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Evidence of reproducible tritium production in a pulsed light-water electrolytic cell

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September, 9, 2025

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Abstract

Reproducibility has long been the main barrier to broad scientific acceptance of low-energy nuclear reactions (LENR). A simple, repeatable experiment that produces nuclides not present in nature, such as tritium, would constitute definitive evidence of low-energy nuclear transmutation. Although tritium has been reported in earlier studies, limited reproducibility and other issues have tempered the impact of those claims. As Storms observed, tritium is the least ambiguous and most readily measured product of the cold-fusion effect[20]. Here we present a simple, low-cost experiment that reproducibly generates a mildly radioactive gas, whose tritium content has been confirmed by independent laboratories.

Keywords: Low Energy Nuclear Reactions (LENR); nickel light water electrolysis; tritium; Nuclear Active Environments (NAE); charge clusters

1 Introduction

The production of small amounts of tritium in both electrolytic cells and in gas reactors has been reported since 1989. The generation of even very small amount of tritium, at low temperature, in environments that contain only non radioactive elements, implies the presence of a new kind of nuclear reactions and consequently the necessity of a deep revision of some widely accepted conceptual foundations in physics. Reports of tritium in LENR experiments began shortly after the 1989 announcement by Fleischmann and Pons. Unlike calorimetric heat measurements, tritium detection offers a nuclear signature that cannot be easily explained by chemical processes. However, issues of contamination, reproducibility, isotopic enrichment, and closed system validation have made interpretation challenging.

Early claims likely received insufficient attention for two main reasons: the lack of full reproducibility in many experiments and the absence of explanations within the framework of established science. The reproducibility of the experiment presented in this work was

achieved after few year of trials which finally lead to understanding the combined effects of the several variables that allow to start and to keep the reactions alive. The operation of this innovative electrolytic cell is based on discoveries about the effects of specific electromagnetic stimuli on matter in both liquid and solid states. This experimental result will be presented along with a preliminary hypothesis, based on the formation of a localized coherent states of electrons in Nuclear Active Environments (NAE) that may explain such surprising behavior [21, 22].

1.1 Previous works

Evidence for tritium has been reported across several LENR modalities, including Pd/D electrolysis, gas loading, co-deposition, and low-voltage discharges. In 1989 Packham and colleagues reported excess tritium in multiple Pd/D_2O electrolytic cells beyond natural background levels. Their work carefully addressed the effects of chemiluminescence and implemented appropriate controls. The early timing of this study made it highly influential, although subsequent replications showed mixed success.[16]

At Los Alamos, Storms and Talcott analyzed over 150 Pd/D_2O electrolytic cells. About 10% of the cells exhibited time dependent tritium growth, with clear contrasts to inactive controls. Their dataset remains one of the most statistically robust in the field, though questions persisted about potential isotope separation effects.[20]

Cedzynska and Will introduced a closed system analytical approach combining distillation, tritium oxidation, and liquid scintillation counting (LSC) to quantify tritium in palladium cathodes. This methodology mitigated losses and false positives, setting a methodological standard for subsequent research. [2]. Building on the earlier methods, Will and collaborators reported also reproducible tritium generation in tightly closed Pd/D_2SO_4 cells, while matched control cells produced no activity. Their work emphasized complete phase mass balance, making it one of the clearest demonstrations of LENR-associated tritium.[23].

The Indian BARC program, led by Iyengar and Srinivasan, produced an extensive early body of LENR research, emphasizing tritium as a major product in Pd and Ti systems. Their national laboratory scale resources allowed systematic testing, though international verification was limited at the time.[10]

In a complementary effort, Krishnan et al. investigated gas loaded Pd and PdAg targets, reporting elevated tritium-to-deuterium ratios in the gas phase . Their results suggested that tritium could be produced outside liquid electrolysis, broadening the experimental landscape.[13]

Adzic and co-workers combined tritium measurements with detailed studies of deuterium loading in Pd cathodes. They argued that simple enrichment or contamination could not explain all of their observations, adding weight to the nuclear hypothesis.[1]

Claytor and colleagues reported tritium production in low-voltage deuterium discharges on Pd and Pd-alloys . Results were batch- and material-dependent, reinforcing the notion that local material conditions play a critical role in LENR activity.[4]

Mosier-Boss and collaborators at SPAWAR reviewed two decades of Pd/D co-deposition studies, highlighting improved reproducibility and multiple nuclear signatures, including

tritium, heat, and energetic particles. Their co-deposition protocol remains a widely adopted approach in the LENR community[15].

Finally, some authors cautioned that isotopic enrichment and separation can bias apparent tritium signals in D₂O systems, concerns that are mitigated in pure light-water operation [5].

2 Experimental setup

The cell consists in a plastic cubic that contains the control electronics and a pyrex glass container filled with 750 cm^3 of ultra pure water (Farmalabor) with a submerged pure (99.99% Sigma-Aldrich) Nickel wire, 1.3 meter long, with a diameter of 300 μ coiled around a plastic support. The wire is surface treated with an abrasive containing nanodiamonds. The wire is crossed by a continuous current of about 1.2 A superimposed on narrow current pulses with high dI/dt that have low averaged power (around 100mW). The wire is irradiated by radio frequency generator (Agilent E4421B or UnaOhm GS123A) adjusted in the range 10-100MHz/0.2-1mW. The cell is in a region with a quite uniform magnetic field tuned by two large Helmholtz coils.

A 660 nm, 2mW laser illuminates an experimentally found active region of the wire. Photons in the keV region are monitored by a First Sensor X100-7 THD detector coupled with a very low noise amplifier followed by an event counter. The average laboratory background registered by the detector is less than one count per second (CPS) while the water temperature at startup, measured by a PT100 sensor and an alcohol thermometer, is equal to the ambient temperature (approximately 22°C).

3 Experimental results

In a typical experiment, the number of detected events gradually rises to about 10 counts per second (CPS) within fifteen to twenty minutes after startup. In this period a fine manual tuning of some parameters as RF frequency is required. In the next fifteen minutes without any further adjustment the number of count per seconds reaches the value of about 20 CPS, while the temperature of the water reaches the value of about 40 °C and the external glass container the value of 36 °C.

Surprisingly, reducing the current to about half its initial value causes only a brief decrease of one CPS, followed by a spontaneous increase to around 23 CPS, accompanied by a water temperature rise to 43°C.

After ten minutes a further current reduction to about 370 mA is followed by an increase of the counts that reaches the value of 25 CPS. After a complete current switch off the number of events per second remained steady around the value of 20-24 CPS for about 30 minutes. No neutrons or high energy gamma have been revealed using an He3 detector and a Ludlum PC-based gamma spectrometer. This keV range radiation is probably due to the formation of tritium, considering that its presence, in this kind of reactors build by the author, has been confirmed by two independent laboratories. The unused ultrapure water does not contain any measurable quantity of tritium. It's interesting to

note that the enriching of the ultrapure water with D_2O does not enhance the production of tritium and that this generation vanishes in pure heavy water.

Technicians from the ENEA (Ente Nazionale Energie Alternative) Department of Fusion and Nuclear Safety Technologies, invited by Prometeon SRL (Bologna), visited the Belluno site of Solitonix SRL on June 16, 2022. The objective was to verify the presence of tritium and radioactive emission generated by a previous version of the cell and by the water used in the research project. The researchers collected two liquid samples, one from the reactor and the other from the ultra pure water tank used for the experiment. The test, performed some days after the inspection, revealed the presence of tritium in the sample taken from the reactor, and none in the blank water from the supplier tank. The reactor was also tested by Tekkna SRL (Potenza) in December 2022: two physicists, one of whom was a nuclear physicist signed a third-party report certifying the presence of tritium generated by a nuclear reaction.

The reproducibility of the tritium signal in independent analyses, the consistency of the data from the various Geiger counters used, and the replication by third-party laboratories reinforce and make it difficult to dispute the authentic nuclear origin of the effects detected.

Finally, a perfect temporal correlation of the data from the laboratory dosimeter (RadiaCode RC 102, a thallium doped cesium hydride detector), with the days the reactor was powered, further confirms the nuclear nature of the observed radiation

4 Discussion

The results presented here provide evidence that tritium can be generated in a pulsed electrolytic system. The observed increase in tritium concentration cannot be accounted for by contamination or by conventional nuclear processes, which predict vanishingly small reaction probabilities under the present experimental conditions. Instead, the findings suggest that *non-conventional* nuclear reactions may have been established within peculiar metal environments, considering that the tritium emission from the nickel wire was not uniform but localized in small confined active region. One possible framework for interpreting these results is the concept of Nuclear Active Environments (NAE), as discussed by Storms, in which nanometric gaps or defects accumulate anomalous high densities of electrons [21].

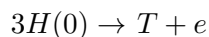
Within such sites, the Coulomb barrier between deuterons may be effectively screened, allowing interactions at distances of a few picometers. In this context, coherence is probably the central concept: electrons, when organized into collective assemblies, can stabilize charge clusters through the balance of Coulomb and Lorentz forces, producing quasi-bosonic behavior and creating conditions favorable for nuclear interaction [22, 11, 12]. In these models, coherent charge assemblies, also referred to as Exotic Vacuum Objects (EVOs) [19, 3, 17], emerge from the synchronized zitterbewegung motion of electron charges. Such coherence is probably the key to understanding how nuclear interactions may proceed under conditions that would normally be non-reactive. When protons are embedded in such clusters, they may enter Ultra Dense Hydrogen states [8,

7]where internuclear separations shrink to picometers.

The pulsed operation of the cell appears to play a decisive role in promoting the formation of these coherent states. Rapid variations in current and voltage generate abrupt changes in local electromagnetic potentials. By the Aharonov–Bohm effect, such variations can impose a synchronized phase shift on the zitterbewegung of many electrons simultaneously, favoring the emergence of coherent aggregates [18, 6].

The laser, the magnetic field, and the RF source may contribute to reducing the entropy of electron states, thereby facilitating the formation of coherent clusters, Ultra-Dense Hydrogen (UDH), or other picometer-scale aggregates [14].

One such pathway may involve the collapse of a chain of three UDH units $H(0)$ into a tritium nucleus:



according to this hypothesis, a chain of three ultra-dense hydrogen units reorganizes into a triton and an electron, releasing energy without emitting neutrons or high energy gamma rays, as momentum conservation results in the electron carrying away most of the energy

This feature of the present findings, the absence of significant neutron or high-energy gamma radiation, is a characteristic of LENR reactions. In such systems, most of the released energy is absorbed primarily by electrons rather than being carried away as hard radiation.

The reproducibility of the tritium signal in independent runs strengthens the case for a genuine nuclear origin rather than chemical or environmental artifacts. It will also be important to examine whether tritium formation is accompanied by other coherent transmutation products, as happens in other many-body LENR experiments [9].

Taken together, these observations indicate that the pulsed electrolytic cell provides a unique environment where coherence creates pathways for nuclear processes otherwise inaccessible at ambient conditions. While the detailed microscopic mechanism remains to be clarified, the evidence supports the conclusion that tritium generation in this system is a real and reproducible manifestation of low-energy nuclear reactions driven by collective coherence.

5 Possible future improvements

While the present work demonstrates reproducible evidence for tritium generation, several refinements can further strengthen the observed effect and its interpretation.

A first priority is a rigorous quantification of tritium using a closed-system approach with liquid scintillation counting, a recombination catalyst and also the isotopic analysis of the nickel wire. It is also important to consider the study of various methods to enhance the nanogap density within the wire.

The X100-7 THD sensor should be verified against a traceable tritium β source to establish absolute sensitivity.

A more extensive metering of DC current, RF excitation, and laser power, synchronized with the radiation count series, would better clarify whether coherent nuclear-active states appear only under specific electromagnetic driving conditions.

Further, complementary radiation diagnostics should be integrated with the use of an High Purity Germanium (HPGe) spectrometer, setting more stringent bounds on branching channels. Together, these improvements could also help validate the possible link between observed tritium production and emerging theoretical models of coherent charge clusters, ultra-dense hydrogen, and nuclear active environments.

6 Conclusions

The experiments described here demonstrate reproducible tritium generation in a pulsed nickel-light-water electrolytic cell. Independent laboratory tests confirmed its presence in active runs but not in controls, ruling out contamination. No high-energy neutrons or hard gamma radiation were observed, supporting an aneutronic reaction pathway.

These findings suggest that coherent electronic structures or ultra-dense hydrogen states may provide conditions for nuclear processes at ambient energy. Although the precise mechanism remains unclear, the reproducibility of the results supports the authenticity of the effect.

Acknowledgments

I dedicate this work to Antonella, who quietly passed away, but who is always with me. I thank Ubaldo Mastromatteo for his invaluable friendship and for the teachings and equipment he provided for this research. I especially thank Guido Parchi and my friend and talented laboratory technician Fernando Rosso.

I thank Francesco Celani, Alberto Iocco, and Giorgio Vassallo for their invaluable assistance.

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7 Appendix A



Servizi per
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LAB N. 1644 L

C2022_0105 - BIANCO -								
Campione	Metodo Prova	Radionuclide	Unità di Misura	Valore Risultati	Incertezza di Misura**	MCR	Valore di Parametro*	Data di Esecuzione
C2022_0105_H	UNI EN ISO 9698:2019	Trizio	Bq/l	< MCR	-	8,600	100	22/04/2022

* Valore di parametro come da D.Lgs n° 28 - 2016

** Fattore di copertura K=2 con intervallo di confidenza pari al 95%

#1 Standard di riferimento Alfa Totale: Am-241

#2 Standard di riferimento Beta Totale: Sr-90

#3 L'attività del Rn-222 è riferita alla data e all'ora di prelievo del campione

FINE RAPPORTO DI PROVA N. CAR-2022-809 rev.0

Il Responsabile del Laboratorio

Dr. Leonardo Baldassarre

Fisico - Specialista in Fisica Sanitaria
Esperto di Radioprotezione 3° Grado n. 584.

tritium analysis of the ultrapure water



Servizi per
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Fisica Sanitaria
Dosimetria



LAB N. 1644 L

C2022_0104 - CAMPIONE 02 -

Campione	Metodo Prova	Radionuclide	Unità di Misura	Valore Risultati	Incertezza di Misura**	MCR	Valore di Parametro*	Data di Esecuzione
C2022_0104_H	UNI EN ISO 9698:2019	Trizio	Bq/l	45,330	16,600	10,200	100	22/04/2022

* Valore di parametro come da D.Lgs n° 28 - 2016

** Fattore di copertura K=2 con intervallo di confidenza pari al 95%

#1 Standard di riferimento Alfa Totale: Am-241

#2 Standard di riferimento Beta Totale: Sr-90

#3 L'attività del Rn-222 è riferita alla data e all'ora di prelievo del campione

FINE RAPPORTO DI PROVA N. CAR-2022-808 rev.0

Il Responsabile del Laboratorio

Dr. Leonardo Baldassarre

Fisico - Specialista in Fisica Sanitaria
Esperto di Radioprotezione 3° Grado n. 584.

tritium analysis of the water used in the reactor



Dipartimento Fusione e Tecnologie per la Sicurezza Nucleare
Divisione Sicurezza e Sostenibilità del Nucleare
Laboratorio Metodi e Tecniche Nucleari per la Sicurezza,
il Monitoraggio e la Tracciabilità
U.O. Radioecologia

RAPPORTO di ANALISI

n° BELLUNO.01

Campioni di: *Acqua per analisi Trizio*
che ci sono stati recapitati il: *16/06/2022*

per conto dell'Istituto: *PROMETEON S.R.L.*
sede legale in Bologna (BO), Via Delle Rose, 48 – CAP 40136

Sigla Campione	Attività ^3H (Bq/l)	Errore (%)
Campione 1 (16/06/2022)	• 18	20
Campione 2 (27/06/2022)	MDL (0,35)	20

Data di riferimento = **29/06/2022**

Limite di rivelazione (Minimum Detection Limit) DL = 0.354 Bq/l

Strumento di misura utilizzato: **Scintillatore Liquido Quantulus 1220**

Procedura Tecnica di rif.: **PRO TNMT 04** - Istruzione Operativa di rif.: **ISL TNMT 09** (senza arricchimento elettrolitico)

L'ENEA è sollevato da ogni responsabilità circa l'utilizzazione dei risultati di misura qui riportati.

Il presente rapporto di analisi si riferisce al singolo campione analizzato.

Il presente documento si compone di n° 1 pagina e non può essere riprodotto parzialmente se non previa autorizzazione del laboratorio.

Data di emissione: **19/07/2022**

Il Responsabile del Laboratorio

Dipartimento Fusione e Tecnologie
per la Sicurezza Nucleare
Divisione Sicurezza e Sostenibilità del
Nucleare

Centro Ricerche "E. Clementel"
Via Martiri di Monte Sole 4
40129 - Bologna

Tel. +39-051-6098888
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ENEA tritium analysis: "Campione 2" is the unused water sample, "Campione 1" the used one



VERBALE DI REPLICA DI TERZE PARTI

Il giorno 18 dicembre 2022 in Baragiano Zona Industriale (Pz) presso la sede della Tekkna s.r.l. sono presenti:

- a) l'amministratore della TEKNA srl il signor Alberto Iocco;
- b) l'avvocato Fabrizio Righes per la Solitonix S.r.l.;
- c) il tecnico della Solitonix s.r.l. signor Fernando Rosso.

Sulla base delle indicazioni fornite dalla Solitonix s.r.l. la società Tekkna srl ha realizzato la copia di un apparato, già costruito dalla Solitonix s.r.l. che denominiamo "reattore", apparato che si sostiene essere in grado di produrre gas Trizio, isotopo dell'Idrogeno.

d) Alle ore 18 il "reattore" viene acceso dopo essere stato caricato con acqua per uso clinico prodotta in data 13/12/2022 dalla S.M. Farmaceutici s.r.l. con sede in Tito Scalo (PZ), di cui viene fornito il documento di analisi.

Sequenza della prova effettuata:

- 1) Verifica che su tutti gli elementi presenti, generatore, strumenti di misura, non è presente alcuna parte che emetta radiazioni superiori a quelle di valore naturale di fondo della radioattività.
- 2) Verifica del valore di radioattività ambientale del laboratorio della TEKNA s.r.l., non si riscontrano anomalie.
- 3) In una parte del "reattore", costituito da una vaschetta in vetro, (modificata per contenere l'acqua (d) ed una parte degli apparati necessari alla produzione del gas), viene versata l'acqua demineralizzata indicata al punto (d).
- 4) Viene acceso l'impianto generatore.

Esecuzione della prova

Per verificare la produzione del gas nell'acqua, il sistema di apparecchiature denominate "reattore" è stato acceso per un'ora.

(Tra le attrezzature necessarie alle prove è presente un bollitore per acqua termostato a 40°C).

Sequenza delle operazioni effettuate:

- aa) Prelievo di un campione di acqua trattata che è stata posta nel bollitore termostato;
- bb) Sul bollitore è stato posto un raccogliore di gas a forma cilindro-conica (cono) realizzato in materiale plastico;
- cc) Acceso il bollitore per un tempo di 10 minuti.
- dd) Il contenitore plastico (cono) è stato posto su un apparato rilevatore di "radiazioni beta".

Rilevazione effettuata

Il misuratore di radiazioni beta ha rilevato una elevata quantità di energia radiata in emissioni beta.

L'emissione da parte del campione è durata durata dalle ore 20 alle ore 23 come visibile dal grafico che viene allegato.



Il giorno seguente (19 dicembre 2022) si è provveduto ad effettuare un'altra prova che ha dato il medesimo risultato.

Si è provveduto quindi a raccogliere due campioni l'uno con l'acqua, riferimento (d) trattata e l'altro non trattato, (campione bianco e un campione contenente l'acqua oggetto della reazione).

I due campioni raccolti sono stati spediti dalla Tekkna S.r.l. al laboratorio di analisi LB in Roma.

Dal rapporto di prova n. TNK023_0826 redatto il 15/02/2023 si evince che il campione prodotto il 18/12/2022 è stato analizzato il 27/01/2023 e riporta la presenza del radionuclide H-3 (Isotopo dell'Idrogeno denominato Trizio).

Risultato della prova

La verifica certificata del laboratorio LB di Roma da piena conferma del sistema di produzione di gas Trizio tramite le apparecchiature progettate dal Dott. Fabrizio Righes e denominate "reattore".

Alla prova erano altresì presenti il dott. Biscione Marco docente di Fisica Nucleare e laboratorio ed il dott. Nino Enrico Docente di Fisica all'università di Potenza che a loro volta sottoscrivono il presente verbale per conferma.

In fede l'amministratore della Tekkna s.r.l. signor Alberto Iocco.

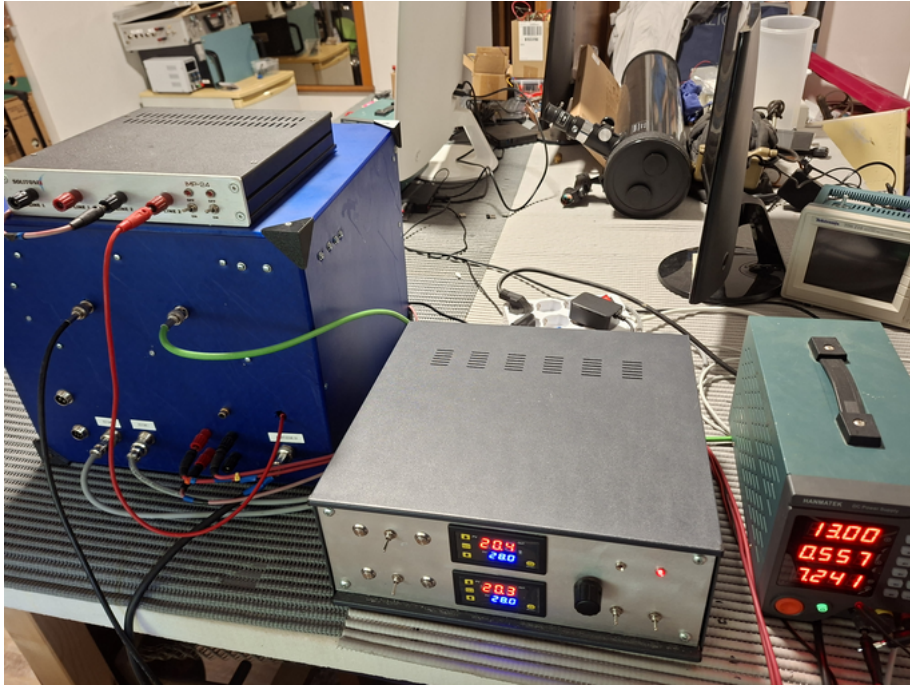
Il Professor Biscione Marco

Il Professor Nino Enrico

Allegati Certificati delle analisi del campione di bianco e del campione inserito nel reattore oltre che dell'acqua utilizzata per il funzionamento del reattore, nonché il grafico del contatore geiger del 18/12/22.

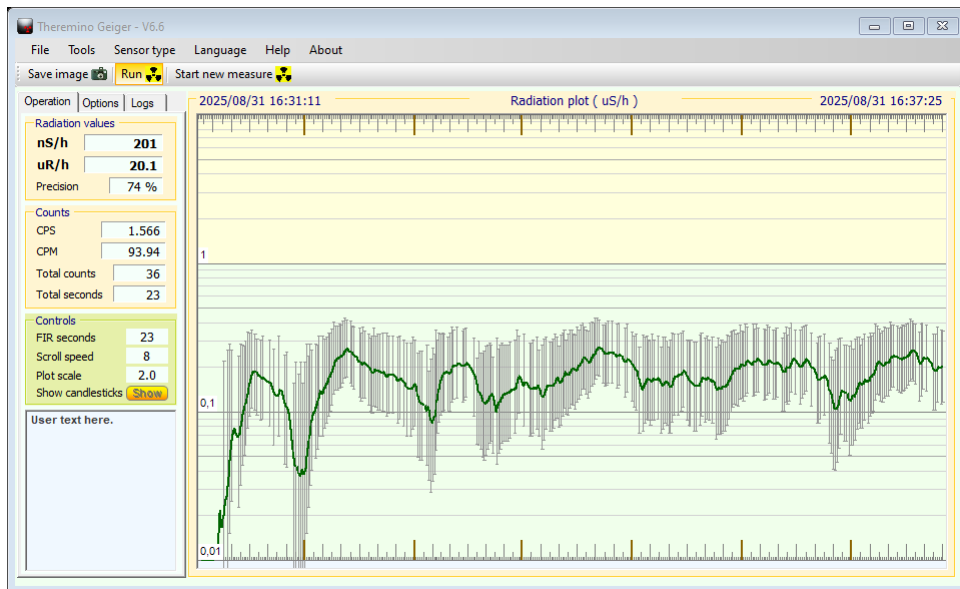
TEKKNA s.r.l.
Alberto IOCCO

8 Appendix B



The reactor is in the blue container

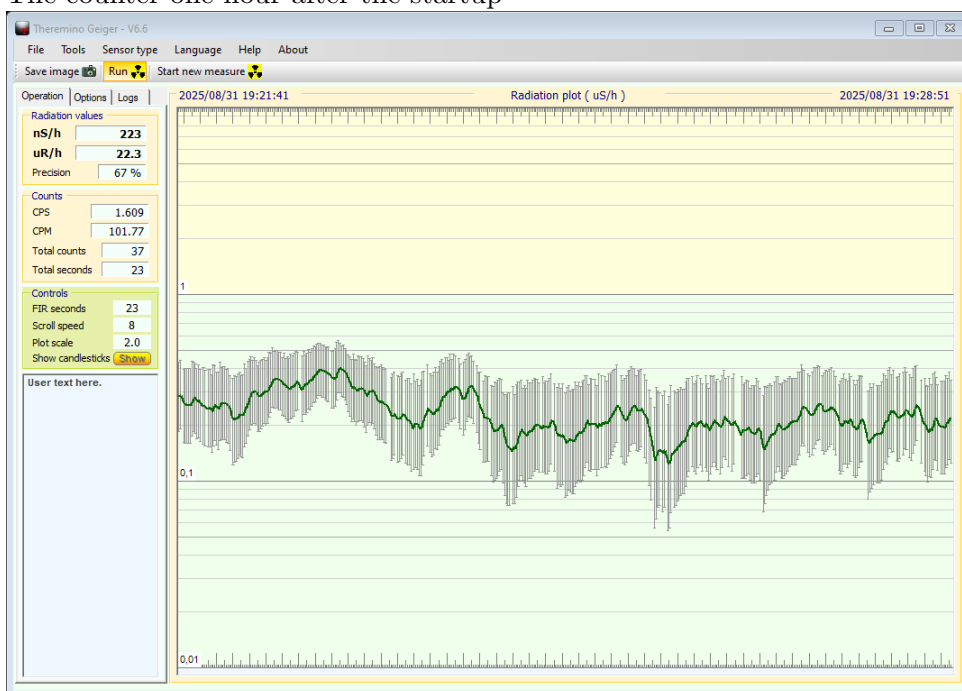
9 Appendix C



The counter soon after the startup



The counter one hour after the startup



The counter two hours after turn-off