

Status of KAGRA physical environmental monitors installation

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- KAGRA PEM installation
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Main task of the PEM subsystem

After finishing the installation tasks, We will start the commissioning phase

One of the important task for commissioner is

Possible upgrade of VT

- V : Volume, try to achieve the good sensitivity
 - Search the origin of noise which makes the noise floor dirty and makes the glitch
 - Line noise characterization, time variance of noise floor, glitch noisy period search, veto, ...
- T : Time, try to achieve the stable operation
 - Reducing the origin of unlock, quick recovery
 - Safety interferometer control system

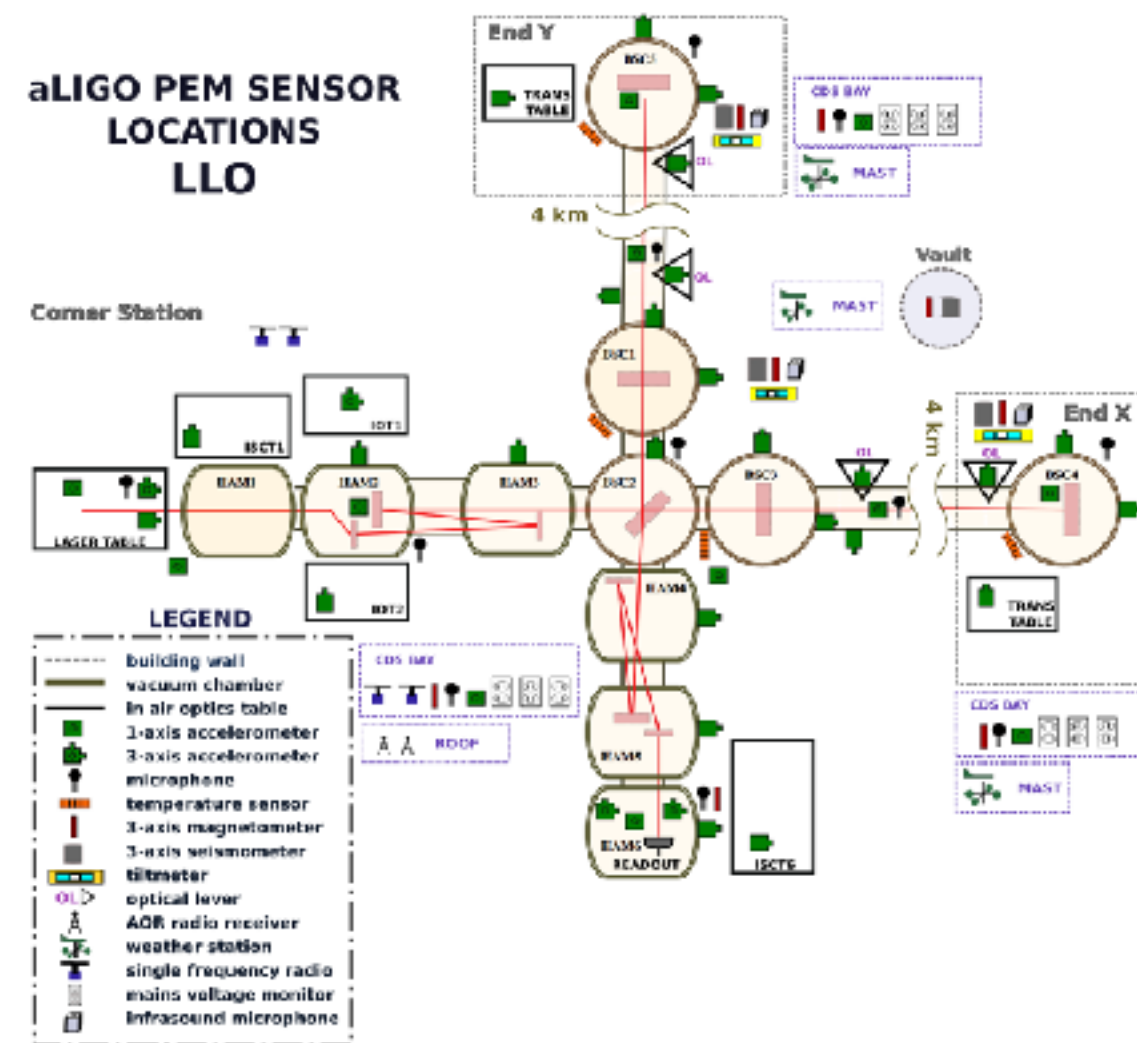
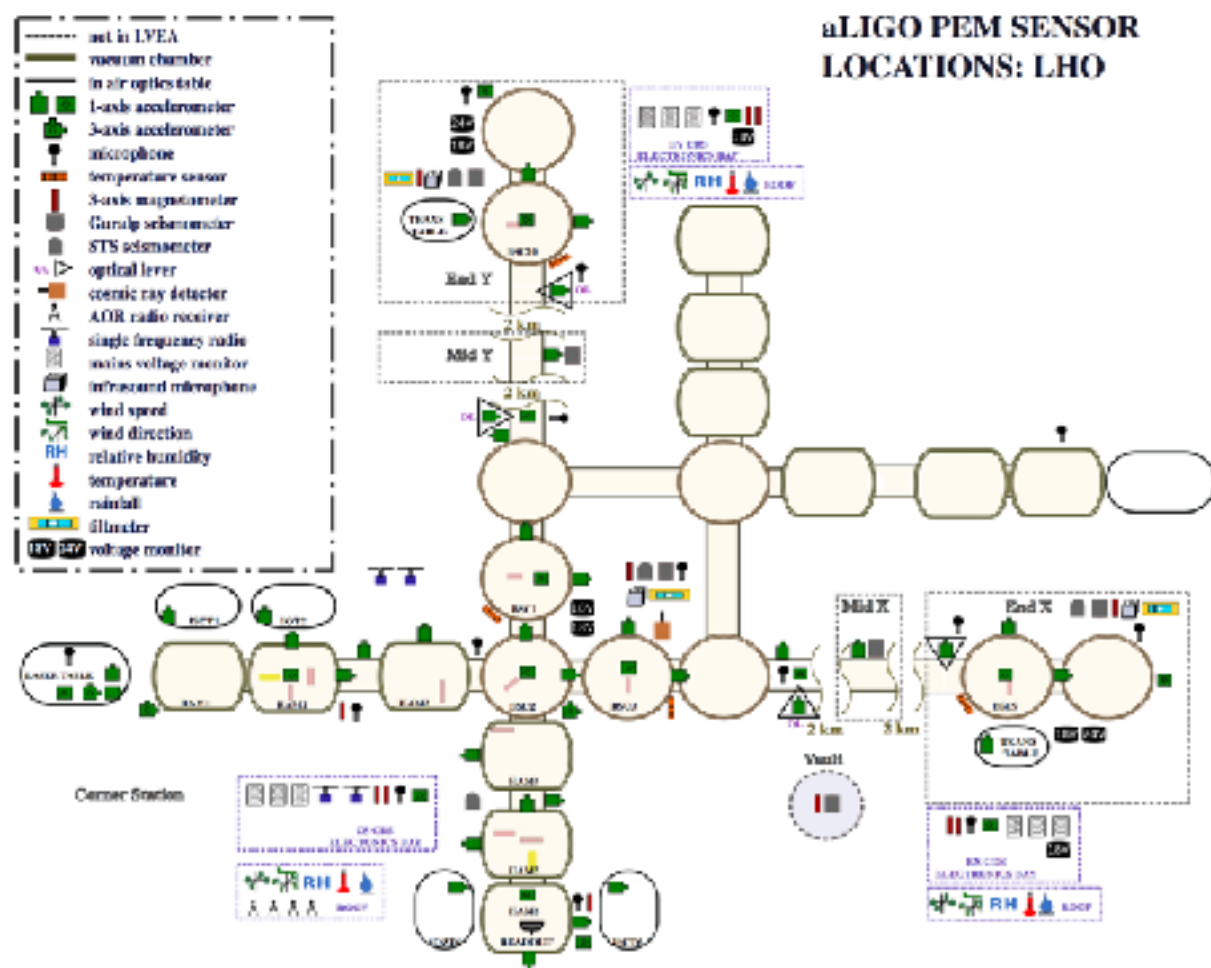
Main task of the PEM subsystem

- Toward the better sensitivity and stable operating, the understanding the environmental features is quite important
 - Weather station, Temperature, humidity, barometer, ...
 - Seismometer, Accelerometer, magnetometer, microphone
 - Power and ground monitor
 - Radio frequency monitor
 - etc etc etc,...
- The PEM, physical environmental monitors, subsystem employ the monitors installation/management and help the commissioning team
- Important information about the underground and cryogenic
 - Future interferometer technique
- Confirm the data quality of the GW channel



aLIGO, AdV PEM

<http://pem.ligo.org/channelinfo/index.php>



- Quite a lot of PEMs are already installed to aLIGO and AdV
- They helps a lot of noise hunting and achieved the good sensitivity and improved the analysis efficiencies

aLIGO, AdV PEM

<https://gwdoc.icrr.u-tokyo.ac.jp/cgi-bin/private/DocDB/ShowDocument?docid=7034>

V1:ENV* fast (1kHz÷20kHz) channels

Buildings monitoring (CEB, NEB, WEB, MCB)

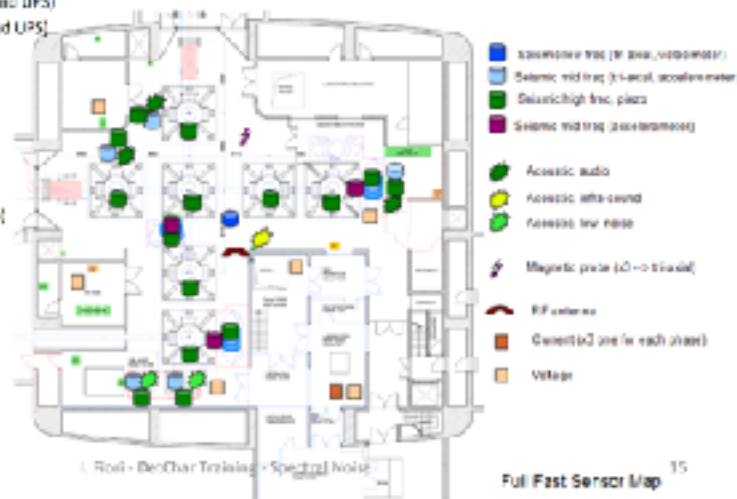
- 1 3D-Seismometer (Guralp) up to 100Hz
- 1 Magnetometers (W,N,Vertical)
- 1 Infrasound Microphone
- 1 RF antenna receiver (dedicated at Virgo RF frequencies)
- Mains Voltage monitors (PS and UPS)
- Mains Current monitor (PS and UPS)

Vacuum tanks monitoring

- each Tower (10), each Cryogenic Trap (4), some Inbar towers (4)
- Accelerometer (wide range)
- 1D velocimeter (< 100Hz range)

In-air Benches monitoring

- (SB, LB, 2 TCS, EDB, EMCB, near SGL)
- Accelerometer (kHz range)
- 3D-seismometer (up to 100Hz)
- Microphone (standard)



I. Fiori, VIR-0471A-17

12/05/23

V1:ENV* slow (1Hz) channels

- Temperature Probe
- Temperature String
- Humidity Probe
- Environmental Module



- Each Building
 - Temperature (probes at 2,4,6,10m height)
 - Pressure
 - Humidity
- LIN and DET labs
 - Temperature
- Each Tower and Minitower
 - Temperature probes, in-vac, at each SA fiber
- External Benches
 - Temperature and Humidity
- Weather Station (on Control Building)
- Lightning detector (still missing) plan joining www.blitzartung.org

I. Fiori, VIR-0471A-17

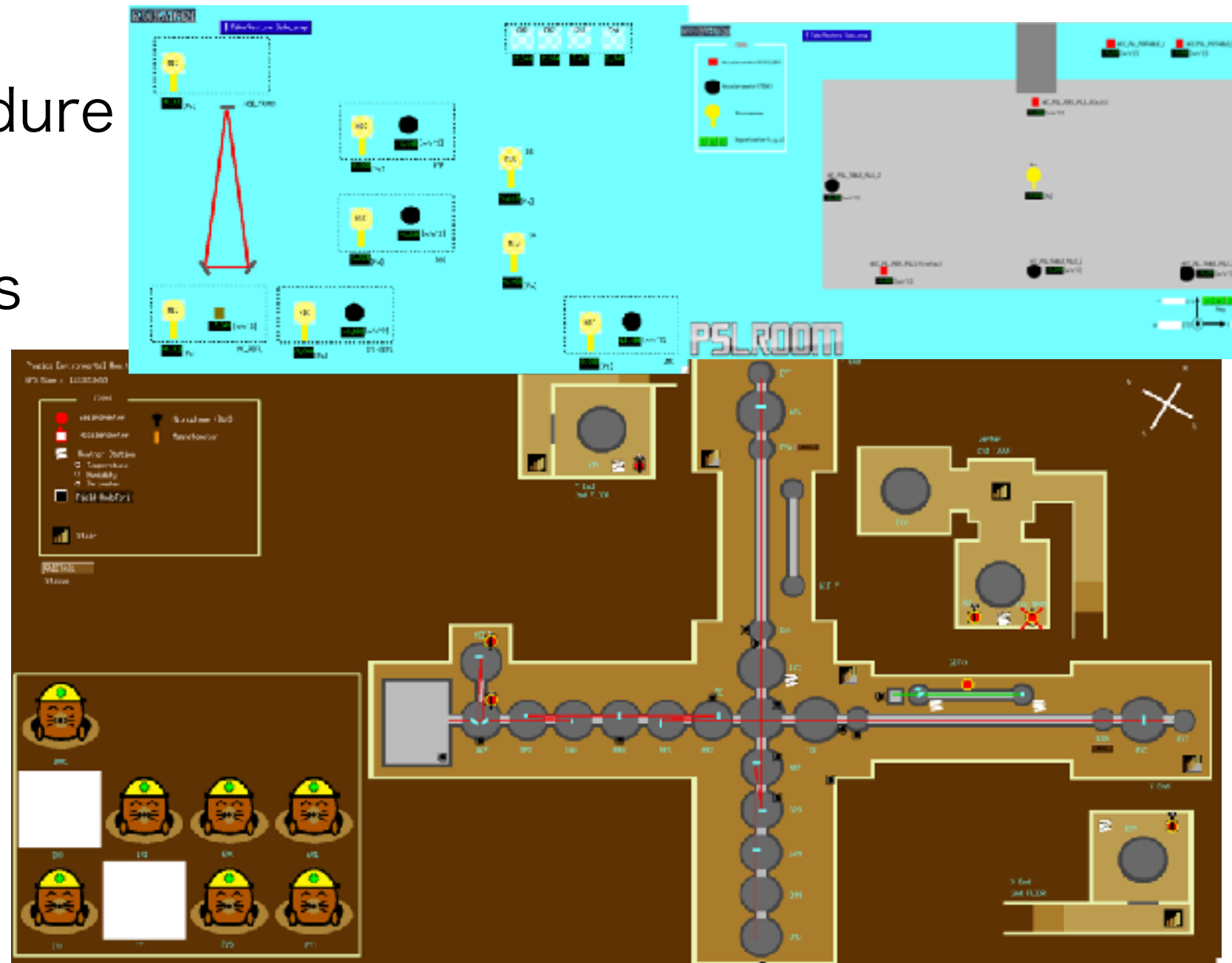
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PEM activities

- PEM installation
 - We already installed the accelerometer, magnetometer and microphone to PSL(Pre Stabilized Laser) room and optical tables

- PEM installation procedure

- PSL room
- Various optical tables
- Air monitors
- Chamber monitors
- PCal monitors
- Weather stations
- Arm monitors
- RF monitors
- Power monitors
- ...

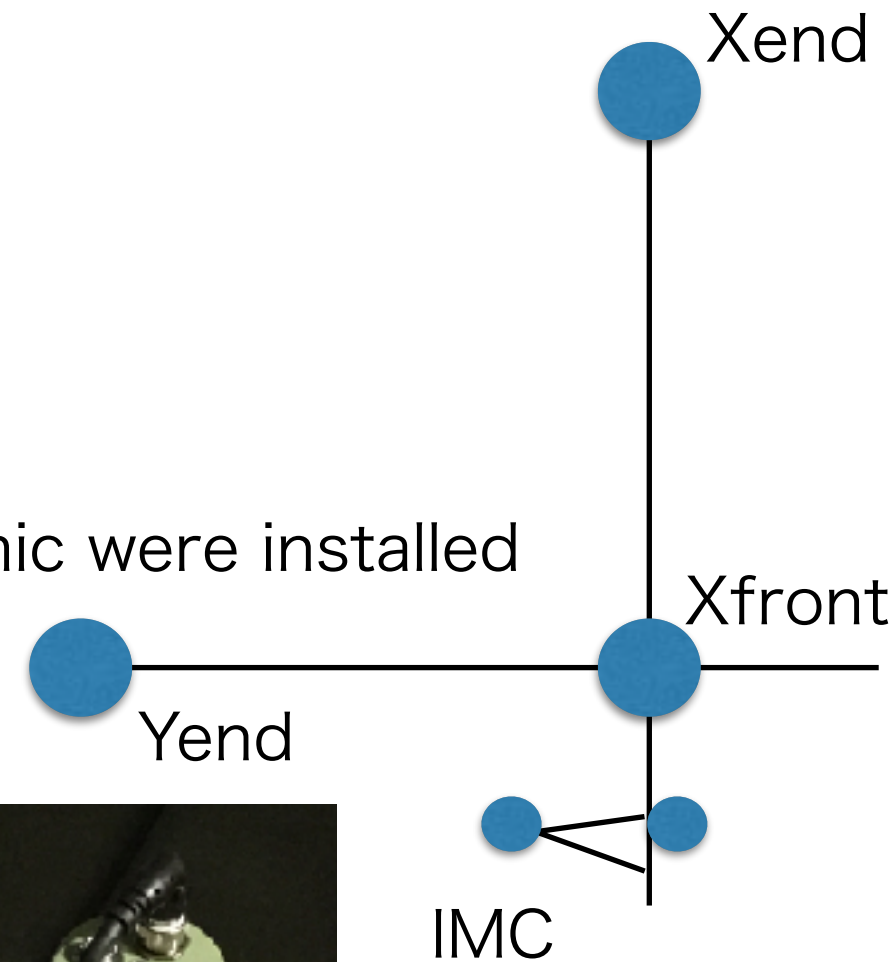
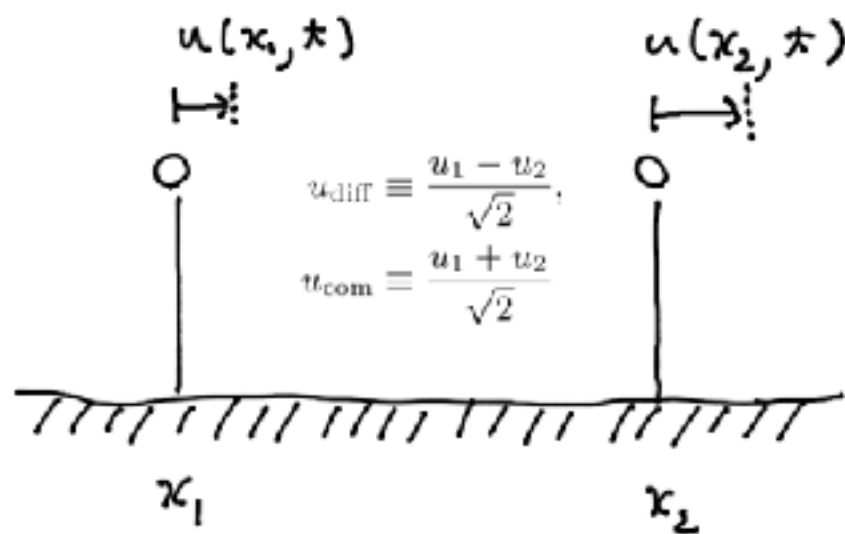


PEM activities

- PEM installation
 - We already installed the accelerometer, magnetometer and microphone to PSL(Pre Stabilized Laser) room and optical tables
- You can see the details at KAGRA wiki
 - <http://gwwiki.icrr.u-tokyo.ac.jp/JGWwiki/KAGRA/Subgroups/PEM>
- Various measurements are planning, ongoing and analyzing now
 - PEM injection, acoustic, vibration, magnetic field, RF, ...
 - Characterization of the detector noise
 - Development of the glitch and Line characterization tools
 - Daily summary page about PEM
 - Search the coherent channel with PEM
 - Evaluate the environmental noise affected to laser stabilization and GW strain signals
 - RF measurements (TTanaka(ICRR))
 - See the next page

🍁🍁 Seismometer

- Miyo(ICRR) and GIF subsystem
- Installed and started the monitors at End, IXV, IMC
 - End seismometer was already installed
- The important results will appear from GIF subsystem
- Air monitor (Humidity, temperature, barometer) and mic were installed

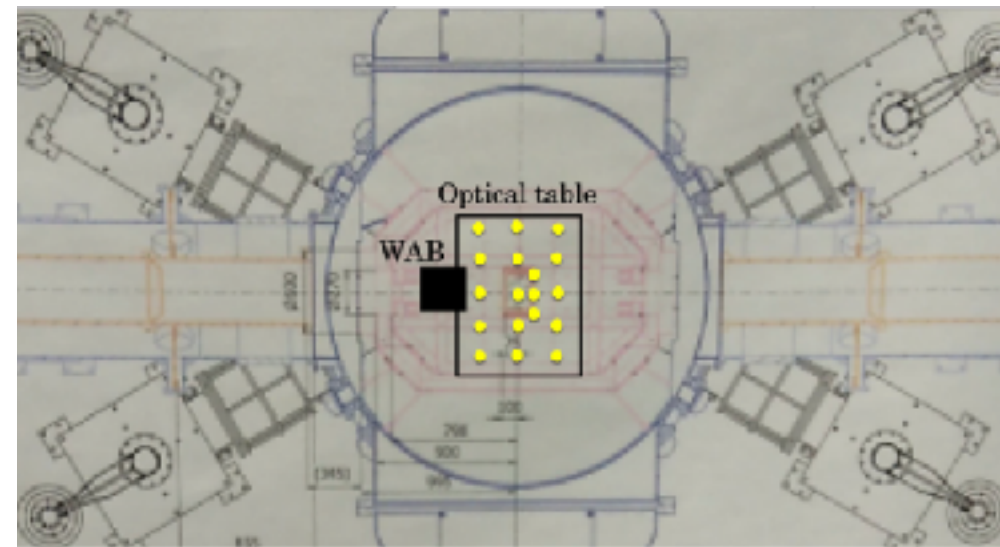
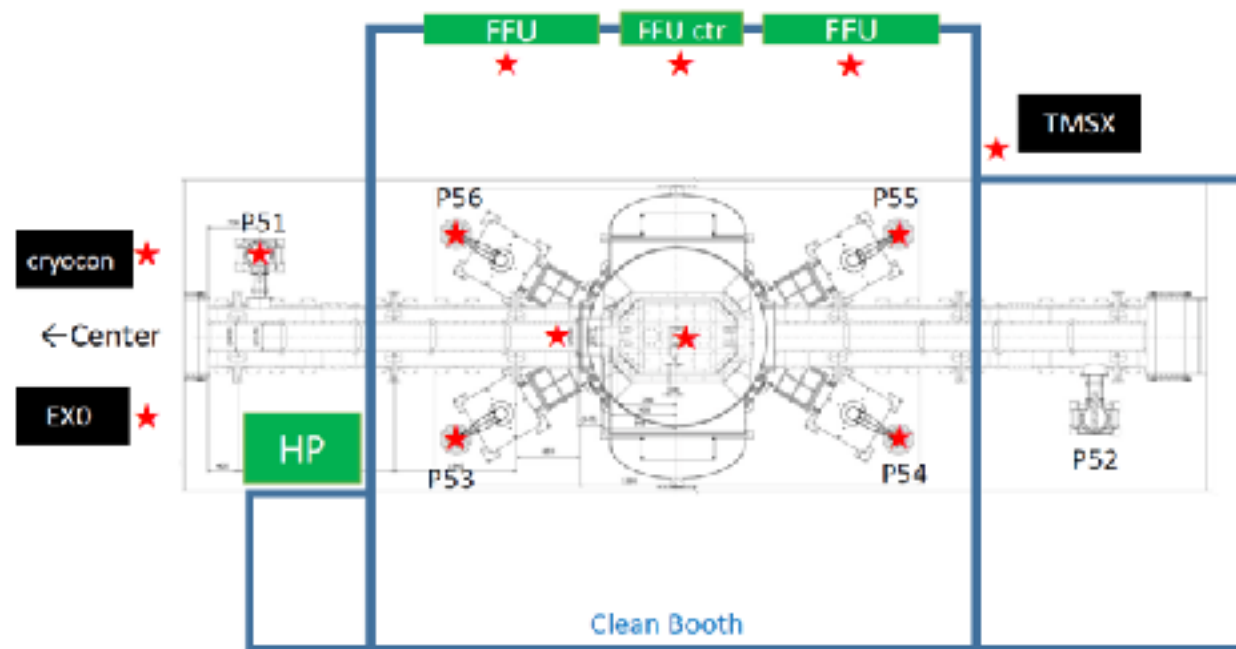


<https://gwdoc.icrr.u-tokyo.ac.jp/cgi-bin/private/DocDB/ShowDocument?docid=8556>

- Three large seismometer(Trillium120QA) observed the each station (center 2F, Xend 2F, Yend 2F)
- Two small seismometer(Trillium compact) observed the arm motion of IMC

🍁🍁 Magnetic field around cryo chamber

- Washimi(KEK), HTanaka(ICRR) and CRY subsystem



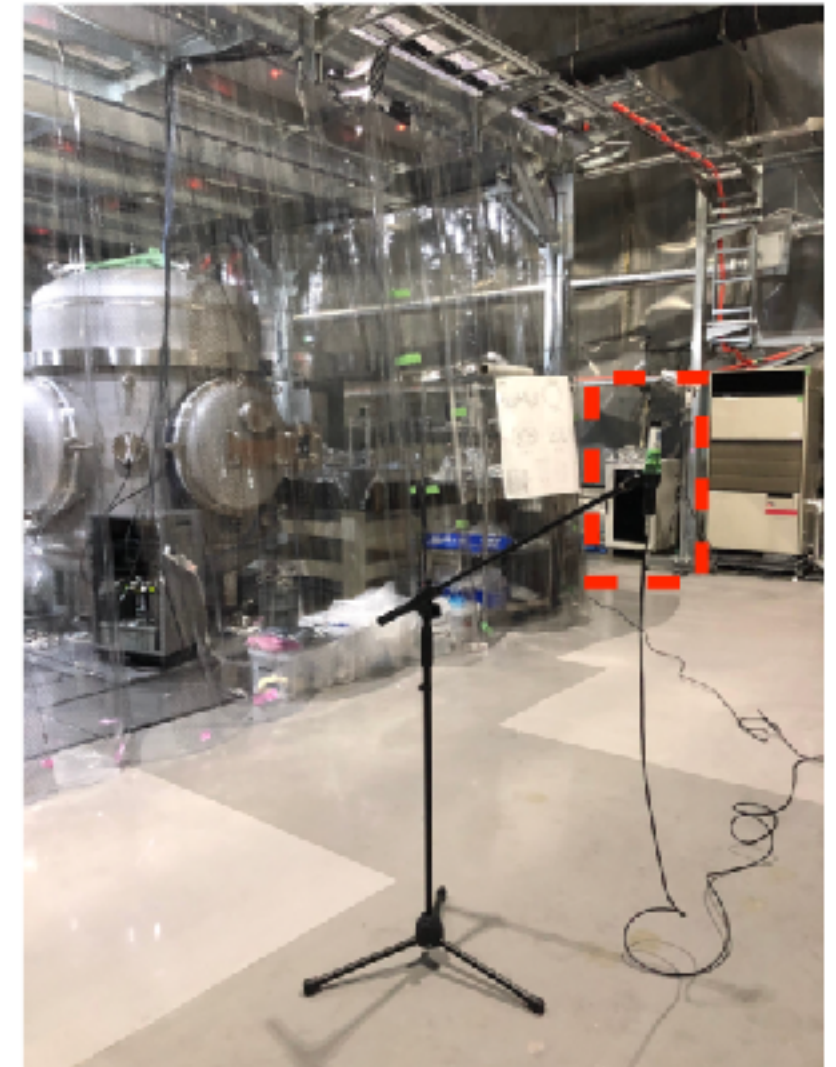
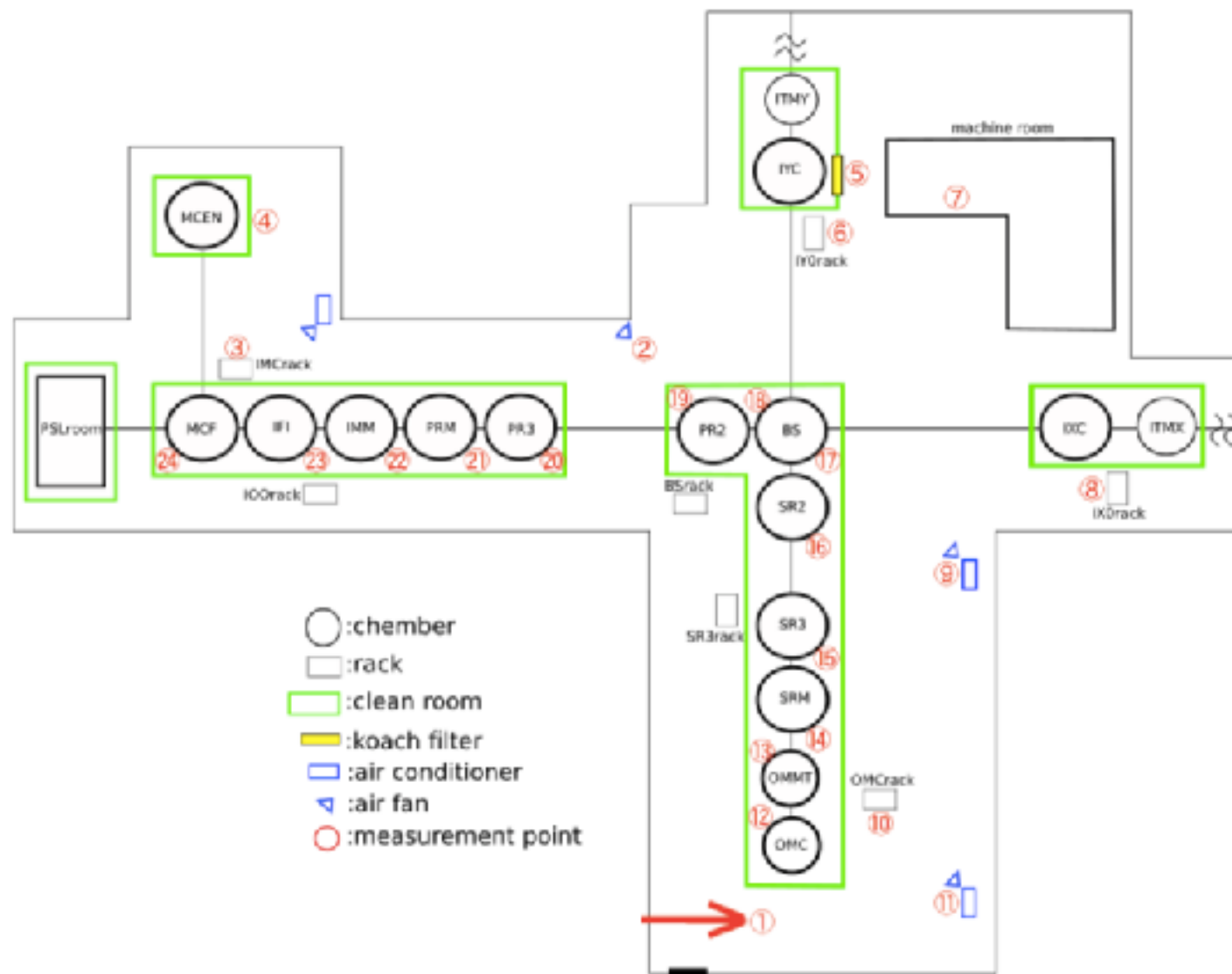
<http://klog.icrr.u-tokyo.ac.jp/osl/?r=7997>

- We measured magnetic field around the cryo chamber
 - Cryo-payload was out for the installation
 - Check the effect of the air conditioner, cooler, digital racks, etc
 - Characterization of the line noise and noise floor

- Analysis is ongoing

🍁🍁 KAGRA noise map development

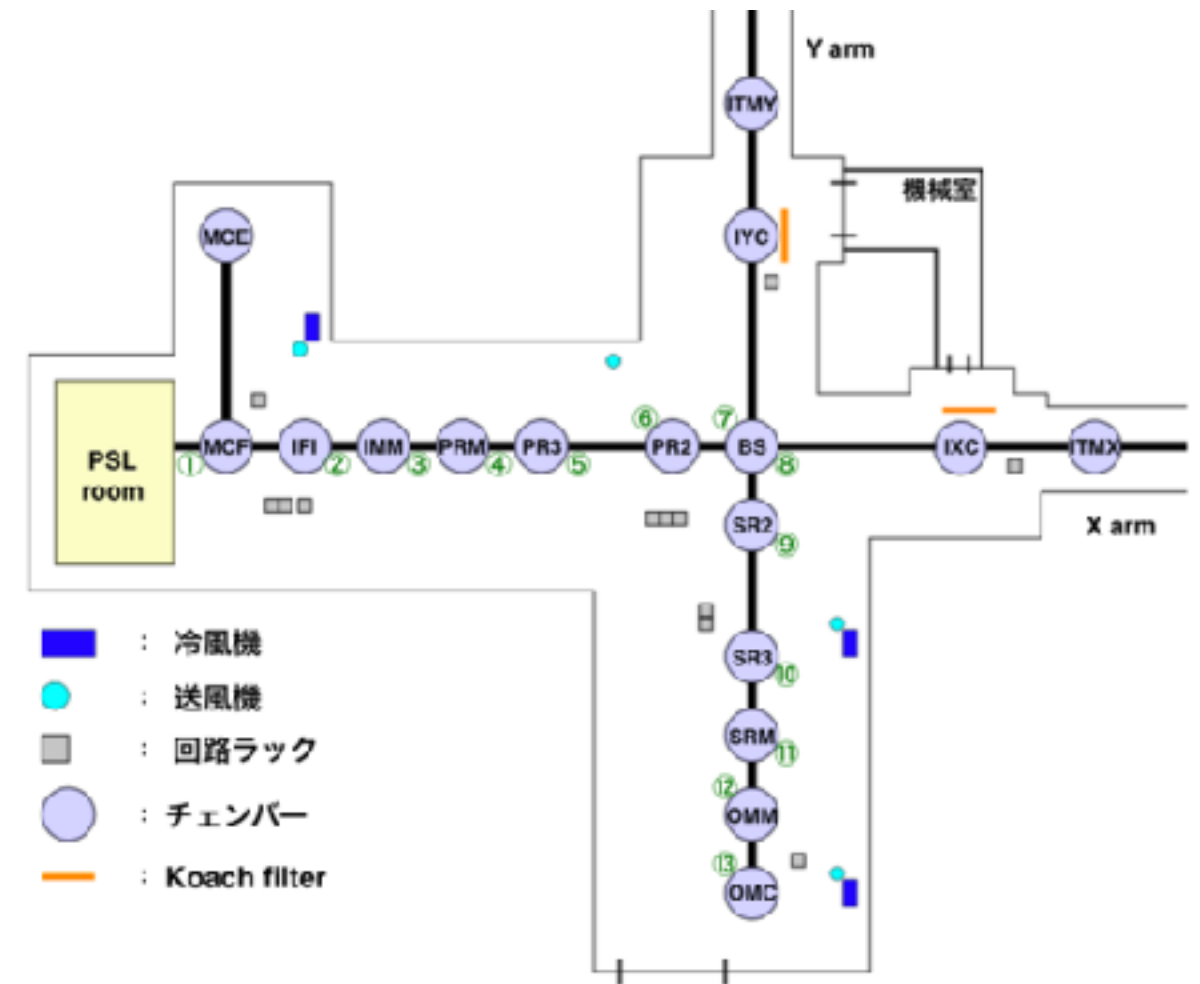
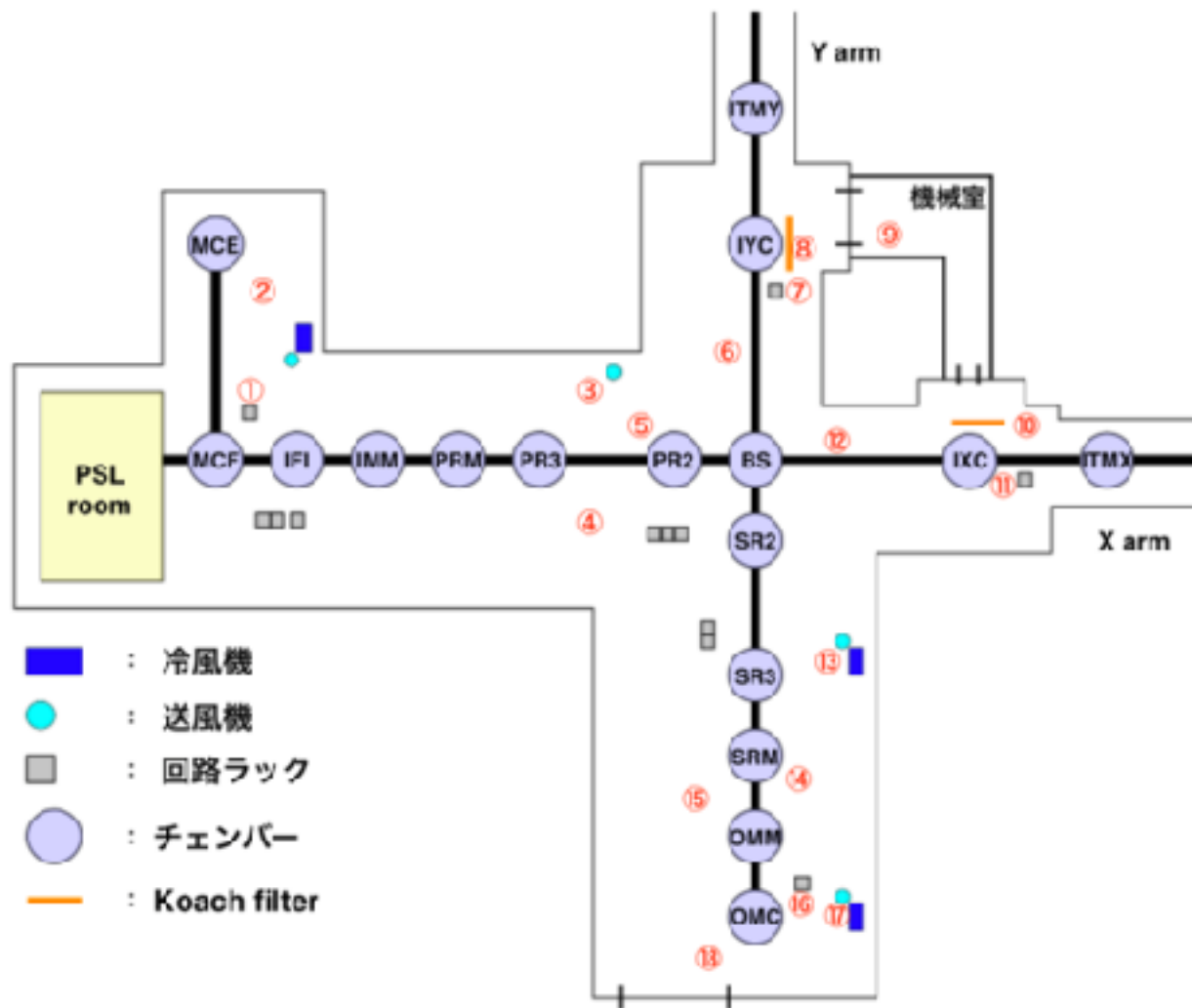
- Kaihotsu, Mori (Toyama Univ.)



- We measured magnetic field and acoustic field for generating the noise map
 - Hint of characteristic line frequency
 - We can use the noise catalog
 - Analysis is ongoing
 - noisy position search, noisy line search

KAGRA noise map development

- Kaihotsu, Mori (Toyama Univ.)



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Summary and future prospect

- We, PEM subsystem, installed the various PEMs to the KAGRA detector
 - KAGRA is two main features toward the next generation
 - Underground and cryogenic
- KAGRA environmental noise measurements and analysis are ongoing
- Future prospect
 - Additional PEM installation
 - Preparation for the PEM injection
 - Detector characterized noise measurement, such as newtonian noise.
 - Power noise measurements(18V, 24V and 100V)

