

Optimization of damping gain in suspensions for X-ARM

Andrey Rodionov

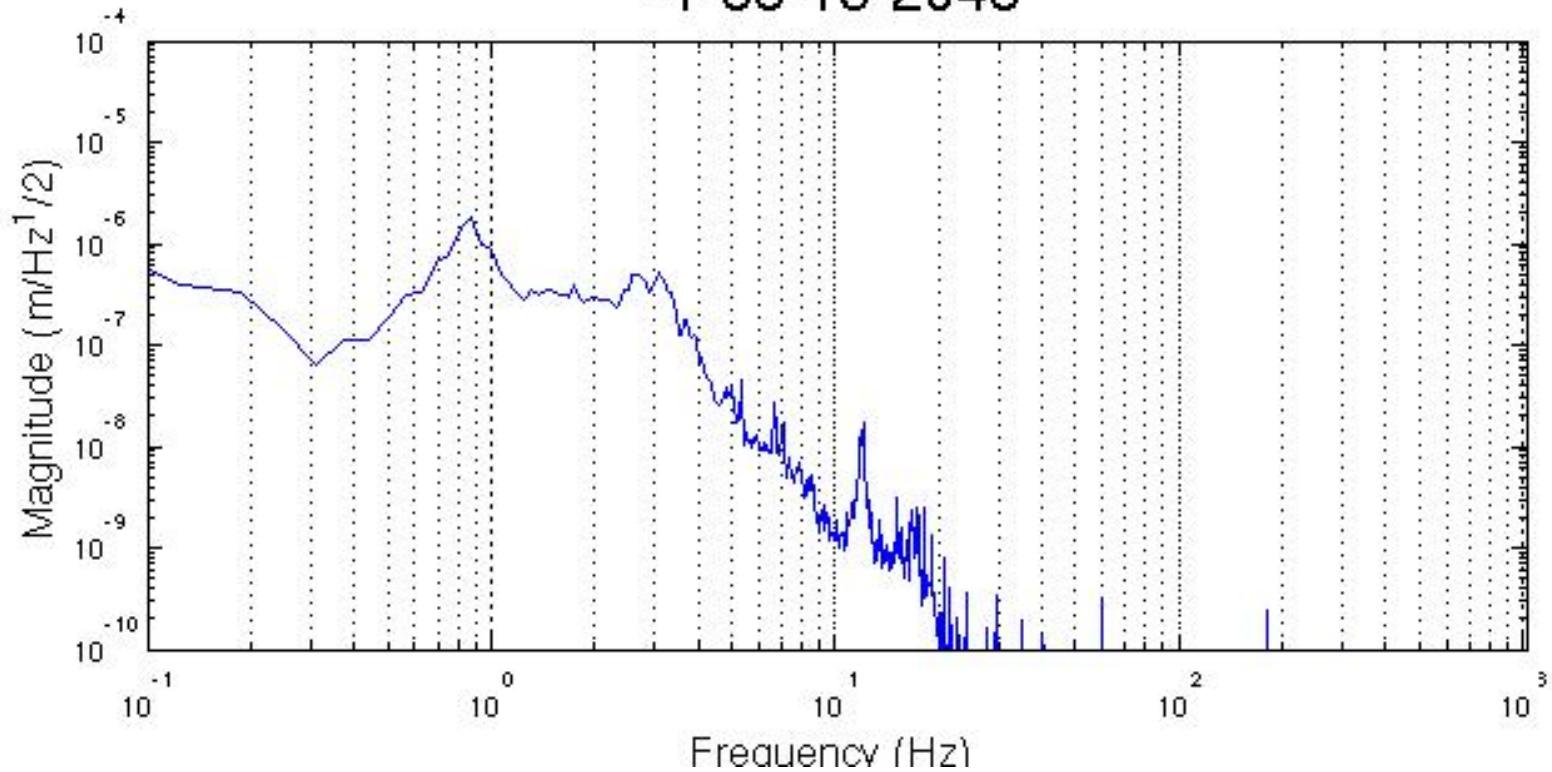
24 October 1907

General description of what I am doing

- Suspension damping gain (Q) for suspended optics in ITMX or ETMX determines the decay constant for “pendulum” oscillation; different $Q \rightarrow$ different ringdown curves, or different FWHM.
I vary Q in interval from 2.0 to 3.6 .
- I analyze power spectrum of the signal that is proportional to the force that we apply to ETMX in order to keep XARM resonating
- **What is the change of this power spectrum if we vary Q ?**
- Let's be specific:
 - \rightarrow I write the value of the damping coefficient Q into the channel “C1:SUS - mirror# - SUSPOS_GAIN” , where “mirror#” takes two values: “ITMX” or “ETMX”.
 - \rightarrow I read the signal from channel “C1:LSC-XARM_CTRL”, and process it using “dtfft2” matlab program \rightarrow power spectrum.

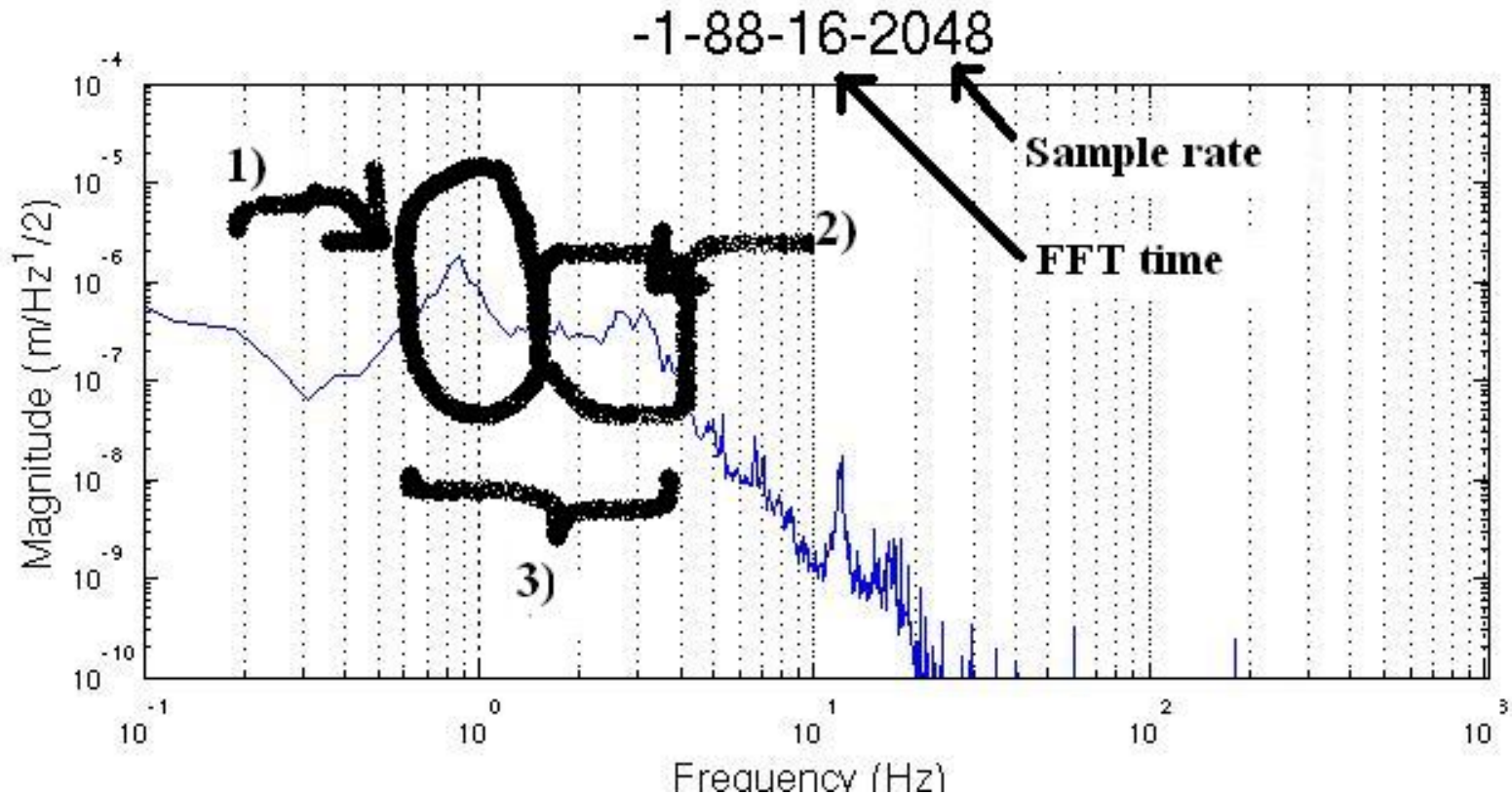
Typical power spectrum

XARM Spectrum -Oct 23 2007 05:42:35 UTC
-1-88-16-2048



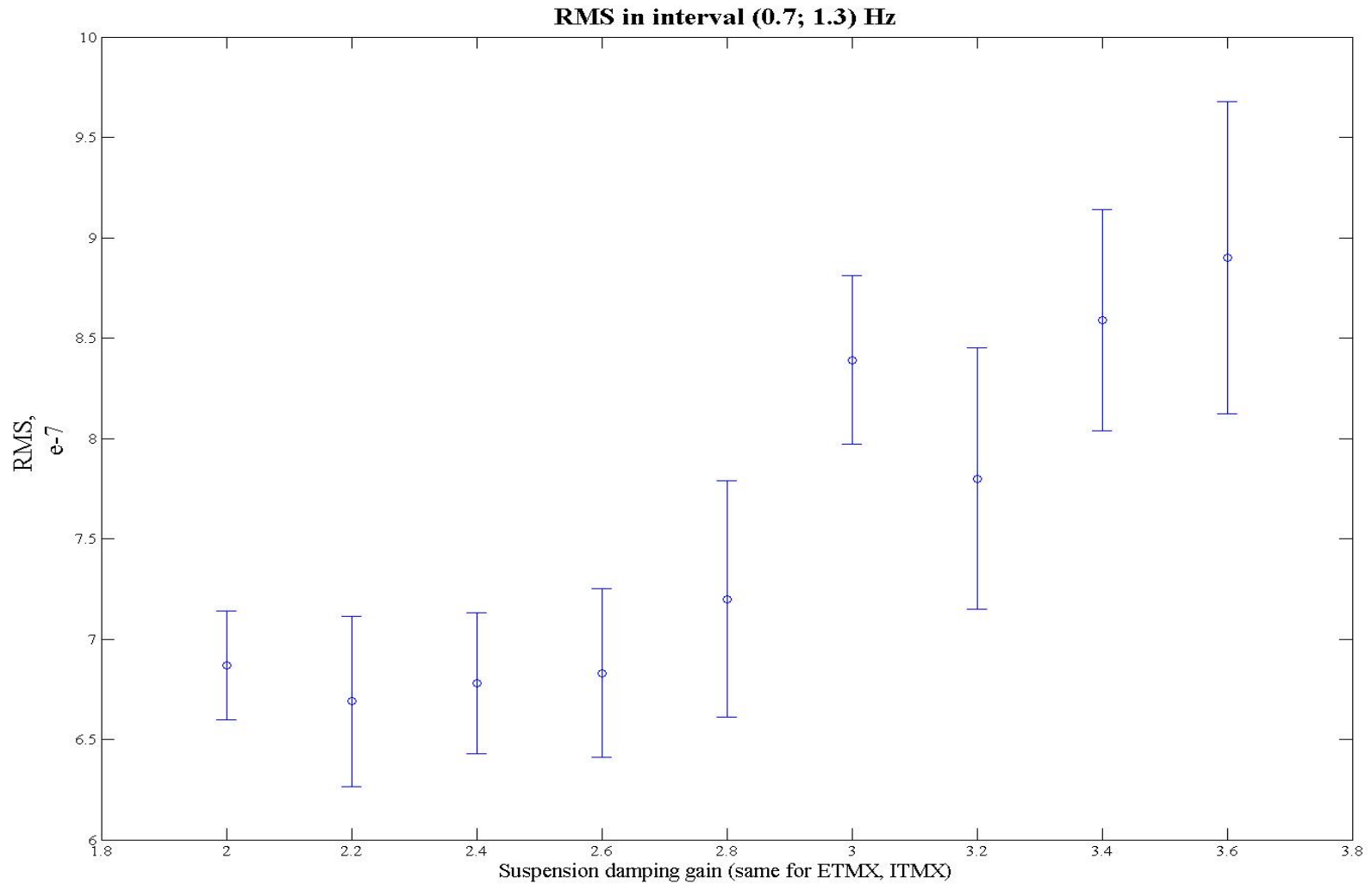
How to characterize peaks

XARM Spectrum -Oct 23 2007 05:42:35 UTC

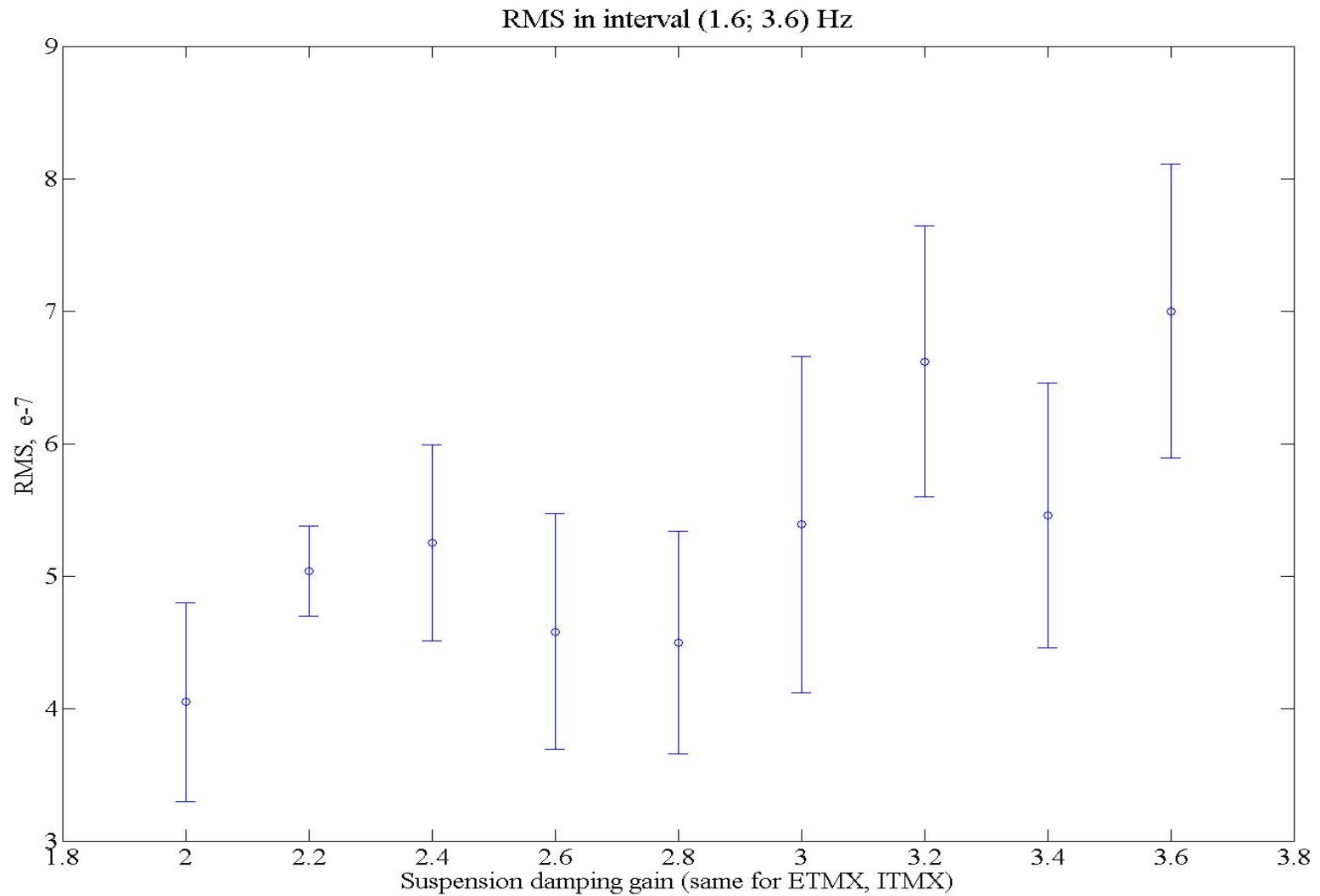


Calculate RMS for (1) peak at $\sim 0.9\text{Hz}$, for (2) peak at $\sim 2\text{Hz}$, for (3) both peaks together

First Results: dependence of RMS on damping gain

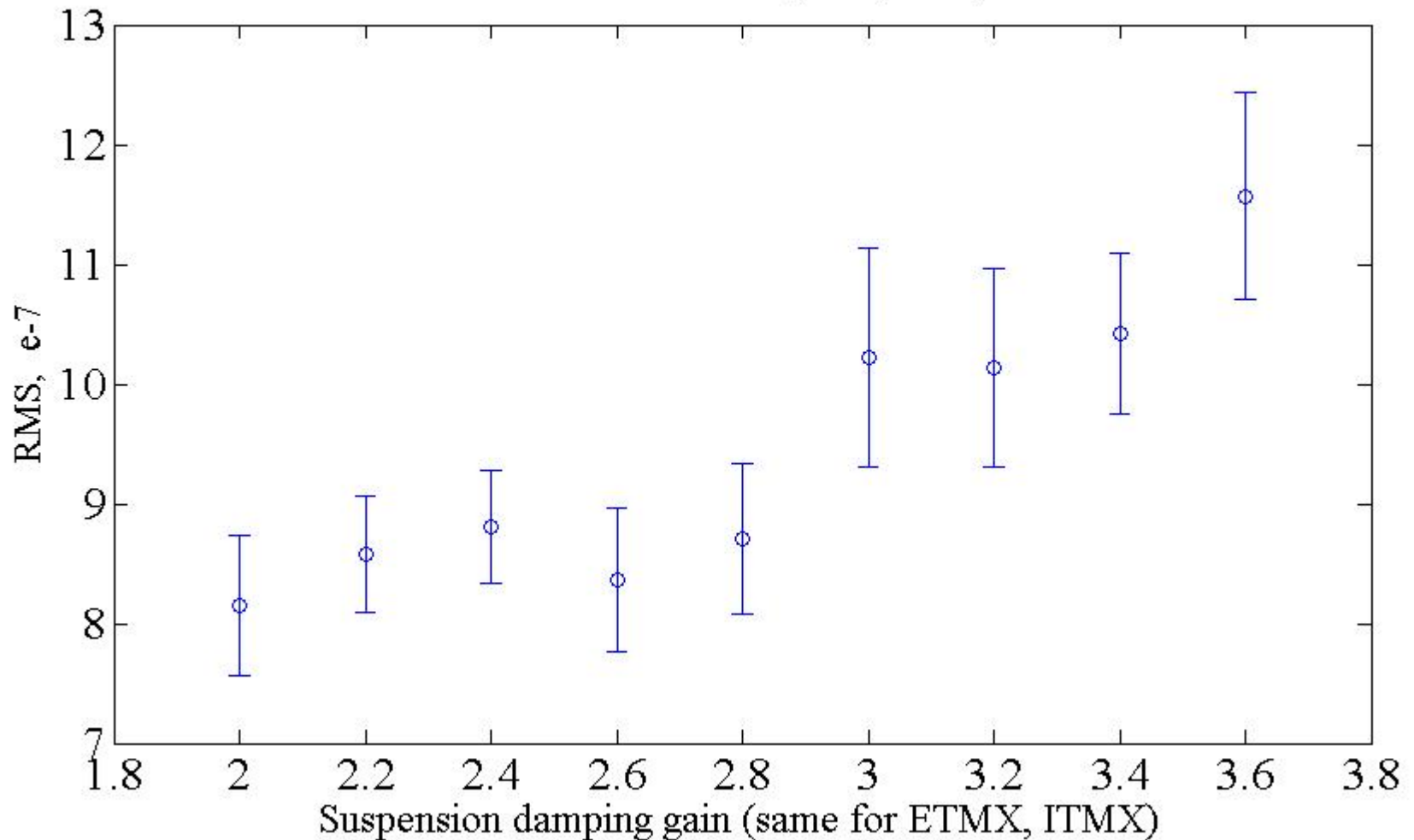


First Results: dependence of RMS on damping gain



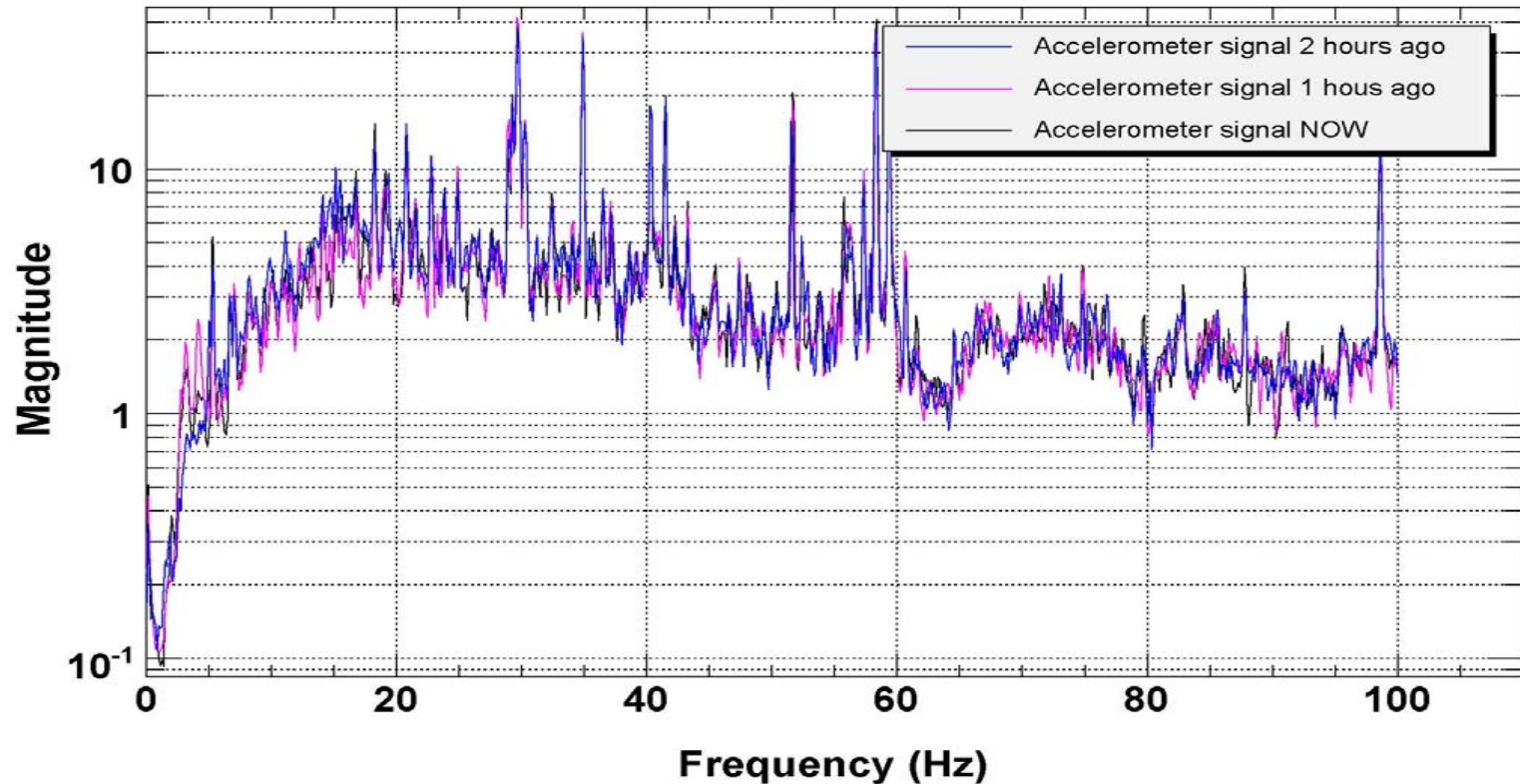
First Results: dependence of RMS on damping gain

RMS in interval (0.5; 3.6) Hz



Proof that the seismic level was the same: signal from "C1:PEM-BS_ACC_EAST_Z"

Power spectrum



*T0=23/10/2007 07:41:06

Avg=15

BW=0.1875

Discussion:

- Peak at ~ 0.9 Hz is always clear, peak at ~ 2 Hz is sometimes clear, sometimes it is double-peak, sometimes it is not discernable.
- Wanted to see minimum \rightarrow is there a minimum?
Should I repeat the same measurements?
Probably yes, with a smaller step near gains = 2.5 - 2.7. (now the step was 0.2).
- Results are jumping significantly in the daytime, so “late evening measurements” are preferable; External seismic level is more stable at “late evening” than at daytime.
- Did not study yet the case of unequal gains in ETMX and ITMX, this was the case of equal gains in ETMX and ITMX.

Should I try other values of gains? Why are reasonable gain values in the interval from 2 to 4 for test masses (so far I acted according to the principle “Rana said...”, but I want to gain better understanding)



THANK YOU
for your
attention and
suggestions

