



Contribution ID: 87

Type: **not specified**

Sub-nanometer displacement measurements in seismic sensors

Tuesday, 14 June 2016 11:30 (20 minutes)

Specific requirements for vibrational characterisation and isolation of big scientific projects like CLIC have led to the development of the seismic sensors which utilise different types of sub-nanometric displacement transducers to measure relative displacement between an inertial mass and the sensor housing. Considering the nature of accelerator environment, magnetic based transducers are usually not considered and thus the recent development is focused mainly to the interferometers, the optical encoders and the capacitive sensors. They all have they pros and cons, but when it comes to a decision which one should be used, it is the resolution which plays one of the most crucial role. Determination of the resolution in sub-nm displacement measurement is however a complicated task, since it is influenced by many factors like mechanical design, ambient environment or data acquisition chain and processing algorithm. This is also a reason why the results of vibration measurements usually have no statement of uncertainty which is very important for reliable comparison of individual transducers.

To overcome these difficulties a sensor design was proposed which implement all of these technologies within the same mechanical body and it will use the same data acquisition and processing. This will remove any ambiguity between the measured data and allow to compare directly the resolution of the different transducers for a given design.

A multireflection Michelson interferometer will also be implemented to the same sensor in order to improve current state of the art sensor's resolution and will be used for the vibrational characterization of the final PACMAN bench.

Summary

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Session Classification: Handling the nanometer