Application Note 18. Online system for automatic detection of remote interactions based on the CYBRES MU EIS impedance spectrometer

Other documents, related to this topic:

- **Application note 12**. MU3.0. Connecting FR Stick I, II, III and actuators FR A1-A3 to MU3.0 RevB board in phytosensing and homeostatic applications
- **User Manual:** CYBRES EIS Differential Impedance Spectrometer for electrochemical and electrophysiological analysis of fluids and organic tissues
- S.Kernbach, V.Zamsha, Y.Kravchenko, Experimental Approach Towards Long-Range Interactions from 1.6 to 13798 km Distances in Bio-Hybrid Systems, NeuroQuantology, 14(3), 456-476, 2016

This description is valid for the following versions:
EIS firmware 1183.x, client program 1.20.x, online script 2.1

Abstract. This application note briefly describes the online system for automatic detection of "remote interactions" by using the electrochemical impedance spectroscopy, semiconductor sensors and phytosensors (based on measurements of plant electrophysiology), the methodology for assessing the results and the use of this system in automatic mode.

Table of content

1. What is the "remote interactions"?

"Remote interactions" represent an experimental technology that explores long-range interactions between objects separated by a considerable distance. The remote effects are well-known in a historical context and were used in various folk practices, their scientific study began only in the 60s of XX century. From a modern point of view, these effects are considered by analogy with quantum phenomena that appear in macroscopic systems. They also possess a probabilistic nature. It is convenient to treat a certain part of "remote interactions" in terminology of telecommunication systems as a "transmitter" and "receiver" with two-way channel for transmitting a "signal" (in both directions). In this term, the "remote interactions" are sometimes denoted as the nonlocal communication effect (NCE).

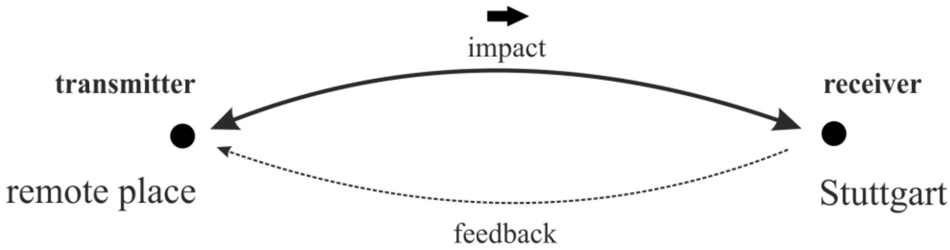

Figure 1. Schematic representation of the "remote interactions" in the terminology of telecommunication systems.

On the transmitter side, the generation of a "signal" occurs, for example, by using special devices, by biological objects, by special psychophysical state of human, and also by a combination between biological and technological systems. Receivers are physical and chemical processes in liquids and solid bodies, detected by using a precision measuring equipment, in this case with the differential impedance spectrometer.

2. What is this system used for?

This system is primarily intended for a scientific research of nonlocal communication effect and accumulation of statistical data. In practical terms, the system is designed to: 1) test and development of corresponding instruments; 2) training and further development of human mental and psychic skills; 3) the development of techniques that enhance the innate human ability for nonlocal phenomena by using instrumental methods. Participation in sessions is free and anonymous, data analysis is performed automatically without the intervention of an experimenter on the receiving side in Stuttgart. This system allows detecting/recording only the fact of transmitting the "signal" and its intensity. The presence of feedback in the form of graphs is convenient for a variety of research, training and "de-bugging" tasks.

3. How the receiving system looks like?

The receiving system is based on performing electrochemical impedance spectroscopy (EIS) in two samples of bi-distilled water (channel 1 and channel 2) at a precisely set temperature. Results of the EIS analysis are represented by the modulus and phase of impedance. The EIS analysis is performed every 5-15 seconds, the obtained values are graphically plotted in internet in real time. In addition, several environmental parameters (temperature, magnetic field, mechanical impact, supply voltage, light intensity, etc.) are also recorded and plotted. This helps to identify the local impacts and to separate the nonlocal impacts on the measuring system.

In addition to EIS measurements the system is equipped with two high-precision semiconductor temperature sensors. As observed during previous experiments, they are sensitive to NCE. Data from these sensors are also plotted in internet in real time. Thus, all graphs are based on the real sensors measuring electrochemical and physical effects in semiconductors and liquids. On the receiver side, the system updates all graphics about once a minute. To update the plots on the transmitter side, it needs to push the "reload" button on your web browser.

Figure 2. Differential impedance spectrometer CYBRES MU EIS, two channels with sample fluids are shown.

4. How to register the impact?

The experiment is divided into three phases with fixed duration: the phase 1 - the time prior to exposure; the phase 2 - the impact, the phase 3 – the time after impact. Identification of impact is based on the difference of sensor dynamics in the phase 2 with respect to phases 1 and 3. Typically, the impact causes the change of a trend (in most cases, see Fig. 5) and a "jump" of dynamics, see Fig. 3.

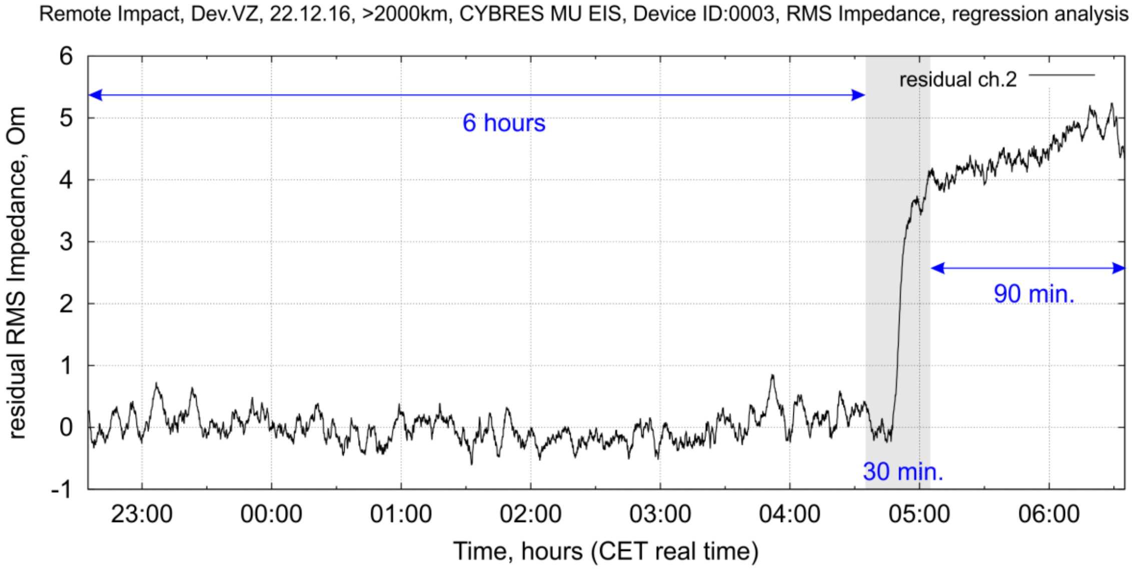

Figure 3. Sample graphs with impact produced by a device on 21-22.12.16 at the distance over 2000km, phases 1-3: 360-30-90 minutes. In general, the duration of these phases can be different.

The graph shown in Fig.3 is obtained by applying a regression analysis between the start point of time window (the point A) and the beginning of impact (the point B) and then by subtracting the linear regression from the raw sensor data.

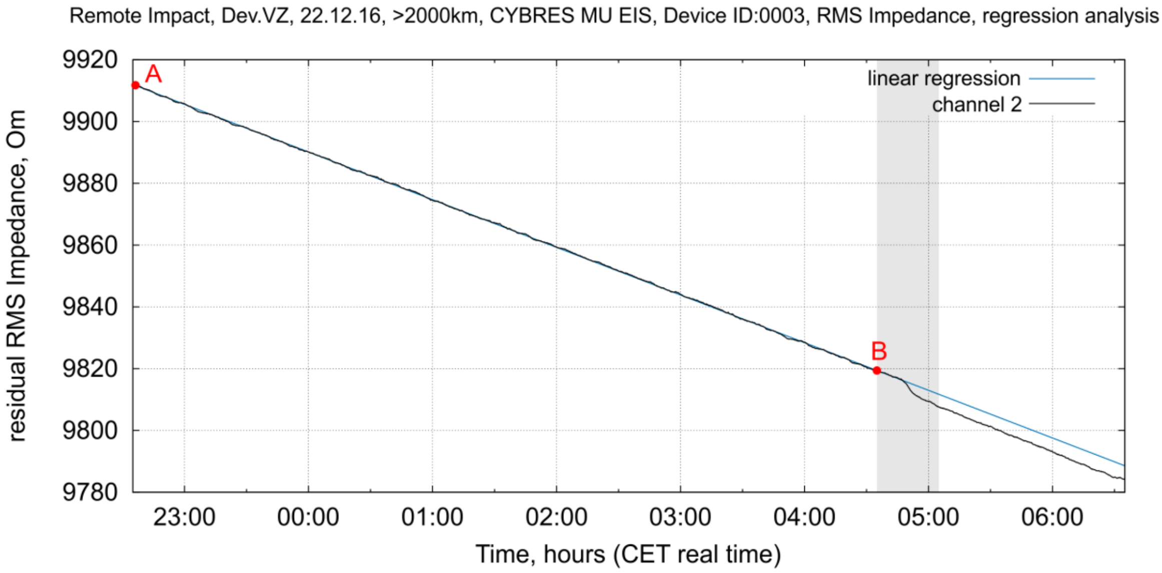

Figure 4. The raw sensor data from the EIS sensor and the linear regression for the case shown in Fig. 3.

The reaction of measurement system often occurs as a change of trend with noised signal, see Fig. 5. Recognition of this change takes a long time, sometimes this time is comparable with the recording time of background signal. If the system has a very noised data after the impact and the change is not recognizable, contact info@cybertronica.de.com for detailed data analysis.

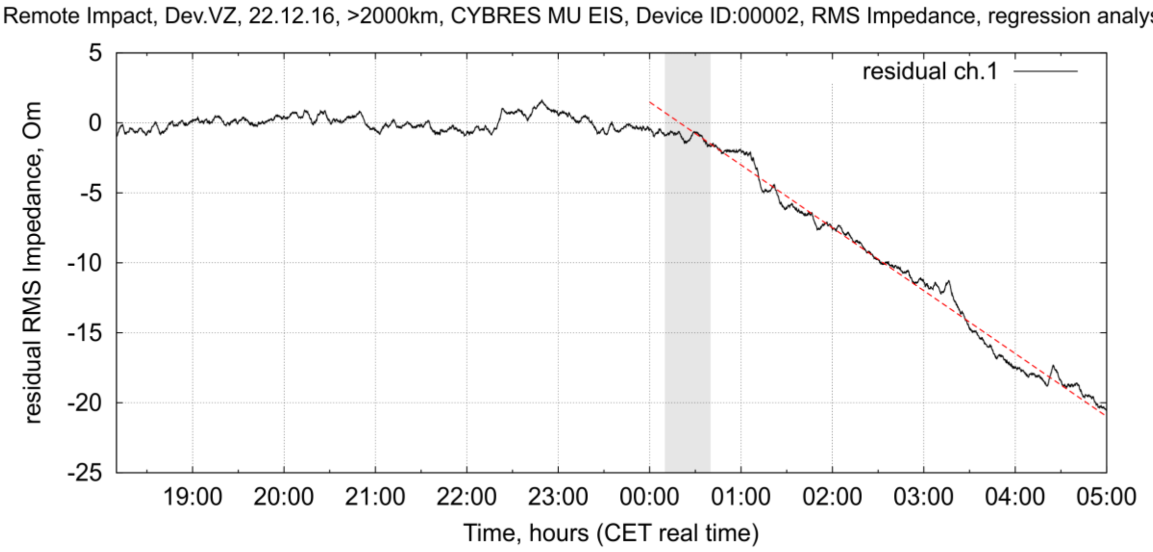

Figure 5. Sample graphics with the impact produced on 22-23.12.16, the EIS sensor changed its trend.

5. What data are contained in the online plots?

Links to all sensors can be found at: cybertronica.de.com/OnlineMeasurements. This page has further references to different phytosensors and impedance spectrometers. It is recommended to start experiments with EIS spectrometers. On the page of a particular device, as shown in Figure 6, the capture of the graphs indicates the device number (Device ID: xxxxx), the recording time in the format "month:day:hour:minute:second" and the graph name.

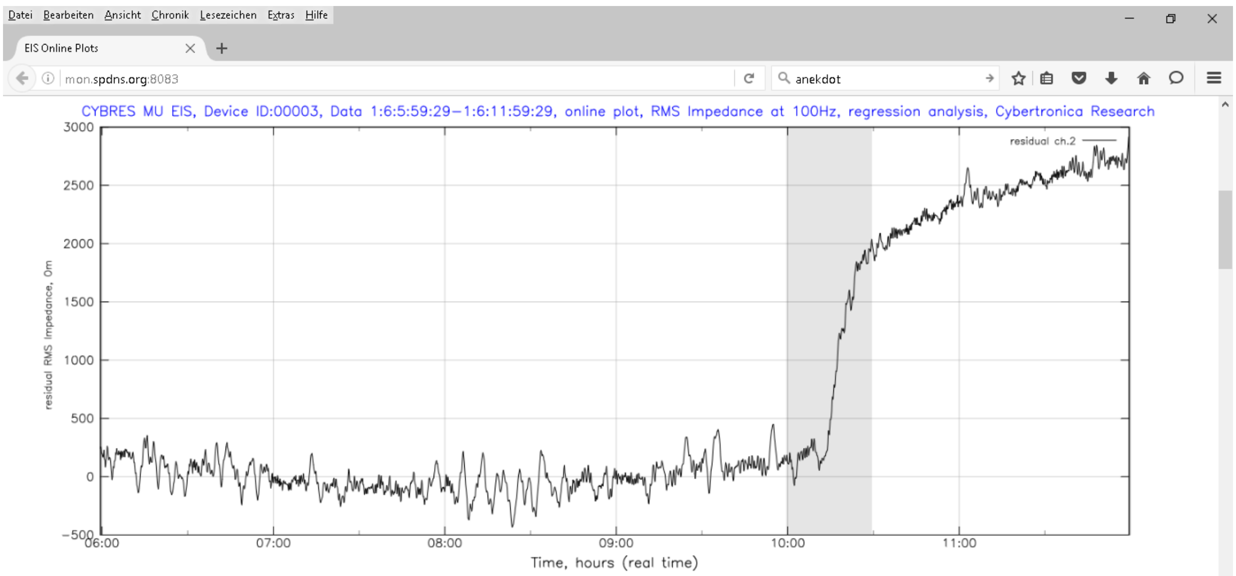

Figure 6. Example of an online graphics of the device ID:00003.

The web page contains 7 graphs (for different versions of the system, the number and type of graphs may vary):

1. EIS dynamics of the first channel (residual curve after linear regression)
2. EIS dynamics of the second channel (residual curve after linear regression)
3. The temperature in the chamber with the spectrometer
4. The temperature of two thermostats (sample fluids and electronic components)
5. Phase of the impedance in channels 1 and 2

6. Intensity of magnetic field and mechanical impact on the X axis
7. Intensity of magnetic field and mechanical impact on the X axis

The first four graphs represent independent sensors, any of them can be used for experiments. In addition to the EIS sensors, the graphs 6 and 7 are generated by a separate magnetometer/accelerometer sensor. As shown by the previous experiments, this sensor is not sensitive to nonlocal phenomena.

6. How to perform experiments with EIS sensors?

Participation in sessions is anonymous and free, before the session participants have to reserve 12 hours-slot in the doodle schedule (or in another proposed calendar, see the link on the web page with all sensors).

1. It needs to select the channel whose dynamics was most linear in the last 6 hours. An example is shown in the figure below, the dynamics of EIS sensor can include small nonlinearity in the form of spikes, trend changes or noise. Due to regression analysis, the data will be horizontally arranged along the X axis and averaged about zero level, see Fig. 7. If the graph is not positioned horizontally, this data channel is not suitable for experiments. The whole data window in the graphs is of 6, 9 or 12 hours (it depends on parameters). Due to data shift each minute, the first region moves back, i.e. the background recording will be 6, 9 or 12 hours long.

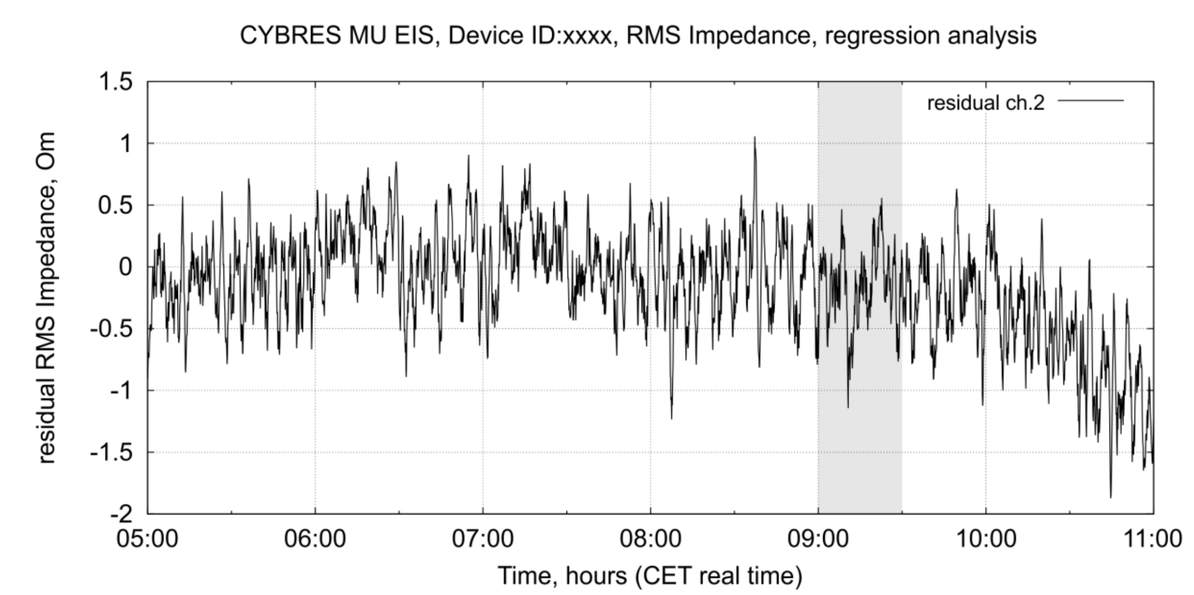

Figure 7. Example of EIS dynamics suitable for performing an experiment.

2. The impact should be 30 minutes long. This duration is selected based on experiments and is optimal for most cases. It is recommended to use so-called “address links” (“nonlocal keys”) for instrumental experiments, links are shown on the web page with sensors. Operator experiments can be performed either with links, but also without any links (only graphs as a “link”).

3. After the impact, it needs to wait until the first (impacted) area will be shifted back to the gray bar. The start of impact should then coincide with the point B (begin of the gray bar), see. Fig. 4. The system automatically performs the regression analysis, whereby any change of dynamics becomes well-recognizable in regards to the background recording. In the case of a positive result, the html page in browser can be locally saved. These graphics can then be forwarded as a file and reviewed in any web-browser. Please report both positive and negative results to info@cybertronica.de.com, in this case it is also possible to obtain extended graphs with manual processing of results.

It is not recommended to undertake more than one impact per a session.

7. How to perform experiments with semiconductor sensors?

Previous experiments have demonstrated some evidences that precision semiconductor temperature sensor in the EIS spectrometer could be sensitive to NCE, see Fig. 8.

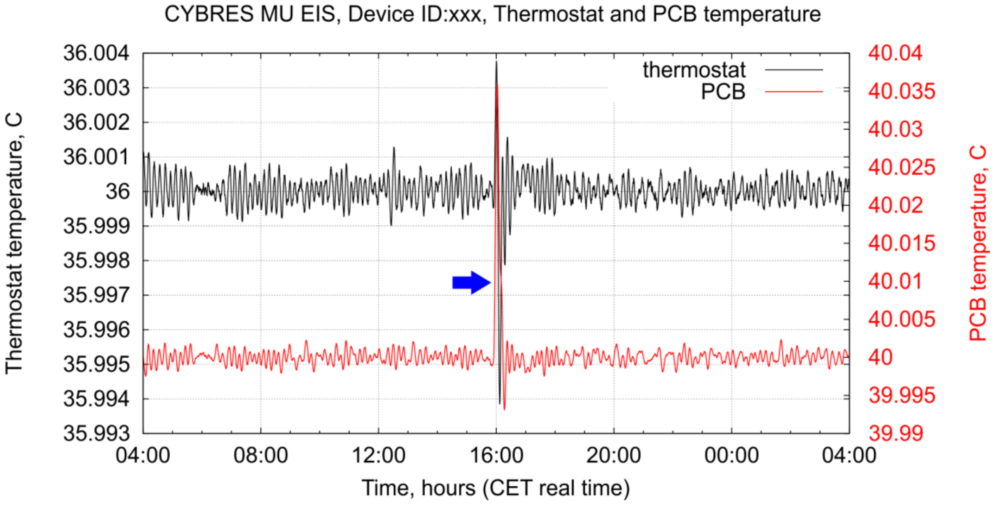

Figure 8. Dynamics of temperature sensors used in the EIS system within 24 hours. The arrow indicates the expected impact.

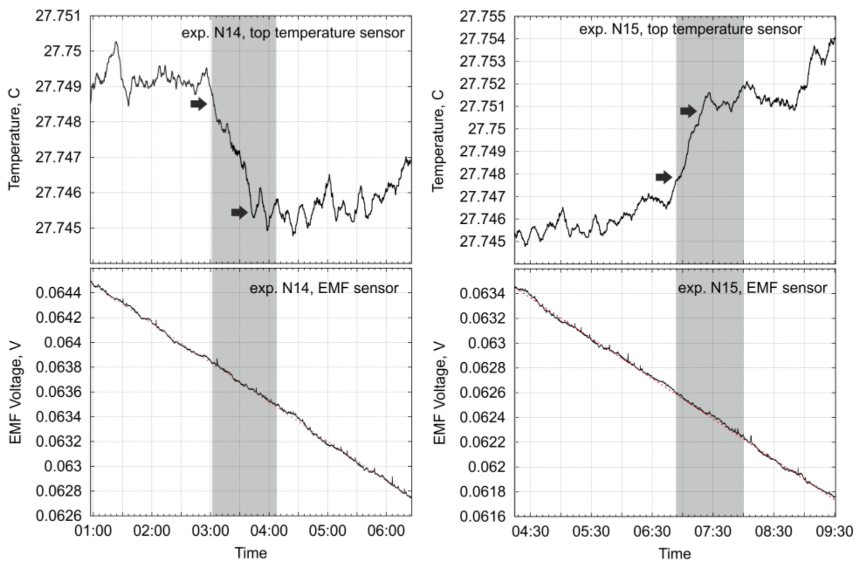

Figure 9. Dependence of the temperature data from the non-electromagnetic impact (indicated by the gray bar), from local experiments, published in *S.Kernbach, The minimal experiment (rus), IJUS, 4(2), 50-61, 2014.*

As shown in Fig. 9, the change in sensor data are at the level of a few hundredths of a degree Celsius. To amplify the change, the temperature sensor is included in the thermal feedback loop with instable oscillatory component. Furthermore, the sensor of same type is used for measuring the ambient temperature. Comparing data from two sensors allows identifying nonlocal effects. Influencing these sensors can be performed together with the impact on EIS sensors or independently of them (regression analysis for the semiconductor sensor is not performed). A positive result can have the form shown in Figs. 8 and 9, i.e., as a spontaneous oscillation or unproportional "jump" of temperature.

8. How to perform experiments with phytosensors?

Differential impedance spectrometer is also used for plant' electrophysiological measurements (biopotentials and tissue conductivity). The experiment involves a few cactus and dracaena plants. In general, the experiments with phytosensors do not differ from the EIS and semiconductor sensors. It must be remembered that the electrophysiology of plants has its own dynamics, thus the data analysis can be very complex. The more linear is the selected region, the more evident will be effects with respect to the background record.

9. Statistical analysis of results

It must be remembered that the generation of a "signal", the process of nonlocal transfer, and the receiving sensors have a probabilistic nature. Therefore, it is necessary to answer the following questions:

1. **In terms of results**: what is the probability that the operator/device on the transmitting side accidentally "guessed" the sensor response, or deliberately misinformed the experimenter on the receiving side?
2. **In term of the sensor**: how likely is it that the experimenter misinterpreted the noise from the sensor as a response to the signal?
3. **In terms of a process**: how likely is it that a long-running random process will generate a noise (the null hypothesis), that will produce results similar to remote impacts?

The following procedure can be used for statistical analysis. Let L is the total length of the data window, which includes the background recording time, the impact time and the time after impact; S is the duration of the impact by operators/device on the sensor. The result is considered to be positive when the dynamics is qualitatively different in the areas S and L-S, as shown in Fig. 3. The amplitude of noised signal in the area after S should be at least two times greater than before S. It is necessary to record the number of positive and negative results and the total number of attempts (n> 30). All attempts must be independent from each other.

1. It is assumed that the positive and negative results have a normal distribution with mean 0.5. Calculate the standard deviation for all results.
2. The probability of accidental appearance of a large noise (e.g. "jumps" in dynamics) during the exposure O_k that lead to a counting as a positive result is $P(O_k) = S/L$. Since attempts are independent, the joint probability for multiple appearance of random-noise-as-positive-result is computed as the multiplication of probabilities. For the time window of 6 hours, $L=480$ *minutes*, $S=30$ *minutes*, $P(O) = 0{,}0625$ and the likelihood of three positive results caused by a random noise is $P(O)^3=2.4e\text{-}4$.
3. Since the distribution of $P(O_k)$ is generally unknown, it needs to apply the non-parametric Mann-Whitney U test to evaluate the degree of "randomness" of $P(O_k)$. For this analysis, it can be assumed that a random process with $S/L=0.5$ (the occurrence of random noise when the background interval is equal to the impact interval) is used as a null hypothesis, the null hypothesis can be rejected at $p=0.01$ (or $p=0.05$).

10. Is there already collected statistics of these experiments?

Yes, a large statistics exists. Experiments with instrumental sensors began in the 80s of XX century. Currently, several groups worldwide are active in development of instrumental, hybrid and operator-based nonlocal technologies. There exists an essential number of publications. The total number of reported instrumental experiments ranging, according to various estimates, between 1000 and 3000. The number of positive results is about 70% - 75% for operator and 80% -85% for instrumental attempts. It is assumed that about 90% of the population has the innate ability for nonlocal phenomena and is capable of further development of these skills, about 10% of the population has these abilities at advanced level, and in ~ 1% -3% these abilities are expressed very strongly.

11. What is the scientific background of these experiments?

This research area belongs to so-called emerging scientific branches, where methodology of scientific nominalism is utilized. This methodology gives empirical facts priority over the theory as opposed to the concept of modern scientific realism that tends to ignore some experimental data, if they cannot be satisfactorily explained by a certain theory. The theoretical explanation of nonlocal phenomena, accepted by majority of scientific community, is currently not available. It is assumed that these phenomena can have some relation to appearance of quantum phenomena in macroscopic systems. Active research is conducted by various academic groups around the world, there are publications on this topic in high-impact journals such as Nature and Science. It should be also remembered, these technologies were developed in past by security agencies in different countries, as evidenced by various official documents. Therefore, it is crucial to maintain openness and transparency of these experiments, to follow the experimental methodology and by possibility to avoid an excessive theorizing due to lack of a large amount of experimental data (that would be sufficient to convince the global scientific community).

12. Disclaimer

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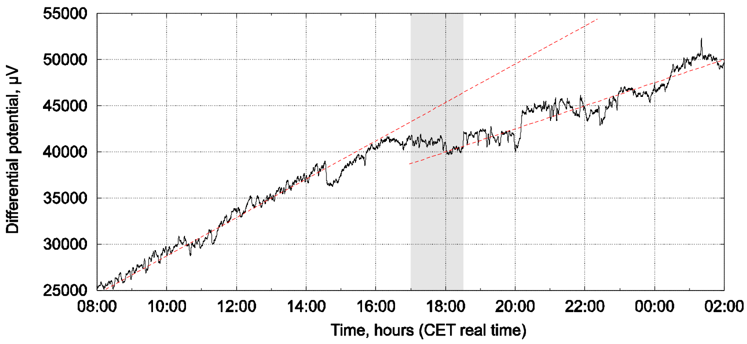
Appendix A. Several examples of positive results

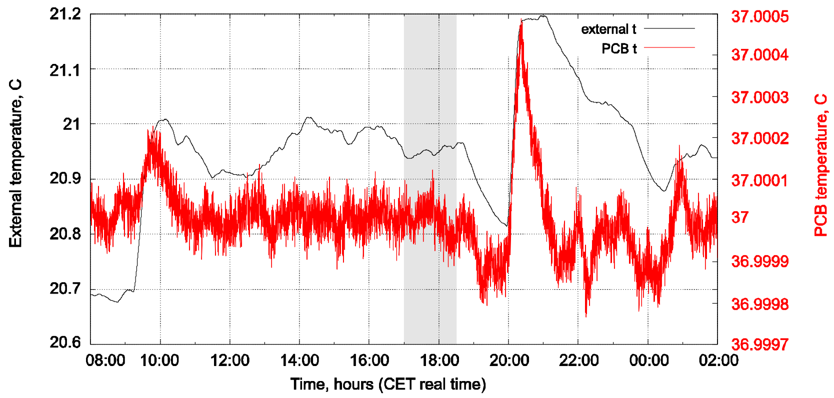
Primary Sensor Data (Phytosensor Biopotential, plant *Cactaceae*)

Remote Impact, Op. EG, 12000km, 15.12.16, CYBRES MU EIS, Device ID:00005, Differential biopotential (with Inst.OpAmp.)

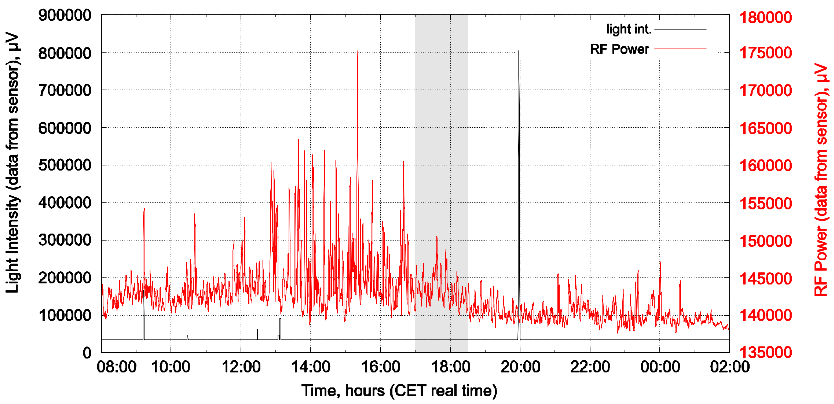


Secondary Sensor Data

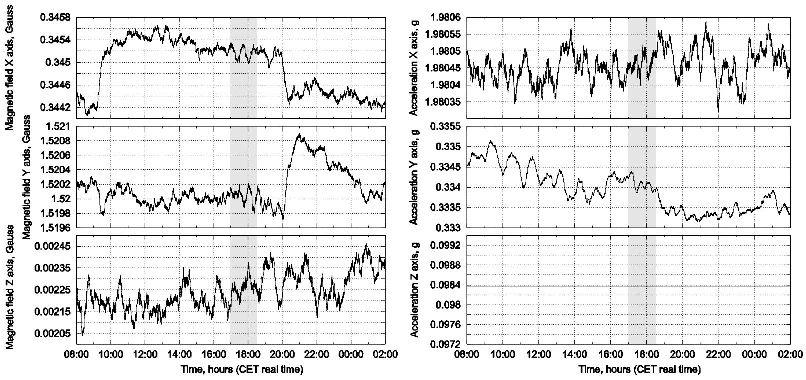
Remote Impact, Op. EG, 12000km, 15.12.16, CYBRES MU EIS, Device ID:00005, External and PCB temperature



Remote Impact, Op. EG, 12000km, 15.12.16, CYBRES MU EIS, Device ID:00005, Light and RF Power 50MHz-3GHz

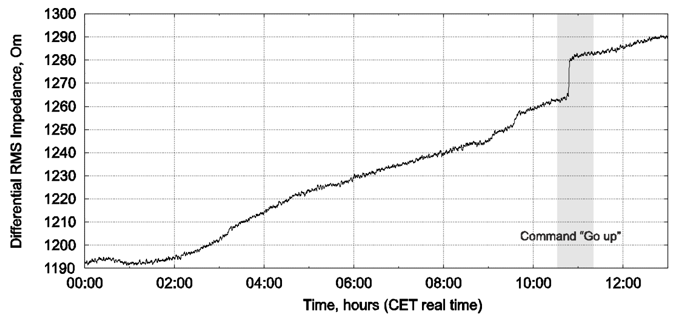


Remote Impact, Op. EG, 12000km, 15.12.16, CYBRES MU EIS, Device ID:00005, 3D Magnetometer/Accelerometer

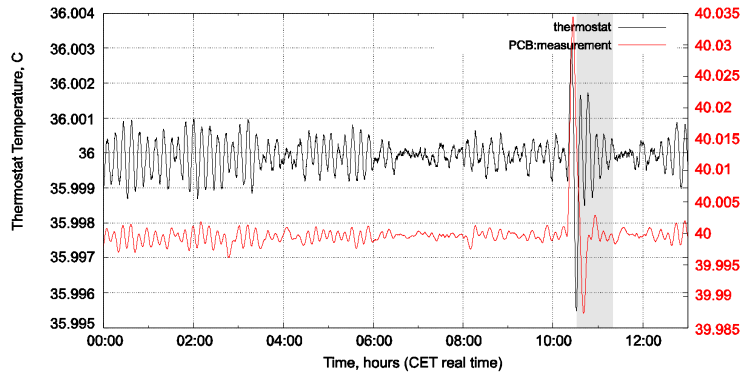


Primary Sensor Data (Electrochemical Impedance Spectrometer)

Remote Impact, Op. EG, 12000 km, 17.12.16, CYBRES MU EIS, Device ID:00003, Differential RMS Impedance

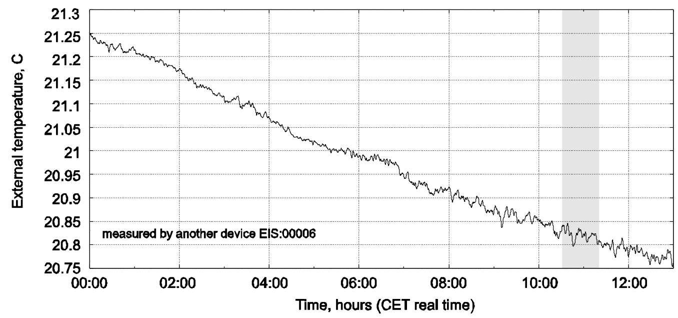


Remote Impact, Op. EG, 12000 km, 17.12.16, CYBRES MU EIS, Device ID:00003, Thermostat and PCB temperature

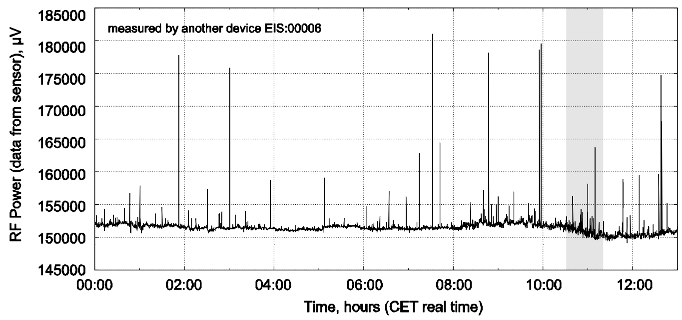


Secondary Sensor Data

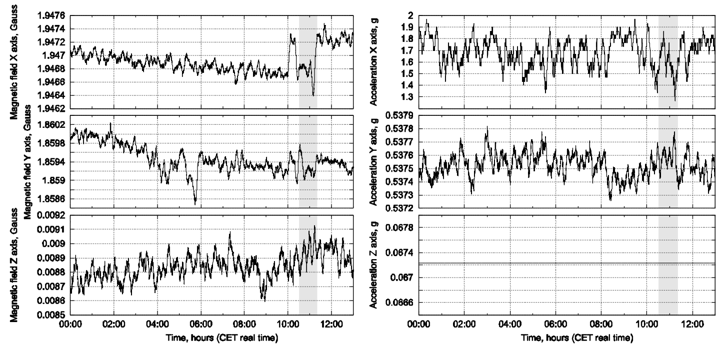
Remote Impact, Op. EG, 12000 km, 17.12.16, CYBRES MU EIS, Device ID:00006, External room temperature



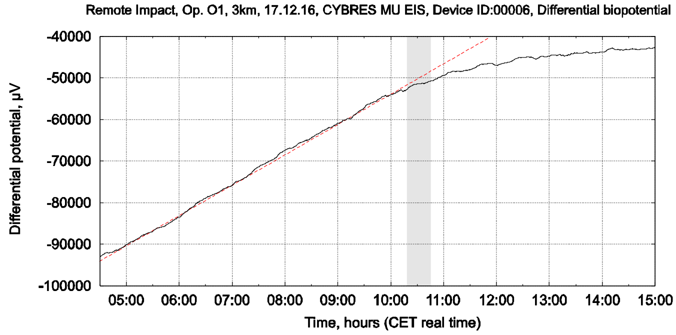
Remote Impact, Op. EG, 12000km, 17.12.16, CYBRES MU EIS, Device ID:00006, RF Power 50MHz-3GHz

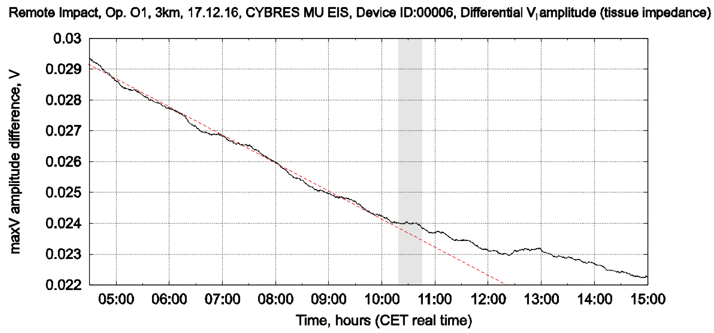


Remote Impact, Op. EG, 12000km, 17.12.16, CYBRES MU EIS, Device ID:00003, 3D Magnetometer/Accelerometer

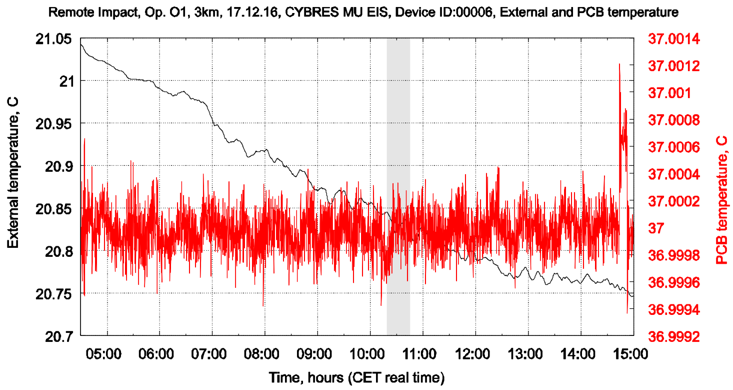


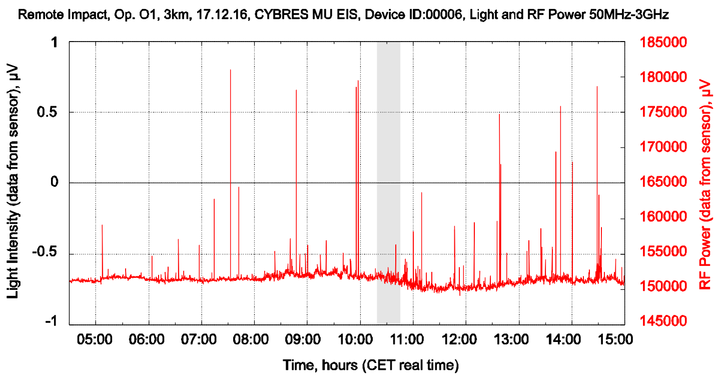
Primary Sensor Data (Phytosensor Biopotential and Tissue Impedance, plant *Cactaceae*)

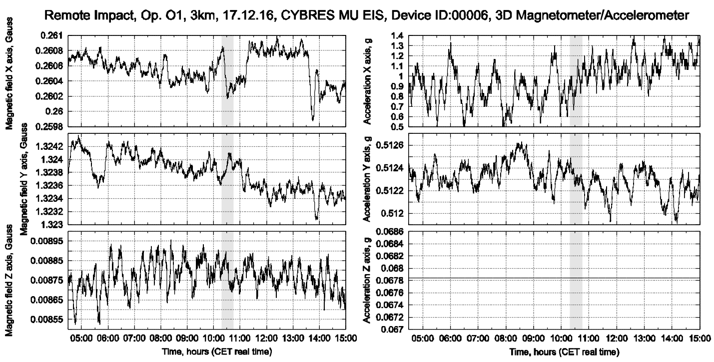




Secondary Sensor Data

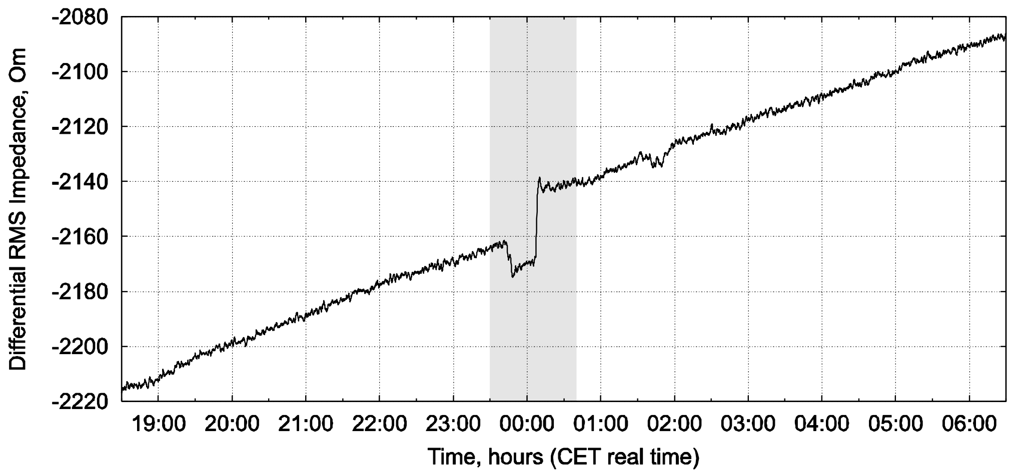






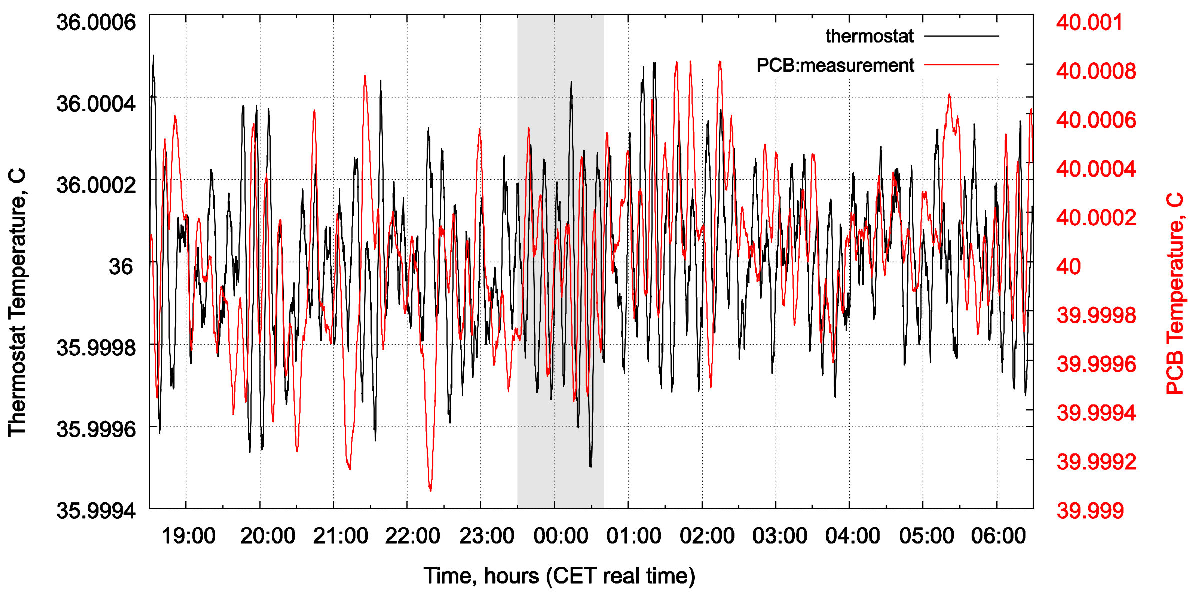
Primary Sensor Data (Electrochemical Impedance Spectrometer)

Remote Impact, Op.JP, 17.12.16, >8500km, CYBRES MU EIS, Device ID:00002, Differential RMS Impedance

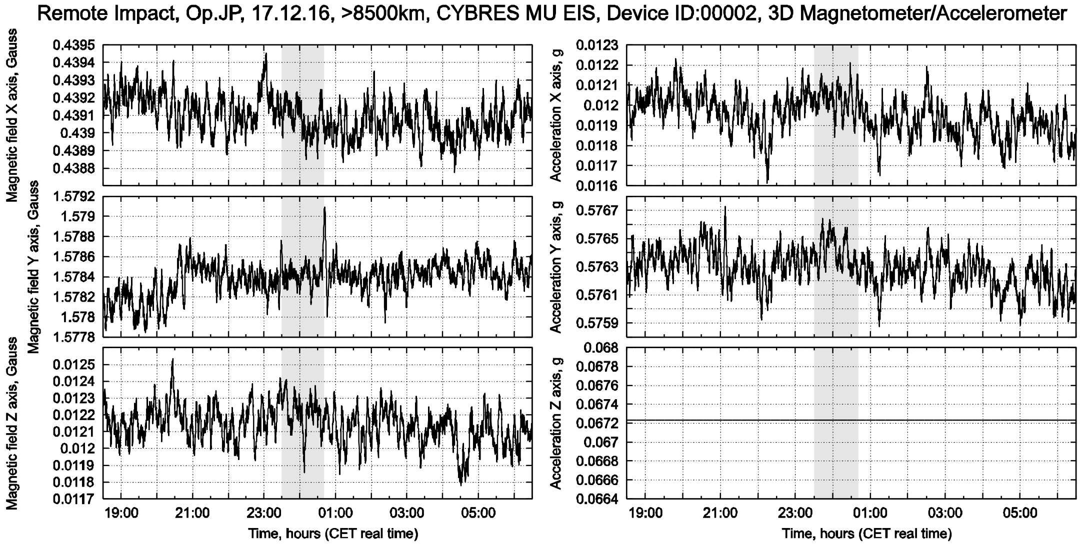


Secondary Sensor Data

Remote Impact, Op.JP, 17.12.16, >8500km, CYBRES MU EIS, Device ID:00002, Thermostat and PCB temperature

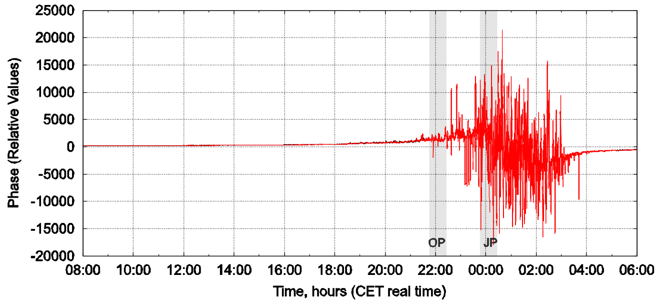


Remote Impact, Op.JP, 17.12.16, >8500km, CYBRES MU EIS, Device ID:00002, 3D Magnetometer/Accelerometer

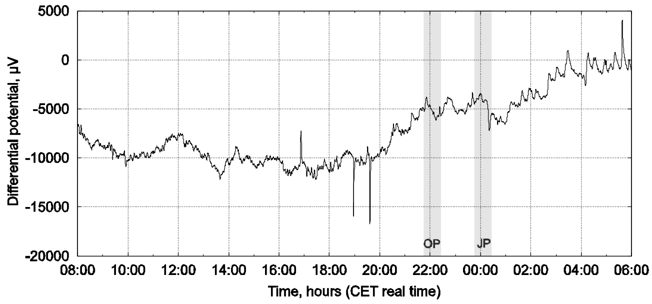


Primary Sensor Data (Phytosensor Biopotential and Tissue Impedance, plant *Dracaena*)

Remote Impact, Op.JP, OP, 17.12.16, >8500km, CYBRES MU EIS, Device ID:00005, FRA, Phase

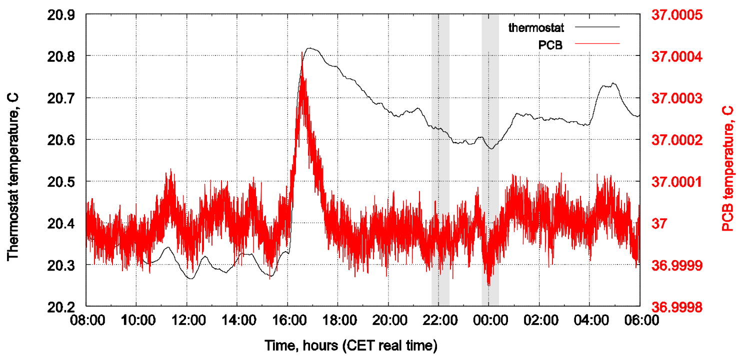


Remote Impact, Op.JP, OP, 17.12.16, >8500km, CYBRES MU EIS, Device ID:00005, Differential biopotential (with Inst.OpAmp.)

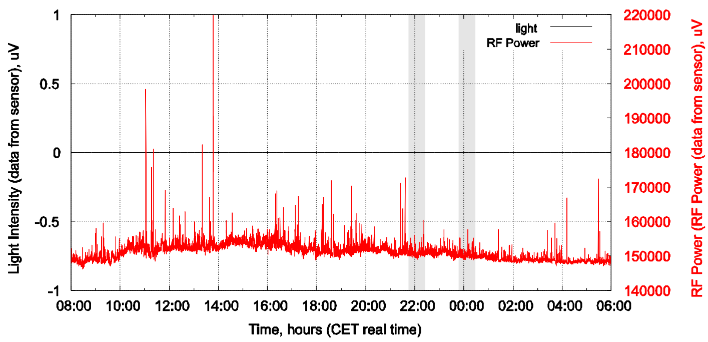


Secondary Sensor Data

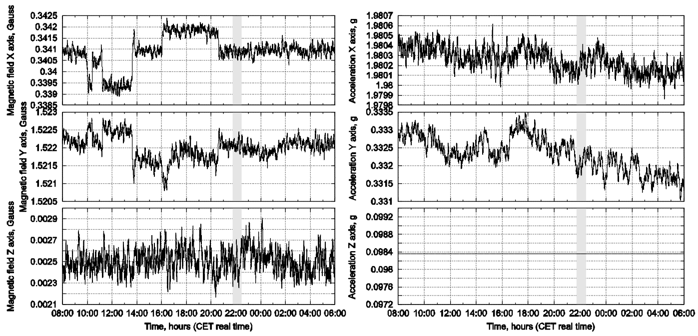
Remote Impact, Op.JP, OP, 17.12.16, >8500km, CYBRES MU EIS, Device ID:00005, Thermostat and PCB temperature



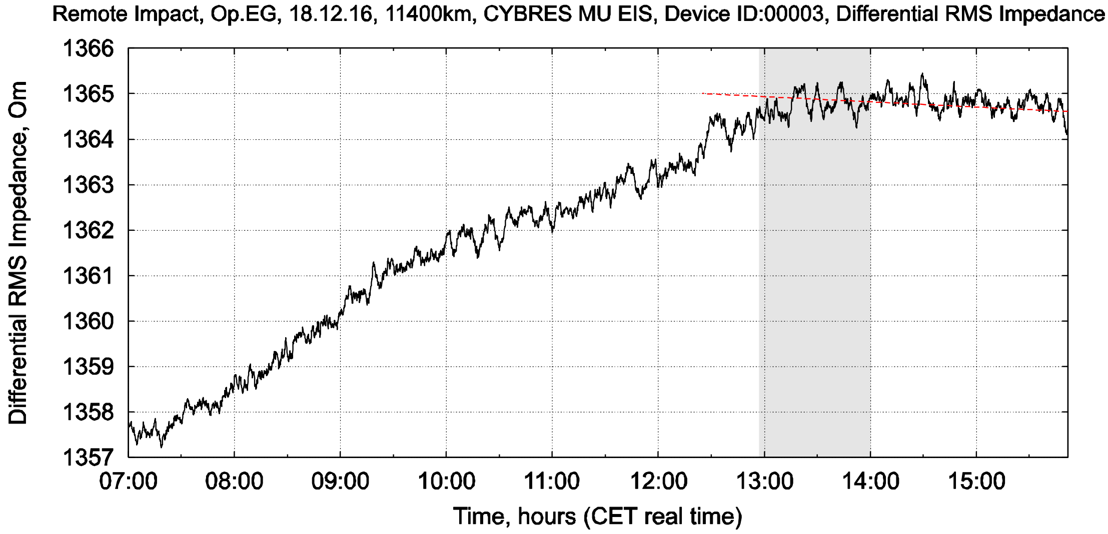
Remote Impact, Op.JP, OP, 17.12.16, >8500km, CYBRES MU EIS, Device ID:00005, Light and RF Power (50MHz-3GHz)



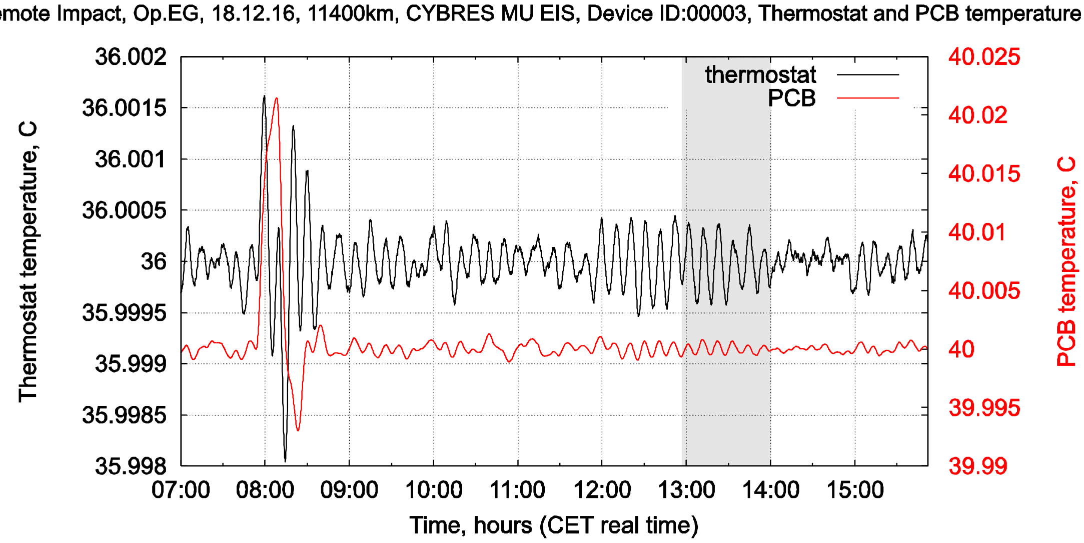
Remote Impact, Op.JP, OP 17.12.16, >8500km, CYBRES MU EIS, Device ID:00005, 3D Magnetometer/Accelerometer

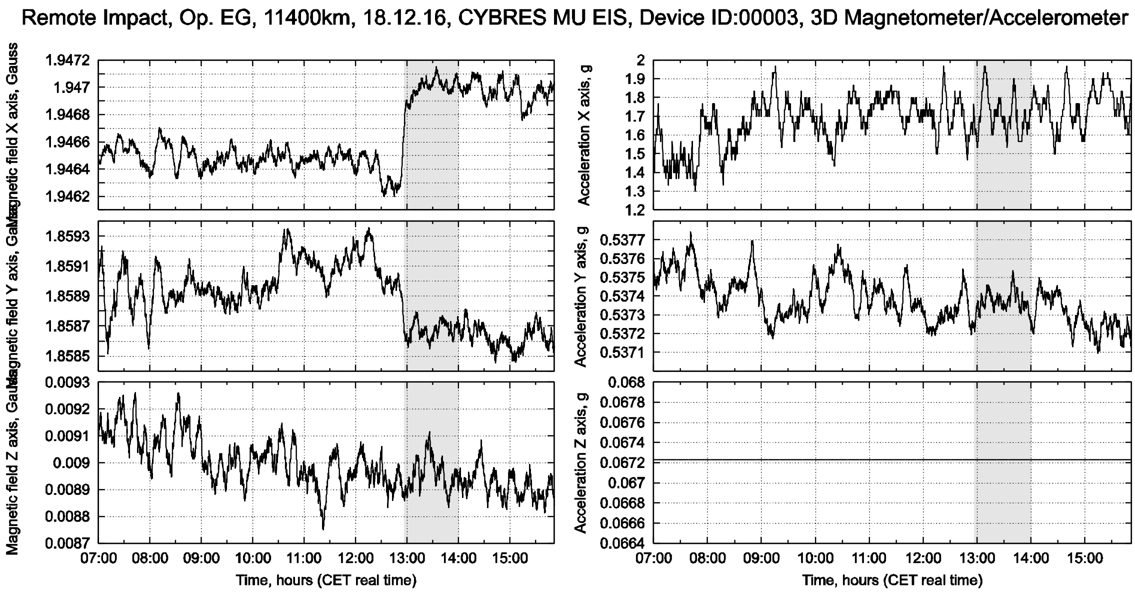


Primary Sensor Data (Electrochemical Impedance Spectrometer)



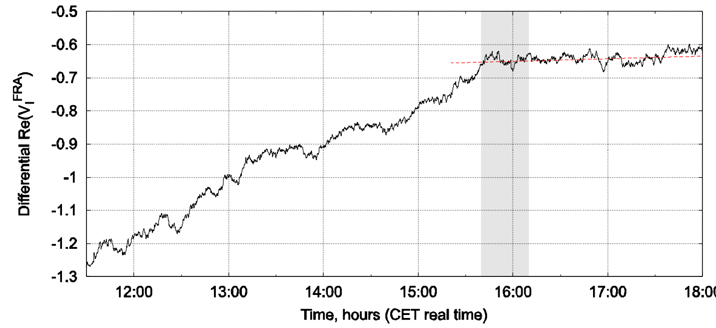
Secondary Sensor Data



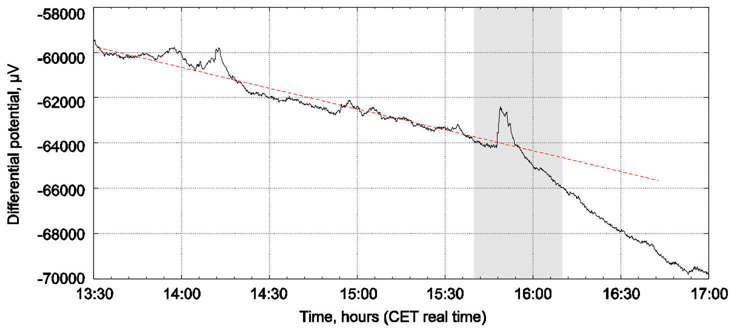


Primary Sensor Data (Phytosensor Biopotential and Tissue Impedance, plant *Cactaceae*)

Remote Impact, Op.O1+OP, 18.12.16, 3km, CYBRES MU EIS, Device ID:00006, FRA, Differential Re(V_I^{FRA})

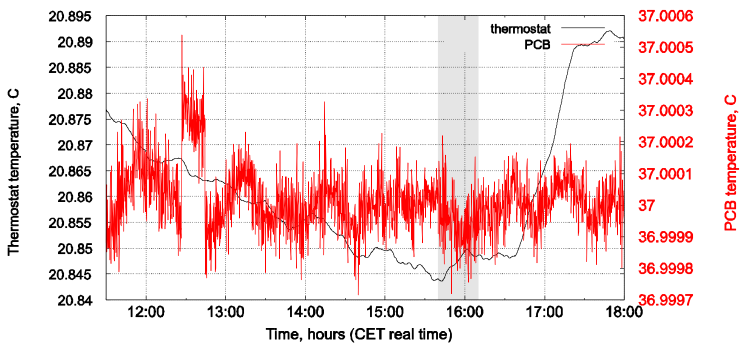


Remote Impact, Op.O1+OP, 18.12.16, 3km, CYBRES MU EIS, Device ID:00006, Differential biopotential (with Inst.OpAmp.)

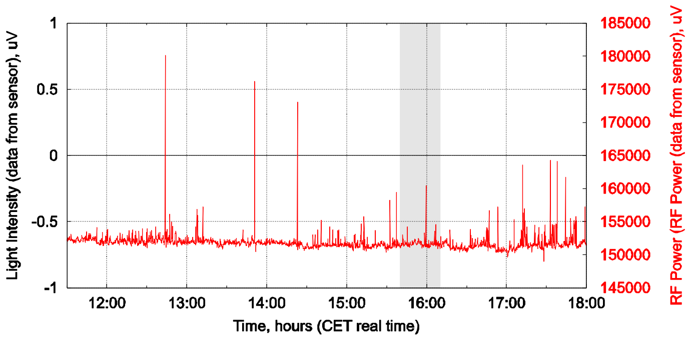


Secondary Sensor Data

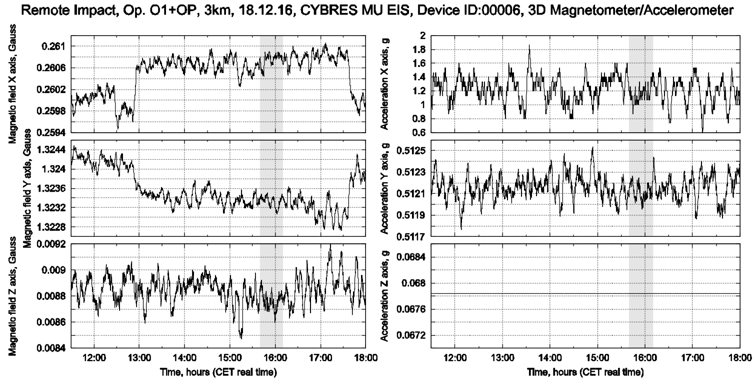
Remote Impact, Op.O1+OP, 18.12.16, 3km, CYBRES MU EIS, Device ID:, Thermostat and PCB temperature



Remote Impact, Op.O1+OP, 18.12.16, 3km, CYBRES MU EIS, Device ID:, Light and RF Power (50MHz-3GHz)

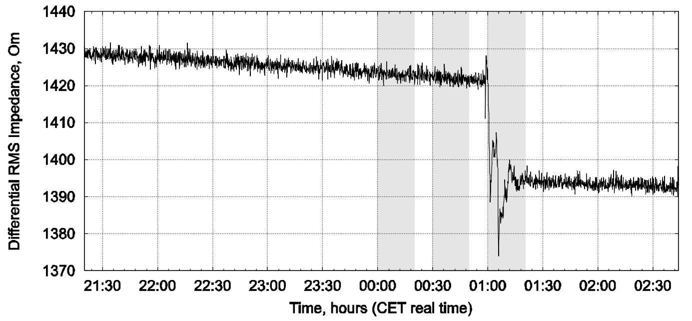


Remote Impact, Op. O1+OP, 3km, 18.12.16, CYBRES MU EIS, Device ID:00006, 3D Magnetometer/Accelerometer

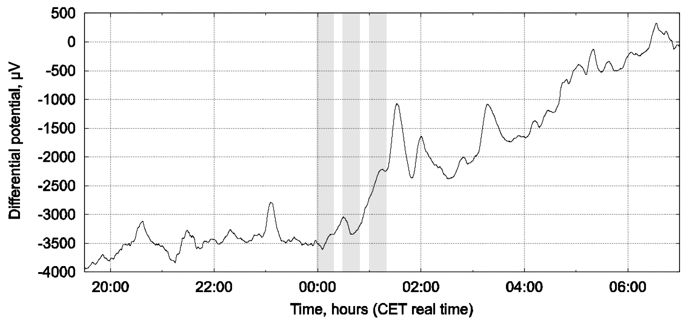


Primary Sensor Data (Thee attempts: Electrochemical Impedance Spectrometer+phytosensor *Dracaena*)

Remote Impact, Op.YZ, >7500km, 20.12.16, CYBRES MU EIS, Device ID:00003, Differential RMS Impedance

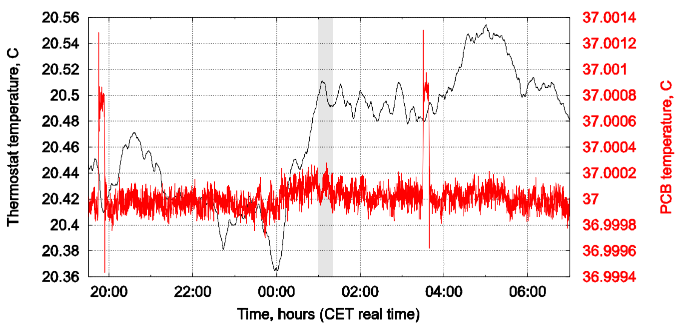


Remote Impact, Op.YZ, >7500km, 20.12.16, CYBRES MU EIS, Device ID:00005, Differential biopotential

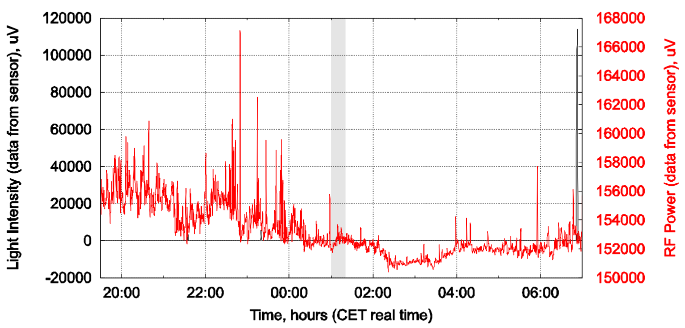


Secondary Sensor Data

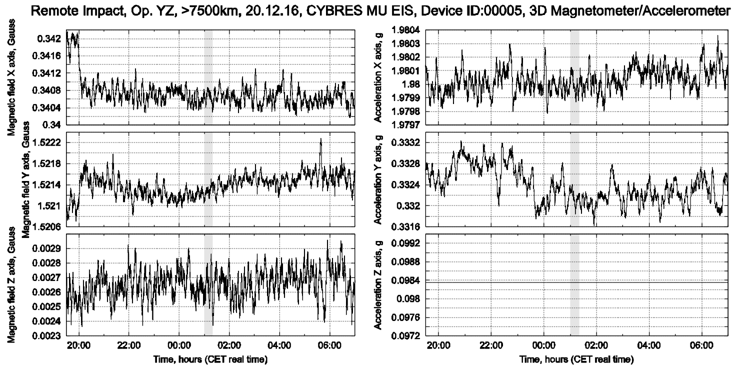
Remote Impact, Op.YZ, >7500km, 20.12.16, CYBRES MU EIS, Device ID:00005, Thermostat and PCB temperature



Remote Impact, Op.YZ, >7500km, 20.12.16, CYBRES MU EIS, Device ID:00005, Light and RF Power (50MHz-3GHz)

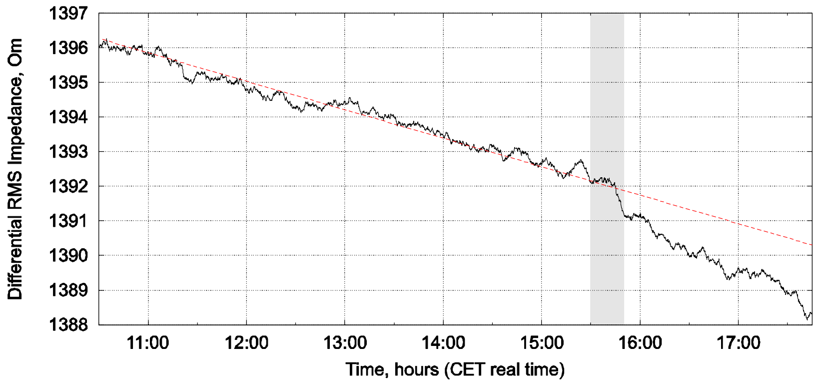


Remote Impact, Op. YZ, >7500km, 20.12.16, CYBRES MU EIS, Device ID:00005, 3D Magnetometer/Accelerometer

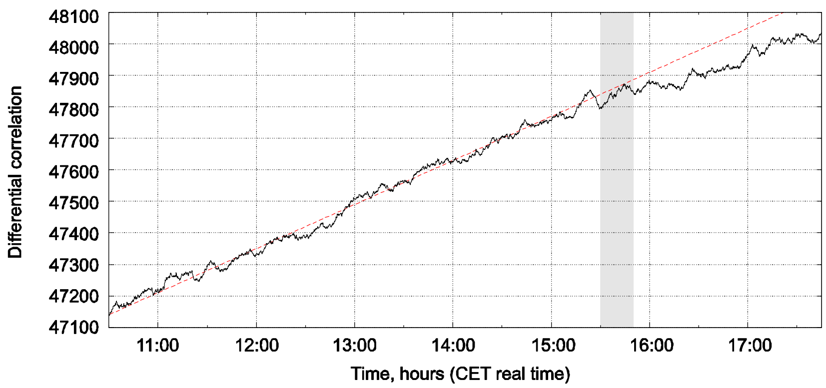


Primary Sensor Data (Electrochemical Impedance Spectrometer)

Remote Impact, Op.YZ, >7500km, 19.12.16, CYBRES MU EIS, Device ID:00003, Differential RMS Impedance

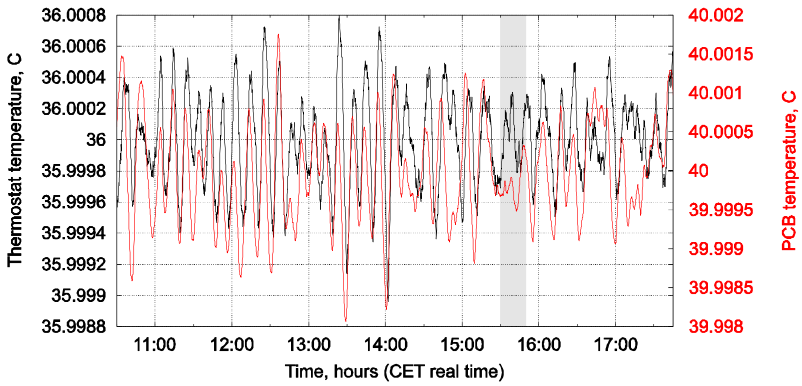


Remote Impact, Op.YZ, >7500km, 19.12.16,CYBRES MU EIS, Device ID:00003, Differential V_V and V_I correlation

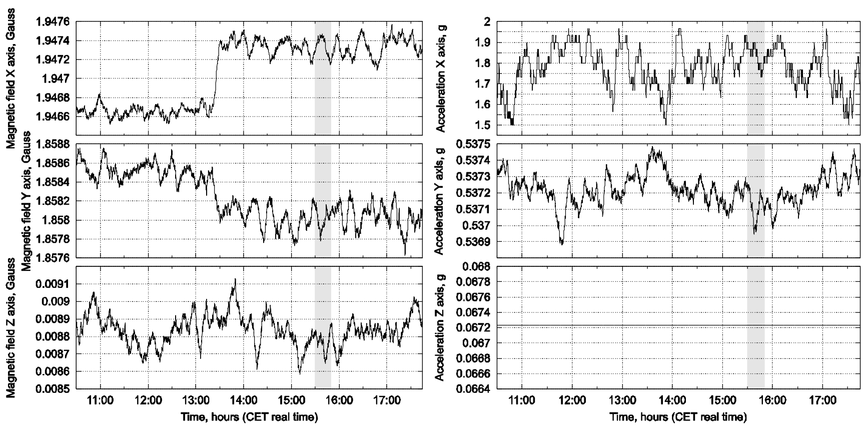


Secondary Sensor Data

Remote Impact, Op.YZ, >7500km, 19.12.16, CYBRES MU EIS, Device ID:00003, Thermostat and PCB temperature

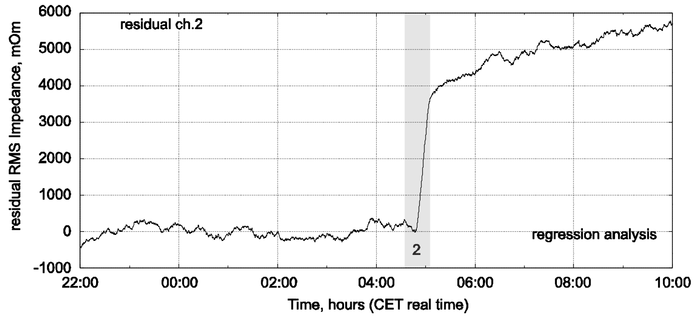


Remote Impact, Op. YZ, >7500km, 19.12.16, CYBRES MU EIS, Device ID:00003, 3D Magnetometer/Accelerometer

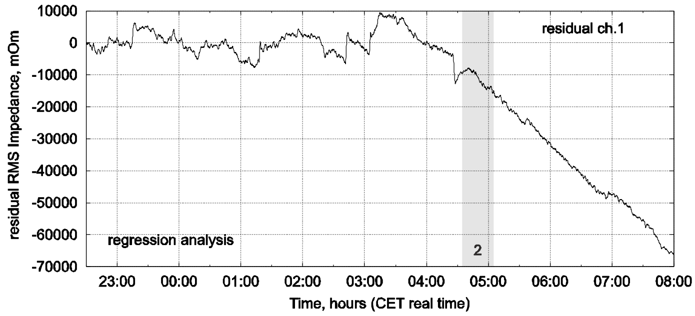


Primary Sensor Data (Electrochemical Impedance Spectrometer)

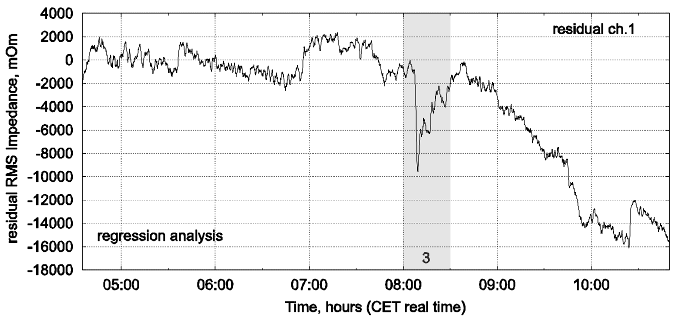
Remote Impact, Dev.VZ, 22.12.16, >2000km, CYBRES MU EIS, Device ID:00003, RMS Impedance



Remote Impact, Dev.VZ, 22.12.16, >2000km, CYBRES MU EIS, Device ID:00002, RMS Impedance

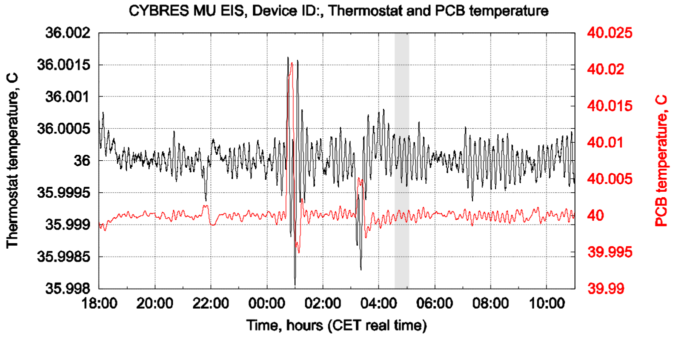


Remote Impact, Dev.VZ, 22.12.16, >2000km, CYBRES MU EIS, Device ID:00002, RMS Impedance

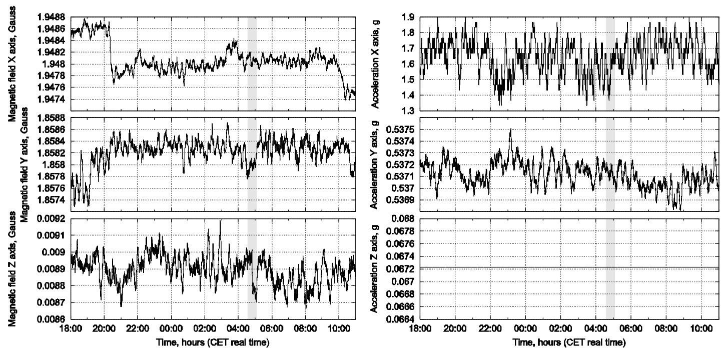


Secondary Sensor Data

CYBRES MU EIS, Device ID:, Thermostat and PCB temperature

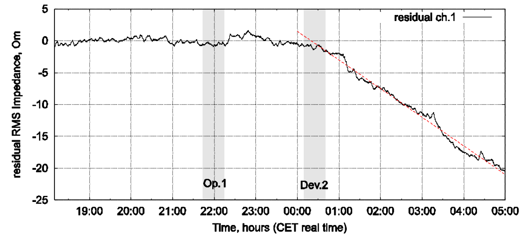


Remote Impact, Dev. VZ, >2000km, 22.12.16, CYBRES MU EIS, Device ID:00003, 3D Magnetometer/Accelerometer

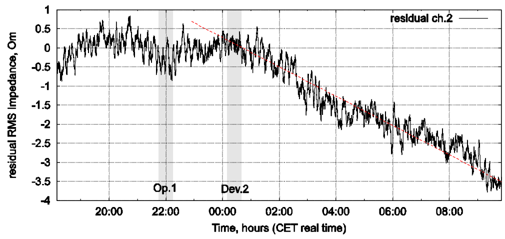


Primary Sensor Data (2x Spectrometers + 2x Phytosensors)

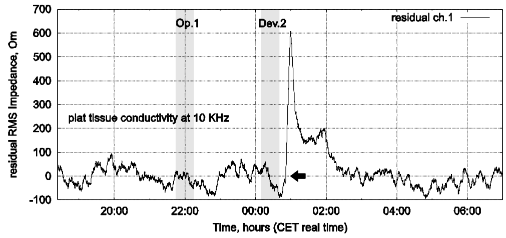
Remote Impact, Dev.VZ, 22.12.16, >2000km, CYBRES MU EIS, Device ID:00002, RMS Impedance, regression analysis



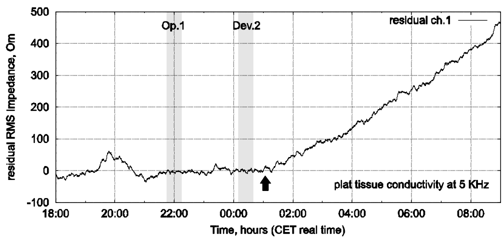
Remote Impact, Dev.VZ, 22.12.16, >2000km, CYBRES MU EIS, Device ID:00003, RMS Impedance, regression analysis



Remote Impact, Dev.VZ, 22.12.16, >2000km, CYBRES MU EIS, Device ID:00006, RMS Impedance, regression analysis

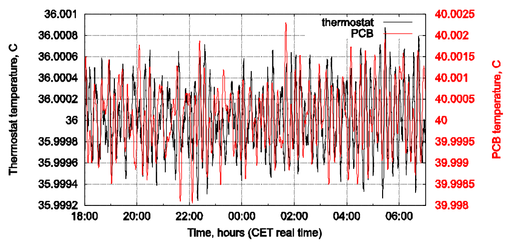


Remote Impact, Dev.VZ, 22.12.16, >2000km, CYBRES MU EIS, Device ID:00008, RMS Impedance, regression analysis

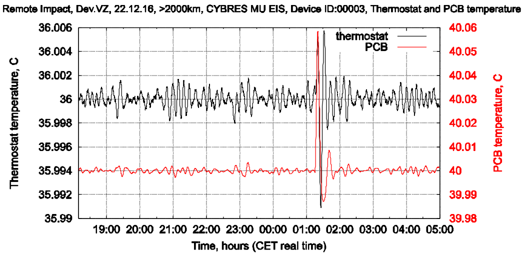


Secondary Sensor Data

Remote Impact, Dev.VZ, 22.12.16, >2000km, CYBRES MU EIS, Device ID:00003, Thermostat and PCB temperature



Remote Impact, Dev.VZ, 22.12.16, >2000km, CYBRES MU EIS, Device ID:00003, Thermostat and PCB temperature



Remote Impact, Dev.VZ, 22.12.16, >2000km, CYBRES MU EIS, Device ID:00008, 3D Magnetometer/Accelerometer