Pixel Bias simulation for SoLAR

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Overview

- We are using COMSOL Multiphysics to do Finite Element Analysis of the electrostatics of the Pixel + SiPM setup
- Investigate how the electric field behaves at the readout plane

Today I will present
- Current status
- First results
- Future plans
Current status

- As of yesterday(!) we have a functioning COMSOL simulation
- These are our (very) first results
- We have a very simple 2D geometry of the PCB with pixels based on the geometry from Saba

- Looking at a 2D slice as marked in red
First COMSOL geometry

- Pixel: W 3mm; H 0.5mm
- SiPM: W 6mm; H 2mm
- PCB: W 100mm; H 3mm
- Cathode: W 100mm; H 3mm
- 0.5mm spacing between Pixel and SiPM
- 0.33mm spacing from PCB borders
- 10 Pixels and SiPMs
Biasing the geometry

- First geometry set up with:
  - 500V/cm drift field
  - 0V bias on pixels
  - -53V on SiPMs (reverse bias)
- Colour scale shows the potential
- Arrows / lines show the electric field lines (i.e. path the electrons will take)
- Even with a reverse-biased SiPM, E-field lines end on SiPMs
  - We want to avoid this to maximise collection of charge, and minimise damage to SiPMs
  - In our geometry SiPMs protrude from PCB board – change this geometry in future work!
Biasing the geometry (ii)

- We need to collect the drifting charges on the pixels
- Changing the relative biases of the pixels and SiPMs to look at how the drift path of the electrons change
- Biasing pixels at +100V, +200V
  - We need to discuss the issues this will cause for readout / power dissipation
  - This is just a first look to get an idea of the scale of the issue

100V

200V
Future plans

- Look at the 2D geometry with SiPMs recessed into PCB
  - This will reduce the surface area of the SiPMs that the drifting electrons can see

- Build a 3D geometry and repeat these simulations

- Other suggestions… ?

- In conclusion: We’ve only just got the machinery working for this. Now we have the ability to test lots of scenarios. Discussing the details of the geometry and what is possible will be a very useful input for us!