Global qEEG Changes Associated With Non-frequency & Non-site Specific Neurofeedback Training

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Overview

- Describe case study demographics
- Provide global NF training concepts
- Present case study NF training sample and trend data
- Dr. Hurd will then discuss qEEG data from 2003-5

Case Study Demographics I

- 63 yo right-handed female
- Dx chronic Lyme disease late 2002
- Self-referred because

  1) past 1.5 years of site/frequency-specific NF training protocols and hyperbaric sessions had not alleviated her SXs, including sleep problems

  2) SPECT scan and MRI data consistent with compromised vasculature and white matter lesions, potentially being an impediment to specific brain driving protocols

Case Study Demographics II

- Self-referred to me in part because of sleep disorders expertise and use of a comprehensive, adaptive targeting NF system
- This “global” NF training took place over 6 months and included 30+ sessions
- A qEEG performed in 2000 was within normal limits (data not shown)
- Subsequent qEEGs were performed in 2003, 2004 and following global NF training 2005

Comprehensive And Adaptive NF Training Approach To Capture Changing EEG

16 target pair neighborhoods (boxes) overall, 8 each hemisphere

Increases or decreases in any box triggers interruption of the music

Sliding average of the median of the last data points collected measures changing rates of change (adaptive targeting)

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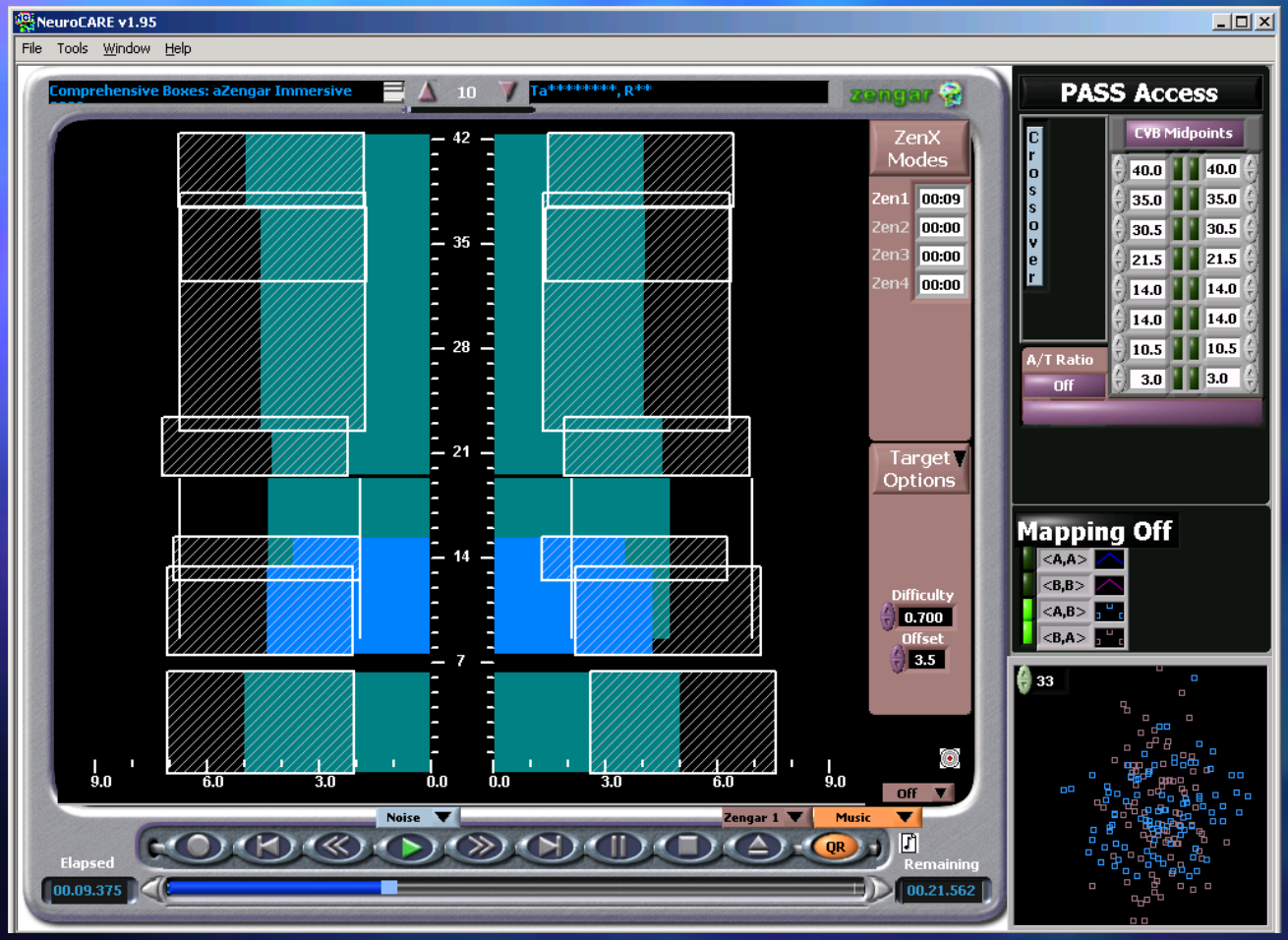
NeuroCARE® Neurofeedback Training System



- 16 target pair neighborhoods (boxes)
- 8-C3, 8-C4
- All target boxes simultaneously active
- CNS “decides” where to add or subtract energy

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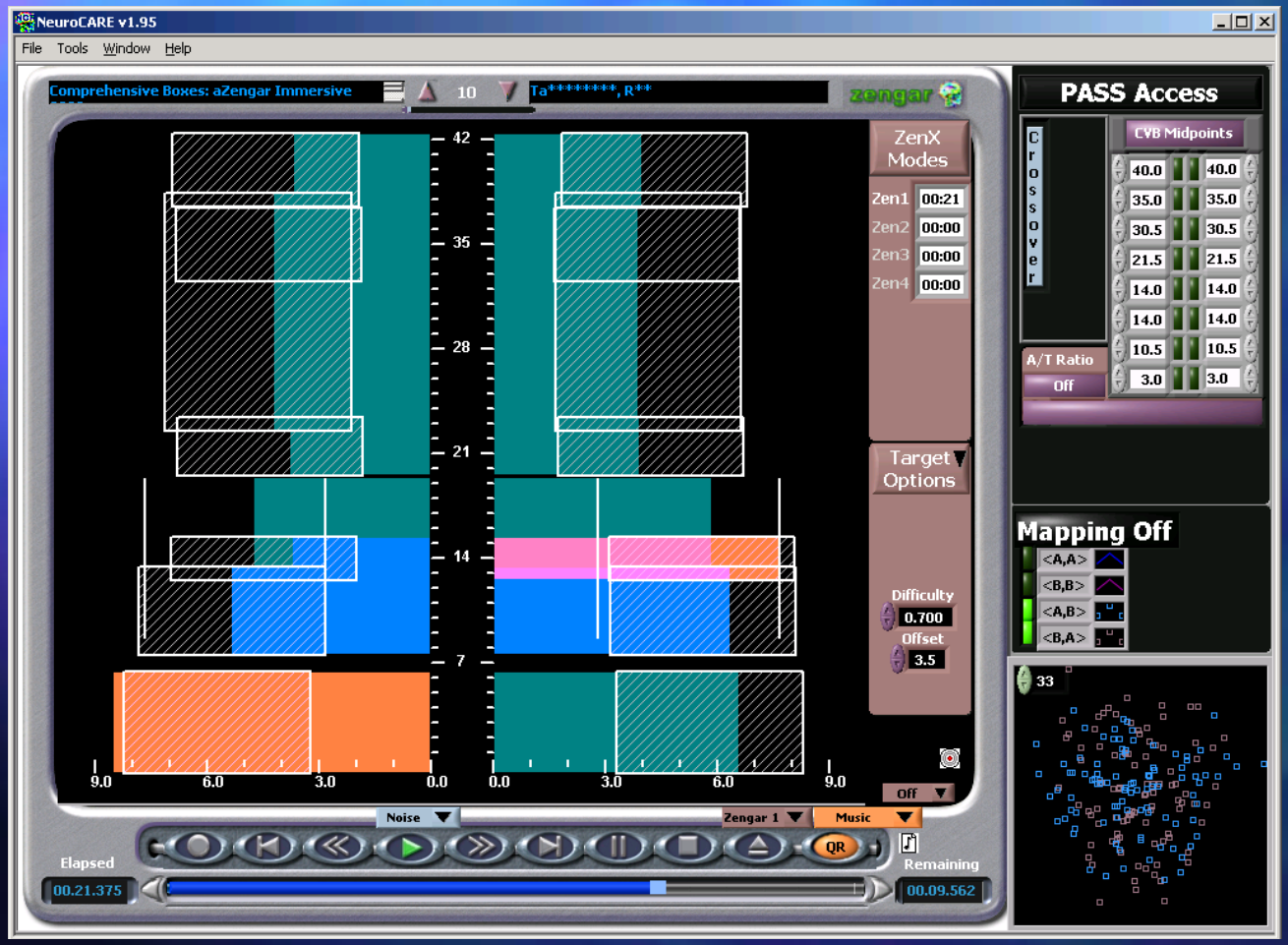

2 target boxes triggering here indicated in orange

0-6 Hz intensity exceeds box in C3

SMR intensity diminished in C4

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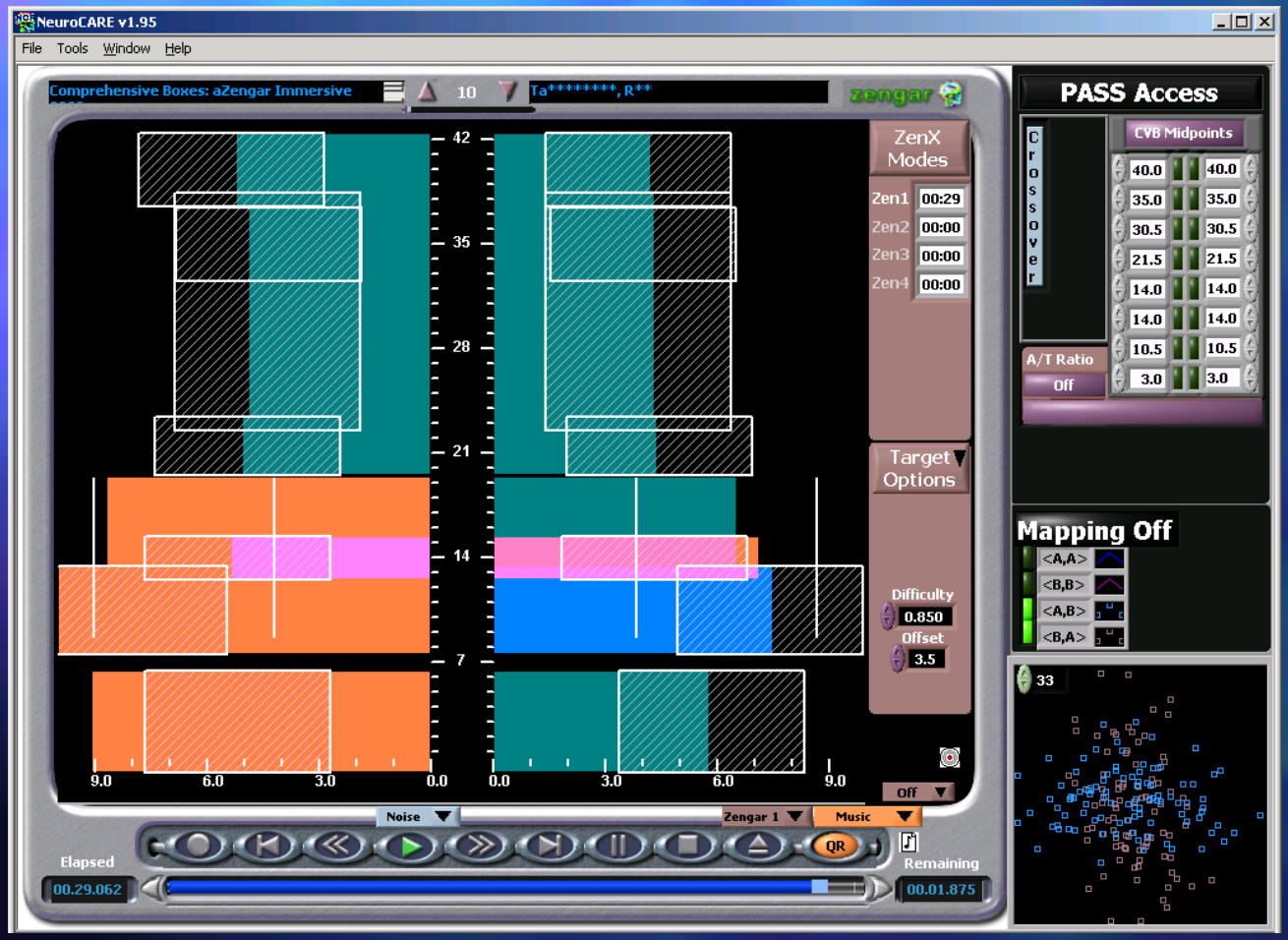

5 target boxes triggering here (4 C3, 1 C4)

CNS “decides” where to add or subtract energy

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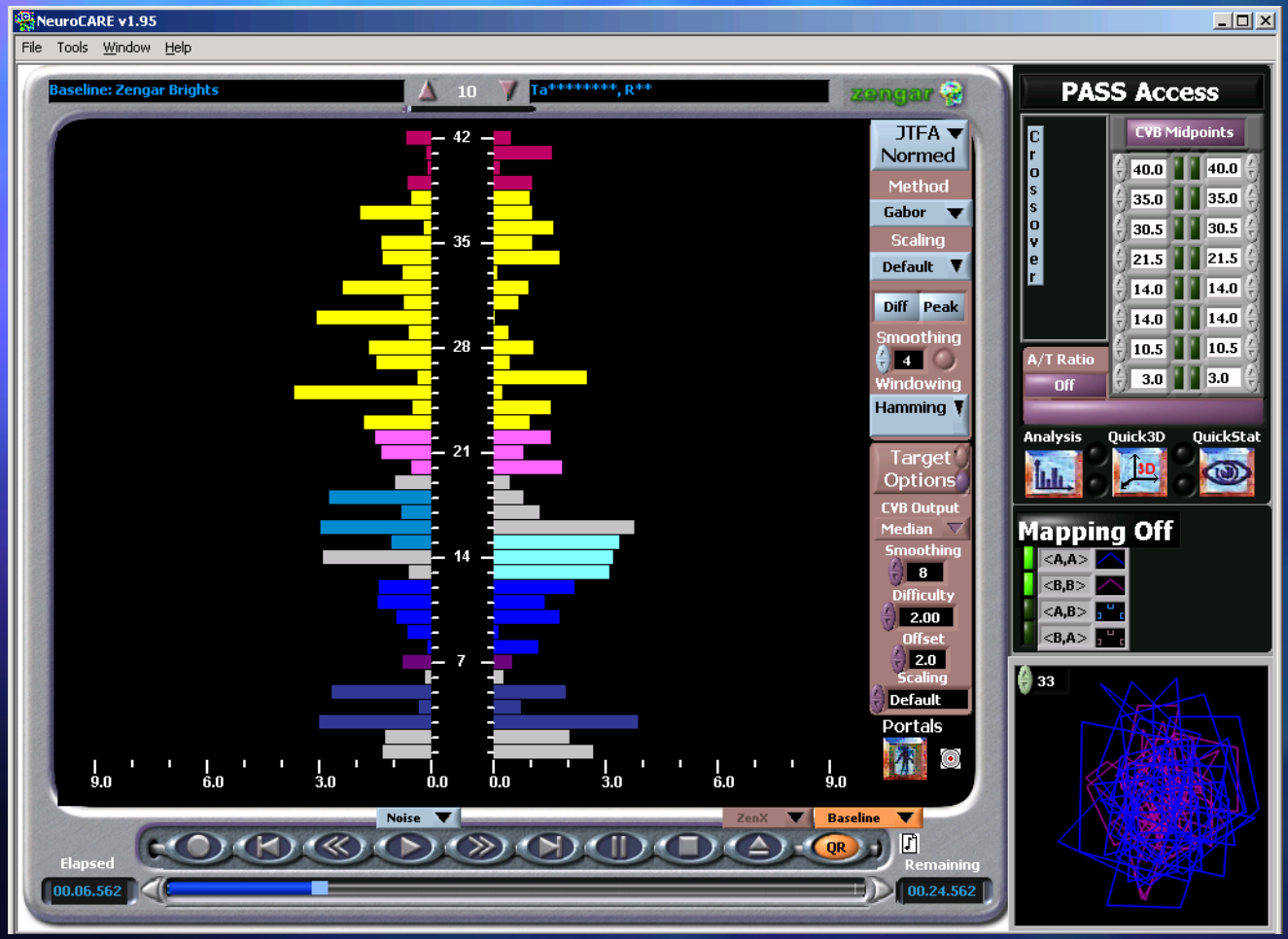
Baseline Pre-Post Training Session



30 second baseline data collected pre and post each training session

15s EO/15s EC

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Auto Correlation Measure

Time-lag the individual moments of the collected data stream

Allows visualization of how similar those moments of the time-frequency analysis are to themselves

Cross Correlation Of Autocorrelation (CCAC) Measure

Correlate the two “time series” derived from the auto correlations

Visualize the similarity between each trajectory of those analyses

Maximally resilient and flexible systems will approach a gentle, logarithmic, flat correlation line across the spectral analysis

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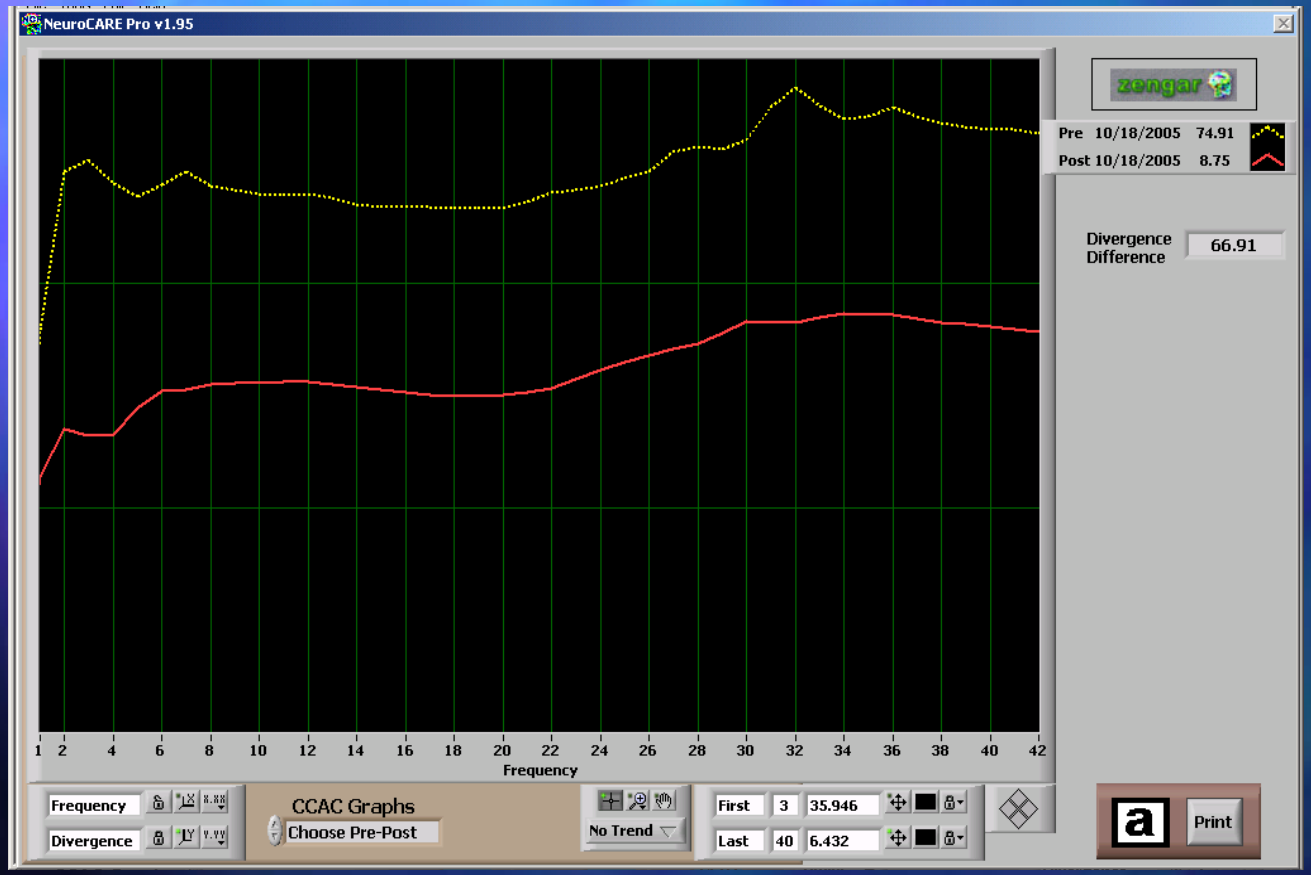
Baseline Pre-Post Training Session CCACs



Pre (yellow-dash) and Post (red-solid) Training Session Baselines

Autocorrelation of C3 crosscorrelated to autocorrelation of C4

Dramatic decrease in emergent variability seen pre to post baseline

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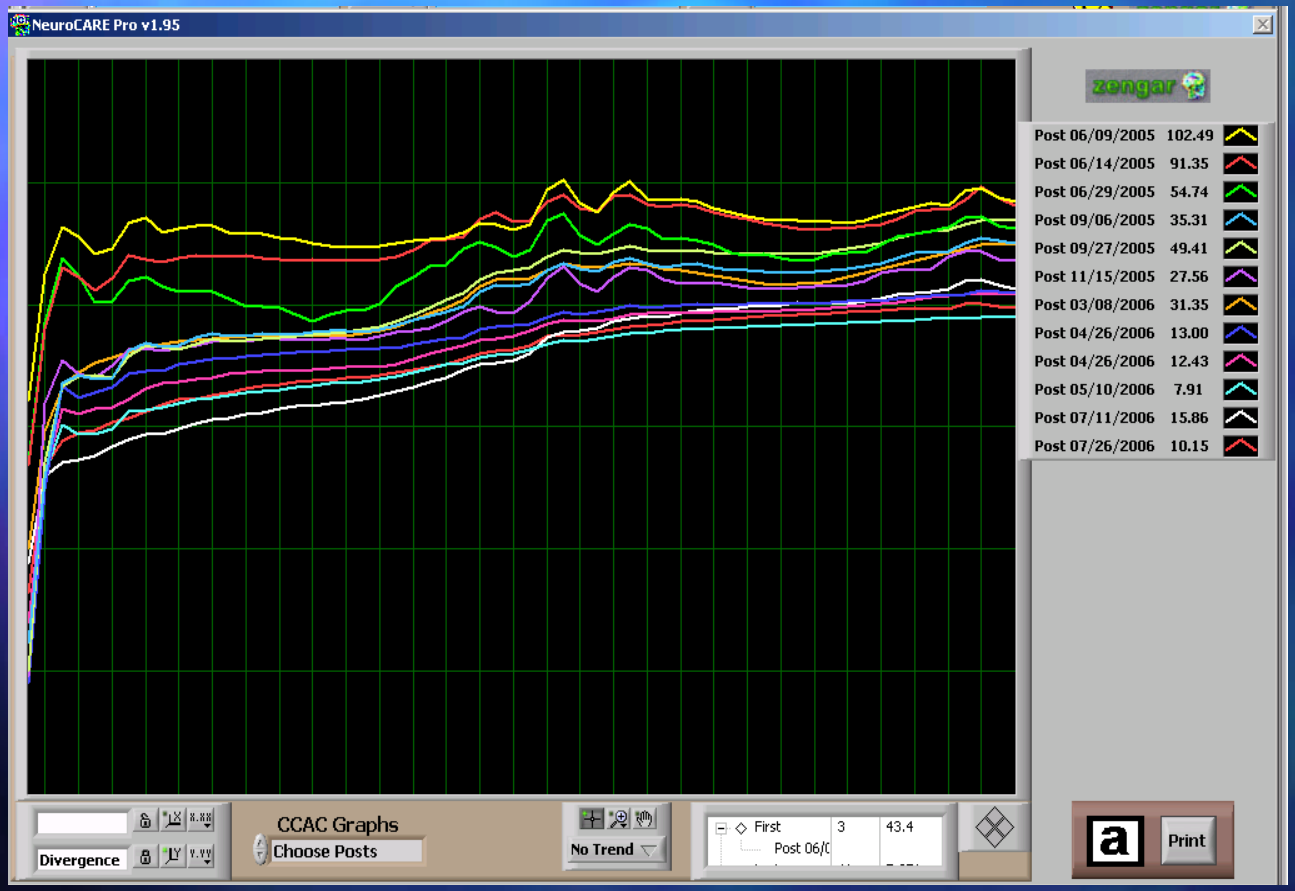
Baseline Post Training Session CCACs



Decrease in emergent variability seen over time

Some “wobble” seen = worsening before further improvement

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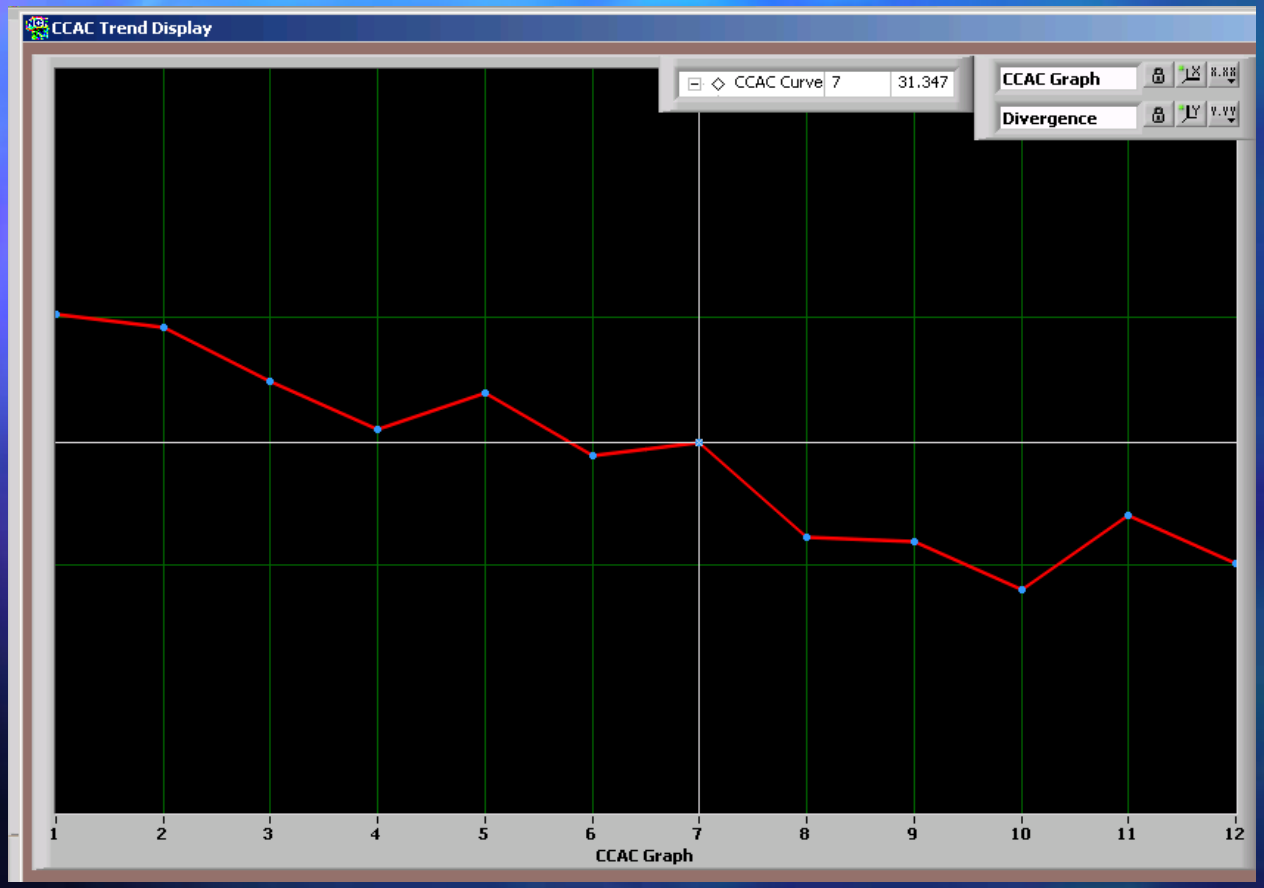
Baseline Post Session CCACs Trendline (12 sessions)



Decreased divergence (CCAC) = increased stability

Reflects enhanced efficiency

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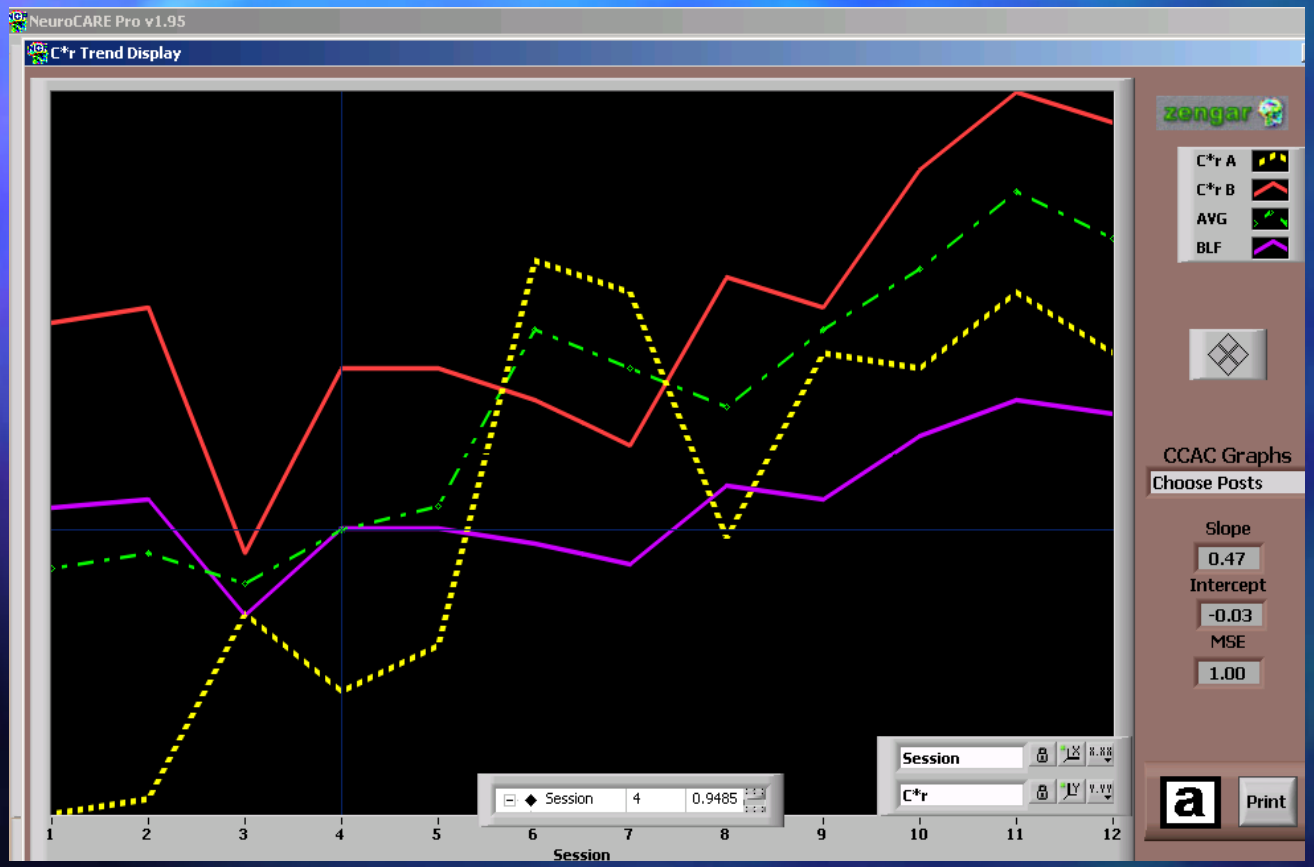
Correlation Dimension: C*r

Measuring the diameter of the system and its trajectory

Increasing C*r over time indicates increased richness and complexity – can handle more information

Seizure is low dimensional, low complexity

Baseline Post Session C*r Trendline (12 sessions)



Increased C*r = increased complexity

Reflects increased information processing capacity

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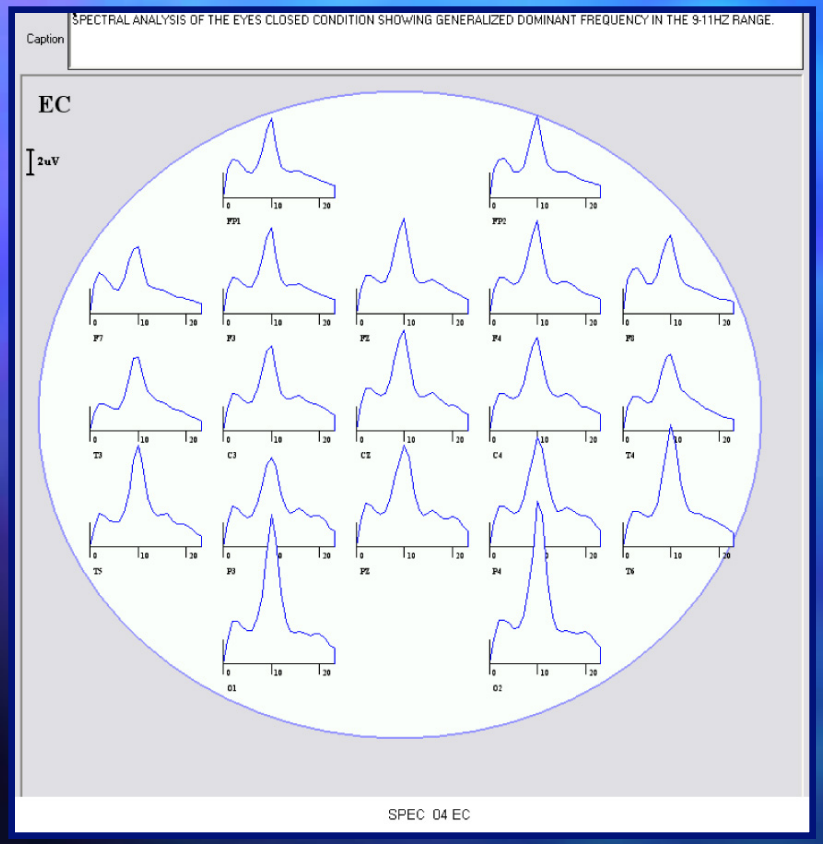
Spectral Analysis of the Eyes Closed Condition

Generalized Dominant Frequency in the 9 - 11 Hz Range



2004

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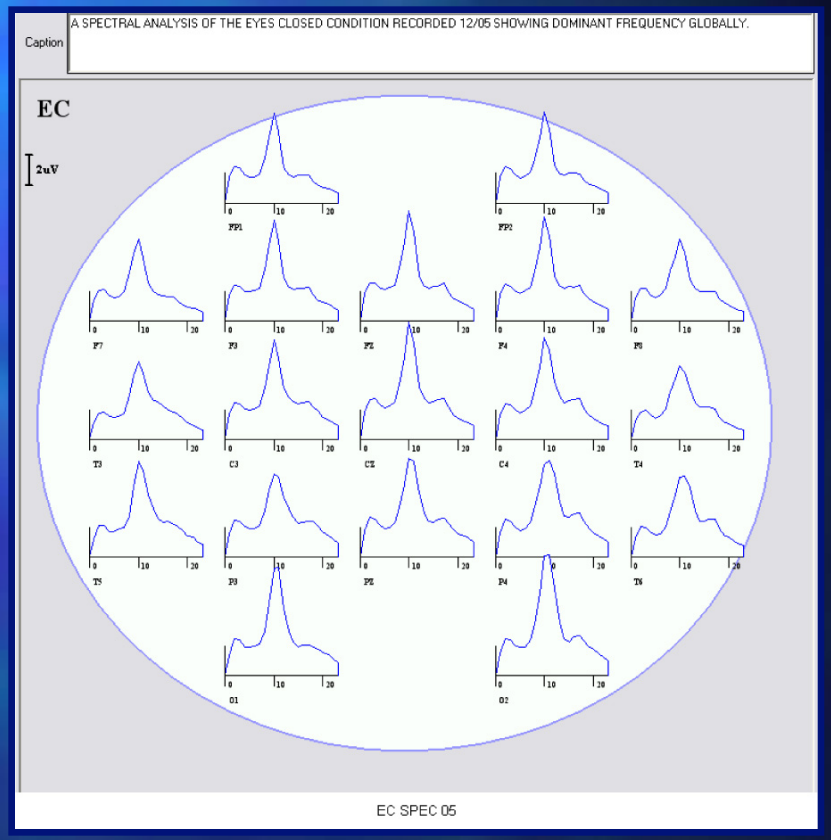

2005

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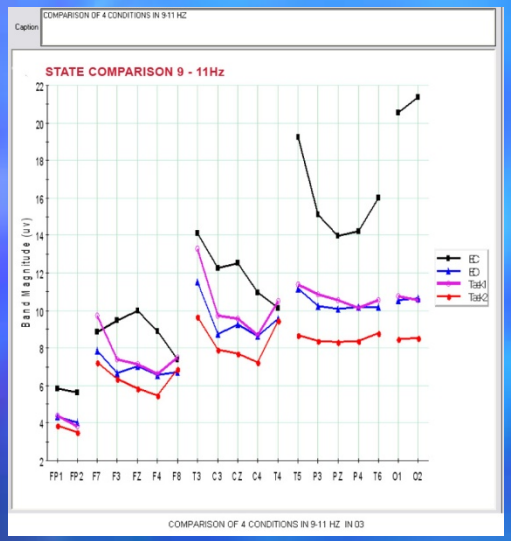
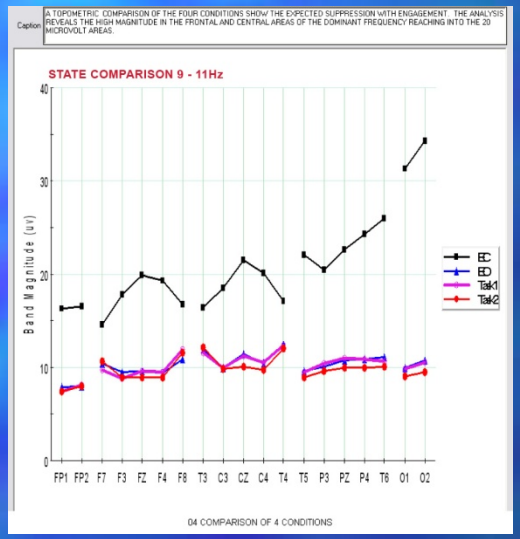
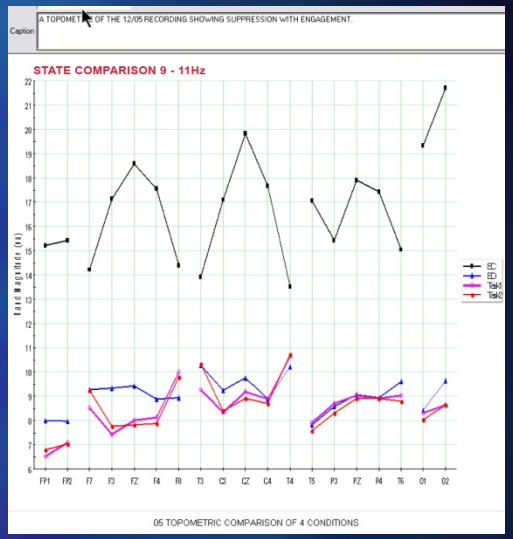
Topometric Comparison
Four Conditions in 9 - 11 Hz Range







2003 2004 2005

Comparison of the four conditions shows the expected suppression with engagement. The analysis reveals the high magnitude in the frontal and central areas of the dominant frequency reaching into the 20 uv range.

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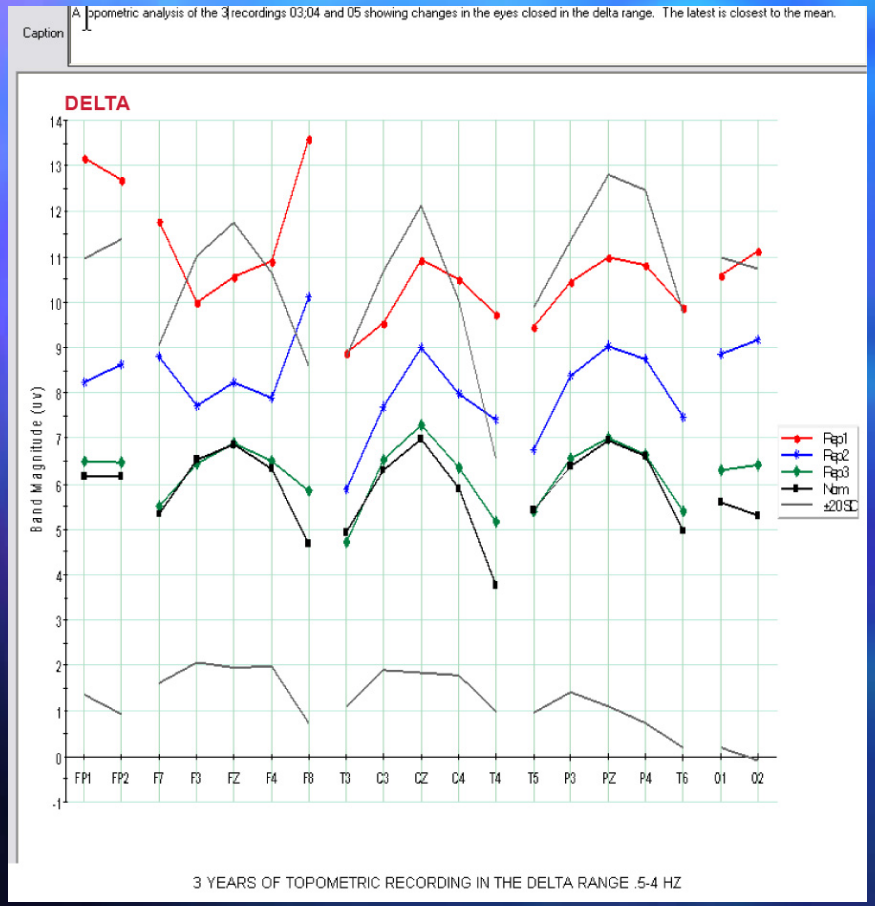
Topometric Comparison
Delta Range Over 3 Years



A Topometric analysis of the three recordings in 2003, 2004 and 2005 showing changes eyes closed in the delta range. The latest is closest to the norm.

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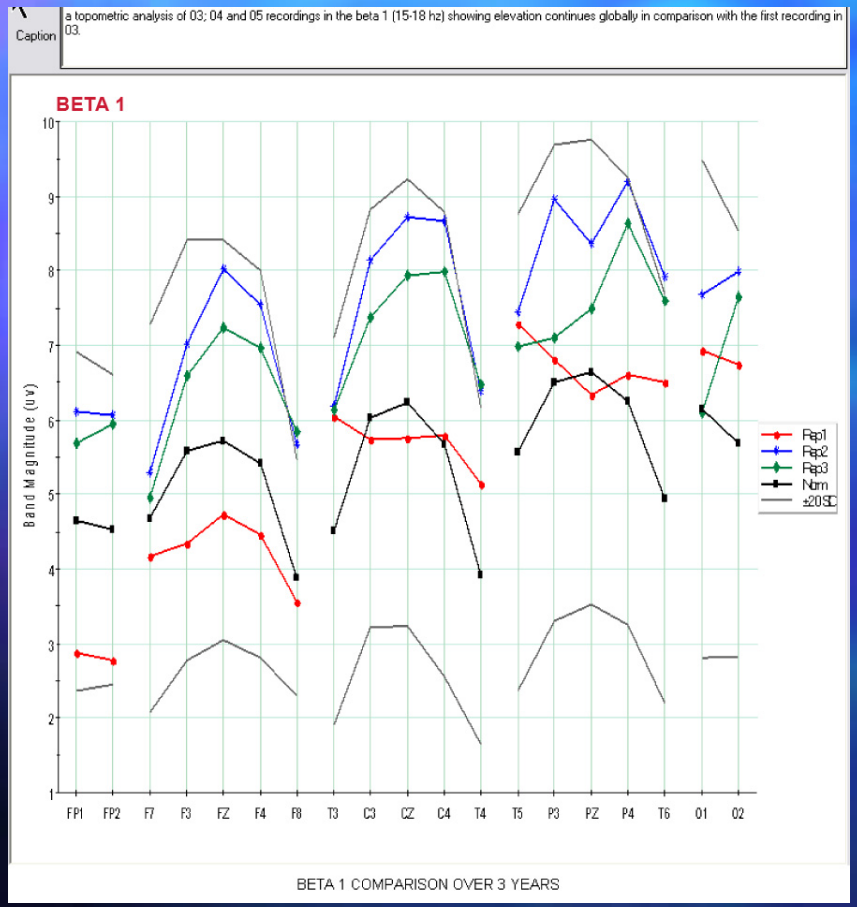
Topometric Comparison
Beta 1 (15-18 Hz) Range Over 3 Years



A Topometric analysis of 2003, 2004 and 2005 recordings in 15-18 Hz band showing elevation continues globally in comparison with the recording in 2003.

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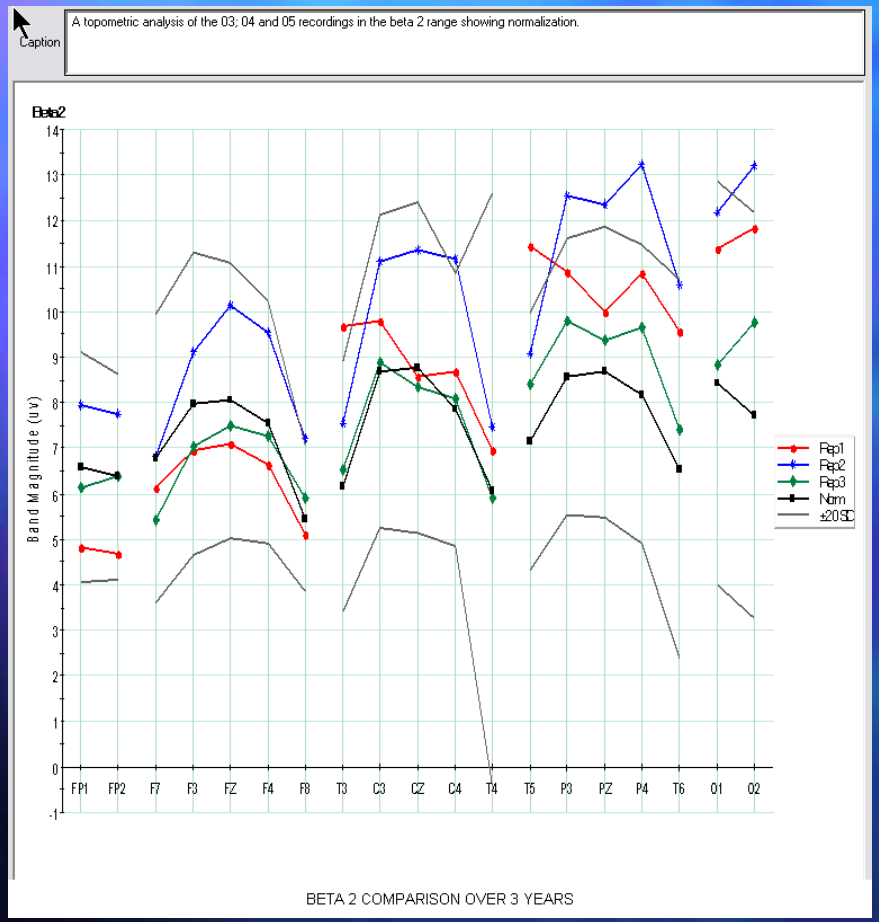
Topometric Comparison
Beta 2 (18-23) Range Over 3 Years



A Topometric analysis of 2003, 2004 and 2005 recordings in the beta 2 range showing normalization

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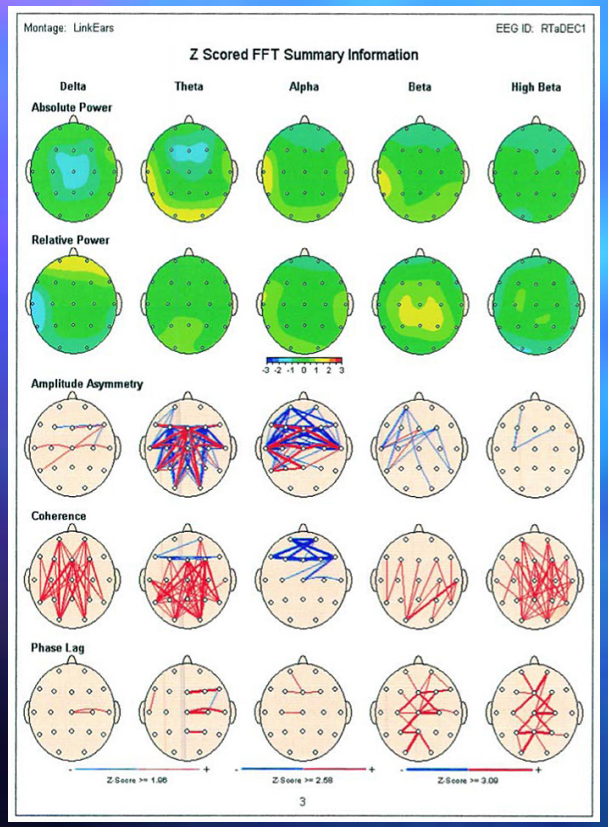
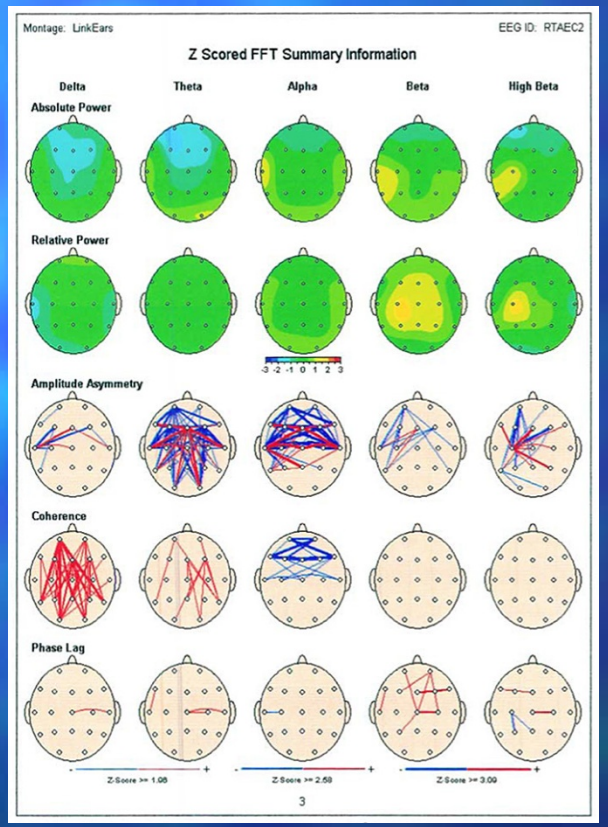
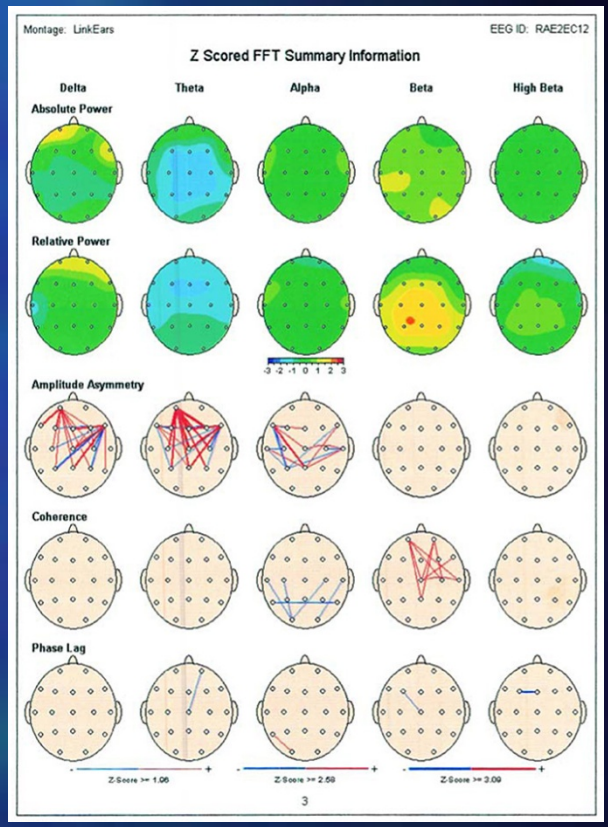
Z Scored FFT Summary Information Eyes Closed



2003



2004



2005

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Summary

- Minimal response to site/frequency specific brain driving protocols and hyperbaric TXs, and evidence of structural damage prompts different approach
- Comprehensive and adaptive global NF training protocol successfully resolves SXs
- Renormalization of qEEG maps confirms and supports functional improvement

Summary

Yale Lyme specialist attending neurologist confirms SX resolution and suggests that she "…not attend Lyme support group meetings because you will make everyone feel worse."