

Application Note

Thickness measurement with two sensors

Executive Summary

In order to evaluate the capability of using two sensors for thickness measurement, an experiment of glass thickness measurement was performed. During the experiment we tested the following aspects:

1. The ability to set the two sensors to the exact same measurement axis.
2. The ability to measure mutually from both sides of a transparent material, and cross talk confrontation.
3. The ability to use both sensors absolute distance measurement to create artificial reference point and use it to create accurate thickness measurement.

1. Application description

Non-contact inspection of absolute glass thickness.

2. Conclusions

Optimet's sensors are highly capable to measure thickness using two sensors setup. The measurements should be performed using reference measurement and with alternately measurements between probes.

3. Setup

Sensors & Setup

Sensor Type:	Two NanoconoProbes Mark 3
Lens focal length:	25mm lens
Sample rate:	3 KHz
Room temp:	23~24 °c

Probe spec:

Working range:	1mm
Standoff:	18mm
Precision:	0.5um
Spot size:	5um

Static measurement with both sensors attached to their positions

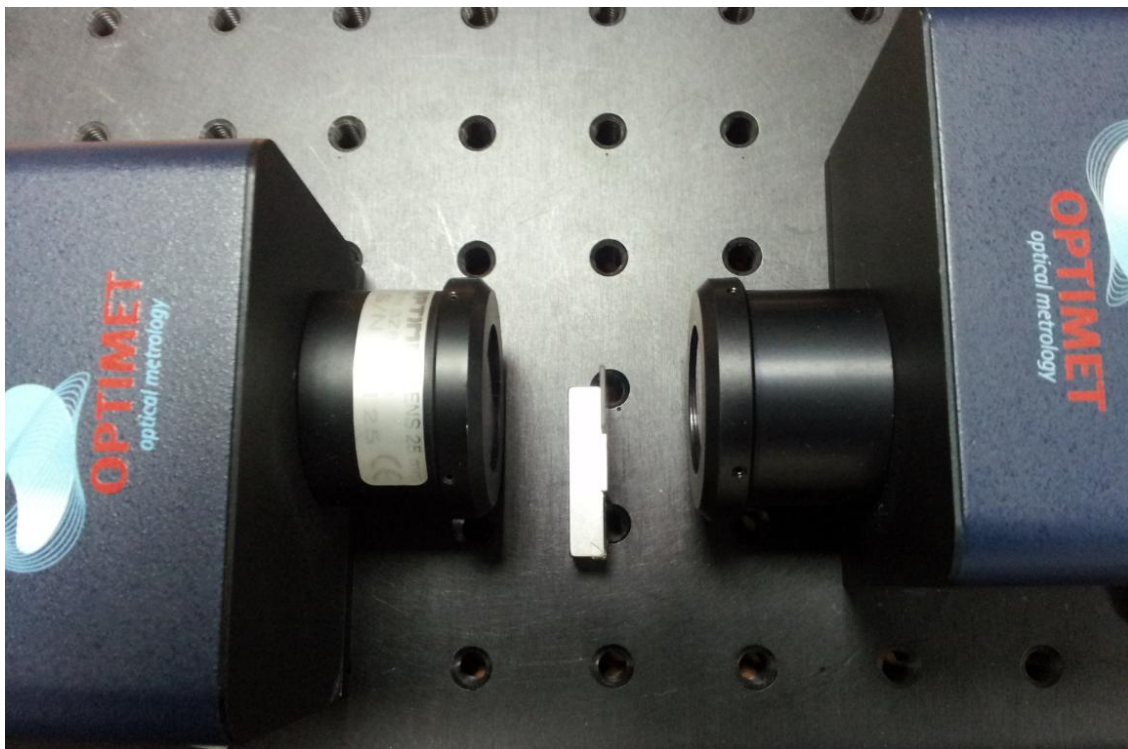
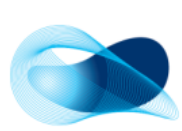


Figure 1 Sensors placement

Target -

- a. Metal Mitutoyo block of 1[mm] – used as reference target.
- b. Glass – used as measured object.

The two objects attached together in parallel used as switched target in order to perform thickness measurement based on reference surface.



Figure 2 Target

4. Experiment steps

1. Setting both sensors to the exact same measurement axis -
During the experiment we discovered that when setting two NanoConoprobes one in front of each other, there is a great cross talk so laser spot of one reflected on the second detector and vice versa. We used this fact for setting the probes on the exact same axis as we aimed the cross talk signals (cross talk signal – signal energy coming from the other probe while laser power of current probe is off , see image below) to be on the center of the detector.

The cross talk can be used for the setup aiming but it also limited the co-measurement and when measuring thickness of transparent target, the sensors should be alternately shuttered in order to avoid the cross talk affection on the measurement.

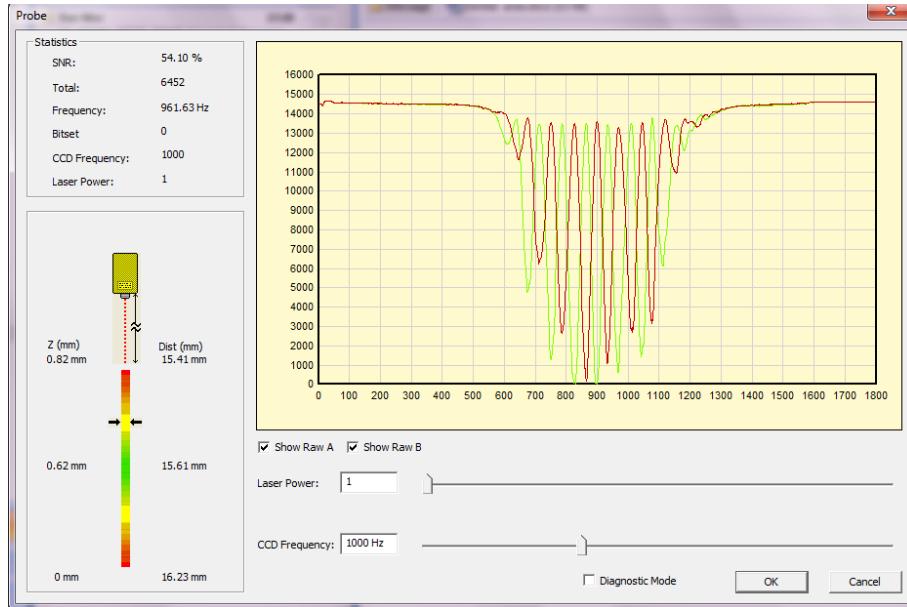
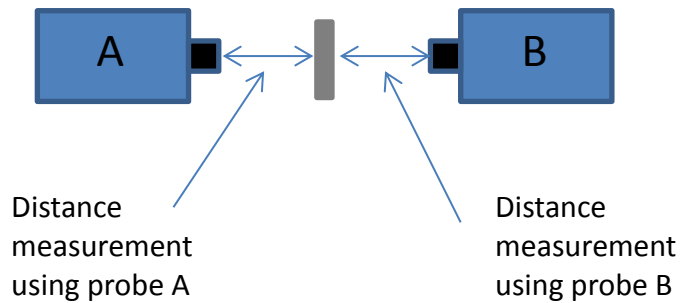


Figure 3 Cross talk signal

2. Reference measurement on Mitutoyo block –



The Mitutoyo block placed on the measurement axis, inside both probes measurement ranges as described in the draw above. Using both probes measurements, we created the reference distance Z_0 :

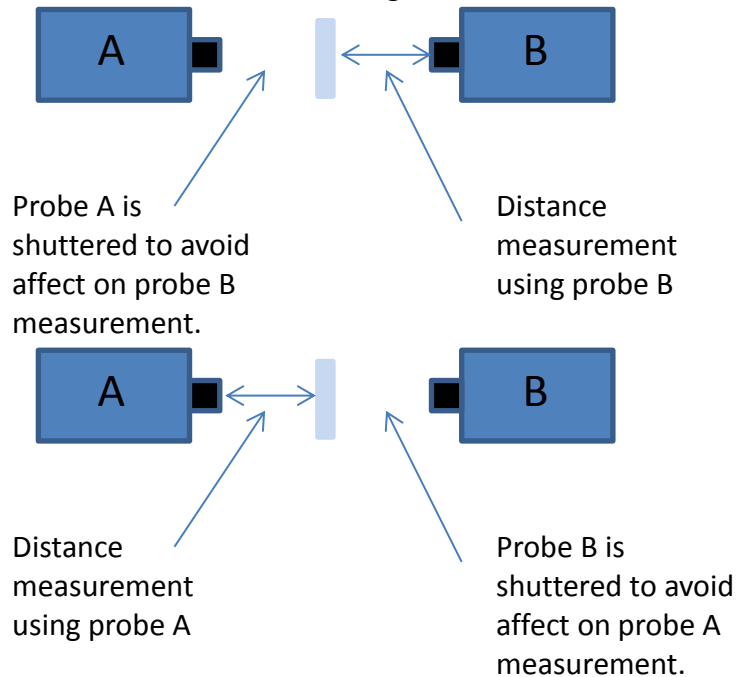
$$Z_0 = d_a + d_b + d_M$$

Where d_a & d_b are the distances measured using both probes and d_M is the Mitutoyo block thickness.

At this step both probes measured mutually.

3. Glass thickness measurement –

The glass object placed instead of the Mitutoyo block without changing or moving any other object in the system. Then we performed two measurements as described in the below drawings.



Then we calculated the glass thickness using the following formula -

$$G_{th} = Z_0 - (d_{ga} + d_{gb})$$

Where:

G_{th} - The glass thickness.

d_{ga} - The distance from glass measured using probe A.

d_{gb} – The distance from glass measured using probe B.

Note : the use of reference measurement is necessary in order to avoid the affect of calibration variations of the two probes and the variations it yield to an absolute distance measurements. Thus we used relative measurement instead of absolute measurement.

5. Results

Following the describes procedure, and placing color filter from Wise Planet on the target –

We measured:

$$Z_o = 32.21_{mm}$$

$$d_a = 15.39_{mm}$$

$$d_b = 15.82_{mm}$$

$$d_M = 1_{mm}$$

$$d_{ga} = 16.15_{mm}$$

$$d_{gb} = 15.80_{mm}$$

$$G_{th} = 0.260_{mm}$$

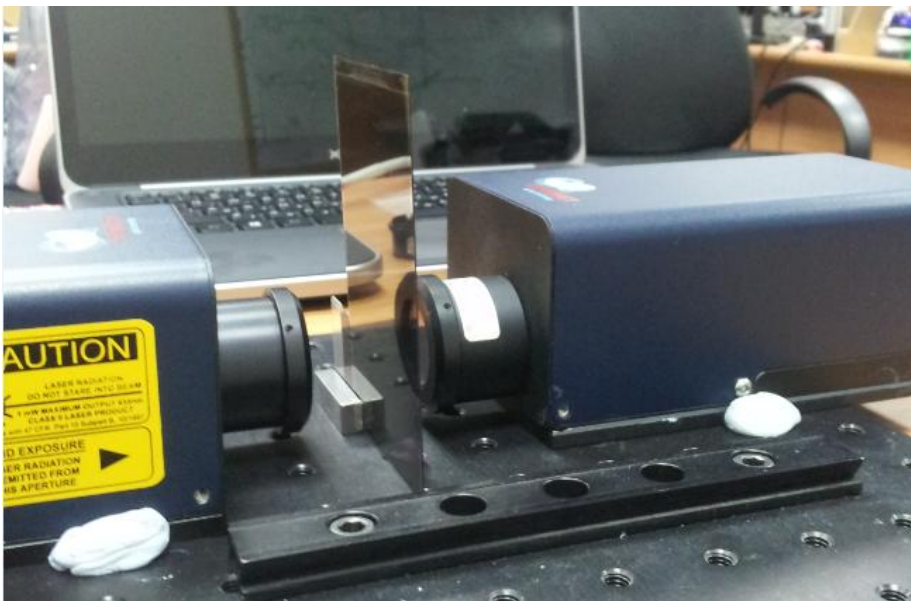
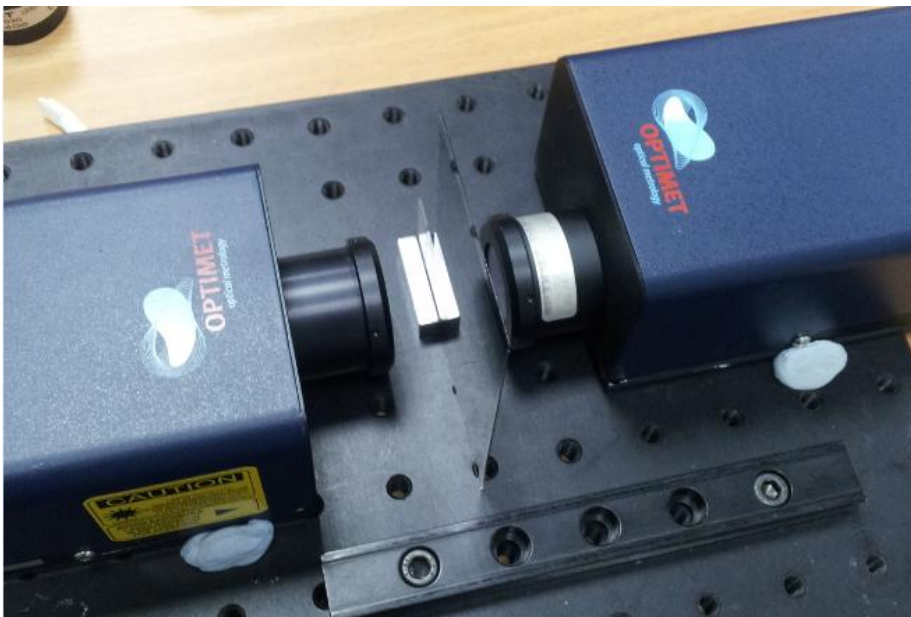


Figure 4 Wise Planet target