Activities of Korean Group

Hyung Mok Lee
February, 2015
on behalf of KGWG

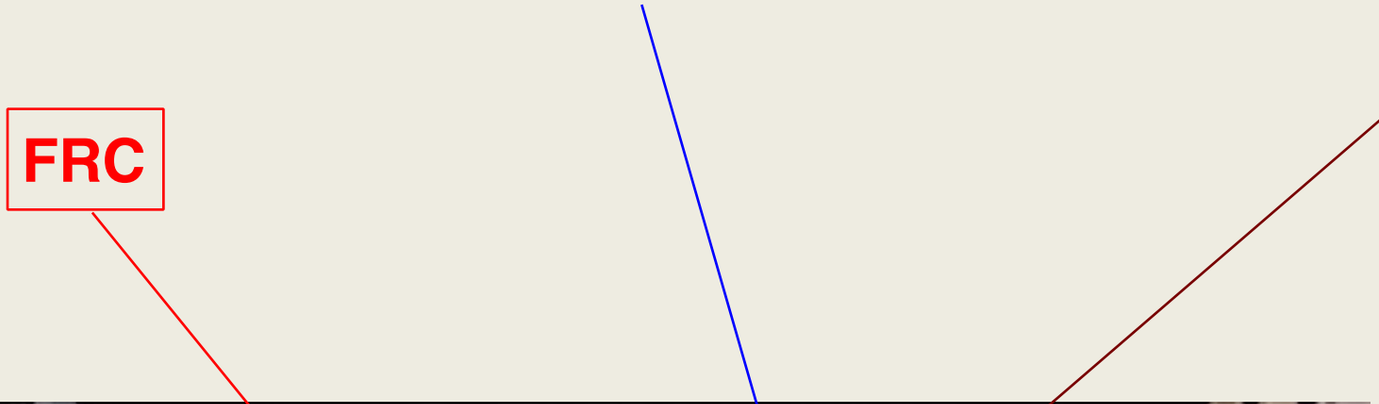
Members

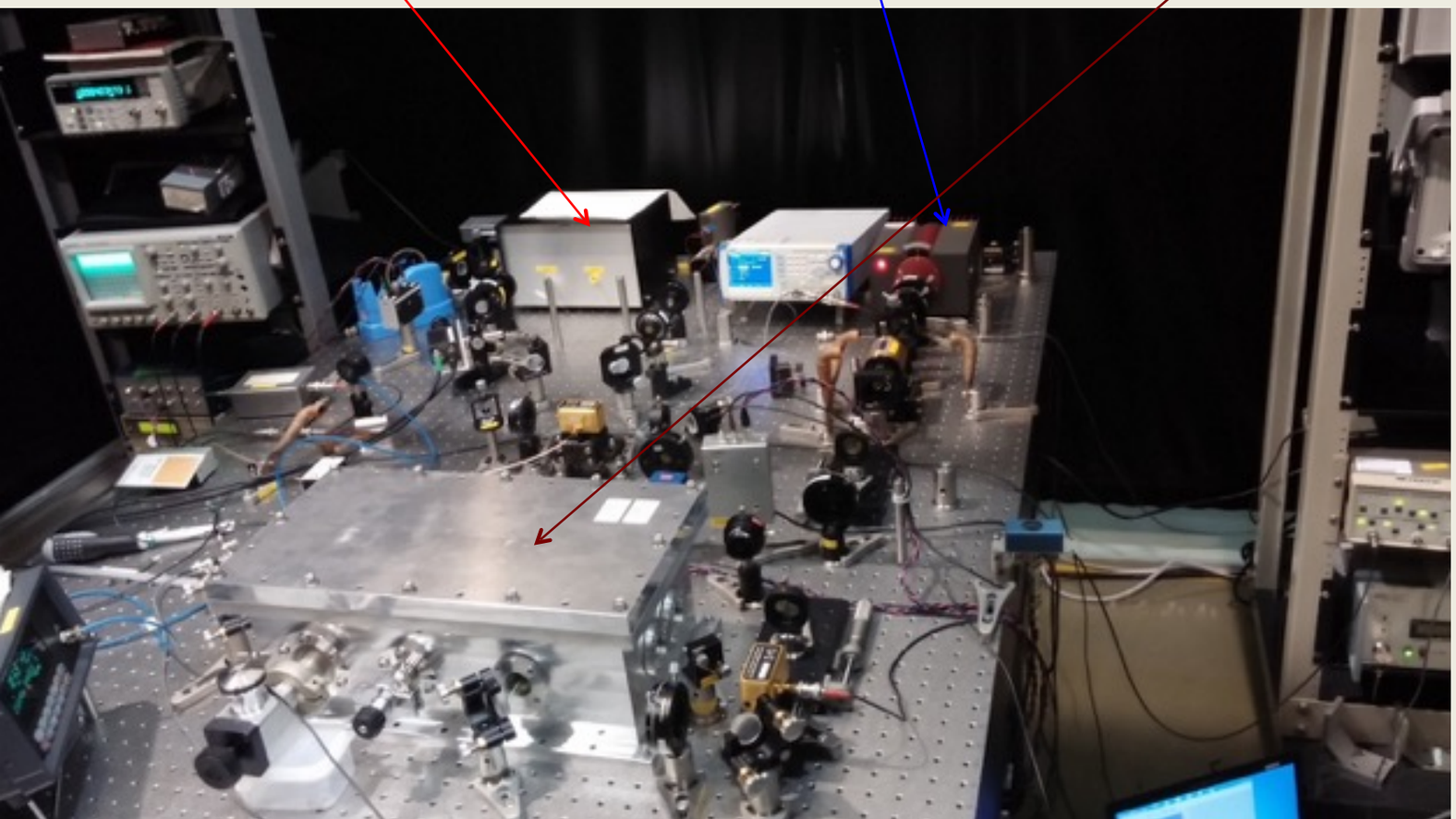
- Experiment:
  - Tai-Hyun Yoon (Lead, Korea Univ.), Kyuman Cho (Sogang U.), Jaewan Kim (Myungji U.)
- Data Analysis
  - Hyung Won Lee (Lead), Jeongcho Kim (Inje U.), John Oh, Sang Hoon Oh, Edwin Sohn (NIMS), Chunglee Kim, Gungwon Kang, Heesuk Cho (KISTI), Changhwan Lee, Young Min Kim (PNU), Hyunkyu Lee, Kyungmin Kim (Hanyang U.)
- Others (Theory, Astrophysics)
  - Hyung Mok Lee (SNU), Sangpyo Kim (Kunsan Nat. U.)

Fiber Ring Cavity (FRC) for KAGRA

Prof. Tai Hyun Yoon (Korea U./ Visiting Prof. of ICRR 2013, 2014)

Frequency stabilization of Master Laser (NPRO) & Pre-Mode Cleaner (PMC)





- Built FRC for IOO Group
- Demonstrated of frequency stabilization of NPRO+PMC at ICRR with Mr. M. Nakano & Prof. S. Kawamura

FRC fabrication: Final design for iKAGRA

Prof. Tai Hyun Yoon
(Korea University)

3rd Fiber Ring Cavity

Reducing line-width 3times

Length: 5.8 m
f_{FSR} = 35 MHz
$\Delta\nu$ = 80 kHz
Finesse = 540
Contrast: 27 %

Splicing & Insertion Losses : 0.01 dB, 0.0023

Gooch & Housego SM Coupler (99.9 % : 0.1 %)

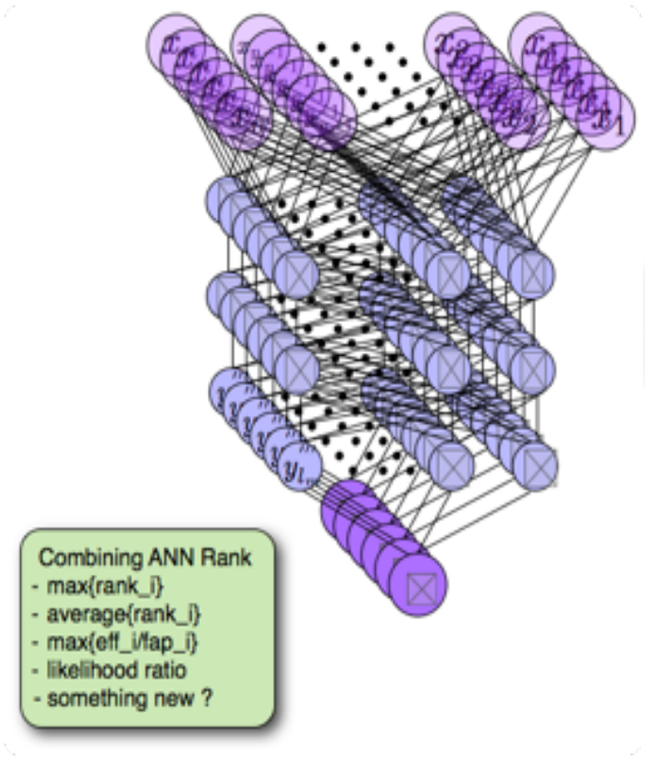
Tilt Sensor for Initial Mirror Alignment of KAGRA

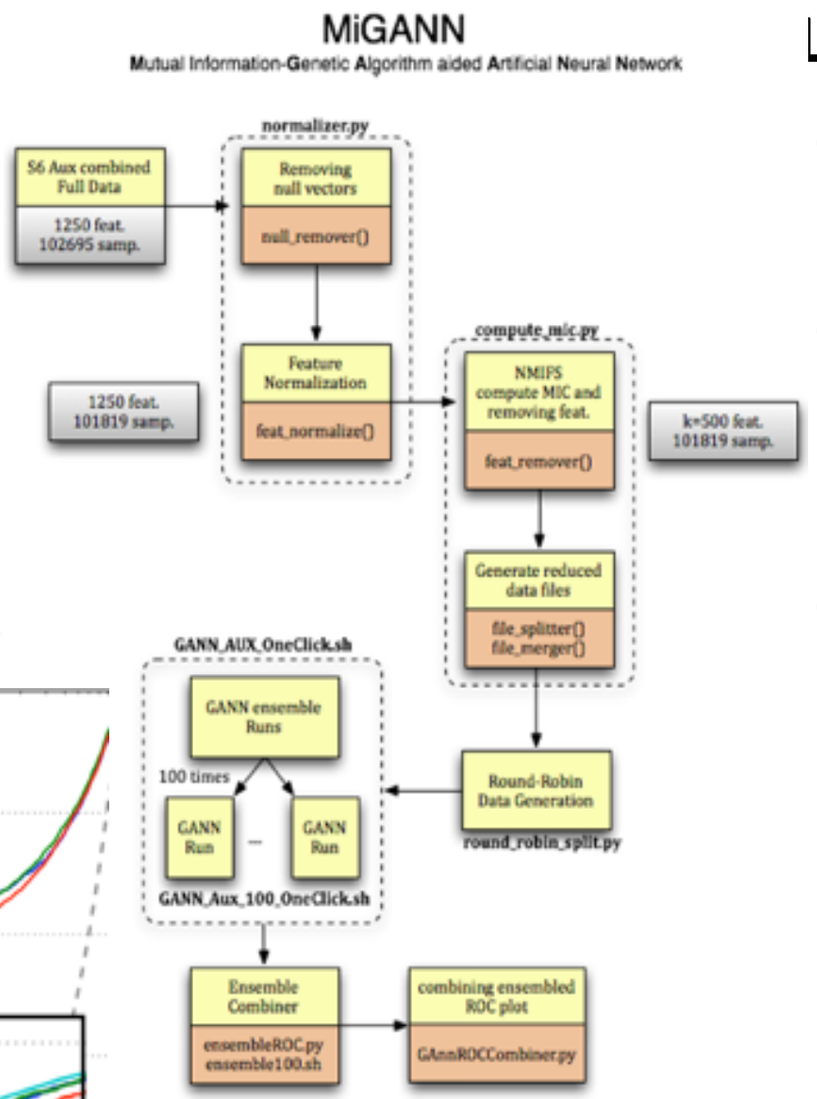
Professor Kyuman Cho, Sogang University

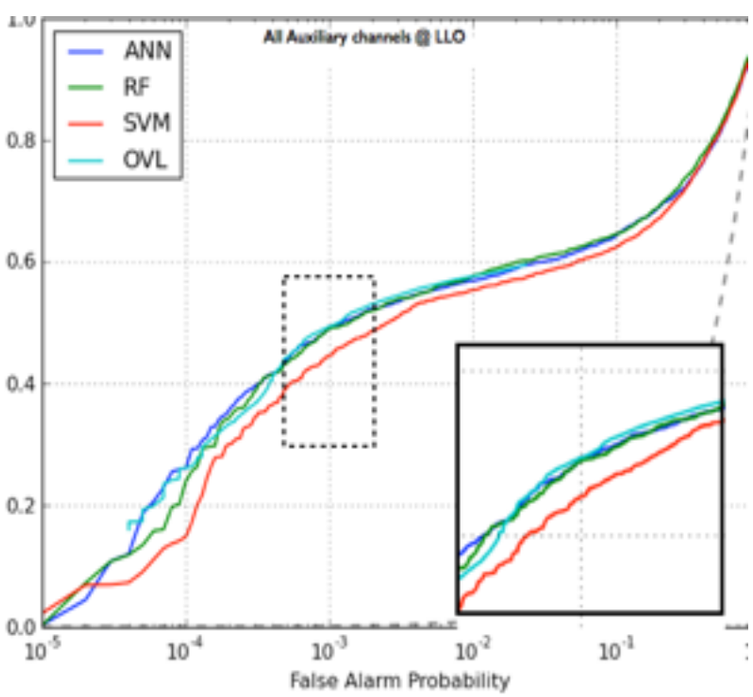
- High sensitivity, wide dynamic, low drift range tilt sensors are very important in initial mirror alignments of KAGRA.
- Optical lever has been used for
  - Local angular alignment of each mirror,
  - Alignment control to lead to lock the interferometer,
  - Monitor drift.
- Prof. Cho proposed new interferometric tilt sensor schemes which, in theory, can provide
  - a better sensitivity,
  - a better stability,
  - a compatible dynamic range to an optical lever.
- Prof. Cho is currently visiting ICRR from Jan. 5 to Feb. 26 to perform
  - Feasibility studies on the proposed tilt sensor schemes
  - Researches on optimizing and designing the tilt sensor

Detector's Characterization @ NIMS (1/2)

(John Oh, Sang Hoon Oh, Edwin Sohn)



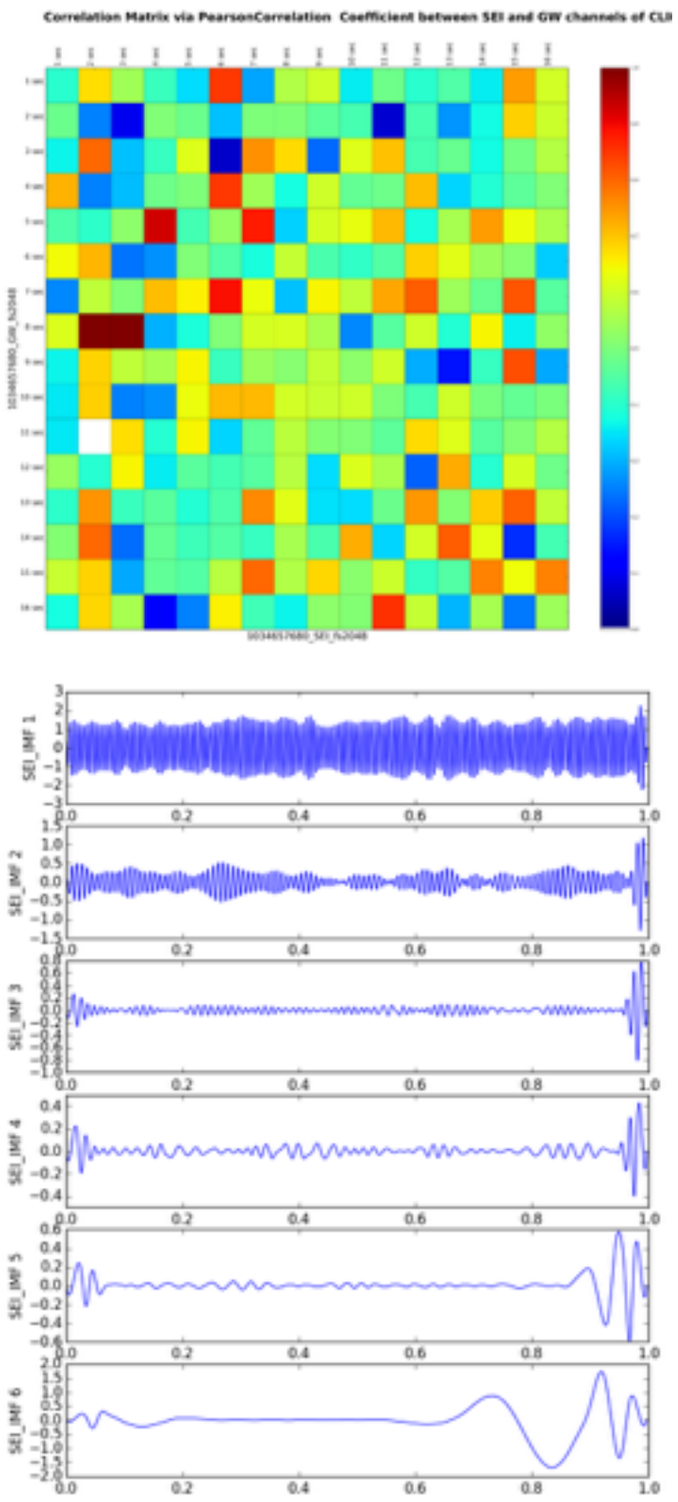


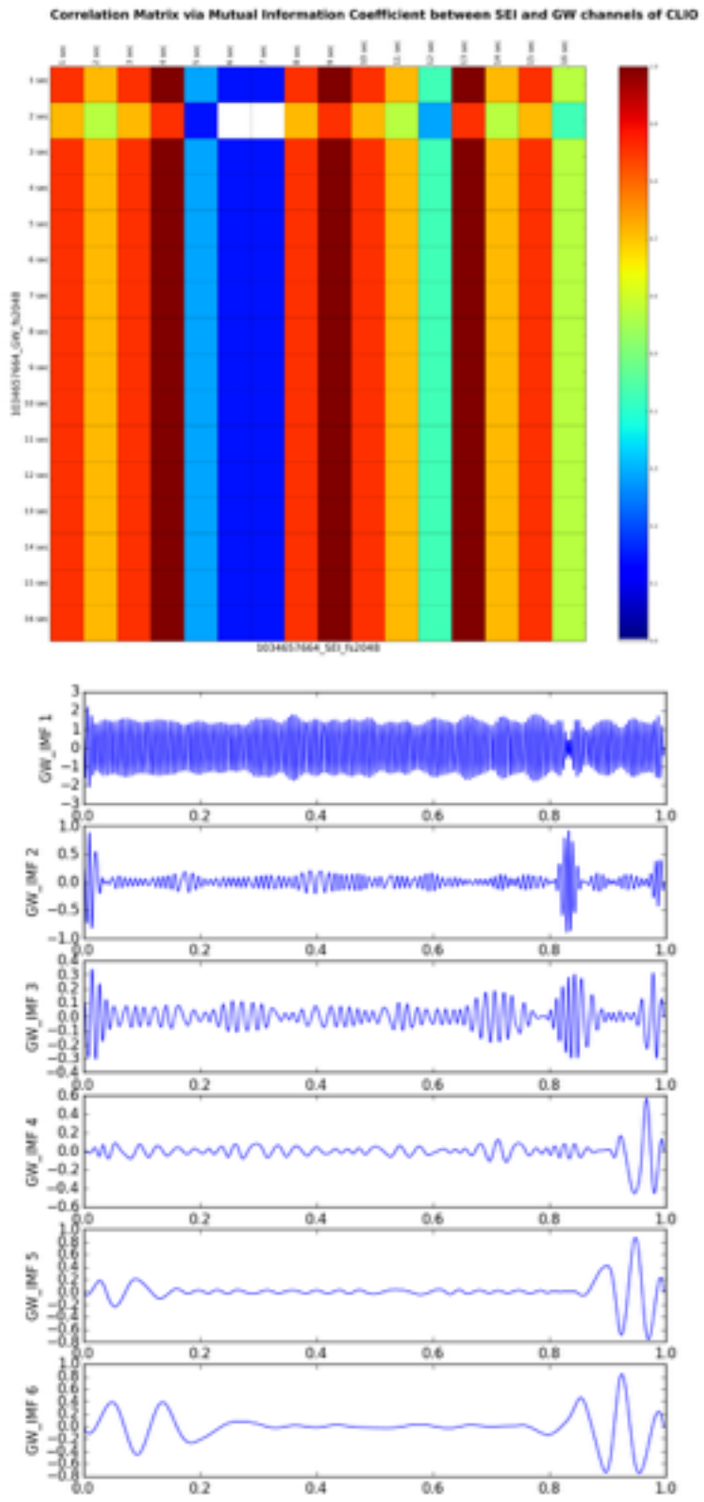


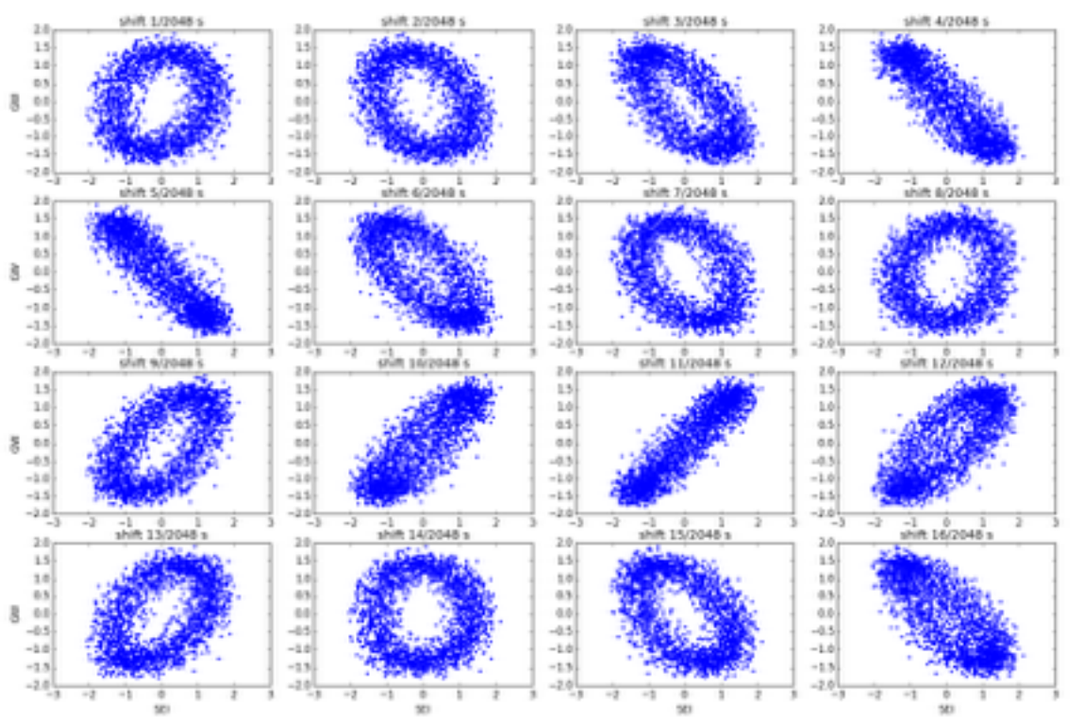
- **Glitch Classification using Machine Learning Algorithms**
  - Genetic Algorithm aided Neural Net Pipeline (GANN Pipeline)
  - iDQ Pipeline (online classification using BDT, ANN, SVM, OVL) in LIGO - testing in KAGRA
  - Improving GANN pipeline: applying Input Variable Selection Algorithm with Mutual Information Coefficient

BDT: Bagged Decision Trees of Random Forest
ANN: Artificial Neural Network
SVM: Support Vector Machine
OVL: Ordered Veto List – Conventional Method of Glitch Determination in LIGO

Detector’s Characterization @ NIMS (2/2)







- **Correlation Analysis of CLIO**

  Data: SEI and GW Channel

  - Pearson R & Mutual Info. Idx.
  - Hilbert Huang Transform
  - Generating Correlation Matrix

  : Monitor the correlated aux. channels

KGWG-KAGRA DAS activities

Hyung Won Lee (Inje U.), Jeongcho Kim (Inje U.), and Chunglee Kim (Kyung Hee U. & KISTI)

MCMC parameter estimation for CBC inspirals

- Effects of amplitude corrections for NS-BH and BH-BH binary inspirals
- Comparison of MCMC performance with the initial vs early-phase advanced LIGO-Virgo

Waveform Study

- Reviewing the post-Newtonian formalism: TaylorF2 (full waveform)
- Implementing post-Newtonian terms for amplitude corrections in LALSuite

Goals for KAGRA:

- Preparing a fast and realistic inspiral waveform in the frequency-domain
- Developing an efficient, reliable sampling scheme
- Considering iKAGRA sensitivity

We plan to write a library for MCMC parameter estimation as a part of KAGALI