E2e modeling of violin mode

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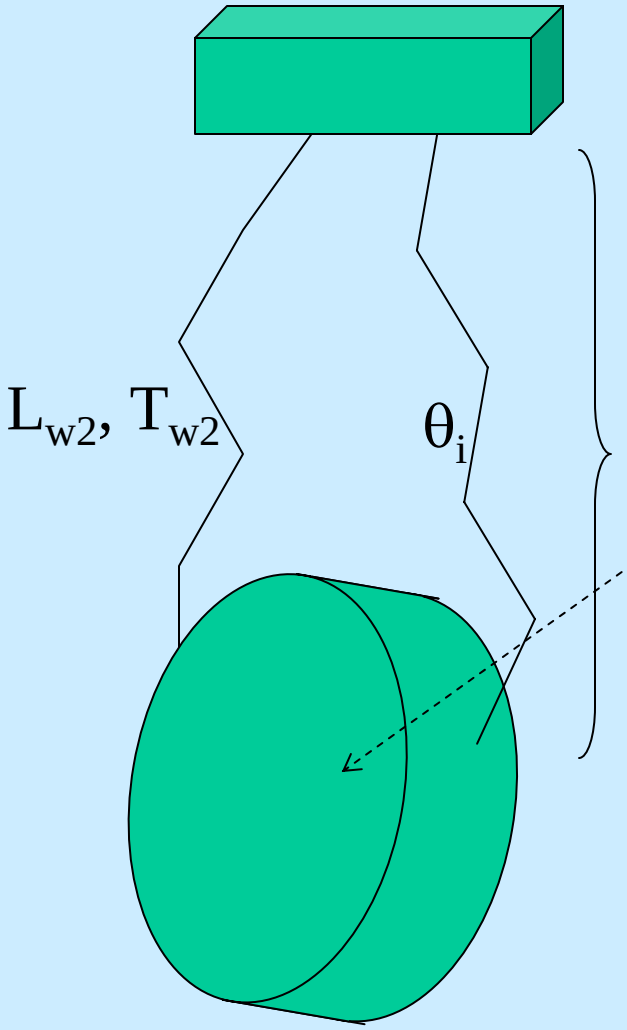
Caltech LIGO

NSF: PHYS-0354942

LLO

Violin model



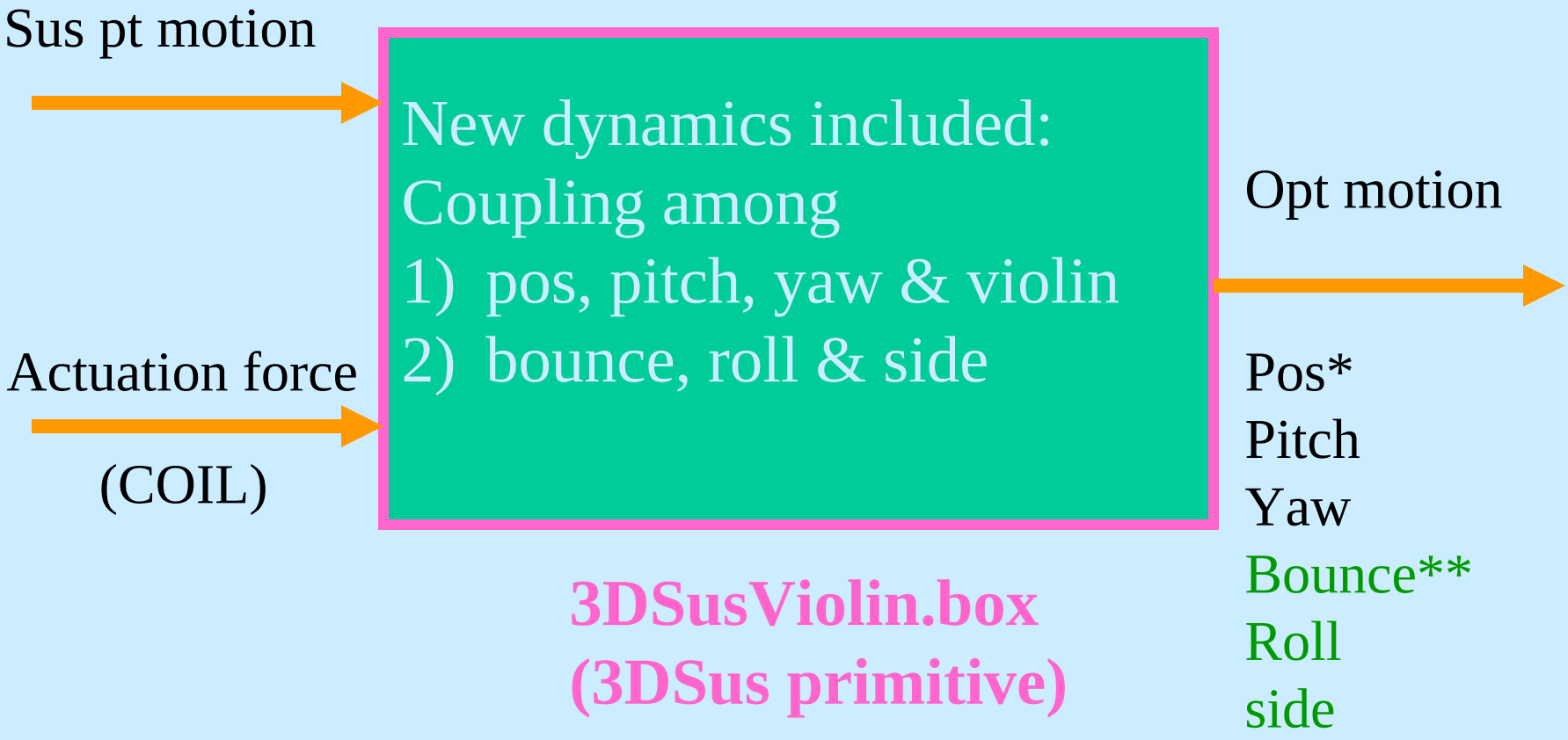
N oscillators (massless string + bob)

L_{w1}, T_{w1} (Wire length, tension)

Optic as final oscillator

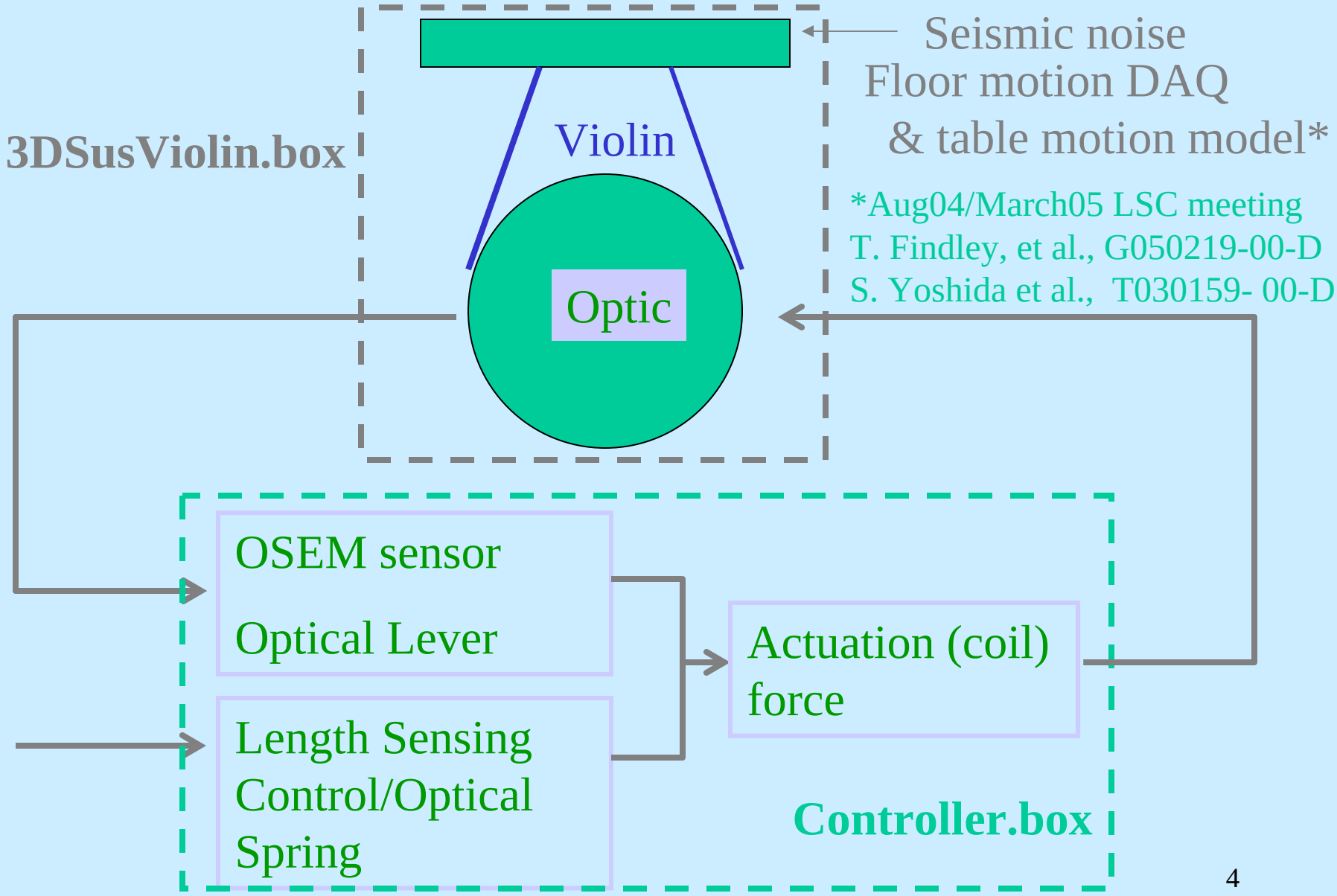
State Space representation (ABCD matrix)
V. Sannibale (LIGO I, Maple)
M. Barton (AdvLIGO, Mathematica)

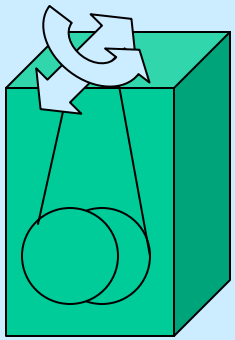
Two State Space boxes (LIGO I)



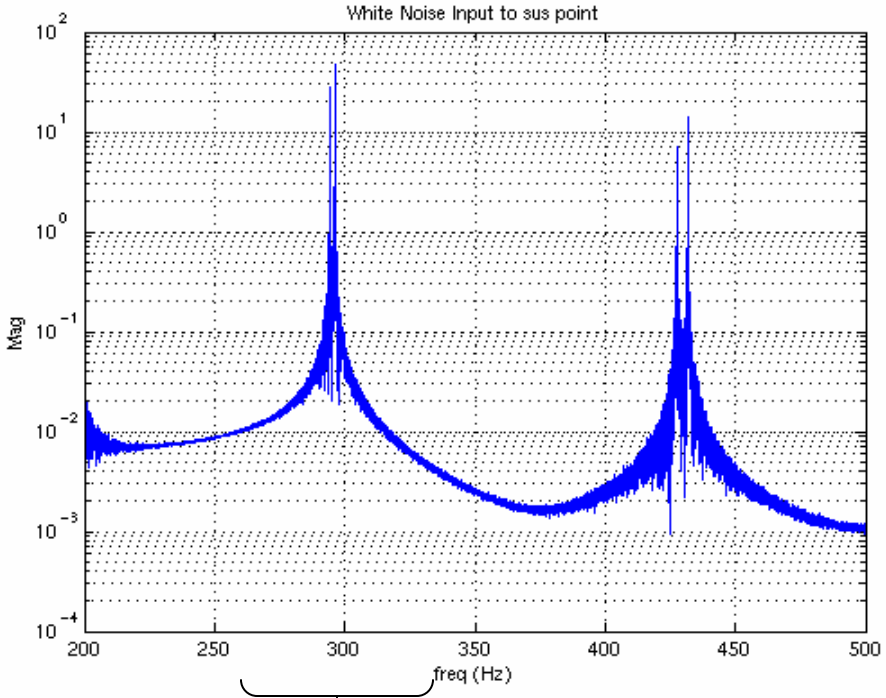
* Under testing, ** Will be added soon.

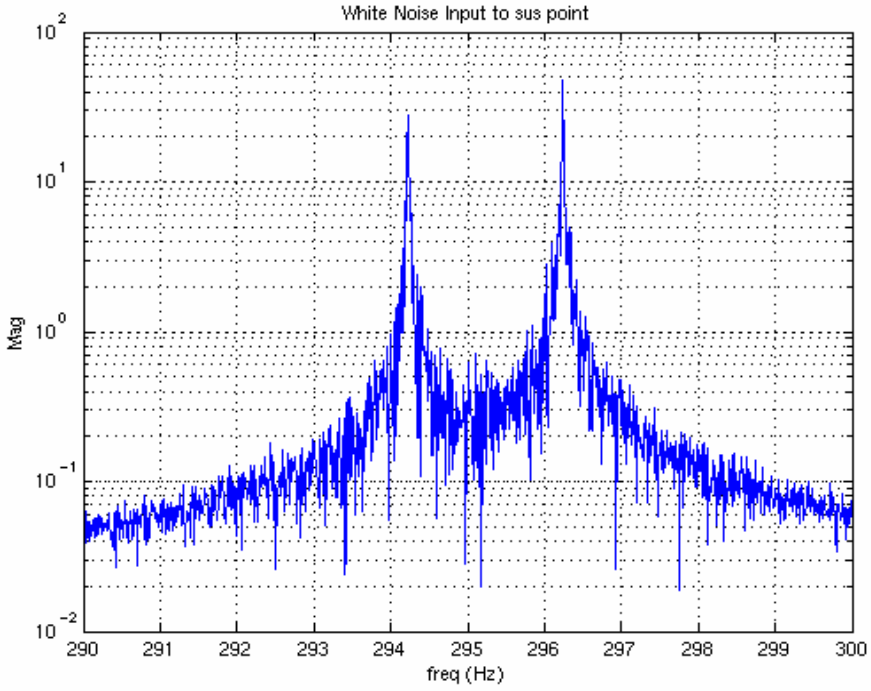
LOS/SOS violin.box



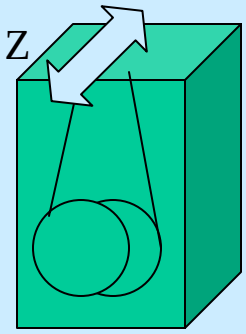


White Noise Input to sus point
(free hanging)





Split due to wire asymmetry

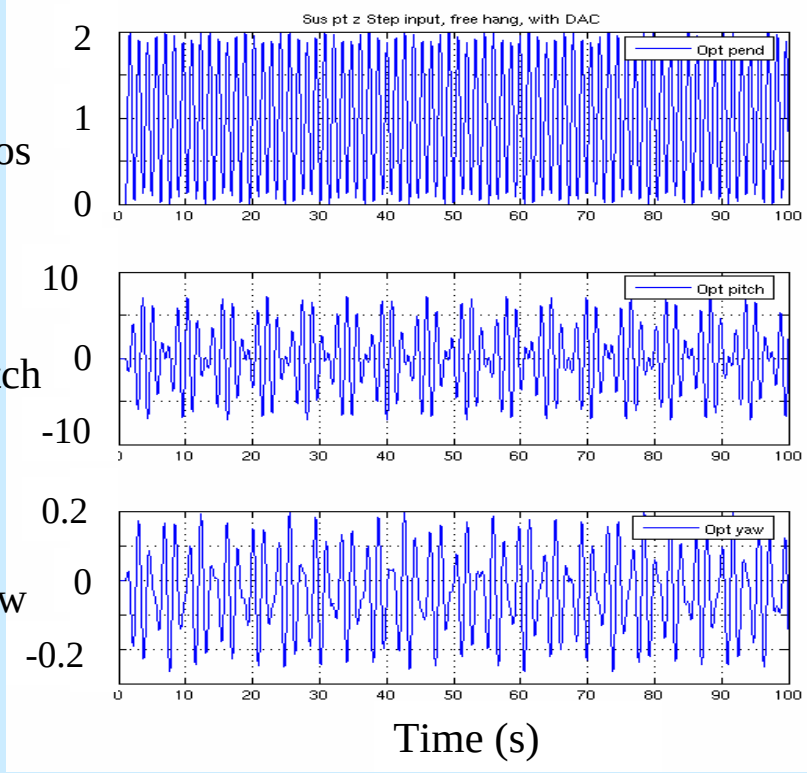


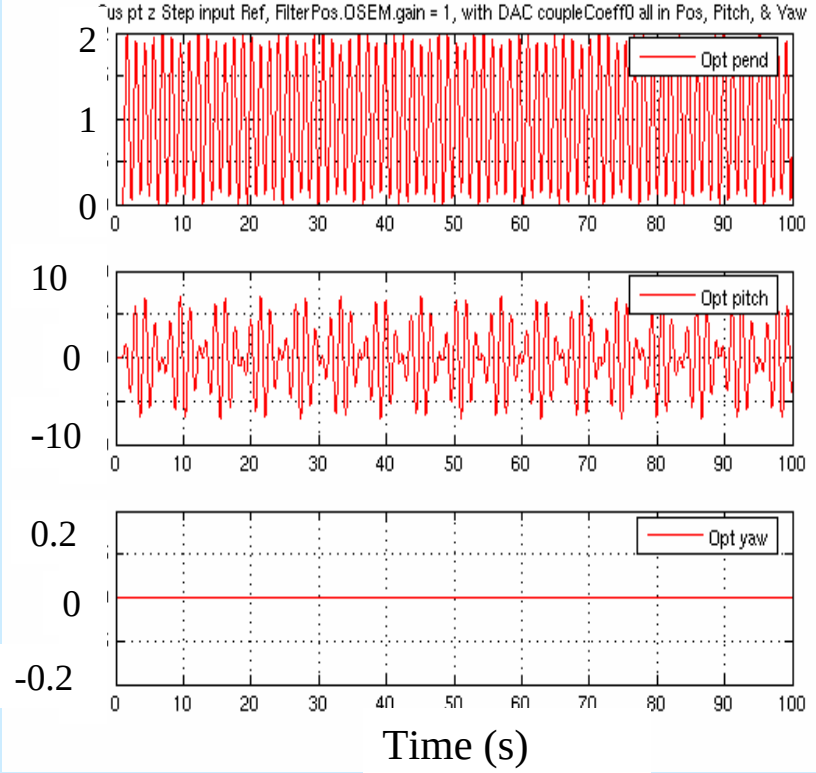
Step Input to sus point z (free hanging)

Z to Opt pos

Z to Opt pitch

Z to Opt yaw

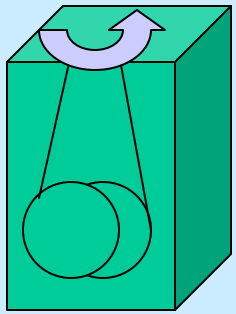




3DsusViolin.box

3Dsus primitive

Sus point z to Opt Yaw coupling: due to wire asymmetry

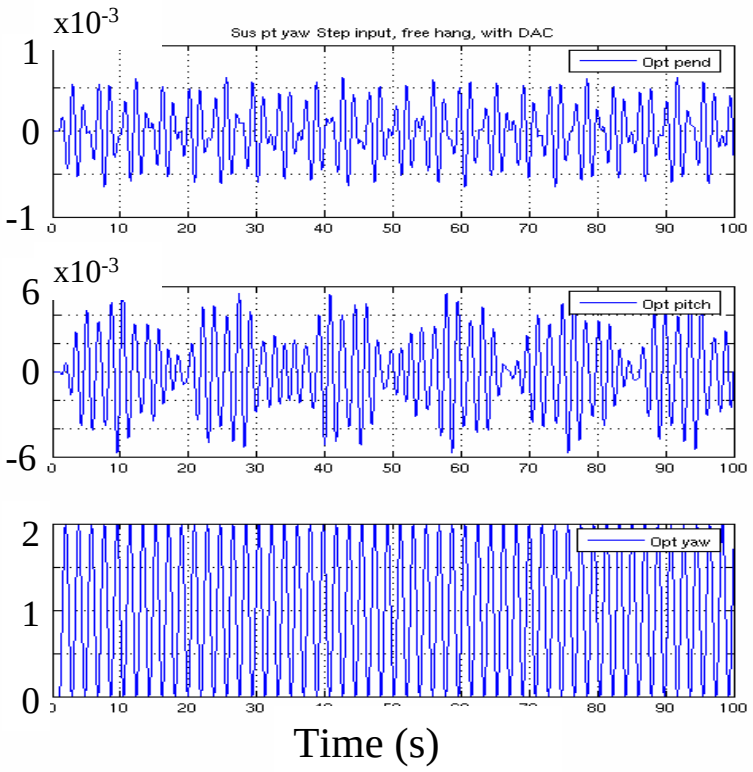


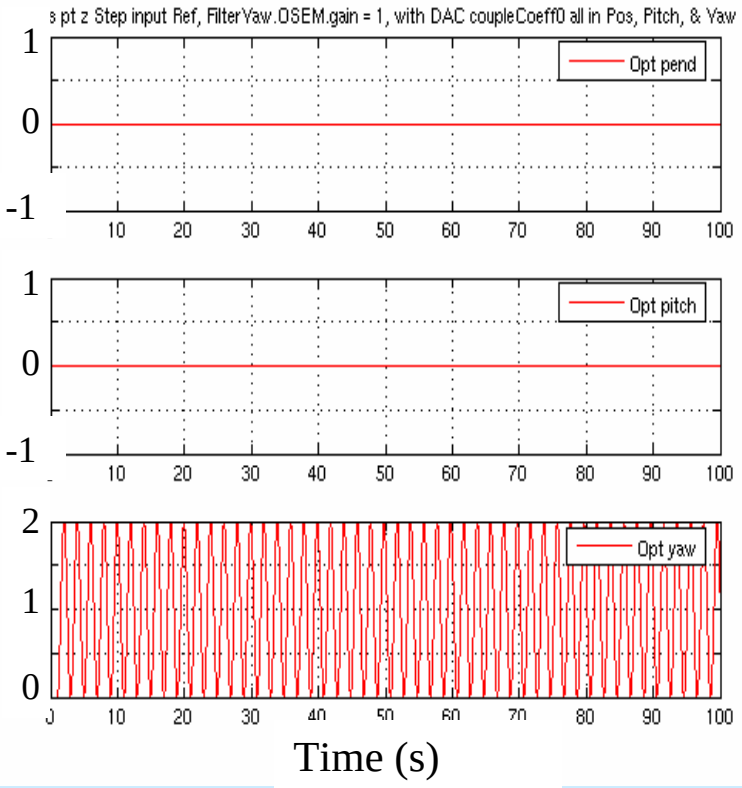
Step Input to sus point yaw (free hanging)

Yaw to Opt pos

Yaw to Opt pitch

Yaw to Opt yaw

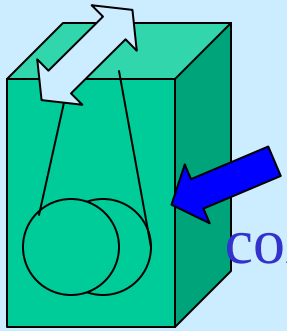




3Dsus_Violin.box

3Dsus primitive

Sus point Yaw to Opt Pos/Pitch coupling: due to wire asymmetry



Step Input to sus point z

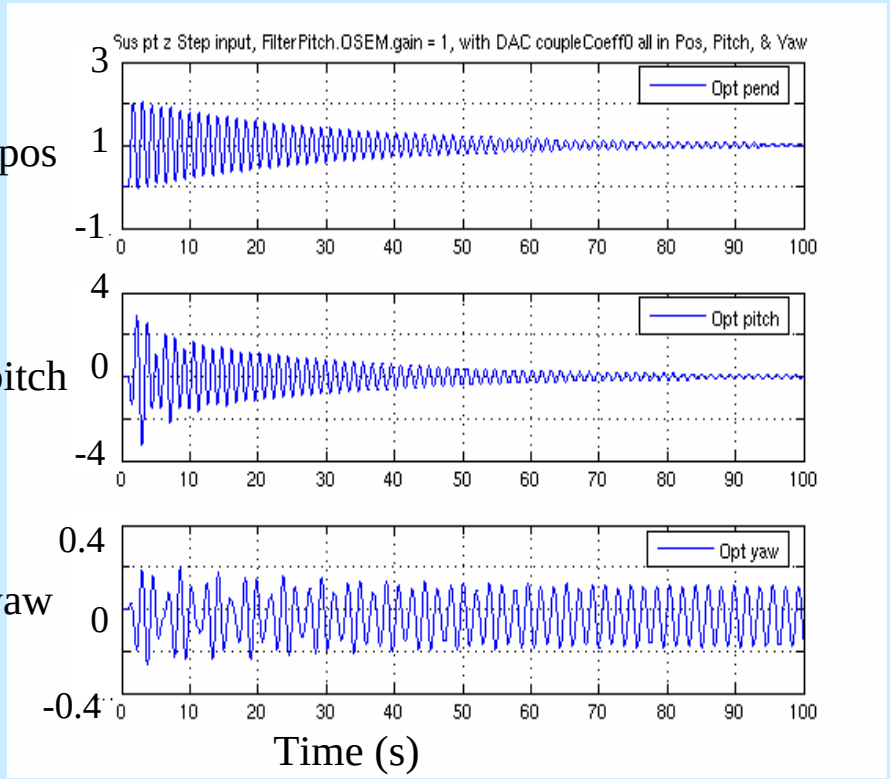
coil force (pitch local damp on)

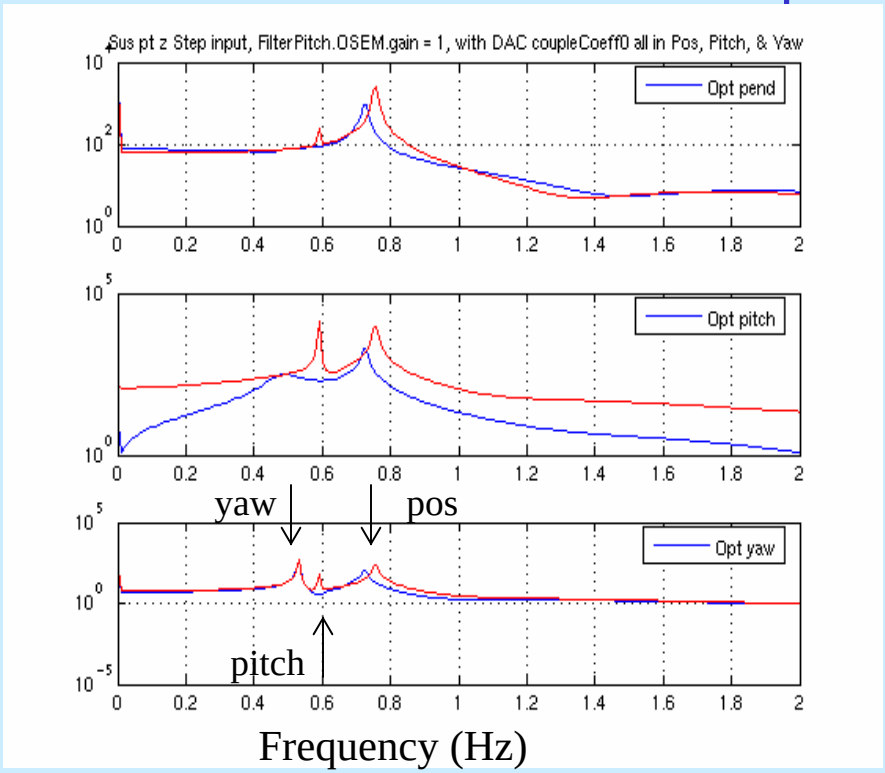
— Free hang
— Local-damped

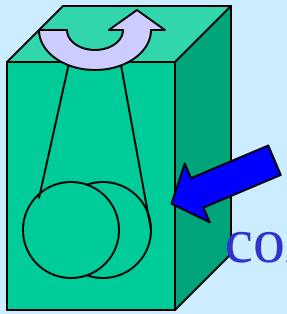
Z to Opt pos

Z to Opt pitch

Z to Opt yaw

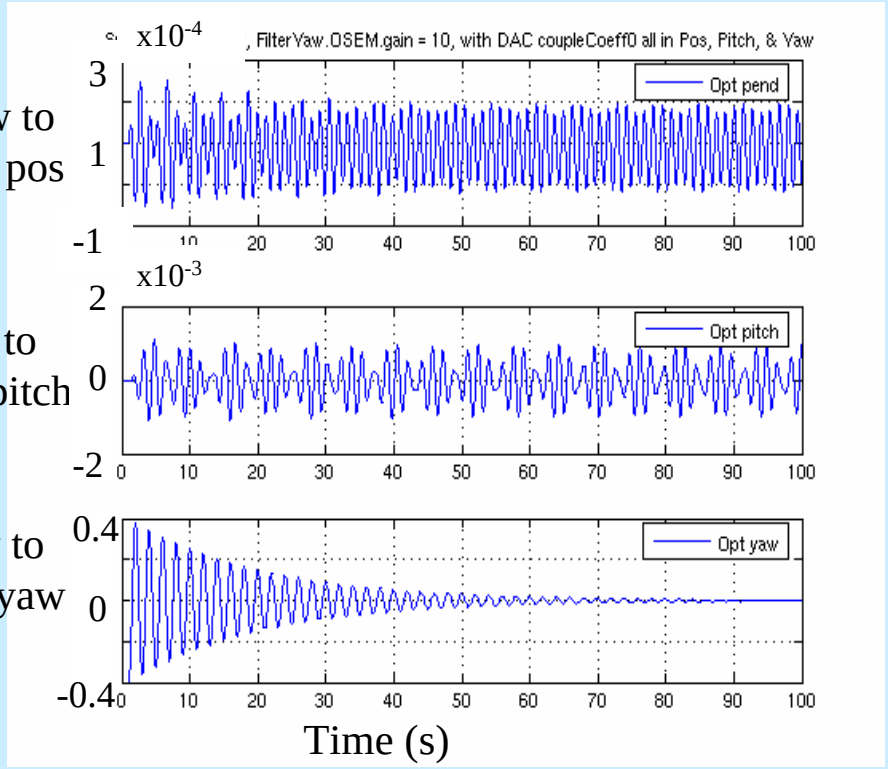


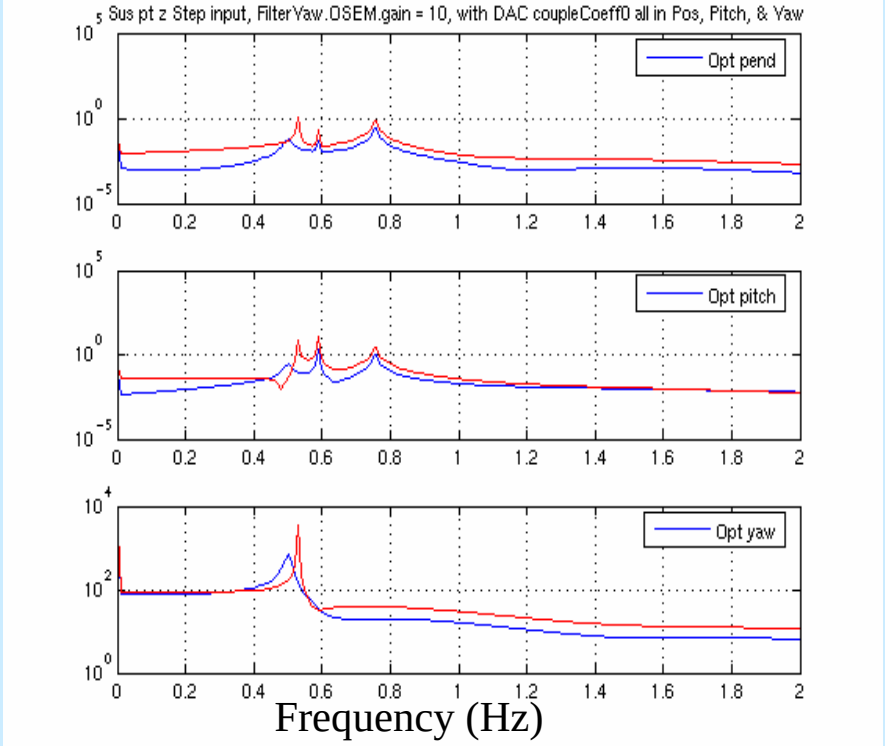




Step Input to sus point yaw (yaw local damp on)

— Free hang
— Local-damped





Plan for AdvLIGO

- HAM, BSC boxes
  stack models needed!

- Suspension (Mark Barton's model,
  6DOF x stages, + violin)
  numerical experiment of MC performance

- Detailed analysis
  location of suspension on HAM table