



Power Management Sub-team

Solar Cell Arrangement and MPPT Calculations

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Solar Cell Arrangement:

The solar cells are arranged into 5 sections to allow for curvature considerations, shadow considerations, etc.

Regulations state that we can have a maximum solar cell area of 5 meters squared [1].

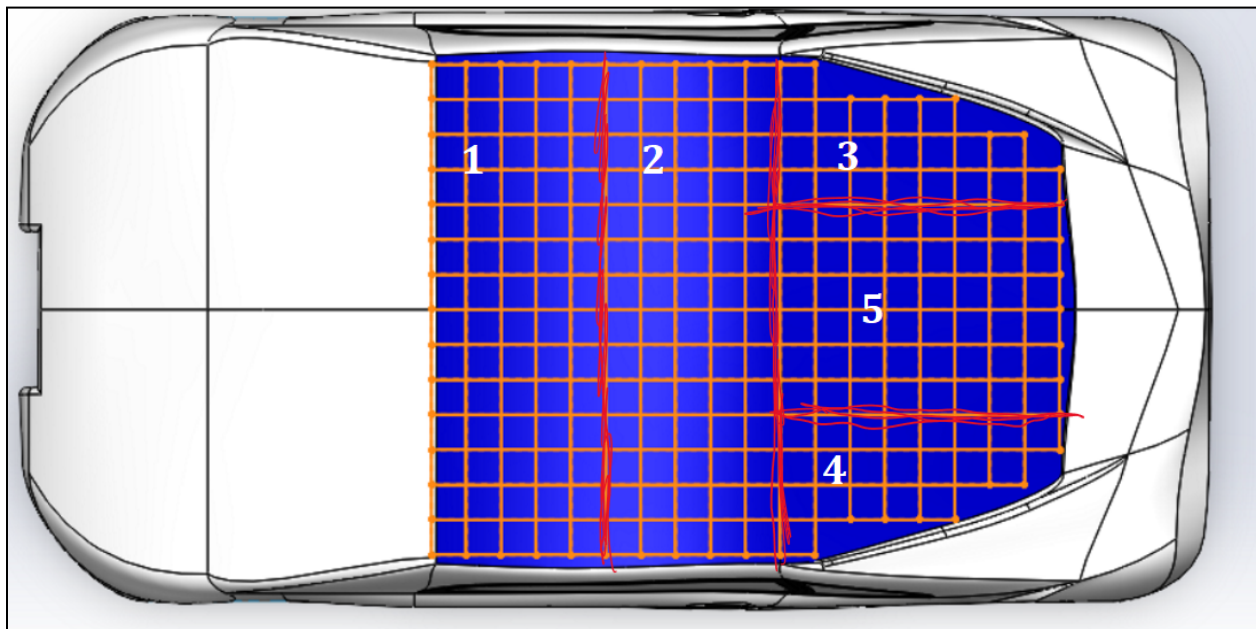


Figure 1 - Solar Cell Sections Labeled

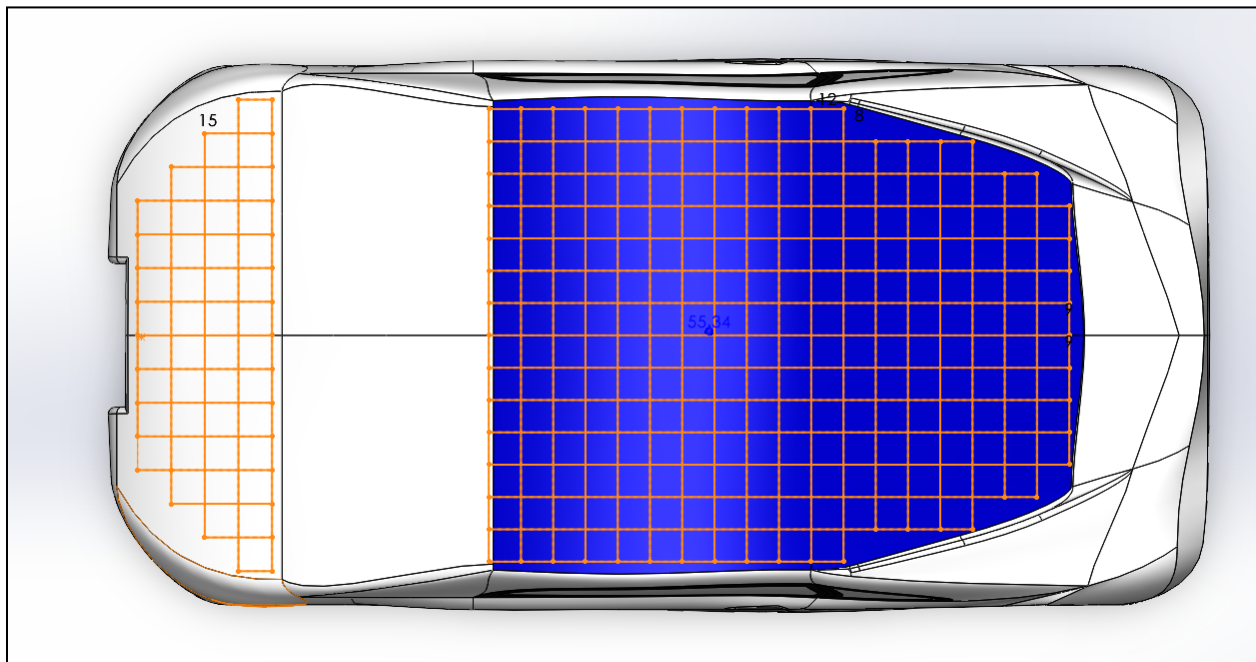


Figure 2 - Solar Cell (with the hood)

The secondary area (In orange) highlights the potential area where we can add more solar cells to the vehicle, however, this is in case of emergencies or in the situation we are not receiving optimal voltage. The tiling was based on the E66 solar cells which are 125 mm by 125 mm [2]. We approximated that each cell can produce up to 0.612 V.

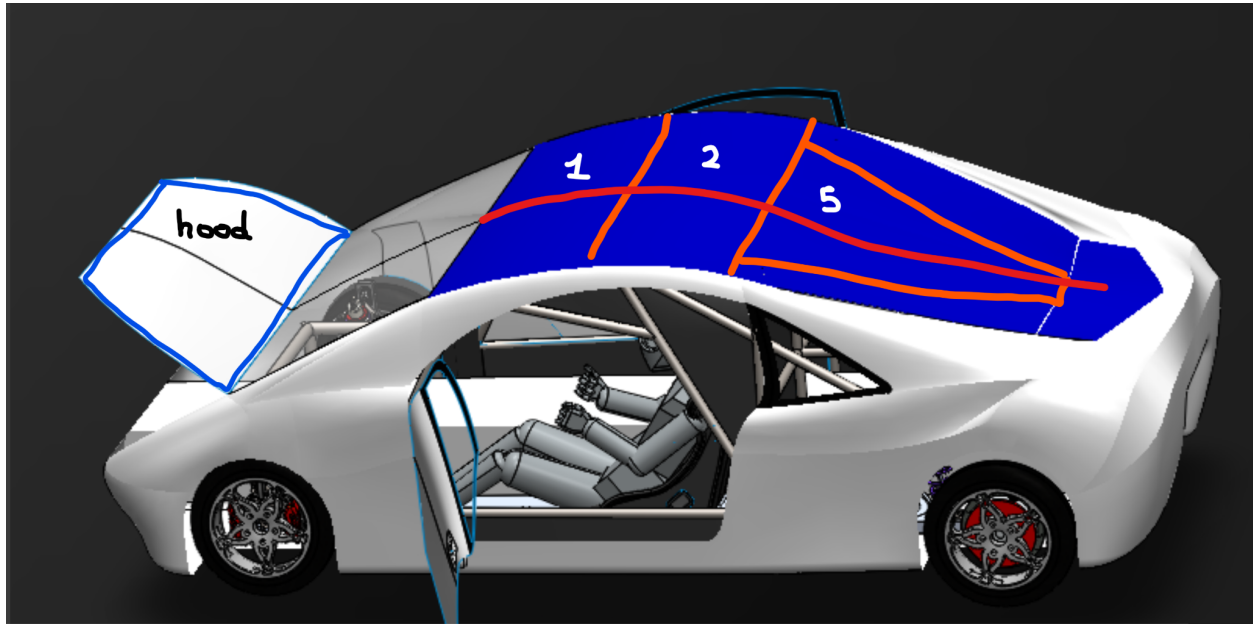
Sections	Cell Count:	Approximate Voltage:
1	70	42.84 V
2	70	42.84 V
3	21	12.852 V
4	21	12.852 V
5	48	29.376
Hood	50	30.6 V
Total	With hood: 280 Without hood: 230	With hood: 171.36 V Without hood: 140.76

Table 1 - Section Calculations + Cell Count

MPPT Count:

As assumed from this, we would require 4 - 5 MPPT's. Around 5 MPPTs are ideal however, if cost is a constraint then 4 MPPTs can be doable by combining sections 1 or 2, or sections 3 and 4. (Most likely sections 3 and 4 as these parts have the least amount of cells, however, sections 1 and 2 would share the most amount of sunlight.)

Updated Solar Array Design



- The red line shows the curvature of the top.
- The orange lines outline the new sections of the solar arrays.
- The hood will replace sections 3 and 4 from the old arrangement.

References/Useful Links:

1. <https://www.americansolarchallenge.org/ASC/wp-content/uploads/2021/12/ASC2024-Regs-EXTERNAL-RELEASE-A.pdf>
2. https://cdn.enfsolar.com/Product/pdf/Cell/5b91fcf3916df.pdf?_ga=2.129740875.699501378.1555670092-1288217596.1555670091