# Microscopic electrical impedance tomography system using a small container with micro-scale electrodes

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**Abstract.** We have been developing a microscopic electrical impedance tomography (micro-EIT) system for long-term monitoring cells or tissues noninvasively. For a preliminary examination of this method, we implemented a hexahedral cuboid container of $48 \times 48 \times 24\ mm^3$ employing dedicated current driving electrodes and 360 voltage sensing electrodes. When considering the total volume of the sample container, the size of sensing electrodes and the distance between electrodes were not small enough to get high spatial resolution images of the cells. In this study, we proposed a miniaturized hexahedral sample container produced by using conventional printed circuit board technology. The volume of the container was $8 \times 8 \times 4\ mm^3$. It included total 128 voltage sensing electrodes placed on the bottom, front and back sides. Each sensing electrodes had 400 $\mu m$ diameter and 400 $\mu m$ distance between them. Attaching $3 \times 3$ pieces of current injection electrodes on the left and right side of a container, we could generate either uniform parallel or diagonal current density distributions inside the container. As we miniaturized the container, we had more measurment noise from small electrodes with high impedance values. We adopted an unit-gain buffer with high input impedance at the input stage of each measurement channels. We reduced routes from sensing electrodes to the buffers and instrumentation amplifiers for minimizing of the input capacitance. Also, we applied automatic calibration procedure for micro-EIT system to maintain the performance. We describe the problems and countermeasures of using micro-scale electrodes and a small container. We evaluate the system with performance indexes. Biological experiments will be performed with living cells or tissues by using developed micro-EIT system.

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