

installation status of PSL and IMC

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JGW-G1707105



Contents

- Overview of bKAGRA-phase1 input optics
- Installation procedure of PSL
- Current status
 - ✓ summary
 - ✓ FSS+IMC
 - ✓ PMC
- Achievement and schedule

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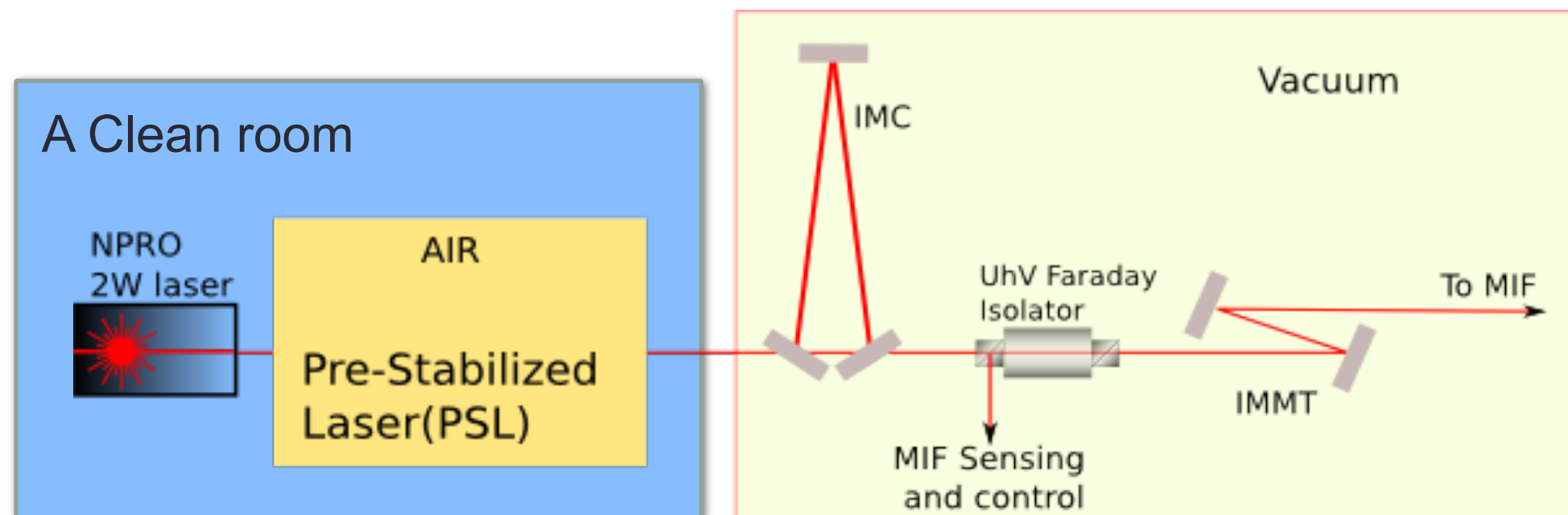
Overview of bKAGRA-p1 input optics

- **In-air optics (In a clean room)**

- ✓ A Laser Source
- ✓ EOMs for IMC and MIF control
- ✓ The pre-mode cleaner(PMC)
- ✓ The frequency stabilization system (FSS)
- ✓ The intensity stabilization system (ISS)

- **In-vacuum optics**

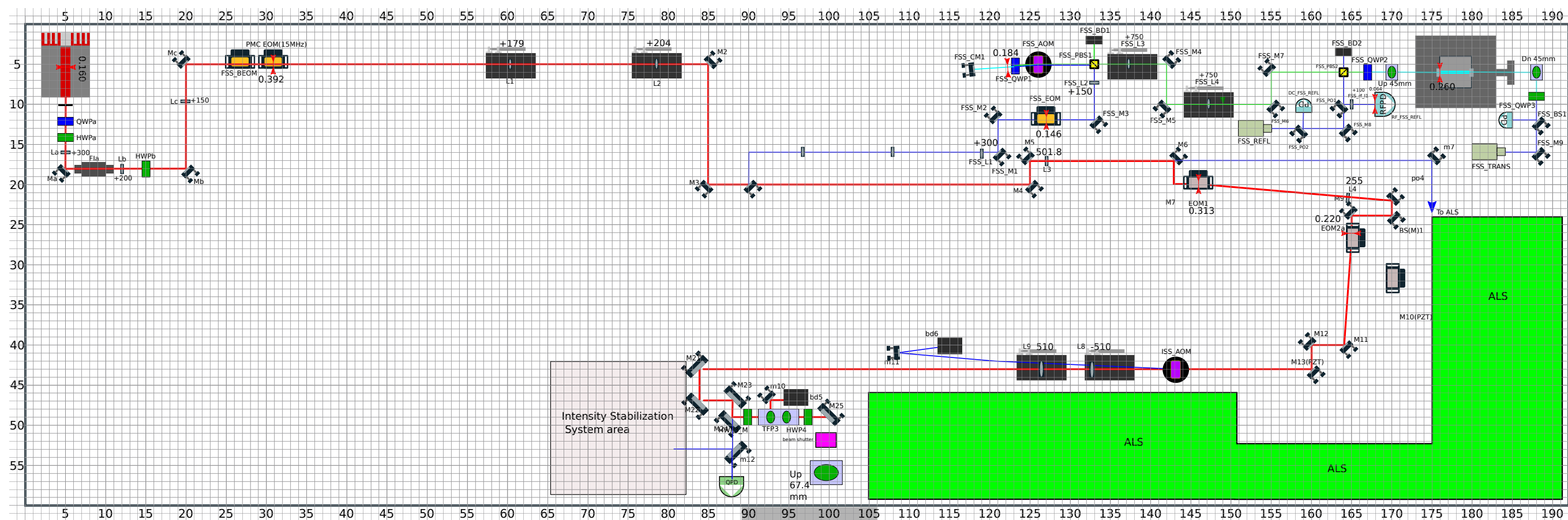
- ✓ 53 m long Input Mode Cleaner (IMC)
- ✓ A vacuum compatible high power faraday isolator
- ✓ An Input Mode Matching Telescope



Contents

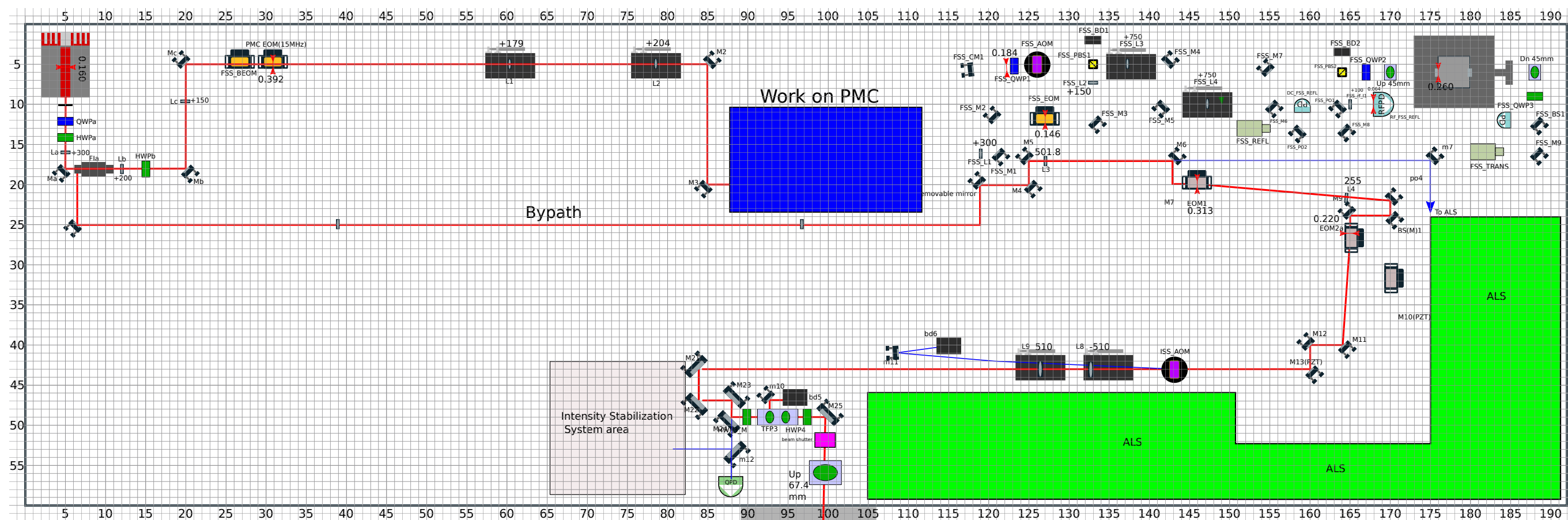
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PSL construction procedure (Main path, FSS)



- the FSS and main path installation has been done without the PMC.
 - ✓ The PMC has not been delivered yet
 - ✓ Put a pick off mirror to the beam to the FSS path, and also lenses to compensate the effect of the curved mirrors of PMC.

PSL construction procedure (PMC)



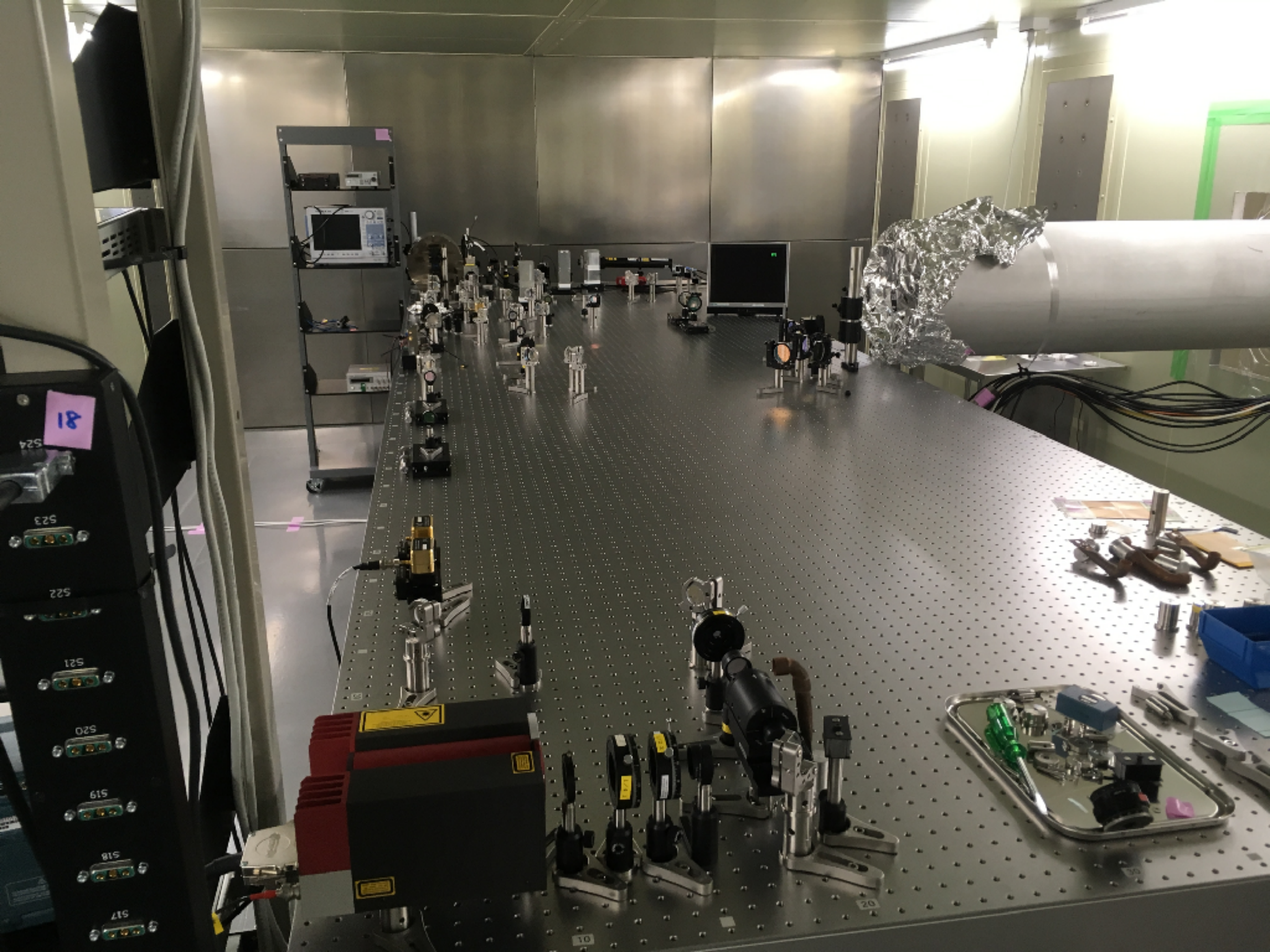
- During installation of PMC a bypassed laser will be used for main beam from PSL.
 - ✓ Not to disturb the MIF commissioning.
 - ✓ Using a reflection beam from a first polarizer of the FI
 - ✓ The removable mirror mount is used as the coupler to the main path so that the beams can be switched immediately.
 - ✓ The beam has been well aligned and mode matched to the IMC
 - ✓ At this configuration we cannot using the FSS

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Current status (summary)

- PSL Main path : **Done** (except for ISS parts)
 - ✓ The beam reached to an output mirror of the PSL
 - ✓ ISS has not installed yet.
- FSS : **Done**
 - ✓ Locked with good stability
 - ✓ Guardian script is working well
- PMC : **Not Yet**
 - ✓ PMC is bought from LIGO
 - ✓ Already assembled but has a trouble.
 - ✓ Installation would not disturb the commissioning
- IMC : Under commissioning
 - ✓ LSC has been locked, but not stable enough. lost lock every 15min
 - ✓ ASC does not worked well



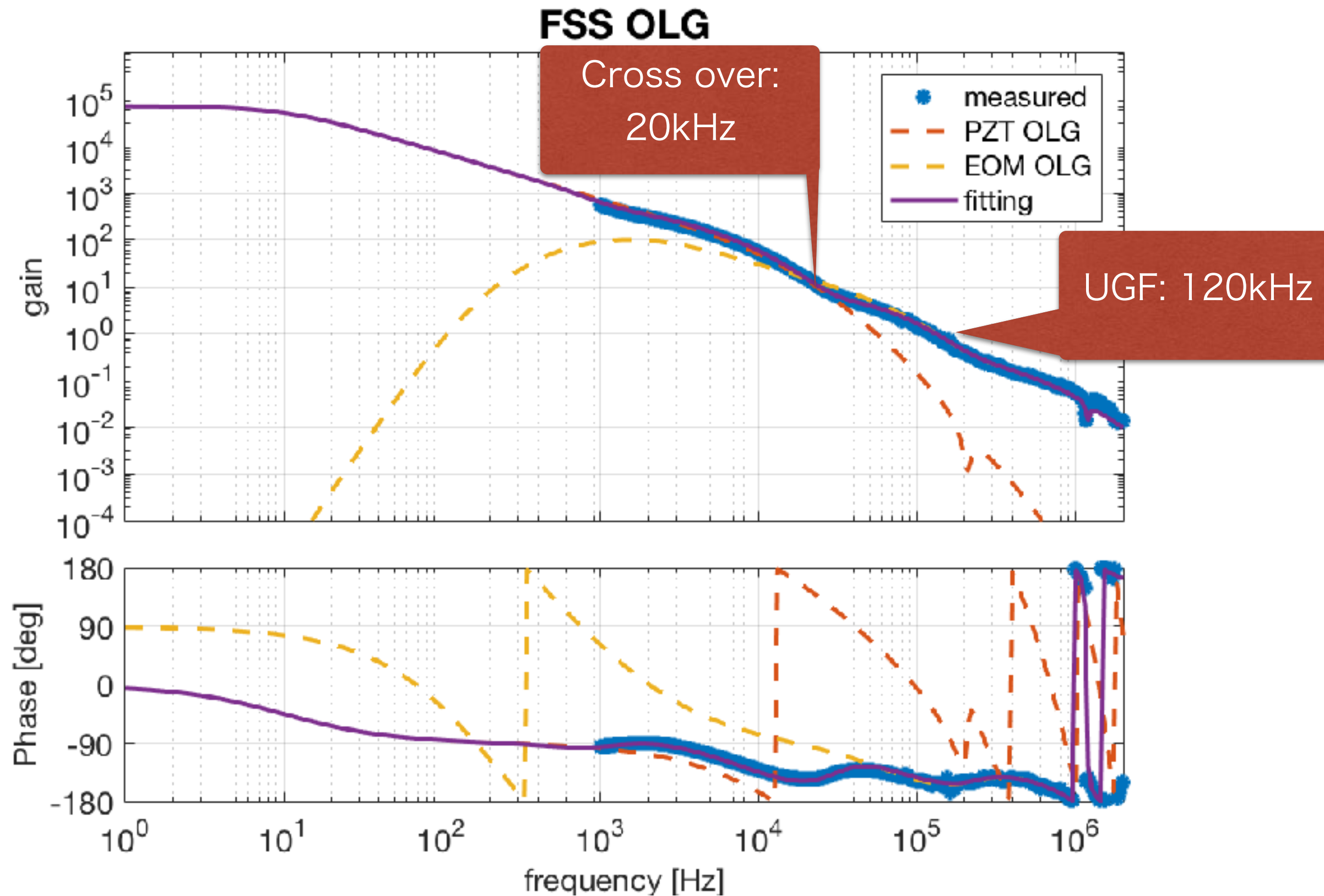
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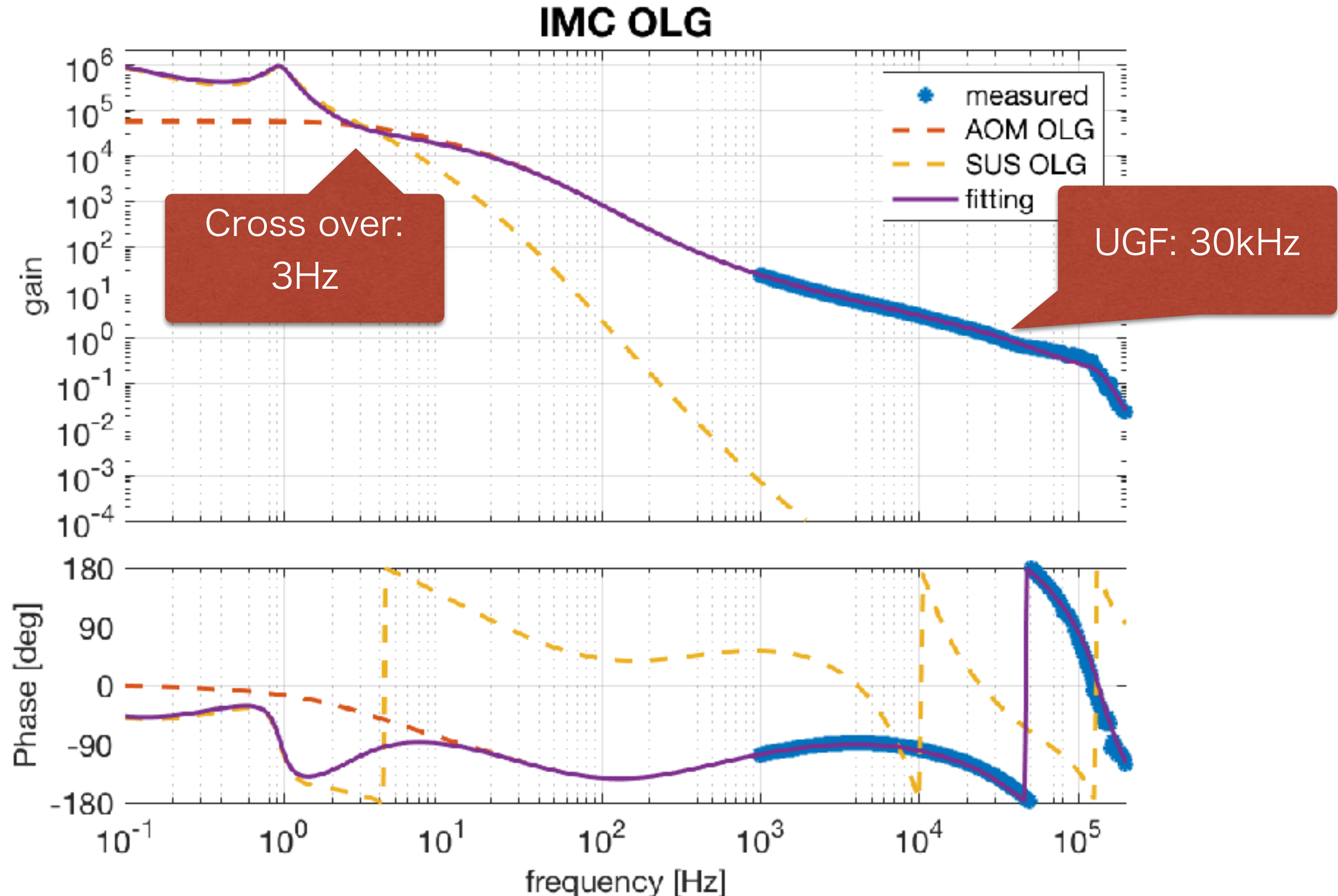
IMC and FSS status

- Lock robustness
 - ✓ the FSS is well stabilized
 - ✓ the IMC was well stabilized and achieved overnight lock
 - ✓ But after increasing the laser power, the IMC is not stable enough.
 - should be investigated
- Compare to iKAGRA
 - ✓ Control signal to the IMC suspension is much smaller
 - ✓ DC drift of laser frequency is suppressed by FSS
 - ✓ Control signal has good coherence with the tidal motion(GIF signal)
 - ✓ A mysterious burst noise in the IMC error signal disappeared
 - ✓ We don't know why, but we are happy.
- ✓ Frequency stability
 - ✓ Almost dominated by a mode cleaner servo
 - ✓ So far the laser power reach to IMC is 2mW, so signal to noise ratio is not good
 - ✓ KOACH filters are one of the noise source

Open loop gain of FSS

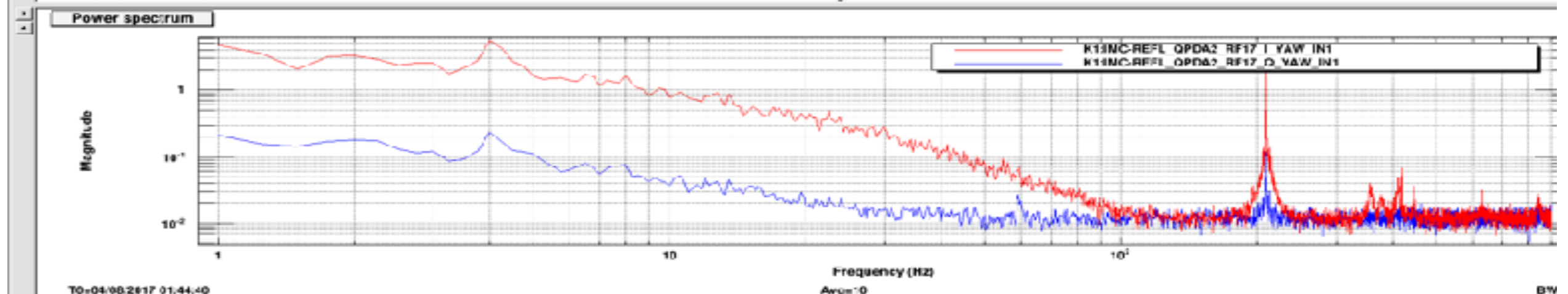
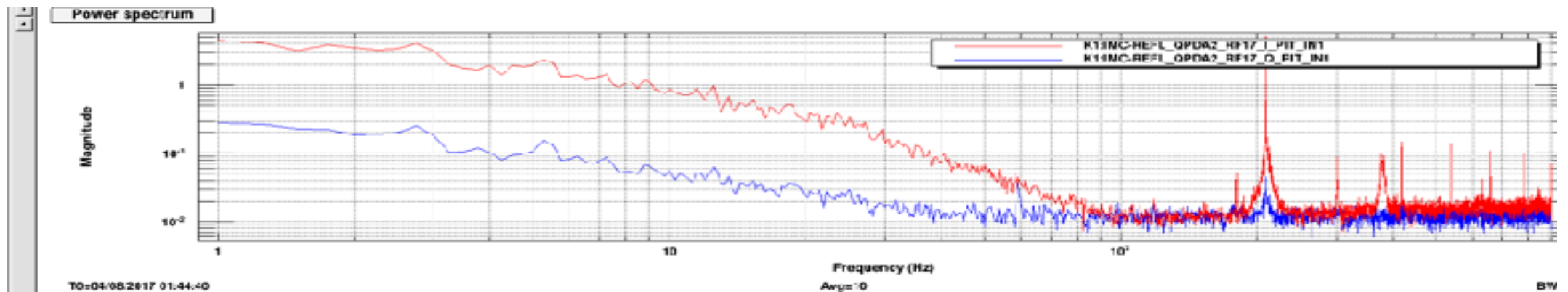


Open loop gain of FSS



IMC ASC(alignment sensing and control)

- The hardware has been installed
 - ✓ RFQPDs, a gouy phase telescope, analog circuits, RT model...
- The signal was observed, but ...
 - ✓ It was so small.
 - ✓ The input beam seems to move a lot
 - ✓ KOACH filters might shake the beam
 - Air flow
 - Shaking optics, periscopes, the optical table and so on.



To do list about IMC + FSS

- Investigation of the IMC locking robustness
- Evacuation of the RefCav chamber
- Installation of a local temperature control of RefCav.
- Servo circuits optimization
- ASC
 - ✓ Enclosure?
 - ✓ improve the goudy phase telescope?
 - ✓ Others

(After PMC installation)

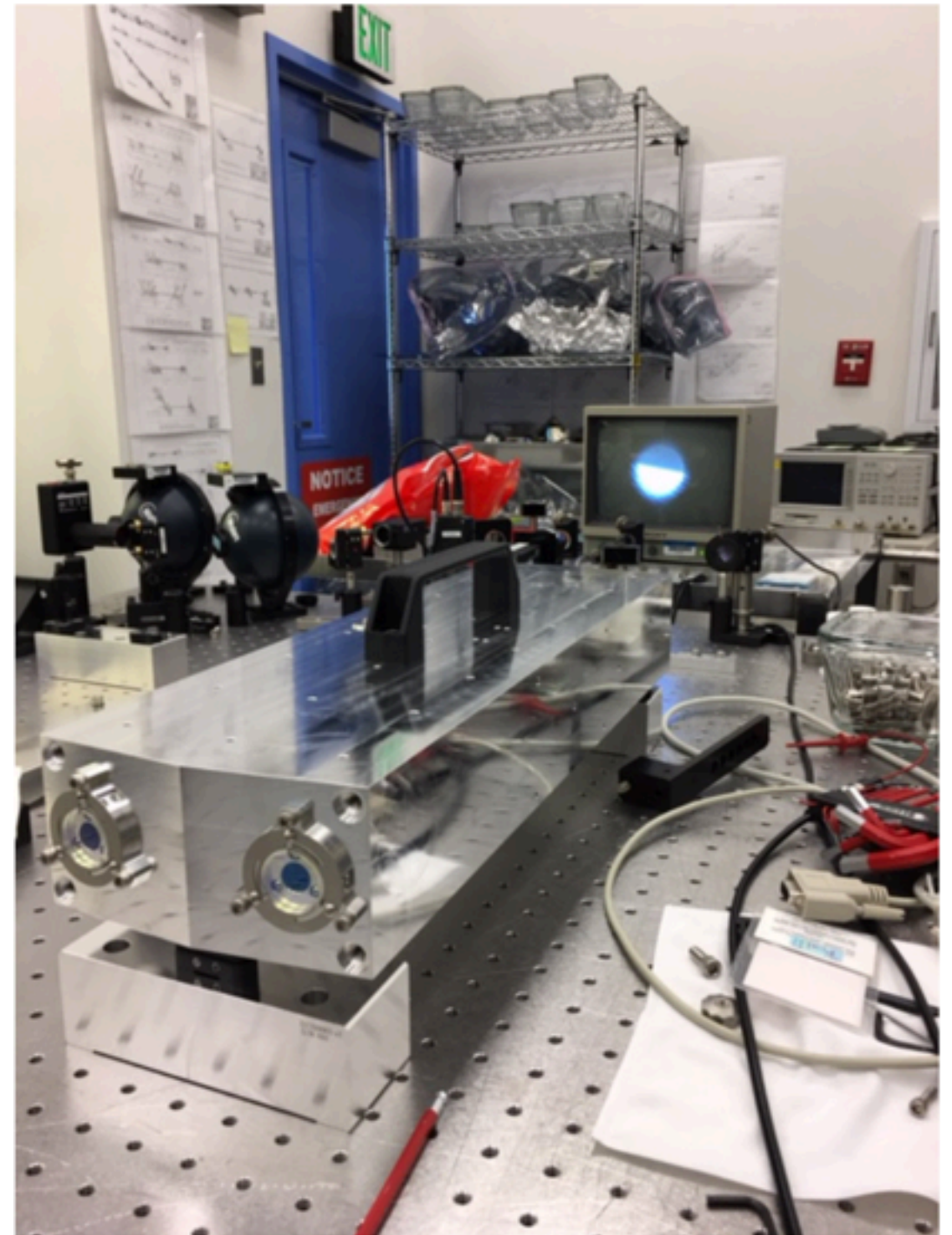
- Lock whole system
- Write guardian code of whole system

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PMC (Pre-Mode Cleaner)

- Bought from LIGO
- It's already assembled and locked
- but it has unexpected resonance under 10kHz
- UGF can reach up to only ~1kHz
 - ✓ Is that enough?
 - ✓ What is a requirement for a UGF of the PMC control?











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Achievement and schedule

- Provide the beam to BS by 9/20

	Apr	May	Jun	Jul	Aug	Sep
Main path	 preparation and installation					
FSS		Align and lock 	 commissioning			
IMC (LSC)			Align and lock 	 commissioning		
IMC (ASC)					Installation 	 commissioning?
PMC						 Installation?

Thanks a lot!

- Y.Enomoto(ICRR)
- J.Kasuya(Tokyo-Tech)
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- K.Nagano(ICRR)
- N.Aritomi(U-Tokyo)
- And more

Appendix

Comparison: glued, with, and without balls: 1-100 kHz

