Status of KAGRA detector characterization

Kazuhiro Hayama
on behalf of DET team

Detector Characterization

The purpose is diagnostics of

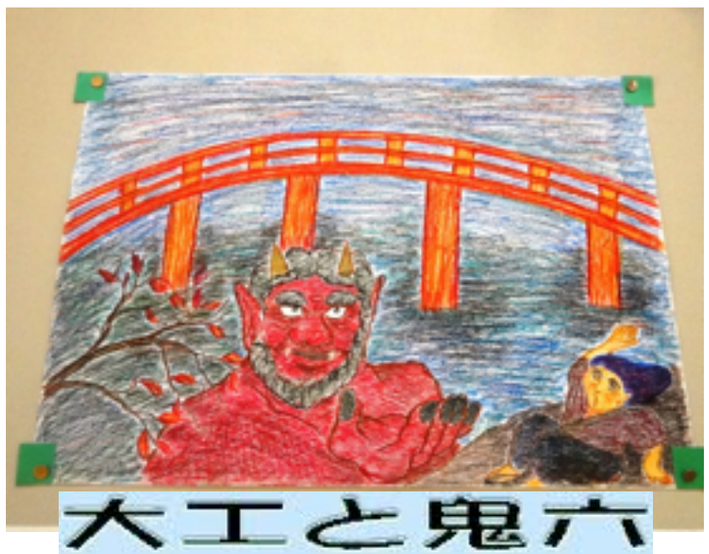
- stationary noise
- non-stationary noise

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

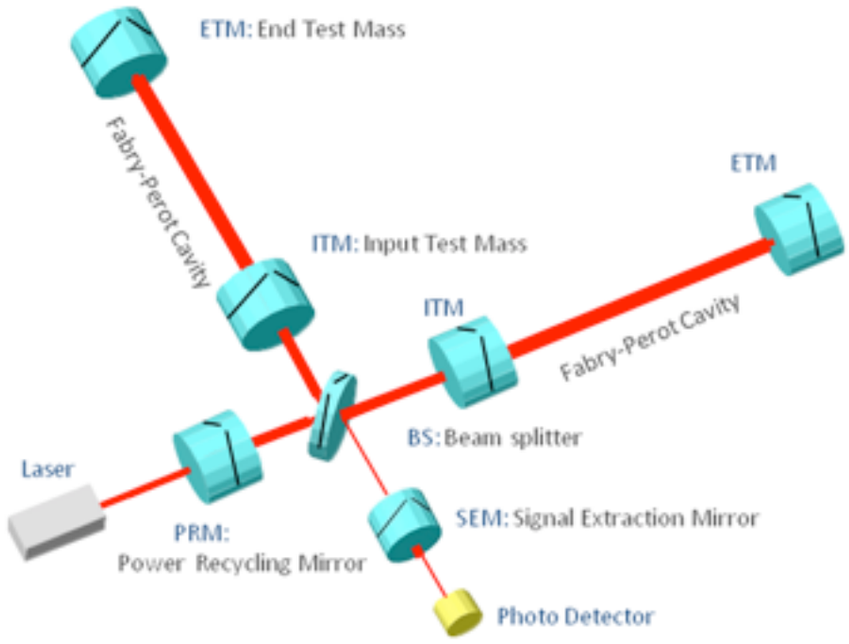
Our dream:
Stable, high sens., glitch-free, GW telescope

Try to build a bridge between DA and Detector

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



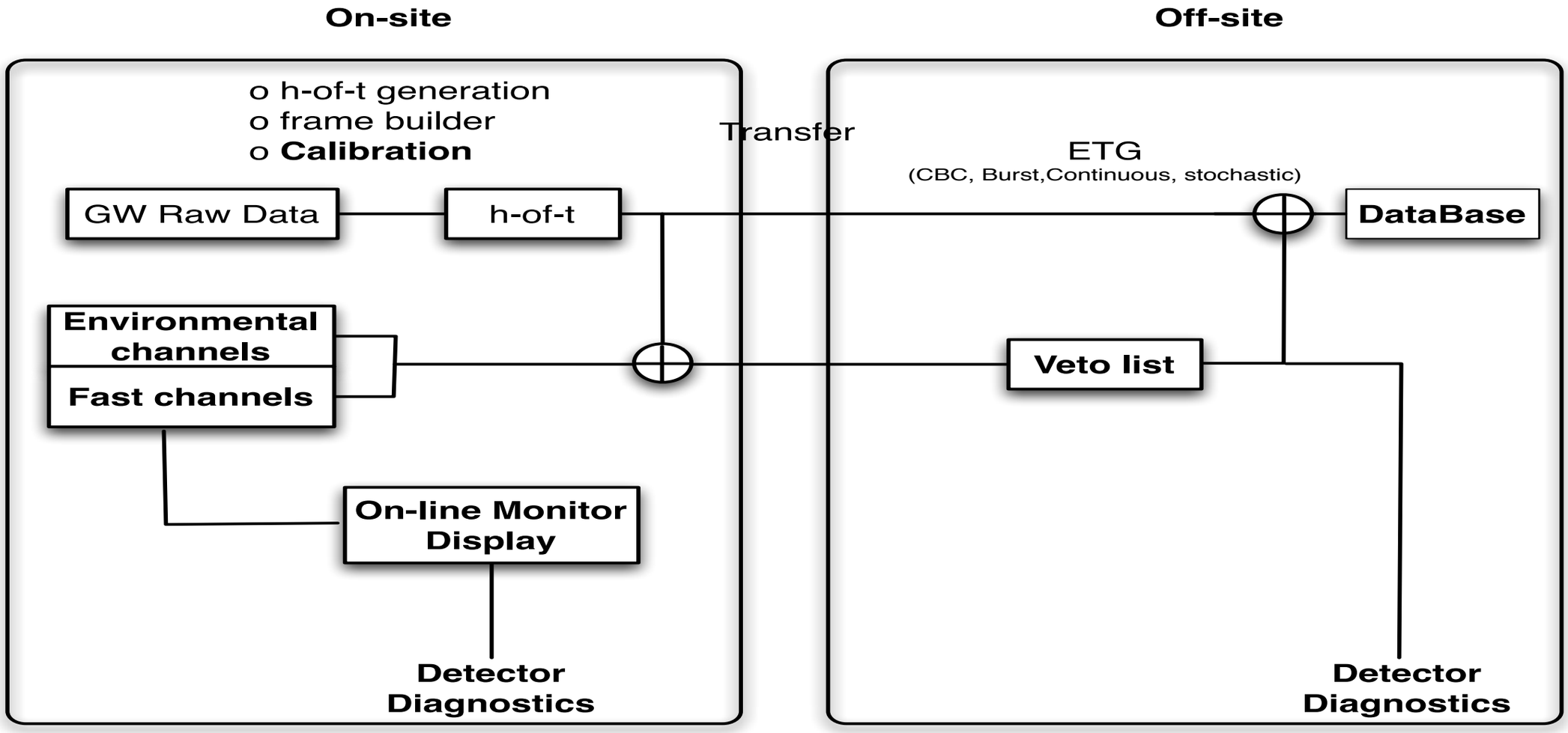
Carpenter and Oniroku



Detector and Data characterization

- Diagnose KAGRA instruments using
- Characterize KAGRA Data using

Same monitoring system



Software development

During commissioning

- subsystem diagnostics
  - Method for localization of noise sources
  - Evaluation of data quality
  - Sophistication of on-line monitor display

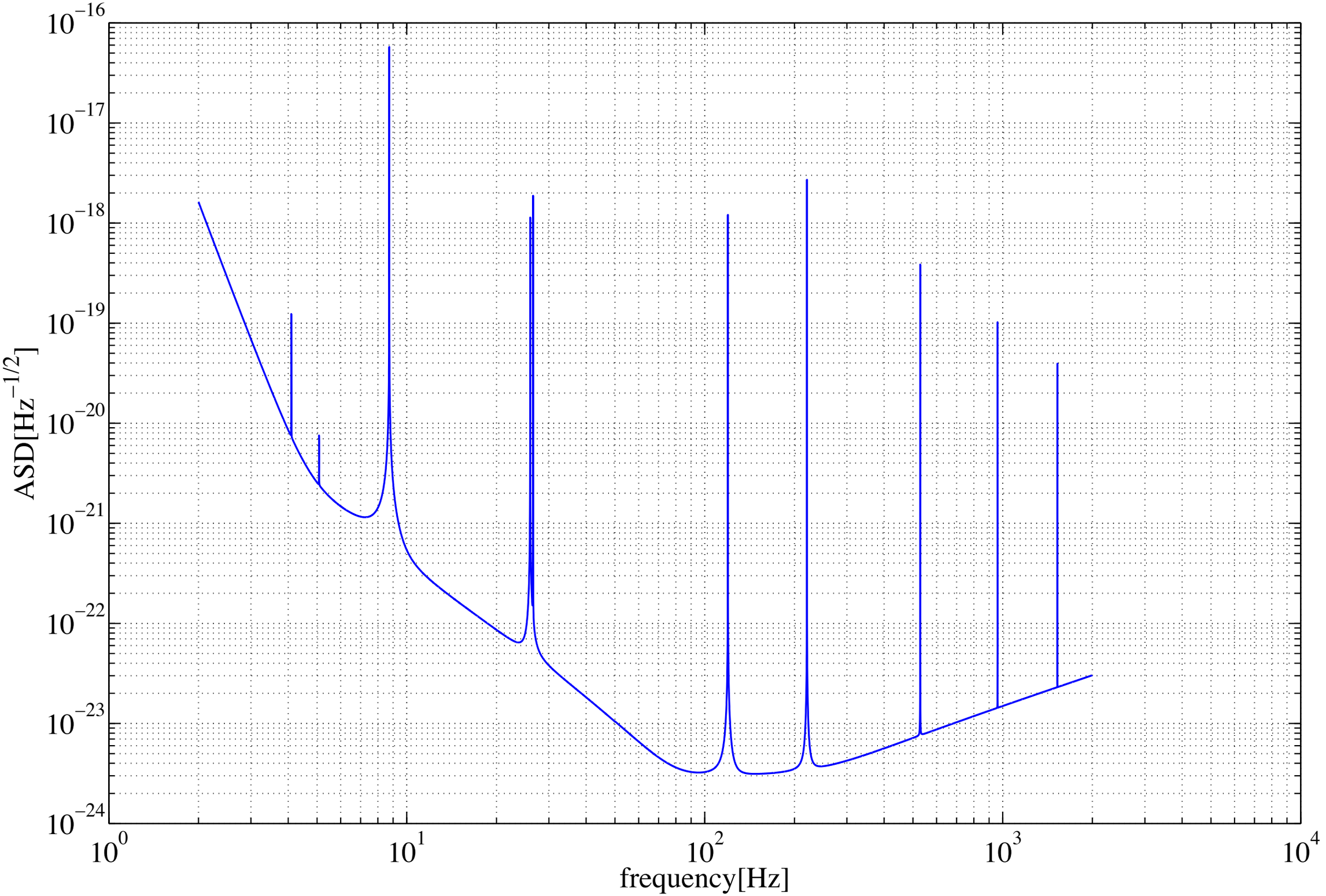
During Observation

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

Characterization of KAGRA

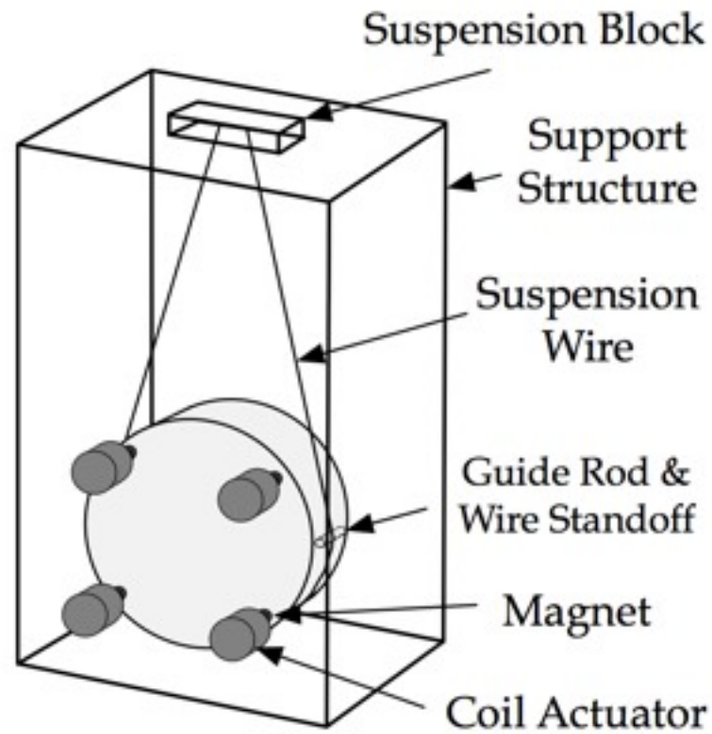
- Violin mode
- Globally correlated magnetic noise

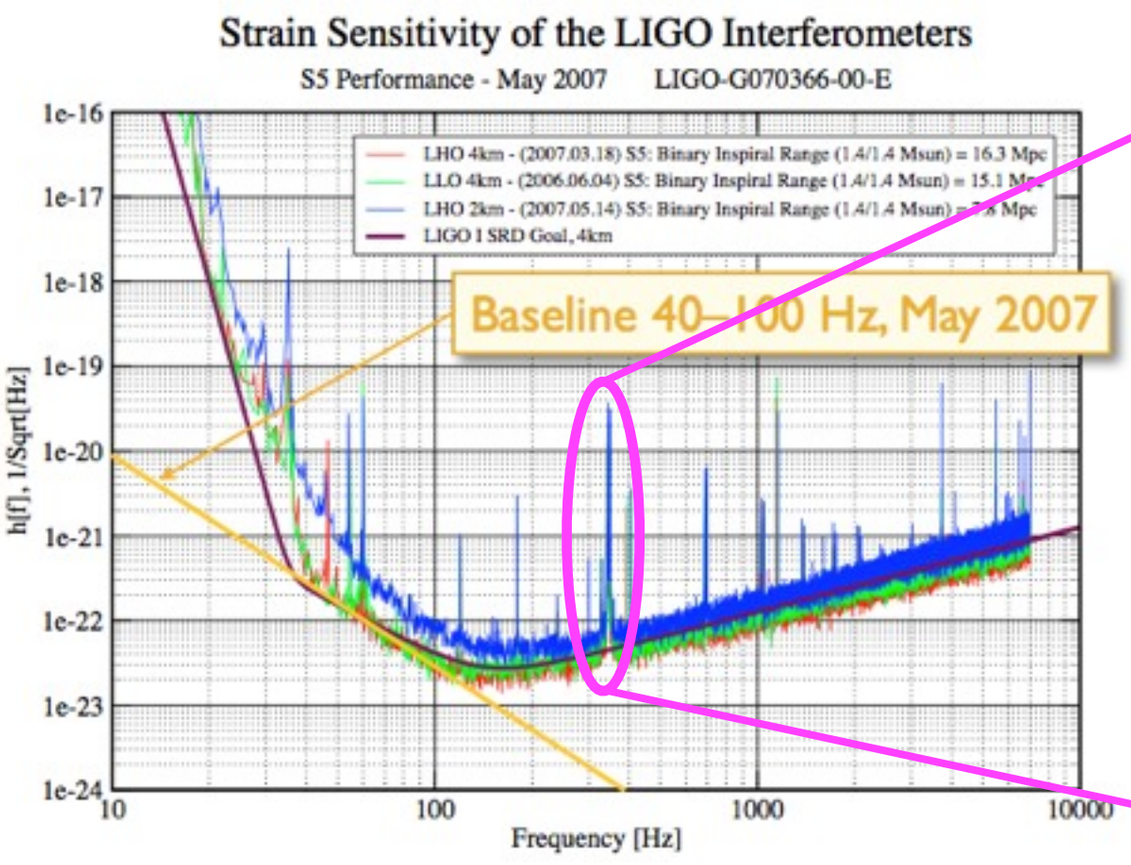
KAGRA sensitivity (Not Official)

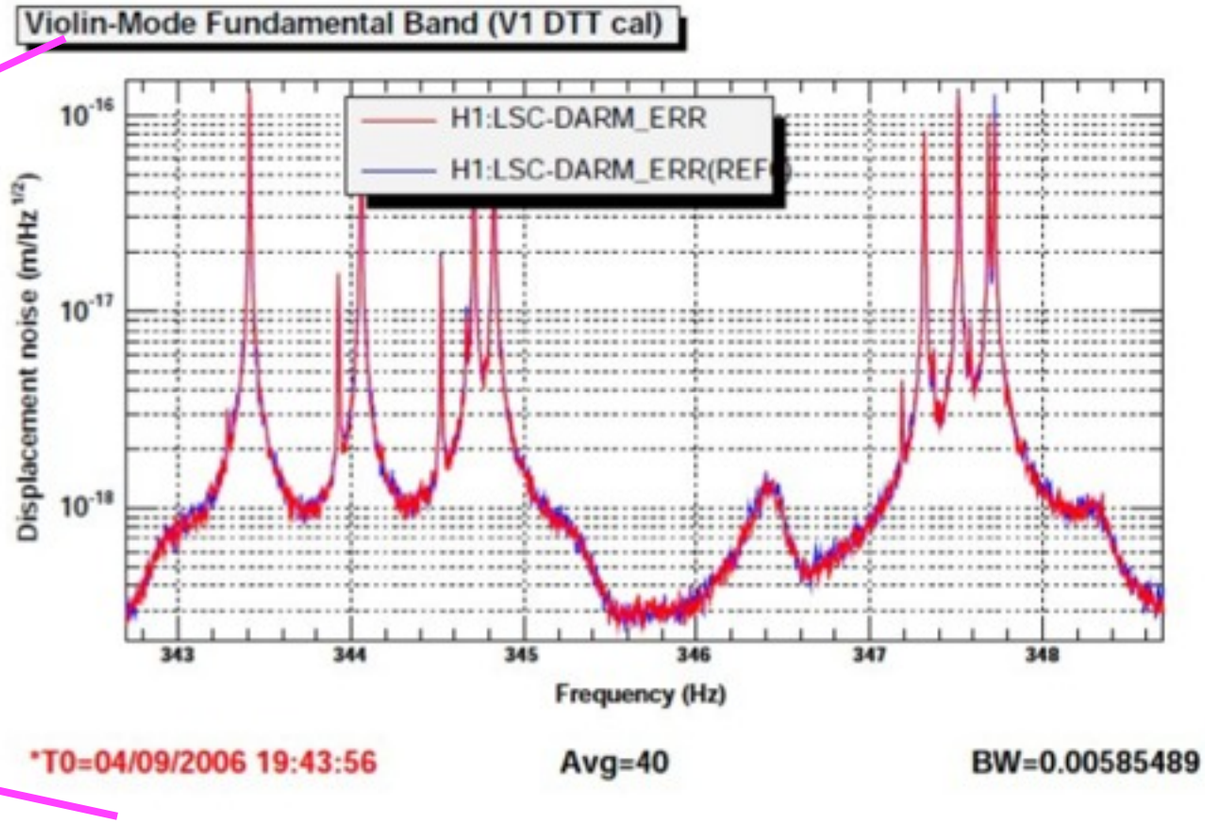


Violin modes in iLIGO

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

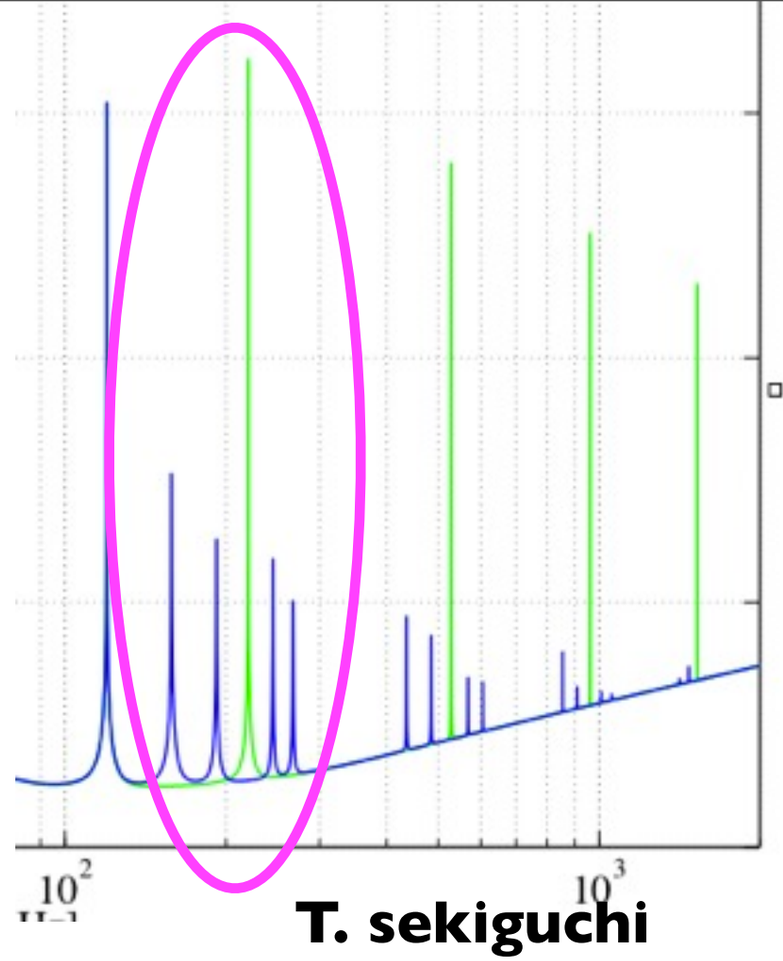






Violin mode study

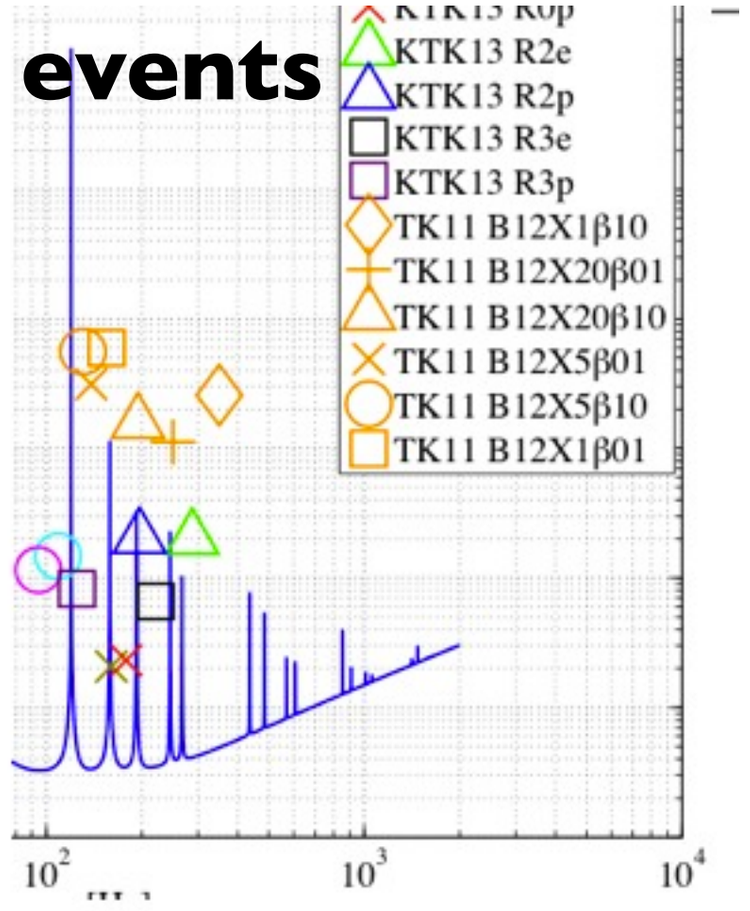
- Violin modes can be separated up to 16 due to weight balance.
- Tails of 1st violin modes make the inspiral range worse. (4sep-> 5%, 16sep->10%)



T. sekiguchi

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

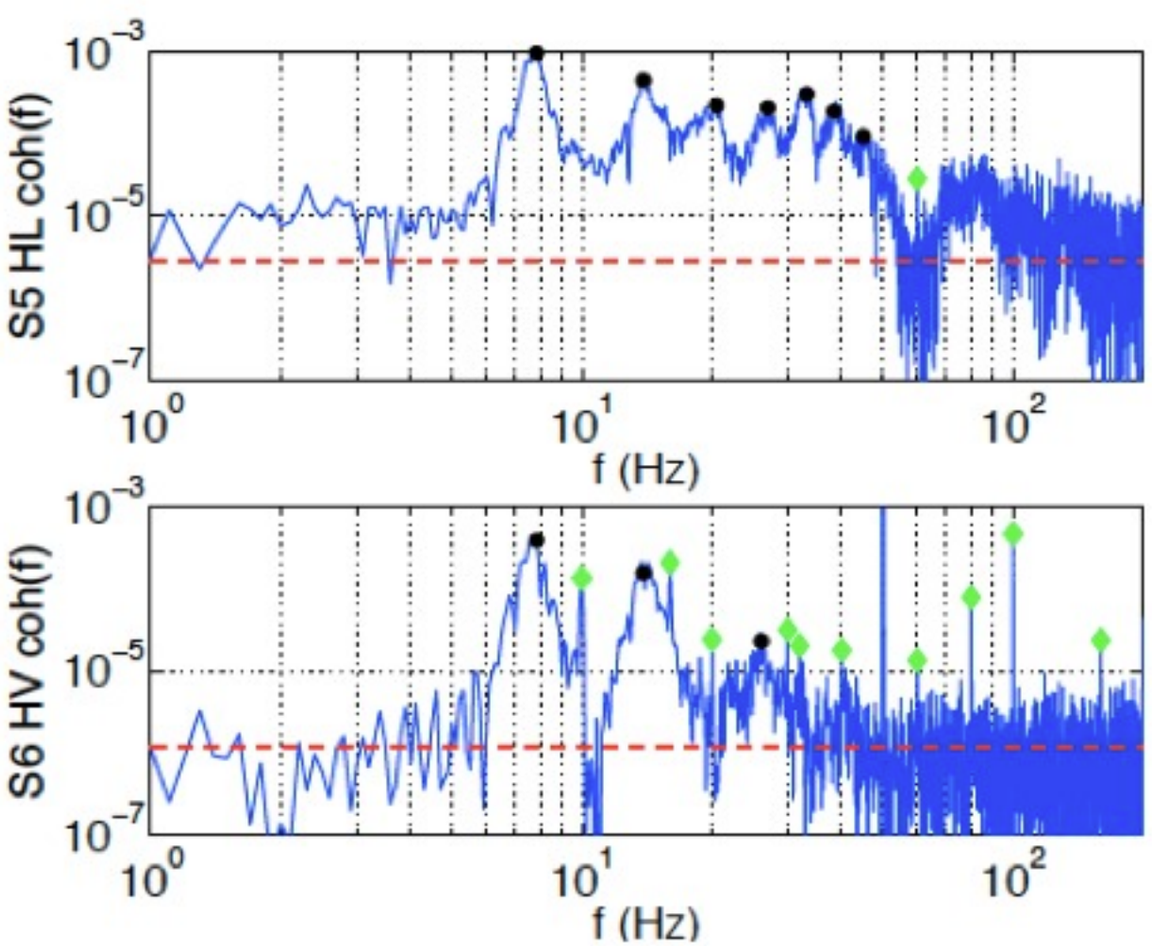
SN events

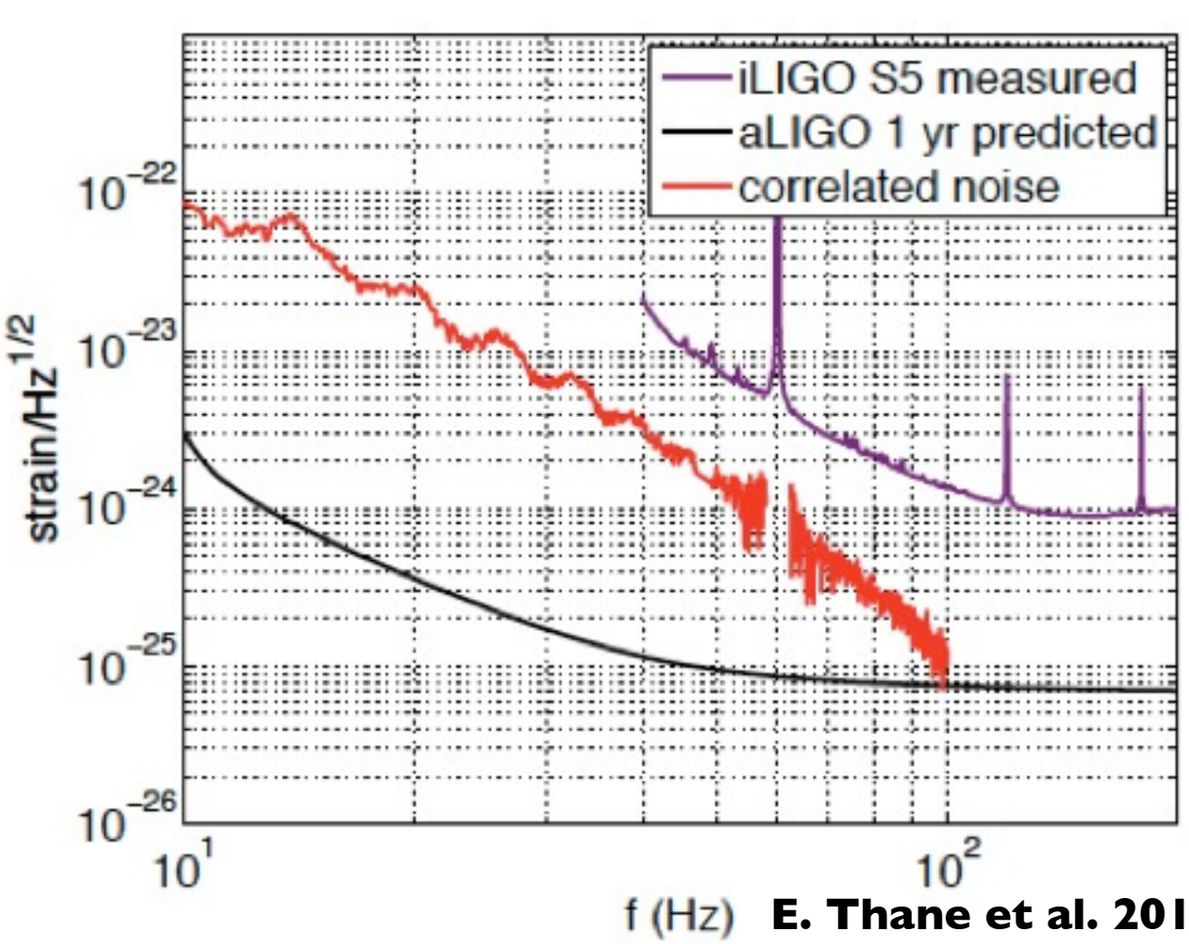


Global correlated magnetic noise

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

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





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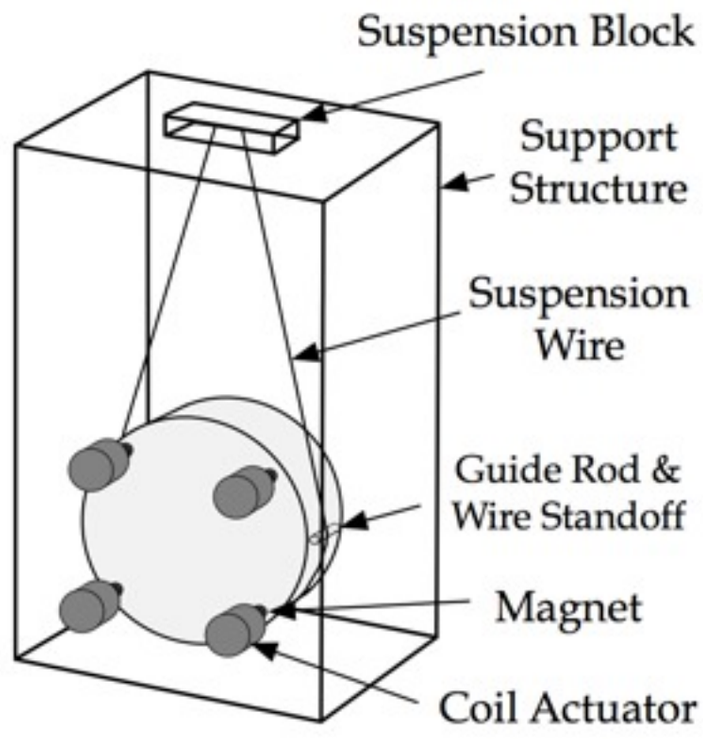
Global correlated magnetic noise

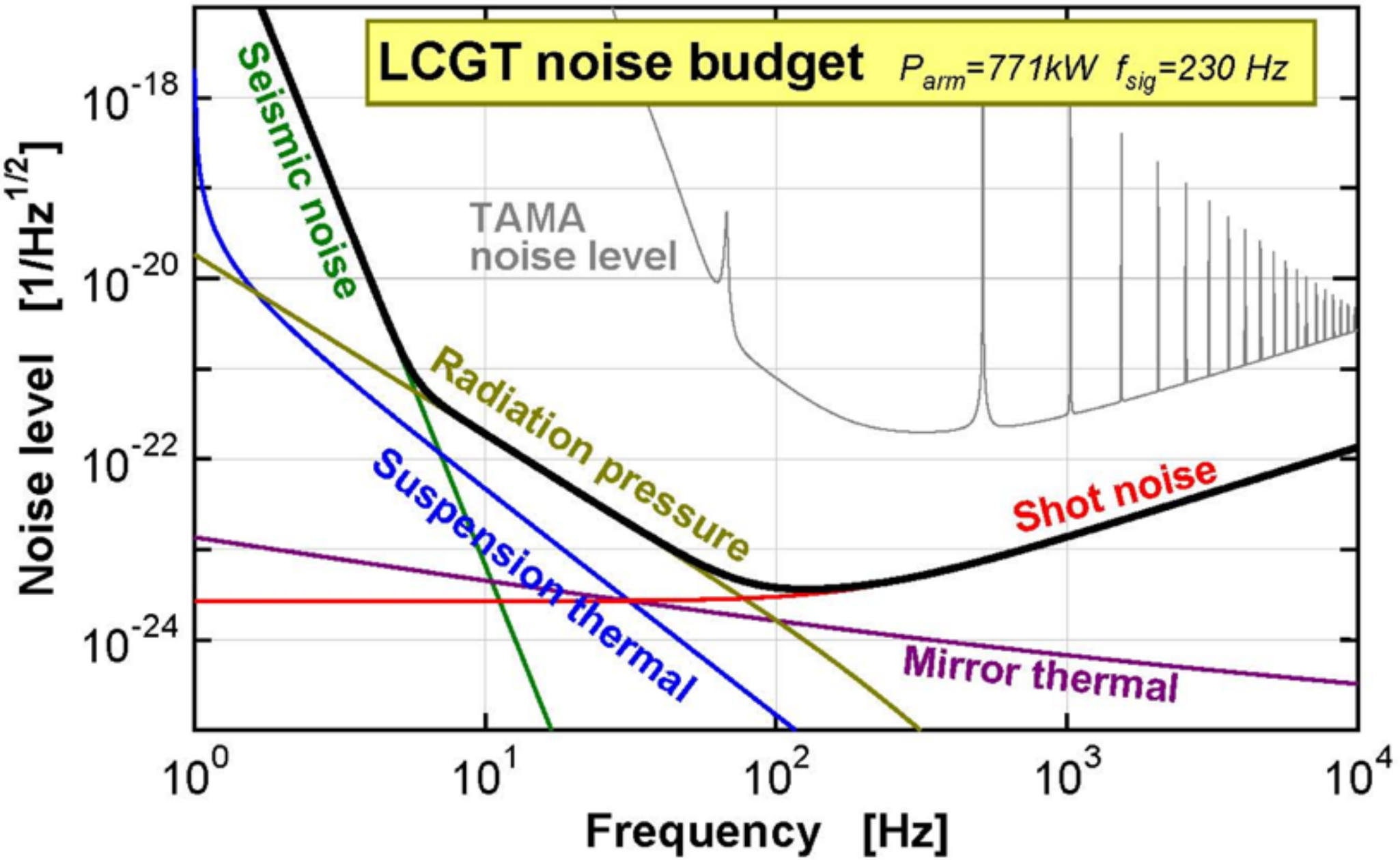
- If we use the same magnet coil actuator, then low frequency band below 100Hz is hopeless
- What is requirement of magnet?
- Other kind of actuator can we use?



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

- Event detection pipelines
  ETG comparison KW HHT preliminary result obtained

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

- To measure channels" responsibility for noise events
  Classification of noise events

  Integrating these information, localize the noise sources.

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

Other activities

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