



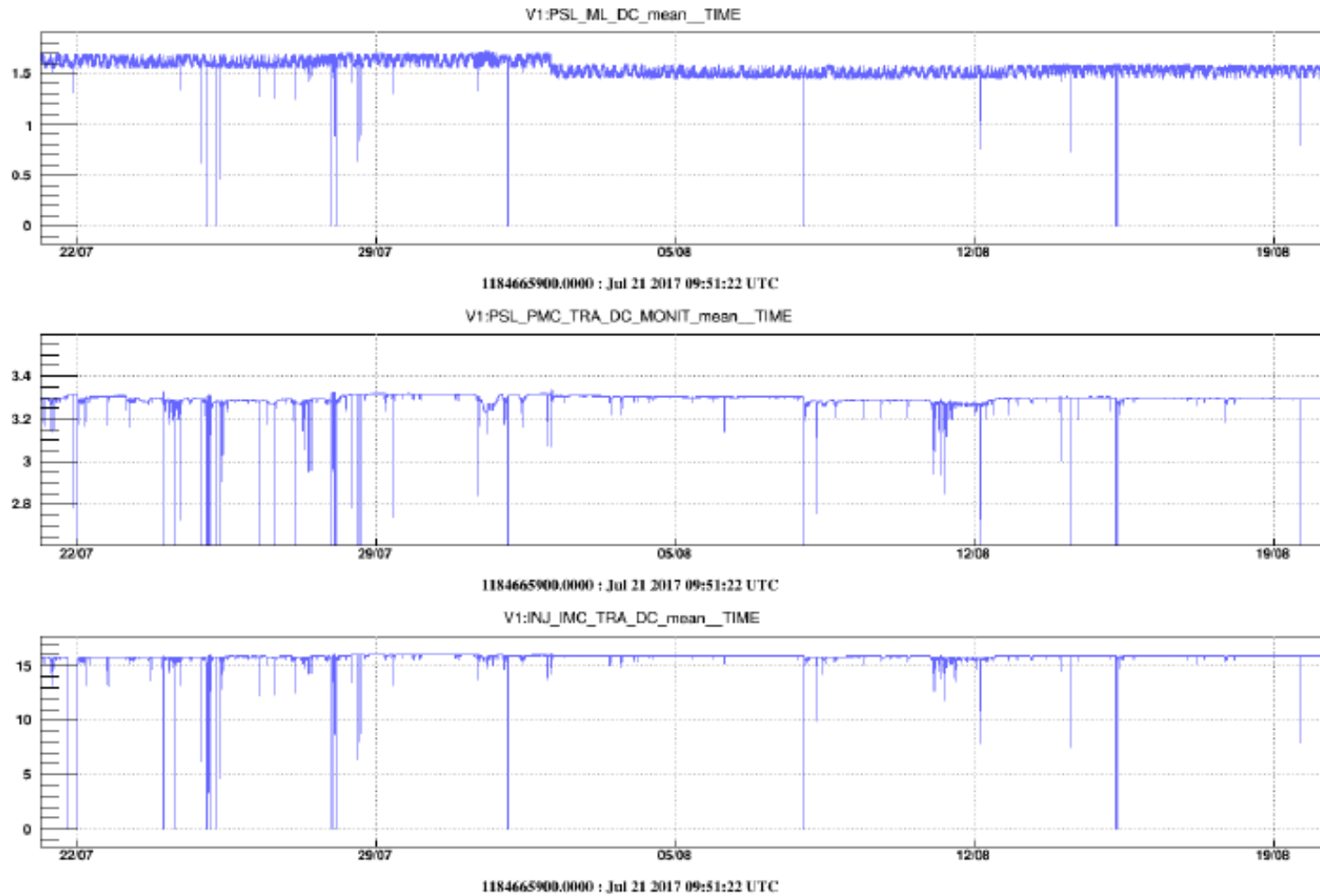
Laser & Injection system (ISYS) status

Virgo week November 2017

E. Genin on behalf of the ISYS group
European Gravitational Observatory



- ❑ Activities around INJ and PSL (ISYS) since Last Virgo week (July 2017)
 - ❑ O2 science run
 - ❑ Post O2 activities
- ❑ Conclusion



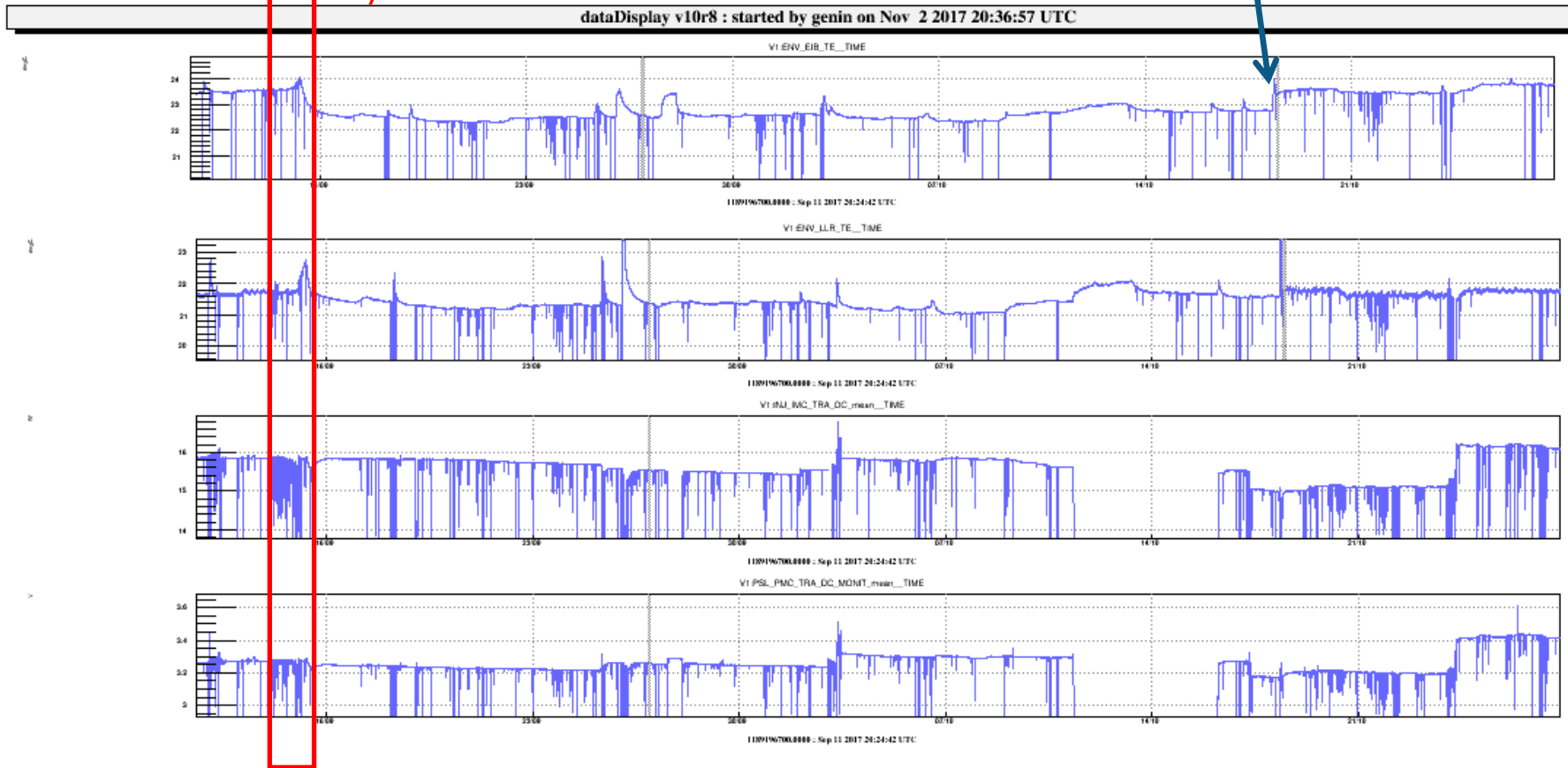
IMC and PMC locked 99.7% of the time

- ❑ The system worked quite well during the run.
- ❑ At the beginning of the run we had again a short period of fast unlocks which seemed to be related to the slave laser pumping diodes (see entry #39005) → reducing the pumping current on both diodes by 0.2A the fast unlocks went away.
- ❑ The IMC and PMC cavities had been locked for more than 99.7% of the time during the run.

INJ clean room air conditioning system: Major failure

INJ air conditioning
system failure

The AC was back
on



INJ clean room air conditioning system: Major failure

- ❑ Switched off for 4 weeks starting from September 15
- ❑ We kept opened the doors separating the clean rooms from the laser lab to keep the temperature in the laser lab constant.
- ❑ We suffered a bit of misalignment of the PMC cavity and loss of PMC output power.

→ very worrying situation.



INJ clean room air conditioning system: Status

- ❑ The air ducts outside of the laser lab have been replaced.
→ the air conditioning is working again. We are back to standard conditions.

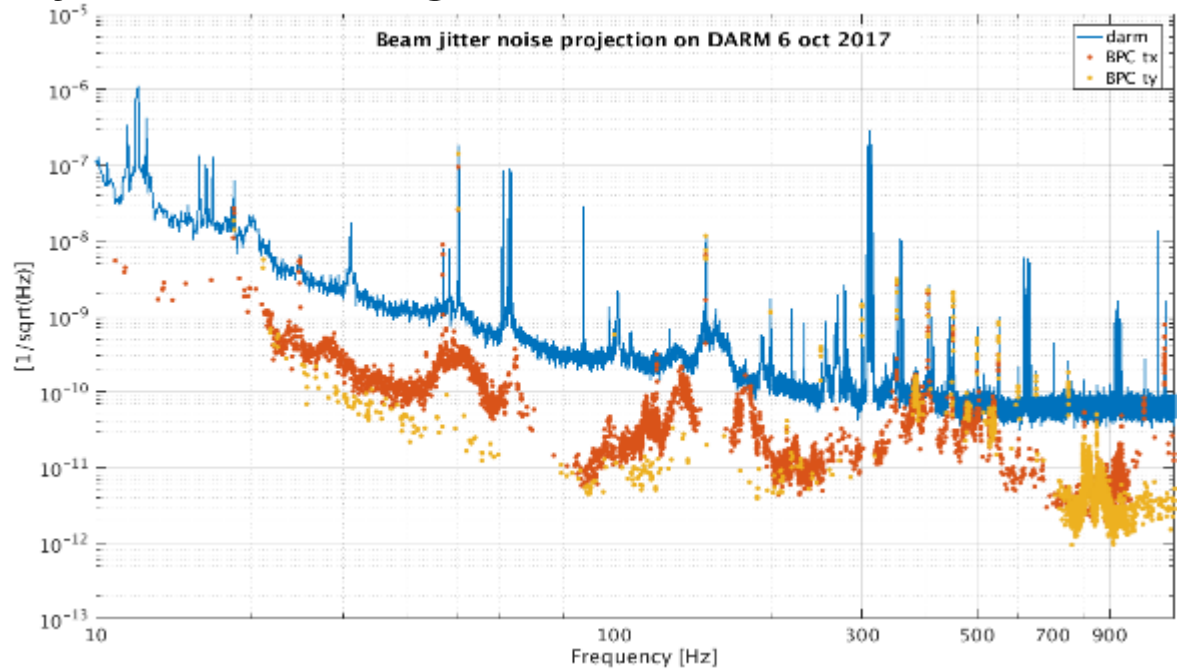
- ❑ Inspection has been made in the atrium
→ the air ducts will have to be replaced there too.

- ❑ Inspection has been made in the laser lab sas (same ducts are used in the laser lab)
→ the air ducts are ok so we can expect that the ducts are also ok the laser room and in the SIB2 area.

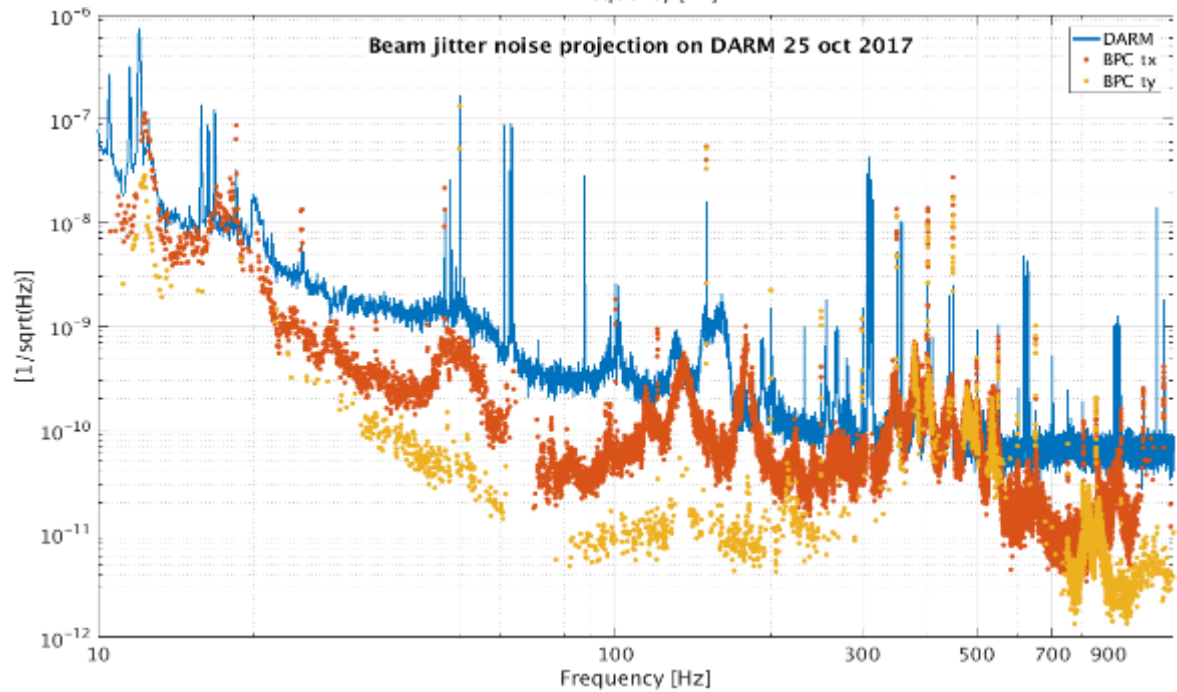
Beam jitter coupling into DARM

It depends on the
ITF working point

6 Oct: 25 Mpc



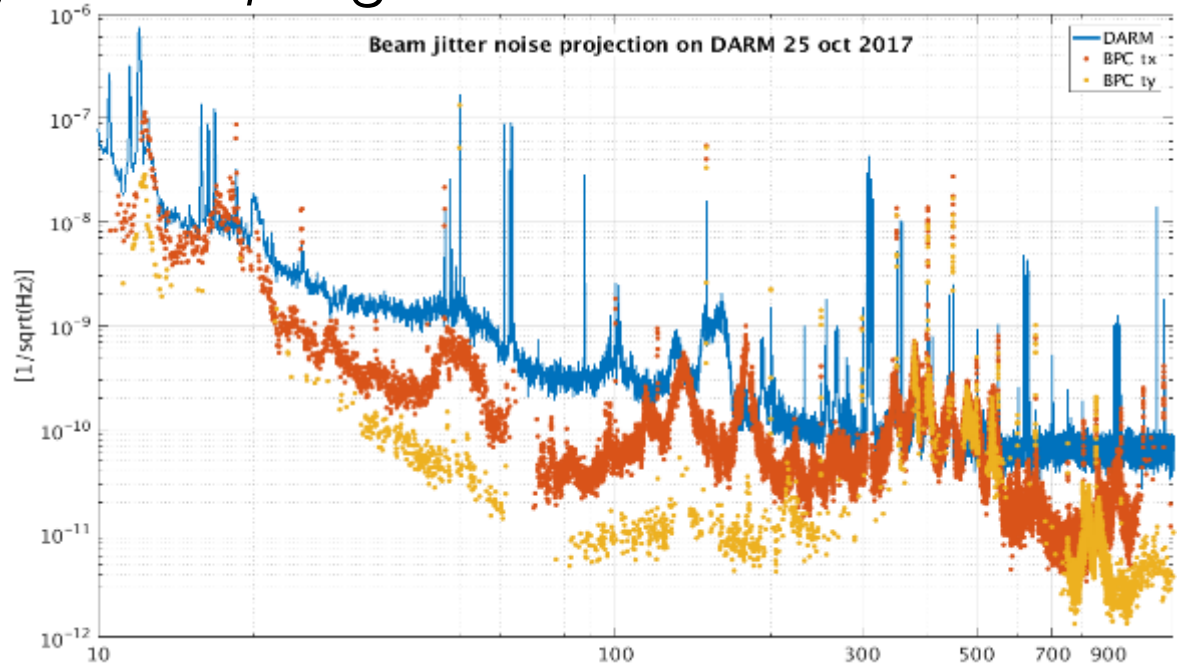
25 Oct: 20 Mpc



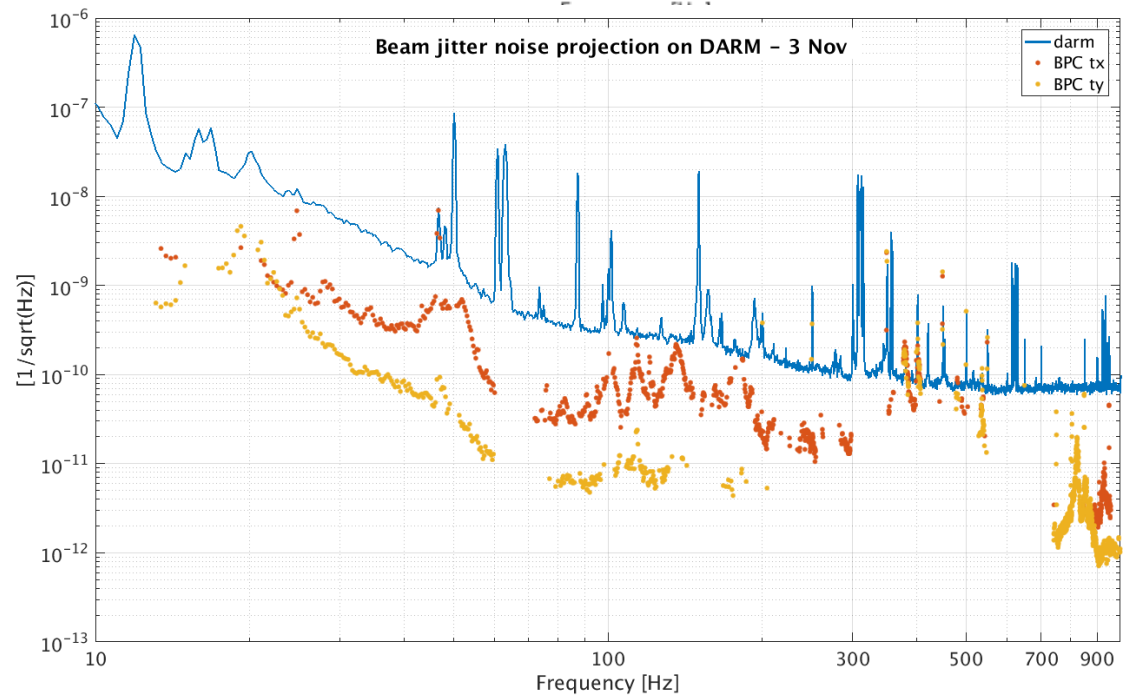
Beam jitter coupling into DARM

It depends on the
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25 Oct



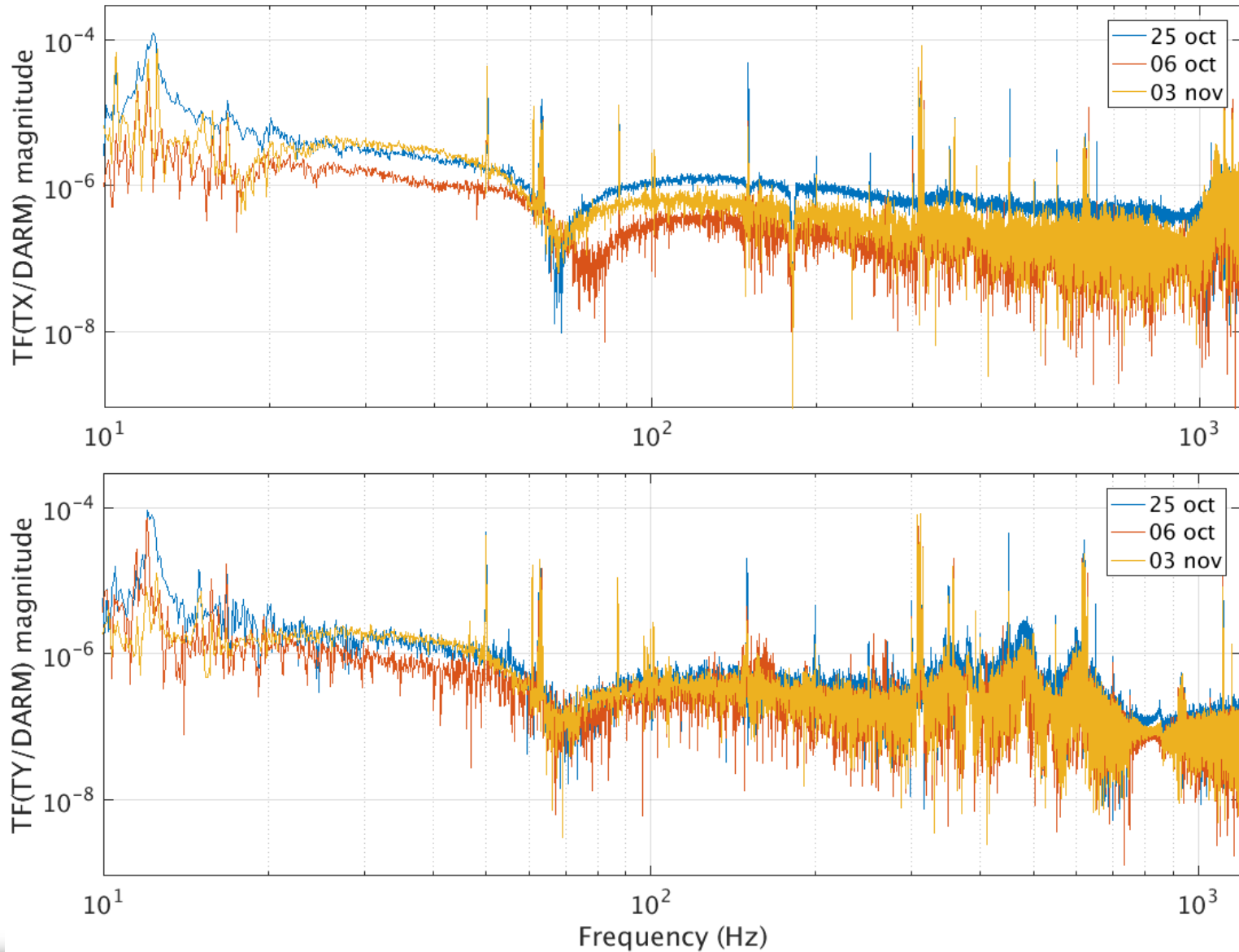
3 Nov



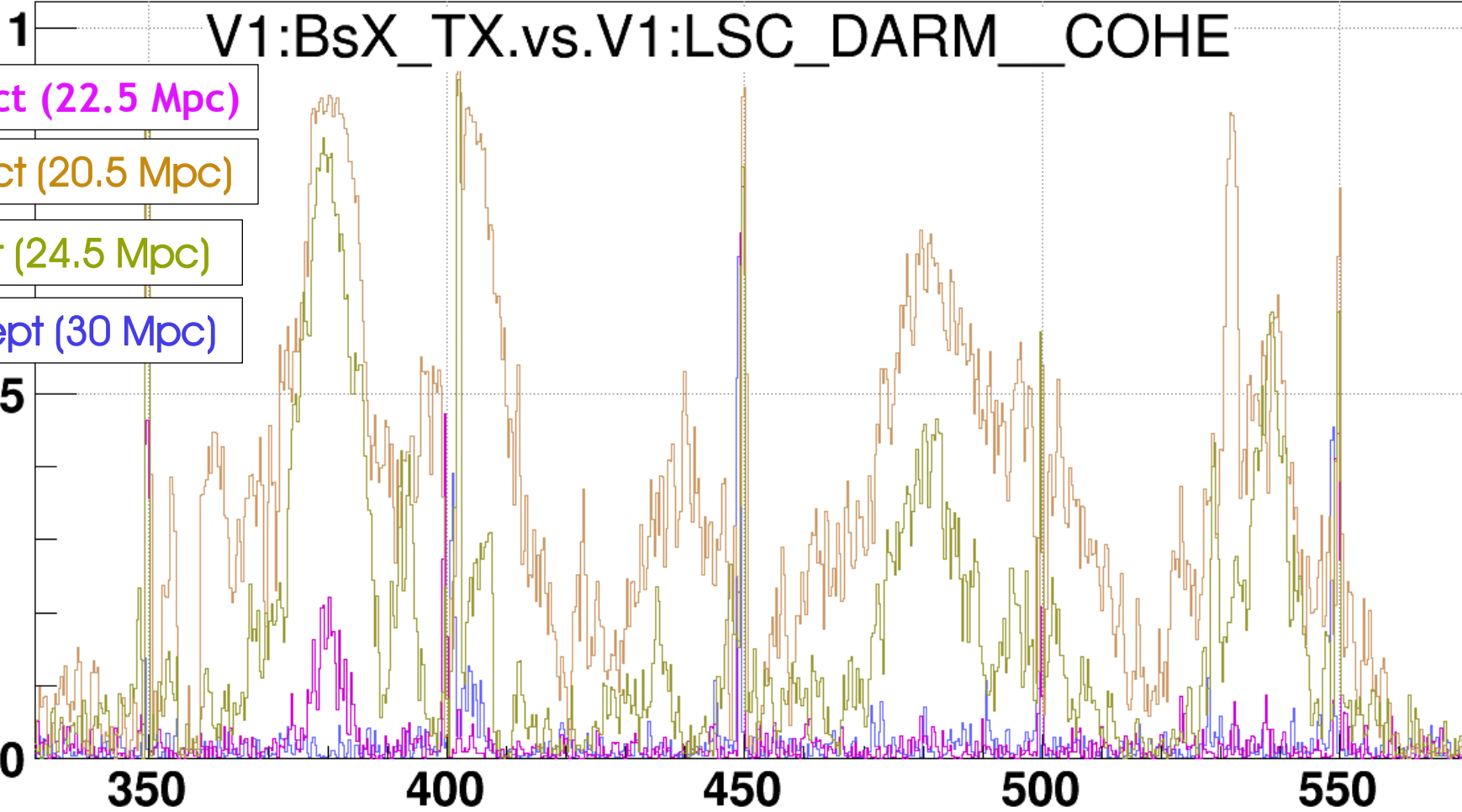
Beam jitter coupling into DARM



The TF between TX and DARM slightly changed

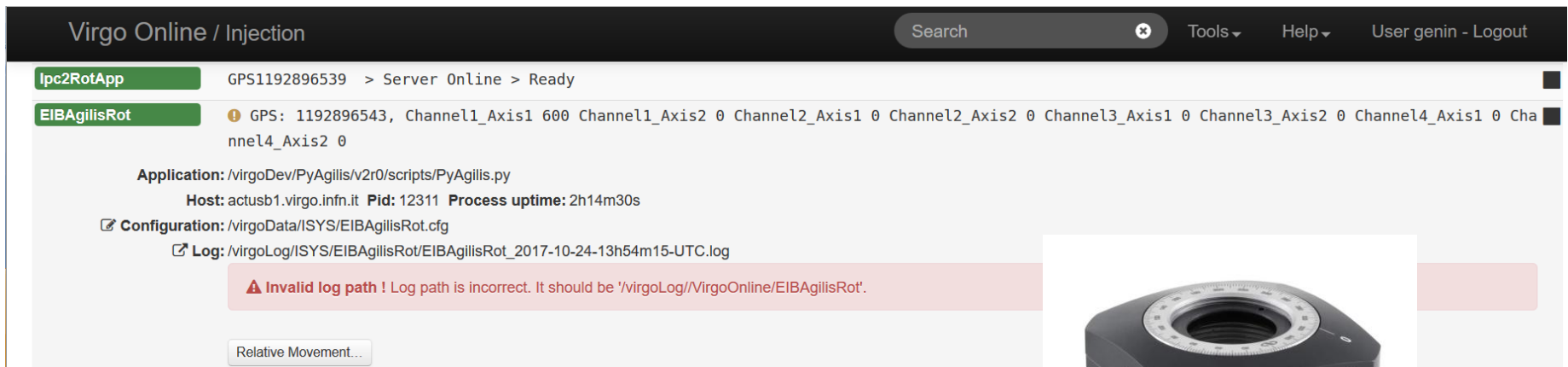


Beam jitter coupling into DARM



Almost no coherence when the sensitivity is better → better working point of the ITF more immune to common noise. We are not yet back to standard working conditions.

- ❑ We have replaced the EIB IPC 1 rotator from Micos by a Newport Agilis one (logbook entry [#39653](#)).
- ❑ We have also installed the new driver and it is now available online thanks to F. Carbognani (see entry [#39804](#)).



Virgo Online / Injection

Search [x] Tools ▾ Help ▾ User genin - Logout

ipc2RotApp GPS1192896539 > Server OnLine > Ready


EIBAgilisRot ⚠ GPS: 1192896543, Channel1_Axis1 600 Channel1_Axis2 0 Channel2_Axis1 0 Channel2_Axis2 0 Channel3_Axis1 0 Channel3_Axis2 0 Channel4_Axis1 0 Channel4_Axis2 0

Application: /virgoDev/PyAgilis/v2r0/scripts/PyAgilis.py
Host: actusb1.virgo.infn.it **Pid:** 12311 **Process uptime:** 2h14m30s

📄 **Configuration:** /virgoData/ISYS/EIBAgilisRot.cfg
🔗 **Log:** /virgoLog/ISYS/EIBAgilisRot/EIBAgilisRot_2017-10-24-13h54m15-UTC.log

⚠ Invalid log path ! Log path is incorrect. It should be '/virgoLog/VirgoOnline/EIBAgilisRot'.

Relative Movement...

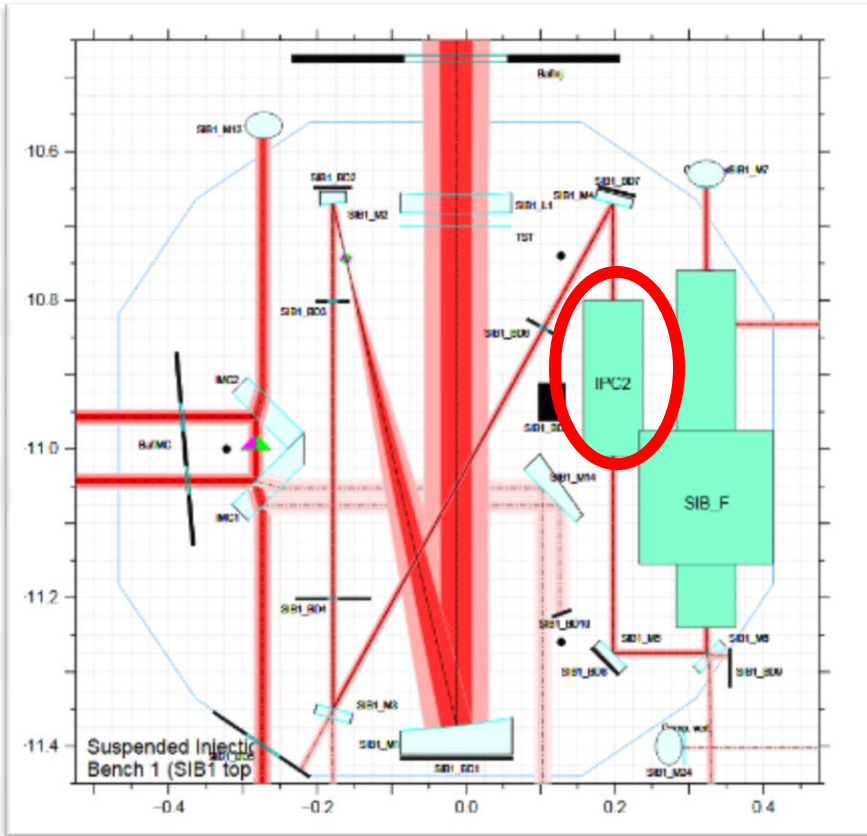


→ will be easy to change the ITF input power.

Next steps: commissioning and upgrades

- ❑ Next weeks are dedicated to TCS commissioning
→ we will raise the laser power up.
- ❑ A list of tasks have been provided to the Commissioning and Detector coordinators.

# task	Sub system	Earliest start	Duration	Before / after MS upgrade	Reference person	Commissioning action	Expected benefit	Needed preparations	Needed ITF configuration
1	ISC/INJ/DET		4 shifts	B	E.Genin/ M.Mantovani/ B. Mours	high/low power test	evaluate the behavior of the ITF with lower and higher power	evaluate the maximum power that can be handled by DET	ITF in final configuration
2	INJ		1 shift + vac	during MS	E. Genin	substitution of the SIB1 polarizers+ opening/closing of the power stabilization electronic box	decrease of 5% of laser power losses introduced by the IPC polarizers/ avoid damaging the power stabilization electronics located in the IB tower.		SIB1 in air
3	INJ/SBE		1w	during MS	E. Genin/ A. Bertolini	EIB suspension	reduce the 20Hz noise		North arm available
4	INJ		1 shift	during MS	E. Genin	IMC RF QPD substitution	50 Hz reduction and standardization of the hardware		IMC available
5	INJ/Elect		0.5 shift	during MS	E. Genin/F. Nocera	Rampeauto substitution	old electronics		IMC available
6	PSL/INJ		4h	during MS	E. Genin	New SL power supplies installation			
7	INJ		4h (installation 2hours+ ITF relocking 2hours)	Before MS/during MS	G.Pillant	22/56MHz EOM replacement	be able to monitor the modulation index amplitude		ITF will have to be relocked with the new modulator we can expect the need to retune some demodulations phases
8	INJ		2 hours	during MS	F. Nocera	Install the monitoring system of the amplitude monitor for the 6/8/22 and 56 MHz	be able to monitor the modulation index amplitude		
9	INJ		2 hours	during MS	G. Pillant	Install another water-cooled beam dump on the EIB to dump the reflection from the IMC cavity	Avoid thermal drift in the EIB enclosure going from		



- ❑ Replace the lossy polarizers by new ones from LMA → reduce by 5% the throughput losses



Brewster Polarizers at 1064 nm (55*20 mm) for the Advanced Virgo Input Bench

Surface 1 : HR coating for polarizer with extinction >40 dB at 55.4° inc. (Ts < 0.01%, Rp < 0.1%)

LMA reference	Transmission S polarization (%)	Reflexion P polarization (%)	Extinction $10 \cdot \log(Tp/Ts)$ in dB
S17073/1	0.0009	0.282	50.4
S17073/2	0.0009	0.260	50.4
S17073/3	0.0009	0.286	50.4

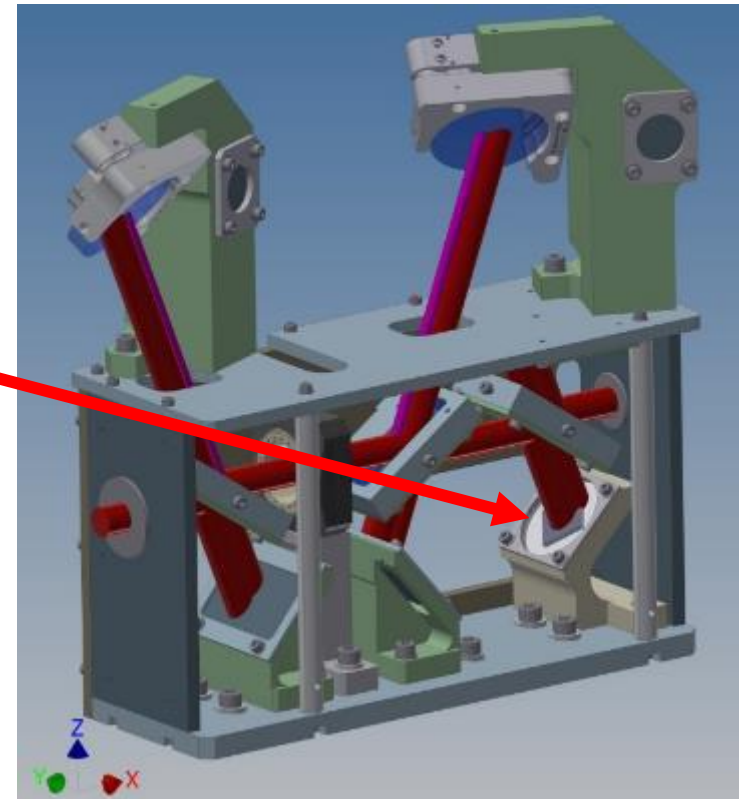
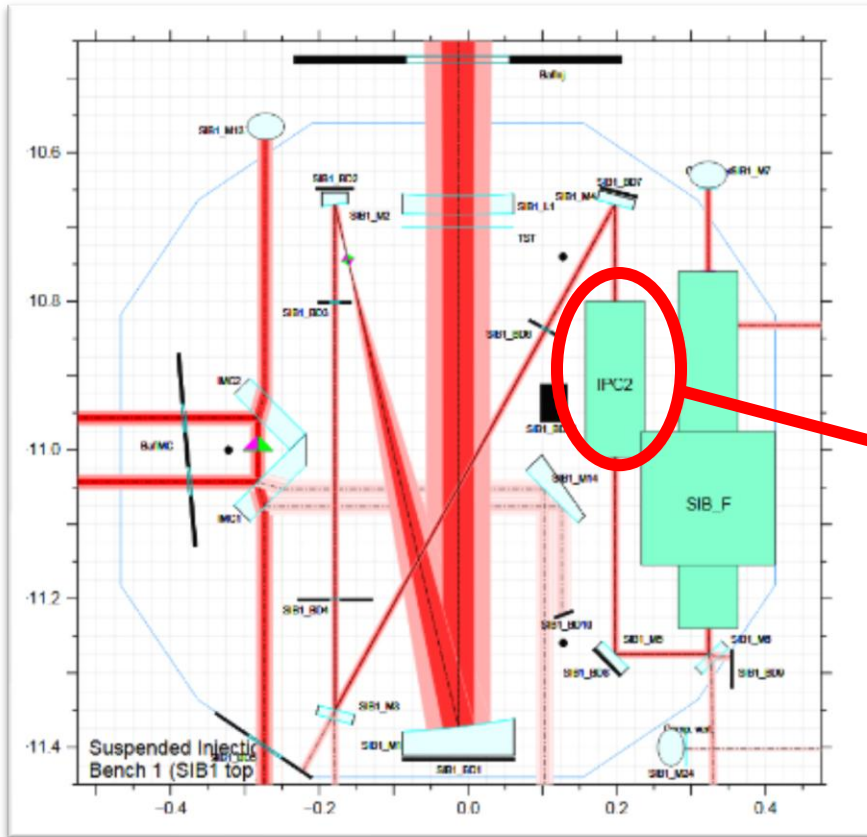
July 2017

- ❑ Replace the Micos rotator (not reliable) by a Newport agilis one.



- ❑ Install monitor of the laser power we inject close to the ITF.

In vacuum monitoring of the power sent to the ITF

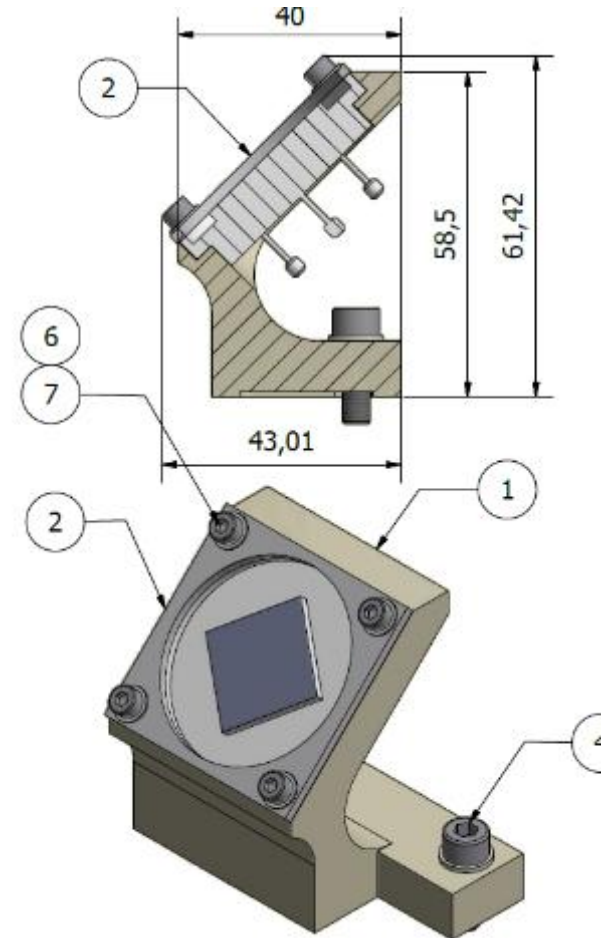


□ PSD (used as a photodiode), we got back from SIB (Virgo) → already cabled.

- ❑ Executive design (by T. Zelenova) sent to the mechanics (ready in ~ 1 week)
- ❑ In vacuum compatibility tests have been done (A. Pasqualetti) → it has been validated
- ❑ Cabling is fine (checked with V. Dattilo) → we'll take cables from the Faraday rotator (which will be replaced), and there are also spare cables



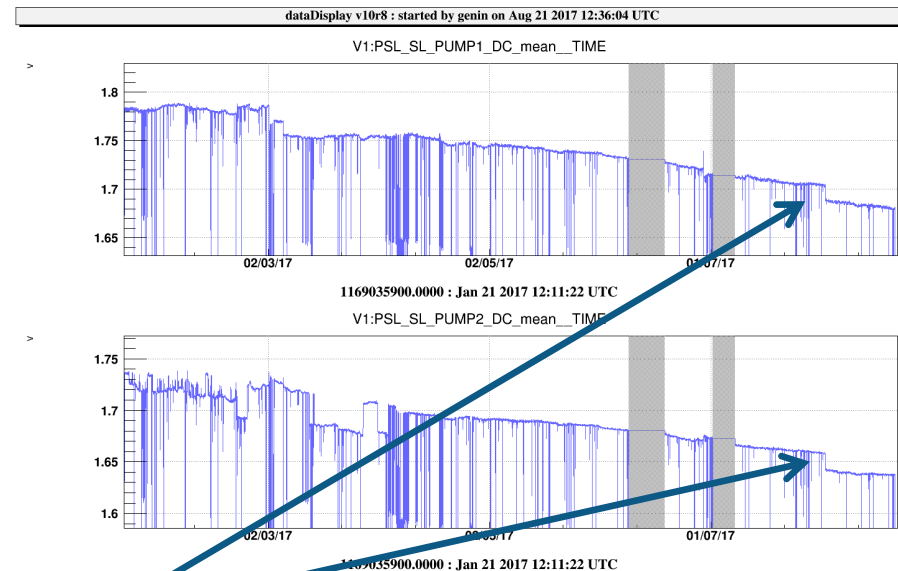
SIB1 IPC upgrade



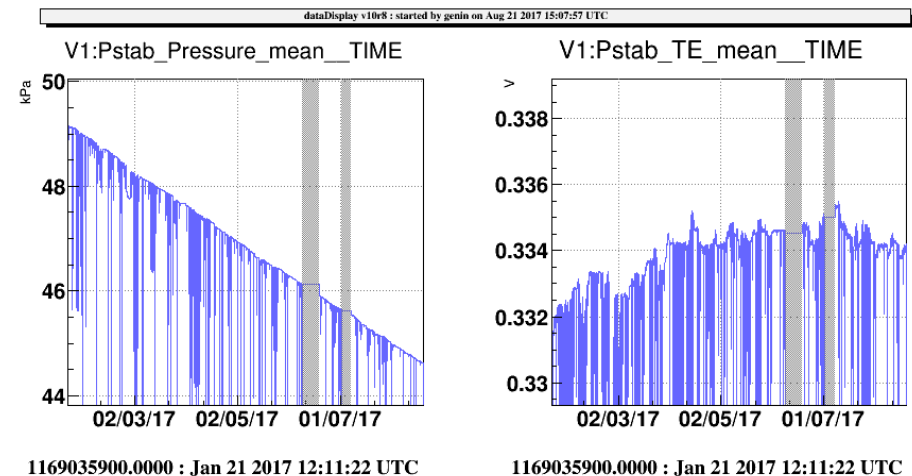
Maintenance: Slave laser pumping diodes aging/ PSTAB electronics box leak

- ❑ Slave laser pumping diodes (see entry #39259).
 - started in May 2017. In August we started to see some glitches and we had to reduce the current applied on the pumping diode to fix it (see entry #39005).

Pumping current decrease



- ❑ Power stabilization electronics box leak (7.86 kPa/year). No effect on the temperature so far (see entry #39250).



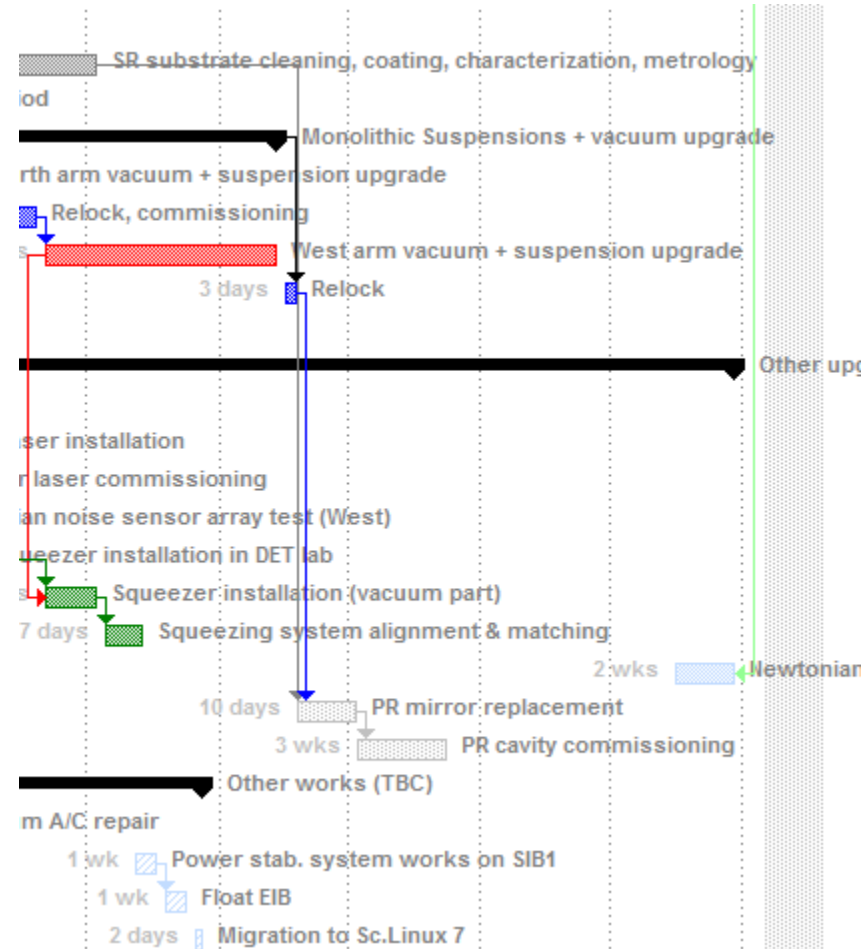
❑ We need to fix the leak of the power stabilization electronics box (to be done during SIB1 intervention and during monolithic suspensions upgrade to minimize ITF down time). It will be done during the shutdown for the West arm MS installation (already inserted in the planning).

❑ The idea is to replace the currently used box by a spare one which has already been tested in air at Nice.

❑ We are preparing the box tests in a vacuum chamber in the EGO optics lab (this week).

❑ We will have to substitute at least the slave laser pumping diodes (before O3 run)
→ after the laser system upgrade.

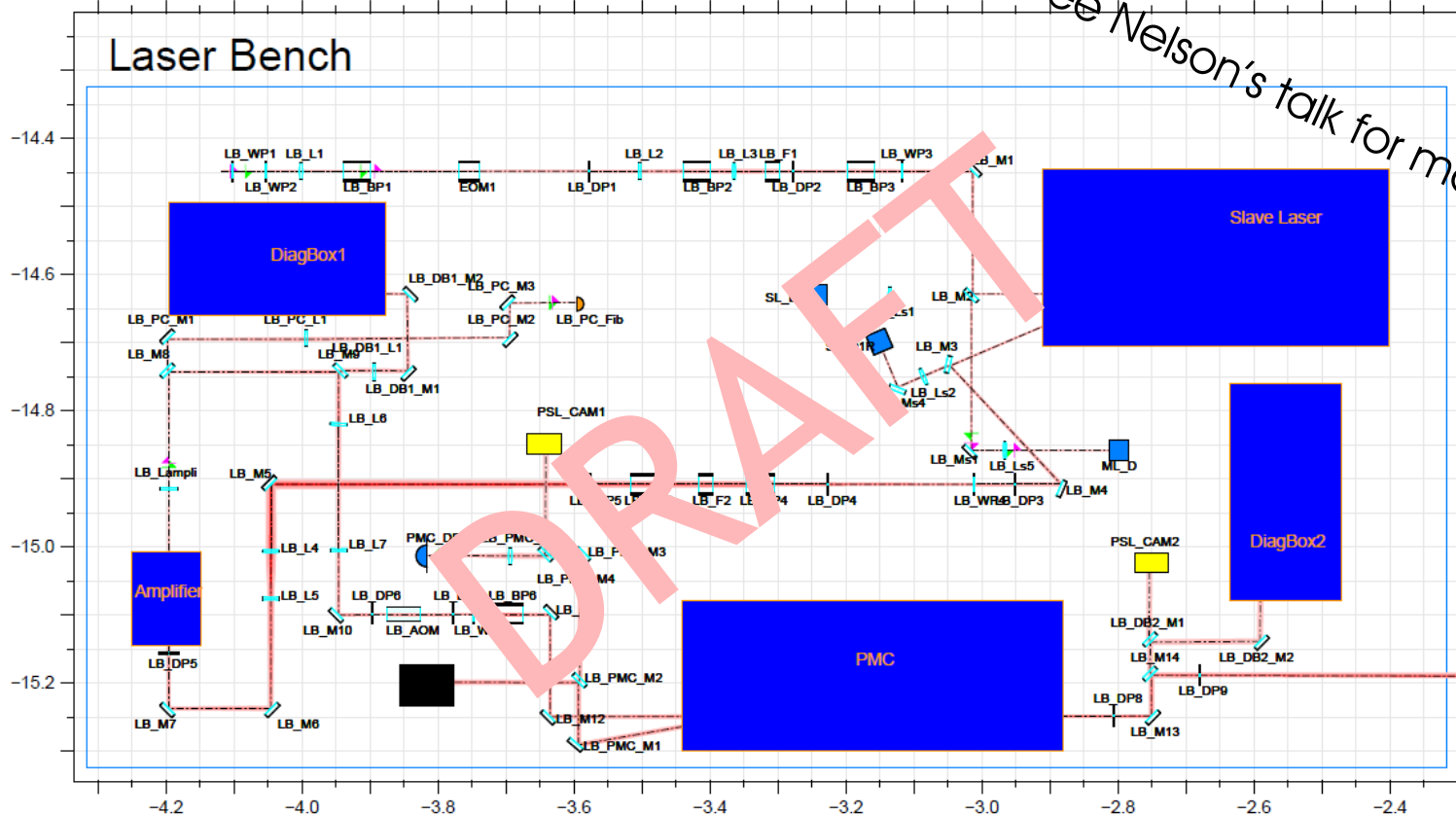
❑ We have to replace the “very old” laser chillers. We are currently finalizing the purchase of 2 new chillers.



Next steps: Laser system upgrade

- The laser bench upgrade has been confirmed. We will keep the current optical table.
- should start a week after the start of the MS upgrade shutdown. The IMC is expected to be relocked at the beginning of January 2018.
- at least, 1 week will be required to commission the laser & Injection system with the increased power.

See Nelson's talk for more details



- ❑ TCS commissioning: raise-up the laser power (to be started this week).
- ❑ Laser system upgrade (December 2017)
- ❑ Mid term (before O3 run):
 - ❑ IB tower intervention: SIB1 IPC upgrade and power stabilization electronic box substitution
 - ❑ EIB cabling reshuffling
 - ❑ Suspend EIB-SAS: a more detailed planning has been prepared with Alessandro. It has been inserted in the planning after the SIB1 intervention.
 - ❑ Install the new power supply for the slave laser.
 - ❑ Further raise up the laser power (up to 50W) if required.

We need to conclude the document motivating the replacement of MC end mirror during O3/O4 break.

→ there are many reasons to replace it. Improve the actuation and the mechanics. Optical losses reduction.

Auxiliary lasers hardware installation in the laser lab and on the EIB (TBC)

Further increase of the laser power?