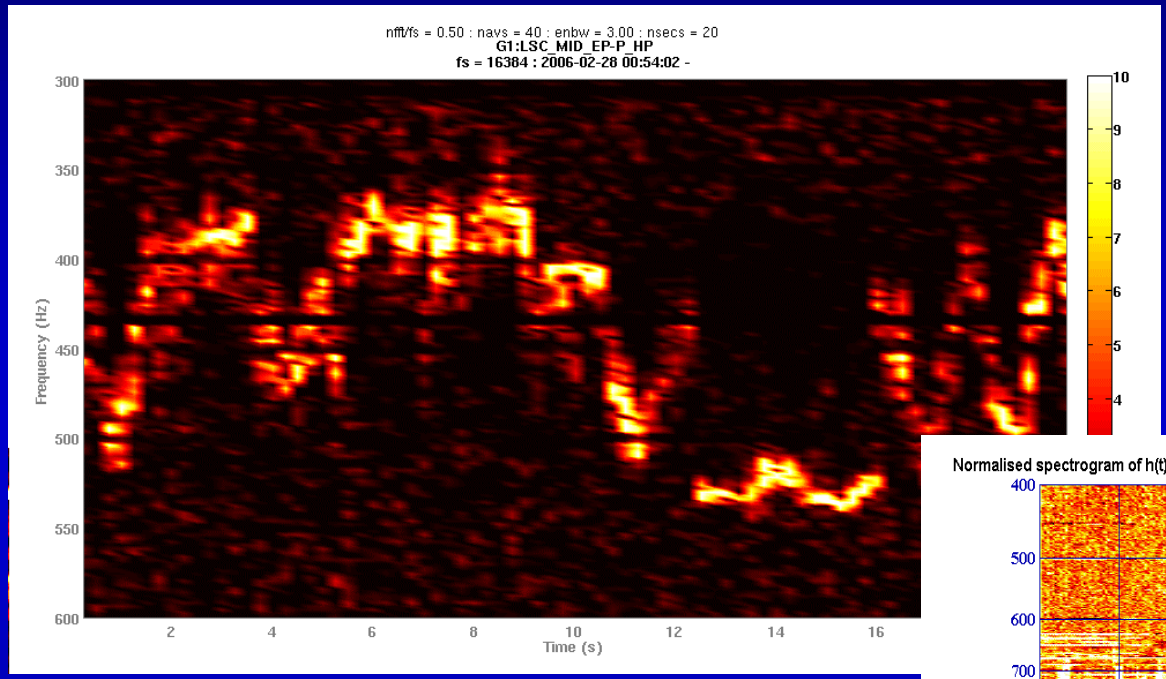
Brainstorming: THE GEO ‚OWL‘

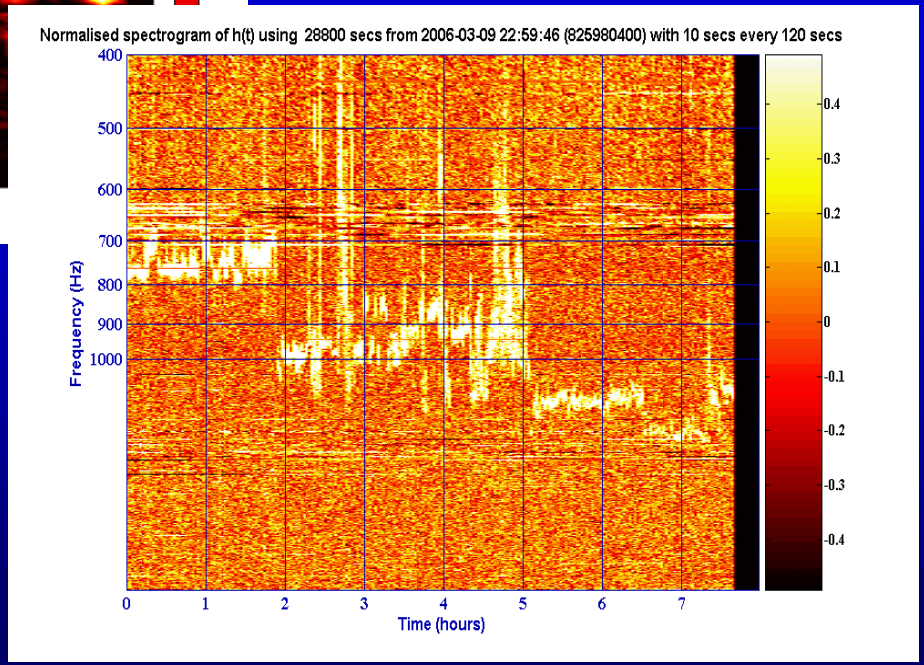
A mysterious species

Max-Planck-Institut für Gravitationsphysik
(Albert-Einstein-Institut)

Universität Hannover

What is the owl?



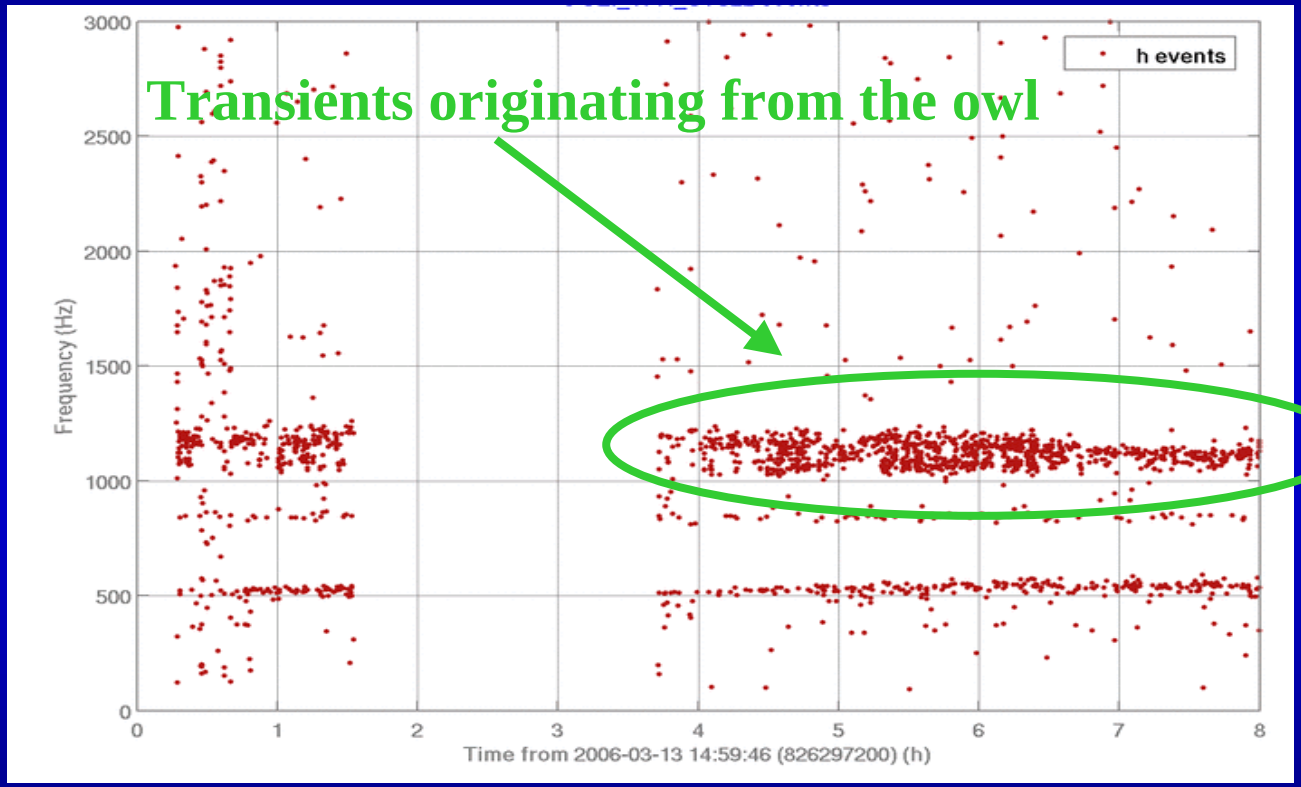


A single moving line:

- high SNR
- moving very fast (up to 100Hz/s)
- Sounds a bit similar to an owl

Why is it a problem? (1)

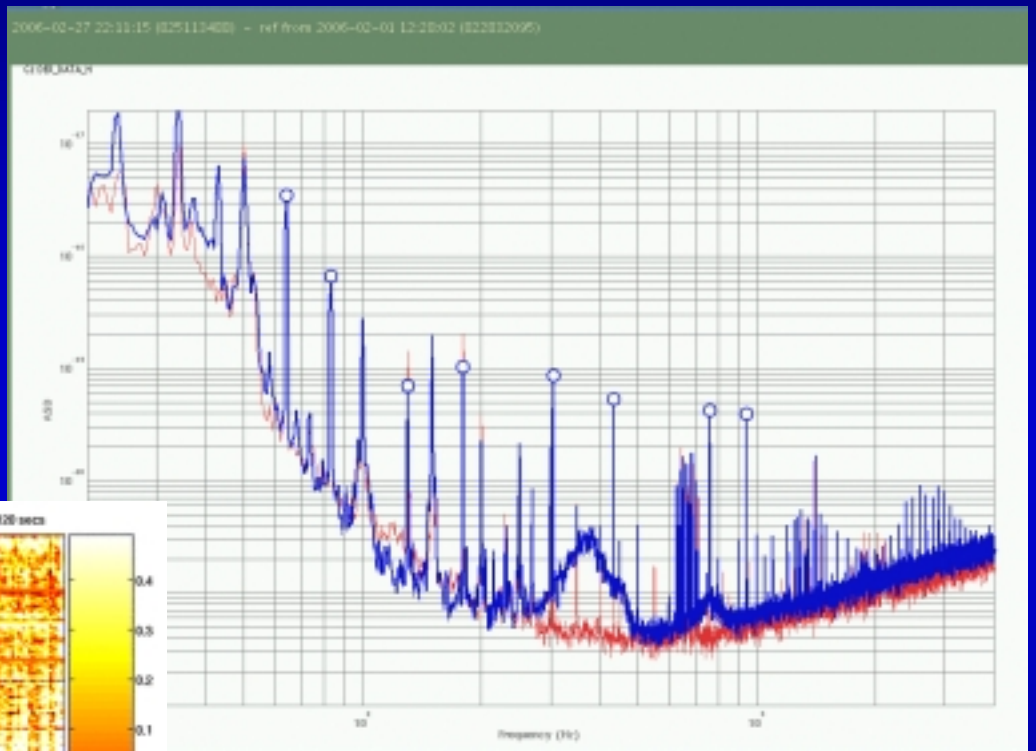
Most time the owl stays above 1 kHz.

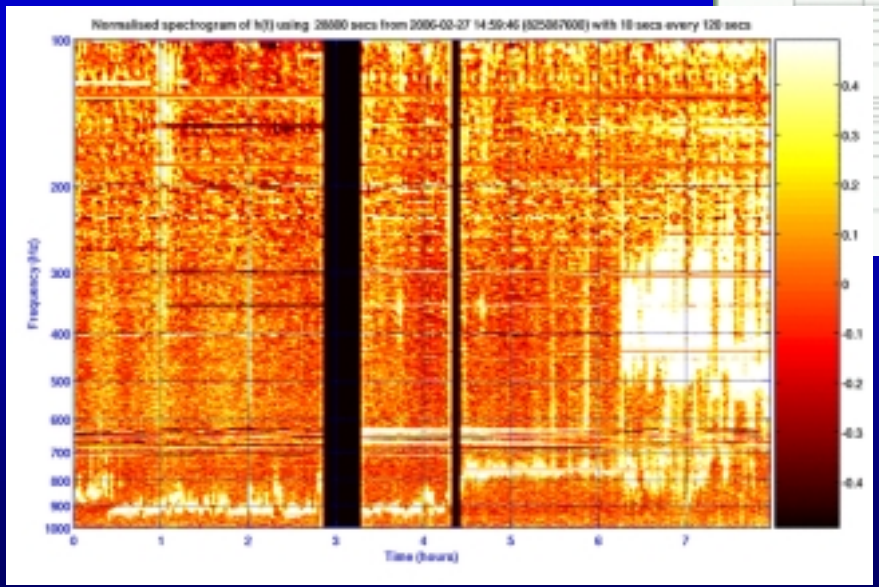


Produces many burst triggers
=> not useful for any burst analysis !

Why is it a problem? (2)

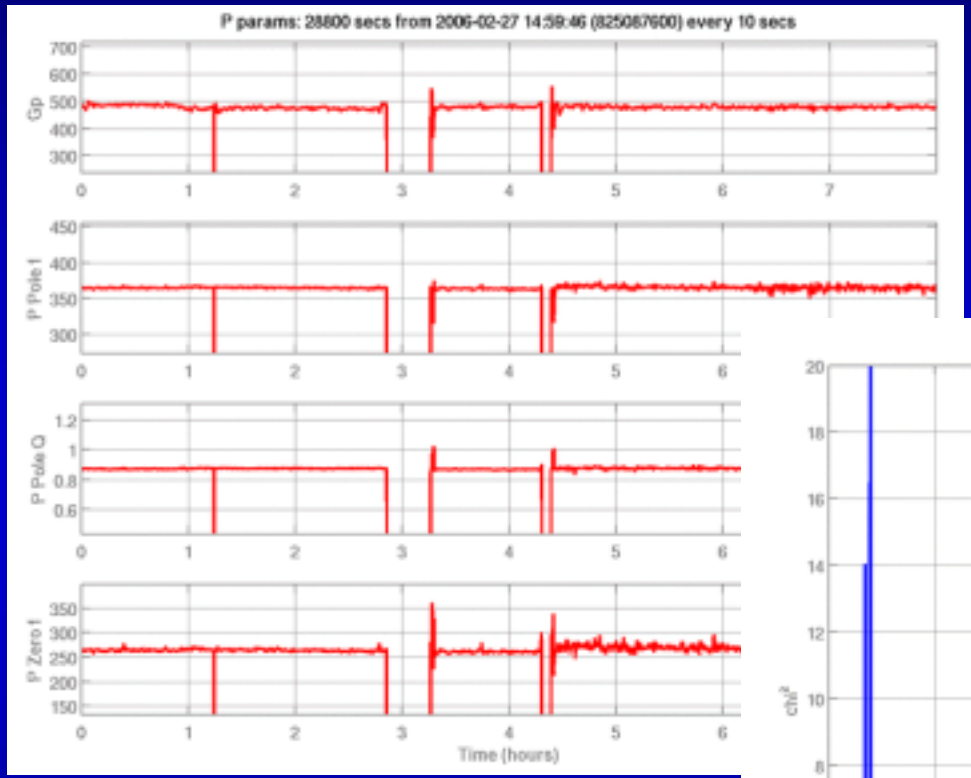
Even worse when the Owl comes to lower Frequencies !!!



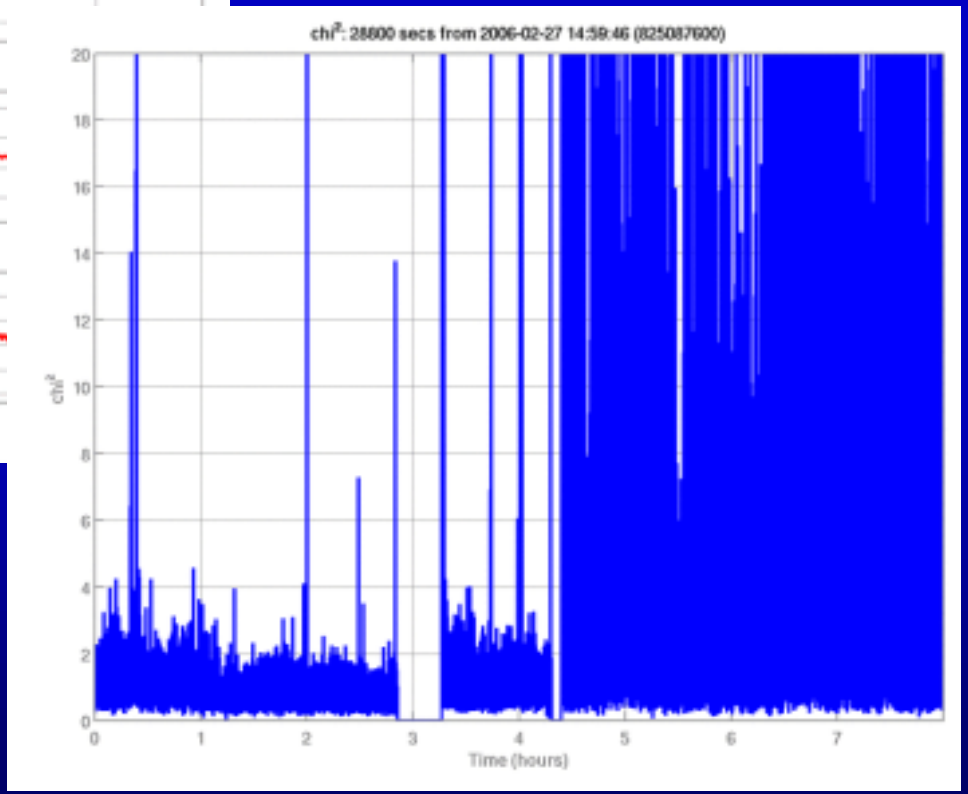


Calibration gets influenced !!!

Why is it a problem? (3)

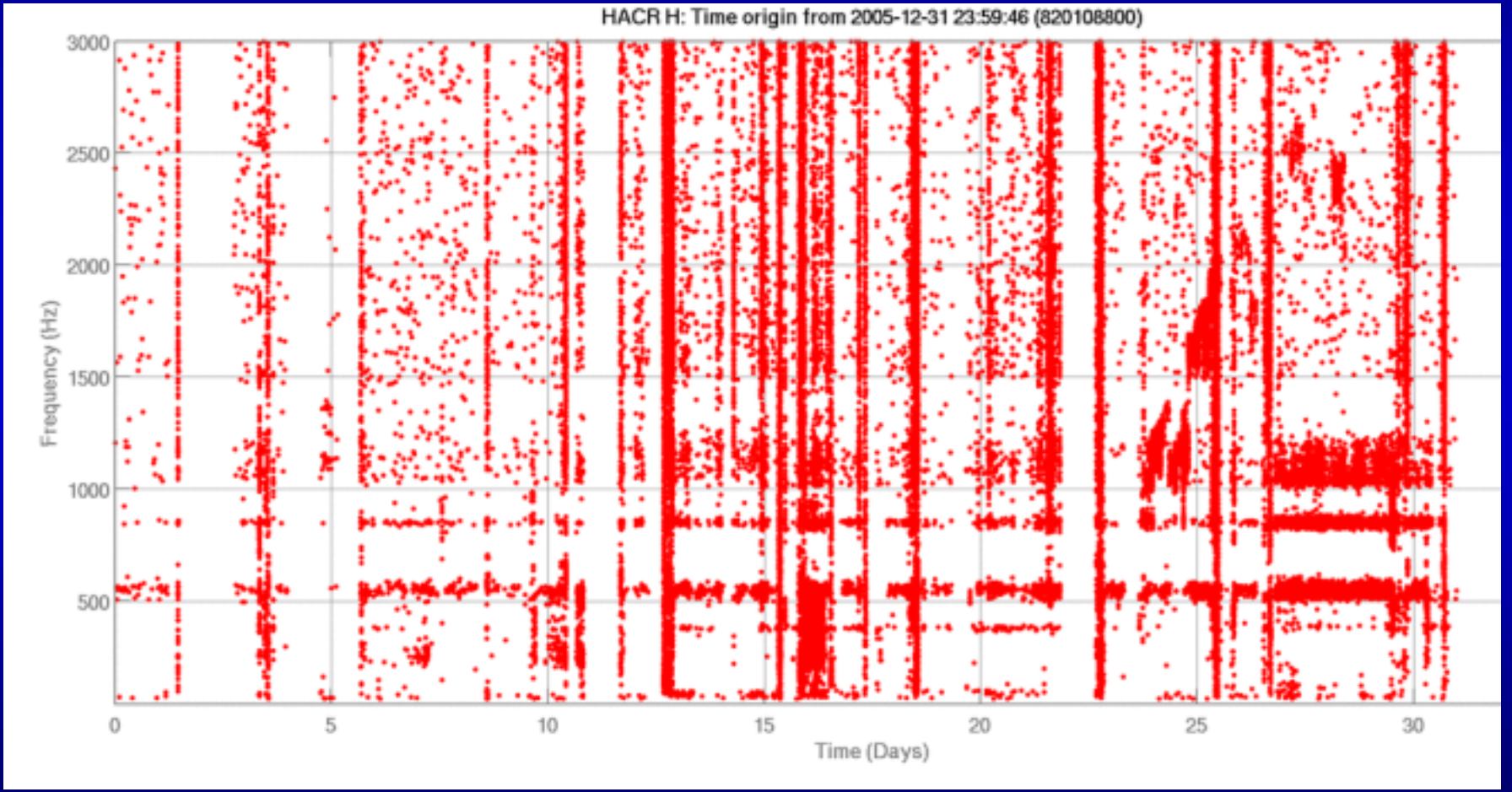


Owl below 800 Hz: Calibration parameter get corrupted.

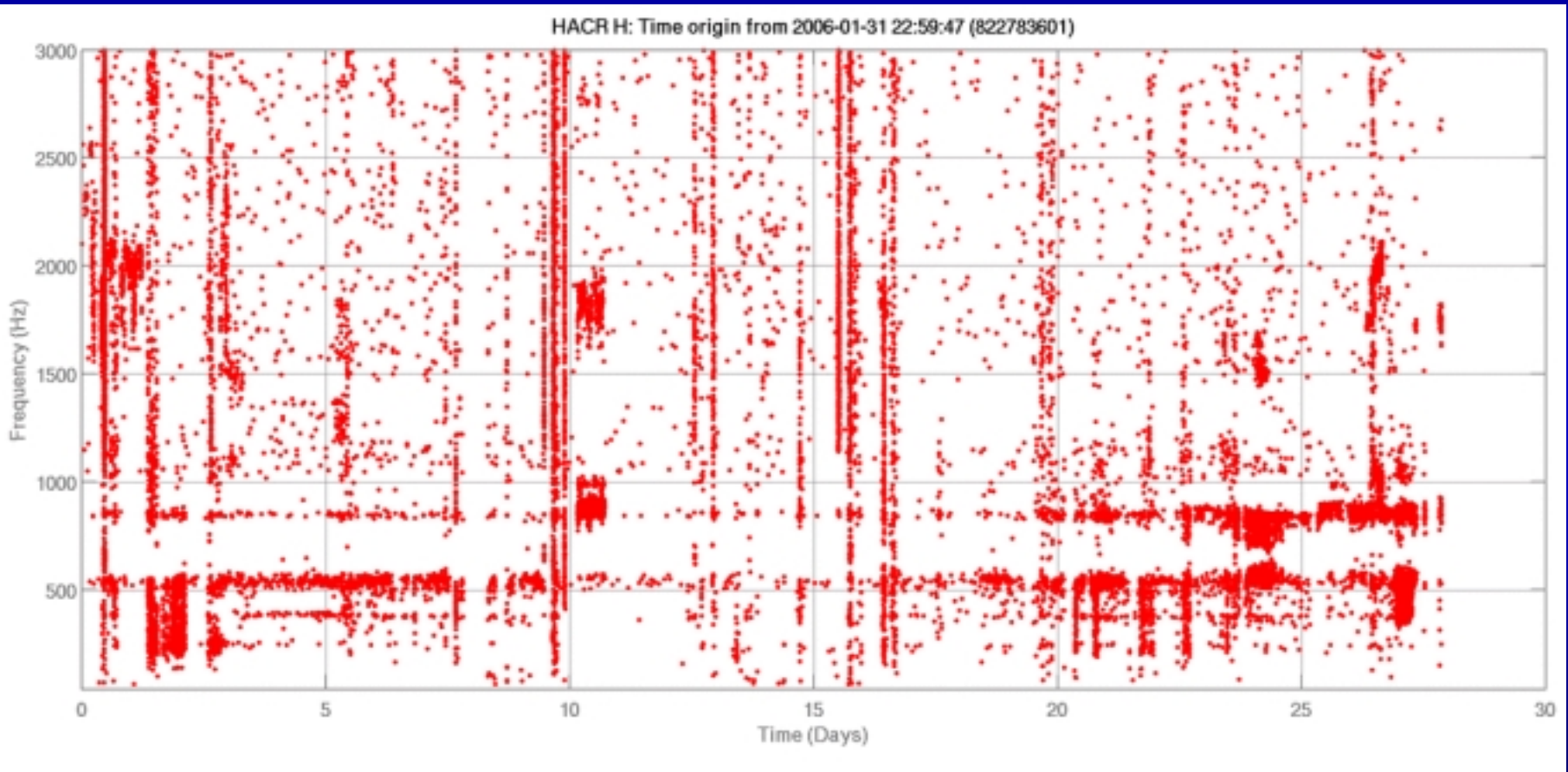


Chi^2 cut flags the data to Not being science quality.

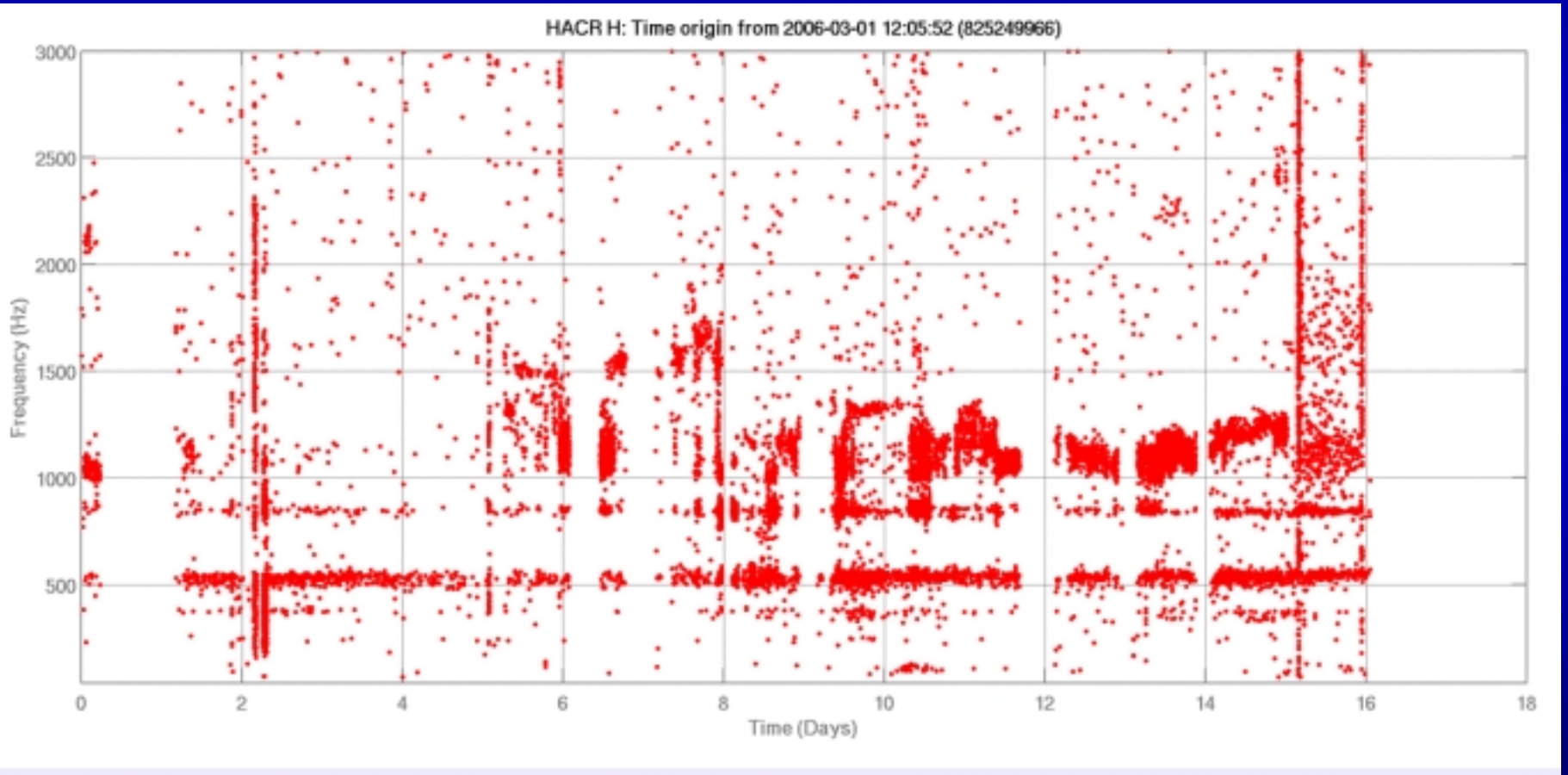
Presence in January



Presence in February



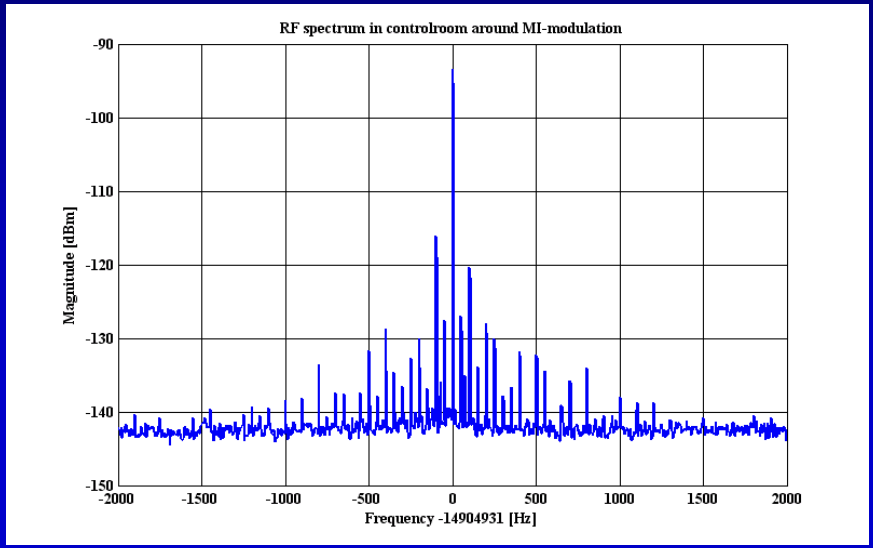
Presence in March

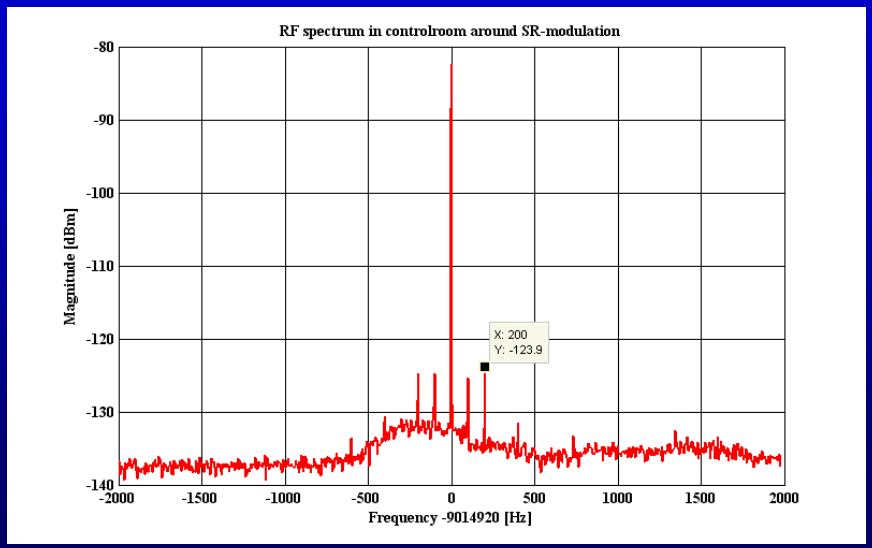


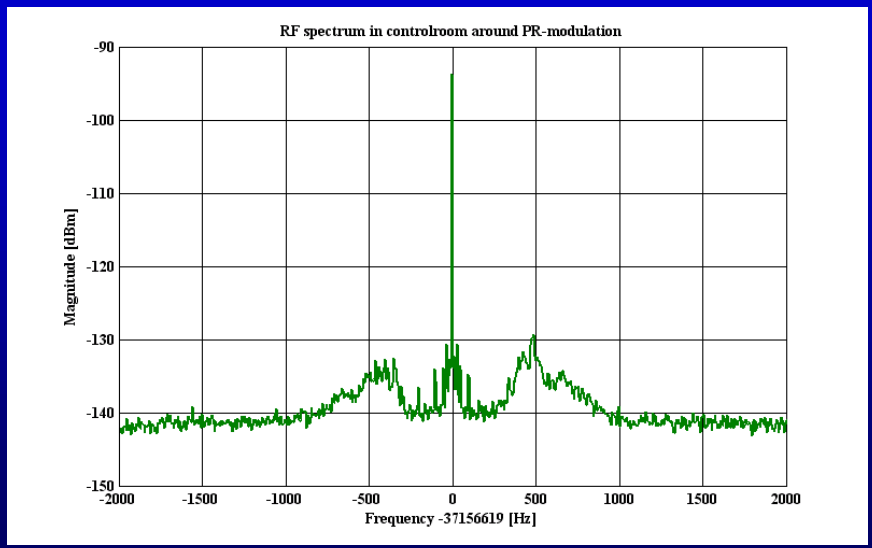
Checking the environmental RF

Fast and wide movement of the line suggests originating from RF beat.

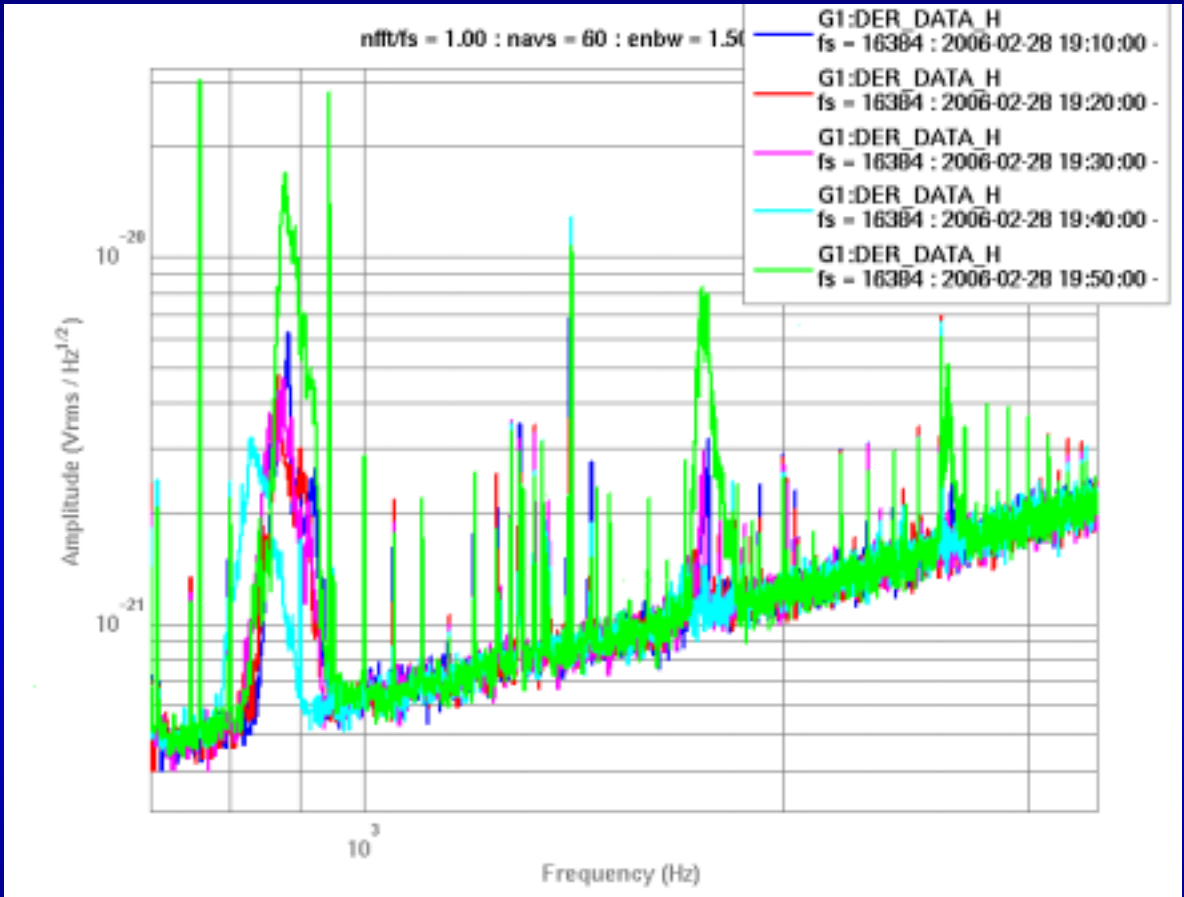
But no suspicious line in the environmental RF.







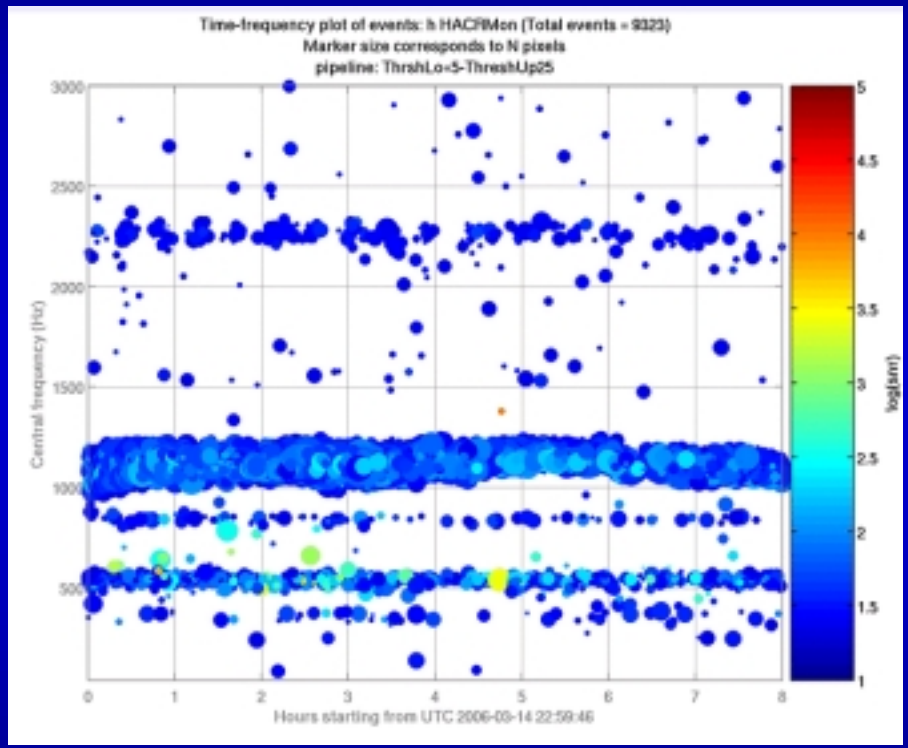
2nd harmonic at DC



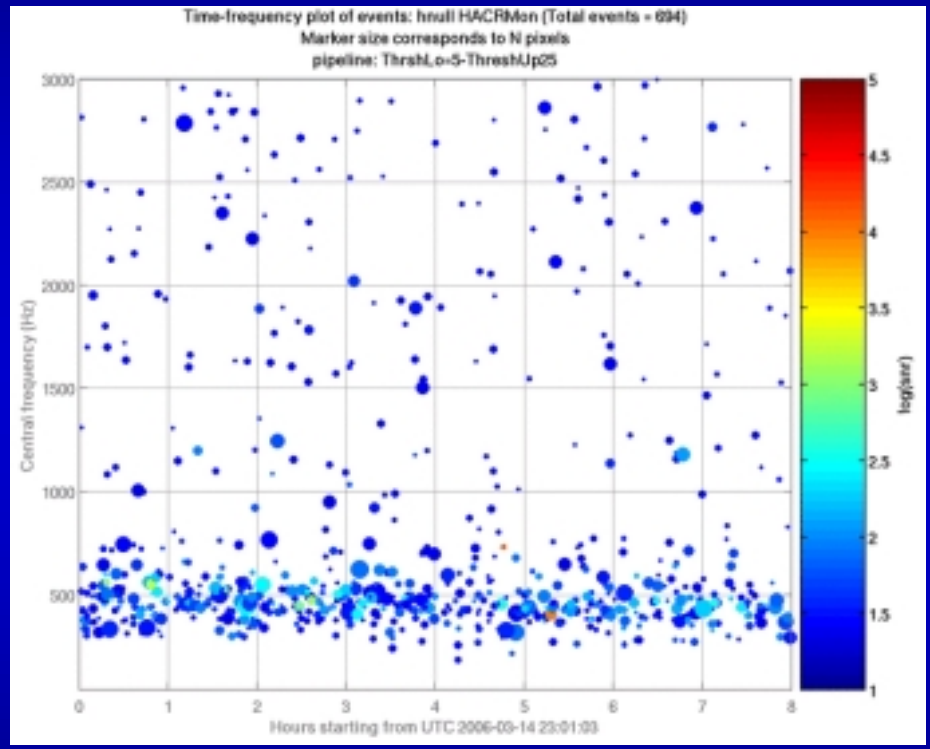
Observation of higher harmonics excludes RF.

Owl is h-like (1)

h(t)=Opt comb of hp and hq



H_null = no grav. wave information



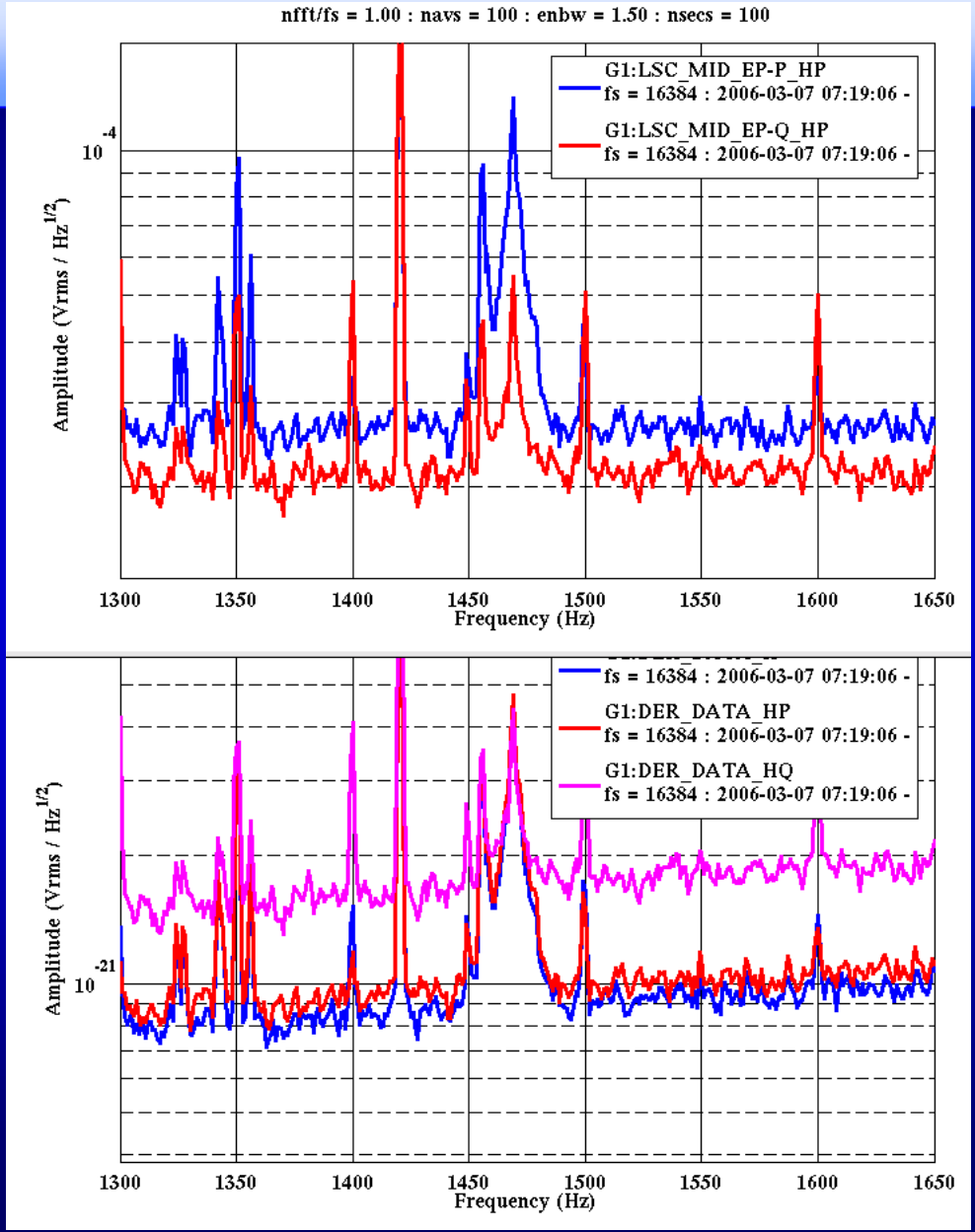
$$h_{\mathrm{P}}(t) = h(t) + N_{\mathrm{P}}(t)$$
$$h_{\mathrm{Q}}(t) = h(t) + N_{\mathrm{Q}}(t)$$

$$h_{\mathrm{null}}(t) = h_{\mathrm{P}}(t) - h_{\mathrm{Q}}(t),$$

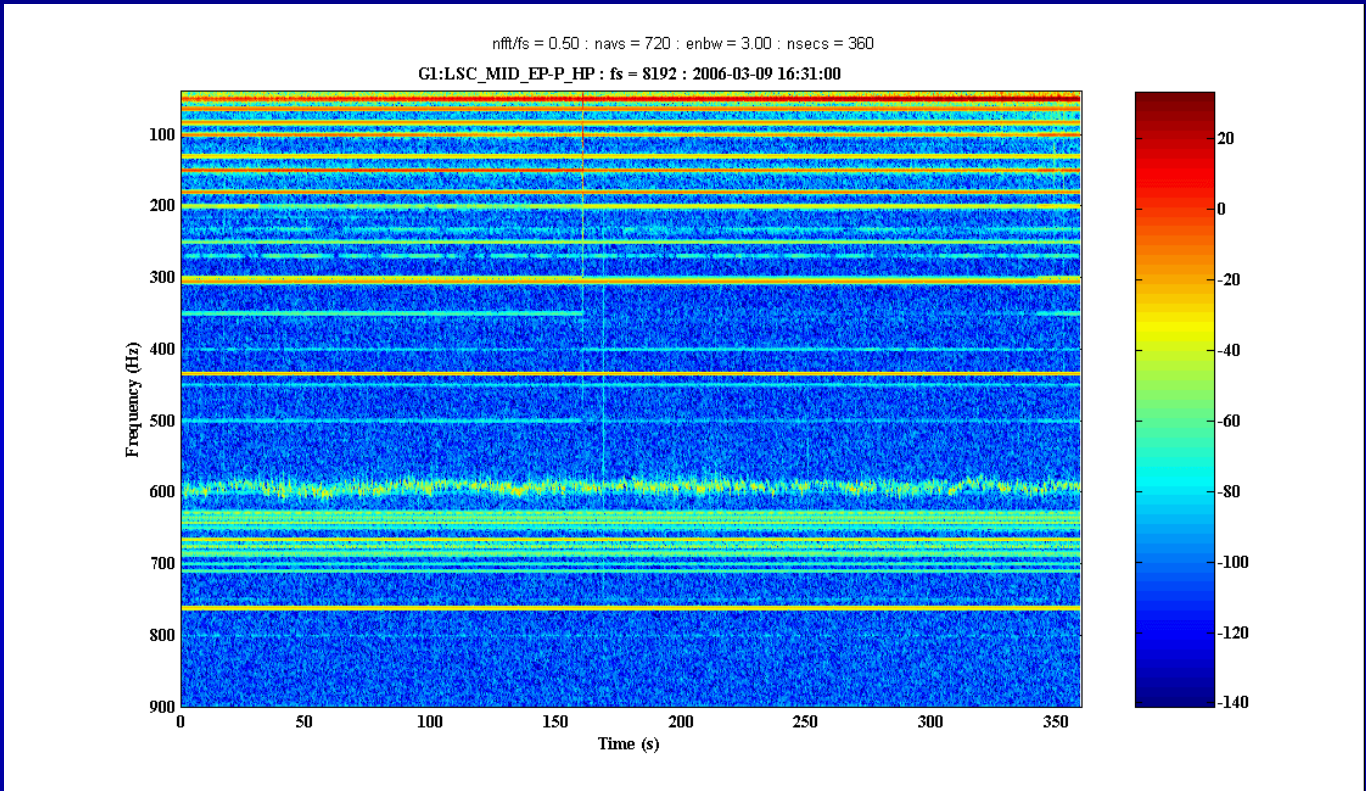
Owl is h-like (2)

Owl doesn‘t match in uncalibrated errorpoints.

But in h(t), hq and hp the owl lines perfectly up

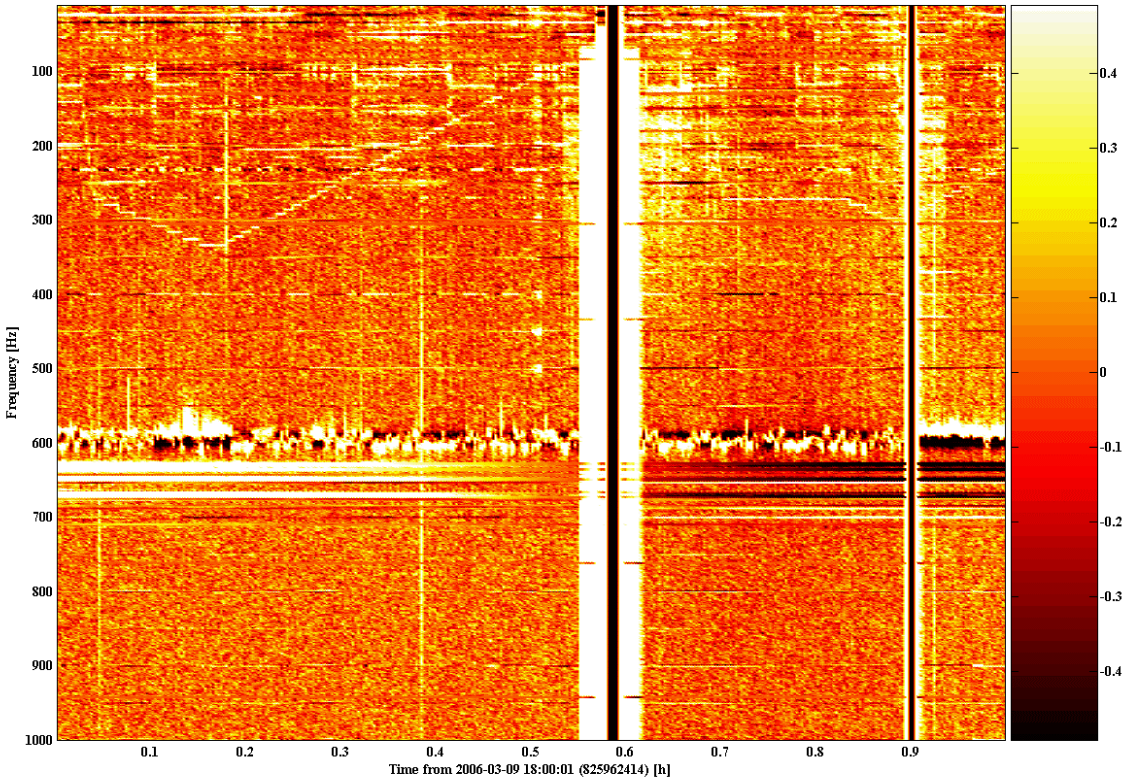


Not a higher order mode heater experiment



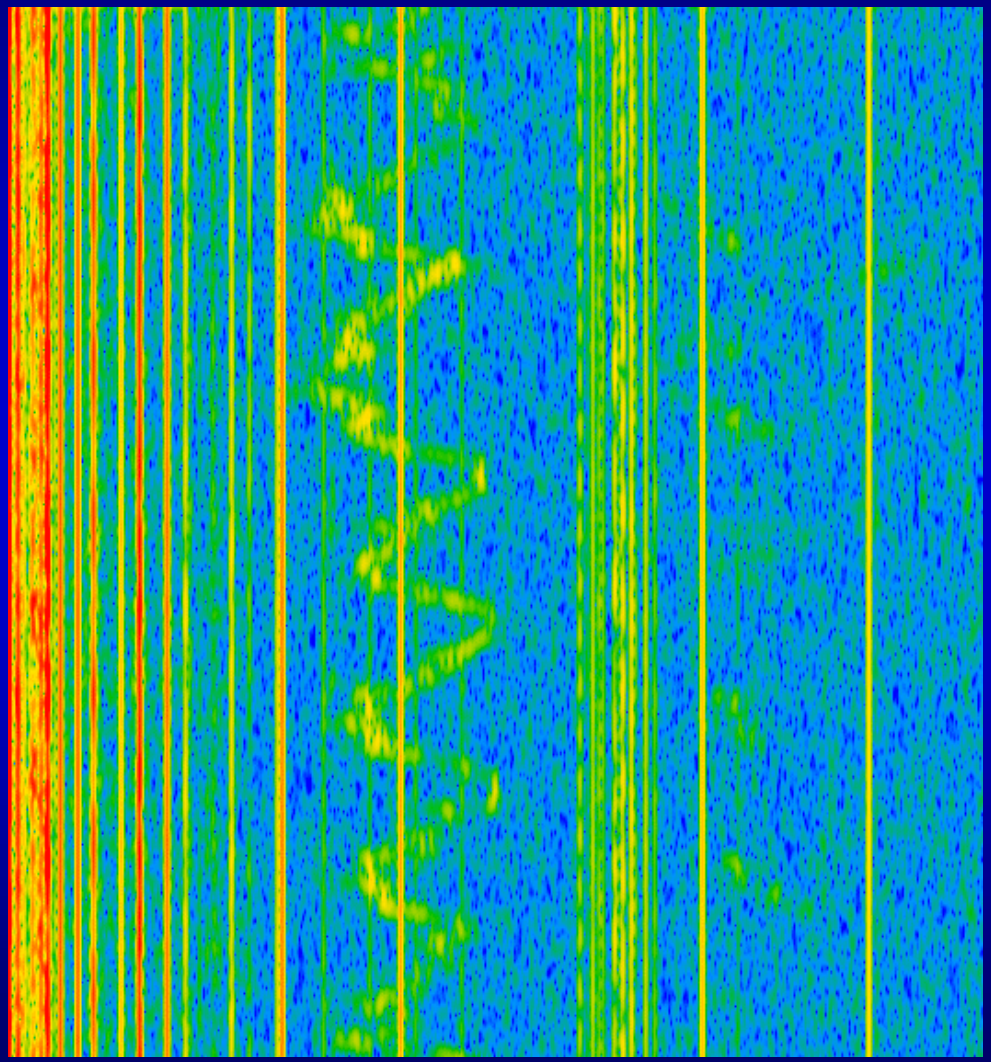
Changing the ROC of one of the folding mirrors doesn‘t change the owl. => Rules out higher order modes.

Not Signal-recycling tuning



Changing the tuning signal-recycling doesn‘t show any clear influence on the owl.

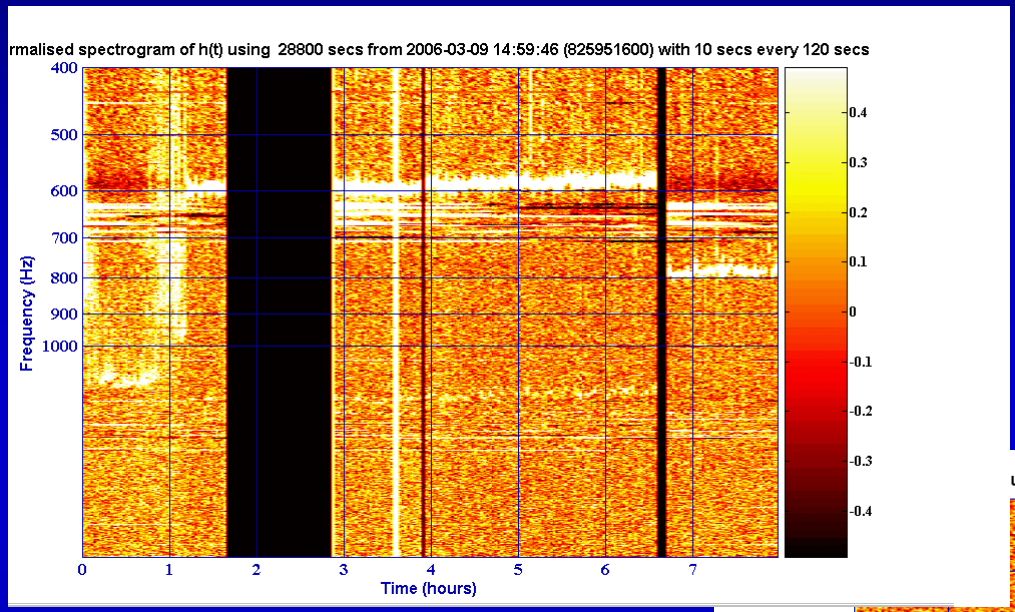
Modulated by pendulum frequencies

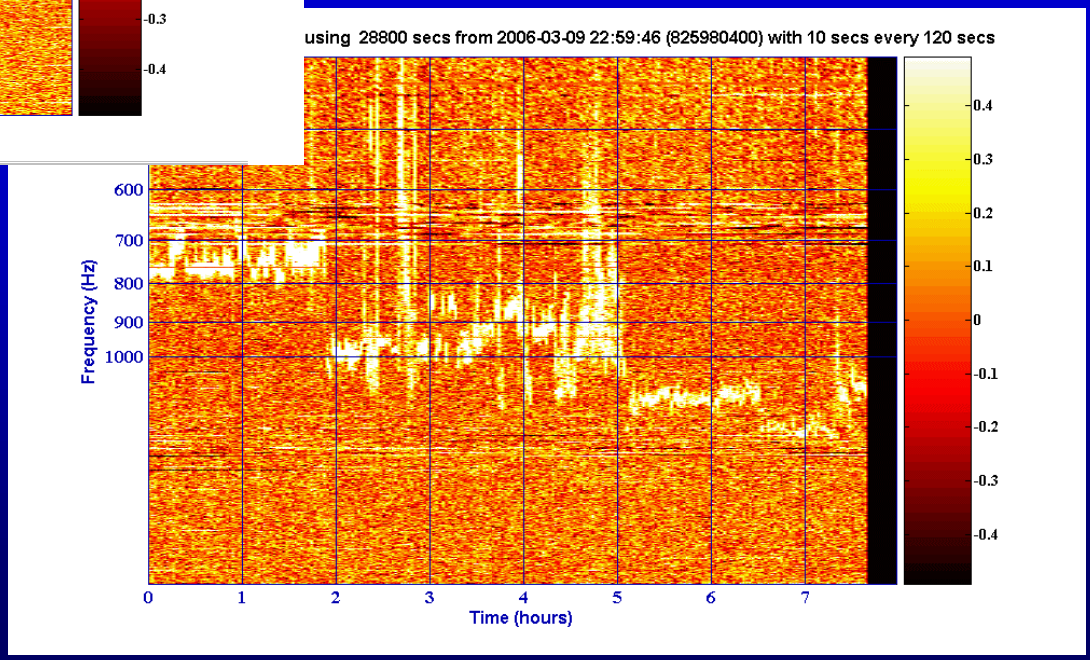


The line was sometimes modulated With about 0.56 Hz.

This matches probably A resonance of one of the pendulums.

Sometimes jumps between locks, but also sometimes not ??

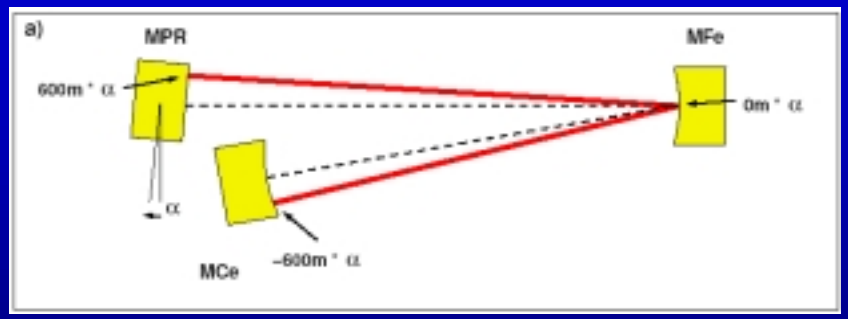




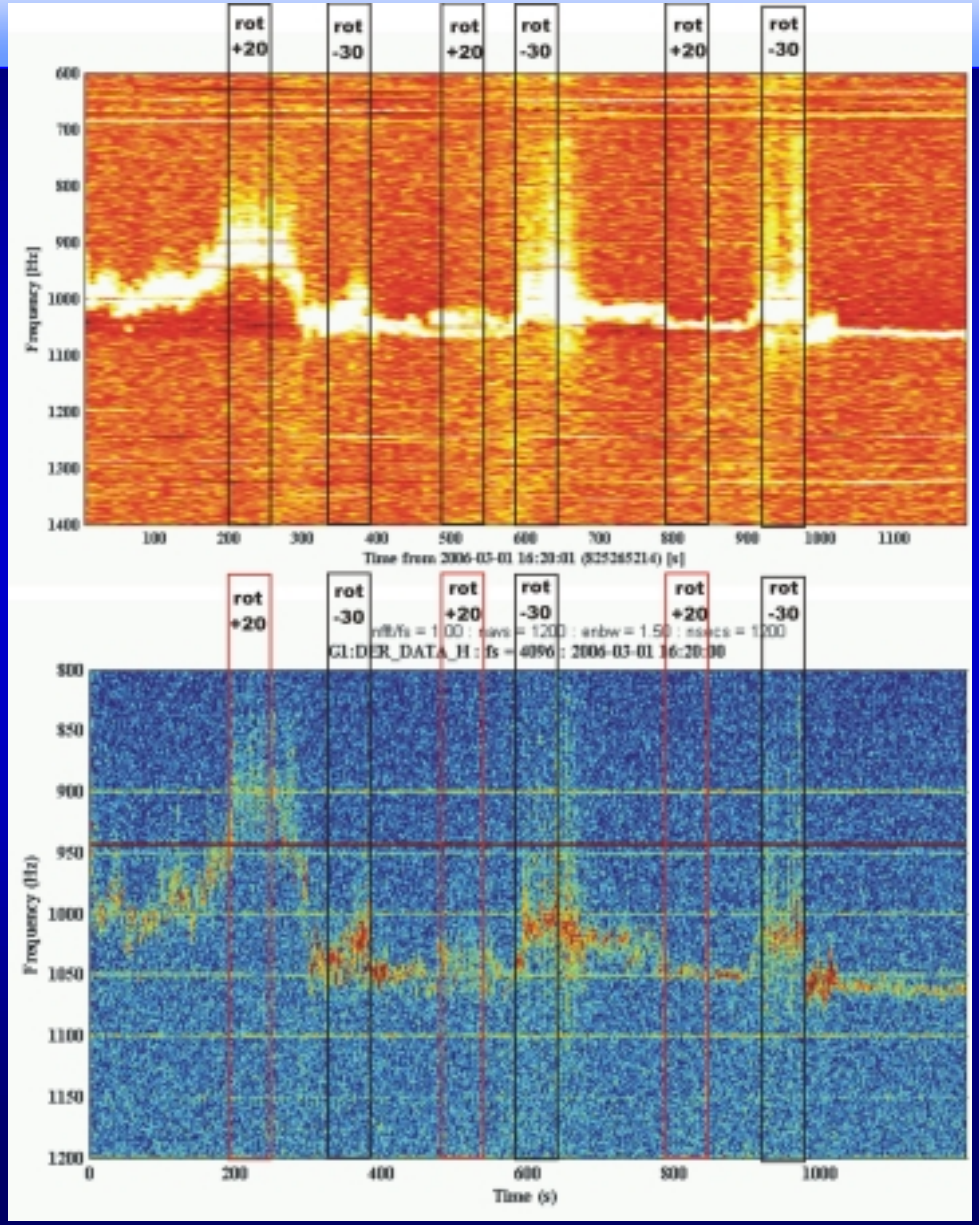
Owl changes with MPR alignment

Misaligning MPR to one side clearly increases the owl.

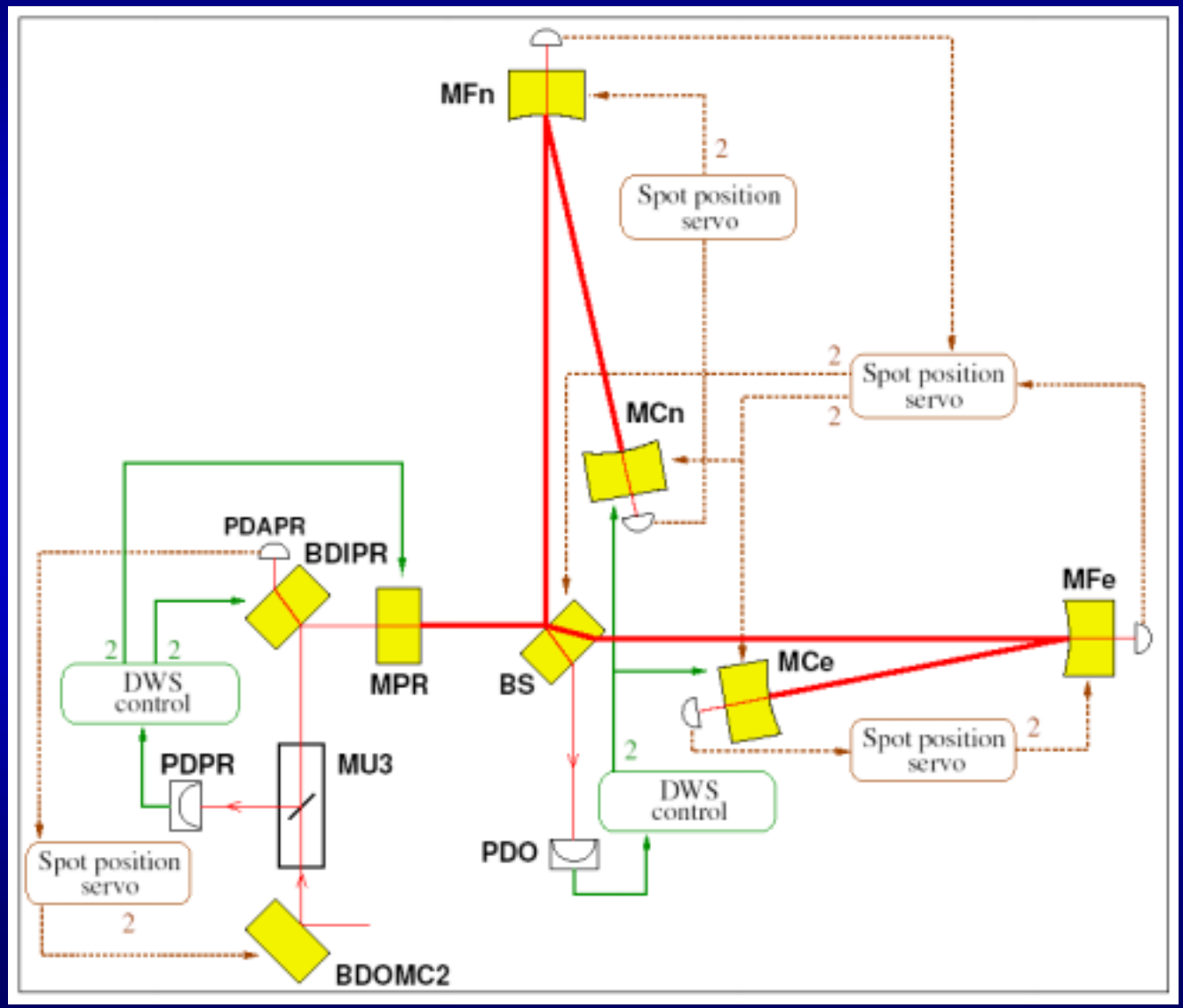
Misaligning MPR to the other side seems to have no effect.



MSR misalignment = no influence

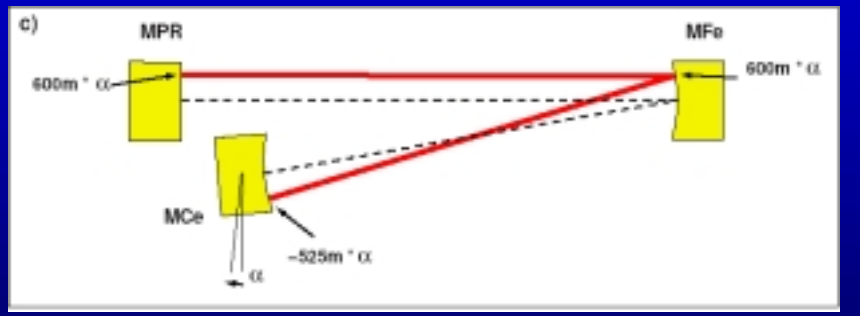


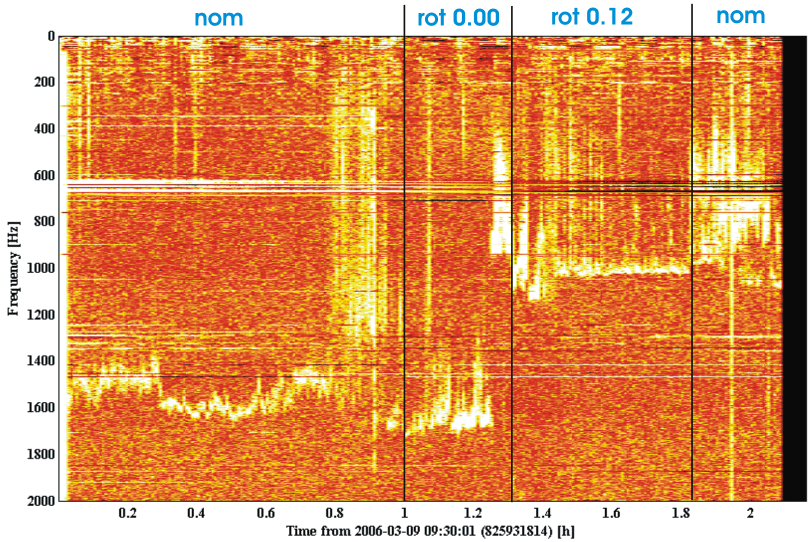
Autoalignment of PRMI

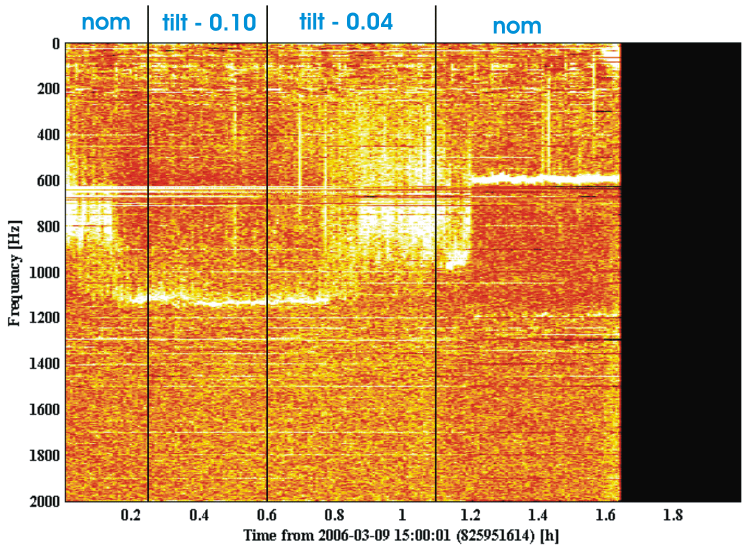


Moving spot position on BDIPR

The owl doesn‘t seem to correlate to the spot position on BDIPR.



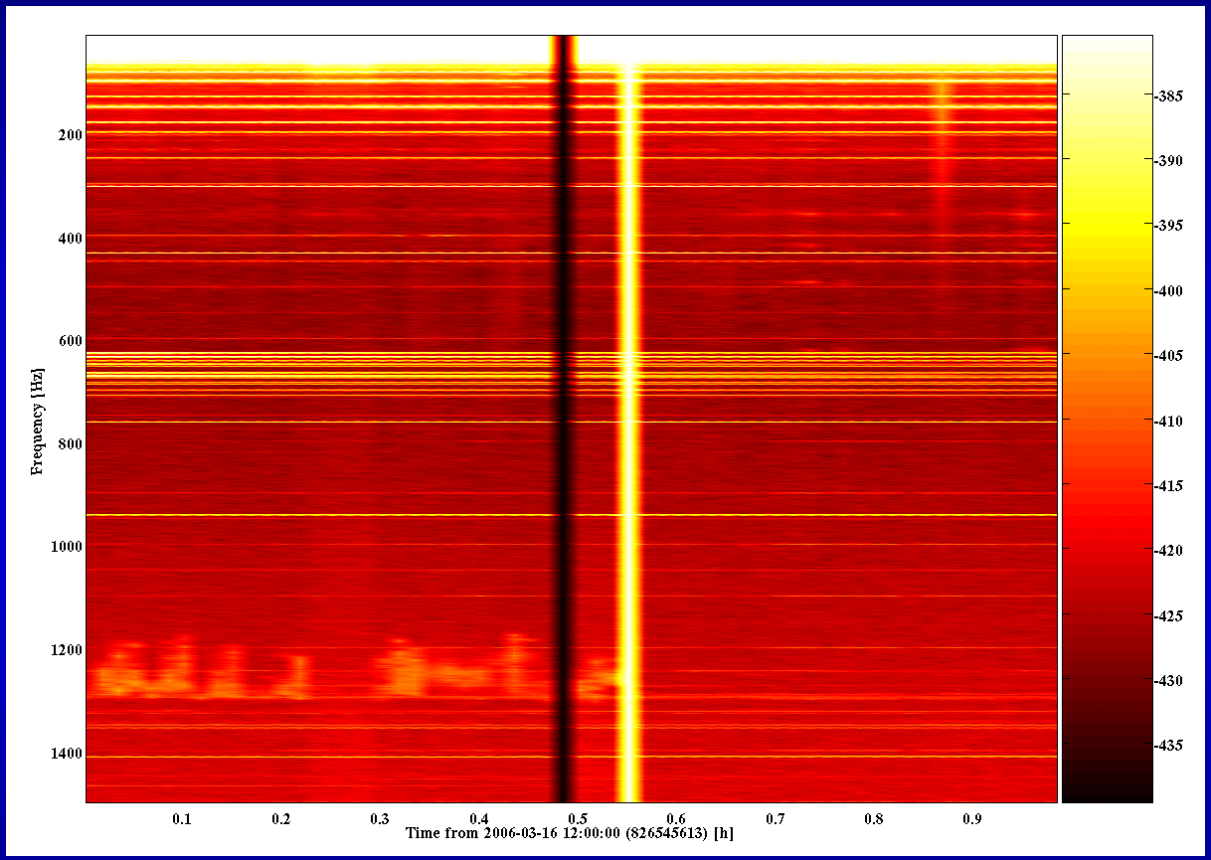




Small things that were checked

- Mi scanner off
- PR scanner off
- Change Master laser pump current
- Pstab loops off
- Sqrt on and off
- Changed gains from MC1, MC2 and PR loop
- MFe,n long, rot, tilt
- BS in rot and tilt
- BDO1 tilt and rot
- MU3 movement

Owl is gone



Suddenly the owl vanished (a few days ago), without any change of the system!

Will the owl come back ?

E N D

Sawtooth behavior

In the hope that it helps our thinking.

Hartmut's observation of the 3rd harmonic of the owl allows its waveform to be estimated.

The harmonics fall of as 1/f - quite accurately.

The simplest waveform that has the required Fourier expansion (assuming components all in phase) is the sawtooth.

See http://mathworld.wolfram.com/FourierSeriesSawtoothWave.html

from which I copy:-

$$f(x) = \frac{1}{2} - \frac{1}{\pi} \sum_{n=1}^{\infty} \frac{1}{n} \sin\left(\frac{n \pi x}{L}\right).$$

Note this is a sawtooth in displacement (or something that couples flat to displacement at 900, 1800 and 2700 Hz.

Note that it has to be a very asymmetrical sawtooth to give all the harmonics - a triangle has only ever second harmonic.

Later listening suggests the owl changes from periods of nearly pure sine wave to this distorted waveform. The change seems random...