Detector Characterization for the underground gravitational-wave detector, KAGRA

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@ TAUP2019, September 10th, 2019

Motivation

Our ultimate questions is...

Does this series of h(t) channel have the GW signal?



Not everyone can easily access to

- What GPS time to analyze?
- When was the ifo operating?
- What channels to see? There are 100,000 aux channels!
- How to determine the detector status?



Detector Characterization!

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How to answer these questions?

Information from interferometer controls • Subsystem's status ETMY 3 km IMC ITMY PSL IFI IMTX ETMX PRM PR3 PR2 BS 1 3 km IMM SR2 SR3 SRM Subsystem Monitoring OMM **Glich and line findings Channel information** омс **Environmental Monitors (PEM)** •

• Study the correlation between PEM and GW channel data

Distinguish the ifo status and data quality by understanding a lot of data and information = Detector Characterization!

Recent Progress of Detchar team

With a lot of help from VIRGO and LIGO

- Installed tools
 - Summary pages (interferometer status by LIGO)
 - ligoDV (signal visualization by LIGO)
 - Omicron (glitch finding by VIRGO)
 - Omega scan (glitch visualization by LIGO-VIRGO)
 - Fscan (line noise visualization by LIGO)
 - Spectrogram plot tool (by Kozakai)
 - Bruco (Correlation search by VIRGO)
- Generating the data quality information (by Yamamoto)

For tool info, Kozakai JGW-1910784

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D. MacLeod A. Urban S. Soni

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Sep/10/2019

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Engineering Run Summary

Engineering Run was done with intermediate ifo configurations so far

- June 8 (X arm) for 6 hours
- July 13 (Michelson ifo) for 6 hours

The purpose is to check the interferometer (ifo) end to end

- Interferometer and related hardware
- Detchar software
- Calibrations
- Deta analysis pipelines

Run summary was created using Summary Pages

- Summary of the Guardian states
 - Guardian is an automatic control system ("State machine") by J. Rollins
 - Many different ifo process towards operation are automatically controlled by Guardian
 - Each process is recorded in the GRD channels

Yokozawa, JGW-G1910474

Engineering Run Summary



Daily Summary Example 1



C. Kozakai

Daily Summary Example 2



No earth quake...

Channel information

Chan Seep/seo/2 gererate data on this page

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Type

Channel

Frametype

Sample rate

9

Units

C. Kozakai

Nightly Summary



By automatically run to create this page during night commissioners can understand the suspension status at a glance when they come in (saving time to compute low frequencies during the work time)







Glitch Summary

- Detchar must be able to say if glitches in h(t) are because of external disturbances or not
- Share information with data analysis pipelines

DetChar : Omicron



DetChar - DRS - IMC - PCAL - PEM - PSL - VIS -

• Omicron was applied on the already-commissioned subsystems Sep/10/20ck loss study using this page. See, 1KOReyama, JGW-G1809258 F. Robinet T. Yamamoto

C. Kozakai

Line Visualization



Our Next Steps

- The top page is waiting for h(t)!
- More improvements for subsystem pages (adding more pages and channels)
- Make more stable (removing expired channels)
- After sharing auxiliary channels, join the LIGO-VIRGO network page