Alternatives To Calorimetry

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Since the first publication of Martin Fleischman and Stanley Pons in 1989, the majority of articles in the LENR field have focused on calorimetry. [1] This is true for both electrolysis experiments and gaseous loading experiments. [2]

Many calorimetry experiments are masterpieces of science [3] Nevertheless, despite the experimental evidence, the results indicating excessive heat have not convinced the scientific community. Well-designed calorimetry experiments are slow to develop. It's an issue, because it would be good to test many alloys systematically. It is likely that there are still unknown alloys whose ability to generate what Ed Storms calls a "Nuclear Active Environment" [4] is greater than that of palladium. It is certain that low concentrations of elements such as lithium, boron, beryllium in these alloys will have undoubtedly positive effects. We need fast and reproducible tests to sort all these alloys and select the most promising samples. Several authors have suggested that the quantum condensation of deuterium nuclei is at the root of the appearance of "NAE" [5] [6] [7] [8]

For this purpose, we propose three simple techniques to implement:

1) The "Fusion Diode" effect: deuterated alloys in contact with a semiconductor cause the appearance of an easy-to-measure electrical voltage. If this voltage is actually due to the direct conversion of LENR, we have a simple method to select the most promising alloys.

2) The Reifenschweiler effect [9]: the variation of tritium beta-rays bremsthralung conversion efficiency as a function of temperature is also a simple method for sorting the most efficient alloys. [10]

3) The magnetic alignment of the tritium pairs: this effect, which we have postulated, but not yet observed, would make it possible to very quickly test many new alloys. [11]

4) The rare neutrons observed are one of the most indisputable proofs of the reality of LENR. A new and extremely sensitive method of detecting neutrons in the 4Pi of space around a LENR device will also be discussed, along with two new improved calorimetry methods.

[1] M. Fleischman and S. Pons. *J. Electroanal. Chem*., (261):301, 1989

[2] Parkhomov, A. and E. Belousova, *Research into Heat Generators Similar to High-temperature Rossi Reactor.* J. Condensed Matter Nucl. Sci., 2016. **19**.

[3] Mc Kubre, M.C.H. et al. Calorimetry and Electrochemistry in the D/Pd System. In the First Annual Conference on Cold Fusion. 1990. University of Utah Research Park, Salt Lake City, Utah, National Cold Fusion Institute]

[4] Storms, E. What Conditions Are Required To Initiate The Lenr Effect? in Tenth International Conference on Cold Fusion. 2003. Cambridge, MA

[5] Hypothesis of the Diafluidity. Fabrice David. *FUSION* n° 49 jan.-fev. 1994 (french edition of *XXIth Century Science et Technology*)

[6] F. Premuda, D.Boni, and De Pasca. La superconduttivita nel palladio carico di deuterio. *XXI Secolo Scienza e Technologia*, 1 :24-31, 1997

[7] Paolo Tripodi, Daniele Di Gioacchino and Jenny Darja Vinko. Superconductivity in PdH: Phenomenological explanation. Physica C Superconductivity 408(1): 350-352, august 2004.

[8] Kim, Y.E. and T.O. Passell. Alternative Interpretation of Low-Energy Nuclear Reaction Processes with Deuterated Metals Based on The Bose-Einstein Condensation Mechanism. in Eleventh International Conference on Condensed Matter Nuclear Science. 2004. Marseille, France.

[9] O. Reifenschweiler, Phys. Lett. A., 184, 149 (1994)

[10] F. David, J. Giles, Beta-decay of tritium as a probe for Bose-Einstein Condensates in metallic lattices. Proceeding of the 17th RCCNT-BL, Sochi, September 26-oct. 3, 2010

[11] About Discrete Breathers And LENR, Fabrice David, 14 th International Workshop on Anomalies in Hydrogen Loaded Metals Asti, Italy , 5-9 june 2017

ALTERNATIVES TO CALORIMETRY

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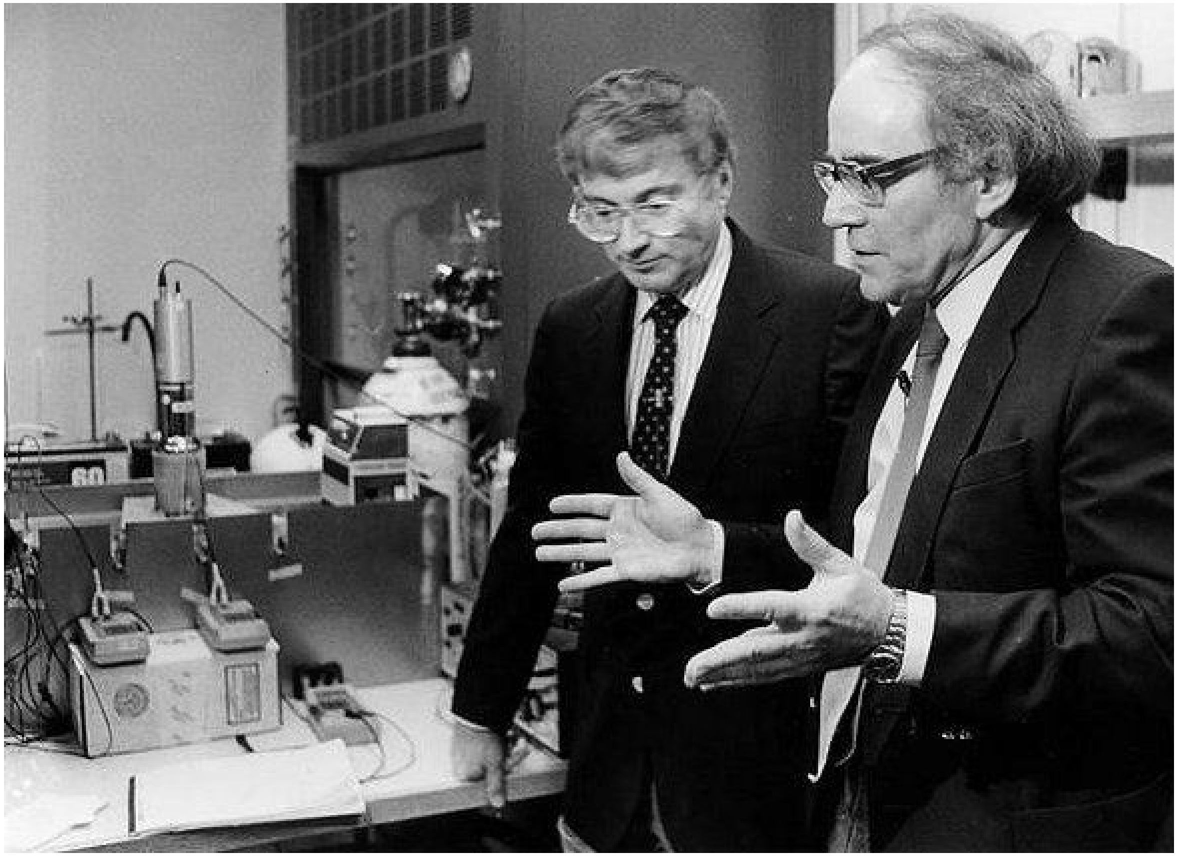
ICCF 21, Colorado State University, Fort Collins, Co.
3-8 june 2018



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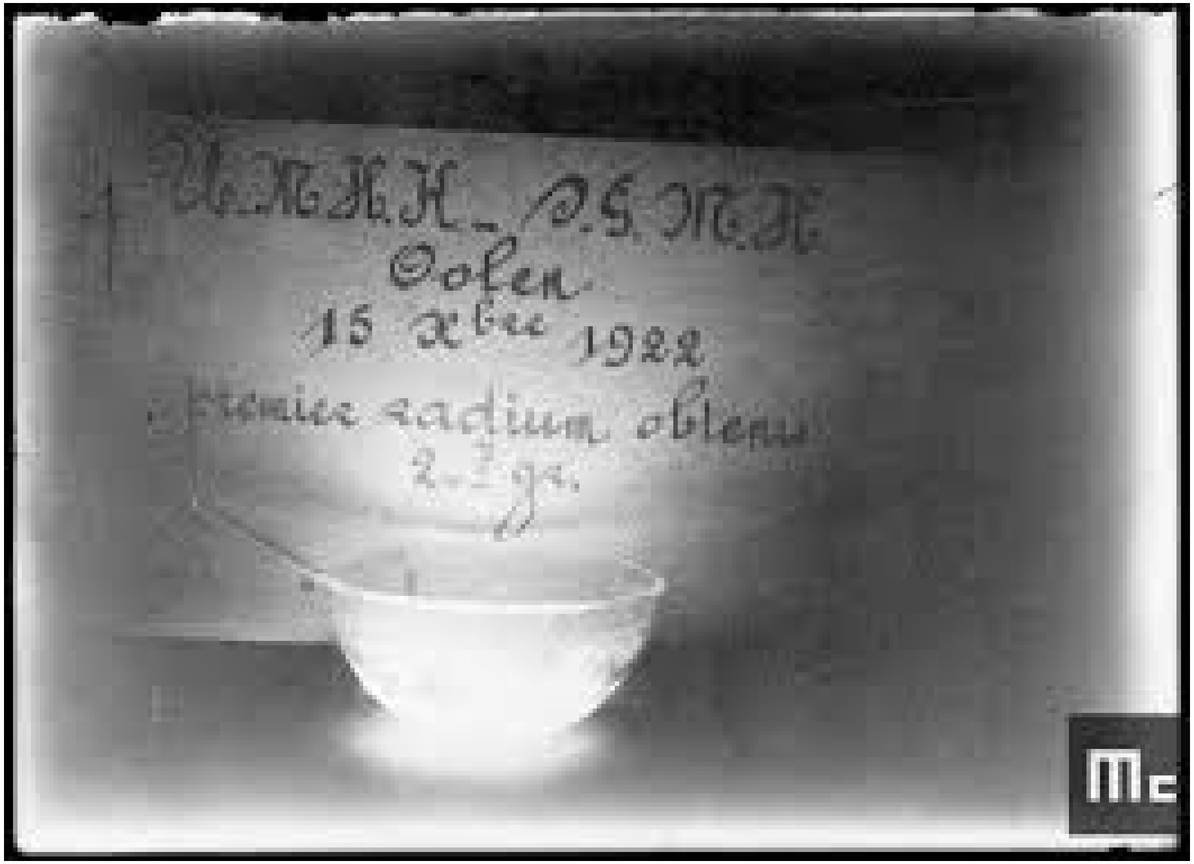


Many calorimetry experiments are masterpieces of science [3] Nevertheless, despite the experimental evidence, the results indicating excessive heat have not convinced the scientific community. Well-designed calorimetry experiments take a very long time to be developed. It's an issue, because it would be good to test many alloys systematically.

Type of Hydride	Metal/ Alloy	Hydride	Structure	Wt.% Hydrogen	Peq., T(K)
Elemental	Pd	$PdH_{0.6}$	*Fm3m*	0.56	0.02 bar @ 298K
AB_5	$LaNi_5$	$LaNi_5H_6$	*P6/mm*	1.37	2 bar @ 298K
AB_2	ZrV_2	$ZrV_2H_{5.5}$	*Fd3m*	3.01	10^{-8} bar @ 323 K
A_2B	Mg_2Ni	Mg_2NiH_4	*P6mm*	3.59	1 bar @ 555 K
AB	FeTi	$FeTiH_2$	*Pm3m*	1.89	5 bar @ 303 K
BCC	TiV_2	TiV_2H_4	*BCC*	2.6	10 bar @ 313 K

Intermetallic Compounds and their Hydrogen Storage Properties comparing to palladium. From “Metal Hydrides for MnH batteriy Applications, Danesh Chandra, Wen-Ming Chien and Anjali Talekar, University of Wisconsin, Material Matters, Vol 6, n°2, Sigma-Aldrich eds, 2010

]

No.	Type	Selected Hydride	Temperature (K) @ 1 atm. *pH2* (des.)	*pH2* (des.) (atm.) @ 298K	Wt.% Hyd.	Density (g/cc)	ΔH° kJ/mol	ΔS° kJ/mol.K	Raw Materials Cost $/kg / $/gH
1	AB_5	$MmNi_5$	217	23	1.46	8.6	21.1	0.097	7.94/0.64
2	AB_5	$MmNi_{4.1}5Fe_{0.85}$	241	11.2	1.14	8.1	25.3	0.105	7.12/0.79
3	AB_5	$MmNi_{4.5}Al_{0.5}$	267	3.8	1.20	8.1	28.0	0.105	7.17/0.79
4	AB_5	$LaNi_5$	285	1.8	1.49	8.3	30.8	0.18	9.87/0.77
5	AB_5	$LaNi_{4.8}Sn_{0.2}$	312	0.5	1.40	8.4	32.8	0.105	9.69/0.78
6	AB_5	$CaNi_5$	316	0.5	1.87	6.6	31.9	0.101	7.56/0.76
7	AB_5	$MmNi_{3.5}Co_{0.7}Al_{0.8}$	346	0.11	1.24	7.6	39.8	0.115	13.25/2.50
8	AB_5	$LaNi_{4.25}Al_{0.75}$	377	0.024	1.13	7.6	44.1	0.117	9.68/1.24
9	AB_2	$TiCr_{1.8}$	182	182	2.43	6	20.1	0.111	8.64/1.02
10	AB_2	$TiZr_{0.02}V_{0.43}Fe_{0.09}Cr_{0.05}Mn_{01.5}$	245	11	1.90	5.8	27.4	0.122	4.82/0.37
11	AB_2	$TiMn_{1.5}$	252	8.4	1.86	6.4	28.7	0.114	4.99/0.44
12	AB_2	$ZrFe_{1.5}Cr_{0.5}$	263	4	1.50	7.6	25.6	0.097	10.90/1.21
13	AB_2	$TiMn_{1.4}V_{0.62}$	268	3.6	2.15	5.8	28.6	0.016	29.40/2.67
14	AB_2	$ZrMn_2$	440	0.0001	1.77	7.4	53.2	0.121	11.29/1.25
15	A_2B	Mg_2NiH_4	528	0.00001	3.60	-	43.2	0.14	6.26/0.19
16	AB	TiFe	265	4.1	1.86	6.5	28.1	0.106	4.68/0.31
17	AB	$TiFe_{0.85}Mn_{0.15}$	276	2.6	1.90	6.5	29.5	0.107	4.83/0.32
18	AB	$TiFe_{0.8}Ni_{0.2}$	346	0.1	1.30	6.5	41.2	0.119	5.5/0.68
19	SS*	$(V_{0.9}Ti_{0.1})_{0.95}Fe_{0.05}$	309	0.5	3.70	6.0	43.2	0.140	10.63/0.59

It is likely that there are still unknown alloys whose ability to generate what Dr. Ed Storms calls a "Nuclear Active Environment" [4] is greater than that of palladium. It is certain that low concentrations of elements such as lithium, boron, beryllium in these alloys will have undoubtedly positive effects. We need fast and reproducible tests to sort all these alloys and select the most promising samples. Several authors have suggested that the quantum condensation of deuterium nuclei is at the root of the appearance of "NAE" [5] [6] [7] [8]. It would be very useful to provide irrefutable proof of the existence of these quantum phases. But on top of that, these quantum phases could provide a relatively easy way to sort out the most useful alloys for LENRs.

For this purpose, we propose three relatively simple techniques :

1) The "Fusion Diode" effect: deuterated alloys in contact with a semiconductor cause the appearance of an easy-to-measure electrical voltage. If this voltage is actually due to the direct conversion of LENR, we have a simple method to select the most promising alloys.

2) The Reifenschweiler effect [9]: the variation of tritium beta-rays bremsthralung conversion efficiency as a function of temperature is also a simple method for sorting the most efficient alloys. [10]

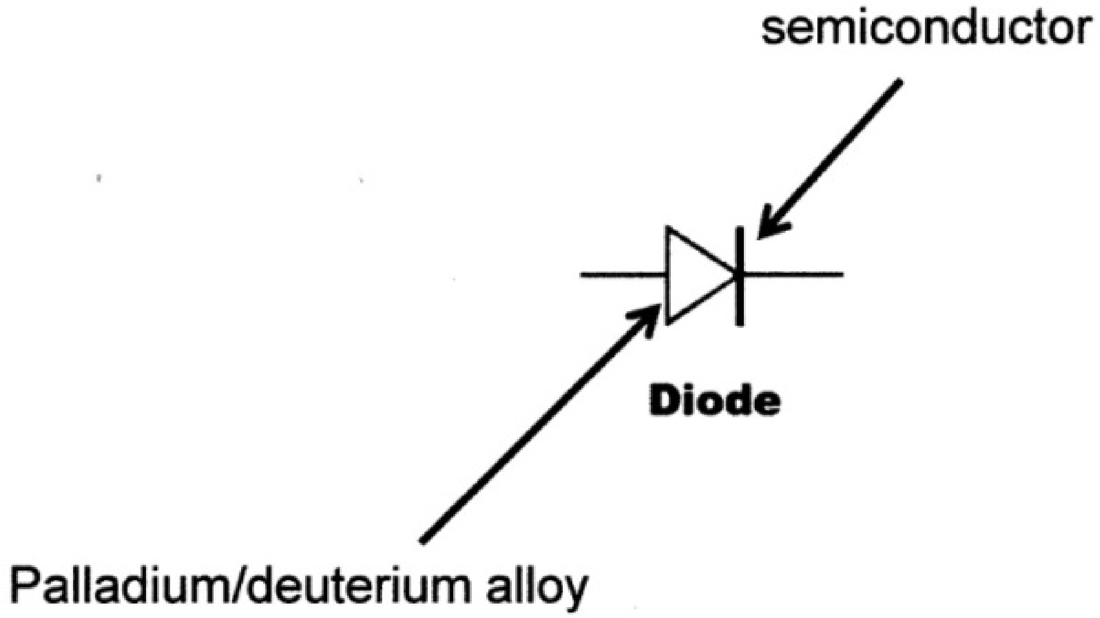
3) The magnetic alignment of the tritium pairs: this effect, which we have postulated, but not yet observed, would make it possible to very quickly test many new alloys. [11]

In this presentation, we want to discuss how it is possible to find alternatives to calorimetric experiments.

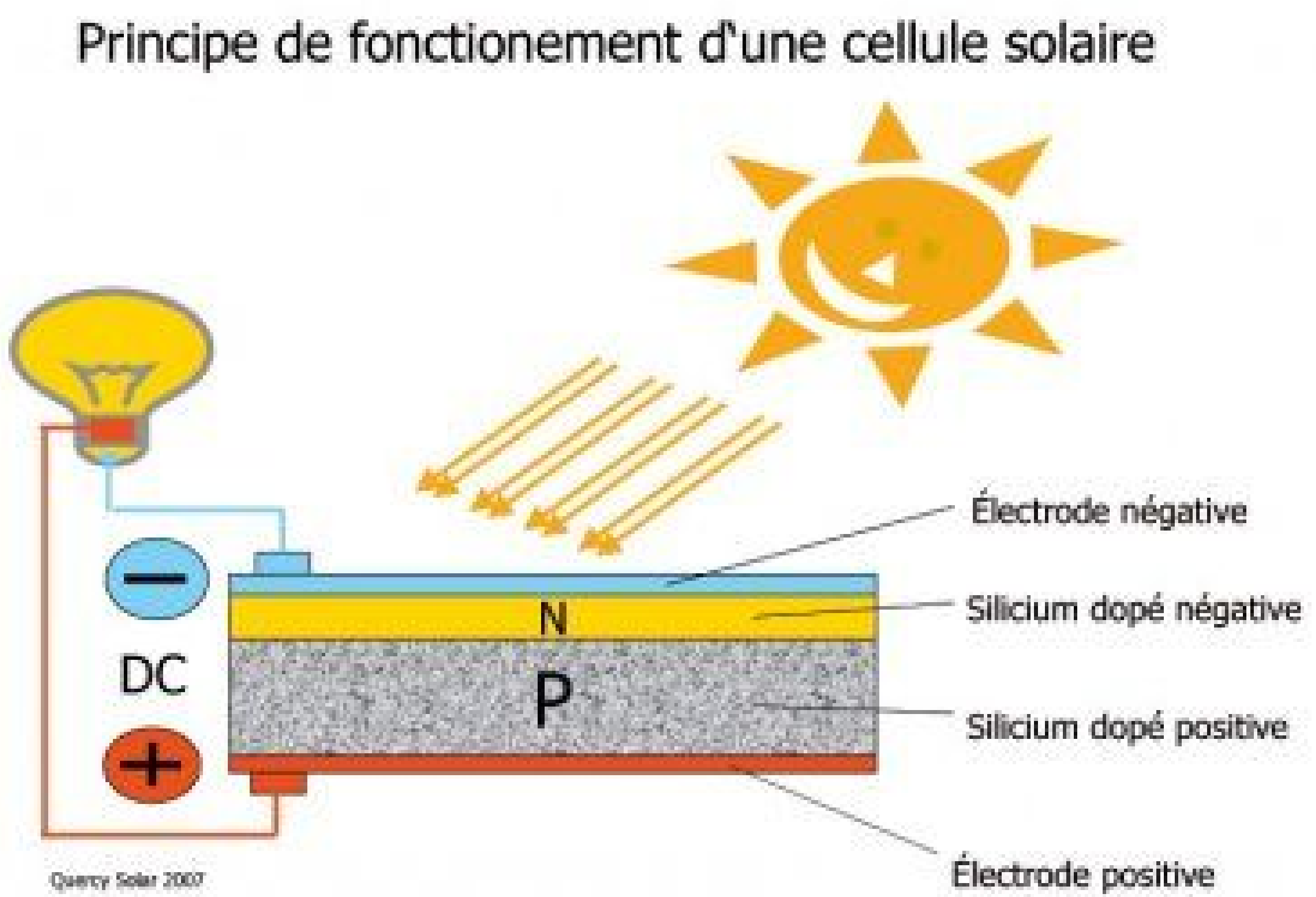
1) The Fusion Diode Effect

It is very difficult to make good calorimetric recordings. It is more easy to count X-rays. But the more easiest way to get a scientific evidence about any kind of phenomena is to do electrical recording.

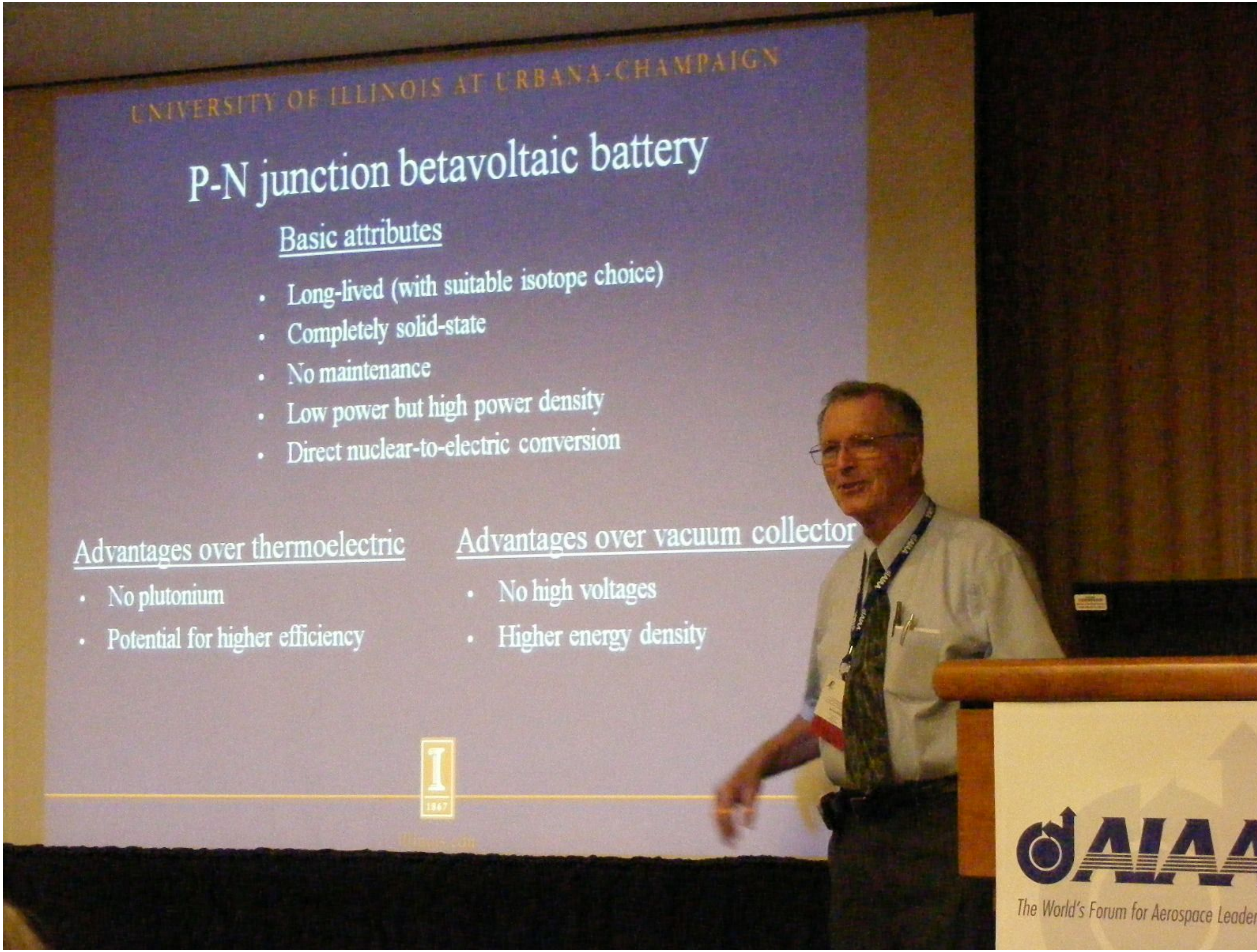
We have suggested the idea of "Fusion Diodes". Fusion diodes are made of a palladium (or other alloys) in close contact with a semiconductor. This is a semiconducting diode.

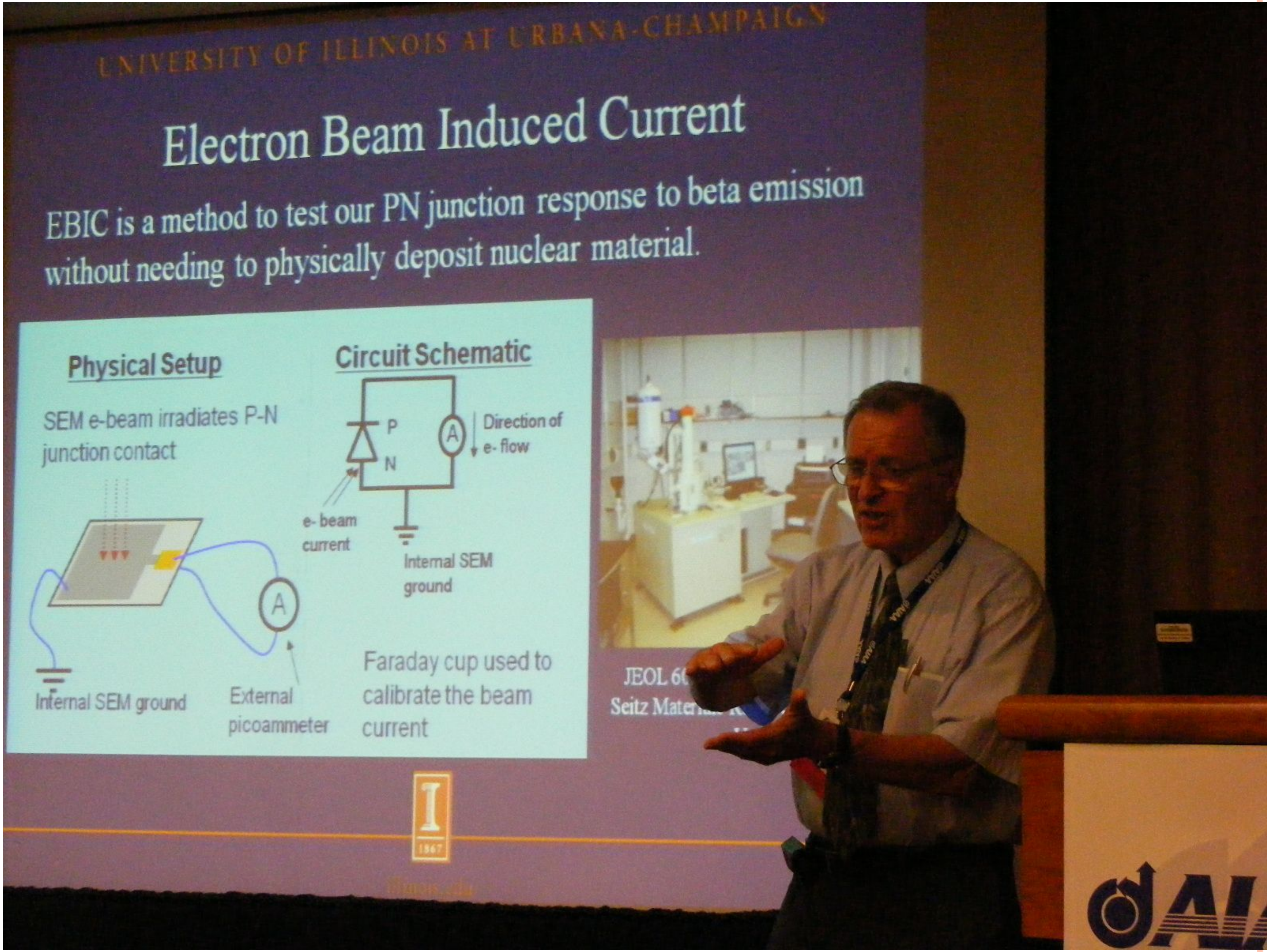


When fusion reactions take place near the metal/semiconductor contact, at the beginning we had high energy quanta, (in the MeV range) and then thermalization occurs, leading to Anomalous Heat Effect **(Down-conversion of Hagelstein).** But before thermalization, the decaying energy match the level of excitation of the electrons of the metal: some energy is transmitted to the electrons before thermalization (Like in a photovoltaic cell, but in our diodes, the energy source is expected to be the fusion of deuterium, protium, or perhaps lithium, Boron, or Beryllium.)



Principe de fonctionement d'une cellule solaire
Électrode négative
N
Silicium dopé négative
DC
P
Silicium dopé positive
Électrode positive
Quercy Solar 2007


UNIVERSITY OF ILLINOIS AT URBANA-CHAMPAIGN
P-N junction betavoltaic battery
Basic attributes
• Long-lived (with suitable isotope choice)
• Completely solid-state
• No maintenance
• Low power but high power density
• Direct nuclear-to-electric conversion
Advantages over thermoelectric
• No plutonium
• Potential for higher efficiency
Advantages over vacuum collector
• No high voltages
• Higher energy density


UNIVERSITY OF ILLINOIS AT URBANA-CHAMPAIGN
Electron Beam Induced Current
EBIC is a method to test our PN junction response to beta emission without needing to physically deposit nuclear material.
Physical Setup
SEM e-beam irradiates P-N junction contact
A
Internal SEM ground
External picoammeter
Circuit Schematic
P
N
A
Direction of e- flow
e- beam current
Internal SEM ground
Faraday cup used to calibrate the beam current
I
1867

We can record the voltage and the intensity of the resulting current at the positive and negative side of the diode. This simple device allows a simple recording of the total output power, because there is no electrical input. We plan to record this electrical energy during months or even years, to exclude the possibility of a chemical origin. It is important to note that theses devices has no electrical input. There is also no thermal input. The energy is released as electrical current, and this is very easy to record with high accuracy. We are using diodes made of palladium as the metal, and silicon as the semiconductor. We have also tried other semiconductors like aluminium nitride and organic semiconducting ink. But we only published our experiments with silicon. The palladium is loaded with deuterium simply by the gas-loading method. We don’t know the effective loading value, but it is probably rather high, because of the micrometer size of the palladium powder.

Fig.3

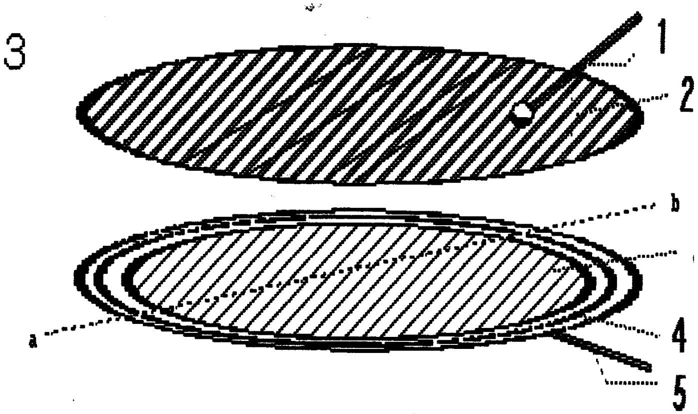
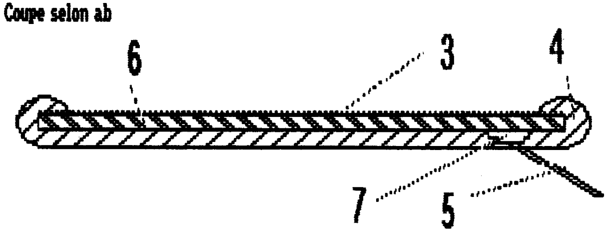
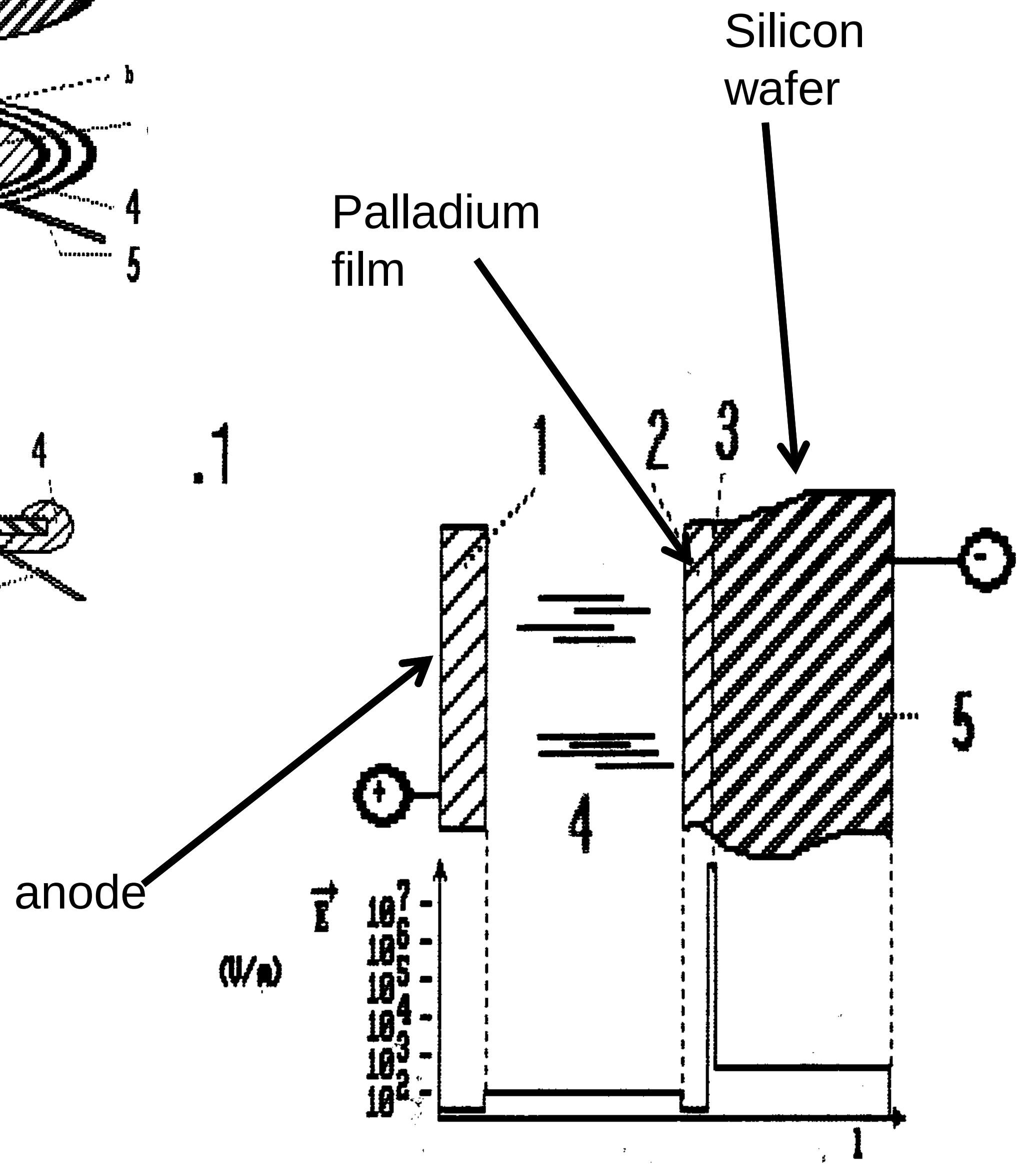
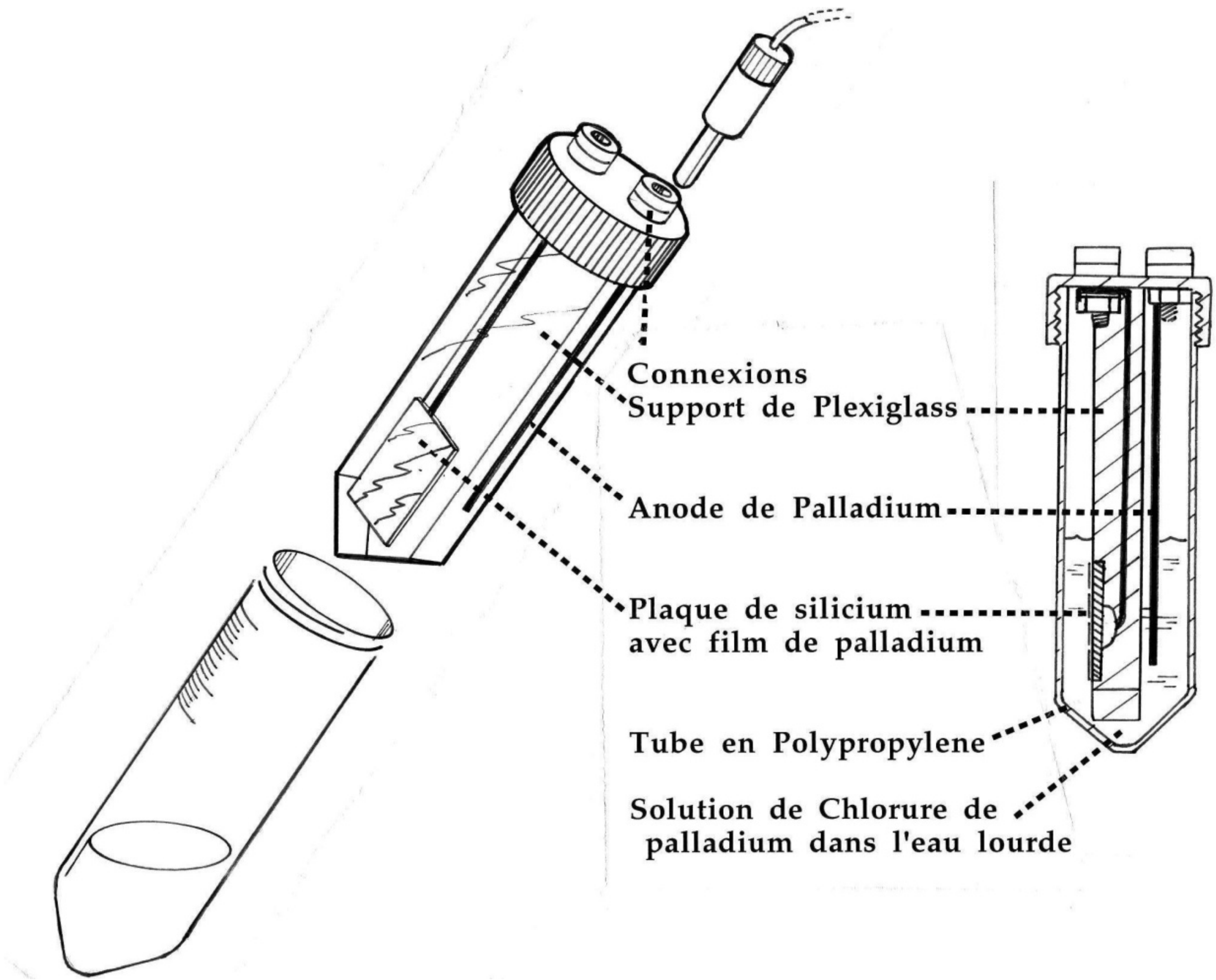


Fig.4 Coupe selon ab

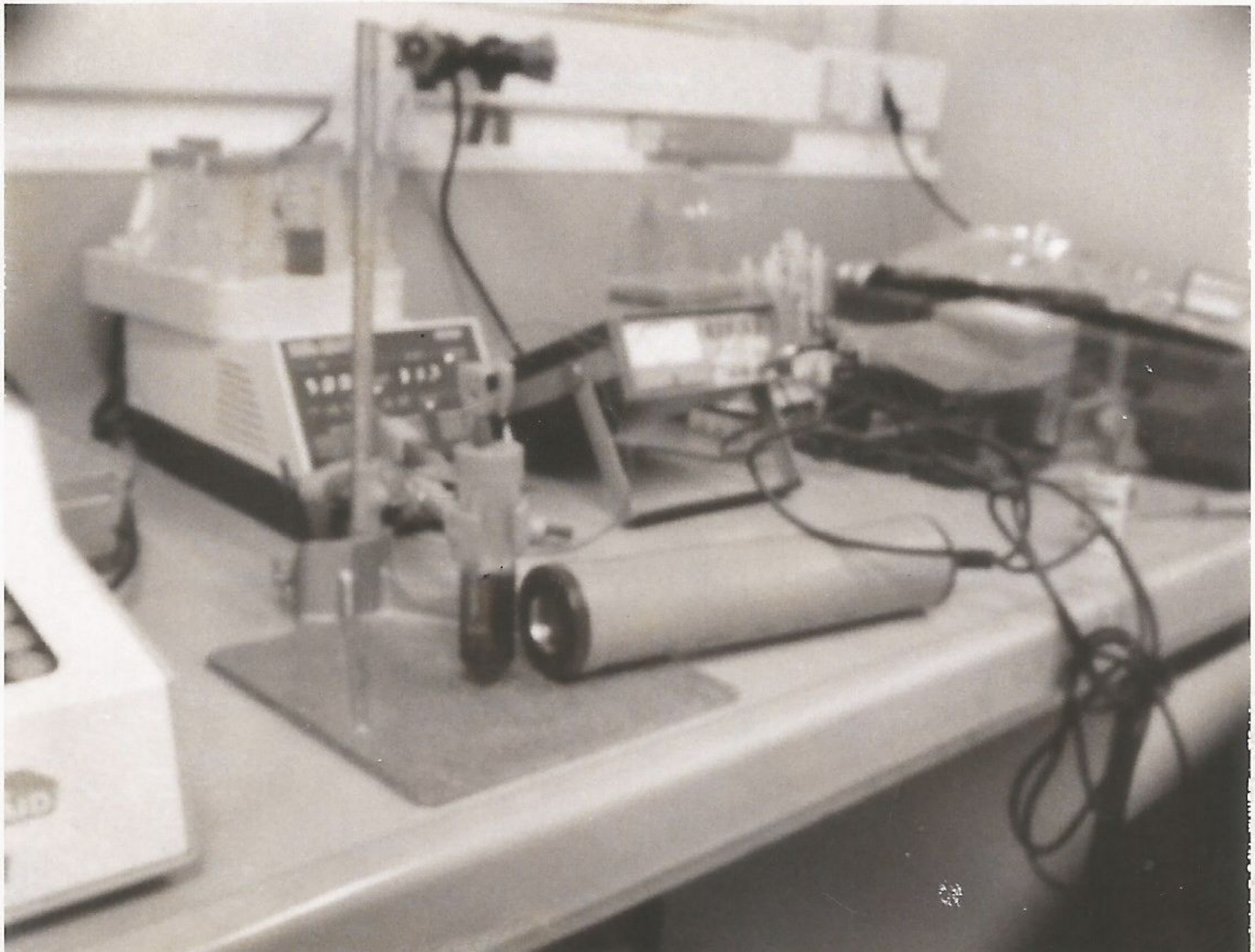




A diode is basically a surface of contact with a metal (electronic conductor) and a semiconductor (hole conductor).


Connexions
Support de Plexiglass
Anode de Palladium
Plaque de silicium
avec film de palladium
Tube en Polypropylene
Solution de Chlorure de
palladium dans l'eau lourde

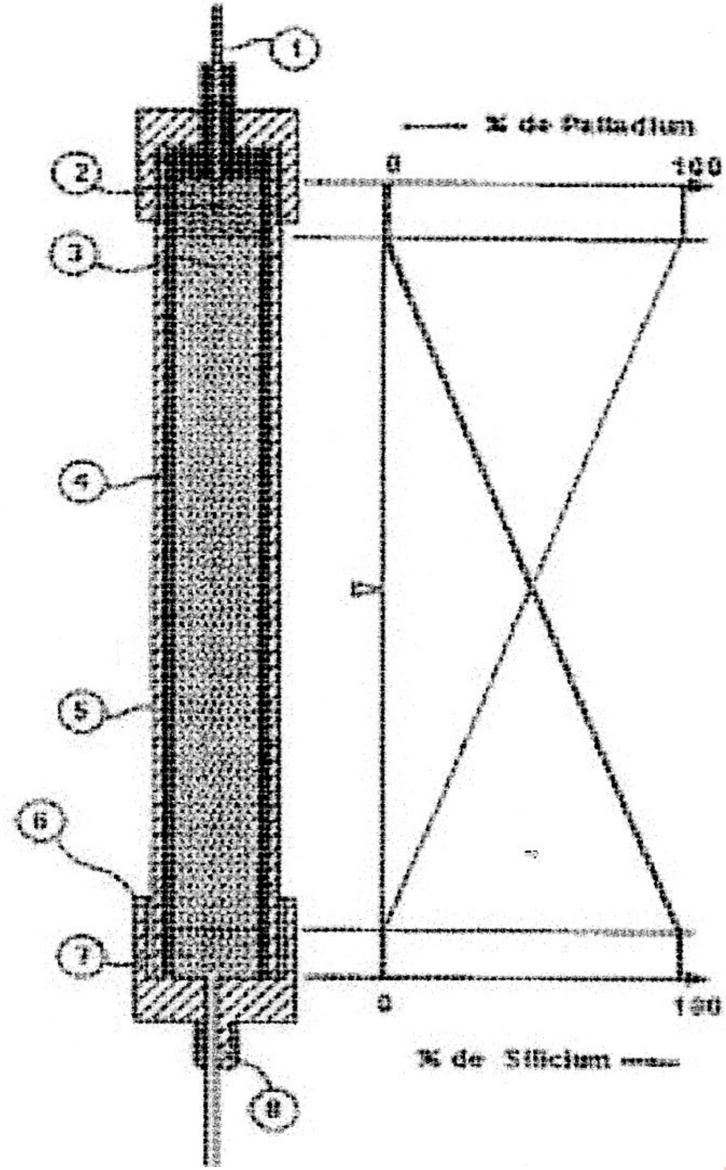

5.0 ml
7.5 ml
10 ml
15 ml
20 ml
25 ml
30 ml
35 ml
40 ml
45 ml

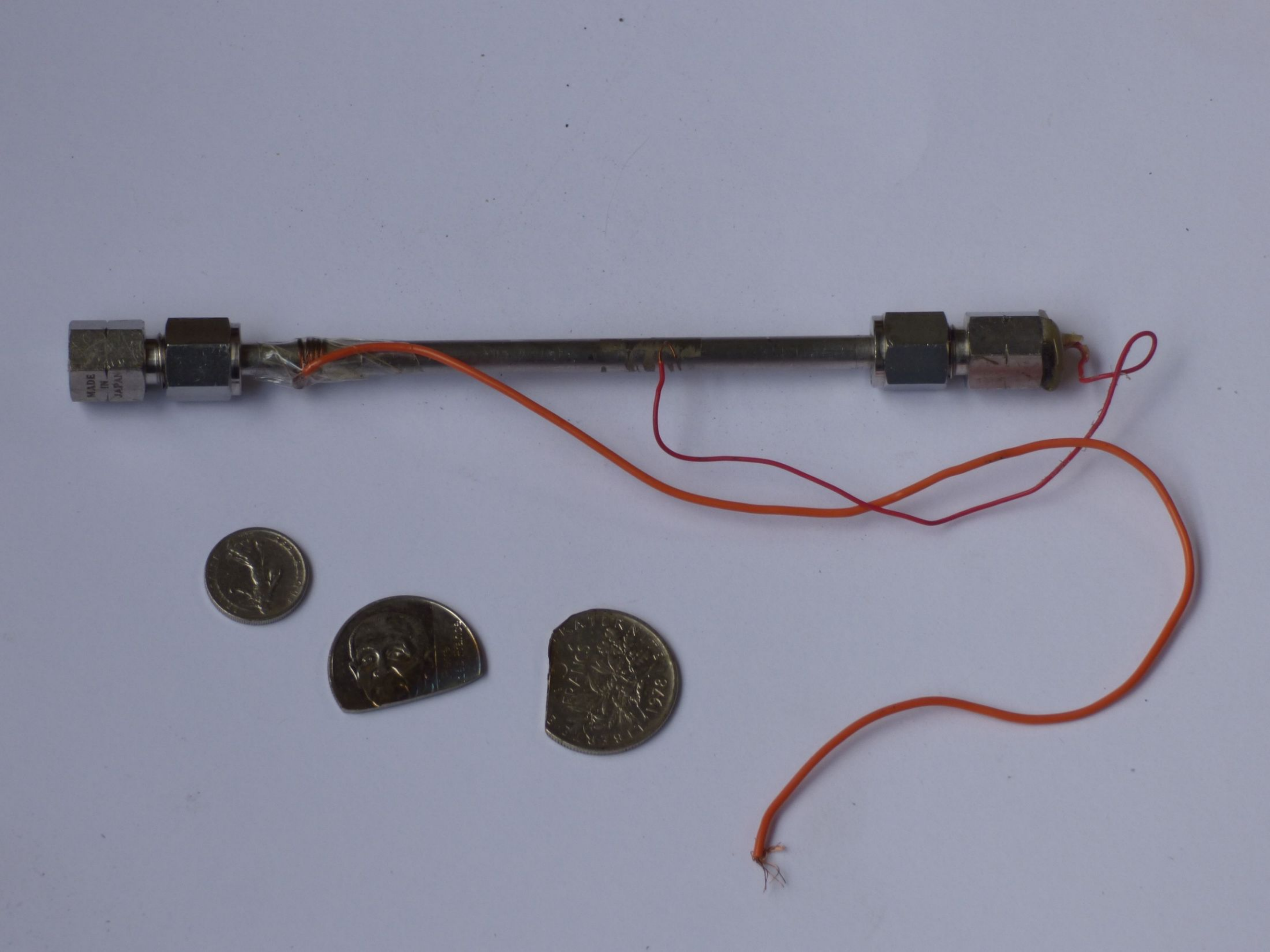


In order to get a surface of junction as large as possible, our fusion diodes are made as powder diodes, with a large surface junction made up of a semiconductor powder in contact with palladium powder charged with deuterium. (5) The weight of palladium powder is comprised between 1 g and 2 g by diode.

1 -Electrical connection.
2 -End cap, with threading.

3 -Mix of silicon and palladium powder.
-At the bottom : pure palladium, and then an increasing concentration of silicon.
-At the middle of the diode : 50% silicon; 50% palladium
-At the top : pure silicon
-The result is a very large surface rectifier diode.
4 –Inner plastic tube for insulation
5 –Aluminium container
7 -End cap
8 - Valve



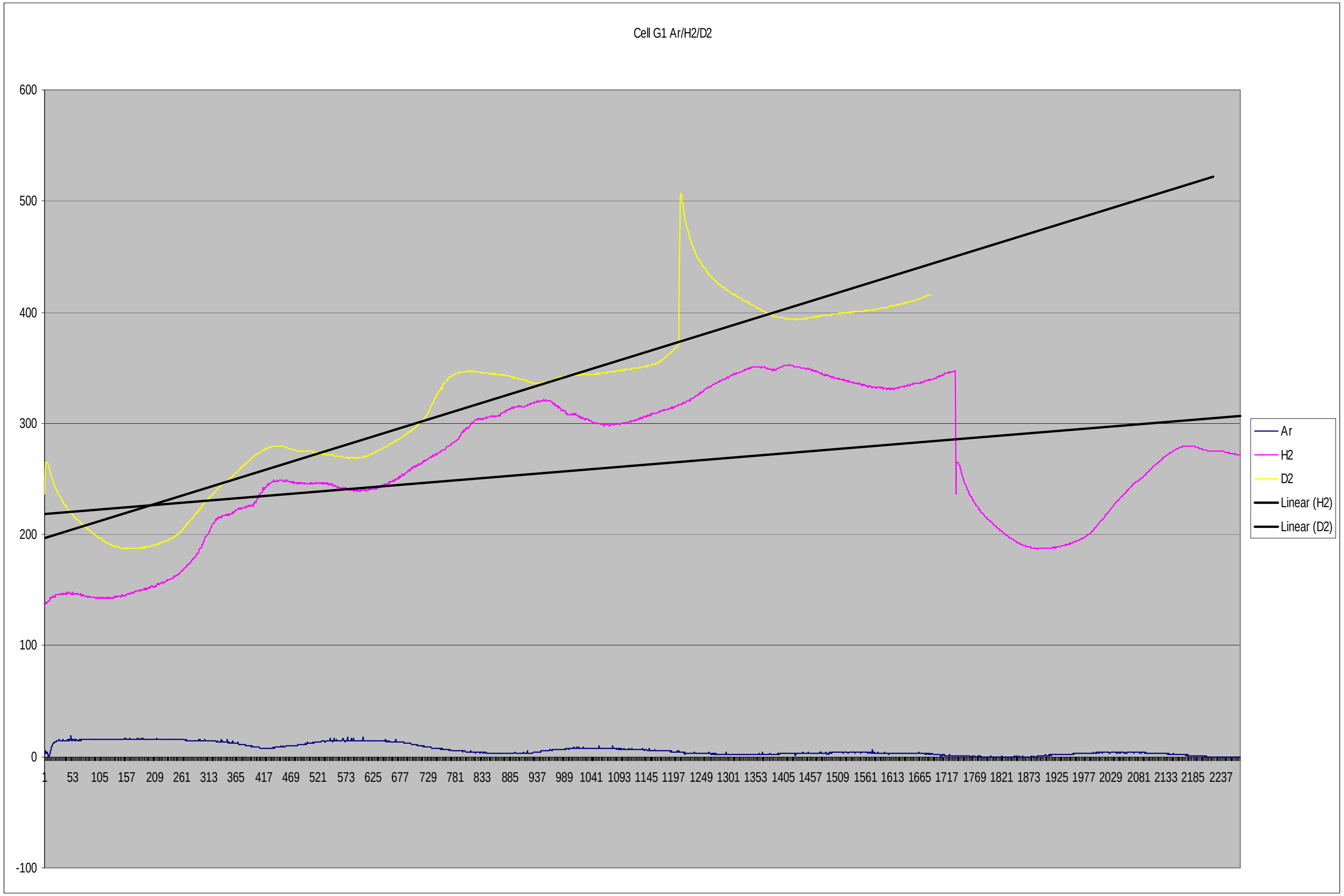

MADE IN JAPAN

This energy very quickly appears as a spontaneous potential difference which can reach over 0.5 volt per junction. (open circuit)

Diodes comprising of a stack of junctions were made, making it possible to obtain over 1 volt at the poles of a very compact device of a few centimeters length. The released power remains very low for the moment, (in the nanowatt range) but it should be noted that it is presented in the form of directly usable electrical energy, and not of thermal energy. (Fig. IV)

Of course, we have made blank and control experiments. We have built three diodes each time, one filed with pure deuterium (1.5 bar) another filed with hydrogen at the same pressure, and another filled with pure argon.

We observed no voltage with argon filling, a little voltage with hydrogen, twice the voltage with deuterium. We think that the observed voltage with hydrogen is generated by the little amount of deuterium in the hydrogen. (0.015% of deuterium in natural hydrogen)



This energy very quickly appears as a spontaneous potential difference which can reach over 0.5 volt per junction. (open circuit) Diodes comprising of a stack of junctions were made, making it possible to obtain over 1 volt at the poles of a very compact device of a few centimeters length. The released power remains very low for the moment, (in the nanowatt range) but it should be noted that it is presented in the form of directly usable electrical energy, and not of thermal energy. (Fig. IV)

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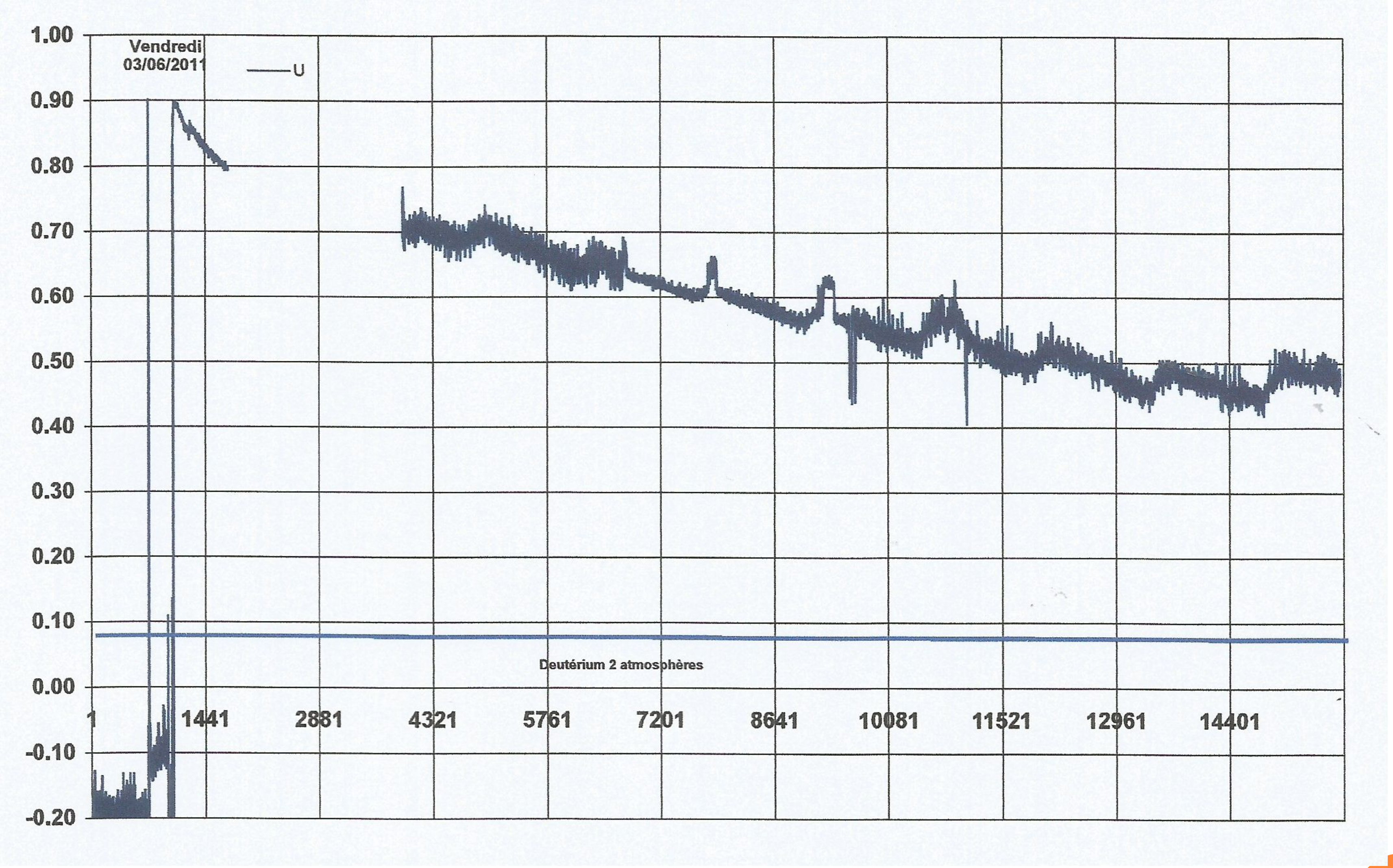


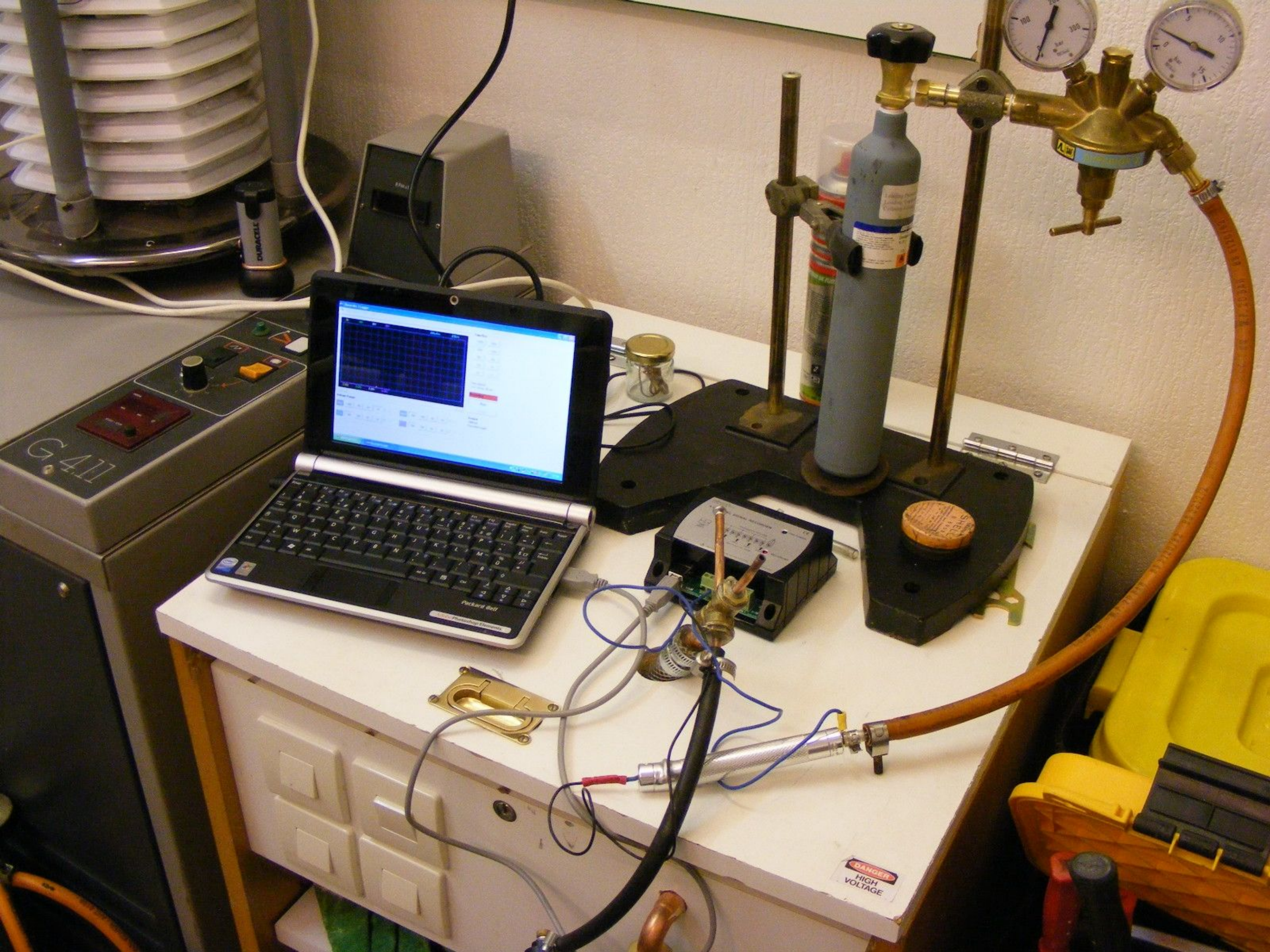
Courtesy Pr. Biberian, university of Marseilles

But it is difficult to avoid the deuterium leak, and the ensuing voltage drop. We plan to seal a diode in a glass tube, and measure the energy produced for several months by copper plating. It will then suffice to weigh the deposited copper to have a reliable estimate of the energy released. Thus, it will be possible to determine whether the energy observed is actually of nuclear origin, or if it is an artefact of electrochemical origin.


W.P. 20 BAR

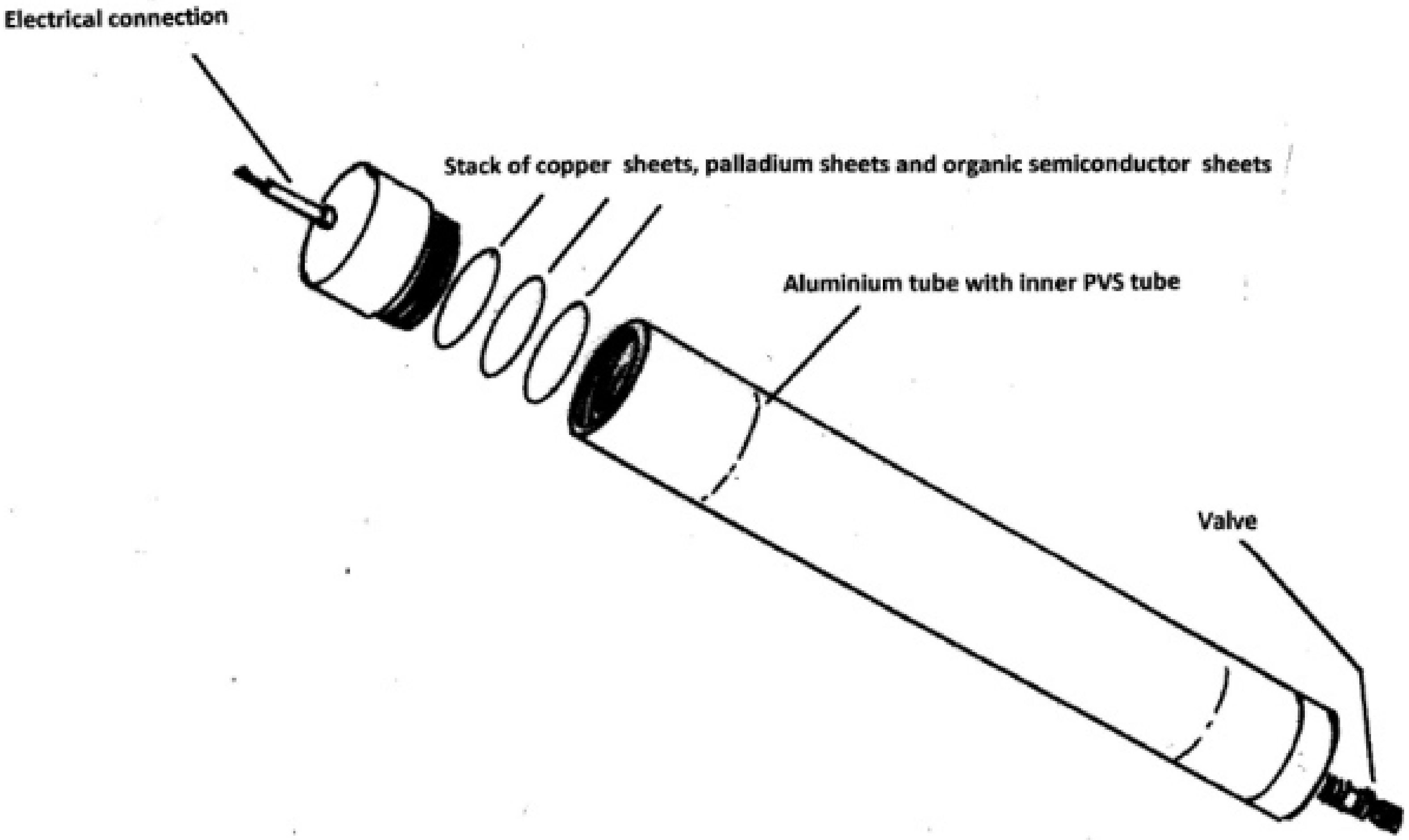
In order to answer to this question, we plan to seal fusion diodes in glass tubes. The energy produced will be estimated by copper electrodeposition. After several months, it will be sufficient to weigh the copper deposited on a cathode whose weight is known at the beginning of the experiment to prove that the energy produced is of nuclear origin. (or not...)
Of course, it is It is rather tedious to work with powders. But the “Fusion Diode” effect is highly reproducible, even with thin films of organic semiconductors. The authors used many different embodiments of the “Fusion Diode”.


ALDRICH
Cat.:21,561-9
Lot.:08010JJ-428
ALDRICH
Palladium, powder
<75micron, 99.9%


G411
DURACELL
Packard Bell
DANGER
HIGH VOLTAGE

Contents
Empty
Contents
Hydrogen

Another team working on "fusion diodes" has made diodes by vacuum metallizing silicon wafers. On one side is deposited a palladium film, and on the other a gold film. (forthcoming publication)



We used sheets of aluminum foil covered on one side by a thin sheet of palladium, and on the other by a layer of semiconducting paint. (Plexcore® Organic Conductive Ink) Little disks are then cut with a punch and these disks are stacked on top of one another and compressed with a hydraulic press. A valve makes it possible to pressurize the container with deuterium.

A better method would be to use a plastic film covered with a palladium sheet on one side, and a gold leaf on the other side.

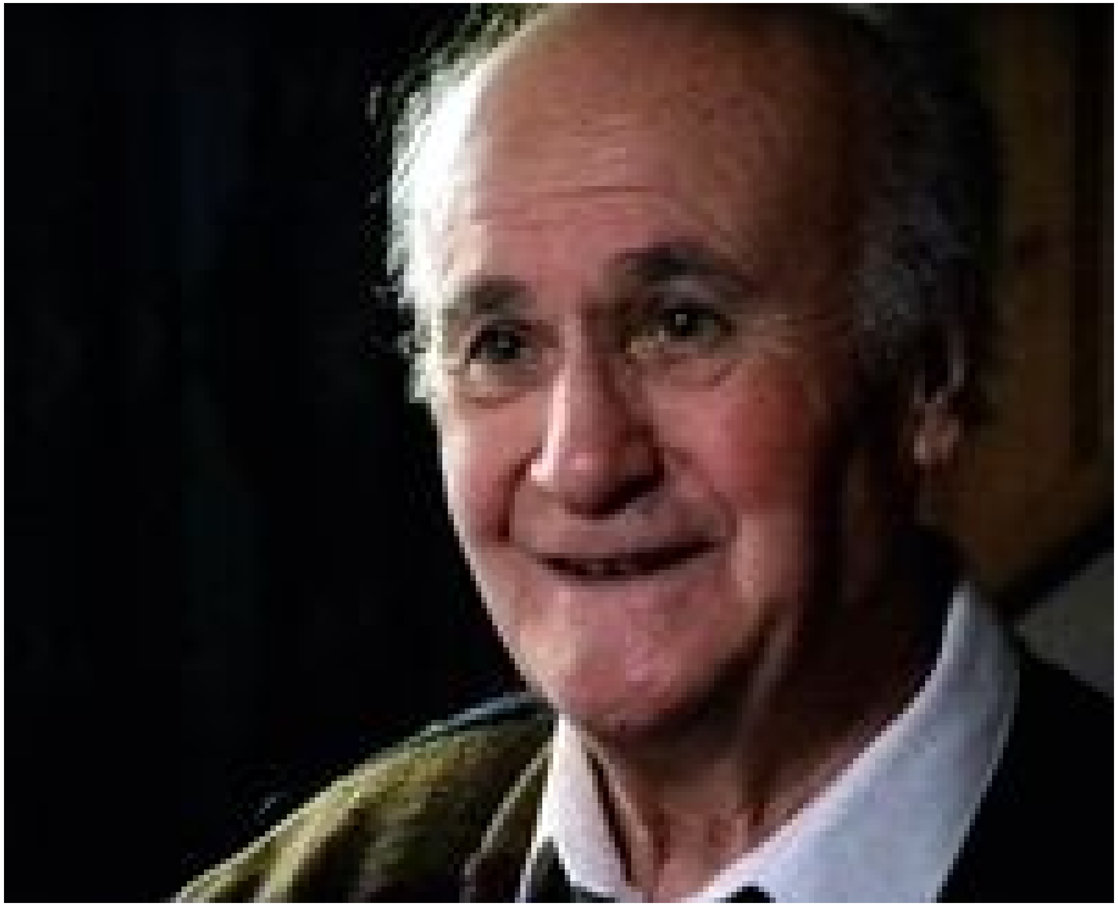
Whether in the form of metal powders or thin metal foils, it is possible to quickly test a large number of alloys containing deuterium or hydrogen. The higher the voltage, the better the LENR properties of the tested alloy.

A large number of new alloys have been developed over the last 20 years by the metal-hydride battery industry, and also for the storage of hydrogen. Many of these alloys are available in the suppliers catalogs (Sigma-Aldrich). These alloys are much cheaper than palladium, and their price will drop considerably as soon as they are produced in industrial quantities.

Nickel alloys look promising. (2)

By way of example, the properties of the $ZrV_2 H_{5.5}$ alloy are better than those of pure palladium. (3% weight of hydrogen versus 0.5% for $PdH_{0.6}$ and Equivallent Pressure at 300 K of 10^{-8} bar versus 0.02 bar for palladium) (Ref: D. Chandra et al., Material Matters, Vol 6, n°2, Sigma-Aldrich eds, 2010)

2) The use of the Reifenschweiler effect.



Otto Reifenschweiler was heading the neutrons generators departement of PHILLIPS during the 60's. In 1964, Reifenschweiler noticed that the ***apparent*** beta-decay of the tritium absorbed into titanium changes with the temperature of the titanium. Reifenschweiler has waited his retirement to publish his observations (9).

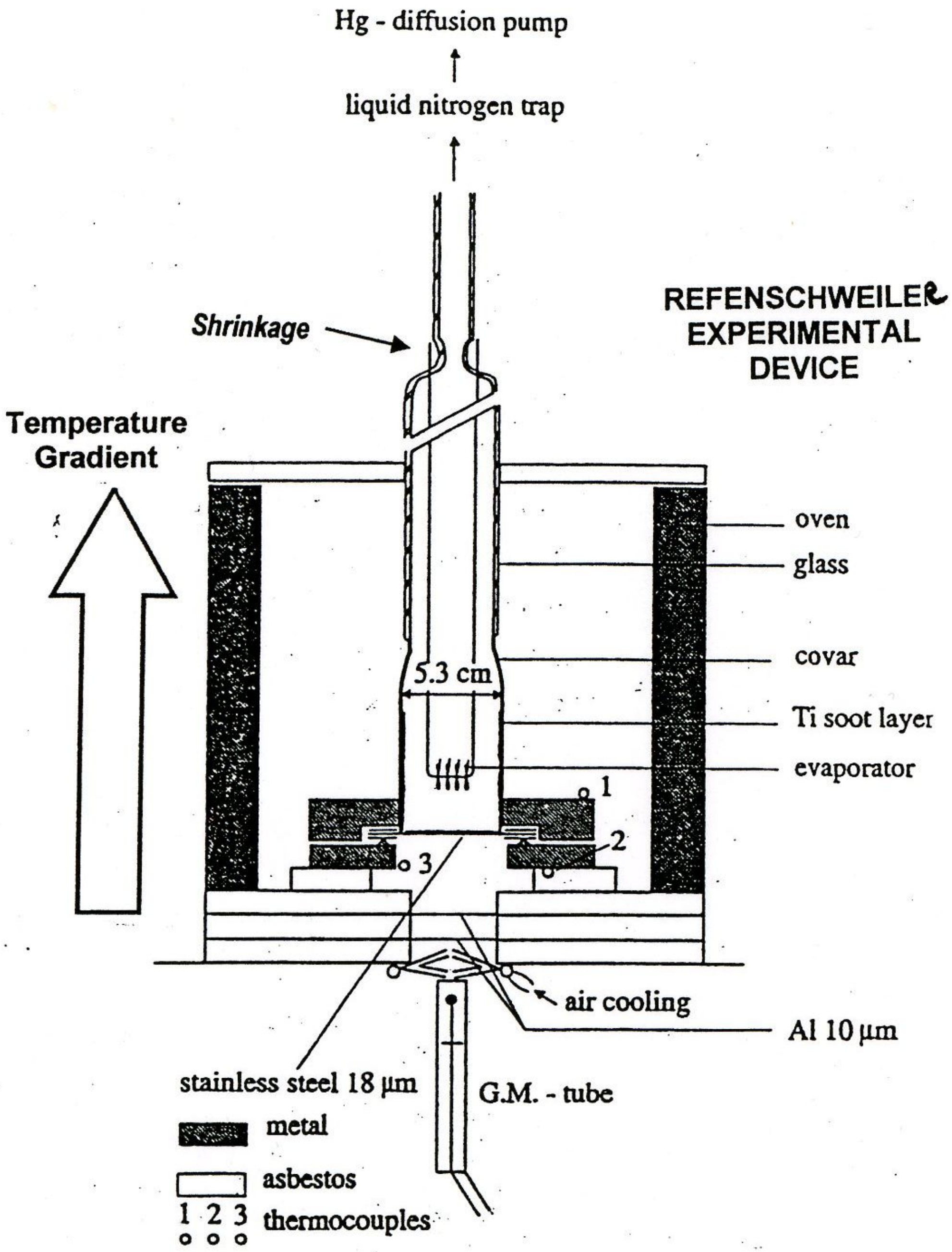
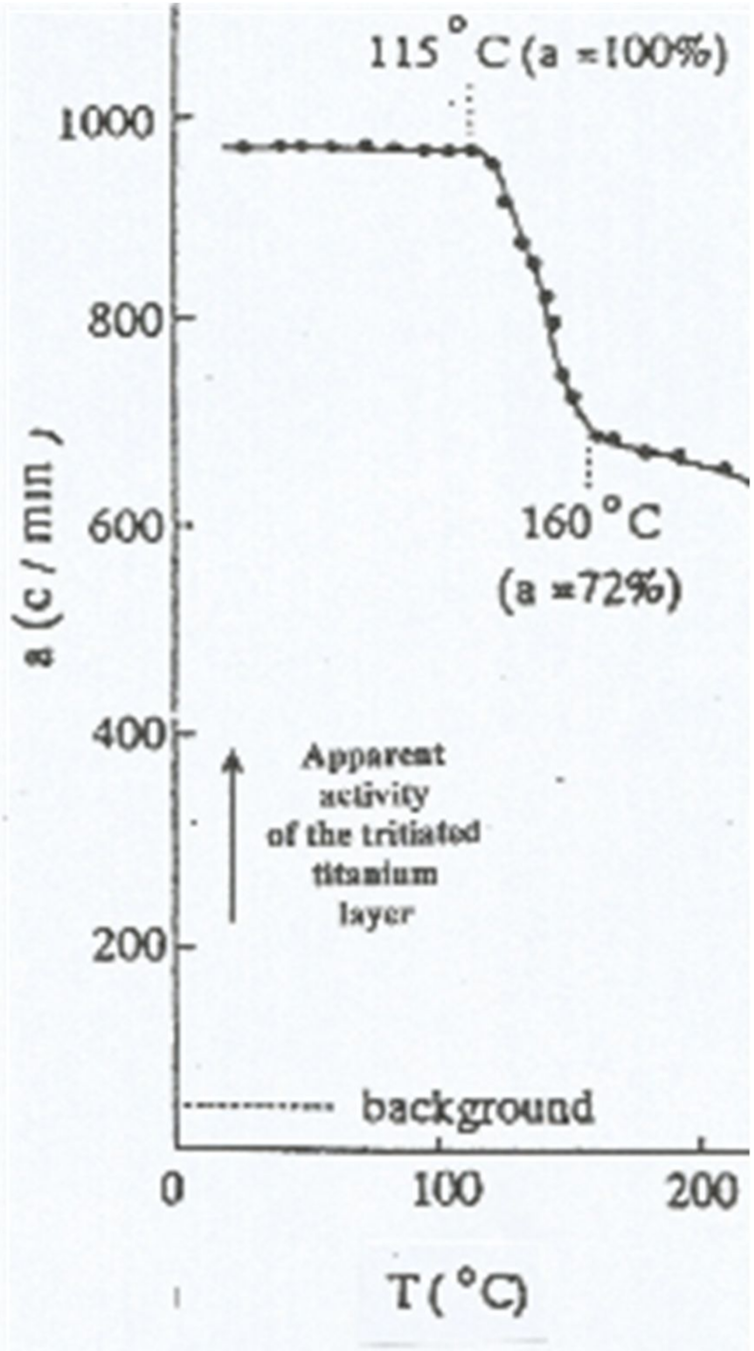


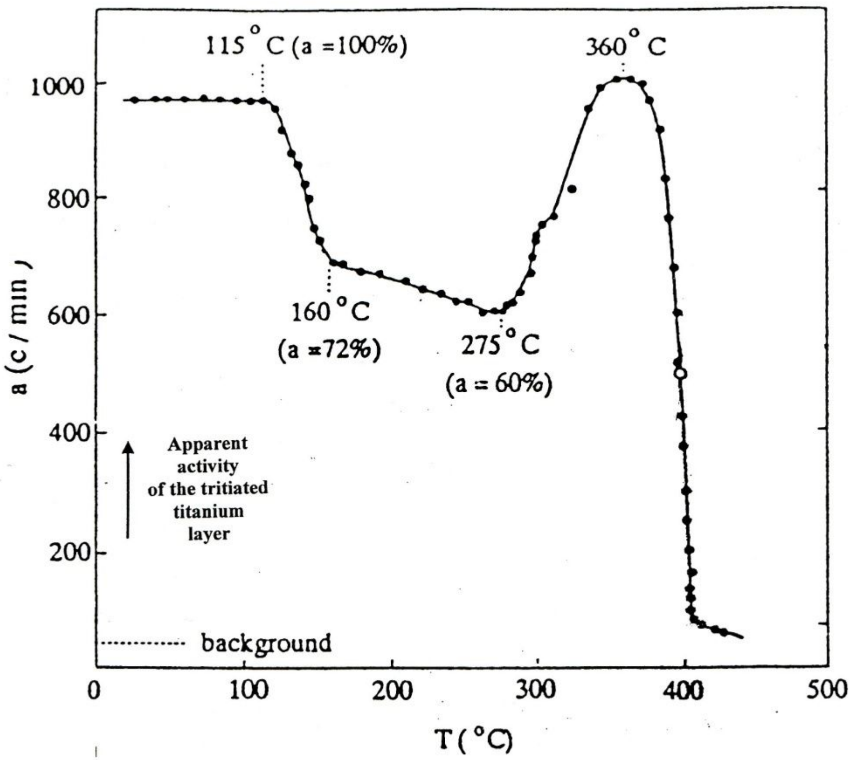
Fig. 3

This is the experimental device of Reifenschweiler.

Please note that there is a strong vertical temperature gradient.



Here is the curve obtained by Reifenschweiller: the apparent radioactivity of tritium decreases by 40% between 100°C and 200°C (the complete curve is a little more complicated)


115 °C (a =100%)
360 °C
160 °C
(a =72%)
275 °C
(a = 60%)
1000
800
600
400
200
a (c / min)
Apparent activity of the tritiated titanium layer
background
0
100
200
300
400
500
T (°C)

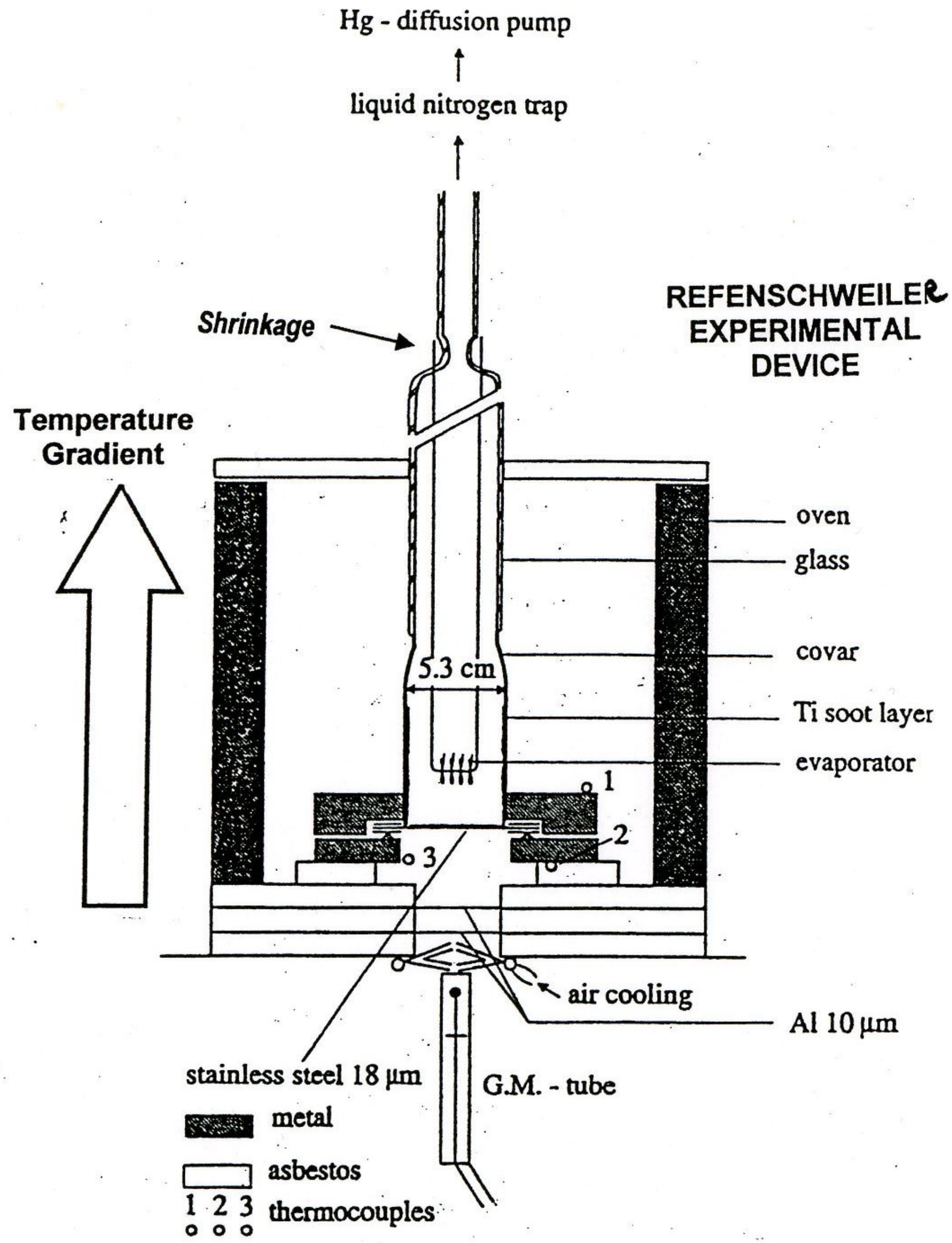
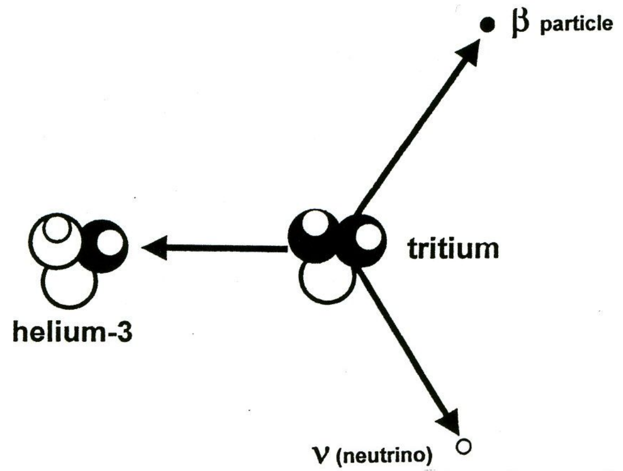

Hg - diffusion pump
liquid nitrogen trap
REFENSCHWEILER EXPERIMENTAL DEVICE
Shrinkage
Temperature Gradient
oven
glass
covar
5.3 cm
Ti soot layer
evaporator
1
2
3
air cooling
Al 10 µm
stainless steel 18 µm
G.M. - tube
metal
asbestos
1 2 3 thermocouples

Fig. 3

In our opinion, the number of disintegrations per second does not change, it is just the yield of counting x-rays produced by bremsstrahlung that varies.

We must remember that the energy of beta-decay is shared beteween three entities:



1- the beta particle (positive or negative electron)
2 -the neutrino
3 -the son nucleus (He^3 in the case of Tritium)

(Fig. 4)

We believe that at low temperatures, the tritium nuclei contained in the metal combine two by two to form composite bosons. (Two tritium nuclei of opposite spin form a composite boson, such as helium 3 nuclei in superfluid helium 3). These composite bosons can therefore form a Bose-Einstein Condensate (We will not discuss here the physical phenomena that make possible the existence of a BEC at room temperature) (10,11)

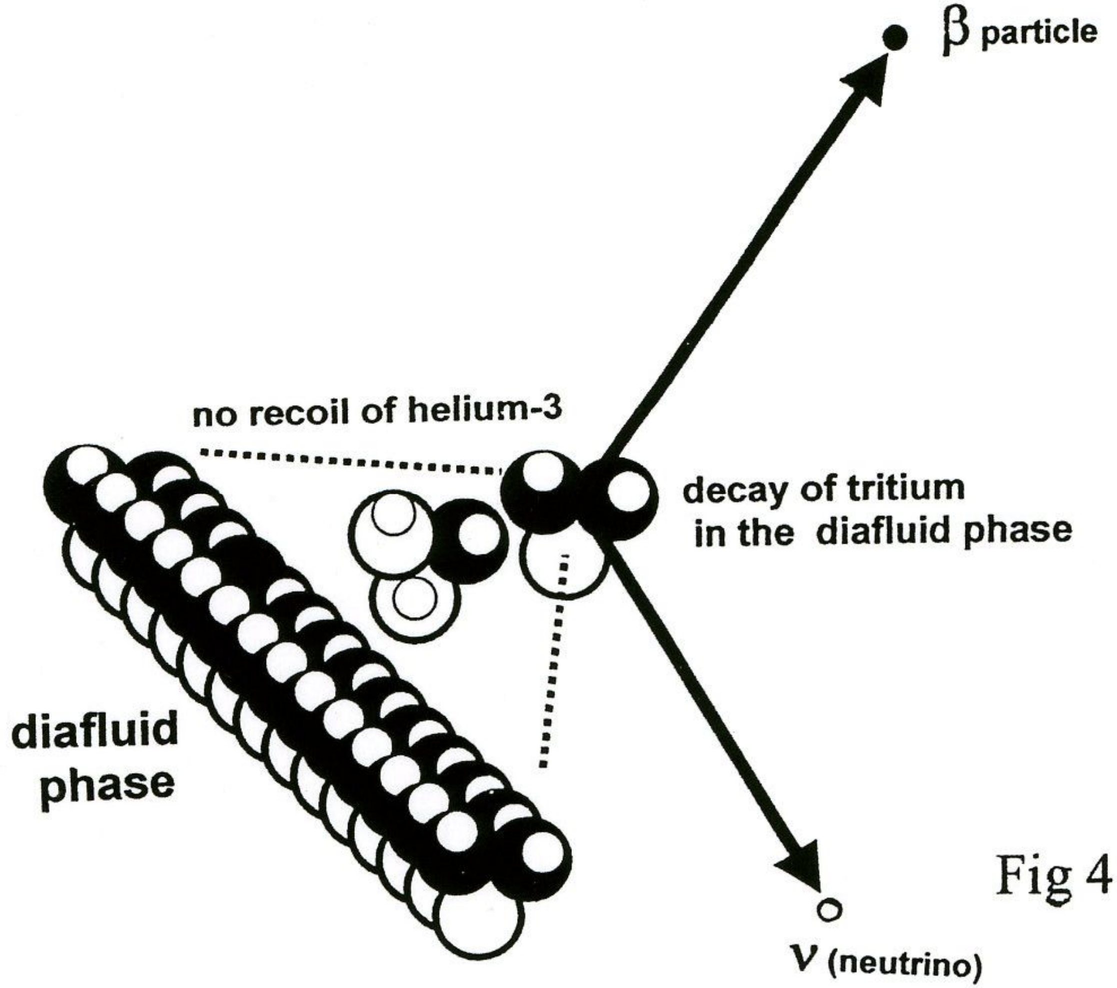
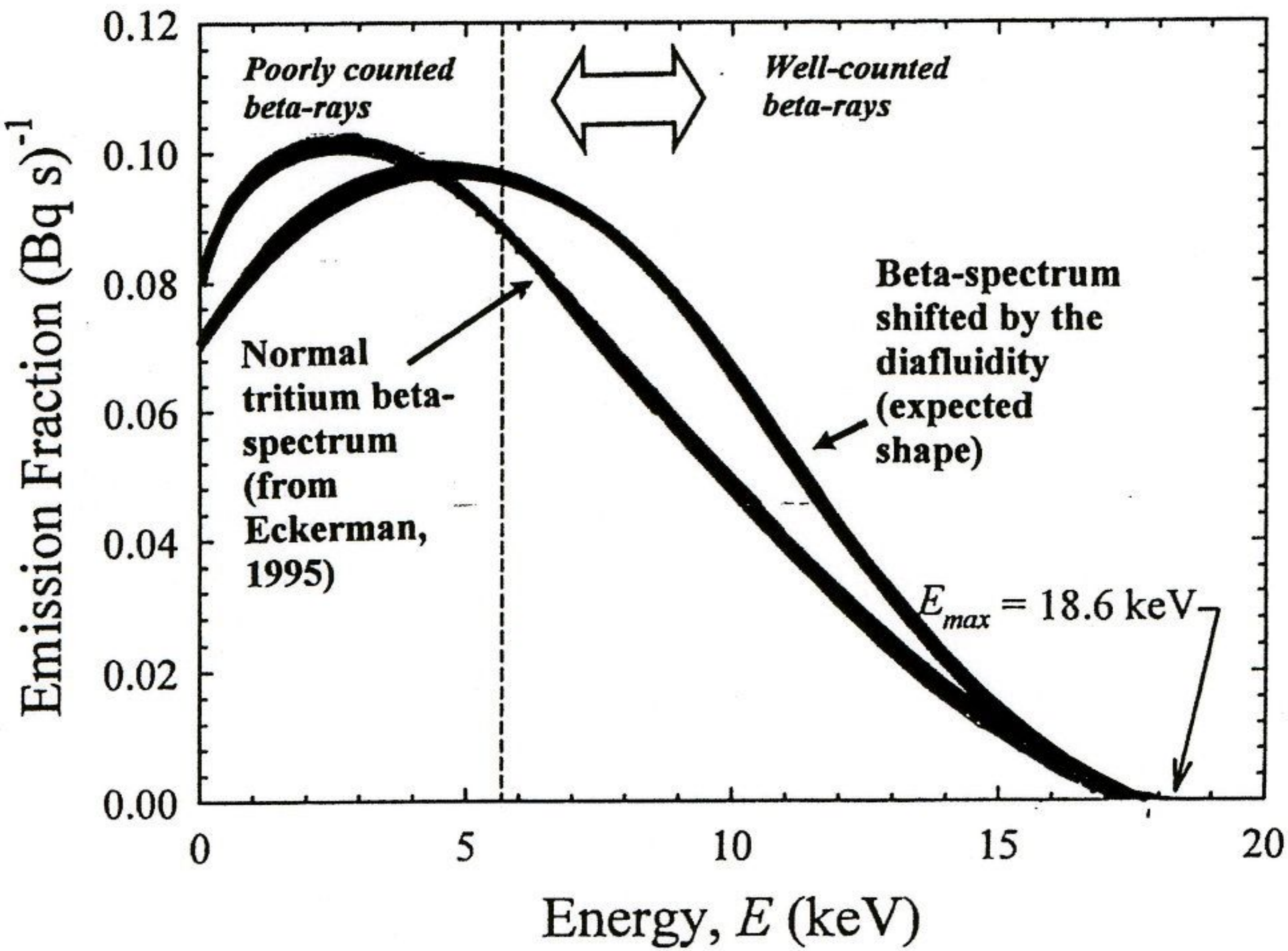


Fig 4 bis

In this case, during the beta decay of a triton in this BEC, there is no more recoil of the nucleus: the energy of beta rays and neutrinos increases. The whole spectrum of beta electrons is shifted slightly towards high energies, and the counting efficiency increases.



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As the temperature increases, the pairs of tritium nuclei breaks and the Bose-Einstein Condensate disappears, and thus the counting efficiency of the radioactivity decreases.

This phenomenon is very important for our field of research because many authors have asserted that the "Nuclear Active Environment" that allows the LENRs is due to the formation of Bose-Einstein Condensates. (4,5,6,7)

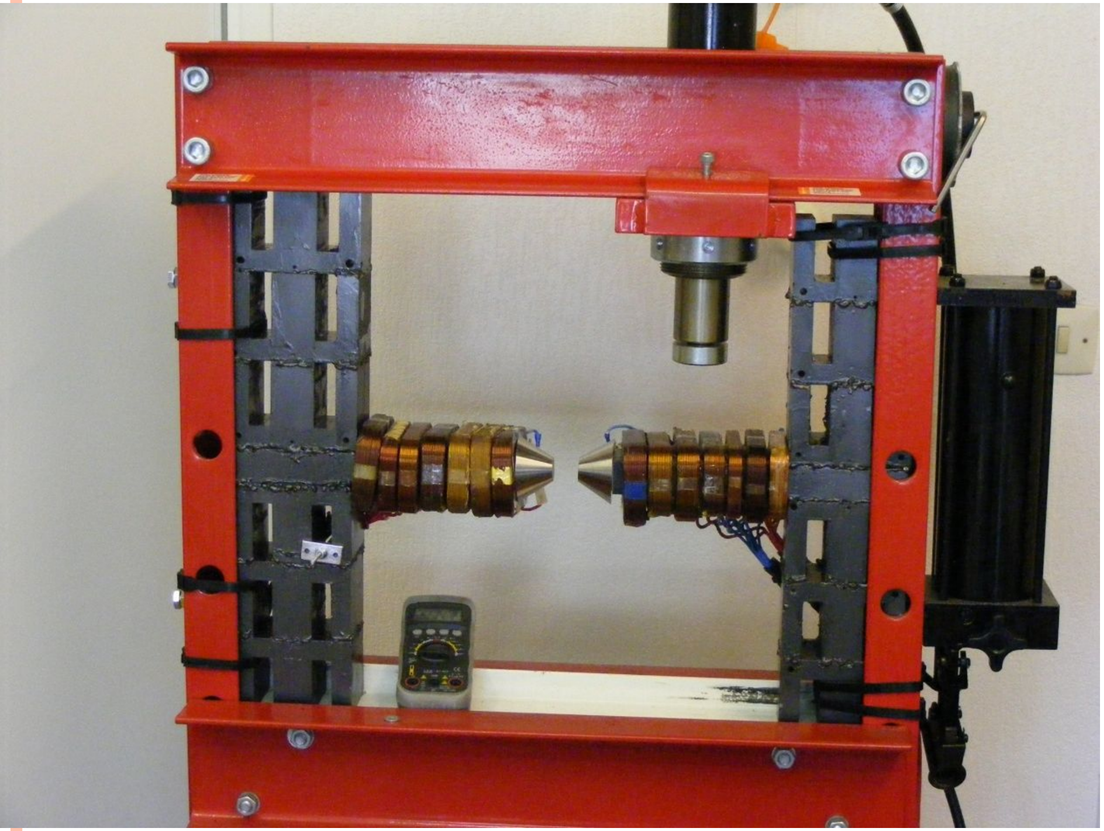
It is therefore possible to use the Reifenschweiller effect to sort the new alloys containing hydrogen according to their capacity to house BECs

(Of course, we will use a simpler experimental device than that of Reifenschweiler: small sealed glass tubes containing the alloy powder and tritium, and a small programmable oven)

It is probably possible to design experimental devices even simpler, and bringing even more convincing results:

3) The magnetic cancellation of the tritium pairs.

This effect, which we have postulated, but not yet observed, would make it possible to very quickly test many new hybrid-forming alloys.



We propose to make sealed glass sources containing alloy powder and tritium. These sources will be placed in the gap of a powerful electromagnet. When the electromagnet will be activated, the spins of the tritium nuclei will align with the magnetic field and the composite bosons will be destroyed. The Condensate of Bose-Einstein will disappear. The beta spectrum will be shifted slightly towards the low energies and the counting efficiency of the radioactivity will decrease.

If it exists, this new effect will be easy to prove and it can be very useful to sort the best NAE alloys, regardless of the theoretical importance of this effect.

CONCLUSION

Despite the quality of the experimental results proving the reality of the Fleischman-Pons effect (Excess heat in palladium and deuterium alloys), the majority of scientists are still not convinced of the existence of LENRs.

We believe that the three phenomena of the "Fusion Diode" effect, the Reifenschweiler effect, and the magnetic suppression of the tritons pairs, if confirmed, could be the basis for new techniques to confirm the calorimetry experiments. It would also be possible to use these effects to quickly select new alloys that can be used to produce LENRs.

Thank you for your attention

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Rules of tiling for this quasicrystalline planar pattern.

ALTERNATIVES TO CALORIMETRY

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Introduction

Since the first publication of Martin Fleischman and Stanley Pons in 1989, the majority of articles in the LENR field have focused on calorimetry. [1] This is true for both electrolysis experiments and gaseous loading experiments. [2]
Many calorimetry experiments are masterpieces of science [3] Nevertheless, despite the experimental evidence, the results indicating excessive heat have not convinced the scientific community. Well-designed calorimetry experiments take a very long time to be developped. It's an issue, because it would be good to test many alloys systematically. It is likely that there are still unknown alloys whose ability to generate what Dr. Ed Storms calls a "Nuclear Active Environment" [4] is greater than that of palladium. It is certain that low concentrations of elements such as lithium, boron, beryllium in these alloys will have undoubtedly positive effects. We need fast and reproducible tests to sort all these alloys and select the most promising samples. Several authors have suggested that the quantum condensation of deuterium nuclei is at the root of the appearance of "NAE" [5] [6] [7] [8]. It would be very useful to provide irrefutable proof of the existence of these quantum phases. But on top of that, these quantum phases could provide a relatively easy way to sort out the most useful alloys for LENRs.

For this purpose, we propose three relatively simple techniques :

The "Fusion Diode" effect: deuterated alloys in contact with a semiconductor cause the appearance of an easy-to-measure electrical voltage. If this voltage is actually due to the direct conversion of LENR, we have a simple method to select the most promising alloys.

2) The Reifenschweiler effect [9]: the variation of tritium beta-rays bremsstrahlung conversion efficiency as a function of temperature is also a simple method for sorting the most efficient alloys. [10]

3) The magnetic alignment of the tritium pairs spins: this effect, which we have postulated, but not yet observed, would make it possible to very quickly test many new alloys. [11]

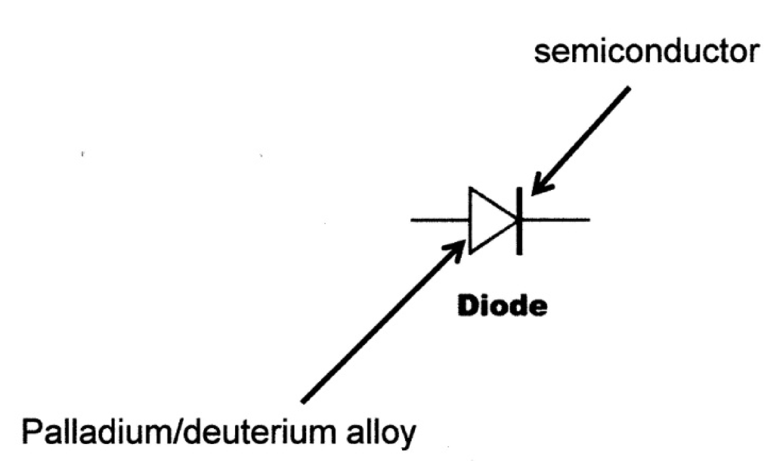
4) With tritium production, the rare neutrons observed are one of the most indisputable proofs of the reality of LENR. A new and extremely sensitive method of detecting neutrons in the 4Pi of space around a LENR device will also be discussed "off" in front of our poster, along with two new improved calorimetry methods.

In this presentation we want to discuss how it is possible to find alternatives to calorimetric experiments.

1) The Fusion Diode Effect

It is very difficult to make good calorimetric recordings. It is more easy to count X-rays. But the more easiest way to get a scientific evidence about any kind of phenomena is to do electrical recording.

We have suggested the idea of "Fusion Diodes". Fusion diodes are made of palladium (or other alloys) in close contact with a semiconductor. This is a semiconducting diode.



When fusion reactions take place near the metal/semiconductor contact, at the beginning we had high energy quanta, (in the MeV range) and then thermalization occurs, leading to Anomalous Heat Effect (Down-conversion of Hagelstein). But before thermalization, the decaying energy match the level of excitation of the electrons of the metal: some energy is transmitted to the electrons before thermalization (Like in a photovoltaic cell, but in our diodes, the energy source is expected to be the fusion of deuterium, protium, or perhaps lithium, Boron, or Beryllium.)

We can record the voltage and the intensity of the resulting current at the positive and negative side of the diode. This simple device allows a simple recording of the total output power, because there is no electrical input. We plan to record this electrical energy during months or even years, to exclude the possibility of a chemical origin. It is important to note that these devices has no electrical input. There is also no thermal input. The energy is released as electrical current, and this is very easy to record with high accuracy. We are using diodes made of palladium as the metal, and silicon as the semiconductor. We have also tried other semiconductors like aluminium nitride and organic semiconducting ink. But we only published our experiments with silicon. The palladium is loaded with deuterium simply by the gas-loading method. We don't know the effective loading value, but it is probably rather high, because of the micrometer size of the palladium powder. A diode is basically a surface of contact with a metal (electronic conductor) and a semiconductor (hole conductor).

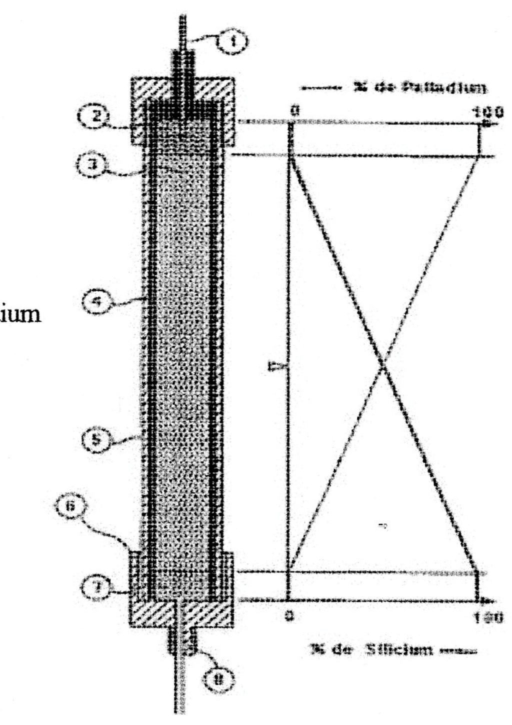
If reactions of cold nuclear transmutation take place near the junction, an excitation of the electrons will occur at this place (as in the junction zone of a photovoltaic cell). A solar cell is nothing more than a flat diode with a large surface. When photons fall on the junction zone, some atoms are excited, and electrons pass from a low energy level to a higher energy level. A spontaneous electric voltage thus will appear. It is what we observed. In our diodes, the nuclear energy is transmitted to the electrons before thermalization.

In order to get a surface of junction as large as possible, our fusion diodes are made as powder diodes, with a large surface junction made up of a semiconductor powder in contact with palladium powder charged with deuterium. (5) The weight of palladium powder is comprised between 1 g and 2 g by diode.

A model of our fusion diode :

1 -Electrical connection.
2 -End cap, with threading.

3 -Mix of silicon and palladium powder.
-At the bottom : pure palladium, and then an increasing concentration of silicon.
-At the middle of the diode : 50% silicon, 50% palladium
-At the top : pure silicon
-The result is a very large surface rectifier diode.
4 –Inner plastic tube for insulation
5 –Aluminium container
7 -End cap
8 - Valve



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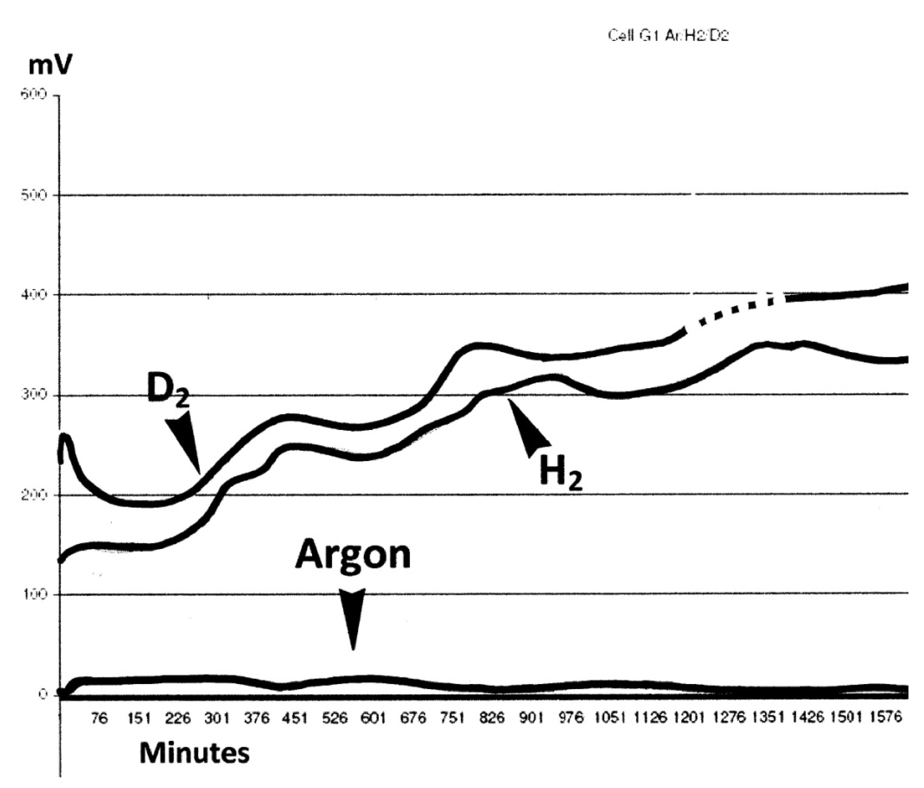
Results

We will show in this presentation some experimental results related to the "Fusion Diodes".

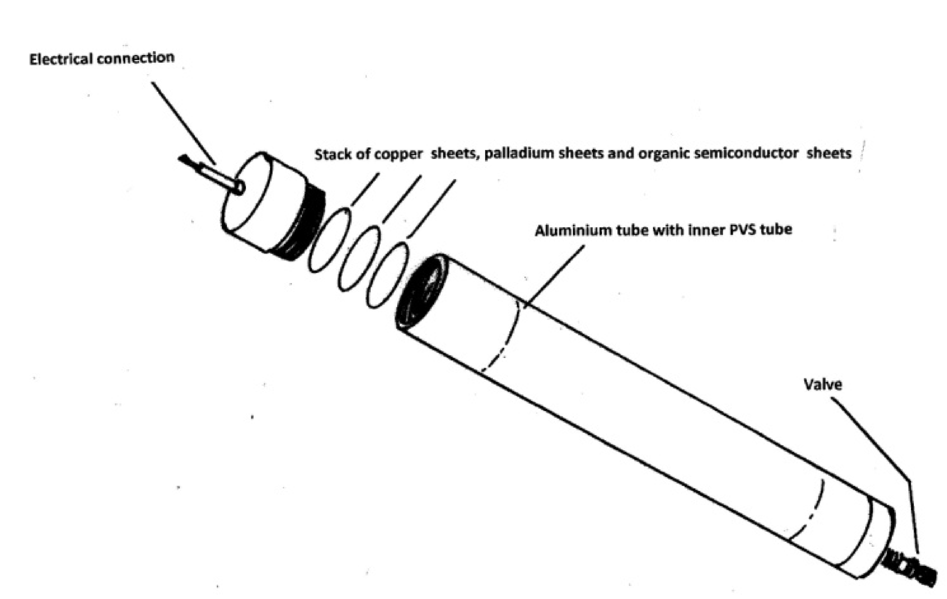
This energy very quickly appears as a spontaneous potential difference which can reach over 0.5 volt per junction. (open circuit)

Diodes comprising of a stack of junctions were made, making it possible to obtain over 1 volt at the poles of a very compact device of a few centimeters length. The released power remains very low for the moment, (in the nanowatt range) but it should be noted that it is presented in the form of directly usable electrical energy, and not of thermal energy. (Fig. IV)
Of course, we have made blank and control experiments. We have built three diodes each time, one filed with pure deuterium (1.5 bar) another filed with hydrogen at the same pressure, and another filled with pure argon.
We observed no voltage with argon filling, a little voltage with hydrogen, twice the voltage with deuterium. We think that the observed voltage with hydrogen is generated by the little amount of deuterium in the hydrogen. (0.015% of deuterium in natural hydrogen)

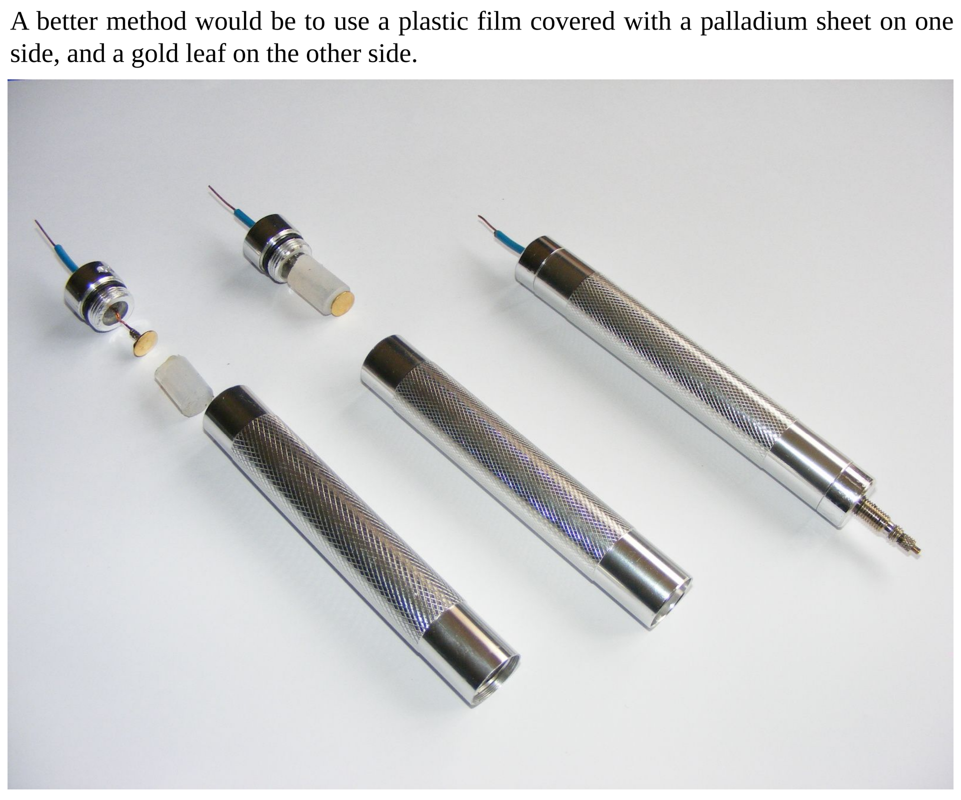


Upper line : voltage at the ends of the deuterium filled diode.
Middle line : voltage at the ends of the hydrogen filled diode
Bottom line : voltage at the ends of the argon filled diode
Vertical axis : millivolts
Horizontal axis: minutes

But it is difficult to avoid the deuterium leak, and the ensuing voltage drop.
Is the electric energy produced by a nuclear reaction, or if it is an artefact of electrochemical origin?
In order to respond to this question, we plan to seal fusion diodes in glass tubes. The energy produced will be estimated by copper electrodeposition. After several months, it will be sufficient to weigh the copper deposited on a cathode whose weight is known at the beginning of the experiment to prove that the energy produced is of nuclear origin. (or not...)
Of course, it is rather tedious to work with powders. But the "Fusion Diode" effect is highly reproducible, even with thin films of organic semiconductors. The authors used many different embodiments of the "Fusion Diode".
Another team working on "fusion diodes" has made diodes by vacuum metallizing silicon wafers. On one side is deposited a palladium film, and on the other a gold film. (forthcoming publication). We used sheets of aluminum foil covered on one side by a thin sheet of palladium, and on the other by a layer of semiconducting paint. (Plexcore® Organic Conductive Ink, Sigma-Aldrich) Little disks are then cut with a punch and these disks are stacked on top of one another and compressed with a hydraulic press. A valve makes it possible to pressurize the container with deuterium.



A better method would be to use a plastic film covered with a palladium sheet on one side, and a gold leaf on the other side.

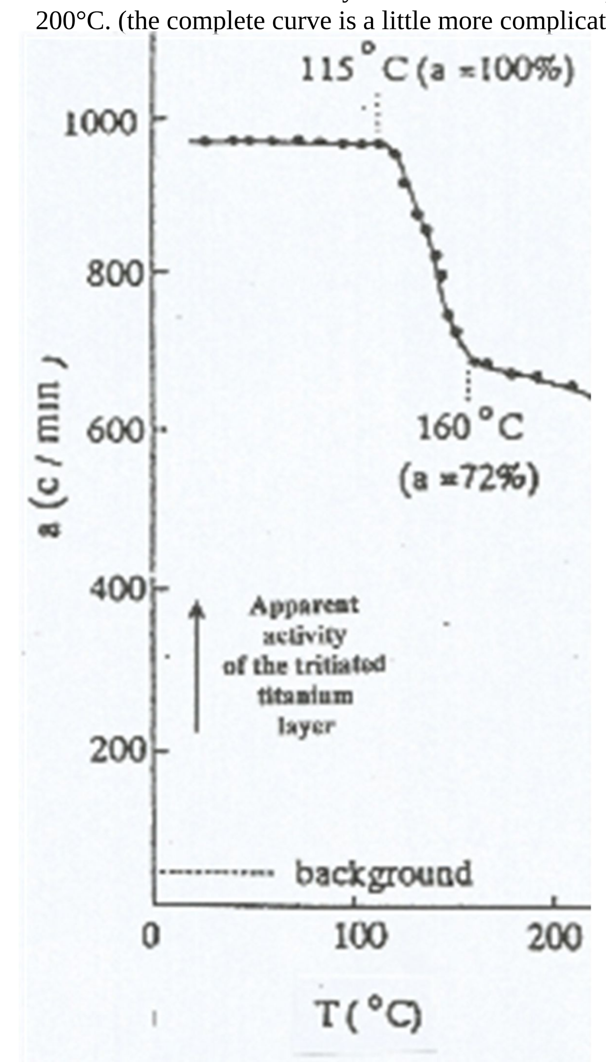


Three steps in the manufacture of a fusion diode

Whether in the form of metal powders or thin metal foils, it is possible to quickly test a large number of alloys containing deuterium or hydrogen. The higher the voltage, the better the LENR properties of the tested alloy.
A large number of new alloys have been developed over the last 20 years by the metal-hydride battery industry, and also for the storage of hydrogen. Many of these alloys are available in the suppliers catalogs (Sigma-Aldrich). These alloys are much cheaper than palladium, and their price will drop considerably as soon as they are produced in industrial quantities. Nickel alloys look promising. (2)
By way of example, the properties of the $ZrV_2\ H_{5.5}$ alloy are better than those of pure palladium. (3% weight of hydrogen versus 0.5% for $PdH_{0.6}$ and Equivallent Pressure at 300 K of 10^{-8} bar versus 0.02 bar for palladium) (Ref: D. Chandra et al., Material Matters, Vol 6, n°2, Sigma-Aldrich eds, 2010)

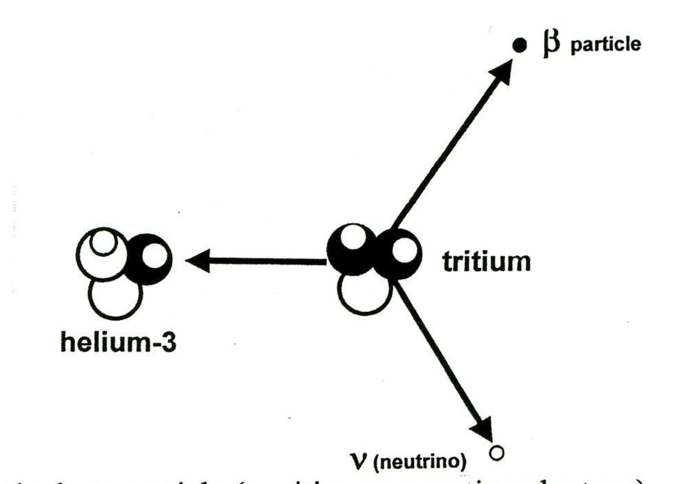
2) The use of the Reifenschweiler effect.

Otto Reifenschweiller was heading the neutrons generators departement of PHILLIPS during the 60's. In 1964, Reifenschweiler noticed that the ***apparent*** beta-decay of the tritium absorbed into titanium changes with the temperature of the titanium. Reifenschweiler has waited his retirement to publish his observations (9).
Here is the curve obtained by Reifenschweiler: the apparent radioactivity of tritium decreases by 40% between 100°C and 200°C. (the complete curve is a little more complicated, and we will discuss it in front of the slides)



← **Vertical axis : count by minute**
Horizontal axis: temperature

Recoil of the nucleus during beta-decay



1- the beta particle (positive or negative electron)
2 -the neutrino
3 -the son nucleus (He^3 in the case of Tritium)

(Fig. 4)

In our opinion, the number of disintegrations per second does not change, it is just the yield of counting x-rays produced by bremsstrahlung that varies.

We believe that at low temperatures, the tritium nuclei contained in the metal combine two by two to form composite bosons. (Two tritium nuclei of opposite spin form a composite boson, such as helium 3 nuclei in superfluid helium 3). These composite bosons can therefore form a Bose-Einstein Condensate (We will not discuss here the physical phenomena that make possible the existence of a BEC at room temperature) (10,11)

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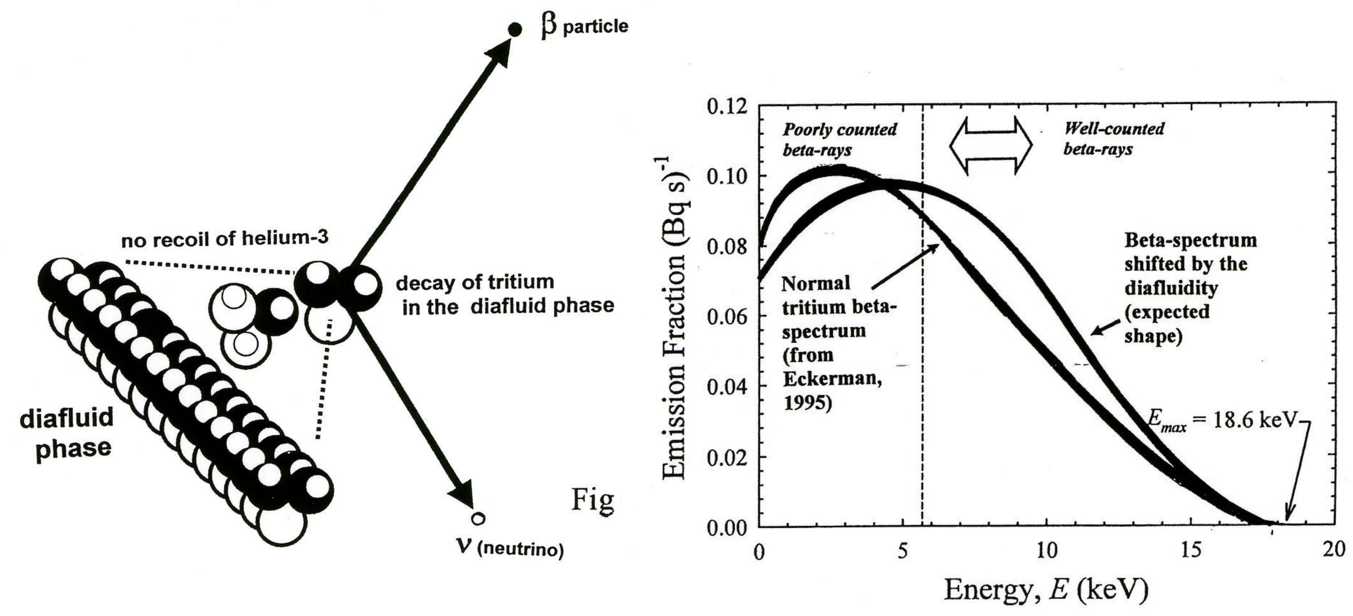

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