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# Current status of Detector Characterization

Kazuhiro Hayama on behalf of the research team

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# Definition and scope

NAOJ

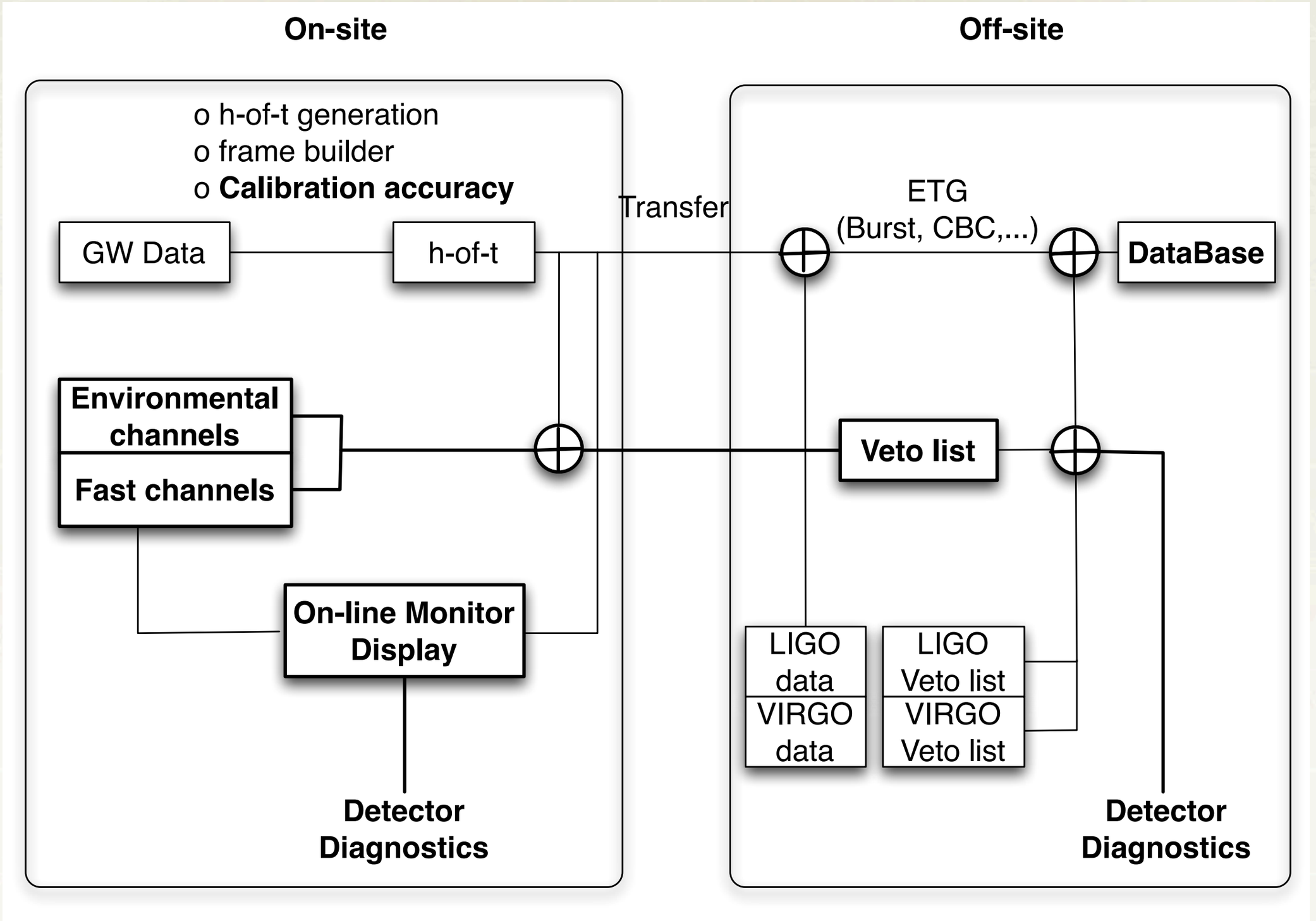
- Determine which data segment is available for science.
- Detector diagnostics: finding non-stationary components in channels. The best way is to kill noise sources before LCGT observing.

- Construction of detchar system in a pre-process server.
- Evaluation/setting of EMs with GIF
- Veto list
- 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.

# Diagram




On-site
Off-site
o h-of-t generation
o frame builder
o Calibration accuracy
Transfer
ETG
(Burst, CBC,...)
GW Data
h-of-t
DataBase
Environmental channels
Fast channels
Veto list
On-line Monitor Display
LIGO data
VIRGO data
LIGO Veto list
VIRGO Veto list
Detector Diagnostics
Detector Diagnostics

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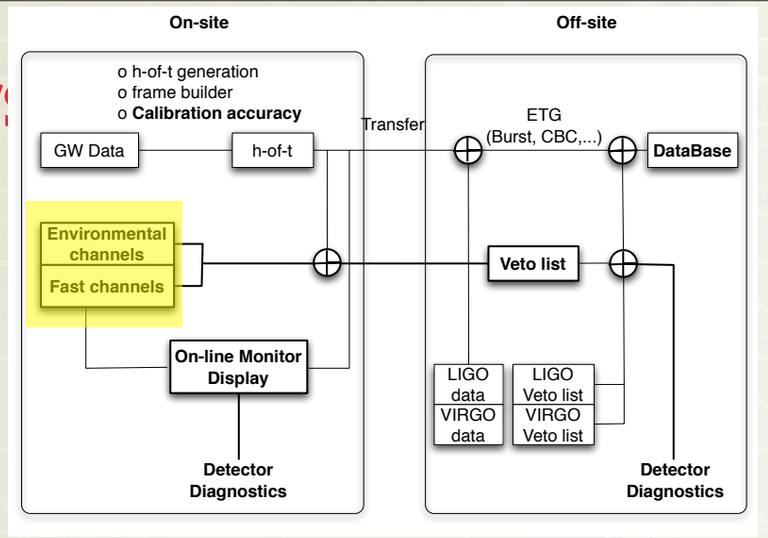
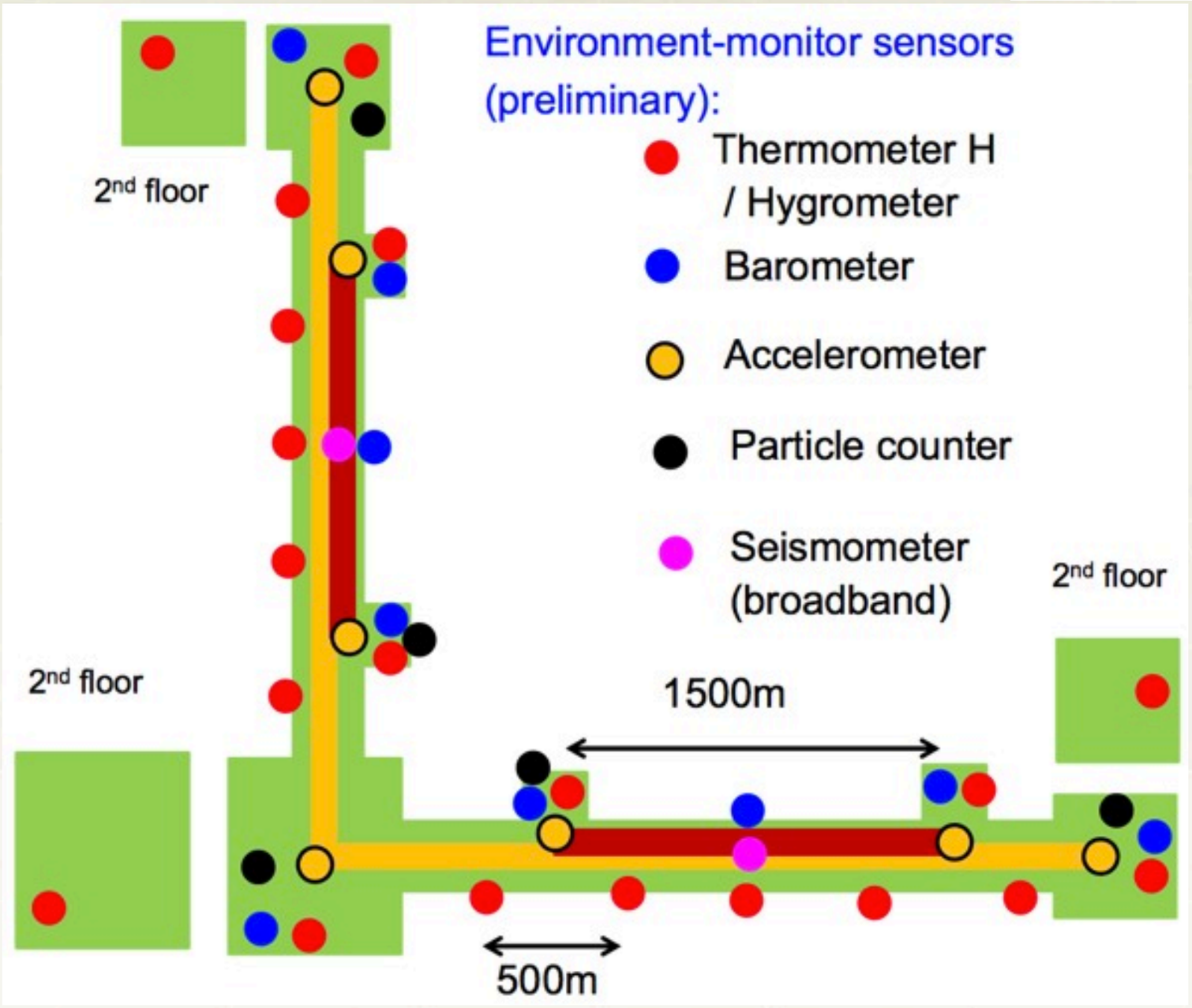
# Environmental monitors




- **Environmental monitor sensors**
  **Number, type will be decided in this year.**

should add magnetometers to Ends, Center

Seismometers at Ends?



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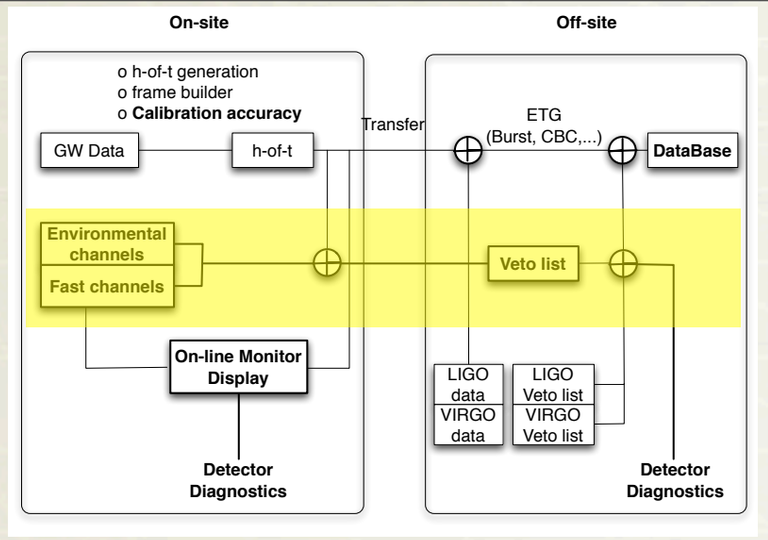
# Veto-list generation




- **Data quality information**
  - **Real-time segment generation**
    **Data quality information of science mode, lock, calibration,...**
    **Segment database**
- **Triggered event database**
- **Real-time veto analysis**
- **Channel information system**
- **Validation tools for segment**
- **Daily Report tool**

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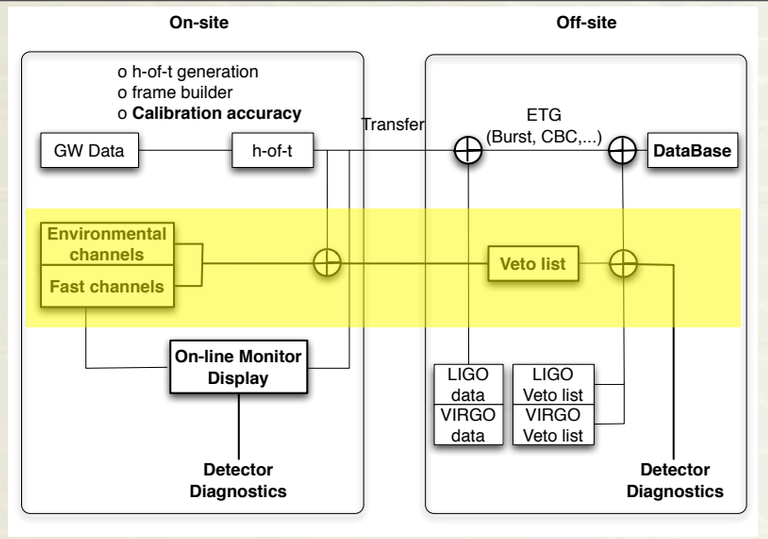
# (cont'd) Veto-list : Target sources




## 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
-

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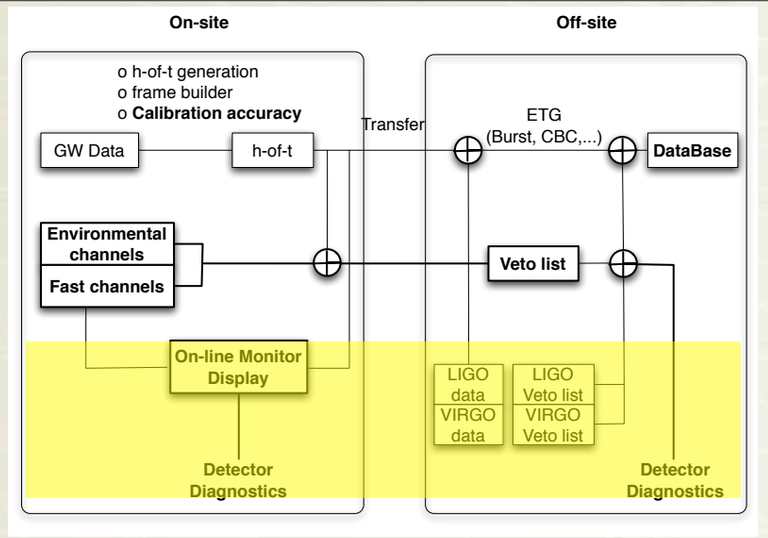
# Detector diagnostics




**Provide information of data quality, non-stationary components, monitoring tools.**

- **Glitch detection pipeline**
- **Coincidence analysis between channels, channel and h-of-t,... Find correlation between channels,**
- **Noise floor monitor tool**
- **...**

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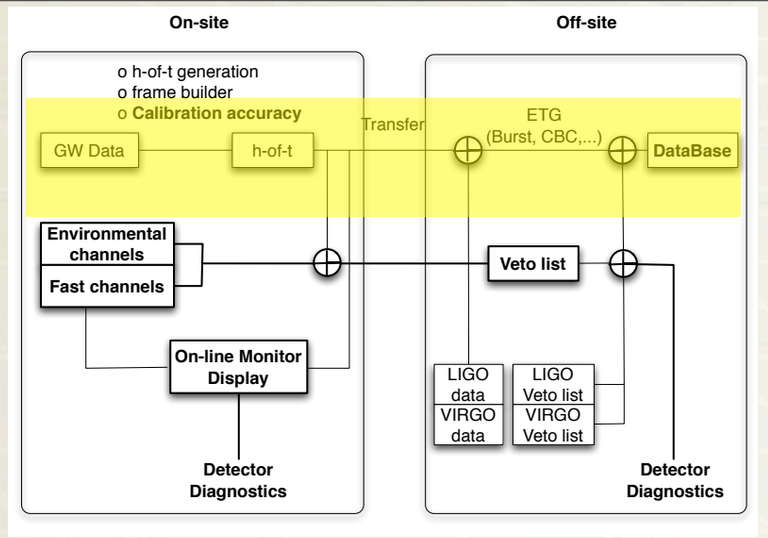
# Calibration accuracy




- **Hardware injection test**
- **Waveform reconstruction**

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# Schedule

NAOJ

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.

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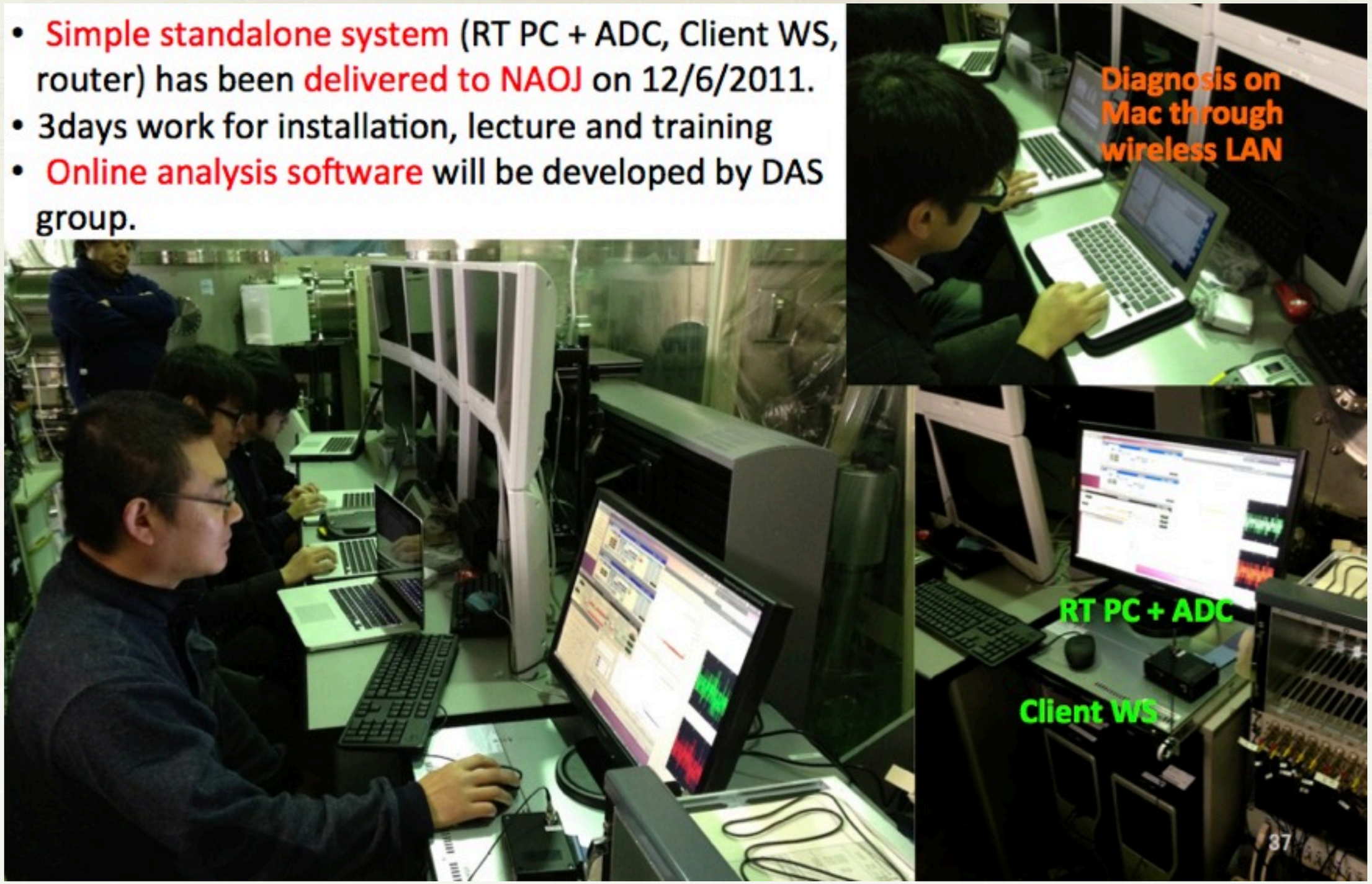
# Digital system at NAOJ

NAOJ

**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.



# Software development



- **Import of LVC software**
  - **Data quality monitor**
  - **Glitch detection pipeline**
  - **Coincidence analysis pipeline**
- **New software requirement / sophistication**
  - **Glitch classification**
  - **Noise modeling (power spectrum and, probably, glitch)**
  - **Tools to know when and how glitches shows up?**

# Activities of KGWG



## 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], Edwin J. Son[3], Ruslan Vaulin[4] , Lindy Blackburn[5]

[1] National Institute for Mathematical Sciences [2] Pusan National University
[3] Sogang University [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

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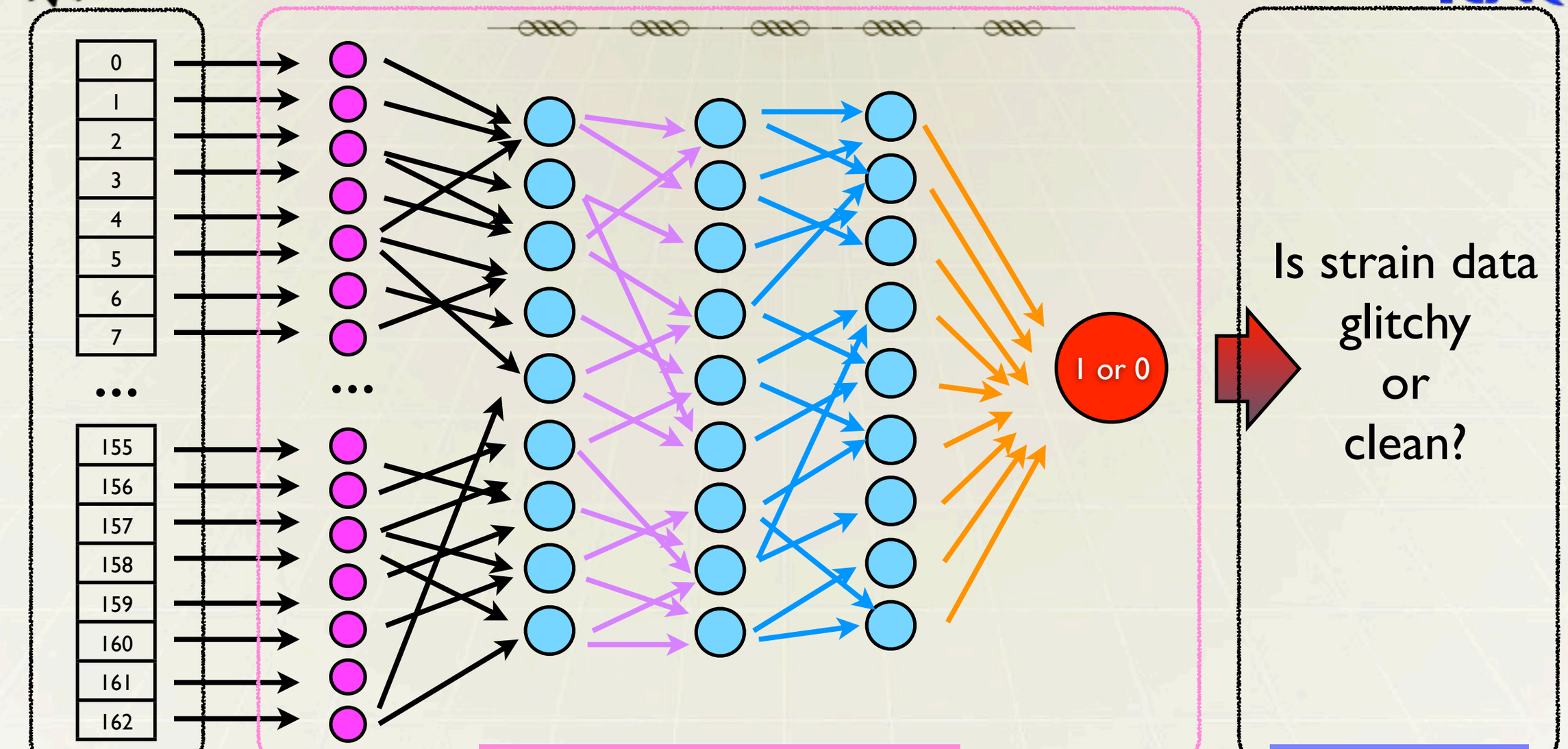
NAOJ

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Optimal input parameters of ANNs

Genetic Algorithm

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# (cont'd) Schedule

NAOJ

| | Name |
|---|---|
| 1 | ⊟**Prototype test in CLIO** |
| 2 | software check in NAOJ |
| 3 | install software in CLIO |
| 4 | CLIO operation |
| | |
| 5 | (w GIF) EM sensor determination |
| | |
| 6 | Software development |
| | |
| 7 | (w GIF) EM sensor delivery |
| | |
| 8 | ⊟**Computing platform** |
| 9 | Computing-platform implementation |
| | |
| 10 | Computing-platform installation |
| | |
| 11 | ⊟**Test operation** |
| 12 | (w GIF) EM-DAQ operation |
| | |
| 13 | (w GIF) detchar test operation |
| | |
| 14 | (w GIF) detchar operation & update |
| | |
| 15 | iLCGT detchar operation |
| | |
| 16 | bLCGT detchar operation |
| | |