# BS Outer frame

Comparison of deformation with and without reinforcement

# BS Outer frame

補強材の有無による変形量の比較

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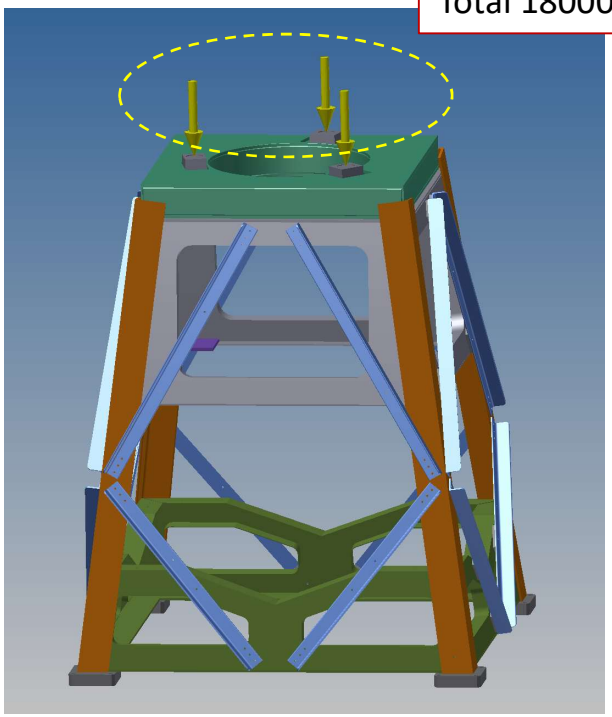
4. まとめ

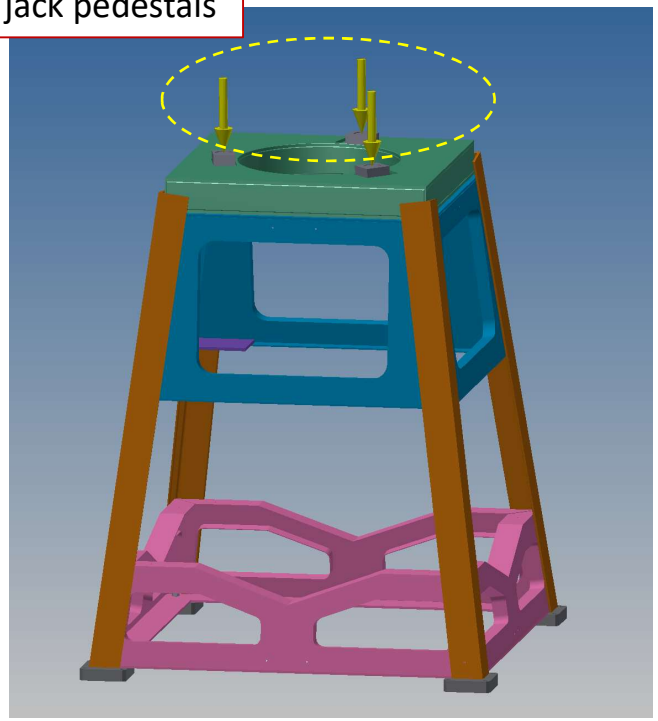
# 1. Deformation due to BS body load

## Analysis model, load conditions

Total 18000N (BS tower) on jack pedestals



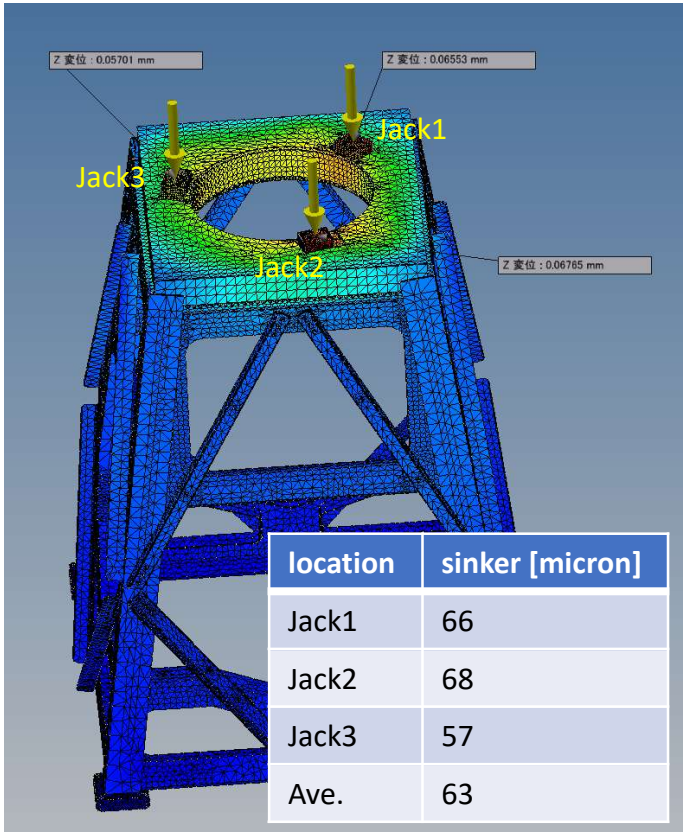
Outer frame with reinforcement



Current outer frame

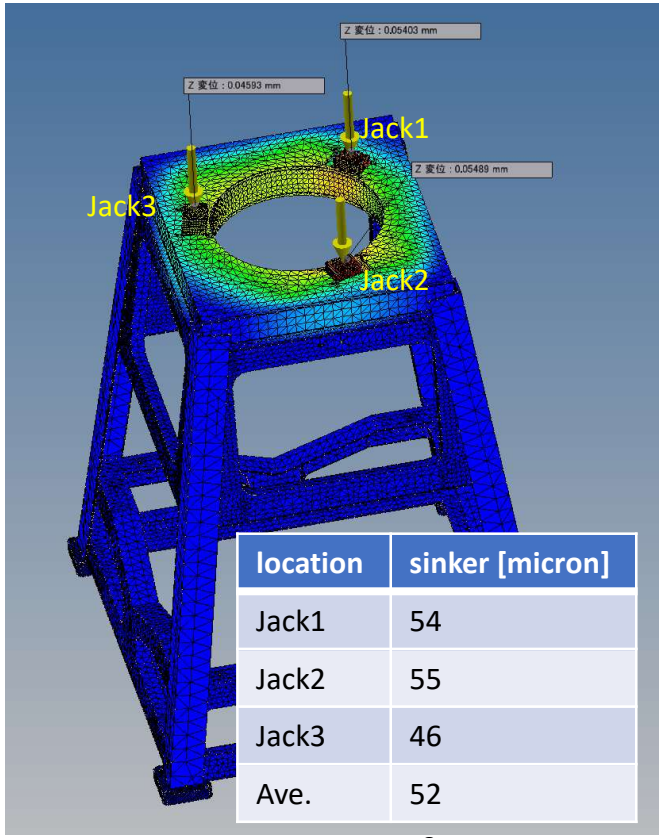
# 1. Deformation due to BS body load

Result (amount of sinker)




| location | sinker [micron] |
|---|---|
| Jack1 | 66 |
| Jack2 | 68 |
| Jack3 | 57 |
| Ave. | 63 |

Outer frame with reinforcement



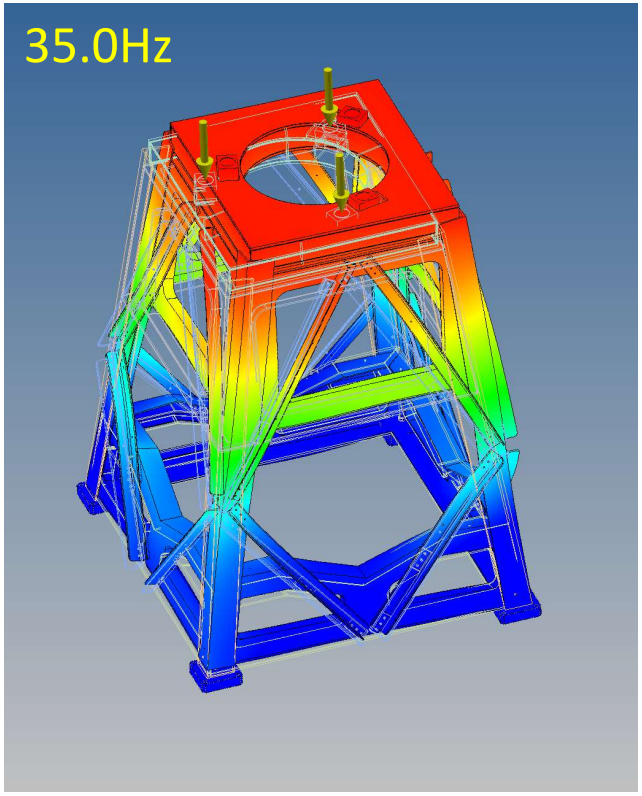

| location | sinker [micron] |
|---|---|
| Jack1 | 54 |
| Jack2 | 55 |
| Jack3 | 46 |
| Ave. | 52 |

Current outer frame

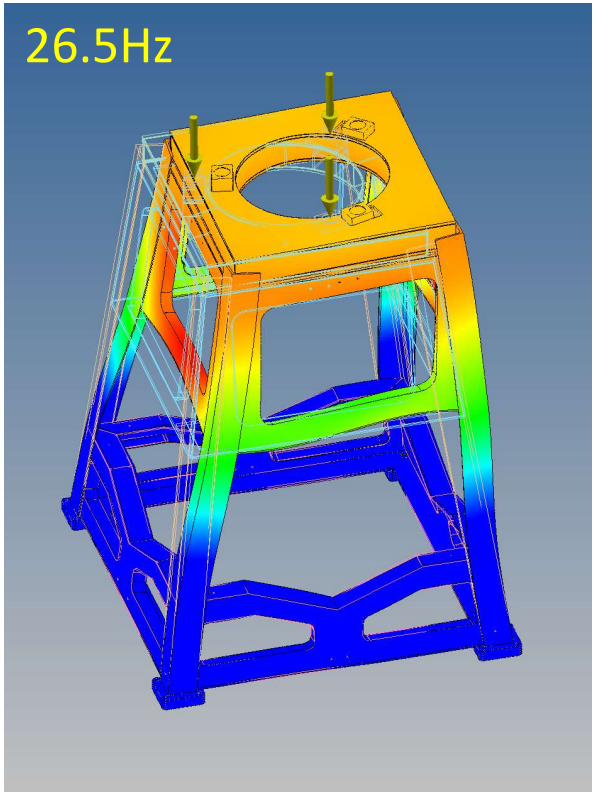
For some reason, the deformations were larger when the model was reinforced. No obvious flaws found in the model.

# 2. Natural frequency

Result (primary mode)




Outer frame with reinforcement

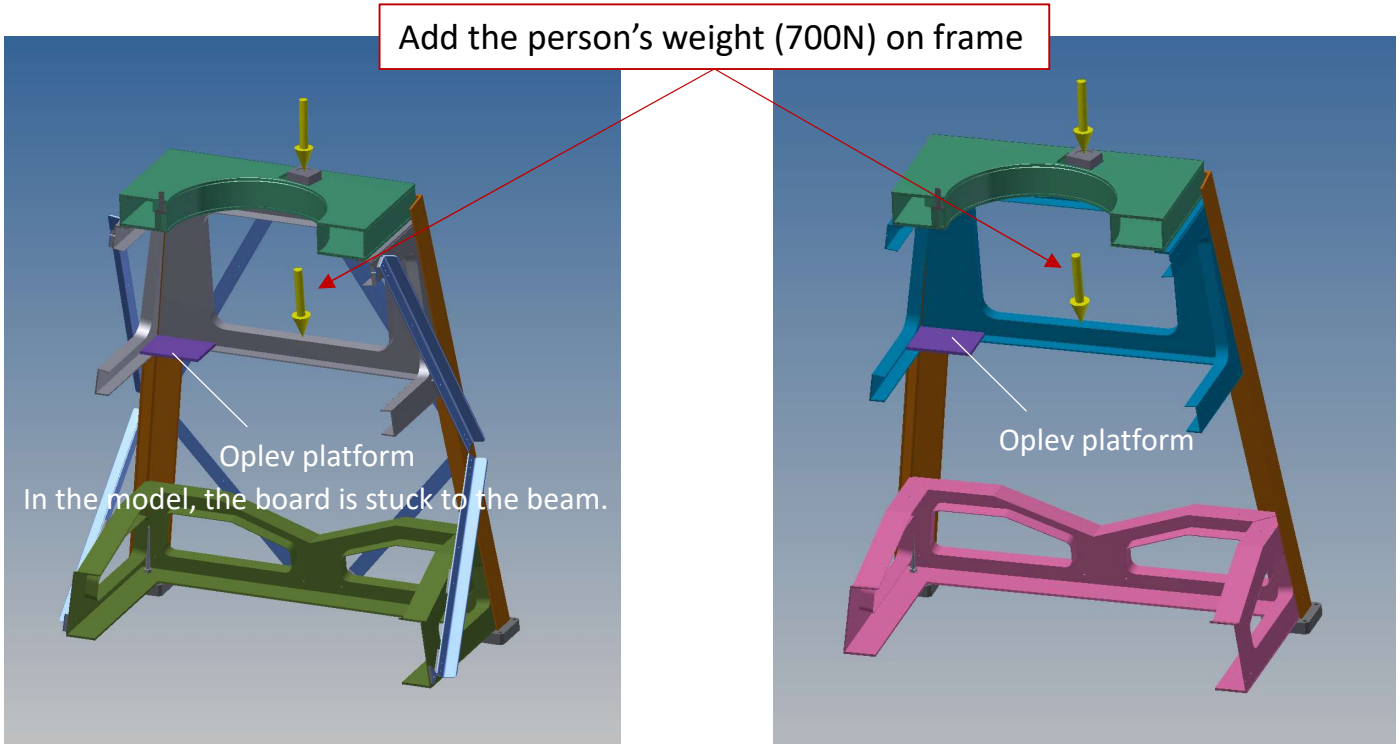



Current outer frame

The natural frequency shows the effect of reinforcement.

# 3. Tilt of the oplev platform when weight is applied to the frame

## Analysis model, load conditions




Outer frame with reinforcement

Current outer frame

# 3. Tilt of the oplev platform when weight is applied to the frame

## Result

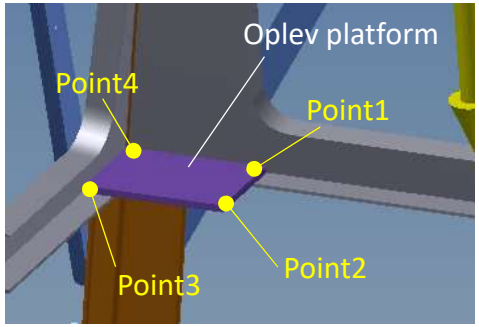
Change in the amount of sinkage when a load is applied by a person

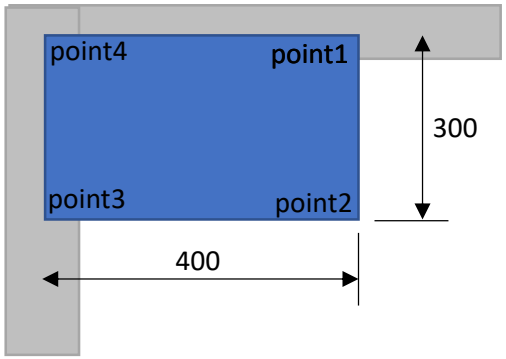
Outer frame with reinforcement

| location | | sinker [micron] |
|---|---|---|
| Oplev | Point1 | 2.4 |
| | Point2 | 5.2 |
| | Point3 | 1.6 |
| | Point4 | 1.5 |
| Jack | Jack1 | 0.4 |
| | Jack2 | 0.5 |
| | Jack3 | 1.1 |

Current outer frame

| location | sinker [micron] |
|---|---|
| Point1 | 1.5 |
| Point2 | 6.8 |
| Point3 | 0.5 |
| Point4 | 0.7 |
| Jack1 | 0.1 |
| Jack2 | 0.1 |
| Jack3 | 0.2 |



# 4. Summary and comment

Comparison results with and without reinforcement

- It is strong enough for the weight of the BS body, but the natural frequency will be higher with reinforcement.
- When a person's weight is applied, only very small changes (a few microns) are seen in both Jack and Oplev.
- The model is supposed to be a bit more rigid than the real thing, as the parts are properly connected to each other.

# 5. Reference

Detail of change in the displacement due to BS body load (no weight of person)

Direction X

| dX | With reinforced | Current frame |
|---|---|---|
| Jack1 | 10.8 | 7.6 |
| Jack2 | 4.6 | 2.4 |
| Jack3 | 4.2 | 1.3 |

[micron]

Direction Y

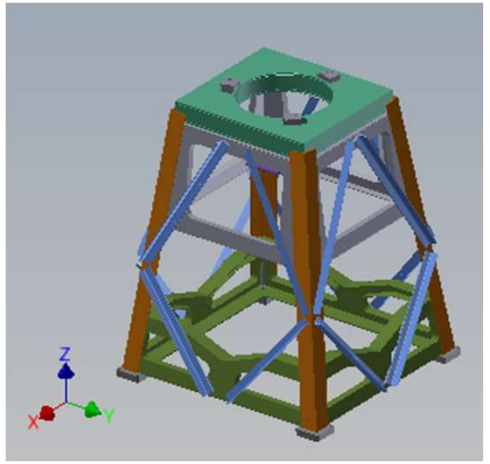
| dY | With reinforced | Current frame |
|---|---|---|
| Jack1 | 11.3 | 11 |
| Jack2 | 8.5 | 8 |
| Jack3 | 2.9 | 1.5 |

[micron]

Direction Z

| dZ | With reinforced | Current frame |
|---|---|---|
| Jack1 | 65.5 | 54 |
| Jack2 | 67.7 | 54.9 |
| Jack3 | 57 | 45.9 |
| Ave. | 63.4 | 51.6 |

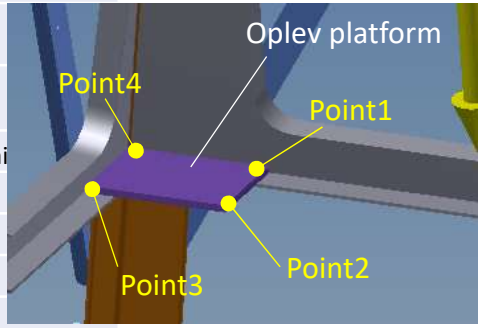
[micron]

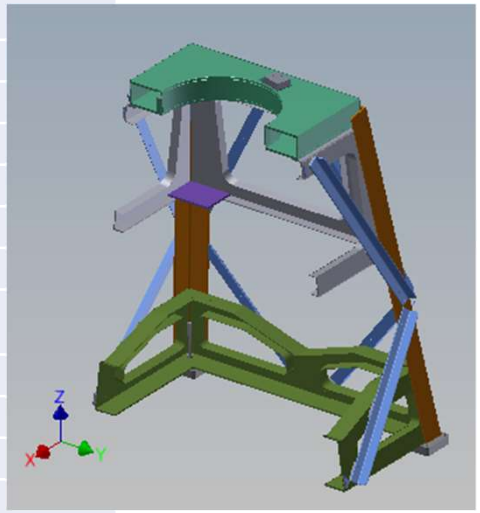


# 5. Reference

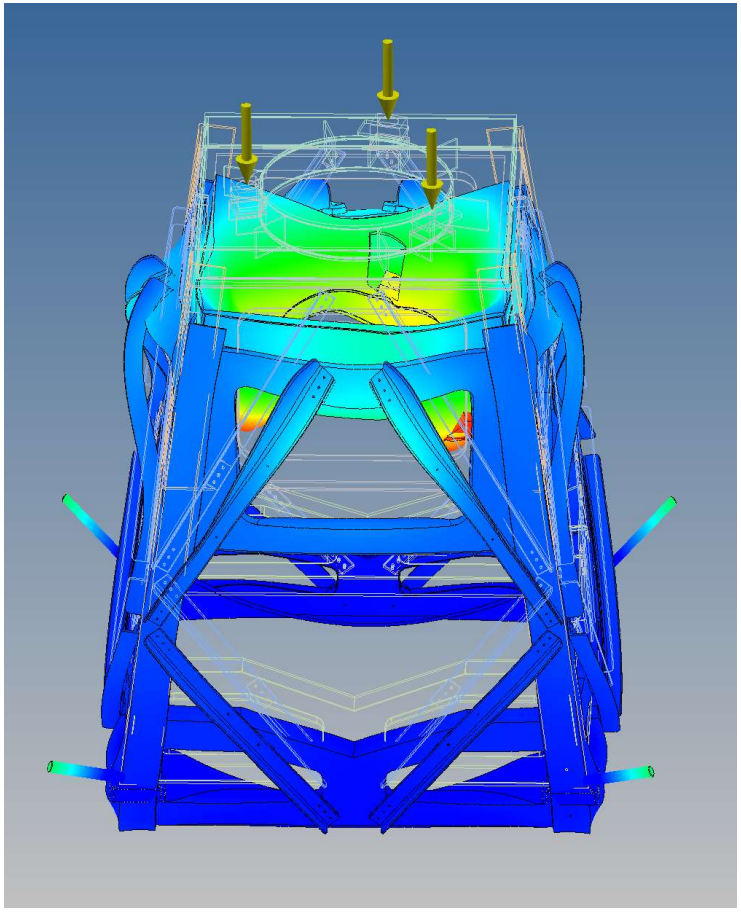
## Detail of change in the displacement when a load is applied by a person

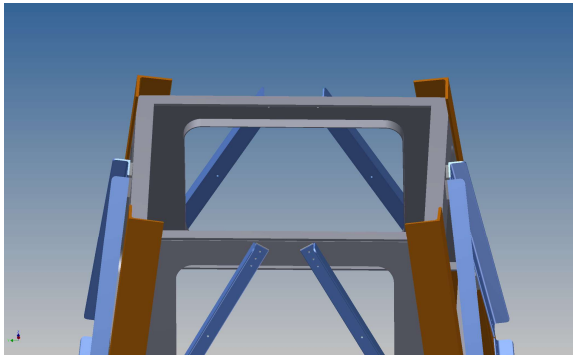
| 補強無し Current frame | | | | | | 補強あり with reinforcement | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | 基本荷重 | 体重あり | 移動量 | | | | 基本荷重 | 体重あり | 移動量 | |
| | | Only BS | Add person's weitght | displacement | | | | Only BS | Add person's weitght | displacement | |
| point1 | dx | 3.3 | 7 | 3.7 | [micron] | point1 | dx | 4 | 8.4 | 4.4 | [mi |
| | dy | 0.1 | 1.1 | 1 | | | dy | 1.1 | 1.6 | 0.5 | |
| | dz | 3.9 | 5.4 | 1.5 | | | dz | 18.6 | 21 | 2.4 | |
| point2 | dx | 3.3 | 7 | 3.7 | | point2 | dx | 4 | 8.3 | 4.3 | |
| | dy | 0.3 | 3.3 | 3 | | | dy | 1 | 2.7 | 1.7 | |
| | dz | 2.9 | 9.7 | 6.8 | | | dz | 16.9 | 22.1 | 5.2 | |
| point3 | dx | 1.1 | 1.4 | 0.3 | | point3 | dx | 0.6 | 2.5 | 1.9 | |
| | dy | 0.3 | 3 | 2.7 | | | dy | 1 | 2.4 | 1.4 | |
| | dz | 5 | 5.5 | 0.5 | | | dz | 19.2 | 20.8 | 1.6 | |
| point4 | dx | 1.1 | 1.4 | 0.3 | | point4 | dx | 0.7 | 2.5 | 1.8 | |
| | dy | 1.3 | 1.1 | -0.2 | | | dy | 1.3 | 1.5 | 0.2 | |
| | dz | 4.6 | 5.3 | 0.7 | | | dz | 19.1 | 20.6 | 1.5 | |
| フレーム | z | | 35.8 | 35.8 | | フレーム | z | 15.2 | 49.1 | 33.9 | |
| Jack1 | z | 54 | 54.1 | 0.1 | | Jack1 | z | 65.5 | 65.9 | 0.4 | |
| Jack2 | z | 54.9 | 55 | 0.1 | | Jack2 | z | 67.7 | 68.2 | 0.5 | |
| Jack3 | z | 45.9 | 46.1 | 0.2 | | Jack3 | z | 57 | 58.1 | 1.1 | |



# 5. Reference





This is an exaggerated representation of the deformation. It gives the impression that the reinforcement is bending the plate that the jack rests on inward.