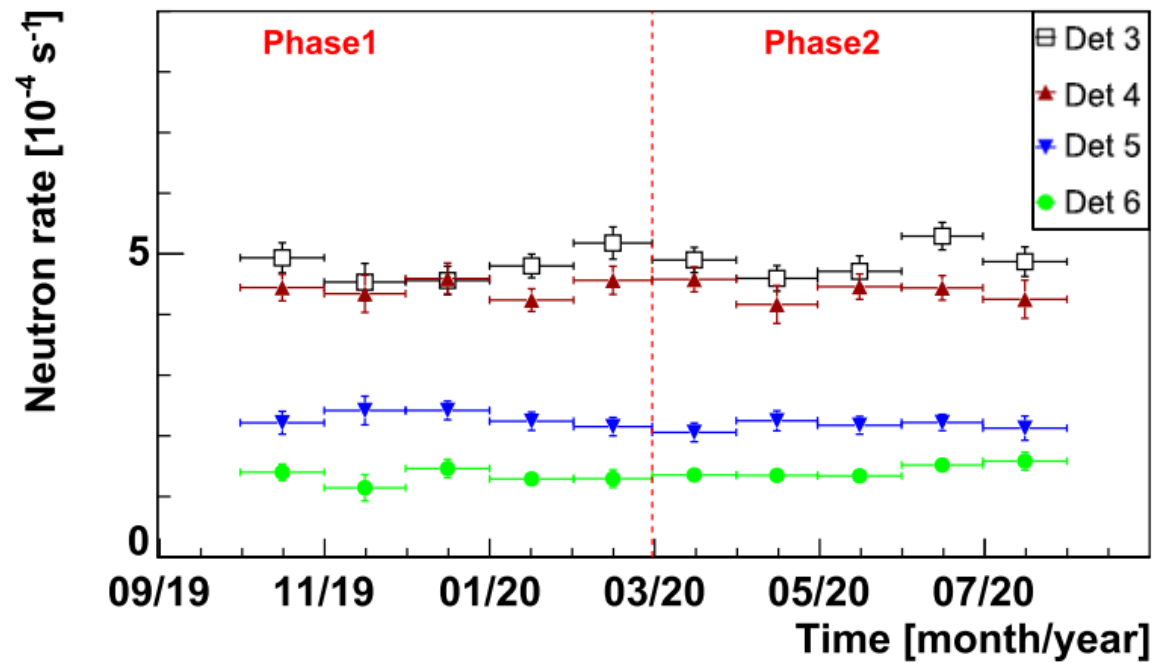
Typical Pulse Height Spectrum – Det1



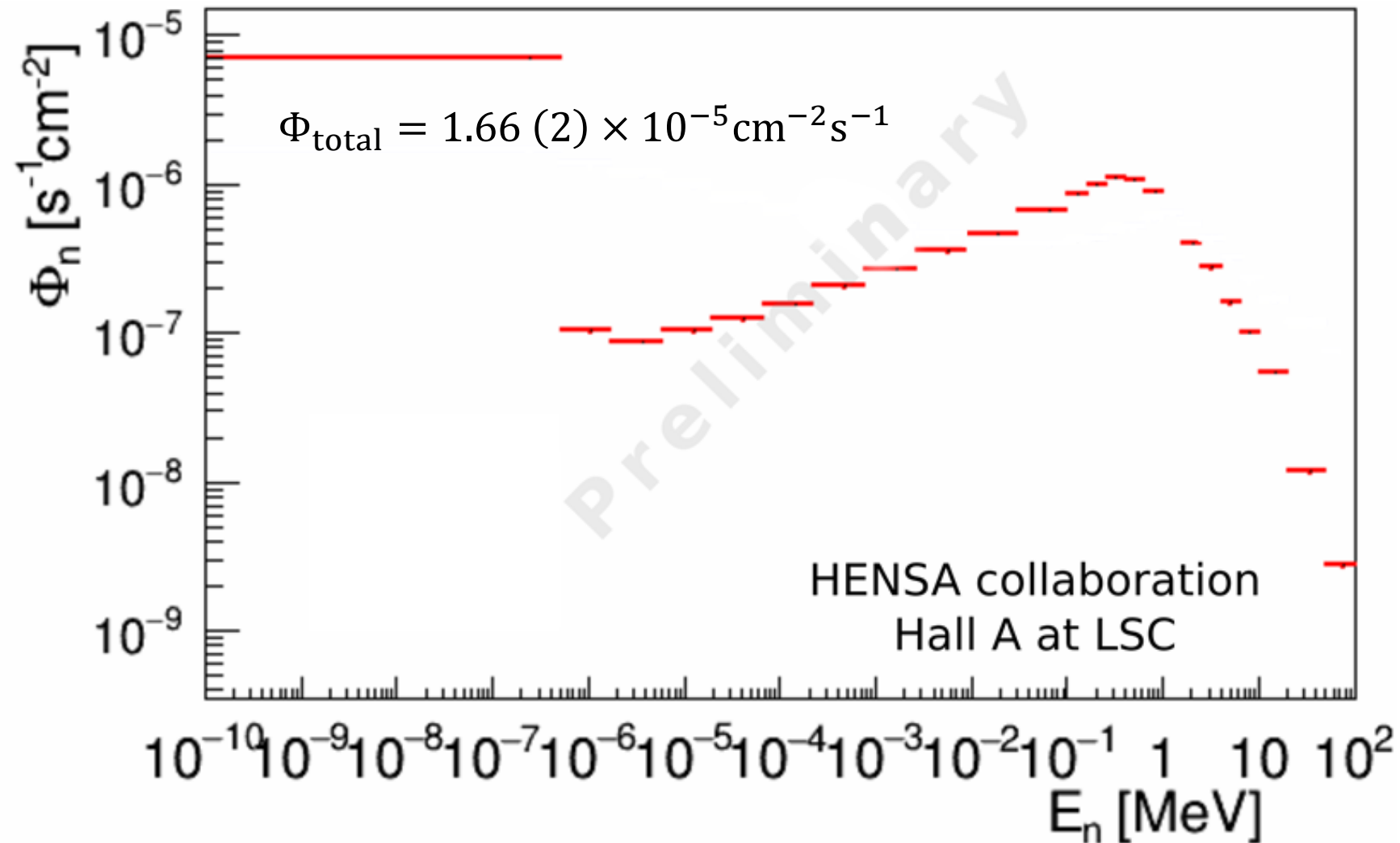
Results in Hall A



Results in Hall A



Results in Hall A



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