World Journal of Neuroscience, 2015, 5, 205-257
Published Online August 2015 in SciRes. http://www.scirp.org/journal/wjns
http://dx.doi.org/10.4236/wjns.2015.54022

Scientific Research Publishing

Chaos, Fractal and Recurrence Quantification Analysis of Surface Electromyography in Muscular Dystrophy

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Received 19 May 2015; accepted 5 July 2015; published 9 July 2015

Abstract

We analyze muscular dystrophy recorded by sEMG and use standard methodologies and nonlinear chaotic methods here including the RQA. We reach sufficient evidence that the sEMG signal contains a large chaotic component. We have estimated the correlation dimension (fractal measure), the largest Lyapunov exponent, the LZ complexity and the %Rec and %Det of the RQA demonstrating that such indexes are able to detect the presence of repetitive hidden patterns in sEMG which, in turn, senses the level of MU synchronization within the muscle. The results give also an interesting methodological indication in the sense that it evidences the manner in which nonlinear methods and RQA must be arranged and applied in clinical routine in order to obtain results of clinical interest. We have studied the muscular dystrophy and evidence that the continuous regime of chaotic transitions that we have in muscular mechanisms may benefit in this pathology by the use of the NPT treatment that we have considered in detail in our previous publications.

Keywords

Chaos Analysis, Correlation Dimension, LZ Complexity, Recurrence Quantification Analysis, Muscular Dystrophy, Chaos and Fractal Estimation by Surface Electromyography

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How to cite this paper: Conte, E., Ware, K., Marvulli, R., Ianieri, G., Megna, M., Conte, S., Mendolicchio, L. and Pierangeli, E. (2015) Chaos, Fractal and Recurrence Quantification Analysis of Surface Electromyography in Muscular Dystrophy. *World Journal of Neuroscience*, **5**, 205-257. http://dx.doi.org/10.4236/wjns.2015.54022

1. Introduction

Surface electromyography is a measure of the electrical activity associated with the contraction of muscle, recorded invasively using electrodes located on the surface of the skin. The obtained signal contains information about neuromuscular and bioelectrical activity of the muscle. The surface EMG usually involves processing techniques in time and frequency domain. They are important since giving indications about the global EMG activity without aiming at an analysis at the single MU level. The RMS (Root Mean Square) is currently used in time domain; instead Spectral Analysis and Amplitude enables estimating the mean and median frequency (MDN). Finally, Muscle Activation estimations are usually performed from single differential signals to obtain indications about the physiological processes occurring during spontaneous or sustained voluntary contractions. Currently, we perform such kind of analysis by using the software Acknowledge 4.0 of the BioPac system [1]. In addition to such standard methodological and clinical investigations, some other investigations are required, focused on the analysis of the relationships between global variables in the sEMG and the underlying physical processes with the finality to extract information of physiological interest from the performed global analysis of the surface EMG signal.

Our investigations start from the view point that interference and muscle cross-talk introduce non-linearity into the standard EMG signal. Nonlinearity, particularly in biological processes, is the constant first condition of chaotic-deterministic biological dynamics giving origin to high complexity in time dynamics.

Generally speaking, in the last ten years in medicine as well as in biological sciences, it has become the critical issue of great interest to determine whether an observed time series of a recorded signal of electrophysiological interest is purely stochastic, or deterministic nonlinear, even chaotic [2] [3].

Detailed methods have been elaborated to explore the intrinsic properties of the observed phenomenon by distinguishing between nonlinear deterministic dynamics and noisy dynamics from a time series [2] [3]. EMG is apparently a complex signal, highly corrupted by noise but really governed by chaotic and fractal dynamics [4]. Consequently, in the attempt to obtain valuable information by EMG analysis, the methods of the nonlinear analysis must be employed. To the best of our knowledge, recently work has been done with great consideration in the international literature [5]-[8] and the finality has been determined that the real dynamics of EMG is chaotic and fractal also if corrupted by noise. The finality of such advanced studies is double since the nonlinear, chaotic-deterministic methodologies would enable us to improve the understanding of the basic physiological involved mechanisms, and, on the other hand, we could arrive to introduce new important indexes of clinical evaluation.

Our work moves just in this direction. It aims to investigate in a detailed manner the chaotic behaviour in a systematic fashion.

The scheme of our approach may be delineated in the following manner. Giving the sEMG, we use spectral analysis as well as standard indexes as RMS and Muscle Activation in order to have clinical evaluation by using the standard methodological approaches. To such standard procedures, we add nonlinear-chaotic deterministic methods, using the standard procedure to reconstruct phase space of the given sEMG time series evaluating in particular the Embedding Dimension, the Lyapunov Exponents, the Correlation Dimension (fractal dimension), and LZ complexity [2] [3]. We also use the technique of the Generalized Mutual Information and Partial Mutual Information for estimation of synchronization and coupling among regions of interest [9]. In addition, we use the method of the Recurrence Quantification Analysis, RQA [10]. It is of importance to outline here that we perform here each investigation by using surrogate data test to verify the validity of our results [2] [3].

The previously mentioned and standard well-known nonlinear chaotic-deterministic methods, used as the estimation of Correlation Dimension, of the Largest Lyapunov Exponent, are well known to scholars so that we will not add here further comments to evidence their importance [2] [3]. The use of the RQA requires instead some further comments.

Recurrence quantification analysis (RQA) is a technique for the detection and analysis of state changes in drifting dynamic systems without posing *a priori* restrictions on data size, stationarity, and statistical distribution. This is very important for the reasons previously mentioned since EMG is often noise corrupted with hidden MU modulating activity.

RQA is a technique of investigation whose application requires high and specific competence but its correct application has given results that have been celebrated in a number of experimental studies in physiology showing its potential ability. The important feature is that it looks at the inner structure of the examined signal.

We have also outlined here that preliminary results in application of RQA in EMG were given by Ikegawa, Shinohara, Fukunaga, Webber and Zbilut [11]. These authors studied the standard variables of the RQA analysis that are the %Rec, the %Det, the %Laminarity, the Trapping Time, the Entropy, the Max Line, and the Trend. They tested the sensitivity of such different indexes extracted from RQA. They obtained that subtle changes in surface EMG can be detected by using the RQA outlining thus the importance to introduce such new and advanced methodology in EMG studies. In their studies these authors were so much interested to three basic variables of the RQA that are the %Rec, the %Det and the %Lam. The profound physiological and clinical reason to use such indexes in such new advanced EMG analysis is that the percentage of determinism (%Det) reflects the amount of rule-obeying structure in the signal dynamic, and is strongly related to the percentage of recurrence (%Rec), which reflects the current state of the system.

Consequently, %Rec and %Det are the most sensitive indexes of nonlinear analysis to be used in conjunction with the spectral analysis to MU analysis. %Det reveals embedded determinisms in an apparently stochastic signal. In addition, the %Rec estimates in detail periodicity in MU dynamics. It results that consequently we obtain two indexes that are of highest valuable interest under the physiological and clinical interest. Finally, the %Lam, added to the trapping time, will evidence the percentage of chaos-chaos transitions that we have in the time dynamics of the considered time series in relation to MU activity. These are some basic reasons because EMG studies conducted by RQA are so important.

Finally we have to report a final statement. The aim to use nonlinear chaotic deterministic methodologies as well as RQA in EMG analysis is not new here. In references [4]-[8], we report the indication of some previous studies that were conducted with excellent results.

The present paper is devoted to the study of muscular dystrophy (facioscapulohumeral muscular dystrophy) where it used the treatment NPT that is due to one of the present authors (KW). Since all the details on the basic methods that were used have been reported by us recently in previous published papers [9] [12], we invite the reader to examine such previous papers and we will not give here further indications.

To be clear, the present paper is so long since we have to present the employed methodologies and the results with figures and tables. Unfortunately this situation leads to here a so long work. According to the usual procedure, the reader expects that the next section will be devoted to the Materials and Methods as in fact it happens in each paper. Instead, in the next section we go directly to the results obtained presently by the application of our nonlinear and chaotic methodologies. We will not report details on the clinical case, on the methods of clinical investigation, on the pathogenesis and on the clinical manifestations as well as considerations on the incidence rate of muscular dystrophy in population. The reason is that we have outlined in the greatest detail all such features in our previous publications in [9] [12] [13]. Therefore, for shortness and in order to give the readers very articulated information on the clinical profile and that we could not realize here in the due details, we consider such papers [9] [12] [13] as integrating section also avoiding in this manner to overload the reader with a lot of information and discussions. Therefore, with the following section, the reader will find directly the results of the present investigation.

2. Materials and Methods

The clinical case is explained in detail in references [9] [12] [13]. Since the present paper overcomes the natural extension of a standard scientific paper, we invite the reader to consider this section as detailed in [9] [12] [13].

3. The Results

In order to explain the conceptual basis of the treatment we have to recall some previously introduced statements. We have to outline again that, according to our approach, the best way to analyze sEMG signal is by using non linear-chaotic deterministic methods. The suggested use of such new methodologies implies obviously that the actual nature of the explored physiological dynamics recorded by sEMG responds actually to the non linear regime of chaotic dynamics and fractal behaviour.

Let us sketch briefly the question under a general profile. The use of the non linear methodologies in medicine and in particular in physiology [2] [3] has offered some new results that are radically different from previous established concepts. The basic concept in the past was as example that the body must maintain a particular homeostasis, a steady state enabling the body to properly function. The basic dynamics of non linear chaotic-deterministic systems is based instead on the particular feature of its intrinsic variability. The results are that existing non linear systems evidence continuous variability and any loss of variability is indicative of some sort of pathology. Presently it is long recognized the ubiquity of chaotic and of fractal temporal dynamics in biological mechanisms. Central to results about chaotic and fractal health relationship in physiology is the now widespread recognition that chaotic and fractal variability means system complexity, and system complexity means a healthy biological system with normal chaotic behaviour.

The overarching premise of the NPT (*KW*) *treatment is that it enables to evoke transitions into and out of system-controlled chaos, requisite for the system to reorganize itself to healthier balance*.

3.1. Let Us Report Our Results before and after the Treatment

a) Standard Estimation of sEMG Signals by RMS

It is well known that by RMS (Root Mean Square) we perform modelling the process as amplitude modulated Gaussian random process whose RMS is related to the constant force and not-fatiguing contraction. MAV (Mean Absolute Value) is calculated by taking the average of the absolute values of the given sEMG signal [14].

For RMS in Ch1 (recording on right trapeze) we obtained the mean value of 0.049 at rest before the treatment and 0.055 after the treatment. For Ch2 (recording on the left trapeze) we had 0.084 before the treatment and 0.048 after the treatment (unities expressed in microvolts). The results are given in **Figures 1-4**.

b) Frequency and Power Analysis

The next step of our analysis was represented from Frequency and Power Analysis. We estimated the Median, Mean and Peak Frequency in Hz and the Mean and the Total Power in $(\text{milliVolts})^2/\text{Hz}$. The results are given in **Figures 5-8**. Each epoch is 1 second.

c) In **Figures 9-12** we give also the estimation of Muscle Activation.

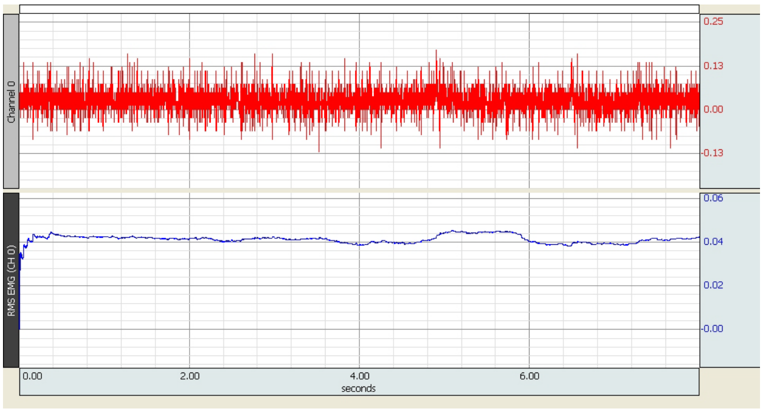

Figure 1. Ch1 RMS estimation at rest before the treatment, mean value RMS = 0.048848.

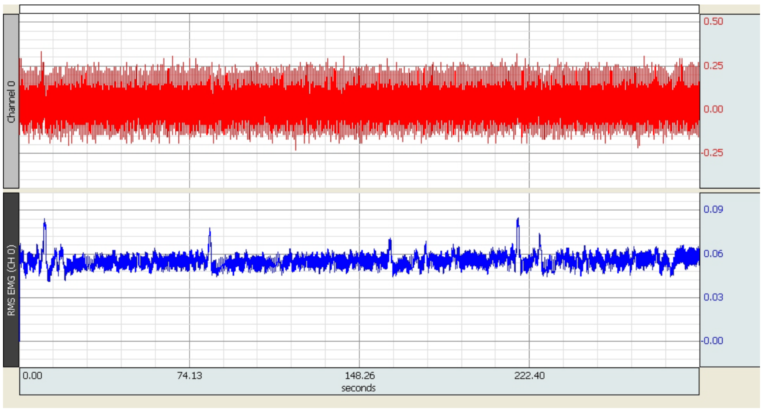

Figure 2. Ch1 RMS estimation at rest after the treatment, mean value RMS = 0.055112.

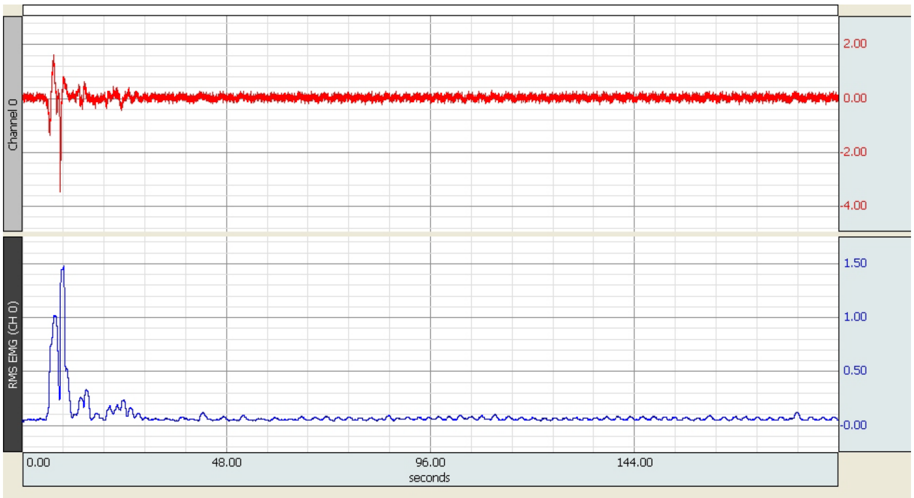

Figure 3. Ch2 RMS estimation at rest before the treatment, mean value RMS = 0.0845668.

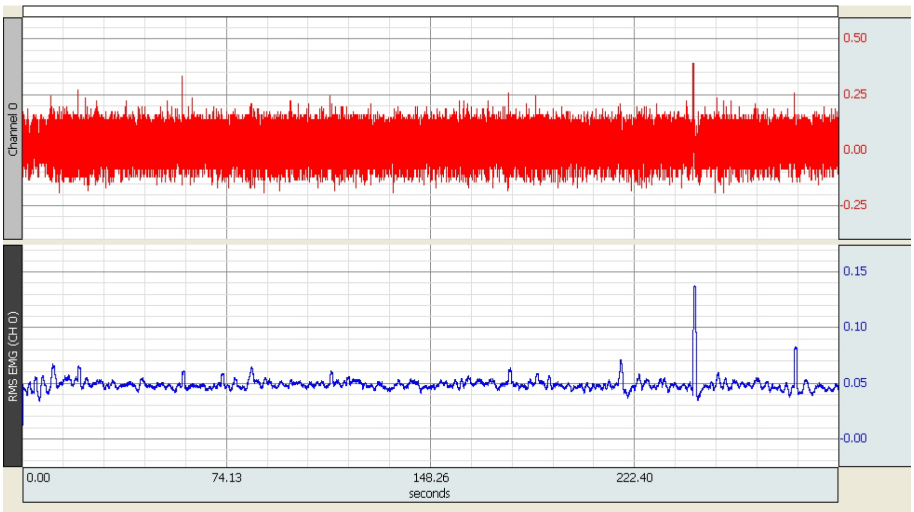

Figure 4. Ch2 RMS estimation at rest before the treatment, mean value RMS = 0.048453.

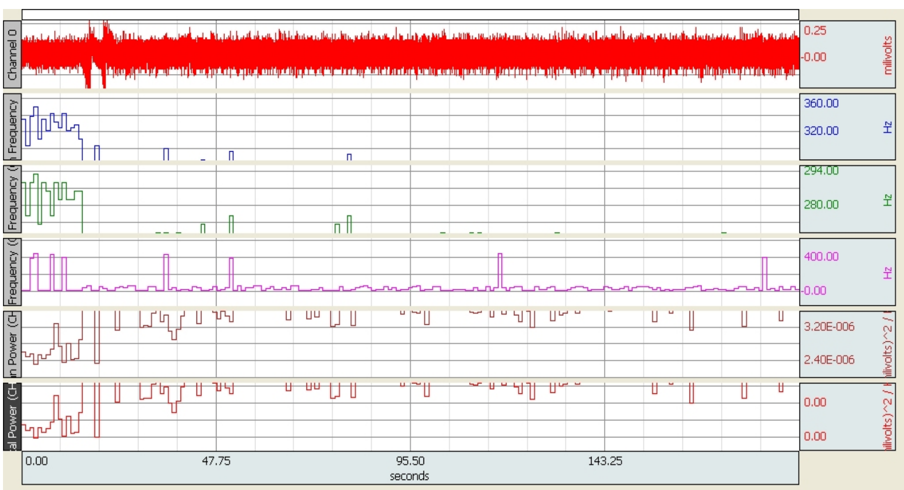

Figure 5. Ch1 at rest before the treatment.

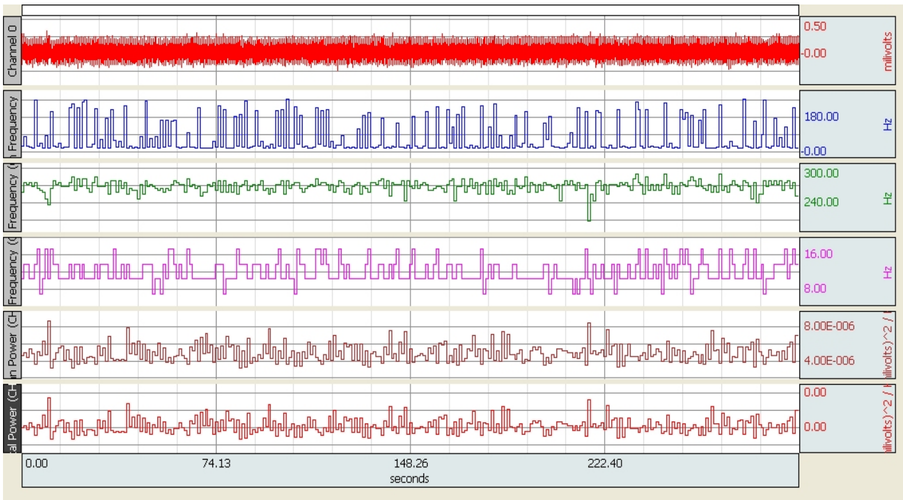

Figure 6. Ch1 after the treatment.

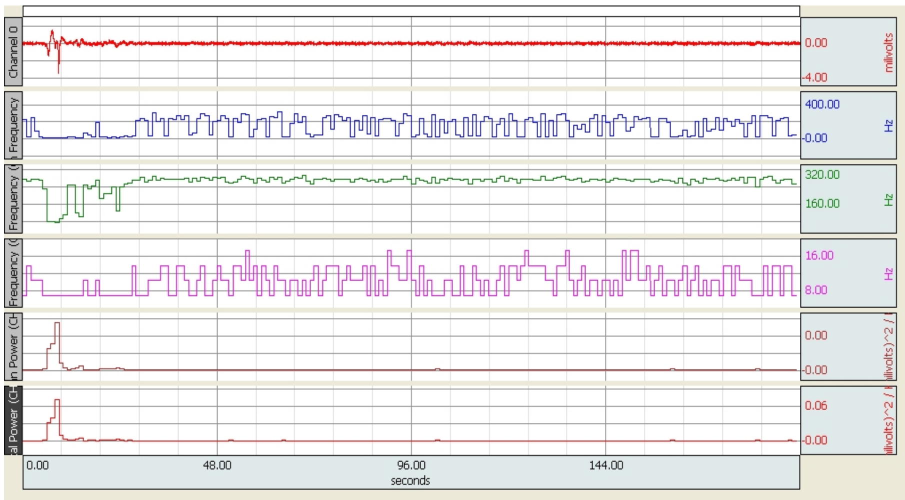

Figure 7. Ch2 before the treatment.

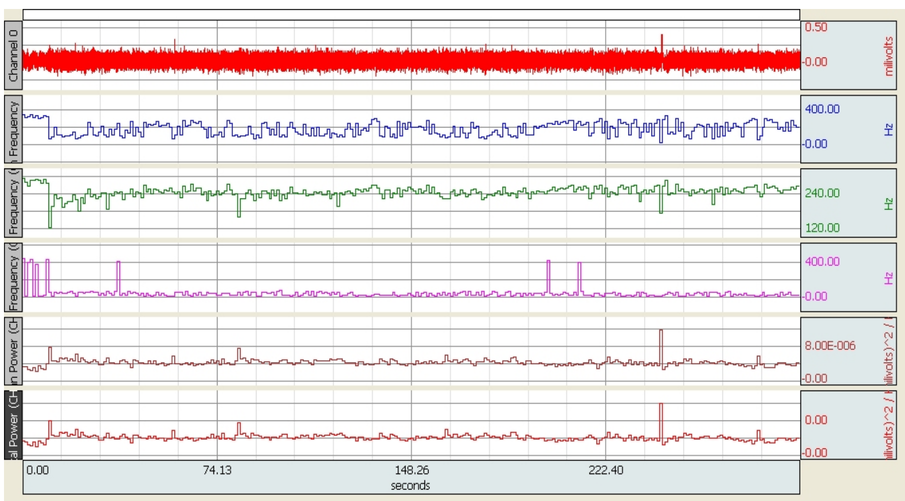

Figure 8. Ch2 after the treatment.

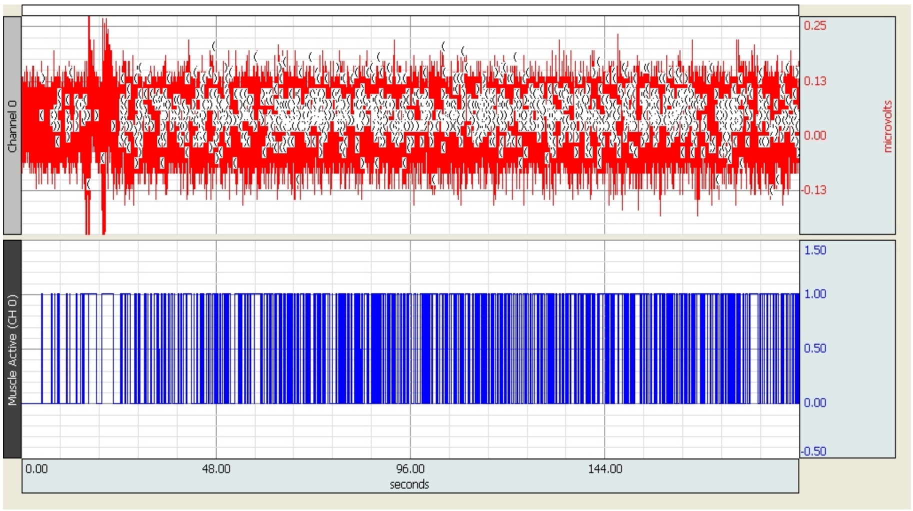

Figure 9. Ch1 at rest before the treatment.

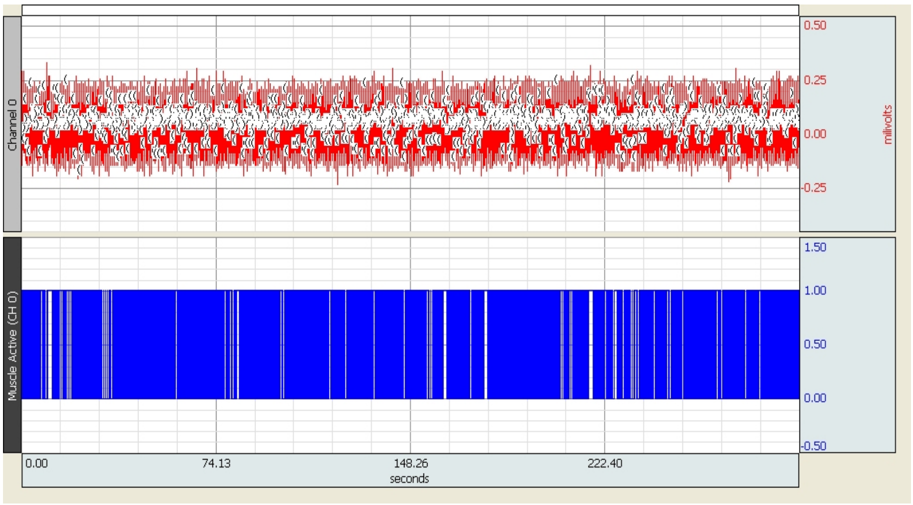

Figure 10. Ch1 at rest after the treatment.

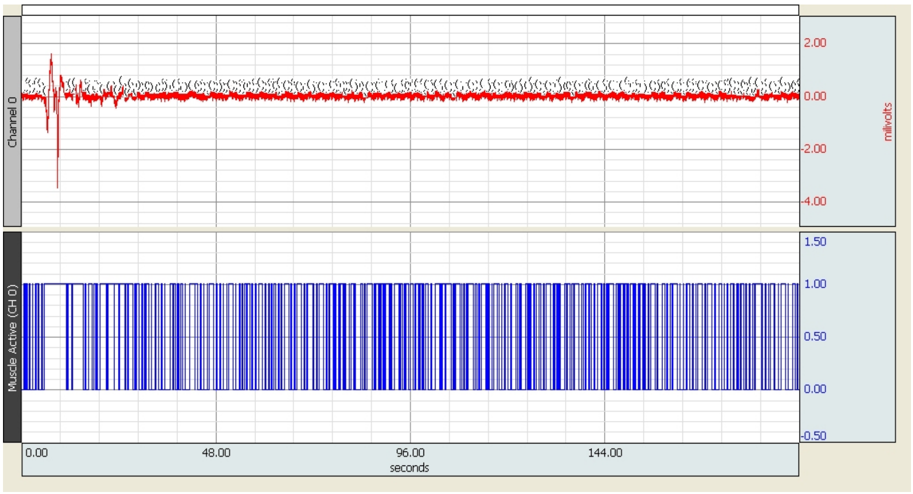

Figure 11. Ch2 at rest before the treatment.

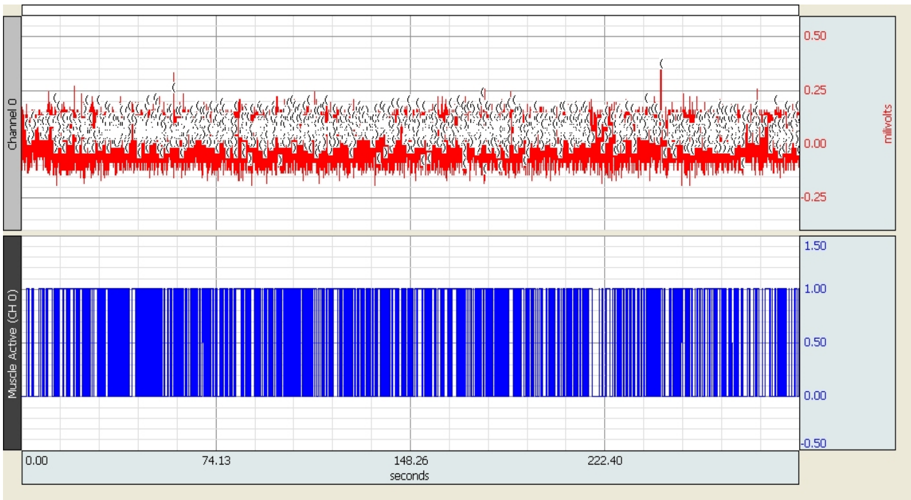

Figure 12. Ch2 at rest after the treatment.

The improvement obtained after the NPT treatment is evident at the simple inspection of the figures since they indicate a more periodic and arranged activity on muscle activity. In addition, in Appendix we report also the numerical results.

d) Chaos Analysis

As previously outlined, the basic finalities of this paper are to explore the NPT treatment of muscular dystrophy by the use of non linear analysis. as a tool that is generally employed in the clinical and biomechanical applications. Accordingly, biomedical signals can be to an extent deterministic, random or chaotic. Deterministic signals have the characteristic of predictability. This is to say that any future time behaviour of the signal could be predicted using some linear analysis tools. For them, mathematical tools (e.g., Fourier transform) are commonly used. To use Fourier transform the signal must be linear, stationary and periodic. These are crucial restrictions that rarely we may find in biomedical signals governed from feedback control loops. The random signals are non-deterministic in the sense that individual data points of the signal may occur in any order, with no possibility of predictability on the future course of the signal. In this case only purely stochastic analytic tools can be applied in electrophysiology. Finally we have chaotic signals. These signals can be viewed as a connecting mesh between deterministic and unpredictable behavioural dynamics, exhibiting time pattern that in principle is slightly predictable, non-periodic or seldom quasi-periodic (an example is the heart beat) but they results strongly dependent from some control parameters and are highly sensitive to initial conditions. Dependence from control parameters means that for some critical values of such control parameters the chaotic system transitates between so much undefined states in time giving origin to a time dynamics that becomes unpredictable for us and thus apparently random but really revealing the signal an inner structure responding to the important realization of the self-organization and high complexity. The system whose counterpart has a chaotic signal as representation, reveals ability to self arrange by itself patterns of organization in its dynamics. This is of course the basic feature of living systems. Chaotic systems are non linear open systems, responding to the external stimuli by self-organizing each time their inner patterns and thus their time dynamics. All the considered systems in biomedicine are open systems that necessarily interact with their outside interacting systems and having time by time the fundamental demand to responds with elasticity to the requirements arriving from the external components. In this sense they self-organize their dynamics responding to inner and out inputs An example is the cardiovascular system that continuously needs self-organization responding to basic requirements of inner and output inputs and providing to heart rhythm variability, blood pressure, respiration, autonomic nervous system modulation, just to quote only some of the interacting components The other basic feature of chaotic systems is that they are highly sensitive to initial conditions. This is to say that each signal starts with some definite values of its variables. Consequently, a time dynamics is generated. In chaotic systems it is sufficient that such initial values of the variables fluctuate also at a so contained level to escape to our computational attention that consequently a total different time dynamics is generated with new and different properties in self-organization and structure to responds with elasticity to the requirements arriving from the external demands. Within chaos theory, the time series that are representative of the time dynamic of the chaotic signals are represented in the phase-space.

Embedded dimension in phase space is estimated by proper techniques that are autocorrelation method and, in particular, the average mutual information, estimating the so called time delay. Using the criterion of the False Nearest Neighbors we are enabled to obtain a proper representation in phase space reconstruction. Usually the analysis arrives to reconstruct the attractor of the given chaotic system and thus representing the states, the patterns and thus the subsequent transitions of the states characterizing the time dynamics of the system. Some indexes may be introduced to analyze chaotic systems. In particular we evaluate the Correlation Dimenion, the Largest Lyapunov Exponent, the Fractal dimension and LZ complexity.

Within biomedical signal processing, chaotic dynamics provide a possible explanation for the different complex and erratic patterns that appear in most bio-signals and in particular in electrophysiology. Current investigations span from studies of brain rhythms to heart rate variability, from blood pressure regulation to neuromuscular system, from breathing system to cardio-respiratory coordination including all the fields relating the complexity of the human and animal anatomo-physiological systems.

The reason to introduce non linear methodologies and chaos analysis in EMG has been explained previously. It is necessary to go on in further details.

The EMG and the sEMG signals are highly non-stationary signals. We know that the neuromuscular control process works through enhancing or inhibiting feedback mechanisms implemented on neuronal circuitry involving the Central Nervous System at various cortical or sub-cortical levels. In addition, we have constantly interaction o0f acting components and the result is a non linear and highly non stationary dynamics. In these conditions the adoption of non-linear chaotic methods is strongly required with the finality to account for the highly non-linear behaviour of such mechanisms by muscle receptors, mechanoreceptors, nociceptors, and joint receptors within local (spinal) and/or central sensory-motor networks. Only the use of non linear-chaotic mechanisms may contribute to elucidate such complex dynamics since non-linear parameters reveal several hidden mechanisms of muscle control that otherwise would be not reflected by variability of other standard linear parameters. In particular, as previously outlined, the RQA method looks at the inner structure of the given EMG signal. The proper reconstruction of the given sEMG signal in phase space is basic importance in RQA since by this way we identify recurrence maps containing subtle patterns that are often difficult to detect by visual inspection. In particular, by using such method, we have appropriate quantifying indexes, some quantitative descriptors that emphasize different features of the map. We previously described that we have four basic variables resulting from RQA analysis that are %REC, %REC, %Laminarity, Trapping Time, and Entropy Among them, percentage of determinism (%DET) must be used examined.

The reason of the basic importance of this index is that the %DET is strictly connected to the level of MU synchronization. sEMG signals generated by a model at sufficient level of MU synchronization shows an evident increase of the %DET parameter while passing from lower (a) to higher (b) levels of MU synchronization. Analogously, we may expect that a similar approach holds for the neuromuscular control system when the muscle task requires the maintenance of the effort for a long period of time. A greater synchronization of the MU activation will help to satisfy this request, despite the contemporaneously increased fatigue. Still, it is evident that, whereas very little differences in the relative spectra are reflected also in the MDF parameter weakly sensitive to the variation of the muscle status, increasing fatigue phenomena ask for a higher level of MU synchronization sensed by a parallel increase in the non-linear parameter %DET.

In the same manner, physiological studies indicate that during an increasing ramp, the relative timing of the phenomena is that at the beginning of the force ramp, there is an increasing level of MU recruitment followed by firing rate increase of the active MU. On the other hand, MU derecruitment takes place as soon as the rapid and little MU firstly recruited become fatigued. Finally the equilibrium between recruitment of the slower and bigger MUs and MU derecruitment determines the phase of MMUR (Maximal Motor Units Recruitment) corresponding to the highest level of MU activity in that muscle. In conclusion as a rule of the chaos non linear analysis in EMG signals, we recognize that ***that chaoticity increases at the beginning of the muscle task, as the result of further MUs recruitment, and then decreases in presence of fatigue phenomena and MUs synchronization***.

In conclusion, the reason to use non linear chaotic methodologies and, in particular, the RQA, is that the use of nonlinear analysis and chaos theory provides an accurate investigation instrument, particularly by %Rec, %Det, %Laminarity (%LAM), Trapping Time, and Entropy. ***In particular, %DET and possibly %REC***

and %LAM are able to detect the presence of repetitive hidden patterns in sEMG which, in turn, senses the level of MU synchronization within the muscle.

Consequently, let us sketch our results such as correlation dimension D2, Largest Lyapunov exponent, L-Z complexity, fractal dimension. Numbers as 13.10.2014 and 17.10.2014 represent our inner classification relating respectively examination at rest before and after the treatment.

3.2. Correlation Dimension

On the basis of our previous studies on controls it results that at rest in sEMG we have usually a value of 2.7 ± 0.4 as D2 value of correlation dimension and a value of 3.80 ± 0.2 in condition of movement. In the present investigation we observed continuous transitions, exploring the condition of the subject minute by minute and we obtained the results that are given in **Figure 13** and **Figure 14** respectively for Ch1 and Ch2. Inspection of **Figure 13** evidences that we had a net recovery in the D2 value after the treatment with a rather stable value, during the time transitions, remaining about 2.58 that enters in the normal range previously indicated. At rest before the treatment we had rather frequent transitions oscillating from a minimum of 1.668 to a maximum value of 3.618 both out of the normal range. In Ch2 at rest before the treatment we had continuous transitions with values ranging from a minimum value 0.178 to a maximum value of 2.917 still entering in the range of the normal values. After the treatment, the values of D2 stabilized about a value of 3.22 that is rather acceptable in consideration that in Ch2 we had the left trapeze (Ch2) that was almost atrophied as we confirm the clinical evaluation finding a value of 0.178 but still able to produce transitions arriving to 2.917 during transitions. The treatment stabilized such behaviour about the value of 3.22 that is not so distant from the normal value. Finally we have to remember here that in any case in EMG signals we have always noise corrupted time series and that all our results were always controlled by using surrogate data in order to dismiss the null hypothesis. The conclusion is

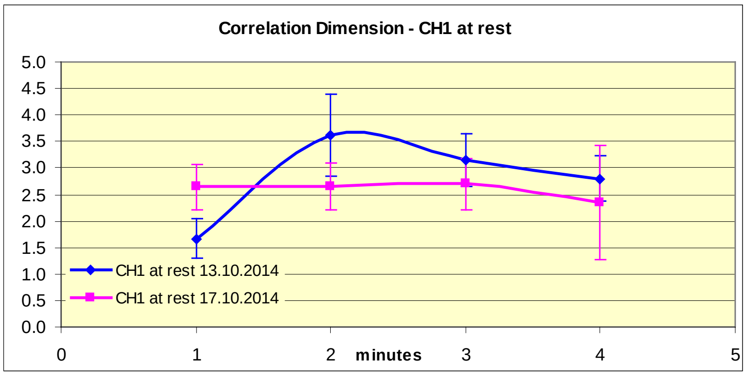

Figure 13. Estimation of correlation dimension in Ch1 at rest before and after therapy.

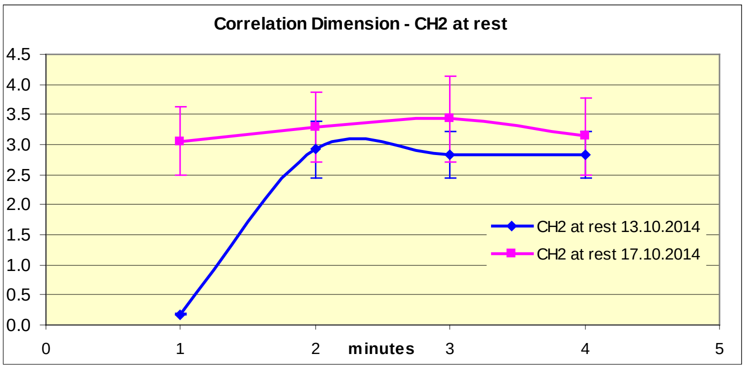

Figure 14. Estimation of correlation dimension in Ch2 at rest before and after therapy.

that the analyzed data confirmed that in sEMG we are in presence of a deterministic chaotic regime that we may delineate and quantify in detail. In particular, the results indicate that the used treatment induced unquestionable improvement.

3.3. Estimation of the Largest Lyapunov Exponent

As previously explained, the estimation of the Largest Lyapunov Exponent represents one important step in chaos analysis.

The Lyapunov exponent of a dynamical system is a quantity that characterizes the rate of separation of infinitesimally close trajectories in the attractor Quantitatively, two trajectories of the attractor reconstructed in the phase space with initial separation δz_0 diverge at a rate given by $\delta z - \delta z_0 \exp(\lambda t)$ where λ is the Lyapunov exponent that we have to estimate. It is common to refer to the largest one as the Maximal Lyapunov exponent λ_E because it determines a notion of predictability for a dynamical system. A positive λ_E is usually taken as an indication that the system is chaotic. Obviously each result must be accepted only after control using surrogate data and evaluating the results with appropriate competence taking into account that we may have also other cases, out of chaotic systems, in which such exponent may result positive.

Let us look at the results of our analysis. The normal value for sEMG measurement on trapeze we have tabulated is $\lambda_E = 0.068 \pm 0.007$ for health young subjects. By using surrogate data analysis we find that $\lambda_E = 0.372 \pm 0.008$ as expected to confirm that we are actually examining a chaotic time dynamics. By these values the null hypothesis may be dismissed and we are sure that we are examining a chaotic muscular dynamics. The previous result relates obviously young subjects at rest for 3 minutes.

In the present case we examined right (Ch1) and left (Ch2) trapezes for a time of three minutes and we obtained the following results.

At rest first control in Ch1, $\lambda_E = 0.147 \pm 0.004$ with surrogate data result $\lambda_E = 0.183 \pm 0.006$. Therefore we have the normal value $\lambda_E = 0.068 \pm 0.007$ against $\lambda_E = 0.147 \pm 0.004$ in the case of the examined muscular dystrophy. After the treatment we had the following estimated $\lambda_E = 0.102 \pm 0.006$ (surrogate data value $\lambda_E = 0.163 \pm 0.008$). We verify that the treatment induced a strong improvement since $\lambda_E = 0.068 \pm 0.007$ is our normal value. $\lambda_E = 0.147 \pm 0.004$ before the treatment and $\lambda_E = 0.102 \pm 0.006$ resulted after the treatment.

This is for the right trapeze. Let us examine now the results that we obtained for the left trapeze (Ch2).

At rest before the treatment we had $\lambda_E = 0.101 \pm 0.006$ (the surrogate data analysis gave $\lambda_E = 0.207 \pm 0.008$, thus confirming that also in this region muscular activity followed a chaotic regime). Left Trapeze resulted less chaotic respect to the λ_E value in the right trapeze with a strong unbalancing ($\lambda_E = 0.147 \pm 0.004$ against $\lambda_E = 0.101 \pm 0.006$) between the two (right-left) muscular dynamics. After the treatment, however, it resulted that $\lambda_E = 0.115 \pm 0.006$ (surrogate data result $\lambda_E = 0.190 \pm 0.007$). In conclusion, after the treatment we had $\lambda_E = 0.102 \pm 0.006$ (Ch1) against $\lambda_E = 0.115 \pm 0.006$ (Ch2) with a strong recovering in unbalancing situation. This was obtained by the treatment lowering strongly the chaoticity in Ch1 and increasing instead lightly the value in Ch2. This is confirmed of course from the results when we examined the attractor dimension by estimating the values of the Correlation Dimension in Ch1 and in Ch2. Looking at the **Figure 13** and **Figure 14** in fact one verifies that in Ch1 the value of the correlation dimension and thus the level of chaotic complexity decreases after the treatment while instead increased that one in Ch2.

3.4. LZ Complexity

It is well known that chaotic systems posses the basic relevant property of the self-organization. Such systems realize patterns that are self-arranged moving their time dynamics through stages on increasing complexity. Therefore it becomes of relevant interest to evaluate the level of complexity of the system during its dynamics. A measure of complexity in chaos analysis is reached by using the algorithmic of Lempel-Ziv that we used in this paper. The index varies between 0 and 1. Maximal complexity (represented by pure randomness) has a value of 1 and perfect predictability has a value of 0. Normal value in trapezes in young subjects has been estimated by us to be LZ = 0.23. In Ch1 we had LZ = 0.93 (high complexity) at rest before the treatment and this values decreased to LZ = 0.75 after the treatment. In Ch2, as well as in the case of the Correlation Dimension and Largest Lyapunov Exponet, we estimated the opposite. We had the initial value of LZ = 0.643 at rest before of the treatment and such value increased to LZ = 0.89 after the treatment again inducing balance between the two regions.

3.5. Recurrence Quantification Analysis

We may now go to examine the results that we obtained by using the previously mentioned Recurrence Quantification Analysis (RQA). In **Figures 15-17** we give the results of the analysis performed on the Ch1 subject before of the treatment while in **Figures 18-21** we have the corresponding results in Ch1 after the treatment. In **Figures 22-24** we have the results in Ch2 before the treatment. In **Figures 25-28** we have the corresponding results after the treatment. All the results are given by epochs of 1 second so that we may appreciate step by step the dynamics and the transitions that were involved.

In **Picture 1** we have in detail the obtained results.

We repeat here that the indexes of the RQA to be estimated in each sEMG data analysis are the %Rec, the %Det, the %Lam, the Entropy and the Trapping Time. The reason is that they are able to detect and to quantify in detail the presence of repetitive hidden patterns in sEMG which, in turn, senses the level of MU synchronization within the muscle in reason of the particular pathology under investigation. In the reported table we give the results that we obtained by investigation of sEMG in epochs of 1 second., In this manner we performed a very accurate analysis (1 second) of the muscle dynamics and its transitions of the subject affected from muscular dystrophy. We performed the comparison of the obtained results for the subject at rest and before and after the treatment. The reader may inspect the obtained values for each epoch and every time compared before respect to after the treatment. It is possible to verify that we obtained an improvement of our RQA indexes in each epoch for Ch1 (right trapeze). All the variables %Rec, %Det, %Lam, Entropy and Trapping Time increased in a

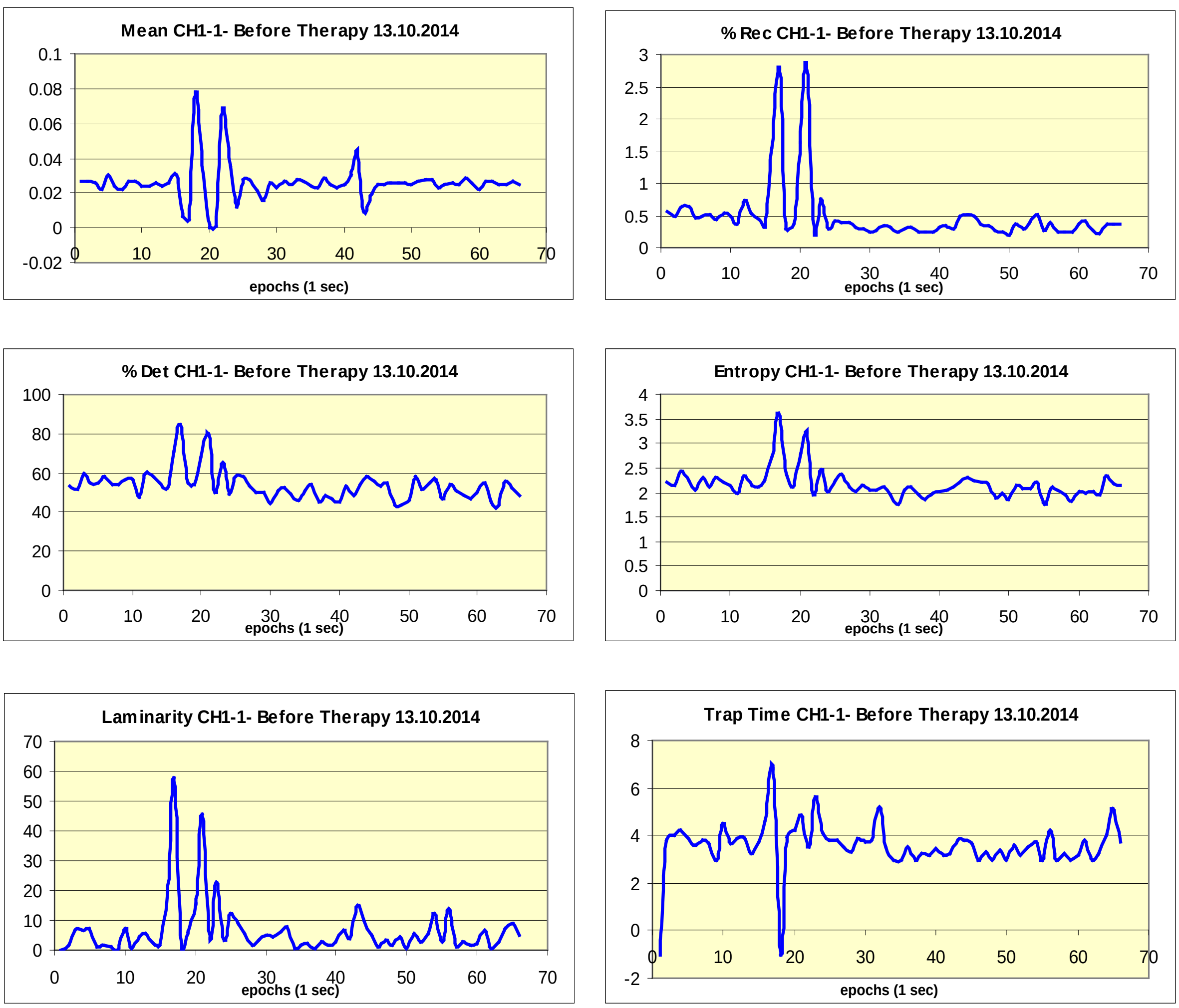

Figure 15. RQA results on Ch1. Subject at rest before treatment. Each epoch is 1 second.

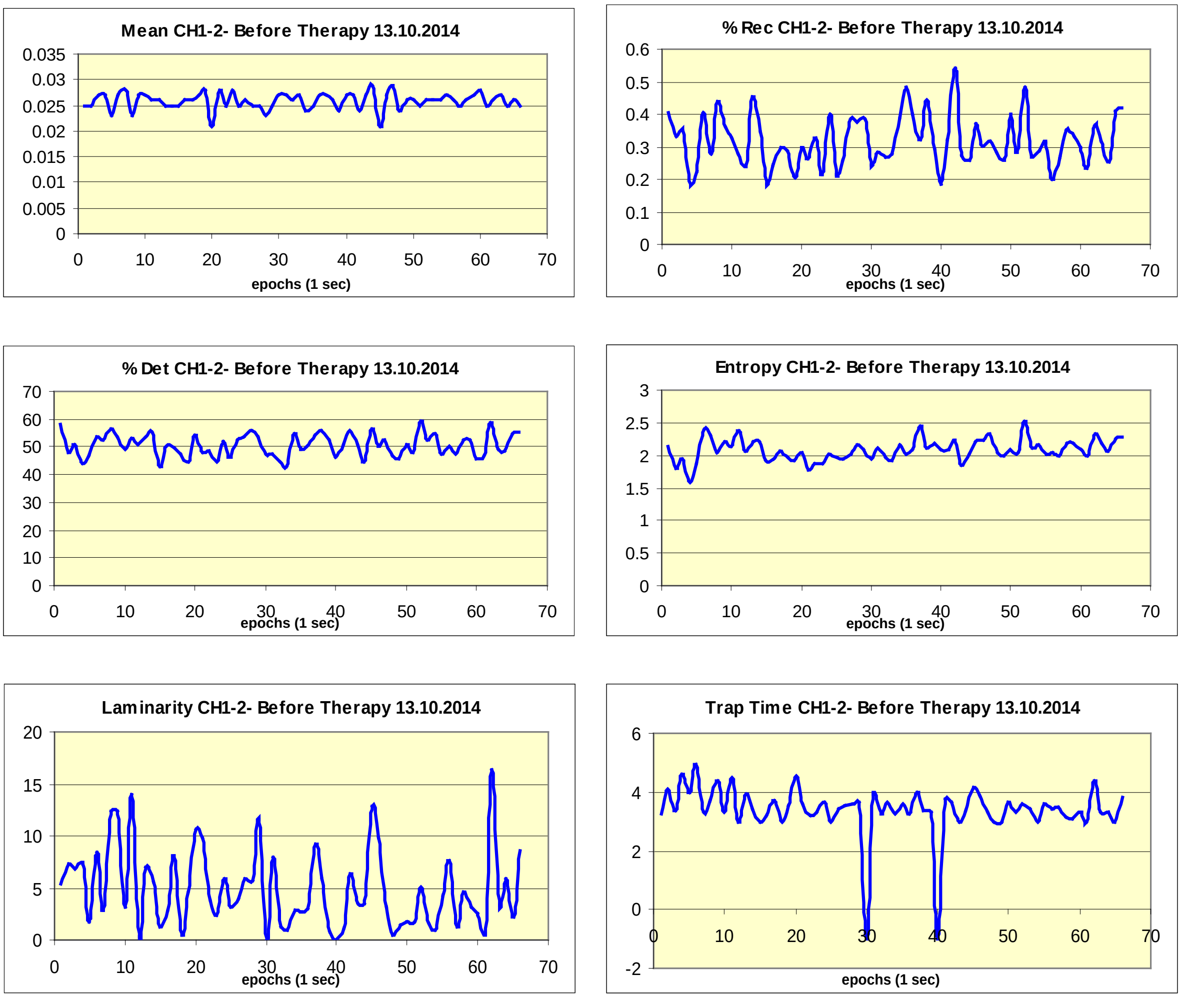

Figure 16. RQA results on Ch1. Subject at rest before treatment. Each epoch is 1 second.

very impressive manner after the treatment respect to before the treatment. Remember that, according to the results of the RQA analysis, an increasing value in %Rec, and %Det identify the percentage of repetitive hidden-patterns in sEMG which, in turn, senses the level of MU synchronization within the muscle. %Det in particular characterizes chaos-order transitions, the duration of a stable interaction. Laminarity quantifies instead the level of chaos-chaos transitions in muscle with the Trapping Time index relates the time the muscle remains in a specific state. We found such parameters all increased. Finally also Entropy resulted increased after the treatment respect to before the treatment evidencing that the system reached a general level of relevant complexity. We obtained instead oscillating results in Ch2 (left trapeze) before respect to after the treatment. We had epochs in which the values of the previously mentioned variables of RQA prevailed before the treatment respect to after the treatment and epoch in which we had the *vice versa*. In substance, as said, Ch1 was placed on the right trapezes and Ch2 on the left Trapeze. We have to consider first of all that the trapezes, are very sensitive and reactive to the sympathetic nervous system so that the psychophysiological condition of the subject must be taken in consideration as we exposed in detail in a previous papers [9] [12] [14]. Obviously, an increase in sympathetic activity will contribute to tense up in the trapezes. In addition, in the dystrophic subject under consideration, clinical inspection evidenced that there was a very significant degree of muscle tension in his right trapezes (Ch1) compared to the much lesser degree of tension in his left trapezes (Ch2). So right from the very beginning, it was always going to be the case that there would be more improvement shown in Ch1 than any other channel In addition there is also a general neurological consideration that explains the importance, previously outlined, of our new methodology that mixes RQA analysis and time dynamics synchronization analysis devoted to the Ch1-Ch2

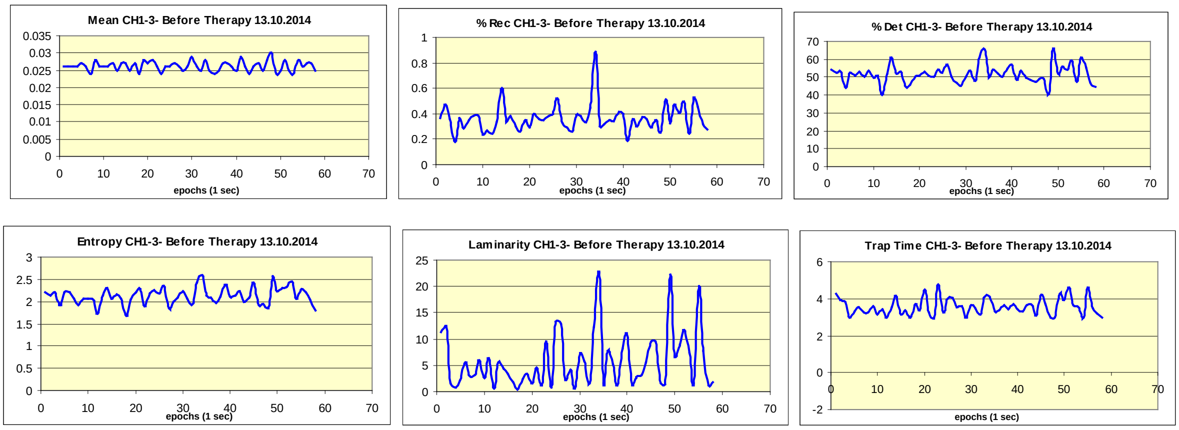

Figure 17. RQA results on Ch1. Subject at rest before treatment. Each epoch is 1 second.

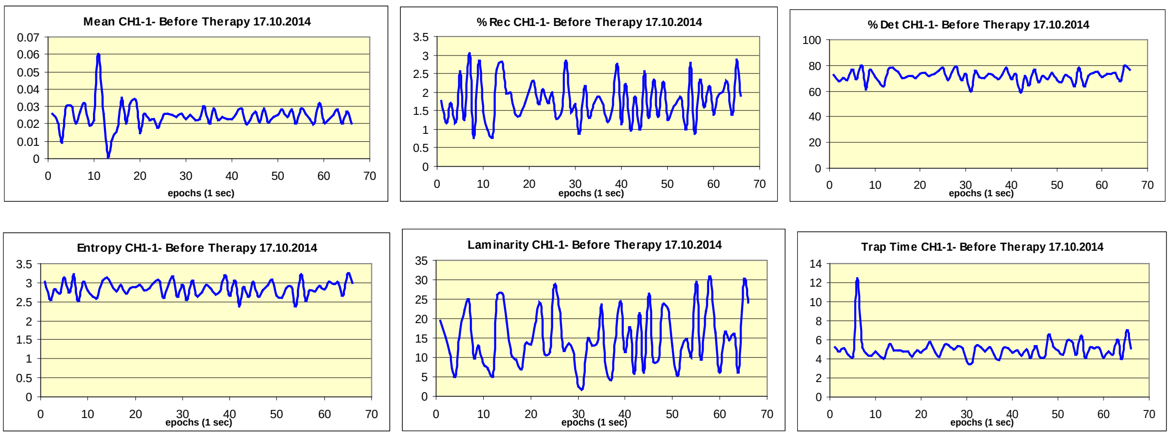

Figure 18. RQA results on Ch1. Subject at rest after the treatment. Each epoch is 1 second.

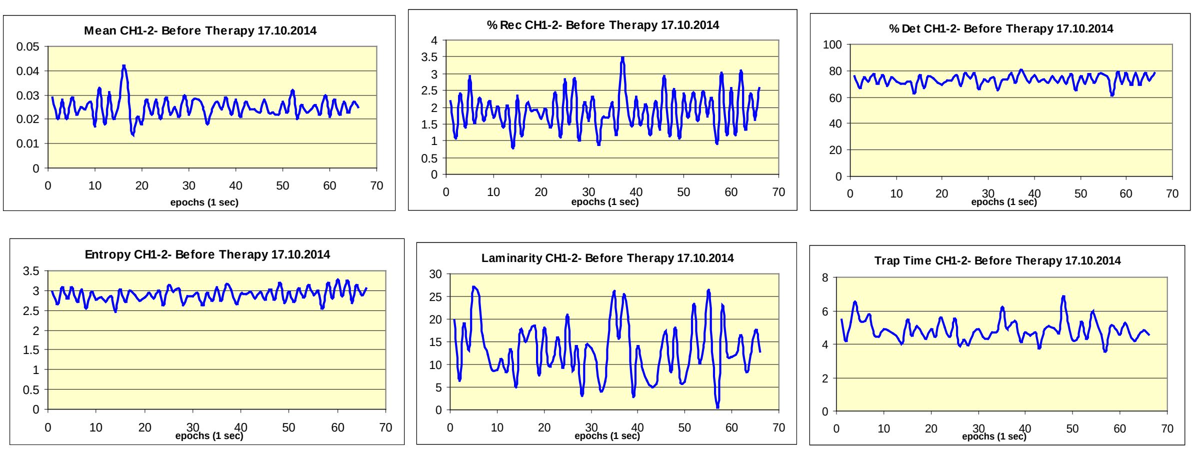

Figure 19. RQA results on Ch1. Subject at rest after the treatment. Each epoch is 1 second.

and Ch8 (brain-EEG)-Ch1 and Ch8-Ch2 and that we will publish in detail in a subsequent paper. The reason involves the contra-lateral hemispheres of the brain. Ch1 is under the control of the left hemisphere of the brain and Ch2 under the control of the right hemisphere. What these data verify is that this subject had long term right hemisphere dominance. The subject was in a very right brain dominating state for a very long time and he had been a very angry impatient person. The distribution of energy in the brain was not bilaterally equal, therefore

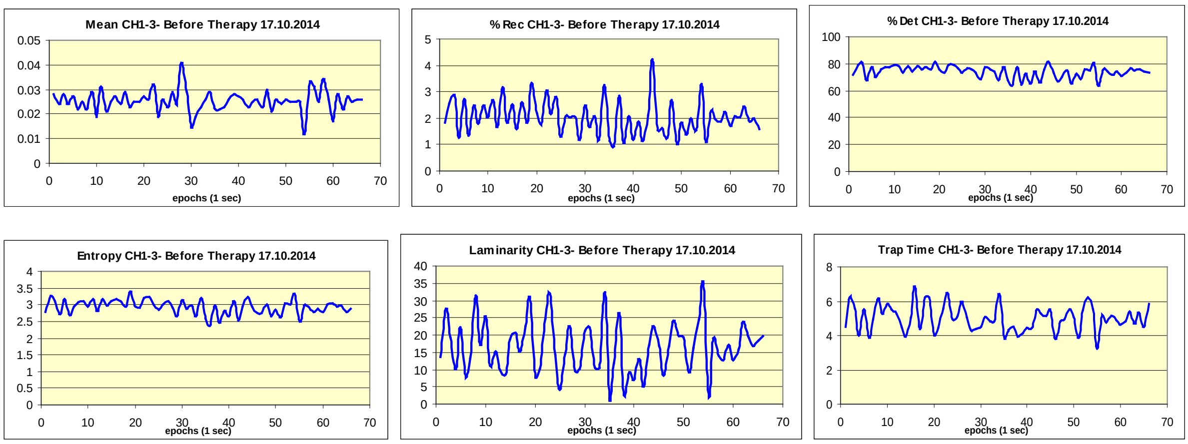

Figure 20. RQA results on Ch1. Subject at rest after the treatment. Each epoch is 1 second.

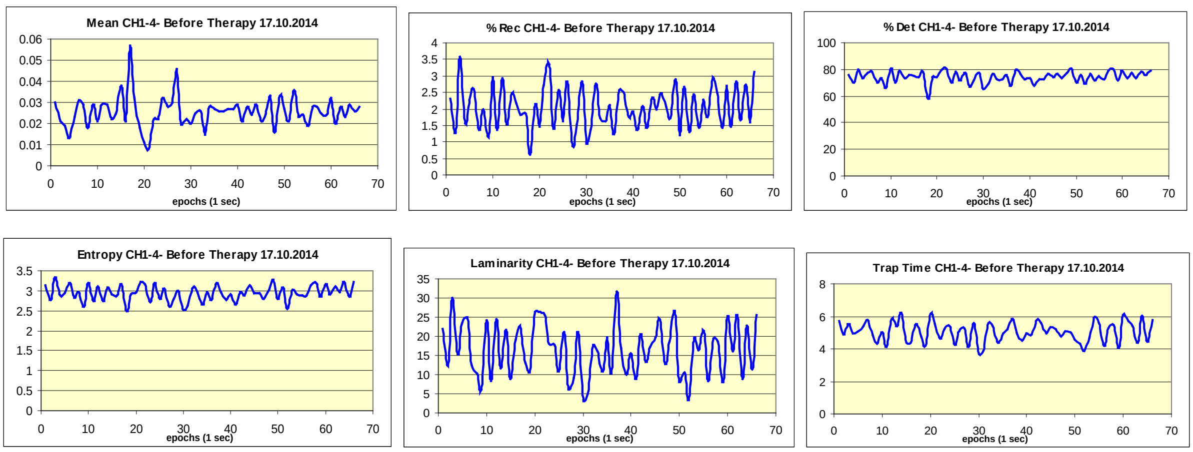

Figure 21. RQA results on Ch1. Subject at rest after the treatment. Each epoch is 1 second.

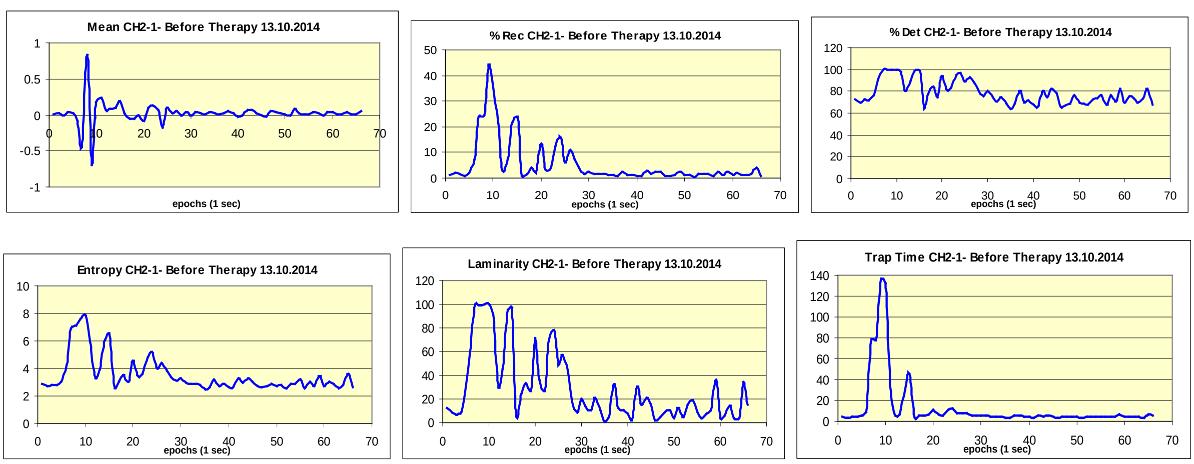

Figure 22. RQA results on Ch2. Subject at rest before treatment. Each epoch is 1 second.

the left hemisphere adopted a permanent hyper protective state, which was then exhibited in the excessive muscle tension in his right trapezes. What the treatment enabled then, was for the distribution of energy and information in the system to become bilaterally stable, correcting these bilateral errors seen on the contralateral sides

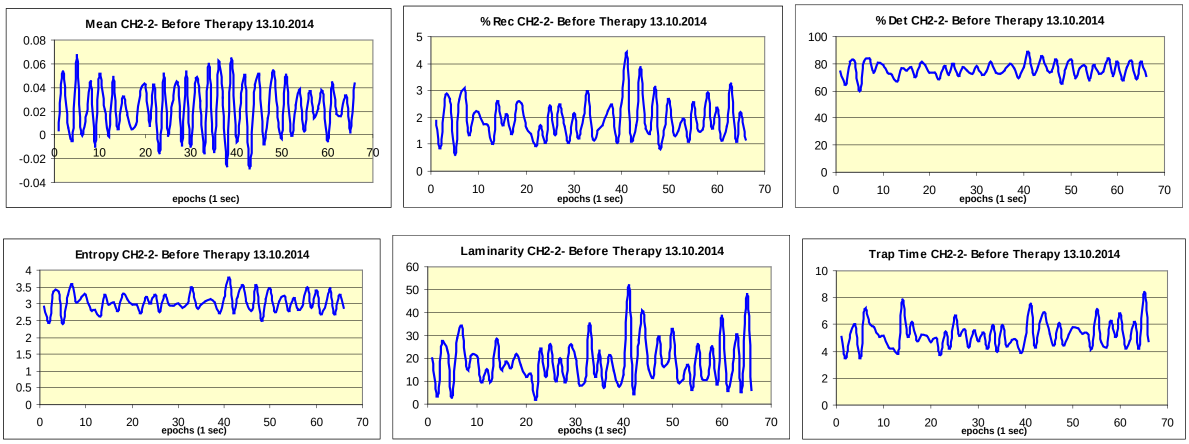

Figure 23. RQA results on Ch2. Subject at rest before treatment. Each epoch is 1 second.

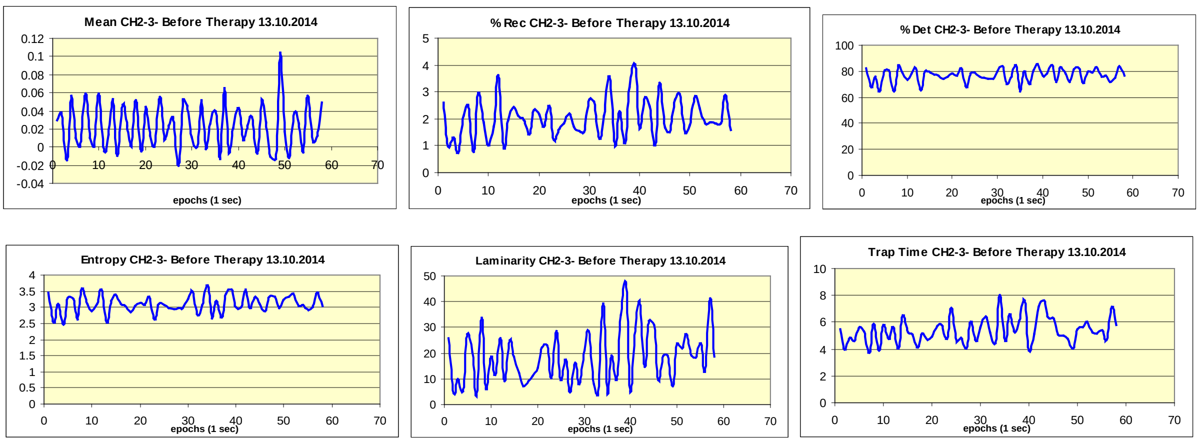

Figure 24. RQA results on Ch2. Subject at rest before treatment. Each epoch is 1 second.

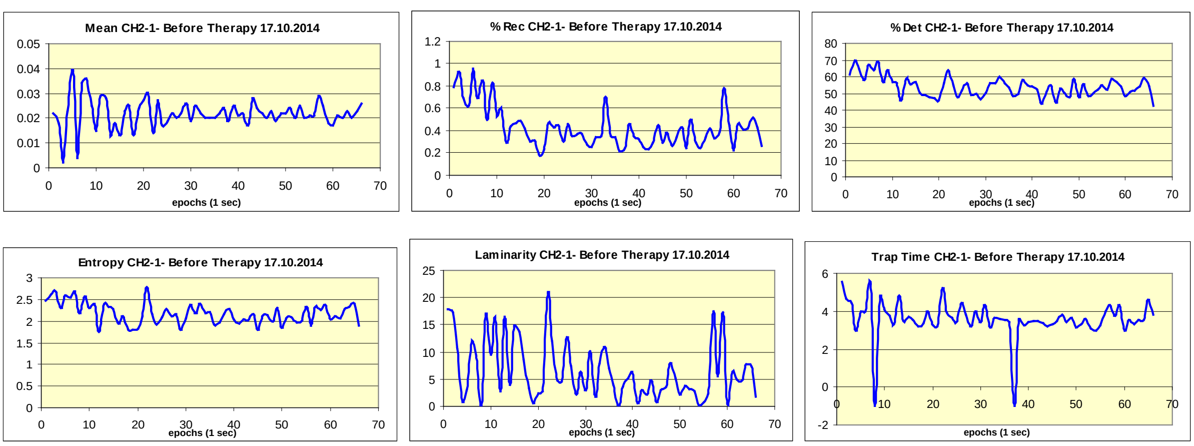

Figure 25. RQA results on Ch2. Subject at rest after the treatment. Each epoch is 1 second.

of the body beneath the neck. All such data will be confirmed by inspection of the results on synchronization Ch1-Brain, Ch2-Brain that we will publish, as said, in the following paper.

Finally, returning to the RQA analysis, we have to outline that all the results were subsequently examined by ANOVA (as reported in the next **Table 1**) and the statistical investigation confirmed that we had the most

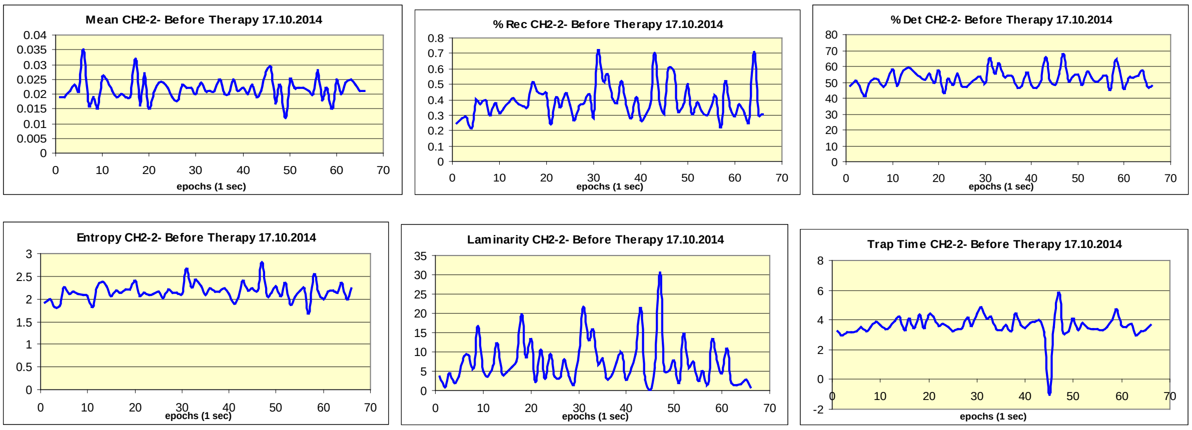

Figure 26. RQA results on Ch2. Subject at rest after the treatment. Each epoch is 1 second.

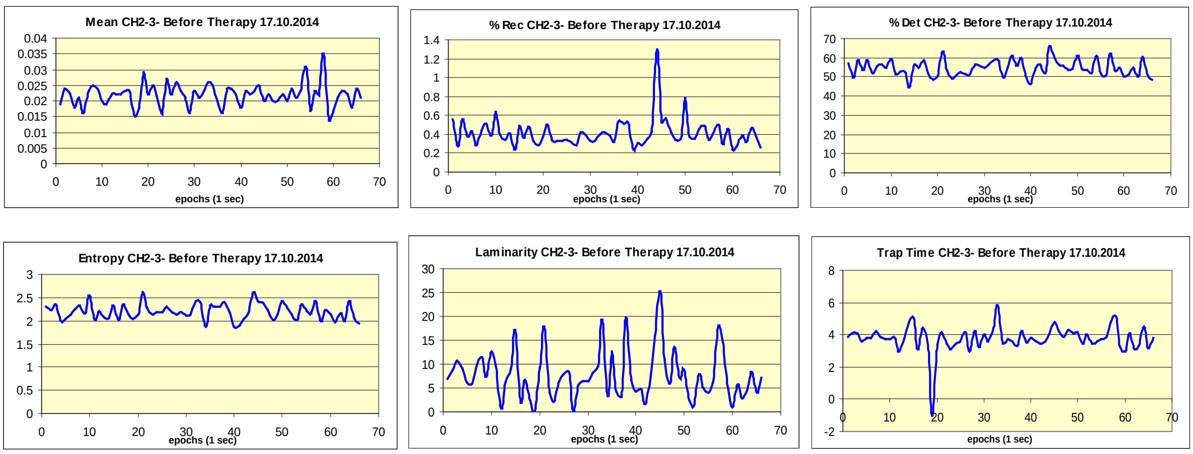

Figure 27. RQA results on Ch2. Subject at rest after the treatment. Each epoch is 1 second.

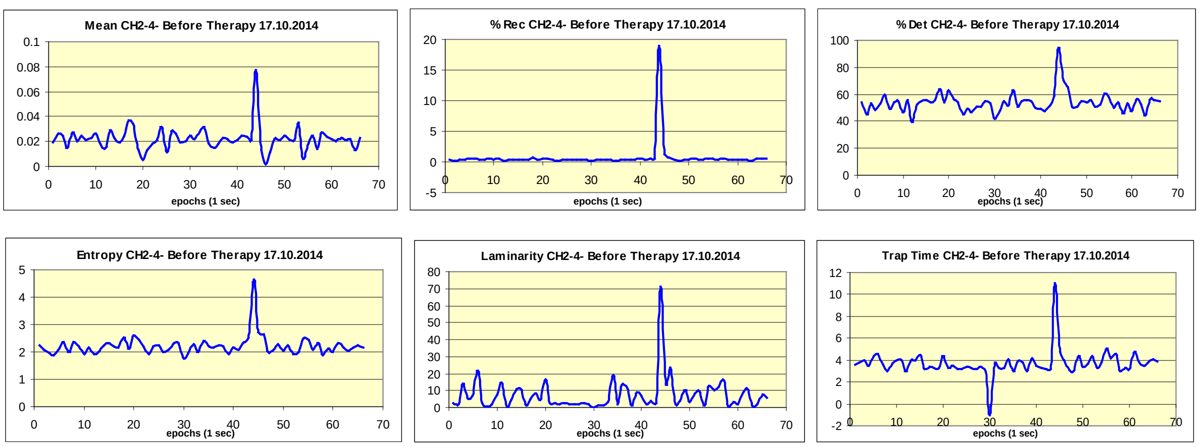

Figure 28. RQA results on Ch2. Subject at rest after the treatment. Each epoch is 1 second.

significant level of statistical significance in the compared data before and after the treatment.

4. Conclusions

First of all let us consider that the object of the present paper was to analyze muscular dystrophy by using standard

	Mean in Epochs	St dev in Epochs																			
Mean b t CH1-1-13.10	0.02562	0.00141	0.027	0.027	0.026	0.022	0.03	0.024	0.022	0.027	0.027	0.024	0.024	0.026	0.024	0.026	0.03	0.007	0.005	0.078	0.03	0
Mean b t CH1-1-17.10	0.02430	0.00424	0.026	0.021	0.009	0.03	0.03	0.02	0.027	0.032	0.019	0.022	0.06	0.026	0.001	0.011	0.018	0.035	0.02	0.032	0.034	0.015
%Rec b t CH1-1-13.10	0.48665	0.12869	0.556	0.478	0.638	0.646	0.461	0.479	0.512	0.44	0.536	0.484	0.377	0.736	0.544	0.437	0.337	1.538	2.784	0.289	0.374	1.623
%Rec b t CH1-1-17.10	1.77220	0.08839	1.771	1.174	1.706	1.186	2.552	1.266	3.04	0.763	2.859	1.485	0.997	0.797	2.627	2.815	1.965	1.999	1.405	1.376	1.695	2.056
%Det b t CH1-1-13.10	53.54055	3.71019	53.4	51.97	59.61	54.48	55.12	58.16	54.27	54.38	56.83	56.77	47.81	60.05	57.75	54.5	52.68	71.25	84.66	54.62	53.83	67.57
%Det b t CH1-1-17.10	71.65464	2.64034	72.5	67.94	70.01	68.87	76.75	68.97	79.54	61.37	76.27	70.71	66.62	63.99	77.41	78.01	75.09	70.07	71.01	71.52	70.49	73.21
Entropy b t CH1-1-13.10	2.16532	0.05798	2.212	2.149	2.432	2.238	2.059	2.298	2.113	2.31	2.205	2.13	1.992	2.326	2.153	2.117	2.248	2.761	3.608	2.362	2.121	2.785
Entropy b t CH1-1-17.10	2.84888	0.01980	3.034	2.556	2.84	2.726	3.135	2.733	3.216	2.526	3.021	2.803	2.638	2.599	3.052	3.134	2.97	2.767	2.951	2.704	2.863	2.879
Laminarity b t CH1-1-13.10	6.41933	3.45634	0	1.76	6.739	6.662	7.292	1.291	1.642	1.235	0.277	6.949	0.72	4.565	5.503	2.377	1.908	19.68	57.62	0	6.011	15.64
Laminarity b t CH1-1-17.10	14.93989	3.22370	19.55	15.35	11.14	5.001	14.87	22.36	24.63	9.981	13.18	8.337	7.187	5.366	26.15	26.32	19.21	10.34	9.433	6.932	13.53	13.29
Trap Time b t CH1-1-13.10	3.56989	3.32340	-1	3.778	4.047	4.244	3.886	3.571	3.778	3.667	3	4.533	3.667	3.886	3.903	3.231	3.714	4.672	6.839	-1	3.957	4.244
Trap Time b t CH1-1-17.10	4.99612	0.10465	5.228	4.828	5.059	4.444	4.252	12.45	5.187	4.597	4.33	4.771	4.265	4.119	5.558	4.923	4.879	4.777	4.743	4.196	4.936	4.682
Mean b t CH1-2-13.10	0.02586	0.00000	0.025	0.025	0.027	0.027	0.023	0.027	0.028	0.023	0.027	0.027	0.026	0.026	0.025	0.025	0.025	0.026	0.026	0.027	0.028	0.021
Mean b t CH1-2-17.10	0.02488	0.00283	0.029	0.02	0.028	0.02	0.029	0.022	0.025	0.024	0.027	0.017	0.033	0.018	0.031	0.02	0.027	0.042	0.035	0.014	0.021	0.018
%Rec b t CH1-2-13.10	0.31773	0.01061	0.403	0.33	0.353	0.185	0.222	0.407	0.279	0.438	0.361	0.327	0.277	0.245	0.455	0.348	0.186	0.245	0.298	0.287	0.207	0.296
%Rec b t CH1-2-17.10	1.89530	0.26941	2.174	1.085	2.415	1.385	2.914	1.537	2.278	1.605	2.169	1.698	2.01	1.405	2.036	0.786	2.342	1.143	2.109	1.891	1.91	1.656
%Det b t CH1-2-13.10	50.65402	2.21819	58.34	47.83	50.88	44.25	47.05	53.52	52.3	56.67	53.9	48.9	53.03	50.71	53.64	55.26	42.9	50	49.59	47.68	44.5	54.35
%Det b t CH1-2-17.10	73.08662	1.59382	76.04	67.12	75.24	72.08	77.33	70.55	76.57	68.64	75.4	71.48	70.32	70.21	71.85	63.28	76.22	67.21	75.64	74.55	70.83	69.31
Entropy b t CH1-2-13.10	2.08277	0.10394	2.145	1.807	1.949	1.582	1.883	2.396	2.305	2.03	2.206	2.146	2.383	2.062	2.214	2.198	1.909	1.947	2.066	1.958	1.932	2.046
Entropy b t CH1-2-17.10	2.89212	0.06505	2.96	2.65	3.093	2.787	3.087	2.725	3.034	2.562	2.954	2.775	2.824	2.729	2.848	2.472	3.016	2.72	3.006	2.875	2.739	2.816
Laminarity b t CH1-2-13.10	4.90455	2.29103	5.399	7.335	6.797	7.353	1.78	8.384	2.92	12.37	12.31	3.25	13.99	0.303	7.011	5.611	1.195	2.923	8.056	0.516	4.665	10.7
Laminarity b t CH1-2-17.10	13.28547	4.99217	19.81	6.404	19.03	13.25	26.79	25.83	16.45	12.12	8.728	8.882	11.28	8.341	13.4	4.972	17.65	14.96	17.32	18.33	7.661	18.06
Trap Time b t CH1-2-13.10	3.40208	0.41224	3.259	4.083	3.345	4.583	4	4.929	3.3	3.712	4.39	3.308	4.486	3	3.909	3.435	3	3.222	3.731	3	3.545	4.571
Trap Time b t CH1-2-17.10	4.83695	0.61377	5.444	4.194	5.311	6.509	5.408	5.389	5.764	4.523	4.453	4.88	4.826	4.647	4.329	4.051	5.429	4.494	5.093	4.658	4.29	4.879
Mean b t CH1-3-13.10	0.02619	#DIV/0!	0.026	0.026	0.026	0.026	0.027	0.026	0.024	0.028	0.026	0.026	0.026	0.027	0.025	0.027	0.027	0.025	0.027	0.024	0.028	0.027
Mean b t CH1-3-17.10	0.02532	0.00141	0.028	0.024	0.028	0.024	0.027	0.022	0.025	0.022	0.029	0.019	0.031	0.021	0.025	0.027	0.024	0.029	0.023	0.025	0.025	0.027
%Rec b t CH1-3-13.10	0.36329	#DIV/0!	0.367	0.469	0.354	0.175	0.362	0.287	0.353	0.382	0.38	0.238	0.272	0.245	0.331	0.6	0.345	0.379	0.3	0.26	0.346	0.293
%Rec b t CH1-3-17.10	2.02494	0.16051	1.83	2.578	2.844	1.274	2.74	1.355	2.46	1.771	2.466	2.052	2.664	1.662	3.17	1.846	2.54	1.575	2.592	1.831	3.338	2.201
%Det b t CH1-3-13.10	51.72107	#DIV/0!	53.95	52.29	53.28	43.87	52.77	50.99	53.15	50.13	53.74	49.79	50.86	40.02	51.72	61.04	52.12	53.16	44.44	45.67	50.04	51.01
%Det b t CH1-3-17.10	73.97953	1.17663	71.73	78.75	80.49	67.64	77.19	69.78	75.95	77.47	77.55	78.69	77.94	73.62	77.97	74.33	77.97	76.13	77.31	75.61	81.63	76.11
Entropy b t CH1-3-13.10	2.12652	#DIV/0!	2.208	2.147	2.199	1.913	2.2	2.198	2.056	1.927	2.056	2.064	2.047	1.732	2.129	2.316	2.074	2.149	2.066	1.687	2.042	2.22
Entropy b t CH1-3-17.10	2.93038	0.07071	2.78	3.265	3.094	2.725	3.175	2.685	2.939	3.065	3.106	2.954	3.171	2.831	3.165	2.972	3.089	3.18	3.104	2.941	3.379	2.94
Laminarity b t CH1-3-13.10	5.80805	#DIV/0!	11.26	12.28	1.606	0.846	2.256	5.503	2.937	3.174	6.043	2.599	6.267	0.605	5.522	4.448	3.369	1.759	0.494	2.474	3.36	1.518
Laminarity b t CH1-3-17.10	16.46862	4.19244	13.74	27.57	19.33	10.09	22.28	7.792	13.43	31.53	17.23	25.49	11.26	15.1	9.793	8.692	18.75	20.63	15.34	22.52	30.91	7.963
Trap Time b t CH1-3-13.10	3.56883	#DIV/0!	4.282	3.949	3.833	3	3.3	3.556	3.231	3.267	3.577	3.125	3.45	3	3.524	4.154	3.133	3.375	3	3.714	3.357	4.5
Trap Time b t CH1-3-17.10	5.00985	0.94894	4.48	6.198	5.602	4	5.538	3.882	4.967	6.172	5.257	5.845	5.514	5.286	4.502	3.91	5.016	6.885	4.36	6.201	6.193	4.051
	Mean in Epochs	St dev in Epochs																				
Mean b t CH2-1-13.10	0.02294	0.02616	0.014	0.023	-0.01	0.033	0.018	-0.08	-0.43	0.836	-0.7	0.168	0.233	0.071	0.079	0.092	0.191	0.023	-0.05	-0.06	-0.01	-0.08
Mean b t CH2-1-17.10	0.02177	0.00283	0.022	0.018	0.002	0.023	0.039	0.004	0.034	0.036	0.025	0.015	0.029	0.028	0.013	0.018	0.013	0.023	0.025	0.013	0.024	0.027
%Rec b t CH2-1-13.10	5.57521	0.22698	1.296	1.846	1.469	0.996	1.945	7.436	24.11	24.58	43.74	36.48	21.53	2.849	7.92	21.43	23.55	0.813	1.681	4.166	2.335	13.38
%Rec b t CH2-1-17.10	0.42677	0.37335	0.792	0.928	0.696	0.62	0.957	0.697	0.844	0.497	0.829	0.533	0.595	0.295	0.443	0.471	0.488	0.418	0.301	0.317	0.174	0.232
%Det b t CH2-1-13.10	78.49726	3.66423	72.77	69.5	72.43	71.97	76.61	90.65	99.52	99.22	99.69	99.67	97.55	80.26	88.87	98.23	98.63	64.96	77.37	84.02	74.85	93.46
%Det b t CH2-1-17.10	54.01748	13.20522	61.57	69.6	64.35	58.33	66.87	64.14	68.95	56.97	63.73	56.94	56.11	45.55	58.84	55.64	56.51	50.41	49.06	47.7	47.23	45.75
Entropy b t CH2-1-13.10	3.52705	0.15910	2.853	2.759	2.827	2.782	3.074	4.248	6.845	7.141	7.587	7.856	5.935	3.376	3.899	6.096	6.483	2.627	3.066	3.526	3.029	4.539
Entropy b t CH2-1-17.10	2.17786	0.40093	2.472	2.617	2.681	2.313	2.596	2.54	2.683	2.177	2.57	2.299	2.381	1.747	2.411	2.326	2.278	1.956	2.122	1.802	1.792	1.83
Laminarity b t CH2-1-13.10	28.70786	2.04566	12.41	8.532	6.864	9.353	30.69	59.73	99.64	99.28	99.76	99.64	91.3	30.57	45.56	95.37	97.61	6.113	24.31	33.77	27.53	71.31
Laminarity b t CH2-1-17.10	6.56533	11.40422	17.9	17.29	10.65	0.957	2.97	11.85	9.402	0	16.82	9.559	16.36	2.768	16.4	4.038	14.65	13.73	8.45	3.429	0.569	2.447
Trap Time b t CH2-1-13.10	12.75483	0.46669	4.459	3.747	4.163	4.384	5.963	8.523	78.82	77.69	136.6	131.9	23.98	5.881	6.453	30.24	45.99	3.655	5.215	5.884	6.12	10.61
Trap Time b t CH2-1-17.10	3.59038	1.25370	5.573	4.636	4.412	3	3.966	3.976	5.441	-1	4.78	4.12	3.788	3.3	4.82	3.5	3.705	3.515	3.219	3.385	4	3.286
Mean b t CH2-2-13.10	0.02235	0.02758	0.004	0.053	0.006	-0	0.067	0.001	0.018	0.045	-0.01	0.051	0.021	-0	0.049	0.005	0.032	0.017	0.005	0.009	0.04	0.042
Mean b t CH2-2-17.10	0.02164	0.00141	0.019	0.019	0.021	0.023	0.021	0.035	0.016	0.019	0.015	0.026	0.025	0.021	0.019	0.02	0.019	0.019	0.032	0.016	0.027	0.015
%Rec b t CH2-2-13.10	1.90232	0.48861	1.873	0.846	2.851	2.666	0.602	2.689	3.067	1.342	2.172	2.175	1.74	1.713	1.004	2.609	1.699	2.12	1.388	2.548	2.522	1.582
%Rec b t CH2-2-17.10	0.38409	0.04101	0.25	0.278	0.284	0.214	0.398	0.373	0.396	0.297	0.376	0.31	0.344	0.386	0.409	0.372	0.355	0.354	0.514	0.458	0.439	0.44
%Det b t CH2-2-13.10	75.55823	2.65377	74.49	64.69	81.57	82.16	60.03	81.52	83.83	73.6	80.49	78.91	73.48	71.55	66.8	76.59	74.7	77.07	70.21	80.41	79.03	73.29
%Det b t CH2-2-17.10	52.49403	0.02899	47.63	50.85	47.65	41.55	48.85	51.99	51.47	47.34	51.91	58.04	47.84	54.94	58.71	58.5	55.46	53.25	51.66	55.45	49.78	57.31
Entropy b t CH2-2-13.10	3.04792	0.00849	2.898	2.425	3.374	3.367	2.393	3.258	3.577	3.048	3.194	3.268	2.808	2.813	2.617	3.273	2.968	3.047	2.769	3.295	3.141	2.99
Entropy b t CH2-2-17.10	2.15964	0.22486	1.918	1.983	1.83	1.855	2.268	2.113	2.152	2.115	2.099	2.067	1.829	2.259	2.371	2.274	2.053	2.193	2.127	2.211	2.219	2.389
Laminarity b t CH2-2-13.10	18.20074	9.70151	20.14	3.157	27.32	23.51	2.872	28.88	34.39	15.38	21.28	21.03	9.348	15.18	9.901	28.6	15.12	18.79	15.49	22.12	17	11.97
Laminarity b t CH2-2-17.10	7.17179	1.89010	3.557	0.801	4.435	1.852	3.605	8.94	9.295	5.824	16.58	4.936	3.669	6.282	12.15	4.183	4.593	6.001	7.593	19.76	8.512	13.27
Trap Time b t CH2-2-13.10	5.25252	0.21708	5.104	3.484	5.478	5.937	3.5	7.125	6.061	5.799	5.109	5.127	4.273	4.191	3.903	7.842	5.093	6.172	4.78	5.217	5.176	4.699
Trap Time b t CH2-2-17.10	3.60242	0.27860	3.273	3	3.188	3.2	3.222	3.553	3.239	3.5	3.877	3.647	3.4	3.5	3.941	4.2	3.3	4.095	3.435	4.357	3.432	4.37
Mean b t CH2-3-13.10	0.02262	#DIV/0!	0.03	0.037	-0.01	0.057	0.01	0.002	0.059	0.01	0.001	0.059	-0.01	0.014	0.053	-0.01	0.047	0.023	0.001	0.052	-0.01	0.044
Mean b t CH2-3-17.10	0.02177	0.00141	0.019	0.024	0.022	0.018	0.021	0.016	0.023	0.025	0.024	0.02	0.019	0.022	0.022	0.022	0.023	0.023	0.015	0.018	0.029	0.022
%Rec b t CH2-3-13.10	2.02916	#DIV/0!	2.595	0.992	1.319	0.721	2.132	2.466	0.76	2.987	1.858	1.034	1.695	3.622	0.953	1.942	2.439	2.109	1.954	1.406	2.324	2.142
%Rec b t CH2-3-17.10	0.41117	0.20577	0.557	0.272	0.557	0.371	0.427	0.284	0.444	0.513	0.387	0.642	0.395	0.344	0.408	0.243	0.489	0.368	0.482	0.332	0.288	0.377
%Det b t CH2-3-13.10	76.89857	#DIV/0!	82.5	67.45	75.58	64.48	80.69	80.71	64.57	83.92	79.27	73.32	78.26	82.34	65.21	79.49	79.42	77.61	76.87	74.15	75.9	78.49
%Det b t CH2-3-17.10	54.47258	6.27628	57.25	49.86	58.52	53.4	58.59	52.13	55.57	56.41	54.6	59.55	51.56	52.45	52.4	44.41	56.54	54.64	58.89	51.71	48.67	50.2
Entropy b t CH2-3-13.10	3.10533	#DIV/0!	3.449	2.517	3.109	2.479	3.289	3.276	2.635	3.592	3.119	2.871	3.114	3.537	2.535	3.195	3.394	3.098	3.038	2.845	3.033	3.135
Entropy b t CH2-3-17.10	2.19841	0.24678	2.299	2.231	2.351	1.989	2.049	2.133	2.258	2.326	2.171	2.546	2.007	2.22	2.053	2.075	2.326	2.026	2.348	2.141	2.037	2.125
Laminarity b t CH2-3-13.10	18.42203	#DIV/0!	25.86	4.511	9.953	5.039	27.19	20.15	3.741	33.56	6.386	18.46	11.59	25.64	9.282	25.14	18.45	12.42	7.174	9.022	11.15	14.37
Laminarity b t CH2-3-17.10	7.68644	0.16122	6.829	8.917	10.65	9.133	6.189	5.918	9.577	11.43	7.344	12.56	9.512	0.647	6.125	8.943	17.23	2.083	6.612	2.455	0	9.174
Trap Time b t CH2-3-13.10	5.38860	#DIV/0!	5.496	3.935	4.827	4.594	5.651	5.334	3.71	5.851	3.871	5.805	4.76	5.648	4.068	6.54	5.233	5.067	4.109	5.13	4.721	4.882
Trap Time b t CH2-3-17.10	3.76294	0.03536	3.85	4.083	4.068	3.605	3.821	3.778	4.195	3.885	3.71	3.747	3.8	3	3.741	4.632	5.09	3.1	4.448	3.3	-1	3.415

Mean b t CH1-1-13.10	0.001	0.068	0.036	0.012	0.028	0.028	0.021	0.016	0.026	0.023	0.027	0.025	0.028	0.027	0.024	0.023	0.029	0.025	0.023	0.025	0.03	0.044	0.009
Mean b t CH1-1-17.10	0.026	0.022	0.023	0.018	0.025	0.026	0.025	0.024	0.026	0.023	0.025	0.022	0.023	0.03	0.02	0.029	0.022	0.024	0.023	0.023	0.026	0.029	0.02
%Rec b t CH1-1-13.10	2.851	0.243	0.749	0.284	0.425	0.388	0.381	0.329	0.283	0.246	0.272	0.331	0.311	0.245	0.285	0.324	0.245	0.233	0.235	0.324	0.338	0.288	0.478
%Rec b t CH1-1-17.10	2.303	1.669	2.07	1.719	1.98	1.286	1.493	2.85	1.467	1.666	0.879	2.154	1.305	1.695	1.88	1.716	1.191	1.498	2.77	1.134	2.214	0.955	1.871
%Det b t CH1-1-13.10	79.563	50.254	65.2	49.26	58.05	57.81	53.41	50.23	49.83	44.23	50.82	52.27	49.29	46.06	50.61	53.89	45.02	48.62	46.68	45.16	53.1	48.28	54.09
%Det b t CH1-1-17.10	74.136	72.156	73.06	75.43	78.06	68.76	74.8	79	68.82	73.17	59.94	75.83	71.14	69.95	73.45	72.66	69.07	72.53	78.13	69.24	73.69	58.5	72.04
Entropy b t CH1-1-13.10	3.232	1.948	2.477	2.004	2.247	2.377	2.116	2.013	2.156	2.04	2.05	2.097	1.948	1.76	2.051	2.127	1.965	1.862	1.97	2.03	2.036	2.127	2.207
Entropy b t CH1-1-17.10	2.928	2.809	2.867	2.985	3.065	2.6	2.976	3.168	2.646	2.927	2.537	3.055	2.666	2.754	2.935	2.855	2.7	2.785	3.179	2.651	3.057	2.392	2.881
Laminarity b t CH1-1-13.10	45.461	3.959	22.86	3.568	12.38	8.923	5.711	1.727	3.409	5.216	4.174	6.189	7.79	0.303	1.56	2.443	0.302	2.754	1.686	2.899	6.428	3.866	14.84
Laminarity b t CH1-1-17.10	18.663	23.919	10.76	11.36	28.57	22.42	12.07	13.64	11.68	2.523	1.912	14.81	13.18	13.87	23.47	7.475	4.234	14.42	24.49	11.34	17.87	5.876	21.38
Trap Time b t CH1-1-13.10	4.882	3.545	5.589	4.1	3.804	3.784	3.52	3.286	3.9	3.714	3.833	5.188	3.5	3	3	3.556	3	3.25	3.2	3.455	3.143	3.214	3.827
Trap Time b t CH1-1-17.10	5.085	5.747	4.644	4.225	5.411	5.423	4.993	5.279	5.058	3.778	3.579	5.309	5.233	4.755	5.265	4.474	3.923	5.111	5.072	4.643	4.866	4.283	5.025
Mean b t CH1-2-13.10	0.028	0.025	0.028	0.025	0.026	0.025	0.025	0.023	0.025	0.027	0.027	0.026	0.027	0.024	0.025	0.027	0.027	0.026	0.024	0.027	0.027	0.024	0.027
Mean b t CH1-2-17.10	0.028	0.022	0.028	0.02	0.029	0.022	0.025	0.021	0.03	0.022	0.028	0.028	0.025	0.018	0.025	0.027	0.024	0.029	0.022	0.028	0.021	0.027	0.024
%Rec b t CH1-2-13.10	0.262	0.326	0.215	0.398	0.215	0.258	0.386	0.375	0.384	0.246	0.284	0.268	0.278	0.391	0.482	0.399	0.322	0.444	0.291	0.183	0.321	0.542	0.273
%Rec b t CH1-2-17.10	1.964	1.385	2.424	1.108	2.817	1.499	2.867	1.01	2.155	1.609	2.296	0.875	1.68	1.682	2.159	1.217	3.441	2.319	1.44	2.312	1.458	2.076	1.166
%Det b t CH1-2-13.10	48.019	48.634	44.7	51.99	46.32	52.59	53.81	56.07	53.35	47.29	47.26	44.61	43.02	54.59	49.23	50.5	54.41	55.9	52.38	46.28	50.62	55.97	50.73
%Det b t CH1-2-17.10	72.405	72.474	76.87	68.82	78.23	74.52	77.9	66.04	73.4	72.12	74.73	65.06	72.37	73.76	77.95	70.62	80.37	75.9	71.07	76.52	72.09	73.51	71.36
Entropy b t CH1-2-13.10	1.788	1.866	1.869	2.016	1.964	1.955	2.02	2.156	2.099	1.954	2.111	1.965	1.916	2.15	2.008	2.083	2.45	2.119	2.18	2.088	2.077	2.236	1.839
Entropy b t CH1-2-17.10	2.95	2.81	2.995	2.644	3.142	2.979	3.046	2.622	2.857	2.847	2.948	2.634	2.953	2.742	3.083	2.754	3.174	3.019	2.647	2.92	2.921	2.979	2.802
Laminarity b t CH1-2-13.10	9.811	3.869	2.304	5.893	3.103	3.935	5.894	5.673	11.6	0	7.92	1.198	0.978	2.91	2.772	3.032	9.133	5.84	0.85	0	1.154	6.335	3.533
Laminarity b t CH1-2-17.10	9.664	11.674	15.87	9.211	20.86	8.824	14.04	3.181	14.31	13.58	11.26	4.04	6.179	21.01	26.11	15.71	25.56	20.46	2.815	14.05	8.847	6.359	4.961
Trap Time b t CH1-2-13.10	3.586	3.188	3.333	3.654	3	3.417	3.538	3.583	3.673	-1	3.957	3.25	3.667	3.286	3.6	3.267	3.967	3.387	3.333	-1	3.75	3.658	3
Trap Time b t CH1-2-17.10	4.414	5.59	4.987	4.441	5.515	3.905	4.231	3.939	4.727	4.911	4.451	4.333	4.667	4.779	6.213	4.955	5.301	5.348	4.1	4.727	4.5	4.726	3.774
Mean b t CH1-3-13.10	0.028	0.026	0.024	0.026	0.026	0.027	0.026	0.025	0.026	0.029	0.026	0.025	0.028	0.025	0.024	0.025	0.027	0.027	0.026	0.025	0.029	0.026	0.024
Mean b t CH1-3-17.10	0.026	0.032	0.019	0.026	0.023	0.029	0.024	0.041	0.029	0.015	0.019	0.023	0.026	0.029	0.022	0.022	0.023	0.026	0.028	0.027	0.026	0.023	0.025
%Rec b t CH1-3-13.10	0.399	0.355	0.349	0.38	0.395	0.519	0.325	0.293	0.259	0.391	0.386	0.331	0.45	0.884	0.299	0.315	0.349	0.34	0.415	0.397	0.183	0.354	0.303
%Rec b t CH1-3-17.10	1.77	3.064	2.167	2.809	1.298	2.062	2.013	2.025	1.17	2.467	1.662	2.057	1.168	3.245	1.152	0.928	2.842	1.039	2.09	1.165	1.87	1.12	2.106
%Det b t CH1-3-13.10	53.127	50.871	50.14	54.26	52.38	57	50.19	47	45.09	50.38	53.81	47.72	60.71	65.46	50.29	54.43	51.7	50.04	54.52	57.13	48.31	53.7	49.59
%Det b t CH1-3-17.10	73.733	79.272	78.76	76.82	73.01	76.73	76.08	73.26	68.65	77.1	75.45	74.2	68.12	77.48	68.06	63.46	77.38	64.61	72.74	65.07	74.27	65.73	75.9
Entropy b t CH1-3-13.10	2.271	1.899	2.176	2.255	2.176	2.348	1.84	1.991	2.096	2.237	2.072	1.944	2.428	2.598	2.13	2.077	1.963	2.111	2.369	2.117	2.132	2.23	1.981
Entropy b t CH1-3-17.10	2.916	3.198	3.244	2.995	2.853	3.017	3.092	2.919	2.661	3.131	2.874	2.969	2.654	3.185	2.593	2.368	2.98	2.475	2.801	2.641	3.116	2.524	2.957
Laminarity b t CH1-3-13.10	4.644	1.254	9.49	0.845	13.39	12.81	2.437	4.219	0.572	7.143	5.83	1.643	12.31	22.55	1.652	7.686	5.177	1.236	8.155	10.9	1.35	2.789	3.263
Laminarity b t CH1-3-17.10	10.11	24.746	32	14.43	4.133	14.75	22.43	9.51	10.06	21.14	22.37	10.48	10.32	32.38	1.737	11.8	26.4	2.832	9.319	7.131	12.99	5.145	17.22
Trap Time b t CH1-3-13.10	3.261	3	4.786	3.25	3.963	4.015	3.556	3.571	3	3.645	3.5	3.143	4.073	4.076	3.333	3.379	3.65	3.4	3.703	3.431	3.333	3.636	3.636
Trap Time b t CH1-3-17.10	4.442	5.576	6.465	4.982	5.167	5.971	5.103	4.328	4.407	4.48	5.081	4.844	4.832	6.441	3.857	4.343	4.496	3.967	4.147	4.421	4.468	5.548	5.277
Mean b t CH2-1-13.10	0.101	0.13	0.068	-0.18	0.101	0.029	0.061	-0.01	0.033	-0	0.032	0.026	0.002	0.039	0.027	0.005	0.028	0.049	0.022	-0.03	-0.01	0.067	0.072
Mean b t CH2-1-17.10	0.03	0.014	0.027	0.017	0.019	0.022	0.02	0.022	0.026	0.019	0.025	0.022	0.02	0.02	0.02	0.022	0.024	0.019	0.025	0.021	0.022	0.017	0.028
%Rec b t CH2-1-13.10	3.222	4.027	12.32	16.05	6.078	10.82	7.425	4.136	1.797	2.324	1.575	1.776	1.525	1.094	1.099	1	2.388	1.034	1.256	0.994	0.934	2.937	1.519
%Rec b t CH2-1-17.10	0.472	0.428	0.452	0.299	0.458	0.347	0.374	0.373	0.278	0.251	0.342	0.354	0.702	0.349	0.337	0.216	0.242	0.461	0.343	0.318	0.25	0.237	0.295
%Det b t CH2-1-13.10	81.211	83.542	94.48	96.4	89.02	92.54	88.14	81.51	75.56	80.28	74.84	70.9	74.79	68.75	63.91	69.01	79.96	69.44	71.38	67.59	65.52	80.74	74.63
%Det b t CH2-1-17.10	56.358	63.815	55.01	47.77	51.46	56.42	49.21	49.7	46.36	50.35	56.18	56.01	59.69	56.33	53.85	48.57	49.54	57.94	54.62	53.89	52.32	43.68	51.09
Entropy b t CH2-1-13.10	3.435	3.607	4.79	5.228	3.991	4.395	3.857	3.353	3.155	3.244	2.955	2.856	2.861	2.766	2.446	2.657	3.206	2.757	2.848	2.647	2.633	3.312	2.949
Entropy b t CH2-1-17.10	2.119	2.785	2.166	1.932	2.079	2.292	2.108	2.154	1.803	2.064	2.381	2.19	2.394	2.194	2.208	1.924	1.97	2.162	2.273	2.039	1.944	2.045	2.026
Laminarity b t CH2-1-13.10	36.658	27.63	69.95	78.18	49.88	57.56	43.35	18.31	8.514	20.25	13.64	10.89	20.88	10.1	0.877	4.794	32	11.93	10.11	7.338	2.858	30.2	14.97
Laminarity b t CH2-1-17.10	2.826	20.751	11.82	4.793	4.639	12.63	7.341	2.121	6.394	3.054	10.05	1.746	7.999	10.9	6.97	3.895	0	3.594	5.195	6.143	0.691	2.926	2.261
Trap Time b t CH2-1-13.10	6.905	5.93	11.06	12.59	8.315	8.167	7.751	5.132	5.291	5.174	5.204	4.369	4.616	4.027	3.25	3.88	5.756	5.484	4.759	4.338	3.6	5.624	4.623
Trap Time b t CH2-1-17.10	3.176	5.203	3.927	3.625	3.44	4.425	3.828	3.2	4	3.444	4.344	3.125	3.661	3.581	3.519	3.4	-1	3.526	3.273	3.435	3.5	3.5	3.375
Mean b t CH2-2-13.10	0.008	0.042	-0.02	0.052	-0	0.027	0.044	-0.01	0.053	-0.01	0.048	0.029	-0.02	0.06	-0.01	0.061	0.031	-0.03	0.064	-0.01	0.031	0.049	-0.03
Mean b t CH2-2-17.10	0.021	0.024	0.024	0.022	0.019	0.018	0.023	0.022	0.022	0.02	0.024	0.021	0.021	0.021	0.025	0.02	0.02	0.025	0.021	0.022	0.02	0.023	0.019
%Rec b t CH2-2-13.10	1.375	0.951	1.695	1.062	2.424	1.343	2.492	1.667	1.058	2.145	1.232	2.051	2.954	1.172	1.54	1.697	2.238	2.435	1.049	2.534	4.373	1.18	1.694
%Rec b t CH2-2-17.10	0.242	0.415	0.35	0.444	0.367	0.264	0.366	0.376	0.438	0.285	0.713	0.523	0.563	0.402	0.374	0.518	0.353	0.278	0.418	0.267	0.291	0.37	0.705
%Det b t CH2-2-13.10	73.719	68.209	78.01	72.11	80.17	70.73	77.77	74.83	72.45	78.41	71.76	74.31	81.79	73.13	72.69	74.68	79.61	76.22	69	77.42	88.41	72.03	77.41
%Det b t CH2-2-17.10	42.959	52.265	48.27	55.23	47.68	46.91	49.7	52.07	53.36	49.78	65.13	55.72	62.18	53.72	54.3	53.31	46.15	47.6	55.98	48.71	46.68	50.6	65.76
Entropy b t CH2-2-13.10	2.99	2.725	3.194	2.999	3.262	2.752	3.254	2.983	2.943	3.012	2.884	3.383	3.487	2.879	2.978	3.076	3.127	3.029	2.717	3.161	3.777	2.71	3.195
Entropy b t CH2-2-17.10	2.057	2.147	2.083	2.112	2.151	2.013	2.207	2.136	2.136	2.121	2.657	2.256	2.424	2.279	2.1	2.222	2.169	2.158	2.224	2.11	1.895	2.036	2.403
Laminarity b t CH2-2-13.10	13.14	2.054	24.13	12.06	26.31	10.19	19.78	9.417	25.78	20.4	8.143	10.14	35.47	12	23.13	7.165	21.27	14.63	7.402	13.06	51.73	4.756	28.26
Laminarity b t CH2-2-17.10	2.143	10.548	3.176	9.577	3.704	3.464	7.968	3.283	1.636	10.41	21.7	12.95	15.97	7.077	8.466	3.147	4.132	7.117	9.763	2.865	5.782	9.559	21.42
Trap Time b t CH2-2-13.10	5.007	3.762	5.498	4.177	6.667	5.13	5.633	4.291	5.543	4.733	5.413	4.184	5.987	4.007	5.93	4.354	4.864	4.868	3.877	5.091	7.513	4.283	6.245
Trap Time b t CH2-2-17.10	4.2	3.612	3.75	3.51	3.235	3.364	3.471	4.167	3.625	4.444	4.853	4.09	4.233	3.382	3.282	3.667	3.278	4.444	3.667	3.444	3.778	3.865	3.968
Mean b t CH2-3-13.10	0.012	0.001	0.055	0.009	0.023	0.032	-0.02	0.052	0.045	0.011	0	0.052	-0	0.026	0.039	-0.01	0.065	-0.01	0.021	0.043	0.008	0.024	0.033
Mean b t CH2-3-17.10	0.025	0.02	0.016	0.027	0.022	0.026	0.023	0.021	0.016	0.023	0.021	0.023	0.026	0.025	0.019	0.016	0.024	0.024	0.022	0.018	0.023	0.022	0.023
%Rec b t CH2-3-13.10	1.726	2.474	1.22	1.641	1.82	2.182	1.727	1.525	1.496	2.729	2.652	1.259	2.122	3.597	1.009	2.285	1.113	3.165	4.041	1.668	2.786	2.478	0.999
%Rec b t CH2-3-17.10	0.501	0.332	0.328	0.335	0.338	0.32	0.287	0.42	0.383	0.334	0.33	0.401	0.422	0.387	0.318	0.534	0.516	0.528	0.237	0.309	0.29	0.355	0.43
%Det b t CH2-3-13.10	76.761	82.053	67.98	78.08	78.76	75.8	75.35	74.34	74.56	79.49	83.49	69.8	75.28	84.77	64.15	79.56	70.4	80.72	85.44	76.53	78.57	84.85	71.95
%Det b t CH2-3-17.10	62.968	53.462	49.06	50.81	52.45	51.12	51.46	56.61	55.64	54.59	56.25	58.88	58.7	49.71	54.66	60.95	55.87	60.01	49.43	46.52	54.86	56.3	51.87
Entropy b t CH2-3-13.10	3.075	3.33	2.633	3.115	3.076	2.964	2.954	2.962	2.986	3.263	3.487	2.745	3.065	3.688	2.644	3.195	2.674	3.439	3.556	3.013	2.997	3.559	2.974
Entropy b t CH2-3-17.10	2.613	2.282	2.134	2.175	2.173	2.3	2.184	2.145	2.196	2.118	2.135	2.428	2.403	1.884	2.323	2.316	2.293	2.395	2.175	1.868	1.902	2.051	2.169
Laminarity b t CH2-3-13.10	22.208	23.104	10.15	28.42	9.522	17.39	4.723	16.32	7.847	21.02	28.57	7.875	4.077	39.25	4.411	19.21	9.838	34.85	46.75	5.04	29.94	40.18	14.55
Laminarity b t CH2-3-17.10	17.949	4.095	2.113	6.352	7.816	8.353	0.258	5.703	6.319	6.509	8.078	9.494	19.22	3.382	12.73	4.354	3.354	19.65	6.583	4.243	4.855	1.67	7.303
Trap Time b t CH2-3-13.10	5.744	5.794	4.726	7.041	4.612	4.827	4.024	6.066	4.567	5.633	6.426	5.208	4.43	7.989	4.615	6.574	5.274	6.146	7.597	3.908	5.192	7.18	7.636
Trap Time b t CH2-3-17.10	4.136	3.438	3.111	3.44	3.567	4.154	3	4.217	3.267	4	3.6	4.4	5.857	3.533	3.727	3.615	3.333	4.242	3.5	3.786	3.562	3.429	3.629

Mean b t CH1-1-13.10	0.019	0.025	0.025	0.026	0.026	0.026	0.025	0.027	0.028	0.028	0.023	0.025	0.026	0.025	0.029	0.026	0.022	0.027	0.027	0.025	0.025	0.027	0.025
Mean b t CH1-1-17.10	0.022	0.027	0.021	0.029	0.021	0.024	0.025	0.028	0.024	0.028	0.02	0.029	0.026	0.023	0.02	0.032	0.021	0.022	0.025	0.028	0.02	0.027	0.02
%Rec b t CH1-1-13.10	0.506	0.476	0.365	0.342	0.258	0.253	0.194	0.372	0.301	0.384	0.502	0.262	0.39	0.241	0.245	0.25	0.369	0.425	0.279	0.225	0.373	0.376	0.374
%Rec b t CH1-1-17.10	1.002	2.547	1.321	2.321	1.338	2.274	1.275	1.485	1.749	1.86	1.013	2.796	0.88	2.339	1.581	2.168	1.39	1.878	2.02	2.272	1.385	2.876	1.896
%Det b t CH1-1-13.10	57.869	55.711	53.63	54.78	43.73	43.16	46.11	58.41	51.93	54.57	56.67	47.07	54.15	50.92	48.44	46.5	49.73	55.08	45.44	42.86	55.34	52.04	48.15
%Det b t CH1-1-17.10	64.858	76.937	67.25	71.9	69.28	73.88	68.43	67.18	72.26	70.27	63.67	78.45	63.56	71.99	74.3	75.13	70.73	73.59	73.34	73.9	68.07	80.13	76.23
Entropy b t CH1-1-13.10	2.296	2.245	2.214	2.177	1.885	1.999	1.856	2.14	2.073	2.084	2.197	1.761	2.083	2.033	1.956	1.816	2.011	1.986	2.027	1.954	2.345	2.184	2.13
Entropy b t CH1-1-17.10	2.645	3.023	2.642	2.804	2.935	3.078	2.673	2.606	2.852	2.885	2.377	3.221	2.526	2.793	2.76	2.914	2.818	3.036	2.958	3.001	2.665	3.243	3.006
Laminarity b t CH1-1-13.10	9.775	4.933	1.22	3.329	1.722	4.59	0.766	5.515	2.625	5.405	11.97	2.836	13.87	1.23	2.624	1.777	2.145	6.45	0.531	2.857	7.167	9.145	4.888
Laminarity b t CH1-1-17.10	6.141	26.393	8.866	9.351	23.52	22.52	13.13	5.261	12.37	14.85	10.62	29.46	9.489	21.87	30.85	16.34	6.17	16.29	14.54	15.82	6.355	29.67	24.11
Trap Time b t CH1-1-13.10	3.774	3.654	3	3.286	3	3.357	3	3.609	3.2	3.5	3.738	3	4.212	3	3.25	3	3.2	3.828	3	3.25	4	5.148	3.7
Trap Time b t CH1-1-17.10	4.082	5.3	4.27	4.221	6.562	5.18	4.871	4.451	5.872	5.818	4.394	6.484	4.072	5.185	5.125	5.082	4.082	4.743	4.433	6.033	4.045	6.958	5.08
Mean b t CH1-2-13.10	0.029	0.021	0.027	0.029	0.024	0.026	0.026	0.025	0.026	0.026	0.026	0.027	0.026	0.025	0.026	0.027	0.028	0.025	0.026	0.027	0.025	0.026	0.025
Mean b t CH1-2-17.10	0.024	0.023	0.028	0.023	0.023	0.022	0.027	0.023	0.032	0.02	0.026	0.023	0.024	0.026	0.022	0.03	0.021	0.028	0.022	0.027	0.023	0.027	0.025
%Rec b t CH1-2-13.10	0.26	0.373	0.303	0.316	0.282	0.261	0.4	0.281	0.485	0.271	0.29	0.312	0.2	0.267	0.35	0.332	0.298	0.233	0.367	0.318	0.252	0.409	0.418
%Rec b t CH1-2-17.10	2.181	1.348	2.915	1.126	2.549	1.07	2.391	1.684	2.446	1.579	2.471	1.708	2.263	0.9	3.038	1.169	2.563	1.161	3.083	1.347	2.407	1.629	2.555
%Det b t CH1-2-13.10	44.434	56.329	50.33	52.55	46.71	45.78	50.83	47.8	59.15	52.24	54.69	47.35	50.19	47.27	52.4	52.24	45.98	46.66	58.72	49.3	48.63	54.87	55.21
%Det b t CH1-2-17.10	75.626	71.036	76.03	70.33	77.51	65.5	75.55	70.36	77.44	70.92	77.55	77.12	74.52	61.59	79.31	70.28	78.41	69.14	78.54	69.49	78.4	72.86	78.29
Entropy b t CH1-2-13.10	2.017	2.218	2.232	2.319	2.032	2	2.082	2.036	2.517	2.114	2.153	2.027	2.048	1.992	2.181	2.19	2.092	1.991	2.328	2.194	2.075	2.26	2.292
Entropy b t CH1-2-17.10	2.968	2.782	3.025	2.785	3.202	2.68	2.956	2.725	3.066	2.83	3.129	2.889	3.005	2.556	3.18	2.8	3.265	2.864	3.26	2.7	3.138	2.883	3.052
Laminarity b t CH1-2-13.10	3.52	12.856	9.788	3.132	0.527	1.422	1.791	1.761	5.15	1.553	1.022	4.276	7.664	1.295	4.661	3.204	2.49	0.636	16.3	3.344	5.882	2.178	8.639
Laminarity b t CH1-2-17.10	5.722	13.896	17.17	8.385	18.14	5.986	6.14	11.79	23.28	10.4	13.91	26.33	10.95	0.687	22.95	11.65	11.63	12.73	16.44	8.402	12.07	17.61	12.75
Trap Time b t CH1-2-13.10	3.364	4.128	3.871	3.333	3	3	3.625	3.333	3.607	3.4	3	3.6	3.444	3.5	3.143	3.071	3.333	3	4.4	3.308	3.333	3	3.842
Trap Time b t CH1-2-17.10	4.903	5.053	4.963	4.716	6.828	5.18	4.243	4.412	5.343	4.34	5.894	5.398	4.596	3.571	5.092	4.92	4.568	5.292	4.726	4.202	4.485	4.833	4.576
Mean b t CH1-3-13.10	0.026	0.027	0.025	0.028	0.03	0.024	0.025	0.028	0.025	0.024	0.028	0.026	0.027	0.027	0.025								
Mean b t CH1-3-17.10	0.026	0.023	0.03	0.021	0.026	0.024	0.026	0.025	0.025	0.025	0.012	0.033	0.031	0.025	0.034	0.026	0.017	0.028	0.022	0.027	0.025	0.026	0.026
%Rec b t CH1-3-13.10	0.374	0.361	0.29	0.352	0.252	0.514	0.329	0.475	0.403	0.496	0.244	0.524	0.454	0.315	0.279								
%Rec b t CH1-3-17.10	4.241	1.559	1.606	1.262	2.693	1.008	1.809	1.386	1.979	1.558	3.298	1.113	2.281	1.959	1.856	2.249	1.691	2.085	2.024	2.431	1.877	2	1.603
%Det b t CH1-3-13.10	48.413	47.603	49.36	49.12	40.47	66.14	51.88	55.9	54.29	59.52	47.47	61.11	55.2	46.82	44.63								
%Det b t CH1-3-17.10	81.408	73.466	67.18	70.28	74.95	65.7	72.22	68.39	75.43	74.66	80.6	63.97	75.92	73.94	72.05	73.99	70.81	73.34	76.54	75.16	75.64	73.88	73.39
Entropy b t CH1-3-13.10	2.084	2.416	1.913	1.938	1.861	2.566	2.222	2.303	2.34	2.445	2.056	2.273	2.202	2.044	1.804								
Entropy b t CH1-3-17.10	3.224	2.946	2.742	2.738	2.997	2.647	2.834	2.629	3.053	3.013	3.326	2.51	2.98	2.944	2.798	2.877	2.794	3.003	3.03	2.947	2.98	2.79	2.88
Laminarity b t CH1-3-13.10	5.489	9.452	9.548	1.684	1.473	22.22	6.842	8.892	11.72	7.428	1.521	20.01	7.793	1.257	1.863								
Laminarity b t CH1-3-17.10	22.503	16.764	8.295	16.79	24.02	19.71	19.32	9.253	16.3	24.54	34.97	2.288	19.03	13.94	12.73	17.05	12.6	15.88	23.87	19.44	16.79	18.31	19.67
Trap Time b t CH1-3-13.10	3.074	4.182	3.733	3	3	4.239	3.957	4.622	3.673	3.548	3	4.609	3.488	3.2	3								
Trap Time b t CH1-3-17.10	5.141	5.448	3.823	4.842	4.938	5.545	5.068	3.873	5.483	6.209	5.535	3.219	5.12	4.742	5.112	4.862	4.61	4.838	5.371	4.672	5.357	4.518	5.822
Mean b t CH2-1-13.10	0.026	-0.004	-0.02	0.056	0.034	0.017	0.004	-0	0.079	0.024	0.004	0.001	0.041	0.027	-0.01	0.033	0.039	0.015	0.011	0.036	0.011	0.007	0.051
Mean b t CH2-1-17.10	0.024	0.022	0.02	0.023	0.019	0.022	0.022	0.024	0.02	0.025	0.02	0.021	0.021	0.029	0.025	0.018	0.017	0.021	0.02	0.023	0.02	0.023	0.026
%Rec b t CH2-1-13.10	2.374	2.306	0.763	0.83	1.303	2.24	1.032	1.136	0.497	1.714	1.6	1.752	1.002	2.545	1.268	2.289	1.172	2.097	1.385	1.408	1.44	3.959	0.975
%Rec b t CH2-1-17.10	0.445	0.293	0.381	0.261	0.341	0.429	0.243	0.496	0.289	0.245	0.34	0.422	0.331	0.391	0.783	0.444	0.223	0.456	0.413	0.421	0.519	0.432	0.264
%Det b t CH2-1-13.10	81.976	78.101	66.03	67.05	69.16	76.32	69.46	69	67.26	72.57	73.55	76.42	67.38	76.14	71.09	82.41	69.88	75.94	73.31	69.38	73.96	82.48	67.59
%Det b t CH2-1-17.10	54.747	44.81	53.02	50.1	47.72	58.49	47.97	55.71	48.46	49.55	52.36	54.57	52.24	58.53	56.7	54.2	48.17	51.27	51.47	54.23	59.49	54.09	42.9
Entropy b t CH2-1-13.10	3.242	3.029	2.683	2.679	2.688	2.893	2.727	2.761	2.579	2.908	2.843	3.215	2.522	3.061	2.722	3.428	2.703	3.049	2.92	2.598	2.78	3.631	2.628
Entropy b t CH2-1-17.10	2.169	1.809	2.134	2.148	2.003	2.301	1.852	2.088	2.098	1.961	1.991	2.325	1.897	2.321	2.257	2.378	2.046	2.122	2.073	2.269	2.339	2.408	1.905
Laminarity b t CH2-1-13.10	21.179	15.532	1.459	4.587	8.289	10.89	3.689	12.21	4.328	15.21	18.93	9.582	4.12	7.196	10.37	36.38	3.544	5.836	14.01	3.441	3.913	34.51	15.31
Laminarity b t CH2-1-17.10	4.775	0.844	2.92	3.598	7.965	5.066	2.236	3.791	3.082	2.82	0.218	0.762	2.388	17.45	5.496	17.31	0.666	6.287	4.973	4.818	7.722	7.376	1.776
Trap Time b t CH2-1-13.10	5.439	4.644	3.462	4.278	4.009	4.678	4.278	3.869	4.143	5	4.88	4.557	4.073	4.005	4.508	6.848	4	4.806	4.729	3.92	3.8	6.659	5.119
Trap Time b t CH2-1-17.10	3.185	3.333	3.462	3.8	3.438	3.667	3.143	3.304	3.6	3.111	3	3.25	4	4.312	3.783	4.319	3	3.515	3.32	3.565	3.522	4.607	3.8
Mean b t CH2-2-13.10	0.042	0.051	-0.01	0.014	0.054	0.019	-0	0.051	-0	0.025	0.038	0.003	0.037	0.015	0.022	0.037	-0.01	0.044	0.018	0.016	0.033	0.002	0.043
Mean b t CH2-2-17.10	0.021	0.028	0.029	0.017	0.023	0.012	0.025	0.022	0.022	0.022	0.021	0.02	0.028	0.018	0.022	0.015	0.025	0.02	0.024	0.025	0.023	0.021	0.021
%Rec b t CH2-2-13.10	3.873	1.589	1.397	3.119	0.841	1.642	2.679	1.357	1.5	1.968	1.116	2.566	1.492	1.528	2.907	1.581	2.346	1.131	1.652	3.243	1.082	2.193	1.182
%Rec b t CH2-2-17.10	0.373	0.311	0.604	0.586	0.326	0.37	0.5	0.306	0.381	0.325	0.297	0.36	0.42	0.223	0.518	0.335	0.294	0.37	0.31	0.255	0.711	0.298	0.308
%Det b t CH2-2-13.10	85.844	75.338	74.11	82.78	65.67	76.9	82.74	69.58	77.01	78.04	68.08	79.08	72.93	73.88	84.14	71.33	81.65	67.56	77.27	82.54	68.55	81.83	70.73
%Det b t CH2-2-17.10	51.226	48.251	55.28	67.55	51.18	53.34	55.14	48.46	56.78	52.62	50.62	52.51	54.06	45.35	63.69	57.61	45.54	52.64	52.79	53.93	57.23	46.93	47.67
Entropy b t CH2-2-13.10	3.541	3.009	2.828	3.542	2.494	3.141	3.47	2.764	3.059	3.244	2.782	3.167	2.811	2.897	3.479	2.872	3.391	2.678	3.024	3.457	2.684	3.274	2.886
Entropy b t CH2-2-17.10	2.179	2.237	2.189	2.803	2.055	2.144	2.289	2.068	2.355	1.883	2.052	2.188	2.239	1.684	2.54	2.171	1.994	2.165	2.182	2.126	2.344	1.992	2.236
Laminarity b t CH2-2-13.10	40.337	15.419	11.66	29.53	16.46	18.64	32.81	9.344	10.55	17.18	6.38	26.09	11.19	11.65	25.33	8.458	38.36	6.799	13.07	30.42	5.231	48.05	6.423
Laminarity b t CH2-2-17.10	2.916	0	5.892	30.63	4.935	5.414	7.806	1.861	14.73	6.084	7.577	2.539	4.888	1.549	13.36	7.312	4.545	10.89	2.07	1.455	1.565	2.741	0.884
Trap Time b t CH2-2-13.10	6.922	5.299	4.483	6.118	4.409	5.202	5.763	5.7	5.289	5.282	4.235	7.11	4.72	4.26	6.258	5.056	6.804	4.26	4.745	6.178	4.241	8.408	4.797
Trap Time b t CH2-2-17.10	3.143	-1	3.512	5.808	3.095	3.24	4.051	3.286	3.783	3.478	3.37	3.364	3.32	3.5	4	4.714	3.6	3.543	3.714	3	3.214	3.3	3.667
Mean b t CH2-3-13.10	-0.007	0.051	0.027	-0.01	-0.01	0.104	0.017	-0.01	0.038	0.026	-0.01	0.056	0.007	0.012	0.049								
Mean b t CH2-3-17.10	0.025	0.02	0.022	0.02	0.02	0.022	0.02	0.024	0.021	0.023	0.031	0.017	0.023	0.022	0.035	0.014	0.017	0.021	0.023	0.022	0.018	0.024	0.021
%Rec b t CH2-3-13.10	3.352	1.667	1.506	2.721	2.931	1.517	1.746	2.861	2.389	1.847	1.889	1.839	1.816	2.875	1.571								
%Rec b t CH2-3-17.10	1.292	0.53	0.564	0.419	0.345	0.356	0.791	0.376	0.358	0.457	0.485	0.345	0.405	0.501	0.3	0.456	0.237	0.278	0.386	0.323	0.471	0.381	0.266
%Det b t CH2-3-13.10	82.832	78.206	72.08	81.82	81.88	71.33	80.18	79.11	82.74	76.16	76.97	72.02	75.01	83.88	76.99								
%Det b t CH2-3-17.10	66.297	59.869	56.37	56.1	53.44	53.96	60.78	54.1	53.55	51.78	61.18	51.79	50.89	61.83	53.01	54.55	50.26	51.24	54.77	50.15	60.68	50.68	48.38
Entropy b t CH2-3-13.10	3.335	3.115	2.893	3.32	3.313	2.962	3.233	3.333	3.417	3.041	3.069	2.91	3.021	3.45	3.043								
Entropy b t CH2-3-17.10	2.619	2.43	2.367	2.233	2.021	2.136	2.434	2.277	2.137	2.013	2.363	2.197	2.149	2.418	1.997	2.234	2.137	1.979	2.161	1.989	2.432	2.049	1.95
Laminarity b t CH2-3-13.10	32.404	30.764	9.404	18.91	19.18	7.331	23.43	21.76	27.39	18.85	18.23	23.82	12.92	41.19	18.56								
Laminarity b t CH2-3-17.10	15.972	25.338	10.86	5.893	13.63	7.083	8.719	2.495	1.104	7.784	5.094	4.011	6.101	17.85	14.84	5.092	0.94	5.773	2.751	4.824	8.241	4.153	7.057
Trap Time b t CH2-3-13.10	6.377	6.307	5.071	5.017	4.737	4.054	5.48	5.635	6.071	5.199	5.121	5.386	4.698	7.161	5.784								
Trap Time b t CH2-3-17.10	4.053	4.763	4.203	3.846	4.318	4.08	4.164	3.455	4	3.429	3.571	3.733	3.846	4.763	5.143	3.241	3	4.062	3.071	3.316	4.486	3.2	3.8

Picture 1. Results of recurrence quantification analysis performed on a time period of 3.33 minutes with epoch investigation of 1 minute.

Table 1. Statistical investigation of difference in results before and after therapy. All the results evidence high significance.

Two-way ANOVA	**CH1-1 before Treatment 13.10.2014 VS CH1-1 after the Treatment 17.10.2014**			
Source of Variation	% of total variation	P value		
Interaction	0.47	1		
RQA	1.27	0.0002		
Epochs	0.45	1		
Source of Variation	P value summary	Significant?		
Interaction	ns	No		
RQA	***	**Yes**		
Epochs	ns	No		
Source of Variation	Df	Sum-of-squares	Mean square	F
Interaction	65	2206	33.93	0.07789
RQA	1	5962	5962	13.68
Epochs	65	2138	32.89	0.07549
Residual	1056	460,100	435.7	
Number of missing values	0			
Two-way ANOVA	**CH1-2 before Treatment 13.10.2014 VS CH1-2 after the Treatment 17.10.2014**			
Source of Variation	% of total variation	P value		
Interaction	0.19	1		
RQA	1.77	P < 0.0001		
Epochs	0.23	1		
Source of Variation	P value summary	Significant?		
Interaction	ns	No		
RQA	***	**Yes**		
Epochs	ns	No		
Source of Variation	Df	Sum-of-squares	Mean square	F
Interaction	65	884.8	13.61	0.03197
RQA	1	8146	8146	19.13
Epochs	65	1076	16.56	0.03889
Residual	1056	449,600	425.7	
Number of missing values	0			
Two-way ANOVA	**CH1-3 before Treatment 13.10.2014 VS CH1-3 after the Treatment 17.10.2014**			
Source of Variation	% of total variation	P value		
Interaction	0.34	1		
RQA	1.88	P < 0.0001		
Epochs	0.28	1		

Continued

Source of Variation	P value summary	Significant?		
Interaction	ns	No		
RQA	***	**Yes**		
Epochs	ns	No		
Source of Variation	Df	Sum-of-squares	Mean square	F
Interaction	65	1606	24.7	0.05617
RQA	1	8936	8936	20.32
Epochs	65	1330	20.46	0.04652
Residual	1056	464,400	439.8	
Number of missing values	0			
Two-way ANOVA	**CH2-1 before Treatment 13.10.2014 VS CH2-1 after the Treatment 17.10.2014**			
Source of Variation	% of total variation	P value		
Interaction	5.51	0.4194		
RQA	1.58	P < 0.0001		
Epochs	5.82	0.3047		
Source of Variation	P value summary	Significant?		
Interaction	ns	No		
RQA	***	**Yes**		
Epochs	ns	No		
Source of Variation	Df	Sum-of-squares	Mean square	F
Interaction	65	296,200	4557	1.027
RQA	1	84,720	84,720	19.1
Epochs	65	312,900	4814	1.085
Residual	1056	4,684,000	4436	
Number of missing values	0			
Two-way ANOVA	**CH2-2 before Treatment 13.10.2014 VS CH2-2 after the Treatment 17.10.2014**			
Source of Variation	% of total variation	P value		
Interaction	0.46	1		
RQA	1.75	P < 0.0001		
Epochs	0.5	1		
Source of Variation	P value summary	Significant?		
Interaction	ns	No		
RQA	***	**Yes**		
Epochs	ns	No		

Continued

Source of Variation	Df	Sum-of-squares	Mean square	F
Interaction	65	2370	36.47	0.07684
RQA	1	9027	9027	19.02
Epochs	65	2593	39.89	0.08405
Residual	1056	501,200	474.6	
Number of missing values	0			
Two-way ANOVA	**CH2-3 before Treatment 13.10.2014 VS CH2-3 after the Treatment 17.10.2014**			
Source of Variation	% of total variation	P value		
Interaction	0.42	1		
RQA	1.67	P < 0.0001		
Epochs	0.45	1		
Source of Variation	P value summary	Significant?		
Interaction	ns	No		
RQA	***	**Yes**		
Epochs	ns	No		
Source of Variation	Df	Sum-of-squares	Mean square	F
Interaction	65	2271	34.93	0.07058
RQA	1	8967	8967	18.12
Epochs	65	2432	37.42	0.07559
Residual	1056	522,700	494.9	
Number of missing values	0			

methodologies and nonlinear chaotic methods here including the RQA.

We have obtained results under different profiles.

First of all we have used all the procedures to test if sEMG signal is chaotic. Our result is that we have reached sufficient evidence that the sEMG signal contains a large chaotic component.

The following basic statements seem to be confirmed:

a) *Chaoticity increases at the beginning of the muscle task, as the result of further MUs recruitment, and then decreases in presence of fatigue phenomena and MUs synchronization.*

b) The use of the RQA method is essential in the sense that the %*DET and possibly* %*REC and* %*LAM are able to detect the presence of repetitive hidden patterns in sEMG which, in turn, senses the level of MU synchronization within the muscle.*

c) We have given detailed criteria to use nonlinear methodologies in sEMG analysis. The signal should be recorded at a frequency not lower than 960 Hz. Since the sEMG signal is affected from continuous transitions induced from its inner neuromuscular mechanisms and connecting directly chaotic dynamics, a correct investigation at physiology as well as clinic requires examining the recorded signal by epochs of 1 second in RQA and of 1 minute in estimation of the standard chaos indexes as estimation of the dimension of the attractor, D2, resulting fractal, largest Lyapunov exponent, and L-Z complexity.

Finally, we have obtained very encouraging results under the clinical profile. The NPT treatment, holding about chaotic mechanisms, gives a net improvement in muscular dystrophy.

To summarize we have to pose the following two basic questions.

What were the merits and demerits of this research using Chaos, Fractal and Recurrence Quantification

Analysis method for surface electromyography?

What significance did this study have in the treatment of muscular dystrophy?

Let us attempt to give a detailed answer. Surface electromyography has been considered for years an electrophysiological signal having noise as basic components. Also according to some previous results that have been recently obtained in literature and that we have properly quoted, this interpretation is not correct. This signal, due to extremely complex network of interacting components, is intrinsically nonlinear and generating a complex dynamics that is fundamentally chaotic, fractal and also noise corrupted. As a consequence, the analysis of the sEMG requires the detailed application of the basic methods of the nonlinear analysis and in particular of chaos and fractal analysis and of the Recurrence Quantification Analysis (RQA) that is a fundamental methodology since it enables us to look at the inner structure of the investigated signal and quantify with detailed variables. The first merit is thus to have studied in detail a case of muscular dystrophy and to have confirmed with unquestionable results that this is really the dynamics of this signal. The second merit is that, using chaos, fractal and RQA analysis, we have given new indexes that are of immediate clinical application. In each case we have given the standard values in the case of normal subjects and we have compared these results with the case of the investigated pathology. It is evident that we have now new indexes of evaluation which are so sensitive to be able to characterize in detail the severity of the pathological condition of the case of muscular dystrophy that we have in examination. The third merit is that we have also given the modality of investigation. We have created a standard protocol of examination of the data that clinicians have, starting with the present paper, to follow in detail. We have attempted to standardize the frequency of sEMG recording and the epochs or windows to fragment the recorded signal in order to apply the nonlinear, chaotic, fractal methods and RQA. We have reached this result after a long work of standardization of the procedure attempting different ways of fragmentation of the recorded signal. We retain that mixing the previous results obtained from other authors and previously quoted with our direct and meticulous analysis, we have today a standardized procedure that may properly represent an actual advance under the clinical profile. Now let us examine the demerits. To perform a chaos analysis and RQA of given electrophysiological signal, no more is a simple matter. As outlined in the course of the present paper, it requires appropriate competence and use of appropriate methods such as the fundamental requirement to use surrogate data. Performing a chaos and fractal and RQA analysis requires adequate competence. Of course, as verified in detail here with a direct case and thus at the experimental level, the use of nonlinear methodologies is absolutely necessary. Therefore, there is software of analysis of sEMG in progress that as soon as possible we will realize and we will publish a subsequent article to illustrate it and give the opportunity to clinicians to use it. To finish there is the most important observation to be still added. The verification that sEMG contains a basic chaotic component is of enormous importance and we think that all the authors that have contributed, in addition to us, to such validation, deserve great consideration. The reason is that verifying the presence of chaos we understand that muscle dynamics is subject to continuous chaos-chaos transitions that obviously result to be so different in normal case respect to one of muscular dystrophy. The reason of the treatments in muscular dystrophy must reside in the possibility to rearrange the altered system about the normal possibilities of chaos-chaos transitions, self-organization and self-arrangement which is the peculiar feature of systems of high complexity subjected to a chaotic dynamics. The NTP treatment illustrated in [9] [12] [13] is resulting highly promising.

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Appendix

Ch1 at rest before the treatment.

Epoch	MedianF	MeanF	PeakF	MeanP	TotalP
1	334.887081	289.537789	6.97681419	2.5904E−06	0.00033416
2	303.491417	275.584161	6.97681419	2.4806E−06	0.00031999
3	338.375488	289.537789	383.724781	2.5441E−06	0.00032819
4	348.84071	293.026196	439.539294	2.2949E−06	0.00029604
5	310.468232	272.095753	10.4652213	2.5319E−06	0.00032661
6	334.887081	289.537789	6.97681419	2.4246E−06	0.00031278
7	320.933453	286.049382	6.97681419	2.5212E−06	0.00032523
8	341.863895	275.584161	429.074073	2.6546E−06	0.00034245
9	331.398674	289.537789	10.4652213	3.2724E−06	0.00042214
10	324.42186	282.560975	6.97681419	2.7374E−06	0.00035313
11	341.863895	289.537789	390.701595	2.3478E−06	0.00030286
12	320.933453	282.560975	6.97681419	2.8049E−06	0.00036183
13	324.42186	282.560975	6.97681419	2.4133E−06	0.00031132
14	327.910267	286.049382	6.97681419	2.4319E−06	0.00031372
15	310.468232	286.049382	6.97681419	2.8853E−06	0.0003722
16	97.6753987	233.723275	41.8608852	4.953E−06	0.00063894
17	55.8145135	97.6753987	59.3029206	1.5174E−05	0.00195746
18	73.256549	258.142125	6.97681419	5.6402E−06	0.00072759
19	303.491417	265.118939	6.97681419	2.3285E−06	0.00030038
20	209.304426	244.188497	48.8376993	3.9448E−06	0.00050888
21	62.7913277	115.117434	31.3956639	1.9434E−05	0.00250695
22	59.3029206	146.513098	6.97681419	7.7758E−06	0.00100308
23	233.723275	247.676904	10.4652213	4.0214E−06	0.00051877
24	254.653718	251.165311	41.8608852	3.1208E−06	0.00040258
25	125.582655	233.723275	55.8145135	4.313E−06	0.00055638
26	94.1869916	184.885576	45.3492922	5.3705E−06	0.00069279
27	118.605841	219.769647	66.2797348	4.4234E−06	0.00057062
28	261.630532	251.165311	59.3029206	3.9122E−06	0.00050468
29	261.630532	258.142125	10.4652213	3.768E−06	0.00048607
30	223.258054	251.165311	6.97681419	3.1874E−06	0.00041117
31	230.234868	258.142125	6.97681419	3.2137E−06	0.00041457
32	282.560975	261.630532	52.3261064	3.2064E−06	0.00041362
33	160.466726	230.234868	55.8145135	3.5264E−06	0.00045491
34	265.118939	268.607346	6.97681419	3.7417E−06	0.00048267

Continued

35	223.258054	247.676904	10.4652213	3.3137E−06	0.00042747
36	300.00301	268.607346	432.56248	3.462E−06	0.0004466
37	275.584161	261.630532	13.9536284	3.0967E−06	0.00039948
38	240.70009	251.165311	41.8608852	2.8826E−06	0.00037186
39	275.584161	268.607346	6.97681419	3.1349E−06	0.0004044
40	230.234868	247.676904	17.4420355	3.4537E−06	0.00044553
41	216.28124	237.211683	17.4420355	4.0841E−06	0.00052685
42	212.792833	254.653718	6.97681419	4.3752E−06	0.0005644
43	230.234868	251.165311	52.3261064	3.6405E−06	0.00046962
44	279.072568	261.630532	38.3724781	3.2773E−06	0.00042277
45	286.049382	272.095753	6.97681419	3.7614E−06	0.00048522
46	261.630532	258.142125	6.97681419	3.8259E−06	0.00049354
47	226.746461	251.165311	13.9536284	3.7744E−06	0.0004869
48	268.607346	265.118939	55.8145135	3.543E−06	0.00045705
49	251.165311	265.118939	6.97681419	3.3808E−06	0.00043612
50	261.630532	258.142125	17.4420355	3.5827E−06	0.00046216
51	279.072568	265.118939	45.3492922	3.4421E−06	0.00044404
52	296.514603	275.584161	380.236373	3.3128E−06	0.00042735
53	240.70009	254.653718	6.97681419	3.8706E−06	0.00049931
54	272.095753	258.142125	59.3029206	3.9635E−06	0.00051129
55	244.188497	247.676904	6.97681419	4.0403E−06	0.0005212
56	198.839204	251.165311	41.8608852	4.0834E−06	0.00052676
57	205.816019	251.165311	41.8608852	4.1876E−06	0.0005402
58	132.55947	240.70009	59.3029206	3.9716E−06	0.00051234
59	177.908762	230.234868	59.3029206	4.6578E−06	0.00060085
60	244.188497	254.653718	6.97681419	3.727E−06	0.00048078
61	254.653718	254.653718	27.9072568	4.1824E−06	0.00053953
62	219.769647	251.165311	52.3261064	3.6122E−06	0.00046598
63	216.28124	251.165311	13.9536284	3.7742E−06	0.00048687
64	230.234868	258.142125	17.4420355	4.5741E−06	0.00059006
65	247.676904	254.653718	38.3724781	4.0695E−06	0.00052497
66	237.211683	258.142125	13.9536284	3.3682E−06	0.00043449
67	209.304426	258.142125	66.2797348	3.7076E−06	0.00047828
68	230.234868	254.653718	59.3029206	4.2102E−06	0.00054312
69	247.676904	258.142125	10.4652213	4.0383E−06	0.00052094
70	132.55947	237.211683	10.4652213	4.0415E−06	0.00052136

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71	251.165311	254.653718	10.4652213	3.3867E−06	0.00043688
72	212.792833	261.630532	13.9536284	3.6472E−06	0.00047048
73	226.746461	247.676904	13.9536284	3.4223E−06	0.00044147
74	223.258054	254.653718	45.3492922	3.7409E−06	0.00048257
75	223.258054	258.142125	10.4652213	3.8909E−06	0.00050192
76	216.28124	261.630532	6.97681419	3.8873E−06	0.00050147
77	237.211683	258.142125	6.97681419	3.2028E−06	0.00041317
78	279.072568	272.095753	6.97681419	3.2485E−06	0.00041906
79	230.234868	258.142125	55.8145135	3.705E−06	0.00047795
80	216.28124	247.676904	10.4652213	3.595E−06	0.00046376
81	293.026196	275.584161	6.97681419	3.6711E−06	0.00047358
82	226.746461	258.142125	13.9536284	3.2214E−06	0.00041556
83	205.816019	240.70009	41.8608852	3.6826E−06	0.00047506
84	244.188497	251.165311	48.8376993	3.8142E−06	0.00049203
85	240.70009	251.165311	66.2797348	3.821E−06	0.00049291
86	198.839204	240.70009	45.3492922	3.7046E−06	0.0004779
87	209.304426	251.165311	6.97681419	3.7922E−06	0.0004892
88	209.304426	247.676904	13.9536284	3.7119E−06	0.00047883
89	108.14062	240.70009	13.9536284	4.0261E−06	0.00051937
90	254.653718	258.142125	52.3261064	4.1528E−06	0.00053571
91	104.652213	230.234868	13.9536284	3.7842E−06	0.00048816
92	230.234868	251.165311	45.3492922	3.7908E−06	0.00048901
93	170.931948	244.188497	6.97681419	3.6241E−06	0.00046751
94	261.630532	258.142125	13.9536284	3.4917E−06	0.00045043
95	230.234868	247.676904	13.9536284	3.8219E−06	0.00049303
96	167.443541	251.165311	38.3724781	4.1546E−06	0.00053594
97	254.653718	258.142125	48.8376993	3.5477E−06	0.00045765
98	251.165311	261.630532	66.2797348	3.5231E−06	0.00045448
99	209.304426	258.142125	10.4652213	3.68E−06	0.00047472
100	219.769647	254.653718	13.9536284	3.2413E−06	0.00041812
101	181.397169	244.188497	13.9536284	3.9054E−06	0.00050379
102	87.2101774	219.769647	55.8145135	4.621E−06	0.00059611
103	170.931948	237.211683	48.8376993	3.784E−06	0.00048813
104	265.118939	268.607346	10.4652213	4.2721E−06	0.0005511
105	265.118939	261.630532	6.97681419	4.0016E−06	0.0005162
106	261.630532	261.630532	10.4652213	3.909E−06	0.00050426

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107	247.676904	251.165311	13.9536284	4.0564E−06	0.00052328
108	244.188497	254.653718	17.4420355	4.3872E−06	0.00056594
109	104.652213	237.211683	17.4420355	4.1632E−06	0.00053705
110	198.839204	244.188497	6.97681419	3.6712E−06	0.00047358
111	279.072568	268.607346	6.97681419	3.5334E−06	0.00045581
112	247.676904	254.653718	41.8608852	3.5109E−06	0.00045291
113	272.095753	268.607346	6.97681419	3.548E−06	0.00045769
114	251.165311	258.142125	6.97681419	3.8504E−06	0.0004967
115	237.211683	251.165311	52.3261064	3.8812E−06	0.00050067
116	279.072568	258.142125	6.97681419	3.4261E−06	0.00044196
117	247.676904	258.142125	41.8608852	3.8321E−06	0.00049434
118	282.560975	258.142125	443.027701	3.8793E−06	0.00050043
119	251.165311	251.165311	45.3492922	3.5018E−06	0.00045173
120	237.211683	254.653718	10.4652213	3.8613E−06	0.00049811
121	216.28124	251.165311	45.3492922	3.7662E−06	0.00048584
122	258.142125	254.653718	55.8145135	3.4682E−06	0.0004474
123	122.094248	237.211683	55.8145135	3.303E−06	0.00042608
124	202.327612	254.653718	10.4652213	3.8057E−06	0.00049093
125	226.746461	254.653718	6.97681419	3.5662E−06	0.00046004
126	122.094248	230.234868	6.97681419	3.1721E−06	0.0004092
127	139.536284	233.723275	55.8145135	3.9483E−06	0.00050933
128	240.70009	258.142125	17.4420355	4.1277E−06	0.00053248
129	244.188497	254.653718	17.4420355	4.0927E−06	0.00052796
130	233.723275	247.676904	45.3492922	3.7908E−06	0.00048901
131	177.908762	237.211683	48.8376993	3.3341E−06	0.0004301
132	268.607346	268.607346	10.4652213	3.9781E−06	0.00051317
133	230.234868	258.142125	10.4652213	3.4789E−06	0.00044878
134	223.258054	251.165311	10.4652213	3.518E−06	0.00045383
135	247.676904	258.142125	13.9536284	3.8981E−06	0.00050285
136	184.885576	247.676904	34.884071	4.255E−06	0.00054889
137	198.839204	251.165311	52.3261064	3.5198E−06	0.00045406
138	219.769647	244.188497	55.8145135	4.0885E−06	0.00052742
139	184.885576	251.165311	45.3492922	4.1534E−06	0.00053579
140	247.676904	258.142125	10.4652213	3.8602E−06	0.00049797
141	226.746461	258.142125	13.9536284	4.1279E−06	0.0005325
142	212.792833	261.630532	13.9536284	3.844E−06	0.00049588

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143	230.234868	258.142125	13.9536284	4.0578E−06	0.00052346
144	143.024691	237.211683	48.8376993	4.3189E−06	0.00055713
145	188.373983	247.676904	38.3724781	3.5904E−06	0.00046316
146	146.513098	244.188497	13.9536284	4.1369E−06	0.00053366
147	251.165311	265.118939	17.4420355	4.4089E−06	0.00056875
148	160.466726	237.211683	31.3956639	4.2528E−06	0.00054861
149	153.489912	247.676904	48.8376993	4.3292E−06	0.00055847
150	132.55947	240.70009	6.97681419	3.623E−06	0.00046737
151	237.211683	265.118939	38.3724781	3.9121E−06	0.00050466
152	83.7217703	216.28124	48.8376993	4.2261E−06	0.00054516
153	188.373983	251.165311	52.3261064	4.6225E−06	0.0005963
154	111.629027	233.723275	48.8376993	4.0117E−06	0.00051751
155	219.769647	244.188497	45.3492922	4.0717E−06	0.00052526
156	244.188497	254.653718	13.9536284	3.3036E−06	0.00042617
157	216.28124	261.630532	41.8608852	3.8059E−06	0.00049096
158	163.955134	237.211683	10.4652213	3.8074E−06	0.00049115
159	191.86239	251.165311	13.9536284	3.8353E−06	0.00049475
160	230.234868	251.165311	10.4652213	3.5171E−06	0.0004537
161	174.420355	233.723275	13.9536284	4.1563E−06	0.00053616
162	202.327612	244.188497	13.9536284	3.6024E−06	0.00046471
163	136.047877	233.723275	13.9536284	3.6078E−06	0.00046541
164	181.397169	240.70009	38.3724781	4.0705E−06	0.0005251
165	251.165311	258.142125	45.3492922	3.1021E−06	0.00040017
166	216.28124	258.142125	48.8376993	3.7131E−06	0.00047899
167	94.1869916	202.327612	66.2797348	4.4282E−06	0.00057124
168	125.582655	233.723275	10.4652213	3.8524E−06	0.00049695
169	108.14062	240.70009	13.9536284	4.0688E−06	0.00052487
170	184.885576	261.630532	13.9536284	3.9563E−06	0.00051036
171	191.86239	254.653718	27.9072568	4.1538E−06	0.00053585
172	205.816019	254.653718	13.9536284	4.2822E−06	0.00055241
173	233.723275	268.607346	17.4420355	4.0768E−06	0.0005259
174	233.723275	258.142125	6.97681419	4.0275E−06	0.00051954
175	174.420355	233.723275	6.97681419	3.7164E−06	0.00047941
176	160.466726	240.70009	27.9072568	3.6924E−06	0.00047632
177	101.163806	233.723275	48.8376993	3.8003E−06	0.00049024
178	268.607346	265.118939	48.8376993	3.1981E−06	0.00041255

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179	163.955134	251.165311	13.9536284	3.9781E−06	0.00051318
180	191.86239	254.653718	13.9536284	3.8343E−06	0.00049462
181	181.397169	237.211683	45.3492922	5.028E−06	0.00064861
182	94.1869916	223.258054	10.4652213	4.5204E−06	0.00058313
183	139.536284	244.188497	397.678409	4.4088E−06	0.00056874
184	146.513098	247.676904	13.9536284	4.4029E−06	0.00056797
185	170.931948	247.676904	24.4188497	4.8495E−06	0.00062559
186	174.420355	258.142125	10.4652213	4.4915E−06	0.00057941
187	230.234868	254.653718	48.8376993	3.3454E−06	0.00043156
188	108.14062	233.723275	17.4420355	3.9115E−06	0.00050459
189	97.6753987	247.676904	13.9536284	4.1803E−06	0.00053926
190	101.163806	237.211683	55.8145135	4.64E−06	0.00059855
191	90.6985845	205.816019	13.9536284	4.0168E−06	0.00051817

Ch1 after the treatment.

Epoch	MedianF	MeanF	PeakF	MeanP	TotalP
1	24.4188497	258.142125	10.4652213	4.6301E−06	0.00059729
2	76.7449561	275.584161	13.9536284	4.9372E−06	0.00063689
3	24.4188497	272.095753	13.9536284	4.3736E−06	0.0005642
4	20.9304426	275.584161	10.4652213	5.3493E−06	0.00069006
5	17.4420355	268.607346	10.4652213	4.7662E−06	0.00061484
6	268.607346	275.584161	13.9536284	3.5869E−06	0.00046271
7	24.4188497	265.118939	17.4420355	5.0231E−06	0.00064798
8	41.8608852	261.630532	6.97681419	4.562E−06	0.0005885
9	17.4420355	258.142125	10.4652213	6.3032E−06	0.00081312
10	80.2333632	247.676904	17.4420355	4.7496E−06	0.0006127
11	13.9536284	237.211683	10.4652213	8.6293E−06	0.00111319
12	209.304426	265.118939	17.4420355	3.1248E−06	0.0004031
13	24.4188497	279.072568	13.9536284	4.1591E−06	0.00053652
14	20.9304426	272.095753	13.9536284	4.9316E−06	0.00063618
15	41.8608852	275.584161	10.4652213	5.5315E−06	0.00071356
16	17.4420355	268.607346	10.4652213	5.6965E−06	0.00073485
17	20.9304426	268.607346	10.4652213	4.0617E−06	0.00052395
18	20.9304426	268.607346	10.4652213	5.3064E−06	0.00068452

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19	230.234868	275.584161	13.9536284	4.1835E−06	0.00053967
20	251.165311	286.049382	10.4652213	3.132E−06	0.00040403
21	17.4420355	261.630532	13.9536284	5.5401E−06	0.00071468
22	226.746461	282.560975	13.9536284	3.609E−06	0.00046557
23	17.4420355	268.607346	10.4652213	5.6466E−06	0.00072841
24	258.142125	282.560975	13.9536284	4.1227E−06	0.00053183
25	268.607346	282.560975	10.4652213	3.664E−06	0.00047265
26	20.9304426	265.118939	10.4652213	4.3772E−06	0.00056466
27	20.9304426	258.142125	10.4652213	4.429E−06	0.00057134
28	34.884071	275.584161	10.4652213	4.3051E−06	0.00055536
29	223.258054	286.049382	13.9536284	3.5742E−06	0.00046107
30	17.4420355	268.607346	10.4652213	5.7124E−06	0.0007369
31	62.7913277	268.607346	13.9536284	4.5667E−06	0.0005891
32	17.4420355	268.607346	13.9536284	5.525E−06	0.00071272
33	170.931948	275.584161	13.9536284	3.9438E−06	0.00050875
34	17.4420355	254.653718	10.4652213	6.8815E−06	0.00088771
35	219.769647	279.072568	10.4652213	4.2662E−06	0.00055034
36	55.8145135	279.072568	17.4420355	4.0561E−06	0.00052324
37	20.9304426	258.142125	10.4652213	4.1566E−06	0.0005362
38	48.8376993	279.072568	10.4652213	4.0383E−06	0.00052094
39	20.9304426	265.118939	13.9536284	4.0766E−06	0.00052588
40	237.211683	275.584161	10.4652213	3.9632E−06	0.00051125
41	17.4420355	254.653718	13.9536284	7.8784E−06	0.00101631
42	24.4188497	265.118939	10.4652213	4.8105E−06	0.00062056
43	17.4420355	261.630532	10.4652213	6.0155E−06	0.000776
44	20.9304426	261.630532	10.4652213	4.6889E−06	0.00060486
45	17.4420355	247.676904	10.4652213	6.2947E−06	0.00081201
46	76.7449561	272.095753	10.4652213	4.1038E−06	0.00052939
47	17.4420355	254.653718	13.9536284	5.9552E−06	0.00076822
48	261.630532	279.072568	13.9536284	4.063E−06	0.00052413
49	20.9304426	268.607346	13.9536284	5.2515E−06	0.00067744
50	66.2797348	272.095753	13.9536284	3.6839E−06	0.00047522
51	20.9304426	268.607346	6.97681419	5.0043E−06	0.00064556
52	76.7449561	265.118939	10.4652213	4.634E−06	0.00059779
53	17.4420355	261.630532	10.4652213	6.0891E−06	0.0007855
54	160.466726	265.118939	6.97681419	4.0904E−06	0.00052766

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55	20.9304426	258.142125	13.9536284	5.4676E−06	0.00070533
56	163.955134	265.118939	10.4652213	3.8258E−06	0.00049353
57	24.4188497	261.630532	17.4420355	4.358E−06	0.00056219
58	156.978319	272.095753	17.4420355	3.6937E−06	0.00047648
59	160.466726	279.072568	13.9536284	4.4968E−06	0.00058009
60	20.9304426	275.584161	10.4652213	4.561E−06	0.00058837
61	17.4420355	272.095753	13.9536284	5.3561E−06	0.00069094
62	20.9304426	272.095753	10.4652213	4.5856E−06	0.00059155
63	20.9304426	258.142125	10.4652213	4.213E−06	0.00054348
64	94.1869916	282.560975	17.4420355	3.5766E−06	0.00046138
65	20.9304426	268.607346	13.9536284	5.5436E−06	0.00071512
66	20.9304426	272.095753	10.4652213	5.1901E−06	0.00066952
67	17.4420355	265.118939	10.4652213	6.3477E−06	0.00081885
68	226.746461	268.607346	10.4652213	3.9033E−06	0.00050353
69	13.9536284	251.165311	10.4652213	6.7746E−06	0.00087392
70	17.4420355	258.142125	10.4652213	4.856E−06	0.00062642
71	17.4420355	258.142125	10.4652213	7.1663E−06	0.00092446
72	17.4420355	272.095753	10.4652213	4.8835E−06	0.00062997
73	17.4420355	268.607346	10.4652213	5.7733E−06	0.00074475
74	48.8376993	275.584161	10.4652213	3.7997E−06	0.00049016
75	20.9304426	261.630532	13.9536284	5.4556E−06	0.00070377
76	240.70009	279.072568	13.9536284	4.1303E−06	0.00053281
77	20.9304426	258.142125	13.9536284	5.6616E−06	0.00073035
78	219.769647	279.072568	6.97681419	4.2442E−06	0.0005475
79	17.4420355	258.142125	10.4652213	6.8705E−06	0.0008863
80	17.4420355	272.095753	10.4652213	5.5736E−06	0.00071899
81	17.4420355	258.142125	10.4652213	5.8432E−06	0.00075378
82	181.397169	275.584161	10.4652213	4.0109E−06	0.00051741
83	24.4188497	254.653718	17.4420355	5.7262E−06	0.00073868
84	195.350797	268.607346	13.9536284	3.136E−06	0.00040454
85	20.9304426	272.095753	13.9536284	5.1085E−06	0.000659
86	261.630532	279.072568	13.9536284	3.1922E−06	0.00041179
87	17.4420355	261.630532	10.4652213	6.5665E−06	0.00084708
88	20.9304426	268.607346	10.4652213	3.7083E−06	0.00047838
89	24.4188497	272.095753	13.9536284	4.3285E−06	0.00055837
90	212.792833	261.630532	13.9536284	3.947E−06	0.00050916

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91	27.9072568	272.095753	13.9536284	4.7035E−06	0.00060676
92	52.3261064	279.072568	10.4652213	4.2834E−06	0.00055257
93	17.4420355	261.630532	10.4652213	5.9883E−06	0.0007725
94	24.4188497	265.118939	13.9536284	4.818E−06	0.00062153
95	13.9536284	254.653718	10.4652213	7.7179E−06	0.00099561
96	34.884071	265.118939	10.4652213	4.2329E−06	0.00054604
97	17.4420355	258.142125	10.4652213	5.5808E−06	0.00071992
98	212.792833	272.095753	13.9536284	3.544E−06	0.00045718
99	27.9072568	272.095753	17.4420355	5.1883E−06	0.00066929
100	219.769647	279.072568	10.4652213	4.2326E−06	0.00054601
101	17.4420355	254.653718	10.4652213	6.6096E−06	0.00085264
102	275.584161	279.072568	13.9536284	3.5159E−06	0.00045355
103	17.4420355	265.118939	10.4652213	4.3497E−06	0.00056111
104	17.4420355	272.095753	10.4652213	5.1215E−06	0.00066068
105	233.723275	275.584161	6.97681419	3.3421E−06	0.00043113
106	34.884071	275.584161	17.4420355	4.8997E−06	0.00063207
107	188.373983	265.118939	13.9536284	3.3539E−06	0.00043266
108	20.9304426	258.142125	13.9536284	4.99E−06	0.00064371
109	27.9072568	265.118939	10.4652213	4.2545E−06	0.00054883
110	17.4420355	268.607346	10.4652213	6.1333E−06	0.00079119
111	17.4420355	272.095753	10.4652213	4.639E−06	0.00059843
112	20.9304426	268.607346	10.4652213	5.7002E−06	0.00073533
113	230.234868	282.560975	17.4420355	4.3727E−06	0.00056407
114	34.884071	272.095753	17.4420355	4.0156E−06	0.00051801
115	212.792833	275.584161	13.9536284	3.5813E−06	0.00046199
116	24.4188497	275.584161	17.4420355	4.6456E−06	0.00059928
117	216.28124	272.095753	13.9536284	4.1634E−06	0.00053707
118	20.9304426	261.630532	10.4652213	6.2428E−06	0.00080532
119	48.8376993	272.095753	10.4652213	4.0479E−06	0.00052218
120	17.4420355	258.142125	10.4652213	7.0015E−06	0.0009032
121	31.3956639	268.607346	10.4652213	4.4191E−06	0.00057006
122	31.3956639	279.072568	17.4420355	5.1059E−06	0.00065866
123	83.7217703	275.584161	13.9536284	4.1372E−06	0.0005337
124	17.4420355	258.142125	10.4652213	6.0415E−06	0.00077935
125	20.9304426	265.118939	13.9536284	5.618E−06	0.00072472
126	17.4420355	254.653718	10.4652213	5.8127E−06	0.00074984

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127	20.9304426	268.607346	10.4652213	4.0071E−06	0.00051692
128	17.4420355	272.095753	10.4652213	5.8913E−06	0.00075998
129	115.117434	275.584161	10.4652213	4.0196E−06	0.00051853
130	17.4420355	254.653718	10.4652213	5.9571E−06	0.00076846
131	188.373983	268.607346	10.4652213	3.4081E−06	0.00043965
132	17.4420355	265.118939	13.9536284	5.1551E−06	0.000665
133	202.327612	258.142125	17.4420355	3.2815E−06	0.00042332
134	20.9304426	275.584161	10.4652213	4.7597E−06	0.00061401
135	17.4420355	275.584161	10.4652213	5.0743E−06	0.00065458
136	20.9304426	272.095753	10.4652213	4.5082E−06	0.00058156
137	31.3956639	279.072568	13.9536284	4.4673E−06	0.00057628
138	174.420355	282.560975	13.9536284	3.6437E−06	0.00047004
139	17.4420355	265.118939	10.4652213	5.5536E−06	0.00071641
140	20.9304426	279.072568	10.4652213	4.7343E−06	0.00061072
141	13.9536284	251.165311	13.9536284	7.555E−06	0.00097459
142	24.4188497	275.584161	10.4652213	4.2913E−06	0.00055358
143	20.9304426	272.095753	13.9536284	4.8118E−06	0.00062073
144	146.513098	272.095753	17.4420355	3.8916E−06	0.00050201
145	20.9304426	272.095753	10.4652213	6.1733E−06	0.00079635
146	20.9304426	279.072568	10.4652213	4.786E−06	0.00061739
147	13.9536284	244.188497	10.4652213	7.3723E−06	0.00095103
148	31.3956639	279.072568	10.4652213	3.7044E−06	0.00047787
149	17.4420355	268.607346	13.9536284	5.323E−06	0.00068667
150	184.885576	265.118939	17.4420355	3.8316E−06	0.00049428
151	24.4188497	279.072568	10.4652213	4.4633E−06	0.00057577
152	17.4420355	265.118939	10.4652213	4.5631E−06	0.00058863
153	17.4420355	272.095753	10.4652213	4.7509E−06	0.00061287
154	27.9072568	275.584161	10.4652213	4.6054E−06	0.0005941
155	205.816019	272.095753	13.9536284	3.9838E−06	0.00051391
156	17.4420355	261.630532	10.4652213	5.449E−06	0.00070292
157	17.4420355	261.630532	10.4652213	4.7522E−06	0.00061304
158	17.4420355	265.118939	13.9536284	5.7174E−06	0.00073755
159	233.723275	268.607346	17.4420355	3.6848E−06	0.00047533
160	17.4420355	268.607346	10.4652213	6.0212E−06	0.00077674
161	20.9304426	265.118939	10.4652213	5.8464E−06	0.00075419
162	17.4420355	258.142125	10.4652213	6.293E−06	0.0008118

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163	216.28124	272.095753	13.9536284	3.6238E−06	0.00046746
164	38.3724781	279.072568	13.9536284	4.5415E−06	0.00058586
165	125.582655	282.560975	10.4652213	3.7838E−06	0.00048811
166	17.4420355	244.188497	10.4652213	5.3972E−06	0.00069624
167	191.86239	268.607346	13.9536284	3.4633E−06	0.00044677
168	17.4420355	268.607346	13.9536284	5.8307E−06	0.00075216
169	233.723275	282.560975	10.4652213	3.9545E−06	0.00051013
170	20.9304426	258.142125	10.4652213	4.2637E−06	0.00055001
171	17.4420355	268.607346	10.4652213	5.3584E−06	0.00069123
172	31.3956639	282.560975	10.4652213	5.1227E−06	0.00066082
173	17.4420355	265.118939	10.4652213	6.8953E−06	0.00088949
174	27.9072568	275.584161	10.4652213	4.4465E−06	0.00057359
175	17.4420355	254.653718	10.4652213	5.4027E−06	0.00069695
176	237.211683	272.095753	17.4420355	3.5709E−06	0.00046065
177	17.4420355	275.584161	6.97681419	5.3261E−06	0.00068706
178	20.9304426	254.653718	10.4652213	5.1119E−06	0.00065943
179	125.582655	279.072568	13.9536284	4.2466E−06	0.00054782
180	17.4420355	254.653718	10.4652213	7.0185E−06	0.00090539
181	247.676904	282.560975	13.9536284	3.9775E−06	0.0005131
182	20.9304426	268.607346	13.9536284	5.1751E−06	0.00066759
183	80.2333632	275.584161	10.4652213	3.8855E−06	0.00050123
184	17.4420355	261.630532	10.4652213	7.4307E−06	0.00095856
185	20.9304426	279.072568	10.4652213	4.2731E−06	0.00055123
186	17.4420355	254.653718	10.4652213	7.0857E−06	0.00091406
187	80.2333632	261.630532	10.4652213	4.7152E−06	0.00060826
188	17.4420355	254.653718	13.9536284	4.6459E−06	0.00059932
189	188.373983	282.560975	13.9536284	4.1528E−06	0.00053571
190	27.9072568	268.607346	10.4652213	4.8055E−06	0.00061991
191	20.9304426	265.118939	10.4652213	5.2277E−06	0.00067437
192	41.8608852	268.607346	10.4652213	3.7301E−06	0.00048118
193	205.816019	286.049382	10.4652213	4.095E−06	0.00052826
194	20.9304426	258.142125	10.4652213	4.0714E−06	0.00052522
195	34.884071	275.584161	10.4652213	5.1097E−06	0.00065915
196	20.9304426	272.095753	10.4652213	5.5678E−06	0.00071825
197	17.4420355	258.142125	10.4652213	5.2845E−06	0.00068171
198	20.9304426	272.095753	10.4652213	5.5463E−06	0.00071547

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199	20.9304426	261.630532	10.4652213	4.7999E−06	0.00061919
200	146.513098	275.584161	13.9536284	3.492E−06	0.00045047
201	62.7913277	272.095753	13.9536284	4.3602E−06	0.00056247
202	184.885576	272.095753	6.97681419	3.6781E−06	0.00047448
203	27.9072568	268.607346	10.4652213	4.7375E−06	0.00061114
204	20.9304426	265.118939	13.9536284	4.3894E−06	0.00056624
205	20.9304426	272.095753	10.4652213	5.4197E−06	0.00069914
206	13.9536284	244.188497	10.4652213	5.3998E−06	0.00069657
207	17.4420355	272.095753	10.4652213	5.1675E−06	0.00066661
208	20.9304426	279.072568	10.4652213	5.1129E−06	0.00065957
209	38.3724781	272.095753	10.4652213	4.9122E−06	0.00063367
210	97.6753987	279.072568	10.4652213	4.8962E−06	0.00063161
211	20.9304426	272.095753	6.97681419	4.3139E−06	0.00055649
212	20.9304426	261.630532	10.4652213	4.9007E−06	0.00063219
213	226.746461	275.584161	6.97681419	4.2336E−06	0.00054614
214	17.4420355	265.118939	10.4652213	4.9386E−06	0.00063707
215	17.4420355	265.118939	10.4652213	5.4337E−06	0.00070095
216	209.304426	272.095753	17.4420355	3.4271E−06	0.0004421
217	13.9536284	209.304426	10.4652213	8.4448E−06	0.00108938
218	24.4188497	254.653718	6.97681419	4.8423E−06	0.00062465
219	17.4420355	244.188497	13.9536284	5.1669E−06	0.00066653
220	212.792833	275.584161	10.4652213	4.6713E−06	0.0006026
221	202.327612	279.072568	10.4652213	4.9025E−06	0.00063242
222	20.9304426	261.630532	13.9536284	5.3093E−06	0.0006849
223	20.9304426	272.095753	10.4652213	4.4505E−06	0.00057411
224	13.9536284	254.653718	10.4652213	7.5727E−06	0.00097688
225	31.3956639	272.095753	10.4652213	4.654E−06	0.00060037
226	17.4420355	272.095753	13.9536284	5.705E−06	0.00073594
227	17.4420355	272.095753	6.97681419	5.8789E−06	0.00075838
228	216.28124	268.607346	13.9536284	3.205E−06	0.00041344
229	20.9304426	275.584161	10.4652213	5.9189E−06	0.00076354
230	27.9072568	272.095753	10.4652213	3.3654E−06	0.00043413
231	20.9304426	275.584161	10.4652213	4.5974E−06	0.00059306
232	17.4420355	268.607346	13.9536284	5.88E−06	0.00075853
233	20.9304426	261.630532	10.4652213	4.4891E−06	0.00057909
234	20.9304426	282.560975	10.4652213	4.5237E−06	0.00058355

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235	258.142125	289.537789	13.9536284	4.4697E−06	0.0005766
236	219.769647	275.584161	17.4420355	3.9836E−06	0.00051388
237	24.4188497	272.095753	10.4652213	4.6353E−06	0.00059795
238	17.4420355	254.653718	10.4652213	4.9055E−06	0.00063281
239	219.769647	286.049382	17.4420355	4.1625E−06	0.00053697
240	20.9304426	261.630532	10.4652213	5.8688E−06	0.00075708
241	27.9072568	272.095753	10.4652213	4.4168E−06	0.00056976
242	20.9304426	261.630532	13.9536284	4.6686E−06	0.00060225
243	20.9304426	272.095753	10.4652213	5.4009E−06	0.00069671
244	17.4420355	261.630532	13.9536284	5.0325E−06	0.00064919
245	24.4188497	272.095753	6.97681419	3.9161E−06	0.00050518
246	254.653718	289.537789	17.4420355	4.0929E−06	0.00052799
247	20.9304426	265.118939	13.9536284	6.2748E−06	0.00080945
248	38.3724781	275.584161	10.4652213	3.7946E−06	0.00048951
249	17.4420355	254.653718	13.9536284	5.4617E−06	0.00070456
250	20.9304426	268.607346	10.4652213	4.5599E−06	0.00058823
251	17.4420355	254.653718	13.9536284	5.2325E−06	0.000675
252	219.769647	275.584161	17.4420355	3.8213E−06	0.00049295
253	167.443541	272.095753	13.9536284	5.1744E−06	0.00066749
254	202.327612	268.607346	17.4420355	3.6434E−06	0.00047
255	27.9072568	279.072568	13.9536284	4.1998E−06	0.00054177
256	188.373983	286.049382	6.97681419	4.5037E−06	0.00058098
257	20.9304426	279.072568	10.4652213	5.031E−06	0.00064899
258	20.9304426	268.607346	10.4652213	4.6666E−06	0.00060199
259	163.955134	282.560975	13.9536284	3.636E−06	0.00046904
260	38.3724781	268.607346	17.4420355	4.7272E−06	0.00060981
261	216.28124	265.118939	13.9536284	3.5833E−06	0.00046224
262	17.4420355	261.630532	13.9536284	5.8821E−06	0.00075879
263	17.4420355	272.095753	10.4652213	4.1271E−06	0.00053239
264	13.9536284	258.142125	10.4652213	7.4702E−06	0.00096365
265	17.4420355	268.607346	10.4652213	5.126E−06	0.00066125
266	20.9304426	258.142125	10.4652213	5.2151E−06	0.00067275
267	244.188497	289.537789	17.4420355	3.7221E−06	0.00048015
268	20.9304426	261.630532	10.4652213	6.6241E−06	0.00085451
269	24.4188497	268.607346	10.4652213	4.8975E−06	0.00063177
270	17.4420355	258.142125	10.4652213	6.0121E−06	0.00077555

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271	48.8376993	272.095753	17.4420355	3.8063E−06	0.00049101
272	27.9072568	279.072568	13.9536284	4.5232E−06	0.00058349
273	27.9072568	272.095753	10.4652213	4.3732E−06	0.00056414
274	17.4420355	268.607346	10.4652213	5.6017E−06	0.00072261
275	17.4420355	261.630532	10.4652213	5.6205E−06	0.00072504
276	275.584161	279.072568	13.9536284	3.7908E−06	0.00048901
277	24.4188497	275.584161	17.4420355	5.5873E−06	0.00072076
278	20.9304426	268.607346	10.4652213	5.2742E−06	0.00068037
279	17.4420355	247.676904	10.4652213	6.2006E−06	0.00079988
280	156.978319	275.584161	17.4420355	3.21E−06	0.00041409
281	13.9536284	240.70009	10.4652213	6.4753E−06	0.00083531
282	20.9304426	254.653718	10.4652213	4.9911E−06	0.00064385
283	87.2101774	254.653718	13.9536284	4.6221E−06	0.00059625
284	268.607346	279.072568	6.97681419	3.5592E−06	0.00045914
285	20.9304426	268.607346	10.4652213	4.4095E−06	0.00056883
286	17.4420355	279.072568	10.4652213	5.2564E−06	0.00067808
287	24.4188497	272.095753	10.4652213	4.6245E−06	0.00059656
288	174.420355	279.072568	13.9536284	4.6143E−06	0.00059524
289	24.4188497	272.095753	13.9536284	5.049E−06	0.00065132
290	69.7681419	279.072568	13.9536284	3.9265E−06	0.00050652
291	20.9304426	261.630532	13.9536284	5.154E−06	0.00066486
292	129.071063	275.584161	17.4420355	4.0859E−06	0.00052708
293	20.9304426	279.072568	10.4652213	5.5855E−06	0.00072054
294	17.4420355	265.118939	13.9536284	6.1353E−06	0.00079146
295	226.746461	275.584161	17.4420355	3.8469E−06	0.00049625
296	17.4420355	251.165311	13.9536284	6.9601E−06	0.00089785

Ch2 before the treatment.

Epoch	MedianF	MeanF	PeakF	MeanP	TotalP
1	216.28124	275.584161	6.97681419	3.8244E−06	0.00049335
2	20.9304426	268.607346	13.9536284	5.1374E−06	0.00066273
3	247.676904	275.584161	10.4652213	3.9908E−06	0.00051481
4	87.2101774	279.072568	10.4652213	4.3786E−06	0.00056483
5	20.9304426	272.095753	10.4652213	5.1981E−06	0.00067055
6	10.4652213	233.723275	6.97681419	8.6262E−06	0.00111278
7	10.4652213	80.2333632	6.97681419	0.00024927	0.03215596
8	6.97681419	80.2333632	6.97681419	0.00030839	0.03978243

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9	10.4652213	76.7449561	6.97681419	0.00055219	0.07123231
10	10.4652213	94.1869916	6.97681419	8.2911E−05	0.01069549
11	10.4652213	115.117434	6.97681419	2.7347E−05	0.00352778
12	20.9304426	251.165311	6.97681419	6.3981E−06	0.00082536
13	17.4420355	251.165311	6.97681419	7.3703E−06	0.00095077
14	10.4652213	122.094248	6.97681419	2.3027E−05	0.0029705
15	10.4652213	104.652213	6.97681419	4.4669E−05	0.00576232
16	62.7913277	251.165311	10.4652213	4.8959E−06	0.00063157
17	38.3724781	233.723275	6.97681419	6.6327E−06	0.00085562
18	17.4420355	247.676904	6.97681419	6.5051E−06	0.00083916
19	191.86239	272.095753	10.4652213	3.8815E−06	0.00050071
20	13.9536284	188.373983	6.97681419	1.0583E−05	0.00136527
21	13.9536284	212.792833	6.97681419	9.5343E−06	0.00122992
22	10.4652213	212.792833	6.97681419	1.1766E−05	0.00151786
23	13.9536284	244.188497	6.97681419	8.5185E−06	0.00109888
24	10.4652213	129.071063	6.97681419	2.0213E−05	0.00260749
25	13.9536284	240.70009	6.97681419	8.108E−06	0.00104594
26	27.9072568	254.653718	6.97681419	5.6532E−06	0.00072926
27	13.9536284	258.142125	6.97681419	6.7986E−06	0.00087702
28	27.9072568	272.095753	13.9536284	3.9718E−06	0.00051236
29	205.816019	272.095753	6.97681419	4.4943E−06	0.00057976
30	237.211683	286.049382	6.97681419	3.3676E−06	0.00043442
31	209.304426	265.118939	6.97681419	3.2813E−06	0.00042329
32	24.4188497	272.095753	10.4652213	3.7946E−06	0.0004895
33	303.491417	289.537789	10.4652213	3.5234E−06	0.00045452
34	202.327612	272.095753	10.4652213	3.9321E−06	0.00050725
35	233.723275	282.560975	13.9536284	3.4918E−06	0.00045044
36	27.9072568	275.584161	13.9536284	3.5007E−06	0.00045158
37	233.723275	279.072568	6.97681419	3.9954E−06	0.0005154
38	216.28124	275.584161	6.97681419	3.6366E−06	0.00046913
39	268.607346	279.072568	13.9536284	3.5284E−06	0.00045516
40	223.258054	275.584161	13.9536284	4.0287E−06	0.0005197
41	261.630532	282.560975	10.4652213	3.5439E−06	0.00045716
42	45.3492922	265.118939	6.97681419	5.3877E−06	0.00069501
43	62.7913277	282.560975	6.97681419	4.6583E−06	0.00060092
44	237.211683	268.607346	10.4652213	3.864E−06	0.00049846
45	289.537789	286.049382	13.9536284	3.736E−06	0.00048194

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46	265.118939	282.560975	6.97681419	3.2518E−06	0.00041948
47	34.884071	272.095753	6.97681419	4.5414E−06	0.00058584
48	195.350797	286.049382	10.4652213	3.7328E−06	0.00048153
49	205.816019	282.560975	13.9536284	3.4098E−06	0.00043986
50	265.118939	286.049382	10.4652213	3.935E−06	0.00050761
51	230.234868	265.118939	10.4652213	3.2506E−06	0.00041933
52	17.4420355	261.630532	6.97681419	6.4955E−06	0.00083792
53	226.746461	265.118939	13.9536284	3.1666E−06	0.00040849
54	191.86239	275.584161	13.9536284	4.1649E−06	0.00053727
55	286.049382	293.026196	10.4652213	3.6967E−06	0.00047687
56	282.560975	282.560975	17.4420355	3.5054E−06	0.0004522
57	20.9304426	275.584161	10.4652213	5.3079E−06	0.00068471
58	111.629027	261.630532	13.9536284	3.5148E−06	0.00045341
59	216.28124	282.560975	6.97681419	4.2348E−06	0.00054629
60	230.234868	272.095753	13.9536284	3.5108E−06	0.0004529
61	17.4420355	265.118939	10.4652213	4.8606E−06	0.00062701
62	251.165311	286.049382	6.97681419	3.3922E−06	0.0004376
63	247.676904	279.072568	13.9536284	3.7878E−06	0.00048862
64	310.468232	286.049382	10.4652213	3.9601E−06	0.00051086
65	17.4420355	258.142125	10.4652213	6.4056E−06	0.00082632
66	20.9304426	268.607346	6.97681419	5.4687E−06	0.00070547
67	170.931948	275.584161	10.4652213	3.8878E−06	0.00050152
68	286.049382	286.049382	10.4652213	3.9864E−06	0.00051424
69	188.373983	282.560975	6.97681419	4.8967E−06	0.00063168
70	251.165311	296.514603	10.4652213	4.5199E−06	0.00058307
71	52.3261064	268.607346	6.97681419	4.178E−06	0.00053896
72	17.4420355	254.653718	10.4652213	6.0756E−06	0.00078376
73	34.884071	275.584161	13.9536284	3.2385E−06	0.00041776
74	38.3724781	275.584161	6.97681419	4.7246E−06	0.00060948
75	240.70009	282.560975	10.4652213	3.6795E−06	0.00047466
76	268.607346	275.584161	13.9536284	3.9909E−06	0.00051482
77	108.14062	268.607346	13.9536284	4.4962E−06	0.00058001
78	275.584161	279.072568	13.9536284	3.364E−06	0.00043396
79	254.653718	279.072568	6.97681419	4.1359E−06	0.00053353
80	205.816019	279.072568	10.4652213	4.0343E−06	0.00052042
81	247.676904	275.584161	13.9536284	3.263E−06	0.00042092
82	20.9304426	265.118939	10.4652213	5.3502E−06	0.00069017

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83	205.816019	275.584161	10.4652213	3.7756E−06	0.00048705
84	101.163806	282.560975	10.4652213	4.3877E−06	0.00056601
85	265.118939	275.584161	13.9536284	3.7831E−06	0.00048802
86	48.8376993	268.607346	6.97681419	5.0426E−06	0.0006505
87	240.70009	272.095753	13.9536284	3.097E−06	0.00039951
88	27.9072568	265.118939	6.97681419	4.9053E−06	0.00063278
89	216.28124	275.584161	10.4652213	3.4674E−06	0.0004473
90	237.211683	265.118939	6.97681419	4.0325E−06	0.00052019
91	230.234868	268.607346	17.4420355	4.1597E−06	0.0005366
92	205.816019	279.072568	13.9536284	3.9325E−06	0.00050729
93	31.3956639	275.584161	13.9536284	5.0905E−06	0.00065667
94	174.420355	279.072568	10.4652213	4.5153E−06	0.00058247
95	293.026196	293.026196	10.4652213	4.1605E−06	0.0005367
96	268.607346	275.584161	17.4420355	3.7774E−06	0.00048728
97	17.4420355	254.653718	10.4652213	5.1204E−06	0.00066054
98	38.3724781	282.560975	6.97681419	5.0985E−06	0.0006577
99	237.211683	272.095753	13.9536284	3.4874E−06	0.00044988
100	52.3261064	268.607346	6.97681419	4.2473E−06	0.00054791
101	20.9304426	261.630532	10.4652213	5.2355E−06	0.00067538
102	275.584161	286.049382	6.97681419	3.3278E−06	0.00042929
103	17.4420355	261.630532	6.97681419	7.3611E−06	0.00094958
104	223.258054	275.584161	6.97681419	4.0541E−06	0.00052298
105	62.7913277	272.095753	10.4652213	4.3963E−06	0.00056712
106	202.327612	282.560975	10.4652213	3.938E−06	0.000508
107	223.258054	279.072568	6.97681419	3.5826E−06	0.00046215
108	38.3724781	275.584161	6.97681419	5.4548E−06	0.00070367
109	20.9304426	272.095753	13.9536284	5.5533E−06	0.00071637
110	244.188497	279.072568	6.97681419	3.6548E−06	0.00047147
111	31.3956639	254.653718	6.97681419	5.4754E−06	0.00070633
112	275.584161	275.584161	13.9536284	3.1221E−06	0.00040275
113	27.9072568	279.072568	10.4652213	4.5276E−06	0.00058407
114	195.350797	268.607346	6.97681419	3.8586E−06	0.00049776
115	258.142125	275.584161	10.4652213	3.667E−06	0.00047304
116	233.723275	279.072568	6.97681419	3.9627E−06	0.00051119
117	17.4420355	265.118939	6.97681419	5.1279E−06	0.0006615
118	160.466726	282.560975	10.4652213	4.7329E−06	0.00061054

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119	226.746461	293.026196	13.9536284	4.1062E−06	0.0005297
120	24.4188497	268.607346	6.97681419	5.4345E−06	0.00070104
121	286.049382	282.560975	13.9536284	3.703E−06	0.00047769
122	205.816019	279.072568	13.9536284	3.1285E−06	0.00040358
123	20.9304426	261.630532	10.4652213	5.1344E−06	0.00066234
124	20.9304426	275.584161	13.9536284	4.93E−06	0.00063598
125	223.258054	275.584161	17.4420355	4.1186E−06	0.00053131
126	244.188497	275.584161	13.9536284	3.3545E−06	0.00043273
127	191.86239	272.095753	13.9536284	3.8805E−06	0.00050058
128	20.9304426	272.095753	13.9536284	5.0126E−06	0.00064662
129	293.026196	289.537789	13.9536284	4.0235E−06	0.00051903
130	20.9304426	272.095753	10.4652213	4.8588E−06	0.00062679
131	209.304426	272.095753	10.4652213	5.1588E−06	0.00066549
132	24.4188497	282.560975	6.97681419	5.1501E−06	0.00066437
133	275.584161	286.049382	13.9536284	4.0269E−06	0.00051946
134	293.026196	289.537789	13.9536284	3.3772E−06	0.00043565
135	209.304426	275.584161	17.4420355	3.8776E−06	0.00050021
136	20.9304426	272.095753	10.4652213	4.7417E−06	0.00061167
137	156.978319	279.072568	6.97681419	3.728E−06	0.00048092
138	111.629027	282.560975	10.4652213	4.2741E−06	0.00055136
139	160.466726	265.118939	13.9536284	3.9168E−06	0.00050527
140	73.256549	268.607346	6.97681419	4.9527E−06	0.0006389
141	230.234868	279.072568	10.4652213	3.4897E−06	0.00045017
142	275.584161	275.584161	10.4652213	4.6092E−06	0.00059459
143	24.4188497	272.095753	6.97681419	5.9721E−06	0.0007704
144	265.118939	279.072568	10.4652213	3.9822E−06	0.00051371
145	184.885576	265.118939	10.4652213	3.3732E−06	0.00043514
146	24.4188497	272.095753	6.97681419	5.205E−06	0.00067145
147	237.211683	282.560975	10.4652213	3.6391E−06	0.00046944
148	279.072568	279.072568	6.97681419	3.9782E−06	0.00051319
149	240.70009	275.584161	17.4420355	3.8072E−06	0.00049113
150	90.6985845	272.095753	10.4652213	4.2891E−06	0.0005533
151	136.047877	268.607346	17.4420355	4.4467E−06	0.00057363
152	251.165311	279.072568	17.4420355	3.4991E−06	0.00045138
153	219.769647	279.072568	10.4652213	4.3495E−06	0.00056109
154	230.234868	279.072568	10.4652213	4.187E−06	0.00054012
155	247.676904	275.584161	13.9536284	4.4304E−06	0.00057153

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156	17.4420355	265.118939	6.97681419	5.6885E−06	0.00073382
157	20.9304426	268.607346	10.4652213	5.1533E−06	0.00066478
158	237.211683	275.584161	13.9536284	2.7316E−06	0.00035237
159	230.234868	272.095753	6.97681419	4.0126E−06	0.00051762
160	181.397169	272.095753	10.4652213	4.2822E−06	0.00055241
161	20.9304426	268.607346	10.4652213	7.0647E−06	0.00091135
162	20.9304426	261.630532	6.97681419	5.8965E−06	0.00076065
163	24.4188497	282.560975	10.4652213	3.9647E−06	0.00051144
164	97.6753987	258.142125	13.9536284	3.9992E−06	0.0005159
165	17.4420355	251.165311	6.97681419	5.9298E−06	0.00076495
166	24.4188497	275.584161	10.4652213	3.7671E−06	0.00048595
167	198.839204	268.607346	13.9536284	3.5598E−06	0.00045922
168	20.9304426	261.630532	6.97681419	5.9082E−06	0.00076216
169	237.211683	282.560975	10.4652213	3.8774E−06	0.00050019
170	80.2333632	275.584161	6.97681419	4.5853E−06	0.00059151
171	111.629027	279.072568	10.4652213	4.2114E−06	0.00054327
172	240.70009	282.560975	10.4652213	3.8703E−06	0.00049927
173	94.1869916	272.095753	6.97681419	5.0568E−06	0.00065232
174	237.211683	268.607346	13.9536284	3.4994E−06	0.00045143
175	202.327612	272.095753	13.9536284	3.3203E−06	0.00042832
176	143.024691	282.560975	6.97681419	5.2413E−06	0.00067613
177	219.769647	272.095753	13.9536284	4.2537E−06	0.00054872
178	174.420355	286.049382	10.4652213	4.5756E−06	0.00059025
179	17.4420355	261.630532	10.4652213	5.4408E−06	0.00070186
180	174.420355	286.049382	10.4652213	3.7573E−06	0.00048469
181	265.118939	286.049382	6.97681419	4.4028E−06	0.00056796
182	17.4420355	244.188497	6.97681419	7.8036E−06	0.00100667
183	261.630532	279.072568	6.97681419	4.4267E−06	0.00057105
184	261.630532	286.049382	13.9536284	3.8736E−06	0.0004997
185	244.188497	289.537789	6.97681419	4.3615E−06	0.00056264
186	27.9072568	272.095753	13.9536284	4.0721E−06	0.0005253
187	209.304426	261.630532	13.9536284	4.0329E−06	0.00052024
188	233.723275	272.095753	6.97681419	4.4001E−06	0.00056761
189	247.676904	275.584161	13.9536284	2.9319E−06	0.00037822
190	24.4188497	275.584161	13.9536284	6.1646E−06	0.00079524
191	34.884071	254.653718	6.97681419	4.8747E−06	0.00062883

Ch2 after the treatment.

Epoch	MedianF	MeanF	PeakF	MeanP	TotalP
1	338.375488	293.026196	439.539294	3.2595E−06	0.00042048
2	310.468232	282.560975	6.97681419	3.1804E−06	0.00041027
3	317.445046	268.607346	397.678409	2.5238E−06	0.00032557
4	345.352302	286.049382	425.585666	2.3314E−06	0.00030075
5	306.979824	286.049382	6.97681419	3.0401E−06	0.00039218
6	334.887081	289.537789	376.747966	2.0005E−06	0.00025806
7	293.026196	286.049382	6.97681419	3.2752E−06	0.0004225
8	313.956639	279.072568	6.97681419	2.7998E−06	0.00036117
9	327.910267	289.537789	13.9536284	2.3943E−06	0.00030887
10	317.445046	279.072568	432.56248	3.7904E−06	0.00048896
11	62.7913277	125.582655	55.8145135	7.7494E−06	0.00099968
12	80.2333632	198.839204	6.97681419	4.568E−06	0.00058927
13	198.839204	237.211683	55.8145135	4.4257E−06	0.00057091
14	101.163806	223.258054	45.3492922	4.3844E−06	0.00056559
15	104.652213	226.746461	48.8376993	5.284E−06	0.00068164
16	87.2101774	195.350797	45.3492922	5.0288E−06	0.00064871
17	90.6985845	209.304426	45.3492922	5.2131E−06	0.00067249
18	97.6753987	212.792833	48.8376993	4.4073E−06	0.00056854
19	101.163806	212.792833	59.3029206	4.8533E−06	0.00062607
20	139.536284	237.211683	38.3724781	4.539E−06	0.00058553
21	55.8145135	219.769647	10.4652213	5.9976E−06	0.0007737
22	76.7449561	181.397169	52.3261064	4.2297E−06	0.00054563
23	94.1869916	226.746461	55.8145135	5.1678E−06	0.00066664
24	108.14062	209.304426	45.3492922	4.7077E−06	0.00060729
25	104.652213	240.70009	52.3261064	4.3484E−06	0.00056094
26	258.142125	258.142125	55.8145135	4.1595E−06	0.00053658
27	191.86239	230.234868	59.3029206	4.3958E−06	0.00056705
28	108.14062	237.211683	48.8376993	4.6315E−06	0.00059746
29	94.1869916	223.258054	48.8376993	4.3509E−06	0.00056127
30	143.024691	230.234868	17.4420355	3.5349E−06	0.000456
31	209.304426	244.188497	41.8608852	3.557E−06	0.00045885
32	108.14062	244.188497	17.4420355	4.2645E−06	0.00055012
33	83.7217703	188.373983	62.7913277	5.1211E−06	0.00066062
34	174.420355	240.70009	41.8608852	3.9769E−06	0.00051302

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35	111.629027	233.723275	17.4420355	4.1158E−06	0.00053094
36	174.420355	247.676904	59.3029206	3.7938E−06	0.0004894
37	240.70009	244.188497	404.655223	3.7951E−06	0.00048957
38	94.1869916	247.676904	17.4420355	4.4186E−06	0.00057
39	76.7449561	219.769647	45.3492922	4.7291E−06	0.00061006
40	160.466726	240.70009	17.4420355	4.2048E−06	0.00054241
41	125.582655	240.70009	59.3029206	3.7569E−06	0.00048464
42	261.630532	258.142125	34.884071	2.9457E−06	0.00038
43	97.6753987	230.234868	55.8145135	4.635E−06	0.00059791
44	195.350797	247.676904	34.884071	4.5237E−06	0.00058356
45	139.536284	244.188497	13.9536284	4.1458E−06	0.00053481
46	83.7217703	226.746461	41.8608852	4.0732E−06	0.00052544
47	254.653718	272.095753	10.4652213	3.931E−06	0.0005071
48	198.839204	247.676904	45.3492922	3.7272E−06	0.00048081
49	230.234868	258.142125	17.4420355	4.4026E−06	0.00056794
50	216.28124	240.70009	6.97681419	3.9327E−06	0.00050731
51	230.234868	258.142125	17.4420355	4.5005E−06	0.00058057
52	268.607346	254.653718	48.8376993	3.6993E−06	0.00047721
53	209.304426	247.676904	13.9536284	3.9322E−06	0.00050725
54	223.258054	244.188497	45.3492922	3.9691E−06	0.00051202
55	216.28124	254.653718	13.9536284	3.379E−06	0.00043589
56	244.188497	251.165311	6.97681419	3.6851E−06	0.00047538
57	195.350797	261.630532	6.97681419	3.7928E−06	0.00048927
58	55.8145135	247.676904	6.97681419	5.7101E−06	0.0007366
59	104.652213	240.70009	55.8145135	3.881E−06	0.00050064
60	212.792833	247.676904	48.8376993	3.8124E−06	0.0004918
61	101.163806	226.746461	48.8376993	3.6108E−06	0.00046579
62	279.072568	268.607346	13.9536284	3.9424E−06	0.00050857
63	209.304426	247.676904	59.3029206	4.1146E−06	0.00053079
64	216.28124	251.165311	13.9536284	3.7035E−06	0.00047775
65	275.584161	275.584161	10.4652213	3.9749E−06	0.00051276
66	247.676904	251.165311	38.3724781	3.36E−06	0.00043345
67	237.211683	261.630532	13.9536284	3.5668E−06	0.00046012
68	265.118939	261.630532	52.3261064	3.8902E−06	0.00050184
69	198.839204	237.211683	13.9536284	3.6634E−06	0.00047258

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70	174.420355	247.676904	13.9536284	3.8201E−06	0.00049279
71	76.7449561	216.28124	48.8376993	4.2512E−06	0.00054841
72	198.839204	251.165311	38.3724781	3.9715E−06	0.00051232
73	83.7217703	233.723275	34.884071	4.7517E−06	0.00061297
74	101.163806	237.211683	38.3724781	3.9648E−06	0.00051146
75	104.652213	251.165311	13.9536284	4.4451E−06	0.00057342
76	139.536284	237.211683	17.4420355	3.6781E−06	0.00047447
77	83.7217703	244.188497	41.8608852	4.9439E−06	0.00063776
78	195.350797	251.165311	41.8608852	3.8218E−06	0.00049302
79	272.095753	275.584161	45.3492922	3.9487E−06	0.00050938
80	237.211683	254.653718	20.9304426	3.7018E−06	0.00047754
81	97.6753987	237.211683	13.9536284	3.5096E−06	0.00045274
82	108.14062	240.70009	20.9304426	4.5437E−06	0.00058613
83	80.2333632	160.466726	52.3261064	7.3883E−06	0.00095308
84	94.1869916	223.258054	13.9536284	4.8747E−06	0.00062884
85	97.6753987	223.258054	52.3261064	5.1509E−06	0.00066446
86	111.629027	244.188497	59.3029206	4.4737E−06	0.0005771
87	212.792833	254.653718	13.9536284	3.9841E−06	0.00051395
88	115.117434	237.211683	48.8376993	4.9863E−06	0.00064323
89	62.7913277	216.28124	52.3261064	4.7102E−06	0.00060761
90	101.163806	240.70009	6.97681419	4.6239E−06	0.00059648
91	76.7449561	226.746461	10.4652213	4.3219E−06	0.00055752
92	244.188497	251.165311	55.8145135	4.0611E−06	0.00052388
93	254.653718	251.165311	48.8376993	4.2344E−06	0.00054624
94	188.373983	244.188497	38.3724781	4.2581E−06	0.00054929
95	104.652213	223.258054	41.8608852	3.6234E−06	0.00046742
96	174.420355	254.653718	55.8145135	4.1023E−06	0.00052919
97	104.652213	233.723275	13.9536284	4.1198E−06	0.00053145
98	247.676904	254.653718	59.3029206	3.988E−06	0.00051446
99	87.2101774	216.28124	69.7681419	4.4963E−06	0.00058003
100	111.629027	237.211683	13.9536284	4.8287E−06	0.00062291
101	80.2333632	223.258054	13.9536284	4.7264E−06	0.00060971
102	198.839204	244.188497	13.9536284	3.9613E−06	0.000511
103	258.142125	265.118939	10.4652213	4.0266E−06	0.00051943
104	188.373983	244.188497	13.9536284	3.647E−06	0.00047047

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105	136.047877	244.188497	48.8376993	4.1624E−06	0.00053695
106	118.605841	240.70009	6.97681419	3.971E−06	0.00051226
107	101.163806	240.70009	13.9536284	4.6431E−06	0.00059896
108	226.746461	254.653718	41.8608852	4.4762E−06	0.00057743
109	115.117434	233.723275	62.7913277	4.6032E−06	0.00059381
110	94.1869916	237.211683	17.4420355	3.9771E−06	0.00051305
111	188.373983	237.211683	66.2797348	3.7124E−06	0.00047889
112	94.1869916	247.676904	6.97681419	4.7527E−06	0.00061309
113	198.839204	244.188497	55.8145135	4.4729E−06	0.00057701
114	97.6753987	247.676904	59.3029206	4.5329E−06	0.00058475
115	97.6753987	237.211683	45.3492922	4.4855E−06	0.00057863
116	122.094248	237.211683	52.3261064	4.5112E−06	0.00058194
117	177.908762	251.165311	45.3492922	4.5197E−06	0.00058304
118	76.7449561	223.258054	17.4420355	4.9667E−06	0.0006407
119	125.582655	237.211683	55.8145135	4.7682E−06	0.0006151
120	122.094248	244.188497	31.3956639	4.676E−06	0.0006032
121	87.2101774	198.839204	52.3261064	4.872E−06	0.00062849
122	104.652213	244.188497	10.4652213	5.0092E−06	0.00064618
123	80.2333632	237.211683	13.9536284	4.5433E−06	0.00058609
124	170.931948	247.676904	17.4420355	4.0973E−06	0.00052855
125	240.70009	251.165311	41.8608852	3.9813E−06	0.00051359
126	174.420355	244.188497	52.3261064	4.135E−06	0.00053341
127	87.2101774	233.723275	17.4420355	4.1692E−06	0.00053782
128	240.70009	258.142125	10.4652213	3.3635E−06	0.0004339
129	108.14062	254.653718	13.9536284	4.1828E−06	0.00053958
130	163.955134	247.676904	13.9536284	4.1755E−06	0.00053864
131	181.397169	258.142125	13.9536284	3.6364E−06	0.0004691
132	153.489912	251.165311	10.4652213	3.7737E−06	0.00048681
133	233.723275	261.630532	10.4652213	3.539E−06	0.00045654
134	289.537789	272.095753	13.9536284	3.6839E−06	0.00047522
135	293.026196	272.095753	31.3956639	3.7833E−06	0.00048805
136	265.118939	261.630532	31.3956639	3.8553E−06	0.00049733
137	94.1869916	240.70009	17.4420355	5.0125E−06	0.00064661
138	83.7217703	223.258054	17.4420355	4.4545E−06	0.00057463
139	212.792833	254.653718	17.4420355	4.2904E−06	0.00055346

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140	188.373983	254.653718	13.9536284	3.6652E−06	0.00047281
141	83.7217703	226.746461	13.9536284	4.8788E−06	0.00062936
142	118.605841	244.188497	55.8145135	4.6586E−06	0.00060096
143	69.7681419	240.70009	13.9536284	4.4667E−06	0.00057621
144	261.630532	261.630532	6.97681419	3.9302E−06	0.000507
145	90.6985845	230.234868	13.9536284	3.5502E−06	0.00045797
146	237.211683	254.653718	17.4420355	3.5872E−06	0.00046275
147	174.420355	251.165311	13.9536284	3.3516E−06	0.00043236
148	254.653718	265.118939	45.3492922	3.7681E−06	0.00048608
149	191.86239	258.142125	13.9536284	3.8652E−06	0.00049861
150	198.839204	251.165311	10.4652213	3.6098E−06	0.00046566
151	191.86239	240.70009	52.3261064	4.3973E−06	0.00056725
152	205.816019	258.142125	10.4652213	3.8938E−06	0.0005023
153	195.350797	244.188497	41.8608852	4.0768E−06	0.0005259
154	163.955134	251.165311	55.8145135	4.2324E−06	0.00054598
155	279.072568	272.095753	10.4652213	3.7461E−06	0.00048325
156	122.094248	244.188497	41.8608852	4.4745E−06	0.00057722
157	230.234868	265.118939	13.9536284	4.1687E−06	0.00053776
158	132.55947	240.70009	10.4652213	4.2329E−06	0.00054604
159	118.605841	244.188497	38.3724781	3.7636E−06	0.00048551
160	83.7217703	230.234868	17.4420355	3.8324E−06	0.00049438
161	101.163806	223.258054	48.8376993	4.27E−06	0.00055083
162	69.7681419	223.258054	13.9536284	5.8853E−06	0.0007592
163	87.2101774	223.258054	45.3492922	4.5135E−06	0.00058225
164	129.071063	247.676904	10.4652213	4.2724E−06	0.00055114
165	209.304426	254.653718	48.8376993	4.8225E−06	0.00062211
166	83.7217703	233.723275	17.4420355	4.804E−06	0.00061972
167	87.2101774	237.211683	34.884071	4.1597E−06	0.0005366
168	195.350797	254.653718	52.3261064	4.3208E−06	0.00055738
169	129.071063	244.188497	59.3029206	4.6778E−06	0.00060343
170	69.7681419	230.234868	13.9536284	5.0118E−06	0.00064652
171	125.582655	237.211683	62.7913277	4.5184E−06	0.00058288
172	251.165311	254.653718	20.9304426	3.7566E−06	0.0004846
173	188.373983	258.142125	13.9536284	3.4489E−06	0.0004449
174	209.304426	244.188497	48.8376993	4.2763E−06	0.00055164

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175	76.7449561	247.676904	13.9536284	4.3805E−06	0.00056508
176	83.7217703	219.769647	62.7913277	4.3301E−06	0.00055859
177	59.3029206	226.746461	6.97681419	5.11E−06	0.00065919
178	90.6985845	237.211683	17.4420355	4.6322E−06	0.00059756
179	104.652213	237.211683	31.3956639	4.2316E−06	0.00054588
180	143.024691	233.723275	62.7913277	4.4132E−06	0.0005693
181	167.443541	244.188497	52.3261064	4.0985E−06	0.00052871
182	108.14062	251.165311	6.97681419	4.1364E−06	0.0005336
183	80.2333632	237.211683	13.9536284	3.7507E−06	0.00048384
184	244.188497	265.118939	13.9536284	4.5866E−06	0.00059167
185	184.885576	244.188497	55.8145135	4.444E−06	0.00057328
186	104.652213	233.723275	59.3029206	4.3912E−06	0.00056647
187	87.2101774	244.188497	6.97681419	5.1928E−06	0.00066987
188	94.1869916	240.70009	13.9536284	5.3251E−06	0.00068694
189	76.7449561	226.746461	34.884071	4.5793E−06	0.00059073
190	212.792833	251.165311	38.3724781	3.796E−06	0.00048969
191	132.55947	247.676904	10.4652213	4.039E−06	0.00052103
192	240.70009	261.630532	45.3492922	3.5375E−06	0.00045634
193	104.652213	244.188497	13.9536284	4.5807E−06	0.0005909
194	101.163806	223.258054	34.884071	4.4075E−06	0.00056857
195	104.652213	247.676904	13.9536284	3.8738E−06	0.00049972
196	205.816019	240.70009	41.8608852	3.8359E−06	0.00049484
197	188.373983	251.165311	41.8608852	3.7566E−06	0.00048461
198	209.304426	247.676904	41.8608852	4.0054E−06	0.0005167
199	219.769647	247.676904	17.4420355	3.9399E−06	0.00050824
200	195.350797	240.70009	52.3261064	3.328E−06	0.00042932
201	237.211683	251.165311	422.097259	3.6198E−06	0.00046695
202	240.70009	254.653718	38.3724781	3.4971E−06	0.00045113
203	233.723275	265.118939	13.9536284	3.8416E−06	0.00049557
204	265.118939	251.165311	31.3956639	3.0692E−06	0.00039593
205	233.723275	258.142125	13.9536284	3.5586E−06	0.00045906
206	258.142125	261.630532	27.9072568	3.3757E−06	0.00043547
207	261.630532	258.142125	48.8376993	3.544E−06	0.00045718
208	240.70009	261.630532	38.3724781	3.2937E−06	0.00042489
209	279.072568	268.607346	17.4420355	3.9918E−06	0.00051494

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210	272.095753	272.095753	13.9536284	3.4073E−06	0.00043955
211	160.466726	247.676904	52.3261064	3.6477E−06	0.00047055
212	237.211683	258.142125	13.9536284	3.8577E−06	0.00049764
213	265.118939	265.118939	397.678409	3.5978E−06	0.00046412
214	223.258054	254.653718	59.3029206	3.6307E−06	0.00046836
215	226.746461	268.607346	13.9536284	4.0037E−06	0.00051647
216	254.653718	261.630532	13.9536284	4.1612E−06	0.0005368
217	90.6985845	223.258054	17.4420355	4.6504E−06	0.0005999
218	129.071063	244.188497	10.4652213	4.0853E−06	0.00052701
219	251.165311	268.607346	41.8608852	3.7262E−06	0.00048068
220	265.118939	258.142125	34.884071	2.7653E−06	0.00035673
221	293.026196	272.095753	13.9536284	3.623E−06	0.00046736
222	129.071063	240.70009	10.4652213	3.9628E−06	0.0005112
223	268.607346	261.630532	38.3724781	4.2437E−06	0.00054744
224	66.2797348	230.234868	45.3492922	5.3061E−06	0.00068448
225	202.327612	247.676904	38.3724781	4.0293E−06	0.00051978
226	181.397169	244.188497	55.8145135	4.2021E−06	0.00054208
227	87.2101774	237.211683	17.4420355	4.7478E−06	0.00061246
228	286.049382	265.118939	41.8608852	4.2365E−06	0.00054651
229	240.70009	272.095753	10.4652213	4.0635E−06	0.00052419
230	254.653718	258.142125	10.4652213	3.3675E−06	0.00043441
231	233.723275	265.118939	13.9536284	3.9961E−06	0.00051549
232	101.163806	240.70009	13.9536284	4.6225E−06	0.00059631
233	244.188497	268.607346	6.97681419	3.5955E−06	0.00046382
234	282.560975	272.095753	17.4420355	4.2329E−06	0.00054604
235	195.350797	244.188497	52.3261064	3.6237E−06	0.00046745
236	73.256549	212.792833	10.4652213	4.2153E−06	0.00054377
237	143.024691	247.676904	48.8376993	4.3569E−06	0.00056204
238	240.70009	254.653718	41.8608852	3.3327E−06	0.00042992
239	136.047877	240.70009	10.4652213	3.55E−06	0.00045795
240	240.70009	254.653718	13.9536284	4.0312E−06	0.00052003
241	90.6985845	247.676904	17.4420355	3.4369E−06	0.00044336
242	240.70009	268.607346	10.4652213	4.0334E−06	0.00052031
243	289.537789	272.095753	10.4652213	3.2934E−06	0.00042485
244	13.9536284	174.420355	6.97681419	1.175E−05	0.00151571

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245	289.537789	268.607346	13.9536284	2.3943E−06	0.00030887
246	327.910267	286.049382	24.4188497	3.049E−06	0.00039332
247	122.094248	237.211683	52.3261064	3.961E−06	0.00051097
248	136.047877	244.188497	41.8608852	3.7777E−06	0.00048732
249	115.117434	240.70009	13.9536284	4.3375E−06	0.00055954
250	293.026196	275.584161	48.8376993	3.3976E−06	0.00043828
251	153.489912	251.165311	10.4652213	4.1082E−06	0.00052996
252	258.142125	258.142125	6.97681419	4.1585E−06	0.00053644
253	83.7217703	247.676904	6.97681419	5.0063E−06	0.00064581
254	104.652213	247.676904	34.884071	4.526E−06	0.00058386
255	66.2797348	233.723275	13.9536284	4.9246E−06	0.00063527
256	150.001505	254.653718	13.9536284	3.8822E−06	0.0005008
257	198.839204	244.188497	41.8608852	3.8597E−06	0.00049791
258	226.746461	247.676904	55.8145135	3.7399E−06	0.00048245
259	216.28124	258.142125	41.8608852	4.2772E−06	0.00055176
260	209.304426	254.653718	13.9536284	4.1337E−06	0.00053325
261	87.2101774	244.188497	55.8145135	4.4733E−06	0.00057706
262	226.746461	251.165311	10.4652213	4.3789E−06	0.00056488
263	198.839204	254.653718	52.3261064	3.9789E−06	0.00051328
264	66.2797348	205.816019	55.8145135	4.0237E−06	0.00051906
265	240.70009	258.142125	48.8376993	3.8629E−06	0.00049831
266	83.7217703	247.676904	41.8608852	4.3957E−06	0.00056704
267	212.792833	265.118939	6.97681419	4.5365E−06	0.0005852
268	94.1869916	237.211683	13.9536284	4.1809E−06	0.00053933
269	247.676904	261.630532	52.3261064	3.6637E−06	0.00047262
270	153.489912	240.70009	59.3029206	4.1697E−06	0.00053789
271	184.885576	251.165311	6.97681419	3.8504E−06	0.0004967
272	237.211683	258.142125	24.4188497	3.6249E−06	0.00046762
273	202.327612	251.165311	13.9536284	3.8054E−06	0.0004909
274	195.350797	247.676904	24.4188497	3.3767E−06	0.0004356
275	80.2333632	244.188497	13.9536284	3.6295E−06	0.00046821
276	240.70009	261.630532	41.8608852	3.1441E−06	0.00040559
277	251.165311	265.118939	13.9536284	3.3405E−06	0.00043093
278	272.095753	265.118939	17.4420355	3.4804E−06	0.00044897
279	296.514603	265.118939	13.9536284	2.7197E−06	0.00035084

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280	282.560975	272.095753	6.97681419	3.4141E−06	0.00044041
281	45.3492922	247.676904	6.97681419	5.6482E−06	0.00072862
282	90.6985845	230.234868	17.4420355	3.5182E−06	0.00045385
283	198.839204	240.70009	52.3261064	3.7675E−06	0.00048601
284	296.514603	275.584161	6.97681419	2.8715E−06	0.00037042
285	275.584161	261.630532	13.9536284	3.0196E−06	0.00038953
286	289.537789	265.118939	13.9536284	2.9761E−06	0.00038392
287	254.653718	268.607346	13.9536284	2.9905E−06	0.00038577
288	251.165311	261.630532	31.3956639	3.5744E−06	0.0004611
289	177.908762	251.165311	10.4652213	3.9805E−06	0.00051348
290	195.350797	244.188497	52.3261064	3.9663E−06	0.00051165
291	146.513098	254.653718	13.9536284	4.0387E−06	0.00052099
292	247.676904	254.653718	27.9072568	3.5755E−06	0.00046124
293	156.978319	254.653718	52.3261064	3.715E−06	0.00047923
294	275.584161	265.118939	13.9536284	3.3349E−06	0.00043021
295	219.769647	258.142125	13.9536284	3.4839E−06	0.00044942
296	191.86239	268.607346	17.4420355	3.972E−06	0.00051238