

Study of Cylindrical Support Tube

July 29, '08
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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?

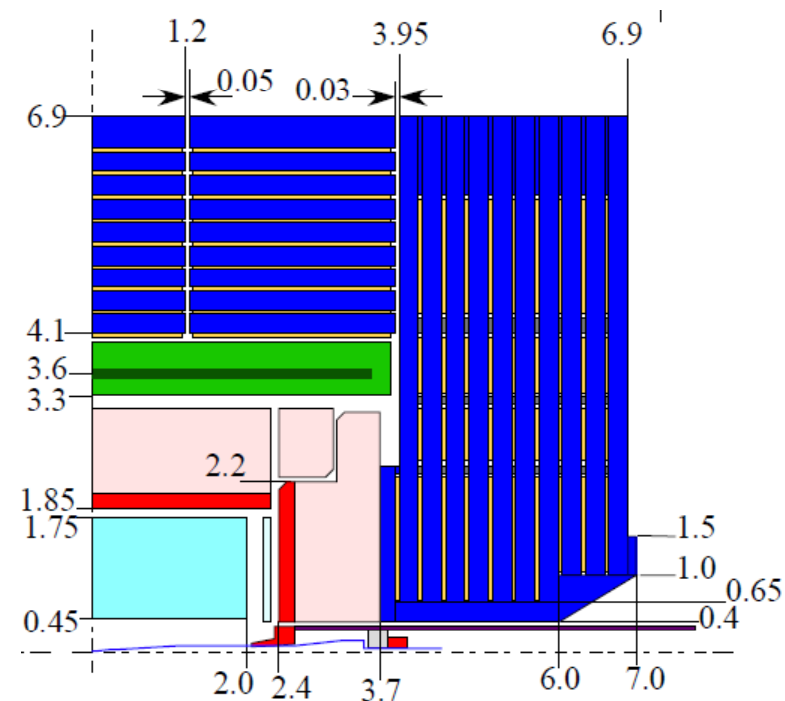
- Material of support tube.

CFRP, Tungsten or others?

Find the minimum amplitude.

- Load conditions.

??

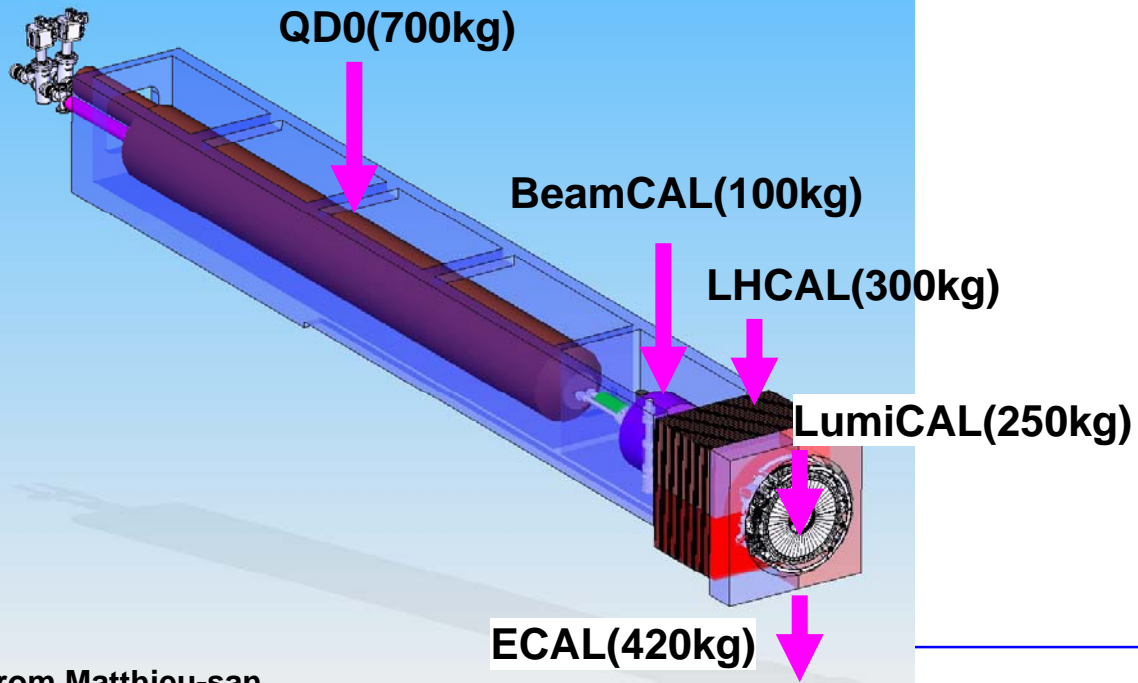


From Matthieu-san,

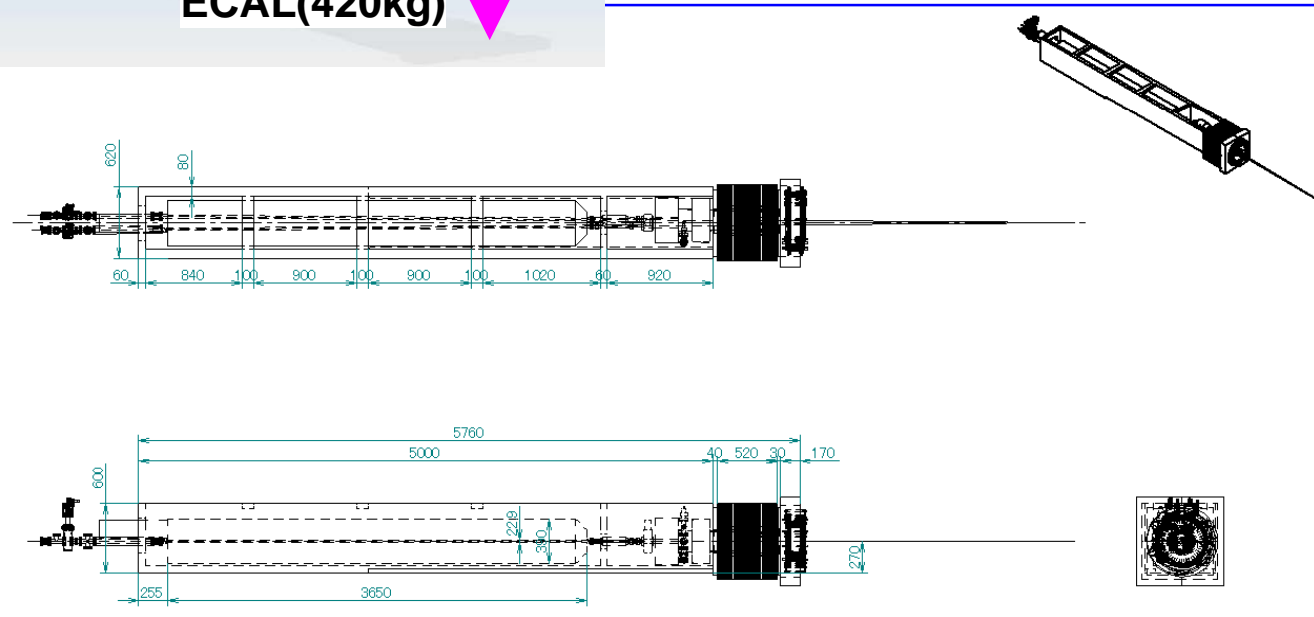
Characteristics of the different components I used :

- QD0 weight : 700Kg
- LHCAL (40 layers of 1 cm W + 2mm Si) : about 3000Kg
- LumiCal : 250Kg
- BeamCal : 100Kg
- ECal ring : 420kg

Square Support Tube

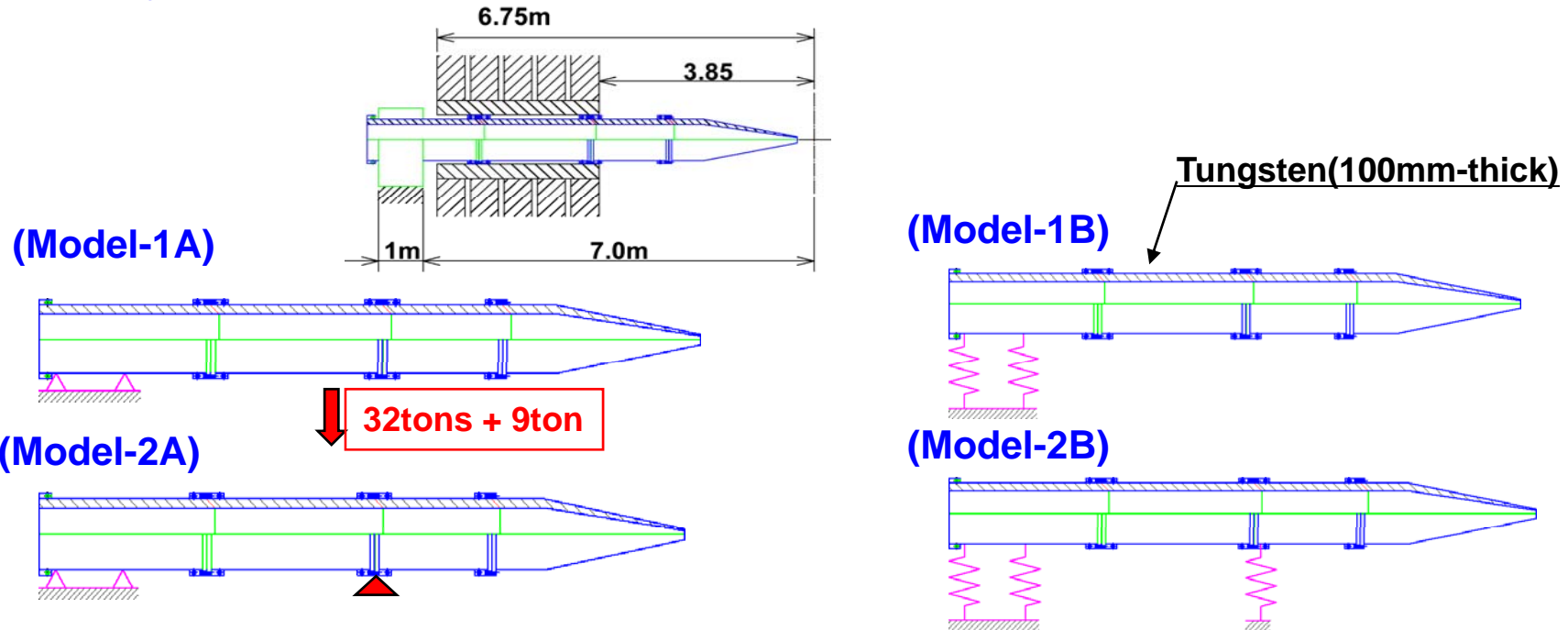


From Matthieu-san



Support tube study for GLD (2005)

Summary of calculations



		Model-1A	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)

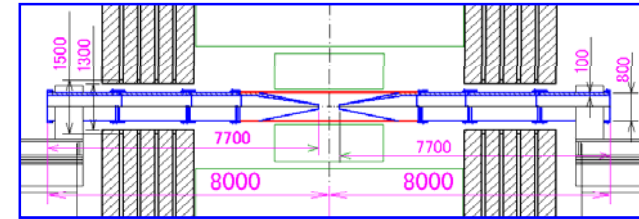
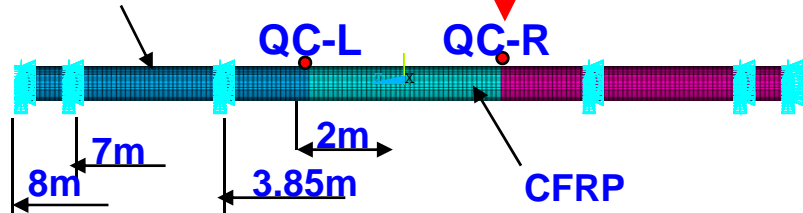
Calculation of relative amplitude

(Model-A)

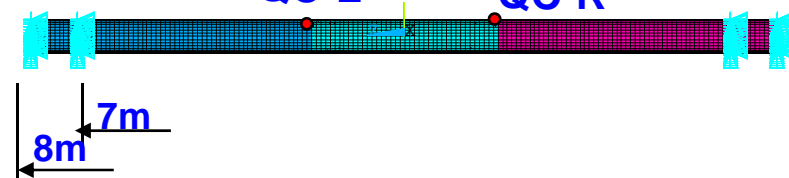
$$F_0 \cos(\omega t) = (m \cdot a) \sin(\omega t)$$

QC-L: Tungsten(100mm)

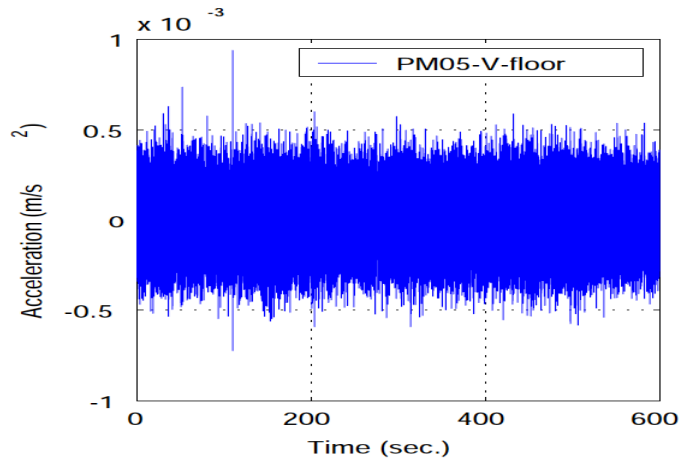
$\omega = 0 - 1000\text{Hz}$



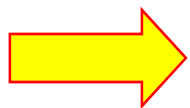
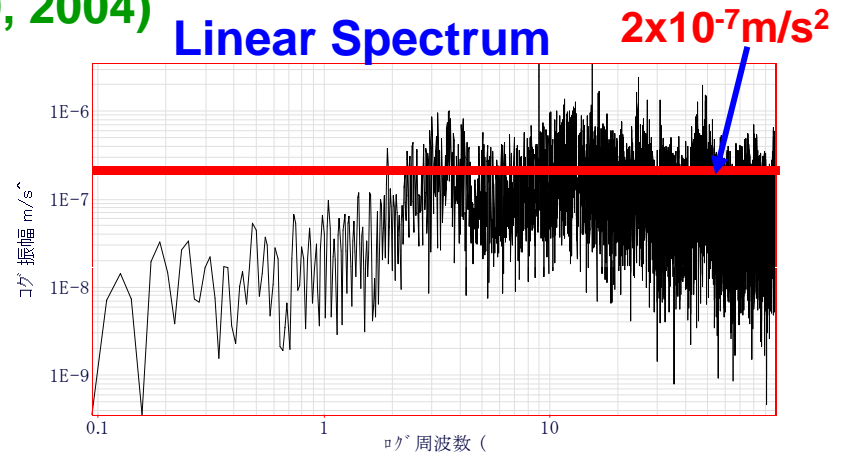
(Model-B)



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

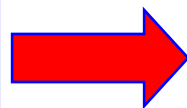


Linear Spectrum



Input Acc. = $2 \times 10^{-7} \text{m/s}^2$
 Mass = $90 \text{tons} / 9.8 [\text{m/s}^2]$

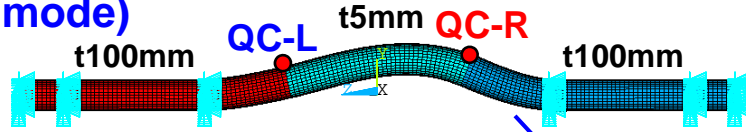
Self weight



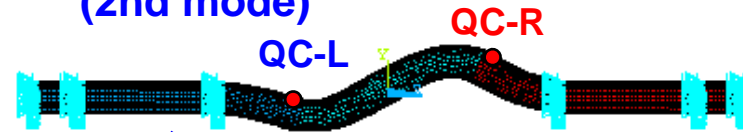
How much is relative amplitude?

Support tube study for GLD (2005)

In case of 100mm-5mm(CFRP)-100mm
(1st mode)



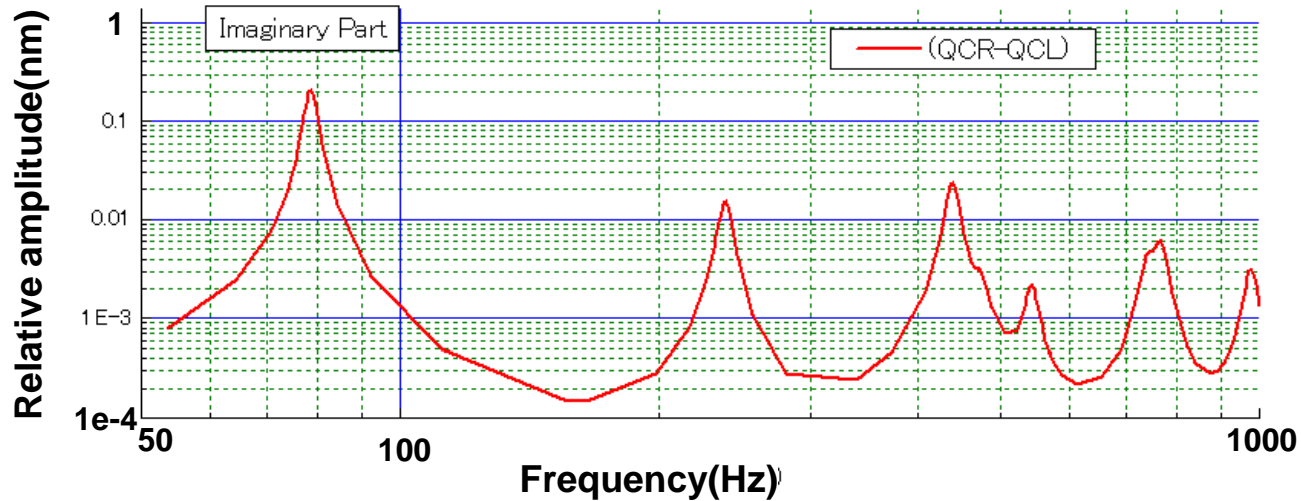
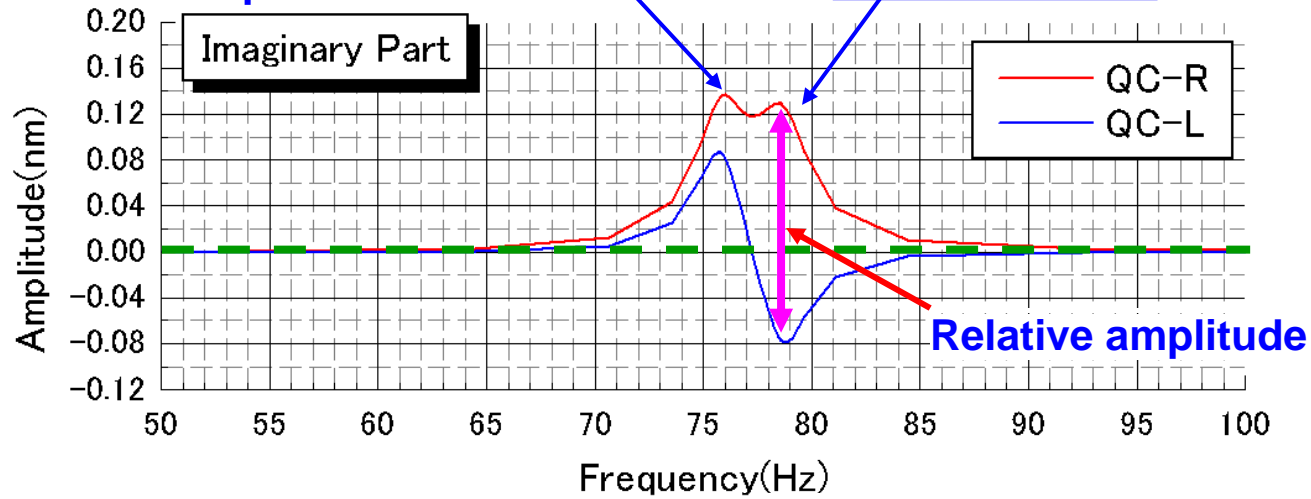
(2nd mode)



Relative amplitude

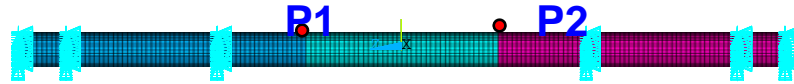
Same phase

Opposite phase



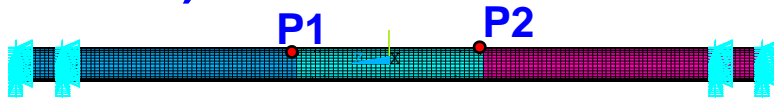
Results

(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.