Analysis Meeting: SACLAY module simulation

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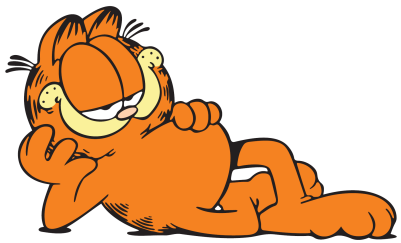
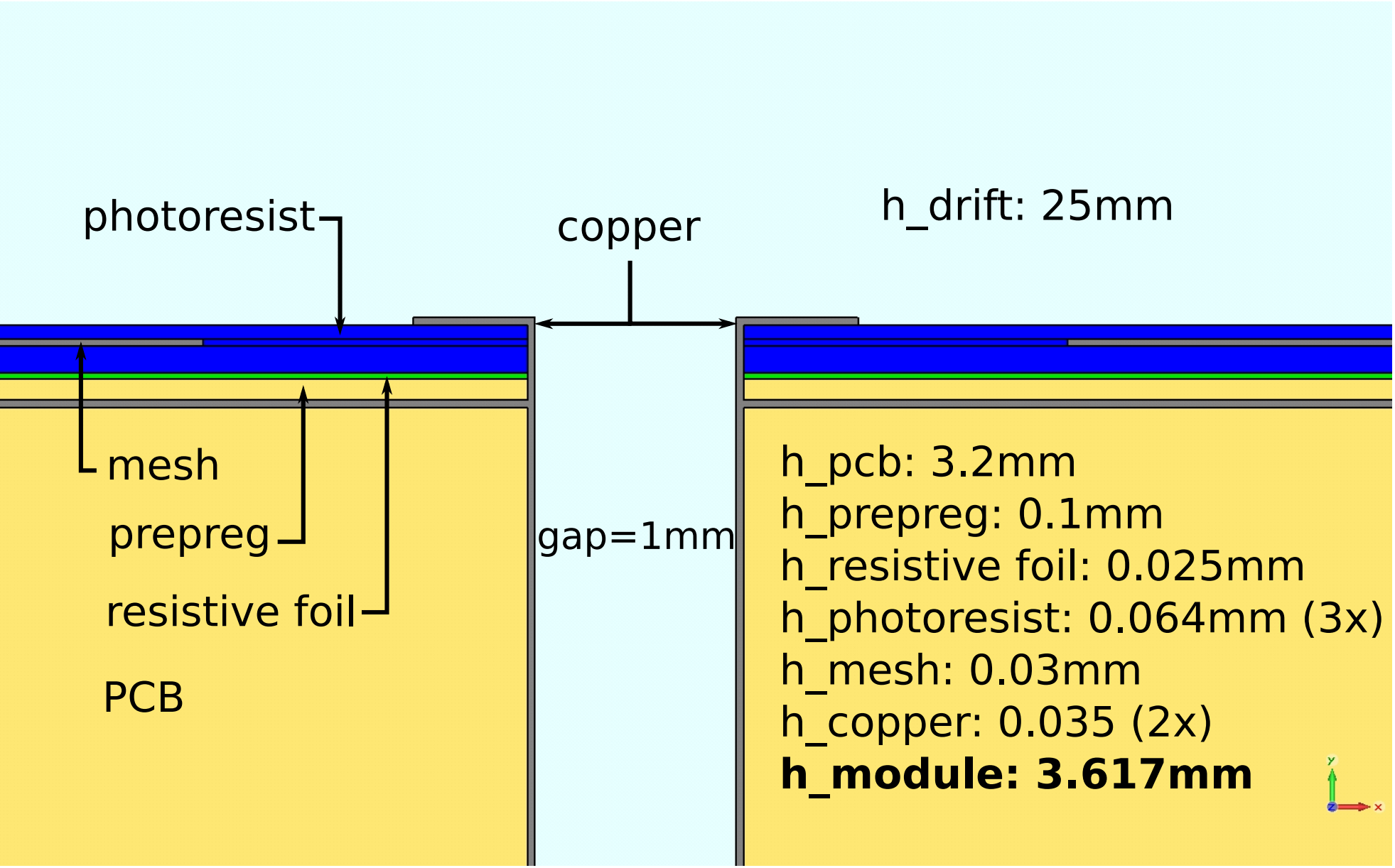
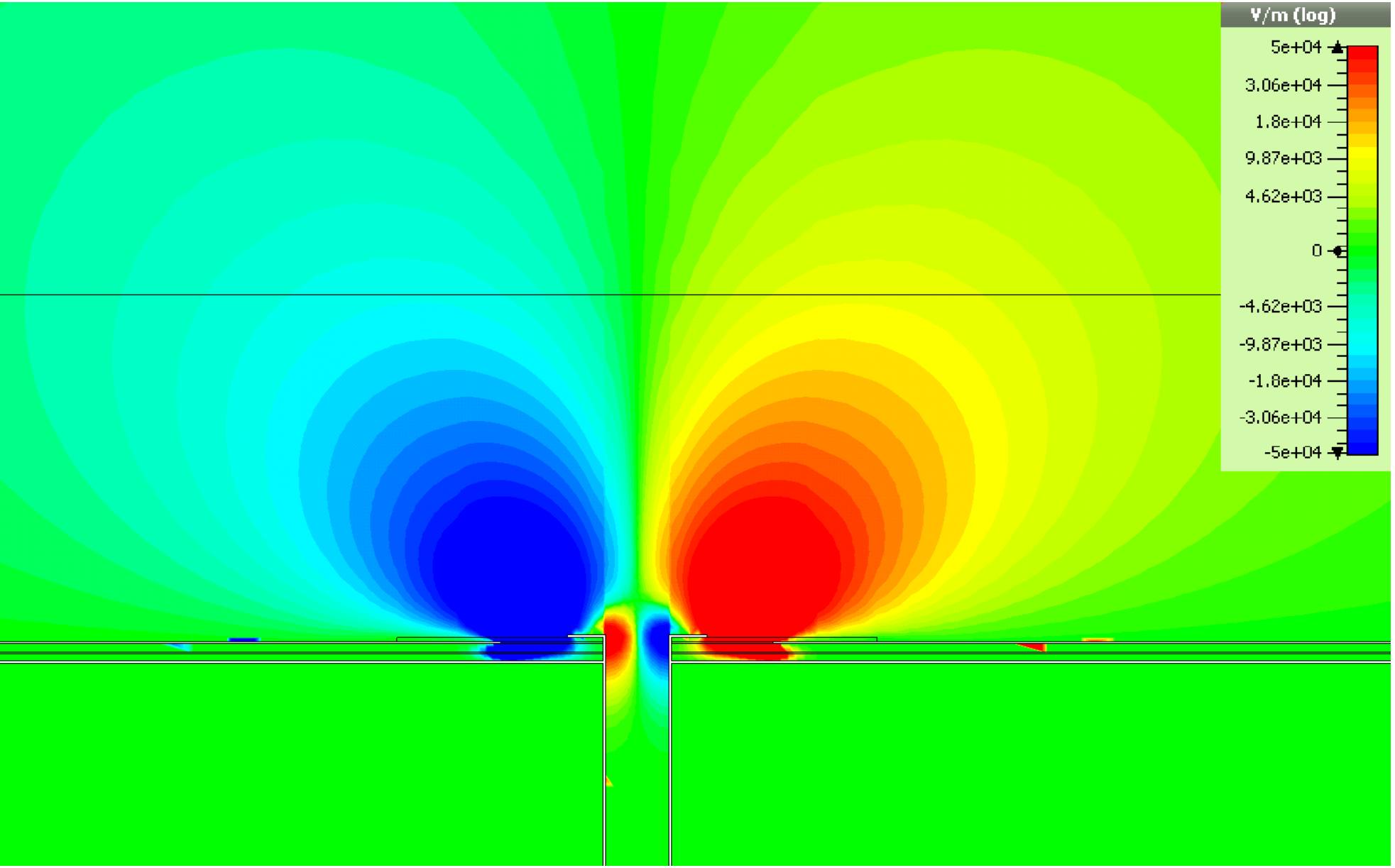
February 5, 2013



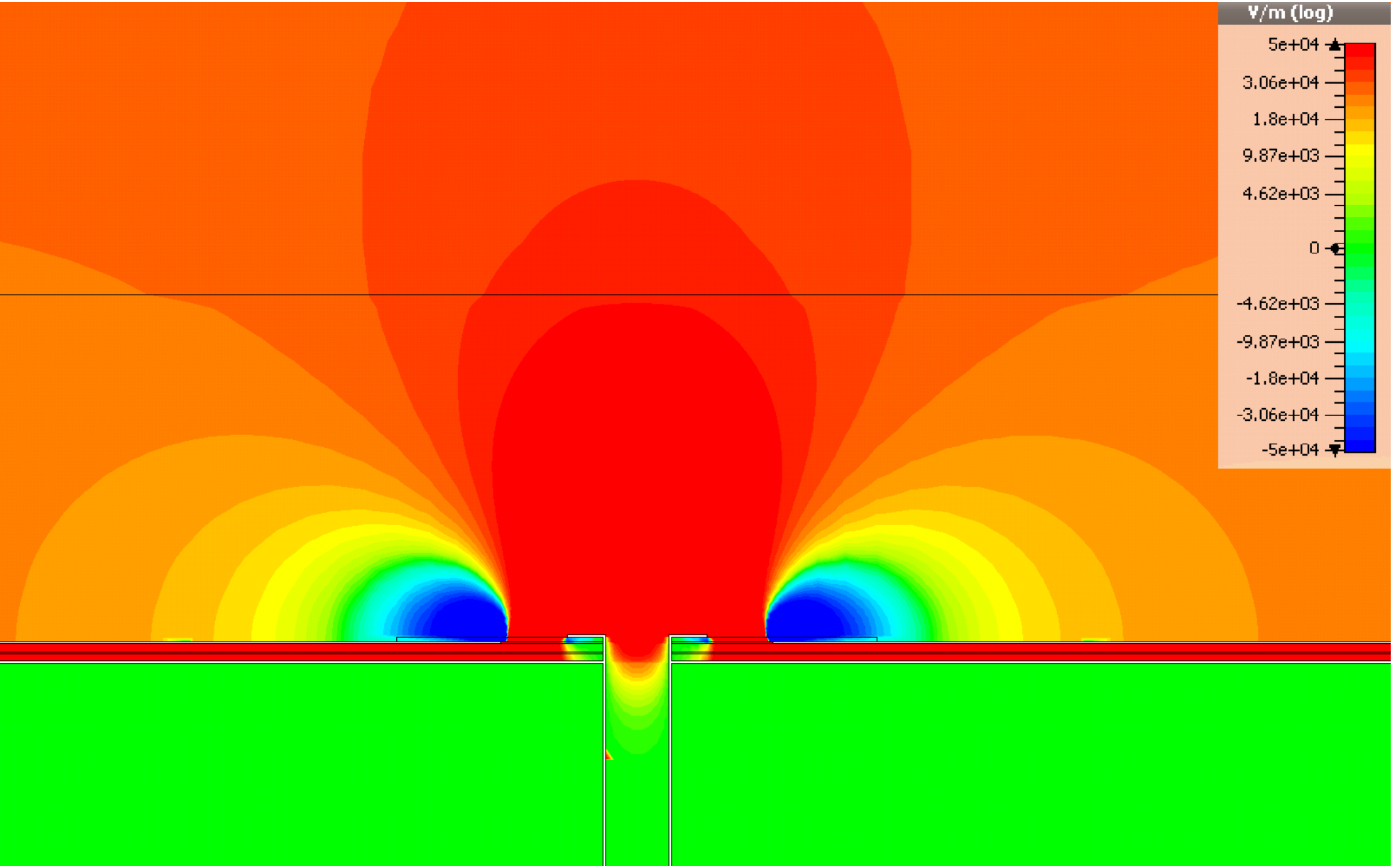
Sketch of the simulation model



Field transverse to the drift field E_x



Field in drift direction E_y



Simulation of a uniform charge distribution

My ansatz for a uniform charge distribution in 1D:

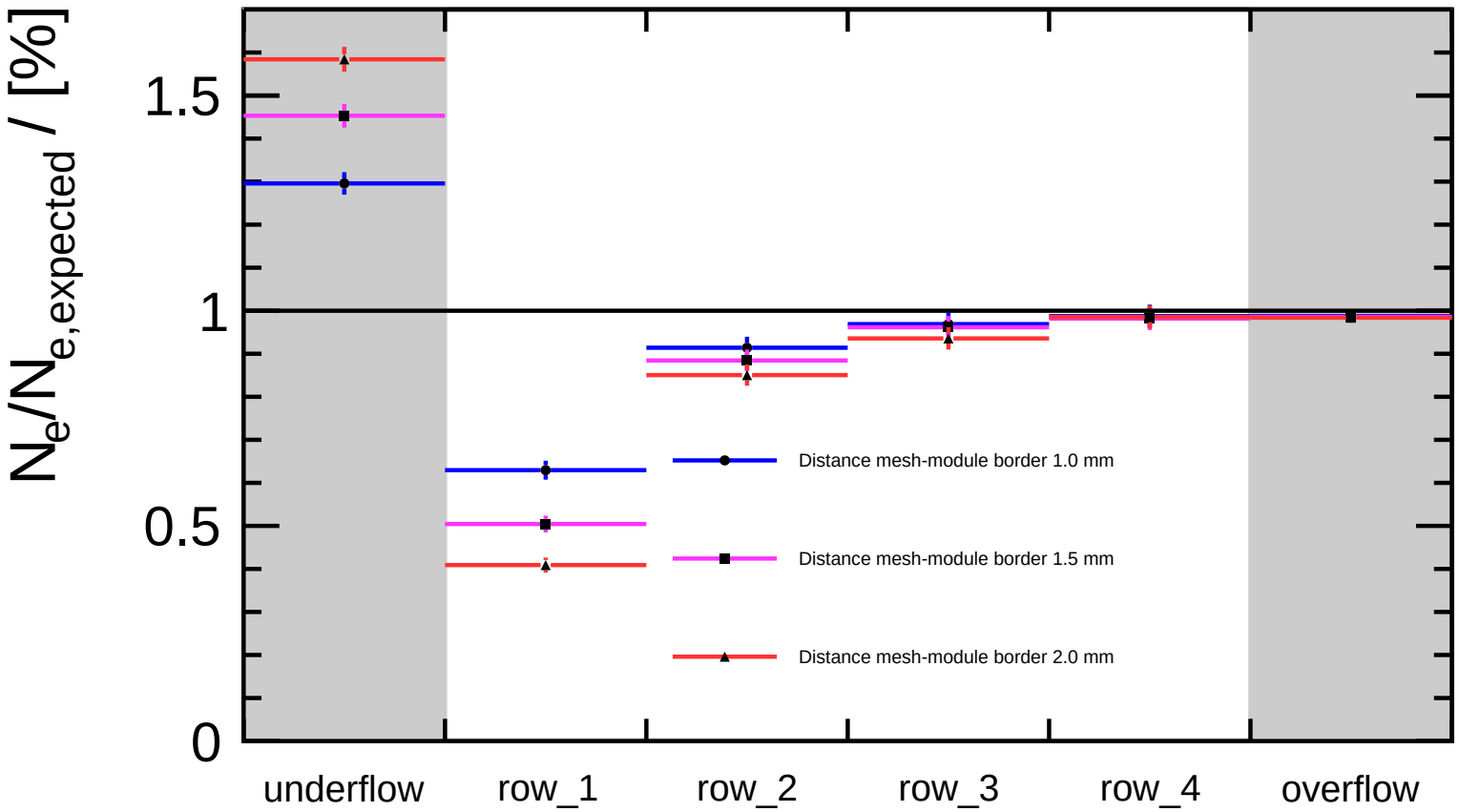
- Release 200 electrons at start positions equally spaced (distance between them is 0.1 mm)
- This is done for 70 start positions and covering the first 4 rows of the module and a bit more
- The pad height is $w = 0.7\,\mathrm{cm}$ (defines the row width)

Now it is possible to calculate how many electrons one would expect on each pad:

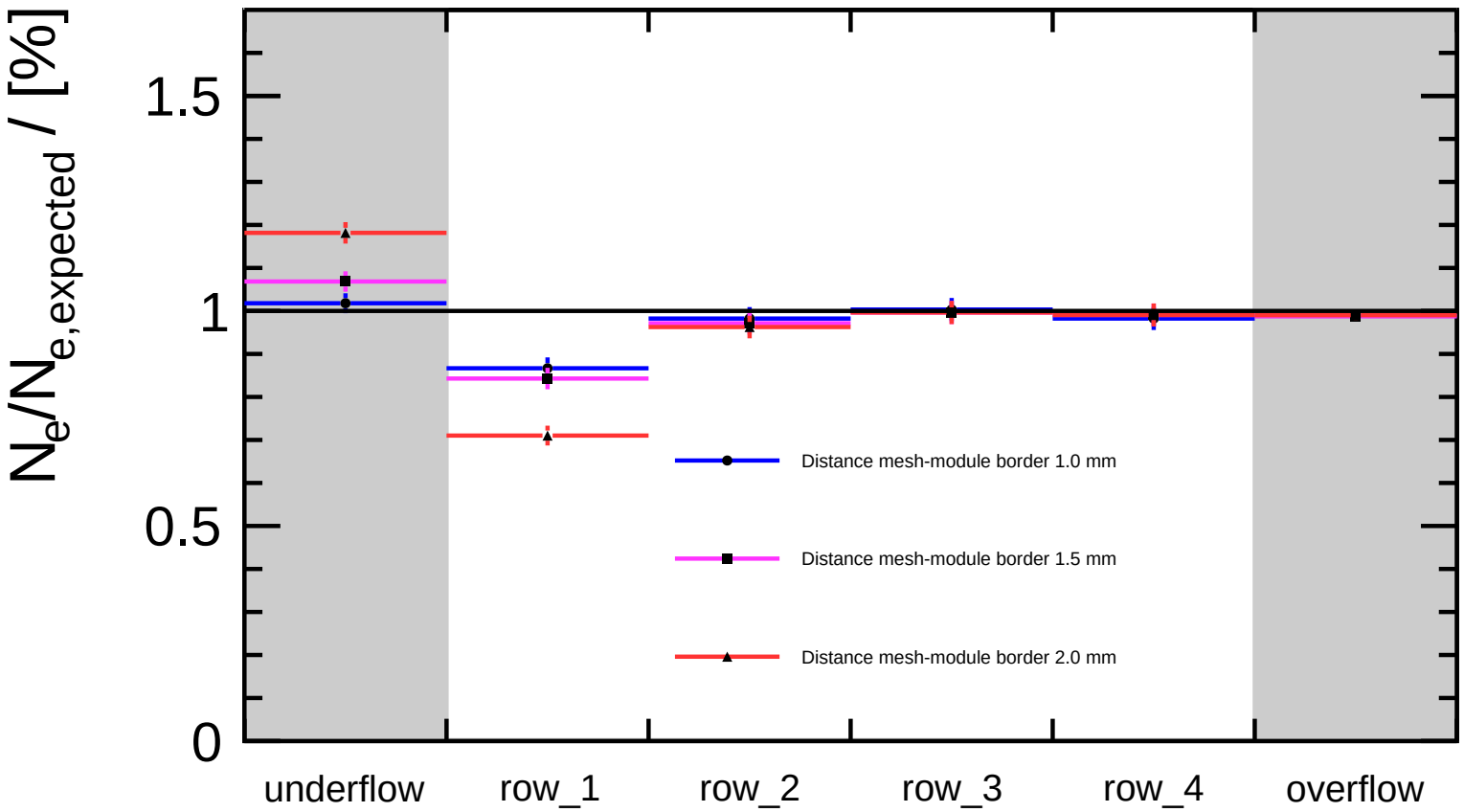
$$N_{\mathrm{underflow}} = n_{\mathrm{e}} \cdot \sum_{\mathrm{i}=1}^{n_{\mathrm{start}}} \int_{-\infty}^{x_{\mathrm{firstPad}}} \frac{1}{\sqrt{2\pi}\sigma} \exp\left(-\frac{1}{2}\left(\frac{x - x_{\mathrm{start}}}{\sigma}\right)^2\right)$$

$$N_{\mathrm{Pad_i}} = n_{\mathrm{e}} \cdot \sum_{\mathrm{i}=1}^{n_{\mathrm{start}}} \int_{x_{\mathrm{Pad_i}}} \frac{1}{\sqrt{2\pi}\sigma} \exp\left(-\frac{1}{2}\left(\frac{x - x_{\mathrm{start}}}{\sigma}\right)^2\right)$$

Results of the drift study



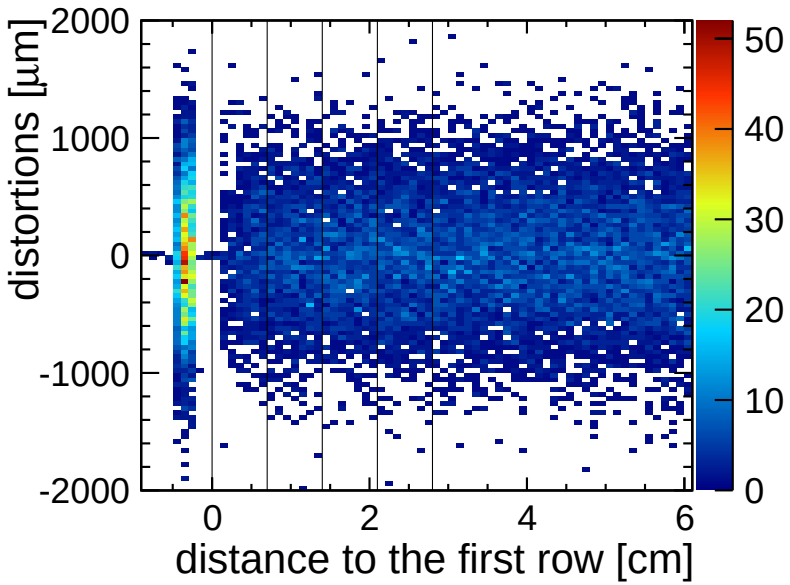
Results of the drift study with magnetic field ($B = 1\,\mathrm{T}$)

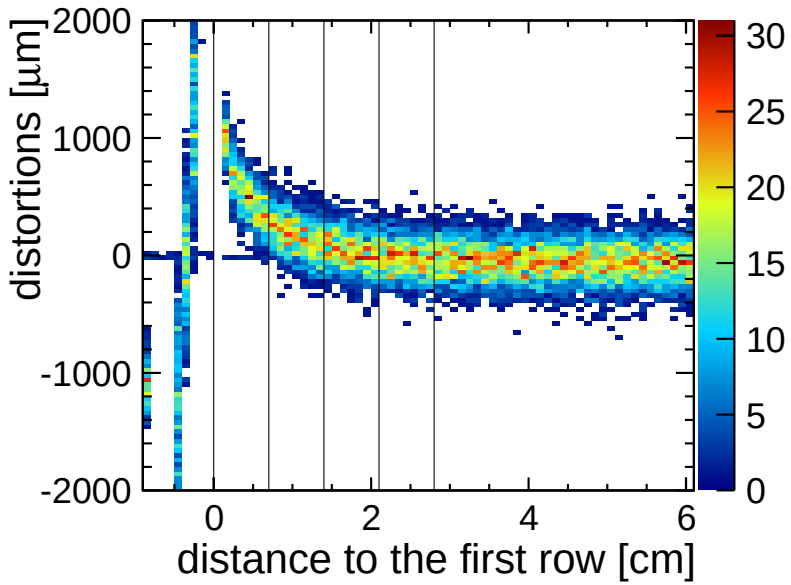


$E \times B$ effects

As one would expect:

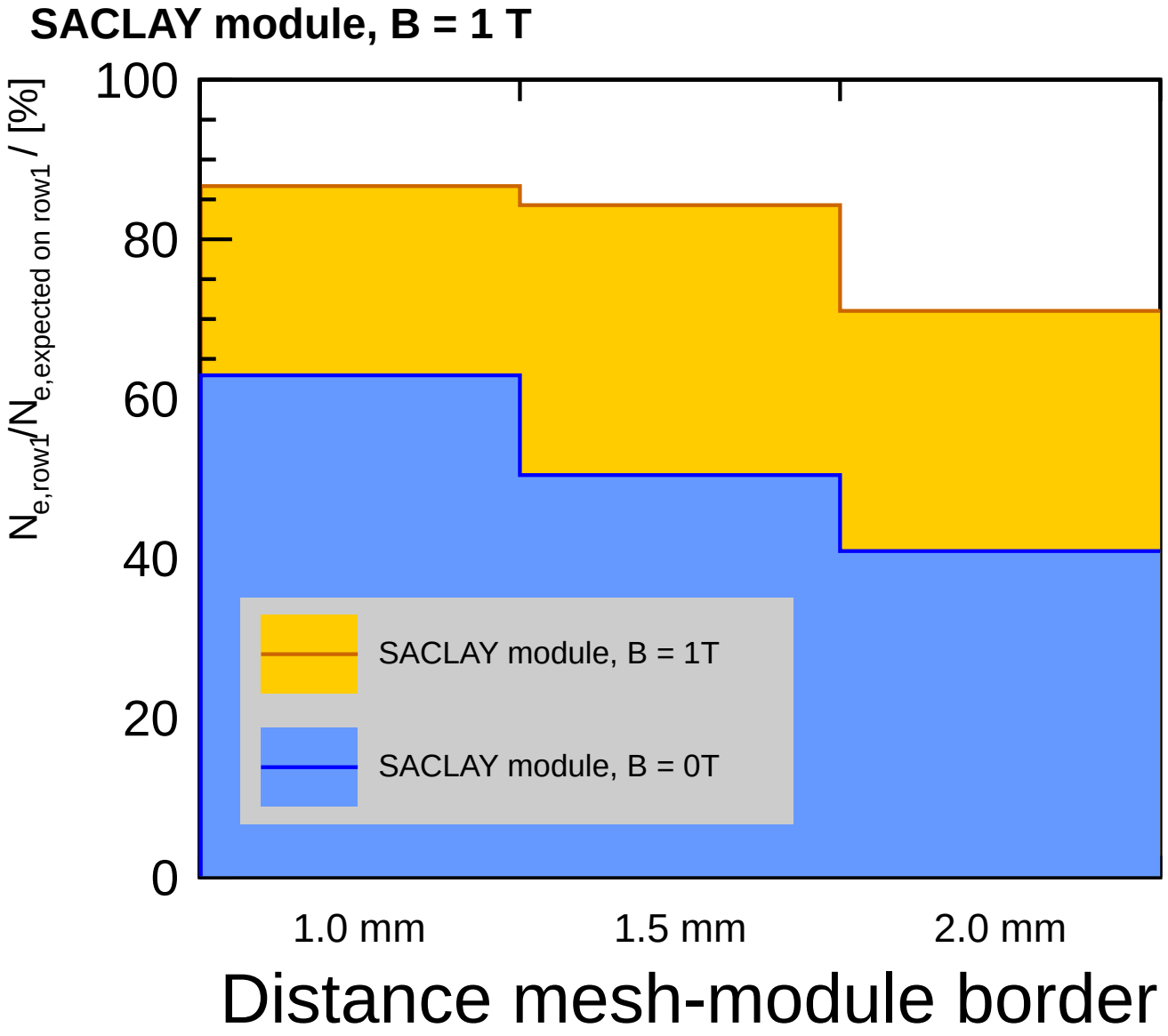
- No distortions without magnetic field
- With magnetic field up to $\approx 5\,\mathrm{mm}$ distortions on the first row



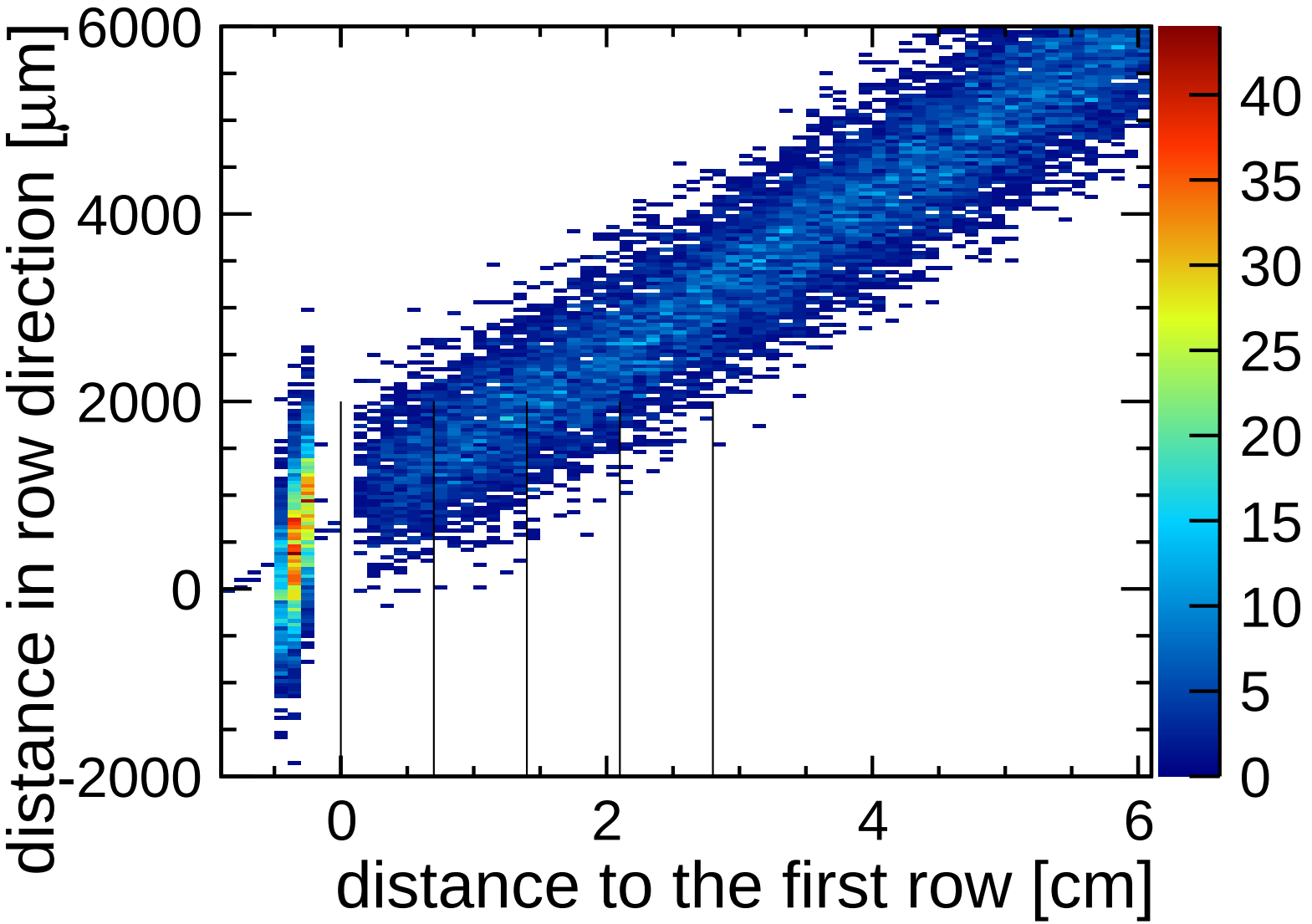


Backup

Summary for the first row (which is most affected)

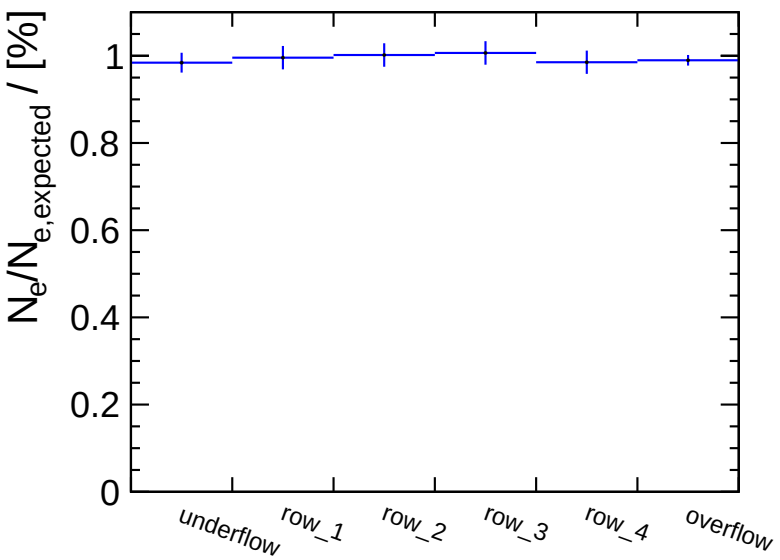


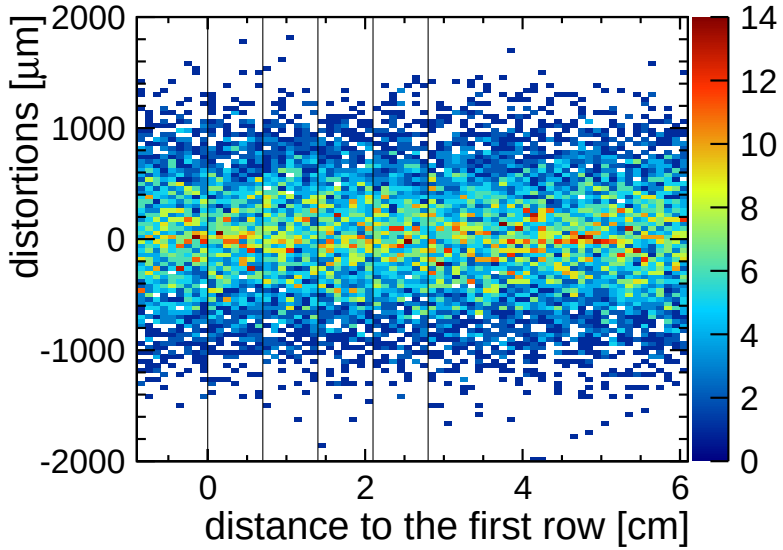
Test with an angle of 5°



Test with no field distortions

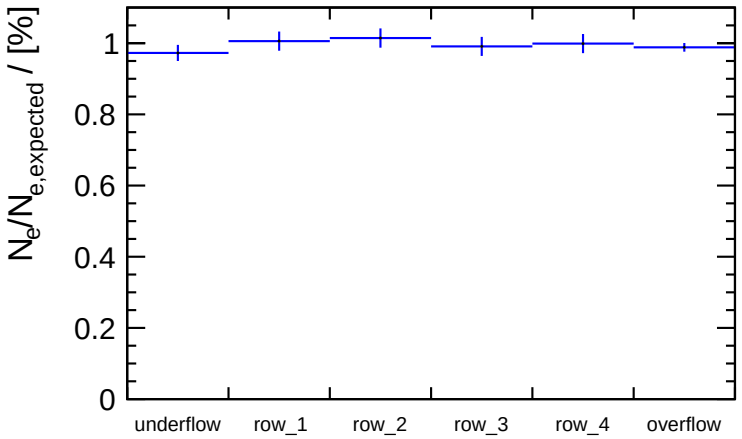
- Here a constant field was applied in drift direction
- Both distributions show the expected behaviour

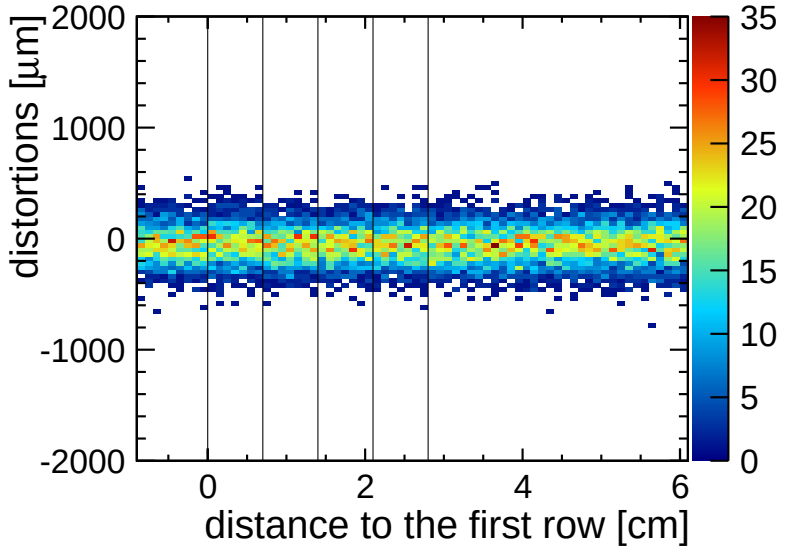




Test with no field distortions and magnetic field ($B = 1\,\mathrm{T}$)

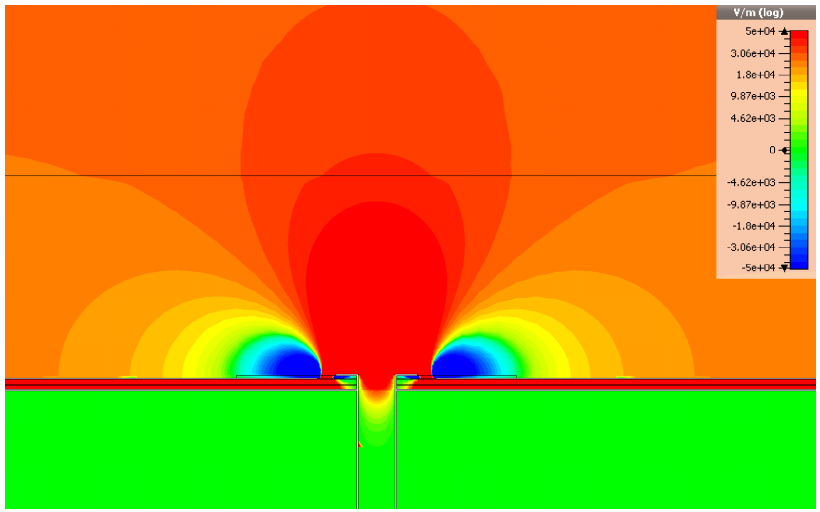
- Here a constant field was applied in drift direction and a magnetic field in drift direction
- Both distributions show the expected behaviour

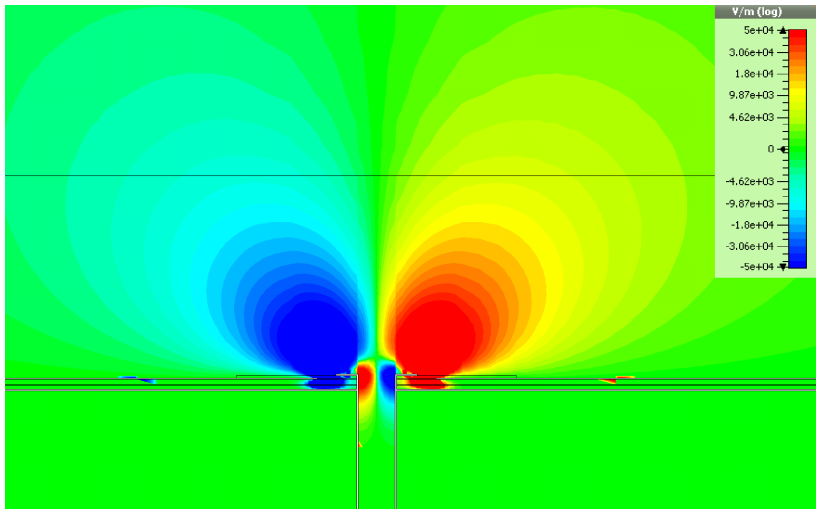




Fields in drift direction (left) and transverse to the drift direction (right)

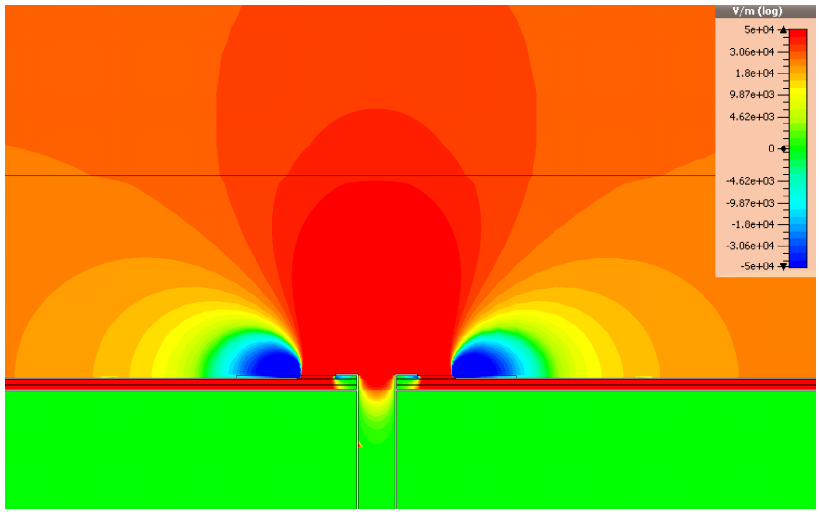
Distance form the mesh to the border of the module: 1 mm

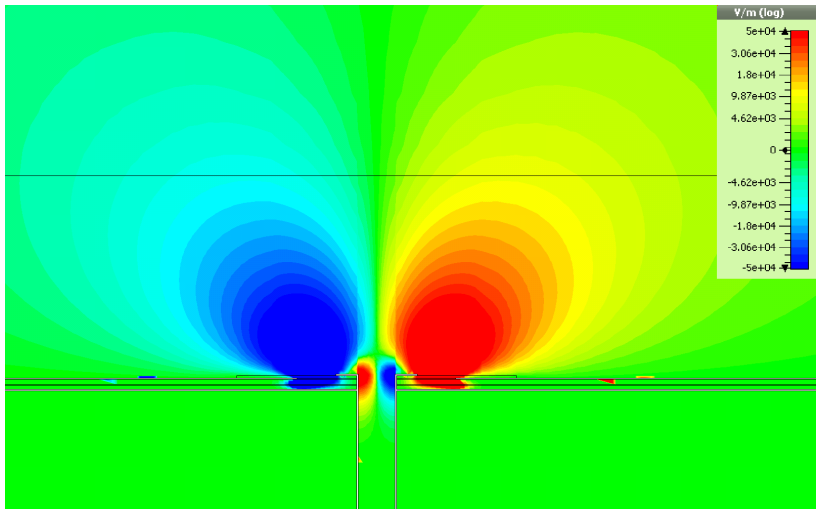




Fields in drift direction (left) and transverse to the drift direction (right)

Distance form the mesh to the border of the module: 1.5 mm





Fields in drift direction (left) and transverse to the drift direction (right)

Distance form the mesh to the border of the module: 2 mm