Name:
Study group No.: 2
Date: April 18, 2017
Experiment No.: **3**
Title of the experiment:

STUDY OF ELECTROSTATIC FIELD ON MODELS

1 Details of the laboratory exercise

1.1 Measurment task

1. To map the equipotential lines of an electric field depending on the electrode configuraiton.
2. To draw the lines of force.
3. To determine the maximum electric field and evaluate its uncertainty.

1.2 Method of measurment

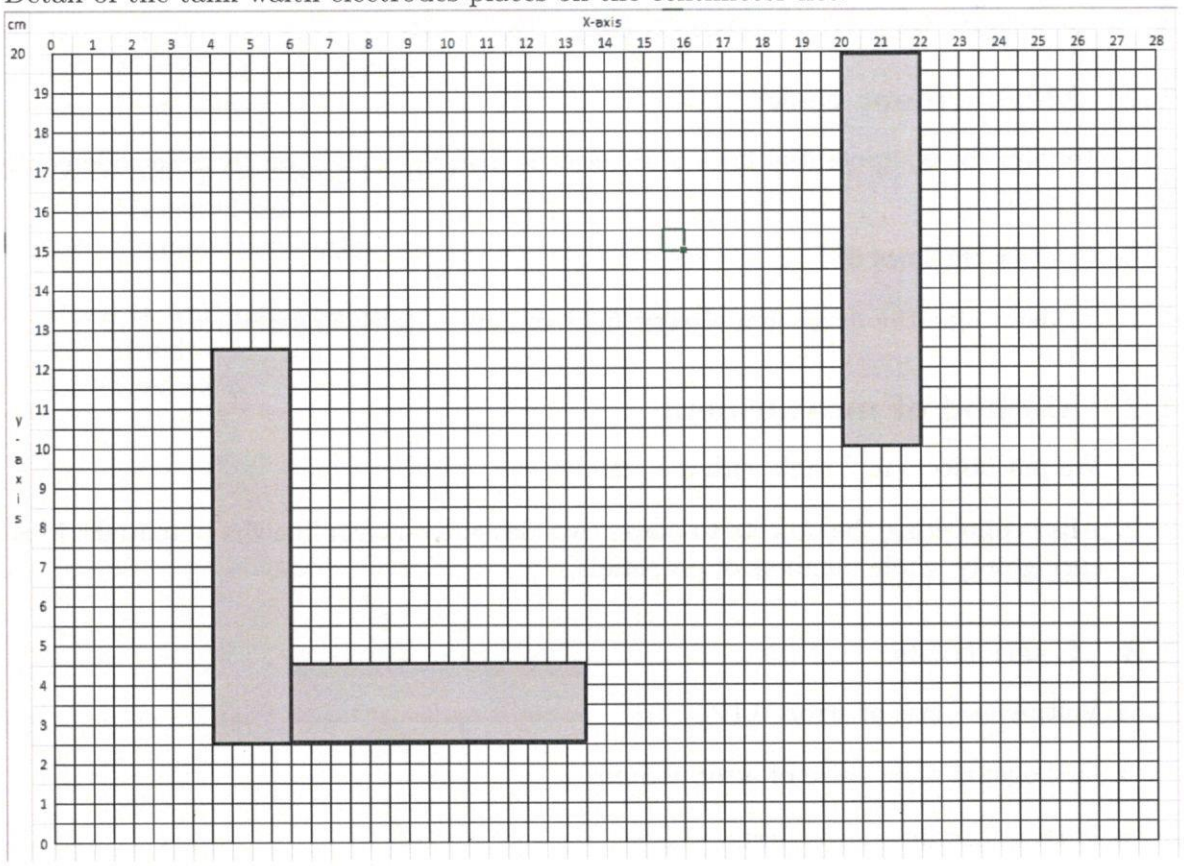
1. We put objects in a tank with a electrolyt.
2. After connecting the objects to power, we measure on each line the potentials. Measuring only whole numbers of potentials.

1.3 Used tools

- Voltmeter - size of error: $0.1V$
- Orthogonal scale - size of error: $0.5mm$
- Potential probe - size of error: 1.5%
- Tank with a electrolyt

2 Data and processing results

Detail of the tank waith electrodes places on the centimeter net.



2.1 Measured values

We measured only 17 lines. For the rest of the lines we had no time left to measure them.

	Y coordinate[cm]								
	0	1	2	3	4	5	6	7	8
Potential[V]	**X coordinate[cm]**								
1	6.75	3.25/10.6	2.4/12.25	1.9	1.6	1.2/10.25	1.25/9.2	1.4/8.25	1.5/7.6
2	14	14.4	14.75	14.8	14.6	14.1	15.8	11.6	10.5
3	17	17	16.75	16.5	16.25	15.6	15	14	13.2
4	20.6	20.1	19.4	18.8	17.6	17.6	16.75	16	15.25
5	27.25	25.5	24.4	22.8	20.5	19.5	18.9	18	17.1
6							23.2	20.5	18.9
7									
8									

Tabulka 1: Positions of points with the same potential

	Y coordinate[cm]							
	9	10	11	12	13	14	15	16
Potential[V]	**X coordinate[cm]**							
1	2/7.2	2.5/6.7	3/6.25					
2	9.9	9.1	8.5	7.75	7	5.4		
3	12.5	11.6	9.75	10.25	9.75	8.8	8	7.1
4	14.5	13.75	13.4	12.7	12.2	11.5	11	10.5
5	16.4	15.75	15.25	14.75	14.2	13.75	13.5	13
6	18	17.4	16.8	16.5	16	15.7	15.5	15.25
7	25.5	18.75	18.25	18	17.7	17.5	17.25	17.2
8		22.5	23.5	19.25/24.4	19/24.75	19/25	18.9/25.5	18.6/25.4

Tabulka 2: Positions of points with the same potential

2.2 Computation outline

First we calculate the magnitude of the maximum electric field. Using the equation $E = \frac{\Delta\varphi}{\Delta s}$. where $\Delta\varphi$ is change of potential and Δs is change in distance. The smaller the Δs the bigger the final value. Point[14.1; 5] with potential $2V$ fits description the most.
$E = \frac{2}{0.00781} = 256.082\ V/m$ Now we calculate the uncertaties.
Uncertainty of potential is equal to uncertainty of the voltmeter.
$u(\Delta\varphi) = 0.1\ V$
Uncertainty of measurement of the distance is equal to uncertainty of the Orthogonal scale.
$u(\Delta s) = 0.0005\ m$

$$u(E) = \sqrt{\left(\frac{u(\Delta\varphi)}{\Delta s}\right)^2 + \left(\frac{\Delta\varphi \cdot u(\Delta s)}{\Delta s^2}\right)^2} = \sqrt{\left(\frac{0.1}{0.00781}\right)^2 + \left(\frac{2 \cdot 0.0005}{0.00781^2}\right)^2} = 20.802\ V/m$$

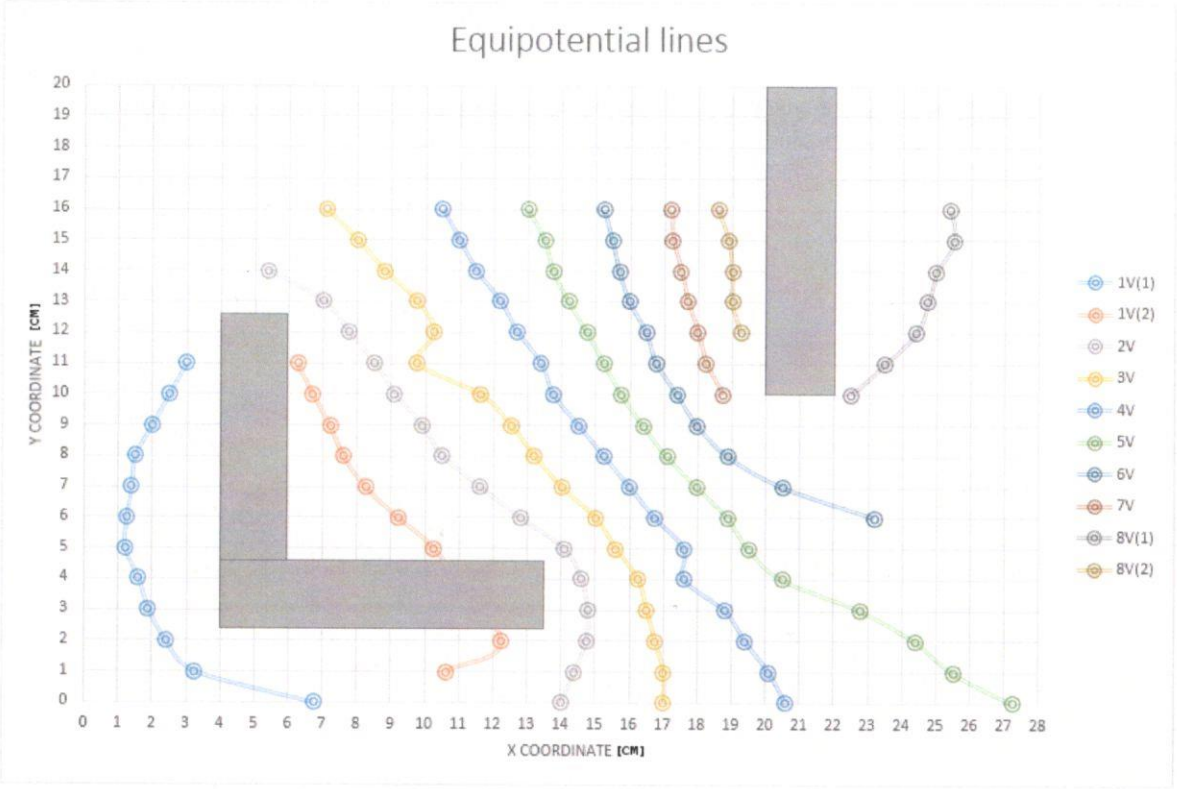
3 Results and conclusion

3.1 Results

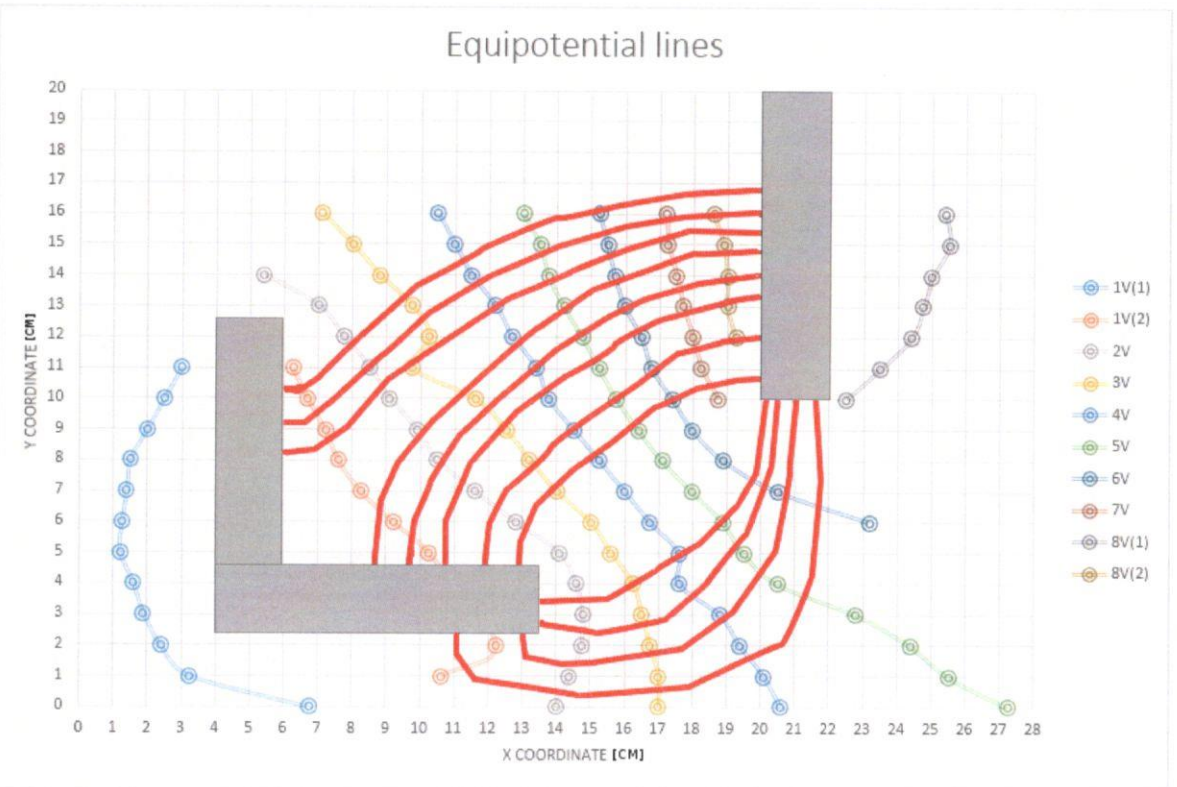
We calculated that the maximum electric field is in point [14.1;5]
The value is $E = (256 \pm 20)\ V/m$.

3.2 Conlusion

Unfortunately we had not enough time to measure all lines and we also had some minor errors in our values but our results are fairly accurate. Graphs of results are at the end of the file.



Obrázek 1: Graph of equipotential lines



Obrázek 2: Graph of quipotential lines with lines of force