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Report on heat production during preliminary tests on the Rossi "Ni-H" reactor.

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In this first and preliminary document are reported the heat production measures done during two short tests done on December 16 2010 [Test 1] and January 14 2011 [Test 2].

On December, 16 2010 I had the opportunity to test, for the first time, a prototype of the Rossi "Ni-H" reactor. A photograph of the apparatus used in both tests is shown in fig.1 and a schematic is shown in fig. 2.

Fig.1

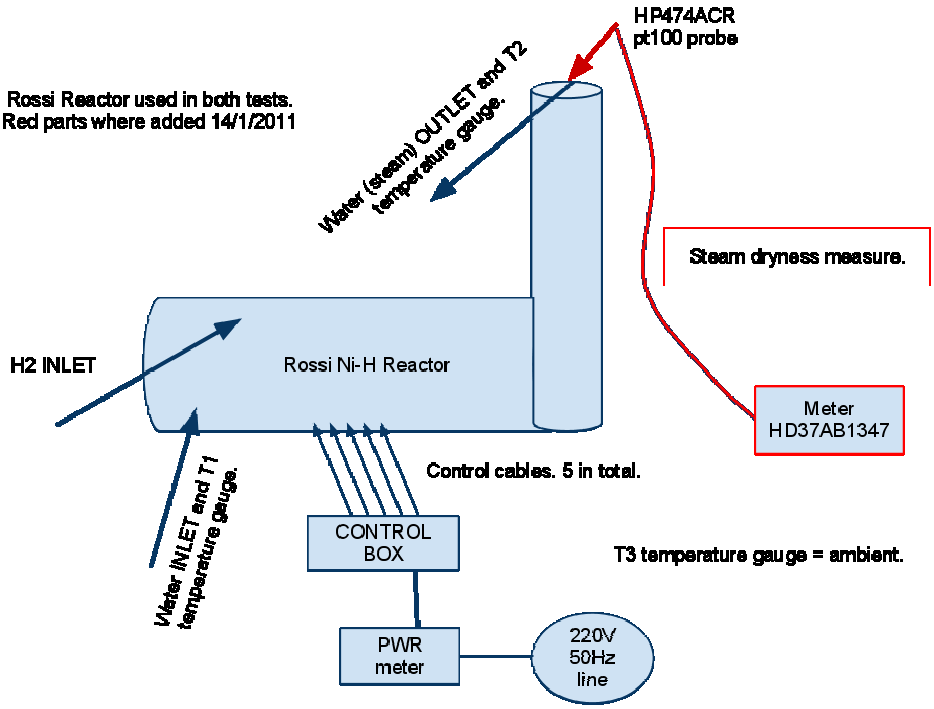


Fig.2

The Rossi Reactor prototype has a main horizontal cylindrical body ending with a vertical pipe. The H2 inlet was connected to a Hydrogen bottle through no return valves. There was no H2 outlet apart from a small purge valve that was closed. Cables where connected to a control box with 5 digital plc that where “controlling the power sent to the resistors inside the reactor”. Prudentially I have lifted the control box in search for any other eventually hidden cable and found none. The weight of the control box was of few Kg. Two water pipes where connected to the system. Temperature was measured and logged by two NTC sensors. Another sensor, in the logger, was measuring the ambient temperature. Power from the 220 V line was monitor and logged by a “WATTUP?” Pro Es power meter.

Before igniting the reactor the water flux was set and measured by collecting, and then weighting, an amount of water in a container in a given time.

The measured flux was of 168 +/- 2 g in 45 +/- 0.1 s.

Then the power was turned on an temperatures started to rise. Figure 3 shows a plot of the temperatures as appeared on the monitor during the test taken from the start to just after the end of the test.

The three lines refer to:

(B) blue line: T1 water input temperature

(Y) yellow line: T2 water (steam) output temperature

(R) red line: ambient temperature

As it can be seen the system was turned on just around 16.55. After approx 30 minutes a kink can be observed in the (Y). Because input power (1120 W also checked via and clamp amperometer) was not modified (see fig. 5 later) this change of slope testify that the reactor was ignited. After a startup period approx 20 minutes long a second where the reactor power was almost constant taking the water to ≈75°C a second kink is found when the reactor fully ignites raising the measured temperature to 101.6 +/-0.1°C and transforming the water into steam.

At this point we can try a simple calculus in order to evaluate the power produced. In order to raise the temperature of 168 g of water by 1°C, ≈ 168*4.185 = 703 J are needed. The water inlet temperature was 15°C so the ΔT was 85°C. We have 703*85=59755 J. To this energy one must add the evaporation heat ≈2272 J/g * 168=381696 J. Total energy in 45 sec is 59755+381696=441451 J, and power is 441451/45=9810 W.

Statistical experimental errors in power estimation, due mainly to flux measurements, can be conservatively estimated in about 1.5%. In this case we have +/- 150 W.

This result is only a lower limit of the energy produced, because the system was not completely isolated and we have not taken into account any heat loss. From the calculation of the "produced power" when the water was at 75°C which give a result that is less than the electrical input power, it is easy to understand that this systematic under estimation surely exceeds the statistical errors.

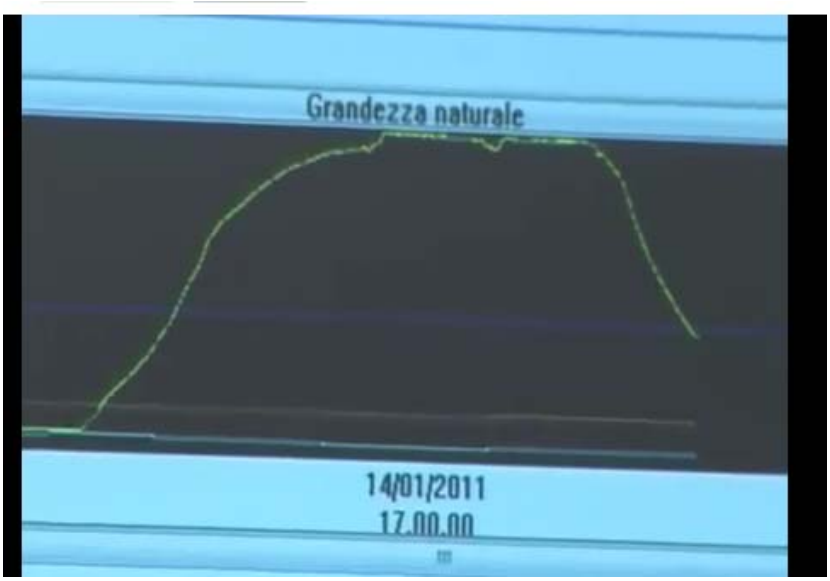
Before ending [Test1] all the power was reduced and then switched off from the resistors and also the hydrogen supply was closed. No pressure decrease was noted in the H2 bottle. Even in this conditions the system kept running self sustaining, for about 15 minutes until it was decided to manually stop the reaction by cooling the reactor using a large water flux (note the decrease of the water input temperature).

The main origin of possible errors in [Test 1] measurement was that the steam was not checked to be completely dry. During [Test 2] this measurement was done by Dr. Galantini, a senior chemist, who used an "air quality monitor" instrument HD37AB1347 from Delta Ohm with a HP474AC probe. Also in [Test 2] a high precision scale (0.1 g) was used to weight the Hydrogen bottle (13 kg) before the

experiment at 13666.7 +/- 0.1 g and after 13668.3 +/- 0.1 g. The cause of this unexpected rise was traced to be the remnant of piece of adhesive tape used to fix the bottle to the table during the experiment. After careful examination of the tape the weight loss was evaluated to be <1g. This is far less the expected weight loss due to chemical burning. In fact 1g of H can produce (max) 285 kJ. In [Test 2] the power measured was 12686 +/- 211 W for about 40 min with a water flux 146.4g +/- 0.1 per 30 +/- 0.5 s. This means that 12686 * 40 * 60 = 30446400 J where produced. Dividing this number by 280 kJ a weight of 107 g is obtained two orders of magnitude larger than the H consumption observed.

As a prudential check the reactor was lifted to seek any eventually hidden power cord. None was found.

During the test the main resistor, used to ignite the reaction, failed due to defective welding. Even in that condition the reactor successfully started operation using the other resistors but the duration of the experiment in full power (≈40 min) was "too short" to observe a self sustaining reaction.



The temperatures recorded in [Test 2] are shown in fig 4. Unfortunately the original data has been lost but the different evolution is evident.

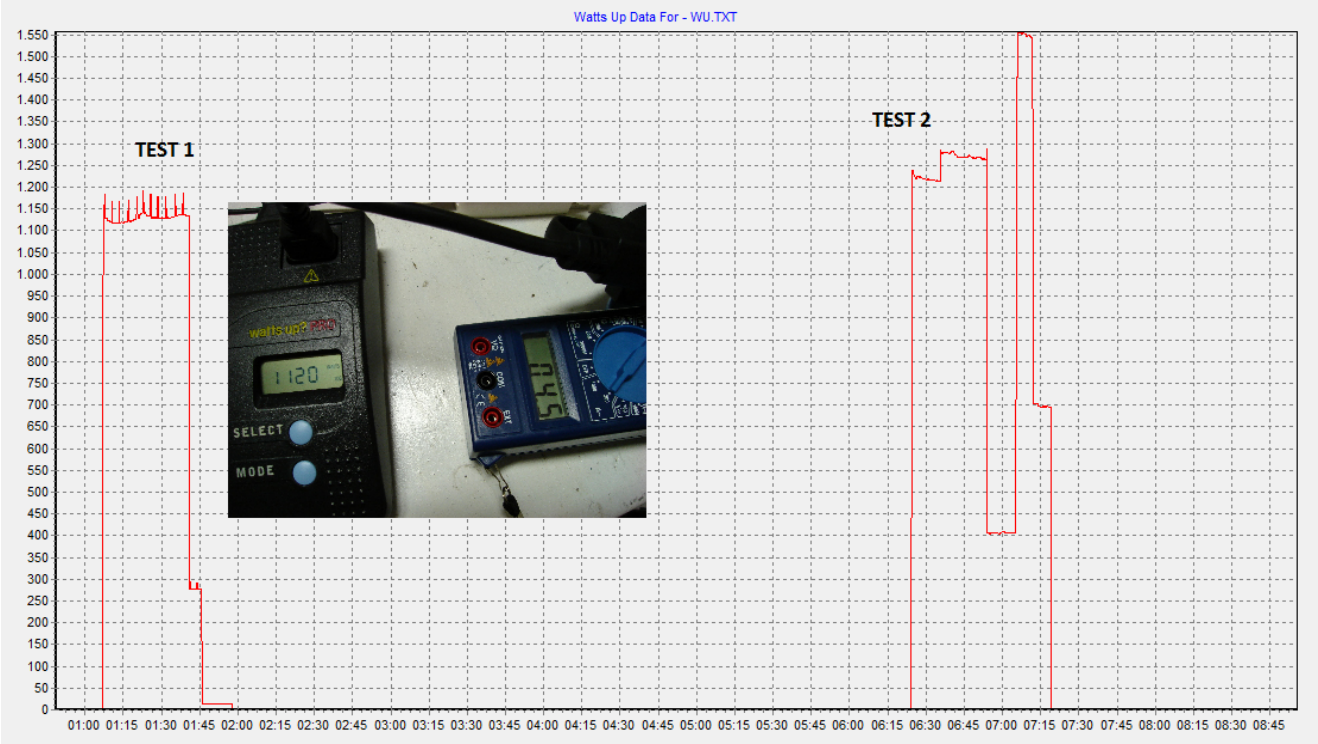


Fig. 5 - Power adsorbed during tests in W. The time abscissa has 15 min tics from counted from the first record. Spikes in [Test 1] are due to line voltage spikes. The anomalous behavior in [Test 2] is clear.

The average power adsorbed during [Test 2] is ≈1022W.

Conclusions

The amount of power and energy produced during both tests is indeed impressive and, together with the self sustaining state reached during [Test 1] could be an indication that the system is working as a new type of energy source. The short duration of the tests suggests that is important to make more long and complete experiments. An appropriate scientific program will be drawn up.

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Bologna 21/01/2011

Experimental evaluation, for radiation protection purpose, of photon and neutron radiation field during the public presentation of the prototype called "Energy Amplifier"

PREFACE

On 14/01/11 at the GM System plant of Via dell'Elettricista 16 in Bologna, I performed radiation field measurements for radiation protection purposes as per your request of 09/11/10.
This report is therefore about the evaluation of the photon and neutron radiation field near the prototype called “Energy Amplifier” during it's public presentation.

The process, the geometry and the materials used for the production of energy inside the “Energy Amplifier” are unknowns that I'm not aware of. Environmental monitoring is defined temporally before, during and after the test in question

The field evaluation can not relate to criteria of functionality of the system and can not be used for comparison in systems different from this one, in the process, in the geometry or in the construction materials used.

TIME DESCRIPTION OF THE TEST

The test has been conducted without interruptions in the measures presented below, which therefore represent, to all intents and purposes, a continuous monitoring of the photon field and of the neutron field samples as summarized in table:

ID	Phase	Start time	End time
0	External environmental background	13:10	13:20
1	Before ignition	15:45	16:22
2	Ignition	16:22	16:45
3	Stability	16:45	17:25
4	Switching off	17:25	17:55
5	After switching off	17:55	19:00

Table 1: Time phases of the present measurements during the presentation of the “Energy Amplifier”.

REPRESENTATION OF THE MEASURE GEOMETRY

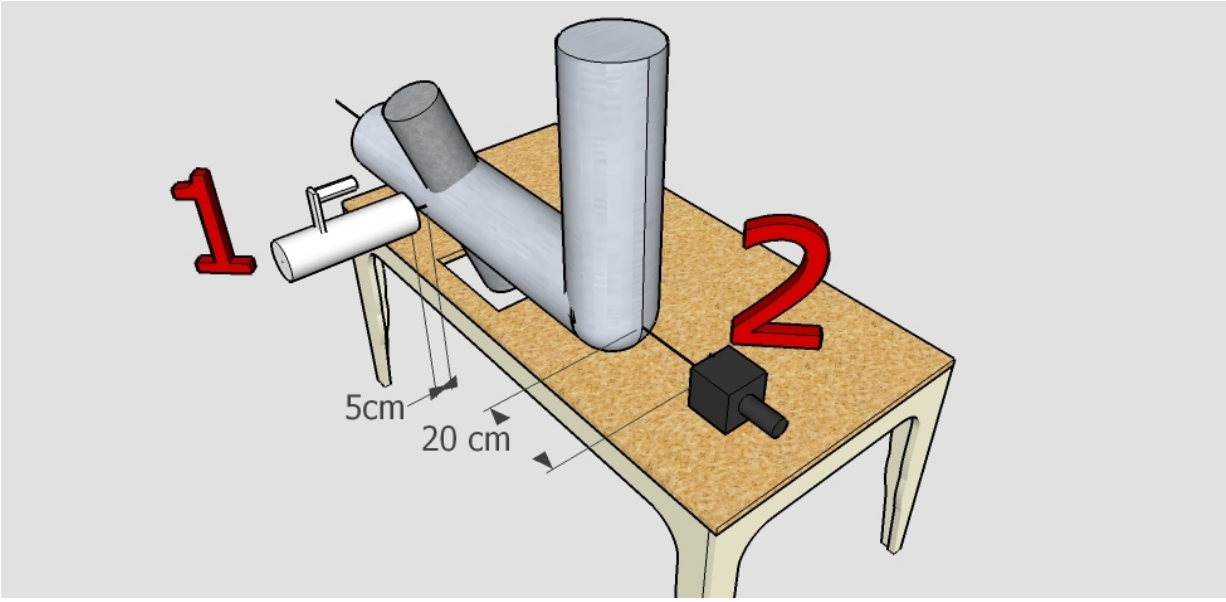

Figure1: This is the perspective representation of the relative position between probes and the "Energy Amplifier". This figure can be used to represent the environment in which the instruments were used. Probe "1" is described in Table 2. Probe "2" is described in Table 4

EVALUATION OF THE X e γ FIELD

This measure has the purpose of detecting, only for radiation protection purposes, the X e γ radiation around the "Energy amplifier" while it is in use.

This measure does not take into account in any way the internal attenuation of the photons produced by the apparatus and cannot in any way be traced back to the production or otherwise of the photons due to the same apparatus.

METHOD

We defined a measurement protocol structured as follows:

- In agreement with the ICRU definitions (*International Commission on Radiation Units and Measurements; rif. Report 57-1998*), we have chosen to evaluate the ambient dose equivalent H*(10) as a dosimetric indicator of the X and γ field;

- The ambient dose equivalent measurements have been performed in dose rate mode;

- The measurement position is not fixed but is variable around the "Energy amplifier" at a minimum distance of measurement from the outer structure equal to d =(5±2) cm. This choice has the purpose of monitoring the possible anisotropic radiation through the mapping of the radiation solid angle around the system;

- The measurements have been repeated at a frequency such that the average of the values is magnitude representative of the dosimetric values distribution;

- The average values are both temporal (time phase) and spatial (different positions of measurement);

- The analysis of the data is based on the comparison with the environmental background measured in an independent temporal phase (phase 0) and in an environment reasonably far from the "Energy amplifier" (d>50m).

MATERIALS

The measurements were performed with the following instrumentation:

• AUTOMESS 6150 AD-b (s/n 93883);
• Last calibration certificate SIT 065/R n. 9521/S/12/10 del 20.12.2010);
• Probe: zinc sulfide (ZnS scintillator) size 3"×3";
• Measuring range 23 keV – 7 MeV;
• Resolution declared of 1 nSv/h;
• Measuring range of 50 nSv/h – 99.99 μSv/h.

Table 2: Specification data of the used instrument for the present measure.

RESULTS

The measured values are shown in the following table:

Temporal Phase	H*(10) [nSv/h]
0	118 ± 10%
1	107 ± 10%
2	111 ± 10%
3	115 ± 10%
4	116 ± 10%
5	123 ± 10%

Table 3: Ambient dose equivalent for each test phase as described in Table 1 (Please note that Phase 0 corresponds to the background value)

The uncertainty on the measure is estimated in accordance with the methods described in ICRU Report 76 *Measurement Quality Assurance for Ionizing Radiation Dosimetry (2006).*

CONCLUSIONS

From the measures it is shown that there are no evidence of meaningful differences of H*(10) compared to the background environmental radiation.

Furthermore the dosimetric measures are not dissimilar from the environmental background measurement both as average and as maximum peak values.

EVALUATION OF THE NEUTRON FIELD

This measurement has the purpose of detecting, only for radiation protection purposes, the neutron radiation around the "Energy amplifier" while it is in use.

The measurement does not take into account in any way the attenuation and the thermatization of neutrons maybe produced or present inside the apparatus and cannot be in any way be traced back to the production or otherwise of neutrons due to the same apparatus.

MATERIALS

For the measurement we used a direct reading electronic detector described by the following technical summary:

Manufacturer:	LUDLUM
Electrometer:	LUDLUM 2221 Scaler/Ratemeter SCA
Probe:	Prescila 42-41 Neutron Radiation Detector (neutron recoil scintillator)
Sensitivity declared by the manufacturer:	350 cpm per mrem/h;
Angular dependance:	15 % in all the measure range

Table 4: Specification data of the instrument used for the present measurement.

The instrument has been periodically calibrated by an accredited ENEA center that has provided the following calibration factors:

- On 17/03/2010 (N°1N10) with AmBe source ($E_{neutrons}$ = 4.4 MeV) equal to 36CPM per μSv/h
- On 28/01/08 with di Pu-Li source ($E_{neutrons}$ = 0.54 MeV) equal to 15 cpm per μSv/h

METHOD

We defined a measurement protocol structured in the following way:

- The evaluation of the neutron field is based on the rate measurement of the counts per minutes (cpm) as they are provided by the instrument, by integrating the registered counts in 60 seconds;

- The measurement position is fixed with respect to the "Energy amplifier" at measurement distance from the external structure equal to d =(20±5)cm. This choice has the purpose to monitoring the neutron radiation in the room in the chosen angular direction. The choice of the position is due the instrument available space;

- The values provided are the average of the values collected in the temporal interval;

- The measurements have been repeated at a frequency such that the average of the values is representative of the distribution of dosimetric values;

- The analysis of the data is based on the comparison with the background measured in an independent temporal phase (phase 0) and in an environment reasonably far from the “Energy amplifier” (d>50m).

RESULTS

The results are presented in temporal rate of counts per minute type (counts per minute) in the same way as what is provided directly by the instrument (average values for each time interval in question):

PHASE	**CPM (counts per minutes)**
0	16 ± 2
1	15 ± 2
2	16 ± 2
3	15 ± 2
4	14 ± 2
5	16 ± 2

Table 5: Count per minute values for each test phase as described in Table 1 (Please note that Phase 0 corresponds to the background value)

CONCLUSIONS

From the measures it is shown that there is no evidence, within the bounds of the instruments presented before, of meaningful differences in the measured values compared to the background environmental radiation.

Further:

- The absence of neutron field observable from the measured background does not allow the dosimetric analysis for a comparison with the calibration values associated with the instrument.
- The measurement results are not dissimilar from the environmental background both as average and as maximum values.

In faith
Dott. Bianchini David

Report of the measurements of the steam qualità generated by means of the E-Cats made by Leonardo Corporation.

1- The probes which have been utilized and the connected elaborators measure the quantity of evaporated water in grams/cubic meter, with a margin of error of +/- 12 grams
2- We chosen as a parameter the temperature of 101.1 Celsius, at which at atmospheric pressure at sea level (100 kPa) in 1 cubic meter must be contained 585 grams of vaporized water, if the steam is saturated, as well known
3- The pressure in the system has been regulated balancing the induced aspiration of the chimney after the sink with the pressure drop along the pipe, until we reached the atmospheric pressure in the chimney and the pipe of the system. The pressure has been measured with a deprimometer with an error margin of +/- 0,5 Pa, which is an error irrelevant to the boiling point of the water
4- The thermometers have a margin of error of +/- 0,05 Celsius
5- I made my measurements only when the temperature was exactly 100.1 Celsius
6- Since the amount of evaporated water , for the saturated steam, is 585 grams/cubic meter, as a consequence if the measured amount of evaporated water is less than this figure, the difference must be or water not evaporated, or condensed water. Conservatively, we calculated the missing steam totally as if it was non evaporated water
7- Conservatively we always considered the error margin of all the instruments as if it was always in favour of the amount of energy produced, so that we always have reduced the amount of energy produced of the possible error margin. In any case, such amounts of energy due to error margins resulted to be irrelevant.

8- The amount of vaporized water measured has always been between 570 and 580 grams/cubic meter.

9- We considered the minimum limit of 570 grams, conservatively, plus we considered the error margin, so that there is a lack of 12 + 15 = 27 grams of vaporized water.

10- This amount of 27 grams is the 4.73% IN MASS of not vaporized water.

11- Therefore the amount of energy produced by means of the E-Cat has to be reduced of 4.73% , if all the error margins are calculated to increase the lack of vaporized water; without calculating the error margins, the reduction of energy skoulb be around the 2%

12- An empirical confirmation, not rigorous though, is the fact that I extracted many times the probe from the chimney of the reactor, and it was “ictu oculi” dry: being the chimney a small vertical cylinder, due to the gravity in short time it would be filled by water, if significant amount of water shouldn’t evaporate, with two consequences: i) the temperature could not be 101.1 Celsius and ii) the probe would have been wet.

13- I have not been requested to make videos

14- To measure the pressure has been used a deprimometer Testo, but I also used a water column vulgaris, and the displacement has been less of 1 mm

15- To measure the temperatures have been used Testo Data loggers, already defined in the reports, property of Leonardo Corp

Bologna, July 25th, 2011

Dr Gilberto Galantini, Order of Chemists of Ferrara N°A 194