Commissioning status

2018/12/17

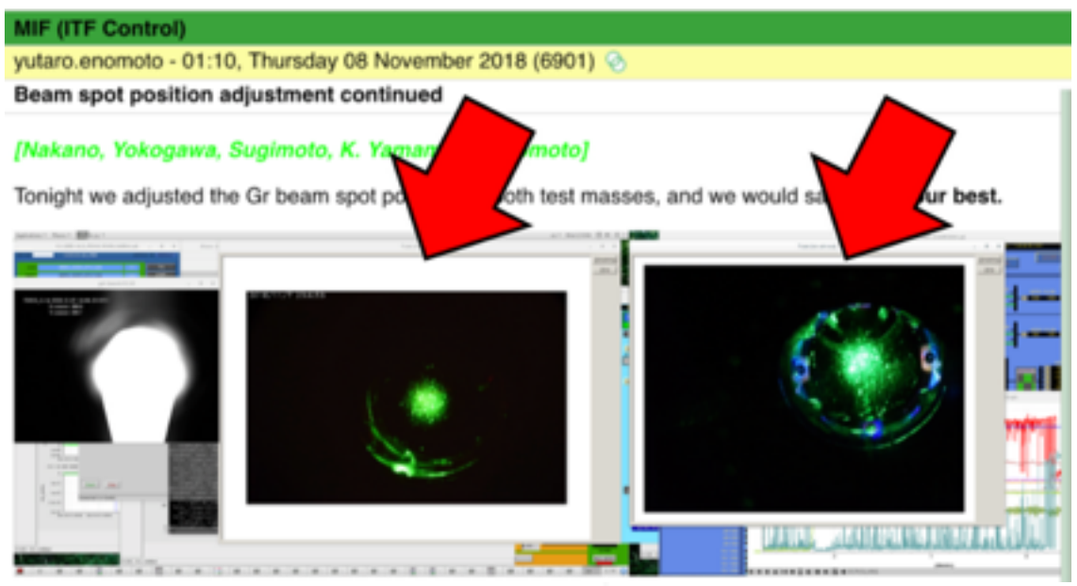
Takaaki Yokozawa

TCam issue

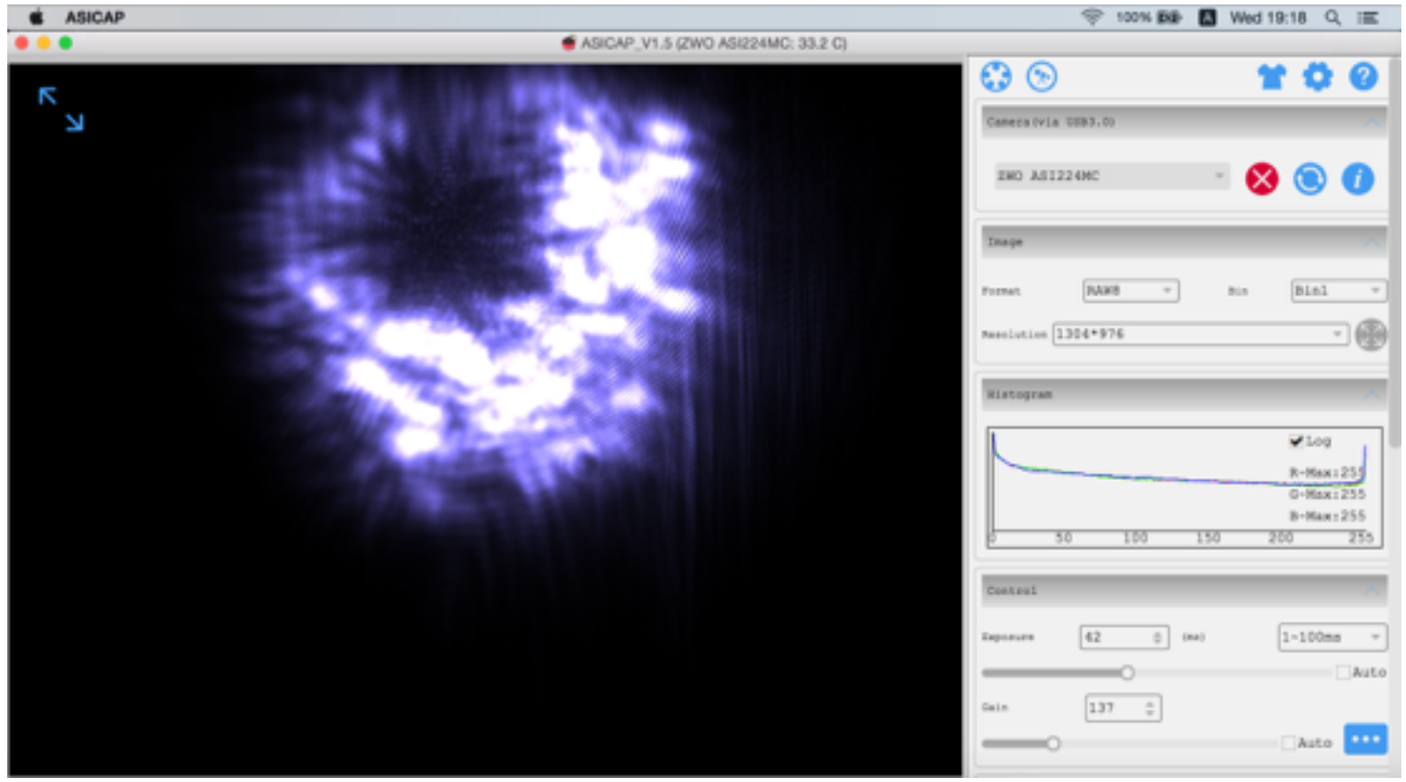
- X front TCam is very important for the X-arm commissioning, we decided to use Nikon camera until this year.
- Accordingly, we installed the new video-like camera system to Y-end

ZWO ASI 224MC

- Next year we will move the Nikon camera to Yend.



- variable exposure, Gain
- Focusing : manual
- No ETMY image due to aluminum of WAB



Recent X arm characterization

- Longest lock: **~20min** (intentionally terminated)
- Cavity length: **2999.992(3)m**
- Mode matching ratio: **91%**
  Carrier power / total power: **88%**
- Roundtrip loss (estimated from reflectivity): **86 ppm**

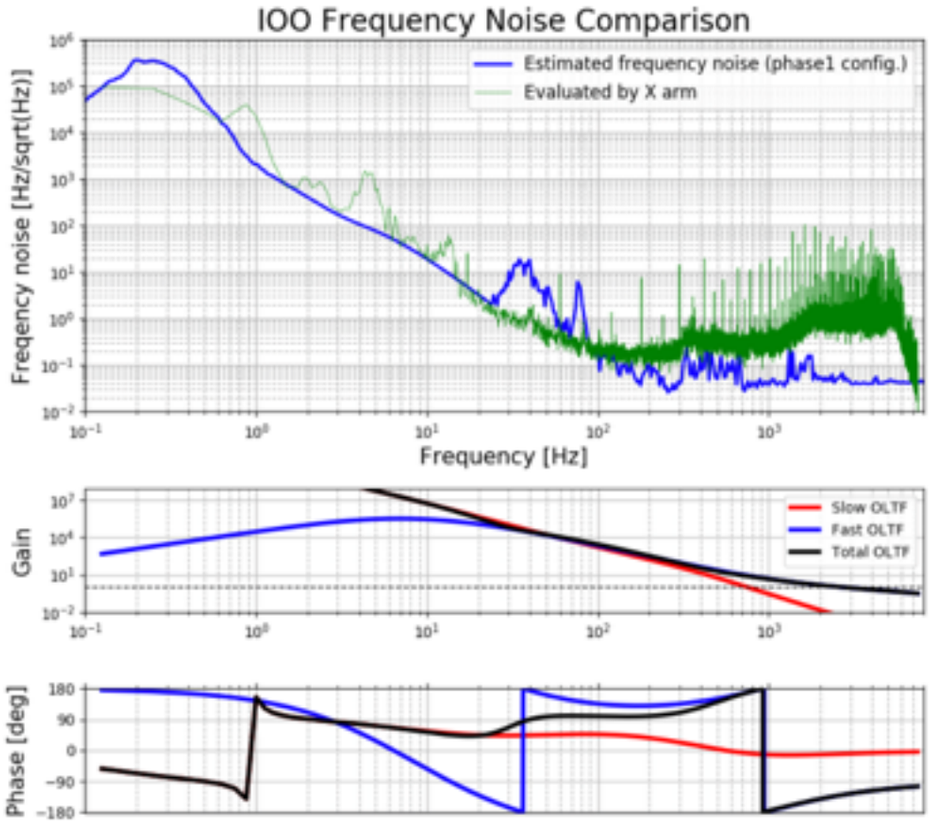
- Needs some remaining tasks until 2018/1/6
  - ALS
  - Automation for lock acquisition and alignment
  - X arm WFS
  - Green fiber setting for Y arm
  - IOO: MC frequency noise hunting
  - VIS: 0.2-0.3Hz noise hunting
  - CAL: calibrated noise for iMC and X arm on monitor at ctrl. room

MIF (ITF Control)

yutaro.enomoto - 16:45, Monday 03 December 2018 (7265)

Frequency noise of the laser injected to MIF were evaluated by X arm

Using the data taken yesterday's lock of X arm, the external disturbance of this loop, (which is dominated by frequency fluctuation of main laser at f >~1 Hz), are quickly plotted here along with the estimated frequency noise of IMC transmission.



NOTE:

-- This estimation of IOO frequency noise was done for the Phase-1 configuration, which is different from current one. So these two traces cannot be compared directly.

-- No precise fitting for OLTF has not yet been done. The OLTF of CARM loop was modelled just using the measured unitiy gain frequency of ~2.5kHz (at this moment, IN1 gain was not 31dB, but 26dB. So UGF was not 5kHz, but 2.5kHz).

MIF (ITF Control)

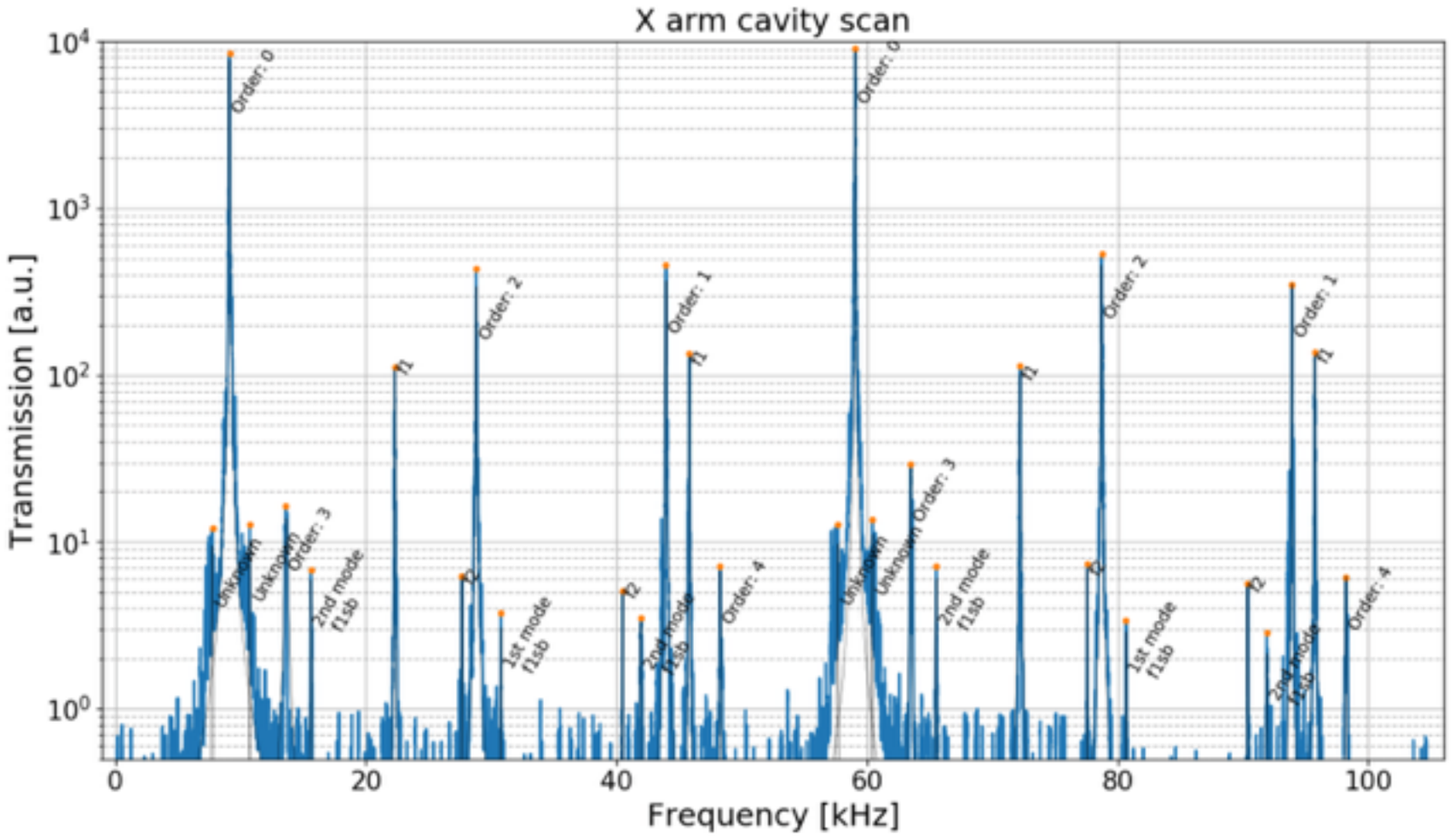
yutaro.enomoto - 01:23, Sunday 09 December 2018 (7307)

X arm cavity characterization with good spot positions

Evaluate the length of arm (2999.99m)
curvature of mirror
mode match ing ratio, Ratio of carrier power

= Cavity scan (as a preparation for the loss measurement) =

We scan the X arm cavity by sweeping the PLL offset frequency, as we did the day before yesterday.
Note that we increased the offset frequency as time past, and so increased the main laser frequency (since AUX X frequency is locked slightly lower than that of main laser).
Here is the result. The list of peak positions and heights are also attached.



From this we get the follwoing information:

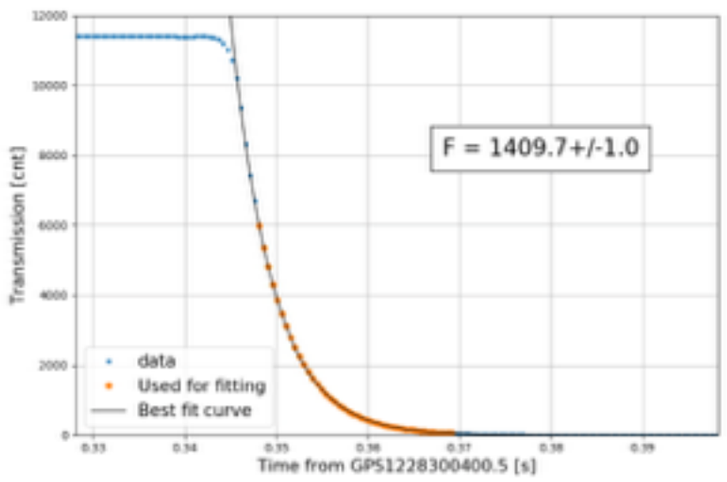
the height of f1 sidebands relative to the carrier (beta^2/4): 0.014(1)
f1 modulation index (beta): 0.24(1)

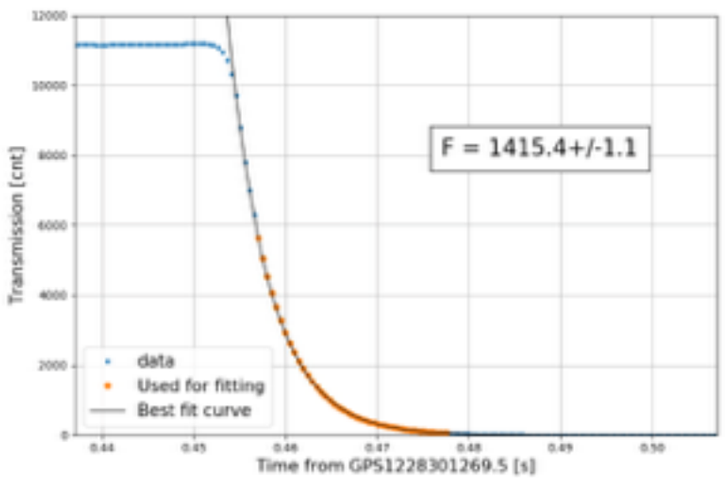
the height of f2 sidebands relative to the carrier (beta^2/4): 0.00070(7)
f2 modulation index (beta): 0.053(3)
Mode matching ratio: 91(1) %
Ratio of carrier power: 88(1) %

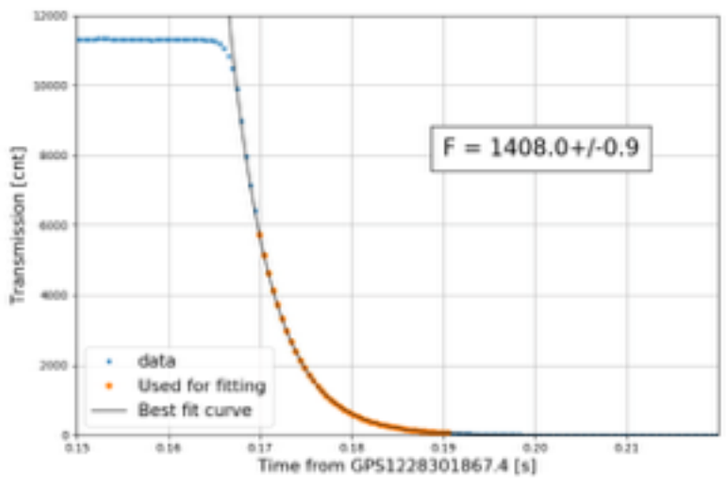
Stop the laser input and check the decay(ringdown)
Well known method for the evaluation finesse

= Ring down =

To know the finesse, we repeated this three times. Here are the results and how the ring down and its fitting looks like.
F (1st): 1409.7 +/- 1.0
F (2nd): 1415.4 +/- 1.1
F (3rd): 1408.0 +/- 0.9
As a whole, F = 1411 +/- 2







Using the measured parameters for ETMX/ITMX, Tloss is estimated as
Tloss = 9 +/- 18 ppm

MIF (ITF Control)

yutaro.enomoto - 23:28, Tuesday 11 December 2018 (7332)

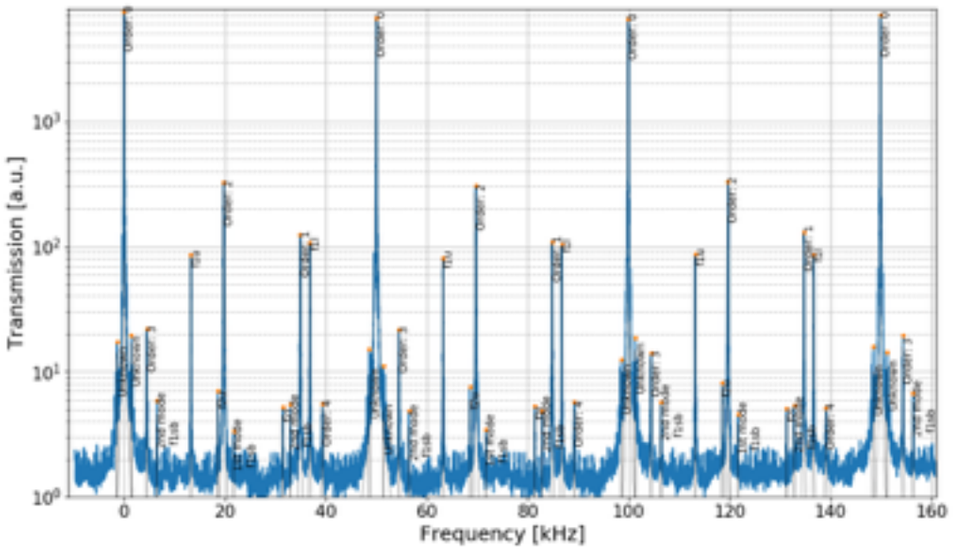
Comment to Summary of today's work (Click here to view original report: 7289)

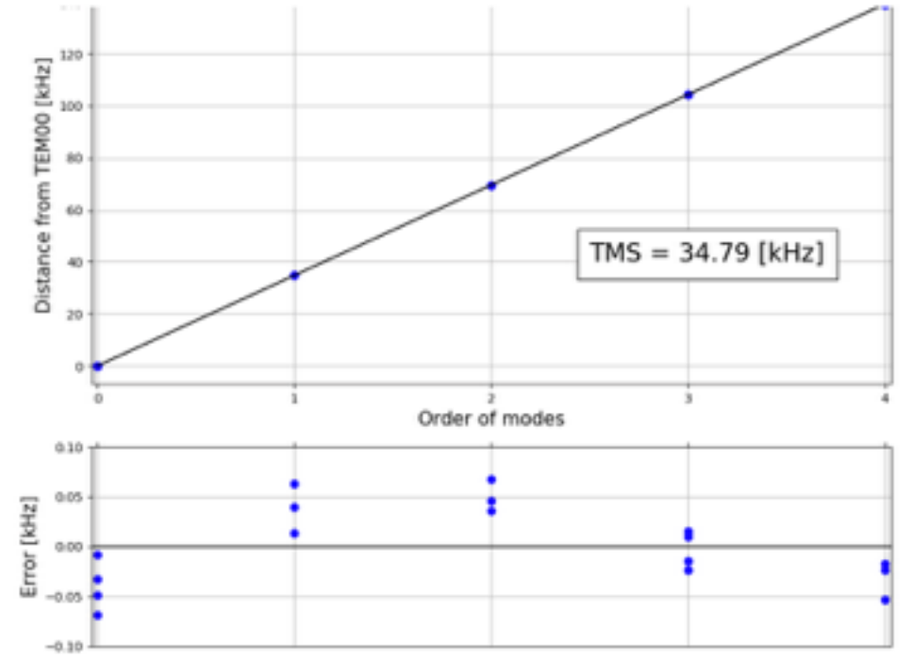
== Comprehensive analysis of the cavity scan held on the last Thursday ==

Here I report the results from the automatic peak finding and fitting of them for the cavity scan we did the other day.
From the fitting results and some mathematics, the cavity length, transverse mode spacing, and roundtrip Gouy phase are obtained:

L = 2999.990(2) [m] <=> FSR = 49.96557(4) [kHz]
TMS = 34.79(5) [kHz]
ζ_{Gouy} = 4.375(5) [rad] = 250.7(3) [deg]

Here I put the two plots, one of which shows the fitting results of the cavity scan and the other of which shows the fitting for the transverse mode spacing.
Note that the error for TMS is evaluated from the systematic error you can see in the bottom plot showing the residual error.





I also attach the code I used.

= Some notes =
* On radii of curvature of ITMX/ETMX.
According to Hirose-san's report, R_ETMX = 1907.83 +/- 2.14 [m], R_ITMX = 1904.54 +/- 2.08 [m].
From these numbers, TMS should be
$TMS_{from\ RoC}$ = 34.703(24) [kHz].
This is not consistent with the value obtained from the cavity scan.
Note that TMS value obtained from the cavity scan we did on Saturday gave us almost the same number, 34.78(5) [kHz]
There is some discrepancy between the measured Gouy phase and that expected from the characterization of the coated test mass. Why???
This dicrepancy corresponds to ~ 5-10 [m] change of the radii of curvature.

Memo (Sorry for Japanese)

Current :
The lock duration of the green laser cavity is ~30min in average(3h max)
The lock duration of the IR laser cavity with green laser transition is 10min with turn off the all air conditioner.
The lock duration of the IR laser cavity(without green laser transition) is quasi-stable.
  ->They didn't check the how stable, but we can lock for a long time
  -> Noise budget and aliment improvement
  -> Lock trial at night and start injection?
But, if there is large seismic noise, the lock was unstable (1day per 1week)