Status report from digital system subgroup

2010/9/27(Mon) LCGT f2f meeting

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Schedule

Before LCGT budgeted

1. Development of prototype system at/using CLIO

After LCGT budgeted

2. Delivering digital systems to subgroups
3. Test bench of digital system for control and real time/offline data analysis using CLIO
3. Development of full digital system for initial LCGT
4. Extension of the digital system for basement LCGT

Delivering digital systems

- 5sets of digital system will be delivered to subgroups
  - Real time PC and software setup
  - Expansion chassis
  - Timing slave board
  - ADC, DAC, Binary Output
  - Interface board to ADC/DAC/BO
  - Anti Alias/Anti imaging
  - whitening/dewhitening
  - Variable gain amp

- Seismic attenuation group
  - 1set with 2ADCs, 2DACs
- Other group?
  - Input/output optics, Laser, Circuit, Vacuum

Schedule: Starts on now and delivers in the end of this FY

Budget: 36M yen for the 1st year

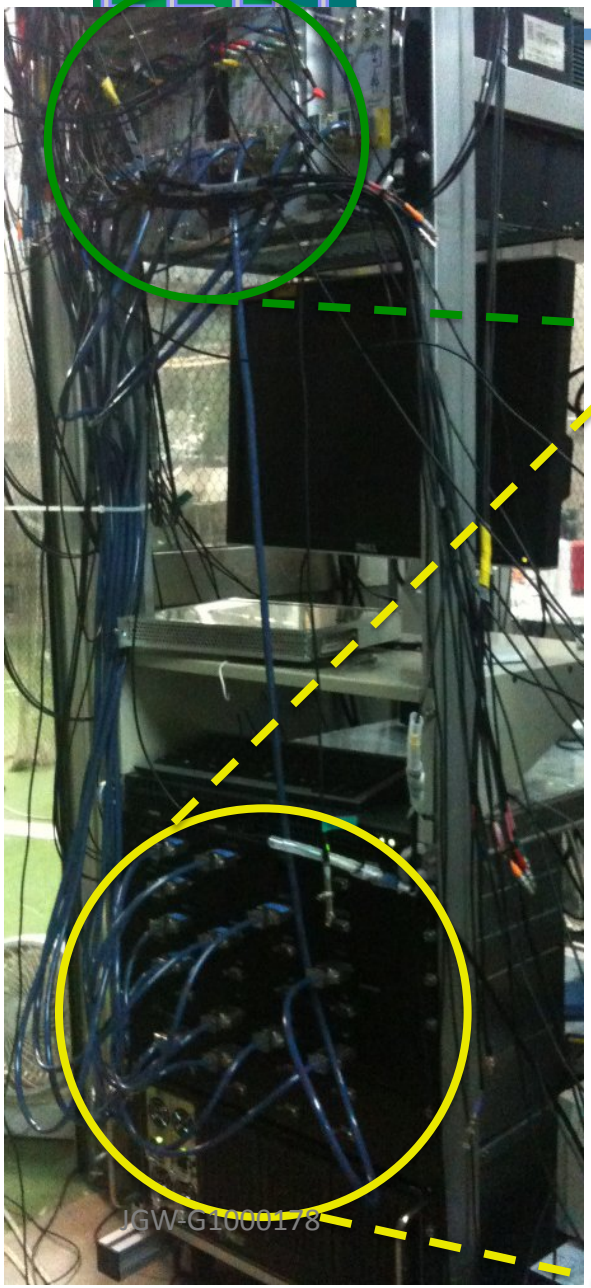
Signal interface matching

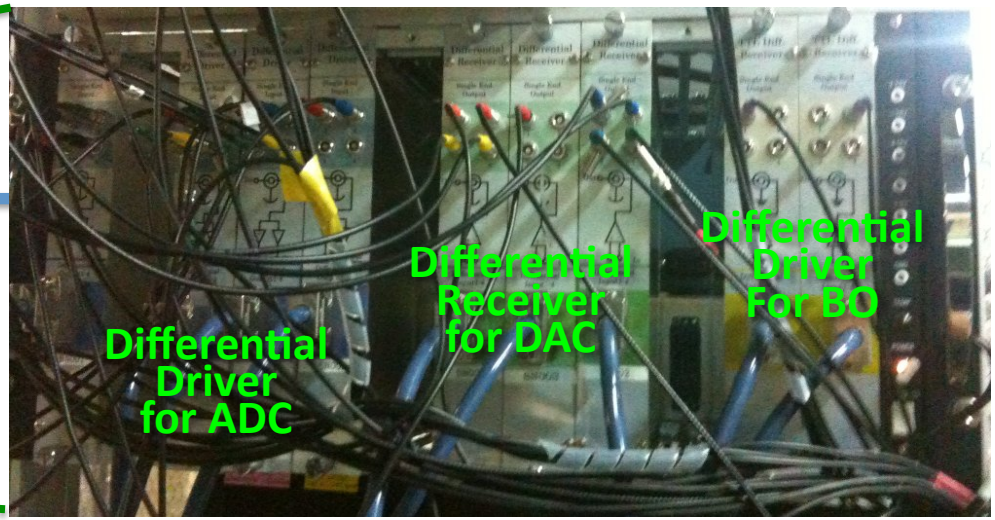
- ADC 32ch/card
  - D-sub 9pin(for 4ch, differential), +/-20V input
    - 16kHz sampling, may be decimated to 2kHz, 256Hz, 16Hz
  - or single end (not recommended, can be included your circuit; diagram provided)
- DAC 16ch/card
  - D-sub 9pin(for 4ch, differential), +/-10V output
  - or single end (not recommended, can be included your circuit; diagram provided)
- BO 32ch/card
  - D-sub 9pin(for 4ch, differential), 0 or +5V output
    - Ex. Variable gain amp for 16 steps/1 D-sub connector
  - or single end (not recommended, can be included your circuit; diagram provided)

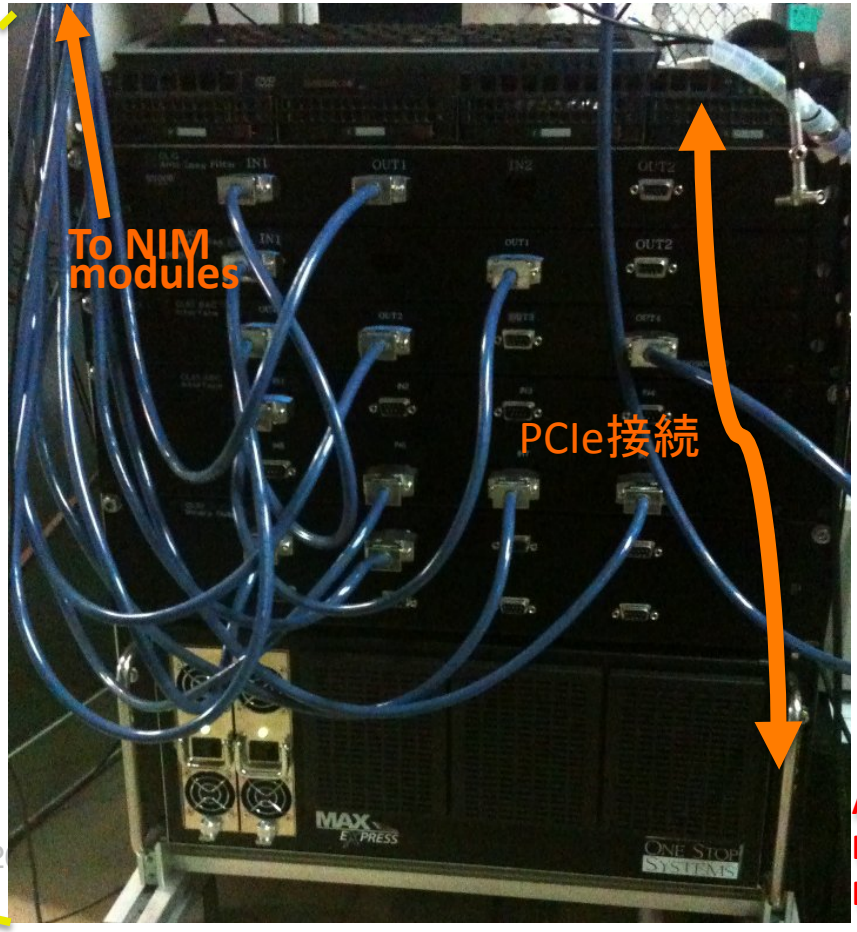
Reference:

http://gw.icrr.u-tokyo.ac.jp/JGWwiki/CLIO/Tasks/DigitalControl/pban_files

Pictures







Real time PC
CentOS 5.2+real time kernel
4core x 2 Xeon

Anti Imaging filters
Anti Alias filters

DAC adapter

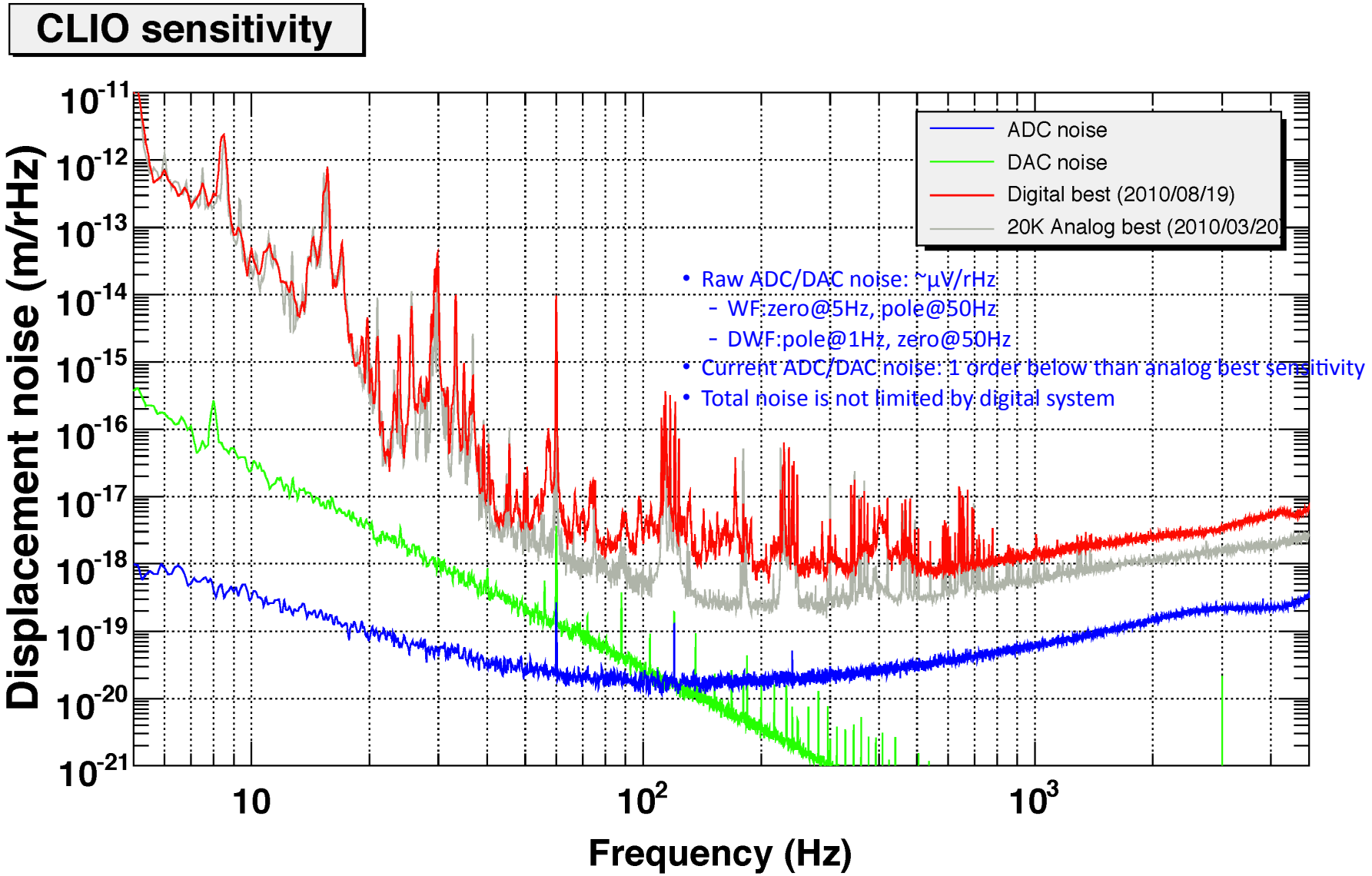
ADC adapter

Binary output adapter

ADC/DAC
In Expansion Chassis

ADC:32ch/枚、$4K
DAC:16ch/枚、$3.5K
Binary Output:32ch/枚、$250

CLIO sensitivity using Digital control



For real LCGT

- Test of multiple expansion chassis
- Test of multiple pc
- Timing system
  - Will be delivered by Columbia University
- Real time data analysis
- Observation test

  ↑---------- using CLIO ----------↑

  ↓---------- beyond CLIO ----------↓
- Data transfer to 3km end
  - using Reflective memory
- Huge number of channels (~1024ch)
- Data storage (3Peta Byte/10Year)
- RSE

Functions of digital system (from ICD)

1. Task area

No.	Function	Description, equipments
1	Digital control system	Main system. PC, ADC/DAC, AA/AI filter, whitening/dewhitening filter, real time OS, control software, monitor software, data storage.
2	Detector tuning system	Adjusts interferometer parameters. Tuning software.
3	Detector diagnosis system	Interferometer self diagnosis. Diagnosis software.
4	Long term monitor	Monitor software, data storage
5	Auto lock / auto alignment sequencer	Real time lock code (fast), auto lock and alignment scripts (slow).
6	Detector operation system for GW observation	Operators, operation scheduling, auto lock scripts.
7	GW search data calibration	Real time calibration shown in the control room. Projectors, calibration signals, real time calibration software
8	Real time data analysis	Real time data analysis shown in the control room. Projectors, real time data analysis software

Channel list

Number of channels	Data acquisition, Data analysis, IFO control	16kHz:64ch, 2kHz:256ch, 64Hz:512ch 16Hz:2048 epics channels (see channel list)	not yet
Data bit resolution	Data acquisition	24bit = 4 Byte integer	not yet
Data transfer rate	Data acquisition	4MB/sec for 16kHz, 2MB/sec for 2kHz, 128kB/sec for 64Hz 128kB/sec for 16Hz	not yet

All epics channels(~10000) are recorded by 16Hz.

6. Channel list

a. 16kHz (total 64ch)

Part	Channel point	Channel number	Description
Laser	Output laser power[W]	1	
	IFO Input laser power[W]	1	
MC	REFL	1	
	MC length feedback	1	
	MC frequency feedback	1	
LSC	I&Q dor DARM, CARM, MICH, PRC, SRC, etc.	10	
	error, feedback	10	
SUS	length * 10 suspensions	10	

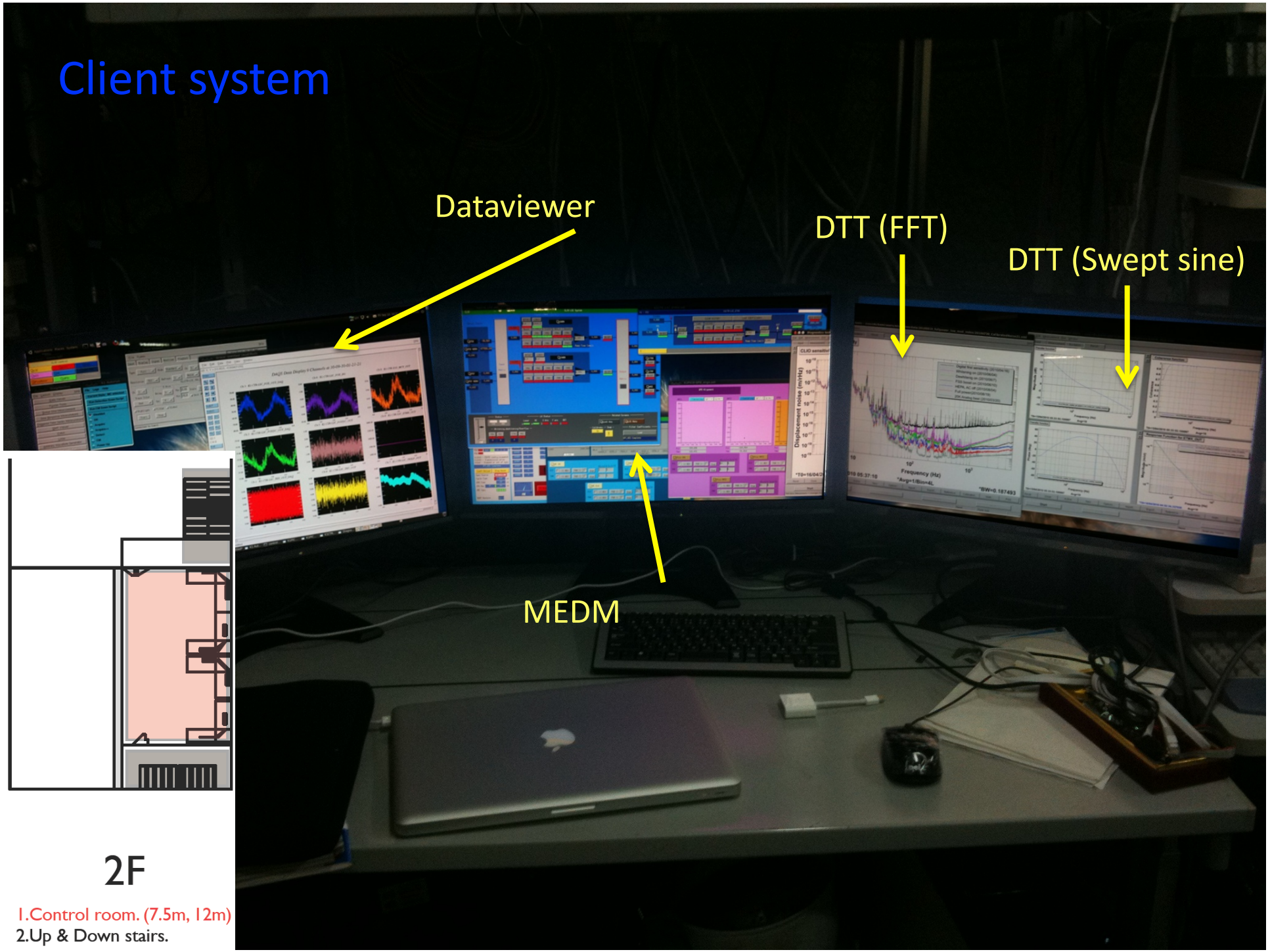
b. 2kHz (total 256ch)

Part	Channel point	Channel number	Description
ASC	WFS	5xpitch, yaw=50	
	Oplev	10xpitch,yaw=100	

c. 64Hz Long term monitor (total 512ch)

Part	Channel point	Channel number	Description
Temperature[deg]	room	10	center, end, arm
	table	10	laser, REFL, AS, pickoff, end
	suspensions	50	Low temperature
	mirrors	50	Low temperature
Humidity[%]	rooms	10	center, end, arm
Dust	rooms	10	center, end, arm
Laser	crystal temperature[degree] and etc.	10	
	Master laser power[W]	2	

Client system



2F

1.Control room. (7.5m, 12m)
2.Up & Down stairs.