



Leading-edge Research Infrastructure Program
Large-scale Cryogenic Gravitational Wave Telescope Project

JGW-E1503830-v10

KAGRA

19 January 2016

Title

Mark Barton, Shoda, Fujii, Fabian, et. al.

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JGW-DCC

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of the KAGRA collaboration.

<http://gwcenter.icrr.u-tokyo.ac.jp>

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1 Introduction

1.1 Purpose and Scope

stuff

1.2 References

Stuff

1.3 Version history

mm/dd/yy: Pre-rev-v1 draft.

1.4 How to edit this document

Use the file at the following link.

1.5 Related documents

1. Recoil Mass (RM): [JGW-D1504531](#).
2. Earthquake stop screws for optic:
 - Short: [JGW-D1504355](#).
 - Medium: [JGW-D1504354](#).
 - Long: [JGW-D1504509](#).
3. Payload earthquake stop: [JGW-D1504477](#).
4. Intermediate Recoil Mass (IRM): [JGW-D1504489](#).
5. Mirror box (a.k.a. Mirror jig): [JGW-D1503789](#).
6. Hexagonal cable clamp holder: [JGW-D1504530](#).
7. Intermediate mass (IM): [JGW-D1504490](#).
8. Intermediate mass assembly procedure: [JGW-T1503907](#).
9. Intermediate stage assembly (IM+IRM): [JGW-D1504491](#).
10. Payload assembly: [JGW-D1504493](#).
11. Bottom filter assembly:
 - Orientation of Bottom Filter in Type B: [JGW-D1503263](#).

12. This document: [JGW-E1503830](#).
13. Spare mirror hanging procedure: [JGW-T1604756](#).
14. VIS wiki: [Installation work information](#).
15. Other documents.

1.6 Pictures of the payload assembly at the site

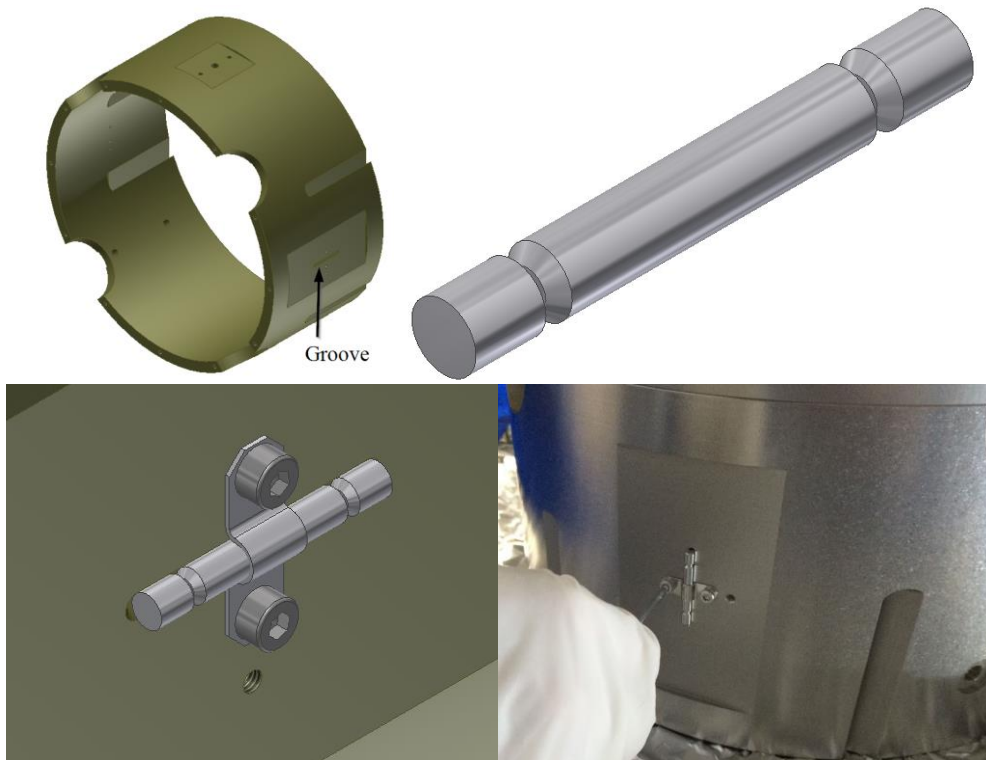
1. October 2015: [5th](#), [6th](#), [7th](#), [8th](#), [9th](#), [10th](#), [13th](#), [14th](#), [15th](#), [16th](#), [19th](#), [20th](#), [21st](#), [22nd](#), [23rd](#), [27th](#), [28th](#), [29th](#), [30th](#).
2. November: 2nd Nov, 2015 : [2nd](#), [3rd](#), [4th](#), [9th](#), [10th](#), [12th](#), [13th](#), [16th](#), [17th](#), [18th](#), [24th](#), [25th](#), [27th](#).
3. December: 7th Dec, 2015 : [7th](#), [8th](#), [9th](#), [10th part 1](#) , [10th part 2](#) , [10th part 3](#), [14th](#), [15th](#), [16th](#), [17th](#), [24th](#), [25th](#).
4. January 2016: 12th Jan, 2016: [12th](#), [13th](#), [20th](#), [21st](#), [22nd](#).
5. February:

1.7 Reports of the payload assembly at the site

1. October 2015: [6th](#), [7th](#), [8th](#), [9th](#), [14th](#), [15th](#), [16th](#), [19th](#).
2. November:
3. December:
4. January 2016:
5. February:

1.8 Assembly of the recoil mass and its pedestal

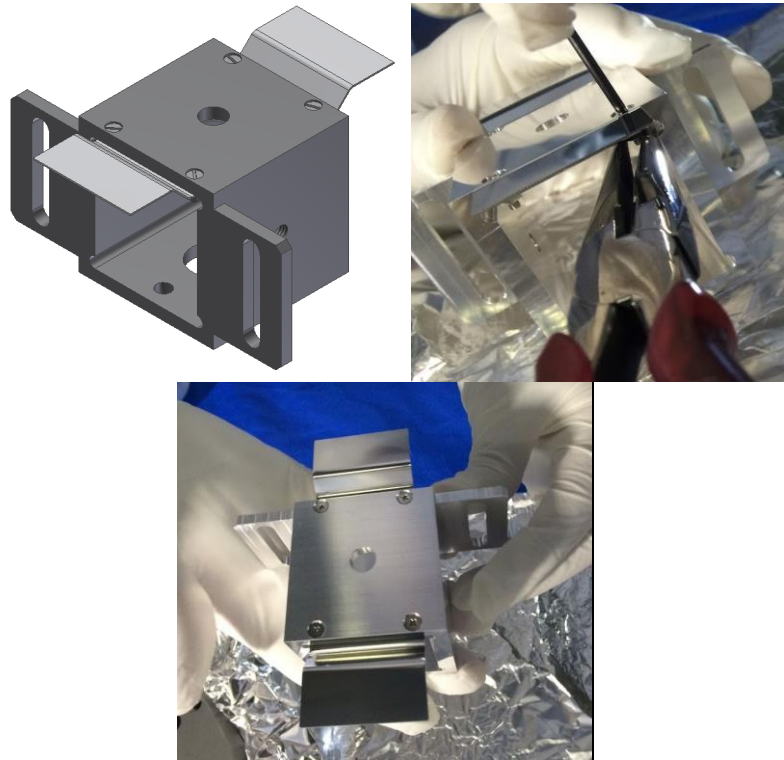
1. Attach wire breakers to RM.
 - On the RM cylinder U00017_424 attach the wire breakers 2×U00015-434 in the grooves on the flats on the sides.
 - Use the clamps 2×U00032-435 and the coated screws 4×ISO 4762 M3×8 mm.



Pictures: [PR3 hanging test, 08/10/2015](#).

2. Attach the cable clamp support to the multipurpose cube.

- Multipurpose cube: U00013-427.
- Cable clamp support U00029-428.
- Screws: 4×DIN EN ISO 2009 M2.5×8 mm, uncoated.
- Nuts: 4×UNI EN 24032 M2.5.



Pictures: [PR3 hanging test, 08/10/2015](#).

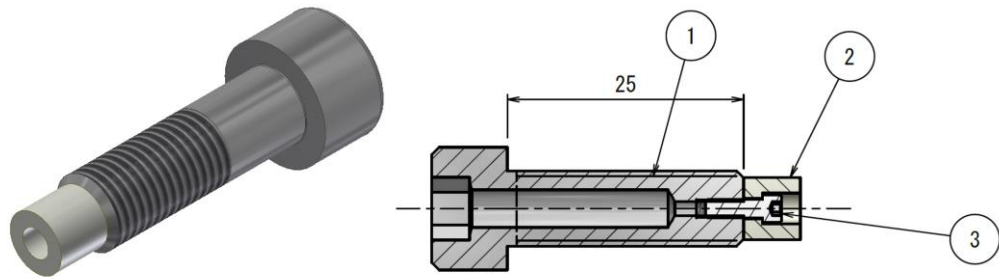
3. Fix the multipurpose assembly on top of the RM. Use the following screws:

2×ISO 4762 M5×12mm coated.



Pictures: [PR3 hanging test, 08/10/2015](#).

4. Assemble 5×[JGW-D1504355](#) earthquake stop screws for the cylindrical part the optic:
 - Coated screws: 5×JGW-D1503761-10 whose specification is ISO4762 M8×25mm with a M2×0.4 threaded hole.
 - PTFE cylindrical head: 5×JGW-D1503761-1.
 - Coated screws: 5×SNSS-M2-6-SD whose size is M2×0.4×6mm.



Pictures: [PR3 hanging test, 08/10/2015](#).

5. Insert them into the cylinder.

One at 12 o'clock where the multipurpose cube is, two at 5 o'clock and two at 7 o'clock.

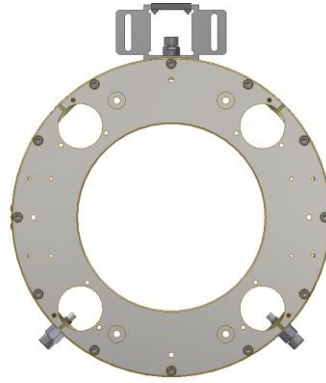
Use lock nuts $5 \times \text{JGW-D1503761-9}$. Set the threaded part of the nut towards the cylinder.



Pictures: [PR3 hanging test, 08/10/2015](#).

6. Attach the back ring of the RM.

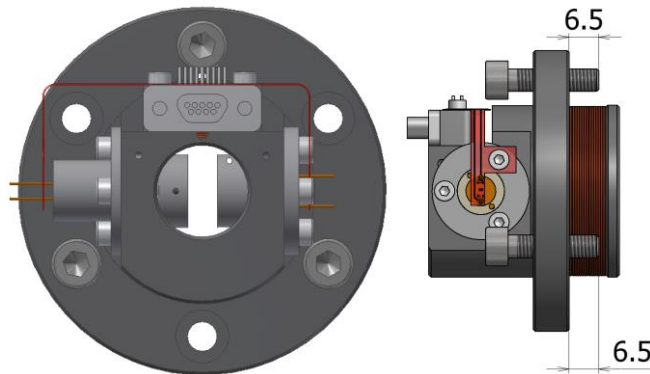
- **Back ring:** U00033_426.
- **Screws:** $12 \times \text{ISO4762}$ M5 \times 18mm **coated**.
- The back side of the RM cylinder has cut-outs for the OSEM.
- The plate is not symmetric with respect to the horizontal plane. See the screws for the OSEMs.



Pictures: [PR3 hanging test, 08/10/2015](#).

7. Insert the push screws into their holes in the OSEMs.

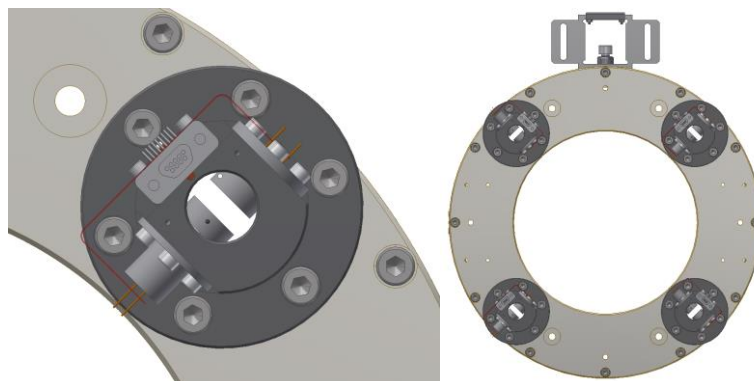
- Screws: 3×ISO4762 M5×20 mm coated per OSEM, 12 in total.
- The screws should stick out 6.5 mm on the opposite side of insertion.

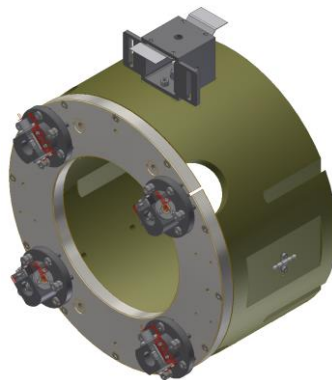


Pictures: no pictures yet.

8. Fix the OSEM to the back ring of the RM.

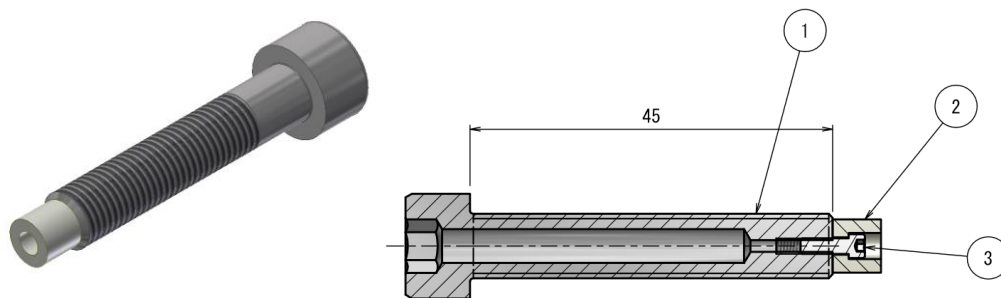
Screws: 3×ISO 4762 M5×20 mm coated per OSEM, 12 in total.





Pictures: [PR3 hanging test, 08/10/2015](#).

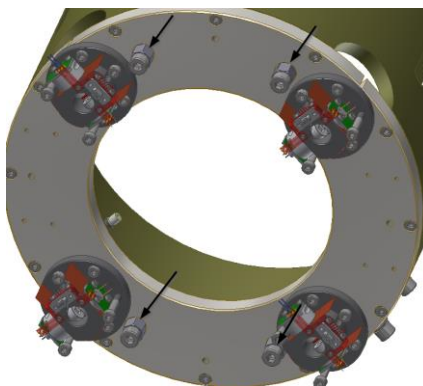
9. Assemble 4×[JGW-D1504354](#) earthquake stop screws for the back face of the optic:
 - ①. 1 Coated screws: 4×JGW-D1503761-11 whose specification is ISO 4762 M8×45 mm with a M2×0.4 threaded hole.
 - ②. PTFE cylindrical head: 4×JGW-D1503761-1.
 - ③. Coated screws: 4×SNSS-M2-6-SD whose size is M2×0.4×6 mm.



Pictures: [PR3 hanging test, 08/10/2015](#).

10. Insert them into the back ring of the RM.

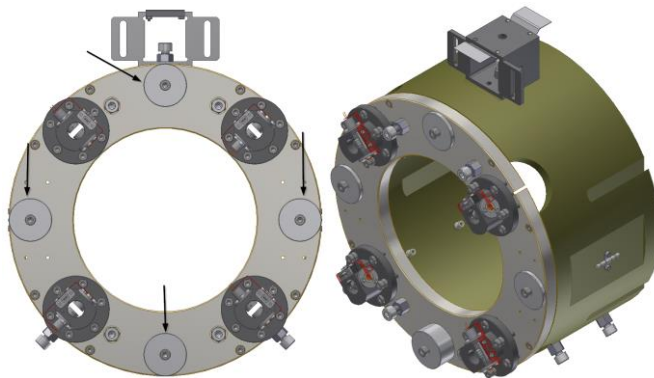
Fix them at 1, 5, 7 and 11 o'clock. Use lock nuts: 5×JGW-D1503761-9. Set the threaded part of the nut towards the back plate.



Pictures: no pictures yet.

11. Put on the back ring the ballast weights. These components are the same for all PR payloads:

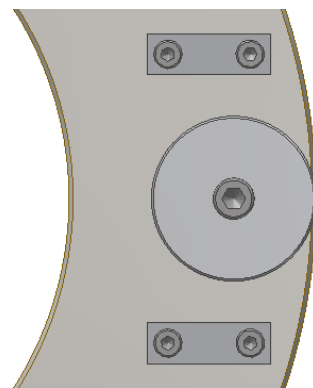
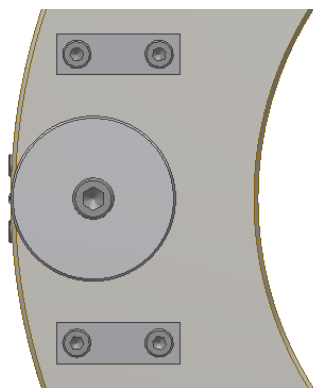
- At 12, 3 and 9 o'clock: 3×JGW-D1504732-1 (thickness = 4.5 mm) with coated ISO4762 M6×10mm screw.
- At 6 o'clock: 1×JGW-D1504732-2 (thickness = 19 mm) with coated ISO4762 M6×25 mm screw.



Drawings: [JGW-D1504732](#).

12. Place cable clamps on the back ring.

- Clamps: 4×JGW-D1503444-40.
- Screws: 8×ISO4762 M4×10 mm coated.

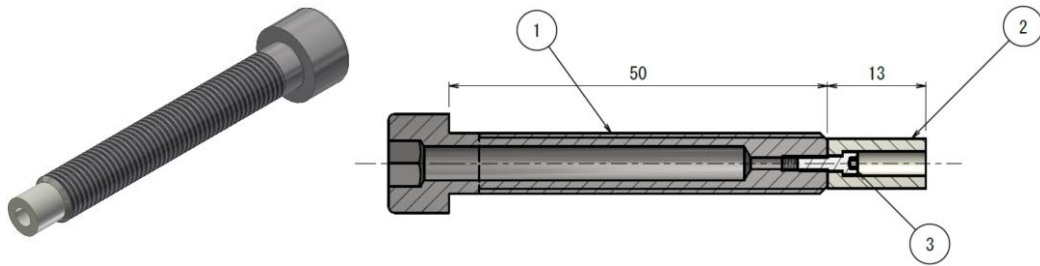


The recoil mass is ready to be brought around the optic, but the pedestal still has to be assembled.

13. Assemble 4×[JGW-D1504509](#) earthquake stop screws for the front face of the optic.

These screws will be used after inserting the Recoil Mass around the hanging mirror.

- ①. Coated screws: 4×JGW-D1503761-7 whose specification is ISO4762 M8×50mm with a M2×0.4 threaded hole.
- ②. PTFE cylindrical head: 4×JGW-D1503761-12.
- ③. Coated screws: 4×SNSS-M2-6-SD whose size is M2×0.4×6mm.



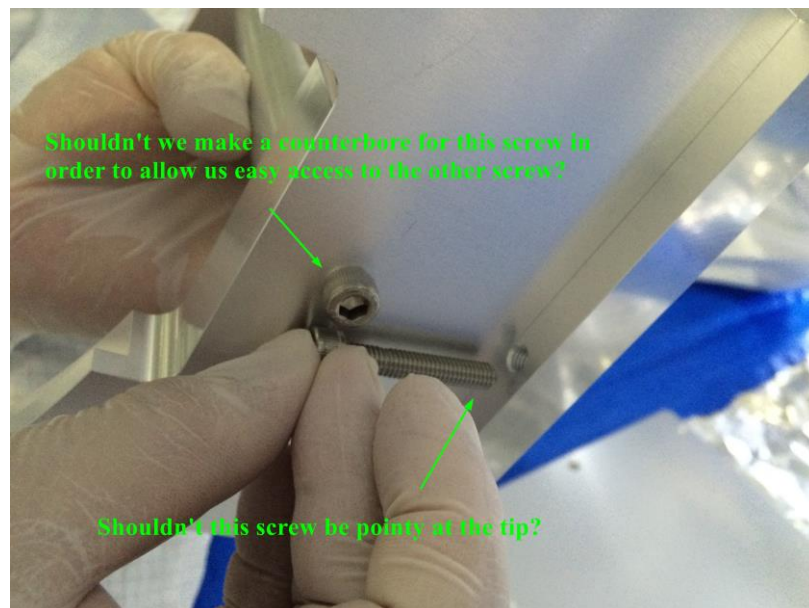
Pictures: [PR3 hanging test, 08/10/2015](#).

14. Begin the assembly of the Recoil Mass pedestal by...

Pictures: [Spare mirror hanging test, 8/10/2015](#).

15. Stuff...

16. More stuff...

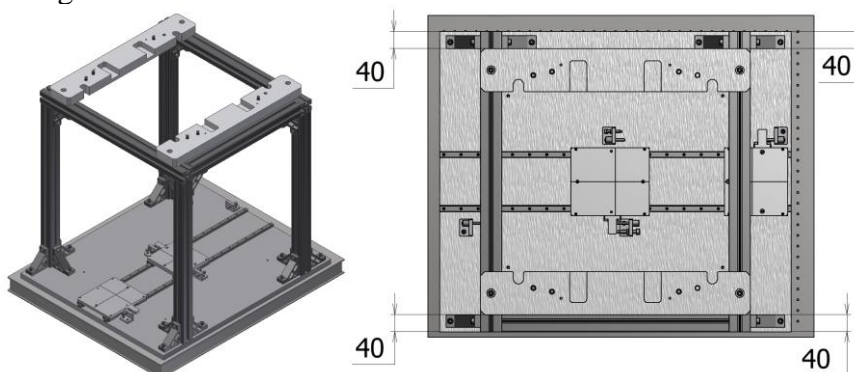


Pictures: [Spare mirror hanging test, 8/10/2015](#).

1.9 Hanging the mirror

1. Prepare the hanging frame and the optic and Recoil Mass trollies.

- Drawing:

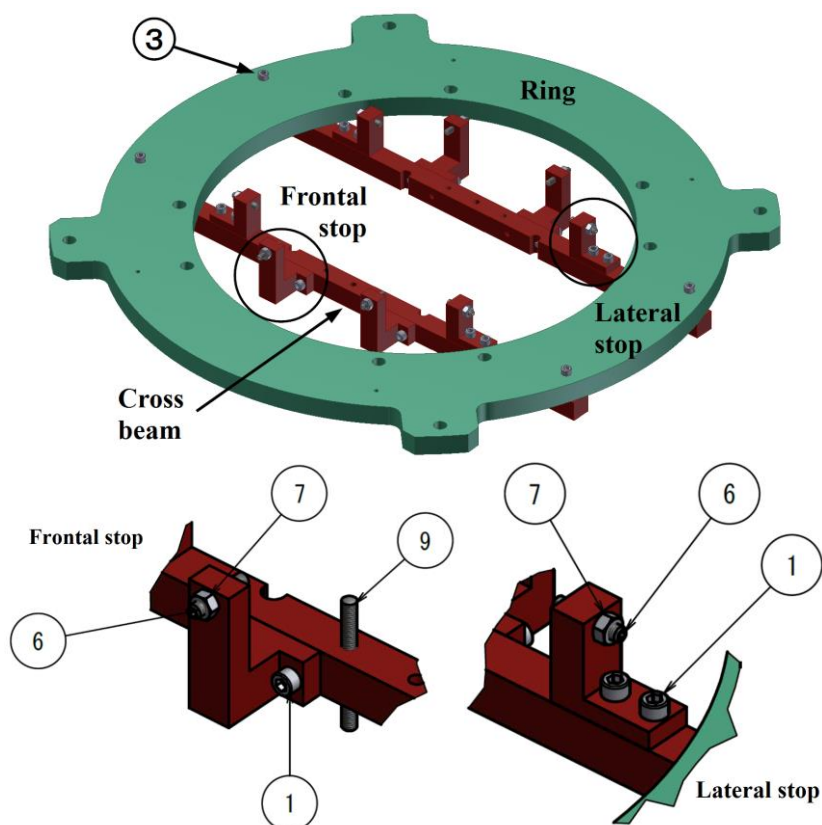




2. Assemble the earthquake stop for the Intermediate Mass:

- Large ring: 1×JGW-D1504453-359,
- Cross beams: 2×U00014_360,
- Lateral stop: 4×JGW-D1504453-362,
- Frontal stop: 4×JGW-D1504453-361,

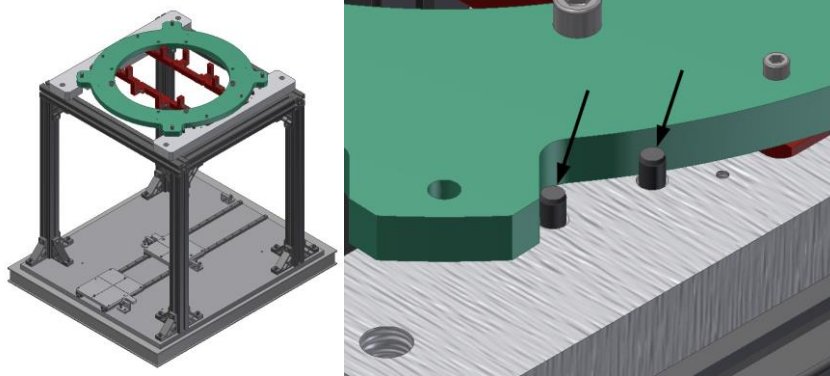
Drawing: [JGW-D1504477](#).



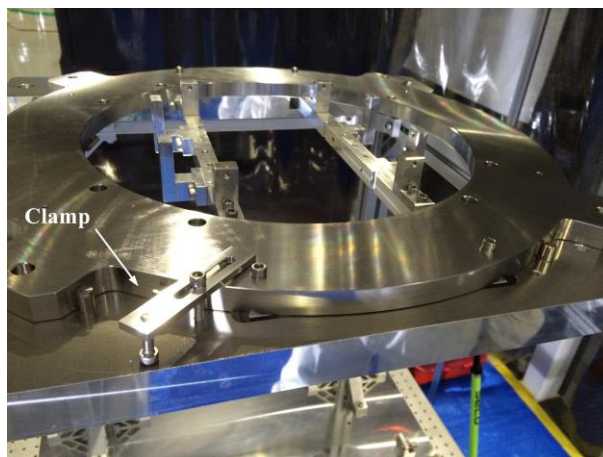
- Fasteners:

- ①. Screws: 16×ISO 4762 M6×25, (some of these have to be shorter to allow us inserting the pull-down screws for the IM! Decide the new length and notify Hirata-san.)
- ③. Screws: 4×ISO 4762 M6×35,
- ⑥. Stud: 8×CSN 02 1187 - M6×30, (buy from Misumi: [ANBNS6-30](#)).
- ⑦. Nut: 8×UNI EN 24032 M6, (made of aluminium, buy from Misumi: [CBALN6](#)).
- ⑨. Stud: 4×ANBNS6-60 from Misumi.

3. Place the earthquake stop ring on the frame. Set it in position using 8 pins which have to be inserted on the frame.



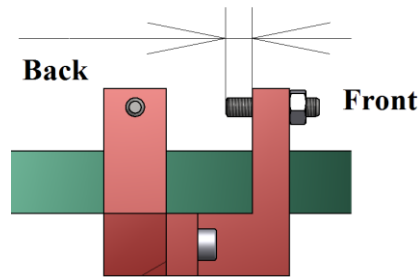
4. Clamp the ring to the frame at the four corners using the Misumi clamps. Use



Pictures: [PR hanging test, 06/10/2015](#).

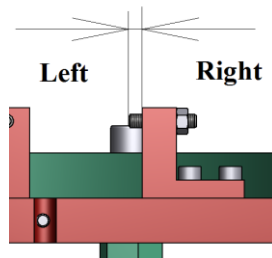
5. Adjust studs ⑥ and ⑨ and lock them with nuts ⑦ (see drawing: [JGW-D1504477](#)).
 - Frontal set screws ⑥: they should stick 9.5 mm toward the center. Do not adjust the ones at the back.

9.5



- Lateral studs ⑥: they should stick 7 mm toward the center. Adjust only the studs on the right side.

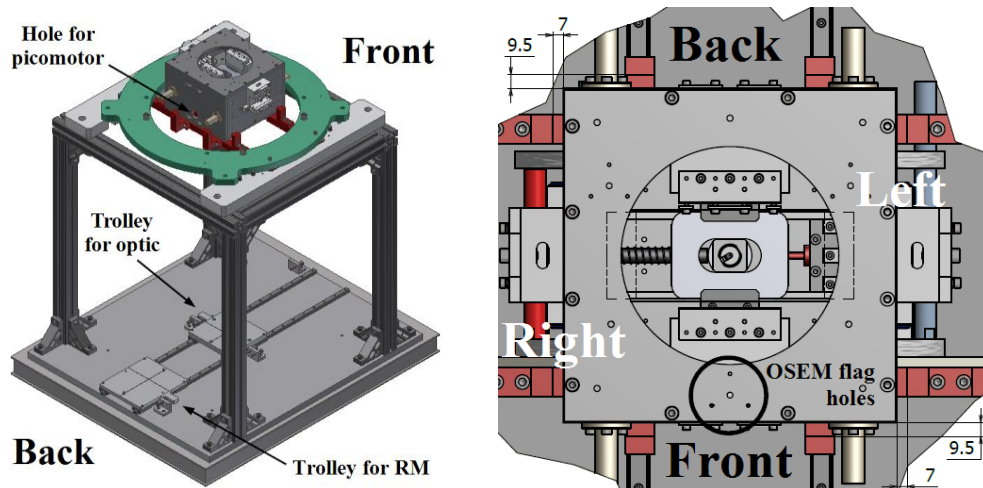
7



6. Bottom set screws ⑨: they should stick 22 mm in the upper direction. The diagram for this step is missing. Hirata-san is checking where in the 3D CAD the set screws ⑨ are.

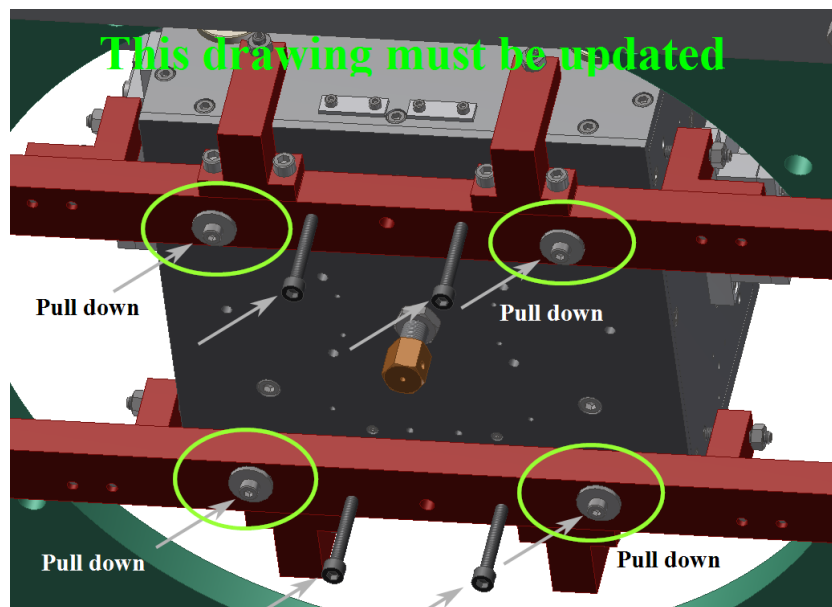
Drawing: [JGW-D1504477](#).

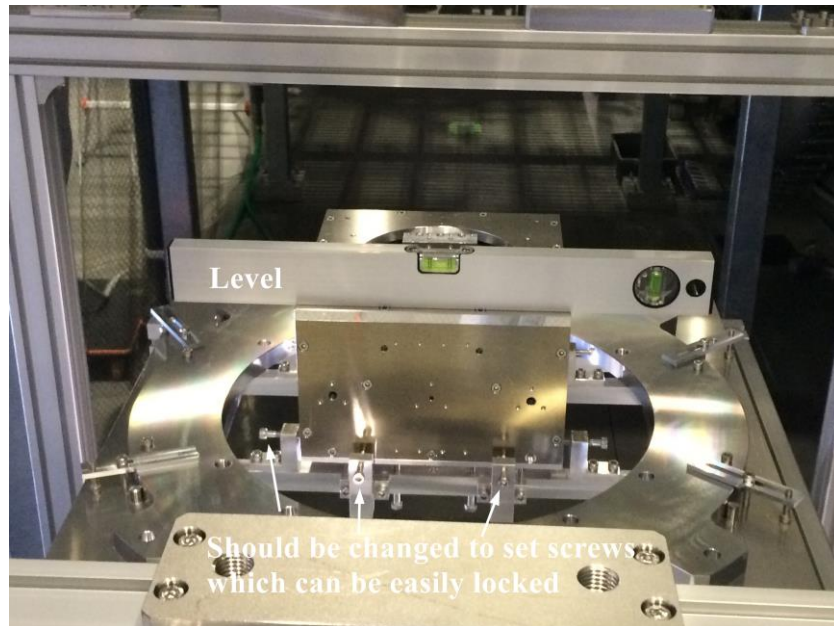
7. Place the Intermediate Mass centred on the frame.
 - Mind the orientation. See the diagram below.
 - Push it toward the front and right stop studs recently adjusted.
 - Secure it with the other front and lateral studs.
 - The Intermediate Mass should be at the centre, check.



8. Secure the Intermediate Mass to the crossbars below using screws to pull it down.

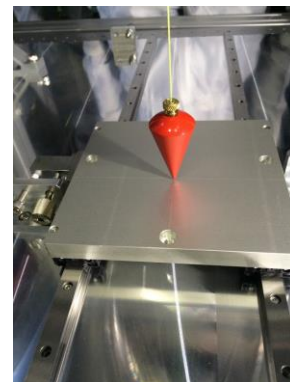
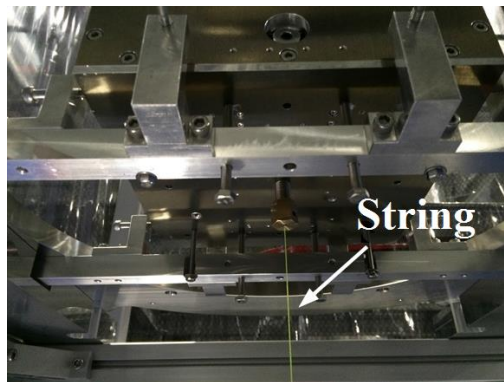
- Screws: 4×M5×55 or 60 mm.
- Washers: 4×M5, 4×M6 and 4×M8.
- As the holes in the crossbeams are not closed and are larger than M5, stack the three types of washers in order to hold the head screw.
- Use the bubble level on top to check the IM is straight.



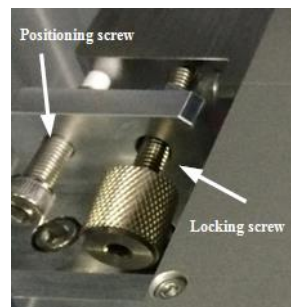
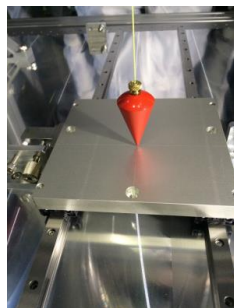


Pictures: [PR3 hanging test, 08/10/2015](#).

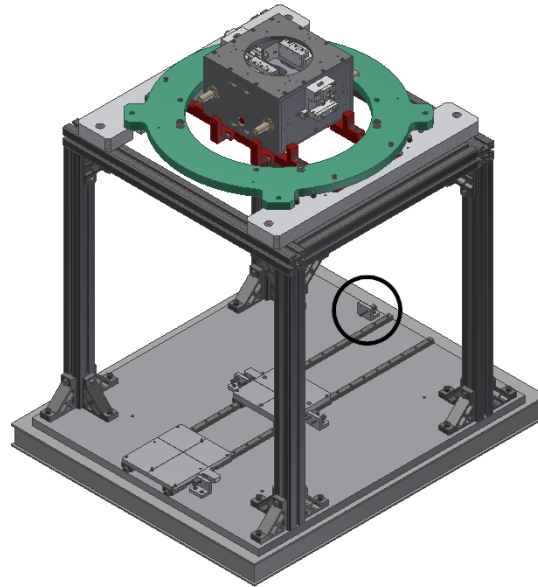
9. Hang a plumb-bob from the magnetic damper holder at the bottom of the IM.



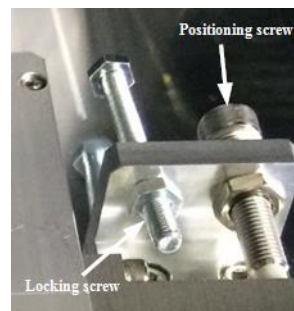
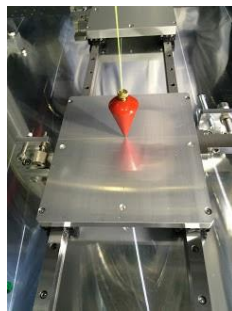
10. Slide the base of the mirror trolley under the IM and place its center where the plumb-bob indicates. Fix it in place with the positioning and locking screws on the sides. Use a nut to fix in place the positioning screw.



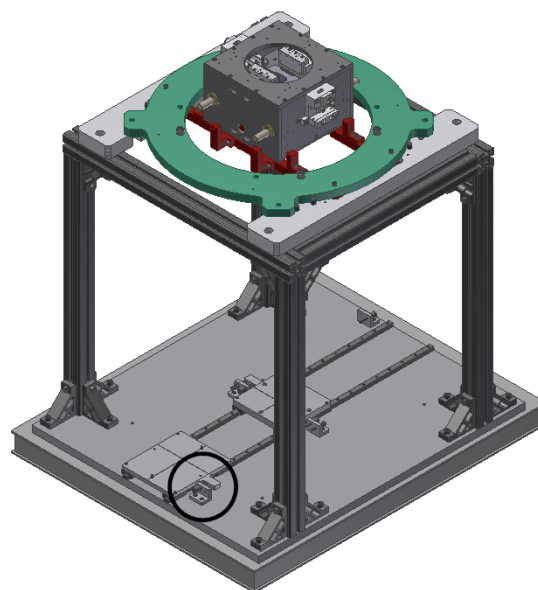
11. Release the locking screw and move away the trolley from the center of the table. Lock it on the far side of the table.



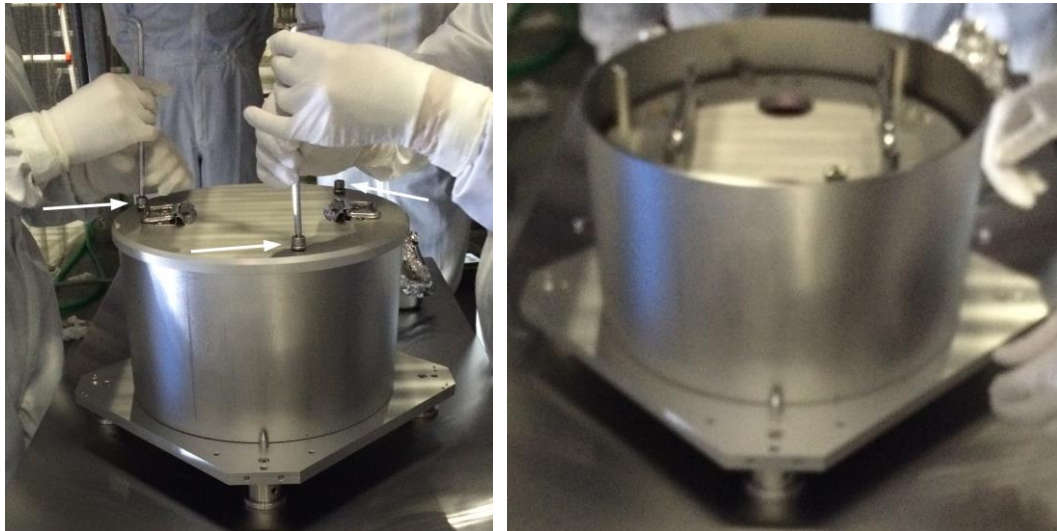
12. Align the Recoil Mass trolley the same way as the optic trolley in the previous step.



13. Release the locking screw and move the trolley away from the center of the table. Lock it on the far side of the table.



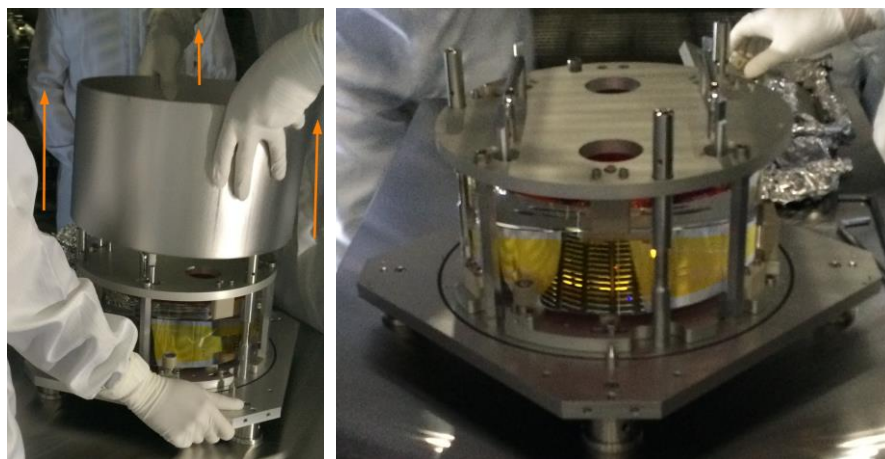
14. Get the mirror box and remove the lid.



Drawing: [JGW-D1503789](#).

Pictures: [Spare mirror hanging test 9/10/2015](#).

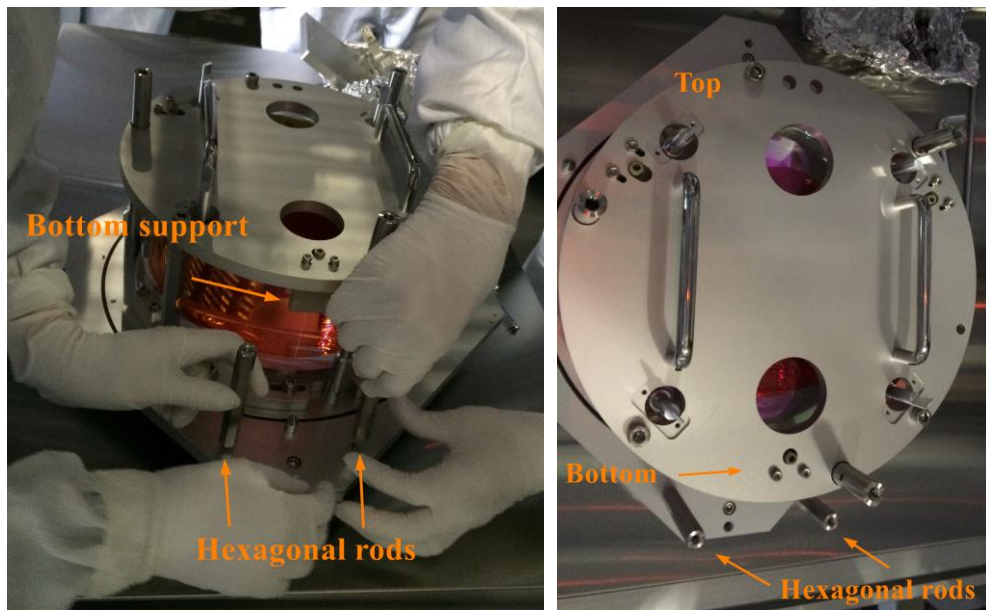
17. Remove the outer cylinder. **What fasteners have to be removed in order to withdraw the cylinder? Ask Tatsumu-san.**



Drawing: [JGW-D1503789](#).

Pictures: [PR3 hanging test, 12/10/2015](#) and [09/10/2015](#).

15. Screw the hexagonal rods at the bottom side. The bottom corner can be recognized by the peek piece supporting the optic.
- Rods: **2×part_number**, do they come with the mirror box? Ask Tatsumi-san.
 - Screws: **2×type_of_screw**, do they come with the mirror box? Ask Tatsumi-san.

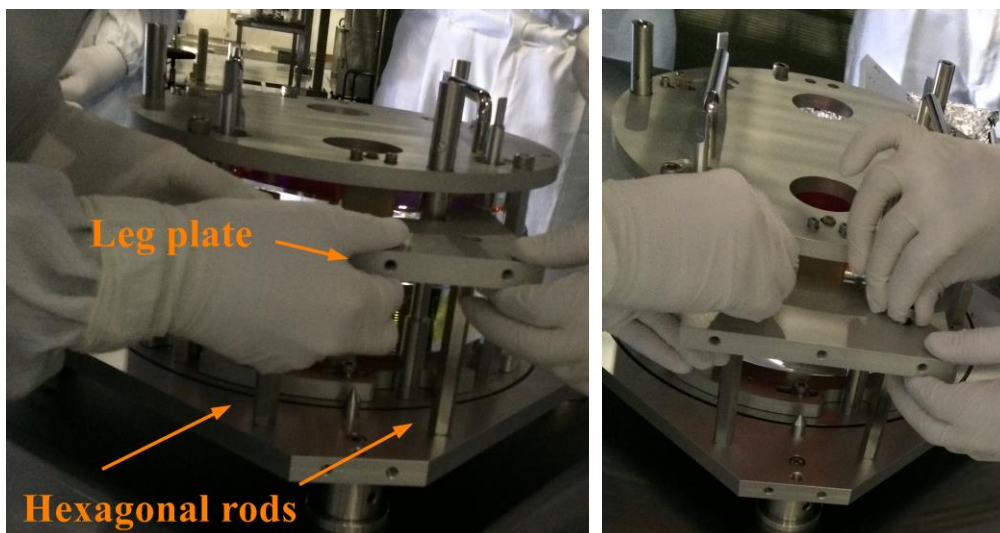


Drawing: [JGW-D1503789](#).

Pictures: [PR3 hanging test, 09/10/2015](#).

18. Attach the leg plate to the hexagonal rods. Will this plate support the optic when vertical, does it have peek or teflon pads at the contact points?

- Leg plate: 1×0C001798. It should come with the mirror box.
- Screws: 2×screw_type, do they come with the mirror box? Ask Tatsumi-san.

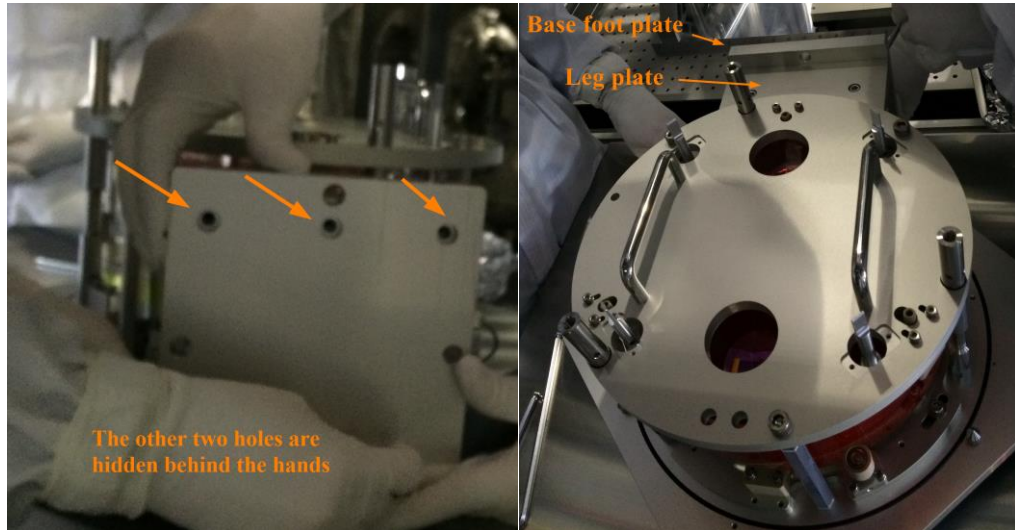


Drawing: [JGW-D1503789](#).

Pictures: [Spare mirror hanging test, 09/10/2015](#).

16. Attach the foot base plate to the mirror box. Use the five holes shown in one of the pictures in the previous step.

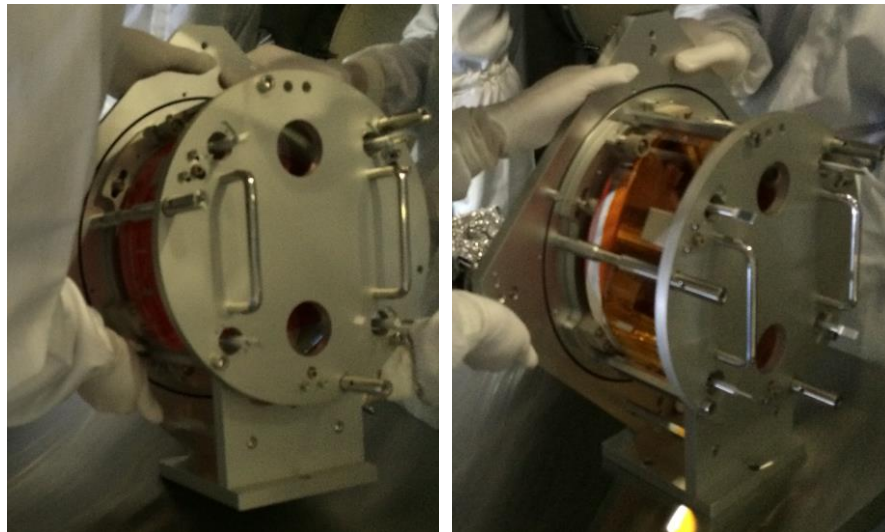
- Foot base plate: 1×0C001838. It should come with the mirror box.
- Screws: 5×type M6×length, do they come with the mirror box? Ask Tatsumi-san.



Drawing: [JGW-D1503789](#).

Pictures: [Spare mirror hanging test, 9/10/2015](#).

17. Make the mirror box stand on the base foot plate.



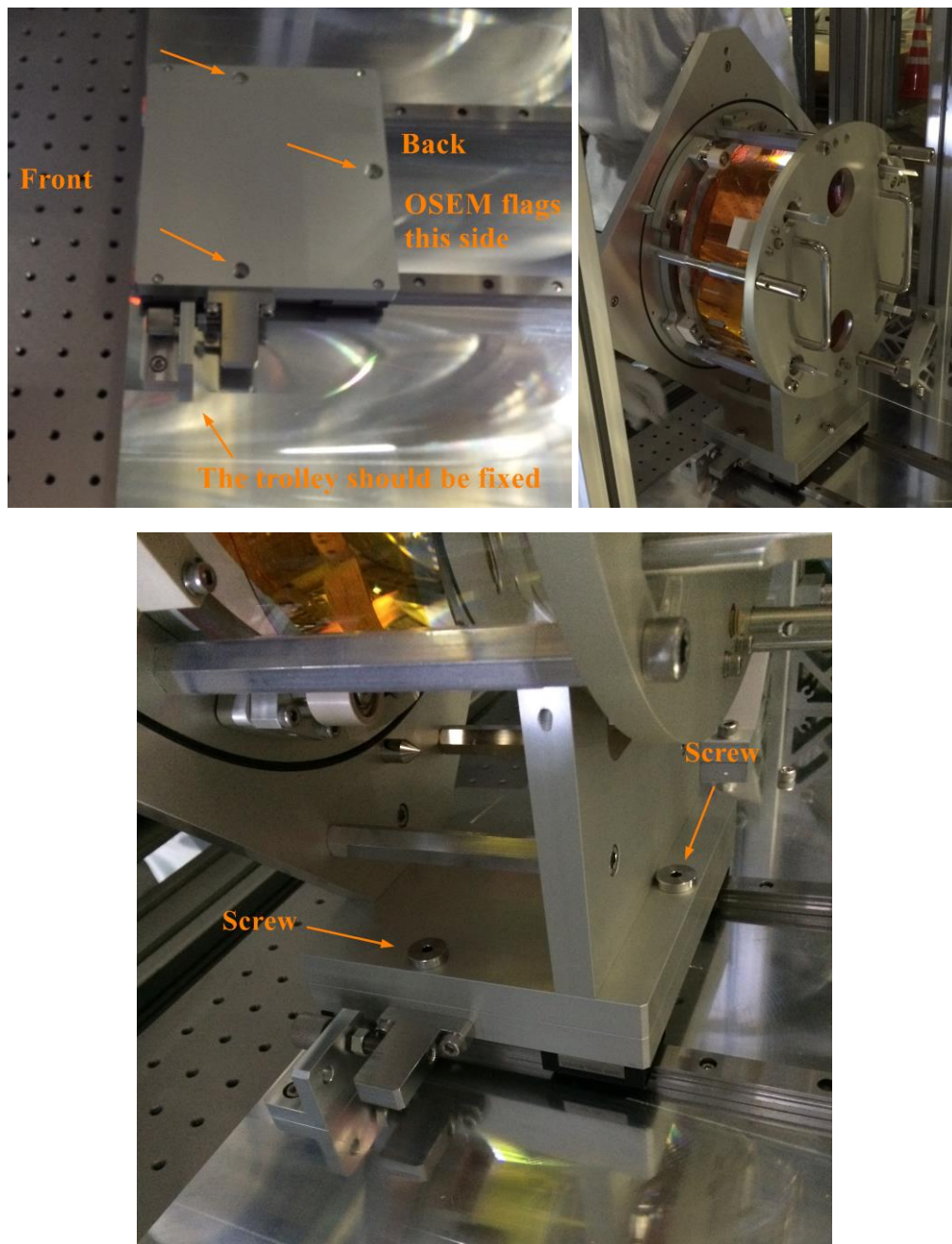
Drawing: [JGW-D1503789](#).

18. This should be the time in which the spacer must be placed in order to compensate the height mismatch found during the hanging test. Was this used for hanging the real PR3 mirror for iKAGRA? Ask Tatsumi-san and Shoda-san.

19. Place the mirror box on its trolley. Three special screws are used.

- Mind the orientation.

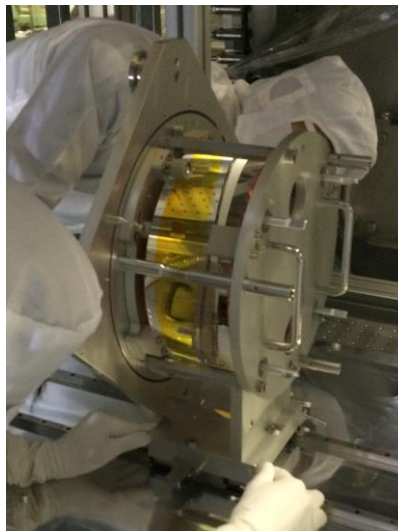
- Secure it with 3×screw_type in the holes indicated in the picture. Do they come with the mirror box? Ask Tatsumi-san.



Drawing: [JGW-D1503789](#).

Pictures: [PR3 hanging test, 09/10/2015](#).

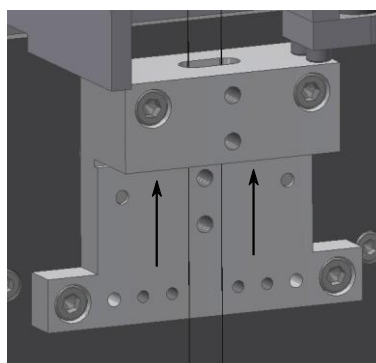
20. Unlock the trolley and place it at the center of the table as determined by the positioning screw previously fixed. Then fix the trolley with the locking screw.



Drawing: [JGW-D1503789](#).

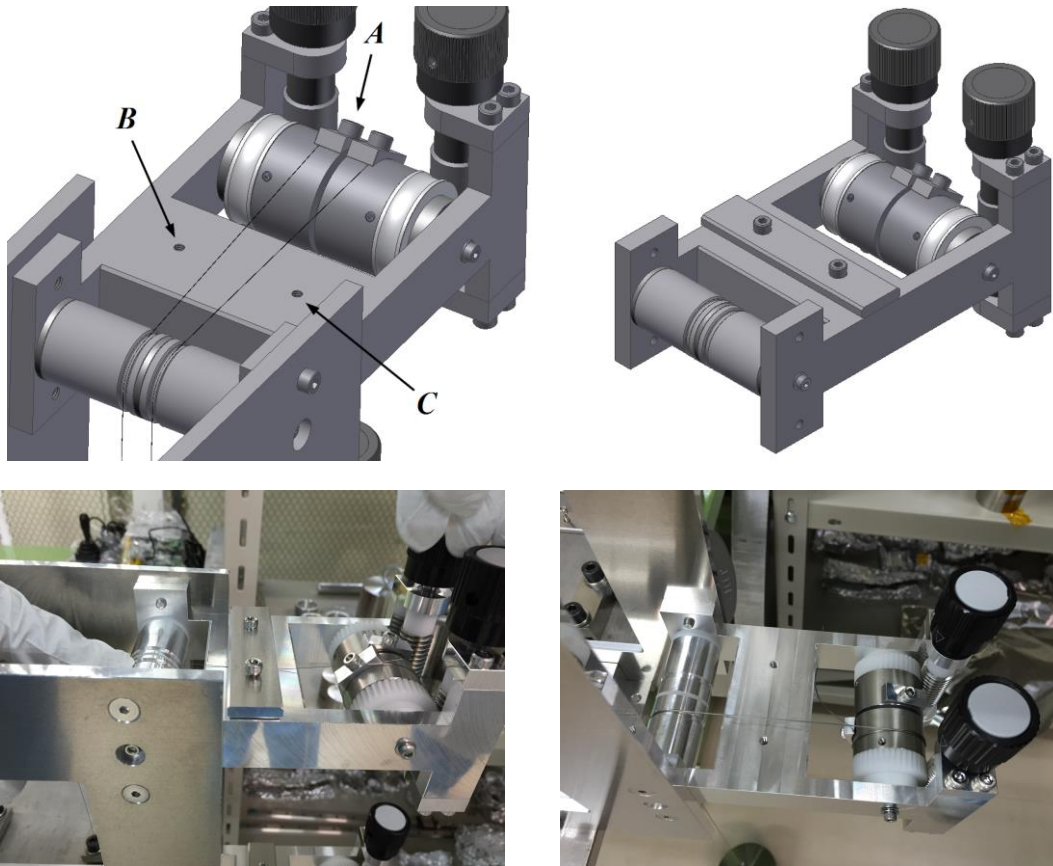
Pictures: [PR3 hanging test, 09/10/2015](#).

21. Get two pieces of 3 m of 200 μm of piano wire. Check they are clean. In LIGO they used methanol, then acetone and finally isopropanol, but ours should be clean already.
22. Bring one end of each wire underneath the mirror through the hole in the case.
23. Bring the wires through the slits in the clamps all the way up to the winches. The clamps should already be on the Intermediate Mass. There is a separate manual for it at [JGW-T1503907](#). In case they are not please use the following fasteners:
 - 2×ISO 4762M6×35mm uncoated screws for the upper holes.
 - 2×ISO 4762M6×16mm uncoated screws for the lower holes.
 - 2×pin 20mm ISO2338B locating pins.

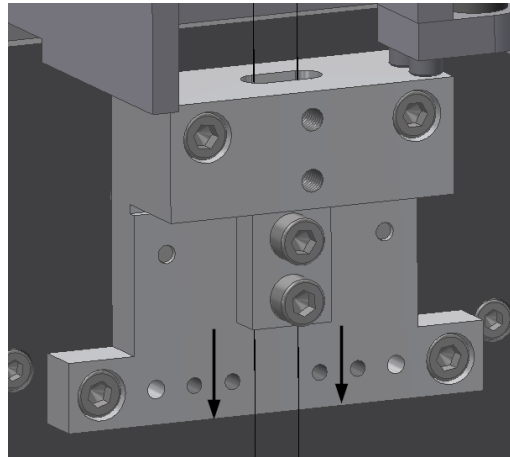


24. Fold the wires over the winch roller with the grooves and bring them to the roller with the clamp and fix them. Clamps referred to as A in the figure have grooves

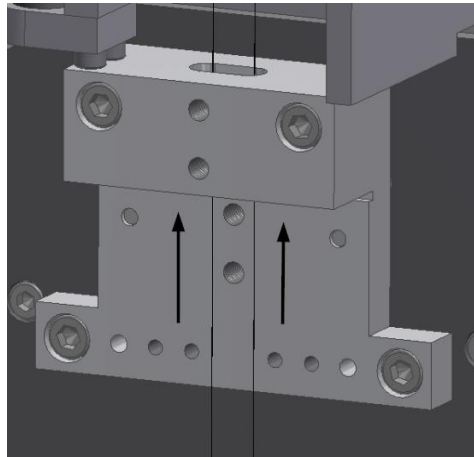
on the round face which can be used to host the wires. In order to do this operation more comfortably it is possible to use an auxiliary flat clamp between the two rollers, but release it once the wires are fixed. Such flat clamp is not shown in the first figure, but its place is indicated by holes *B* and *C*. Rotate the roller to wind the wire at least one loop. This is to avoid cutting the wire with the clamp. (What are the size of the screws for the clamps?)



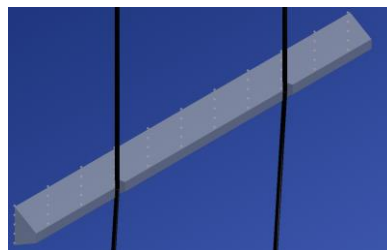
25. Create tension in the pair of wires by pulling them down from below the clamp assembly in the IM and then **softly** fix them with the upper clamp without the vertical grooves. Use 2 × ISO 4762 M6 × 16 mm coated screws.



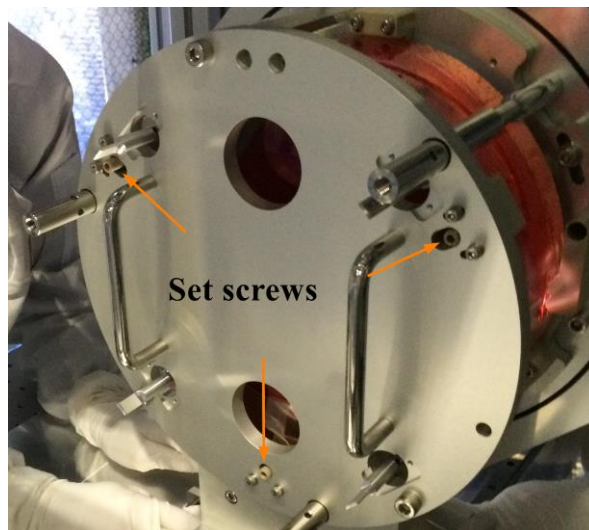
26. At the other side of the payload bring the other two ends of the wires up through the slit in the clamp all the way to the winches.



27. As in step 18, fold the wires over the winch roller. Before clamping them create tension by pulling them and making sure they go within the grooves of the four wire breakers around the TM. The figure shows one wire breaker and the grooves are clearly seen. Note that in reality the glass beads are not as neatly placed as depicted.



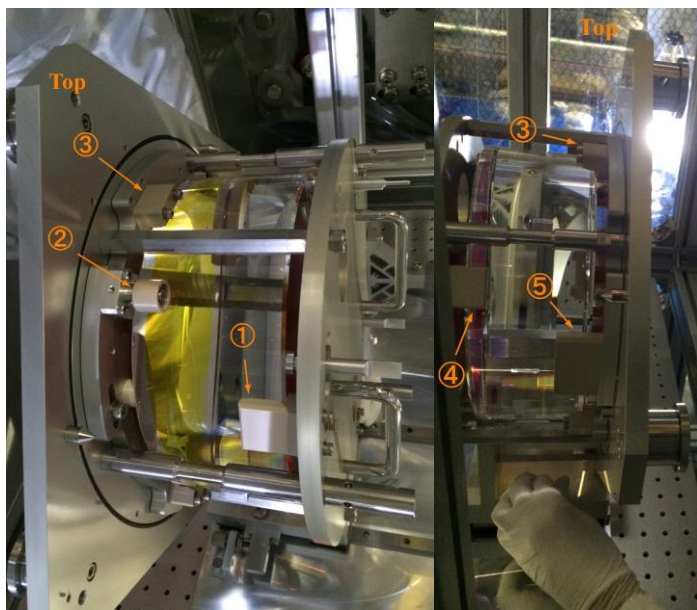
28. Set up measuring system, measure and adjust. **A more detailed explanation is needed.**
29. Loosen the three peek set screws constraining the optic horizontally.



Drawing: [JGW-D1503789](#).

Pictures: [PR3 hanging test, 09/10/2015](#).

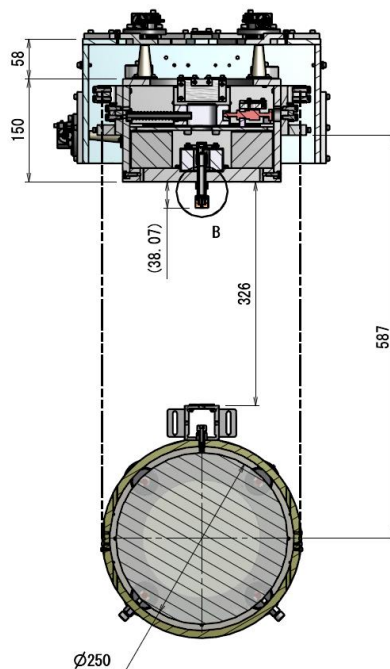
30. Remove five peek stoppers that constrain the optic. Stopper ⑤ can be withdrawn away from the optic rather than completely removed. They are placed around the upper half of the mirror.



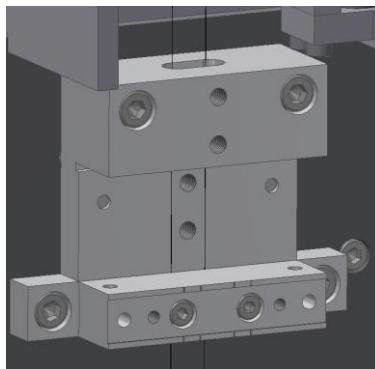
Pictures: [PR3 hanging test, 09/10/2015](#).

31. Release the clamp adjusted in step 25.
32. Lift the mirror slightly with the wires. Do not go very far up. Move the case to make the optic hang completely free. This will allow us to lift the mirror further and to align it.
33. Use the four upper knobs to lift the optic 3 mm from their resting position on

the support. The height of the wire breakers must be 251 mm after lifting. Use a height gauge. (Check the height with Hirata-san's drawing!)



34. Using the knobs also, align the optic with the optical lever. A more detailed explanation is needed. This is written in Shoda-san's document. This is as far as Shoda-san's document goes in English on the 21/01/2015.
35. Once the optic is aligned close the lower clamps, which have grooves. Make sure the wires are held within the grooves. Do this on both sides of the IM. **These clamps should not be tightened. They should only be closed gently.** The intention is to produce an elastic deformation of the wires. Use a torque wrench with a TBD torque spec. Use the following fasteners:
- 2×ISO4762 M4×20 mm screws coated,
 - Locating pins: 2×pin12mm ISO2338B.

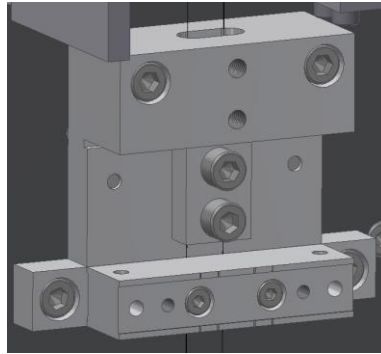


36. Check whether the alignment of the optic changed. In case it did, release the

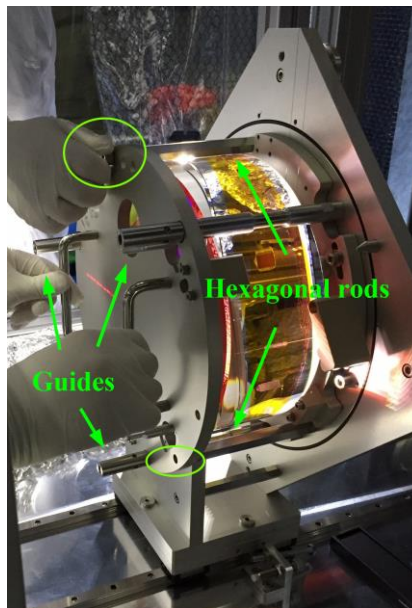
clamps and go back to step 34. Otherwise continue to the next step.

37. Check the height of the various components. **A more detailed explanation is needed.**

38. Tighten the upper clamps on both sides of the Intermediate Mass. These clamps do not have grooves. The aim is to produce a plastic deformation of the wires in order to hold the mirror. Use the same screws as in step 25.



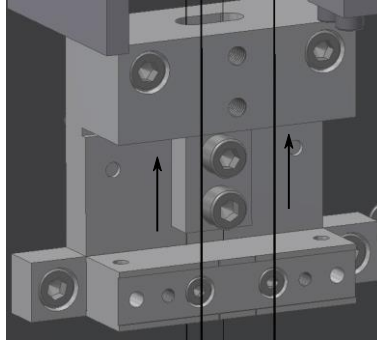
39. Remove the screws holding the back plate of the mirror box (the one with the handles) to the three horizontal hexagonal rods. The plate will not fall because there are four guiding rods holding it.



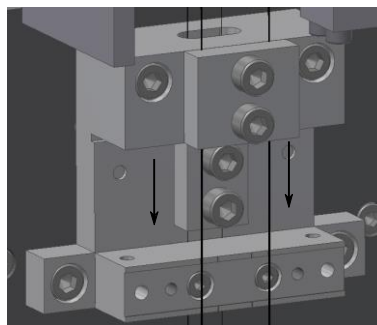
40. Remove the back plate by pulling from the handles.



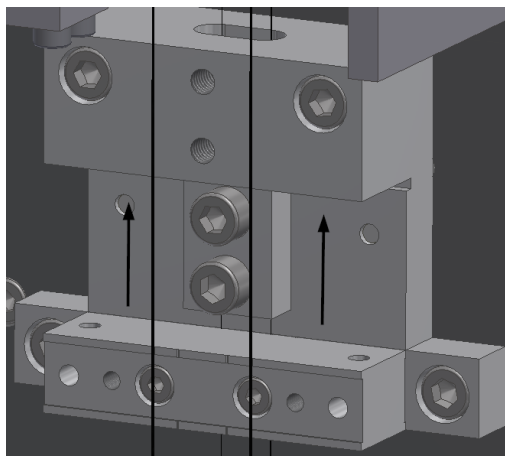
41. Place the RM with its support on the rails.
 - Push the cylinder to the rim.
 - Adjust the height of the wire breakers to 251 mm above the table with the height gauge.
42. Bring the RM as close as possible to the optic without removing the protective case of the optic. Coarsely set the tilt of the RM by adjusting the screws at the base of the support of the RM. A bubble level can be placed on the multipurpose cube. By visual inspection align the OSEM cavities with the flags on the optic.
43. Bring the RM around the optic to the position where the positioning screw of the trolley indicates.
44. Close the Recoil Mass with the front ring.
 - Front ring: U00028_438.
 - Screws: 12 × ISO4762 M5 × 30, coated.
45. Insert the earthquake stop screws 4 × JGW-D1504509 assembled in step 13. Do not screw the earthquake stop screws all the way in.
46. Get two pieces of 3 m of 650 μm tungsten wire. It should be clean already.
47. Bring the ends of the wires underneath the Recoil Mass through the hole in the pedestal.
48. On one side of the payload bring the wires in front of the clamps on the IM all the way up to the winches.



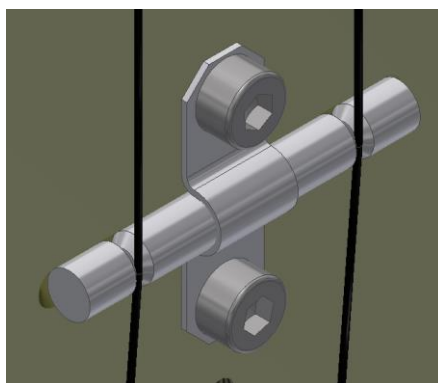
49. Fold the wires over the winch roller with the grooves and bring them to the roller with the clamp and fix them. Use the clamp between the two rollers if necessary but release it once the wire is fixed.
50. Create tension in the pair of wires by pulling them down from below the clamp assembly in the IM and then gently fix them with the upper flat clamp without the vertical grooves. The function of the clamp at this stage is only to keep the tension of the wire above the clamp.



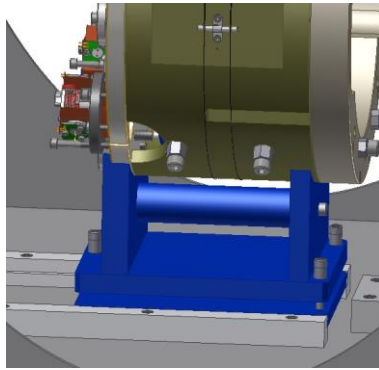
51. At the other side of the payload bring the wires all the way to the winches.



52. Fold the wires over the winch roller with the grooves and bring them to the roller with the clamp. Create tension by pulling the wires up, but not enough that would lift the RM. Make sure the wires go within the grooves of the two wire breakers around the RM. Fix the wires onto the roller with the clamps. Use the flat clamp in between the two rollers if necessary.

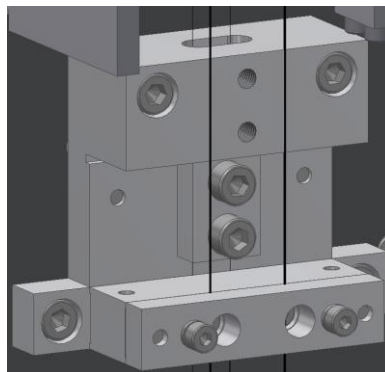


53. Remove any components of the RM support that would keep it from hanging. (As far as I understand, in the current design there is nothing of this sort.)
54. Release the clamp adjusted in step 50.
55. Bring down the RM support slowly. Do it while looking at the positions of the flags within the OSEMs. The flags should not come close to the OSEM body. If the RM still comes down with the support increase the tension in the wires by adjusting the knobs of the winches. Bring down the support until the RM hangs.

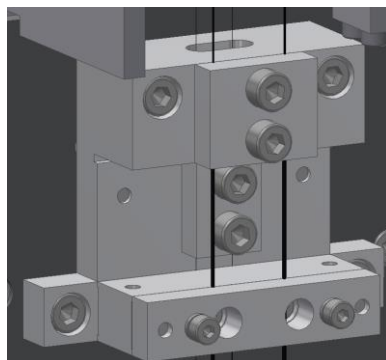


56. Using the knobs align the RM with the optical lever using the reflection on the prism. Do this first in pitch and then in roll by rotating the right angle prism 90 degrees. (How was this actually made?)
57. Measure again the height of the wire breakers. It should be 251 mm.
58. Close the lower clamps, which have grooves, in order to fix the wires in position (20 mm separation). **These clamps should not be tightened strongly, but gently in order to produce an elastic deformation.** Torque spec TBD. Use the following fasteners:

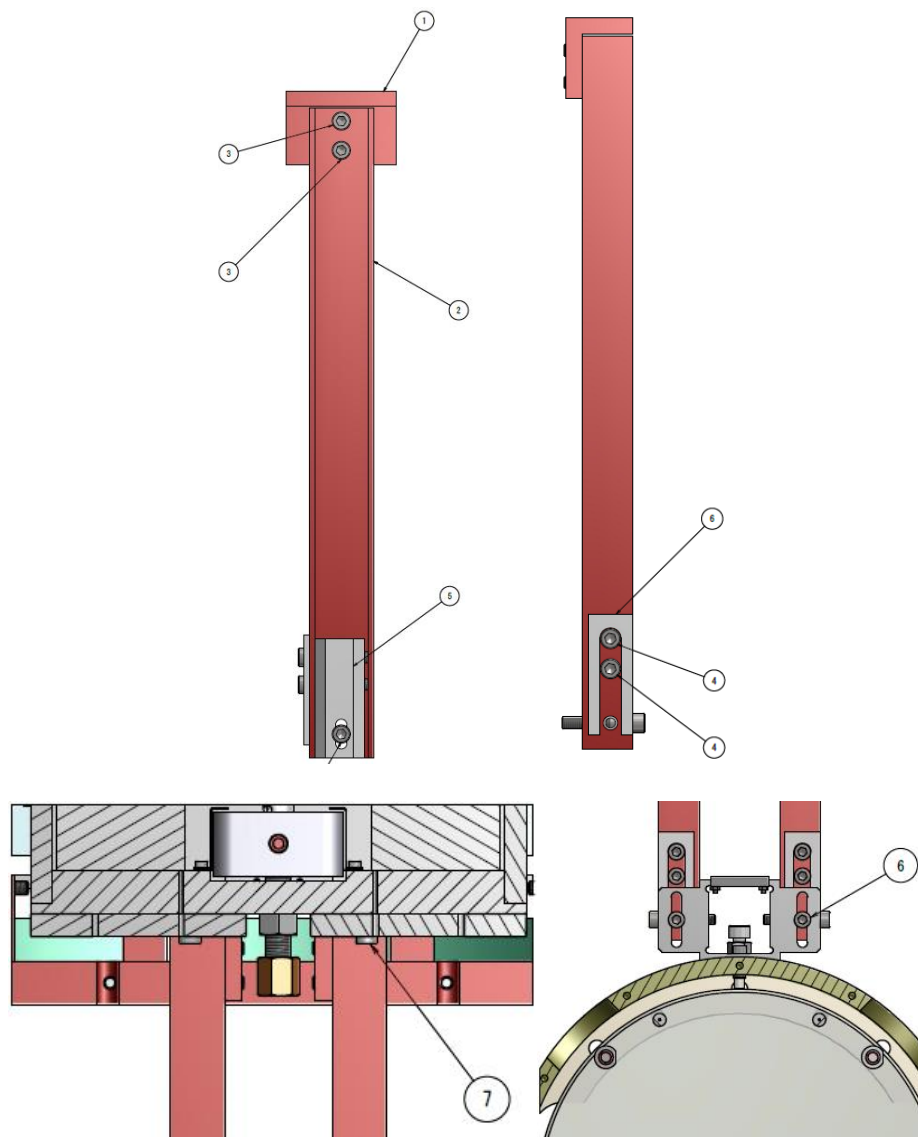
- Screws: 2 × ISO 4762 M4 × 25 mm coated.
- Locating pins: 2 × pin 12 mm ISO 2338 B.



59. Check whether the alignment of the TM changed. In case it did, release the clamps and go back to step 56. Otherwise, continue to the next step.
60. Tighten the upper clamps on both clamp assemblies. Torque spec TBD. These clamps do not have grooves. These clamps are meant to hold the weight of the RM and a plastic deformation of the wires should be achieved. Use the following screws per assembly: 2 × ISO 4762 M6 × 20 mm.



61. Check the output of the OSEMs. Provided the OSEMs were aligned and set at the correct position with respect to the RM, the flags should be close to their nominal positions and the output voltage should be close to 6 V. If they are not then either the OSEMs were not aligned when mounted on the RM or the RM is not aligned with respect to the TM. In the first case please align the OSEMs individually. This may be hard without the lower section of the earthquake stop around the RM. So, the earthquake stop should be assembled now before realignment of the OSEM. Please execute step 58 and then come back.
62. The wires can be cut and the winch system can be removed. In the newly vacant holes in top of the IM insert 4×ISO4762 M5×16mm.
63. Lock the RM to the IM with the following components:
- ①. Clamp security joint on the upper part: 2×U00036 387.
 - ②. Security bar: 2×U00037 388.
 - ③. Screws for attaching ① and ②: 4×ISO4762 M6×12mm without coating.
 - ④. Screws for fixing ⑤ to ②: 6×ISO4762 M6×35mm without coating. There will be 2 screws spare.
 - ⑤. Frontal lock aid for the lower part: 2×JGW-D1503761-5.
 - ⑥. Spacer frontal lock for the lower part: 2×JGW-D1503761-6.
 - ⑦. Screws for fixing ① to the IM: 4×ISO4762 M6×12mm without coating.

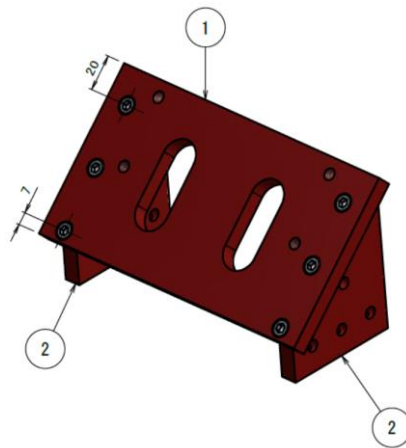


Drawing: Hirata-san is currently working in this drawing. Check the part numbers after the drawing is finished.

64. Put together 2 instances of the “Locking recoil mass” assembly:

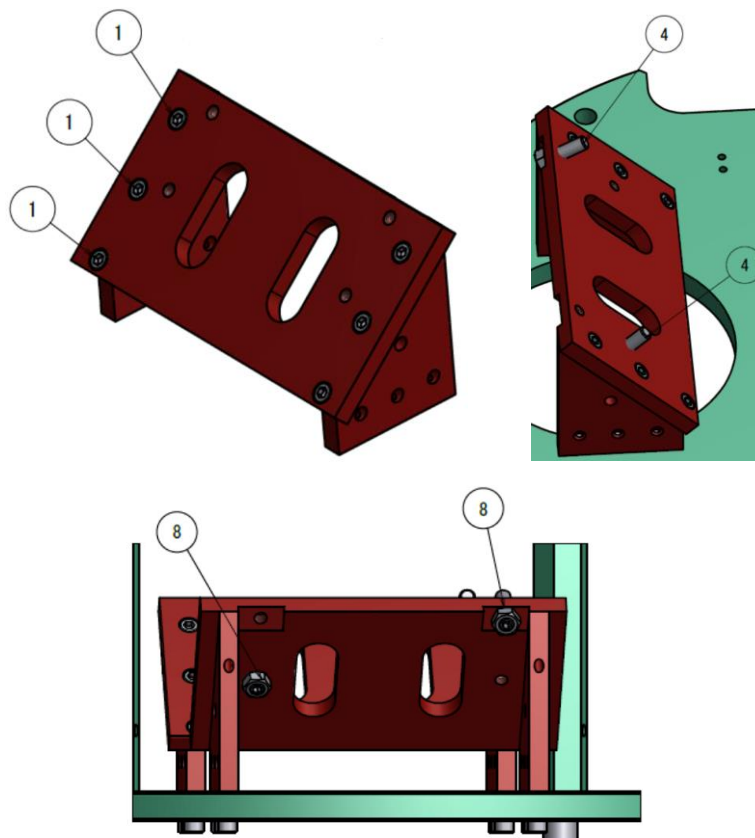
Use the following components:

- ①. 2×JGW-D1504504,
- ②. 4×JGW-D1504453-442,



Use the following fasteners:

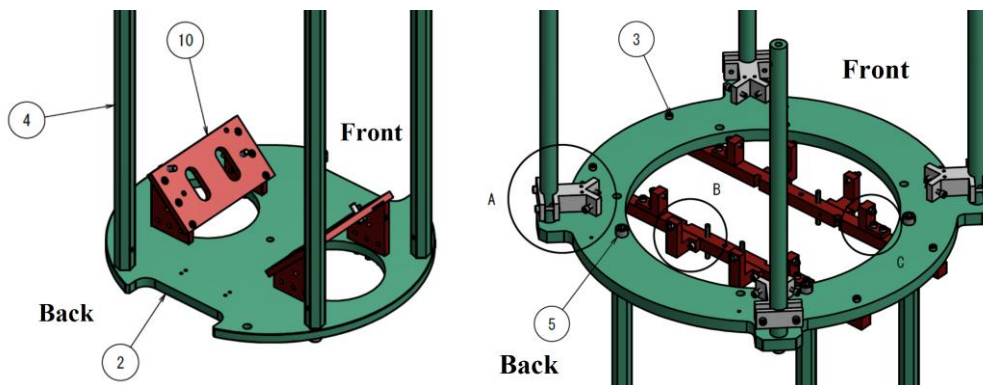
- ①. Coated screws: 12×ISO4762 M6×16 mm.
- ④. Coated set screws: 4×ISO4026 M8×30 mm. (Get from Misumi.)
- ⑧. Nut: 4×DIN EN 24032 M8. (We should get aluminium nuts from Misumi in order to avoid surface treatment in set screws ④.)



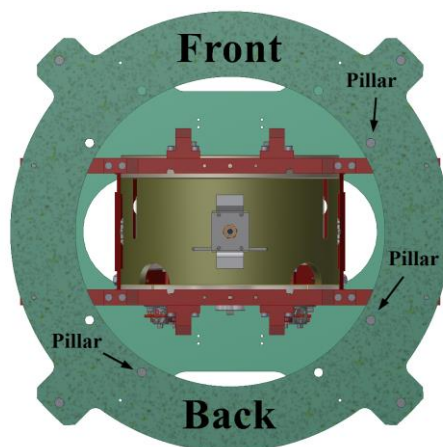
65. Assemble the earthquake stop around the Recoil Mass.

- Attach hexagonal rods ④ 3×JGW-D1504453-363 to the big ring JGW-D1504453-359 underneath the Intermediate Mass. The length of the rods

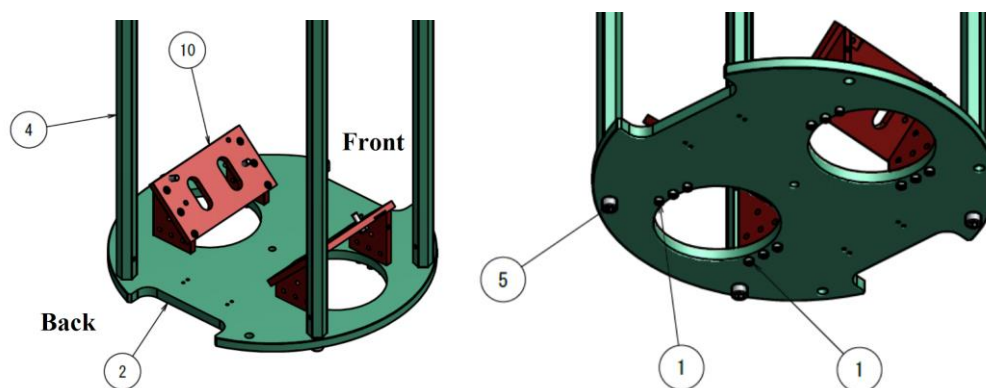
should be 672mm. Use **coated** screws ⑤ 3×ISO4762 M12×35mm. **Was the length of these screws changed? Ask Shoda-san.**



- The position where they should be depends on the particular optic which is being hanged. For PR2 and PR3 use the following configuration for the big ring JGW-D1504453-359 as seen from the top. Note that the plate is symmetric.

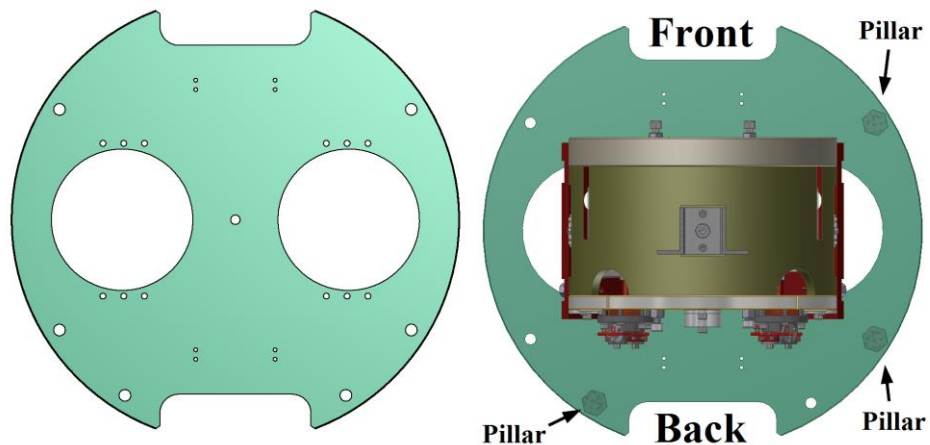


- Attach the bottom plate ② JGW-D1504453-364 to the hexagonal pillars. Use **coated** screws ⑤ ISO4762 M12×35mm. **Was the length of these screws changed? Ask Shoda-san.**

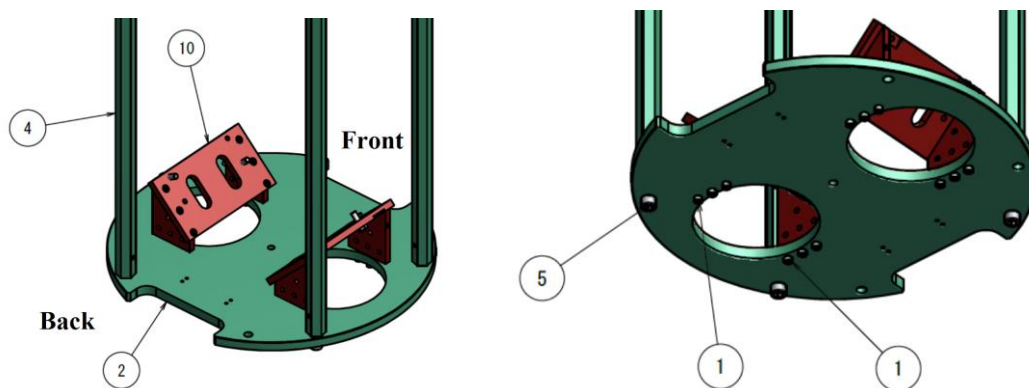


- For PR2 and PR3 use the following configuration for the bottom plate JGW-

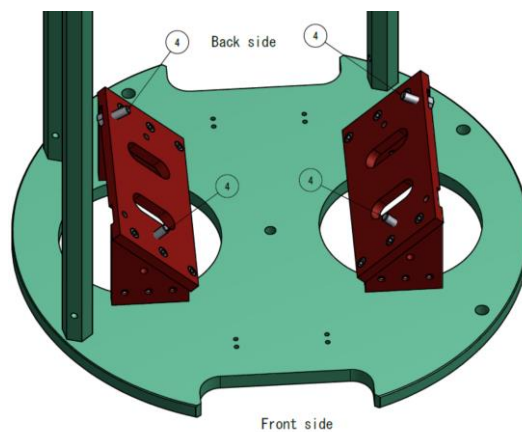
D1504453-364 as seen from the top. Note that the plate is symmetric.



- Attach the 2 instances of the ⑩ “Locking recoil mass” assembly onto the bottom plate JGW-D1504453-364. Use **coated** screws ① 12×ISO4762-M6×25mm.



- Note that the stop set screws on the back side have to be higher than the set screws on the front side.



Drawing: [JGW-D1504477](#).

66. Put the Bottom Filter in place. Doing this requires a lot of work (hanging frame, traverser, orientation and position of the Bottom Filter, crane work, etc.) and depends on the type of suspension. Update when the scope of this document is decided.
67. Attach ballast bodies on top of the IM according to the following pictures. Do not tighten the screws strongly since the distribution of the bodies will have to be changed when balancing the IM.

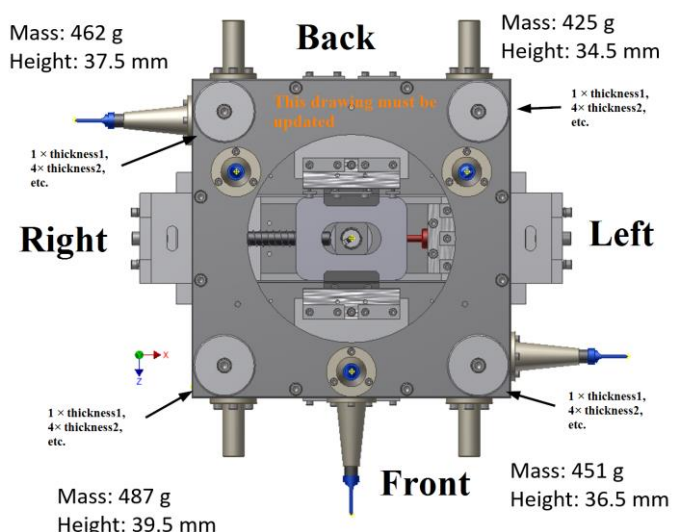
- Inventory for PR2:

Item	Part number	Name	Dimensions (mm)	Qty.
2	JGW-D1504731-2	Compensation disc top PR2	t = 30.5 , $\varnothing = 45$	4
3	JGW-D1504731-3	Compensation disc top t1	t = 1 , $\varnothing = 45$	26

Drawings: [JGW-D1504731](#).

- Distribution for PR2:

Position	JGW-D1504731-2 Qty.	JGW-D1504731-3 Qty.	Thickness (mm)
Back, left	1	4	34.5
Front, left	1	6	36.5
Front, right	1	9	39.5
Back, right	1	7	37.5
Total	4	26	



Drawings: [JGW-D1504731](#).

- Screws for PR2: Use 4 x ISO4762-M6 x 40mm. Note that disc JGW-D1504731-2 has a counterbore and must be on top.

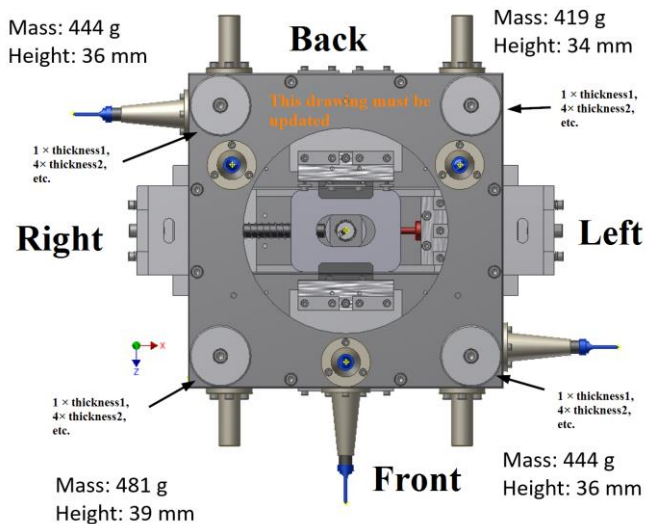
- Inventory for PR3:

Item	Part number	Name	Dimensions (mm)	Qty.
5	JGW-D1504731-5	Compensation disc top PR3	$t = 30$, $\varnothing = 45$	4
3	JGW-D1504731-3	Compensation disc top t1	$t = 1$, $\varnothing = 45$	25

Drawings: [JGW-D1504731](#).

- Distribution for PR3:

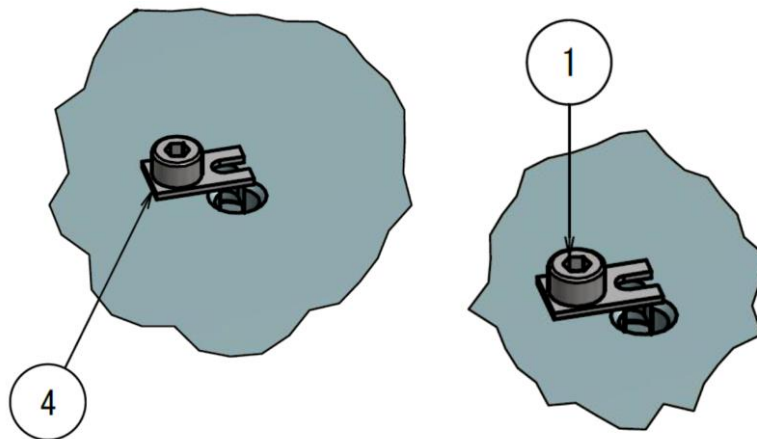
Position	JGW-D1504731-5 Qty.	JGW-D1504731-3 Qty.	Thickness (mm)
Back, left	1	4	34
Front, left	1	6	36
Front, right	1	9	39
Back, right	1	6	36
Total	4	25	



- Screws for PR3: Use 4 × ISO4762-M6×40mm. Note that disc JGW-D1504731-5 has a counterbore and must be on top.

68. Hang the top plate of the Intermediate Recoil Mass (IRM) from the BF using

- Top plate: 1×U00004_414.
- Suspension rods: 3×what is the part number?
- Suspension wire head fixture: ④ 3×10208_286.
- Uncoated screws: ① 3×ISO4762-M4×8mm.
- Picture of the RM and the bottom of the BF showing where the rods have to be hooked.



Drawings: [JGW-D1504489](#). In which drawing does the suspension rods appear?

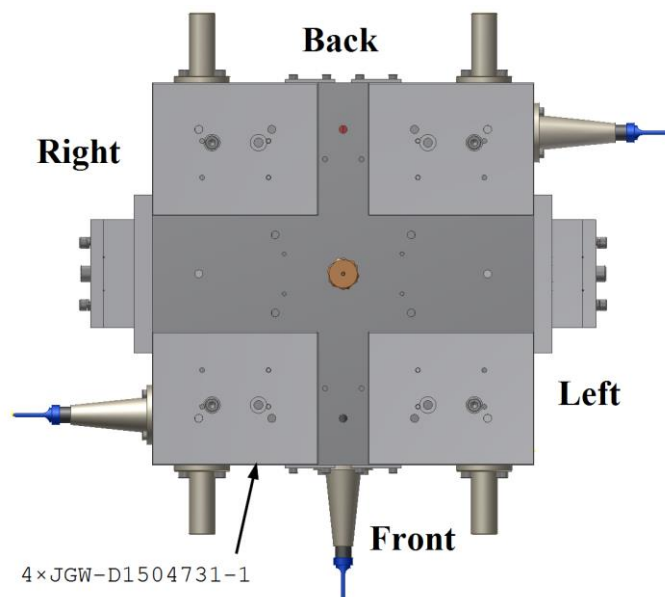
69. Hang the IM from the BF. A detailed explanation is needed.

70. Secure the IM to the earthquake stop.

71. Remove the screws and washers introduced in step 8.

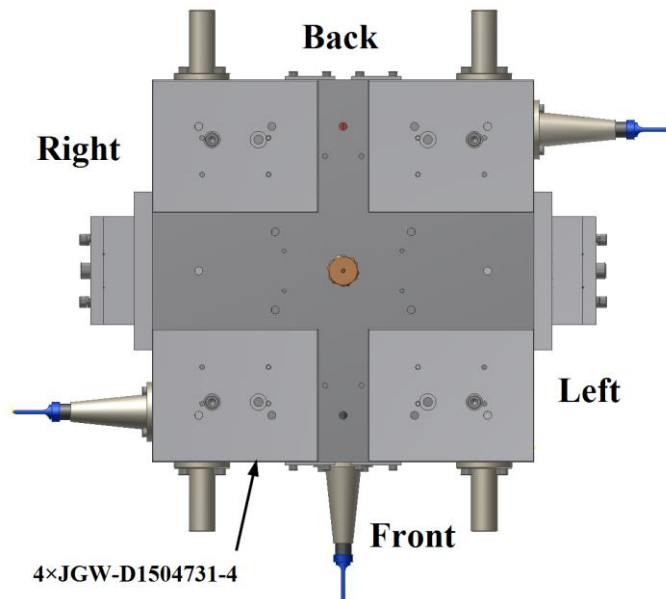
72. Using the recently vacant threaded holes attach the ballast bodies at the bottom of the IM.

- For PR2
 - i. Ballast bodies: 4×JGW-D1504731-1 (thickness=10 . 8mm),
 - i. Screws: 4×ISO4762-M5×16mm. **These screws have to be vented for all PR payloads.**

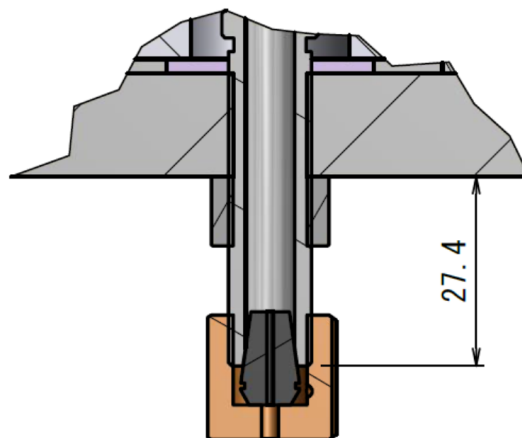


- For PR3
 - i. Ballast bodies: 4×JGW-D1504731-4 (thickness=10 . 6mm),

- ii. Screws: $4 \times \text{ISO4762-M5} \times 16\text{mm}$. **These screws have to be vented for all PR payloads.**



73. Stuff.



74. Stuff

75.