Lock Losses at GEO 600 during coincidence run

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LSC Detector Characterisation
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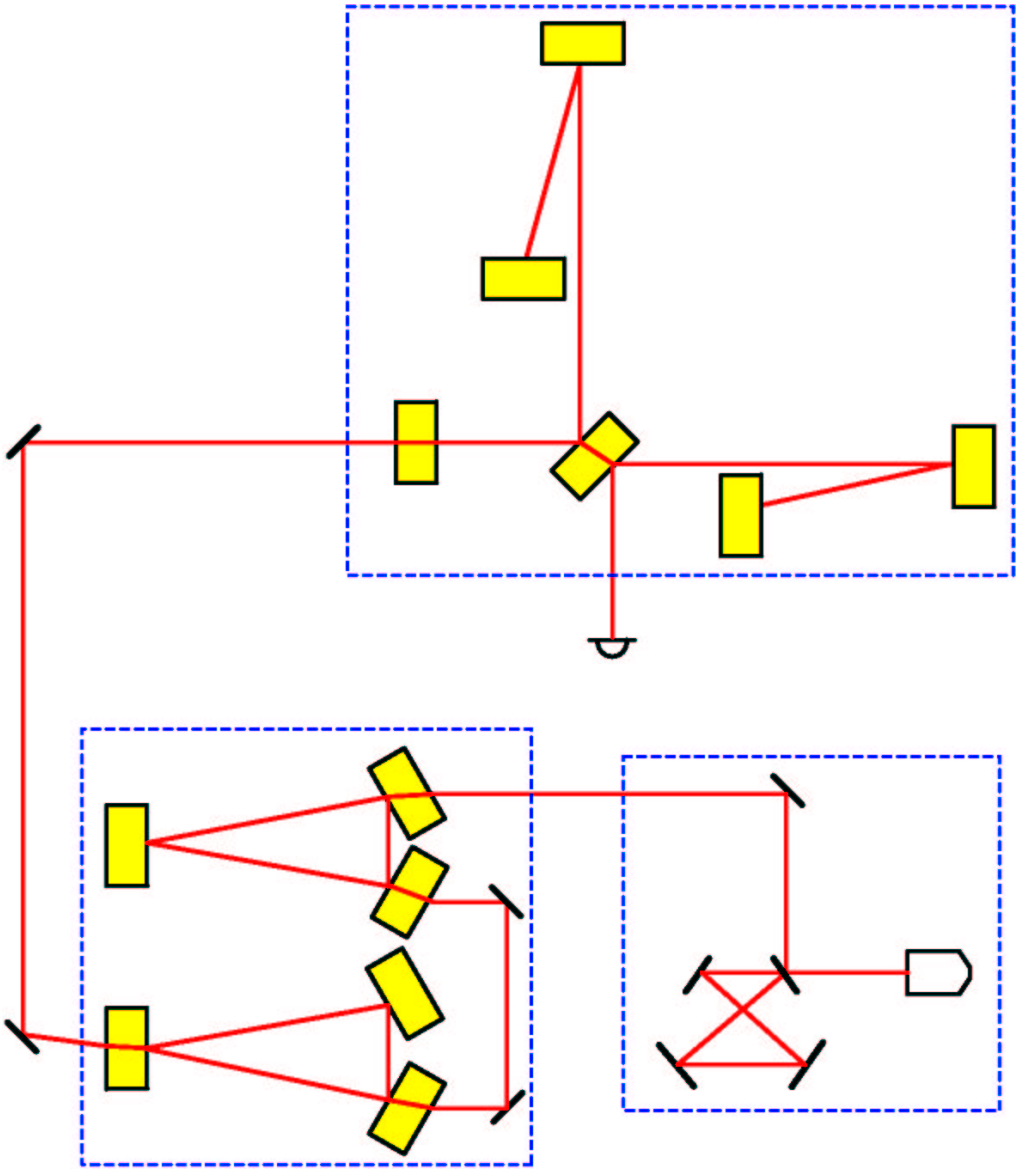
Locking Scheme



Possible Lock Losses:

- Power recycling cavity and Michelson
- Mode Cleaners (most common lock loss)
- Injection locked slave laser (~25 % of lock losses)

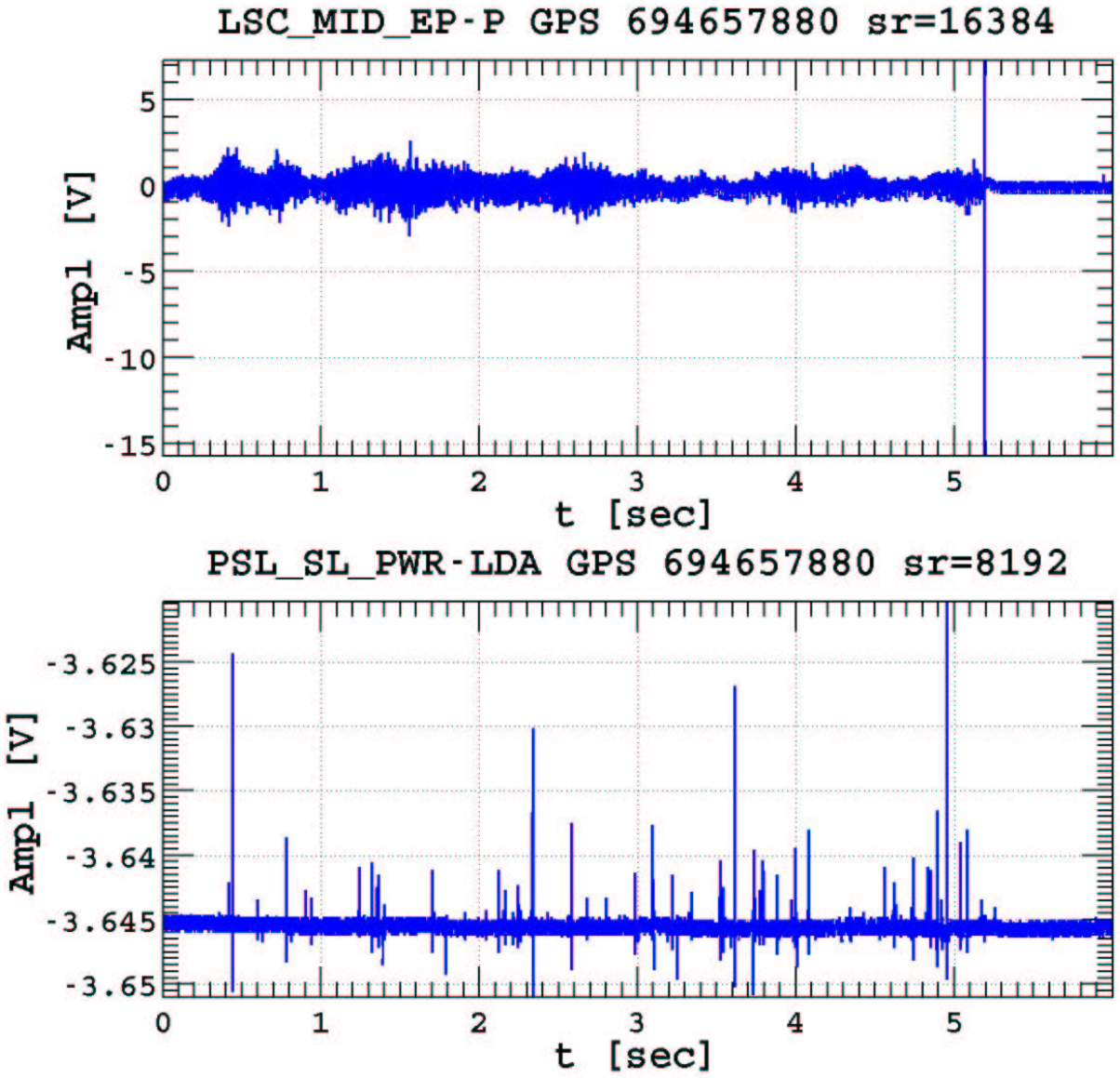
Strategy

➔ Identify sources of lock loss by looking into all channels at a time of lock loss

MIC/MID: 7 channels
Mode cleaners: 6 channels
Laser system: 6 channels
PEM: 23 channels
1000 labview channels (sample rate 1 Hz)

➔ Investigate a certain source of lock loss by looking into the data of the whole run of a selected group of channels

Pump diode spike noise



Spike noise visible in:

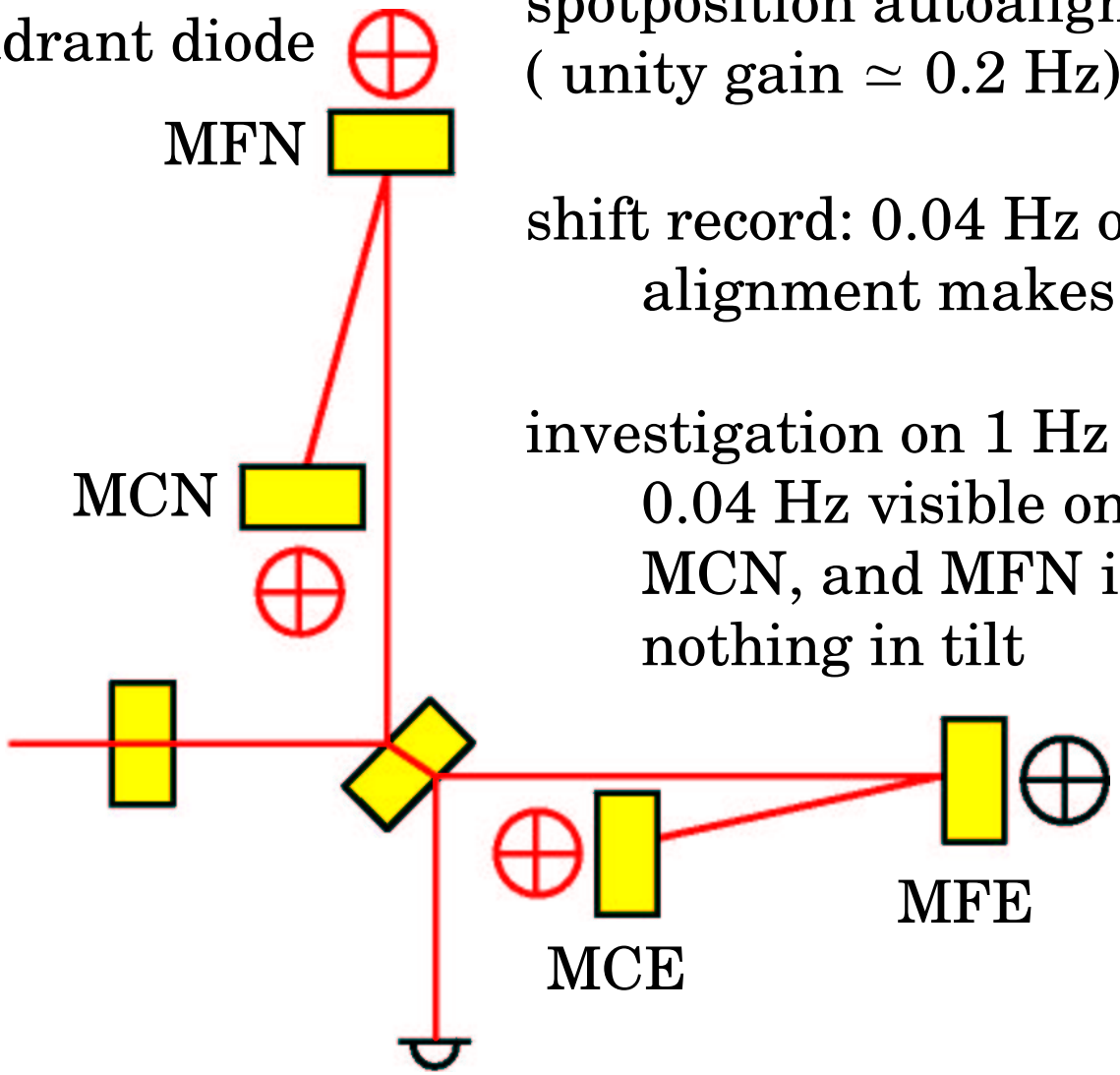
- all laser power monitors
- EP/FP of MCs and PRC
- magnetometers next to mode cleaner tank and laser bench

Actions taken:

- rack, that houses laser electronics, has been rearranged
- additional monitors are installed
- compare DCR results

Spotposition Oscillation

rotation –yaw
tilt – pitch



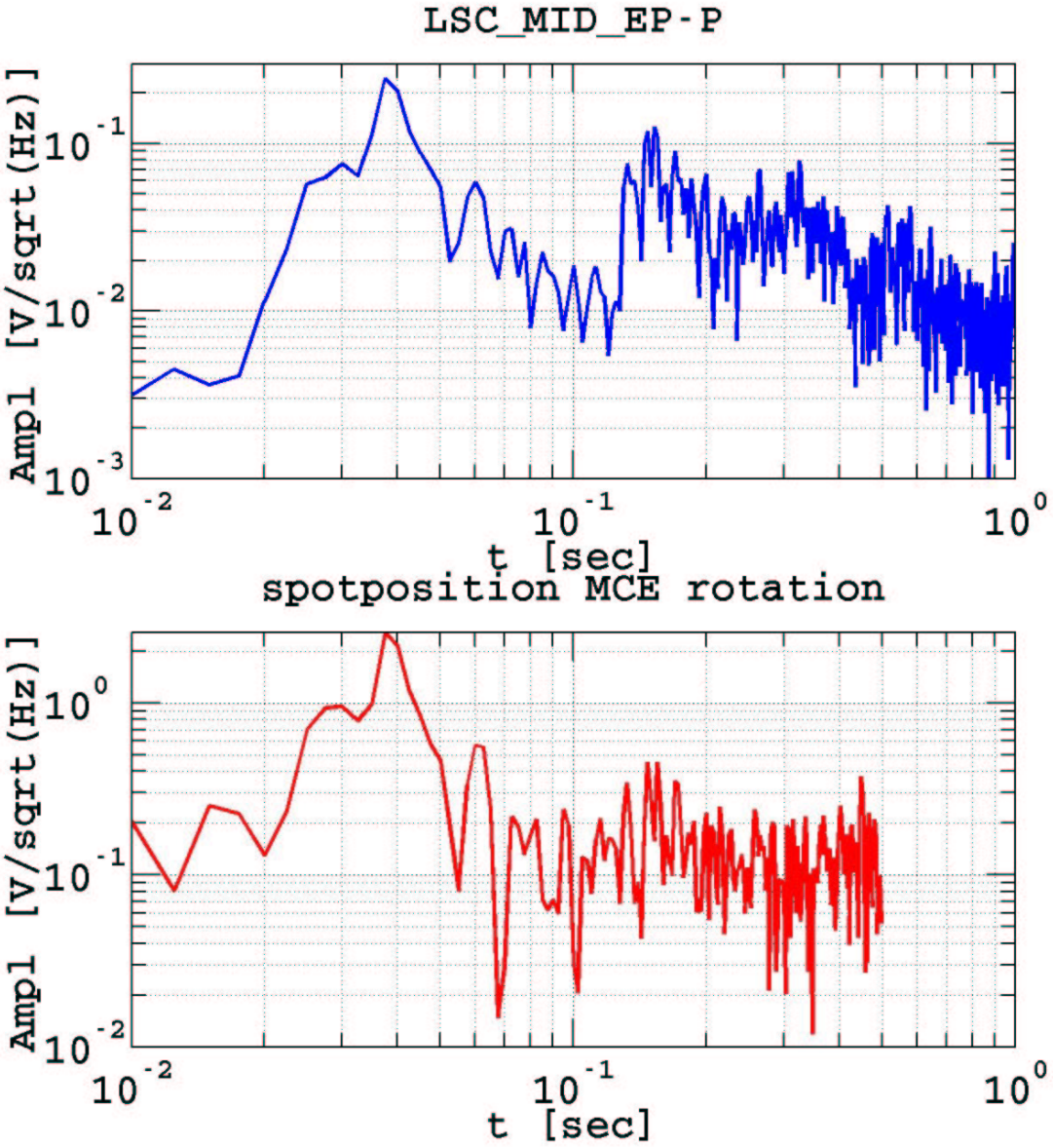
spotposition autoalignment
(unity gain ≃ 0.2 Hz)

shift record: 0.04 Hz oscillation in rotational
alignment makes locking difficult

investigation on 1 Hz labview data:
0.04 Hz visible on spotposition MCE,
MCN, and MFN in rotation;
nothing in tilt

Spotposition Oscillation

rotation –yaw
tilt – pitch

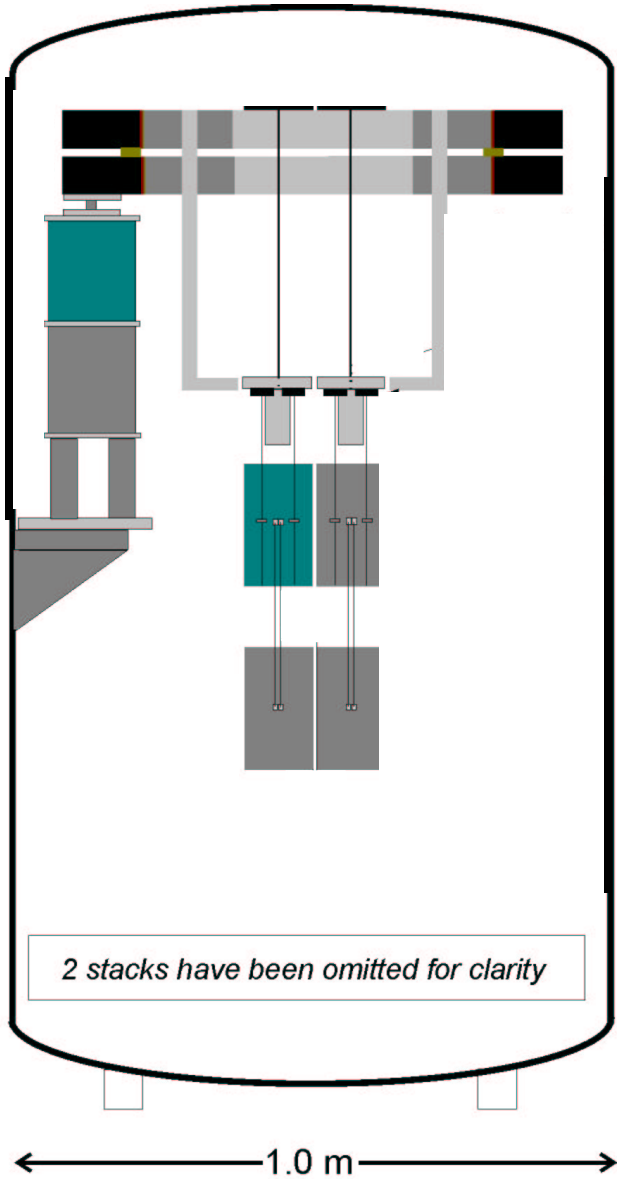


- 0.04 Hz appear in michelson error point
- environmental or servo loop oscillation?
- check behaviour with differential wave front sensing autoalignment running
  (unity gain ≃ 10 Hz)
- optimize spotposition sensors

Seismic

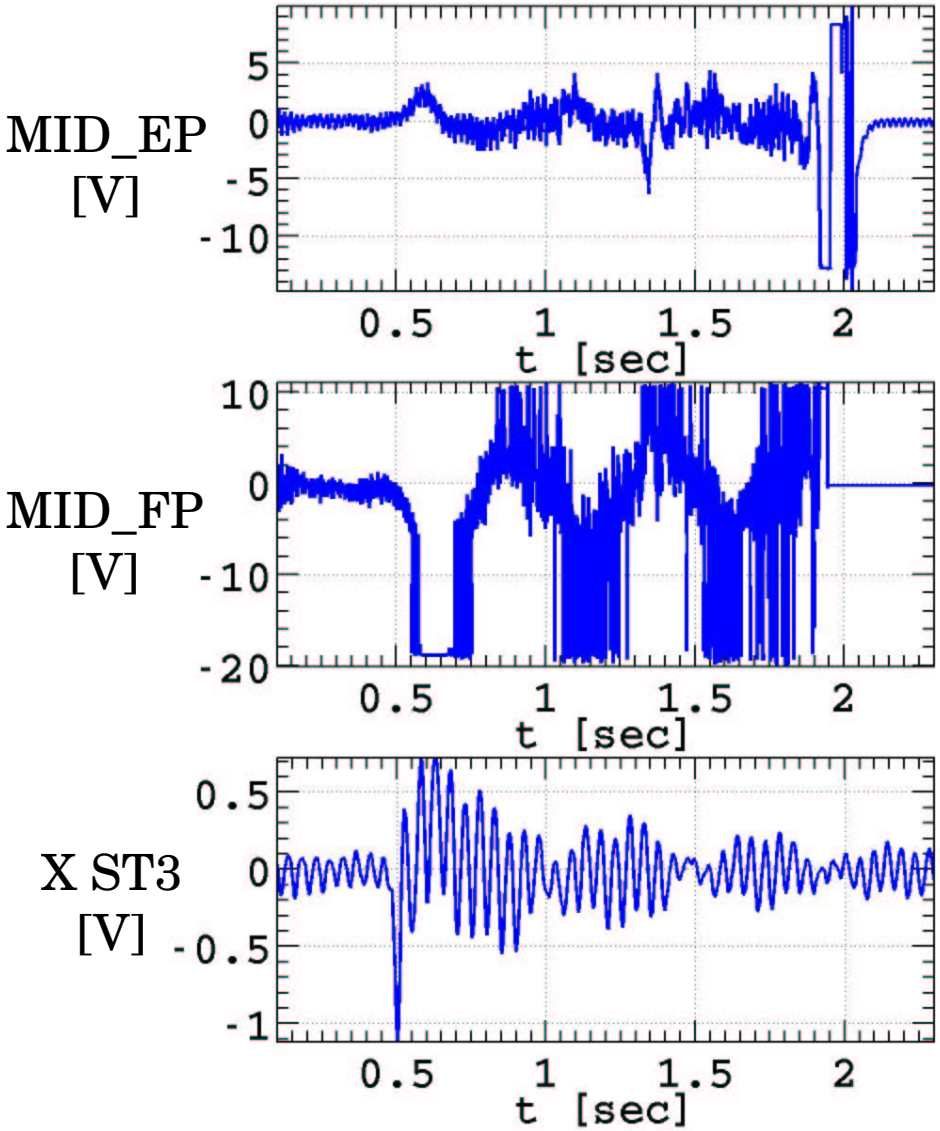
- lock losses can be correlated to distant earthquakes
- some lock losses are due to local seismic

Seismometers in vacuum tanks



- suspension rests on 3 stacks which contain seismometers
- events of stack seismometers do not always coincide with events in seismometers on the ground (movement of vacuum system)
- two events per day in average
- during the whole run 8 locklosses could be correlated to events in the stack seismometers in the north tank

Seismometers in vacuum tanks



- high frequency FP saturates
- if lock loss occurs, depends on the amplitude and shape of the event
- with differential wave front autoalignment running no lock loss occurs
- compare DCR results
- monitor stacks in other tanks

Summary

➔ main identified sources of 36 lock losses of one day

laser spike noise	12
seismic	2
stack movement	2
spotposition rotation	2
not identified	9
servo loop	7
manual alignment	2

➔ investigation of a specific lock loss

seismometers in stack 8/33 or 8/26 events