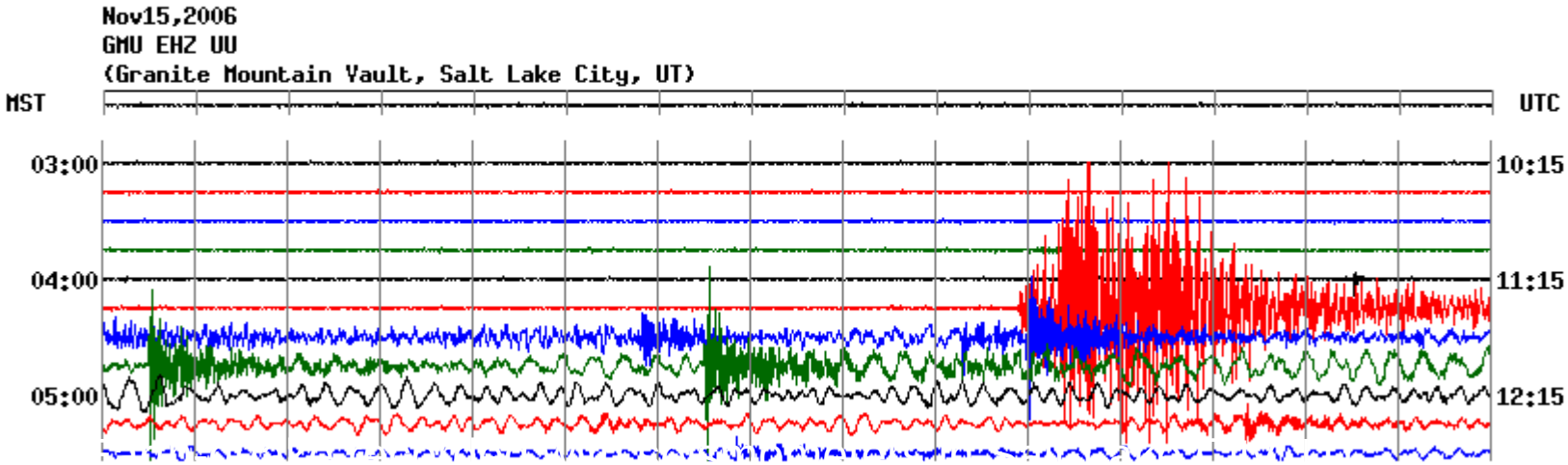
Japan Earth-Quake November 15, 2006

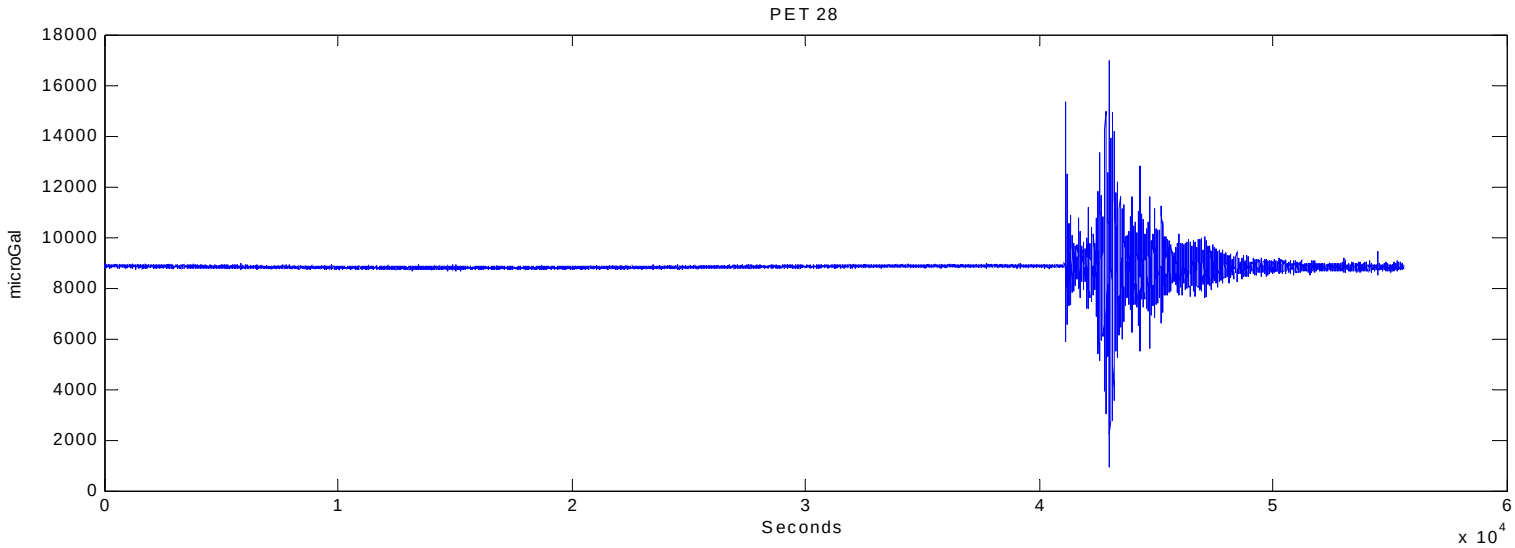
Serendipitously recorded at MGL

Using 5 Newly Built gPhone Gravity Meters

(The meters were not ready for shipment)

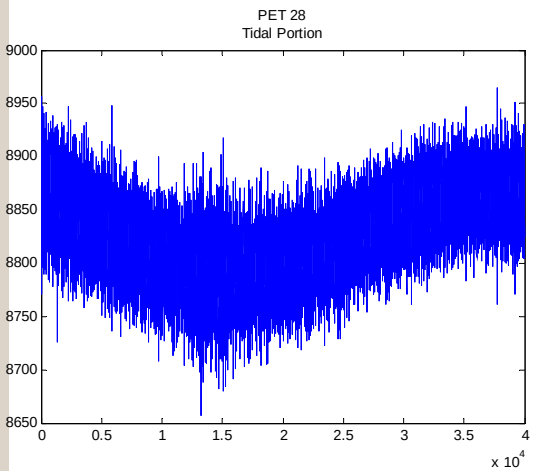
MICRO g LACOSTE

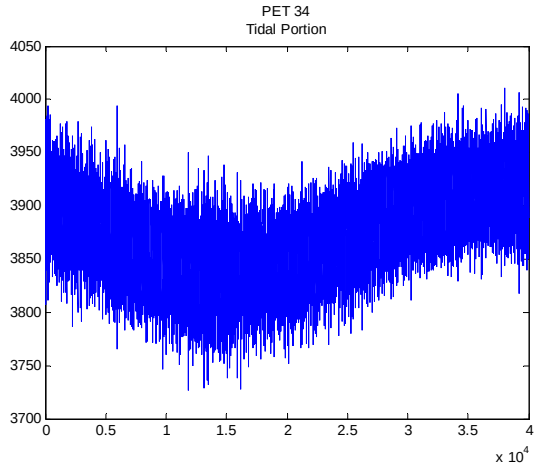

Nov15,2006
GMU EHZ UU
(Granite Mountain Vault, Salt Lake City, UT)
MST
UTC
03:00
04:00
05:00
10:15
11:15
12:15

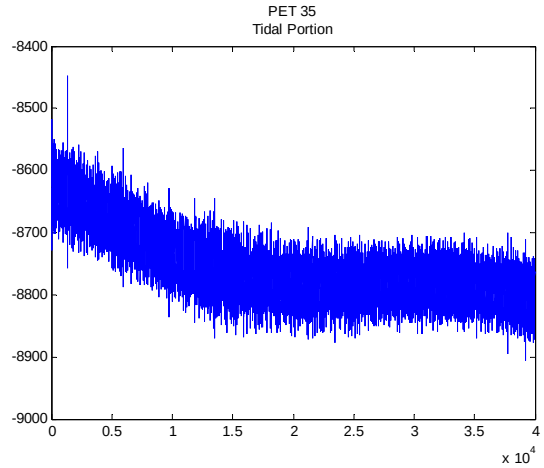

PET 28
microGal
Seconds
x 10^4
18000
16000
14000
12000
10000
8000
6000
4000
2000
0
0
1
2
3
4
5
6

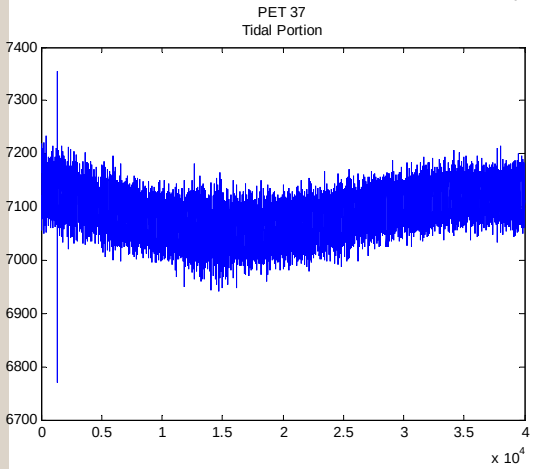
Pre-Earthquake Data

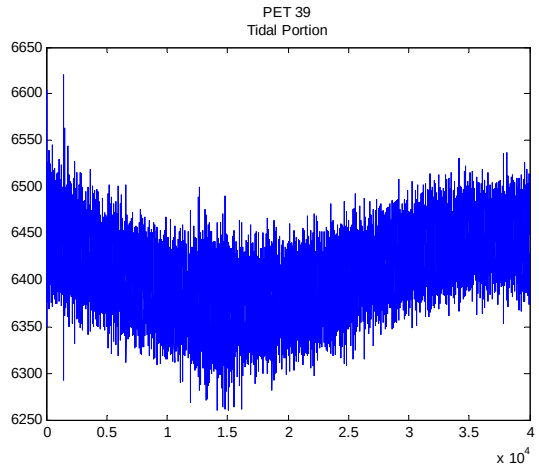
(Meters are not yet ready to ship)











*Time series data (1s) prior to earth quake. Note that gPhone #35 has high drift

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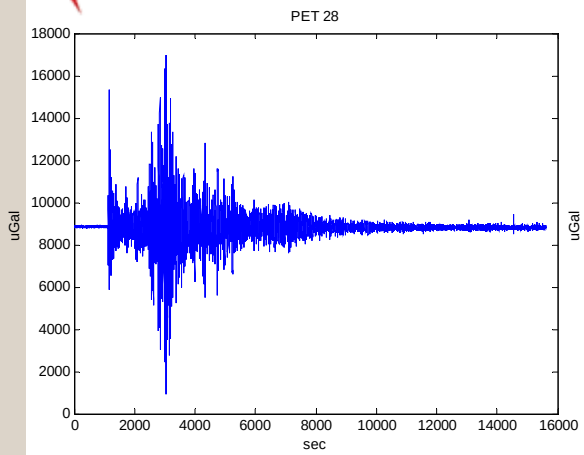
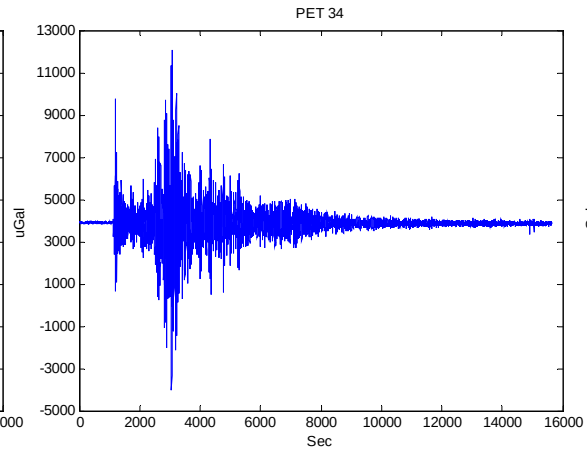
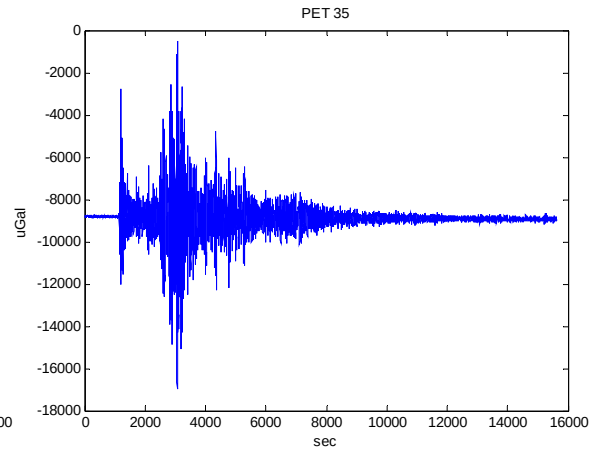
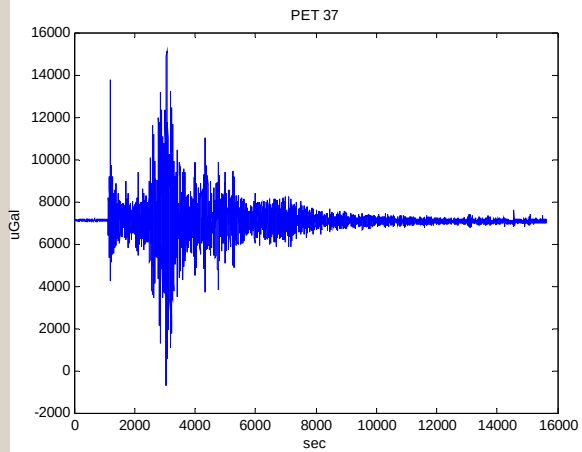
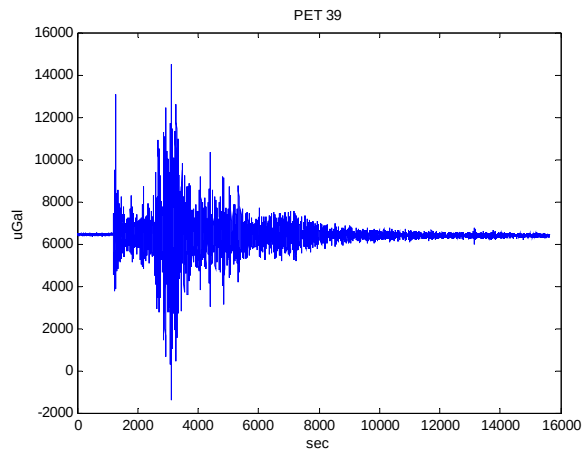
After onset of Earthquake (4 hour record, 1s data)











* All Plotted on Same Scale (18 mGal scale)

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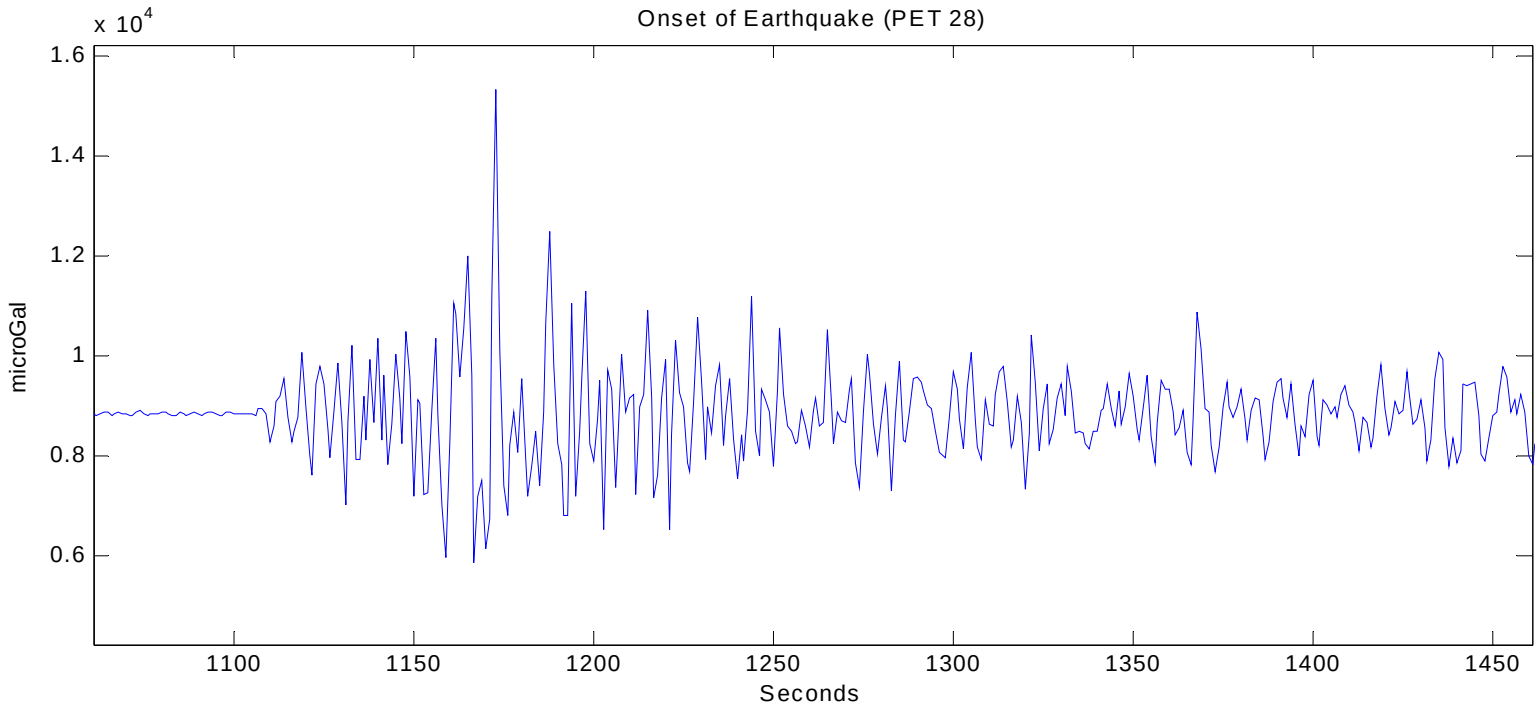
Onset of earthquake from gPhone #28

(6 minutes)



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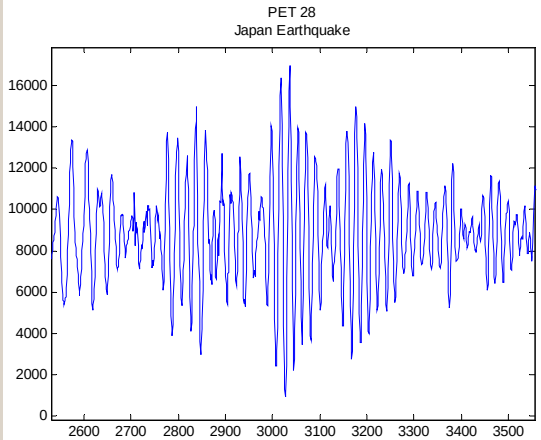
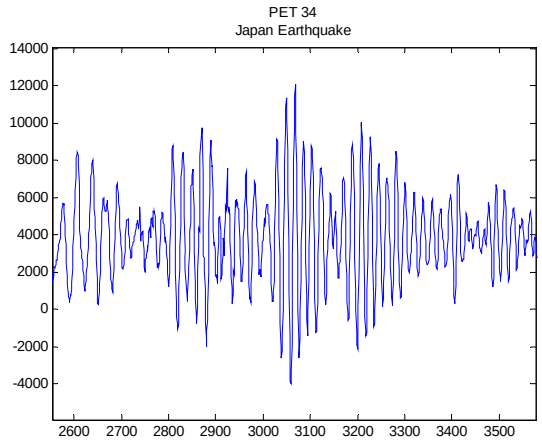
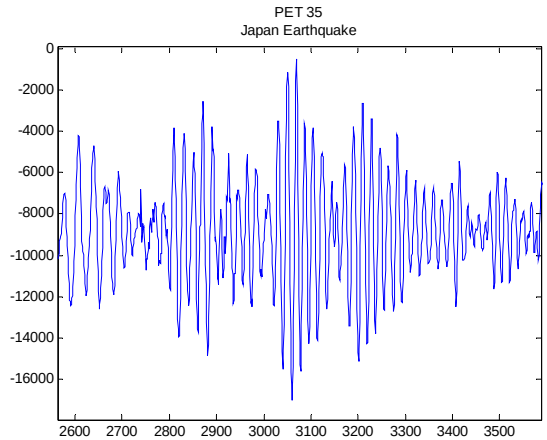
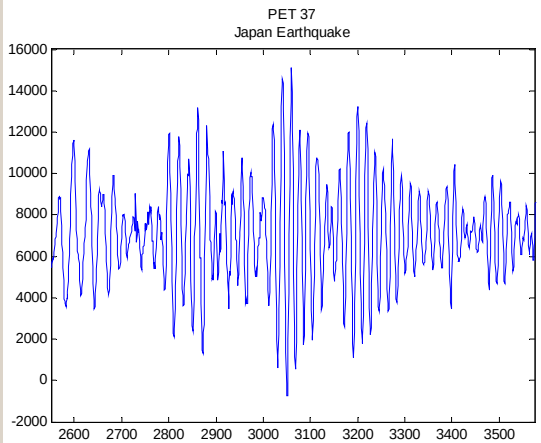
All gPhone Gravity Meters

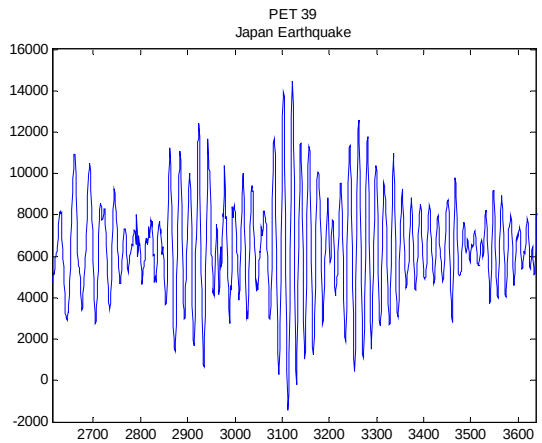
(Time series data - 15 minutes during earthquake)



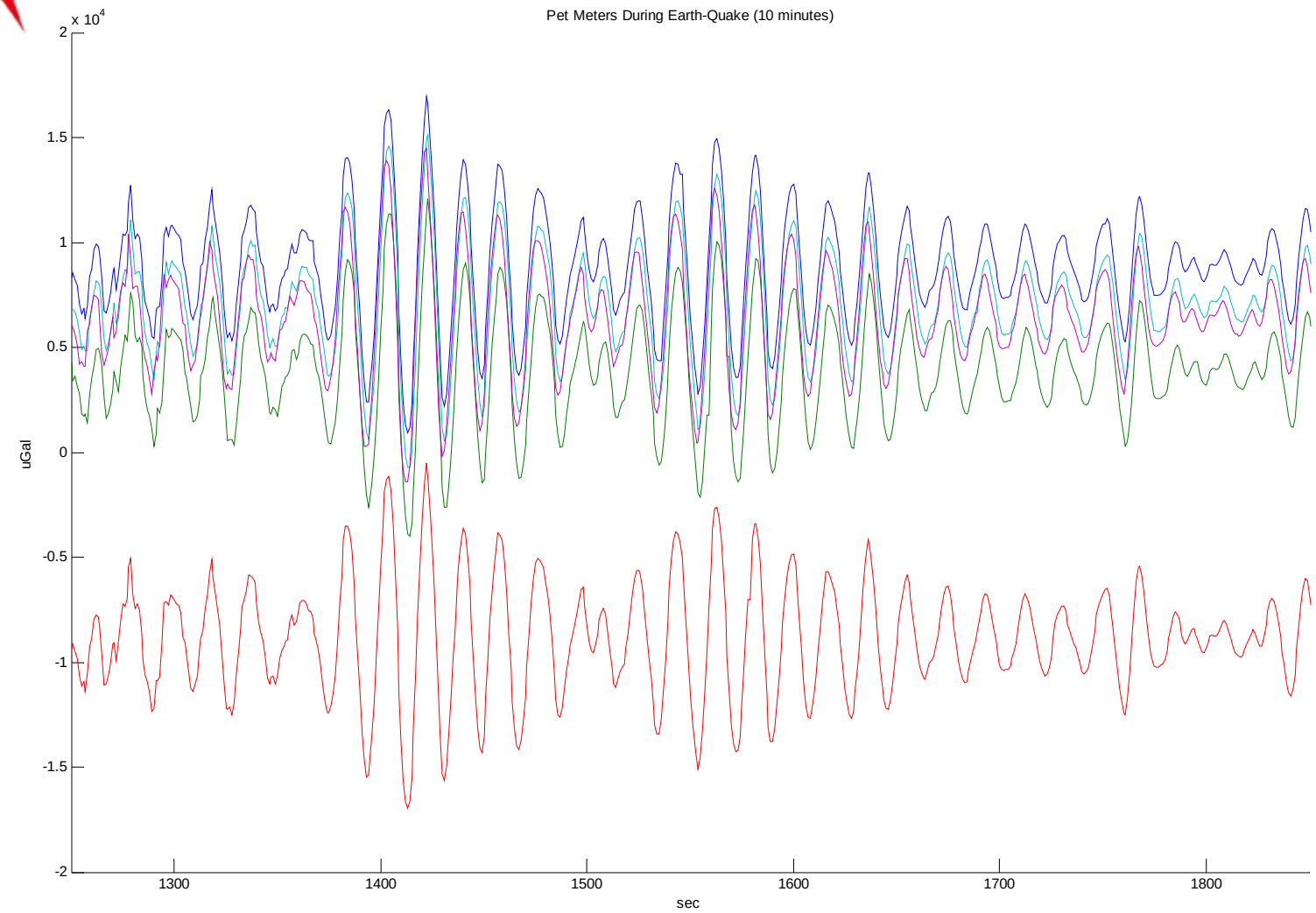








Five gPhone gravity meters during earth-quake



Plotted with original feedback offsets of meters (±10 mGal)

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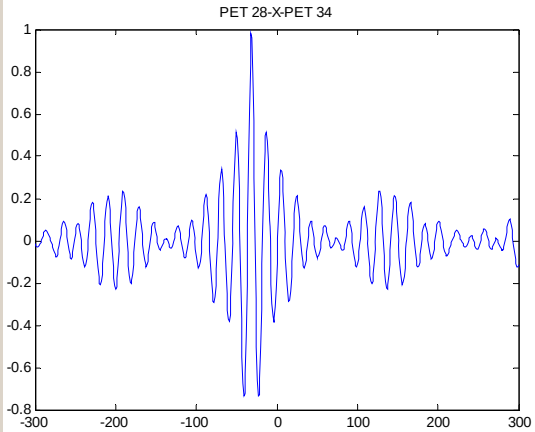
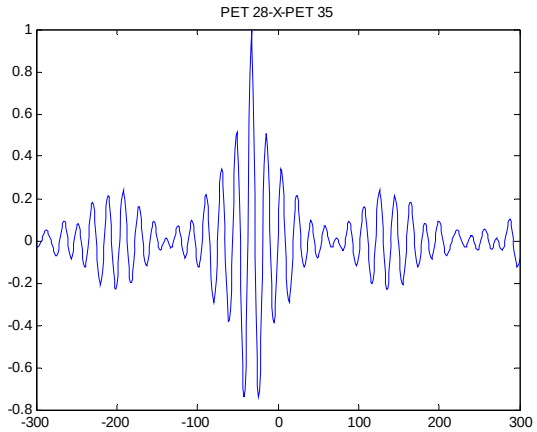
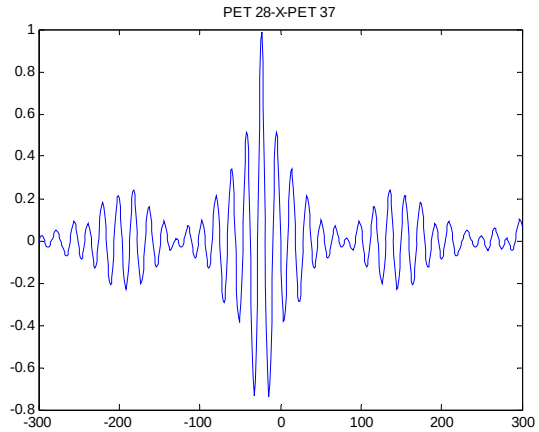
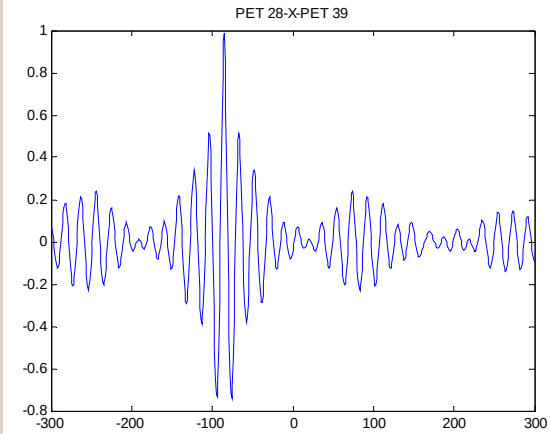
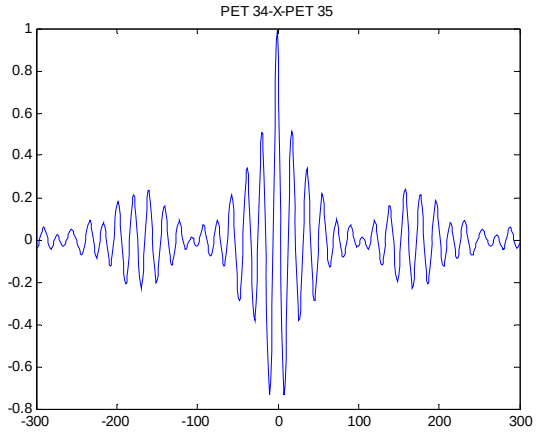
Cross covariance (± 5minutes Lag)

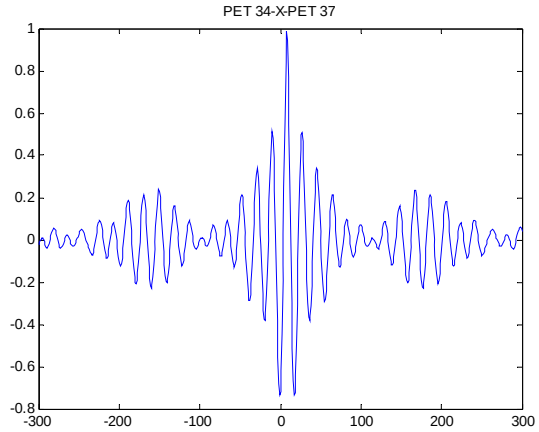






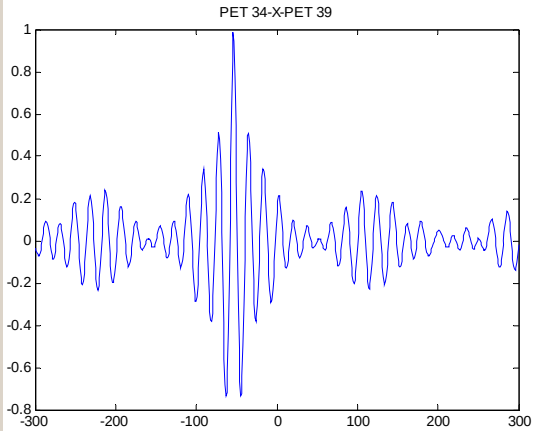


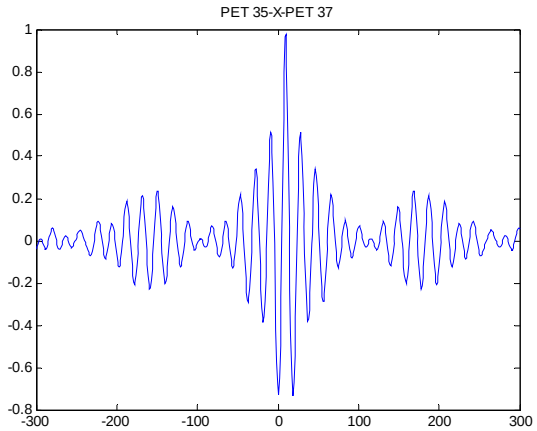


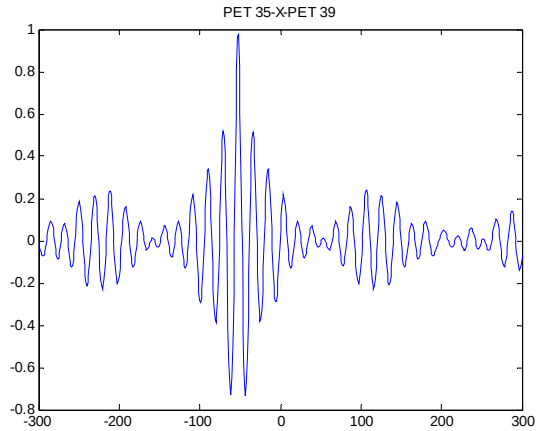


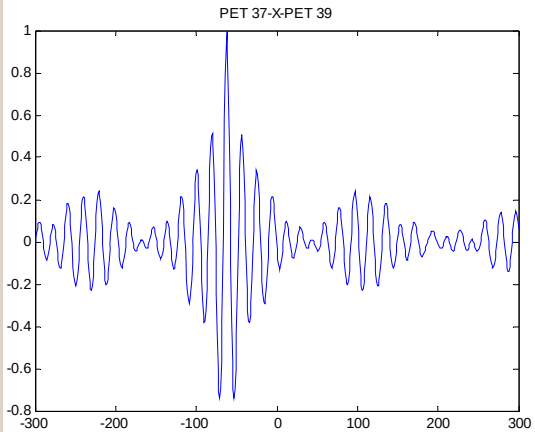
*Correlation is limited to about 90-98% because of clock differences (±0.5s)

Continued….









*Correlation is limited to about 90-98% because of clock differences (±0.5s)

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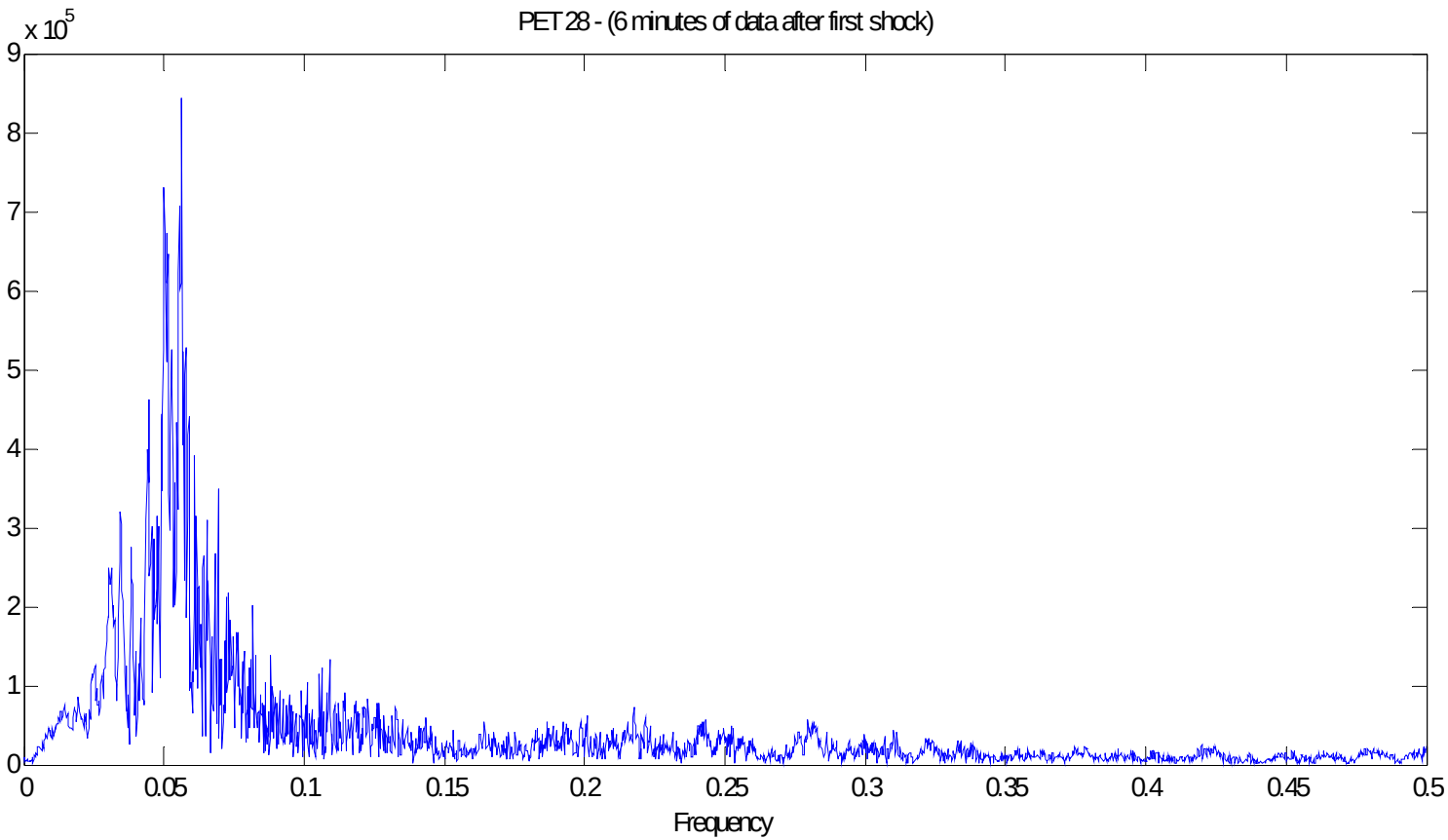
Spectrum of 1 hour of data

(after start of earthquake)



Linear-Linear Plot

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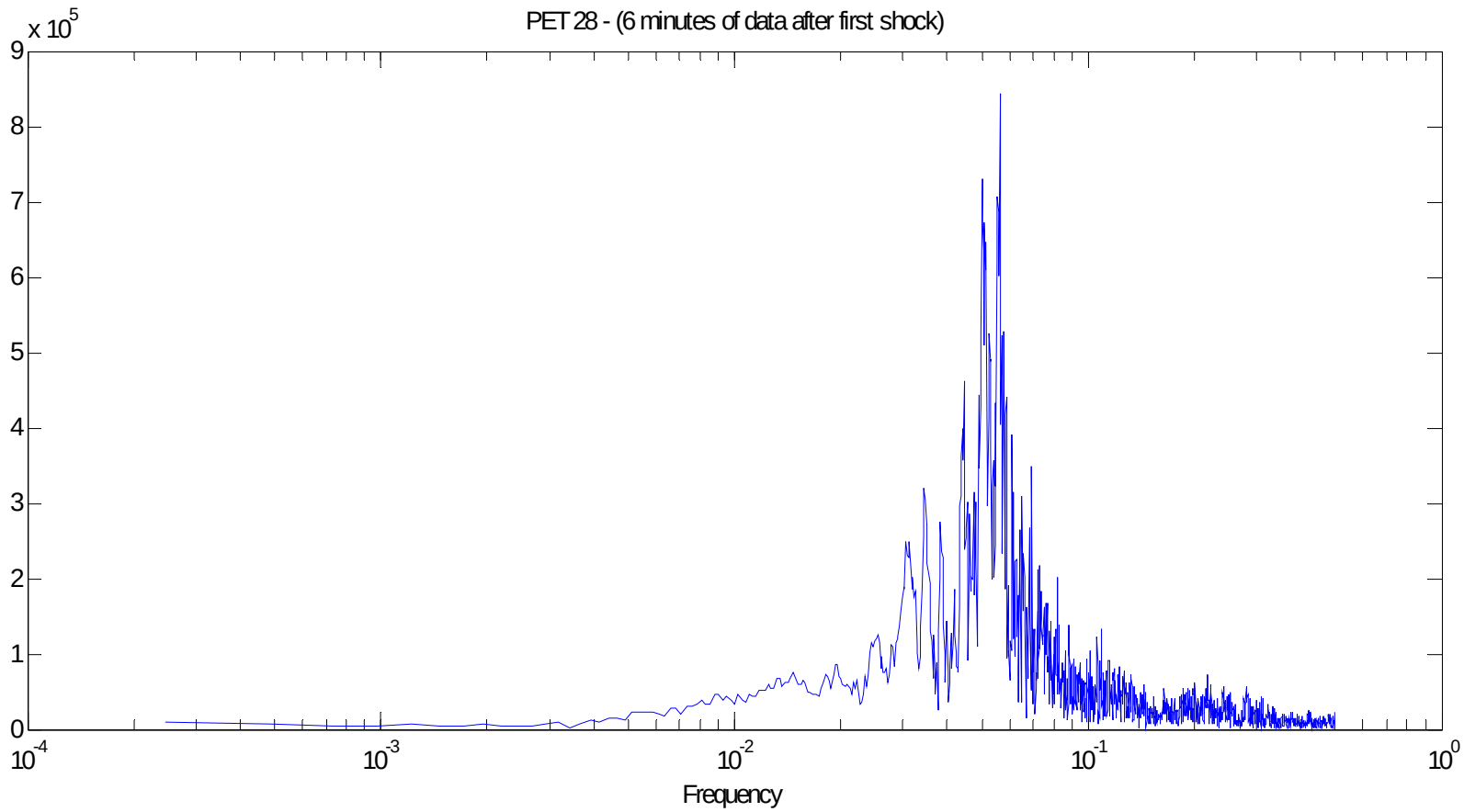
Spectrum of 1 hour of data (after start of earthquake)



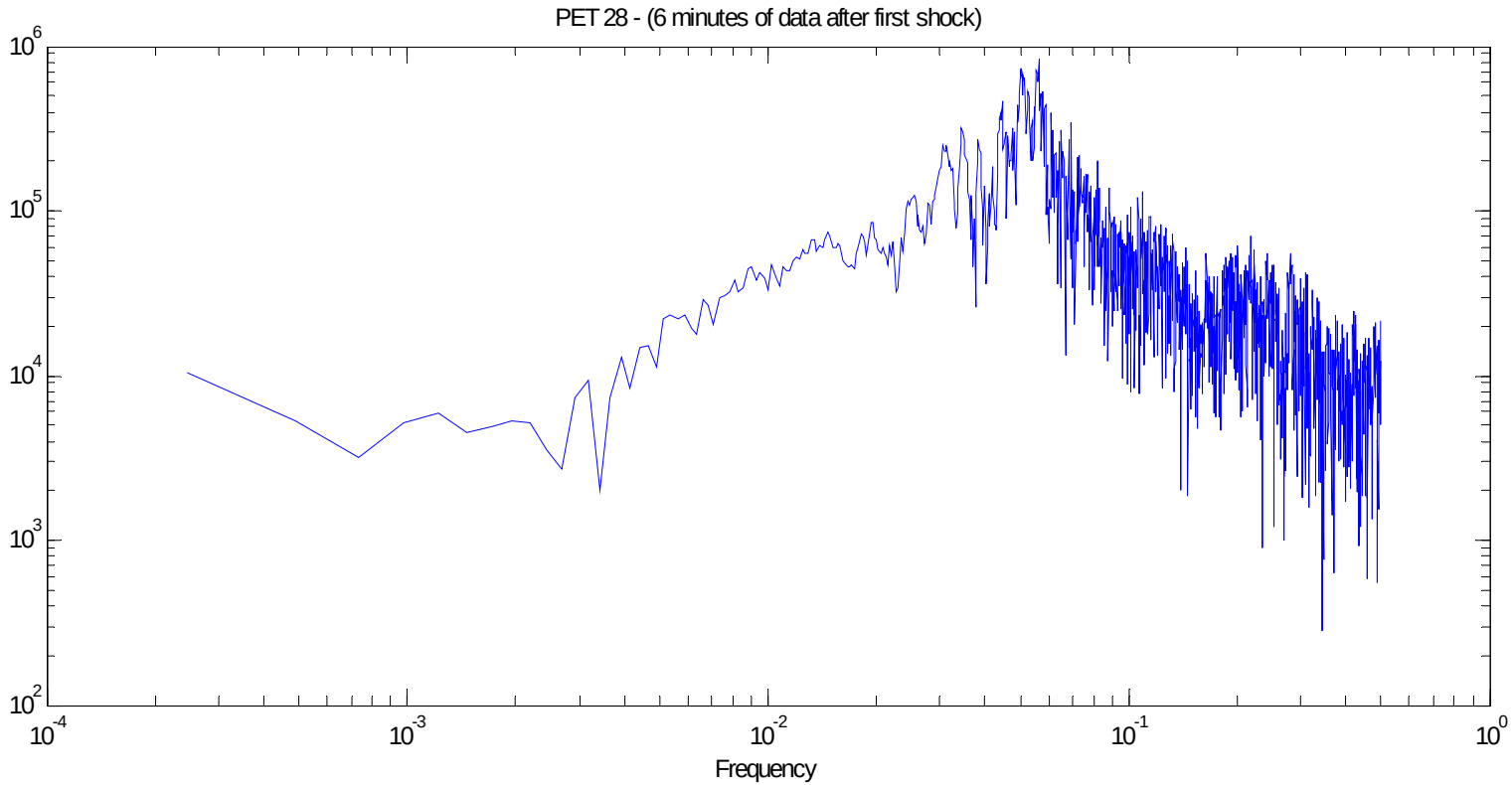
Linear-Log Plot

Continued….

MICROg LACOSTE

Spectrum of 1 hour of data

(after start of earthquake)



Log-Log Plot

Continued….

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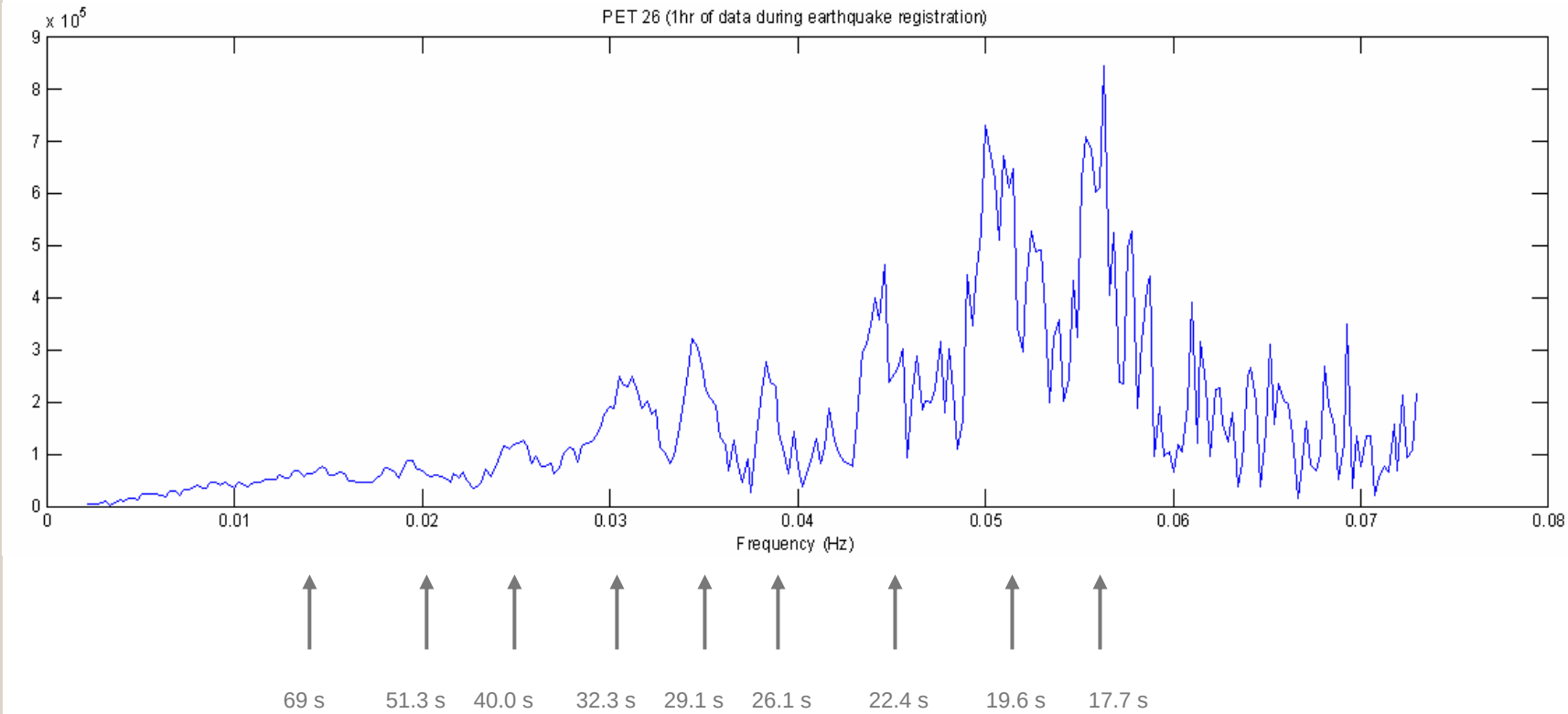
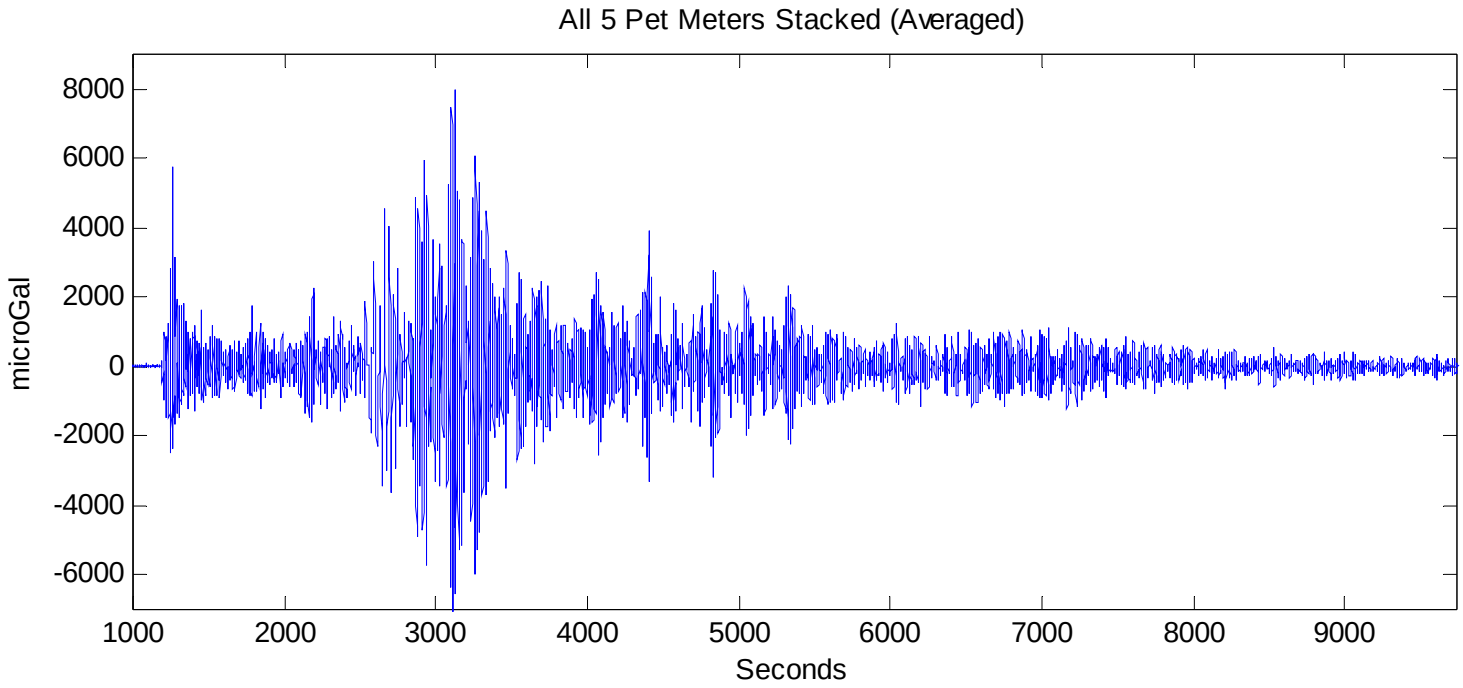
Low frequencies in earth-quake (1 hr record)



Onset of Earth Quake
Stacking of all 5 gPhones



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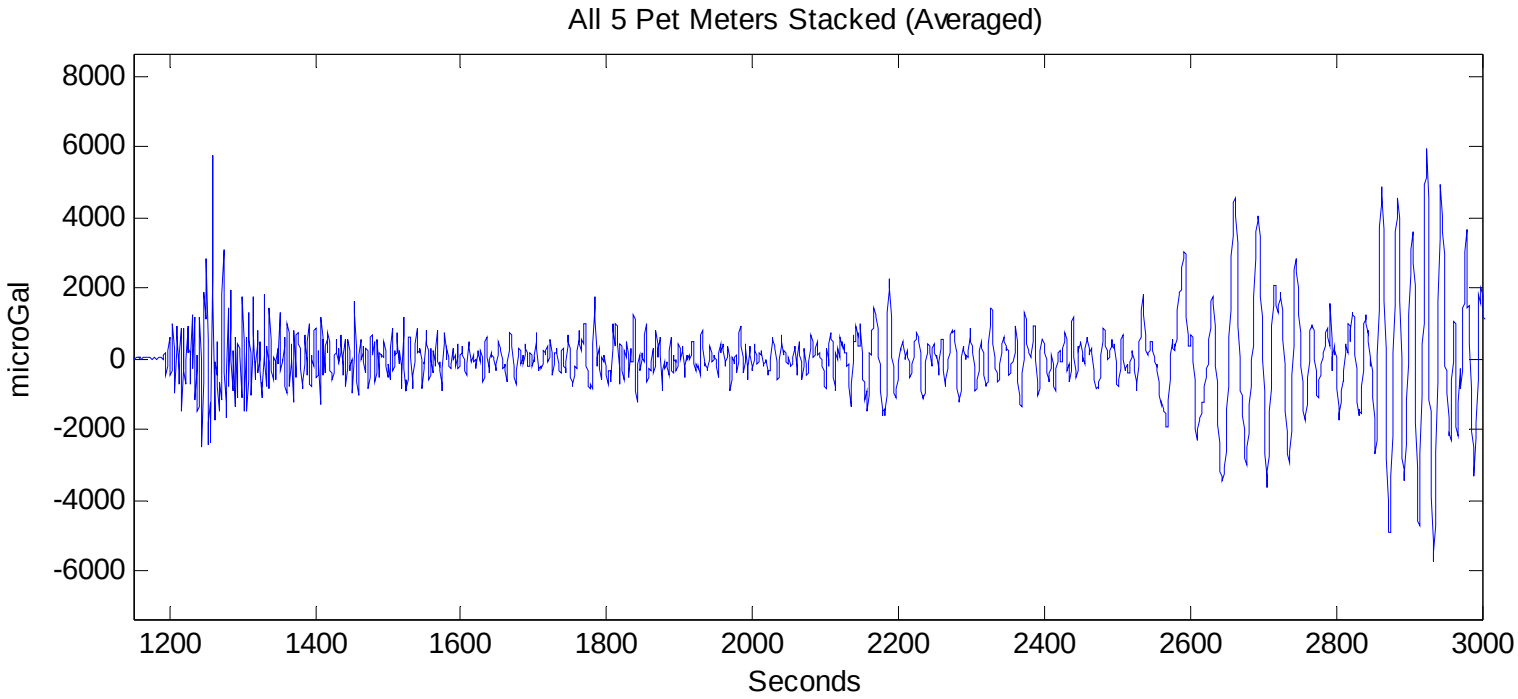
Onset of Earth Quake Stacking of all 5 gPhones (a closer look at beginning)



Continued…

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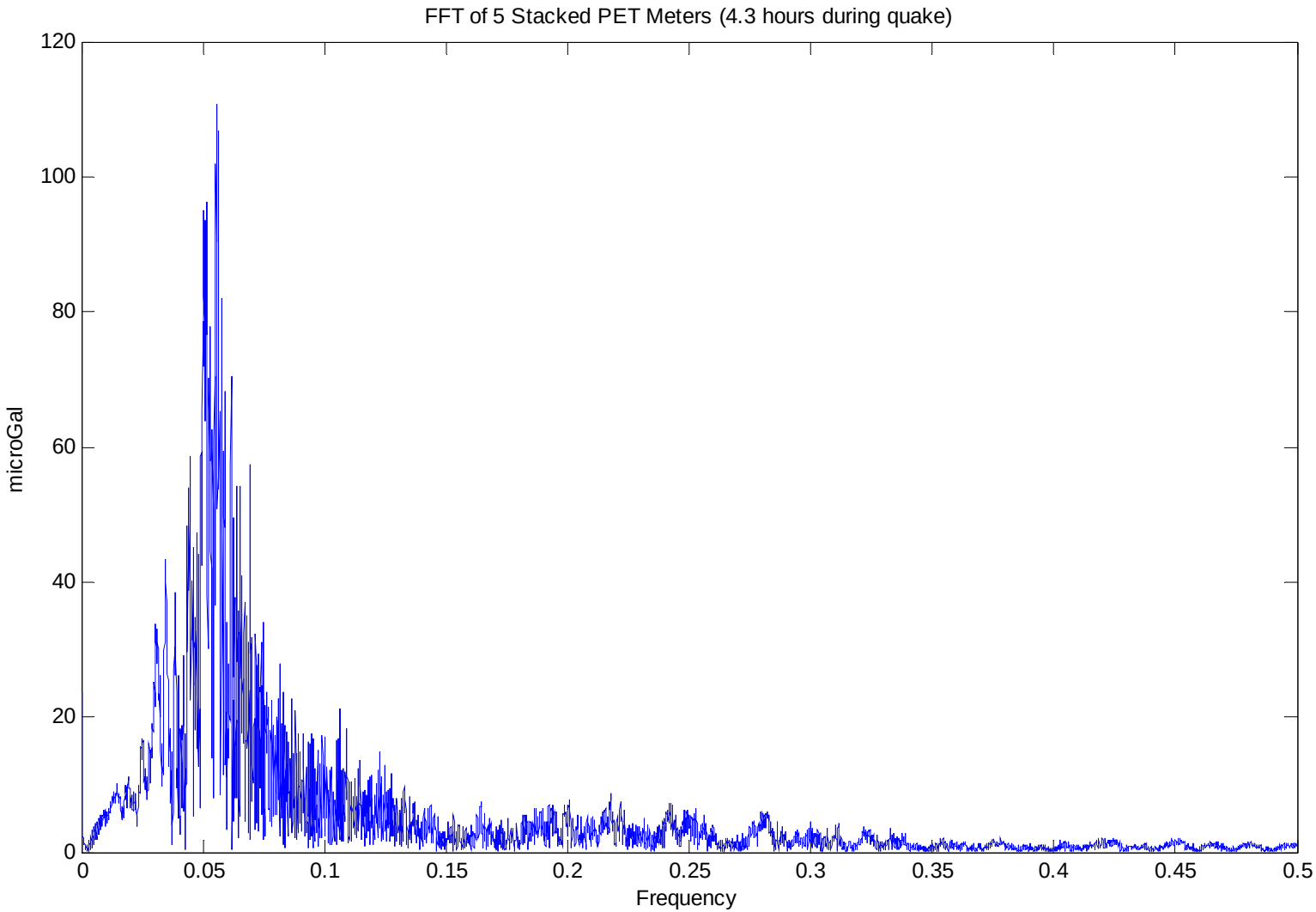
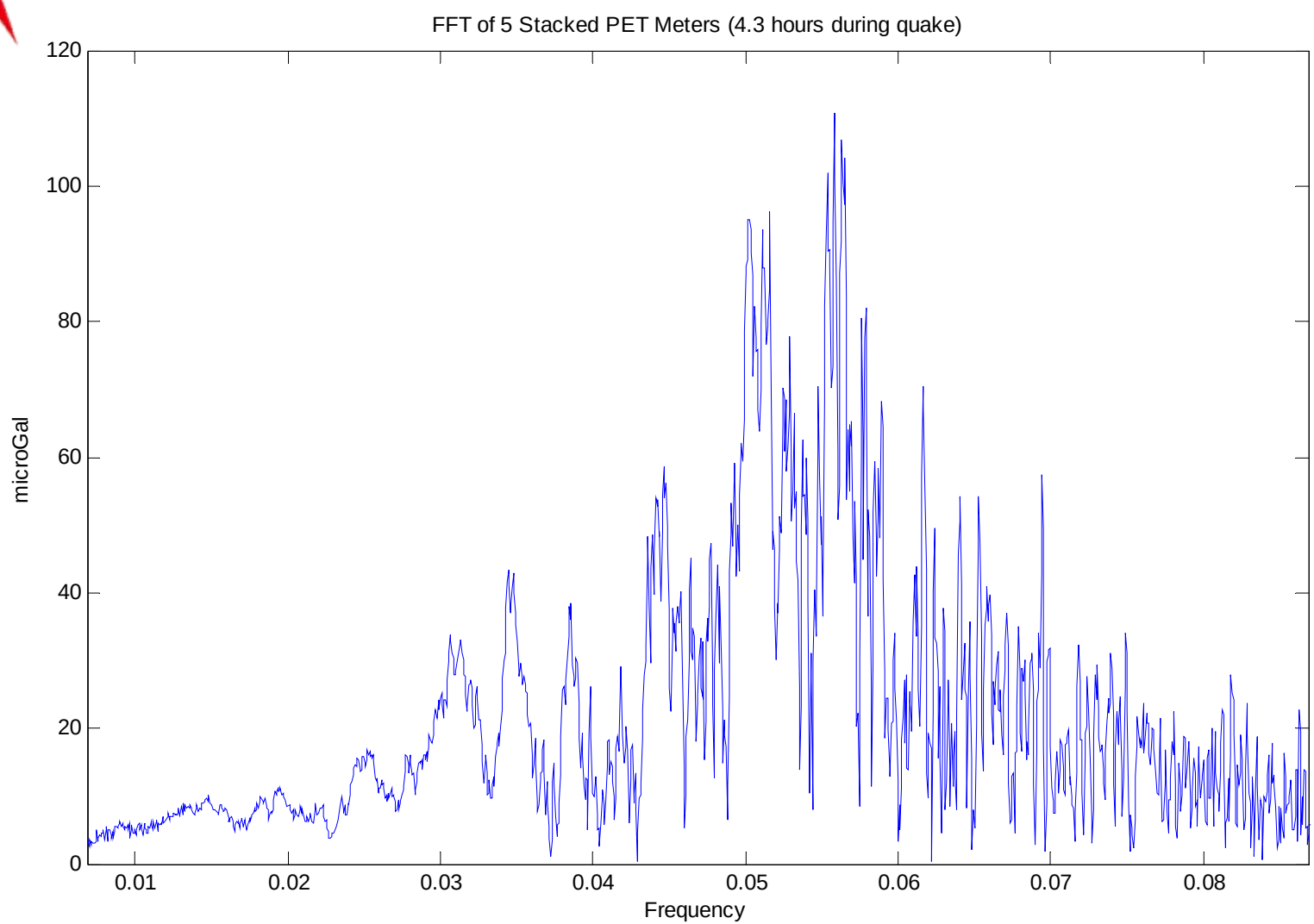
FFT (full)



MICROg LACOSTE

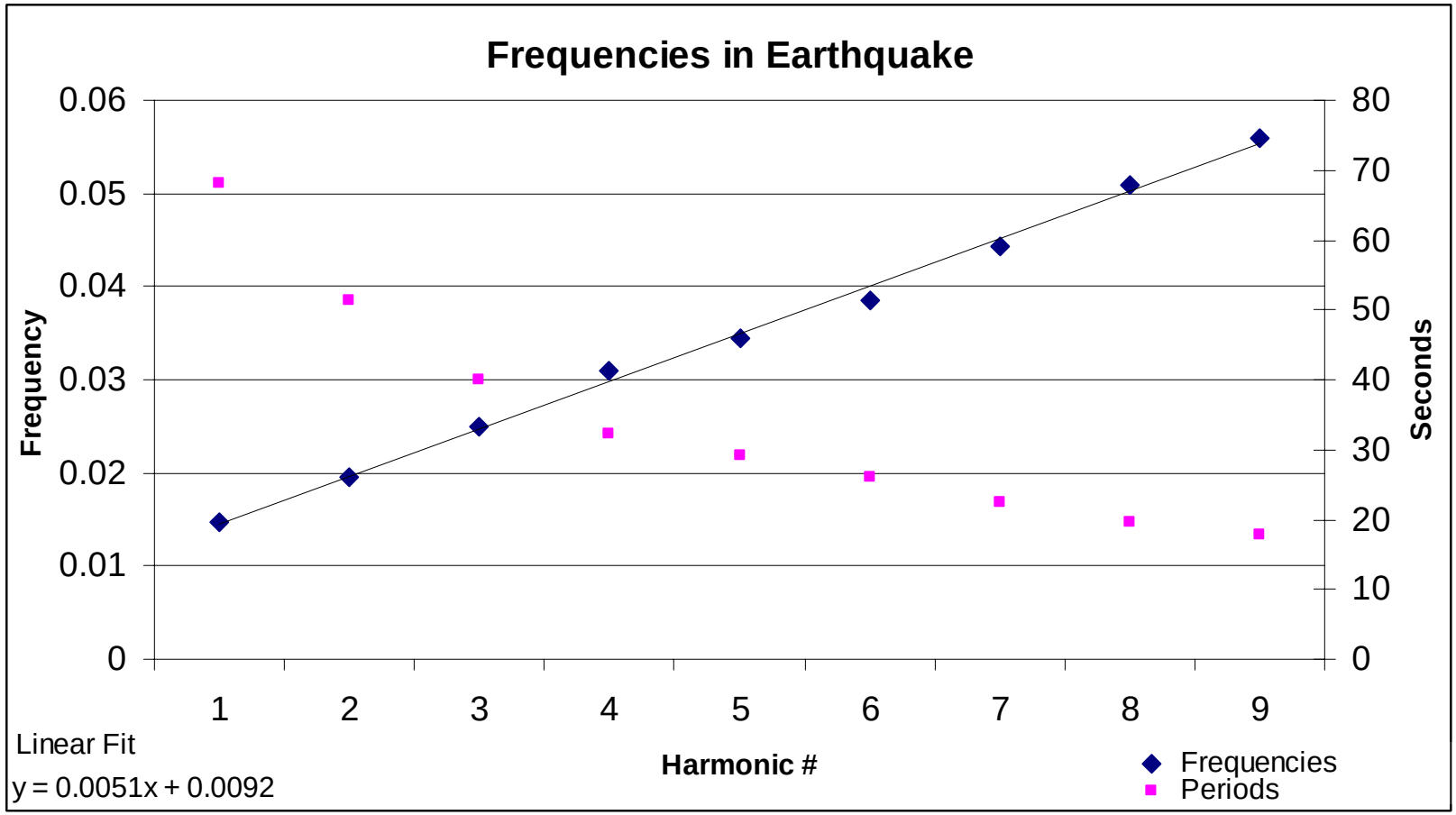
FFT (low frequencies)



Continued…

MicroG LaCoste

Plot of Frequencies in FFT



*The frequencies appear to be harmonics

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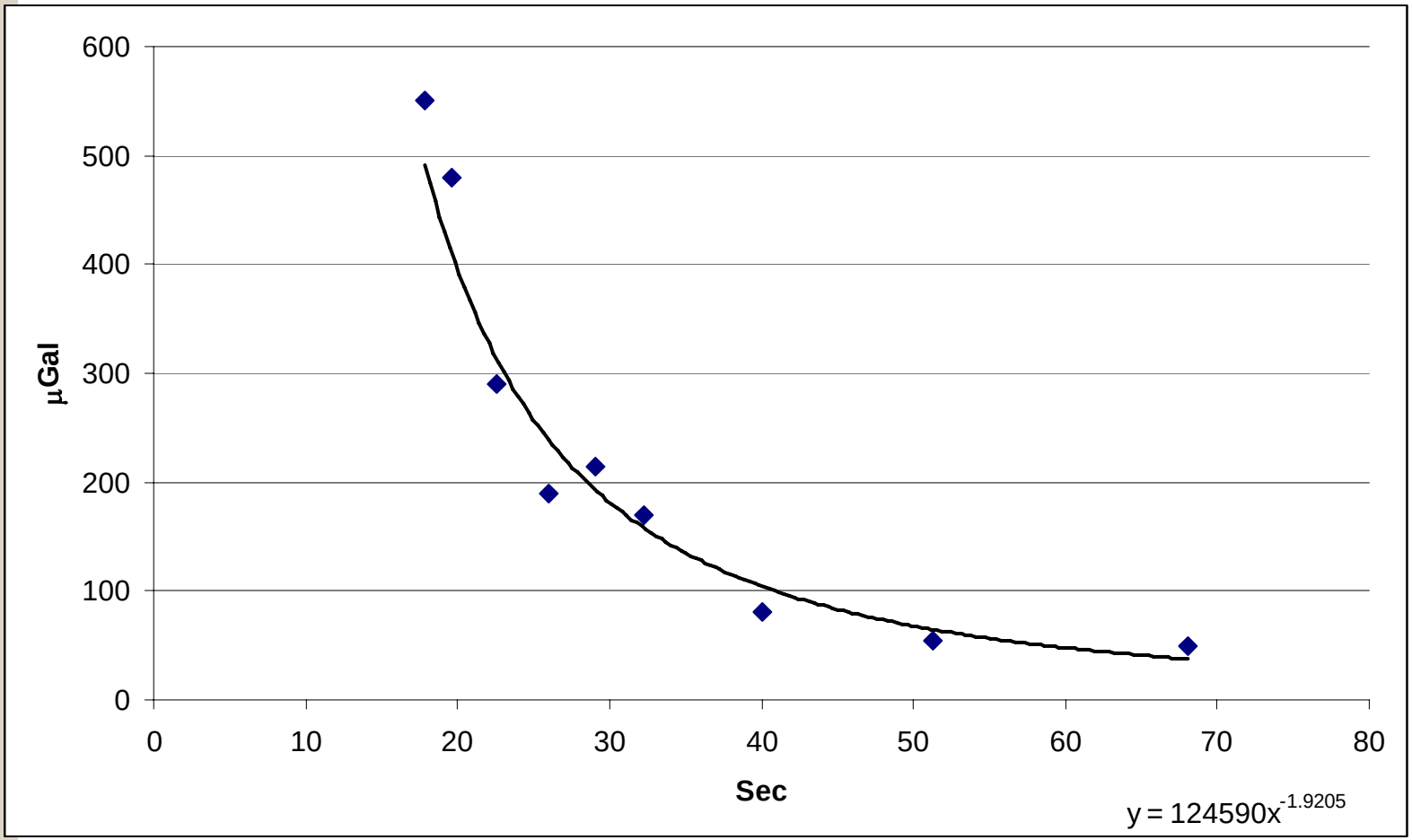
Amplitude of earth-quake peaks (plotted versus period)

(4 hours of data after start of shock)



Amplitude appears to follow power law

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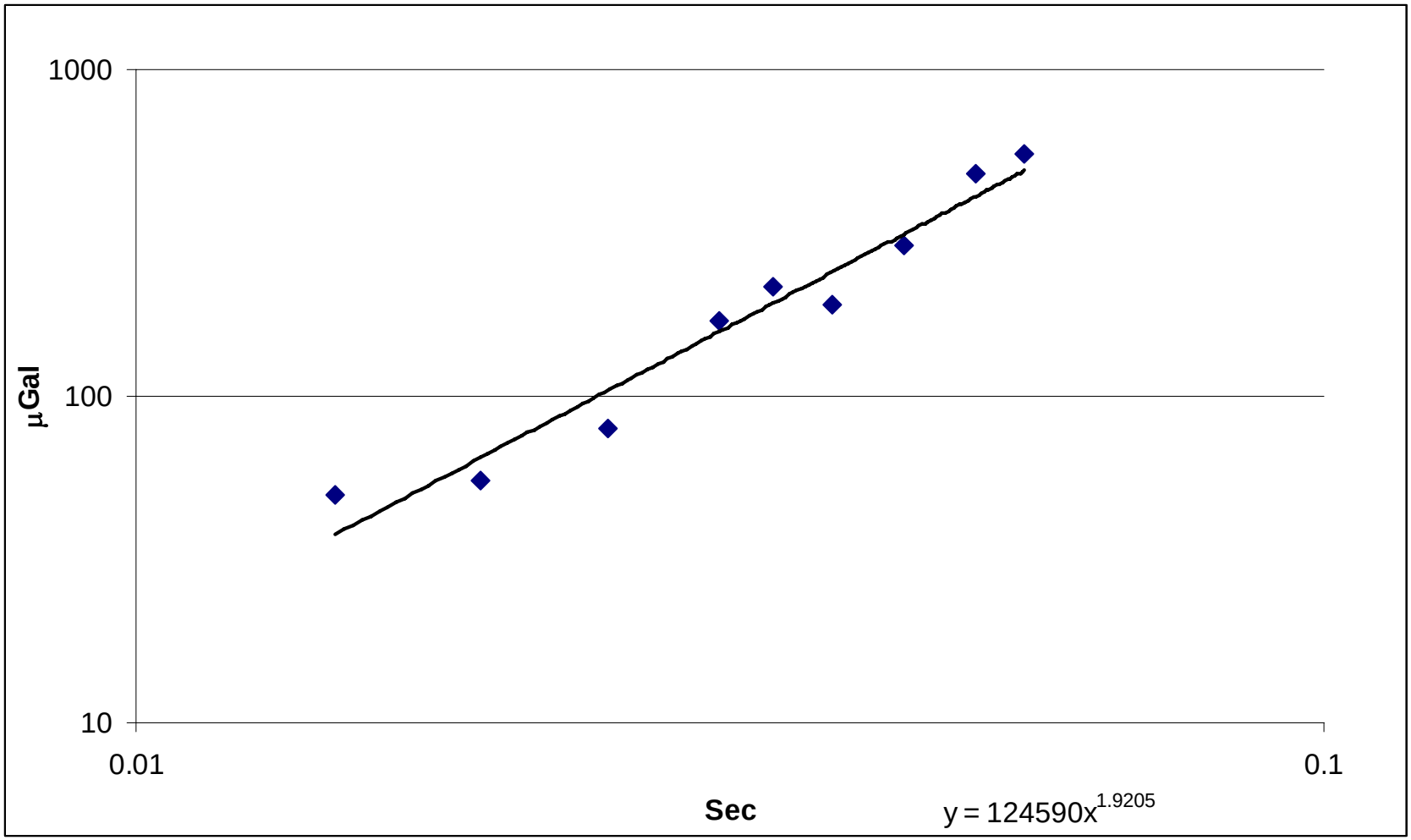
Amplitude of peaks (4 hours of data after start of shock) plotted against frequency



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Conclusions

- All five gPhones saw essentially the same earth-quake signal of 18mGal p-p
- The main differences in the signal were due to fact that time synchronization was not set (± 0.5s discrepancies between meters).
- The peaks appeared to be harmonics that roughly followed a power law in amplitude

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