Reprocessing of h(t) of the last two weeks of the Observing Run O3a

L. Rolland, M. Seglar-Arroyo, D. Verkindt

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Contents

1 Introduction

In the last two weeks of O3A, from September 16 2019 to September 30 2019, the ITF went into several working point changes due to tests done on the control of the etalon effect. This implied a non-optimal noise subtraction in h(t) when using the signals SIB2_B2_8MHz_I (above 150 Hz) and SPRB_B4_56MHz_Q (below 150 Hz).
The signal SIB2_B2_8MHz_I is used to control the PRCL degree of freedom and contains known length noise that can be subtracted from h(t). The signal SPRB_B4_56MHz_Q is used to control the laser frequency via the SSFS loop and contains known frequency noise that can be subtracted from h(t).

Figure 1 shows the evolution of the BNS range over those two weeks, the evolution of the Ring Heater temperature and gives a summary of the ITF condition.

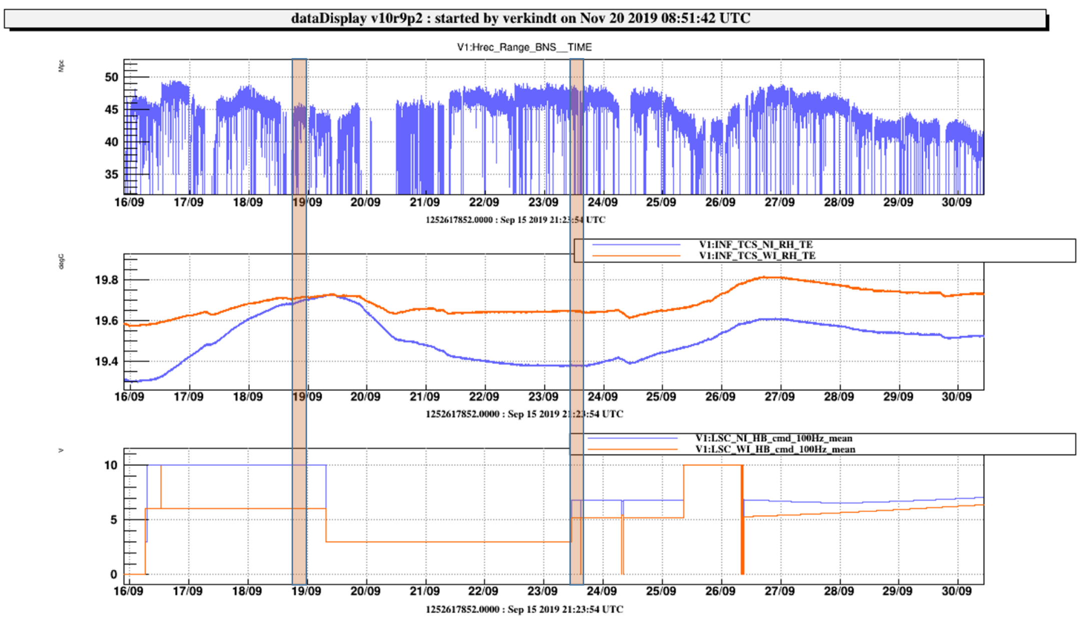

Figure 1: Upper plot: evolution of the BNS range. Middle plot: evolution of the temperature of the Ring Heater of the NI and WI mirrors. Lower plot: command level for the changes of RH temperature. The two vertical bars show the Sep 18 and Sep 23 time window used to check the online h(t) and the reprocessed h(t).

Figure 2 and Figure 3 show the coherence between online h(t) (raw and clean,respectively) and the subtracted witness signals, when the ITF was at a good working point for online noise subtraction (Sep 23) and when it was not (Sep 18). These two times, in particular the 18 September 2019 at 20:30:00 UTC and the 23 September 2019 at 12:00:00 UTC, are selected to study the coherence between SPRB_B4_56MHz_Q and SIB2_B2_8MHz_I , the noise subtraction and the effect in the reprocessing.

Figure 2 shows that large coherence between online h_raw and the two witness channels in the 50 to 150 Hz range is observed in certain time intervals (Sep 18), while sometimes it is not (Sept 23). Figure 3 shows that after noise subtraction, the coherence of h_clean with SPRB_B4_56MHz_Q is nicely reduced while there is still large coherence with SIB2_B2_8MHz_I in the 50 to 150 Hz range. It indicates that the noise seen in h_raw and SIB2_B2_8MHz_I is not coherent with the one subtracted using SPRB_B4_56MHz_Q .

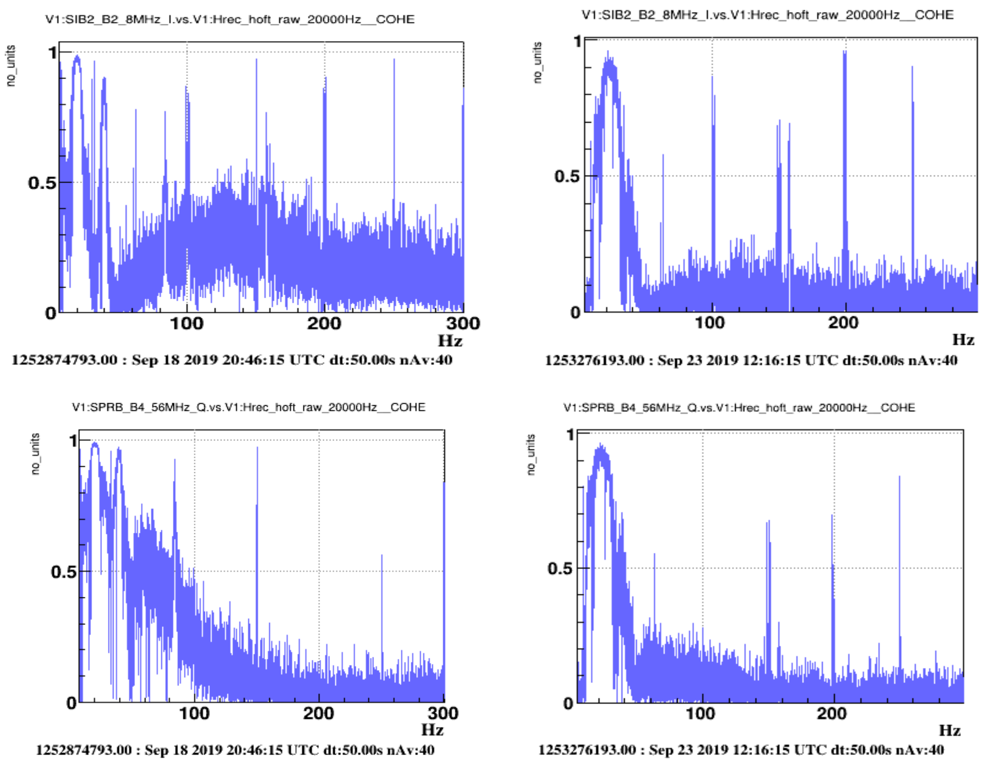

Figure 2: Coherence between online h_raw and SIB2_B2_8MHz_I *and* SPRB_B4_56MHz_Q *, when noise subtraction is not good (left column) and when it is (right column).*

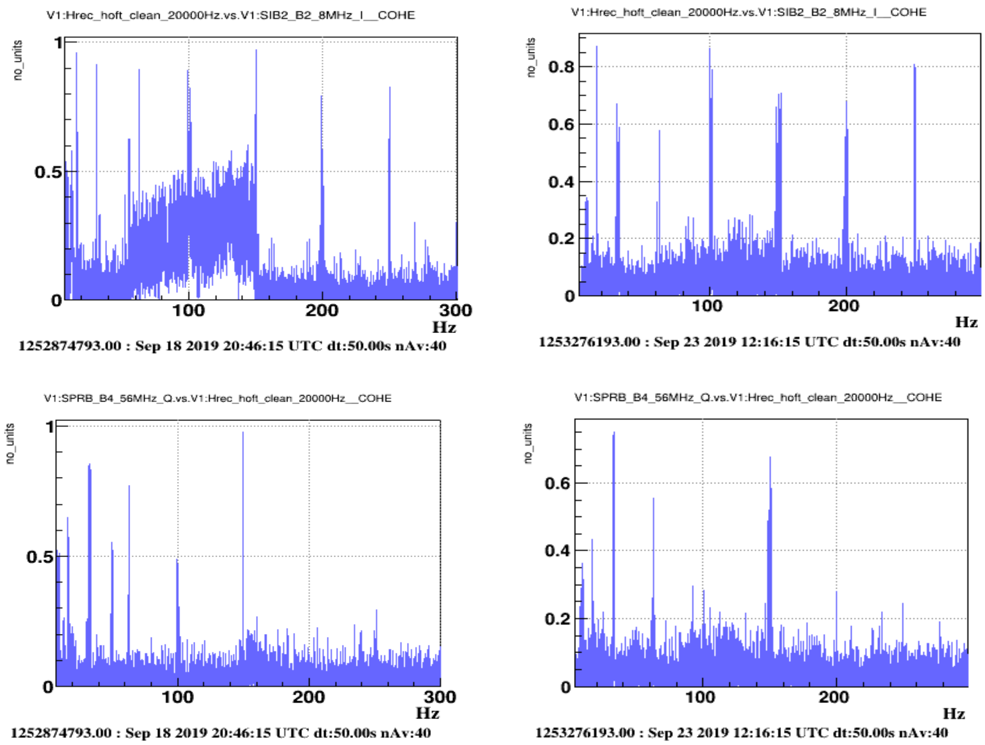

Figure 3: Coherence between online h_ clean and SIB2_B2_8MHz_I *and* SPRB_B4_56MHz_Q *when noise subtraction is not good (left column) and when it is (right column)*

Thus we decided to reprocess the h(t) signal over this two-week time period with a new configuration of the noise subtraction: SIB2_B2_8MHz_I subtracted down to 50 Hz and SPRB_B4_56MHz_Q subtracted up to 150 Hz. This reprocessing allowed to gain between 0 to 3 Mpc on the BNS range, depending on the working point of the ITF (see Fig. 11).

2 Characteristics of the subtracted noise

Figure 4 shows the coherence between SIB2_B2_8MHz_I and SPRB_B4_56MHz_Q in the frequency range 50-150 Hz, where the two signal subtractions overlap. It shows that, most of the time, the coherence between the two signals is limited below 50 Hz and thus the noise subtraction applied in the reprocessing can be done. A few non-stationary coherent lines are anyway visible around several frequencies, e.g. around 85 Hz or 350 Hz (see Fig. 5). Although the origin of these lines is still to be investigated, the 85 Hz line, which is in the overlap domain (50 Hz to 150 Hz) did not prevent to obtain an acceptable result in the reprocessing.

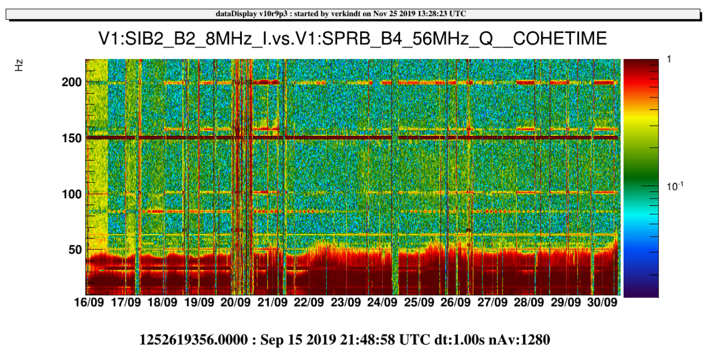

Figure 4: Time evolution of the coherence between SIB2_B2_8MHz_I *and* SPRB_B4_56MHz_Q *signals over the two weeks of the reprocessing.*

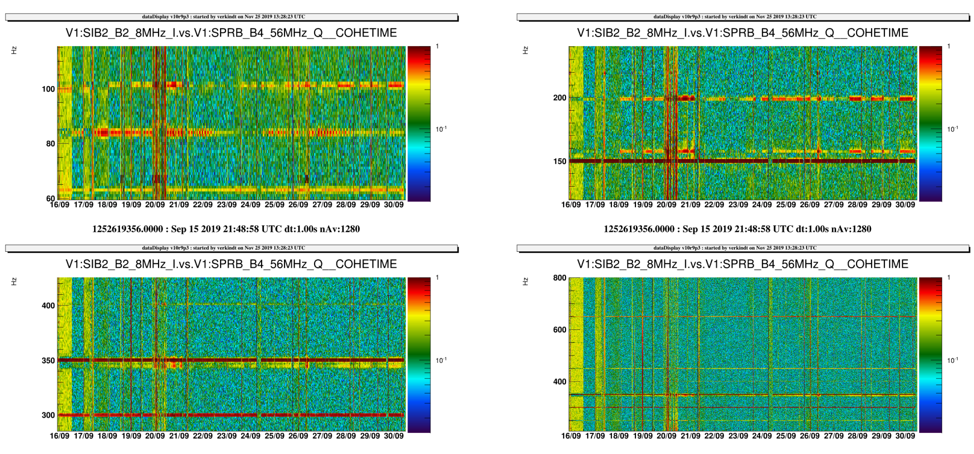

Figure 5: Time evolution of the coherence between SIB2_B2_8MHz_I *and* SPRB_B4_56MHz_Q *signals. Zoom around the coherent lines at 85 Hz, 101 Hz, 158 Hz, 200 Hz, 350 Hz and 650 Hz.*

3 Comparison of online h(t) and reprocessed h(t)

The comparison between online h(t) and reprocessed h(t) is performed for the two different reference times previously mentioned.

3.1 Coherence checks

We compare the coherence between the reprocessed h(t)_clean and the signal SIB2_B2_8MHz_I and the coherence between the reprocessed h(t)_clean and the signal SPRB_B4_56MHz_Q . These, shown in Figure 6, show a similar spectral behaviour for the two aforementioned reference times with low coherence (except for some lines at the main frequency and harmonics). It indicates that the noise subtraction worked properly for both periods.

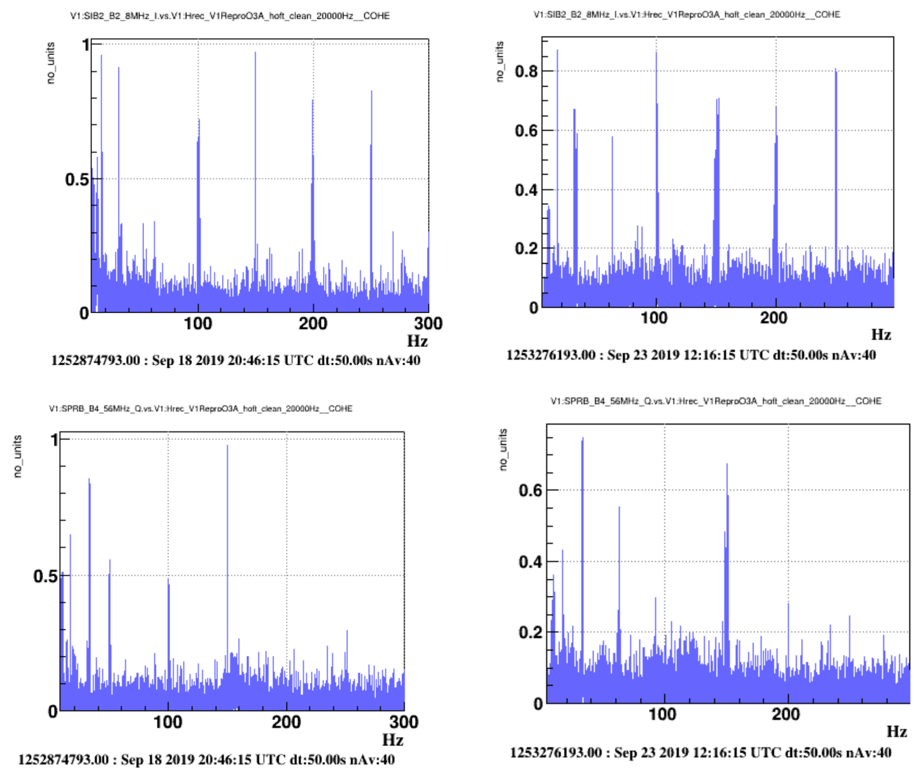

Figure 6: Coherence between reprocessed h(t)_clean and SIB2_B2_8MHz_I *and* SPRB_B4_56MHz_Q *, on Sep 18 (left column) and Sep 23 (right column).*

3.2 Transfer function between reprocessed h(t) and online h(t)

We checked the transfer function modulus and phase between the online h(t) and the reprocessed h(t) (see Fig. 7). As expected, the modulus is near 1 and the phase is near 0 below 50 Hz and above 150 Hz. In between, where SIB2_B2_8MHz_I and SPRB_B4_56MHz_Q subtractions overlap, we observe fluctuations of the modulus which average around 5% for Sep 23 and 40% for Sep 18. This corresponds to an improvement due to the reprocessing where, in both cases, the reprocessed h(t) is lower than the online h(t).

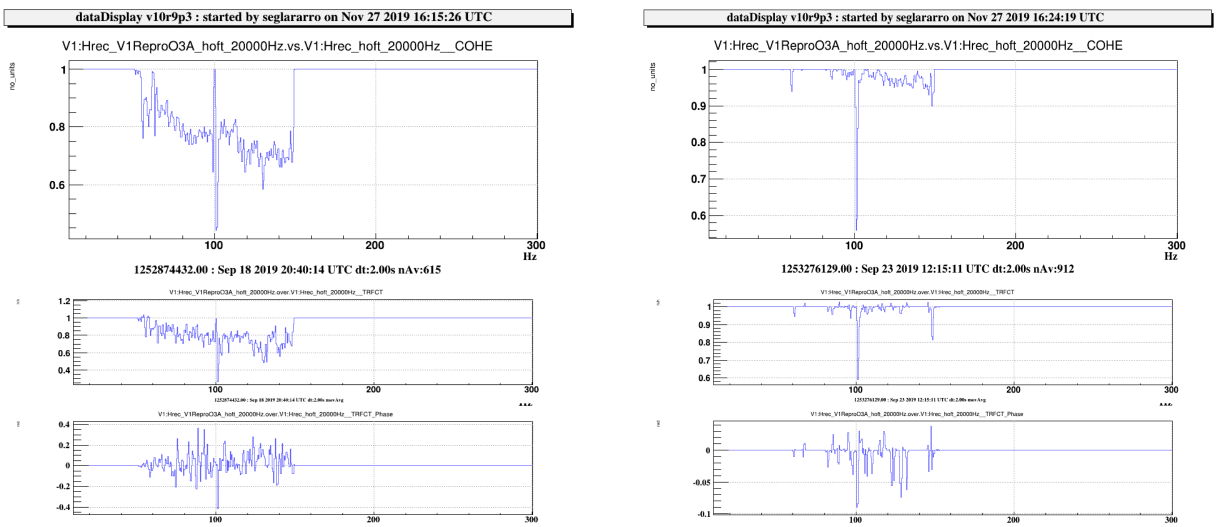

Figure 7: Coherence, transfer function module and transfer function phase between reprocessed h(t) and online h(t) for the data obtained on September 18 (left) and on September 23 (right).

3.3 Checks on transient noises with Omicron triggers

An additional check has been done by N. Arnaud. Fig. 8 shows that the Omicron triggers are identical, with similar SNR level, for the online h(t) and the reprocessed h(t), at least on the Sep 18 and Sep 23 dates where we focused our checks.

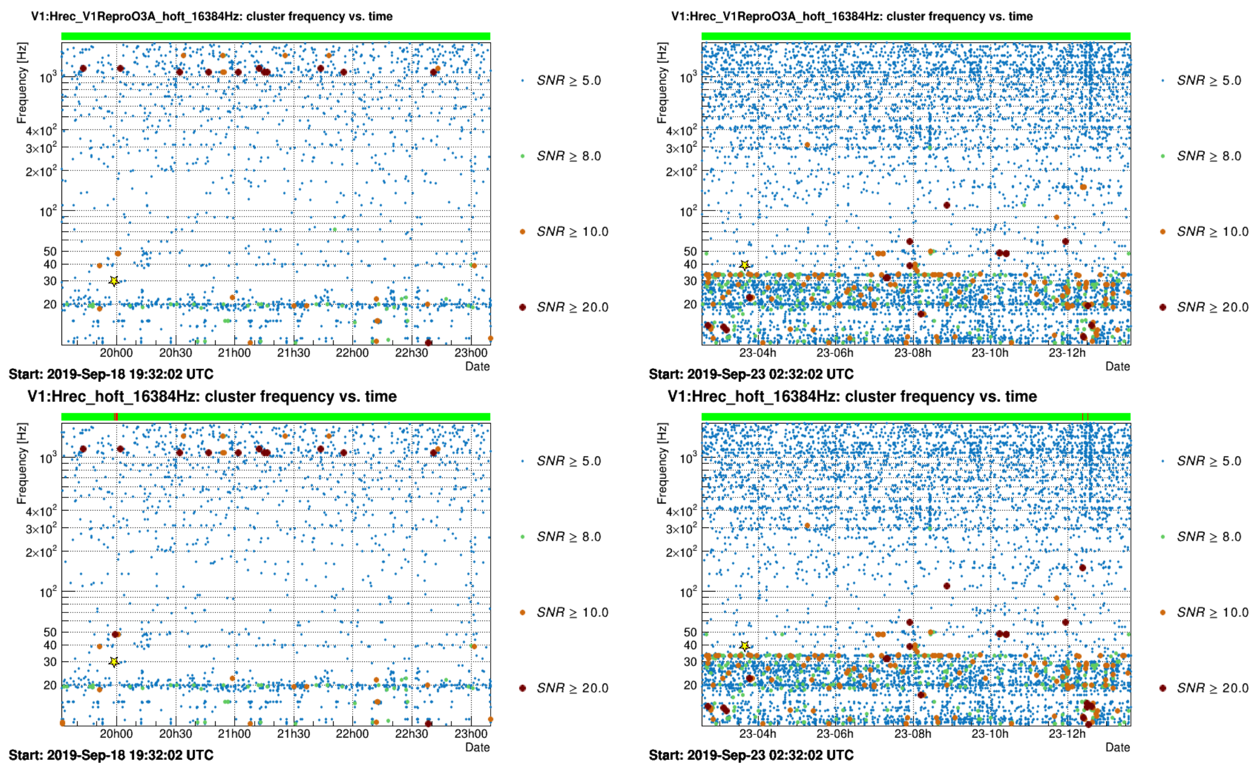

Figure 8: Time-frequency plots showing the Omicron triggers detected in online h(t) (lower row) and in reprocessed h(t) (upper row), over a couple of hours of September 18 (left) and September 23 (right).

3.4 Validation of reprocessed h(t) uncertainties with hardware injections

Looking at the transfer function between reprocessed h(t) and a h(t) signal reconstructed from sinusoidal signals injected with NE/WE mirror electromagnetic actuators or with NE/WE photon calibrators, we can check the temporal evolution of the reprocessed h(t) signal with respect to known injections. Figure 9 shows a good stability of the module and phase, for each frequency injected over the two weeks.

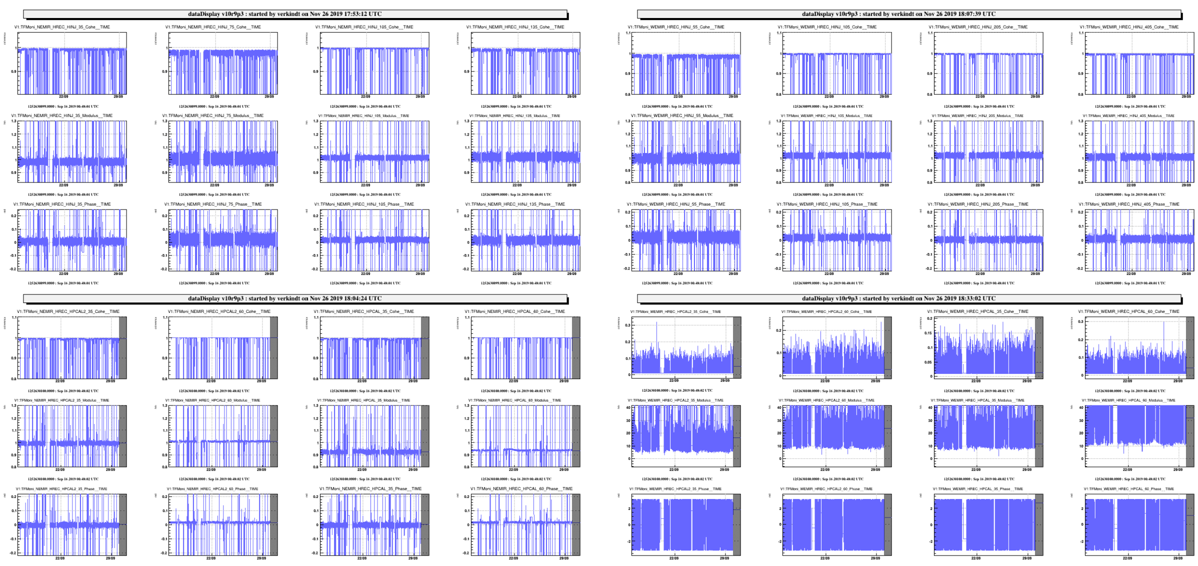

Figure 9: Transfer function between reprocessed h(t) and the h(t) reconstruction with NE mir actuator or NE PCal (left) or with WE mir actuator or WE PCal (right). The PCAL2 plots are for PCal PD2 photodiodes, the PCAL plots are for PCal PD1 photodiode. On NE, PCal PD1 is known to have a problem, this explains the wrong value of the module in lower-left plot. WE PCal was off during the last two weeks of September, this explains the bad result of the lower-right plot.

Finally, for each injected frequency, we have computed the average of the module and the average of the phase over an hour, again, around Sep 18 20:30 UTC (Fig. 10, left) and around Sep 23 12:00 UTC (Fig. 10, right). We could observe that the pattern and the systematic errors are similar to what was obtained with online h(t).

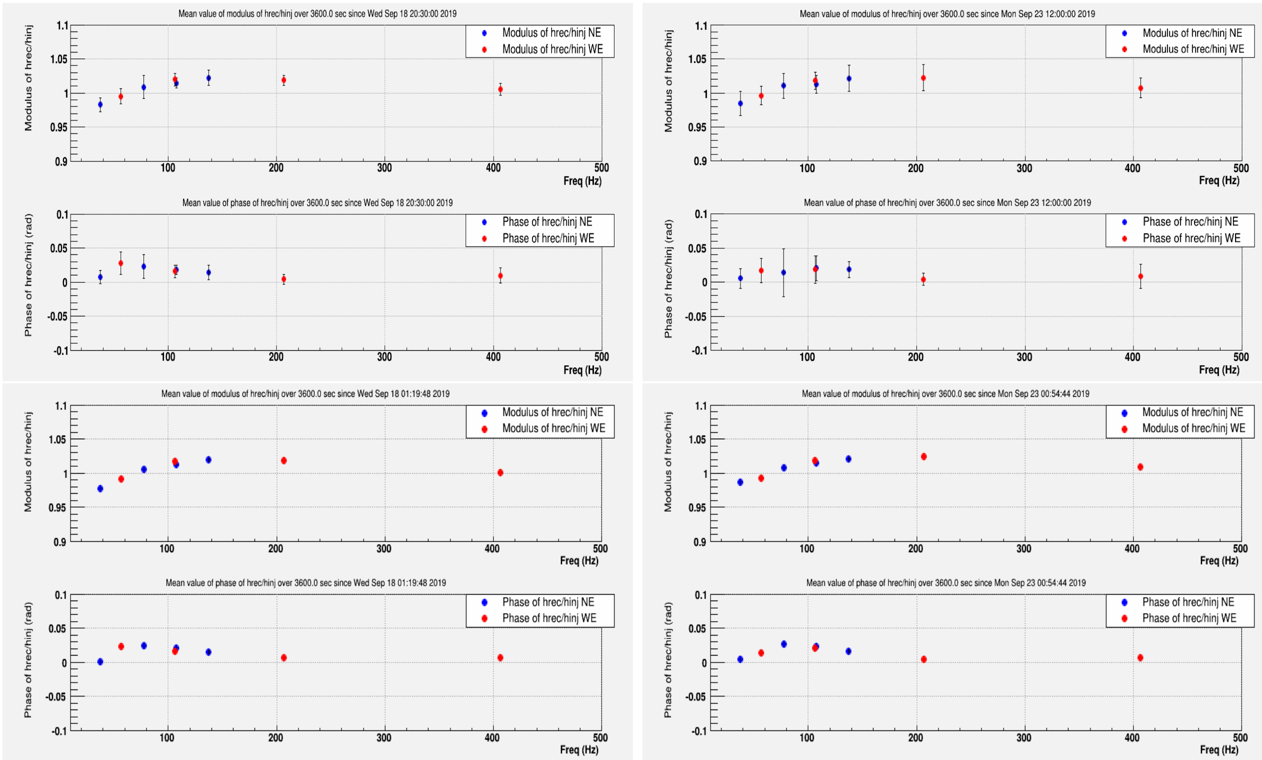

Figure 10: Transfer function between h(t) reprocessed and the h(t) reconstruction with NE/WE mirror actuators averaged over one hour for each frequency line injected on September 18 (left) and on September 23 (right). The four upper plots are for reprocessed h(t). The four lower plots are for online h(t).

3.5 Improvement of the BNS range

Figure 11 compares the BNS range of the h(t) computed online for O3a and the BNS range of the reprocessed h(t). The spread between the two BNS range is time-dependent.

The BNS range of the reprocessed h(t) is *in general* always above the BNS range of the online h(t), sometimes up to 3 Mpc. However, in certain points, the BNS range of the reprocessed h(t) is lower than the BNS range of the online h(t) (see Fig. 12). These cases are all coincident with the recovering after large glitch in h(t).

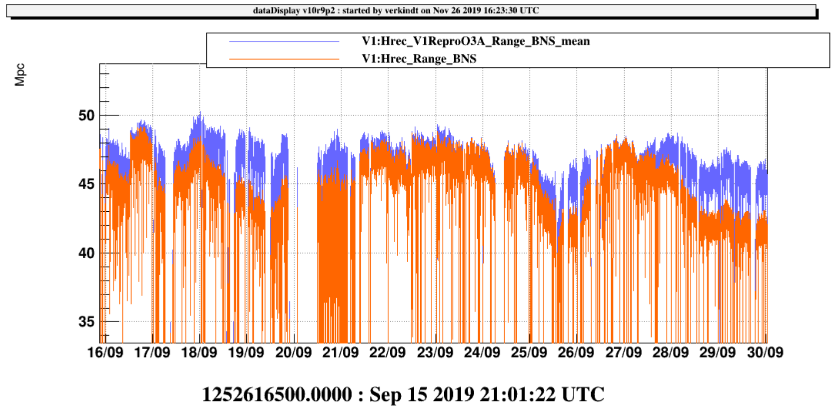

Figure 11: BNS range of the online h(t) (orange) and of the reprocessed h(t) (blue).

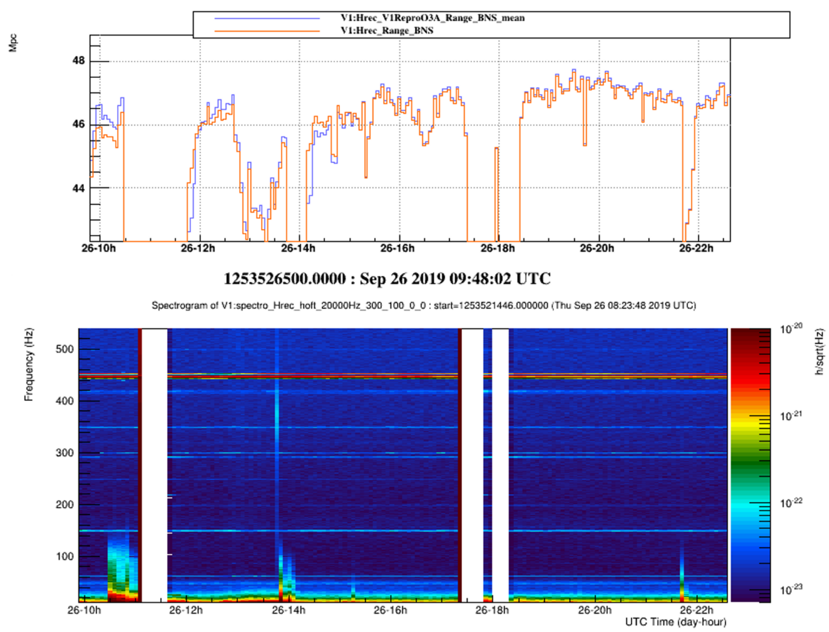

Figure 12: Zoom on some cases where the BNS range of the reprocessed h(t) is lower than the BNS range of online h(t). This is coincident with the recovering after the occurence of a large glitch visible in the spectrogram of h(t).

4 Details about reprocessing

- The reprocessing has been done with the same Hrec version (v3r09p4) that was used during O3a.
- The configuration used is the same as the Hrec configuration running online during O3a, except the following lines:

```
CHANNEL   V1:SPRB_B4_56MHz_Q  1e-20        0.    0  ONE  0. NONE
ADD_DTF   8 150 500 40 5 .04 18
CHANNEL   V1:SIB2_B2_8MHz_I  1e-20        0.    0       ONE  0. NONE
ADD_DTF   50 3500 500 40 5 .04 18
```

- The reprocessed channels have the prefix V1:Hrec_V1ReproO3A
- The reprocessed data are in
  /data/prod/hrec/O3A/V1Repro/V1ReproO3A_September_20.ffl (frames of 20 sec)
  /data/prod/hrec/O3A/V1Repro/V1ReproO3A_September.ffl (frames of 1 sec)
  /data/prod/hrec/O3A/V1Repro/V1ReproO3A_September_trend.ffl (trend frames of 1800s)

5 Discussion

The noise subtraction was modified to have an overlap between SPRB_B4_56MHz_Q and SIB2_B2_8MHz_I in the 50-150 Hz range since no coherence is observed between them in this frequency range. We checked that the noise was indeed better subtracted in the reprocessed channel. In addition, hardware injections allowed to validate that the systematic uncertainties are similar to those of the online h(t). This reprocessing allows to gain up to 3 Mpc on the BNS range in the last two weeks of O3a.

Despite the fact that the reprocessing was not affected, coherent lines between SIB2_B2_8MHz_I and SPRB_B4_56MHz_Q should be investigated. More generally, the coherence between the signals subtracted in h(t) would deserve a systematic study.

Looking at the stability of the systematic errors on the h(t) reconstructed online during O3a (less than 5% in amplitude and less than 40 mrad in phase), and looking at the stability of the ITF working point during O3a, we decided not to reprocess any other time period of O3a.

A Hrec configuration used for reprocessing

```
# Server /virgoApp/Hrec/v3r09p4/Linux-x86_64-CL7/Hrec.exe
# Config file : /data/prod/hrec/O3A/V1Repro/Hrec_TestSeptember2019_mix.cfg

# Main priority
CFG_PRIO 0

# working directory path
CFG_PWD /data/prod/hrec/O3A/V1Repro

CFG_NOFILESAVE
CFG_NODBSAVE            # No commit into Db

DEBUG 3

# line <16> commented out by ‘CfgParse’ preprocessor
define HREC_PREFIX V1:Hrec_V1ReproO3A

OUTPUT_PREFIX HREC_PREFIX

##----------------------------------------------------- HI
HI_CHANNEL V1:CAL_HI_DetChar_flag           1  8
HI_CHANNEL V1:CAL_NE_MIR_Z_NOISE_HI_DetChar  1  8
HI_CHANNEL V1:CAL_HI_CW_flag                1  9
HI_CHANNEL V1:CAL_NE_MIR_Z_NOISE_HI_CW       1  9


##------------------------------------------------------Fd
FDIN_FILE /virgoData/ffl/raw.ffl  1252540000  1376000   # 15 Sep 2019 00:00:00 UTC to 30 Sep 2019 22:00:00 UTC

FDIN_TAG  "V1:CAL_NE_MIR_Z_NOISE* V1:CAL_HI* V1:Sc_*_MAR_Z_CORR V1:Sc_*_MIR_Z_CORR V1:CAL_*_MIR_Z_NOISE V1:PCAL_*_PD*_hpcal V1:SDB2_B1*_PD*_Blended
 V1:META_ITF_LOCK* \
        V1:DQ_META* V1:SAT* V1:SIB2_B2_8MHz_I V1:SPRB_B4_56MHz_Q V1:SDB2_B1s1_PD1_Blended V1:SNEB_B7_DC V1:SWEB_B8_DC "

FDIN_FRAME_DURATION 4

FDIN_COMBINE_CHANNELS V1:B1 0.495 V1:SDB2_B1_PD1_Blended 0.505 V1:SDB2_B1_PD2_Blended

FDOUT_FRAME_DURATION 1
FDOUT_RANGE_GATING_NEW HREC_PREFIX_hoft_16384Hz 1.4 10 32 0.6 0.25 0.3125 10
FDOUT_BITOP  V1:DQ_ANALYSIS_STATE_VECTOR HREC_PREFIX_STATE_VECTOR   AND 0xffff

# Destination Cm name - channel tags - 0: CmSend, >0: queue size and CmPost - retry - <checksum>

# Compression type  - nbThread
FDOUT_COMPRESSION  9 0

FDOUT_FILE /data/prod/hrec/O3A/V1Repro/V1ReproO3A_September/V-V1ReproO3A 2000 "HREC_PREFIX* V1:DQ_ANALYSIS_STATE_VECTOR*"

PROCESSING_TAG HrecV0

##------------------------------------------------------Some global parameters
MIN_LOCK_STATE 159
START_FRQUENCY 8.
FINESSE_REF 450
TIME_MARGIN_BAD_SNR 200
SHAPING_FILTER 1 20 3

##------------------------------------------------------Subtraction of controls, Calibration and Noise channels
#--------------Remove  Main channels and define the raw channel before noise subtraction
# line <72> commented out by ‘CfgParse’ preprocessor
# include HRec_MainChannels_FromPCal.cfg

# </virgoData//VirgoOnline/HRec_MainChannels_FromPCal.cfg> =====>

#-------Channels used for the reconstruction of hoft_raw; the first channel must be B1
#        name     Gain (W)       delay    debug    OpticalGainName
B1_AA_FILTER 10000. 8 #8th order Butterworth filter of B1 sensing
CHANNEL   V1:B1   -1.e-3        -58.e-6    0       CAVITIES  0. NONE
# remark: -12 us from 1 MHz/IRIG-B ; +152 us from 20 kHz/1 MHz ; -82 us that is the delay of the AA correction used in HRec
# and a sign "-"

#                           Gain is in m/V, delay in s
# include 10 us which is the extra-delay of NE,WE optical response wrt to GW optical response
CHANNEL   V1:Sc_NE_MIR_Z_CORR    0.4833e-6  -172.2e-6    0  NE 0. NONE
ADD_POLE    0.6    1000
ADD_POLE   123.46     0
ADD_ZERO   129.81     0

CHANNEL   V1:Sc_WE_MIR_Z_CORR    0.4007e-6  -171.2e-6     0 WE  0. NONE
ADD_POLE    0.6   1000
ADD_POLE   113.04    0
```

```
ADD_ZERO   115.22    0


CHANNEL   V1:Sc_BS_MIR_Z_CORR    1.07025e-6  +383.6e-6    0 BS  0.  NONE
ADD_POLE    0.6   1000
ADD_ZERO    649.3    0.6602
ADD_ZERO   1225.3    1.6026

CHANNEL   V1:Sc_PR_MIR_Z_CORR    0.8253e-6   -179.0e-6    0 PR 0. NONE
ADD_POLE    0.6   1000
ADD_POLE  304.9      0
# Optical response: only the cavity pole.

CHANNEL   V1:Sc_NE_MAR_Z_CORR    1.3529e-6   +749.4e-6    0 NE 0. NONE
ADD_POLE    0.6   1000
ADD_POLE    0.6   1000
ADD_POLE   62.77     0
ADD_ZERO   100.19     0

CHANNEL   V1:Sc_WE_MAR_Z_CORR    1.3581e-6   +701.4e-6    0 WE 0. NONE
ADD_POLE    0.6   1000
ADD_POLE    0.6   1000
ADD_POLE   60.25     0
ADD_ZERO   92.56     0

CHANNEL   V1:Sc_BS_MAR_Z_CORR   -4.7865e-6  +1043.0e-6    0 BS 0. NONE
ADD_POLE    0.6   1000
ADD_POLE    0.6   1000
ADD_POLE    51.69    0.
ADD_ZERO    83.37    0.


# <===== </virgoData//VirgoOnline/HRec_MainChannels_FromPCal.cfg>

H_FREQUENCY 20000 HREC_PREFIX_hoft_raw_20000Hz

#--------------Remove  Noise channels and define the clean channel to be used for hrec checks and HWII use
# line <78> commented out by 'CfgParse' preprocessor
# include HRec_NoiseChannels.cfg

# </virgoData//VirgoOnline/HRec_NoiseChannels.cfg> =====>

# Reconstruction channels to get hoft_clean
CHANNEL   V1:SPRB_B4_56MHz_Q  1e-20       0.    0       ONE  0. NONE
ADD_DTF   8 150 500 40 5 .04 18
ADD_DTF_HOLE  50    1.0 2
#ADD_DTF_HOLE  50 1. 2
SAVE_FFT V1:SPRB_B4_56MHz_Q     0. 3000. 1000

#--------------Define the raw channel after frequency noise subtraction  (temporary channel for checks)
H_FREQUENCY 20000 HREC_PREFIX_hoft_clean_B4_20000Hz

#--------------Remove frequency noise
CHANNEL   V1:SIB2_B2_8MHz_I  1e-20       0.    0       ONE  0. NONE
ADD_DTF   50 3500 500 40 5 .04 18 # /users/mours/Hrec/V1O2Repro2A/tuneB2cor/InitAug1.gwf
ADD_DTF_HOLE  50    1.0 2
ADD_DTF_HOLE  730.3 1.0 0
SAVE_FFT V1:SIB2_B2_8MHz_I      0. 3000. 1000

#--------------Define the raw channel after frequency noise subtraction  (temporary channel for checks)
H_FREQUENCY 20000 HREC_PREFIX_hoft_clean_B4_B2_20000Hz

#--------------Remove 56MHz RIN noise
CHANNEL   V1:SDB2_B1s1_PD1_Blended  1e-20       0.    0       ONE  0. NONE
ADD_DTF   40 1000 500 40 5 .04 18
ADD_DTF_HOLE  50 1. 12
ADD_DTF_HOLE  448 20. 2
ADD_DTF_HOLE  19.1 0.2 0
ADD_DTF_HOLE  67.1 0.2 0
ADD_DTF_HOLE  63.0 1.0 0
SAVE_FFT V1:SDB2_B1s1_PD1_Blended       0. 2000. 1000

#--------------Remove B7 scattered light
CHANNEL   V1:SNEB_B7_DC  1e-20       0.    0       ONE  0. NONE
ADD_DTF   10 70 500 40 5 .04 18
ADD_DTF_HOLE  5 0.1 14
ADD_DTF_HOLE  50 1. 2
ADD_DTF_HOLE  55 0.3 0
#ADD_DTF_HOLE  19.1 0.2 0
ADD_DTF_HOLE  67.1 0.2 0
ADD_DTF_HOLE  63.0 1.0 0
SAVE_FFT V1:SNEB_B7_DC      0. 2000. 1000

#--------------Remove B8 scattered light
```

```
CHANNEL   V1:SWEB_B8_DC  1e-20       0.    0       ONE  0. NONE
ADD_DTF   10 70 500 40 5 .04 18
ADD_DTF_HOLE  5 0.1 14
ADD_DTF_HOLE  50 1. 2
ADD_DTF_HOLE  55 0.3 0
#ADD_DTF_HOLE  19.1 0.2 0
ADD_DTF_HOLE  67.1 0.2 0
ADD_DTF_HOLE  63.0 1.0 0
SAVE_FFT V1:SWEB_B8_DC      0. 2000. 1000
# <===== </virgoData//VirgoOnline/HRec_NoiseChannels.cfg>

H_FREQUENCY 20000 HREC_PREFIX_hoft_clean_20000Hz


#-------------Remove  CAL channels
# line <84> commented out by ‘CfgParse’ preprocessor
# include HRec_CalChannels_FromPCal.cfg

# </virgoData//VirgoOnline/HRec_CalChannels_FromPCal.cfg> =====>

#-------------Remove external noise used to check h_raw uncertainties

# include 10 us which is the extra-delay of NE,WE optical response wrt to GW optical response
# same response as for Sc_NE_MIR_Z_CORR (DeltaL/Sc) multiplied by Sc/CAL response
CHANNEL   V1:CAL_NE_MIR_Z_NOISE    0.4829e-6  +240.3e-6    0  NE 0. NONE
ADD_POLE    0.6    1000
ADD_POLE   123.46     0
ADD_ZERO   129.81     0
ADD_POLE   8174.0     0
ADD_POLE   8174.0     0

CHANNEL   V1:CAL_WE_MIR_Z_NOISE    0.4008e-6  +241.3e-6     0  WE  0. NONE
ADD_POLE    0.6   1000
ADD_POLE   113.04    0
ADD_ZERO   115.22    0
ADD_POLE   8174.0     0
ADD_POLE   8174.0     0

#-------------Remove PCal permanent lines
# PCAL delay is 112 us for PD1 sensing, the end mirror optical response is 10 us: -112 + 10 ?s = -102 us
# hpcal channels are in h, gain is needed to convert them into meters

CHANNEL   V1:PCAL_NEB_PD2_hpcal    -3000.  -102e-6    0  NE 0. NONE

CHANNEL   V1:PCAL_WEB_PD2_hpcal    -3000.  -102e-6    0  WE 0. NONE

#-------------Remove Hardware injections


# <===== </virgoData//VirgoOnline/HRec_CalChannels_FromPCal.cfg>

##----------------------------------------------------Optical gains
/* Calibration line frequencies have been changed on August 17, 2018:
NE is now 62.5  (was 63.3)  357.5 (was 358.3)
WE is now 61.5  (was 60.8)  356.5 (was 355.8)
BS is now 61.0  (was 62.8)  356.0 (was 357.8)
PR is now 63.0  (was 62.3)  358.0 (was 357.3)
-------------------------------------*/

#--------- this is to compute the optical gains with the usual permanent lines ---
GET_OGAIN 4 2 V1:Sc_NE_MIR_Z_CORR   62.5  10. V1:Sc_WE_MIR_Z_CORR   61.5  10. V1:Sc_BS_MIR_Z_CORR  61.0  10. V1:Sc_PR_MIR_Z_CORR  63.0 0.
GET_OGAIN_FREQ_BCKGRND 62 2
GET_OGAIN 4 2 V1:Sc_NE_MIR_Z_CORR  357.5  10. V1:Sc_WE_MIR_Z_CORR  356.5  10. V1:Sc_BS_MIR_Z_CORR 356.0  10. V1:Sc_PR_MIR_Z_CORR 358.0 0.
GET_OGAIN_FREQ_BCKGRND 357 2

#----------- name   coef1     channel        coef2    channel2
DEFINE_OGAIN  NE      0. V1:Sc_NE_MIR_Z_CORR_357.5  1. V1:Sc_NE_MIR_Z_CORR_62.5 51
DEFINE_OGAIN  WE      0. V1:Sc_WE_MIR_Z_CORR_356.5  1. V1:Sc_WE_MIR_Z_CORR_61.5 51

DEFINE_OGAIN  BS      0. V1:Sc_BS_MIR_Z_CORR_356.0  1. V1:Sc_BS_MIR_Z_CORR_61.0 51
DEFINE_OGAIN  PR      0. V1:Sc_PR_MIR_Z_CORR_358.0  1. V1:Sc_PR_MIR_Z_CORR_63.0 51
DEFINE_OGAIN CAVITIES 0.5 NE      0.5 WE 0

#---------faster optical gain for OMC tuning
DEFINE_OGAIN NE_11      0. V1:Sc_NE_MIR_Z_CORR_357.5  1. V1:Sc_NE_MIR_Z_CORR_62.5 11
DEFINE_OGAIN NE_21      0. V1:Sc_NE_MIR_Z_CORR_357.5  1. V1:Sc_NE_MIR_Z_CORR_62.5 21

#--------- this is to get a gain of 1
GET_OGAIN 1 2 V1:B1   62.5  0.
DEFINE_OGAIN  ONE     0. V1:B1_62.5  1. V1:B1_62.5

##----------------------------------------------------Finesse
FINESSE_ADJUST 430 455 NE 0.5 V1:Sc_NE_MIR_Z_CORR_62.5 WE 0.5 V1:Sc_WE_MIR_Z_CORR_61.5 BS 0. V1:Sc_BS_MIR_Z_CORR_61.0 21
```

```
##------------------------------------------------------Define the output channels
H_FREQUENCY 20000 HREC_PREFIX_hoft_20000Hz
H_FREQUENCY 16384 HREC_PREFIX_hoft_16384Hz
H_FREQUENCY 200   HREC_PREFIX_hoft_2_200Hz 1 2

#-------------------------
RANGE_CHANNEL HREC_PREFIX_hoft_20000Hz

#-----------------------------------------
SAVE_FFT V1:B1  0. 2000. 500
SAVE_FFT V1:Sc_BS_MIR_Z_CORR 0. 2000. 500
SAVE_FFT V1:Sc_PR_MIR_Z_CORR 0. 2000. 500
SAVE_FFT V1:Sc_NE_MIR_Z_CORR 0. 2000. 500
SAVE_FFT V1:Sc_WE_MIR_Z_CORR 0. 2000. 500
SAVE_FFT V1:Sc_NE_MAR_Z_CORR 0. 2000. 500
SAVE_FFT V1:Sc_WE_MAR_Z_CORR 0. 2000. 500
SAVE_FFT V1:Sc_BS_MAR_Z_CORR 0. 2000. 500
SAVE_FFT HREC_PREFIX_hoft_Watt   0. 2000. 500
# <===== </virgoData//VirgoOnline/HRec.cfg>
```