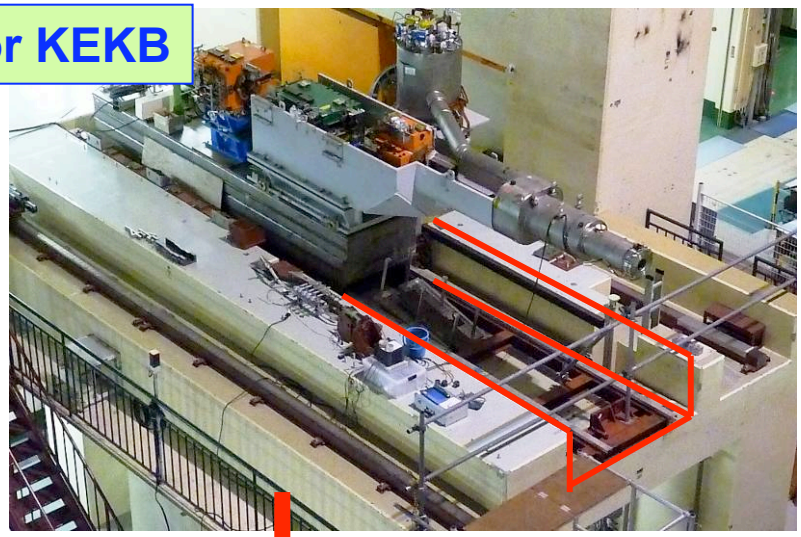
# Magnet Support (Moving stage/ KEKB floor modification)

**H. Yamaoka**

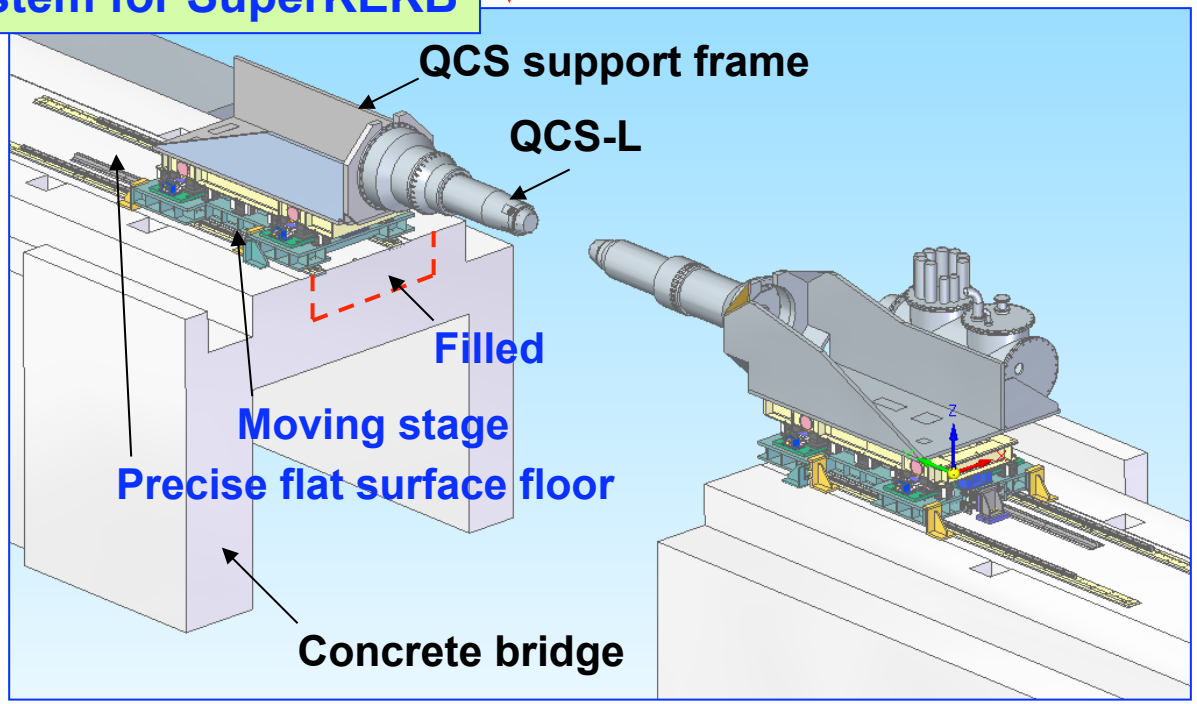
**and**

Magnet group

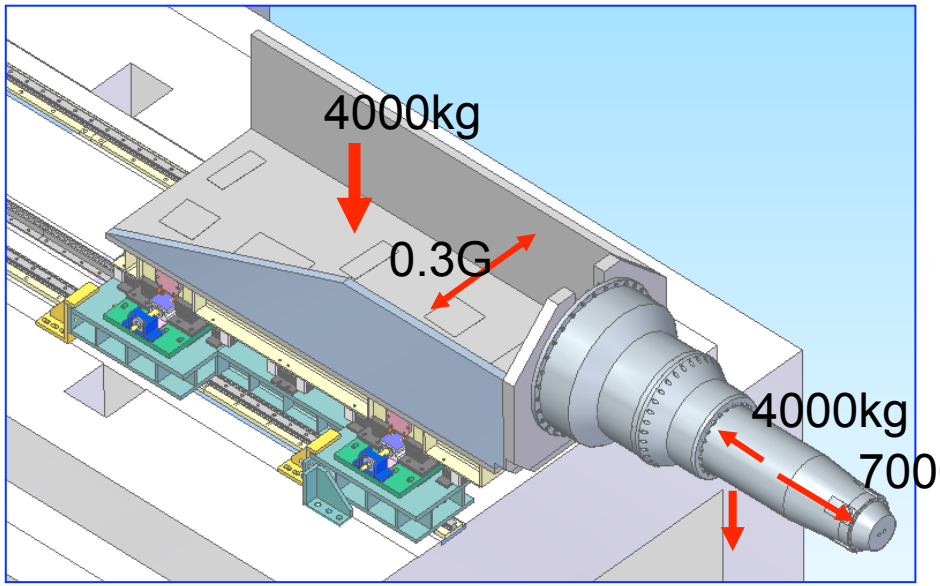
## QCS support system for KEKB



## QCS support system for SuperKEKB



# Mechanical design




## Load conditions (Vertical dir.)

Self-weight (QCS): 2500kg

Self-weigh(Supp. Frame): 10000kg

Weight of magnets: 4000kg

## Magnetic force(axial dir.)

Inner direction: 7000kg

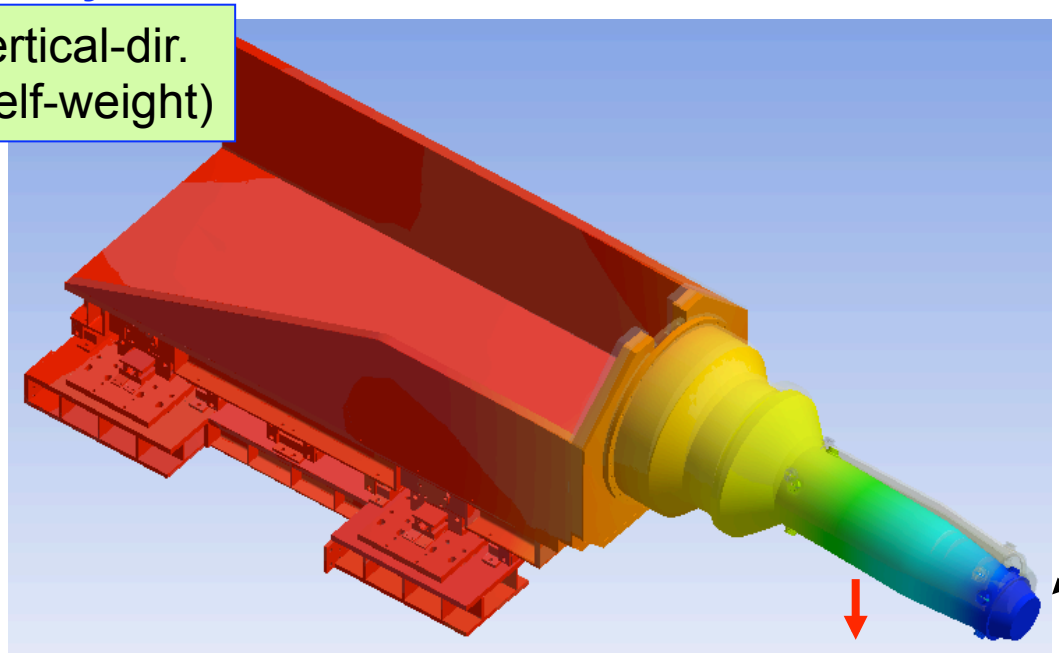
Outer direction: 4000kg

## Seismic load

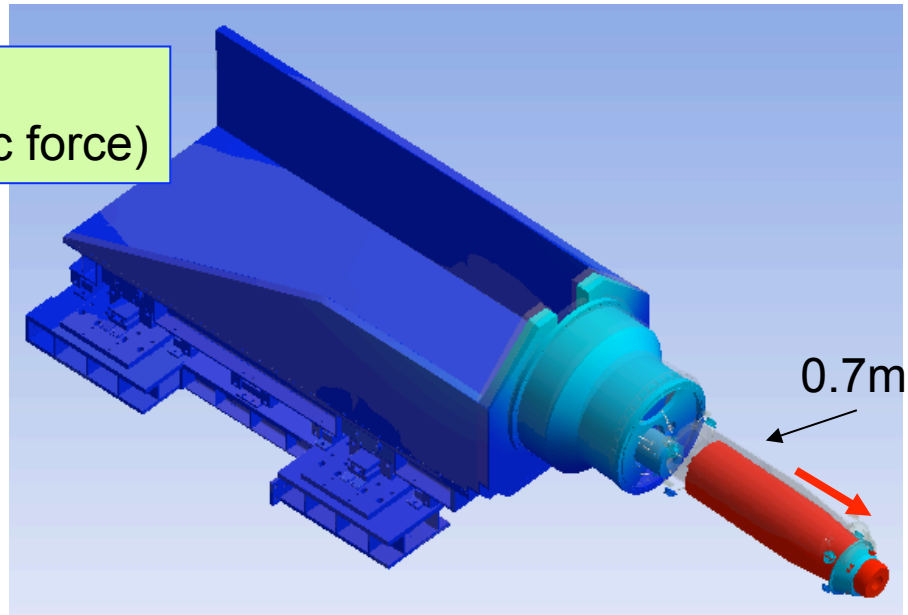
0.3G in the horizontal direction

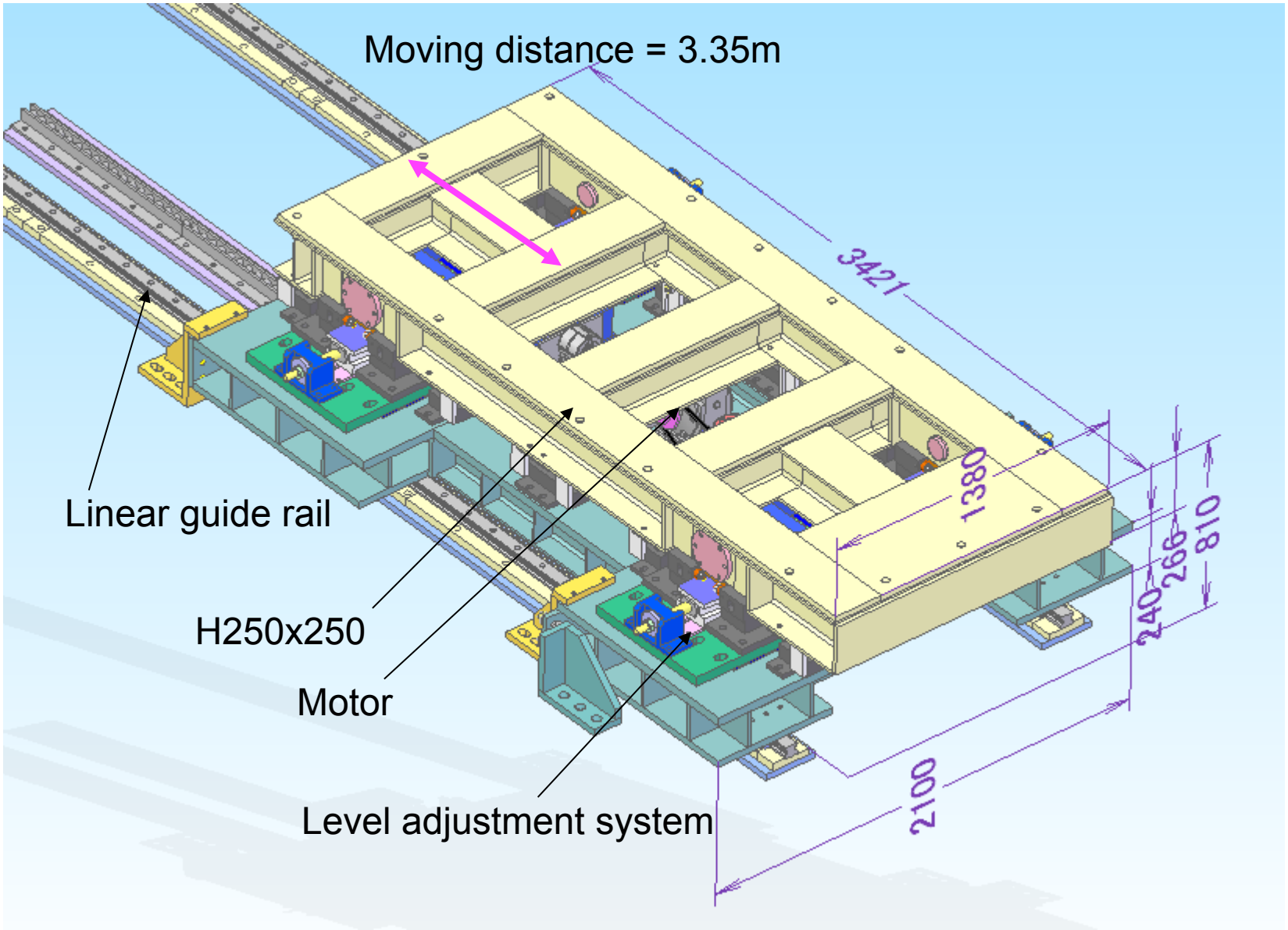
## Static analysis

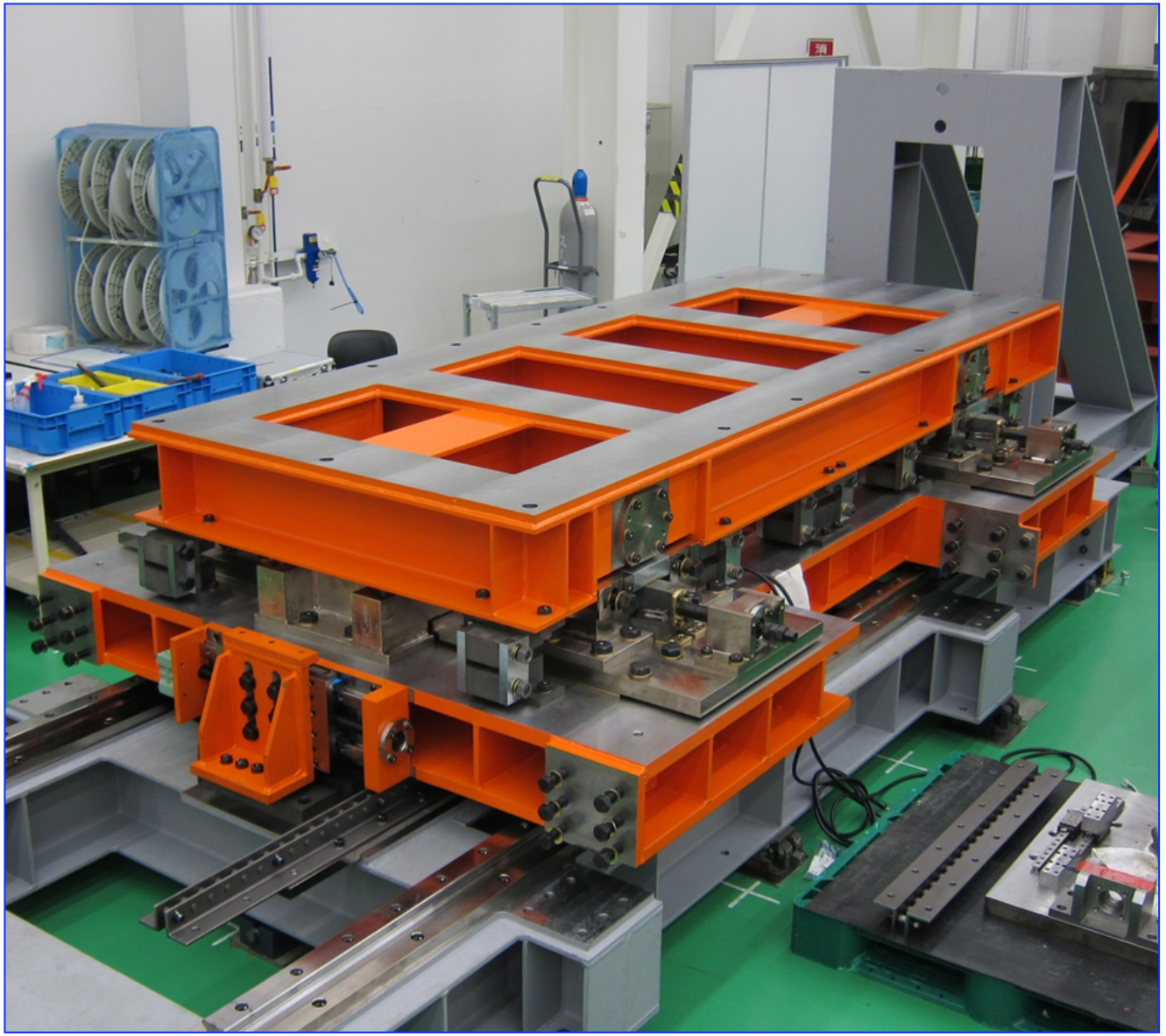
Vertical-dir.
(self-weight)



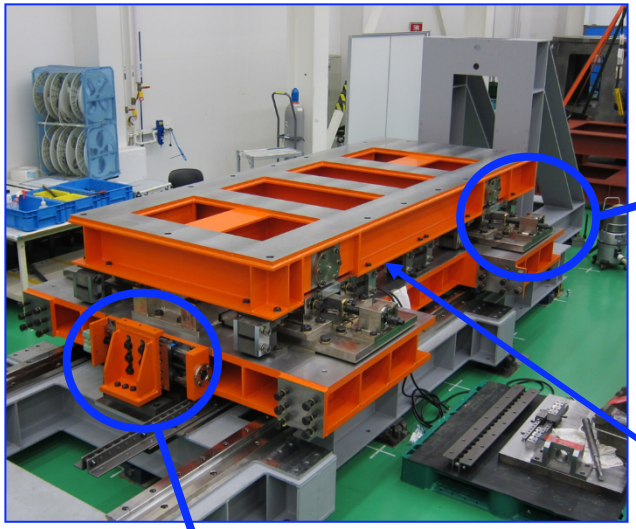

Axial-dir.
(Magnetic force)

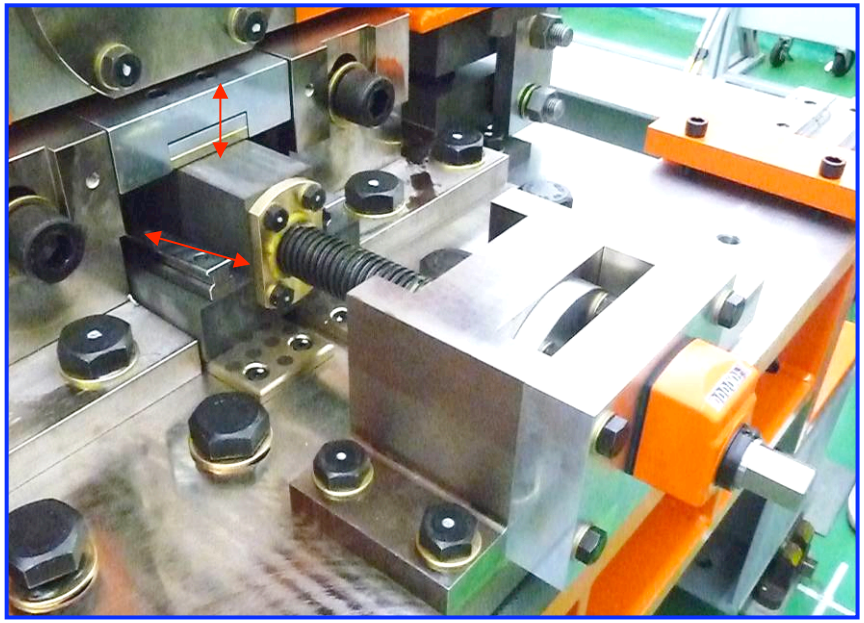


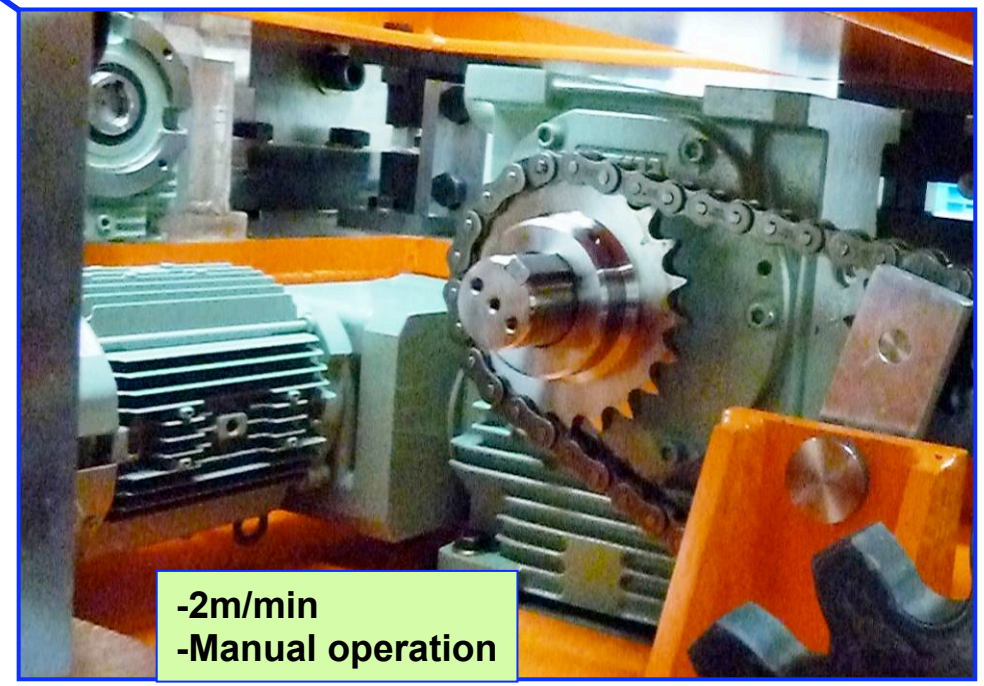

Moving distance = 3.35m
3421
1380
810
266
240
2100
Linear guide rail
H250x250
Motor
Level adjustment system



➔ **Assembling is in progress…**



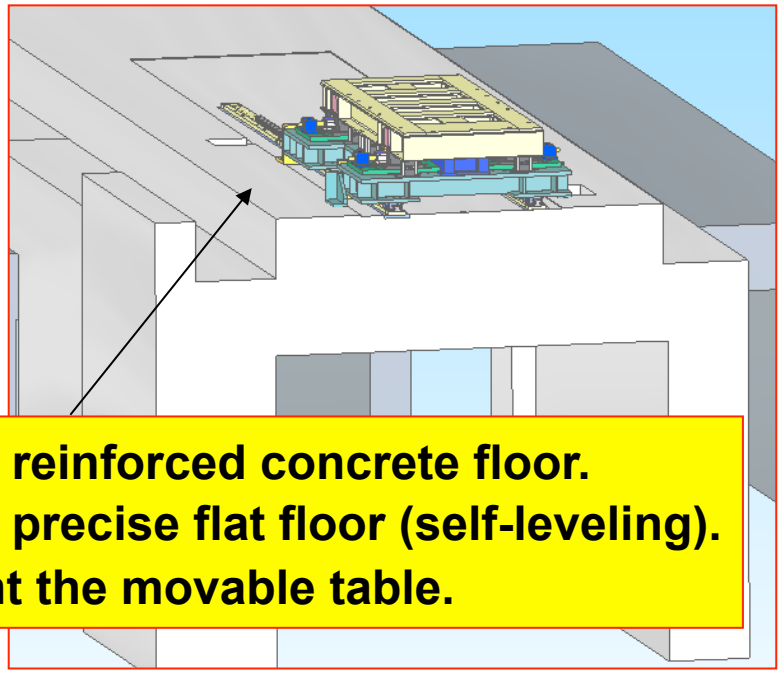



-2m/min
-Manual operation

# KEKB concrete floor modification

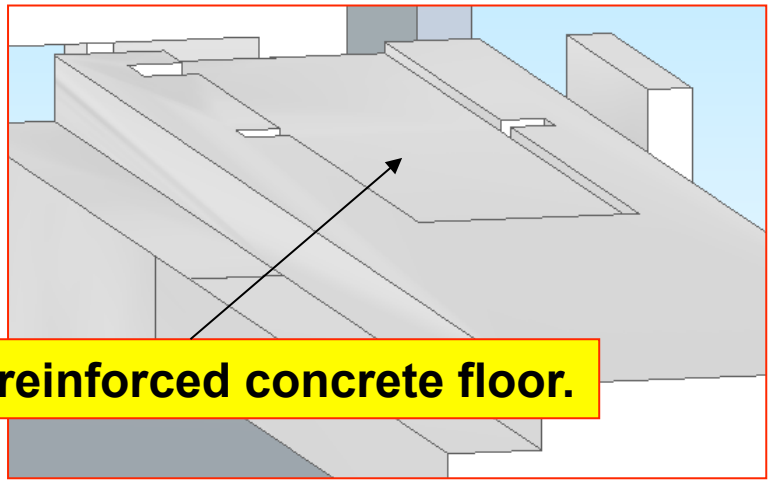
# KEKB concrete floor modifications

## L-side



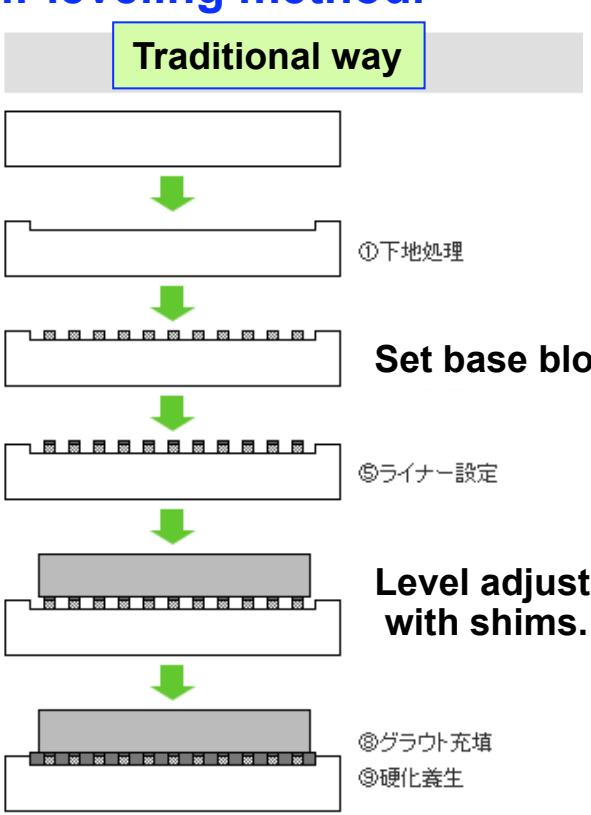
-Make reinforced concrete floor.
-Make precise flat floor (self-leveling).
-Mount the movable table.

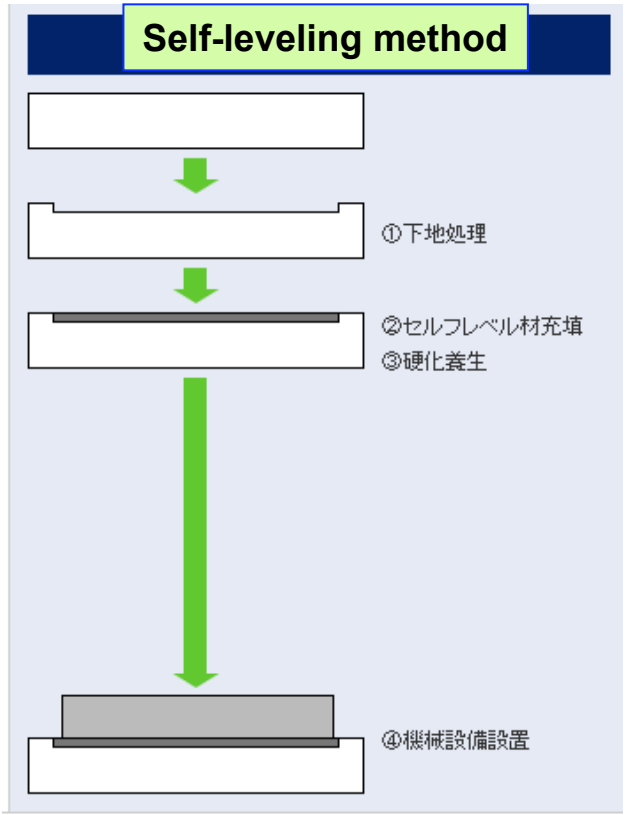
## R-side



-Make reinforced concrete floor.

# We apply self-leveling method.

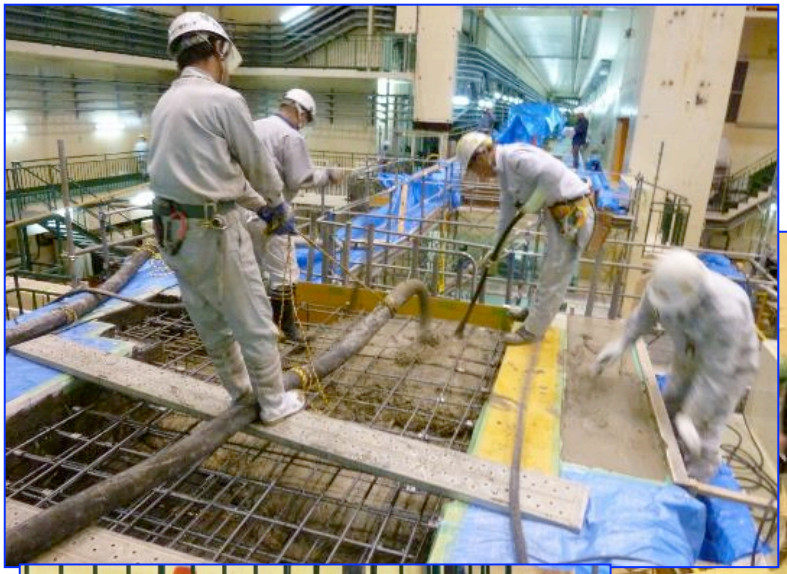


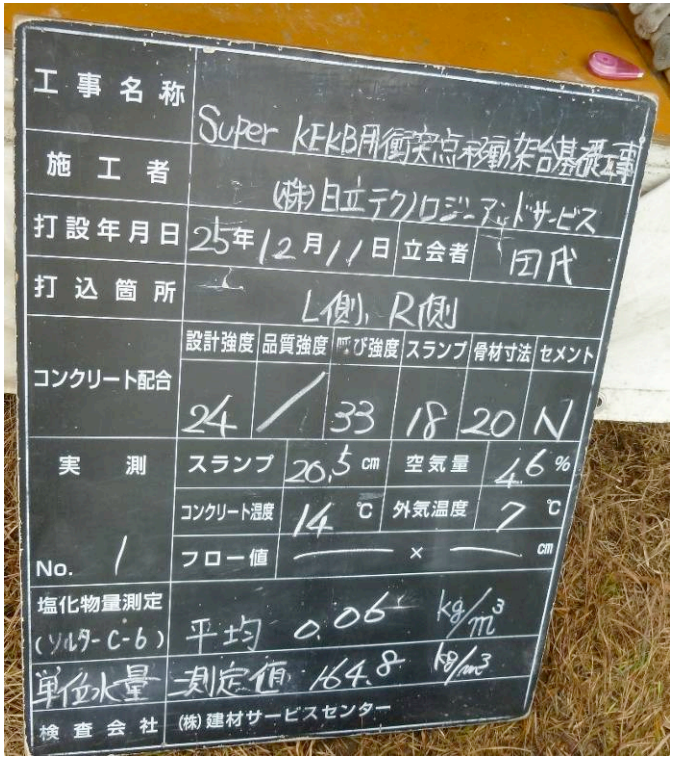



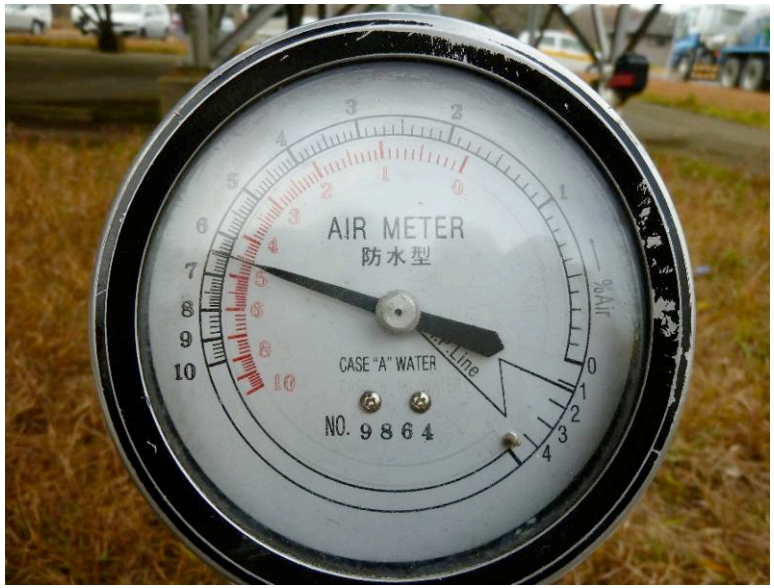

➔ - Save working time.
- Improve vibration property.

## Set steel rods

## Dec.11,  Fill with concrete




工事名称
Super KEKB用衝突点実験棟鉄骨建方工事
施工者
(株)日立テクノロジーアンドサービス
打設年月日
25年12月11日
立会者
団代
打込箇所
L側, R側
コンクリート配合
設計強度 品質強度 呼び強度 スランプ 骨材寸法 セメント
24 / 33 18 20 N
実測
スランプ 20.5 cm
空気量 4.6 %
コンクリート温度 14 ℃
外気温度 7 ℃
No. 1
フロー値 — × — cm
塩化物量測定
(ソルター-C-b)
平均 0.06 kg/m³
単位水量
測定値 164.8 kg/m³
検査会社
(株)建材サービスセンター

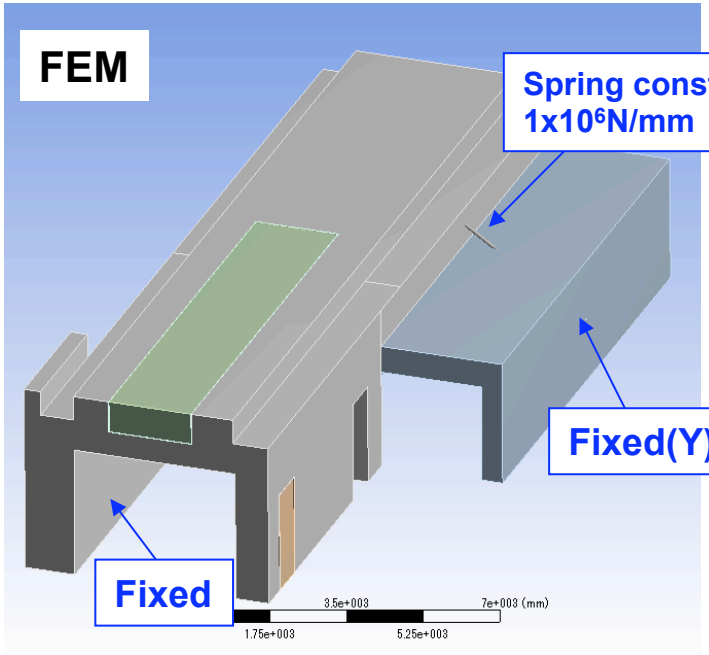

AIR METER
防水型
%Air
CASE "A" WATER
Line
NO. 9864

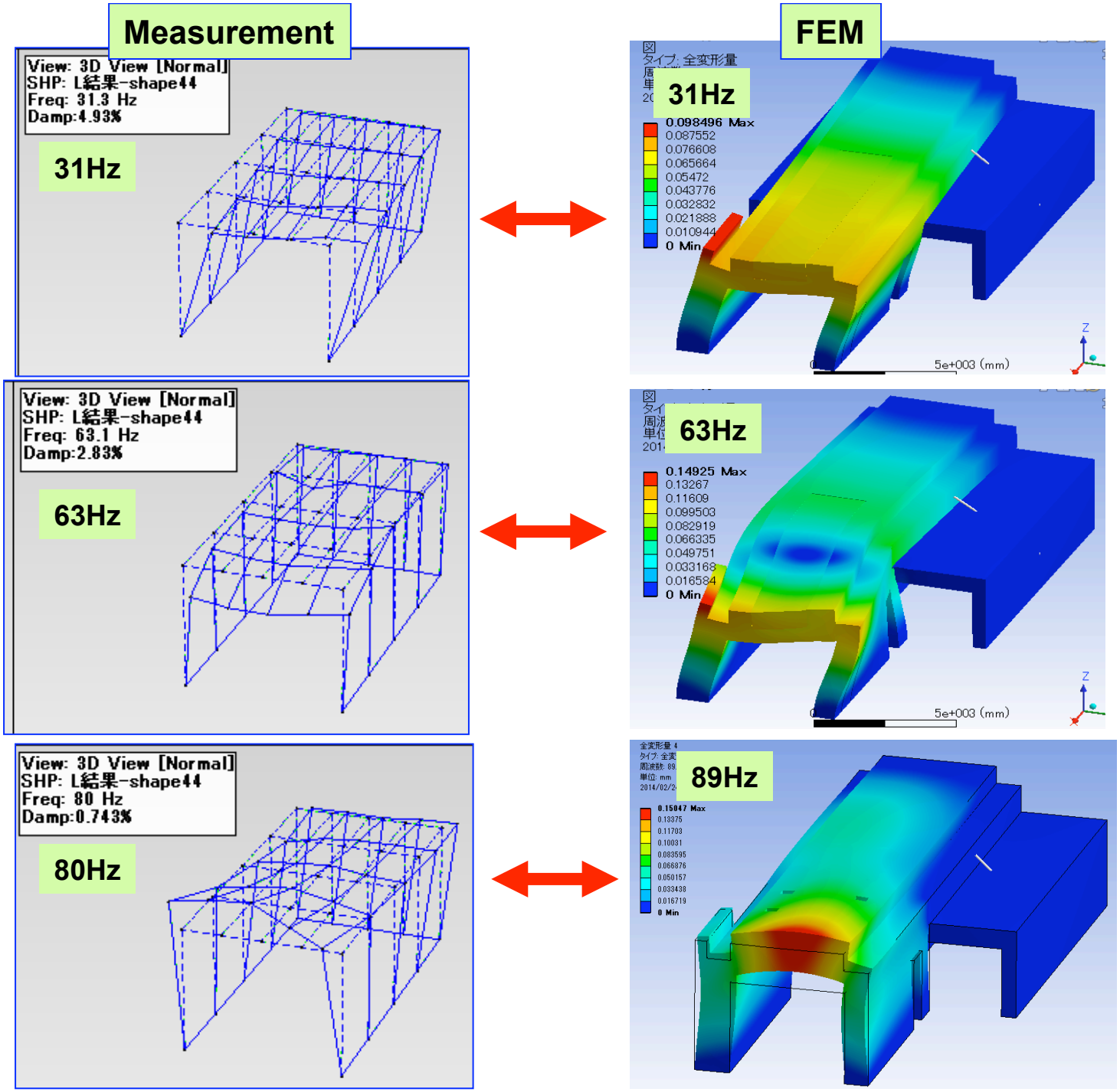

平均水/セメント
(%)
45.6
平均水量
(kg/m³)
164.8
測定モード
Kett
生コン水分計HI-300J

## Dec. 07, High precision flat surface floor (Self-leveling method)

# Modal test of concrete bridge


Vibration properties must be changed due to the modifications.
→Resonant frequencies
→Mode shapes
are measured and compared to FEM.

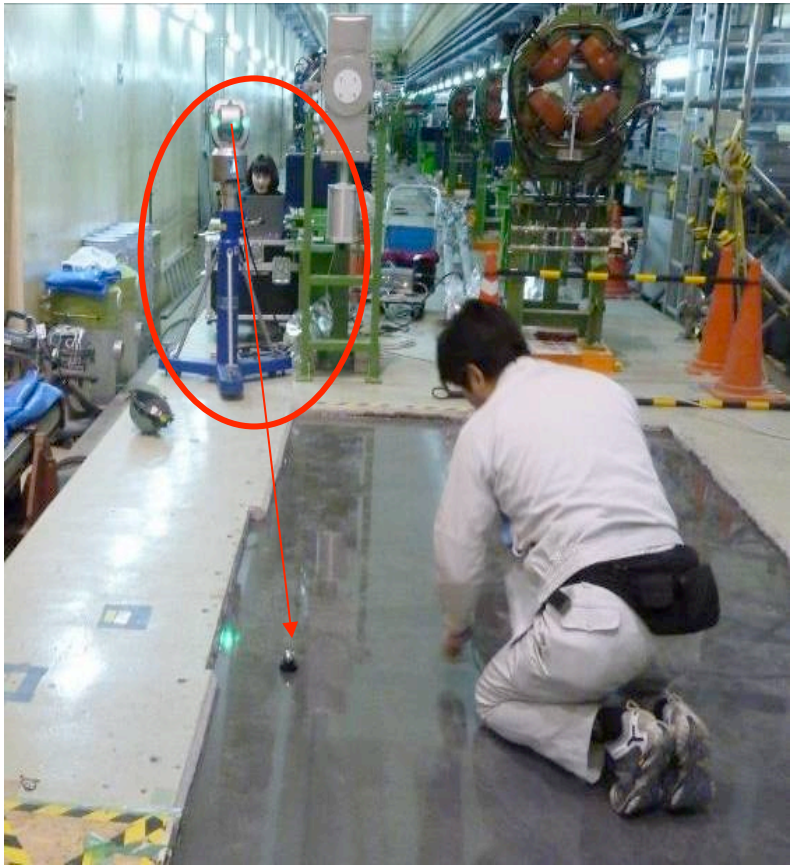



Measurement
FEM
View: 3D View [Normal]
SHP: L結果-shape44
Freq: 31.3 Hz
Damp:4.93%
31Hz
31Hz
0.098496 Max
0.087552
0.076608
0.065664
0.05472
0.043776
0.032832
0.021888
0.010944
0 Min
5e+003 (mm)
View: 3D View [Normal]
SHP: L結果-shape44
Freq: 63.1 Hz
Damp:2.83%
63Hz
63Hz
0.14925 Max
0.13267
0.11609
0.099503
0.082919
0.066335
0.049751
0.033168
0.016584
0 Min
5e+003 (mm)
View: 3D View [Normal]
SHP: L結果-shape44
Freq: 80 Hz
Damp:0.743%
80Hz
89Hz
0.15047 Max
0.13375
0.11703
0.10031
0.083595
0.066876
0.050157
0.033438
0.016719
0 Min

## Jan. 6,7th ,Flatness of the floor was measured.

**High precision level**

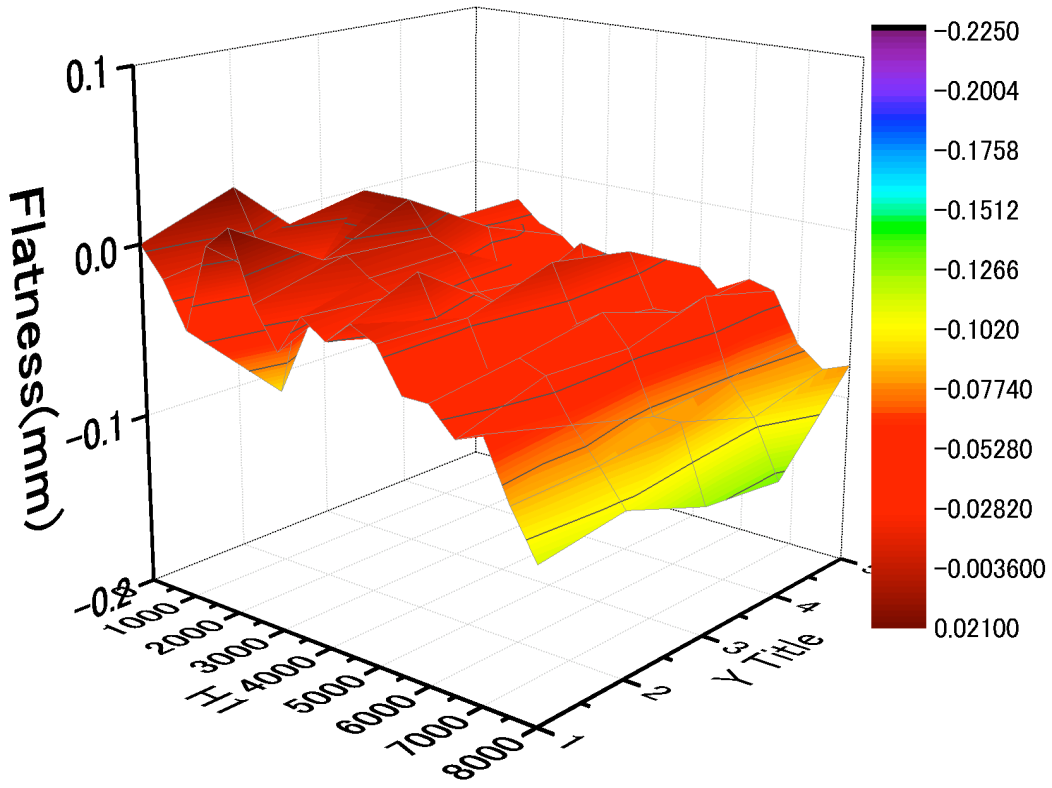
**Laser tracker**



## Result (Measured with Laser Tracker)

Unit: mm

| | 200 | 500 | 1000 | 1500 | 1800 |
|---|---|---|---|---|---|
| 0 | 0 | 0.02 | −0.029 | −0.033 | −0.058 |
| 500 | −0.017 | −0.008 | −0.06 | −0.045 | −0.045 |
| 1000 | −0.043 | −0.096 | 0.011 | −0.021 | −0.02 |
| 1500 | 0.008 | −0.034 | 0.011 | −0.06 | −0.033 |
| 2000 | 0.021 | −0.011 | 0.011 | −0.019 | −0.038 |
| 2500 | −0.018 | −0.005 | −0.008 | −0.074 | −0.05 |
| 3000 | −0.041 | −0.015 | −0.014 | −0.066 | −0.056 |
| 3500 | −0.018 | −0.022 | −0.035 | −0.04 | −0.061 |
| 4000 | −0.028 | −0.005 | −0.04 | −0.017 | −0.05 |
| 4500 | −0.015 | −0.036 | −0.028 | −0.092 | −0.081 |
| 5000 | −0.022 | −0.024 | −0.008 | −0.016 | −0.04 |
| 5500 | −0.046 | −0.057 | −0.04 | −0.047 | −0.055 |
| 6000 | −0.046 | −0.039 | −0.03 | −0.046 | −0.041 |
| 6500 | −0.061 | −0.045 | −0.047 | −0.033 | −0.045 |
| 7000 | −0.054 | −0.068 | −0.082 | −0.078 | −0.074 |
| 7500 | −0.087 | −0.086 | −0.081 | −0.097 | −0.086 |
| 8000 | −0.113 | −0.106 | −0.125 | −0.131 | −0.08 |




➔ **Flatness is about less than 0.1mm.**

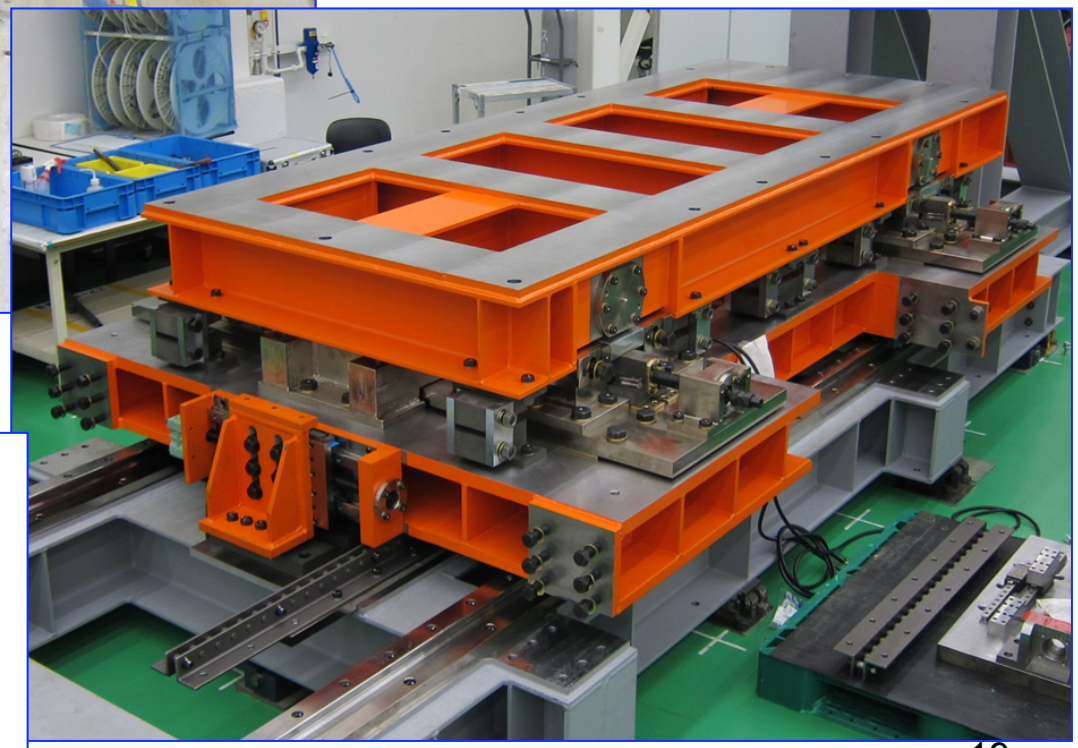
# Conclusion

## Present situation

At KEK @ Mar. 3rd

-Modification of the floor is completed.

-Waiting to install the movable table.

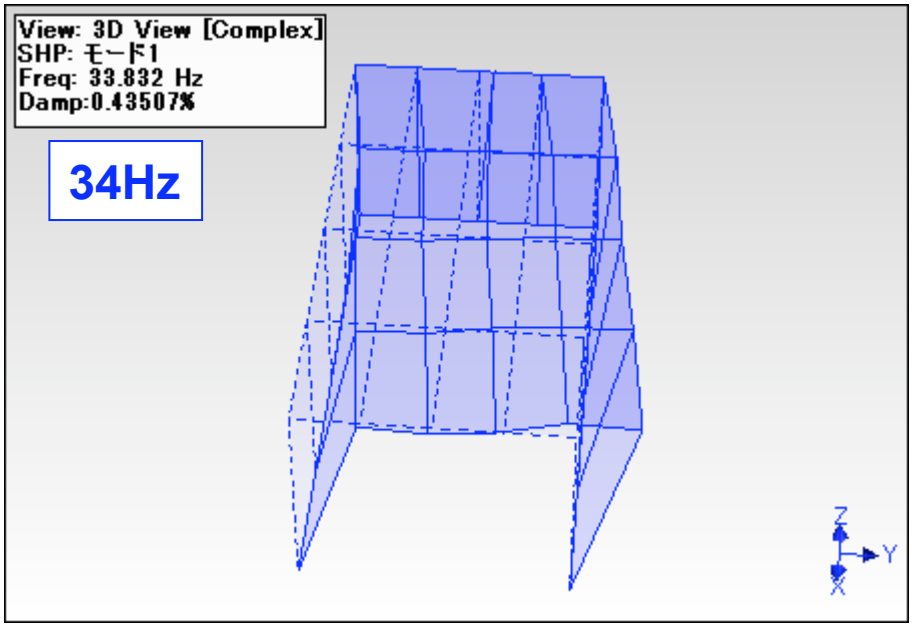


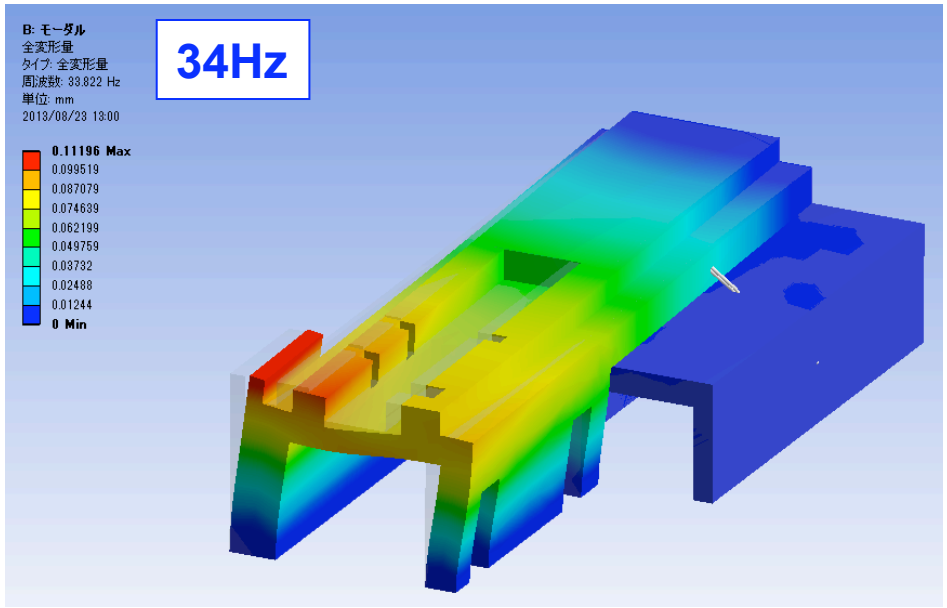
At factory of fabricator;

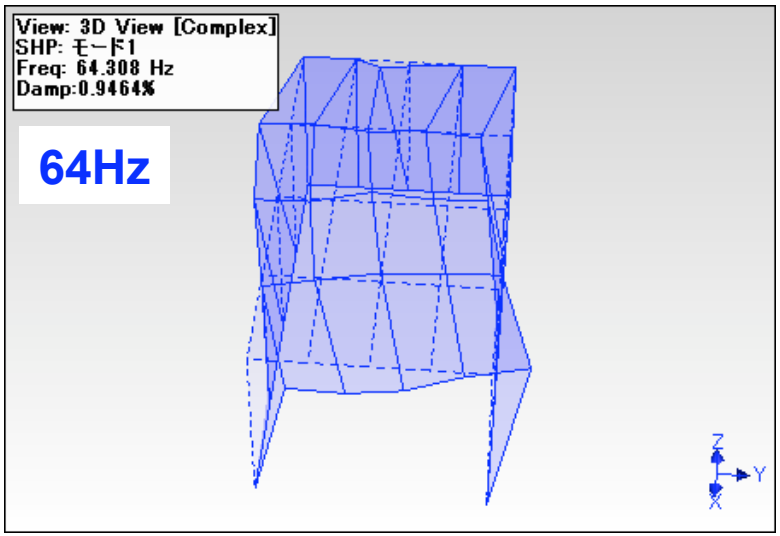
-Assembling is in progress…

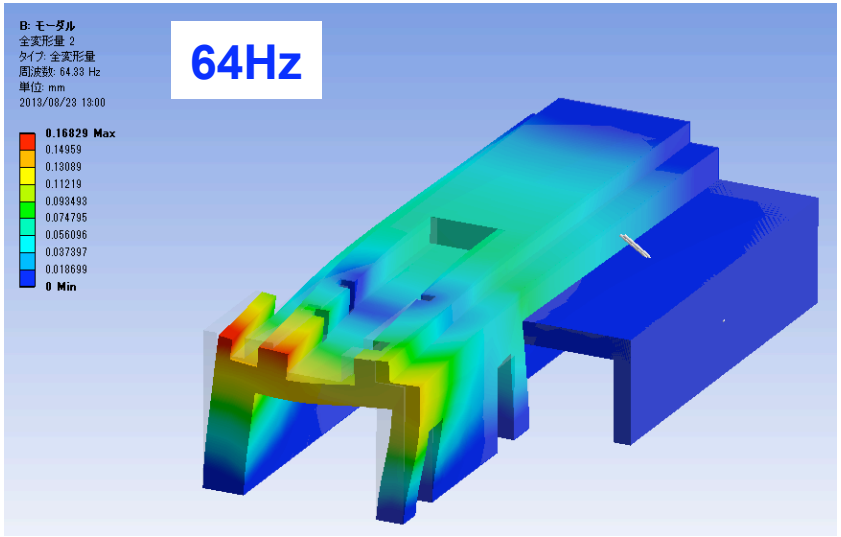
Assembling in KEK,

→ Middle of March.



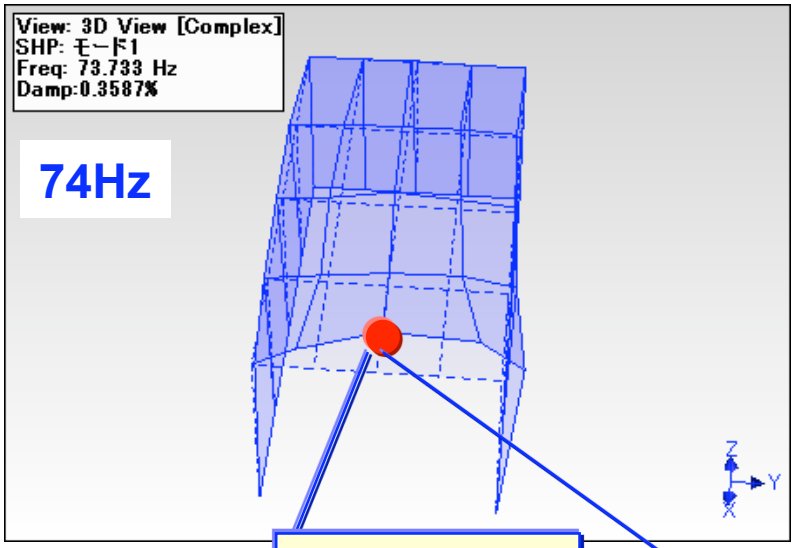



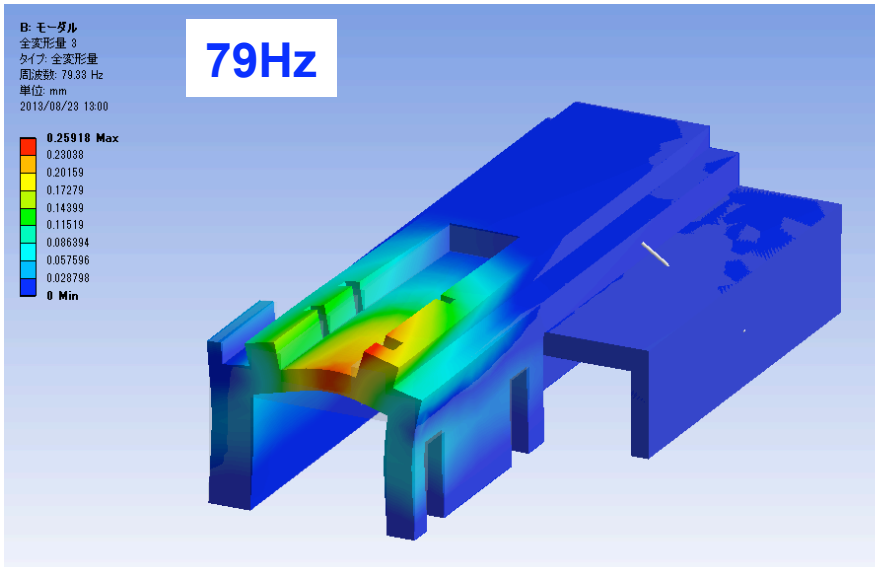



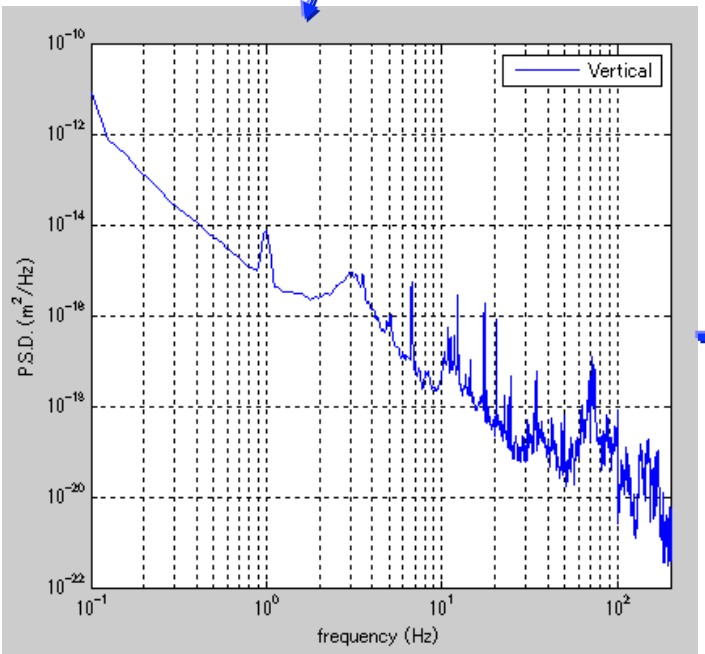

**Measurement**

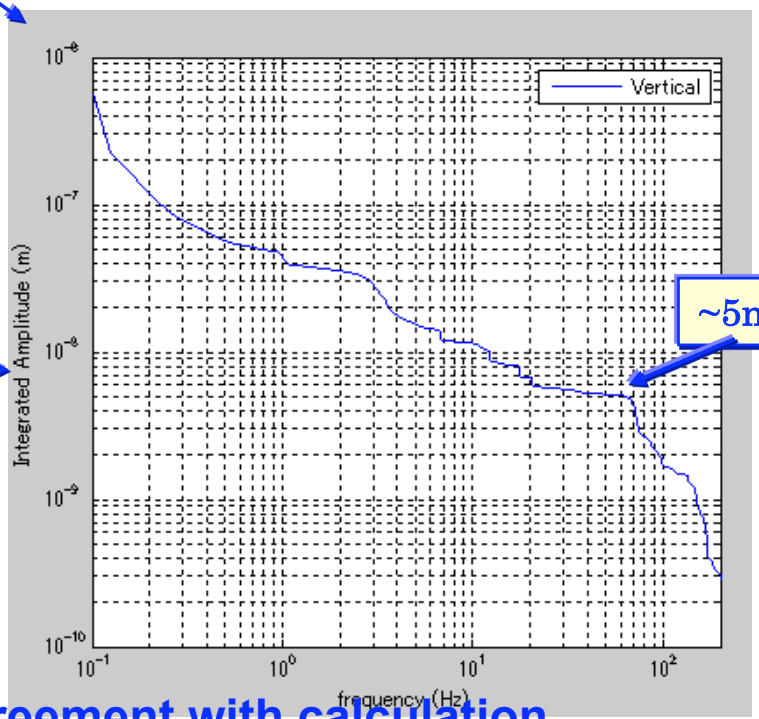
**ANSYS**




この点での各値

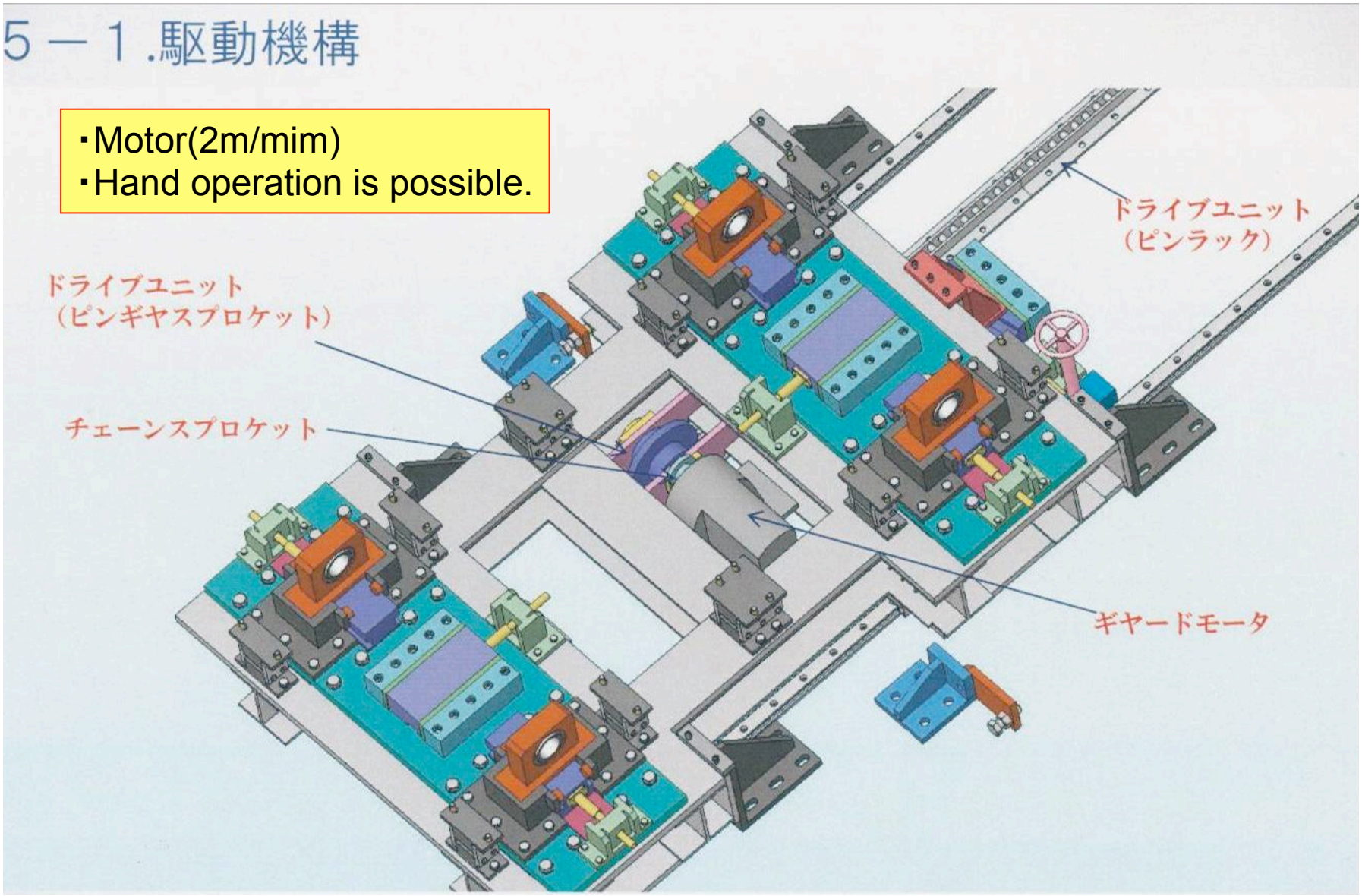


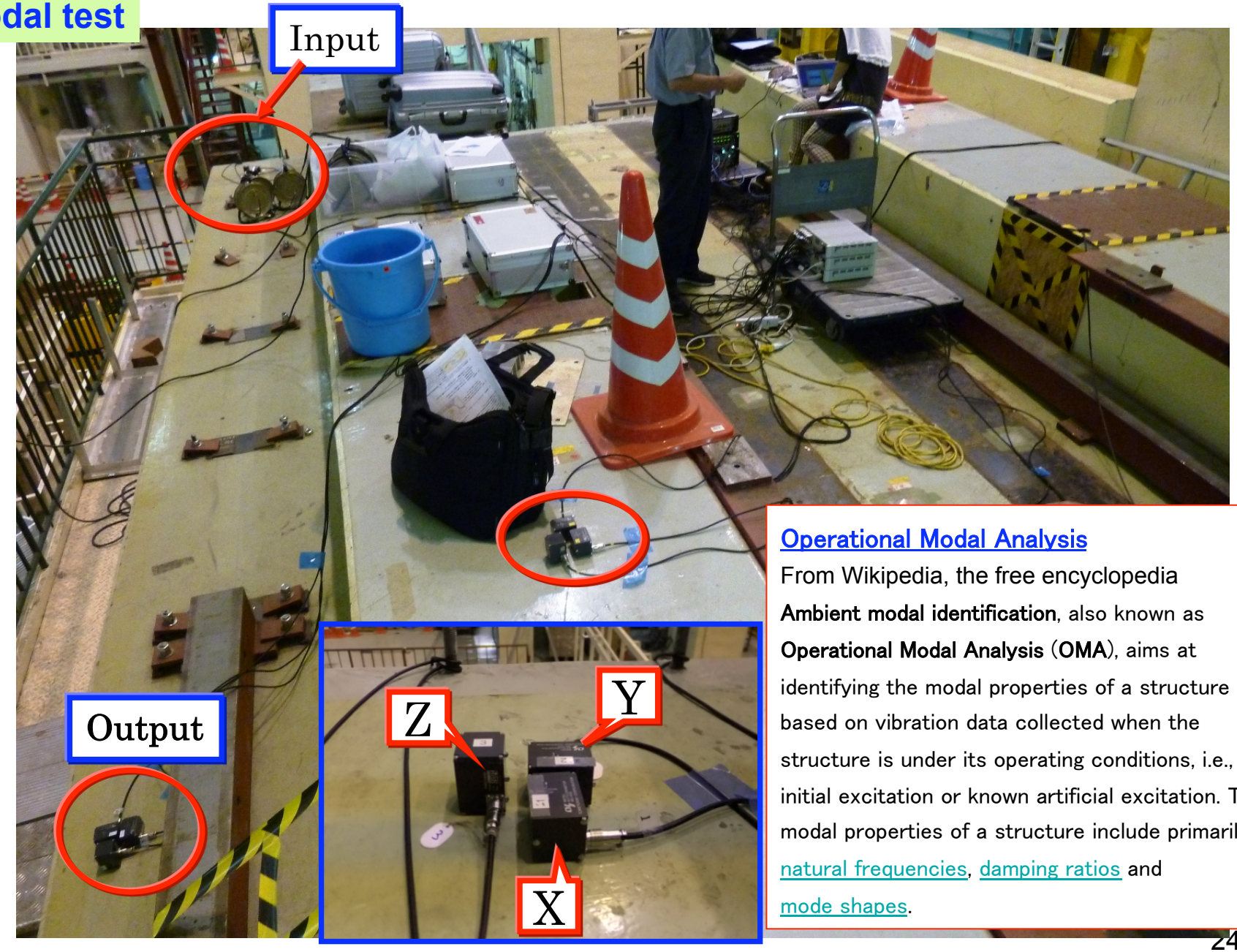

→ Measurement data is good agreement with calculation.

# 5－1.駆動機構

・Motor(2m/mim)
・Hand operation is possible.



# Modal test




## Operational Modal Analysis

From Wikipedia, the free encyclopedia

**Ambient modal identification**, also known as **Operational Modal Analysis** (**OMA**), aims at identifying the modal properties of a structure based on vibration data collected when the structure is under its operating conditions, i.e., no initial excitation or known artificial excitation. The modal properties of a structure include primarily the natural frequencies, damping ratios and mode shapes.