Evaluation of the calibration method on a large campaign of measurement

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September 28, 2015

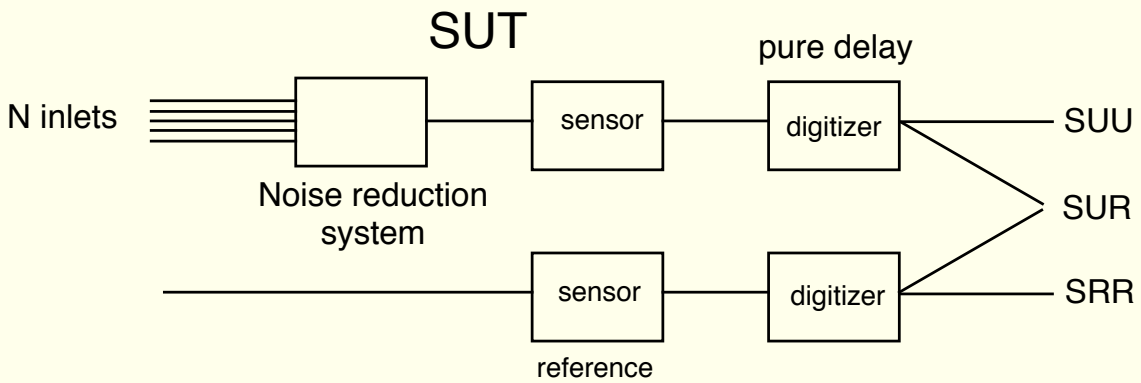
IMS study

In the framework of the calibration project, a study has been conducted by the IMS that provides some theoretical and practical results:

- determining closed form expression for the asymptotic distributions of the estimators,
- sizing a statistic for testing the magnitude square coherence (MSC) level,
- introducing a weighted estimator of the sensor under test (SUT) response based on the estimated value of the MSC estimator variance,
- proposal of a filter bank analysis for the SUT estimation,
- providing a simple wind coherence model which explains an observed artefact of the noise reduction system (NRS),
- Evaluation on a very large campaign of measurement on IS26

This presentation mainly focuses on the last item

Typical condition of measurement



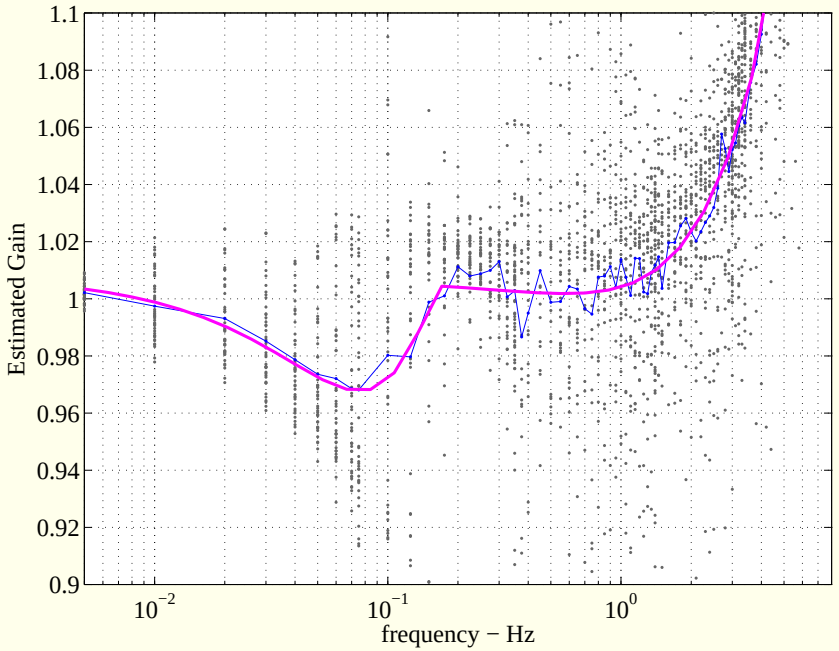
$$\widehat{SUT} \approx \frac{\widehat{SUU}}{\widehat{SUR}} \times SREF$$

- objective: calibrate the system under test (SUT), i.e. NRS+sensor.
- two kinds of signals: acoustic meaning about 300 m/s, and non acoustic, typically wind, meaning about 3 m/s,
- non spatially coherent signals are said "noise".
- acoustic signals is spatially coherent regarding the size of the SUT.

NRS effect

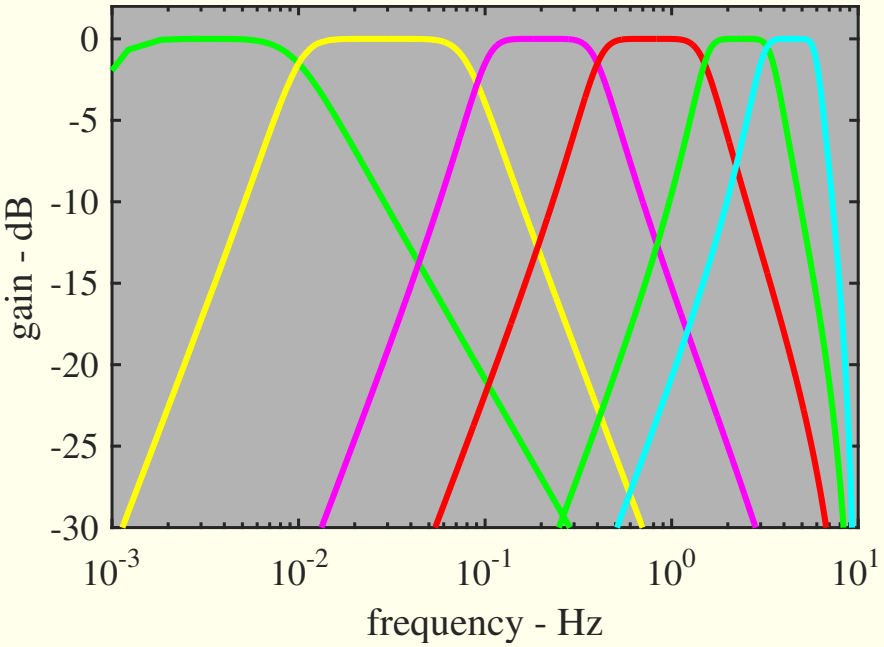
The ratio $\frac{v_{\text{wind}}}{f}$ can be interpreted as a wavelength. Therefore

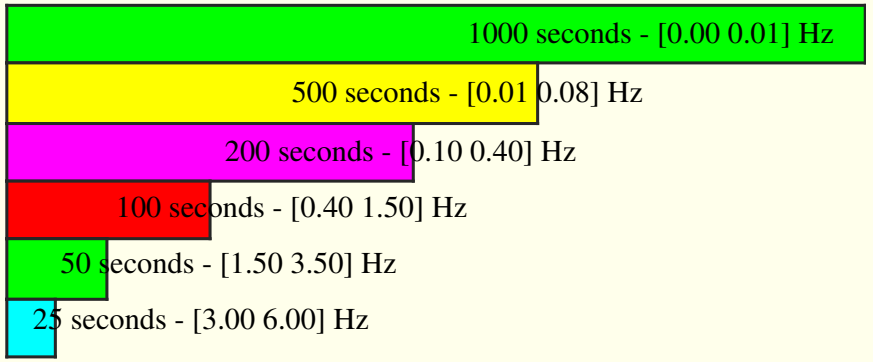
- at very low frequency, the wind appears as spatially coherent for all SUT inlets and SREF inlet. Therefore everything occurs as there is NO noise, and the MSC is almost 1,
- at high frequency, the wind appears as spatially NON coherent. Therefore the NRS plays its role to reduce the noise,
- at the mid frequency range, a small part of the wind appears as spatially coherent for near inlets. Therefore a dip artefact is observed.



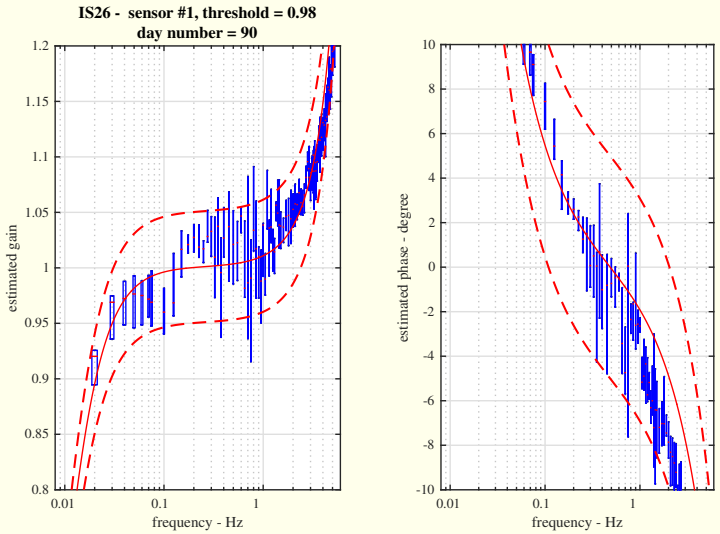
Manage the stationarity

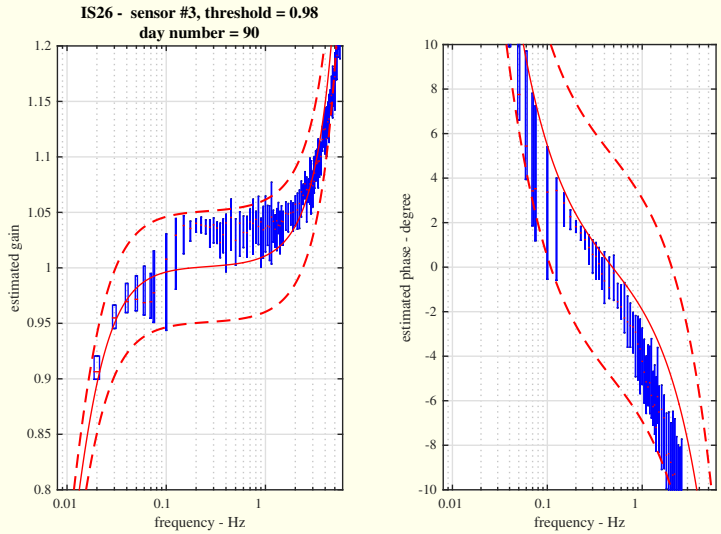
Spectrum analysis requires stationarity. In high frequencies the duration where we can expect stationarity can be considered smaller. Hence the use of a filter bank. An example is given below.

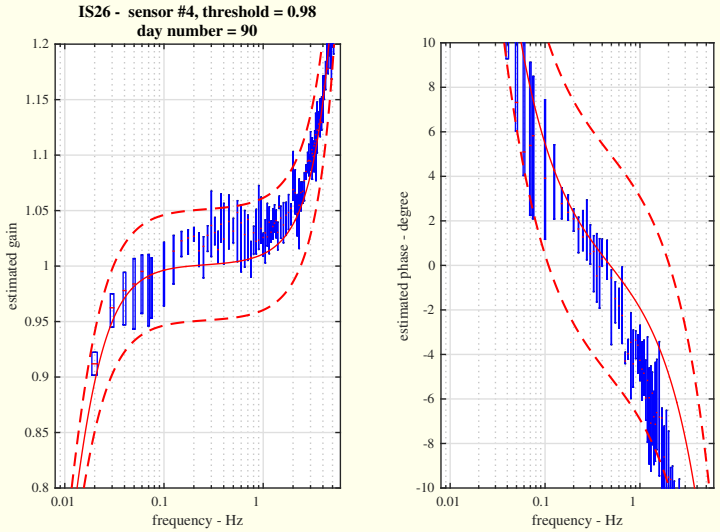


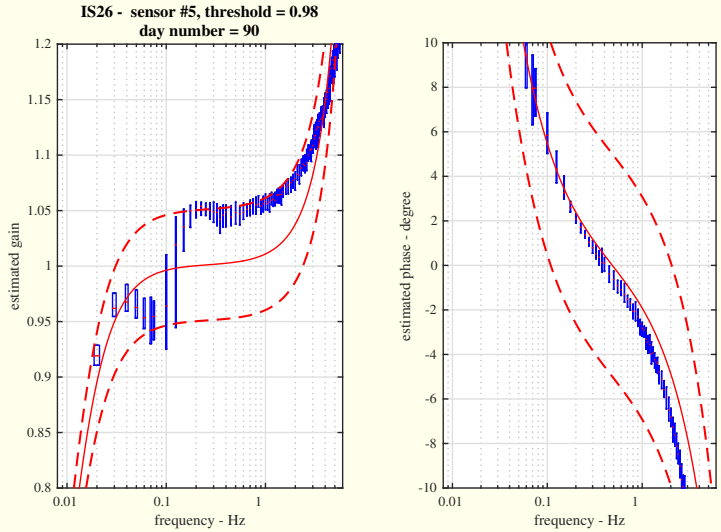


Results on confidence interval

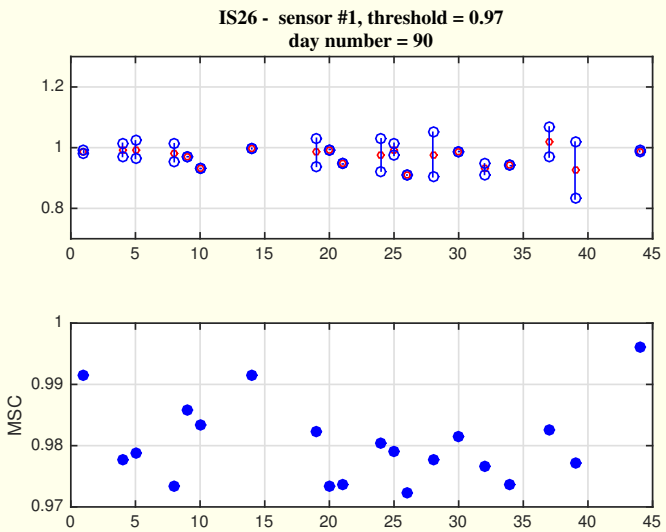


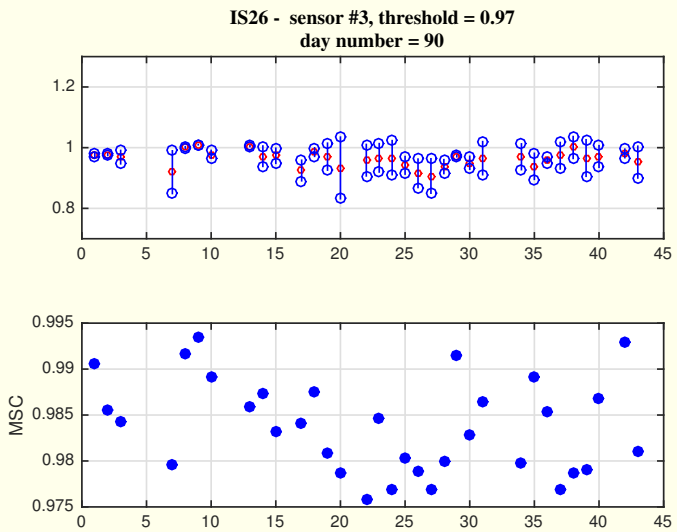


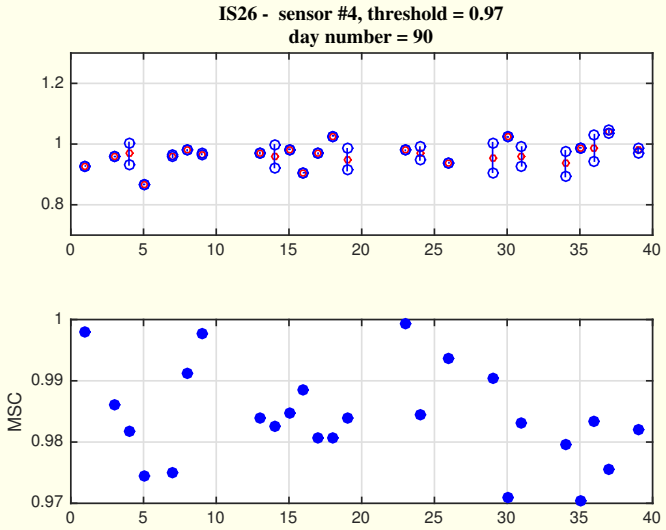


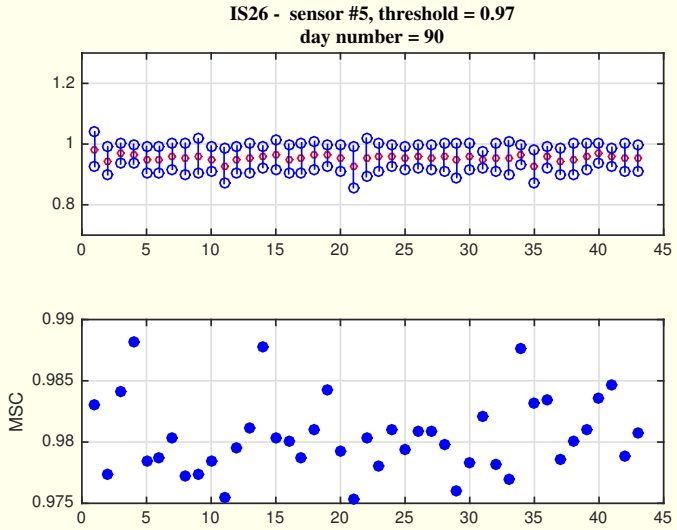


Temporal variability at the 1 Hz frequency value









Conclusion

The experimental results obtained during 3 months on IS26 fully validate the calibration method.

THANKS FOR YOUR ATTENTION