Comments on the "Laser step diagonal tests", a PowerPoint document on 17 Feb 2003 produced and distributed by Renishaw

The above document produced and distributed by Renishaw is an attempt to discredit the validity of Optodyne's new and patented laser vector measurement technique (or laser step diagonal technique) for the measurement of volumetric positioning errors. Some of the statements in the document refer to rare special cases, some are speculations, and some are exaggerated and misleading. We will not try to rebuttal all the issues point by point in this document, but will provide that information on request. Here we will comment solely on the concluding statement, slide #23. In this slide, all 3 conclusions basically state that the Laser step diagonal measurement can not be used to accurately determine the linear positioning errors and should not be used for linear error compensation.

Unfortunately, readers of the Renishaw document will be confused. Linear positioning errors can easily be measured by any laser system. It is the **straightness and squareness** errors which are very difficult to measure by a conventional laser system, but can be easily measured by the laser vector technique.

Please note that the linear positioning errors measurement and compensation (sometimes called pitch error compensation) have been performed by laser interferometers or others for more than 30 years. In fact for most of the machine tools, the linear positioning errors have been reduced by better lead screw, linear encoders, or pitch error compensation. Now, the major errors are the straightness and squareness errors. When these errors are measured with a conventional laser interferometer, expensive and complex optics such as Wollaston prism are required. The optics is extremely difficult to align. It may take a few days instead of a few hours to perform the measurement. This is why the straightness measurement technique has been available for a long time, but is not commonly used.

The key advantage of the laser vector measurement technique is the capability to measure the straightness (vertical and horizontal) and squareness errors of all 3 axes in a short time, and also to generate the straightness or Sag or volumetric compensation tables to compensate these errors.

In conclusion, if you just want to measure the linear positioning errors, you can use any laser interferometer including Renishaw and Optodyne. However, if you want to measure the volumetric positioning errors, the Optodyne's laser vector technique offers the easy alignment, setup and operation. It can measure all these errors in a few hours instead of a few days.

References

C. Wang, "3 Dimensional machine tool positioning accuracy", Tooling & Production, August 2003.

C. Wang, "Volumetric accuracy defines machine accuracy", Manufacturing Engineering, Feb 2004.

More references and technical articles about the vector technique can be downloaded from Optodyne's web site at www.optodyne.com