Higher Technical School of Industrial Engineers and Telecommunications

Characterization of cerebral activity in PD's patients through an Autoregressive Model

Degree in Telecommunications Engineering

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CHAPTER 0: GLOSARY

0.GLOSARY

PDTR: Parkinson's Disease Therapy
PD: Parkinson's Disease
FFT: Fast Fourier Transform
NFFT: Number of points of Fast Fourier Transform
STN: Subthalamic Nucleus
PDS: Power Spectral Density
EMG: Electromyography signals.
EEG: Electroencephalogram
UPDRS: Unified Parkinson's Disease Rating Scale
ECoG: Electrocorticography

ON state: clinical state after dopaminergic therapy administration. Some of the PD symptoms are vanish or ameliorate. In some cases, adverse side-effects can occur (involuntary movements, impulsivity etc)

OFF state: clinical state of PD patients characterised by the presence of motor and cognitive symptoms that characterise the clinic of PD

CHAPTER 1: INTRODUCTION

1.1 Introduction: Parkinson's Disease

The first description of the Parkinson's Disease (PD) took place with a monograph written in 1817 by James Parkinson. In his publication "An essay on the shaking palsy" [21] he described the symptomatology of with 6 patients he discovered in London and who presented tremor in rest, changes in the walking and changes in the natural reflexes.

The prevalence of PD is foreseen between 1-3 by 1.000 inhabitants in Europe. In Spain this disease affects to more than 70.000 people. This quantity locates PD in the second place of the group of neurodegenerative diseases with a narrow distance from Alzheimer.

The three main symptoms of PD are: tremor, rigidity and bradykinesia (difficulty to start movement, slowness and clumsiness in voluntary movements.

To date, there is no cure for PD. Therapies are focused on controlling the symptoms and commonly must be personalized to each patient. Current drugs aim to ameliorate the symptomatology by increasing the levels of dopamine in the brain. However, in some cases, the chronic treatment of levodopa produces in the patient some difficulties (in motor and psychiatric functions) and in frequently results in severe side effects. As a consequence of that, the monitoring of the patient is fundamental.

Patients who have been treated with medicine for a long time or have received an important dose of it, used to develop a decrease of response to the treatment and an amount of undesirable secondary expressions such as: dyskinesia, strange gestures or abnormal movements.

An alternative to this problem can be: changing doses, rising up the number of doses, make therapeutic holidays, etc… Anyway, little by little these methods become less effective and other therapies such as Deep Brain Stimulation can be applied

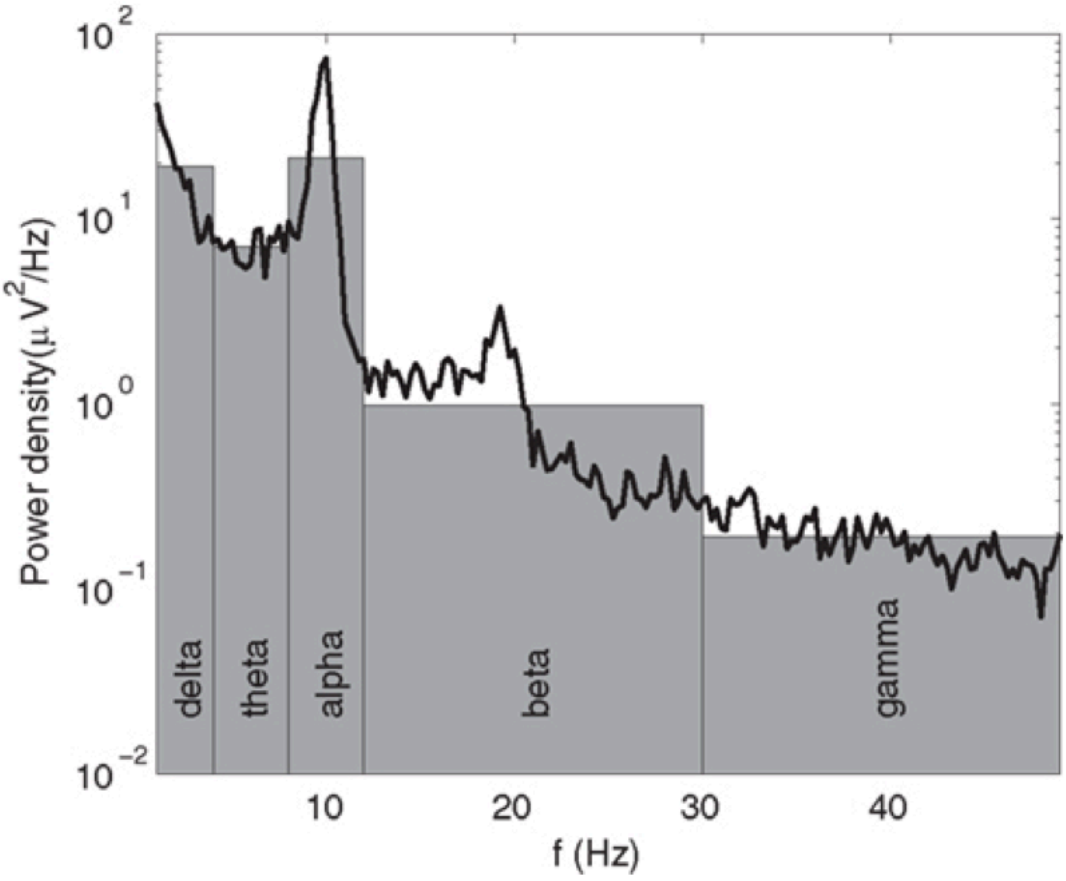
1.2 Deep Brain Stimulation (DBS)

Deep Brain Stimulation (DBS) is a surgical procedure which is used to reduce symptoms of PD such as: tremor, rigidity, stiffness, slow movement

It is mainly indicated for patients which symptoms cannot be controlled adequately with medicine treatments.

DBS uses a surgically implanted battery-operated medical device which is called "neurostimulator" to deliver electrical stimulation to some areas in the brain that control movement. Although not completely proved, it is believed that stimulation acts by blocking the abnormal activity that causes some of the mayor motor disturbances in PD patients.

The positioning of the Deep Brain Stimulations as well as treating the disease has permitted to register the different structures of basal ganglia in these patients. The ground-breaking finding has been the detection of an excessive synchronism in the Beta band in patients with PD which decreases or disappears after giving the patient dopamine. In Local Field Potentials of neuronal actions (which are usually obtained during the colocation of the electrode) this synchronism is observed in the shape of outbreaks of rhythmical shocks and synchrony in the group of neurons at these frequencies. In the Local Field Potentials across the stimulators which are usually made just in the following days after the surgery, before the second surgery when it's internalized the system and the batteries are connected. This hipersynchrony can be seen in the shape of oscillations which are distinctly visible in the Beta Range, especially in the Low Beta Range (13-20 Hz). In the following graph, it can be seen the names of the frequency range.



Graph 1: Names of the frequency range [4]

Beta activity is not the unique anomalous oscillation observed in patients with PD. For instance, it can be seen oscillations of Theta-Alfa (4-10 Hz) related with the presence of dyskinesias induced by the medicine and with the presence of a disorder of the impulse's control (in both cases, after taking medicine) and related with the tremor.

The treatment of PD through DBS of the Subthalamic nucleus has permitted to register the oscillatory activity among the nucleus. It has been observed that the

exaggerating synchronisation of neuronal populations in the basal ganglia (especially in low frequencies) keeps a direct relationship with the expression of motor symptoms in the patients. As a consequence of that, characterizing and understanding the mechanisms generators of these oscillations represents an important challenge when we focus on the knowledge of the disease, mainly in what relates to the design of precocious diagnostic methods and the verification of new therapies bases on neuromodulation by electric stimulation.

In the DBS treatment, the colocation of deep stimulators in the patients restrict to a reduced number of structures and rarely more that 2 stimulators are implanted in each character.

1.3 Helping texts

As a help and introduction to the state of the art in the electrophysiology of PD, a number of scientific papers were reviewed and studied. Following are summarized the main findings and procedures described in the 4 studied than are the most relevant for the aims of this project.

1.3.1 "Oscillatory activity in the human basal ganglia: more than just beta, more than just Parkinson's disease" [4]

In this work, authors show their personal point of view and understanding about the state of the art of the current knowledge of the oscillatory activity and their role in the pathophysiology of PD. In a *Comment* paper about the work of Tan et. al. (2013), authors stress the role of the beta oscillations and other oscillatory activities as important mechanism involved in the pathophysiology of PD.

Specifically, Tan et al. (2013) analyse the local field potentials (LFP) recorded in the STN of PD patients and evaluate the changes in oscillatory activity within a motor paradigm where subjects are asked to hold and release some specific objects. They found was that *beta* activity was related to the release phase, while grip maintenance related most to theta and gamma/high-frequency activity. Interestingly, the effect of the motor state of the patient on some of these relationships was not significant. Tan's paper confirms that the local field potential activity in the basal ganglia of PD patients in the OFF state is dominated by prominent beta oscillations.

Actually, it is widely accepted that abnormal beta activity is an excellent marker of PD in human patients. Together with this frequency range, there are other frequency bands where several studies have shown alterations.

- In the gamma and theta ranges, when patients are in the ON state (improved motor state as a result of the effect of the therapy)
- Presence of oscillations in theta/alpha bands during the ON state are accompanied by the occurrence of side effects as dyskinesias or the presence of impulse control disorders

- High-frequency oscillations (200-400 Hz) can be observed in most PD patients in the STN if the signal is recorded in wide band. During the OFF state: they are limited to the dorsal region of the nucleus and peak at 250 Hz. ON state: they show a more widespread spatial distribution and shift their frequency to around 350 Hz.

As a result, authors conclude that although oscillatory activity in the beta range may play a critical role in the motor function, gamma and high-frequency activities could also be involved in movement execution while phenomena in the theta range could be related to more cognitive process.

1.3.2 Slow oscillatory activity and levodopa-induced dyskinesias in PD [3]

In this study, authors showed that the presence of levodopa-induced dyskinesias is accompanied by the appearance of theta oscillations in the STN of PD patients.

Levodopa (L-DOPA) is the precursor of dopamine, so it is used as a drug to re-establish the levels of this neurotransmitter in the PD brain. After a long-term treatment based in L-DOPA, patients develop resilience to the drug and very often suffer of severe side effects as L-DOPA-induced dyskinesias. This form of involuntary movements could be elicited in the face, upper and lower forelimbs and could involve many segments of the body at the same time.

In this study, authors recorded and studied the local field potentials (LPF) from the macroelectrodes of the DBS stimulators implanted in the subthalamic nucleus (STN) in 14 patients during the "OFF" and "ON" motor states (before/after administration of the pharmacologic therapy). In 11 out of 14, levodopa elicited dyskinesias.

Recording sessions were conducted 2-4 days after surgery, having ensured that the patients' general state was satisfactory.

Electromyography (EMG) signals were recorded with disposable surface electrodes to assess the presence of dyskinesias or tremor on the limb muscles previously reported to show abnormal activities. Oscillatory activity was amplified 100.000 fold and filtered at 0.3-100 Hz before being digitalized at 200 Hz by an analogic to digital (A/D) converted connected to a PC. EEG activity was amplified 20.000-fold, filtered at 0.3-100 Hz and digitalized at 200 Hz using the same A/D converter.

All sessions began with patients in the "OFF" motor state after overnight withdrawal of antiparkinsonian medication and the "ON" motor state was subsequently achieved by oral administration of levodopa. Activity was continuously registered: from the "OFF" motor state, across an intermediate state (where diphasis dyskinesias and beginning of the motor improvement was observed) to the ON state where amelioration or the presence of dyskinesias occurred.

Analyses based on Fast Fourier Transform (FFT) and filtering allowed authors to detect differences in between the spectral content of the ON and OFF periods. And more importantly, these differences correlated with the clinical state of the patients.

Briefly, the ON/OFF periods where characterised by:

- In the OFF state, activity in the 11-30 Hz band (beta band) was recorded. This band reduced in amplitude 45,2 % in the ON state.
- In the ON state, and coincident with the occurrence of dyskinesias, an increment of 77.6 % was observed in the 4-10 Hz band in all patients who showed dyskinesia.
- In the ON state, an increase of 17,8 % in the 60-80 Hz range (gamma band) was observed in the majority of the patients.
- In patients with severe tremor at rest, the predominant peak coincided with the tremor frequency (4-6 Hz).
- And more importantly, in those patients (3) not developing dyskinesia, there was no increment in the 4-10 Hz band.

All these results suggest the existence of a strong correlation between the spectral characteristics of the STN oscillatory activity and the clinical symptomatology, and in particular with the presence of levodopa-induced dyskinesias.

1.3.3 Coupling between Beta and High-Frequency Activity in the Human Subthalamic Nucleus might be a Pathophysiological Mechanism in PD [2]

This paper completes the characterization of the oscillatory activity recorded on the STN of PD patients. The two main findings of this study describe:

- The presence of oscillatory activity in the 300-400 Hz range
- The fact that the amplitude of this high frequency activity depends on the phase of the oscillations in the beta range (15-30 Hz)

Again, in the OFF state the oscillatory activity is mainly characterized by the presence of activity in the beta range (10-30 Hz). Nevertheless, the use of a higher sampling frequency (2000 vs 200 Hz) allowed first, to detect activities in the 300-400 range, and then to detect the presence of two different components in the beta range. One peak within the low-beta band (12-20 Hz), together with a smaller peak in the high –beta band (20-30 Hz). The low-beta peak disappeared or was greatly reduced in the on motor state, whereas the high-beta peak remained at similar power.

Related to the high frequency oscillations, there is also a shift in the central frequency when patients transited from the OFF to the ON state. Together with this shift, there is also a change in the relation between the beta and the high frequency oscillations that characterise the motors state of the patients, thus suggesting the possibility that nonlinear coupling between frequencies may not simply be a

physiological mechanism (as shown previously in humans and animal models) but also may take part in the pathophysiology of bradykinesia and rigidity in PD.

1.3.4 Loss of Consciousness Is Associated with Stabilization of Cortical Activity [1]

Although this last paper is not directly related to PD, it describes an important approach for the aim of the project. In this case, the study presents a stability analysis applied to high-density electrocortigography (ECoG) recordings in primates during the transition between deep anaesthesia and consciousness. ECoG array consists of 128 electrodes and activity is modelled by means of an autoregressive model (AR).

The study shows several results about the relation between consciousness and stability of the system assessed by means of the multivariate AR model.

Indeed, a multivariate AR model could also help us to characterize the oscillatory activity of PD patients, providing us with a more detailed description of the ON and OFF states, and –if possible- a dynamic description of the OFF – to – ON transition

CHAPTER 2: SITUATION AND OBJECTIVES OF THE PROJECT

2. Situation and objectives of the project

For years, the Neurophysiology Group at the CIMA (Centro de Investigación Médica Aplicada) and CUN (Clínica Universidad de Navarra) in Pamplona have been involved in the study and characterization of the oscillatory activity in PD. Using animal models and recordings from PD patients they aim to more deeply understand the role of electrophysiological activity in the pathophysiology of this disease.

They have several publications were they have studied recordings obtained from deep electrodes in PD patients under Deep Brain Stimulation therapy.

In this project we will have the opportunity to access to the local field potentials (LFP) recorded from the stimulation macroelectrodes of the DBS systems implanted in the subthalamic nucleus (STN) of 14 patients with PD.

Although some of the characteristics of this oscillatory activity have already been described, many other remain to be evaluated. In light of the studies showed in the introduction and references therein, we note that in PD studies STN activity is almost exclusively studied by means of univariated or bivariated methods. This fact precludes the possibility of carrying analyses as those proposed in [1], where authors are able to fit an autoregressive model (AR) and thereafter to proceed with a study of the stability of the system, thus providing a deeper description of the state of the parkinsonian brain.

With the aim of obtaining a similar framework for the STN signals, the general objective of this project is devoted to define AR models for the oscillatory activity from PD patients during both states, before and after the effect of the dopaminergic therapy.

Specifically, we will aim at:

- Establishing the suitability of AR models to fit the STN activity
- Define strategies to obtain such AR models
- If possible, provide AR models to describe time-varying characteristics of STN activity when transiting from OFF to ON states.

CHAPTER 3: SOFTWARE

3.Software

All the information that we have is completely anonymous, each of the patients is registered and named following the next procedure: *PDTRXX* being xx the number of the patient. Like this, the register of the patient is completely anonymous.

We have two type of signals from each patient: the first one is shorter and the second one is longer, we are going to study the second one due to it provides us more information. These long signals contain both OFF and ON state and also the transition between them.

3.1 Spike

Spike is a multi-channel continuous data acquisition and analysis package. The signals that we have received from CIMA must be opened with this software. We were given two different types of signals:

- Short Signals: the length of these signals were up to 1000 seconds.
- Long Signals: in this case, they were longer, around 3000 seconds.

An example of the way the signal looks in Spike appears in the figure 1; in this particular case, this was the second patient and it's a short signal.

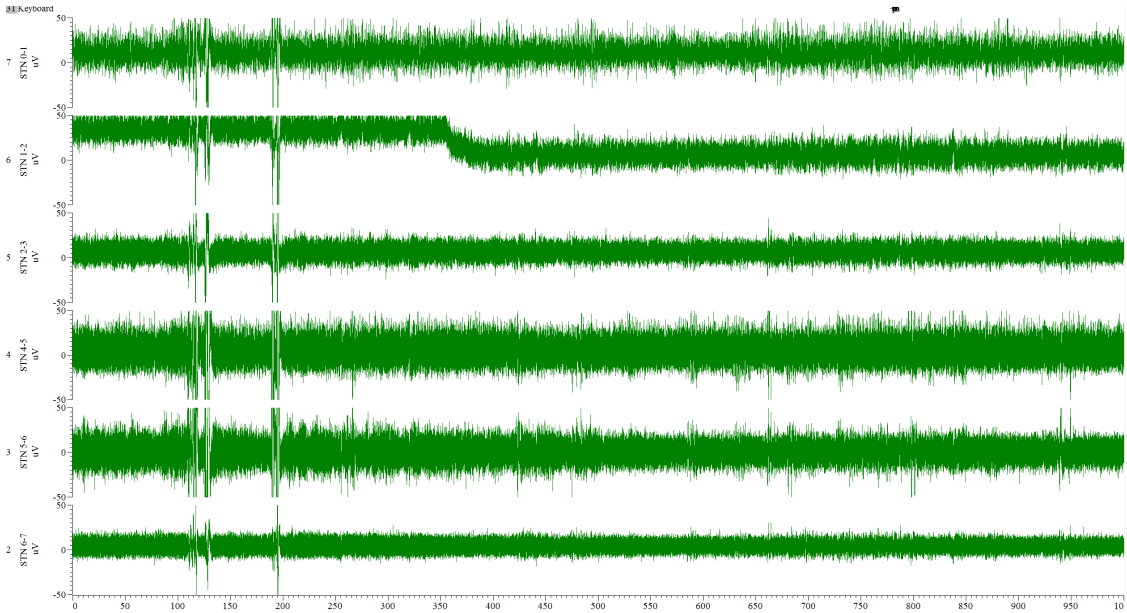


Figure 1: An example of how Spike's software displays the signals. In this case, it's the short signal of the second patient

Each signal, as it can be seen in Figure 1, is composed by 6 channels which are respectively the followings ones:

- STN 0-1: The deepest electrode of the left stimulator
- STN 1-2: The central electrode from the left stimulator

- STN 2-3: The most superficial electrode from the left stimulator
- STN 4-5: The deepest electrode of the right stimulator
- STN 5-6: The central electrode from the right stimulator
- STN 6-7: The most superficial electrode from the right stimulator

Where STN stands for subthalamic nucleus. No matter the length of the signals, both long and short signals have 6 channels and all are named in the same way.

After being used to that software, we have to make 3 cuts of the long signal according to our study. These three zones are:

- ON state
- OFF state
- Transition state

This is one of the critical part of the analysis because we must be very careful in the way we are choosing these shortcuts. The signals we are going to choose; will be the signals we are going to process. Spike helps us to make these cuts with the markers. Thanks to that, it's very easy to divide the long signals in the parts we are interested in. The length of the segments we are making, should be between 200 and 300 seconds. After having made a careful research, we had to admit that the most part of the signals was affected by noise so, the majority of the segments have 200 seconds approximately.

In the following table (table 1), we are going to show the intervals of time that we have chosen for the OFF and ON state in each patient.

		OFF	ON
PDTR	1	Too noisy	Too noisy
PDTR	2	50-250 seconds	2650-2820 seconds
PDTR	3	170-370 seconds	3180-3380 seconds
PDTR	4	230-420 seconds	3380-3350 seconds
PDTR	5	100-300 seconds	1200-1400 seconds
PDTR	6	170-370 seconds	3500-3700 seconds
PDTR	7	555-710 seconds	3160-3345 seconds
PDTR	8	235-435 seconds	4340-4540 seconds
PDTR	9	100-300 seconds	Too noisy
PDTR	10	40-240 seconds	2100-2300 seconds
PDTR	11	310-510 seconds	4240-4440 seconds
PDTR	12	10-210 seconds	3940-4140 seconds
PDTR	13	60-260 seconds	3630-3830 seconds
PDTR	14	Too noisy	Too noisy

Table 1: Extract of the intervals of time chosen for each patient in each state

After watching this table, we assume that we get rid of the signals given by PDTR1 and PDTR14 due to the bad quality of them. We also prefer not to study the state "ON" of the ninth patient because it has resulted impossible to find a period of 200 seconds free of interferences.

Apart from making these shortcuts, according to the quality of the signals, we have made another table in which the segments of time chosen are ordered from the best to the worst value (being the first one, the segment with less interferences has and the last one, the segment with more). It's shown in Table 2.

		QUALITY OF SIGNALS
PDTR	6	Best
PDTR	7	
PDTR	11	
PDTR	13	
PDTR	5	
PDTR	3	
PDTR	4	
PDTR	10	
PDTR	8	
PDTR	2	
PDTR	12	
PDTR	9	
PDTR	1	
PDTR	14	Worst

Table 2: The best and worst signals ordered by their quality

3.1.1 Power Spectral Density Function

Power Spectral Density is a measure of the intensity of a signal's power in the frequency domain. In the practice, PSD is computed from the FFT spectrum of a signal. The Power Spectral Density is a useful way to be able to characterize the amplitude in a frequency axis.

	Off	On
PDTR-2	PowerSpectrumPDTR-2-OFF	PowerSpectrumPDTR2-L-ON
PDTR-3	PowerSpectrumPDTR-3-OFF	PowerSpectrumPDTR-3-L-ON
PDTR-4	PowerSpectrumPDTR-4-OFF	PowerSpectrumPDTR4-L-ON
PDTR-5	PowerSpectrumPDTR-5-OFF	PowerSpectrumPDTR-5-L-ON
PDTR-6	PowerSpectrumPDTR-6-OFF	PowerSpectrumPDTR-6-L-ON
PDTR-7	PowerSpectrumPDTR7-L-OFF	PowerSpectrumPDTR7-L-ON
PDTR-8	PowerSpectrumPDTR8-L-OFF	PowerSpectrumPDTR8-L-ON
PDTR-9	PowerSpectrumPDTR-9-OFF	PowerSpectrumPDTR9-L-ON
PDTR-10	PowerSpectrumPDTR-10-OFF	PowerSpectrumPDTR10-L-ON
PDTR-11	PowerSpectrumPDT11-L-OFF	PowerSpectrumPDTR11-L-ON
PDTR-12	PowerSpectrumPDTR13-L-OFF	PowerSpectrumPDTR13-L-ON
PDTR-13	PowerSpectrumPDTR13-L-OFF	PowerSpectrumPDTR13-L-ON

Table 3: Name of the files for the power density function in Spike's software

Spike is a good software to revise the signals and also for making the firsts preliminary analysis. In CIMA, they use it because Spike is the software that controls the ADC converter.

After taking into consideration which are the best signals, we know that Spike makes the power spectrum of the signals thanks to a function that implements it. So, we have applied that function and we have made a database in Spike in which we have saved the power spectrum of each patient and each state (table 3). We only had to choose the type of window and the size of FFT (in our case Hanning and 4096 respectively).

An example of the way Spike displays the Power Density Spectrum of our signal is shown in Figure 2. The units are uV^{-2} and Hertz in y and x axis respectively.

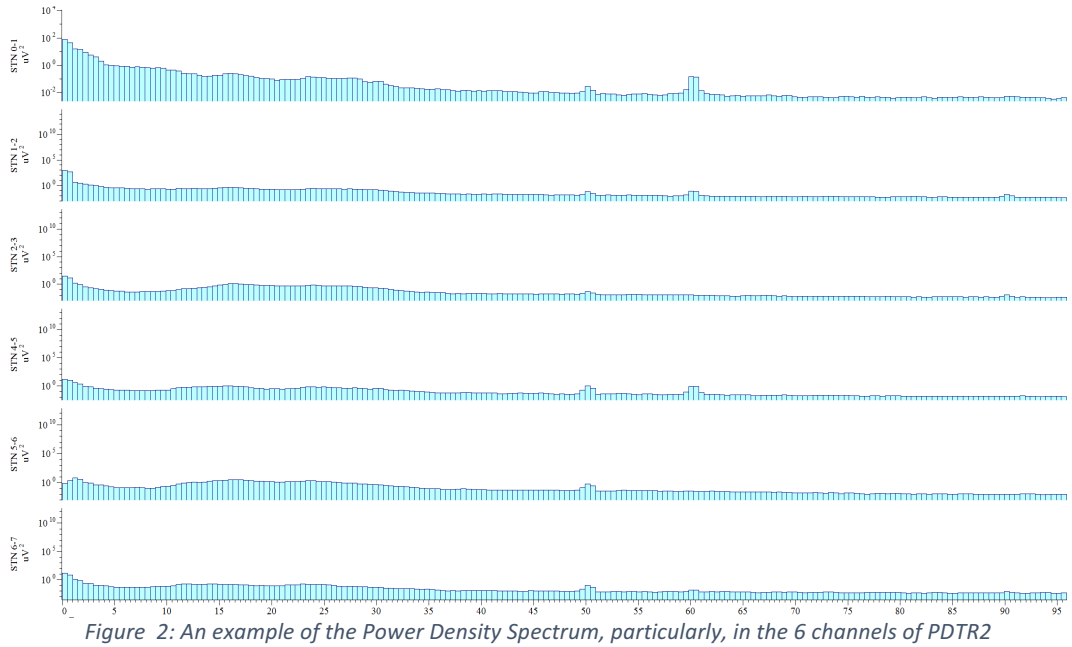


Figure 2: An example of the Power Density Spectrum, particularly, in the 6 channels of PDTR2

Spike displays it as a histogram, but you can change it if you want. In figure 2, I have printed only frequencies from 0 to 95 Hz because we are interested in studying this range of frequencies.

Another point that we appreciate after computing Power Spectrum Density, is that signals are polluted with mains interference noise in the following frequencies:

- 50 Hz
- 100 Hz
- 150 Hz

As we are trying to deliver an autoregressive model, we have to look into our signals to see if the peaks in 50, 100 and 150 Hz are really important in amplitude according to the rest of the signal. I have prepared an appendix (Appendix 1) in which I have displayed all the amplitudes of the signal in 50,100 and 150 Hz to see if it could affect our signals or not. This is something very important because it can rise up the order of the AR model.

3.2 Matlab Software

Our intention is to manipulate the signals. So, instead of using the software I've just mentioned, the Spike's 7.07 v2 software, we thought that Matlab could help us better in order to make a better analysis of the signal.

The first step now was exporting all the signals to Matlab so that we can analyse them in that software. Thanks to Spike, it was a straightforward step due to I have marked the signals with the cursors before. There's an option in Spike2 7.07 for which you can export the number of channels that you are interested in. In our case, as we need all the channels we will select the option "All channels" that appears in the Figure 3.

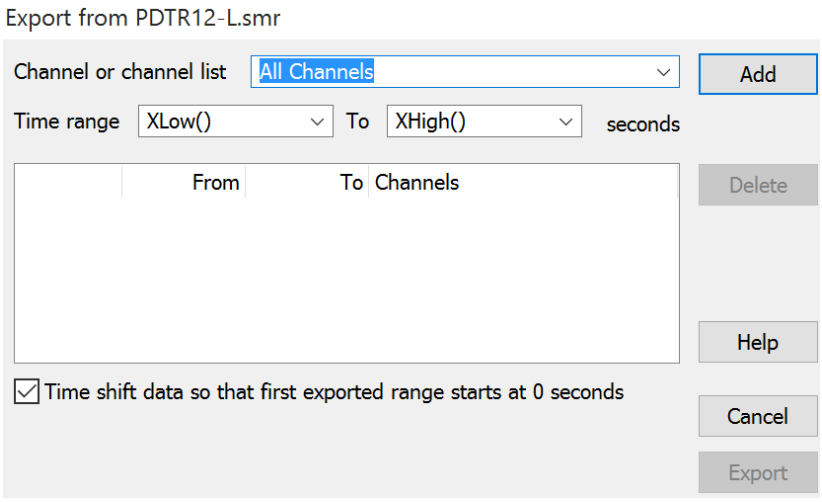


Figure 3: Displays how we add the channels we want to export in Spike's software

There's also an option for selecting the time range for the user. In our situation, as it has been mentioned previously, signals have been marked with the cursors, so in each signal we will use:

- Time range from Cursor1 to Cursor2 for "OFF" state.
- Time range from Cursor3 to Cursor4 for "ON" state.
- Time range from Cursor5 to Cursor6 for "Transition" state.

Once we have created the new folder with all the ".mat" files, now we have to plot the information we get in Matlab with the aim of comparing it with Spike 2 7.07 to see if the results are corroborated.

3.2.1 Pwelch tool

The process of the application of the Power Spectral Density is not as easy as it was in Spike. In this case, we will make use of the "Pwelch" tool provided by Matlab.

3.2.1.1 How Pwelch works?

"pwelch.m" function estimates the Power Density Function of a given signal using Welch's for estimating the periodogram. The syntax we use is the following one:

$$[pxx, f] = pwelch(x, window, noverlap, nfft, fs)$$

The signal we are going to analyse, in the example case "x", is divided in "k" sections which have Nfft points that can be overlapped. "k" is calculated with these parameters:

- m: the length of x.
- n: number of points overlapped.
- l=Nfft: length of each section

$$k = \frac{m - n}{l}$$

We apply the specific window to each section of the "x" signal. The spectrum of each section is calculated based on FFT. After these calculations, we get the average of the squared magnitude spectrum which is multiplied by the inverse of the sampling frequency to obtain the PDS.

3.2.1.2 Pwelch parameters

- Values of the signal: in each channel I had to add to the name of the variable ".values" with the intention to get the values that Pwelch needs.
- Type of window: hanning
- Overlap: 75 % of the length

- FFT size: 4096
- Sample frequency: It was the same in every patient, around 2,000 Hz.

After doing that, we saw that the results obtained with Matlab were similar to the ones got by Spike2 7.07 so we carry on with our analysis. Figure 5 shows the Power Density Function of the channel 6-7 for the patient 2 in Matlab and the Figure 6 shows the Power Density Function of the same channel and same patient calculated with Spike's Software.

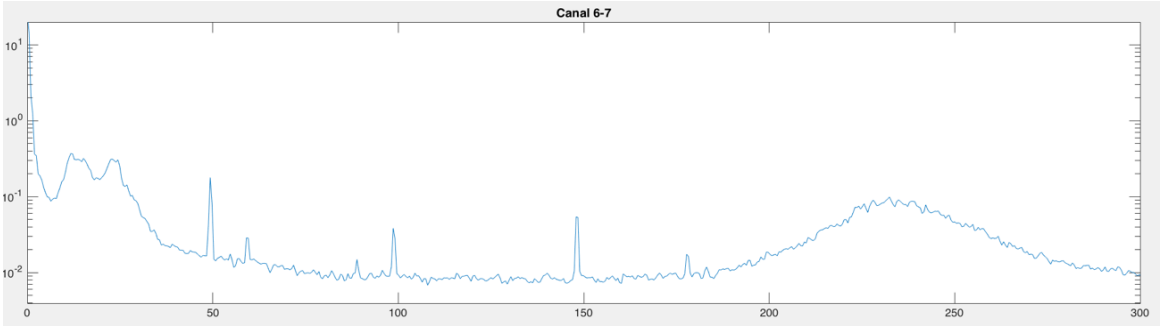


Figure 5: Power Density Function calculated with Pwelch in Matlab Software

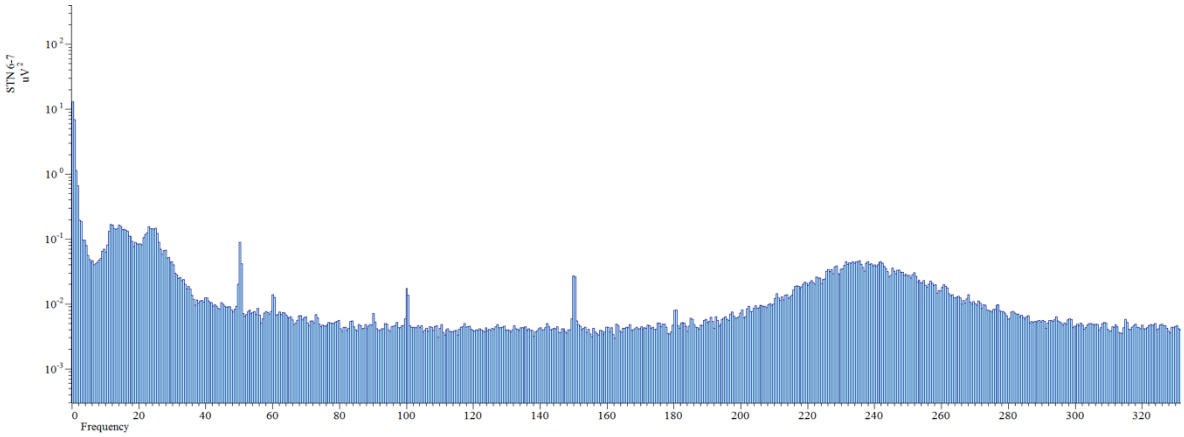


Figure 6: Power Density Function calculated in Spike Software

It's very important to say that in 50 Hz ,100 Hz and in 150 Hz we have interferences that can be seen in the Power Density Function calculated by Matlab or Spike. As we are trying to implement an AR model, these frequencies can alter the AR order. In the following chapters, we will filter the signal in order to have it the cleanest we can.

Apart from the mains interferences, in both figures 5 and 6 we can see the following components:

- Low Beta component: from 12 Hz to 20 Hz.
- High Beta component: from 20 Hz to 30 Hz.
- Theta component: around 250 Hz.

Low Beta in the ON state has a decrease in amplitude and the Theta component, in certain cases, suffers from a movement in frequency. However, High Beta keeps at the same frequency with approximately the same amplitude regardless of the state.

Of course, as well as exporting the intervals of time in which we are interested in, we have exported the whole signal in case we need it for the future.

3.3 AR model

3.3.1 Introduction

AR model is the most popular model for spectral estimation of temporal series. This is due to the fact that AR parameters can be found resolving linear equations. For a detailed estimation of ARMA's parameters or MA's parameters, we will need to resolve a group of equations which are not linear.

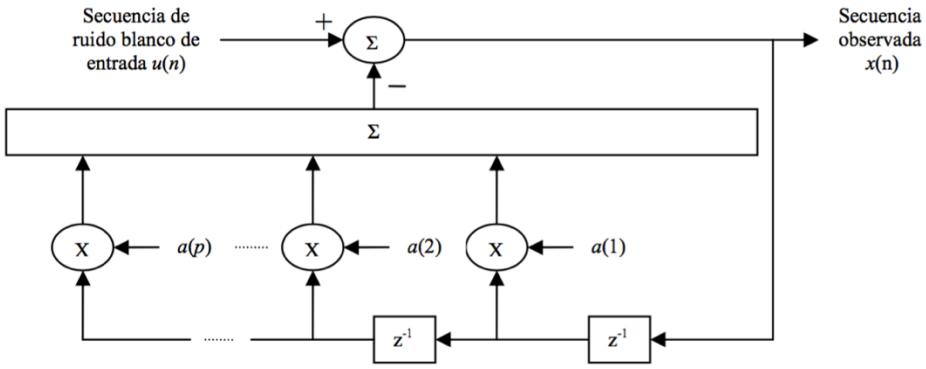


Figure 7: Autoregressive model of a random process

The autoregressive model explains that the output variable depends linearly on its own previous values. At the input, we have a sequence of white noise due to the fact that its average is zero and its variance is σ_u^2. Of course, the Power Density Function of the noise is σ_u^2. Spectral estimators got in an AR model are less biased and have a lower variability that conventional spectral estimators based on Fourier transform. This model is used to be named as All-Poles. In the figure 7 appears an AR process.

As there are only poles in this model, and knowing that A(z) is the characteristic polynomic of the AR model. The PDS is:

$$P_{xx}^{AR}(f) = \frac{\sigma_u^2}{|A(f)|^2}$$

3.3.3 ARFIT- A Matlab Package

In order to work with the autoregressive model, we will make use of this package designed by Tapio Schneider and Arnold Neumaier [9].

ARFIT is a collection of Matlab modules for modelling and analysing multivariate time series with autoregressive (AR) models. ARFIT contains modules for fitting AR

models to given time series data, for analyzing eigenmodes of a fitted model, and for simulating AR processes.

ARFIT estimates the parameters of AR models from given time series data with a stepwise least squares algorithm that is computationally efficient, in particular when the data are high-dimensional. ARFIT modules construct approximate confidence intervals for the estimated parameters and compute statistics with which the adequacy of a fitted model can be assessed.

Dynamical characteristics of the modelled time series can be examined by means of a decomposition of a fitted AR model into eigenmodes and associated oscillation periods, damping times, and excitations. The ARFIT module that performs the eigen decomposition of a fitted model also constructs approximate confidence intervals for the eigenmodes and their oscillation periods and damping times

3.3.3.1 Frequencies of interest

For our case, the components we need to get with AR model are Low Beta and High Beta. In the OFF state, as it can be seen in the figure 8, Low Beta and High Beta components are completely visible.

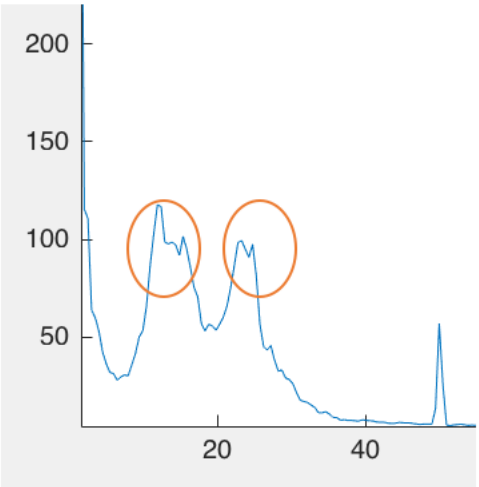


Figure 8: Low Beta and High Beta Components in the Patient 2 OFF state

However, in the ON state, Low Beta component suffers from an important decrease in amplitude. Beta component remains practically in the same frequency with its same amplitude. In the Figure 9 it can bee seen how the Low Beta component decreases and the High Beta component remains without changes.

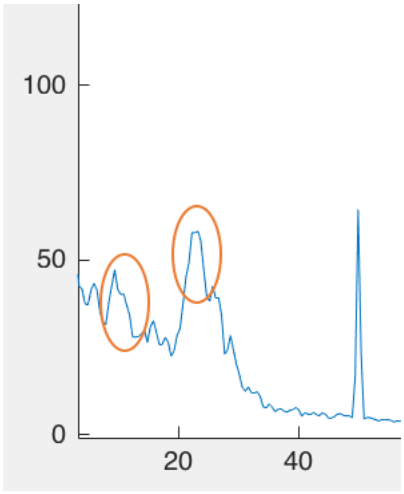


Figure 9: Low Beta and High Beta component in the Patient 2 ON state

3.3.3.2 Election of AR order

Establishing a correct AR order is one of the critical parts of our work. We have made an important research on Internet about the way scientists make a criterion for setting the order. This took us by surprise, because in the totality of the bibliography we have read none of the writers uses Power Density Function of the signals to obtain a good AR order.

3.3.3.2.1 Signals have to be very carefully cleaned

One of the problems of the signal which has been previously cited before is the interferences that exist in our signals. In the following chapters there's an exhaustive study of the way we can improve the quality of our signals: filtering, decimating…

This is a part of the work that requires to be studied thoroughly because ARFIT package is going to reproduce the most important peaks of our signals. If these peaks are the noise interferences, ARFIT will never reproduce our components of interest (Low Beta and High Beta).

For having our signals cleaned enough we have decided to filter the signal with slots in the frequencies which are polluted by interferences from mains. Also we thought that it could be a good idea to implement a low pass filter to avoid the High Frequency component. We are mainly interested in the Low Beta and High Beta component and, as these frequencies appears between 10-30 Hz a Low pass filter with a cut off frequency among 50 Hz won't eliminate our components.

3.3.3.2.2 Comparison between PSD of the signal and PDS of the components obtained by ARFIT package.

Our study of the best AR order is based on a comparison between the Power Density function of the reconstruction of the Low Beta and High Beta component obtained

thanks to ARFIT package and the Power Density Function of the original signal estimated through a Welch periodogram.

First of all, we get the coefficients thanks to ARFIT package and we insert them in the A vector. In this case, we are going to use the tool "freqz" which returns the n-point frequency response vector Y, and the corresponding angular frequency vector, W, for the digital filter with numerator and denominator polynomial coefficients stored in b and a, respectively. As this reconstruction has only poles, the parameters of the "freqz" are: a=vector A.

```
[Y,W]=freqz(1,A,Nfft);
fn = fs*(W/(2*pi));
yn = ((Y.^2)/(sum(Y)))*(1/sqrt(Nfft));
semilogx(fn,10*log10(yn));
```

Figure 10: How we get the components of the ARFIT package and we compare it with the original Power Density Function of the signal

After that, we have to normalize the values which have been got by "freqz". In the following two equations, is explained how we make this normalization.

$$Normalized\ Frequency = \frac{fs\ x\ W}{2\pi}$$

$$Normalized\ Values = \frac{Y^2}{\sum Y} x \frac{1}{\sqrt{Nfft}}$$

After all, we use a semi logarithm axis to plot the values and with a "hold on" we make the comparison with the Power Density Function of the original signal.

3.3.3.4 High Dimensional Time Series

We know that this package is computationally efficient in particular when time series are high dimensional. However, in our case, we were very careful using ARFIT because as our database is not as high dimensional as the ones that have used it, we had in mind that it cannot work properly. But then, after using it, we saw that the results were good enough.

CHAPTER 4: Adaptation of the signal for a proper AR analysis

4. Adaptation of the signal for a proper AR analysis

The effort of making a cleaner signal is truly beneficial for our study because the cleaner the signals become, the lower the ARFIT order is.

4.1 Slot Filter to eliminate mains interferences

As I have cited before in Spike2 7.07 and in the last chapter there are mains interferences that we have to get rid of. These interferences can really alter the AR-order of the model, making it increase. As a consequence of that, we thought that filtering the signal with slots can be beneficial to our study.

To design the filter, we have to be cautious because in the Theta range we have an interference but we also have a frequency component, so firstly; we have to check

- Interferences in:
  - 50 Hz
  - 150 Hz
  - 250 Hz

And then, be aware of the existence of the Theta range. For that, we have searched among the patients to see in how many of them there are interferences in 50 ,150 and 250 and also have the component theta visible in its periodogram. This information is available in the Appendix 2. Thanks to this study, we are able to filter the signal properly without polluting it. We have designed 3 different filters.

4.1.1 Real Slot filter

This was the filter we started with. We thought that it was a good idea to make a Notch real filter with slots in the components we want to delete. We put slots in the following frequencies:

- 0 Hz
- 50 Hz
- 100 Hz
- 150 Hz
- 200 Hz
- 250 Hz

The poles we use had a radius near from the circle unit but never bigger than it. Approximating our ratio to the unit circle we make our slot narrower. In the Figure 11 it is printed how the Slot Real Filter looks in frequency in magnitude.

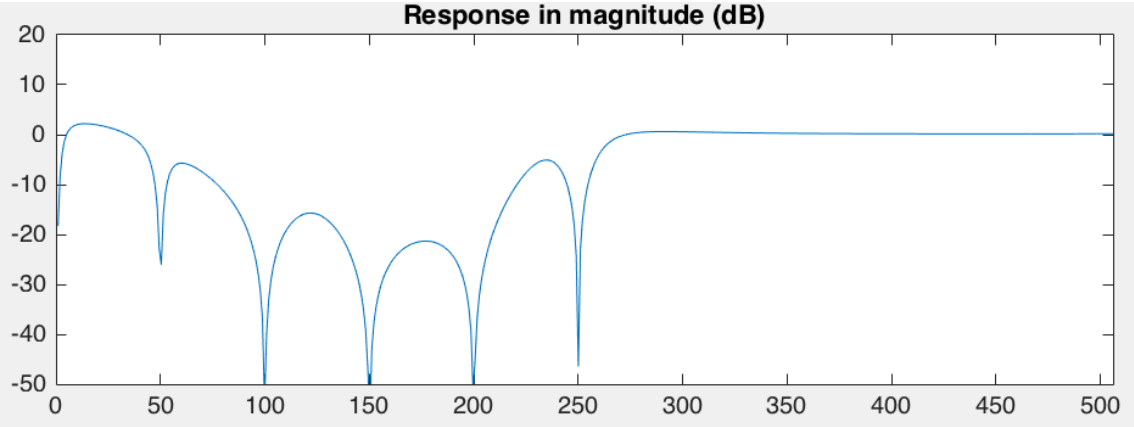


Figure 11: Response in magnitude Slot Real Filter

As we can see, slots are correctly situated on the frequencies we want to get rid of. The phase is printed in the Figure 12.

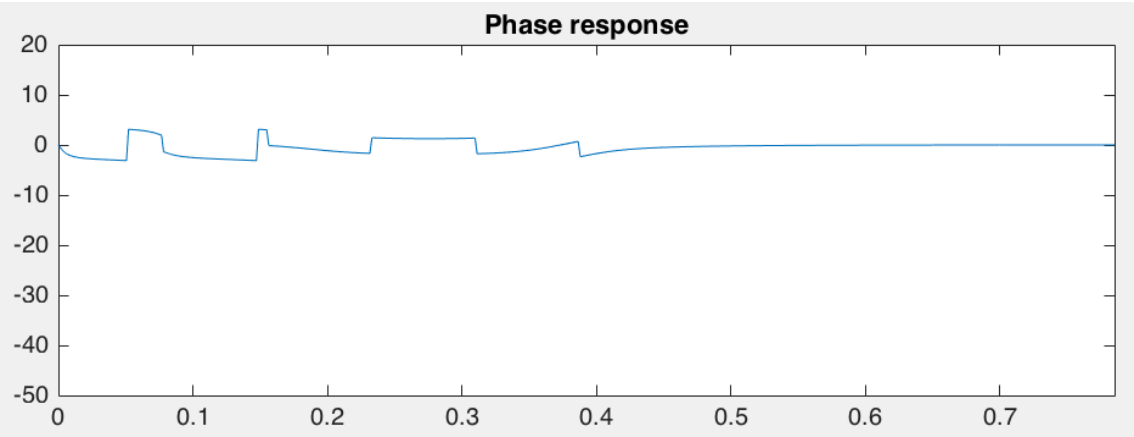


Figure 12: Phase response of the Slot Real Filter

We can appreciate that these changes appear just when there is a slot. However, these changes are not very important in our signal and won't affect the phase of the signal of our Parkinson Patients Signals.

4.1.2 Ideal Slot Filter

The second filter we have designed was an ideal filter. Looking into Internet we found that in Matlab exists a function which provides the user the possibility of creating an ideal notch filter.

At first, we thought that applying this function will sort out all our problems in terms of filtering. In the figure 13 it's printed the magnitude in dB's and in figure 14 its correspondent phase.

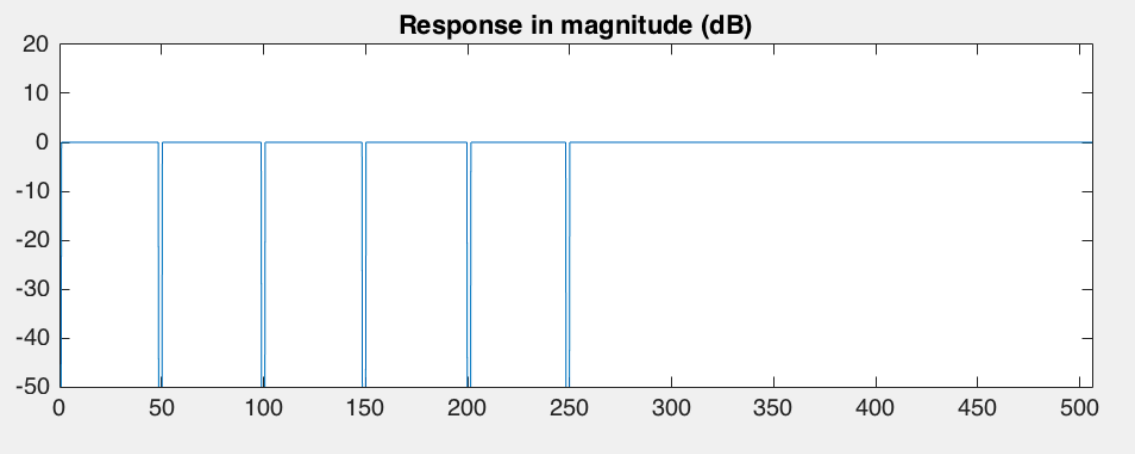


Figure 13: Response in magnitude of the Slot Ideal Filter

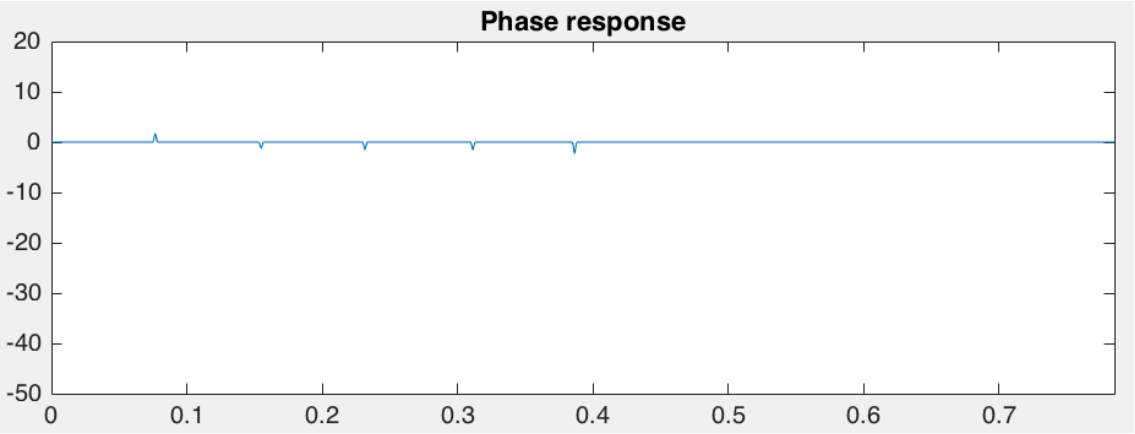


Figure 14: Phase response of the Slot Ideal Filter

In this case, slots are perfectly designed with a high slope and are well situated in the frequencies we want to eliminate. As we are using an ideal filter given by Matlab, the changes in the phase are almost insignificant.

4.1.3 Real or Ideal in terms of decreasing AR order

Comparing both filters, we have to say that the best filter to eliminate the frequencies is the ideal filter. It also doesn't have any effect in the phase of the signal. However, it is not our unique intention to eliminate the frequencies, we want to reduce the order of our AR model.

If we use the ideal slots, the slopes are practically vertical and the AR order will waste too many poles trying to reproduce this slope. As a consequence of this, we have chosen that the best slots are the Real Slots.

4.2 Low Pass Filter: Two functions

As it has been explained before, our frequencies of interest are Low Beta and High Beta, in this research we are not going to study the evolution of the Theta component between the OFF and ON state.

As a consequence of that, we thought that for making our signal even cleaner, we can apply a Low Pass filter (as it was suggested in the point 2.2.3.3.2.1) for getting rid of the high frequency. As our components are between 10-30 Hz approximately, we use a low pass filter with a cut frequency of 50 Hz.

For the design of a Low Pass filter we have considered two different types:

- Chebysev filter
- Butterworth filter

Of course, we ruled out the possibility of using an ideal Low Pass filter because we will have the same problems as we had with the ideal slots.

Other of the necessities of using this Low Pass filter is because as we will explain in the following chapters, we are going to reduce the sampling frequency. In other words, we are going to decimate the signal. This filter will avoid the aliasing created by the process of decimation. If there isn't a filter before the process of decimating the signal, the result will be completely polluted by the effect of aliasing.

4.2.1 Real Slots Filter and Butterworth filter

Of course, as we have just mentioned, in this part we are implementing a Butterworth Low Pass filter. It has to be said that, as our Butterworth filter has a cut off frequency at about 50 Hz we can get rid of the following harmonics:

- 100 Hz
- 150 Hz
- 200 Hz
- 250 Hz

We are only going to keep the slot corresponding to 50 Hz because it's the only frequency the filter doesn't eliminate. In the Figure 15 is the response in magnitude and in the Figure 16 is the phase response. The order of the Butterworth Filter is 6.

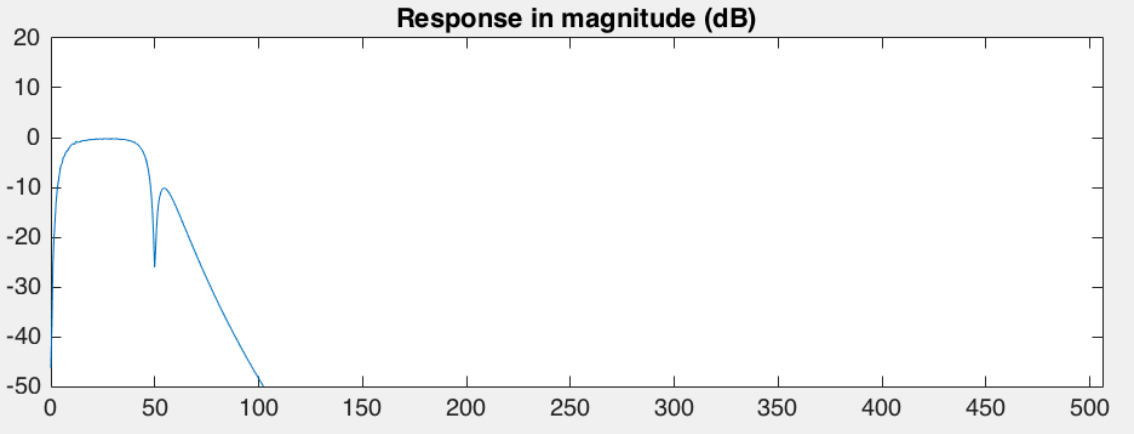


Figure 15: Response in magnitude of The Butterworth Filter with a real slot in 50 Hz

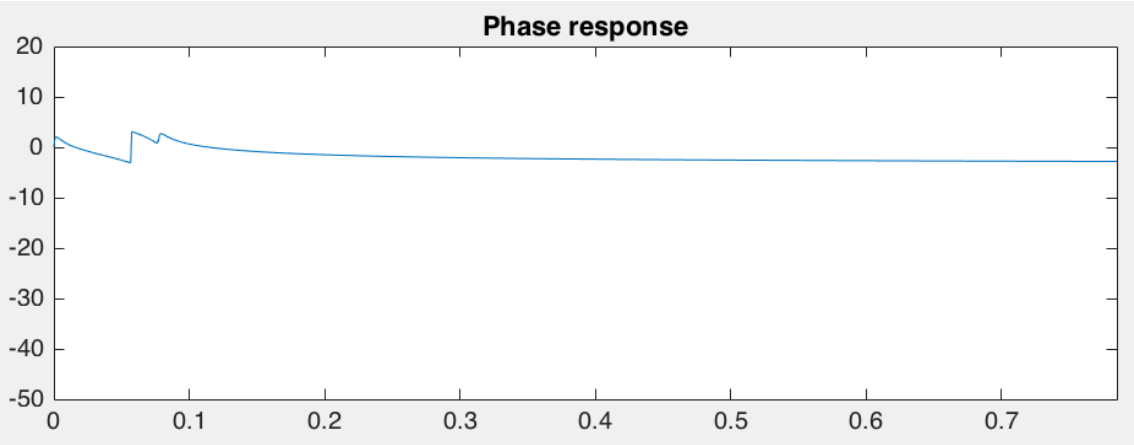


Figure 16: Phase response of the Butterworth Filter with a real slot in 50 H

4.2.1.1 Designing of the 50 Hz Slot

One of the main problems we have had designing filters is that we have a mains interference in 50 Hz. It appears in the majority of our signals and it's very important to get rid of it for AR analysis. This peak, in fact, can alter AR order totally, so, we have to design a slot there very cautiously.

4.2.1.1.1 Real Slot

As we have mentioned before, we have to design a real slot. We'll do it putting a zero in the frequency we want to eliminate (f=50 Hz and also in f=0 Hz). In the figure 17 can be seen how we are putting zero's in the frequencies of interest and also we are putting poles in these frequencies to make the slots narrower.

```
rp = 0.985;
rz = 0.999;
A0 = [1 -2*rp rp^2];
B0 = [1 -2*rz rz^2];
A1 = [1 -2*rp*cos(Wi) rp^2];
B1 = [1 -2*rz*cos(Wi) rz^2];

[B_b,A_b]=butter(6,Wc);

B = conv(B0,B1);
A = conv(A0,A1);

B_f = conv(B,B_b);
A_f = conv(A,A_b);

[H,F] = freqz(B_f,A_f,N,'whole',fs);
```

Figure 17: The code in Matlab for designing this Butterworth filter with 2 real slots in 0 and 50 Hz.

The fact of using poles for making narrower the slot is something particularly critical because if we use a slot which is very narrow, it could be harmful for our design. We have to make an agreement between the narrowness of the slot and the elimination of the frequency.

For an adequate design of the filter we are going to change the radius of the zeros to see which wants is better for our situation. We are going to take one of the signals, we'll put it in a filter and finally we'll compute the power density function to compare the input and the output of the signal.

Apart from that, we have also normalized the frequency and the values got by periodogram with the aim of having both signals (input and output) in the same level. The commands we use for normalizing the signal are the followings ones:

```
[pvalues3,wval] = pwelch(values3,window,overlap,Nfft);
```

$$Normalized\ Frequency = \frac{Fs\ x\ wval}{2\pi}$$

$$Normalized\ Values = \frac{pvalues3^2}{\sum pvalues3} x \frac{1}{\sqrt{Nfft}}$$

We have studied 3 different radiuses and the Figures 18, 19, 20 are taken for the patient two from its STN 5-6 channel.

- Rz=0.895

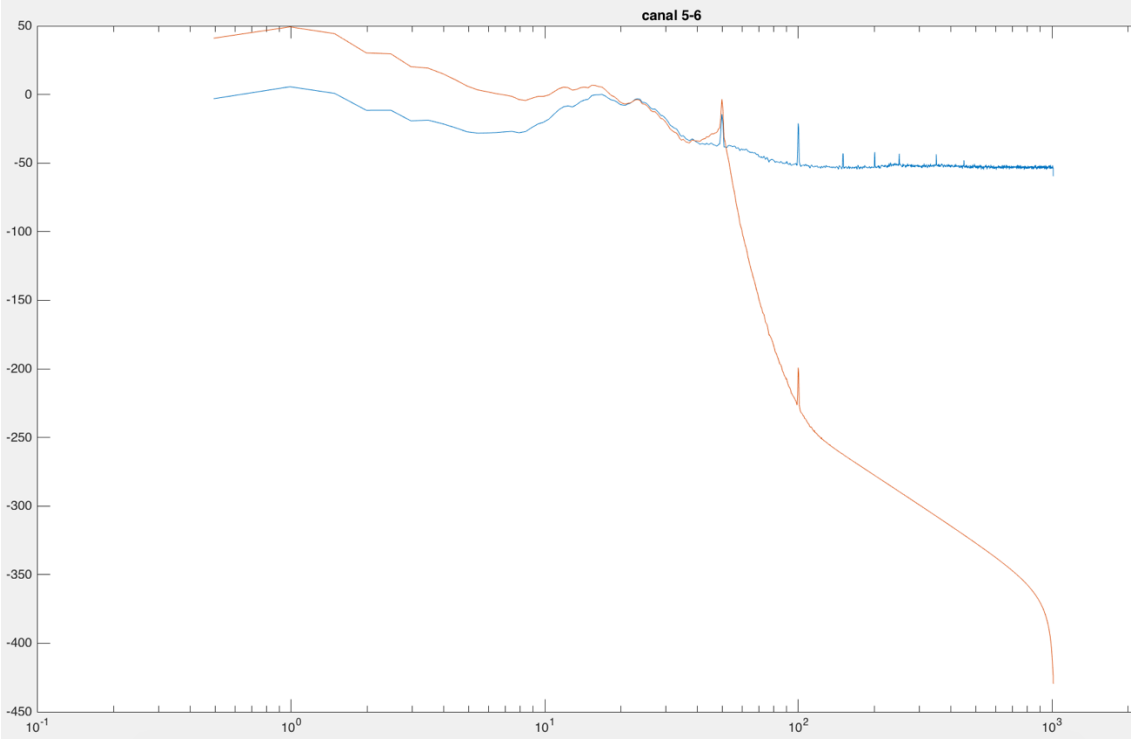


Figure 18: Butterworth filter with Rz = 0.895

In this first case, it appears in the Figure 18. It can be seen that the output signals (orange one) differs from the input signal (blue one) at the beginning until the High Beta component.

We need to have a high range of similarity between input and output signal because when we try to make the reconstruction of the signal with the ARFIT package if the output from the filter differs from the input, the reconstruction will be wrong.

- Rz=0.999

The second study has a 0.999 radius for the zero located in 50 Hz. This is supposed to be the best parameter because, as it is near unit circle, it only modifies the frequency we are interested in. Also, as it's real it will not rise up so much our p order when we apply an AR model.

We make the same process as the previous one, we are going to make a comparison between the input and output signal. It appears in the Figure 19.

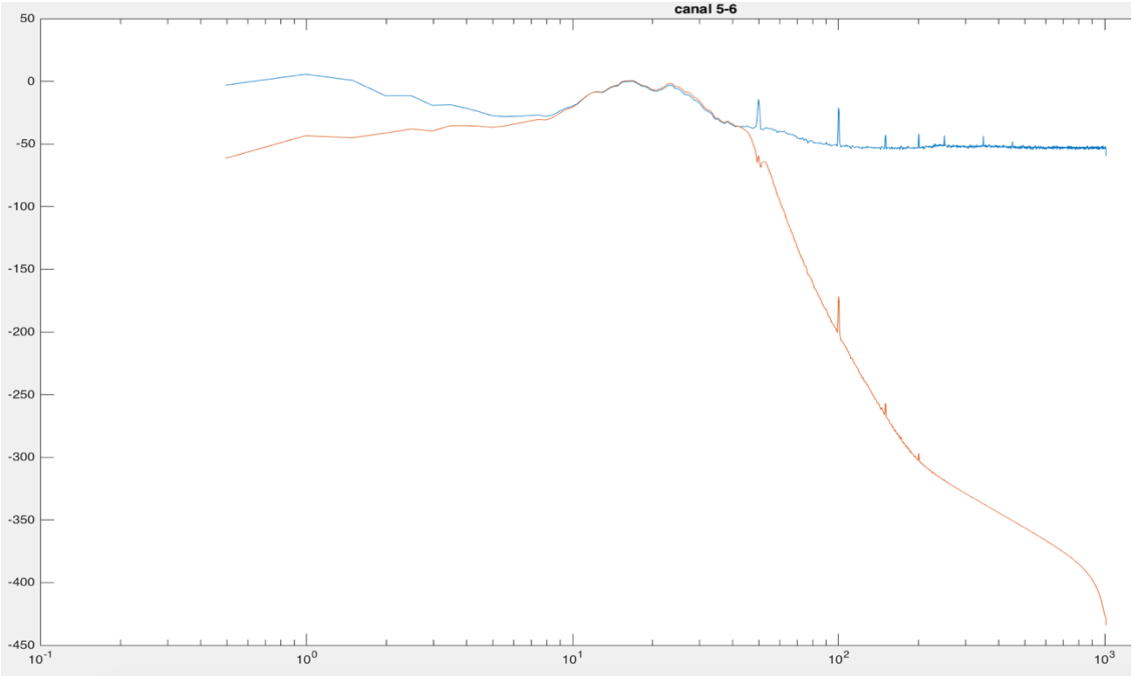


Figure 19: Butterworth filter with Rz = 0.999

As we have predicted, this is the best parameter because the input and output are almost the same in the interval of the Low Beta and High Beta.

- Rz=1,2

We also make the proof of putting a radius bigger than 1 to see if it was a good approximation. In the figure 12 it's printed how it looks. It doesn't even eliminate the component in 50 Hz.

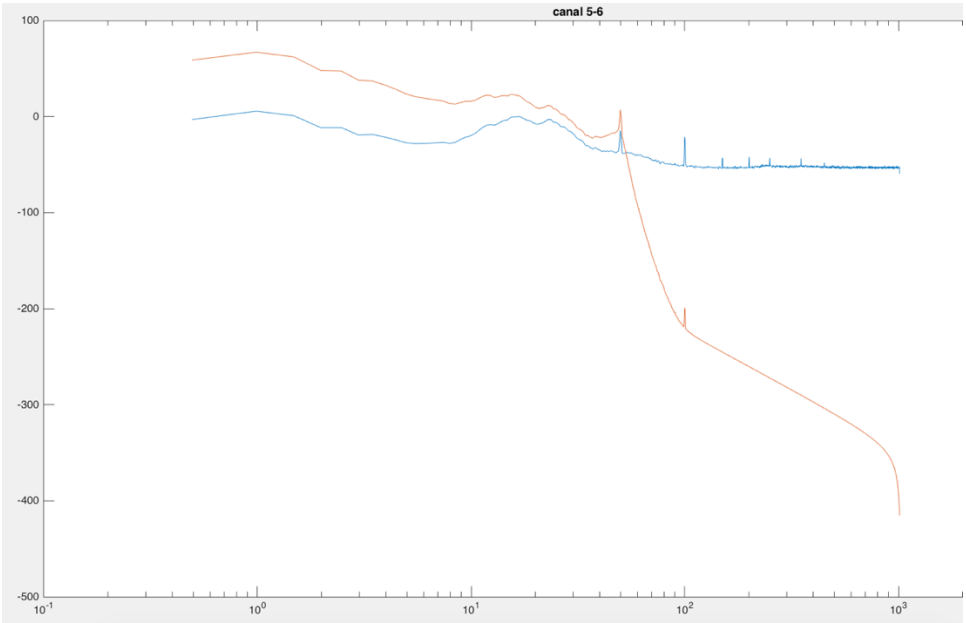


Figure 20: Butterworth filter with Rz = 1.2

It's obvious that the best slot of the three we have designed is the second one because it rejects the frequency in 50 and it doesn't make a huge slope, so, AR model will be able to cope with this slot. Besides, the approximation is almost perfect, the filter doesn't introduce any distortion in magnitude in the frequency band pass. We have to add that the radius of the zeros doesn't interfere in the stability of the system.

4.2.2 Real Slots Filter and Chebyshev filter

We wanted to have another type of filter in order to compare which one let us use an AR model with a lower p order. At first, we thought that Chebyshev's filters will be useless due to the fact that the slope of a Chebyshev filter is higher than in Butterworth for the same order of the filter. However, we designed one to see how it worked.

We designed the filter with a 6^{th} order and with a peak to peak passband ripple of 0.5 dB. In the Figure 21 it's shown the Magnitude response in dB's and in the Figure 22 response in phase.

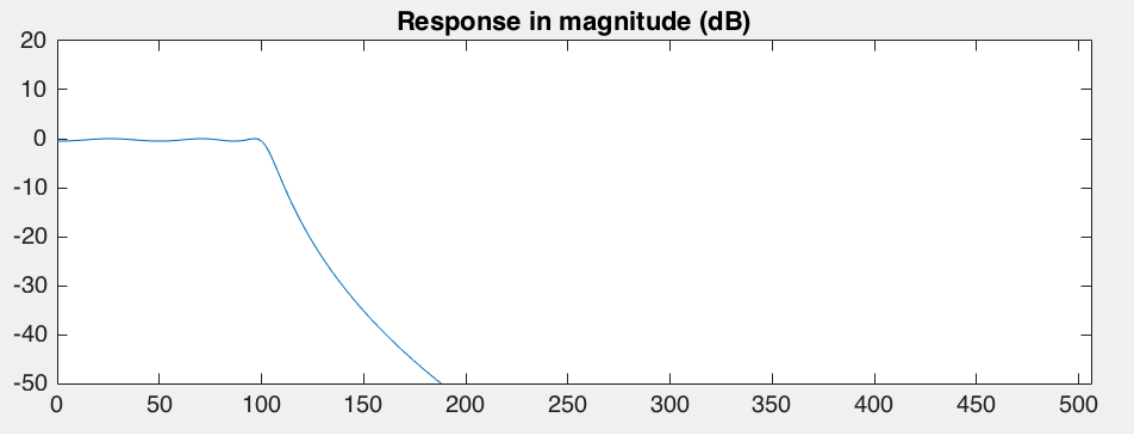


Figure 21: Response in magnitude of a Chebyshev Filter with order 6 and fcut=50 Hz

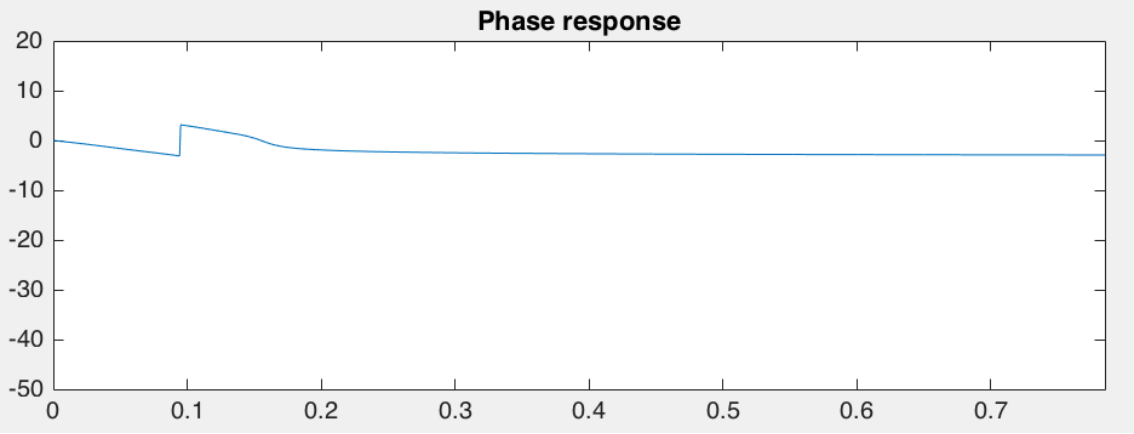


Figure 22: Phase response of a Chebyshev Filer with order 6 and fcut =50

We have followed the same process to evaluate which is the best radius to reject the frequency of 50 Hz. Of course, in this case we only study the case of real slots because the ideal slot as we have cited before will be harmful for our AR analysis.

Identically as in the previous case, we have studied 3 different radius and the Figures 23, 24, 25 are taken for the patient two from its STN 5-6 channel.

- Rz = 0.895

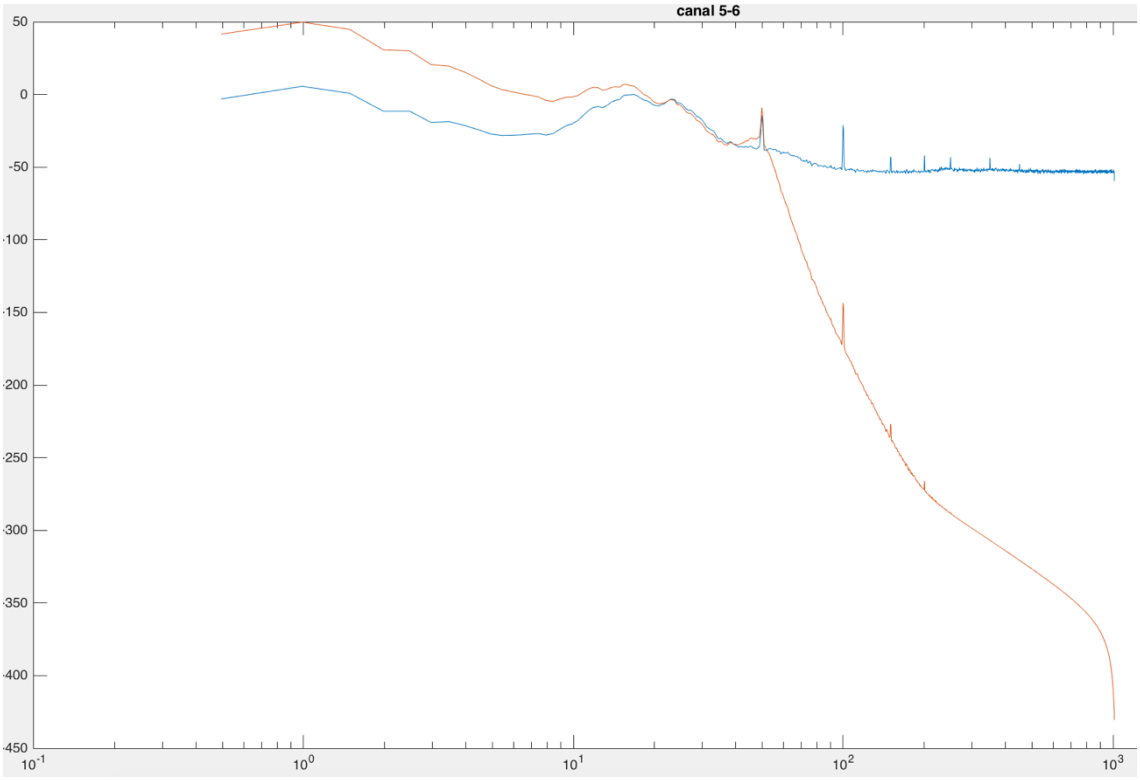


Figure 23: Chebyshev filter with Rz = 0.895

In the Figure 23, it can be seen that input and output signals are not very similar and also the filter doesn't reject the noise interference in 50 Hz.

- Rz = 0.999

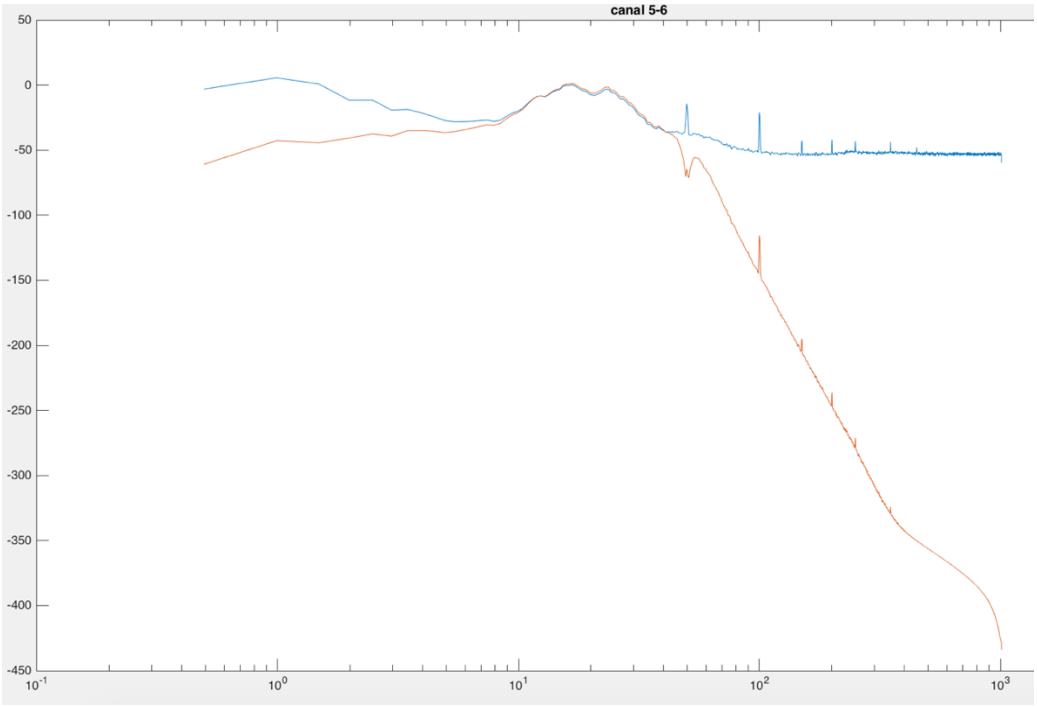


Figure 24: Chebyshev filter with Rz = 0.999

In this case, input and output signals are practically the same and also it rejects perfectly the 50 Hz frequency with a real slot which has not a high slope.

- Rz = 1.2

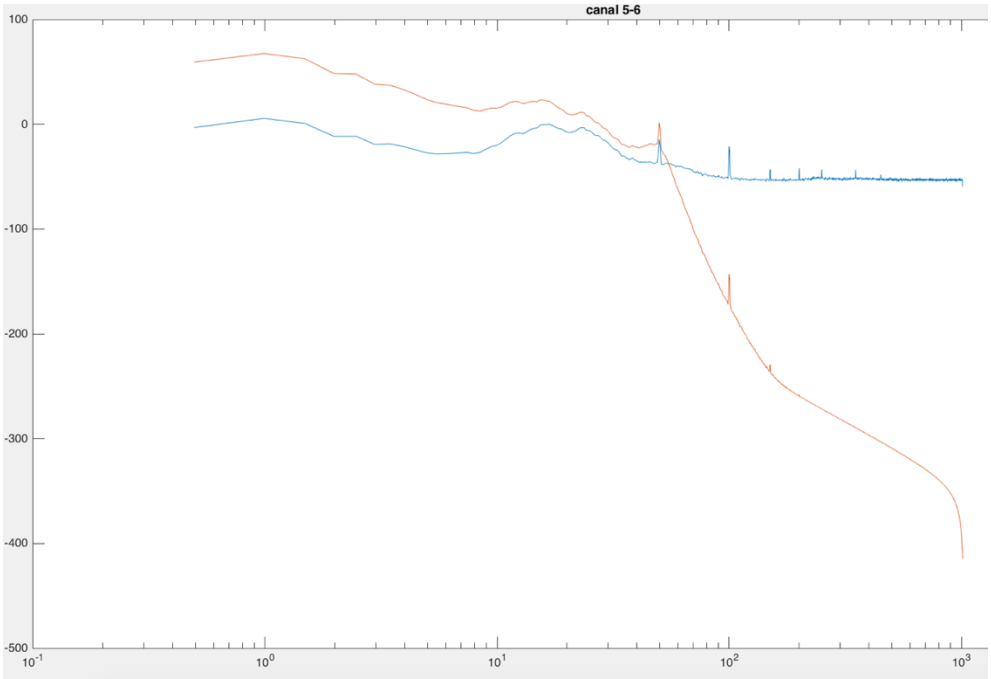


Figure 25: Chebyshev filter with Rz = 1.2

In the figure 25 nor the input and output are equal neither the filter rejects the frequency of 50 Hz. We have to say that this radius is not a good one for our design.

As it can be seen, we have to use Rz= 0.999 because this is the only one which gets rid of 50 Hz frequency and also reproduces the input signal almost in an ideal way.

All the filters have been designed as a Matlab function with the intention of having a cleaner code due to the fact that parameters can be added directly for not doing the same loop again and again.

4.3 Butterworth or Chebyshev

Of course, we have to be sure in which filter we are interested to work with. Undoubtedly, the best parameters to both filters are using a Rz= 0.999 as we have seen in the last figures.

With the aim of choosing which was the best filter for our analysis we have made a correlation of the output signal in Butterworth filter and in Chebyshev filter with the input. We appreciate that this percentage was almost equal in both cases with a percentage of 82,14 % for Butterworth and 82,22 % for Chebyshev.

The following step was trying to put the filtered signal into an AR model to see how it works. In the following figure, it's shown what we are explaining:

Figure 26: Diagram which shows the filter and then the ARFIT

When we have done this, we realize that Butterworth filter worked better than Chebyshev filter due to the verticality of the rejection slope. So, in the following sections, when we talk about filters, it's taken for granted that we are using the Butterworth filter.

We have to highlight that each one of the filters which have been designed was implemented with a function so that we can apply this function and not to copy again and again the same code.

4.4 Frequencies of interest

We are going to search into our database to locate the exact position of Low Beta frequency, High Beta frequency and Theta frequency. Thanks to that, we will know exactly where are located those frequencies and their amplitude. Apart from that, we are going to look into signals that have Theta component for knowing in how many of them this component is visible.

This study is in the Appendix 3 in which says that theta component appears in the 34 % of the signals (taking into account that it appears in both ON and OFF state). Regardless the appearance in both states, theta component is present in the 40 % signals of our entire database.

Due to the fact that our filter is going to eliminate the Theta component, we are going to copy in a folder the patients in which the Theta component is visible for future work.

4.5 Decimation

Decimation is the process of reducing the sampling rate of a signal. It's complementary to interpolation, in this case, interpolation increases the sampling rate in a multi-rate digital signal processing system.

We come up with this idea because, as we are mainly interested in two components which are located from 10 Hz – 30 Hz, decimation can help us to study these frequencies.

The Low Pass filter and the process of decimation, the range of frequencies where the Low Beta and High Beta components comes to take up the entire Nyquist interval. This produces a higher frequency resolution and makes us be sure that the poles generated by the ARFIT package are located in the band of the frequency of interest.

Decimation is a strategy that produces an effective reduction in the sampling frequency. In the "n axis", (M-1) samples of each group of consecutive M are neglected as if would have been sampled by a period Ts' = MTs. This produces a compression

$$x[n] \rightarrow x[Mn] = x(MnTs)$$

In the frequency axis, spectral replicas are nearer because they are located over kfs'

$$Ts' = MTs \rightarrow fs' = fs/M$$

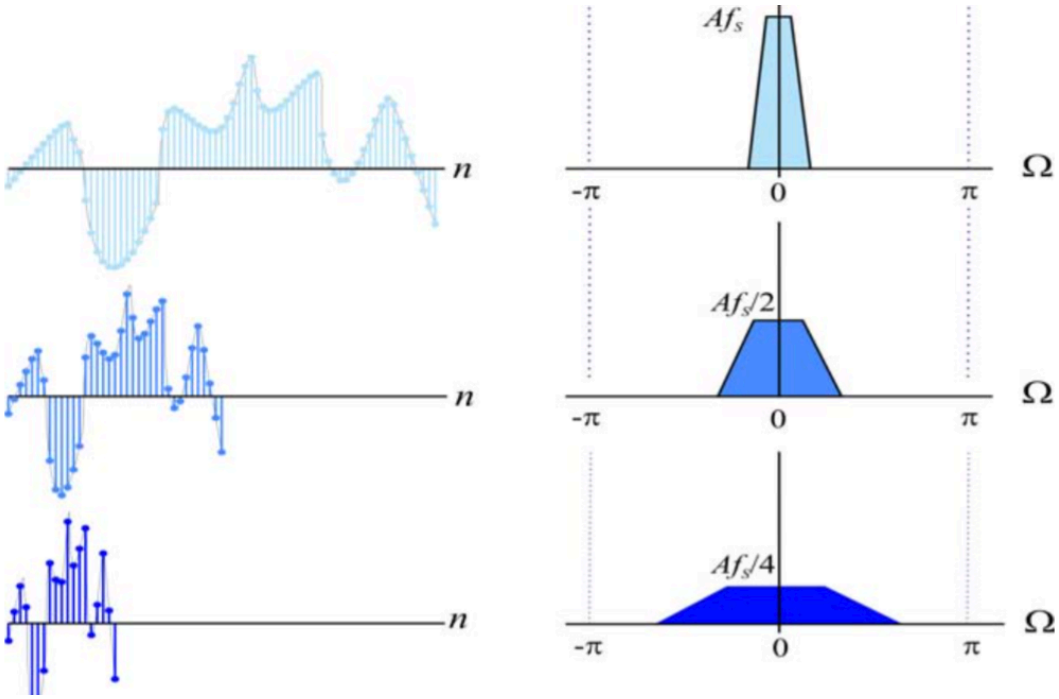


Figure 27: Decrease in the sampling rate

In the figure 27, it's shown that if sampling rates decrease, in the omega axis the spectrum broadens. That's what we want, to have our low Beta and High Beta broadens.

Our block diagram now is the following one:

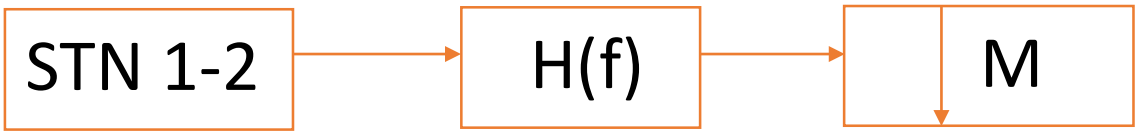


Figure 28: Diagram of the process before AR analysis

In the first part we have our patient with its 6 channels, then we applied the Butterworth filter with the real slot in 50 Hz and 0 Hz to one of the channels and finally we obtained a signal with almost no noise and ready to be inserted in an AR model.

4.5.1 M decimation constant

For choosing M constant, we have to say that if we choose a M big enough, ARFIT will reduce p ARFIT order. However, this implies a cost, we cannot increase M until whatever we want.

As we are using a Butterworth filter, the fall of the slope is not very fast, so, in case we would like to increase the M constant, we should be aware of the necessity of rising up the selectivity of Butterworth's filter.

However, it's not only that point, we have to be cautious due to the fact that, if we increase the selectivity of the Butterworth filter, ARFIT model will have a p order higher

than before. In other words, we have to reach an agreement for which we can increase M decimation constant, increasing the criticality of the filter without rising up too much the p order of the AR model.

For Chebyshev filters, as the fall in frequency is faster than in Butterworth's, we don't need to increase the criticality of the filter. So, in this case it will be easier to make an increase of M decimation constant.

After making proofs, we have assumed that the M constant decimation is 8 or 10. For an M of 12, it's not correct. In the Appendix 4 that appears at the end, we have made a research to show which are the best parameters. After having studied these results, we have to say that Decimation is beneficial for our study and also that the best factor of decimation for our study is M = 10.

4.6 Signal's length

Having known that we are working with signals that have in each of them 6 channels and we will make a multivariate AR analysis, we have to be very careful about the size of each channel. Spike's software has an error that consists in: once you have chosen your cursors for which you want export the signal to Matlab, Spikes in some cases chooses different sizes for each channel. In the figure 28, we can see that changes in length are very low, in that case, all channels have the same length with the exception of the last one.

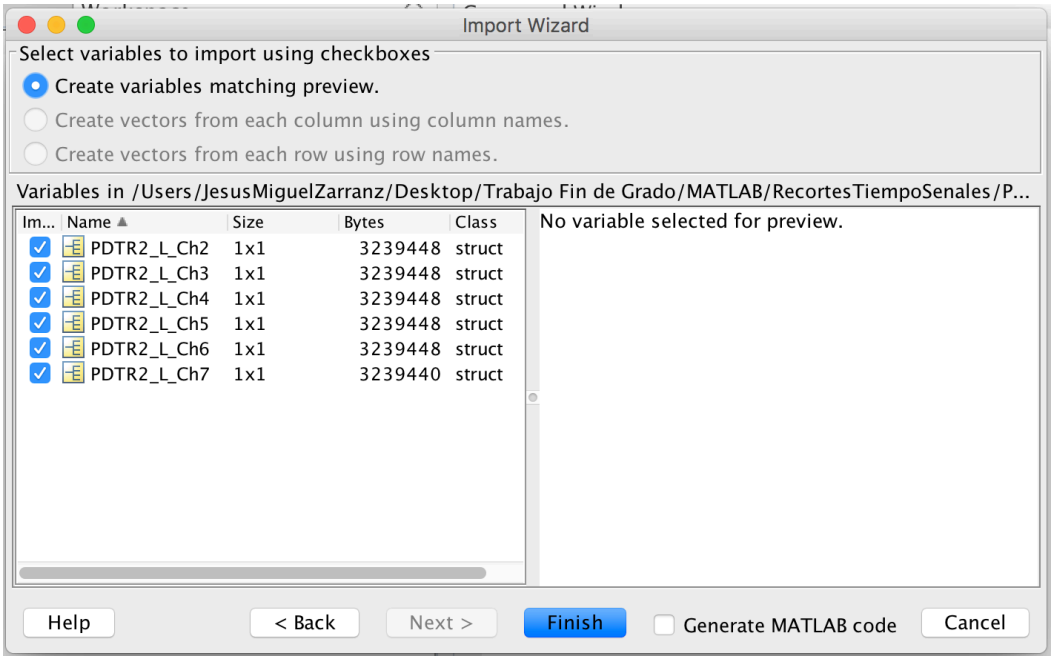


Figure 28: Error that appears when we take the values exported by Spike

We didn't take into account that when we export signals, channels could have different lengths. So, we made a throughout research in the patients signals and we see that the majority of them have different channels' length for the same patient. What we did was easy, we have to redo all the exportations checking that in the same patient,

channel's length was the same for all of them. After doing it, we updated the database with the new values, now being sure that channels have the same length for each patient.

The same patient with its 6 channels appears in the figure 10, in this case having the same length for each channel.

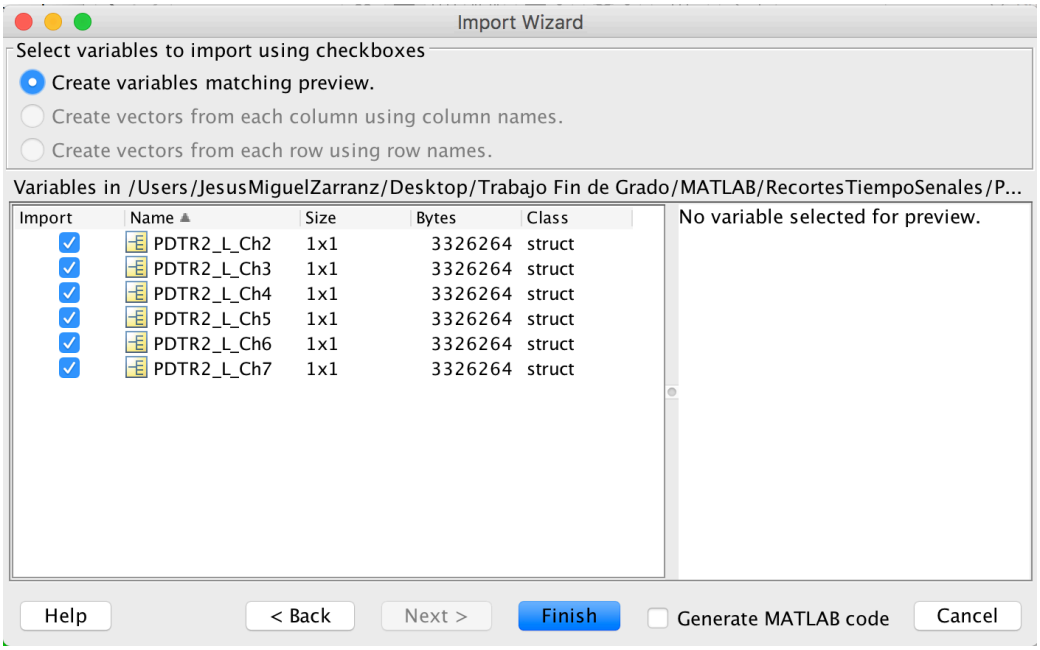


Figure 29: Error which have been sorted out

Apart from the length of each channel, we thought that having the same length for all the patients could be a really good idea in case we would like to manipulate various patients at the same time. So, we also made a research in all signals to see which one has the minimum length.

We load all signals in a Matlab script for OFF and ON state and we look for the minimum value of both states. For OFF state, we saw that the minimum value was 316.200 and for ON state was 439.158. We took the lowest value of the two extracted and for the following situations, we force our signals to have this length.

Of course, after the process of decimation, we have to say that now this length has to be divided by M constant of decimation, in our case 10. So, we take the minimum values of the values of the last paragraph (in this case 316.200) and we divide it by the factor of decimation (M=10). We obtained 31.620. Finally, our signals must have this length.

4.7 ARFIT ORDER

4.7.1 Relationship between poles and order of ARFIT

AR order is directly related to the number of poles. For instance, if our order is p= 10, we wil get 10 poles, or in other words, 5 pairs of poles complex conjugated. As a consequence of this, the maximum frequencies we obtain are also directly related to the poles.

In the figure 30, it can be seen the way we implement the functions given by the ARFIT package. In the case of this figure, it can be appreciated that we are using an AR with an order of p = 16.

```
pmin = 16;
pmax = 16;
[west, Aest, Cest, SBC, FPE, th] = arfit(h2_aux', pmin, pmax);
[S, Serr, per, tau,exctn] = armode(Aest,Cest,th);
```

Figure 30: Example of the order in the ARFIT package

In the Figure 31, as a consequence of the use of an AR with a p order = 16, from Matlab we get 16 poles.

16x1 complex double

	1	2	3	4
1	-0.5722 + 0.5216i			
2	-0.5722 - 0.5216i			
3	-0.2998 + 0.7588i			
4	-0.2998 - 0.7588i			
5	-0.1502 + 0.8288i			
6	-0.1502 - 0.8288i			
7	0.2354 + 0.8990i			
8	0.2354 - 0.8990i			
9	0.4597 + 0.7639i			
10	0.4597 - 0.7639i			
11	0.8815 + 0.1806i			
12	0.8815 - 0.1806i			
13	0.8465 + 0.3948i			
14	0.8465 - 0.3948i			
15	0.6366 + 0.5850i			
16	0.6366 - 0.5850i			

Figure 31: Verification of the theory that the order of the AR model is directly related to the number of poles

In the following figure, it can be see that the 16 poles are 8 pairs of complex conjugated poles as we have foreseen. They are printed thanks to the help of the tool "zplane".

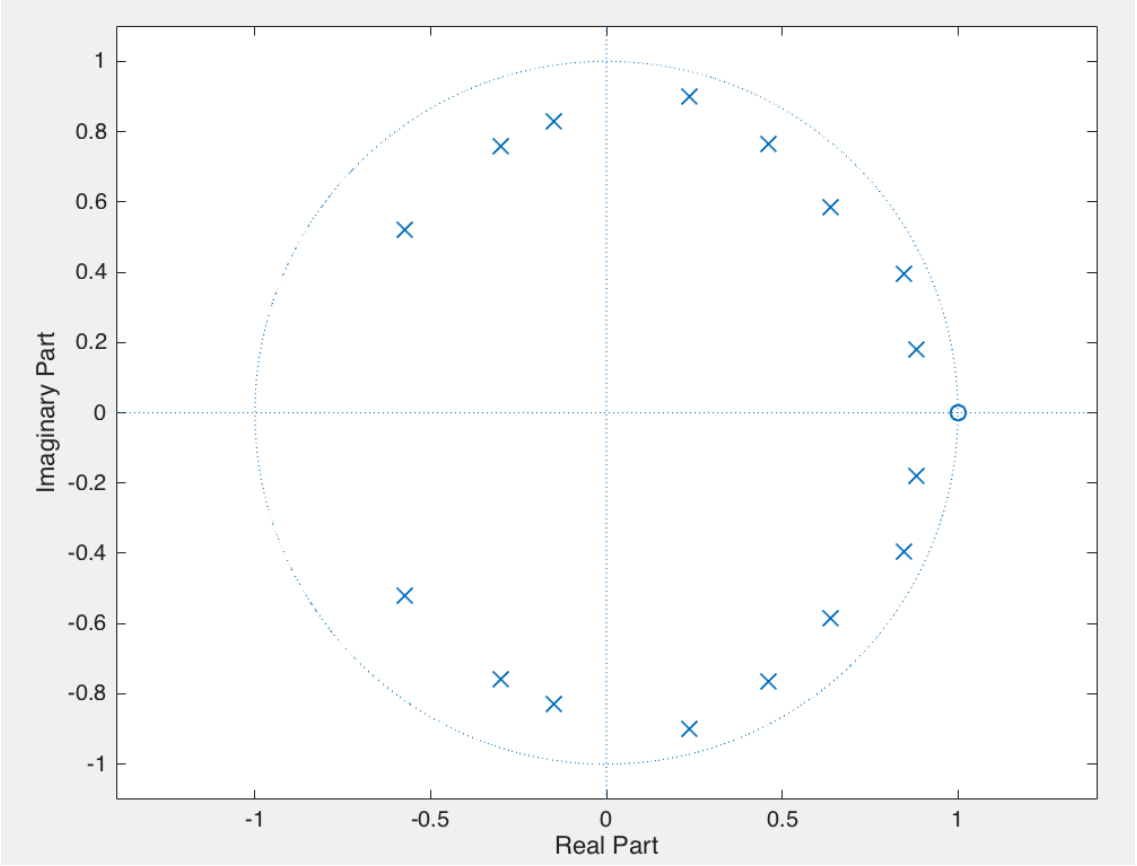


Figure 32: Poles printed in the Zplane

Once we have our poles well located, It's important to say that the frequencies are also related to the p order of the AR model. Frequencies are obtained making the product of the sampling frequency and the variable per which is calculated thanks to the armode in the figure 30.

4.7.2 Univariate analysis

Before of mixing patients, searching for correlations between them or creating new time intervals; we have studied our signals carefully channel by channel with the aim of finding an ideal AR order.

4.7.2.1 Adjusting the order

All the results which are going to be explained come from the STN 6-7 of the patient 2. As we don't know from which order to start, we have made a sweep between 12 to 18 to see which p order reproduces better our components Low Beta and High Beta. In the following figures we are going to compare PDS of a signal which has been filtered

with a Butterworth Low Pass filter with two real slots in 0 and 50 Hz and decimated with M =10 with the reconstruction got by ARFIT package.

4.7.2.1.1 AR(p=12)

Applying an AR(p=12) from the STN 6-7 channel of the patient two we get the following results:

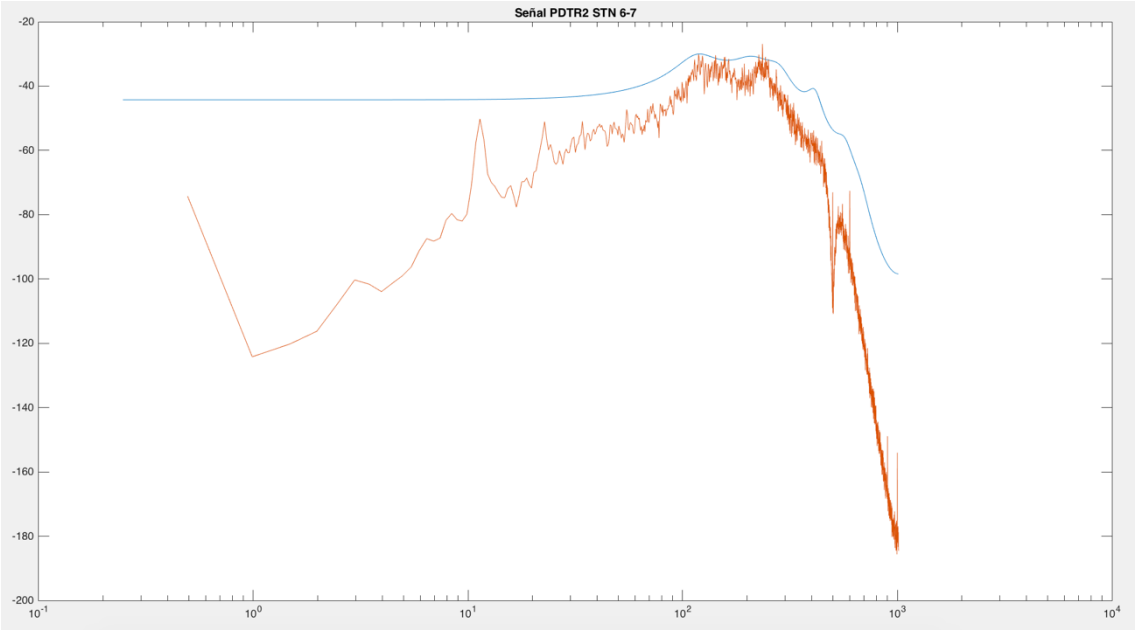


Figure 33: AR(p=12)

In this case, we can see that the reconstruction of both Low Beta and High Beta is not well enough because the Low Beta component doesn't correspond to the Low Beta component given by The Welch periodogram.

4.7.2.1.2 AR(p=14)

Applying an AR(p=14) from the STN 6-7 channel of the patient two we get the following results:

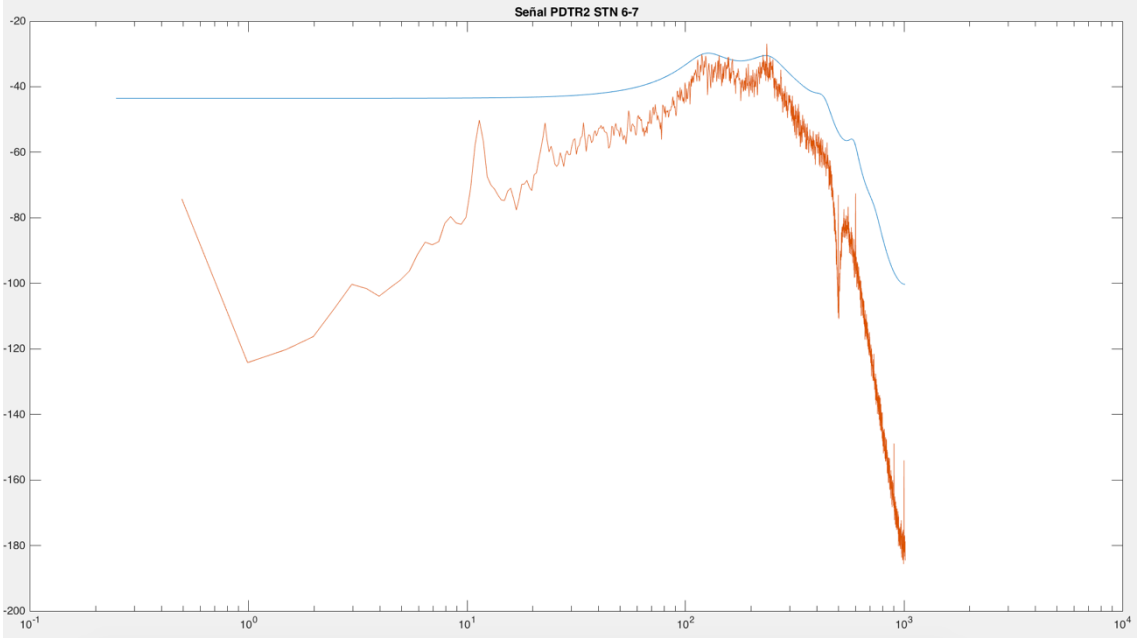


Figure 34: AR (p=14)

In this case, the High Beta component is more or less well predicted. However, the Low Beta component is not perfectly situated in comparison with the one calculated by the The Welch periodogram.

4.7.2.1.3 AR(p=16)

Applying an AR(p=16) from the STN 6-7 channel of the patient two we get the following results:

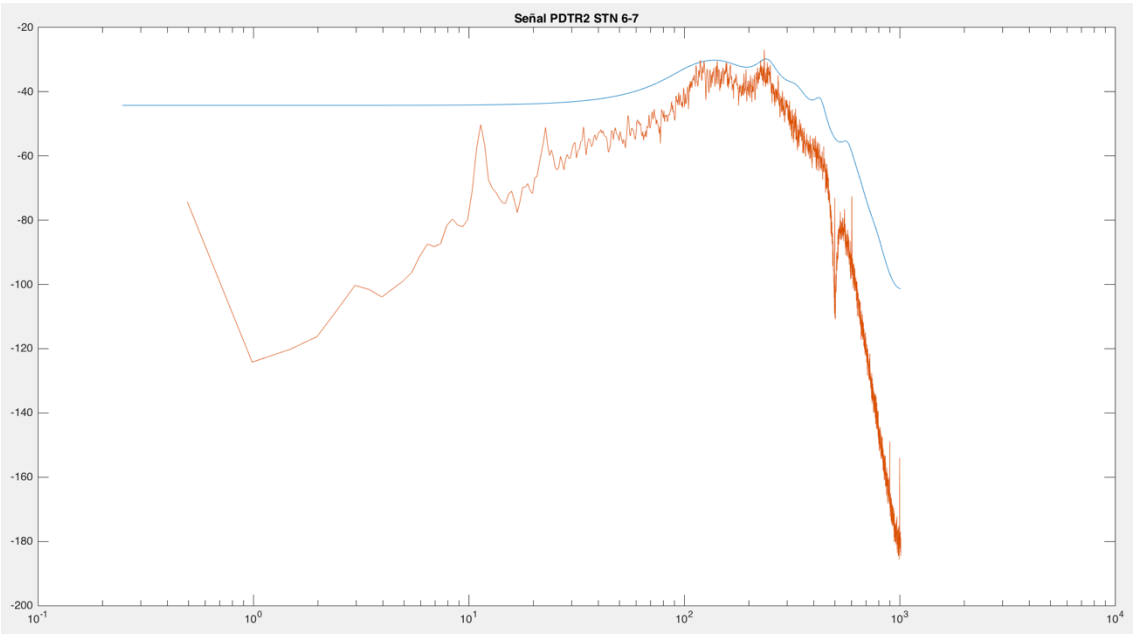


Figure 35: AR (p=16)

In this case, as it can be seen, Low Beta and High Beta components are perfectly situated.

4.7.2.1.4 Conclusion AR(p=16)

After studying the three results got in the figures 33, 34 ,35 we dare to say that having an AR model with an order of p = 16 is a good approximation for reconstructing well our Low Beta and High Beta components.

As it can be seen, we need to put extra poles to foresee well our components Low Beta and High Beta. If we choose a lower order, as 12 in the figure 33, the Low Beta and High Beta components suffer from a frequency movement.

4.7.2.2 Corroboration of our research

As we can have seen in the last figures, ARFIT reconstruction produces a kind of frequency displacement that makes the ARFIT reconstruction be different from the The Welch periodogram. If we apply a lower p order, this difference becomes higher.

As a consequence of that, we need that our prediction of the AR order has to be truly well proved. We have prepared a thorough research that can be seen in the Appendix 5 in which we are going to calculate:

- The difference between the Low Beta reference component and the Low beta reconstructed with ARFIT package. We will name this difference EPSILON LOW
- The difference between the High Beta reference component real and the High beta reconstructed with ARFIT package. We will name this difference EPSILON HIGH
- The ratio between the Low Beta reference component real and the Low beta reconstructed with ARFIT package. We will name this difference LOW EPSILON RATIO
- The ratio between the High Beta reference component real and the High beta reconstructed with ARFIT package. We will name this difference HIGH EPSILON RATIO
- The logarithm of the LOW EPSILON RATIO
- The logarithm of the HIGH EPSILON RATIO

PDTR X	REAL FREQUENCY VALUES		ARFIT FREQUENCY VALUES		EPSILON LOW	EPSILON HIGH
CHANNEL	LOW BETA	HIGH BETA	LOW BETA	HIGH BETA		
STN Y						

Table 4: Explanation of how Appendix 5 will look

LOW	HIGH	LOW	HIGH
EPSILON RATIO	EPSILON RATIO	LOG RATIO	LOG RATIO

Table 5: Explanation of how Appendix 5 will look (second part)

We are going to make this research for both ON and OFF state from all the patients and with two values of p:

- AR(p=10)

These are the averages results for each patient for the values of:

  - Difference of epsilon:

EPSILON OFF STATE PATIENTS (DIFFERENCE IN FREQUENCY)					
	LOW	HIGH		LOW	HIGH
AVERAGE PSILON PDTR2	2,67	9,49	AVERAGE PSILON PDTR8	3,01	7,48
AVERAGE EPSILON PDTR3	4,16	12,99	AVERAGE EPSILON PDTR9	2,87	9,78
AVERAGE EPSILON PDTR4	0,61	5,25	AVERAGE EPSILON PDTR10	1,05	3,98
AVERAGE EPSILON PDTR5	2,25	4,54	AVERAGE EPSILON PDTR11	1,63	4,77
AVERAGE EPSILON PDTR6	1,27	7,11	AVERAGE EPSILON PDTR12	1,32	8,73
AVERAGE EPSILON PDTR7	8,02	7,96	AVERAGE EPSILON PDTR13	0,94	6,46

EPSILON ON STATE PATIENTS (DIFFERENCE IN FREQUENCY)					
	LOW	HIGH		LOW	HIGH
AVERAGE EPSILON PDTR2	3,07	10,40	AVERAGE PSILON PDTR8	3,23	8,54
AVERAGE EPSILON PDTR3	3,80	13,19	AVERAGE EPSILON PDTR9	NO	NO
AVERAGE EPSILON PDTR4	0,62	5,85	AVERAGE EPSILON PDTR10	0,61	4,64
AVERAGE EPSILON PDTR5	3,45	5,30	AVERAGE EPSILON PDTR11	2,77	7,98
AVERAGE EPSILON PDTR6	2,95	10,88	AVERAGE EPSILON PDTR12	1,91	10,30
AVERAGE EPSILON PDTR7	7,36	9,24	AVERAGE EPSILON PDTR13	2,97	8,03

Table 6: Epsilon OFF and ON state patients, difference in frequency

  - Ratio of Epsilon

EPSILON OFF STATE PATIENTS (RATIO IN FREQUENCY)					
	LOW	HIGH		LOW	HIGH
AVERAGE PSILON PDTR2	1,21	1,41	AVERAGE EPSILON PDTR8	1,23	1,31
AVERAGE EPSILON PDTR3	1,30	1,62	AVERAGE EPSILON PDTR9	1,24	1,41
AVERAGE EPSILON PDTR4	1,00	1,20	AVERAGE EPSILON PDTR10	0,92	1,19
AVERAGE EPSILON PDTR5	1,20	1,18	AVERAGE EPSILON PDTR11	1,10	1,28
AVERAGE EPSILON PDTR6	1,17	1,33	AVERAGE EPSILON PDTR12	1,16	1,37
AVERAGE EPSILON PDTR7	1,72	1,32	AVERAGE EPSILON PDTR13	1,16	1,29

EPSILON ON STATE PATIENTS (RATIO IN FREQUENCY)					
	LOW	HIGH		LOW	HIGH
AVERAGE PSILON PDTR2	1,23	1,45	AVERAGE EPSILON PDTR8	1,25	1,36
AVERAGE EPSILON PDTR3	1,27	1,63	AVERAGE EPSILON PDTR9		
AVERAGE EPSILON PDTR4	1,05	1,22	AVERAGE EPSILON PDTR10	0,99	1,21
AVERAGE EPSILON PDTR5	1,26	1,20	AVERAGE EPSILON PDTR11	1,18	1,34
AVERAGE EPSILON PDTR6	1,33	1,45	AVERAGE EPSILON PDTR12	1,32	1,42
AVERAGE EPSILON PDTR7	1,67	1,36	AVERAGE EPSILON PDTR13	1,25	1,34

Table 7: Ratio of the frequencies of OFF and ON state patients

- Logarithm of ratio of epsilon

EPSILON OFF STATE PATIENTS (RATIO OF FREQUENCY IN LOGARITHM)					
	LOW	HIGH		LOW	HIGH
AVERAGEEPSILON PDTR2	0,08	0,15	AVERAGE EPSILON PDTR8	0,09	0,12
AVERAGE EPSILON PDTR3	0,11	0,21	AVERAGE EPSILON PDTR9	0,09	0,15
AVERAGE EPSILON PDTR4	0,00	0,08	AVERAGE EPSILON PDTR10	-0,04	0,07
AVERAGE EPSILON PDTR5	0,08	0,07	AVERAGE EPSILON PDTR11	0,04	0,11
AVERAGE EPSILON PDTR6	0,07	0,12	AVERAGE EPSILON PDTR12	0,06	0,14
AVERAGE EPSILON PDTR7	0,24	0,12	AVERAGE EPSILON PDTR13	0,07	0,11

EPSILON ON STATE PATIENTS (RATIO OF FREQUENCY IN LOGARITHM)					
	LOW	HIGH		LOW	HIGH
AVERAGEEPSILON PDTR2	0,09	0,16	AVERAGE EPSILON PDTR8	0,10	0,13
AVERAGE EPSILON PDTR3	0,11	0,21	AVERAGE EPSILON PDTR9		
AVERAGE EPSILON PDTR4	0,02	0,09	AVERAGE EPSILON PDTR10	-0,01	0,08
AVERAGE EPSILON PDTR5	0,10	0,08	AVERAGE EPSILON PDTR11	0,07	0,13
AVERAGE EPSILON PDTR6	0,12	0,16	AVERAGE EPSILON PDTR12	0,12	0,15
AVERAGE EPSILON PDTR7	0,22	0,13	AVERAGE EPSILON PDTR13	0,10	0,13

Table 8: Logarithm of ratio of epsilon for ON and OFF state patients

- AR(p=16)

These are the averages results for each patient for the values of:

- Difference of epsilon:

EPSILON OFF STATE PATIENTS (DIFFERENCE IN FREQUENCY)					
	LOW	HIGH		LOW	HIGH
AVERAGE EPSILON PDTR2	2,49	0,83	AVERAGE EPSILON PDTR8	0,58	1,24
AVERAGE EPSILON PDTR3	0,39	5,69	AVERAGE EPSILON PDTR9	0,62	1,84
AVERAGE EPSILON PDTR4	3,18	0,73	AVERAGE EPSILON PDTR10	3,92	1,50
AVERAGE EPSILON PDTR5	1,20	1,18	AVERAGE EPSILON PDTR11	1,76	0,60
AVERAGE EPSILON PDTR6	1,17	1,33	AVERAGE EPSILON PDTR12	0,68	0,72
AVERAGE EPSILON PDTR7	2,20	1,36	AVERAGE EPSILON PDTR13	1,17	0,71

EPSILON ON STATE PATIENTS (DIFFERENCE IN FREQUENCY)					
	LOW	HIGH		LOW	HIGH
AVERAGE EPSILON PDTR2	1,70	1,82	AVERAGE EPSILON PDTR8	1,53	1,76
AVERAGE EPSILON PDTR3	0,38	5,78	AVERAGE EPSILON PDTR9		
AVERAGE EPSILON PDTR4	3,27	1,14	AVERAGE EPSILON PDTR10	4,46	1,33
AVERAGE EPSILON PDTR5	0,94	1,92	AVERAGE EPSILON PDTR11	1,99	0,31
AVERAGE EPSILON PDTR6	2,43	1,91	AVERAGE EPSILON PDTR12	1,27	1,24
AVERAGE EPSILON PDTR7	2,28	1,44	AVERAGE EPSILON PDTR13	2,09	3,35

Table 9: Epsilon OFF and ON state patients, difference in frequency

- Ratio of Epsilon

EPSILON OFF STATE PATIENTS (RATIO OF FREQUENCY)					
	LOW	HIGH		LOW	HIGH
AVERAGE PSILON PDTR2	0,86	1,06	AVERAGE EPSILON PDTR8	0,94	1,08
AVERAGE EPSILON PDTR3	0,98	1,27	AVERAGE EPSILON PDTR9	1,06	1,10
AVERAGE EPSILON PDTR4	0,82	0,98	AVERAGE EPSILON PDTR10	0,79	0,92
AVERAGE EPSILON PDTR5	0,99	1,00	AVERAGE EPSILON PDTR11	0,88	1,02
AVERAGE EPSILON PDTR6	0,96	1,07	AVERAGE EPSILON PDTR12	0,88	1,08
AVERAGE EPSILON PDTR7	1,25	1,06	AVERAGE EPSILON PDTR13	0,88	0,97

EPSILON ON STATE PATIENTS RATIO OFF FREQUENCY)					
	LOW	HIGH		LOW	HIGH
AVERAGE PSILON PDTR2	0,97	1,06	AVERAGE EPSILON PDTR8	1,01	1,06
AVERAGE EPSILON PDTR3	0,98	1,28	AVERAGE EPSILON PDTR9		
AVERAGE EPSILON PDTR4	0,81	0,97	AVERAGE EPSILON PDTR10	0,76	0,92
AVERAGE EPSILON PDTR5	0,88	0,90	AVERAGE EPSILON PDTR11	0,91	1,05
AVERAGE EPSILON PDTR6	0,83	1,05	AVERAGE EPSILON PDTR12	0,90	1,09
AVERAGE EPSILON PDTR7	1,24	1,06	AVERAGE EPSILON PDTR13	0,98	1,06

Table 10: Ratio of the frequencies of OFF and ON state patients

- Logarithm of ratio of epsilon

EPSILON OFF STATE PATIENTS (LOGARITHM OF THE RATIO OF FREQUENCY)					
	LOW	HIGH		LOW	HIGH
AVERAGEEPSILON PDTR2	-0,06	0,03	AVERAGE EPSILON PDTR8	-0,03	0,03
AVERAGE EPSILON PDTR3	-0,01	0,10	AVERAGE EPSILON PDTR9	0,02	0,04
AVERAGE EPSILON PDTR4	-0,09	-0,01	AVERAGE EPSILON PDTR10	-0,10	-0,03
AVERAGE EPSILON PDTR5	0,00	0,00	AVERAGE EPSILON PDTR11	-0,06	0,01
AVERAGE EPSILON PDTR6	-0,02	0,03	AVERAGE EPSILON PDTR12	-0,05	0,03
AVERAGE EPSILON PDTR7	0,10	0,03	AVERAGE EPSILON PDTR13	-0,06	-0,01

EPSILON ON STATE PATIENTS (LOGARITHM OF THE RATIO OF FREQUENCY)					
	LOW	HIGH		LOW	HIGH
AVERAGE EPSILON PDTR2	-0,01	0,03	AVERAGE EPSILON PDTR8	0,01	0,03
AVERAGE EPSILON PDTR3	-0,01	0,11	AVERAGE EPSILON PDTR9		
AVERAGE EPSILON PDTR4	-0,09	-0,02	AVERAGE EPSILON PDTR10	-0,12	-0,04
AVERAGE EPSILON PDTR5	-0,06	-0,05	AVERAGE EPSILON PDTR11	-0,04	0,02
AVERAGE EPSILON PDTR6	-0,08	0,02	AVERAGE EPSILON PDTR12	-0,05	0,04
AVERAGE EPSILON PDTR7	0,09	0,03	AVERAGE EPSILON PDTR13	-0,01	0,03

Table 11: Logarithm of ratio of epsilon for ON and OFF state patients

4.7.2.3 Conclusion of the results

As we can see in the last figures, our predictions in the section 3.7.1.4 about having an AR(p=16) are correct because in the last figures we can appreciate that the difference between the frequencies reconstructed by ARFIT and the frequencies obtained in the Welch periodogram are much lower in the study of AR (p=16) than in AR (p=10).

Besides that, the ratio between the frequencies reconstructed by ARFIT and the frequencies obtained in the Welch periodogram in the AR (p=16) approaches much more to 1 than in AR (p=10). This means that the frequencies are much closer. Consequently, we have to say that the frequency movement is much lower in the AR (p=16) than in AR (p=10).

4.7.2.4 Our signals are stationary?

We thought that it will me a good idea to divide the whole signal into windows with an overlap with the aim of finding how stationary are the signals we have been given by CIMA. We have prepared a loop in which we put the size of the window we are interested in. We also calculate the shift because for this case, we assume that signals will be overlapped. This concept is explained in the following figure:

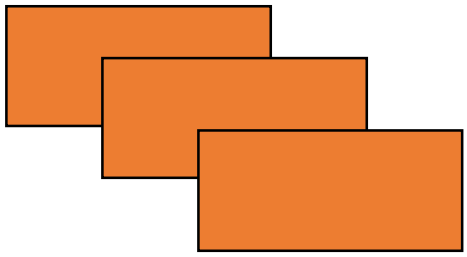


Figure 36: Explanation of a sliding window

We apply the sliding window to a single channel. This process is only used for univariate signals. We have to insert the following parameters: shift, length of the window and the number of windows.

One of the most important parameter is the number of windows. We calculate it making the difference between the length of the input signal and the length of the window. Then, we divide this difference between the shift. Finally, we apply the "floor" function to get an integer number. This process is explained in the 37 figure:

```
num_window= floor((length(h2)-tam_ventana)/(shift));
```

Figure 37: Calculation of the number of window for the sliding window

After having all the parameters well arranged, we enter in the loop that appears in the figure 38.

```
for i=1:num_windows

    j=(i-1)*shift+1;

    h_envent=(h6(j:j+tam_ventana-1))';
```

Figure 38: Loop for the sliding window

In this loop we start counting the number of windows we have. In j index, it's shown the start point of the window. Secondly, in the variable h_envent, which starts in j and finishes in the j variable plus window size plus one, we have our window saved.

After this process and, still in the for loop, we use the ARFIT model to each one of the windows generated with the aim of finding how stationary is our signal. For this case, we are using the patient 4 in the OFF state with an ARFIT p order of 16.

Frequencies get by Windowing signal (Hz)	Frequencies get by the hole Signal (Hz)
877.3679	877.5
741.2018	741.5
601.3522	601.8
451.5289	452.1
46.6984	45.21
33.9918	33.9
18.3937	18.7
0	0

Table 12: Frequencies got by sliding windows and without it

As we can see in the Table 12, there are almost no differences between analysing our signal in little parts (windows) than analysing the signal without sliding window.

ARFIT package gives us more or less the same frequencies in both situations, so we can be sure of the stationarity of our signals.

4.7.3 Multivariate analysis

Trying to make a multivariate analysis is something that we have to think carefully. The dimensions of the matrix have to be the following one:

$$A = (mx(mxp'))$$

Being m the number of signals included and p' the order of the AR model. This matrix has to be square. In our case, the matrix will have the dimensions 16x16 with a p' order equals to 1.

Once it has been seen that the best order for the AR univariate model is 16, we have to try to increase the number of signals we have been given. We came up with two ideas mainly:

- The first one was trying to make combinations of patients
- The second one was trying to make new intervals of time of 200 seconds to have more signals. We could do it because the length of the time series we were provided had 3.000 seconds.

4.7.3.1 Combinations of patients

As I have introduced in the lasts paragraphs the process of combination of patients was tedious and very long. At first, we have to load all signals and all channels from all the patients. Secondly, when we have all our channels well named and well loaded, we have to follow the procedure which was previously explained:

- Unifying the channel's length because we were going to compare each channel with all the channels from all the patients.
- Filtering the signal with the Butterworth filter which was designed with a real slot in 0 Hz and in 50 Hz.
- Making a decimation of the output signal from the filter (M=10 as we cited before)

Once we have our signals filtered, decimated and cut, with the help of PWELCH, we made the Power Density Function of all the channels from every patient.

```
[pxx2,f2] = pwelch(h2_aux_m,window,overlap,Nfft,fs);
```

Figure 39: An example of the use of the pwelch function

In the figure 39, we can see how we used the pwelch's function, given that:

- Sampling frequency = 2.0243e+03 Hz is the same for all the channels

- Window = hanning (L=4096)
- Nfft = 4096
- Overlap = floor (3/4*L)

After doing this, we turn to Matlab to find a tool to compare signals. We did it with the help of "corrcoef" function. "Corrcoef" compares one by one the two signals which are introduced and finally provides you a matrix 2x2 in which diagonal is written the proportion from 0 to 1 of the similarity of both signals. In the figure 40 it's shown how we compare, in this particular case, the power density function of channel 2 from the patient 2 with all the channels from patient 2. Then, we compare the channel 3 with all the channels from patient 2 and so on.

```
pxx2_pxx2_corr = corrcoef(pxx2,pxx2);
percentage_pxx2_pxx2_corr = abs(pxx2_pxx2_corr(1,2))*100;
```

Figure 40: Example of the use of "corrcoef" function

Once we have compared all signals, and we have got all the percentages of similarity, we put all together in a vector. This process is shown in the figure 41.

```
percentage_h2_rest_h2 = [percentage_pxx2_pxx7_corr percentage_pxx2_pxx6_corr
                         percentage_pxx2_pxx5_corr percentage_pxx2_pxx4_corr
                         percentage_pxx2_pxx3_corr percentage_pxx2_pxx2_corr];
```

Figure 41: Example of the creation of the vector of percentage of similarity

What we do now is putting these results in a matrix 6x6 to have the values of correlation correctly and then for making us the work easier, we export each matrix to an Excel file for copying this information to a file in which we have all the correlations from each patient. This last procedure is shown in the figure 42.

```
table_percentage_h2_h2 = {percentage_h7_rest_h2; percentage_h6_rest_h2;
                          percentage_h5_rest_h2; percentage_h4_rest_h2;
                          percentage_h3_rest_h2; percentage_h2_rest_h2;};

xlswrite('h2_h2.csv',table_percentage_h2_h2);
```

Figure 42: Explanation of the creation of the matrix of correlations and the exportation to an Excel file

This was the example that we did in order to see if the values were correct, for us comparing the channels of patient 2 with the channels of patient 2 is useless. We only did that with the aim of showing that the values obtained are correct because the diagonal values of the matrix are 100 %. This makes sense because values that appear in the diagonal of this case are comparing the same signals; that's why we see a 100 % of correlation.

4.7.3.1.1 Patients with more correlation

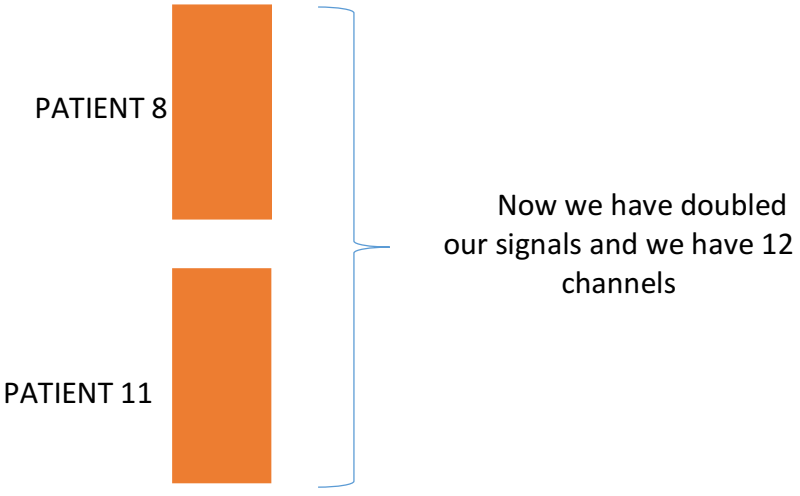
Making the explained process for all the combinations possible of each patient, we put all the matrix created in the same file. The percentage of correlation among all patients and channels is in the Appendix 7.

PATIENTS	PDTR2	PDTR3	PDTR4	PDTR5	PDTR6	PDTR7	PDTR8	PDTR9	PDTR10	PDTR11	PDTR12
PDTR2	75,11	68,47	67,17	41,22	59,92	52,07	69,68	58,01	47,47	61,41	51,31
PDTR3		93,29	53,87	63,11	57,31	57,81	76,57	55,27	40,22	65,25	54,17
PDTR4			82,58	30,17	58,38	44,53	60,49	57,24	63,10	50,78	53,44
PDTR5				63,10	37,91	43,76	49,61	44,30	15,99	40,44	39,78
PDTR6					55,69	46,25	59,71	50,64	41,42	51,01	46,15
PDTR7						74,17	49,89	54,83	27,75	34,31	43,06
PDTR8							84,57	53,23	41,16	74,47	53,67
PDTR9								74,08	42,67	43,72	53,84
PDTR10									69,96	35,68	40,26
PDTR11										75,16	43,06
PDTR12											54,83

Table 13: Percentage of correlations among all patients

In the table 13 what we have done is making the average of each matrix taking into account all the channels. As expected, the values in which the correlation is higher are the ones in the diagonal. That's because in the diagonal we are comparing the patient with itself.

We can say that the most similar patients are the patient 8 and the patient 11, which have a correlation of 74,47 % and the patient 8 and 3 which have a correlation of 76,56 %. In case we need to add patients in order to have more signals, we will choose patient 3 and patient 8 or patient 8 and patient 11.

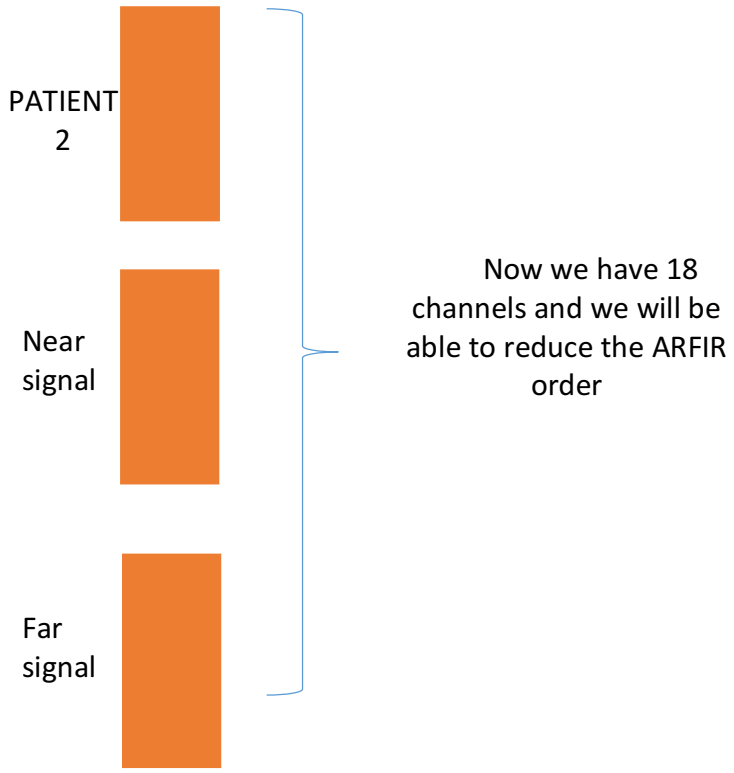


4.7.3.2 Taking more time extracts

The second option is coming back from Spike software to take more extracts for the OFF and ON state. Signals that we have are long enough to extract from them another 2 blocks from each state from each patient. So what we did was choosing:

- A block of 200 seconds which is more or less near the one we chose at first.
- Another block of 200 seconds which is further from the one we chose at first.

From this way, we can have 18 signals from the same patient. Taking into account that we are working with signals from the same patient, we did the correlation from this 3 signals in order not to have 3 signals which are the same. Thanks to that, we check that the extracts obtained are stationary enough to assure the effective increase in the number of channels



4.7.3.2.1 Movement in frequency

What it has been seen in this process is that there's a frequency movement that affects the poles depending on the order in the AR model. For corroborating that p=16 is the best choice for univariate analysis we have made a study working with: 12 signals,

16 signals and 18 signals. In the last case (18 signals) we don't have to eliminate any of the signals (3 registers multiplied by 6 channels = 18 signals).

For knowing which signal has to be removed from the study in cases of 12,16 and 18 signals, we have made a research for setting the correlation between the signals. The ones which are less correlated will be removed for the cases of: 12,16 and 18.

- Case of 18 signals:

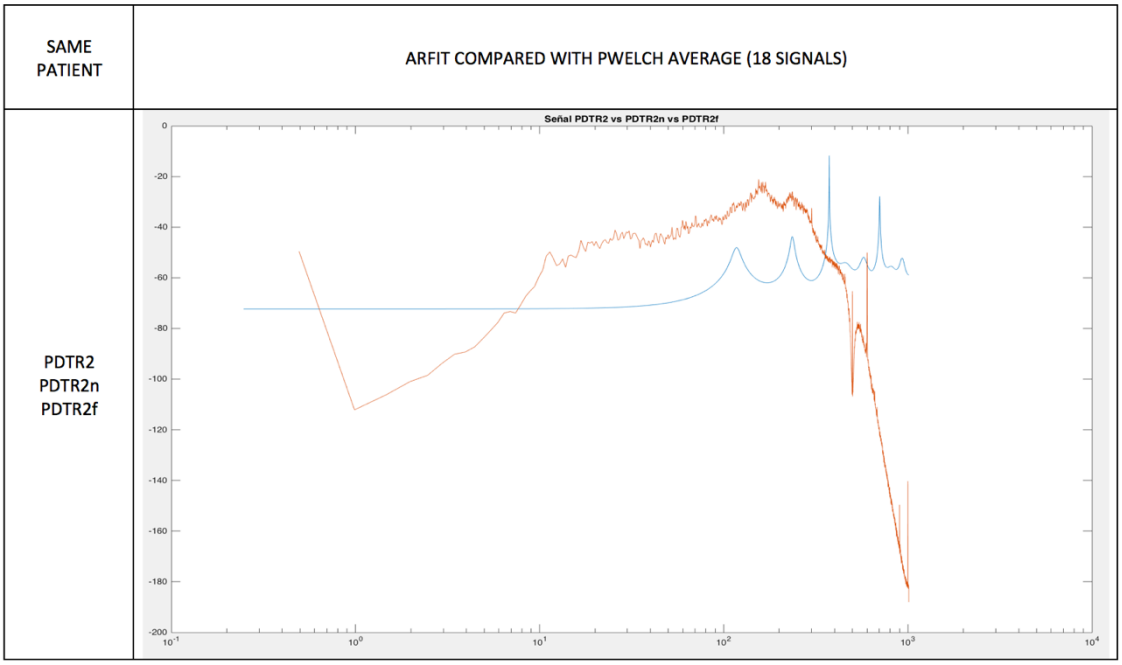


Figure 43: Multivariate case with 18 signals

As it can be seen in the Figure 43 the High Beta which has been reconstructed is well predicted but the Low Beta is completely moved from the real one.

- Case of 16 signals:

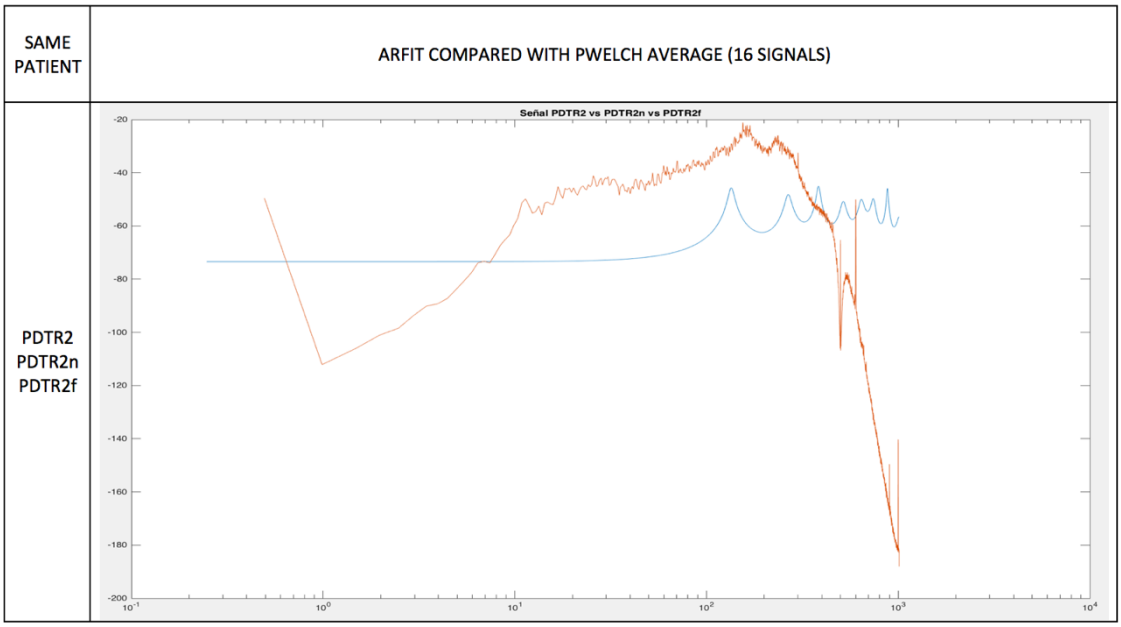


Figure 44: Multivariate case with 16 signals

In the figure 44 High Beta component and Low Beta component are more or less well predicted.

- Case of 12 signals

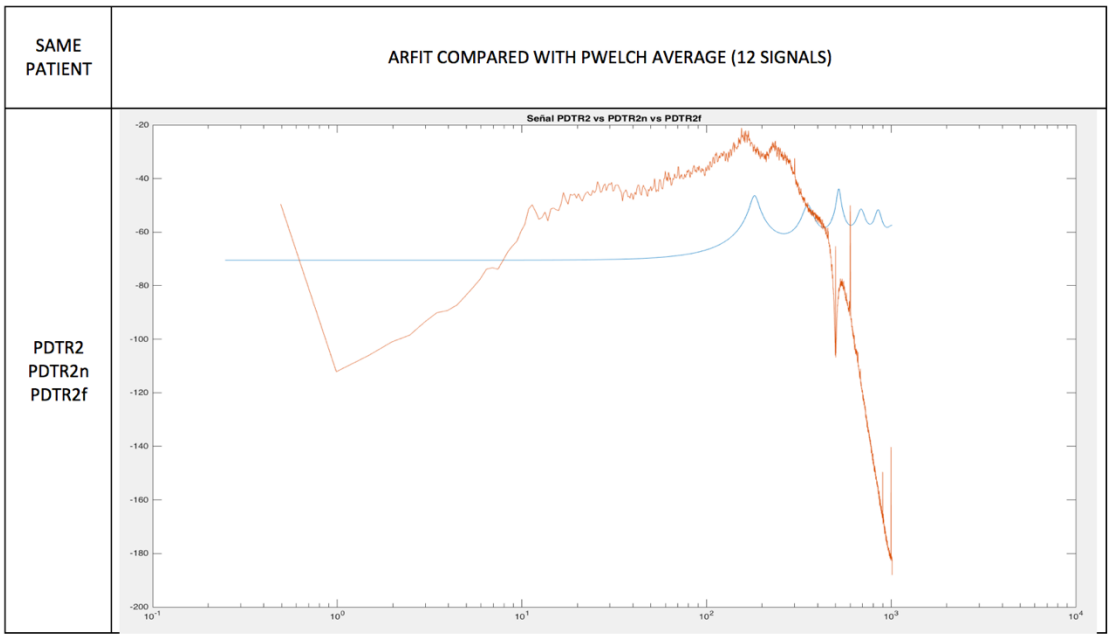


Figure 45: Multivariate case with 12 signals

In this case nor the Low Beta neither the High Beta are well predicted.

As it was predicted for the univariate case, the p order for the AR model in the multivariate case is 1, but using 16 signals.

CHAPTER 5: CONCLUSION

5.Conclusion

In this project we aimed at developing a multivariate framework to study the oscillatory activity of PD patients. To do that, we had the opportunity to access to *real signals*: the local field potentials (LFP) recorded from the stimulation macroelectrodes of the DBS systems implanted in the subthalamic nucleus (STN) of 14 patients with PD.

Inspired by a previous paper where authors build a multivariate model to describe the ECoG signals recorded from anaesthetized monkeys, here we aimed to assess the suitability of AR models to fit the STN activity, define an approach to do so and finally obtain the parameters that characterize these signals across different stage

The fact of being so cautious with the treatment of the signal is because we want to have the smallest order for our AR model. If we hadn't implemented a Low Pass Filter, the order would have increased a lot due to the signal. We need to have it the cleanest we can. However, as we can't modulate the 300 Hz, we won't be able to modulate the connection between Beta and 300 Hz. This will be studied in the future in order to integrate it.

In the totality of the texts we have read, the election of the AR order is not as justified as in our case. In fact, choosing a good p order for the AR model is critical according to the results we have obtained. If we take a bad decision choosing the order, we probably wouldn't be able to reproduce the components we want to. It's also important because the fact of choosing badly the order implies the existence of a frequency movement that alters the reproduction of our frequencies of interest.

Overall, the results of this project suggest that -although it is possible to use AR models to study STN activity from PD patients-, there are some constraints due to the nature of the signals that remain to be solved. Anyway, we consider that this framework constitutes an interesting tool for the study of the oscillatory activity in PD patients and we expect to develop the techniques to obtain a time-varying characterization of the signals/models in the future.

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CHAPTER 7: APPENDIXES

Appendix 1: the amplitudes of the signal in 50,100 and 150 Hz

		ESTADO OFF				ESTADO ON		
		50 Hz	150 Hz	250 Hz		50 Hz	150 Hz	250 Hz
PDTR 2	STN 0-1	0,0267	0,06	No se aprecian valores alejados		0,0341	0,077	-
	STN 1-2	0,0504	0,009			0,0913	0,0126	-
	STN 2-3	0,0479	0,00677			0,0476	0,006	-
	STN 4-5	0,788	0,0367			0,993	0,0358	-
	STN 5-6	0,391	0,0197			0,696	0,0308	0,0232
	STN 6-7	0,0946	0,03			0,097	0,031	-
PDTR 3	STN 0-1	0,0187	0,004	0,004		0,0206	0,003	0,00558
	STN 1-2	0,0455	0,0161	0,0194		0,0312	0,0121	0,0161
	STN 2-3	0,0216	0,119	0,0896		0,0216	0,0897	0,0815
	STN 4-5	1,7	0,0216	0,0419		2,06	0,0237	0,0381
	STN 5-6	0,163	0,0524	0,0204		0,197	0,0434	0,0186
	STN 6-7	0,294	0,114	0,0226		0,221	0,103	0,017
PDTR 4	STN 0-1	0,255	0,00835	0,00759		0,226	0,006	0,008
	STN 1-2	0,0523	0,0223	0,02		0,0421	0,0164	0,00397
	STN 2-3	0,0484	0,04	0,04		0,0518	0,0322	0,0322
	STN 4-5	0,267	0,0187	0,0777		0,286	0,0182	0,0915
	STN 5-6	0,0662	0,0133	0,146		0,0708	0,0142	0,00974
	STN 6-7	0,0196	0,0461	0,0111		0,0231	0,0371	0,0119

		ESTADO OFF				ESTADO ON		
		50 Hz	150 Hz	250 Hz		50 Hz	150 Hz	250 Hz
PDTR 5	STN 0-1	0,141	0,00815	0,119		0,12	0,00784	0,0144
	STN 1-2	0,193	0,00854	0,0045		0,219	0,00672	0,00585
	STN 2-3	0,674	0,0137	0,00939		0,694	0,0157	0,0118
	STN 4-5	0,0429	0,0026	0,00387		0,038	0,0029	0,00445
	STN 5-6	0,0592	0,00587	0,00159		0,0643	0,00504	0,00141
	STN 6-7	0,0598	0,0191	0,00253		0,0655	0,018	0,00187
PDTR 6	STN 0-1	0,108	0,0121	0,01		0,131	0,0111	0,0178
	STN 1-2	0,0517	0,0293	0,0104		0,0472	0,0294	0,0114
	STN 2-3	0,0438	0,0186	0,0154		0,053	0,017	0,017
	STN 4-5	0,0851	0,0438	0,064		0,0775	0,033	0,0775
	STN 5-6	0,0192	0,0159	0,00264		0,0159	0,012	0,00386
	STN 6-7	0,038	0,0345	0,00321		0,0317	0,0278	0,00573
PDTR 7	STN 0-1	0,137	0,0039	0,0018		0,158	0,00389	0,00385
	STN 1-2	0,0538	0,0119	0,00813		0,0574	0,0127	0,00954
	STN 2-3	0,0281	0,0451	0,0373		0,03	0,0438	0,0362
	STN 4-5	0,227	0,0159	0,041		0,266	0,014	0,0438
	STN 5-6	0,0994	0,015	0,0064		0,0965	0,016	0,00567
	STN 6-7	0,0356	0,0294	0,00331		0,026	0,0286	0,00688

		ESTADO OFF				ESTADO ON		
		50 Hz	150 Hz	250 Hz		50 Hz	150 Hz	250 Hz
PDTR 8	STN 0-1	0,0844	0,0928	0,0578		0,187	0,17	0,045
	STN 1-2	0,573	0,153	0,0279		0,651	0,174	0,0317
	STN 2-3	0,404	0,0176	0,0121		1,44	0,0166	0,0166
	STN 4-5	0,142	0,118	0,0075		0,237	0,147	0,00707
	STN 5-6	0,0622	0,00778	0,00533		0,0401	0,00973	0,00502
	STN 6-7	0,0578	0,0768	0,0139		0,116	0,028	0,0144
PDTR 9	STN 0-1	0,461	0,0628	0,0221		-	-	-
	STN 1-2	0,906	0,292	0,0365		-	-	-
	STN 2-3	0,0658	0,0108	0,00557		-	-	-
	STN 4-5	0,707	0,187	0,0308		-	-	-
	STN 5-6	0,864	0,0197	0,00927		-	-	-
	STN 6-7	0,674	0,122	0,0183		-	-	-
PDTR 10	STN 0-1	0,106	0,0233	0,0159		0,0544	0,0282	0,012
	STN 1-2	0,256	0,0165	0,0241		0,255	0,0319	0,015
	STN 2-3	0,0631	0,0244	0,0357		0,0476	0,0184	0,0104
	STN 4-5	0,0393	0,0025	0,00646		0,0358	0,00228	0,00333
	STN 5-6	0,023	0,013	0,00316		0,0173	0,0143	0,00197
	STN 6-7	0,0082	0,00991	0,00464		0,0176	0,0132	0,0018

		ESTADO OFF				ESTADO ON		
		50 Hz	150 Hz	250 Hz		50 Hz	150 Hz	250 Hz
PDTR 11	STN 0-1	0,0169	0,0037	0,00595		0,017	0,00494	0,0106
	STN 1-2	0,0285	0,0111	0,00834		0,0345	0,00919	0,00919
	STN 2-3	0,00624	0,067	0,00458		0,00428	0,0612	0,05556
	STN 4-5	0,253	0,0314	0,0417		0,231	0,0286	0,0672
	STN 5-6	0,0435	0,036	0,0247		0,0528	0,0329	0,0226
	STN 6-7	0,165	0,0934	0,0205		0,2	0,0938	0,0273
PDTR 12	STN 0-1	0,0286	0,0346	0,0215		0,426	0,0397	0,0272
	STN 1-2	0,379	0,0269	0,0269		0,923	0,232	0,0372
	STN 2-3	0,0483	0,0706	0,137		0,336	0,0979	0,108
	STN 4-5	0,243	0,0128	0,0248		0,791	0,0285	0,0458
	STN 5-6	0,0411	0,0176	0,0176		0,0518	0,0152	0,0167
	STN 6-7	0,131	0,0101	0,0196		0,912	0,00492	0,048
PDTR 13	STN 0-1	0,0488	0,00971	0,00664		0,0264	0,00846	0,00636
	STN 1-2	0,0971	0,00689	0,0111		0,123	0,0116	0,00963
	STN 2-3	0,018	0,0512	0,0923		0,0172	0,0866	0,0716
	STN 4-5	0,0748	0,0149	0,0198		0,049	0,0172	0,0335
	STN 5-6	0,0926	0,036	0,0435		0,0503	0,0503	0,314
	STN 6-7	0,0142	0,0404	0,0367		0,0102	0,0467	0,024

Appendix 2: Existence of frequency component in 50, 150 and 250 and Theta component

PDTR-2 OFF	CH 0-1	YES	YES	YES	NO	
	CH 1-2	YES	YES	YES	NO	
	CH 2-3	YES	YES	NO	NO	
	CH 4-5	YES	YES	YES	NO	
	CH 5-6	YES	YES	YES	NO	
	CH 6-7	YES	YES	YES	YES	Channel Chosen
	Frequency	50 Hz	150 Hz	250 Hz	Theta	

PDTR-2 ON	CH 0-1	YES	YES	NO	NO
	CH 1-2	YES	YES	NO	NO
	CH 2-3	YES	YES	NO	NO
	CH 4-5	YES	YES	NO	NO
	CH 5-6	YES	YES	YES	NO
	CH 6-7	YES	YES	NO	NO
	Frequency	50 Hz	150 Hz	250 Hz	Theta

PDTR-3 OFF	CH 0-1	YES	NO	NO	NO
	CH 1-2	NO	YES	YES	NO
	CH 2-3	NO	YES	YES	NO
	CH 4-5	YES	YES	YES	NO
	CH 5-6	YES	YES	YES	NO
	CH 6-7	YES	YES	YES	NO
	Frequency	50 Hz	150 Hz	250 Hz	Theta

PDTR-3 ON	CH 0-1	YES	YES	YES	NO
	CH 1-2	YES	YES	YES	NO
	CH 2-3	YES	YES	YES	NO
	CH 4-5	YES	YES	YES	NO
	CH 5-6	YES	YES	YES	NO
	CH 6-7	YES	YES	YES	NO
	Frequency	50 Hz	150 Hz	250 Hz	Theta

PDTR-4 OFF	CH 0-1	YES	YES	YES	NO	
	CH 1-2	YES	YES	NO	YES	
	CH 2-3	YES	YES	YES	YES	Channel chosen
	CH 4-5	YES	YES	YES	NO	
	CH 5-6	YES	YES	YES	YES	Channel chosen
	CH 6-7	YES	YES	YES	YES	Channel chosen
	Frequency	50 Hz	150 Hz	250 Hz	Theta	

PDTR-4 ON	CH 0-1	YES	YES	YES	NO
	CH 1-2	YES	YES	NO	NO
	CH 2-3	YES	YES	YES	NO
	CH 4-5	YES	YES	YES	NO
	CH 5-6	YES	YES	YES	NO
	CH 6-7	YES	YES	YES	NO
	Frequency	50 Hz	150 Hz	250 Hz	Theta

PDTR-5 OFF	CH 0-1	YES	YES	YES	NO
	CH 1-2	YES	YES	YES	NO
	CH 2-3	YES	YES	YES	NO
	CH 4-5	YES	YES	YES	NO
	CH 5-6	YES	NO	YES	NO
	CH 6-7	YES	YES	NO	NO
	Frequency	50 Hz	150 Hz	250 Hz	Theta

PDTR-5 ON	CH 0-1	YES	YES	YES	NO
	CH 1-2	YES	YES	YES	NO
	CH 2-3	YES	YES	YES	NO
	CH 4-5	YES	NO	YES	NO
	CH 5-6	YES	YES	NO	NO
	CH 6-7	YES	YES	NO	NO
	Frequency	50 Hz	150 Hz	250 Hz	Theta

PDTR-6 OFF	CH 0-1	YES	YES	YES	NO	
	CH 1-2	YES	YES	NO	YES	
	CH 2-3	YES	YES	YES	NO	
	CH 4-5	YES	YES	YES	NO	
	CH 5-6	YES	YES	YES	YES	Channel chosen
	CH 6-7	YES	YES	YES	YES	Channel chosen
	Frequency	50 Hz	150 Hz	250 Hz	Theta	

PDTR-6 ON	CH 0-1	YES	NO	YES	NO	
	CH 1-2	YES	YES	NO	NO	
	CH 2-3	YES	YES	YES	NO	
	CH 4-5	YES	YES	YES	NO	
	CH 5-6	YES	YES	YES	NO	
	CH 6-7	YES	YES	YES	NO	
	Frequency	50 Hz	150 Hz	250 Hz	Theta	
PDTR-7 OFF	CH 0-1	YES	YES	YES	NO	
	CH 1-2	YES	YES	YES	NO	
	CH 2-3	YES	YES	YES	NO	
	CH 4-5	YES	YES	YES	NO	
	CH 5-6	YES	YES	YES	NO	
	CH 6-7	YES	YES	YES	NO	
	Frequency	50 Hz	150 Hz	250 Hz	Theta	
PDTR-7 ON	CH 0-1	YES	YES	NO	YES	
	CH 1-2	YES	YES	YES	YES	Channel chosen
	CH 2-3	YES	YES	YES	YES	Channel chosen
	CH 4-5	YES	YES	YES	NO	
	CH 5-6	YES	YES	YES	NO	
	CH 6-7	YES	YES	YES	NO	
	Frequency	50 Hz	150 Hz	250 Hz	Theta	
PDTR-8 OFF	CH 0-1	YES	YES	YES	NO	
	CH 1-2	YES	YES	YES	NO	
	CH 2-3	YES	YES	YES	NO	
	CH 4-5	YES	YES	YES	NO	
	CH 5-6	YES	YES	YES	YES	Channel chosen
	CH 6-7	YES	YES	YES	NO	
	Frequency	50 Hz	150 Hz	250 Hz	Theta	
PDTR-8 ON	CH 0-1	YES	YES	YES	NO	
	CH 1-2	YES	YES	YES	NO	
	CH 2-3	YES	YES	YES	NO	
	CH 4-5	YES	YES	YES	NO	
	CH 5-6	YES	YES	NO	NO	
	CH 6-7	YES	YES	YES	NO	
	Frequency	50 Hz	150 Hz	250 Hz	Theta	

PDTR-9 OFF	CH 0-1	YES	YES	YES	NO	
	CH 1-2	YES	YES	YES	NO	
	CH 2-3	YES	YES	YES	NO	
	CH 4-5	YES	YES	YES	NO	
	CH 5-6	YES	YES	YES	NO	
	CH 6-7	YES	YES	YES	NO	
	Artefactos	50 Hz	150 Hz	250 Hz	Theta	

PDTR-10 OFF	CH 0-1	YES	YES	NO	NO
	CH 1-2	YES	NO	NO	NO
	CH 2-3	YES	YES	NO	YES
	CH 4-5	YES	NO	YES	NO
	CH 5-6	YES	YES	YES	NO
	CH 6-7	YES	YES	YES	NO
	Frequency	50 Hz	150 Hz	250 Hz	Theta

PDTR-10 ON	CH 0-1	NO	YES	NO	NO
	CH 1-2	YES	YES	NO	NO
	CH 2-3	YES	YES	NO	NO
	CH 4-5	YES	YES	YES	NO
	CH 5-6	YES	YES	YES	NO
	CH 6-7	YES	YES	YES	NO
	Frequency	50 Hz	150 Hz	250 Hz	Theta

PDTR-11 OFF	CH 0-1	YES	NO	YES	NO	
	CH 1-2	YES	YES	YES	NO	
	CH 2-3	YES	YES	YES	NO	
	CH 4-5	YES	YES	YES	NO	
	CH 5-6	YES	YES	YES	YES	Channel chosen
	CH 6-7	YES	YES	YES	YES	Channel chosen
	Frequency	50 Hz	150 Hz	250 Hz	Theta	

PDTR-11 ON	CH 0-1	NO	NO	NO	NO
	CH 1-2	YES	YES	YES	NO
	CH 2-3	NO	YES	YES	NO
	CH 4-5	YES	YES	YES	NO

	CH 5-6	V	YES	YES	NO
	CH 6-7	SI	YES	YES	NO
	Frequency	50 Hz	150 Hz	250 Hz	Theta

PDTR-12 OFF	CH 0-1	NO	YES	YES	NO	
	CH 1-2	YES	YES	YES	NO	
	CH 2-3	YES	YES	YES	YES	Channel chosen
	CH 4-5	YES	YES	YES	NO	
	CH 5-6	YES	YES	YES	NO	
	CH 6-7	YES	YES	YES	NO	
	Frequency	50 Hz	150 Hz	250 Hz	Theta	

PDTR-12 ON	CH 0-1	YES	YES	YES	YES	Channel chosen
	CH 1-2	YES	YES	YES	YES	Channel chosen
	CH 2-3	YES	YES	YES	YES	Channel chosen
	CH 4-5	YES	YES	YES	NO	
	CH 5-6	YES	YES	YES	NO	
	CH 6-7	YES	YES	YES	NO	
	Frequency	50 Hz	150 Hz	250 Hz	Theta	

PDTR-13 OFF	CH 0-1	YES	YES	YES	NO	
	CH 1-2	YES	YES	YES	NO	
	CH 2-3	YES	YES	YES	NO	
	CH 4-5	YES	NO	YES	NO	
	CH 5-6	YES	YES	NO	YES	
	CH 6-7	YES	YES	YES	YES	Channel chosen
	Frequency	50 Hz	150 Hz	250 Hz	Theta	

PDTR-13 ON	CH 0-1	YES	YES	YES	NO	
	CH 1-2	YES	YES	YES	NO	
	CH 2-3	NO	YES	YES	NO	
	CH 4-5	YES	YES	YES	YES	Channel chosen
	CH 5-6	YES	YES	YES	YES	Channel chosen
	CH 6-7	YES	YES	YES	YES	Channel chosen
	Frequency	50 Hz	150 Hz	250 Hz	Theta	

Channels chosen	**PDTR-2 OFF**	CH 6-7
	PDTR-4 OFF	CH 2-3
		CH 5-6
		CH 6-7
	PDTR-6 OFF	CH 5-6
		CH 6-7
	PDTR-8 OFF	CH 5-6
	PDTR-11 OFF	CH 5-6
		CH 6-7
	PDTR-13 OFF	CH 6-7
	PDTR-7 ON	CH 1-2
		CH 2-3
	PDTR-12 ON	CH 0-1
		CH 1-2
		CH 2-3
	PDTR-13 ON	CH 4-5
		CH 5-6
		CH 6-7

Appendix 3: Appearance of Low Beta, High Beta and Theta

PDTR-2	OFF	Low Beta	High Beta	Teta	
STN 0-1	Amplitud	0,4124	0,282	0,011	SI
	Frecuencia	14,83	23,23	234,8	
STN 1-2	Amplitud	0,8099	0,492	0,011	SI
	Frecuencia	15,81	23,72	238,3	
STN 2-3	Amplitud	2,642	1,271	0,009	SI
	Frecuencia	16,8	23,23	232,3	
STN 4-5	Amplitud	2,027	1,301	0,032	SI
	Frecuencia	15,32	23,72	232,8	
STN 5-6	Amplitud	6,234	4,24	0,01667	SI
	Frecuencia	16,31	23,72	232,8	
STN 6-7	Amplitud	0,3686	0,312	0,08	SI
	Frecuencia	12,36	23,23	230,3	

PDTR-2	ON	Low Beta	High Beta	Teta	
STN 0-1	Amplitud	0,1558	0,11	0,008	SI
	Frecuencia	14,83	23,23	294,1	
STN 1-2	Amplitud	0,161	0,3084	0,016	SI
	Frecuencia	15,81	23,72	326	
STN 2-3	Amplitud	0,2683	0,3367	0,014	SI
	Frecuencia	16,8	23,23	321,7	
STN 4-5	Amplitud	0,1431	0,5954	0,039	SI
	Frecuencia	15,32	23,72	321,2	
STN 5-6	Amplitud	0,3379	0,66	0,0354	SI
	Frecuencia	16,31	23,72	324,2	
STN 6-7	Amplitud	0,087	0,1811	0,009	SI
	Frecuencia	12,36	23,23	331,1	

PDTR-3	OFF	Low Beta	High Beta	Teta	
STN 0-1	Amplitud	2,45	1,149	NO	SI
	Frecuencia	13,84	21,25	NO	
STN 1-2	Amplitud	4,512	1,494	0,016	SI
	Frecuencia	13,34	21,25	355,8	
STN 2-3	Amplitud	4,128	1,686	0,0103	SI
	Frecuencia	14,33	21,25	343,5	
STN 4-5	Amplitud	2,073	0,9638	NO	
	Frecuencia	14,83	21,75	NO	
STN 5-6	Amplitud	11,56	2,919	NO	
	Frecuencia	13,84	20,26	NO	
STN 6-7	Amplitud	4,308	1,251	NO	
	Frecuencia	15,32	20,26	NO	

PDTR-3	ON	Low Beta	High Beta	Teta	
STN 0-1	Amplitud	0,04851	0,90	0,006	
	Frecuencia	13,84	21,25	312	
STN 1-2	Amplitud	0,3316	0,3712	0,01127	SI
	Frecuencia	13,34	21,25	331,1	
STN 2-3	Amplitud	0,077	0,1458	0,008	SI
	Frecuencia	14,33	21,25	327,7	
STN 4-5	Amplitud	0,4148	0,4967	NO	
	Frecuencia	14,83	21,75	NO	
STN 5-6	Amplitud	0,4181	0,4835	NO	
	Frecuencia	13,84	20,26	NO	
STN 6-7	Amplitud	0,3204	0,4192	NO	
	Frecuencia	15,32	20,26	NO	

PDTR-4	OFF	Low Beta	High Beta	Teta	
STN 0-1	Amplitud	0,1137	0,07	0,008	SI
	Frecuencia	17,3	26,69	231,8	
STN 1-2	Amplitud	0,9438	0,1186	0,03192	SI
	Frecuencia	17,3	29,65	242,7	
STN 2-3	Amplitud	0,4791	0,1082	0,034	SI
	Frecuencia	17,3	27,18	245,1	
STN 4-5	Amplitud	0,2004	0,1264	NO	
	Frecuencia	17,79	28,17	NO	
STN 5-6	Amplitud	0,1602	0,1135	0,02158	SI
	Frecuencia	17,3	29,65	241,7	
STN 6-7	Amplitud	0,3084	0,1031	0,01257	SI
	Frecuencia	18,29	28,17	248,6	

PDTR-4	ON	Low Beta	High Beta	Teta
STN 0-1	Amplitud	0,04	0,08	NO
	Frecuencia	17,3	26,69	NO
STN 1-2	Amplitud	0,09	0,1639	NO
	Frecuencia	17,3	29,65	NO
STN 2-3	Amplitud	0,06404	0,07111	NO
	Frecuencia	17,3	27,18	NO
STN 4-5	Amplitud	0,05676	0,1402	NO
	Frecuencia	17,79	28,17	NO
STN 5-6	Amplitud	0,0945	0,1229	NO
	Frecuencia	17,3	29,65	NO
STN 6-7	Amplitud	0,07807	0,1463	NO
	Frecuencia	18,29	28,17	NO

PDTR-5	OFF	Low Beta	High Beta	Teta
STN 0-1	Amplitud	1,93	0,1231	NO
	Frecuencia	13,84	26,69	NO
STN 1-2	Amplitud	0,8278	0,09792	NO
	Frecuencia	14,33	26,19	NO
STN 2-3	Amplitud	3,697	0,404	NO
	Frecuencia	13,84	27,18	NO
STN 4-5	Amplitud	BASURA	BASURA	BASURA
	Frecuencia	BASURA	BASURA	BASURA
STN 5-6	Amplitud	0,4605	0,02746	NO
	Frecuencia	14,33	28,17	NO
STN 6-7	Amplitud	0,1824	0,01657	NO
	Frecuencia	14,33	29,65	NO

PDTR-5	ON	Low Beta	High Beta	Teta
STN 0-1	Amplitud	1,31	0,1059	NO
	Frecuencia	13,84	26,69	NO
STN 1-2	Amplitud	0,4912	0,0772	NO
	Frecuencia	14,33	26,19	NO
STN 2-3	Amplitud	2,435	0,258	NO
	Frecuencia	13,84	27,18	NO
STN 4-5	Amplitud	BASURA	BASURA	BASURA
	Frecuencia	BASURA	BASURA	BASURA
STN 5-6	Amplitud	0,3416	0,022	NO
	Frecuencia	14,33	28,17	NO
STN 6-7	Amplitud	0,1047	0,01571	NO
	Frecuencia	14,33	29,65	NO

PDTR-6	OFF	Low Beta	High Beta	Teta	
STN 0-1	Amplitud	0,7085	0,196	NO	
	Frecuencia	16,31	28,17	NO	
STN 1-2	Amplitud	0,199	0,354	0,023	SI
	Frecuencia	17,300	25,700	237,200	
STN 2-3	Amplitud	0,312	0,076	NO	
	Frecuencia	16,810	28,17	NO	
STN 4-5	Amplitud	BASURA	BASURA	BASURA	
	Frecuencia	BASURA	BASURA	BASURA	
STN 5-6	Amplitud	0,010	0,005	0,001	SI
	Frecuencia	11,370	22,400	233,800	
STN 6-7	Amplitud	0,013	0,006	0,001	SI
	Frecuencia	11,370	22,240	238,300	

PDTR-6	ON	Low Beta	High Beta	Teta	
STN 0-1	Amplitud	0,073	0,155	NO	
	Frecuencia	16,31	28,17	NO	
STN 1-2	Amplitud	0,048	0,219	0,027	SI
	Frecuencia	17,300	25,700	356,300	
STN 2-3	Amplitud	0,034	0,065	0,010	
	Frecuencia	16,810	28,17	357,100	
STN 4-5	Amplitud	BASURA	BASURA	BASURA	
	Frecuencia	BASURA	BASURA	BASURA	
STN 5-6	Amplitud	0,009	0,002	NO	
	Frecuencia	11,370	22,400	NO	
STN 6-7	Amplitud	0,009	0,004	NO	
	Frecuencia	11,370	22,240	NO	

PDTR-7	OFF	Low Beta	High Beta	Teta	
STN 0-1	Amplitud	0,163	0,032	NO	
	Frecuencia	10,870	26,190	NO	
STN 1-2	Amplitud	1,991	0,099	0,005	SI
	Frecuencia	10,870	24,710	231,800	
STN 2-3	Amplitud	0,975	0,091	NO	
	Frecuencia	10,870	26,190	NO	
STN 4-5	Amplitud	BASURA	BASURA	BASURA	
	Frecuencia	BASURA	BASURA	BASURA	
STN 5-6	Amplitud	0,411	0,069	NO	
	Frecuencia	13,340	25,700	NO	
STN 6-7	Amplitud	0,066	0,042	NO	
	Frecuencia	10,380	24,220	NO	

PDTR-7	ON	Low Beta	High Beta	Teta	
STN 0-1	Amplitud	0,014	0,016	0,006	
	Frecuencia	10,870	26,190	274,300	
STN 1-2	Amplitud	0,030	0,017	0,007	SI
	Frecuencia	10,870	24,710	274,200	
STN 2-3	Amplitud	0,050	0,016	0,004	
	Frecuencia	10,870	26,190	283,200	
STN 4-5	Amplitud	BASURA	BASURA	BASURA	
	Frecuencia	BASURA	BASURA	BASURA	
STN 5-6	Amplitud	0,019	0,029	NO	
	Frecuencia	13,340	25,700	NO	
STN 6-7	Amplitud	0,019	0,025	NO	
	Frecuencia	10,380	24,220	NO	

PDTR-8	OFF	Low Beta	High Beta	Teta	
STN 0-1	Amplitud	2,479	0,891	NO	
	Frecuencia	15,020	26,640	NO	
STN 1-2	Amplitud	7,546	1,232	NO	
	Frecuencia	15,990	25,670	NO	
STN 2-3	Amplitud	0,372	0,072	0,013	SI
	Frecuencia	15,020	27,130	231,400	
STN 4-5	Amplitud	0,118	0,025	NO	
	Frecuencia	12,590	24,220	NO	
STN 5-6	Amplitud	0,487	0,115	0,008	SI
	Frecuencia	12,590	22,700	235,900	
STN 6-7	Amplitud	0,417	0,035	0,006	SI
	Frecuencia	15,990	23,250	232,500	

PDTR-8	ON	Low Beta	High Beta	Teta	
STN 0-1	Amplitud	0,670	2,453	0,055	
	Frecuencia	15,020	26,640	331,400	
STN 1-2	Amplitud	1,406	5,017	0,050	
	Frecuencia	15,990	25,670	341,500	
STN 2-3	Amplitud	0,110	0,217	0,012	SI
	Frecuencia	15,020	27,130	340,500	
STN 4-5	Amplitud	0,060	0,098	0,010	
	Frecuencia	12,590	24,220	310,000	
STN 5-6	Amplitud	0,200	0,242	0,016	SI
	Frecuencia	12,590	22,700	317,800	
STN 6-7	Amplitud	0,025	0,032	0,008	SI
	Frecuencia	15,990	23,250	322,600	

PDTR-9	OFF	Low Beta	High Beta	Teta
STN 0-1	Amplitud	0,009	0,002	NO
	Frecuencia	11,860	22,400	NO
STN 1-2	Amplitud	0,004	0,003	NO
	Frecuencia	14,830	25,700	NO
STN 2-3	Amplitud	0,006	0,002	NO
	Frecuencia	14,830	24,220	NO
STN 4-5	Amplitud	0,204	0,219	NO
	Frecuencia	16,800	25,700	NO
STN 5-6	Amplitud	0,027	0,019	NO
	Frecuencia	12,850	22,240	NO
STN 6-7	Amplitud	0,011	0,007	NO
	Frecuencia	15,810	25,700	NO

PDTR-10	OFF	Low Beta	High Beta	Teta	
STN 0-1	Amplitud	6,630	0,184	0,020	SI
	Frecuencia	17,760	27,130	273,100	
STN 1-2	Amplitud	38,530	0,615	0,030	SI
	Frecuencia	17,760	34,520	252,000	
STN 2-3	Amplitud	3,107	0,176	0,080	SI
	Frecuencia	17,260	29,590	252,000	
STN 4-5	Amplitud	1,128	0,022	NO	
	Frecuencia	19,240	29,100	NO	
STN 5-6	Amplitud	0,170	0,015	NO	
	Frecuencia	19,730	29,100	NO	
STN 6-7	Amplitud	0,028	0,005	NO	
	Frecuencia	19,730	27,130	NO	

PDTR-10	ON	Low Beta	High Beta	Teta	
STN 0-1	Amplitud	0,550	0,213	0,030	SI
	Frecuencia	17,760	27,130	303,400	
STN 1-2	Amplitud	0,490	0,176	0,030	SI
	Frecuencia	17,760	34,520	314,200	
STN 2-3	Amplitud	0,383	0,126	NO	
	Frecuencia	17,260	29,590	NO	
STN 4-5	Amplitud	0,050	0,014	0,008	
	Frecuencia	19,240	29,100	330,900	
STN 5-6	Amplitud	0,070	0,013	0,003	
	Frecuencia	19,730	29,100	340,000	
STN 6-7	Amplitud	0,011	0,005	NO	
	Frecuencia	19,730	27,130	NO	

PDTR-11	OFF	Low Beta	High Beta	Teta	
STN 0-1	Amplitud	1,405	0,095	0,008	SI
	Frecuencia	14,830	25,700	279,400	
STN 1-2	Amplitud	3,162	0,172	0,007	SI
	Frecuencia	15,320	28,170	344,500	
STN 2-3	Amplitud	0,359	0,025	0,002	SI
	Frecuencia	16,310	26,690	240,700	
STN 4-5	Amplitud	0,278	0,222	NO	
	Frecuencia	16,310	26,190	NO	
STN 5-6	Amplitud	4,013	0,316	0,033	SI
	Frecuencia	16,310	27,180	245,600	
STN 6-7	Amplitud	1,998	0,122	0,021	SI
	Frecuencia	17,300	27,680	241,700	

PDTR-11	ON	Low Beta	High Beta	Teta	
STN 0-1	Amplitud	0,069	0,088	0,040	SI
	Frecuencia	14,830	25,700	323,200	
STN 1-2	Amplitud	0,041	0,209	0,071	SI
	Frecuencia	15,320	28,170	321,700	
STN 2-3	Amplitud	0,017	0,022	0,004	SI
	Frecuencia	16,310	26,690	325,300	
STN 4-5	Amplitud	0,079	0,286	0,052	
	Frecuencia	16,310	26,190	319,800	
STN 5-6	Amplitud	0,087	0,318	0,041	SI
	Frecuencia	16,310	27,180	325,200	
STN 6-7	Amplitud	0,034	0,094	0,017	SI
	Frecuencia	17,300	27,680	326,100	

PDTR-12	OFF	Low Beta	High Beta	Teta	
STN 0-1	Amplitud	2,273	0,249	0,024	SI
	Frecuencia	13,340	26,190	269,400	
STN 1-2	Amplitud	5,737	0,355	0,034	SI
	Frecuencia	13,340	26,690	288,600	
STN 2-3	Amplitud	17,540	0,606	0,180	SI
	Frecuencia	17,790	26,690	234,800	
STN 4-5	Amplitud	0,057	0,014	NO	
	Frecuencia	13,840	24,710	NO	
STN 5-6	Amplitud	0,030	0,118	NO	
	Frecuencia	17,790	25,200	NO	
STN 6-7	Amplitud	0,023	0,010	NO	
	Frecuencia	18,780	20,760	NO	

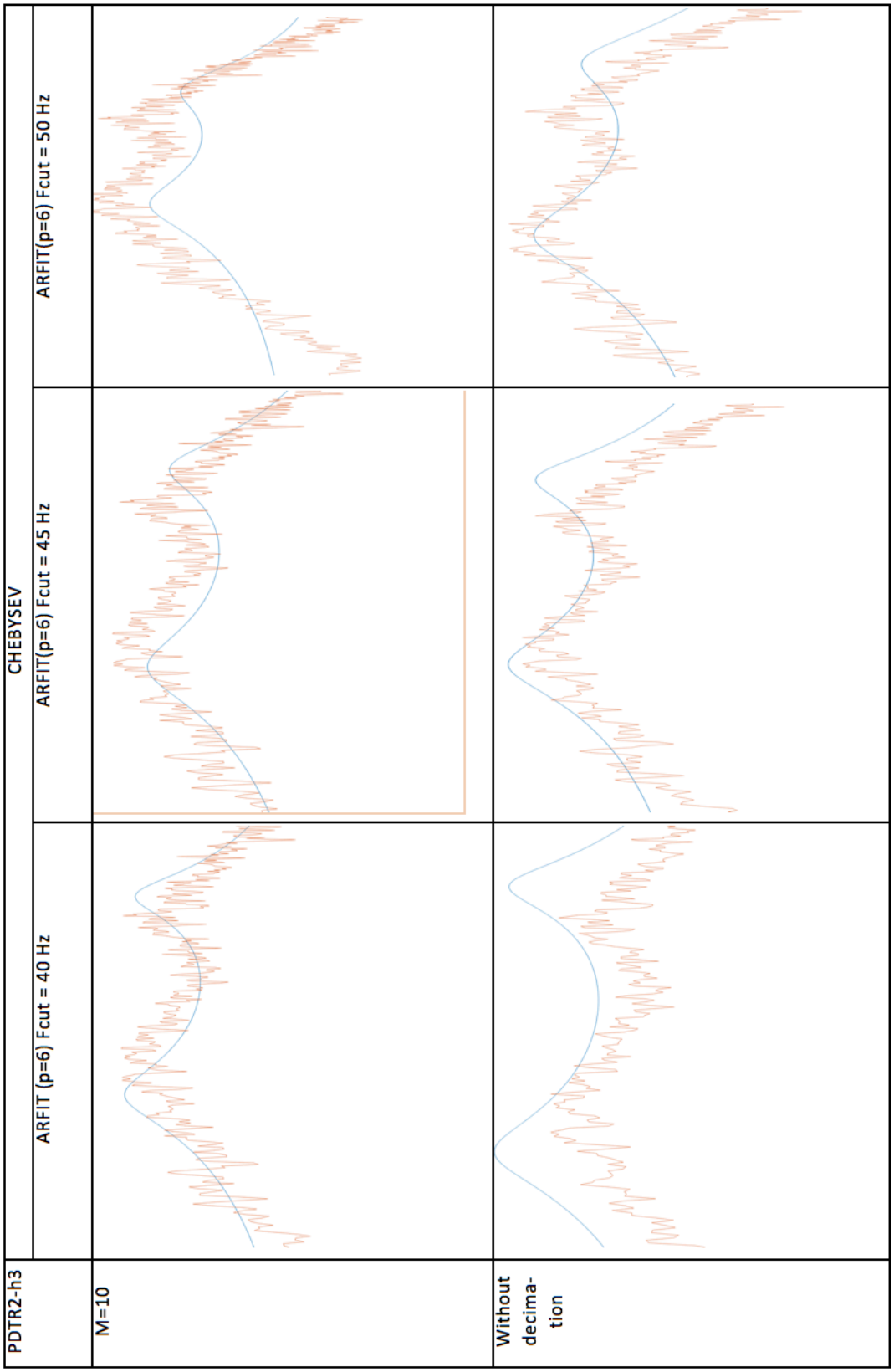
PDTR-12	ON	Low Beta	High Beta	Teta	
STN 0-1	Amplitud	0,104	0,279	0,048	SI
	Frecuencia	13,340	26,190	278,200	
STN 1-2	Amplitud	0,123	0,235	0,077	SI
	Frecuencia	13,340	26,690	267,400	
STN 2-3	Amplitud	0,204	0,204	0,039	SI
	Frecuencia	17,790	26,690	287,100	
STN 4-5	Amplitud	0,021	0,013	NO	
	Frecuencia	13,840	24,710	NO	
STN 5-6	Amplitud	0,011	0,011	NO	
	Frecuencia	17,790	25,200	NO	
STN 6-7	Amplitud	0,010	0,011	NO	
	Frecuencia	18,780	20,760	NO	

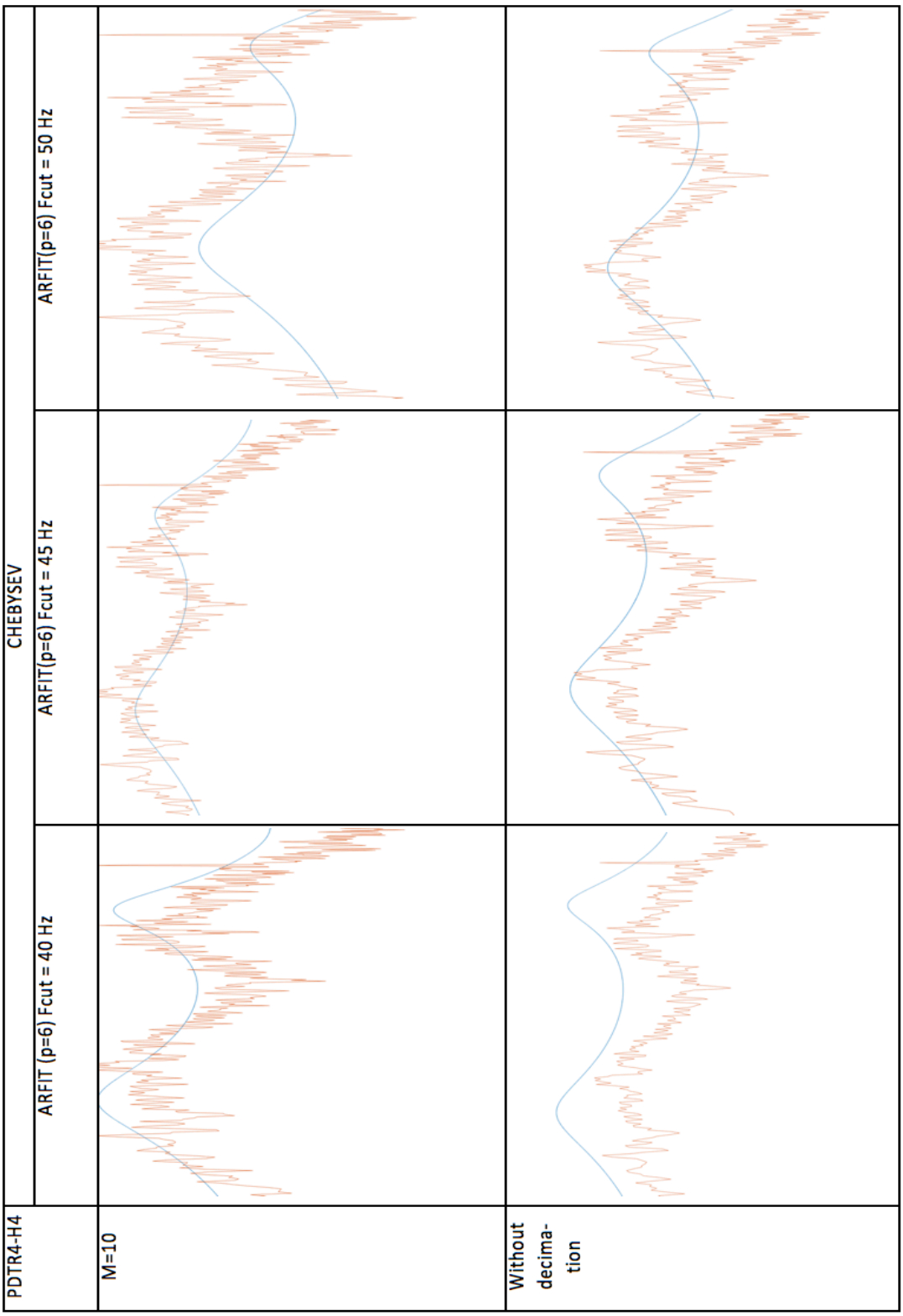
PDTR-13	OFF	Low Beta	High Beta	Teta	
STN 0-1	Amplitud	0,384	0,049	NO	
	Frecuencia	16,310	23,720	NO	
STN 1-2	Amplitud	4,334	0,085	NO	
	Frecuencia	11,860	23,230	NO	
STN 2-3	Amplitud	4,334	0,077	NO	
	Frecuencia	11,860	23,720	NO	
STN 4-5	Amplitud	2,191	0,330	NO	
	Frecuencia	15,810	23,230	NO	
STN 5-6	Amplitud	18,120	0,306	0,079	SI
	Frecuencia	16,310	30,150	234,300	
STN 6-7	Amplitud	15,700	0,154	0,049	SI
	Frecuencia	16,310	30,150	232,200	

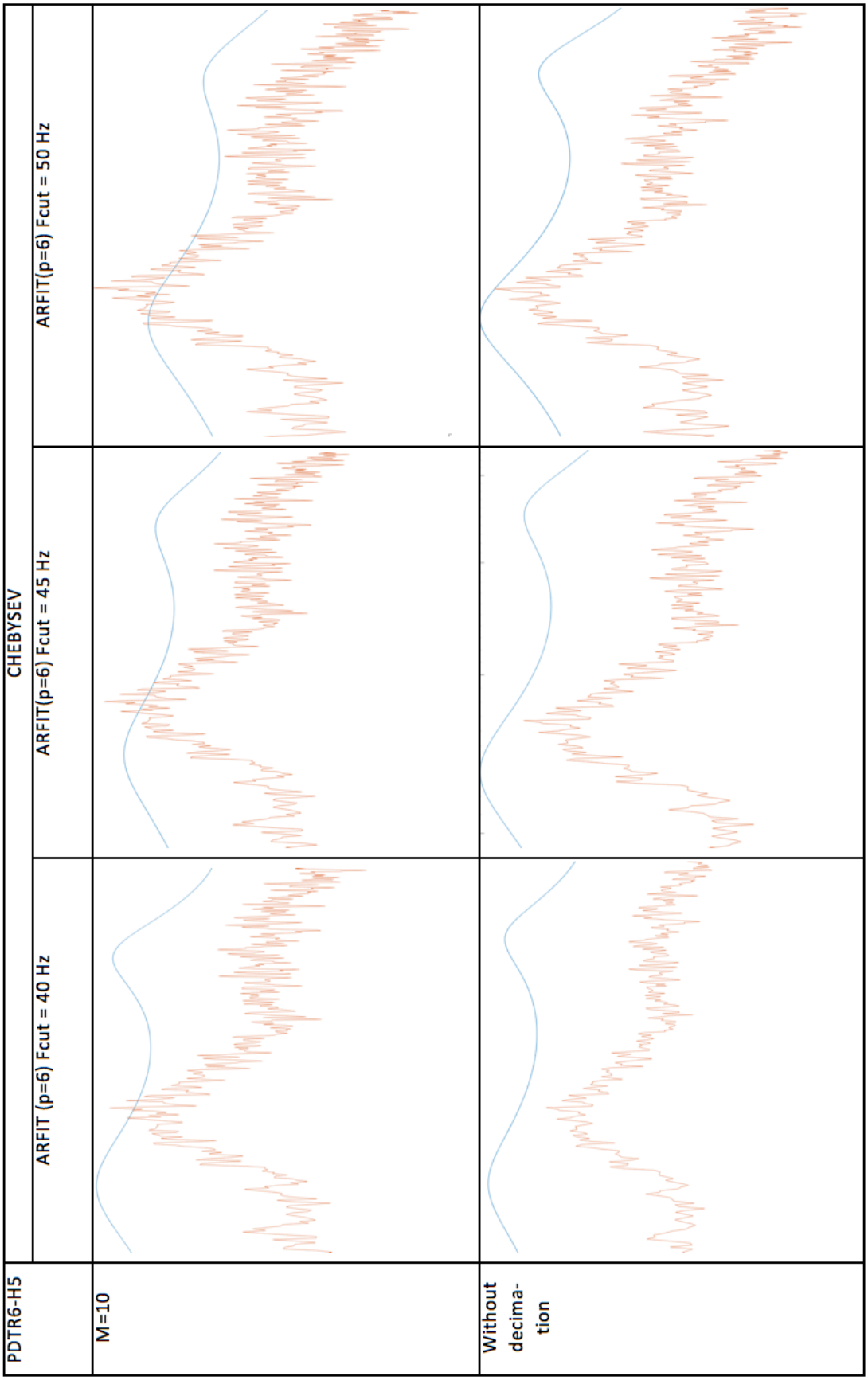
PDTR-13	ON	Low Beta	High Beta	Teta	
STN 0-1	Amplitud	0,050	0,050	0,040	
	Frecuencia	16,310	23,720	296,000	
STN 1-2	Amplitud	0,058	0,104	0,007	
	Frecuencia	11,860	23,230	319,400	
STN 2-3	Amplitud	0,050	0,133	0,006	
	Frecuencia	11,860	23,720	314,800	
STN 4-5	Amplitud	0,223	0,233	0,047	
	Frecuencia	15,810	23,230	279,200	
STN 5-6	Amplitud	0,154	0,146	0,046	SI
	Frecuencia	16,310	30,150	285,700	
STN 6-7	Amplitud	0,050	0,030	0,013	SI
	Frecuencia	16,310	30,150	291,100	

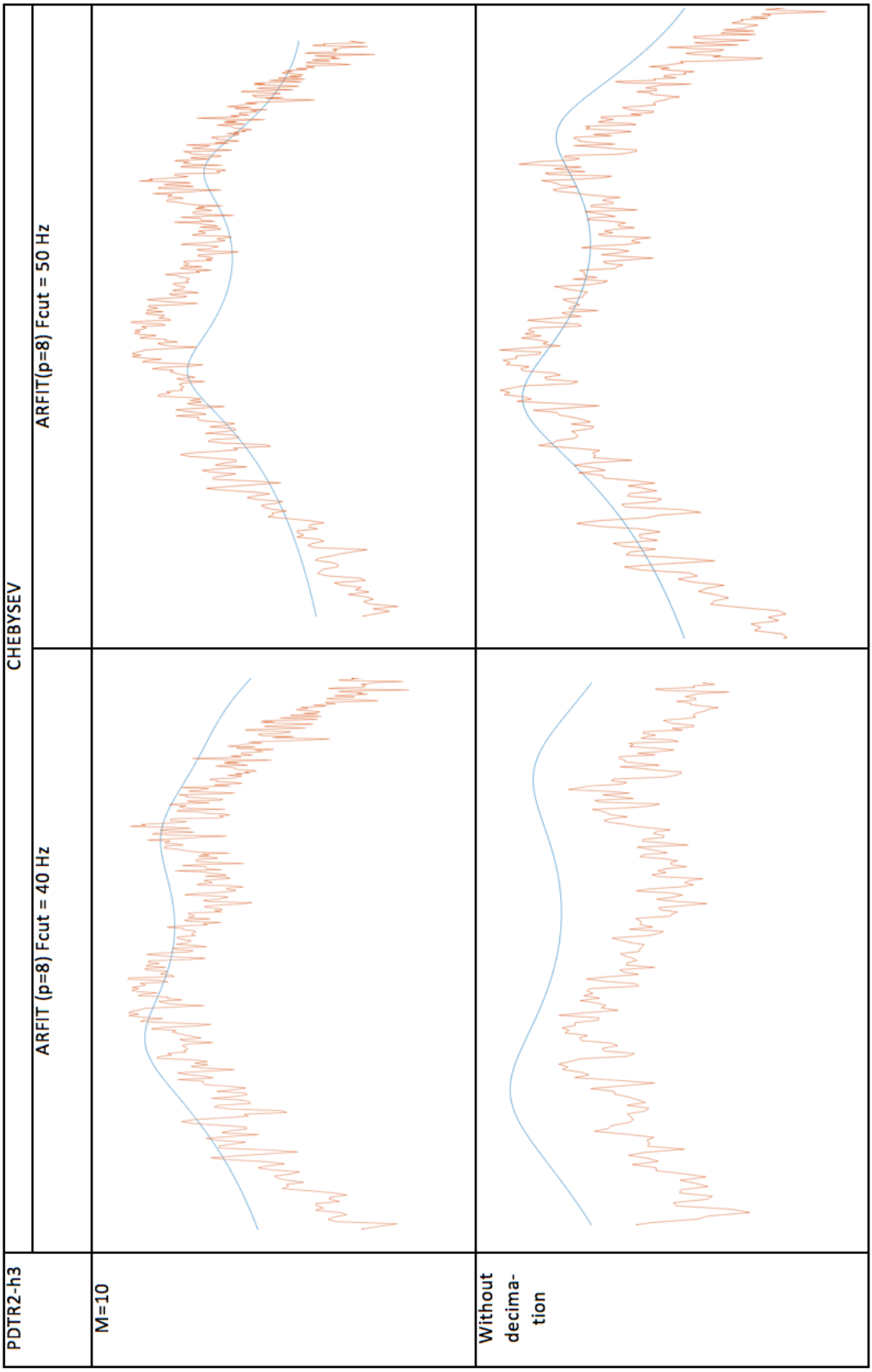
Appendix 4: Decision of M for Decimation

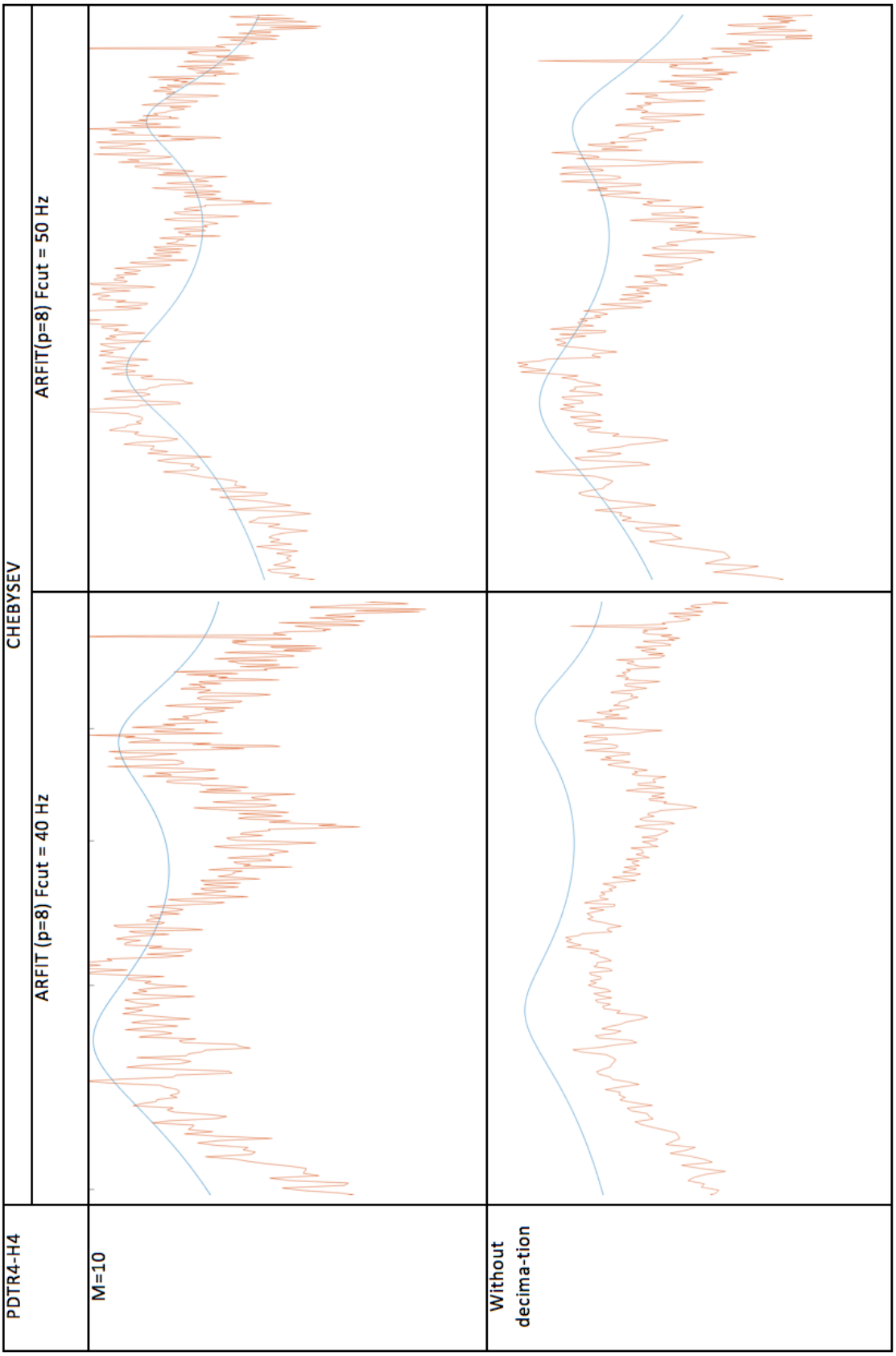
CHEBYSEV

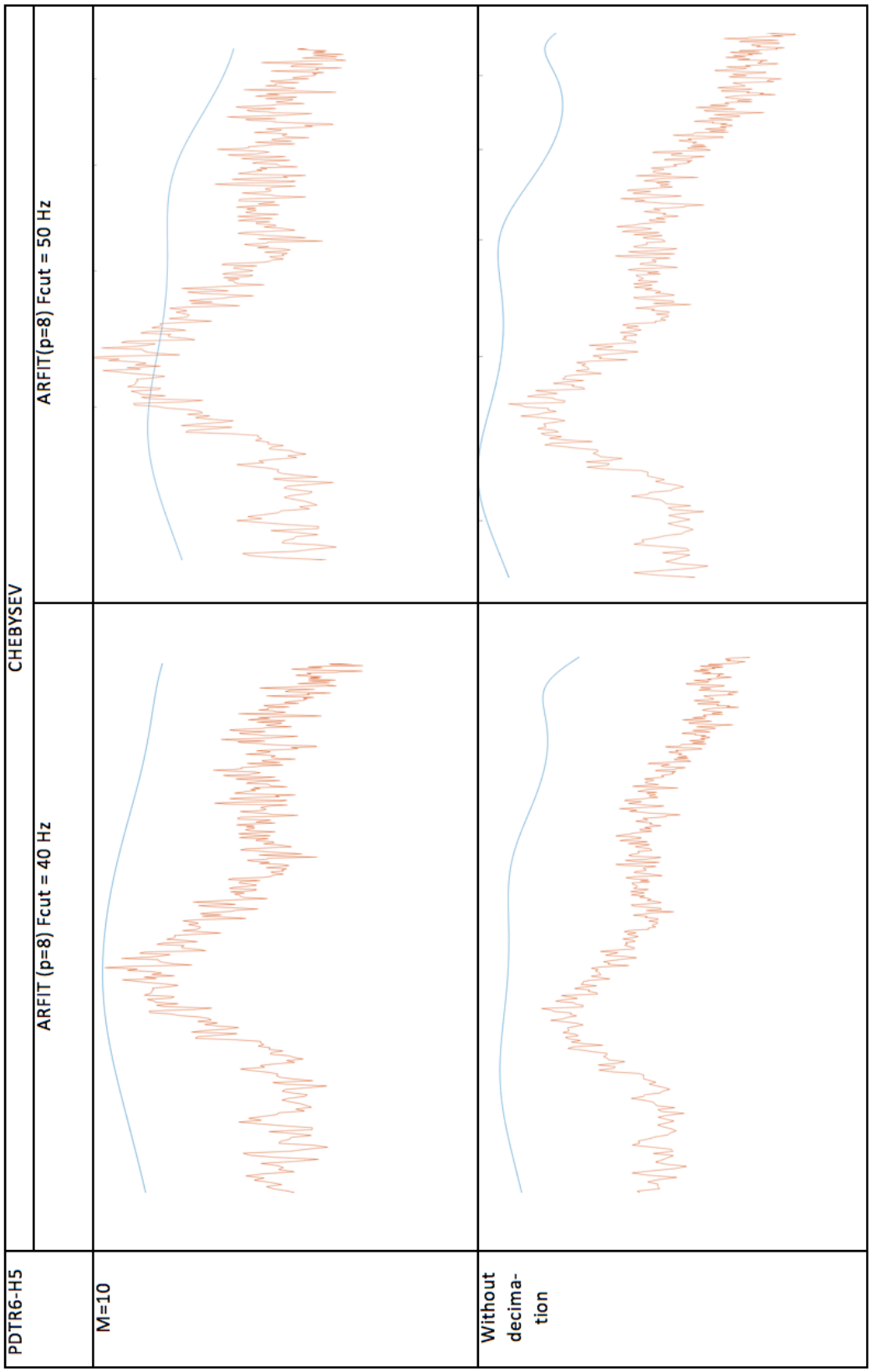


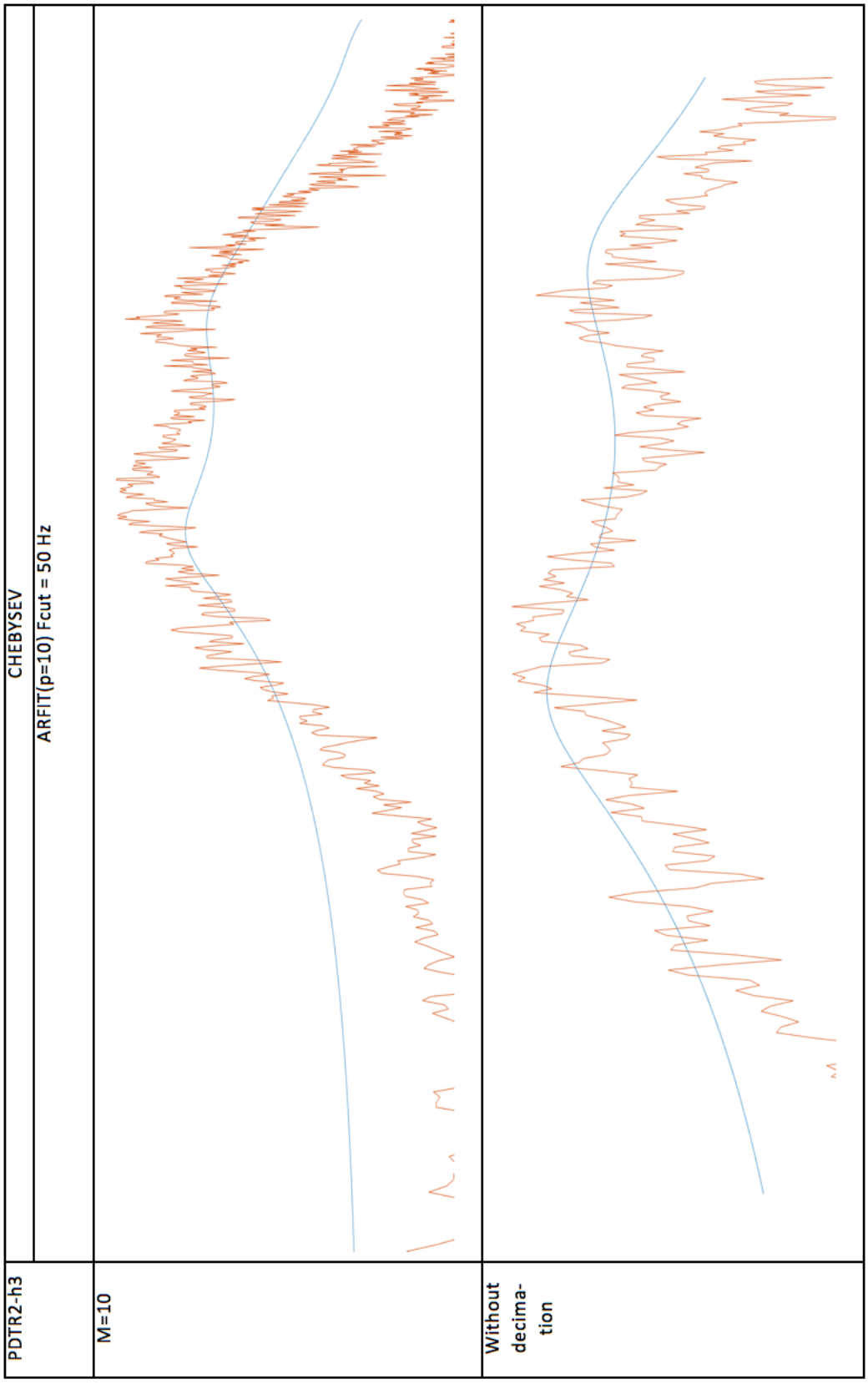

PDTR4-H4
CHEBYSEV
ARFIT (p=6) Fcut = 40 Hz
ARFIT(p=6) Fcut = 45 Hz
ARFIT(p=6) Fcut = 50 Hz
M=10
Without decima-tion

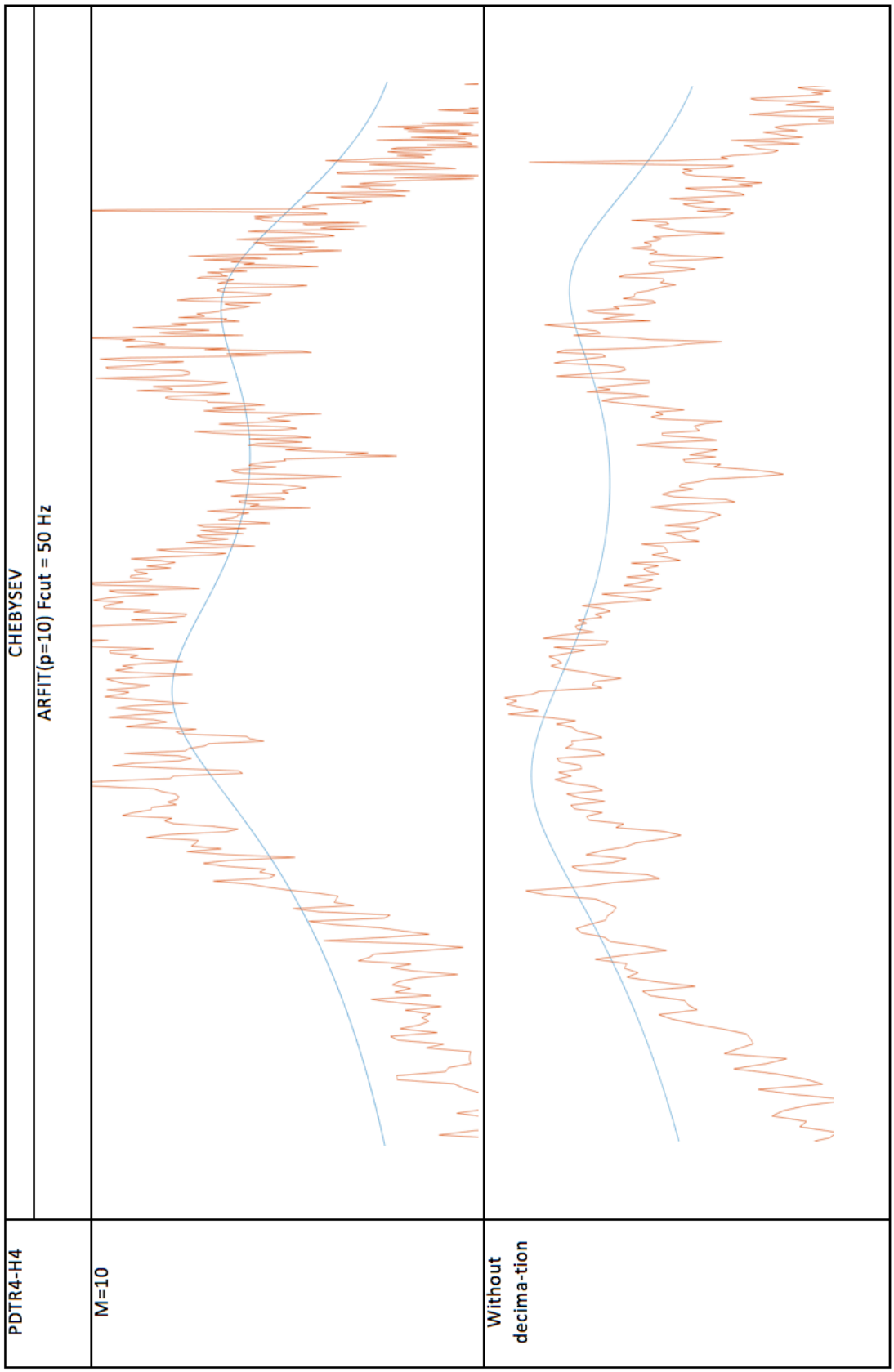

PDTR6-H5
CHEBYSEV
ARFIT (p=6) Fcut = 40 Hz
ARFIT(p=6) Fcut = 45 Hz
ARFIT(p=6) Fcut = 50 Hz
M=10
Without decima-tion

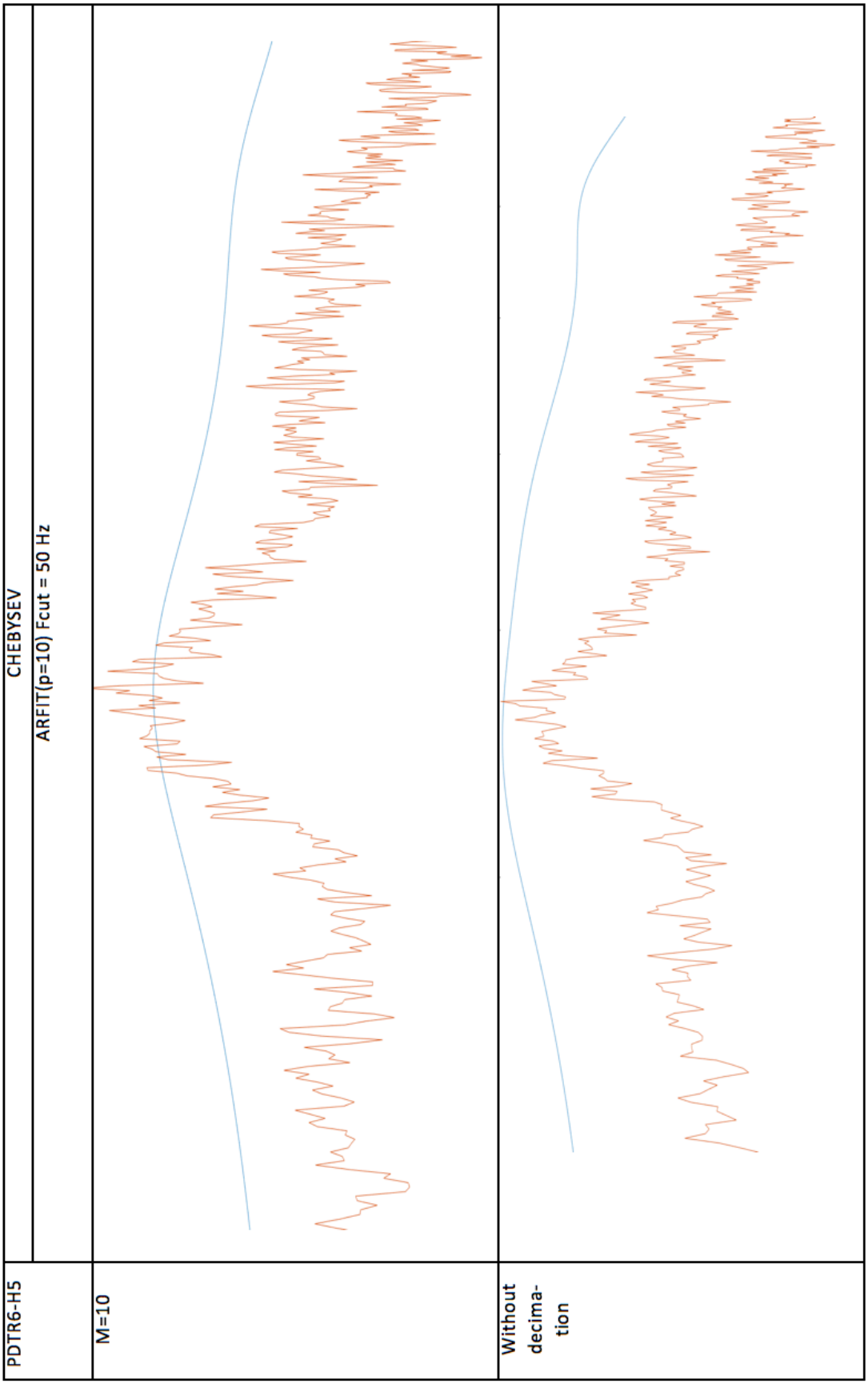

CHEBYSEV
ARFIT (p=8) Fcut = 40 Hz
ARFIT(p=8) Fcut = 50 Hz
PDTR2-h3
M=10
Without decima-tion

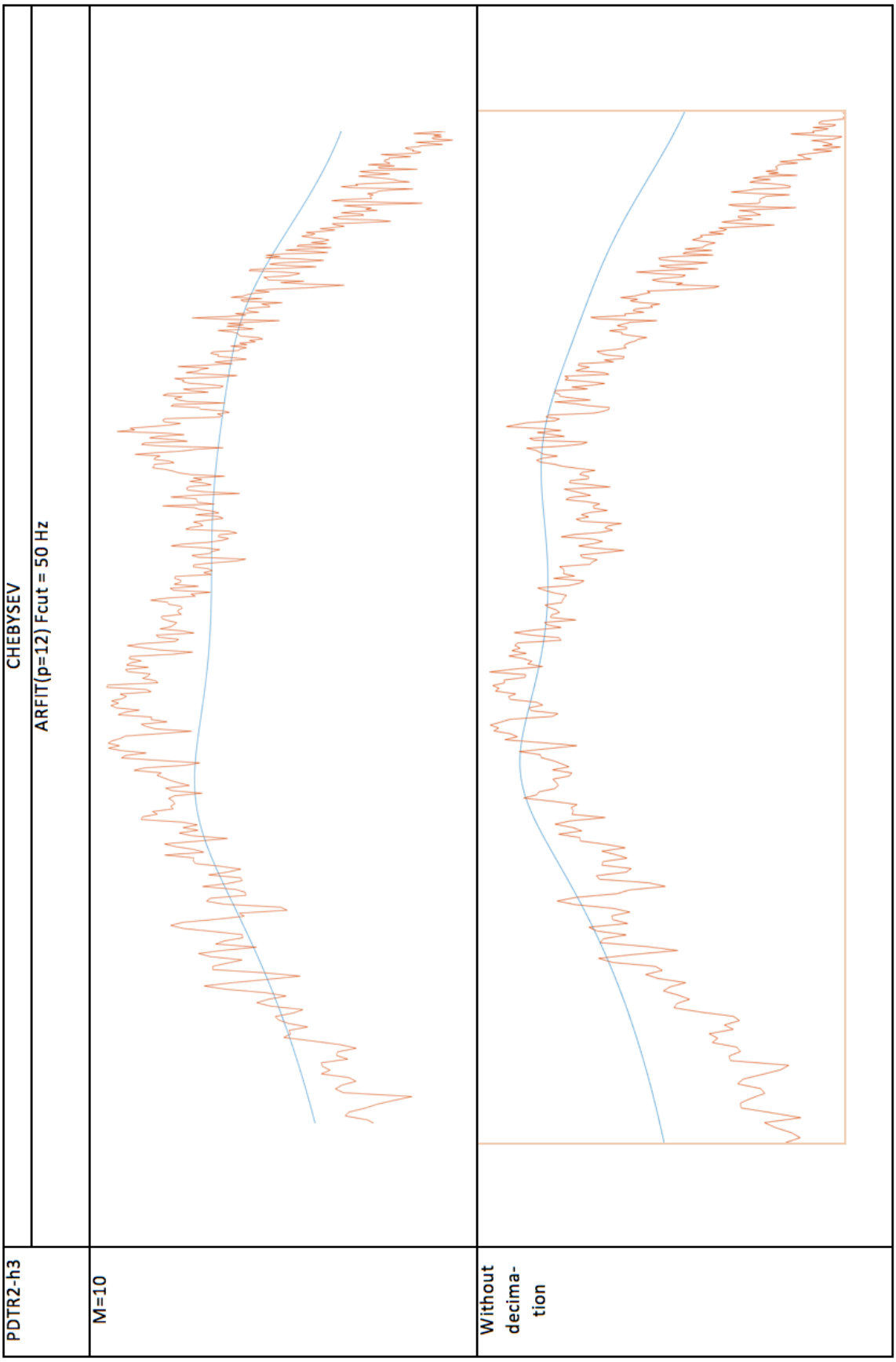

PDTR4-H4
CHEBYSEV
ARFIT (p=8) Fcut = 40 Hz
ARFIT(p=8) Fcut = 50 Hz
M=10
Without decima-tion

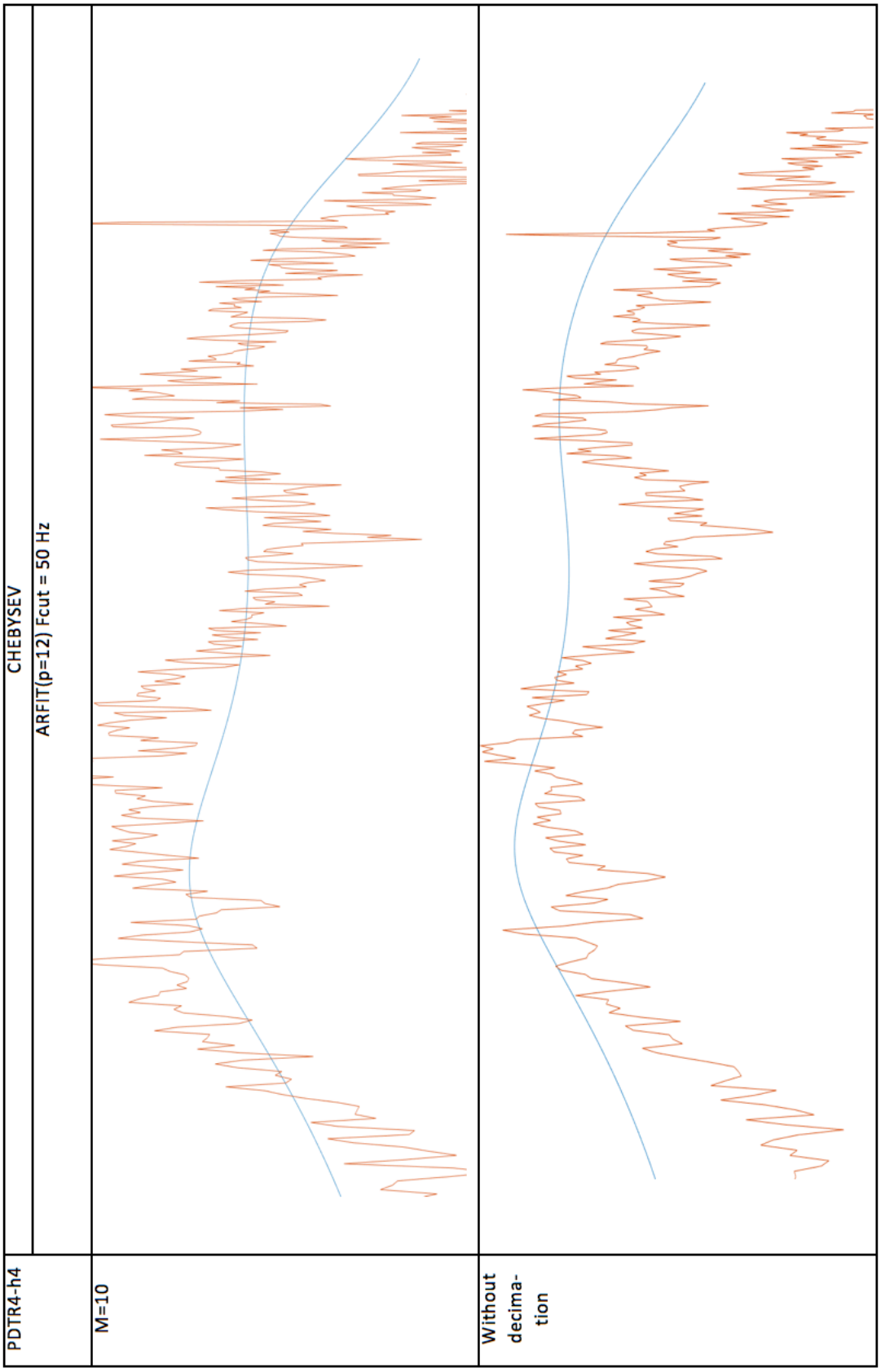

PDTR6-H5
CHEBYSEV
ARFIT (p=8) Fcut = 40 Hz
ARFIT(p=8) Fcut = 50 Hz
M=10
Without decima-tion

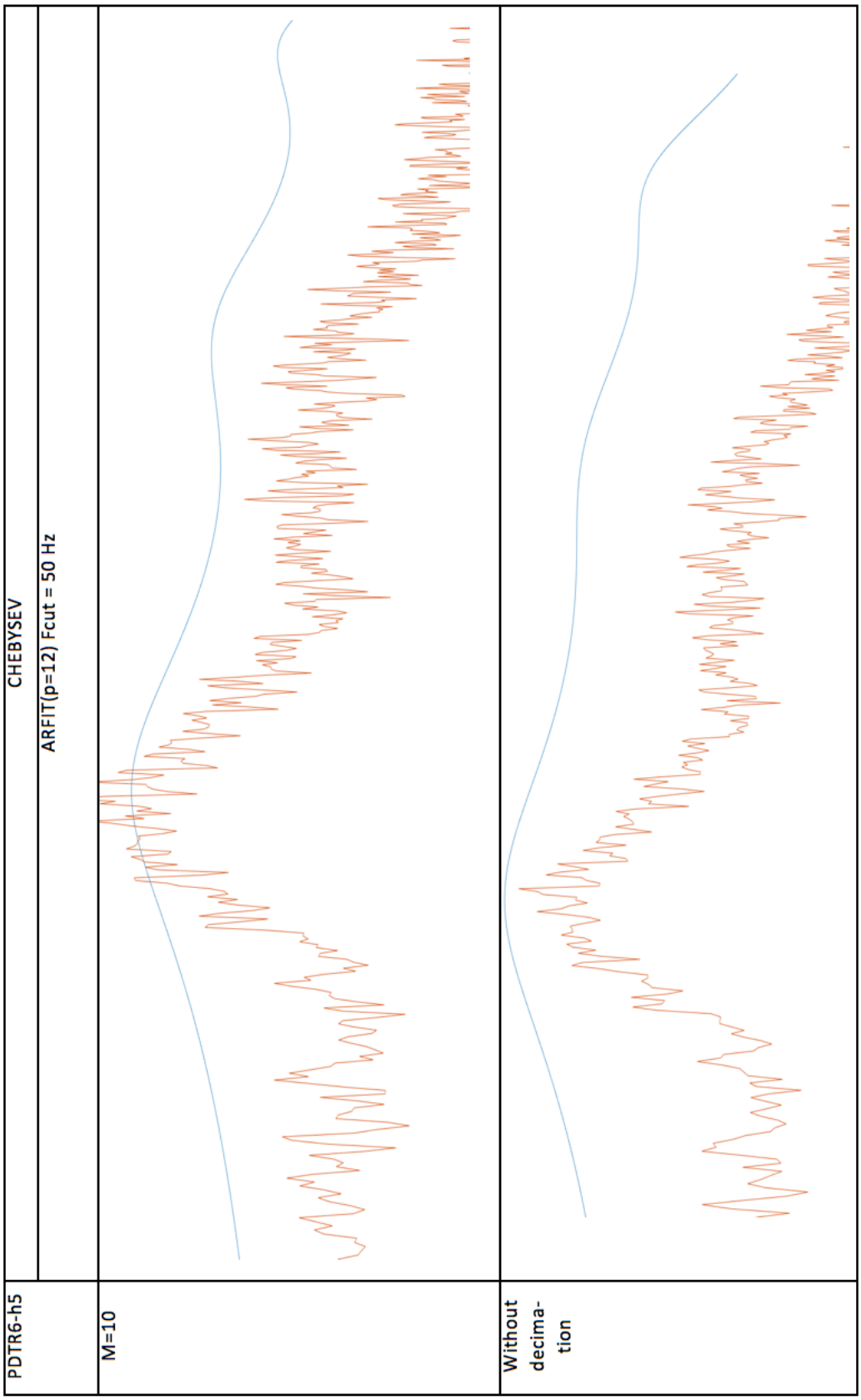

PDTR2-h3
CHEBYSEV
ARFIT(p=10) Fcut = 50 Hz
M=10
Without decima-tion


CHEBYSEV
ARFIT(p=10) Fcut = 50 Hz
PDTR4-H4
M=10
Without decima-tion

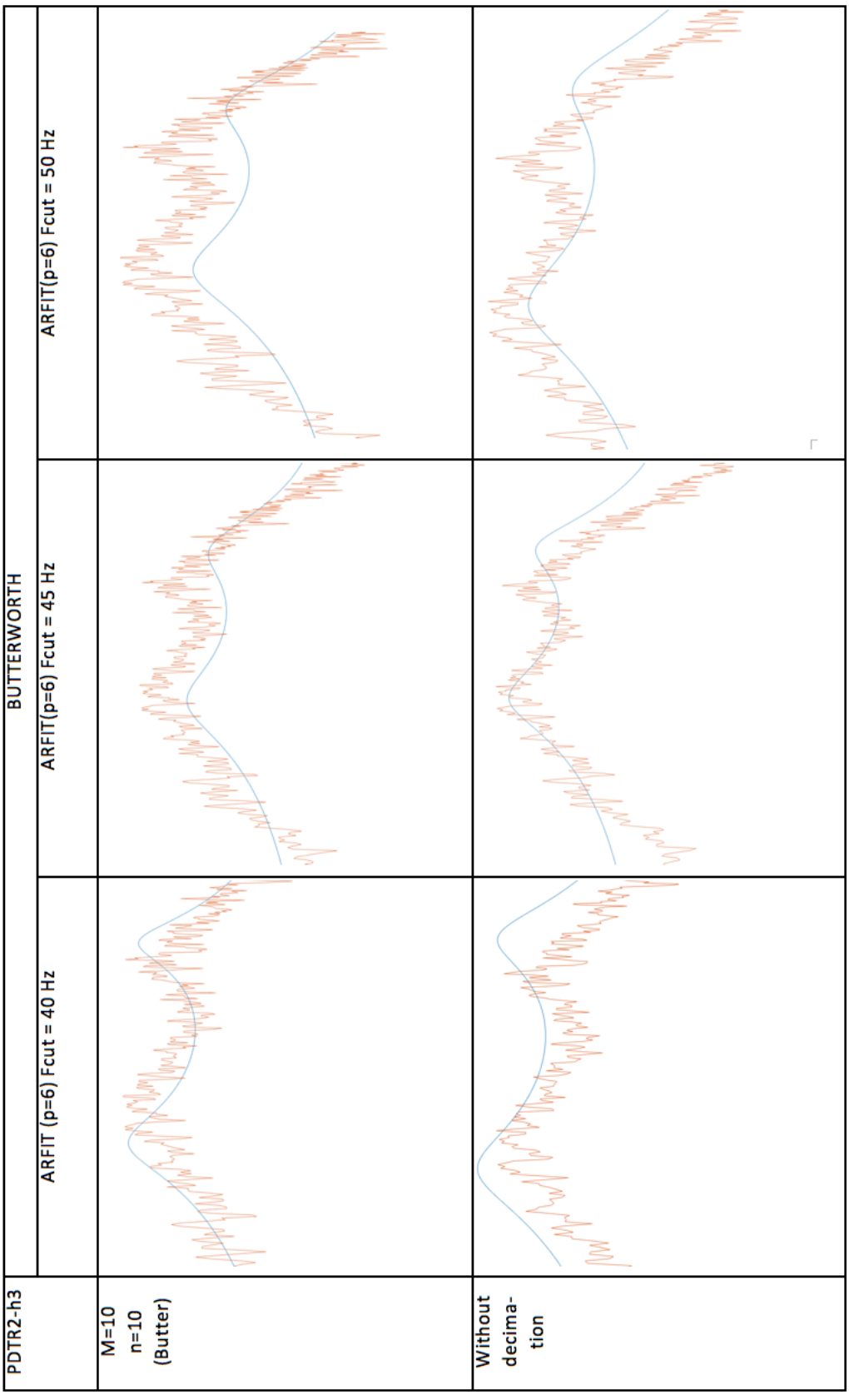

CHEBYSEV
ARFIT(p=10) Fcut = 50 Hz
PDTR6-H5
M=10
Without decima-tion

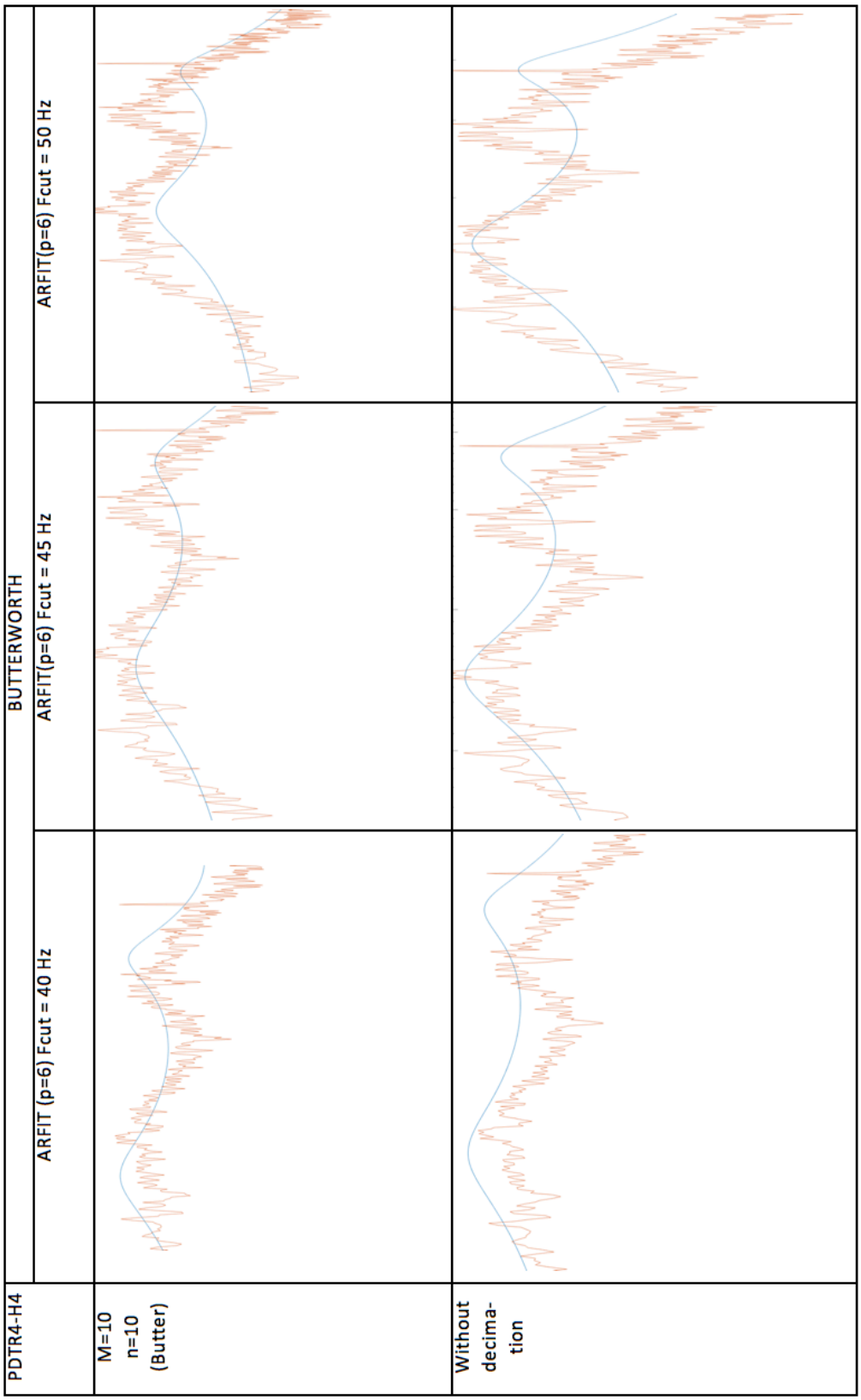

CHEBYSEV
ARFIT(p=12) Fcut = 50 Hz
PDTR2-h3
M=10
Without decima-tion

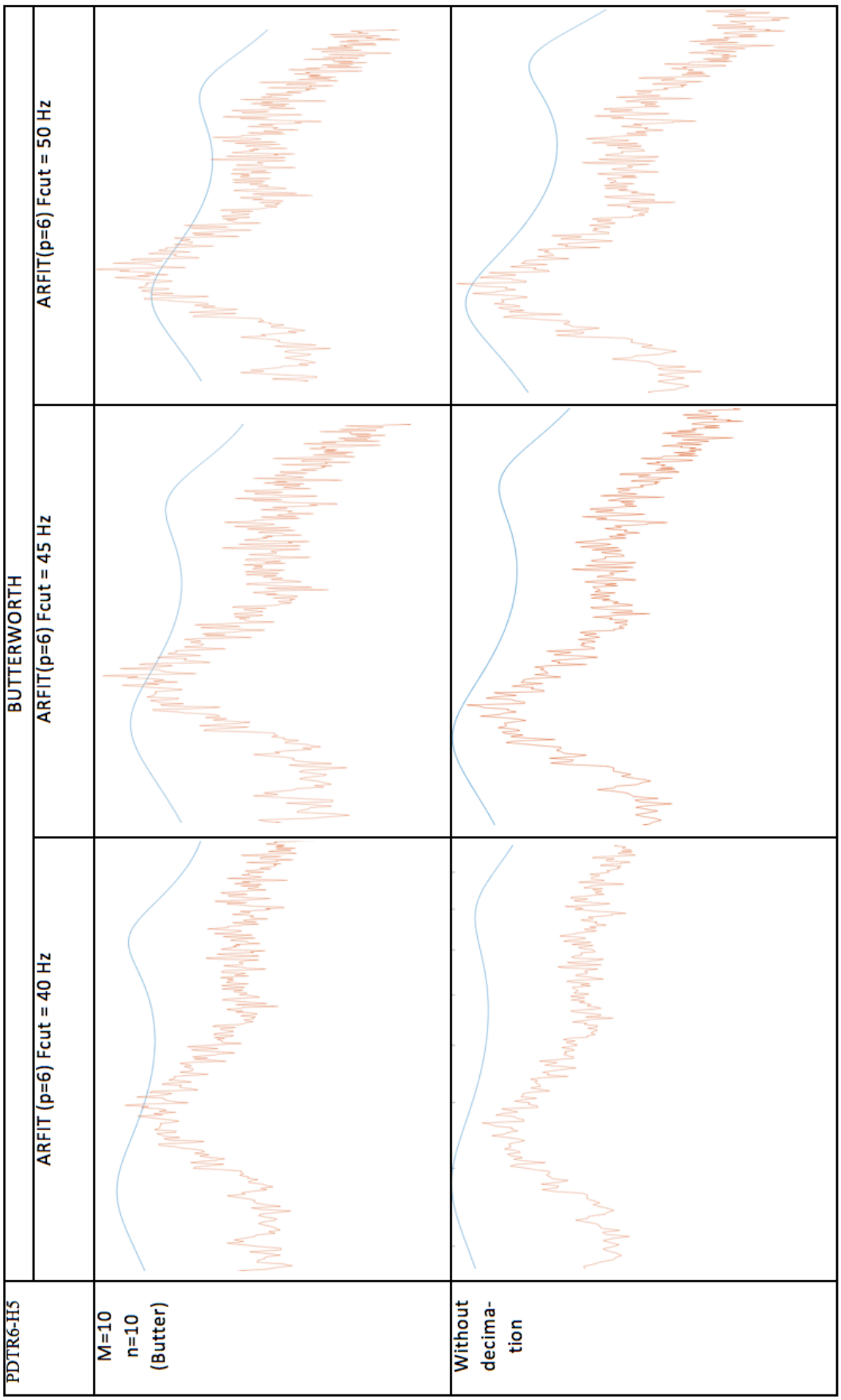

CHEBYSEV
ARFIT(p=12) Fcut = 50 Hz
PDTR4-h4
M=10
Without decima-tion

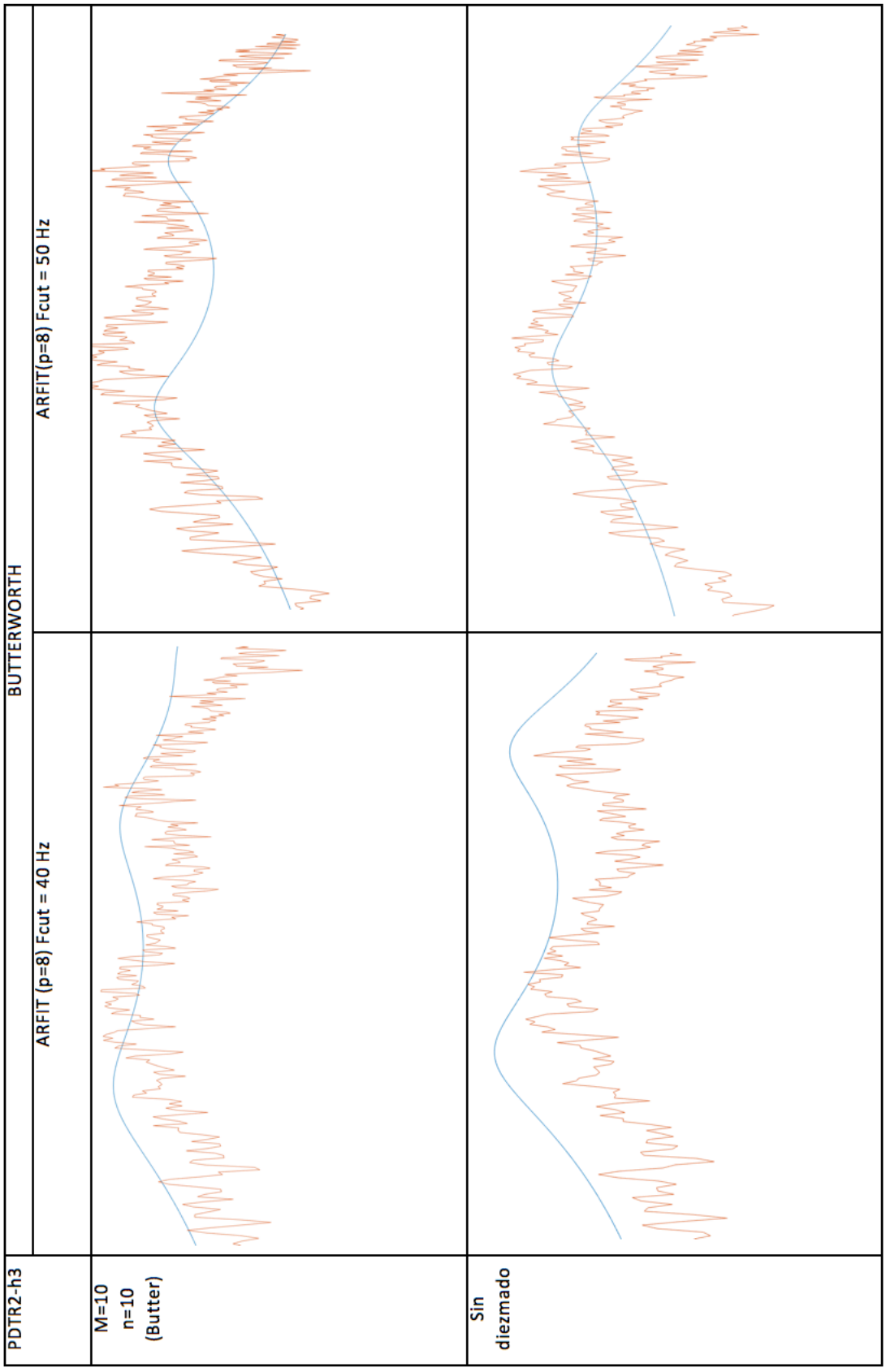

PDTR6-h5
CHEBYSEV
ARFIT(p=12) Fcut = 50 Hz
M=10
Without decima-tion

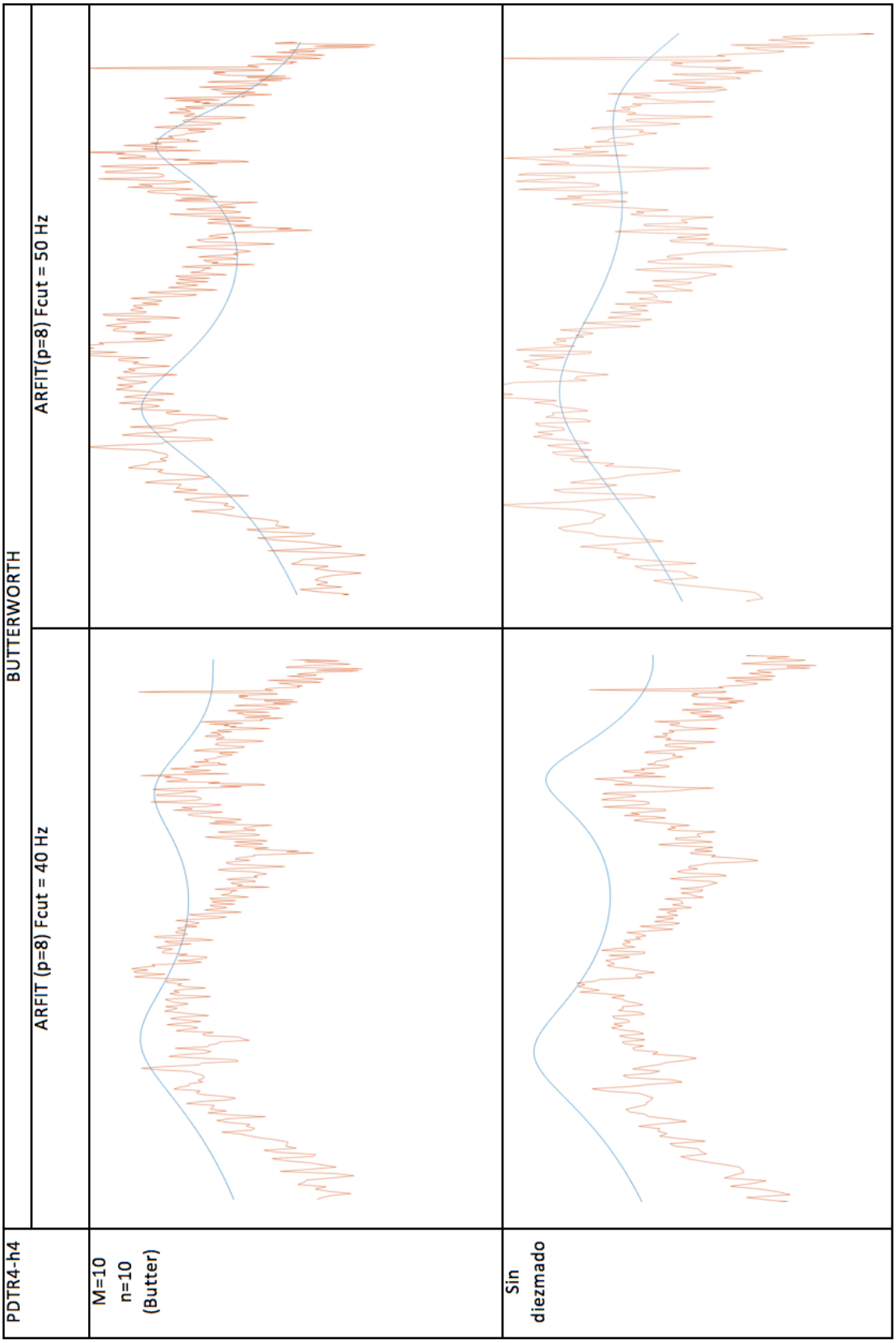
BUTTERWORTH

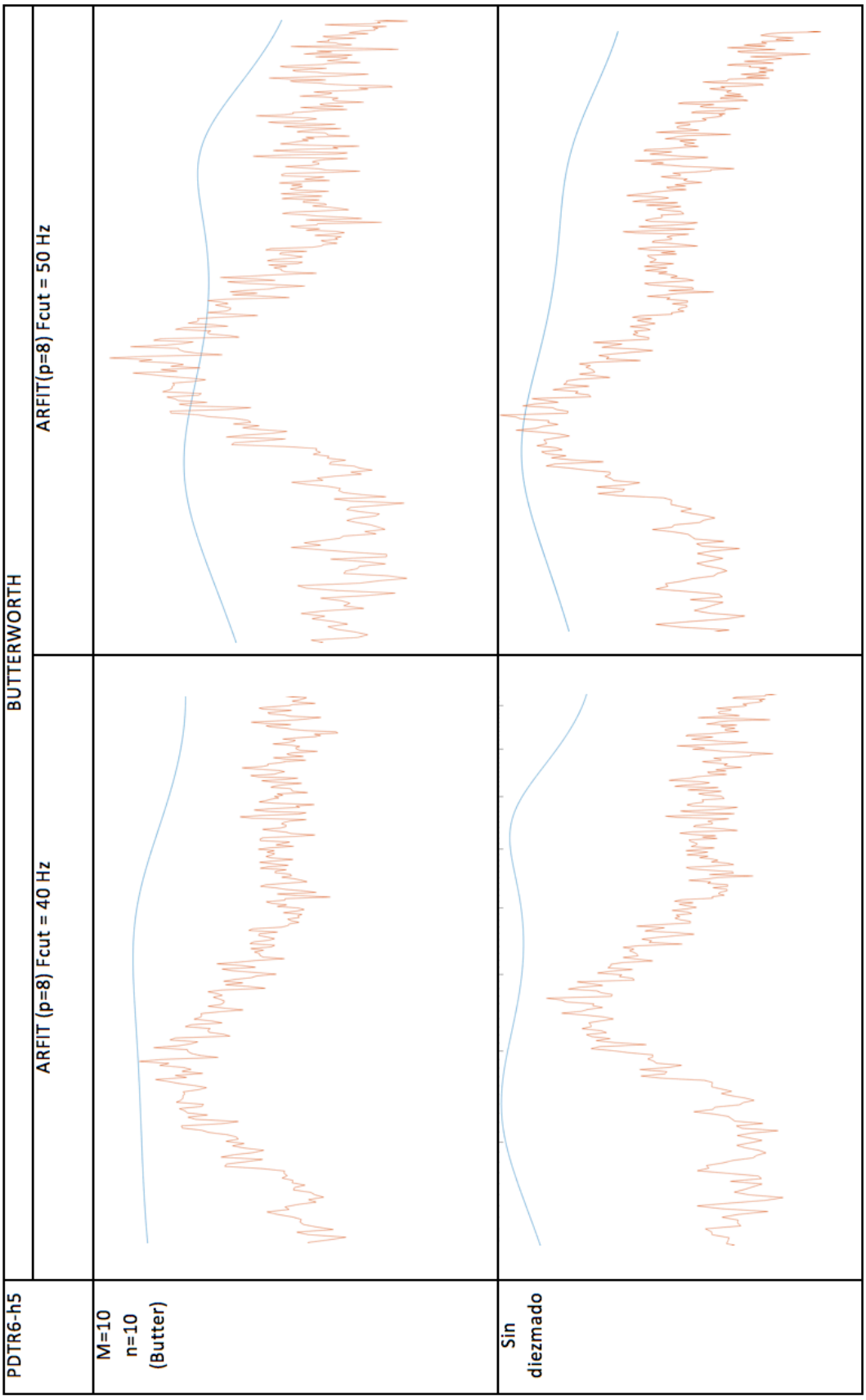


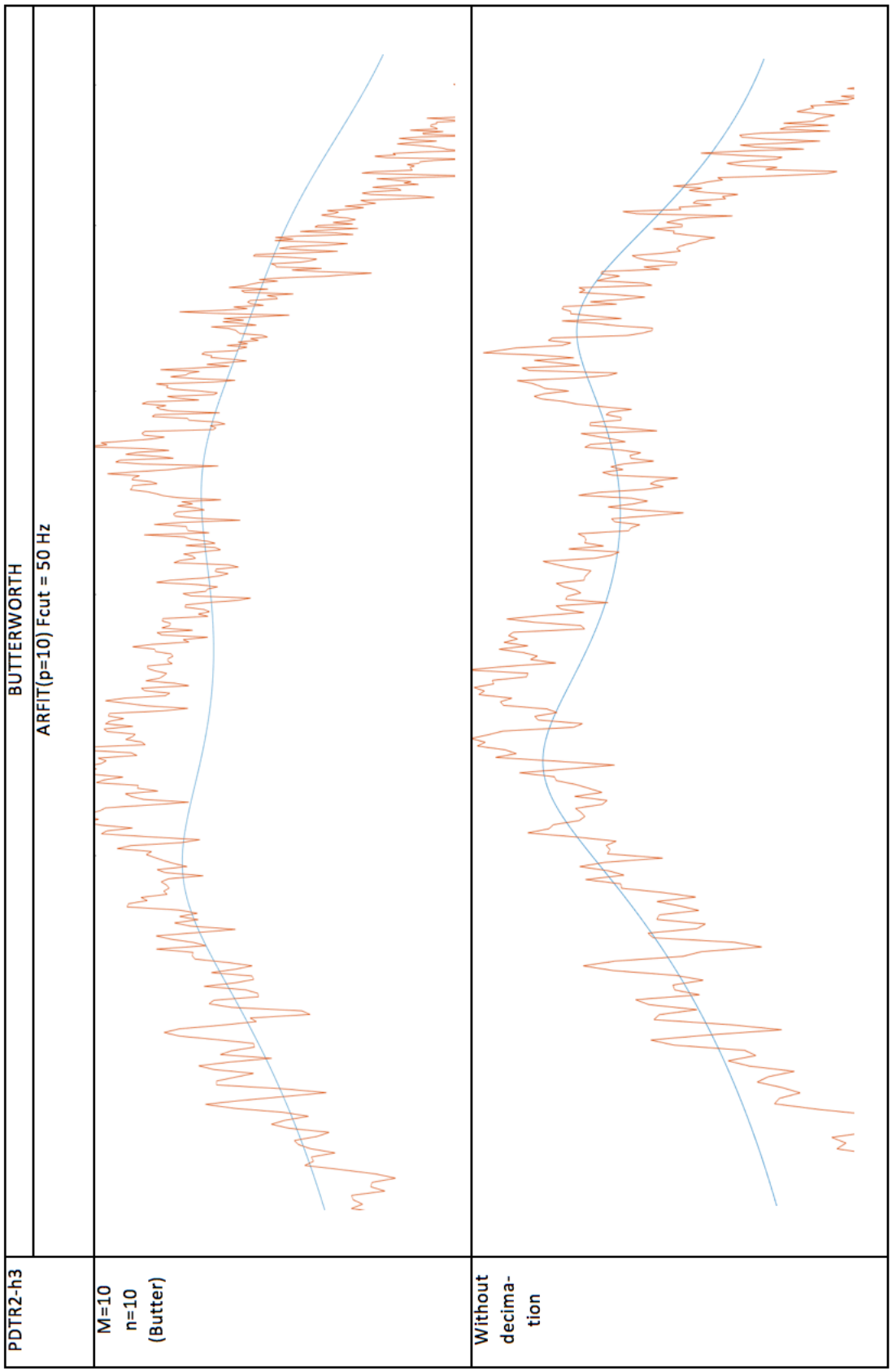

PDTR4-H4
BUTTERWORTH
ARFIT (p=6) Fcut = 40 Hz
ARFIT(p=6) Fcut = 45 Hz
ARFIT(p=6) Fcut = 50 Hz
M=10
n=10
(Butter)
Without
decima-
tion

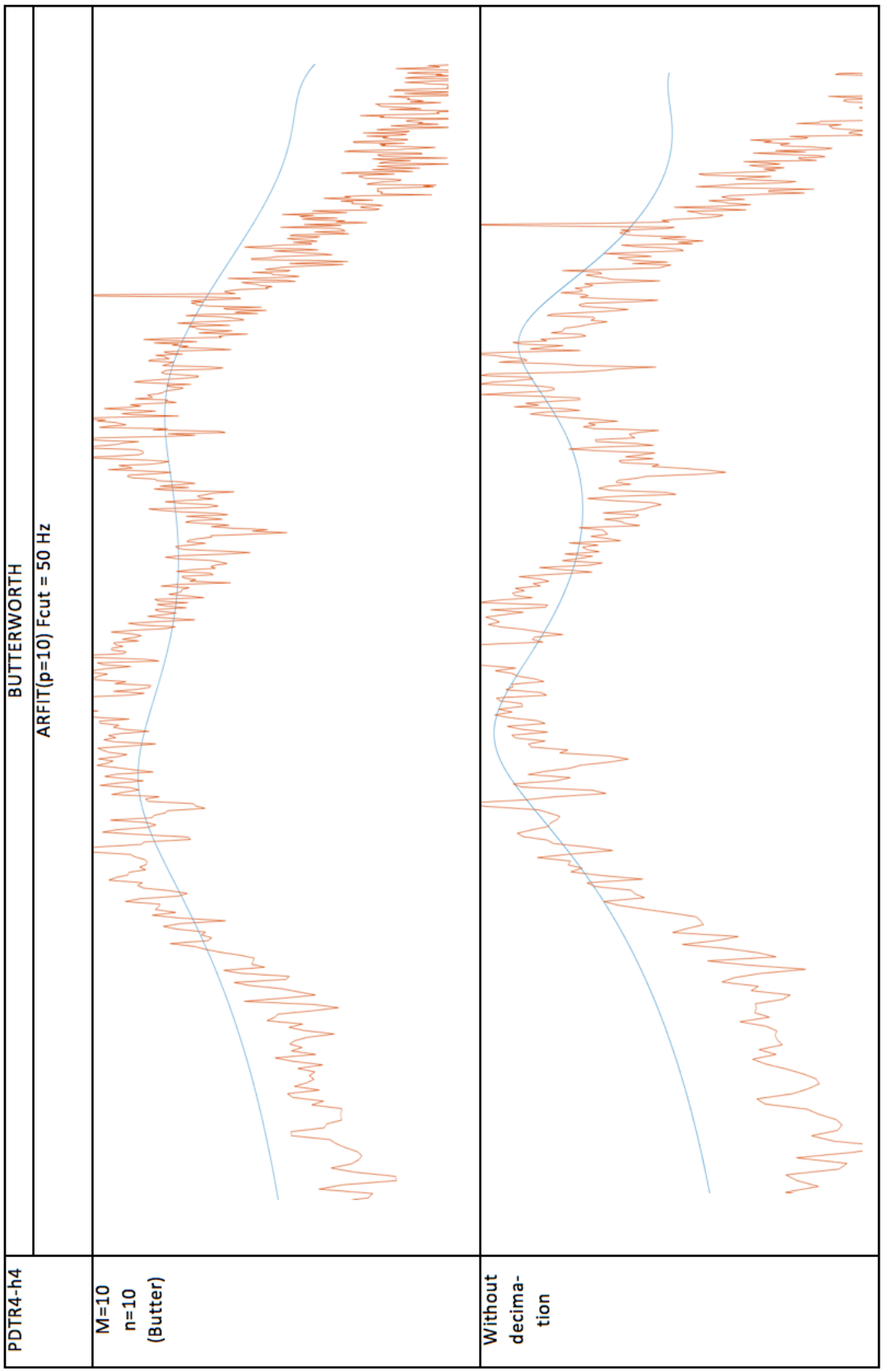

PDTR6-H5
BUTTERWORTH
ARFIT (p=6) Fcut = 40 Hz
ARFIT(p=6) Fcut = 45 Hz
ARFIT(p=6) Fcut = 50 Hz
M=10
n=10
(Butter)
Without
decima-
tion

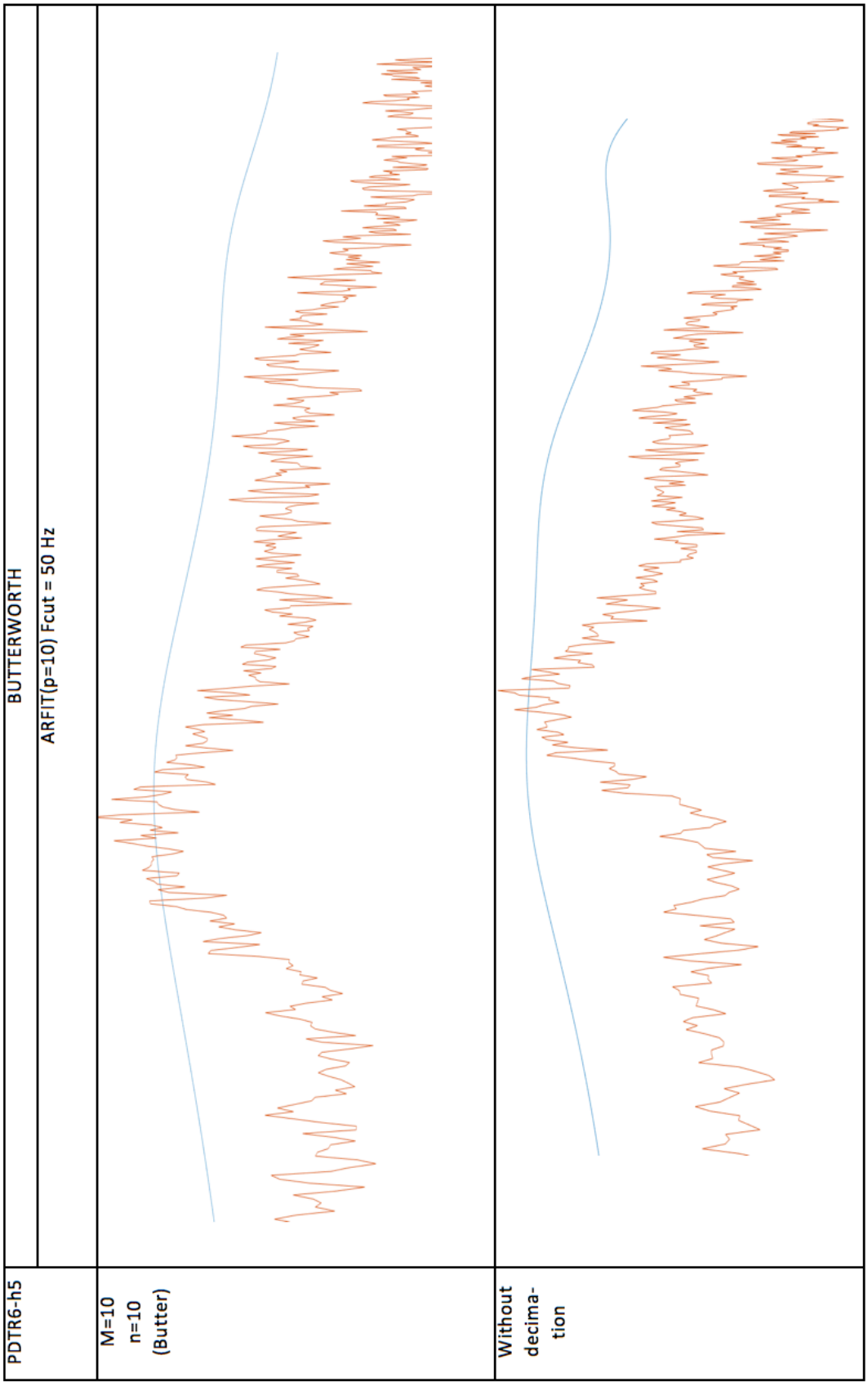

PDTR2-h3
BUTTERWORTH
ARFIT (p=8) Fcut = 40 Hz
ARFIT(p=8) Fcut = 50 Hz
M=10
n=10
(Butter)
Sin
diezmado

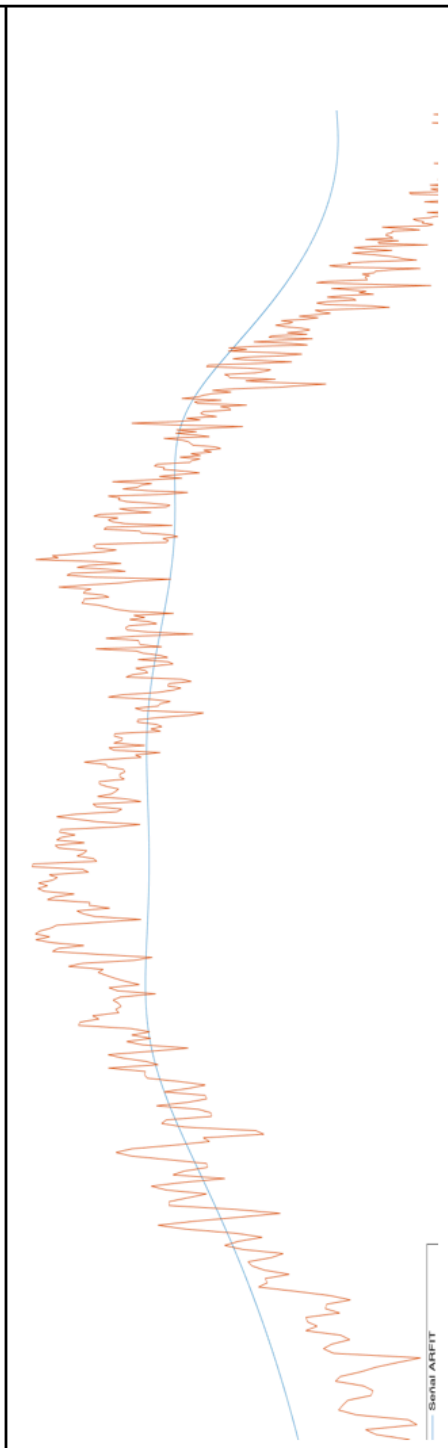
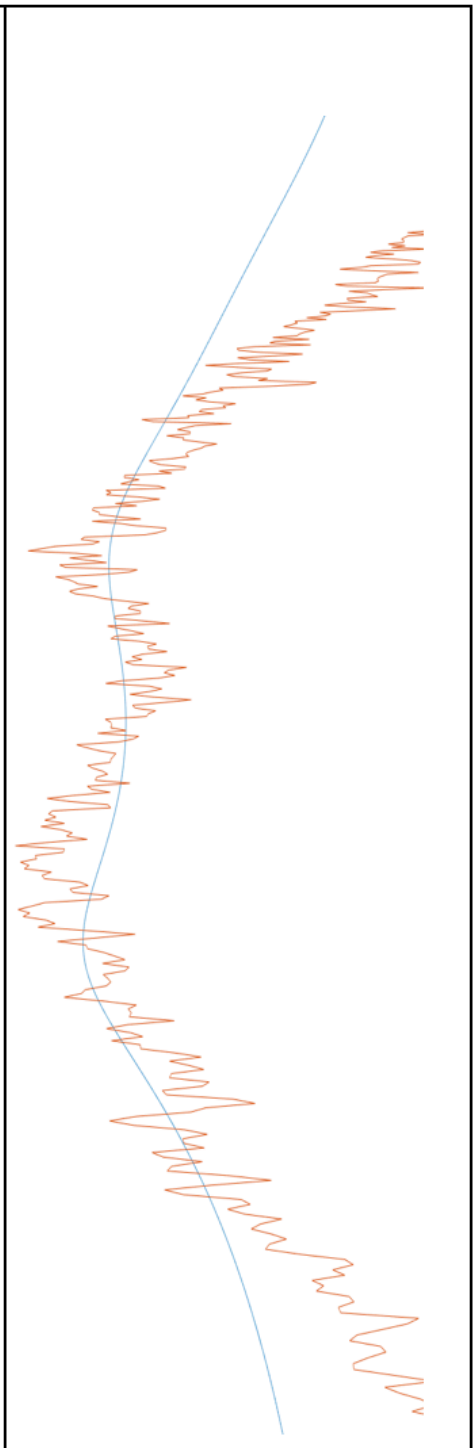

PDTR4-h4
BUTTERWORTH
ARFIT (p=8) Fcut = 40 Hz
ARFIT(p=8) Fcut = 50 Hz
M=10
n=10
(Butter)
Sin
diezmado

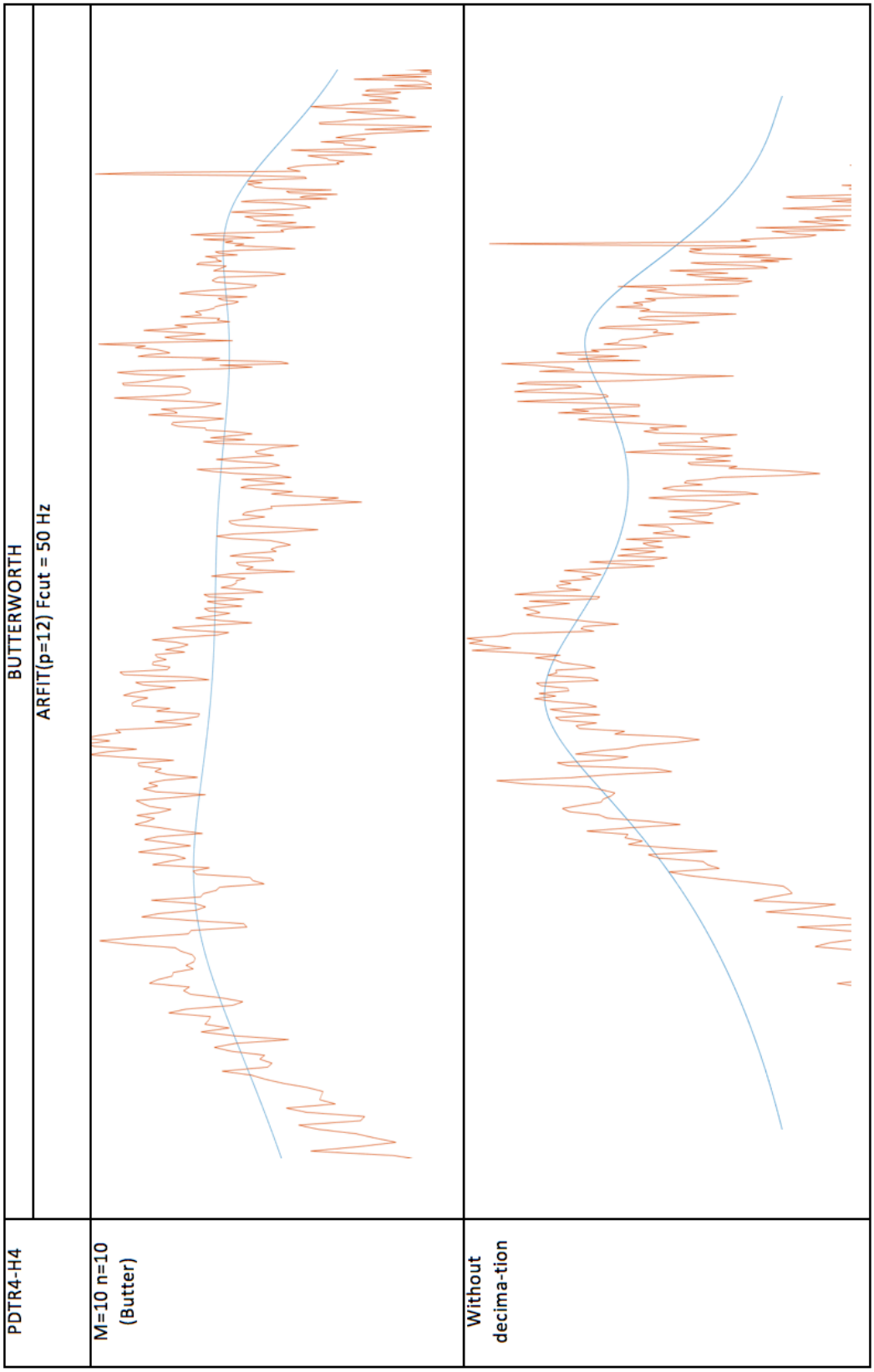

PDTR6-h5
BUTTERWORTH
ARFIT (p=8) Fcut = 40 Hz
ARFIT(p=8) Fcut = 50 Hz
M=10
n=10
(Butter)
Sin
diezmado

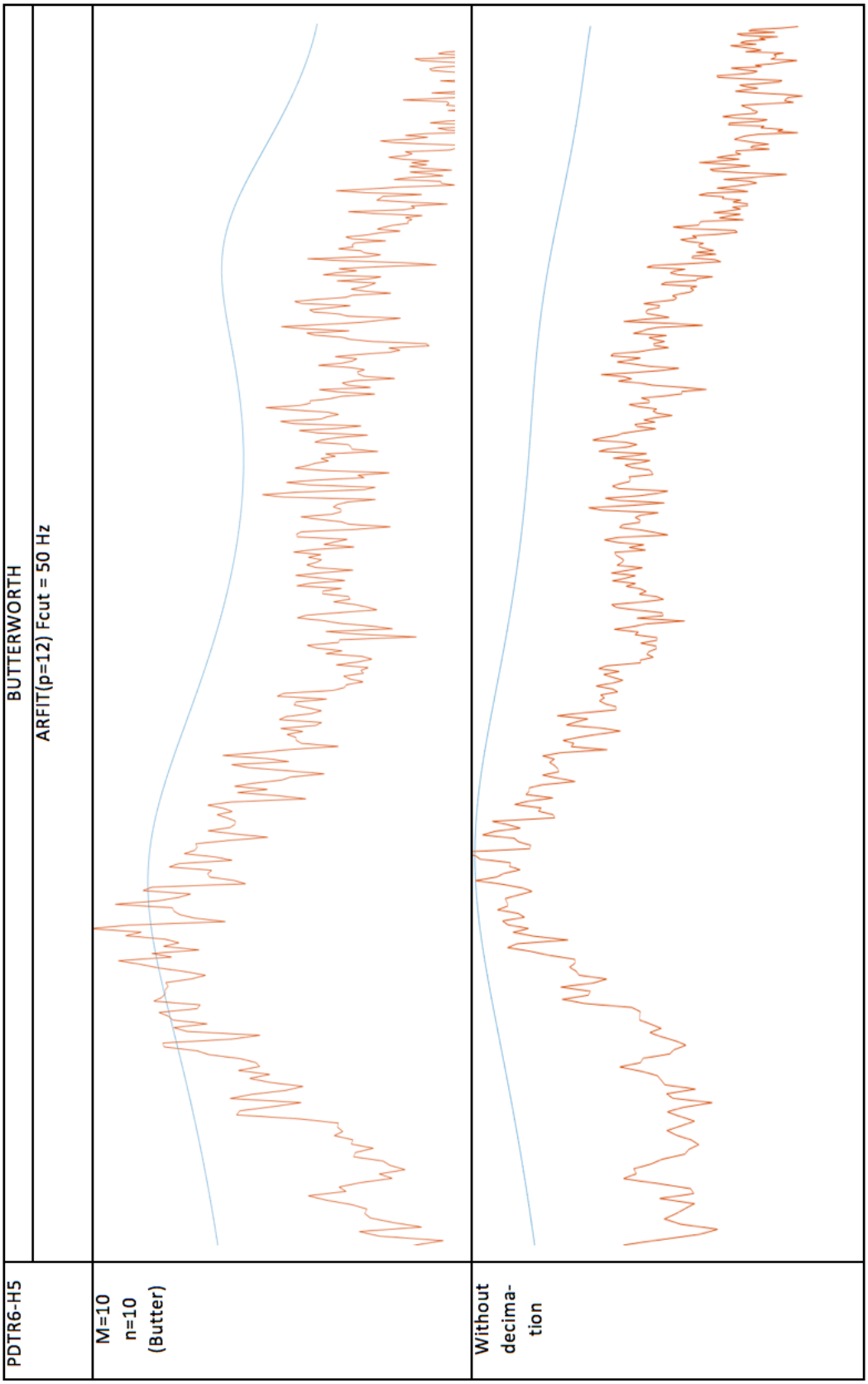

PDTR2-h3
BUTTERWORTH
ARFIT(p=10) Fcut = 50 Hz
M=10
n=10
(Butter)
Without
decima-
tion


PDTR4-h4
BUTTERWORTH
ARFIT(p=10) Fcut = 50 Hz
M=10
n=10
(Butter)
Without
decima-
tion


PDTR6-h5
BUTTERWORTH
ARFIT(p=10) Fcut = 50 Hz
M=10
n=10
(Butter)
Without
decima-
tion

PDTR2-h3	BUTTERWORTH ARFIT(p=12) Fcut = 50 Hz
M=10 n=10 (Butter)	
Without decima-tion	


PDTR4-H4
BUTTERWORTH
ARFIT(p=12) Fcut = 50 Hz
M=10 n=10
(Butter)
Without
decima-tion


PDTR6-H5
BUTTERWORTH
ARFIT(p=12) Fcut = 50 Hz
M=10
n=10
(Butter)
Without
decima-
tion

Appendix 5: Values obtained for get the epsilon produced by ARFIT

AR(P=10)

OFF STATE

PATIENT 2 OFF STATE							LOW	HIGH	LOW	HIGH
PDTR2	REAL FREQUENCY VALUES		ARFIT FREQUENCY VALUES		EPSILON LOW	EPSILON HIGH	EPSILON RATIO	EPSILON RATIO	LOG RATIO	LOG RATIO
CHANNEL	LOW BETA	HIGH BETA	LOW BETA	HIGH BETA						
STN 6-7	12,36	23,23	19,08	34,62	6,72	11,39	1,54	1,49	0,19	0,17
STN 5-6	16,31	23,72	18,77	33,57	2,46	9,85	1,15	1,42	0,06	0,15
STN 4-5	15,32	23,23	19,32	33,47	4,00	10,24	1,26	1,44	0,10	0,16
STN 2-3	16,80	23,72	18,84	32,96	2,04	9,24	1,12	1,39	0,05	0,14
STN 1-2	15,81	23,72	16,97	31,75	1,16	8,03	1,07	1,34	0,03	0,13
STN 0-1	14,83	23,23	17,12	31,78	2,29	8,55	1,15	1,37	0,06	0,14

PATIENT 3 OFF STATE							LOW	HIGH	LOW	HIGH
PDTR2	REAL FREQUENCY VALUES		ARFIT FREQUENCY VALUES		EPSILON LOW	EPSILON HIGH	EPSILON RATIO	EPSILON RATIO	LOG RATIO	LOG RATIO
CHANNEL	LOW BETA	HIGH BETA	LOW BETA	HIGH BETA						
STN 6-7	15,32	20,26	18,25	34,03	2,93	13,77	1,19	1,68	0,08	0,23
STN 5-6	13,84	20,26	18,56	34,18	4,72	13,92	1,34	1,69	0,13	0,23
STN 4-5	14,83	21,75	18,47	34,14	3,64	12,39	1,25	1,57	0,10	0,20
STN 2-3	14,33	21,25	18,69	33,94	4,36	12,69	1,30	1,60	0,12	0,20
STN 1-2	13,34	21,25	18,21	33,84	4,87	12,59	1,37	1,59	0,14	0,20
STN 0-1	13,84	21,25	18,70	33,91	4,86	12,66	1,35	1,60	0,13	0,20

PATIENT 3 OFF STATE							LOW	HIGH	LOW	HIGH
PDTR2	REAL FREQUENCY VALUES		ARFIT FREQUENCY VALUES		EPSILON LOW	EPSILON HIGH	EPSILON RATIO	EPSILON RATIO	LOG RATIO	LOG RATIO
CHANNEL	LOW BETA	HIGH BETA	LOW BETA	HIGH BETA						
STN 6-7	15,32	20,26	18,25	34,03	2,93	13,77	1,19	1,68	0,08	0,23
STN 5-6	13,84	20,26	18,56	34,18	4,72	13,92	1,34	1,69	0,13	0,23
STN 4-5	14,83	21,75	18,47	34,14	3,64	12,39	1,25	1,57	0,10	0,20
STN 2-3	14,33	21,25	18,69	33,94	4,36	12,69	1,30	1,60	0,12	0,20
STN 1-2	13,34	21,25	18,21	33,84	4,87	12,59	1,37	1,59	0,14	0,20
STN 0-1	13,84	21,25	18,70	33,91	4,86	12,66	1,35	1,60	0,13	0,20

PATIENT 4 OFF STATE							LOW	HIGH	LOW	HIGH
PDTR2	REAL FREQUENCY VALUES		ARFIT FREQUENCY VALUES		EPSILON LOW	EPSILON HIGH	EPSILON RATIO	EPSILON RATIO	LOG RATIO	LOG RATIO
CHANNEL	LOW BETA	HIGH BETA	LOW BETA	HIGH BETA						
STN 6-7	18,29	28,17	16,73	32,57	1,56	4,40	0,91	1,16	-0,04	0,06
STN 5-6	17,30	29,65	17,92	33,66	0,62	4,01	1,04	1,14	0,02	0,06
STN 4-5	17,79	28,17	17,90	34,57	0,11	6,40	1,01	1,23	0,00	0,09
STN 2-3	17,30	27,18	18,10	34,19	0,80	7,01	1,05	1,26	0,02	0,10
STN 1-2	17,30	29,65	16,65	33,06	0,65	3,41	0,96	1,12	-0,02	0,05
STN 0-1	17,30	26,69	18,23	34,46	0,93	7,77	1,05	1,29	0,02	0,11

PATIENT 5 OFF STATE						
PDTR5	REAL FREQUENCY VALUES		ARFIT FREQUENCY VALUES		EPSILON LOW	EPSILON HIGH
CHANNEL	LOW BETA	HIGH BETA	LOW BETA	HIGH BETA		
STN 6-7	14,33	29,65	16,50	32,58	2,17	2,93
STN 5-6	14,33	28,17	13,95	31,47	0,38	3,30
STN 4-5	BAD DATA	BAD DATA	BAD DATA	BAD DATA	BAD DATA	BAD DATA
STN 2-3	13,84	27,18	19,22	32,80	5,38	5,62
STN 1-2	14,33	26,19	19,37	34,12	5,04	7,93
STN 0-1	13,84	26,69	16,42	31,17	2,58	4,48

LOW EPSILON RATIO	HIGH EPSILON RATIO	LOW LOG RATIO	HIGH LOG RATIO
1,15	1,10	0,06	0,04
0,97	1,12	-0,01	0,05
BAD DATA	BAD DATA	BAD DATA	BAD DATA
1,39	1,21	0,14	0,08
1,35	1,30	0,13	0,11
1,19	1,17	0,07	0,07

PATIENT 6 OFF STATE						
PDTR6	REAL FREQUENCY VALUES		ARFIT FREQUENCY VALUES		EPSILON LOW	EPSILON HIGH
CHANNEL	LOW BETA	HIGH BETA	LOW BETA	HIGH BETA		
STN 6-7	16,31	22,24	17,89	34,09	1,58	11,85
STN 5-6	17,30	22,40	17,98	34,30	0,68	11,90
STN 4-5	BAD DATA	BAD DATA	BAD DATA	BAD DATA	BAD DATA	BAD DATA
STN 2-3	16,81	28,17	17,16	32,75	0,35	4,58
STN 1-2	11,37	25,70	19,82	35,18	8,45	9,48
STN 0-1	11,37	28,17	12,39	31,13	1,02	2,96

LOW EPSILON RATIO	HIGH EPSILON RATIO	LOW LOG RATIO	HIGH LOG RATIO
1,10	1,53	0,04	0,19
1,04	1,53	0,02	0,19
BAD DATA	BAD DATA	BAD DATA	BAD DATA
1,02	1,16	0,01	0,07
1,74	1,37	0,24	0,14
1,09	1,11	0,04	0,04

PATIENT 7 OFF STATE						
PDTR7	REAL FREQUENCY VALUES		ARFIT FREQUENCY VALUES		EPSILON LOW	EPSILON HIGH
CHANNEL	LOW BETA	HIGH BETA	LOW BETA	HIGH BETA		
STN 6-7	10,38	24,22	19,47	31,71	9,09	7,49
STN 5-6	13,34	25,70	19,65	31,67	6,31	5,97
STN 4-5	BAD DATA	BAD DATA	BAD DATA	BAD DATA	BAD DATA	BAD DATA
STN 2-3	10,87	26,19	19,10	33,90	8,23	7,71
STN 1-2	10,87	24,71	19,07	33,97	8,20	9,26
STN 0-1	10,87	26,19	19,46	36,19	8,59	10,00

LOW EPSILON RATIO	HIGH EPSILON RATIO	LOW LOG RATIO	HIGH LOG RATIO
1,88	1,31	0,27	0,12
1,47	1,23	0,17	0,09
BAD DATA	BAD DATA	BAD DATA	BAD DATA
1,76	1,29	0,24	0,11
1,75	1,37	0,24	0,14
1,79	1,38	0,25	0,14

PATIENT 8 OFF STATE						
PDTR8	REAL FREQUENCY VALUES		ARFIT FREQUENCY VALUES		EPSILON LOW	EPSILON HIGH
CHANNEL	LOW BETA	HIGH BETA	LOW BETA	HIGH BETA		
STN 6-7	15,99	23,25	17,98	33,46	1,99	10,21
STN 5-6	12,59	22,70	17,44	31,84	4,85	9,14
STN 4-5	12,59	24,22	16,97	33,23	4,38	9,01
STN 2-3	15,02	27,13	17,55	32,75	2,53	5,62
STN 1-2	15,99	25,67	17,92	32,29	1,93	6,62
STN 0-1	15,02	26,64	18,61	32,24	3,59	5,60

LOW EPSILON RATIO	HIGH EPSILON RATIO	LOW LOG RATIO	HIGH LOG RATIO
1,12	1,44	0,05	0,16
1,39	1,40	0,14	0,15
1,35	1,37	0,13	0,14
1,17	1,21	0,07	0,08
1,12	1,26	0,05	0,10
1,24	1,21	0,09	0,08

PATIENT 9 OFF STATE						
PDTR9	REAL FREQUENCY VALUES		ARFIT FREQUENCY VALUES		EPSILON LOW	EPSILON HIGH
CHANNEL	LOW BETA	HIGH BETA	LOW BETA	HIGH BETA		
STN 6-7	15,81	25,70	18,30	35,06	2,49	9,36
STN 5-6	12,85	22,24	18,13	34,15	5,28	11,91
STN 4-5	16,80	25,70	17,68	32,76	0,88	7,06
STN 2-3	14,83	24,22	17,45	34,51	2,62	10,29
STN 1-2	14,83	25,70	18,04	34,67	3,21	8,97
STN 0-1	11,86	22,40	17,59	34,42	5,73	12,02

LOW EPSILON RATIO	HIGH EPSILON RATIO	LOW LOG RATIO	HIGH LOG RATIO
1,16	1,36	0,06	0,13
1,41	1,54	0,15	0,19
1,05	1,27	0,02	0,11
1,18	1,42	0,07	0,15
1,22	1,35	0,09	0,13
1,48	1,54	0,17	0,19

PATIENT 10 OFF STATE						
PDTR10	REAL FREQUENCY VALUES		ARFIT FREQUENCY VALUES		EPSILON LOW	EPSILON HIGH
CHANNEL	LOW BETA	HIGH BETA	LOW BETA	HIGH BETA		
STN 6-7	19,73	27,13	17,72	35,46	2,01	8,33
STN 5-6	19,73	29,10	16,94	34,80	2,79	5,70
STN 4-5	19,24	29,10	17,01	35,13	2,23	6,03
STN 2-3	17,26	29,59	17,17	34,62	0,09	5,03
STN 1-2	17,76	34,52	16,44	34,14	1,32	0,38
STN 0-1	17,76	27,13	16,84	34,44	0,92	7,31

LOW EPSILON RATIO	HIGH EPSILON RATIO	LOW LOG RATIO	HIGH LOG RATIO
0,90	1,31	-0,05	0,12
0,86	1,20	-0,07	0,08
0,88	1,21	-0,05	0,08
0,99	1,17	0,00	0,07
0,93	0,99	-0,03	0,00
0,95	1,27	-0,02	0,10

PATIENT 11 OFF STATE							LOW	HIGH	LOW	HIGH
PDTR11	REAL FREQUENCY VALUES		ARFIT FREQUENCY VALUES		EPSILON LOW	EPSILON HIGH	EPSILON RATIO	EPSILON RATIO	LOG RATIO	LOG RATIO
CHANNEL	LOW BETA	HIGH BETA	LOW BETA	HIGH BETA						
STN 6-7	17,30	27,68	15,67	31,98	1,63	4,30	0,91	1,16	-0,04	0,06
STN 5-6	16,31	27,18	14,76	30,77	1,55	3,59	0,90	1,13	-0,04	0,05
STN 4-5	16,31	26,19	19,44	34,88	3,13	8,69	1,19	1,33	0,08	0,12
STN 2-3	16,31	26,69	13,66	31,69	2,65	5,00	0,84	1,19	-0,08	0,07
STN 1-2	15,32	28,17	15,91	30,98	0,59	2,81	1,04	1,10	0,02	0,04
STN 0-1	14,83	25,70	16,32	31,94	1,49	6,24	1,10	1,24	0,04	0,09

PATIENT 12 OFF STATE							LOW	HIGH	LOW	HIGH
PDTR12	REAL FREQUENCY VALUES		ARFIT FREQUENCY VALUES		EPSILON LOW	EPSILON HIGH	EPSILON RATIO	EPSILON RATIO	LOG RATIO	LOG RATIO
CHANNEL	LOW BETA	HIGH BETA	LOW BETA	HIGH BETA						
STN 6-7	18,78	20,76	17,92	34,99	0,86	14,23	0,95	1,69	-0,02	0,23
STN 5-6	17,79	25,20	17,92	35,03	0,13	9,83	1,01	1,39	0,00	0,14
STN 4-5	13,84	24,71	18,30	35,22	4,46	10,51	1,32	1,43	0,12	0,15
STN 2-3	17,79	26,69	17,41	33,08	0,38	6,39	0,98	1,24	-0,01	0,09
STN 1-2	13,34	26,69	18,69	33,29	5,35	6,60	1,40	1,25	0,15	0,10
STN 0-1	13,34	26,19	18,63	33,31	5,29	7,12	1,40	1,27	0,15	0,10

PATIENT 13 OFF STATE							LOW	HIGH	LOW	HIGH
PDTR13	REAL FREQUENCY VALUES		ARFIT FREQUENCY VALUES		EPSILON LOW	EPSILON HIGH	EPSILON RATIO	EPSILON RATIO	LOG RATIO	LOG RATIO
CHANNEL	LOW BETA	HIGH BETA	LOW BETA	HIGH BETA						
STN 6-7	16,31	30,15	16,97	33,28	0,66	3,13	1,04	1,10	0,02	0,04
STN 5-6	16,31	30,15	17,11	33,53	0,80	3,38	1,05	1,11	0,02	0,05
STN 4-5	15,81	23,23	17,53	33,98	1,72	10,75	1,11	1,46	0,04	0,17
STN 2-3	11,86	23,72	16,89	32,40	5,03	8,68	1,42	1,37	0,15	0,14
STN 1-2	11,86	23,23	16,94	31,54	5,08	8,31	1,43	1,36	0,15	0,13
STN 0-1	16,31	23,72	16,28	32,55	0,03	8,83	1,00	1,37	0,00	0,14

ON STATE

PATIENT 2 ON STATE							LOW	HIGH	LOW	HIGH
PDTR2	REAL FREQUENCY VALUES		ARFIT FREQUENCY VALUES		EPSILON LOW	EPSILON HIGH	EPSILON RATIO	EPSILON RATIO	LOG RATIO	LOG RATIO
CHANNEL	LOW BETA	HIGH BETA	LOW BETA	HIGH BETA						
STN 6-7	12,36	23,23	18,93	35,86	6,57	12,63	1,53	1,54	0,19	0,19
STN 5-6	16,31	23,72	18,63	34,29	2,32	10,57	1,14	1,45	0,06	0,16
STN 4-5	15,32	23,23	19,17	35,17	3,85	11,94	1,25	1,51	0,10	0,18
STN 2-3	16,80	23,72	18,52	33,53	1,72	9,81	1,10	1,41	0,04	0,15
STN 1-2	15,81	23,72	18,44	33,33	2,63	9,61	1,17	1,41	0,07	0,15
STN 0-1	14,83	23,23	17,97	31,65	3,14	8,42	1,21	1,36	0,08	0,13

PATIENT 3 ON STATE							LOW	HIGH	LOW	HIGH
PDTR3	REAL FREQUENCY VALUES		ARFIT FREQUENCY VALUES		EPSILON LOW	EPSILON HIGH	EPSILON RATIO	EPSILON RATIO	LOG RATIO	LOG RATIO
CHANNEL	LOW BETA	HIGH BETA	LOW BETA	HIGH BETA						
STN 6-7	15,32	20,26	17,87	33,62	2,55	13,36	1,17	1,66	0,07	0,22
STN 5-6	13,84	20,26	18,01	34,17	4,17	13,91	1,30	1,69	0,11	0,23
STN 4-5	14,83	21,75	18,05	34,11	3,22	12,36	1,22	1,57	0,09	0,20
STN 2-3	14,33	21,25	18,27	34,32	3,94	13,07	1,27	1,62	0,11	0,21
STN 1-2	13,34	21,25	18,06	33,82	4,72	12,57	1,35	1,59	0,13	0,20
STN 0-1	13,84	21,25	18,56	35,18	4,72	13,93	1,34	1,66	0,13	0,22

PATIENT 4 ON STATE						
PDTR4	REAL FREQUENCY VALUES		ARFIT FREQUENCY VALUES		EPSILON LOW	EPSILON HIGH
CHANNEL	LOW BETA	HIGH BETA	LOW BETA	HIGH BETA		
STN 6-7	18,29	28,17	18,24	34,11	0,05	5,94
STN 5-6	17,30	29,65	18,26	33,64	0,96	3,99
STN 4-5	17,79	28,17	18,52	35,64	0,73	7,47
STN 2-3	17,30	27,18	18,59	34,28	1,29	7,10
STN 1-2	17,30	29,65	18,16	33,45	0,86	3,80
STN 0-1	17,30	26,69	18,72	35,05	1,42	8,36

LOW EPSILON RATIO	HIGH EPSILON RATIO	LOW LOG RATIO	HIGH LOG RATIO
1,00	1,21	0,00	0,08
1,06	1,13	0,02	0,05
1,04	1,27	0,02	0,10
1,07	1,26	0,03	0,10
1,05	1,13	0,02	0,05
1,08	1,31	0,03	0,12

PATIENT 5 ON STATE						
PDTR5	REAL FREQUENCY VALUES		ARFIT FREQUENCY VALUES		EPSILON LOW	EPSILON HIGH
CHANNEL	LOW BETA	HIGH BETA	LOW BETA	HIGH BETA		
STN 6-7	14,33	29,65	17,91	33,47	3,58	3,82
STN 5-6	14,33	28,17	15,97	32,30	1,64	4,13
STN 4-5	BAD DATA	BAD DATA	BAD DATA	BAD DATA	BAD DATA	BAD DATA
STN 2-3	13,84	27,18	18,95	33,20	5,11	6,02
STN 1-2	14,33	26,19	19,11	34,54	4,78	8,35
STN 0-1	13,84	26,69	17,24	31,94	3,40	5,25

LOW EPSILON RATIO	HIGH EPSILON RATIO	LOW LOG RATIO	HIGH LOG RATIO
1,25	1,13	0,10	0,05
1,11	1,15	0,05	0,06
BAD DATA	BAD DATA	BAD DATA	BAD DATA
1,37	1,22	0,14	0,09
1,33	1,32	0,13	0,12
1,25	1,20	0,10	0,08

PATIENT 6 ON STATE						
PDTR6	REAL FREQUENCY VALUES		ARFIT FREQUENCY VALUES		EPSILON LOW	EPSILON HIGH
CHANNEL	LOW BETA	HIGH BETA	LOW BETA	HIGH BETA		
STN 6-7	16,31	22,24	18,39	36,03	2,08	13,79
STN 5-6	17,30	22,40	18,12	35,25	0,82	12,85
STN 4-5	BAD DATA	BAD DATA	BAD DATA	BAD DATA	BAD DATA	BAD DATA
STN 2-3	16,81	28,17	18,99	37,05	2,18	8,88
STN 1-2	11,37	25,70	19,18	37,42	7,81	11,72
STN 0-1	11,37	28,17	19,04	36,45	7,67	8,28

LOW EPSILON RATIO	HIGH EPSILON RATIO	LOW LOG RATIO	HIGH LOG RATIO
1,13	1,62	0,05	0,21
1,05	1,57	0,02	0,20
BAD DATA	BAD DATA	BAD DATA	BAD DATA
1,13	1,32	0,05	0,12
1,69	1,46	0,23	0,16
1,67	1,29	0,22	0,11

PATIENT 7 ON STATE						
PDTR7	REAL FREQUENCY VALUES		ARFIT FREQUENCY VALUES		EPSILON LOW	EPSILON HIGH
CHANNEL	LOW BETA	HIGH BETA	LOW BETA	HIGH BETA		
STN 6-7	10,38	24,22	18,41	32,59	8,03	8,37
STN 5-6	13,34	25,70	18,81	34,82	5,47	9,12
STN 4-5	BAD DATA	BAD DATA	BAD DATA	BAD DATA	BAD DATA	BAD DATA
STN 2-3	10,87	26,19	18,44	34,54	7,57	8,35
STN 1-2	10,87	24,71	18,96	35,42	8,09	10,71
STN 0-1	10,87	26,19	18,88	36,08	8,01	9,89

LOW EPSILON RATIO	HIGH EPSILON RATIO	LOW LOG RATIO	HIGH LOG RATIO
1,77	1,35	0,25	0,13
1,41	1,35	0,15	0,13
BAD DATA	BAD DATA	BAD DATA	BAD DATA
1,70	1,32	0,23	0,12
1,74	1,43	0,24	0,16
1,74	1,38	0,24	0,14

PATIENT 8 ON STATE						
PDTR8	REAL FREQUENCY VALUES		ARFIT FREQUENCY VALUES		EPSILON LOW	EPSILON HIGH
CHANNEL	LOW BETA	HIGH BETA	LOW BETA	HIGH BETA		
STN 6-7	15,99	23,25	18,27	34,66	2,28	11,41
STN 5-6	12,59	22,70	18,29	33,48	5,70	10,78
STN 4-5	12,59	24,22	18,72	35,32	6,13	11,10
STN 2-3	15,02	27,13	18,15	33,91	3,13	6,78
STN 1-2	15,99	25,67	17,64	32,52	1,65	6,85
STN 0-1	15,02	26,64	17,80	32,75	2,78	6,11

LOW EPSILON RATIO	HIGH EPSILON RATIO	LOW LOG RATIO	HIGH LOG RATIO
1,14	1,49	0,06	0,17
1,45	1,47	0,16	0,17
1,49	1,46	0,17	0,16
1,21	1,25	0,08	0,10
1,10	1,27	0,04	0,10
1,19	1,23	0,07	0,09

PATIENT 10 OFF STATE						
PDTR10	REAL FREQUENCY VALUES		ARFIT FREQUENCY VALUES		EPSILON LOW	EPSILON HIGH
CHANNEL	LOW BETA	HIGH BETA	LOW BETA	HIGH BETA		
STN 6-7	19,73	27,13	18,69	36,87	1,04	9,74
STN 5-6	19,73	29,10	18,58	36,26	1,15	7,16
STN 4-5	19,24	29,10	18,25	36,07	0,99	6,97
STN 2-3	17,26	29,59	18,04	34,47	0,78	4,88
STN 1-2	17,76	34,52	18,29	35,09	0,53	0,57
STN 0-1	17,76	27,13	17,87	34,48	0,11	7,35

LOW EPSILON RATIO	HIGH EPSILON RATIO	LOW LOG RATIO	HIGH LOG RATIO
0,95	1,36	-0,02	0,13
0,94	1,25	-0,03	0,10
0,95	1,24	-0,02	0,09
1,05	1,16	0,02	0,07
1,03	1,02	0,01	0,01
1,01	1,27	0,00	0,10

PATIENT 11 ON STATE							LOW	HIGH	LOW	HIGH
PDTR11	REAL FREQUENCY VALUES		ARFIT FREQUENCY VALUES		EPSILON LOW	EPSILON HIGH	EPSILON RATIO	EPSILON RATIO	LOG RATIO	LOG RATIO
CHANNEL	LOW BETA	HIGH BETA	LOW BETA	HIGH BETA						
STN 6-7	17,30	27,68	19,02	35,33	1,72	7,65	1,10	1,28	0,04	0,11
STN 5-6	16,31	27,18	18,91	35,17	2,60	7,99	1,16	1,29	0,06	0,11
STN 4-5	16,31	26,19	19,28	36,65	2,97	10,46	1,18	1,40	0,07	0,15
STN 2-3	16,31	26,69	18,57	33,43	2,26	6,74	1,14	1,25	0,06	0,10
STN 1-2	15,32	28,17	19,01	34,96	3,69	6,79	1,24	1,24	0,09	0,09
STN 0-1	14,83	25,70	18,95	34,52	4,12	8,82	1,28	1,34	0,11	0,13

PATIENT 12 ON STATE							LOW	HIGH	LOW	HIGH
PDTR12	REAL FREQUENCY VALUES		ARFIT FREQUENCY VALUES		EPSILON LOW	EPSILON HIGH	EPSILON RATIO	EPSILON RATIO	LOG RATIO	LOG RATIO
CHANNEL	LOW BETA	HIGH BETA	LOW BETA	HIGH BETA						
STN 6-7	18,78	20,76	18,34	35,44	0,44	14,68	0,98	1,71	-0,01	0,23
STN 5-6	17,79	25,20	18,79	35,60	1,00	10,40	1,06	1,41	0,02	0,15
STN 4-5	13,84	24,71	18,41	35,67	4,57	10,96	1,33	1,44	0,12	0,16
STN 2-3	17,79	26,69	18,55	34,61	0,76	7,92	1,04	1,30	0,02	0,11
STN 1-2	13,34	26,69	19,10	36,27	5,76	9,58	1,43	1,36	0,16	0,13
STN 0-1	13,34	26,19	18,94	35,58	5,60	9,39	1,42	1,36	0,15	0,13

PATIENT 13 ON STATE							LOW	HIGH	LOW	HIGH
PDTR13	REAL FREQUENCY VALUES		ARFIT FREQUENCY VALUES		EPSILON LOW	EPSILON HIGH	EPSILON RATIO	EPSILON RATIO	LOG RATIO	LOG RATIO
CHANNEL	LOW BETA	HIGH BETA	LOW BETA	HIGH BETA						
STN 6-7	16,31	30,15	18,28	35,34	1,97	5,19	1,12	1,17	0,05	0,07
STN 5-6	16,31	30,15	18,51	34,48	2,20	4,33	1,13	1,14	0,05	0,06
STN 4-5	15,81	23,23	18,45	34,76	2,64	11,53	1,17	1,50	0,07	0,18
STN 2-3	11,86	23,72	18,30	33,64	6,44	9,92	1,54	1,42	0,19	0,15
STN 1-2	11,86	23,23	17,80	33,63	5,94	10,40	1,50	1,45	0,18	0,16
STN 0-1	16,31	23,72	17,89	33,72	1,58	10,00	1,10	1,42	0,04	0,15

AR(P=16)

OFF STATE

PATIENT 2 OFF STATE							LOW	HIGH	LOW	HIGH
PDTR2	REAL FREQUENCY VALUES		ARFIT FREQUENCY VALUES		EPSILON LOW	EPSILON HIGH	EPSILON RATIO	EPSILON RATIO	LOG RATIO	LOG RATIO
CHANNEL	LOW BETA	HIGH BETA	LOW BETA	HIGH BETA						
STN 6-7	12,36	23,23	13,80	26,59	1,44	3,36	1,12	1,14	0,05	0,06
STN 5-6	16,31	23,72	14,30	26,89	2,01	3,17	0,88	1,13	-0,06	0,05
STN 4-5	15,32	23,23	12,72	23,37	2,60	0,14	0,83	1,01	-0,08	0,00
STN 2-3	16,80	23,72	12,72	24,20	4,08	0,48	0,76	1,02	-0,12	0,01
STN 1-2	15,81	23,72	12,62	24,62	3,19	0,90	0,80	1,04	-0,10	0,02
STN 0-1	14,83	23,23	12,38	23,74	2,45	0,51	0,83	1,02	-0,08	0,01

PATIENT 3 OFF STATE							LOW	HIGH	LOW	HIGH
PDTR2	REAL FREQUENCY VALUES		ARFIT FREQUENCY VALUES		EPSILON LOW	EPSILON HIGH	EPSILON RATIO	EPSILON RATIO	LOG RATIO	LOG RATIO
CHANNEL	LOW BETA	HIGH BETA	LOW BETA	HIGH BETA						
STN 6-7	15,32	20,26	13,92	26,76	1,40	6,50	0,91	1,32	-0,04	0,12
STN 5-6	13,84	20,26	14,20	26,87	0,36	6,61	1,03	1,33	0,01	0,12
STN 4-5	14,83	21,75	13,92	26,88	0,91	5,13	0,94	1,24	-0,03	0,09
STN 2-3	14,33	21,25	14,29	26,94	0,04	5,69	1,00	1,27	0,00	0,10
STN 1-2	13,34	21,25	13,92	26,72	0,58	5,47	1,04	1,26	0,02	0,10
STN 0-1	13,84	21,25	13,49	26,20	0,35	4,95	0,97	1,23	-0,01	0,09

PATIENT 4 OFF STATE						
PDTR2	REAL FREQUENCY VALUES		ARFIT FREQUENCY VALUES		EPSILON LOW	EPSILON HIGH
CHANNEL	LOW BETA	HIGH BETA	LOW BETA	HIGH BETA		
STN 6-7	18,29	28,17	14,44	27,75	3,85	0,42
STN 5-6	17,30	29,65	13,92	26,95	3,38	2,70
STN 4-5	17,79	28,17	14,45	28,01	3,34	0,16
STN 2-3	17,30	27,18	14,46	27,65	2,84	0,47
STN 1-2	17,30	29,65	14,43	27,61	2,87	2,04
STN 0-1	17,30	26,69	14,39	27,54	2,91	0,85

LOW EPSILON RATIO	HIGH EPSILON RATIO	LOW LOG RATIO	HIGH LOG RATIO
0,79	0,99	-0,10	-0,01
0,80	0,91	-0,09	-0,04
0,81	0,99	-0,09	0,00
0,84	1,02	-0,08	0,01
0,83	0,93	-0,08	-0,03
0,83	1,03	-0,08	0,01

PATIENT 5 OFF STATE						
PDTR5	REAL FREQUENCY VALUES		ARFIT FREQUENCY VALUES		EPSILON LOW	EPSILON HIGH
CHANNEL	LOW BETA	HIGH BETA	LOW BETA	HIGH BETA		
STN 6-7	14,33	29,65	14,04	27,84	0,29	1,81
STN 5-6	14,33	28,17	14,02	27,97	0,31	0,20
STN 4-5	BAD DATA	BAD DATA	BAD DATA	BAD DATA	BAD DATA	BAD DATA
STN 2-3	13,84	27,18	14,07	27,33	0,23	0,15
STN 1-2	14,33	26,19	13,88	27,53	0,45	1,34
STN 0-1	13,84	26,69	13,75	27,37	0,09	0,68

LOW EPSILON RATIO	HIGH EPSILON RATIO	LOW LOG RATIO	HIGH LOG RATIO
0,98	0,94	-0,01	-0,03
0,98	0,99	-0,01	0,00
BAD DATA	BAD DATA	BAD DATA	BAD DATA
1,02	1,01	0,01	0,00
0,97	1,05	-0,01	0,02
0,99	1,03	0,00	0,01

PATIENT 6 OFF STATE						
PDTR6	REAL FREQUENCY VALUES		ARFIT FREQUENCY VALUES		EPSILON LOW	EPSILON HIGH
CHANNEL	LOW BETA	HIGH BETA	LOW BETA	HIGH BETA		
STN 6-7	16,31	22,24	13,61	26,69	2,70	4,45
STN 5-6	17,30	22,40	13,17	26,18	4,13	3,78
STN 4-5	BAD DATA	BAD DATA	BAD DATA	BAD DATA	BAD DATA	BAD DATA
STN 2-3	16,81	28,17	13,89	27,39	2,92	0,78
STN 1-2	11,37	25,70	14,18	27,39	2,81	1,69
STN 0-1	11,37	28,17	13,96	27,58	2,59	0,59

LOW EPSILON RATIO	HIGH EPSILON RATIO	LOW LOG RATIO	HIGH LOG RATIO
0,83	1,20	-0,08	0,08
0,76	1,17	-0,12	0,07
BAD DATA	BAD DATA	BAD DATA	BAD DATA
0,83	0,97	-0,08	-0,01
1,25	1,07	0,10	0,03
1,23	0,98	0,09	-0,01

PATIENT 7 OFF STATE						
PDTR7	REAL FREQUENCY VALUES		ARFIT FREQUENCY VALUES		EPSILON LOW	EPSILON HIGH
CHANNEL	LOW BETA	HIGH BETA	LOW BETA	HIGH BETA		
STN 6-7	10,38	24,22	13,70	26,63	3,32	2,41
STN 5-6	13,34	25,70	13,71	26,96	0,37	1,26
STN 4-5	BAD DATA	BAD DATA	BAD DATA	BAD DATA	BAD DATA	BAD DATA
STN 2-3	10,87	26,19	14,20	26,71	3,33	0,52
STN 1-2	10,87	24,71	14,38	27,26	3,51	2,55
STN 0-1	10,87	26,19	14,43	27,35	3,56	1,16

LOW EPSILON RATIO	HIGH EPSILON RATIO	LOW LOG RATIO	HIGH LOG RATIO
1,32	1,10	0,12	0,04
1,03	1,05	0,01	0,02
BAD DATA	BAD DATA	BAD DATA	BAD DATA
1,31	1,02	0,12	0,01
1,32	1,10	0,12	0,04
1,33	1,04	0,12	0,02

PATIENT 8 OFF STATE						
PDTR8	REAL FREQUENCY VALUES		ARFIT FREQUENCY VALUES		EPSILON LOW	EPSILON HIGH
CHANNEL	LOW BETA	HIGH BETA	LOW BETA	HIGH BETA		
STN 6-7	15,99	23,25	14,03	27,18	1,96	3,93
STN 5-6	12,59	22,70	12,58	25,68	0,01	2,98
STN 4-5	12,59	24,22	13,36	26,85	0,77	2,63
STN 2-3	15,02	27,13	14,00	27,62	1,02	0,49
STN 1-2	15,99	25,67	14,06	27,01	1,93	1,34
STN 0-1	15,02	26,64	13,80	26,82	1,22	0,18

LOW EPSILON RATIO	HIGH EPSILON RATIO	LOW LOG RATIO	HIGH LOG RATIO
0,88	1,17	-0,06	0,07
1,00	1,13	0,00	0,05
1,06	1,11	0,03	0,04
0,93	1,02	-0,03	0,01
0,88	1,05	-0,06	0,02
0,92	1,01	-0,04	0,00

PATIENT 9 OFF STATE						
PDTR9	REAL FREQUENCY VALUES		ARFIT FREQUENCY VALUES		EPSILON LOW	EPSILON HIGH
CHANNEL	LOW BETA	HIGH BETA	LOW BETA	HIGH BETA		
STN 6-7	15,81	25,70	14,80	28,34	1,01	2,64
STN 5-6	12,85	22,24	18,08	30,08	5,23	7,84
STN 4-5	16,80	25,70	16,29	25,05	0,51	0,65
STN 2-3	14,83	24,22	16,48	28,16	1,65	3,94
STN 1-2	14,83	25,70	14,52	26,90	0,31	1,20
STN 0-1	11,86	22,40	11,90	23,02	0,04	0,62

LOW EPSILON RATIO	HIGH EPSILON RATIO	LOW LOG RATIO	HIGH LOG RATIO
0,94	1,10	-0,03	0,04
1,41	1,35	0,15	0,13
0,97	0,97	-0,01	-0,01
1,11	1,16	0,05	0,07
0,98	1,05	-0,01	0,02
1,00	1,03	0,00	0,01

PATIENT 10 OFF STATE							LOW	HIGH	LOW	HIGH
PDTR10	REAL FREQUENCY VALUES		ARFIT FREQUENCY VALUES		EPSILON LOW	EPSILON HIGH	EPSILON RATIO	EPSILON RATIO	LOG RATIO	LOG RATIO
CHANNEL	LOW BETA	HIGH BETA	LOW BETA	HIGH BETA						
STN 6-7	19,73	27,13	14,70	27,40	5,03	0,27	0,75	1,01	-0,13	0,00
STN 5-6	19,73	29,10	15,14	28,01	4,59	1,09	0,77	0,96	-0,12	-0,02
STN 4-5	19,24	29,10	14,90	27,91	4,34	1,19	0,77	0,96	-0,11	-0,02
STN 2-3	17,26	29,59	14,17	26,70	3,09	2,89	0,82	0,90	-0,09	-0,04
STN 1-2	17,76	34,52	14,22	26,96	3,54	7,56	0,80	0,78	-0,10	-0,11
STN 0-1	17,76	27,13	14,45	25,65	3,31	1,48	0,81	0,95	-0,09	-0,02

PATIENT 11 OFF STATE							LOW	HIGH	LOW	HIGH
PDTR11	REAL FREQUENCY VALUES		ARFIT FREQUENCY VALUES		EPSILON LOW	EPSILON HIGH	EPSILON RATIO	EPSILON RATIO	LOG RATIO	LOG RATIO
CHANNEL	LOW BETA	HIGH BETA	LOW BETA	HIGH BETA						
STN 6-7	17,30	27,68	14,32	27,53	2,98	0,15	0,83	0,99	-0,08	0,00
STN 5-6	16,31	27,18	13,93	27,32	2,38	0,14	0,85	1,01	-0,07	0,00
STN 4-5	16,31	26,19	14,22	27,55	2,09	1,36	0,87	1,05	-0,06	0,02
STN 2-3	16,31	26,69	14,21	27,78	2,10	1,09	0,87	1,04	-0,06	0,02
STN 1-2	15,32	28,17	13,97	27,36	1,35	0,81	0,91	0,97	-0,04	-0,01
STN 0-1	14,83	25,70	14,12	27,63	0,71	1,93	0,95	1,08	-0,02	0,03

PATIENT 12 OFF STATE							LOW	HIGH	LOW	HIGH
PDTR12	REAL FREQUENCY VALUES		ARFIT FREQUENCY VALUES		EPSILON LOW	EPSILON HIGH	EPSILON RATIO	EPSILON RATIO	LOG RATIO	LOG RATIO
CHANNEL	LOW BETA	HIGH BETA	LOW BETA	HIGH BETA						
STN 6-7	18,78	20,76	14,08	27,14	4,70	6,38	0,75	1,31	-0,13	0,12
STN 5-6	17,79	25,20	14,10	27,07	3,69	1,87	0,79	1,07	-0,10	0,03
STN 4-5	13,84	24,71	13,83	26,99	0,01	2,28	1,00	1,09	0,00	0,04
STN 2-3	17,79	26,69	14,19	27,05	3,60	0,36	0,80	1,01	-0,10	0,01
STN 1-2	13,34	26,69	13,73	26,75	0,39	0,06	1,03	1,00	0,01	0,00
STN 0-1	13,34	26,19	12,93	26,42	0,41	0,23	0,97	1,01	-0,01	0,00

PATIENT 13 OFF STATE							LOW	HIGH	LOW	HIGH
PDTR13	REAL FREQUENCY VALUES		ARFIT FREQUENCY VALUES		EPSILON LOW	EPSILON HIGH	EPSILON RATIO	EPSILON RATIO	LOG RATIO	LOG RATIO
CHANNEL	LOW BETA	HIGH BETA	LOW BETA	HIGH BETA						
STN 6-7	16,31	30,15	14,44	26,56	1,87	3,59	0,89	0,88	-0,05	-0,06
STN 5-6	16,31	30,15	13,92	25,37	2,39	4,78	0,85	0,84	-0,07	-0,07
STN 4-5	15,81	23,23	12,75	24,51	3,06	1,28	0,81	1,06	-0,09	0,02
STN 2-3	11,86	23,72	12,14	23,75	0,28	0,03	1,02	1,00	0,01	0,00
STN 1-2	11,86	23,23	11,70	23,98	0,16	0,75	0,99	1,03	-0,01	0,01
STN 0-1	16,31	23,72	12,18	23,99	4,13	0,27	0,75	1,01	-0,13	0,00

ON STATE

PATIENT 2 ON STATE						
PDTR2	REAL FREQUENCY VALUES		ARFIT FREQUENCY VALUES		EPSILON LOW	EPSILON HIGH
CHANNEL	LOW BETA	HIGH BETA	LOW BETA	HIGH BETA		
STN 6-7	12,36	23,23	14,54	27,30	2,18	4,07
STN 5-6	16,31	23,72	13,52	24,99	2,79	1,27
STN 4-5	15,32	23,23	13,94	25,97	1,38	2,74
STN 2-3	16,80	23,72	17,48	20,80	0,68	2,92
STN 1-2	15,81	23,72	17,30	28,08	1,49	4,36
STN 0-1	14,83	23,23	12,04	23,43	2,79	0,20

LOW EPSILON RATIO	HIGH EPSILON RATIO	LOW LOG RATIO	HIGH LOG RATIO
1,18	1,18	0,07	0,07
0,83	1,05	-0,08	0,02
0,91	1,12	-0,04	0,05
1,04	0,88	0,02	-0,06
1,09	1,18	0,04	0,07
0,81	1,01	-0,09	0,00

PATIENT 3 ON STATE						
PDTR3	REAL FREQUENCY VALUES		ARFIT FREQUENCY VALUES		EPSILON LOW	EPSILON HIGH
CHANNEL	LOW BETA	HIGH BETA	LOW BETA	HIGH BETA		
STN 6-7	15,32	20,26	13,86	26,70	1,46	6,44
STN 5-6	13,84	20,26	13,97	26,76	0,13	6,50
STN 4-5	14,83	21,75	13,80	26,81	1,03	5,06
STN 2-3	14,33	21,25	14,15	27,15	0,18	5,90
STN 1-2	13,34	21,25	13,74	26,63	0,40	5,38
STN 0-1	13,84	21,25	14,05	26,82	0,21	5,57

LOW EPSILON RATIO	HIGH EPSILON RATIO	LOW LOG RATIO	HIGH LOG RATIO
0,90	1,32	-0,04	0,12
1,01	1,32	0,00	0,12
0,93	1,23	-0,03	0,09
0,99	1,28	-0,01	0,11
1,03	1,25	0,01	0,10
1,02	1,26	0,01	0,10

PATIENT 4 ON STATE						
PDTR4	REAL FREQUENCY VALUES		ARFIT FREQUENCY VALUES		EPSILON LOW	EPSILON HIGH
CHANNEL	LOW BETA	HIGH BETA	LOW BETA	HIGH BETA		
STN 6-7	18,29	28,17	14,47	27,30	3,82	0,87
STN 5-6	17,30	29,65	13,84	27,02	3,46	2,63
STN 4-5	17,79	28,17	14,15	26,78	3,64	1,39
STN 2-3	17,30	27,18	14,43	27,59	2,87	0,41
STN 1-2	17,30	29,65	14,17	27,43	3,13	2,22
STN 0-1	17,30	26,69	14,49	27,43	2,81	0,74

LOW EPSILON RATIO	HIGH EPSILON RATIO	LOW LOG RATIO	HIGH LOG RATIO
0,79	0,97	-0,10	-0,01
0,80	0,91	-0,10	-0,04
0,80	0,95	-0,10	-0,02
0,83	1,02	-0,08	0,01
0,82	0,93	-0,09	-0,03
0,84	1,03	-0,08	0,01

PATIENT 5 ON STATE						
PDTR5	REAL FREQUENCY VALUES		ARFIT FREQUENCY VALUES		EPSILON LOW	EPSILON HIGH
CHANNEL	LOW BETA	HIGH BETA	LOW BETA	HIGH BETA		
STN 6-7	14,33	29,65	14,11	27,78	0,22	1,87
STN 5-6	14,33	28,17	14,04	27,83	0,29	0,34
STN 4-5	BAD DATA	BAD DATA	BAD DATA	BAD DATA	BAD DATA	BAD DATA
STN 2-3	13,84	27,18	12,83	25,49	1,01	1,69
STN 1-2	14,33	26,19	10,70	21,55	3,63	4,64
STN 0-1	13,84	26,69	10,66	21,50	3,18	5,19

LOW EPSILON RATIO	HIGH EPSILON RATIO	LOW LOG RATIO	HIGH LOG RATIO
0,98	0,94	-0,01	-0,03
0,98	0,99	-0,01	-0,01
BAD DATA	BAD DATA	BAD DATA	BAD DATA
0,93	0,94	-0,03	-0,03
0,75	0,82	-0,13	-0,08
0,77	0,81	-0,11	-0,09

PATIENT 6 ON STATE						
PDTR6	REAL FREQUENCY VALUES		ARFIT FREQUENCY VALUES		EPSILON LOW	EPSILON HIGH
CHANNEL	LOW BETA	HIGH BETA	LOW BETA	HIGH BETA		
STN 6-7	16,31	22,24	13,73	26,62	2,58	4,38
STN 5-6	17,30	22,40	11,76	25,25	5,54	2,85
STN 4-5	BAD DATA	BAD DATA	BAD DATA	BAD DATA	BAD DATA	BAD DATA
STN 2-3	16,81	28,17	18,01	26,85	1,20	1,32
STN 1-2	11,37	25,70	9,21	26,81	2,16	1,11
STN 0-1	11,37	28,17	9,10	26,79	2,27	1,38

LOW EPSILON RATIO	HIGH EPSILON RATIO	LOW LOG RATIO	HIGH LOG RATIO
0,84	1,20	-0,07	0,08
0,68	1,13	-0,17	0,05
BAD DATA	BAD DATA	BAD DATA	BAD DATA
1,07	0,95	0,03	-0,02
0,81	1,04	-0,09	0,02
0,80	0,95	-0,10	-0,02

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PATIENT 7 ON STATE						
PDTR7	REAL FREQUENCY VALUES		ARFIT FREQUENCY VALUES		EPSILON LOW	EPSILON HIGH
CHANNEL	LOW BETA	HIGH BETA	LOW BETA	HIGH BETA		
STN 6-7	10,38	24,22	13,13	25,88	2,75	1,66
STN 5-6	13,34	25,70	13,97	26,92	0,63	1,22
STN 4-5	BAD DATA	BAD DATA	BAD DATA	BAD DATA	BAD DATA	BAD DATA
STN 2-3	10,87	26,19	13,72	26,85	2,85	0,66
STN 1-2	10,87	24,71	14,18	27,53	3,31	2,82
STN 0-1	10,87	26,19	14,61	27,81	3,74	1,62

LOW EPSILON RATIO	HIGH EPSILON RATIO	LOW LOG RATIO	HIGH LOG RATIO
1,26	1,07	0,10	0,03
1,05	1,05	0,02	0,02
BAD DATA	BAD DATA	BAD DATA	BAD DATA
1,26	1,03	0,10	0,01
1,30	1,11	0,12	0,05
1,34	1,06	0,13	0,03

PATIENT 8 ON STATE							LOW	HIGH	LOW	HIGH
PDTR8	REAL FREQUENCY VALUES		ARFIT FREQUENCY VALUES		EPSILON LOW	EPSILON HIGH	EPSILON RATIO	EPSILON RATIO	LOG RATIO	LOG RATIO
CHANNEL	LOW BETA	HIGH BETA	LOW BETA	HIGH BETA						
STN 6-7	15,99	23,25	14,10	26,58	1,89	3,33	0,88	1,14	-0,05	0,06
STN 5-6	12,59	22,70	13,94	26,39	1,35	3,69	1,11	1,16	0,04	0,07
STN 4-5	12,59	24,22	14,61	26,97	2,02	2,75	1,16	1,11	0,06	0,05
STN 2-3	15,02	27,13	16,97	24,51	1,95	2,62	1,13	0,90	0,05	-0,04
STN 1-2	15,99	25,67	14,31	27,07	1,68	1,40	0,89	1,05	-0,05	0,02
STN 0-1	15,02	26,64	14,25	26,88	0,77	0,24	0,95	1,01	-0,02	0,00

PATIENT 9 ON STATE							LOW	HIGH	LOW	HIGH
PDTR9	REAL FREQUENCY VALUES		ARFIT FREQUENCY VALUES		EPSILON LOW	EPSILON HIGH	EPSILON QUOTIENT	EPSILON QUOTIENT	LOG QUOTIENT	LOG QUOTIENT
CHANNEL	LOW BETA	HIGH BETA	LOW BETA	HIGH BETA						
STN 6-7	15,81	25,70					0,00	0,00		
STN 5-6	12,85	22,24					0,00	0,00		
STN 4-5	16,80	25,70					0,00	0,00		
STN 2-3	14,83	24,22					0,00	0,00		
STN 1-2	14,83	25,70					0,00	0,00		
STN 0-1	11,86	22,40					0,00	0,00		

PATIENT 10 ON STATE							LOW	HIGH	LOW	HIGH
PDTR10	REAL FREQUENCY VALUES		ARFIT FREQUENCY VALUES		EPSILON LOW	EPSILON HIGH	EPSILON RATIO	EPSILON RATIO	LOG RATIO	LOG RATIO
CHANNEL	LOW BETA	HIGH BETA	LOW BETA	HIGH BETA						
STN 6-7	19,73	27,13	14,51	27,23	5,22	0,10	0,74	1,00	-0,13	0,00
STN 5-6	19,73	29,10	14,44	27,19	5,29	1,91	0,73	0,93	-0,14	-0,03
STN 4-5	19,24	29,10	14,56	27,17	4,68	1,93	0,76	0,93	-0,12	-0,03
STN 2-3	17,26	29,59	13,77	26,69	3,49	2,90	0,80	0,90	-0,10	-0,04
STN 1-2	17,76	34,52	13,62	26,60	4,14	7,92	0,77	0,77	-0,12	-0,11
STN 0-1	17,76	27,13	13,55	26,49	4,21	0,64	0,76	0,98	-0,12	-0,01

PATIENT 11 ON STATE							LOW	HIGH	LOW	HIGH
PDTR11	REAL FREQUENCY VALUES		ARFIT FREQUENCY VALUES		EPSILON LOW	EPSILON HIGH	EPSILON RATIO	EPSILON RATIO	LOG RATIO	LOG RATIO
CHANNEL	LOW BETA	HIGH BETA	LOW BETA	HIGH BETA						
STN 6-7	17,30	27,68	13,72	26,89	3,58	0,79	0,79	0,97	-0,10	-0,01
STN 5-6	16,31	27,18	13,89	27,07	2,42	0,11	0,85	1,00	-0,07	0,00
STN 4-5	16,31	26,19	14,26	27,28	2,05	1,09	0,87	1,04	-0,06	0,02
STN 2-3	16,31	26,69	13,34	26,68	2,97	0,01	0,82	1,00	-0,09	0,00
STN 1-2	15,32	28,17	14,18	27,45	1,14	0,72	0,93	0,97	-0,03	-0,01
STN 0-1	14,83	25,70	13,79	27,00	1,04	1,30	0,93	1,05	-0,03	0,02

PATIENT 12 ON STATE							LOW	HIGH	LOW	HIGH
PDTR12	REAL FREQUENCY VALUES		ARFIT FREQUENCY VALUES		EPSILON LOW	EPSILON HIGH	EPSILON RATIO	EPSILON RATIO	LOG RATIO	LOG RATIO
CHANNEL	LOW BETA	HIGH BETA	LOW BETA	HIGH BETA						
STN 6-7	18,78	20,76	14,27	27,38	4,51	6,62	0,76	1,32	-0,12	0,12
STN 5-6	17,79	25,20	13,87	26,88	3,92	1,68	0,78	1,07	-0,11	0,03
STN 4-5	13,84	24,71	13,96	27,10	0,12	2,39	1,01	1,10	0,00	0,04
STN 2-3	17,79	26,69	14,10	27,20	3,69	0,51	0,79	1,02	-0,10	0,01
STN 1-2	13,34	26,69	14,08	27,07	0,74	0,38	1,06	1,01	0,02	0,01
STN 0-1	13,34	26,19	14,05	26,88	0,71	0,69	1,05	1,03	0,02	0,01

PATIENT 13 ON STATE							LOW	HIGH	LOW	HIGH
PDTR13	REAL FREQUENCY VALUES		ARFIT FREQUENCY VALUES		EPSILON LOW	EPSILON HIGH	EPSILON RATIO	EPSILON RATIO	LOG RATIO	LOG RATIO
CHANNEL	LOW BETA	HIGH BETA	LOW BETA	HIGH BETA						
STN 6-7	16,31	30,15	14,36	26,95	1,95	3,20	0,88	0,89	-0,06	-0,05
STN 5-6	16,31	30,15	14,22	27,25	2,09	2,90	0,87	0,90	-0,06	-0,04
STN 4-5	15,81	23,23	14,40	27,13	1,41	3,90	0,91	1,17	-0,04	0,07
STN 2-3	11,86	23,72	14,28	27,26	2,42	3,54	1,20	1,15	0,08	0,06
STN 1-2	11,86	23,23	14,29	27,28	2,43	4,05	1,20	1,17	0,08	0,07
STN 0-1	16,31	23,72	13,82	26,43	2,49	2,71	0,85	1,11	-0,07	0,05

Appendix 6: Correlation between patients

PACIENTE NÚMERO 2

	PDTR2					
	STN 0-1	STN 1-2	STN 2-3	STN 4-5	STN 5-6	STN 6-7
PDTR2						
STN 0-1	100,00	66,67	38,01	46,54	39,16	50,04
STN 1-2	66,67	100,00	85,97	90,09	85,93	79,22
STN 2-3	38,01	85,97	100,00	84,46	93,65	77,12
STN 4-5	46,54	90,09	84,46	100,00	91,46	92,71
STN 5-6	39,16	85,93	93,65	91,46	100,00	87,50
STN 6-7	50,04	87,12	77,12	92,71	87,50	100,00

	PDTR3					
	STN 0-1	STN 1-2	STN 2-3	STN 4-5	STN 5-6	STN 6-7
PDTR2						
STN 0-1	39,09	46,48	39,19	55,80	39,29	44,25
STN 1-2	75,35	76,62	77,67	83,78	73,59	79,22
STN 2-3	66,47	61,00	71,70	65,10	59,63	67,45
STN 4-5	78,39	78,98	80,42	83,28	76,88	80,55
STN 5-6	74,72	70,59	78,15	74,09	68,81	75,29
STN 6-7	78,44	80,10	78,12	87,44	76,15	78,17

PDTR4

	STN 0-1					
PDTR2						
STN 0-1	66,02	43,64	41,50	55,66	78,00	45,05
STN 1-2	83,73	68,77	70,62	72,94	79,27	75,17
STN 2-3	74,71	79,39	79,42	66,29	56,93	79,15
STN 4-5	74,78	63,36	66,06	65,66	67,15	69,66
STN 5-6	73,50	75,35	76,83	64,18	58,28	75,97
STN 6-7	75,56	59,23	65,95	64,36	69,99	66,88

PDTR5

	STN 0-1					
PDTR2						
STN 0-1	33,51	42,52	29,25	48,11	45,29	58,52
STN 1-2	53,84	64,28	54,43	28,93	56,42	63,13
STN 2-3	31,97	39,10	32,11	9,82	33,40	36,81
STN 4-5	54,99	65,20	56,67	18,84	53,99	57,30

STN 5-6	42,44	49,93	42,87	11,59	42,24	45,18
STN 6-7	54,03	65,16	56,42	21,09	50,39	55,46

	PDTR6					
	STN 0-1	STN 1-2	STN 2-3	STN 4-5	STN 5-6	STN 6-7
PDTR2						
STN 0-1	44,07	38,15	49,08	24,42	67,11	73,65
STN 1-2	79,90	77,48	85,81	29,67	76,90	83,27
STN 2-3	85,73	73,32	90,28	20,33	56,36	62,66
STN 4-5	76,48	75,89	82,85	29,14	72,25	74,30
STN 5-6	81,08	70,43	87,52	23,94	62,71	67,34
STN 6-7	64,93	72,13	74,09	30,82	76,47	77,09

	PDTR7					
	STN 0-1	STN 1-2	STN 2-3	STN 4-5	STN 5-6	STN 6-7
PDTR2						
STN 0-1	58,50	34,60	44,55	61,39	41,53	63,13
STN 1-2	69,76	40,58	50,96	76,81	58,72	81,76
STN 2-3	49,03	20,69	29,91	51,38	32,27	58,99
STN 4-5	64,48	41,33	48,94	72,55	58,75	76,63
STN 5-6	53,52	27,17	35,95	58,60	42,78	64,41
STN 6-7	70,44	46,73	55,79	79,84	63,91	81,18

	PDTR8					
	STN 0-1	STN 1-2	STN 2-3	STN 4-5	STN 5-6	STN 6-7
PDTR2						
STN 0-1	43,76	38,57	55,86	67,85	45,02	36,86
STN 1-2	85,17	77,96	84,13	79,03	81,99	72,76
STN 2-3	78,77	79,58	71,50	57,23	72,85	81,17
STN 4-5	86,08	78,25	83,35	72,75	81,98	69,80
STN 5-6	78,92	78,04	74,77	61,69	76,47	77,82
STN 6-7	76,08	66,21	76,98	73,22	78,63	60,07

	PDTR9					
	STN 0-1	STN 1-2	STN 2-3	STN 4-5	STN 5-6	STN 6-7
PDTR2						
STN 0-1	83,45	81,14	82,79	50,05	70,57	83,97
STN 1-2	58,17	60,04	55,71	84,97	88,15	75,51
STN 2-3	28,54	31,90	28,09	83,55	73,89	48,63
STN 4-5	42,89	44,61	40,09	82,22	80,35	63,45
STN 5-6	33,45	35,67	31,73	83,97	76,61	54,27

STN 6-7	49,07	49,46	44,85	82,98	83,24	68,49

	PDTR10					
	STN 0-1	STN 1-2	STN 2-3	STN 4-5	STN 5-6	STN 6-7
PDTR2						
STN 0-1	57,95	20,37	47,65	15,36	34,33	57,46
STN 1-2	59,68	39,99	61,35	32,47	50,93	69,07
STN 2-3	55,67	56,84	67,70	45,17	56,73	62,45
STN 4-5	50,15	36,85	53,24	30,12	45,65	60,03
STN 5-6	55,08	51,93	66,31	45,28	57,42	64,20
STN 6-7	48,88	31,53	56,07	32,49	48,84	65,07

	PDTR11					
	STN 0-1	STN 1-2	STN 2-3	STN 4-5	STN 5-6	STN 6-7
PDTR2						
STN 0-1	46,76	31,16	45,40	63,60	35,09	33,46
STN 1-2	70,91	62,90	69,06	90,05	70,06	63,51
STN 2-3	58,14	62,25	72,12	75,83	75,82	78,24
STN 4-5	66,79	61,65	62,22	84,77	69,76	60,64
STN 5-6	61,24	60,15	67,07	76,95	73,59	72,72
STN 6-7	59,63	50,07	51,37	81,97	56,50	50,07

	PDTR12					
	STN 0-1	STN 1-2	STN 2-3	STN 4-5	STN 5-6	STN 6-7
PDTR2						
STN 0-1	34,49	30,91	24,52	88,98	89,48	87,45
STN 1-2	53,48	56,75	51,73	67,92	69,19	68,31
STN 2-3	33,14	41,68	70,04	37,68	44,87	43,91
STN 4-5	51,65	56,19	48,90	52,59	51,81	51,41
STN 5-6	40,72	49,94	65,32	42,64	46,67	45,57
STN 6-7	55,96	56,48	42,61	57,46	55,51	54,64

PACIENTE NÚMERO 3

	PDTR3					
	STN 0-1	STN 1-2	STN 2-3	STN 4-5	STN 5-6	STN 6-7
PDTR3						
STN 0-1	100,00	94,61	98,10	86,85	93,09	92,98
STN 1-2	94,61	100,00	91,68	91,22	94,30	92,63

STN 2-3	98,10	91,68	100,00	84,70	91,75	93,16
STN 4-5	86,85	91,22	84,70	100,00	89,87	88,85
STN 5-6	93,09	94,30	91,75	89,87	100,00	97,17
STN 6-7	92,98	92,63	93,16	88,85	97,17	100,00

	PDTR4					
	STN 0-1	STN 1-2	STN 2-3	STN 4-5	STN 5-6	STN 6-7
PDTR3						
STN 0-1	59,75	46,97	53,44	49,13	59,90	50,54
STN 1-2	59,75	46,97	53,44	49,13	59,90	50,54
STN 2-3	59,81	52,97	59,81	48,42	52,37	55,47
STN 4-5	71,49	52,38	59,86	61,15	72,45	60,00
STN 5-6	52,22	41,60	48,42	43,06	52,99	45,21
STN 6-7	58,95	50,11	55,07	49,89	58,06	52,92

	PDTR5					
	STN 0-1	STN 1-2	STN 2-3	STN 4-5	STN 5-6	STN 6-7
PDTR3						
STN 0-1	82,17	86,64	82,99	22,32	76,35	77,26
STN 1-2	82,17	86,64	82,99	22,32	76,35	77,26
STN 2-3	78,75	80,85	77,24	15,12	77,33	76,29
STN 4-5	73,04	81,22	74,83	27,90	68,67	72,82
STN 5-6	83,83	87,57	84,64	17,38	79,00	78,02
STN 6-7	78,32	83,84	77,93	18,92	77,42	77,57

	PDTR6					
	STN 0-1	STN 1-2	STN 2-3	STN 4-5	STN 5-6	STN 6-7
PDTR3						
STN 0-1	62,15	44,86	68,07	33,94	69,09	66,87
STN 1-2	60,99	45,51	66,68	33,83	76,53	71,65
STN 2-3	67,76	48,20	73,20	33,67	67,96	66,42
STN 4-5	61,13	59,28	68,51	34,33	80,88	79,74
STN 5-6	59,94	41,05	64,79	32,15	71,40	66,16
STN 6-7	70,05	45,90	74,31	32,09	74,25	70,34

	PDTR7					
	STN 0-1	STN 1-2	STN 2-3	STN 4-5	STN 5-6	STN 6-7
PDTR3						
STN 0-1	56,94	37,17	41,93	61,49	70,30	66,60
STN 1-2	56,94	46,65	51,16	70,69	80,54	74,18
STN 2-3	48,58	35,00	39,79	58,88	65,43	65,24

STN 4-5	68,52	48,59	56,17	81,44	80,05	83,74
STN 5-6	51,18	43,38	45,87	63,89	77,40	68,30
STN 6-7	54,20	42,41	45,87	62,15	68,87	68,41

	PDTR8					
	STN 0-1	STN 1-2	STN 2-3	STN 4-5	STN 5-6	STN 6-7
PDTR3						
STN 0-1	79,44	76,14	81,97	70,43	79,02	65,05
STN 1-2	80,32	74,49	85,72	79,72	84,23	63,68
STN 2-3	83,29	81,22	83,93	69,51	79,00	69,53
STN 4-5	76,83	67,20	82,71	81,39	82,05	58,00
STN 5-6	79,51	74,59	84,07	72,64	80,14	61,84
STN 6-7	84,63	81,66	87,45	75,17	81,69	71,37

PDTR9

	STN 0-1	STN 1-2	STN 2-3	STN 4-5	STN 5-6	STN 6-7
PDTR3						
STN 0-1	41,81	42,28	39,14	62,53	70,91	61,11
STN 1-2	50,79	50,45	47,32	60,88	74,29	69,93
STN 2-3	39,73	40,83	37,46	64,56	71,12	59,76
STN 4-5	58,00	57,98	53,86	72,65	83,54	77,56
STN 5-6	44,38	43,57	40,92	55,74	67,40	62,63
STN 6-7	46,81	46,89	44,01	61,80	71,99	65,47

	PDTR10					
	STN 0-1	STN 1-2	STN 2-3	STN 4-5	STN 5-6	STN 6-7
PDTR3						
STN 0-1	43,54	27,62	49,37	31,64	46,14	56,30
STN 1-2	46,62	24,69	46,55	26,34	41,46	55,65
STN 2-3	45,50	31,63	50,49	32,11	46,46	56,01
STN 4-5	50,58	25,93	53,56	29,70	47,65	65,59
STN 5-6	41,87	22,43	41,31	24,97	38,79	50,60
STN 6-7	47,89	28,87	48,30	29,07	44,32	56,15

	PDTR11					
	STN 0-1	STN 1-2	STN 2-3	STN 4-5	STN 5-6	STN 6-7
PDTR3						
STN 0-1	79,58	68,60	56,63	69,92	70,21	51,32
STN 1-2	79,14	64,20	56,08	74,59	66,07	48,27
STN 2-3	82,10	73,41	61,88	71,73	76,17	57,34
STN 4-5	71,25	54,55	51,23	81,98	57,16	45,66

STN 5-6	80,56	68,26	55,04	69,00	66,88	45,92
STN 6-7	84,33	74,48	64,18	74,19	76,01	55,06

	PDTR12					
	STN 0-1	STN 1-2	STN 2-3	STN 4-5	STN 5-6	STN 6-7
PDTR3						
STN 0-1	59,17	73,42	39,41	52,09	46,07	45,30
STN 1-2	72,36	80,28	36,62	60,62	52,43	52,18
STN 2-3	54,66	71,59	43,77	50,52	46,00	45,16
STN 4-5	69,23	70,78	36,97	67,43	61,95	61,78
STN 5-6	65,10	76,51	34,34	53,25	45,52	45,02
STN 6-7	58,95	71,41	42,35	55,59	50,93	50,02

PACIENTE NÚMERO 4

	PDTR4					
	STN 0-1	STN 1-2	STN 2-3	STN 4-5	STN 5-6	STN 6-7
PDTR4						
STN 0-1	100,00	76,35	83,41	85,86	86,01	83,62
STN 1-2	76,35	100,00	92,39	75,64	63,20	85,07
STN 2-3	83,41	92,39	100,00	76,12	64,32	87,00
STN 4-5	85,86	75,64	76,12	100,00	82,19	87,16
STN 5-6	86,01	63,20	64,32	82,19	100,00	70,74
STN 6-7	83,62	85,07	87,00	87,16	70,74	100,00

	PDTR5					
	STN 0-1	STN 1-2	STN 2-3	STN 4-5	STN 5-6	STN 6-7
PDTR4						
STN 0-1	33,84	44,51	33,35	34,63	38,53	49,26
STN 1-2	18,51	26,44	17,88	17,36	21,54	28,91
STN 2-3	24,02	31,54	23,99	18,65	25,46	31,96
STN 4-5	26,18	37,37	26,75	30,48	30,09	40,24
STN 5-6	37,64	51,39	37,32	41,42	43,18	55,90
STN 6-7	23,22	32,75	24,10	19,45	25,81	33,44

	PDTR6					
	STN 0-1	STN 1-2	STN 2-3	STN 4-5	STN 5-6	STN 6-7
PDTR4						
STN 0-1	71,71	76,91	75,88	26,83	69,85	79,92
STN 1-2	80,30	57,42	80,42	20,23	56,46	61,19

STN 2-3	73,48	62,02	75,87	20,82	57,26	63,44
STN 4-5	72,30	69,01	72,41	24,20	63,86	74,66
STN 5-6	63,96	63,57	66,84	30,22	78,66	86,61
STN 6-7	77,01	70,77	78,73	21,30	60,22	70,71

	PDTR7					
	STN 0-1	STN 1-2	STN 2-3	STN 4-5	STN 5-6	STN 6-7
PDTR4						
STN 0-1	66,93	31,27	43,26	70,27	44,54	73,38
STN 1-2	46,41	19,96	29,25	42,94	24,98	49,60
STN 2-3	49,05	21,00	31,04	49,77	31,32	55,46
STN 4-5	60,17	29,80	39,32	58,07	35,97	62,39
STN 5-6	74,84	46,38	56,09	73,35	50,69	76,18
STN 6-7	55,76	25,33	36,26	54,45	31,54	60,74

	PDTR8					
	STN 0-1	STN 1-2	STN 2-3	STN 4-5	STN 5-6	STN 6-7
PDTR4						
STN 0-1	68,17	59,15	67,42	68,16	64,45	56,81
STN 1-2	60,05	63,46	59,89	55,25	60,19	72,00
STN 2-3	59,35	59,31	58,87	53,36	59,71	64,04
STN 4-5	61,85	53,00	61,35	63,05	56,77	52,17
STN 5-6	63,57	51,99	69,13	76,61	60,88	48,00
STN 6-7	63,02	59,05	60,03	56,27	59,11	61,80

	PDTR9					
	STN 0-1	STN 1-2	STN 2-3	STN 4-5	STN 5-6	STN 6-7
PDTR4						
STN 0-1	55,83	59,70	53,84	85,12	85,23	73,20
STN 1-2	34,64	38,15	34,64	67,72	64,91	52,27
STN 2-3	33,43	37,64	32,73	75,88	70,97	53,58
STN 4-5	50,01	53,12	49,18	71,94	73,40	64,29
STN 5-6	73,02	73,17	70,93	68,70	81,77	82,74
STN 6-7	38,60	42,06	37,40	79,78	74,26	56,59

	PDTR10					
	STN 0-1	STN 1-2	STN 2-3	STN 4-5	STN 5-6	STN 6-7
PDTR4						
STN 0-1	60,00	44,30	70,77	47,22	64,54	80,50
STN 1-2	80,22	82,68	82,95	56,56	65,76	68,08
STN 2-3	70,01	72,14	84,93	66,44	75,16	77,05

STN 4-5	65,76	55,04	69,45	44,92	59,32	74,14
STN 5-6	62,93	33,23	60,92	30,37	51,22	74,71
STN 6-7	69,97	42,06	81,64	61,46	71,43	77,05

	PDTR11					
	STN 0-1	STN 1-2	STN 2-3	STN 4-5	STN 5-6	STN 6-7
PDTR4						
STN 0-1	49,11	39,22	52,47	84,24	50,11	55,62
STN 1-2	40,29	34,93	56,01	66,83	61,33	84,91
STN 2-3	40,55	34,33	48,84	67,84	54,16	73,16
STN 4-5	39,82	29,74	44,48	75,81	44,34	56,72
STN 5-6	49,26	34,80	47,60	80,62	42,88	44,58
STN 6-7	40,25	33,72	48,74	72,61	51,72	67,96

	PDTR12					
	STN 0-1	STN 1-2	STN 2-3	STN 4-5	STN 5-6	STN 6-7
PDTR2						
STN 0-1	44,07	41,77	52,44	68,00	73,37	72,68
STN 1-2	31,49	36,85	87,22	46,63	56,08	54,00
STN 2-3	35,54	39,34	78,00	45,76	53,18	52,26
STN 4-5	41,72	37,75	59,65	62,22	68,30	67,93
STN 5-6	48,70	41,99	39,36	81,62	83,54	83,80
STN 6-7	36,98	38,46	76,95	50,13	58,48	57,67

PACIENTE NÚMERO 5

	PDTR5					
	STN 0-1	STN 1-2	STN 2-3	STN 4-5	STN 5-6	STN 6-7
PDTR5						
STN 0-1	100,00	95,12	98,26	18,62	90,85	88,01
STN 1-2	95,12	100,00	94,40	23,89	88,88	87,72
STN 2-3	98,26	94,40	100,00	16,84	85,97	82,87
STN 4-5	18,62	23,89	16,84	100,00	26,49	33,65
STN 5-6	90,85	88,88	85,97	26,49	100,00	96,21
STN 6-7	88,01	87,72	82,87	33,65	96,21	100,00

	PDTR6					
	STN 0-1	STN 1-2	STN 2-3	STN 4-5	STN 5-6	STN 6-7
PDTR5						
STN 0-1	36,41	26,27	39,96	33,26	53,90	49,31

STN 1-2	45,35	35,99	49,12	36,39	65,50	61,79
STN 2-3	34,75	29,87	38,63	32,31	54,82	49,45
STN 4-5	19,17	17,10	19,42	13,29	34,37	36,72
STN 5-6	41,57	25,32	44,81	32,54	55,75	53,18
STN 6-7	46,08	30,69	49,72	35,46	63,77	63,16

	PDTR7					
	STN 0-1	STN 1-2	STN 2-3	STN 4-5	STN 5-6	STN 6-7
PDTR5						
STN 0-1	34,33	30,65	32,78	52,12	78,88	55,62
STN 1-2	49,40	42,49	46,11	63,04	81,26	67,07
STN 2-3	37,65	35,39	37,60	56,25	83,35	58,94
STN 4-5	33,02	23,51	28,00	33,99	23,51	33,60
STN 5-6	35,78	29,09	31,05	45,68	62,05	51,23
STN 6-7	45,64	33,78	37,69	54,03	64,78	59,51

	PDTR8					
	STN 0-1	STN 1-2	STN 2-3	STN 4-5	STN 5-6	STN 6-7
PDTR5						
STN 0-1	63,66	56,31	68,19	58,52	62,59	39,50
STN 1-2	71,27	61,81	77,14	69,64	70,64	46,18
STN 2-3	63,25	54,39	67,51	58,98	65,31	37,53
STN 4-5	21,19	14,50	27,18	37,32	19,53	11,82
STN 5-6	64,72	59,76	69,61	56,79	54,46	41,44
STN 6-7	66,12	59,89	73,36	65,88	57,77	43,55

	PDTR9					
	STN 0-1	STN 1-2	STN 2-3	STN 4-5	STN 5-6	STN 6-7
PDTR5						
STN 0-1	38,12	37,81	35,23	33,09	47,88	51,48
STN 1-2	46,98	46,50	42,93	41,83	57,67	61,56
STN 2-3	36,21	35,59	32,47	34,95	48,57	50,55
STN 4-5	43,45	42,62	42,29	25,08	35,34	44,73
STN 5-6	44,97	46,02	43,57	35,71	51,07	55,51
STN 6-7	57,61	58,55	55,65	41,71	60,17	67,49

	PDTR10					
	STN 0-1	STN 1-2	STN 2-3	STN 4-5	STN 5-6	STN 6-7
PDTR5						
STN 0-1	26,39	5,92	15,86	4,22	15,85	28,11
STN 1-2	34,73	9,85	23,72	7,53	21,98	38,01

STN 2-3	25,51	5,48	15,34	3,92	15,26	27,75
STN 4-5	25,73	4,70	18,80	3,81	13,65	27,75
STN 5-6	30,63	7,07	19,89	5,12	18,63	32,76
STN 6-7	39,54	58,55	28,27	8,46	24,75	42,30

	PDTR11					
	STN 0-1	STN 1-2	STN 2-3	STN 4-5	STN 5-6	STN 6-7
PDTR5						
STN 0-1	76,34	54,30	34,10	54,87	49,20	25,24
STN 1-2	80,35	58,30	40,26	64,94	53,64	30,83
STN 2-3	72,34	50,08	31,00	55,70	45,70	23,19
STN 4-5	21,36	10,53	17,29	30,90	11,07	9,80
STN 5-6	83,76	60,27	39,20	55,75	55,84	29,24
STN 6-7	81,21	57,99	43,82	63,33	54,84	32,24

	PDTR12					
	STN 0-1	STN 1-2	STN 2-3	STN 4-5	STN 5-6	STN 6-7
PDTR5						
STN 0-1	67,06	84,44	13,89	49,42	36,83	37,63
STN 1-2	68,38	80,18	18,34	57,05	45,80	46,37
STN 2-3	71,97	86,14	13,18	46,42	33,09	34,37
STN 4-5	18,77	15,34	5,46	46,74	45,99	45,10
STN 5-6	46,63	68,28	14,60	55,63	45,83	46,79
STN 6-7	51,58	69,67	18,23	68,44	59,92	60,07

PACIENTE NÚMERO 6

	PDTR6					
	STN 0-1	STN 1-2	STN 2-3	STN 4-5	STN 5-6	STN 6-7
PDTR6						
STN 0-1	100,00	59,93	96,18	22,76	60,87	66,06
STN 1-2	59,93	100,00	65,97	18,39	49,97	60,97
STN 2-3	96,18	65,97	100,00	24,80	67,10	72,23
STN 4-5	22,76	18,39	24,80	100,00	35,83	35,06
STN 5-6	60,87	49,97	67,10	35,83	100,00	90,07
STN 6-7	66,06	60,97	72,23	35,06	90,07	100,00

	PDTR7					
	STN 0-1	STN 1-2	STN 2-3	STN 4-5	STN 5-6	STN 6-7
PDTR6						

STN 0-1	48,55	26,06	32,13	42,08	31,05	51,80
STN 1-2	59,68	25,51	37,61	67,66	39,11	69,43
STN 2-3	55,28	29,40	37,39	51,39	37,08	60,32
STN 4-5	27,68	22,00	24,47	29,73	32,12	31,53
STN 5-6	74,30	60,66	66,26	75,31	65,55	77,61
STN 6-7	74,20	50,33	59,93	77,37	60,74	80,60

	PDTR8					
	STN 0-1	STN 1-2	STN 2-3	STN 4-5	STN 5-6	STN 6-7
PDTR6						
STN 0-1	84,73	88,06	80,18	66,28	73,76	89,78
STN 1-2	66,19	51,40	54,32	49,44	58,04	44,43
STN 2-3	86,50	88,93	83,29	70,48	77,62	89,96
STN 4-5	28,67	24,75	31,61	31,87	28,51	21,39
STN 5-6	67,41	60,04	76,69	82,82	71,06	55,75
STN 6-7	69,22	60,47	75,60	80,41	70,12	55,96

	PDTR9					
	STN 0-1	STN 1-2	STN 2-3	STN 4-5	STN 5-6	STN 6-7
PDTR6						
STN 0-1	37,46	40,26	37,84	67,21	67,06	53,63
STN 1-2	29,21	33,33	26,92	85,49	71,40	47,61
STN 2-3	41,97	44,62	41,35	74,91	74,39	59,21
STN 4-5	26,10	26,50	24,19	22,34	30,05	31,56
STN 5-6	69,83	67,91	67,19	62,78	79,49	81,57
STN 6-7	73,15	72,43	70,27	70,89	85,02	83,30

	PDTR10					
	STN 0-1	STN 1-2	STN 2-3		STN 5-6	STN 6-7
PDTR6						
STN 0-1	66,06	61,18	63,65	37,73	50,89	59,37
STN 1-2	36,25	31,36	44,72	28,50	41,36	55,05
STN 2-3	65,60	57,88	67,20	40,04	54,39	64,65
STN 4-5	23,63	10,76	19,63	9,14	16,56	25,09
STN 5-6	64,13	34,16	59,06	29,67	46,75	66,59
STN 6-7	64,01	35,34	63,79	35,99	54,45	74,56

	PDTR11					
	STN 0-1	STN 1-2	STN 2-3	STN 4-5	STN 5-6	STN 6-7
PDTR6						

STN 0-1	68,89	72,68	82,35	75,13	86,30	85,06
STN 1-2	34,49	30,38	37,31	78,00	39,44	41,78
STN 2-3	70,38	71,63	81,73	79,71	85,08	82,30
STN 4-5	31,24	20,33	19,20	30,22	23,00	17,35
STN 5-6	60,91	44,36	51,67	75,33	53,69	48,50
STN 6-7	59,47	44,17	52,97	79,95	52,04	48,67

	PDTR12					
	STN 0-1	STN 1-2	STN 2-3		STN 5-6	STN 6-7
PDTR6						
STN 0-1	33,53	44,48	73,03	46,97	53,74	52,37
STN 1-2	37,94	34,63	39,89	39,15	43,12	44,96
STN 2-3	37,48	47,10	70,49	51,57	57,65	55,64
STN 4-5	23,69	28,51	13,81	29,85	27,11	27,87
STN 5-6	56,33	54,24	41,56	74,79	73,06	73,91
STN 6-7	54,76	52,16	43,68	79,29	79,88	80,91

PACIENTE NÚMERO 7

	PDTR7					
	STN 0-1	STN 1-2	STN 2-3	STN 4-5	STN 5-6	STN 6-7
PDTR7						
STN 0-1	100,00	80,86	90,69	79,17	52,39	81,65
STN 1-2	80,86	100,00	95,86	56,78	43,78	56,51
STN 2-3	90,69	95,86	100,00	67,89	49,92	69,03
STN 4-5	79,17	56,78	67,89	100,00	80,40	94,77
STN 5-6	52,39	43,78	49,92	80,40	100,00	77,30
STN 6-7	81,65	56,51	69,03	94,77	77,30	100,00

	PDTR8					
	STN 0-1	STN 1-2	STN 2-3	STN 4-5	STN 5-6	STN 6-7
PDTR7						
STN 0-1	55,77	44,27	61,13	69,03	54,38	39,03
STN 1-2	37,26	29,02	45,88	51,50	38,19	22,83
STN 2-3	42,26	32,68	50,69	58,46	44,55	27,44
STN 4-5	59,38	43,68	64,61	75,75	70,06	36,07
STN 5-6	56,27	43,87	64,43	71,09	73,95	33,29
STN 6-7	66,04	52,20	70,17	77,92	72,18	45,01

	PDTR9

	STN 0-1	STN 1-2	STN 2-3	STN 4-5	STN 5-6	STN 6-7
PDTR7						
STN 0-1	57,15	56,77	51,57	62,79	71,31	71,43
STN 1-2	41,51	38,14	37,14	29,07	43,17	50,27
STN 2-3	48,76	45,89	43,57	41,57	53,54	58,92
STN 4-5	60,97	61,12	55,75	71,19	80,39	77,19
STN 5-6	48,29	46,99	43,89	43,26	60,55	64,67
STN 6-7	61,82	61,21	57,86	72,96	81,73	78,48

	PDTR10					
	STN 0-1	STN 1-2	STN 2-3	STN 4-5	STN 5-6	STN 6-7
PDTR7						
STN 0-1	48,62	21,42	47,22	21,78	38,59	60,09
STN 1-2	33,62	8,06	24,32	5,50	16,11	32,51
STN 2-3	40,49	13,58	34,05	12,08	24,83	43,06
STN 4-5	45,46	17,79	43,62	20,02	37,32	59,04
STN 5-6	34,40	9,16	24,82	8,48	21,42	38,04
STN 6-7	51,00	61,21	48,72	24,07	41,53	62,36

	PDTR11					
	STN 0-1	STN 1-2	STN 2-3	STN4.5	STN 5-6	STN 6-7
PDTR7						
STN 0-1	42,75	29,15	37,39	70,88	33,84	31,98
STN 1-2	30,83	21,01	22,06	39,44	21,59	15,92
STN 2-3	34,48	21,61	25,45	50,59	24,04	20,95
STN 4-5	46,25	27,17	32,60	78,84	30,46	27,43
STN 5-6	53,84	31,94	27,79	62,61	31,72	20,19
STN 6-7	55,46	37,78	41,56	82,87	40,96	36,87

	PDTR12					
	STN 0-1	STN 1-2	STN 2-3	STN 4-5	STN 5-6	STN 6-7
PDTR7						
STN 0-1	39,42	34,69	27,42	61,27	59,40	61,54
STN 1-2	30,16	26,59	10,39	40,22	33,45	37,64
STN 2-3	35,29	31,12	16,73	48,78	42,83	46,32
STN 4-5	66,20	56,24	24,20	67,95	63,06	63,03
STN 5-6	85,96	82,53	15,34	57,68	45,24	45,53
STN 6-7	63,14	58,18	31,85	68,50	64,65	65,26

PACIENTE NÚMERO 8

	PDTR8					
	STN 0-1	STN 1-2	STN 2-3	STN 4-5	STN 5-6	STN 6-7
PDTR8						
STN 0-1	100,00	94,81	92,68	74,56	82,84	79,76
STN 1-2	94,81	100,00	90,53	69,20	80,14	89,74
STN 2-3	92,68	90,53	100,00	84,59	86,03	79,28
STN 4-5	74,56	69,20	84,59	100,00	83,33	66,02
STN 5-6	82,84	80,14	86,03	83,33	100,00	79,04
STN 6-7	79,76	89,74	79,28	66,02	79,04	100,00

	PDTR9					
	STN 0-1	STN 1-2	STN 2-3	STN 4-5	STN 5-6	STN 6-7
PDTR8						
STN 0-1	40,51	43,03	38,63	69,54	72,58	59,66
STN 1-2	34,47	36,88	34,03	60,29	63,58	51,93
STN 2-3	54,29	55,26	52,16	63,09	75,41	71,35
STN 4-5	66,32	66,13	64,30	58,77	78,31	81,01
STN 5-6	44,37	45,56	42,81	65,88	73,98	63,91
STN 6-7	31,06	33,28	31,66	56,68	59,15	47,96

	PDTR10					
	STN 0-1	STN 1-2	STN 2-3	STN 4-5	STN 5-6	STN 6-7
PDTR8						
STN 0-1	49,58	35,82	44,13	20,18	36,64	51,18
STN 1-2	52,68	43,31	46,74	22,66	36,49	45,63
STN 2-3	58,46	36,07	48,99	21,13	38,75	55,22
STN 4-5	61,91	32,23	49,50	19,33	37,09	58,01
STN 5-6	53,75	38,05	49,00	24,23	38,93	52,42
STN 6-7	60,41	55,35	57,03	30,58	42,04	47,56

	PDTR11					
	STN 0-1	STN 1-2	STN 2-3	STN 4-5	STN 5-6	STN 6-7
PDTR8						
STN 0-1	81,08	77,65	74,68	83,20	84,53	67,57
STN 1-2	82,21	83,44	84,55	73,23	93,26	77,86
STN 2-3	83,04	75,75	75,77	81,58	81,09	66,26
STN 4-5	66,77	54,04	64,05	80,36	61,05	53,58
STN 5-6	69,44	62,91	69,67	78,28	71,55	63,62
STN 6-7	73,45	77,57	89,43	65,72	90,24	85,80

	PDTR12					
	STN 0-1	STN 1-2	STN 2-3	STN 4-5	STN 5-6	STN 6-7
PDTR8						
STN 0-1	51,83	62,17	48,49	51,27	50,40	49,73
STN 1-2	40,95	56,72	56,86	44,01	45,37	43,43
STN 2-3	57,52	65,86	47,64	65,06	62,09	60,78
STN 4-5	64,72	61,15	40,74	75,81	72,44	70,69
STN 5-6	72,28	72,47	50,21	54,69	51,71	49,97
STN 6-7	34,38	47,38	68,66	38,96	44,17	40,96

PACIENTE NÚMERO 9

	PDTR9					
	STN 0-1	STN 1-2	STN 2-3	STN 4-5	STN 5-6	STN 6-7
PDTR9						
STN 0-1	100,00	92,82	91,93	41,96	69,44	85,05
STN 1-2	92,82	100,00	82,47	45,05	71,48	85,55
STN 2-3	91,93	82,47	100,00	39,63	65,00	78,98
STN 4-5	41,96	45,05	39,63	100,00	87,54	61,50
STN 5-6	69,44	71,48	65,00	87,54	100,00	85,79
STN 6-7	85,05	85,55	78,98	61,50	85,79	100,00

	PDTR10					
	STN 0-1	STN 1-2	STN 2-3	STN 4-5	STN 5-6	STN 6-7
PDTR9						
STN 0-1	56,71	15,59	47,45	15,85	33,95	55,84
STN 1-2	56,06	18,38	47,70	17,07	35,28	56,78
STN 2-3	55,61	16,88	46,41	14,78	32,49	53,98
STN 4-5	47,86	39,48	66,36	47,16	61,93	73,38
STN 5-6	60,65	36,22	68,99	41,84	60,95	78,76
STN 6-7	64,79	85,55	57,27	25,45	45,52	67,46

	PDTR11					
	STN 0-1	STN 1-2	STN 2-3	STN 4-5	STN 5-6	STN 6-7
PDTR9						
STN 0-1	43,02	26,92	37,06	55,83	29,26	26,37
STN 1-2	44,72	29,12	38,84	59,20	31,50	28,80
STN 2-3	42,12	27,62	38,15	53,15	29,99	27,39
STN 4-5	46,77	39,67	48,38	81,94	51,25	52,62
STN 5-6	58,52	46,14	55,75	85,94	54,57	52,51

STN 6-7	56,92	39,33	49,70	76,78	45,12	42,01

PDTR12

	STN 0-1	STN 1-2	STN 2-3	STN 4-5	STN 5-6	STN 6-7
PDTR9						
STN 0-1	42,78	36,64	19,54	83,34	82,71	81,93
STN 1-2	41,50	36,35	22,25	81,00	81,11	80,48
STN 2-3	39,39	33,42	20,48	80,68	81,22	79,92
STN 4-5	40,23	40,62	51,28	50,93	55,73	55,58
STN 5-6	55,33	53,26	46,93	73,97	75,43	75,16
STN 6-7	56,41	52,69	33,77	87,05	85,39	84,12

PACIENTE NÚMERO 10

	PDTR10					
	STN 0-1	STN 1-2	STN 2-3	STN 4-5	STN 5-6	STN 6-7
PDTR10						
STN 0-1	100,00	84,34	79,44	37,90	49,74	58,68
STN 1-2	84,34	100,00	73,37	47,09	47,13	42,44
STN 2-3	79,44	73,37	100,00	72,53	82,32	83,97
STN 4-5	37,90	47,09	72,53	100,00	93,71	74,24
STN 5-6	49,74	47,13	82,32	93,71	100,00	90,24
STN 6-7	58,68	42,44	83,97	74,24	90,24	100,00

	PDTR11					
	STN 0-1	STN 1-2	STN 2-3	STN 4-5	STN 5-6	STN 6-7
PDTR10						
STN 0-1	40,84	29,02	48,52	57,82	52,22	74,21
STN 1-2	21,15	17,51	35,59	37,84	45,49	77,06
STN 2-3	32,36	24,80	43,05	55,10	45,21	66,77
STN 4-5	12,90	11,04	20,38	27,18	21,39	36,66
STN 5-6	27,86	22,87	33,49	46,22	33,35	45,01
STN 6-7	40,87	30,50	42,64	66,47	39,50	46,84

	PDTR12					
	STN 0-1	STN 1-2	STN 2-3	STN 4-5	STN 5-6	STN 6-7
PDTR10						
STN 0-1	37,45	40,23	78,75	62,08	67,83	65,67
STN 1-2	19,99	26,81	91,65	25,44	35,17	31,87
STN 2-3	29,62	31,15	76,70	51,24	60,49	58,85

STN 4-5	13,59	15,90	55,84	18,87	27,46	28,52
STN 5-6	24,18	25,94	56,67	37,94	46,10	46,21
STN 6-7	37,92	35,56	51,36	61,85	68,21	67,51

PACIENTE NÚMERO 11

	PDTR11					
	STN 0-1	STN 1-2	STN 2-3	STN 4-5	STN 5-6	STN 6-7
PDTR11						
STN 0-1	100,00	87,61	73,63	66,73	82,27	55,62
STN 1-2	87,61	100,00	83,69	53,51	86,84	57,68
STN 2-3	73,63	83,69	100,00	61,54	87,27	75,02
STN 4-5	66,73	53,51	61,54	100,00	64,89	60,34
STN 5-6	82,27	86,84	87,27	64,89	100,00	84,13
STN 6-7	55,62	57,68	75,02	60,34	84,13	100,00

	PDTR12					
	STN 0-1	STN 1-2	STN 2-3	STN 4-5	STN 5-6	STN 6-7
PDTR11						
STN 0-1	41,35	62,01	34,19	51,82	48,06	47,26
STN 1-2	24,45	42,12	31,76	31,81	32,49	30,66
STN 2-3	27,79	39,52	51,09	43,89	48,72	47,31
STN 4-5	58,54	60,58	47,09	68,43	68,53	67,58
STN 5-6	28,10	47,52	57,42	37,72	40,90	38,73
STN 6-7	24,78	37,62	81,68	34,54	42,97	40,27

PACIENTE NÚMERO 12

	PDTR12					
	STN 0-1	STN 1-2	STN 2-3	STN 4-5	STN 5-6	STN 6-7
PDTR2						
STN 0-1	100,00	87,93	25,82	52,91	43,04	42,77
STN 1-2	87,93	100,00	34,85	50,26	38,69	38,97
STN 2-3	25,82	34,85	100,00	28,74	39,10	37,77
STN 4-5	52,91	50,26	28,74	100,00	93,14	92,25
STN 5-6	43,04	38,69	39,10	93,14	100,00	94,14
STN 6-7	42,77	38,97	37,77	92,25	94,14	100,00