

PEM status

PEM expand meeting

2019/06/11 T.Yokozawa

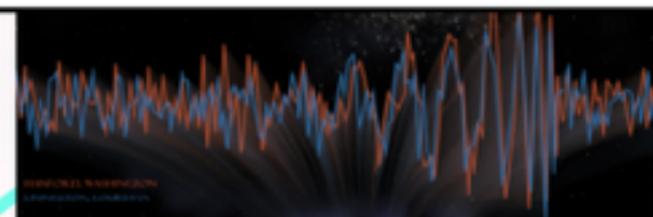
Physical Environmental Monitors

Everyone can be a hero
of the noise hunting!

PEM Characterization

Data analysis/Theory

Detector/Instruments



Install monitors

PEM Injection

Facility monitor

- Power supply
- Temperature



Underground/cryogenic
environment

- Newtonian noise
- Schumann resonance

Optical table monitor

- Accelerometer
- Microphone

Environmental Veto

Noise hunting

- Coupling with triggered glitch
- Serious line identification

Noise identification

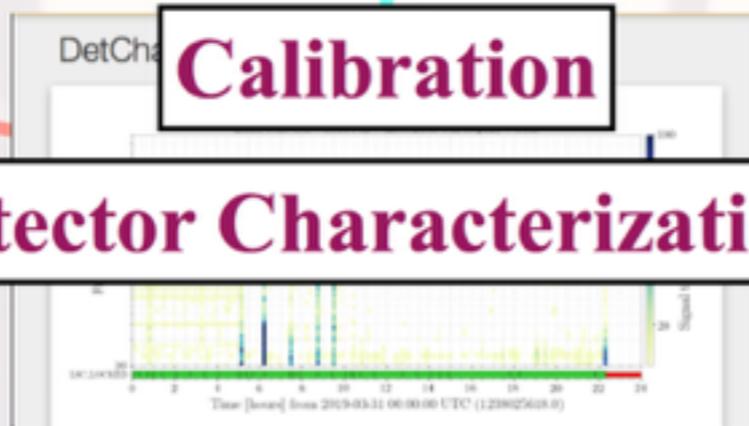
- Optics, Laser
- Suspension, cryopayload
- etc,etc,etc,...

Calibration

Detector Characterization

Health check

- lock information
- detector health



Last PEM expand meeting

2018/12/17

- PEM insthllation(Yokozawa 10min)  pdf
- PEM activities1 (Kaihotsu, Mori 10min)
- PEM activities 2 (TTanaka 10min)
- PEM activities 3 (Miyo 10min) [下の”Comment”を見てください]
- PEM activities 4 (Yamakoh 10min)
- Commissioning (Enomoto 10min)
- Summary page 1 (Kokeyama 10min)
- Summary page 2 (Yuzurihara 10min)  pdf
- Useful tools (TYamamoto 10min)
- LLO report (Yokozawa 10min)
- Suggestion from bKAGRA phase1 PEM team(Nagano 10min)
- Future prospect+discussion(Yokozawa+ 10min)

2nd PEM expand meeting

· 2019/06/11

=== Agenda ===

- PEM status (Yokozawa) (10min)
- Virgo PEM measurements (Yokozawa) (10min)
- Characterization of the EXC chamber (Washimi) (10min)
- Power supply monitors (Washimi) (10min)
- Acoustic and magnetic field measurement (Kaihotsu) (10min)
- Current PEM measurements (Mori) (10min)
- Ground motion (Miyo) (10min)
- Sound injection (TTanaka) (10min)
- PEM injection plan (TTanaka) (10min)
- Kozapy+ (Kozakai) (20min)
- Report from DetChar (Yamamoto, Kokeyama) (10min)
- Summary and future prospect (Yokozawa) (10min)

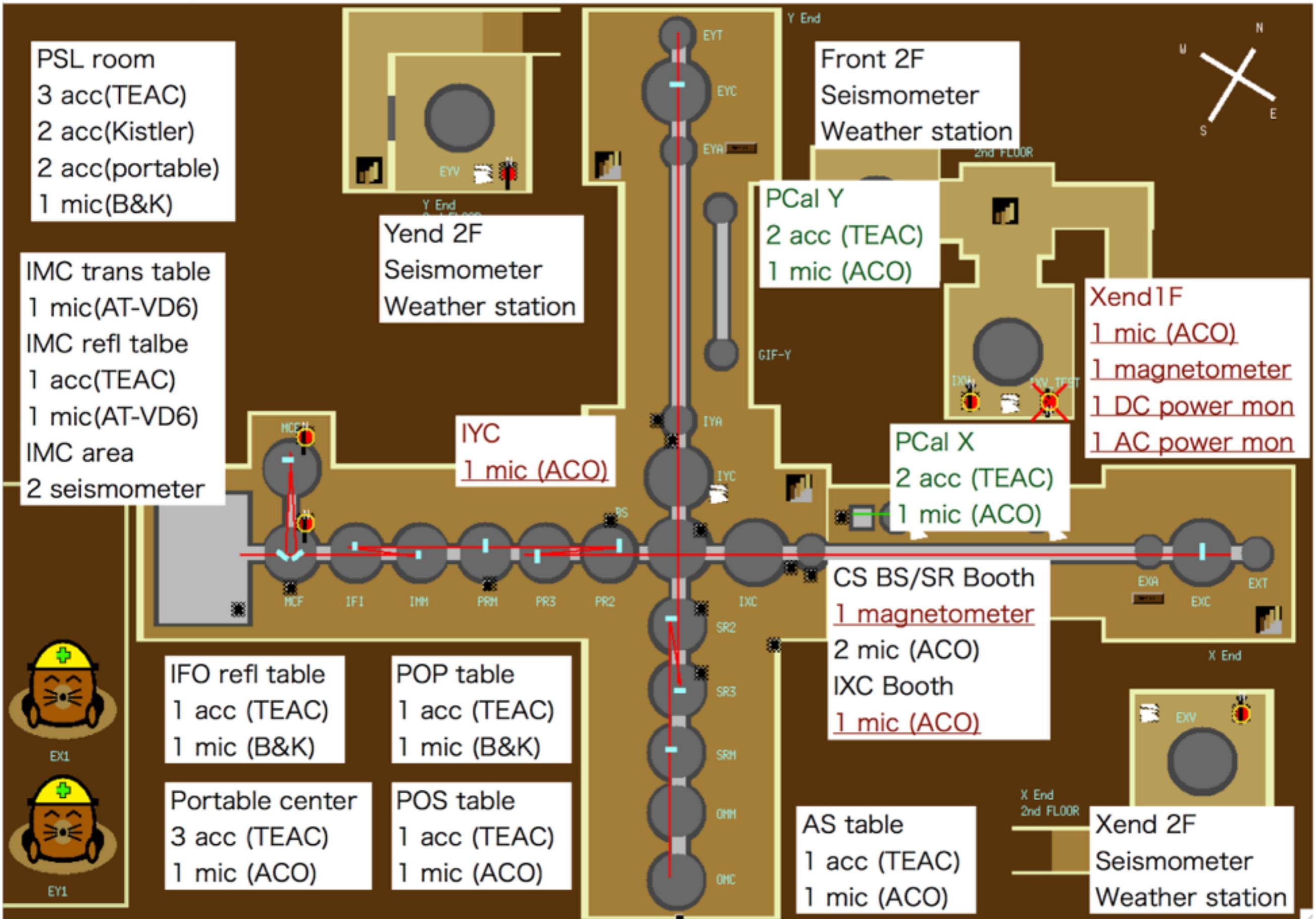
History of the PEM activities

- 12 1st expand meeting, introduce the github, Morihotsu PEM map
- 1 Washimi-san became KAGRA member, Miyo-san married, PEM channel names changed
- 2 Magnetic field measurements around the cryo chambers, KIW5 meeting
- 3 Kozapy project started, JPS meeting, seismon discussion, PEM injection
- 4 Power supply monitors, RF issue, ondotori monitor upgrade, F2F meeting
- 5 PEM install2, Virgo PEM team staying, PEM spread sheet, PEM webpage
- 6 KIW6, 1st engineering run
- 7
- ...

O3



PEM placements



PEM placements

PSL room
 3 acc(TEAC)
 2 acc(Kistler)
 2 acc(portable)
 1 mic(B&K)

IMC trans table
 1 mic(AT-VD6)
 IMC refl talbe
 1 acc(TEAC)
 1 mic(AT-VD6)
 IMC area
 2 seismometer



IFO refl table
 1 acc (TEAC)
 1 mic (B&K)

Portable center
 3 acc (TEAC)
 1 mic (ACO)

POP table
 1 acc (TEAC)
 1 mic (B&K)

POS table
 1 acc (TEAC)
 1 mic (ACO)

Yend 2F
 Seismometer
 Weather station

PCal Y
 2 acc (TEAC)
 1 mic (ACO)

Front 2F
 Seismometer
 Weather station

CS BS/SR Booth
 1 magnetometer
 2 mic (ACO)
 IXC Booth
 1 mic (ACO)

AS table
 1 acc (TEAC)
 1 mic (ACO)

Xend 1F
 1 mic (ACO)
 magnetometer
 power mon
 power mon

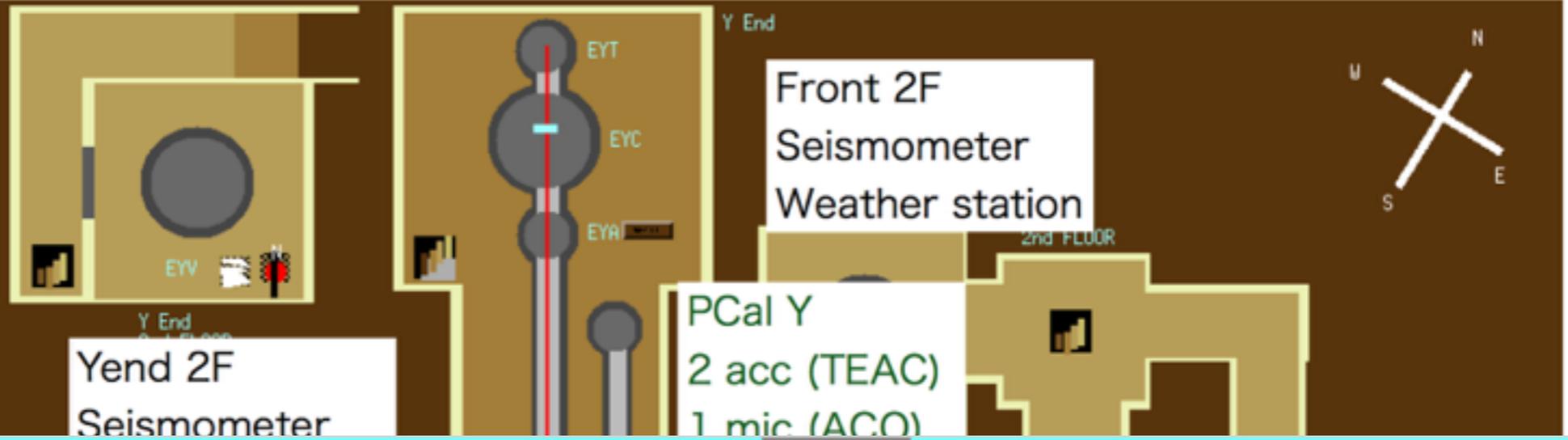
Xend 2F
 Seismometer
 Weather station

You can find the detail by
<http://k1sum0/~controls/PEMmap/>
 (Thank you Washimi-san)



PEM placements

PSL room
 3 acc(TEAC)
 2 acc(Kistler)
 2 acc(portable)
 1 mic(B&K)



IMC trans table

KAGRA-PEM ! Take/Restore Safe.snap

ITEMS

- Accelerometer(KISTLER)
- Accelerometer(TEAC)
- Microphone
- Magnetometer

ACC_PSL_PORTABLE_1: $7.067e-04$ [m/s²]

ACC_PSL_PORTABLE_2: $1.717e-03$ [m/s²]

ACC_PSL_PERI_PSL1_X: $3.453e-03$ [m/s²]

Mic: $2.261e-03$ [Pa]

ACC_PSL_TABLE_PSL2_Z: $-1.044e-05$ [m/s²]

PEM placements

PSL room
 3 acc(TEAC)
 2 acc(Kistler)
 2 acc(portable)
 1 mic(B&K)

IMC trans table
 1 mic(AT-VD6)
 IMC refl talbe
 1 acc(TEAC)
 1 mic(AT-VD6)
 IMC area
 2 seismometer



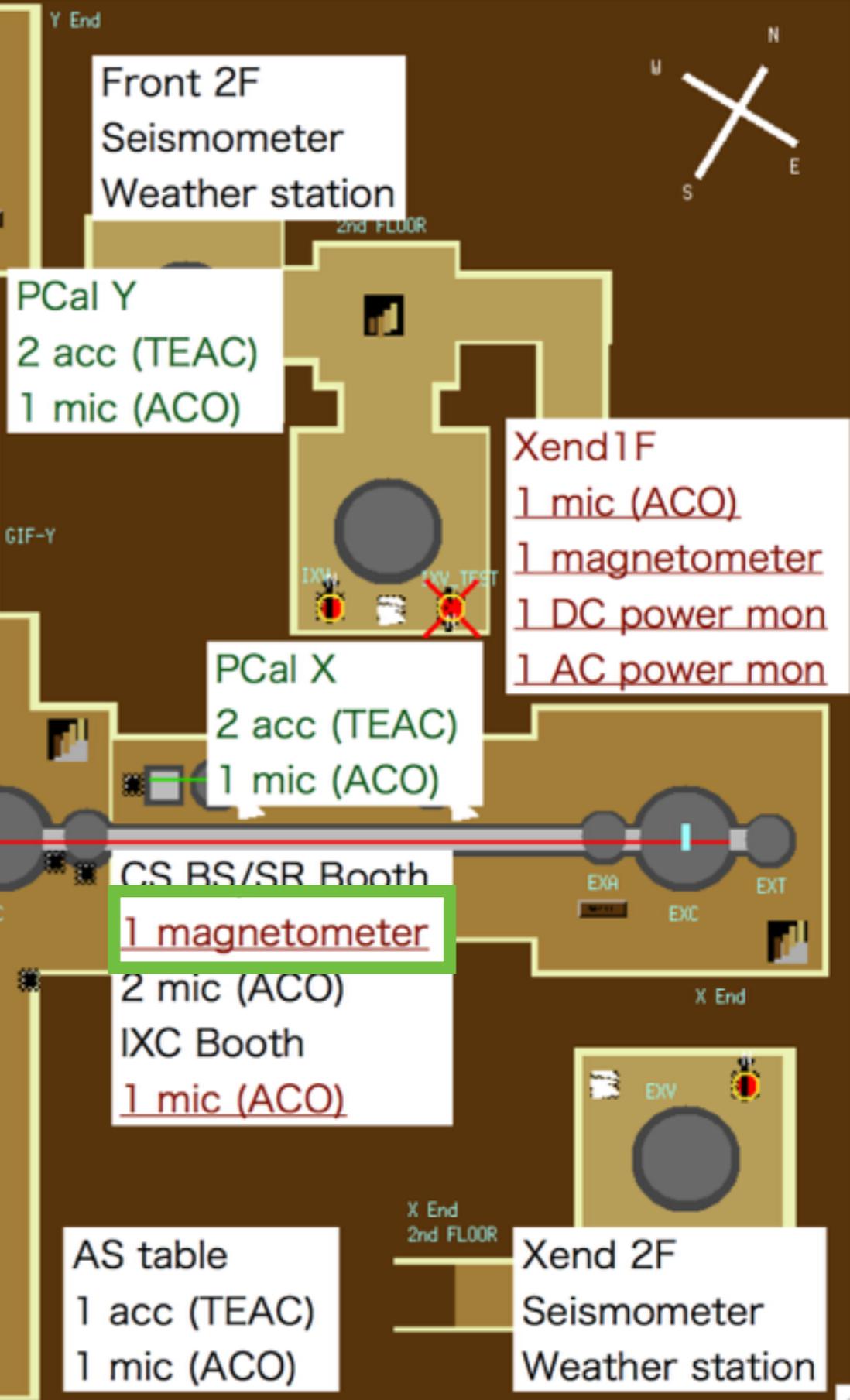
EX1



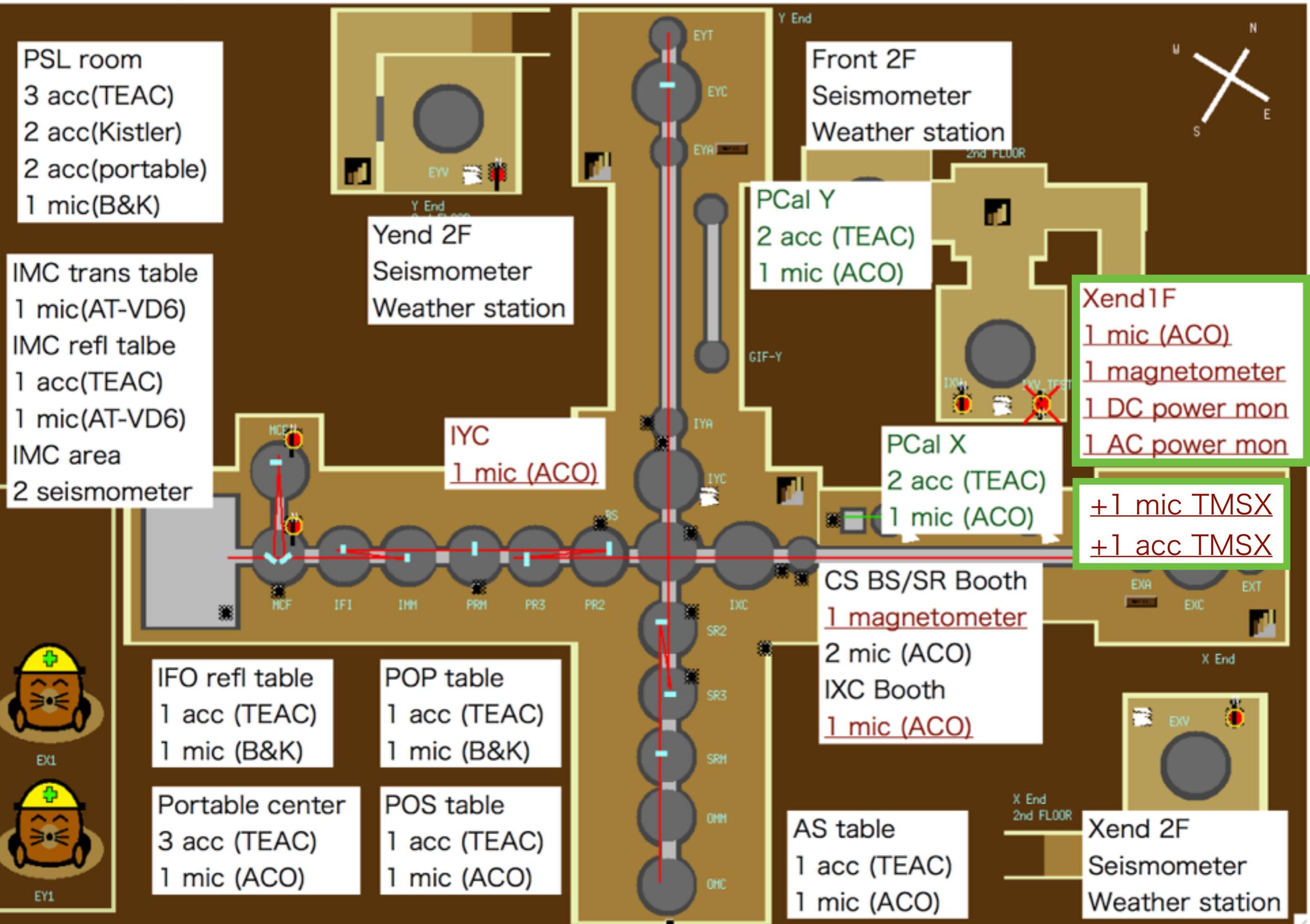
EY1

IFO refl ta
 1 acc (TE
 1 mic (B&

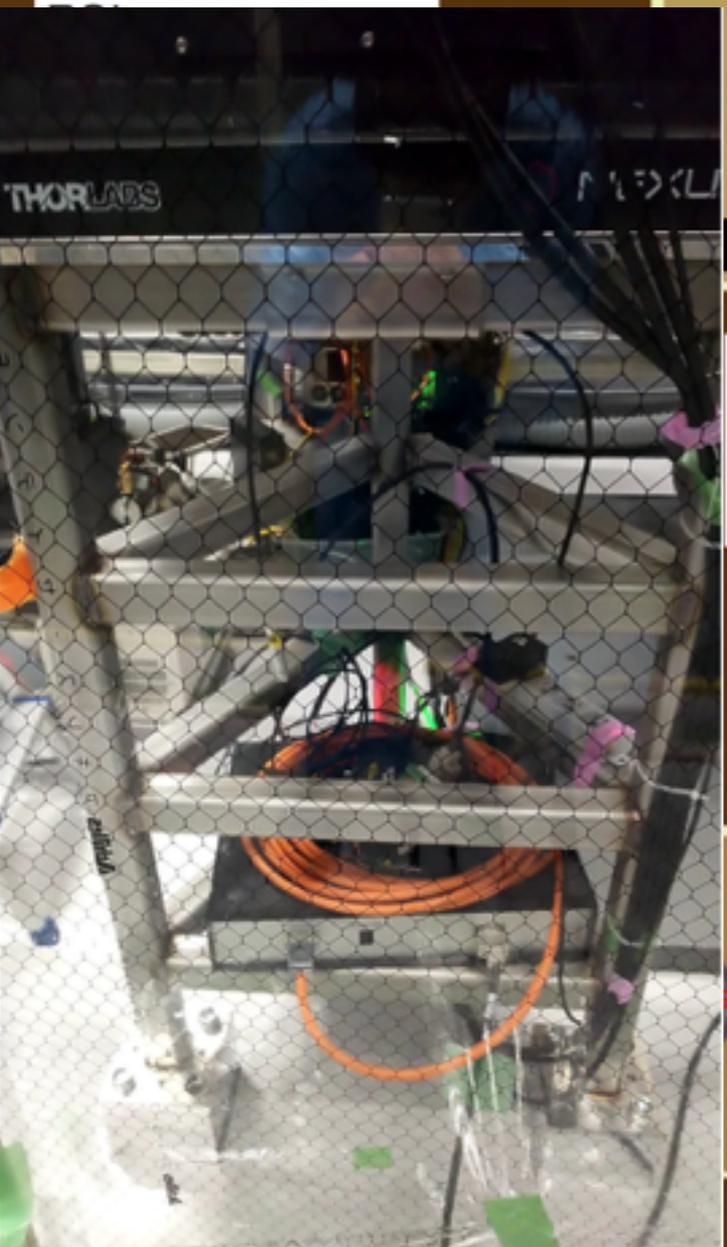
Portable
 3 acc (TE
 1 mic (ACO)



PEM placements

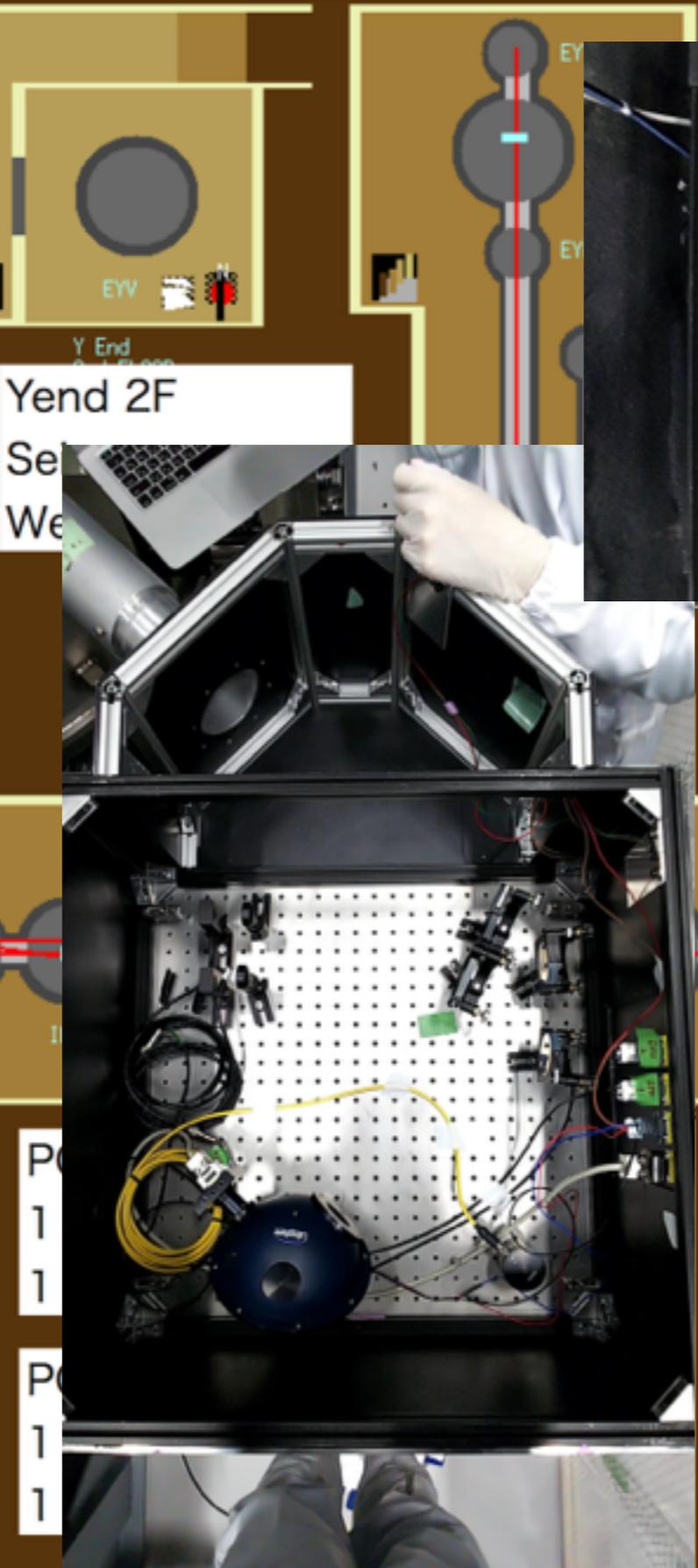


PEM placements

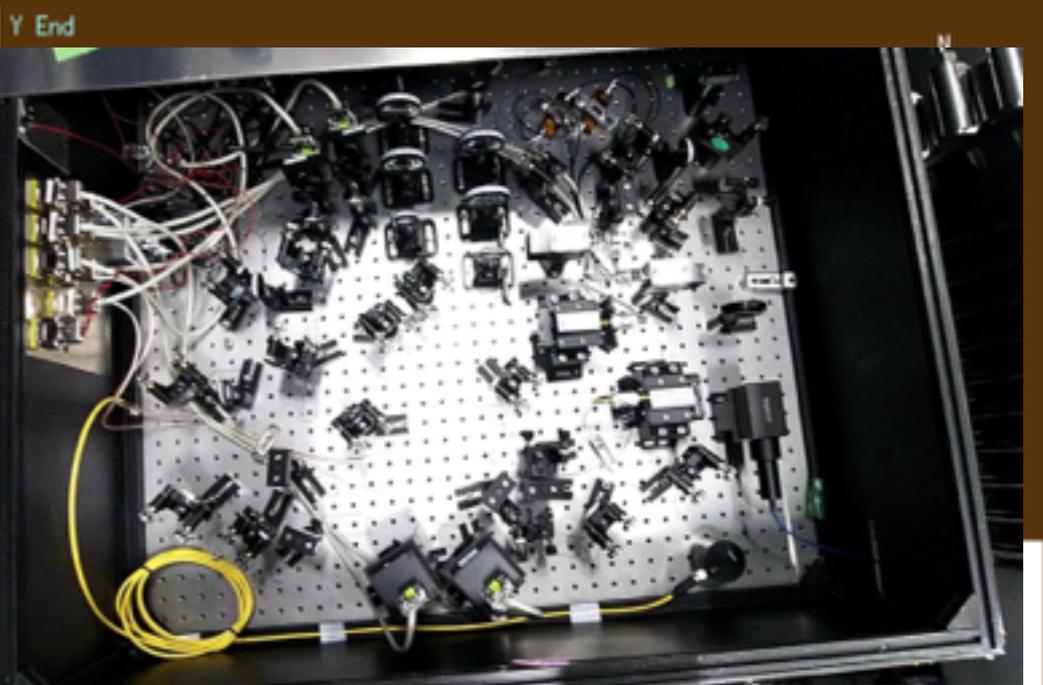


1 acc (TEAC)
1 mic (B&K)

Portable center
3 acc (TEAC)
1 mic (ACO)



Yend 2F
Seismometer
Weather station



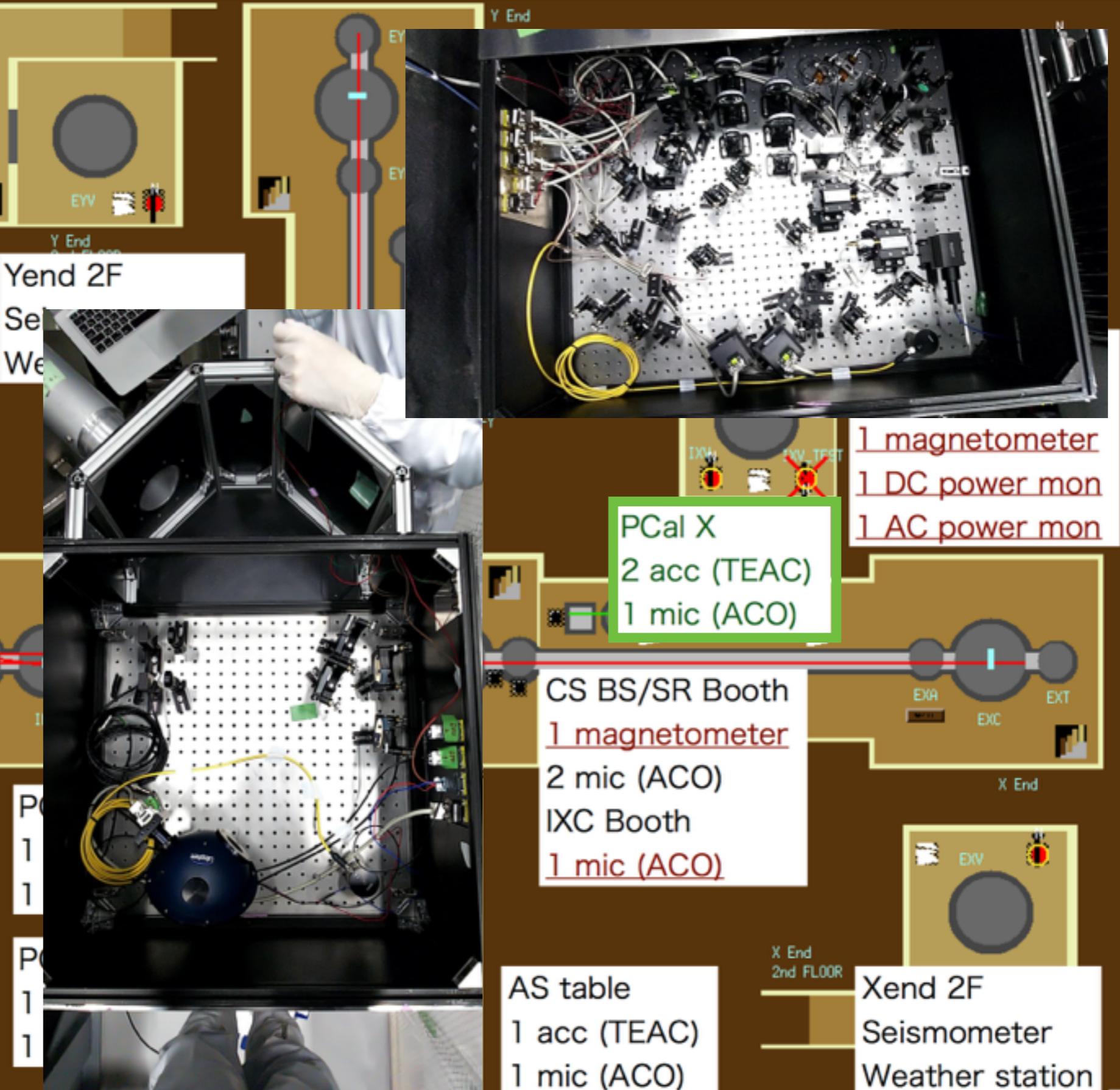
1 magnetometer
1 DC power mon
1 AC power mon

PCal X
2 acc (TEAC)
1 mic (ACO)

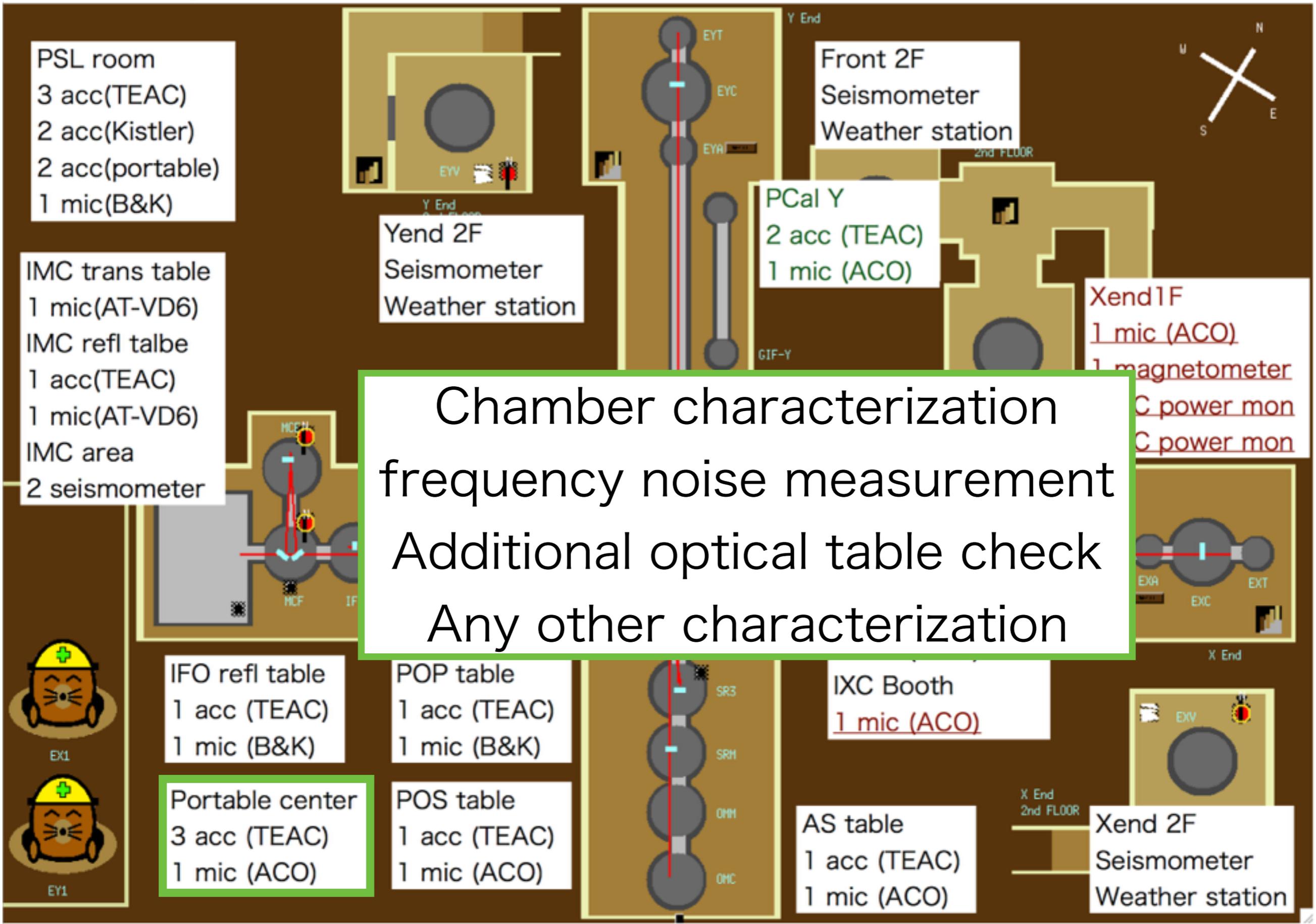
CS BS/SR Booth
1 magnetometer
2 mic (ACO)
IXC Booth
1 mic (ACO)

AS table
1 acc (TEAC)
1 mic (ACO)

Xend 2F
Seismometer
Weather station



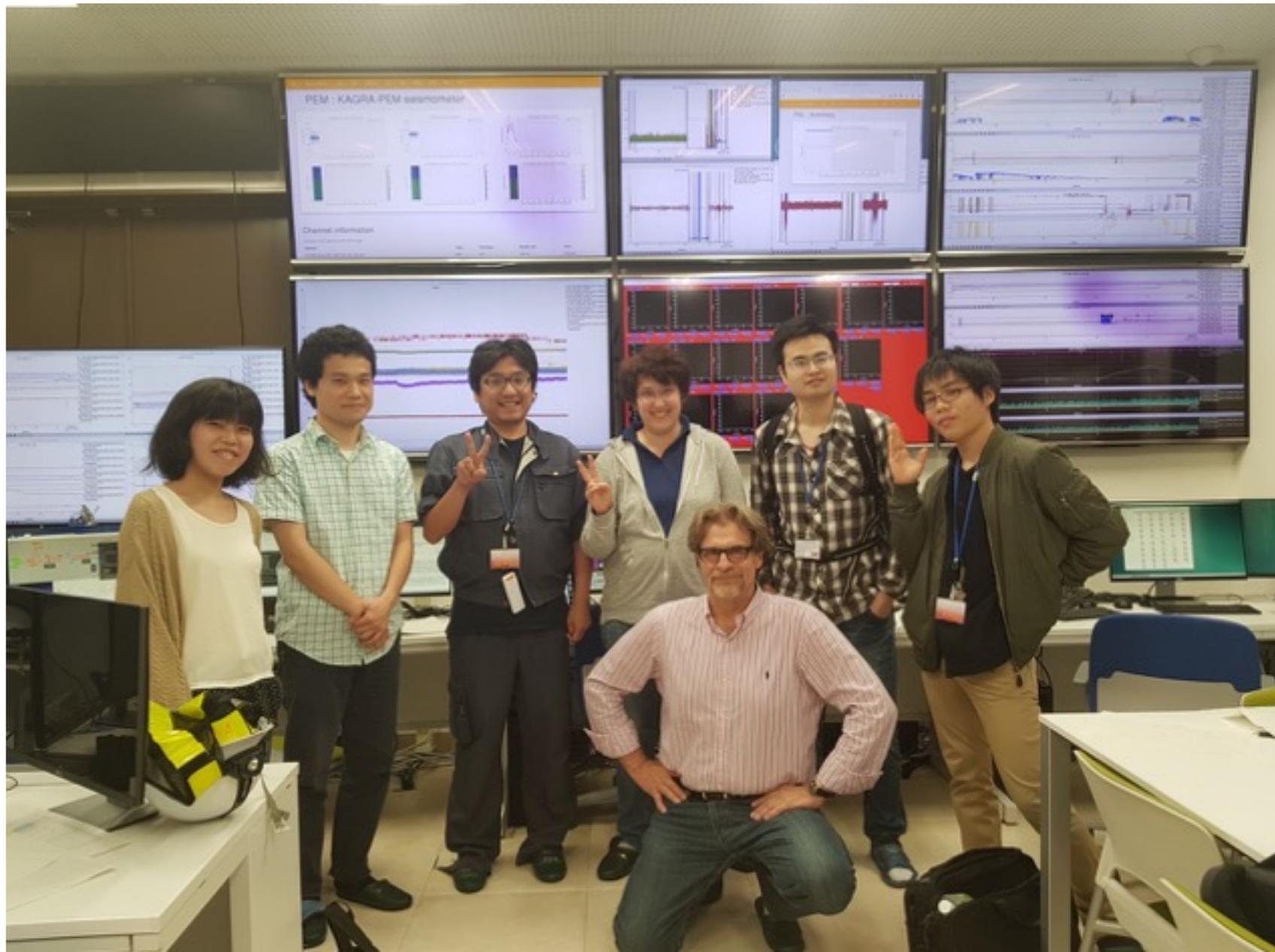
PEM placements



Chamber characterization
 frequency noise measurement
 Additional optical table check
 Any other characterization

Virgo PEM measurements

PEM expand meeting
2019/06/11 T.Yokozawa



PEM measurements with Virgo team

- Virgo team
 - Federico Paoletti and Irene Fiori (help Eleonora Polini)
 - 12th May - 21st May
- Main measurements
 - Sound decay measurements
 - IYC chamber measurements
 - Comparison with Virgo and KAGRA PEMs
- Seminar about the Virgo PEM
- The results will be discussed continuously (Every one month)

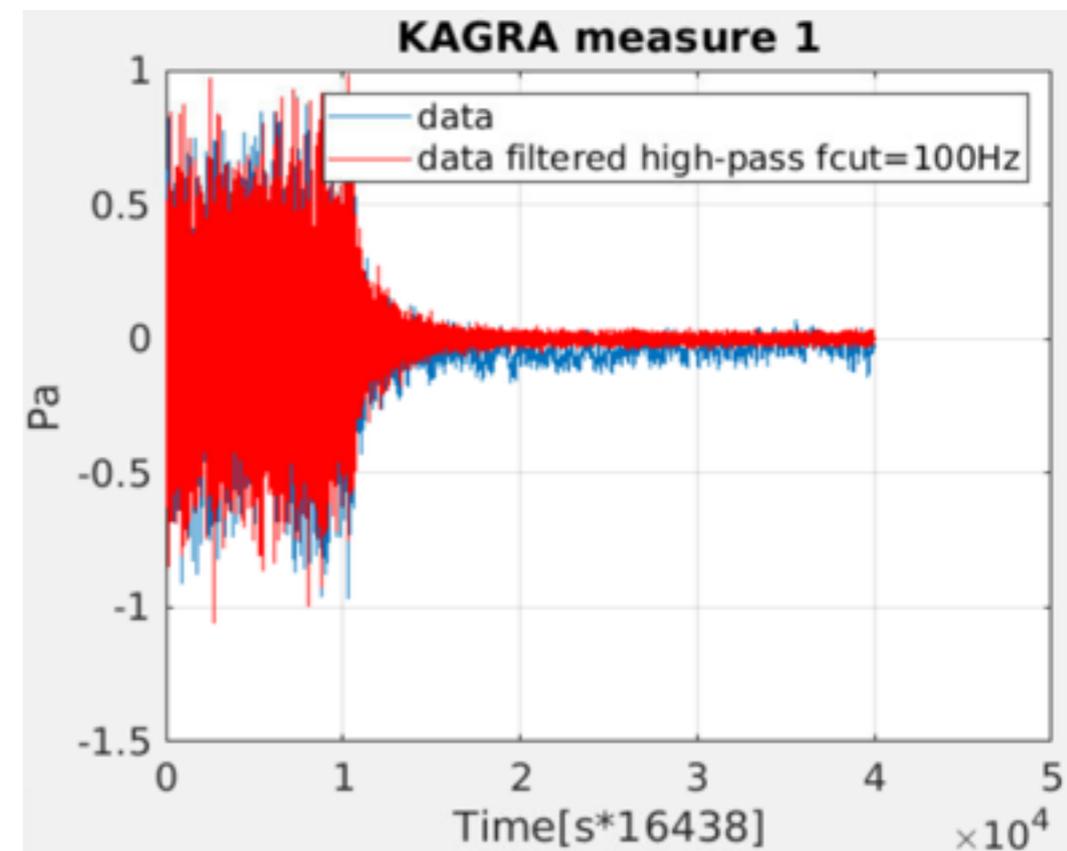
Sound decay measurement

- (1) Inject the white sound from the KAGRA speaker
- (2) Measure the decay time by the Virgo microphone
 - R60(decay time to -60dB) is useful unit for this measurement

The detail is written in <http://klog.icrr.u-tokyo.ac.jp/osl/?r=8920>

Washimi-san plans to take advanced data

- Significant injection source with various position



IYC chamber measurement

Data taking at the IYC area :

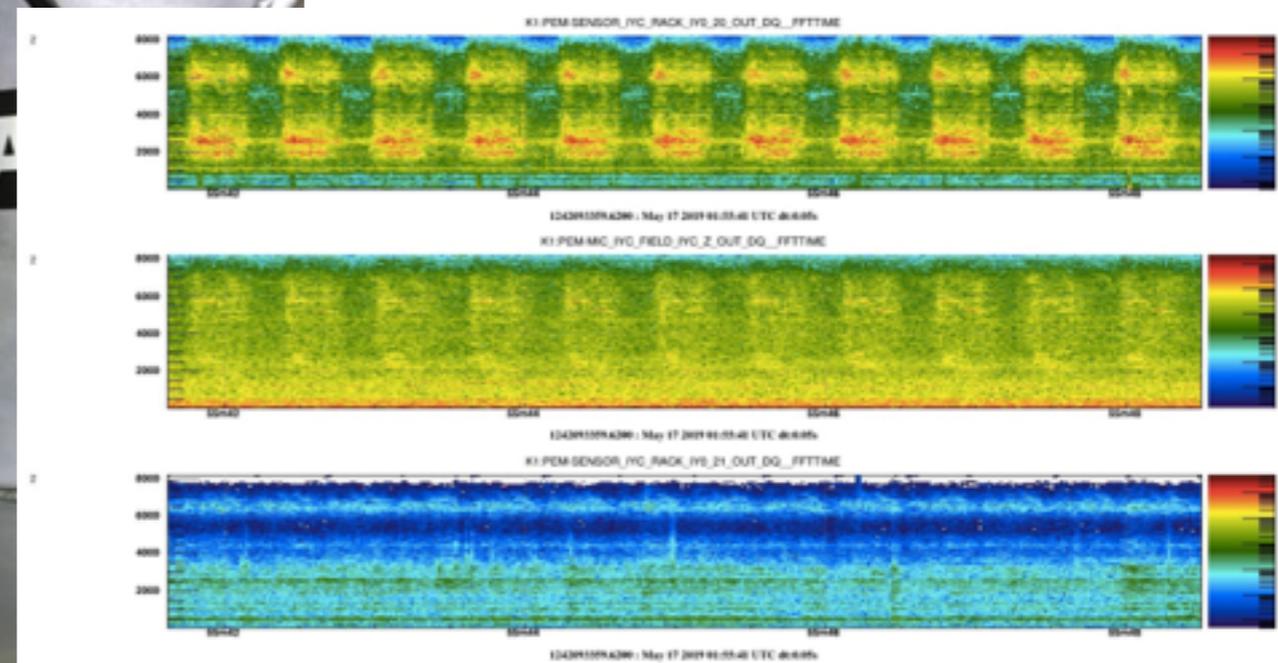
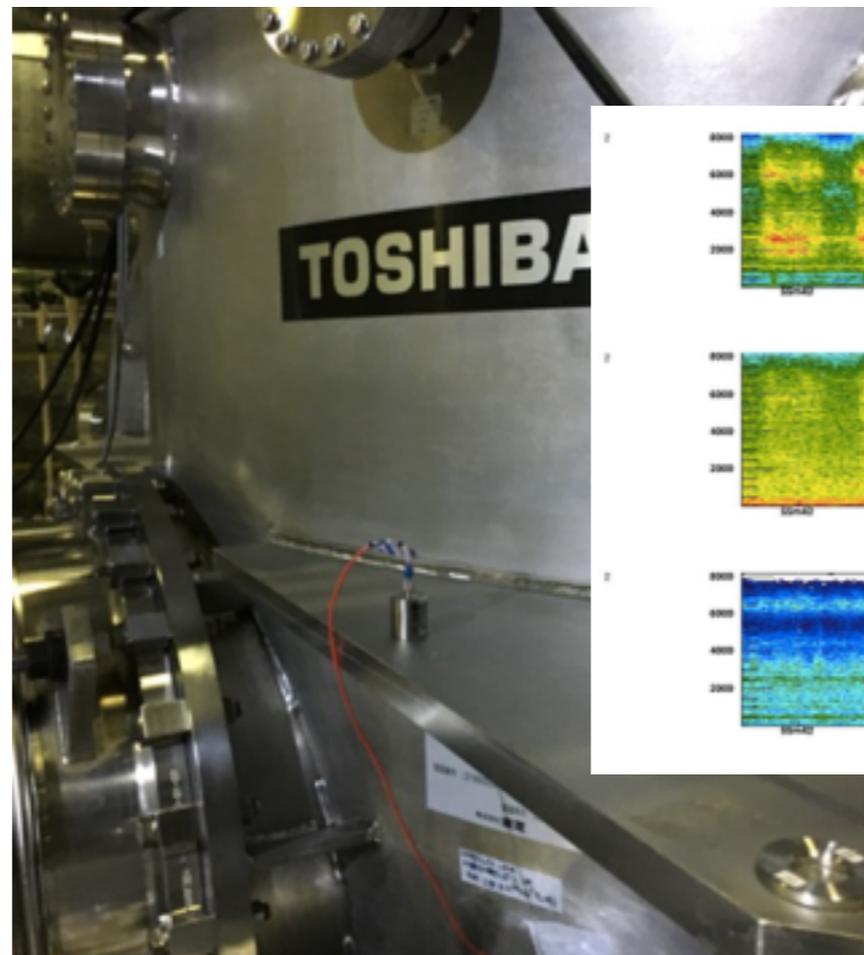
(1) Set a Virgo accelerometers to the chamber and cooler

(2) Set a KAGRA magnetometer

- Coupling function between cooler and PEMs

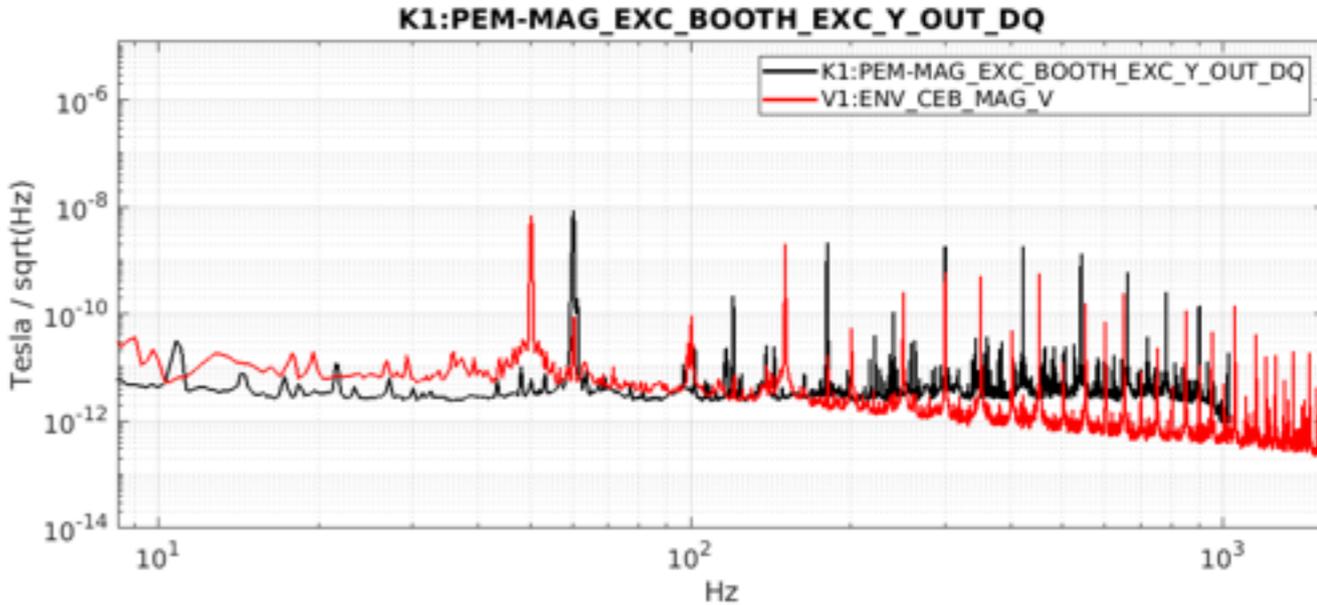
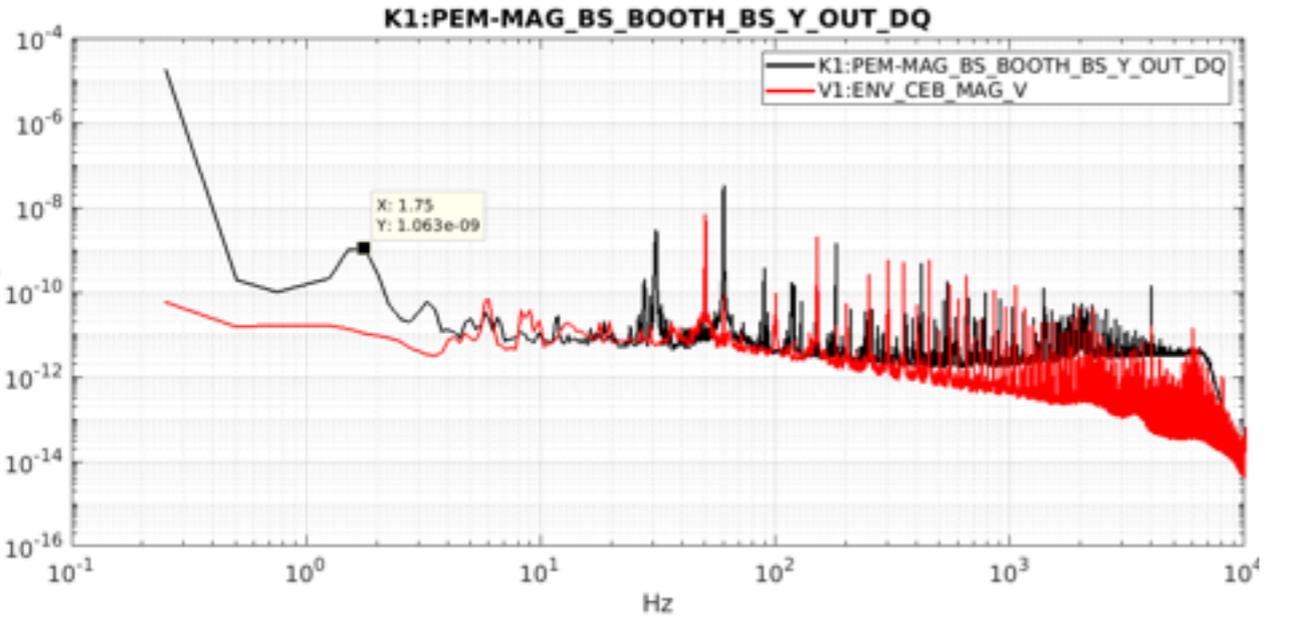
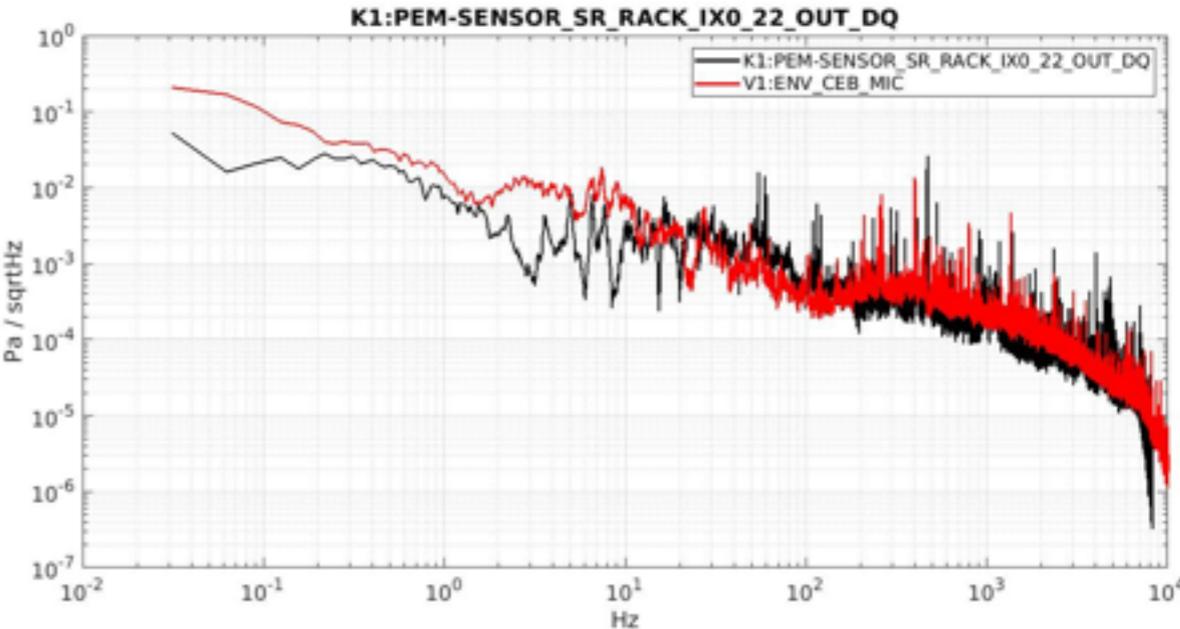
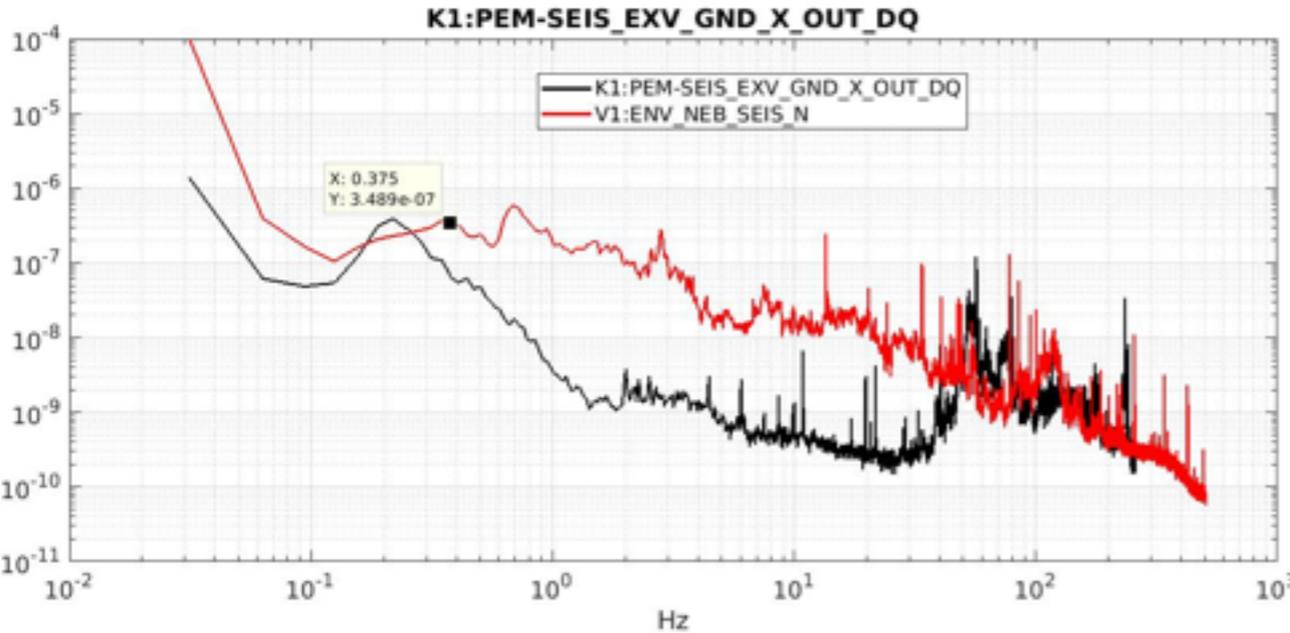
The detail is written in <http://klog.icrr.u-tokyo.ac.jp/osl/?r=8919>

Washimi-san did the additional measurement by KAGRA accelerometer



Comparison with Virgo KAGRA PEMs

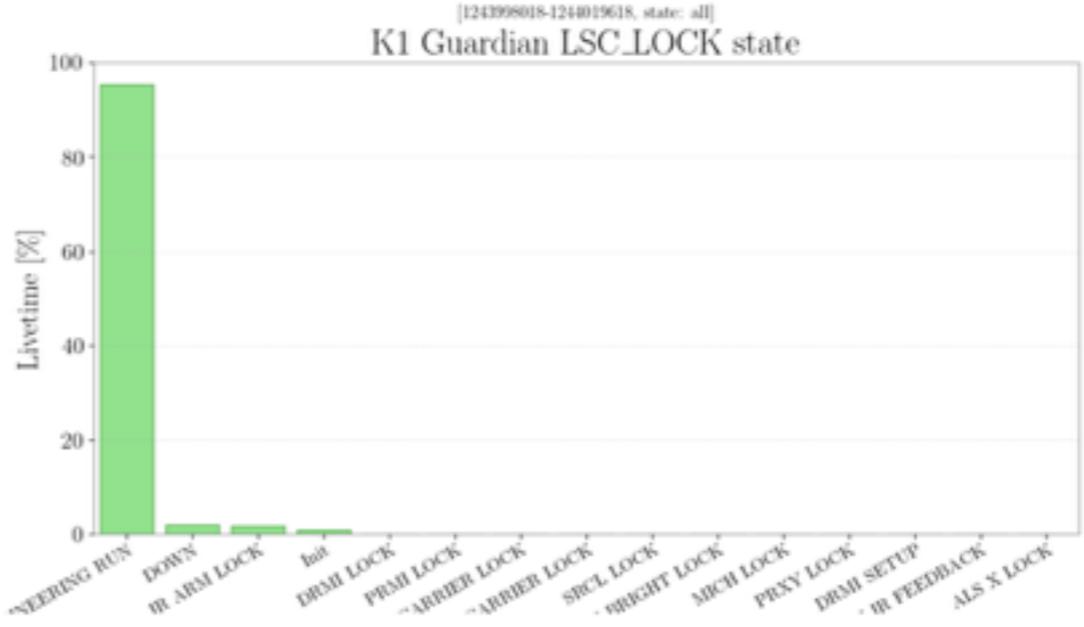
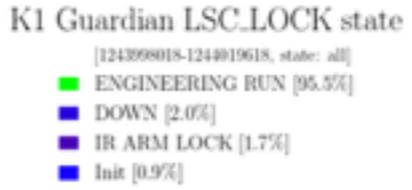
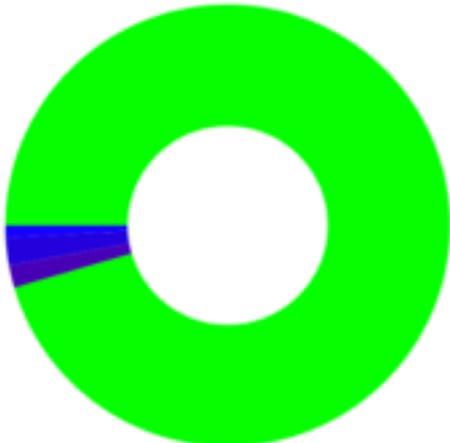
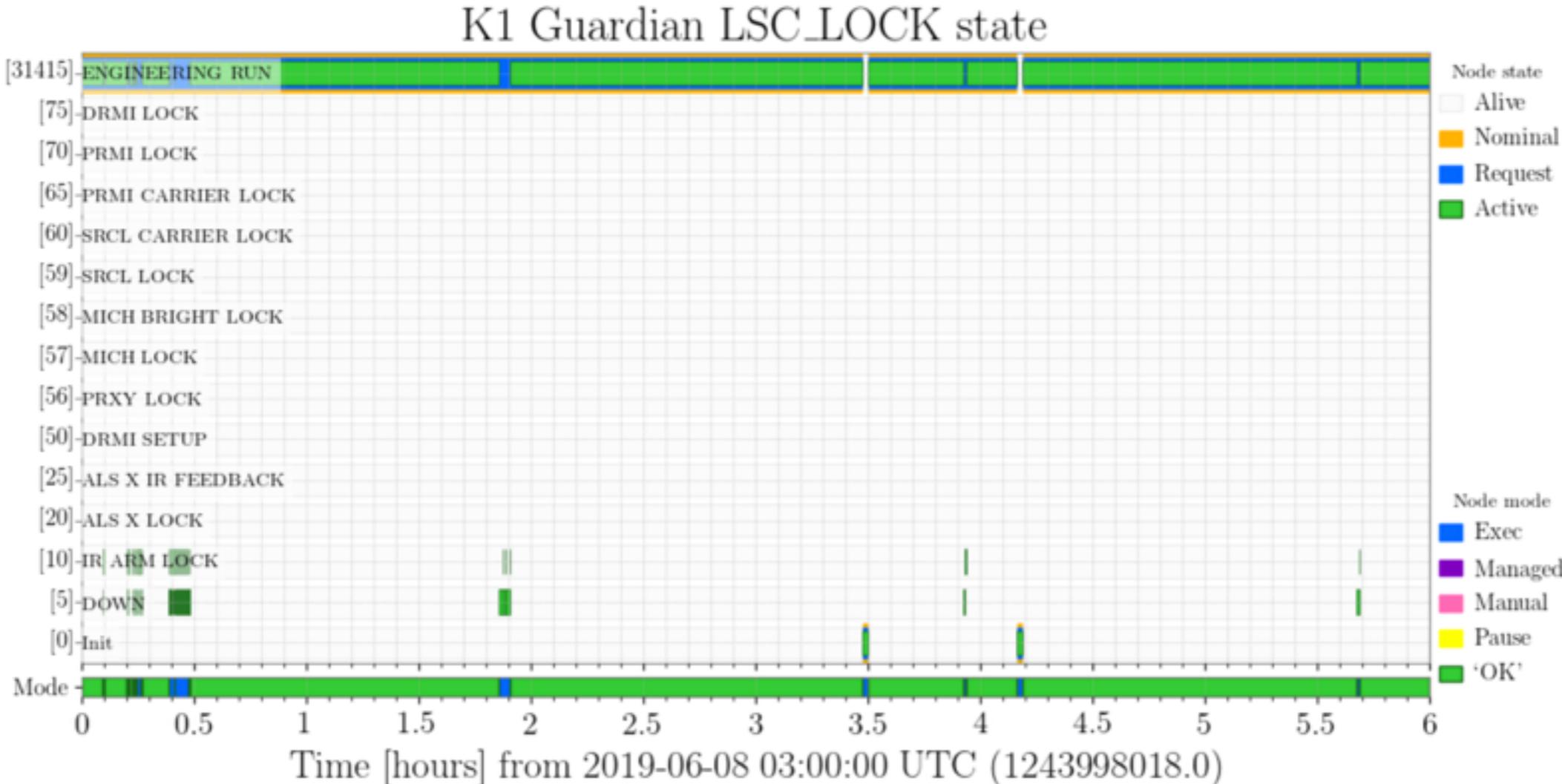
The detail is written in <http://klog.icrr.u-tokyo.ac.jp/osl/?r=8923>



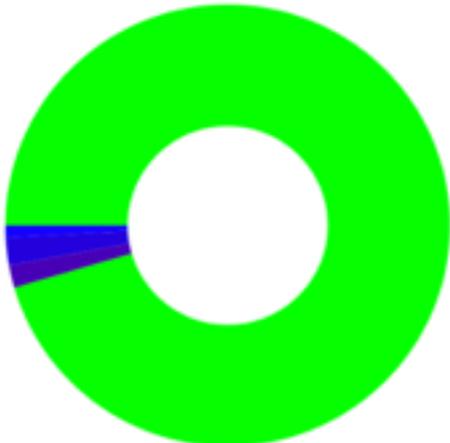
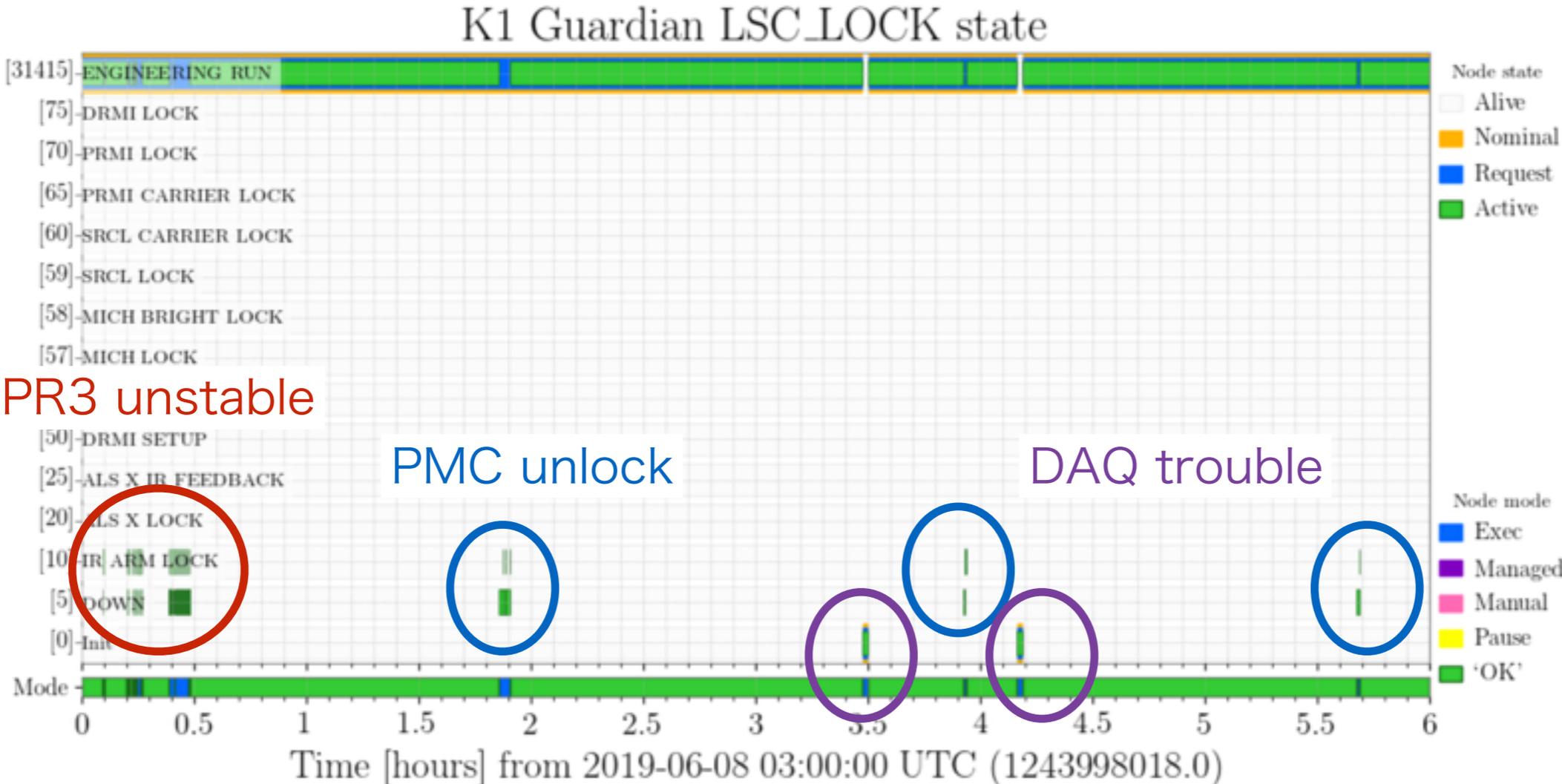
During the Virgo team visiting

- Many channels changed to 16kHz sampling(usually 2kHz)
- K1:PEM-SENSOR_SR_RACK_IX0_22 Virgo Microphone
- K1:PEM-SENSOR_IYC_RACK_IY0_(20/21) Virgo Accelerometer
- Thank you very much for your co-operation!

Lock status



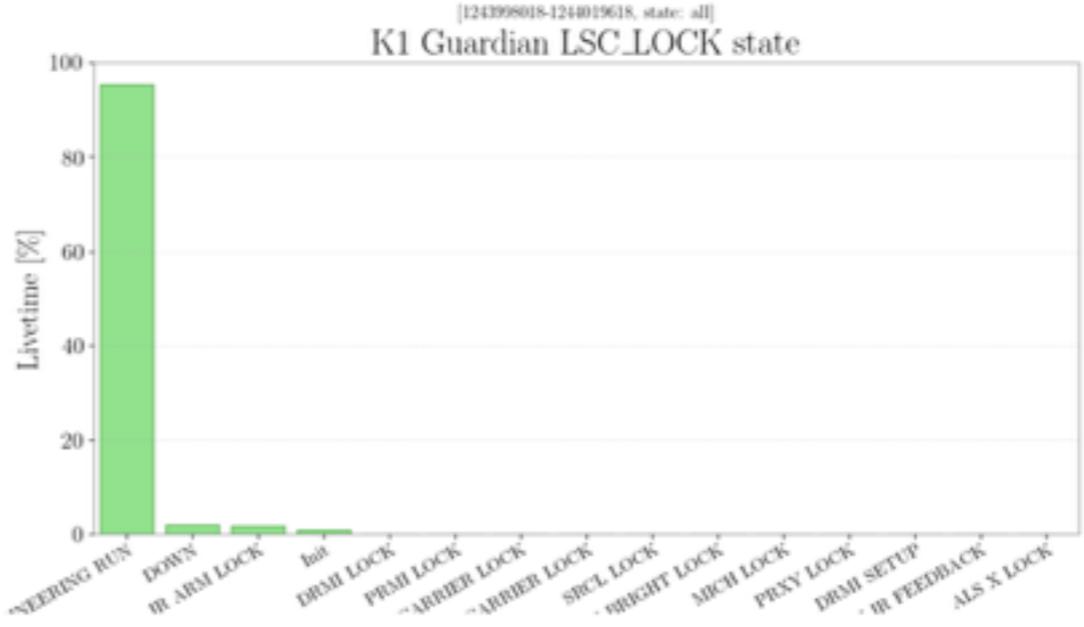
Lock status



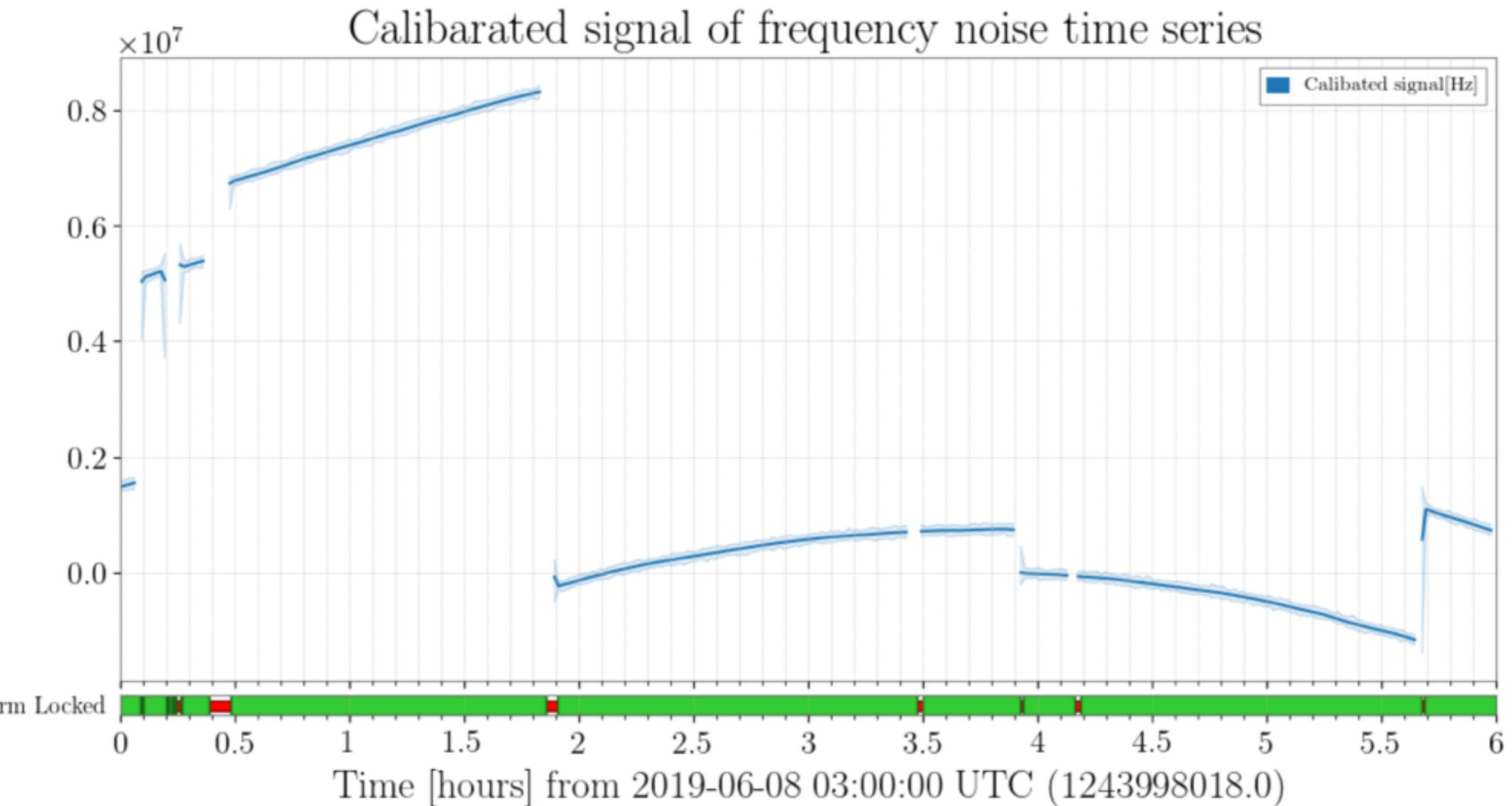
K1 Guardian LSC_LOCK state
 [1243998018-1244019618, state: all]

- ENGINEERING RUN [95.5%]
- DOWN [2.0%]
- IR ARM LOCK [1.7%]
- Init [0.9%]

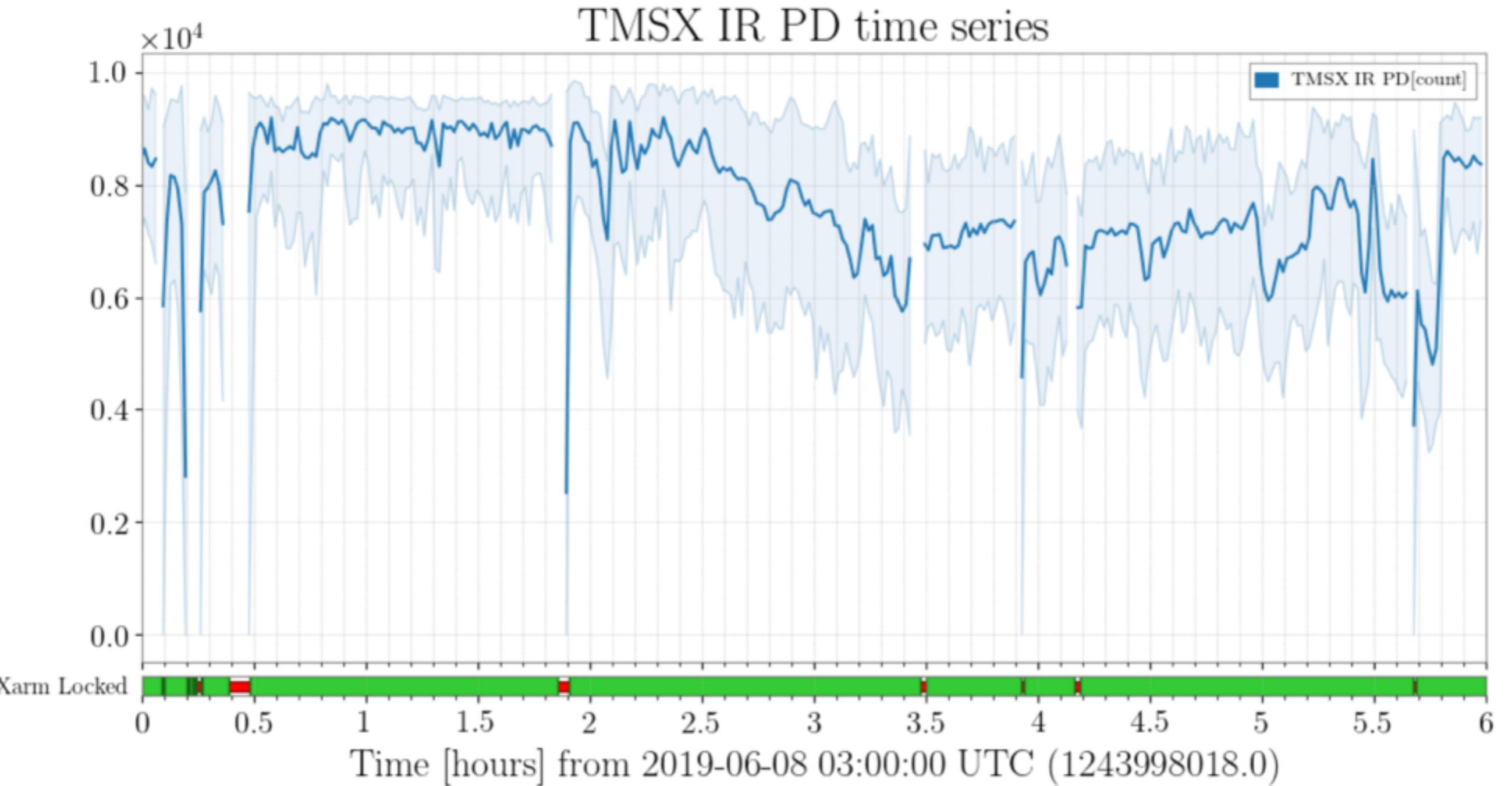
95.5%!



calibrated frequency noise

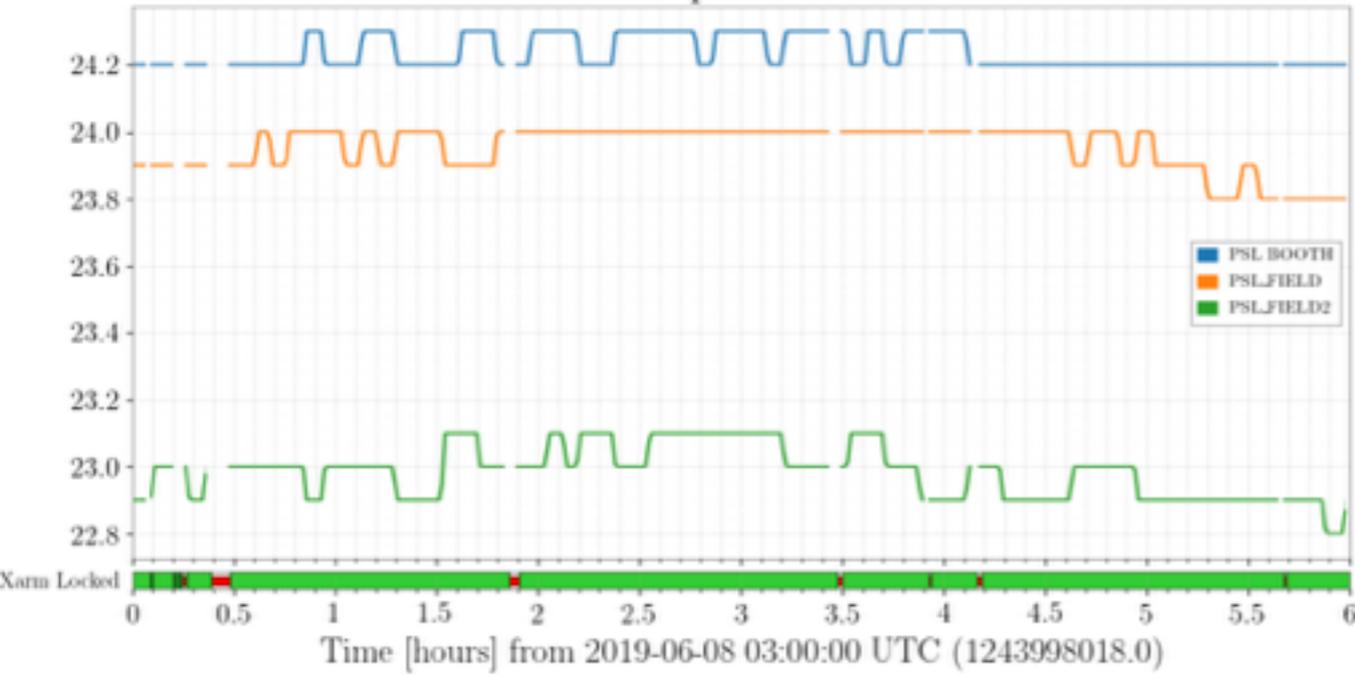


Transmitted light intensity

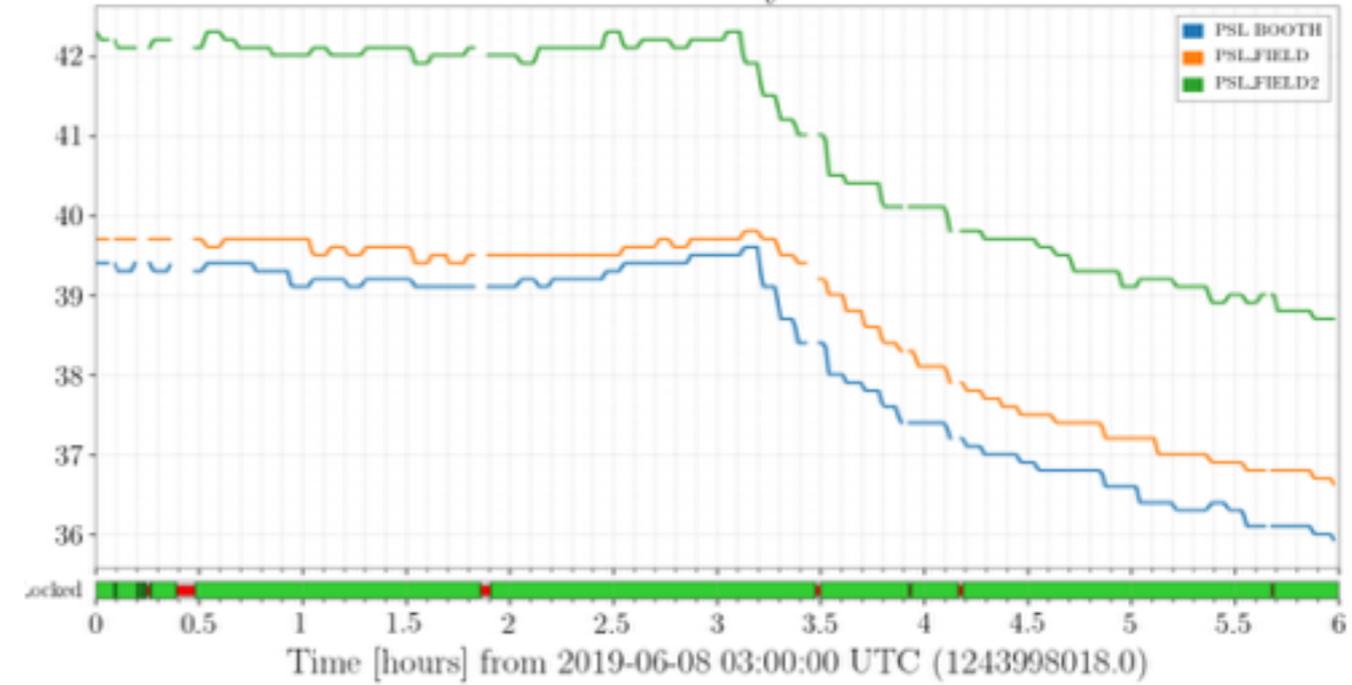


Temperature/Humidity

Ondotori temperature PSL room

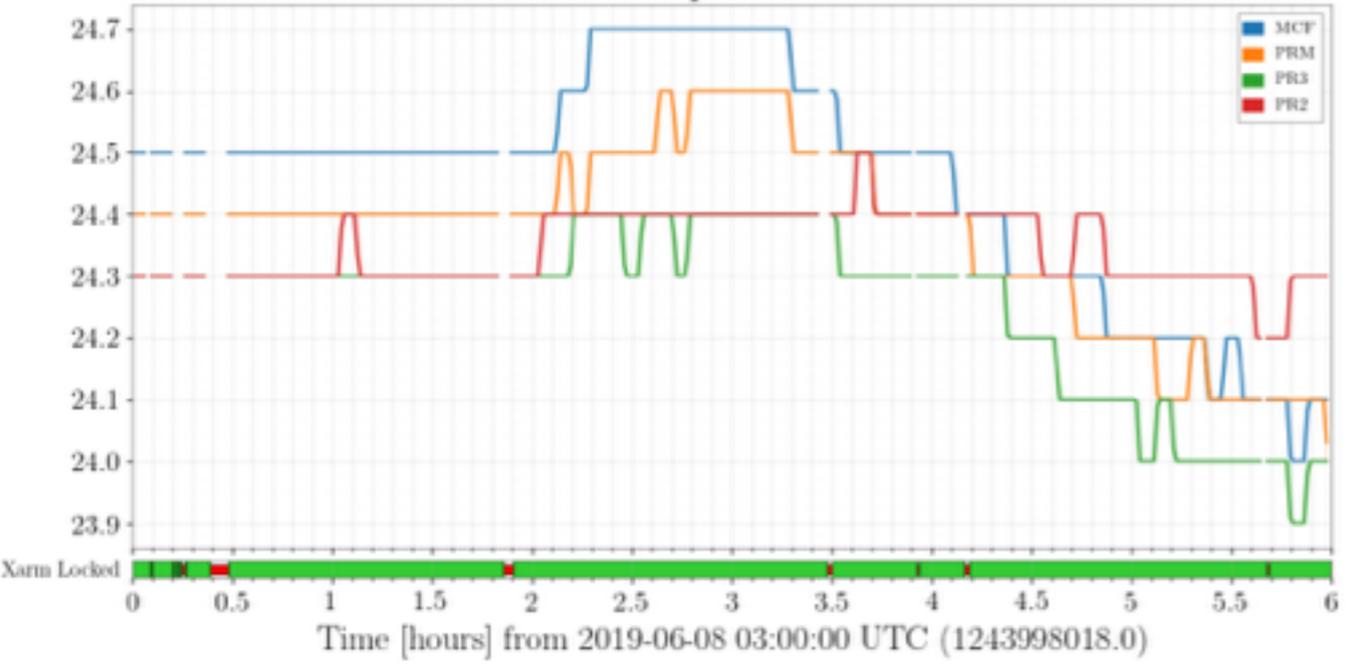


Ondotori Humidity PSL room

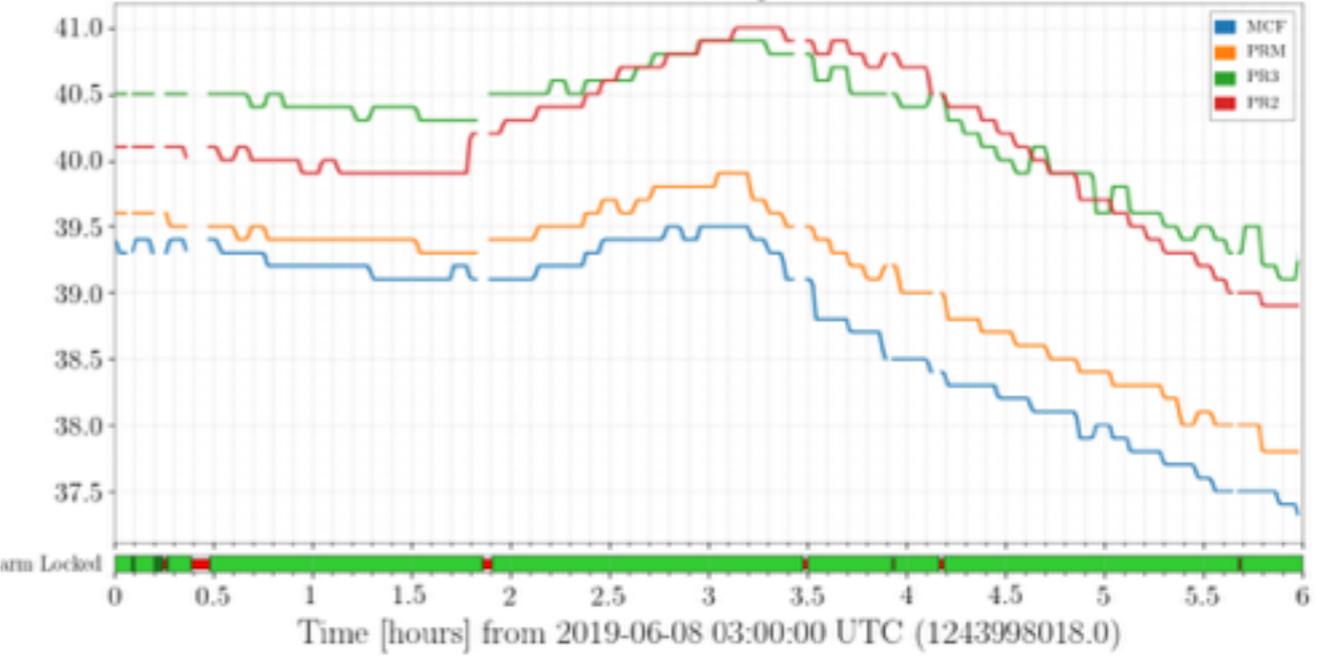


Temperature/Humidity

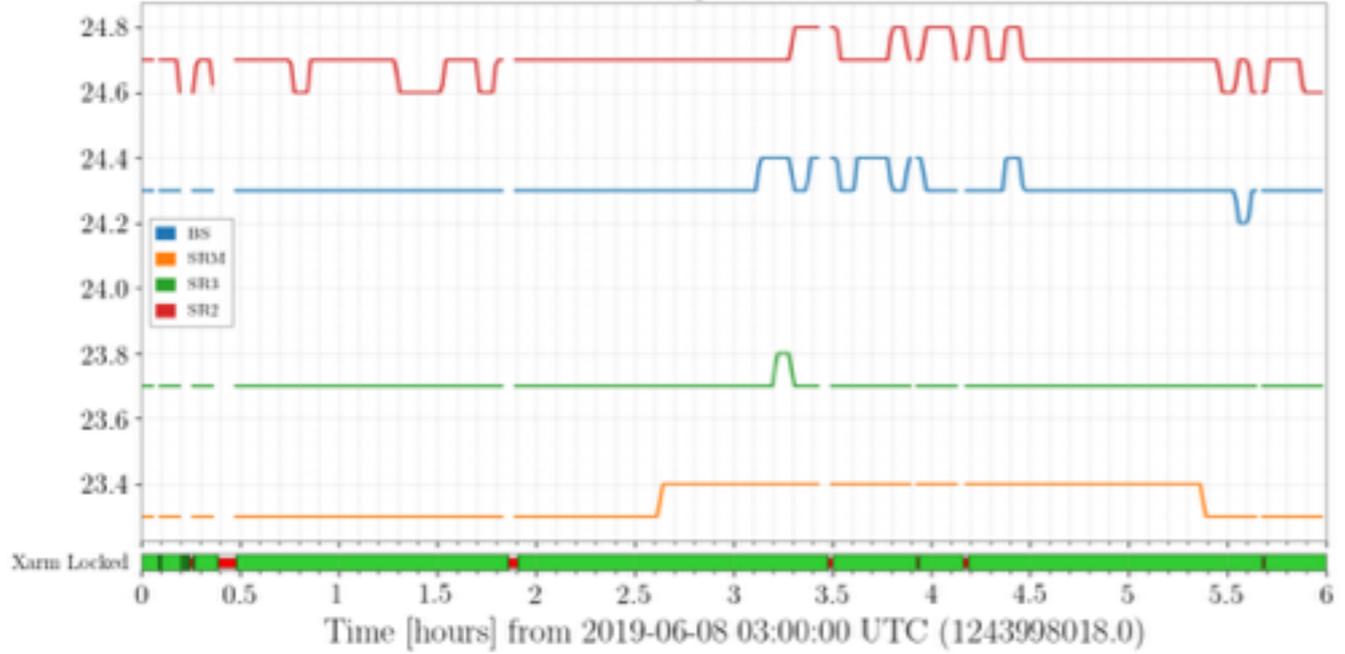
Ondotori Temperature PR booth



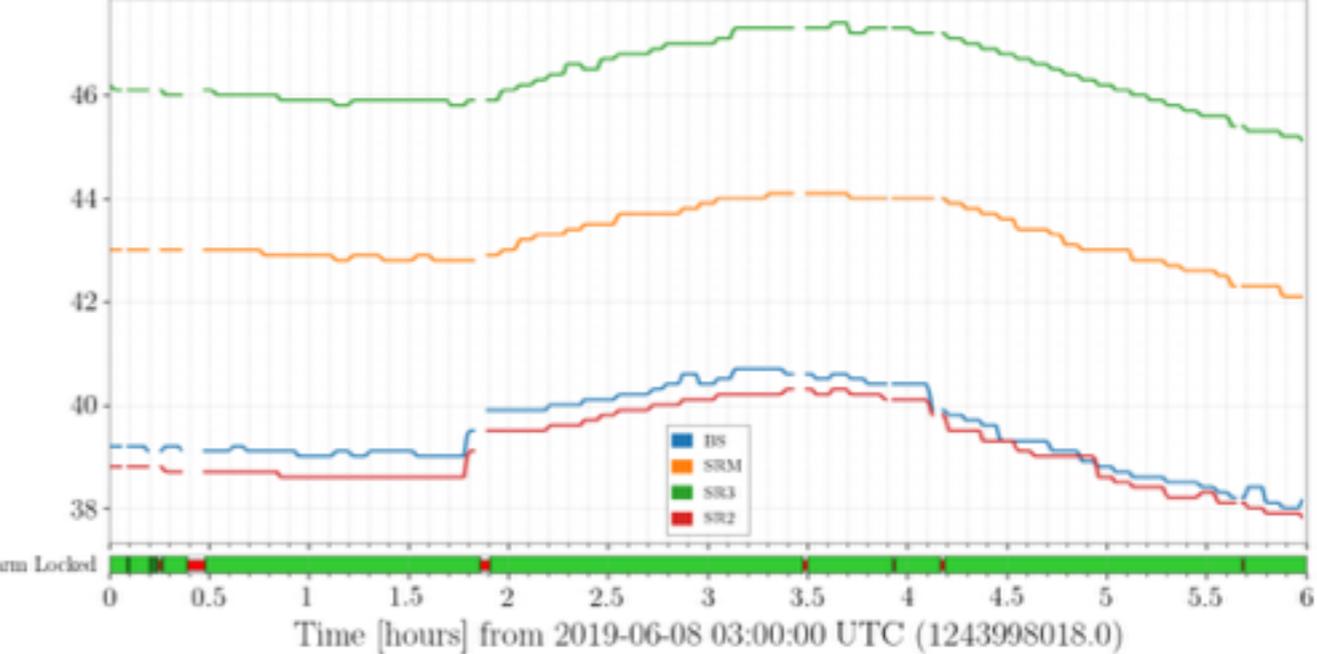
Ondotori Humidity PR booth



Ondotori Temperature SR booth

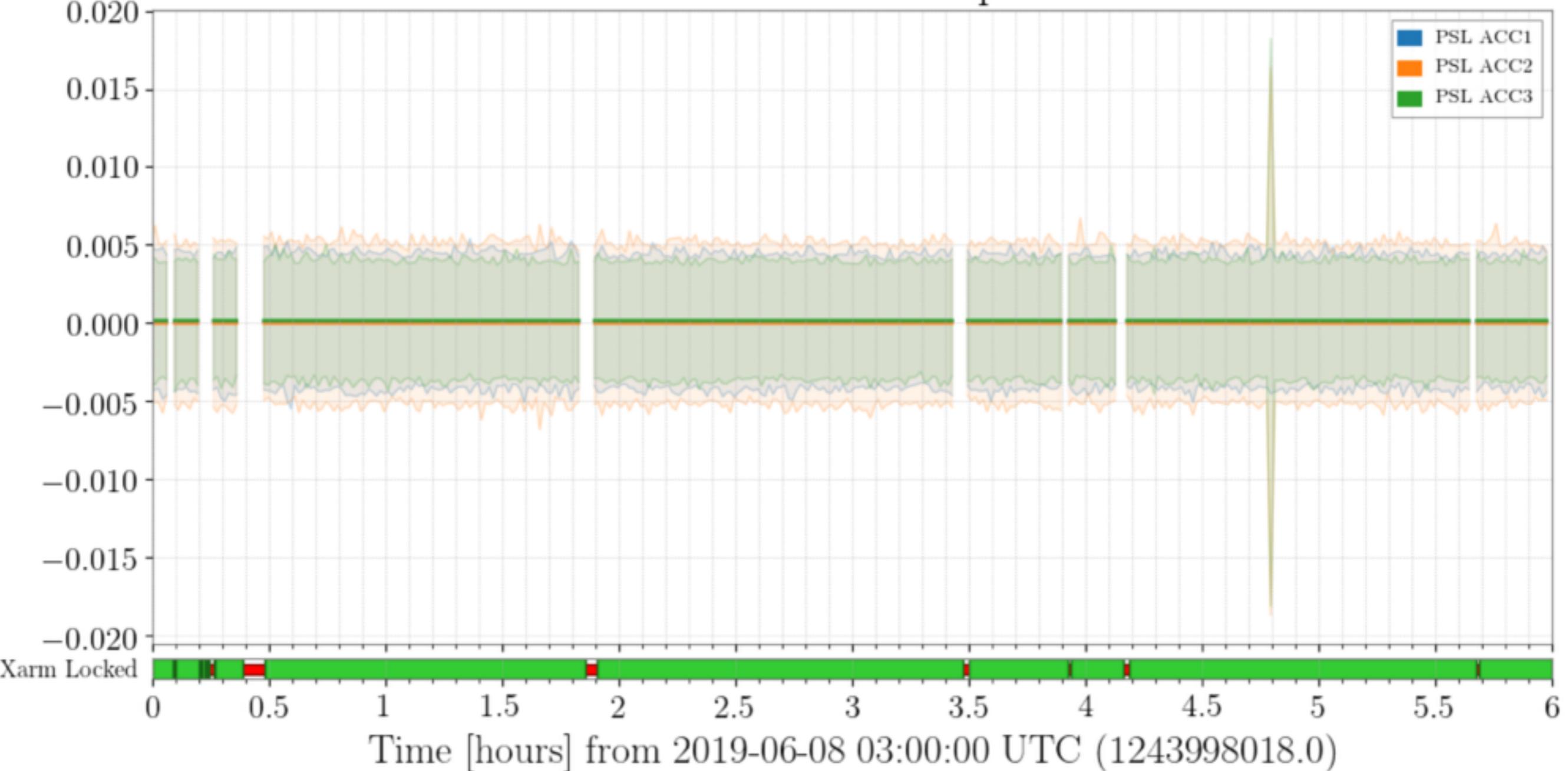


Ondotori Humidity SR booth



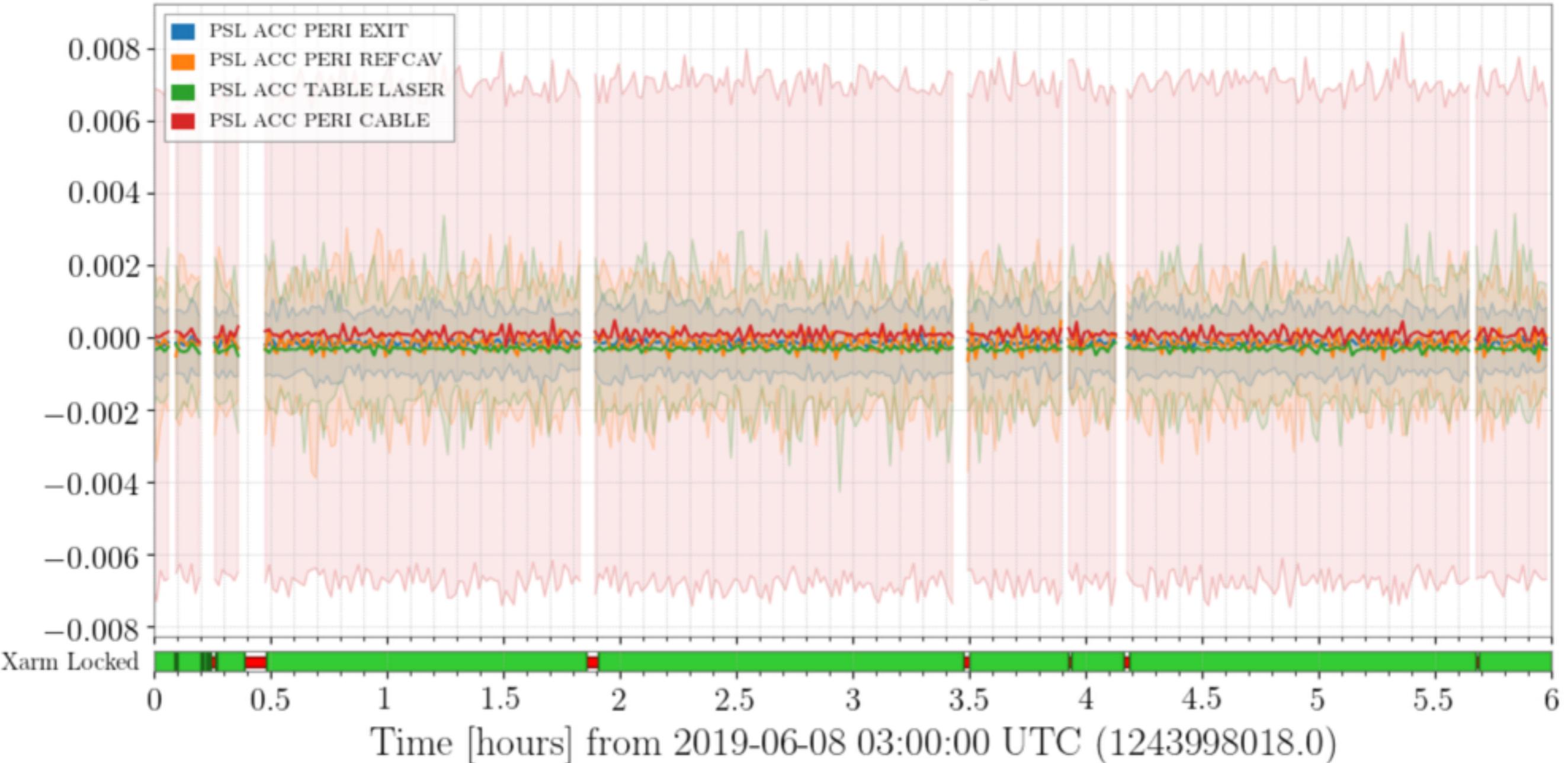
PSL PEMs

PSL TEAC Accelerometers amplitude time series



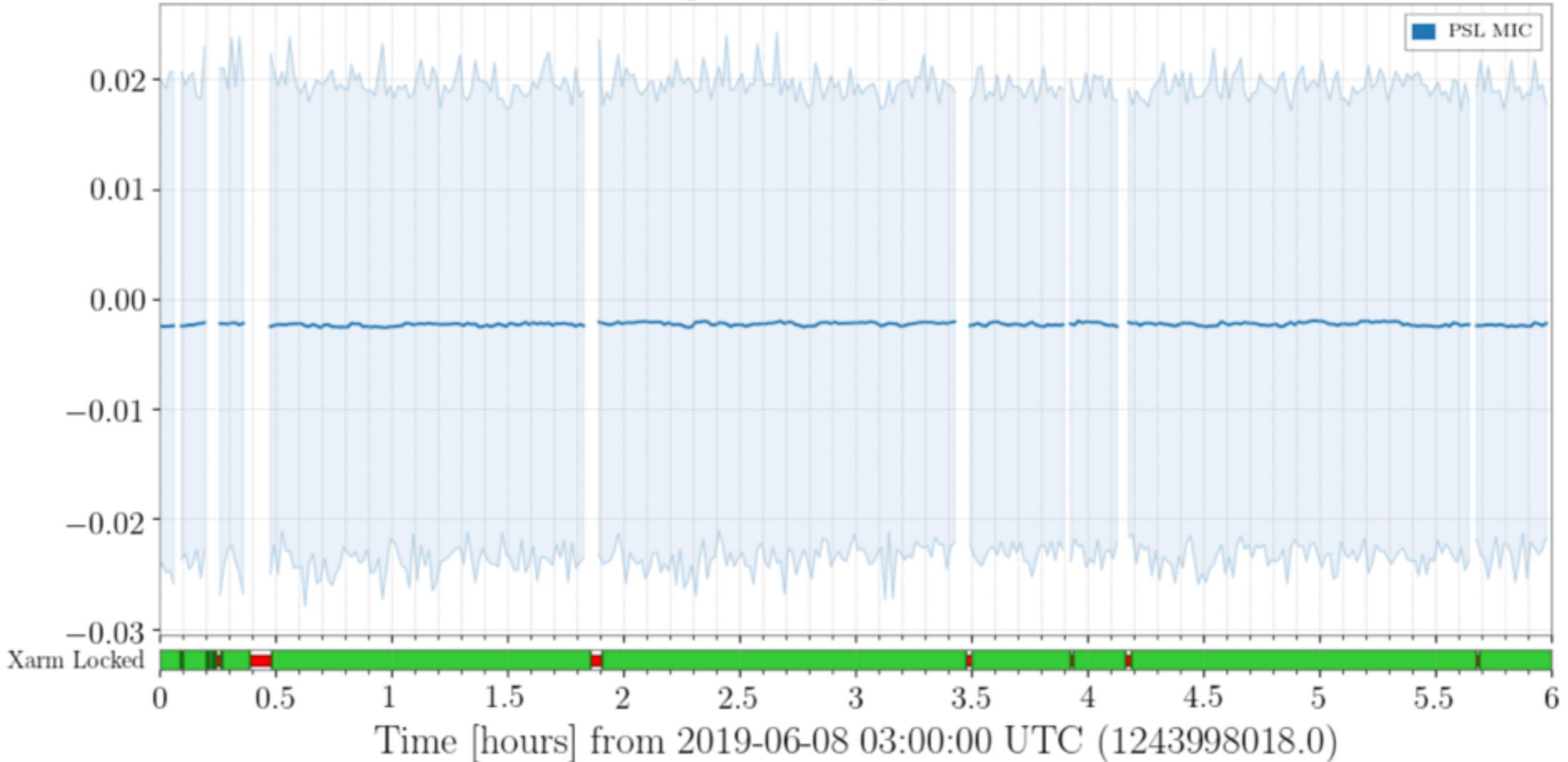
PSL PEMs

PSL TEAC Accelerometers amplitude time series



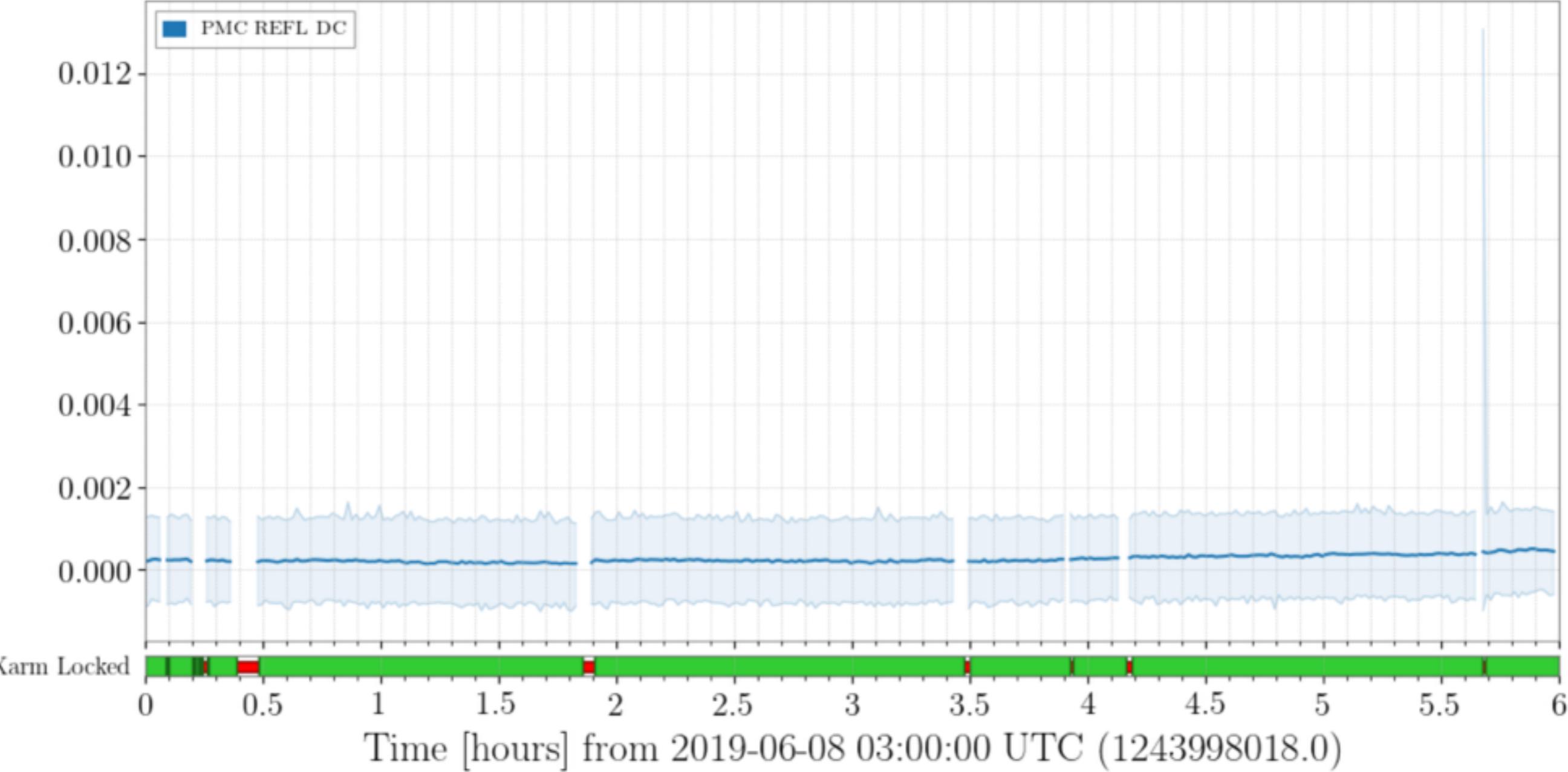
PSL PEMs

PSL Microphone amplitude time series



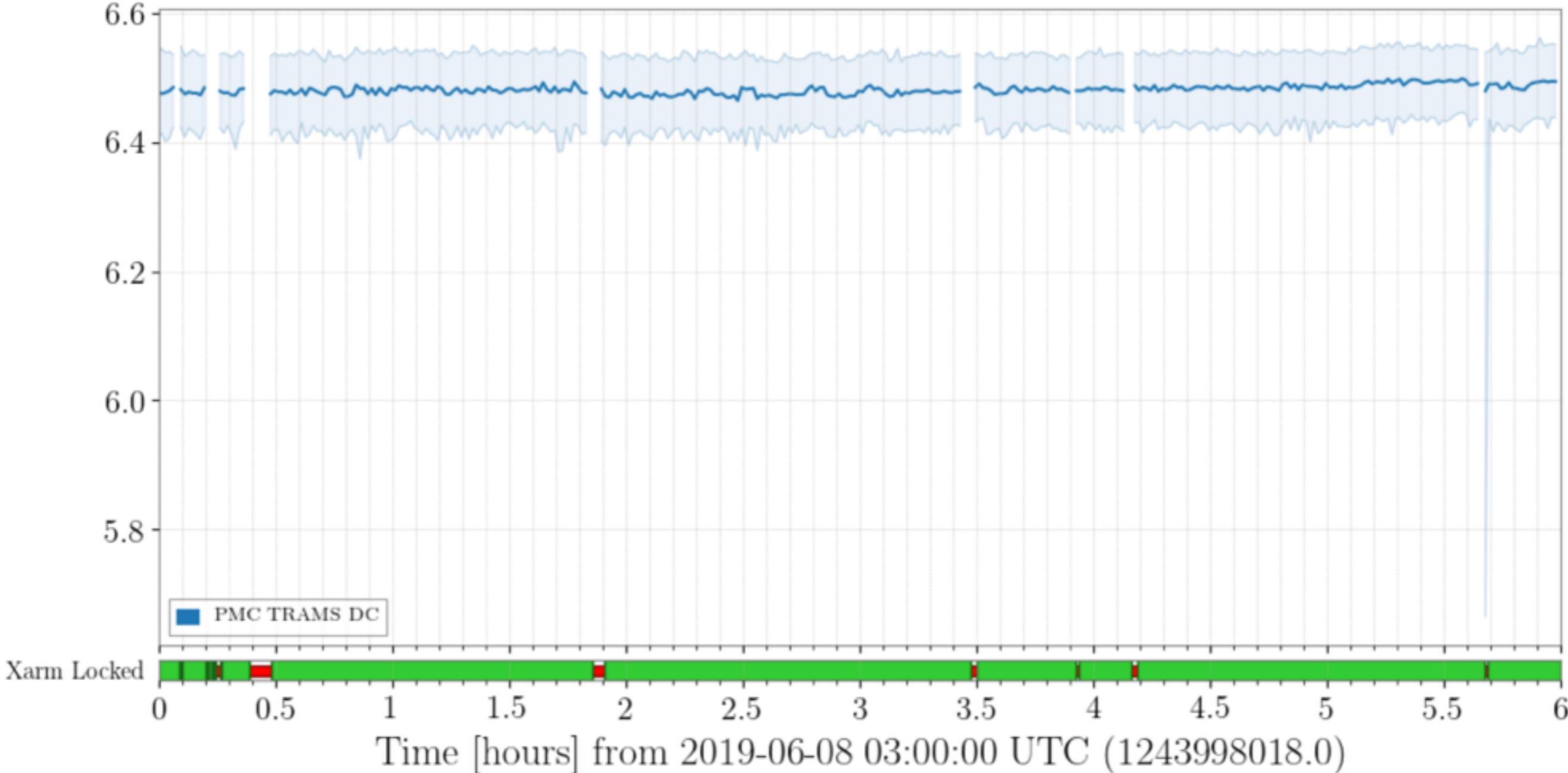
PSL PMC signals

PSL PMC REFL DC time series



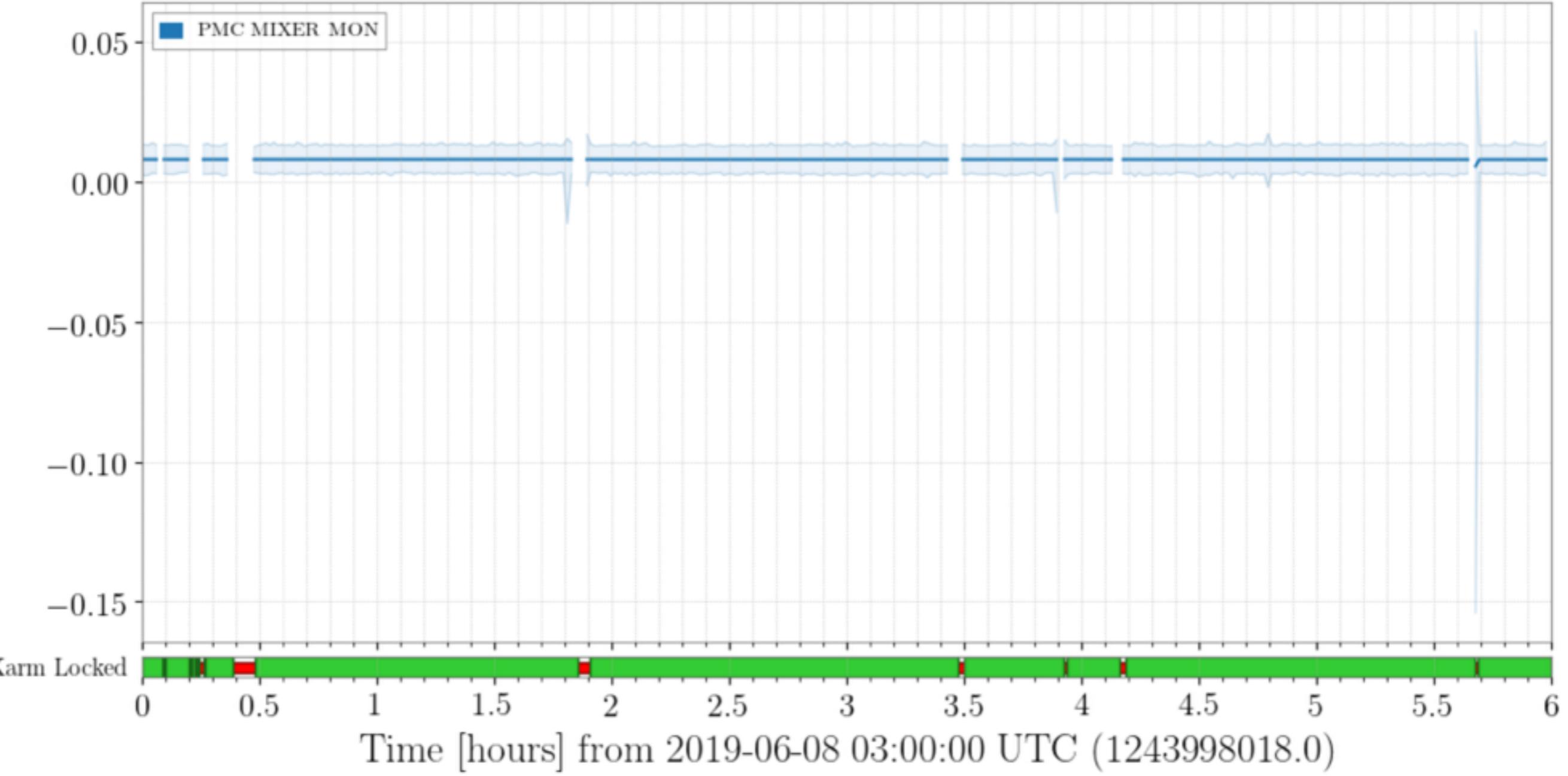
PSL PMC signals

PSL PMC TRANS DV time series



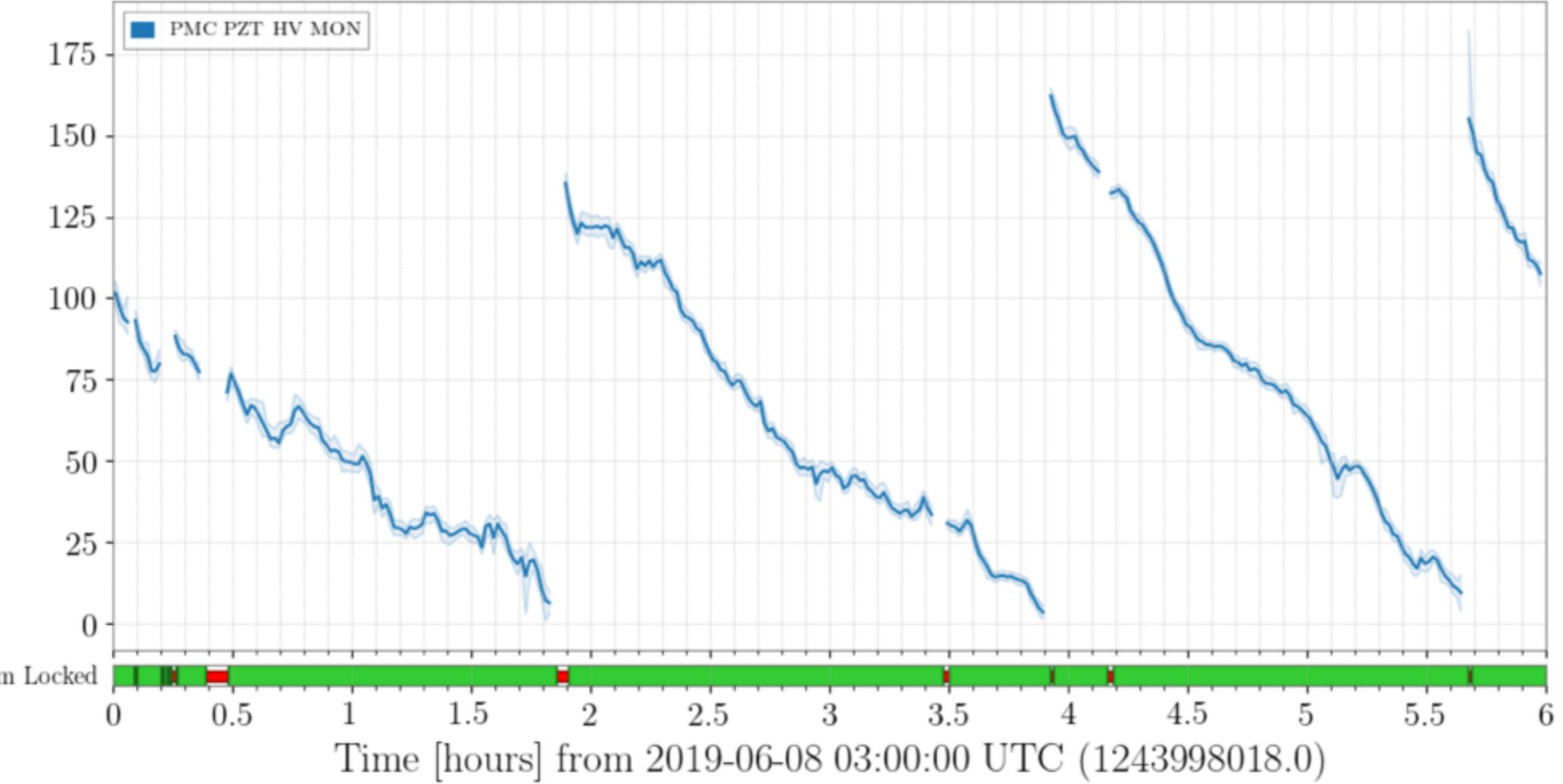
PSL PMC signals

PSL PMC MIXER MON time series



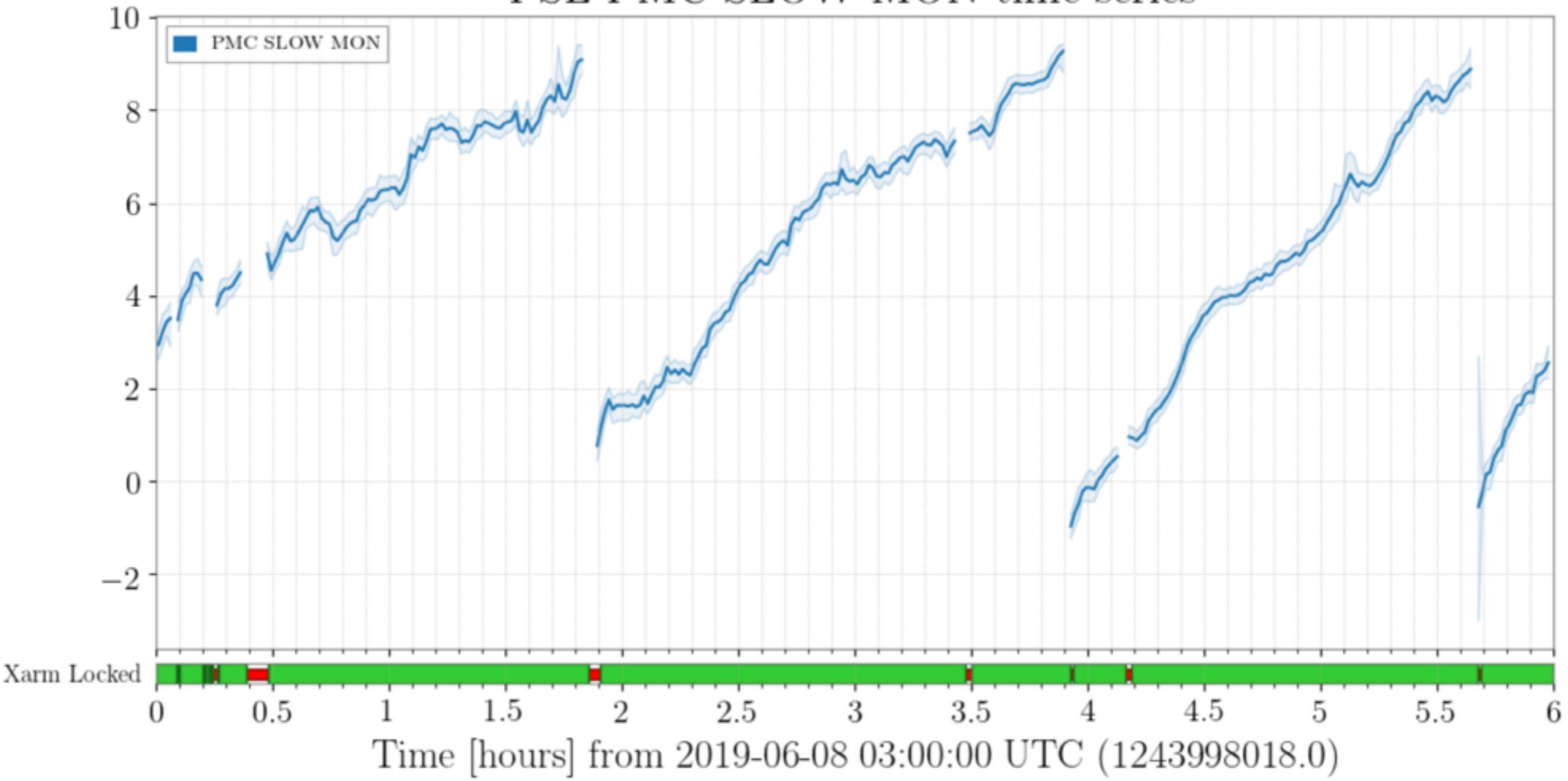
PSL PMC signals

PSL PMC PZT HV MON time series



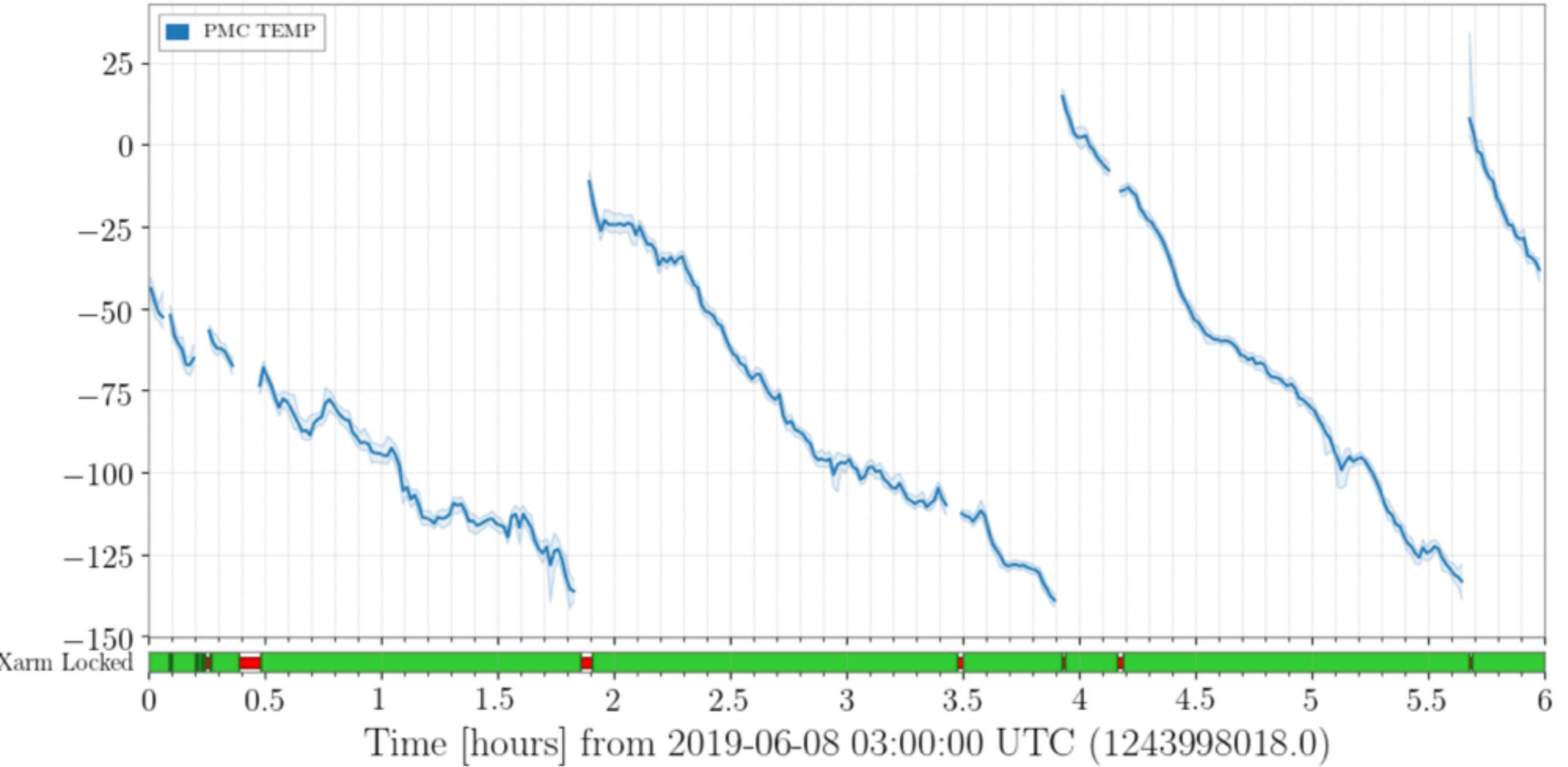
PSL PMC signals

PSL PMC SLOW MON time series



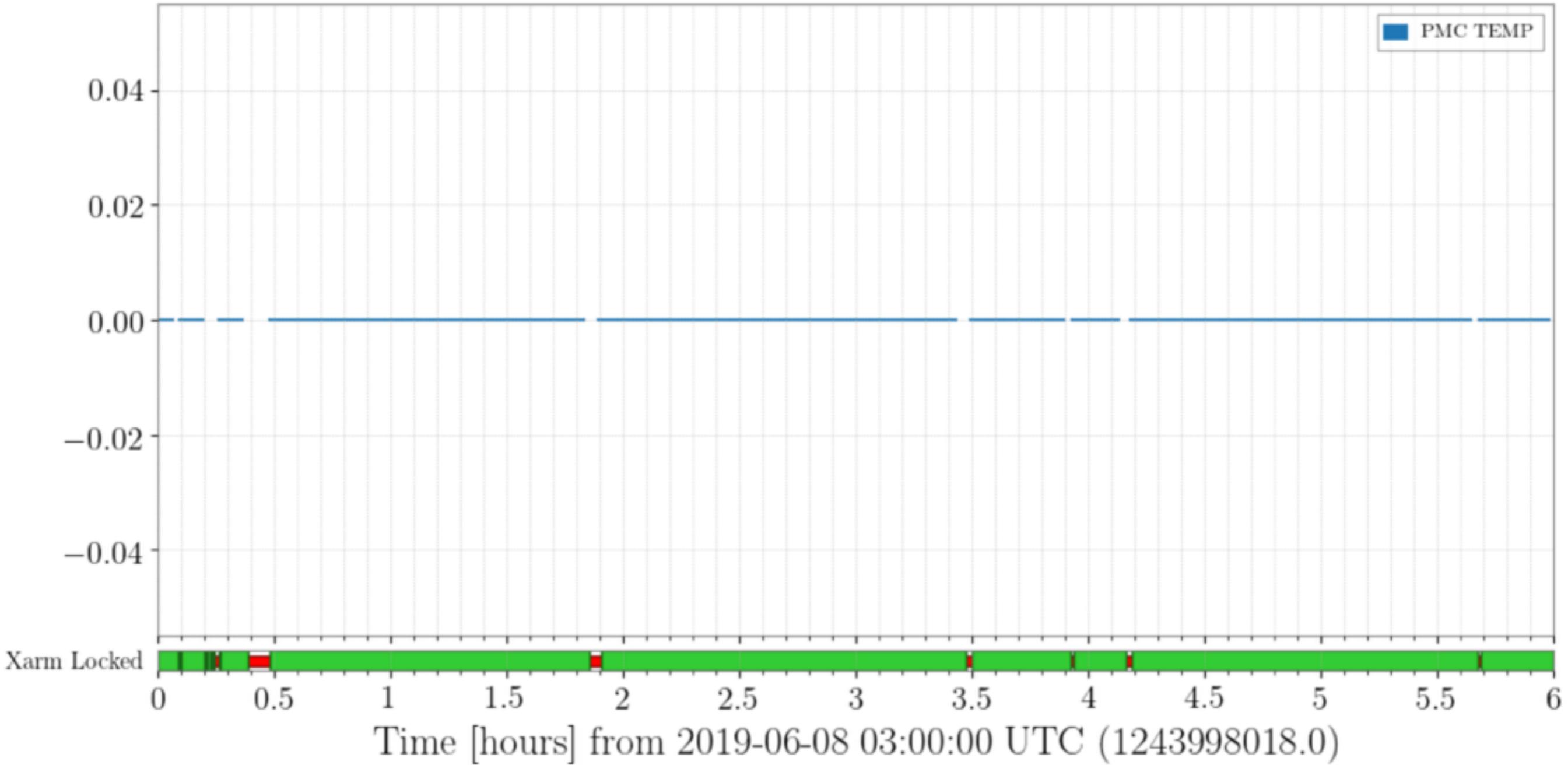
PSL PMC signals

PSL PMC FAST MON time series



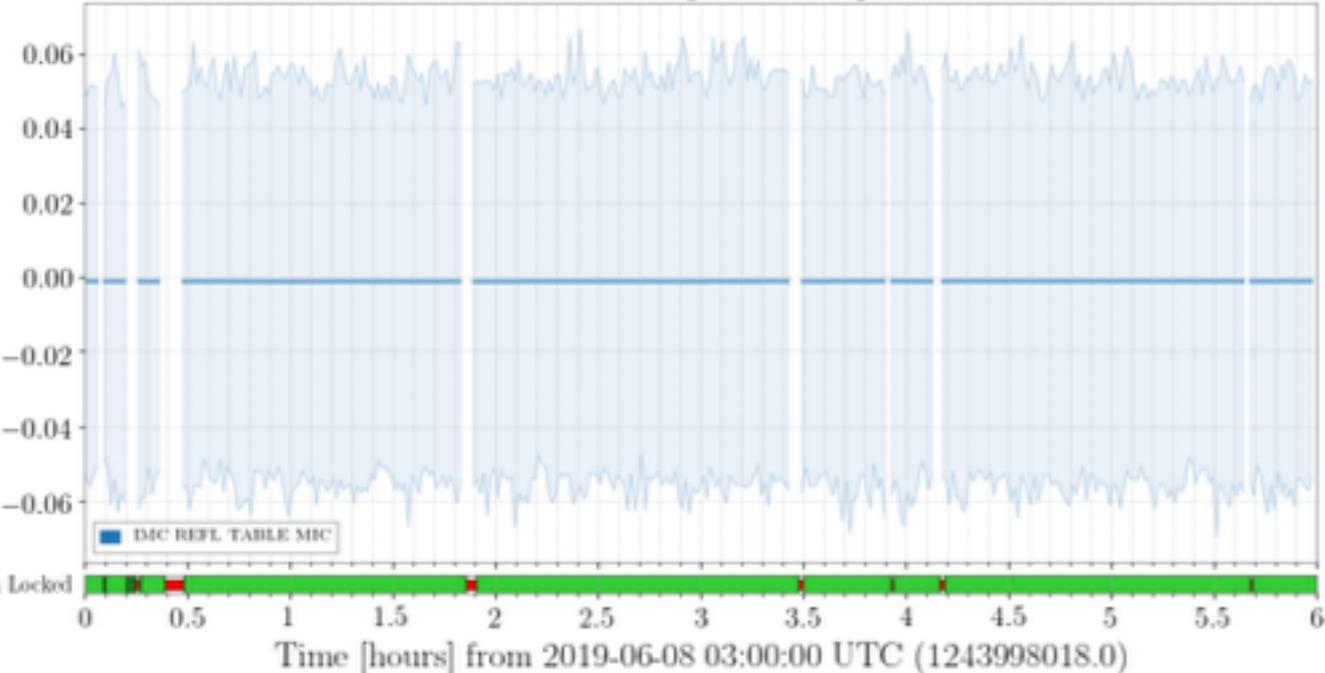
PSL PMC signals

PSL PMC TEMP time series

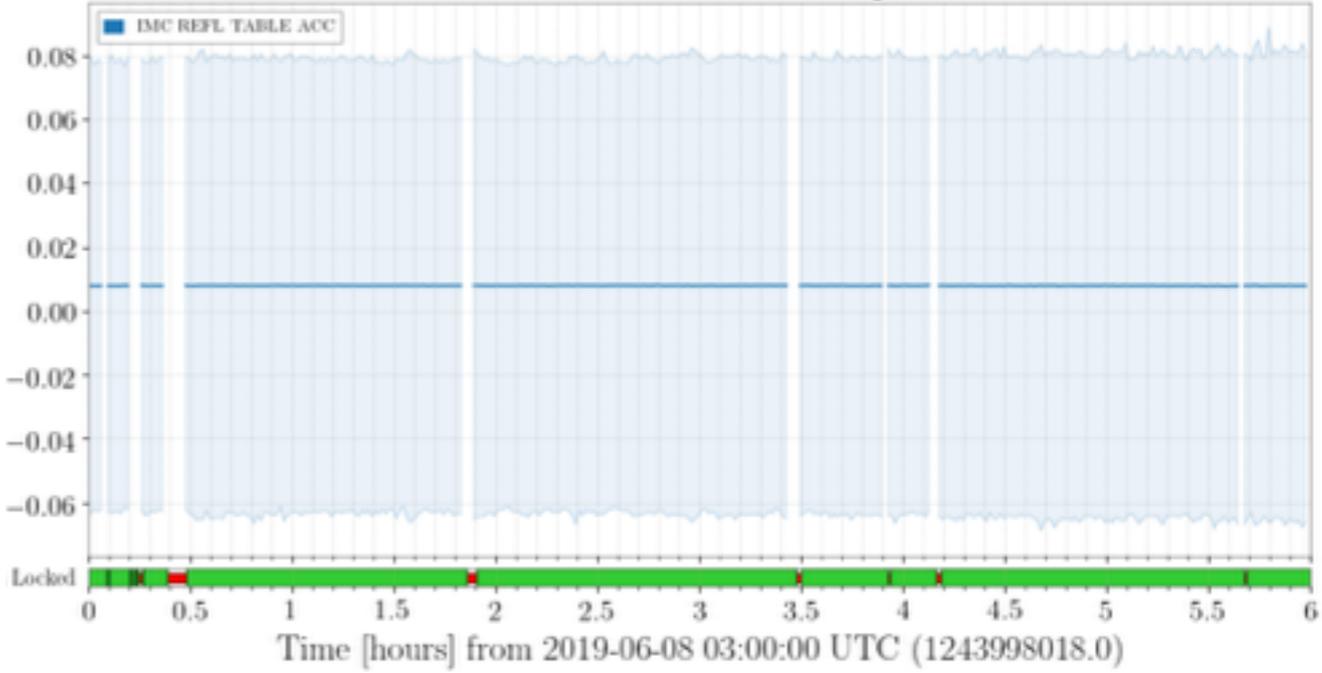


IMC PEMs

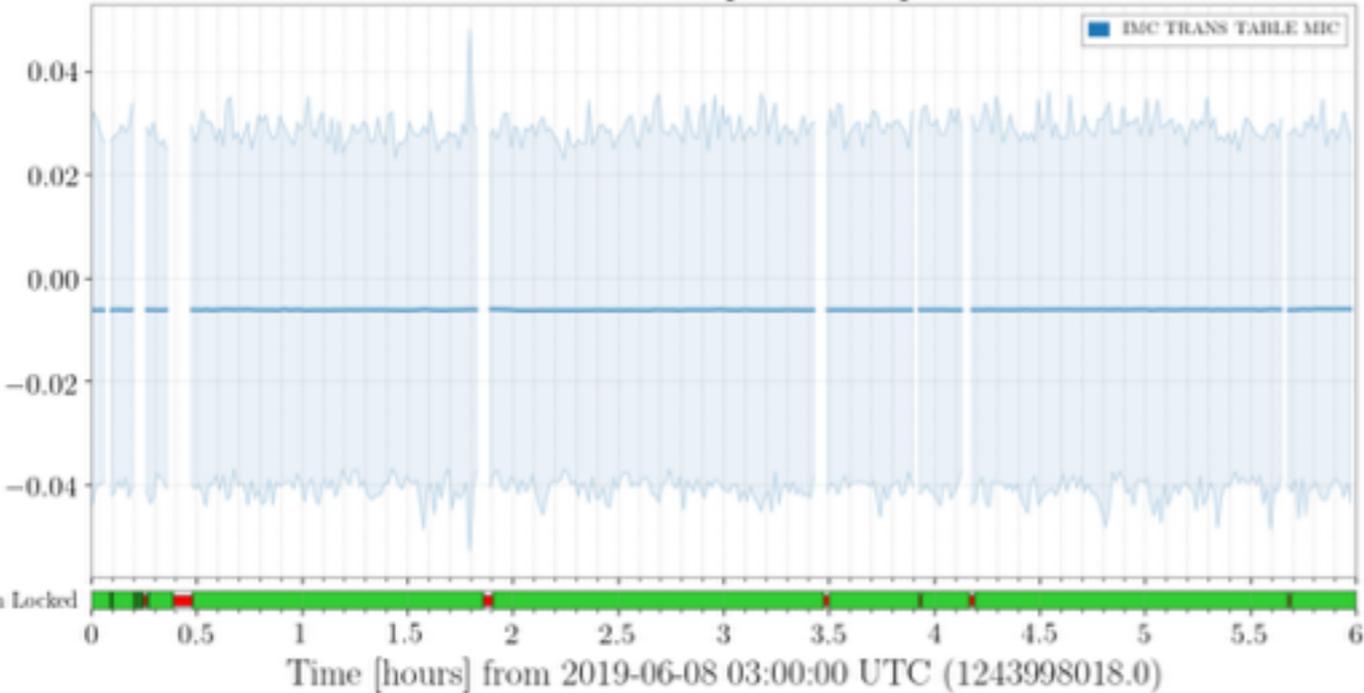
IMC REFL TABLE Microphone amplitude time series



IMC REFL TABLE Accelerometer amplitude time series

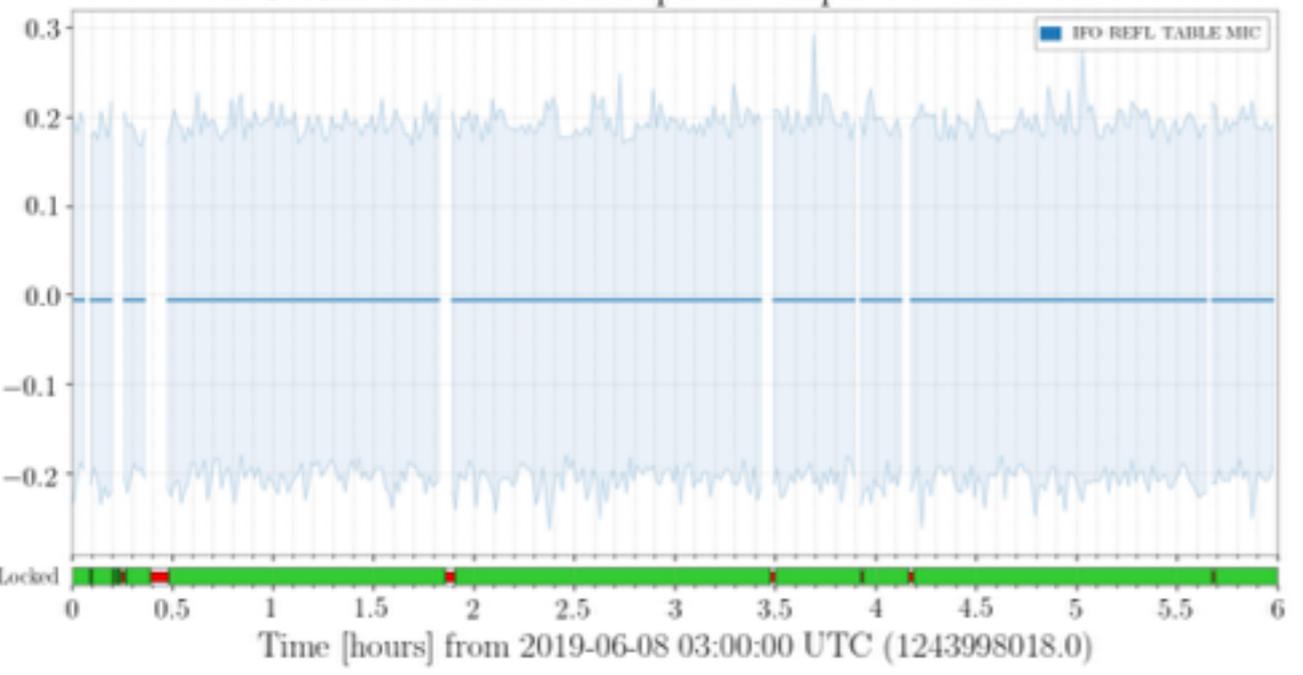


IMC TRANS TABLE Microphone amplitude time series

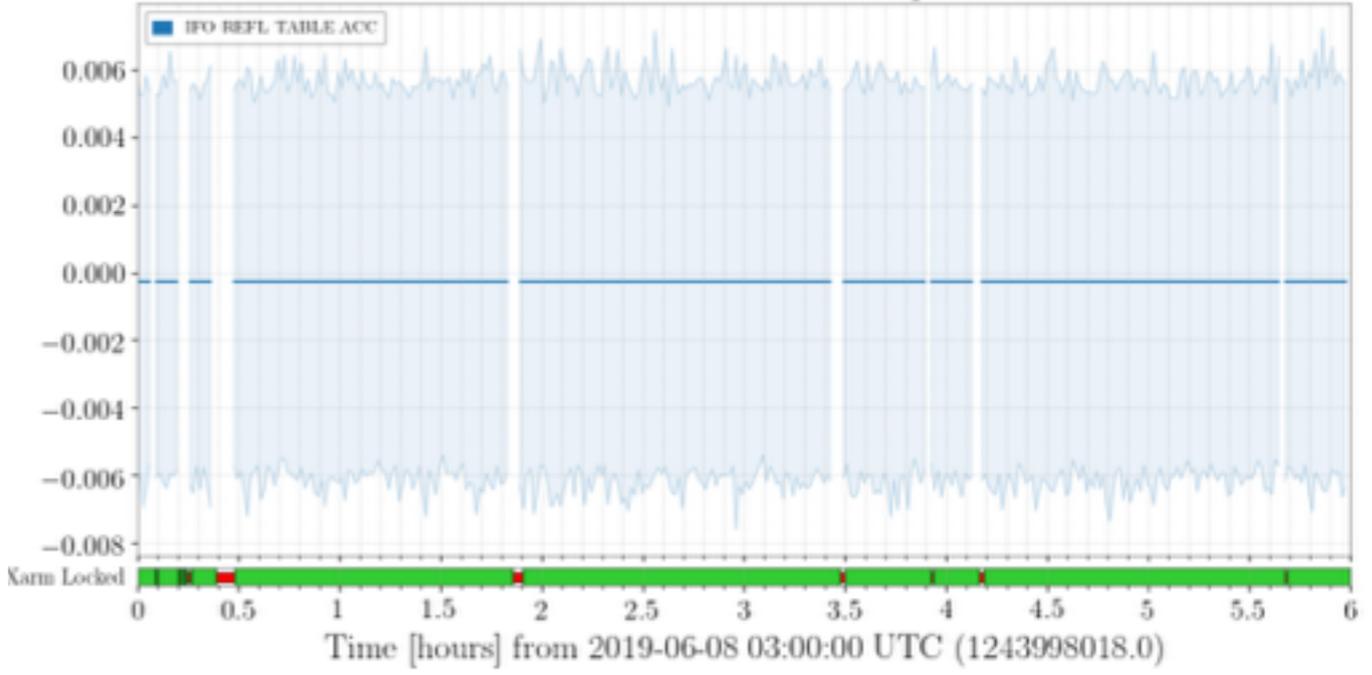


IFO refl / TMSX PEMs

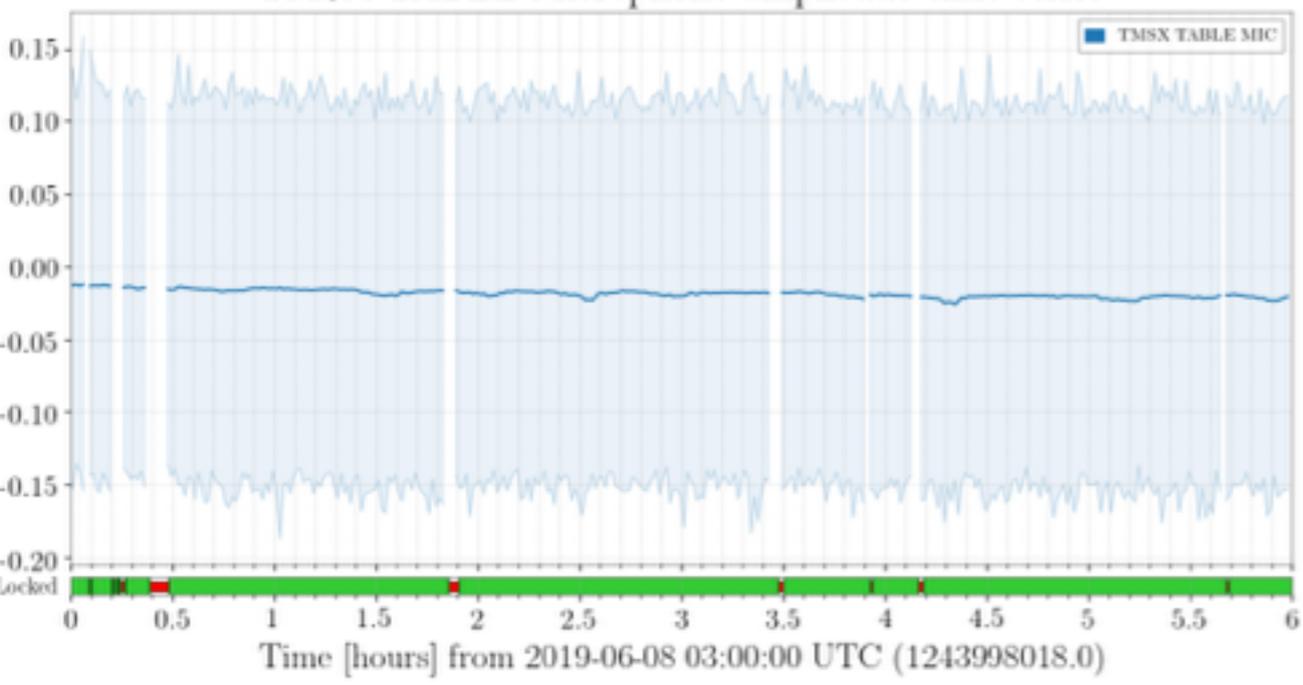
IFO REFL TABLE Microphone amplitude time series



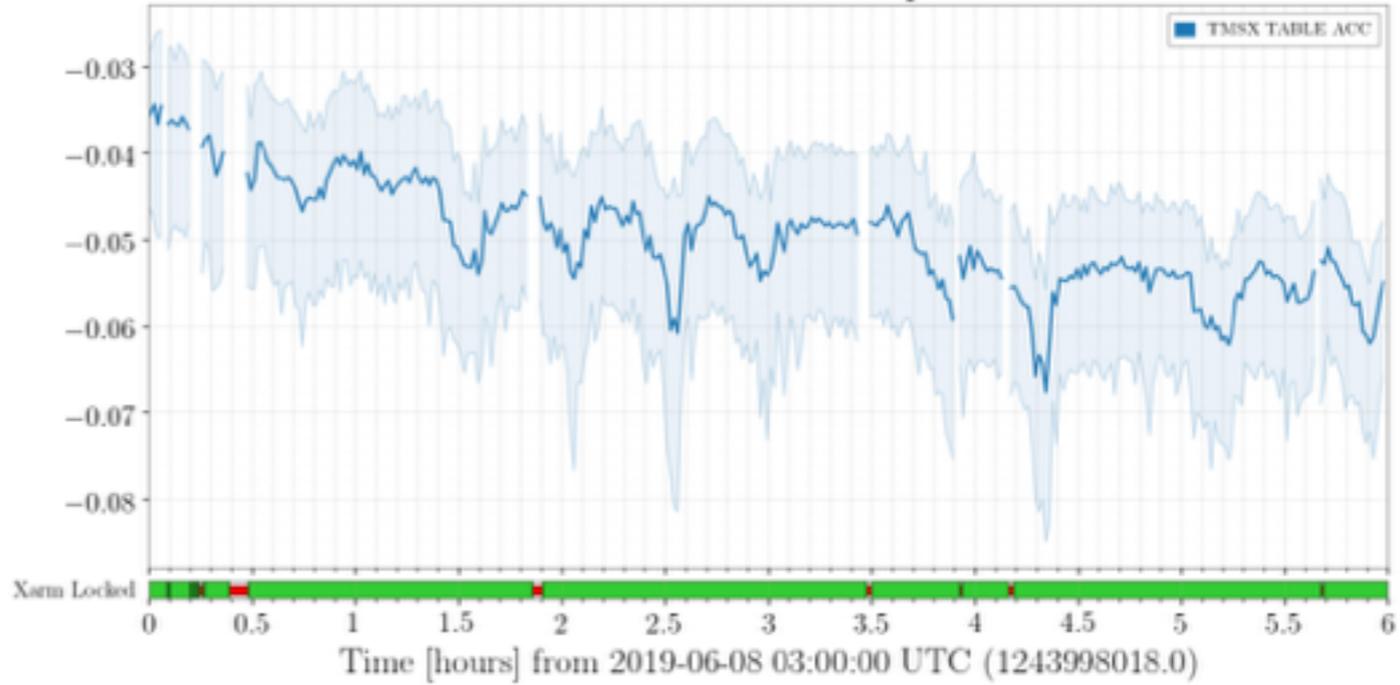
IFO REFL TABLE Accelerometer amplitude time series



TMSX TABLE Microphone amplitude time series

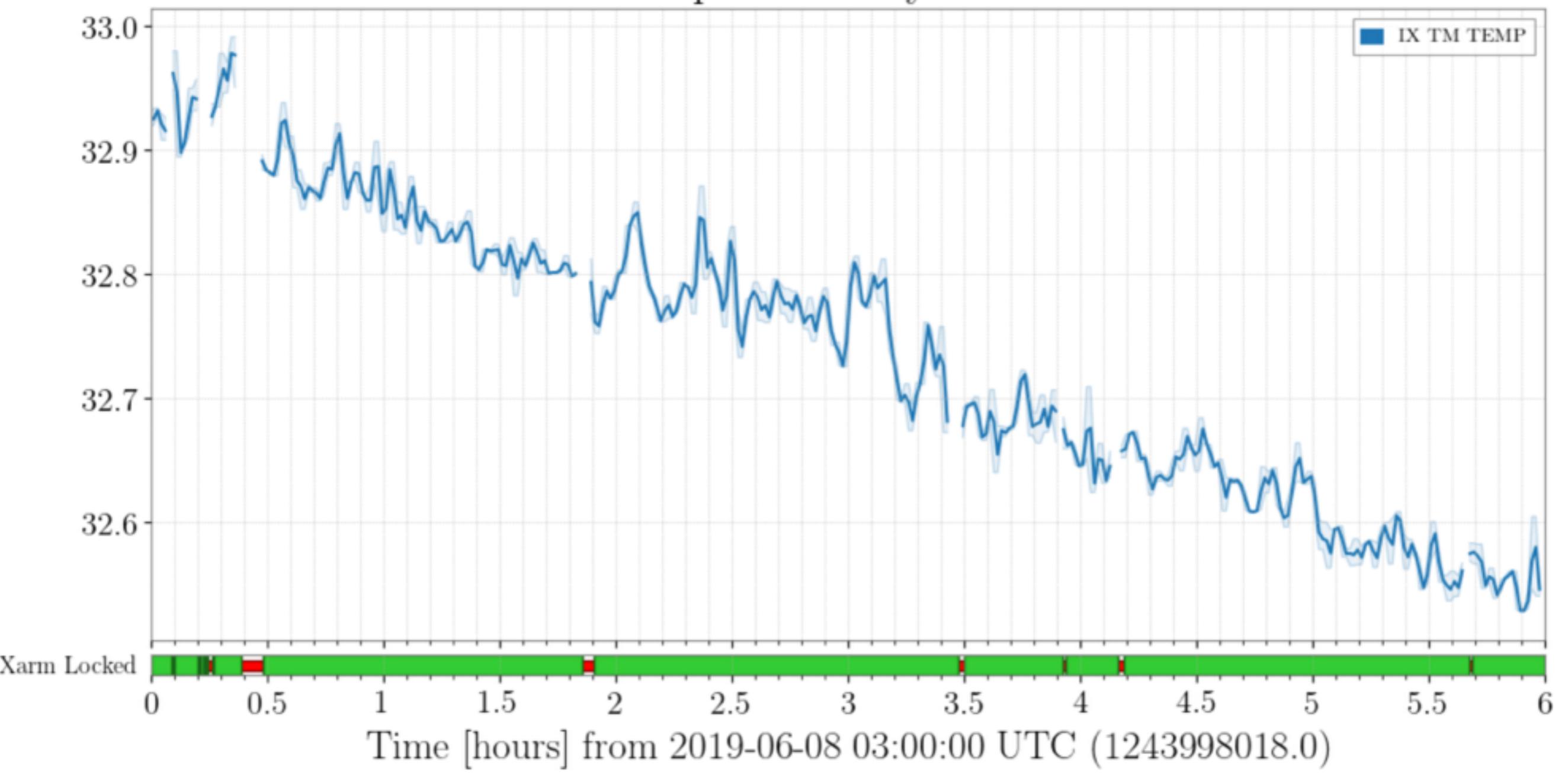


TMSX TABLE Accelerometer amplitude time series



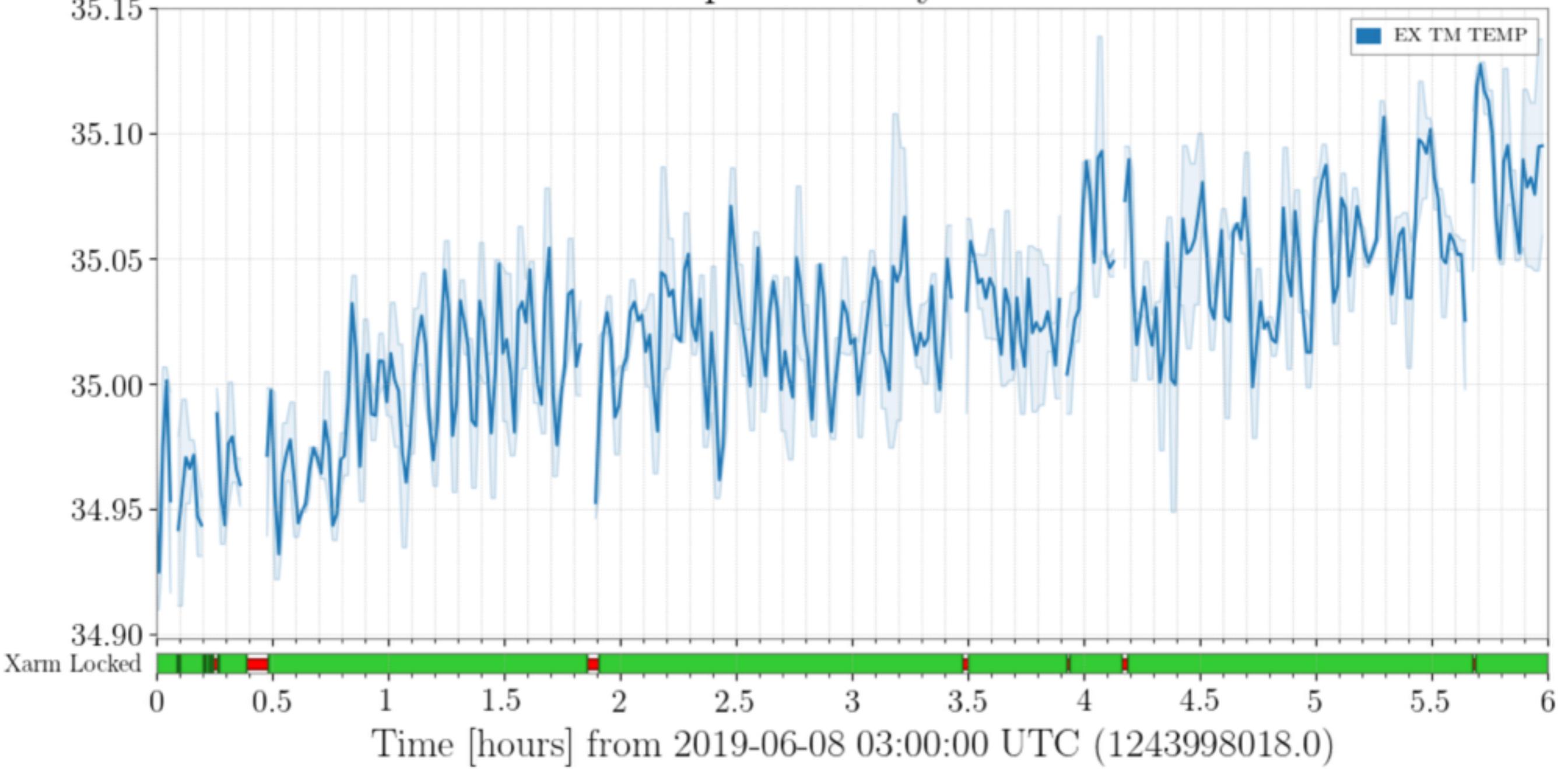
IX TM temp

IX TM Temperature cryocon time series



EX TM temp

EX TM Temperature cryocon time series



Summary and future work

- (Very) basic plots for the important channels
 - Only time series
 - Duty cycle from the guardian
- Next step (before chief meeting next week)
 - Add the plots for the control and suspension
 - Spectrogram
 - (If possible) glitch and line

Backups

PSL room

Control Diagram

Important channels (DQ)

Channel Name	Physical meaning
1 K1:PSL-PMC_CAV_REFL_DC_OUT_DQ	Power at the reflection port
2 K1:PSL-PMC_CAV_TRANS_DV_OUT_DQ	Power at the transmitting port
3 K1:PSL-PMC_MIXER_MON_OUT_DQ	Error signal of the PMC cavity
4 K1:PSL-PMC_PZT_HV_MON_OUT_DQ	Control signal
5 K1:PSL-PMC_SLOW_MON_OUT_DQ K1:PSL-PMC_PZT_SLOW_MON_OUT_DQ	Slow feedback signal
6 K1:PSL-PMC_PZT_FAST_MON_OUT_DQ K1:PSL-PMC_FAST_MON_OUT_DQ	Fast feedback signal
7 K1:PSL-PMC_TEMP_OUT_DQ	Feedback signal for the temperature loop (slowest control)

* They are all "unsafe" each other

