2022 DGIST 하계 인턴 최종 발표

BMI_인턴 오정은

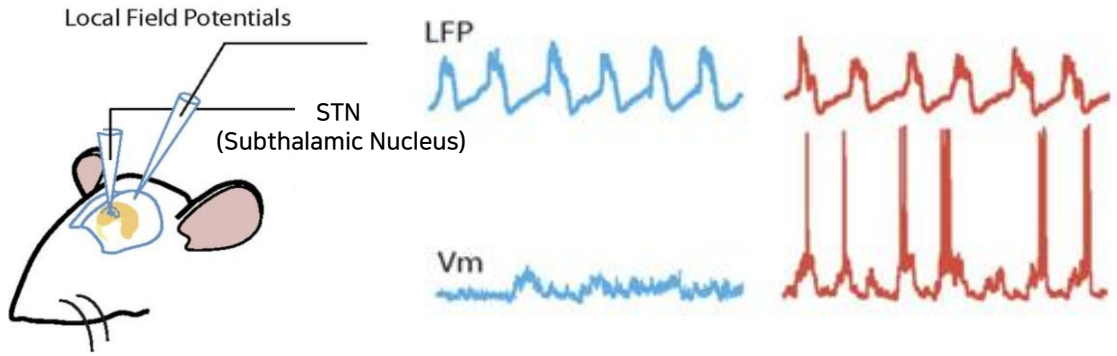
목 차

- Summary of Previous Works
  - Spike & LFP Local Field Potential
  - DSP Digital Signal Processing
  - FFT Fast Fourier Transform
  - PSD Power Spectral Density
- Last Week & This Week
  - FFT vs Welch's Method
  - FOOOF Algorithm Fitting Oscillations and One-Over-f
  - Aperiodic & Periodic
- Final Works
  - Plotting & Comparison

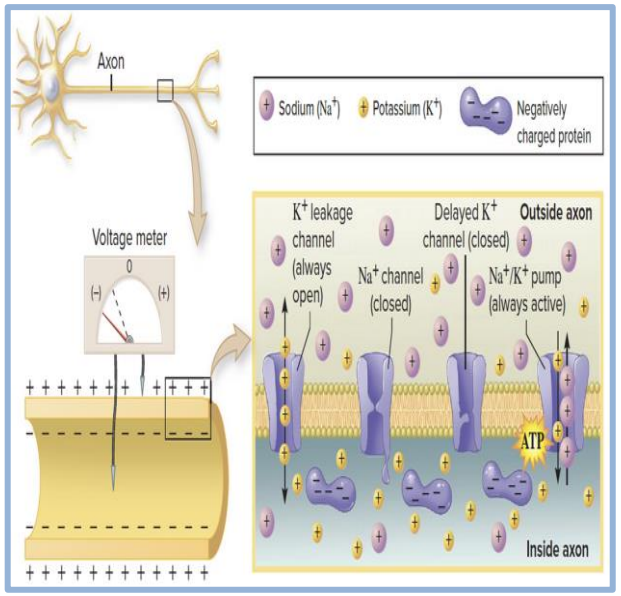
Summary of Previous Works

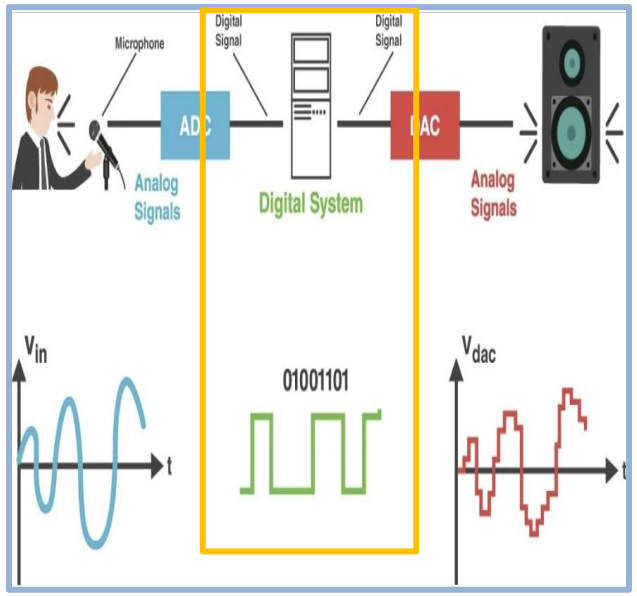
Summary of Previous Works

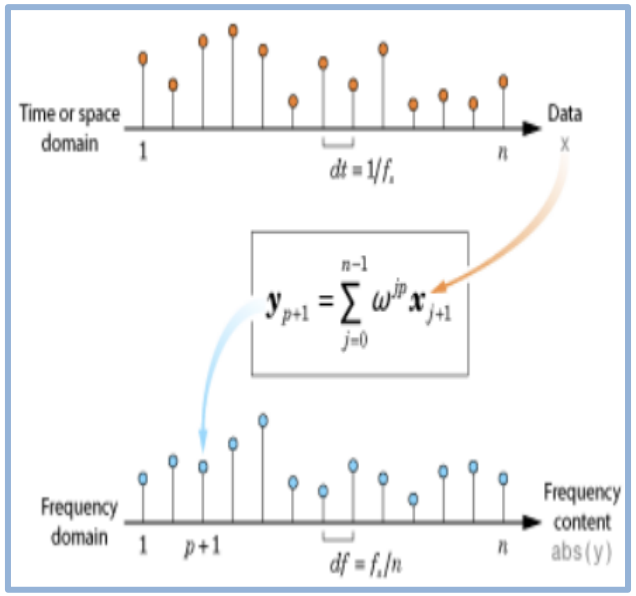
- **PD rat model vs Normal rat model**
  - LFP를 PSD로 분석
  - 파킨슨 질병 Parkinson's disease: PD 유발된 쥐
  - 정상 쥐 뇌파 비교

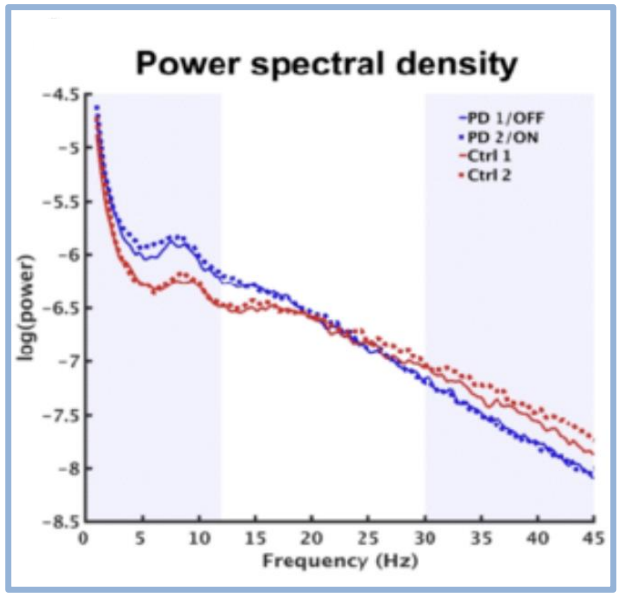


Spike & Local Field Potential → Digital Signal Processing → Fast Fourier Transform → Power Spectral Density









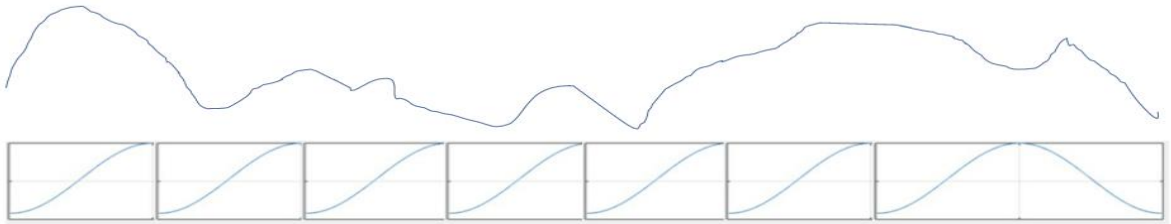
Last Week & This Week

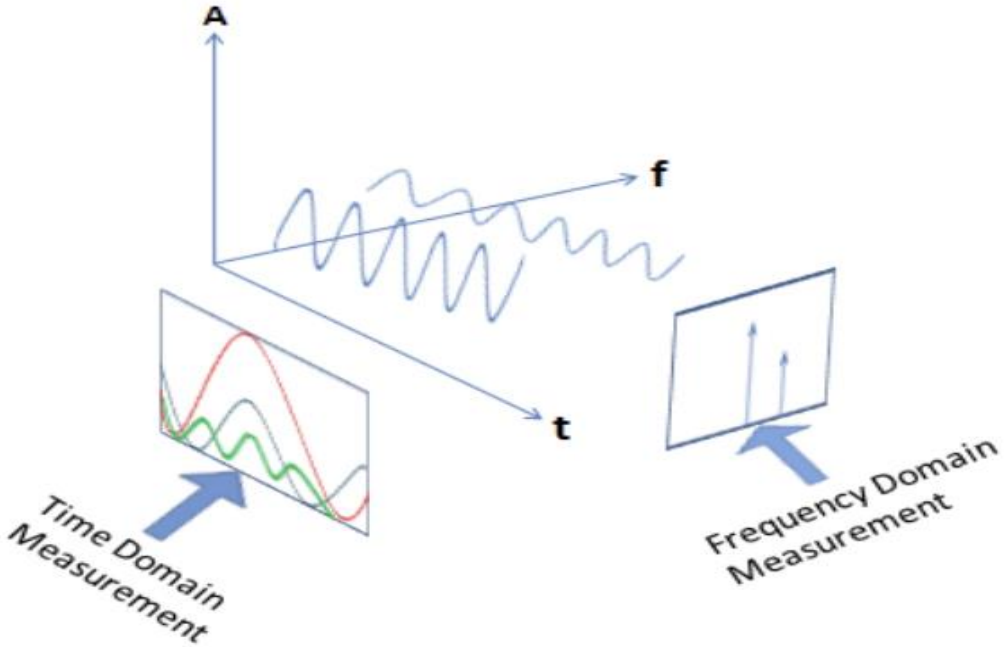
Last Week & This Week

- Power Spectral Density PSD
  - FFT 사용
  - Welch's Method 사용

- FFT vs Welch's Method
  - 비교적 계산 간단 - FFT
  - 노이즈 감소 – Welch's

- Welch's Method
  - 주파수 power의 수치를 추정하기 위한 사용 방법
    - Average the squared FFT over multiple windows
    - Simplest method, use when you have a long signal





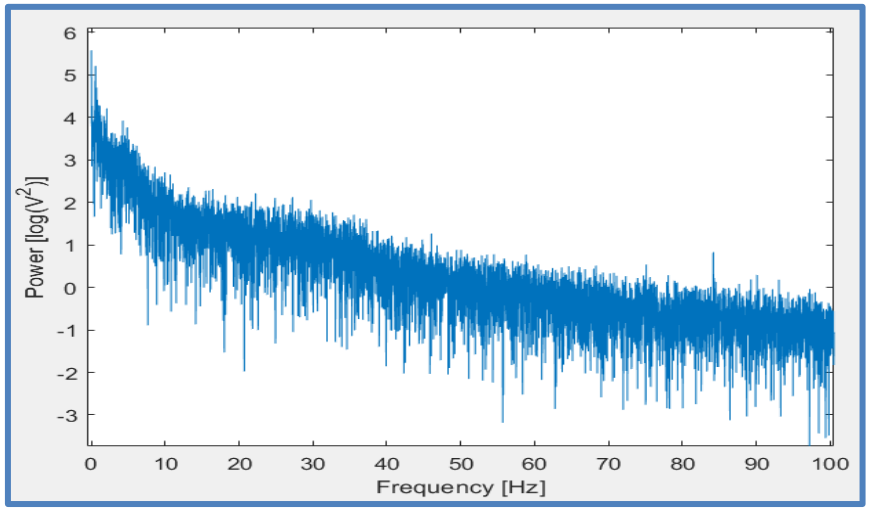
Last Week & This Week

```
%% Raw Data - fft-power domain
N = length(data);
xdft = fft(data*10^6);
xdft = xdft(1:N/2+1);
psdx = (1/(fs*N))*abs(xdft).^2;
psdx(2:end-1) = 2*psdx(2:end-1);
f = 0:fs/N:fs/2;

figure()
plot(f, log10(psdx))
xlabel('Frequency [Hz]')
ylabel('Power [log(V^2)]')
```

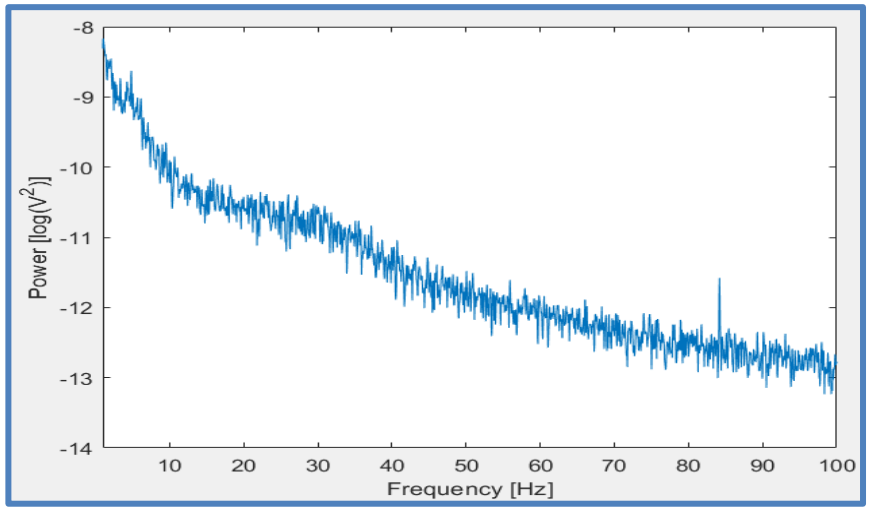
FFT Code

```
%% Raw Data - pwelch-power domain
[pxx, f] = pwelch(data, [], [], [], fs);

figure()
plot(f, log10(pxx))
xlabel('Frequency [Hz]')
ylabel('Power [log(V^2)]')
xlim([1 100])
```

Pwelch Code



Noise Reduction



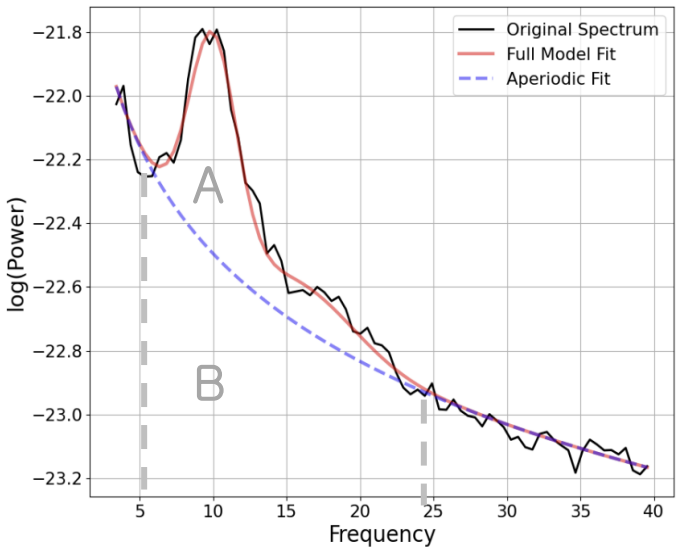
Last Week & This Week

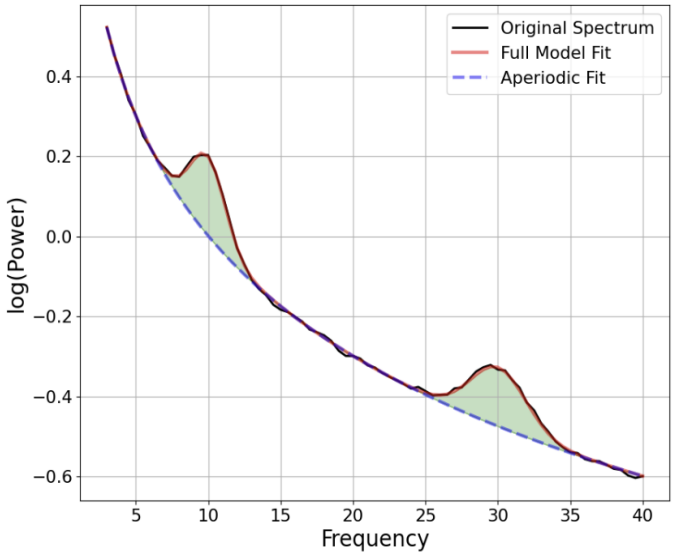
- Fitting Oscillations & One-Over-F Algorithm
  - LFP의 Aperiodic & Periodic Components 분리
  - 더 정확한 분석을 도와주는 알고리즘

Combined vs Separated

- Periodic Component
  - 특정 주파수에 치중해서 갖는 파워

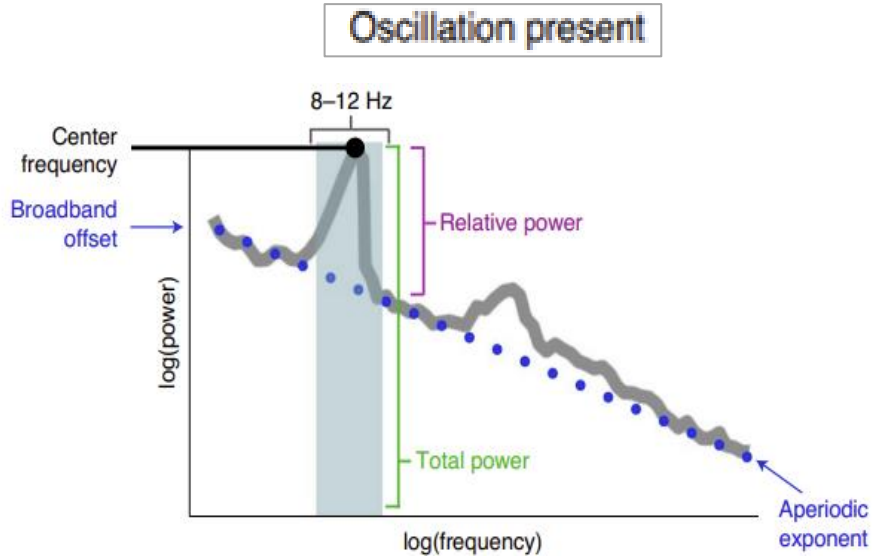
- Aperiodic Component
  - 특정 주파수에 치중되는 값을 갖지 않는 파워

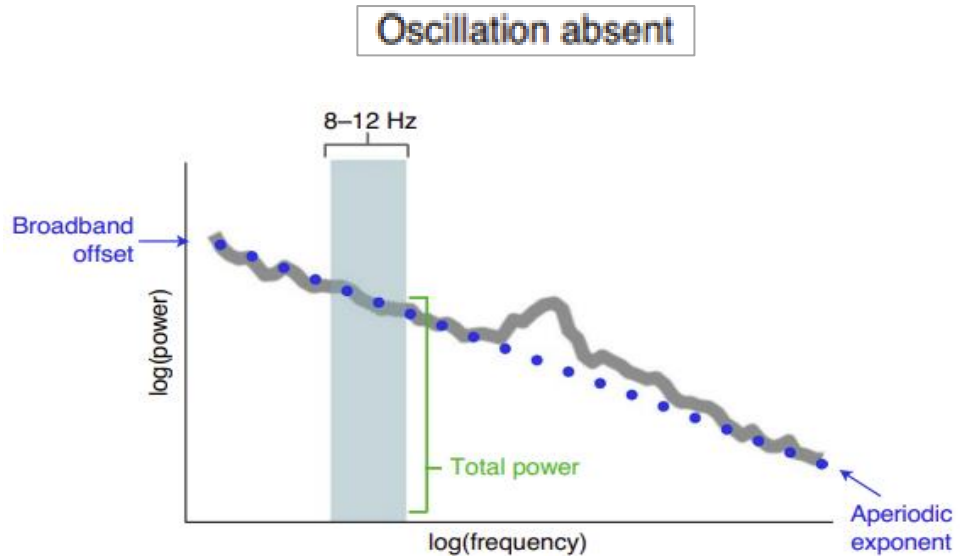




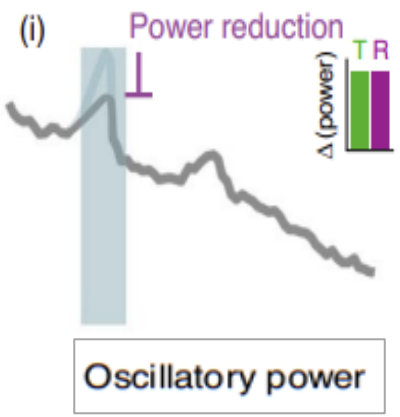
Last Week & This Week

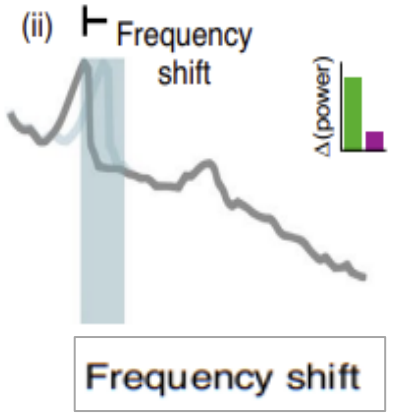
Case #1

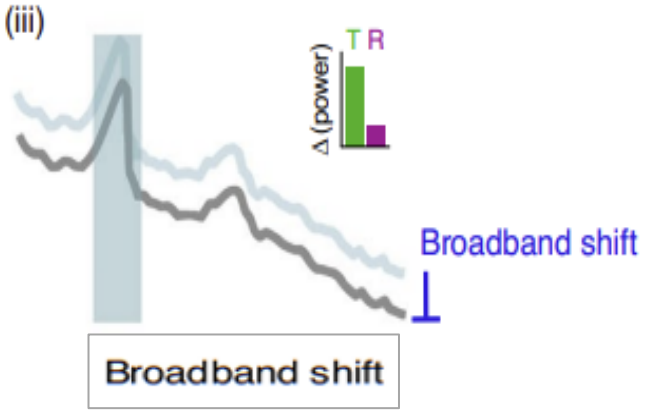


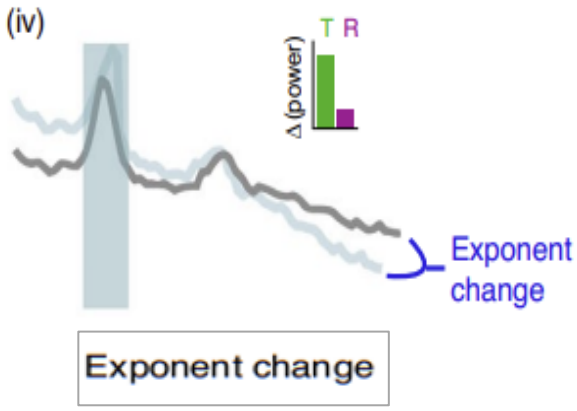


Case #2



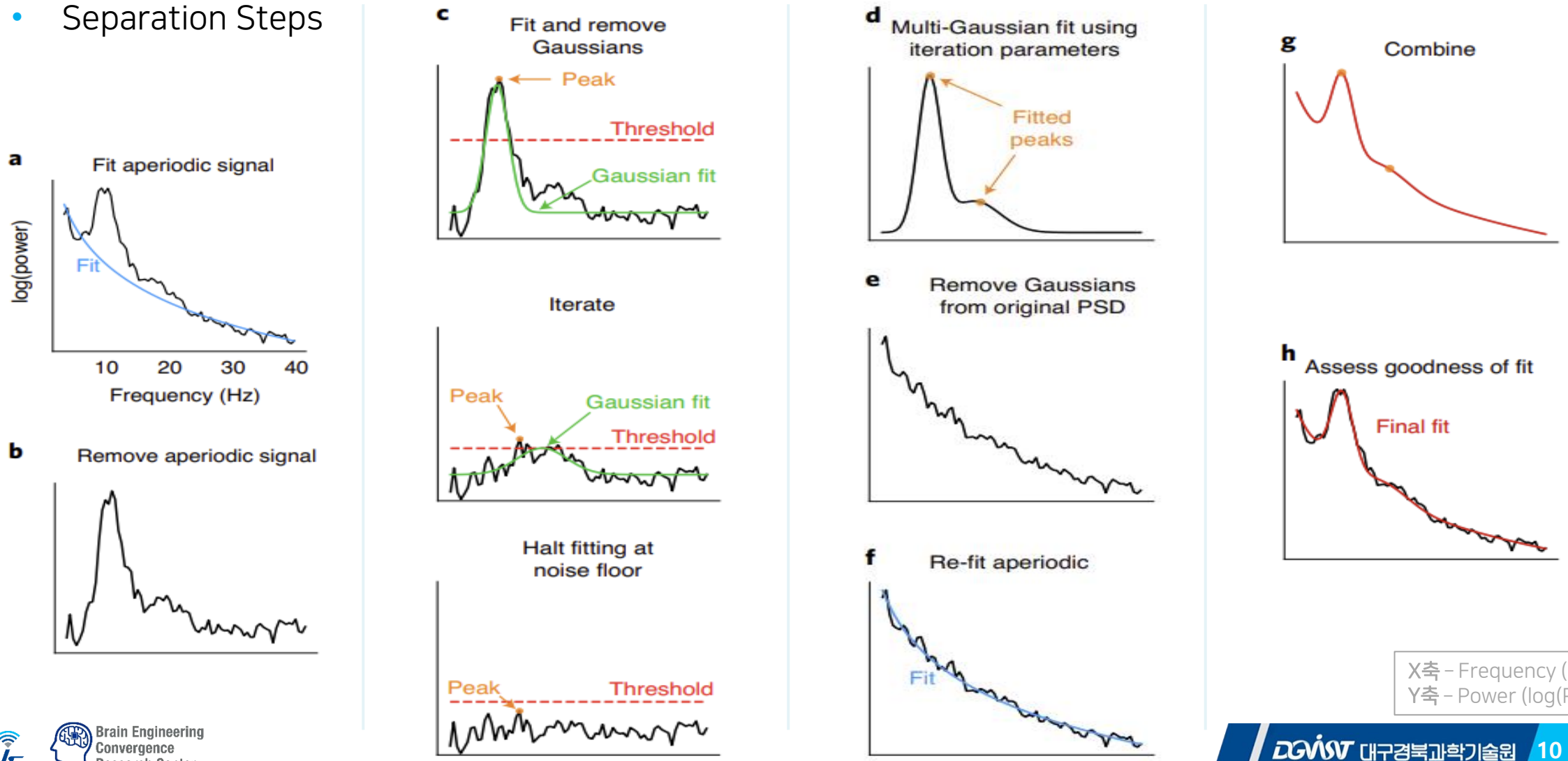






Last Week & This Week

- LFP의 Aperiodic & Periodic
  - Separation Steps



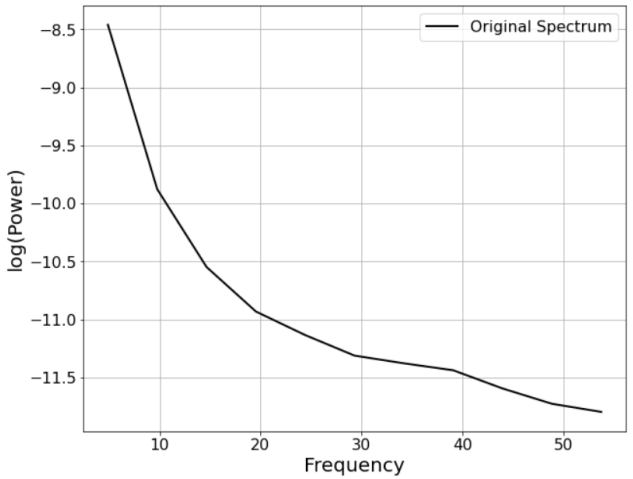
X축 – Frequency (Hz)
Y축 – Power (log(Power))

Final Works

Final Works

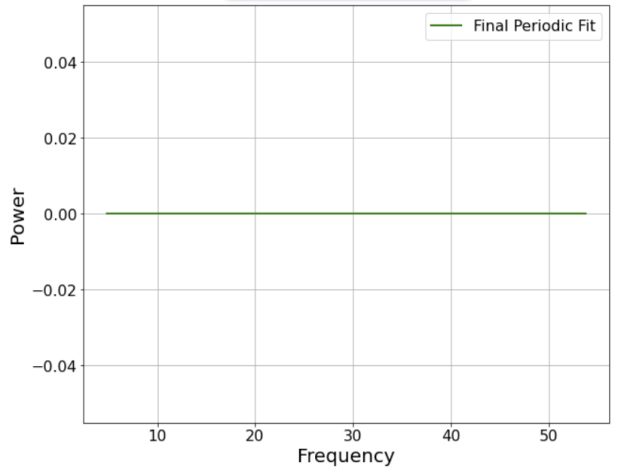
- Normal rat model
  - Beta Band Oscillations

Original Spectrum

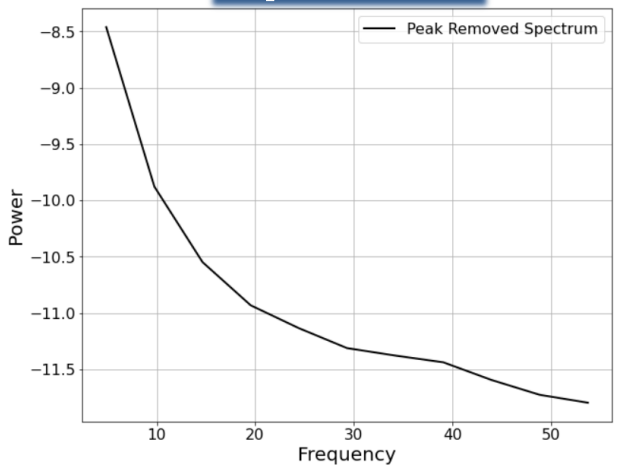


Separation

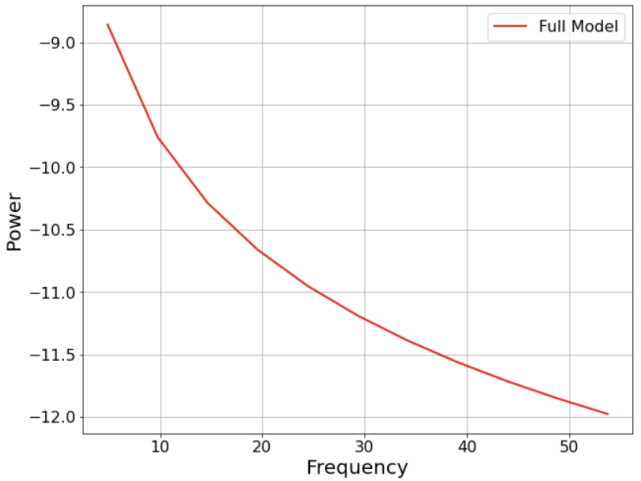
Periodic



Aperiodic



Full Model



X축 – Frequency (Hz)
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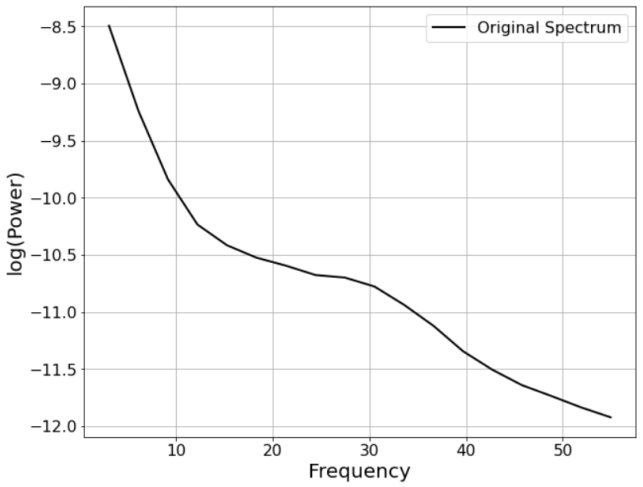
Final Works

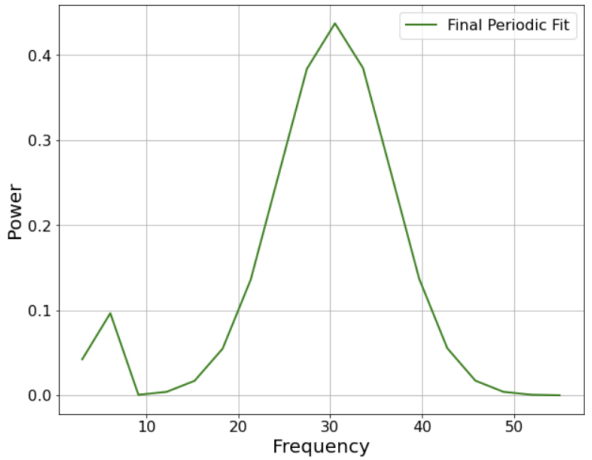
- PD rat model
  - Beta Band Oscillations

Original Spectrum

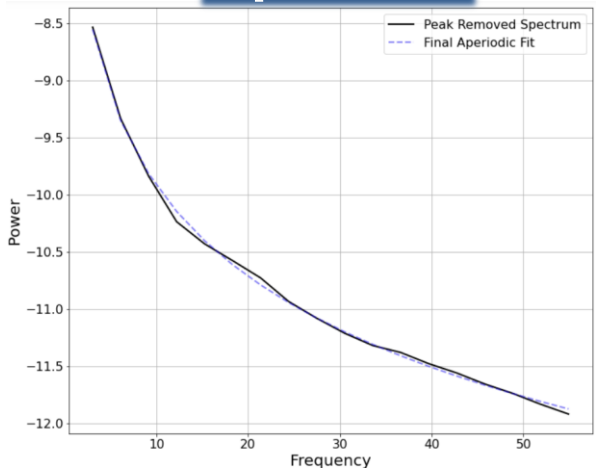


Separation

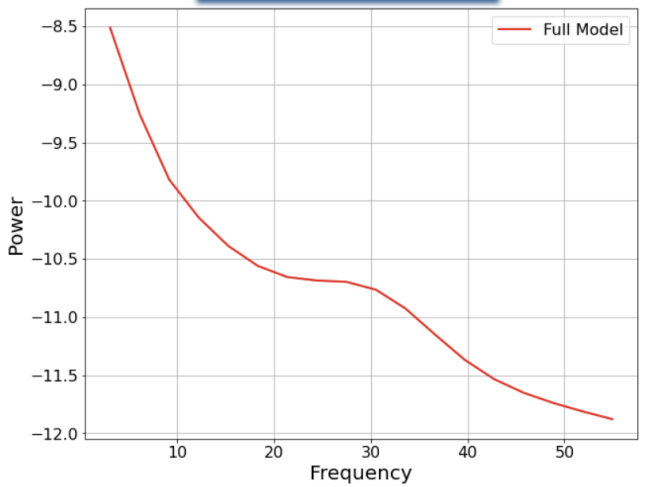
Periodic



Aperiodic



Full Model



X축 – Frequency (Hz)
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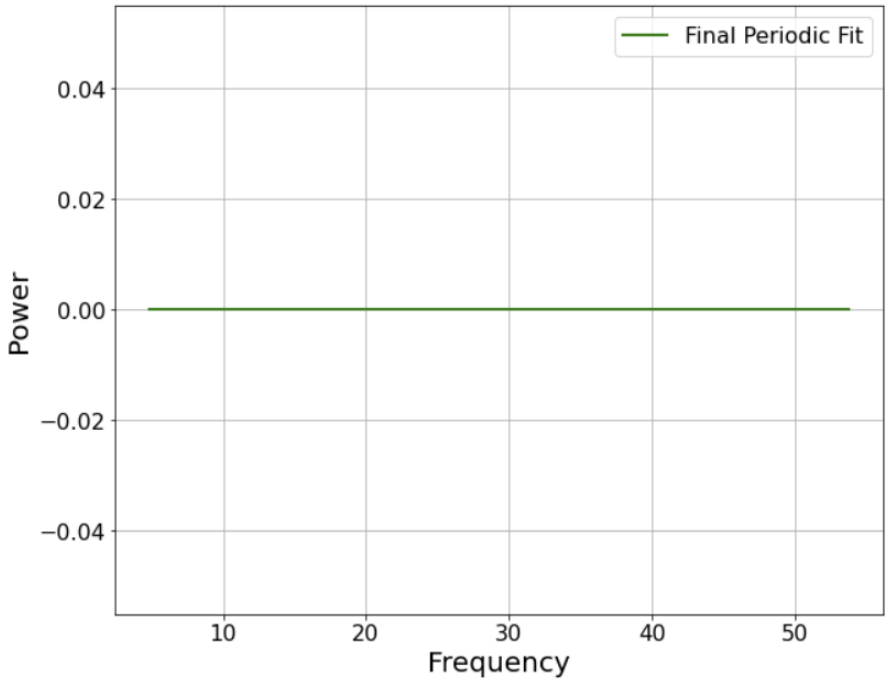
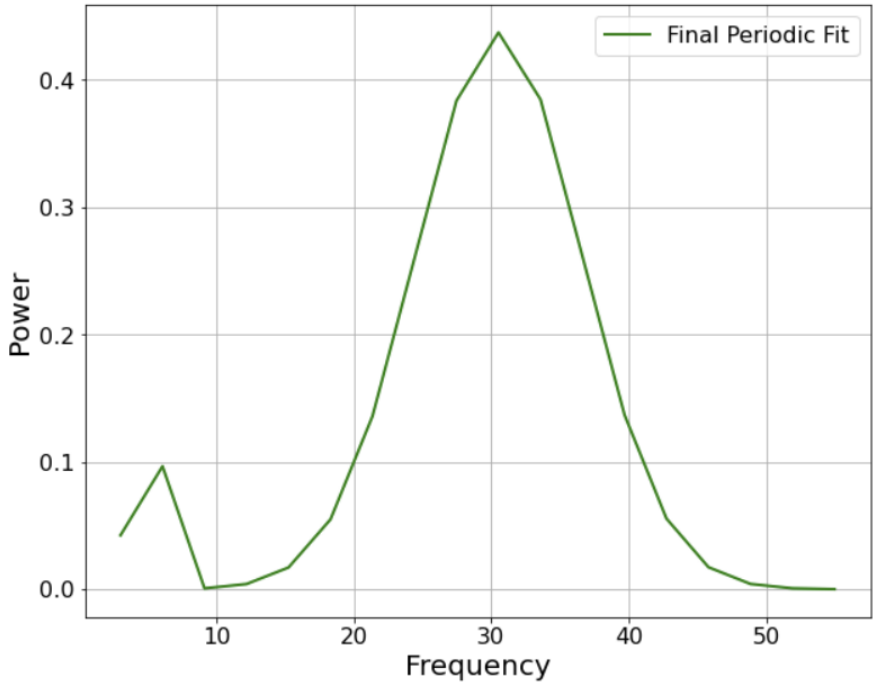
Final Works

- Normal rat model



Periodic

- PD rat model



Periodic

X축 – Frequency (Hz)
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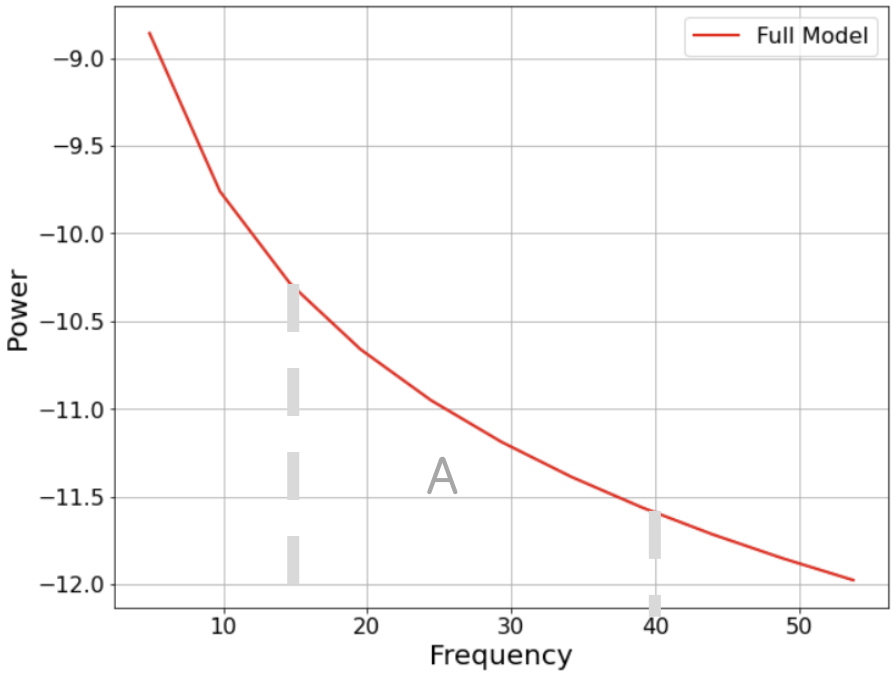
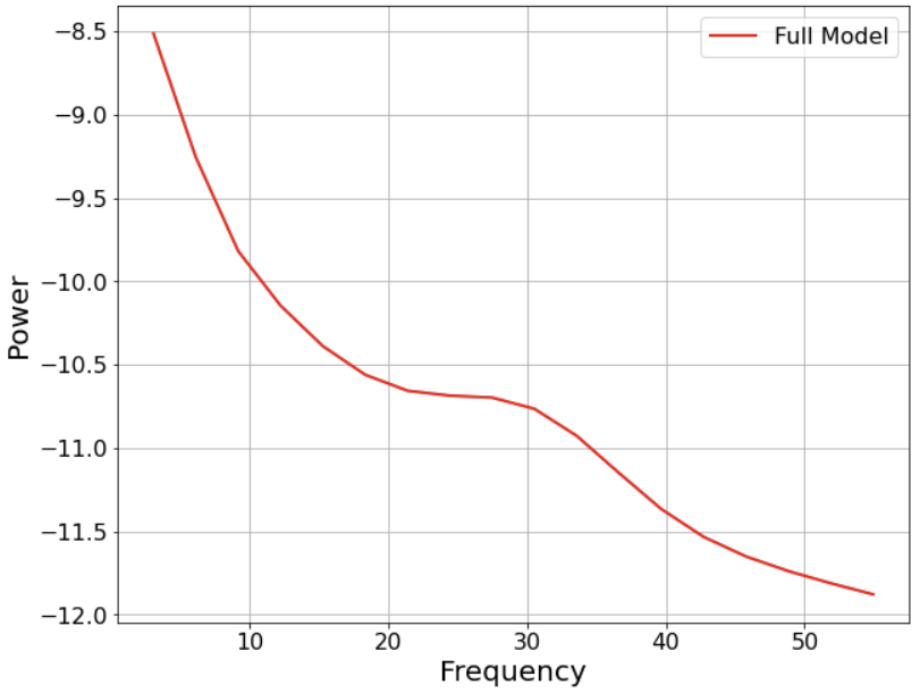
Final Works

- Normal rat model



Full Model

- PD rat model



Full Model

X축 – Frequency (Hz)
Y축 – Power (log(Power))

Q&A

Thank you