Response to Reviewer 2 Comments

Although I appreciate the efforts of the authors to improve their manuscript, some concerns still remain.

**Point 1:** In particular the uncertainty evaluation is not clear as well as the outcomes of your study and your contribution respect to other devices in literature, e.g. what is the relationship between the accuracy claimed for other devices in literature and your error analysis for the displacement calculation model of your system? Is your system more accurate or suitable than the measurement systems you referenced in your introduction?

**Response:**
Thank you for your careful review. We appreciate your efforts to review our manuscript.

The uncertainty evaluation for the error of displacement calculation model (DCM) is about the difference between the displacement calculated from DCM and the displacement calibrated from HEIDENHAIN-CERTO length gauge (H.). This error is also called mapping error in the reference [1]. Our DCM includes several polynomial functions independent with each other. Some systematic errors of our capacitive displacement system (CDS) is corrected by these independent polynomial functions. The error of DCM is the comprehensive error of these functions.

Another kind of error is called drift error [1], which may be caused by environmental conditions such as temperature variation. Our entire experimental setup is placed on an active vibration isolation platform in a clean room and the room temperature is controlled at about 20°C. In the well-controlled environments, this kind of uncertainty is not included in the uncertainty evaluation. The uncertainty of drift error for devices in most literature is also not evaluated if the environmental conditions is well controlled.

The third kind of error is caused by noise, and this kind of measurement uncertainty is usually evaluated by resolution analysis. If the measurement noise is approximately Gaussian distributed, the resolution can be quantified by the standard deviation $\sigma$ (RMS value) of the noise [1]. We evaluated the resolution of CDS in the manuscript.

Other kinds of errors can influence the final accuracy of CDS. Here, the final accuracy is about the difference between the calculated displacement from DCM and the true displacement position. These kinds of errors include the connection error between our CDS and H., the accuracy of the H. and so on. But these kinds of errors doesn’t belong to the error of CDS itself. We didn’t evaluate the uncertainty of these errors. These errors are related to the metrological traceability and the uncertainty of these kinds of error for devices in many other literature is also not evaluated [1].

Based on the above description, the uncertainty of other devices in literature is usually only about the mapping error, which is also called error of DCM in our manuscript. Drift error is not evaluated because experiments is performed in the well-controlled environmental conditions. Uncertainty of noise error is evaluated by resolution analysis. The uncertainty of our CDS is evaluated under the same standards with other devices in literature. The uncertainty
and resolution of our DCM reaches less than 40 nm and 4.8 nm, respectively, and our CDS are more accurate than the measuring system referred in the references in our introduction [2-4].

**Point 2:** Moreover it is not clear how is it possible that some physical quantities you used are dimensionless, i.e. variable signal and standard deviation of the noise.

**Response:**
In our researches, a kind of Capacitance-to-Digital Converter (CDC) is used to measure the relative capacitance. The CDC is used to converts capacitive information into digital signal by counting number of discharging-time increment of a resistance-capacitance (RC) circuit. The output of CDC is integers within 24 bits, and has no physical meaning. Thus the variable signal ($\Delta y$), signal noise ($\sigma_N$) and signal resolution ($\eta$) are dimensionless. The relationship between the measured signal value and displacement is established through calibration parameters. To keep simplicity, analysis is in the level of measured signal values before being converted so that some physical quantities are dimensionless. Nevertheless, the analysis is capable to provide sensitive information of our devices by considering the linear components of the calibration parameters.