Detector Characterization

Kazuhiro Hayama

On behalf of DET subsystem

Human Resources, Cooperation

- **Chair : Hayama**
- **Active members on software development :**

  Yamamoto, Yuzurihara, Ueno, Miyamoto (OCU), Itoh (RESCEU)

- **Measurement of environment :**

  KAGRA members + ERI +OCU

Current Tasks

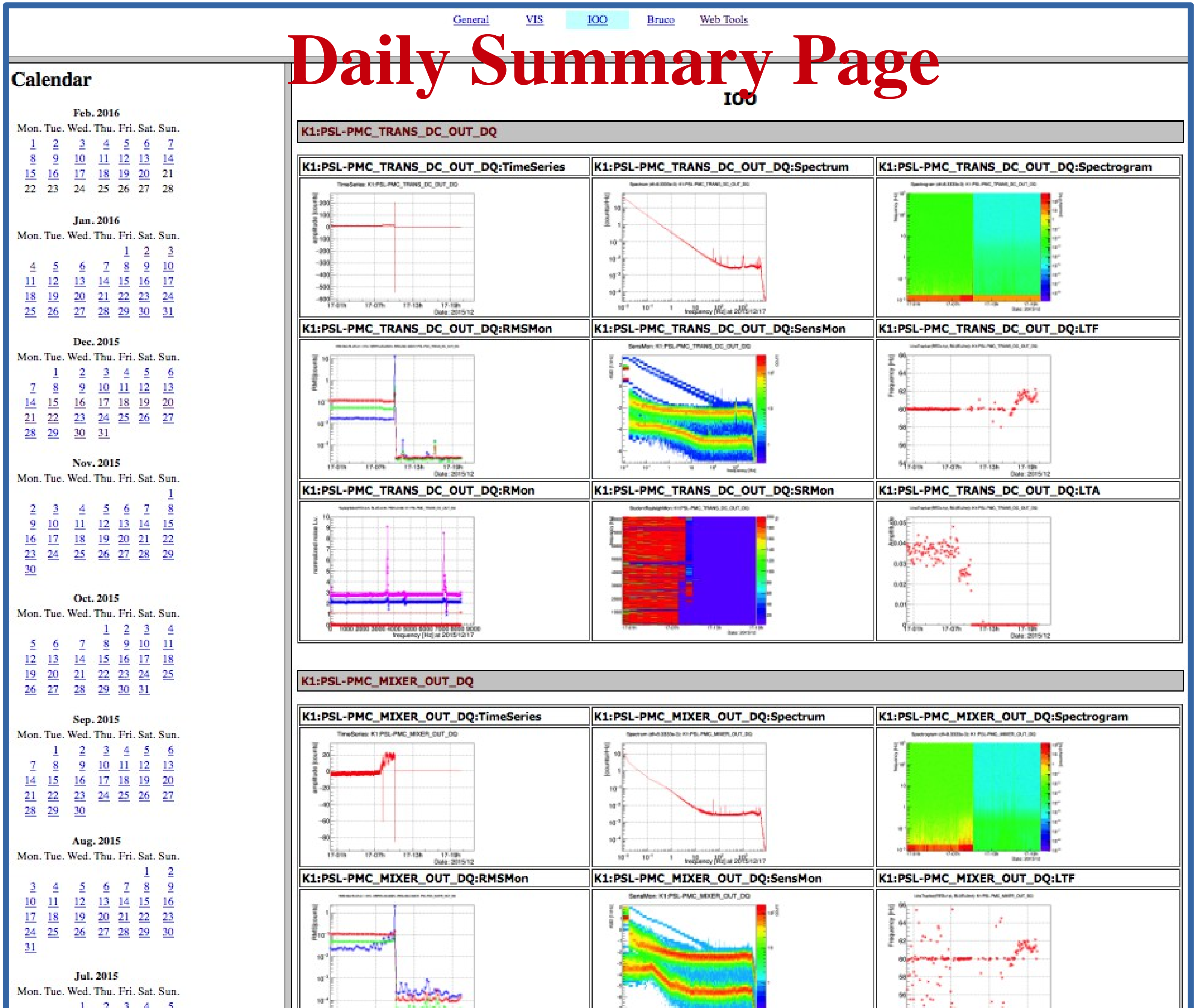
- Environmental monitor sensors with GIF
- Environment and Instrument monitor
- Development of characterization system

Preparing Environmental Sensors

With GIF

- **Hygrometer, thermometer, barometer are tested at the center area of KAGRA now.**
- **Seismometers, accelerometers are waiting for installation. (Feb ~ earlyMarch)**
- **Magnetometers will be introduced in the middle of this March.**
- **Slow data acquisition system will be set up ~early this March.**

Preparation of monitoring system



Daily Summary Page

General VIS IOO Bruco Web Tools

Calendar

Feb. 2016

Mon.	Tue.	Wed.	Thu.	Fri.	Sat.	Sun.
1	2	3	4	5	6	7
8	9	10	11	12	13	14
15	16	17	18	19	20	21
22	23	24	25	26	27	28

Jan. 2016

Mon.	Tue.	Wed.	Thu.	Fri.	Sat.	Sun.
				1	2	3
4	5	6	7	8	9	10
11	12	13	14	15	16	17
18	19	20	21	22	23	24
25	26	27	28	29	30	31

Dec. 2015

Mon.	Tue.	Wed.	Thu.	Fri.	Sat.	Sun.
	1	2	3	4	5	6
7	8	9	10	11	12	13
14	15	16	17	18	19	20
21	22	23	24	25	26	27
28	29	30	31			

Nov. 2015

Mon.	Tue.	Wed.	Thu.	Fri.	Sat.	Sun.
						1
2	3	4	5	6	7	8
9	10	11	12	13	14	15
16	17	18	19	20	21	22
23	24	25	26	27	28	29
30						

Oct. 2015

Mon.	Tue.	Wed.	Thu.	Fri.	Sat.	Sun.
			1	2	3	4
5	6	7	8	9	10	11
12	13	14	15	16	17	18
19	20	21	22	23	24	25
26	27	28	29	30	31	

Sep. 2015

Mon.	Tue.	Wed.	Thu.	Fri.	Sat.	Sun.
	1	2	3	4	5	6
7	8	9	10	11	12	13
14	15	16	17	18	19	20
21	22	23	24	25	26	27
28	29	30				

Aug. 2015

Mon.	Tue.	Wed.	Thu.	Fri.	Sat.	Sun.
					1	2
3	4	5	6	7	8	9
10	11	12	13	14	15	16
17	18	19	20	21	22	23
24	25	26	27	28	29	30
31						

Jul. 2015

Mon.	Tue.	Wed.	Thu.	Fri.	Sat.	Sun.
		1	2	3	4	5

IOO

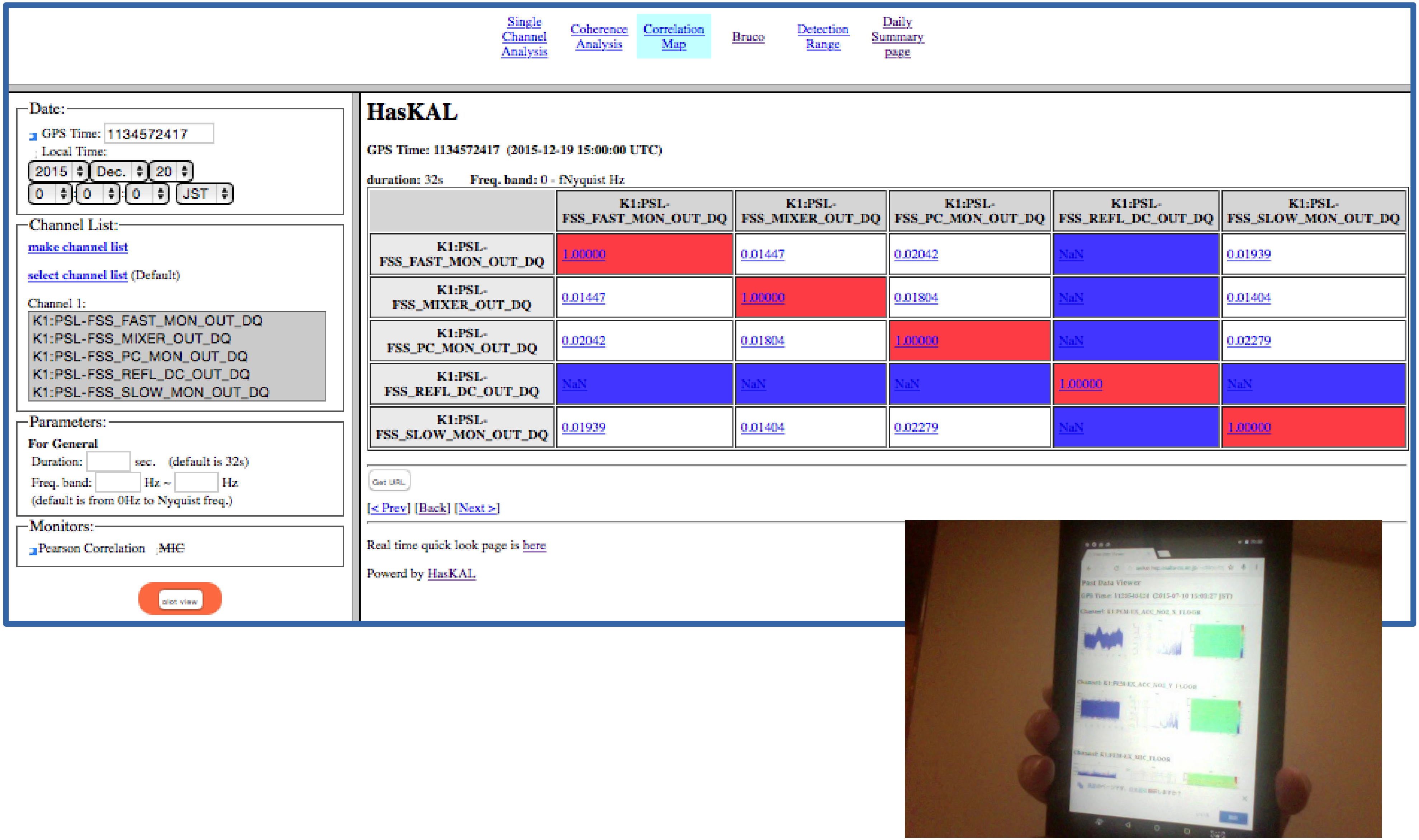
K1:PSL-PMC_TRANS_DC_OUT_DQ

K1:PSL-PMC_TRANS_DC_OUT_DQ:TimeSeries	K1:PSL-PMC_TRANS_DC_OUT_DQ:Spectrum	K1:PSL-PMC_TRANS_DC_OUT_DQ:Spectrogram
K1:PSL-PMC_TRANS_DC_OUT_DQ:RMSMon	K1:PSL-PMC_TRANS_DC_OUT_DQ:SensMon	K1:PSL-PMC_TRANS_DC_OUT_DQ:LTF
K1:PSL-PMC_TRANS_DC_OUT_DQ:RMon	K1:PSL-PMC_TRANS_DC_OUT_DQ:SRMon	K1:PSL-PMC_TRANS_DC_OUT_DQ:LTA

K1:PSL-PMC_MIXER_OUT_DQ

K1:PSL-PMC_MIXER_OUT_DQ:TimeSeries	K1:PSL-PMC_MIXER_OUT_DQ:Spectrum	K1:PSL-PMC_MIXER_OUT_DQ:Spectrogram
K1:PSL-PMC_MIXER_OUT_DQ:RMSMon	K1:PSL-PMC_MIXER_OUT_DQ:SensMon	K1:PSL-PMC_MIXER_OUT_DQ:LTF

Web-Based Tools


Single Channel Analysis
Coherence Analysis
Correlation Map
Bruco
Detection Range
Daily Summary page

Date:

GPS Time: 1134572417

Local Time:

2015 Dec. 20

0 : 0 : 0 JST

Channel List:

make channel list

select channel list

 (Default)

Channel 1:

K1:PSL-FSS_FAST_MON_OUT_DQ
K1:PSL-FSS_MIXER_OUT_DQ
K1:PSL-FSS_PC_MON_OUT_DQ
K1:PSL-FSS_REFL_DC_OUT_DQ
K1:PSL-FSS_SLOW_MON_OUT_DQ

Parameters:

For General

Duration: ☐ sec. (default is 32s)

Freq. band: ☐ Hz ~ ☐ Hz

(default is from 0Hz to Nyquist freq.)

Monitors:

Pearson Correlation ~~MIC~~

plot view

HasKAL

GPS Time: 1134572417 (2015-12-19 15:00:00 UTC)

duration: 32s **Freq. band:** 0 - fNyquist Hz

	K1:PSL-FSS_FAST_MON_OUT_DQ	K1:PSL-FSS_MIXER_OUT_DQ	K1:PSL-FSS_PC_MON_OUT_DQ	K1:PSL-FSS_REFL_DC_OUT_DQ	K1:PSL-FSS_SLOW_MON_OUT_DQ
K1:PSL-FSS_FAST_MON_OUT_DQ	1.00000	0.01447	0.02042	NaN	0.01939
K1:PSL-FSS_MIXER_OUT_DQ	0.01447	1.00000	0.01804	NaN	0.01404
K1:PSL-FSS_PC_MON_OUT_DQ	0.02042	0.01804	1.00000	NaN	0.02279
K1:PSL-FSS_REFL_DC_OUT_DQ	NaN	NaN	NaN	1.00000	NaN
K1:PSL-FSS_SLOW_MON_OUT_DQ	0.01939	0.01404	0.02279	NaN	1.00000

[< Prev] [Back] [Next >]

Real time quick look page is here

Powerd by HasKAL

Past Data Viewer

Detchar software

Non-Stationarity

- Glitch Monitor

Line

- Line Finder
- Line Tracking
- Line Removal

Gaussianity

- Rayleigh Monitor
- Non-Gaussianity M
- RMS Monitor
- Noise Floor Monitor

Time-Series Spectrum

- Time-Series Monitor
- Spectrum Monitor
- Spectrogram Monitor

GW Range

- Sensitivity Monitor
- Range Monitor
  - Inspiral
  - Inspiral-Merger-Ringdown
  - Ringdown
  - Stochastic

Correlation

- Coherence Finder
- Multiple-channel coherence finder (BruCo)
- Pearson correlation Finder
- NonLinear correlation Finder

User Interface

- Realtime Quick look webpage
- Daily summary webpage
- GUI Interface
- Web-Base Interface
- Command-line Interface

System Health

- Health monitor
- File Finder (New)

- Globally Correlated magnetic noise
- Violin mode
- Multi-channel analysis
- Newtonian noise
  - Effect of water inside the mountain

Example : GW150914

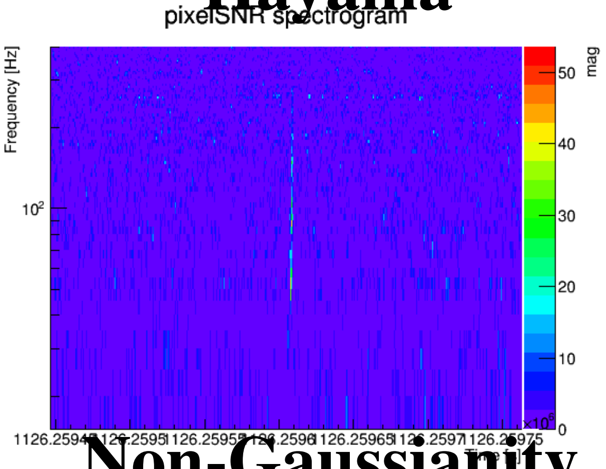
Data Characterization around GW150914

http://seikai.hep.osaka-cu.ac.jp/~chino/GW150914/characterizeGW150914.html

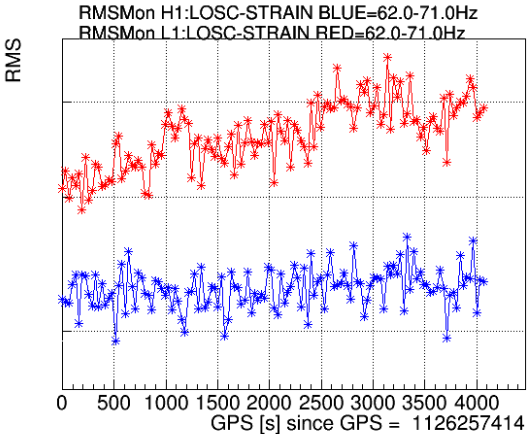
Yuzurihara, Yamamoto

- **Seen the signal clearly**
- **Amp. of Power line(60Hz) fluctuated ~+-5E-21**
- **Amp. of 500Hz line decreasing**
- **>100Hz, Gaussianity pretty good**
- **<100Hz, non-Gaussian**
- **516Gz line: strange behavior.**

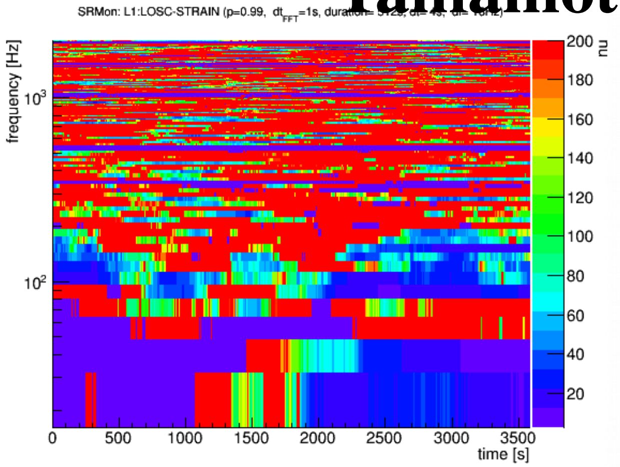
Glitch pipeline Hayama



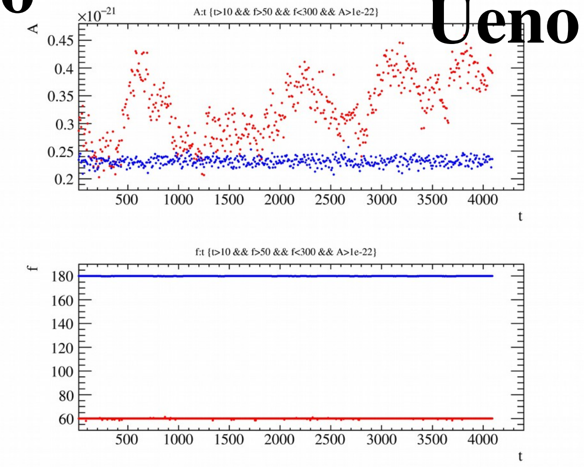
BLRMS (60~70Hz) Yuzurihara



Non-Gaussianity Yamamoto



Line Tracking Ueno

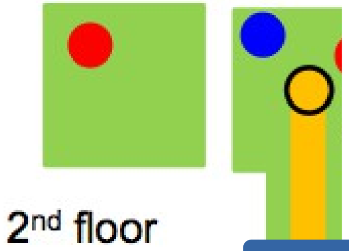


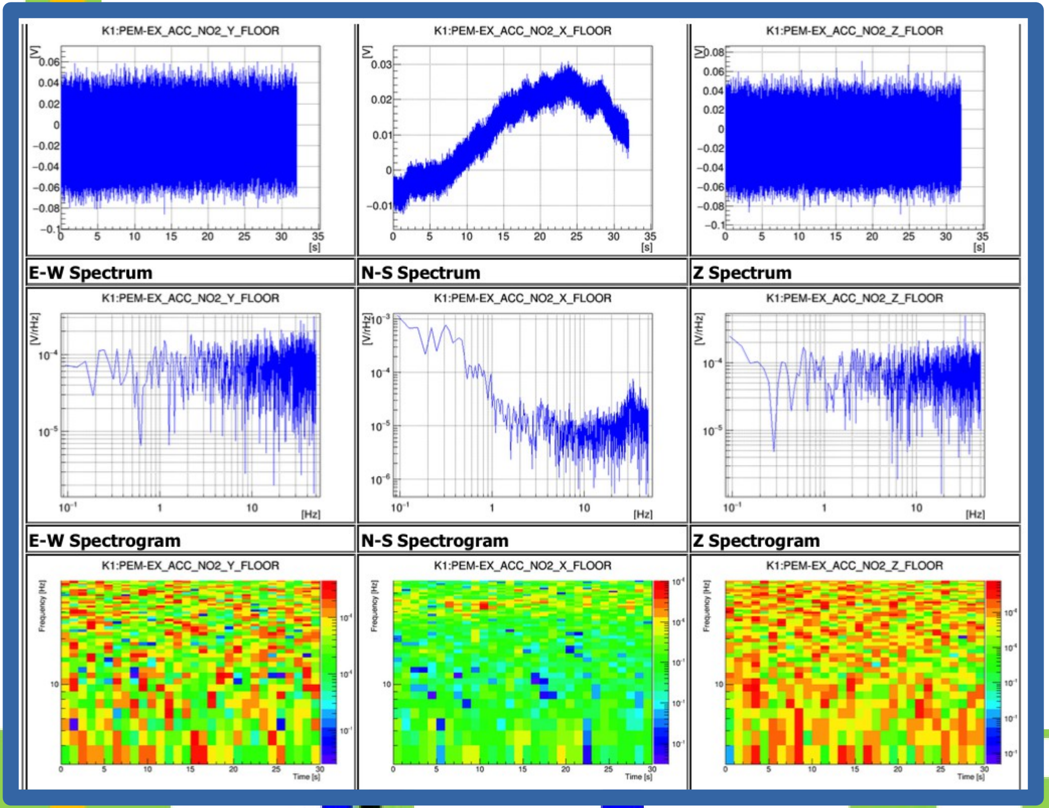
Towards bKAGRA

- Addition of Guardian info to the webpage(also for iKAGRA)
- Initial PEM plan will be finished in ~ this summer.
- Measurement of the magnetic field around mirrors
- Development of PEM injection system
- Channel selection to monitor
    - With Subsystems
    - With PEM injection study(2016-2017)

Real-time environment monitor

Env Monitor at the X-End




K1:PEM-EX_ACC_NO2_Y_FLOOR

K1:PEM-EX_ACC_NO2_X_FLOOR

K1:PEM-EX_ACC_NO2_Z_FLOOR

E-W Spectrum

N-S Spectrum

Z Spectrum

K1:PEM-EX_ACC_NO2_Y_FLOOR

K1:PEM-EX_ACC_NO2_X_FLOOR

K1:PEM-EX_ACC_NO2_Z_FLOOR

E-W Spectrogram

N-S Spectrogram

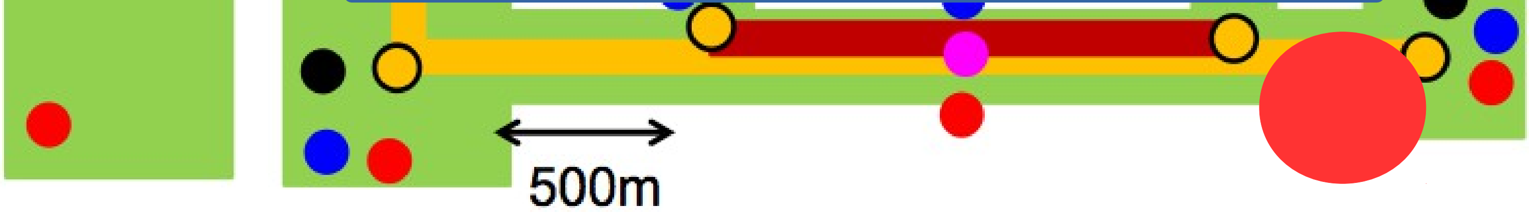
Z Spectrogram

K1:PEM-EX_ACC_NO2_Y_FLOOR

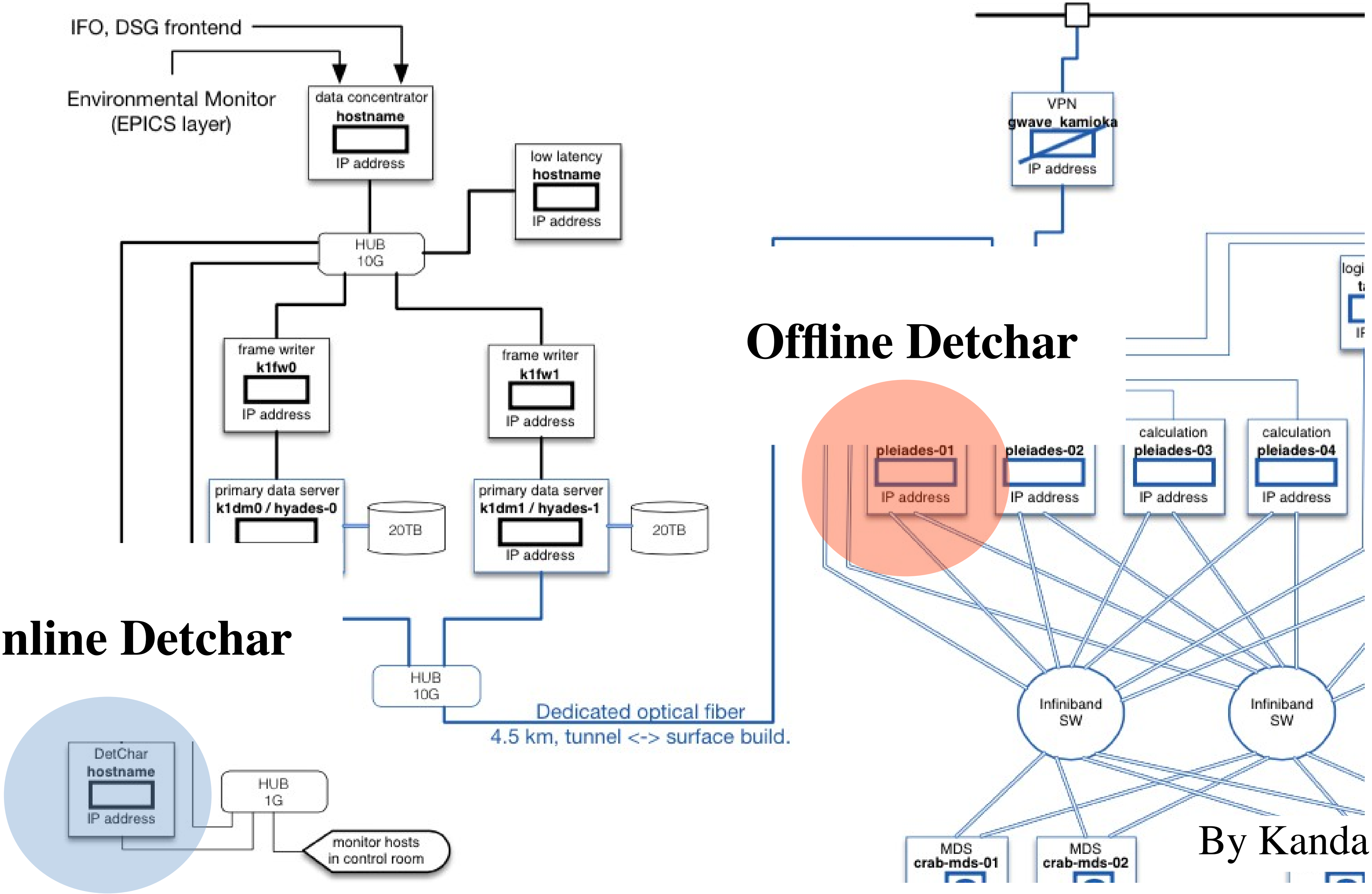
K1:PEM-EX_ACC_NO2_X_FLOOR

K1:PEM-EX_ACC_NO2_Z_FLOOR

[V]
[s]
[V/√Hz]
[Hz]
Frequency [Hz]
Time [s]


2nd floor
500m

Network


IFO, DSG frontend
Environmental Monitor (EPICS layer)
data concentrator
hostname
IP address
low latency
hostname
IP address
HUB 10G
frame writer
k1fw0
IP address
frame writer
k1fw1
IP address
primary data server
k1dm0 / hyades-0
20TB
primary data server
k1dm1 / hyades-1
IP address
20TB
HUB 10G
Dedicated optical fiber
4.5 km, tunnel <-> surface build.
DetChar
hostname
IP address
HUB 1G
monitor hosts in control room
VPN
gwave_kamioka
IP address
logi
IP
pleiades-01
IP address
pleiades-02
IP address
calculation
pleiades-03
IP address
calculation
pleiades-04
IP address
Infiniband SW
Infiniband SW
MDS
crab-mds-01
MDS
crab-mds-02

Offline Detchar

Online Detchar

By Kanda