USER-FRIENDLY APP FOR MEASURING AND DISPLAYING TUBING PARAMETERS

Abstract — we provide an overview of the user-friendly software application developed for the purposes of measuring glass and plastic tubing using OptiGauge II thickness measurement system.

Index Terms —non-contact metrology, material thickness, tubing, balloons, catheters, outer diameter, inner diameter, concentricity, ovality.

I. INTRODUCTION

Medical tubing is used for numerous applications, primarily for transporting and delivering liquids and gases, as well as for guiding surgical instrumentation. Medical tubing is subject to high quality and compliance standards. These standards require accurate metrology solutions to establish a precise and consistent manufacturing process. Medical grade tubing and balloons are held to strict dimensional parameters including wall thickness, inner diameter (ID), outer diameter (OD), concentricity, and ovality.

Despite insufficient accuracy and high likelihood of cross-contamination, standard mechanical calipers are often used for quality control procedures.

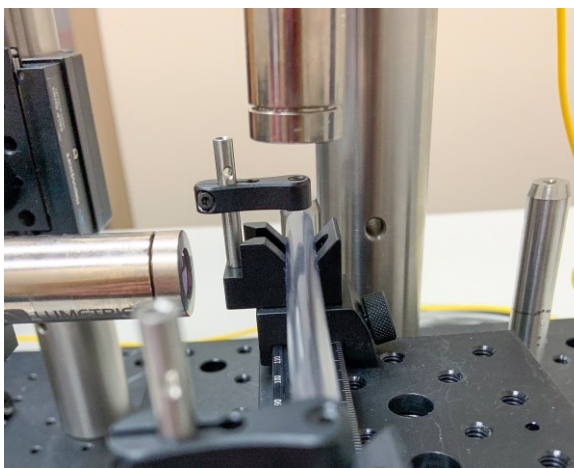Lumetrics develops and manufactures non-contact light-based metrology solutions for the medical device

Figure 1: Glass tubing being measured by two optical probes. One probe is located above the tubing and another to the left of it.
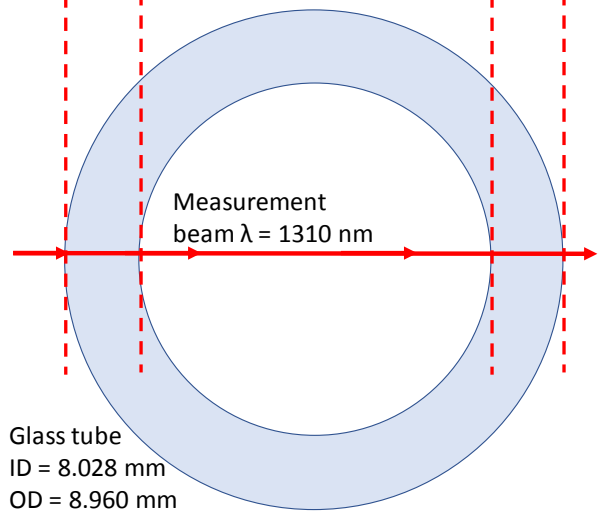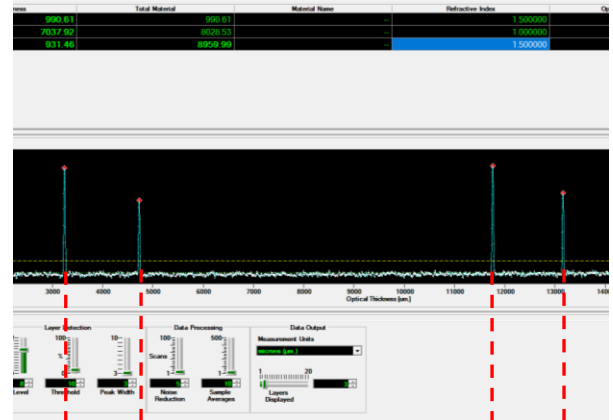

Figure 2: OptiGauge Control Center interface showing four signal peaks that correspond to the four surfaces of the tube traversed by the measurement beam.

industry, as well as for many other industrial production applications. The OptiGauge line of products uses partial coherence interferometry for accurate and precise measurements of various devices and parts manufactured using plastic, glass and other materials.

Figure 1 shows an example of glass tubing measured in laboratory conditions using the OptiGauge. Two probes are visible in the picture, located above and to the left of the tube. Each probe emits a beam of light, which traverses the medical tubing. The four surfaces of the tube located along the beam – the two opposite outer and the two opposite inner walls along the beam – reflect a portion of
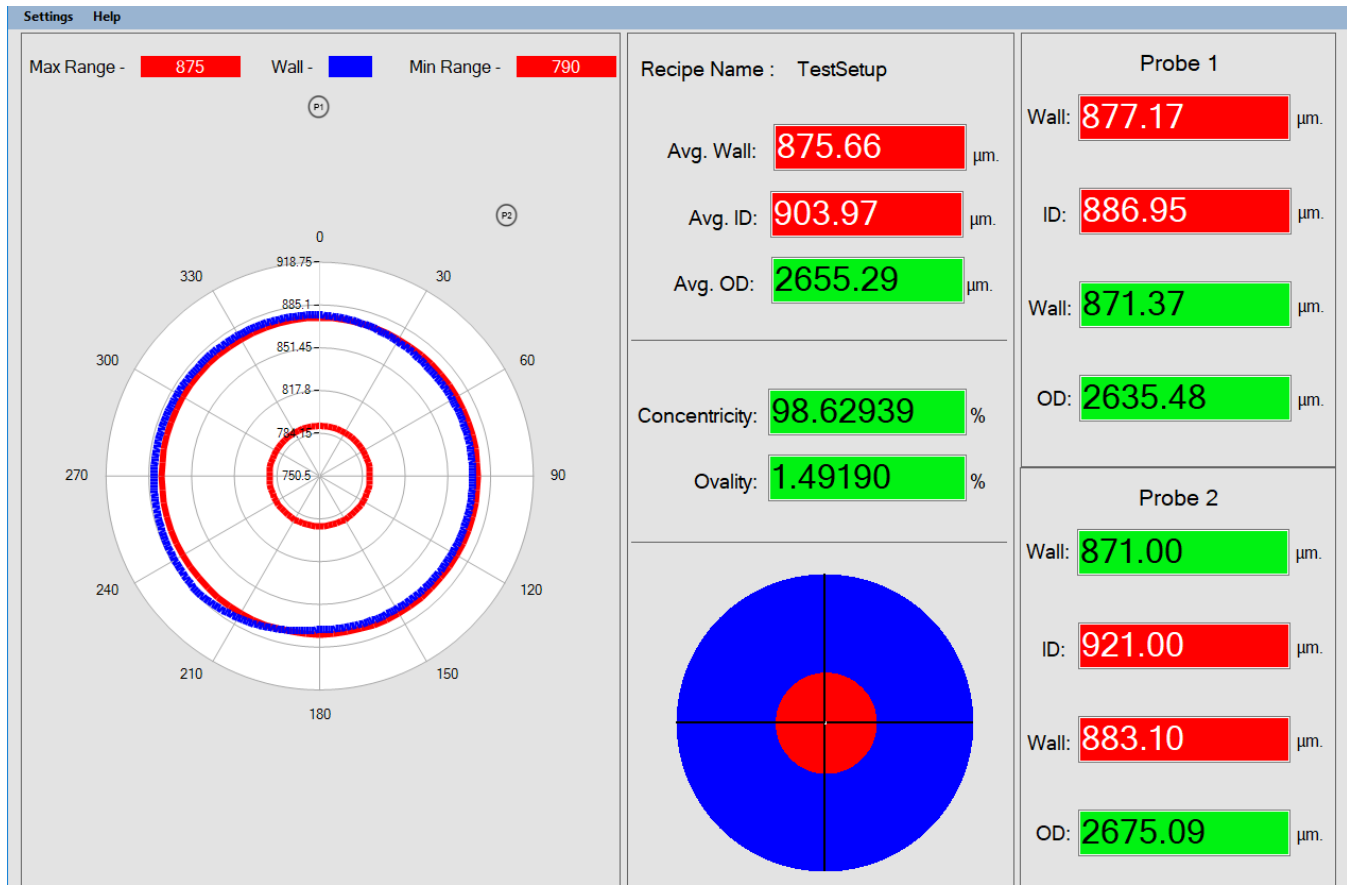
Figure 3: Tubing measurement software interface showing an out-of-spec measurement.

the light back into the probe. The four reflections are then collected by the same probe and then transmitted to the interferometer for analysis. The analysis extracts the value of the spatial separation between the reflections.

Figure 2 shows the screenshot from the standard software suite (OptiGauge Control Center, OCC) supplied with the OptiGauge and used for basic measurement applications. The screenshot contains a graph with 4 signal peaks. Each peak corresponds to a reflection from the tube. In the schematic below the screenshot and beam of light enters the tube from the left. Therefore, the left peak in the graph corresponds to the reflection off the left outer wall; the second peak corresponds to the left inner wall and so on. The distances between the peaks are equal to the distances between the corresponding surfaces. The OCC displays those measurements (not shown in the screenshot).

II. TUBING MEASUREMENT APPLICATION

While OCC is versatile and convenient for many measurement applications, sometimes a more streamlined approach is needed for quick determination of sample quality. Often, a technician-level operator conducts the measurements.

The Tubing Measurement Application is a custom add-on software with a simple and intuitive user interface aimed at streamlining the measurements of the tubing samples. The application allows creating, selection and execution of recipes. A recipe contains information about tolerances for ID, OD, wall thickness, concentricity, and ovality.[1] If adjustments are needed for the OptiGauge settings, the operator can open the OptiGauge Control Center from within the App.

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[1] If only one probe is used, the ovality calculations are not available.

Figure 3 shows an example of the Polar App user interface when the measurement results are outside of the specifications according to the recipe. The plot on the left-hand side provides a visual representation of the wall thickness of the tube (blue line) as compared to the tolerance range (two red circles). The smaller red circle represents the low end of the tolerance range, while the larger circle represents the upper tolerance range. The blue circle is obtained using the four wall thickness measurements from the two probes. Notice that the blue circle crosses one of the red circles, indicating an "out-of-spec" measurement. When the blue circle is fully located in the space between the two red circles – the measurement is "in-spec".

Figure 4 shows an example where the measurements are within the specifications. Recipe parameters were modified to obtain this example while measuring the same tubing as in Figure 3.

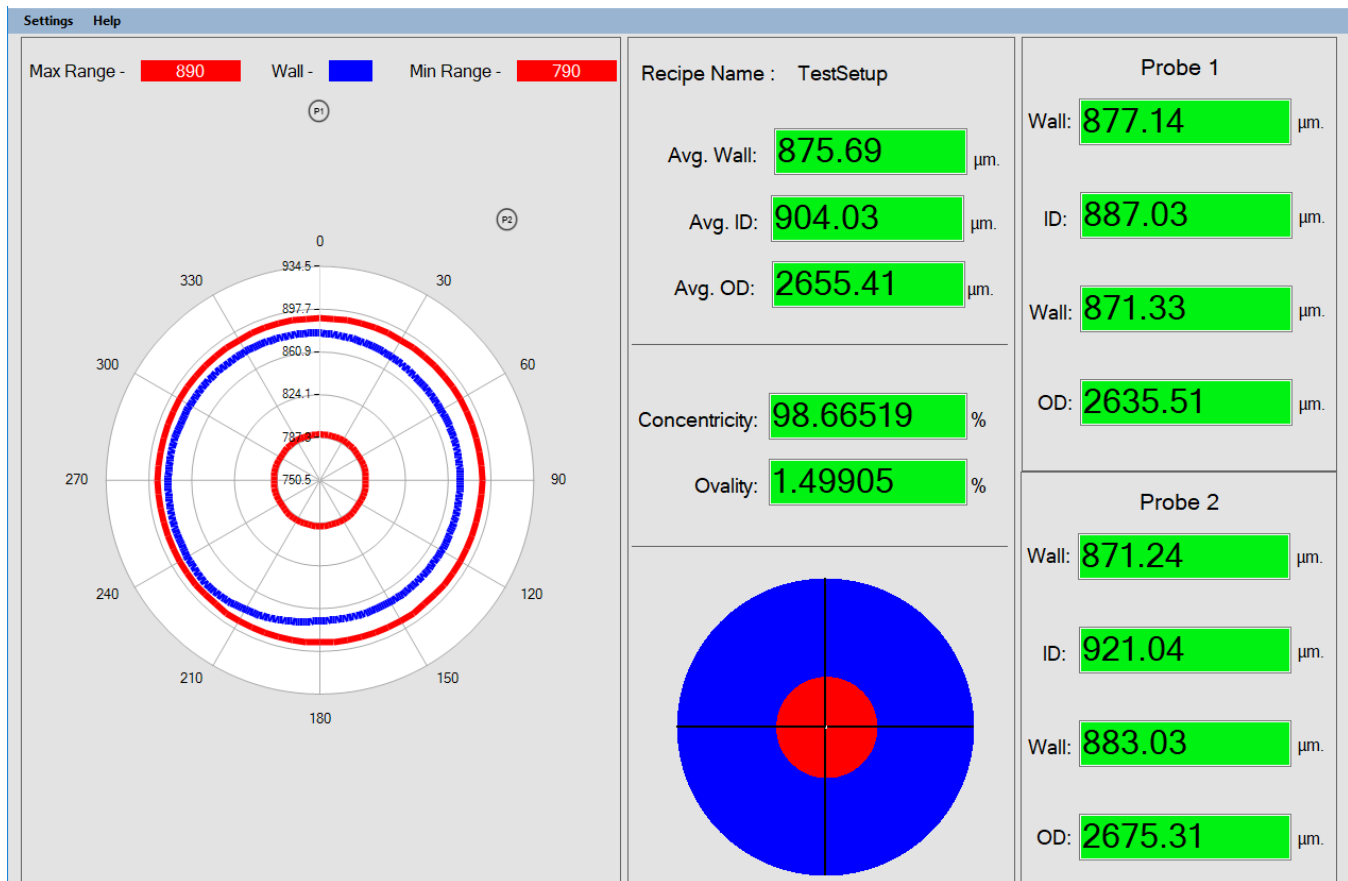## For additional information:
E-mail: sales@lumetrics.com or engineering@lumetrics.com

Figure 4: Measurement that meets specification.