

Status of KGWG- KAGRA DetChar Activities

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On behalf of KGWG-Detchar Working Group

2016. 12. 7 - 8
KAGRA F2F Meeting @ U. of Tokyo

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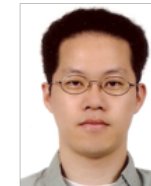
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/ EtaGen



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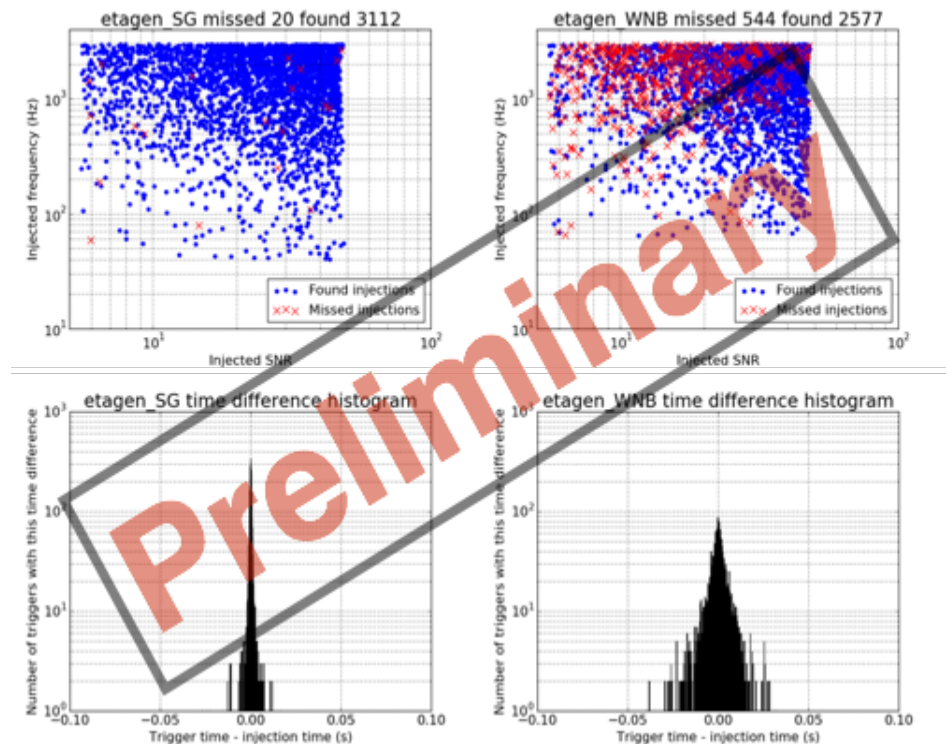
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Deep Learning/ CAGMon
/ EtaGen

Project Milestones

- **EtaGen** : An Event Trigger Generator based on Hilbert-Huang Transform
To find almost all the injections or transient signals in the time series data
- **CAGMon** : A Detchar Tool via Correlation Scores
To clarify the correlation between auxiliary channels and GW channels in order to find any nonlinear couplings that may be harmful to detect a signal
- **Safe Channel Study**
To figure out uncorrelated or weakly correlated auxiliary channels to hardware injections in $h(t)$ in order to use for investigation on detector characterization
- **Machine Learning for Glitch Classification**
To classify glitches by using morphology in $h(t)$ and auxiliary channels and to figure out which auxiliary channels are responsible for glitch appearance

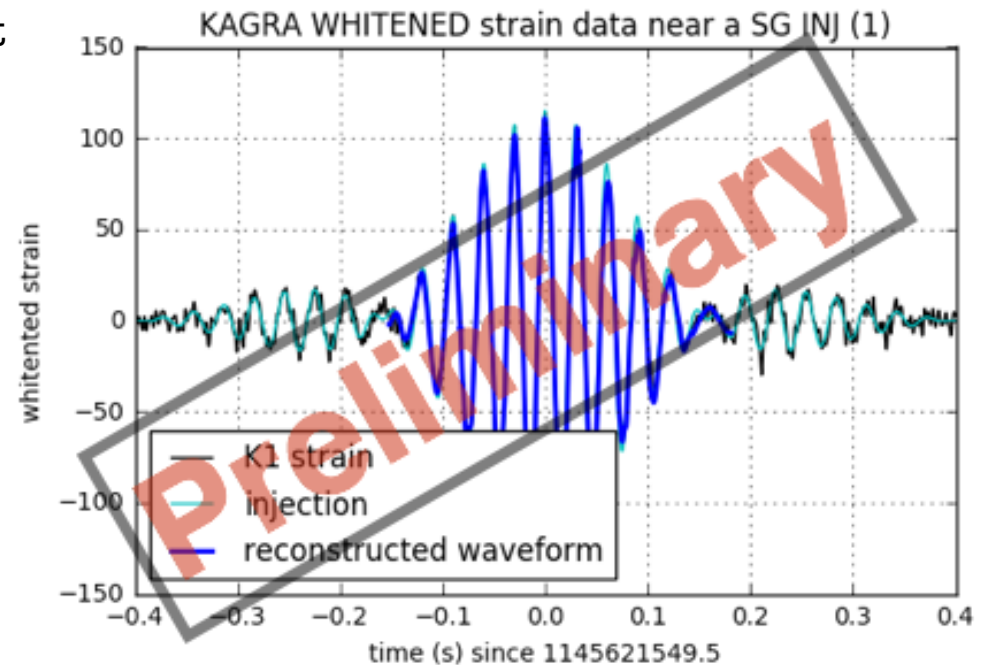
Status Report I – EtaGen (η -Gen)

- EtaGen is an event trigger generator based on Hilbert-Huang Transform.
- The efficiency of EtaGen finding simulated sine-Gaussian and white noise burst signals are over 90%.
- Triggers generated near the injection times will be used in the further analyses, e.g., finding safe/ unsafe auxiliary channels.



Status Report I – EtaGen (η -Gen) (contd.)

- EtaGen is currently a test version and not released to the public.
- The user interface is almost fixed and a hands-on tutorial will be given at the Boot Camp on Dec. 9.
- After some tedious works on bug-fixing, it will be released with a paper.
- One more thing. In addition to ETG functions, EtaGen can now reconstruct waveforms.



Status Report II - CAGMon

CAGMon Project: Analysis Results

- Correlation analysis based Detchar Tool using MIC, PearsonR, and Kendall's tau coefficients -

Developers & Contributors

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IKAGRA Runs: 1142899217-1143446417 (1st) / 1144368017-1145064417 (2nd)

Code: <https://github.com/gw-analysis/CAGMon.git>

! DQ Channel Info: [IKAGRA.DQ.Channel.IMC.PSL](#) | [IKAGRA.DQ.Channel.LSC](#) | [IKAGRA.DQ.Channel.PEM](#) | [IKAGRA.DQ.Channel.VIS](#)

Project Goal

CAGMon is a sort of DetChar tool for finding correlation between gravitational wave channel and thousands of auxiliary channels of gravitational-wave detector. It computes Pearson's product-moment correlation coefficient, Kendall's tau coefficient, and Maximal Information Coefficient (MIC) between both channel data and generate channel list with high-scored correlation value for a given data segment. The tool 1) uses time-series data segment and 2) generates "Correlation Matrix" and Scatter Plots.

Theoretical Background

CAGMon Analysis Results

Software

- Correlation analysis using MIC, PearsonR, and Kendall's tau coefficients

- python 2.7.3
- matplotlib
- minipy
- pylal, lalpython

User's Guide

This page shows the global trend of the correlation between GW channel and auxiliary channels during the analyzed time period. If you click the individual figure, then you find the CMatrix and the relevant scattered plots during the time segment.

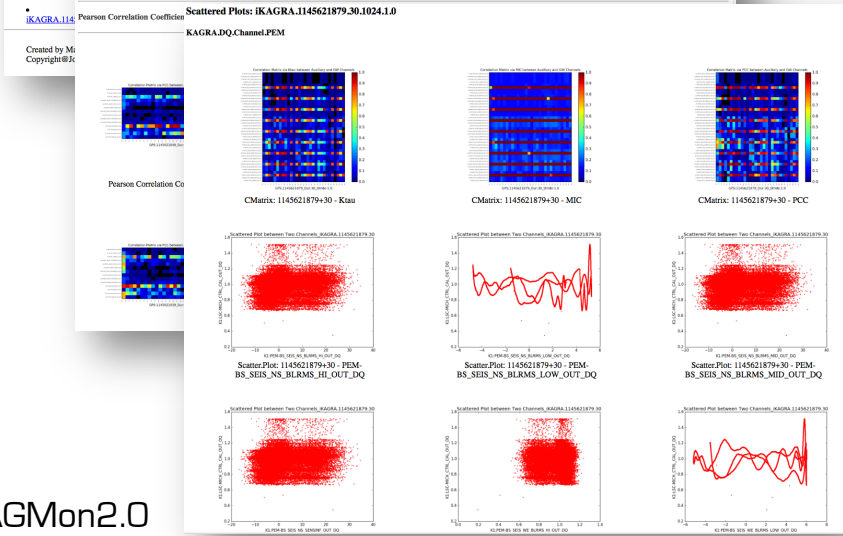
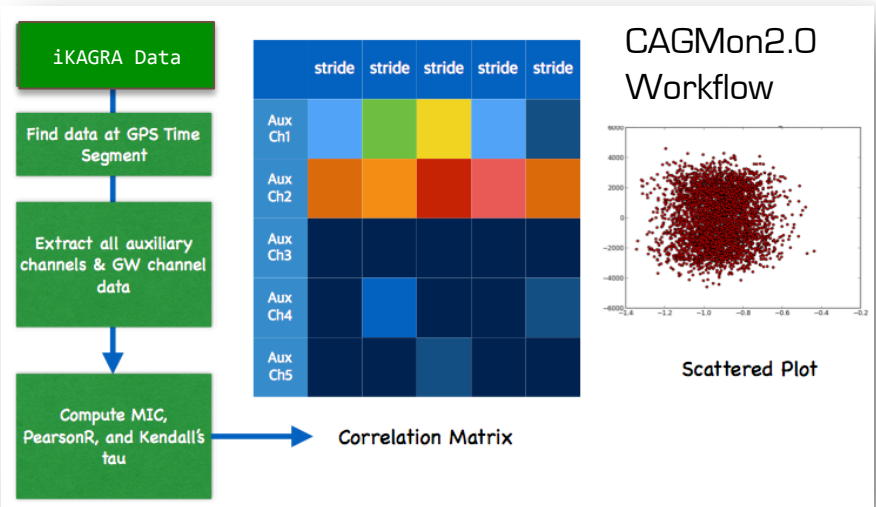
! HOME | [IKAGRA.DQ.Channel.IMC.PSL](#) | [IKAGRA.DQ.Channel.LSC](#) | [IKAGRA.DQ.Channel.PEM](#) | [IKAGRA.DQ.Channel.VIS](#)

Analyzed: [KAGRA.DQ.Channel.IMC.PSL](#)

Scattered Plots: [IKAGRA.1145621879.30.1024.1.0](#)

[IKAGRA.1145621879.30.1024.1.0](#)

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The screenshot shows the GitHub repository page for 'gw-analysis / CAGMon'. It displays the repository name, commit history, and a list of files. The files listed include 'CAGConfig.ini', 'CAGMkSh.py', 'CAGMonLk.py', 'CAGWebBuild.py', 'CAGWebUIs.py', 'K1_KAGRA.DQ.Channel.IMC.PSL', 'K1_KAGRA.DQ.Channel.LSC', 'K1_KAGRA.DQ.Channel.PEM', 'K1_KAGRA.DQ.Channel.VIS', 'MainHTML.py', 'MainWebBuild.py', 'README.md', and 'mkcache.py'. The 'README.md' file is highlighted, and its content is shown below the repository list.

CAGMon 2.0 README

This program generates correlation analysis result between both different channel data, drawing correlation matrix & scattered plots

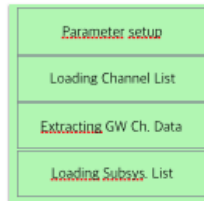
CAGMon2.0
Summary Page
<http://seikai.icrr.u-tokyo.ac.jp/~johnoh/>

CAGMon2.0
Code Release
6
@GitHub.KAGRA-Detchar

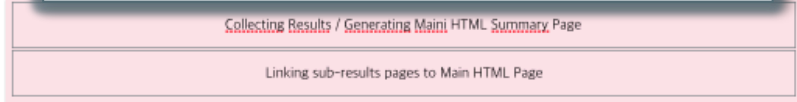
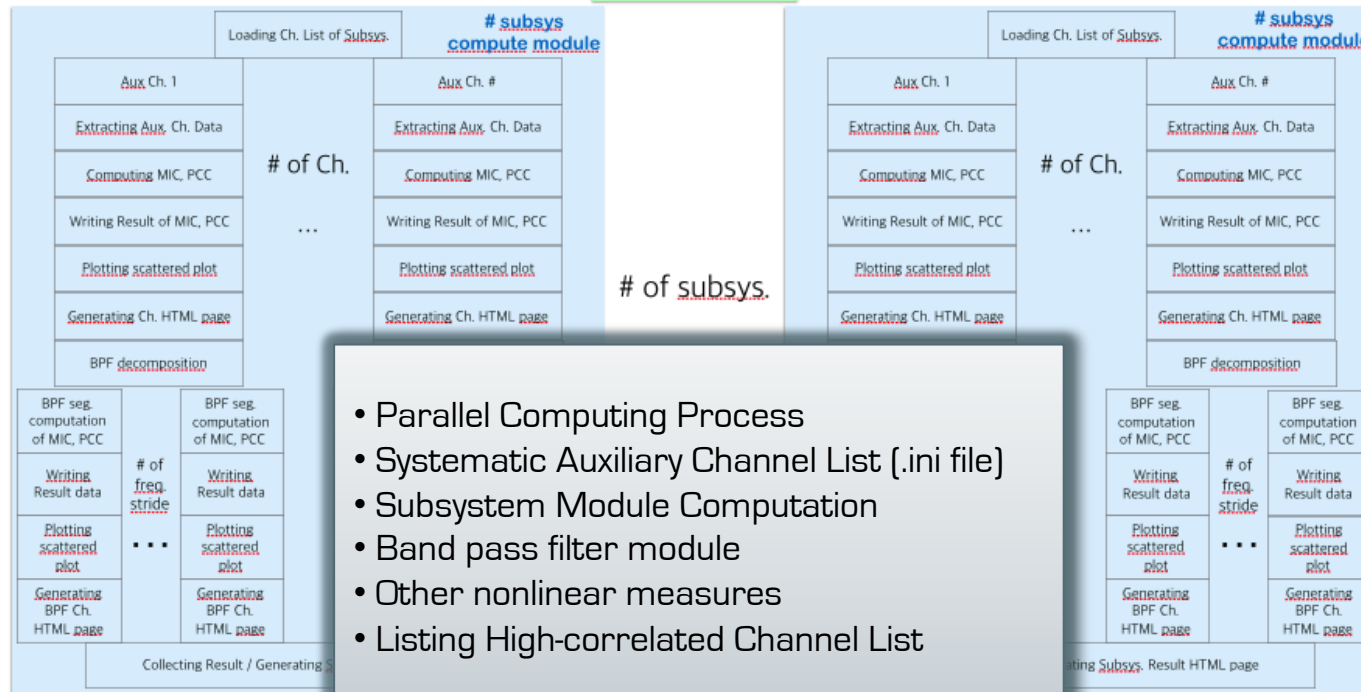
Status Report II – CAGMon (contd.)

CAGMon Tool 3.0 Workflow

Contributors: JJO, YMK, SHO, EJS, HSK, HK



Preprocess



Postprocess

Timeline - CAGMon

Year	2016		2017									
Month	11	12	1	2	3	4	5	6	7	8	9	10
Code Devel	Channel List I/O Code	High Scored Channel List Extract Module	Trigger-based Code (tCAG)	Time-series Code Review			sCAGMon Frozen (Serial CAGMon)	Code Optimization	Parallelize	Parallelize	Code Frozen	pCAGMon Frozen (Parallel CAGMon)
Interface					Summary Page Interface Modify	Interact. Page for tCAG					Interface Frozen	
Build/Documentation					Package Build	Documentation				Parallel Package Build	Documentation Frozen	
Test Run	Test In LLO/LHO	Test in LLO/LHO	Test in ICRR	Test in ICRR	Test in LLO/LHO ICRR	Test in ICRR	Run in ICRR	Test in ICRR	Test in ICRR	Test in ICRR	Installation in KAGRA Server	Run in ICRR



- Current summary page and example runs: <http://seikai.icrr.u-tokyo.ac.jp/~johnoh/>

Timeline - EtaGen

Oct	Nov	Dec and after (2017)
Current version of EtaGen (Python core) is already installed in /home/eddy	New EtaGen module (C++ core) will be installed in /home/eddy (It can be installed in /home/detchar if requested)	Fine-tuning and upgrades

- Preliminary results in http://seikai.icrr.u-tokyo.ac.jp/~eddy/etagen_list.html

Timeline - Safe Channel Study

	Nov. 2016	Dec. 2016	Jan. 2017	Feb. 2017	Mar. 2017
Trigger based	hVeto onto Omicron Triggers: Code Development for KAGRA and its Test Runs			Categorizing Safe/ Unsafe Channels: Comparison between hVeto and CAGMon	
Correlation based	Application of CAGMon: Categorizing Safe/ Unsafe Channels				

Timeline - Machine Learning for Glitch Classification

	2017 Feb	2017 Mar.	2017 Apr.	2017 May
Trigger Classification [Tensorflow]	Development of ANN using Tensorflow	Data Preparation using LIGO data Test/Run	Defining ROCs and FOMs Documentation & Code Build	Defining ROCs and FOMs Documentation & Code Build
Channel Analysis	Code development for Analyzing Significant Channels	Test Runs of the Code onto aLIGO / KAGRA	Development of iDQ/ANN interface for KAGRA and its Test Runs	