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Current status of Detector Characterization for KAGRA

Kazuhiro Hayama on behalf of the research team

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Definition and scope

- 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 KAGRA observing.
- Distribution of Veto information

- 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 KAGRA should be taken care with detchar and distributed so that other collaborators are not concerned about it to some extent.

Relation to neighbors

Data Analysis

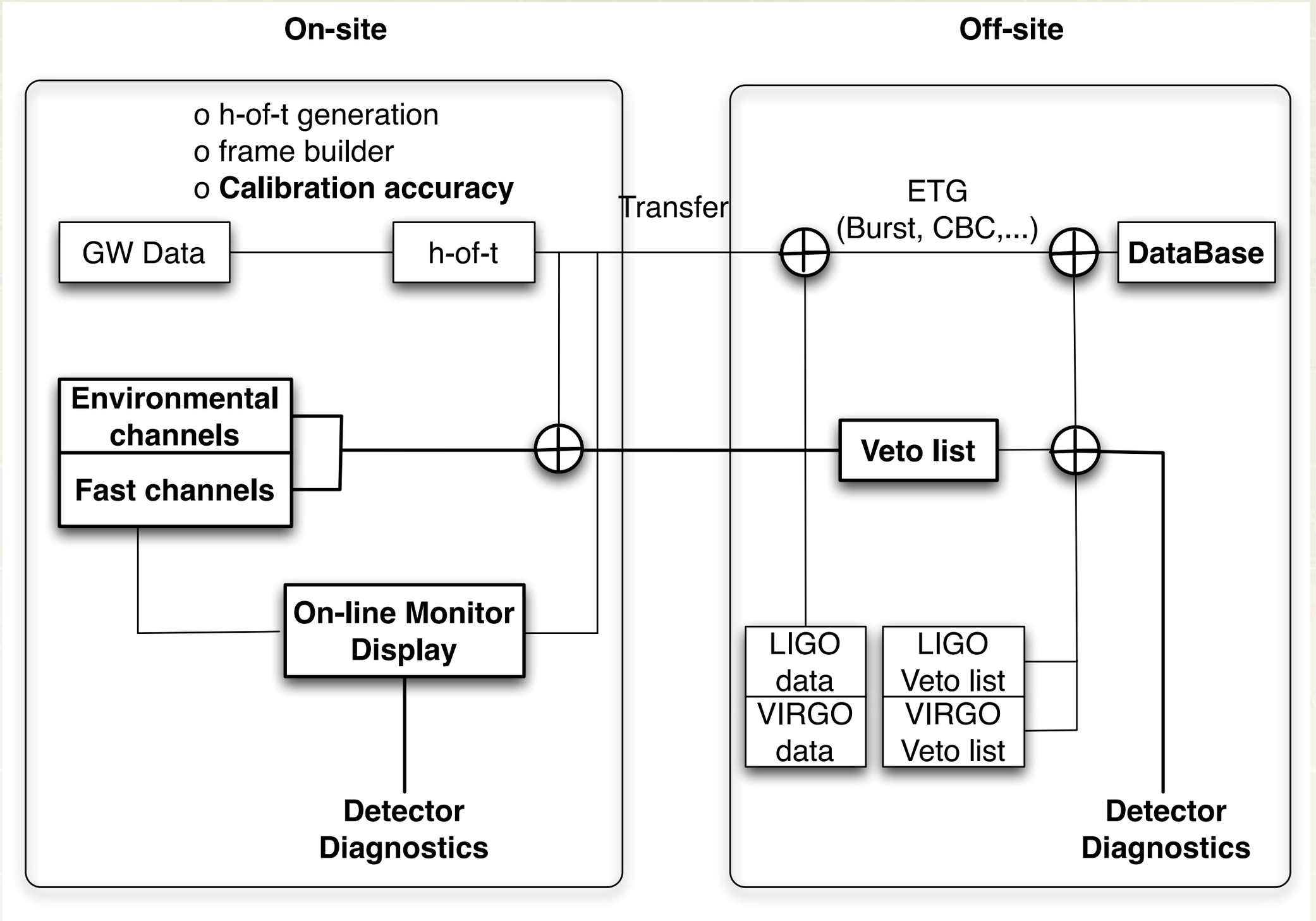
Veto info., target veto , Data quality, calibration accu.

Detector Characterization

PEM, Aux. channels, Online-monitors, diagnostics

Instruments

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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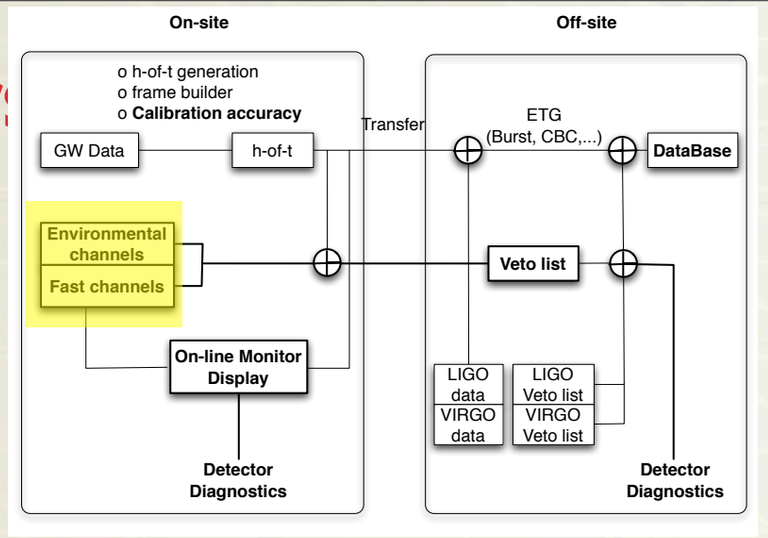
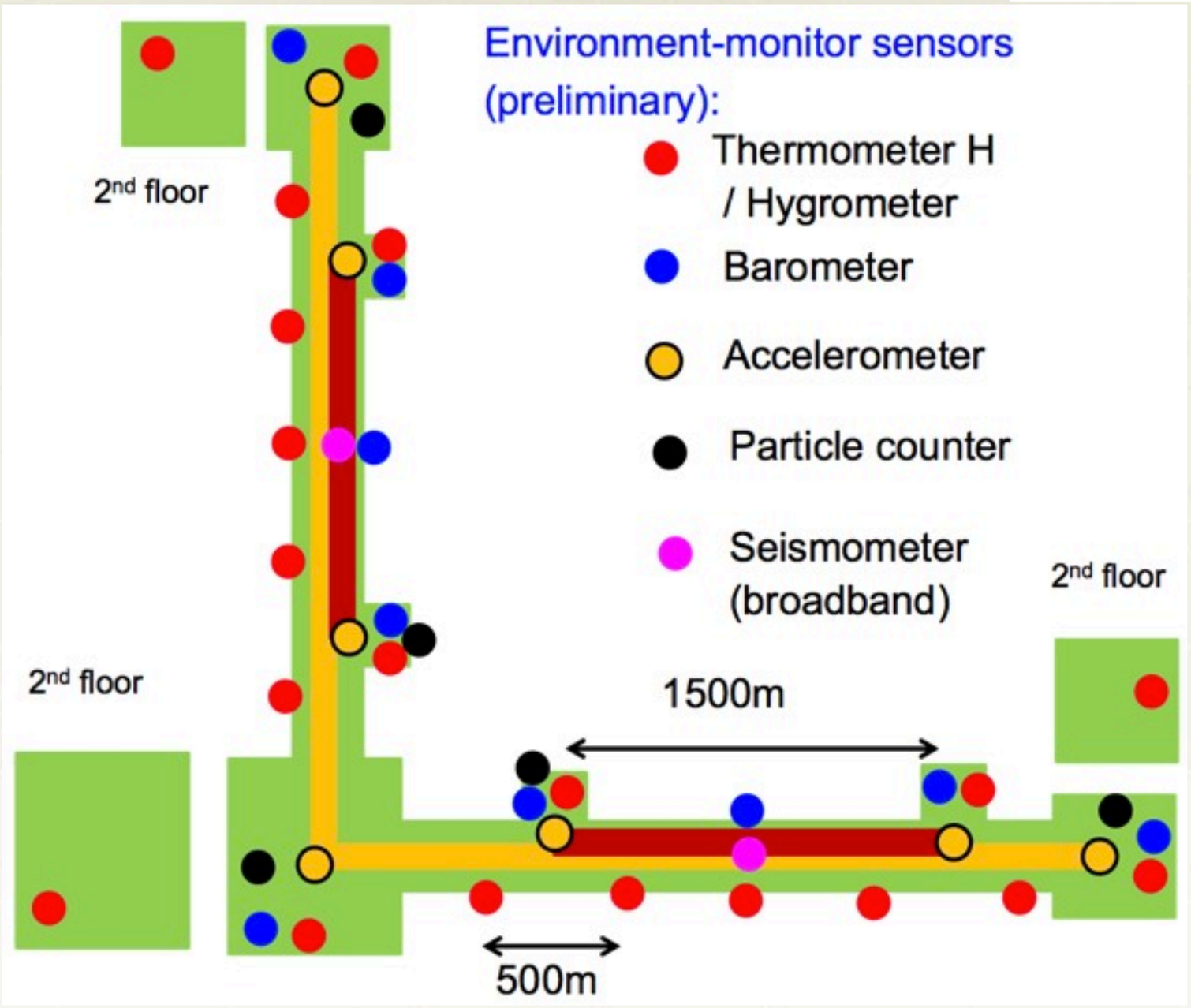
Environmental monitors



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

should add magnetometers to Ends, Center

Seismometers at Ends?



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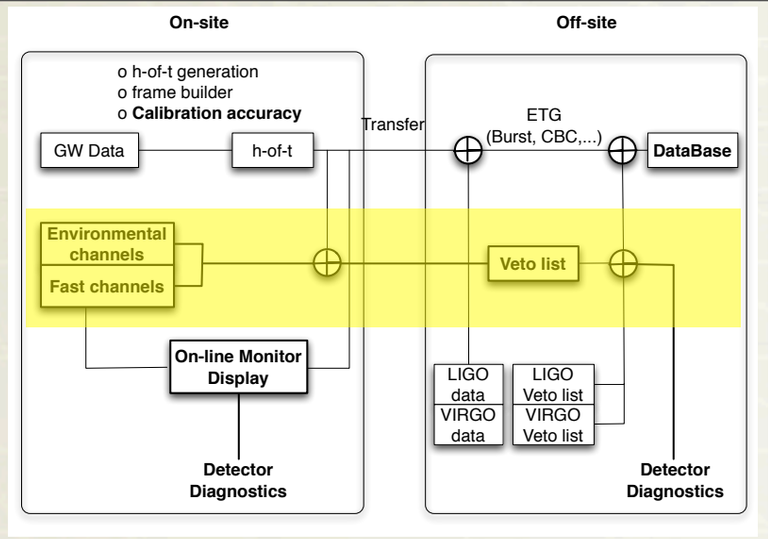
Veto-list generation



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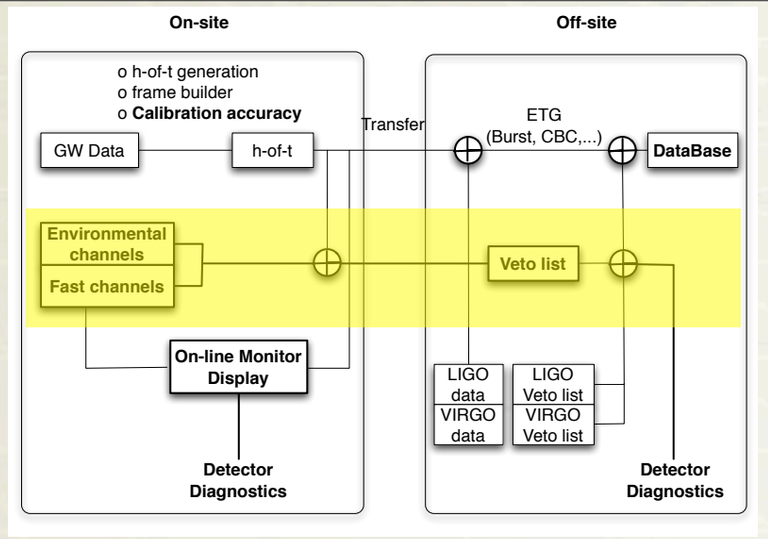
(cont'd) Veto-list : Target sources



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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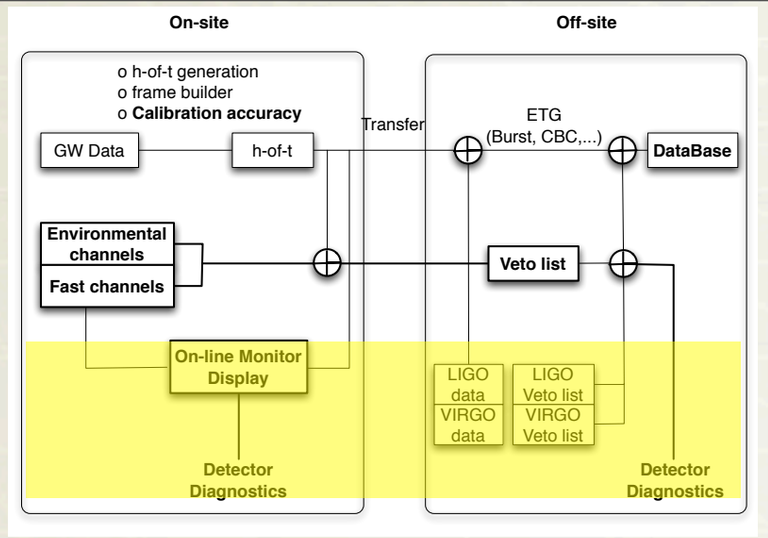
Detector diagnostics



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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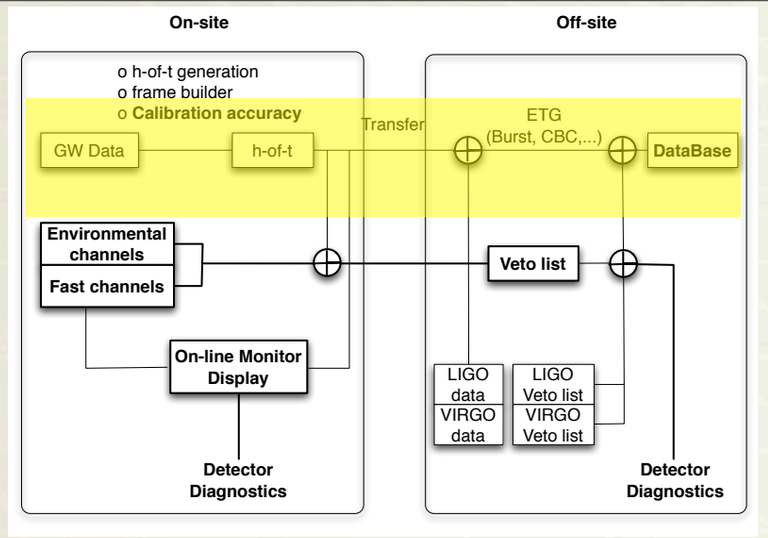
Calibration accuracy



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

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Schedule

NAOJ

I. **Prototype test in CLIO**
   - o Installation test of basic detchar system at NAOJ and soft development.
   - o Test operation of basic 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.

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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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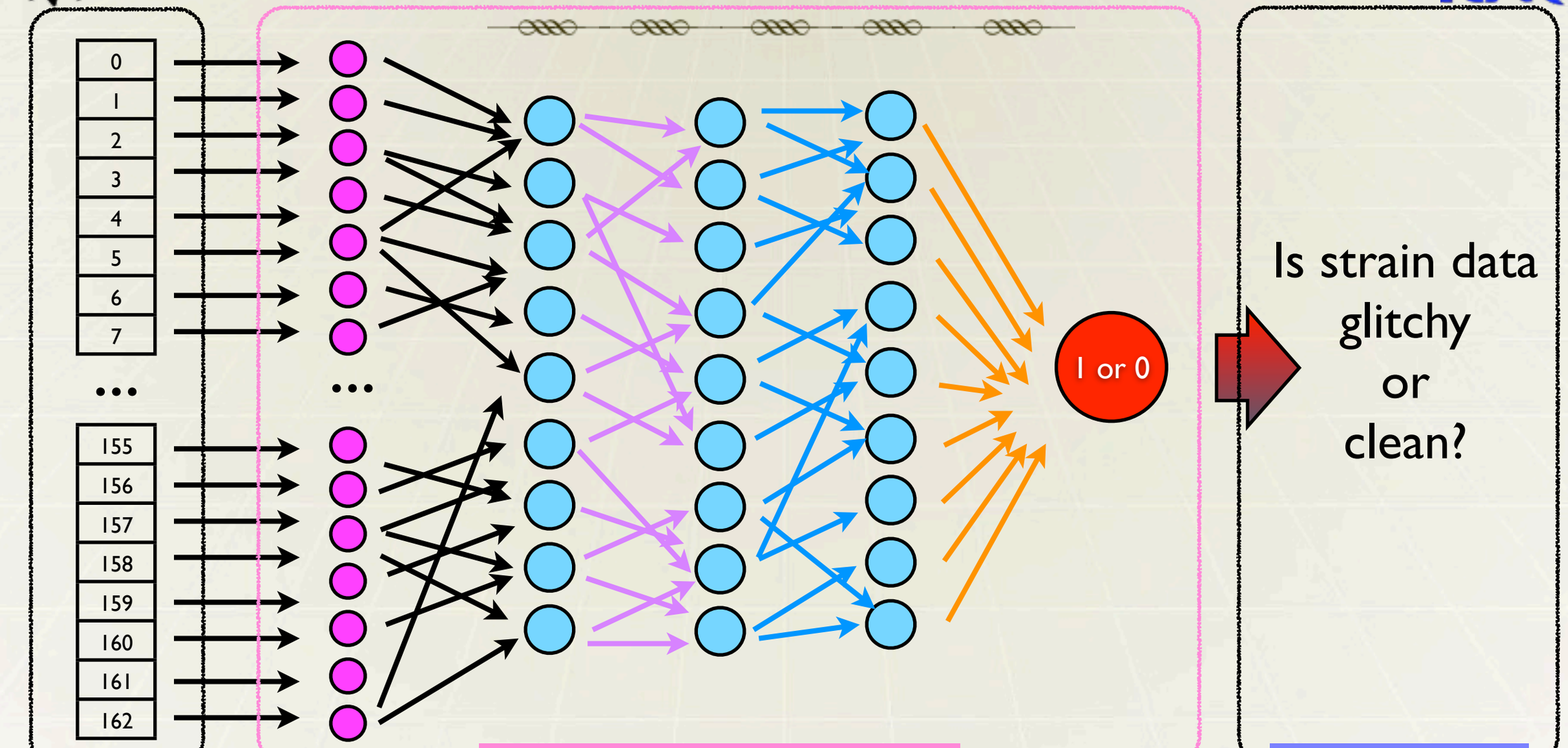
NAOJ



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Optimal input parameters of ANNs

Genetic Algorithm

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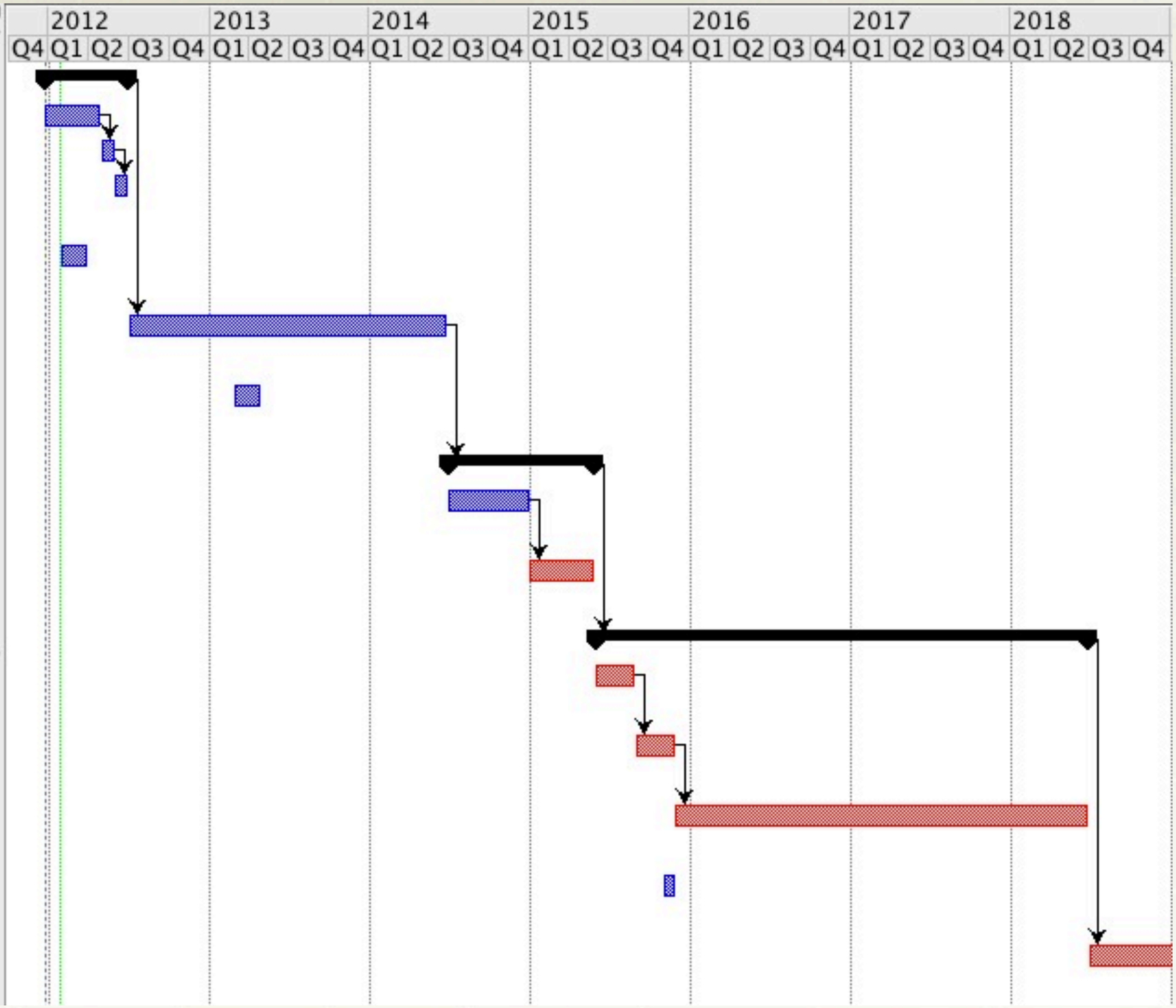
(cont'd) Schedule

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



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We are working on

NAOJ

- **Implementing detchar system into digital system at NAOJ.**
- **Testing the system and developing detchar software.**
- **Developing online-analysis software.**
- **...**
- **Will make your account to the detchar workstation if you like!**