

## KAGRA Cryo-Integration meeting and Cryogenic Payload meeting

18th of March 2014 (Tue) 13:00-17:30

311, Second Research Complex, Kashiwa campus

Attendees: Chen, Hirose, Khalaidovski, Nawrodt, Suzuki, Tomaru, Yamamoto

SeeVogh : Uchiyama

# Cryo-integration meeting

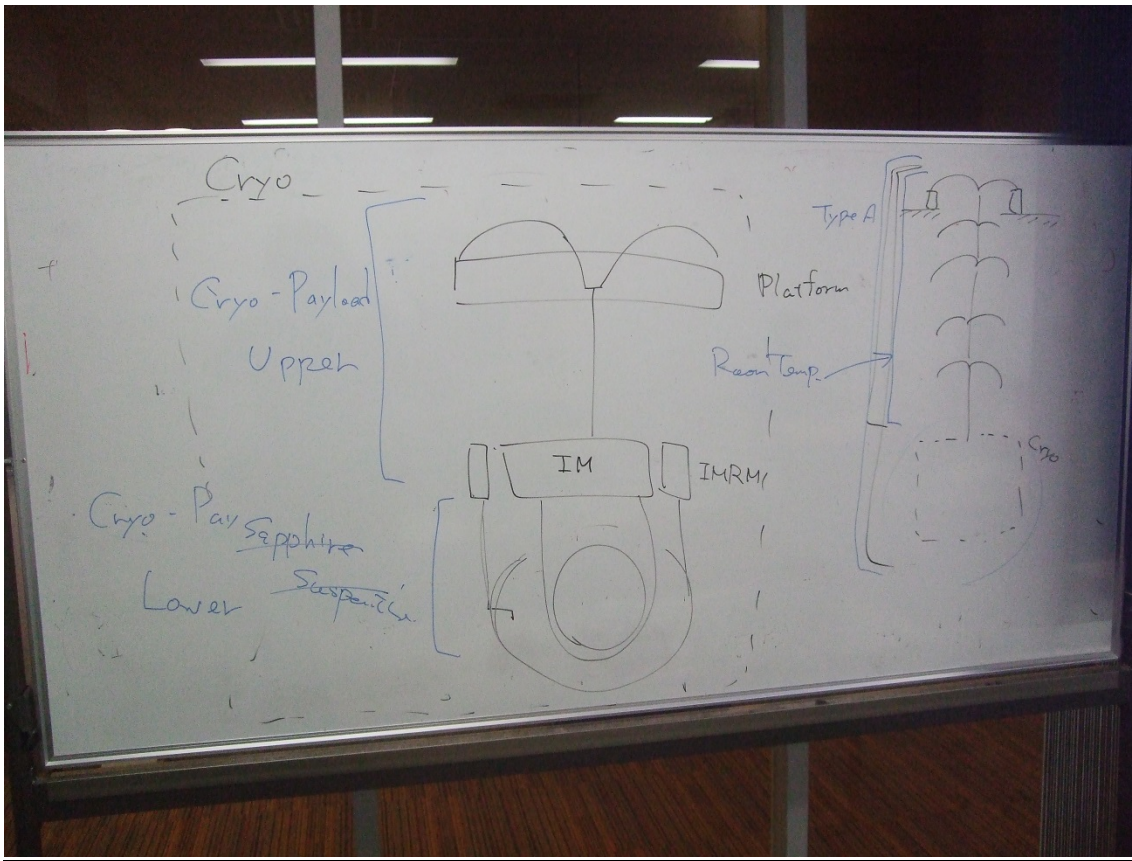
## Important or urgent items

### 1. Interface with other subgroup (Tomaru)

Takayuki made wiki page for cryo-integration meeting (<http://gwwiki.icrr.u-tokyo.ac.jp/JGWwiki/KAGRA/Subgroups/CRY/CSIM>).

This page shows the task items and persona who are in charge. If you have items to report or discuss, please put your slides and so on here. We discussed the name of total system and parts as photo pn .

Takayuki showed the design of cryo duct on the ceiling of radiation shield (<http://gwdoc.icrr.u-tokyo.ac.jp/cgi-bin/private/DocDB/ShowDocument?docid=2259>). Please check and let him know your comments. Black baffles are on the both end of duct. The radiation through this pipe with baffles is enough small. There is the support on the top of the duct. The heat transfer from this support must be small. It is difficult to make one large duct instead of four ducts.



White board : Name of total system and parts

## 2. Overall design (Hirose)

On the last Thursday, we have kick off meeting with High Precision Device, which is a candidate to draw design (for Platform, Intermediate Mass, Intermediate Recoil Mass). In this morning, Eiichi discuss them. They send the list of questions. Eiichi circulated it before this meeting. Answers for some questions are still open. It should be closed in today because Eiichi will be in his official trip tomorrow. So, please fill and send Eiichi. HPD would like to not only draw design but also make. If the cost is enough low, it is OK. But, probably, from point of view of modification, Japanese company is better (Takayuki looks for company for mechanical manufacture.->(#089)). The date of the next meeting is not decided yet.

**AI**

(#023)Baffle design : Mirror can observe the frame of hole of radiation shield for laser beam. It is an issue of scattered light. We also consider how to reduce the size of baffle. Other concerns are as follows; whether heat path on baffle is necessary ?, deformation under gravity, in the case of SolBlack .... We must consider the structure between baffle and hole for laser beam on radiation shield.

(#043)Kazuhiro Yamamoto will ask Takashi Uchiyama how much CLIO suspension rotates during cooling. Kazuhiro summarizes the requirement of dynamic range of mirror position and yaw rotation because the top of Type A must be adjusted for this purpose. He also asks Takashi what happened in CLIO. -> Kazuhiro summarizes what happened in CLIO and his guess about what happens in KAGRA (16-17pages of [<http://gwdoc.icrr.u-tokyo.ac.jp/cgi-bin/private/DocDB/ShowDocument?docid=1861>]). Vertical drift is an issue (->#086).

(#065)Tomotada investigates ECB on Al6\*\*\* for wide angle scattered light baffle (although he has already asked ATC and they replied that it is possible).

(#074)Suzuki-san discusses protection strategy for mirror and shield in SEO meeting.

(#078)Kazuhiro fixes the dimension of wire between Bottom filter and Platform (Ti-6Al-4V) and check it can be manufactured.

(#079)Kazuhiro checks whether 80 cables can be along the metal wire between Bottom filter and Platform. Mockup (#034) can be useful.

(#081)Takayuki circulates the design drawing of the cryo duct on the ceiling of radiation shield.-> He did and showed in this meeting(<http://gwdoc.icrr.u-tokyo.ac.jp/cgi-bin/private/DocDB/ShowDocument?docid=2259>).

(#084)Takayuki checks the view ports of cryostat for SHORT RANGE optical lever.

(#086)Vertical drift by thermal shrink.

(#087)Monitor system for top of the cryo duct on the ceiling of radiation shield. (only for installation ?, where (from bottom filter side)?, monitor system for wire to suspend bottom filter (there are appropriate view ports.))

(#088)Takayuki prepares "necessary item" list in wiki. If somebody finds something necessary, s/he writes it.

(#089)Takayuki looks for company for mechanical manufacture.

(#090)Suzuki-san and Takayuki prepare the flange at the top of cryostat to separate cryostat from room temperature part.

## Cryo-payload meeting

### 1. Sapphire monolithic suspension (Khalaidovski)

#### Important or urgent items

Dan explained his strategy for Ph.D. thesis. Main topics are as follows:

- (1) Indium bonding
- (2) Sapphire fiber with square nail heads
- (3) Hydroxide Catalysis Bonding
- (4) Diffusion bonding
- (5) Blade for pendulum test
- (6) Pendulum test 1
- (7) Pendulum test 2

Takayuki pointed out: before Q measurement, Dan must evaluate the upper limit of the mechanical dissipation in each part. And he must consider how to measure mechanical loss.

Minimum success should include (1),(2),(3) and (4).

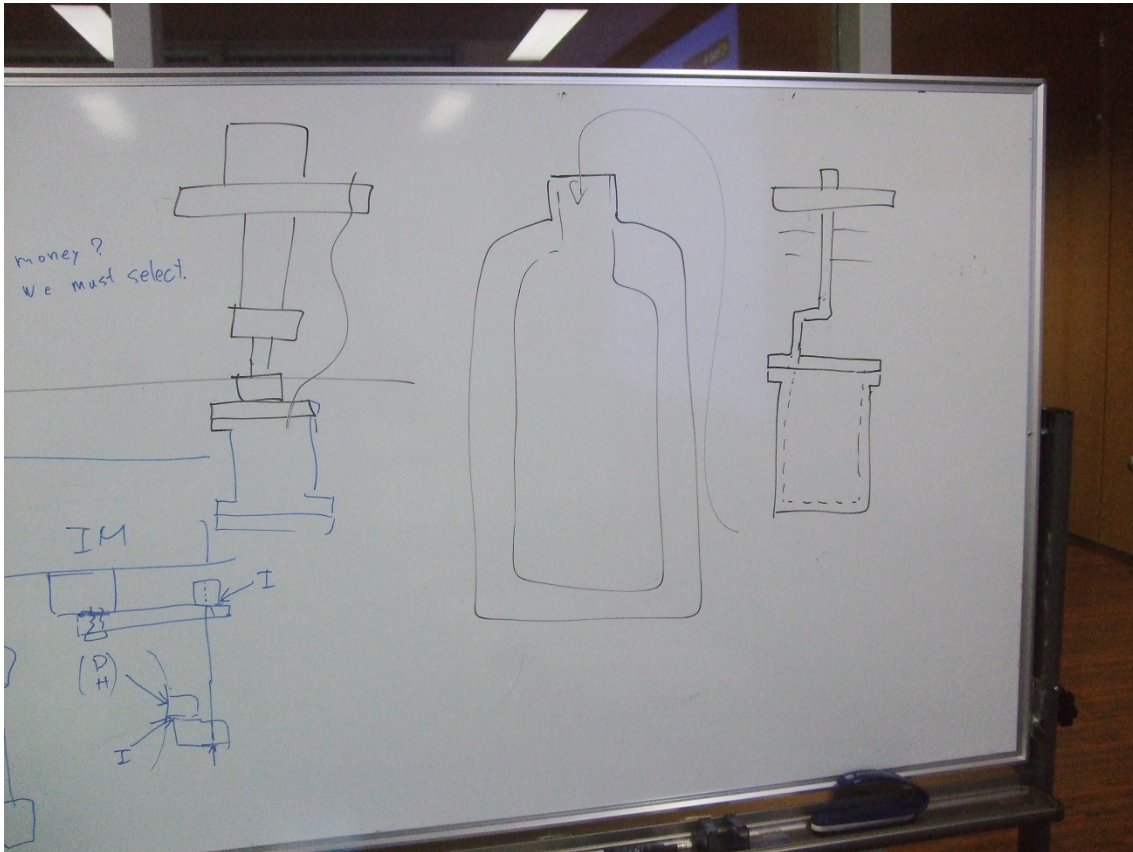
Dan will check KEK cryostats whether they can be used for his experiments (schematic view on the next page).

Techniques for indium must be established as soon as possible.

We decide which Hydroxide Catalysis Bonding or Diffusion Bonding will be adopted.

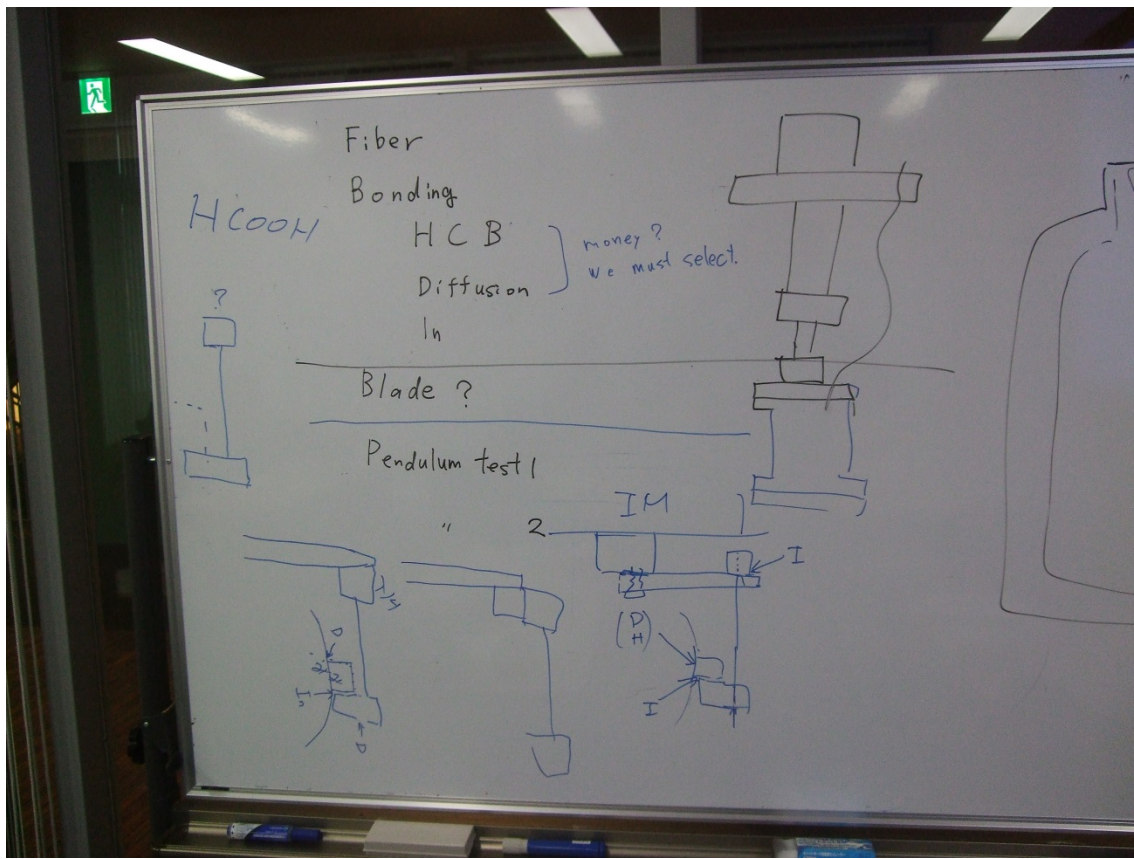
Blade is a problem. We must decide strategy as soon as possible.

Pendulum test is a tricky part. We must consider what information can be derived for KAGRA. We also discuss structure of sapphire monolithic suspension as photo in the next page.



**Whiteboard : Schematic view of cryostat in KEK and some ideas.**





**Whiteboard : Schematic view of sapphire monolithic suspension .**

### **AI**

(#020) Kazuhiro summarize the length of sapphire fiber. He must take bending point and adjustment of diameter into account. -> He explained. He will discuss with Sascha.

(#024) Yoichi Aso and Eiichi Hirose prepare the plan and R&D items of optical contact and screw, respectively by Christmas. -> Kazuhiro summarizes points and consults with them.

(#053) Rahul investigates thermal distribution model.

(#060) Yusuke will summarize outline of investigation for cradle sapphire suspension with screws.

(#076) We ask Zygo can make sapphire block which has round surface (curvature of radius is exactly same as that of mirror barrel surface)

(#083) Details of strength test of sapphire blade spring are considered (also clamp).

(#085) Kazuhiro will ask Japan Cell quotation for direct bonding

(5mm\*10mm\*20mm, 60 blocks). -> Quotation arrived.

## Details

(1) Thermal resistance of screw connection (in actual, the indium is inserted and it transfers heat) will be measured. First of all, we must ask Yusuke where it is. Alignment of two sapphire blocks is necessary.

## 2. Vertical spring (blade metal spring) (Takahashi)

### Important or urgent items

Ishizaki-san and Takahashi-san installed the spring in 1/4 cryostat. Cooling test will start soon.

### AI

(#012) Kazuhiro rewrite schedule.-> He rewrote. However, it must be rewritten again. We must fix the outline of strategy at first.-> He wrote and is discussing with Ishizaki-san and Ryutaro.

(#046) Kazuhiro Hayama evaluates the amplitude of gravitational wave from pulsars between 10Hz and 20Hz. He will take into account the direction of KAGRA interferometer and pulsars.

## 3. Material (Suzuki)

### Important or urgent items

No important news.

### AI

(#035) Monitor system to check whether the wire between room and cryogenic temperature touches the cryoduct. -> Kazuhiro consults with Ettore. He summarized. 22-24 pages of Payload strategy (in Japanese) (<http://gwdoc.icrr.u-tokyo.ac.jp/cgi-bin/private/DocDB/ShowDocument?docid>)

=1861). At least, monitor for installation is necessary.->(087)

(054)Yusuke measures annealed thermal conductivity of aluminum and copper. Higher temperature annealing could increase conductivity.->Unfortunately, annealing does not change the conductivity of copper. We must check whether size effect limits the conductivity or not.

(071)Tokoku-san summarizes measurement of magnetism of stainless (316L) and Solblack and DLC.

(091)Kazuhiro Yamamoto summarizes the requirement of magnetism.

(092)Takayuki investigates how to anneal tungsten.

(093)Yusuke check where Al samples with clamps for thermal resistance measurement.

#### 4.Control(Chen)

##### Important and urgent issues

No important news.

##### AI

(019)Ryutaro will consult Saito-san on the outgas of board for OSEM.

(044)Suzuki-san asks Saito-san whether Nitofix is ultra high vacuum compatible.-> Suzuki-san will reserve the out gas measurement system at KEK

(<http://gwdoc.icrr.u-tokyo.ac.jp/cgi-bin/private/DocDB/ShowDocument?docid=2101>). For baking, the spacer between magnet and mirror is necessary because baking mirror with glued magnet causes contamination.

(056)We must decide strategy and schedule for LVDT.-> Takanori is discussing with Ettore and Alessandro.

(057)Out gas from Photo diode, LED and motor should be checked (Dan and Kazuhiro?).

(069)Kazuhiro Yamamoto summarizes the effect of local Earth magnetic field fluctuation on coil magnet actuator and requirement for magnetic field.

(070)Kazuhiro investigates the diffraction loss by coil.

(075)Ceramic bearing test