Summary of iKAGRA Test Run Mar 25-31, 2016

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Quick Facts

- 3 km Michelson, mid-fringe lock
- input power to BS ~ 220 mW
- power at detection port (REFL) ~ 8 mW
- duration: Mar 25 9:00 JST - Mar 31 17:00 JST
  (from 1142899217 to 1143446417 in GPS time)
- duty cycle (lock): 85.2 % (IMC was 94.4 %)
- total locked time: 129.5 hours
- longest lock: ??? hours (but typically ~ ??? minutes)
- strain sensitivity: ~3e-15 /rtHz @ 100 Hz
  (~1pc for NS-NS binary range)

Thanks to inputs from Y. Aso, O. Miyakawa, K. Kokeyama, K. Hayama, Y. Sasaki, M. Nakano, Y. Enomoto, etc ……

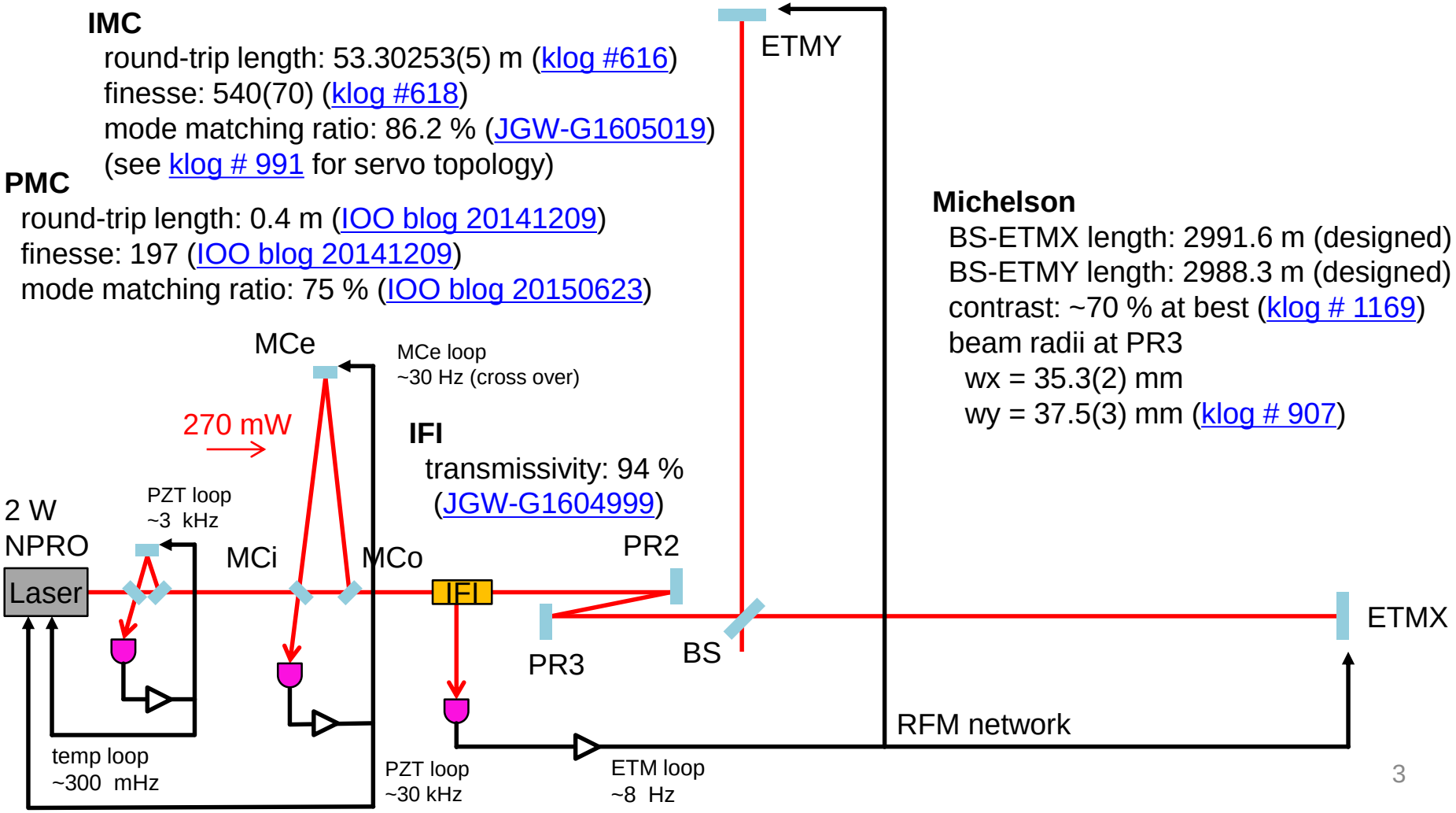
Interferometer Configuration

- 3 km Michelson, mid-fringe lock, UGF ~8 Hz
- suspended mirrors DC alignment controlled with oplevs

IMC
round-trip length: 53.30253(5) m (klog #616)
finesse: 540(70) (klog #618)
mode matching ratio: 86.2 % (JGW-G1605019)
(see klog # 991 for servo topology)

PMC
round-trip length: 0.4 m (IOO blog 20141209)
finesse: 197 (IOO blog 20141209)
mode matching ratio: 75 % (IOO blog 20150623)

Michelson
BS-ETMX length: 2991.6 m (designed)
BS-ETMY length: 2988.3 m (designed)
contrast: ~70 % at best (klog # 1169)
beam radii at PR3
wx = 35.3(2) mm
wy = 37.5(3) mm (klog # 907)



Suspensions and Mirrors

- fused silica, room temperature

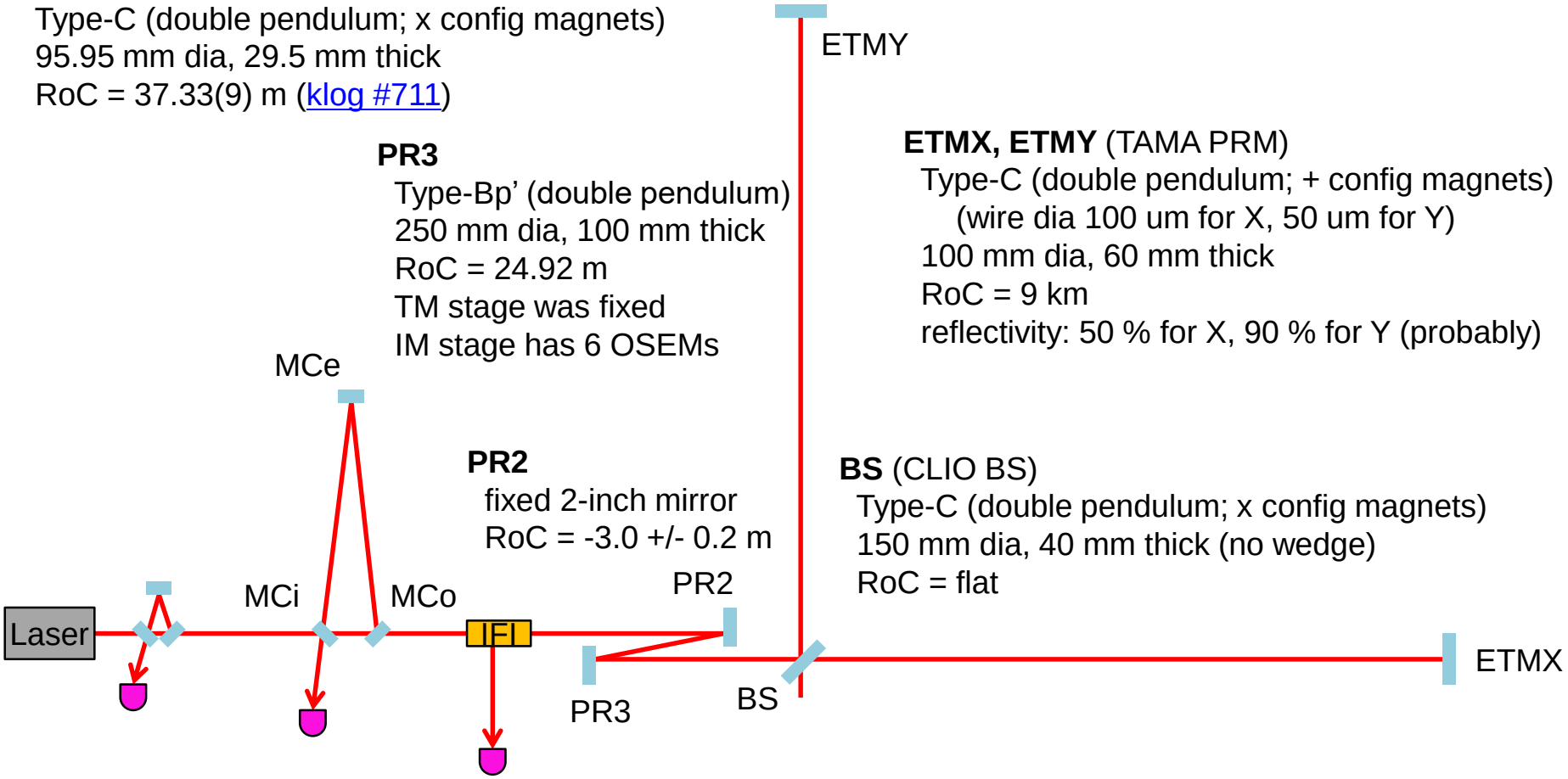
MCi, MCo, MCe
Type-C (double pendulum; x config magnets)
95.95 mm dia, 29.5 mm thick
RoC = 37.33(9) m (klog #711)

PR3
Type-Bp' (double pendulum)
250 mm dia, 100 mm thick
RoC = 24.92 m
TM stage was fixed
IM stage has 6 OSEMs

ETMX, ETMY (TAMA PRM)
Type-C (double pendulum; + config magnets)
(wire dia 100 um for X, 50 um for Y)
100 mm dia, 60 mm thick
RoC = 9 km
reflectivity: 50 % for X, 90 % for Y (probably)

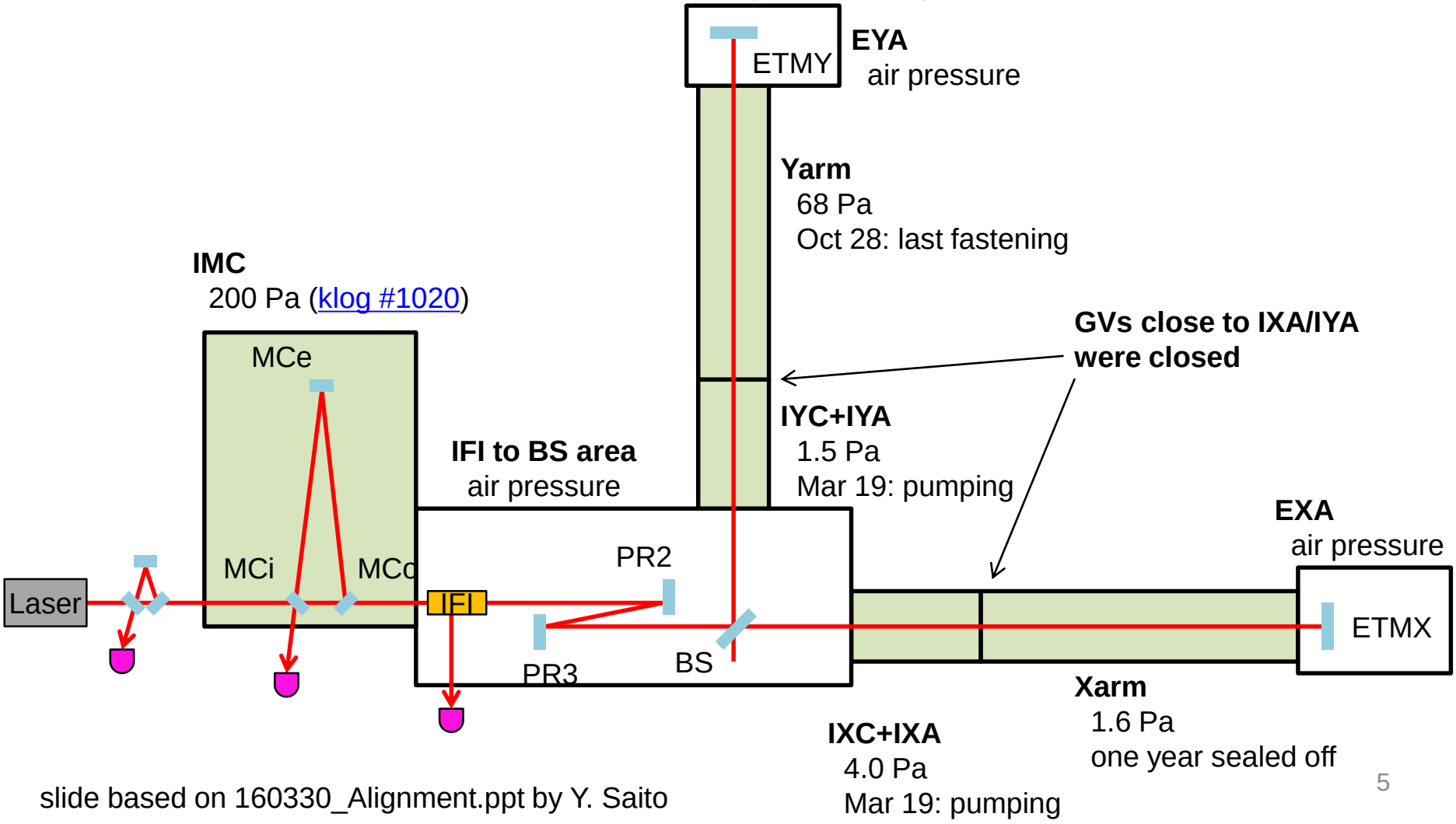
PR2
fixed 2-inch mirror
RoC = -3.0 +/- 0.2 m

BS (CLIO BS)
Type-C (double pendulum; x config magnets)
150 mm dia, 40 mm thick (no wedge)
RoC = flat



Vacuum

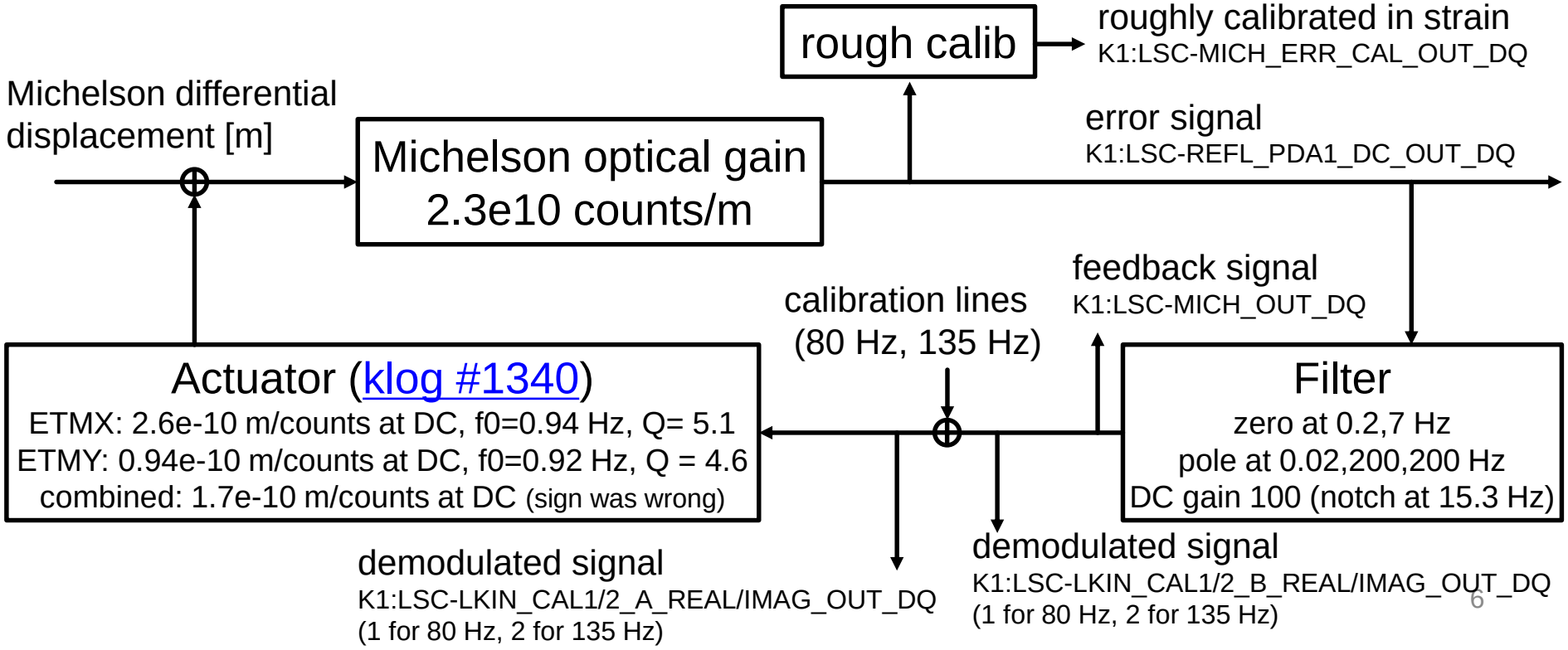
- central part and both ends were at air (PR2-BS was not connected, but covered; klog #1078)



slide based on 160330_Alignment.ppt by Y. Saito

Calibration

- calibration of error signal (optical gain)
  2.3e10 counts/m (klog #1169)
- calibration of feedback signal (actuator efficiency)
  1.8e-14 m/counts @ 80 Hz (klog #1169)
- calibration lines at 80 Hz and 135 Hz to monitor loop gain



Detector Characterization

- SOME PLOTS BY HAYAMA-SAN, SASAKI-KUN
- duty cycle (for Michelson and IMC)
- lock duration (for Michelson and IMC)
- Michelson drift vs tidal effect
- open loop gain drift

Issues in March Test Run

- Michelson lock was lost every ~30 minutes
- Alignment was adjusted manually ~ once per day
- Calibration was done offline
- PMC was re-locked manually
- GVs close to IXA/IYA was closed
- PR2-BS duct was not connected
- Some unsafe issues left unaddressed

What's New in April Test Run

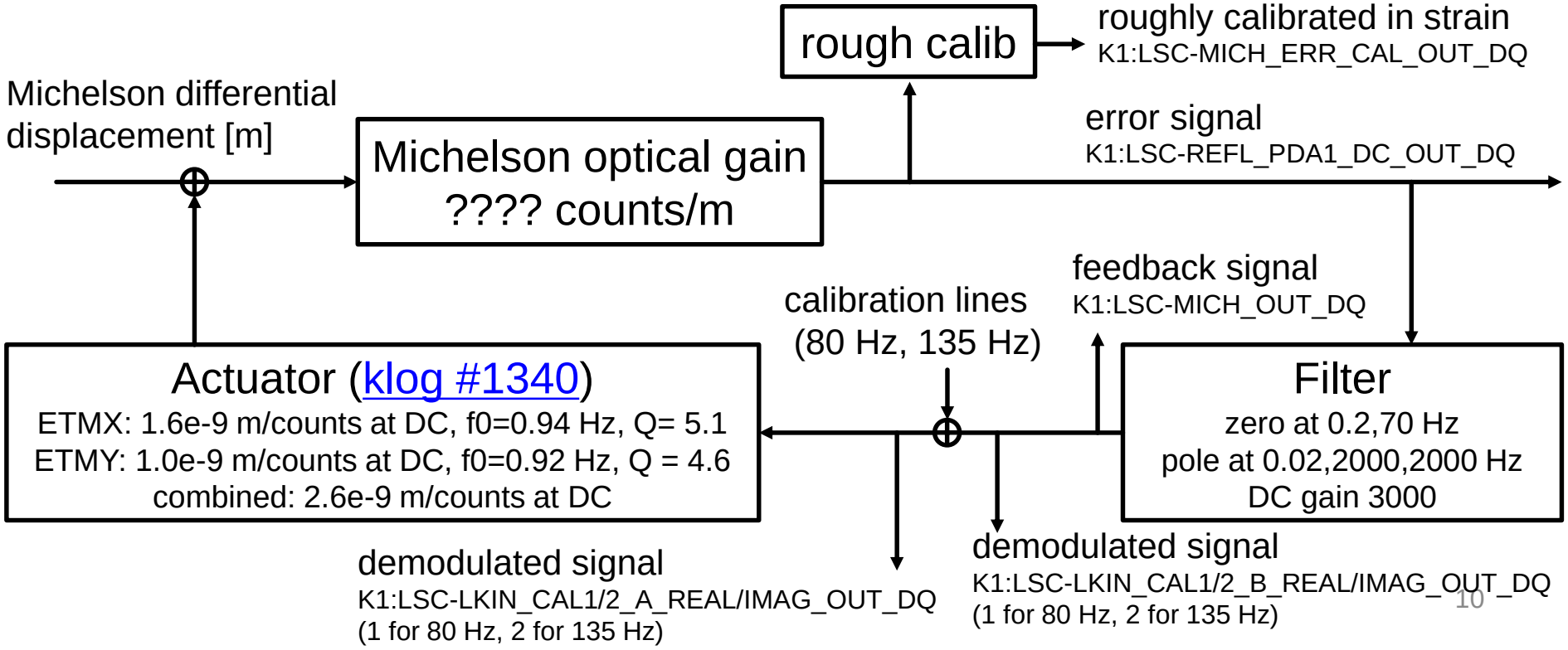
- Michelson lock was lost every ~30 minutes
  -> improved to ????(x16 ?)
  new actuation efficiency (ETM differential): 2.6e-9 m/C at DC (klog #1340)
  folded oplev for ETMs to reduce length to angle (klog #1355)
- Alignment was adjusted manually ~ once per day

- Calibration was done offline

- PMC ~~was re-locked manually~~ remote control restored (klog #1351)
- GVs close to IXA/IYA was ~~closed~~ opened (klog #1338)
- PR2-BS duct was ~~not connected~~ connected
- Some unsafe issues ~~left unaddressed~~ partially addressed

Calibration for April Test Run (TO BE UPDATED)

- calibration of error signal (optical gain)
  ???? counts/m
- calibration of feedback signal (actuator efficiency)
  2.6(1)e-9 m/counts @ DC (klog #1340)
- calibration lines at 80 Hz and 135 Hz to monitor loop gain



What To Do After April Test Run

- evacuate central part and both ends
  to open all GVs
  to investigate alignment change during evacuation
- PR3 height check
- oplev stability, noise measurements with fixed mirror
- investigate scattering noise from vibration of ducts
- what else?