

# Procedure how to assemble the WAB

## General Notes

- Please read the section of this document you are going to work on today BEFORE you start the work and remember as much as possible. Because the some of the work does not give you time to read this document.
  
- Clean the clean room everyday.
- Take the log. Leave them on k-log.
- Take many pictures. Leave them on k-log.
- Fix the suspension and cover it when you leave, and when you open the top window of the clean booth.
- When you moved tools, circuits, and so on, which belongs to the other subsystems, please make the log, and be sure to return it when finished. Especially, the information about where the circuits is necessary to be updated on the JGW doc DB.
- Take enough rest. If you feel tired, do not hesitate to go outside and take a rest.
- Wear proper items if necessary (safety gloves, helmets,,)
- You need two people who have crane licenses when you use the crane.
- If you got injured, please tell the responsibility person as soon as possible.
- When you work around/inside the vacuum chamber, wear clean inner wears and class-1 clean wear, which is the blue ones or ones with separated hood. And blow the air to remove your dust when you enter the clean room.
- Bring the clean suits outside for cleaning every Friday. After you brought them to the office, count the number of the suits w/ hood, suits w/o hood, hood, mask, gloves, and shoes.

# Drawings

Should be found in the JGW document server (Author: Obuchi-san).

## List of Items

- BASE PLATE (1x)
- BASE PLATE SIDE + MIRROR (→ 2x)
- BASE PLATE STIFFENER (2x)
- SUSPENSION SUPPORT STRUCTURE PLATE (1x)
- SUSPENSION SUPPORT STRUCTURE BEAM STIFFENER (4x)
- SUSPENSION EQ STOP PLATE (2x)
- SUSPENSION SUPPORT STRUCTURE BEAM (2x)
- SUSPENSION EQ STOP ROD (8x)
- BAFFLE (1x)
- BAFFLE FLANGE (2x)
- BAFFLE FLANGE DISTANCE SPACER (4x)
- BAFFLE WING PLATE (4x)
- BAFFLE FLANGE RETAINER PIN (2x)
- BAFFLE FLANGE RETAINER PIN THREADED (2x)
- SUSPENSION DAMPER PLATE (4x)
- SUSPENSION PLATFORM PLATE STIFFENER (2x)
- SUSPENSION PLATFORM (1x)
- SUSPENSION YAW ADJUSTER BOSS BLOCK (1x)
- SUSPENSION Z-STAGE TOP PLATE (1x)
- SUSPENSION Z-STAGE BOTTOM PLATE (1x)
- SUSPENSION X-Y TRANSLATOR STAGE (1x)
- SUSPENSION BLADE SPRING ANCHOR BLOCK (1x)
- SUSPENSION BLADE SPRING (2x)
- SUSPENSION BLADE SPRING RETAINER PLATE (2x)
- SUSPENSION DAMPER T-BEAM (2x)
- SUSPENSION DAMPER PLATE SPRING (4x)
- SUSPENSION DAMPER PLATE SPRING RETAINER (4x)
- SUSPENSION DAMPER PLATE SPRING RETAINER THREADED (4x)
- SUSPENSION DAMPER MOUNT BRACKET (2x)
- SUSPENSION DAMPER MAGNET BASE PLATE (4x)

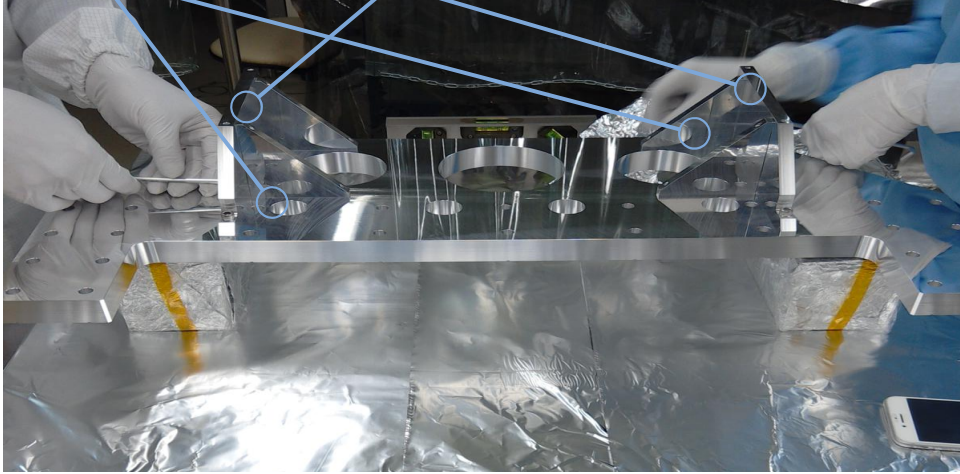
- SUSPENSION DAMPER MAGNET (> 8x)
- \* JIG SHIPPING LOCK SHIELD PLATE (2x)
- \* JIG SHIPPING LOCK T BRACKET (2x)
- \* BAFFLE SHIPPING LOCK BRACKET A (2x)
- \* JIG WIRE ASSEMBLY TOOL HANDLING PLATE (1x)
- \* JIG WIRE ASSEMBLY TOOL BRACKET C (1x)
- \* JIG WIRE ASSEMBLY TOOL BASE PLATE (1x)
- \* JIG WIRE ASSEMBLY TOOL BRACKET B (1x)
- \* SUSPENSION WIRE (4x)
- \* SUSPENSION WIRE ANCHOR + MIRROR (→ 4x)
- \* SUSPENSION WIRE ANCHOR Y-BRACKET (2x)
- \* SUSPENSION WIRE ANCHOR RETAINER (2x)
- \* BAFFLE WIRE ANCHOR WASHER (4x)
- \* M6
- \* M5
- \* M4
- \* M3
- CBSTSR2.5-4 (8x)
- SFBJ2.5-6 (8x)
- \* SUSPENSION Z-STAGE JACK SCREW (3x)

# Check-List

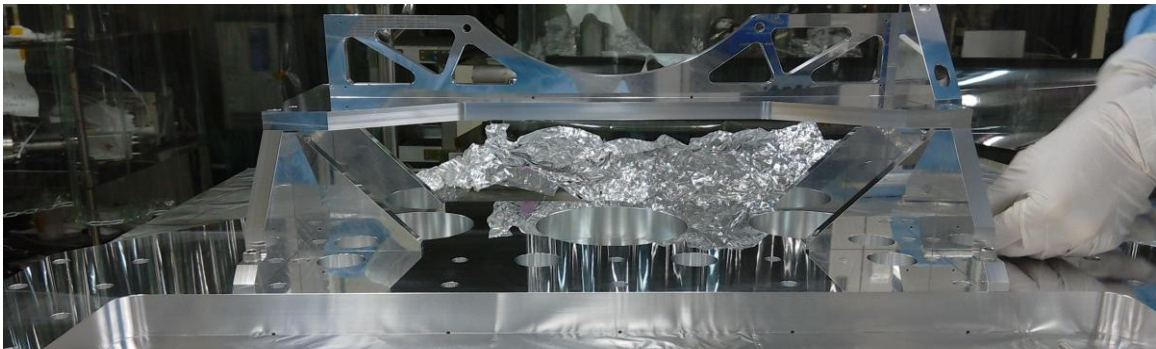
# Detailed Description

## 1. Suspension Base (2 Persons)

- On the prepared table, first set the base plate in a 90° angle on its front-side\* and screw the base plate sides on it from the bottom of the base plate.
- Set the base plate to its nominal position and screw the base plate sides also from top.
- Screw the base plate stiffener to the base plate sides



- Put the suspension support structure plate on the base plate sides and screw it tight.
- Put the suspension EQ stop plate and the suspension support structure beam stiffener on the suspension support structure plate; screw the stiffeners and the stop-plate (from bottom of the structure-plate) but do not tighten the screws.

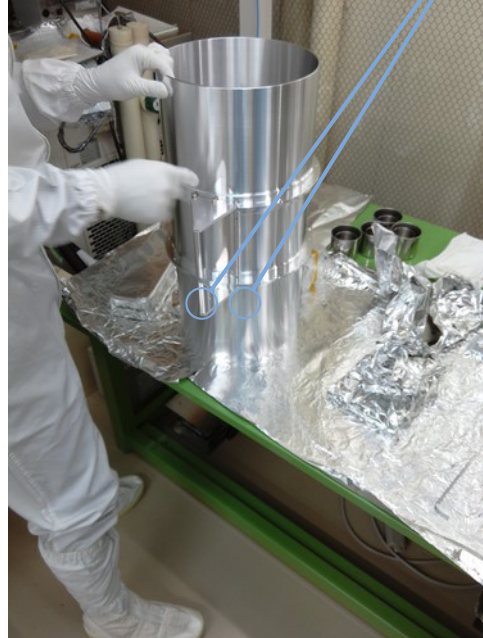
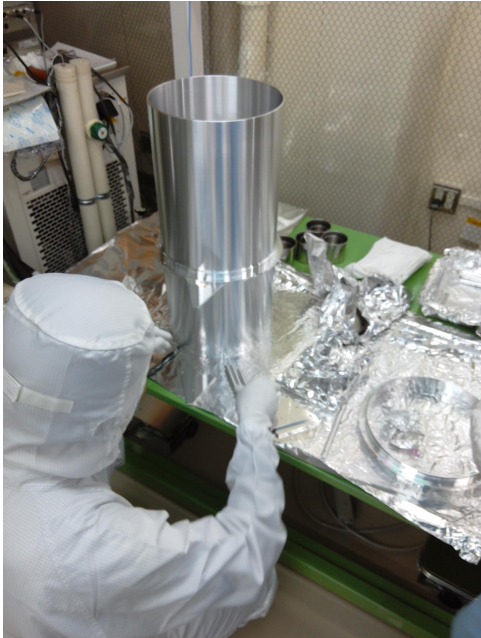


- Put the suspension support structure beams between the stiffener and the stop-plate and screw them together; start tighten all screws
- Set two pairs of suspension EQ stop rods on the stop-plate by first inserting a FABBS6x30 into one rod, then inserting the open-end of the FABBS6x30 through the respective holes in the stop-plate, and lastly screwing and tightening the other rod on that open-end.

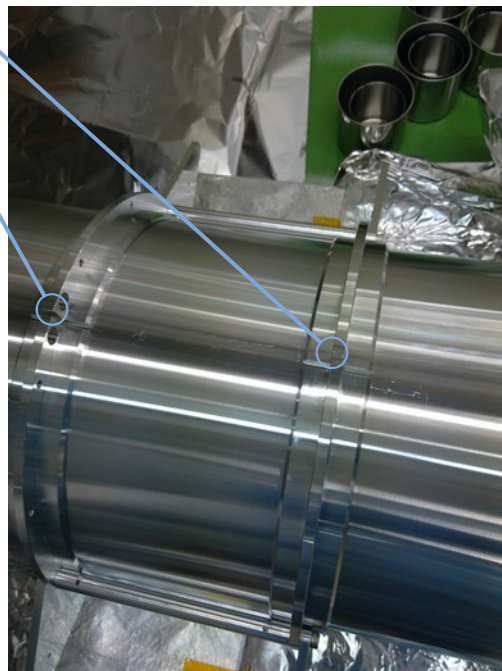


## 2. Baffle Preparation (1-2 Persons)

- Set the baffle in an upward position and pull a baffle flange from top of the baffle over it toward the flange assembly's lower position (should be indicated by a line\*)  
→ use PEEK-stripes for an easier slide between baffle and flange
- screw the baffle flange distance spacer on the (now) lower flange and tighten the screws
- Pull another flange over the top of the baffle until the position destined by the spacers is reached



- Mount the baffle wing plates on each side of the flanges
- Set the baffle flange retainer pin and the baffle flange retainer pin threaded on each side of the open end of the flanges and fix them with two M5x20\* screws; tighten them carefully and symmetrically with respect to the flanges

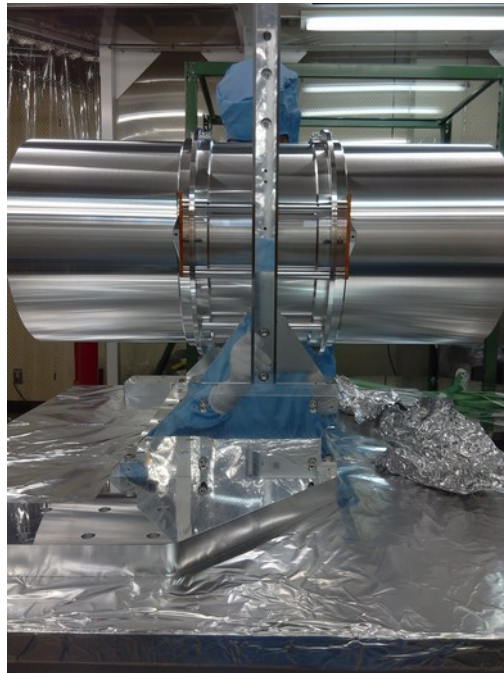


- Mount the suspension damper plates on each baffle wing plate with a nonmagnetic screw\*

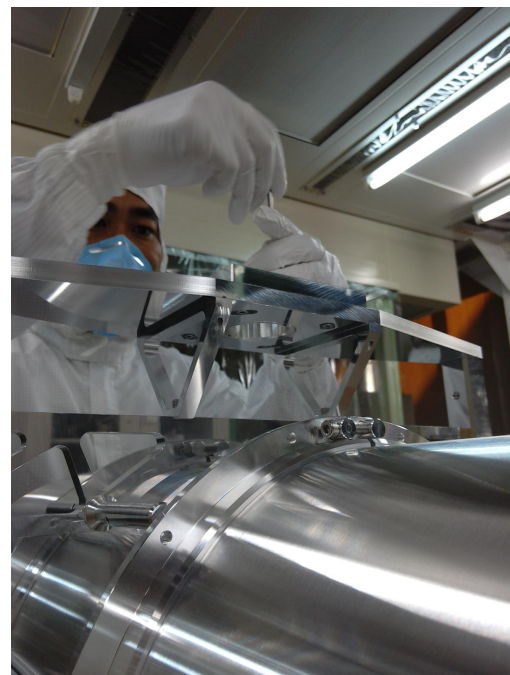
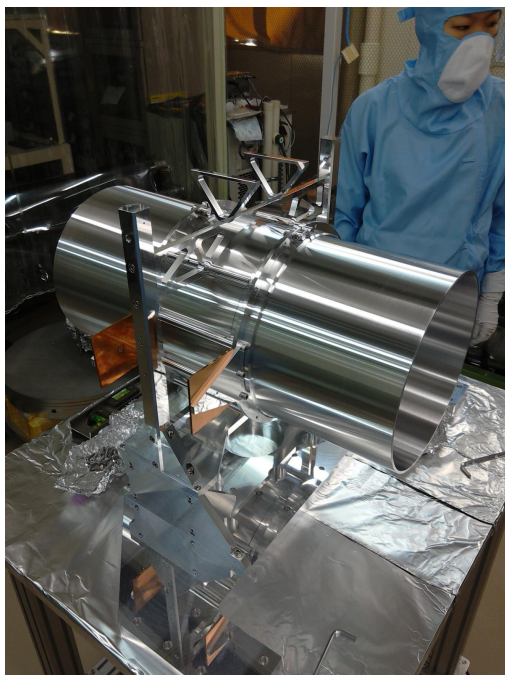


### 3. Insert Baffle and Suspension Roof (2 Persons)

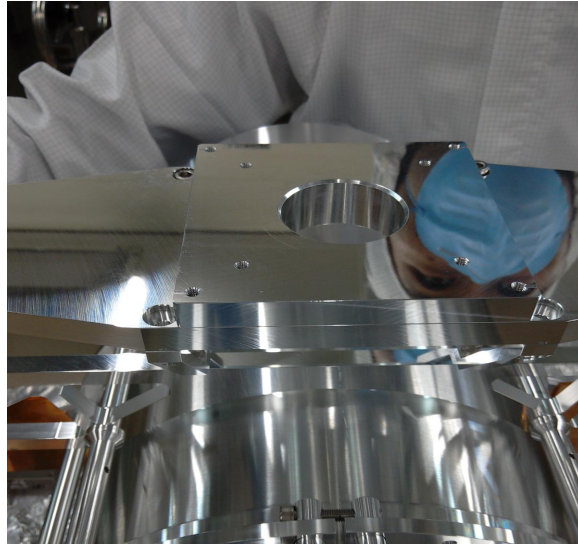
- Set the baffle inside the (half) assembled suspension structure so that the EQ stop rods keep it in position (if properly set, the rods may be even not necessary for that)



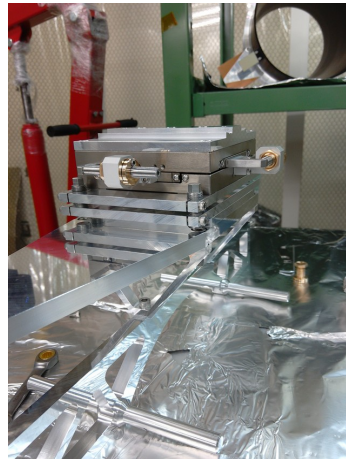
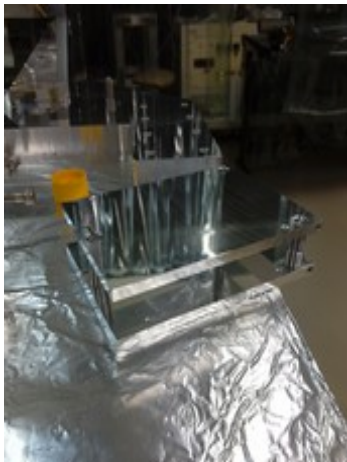
- Set the upper suspension EQ stop-plate in between the two suspension support structure beams and screw it to them (do not tighten yet!)
- Mount the two Suspension Platform Plate Stiffeners on the upper suspension EQ stop-plate by using the respective screw holes on the stop-plate (M4?)
- Set the Suspension Platform Plate on the top of the suspension support structure beams and the Suspension Platform Plate Stiffeners alike; Screw them tight



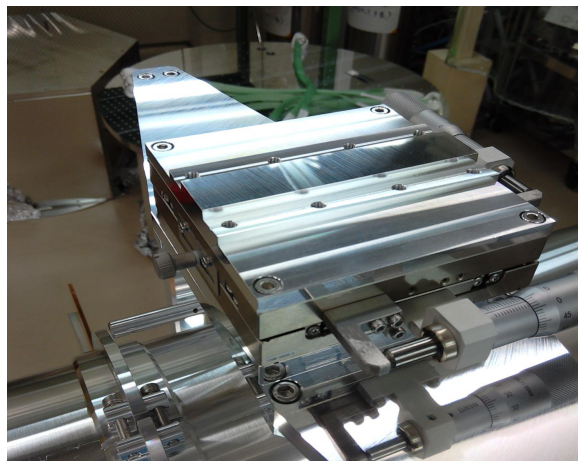
- Set the Suspension Yaw Adjuster Boss Block onto the Suspension Platform Plate (screw it from the bottom of the platform-plate)



- Mount the Z-translator stage (two plates with three two-thread screws\*) on the Suspension Yaw Adjuster Boss Block with M4 screws
- Mount the X-Y translator stage on the Z-translator stage with M4 screws



- Mount the Suspension Blade Spring Anchor Block on the X-Y translator stage





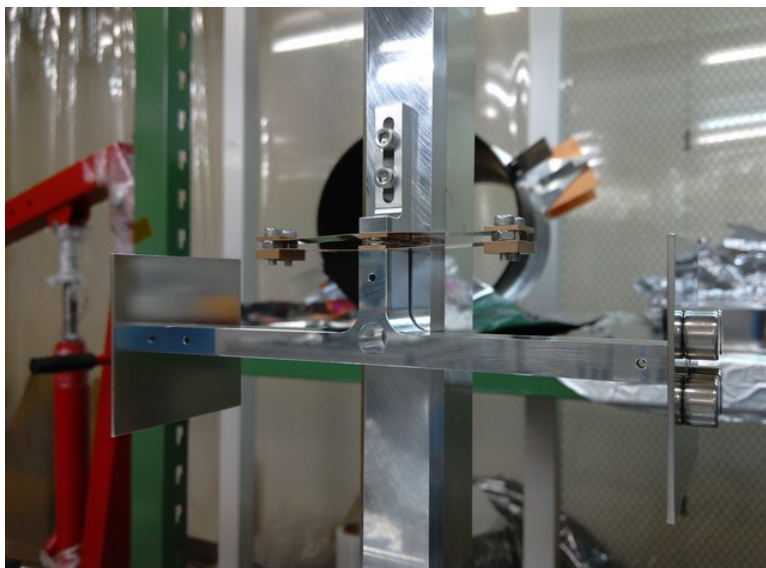
## 4. Damper (1 Person)

The two damper suspensions have to be assembled outside the WAB suspension first. After that, they can be placed on their positions on the suspension support structure beams.

The actual assembly of the dampers is relatively simple and straight forward (please refer also to the Suspension Damper Assembly document):

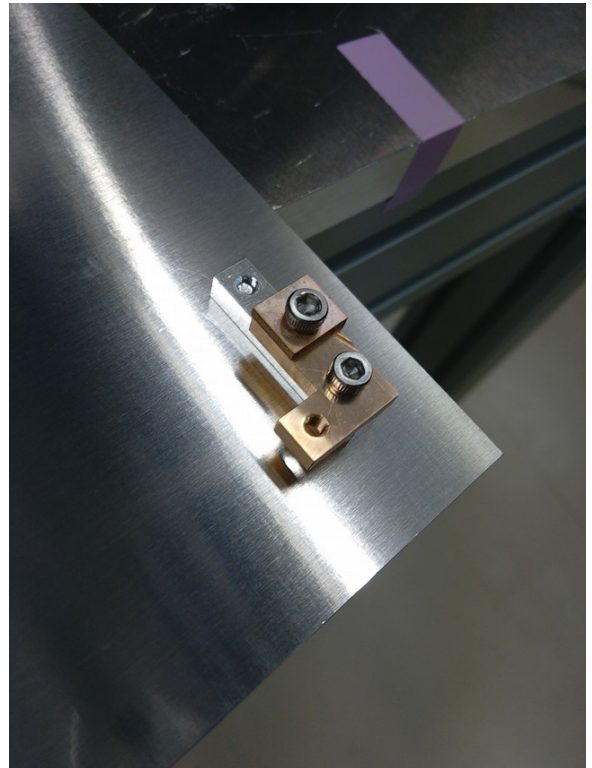
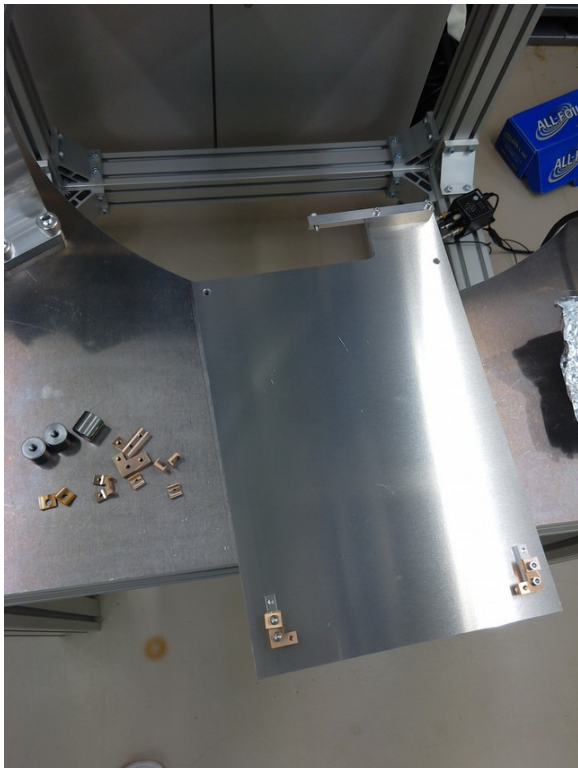
- Take the Suspension Damper Mount Bracket and screw a Suspension Damper Plate Spring on its bottom side (use CBSTSR ultra low head cap screws for that)
- Do the same for the Suspension Damper T-Beam only that the spring-plate needs to be screwed on its top
- Screw the ends of each spring-plate on the bracket and T-beam to its counterpart; use the Suspension Damper Plate Retainers for that by setting them so that the spring-plates are in between them;  
Between each end of the spring-plate, set a spacer\* (for the cooling-test, we are using simple nuts for that purpose) preventing the spring-plates touching each other.  
**Note:** there are two different retainers, one is threaded (and bigger) and the other one thinner and non-threaded. The threaded one is to be set on the bottom and the non-threaded one on top!  
Also here, use the CBSTSR screws!
- Screw the two Suspension Damper Magnet Base Plates on each side of the “T” with the SFBJ flat head screws
- (?) Set the magnets to their supposed places on the Suspension Damper Magnet Base Plates

After assembly of the dampers, screw them on the suspension support structure beams.

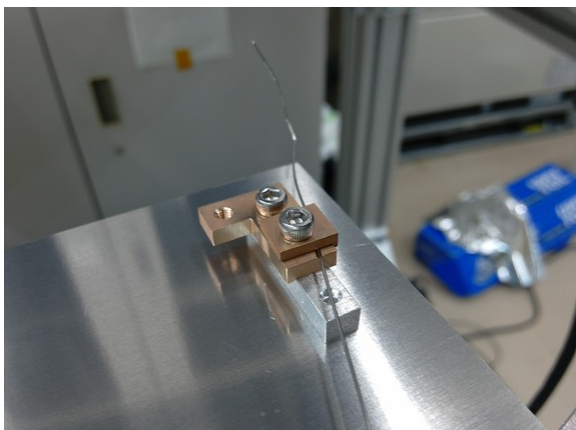


## 5. Hanging (2-3 Persons)

- On the Suspension Blade Spring Anchor Block, mount the Suspension Blade Springs (use M5x15\* screws)
- Set up the winding-jig by taking the Wire-Jig Base Plate and mount the bottom part of the wire clamps on it → triangular shape (the wire grooves of the bottom clamp should show to the top; those of the top clamp should show to the bottom)

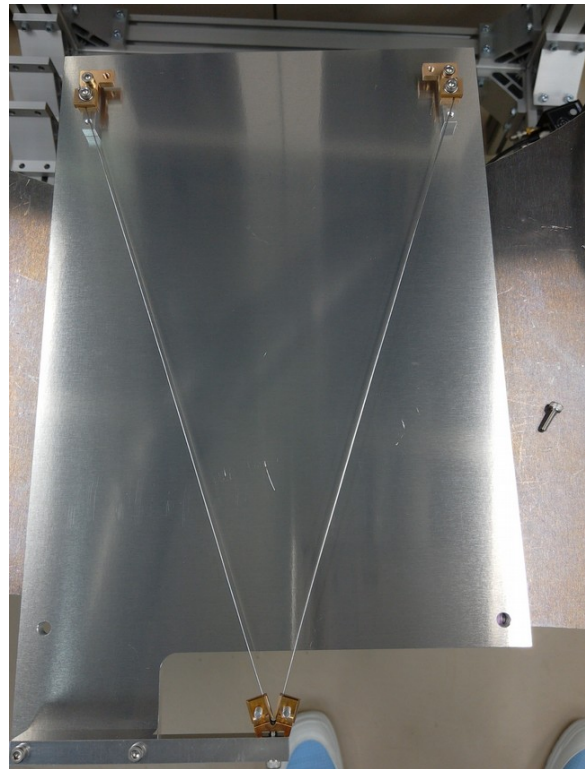
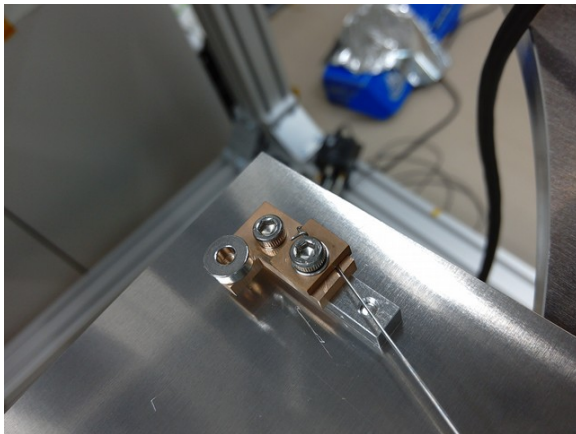


- Cut a steel-wire into two pieces of ca. 30 cm length and set the end of one of those pieces into the groove of one of the bottom wire-clamp; fix it there with the bottom wire clamp retainer
- Set the other end into the groove of the top wire-clamp (observe from the bottom side as the groove is upside down) and fix it with a topside wire-clamp retainer (M4 x 15 screws\*) (Note: hold the wire tight before fixing it)





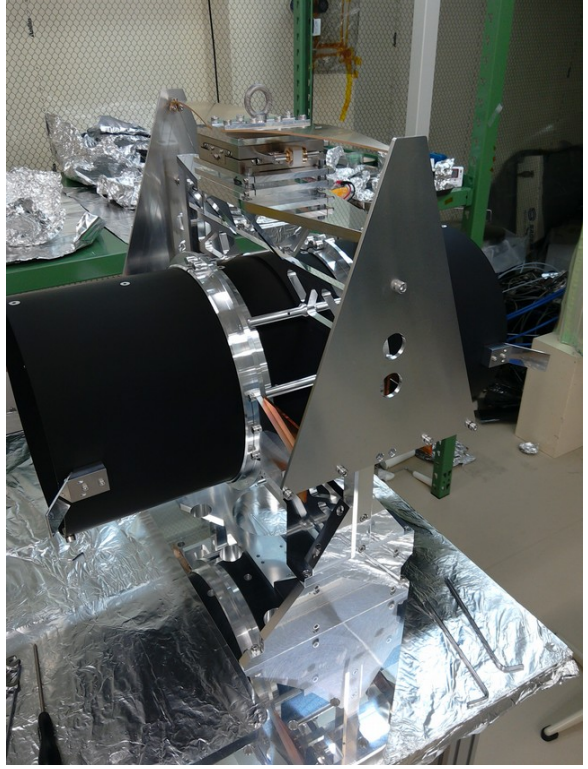
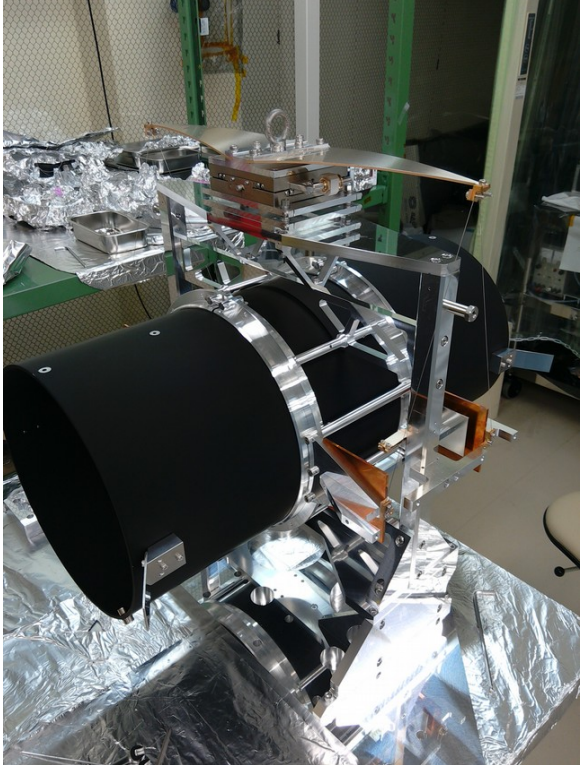
- Do the same for the other side
- For additional security, wind the ends of the wires around the head of the fixing screws on the retainers



- The result is a triangular shaped setup of two wires clamped together
- Put a 3mm\* thick washer on the open screw hole of each of the bottom wire-clamp
- Put the Wire Assembly Support Shield\* on the fixed wire assembly so that the screw holes are fitting with the top M4 screws and the screw holes of the bottom wire-anchors
- Screw them together by using nuts and M4 x 8\* screws



- Unscrew the anchors from the Wire-Jig Base Plate and take the Wire Assembly Support Shield\* with the now mounted wire assembly to the WAB (use the two holes in the shield for holding)
- Mount the top Baffle Wire Anchor to the end point of the Wing Blade (use M4 screw\*) and the bottom ones to the two Baffle Wing Plates; unscrew the Wire Assembly Support Shield\* from the Wire-Anchors  
Note: it is necessary to lift the whole baffle structure for that or to push the wing blades down until the hanging is finished! → special clamps for the blades or a third person is needed!
- Prepare the second wire assembly with the same steps as above and mount it to the other side of the WAB
- Now fix the bottom Wire-Anchors to the Baffle Wing Plates  
→ It is, therefore, necessary either to hold the baffle in position or to push the Wing-Blades down to hold have the Wire-Anchors in perfect location for screwing. A third person or clamps for the Wing-Blades may be needed!
- Release the baffle or the Wing-Blades, respectively
- In order to keep the wires protected during transport or installation into the test-mass chamber, mount a the triangular shaped Protection-Shield on each site of the WAB





## 6. Adjustment

Setting-up the adjustment of the WAB is one of the most crucial things as a misaligned baffle may reduce significantly the purpose of the WAB.

However, not all of the degrees of freedom (DoF) are equally crucial to the influence of back-scattering or diffraction of the main-beam in KAGRA.

The most important DoF are the “Yaw”, the Y- and the Z-direction (X marks the direction of the main-beam, Z is vertical).

### Note:

- If we stick to Obuchi-san’s new design of how to hang the baffle, the “Roll” and especially the “Pitch” DoF may be not significantly misaligned as the length of each wire cannot vary as much as it would before.
- In the current design (if the wires are all of the same length), the X and Y position of the baffle is not a real DoF. Instead, there are a X- and Y-pendulum DoF because of the stiffness of the wires.

Alignment of the baffle should be finished if the center of the baffle is 26.8cm (considering 27cm as working-height in the cryostat @20K) above the ground with the EQ-stopper in equal distance to the flanges around the baffle and the baffle itself.

An Offset in the X-pendulum, “Roll”, and Z DoF can be set with the three-head adjustment stage on the Suspension Yaw Adjuster Boss Block which itself controls the offset in “Yaw”.

The X-Y translator stage controls the X- and Y-position’s offset of the baffle itself.