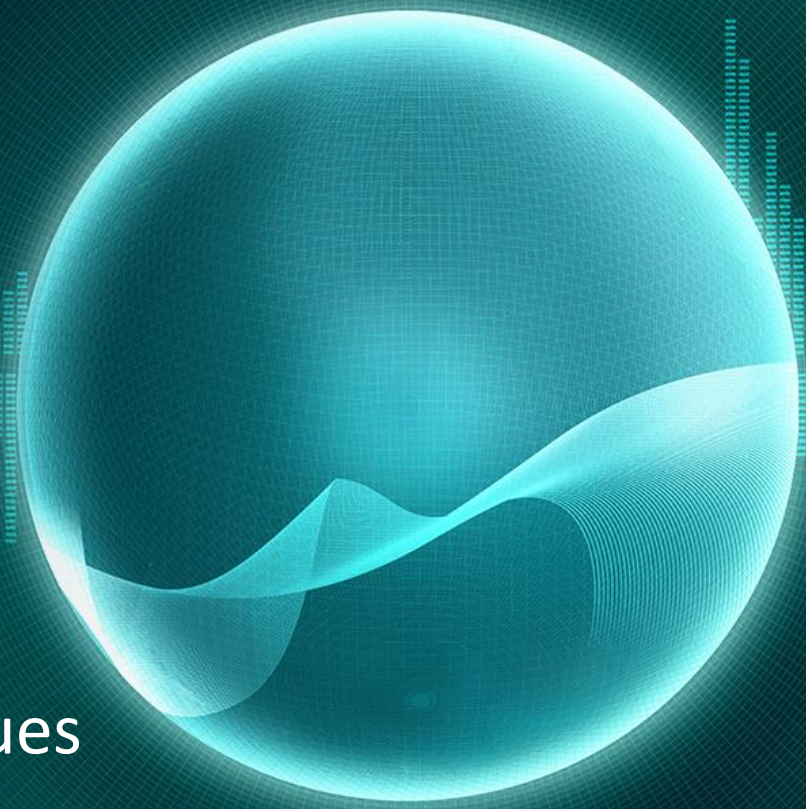
SnT 2019

CTBT: SCIENCE AND TECHNOLOGY CONFERENCE



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SSI Calibration Module

Operational Manual Requirements

- The IMS **Operational Manual** includes **strict requirements** regarding calibration of IMS seismic stations:
  - On-site calibration results are used as QC for instrument **stability**
    - "stability ": +/- 5% to the instrument nominal response
    - over the full IMS passband
    - yearly basis verification
  - **Planning** and **communication**
    - at the Network level: attribution of calibration time slots to Stations
    - at the Station level: calibration messages exchanges between SO and the IDC

Calibration Challenges

- **high number** of sensor-digitizer **combinations** (hardware/software/procedures/training)
- PTS **resources to train** Station Operators on calibration activities
- **variety** and **complexity** of hardware/software issues
- compliance with the OM requirements for **full frequency calibration** and sending of results at the **IMS2.0 format**
- compliance with **command and control** and **authentication** requirements while performing on-site calibration activities

Calibration Challenges

- On-site calibration is a **complex** and technical process involving **different** tasks and people:
  - Initial Planning (PTS)
  - Initial communication (PTS, SO) → refined planning
  - Calibration task (SO)
  - Results review (SO)
  - IMS2.0 reviewed results sending (SO)
  - Update of Calib values in the CD1.1 data stream (SO)
  - Reviewed results reception and validation (PTS)
  - Validated results publication (PTS)

Addressing Challenges

- **Engineering resources** from IMS and IDC Divisions were invested to resolve these challenges
  - **CAMT** to semi-automatize the planning and scheduling of calibration activities, the communication with SO and the receipt, storage, review and reporting of seismic calibration results
  - **SSI Calibration Module** to provide a standardized and user-friendly interface for SO to perform calibration tasks and send **interpreted full-frequency** calibration results to the IDC in **IMS2.0** format
  - development of **training material** and user manuals for station specific configurations
  - inclusion of calibration activities as part of regular SO **trainings**

SSI Calibration Module: Features

- Calibration operational **process** fully supported by the calibration module
- Communication between the PTS and the Station using standardized **IMS2.0** format (including full-frequency response presentation)
- Command and Control **authentication** (through SSI Authentication module)
- Define, perform, review and report on a calibration
- **Auto-evaluation** of the calibration results (IN_SPEC YES or NO)
- Variety of the sensor/digitizer **combinations** supported (Nanometrics Europa, Guralp D24, Quanterra Q330, MariPro DDFI)
- GUI executed locally, all communications with the workstation are using CLI commands, thus minimizing the load on GCI **bandwidth** and allowing smooth calibration of remote sites from CRF or PTS

SSI Calibration Module: User Modes

- **SEMI-AUTOMATED**. This is the **default** user mode. The Station Operator keeps the control on all the steps of the calibration
- **AUTOMATED**. This mode is meant to be used at remote stations, lacking human or technical resources to use semi-automated mode
- **MANUAL**. This mode allows the possibility to perform unscheduled calibrations by defining any scenario

Supported Hardware

- Supported **digitizers**
  - Güralp DM24
  - Nanometrics Europa-T / Europa HRD
  - Quanterra Q330HR


Guralp DM24

EuropaT


Q330HR

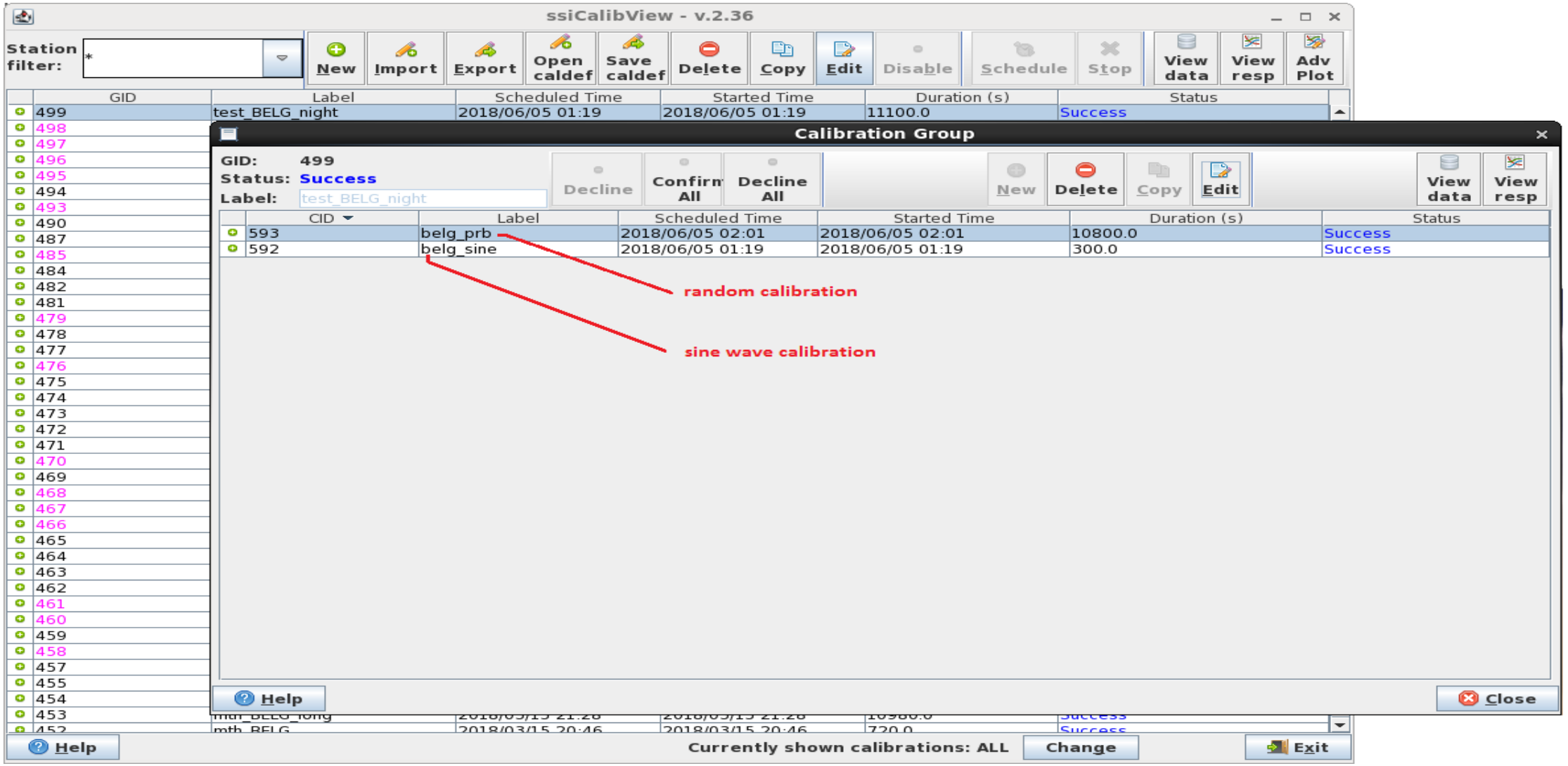
- Tested configurations (**digitizers/sensors**)
  - DM24 + CMG-3T
  - DM24 + STS-2
  - EuropaT + CMG-3T
  - EuropaT + STS-2
  - EuropaT + GS13
  - Q330HR + CMG-3T
  - Q330HR + STS-2


CMG-3T

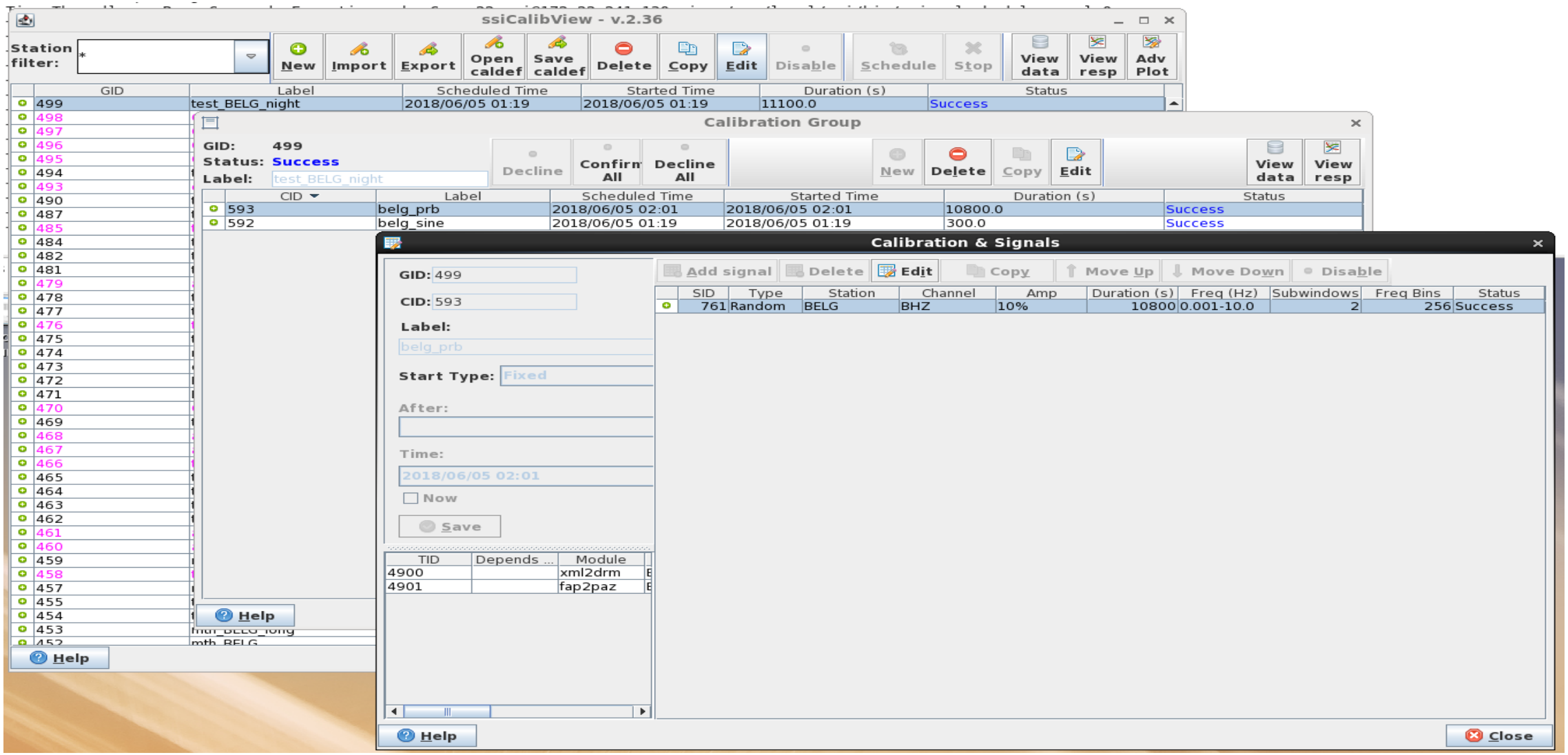

STS-2


GS13

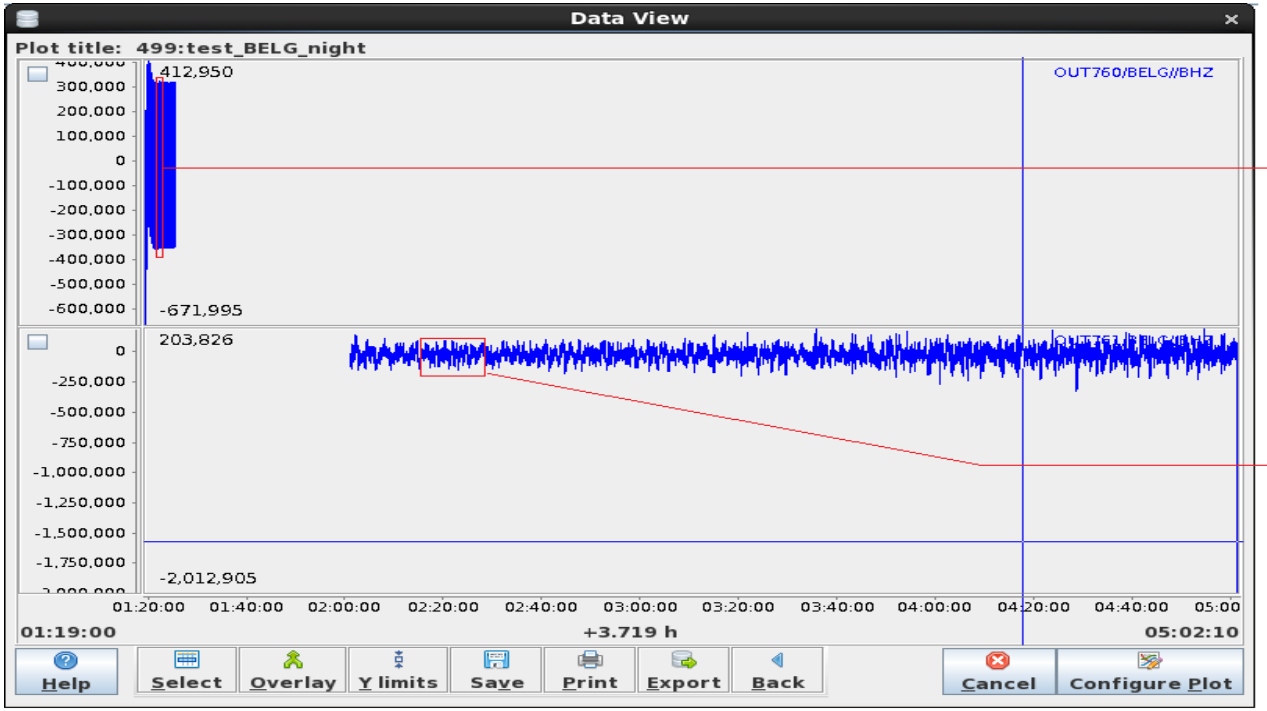
Calibration Scenario Definition and Scheduling

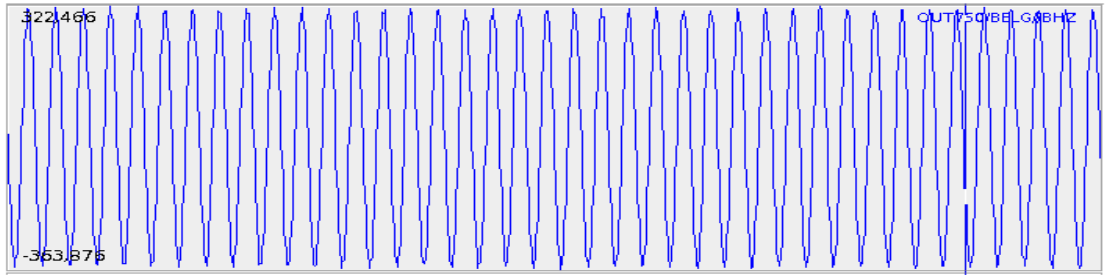


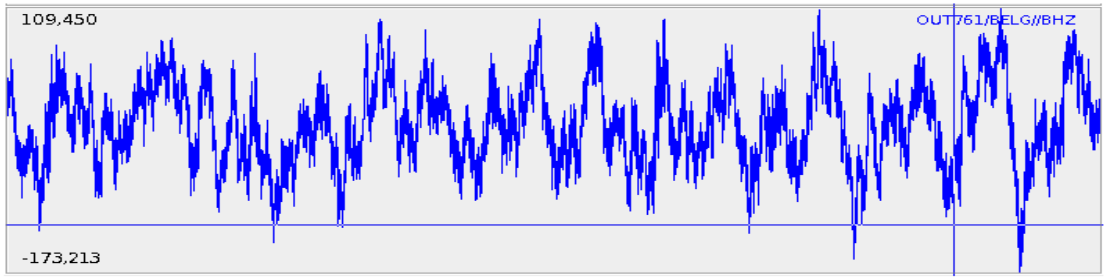
Calibration Signal(s) Definition



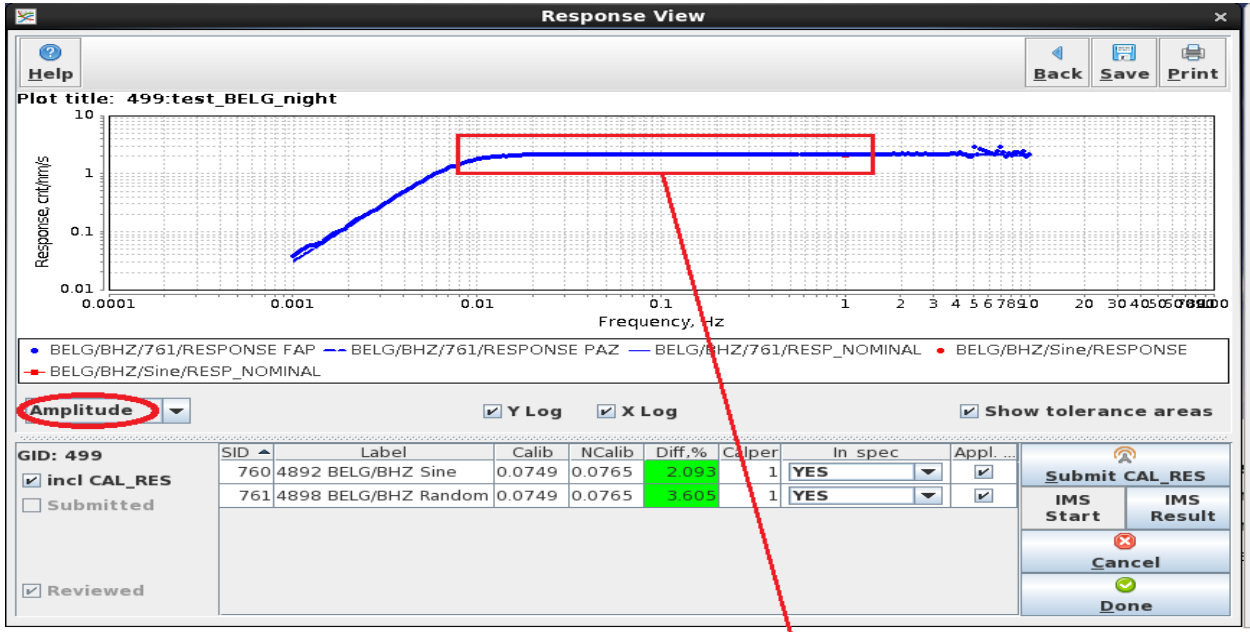
Output Signal Review

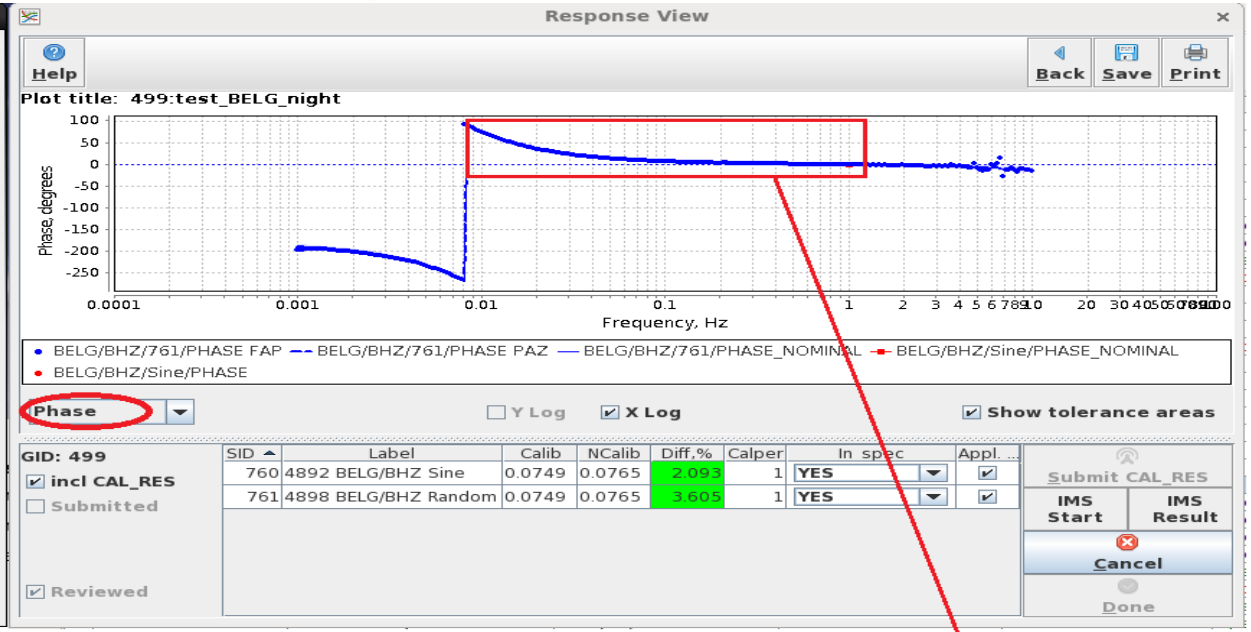


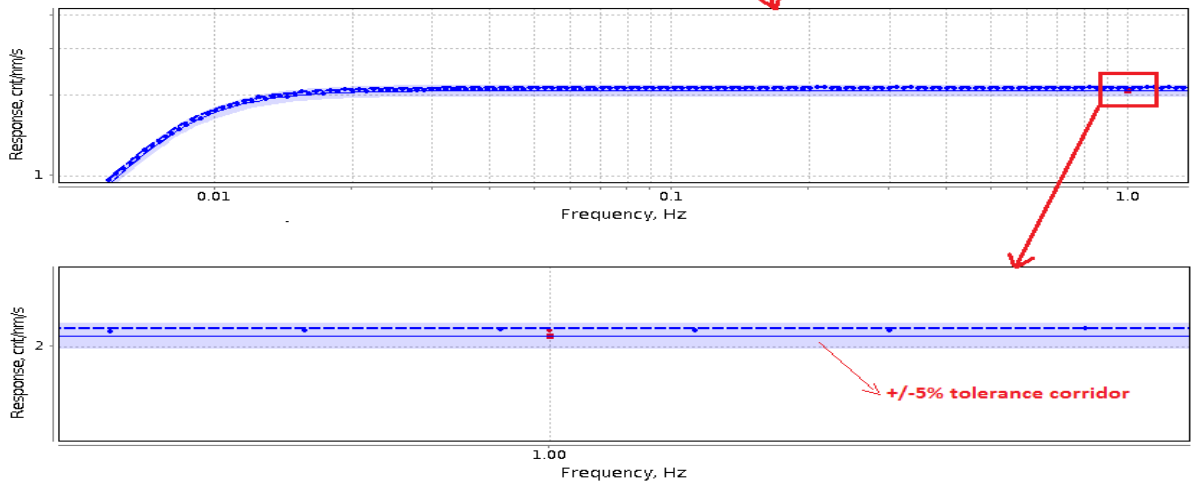


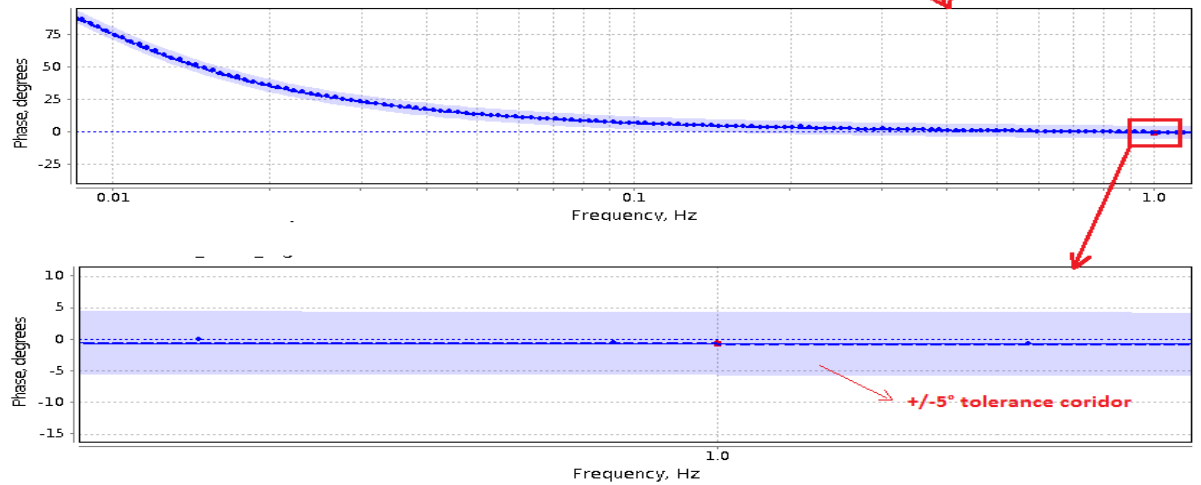


Calibration Results Interpretation

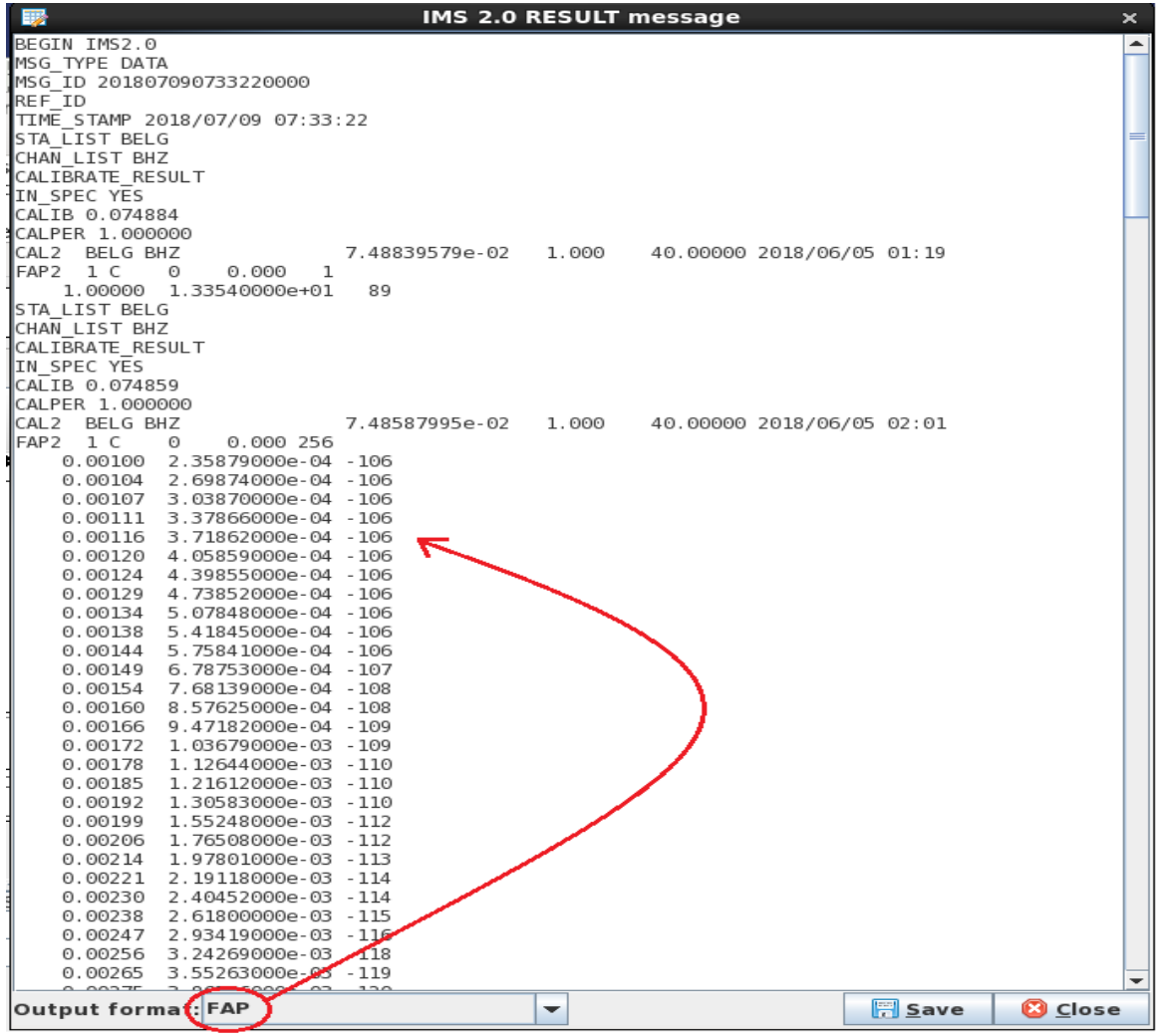


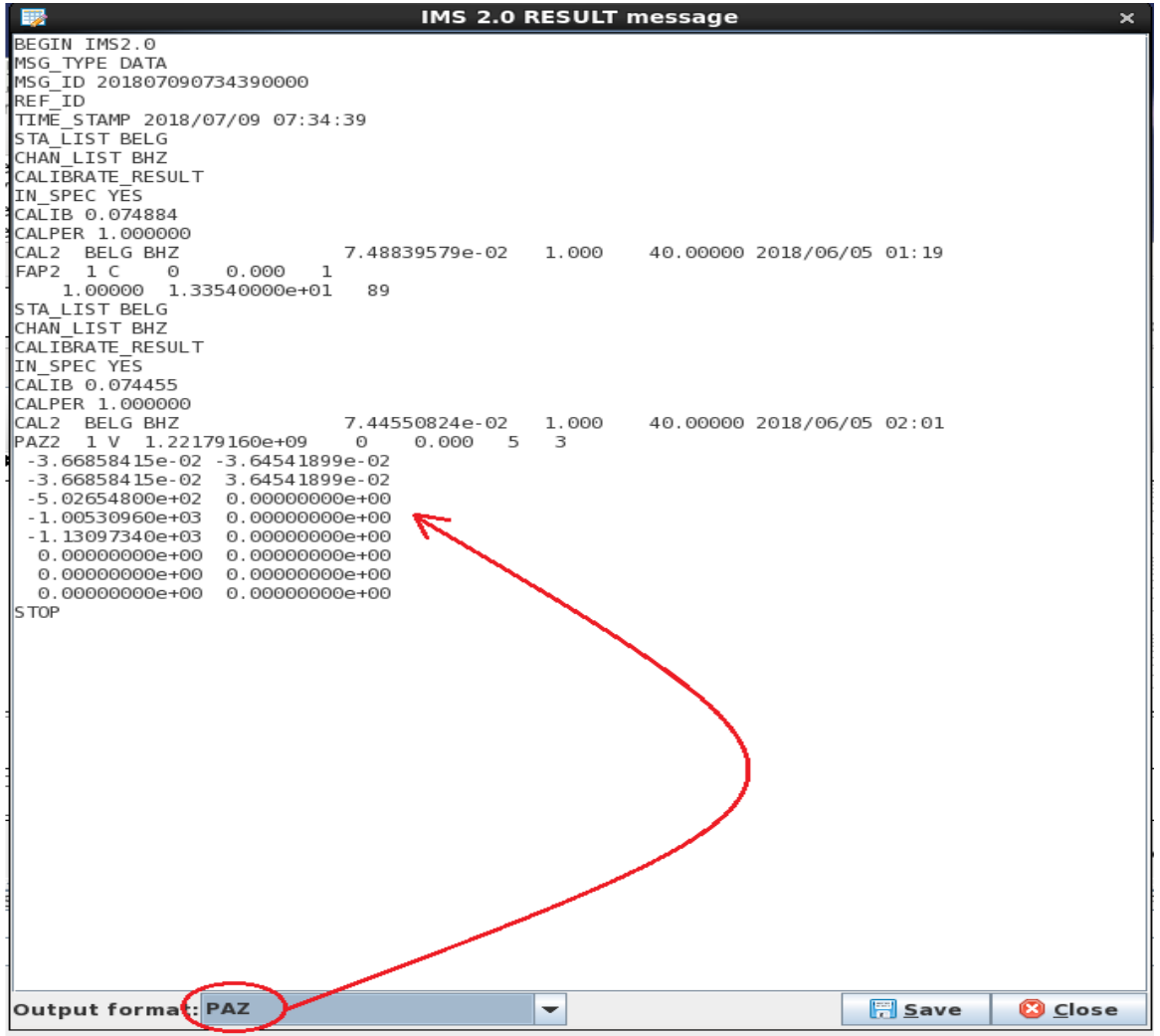






IMS2.0 calibrate result message





Latest Updates

- FAP2PAZ **interpolation** developed: smoothing function ; support SO interpretation
- Rolling-out of SSI including SSI Calibration Module: **~51 stations**
- 2019
  - KEST calibration using SSI Calibration Module: 3C, Europa-T/Güralp
  - ARCES calibration using SSI Calibration Module: **25-element array**, **75 channels**, Güralp/Güralp

    → NOA: 42-element array, 56 channels

    → JMIC: 3C

    → SPITZ: 9-element array, 31 channels

Conclusion

- The purpose of On-site Calibration is to ensure Station **data quality over time**.
- The SSI Calibration Module is contributing to
  - Increase the number of Stations sending **full-frequency reviewed** results in **IMS2.0** format
  - **Standardize** practices when performing a calibration task and sending calibration reviewed results to the PTS
  - **Standardize** the **validation** of these results at the PTS
  - **Reduce** the number of technical issues (due to diversity of equipment / software / calibration results format)
  - Enhance PTS capability to provide **support** and perform calibration remotely on the SO behalf
- Calibration Tasks → **Data Interpretation**

THANK YOU