Current status of Detector Characterization

Kazuhiro Hayama on behalf of the research team

1

Definition and scope

- Determine which data segment is available for science.

- Detector diagnostics. Killing noise sources. Improvement to instruments. The best way is to kill noise sources before LCGT observing.

- Construction of detchar system in a pre-process server.

- Evaluation/setting of EMs with GIF

- Veto list: number should be one-to-one correspondence

- Distribution of veto list to other collaborations.

- Influence of the accuracy of calibration on h-of-t reconstruction.

- The unique information of LCGT should be taken care with detchar and distributed so that other collaborators are not concerned about it to some extent.
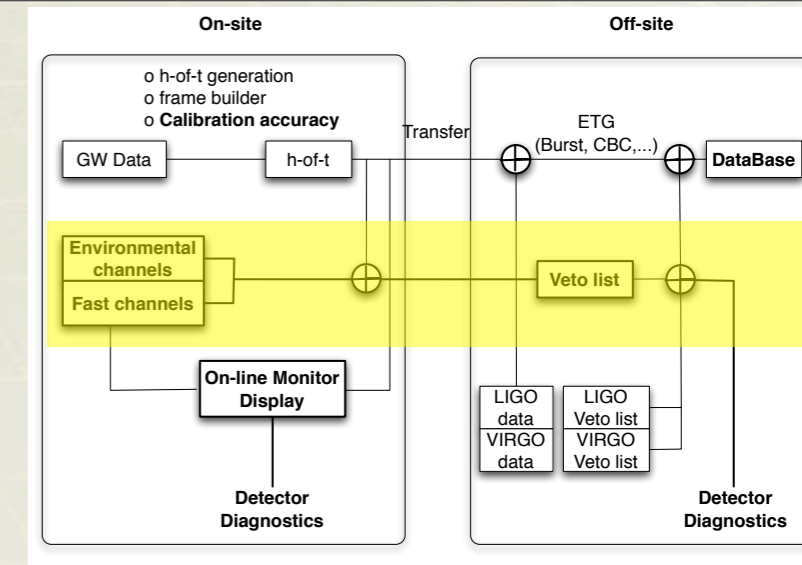
2012年2月1日水曜日

Diagram

On-site

o h-of-t generation
o frame builder
o **Calibration accuracy**

| GW Data | h-of-t |

Transfer

Environmental channels

Fast channels

On-line Monitor Display

Detector Diagnostics

Off-site

ETG
(Burst, CBC,...)

DataBase

Veto list

| LIGO data | LIGO Veto list |
| VIRGO data | VIRGO Veto list |

Detector Diagnostics

3

2012年2月1日水曜日
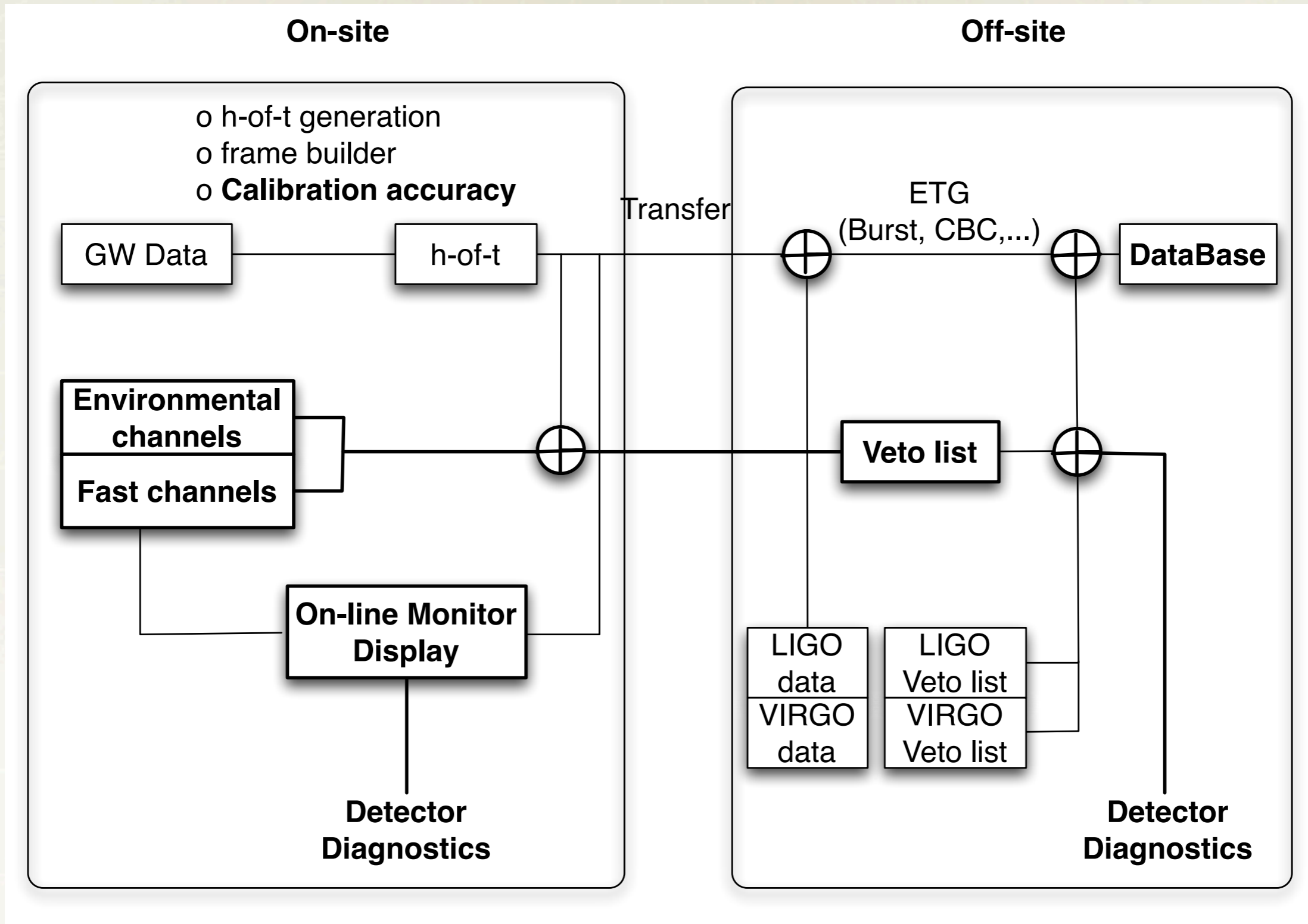
Environmental monitor sensors
Number, type will be decided in this year.
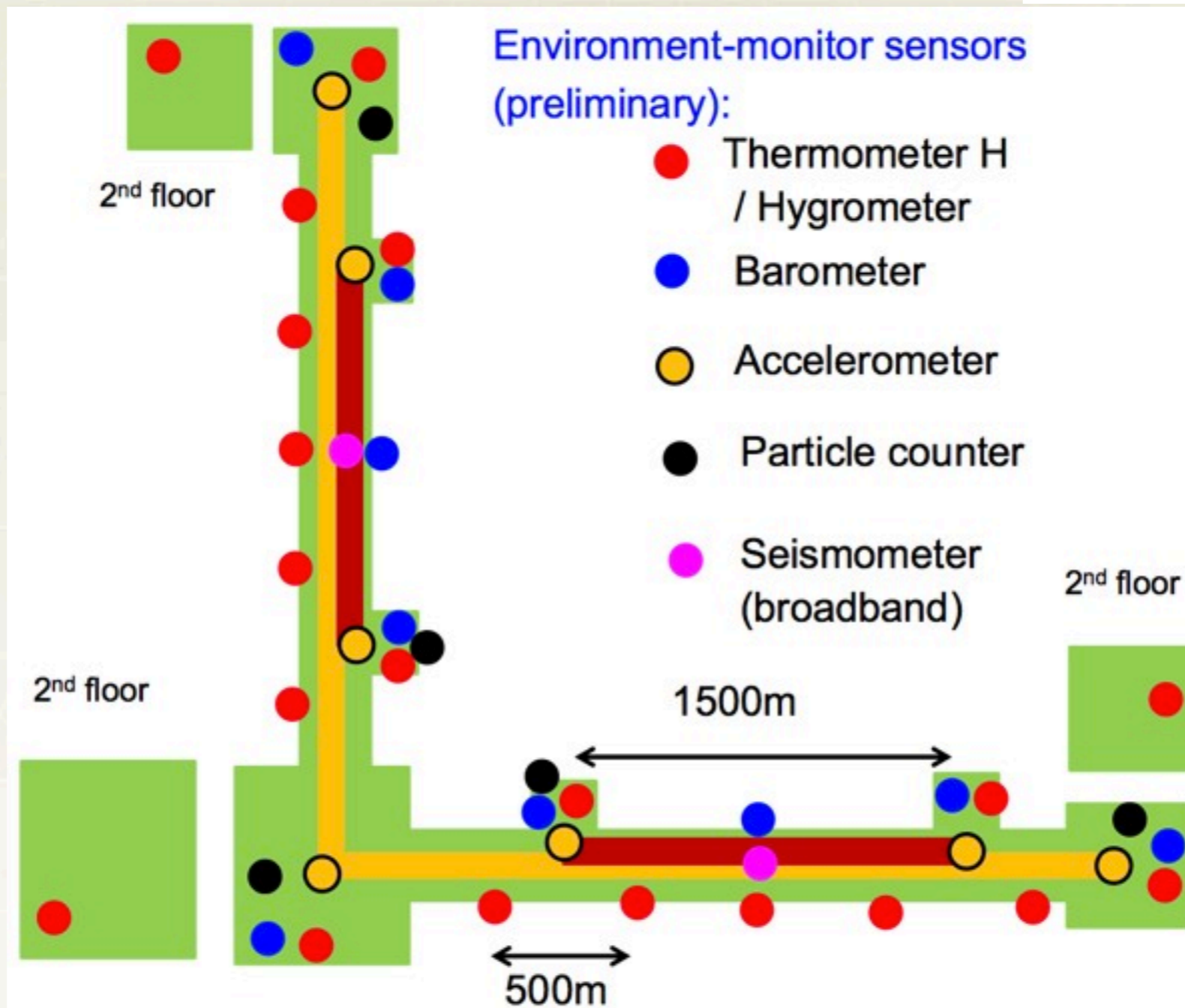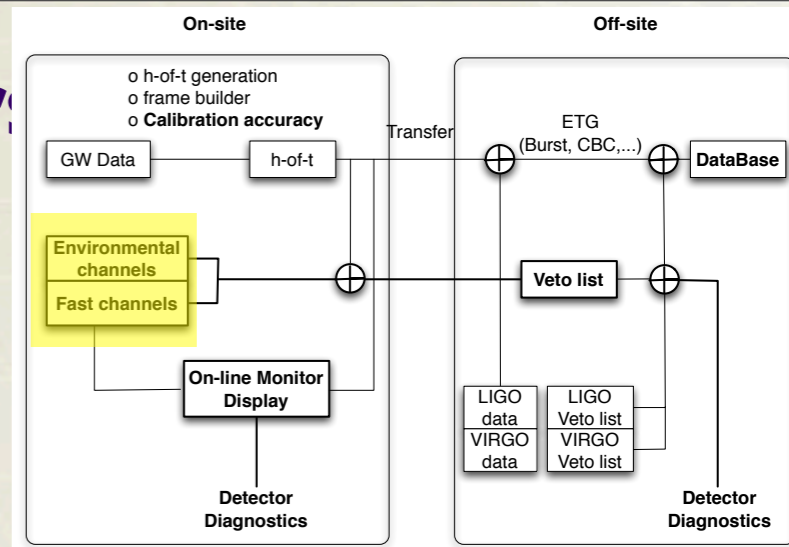
should add magnetometers to Ends, Center

Seismometera at Ends?

Environment-monitor sensors (preliminary):

- 🔴 Thermometer H / Hygrometer
- 🔵 Barometer
- 🟠 Accelerometer
- ⚫ Particle counter
- 🟣 Seismometer (broadband)

2nd floor

1500m

500m

4

Veto-list generation

🔴 **Data quality information**

- 🟢 **Real-time segment generation**
  Data quality information of science mode, lock, calibration,...
  soft : DMT(data monitoring tool)

- 🟢 **Segment database**

🔴 **Triggered event database**

🔴 **Real-time veto analysis**

- 🟢 **soft:** critical coupling likelihood method, bispectral analysis, hveto, ...

🔴 **Channel information system**

🔴 **Validation tools for segment**

🔴 **Daily Report tool**

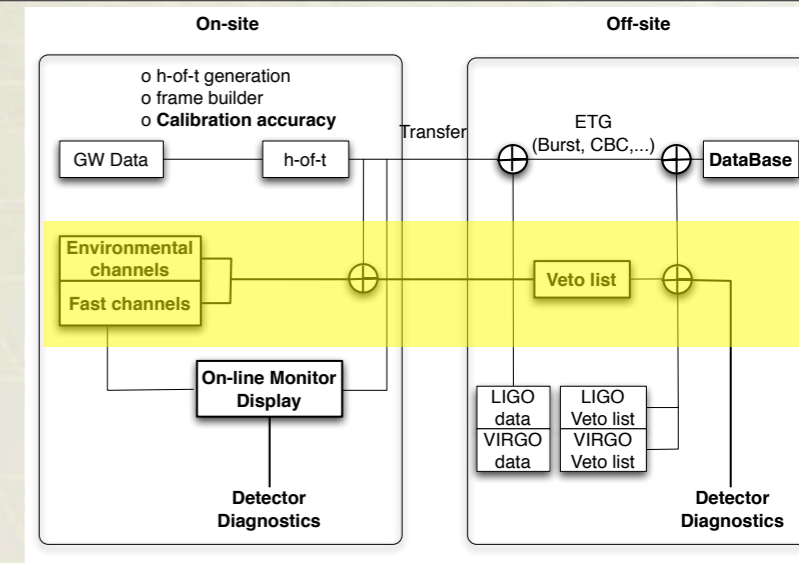# (cont'd) Veto-list : Target sources

Transient GW search (CBC, Burst)

- **Real-time glitch detection**
- **Glitch classification**
- **Coincidence analysis between the GW channel and auxiliary sensor channels.**
- **...**

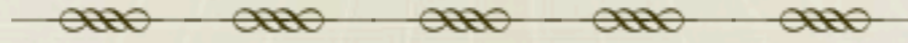## Continuous GW search (pulsar, LMXB)

- **Line tracking**
- **Line detection**
- **Removal of high frequency spikes**
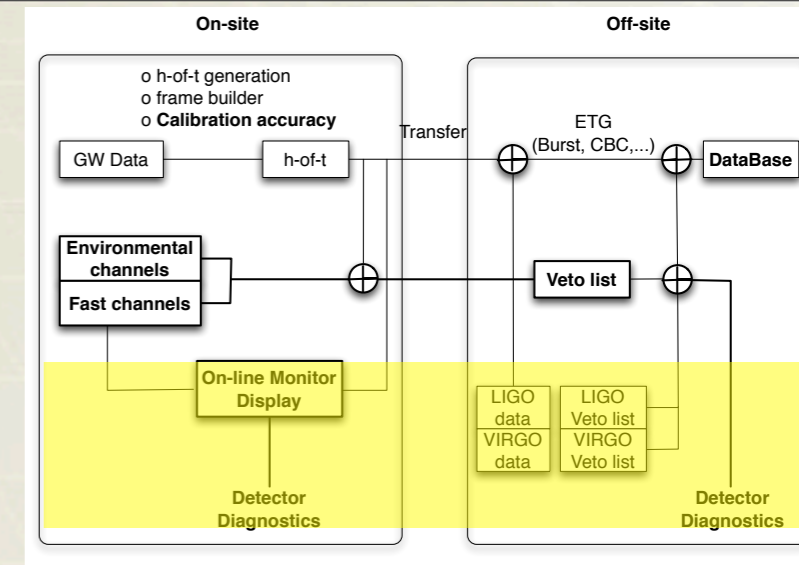- **...**

Stochastic GW search (Early univ, ...)

- **Noise Floor monitor**
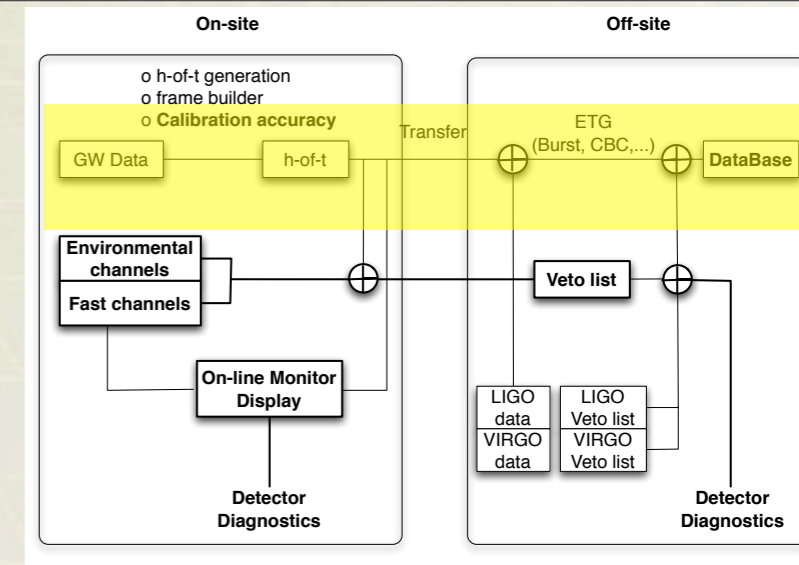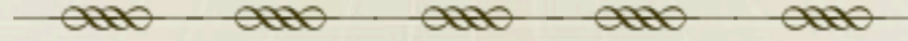
Detector diagnostics

Provide information of data quality, non-stationary components, monitoring tools.
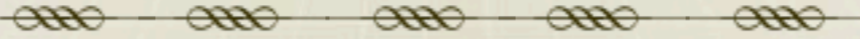
🔴 **Glitch detection pipeline**
soft : **Omega**

🔴 **Coincidence analysis between channels, channel and h-of-t,...**
Find correlation between channels,
soft : CCL, hveto, multivariate statistics,...

🔴 **Noise floor monitor tool**
soft : **noisefloormon**

🔴 **...**

Calibration accuracy

- 🔴 **Hardware injection test**
  soft :

- 🔴 **Waveform reconstruction**
  soft : cWB, Omega, RIDGE, ...

I. **Prototype test in CLIO**
   o **Installation test of base detchar system at NAOJ and soft development.**
   o **Operation test of base detchar system during CLIO operation.**
   o **Software development**

II. **Computation platform**
   o **2Q-4Q2014: Implementation of detchar system in a pre-process server.**
   o **1Q-3Q2015: Installation of the pre-process server to a building.**

III. **Test operation**
   o **Test operation of the detchar system when EM operation in GIF ~March in 2015.**
   o **Operation of the detchar system during GIF operation from ~ June, 2015.**
   o **Operation during iKAGRA in ~ Nov. 2015.**
   o **Software development**

IV. **Operation**
   o **Operation during bKAGRA from ~ Aug. 2018.**

Hayama(NAOJ), Miyakawa(ICRR), Yamamoto, Yuzurihara(OCU), Susa(Titech), Dan (UT)

- Simple standalone system (RT PC + ADC, Client WS, router) has been delivered to NAOJ on 12/6/2011.
- 3days work for installation, lecture and training
- Online analysis software will be developed by DAS group.

Diagnosis on Mac through wireless LAN

RT PC + ADC

Client WS

37

10

Software development
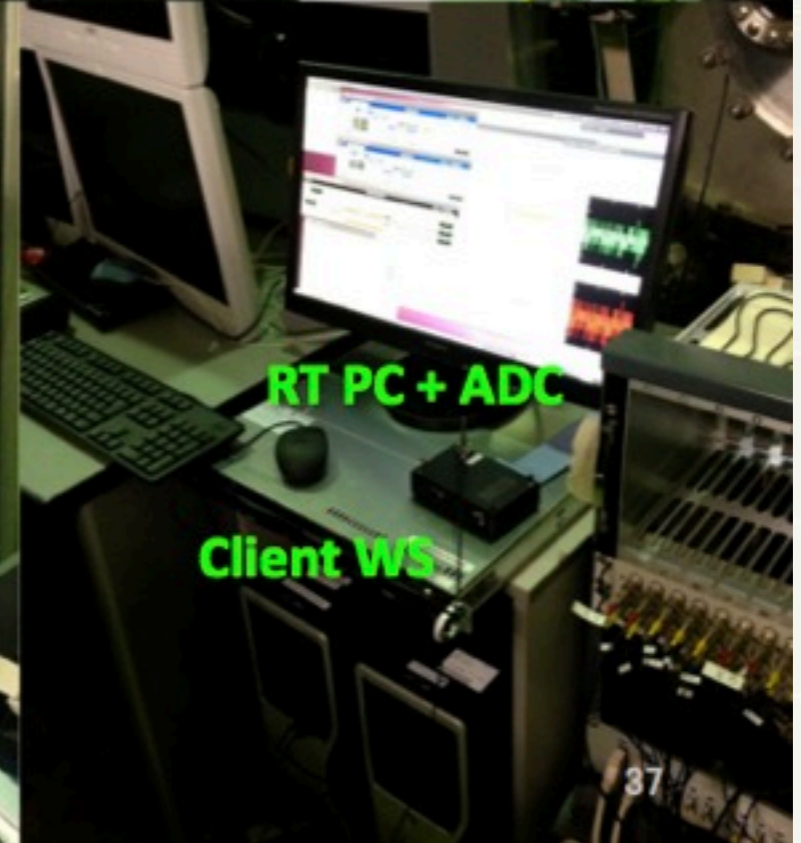
- 🔴 **Import of LVC software**
  - 🟢 **Data quality monitor**
  - 🟢 **Glitch detection pipeline**
  - 🟢 **Coincidence analysis pipeline**

- 🔴 **New software requirement / sophistication**
  - 🟢 **Glitch classification**
  - 🟢 **Noise modeling (glitch and power spectrum)**
  - 🟢 **Tools to know when and how glitches shows up?**

Application of ANNs to Glitch Identification Study using Auxiliary Channels

John J. Oh[1], Sang Hoon Oh[1], Young-Min Kim[1,2],

Chang-Hwan Lee[2], Ruslan Vaulin[3], Lindy Blackburn[4]

[1] National Institute for Mathematical Sciences [2] Pusan National Univeristy
[3] MIT [4] Goddard Space Flight Center, NASA

Goals: Applying artificial neural networks (ANNs) to auxiliary channel information,

✦ Provide a highly efficient and reliable noise transient (glitch) identification tool

✦ Develop a method to trace down the culprit channel(s) causing noise transient in strain data

✦ Potentially establish a new ranking statistic useful for CBC search

12

2012年2月1日水曜日