

# **Measurement of Magnetic field around KAGRA**

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Nishizawa, Miyakawa, Miyoki, Yano**

37km from the Nippon Sea

Ikenoyama Mt.

1000m Underground

Mozumi area

一(ichi)  
分(bu)  
厘(rin)  
毛(mou)  
糸(shi)  
忽(kofsu)  
微(bi)  
纖(sen)  
沙(sya)  
塵(zin)  
埃(ai)  
渺(byou)  
漠(baku)  
模糊(moka)  
逡巡(syunjun)  
須臾(syuyu)  
瞬息(syunsoku)  
彈指(danshi)  
刹那(setuna)  
六德(riittoku)

LCGT project

3 km

LCGT Image

XMASS

Kamland

CLIO

SG

Super Kamiokande

358m Altitude

Atotsu Entrance

Atotsu river

Takahara river



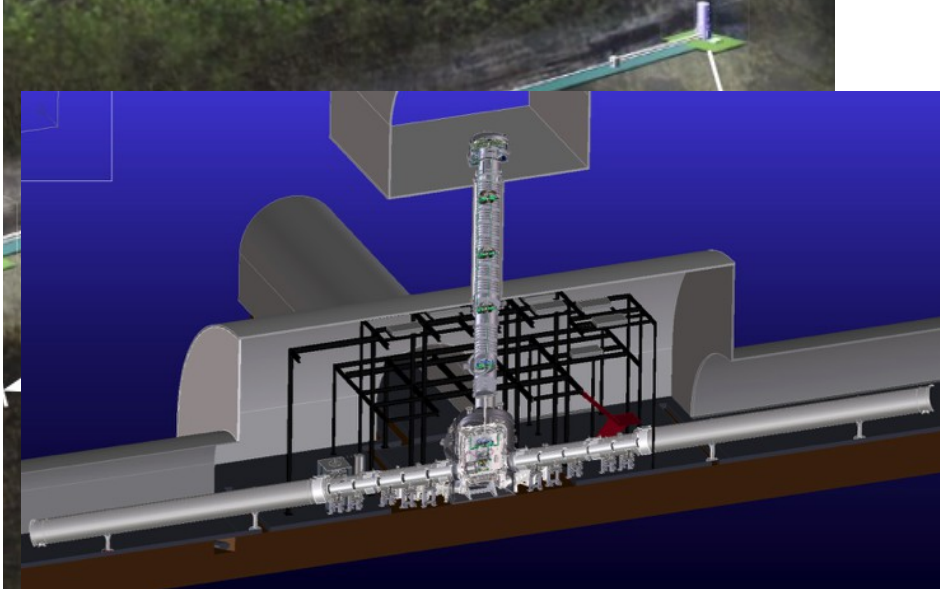
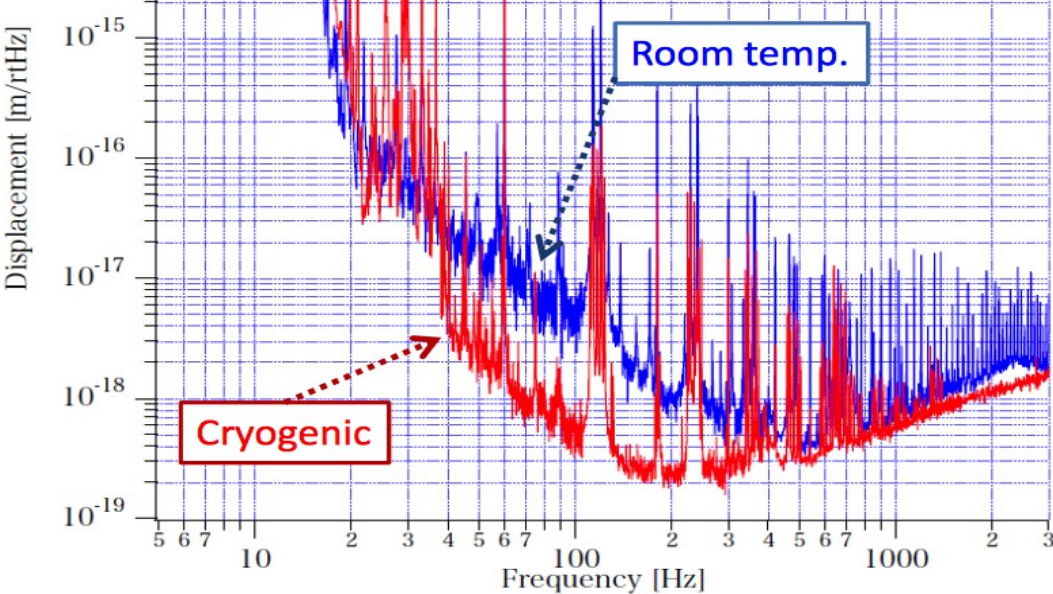
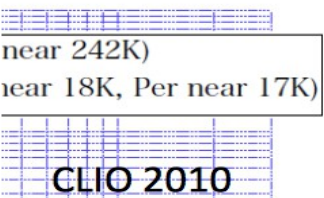
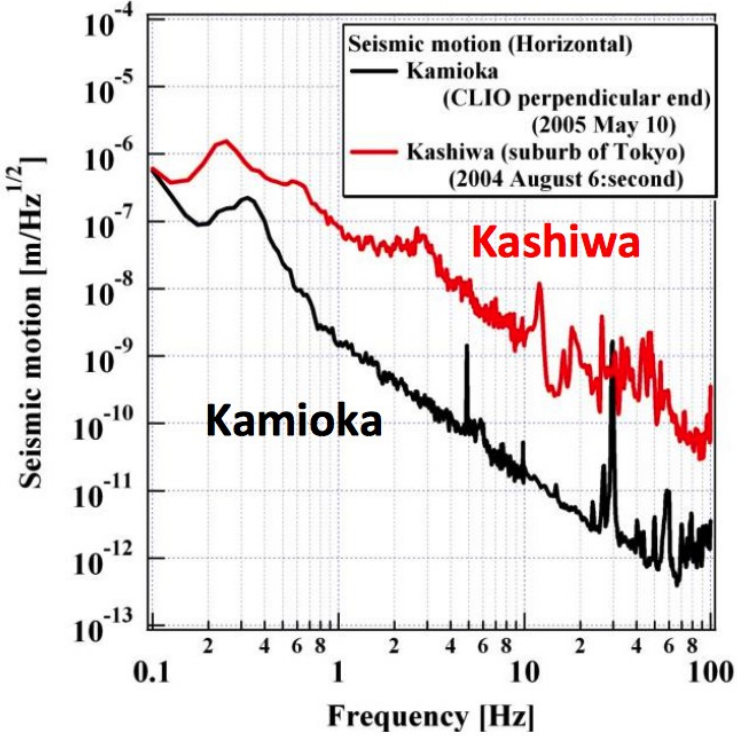
to Takayama

to Tateyama

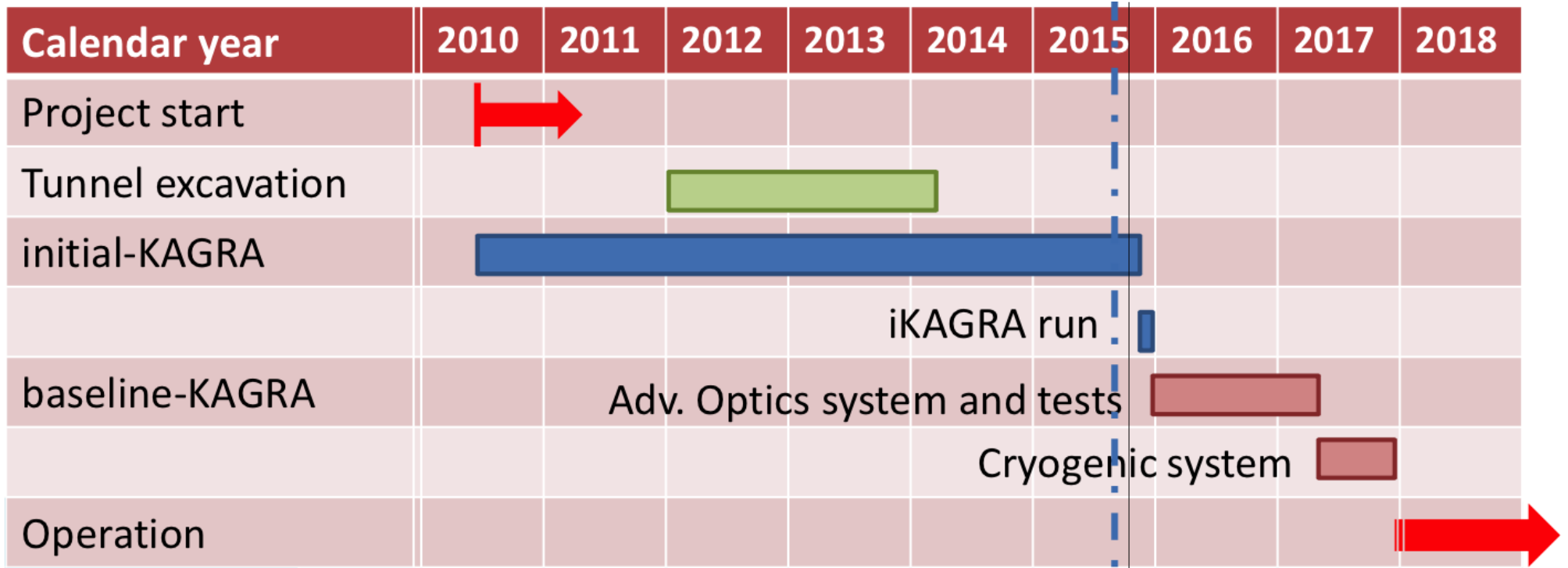
1京  
100兆  
10兆  
1兆  
100億  
10億  
1億  
1000万  
100万  
10万  
1万  
1000  
100  
10  
1  
1/10  
1/100  
1/1000  
1/1万  
1/10万  
1/100万  
1/1000万  
1/1億  
1/10億  
1/100億  
1/1000億  
1/1兆  
1/10兆  
1/100兆  
1/1000兆  
1/1京  
1/10京  
1/100京  
1/1000京

# KAGRA

- Arm: 3 k m
- Underground
  - Reduction of Seismic noise
- 20K sapphire mirror
  - Reduction of thermal noise



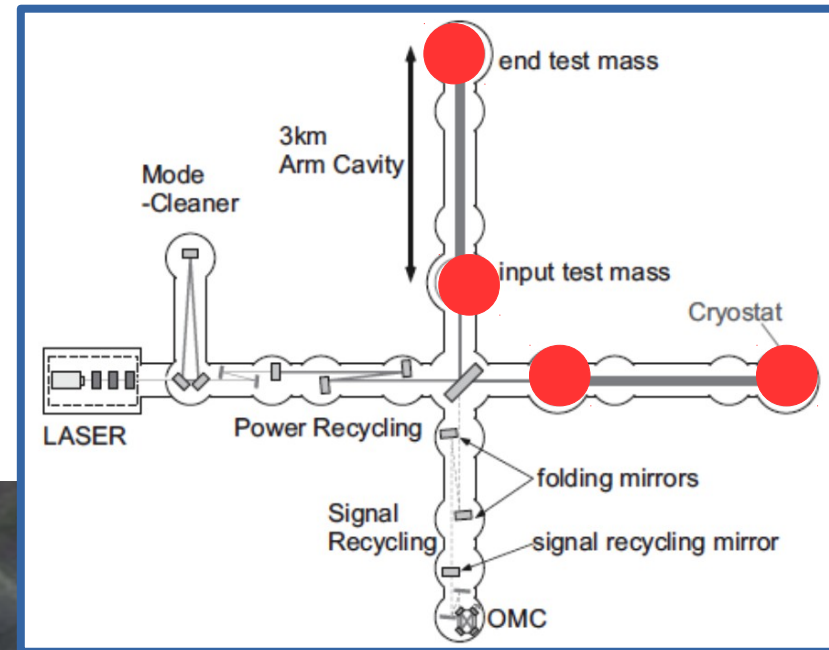
# KAGRA Schedule



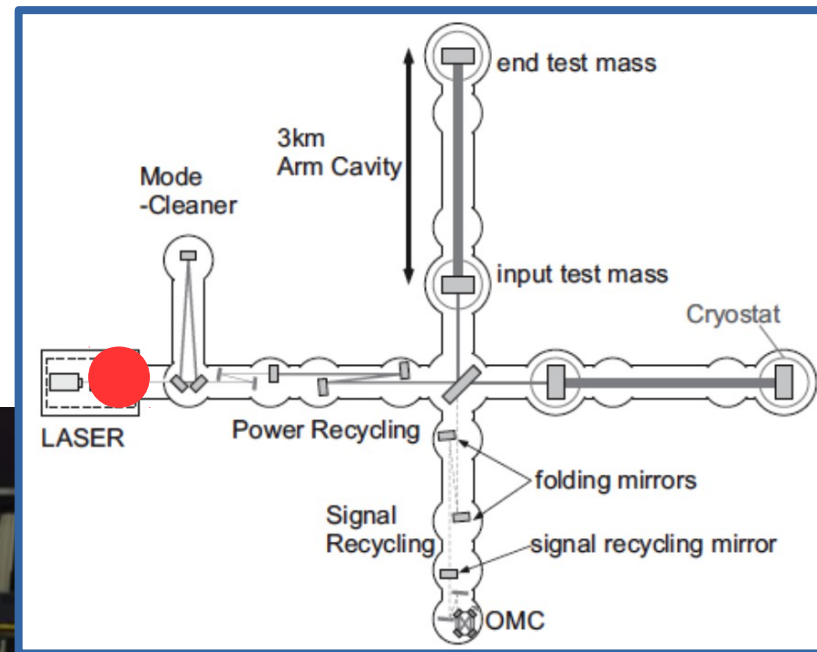
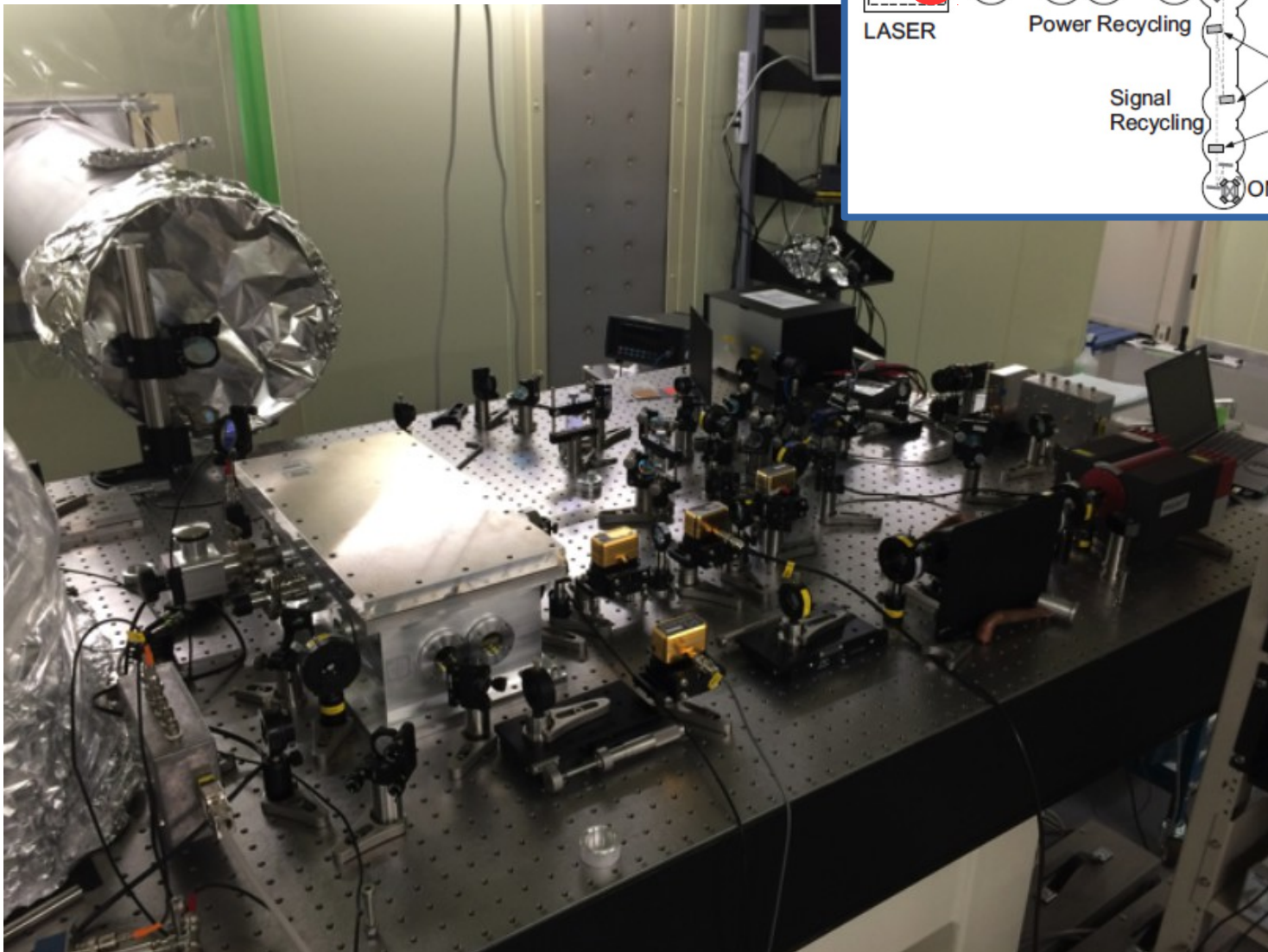
# Excavation (2012-2014)



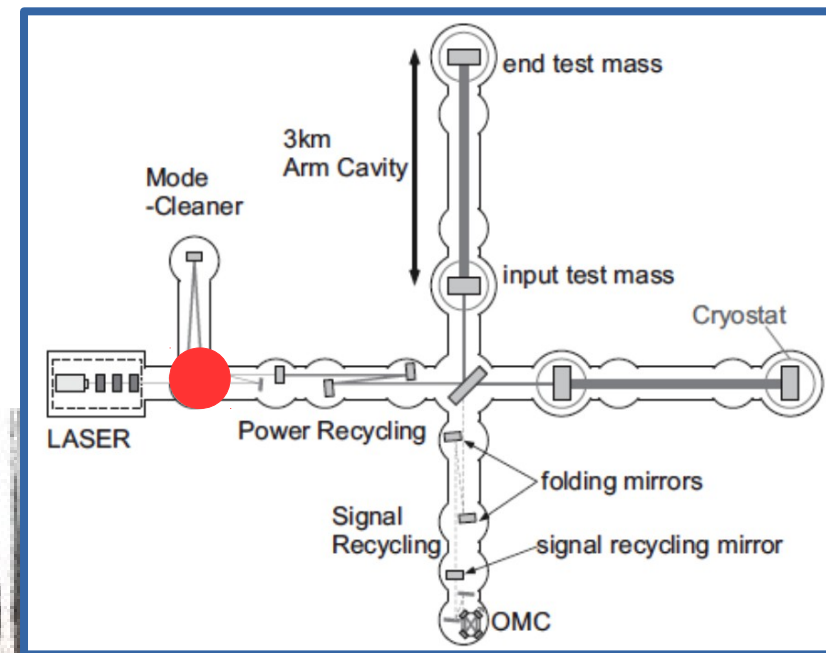
# Cryostat installed



# Pre-Mode Cleaner Locked



# Mode Cleaner(2015 Dec)





**A lot of task on going  
for engineering run in March**

# Motivation of the measurement of the magnetic field

- **How strong the magnetic field due to the Schumann resonance at the KAGRA site.**
- **The underground can shield the magnetic field?**
- **How is the geomagnetic field at the KAGRA site?**

# Magnetometer and DAQ

**Phoenix geophysics  
AMTC-30**



**MTU-5A**

**DAQ**

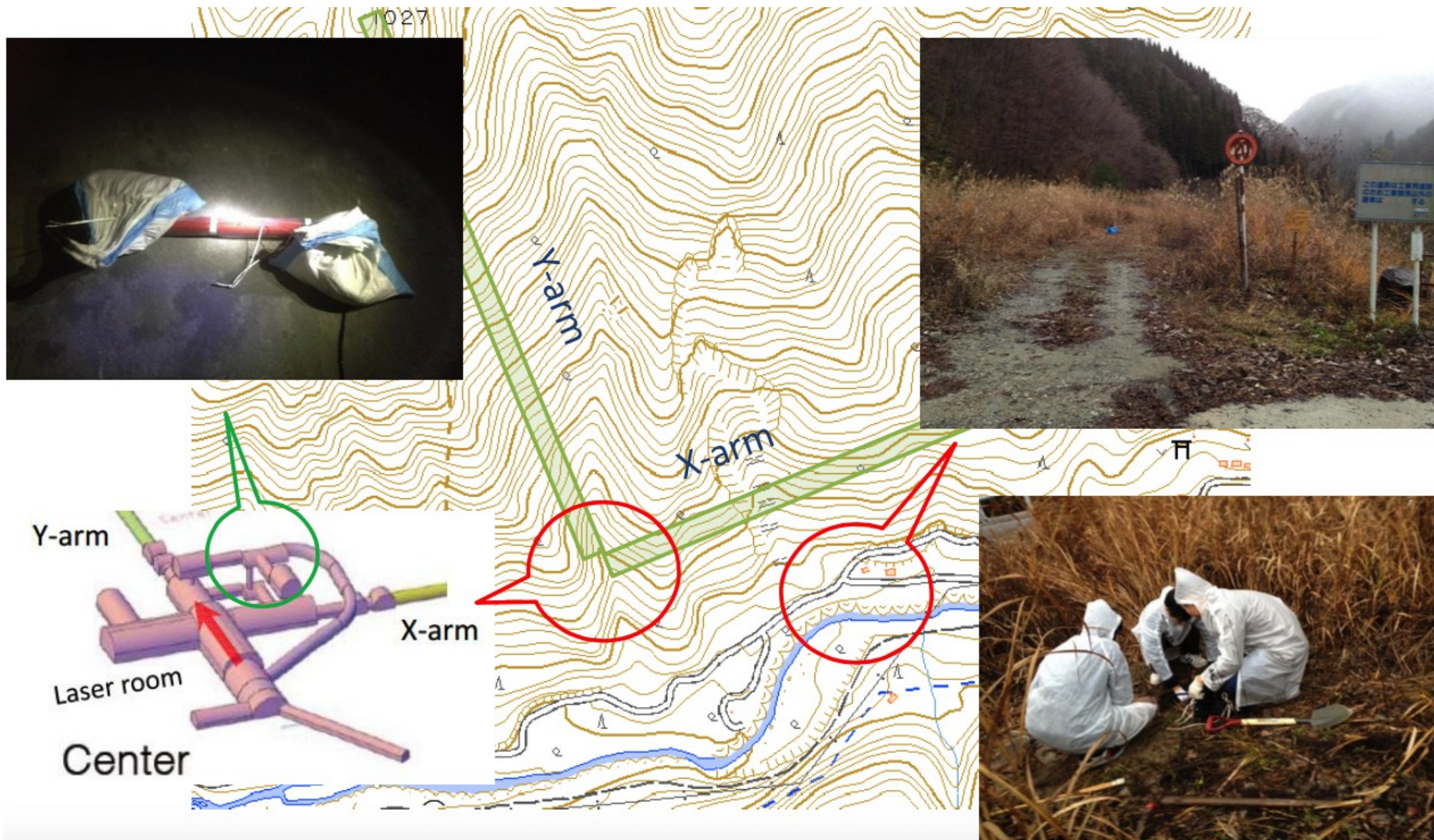


**Magnetotellurics method**

**Frequency band:  
1-10000Hz**

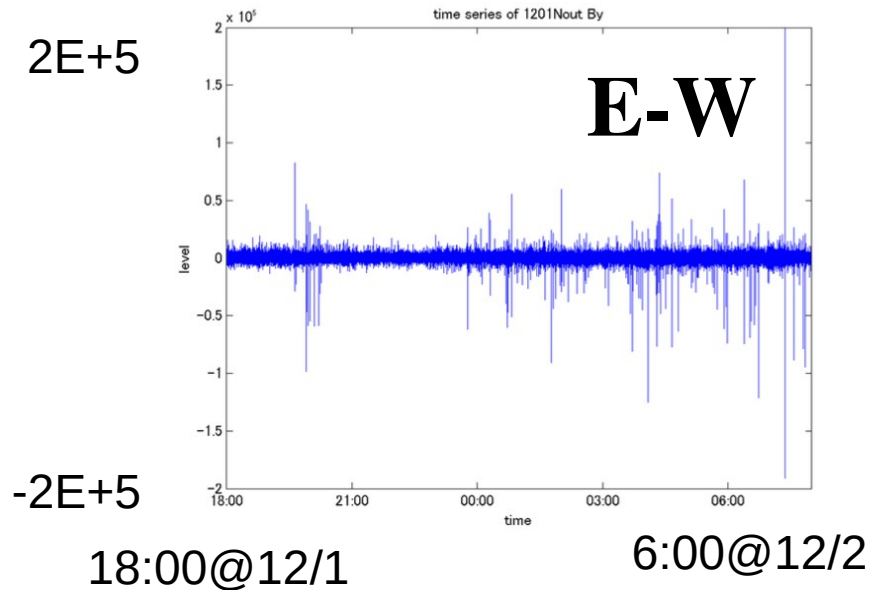
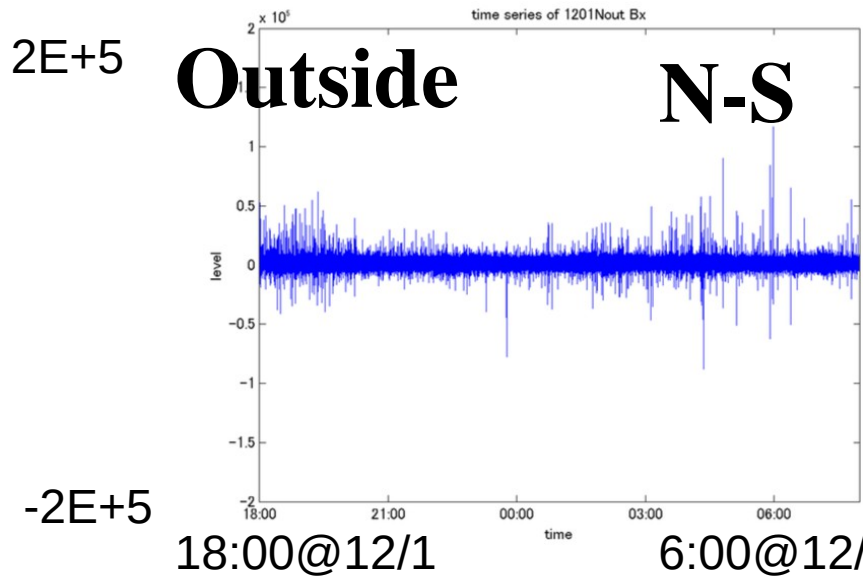
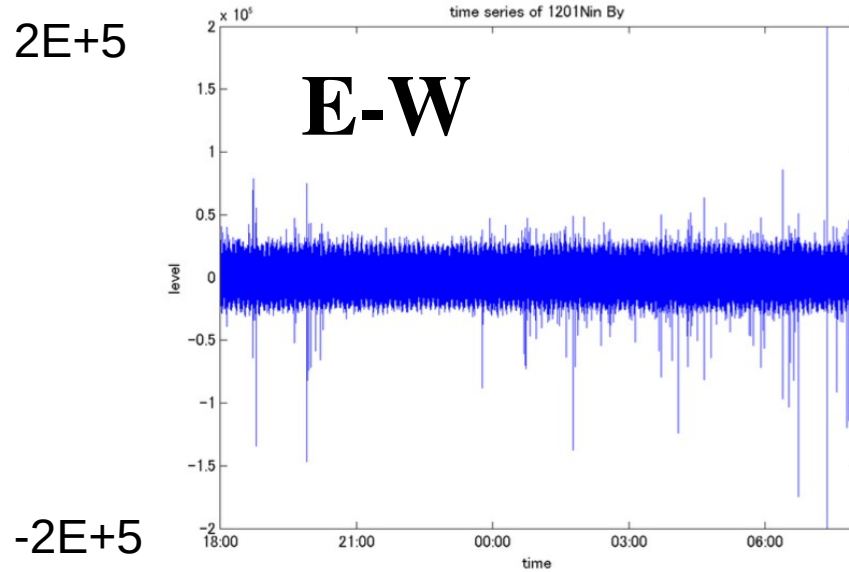
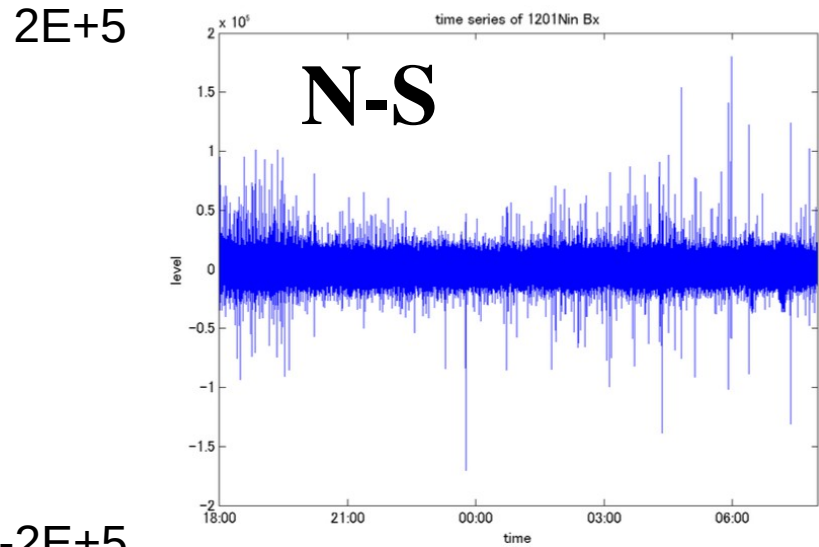
**Sensor noise  
 $1E-6nT/Hz^{-1/2}$**

# 2015 12/1-12/3

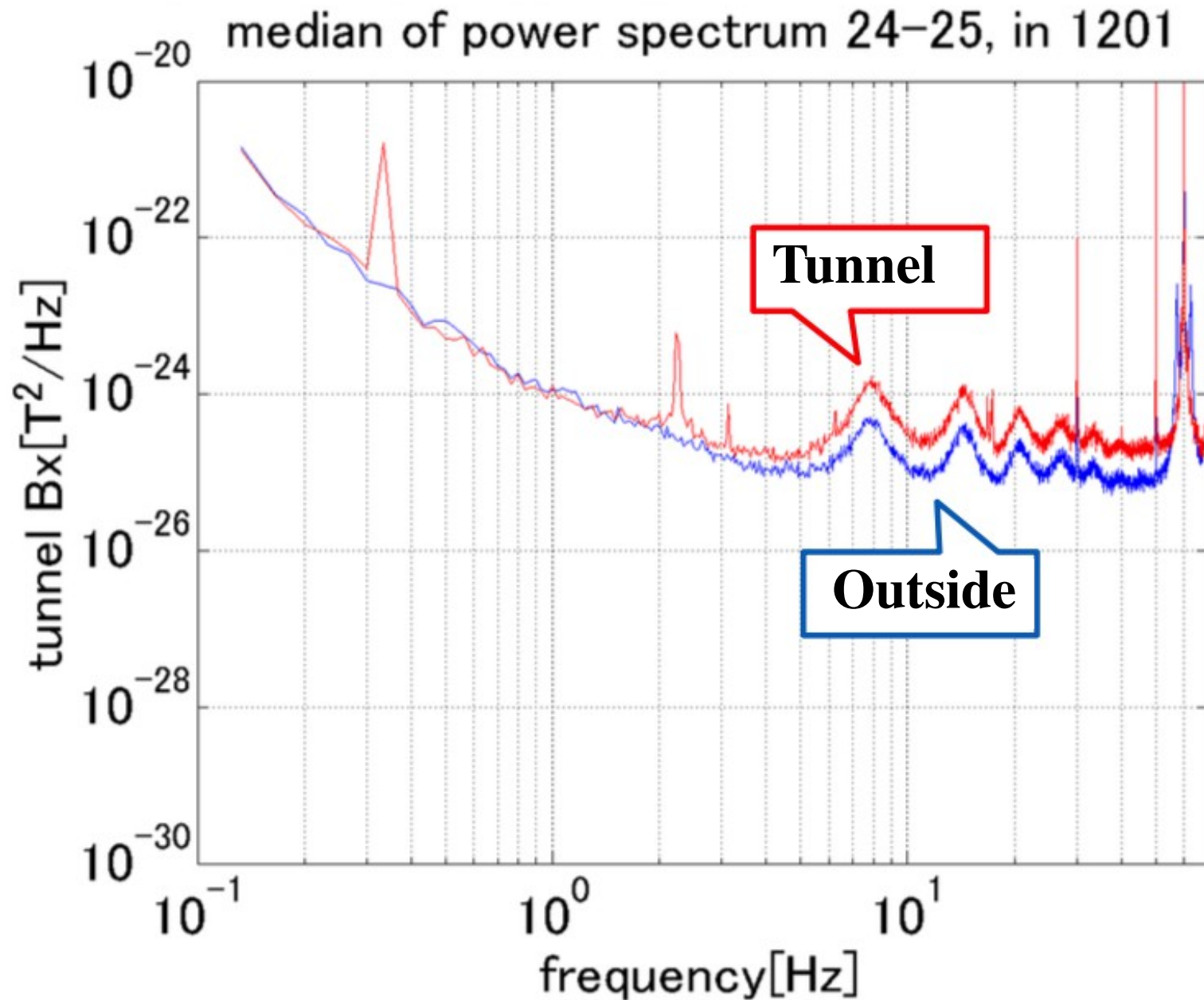


# 18:00, 12/1 – 6:00, 12/2

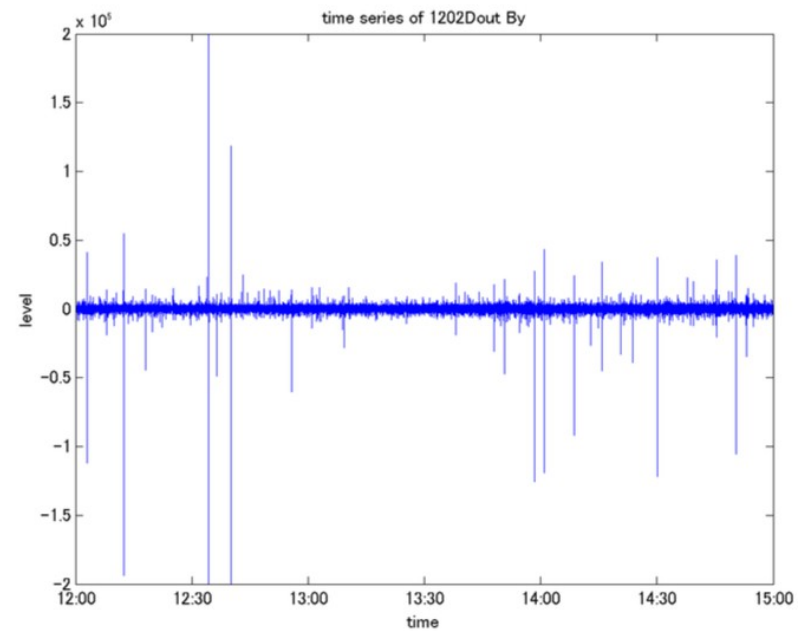
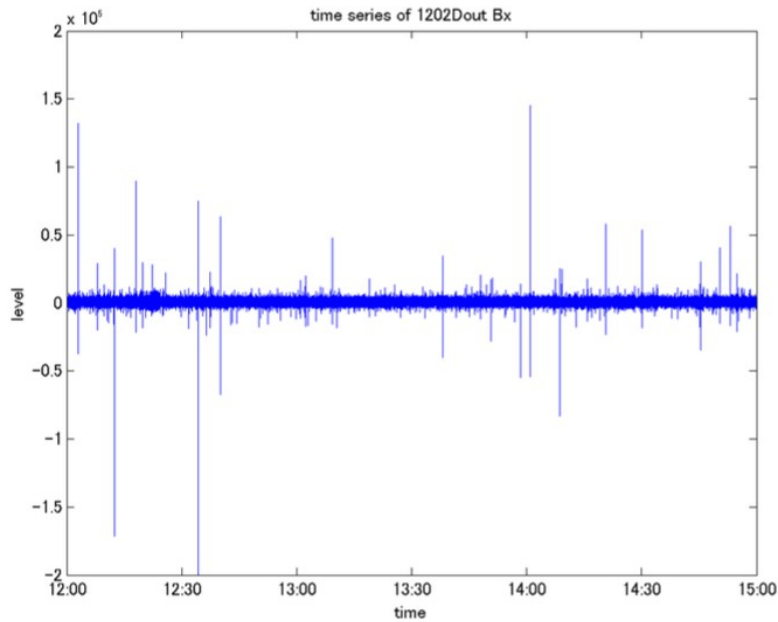
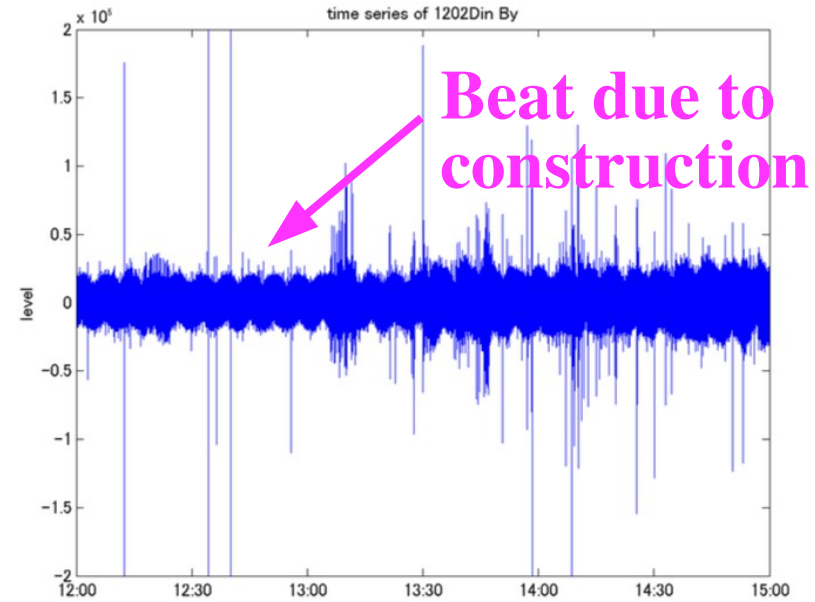
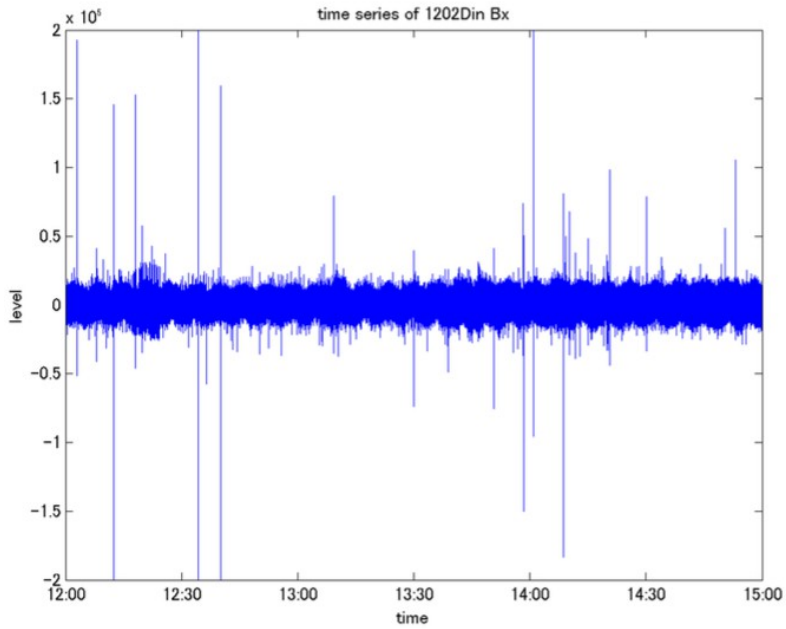
## Tunnel



# Power spectrum

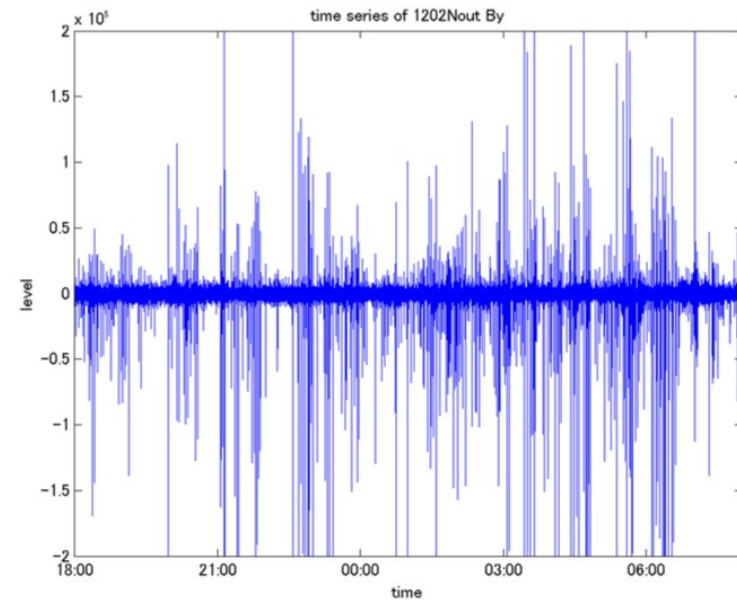
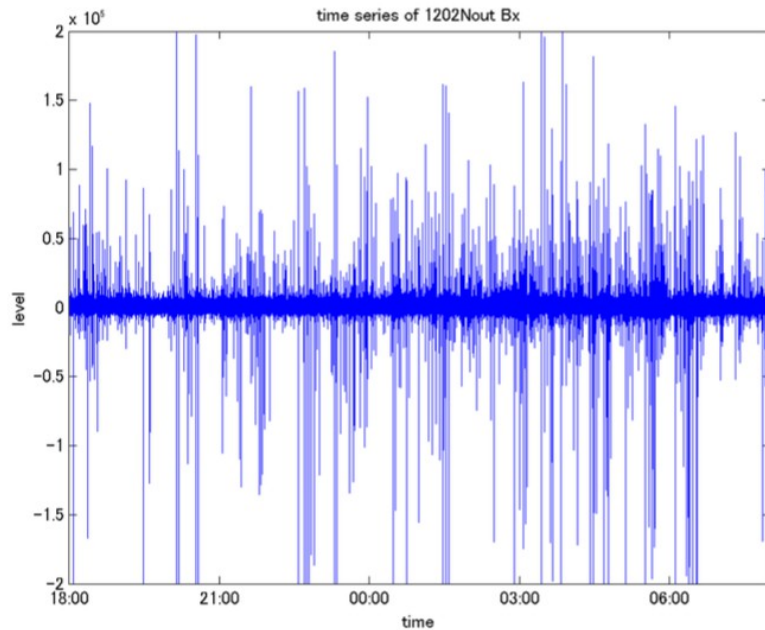
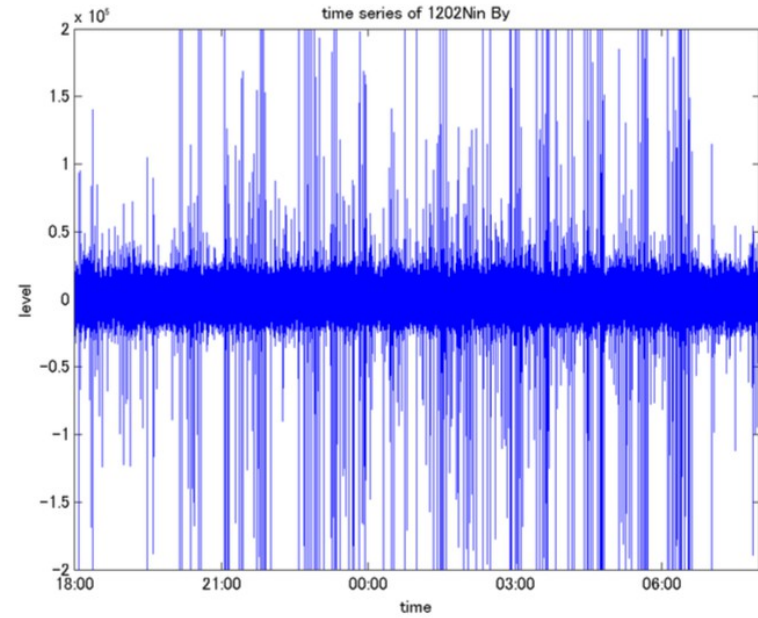
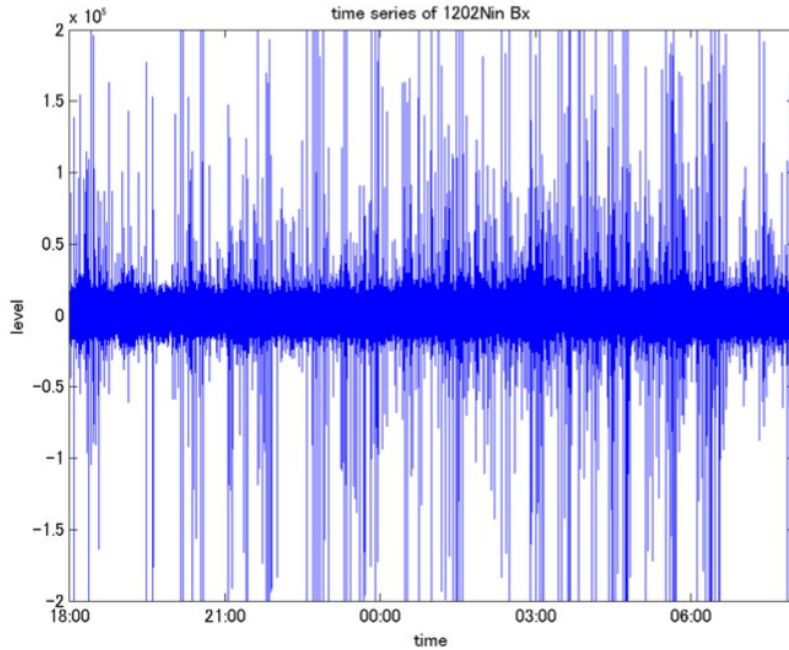


# 12:00, 12/2 – 15:00, 12/2



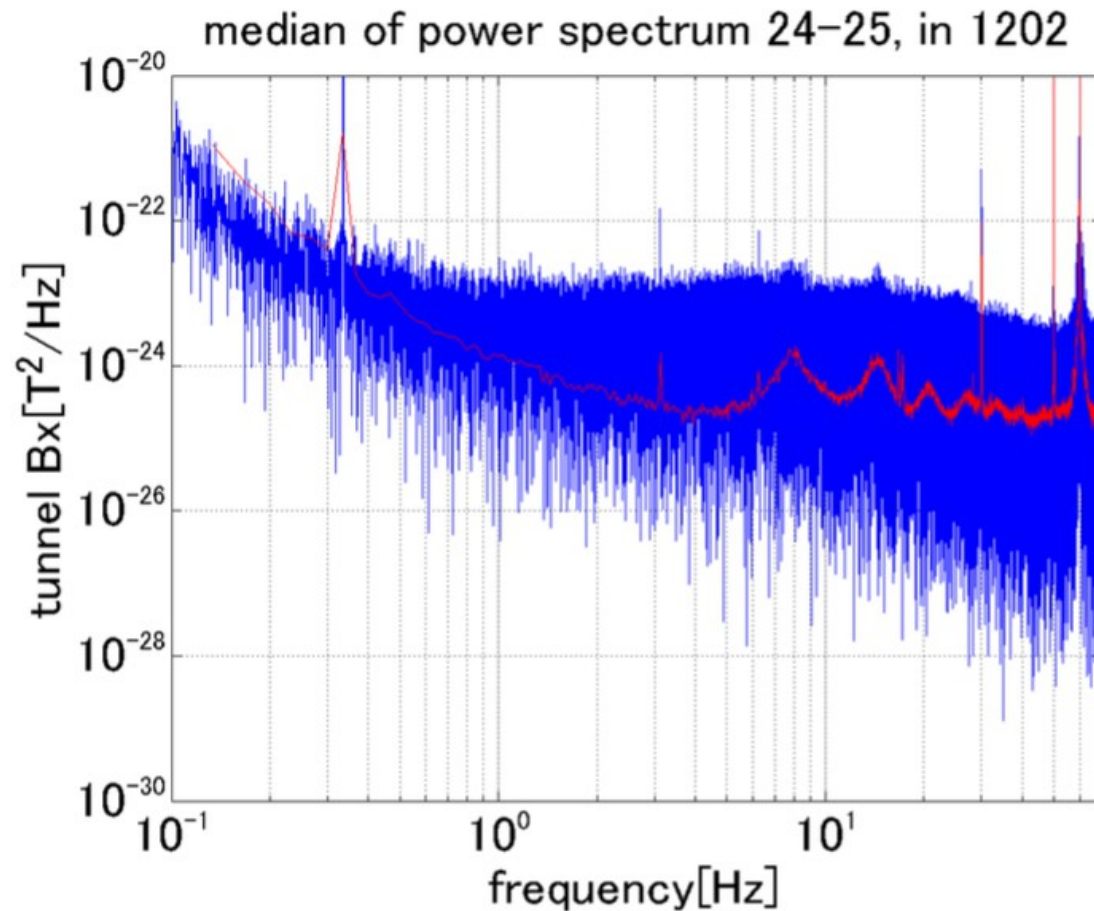
# 18:00, 12/2 – 8:00, 12/3

## Bad weather, many lightning





# The median PSD is the same level as the one on 12/1



# Summary

- **The Schumann resonances up to 5<sup>th</sup> were seen clearly at the tunnel and outside of the KAGRA.**
- **The geomagnetic field at the KAGRA site is**
  - **5E-13T/rHz@10Hz (tunnel)**
  - **3E-13T/rHz@10Hz (outside)**
- **The magnetic field at the tunnel is larger than outside.**

