I KNOW WHAT YOU'RE THINKING. "DID HE FIRE SIX SHOTS OR ONLY FIVE?" WELL, TO TELL YOU THE TRUTH , IN ALL THIS EXCITE-MENT I KIND OF LOST TRACK MYSELF. BUT BEING AS THIS IS A .44 MAGNUM, THE MOST POWERFUL HANDGUN IN THE WORLD, AND WOULD BLOW YOUR HEAD CLEAN OFF, YOU'VE GOT TO ASK YOURSELF ONE QUESTION:

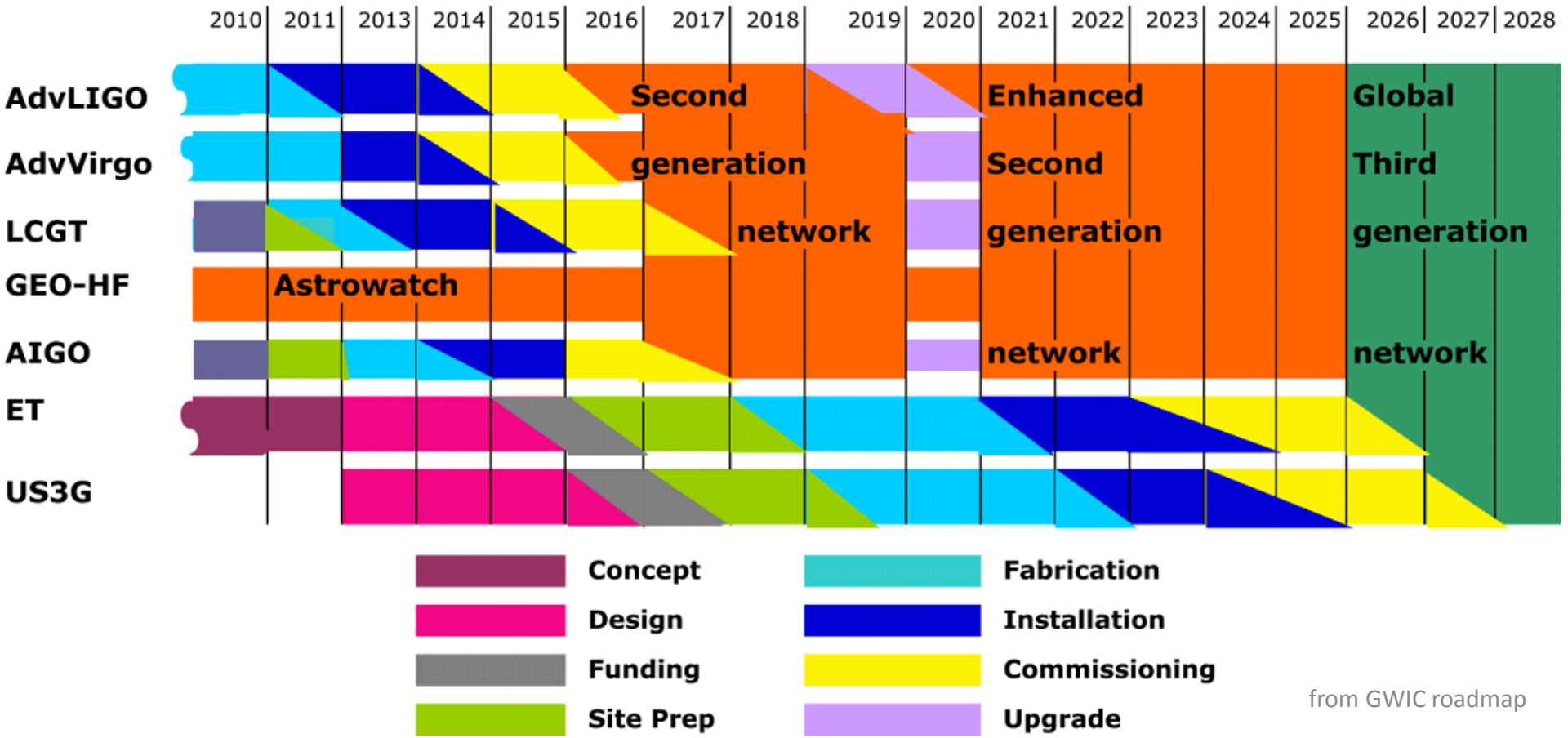
DO I FEEL LUCKY?
WELL, DO YA, PUNK?

YES WE (GEO) DO! BUT ONLY WITH A LITTLE HELP (DETCHAR) FROM YOU!

JONATHAN LEONG FOR THE LSC
LVC MEETING, KRAKOW, SEPTEMBER 2010
LIGO-G1000807

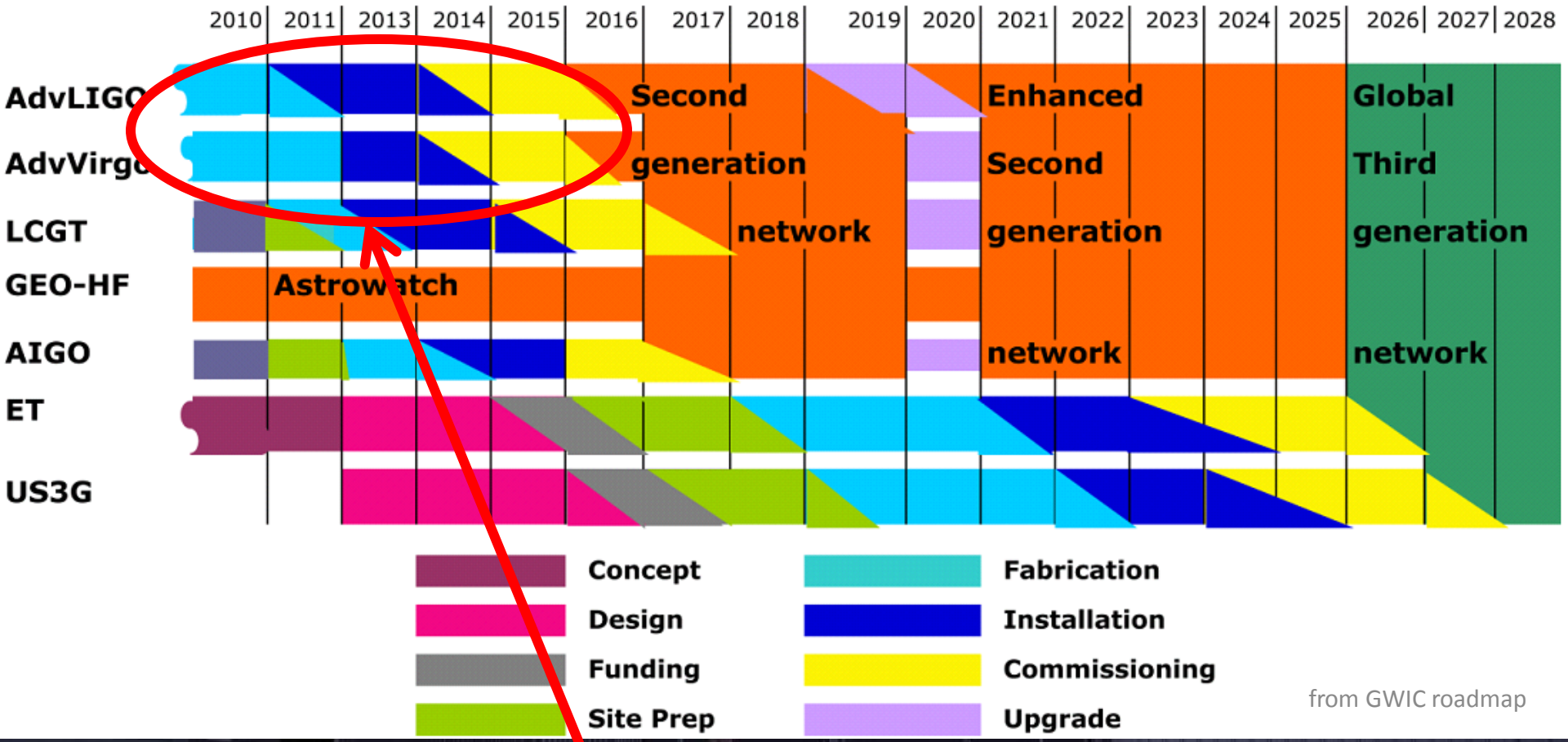

The Dark Ages are coming!!!

The Dark Ages are coming!!!



from GWIC roadmap

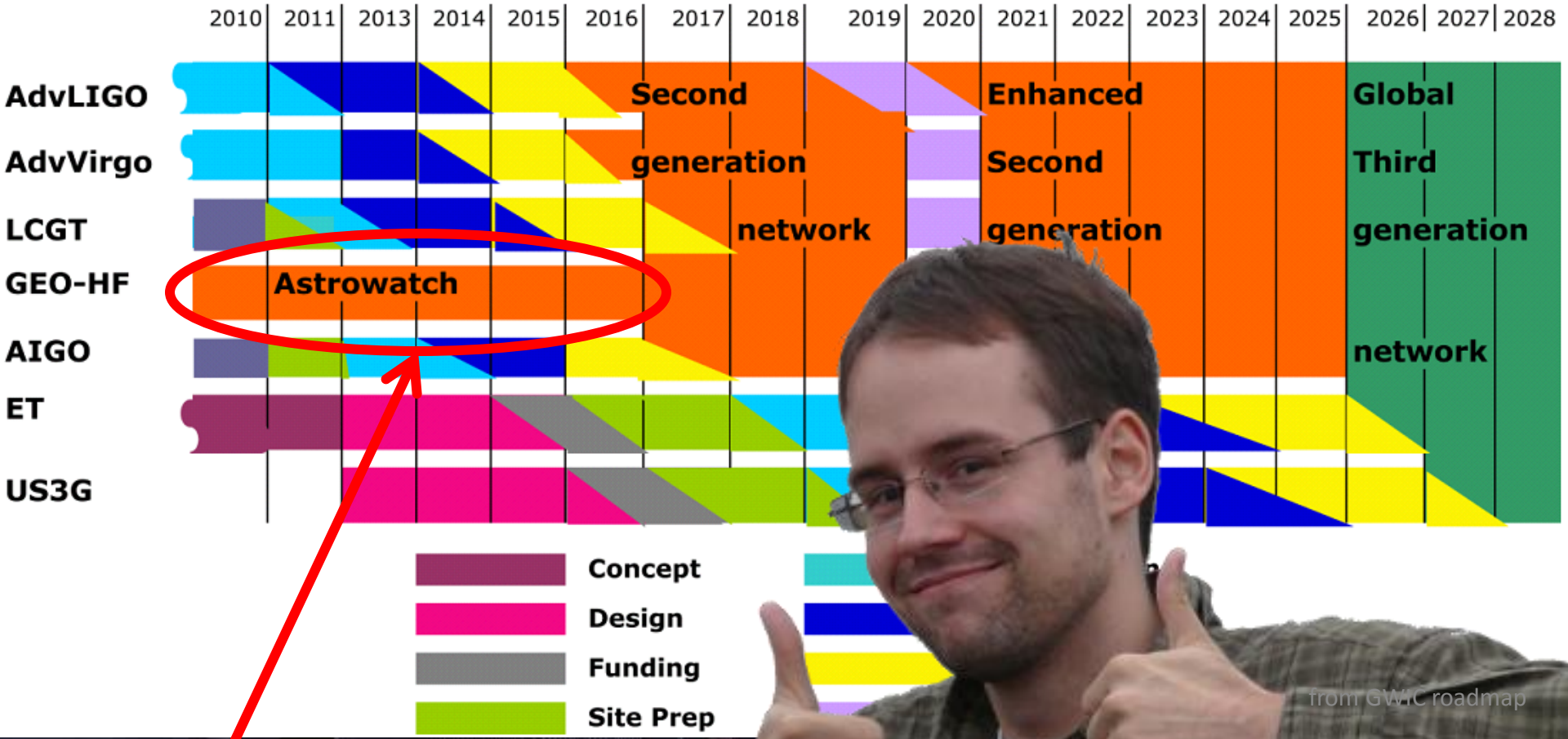
The Dark Ages are coming!!!



from GWIC roadmap

No data for 4-5 years

The Dark Ages are coming!!!

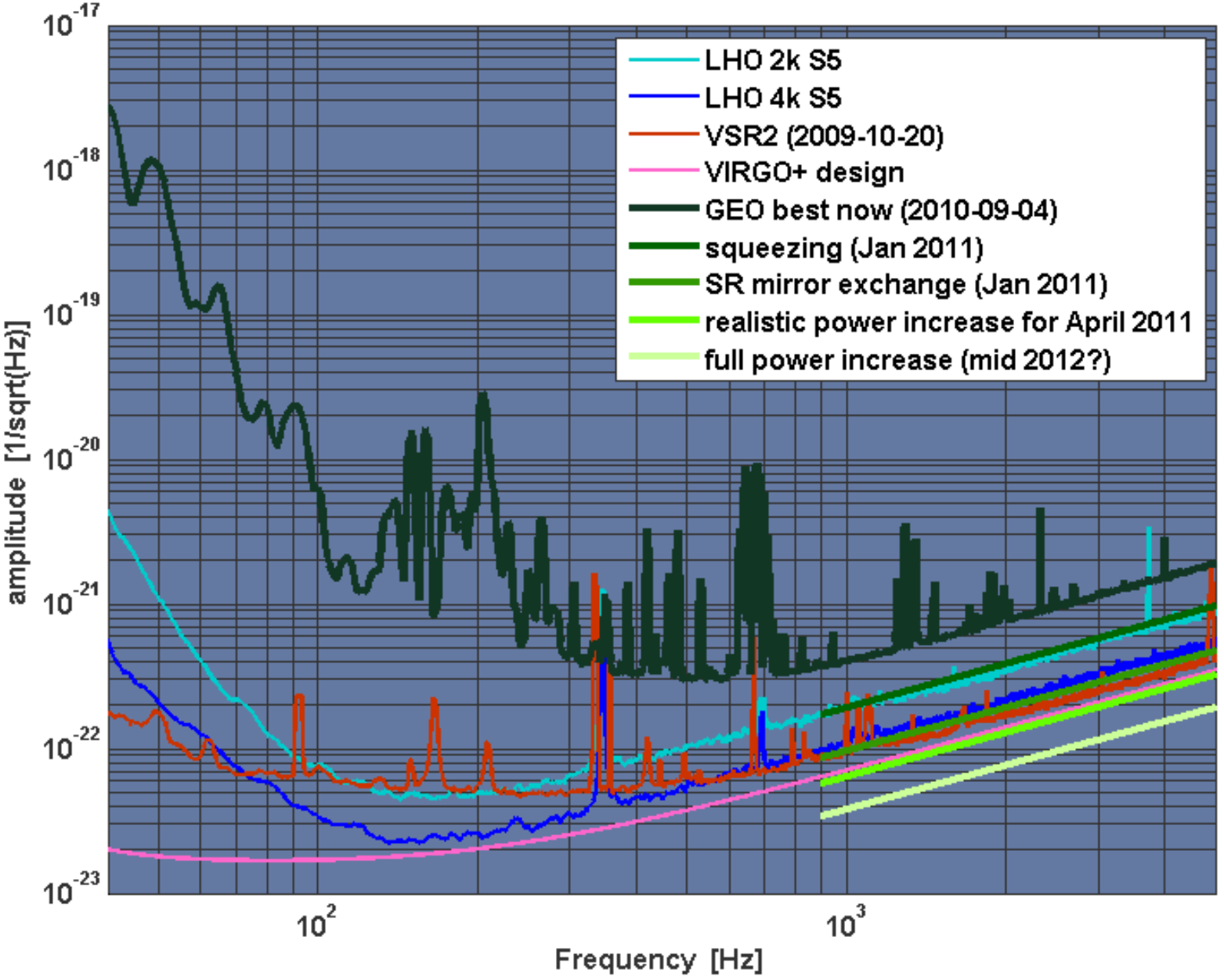


from GWIC roadmap

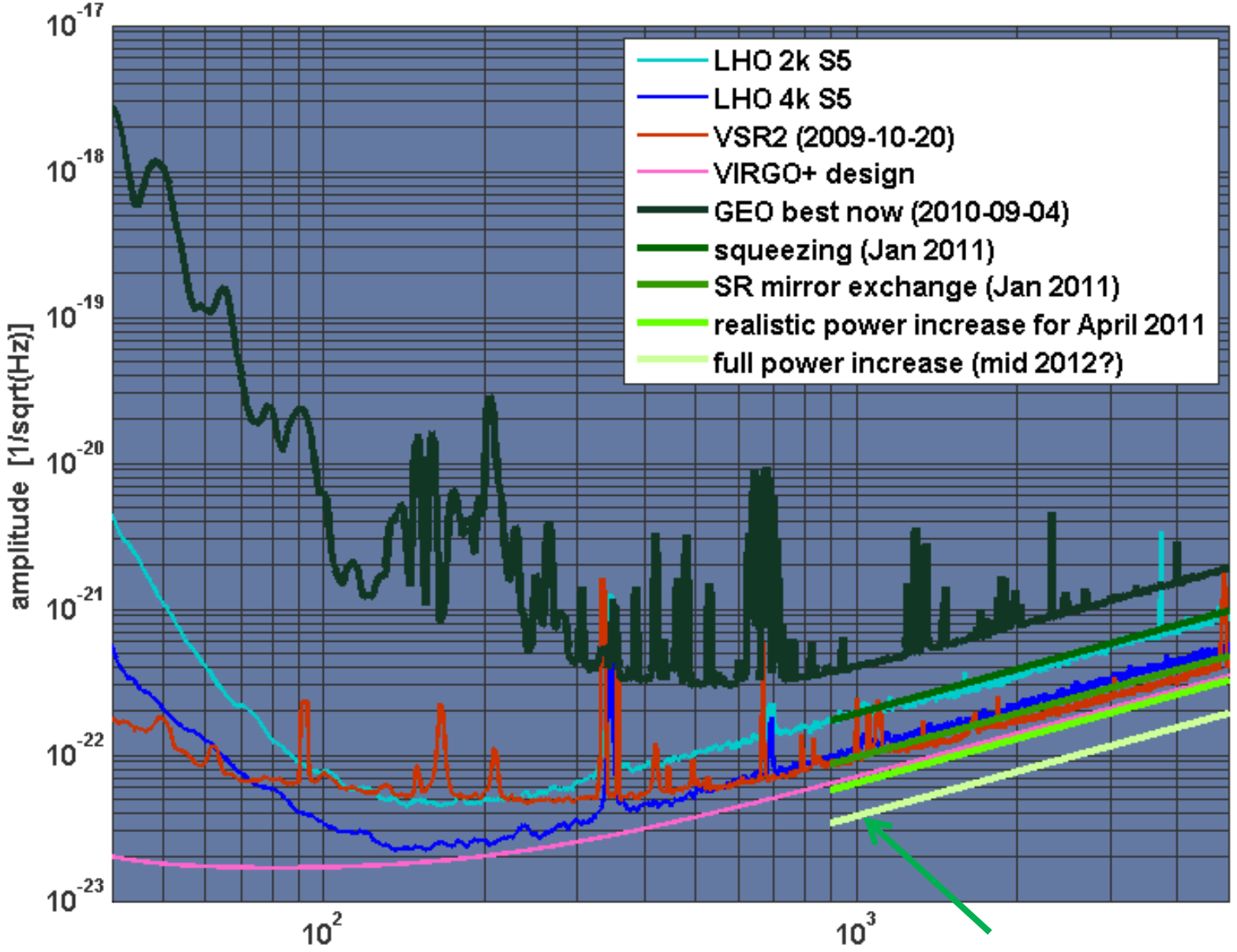
Eh? ... Eh?


Pour a little
GEO glory
into that
void!

We make our dude (GEO-) HF nice



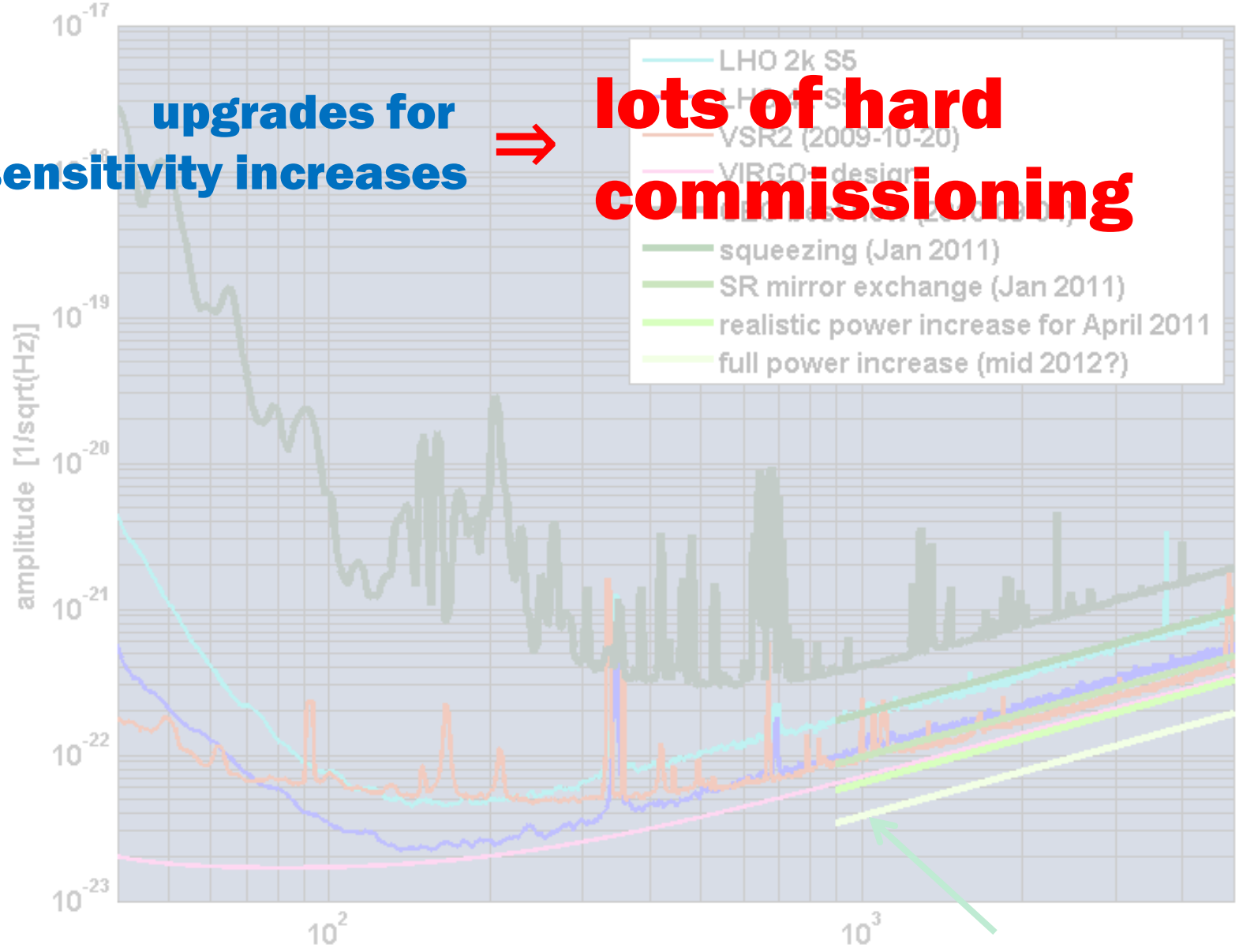
We make our dude (GEO-) HF nice



Factor 2 better than ever!

We make our dude (GEO-) HF nice

upgrades for sensitivity increases ⇒ **lots of hard commissioning**



Factor 2 better than ever!

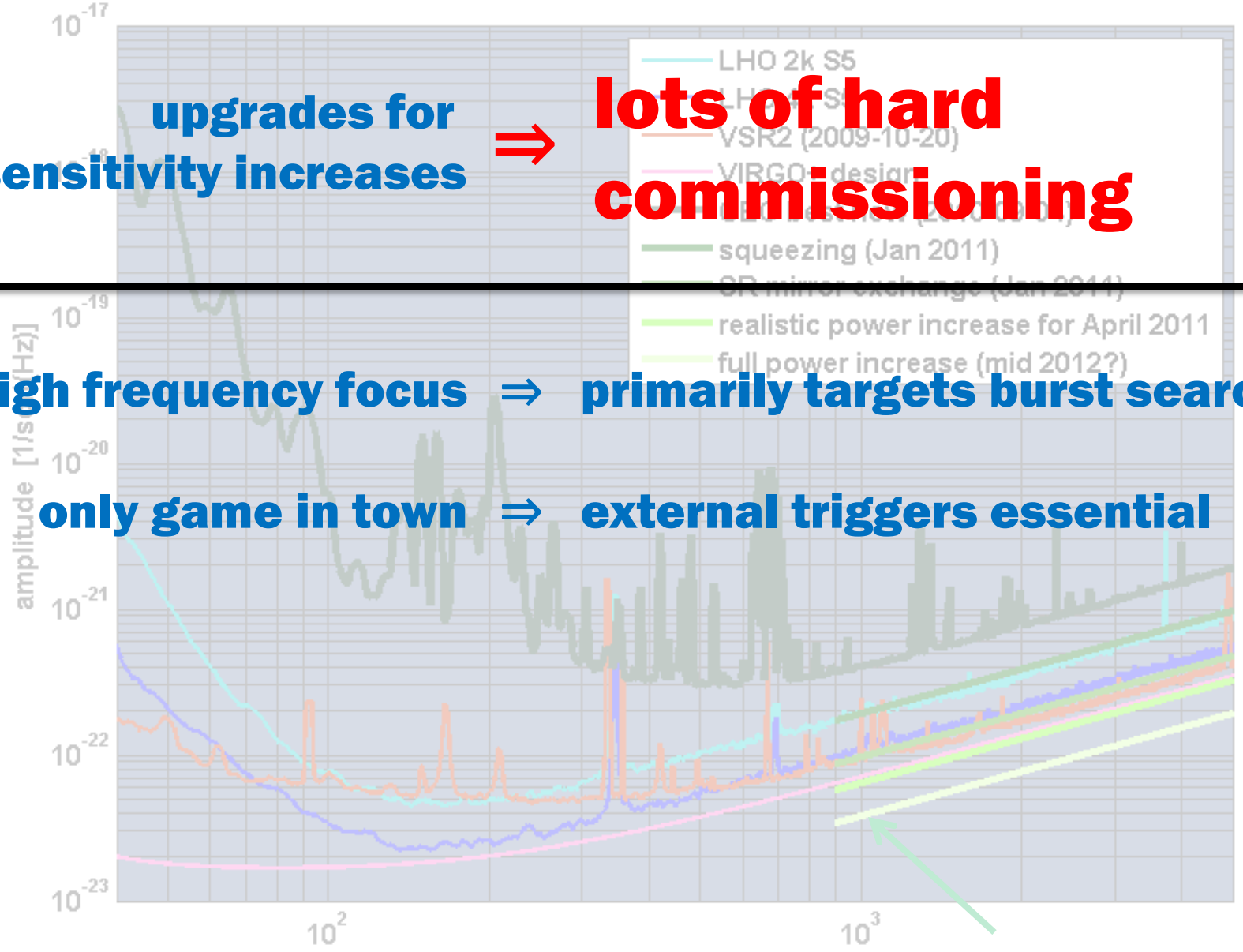
We make our dude (GEO-) HF nice

upgrades for sensitivity increases ⇒ **lots of hard commissioning**

---

high frequency focus ⇒ primarily targets burst searches

only game in town ⇒ external triggers essential



Factor 2 better than ever!

We make our dude (GEO-) HF nice

upgrades for sensitivity increases ⇒ **lots of hard commissioning**

---

high frequency focus ⇒ **primarily targets burst searches**

only game in town ⇒ **external triggers essential**

⇓

glitch reduction/identification more important than ever!

Factor 2 better than ever!


growth of
importance
of GEO
&
difficulty in
single detector
searches
⇓
growth in
DetChar activities


I think DetChar is…
• environmental couplings
• glitch vetos
• line identification
⇘ data quality
• calibration


for analysis
I think DetChar ^ is…
• environmental couplings
• glitch vetos
• line identification
⇘ data quality
• calibration

Commissioning /Analysis Duality

Commissioning /Analysis Duality

Commissioning /Analysis Duality

Commissioning /Analysis Duality


The new wave!

DetChar for commissiong

- important! particularly transient studies
- commissioners already familiar
- **room for more**
- illustration with summer commis-sioning story

The new wave!

Summer at GEO600

Summer at GEO600

- Prepare for joint run
- Move forward with GEO-HF upgrades
- Emphasize upgrades w/ run usage chance
- Activities:
  - OMC auto-alignment
  - Power up
  - Squeezing implementation
  - 120Hz transient noise

Moving forward in parallel

Moving forward in parallel

- OMC auto-alignment
- Power up
- Squeezing implementation
- 120Hz transient noise

implement hardware upgrades

investigative, more data intensive

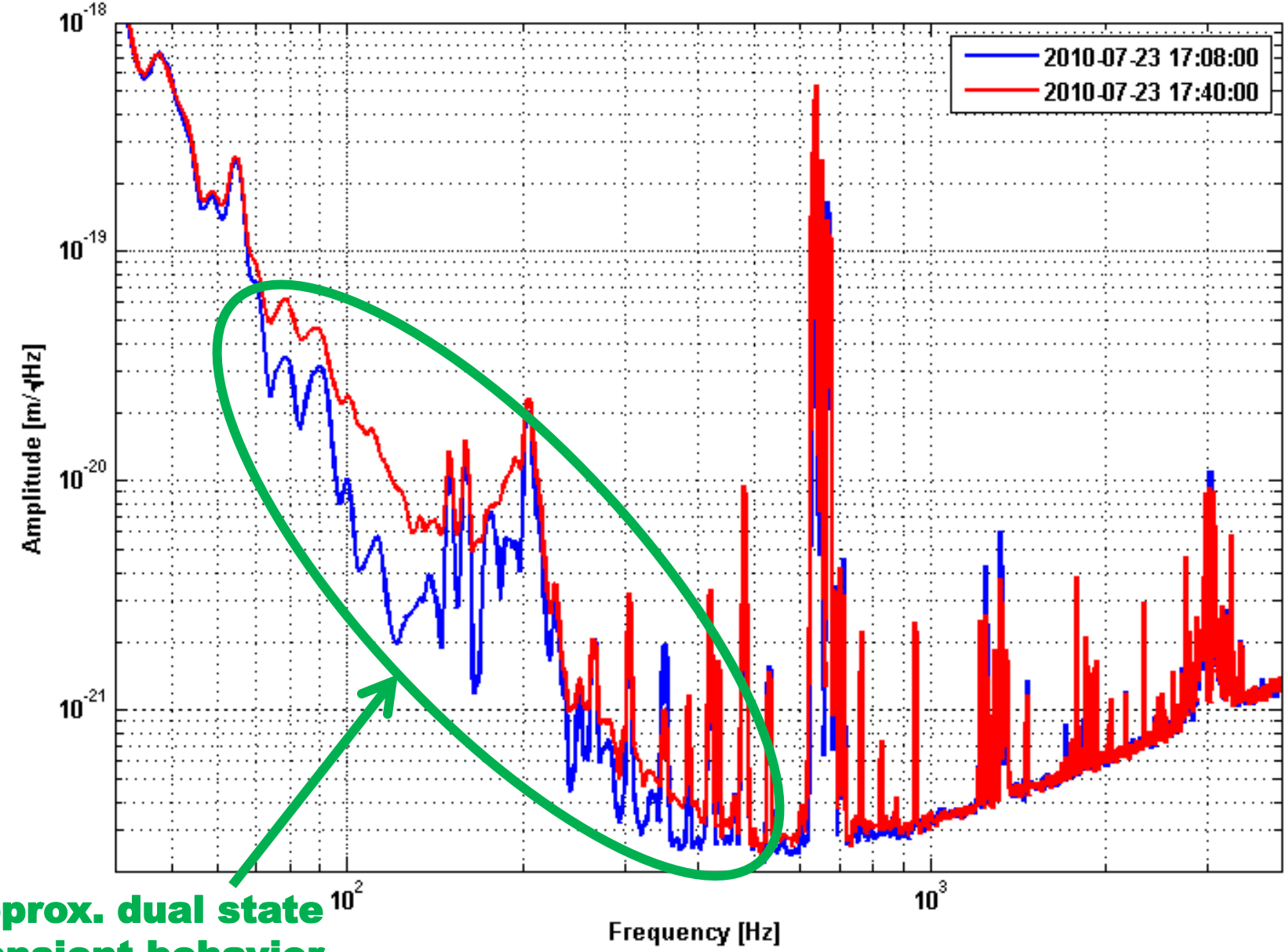
Fire Marshall in the house!

http://www.youtube.com/watch?v=XdR2T6YKAUc

Fire Marshall in the house!

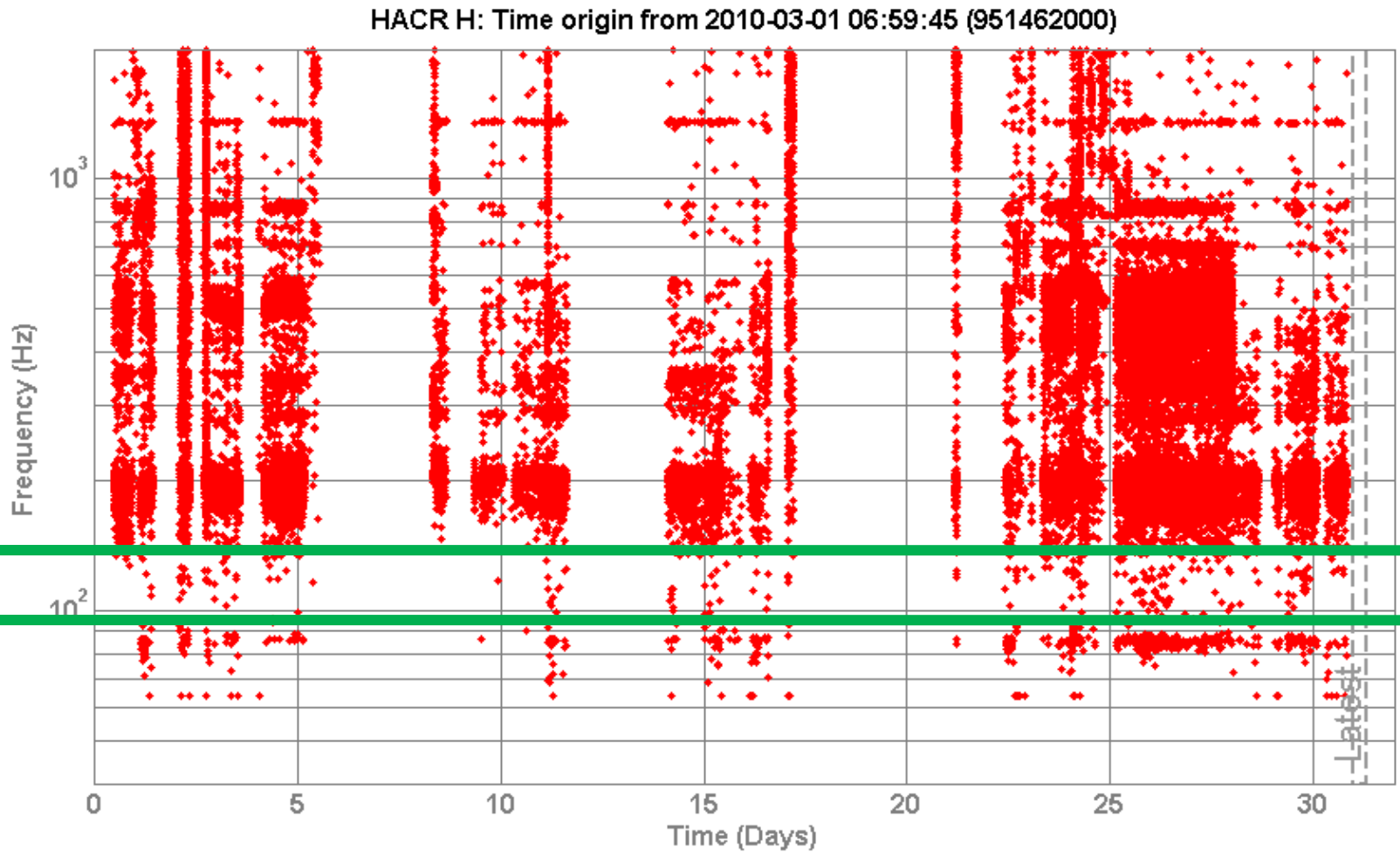
- OMC auto-alignment difficult to implement
- Power up investiga-tions inconsistent
- Squeezing phase difficult to lock

Why so flaky?



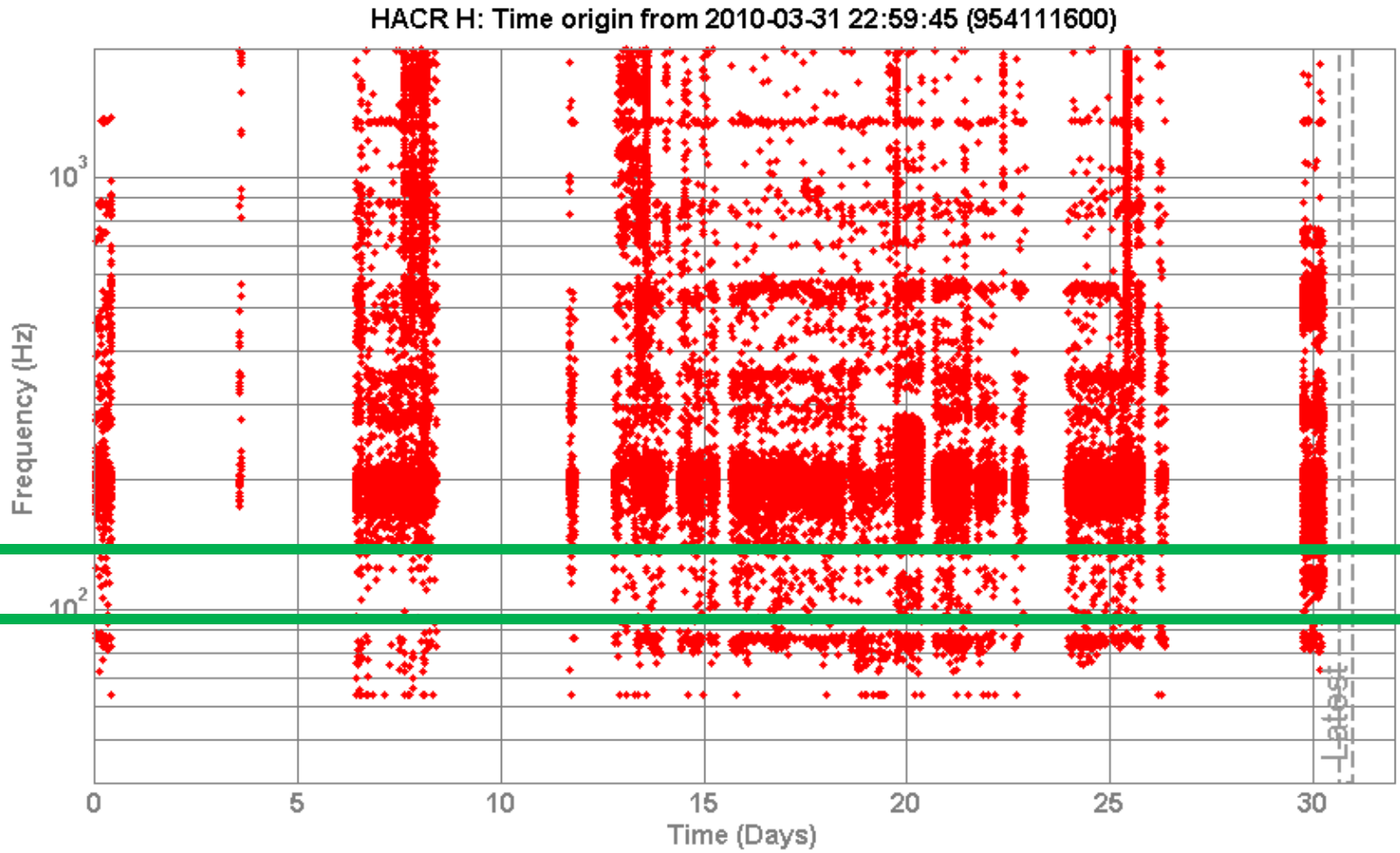
approx. dual state transient behavior

Epic history: March



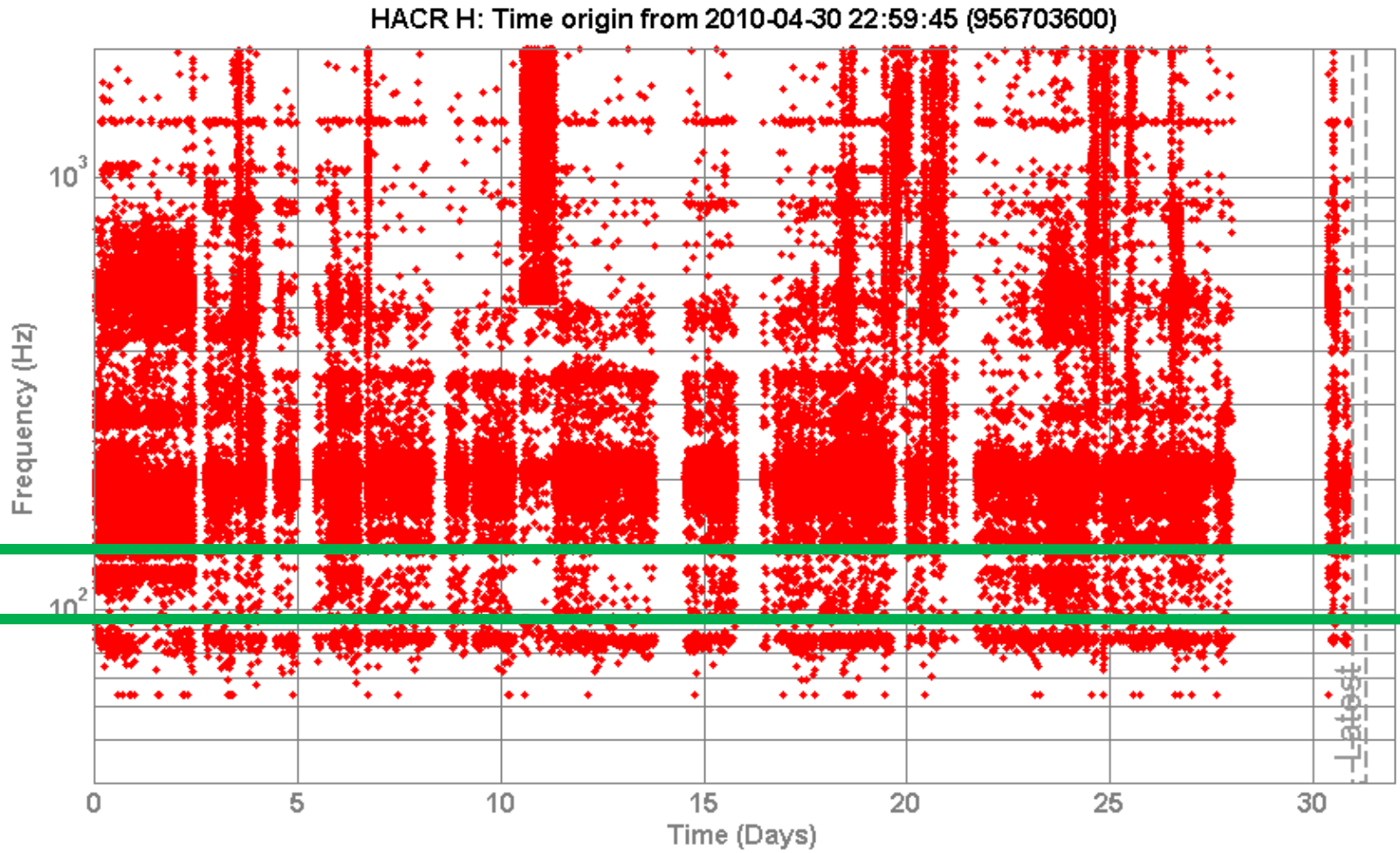
work done by Jake Slutsky

Epic history: April



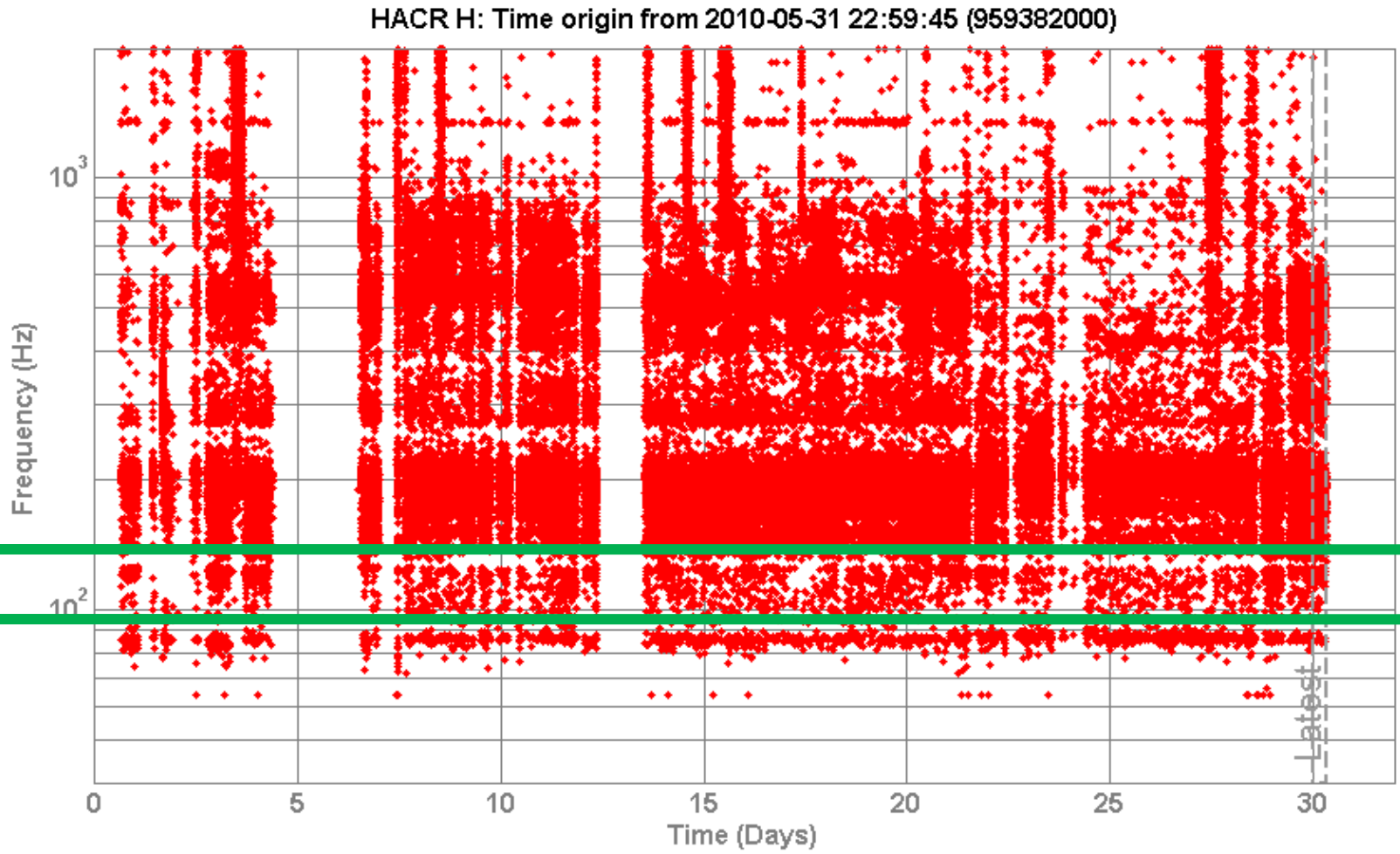
work done by Jake Slutsky

Epic history: May



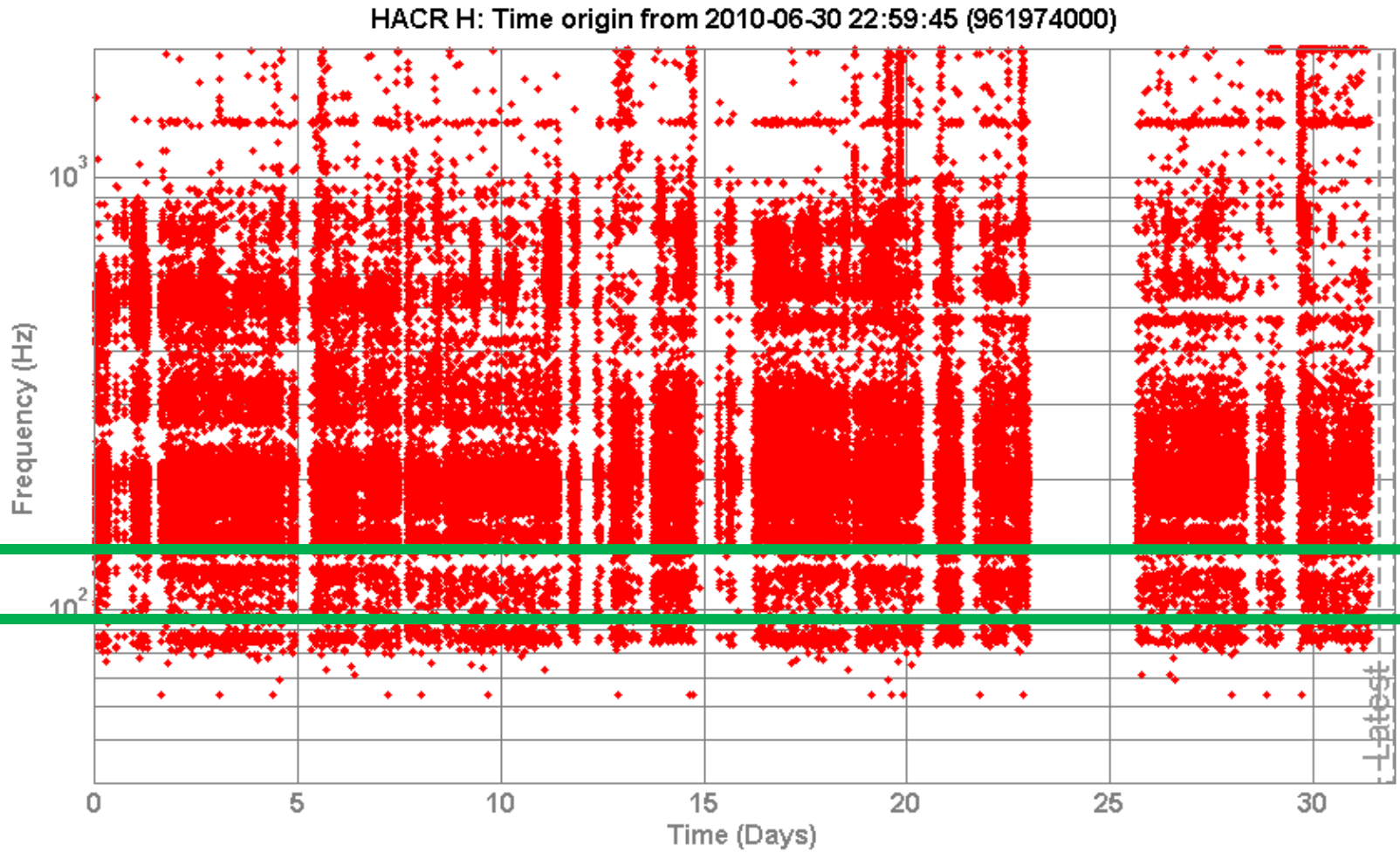
work done by Jake Slutsky

Epic history: June



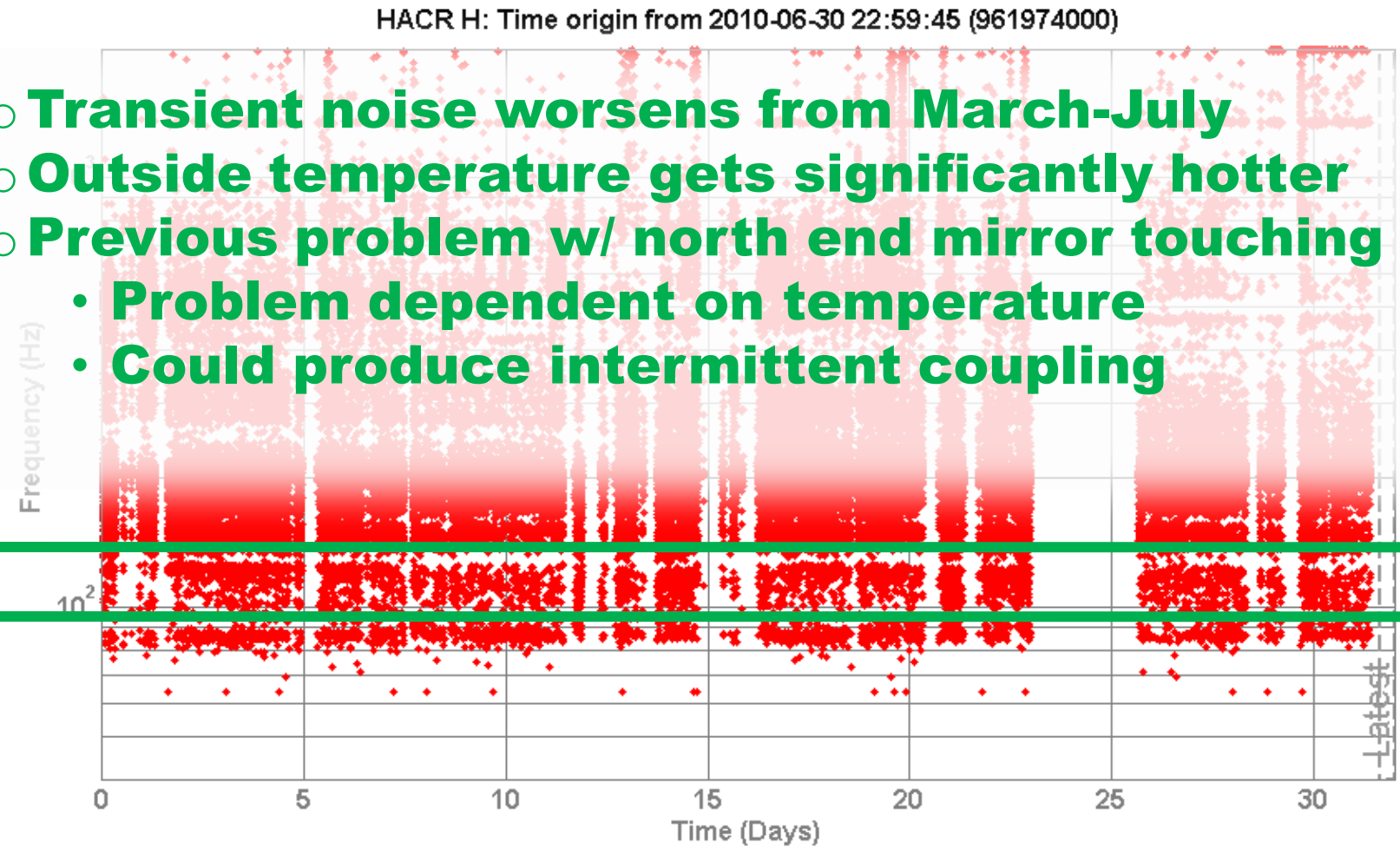
work done by Jake Slutsky

Epic history: July



work done by Jake Slutsky

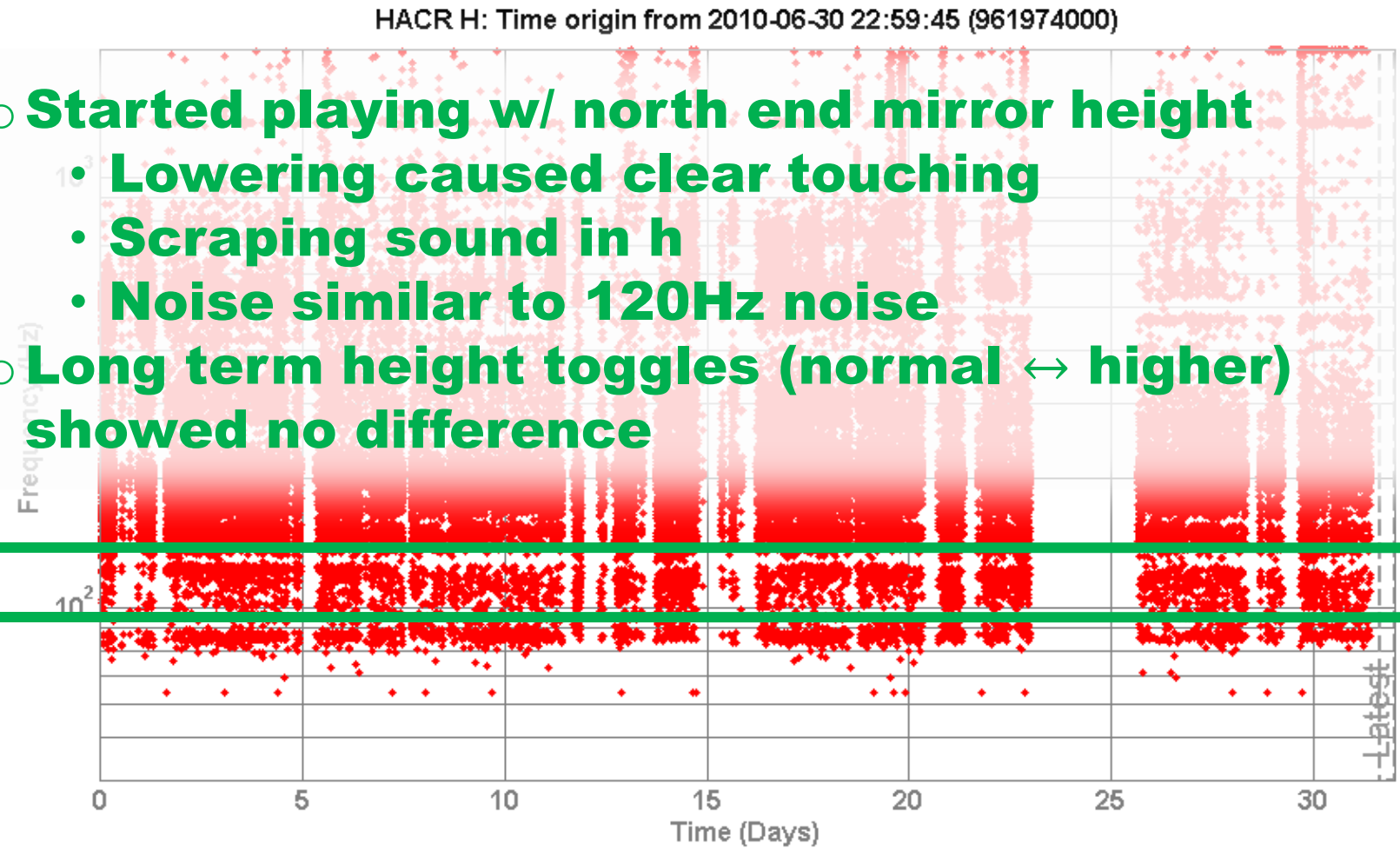
Epic history: July



- Transient noise worsens from March-July
- Outside temperature gets significantly hotter
- Previous problem w/ north end mirror touching
  - Problem dependent on temperature
  - Could produce intermittent coupling

work done by Jake Slutsky

Hanging on like a yo-yo

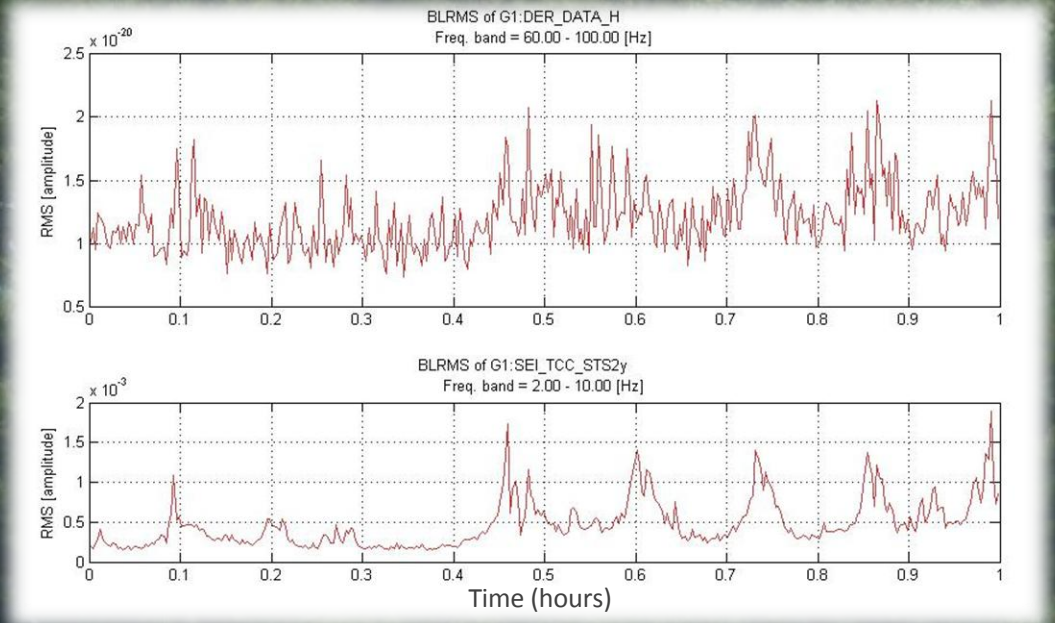


- Started playing w/ north end mirror height
  - Lowering caused clear touching
  - Scraping sound in h
  - Noise similar to 120Hz noise
- Long term height toggles (normal ↔ higher) showed no difference

work done by Jake Slutsky


We love eat!

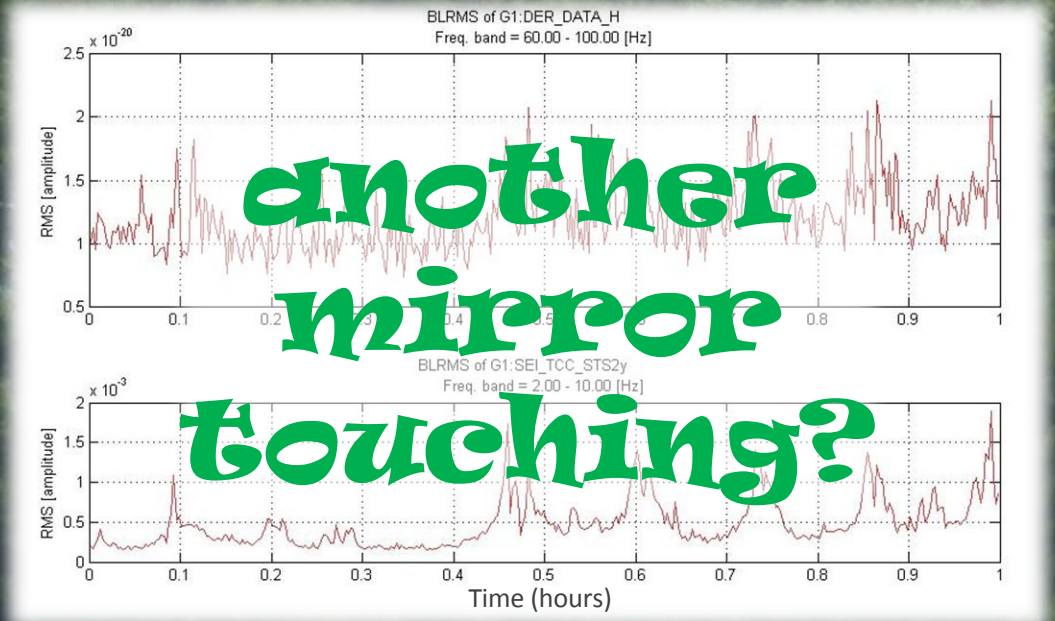
We love eat!



- **Tractor provokes 120Hz noise**
- **BLRMS analysis confirms seismic correlation**
- **h audio similar to north end touching**

work done by Borja Sorazu

We love eat!



another mirror touching?

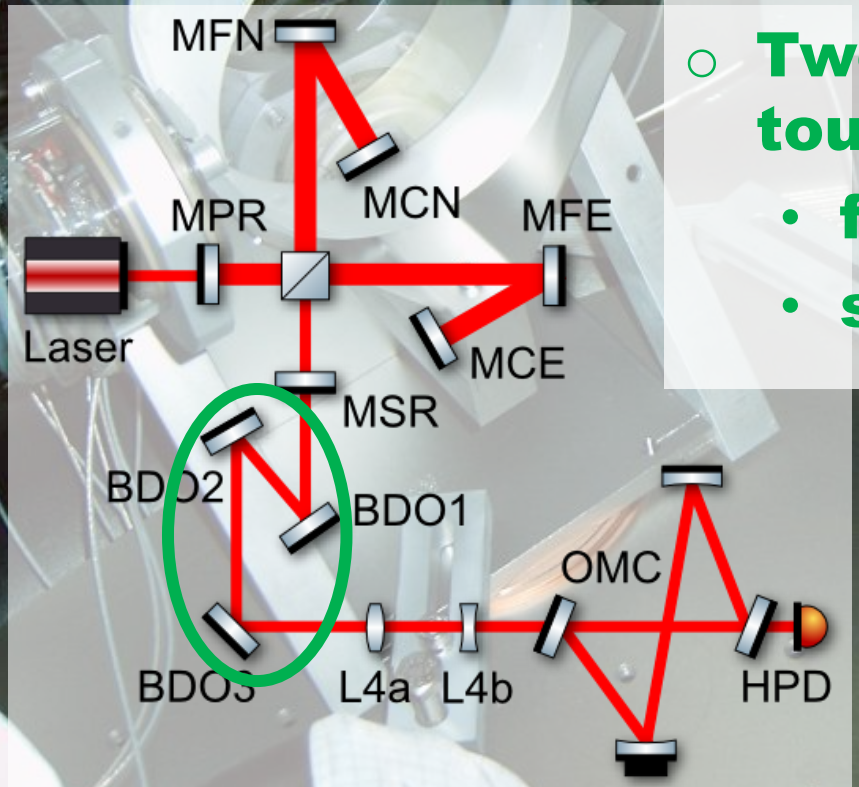
- Tractor provokes 120Hz noise
- BLRMS analysis confirms seismic correlation
- h audio similar to north end touching

work done by Borja Sorazu

The usual suspects

The usual suspects

- OMC new & problem new
- BDO alignment altered
- Two possible touch points
  - flags
  - safety catcher



The Marshall is burnt

- BDO3 touching
- 3 BDO mirrors ⇒ 1 extra DOF
- Re-aligned BDOs to prevent touching
- Bye bye 120Hz noise!

The summer is over and we've learned again that...

The IFO is one interconnected beast!

- OMC auto-alignment uses BDOs (now implemented)
  - Power up found to require OMC auto-alignment
- Squeezing phase lock uses BDOs

The IFO is one interconnected beast!

- OMC auto-alignment uses BDOs (now implemented)
  - Power up found to require OMC auto-alignment
- Squeezing phase lock uses BDOs

- Commissioning walks forward on a quasi-stable IFO
- Transient/stability studies essential to good commissioning

We did some stuff…

We did some stuff:

Summary pages

GEO Summary Report Groups - Mozilla Firefox

File Edit View History Bookmarks Tools Help

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

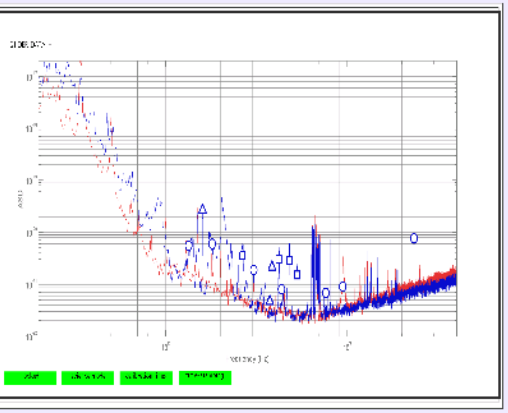
GEO Summary Report Groups

GEO Summary Pages

Current Detector Status (969047946)

Statistic	secs	hours
locked time	8834	2.45
science time	8534	2.37
unlocked time	0	0.00
-	-	-
-	-	-
-	-	-

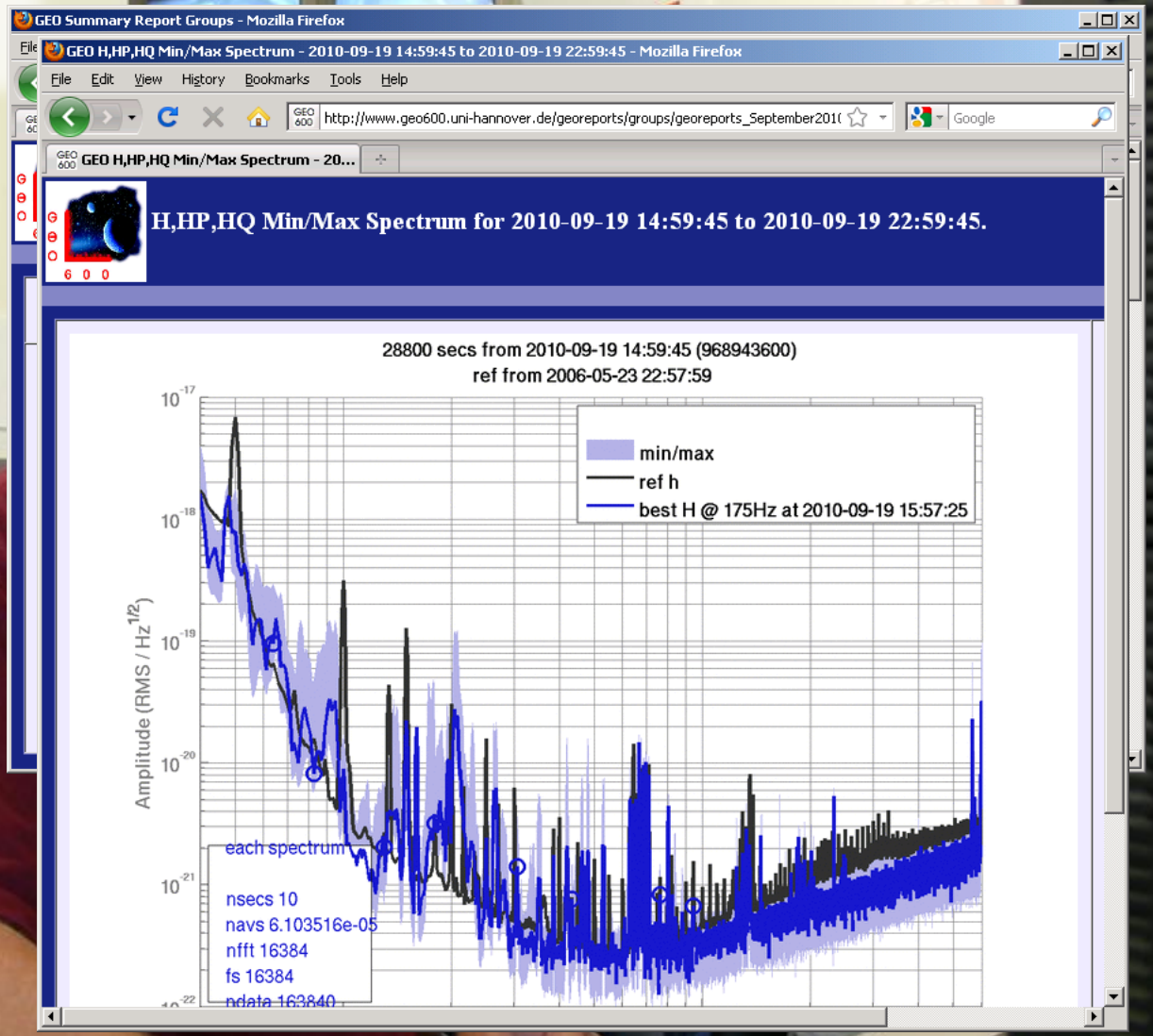
detector locked
hardware maintenance off
software maintenance off
calibration lines on
timestamping ok
calibration ok
-



We did some stuff:

Summary pages

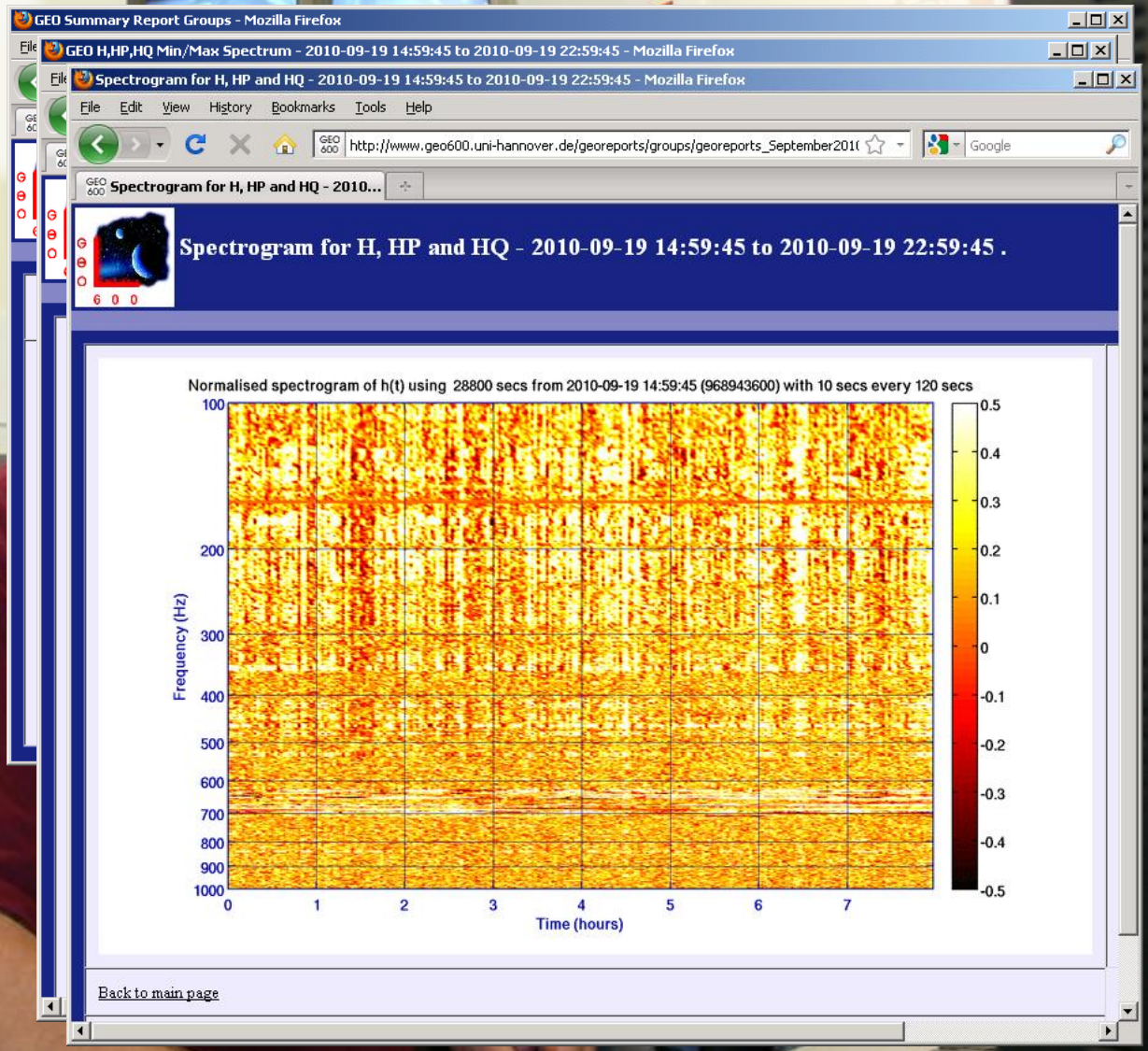
- 8hr spectra



We did some stuff:

Summary pages

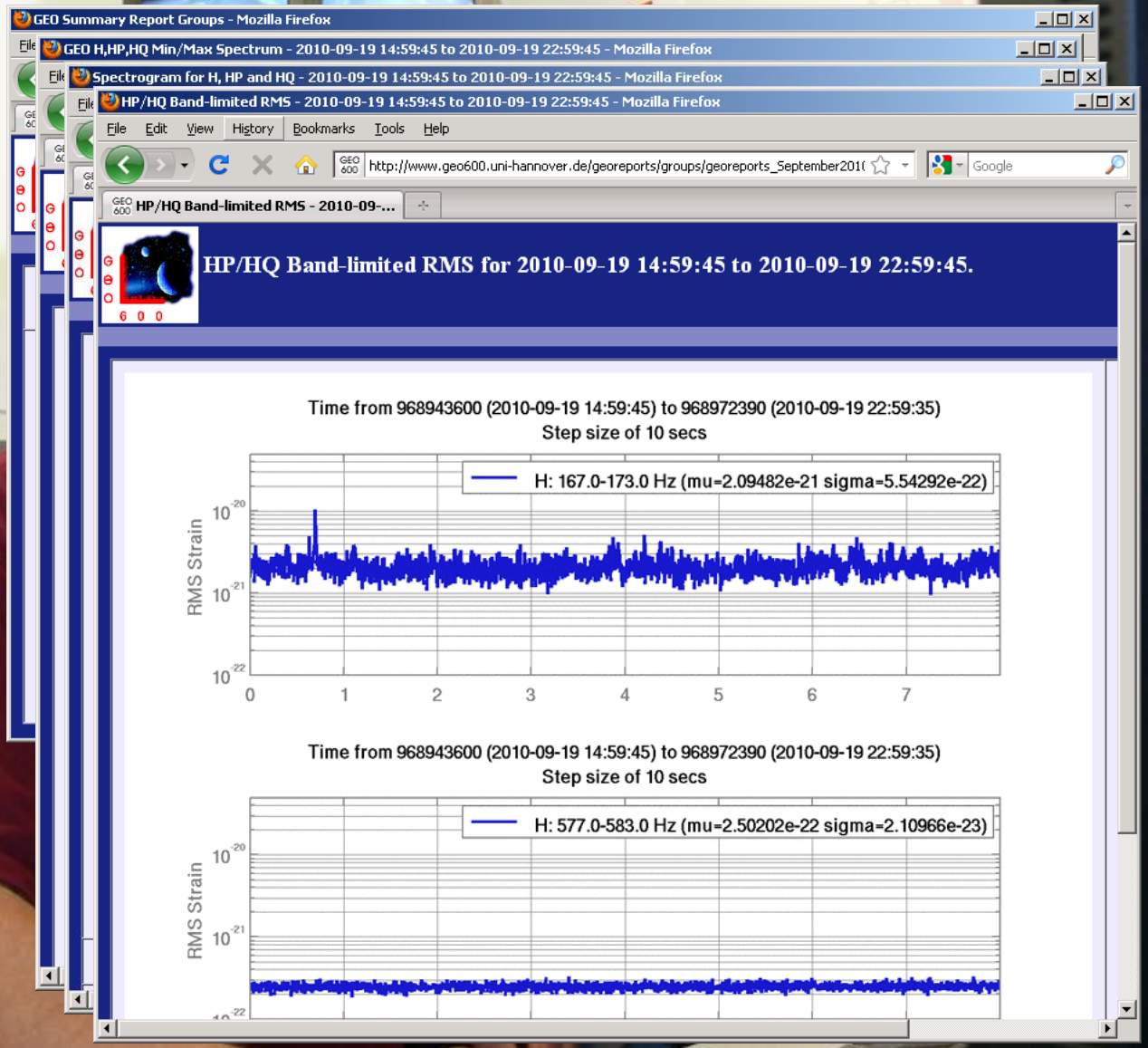
- 8hr spectra
- Spectrogram



We did some stuff:

Summary pages

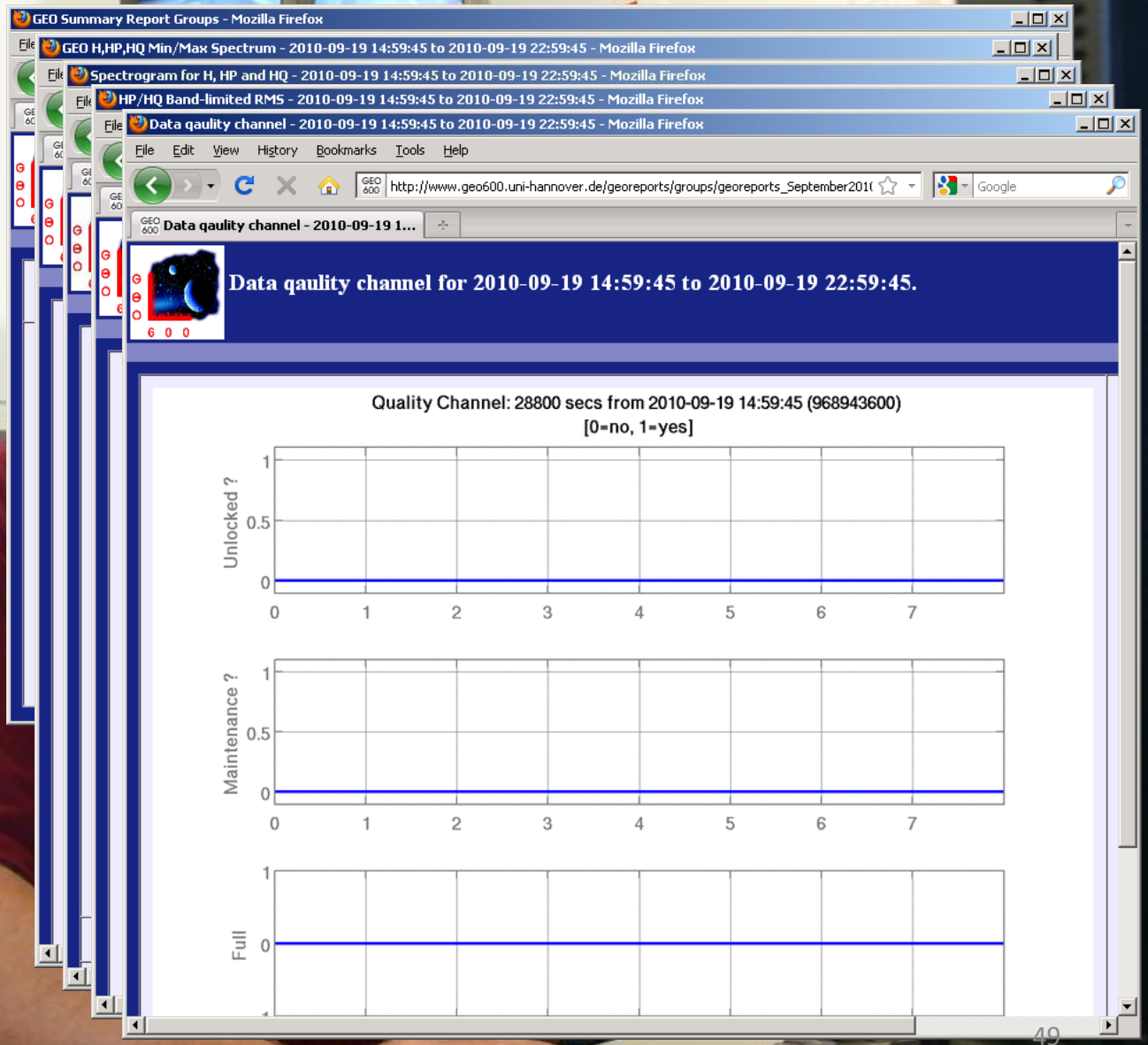
- Shr spectra
- Spectrogram
- BLRMS



We did some stuff:

Summary pages

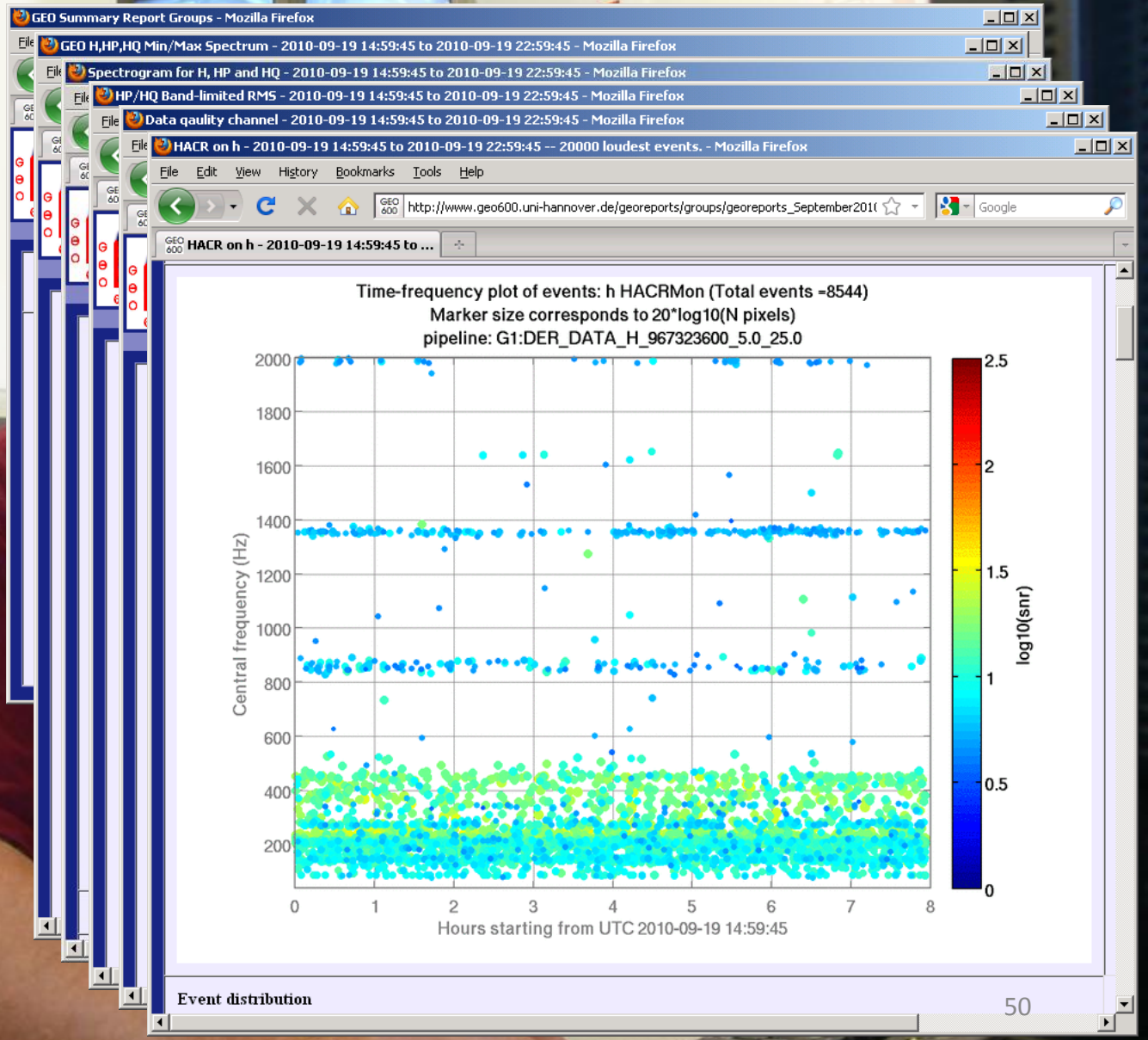
- Shr spectra
- Spectrogram
- BLRMS
- Minimal DQ



We did some stuff:

Summary pages

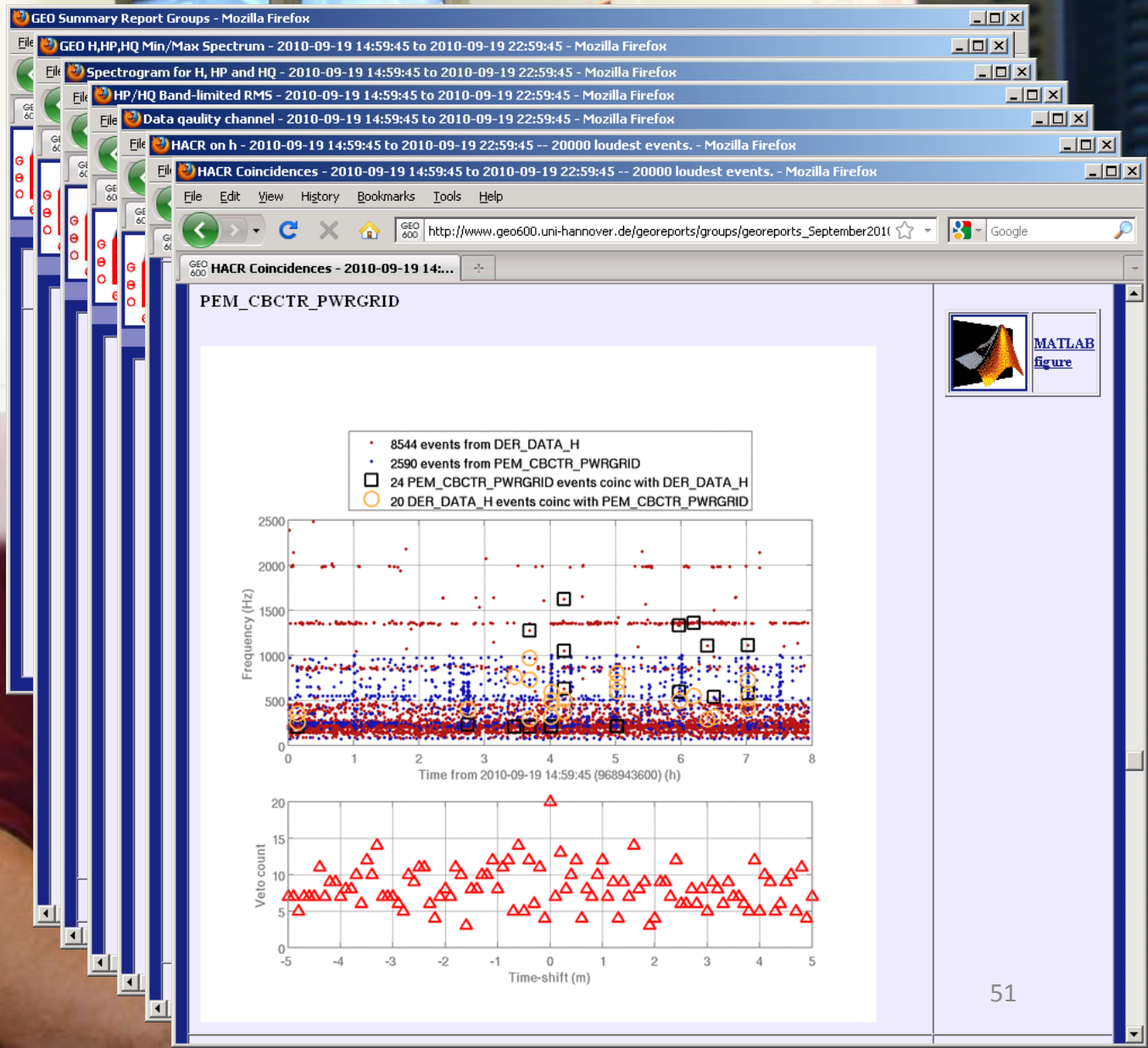
- Shr spectra
- Spectrogram
- BLRMS
- Minimal DQ
- HACR



We did some stuff:

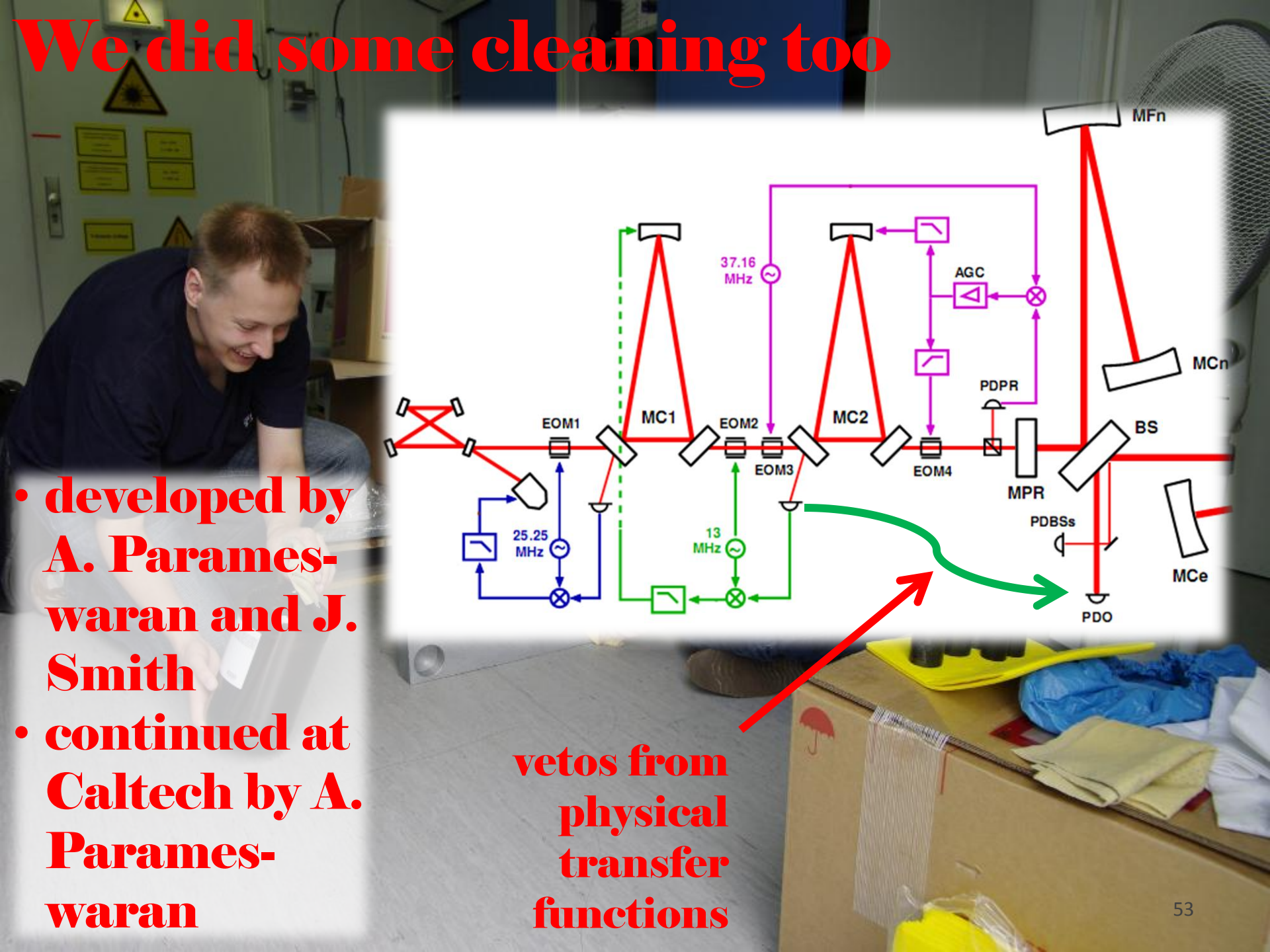
Summary pages

- Shr spectra
- Spectrogram
- BLRMS
- Minimal DQ
- HACR
- HACR coincidences



We did some cleaning too

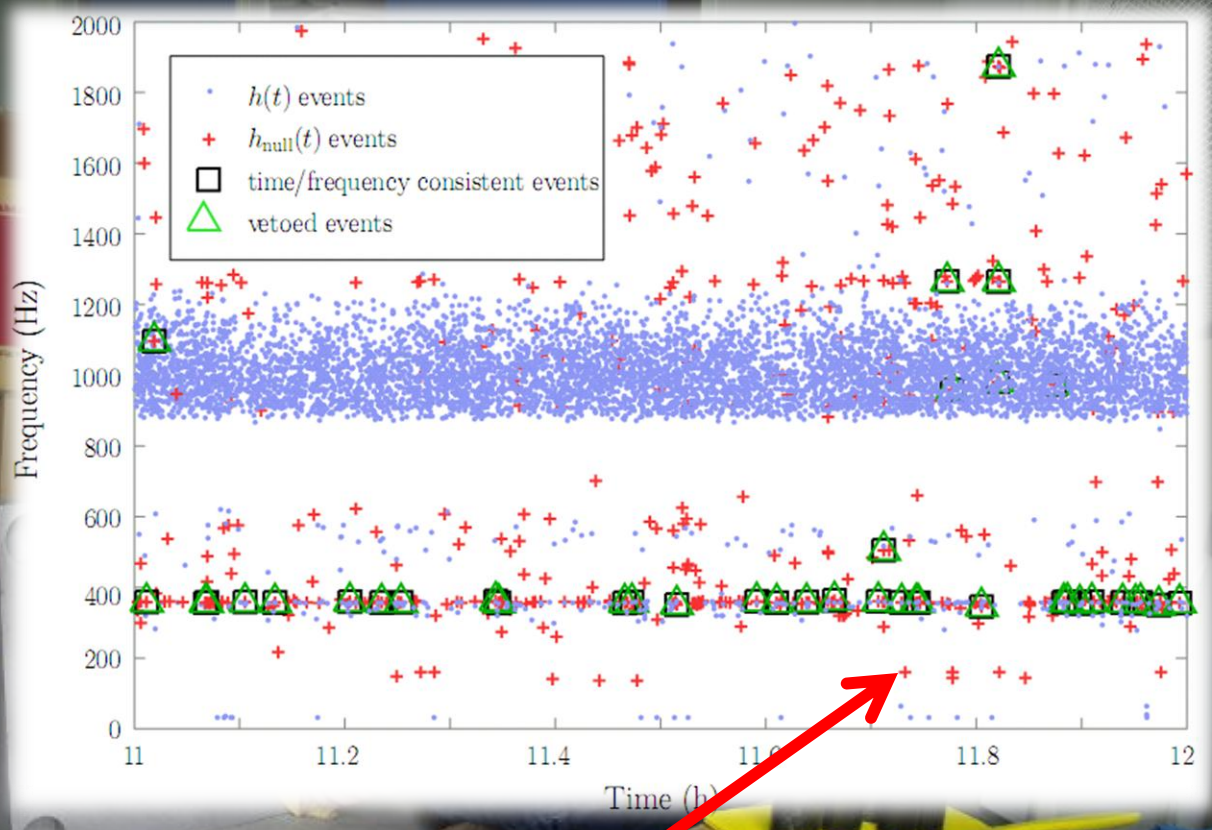
We did some cleaning too



- developed by A. Parames-waran and J. Smith
- continued at Caltech by A. Parames-waran

vetos from physical transfer functions

We did some cleaning too



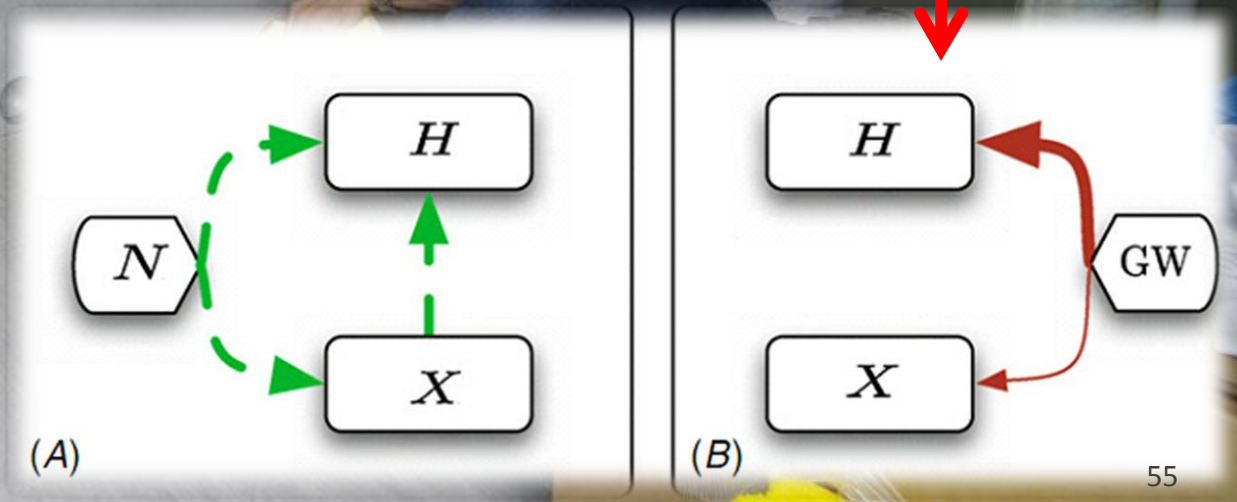
- developed by M. Hewitson
- low false-veto rate
- important for class of events shown

h null-stream glitch events

We did some cleaning too

remove statistical vetos which match known GW coupling

- developed by S. Hild
- for channels w/ possible GW coupling
- decreases false veto rate for statistical vetos

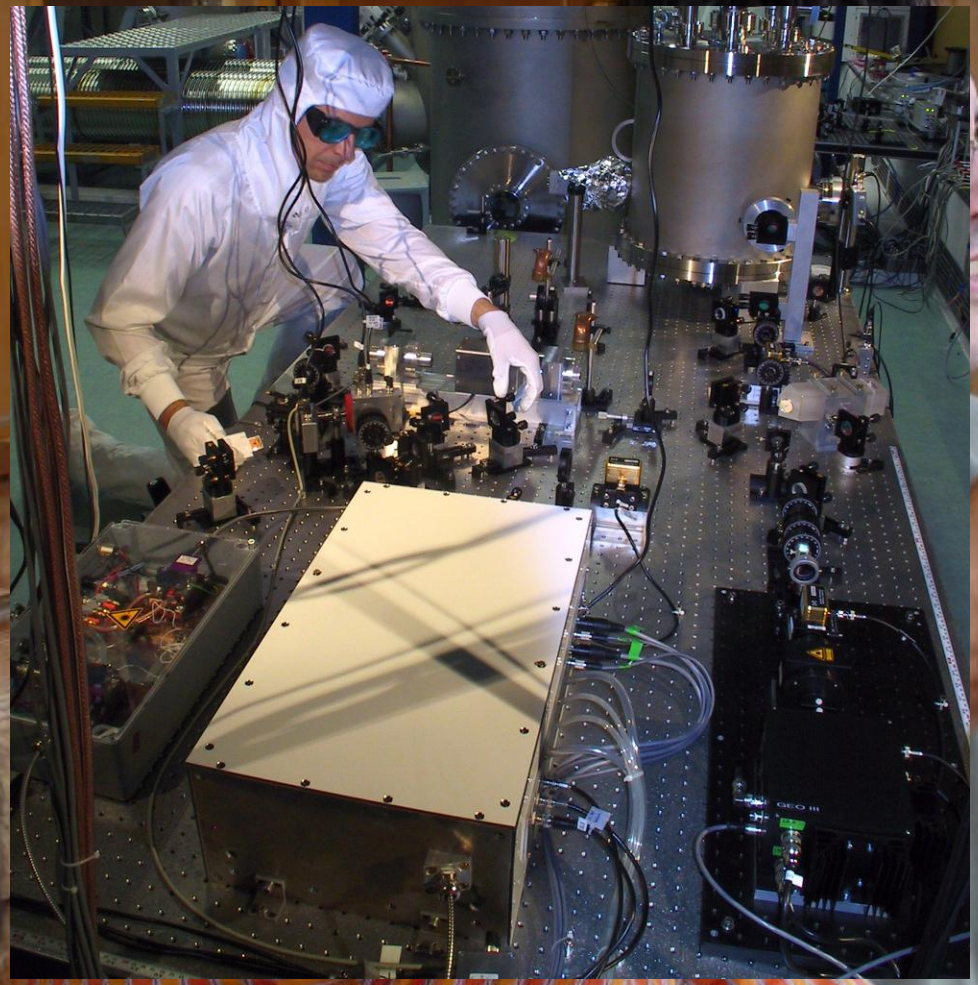


We've got additional strengths (außer GW)

We've got additional strengths (außer GW)

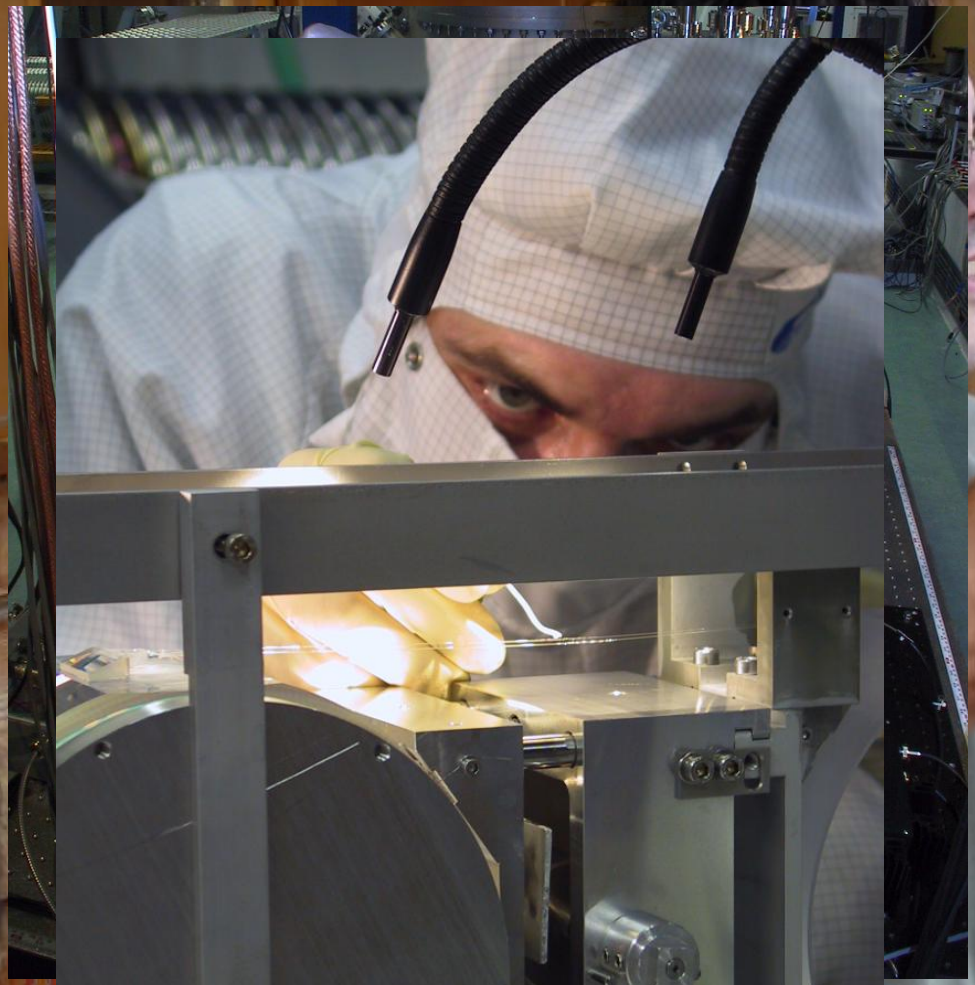
History shows GEO to be a test-bed for advanced techniques

We've got additional strengths (außer GW)



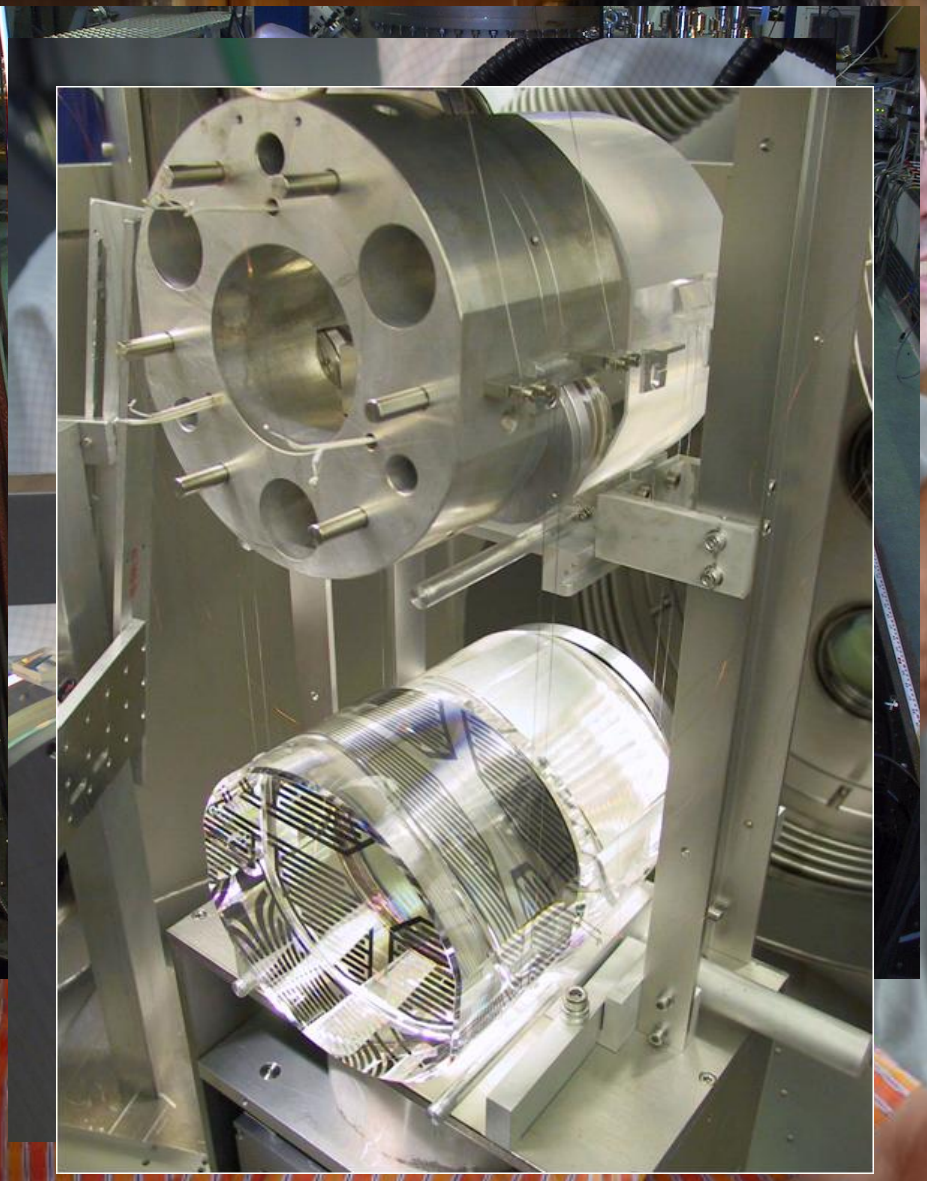
We source lasers!

We've got additional strengths (außer GW)



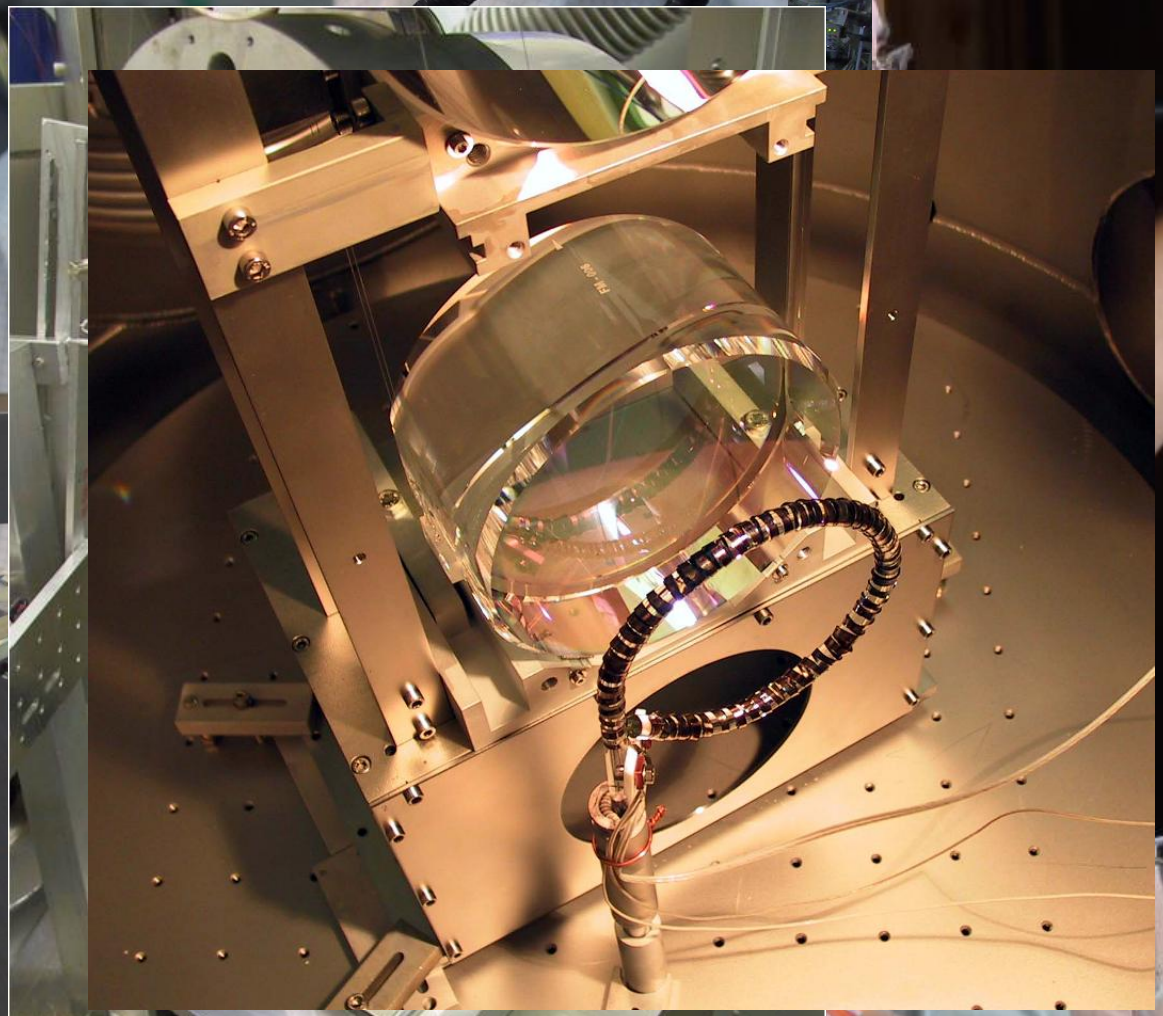
We hang fancy suspensions

We've got additional strengths (außer GW)



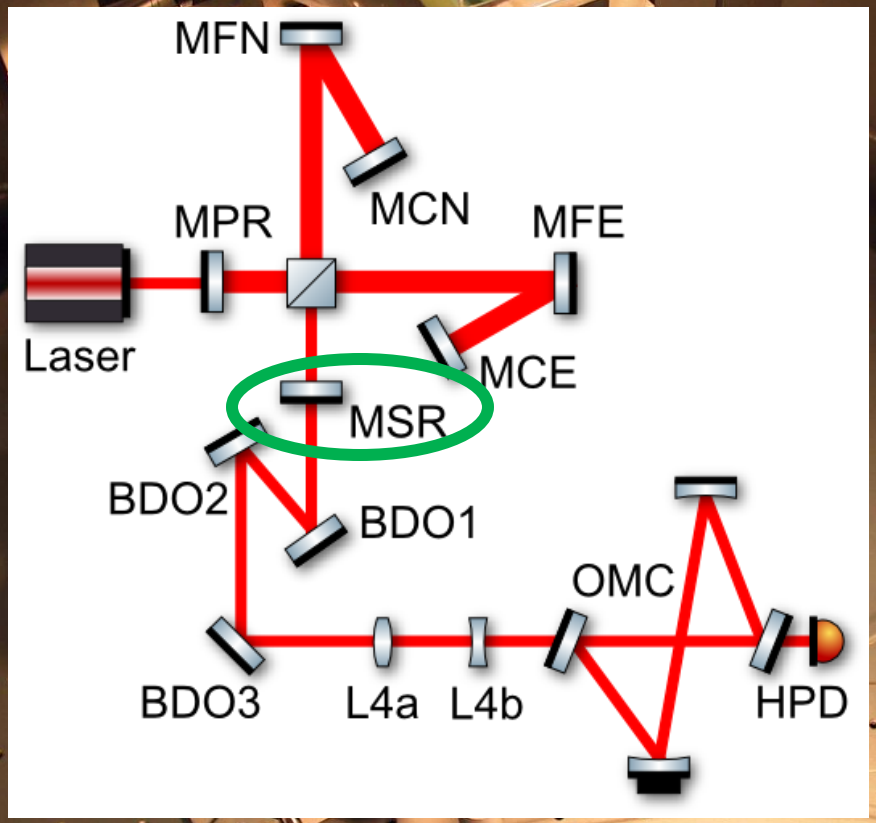
We've got cool actuators!

We've got additional strengths (außer GW)



We thermally compensate

We've got additional strengths (außer GW)



We implement advanced IFO configurations

We've got additional strengths (außer GW)

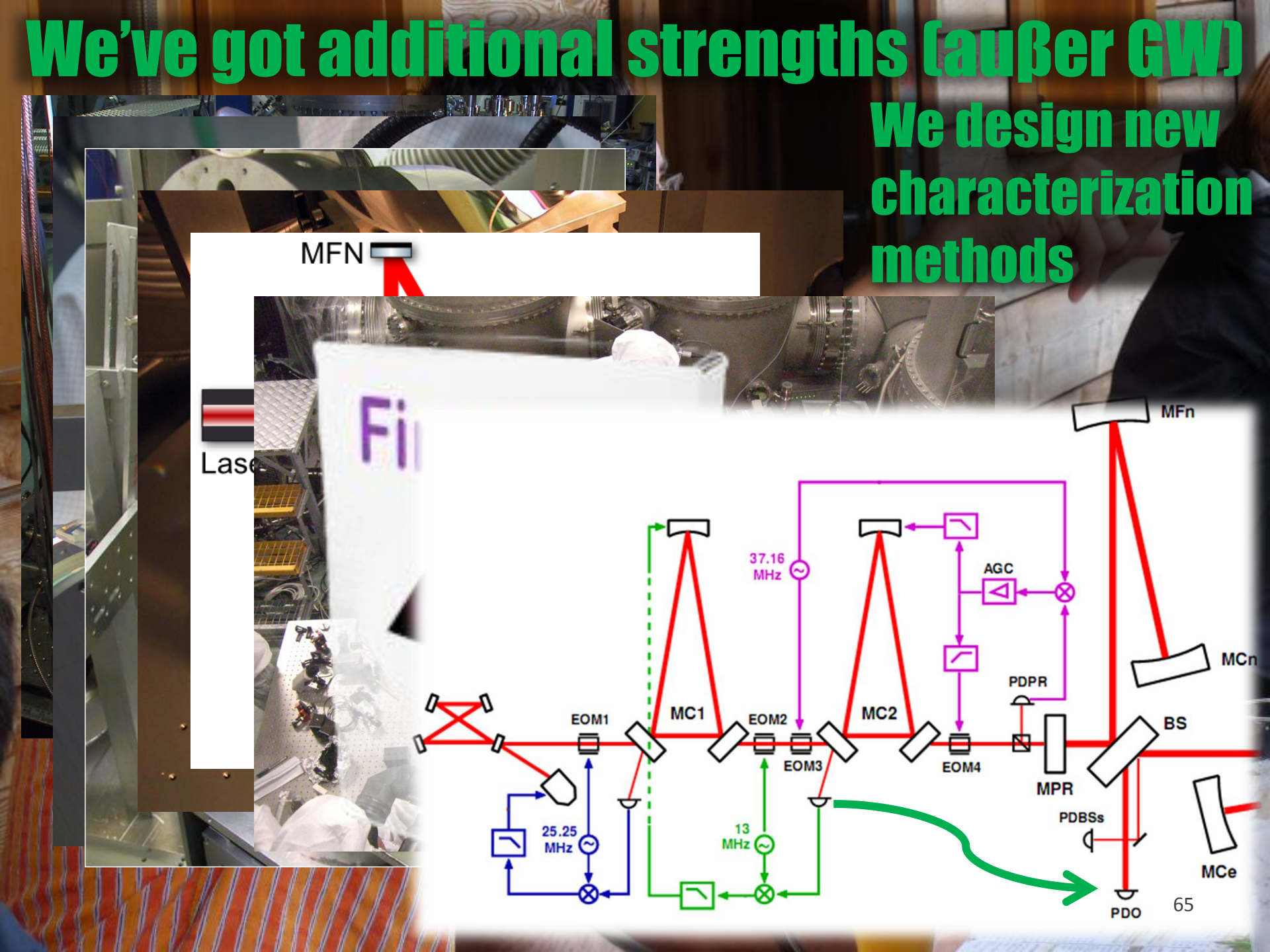
We've got additional strengths (außer GW)

We write neat software

- Finesse
- OptoCad
- WaveProp
- OSCAR
- etc.

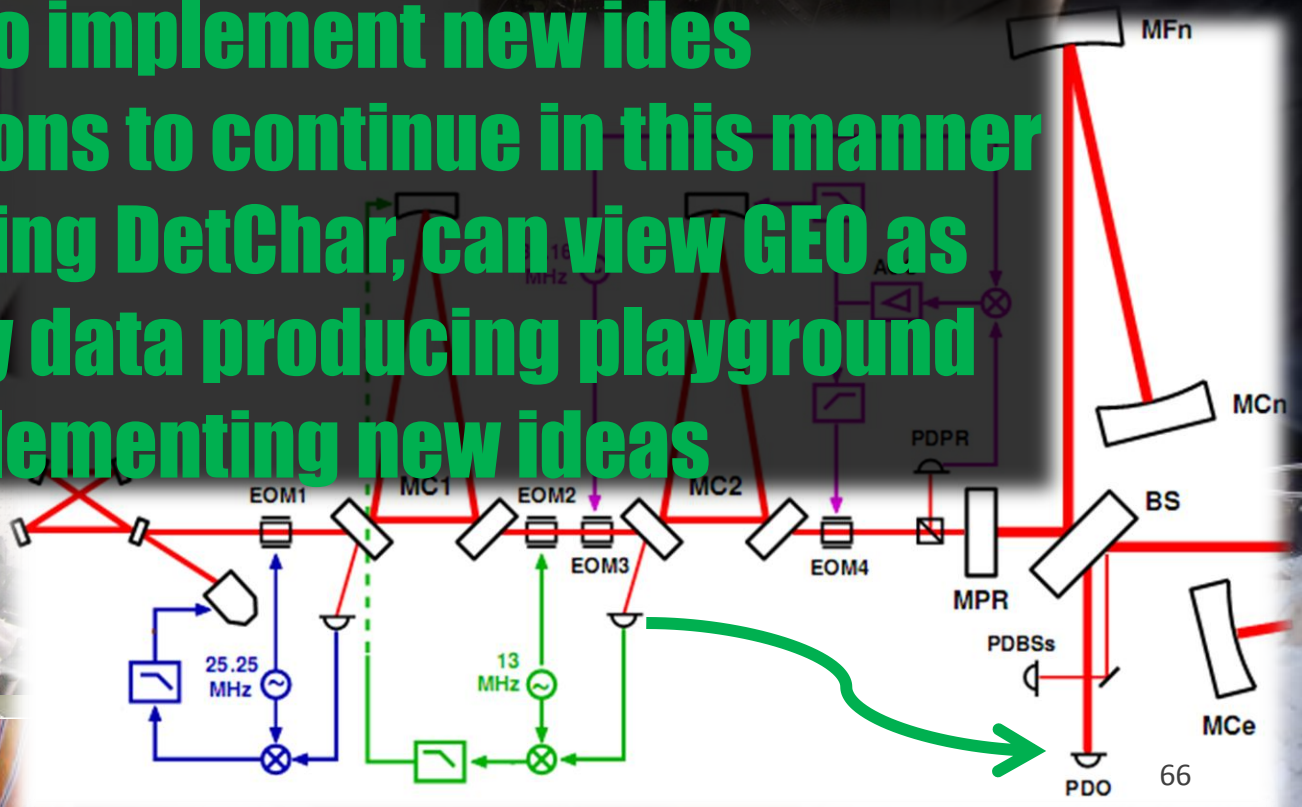
We've got additional strengths (außer GW)

We design new characterization methods



We've got additional strengths (außer GW)

- Results from a great freedom enjoyed in GEO to implement new ides
- Intensions to continue in this manner
- Regarding DetChar, can view GEO as the only data producing playground for implementing new ideas



A transient future

A transient future

Deeper studies of glitch sources for removal/characterization

- Implement more advanced physical transfer function vetos
- Integrate into summary pages for commissioner feedback
- Install new sensors to hunt down glitches
- Build state-space models to understand couplings better (already started by A. Lombardi)

A transient future

- Characterize and prevent squeezing glitches
- New FOMs which include glitch rate to force commissioners to notice
- More detailed data quality info

It’s not an easy job!

It's not an easy job!

- Not much existing infrastructure
- Working on building up
- We invite YOU!

We like each other!

We like each other!

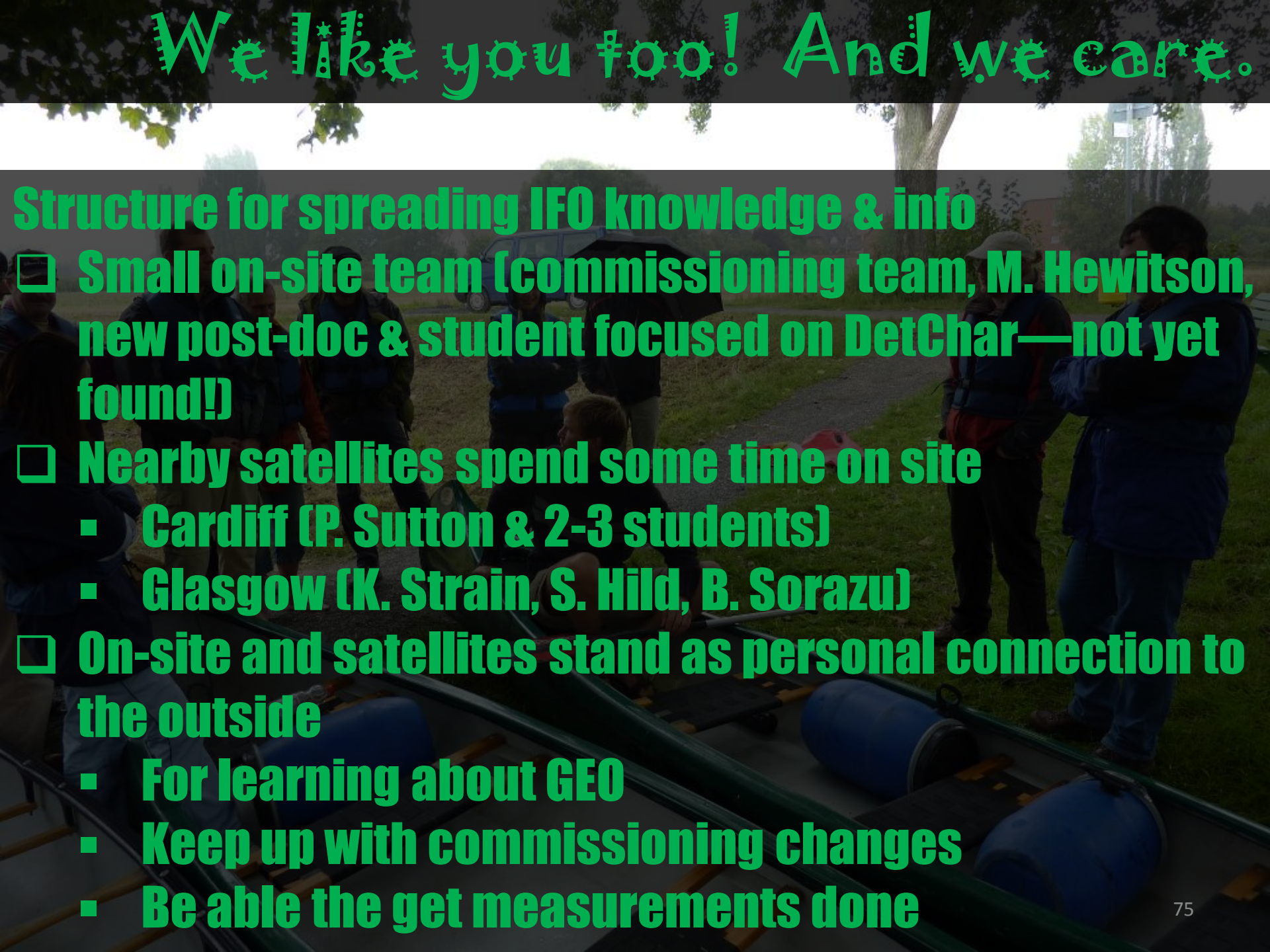
Problems to be tackled are complex and interconnected

⇓

Close personal connections are high priority in IFO (commissioning & DetChar) work

We like you too! And we care.

We like you too! And we care.



Structure for spreading IFO knowledge & info

- Small on-site team (commissioning team, M. Hewitson, new post-doc & student focused on DetChar—not yet found!)
- Nearby satellites spend some time on site
  - Cardiff (P. Sutton & 2-3 students)
  - Glasgow (K. Strain, S. Hild, B. Sorazu)
- On-site and satellites stand as personal connection to the outside
  - For learning about GEO
  - Keep up with commissioning changes
  - Be able the get measurements done

March w/ hope
into the future...

- Making sure to catch everything during GEO glory requires heavy DetChar
- Level of DetChar huge! ⇒ We can use help
- Those interested in helping & learning about GEO will meet a willing group to educate and update for smooth operation
- Already have a wiki:

  https://www.lsc-group.phys.uwm.edu/twiki/bin/view/GEODC/

  and mailing list:

  contact P. Sutton or M. Hewitson

March w/ hope into the future…


GEO can be a shining beacon throughout the dark ages