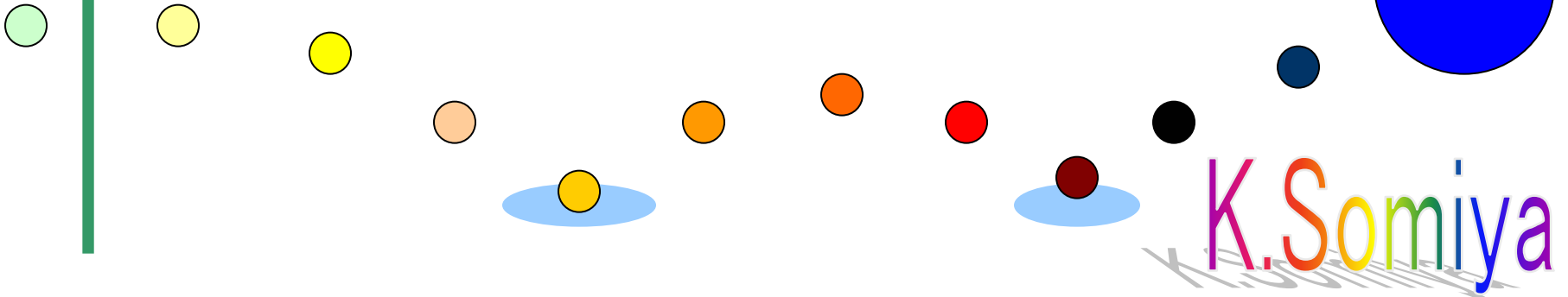


# Interface Control

LCGT f2f meeting  
Jul. 2012

*Tokyo Inst of Technology*  
**Kentaro Somiya**



# Contents

- Interface parameter updates since the last time
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  - Windows
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  - Mirror coatings
  - borehole size
  - ... etc.
- On-going small working groups
  - layout, cabling, interlock, detector diagnostics, connectors
- Remarks on ICD
- Duty factor

# Test mass curvature

Related subsystems: MIR, MIF, AOS, Sensitivity

The values used to be... RITM=flat, RETM=7km (ICD)

New values are... RITM=1.9km, 1.9km

## Reason of the change

- Reference sphere is the same as aLIGO -> cheaper
- Negative g-factor is good

## Influence of the change

- Sensitivity becomes worse by ~2%
- Layout is changed
- OMC design is changed

# ITM wedge

Related subsystems: MIR, MIF, AOS, CRY

The values used to be... 0.2 deg for Sapphire (ICD)  
then 0.02 deg was suggested

New values are... TBD; under discussion

## Reason of the suggestion

- With 0.02 deg, PR2/PR3 can be used for BRT
- But 0.02 deg on Sapphire may be hard to fabricate

## Objection to the change to 0.02 deg

- cryo-duct aperture cannot be increased much
- no solution for the layout

# Heat transfer maneuver

Related subsystems: MIF, AOS, CRY, VIS, Sensitivity

It used to be... PTC -> 8K shield -> IM -> TM

New maneuver is... (PTC -> 8K shield) + (PTC -> IM)

## Reason of the change

- To avoid the IM temperature increase when the 8K shield is heated up by the scattering light

## Influence of the change

- Full power can be injected
- Sensitivity would become better by ~4%
- Isolation of the heat link vibration is needed

# Tunnel dimension

Related subsystems: TUN, VAC, GIF

The values used to be... 35cm btw beam & tunnel center  
New values are... 50cm

## Reason of the change

- Construction company uses NATM instead of TBM

## Influence of the change

- Aisle becomes larger
- More room btw GIF duct and wall  
(50cm)



# Borehole dimension

Related subsystems: TUN, VAC, VIS, CRY

The values used to be...  $\phi 1150\text{mm}$  (ICD says 1200mm)  
New values are... TBD

## Reason of the change

- Construction company uses NATM instead of TBM for the borehole as well

## Influence of the change

- To be discussed...

\* Cryostat top aperture is  $\phi 800$ .

# Baffles and cryo-ducts

Related subsystems: AOS, MIF, VAC, VIS, CRY, MIR

The values used to be... undecided  
New values are... partially decided

## Reason of the change

- Too much heat introduced to the shield duct
- Scattering light issues

## Influence of the change

- Shield duct temperature 74K -> 82K (tolerable)
- Discussions on-going

Ref: JGW-G1201088



# iKAGRA laser power

Related subsystems: LAS, IOO, MIF, EO, Sensitivity

The values used to be... 42 or 55W

New values are... 10W

## Reason of the change

- No money

## Influence of the change

- Worse sensitivity of iKAGRA

# Output Faraday

Related subsystems: IOO, AOS, VIS, MIF

The values used to be... none

New values are... to be installed

## Reason of the change

- Mike Smith pointed out the necessity (in order to avoid the back scattering)

## Influence of the change

- a few percent loss of the signal
- additional suspension is necessary

# Transmission monitor system

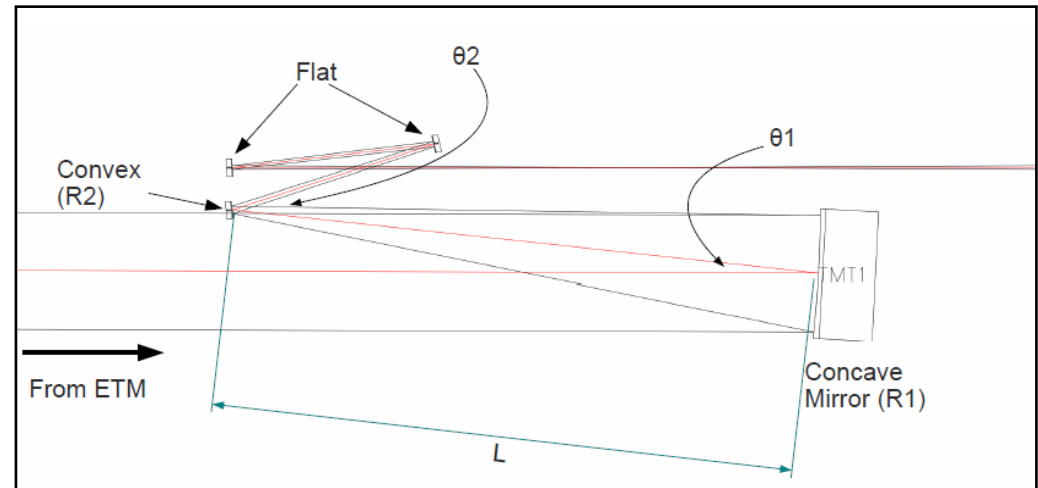
Related subsystems: AOS, MIF, VIS, MIR

The values used to be... undetermined  
New values are... partially determined

## Influence

- Layout update
- WFS sensitivity

\* no TMS for ITMs



# DLC coating inside the cryostat

Related subsystems: CRY, AOS

It used to be... coated to the overall surface  
New method is... coated panels attached on the surface

## Reason of the change

- The cryostat is too big to coat and anneal

## Influence of the change

- not in particular

# Windows

Related subsystems: CRY, VAC, AOS, MIF

It used to be... undetermined

New method is... fused silica,  $\phi?$ mm,  $t$ 10mm,  $\lambda/4$

Influence of the change

- not in particular

# Mirror coatings

Related subsystems: MIR, MIF, CRY, AOS

It used to be... unsolved

Now it is... orderable to LMA

## Reason of the change

- Successful Communication btw Mio and Flaminio

## Influence of the change

- Possibly less absorption
- Possibly lower mechanical loss

## Note

- It is not fixed yet to make an order to LMA
- R&D plan at NAO

# Environmental monitors

Related subsystems: GIF, MIF, DGS, DAS, VAC,  
TUN, FCL, etc.

It used to be... candidates listed

Now we have... concrete list of the sensors

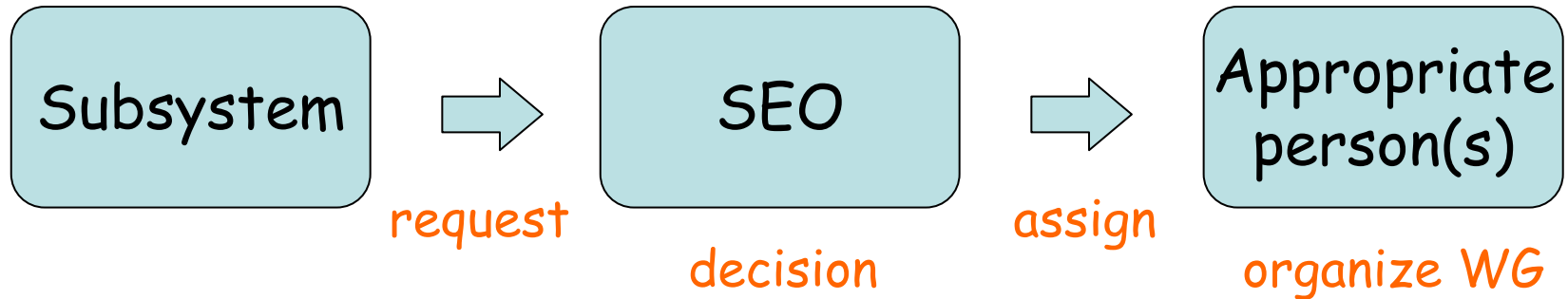
\* Ref: JGW-T1201032

GIF provided other subsystems a questionnaire.

1<sup>st</sup> round result ... ?

2<sup>nd</sup> round has been postponed.

# Mini working groups



Some of the interface-related issues have been questioned by subsystems, and SEO have asked an appropriate person(s) to organize a mini WG.

Once the issue is solved, a report should be sent to and reviewed by SEO.



# List of Mini WGs

Theme	description	related subsystems	assigned person(s)	progress report	final report
layout	optical layout	MIF, VAC, AOS, IOO, etc.	Miyoki	on wiki	X
interlock	instrument control for safety	MIF, DGS, etc.	Aso	on wiki	X
cabling	consistent use of cables	CRY, VIS, etc.	?	?	X
connectors	consistent use of connectors	CRY, VIS, etc.	?	?	X
diagnostics	diagnostic tools for IFO commissioning	MIF, DGS, etc.	Hayama	?	X

Let me know if there are missing interface items.

# ICD updates

It has been pointed out that

- Current ICD is not an ICD but just a parameter list
- Too little information is shown in the current ICD.

Though the ICD is on the SVN,

- No one has tried to make an update except for me.

Incidentally, it is also a problem that

- It is hard to find reference for interface items
- It is hard to find reference for requirements.



**ICD wiki**

## KAGRA Interface Control

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### Contents

1. [Scope of each subsystem](#)
2. [Table of the interface items between subsystems](#)
3. [Working groups for important interface issues](#)
4. [Parameter list](#)
5. [Requirements and tolerance](#)
6. [Duty factor](#)
7. [Reference](#)

 **Click!**

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### 1. Scope of each subsystem

- Tunnel (TUN/TU): *Tunnel design, Underground lab area, Access tunnel, and Safety*
- Facility (FCL/FA): *TBD*
- Vacuum (VAC/VA): *Two beam tubes, Chambers, Baffles, Beam targets, Layout, and Pumps*
- Cryogenic (CRY/CR): *Cryostat, Shield, Cryo duct, Cryo-cooler, Cryo-suspension, and Heat link*
- Vibration Isolation (VIS/VI): *Four Type-A systems, Seven Type-B systems, and Several Type-C systems*

## 2. Table of the interface items between subsystems

	TUN	FCL	VAC	CRY	VIS	MIR	LAS	MIF	IOO	AOS	AEL	DGS	DAS	GIF
TUN	--	0	0	0	0	0	0	0	0	0	0	0	0	0
FCL	0	--	0	0	0	0	0	0	0	0	0	0	0	0
VAC	0	0	--	0	0	0	0	0	0	0	0	0	0	0
CRY	0	0	0	--	0	0	0	0	0	0	0	0	0	0
VIS	0	0	0	0	--	0	0	0	0	0	0	0	0	0
MIR	0	0	0	0	0	--	0	0	0	0	0	0	0	0
LAS	0	0	0	0	0	0	--	0	0	0	0	0	0	0
MIF	0	0	0	0	0	0	0	--	0	0	0	0	0	0
IOO	0	0	0	0	0	0	0	0	--	0	0	0	0	0
AOS	0	0	0	0	0	0	0	0	0	--	0	0	0	0
AEL	0	0	0	0	0	0	0	0	0	0	--	0	0	0
DGS	0	0	0	0	0	0	0	0	0	0	0	--	0	0
DAS	0	0	0	0	0	0	0	0	0	0	0	0	--	0
GIF	0	0	0	0	0	0	0	0	0	0	0	0	0	--

An interface item table at a glance is [here](#).

## 3. Working groups for important interface issues

- [Layout](#) (VAC,MIF,AOS,IOO, etc.)
- [Cabling](#) (VIS,CRY, etc.)
- [Interlock](#) (MIF,IOO,LAS, etc.)
- [Detector diagnostics](#) (MIF,DAS, etc.)
- [Connectors](#) (VAC,CRY,DGS etc.)

## 4. Parameter list

- Parameter list is [here](#).

重力波 Gravitational Wave Group KentaroSomiya Settings Logout

## Interface/VAVI

Interface/IOAO » Interface/AODG » Interface/AODA » Interface/IFIO » Interface/VAVI

RecentChanges FindPage HelpContents LCGT/ELITES/WP3 **Interface/VAVI**

Edit (Text) Info Add Link Attachments More Actions: ▾

### Interface between VAC and VIS

#### Interface Item (1) VIS dimension

Type-A	TBD
Type-B	1500 (dia.) × 3200 (height, including 200mm legs)
Type-C	2000 (dia.) × 3200 (height, including 200mm legs)

See the slides for the external review ([here](#)).  
Also see [here](#) for Type-A chamber room.

#### Interface Item (2) Feed-through flange

TBD

List of the items has been collected from subsystems.

Some information can be shown here, though it is not recommended to show values.

The best way would be just to link a document that best describes the item.

- One can put as much information as necessary
- It will become easier to find a seeking document
- Prompt updates will be possible

# Duty factors

	loss	freq(1/yr)
(A) Maintenance		
- long	60	0.5
- medium	5	1
- short (adjustment)	0.5	12
-----		
subtotal	41.0 days	
(B) Malfunctions		
- laser exchange	4	0.2
- DGS system error	4	0.5
- AEL malfunction	4	1.0
- FCL accident	4	1.0
- suspension break	50	0.2
- DAS PC exchange	1	0.5
- local sensor error	1	0.5
-----		
subtotal	21.8 days	
-----		
total	62.8 days (=17.2%)	

- Cooling/heating time prolongs the total maintenance time:
  - temperature elevation (15d)
  - vacuum leak (0.1d)
  - maintenance (10d)
  - vacuum (5d)
  - cooling (30d)
- Malfunctions must be avoided as much as possible

I/O unlock	1/day	20 min
laser down	1/year	1 hour
MC unlock	2/year	30 min
OMC adjust	2/year	30 min
big earthquake	1/week	2 hour
others	1/week	2 hour
-----		
total	0.91 hours/day	(=3.80%)

$$(1-0.172) \times (1-0.0380) \rightarrow 80\%$$

End