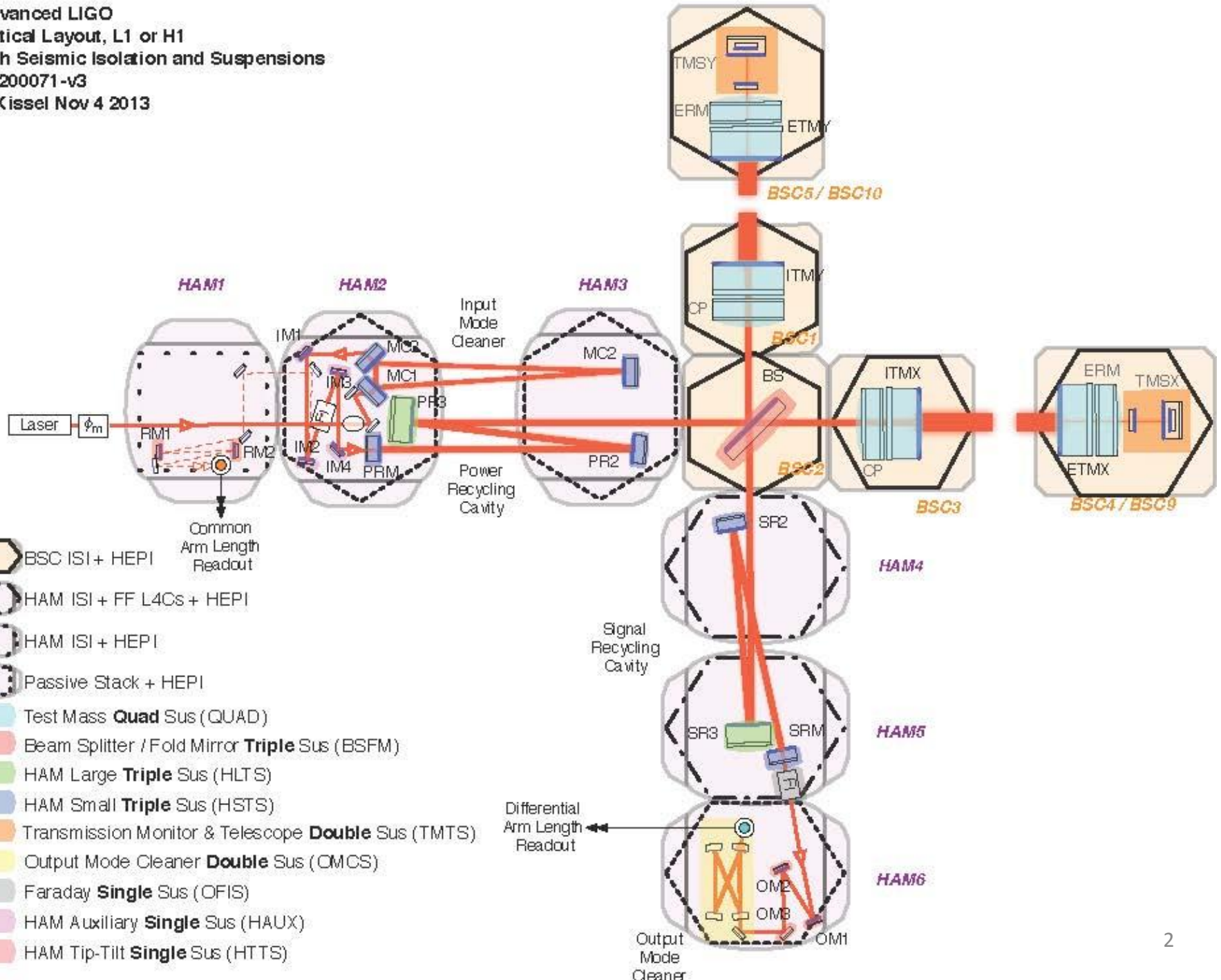


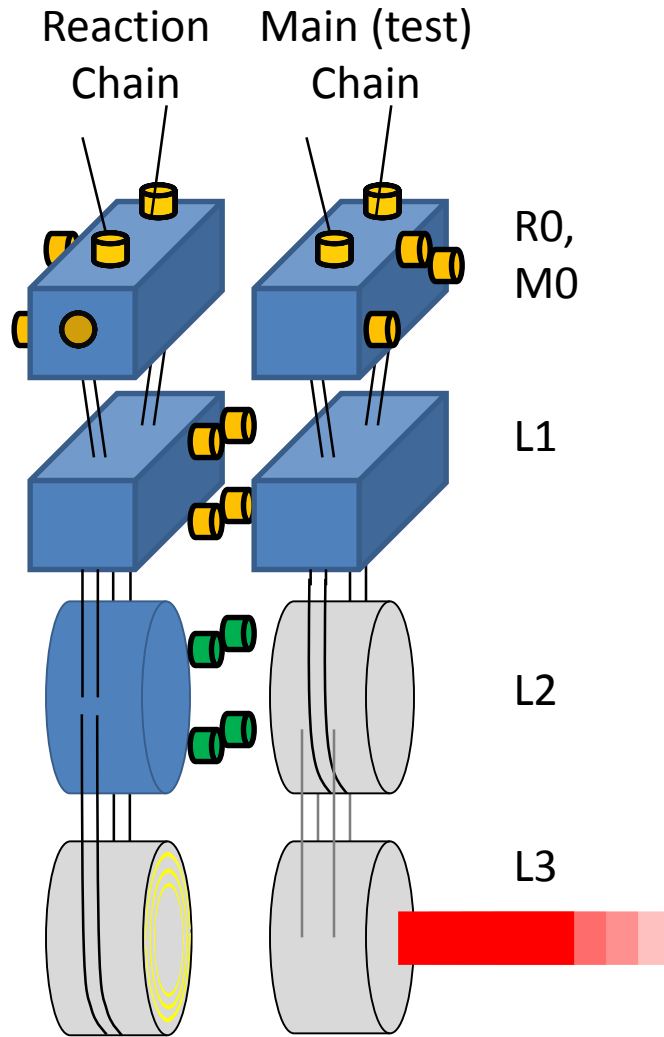
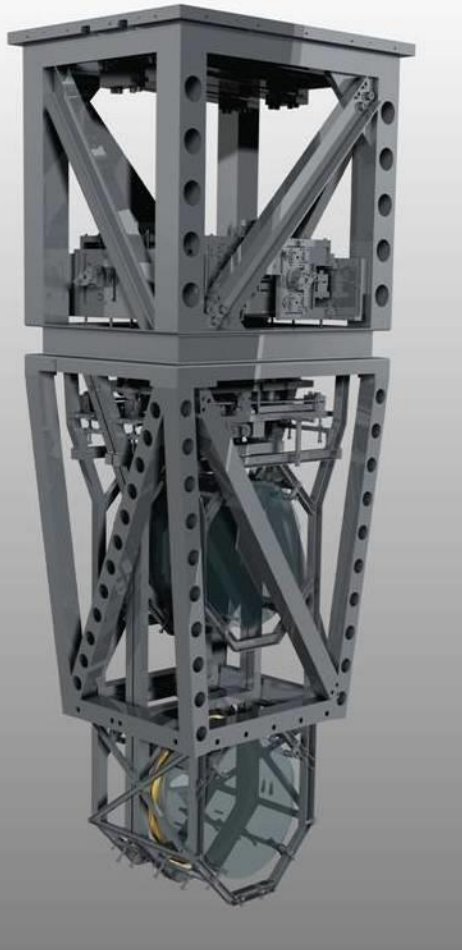
Advanced LIGO Suspensions Quick Start Guide

J. Romie, B. Shapiro, M. Barton

Advanced LIGO
 Optical Layout, L1 or H1
 with Seismic Isolation and Suspensions
 G1200071-v3
 J. Kissel Nov 4 2013



Quadruple Suspension (Quad)



Purpose

- Input Test Mass (ITM, TCP)
- End Test Mass (ETM, ERM)


Location

- H1 - BSC 1, 3, 9, 10
- L1 – BSC 1, 3, 4, 5

Control

- Local – damping at M0, R0
- Global – LSC & ASC at all 4

Sensors/Actuators

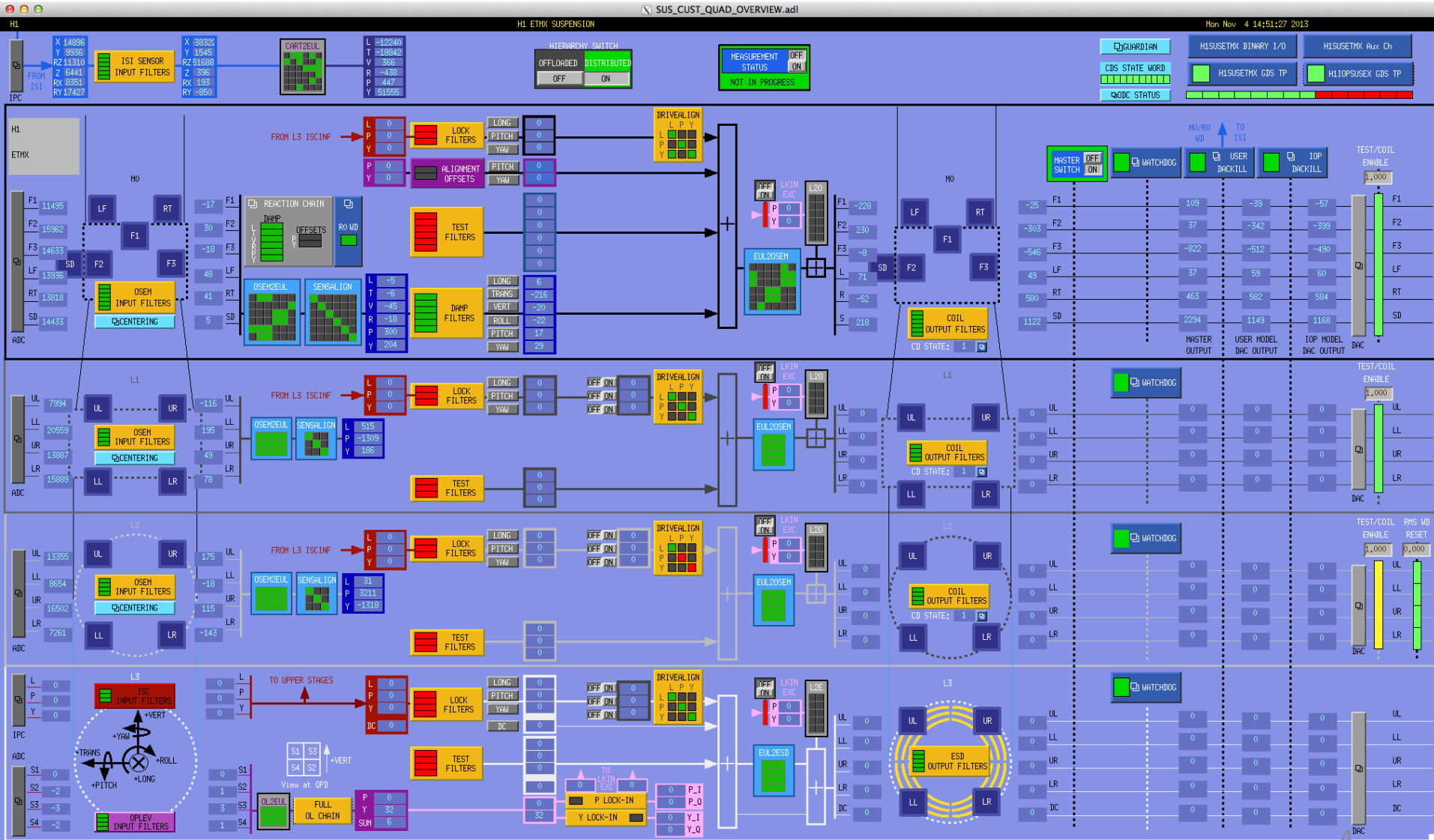
-  BOSEMs at M0, R0, L1

-  AOSEMs at L2

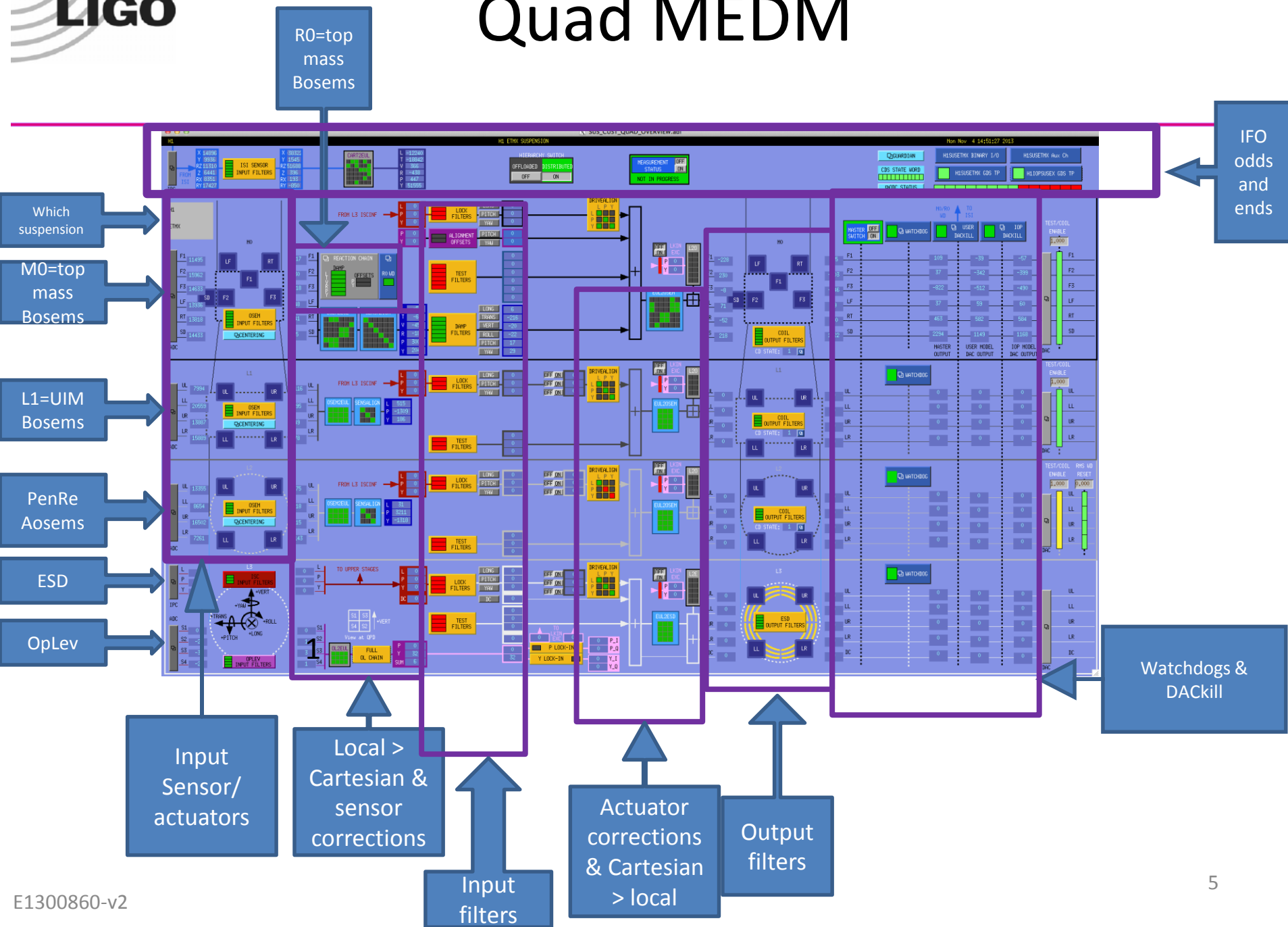
- Optical levers and IFO signals at L3

- Electrostatic drive (ESD) at L3

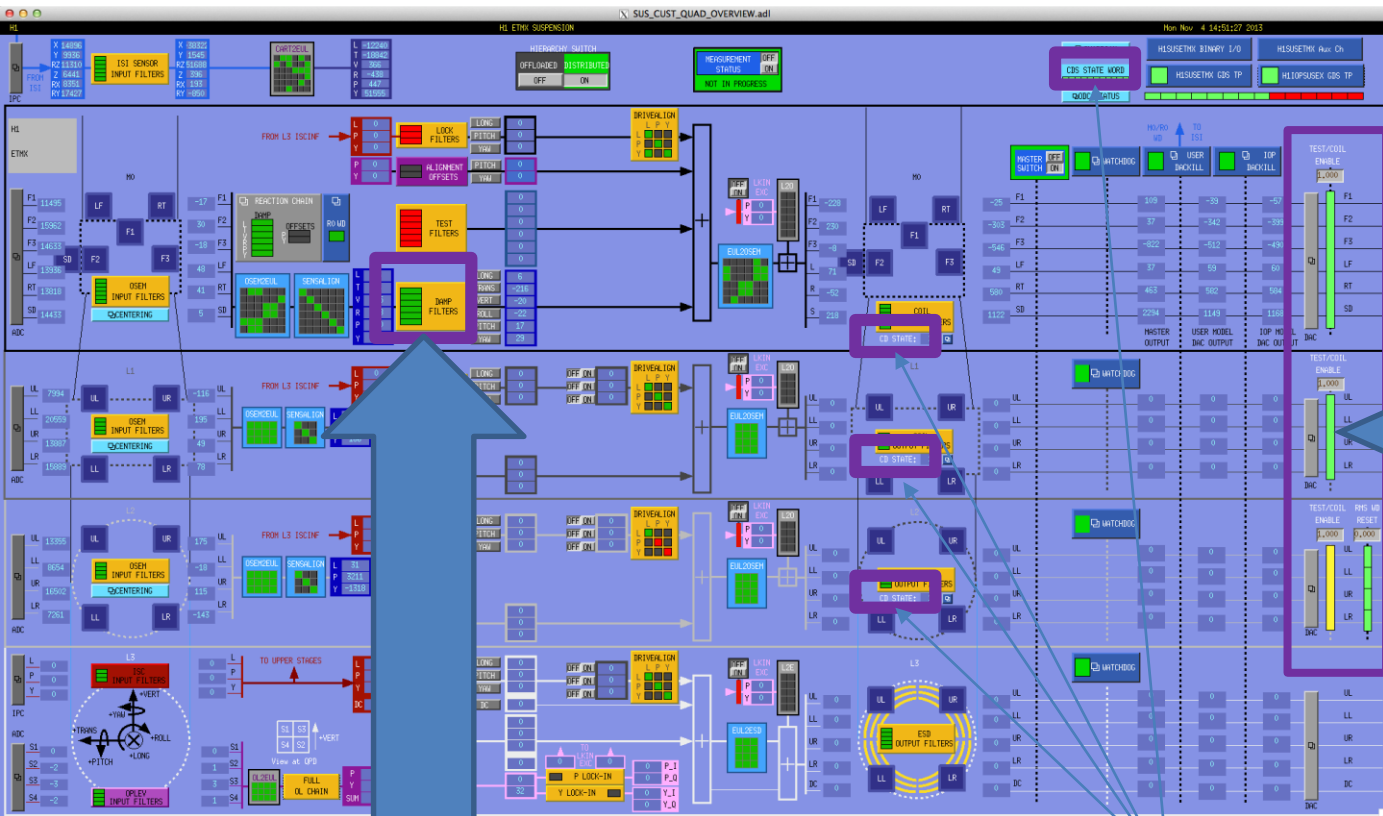
Quad MEDM Overview Screen



Quad MEDM



Quad MEDM



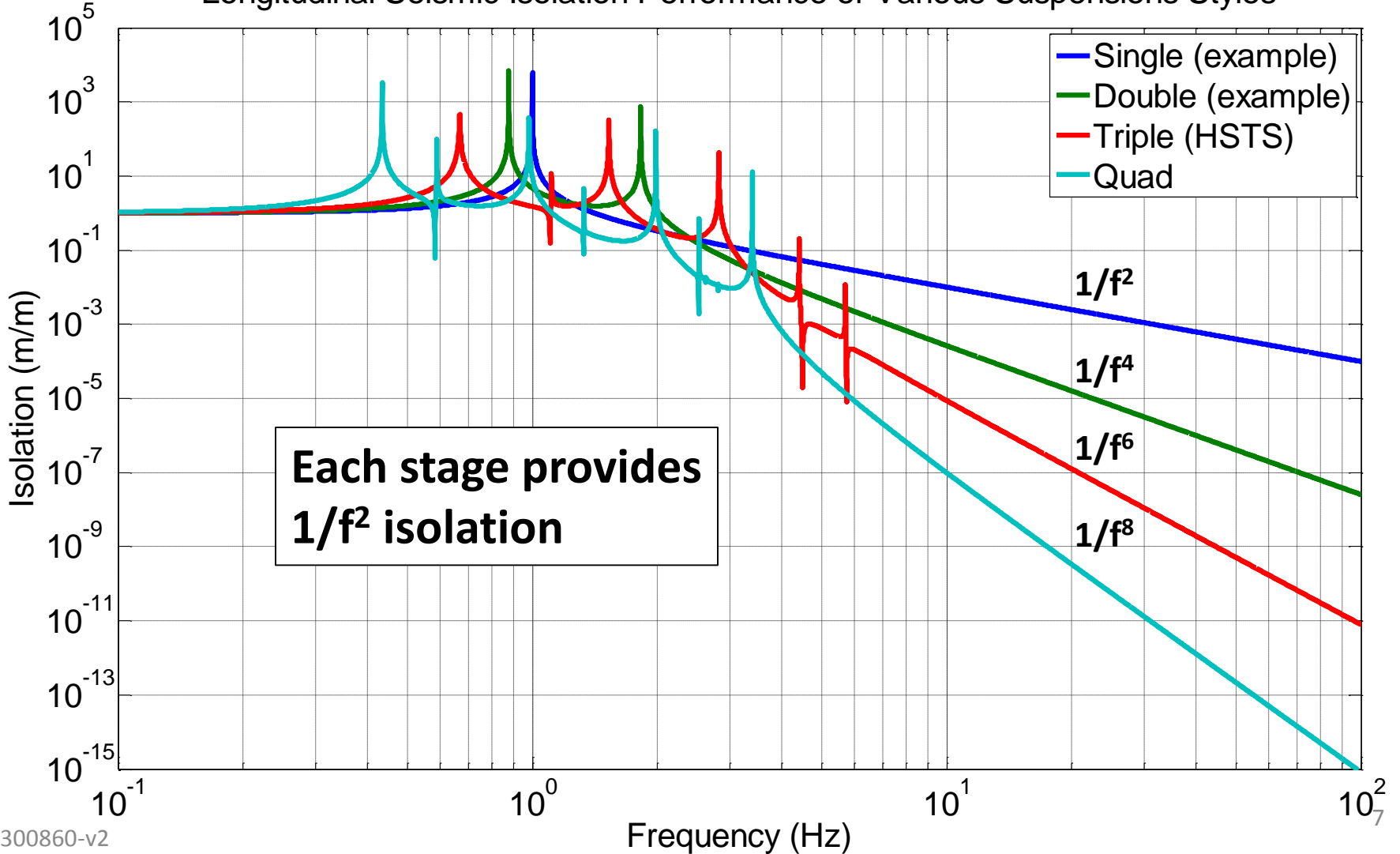
Coil/drive: enable or disable
 Green=enabled
 Red=disabled
 Yellow=intermediate

Damping Filter-
 click on this for
 damping loops

Check state of IFO:
 Acquire (locking)
 Low Noise (running)

Suspension Isolation Performance

Longitudinal Seismic Isolation Performance of Various Suspensions Styles



Beamsplitter/Folding Mirror (BSFM)

Purpose

- BS, (FMX and FMY)

Location

- Beamsplitter – BSC 2, (4)
- (Fold Mirror – BSC 6, 8)

Control

- Local – damping at M1
- Global – LSC & ASC at M2

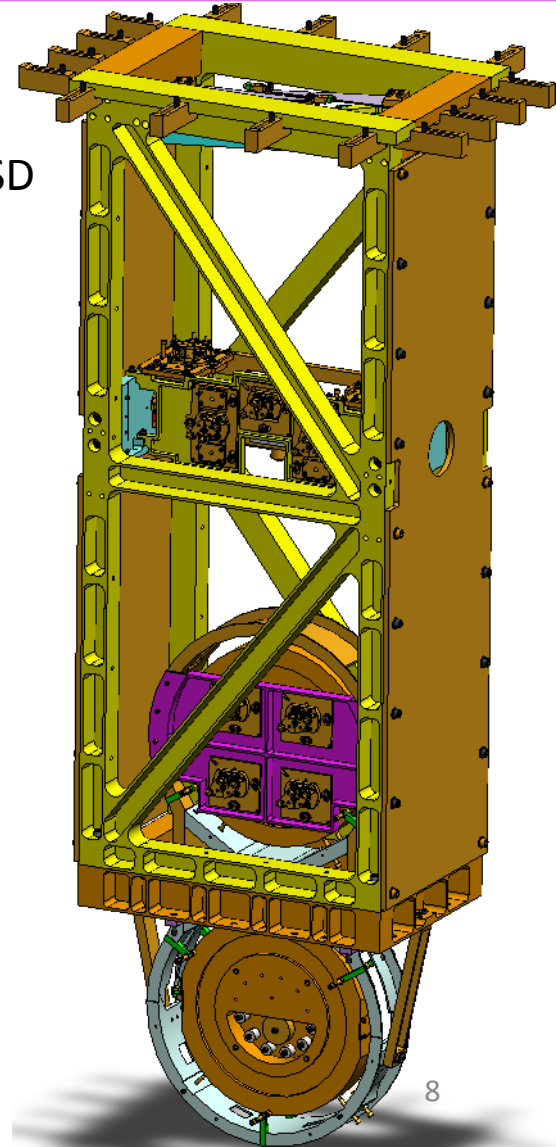
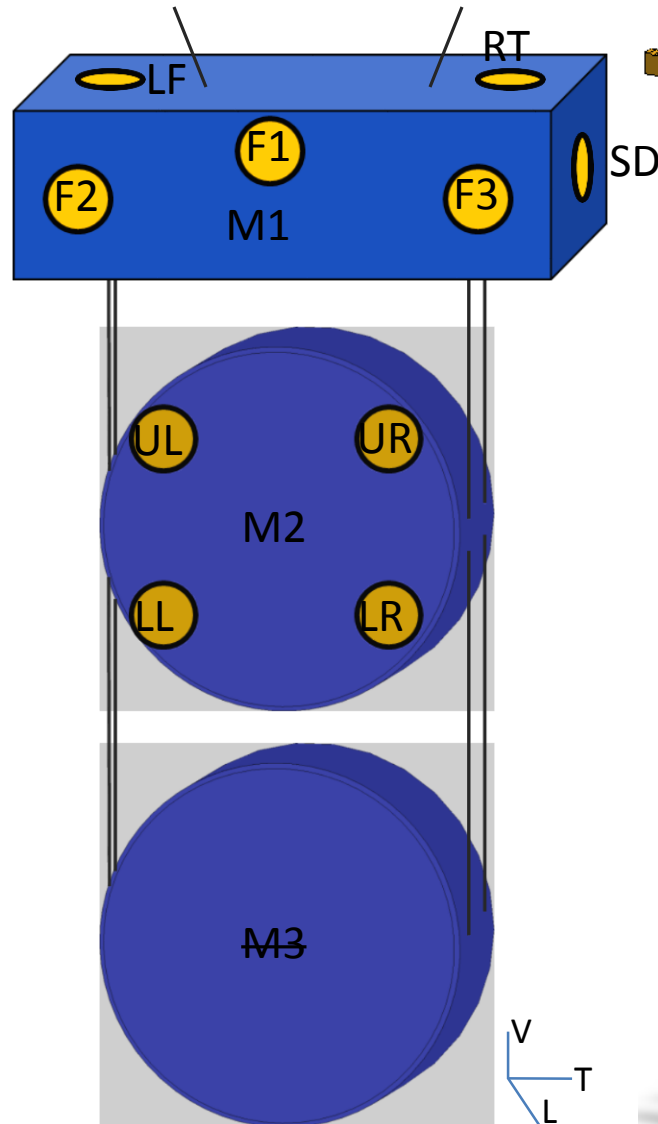
Sensors/Actuators

- ● BOSEMs at M1 and M2
- Optical levers and interferometric signals on M3

Naming: L1:SUS-FMX_M1...

Documentation

- Final design review - T080218
- Controls arrangement – E1100108



HAM Large Triple Suspension (HLTS)

Purpose

- PR3, SR3



Location

- HAM 2, 5, (8, 11)

Control

- Local – damping at M1
- Global – LSC & ASC at all 3

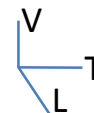
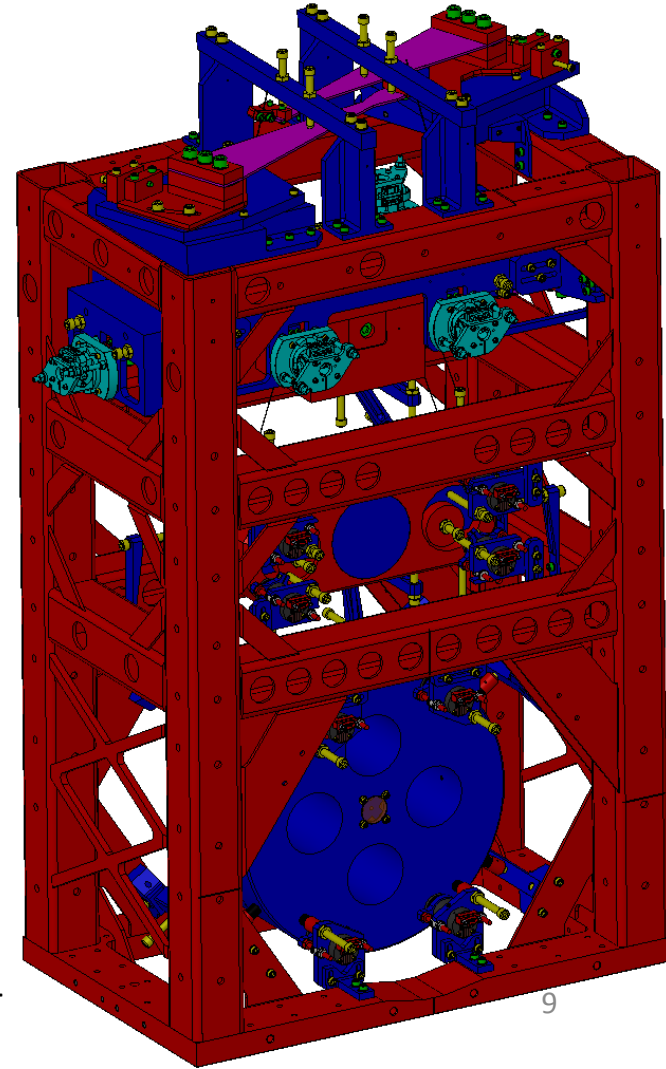
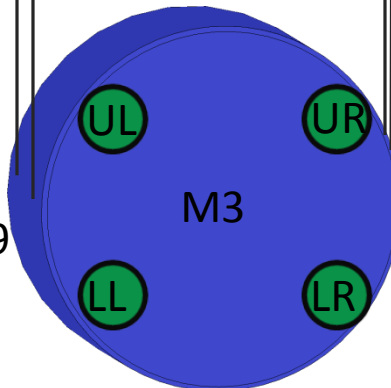
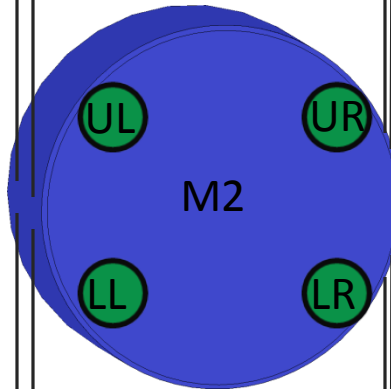
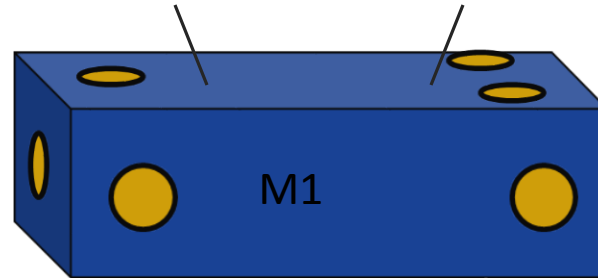
Sensors/Actuators

-  BOSEMs at M1
-  AOSEMs at M2 and M3
- Optical levers and interferometric signals on M3

Naming: L1:SUS-SR3_M1...

Documentation

- Final design review – T1000012
- Controls arrangement – E1100109



HAM Small Triple Suspension (HSTS)

Purpose

- PRM, PR2, SRM, SR2
- MC1, MC2, MC3



Location

- HAM 2, 3, 4, 5, (8, 9, 10, 11)

Control

- Local – damping at M1
- Global – LSC & ASC at all 3

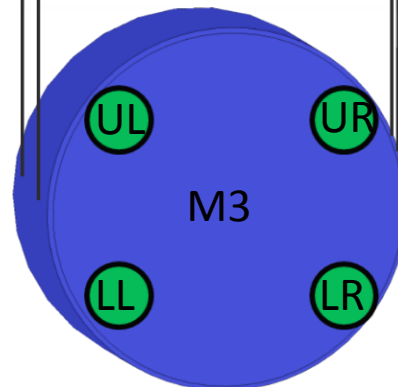
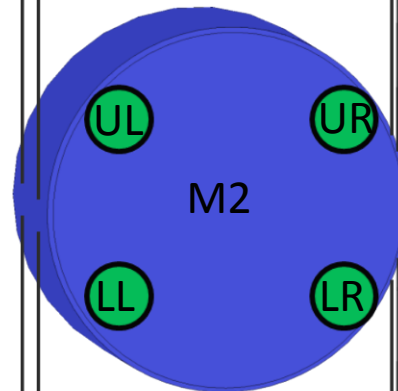
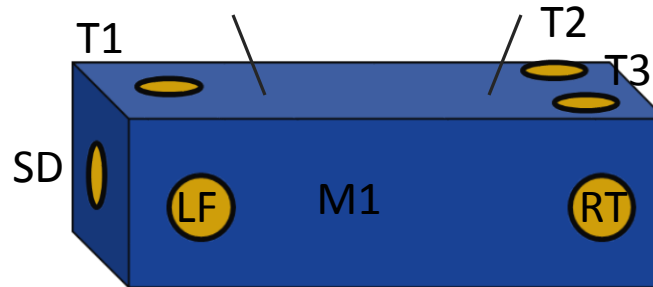
Sensors/Actuators

-  BOSEMs at M1
-  AOSEMs at M2 and M3
- Optical levers and interferometric signals on M3

Naming: L1:SUS-PRM_M1...

Documentation

- Final design review - T0900435
- Controls arrangement – E1100109



Output Mode Cleaner Double (OMCS)

Location

- HAM 6, (12)

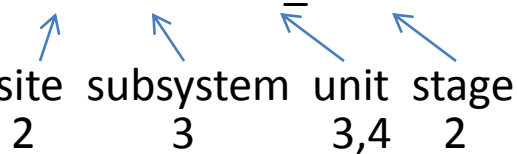
Control

- Local – damping at M1
(true for all SUS's)

Sensors/Actuators

-  BOSEMs at top mass

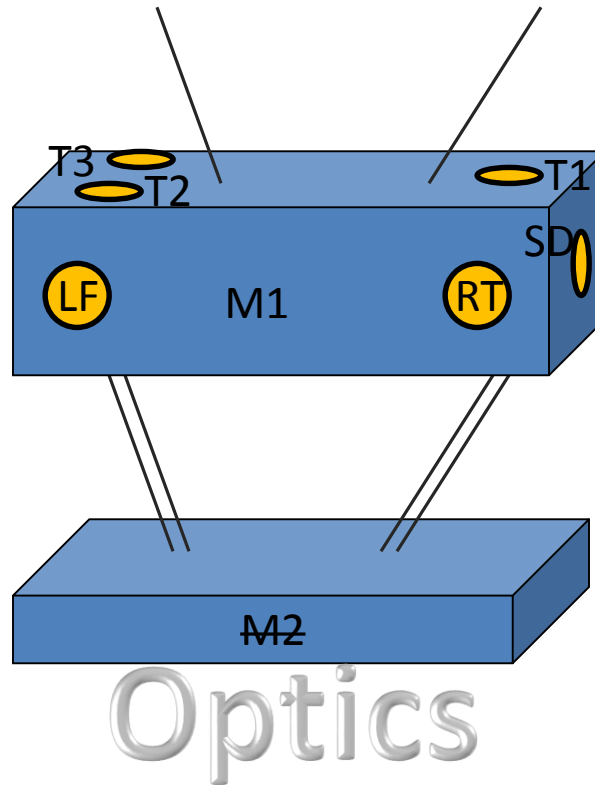
Top mass naming convention

- L1:SUS-OMC_M1...
- 

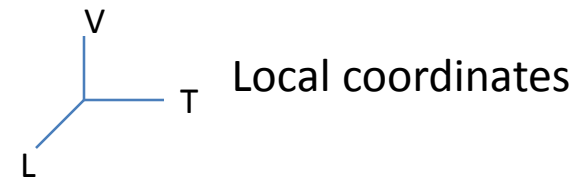
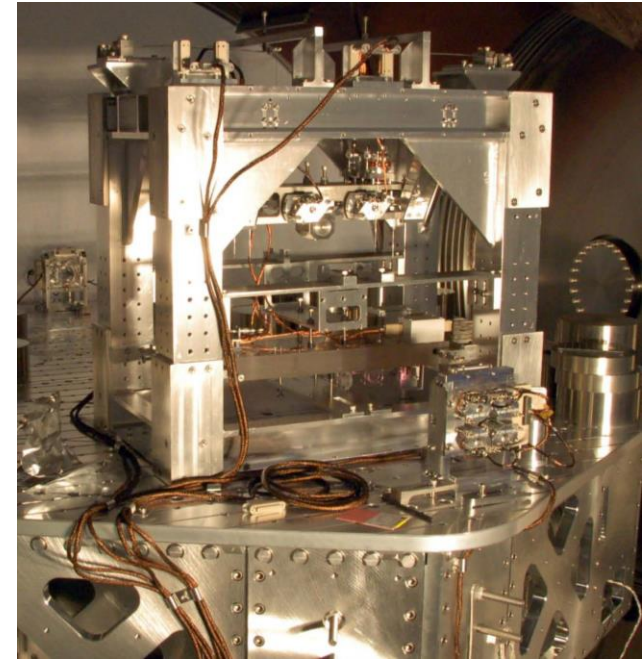
 site subsystem unit stage
 2 3 3,4 2

Documentation

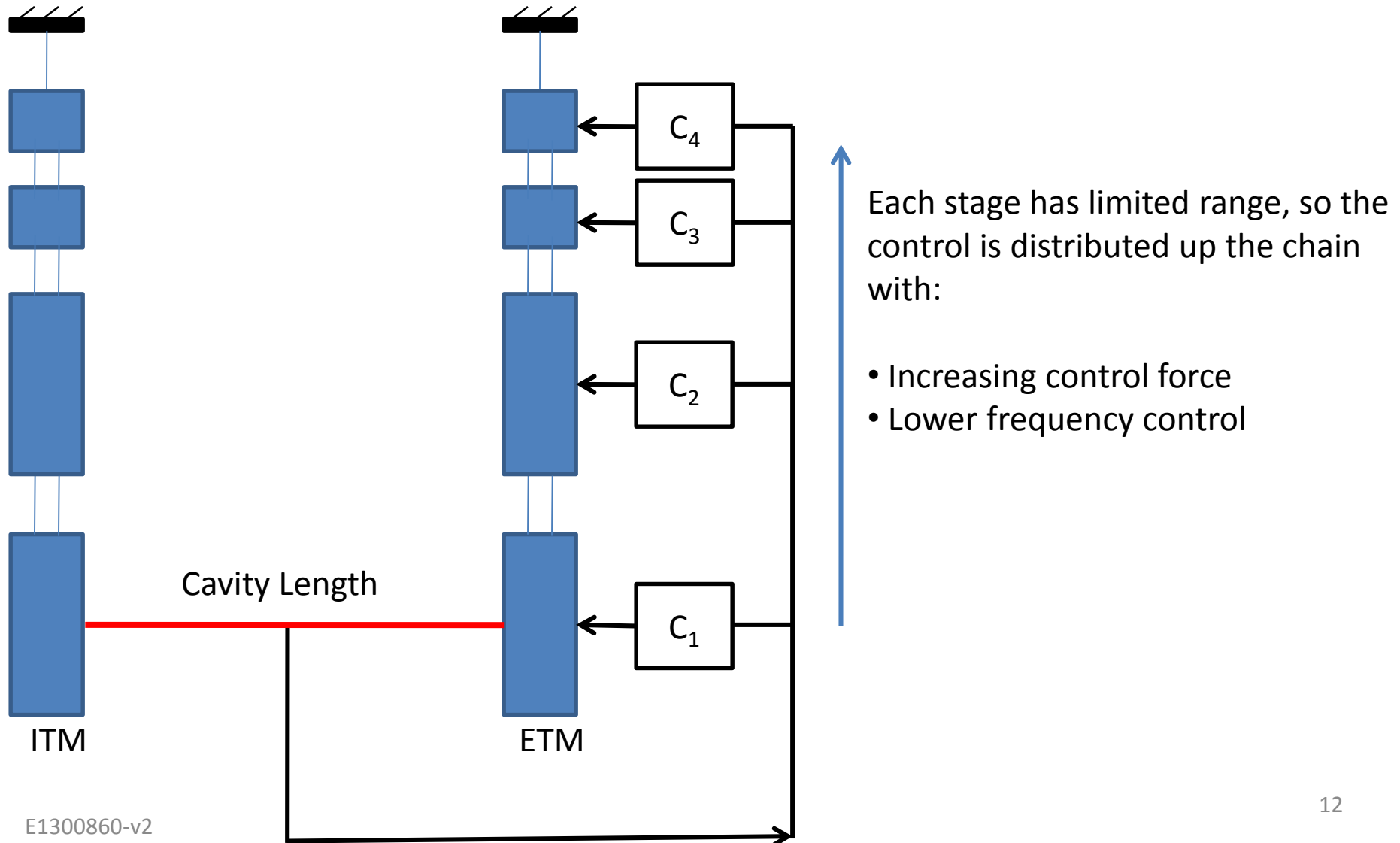
- Final design review - T0900060
- HAM SUS controls arrangement – E1100109



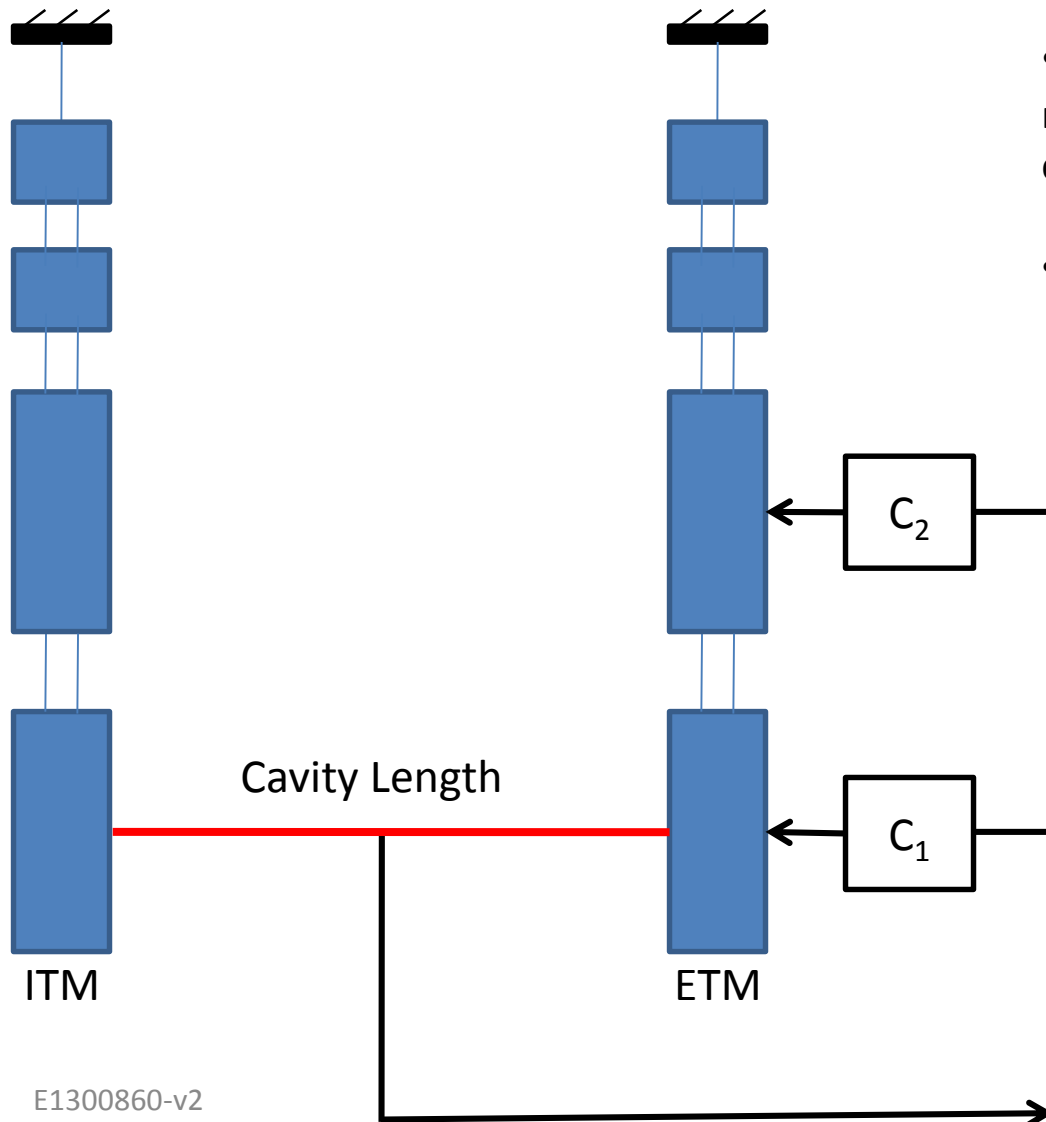
In use during S6



Global Cavity Control (LSC)

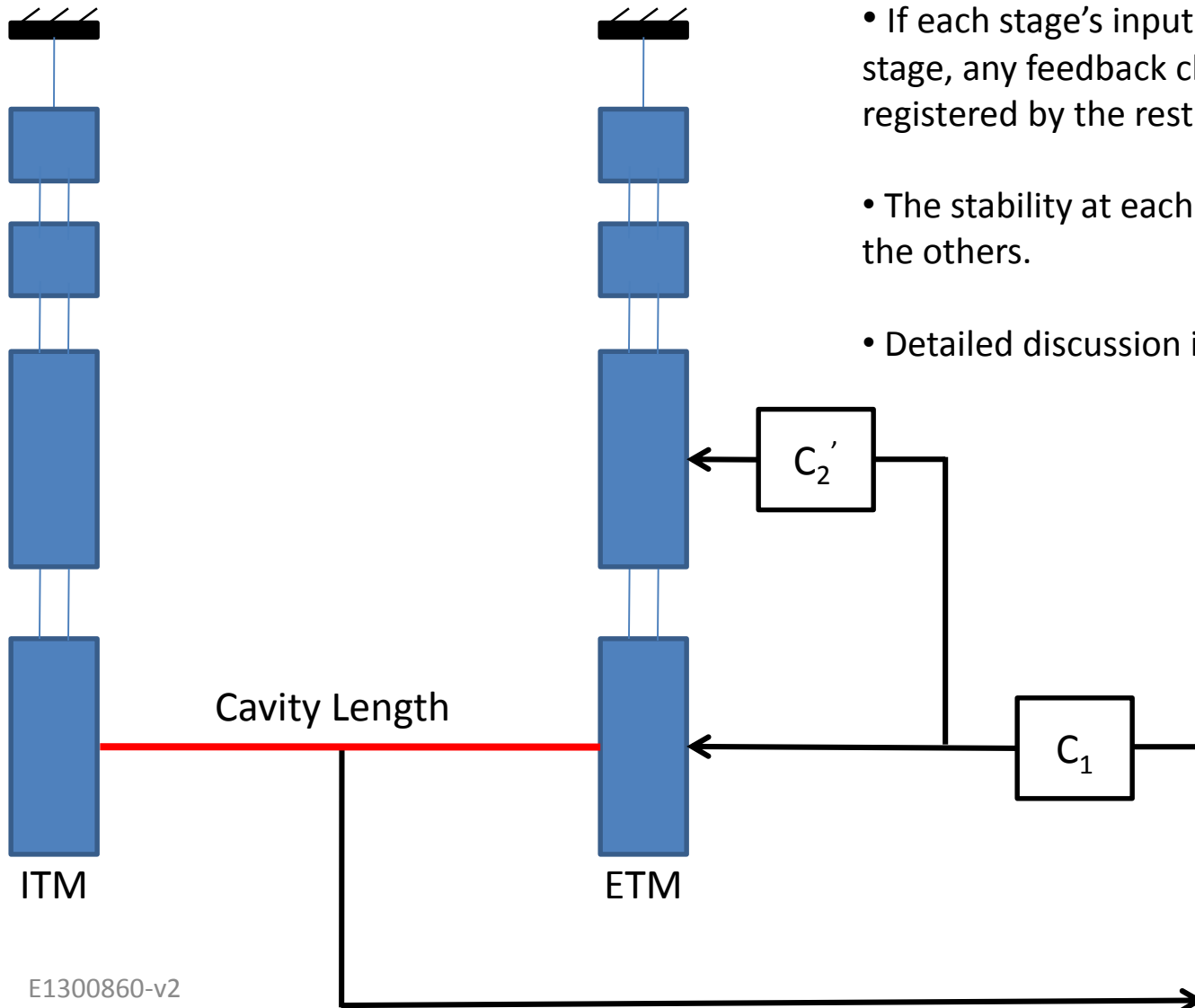


Parallel Control of Cavity Length



- With parallel feedback, changing one loop requires changing the others to account for changes in gain and stability.
- The stability of all stages are coupled

Hierarchical Control of Cavity Length



- If each stage's input is the output of the previous stage, any feedback change is automatically registered by the rest of the loop.
- The stability at each stage is independent from the others.
- Detailed discussion in T1000242 & G1200632.