Charles Andrew

The Central Indiana Section 1133 fall meeting was held on November 13, 2014 at Purdue University regional campus in Columbus Indiana. The facility we met in is called the Advanced Manufacturing Center of Excellence (AMCE) and is connected to the Purdue campus. A total of 34 participants were in attendance. The weather outside was very cold with an early taste of winter including snow flurries.

The meeting started with a welcome from our host Joe Fuehne with Indiana University - Purdue University Columbus (IUPUC) School of Engineering Technology. Joe gave an overview of the AMCE, Purdue University and its relationship with Indiana University - Purdue University Columbus (IUPUC). He also introduced the AMCE metrology laboratory and display case of historical measurement artifacts.

The first speaker was Joe Fuehne PhD, Director and Maha Associate Professor, Mechanical Engineering Technology, Purdue College of Technology, Advanced Manufacturing Center of Excellence (AMCE). His topic was "Introduction to Geometric Dimensioning and Tolerances (GD&T)." His presentation was based on ASME Y14.55-2009 and included "Why do we need GD&T? And What Types of GD&T are There?"

GD&T is a symbolic language used on engineering drawing and CAD drawings. GD&T is used to reduce manufacturing costs, protect functional relationship on a part, ensure part can be assembled, reduce drawing revisions, verify with functional gage, improve repeatability, outsource part, and analyze designs. GD&T overcomes many problems of Coordinate Tolerancing such as the need for more notes and language dependencies.

Joe discussed the major components of GD&T including symbols and provided real world examples. GD&T is a global language that is being adopted by more and more large companies. Obviously dimensional calibration laboratories need to understand this language and be prepared to apply it accordingly.

Special thanks to Tangent Labs of Indianapolis for providing lunch for the group.

Our second speaker was Anthony Hamilton, Senior Engineer, Eli Lilly and Company. His topic was "Uncertainty Analysis Tips for Instrumentation Calibration." Tony presented several tips about uncertainty that he has learned while performing uncertainty analysis for pressure and flow calibration systems.

Tony discussed experimental standard deviation of the mean to include requirements, math, uses (measurement system stability and instrument output sensitivity) and alternatives (repeatability/reproducibility R&R, ANOVA and resolution).

ILAC P14 (International Laboratory Accredited Cooperative) requires accredited labs to be able to show measurement uncertainty of the unit under test (UUT).

For the best analysis follow the GUM (Guide to the Expression of Uncertainty in Measurement).

Do not put in aspect of uncertainty as normal if you have not analyzed it personally. GUM requires that data be analyzed (or from an accredited lab which requires that data be analyzed) to be used as normal in measurement uncertainty.

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Tony covered standard uncertainty of the resolution, normal vs. rectangular distributions, measurement uncertainty of the reference and TUR (test uncertainty ratio). Tony concluded his discussion with audience participation. One fact brought out was an area of top nonconformance, *ISO/IEC 17025* sections 5.4.6.3 and 5.4.6.1, written procedures are required.

The third speaker was Ryan Fischer, Calibration Program Manager, Laboratory Accreditation Bureau (LAB). His topic was "How to Apply *ILAC P14* to Laboratory Measurements."

Ryan told us accreditation bodies seem to have different interpretations of *ILAC P14*. It is important to note that customer requirements allow labs to deviate with process as long as communication is (at minimum) documented via contract review. How to make inconsistencies consistent with accreditation assessments?

The least favorite and perhaps the least understood requirement of *ISO/IEC 17025* is found in section 5.10.4.2 where it states, "When statements of compliance are made, the uncertainty of measurement shall be taken into account." Least favorite because: Labs do not understand uncertainty very well, Laboratories lack tools to automate this activity, and Laboratories' customers do not understand uncertainty.

Accrediting bodies are trying to come together to provide a unified front. Understanding *ILAC P14* and *ISO/IEC 17025*, discerning differences between a test uncertainties, CMC scope uncertainties, and measurement uncertainties, and the ability to determine customer needs and apply an agreeable method for taking uncertainty into account. Ryan concluded his presentation with real life examples and practical solutions.

Our final session was a discussion panel with a topic of "Real Life Examples of GD&T." Many questions were asked and the discussion was lively.

The NCSLI Central Indiana Section steering committee members are John Bush, Eli Lilly and Company, Elizabeth Robinette, Eli Lilly and Company, Kevin Pata of Roche Diagnostics and Kevin Broderick of Tangent Labs.

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