Contribution ID: **66** Type: **Presentation**

Determining alignment measurements uncertainties for large assemblies using stochastic analysis techniques

Tuesday, 21 March 2017 09:45 (25 minutes)

Accurate, specific and traceable uncertainty budgeting of measurements is identified as key tool allowing micrometre alignment of large assemblies. The lack of standard methods to allow such accurate uncertainty statements is identified as a major research gap. As an answer to this a new uncertainty budgeting strategy following the International Standard of Uncertainty in Measurement (GUM - Supplement 1) is proposed. In this strategy the various error sources are evaluated experimentally and then propagated as probability density functions via either empirical or numerical stochastic (Monte Carlo) models. The method is applied in two different ways in the PACMAN project with regard to CLIC magnet assembly's alignment studies. In the first a Monte Carlo model of the CMM measurements Is used to propagate and evaluate the task specific uncertainty of the laboratory alignment measurements. In the second, thermal measurements of the real alignment conditions of the assembly are used as input into stochastic empirical and numerical models. Mean results of those are being used for compensation of the thermally related drift of the assembly with respect to the laboratory alignment measurements. The stochastic compensation models probability density functions are used as quantification of their uncertainty. Those methods are validated against precision coordinate measurements of calibrated artefacts and references. With this methodology the global uncertainty budget can be now be determined accurately as function of the exact conditions of each specific contributing factor (structures operational temperature and its gradients, measurement strategy, instrumentation used, etc.). It is argued that this methodology would provide a more accurate approach on the tight uncertainty budgeting allocated for the alignment requirements of the future particle accelerators projects. The method could be easily extrapolated/applied for the uncertainty budgeting required for any other large assembly's high precision alignment.

Primary author: Mr DOYTCHINOV, Iordan (CERN/Cranfield University)

Presenter: Mr DOYTCHINOV, Iordan (CERN/Cranfield University)

Session Classification: High-precision Engineering