Status of KAGRA detector characterization

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on behalf of DET team

Detector Characterization

The purpose is diagnostics of KAGRA

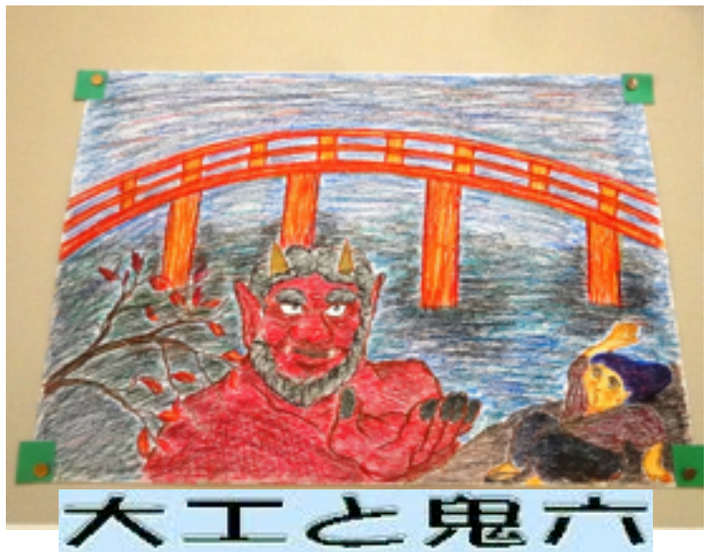
- stationary noise behavior
- non-stationary noise behavior

- Estimating noise budget
  - Monitoring detector subsystems through instrumental channels
  - Monitoring environmental events through environmental channels

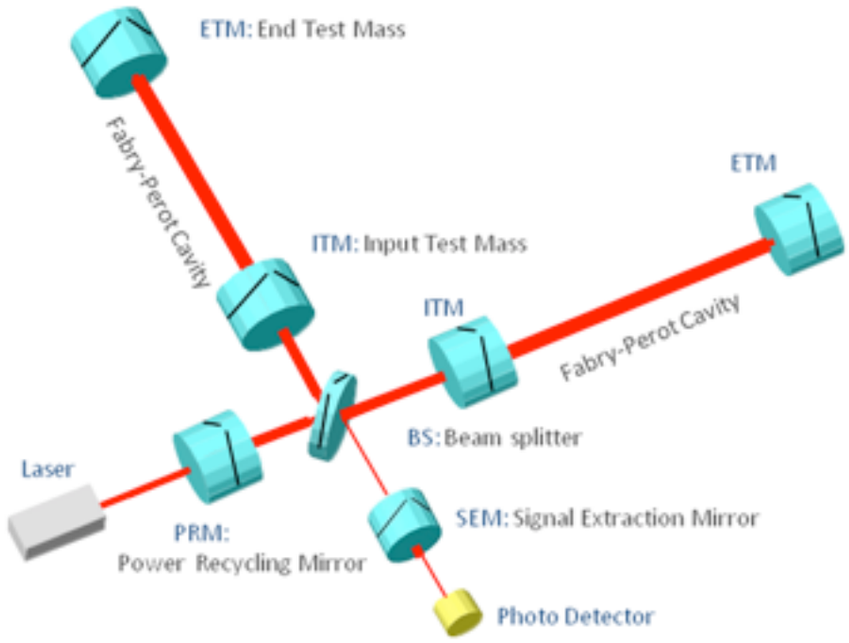
Our dream:
Stable, high sens., glitch-free, GW telescope

Detector characterization

So that people of two islands can interact using same language.



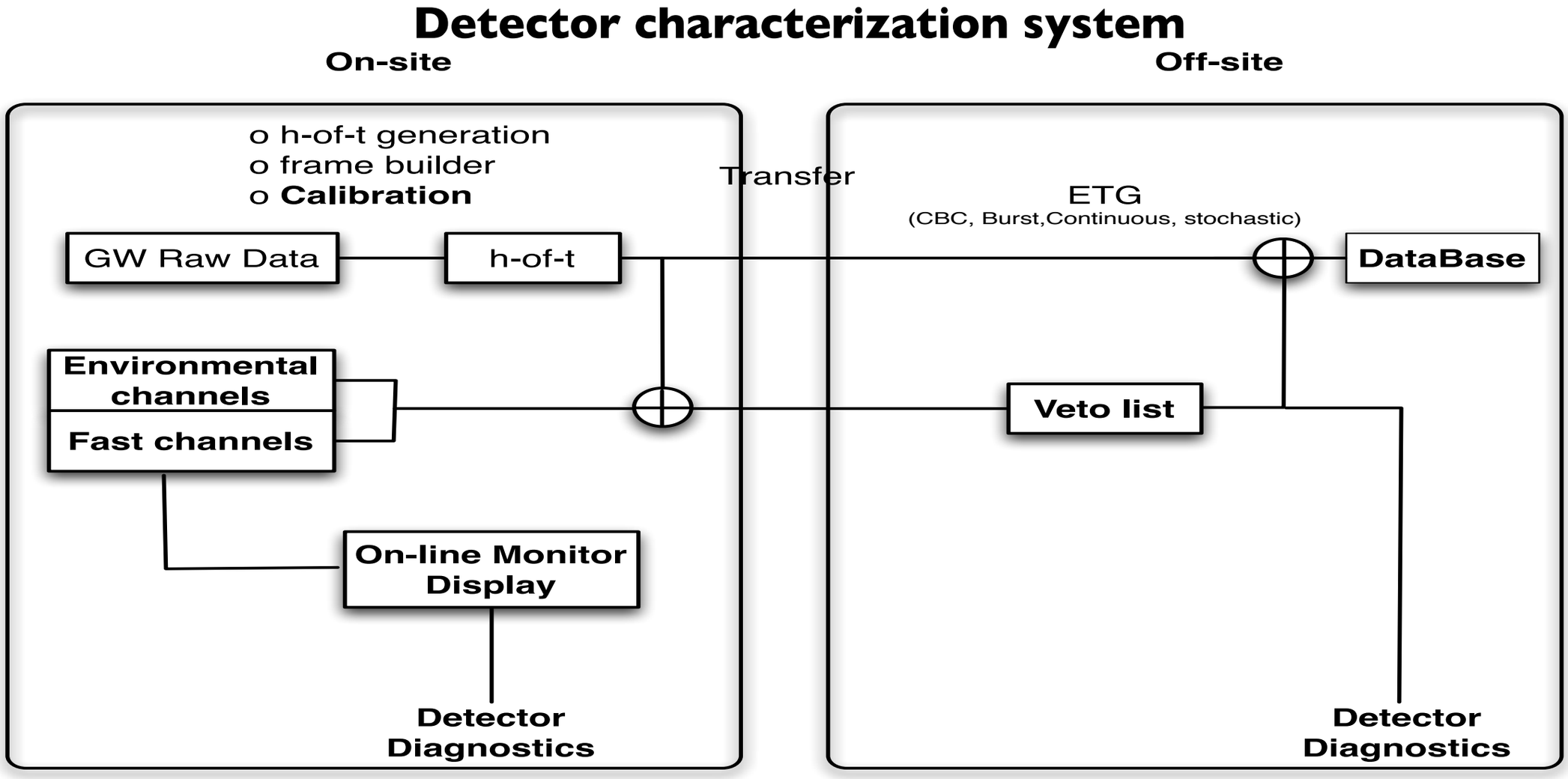
Carpenter and Oniroku



Detector and Data characterization

- Diagnosing KAGRA instruments using
- Characterizing KAGRA Data using

Same system



Software development

During commissioning

- subsystem diagnostics
  - Localization of noise sources by multi-channel analysis
  - Evaluation of data quality
  - On-line monitor display

During Observation

- Veto analysis

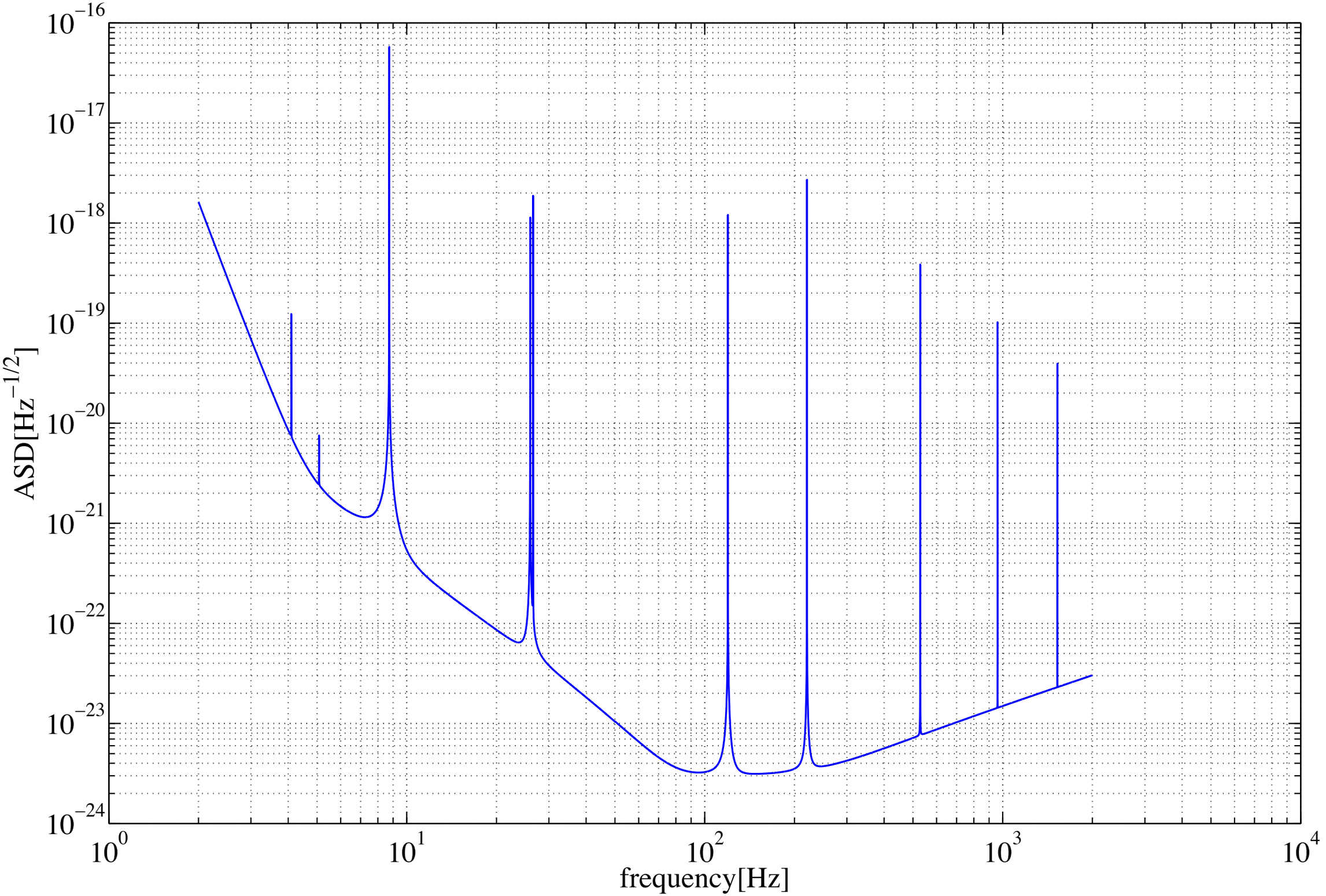
  to distinguish triggered events are GW or not
- Data quality flag
- Distribution of data quality information to both internal and external collaborators

Characterization of KAGRA

Case study

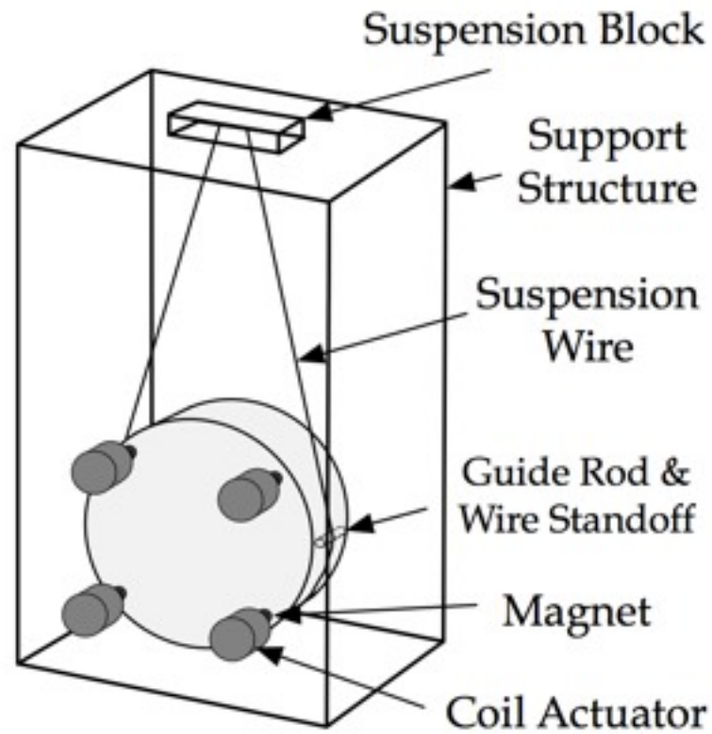
- Violin mode
- Globally correlated magnetic noise

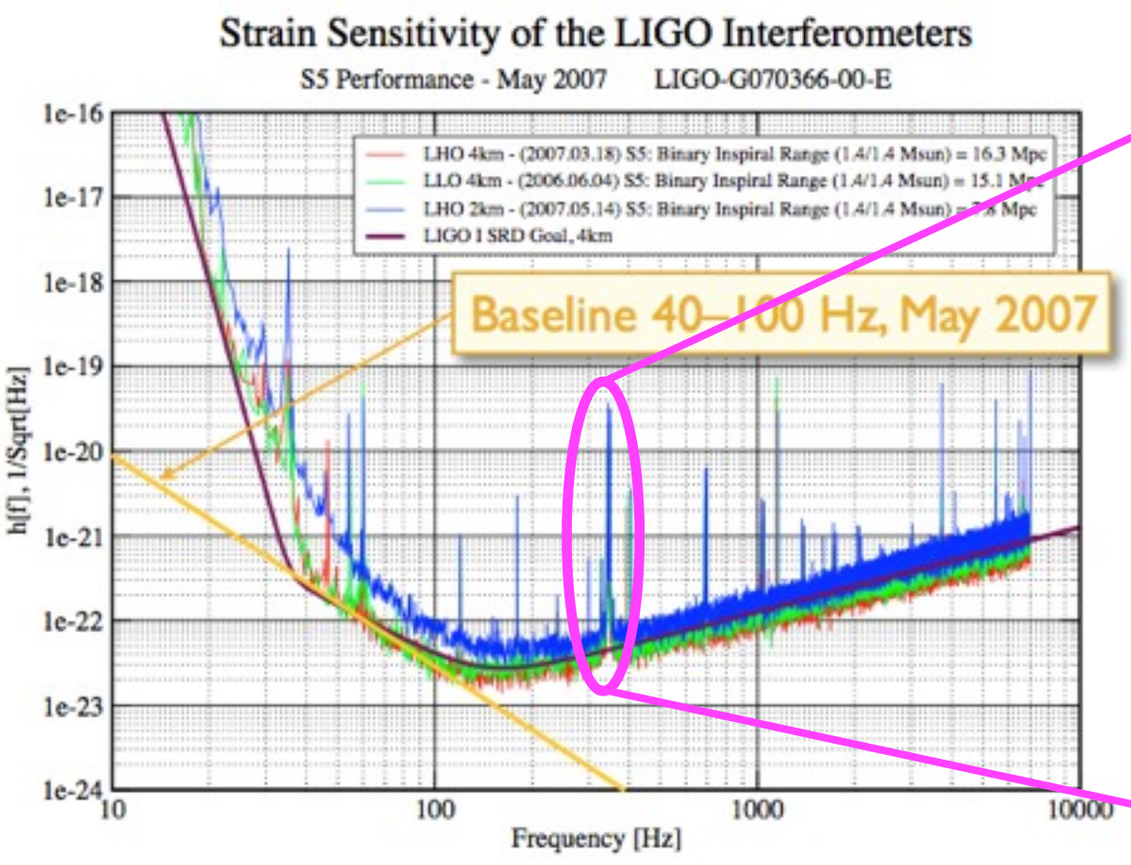
KAGRA sensitivity (Not Official)

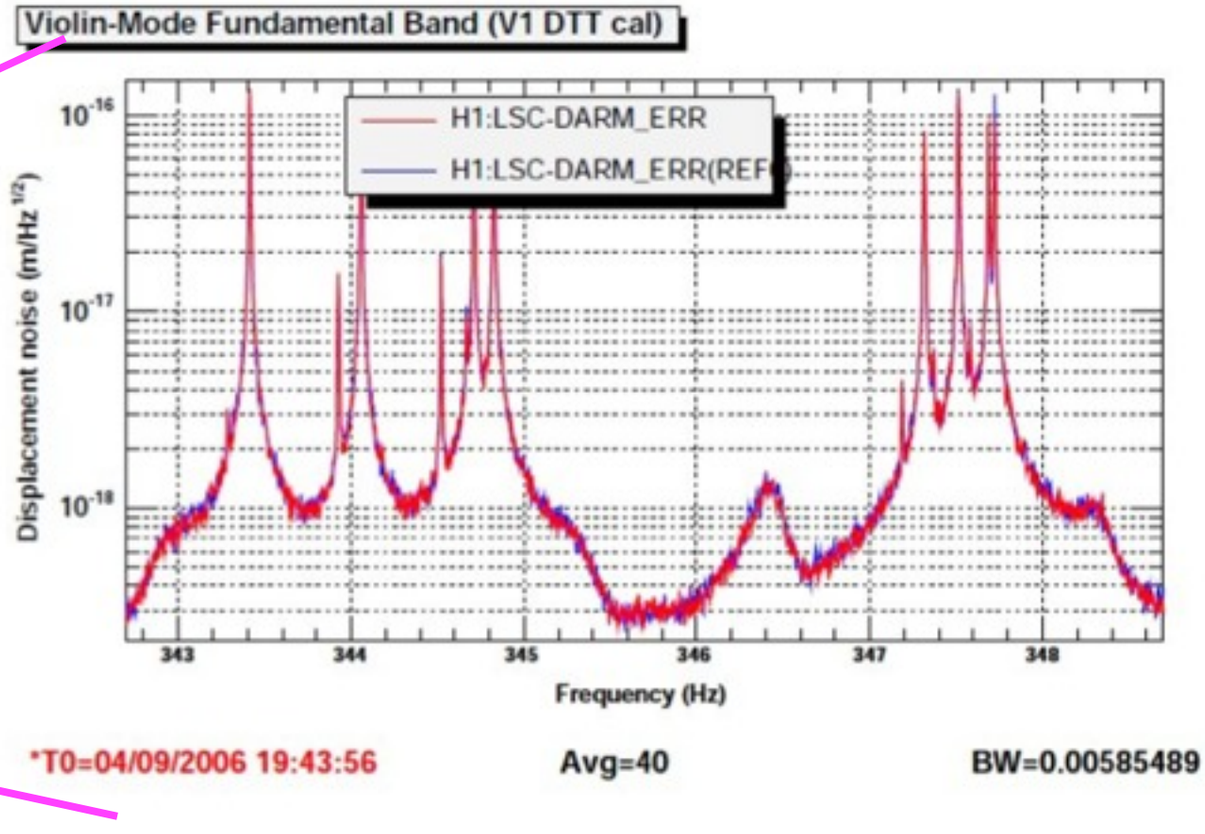


Violin modes in iLIGO

- Violin modes in iLIGO were separated into 8 due to weight balance.

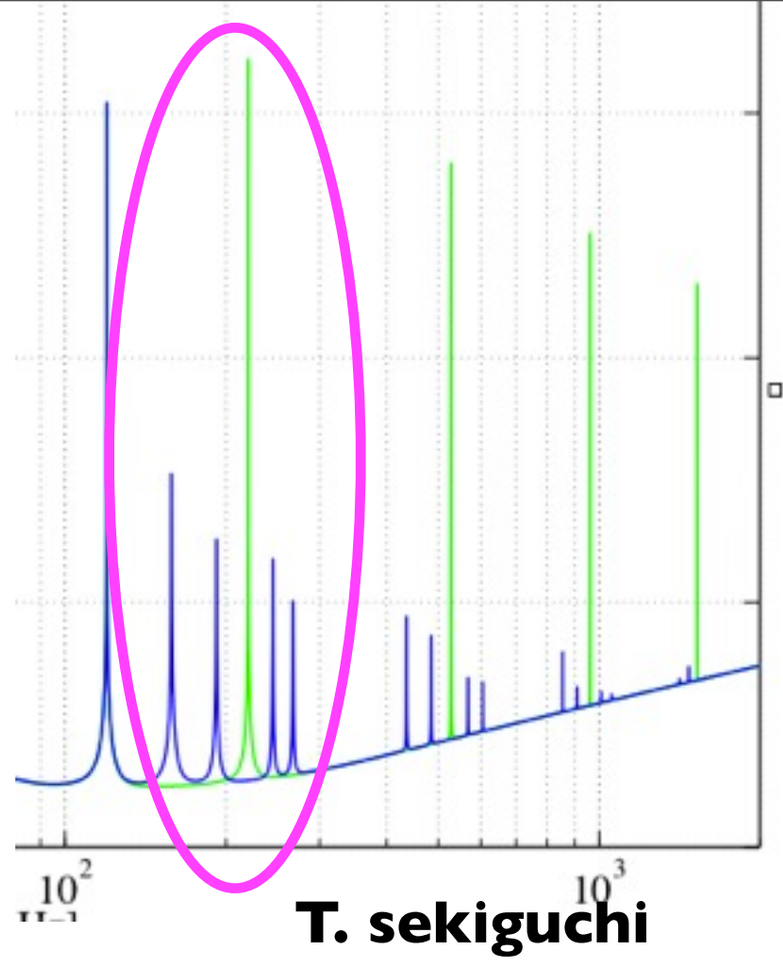






Violin mode study

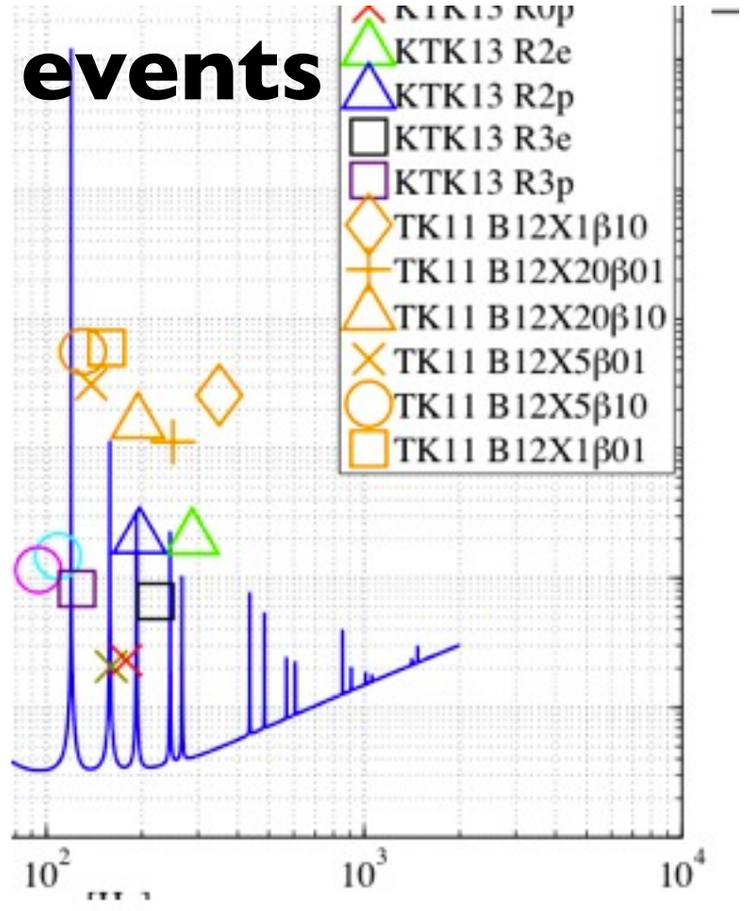
- Violin modes can be separated up to 16 due to weight balance.
- Tails of 1st violin modes make the inspiral range worse. (4sep-> 5%, 16sep->10%)



T. sekiguchi

- Detection of SN events is affected, too.
- What about excitation by spike glitches?
- How we can damp them??

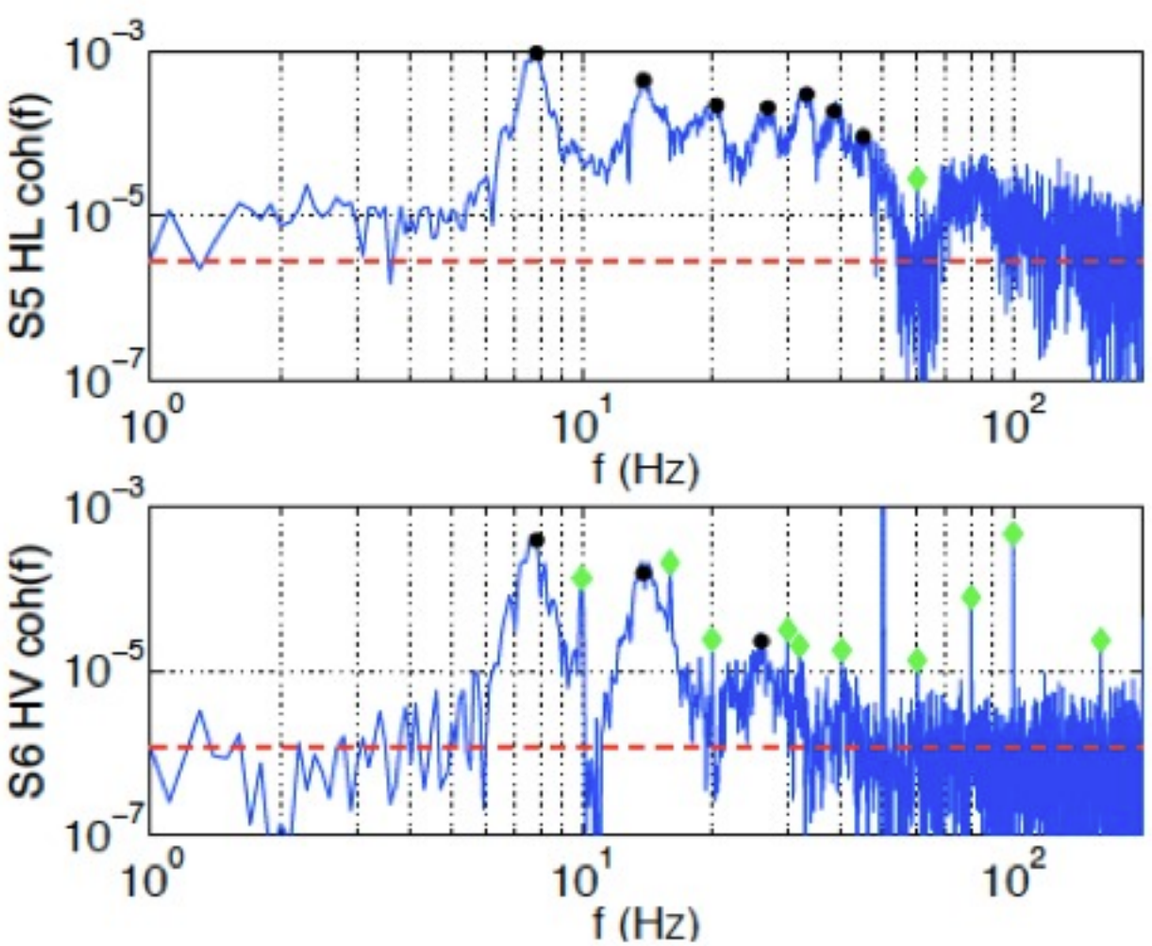
SN events

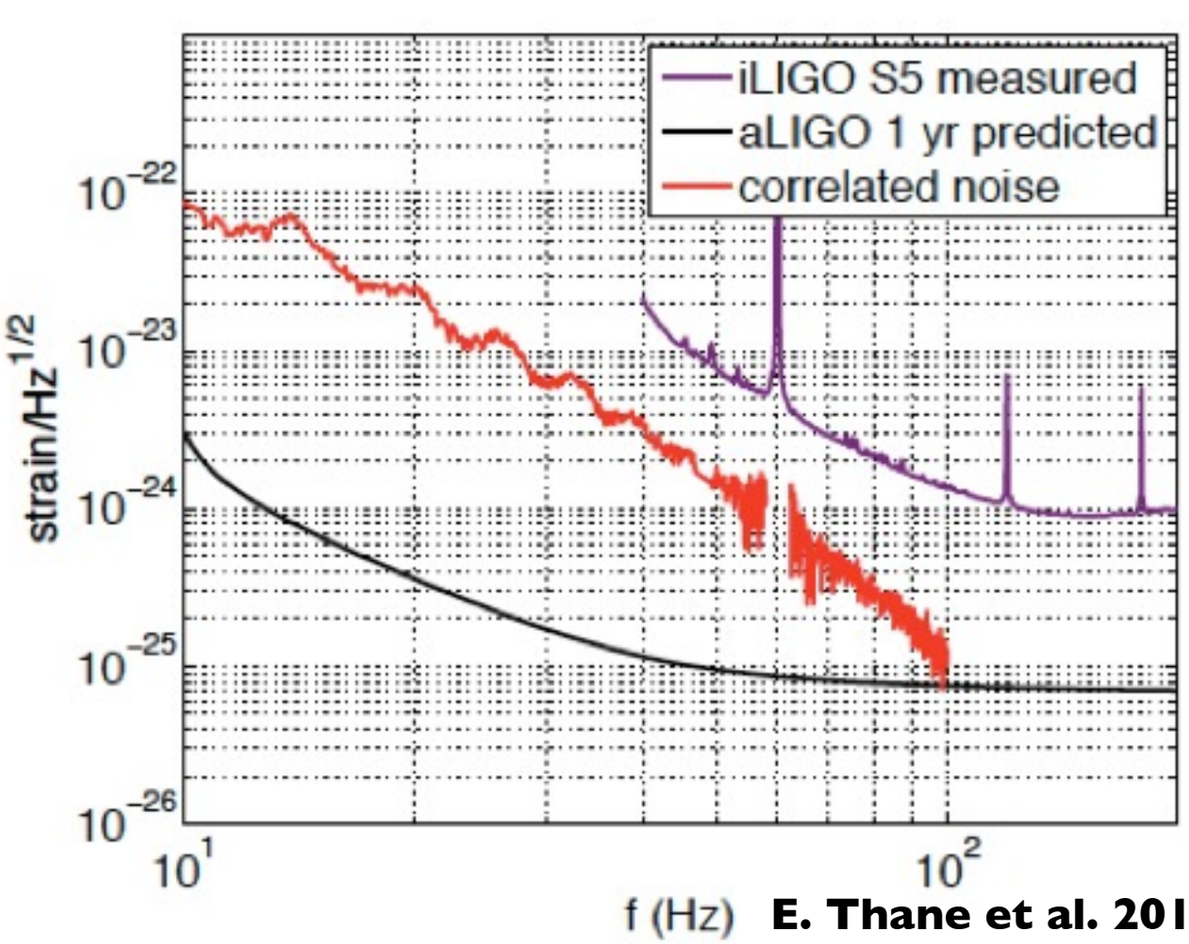


Global correlated magnetic noise

- Schumann resonance
  - very weak (0.5-1E-12T/rHz) (Earth's:1E-5T)
  - Long coherent length ~1000km
  - Correlation shows up by 1year integration

$$T(f) = 0.003(f/1\,\mathrm{Hz})^{-3}\,\mathrm{m/T}$$

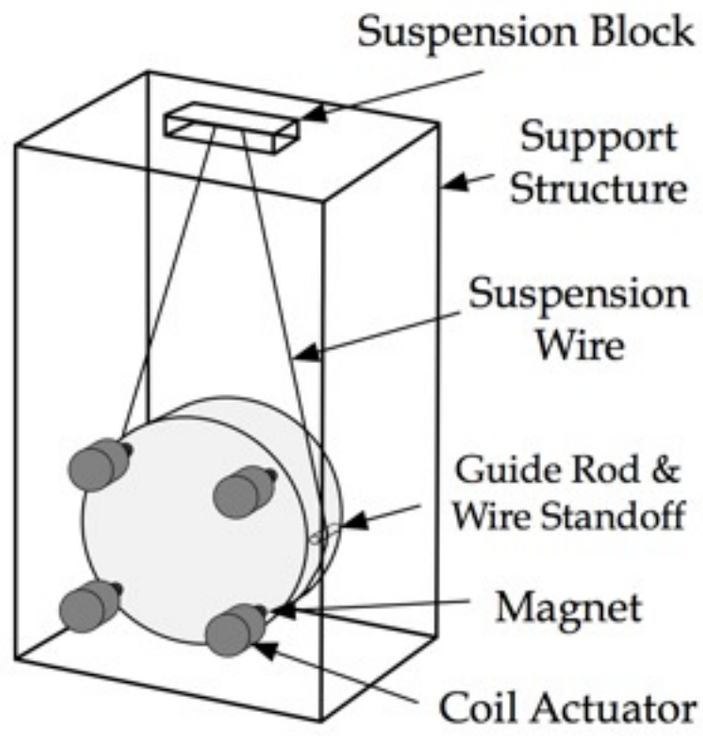




E. Thane et al. 2013

Global correlated magnetic noise

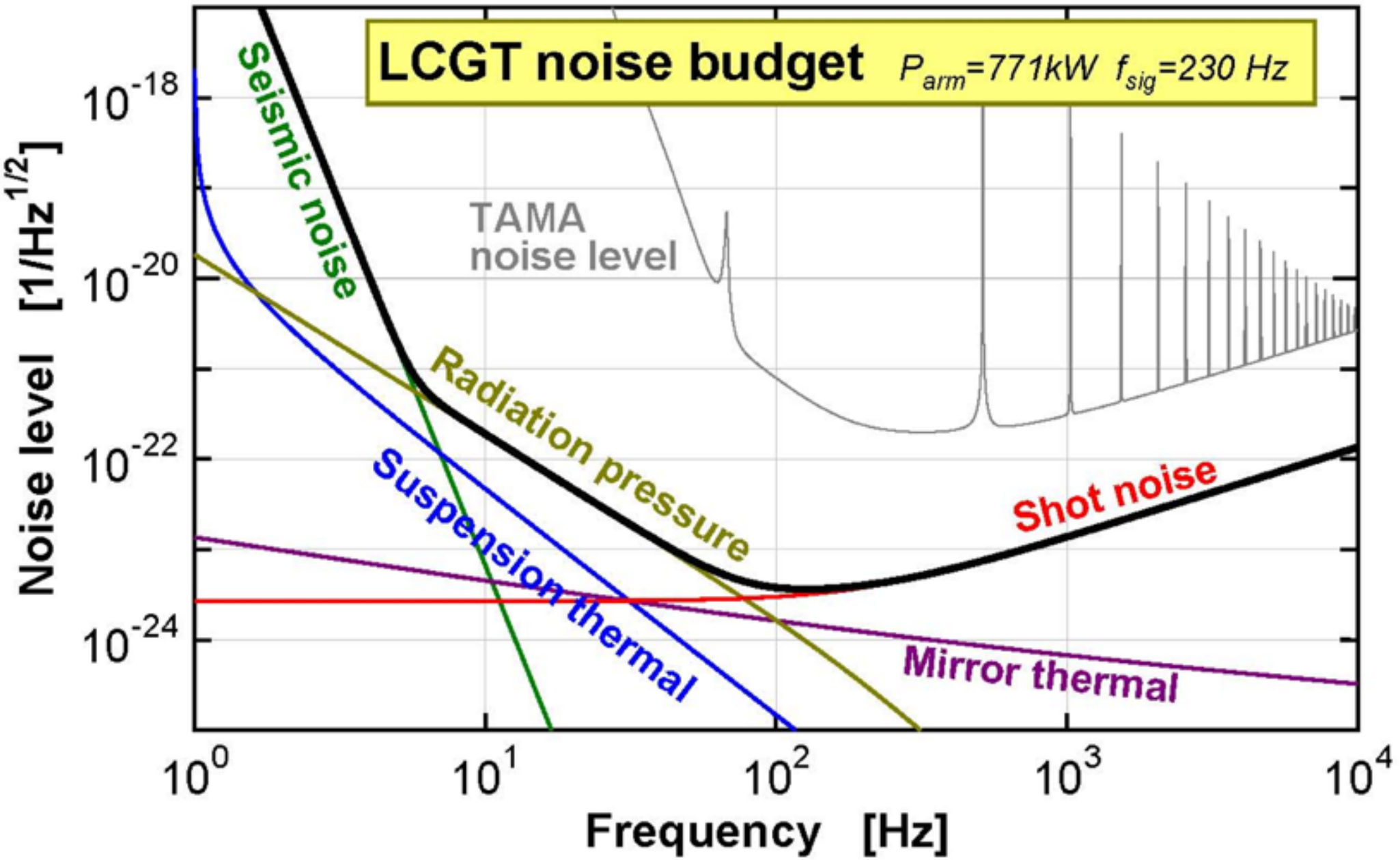
- If we use the same magnet coil actuator, then low frequency band below 100Hz is hopeless
- What is requirement of magnet?
- Other kind of actuator can we use?



Plan for measurement of magnetic field of KAGRA site

- We will measure the magnetic field in KAGRA site.
- Since KAGRA is under the mountain, the magnetic field might be different.
- To obtain the transfer function from outside to inside.

Noise Budget



Multi-channel analysis

Collaboration with KGWG

Initial Goal:
Development of a method for
localizing noise sources using auxiliary channels and PEMs.
Support to kill noise sources

- **So far several groups in LSC(including KGWG) have made their efforts on a post-processing analysis (mainly Veto) to distinguish whether triggered events are glitches or not.**
- **Our project focuses on a tool useful for commissioning.**

Project topics on-going

- **Event detection pipelines**
  (ETG comparison : KW and HHT) See Y. Kim's talk

- **Future selection statistics (t- or z- statistics)**

- **To measure channels' responsibility for noise events, then Classification of noise events**

Integrating these information, localize the noise sources.

First exam is to localize hardware injection we generated during last CLIO operation.

Mini meeting this morning
We will have bi-week meeting to get good scientific outcome.

Other activities

- Collaboration with UTB detchar team
- Collaboration with LVC detchar group(Global magnetic noise)
- ...