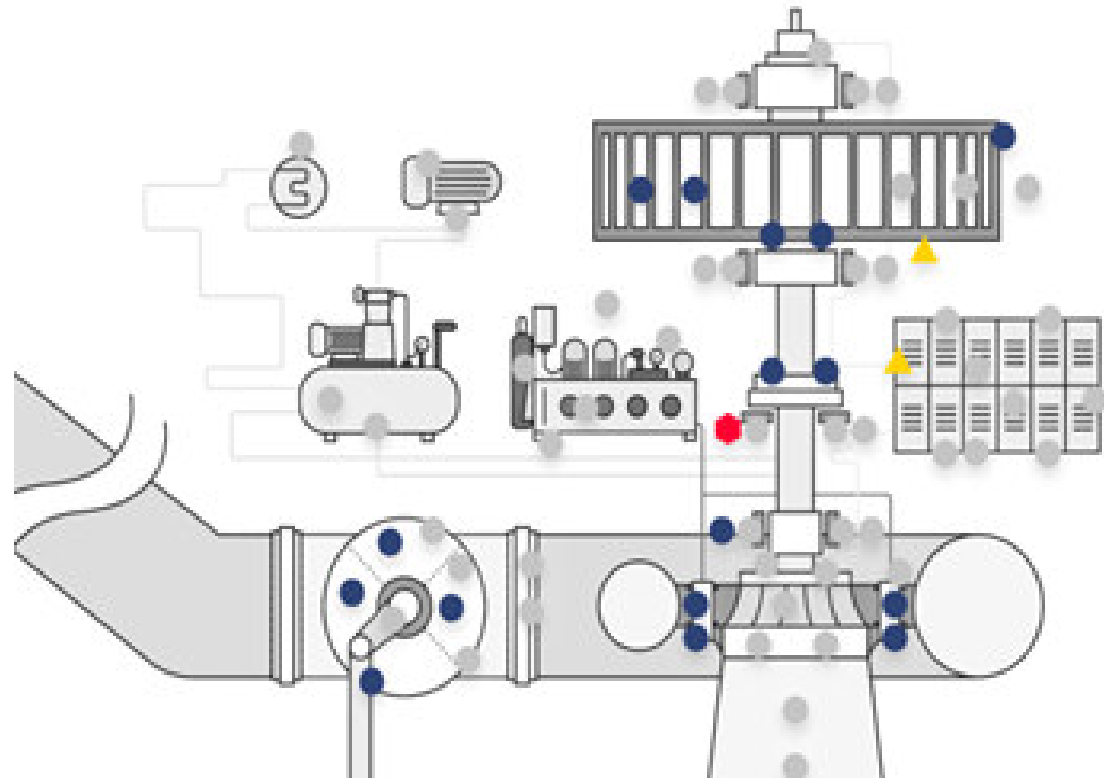




WQX

Sound Recorder Analytic Server operation manual

VOITH



Hardware

Sound Recorder cabinet

VOITH



- Cabinet for Sound Recorder edge device (Blue Box)
- Power supply (110-240 V AC) power supply (not included on the image)
- Terminals for direct connection to Ethernet and power supply
- Mounting point for microphone on top of the cabinet (optional up to 15m cable possible)
- Acrylic case for marketing purpose (does not fulfils any standard ...)

Hardware

Edge Devices – Sound Recorder

VOITH



- Ambient: -40 ... 85 °C, < 95% Humidity
- ARMv8 Processor: 1 GHz
- Ethernet interface (RJ45)
- Power requirements: 24V, 1.2 A
- Dimensions
215 x 60 x 176 mm
- OS: Linux
- 4 Microphone inputs (only 1 usable !)

Hardware

Edge Devices – Microphone

VOITH



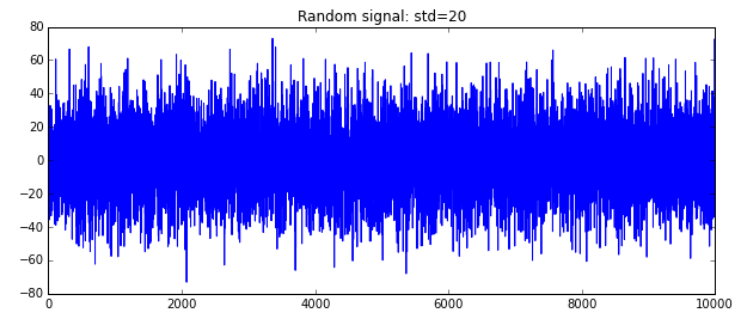
- Nominal Microphone Diameter 1/4"
- Frequency Response (± 2 dB) 20 to 10000 Hz
- Sensitivity 45 mV/Pa
- Electrical Connector (Output) BNC Jack
- Size - Diameter (overall) 12.7 mm
- Size - Diameter (head) 7 mm

Acoustic Measurement - Basics

Microphone measures sound pressure in Pa.

Example: Sound pressure signal with

- **$p_{\text{rms}} = 20 \text{ Pa}$** (standard deviation)
- has peak values around **$\pm 60 \text{ Pa}$**
- has sound pressure level **$L_p = 120 \text{ dB}$**



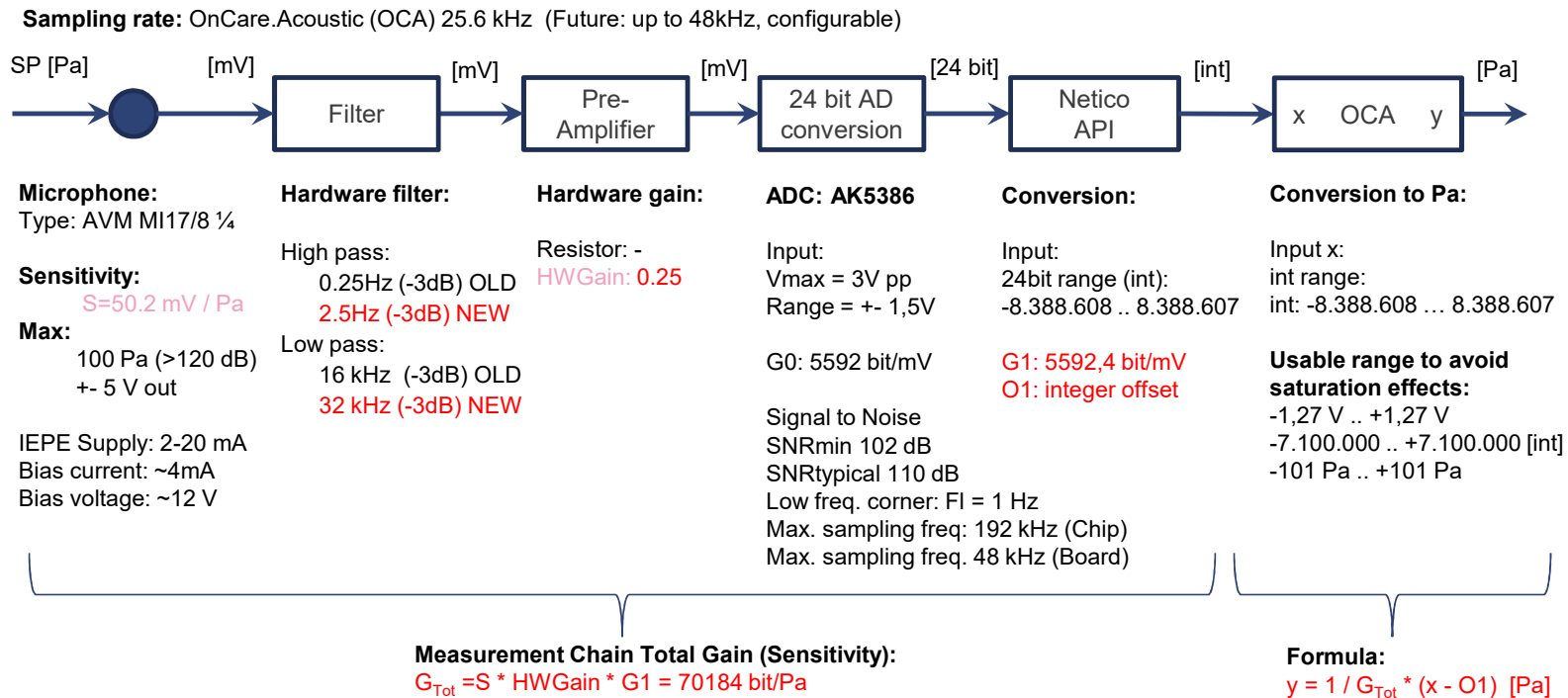
L_p is calculated by

$$L_p = 20 \cdot \log_{10} \left(\frac{p_{\text{rms}}}{p_0} \right) [\text{dB}]$$

with: $p_0 = 2 \cdot 10^{-5} \text{ Pa}$ „threshold of hearing“

OCA Audio Measurement Chain

VOITH



Remarks:

- Gain = Output / Input
- G0 is the theoretical gain of the ADC, based on data sheet. G1/O1 is the real gain/offset, as calibrated during manufacturing.
- “Sensitivity” is an other word for “Gain”, but usually used for sensors.
- Random signal with 20 Pa standard deviation corresponds to about 120 dB

Hardware Analytic Server

VOITH

HPE ProLiant ML30 Gen10 塔式服务器

英特尔®，让效能更强劲

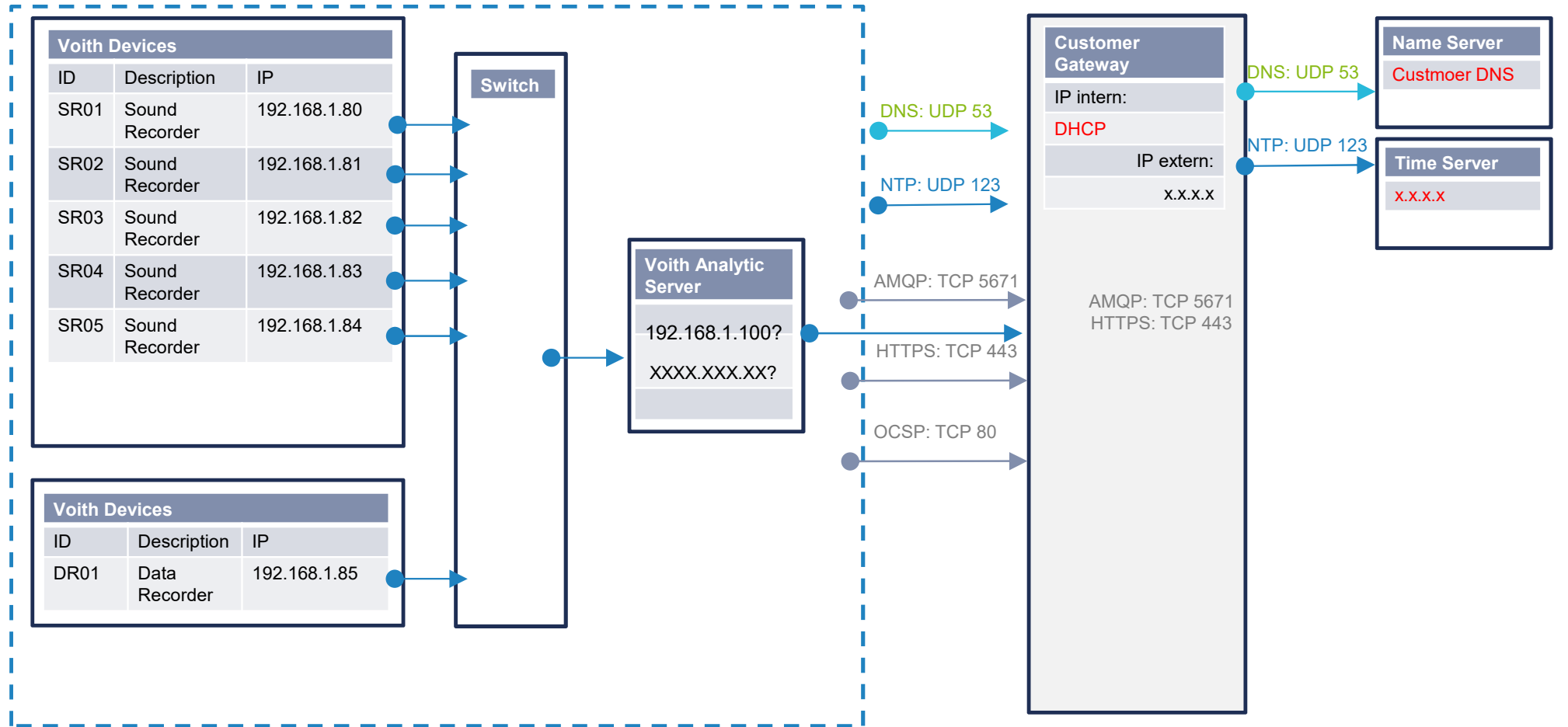


HPE ProLiant ML30 Gen10 Server		1
P06762-B21	HPE ProLiant ML30 Gen10 8 SFF Hot Plug CTO Server	1
874578-B21	HPE ML Gen10 Tower to Rack Conversion Kit with Sliding Rail Rack Shelf and Cable Management Arm	1
P17104-L21	HPE DL20 Gen10 E-2234 FIO Kit	1
879507-B21	HPE 16GB (1x16GB) 2Rx8 DDR4-2666 CAS-19-19-19 Unbuffered Standard Memory Kit	4
865408-B21	HPE 500W Flex Slot Platinum Hot Plug Low Halogen Power Supply Kit	2
P06305-B21	HPE ML30 Gen10 4U RP5 Enablement Kit	1
P06303-B21	HPE ML30 Gen10 Front PCI Fan and Baffle Kit	1
P06307-B21	HPE ML30 Gen10 Mini SAS Cable Kit	2
P04560-B21	HPE 480GB SATA 6G Read Intensive SFF (2.5in) SC 3yr Wty DS SSD	2
872481-B21	HPE 1.8TB SAS 12G Enterprise 10K SFF (2.5in) SC 3yr Wty 512e DS HDD	4
804394-B21	HPE Smart Array E208i-p SR Gen10 (8 Internal Lanes/No Cache) 12G SAS PCIe Plug-in Controller	1
512485-B21	HPE iLO Adv 1-svr Lic 1yr Support	1

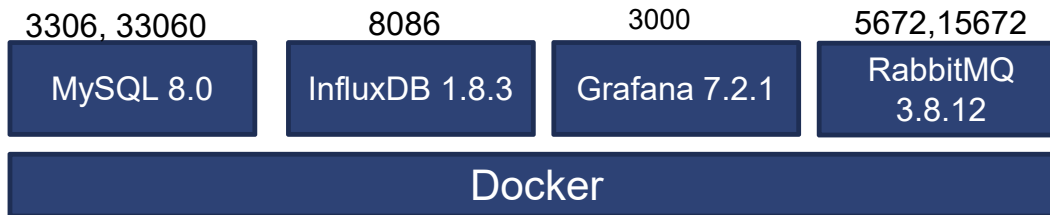
Network Diagram – OnCare.Acoustic CSG Power

VOITH

Voith scope of supply



Server Modules – 2021-02-23



Server Setup Procedures:

- Install Ubuntu 18.04
- Install docker
- Install docker containers: Grafana, InfluxDB, MySQL, RabbitMQ
- Install pyenv, and python 3.7.5 (global python)
- Install python packages

Configuration:

- Script/command Autorun docker containers
- reboot by crontab (application)
- reboot sound recorder (ref. hdh)

```
d4c@d4c-ProLiant-ML30-Gen10:~$ pip list
Package            Version
-----
certifi             2020.6.20
chardet             3.0.4
click               7.1.2
essentia            2.1b6.dev234
Flask               1.1.2
idna                2.10
influxdb            5.3.0
itsdangerous        1.1.0
Jinja2              2.11.2
lxml                4.6.1
MarkupSafe          1.1.1
msgpack             0.6.1
numpy               1.19.4
opcua               0.98.12
paho-mqtt           1.5.1
pandas              1.1.4
pika                1.2.0
pip                 21.0.1
python-dateutil     2.8.1
pytz                2020.4
PyWavelets          1.1.1
PyYAML              5.3.1
requests            2.24.0
scipy               1.5.3
setuptools          41.2.0
six                 1.15.0
urllib3             1.25.11
Werkzeug            1.0.1
d4c@d4c-ProLiant-ML30-Gen10:~$
```

Server Application – 2021-02-23



Applications:

- Process 1: Communication over AMQP adaptation on Python 3, write wavefile into audio folder
- Process 2 : read audio file, and processing: spectrogram, spectrum, waveform & spectrogram dump into InfluxDB, spectrum into MySQL, characteristic features in InfluxDB.
 - Two grafana dashboard for spectrogram & waveform
- Process 1 & 2 – MQTT topic notification
- backend : flask 3 web pages
 - page 1: list audio files
 - page 2: present spectrogram and waveform (incl. characteristic features & alarm)
 - page 3: subpage of Page 1: iframe window, spectrum
- UI: grafana dashboard templates, each corresponding one json file.

Crontab –l

```
@reboot cd /home/d4c/recorder && /home/d4c/.pyenv/shims/python  
/home/d4c/recorder/subscribe_rabbitmq.py > /home/d4c/recorder/crondsub.log  
2>&1
```

```
@reboot cd /home/d4c/recorder && /home/d4c/.pyenv/shims/python  
/home/d4c/recorder/analyze_wave.py --database OnSite >  
/home/d4c/recorder/crondana.log 2>&11: Communication over AMQP adaptation  
on Python 3, write wavefile into audio folder
```

```
sudo docker run -d --volume=/data/mysql:/var/lib/mysql --restart=unless-stopped \  
--name=mysql -p 3306:3306 -e MYSQL_ROOT_PASSWORD=voith41081 --network-  
alias=mysql --network=bbdockernet mysql:latest
```

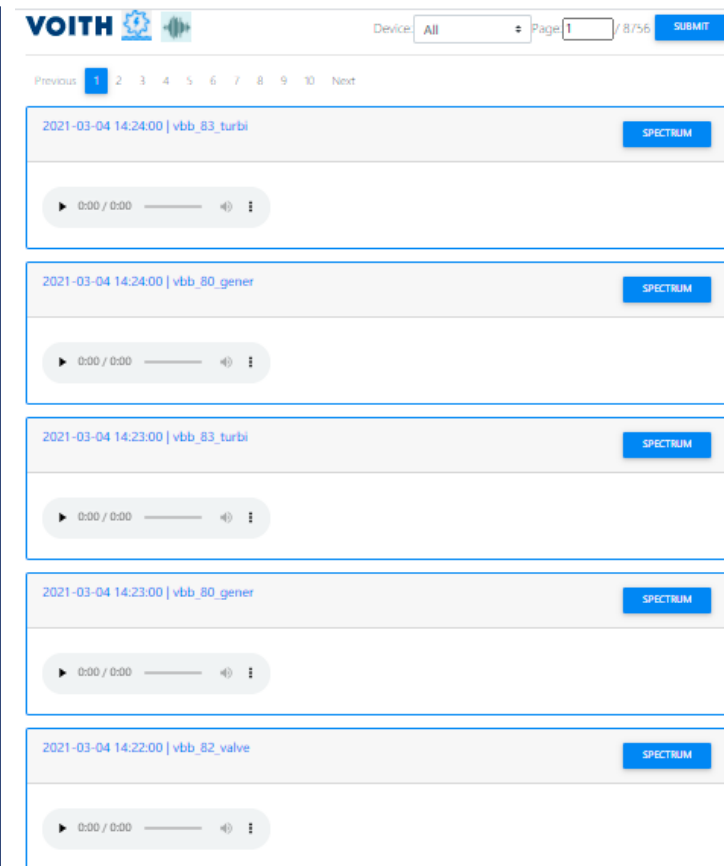
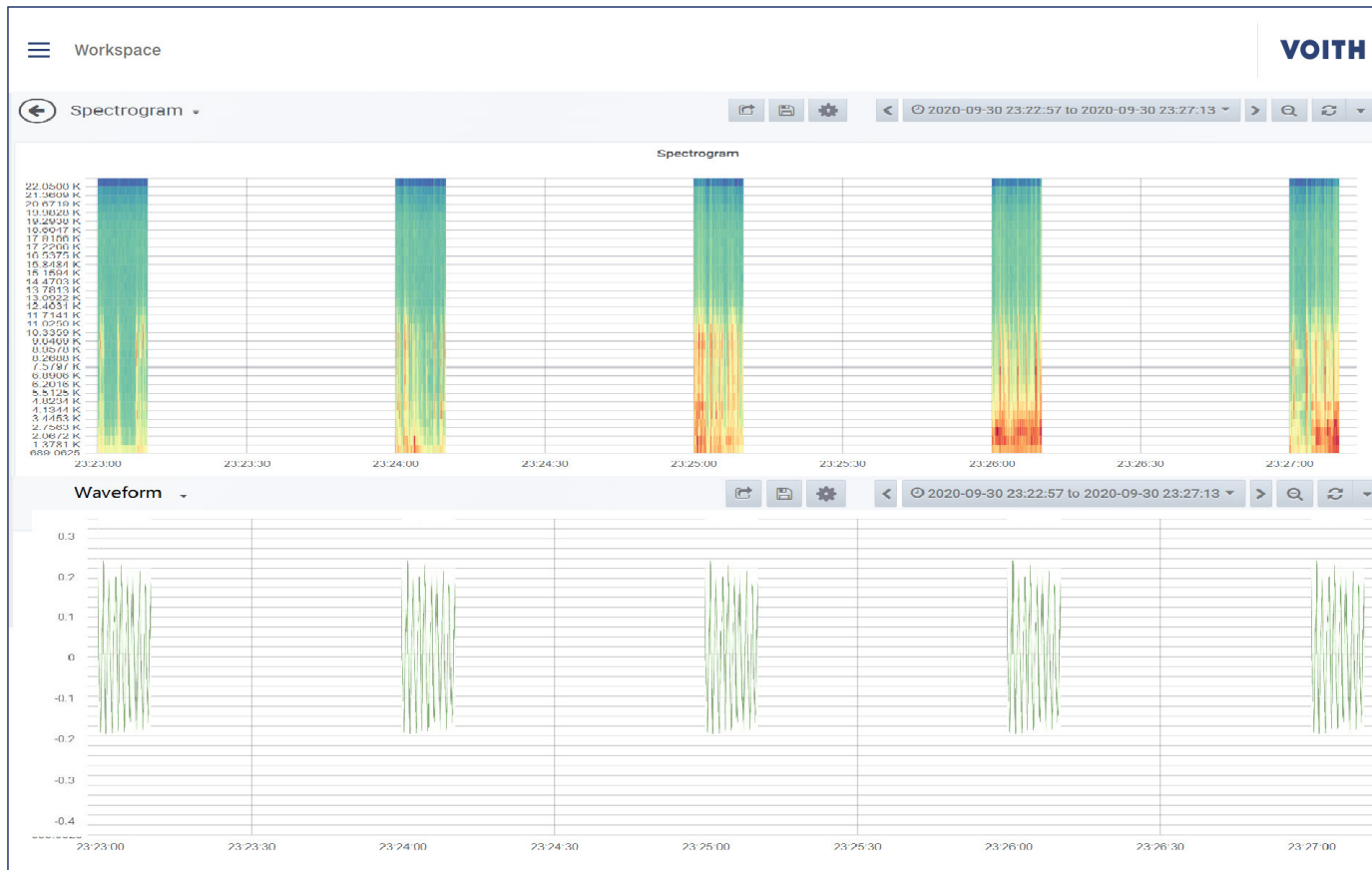
```
sudo docker run -d  
--volume=/data/influxdb:/var/lib/influxdb --restart=unless-stopped \  
--name=influxdb -p 8086:8086 --network-alias=influxdb --network=bbdockernet  
influxdb:1.8.3
```

```
sudo docker run -d  
--volume=/data/rabbitmq-data:/var/lib/rabbitmq --restart=unless-stopped \  
--name=rabbitmq -p 15672:15672 -p 5672:5672 --network-alias=rabbitmq --  
network=bbdockernet rabbitmq:3.8.12
```

```
Sudo docker run -d --restart=unless-stopped -v  
/data/grafana/grafana.ini:/etc/grafana/grafana.ini -v /data/grafana:/var/lib/grafana -v  
/data/grafana/dashboards:/usr/share/grafana/public/dashboards --name=grafana -p  
3000:3000 --network=bbdockernet grafana/grafana:7.2.1
```

Visualization by responsive web design for PC/tablet/mobile

VOITH





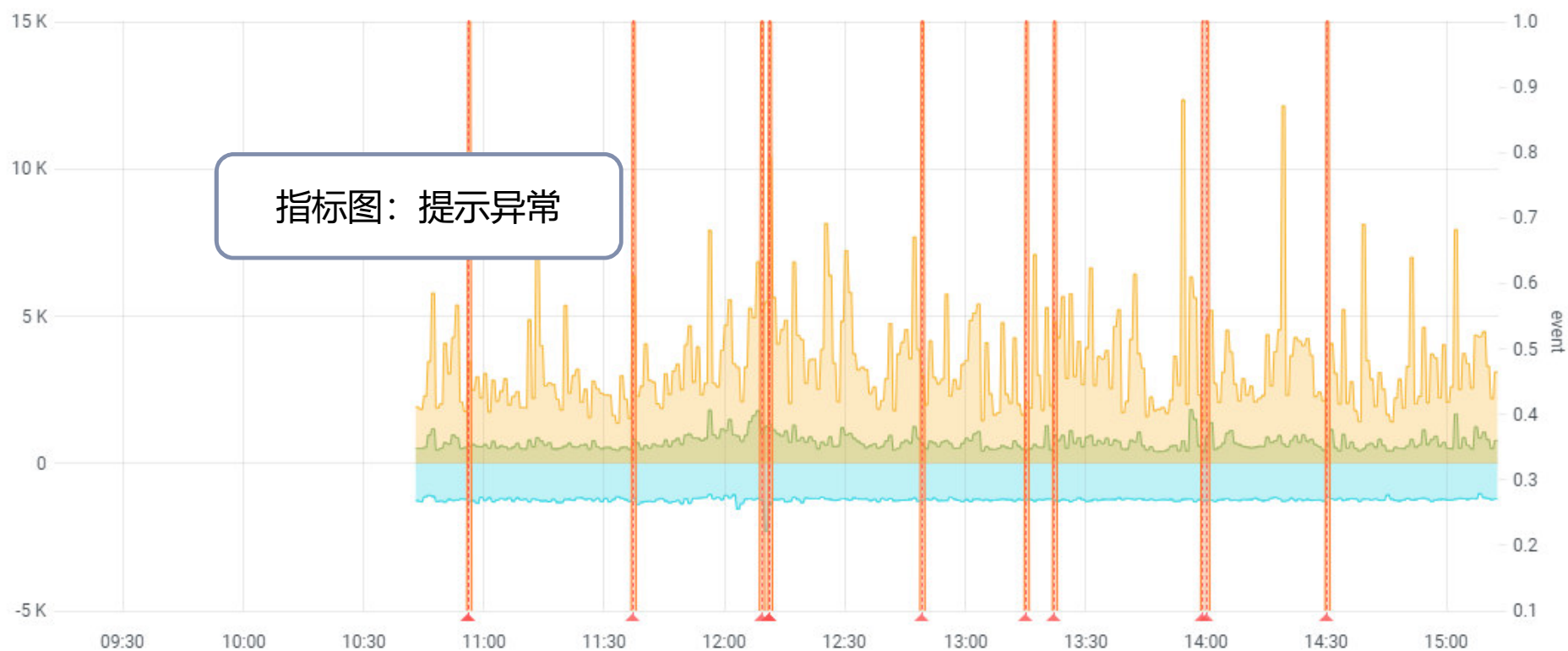
浏览器访问：
<http://serverIP:5000>
1.选择声学采样点
2.提交submit

采样点: vbb_80_gener

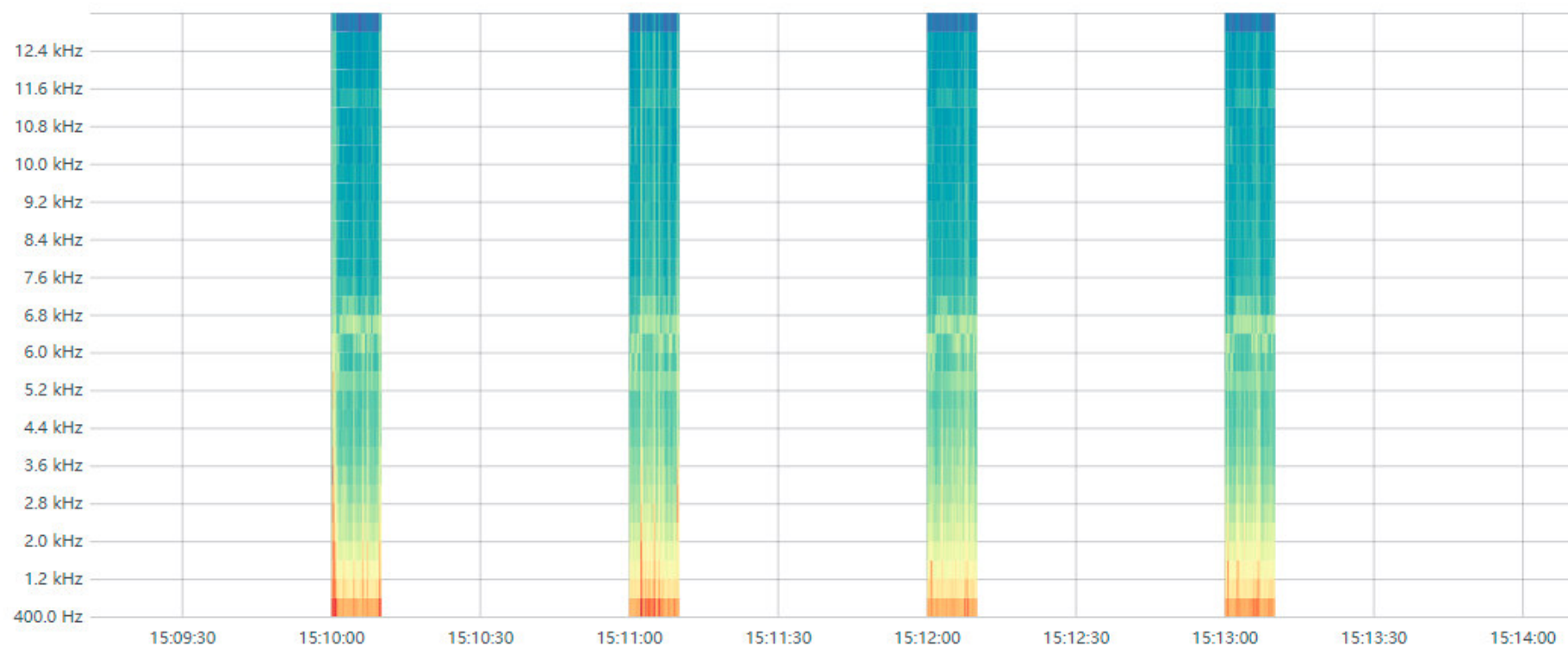
提交

指标图

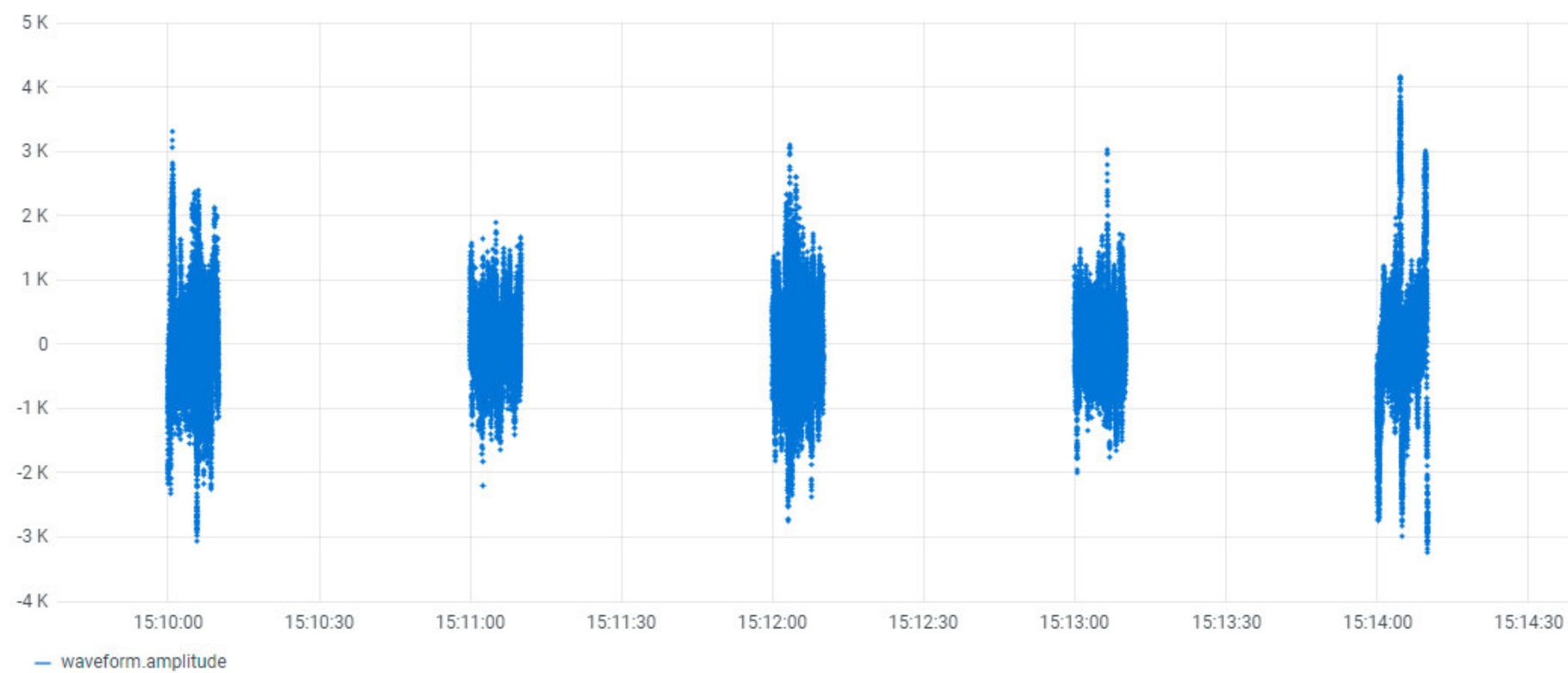
指标图：提示异常



频谱图



波形图





点击出来新的tab窗口：
声音播放及频谱

采样点:

All

页码:

1

/ 8769

提交

上一页

1

2

3

4

5

6

7

8

9

10

下一页

选择声学采样点

2021-03-04 15:16:00 | vbb_83_turbi

点击加载频谱

频谱

▶ 0:00 / 0:00



2021-03-04 15:16:00 | vbb_80_gener

频谱

▶ 0:00 / 0:00

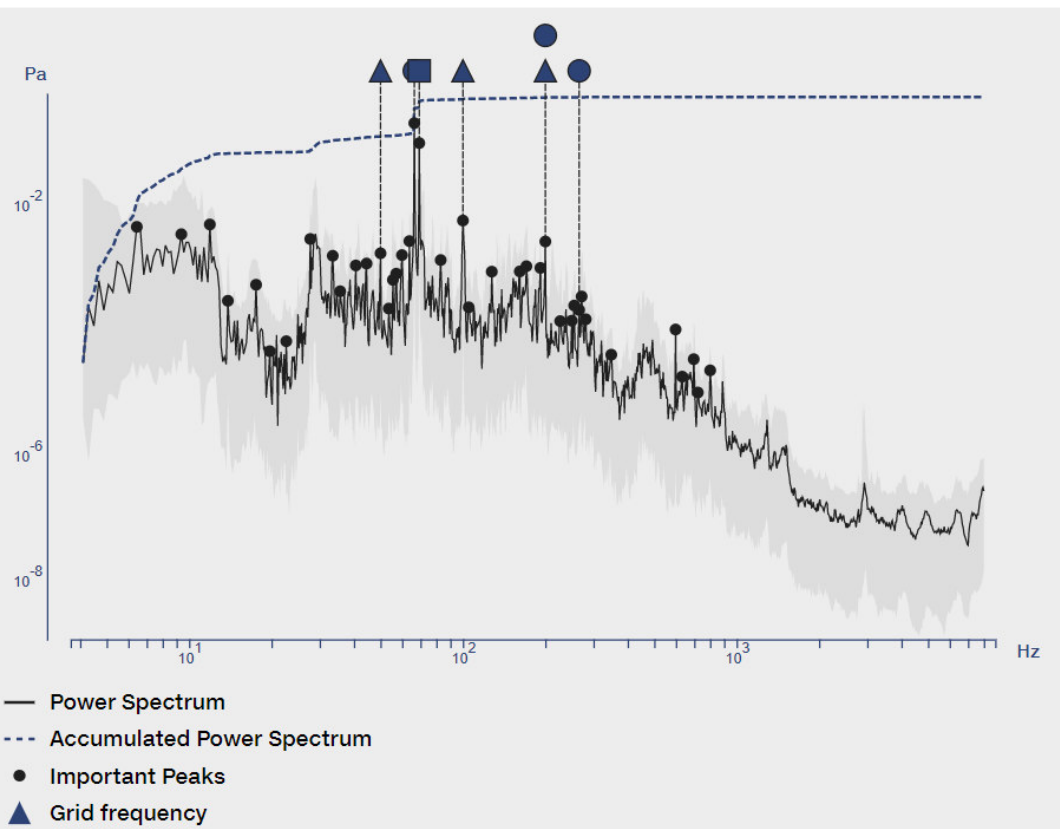


2021-03-04 15:16:00 | vbb_82_valve

频谱

What do we need OnCare.Acoustic Cloud for?

OnPerformance.Lab



- The OnPerformance.Lab diagnosis the typically machine behavior based on the frequency spectrum of the machine
- Anomalies, which are generated by the algorithms, are categorized by the OPL
- If the anomaly is detected as a machine failure, the OPL will contact the customer immediately
- The customer is able to see the machine condition in the user interface

VOITH