

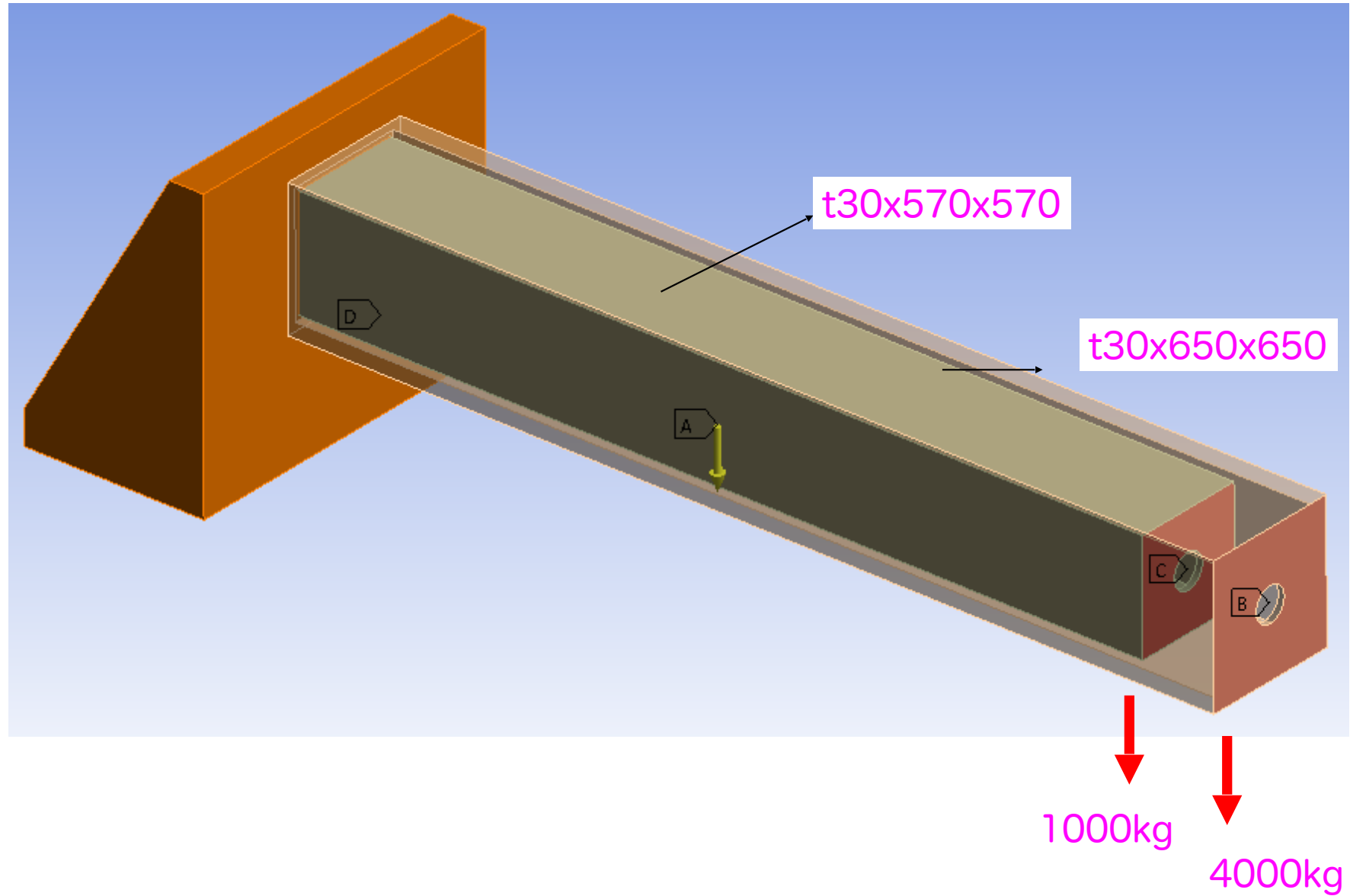
Nov. 24, 2021  
H.Y.

# ILD QD0 Vibration Analysis

In a case of the QD0 cantilever support from BDS tunnel

Hiroshi Yamaoka, KEK

# ILD Support tube (TDR)

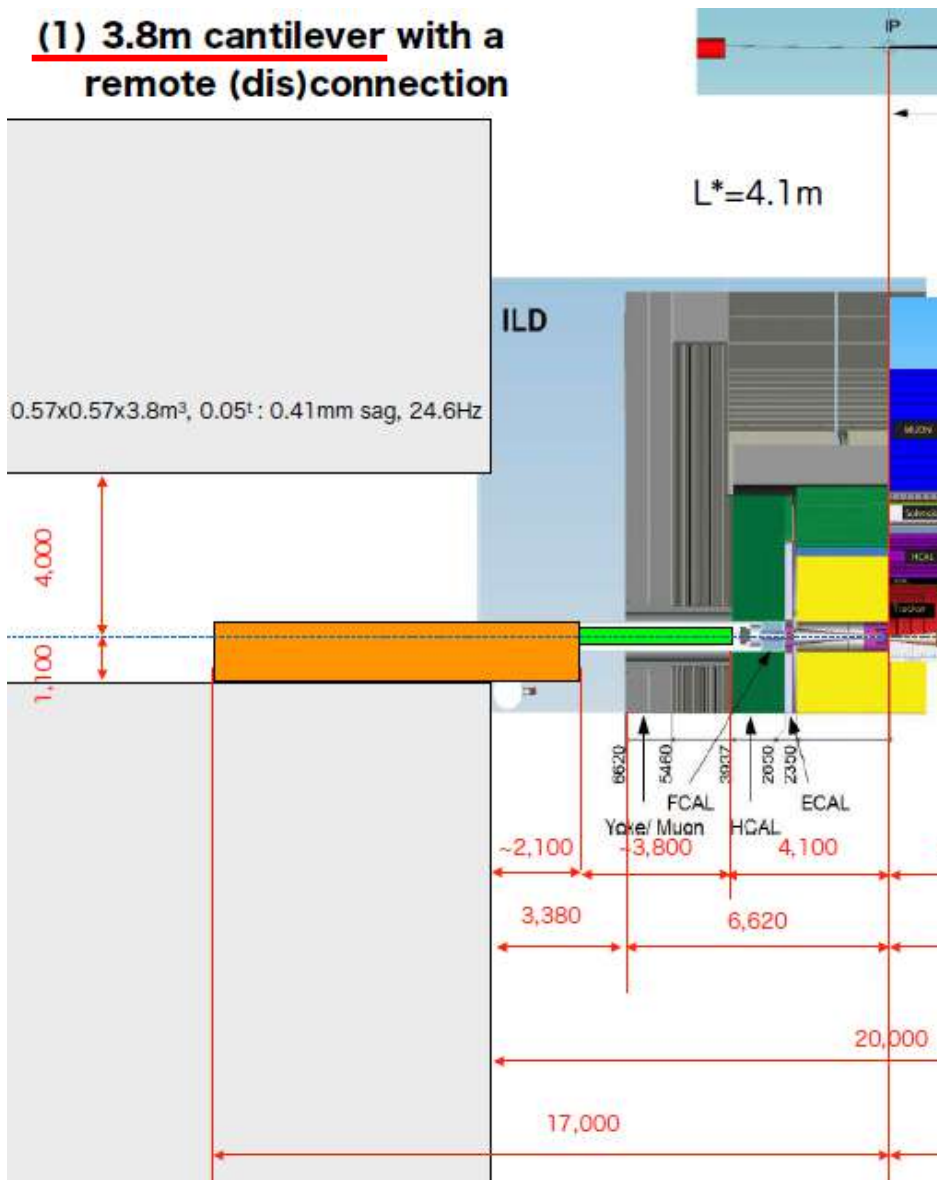


inner rectangular pipe:  $t30 \times 570 \times 570 \times 4338L$  (mm)

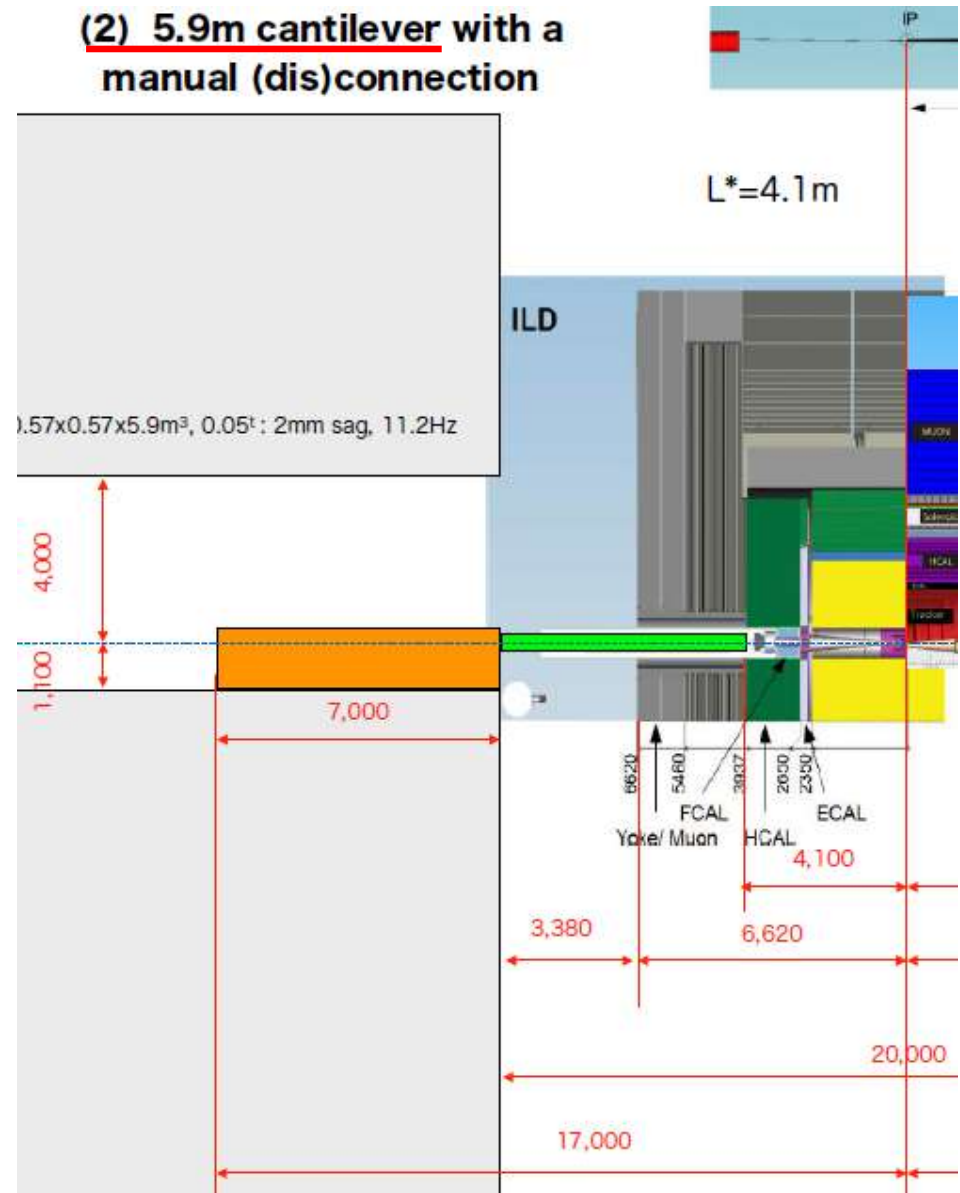
outer rectangular pipe:  $t30 \times 650 \times 650 \times 5485L$  (mm)

# QD0 cantilever support from BDS tunnel

**(1) 3.8m cantilever with a remote (dis)connection**

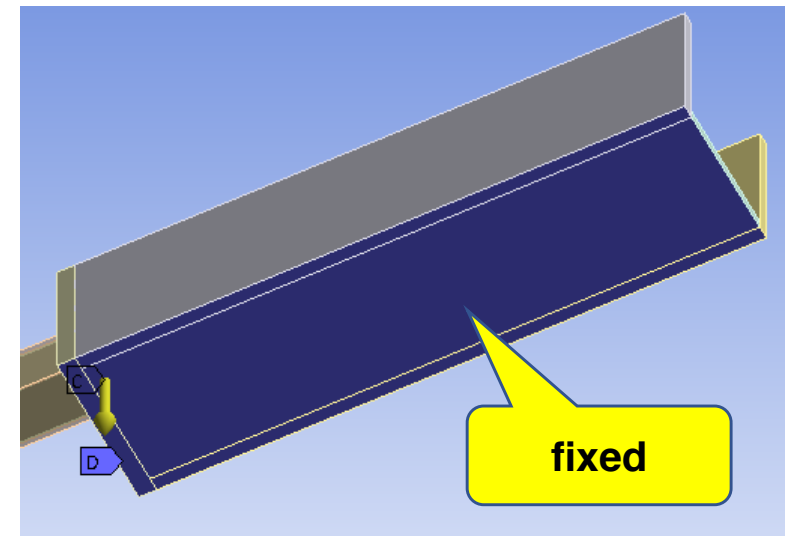
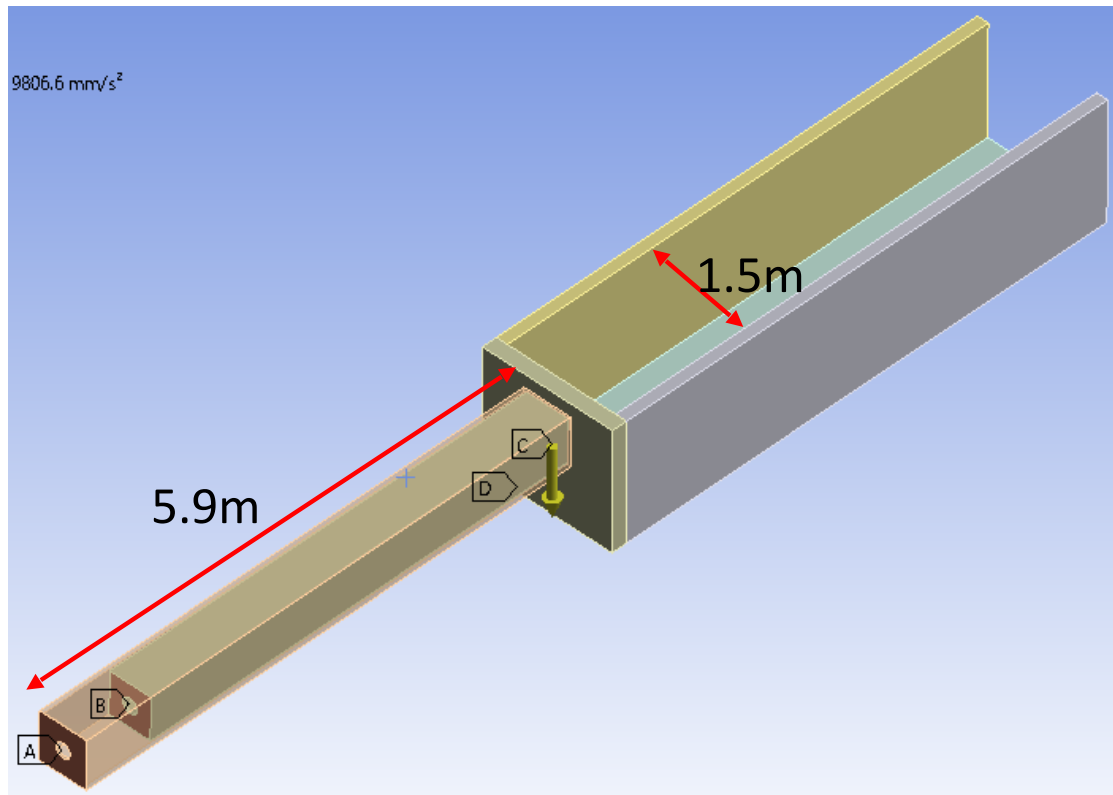
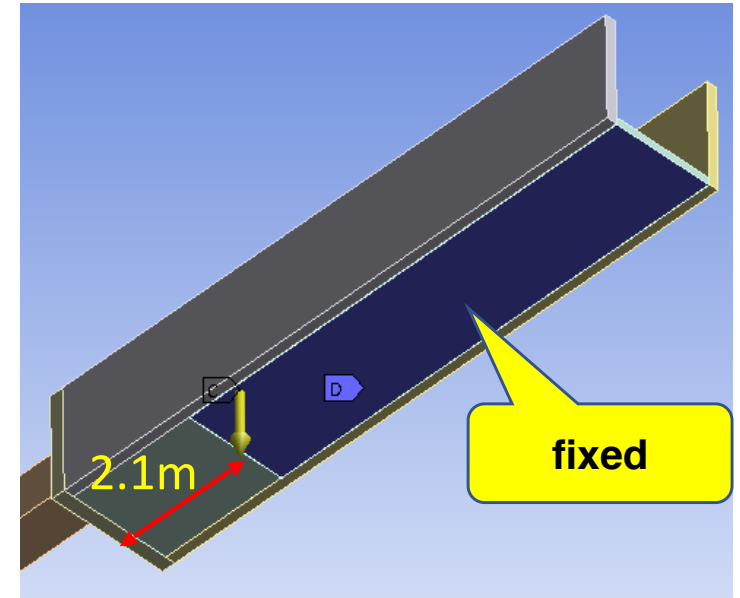
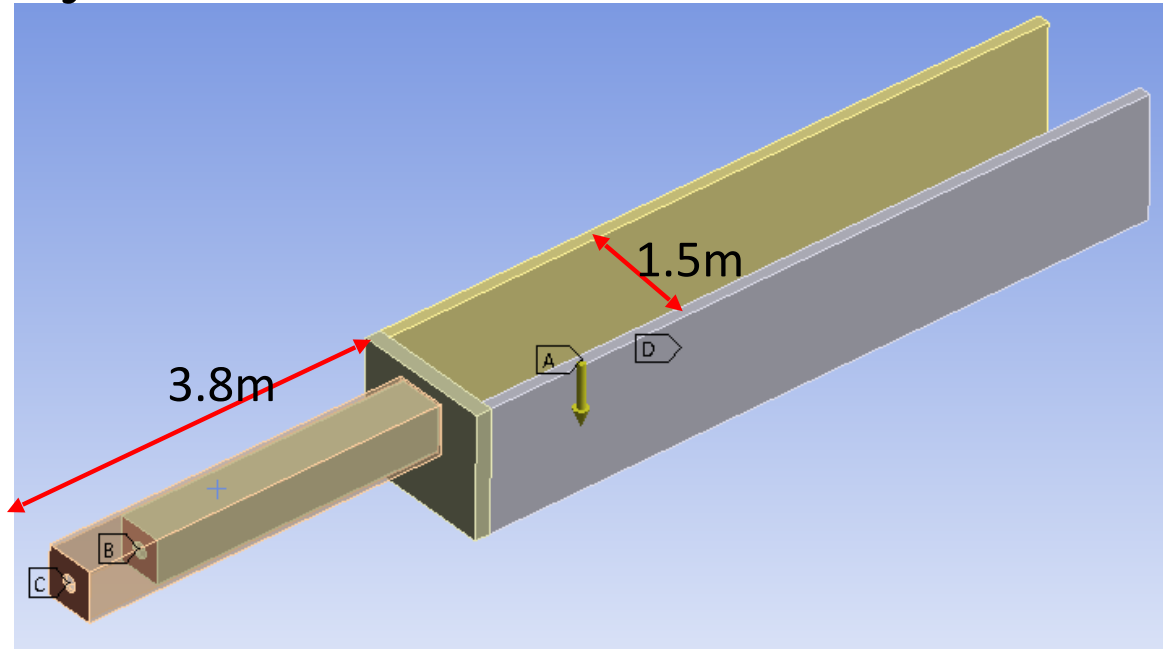


**(2) 5.9m cantilever with a manual (dis)connection**

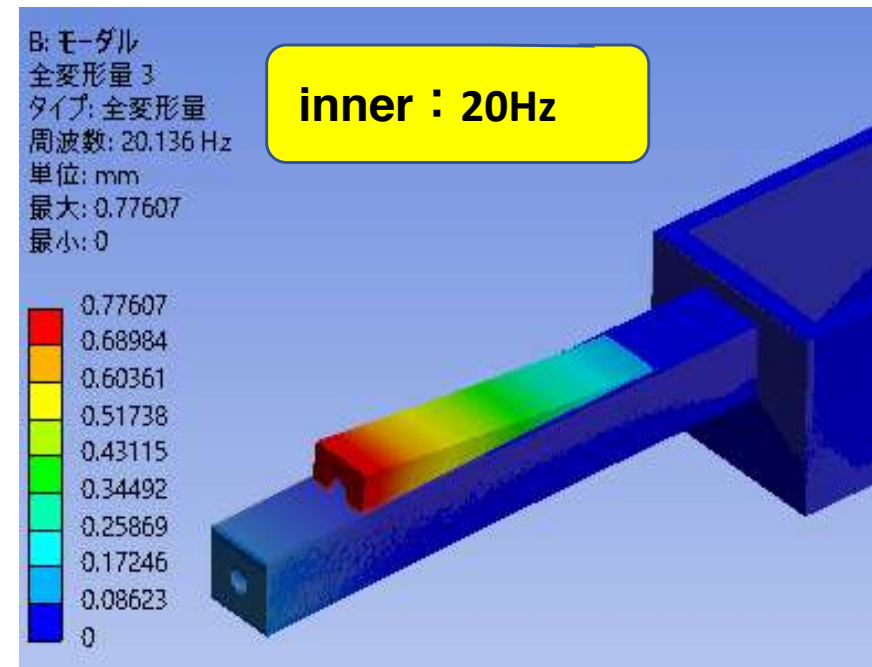
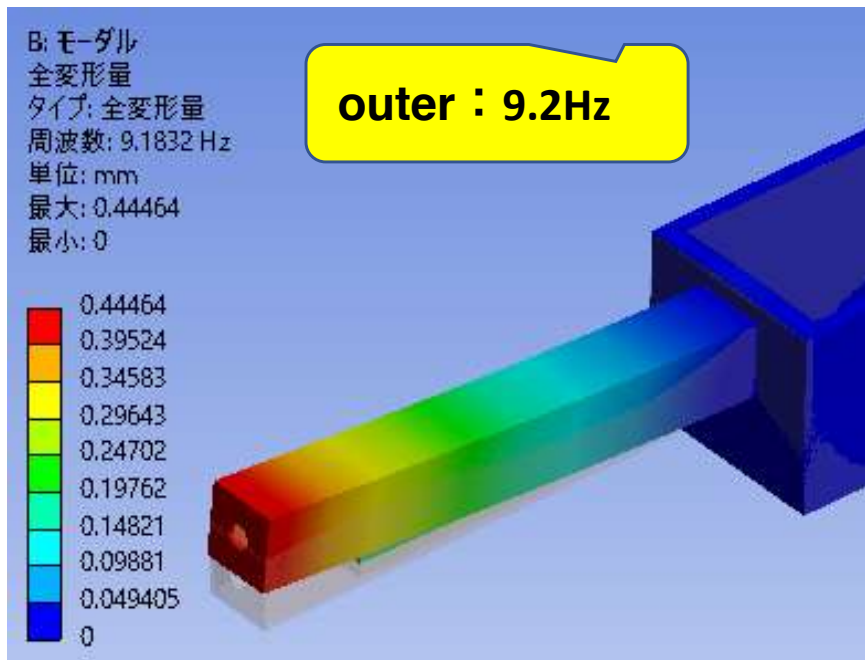
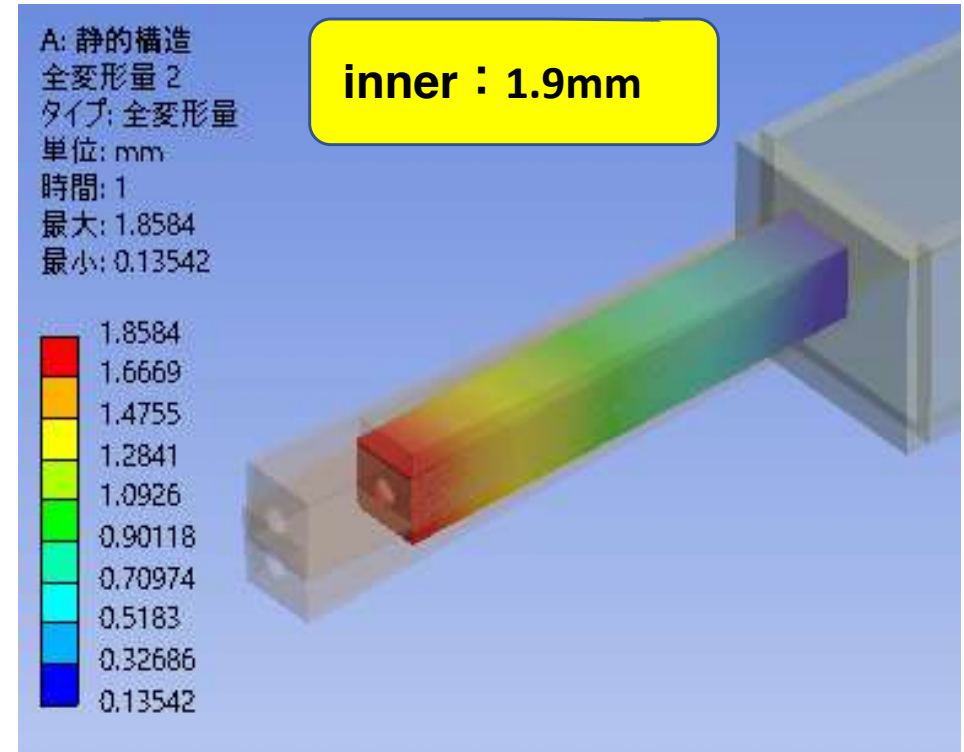
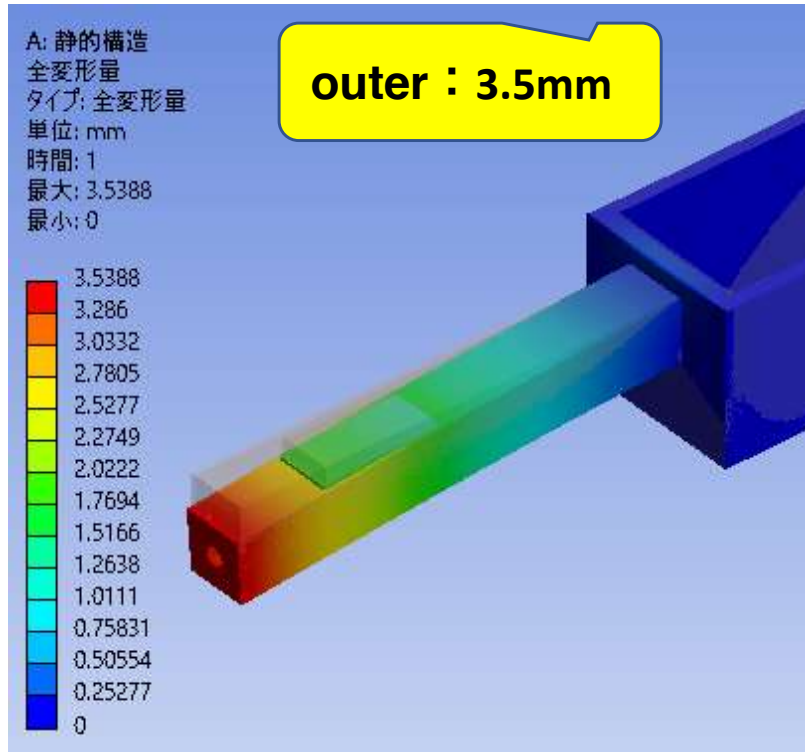


Analyzing the vibration response with these two shapes

# Analysis model



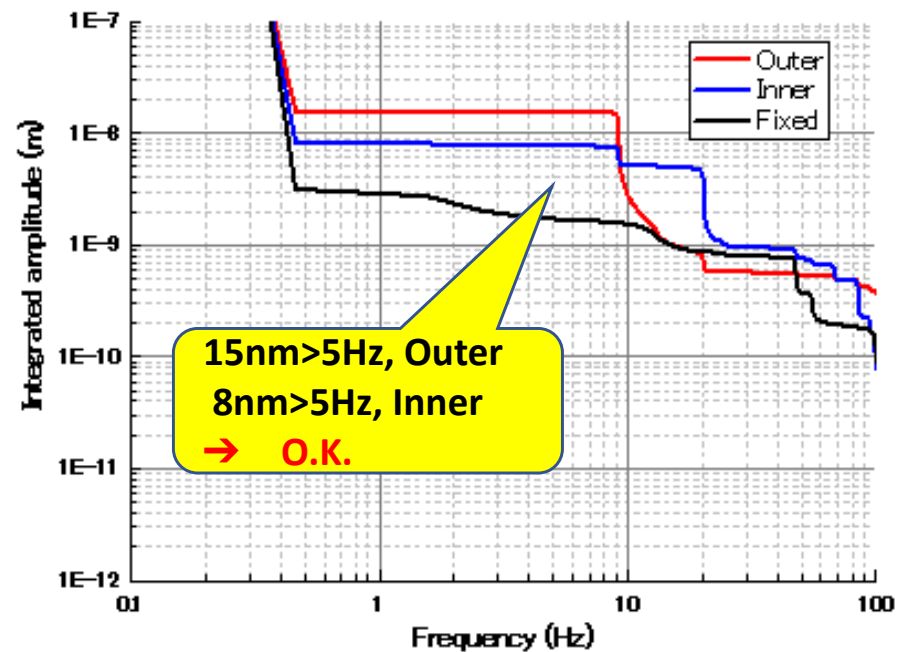
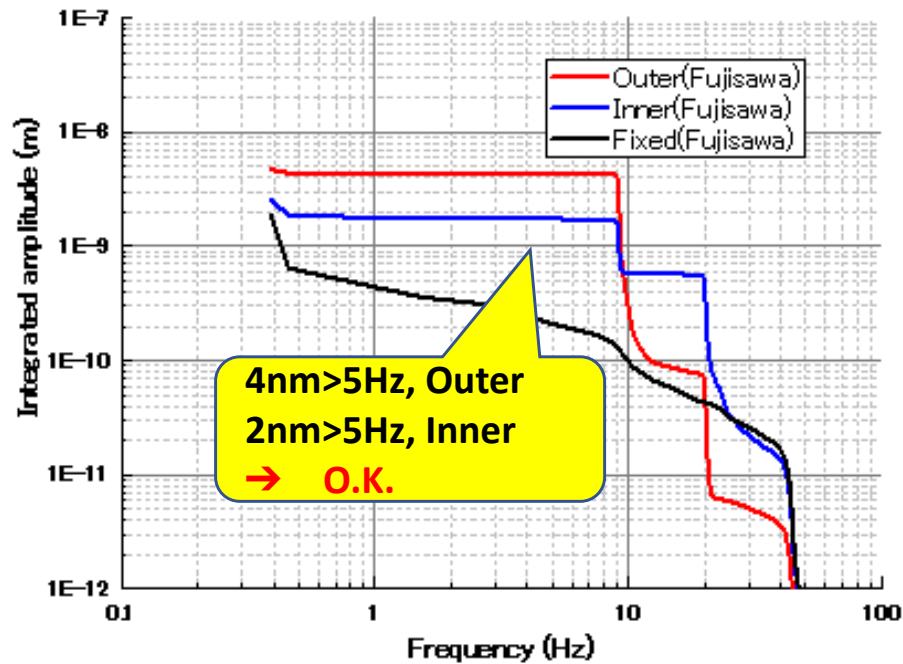
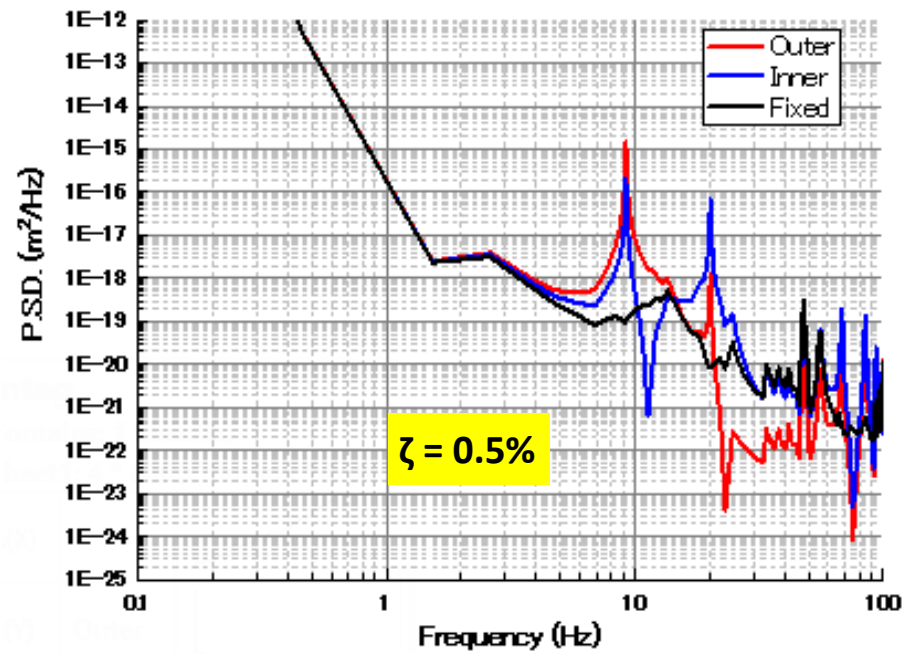
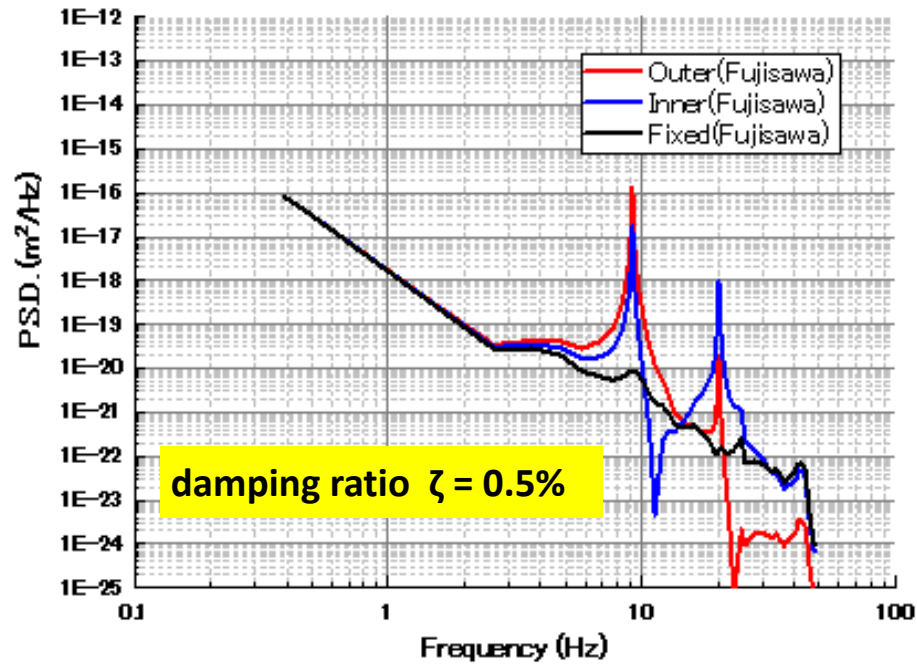
# Static (A) and Modal (B) analysis : 3.8m cantilever



# Dynamic analysis at Kitakami and CMS sites: 3.8m cantilever

Fujisawa (a representative of Kitakami)

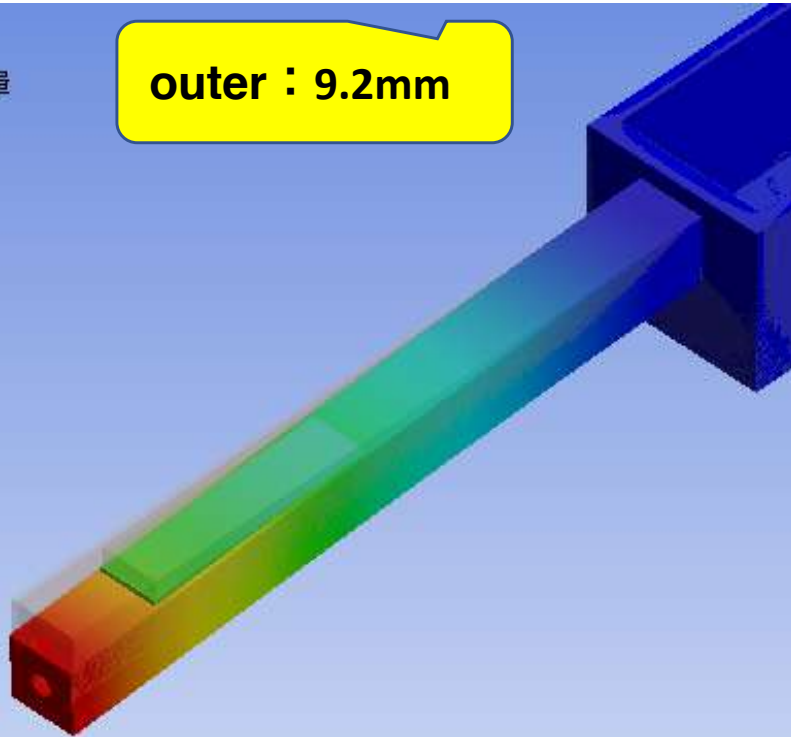
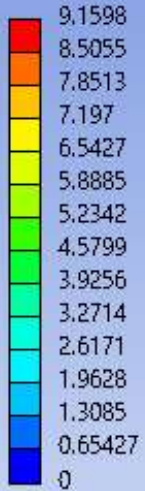
CMS



# Static (A) and Modal (B) analysis : 5.9m cantilever

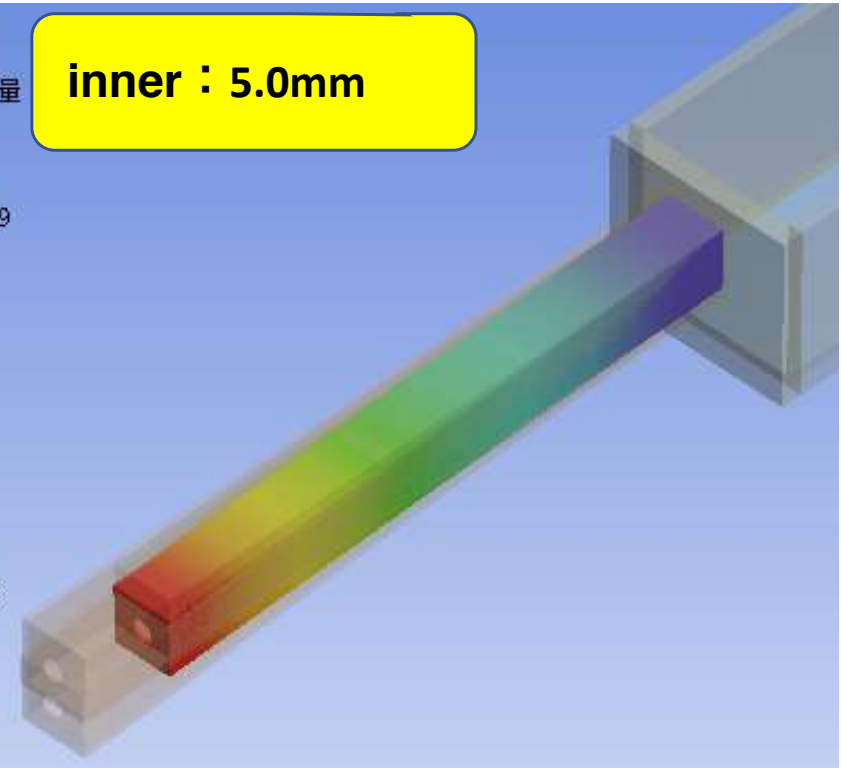
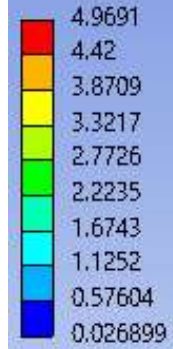
A: 静的構造  
全変形量  
タイプ: 全変形量  
単位: mm  
時間: 1  
最大: 9.1598  
最小: 0

outer : 9.2mm



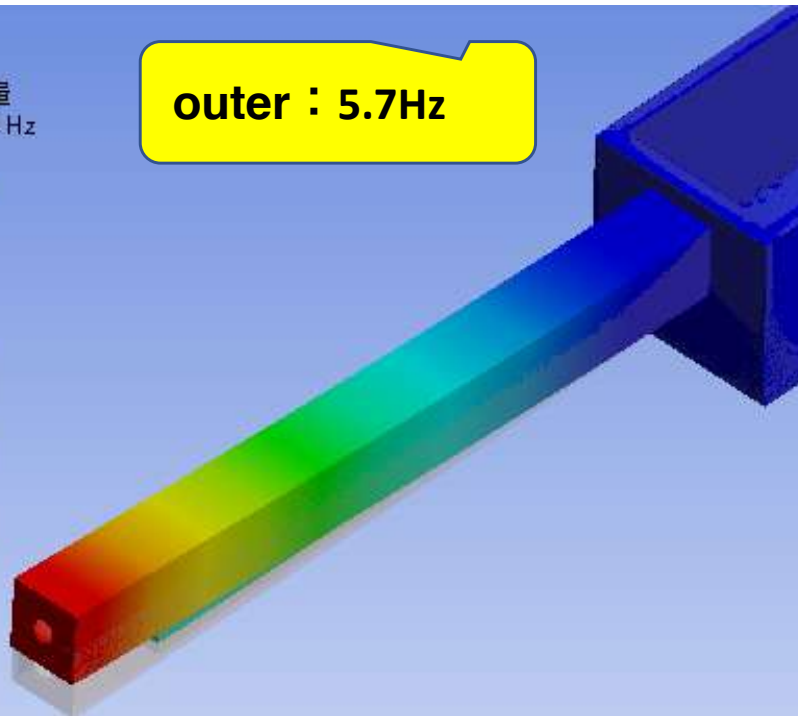
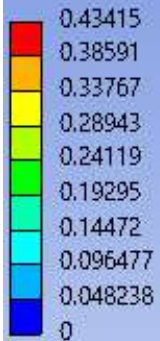
A: 静的構造  
全変形量 2  
タイプ: 全変形量  
単位: mm  
時間: 1  
最大: 4.9691  
最小: 0.026899

inner : 5.0mm



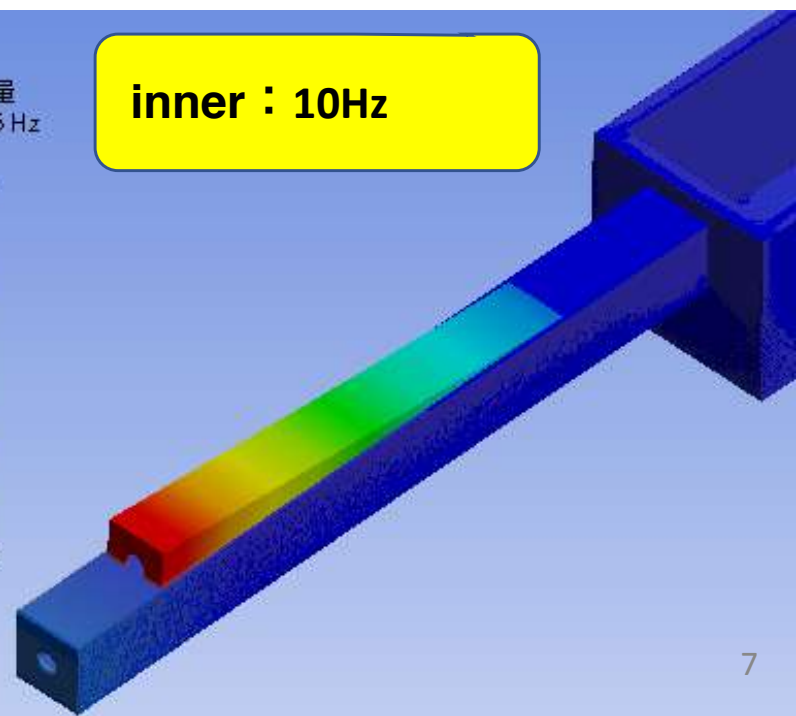
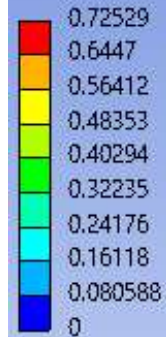
B: モーダル  
全変形量  
タイプ: 全変形量  
周波数: 5.6815 Hz  
単位: mm  
最大: 0.43415  
最小: 0

outer : 5.7Hz



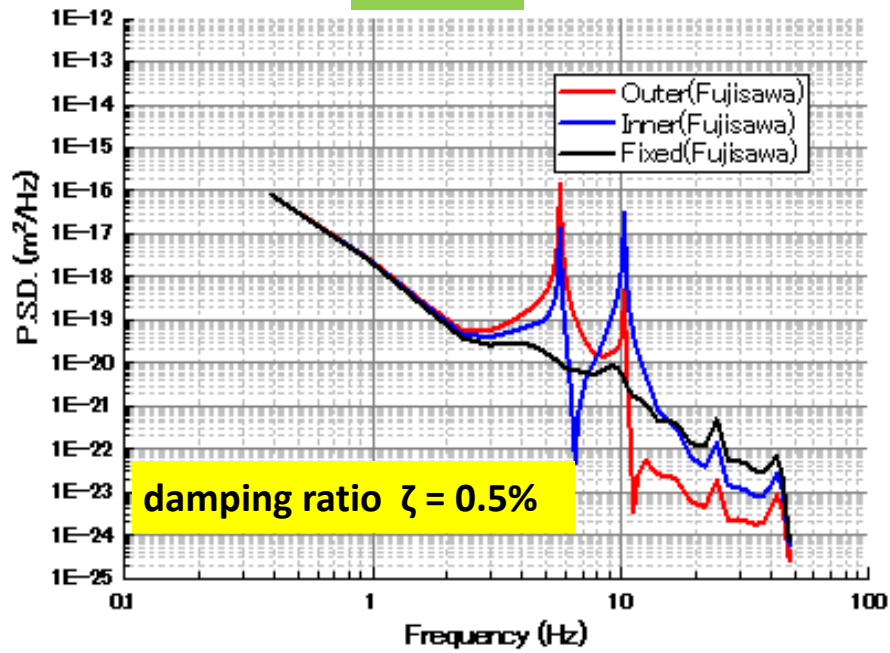
B: モーダル  
全変形量 3  
タイプ: 全変形量  
周波数: 10.295 Hz  
単位: mm  
最大: 0.72529  
最小: 0

inner : 10Hz

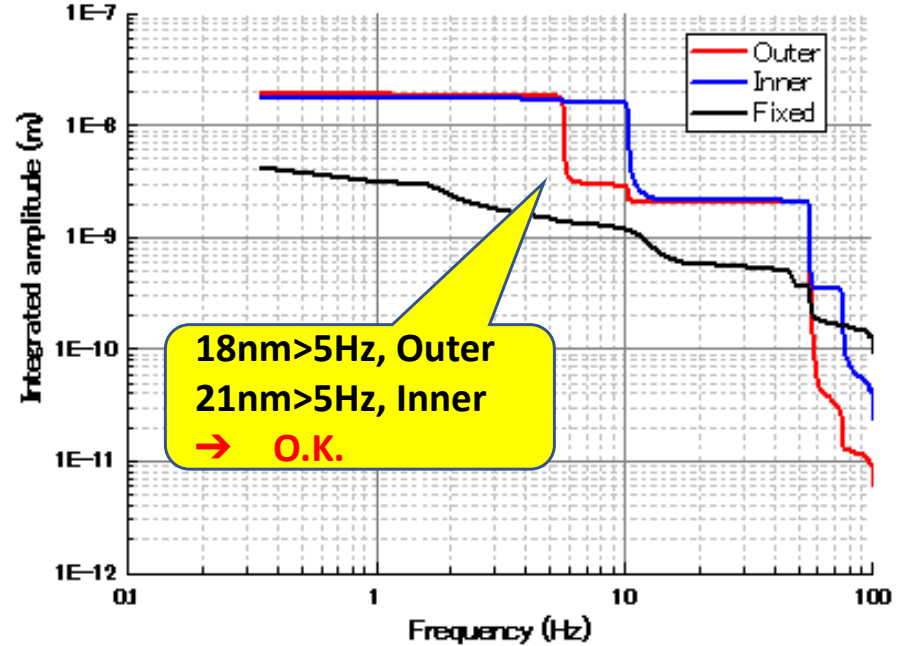
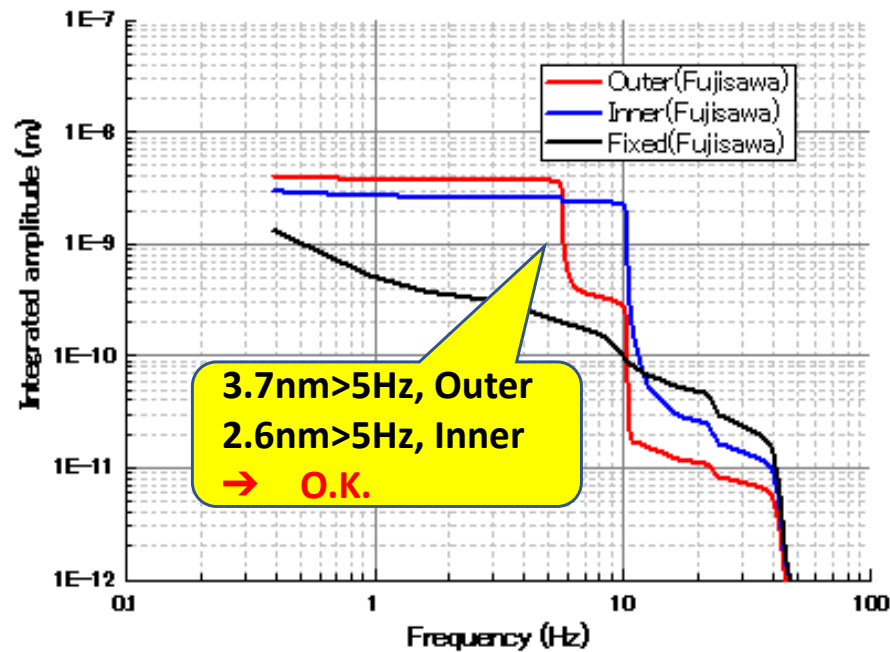
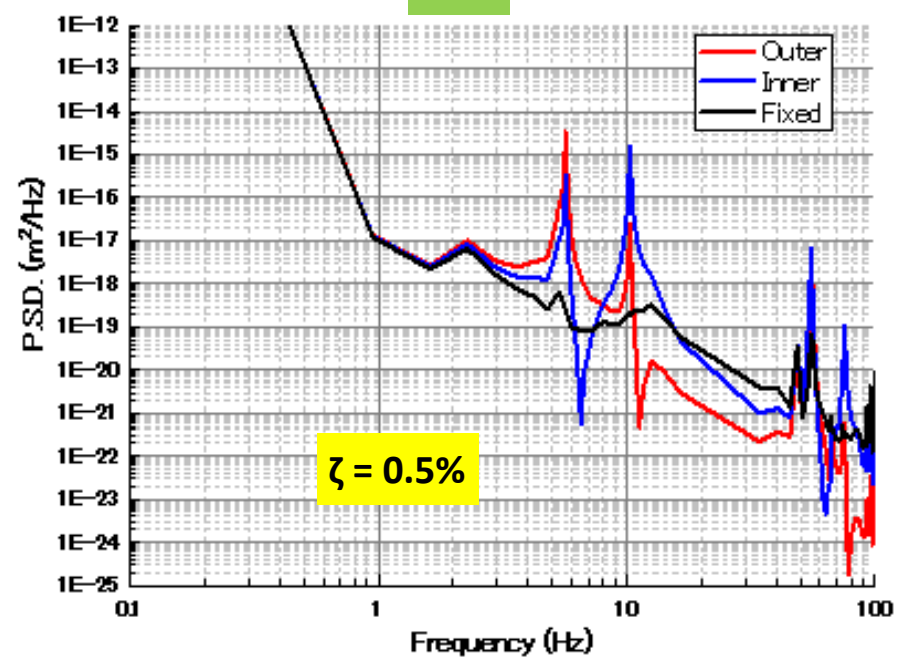


# Dynamic analysis at Kitakami and CMS sites: 5.9m cantilever

Fujisawa



CMS





# Summary of calculations

		<u>3.8m cantilever</u>	<u>5.9m cantilever</u>
<b>Sag at the tip</b>	<b>(outer)</b>	3.5mm	9.2mm
	<b>(inner)</b>	1.9mm	5.0mm
<b>First natural frequency</b>	<b>(outer)</b>	9.2Hz	5.7Hz
	<b>(inner)</b>	20Hz	10Hz
<b>Displacement response at &gt; 5Hz</b>			
<b>Fujisawa/Kitakami site</b>	<b>(Outer)</b>	4nm	3.7nm → O.K.
	<b>(Inner)</b>	2nm	2.6nm → O.K.
<b>CMS/CERN site</b>	<b>(Outer)</b>	15nm	18nm → O.K.
	<b>(Inner)</b>	8nm	21nm → O.K.

, where the damping ratio is assumed to be  $\zeta = 0.5\%$  in this ANSYS analysis