Report on KAGRA detector characterization

Detector characterization group

Detector Characterization

- Evaluation of data quality
  - Determine which data segment is available for science.
- Support diagnostics: --> help to shorten commissioning period
  finding non-stationary components, change in channels.
  It will help to kill noise sources before KAGRA observing.
- Distribution of Veto information

- Construction of detchar system in a pre-process server.
- Evaluation/setting of PEMs with GIF
- 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 within detchar so that other collaborators are not concerned about it to some extent.

Interfaces

KAGRA GW telescope

PEM, Aux. channels, Online-monitors, diagnostics

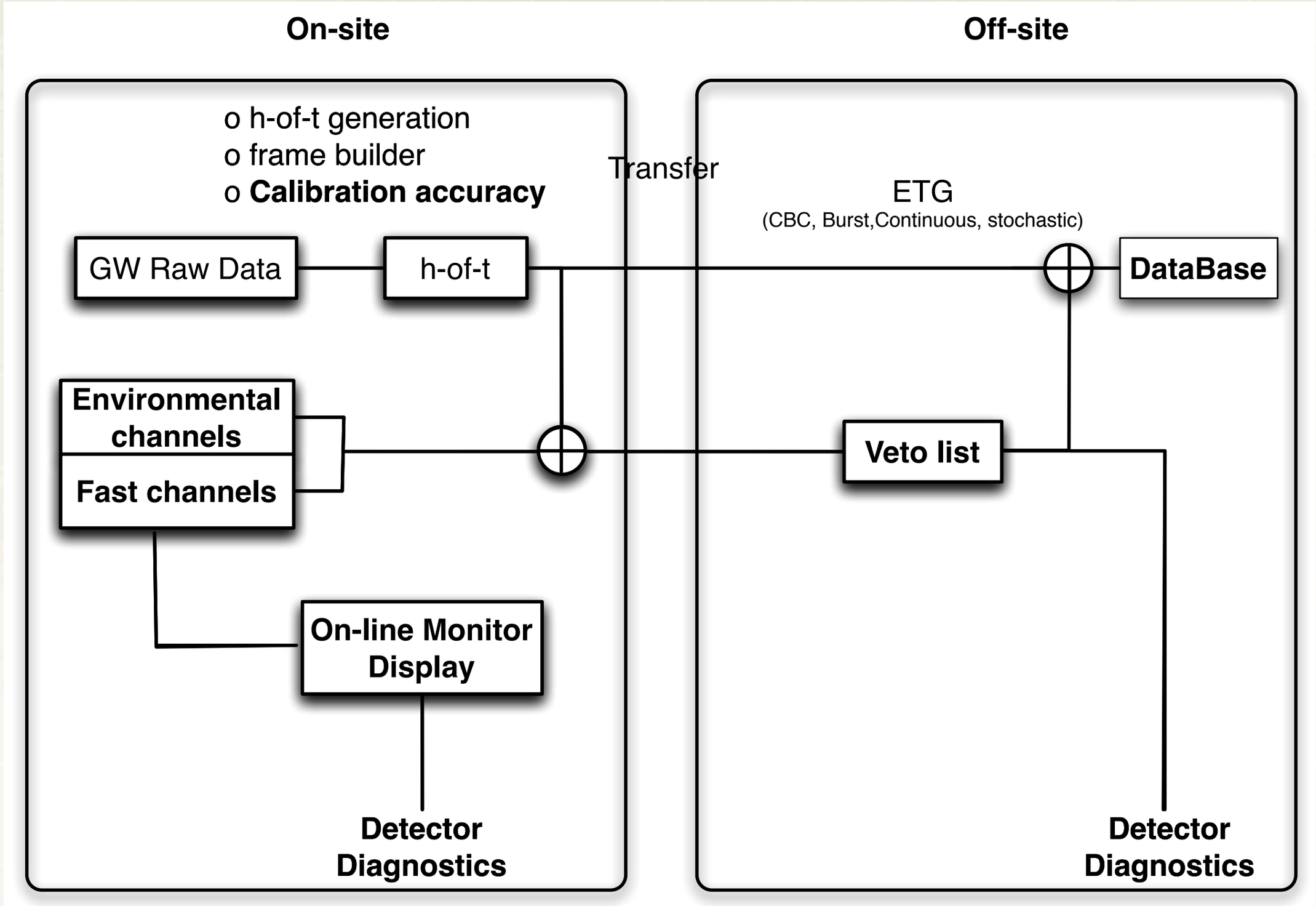
Detector Characterization

Veto info, target veto, Data quality, calibration accuracy

Data Analysis

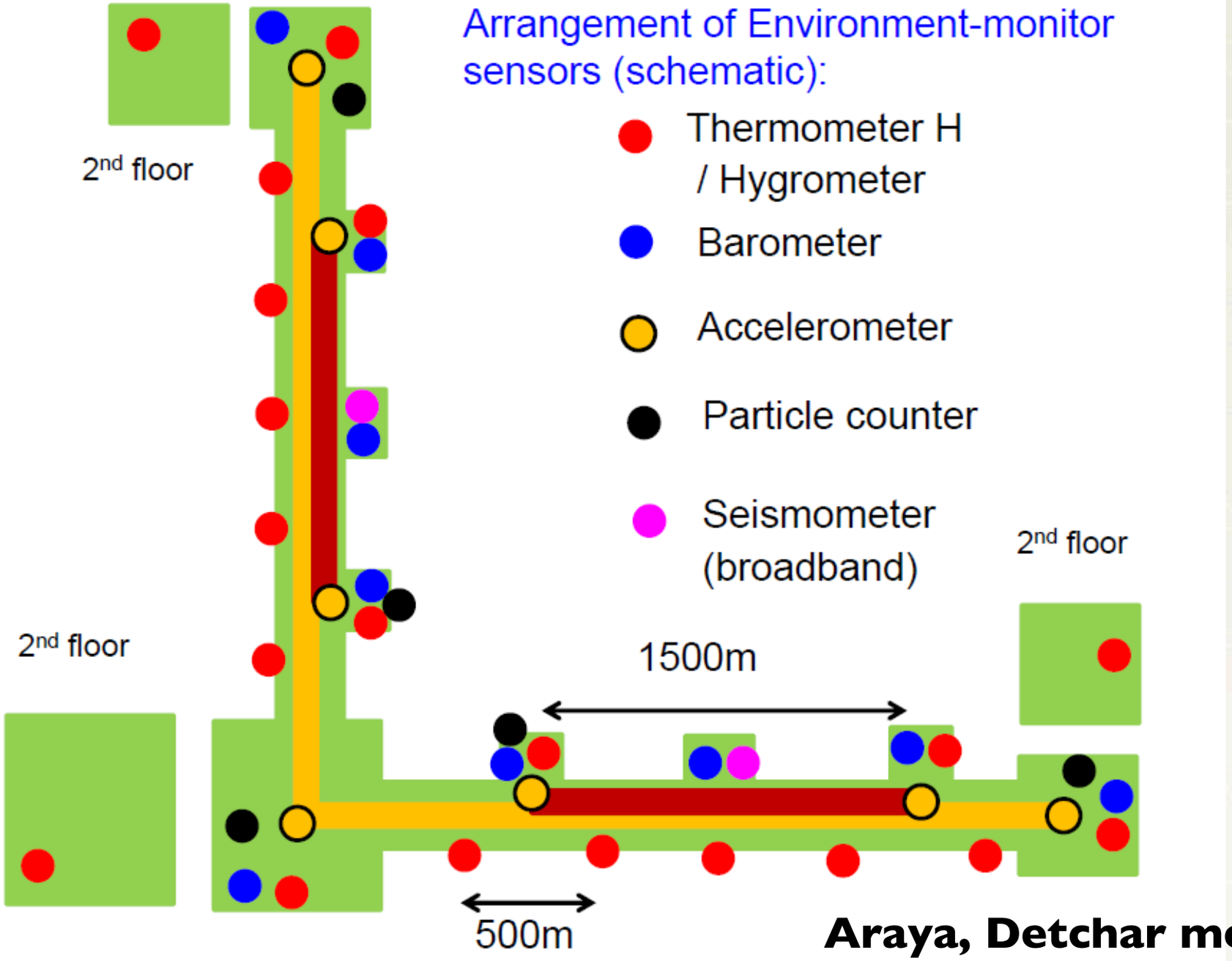
- **Channels: Interfaced with many subsystems**

Flow Chart


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

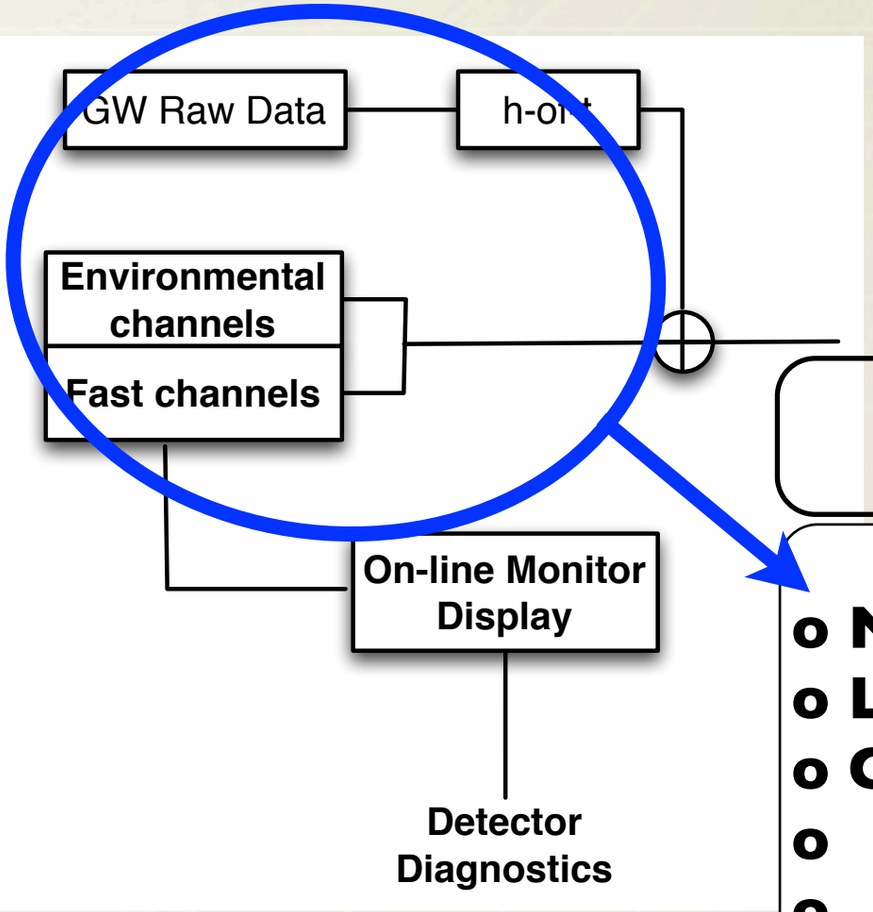
Physics and Environmental Monitors

Selecting Physics and Environmental Monitor (PEM) (GIF)



Araya, Detchar meeting in May 2012

Detchar Base System

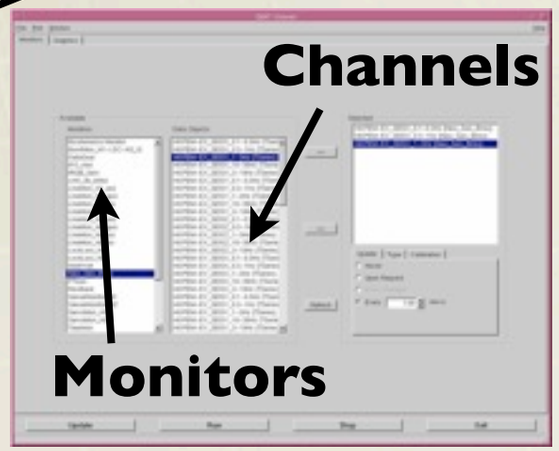


Announce its running

Server

Monitors

- o NoiseFloorMon
- o LineMon
- o GlitchMon
- o
- o
- .....



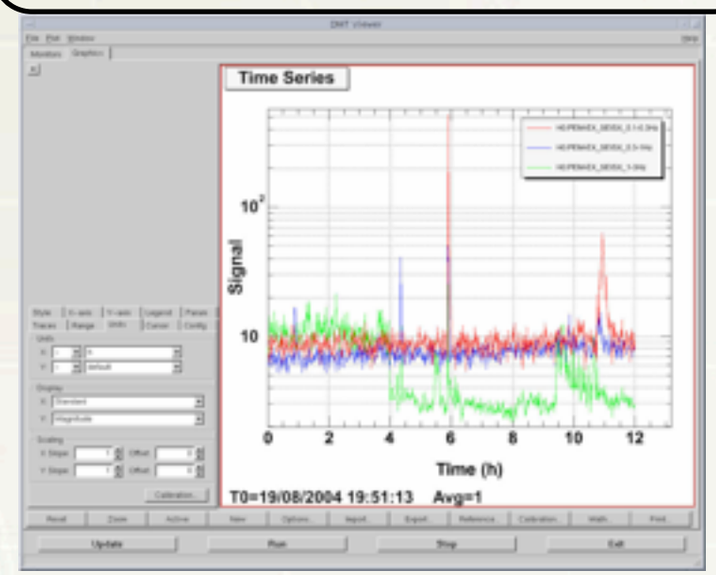
Monitors ?
Channels ?

Monitors
Channels
Available

Request Data

Data

Viewer

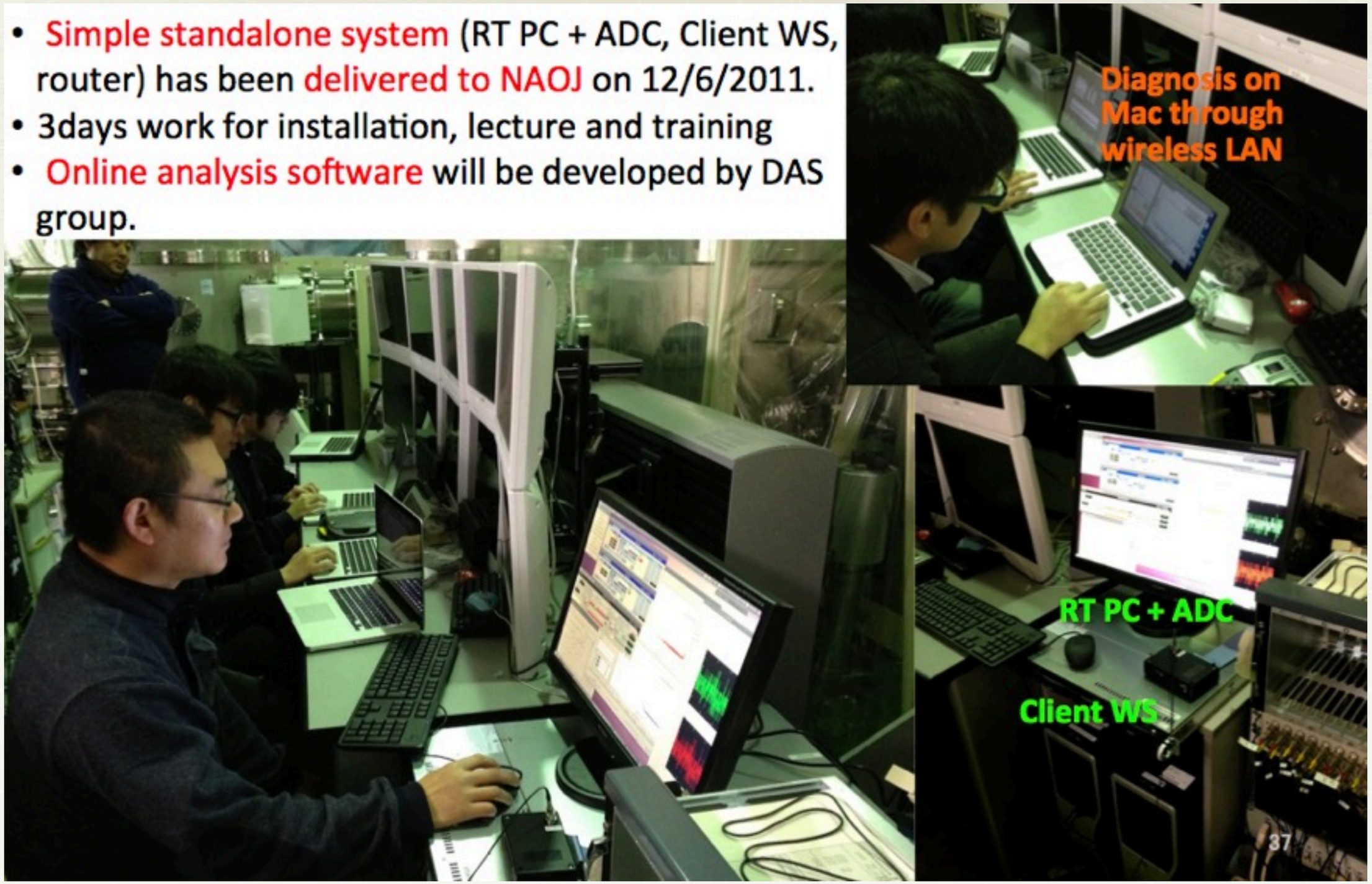


- **Determine which data segment is available for science.**
-

Developing the system on digital at NAOJ

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

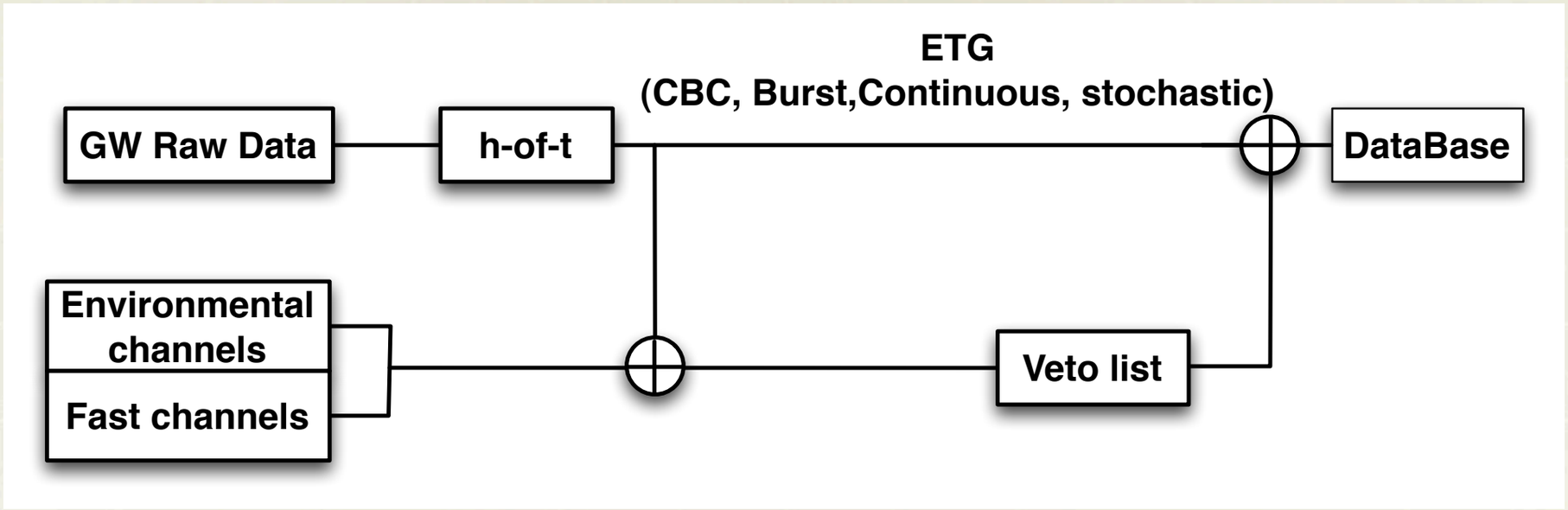
- Simple standalone system (RT PC + ADC, Client WS, router) has been delivered to NAOJ on 12/6/2011.
- 3days work for installation, lecture and training
- Online analysis software will be developed by DAS group.



Data quality analysis

- Data quality information
  - Real-time segment-database generation
    Data quality information of science mode, lock, calibration, ...
  - Categorization
- Triggered event database
- Real-time veto analysis
- Daily Report tool

For Event Searches



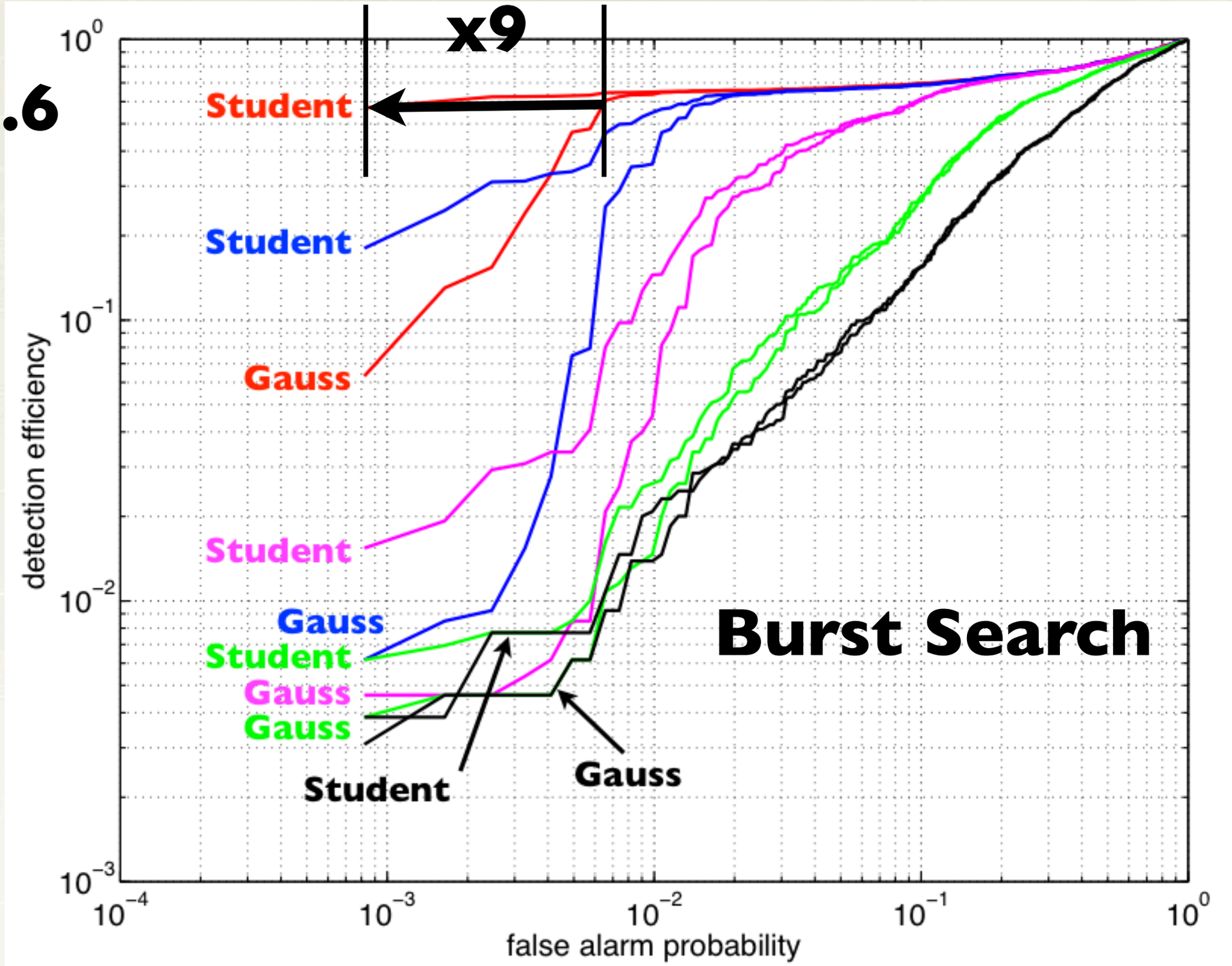
Veto list generation

Transient GW (CBC, Burst)	Continuous GW (pulsar, LMXB, ...)	Stochastic GW (Early Univ, ...)
• Real-time glitch detection • Glitch classification • Coincidence analysis between the GW channel and auxiliary sensor channels. • ...	• Line tracking • Line detection • Removal of high frequency spikes • ...	• Noise floor monitor • Non-stationary • ...

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?**
  - **Multivariate analysis**

New Noise Modeling



11 paper submission ready

Application of ANNs to Glitch Identification Study using Auxiliary Channels

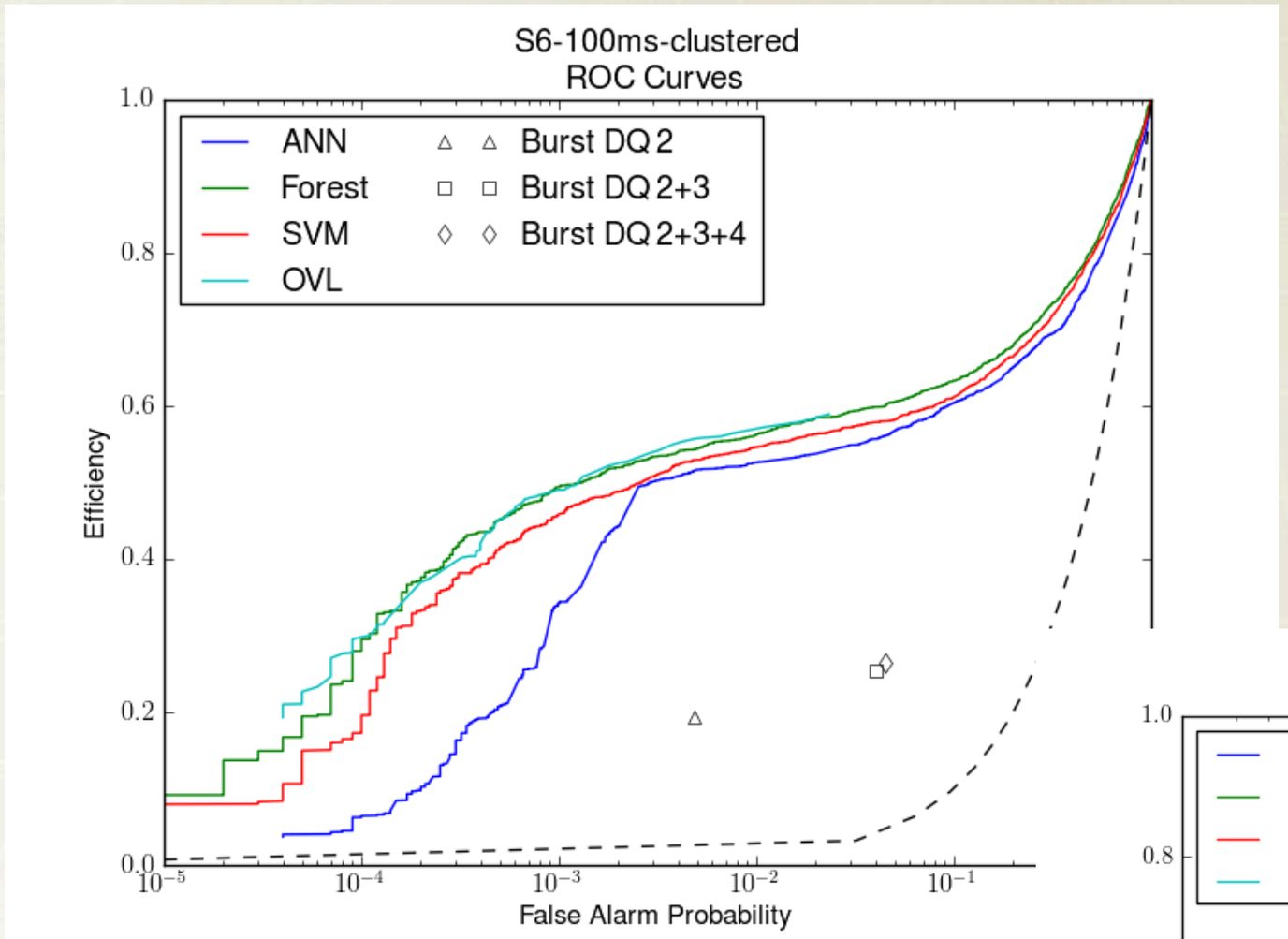
John J. Oh[1], Sang Hoon Oh[1], Young-Min Kim[1,2], Chang-Hwan Lee[2], Edwin J. Son[3], Ruslan Vaulin[4] , Lindy Blackburn[5]

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

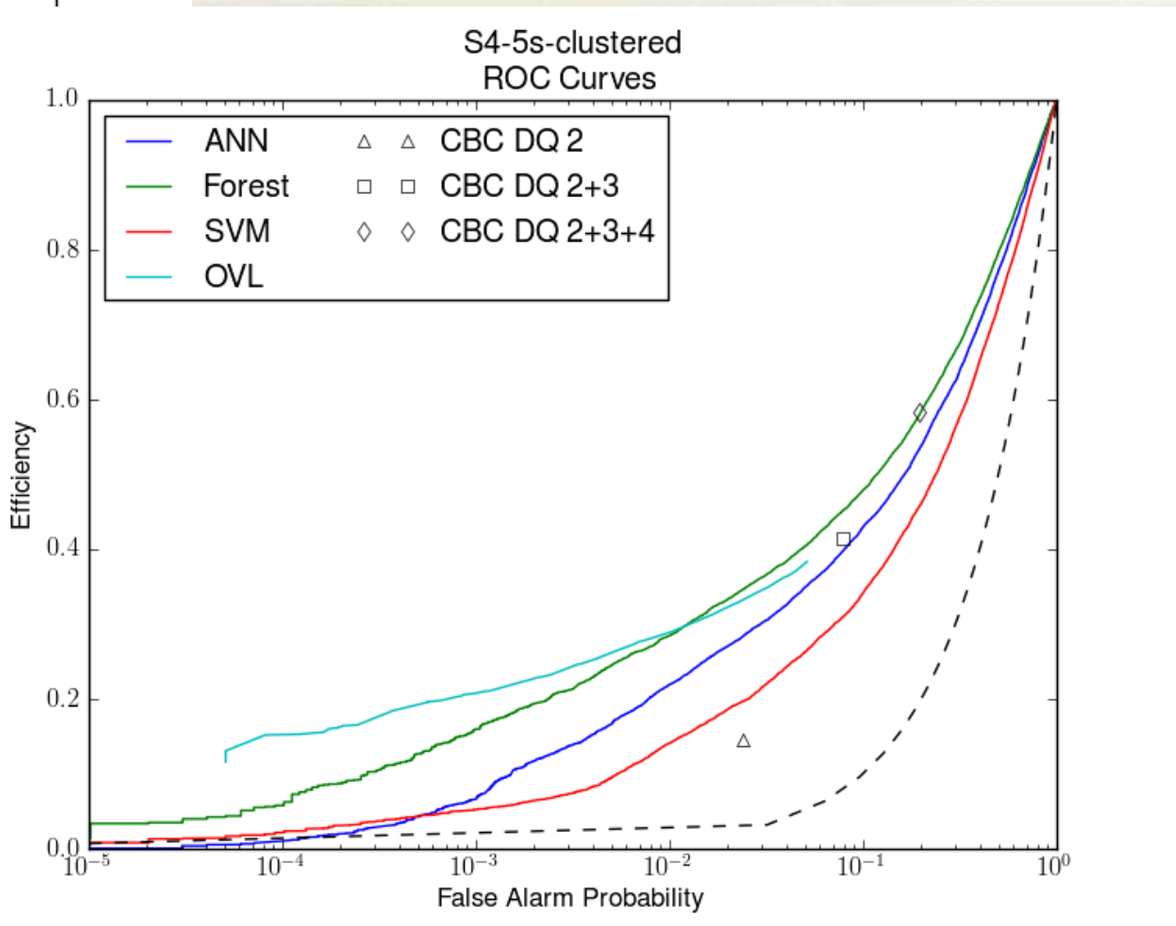
Goals: Applying artificial neural networks (ANNs) to auxiliary channel information,

- ✦ 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

Trying improvement



Hodge, K. in GWPAW2012



Schedule

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