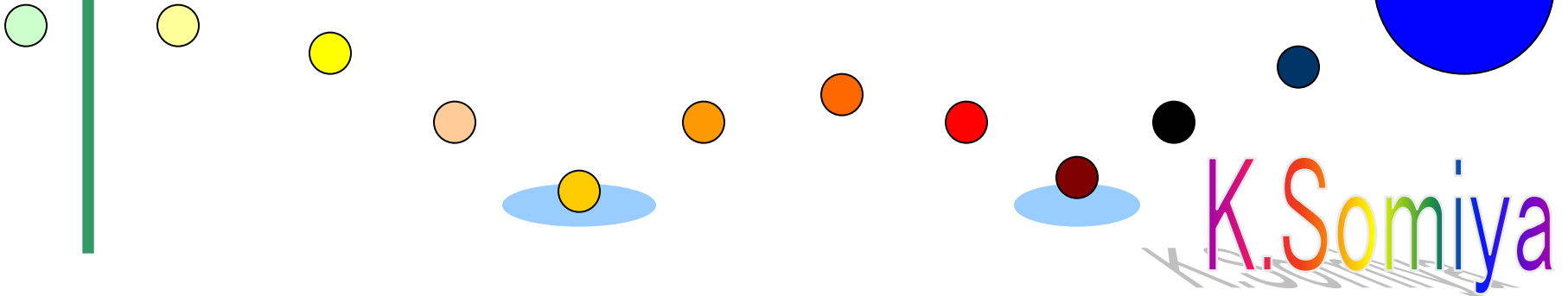


Interface Control Document

LCGT f2f meeting
Feb. 2012

Tokyo Inst of Technology
Kentaro Somiya



Contents

- Review of ICD (Interface Control Document)
- Updates since the August meeting
- Issues and discussions on ICD

ICD is available here (SVN):

<https://granite.phys.s.u-tokyo.ac.jp/svn/LCGT/trunk/ICD/>

Without the interface control...

- (1) Two people may think that the other guy will take care of a shared item.
- (2) Some items could belong to none of the subsystems.



- (3) Two people may assume different parameters for a shared item.

⇒ **Importance of interface control**

ICD structure (Interface Control Document)



TortoiseSVN
Techfuels.com

SVN = Apache Subversion

SVN server

ASC code

SAS code

Param.List

ICD

updates

members

Ex: MIF

Latex

VBA

```

1 ip.k_GAS4 4.73.E+02 kg/s^2 kspring constant of 4th GAS filter visl
2 ip.gT_GAS4 #NAME? % kT dependence of spring constant
3 ip.loss_GAS4blade 1.00.E-02 % %loss of GAS filter blades visl
4 ip.m_joint 1.00.E-01 kg %mass of GAS filter joint for wire
5 ip.usus_GASPF 2.70.E+00 Km %wire length btw 4th GAS filter and P
7 ip.d_GAS4 3.11.E-03 Km %wire diameter (4th GAS) visl
8 ip.n_GAS4 1.00.E+00 % %number of wires (4th GAS) visl
9 ip.E_GAS4 1.88.E+11 kPa %wire young's modulus (4th GAS) visl
10 ip.tensile_GAS4 2.00.E+09 kPa %wire tensile strength (4th GAS)
11 ip.loss_GAS4wire #NAME? % %loss of wire (4th GAS) visl
12 ip.usus_GAS4 2.10.E+00 Km %wire length btw 4th GAS filter and C
13 ip.dsus_GAS4 3.74.E-03 Km %wire diameter (4th GAS) -vis,dg
14 ip.num_GAS4wire 1.00.E+00 % %number of wires (4th GAS)
15 ip.m_payload 1.20.E+02 kg %total mass suspended by 4th GAS filt
16 ip.radius_BS 1.90.E-01 Km %SBS radius -mir,mif
17 ip.thickness_BS 1.20.E-01 Km %SBS thickness -mir,mif
18 ip.R_BS 5.00.E-01 % %SBS reflectivity -mir,mif
19 ip.loss_BS_HR 5.00.E-05 % %SBS HR surface optical loss -mir,mi
20 ip.loss_BS_AR 5.00.E-05 % %SBS AR surface reflectivity -mir,mi
21 ip.RoC_BS 1.00.E+05 Km %RoC of BS -mir,mif
22 ip.abso_BS 1.00.E-08 1/m %SBS substrate absorption -mir,mi
23 ip.wedge_BS 3.83.E-01 kg/m %XAR wedge of BS -mir,mif,vac
24 ip.diameter_cryo8K 5.00.E-01 Km %radiation shield diameter cry,va
25 ip.diameter_aperture 2.50.E-01 Km %radiation shield aperture
26 ip.diameter_tophole 1.50.E-01 Km %top hole diameter (to SAS) -cry,va
27 ip.heat_frontop 1.00.E-02 W/m %radiation from upper stages -cry,va
28 ip.heat_frontBS 1.00.E-02 W/m %radiation from BS chamber -cry,va
29 ip.heat_fromArm 1.00.E-02 W/m %radiation from arm cavity -cry,va
30 ip.heat_cryoshield 1.00.E-01 W/m %heat from radiation shield cry,va
31 ip.heat_reartr trenchield #NAME? % %heat from reartr trenchield
  
```

```

31 Use line-break after each sentence to i
32
33 \section[Overview]{
34
35 This document presents the interface information that should
36 listing LCGT subsystems.
37 The interface information includes (i) definition of each s
38 and (iii) optical layout of the detector.
39 The document is uploaded on the LCGT SVN server (Url[https
40 trunk/ICD]) and the contents are to be updated on a real-ti
41
42 \section[Allocation of the tasks for LCGT]{
43
44 The scope of each subsystem and the boundaries of subsystem
45 ents must be included in one or more subsystems.
46 The components shared by more than one subsystems, namely [
47 fully controlled to avoid a contradictory assumption of the
48
49 \subsection[List of the subsystems and 3-letter codes]{
50 Analog Electronics (AEL)WV
51 Auxiliary Optics (AOS)WV
52 Cryogenics (CRY)WV
53 Digital System (DGS)WV
54 Facility (FCL)WV
55 Input and Output Optics (IOO)WV
56 Laser (LAS)WV
  
```

filters, real-time OS, control software, monitor software, data storage,
and the related interface parameters are listed in Table 4.

Interface	AEL	CRY	DGS	FCL	IOO	LAS
beamline	OK	OK	OK	OK	OK	OK
power_AEL	OK	OK	OK	OK	OK	OK
power_AOS	OK	OK	OK	OK	OK	OK
power_DGS	OK	OK	OK	OK	OK	OK
power_FCL	OK	OK	OK	OK	OK	OK
power_IOO	OK	OK	OK	OK	OK	OK
power_LAS	OK	OK	OK	OK	OK	OK

Table 4: Interface parameters that DGS subsystem is in charge of.

3.5 FCL

The components that the FCL subsystem is in charge are as follows:
buildings, car parking, power supply system, clean air rooms, air conditioners, optical fibers, cranes, vacuum access, clean booth on access, acoustic isolation boxes,
and the related interface parameters are listed in Table 5.

Interface	AEL	CRY	DGS	FCL	IOO	LAS
beamline	OK	OK	OK	OK	OK	OK
power_AEL	OK	OK	OK	OK	OK	OK
power_AOS	OK	OK	OK	OK	OK	OK
power_DGS	OK	OK	OK	OK	OK	OK
power_FCL	OK	OK	OK	OK	OK	OK
power_IOO	OK	OK	OK	OK	OK	OK
power_LAS	OK	OK	OK	OK	OK	OK

Table 5: Interface parameters that FCL subsystem is in charge of.

3.6 GIF

The components that the GIF subsystem is in charge are as follows:
thermometers, micrometers, particle meters, microphones, hygrometers, baseline interferometers, barometers, accelerometers,
There are no interface parameters that GIF is in charge of.

3.7 IOO

The components that the IOO subsystem is in charge are as follows:
PAC mirrors, BC mirrors, BC servo, phase-lock system for green, PAC for gr1, PAC for gr2, MC servo, variable attenuator, BS servo, OMC broadband,
and the related interface parameters are listed in Table 6.

Parameter list

VBA transforms the list to the table below.
(Visual Basic Application)

Microsoft Excel - iplist2.xls

	A	B	C	D	G	H	I	J	K	L	M	N	O	P	Q	R	S	T	V	W	X
1					TU	PA	VA	VI	MI	CR	IF	DG	EL	IO	LA						
2	drange_PD	#NAME?		PD dynamic range								IF	DG	EL	IO						
3	drange_QPD	#NAME?		QPD dynamic range								IF	DG	EL	IO						
4	aperture_rfpd_hi	3.00.E-03	m	RF PD aperture (high								IF		EL							
5	aperture_rfpd_lo	3.00.E-03	m	RF PD aperture (low								IF		EL							
6	aperture_dcpd_hi	3.00.E-03	m	DC PD aperture (high								IF		EL							
7	aperture_dcpd_lo	3.00.E-03	m	DC PD aperture (low								IF		EL							
8	input_rfpd_high	3.00.E-01	W	RF PD input power (h								IF		EL							
9	input_rfpd_low	1.00.E-01	W	RF PD input power (l								IF		EL							
10	input_dcpd_high	1.00.E-01	W	DC PD input power (h								IF		EL							
11	input_dcpd_low	1.00.E-02	W	DC PD input power (l								IF		EL							
12	RFHOMsuppression	#NAME?		RF HOM suppression a								IF		EL							
13	Dcpowersupply	2.40.E+01	V	DC power supply								IF		EL							
14	dcvoltage	1.00.E-01	V	maximum DC voltage f								IF		EL							
15	noise_PD	1.00.E-09	V/rHz	electric noise on de								IF		EL							
16	error_IQ	1.00.E-02		error of 90deg for I								IF	DG	EL							
17	loss_PD	5.00.E-02		1 - quantum efficien								IF		EL	IO						
18	noise_QPD	1.00.E-09	V/rHz	QPD noise								IF	DG	EL	IO						
19	actuator_IM	#NAME?		actuator power on IM				VI				IF		EL							
20	actuate_range	#NAME?		actuation range (AC)				VI				IF		EL							
21	noise_actuator	#NAME?		actuator noise				VI				IF		EL							
22	actuator_ITM	#NAME?		actuator power on IT				VI				IF		EL							
23	actuator_ETM	#NAME?		actuator power on ET				VI				IF		EL							
24	emissivity_TM	#NAME?		emmissivity of surfac								IF		EL							
25	Tm_TM	2.00.E+01	K	temperature				VI	MI	CR	IF			EL							
26	specificheat_TM	6.90.E-01	J/K/kg	specific heat of TM				VI	MI	CR	IF			EL							
27	kappa_TM	1.57.E+04	W/m/K	thermal conductivit				VI	MI	CR	IF			EL							
28	diameter_cryo8K	5.00.E-01	m	radiation shield dia				VA				CR		IF							
29	emissivity_vacuu	3.00.E-02		duct emissivity				VA				CR		IF							
30	diameter_apertur	2.50.E-01	m	radiation shield ape				VA				CR	IF	IF							
31	heat_fromBS	1.00.E-02	W	radiation from BS ch				VA				CR	IF	IF							
32	heat_fromArm	1.00.E-02	W	radiation from arm c				VA				CR	IF	IF							
33	heat_fromField	1.00.E-04	W	heat from radiation				VA				CR	IF	IF							

Related subsystems are shown in color

Subsystem in charge is shown in bold letters

Sorted by the subsystem in charge

Create tables with each subsystem in charge (used in ICD)

Checking updates in SVN

```
st.txt Revision 441 - TortoiseMerge
Edit  Navigate  View  Help

iplist.txt Revision 440
255 ip.cmrr_seis ->="=TBD">%CMRR (3km)->tun,fcl,vis,vac
256 ip.cmrr_cutoff ->="=TBD">%CMR_cutoff_frequency ->tun,fcl,vis,vac
257 ip.diameter_SRM ->=2.50.E-01->%SRM_diameter ->mir,mif,aos
258 ip.thickness_SRM ->=1.00.E-01->%SRM_thickness ->mir,mif,aos
259 ip.diameter_SR2 ->=2.50.E-01->%SR2_diameter ->mir,mif,aos
260 ip.thickness_SR2 ->=1.00.E-01->%SR2_thickness ->mir,mif,aos
261 ip.diameter_SR3 ->=2.50.E-01->%SR3_diameter ->mir,mif,aos
262 ip.thickness_SR3 ->=1.00.E-01->%SR3_thickness ->mir,mif,aos
263 ip.R_SRM ->=9.00.E-01->%SRM_reflectivity ->mif,mir,aos
264 ip.loss_SRM ->=1.00.E-04->%SRM_optical_loss ->mif,mir,aos
265 ip.loss_SR2 ->=1.00.E+04->%SR2_optical_loss ->mif,mir,aos
266 ip.loss_SR3 ->=1.00.E+04->%SR3_optical_loss ->mif,mir,aos
267 ip.RoC_SRM ->=3.70.E+02->%RoC_of_SRM ->mif,mir,aos
268 ip.RoC_SR2 ->=4.17.E+00->%RoC_of_SR2 ->mif,mir,aos
269 ip.RoC_SR3 ->=3.23.E+01->%RoC_of_SR3 ->mif,mir,aos
270 ip.wedge_SRM ->=3.00.E-01->%deg ->%wedge_angle_of_SRM ->mif,mir,ioo,va
271 ip.actuator_ITM ->="=TBD">%actuator_power_on_ITM ->ael,mif,vis,ac
272 ip.actuator_ETM ->="=TBD">%actuator_power_on_ETM ->ael,mif,vis,ac
273 ip.diameter_TM ->=2.50.E-01->%TM_diameter ->mir,cry,mif,aos
274 ip.thickness_TM ->=1.50.E-01->%TM_thickness ->mir,cry,mif,aos

275 ip.emissivity_TM ->=8.00.E-02->%emmissivity_of_surface_of_TM ->cr
276 ip.specifichheat_TM ->=6.90.E-01->%J/K/kg-%specific_heat_of_TM ->cry,mi
277 ip.kappa_TM ->=1.57.E+04->%W/m/K-%thermal_conductivity_of_TM ->cry,mi
278 ip.ear_distance ->=2.46.E-01->%distance_of_flat_ear_surfaces ->mi
279 ip.loss_sleeks ->="=TBD">%scratches_and_sleeks_loss ->mir,mif,cry,ac
280 ip.loss_points ->=1.00.E-05->%point_defects_loss ->mir,mif,cry,aos
281 ip.surfacerms_center ->=3.00.E-10->%central_region_surface_rms ->mi
282 ip.surfacerms_outer ->=1.00.E-09->%outer_region_surface_rms ->mir,mi
283 ip.BRDF ->=1.40.E-05->%BRDF ->mir,mif,aos,cry
284 ip.surfacecenter ->=1.20.E-01->%border_of_central_region ->mir,mi
285 ip.flatness_AR_TM ->="=TBD">%AR_side_surface_flatness ->mir,mif,ac
286 ip.RoC_TM_fromAR ->="=TBD">%ROC_seen_from_AR_side ->mir,mif,aos
287 ip.birefringence ->="=TBD">%birefringence ->mir,mif,aos
288 ip.w_ETM ->=4.53.E-02->%beam_radius_on_ETM ->mif,mir,ioo,aos
289 ip.w_ITM ->=3.43.E-02->%beam_radius_on_ITM ->mif,mir,ioo,aos

iplist.txt Revision 441
255 ip.cmrr_seis ->="=TBD">%CMRR (3km)->tun,fcl,vis,vac
256 ip.cmrr_cutoff ->="=TBD">%CMR_cutoff_frequency ->tun,fcl,vis,vac
257 ip.diameter_SRM ->=2.50.E-01->%SRM_diameter ->mir,mif,aos
258 ip.thickness_SRM ->=1.00.E-01->%SRM_thickness ->mir,mif,aos
259 ip.diameter_SR2 ->=2.50.E-01->%SR2_diameter ->mir,mif,aos
260 ip.thickness_SR2 ->=1.00.E-01->%SR2_thickness ->mir,mif,aos
261 ip.diameter_SR3 ->=2.50.E-01->%SR3_diameter ->mir,mif,aos
262 ip.thickness_SR3 ->=1.00.E-01->%SR3_thickness ->mir,mif,aos
263 ip.R_SRM ->=9.00.E-01->%SRM_reflectivity ->mif,mir,aos
264 ip.loss_SRM ->=1.00.E-04->%SRM_optical_loss ->mif,mir,aos
265 ip.loss_SR2 ->=1.00.E+04->%SR2_optical_loss ->mif,mir,aos
266 ip.loss_SR3 ->=1.00.E+04->%SR3_optical_loss ->mif,mir,aos
267 ip.RoC_SRM ->=3.70.E+02->%RoC_of_SRM ->mif,mir,aos
268 ip.RoC_SR2 ->=4.17.E+00->%RoC_of_SR2 ->mif,mir,aos
269 ip.RoC_SR3 ->=3.23.E+01->%RoC_of_SR3 ->mif,mir,aos
270 ip.wedge_SRM ->=3.00.E-01->%deg ->%wedge_angle_of_SRM ->mif,mir,ioo,va
271 ip.actuator_ITM ->="=TBD">%actuator_power_on_ITM ->ael,mif,vis,ao
272 ip.actuator_ETM ->="=TBD">%actuator_power_on_ETM ->ael,mif,vis,ao
273 ip.diameter_TM ->=2.20.E-01->%TM_diameter ->mir,cry,mif,aos
274 ip.thickness_TM ->=1.50.E-01->%TM_thickness ->mir,cry,mif,aos
275 ip.Tm_TM ->=2.00.E+01 ->%K ->%temperature ->cry,mir,mif
276 ip.emissivity_TM ->=8.00.E-02->%emmissivity_of_surface_of_TM ->cr
277 ip.specifichheat_TM ->=6.90.E-01->%J/K/kg-%specific_heat_of_TM ->cry,mi
278 ip.kappa_TM ->=1.57.E+04->%W/m/K-%thermal_conductivity_of_TM ->cry,mi
279 ip.ear_distance ->=2.46.E-01->%distance_of_flat_ear_surfaces ->mi
280 ip.loss_sleeks ->="=TBD">%scratches_and_sleeks_loss ->mir,mif,cry,ao
281 ip.loss_points ->=1.00.E-05->%point_defects_loss ->mir,mif,cry,aos
282 ip.surfacerms_center ->=3.00.E-10->%central_region_surface_rms ->mi
283 ip.surfacerms_outer ->=1.00.E-09->%outer_region_surface_rms ->mir,mi
284 ip.BRDF ->=1.40.E-05->%BRDF ->mir,mif,aos,cry
285 ip.surfacecenter ->=1.20.E-01->%border_of_central_region ->mir,mi
286 ip.flatness_AR_TM ->="=TBD">%AR_side_surface_flatness ->mir,mif,ao
287 ip.RoC_TM_fromAR ->="=TBD">%ROC_seen_from_AR_side ->mir,mif,aos
288 ip.birefringence ->="=TBD">%birefringence ->mir,mif,aos
289 ip.w_ETM ->=4.53.E-02->%beam_radius_on_ETM ->mif,mir,ioo,aos
290 ip.w_ITM ->=3.43.E-02->%beam_radius_on_ITM ->mif,mir,ioo,aos
```

- SVN "Show Log" command shows the updates in yellow
- Changes of the mirror diameter and temperature are shown above
- Email alert could be sent to a mailing list (to be discussed)

Updates since the last f2f meeting

- AOS, DAS, GIF have been included
- A physical constant list has been added
- Links to the layout and schedule information

Recent updates ('12 Dec~) and To-do list

- More information collected from sub-systems during the internal review
- Availability requirement to be listed
- Compatibility tests with simulation codes

Issues on ICD

Some people pointed out the following issues during the review.

“ICD is just a list of parameters and not enough to operate the detector 😞 ”

SEO's opinion

- That's absolutely right!
- However, the prompt update of ICD is very important, so a phonebook-like document is not suitable unless we had money to hire engineers for it.
- We've been trying to decrease burdens on sub-systems as much as possible.

Possible solutions/suggestions

- (1) Cross-cutting sub-systems (DGS and AEL) may have to provide detailed interface documents at last.
- (2) Closely connected subsystems are demanded to have more communications:
 - Optics groups: MIF-IOO-AOS (MIR, VIS, VAC)
 - Suspension groups: VIS-CRY
- (3) AEL and FCL activity should be restarted asap.
- (4) Subsystems that didn't finish the ICD at the review should do it by March [MIF, IOO, MIR, LAS, CRY]

End