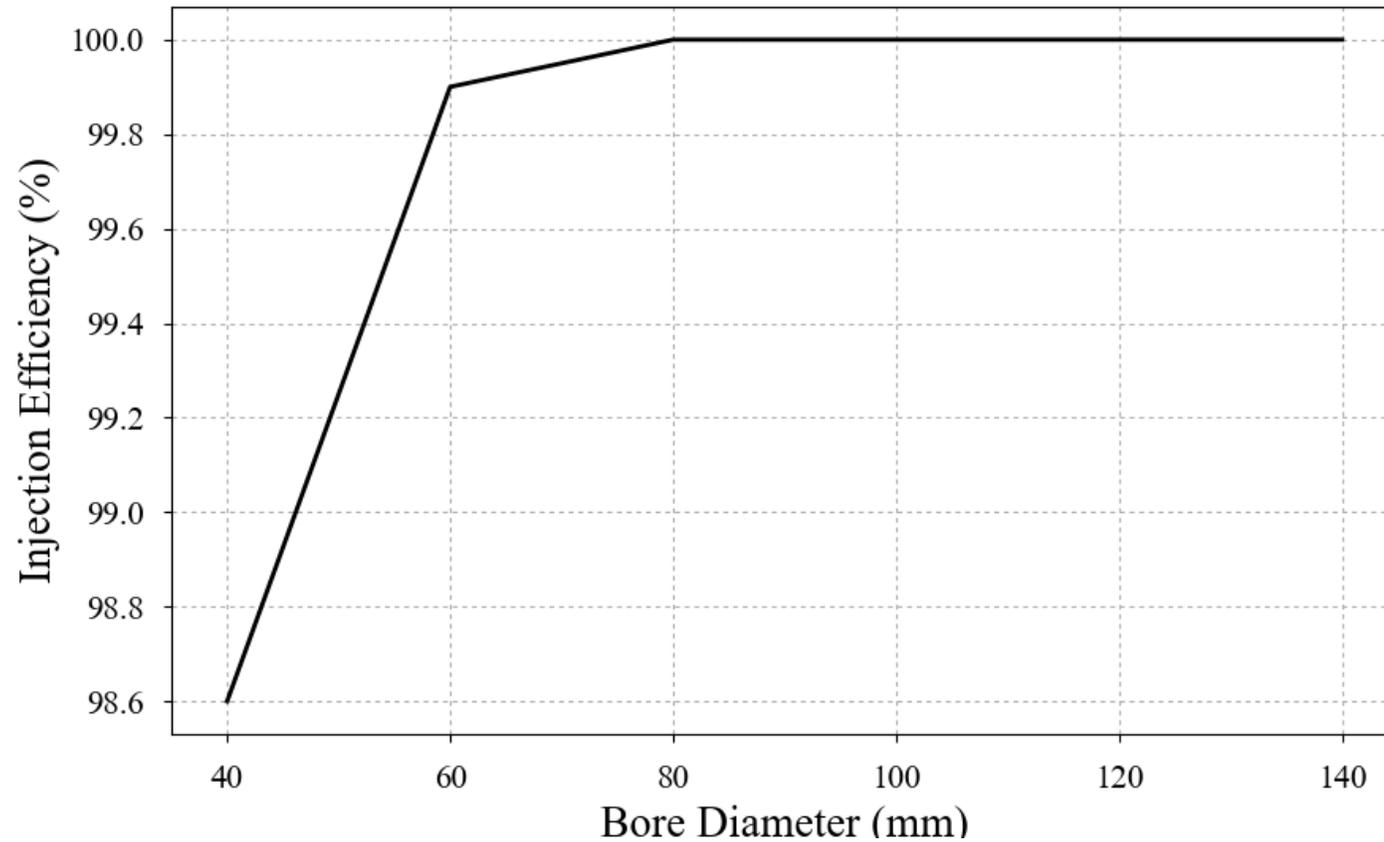


Simulation of Electrodes for KU Magnet

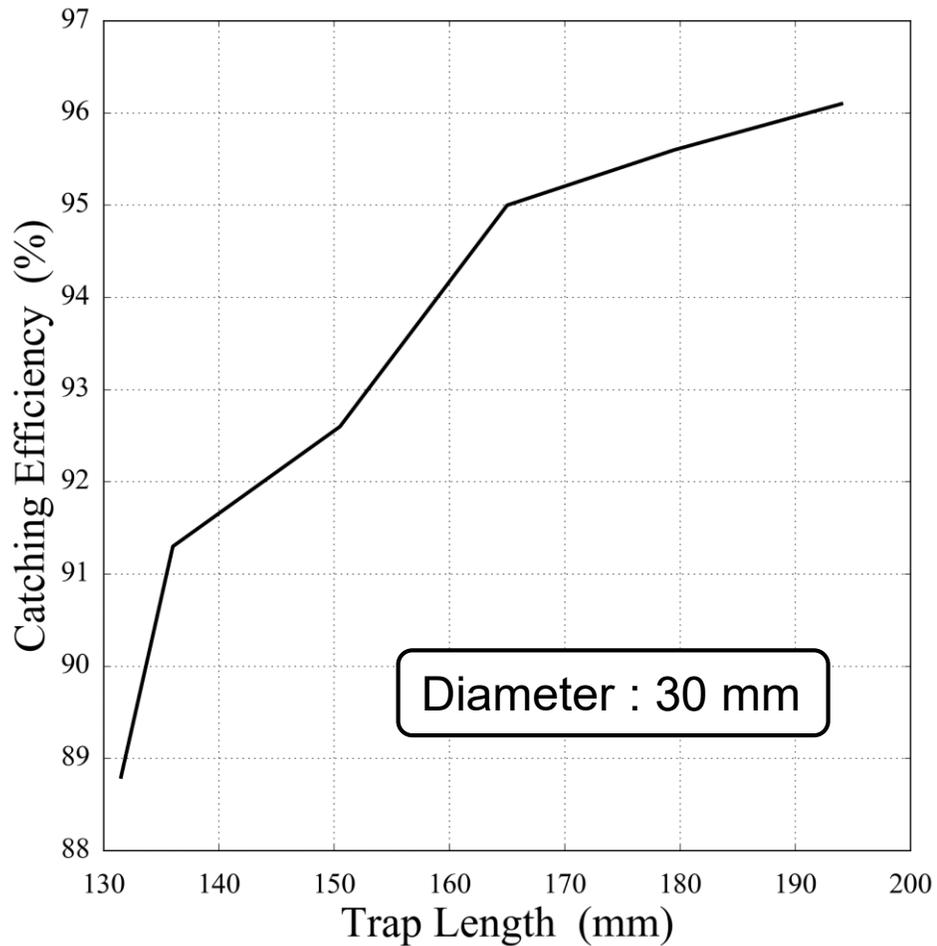
Kyoung-Hun Yoo

2017. 06. 08

Injection Efficiency with various Magnet Bore Diameter



Catching Efficiency with various Trap Length and Diameter of Electrodes

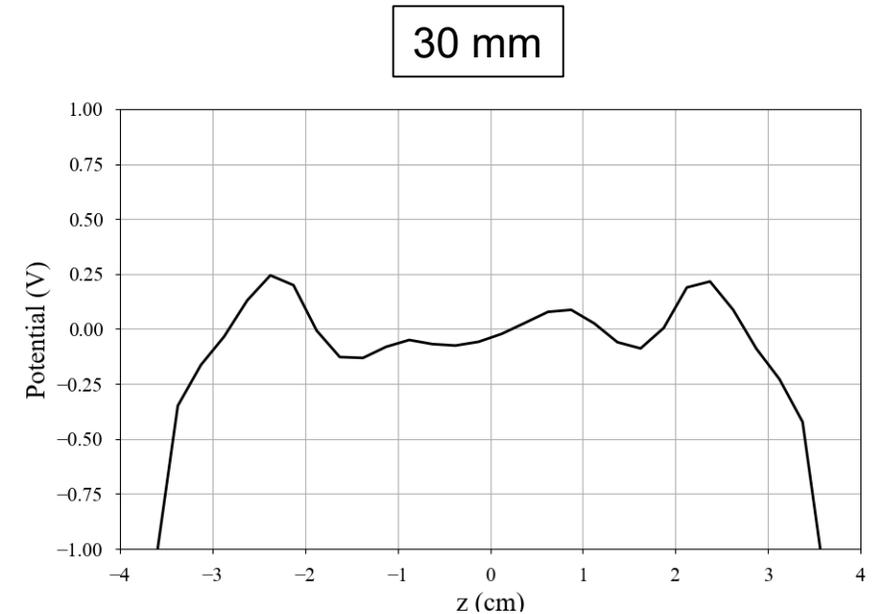
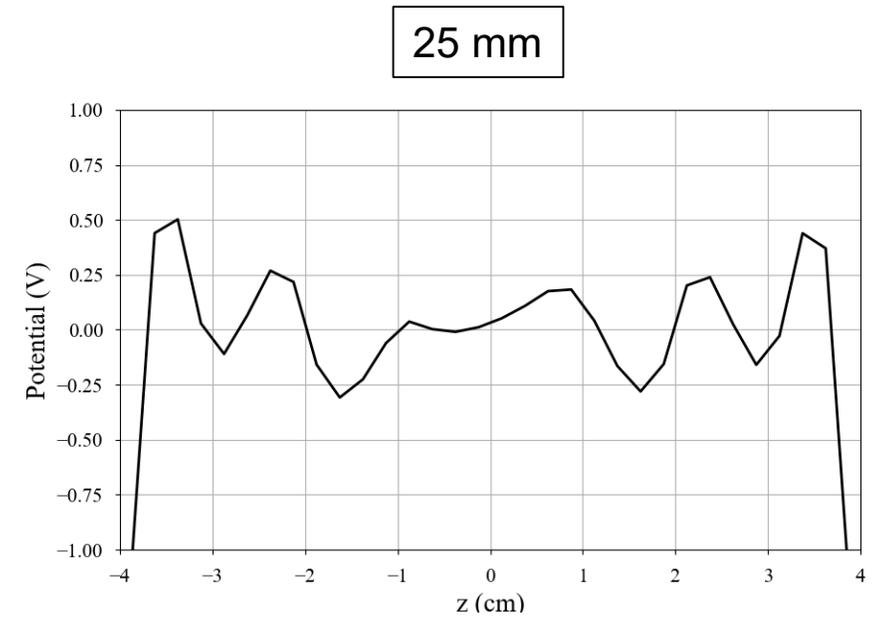
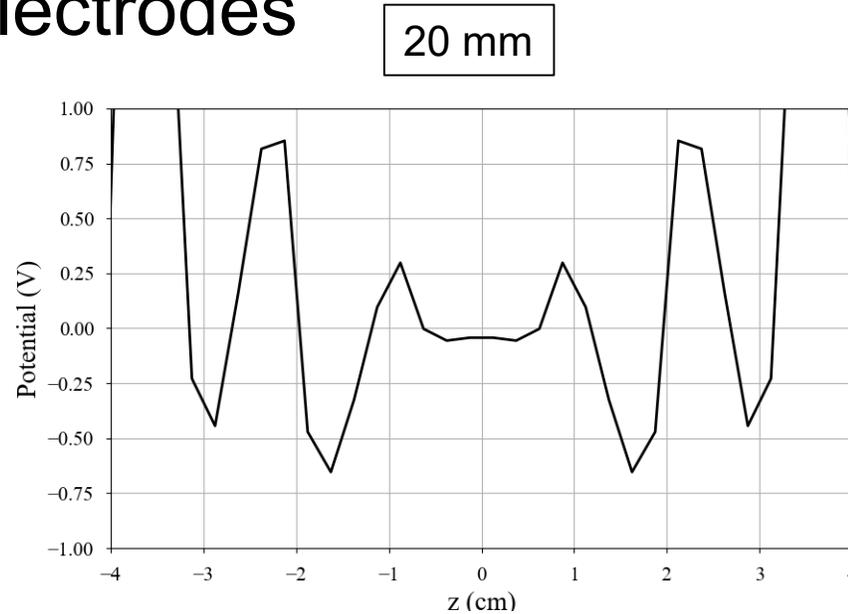


Trap Length : 122.5 mm

ID (mm)	20	25	30
Eff (%)	87.45	88.18	88.44

If using KU Magnet, trap length have to be determined based on length of magnet.

Errors between Potential & Fitted Curve in Harmonic Well with various Diameter of Electrodes

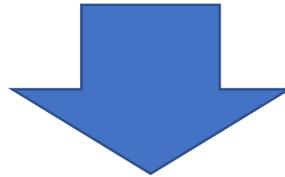
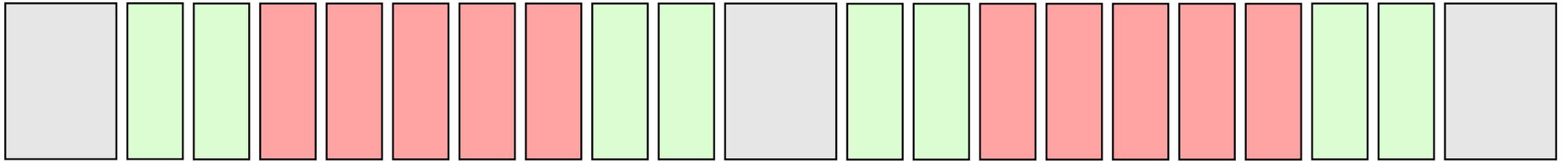


When decreasing diameter of electrodes, length of them in harmonic well needs to be reduced to make more precise harmonic well. When reducing length of it, perturbation by high voltage may be also reduced. Applied voltage will be re-calculated after determining size of electrodes

Methods to Reduce Length of Electrodes in Harmonic Well

Better for alignment
Harder transportation due to different length
Needs more precise voltage control

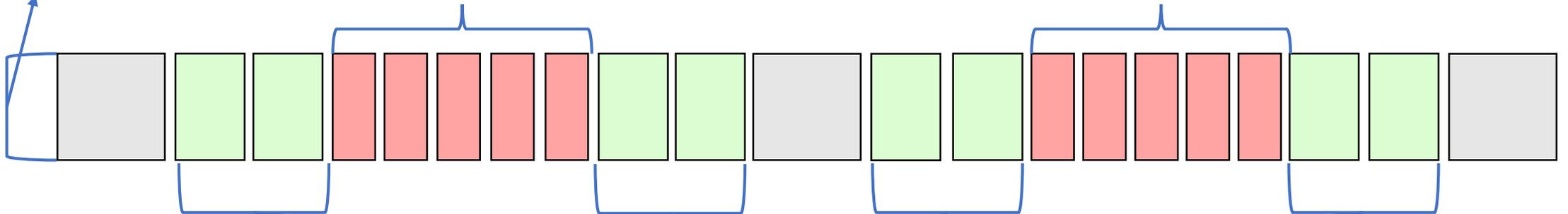
Case I



Reduce diameter

Reduce length

Reduce length

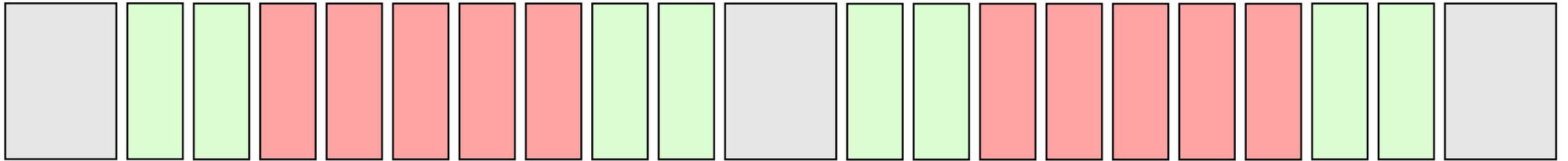


Increase length

Methods to Reduce Length of Electrodes in Harmonic Well

Better for transportation
Needs more precise alignment

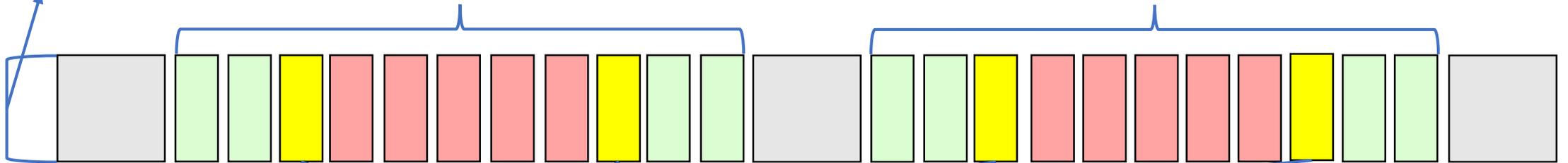
Case II



Reduce diameter

Reduce length

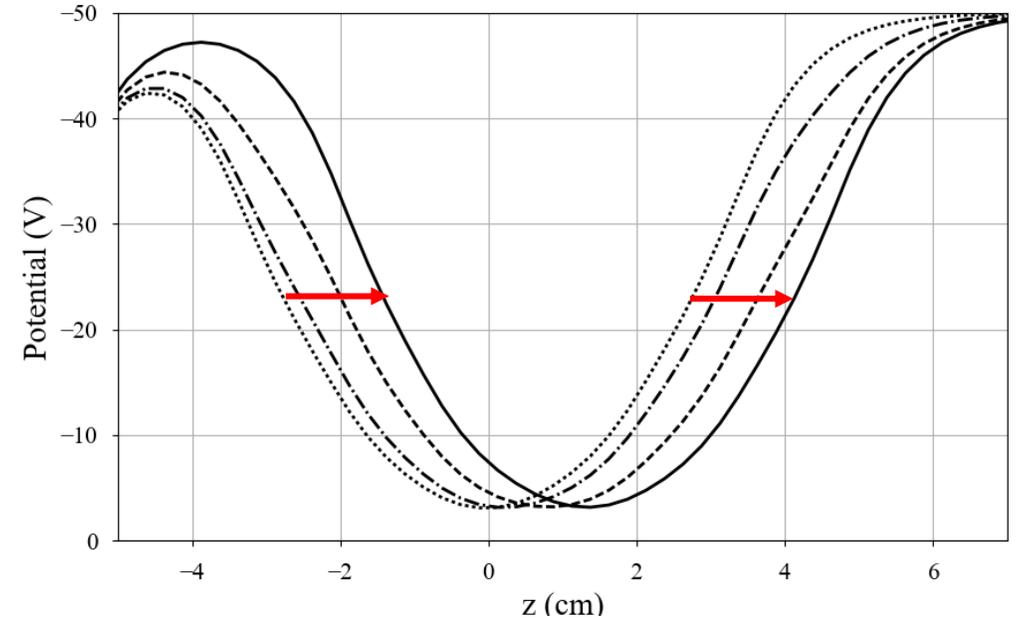
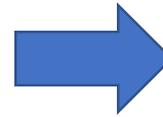
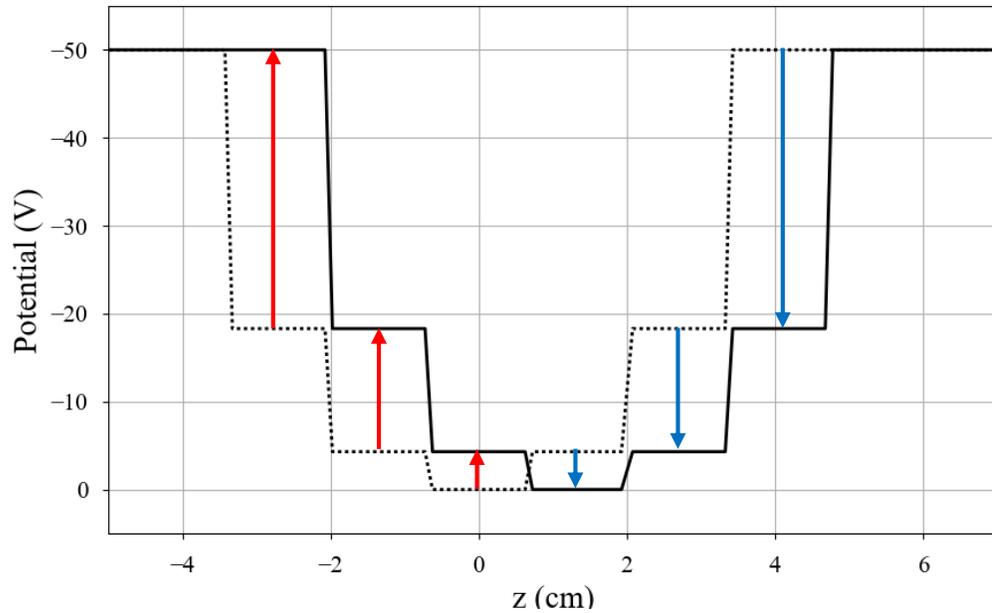
Reduce length



Additional Electrodes

In both cases, harmonic well region is reduced, so higher voltage may be needed to confine a number of pbar.

Switching Potential for Transportation



Simulation moving potential well by one electrode.
Inner diameter of electrodes : 30 mm
Due to potential on electrodes outside harmonic well, it is a little different.

Switching Potential for Transportation

$$\Phi_0(z) = -2.625 z^2 - 0.0463 z - 3.068$$



$$\Phi_1(z) = -2.545 z^2 - 1.303 z - 3.239$$



$$\Phi_2(z) = -2.516 z^2 - 4.067 z - 4.662$$



$$\Phi_4(z) = -2.596 z^2 - 6.972 z - 7.676$$

Quadratic functions every few time steps obtained by curve fitting with potential distribution from WARP. There is a little difference due to potential on electrodes outside harmonic well. If length of harmonic well decreases reducing inner diameter, It may almost disappear considering voltage applied on other electrodes. Also, function switching potential when passing through High Voltage electrode needs to be calculated.