Study of Cylindrical Support Tube

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Boundary conditions;

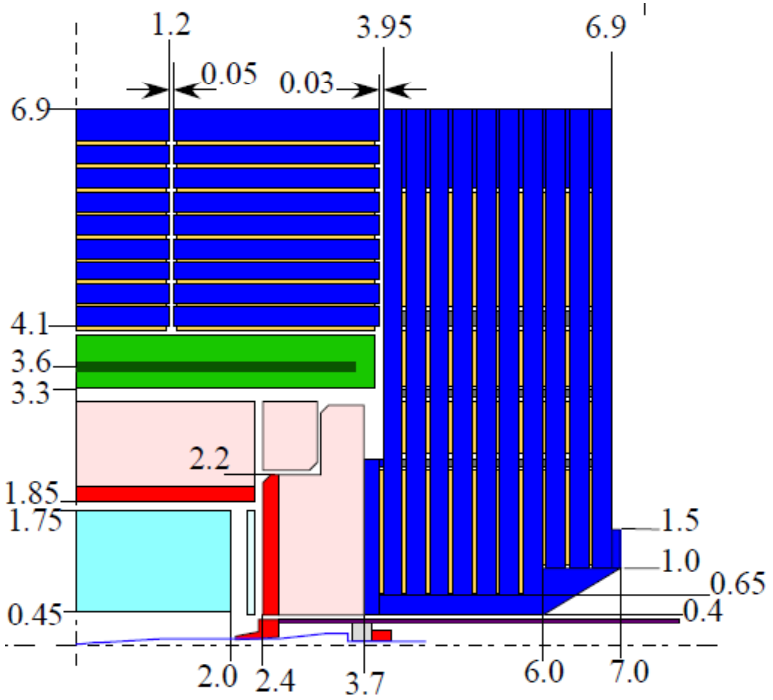
- Size?
  0.75m-dia x 6m-long?

- Allowable amplitude?
  A few-mm for static load.
  2nm? 50nm? for ground motion.

- Support conf.?
  Cantilever or support at E.Y.
  or should be connected both tubes for relative motion?

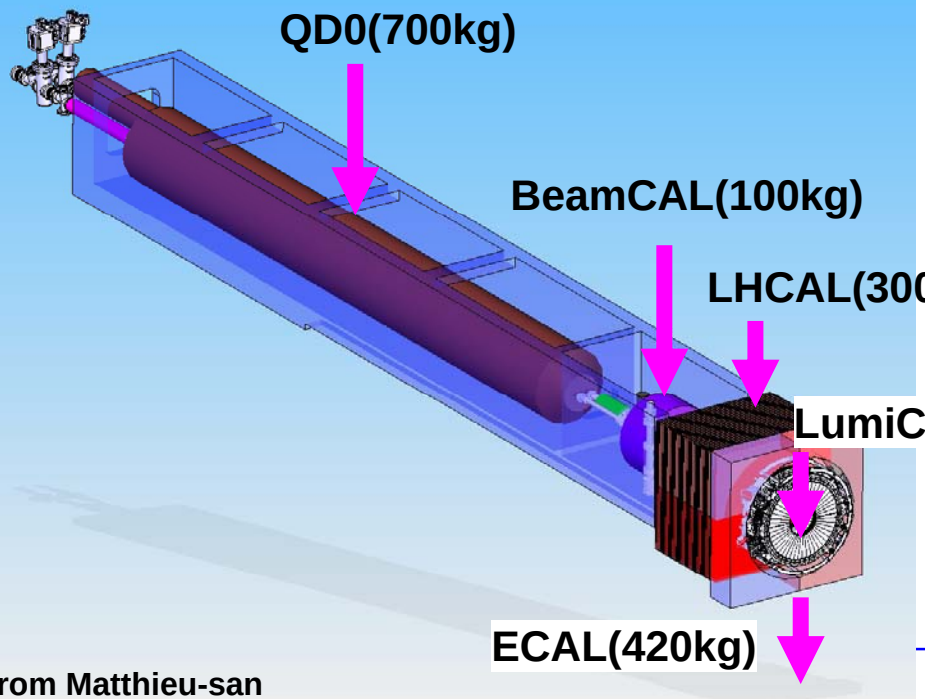
- Material of support tube.
  CFRP, Tungsten or others?
  Find the minimum amplitude.

- Load conditions.
  ??

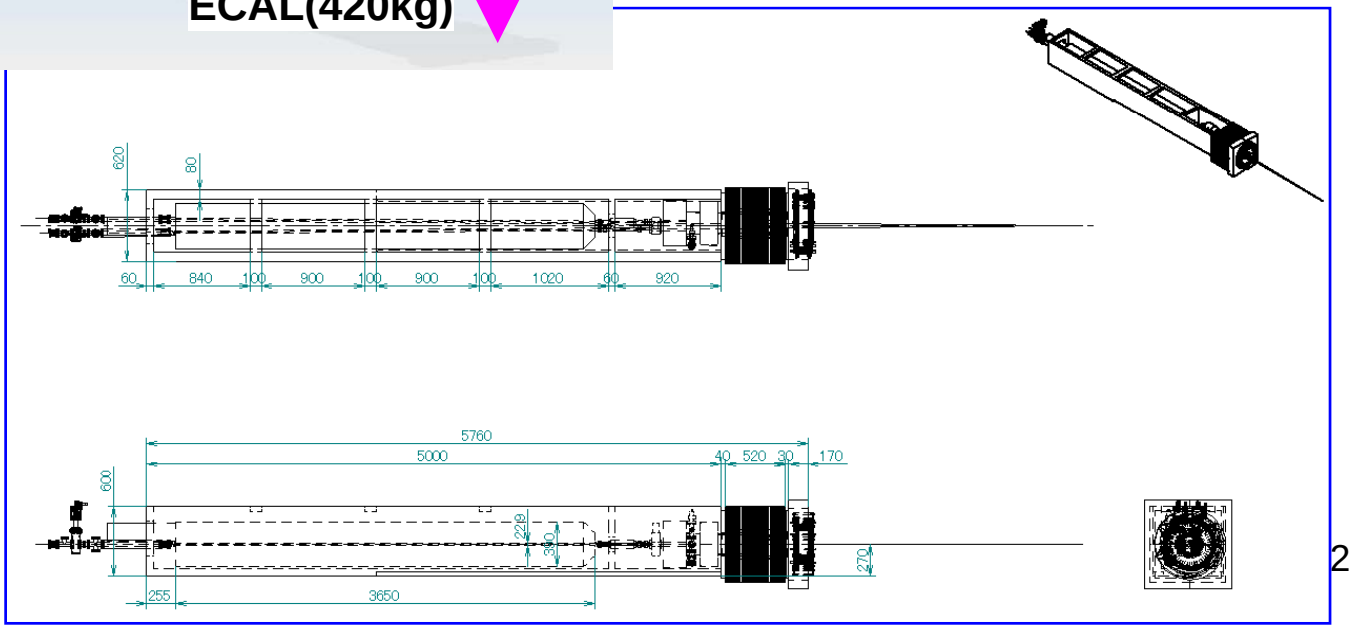


From Matthieu-san,
Characteristics of the different components I used :
- QD0 weight : 700Kg
- LHCal (40 layers of 1 cm W + 2mm Si) : about 3000Kg
- LumiCal : 250Kg
- BeamCal : 100Kg
- ECal ring : 420kg

Square Support Tube

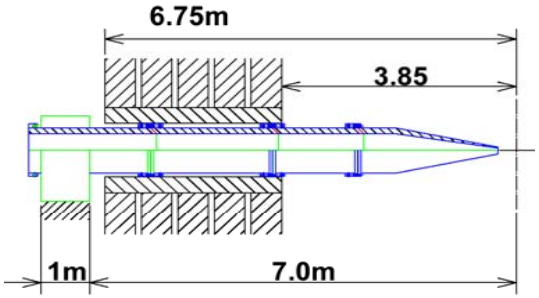


From Matthieu-san

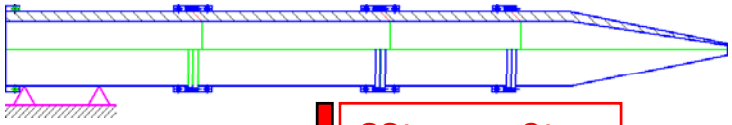


Support tube study for GLD (2005)

Summary of calculations

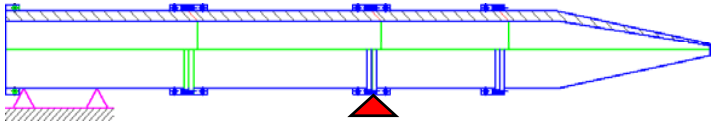


(Model-1A)



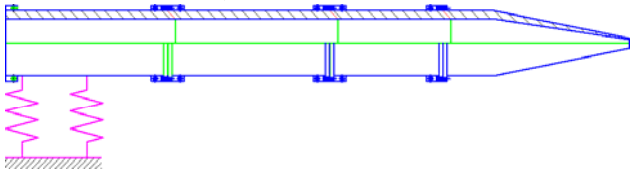
32tons + 9ton

(Model-2A)

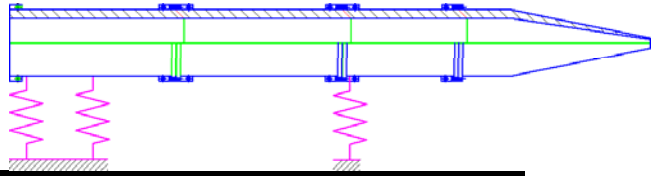


Tungsten(100mm-thick)

(Model-1B)



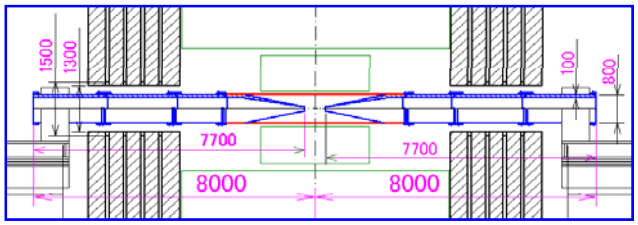
(Model-2B)



		Model-1A	Model1-B	Model-2A	Model-2B
Deformation(mm)		1.6	-	0.09	-
Stress(MPa)		23	-	5	-
Natural frequency(Hz) (Vertical)	1st mode	17	15	71	15
	2nd Mode	81	38	179	54
	3rd mode	173	105	202	93
Harmonic response(nm) @QC1		8.0	8.0	0.2	6.0
Spectrum analysis(nm^2/Hz) @QC1	1st mode	6.5	2.0	4.3	2.7
	2nd Mode	-1.7	1.1	0.2	0.2
	3rd mode	-0.4	0.1	1.9	0.002

Support tube study for GLD (2005)

Calculation of relative amplitude

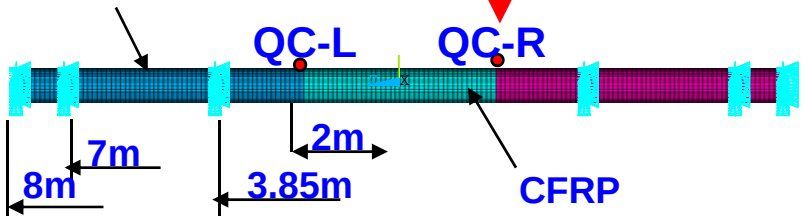


(Model-A)

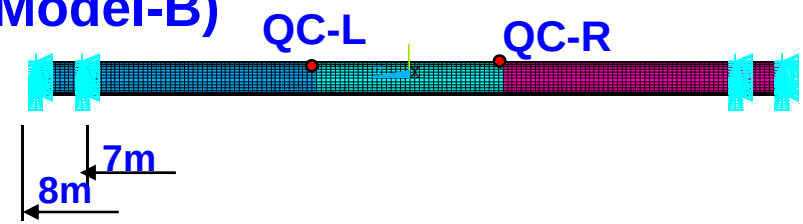
$F_0\cos(\omega t)=(m \cdot a)\sin(\omega t)$

QC-L: Tungsten(100mm)

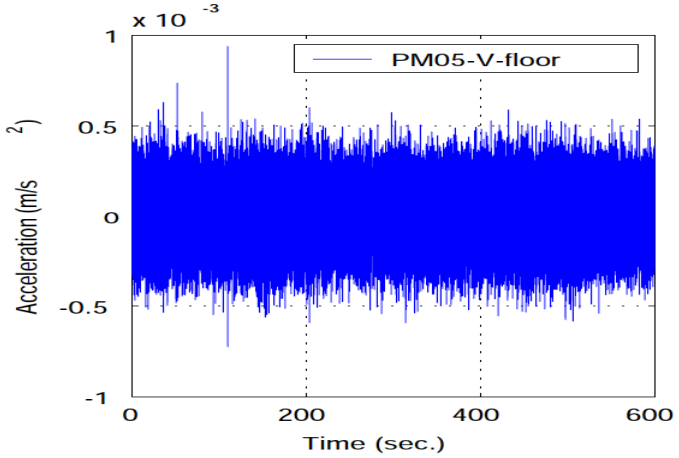
$\omega = 0 - 1000$Hz



(Model-B)

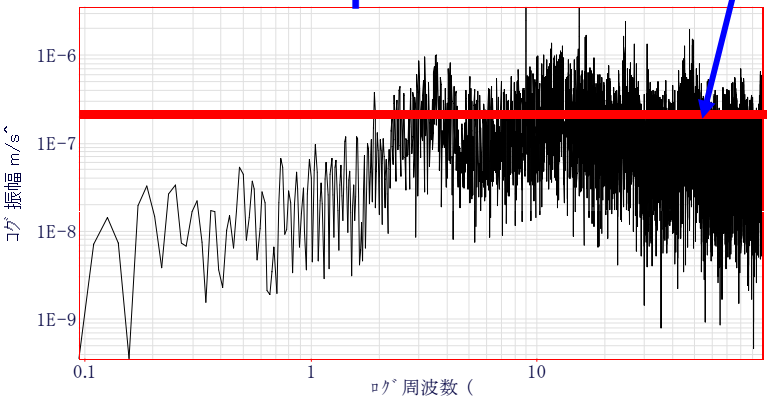


Data: Vertical @KEK: ATF(17:00 Feb. 10, 2004)



Linear Spectrum

2×10^{-7}m/s^2



Input Acc. = 2×10^{-7}m/s^2

Mass=90tons/9.8[m/s^2]

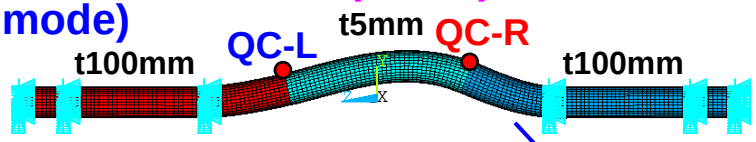
Self weight

How much is relative amplitude?

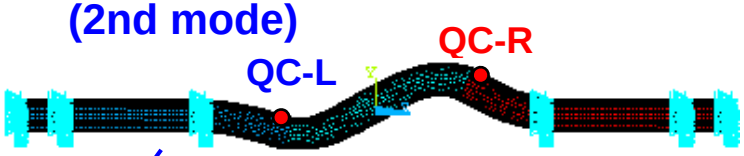
Support tube study for GLD (2005)

In case of 100mm-5mm(CFRP)-100mm

(1st mode)



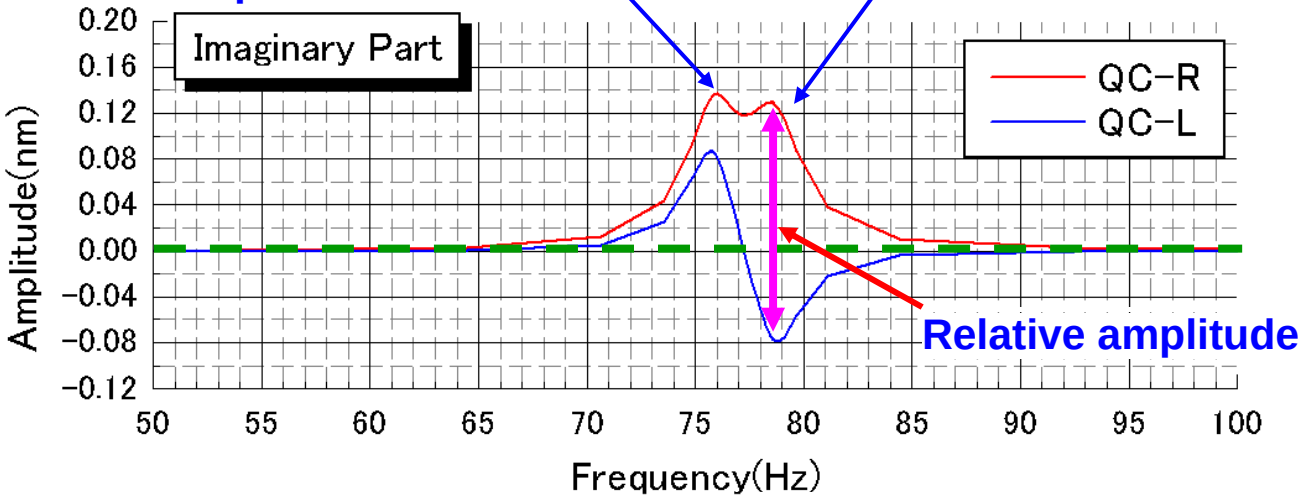
(2nd mode)

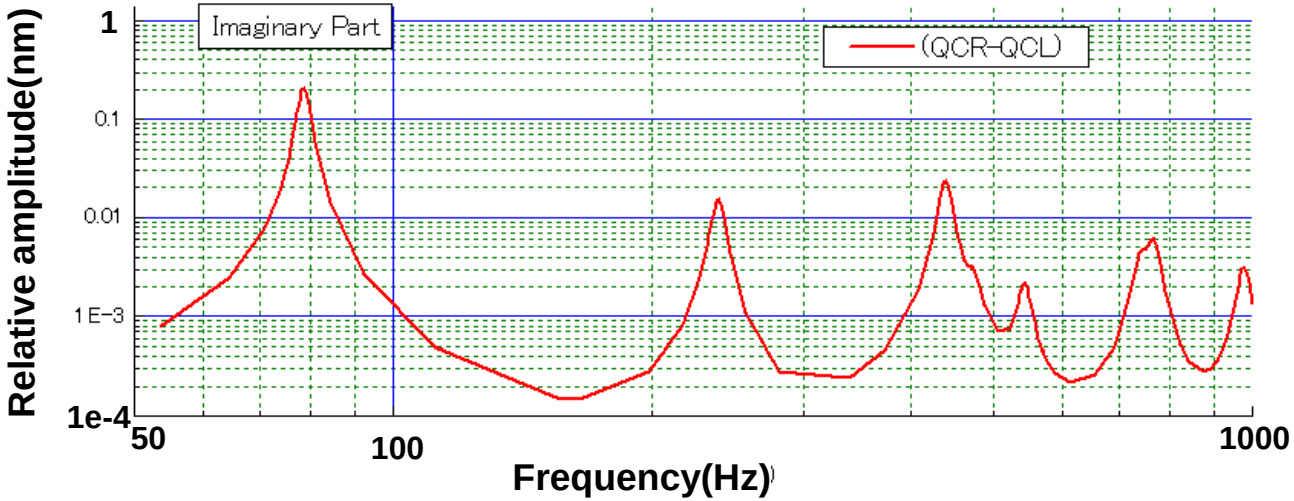


Same phase

Opposite phase

Relative amplitude

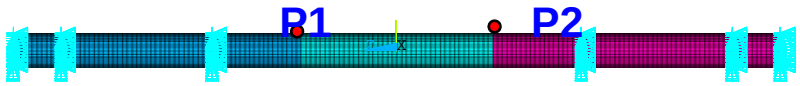




Support tube study for GLD (2005)

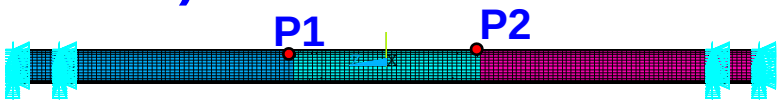
Results

(Model-A)



- Natural frequency: 76Hz
- Relative amp. : 0.2nm max. < 2nm

(Model-B)



- Natural frequency: 17Hz,
- Relative amp. : 2～3nm

→Study of the cylindrical support tube has just begun.

- Square? Cylinder?
- CFRP? or Other materials?
- Support configuration.