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# Enhance data quality control with interactive station monitoring tools in the OPS centre.

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CTBTO Preparatory Commission

CTBTO PREPARATORY COMMISSION

## INTRODUCTION

The requirement for data availability emphasizes the significance of data quality monitoring. In conjunction with other PTS monitoring tools, the Multi-Technology Integration Portal was developed to support PTS monitor data quality at the station and network levels in a more systematic, timely, reliable, and accurate approach. As well as supporting other technical routine activities to ensure station performance meets the IMS Operational Manual requirements. This assists the OPS Centre, especially when dealing with incidents, in monitoring data quality at the station and network levels..

## METHODS/DATA

The method entails integrating/aggregating existing PTS monitoring tools and displaying them on a single portal. The Multi-Technology Integration portal has been developed to provide an informative view of data quality that allows the user to obtain a concise summary of the station status. Data is gathered from the station Information (DOTS), SOH-Grafana, PRTools, IRS-ITS reporting system, PSD/PDF, residual, calibration (CAMT- CalxPy), station configuration, and other sources.

START

## RESULTS

The results show that using these methods led to a significant improvement in data quality monitoring in the OPS Centre.
This enhances data accuracy and identifies incident sources, allowing more reliable troubleshooting.
This approach supports identifying and informing OPS of potential incidents at an early stage by continuously monitoring station data quality.
Efficient in terms of time and operational efficiency when dealing with incidents.
Maintain the IMS network's high performance.

## CONCLUSION

In dealing with station incidents and monitoring IMS networks, the use of Multi-Technology Integration Portal along with other PTS monitoring tools has resulted in significant enhancements in OPS data quality monitoring.
These benefits contribute to the overall reliability of IMS network performance.

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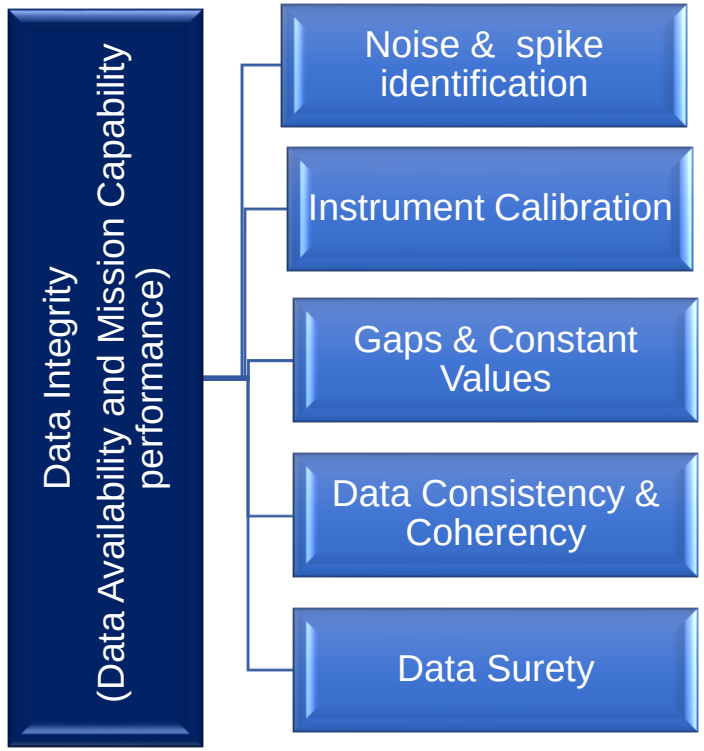
# Introduction

The International Monitoring System (IMS) is a globally distributed network of monitoring facilities using sensors from seismic, hydroacoustic, infrasound, and radionuclide technologies. The need for data availability increased the significance of data quality monitoring. This task is addressed through the creation of a platform for the fast and easy identification of data acquisition problems, as well as regular activities to ensure that station characteristics meet the requirements of the IMS draft Operational Manuals.

The Provisional Technical Secretariat (PTS) has developed a **Multi-Technology Integration Portal** internal platform with a variety of monitoring tools to facilitate data quality monitoring. This portal has been developed to support **Internal/PTS** on the daily IMS station – network monitoring.

The accurate and reliable data in PTS context is facilitates efficient troubleshooting at any level, enables informed decision-making in any type of incidents, supports predictive analysis, and drives continuous improvement on the station performance. It provides the necessary foundation for Station Operator and PTS to optimize their operations, improve data transmission quality, and achieve desired outcomes that meet the requirement. (Data Availability and Mission Capability performance).

In terms of data quality, what does OPS monitor?




Compliance with Standards it involves verifying that the acquired data meets the specified requirements, such as sampling rate, amplitude range, frequency response, and other relevant parameters.

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# How OPS improves data quality monitoring ?

OPS's approaches to handling incidents and improving data quality monitoring are as follows:

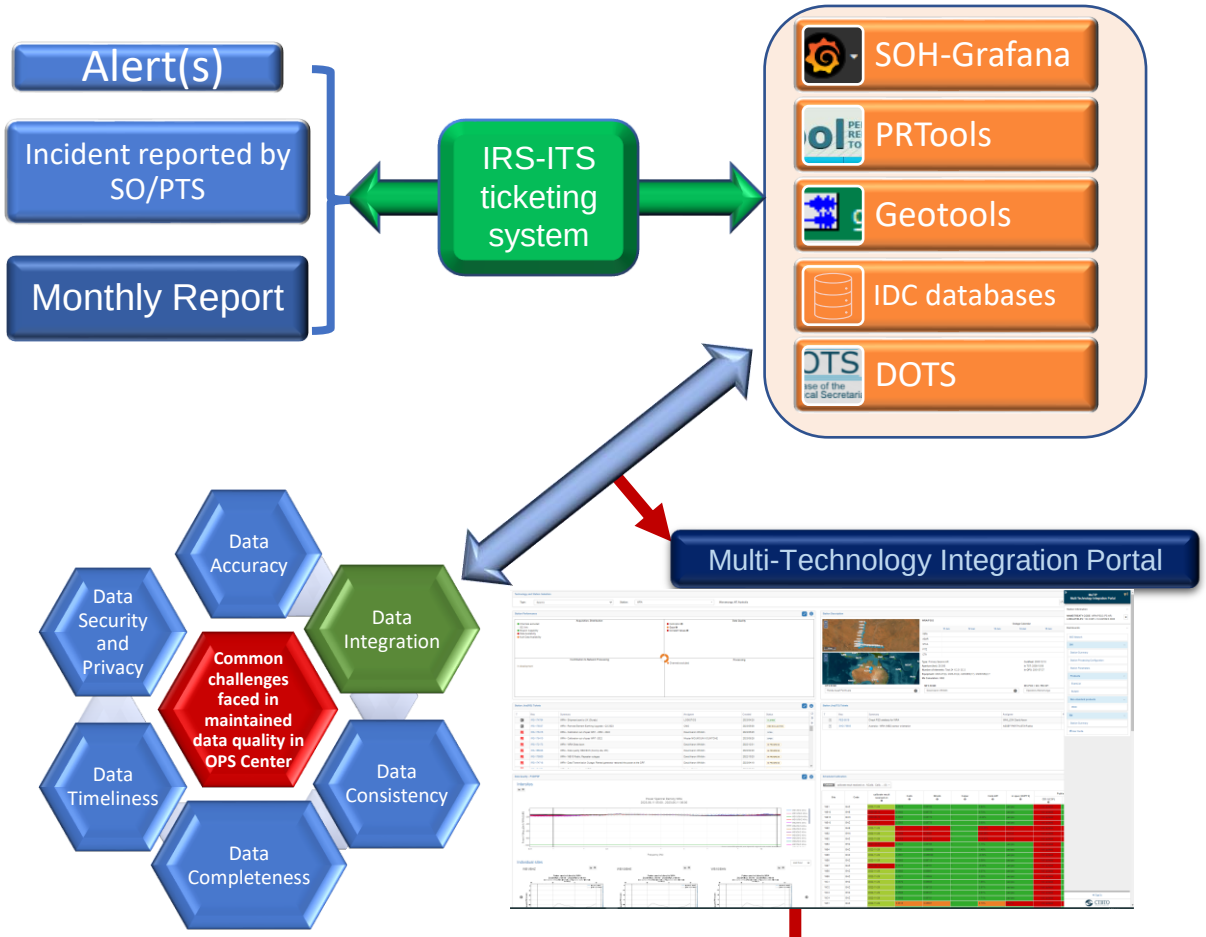
1. OPS is primarily based on real-time monitoring and alerts for incident management.

2. OPS validates and verifies data by utilizing OPS Tools (SOH, PRTools, Geootools, and others) as well as existing databases.

3. Data quality control evaluated the overall quality of monitored station data using defined Data Quality Metrics and Indicators as specified in the Station O&M. Multi-Technology Integration Portal is particularly supported at this stage to ensure OPS can have more reliable data quality monitoring.

4. Continuously evaluate and improve on data quality based on the feedback, analysing data quality reports and process.

This approaches is also used to review Station Performance on a monthly (Monthly Report) or yearly (SSR's) basis.




- **The dedicated portal** gathered information from various OPS tools and database(s) and visualized station data/information on a dedicated page for preliminary/summary/detail analysis.
- Using the provided indicator, this tool can detect anomalies, outliers, and inconsistencies in data.

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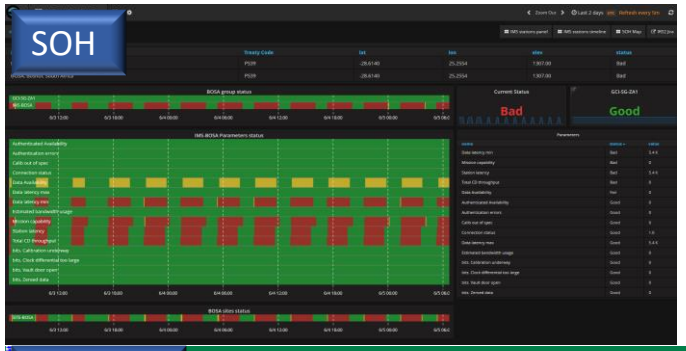
# Use Case(s) in the PTS - OPS Center

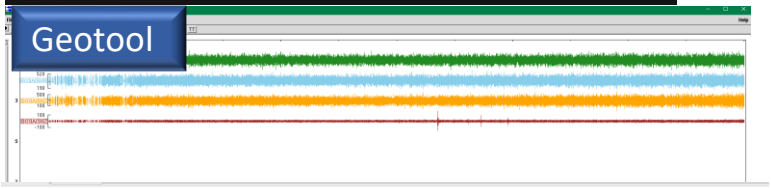
## Handling Incident - Alert

ALRT-229810 BOSA PS PS39 ACTIVE

SOH



Geotool



PRTools

Data Quality > Gaps

Gaps (%). Values by channel

| | Entity | Station | 30 May 2023 | 31 May 2023 | 01 Jun 2023 | 02 Jun 2023 | 03 Jun 2023 | 04 Jun 2023 | 05 Jun 2023 |
|---|---|---|---|---|---|---|---|---|---|
| 1 | BOSA_BHE | BOSA | 0.0041 | 0.00005 | 0 | 0 | 0 | 0 | N/A |
| 2 | BOSA_B... | BOSA | 0.0041 | 0.00005 | 0 | 0 | 0 | 0 | N/A |
| 3 | BOSA_BHZ | BOSA | 0.0041 | 0.00005 | 0 | 0 | 0 | 0 | N/A |
| 4 | BOSA_SHZ | BOSA | 0.0041 | 0.00005 | 0 | 0 | 0 | 0 | N/A |

IRS

RS) Tickets

| T | Key | Summary | Assignee | Started | Status |
|---|---|---|---|---|---|
| PR | IRS-175135 | BOSA - Lightning strike; damaged Cisco ASA device | OPS Centre | 2023/05/10 | IN PROGRESS |

Station Performance

Boshof, South Africa (Air Force Technical Applications Center)

Station Performance

Acquisition, Distribution
- Channels excluded
- GCI link
- Mission Capability
- Data Availability
- Auth Data Availability

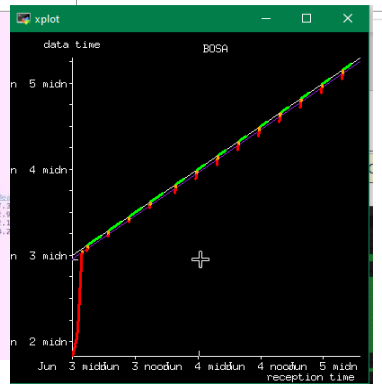
Data Quality
- Calibration
- Gaps
- Constant Values

Gaps

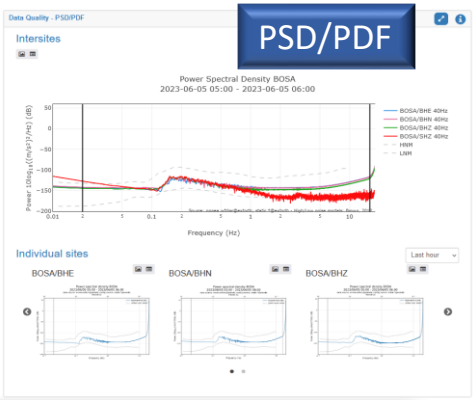
[Gaps Status]
- BOSA_BHE: 0.006391166022959007
- BOSA_BHN: 0.006392510837735421
- BOSA_BHZ: 0.006386576134842002
- BOSA_SHZ: 0.006385890329599328

Constant Values

[Constant Values Status]
- BOSA_BHE: 0.0013094242463158744
- BOSA_BHN: 0.0005310843210487116
- BOSA_BHZ: 0.0003594713249889713
- BOSA_SHZ: 0




PSD/PDF




The incident handling procedure in OPS includes an assessment on the data quality.

- Alert is **Active (SOH) (or Alert has ended-outage >1 hour)**
- The **Station Performance indicator** confirms that the alert is active due to lost DAU, MCU, gaps and Authentication DA.
- Check the **SOH-Grafana** for more information on the parameter that caused the BAD status.
- Geotool can provide information on waveform data.
- Check **KPI performance** with **PRTools**.
- The **Station Summary** section is used to validate the data quality (PSD/PDF, residuals, and configuration current status).
- Establish communication with the Station Operator/PTS via **IRS-JIRA** for troubleshooting.

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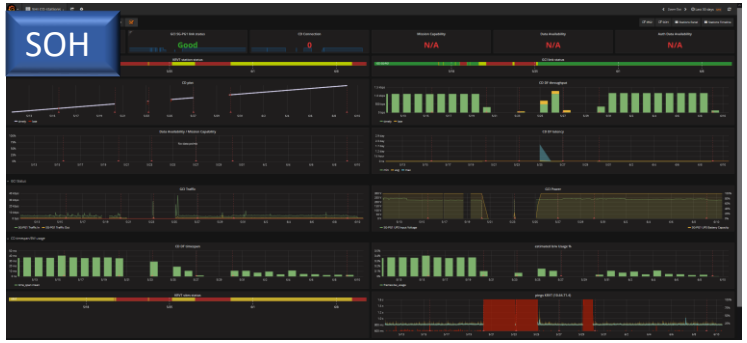
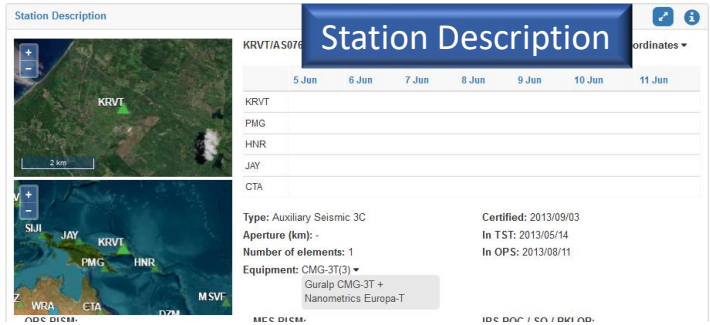
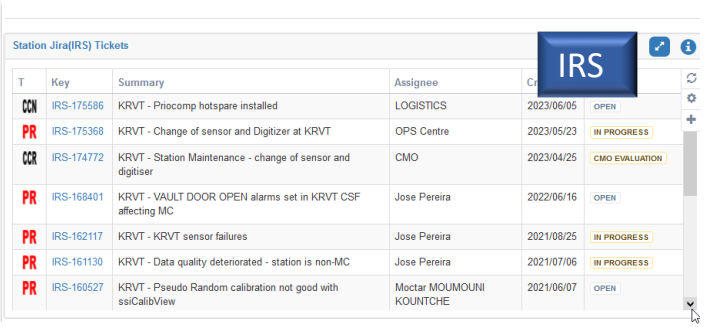
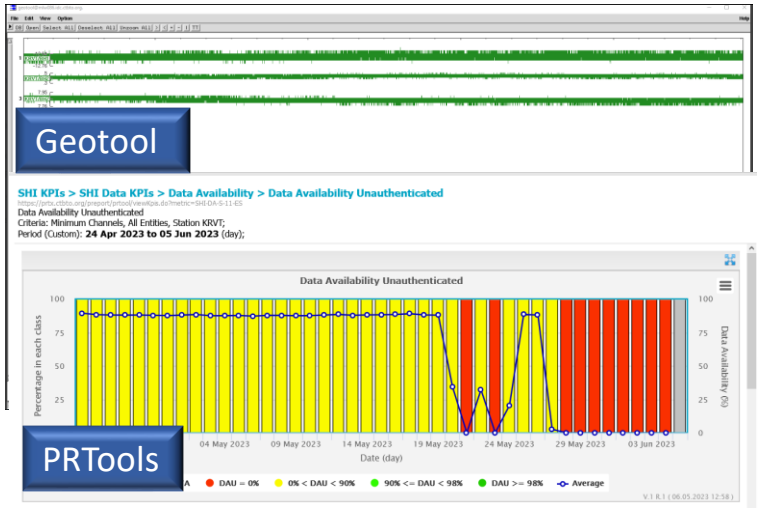
# Use Case(s) in the PTS OPS Center

## Equipment changed required due data quality deteriorated

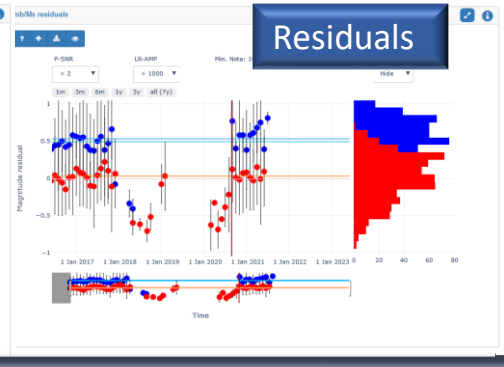


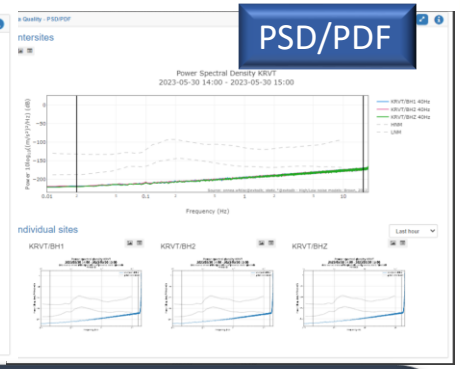








The quality of the data transmission has deteriorated:

- DAU/MCU degraded; **PRTools** was used to assess station KPI performance.
- **Geotool** confirmed that the station is only transmiting digitizer noise.
- More information about the Station Performance can be found on the **SOH-Grafana**.
- The **Station Summary** section is where the data quality issue (PSD/PDF, residuals, and current configuration status) is validated. PSD/PDF and residuals plots provided information on the anomaly that could result in **equipment failure.**
- Verified the existing reports for more information and communicate with the Station Operator/PTS via **IRS-JIRA** for troubleshooting.

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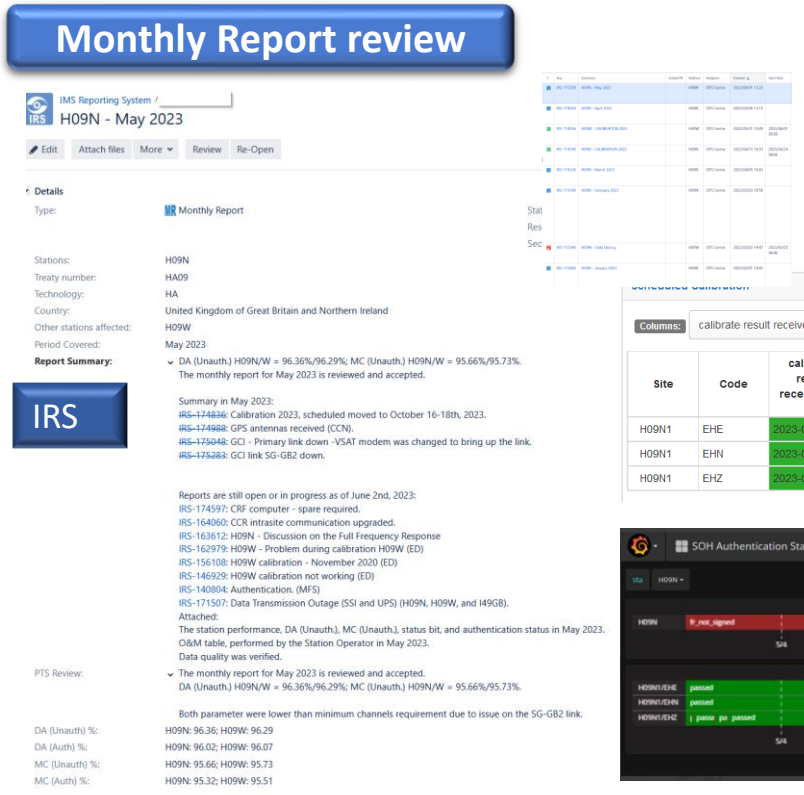
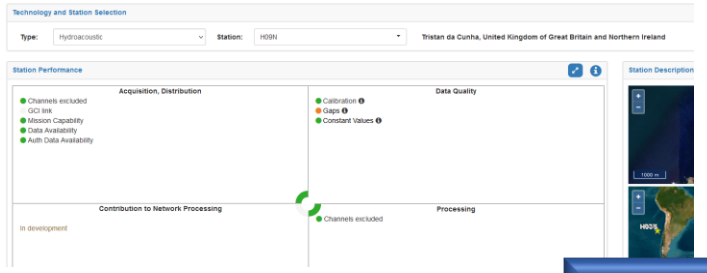
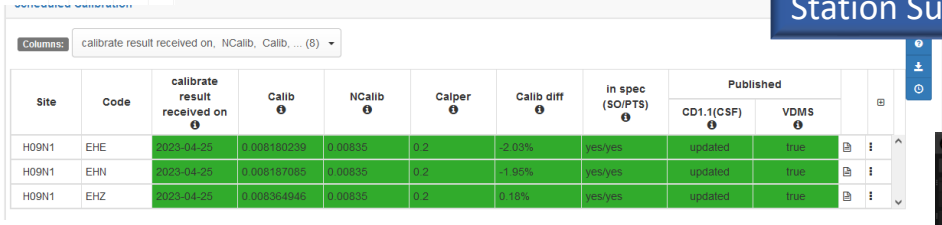
# Reviewing the Station Performance

## Monthly Report review

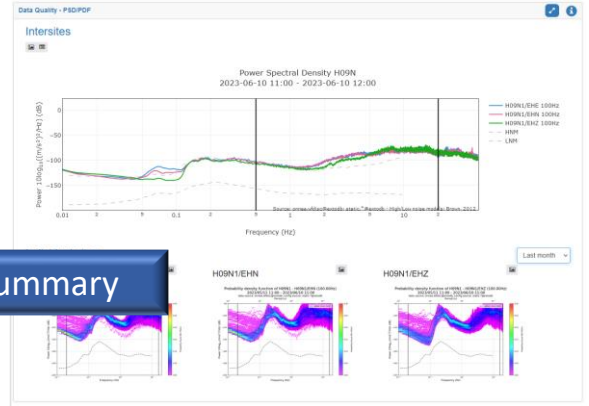



IRS



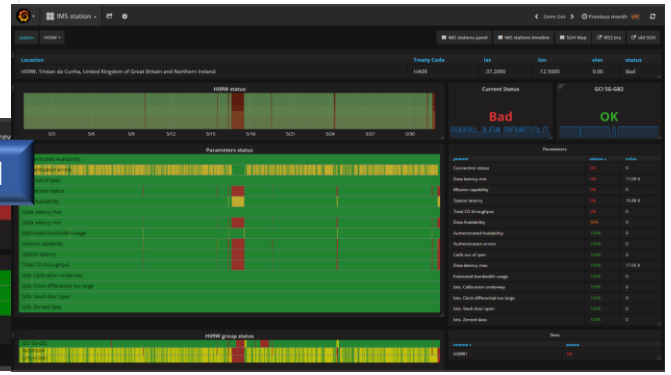



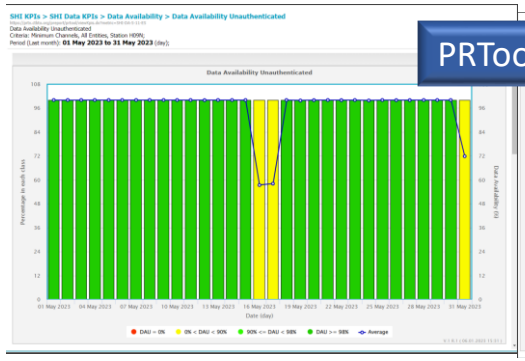

Station Summary





SOH




PRTools

Monthly report review:

- **PRTools** is used to verify KPI station performance.
- Review and verify the station O&M Activity (Status Bit) on the **SOH-grafana**.
- **SOH-grafana** confirmed the station's performance and authenticity.
- **Geotool** to confirmed the data quality of the waveform.
- In the **Station Summary section**, PTS can analyze data quality station performance (PSD/PDF, residuals, calibration, and configuration status).

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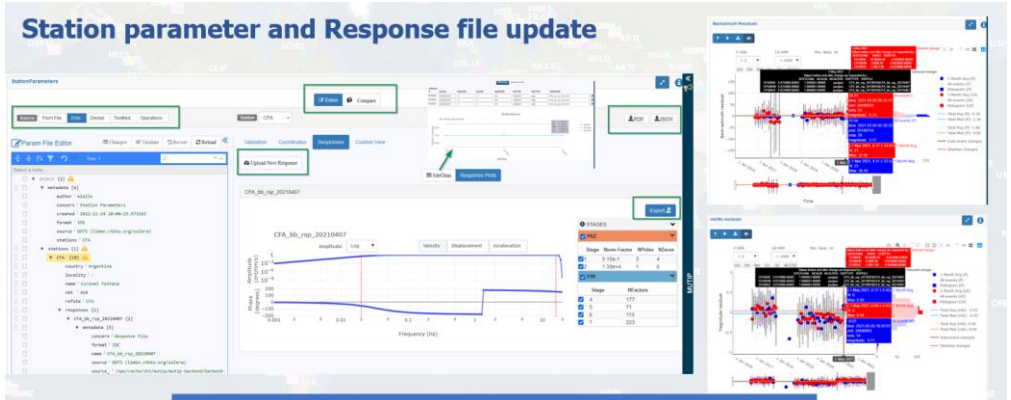
# Other use case(s) in OPS Center

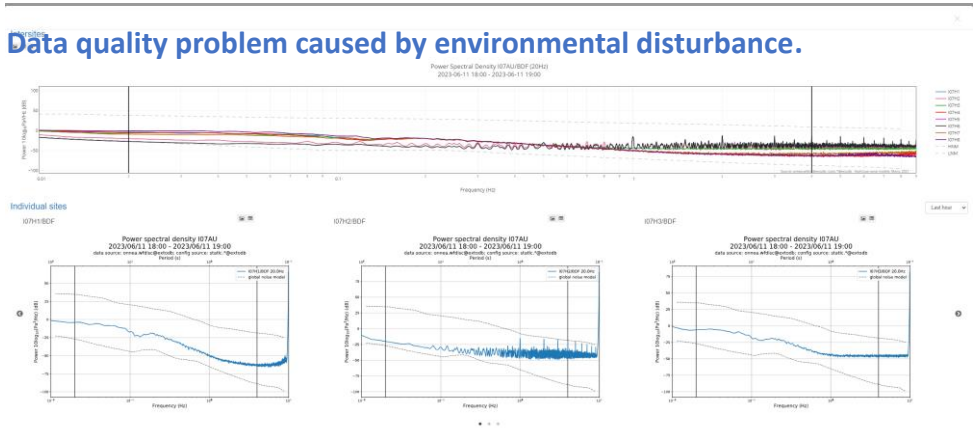
- Support on the station Parameter Update process.
- Identify the Orientation Issue at Station.
- Identify the discrepancies among internal database(s).

## Station parameter and Response file update

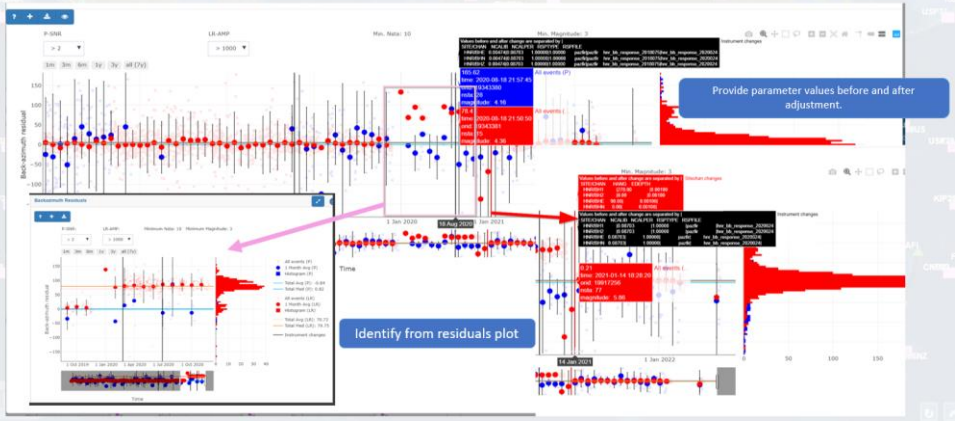


To verified and track changes to station parameters and response file update.
MuTIP also provide tools for determining whether the format is correct.

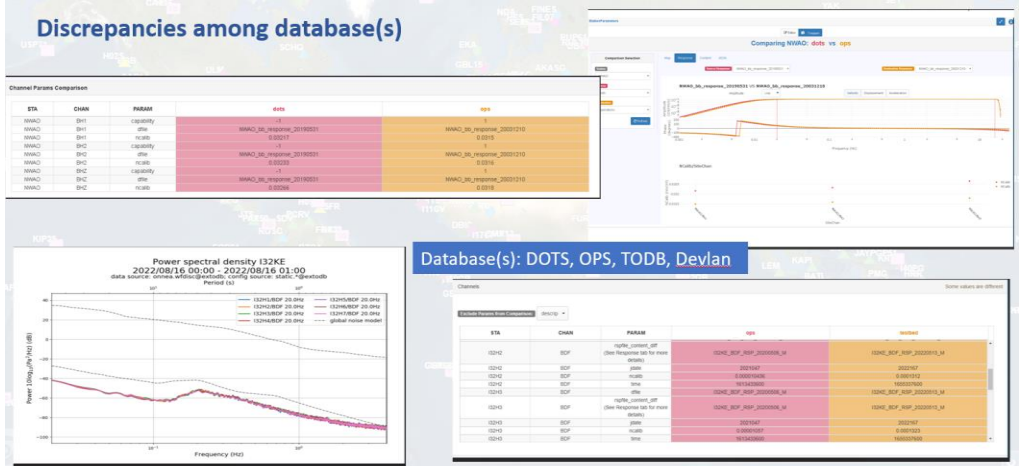
## Data quality problem caused by environmental disturbance.



## Orientation Issue:




## Discrepancies among database(s)

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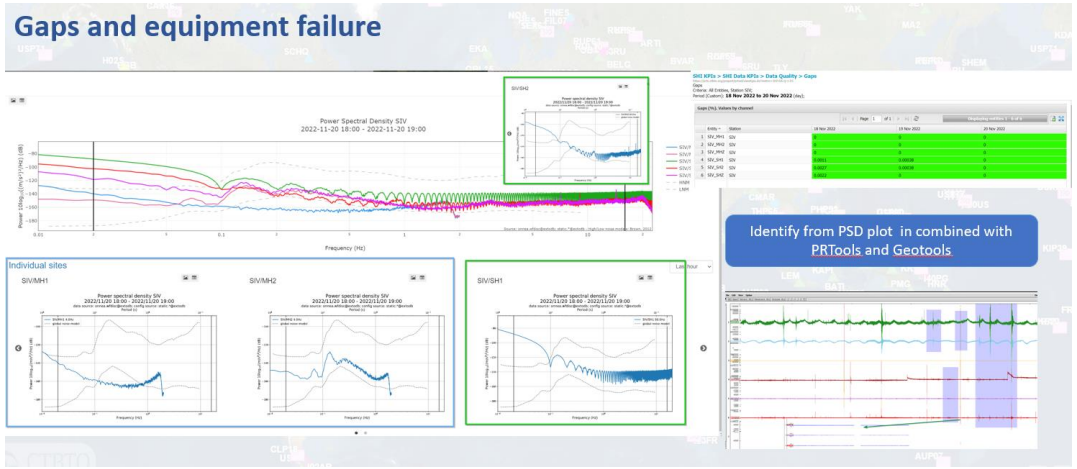
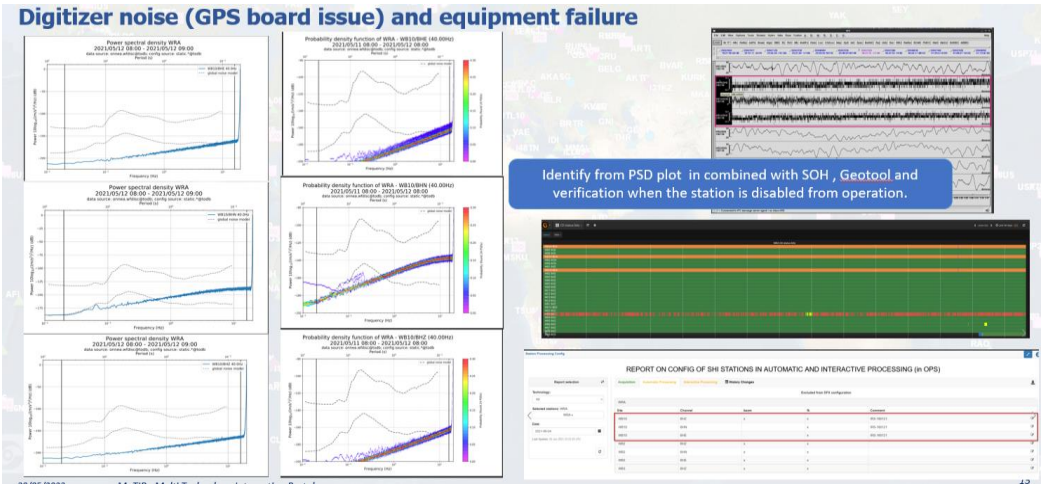
# Other use case(s) in OPS Center

- Identify the equipment failure (ex: the equipment only providing noise/spike).
- Identify Mass Centering is required.
- Identify the gaps and constant value.

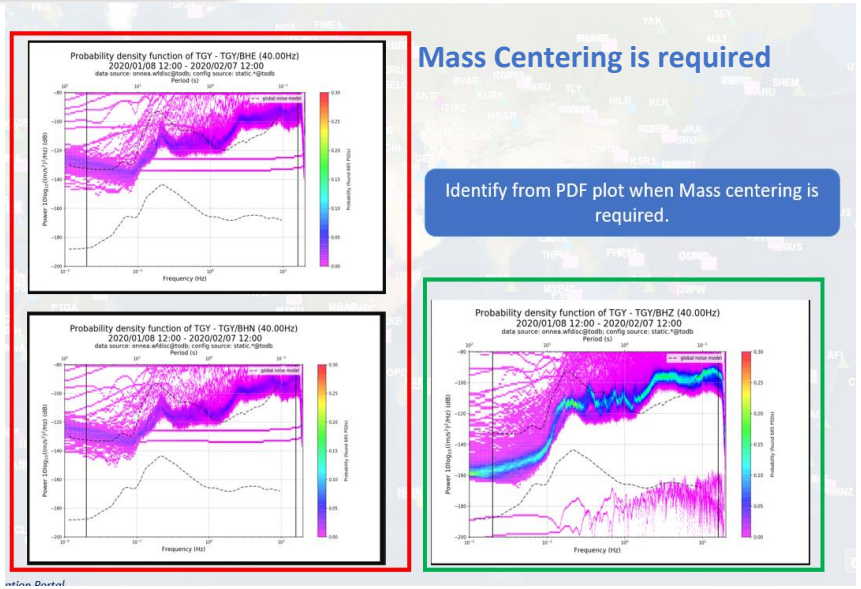
## Gaps and equipment failure




## Digitizer noise (GPS board issue) and equipment failure




## Mass Centering is required




Advantages from data quality monitoring with Multi-Technology Integration Portal: Enhances operational processes by providing real-time visibility, enabling proactive issue detection, improving decision-making, fostering collaboration between Station Operator and PTS, facilitating predictive maintenance, and driving continuous process improvement. These benefits contribute to increased efficiency, reduced downtime, an optimized troubleshooting escalation process, and improved overall station operational performance.



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# Conclusion

The **objective** of seismic data quality monitoring is to ensure that the acquired seismic data is accurate, reliable, and of high quality. By implementing a **systematic monitoring process and reliable platform/tools**, potential issues can be detected and addressed early on, leading to improved interpretations, better decision-making, and more robust data transmission.

The Multi-Technology Integration Portal was developed as a result of **a cross-divisional project** to support PTS with **data quality monitoring** and other **technical** routine activities to ensure that station performance meets the requirements of the IMS Operational Manual.

Using a Multi-Technology Integration portal in conjunction with other PTS monitoring tools is an excellent way to **enhance data quality monitoring** in the OPS Center.

These benefits contribute to the overall **reliability of IMS network performance**.

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Please visit other interesting posters for other tools that are integrated in the Multi-Technology Integration Portal and future development.

CalxPy
Calibration by Comparison

CalxPy: A Software for Calibration Against a Reference
**P3.1-578**

Evaluation of the International Monitoring System Seismic, Hydroacoustic and Infrasound Network Performance with NetMOD
**P4.1-469**



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# References


- IMS Reporting System (https://irs.ctbto.org/)
- SOH-Grafana (https:// soh.ops.ctbto.org)
- PRTools (https://prtx.ctbto.org/)
- Geotools
- Draft Operational Manual for SHI monitoring (CTBT/WGB/TL-11,17/15/Rev.7)
- Internal documentation






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