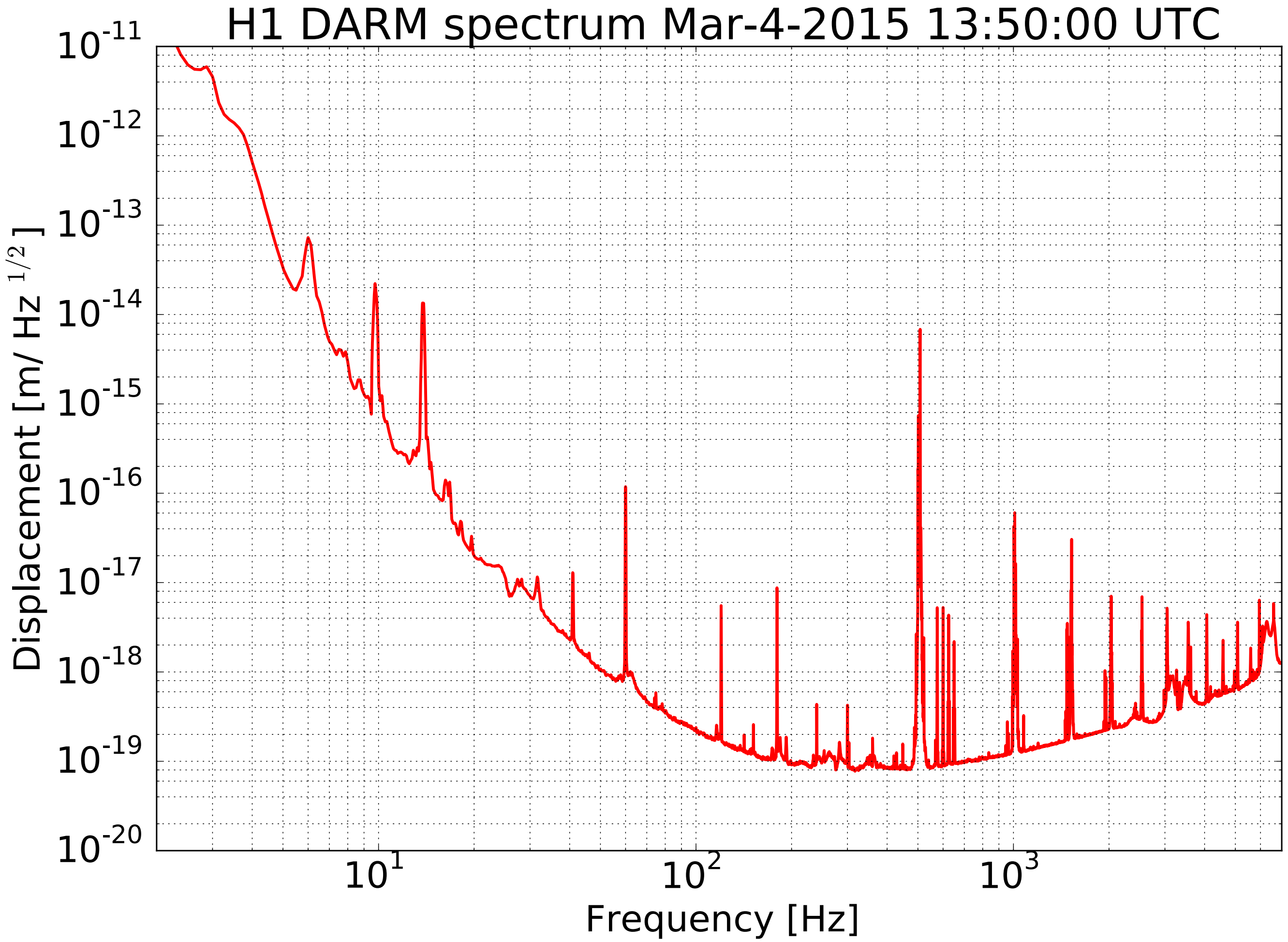
aLOG Review (LHO)
Apr 06 - 19, 2015

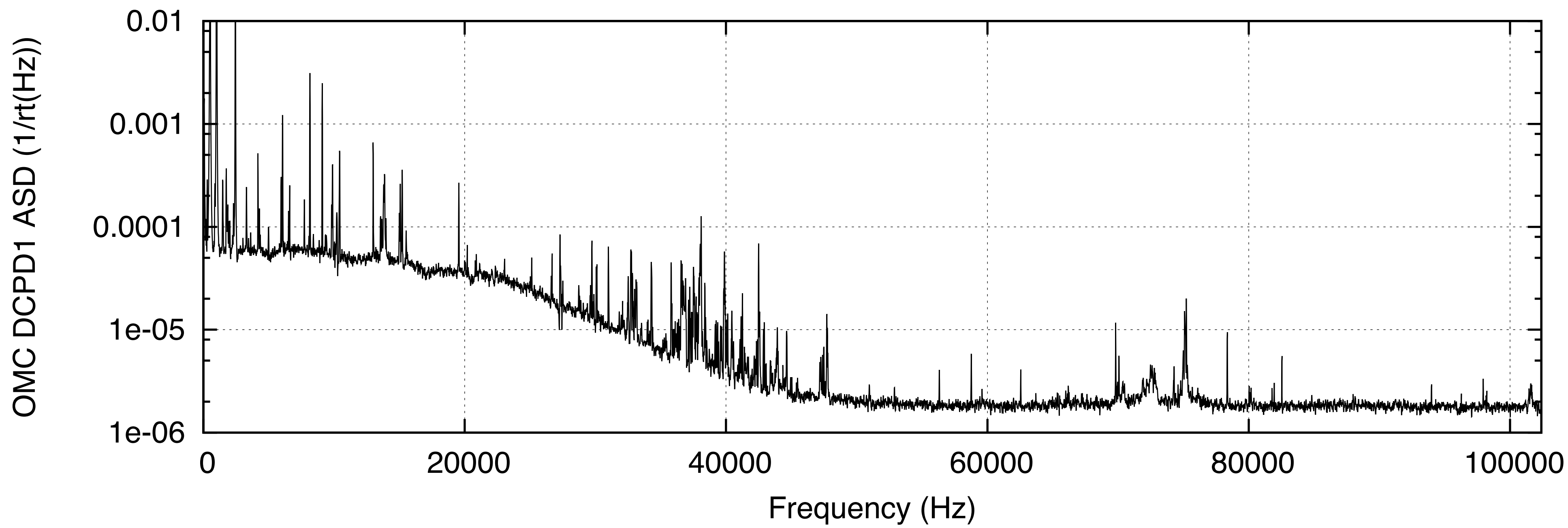


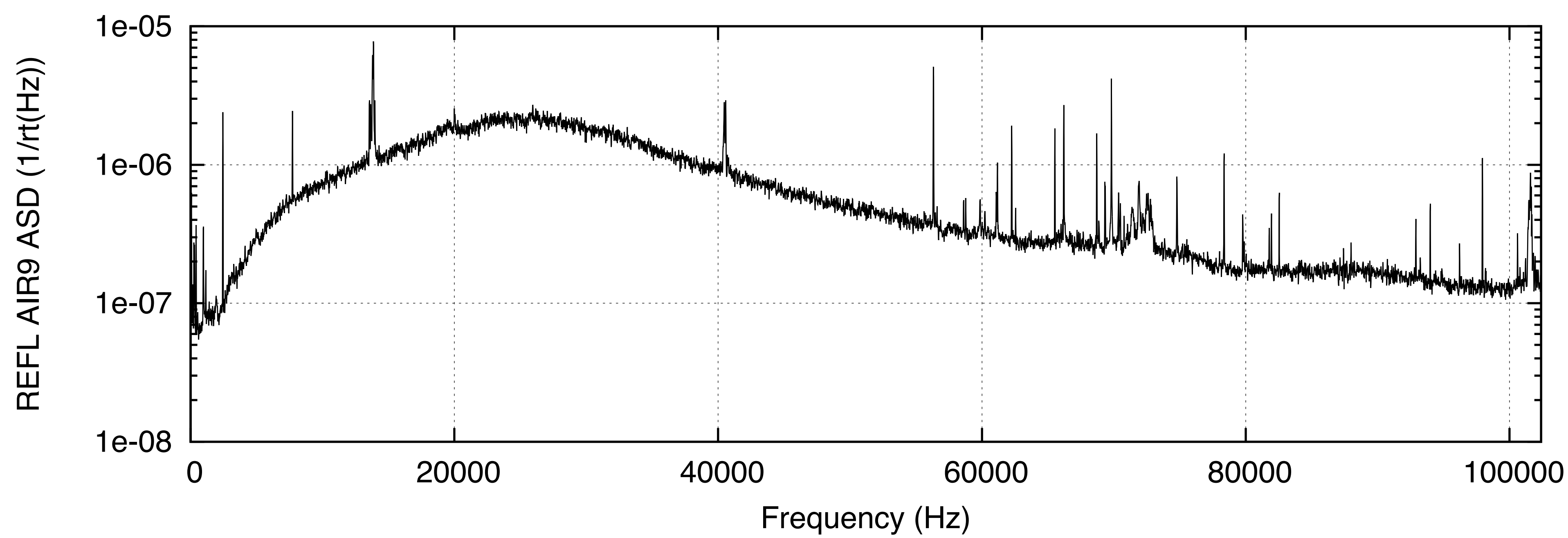
SangHoon Oh

KAGRA DetChar Telecon
Apr 21, 2015

Coherence with REFL AIR9 and OMC DCPD1 [aLog17711]

ASD during the lock around 00:43:42 Tue 07 Apr 2015 (UTC)





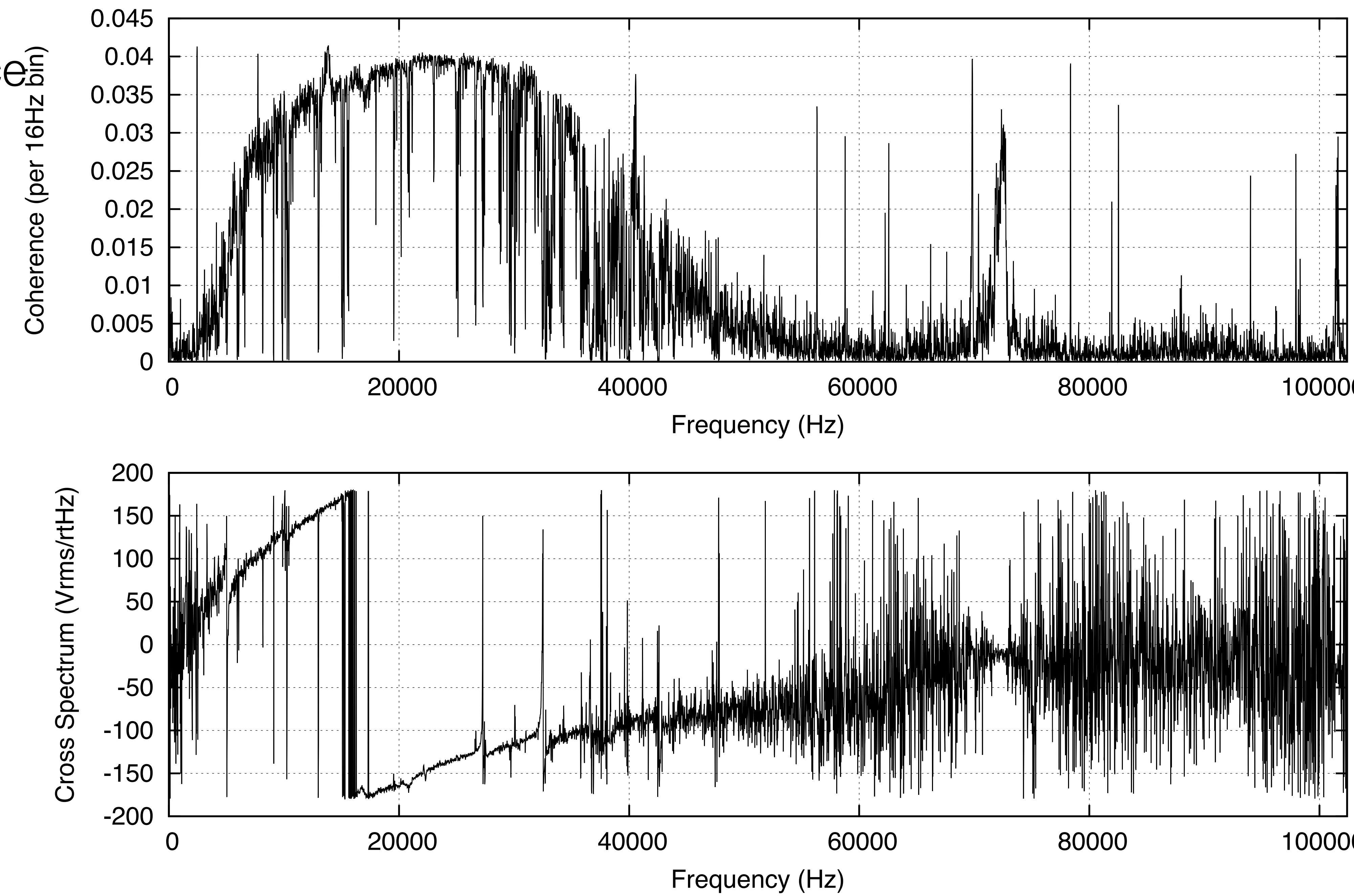
Reports until 08:43,
Thursday 09 April 2015

Coherence with REFL AIR9 and OMC DCPD1 [aLog17711]

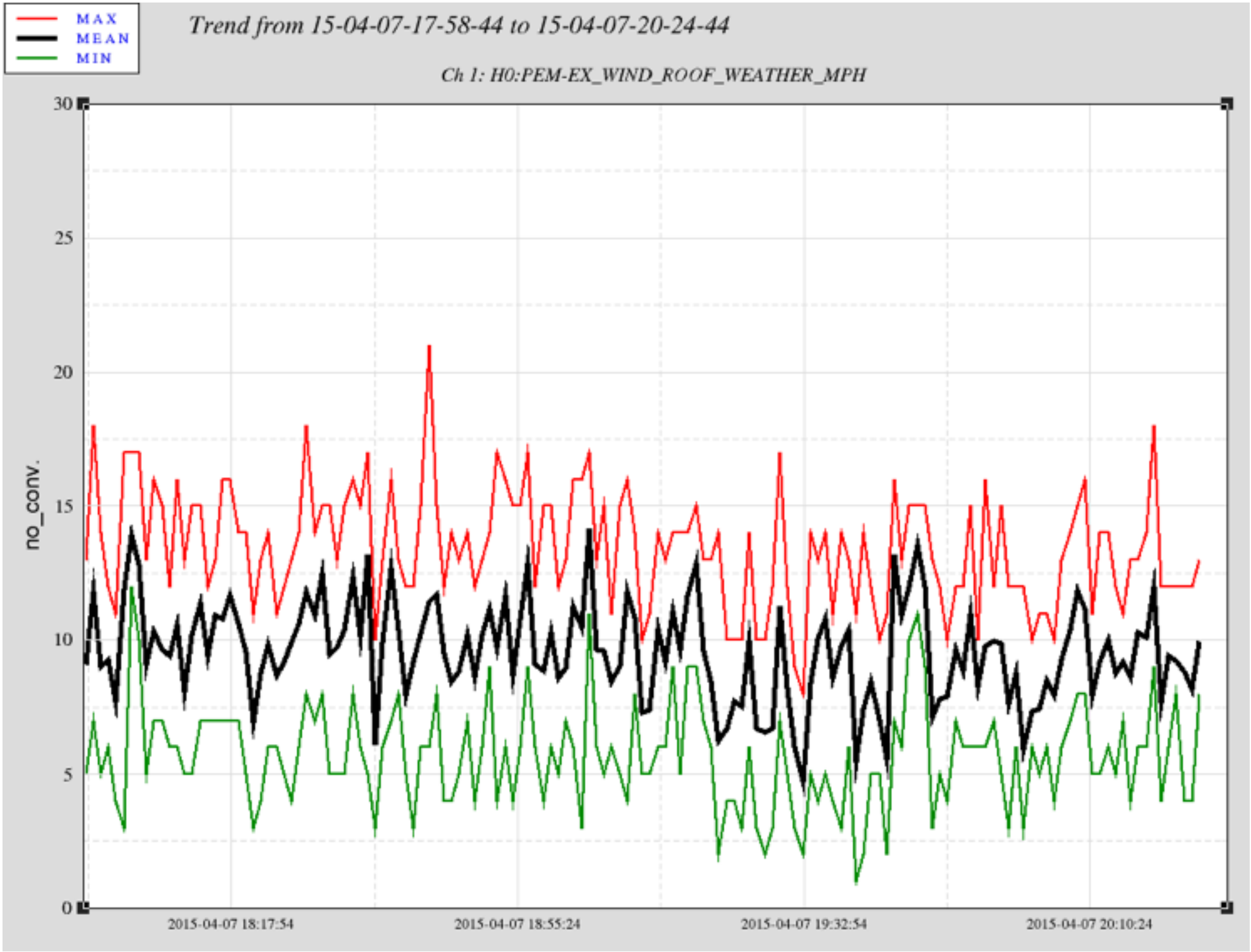
Coherence/Cross spectrum during the lock

the peak coherence

- ~ 0.04 Hz
- over a 16Hz bin
- or 0.64 over the whole bin



H1 ISI ETMX Configuration Comparison with Wind at 10-20 [mph] [aLog17729] by J. Kissel & J. Warner



Reports until 17:40, Tuesday 07 April 2015

H1 ISI ETMX Configuration Comparison with Wind at 10-20 [mph] [aLog17729]

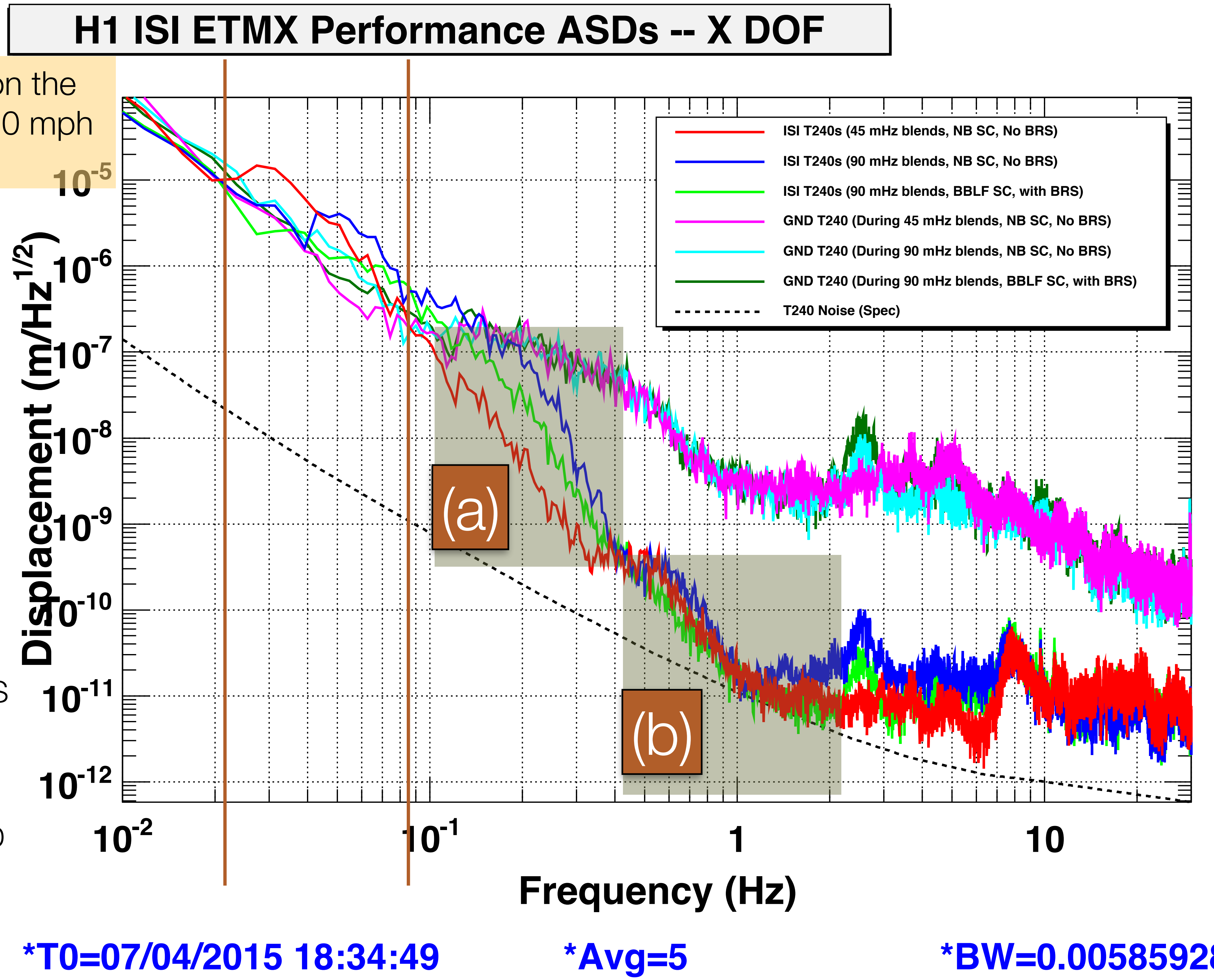
To supplement Krishna's data on the performance impact during 5-10 mph aLog16465

Configurations

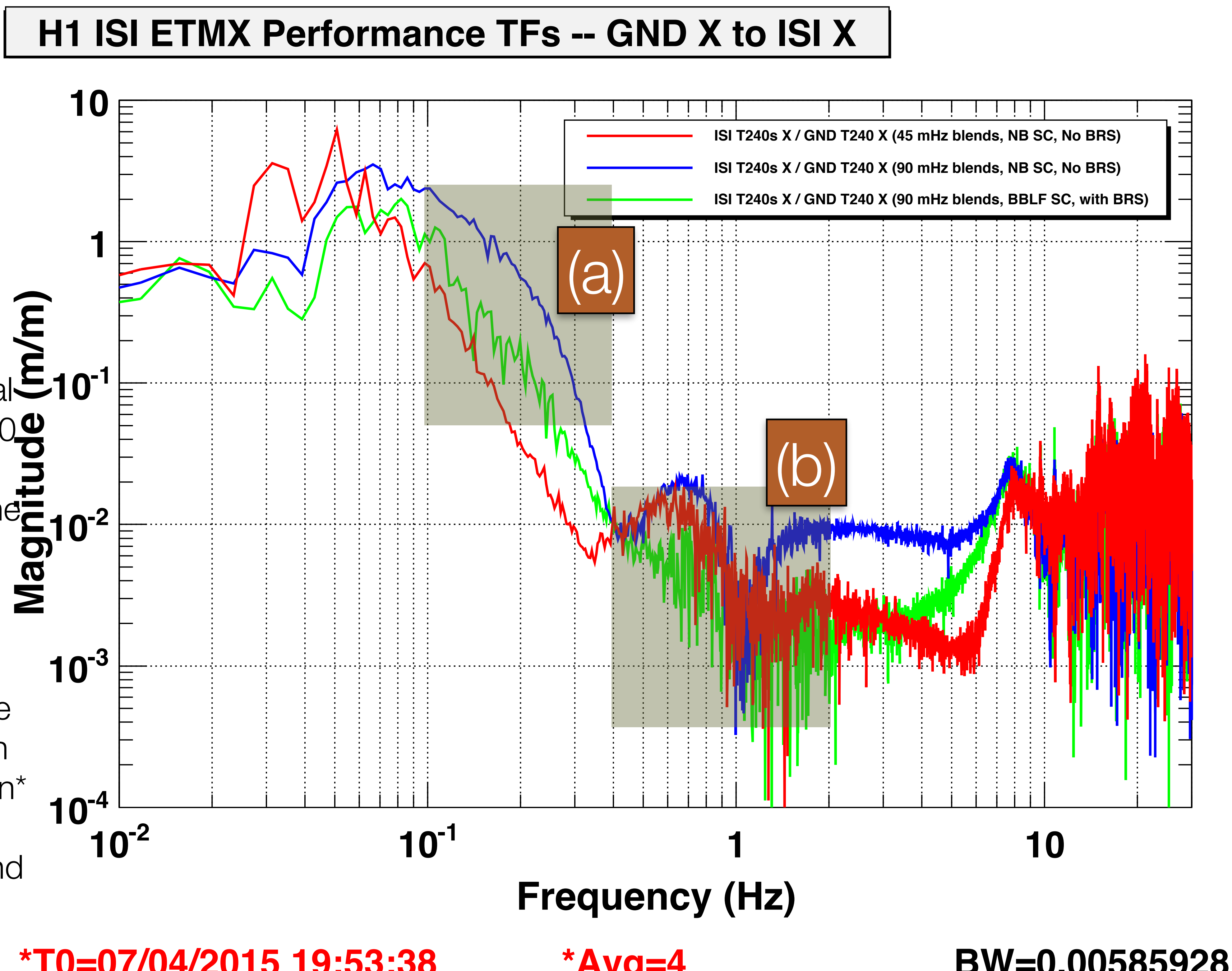
(1) Nominal -- 45 mHz blend; DeRosa's 0.43 Hz only, narrow-band, sensor correction (NB SC); GND T240 alone used for sensor correction, no BRS (Red)

(2) Windy when BRS doesn't work -- 90 mHz blend; DeRosa's 0.43 Hz only sensor correction (NB SC); GND T240 alone used for sensor correction, no BRS (Blue)

(3) Windy with a functional BRS -- 90 mHz blend; Mittleman's broad-band, low-frequency, sensor correction (BBLF SC); Tilt is subtracted from the GND T240 with the BRS, and the super sensor is used for sensor correction. (Green)



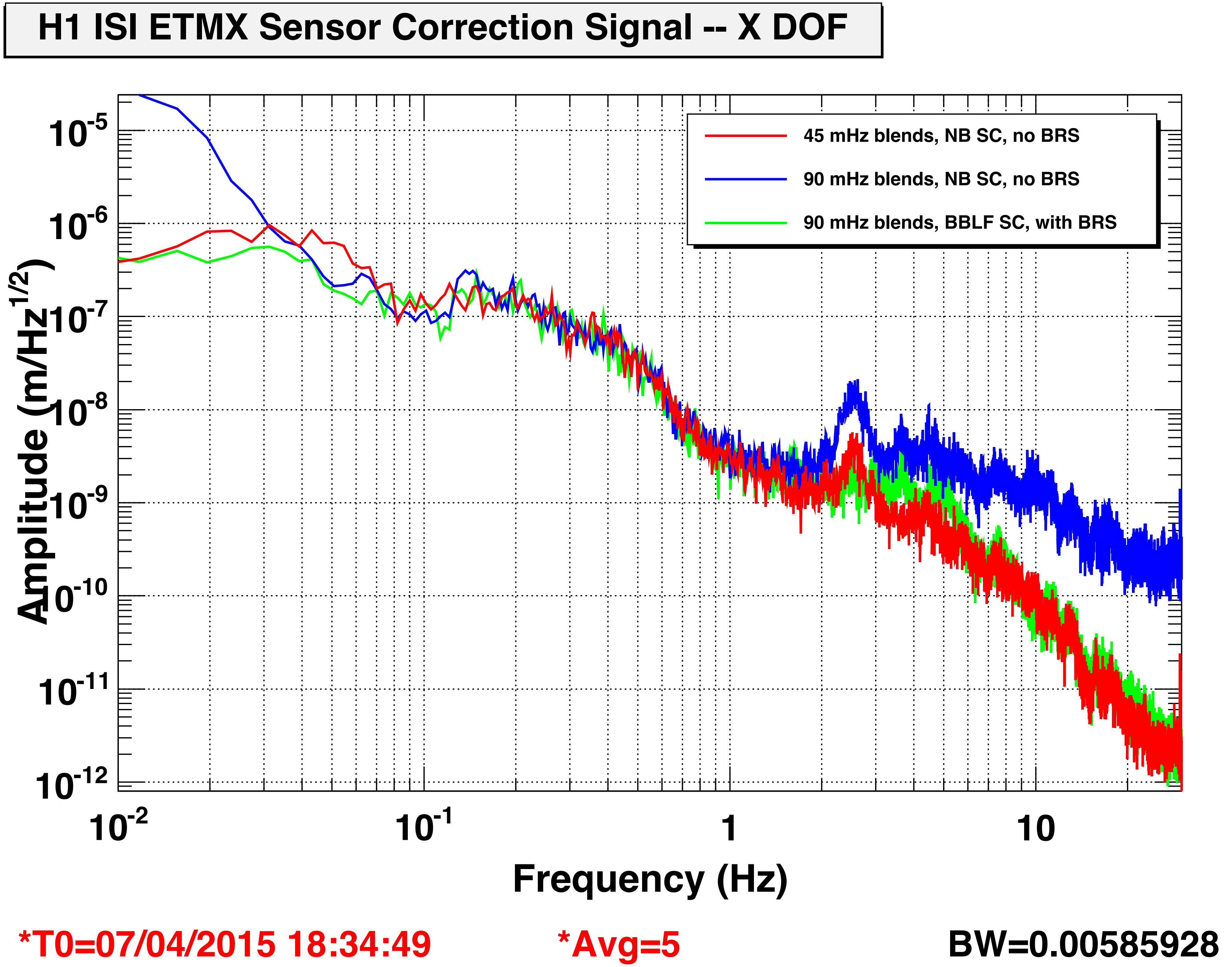
H1 ISI ETMX Configuration Comparison with Wind at 10-20 [mph] [aLog17729]



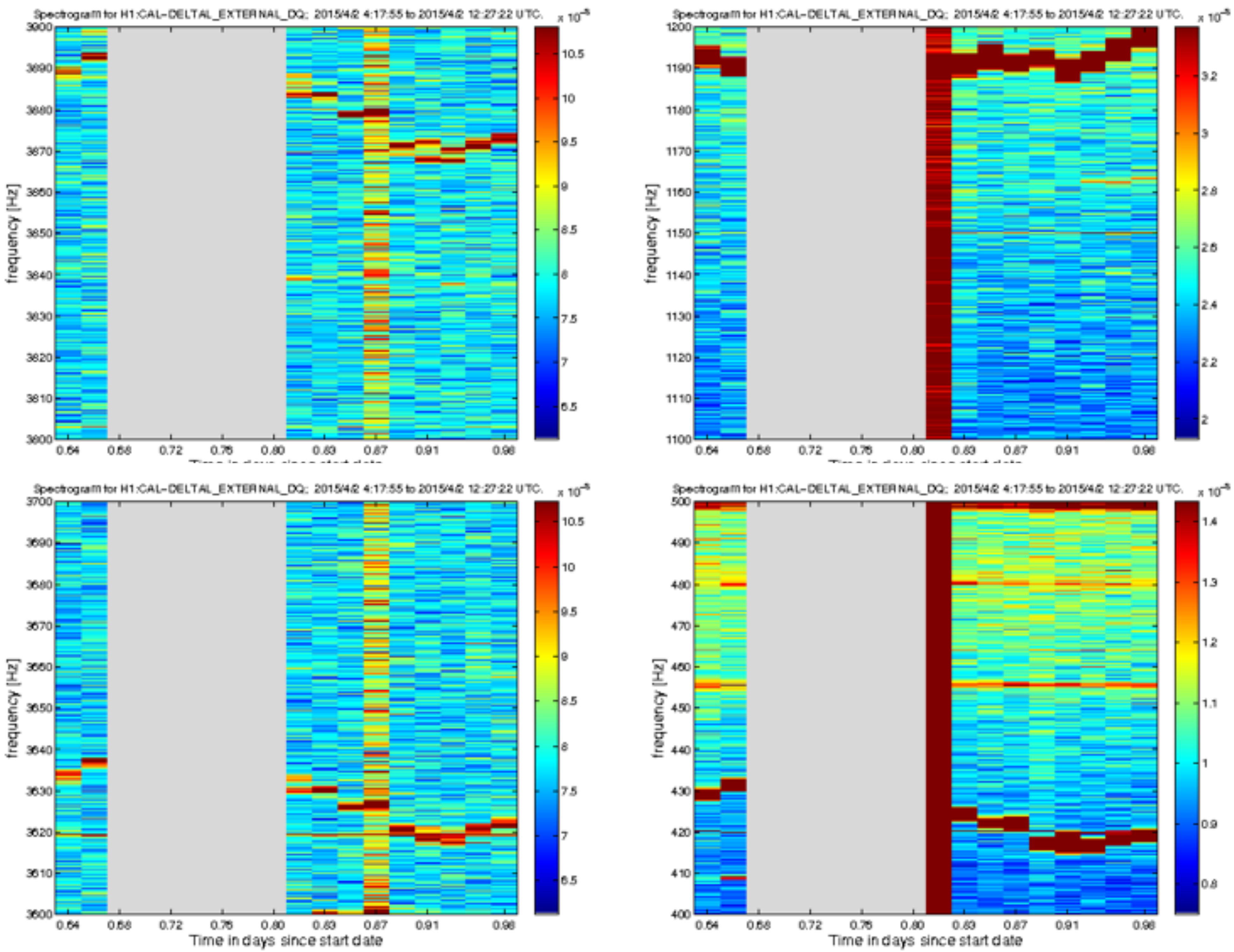
(Green) we're basically blending in the tilt-free, inertial ground super sensor at 20-30 [mHz]. So we win back all of the noise introduced when the noisy displacement sensor is used out to high frequency, and in the 0.1 to 0.4 [Hz] band, we're only at most a factor of 2 to 3 away from the best nominal configuration. In fact, the performance is *even* better than the nominal configuration between 0.4 and 2 [Hz].

H1 ISI ETMX Configuration Comparison with Wind at 10-20 [mph] [aLog17729]

(Green) We can see that Configuration (3) has the *least* amount of sensor correction request below 0.1 [Hz], because the BRS has subtracted out the tilt from the GND T240 of this region.



Fscan of H1:CAL-DELTAL_EXTERNAL_DQ [aLog17768]

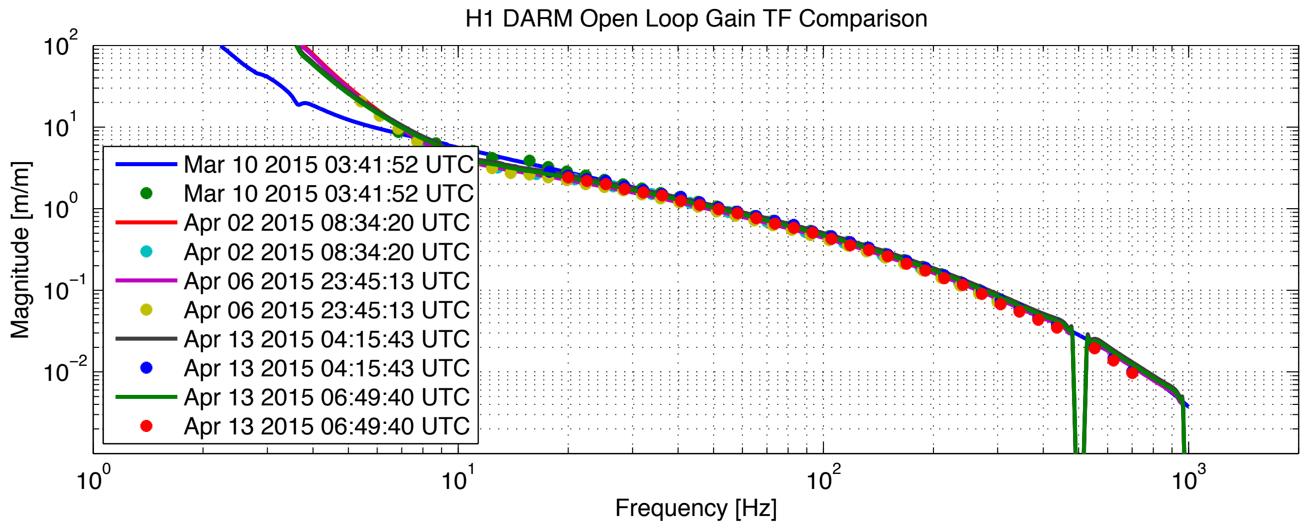


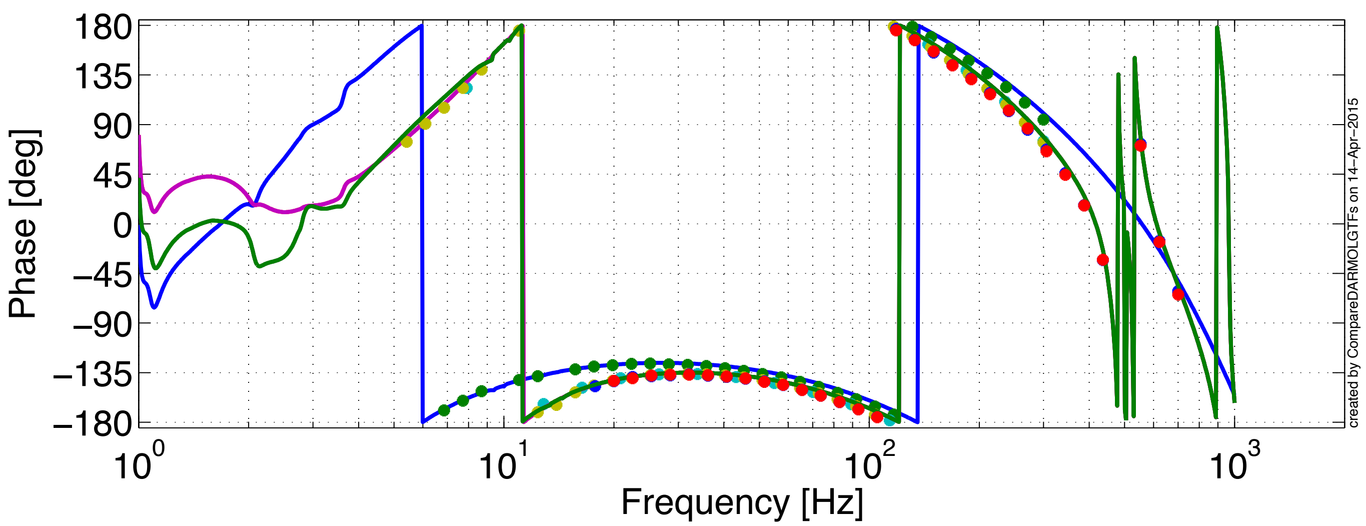
Examples of wandering lines during Apr 2 lock

Fcan plots

Reports until 08:43, Thursday 09 April 2015

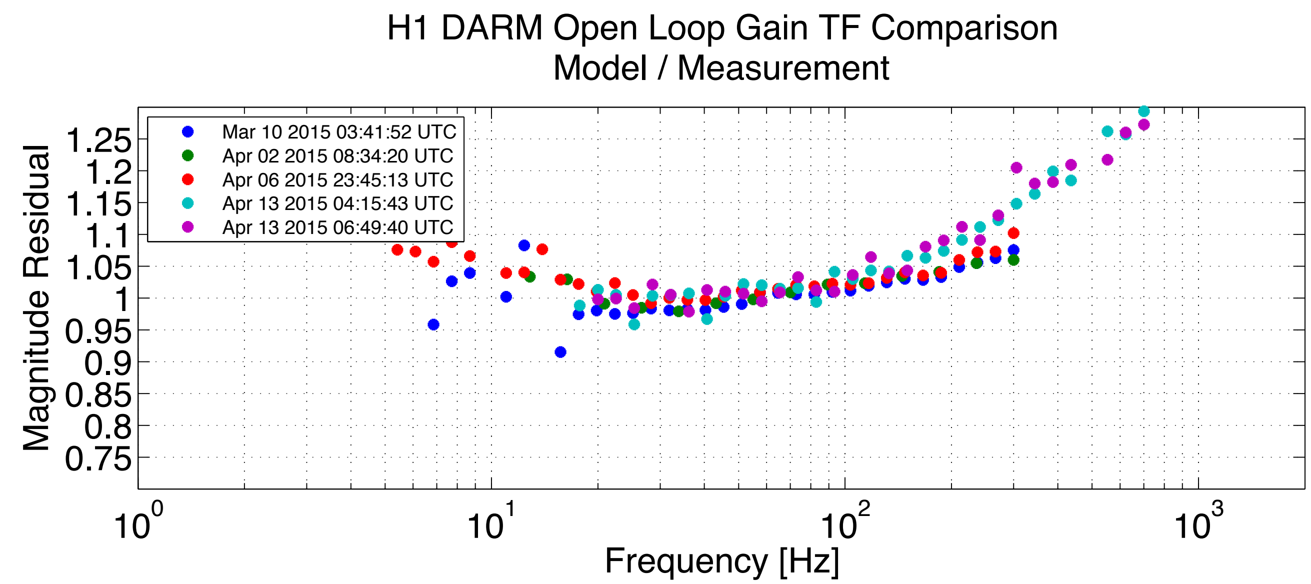
Analysis of DARM OLGTFs out to Higher Freq. - Coupled Cavity Pole Mysteries [aLog17863]

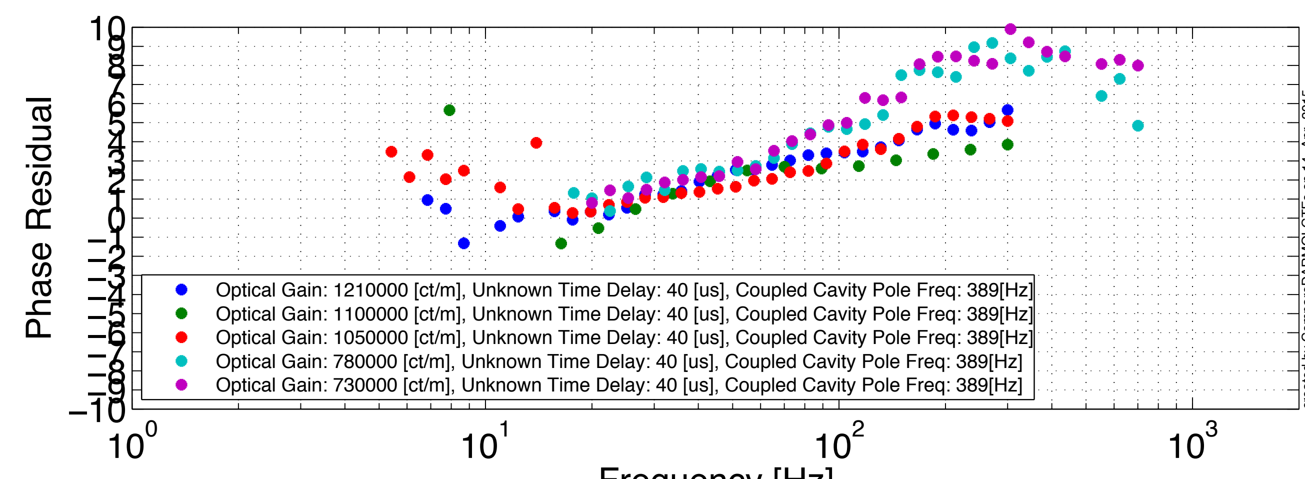




Reports until 13:56, Tuesday 14 April 2015

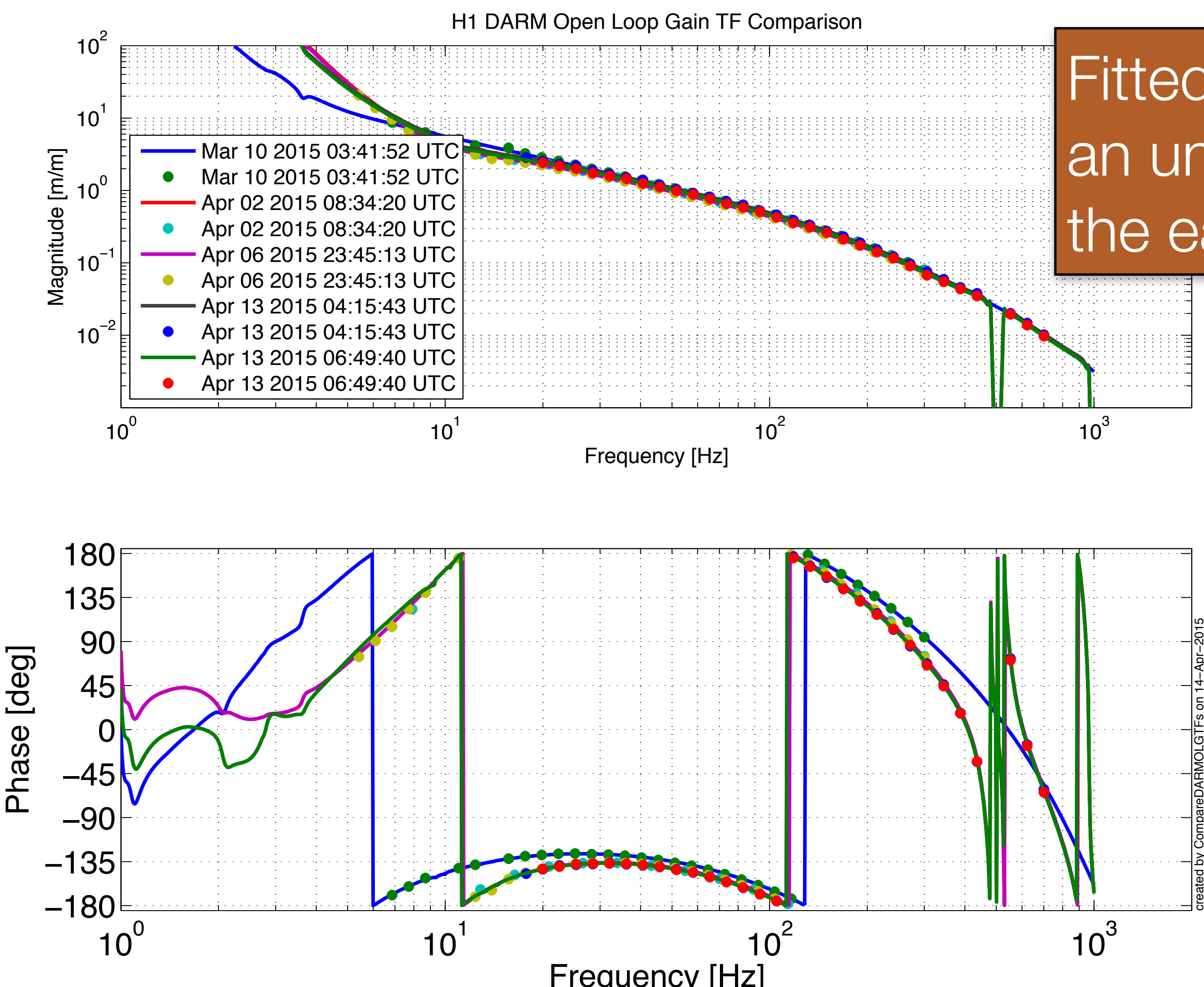
fixed cavity pole frequency of 389 [Hz]



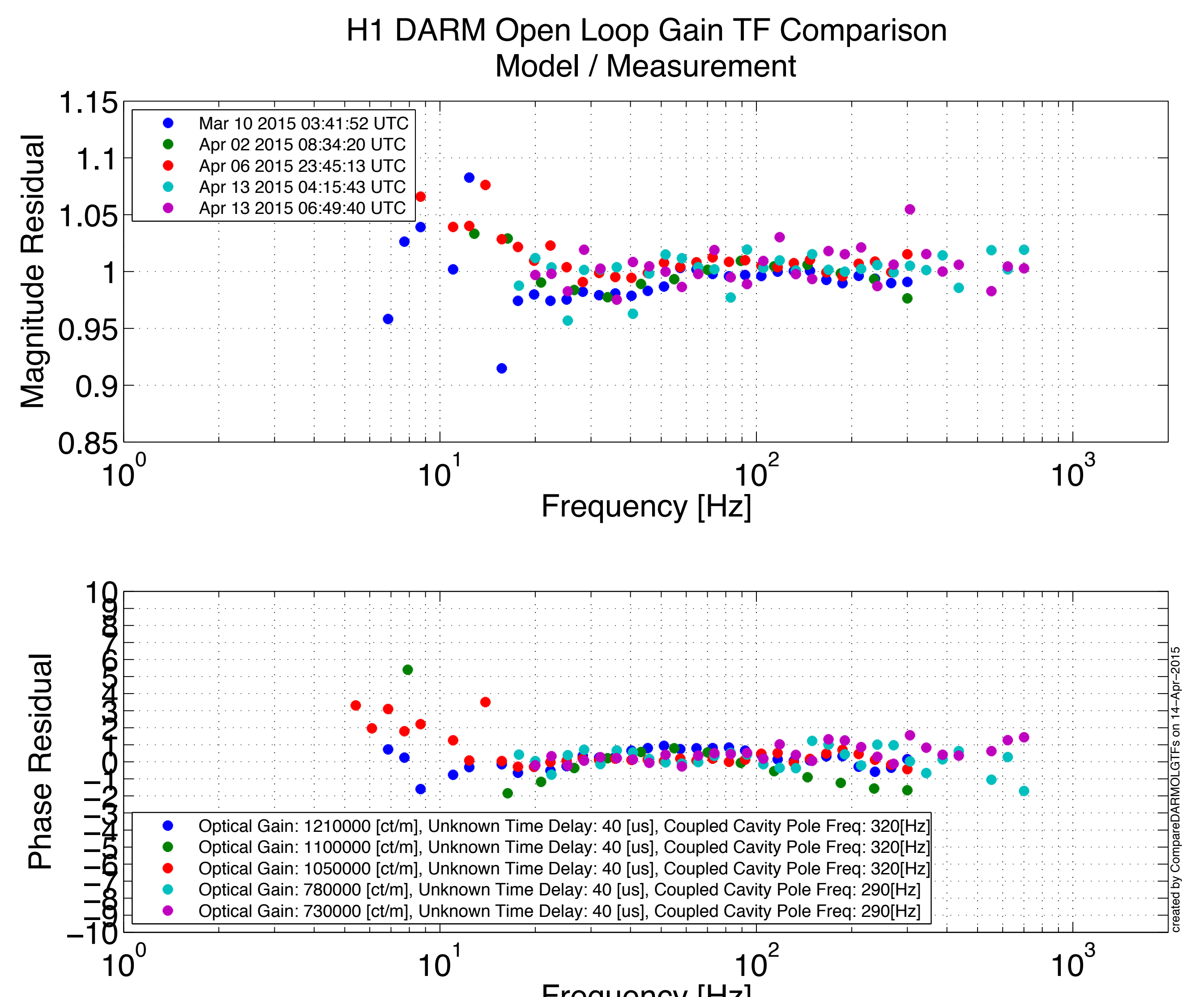


(1) systematic difference in frequency-dependent discrepancy between the earlier, 5-300 [Hz] data and the later, post-HAM6 vent, data.
(2) fit the discrepancy's frequency dependence with DARM coupled cavity pole down to an unrealistically (??) low 320 [Hz] and 290 [Hz] for the earlier and later data, respectively.
(3) used the same time delay for *all* of the data sets. The 40 [us] was chosen *after* I'd shifted the coupled-cavity pole frequency down in order to get the phase to be flat as a function of frequency.

Analysis of DARM OLGTFs out to Higher Freq. - Coupled Cavity Pole Mysteries [aLog17863]



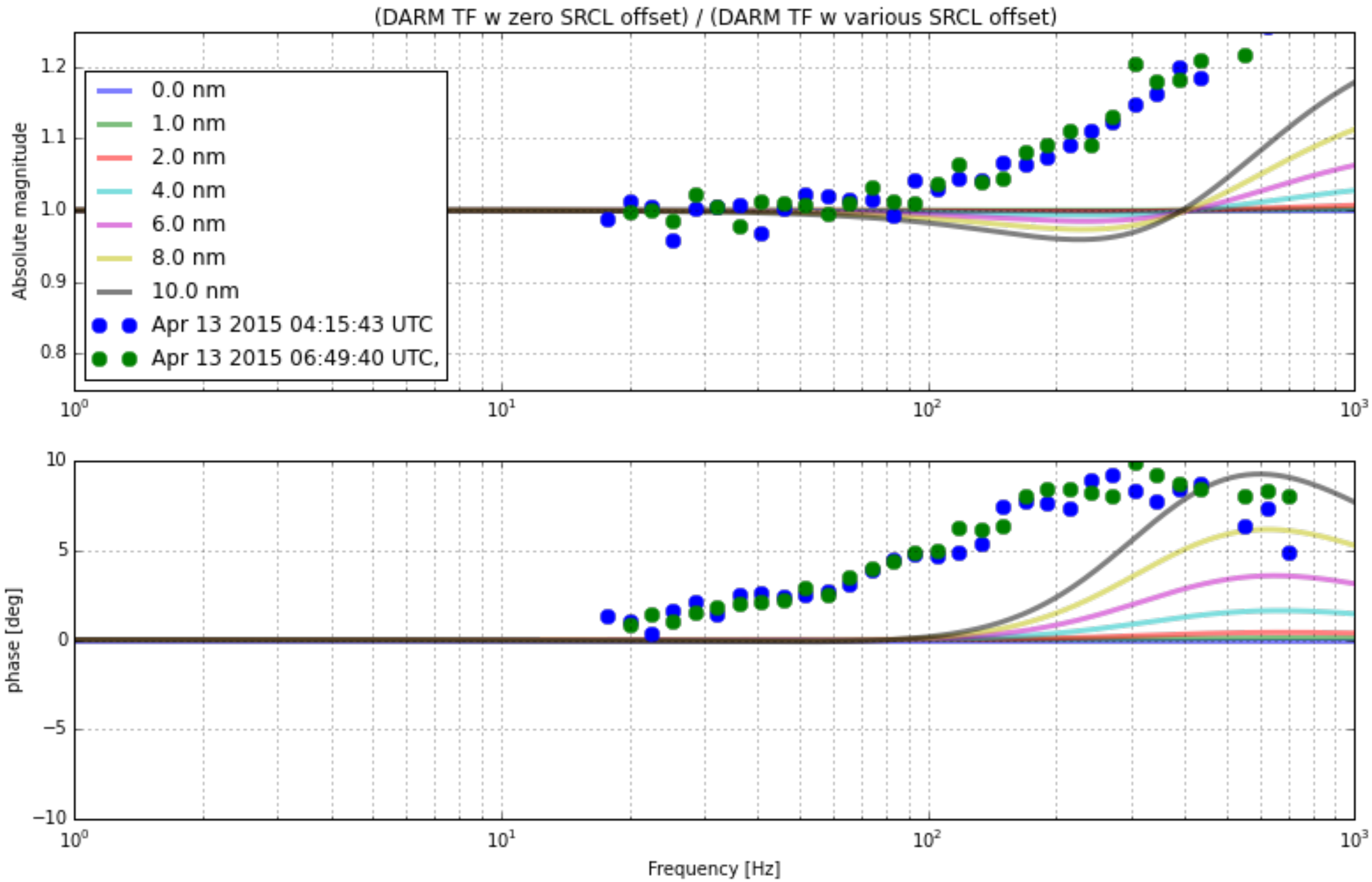
Fitted with DARM coupled cavity pole down to an unrealistically low 320 [Hz] and 290 [Hz] for the earlier and later data, respectively



Possible causes

- DARM coupled cavity pole is lower than expected because of SRCL offset, low power recycling gain, or IFO alignment
- ESD / SUS isn't exactly 1/f^2 at high frequency
- Some nasty frequency dependence of the linearization algorithm

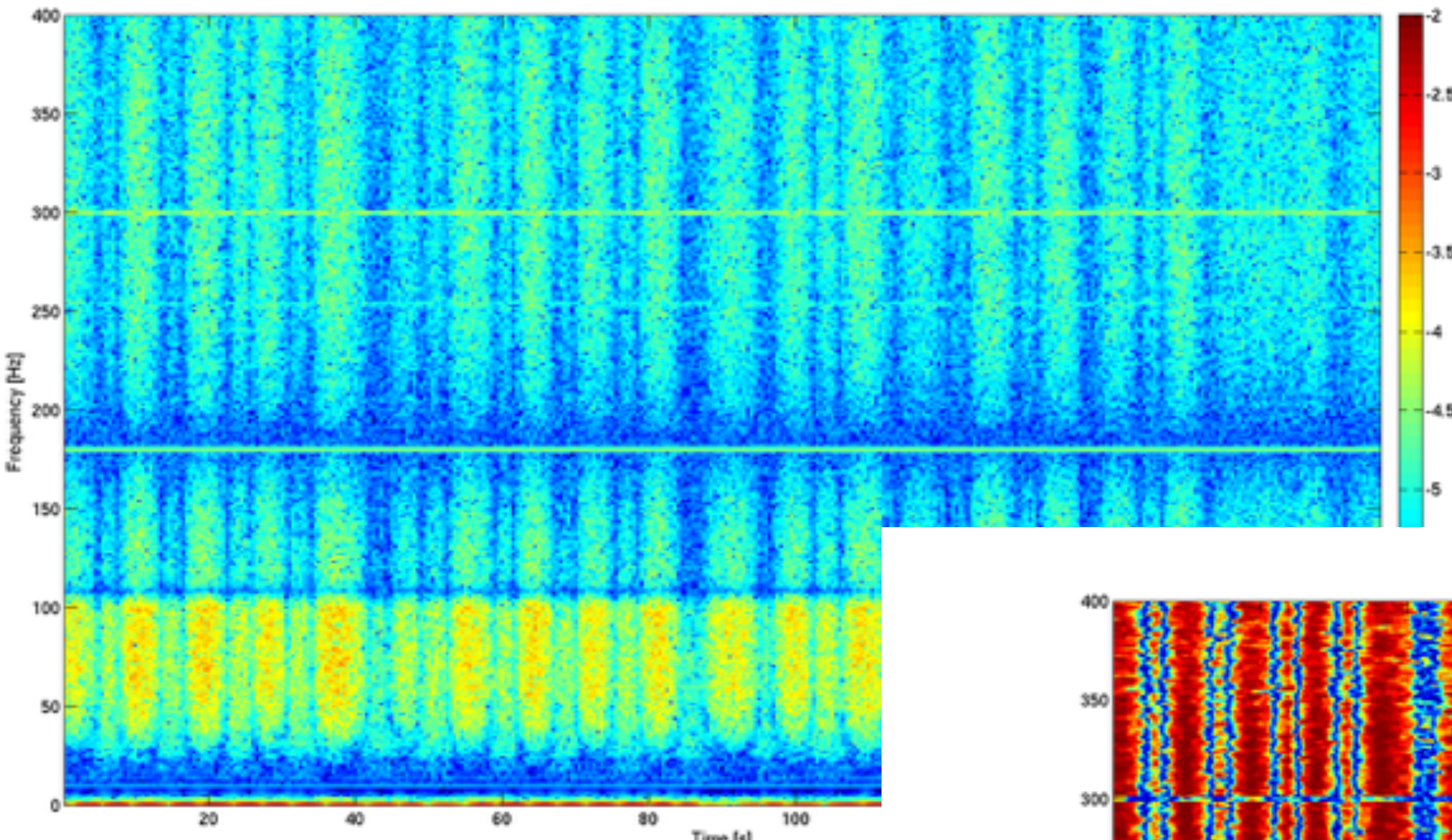
Analysis of DARM OLGTFs out to Higher Freq. - Coupled Cavity Pole Mysteries [aLog17863]



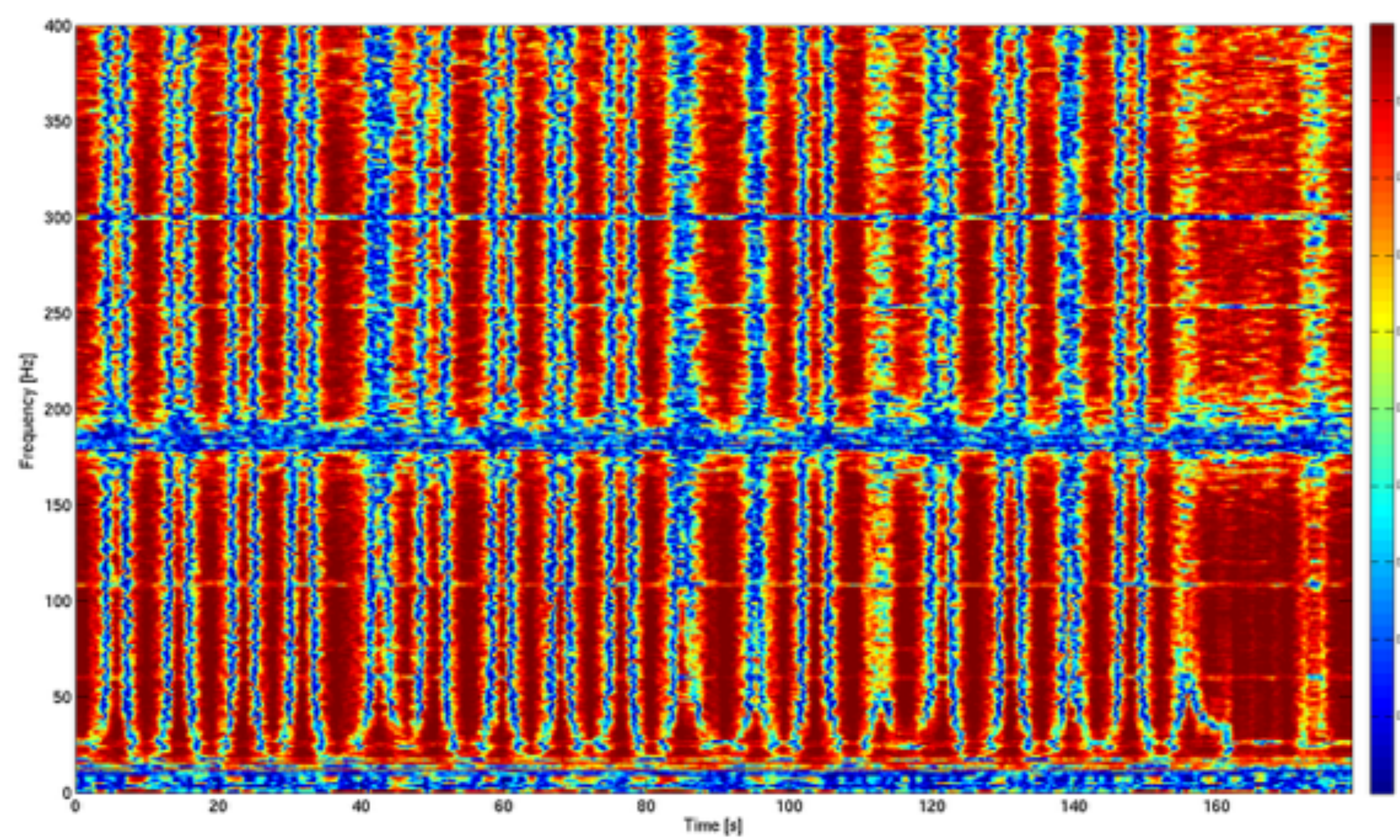
SRCL offset is ruled out among the possible casues!

SRCL non stationary coupling: modulated by alignment [aLog17912]

Reports until 12:42, Thursday 16 April 2015

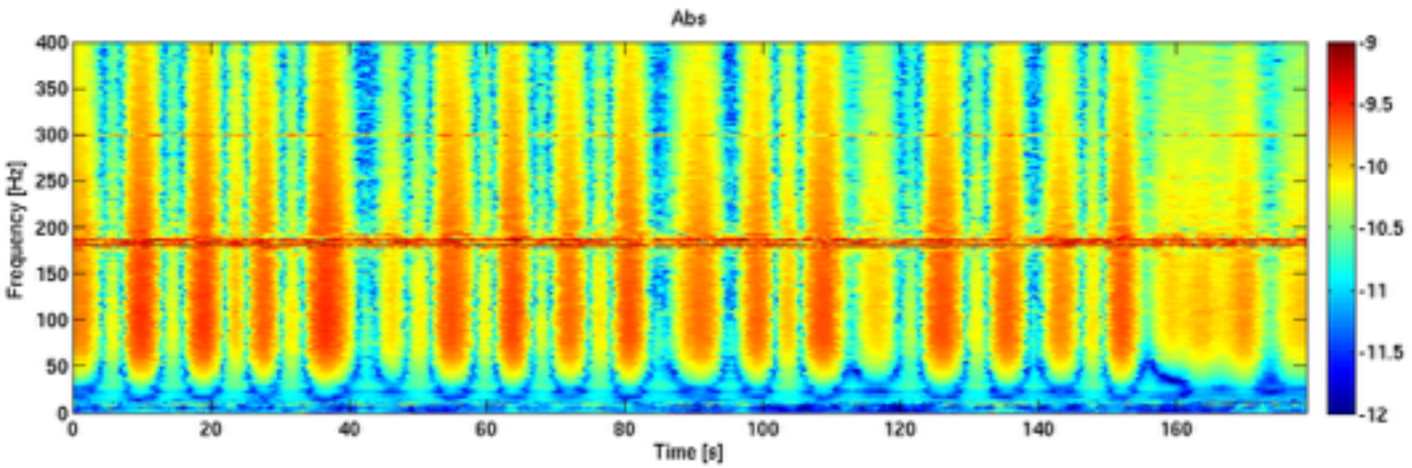


a spectrogram of DARM during the SRCL noise injection. The non stationarity behavior of the noise is very evident.

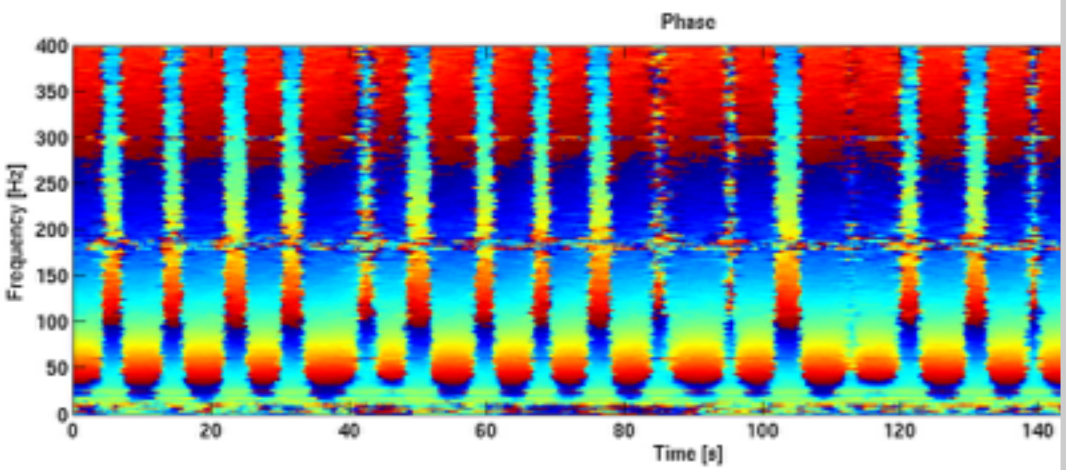


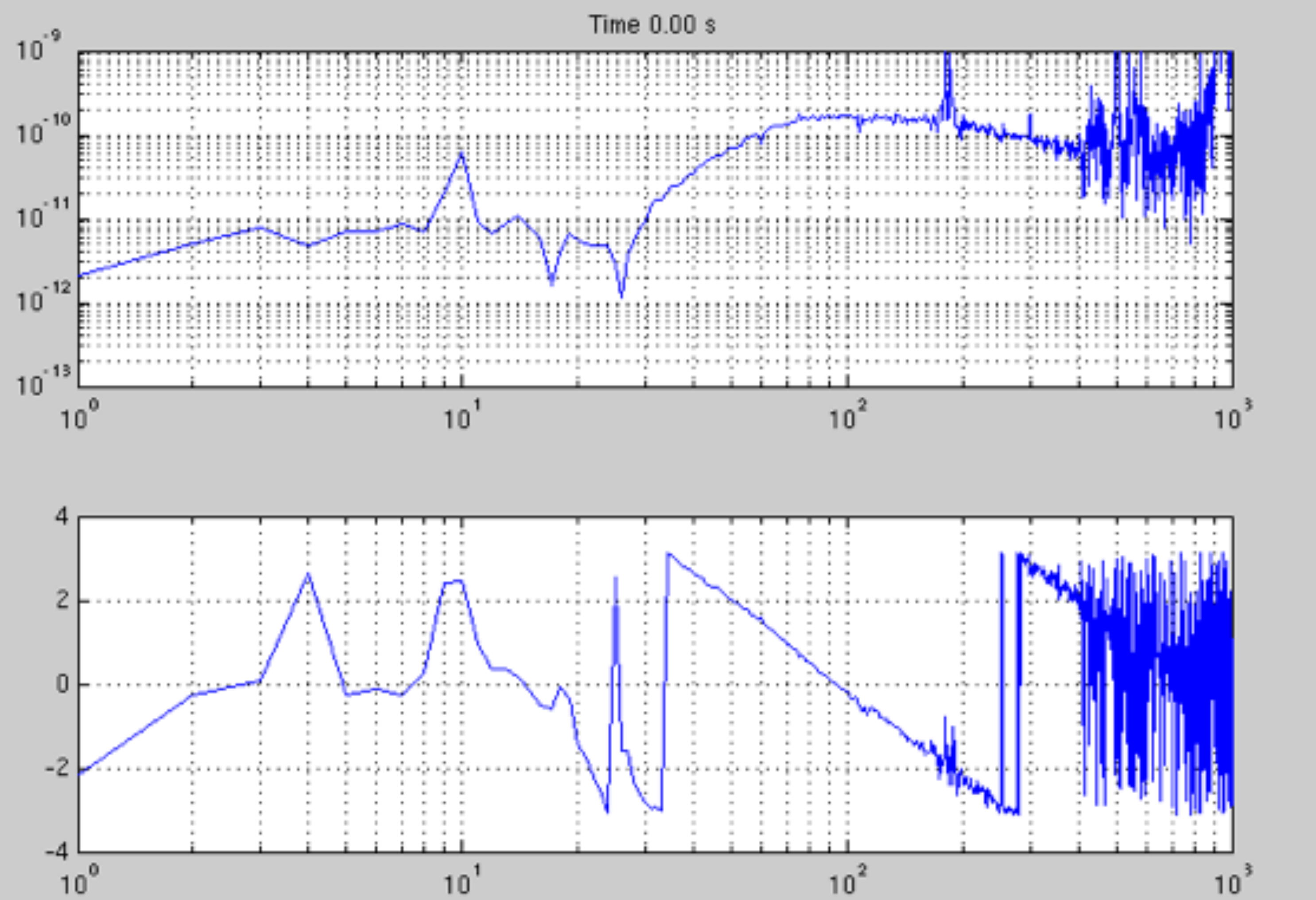
coherogram, which is basically the same thing as the spectrogram, but showing how coherence changes over time

SRCL non stationary coupling: modulated by alignment [aLog17912]



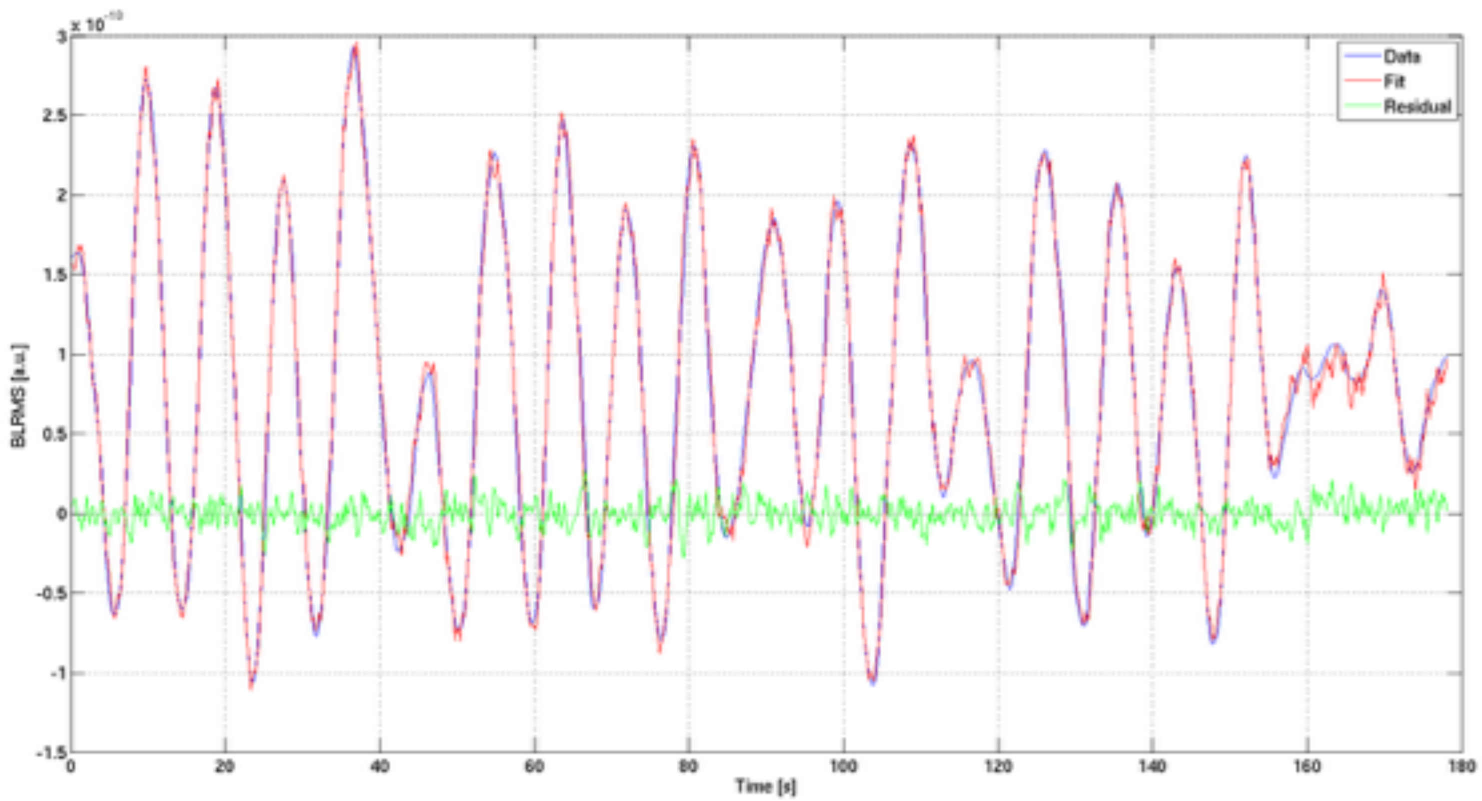
the transfer-function-gram, which again shows how the transfer function from SRCL to DARM changes over time



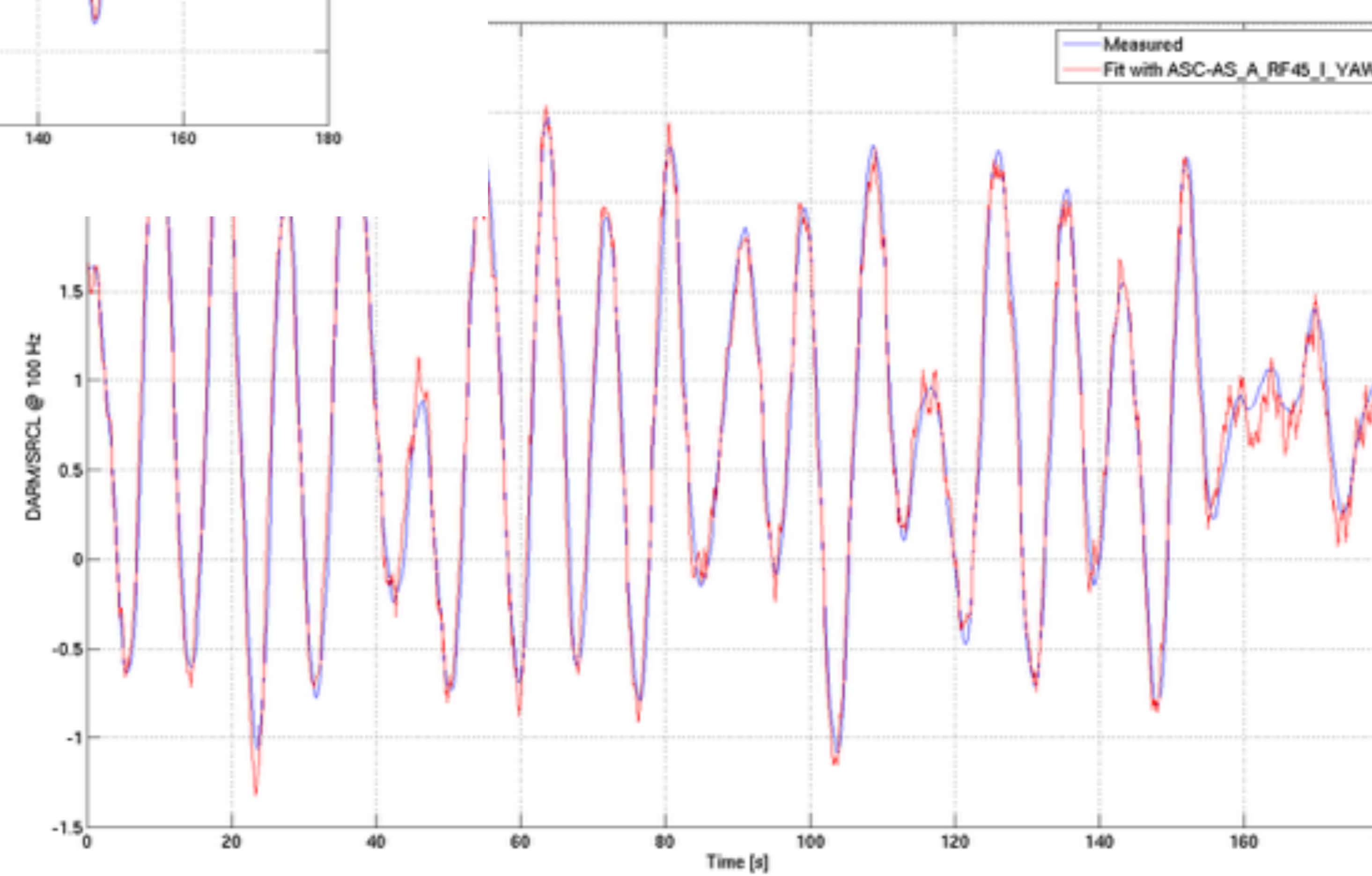


an **animation of the transfer function** between SRCL and DARM over time, which makes even more clear how the coupling changes amplitude and sign.

SRCL non stationary coupling: modulated by alignment [aLog17912]



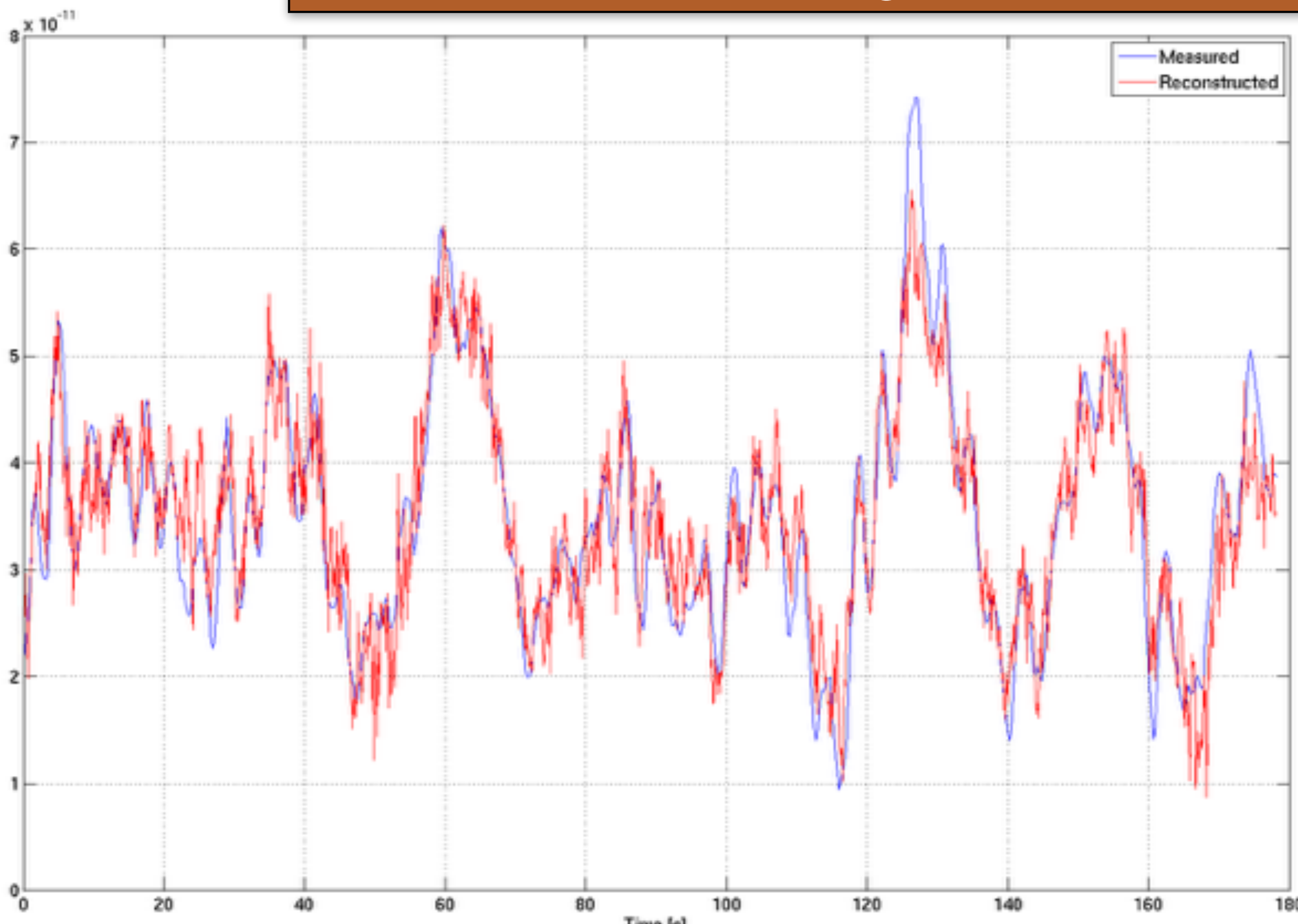
the blue trace how this gain varies over time. The red trace is the best fit obtained using my algorithm and all ASC error signals. The green is the residual, which shows hoiw the reconstruction is very good



the main contributor is **H1:ASC-AS_A_RF45_I_YAW_OUT_DQ**.
the fit is very good even if only this signal is used: so the conclusion is that the SRCL coupling is modulated completely by angular fluctuations visible in the AS port

SRCL noise non stationarity has improved by boosting DHARD yaw [aLog17928]

It turned out that this signal is basically equal to the DHARD yaw error signal.



the main contributor is **H1:ASC-AS_A_RF45_I_YAW_OUT_DQ**.
the fit is very good even if only this signal is used: so the conclusion is that the SRCL coupling is modulated completely by angular fluctuations visible in the AS port

- contrarily to what stated in last night entry, the SRCL coupling is both lower and more stationary. The third attachment shows the SRCL coupling gain (average of the TF in the 100 Hz region) as a function of time. It is on average about 3.5e-11 and fluctuating by some 2e-11. Before DHARD boosting, the coupling was fluctuating between -10e-11 and +27e-11.
- Now the channel ranking gives a different answer: SRCL coupling is mostly modulated like ASC-AS_A_RF36_Q_PIT, and only partially as DHARD YAW. So it seems that we removed most of the fluctuations caused by DHARD, but now we have some other loops to improve. If I'm not mistaken, AS36 signals should be used to control some SRC degree of freedoms

Reports until 10:47, Friday 17 April 2015

Abbreviations

- **REFL**: Reflected Light Port on ISCT1
- **BRS**: Beam Rotation Sensor
- **NB**: Narrow Band (‘0.43 Hz only’)
- **CPS**: Capacitive Position Sensor, an element of aLIGO seismic isolation system
- **SC**: Sensor Correction
- **ST1**: Stage 1 in ISI
- **ISI**: Internal Seismic Isolator
- **OMC**: Output Mode Cleaner
- **DCPD**: DC Photodiode
- **PSL**: Pre-Stabilized Laser
- **FSS**: Frequency Stabilization Servo
- **OLGTFs**: Open Loop Gain Transfer Functions
- **SRCL**: Signal Recycling Cavity Length
- **PIT**: Pitch
- **AS**: Anti-symmetric