

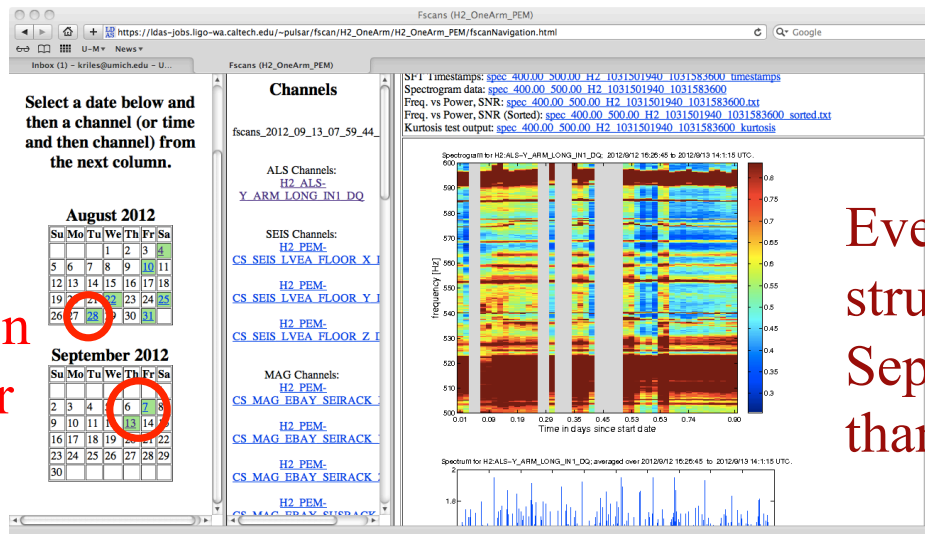
# Update on H2 OAT line studies, comparing late August 28 to September 7 and September 13 spectra

Results here based on Fscans and SFTs generated by Greg Mendell and on reports from Alberto Colla's Noemi line-finding program

Wiki page for H2 OAT line investigations:

<https://wiki.ligo.org/foswiki/bin/view/DetChar/OneArmTestLineInvestigations>

Fscan navigation calendar



Even "richer" structure in Sept 13 data than before

Keith Riles – U. Michigan – October 12, 2012 – Report for LHO alog

## Reminder of combs found in August 28 data (0-1000 Hz)

Combs marked on spectra: (digits after decimal depend on width and maximum harmonic)

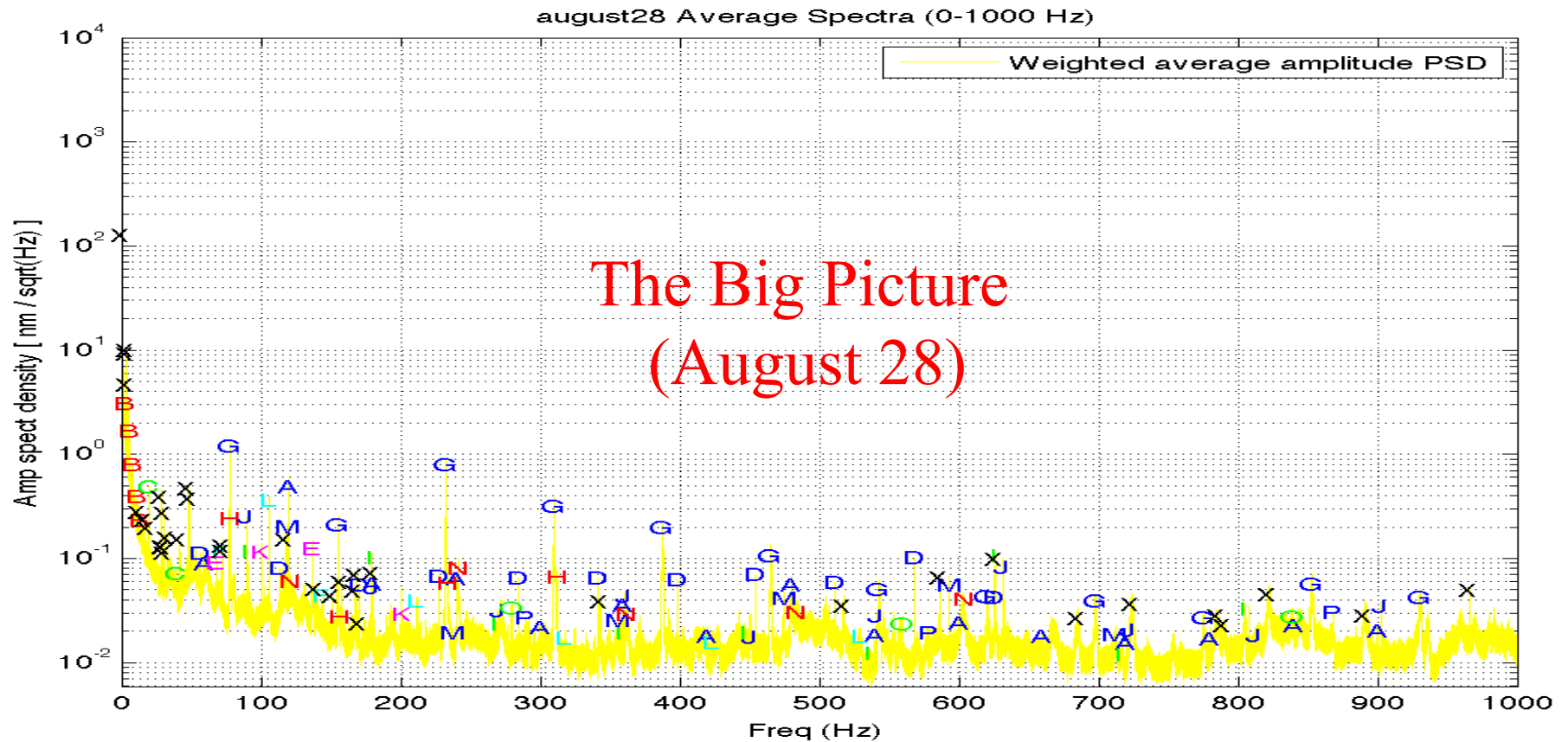
A – 60.0 Hz	(up to 15th harmonic at 900 Hz)
B – 2.745 Hz	(up to 5th harmonic at 13.725 Hz)
C – 19.62 Hz	(up to 2nd harmonic at 39.24 Hz)
D – 56.84065 Hz	(up to 11th harmonic at 625.2472 Hz)
E – 68.59 Hz	(up to 2 <sup>nd</sup> harmonic at 137.18 Hz)
F – 72.09 Hz	(up to 2 <sup>nd</sup> harmonic at 144.18 Hz)
G – 77.54 Hz	(up to 12 <sup>th</sup> harmonic at 930.48 Hz)
H – 78.00 Hz	(up to 4 <sup>th</sup> harmonic at 312.00 Hz)
I – 89.415 Hz	(up to 9 <sup>th</sup> harmonic at 804.735 Hz)
J – 90.29 Hz	(up to 10 <sup>th</sup> harmonic at 902.90 Hz)
K – 100.678 Hz	(up to 2 <sup>nd</sup> harmonic at 201.356 Hz)
L – 105.91 Hz	(up to 5 <sup>th</sup> harmonic at 529.55 Hz)
M – 118.59 Hz	(up to 6 <sup>th</sup> harmonic at 711.54 Hz)
N – 120.7 Hz	(up to 5 <sup>th</sup> harmonic at 603.5 Hz)
O – 279.60 Hz	(up to 3 <sup>rd</sup> harmonic at 838.80 Hz)
P – 289.48 Hz	(up to 3 <sup>rd</sup> harmonic at 868.44 Hz)

No new combs spotted in Sept 7 data

One new comb in Sept 13 data: 356.8 Hz (up to 2<sup>nd</sup> harmonic at 713.6 Hz)

Other (single) lines from August 28 (marked with black 'x' in spectra):

0.45, 3.938, 4.012, 4.294, 12.08, 16.36, 18.83, 28.28, 29.625, 29.78, 30.18, 30.86, 32.73, 41.88, 48.02, 49.01, 72.37, 117.455, 138.9, 151.02, 157.75, 167.018, 167.80, 170.93, 179.73, 343.05, 517.5, 586.3, 625.9, 685.0, 724.2, 785.1, 789.9, 822.5, 891.2, 966.291 Hz



New single lines from Sept 7 (marked with magenta 'Y' in spectra):

1.025, 35.260, 47.95, 48.95, 58.66, 58.83, 78.8, 178.7, 238.5, 477.2,  
484.1, 486.7, 553.0, 585.7, 596.1, 625.6, 631.7, 715.8, 804.4, 808.2095,  
882., 889., 893., 948., 979., 983. Hz

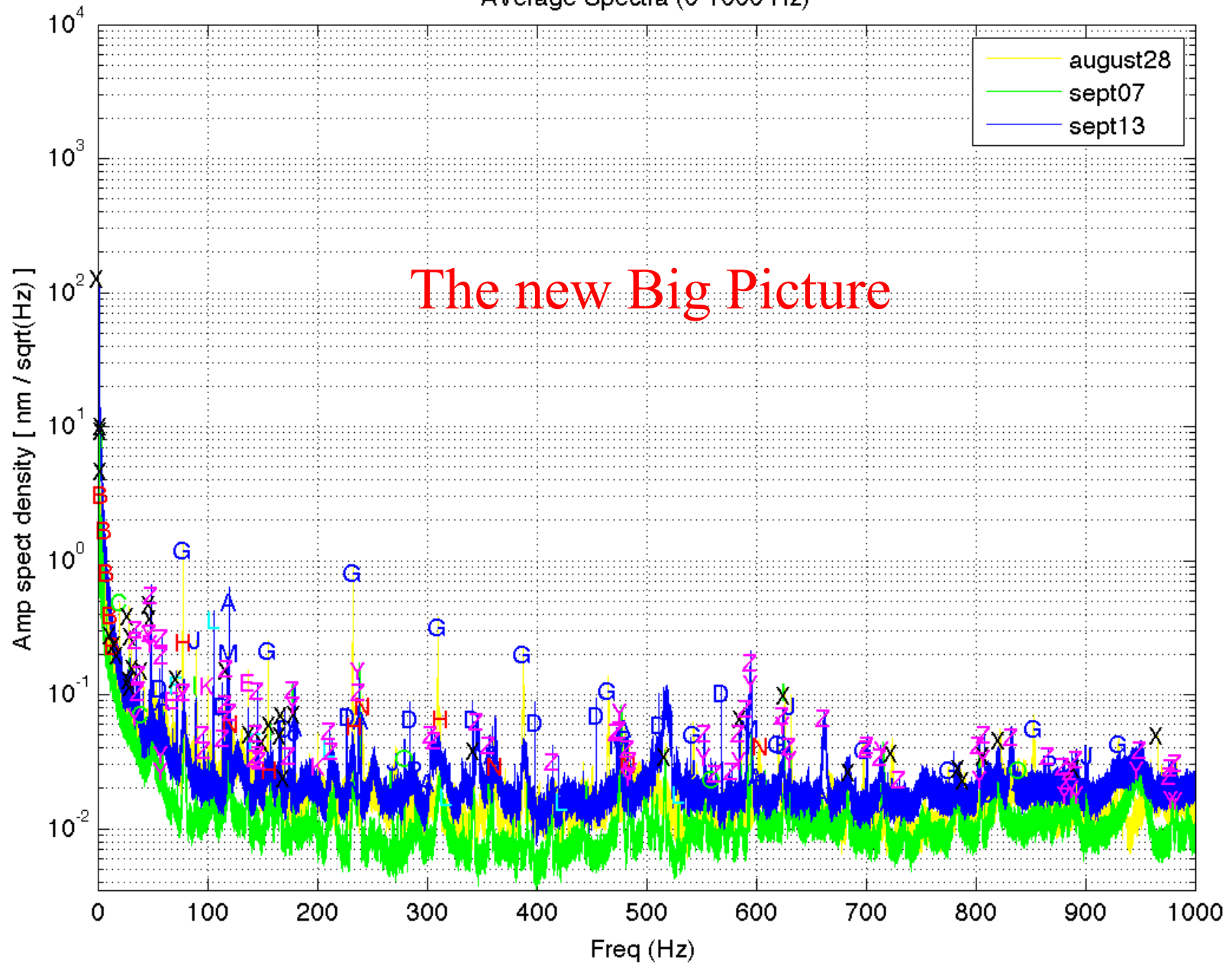
New single lines from Sept 13 (marked with magenta 'Z' in spectra):

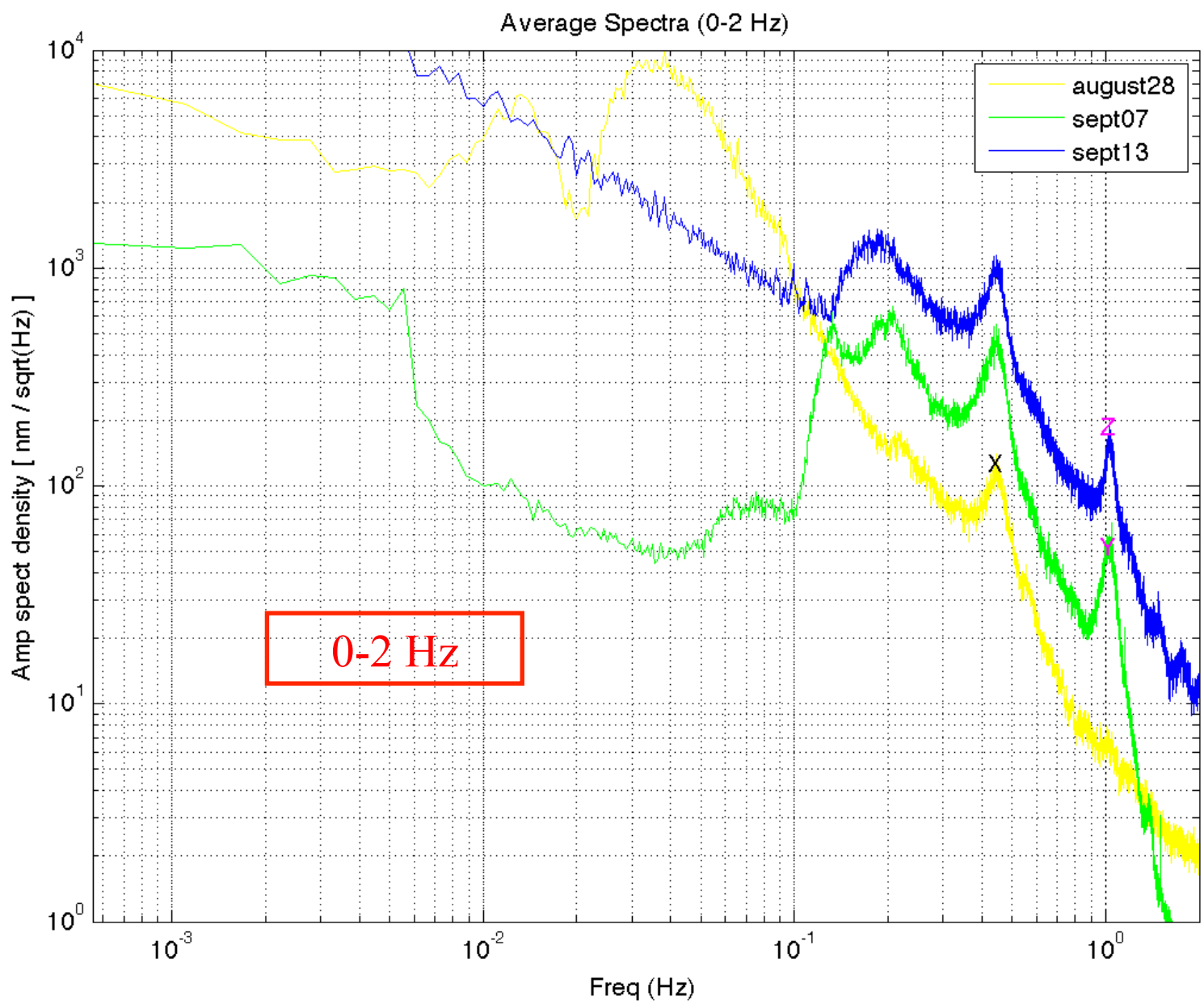
1.025, 35.208, 35.260, 36.7, 38.38, 47.8, 48.9, 58.66, 58.83, 78.8, 96.7,  
97.75, 115.0, 117.0, 118.25, 121.48, 143.9, 144.5, 145.6, 146.7, 147.7,  
174.7, 178.45, 211.1, 213.4, 238.0, 304., 306.9, 346.2, 414.5, 473.1,  
475.5, 483.1, 485.8, 522.5, 552.7, 563.2, 577.6, 584.9, 591.3, 595.2,  
624.6, 630.7, 662.3, 700.8, 701.3, 730.7, 803.2, 808.2095, 832.7, 866.4,  
880.5, 884., 887., 892., 950.5, 976.4, 978.2, 981.8 Hz

September 7 – Still using laser in optics lab as reference for ALS

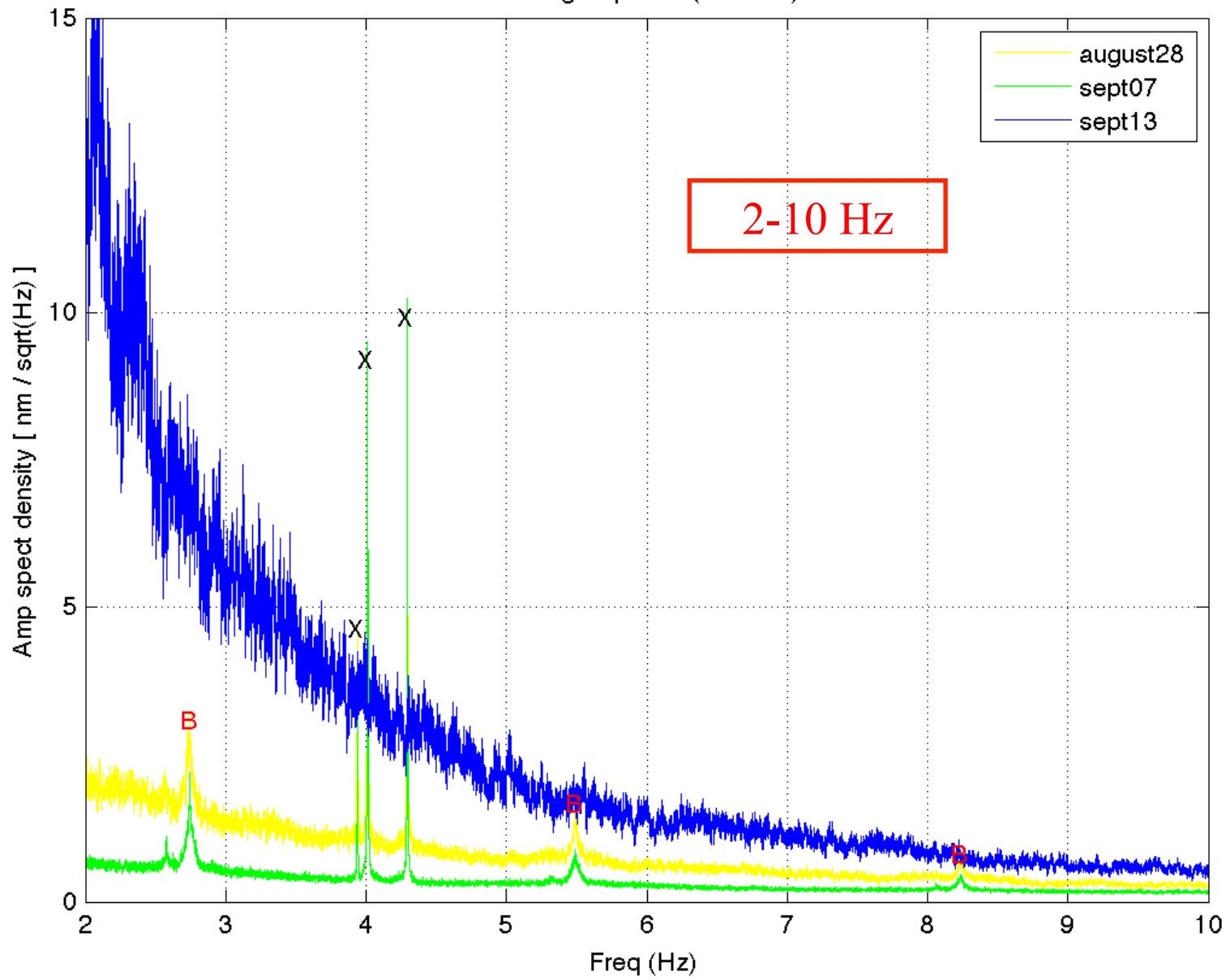
September 13 – Using aLIGO PSL as reference

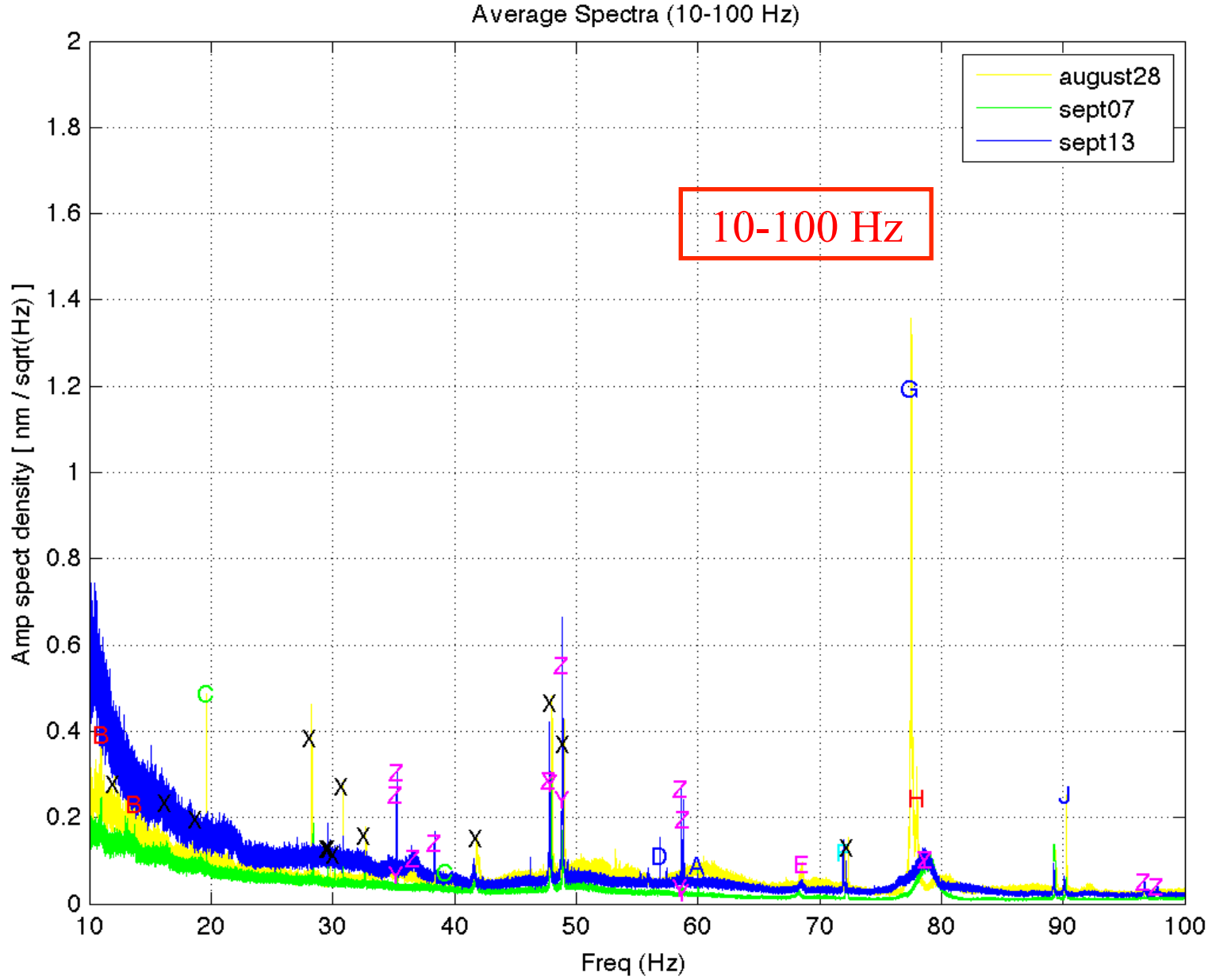
Average Spectra (0-1000 Hz)





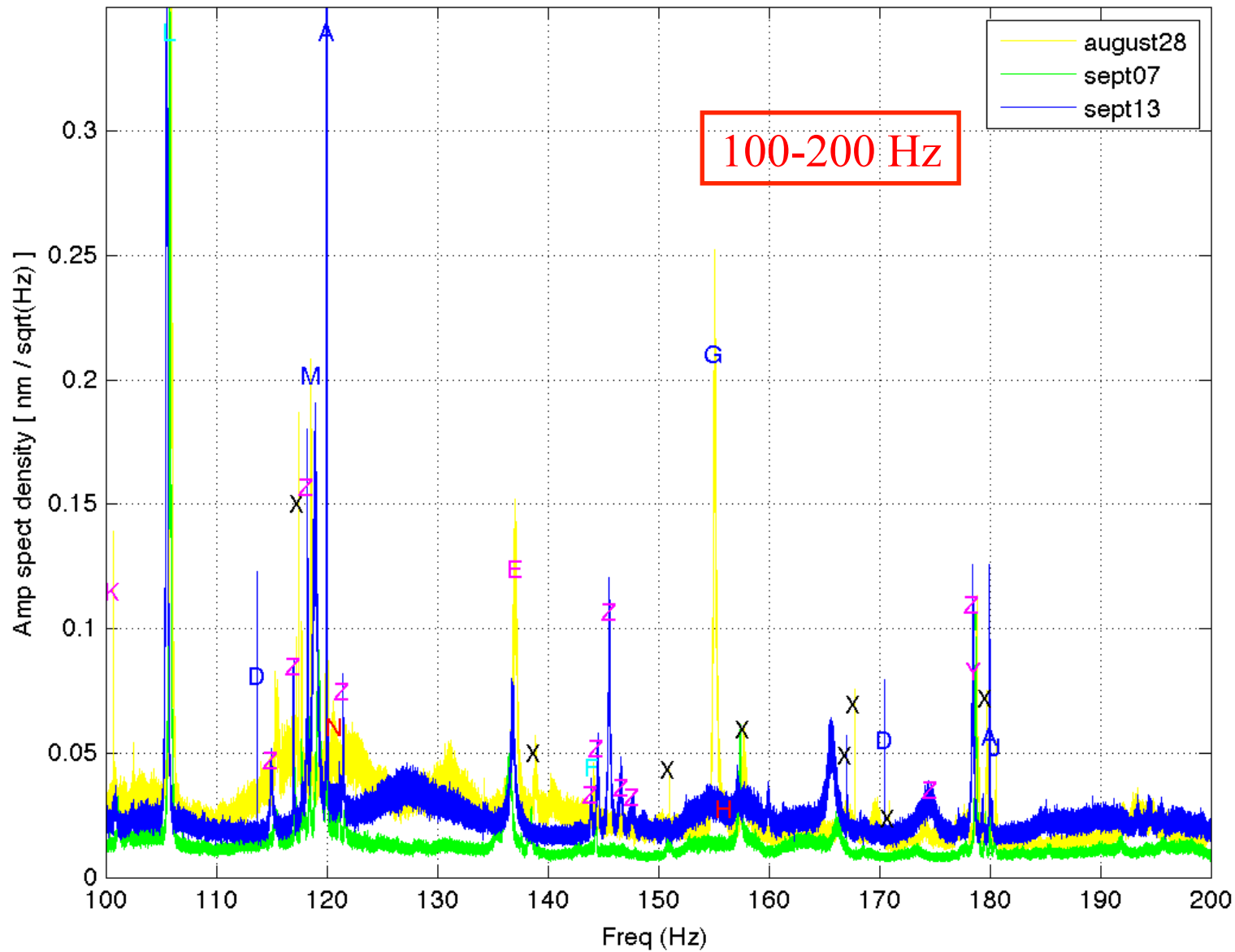
Average Spectra (2-10 Hz)



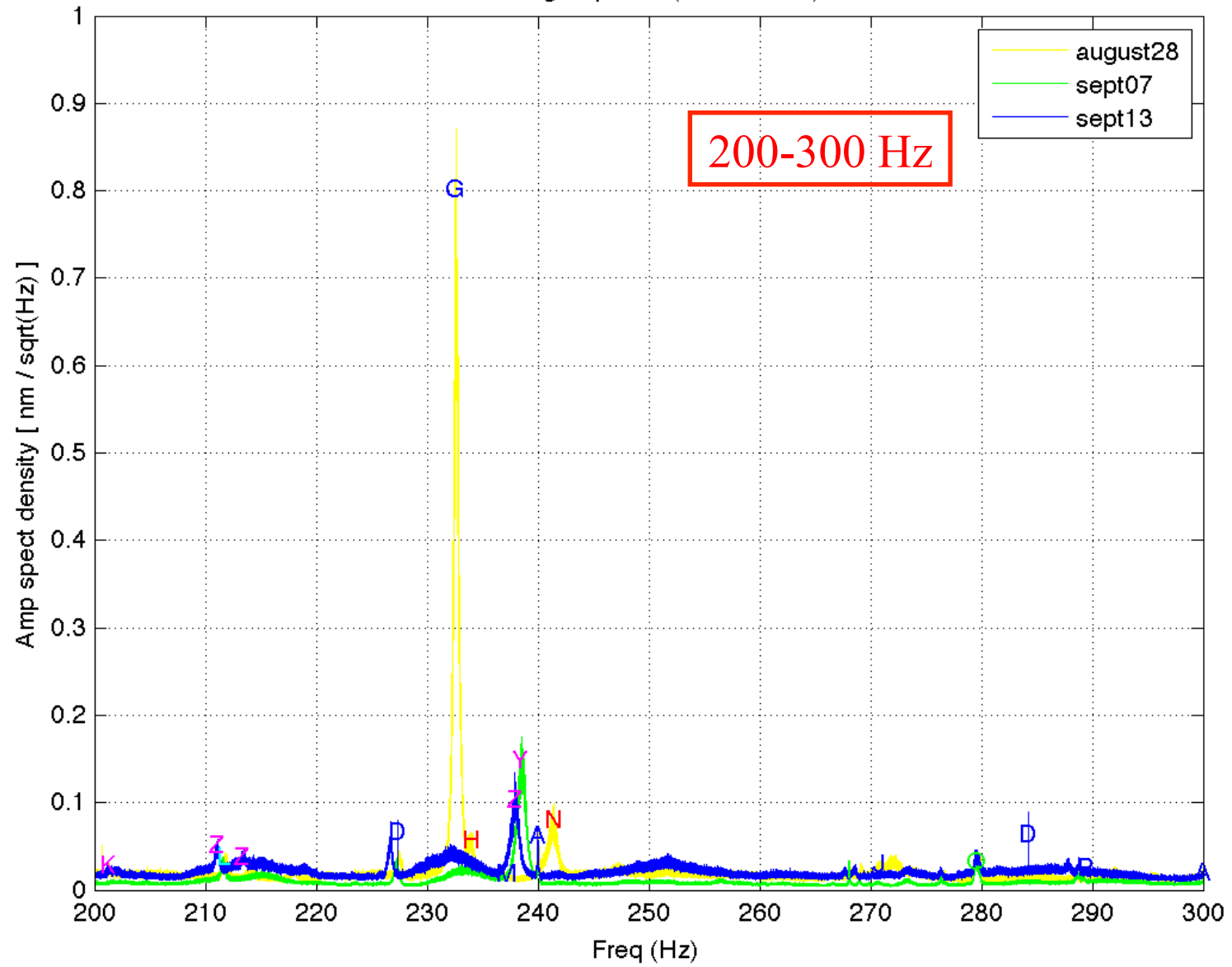




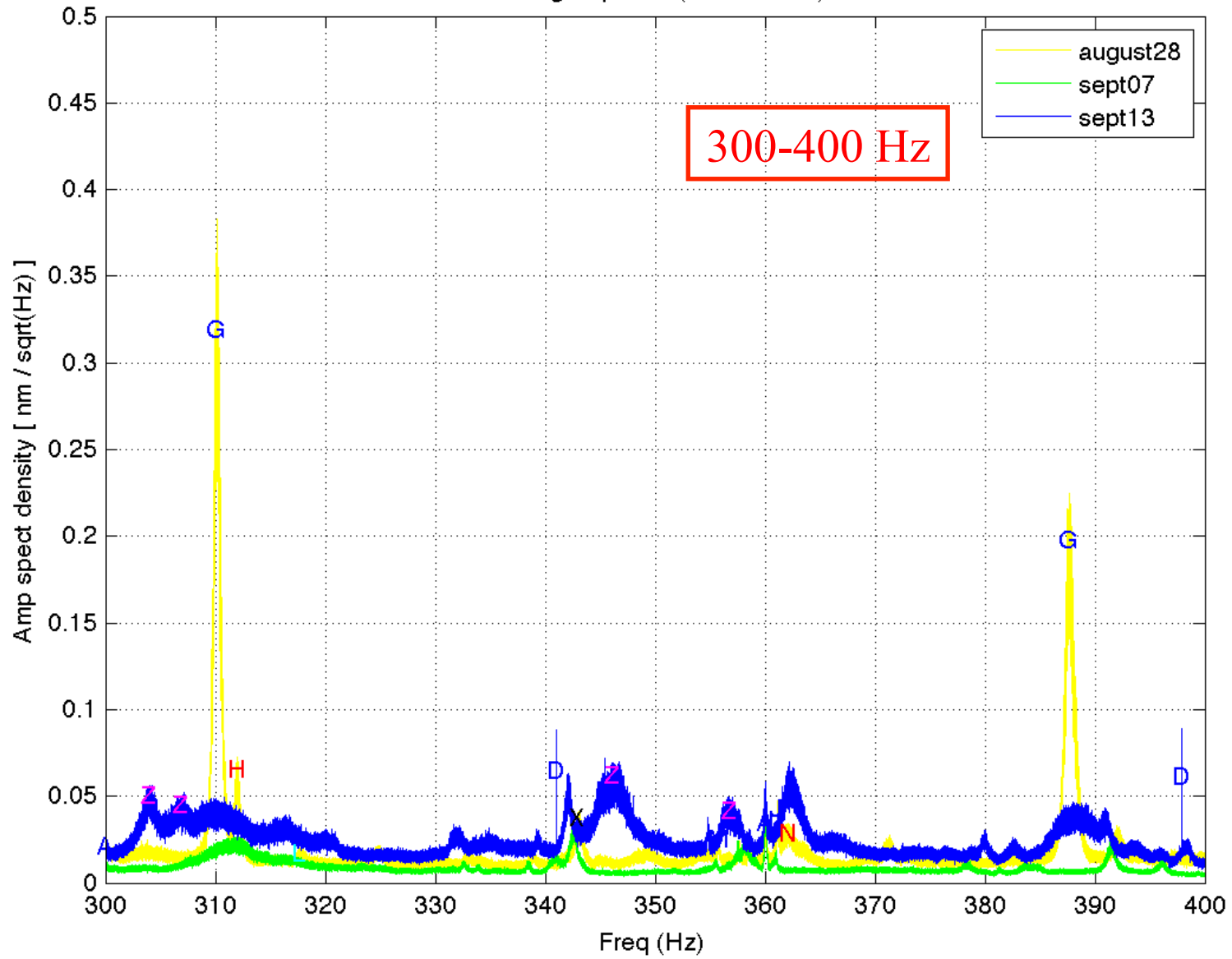
Average Spectra (100-200 Hz)



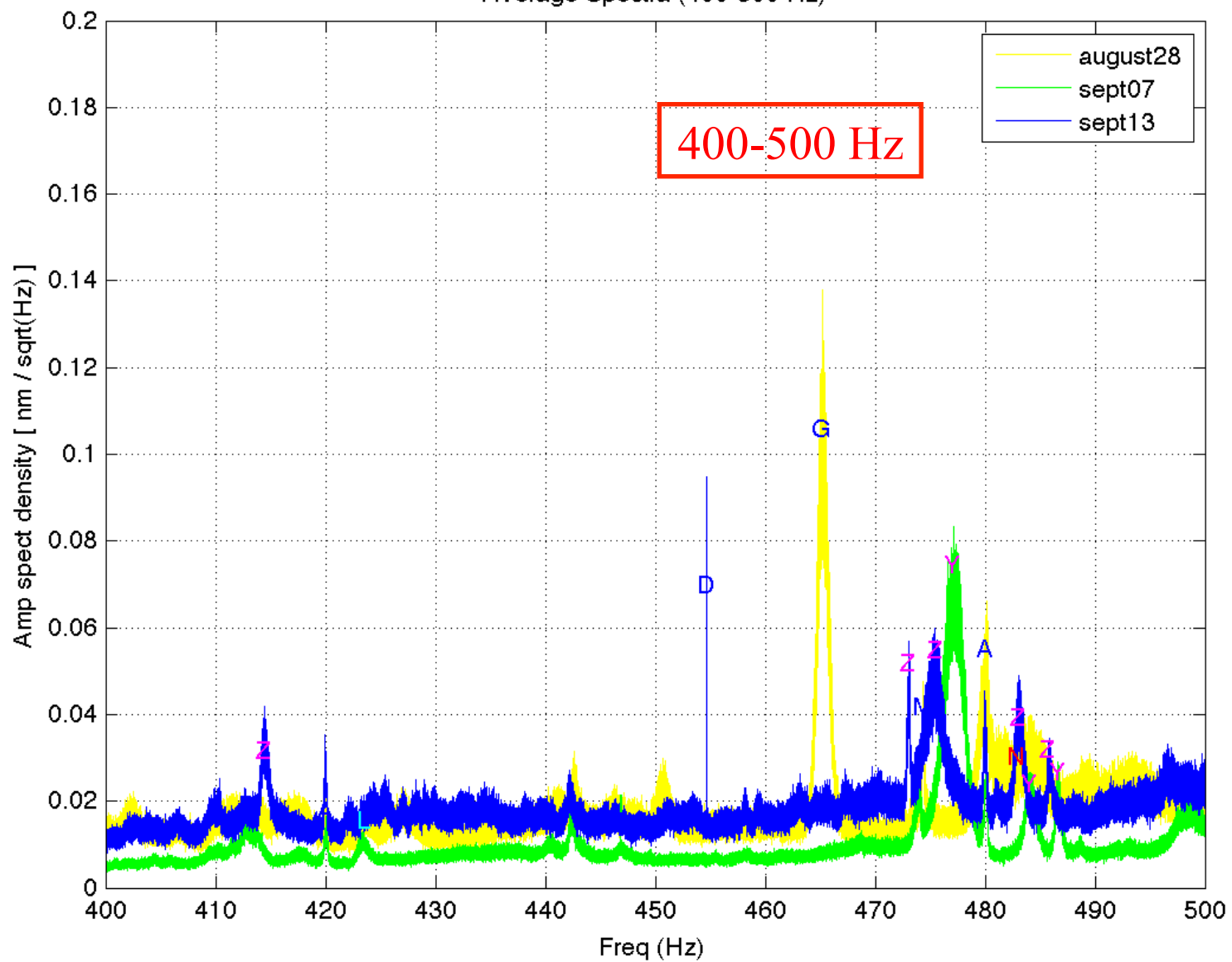
Average Spectra (200-300 Hz)



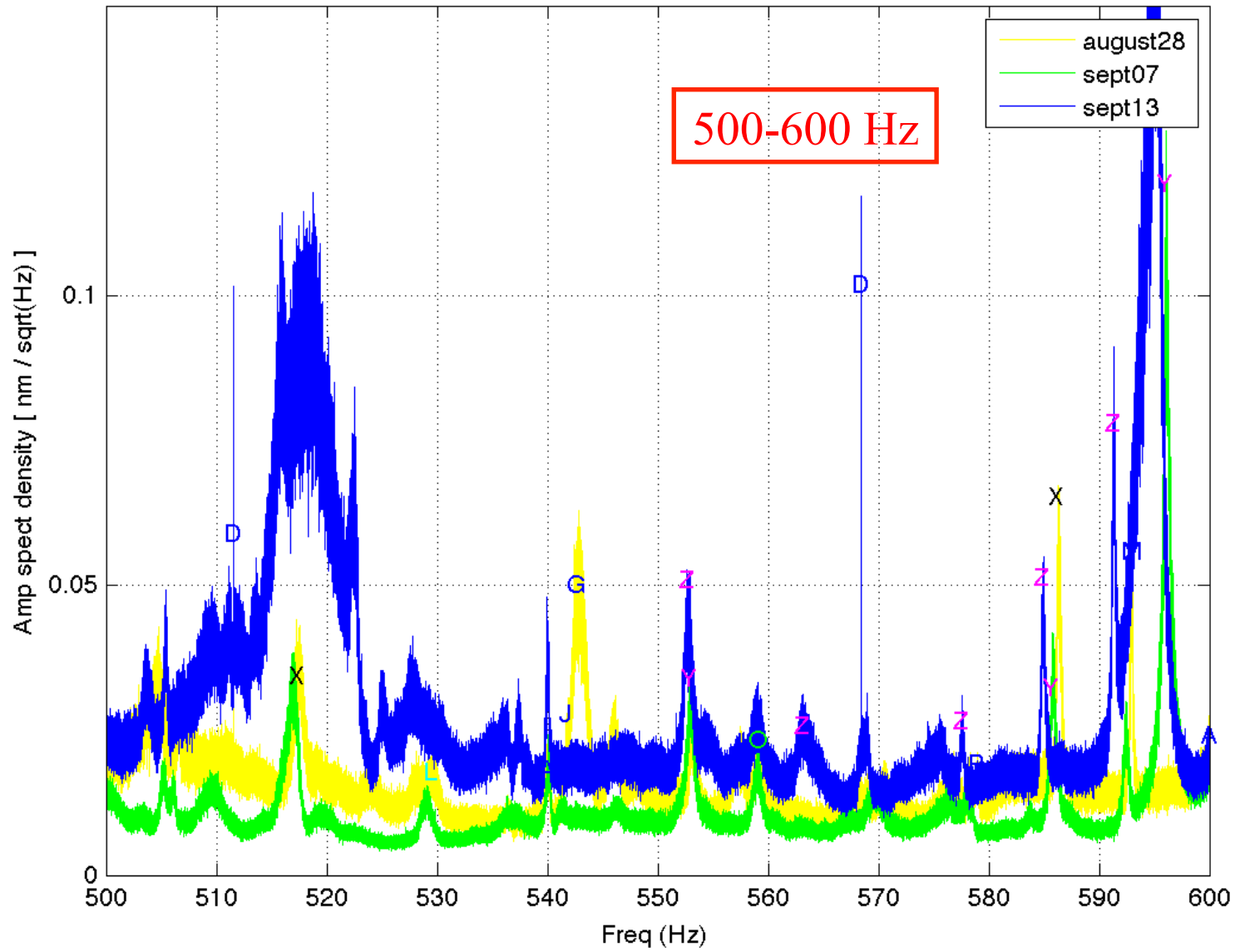
Average Spectra (300-400 Hz)



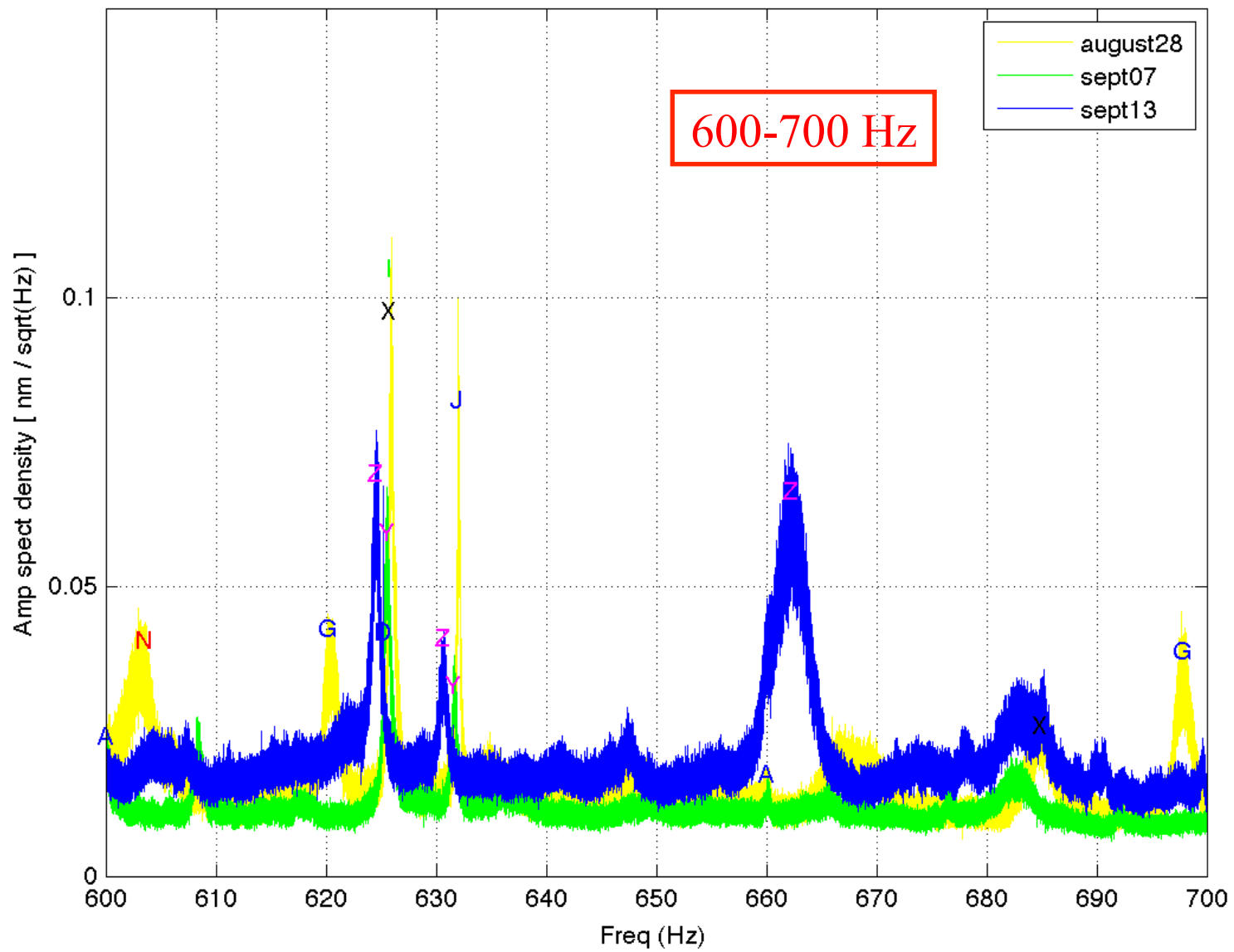
Average Spectra (400-500 Hz)



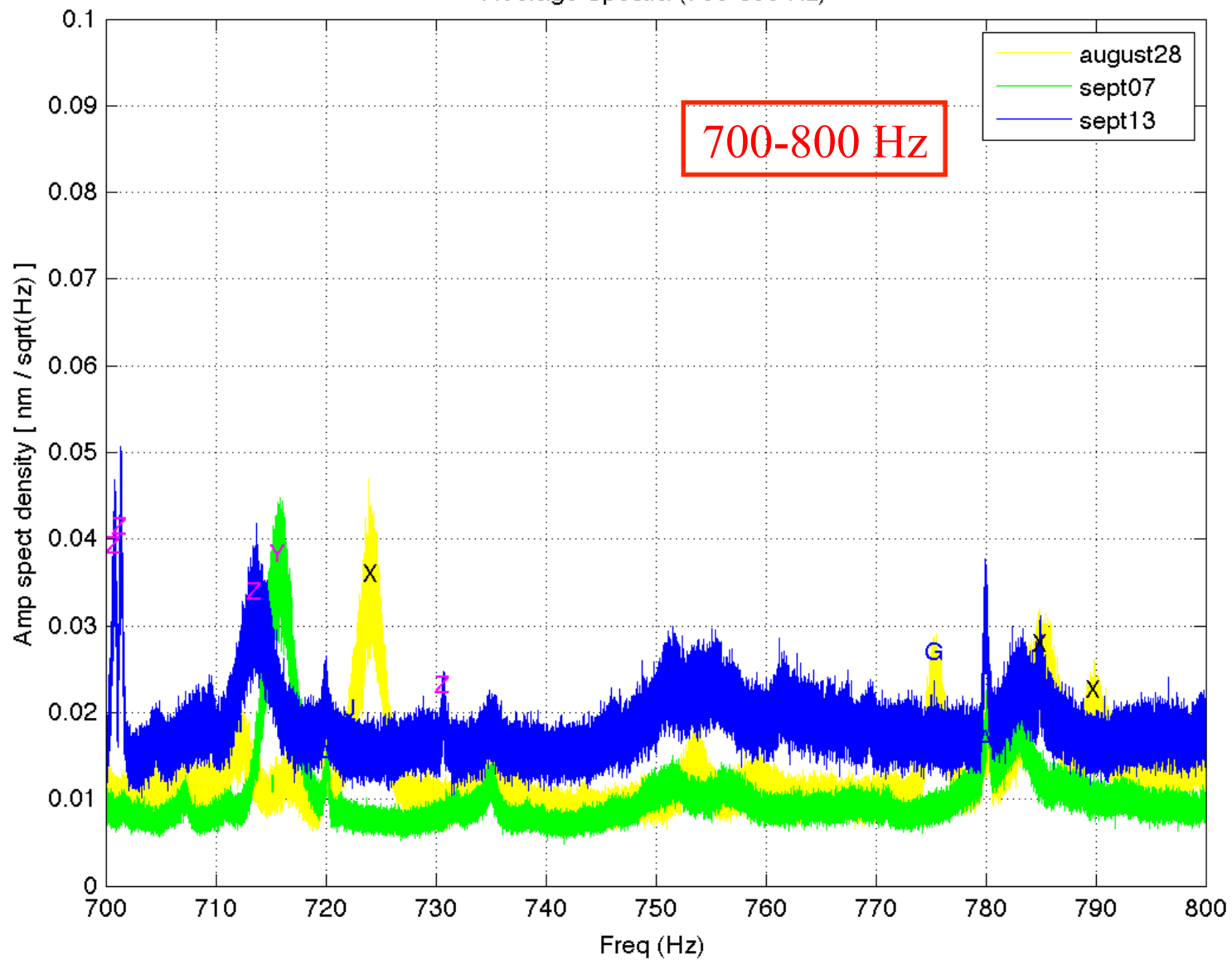
Average Spectra (500-600 Hz)



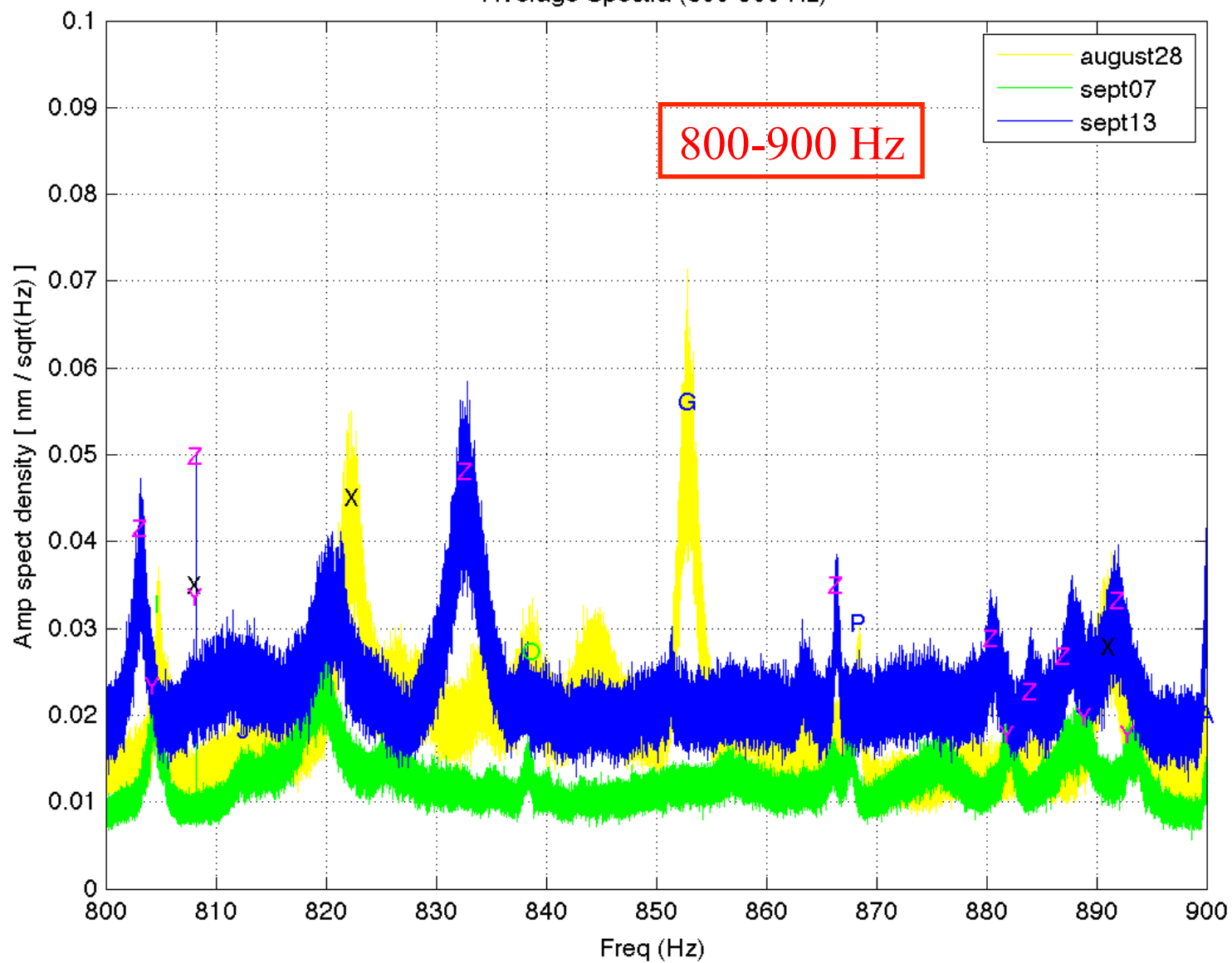
Average Spectra (600-700 Hz)



Average Spectra (700-800 Hz)

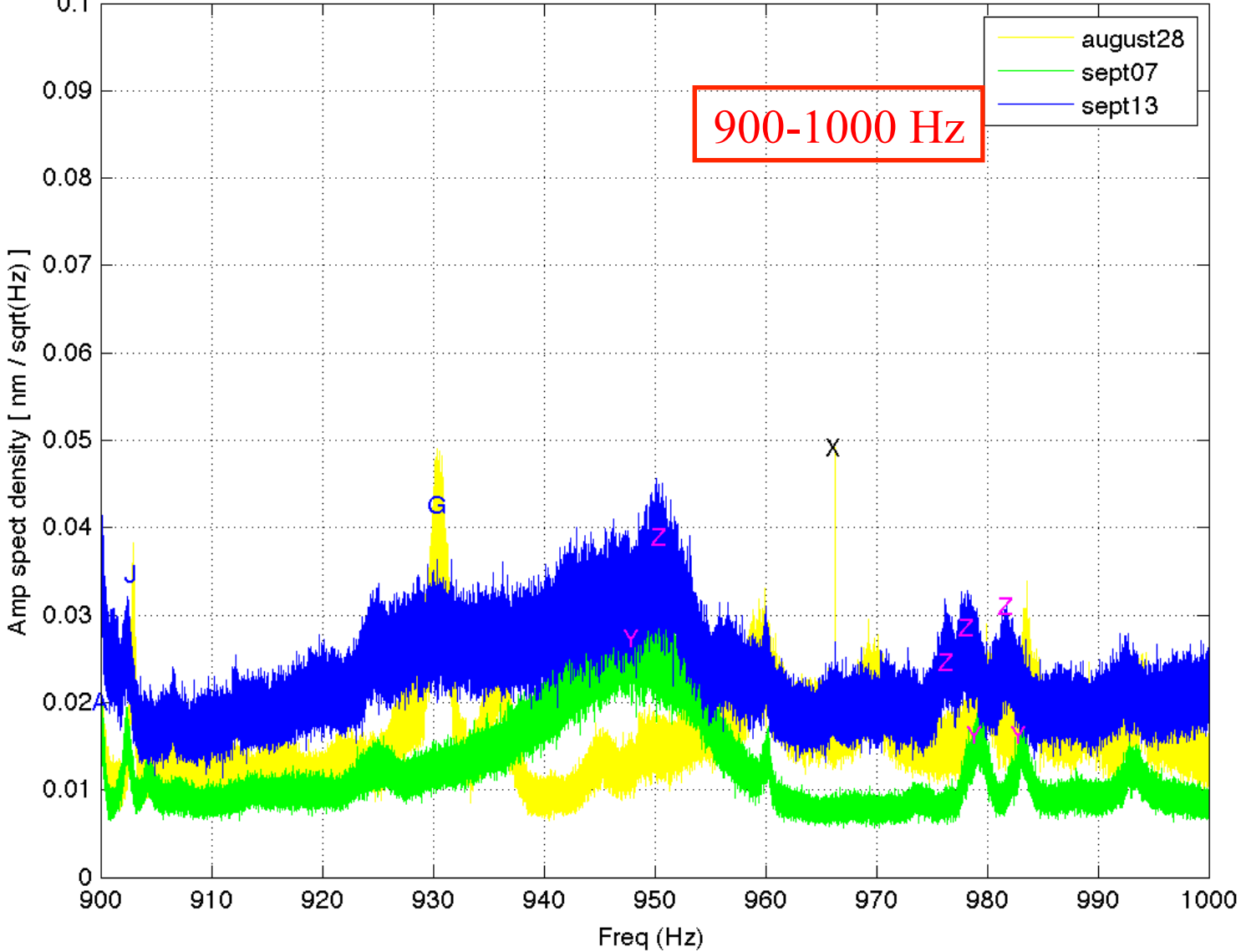


Average Spectra (800-900 Hz)





Average Spectra (900-1000 Hz)



## Information from auxiliary channels showing correlations with the new lines

(using the Virgo Noemi coincidence finder)

Noemi line summary page for primary channel:

[https://ldas-jobs.ligo-wa.caltech.edu/~pulsar/NoEMi/OAT/lines\\_page/LIGOH\\_OAT/](https://ldas-jobs.ligo-wa.caltech.edu/~pulsar/NoEMi/OAT/lines_page/LIGOH_OAT/)

Noemi index page for viewing all channels by date:

[https://ldas-jobs.ligo-wa.caltech.edu/~keithr/noemi\\_peakmap\\_daZ\\_select.html](https://ldas-jobs.ligo-wa.caltech.edu/~keithr/noemi_peakmap_daZ_select.html)

### New September 7 lines:

Z – 1.025 Hz	Correlations with EY seis channels (& OSEM / Oplev channels)
Z – 35.260 Hz	?
Z – 47.95 Hz	Correlations with LVEA mag channels
Z – 48.95 Hz	Correlations with LVEA mag channels
Z – 58.66 Hz	Correlations with LVEA & EY seis / accel / mag channels
Z – 58.83 Hz	Correlations with LVEA & EY seis / accel / mag channels
Z – 78.8 Hz	?
Z – 178.7 Hz	?
Z – 238.5 Hz	?
Z – 477.2 Hz	?
Z – 484.1 Hz	?
Z – 486.7 Hz	?

Z – 553.0 Hz ?  
Z – 585.7 Hz ?  
Z – 596.1 Hz ?  
Z – 625.6 Hz ?  
Z – 631.7 Hz ?  
Z – 715.8 Hz ?  
Z – 804.4 Hz ?  
Z – 808.2095 Hz ?  
Z – 882. Hz ?  
Z – 889. Hz ?  
Z – 893. Hz ?  
Z – 948. Hz ?  
Z – 979. Hz ?  
Z – 983. Hz ?

### **New September 13 lines:**

Z – 1.025 Hz	Correlations with EY seis channels (& OSEM / Oplev channels)
Z – 35.208 Hz	Correlations with LVEA seis / acc / mic / mag channels
Z – 36.7 Hz	?
Z – 38.38 Hz	?
Z – 47.8 Hz	Correlations with LVEA mag channels
Z – 48.9 Hz	Correlations with LVEA mag channels
Z – 58.66 Hz	Correlations with LVEA and EY seis / acc / mag channels
Z – 58.83 Hz	Correlations with LVEA and EY seis / acc / mag channels
Z – 78.8 Hz	?
Z – 96.7 Hz	?
Z – 97.75 Hz	?
Z – 115.0 Hz	?
Z – 117.0 Hz	?
Z – 118.25 Hz	?
Z – 121.48 Hz	?
Z – 143.9 Hz	?
Z – 144.5 Hz	?
Z – 145.6 Hz	?
Z – 146.7 Hz	?
Z – 147.7 Hz	?
Z – 174.7 Hz	?
Z – 178.45 Hz	?

Z – 211.1 Hz ?  
Z – 213.4 Hz ?  
Z – 238.0 Hz ?  
Z – 306.9 Hz ?  
Z – 346.2 Hz ?  
Z – 414.5 Hz ?  
Z – 473.1 Hz ?  
Z – 475.5 Hz ?  
Z – 483.1 Hz ?  
Z – 485.8 Hz ?  
Z – 522.5 Hz ?  
Z – 552.7 Hz ?  
Z – 563.2 Hz ?  
Z – 577.6 Hz ?  
Z – 584.9 Hz ?  
Z – 591.3 Hz ?  
Z – 595.2 Hz ?  
Z – 624.6 Hz ?  
Z – 630.7 Hz ?  
Z – 662.3 Hz ?  
Z – 700.8 Hz ?  
Z – 701.3 Hz ?

Z – 730.7 Hz ?  
Z – 803.2 Hz ?  
Z – 808.2095 Hz ?  
Z – 832.7 Hz ?  
Z – 866.4 Hz ?  
Z – 880.5 Hz ?  
Z – 884. Hz ?  
Z – 887. Hz ?  
Z – 950.5 Hz ?  
Z – 976.4 Hz ?  
Z – 978.2 Hz ?  
Z – 981.8 Hz ?

## Comments on Sept 7 spectrum:

- Noise floor is generally lower than for Aug 28,
- Some Aug 28 combs no longer visible
- Some Aug 28 combs have moved (and move again by Sept 13)

## Aug 28 combs not visible on Sept 7:

D – 56.84065 Hz	(up to 11th harmonic – Aug 13) – But reappears Sept 13!
G – 77.54 Hz	(up to 12 <sup>th</sup> harmonic – Aug 13)
H – 78.00 Hz	(up to 4 <sup>th</sup> harmonic – Aug 13)
K – 100.678 Hz	(up to 2 <sup>nd</sup> harmonic – Aug 13)
N – 120.7 Hz	(up to 5 <sup>th</sup> harmonic – Aug 13)

Aug 28 combs that moved by Sept 7 and moved again by Sept 13:

E – 68.59 Hz	→ 68.25 Hz	→ 68.50 Hz	(up to 2 <sup>nd</sup> harmonic)
F – 72.09 Hz	→ 72.16 Hz	→ 71.95 Hz	(up to 2 <sup>nd</sup> harmonic)
I – 89.415 Hz	→ 89.378 Hz	→ 89.239 Hz	(up to 9 <sup>th</sup> harmonic)
J – 90.29 Hz	→ 90.24 Hz	→ 90.11 Hz	(up to 10 <sup>th</sup> harmonic)
L – 105.91 Hz	→ 105.82 Hz	→ 105.55 Hz	(up to 5 <sup>th</sup> harmonic)
M – 118.59 Hz	→ 118.48 Hz	→ 118.26 Hz	(up to 6 <sup>th</sup> harmonic)
P – 289.48 Hz	→ 289.23 Hz	→ 288.80 Hz	(up to 3 <sup>rd</sup> harmonic)



## Comments on Sept 13 spectrum:

- Noise floor is generally higher than for Aug 28,
- Many more lines, some quite loud
- Odd new structure in 144-148 Hz range:

