



Status of GEO600

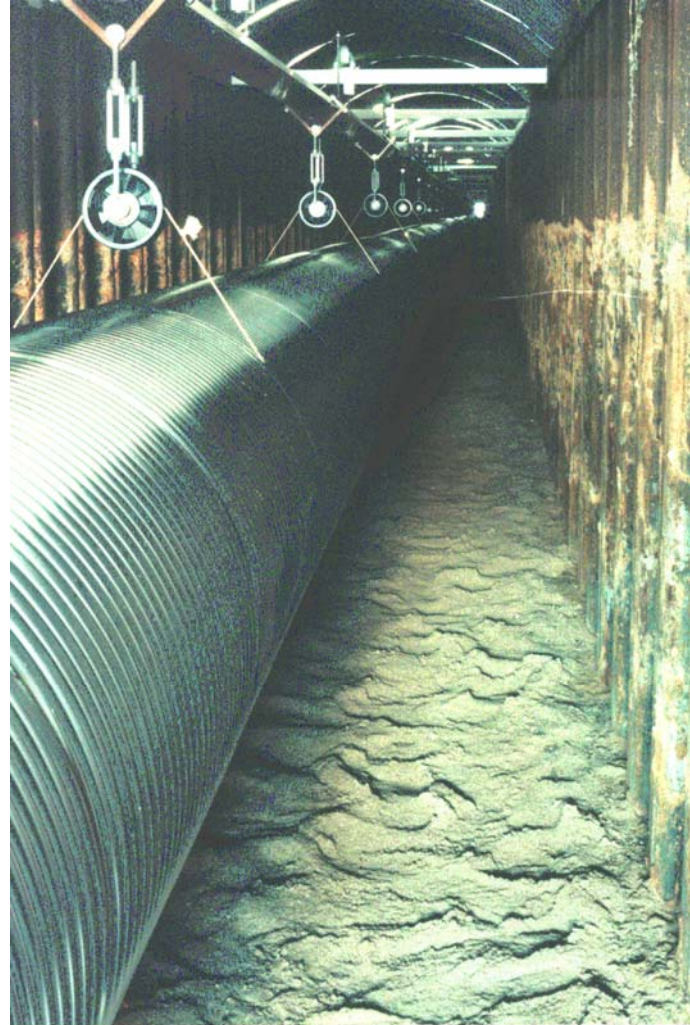
Harald Lück

for the GEO Team

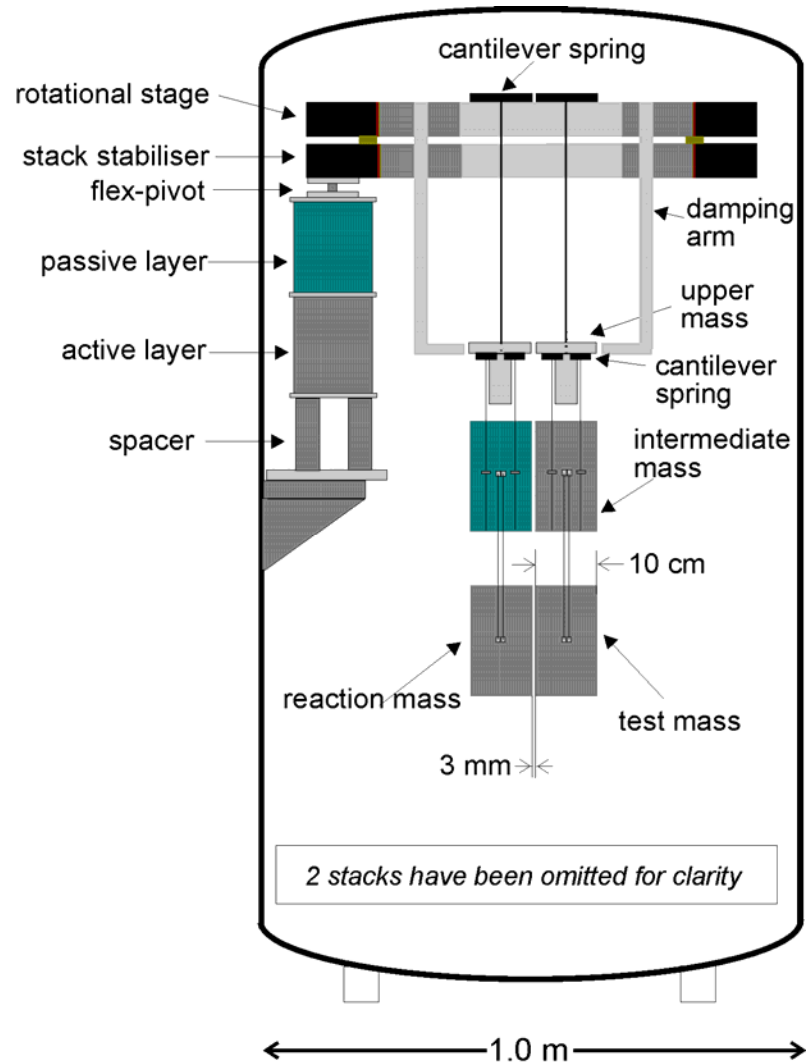
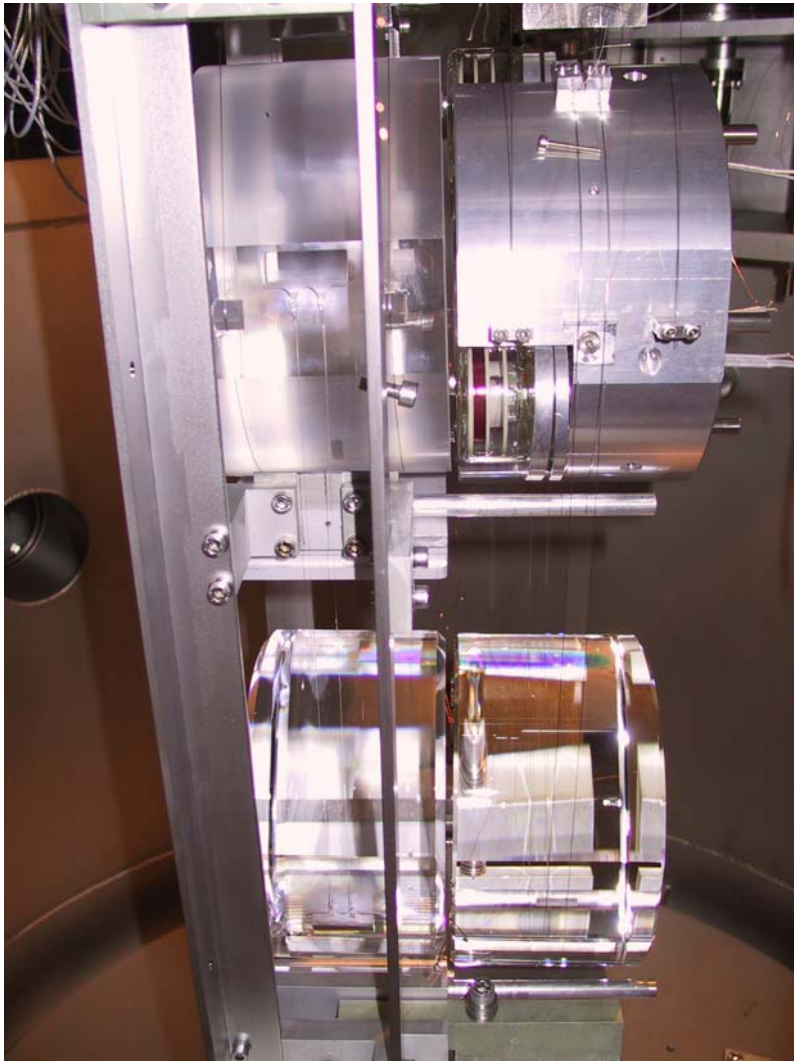
LIGO-G060279-00-Z



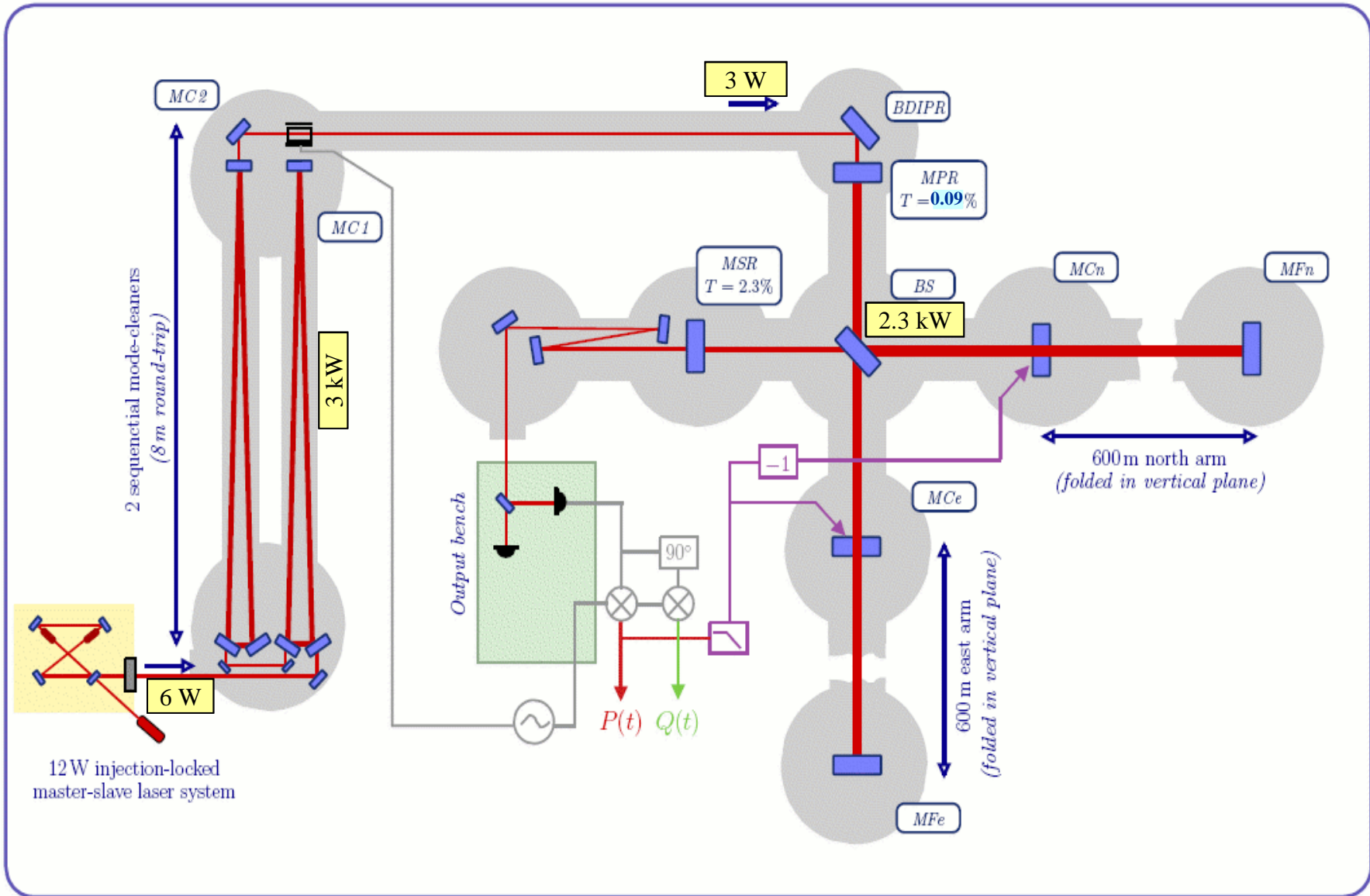
Tube / Trench



Triple Pendulum + Reaction Pendulum



GEO600 Optical Layout

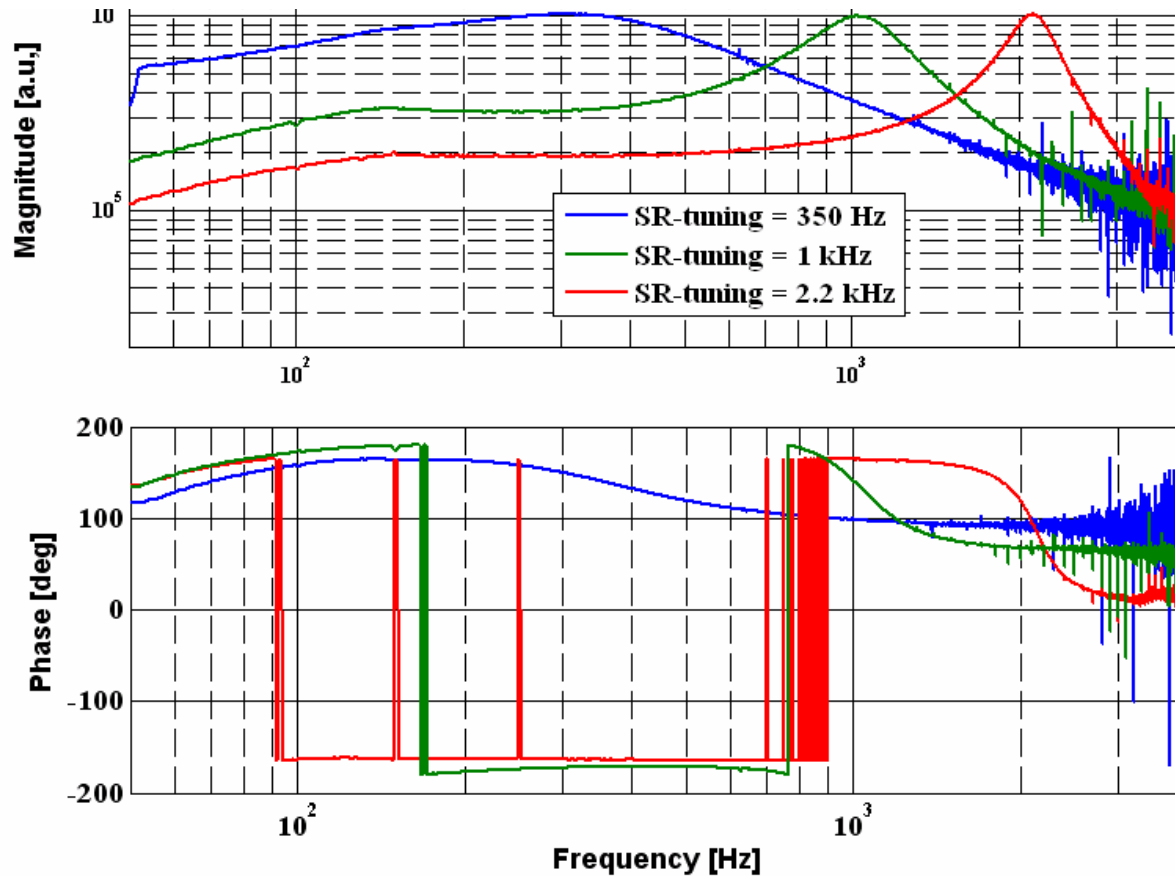




Tunable optical transfer function



Signal Recycling provides an adjustable optical response
(see talk by Stefan Hild)



Lock acquisition at 2.5 kHz, **OPERATION NOW at 550 Hz.**



Recent work on GEO600

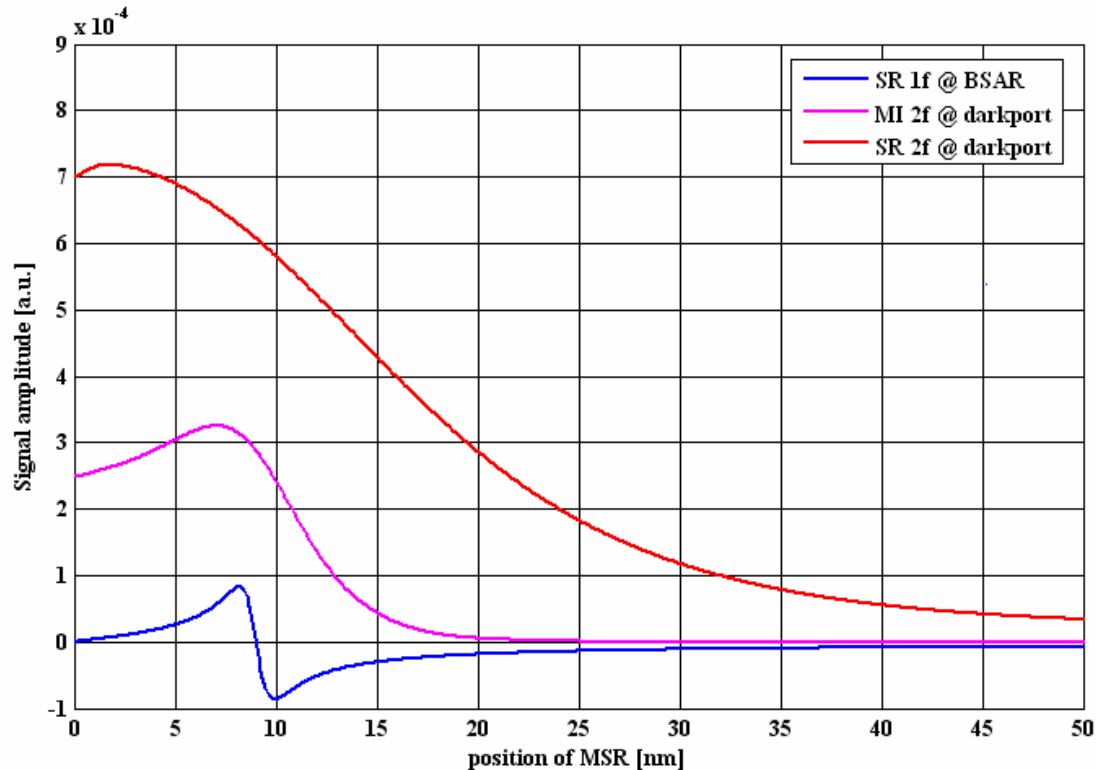


- Commissioning:
 - improving detector sensitivity
 - improving detector reliability
 - improving detector characterization
- Joined S5 in *overnight & weekend mode* January 20th
- Joined S5 in *24/7 mode* May 1st

Locking procedure (fully automated)

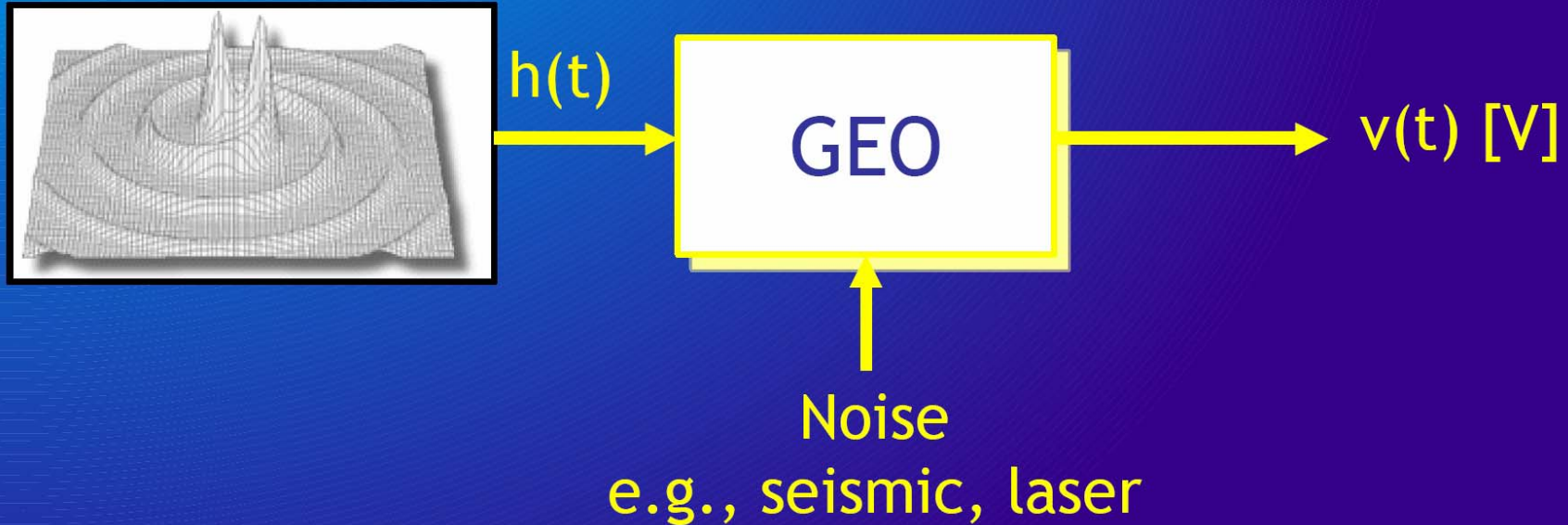


- PR error signal always available due to asymmetry in RS ($\sim 48/52$)



- Ramping up power to 'final' value
- In Total: ~ 3 min

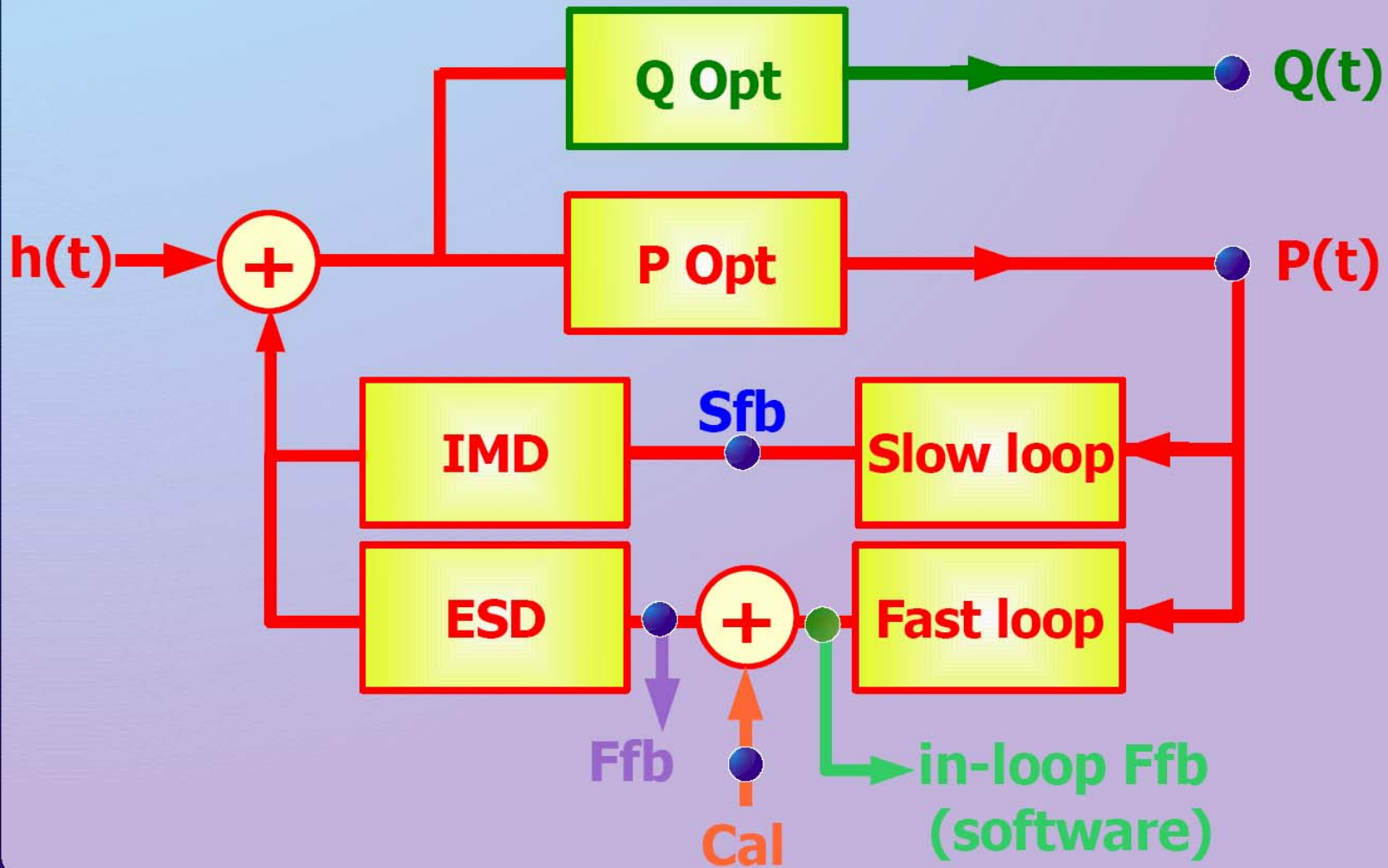
Response of GEO to GWs



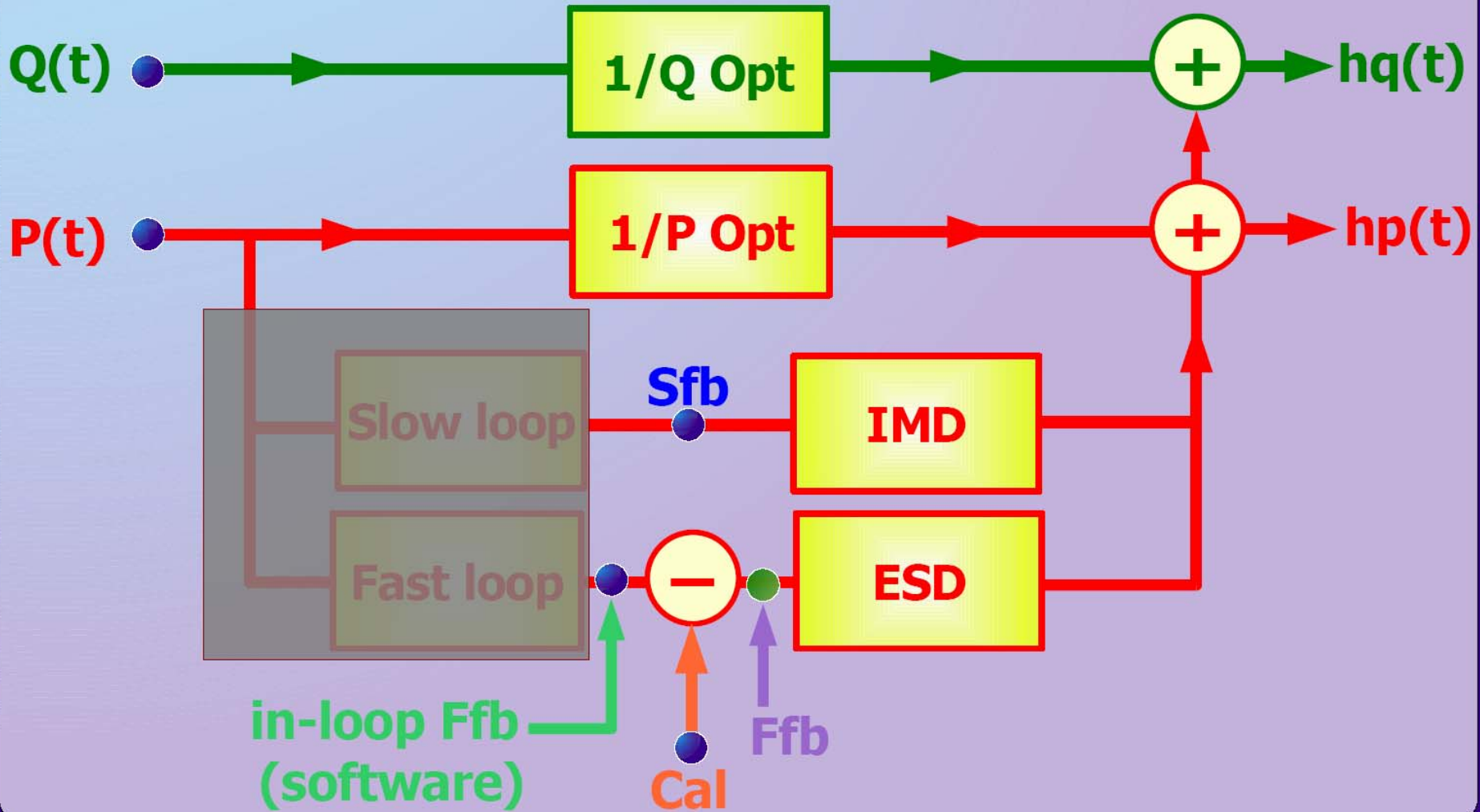
calibrate



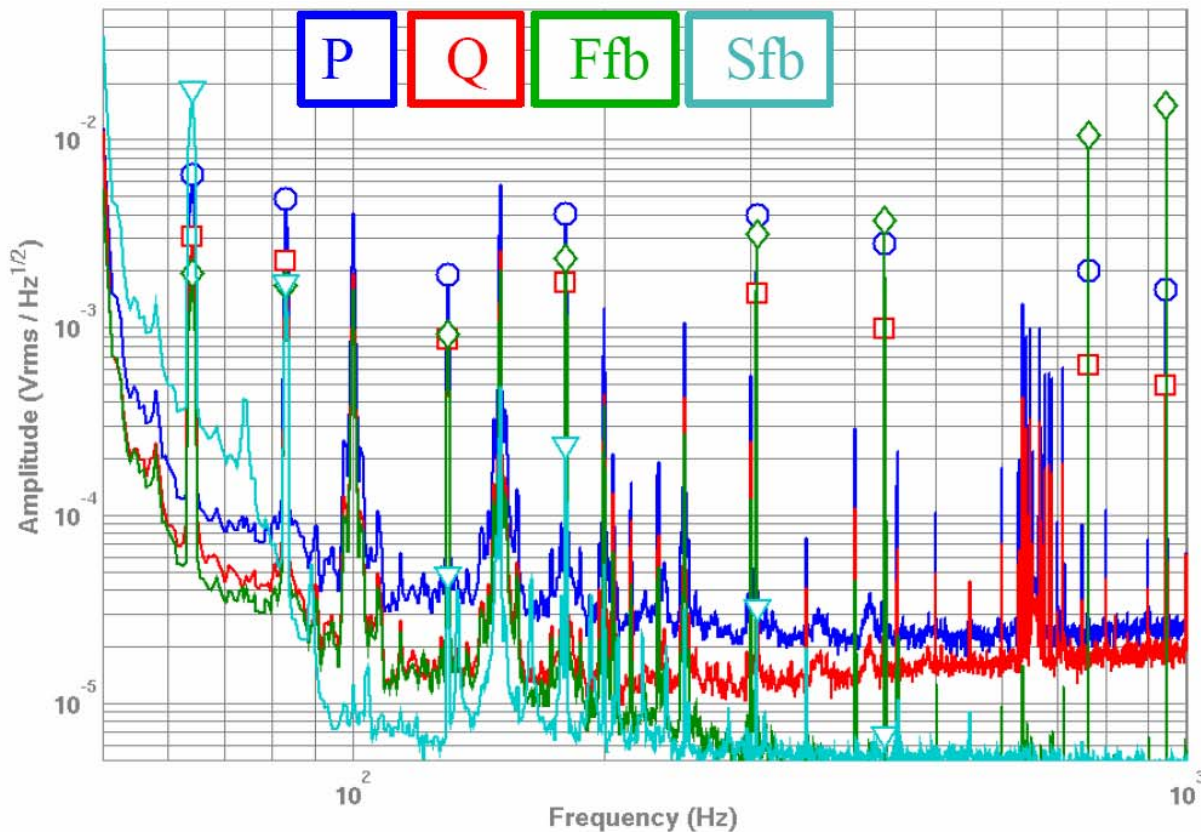
Michelson longitudinal loop



Calibration

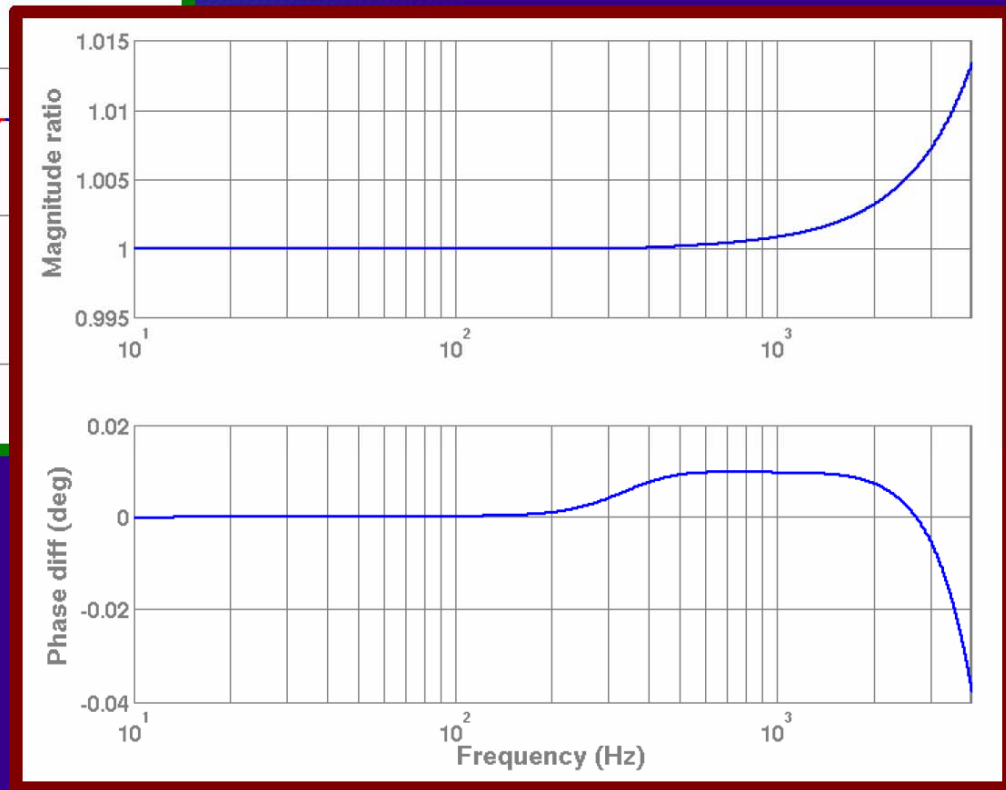
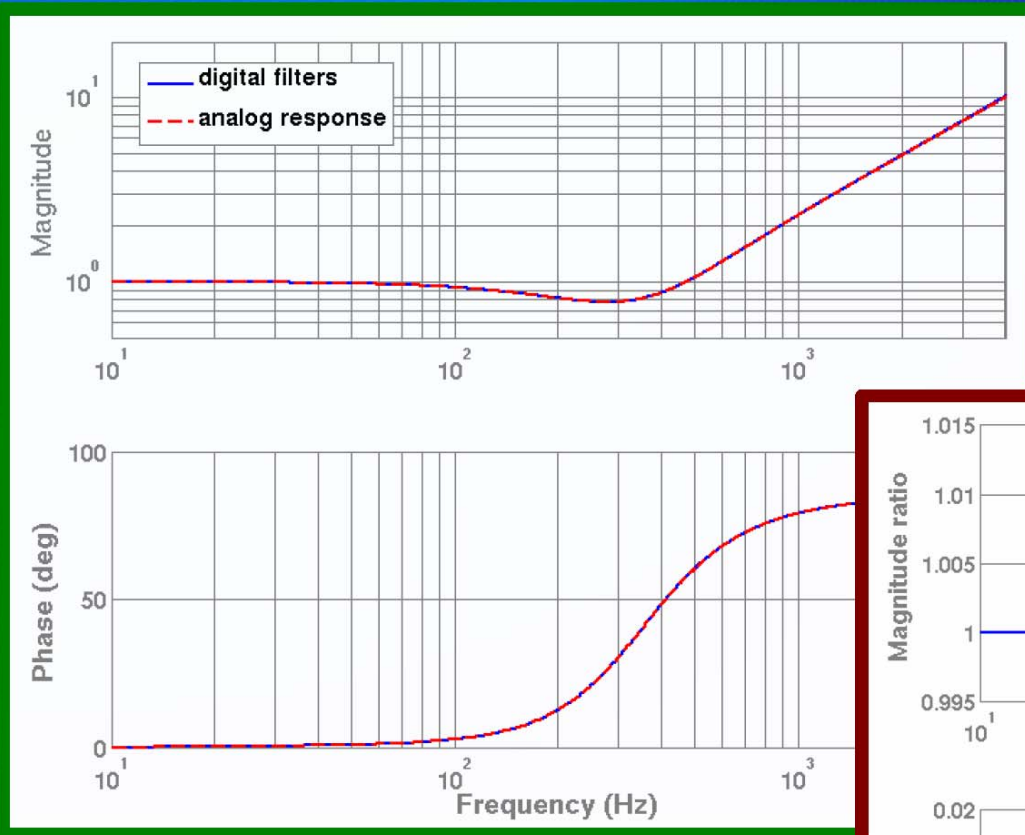


Estimating optical response



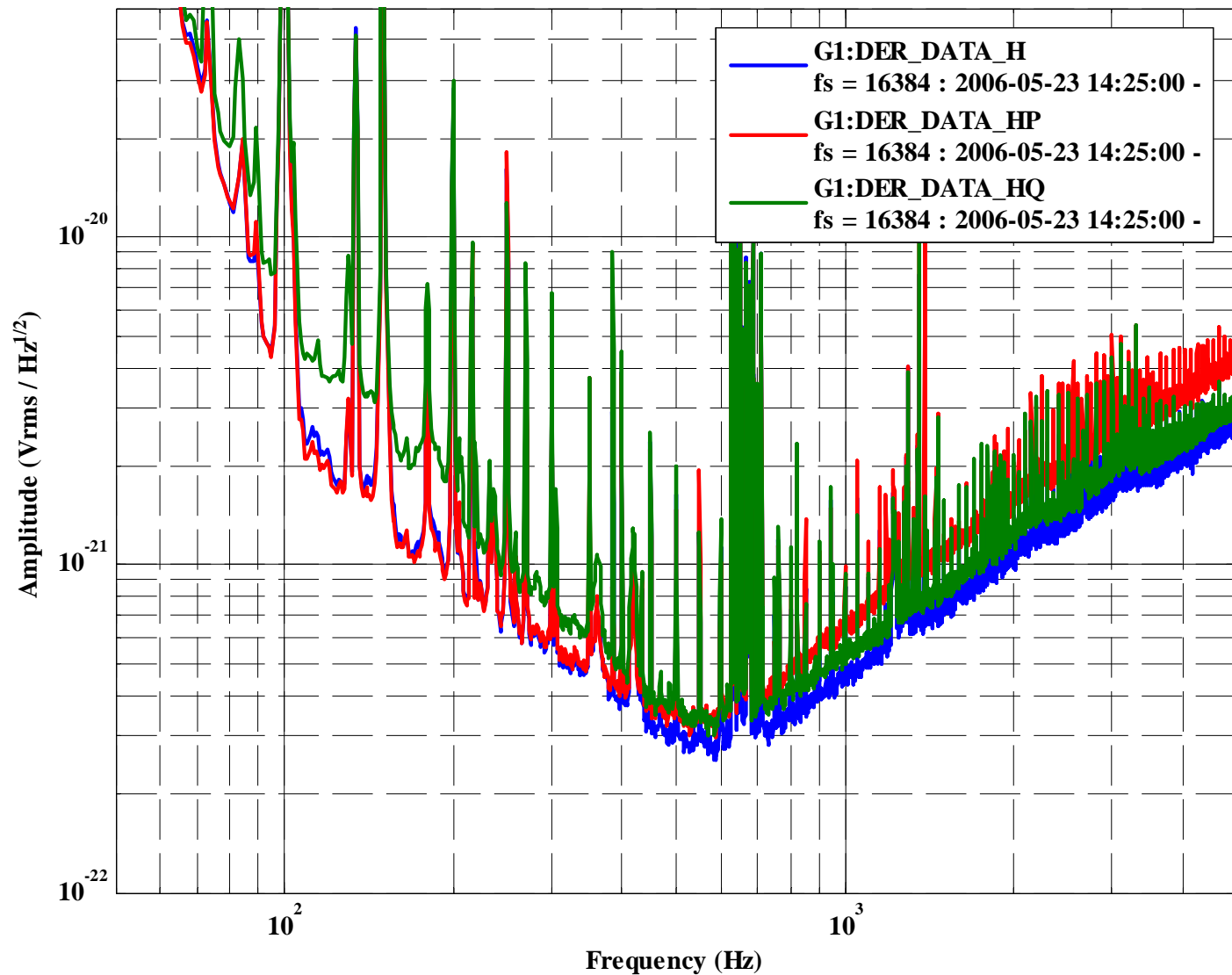
- Inject calibration lines
- measure transfer function from feedbacks to P and Q
- fit model optical response to measurements
 - get parameters
- done once per second

Inverse optical response filters



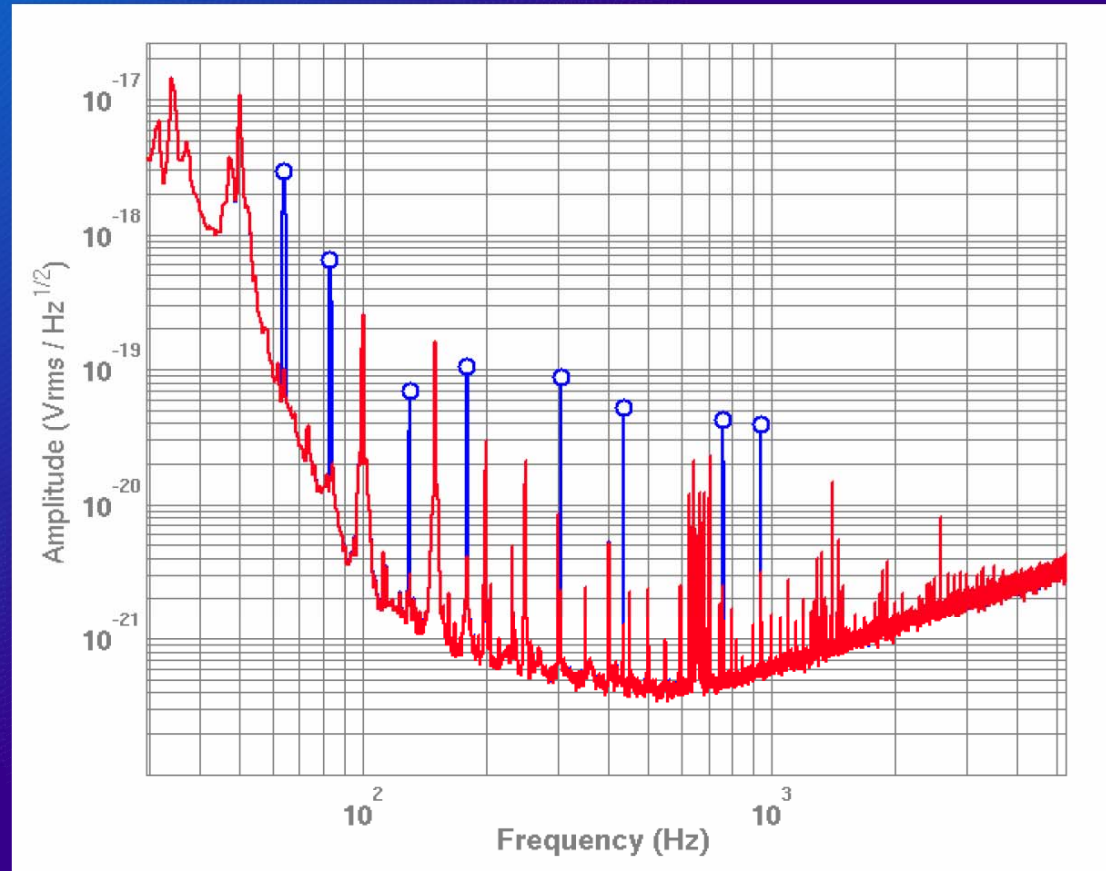
Combining HP and HQ

nfft/fs = 1.00 : navs = 200 : enbw = 1.50 : nsecs = 200



Using full recorded information

- Using the full recorded information (errorpoints and feedbacks) we can suppress all noise added in between
 - Including calibration lines

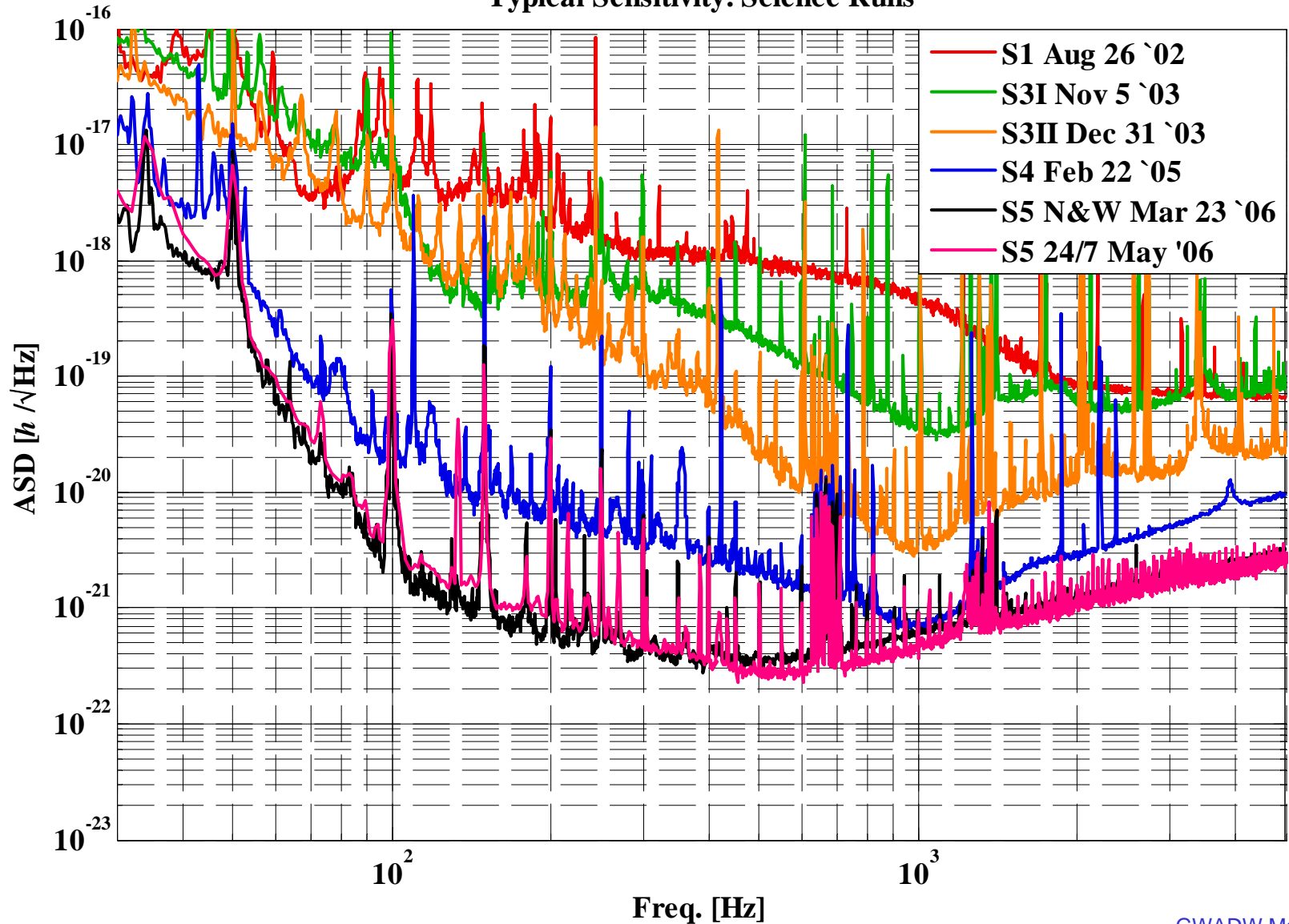




Sensitivity in Science Runs



Typical Sensitivity: Science Runs

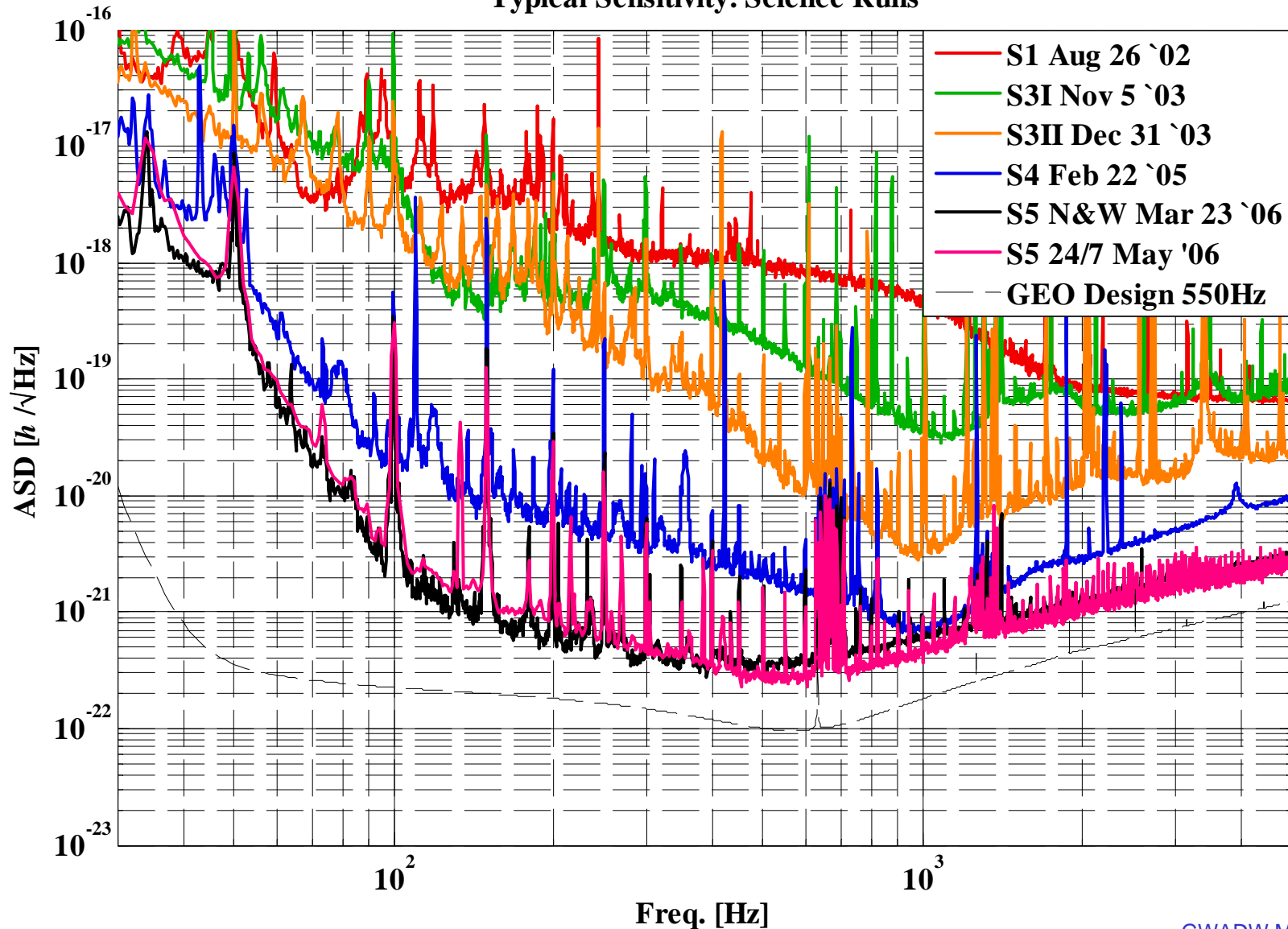




Sensitivity in Science Runs



Typical Sensitivity: Science Runs

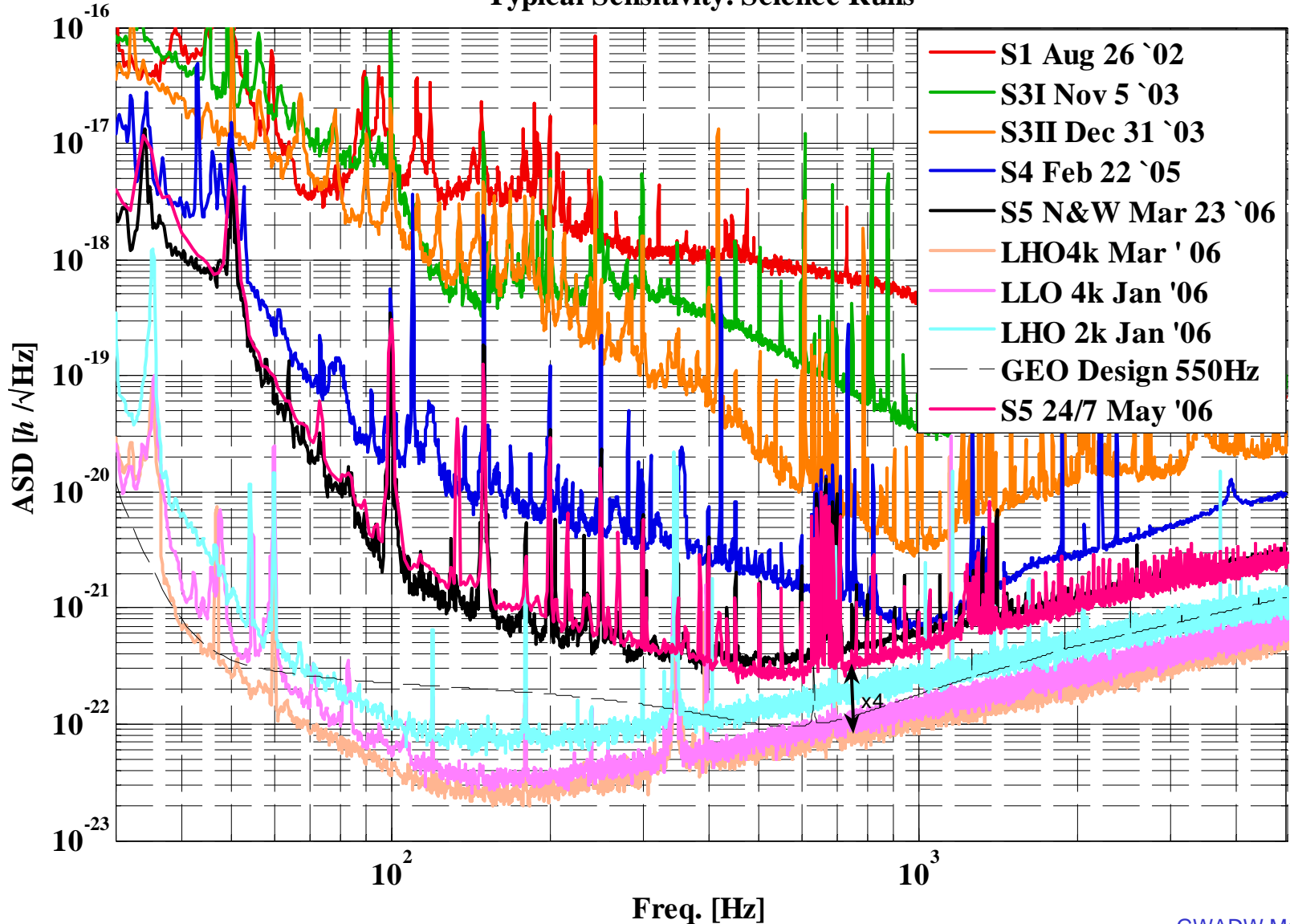




Sensitivity in Science Runs

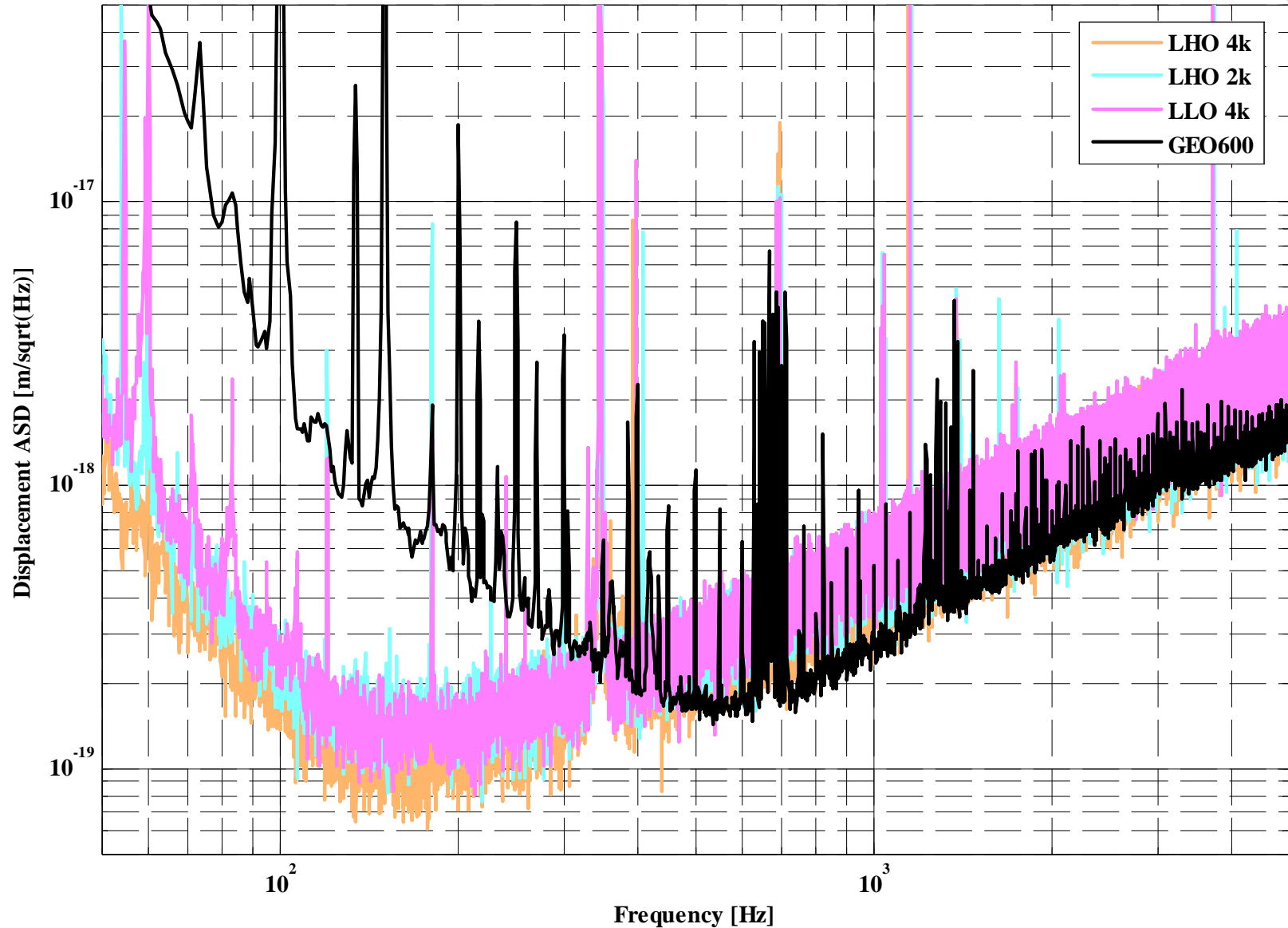


Typical Sensitivity: Science Runs





Displacement Sensitivity





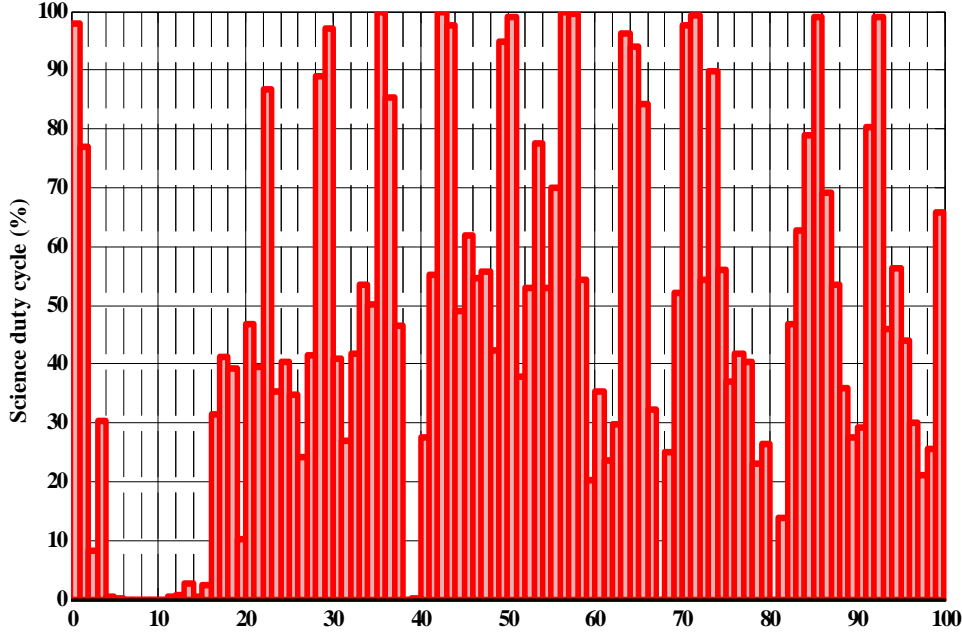
S5 Duty Cycle N&W + 24/7 (24/05/06)



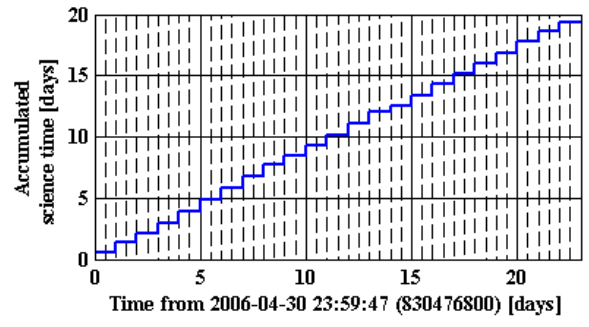
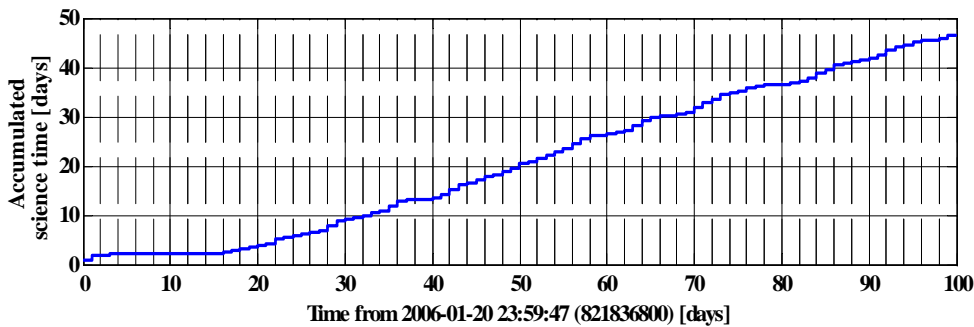
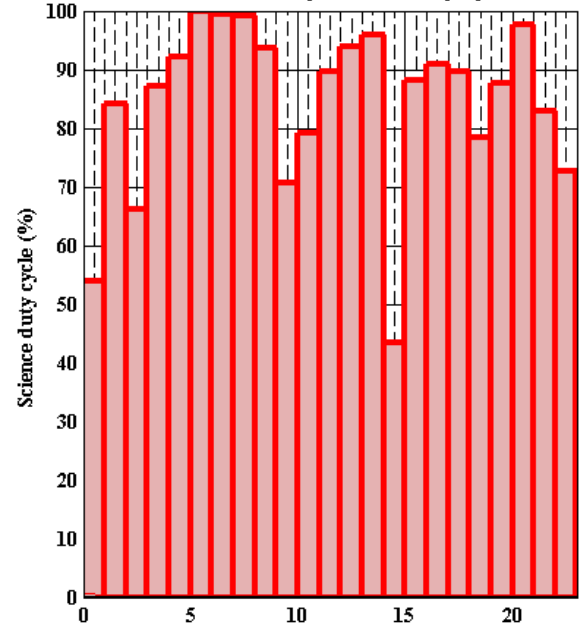
N&W

24/7

Total science time: 46.5 days, Overall Duty Cycle: 46.5 %



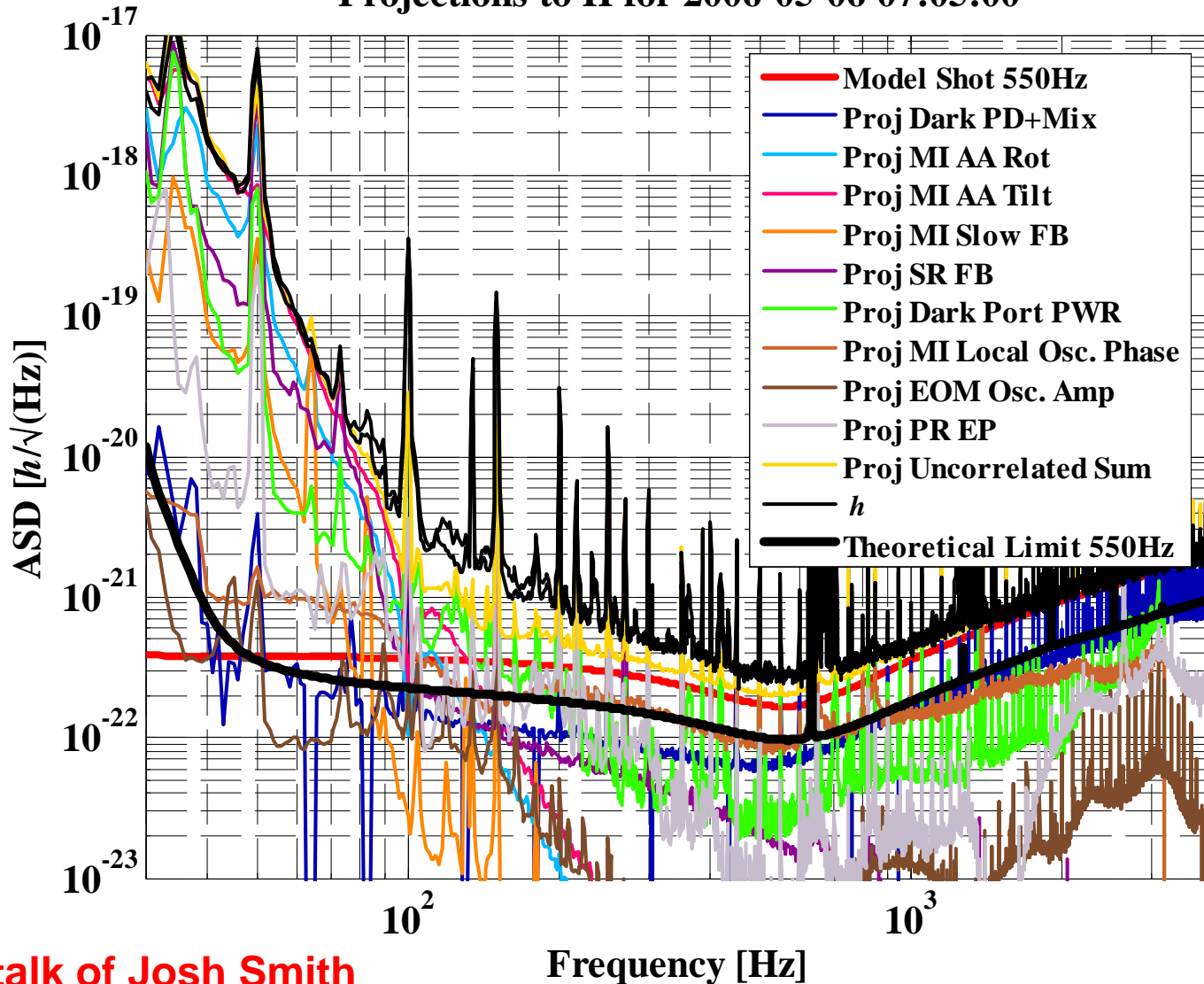
Total science time: 19.4 days, Overall Duty Cycle: 84.2 %



Noise Projections

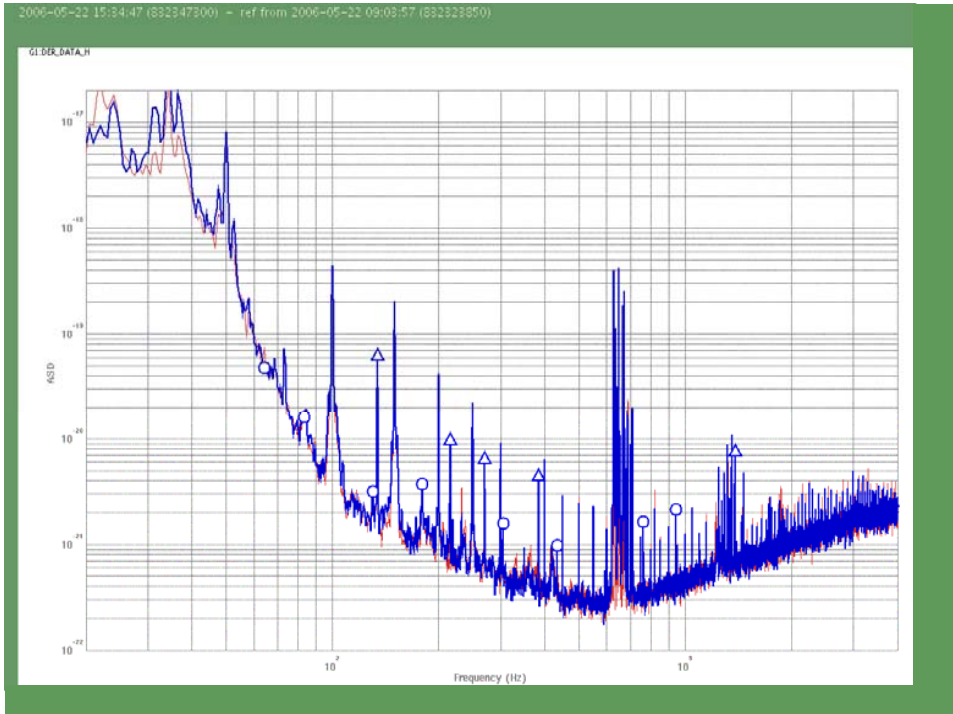


Projections to H for 2006-05-06 07:05:00

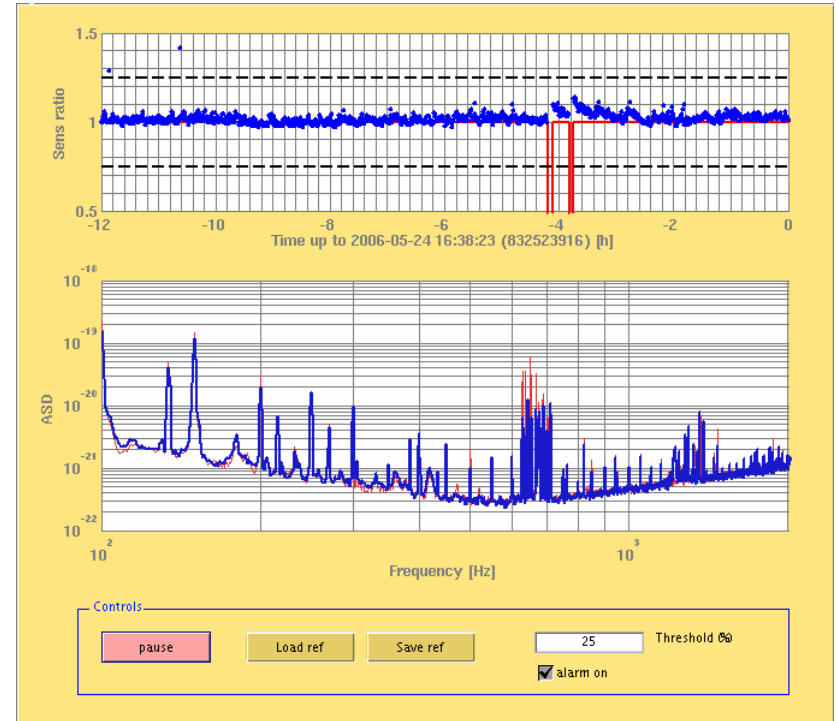


See talk of Josh Smith

Online Monitors: $h(f)$



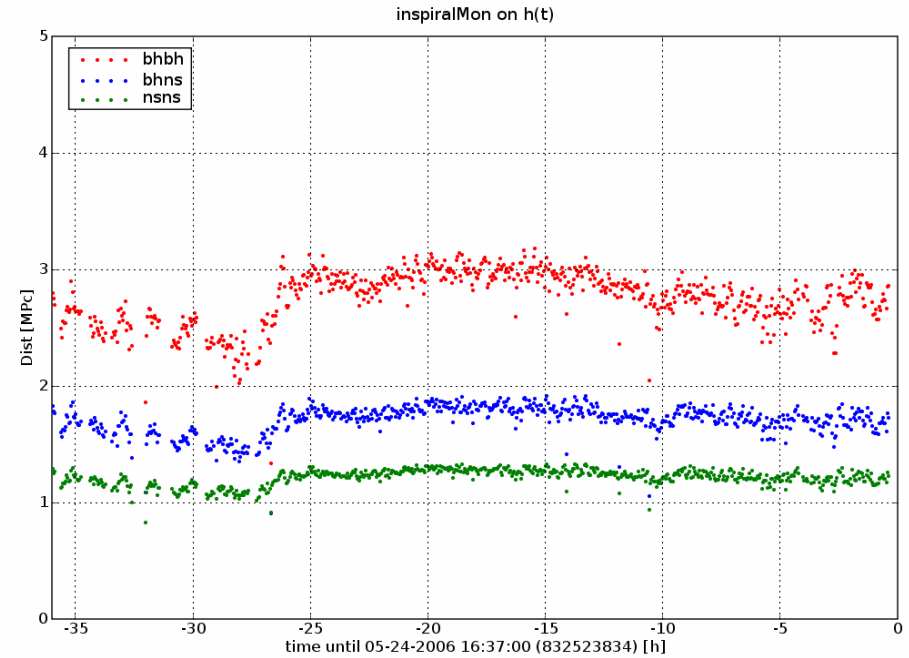
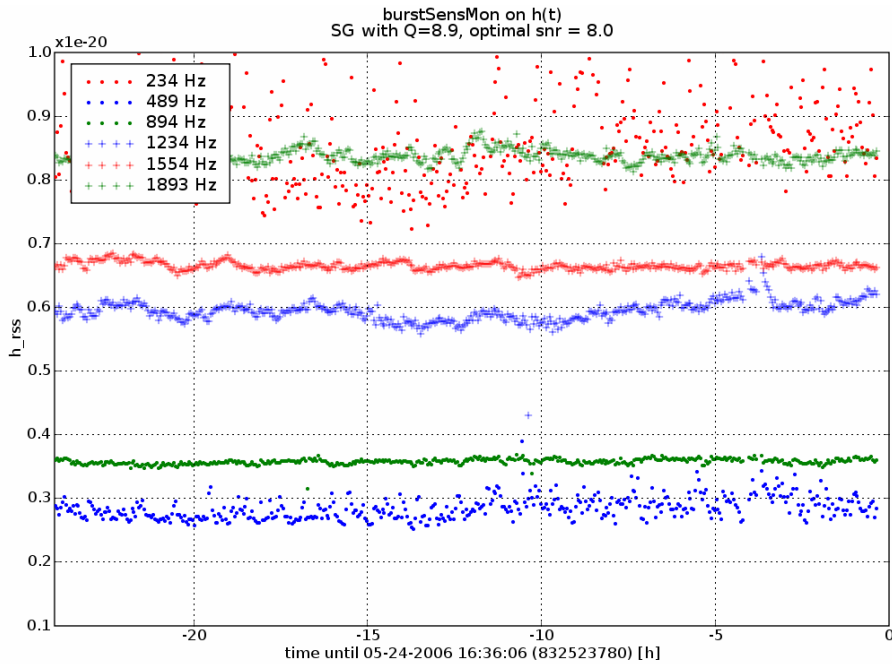
Current



Current + last 12 hours



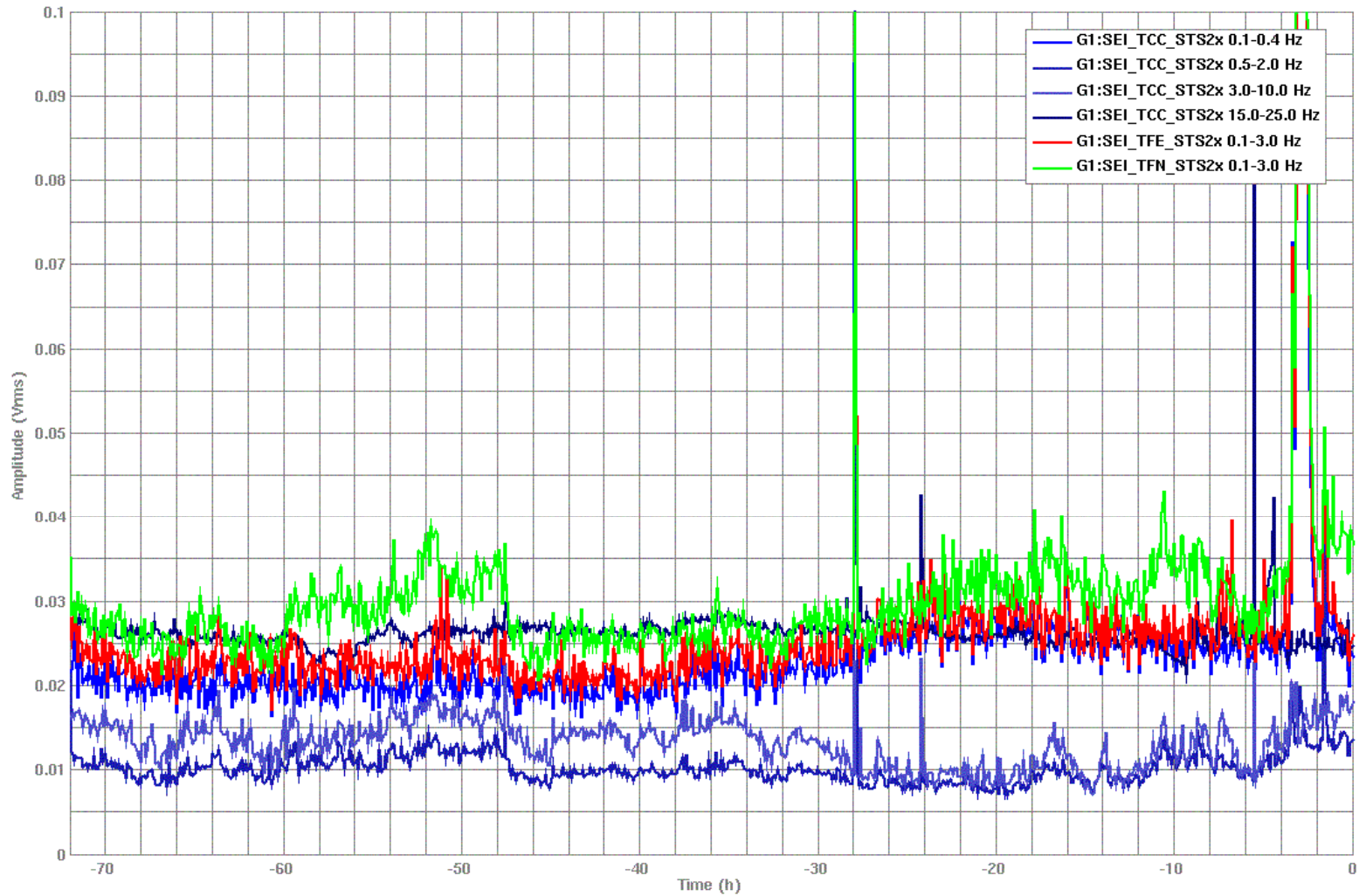
Online Monitors: Sensitivity



Burst Sensitivity for Sine-Gaussians with $Q=8.9$ and an SNR of 8.0 for optimal orientation

Sensitivity for inspiralling binary (NS-NS, NS-BH, BH-BH) systems

Online Monitors

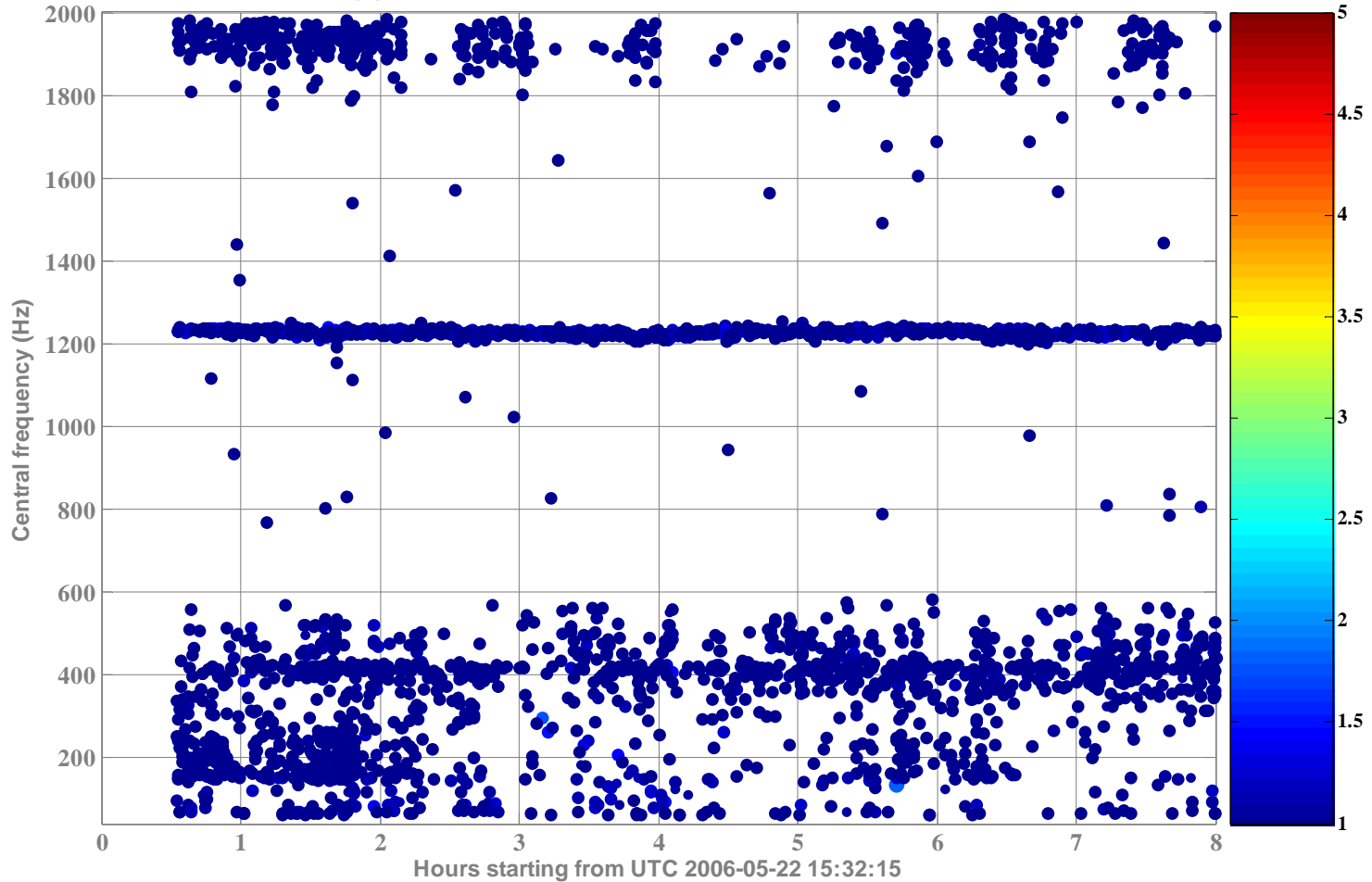




Online Monitors: HACR burst-like events



Time-frequency plot of events: h HACRMon (Total events =3192)
Marker size corresponds to $20 \cdot \log_{10}(N \text{ pixels})$
pipeline: G1:DER_DATA_H_832305600_5.0_25.0

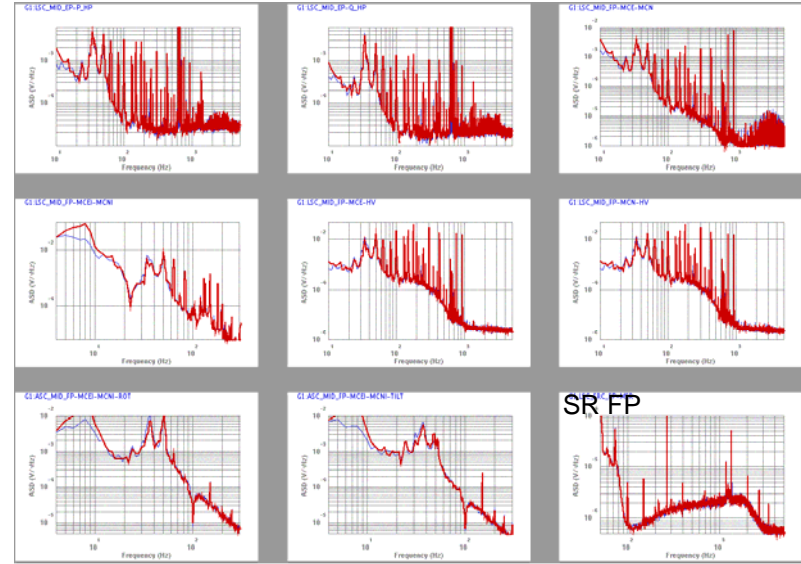
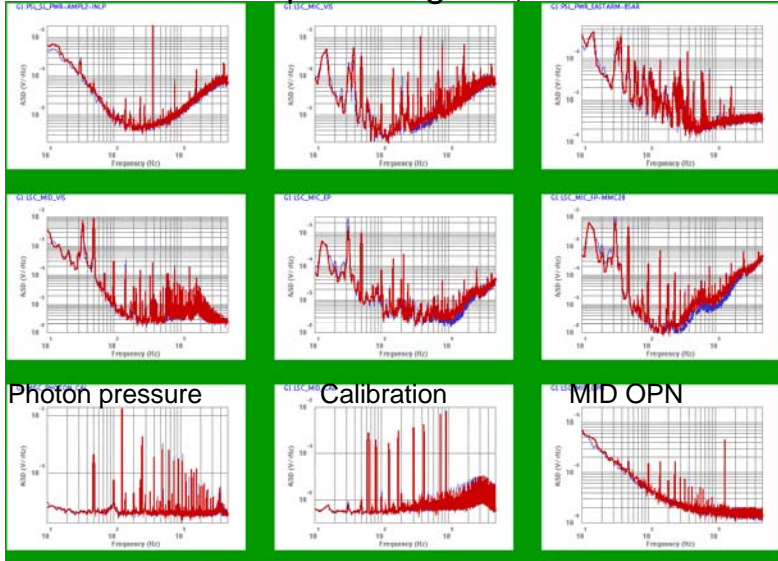




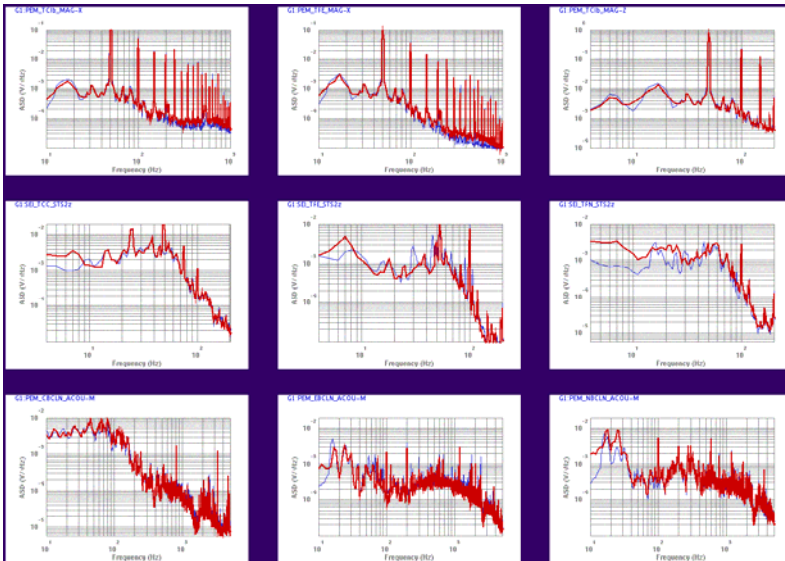
Online Monitors: Spectra



MIC + power signals, etc.



MID Signals



Magnetic

Seismic

Acoustic

Online spectra + references
to see at a glance whether
every system behaves well

ALARM!



alarm050221.vi

File Edit Operate Tools Browse Window Help

auto mod

Ignore Select Device

Module? System Acronym 1 Acronym 2

CONTRL STATUS HARDMAINT

Set Range Ignore

KW 22 MO DI MI DO FR SA SO

29. Mai 06 30. Mai 06 31. Mai 06 1. Jun 06 2. Jun 06 3. Jun 06 4. Jun 06

00:00 NORBERT

01:00

02:00

03:00

04:00 MICHA MICHA MICHA MARC MARC

05:00

06:00

07:00

08:00

09:00 NORBERT MICHA

10:00

11:00

12:00

13:00 NORBERT NORBERT NORBERT NORBERT MICHA

14:00

15:00

16:00

17:00

18:00 MARC MARC MARC MICHA NORBERT

19:00

20:00

21:00 MICHA NORBERT

22:00

23:00

Display Device Parameters

Row to Delete

INSERT 1 DELETE

Descriptor Lower L

AAMC1 : ROT : ERRP-B -1.0000

EMON : TEMP : CB/C_TCE 19.0000

MFN : CHI : FLAG -5.1000

MFN : CHI : GAIN 24.0000

CONTRL : STATUS : SCIENCE 1.0000

Alarm Bells!

On Site Alarm

3 Operators hired, 2 shifts / working day (8:00-18:00)



Setup Monitoring

List of monitored systems

detector					
system name	monitoring status	change status	age of check file	view trend data (1Hz)	
alchemist	ACTIVE	deactivate	0d 00:00:03	last 3h	last 12h
DAQS_TimingCheck_C	ACTIVE	deactivate	0d 00:00:06	last 3h	last 12h
DAQS_TimingCheck_E	ACTIVE	deactivate	0d 00:00:06	last 3h	last 12h
DAQS_TimingCheck_N	ACTIVE	deactivate	0d 00:00:06	last 3h	last 12h
hSensMon	ACTIVE	deactivate	0d 00:00:29	last 3h	last 12h
IFOLock	ACTIVE	deactivate	0d 00:00:06	last 3h	last 12h
IFOLockLong	ACTIVE	deactivate	0d 00:00:06	last 3h	last 12h
LSC_MID_CAL	ACTIVE	deactivate	0d 00:00:06	last 3h	last 12h
pandora	ACTIVE	deactivate	0d 00:00:03	last 3h	last 12h
Photon_Calibrator	ACTIVE	deactivate	0d 00:00:06	last 3h	last 12h
thot	ACTIVE	deactivate	0d 00:00:03	last 3h	last 12h

infrastructure					
system name	monitoring status	change status	age of check file	view trend data (1Hz)	
POWER_CENTRAL	ACTIVE	deactivate	0d 00:00:06	last 3h	last 12h
PRESS_CC	ACTIVE	deactivate	0d 00:00:06	last 3h	last 12h
PRESS_E	ACTIVE	deactivate	0d 00:00:06	last 3h	last 12h
PRESS_MC	ACTIVE	deactivate	0d 00:00:06	last 3h	last 12h
PRESS_N	ACTIVE	deactivate	0d 00:00:06	last 3h	last 12h
TEMP_CENTRAL_CLEANROOM	ACTIVE	deactivate	0d 00:00:06	last 3h	last 12h
TEMP_CENTRAL_CONTROLROOM	ACTIVE	deactivate	0d 00:00:06	last 3h	last 12h
TEMP_CENTRAL_GALLERY	ACTIVE	deactivate	0d 00:00:06	last 3h	last 12h
TEMP_EAST_GALLERY	ACTIVE	deactivate	0d 00:00:06	last 3h	last 12h
TEMP_NORTH_GALLERY	ACTIVE	deactivate	0d 00:00:06	last 3h	last 12h

Select operators that will be informed at any time about problems with the detector or the infrastructure

detector	infrastructure	userid (Name)	mobile phone	email
<input type="checkbox"/>	<input type="checkbox"/>	aei_mobile1 (,)	+49 (160) 9081	
<input type="checkbox"/>	<input type="checkbox"/>	bfw (Willke, Benno)	+49 (174) 9081	
<input type="checkbox"/>	<input checked="" type="checkbox"/>	hal (Lück, Harald)	+49 (174) 8701	
<input type="checkbox"/>	<input type="checkbox"/>	hartmut (,)	+49 (174) 1641	
<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	hartmut_email (,)		hartmut.grote@aei.mpg.de
<input type="checkbox"/>	<input type="checkbox"/>	josh_email (,)		joshua.smith@aei.mpg.de
<input type="checkbox"/>	<input type="checkbox"/>	marc (Brinkmann, Marc)	+49 (175) 5301	
<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	marc_email (,)		marc.brinkmann@aei.mpg.de
<input type="checkbox"/>	<input type="checkbox"/>	martin (Hewitson, Martin)	+49 (173) 2401	
<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	martin_email (,)		martin.hewitson@aei.mpg.de
<input type="checkbox"/>	<input type="checkbox"/>	michael (Weinert, Michael)	+49 (173) 8061	
<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	michael_email (,)		michael.weinert@aei.mpg.de
<input type="checkbox"/>	<input type="checkbox"/>	norbert (,)	+49 (160) 9911	
<input type="checkbox"/>	<input type="checkbox"/>	norbert_email (,)		norbert.rainer@aei.mpg.de
<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	sthild (Hild, Stefan)	+49 (172) 4471	
<input type="checkbox"/>	<input type="checkbox"/>	sthild_email (,)		stefan.hild@aei.mpg.de

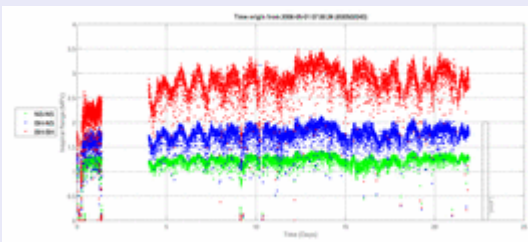
Submit



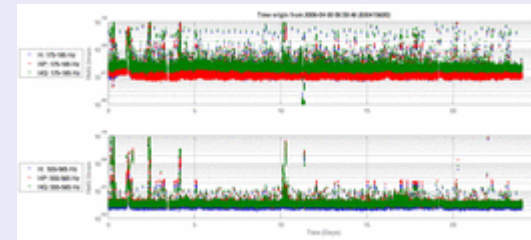
GEO Summary pages: monthly developments



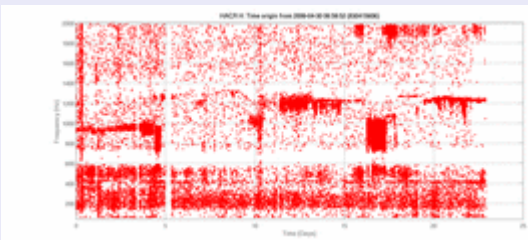
**Inspiral H
history**



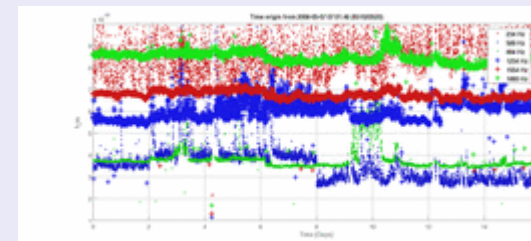
BLRMS history



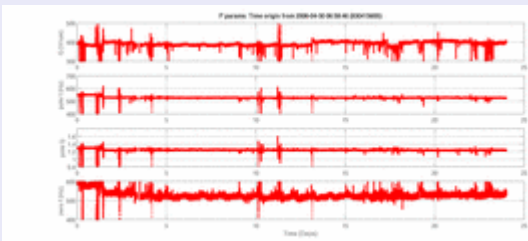
**HACR H
history**



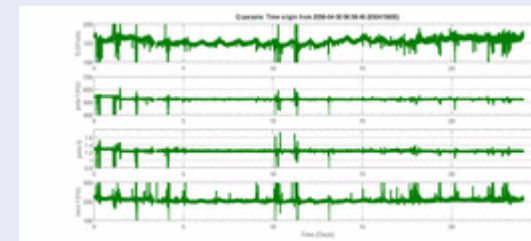
**BurstSensMon
history**



**P params
history**



Q params history



#	Report Tag	Start Time (UTC)	Start Time (GPS)	Duration (s)	Duration (H)	Duty Cycle (%)	Link
1	Wed_1	2006-05-23 22:59:46	832460400	28800	8.00	100.00	Link
2	Tue_3	2006-05-23 14:59:46	832431600	28800	8.00	100.00	Link
3	Tue_2	2006-05-23 06:59:46	832402800	28800	8.00	79.36	Link
4	Tue_1	2006-05-23 00:59:46	832374000	28800	8.00	87.50	Link

GEO Summary pages



<http://www.geo600.uni-hannover.de/georeports/>
(reader/readonly)

Segments of 8 hours:

Sensitivity

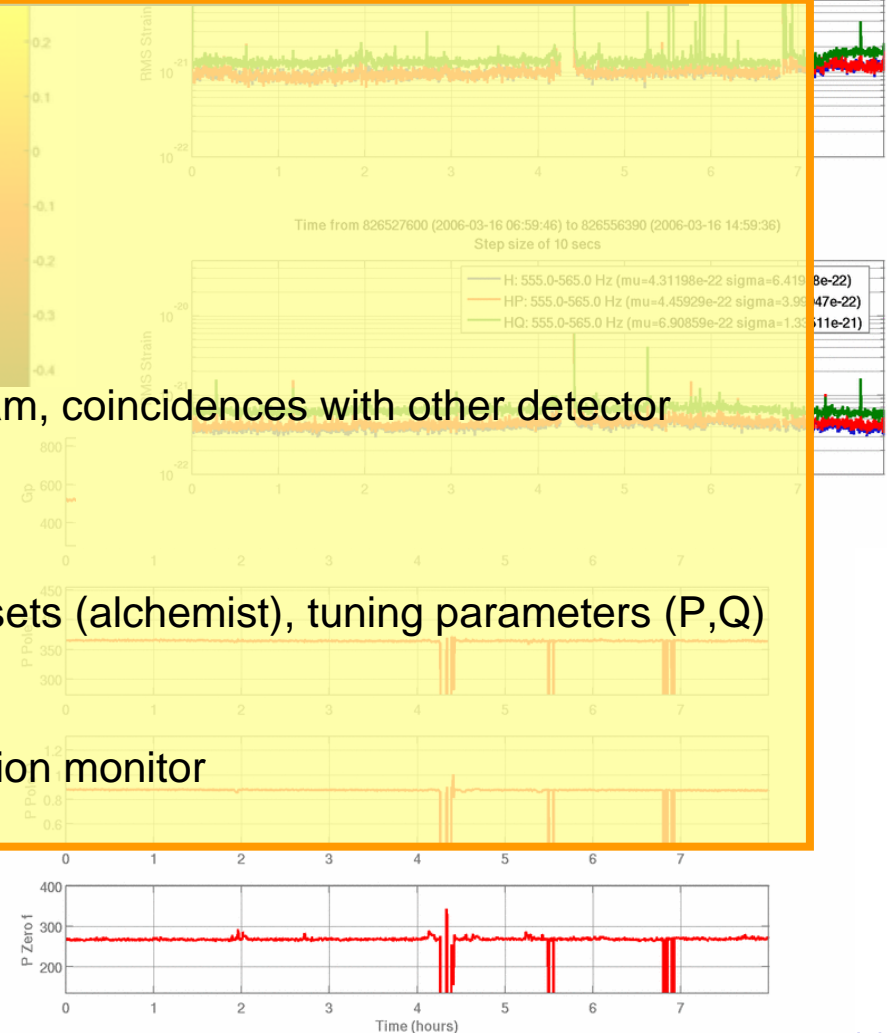
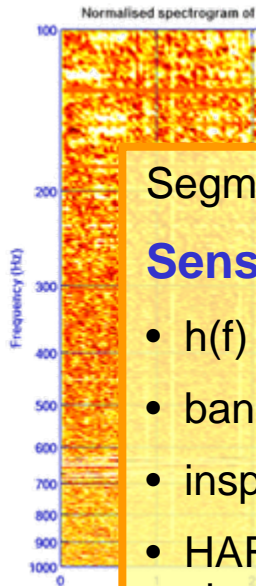
- $h(f)$
- band-limited rms
- inspiral & burst sensitivity monitor
- HARC events (TF events), null-stream, coincidences with other detector channels (35 channels)

Data Quality and Calibration

- Data quality, χ^2 , DAQs timing offsets (alchemist), tuning parameters (P,Q)

Detector Characterization

- lines, glitches, coincidences, saturation monitor

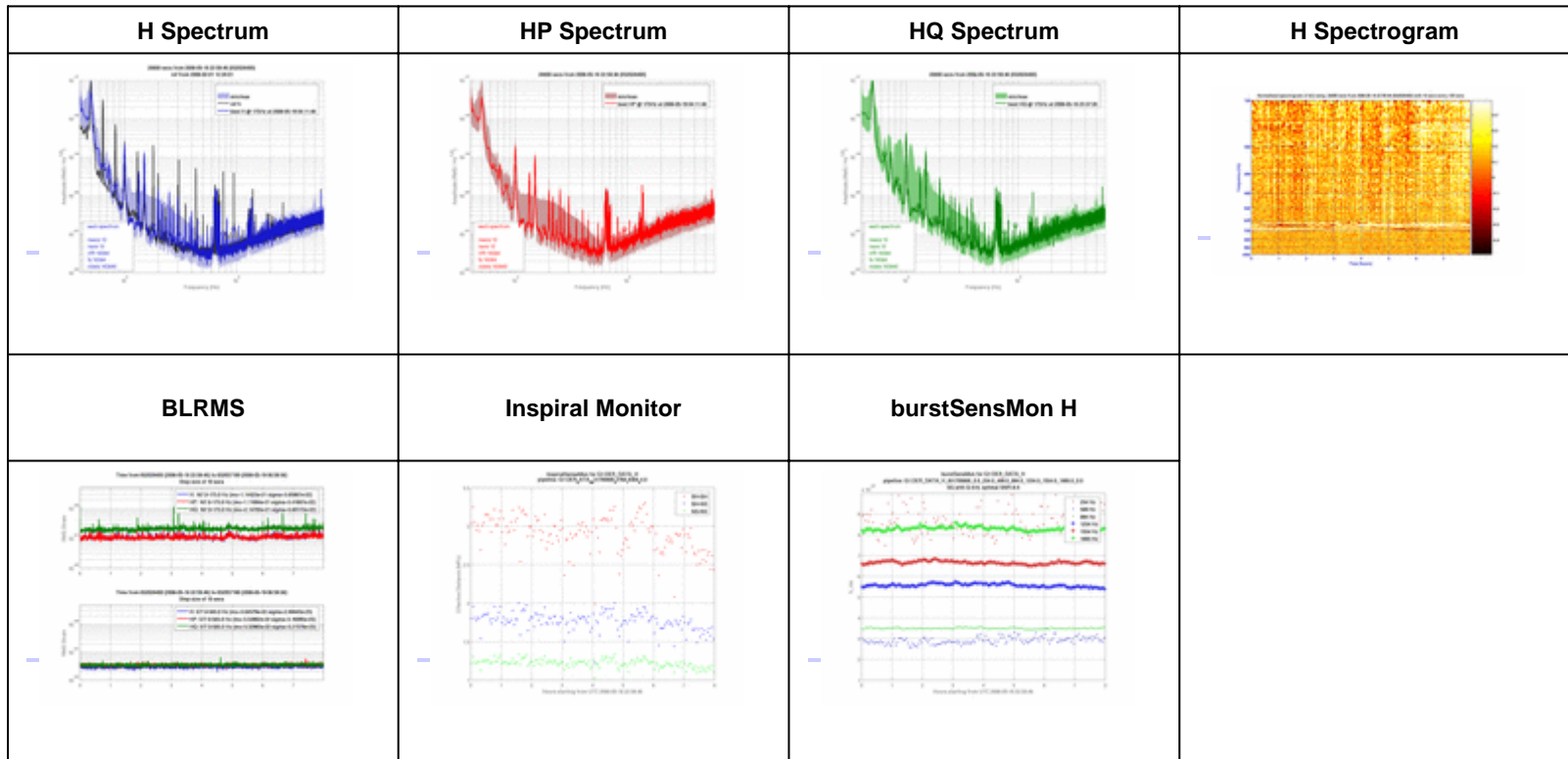


GEO summary pages



<http://www.geo600.uni-hannover.de/georeports/>
(reader/readonly)

Sensitivity

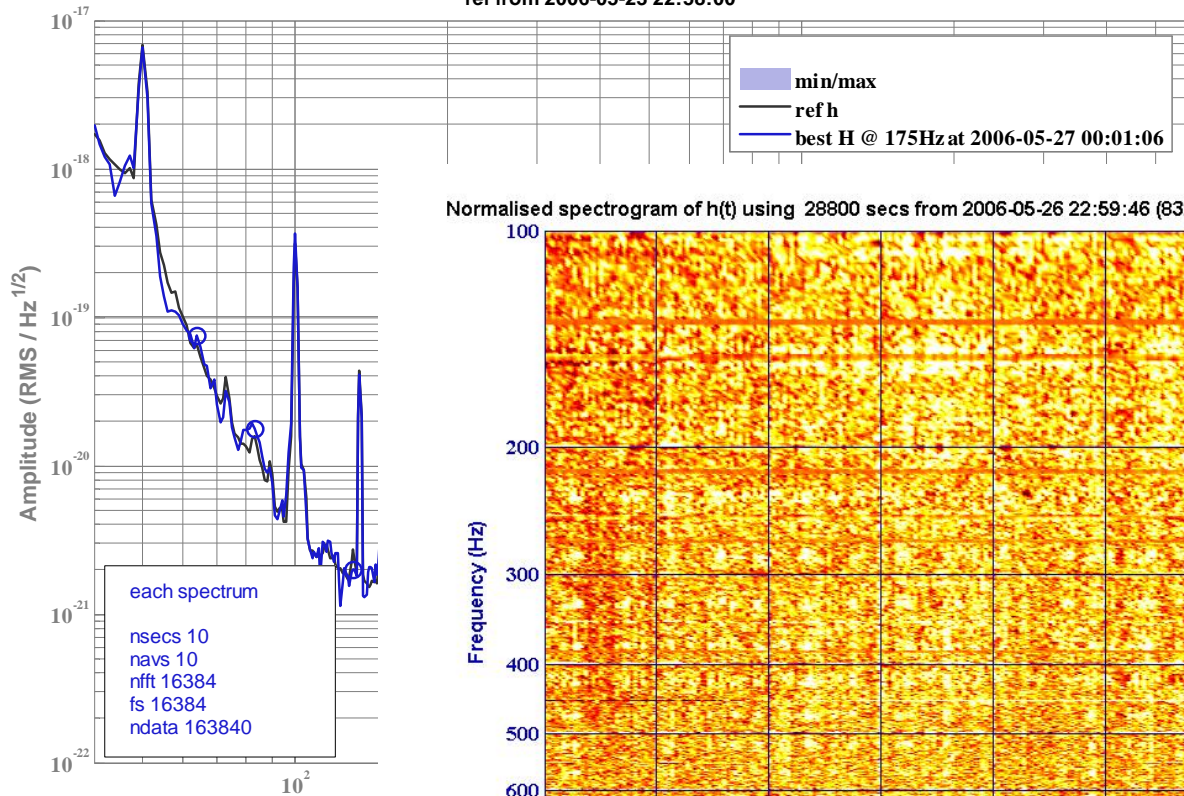




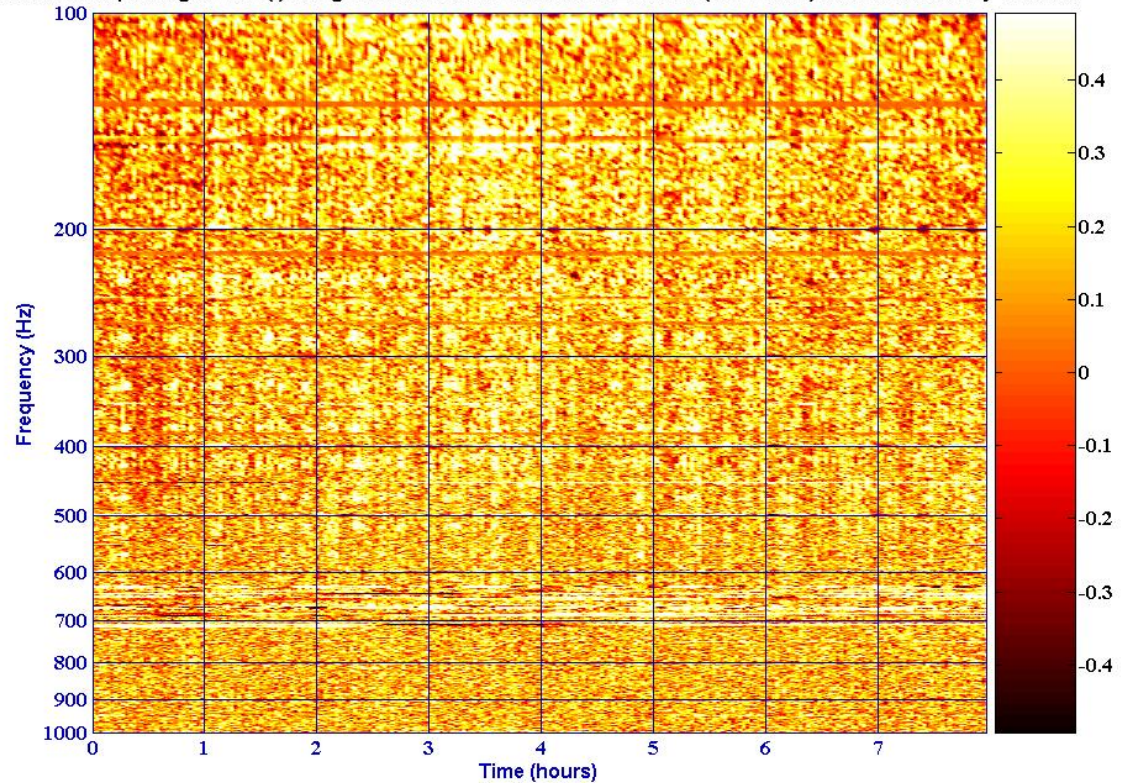
Sensitivity for 8 h Shift



28800 secs from 2006-05-26 22:59:46 (832719600)
ref from 2006-05-23 22:58:00



Normalised spectrogram of h(t) using 28800 secs from 2006-05-26 22:59:46 (832719600) with 10 secs every 120 secs

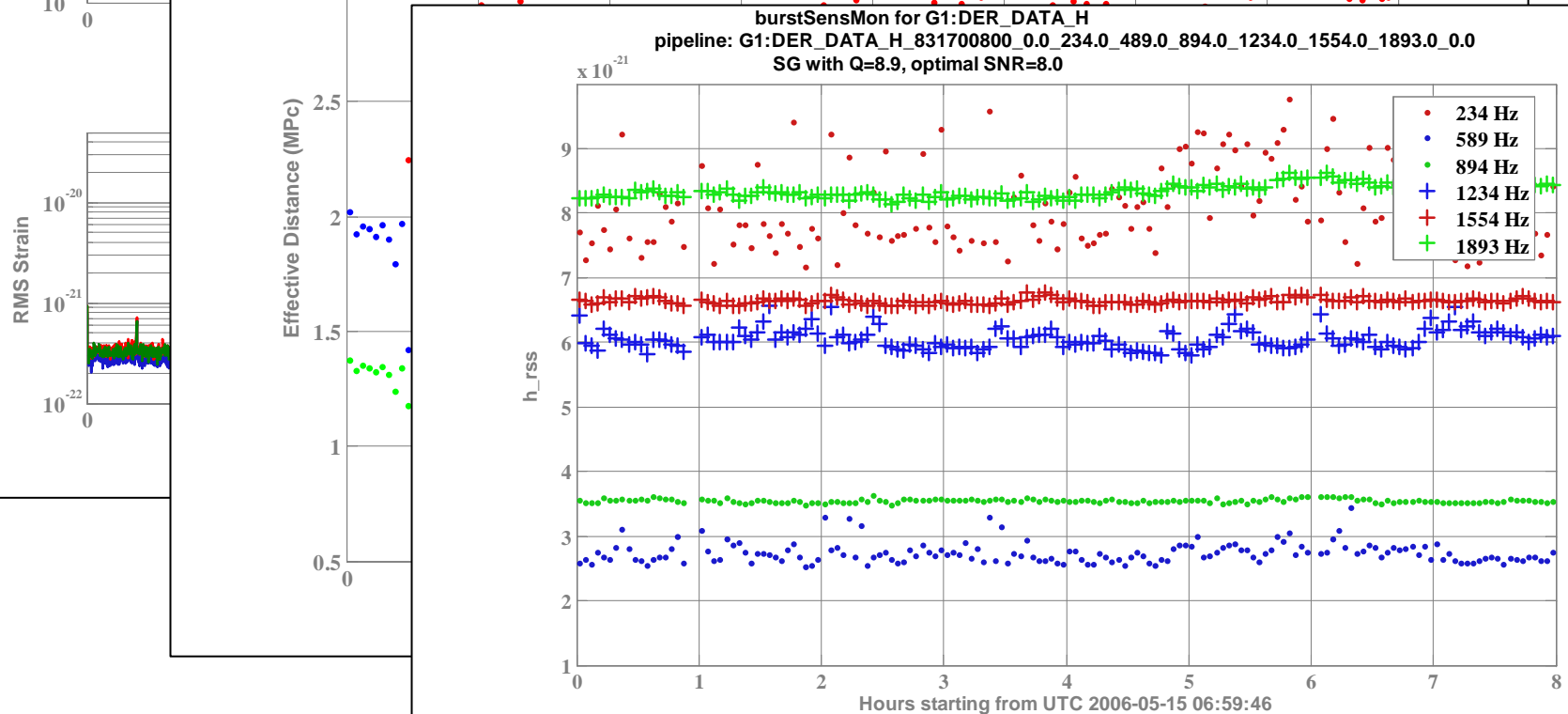
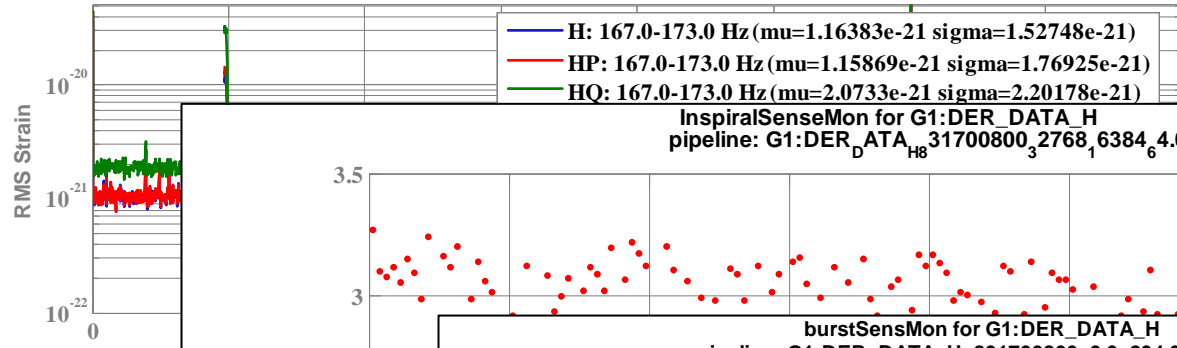




Sensitivity Monitors



Time from 831711600 (2006-05-15 06:59:46) to 831740390 (2006-05-15 14:59:36)
Step size of 10 secs



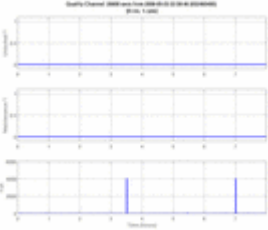
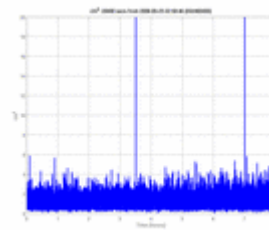
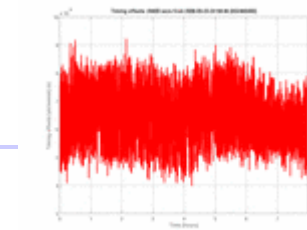
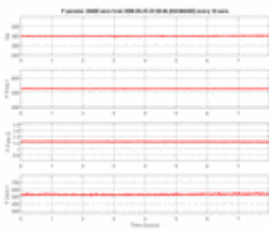
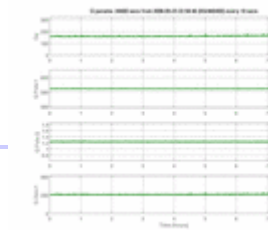


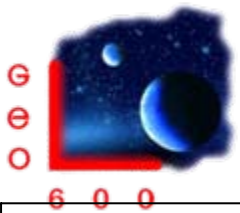
GEO summary pages



<http://www.geo600.uni-hannover.de/georeports/>

Data Quality and Calibration

Data quality	chi ²	DAQs timing offsets (alchemist)	P Params	Q Params
				

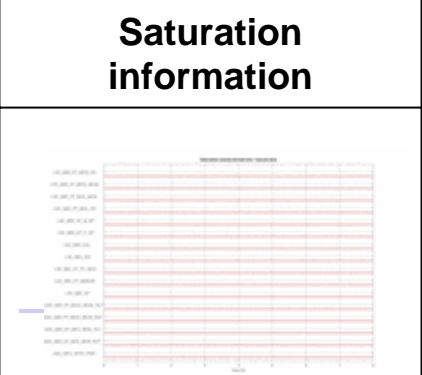


GEO summary pages (Det. Char.)



Glitch rate DER_DATA_H (HACR)	Glitch rate DER_DATA_HNULL (HACR)	Glitch rate DER_DATA_HP (HACR)	Glitch rate DER_DATA_HQ (HACR)
Further HACR time-frequency plots	HACR coincident events	hnull veto	HACR Loudest events

<http://www.geo600.uni-hannover.de/georeports/>

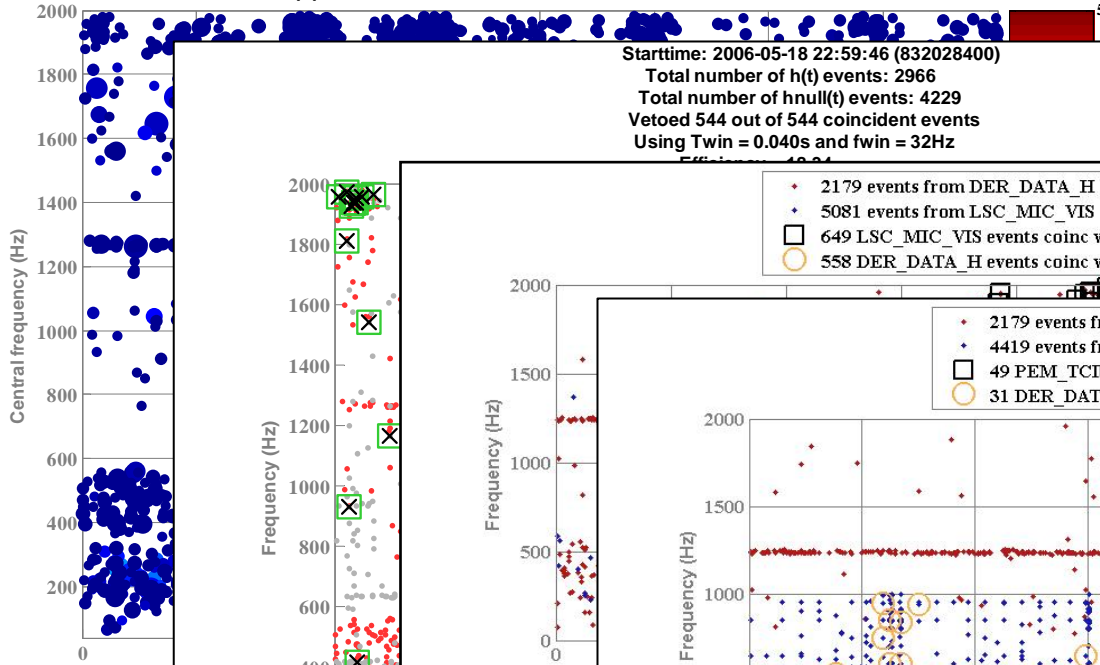




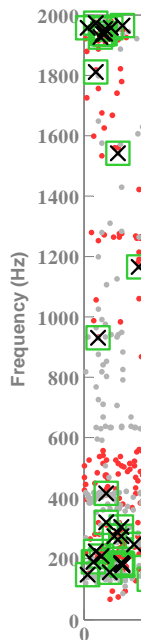
Events, Vetoes & Coincidences



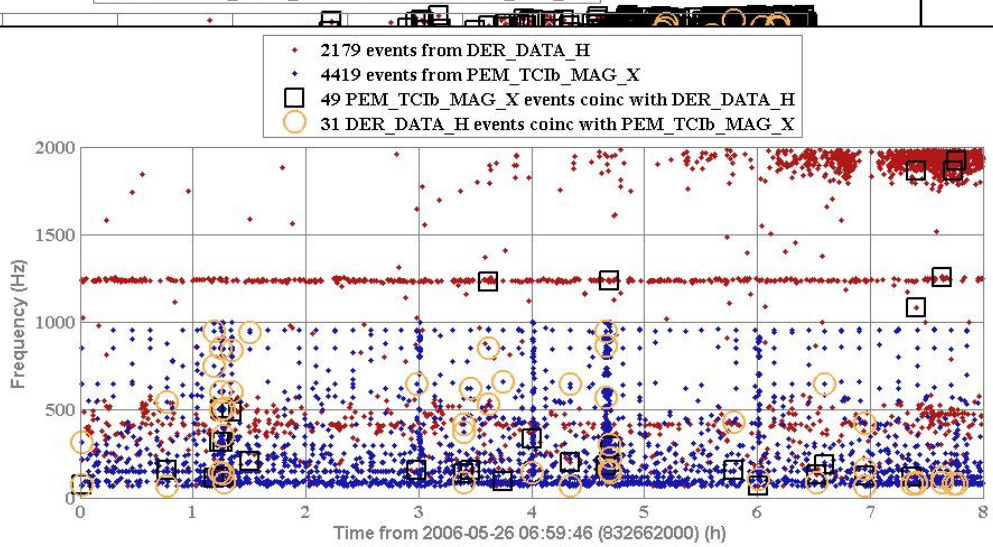
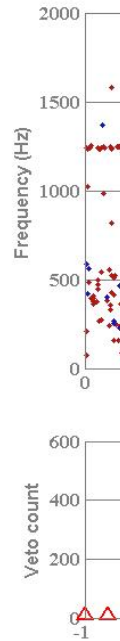
Time-frequency plot of events: h HACRMon (Total events =2966)
Marker size corresponds to (N pixels)
pipeline: G1:DER_DATA_H_831700800_5.0_25.0



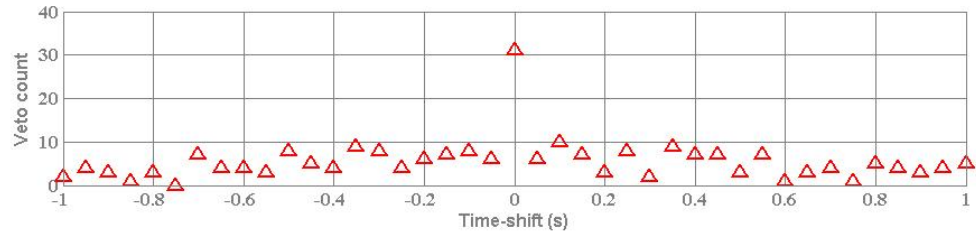
Starttime: 2006-05-18 22:59:46 (832028400)
Total number of h(t) events: 2966
Total number of hnull(t) events: 4229
Vetoed 544 out of 544 coincident events
Using Twin = 0.040s and fwin = 32Hz



2179 events from DER_DATA_H
5081 events from LSC_MIC_VIS
649 LSC_MIC_VIS events coinc with DER_DATA_H
558 DER_DATA_H events coinc with LSC_MIC_VIS



2179 events from DER_DATA_H
4419 events from PEM_TCIb_MAG_X
49 PEM_TCIb_MAG_X events coinc with DER_DATA_H
31 DER_DATA_H events coinc with PEM_TCIb_MAG_X

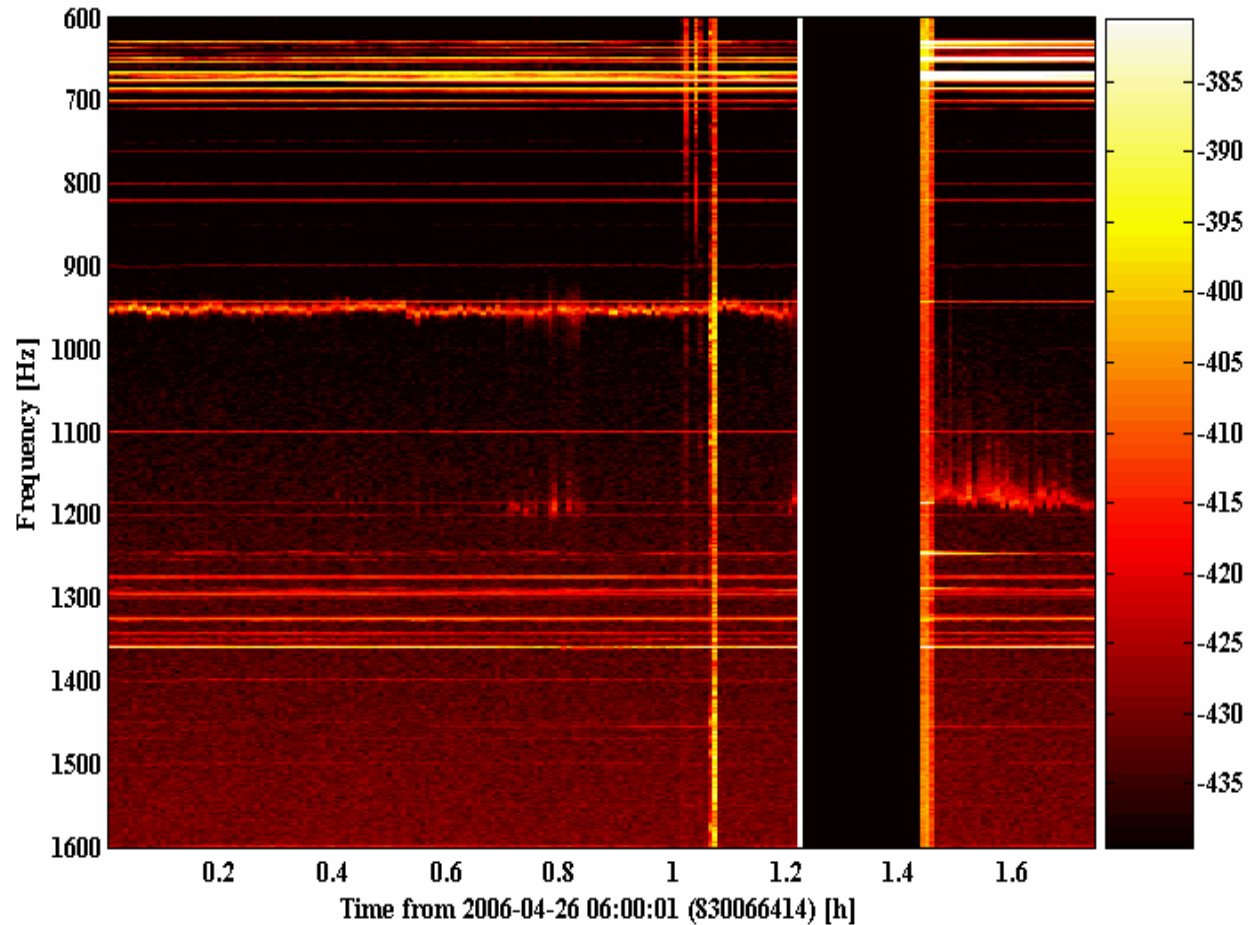
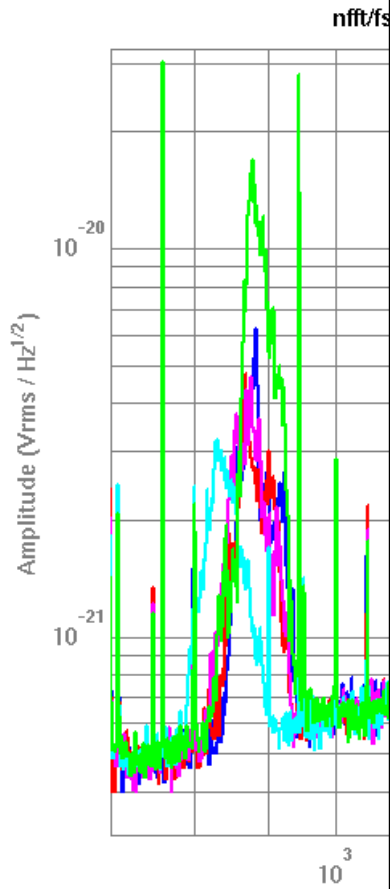




Remaining Problems...after comissioning

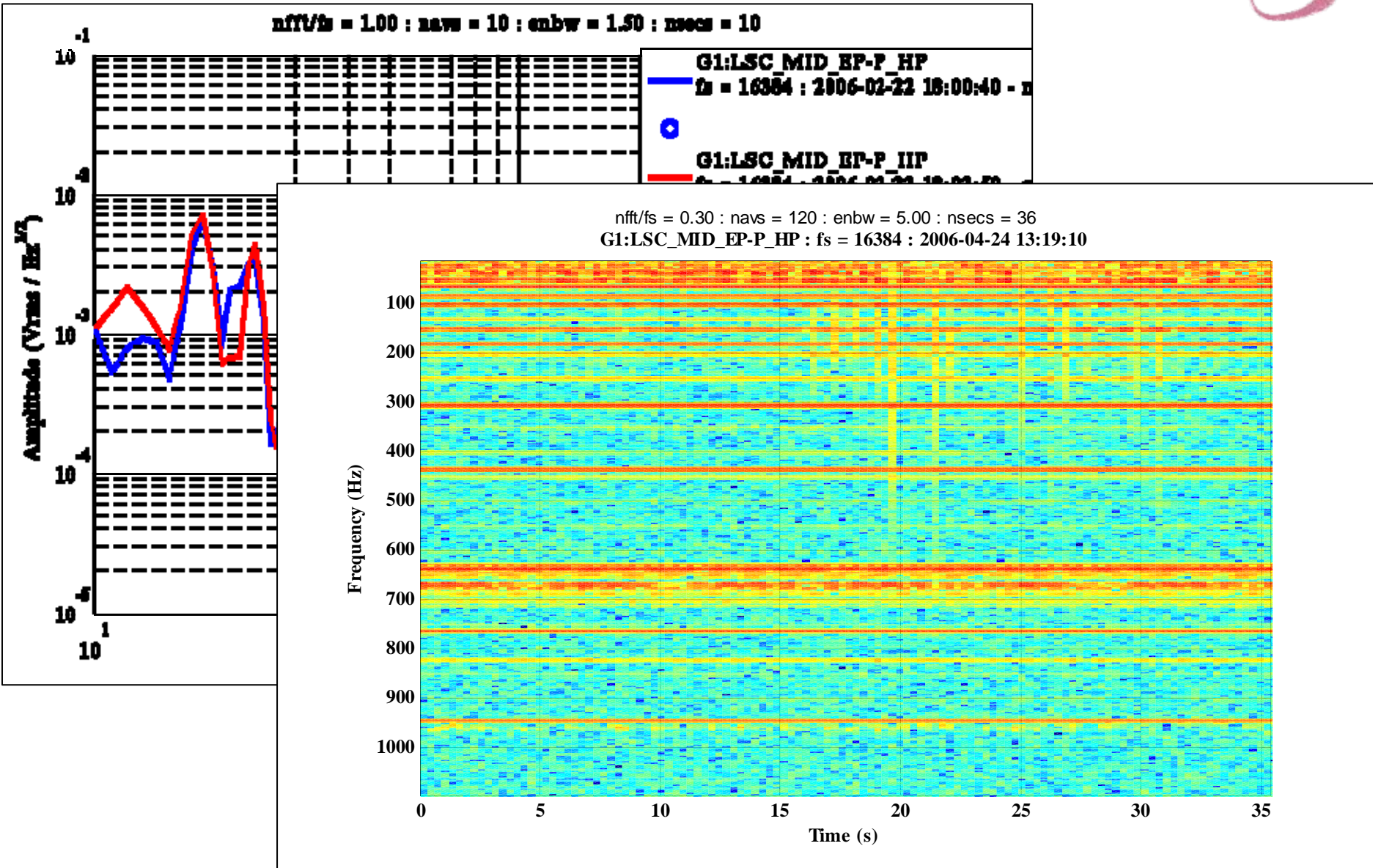


‘The Owl’ – a rapidly moving line with higher harmonics



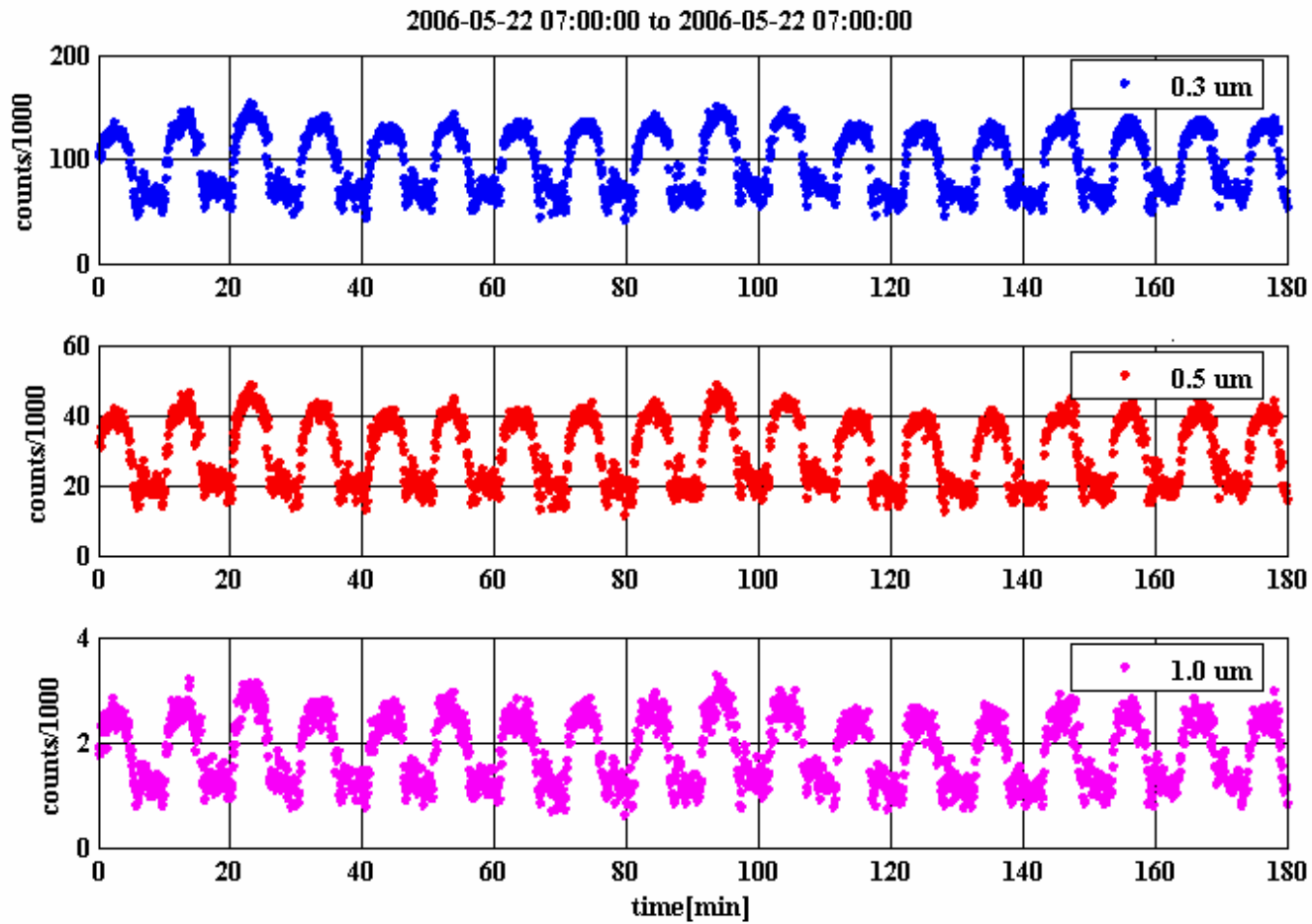


Power up Glitches





Dust (problem solved? See Josh's talk)





Prospect



- Stay in current state (owl permitting) until ~autumn and take data
- Continue detector characterization (Coincidences, Vetoes, ...)
- ~autumn: maintenance period, try to find source of power-up glitches, owl, power loss ...