Splitboard simulation and design example

Full bamboo core
Bamboo density: 700kg/m3
Bamboo Y modulus 15000
Core thickness profile: 2.5-6.5-2.5 mm

board length 1590mm
effective length 1400mm
tip width 320mm
tail width 300mm
waist widht 265mm

5mm sidewalls ABS

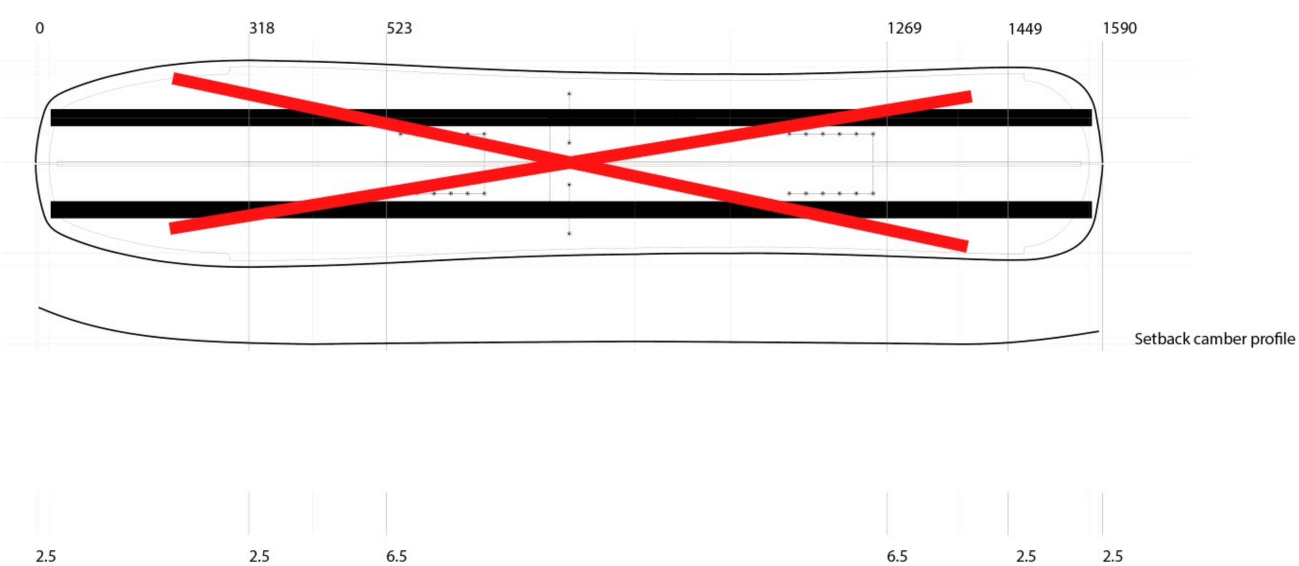
1.2mm edges, 2mm wide

Layup:

- Triaxial glass fabric: 0 ply: 288g ,1200 tex, +/-45 ply: 217g , 300tex

- 2 x 25mm UD carbon stringers 130gms (top and bottom) (black in picture)

- Carbon X stringer (+/-45 degrees) top and bottom for torsional stiffness 2x 50mm 130gms carbon (top and bottom)(red)

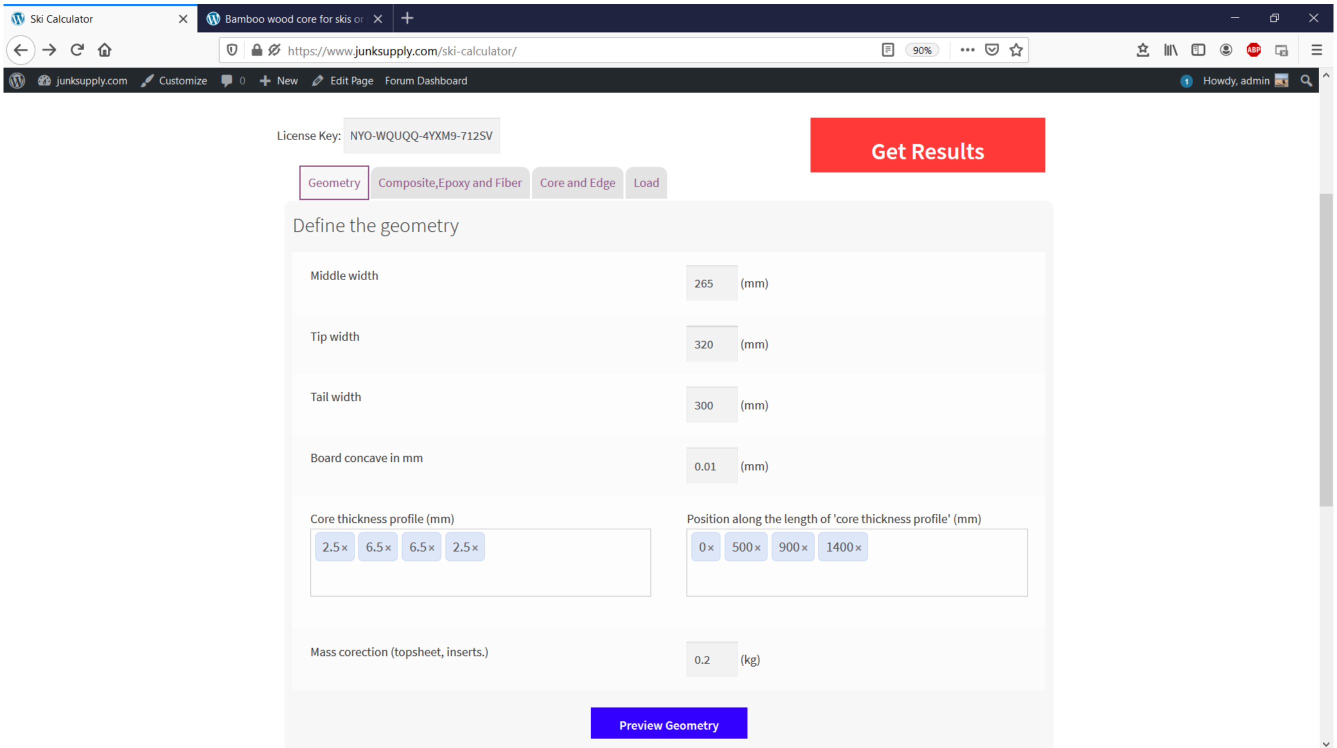


Reason why we add X carbon stringers is because glass is a bit damp and ‘boaring’ so we would like to improve the torsional stifness and responsiveness of the board.

In following simulations we assume that the UD stringers are placed directly on the core. This way we use same core thickness for all simulations. If you however place the UD stringers on the outside of triax glass, which is about 0.7mm thick, make sure you add 2x0.7mm=1,4mm to your simulated core thickness for these simulations!!!

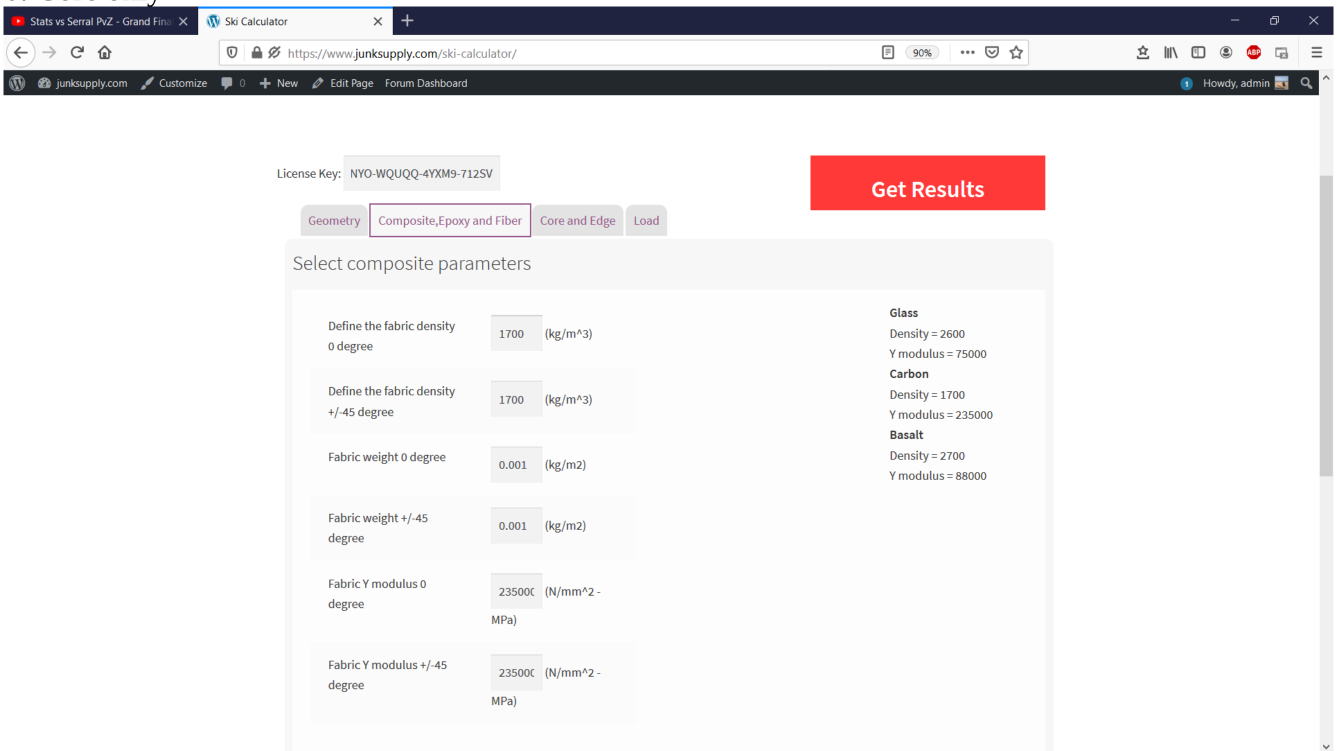
Now simulator will always assume that the top and bottom layup is identical.

Geometry definition



We will simulate this task in 3 parts:
0) Core only
1) first we will just simulate the impact of ud stringers in length on this core
2) secondly we will simulate the impact of UD stringers in X (torsion) on this core
3) we will simulate the effect of glass fabric on the core
4) Finally we will combine all of them.

0. Core only


Stats vs Serral PvZ - Grand Fina
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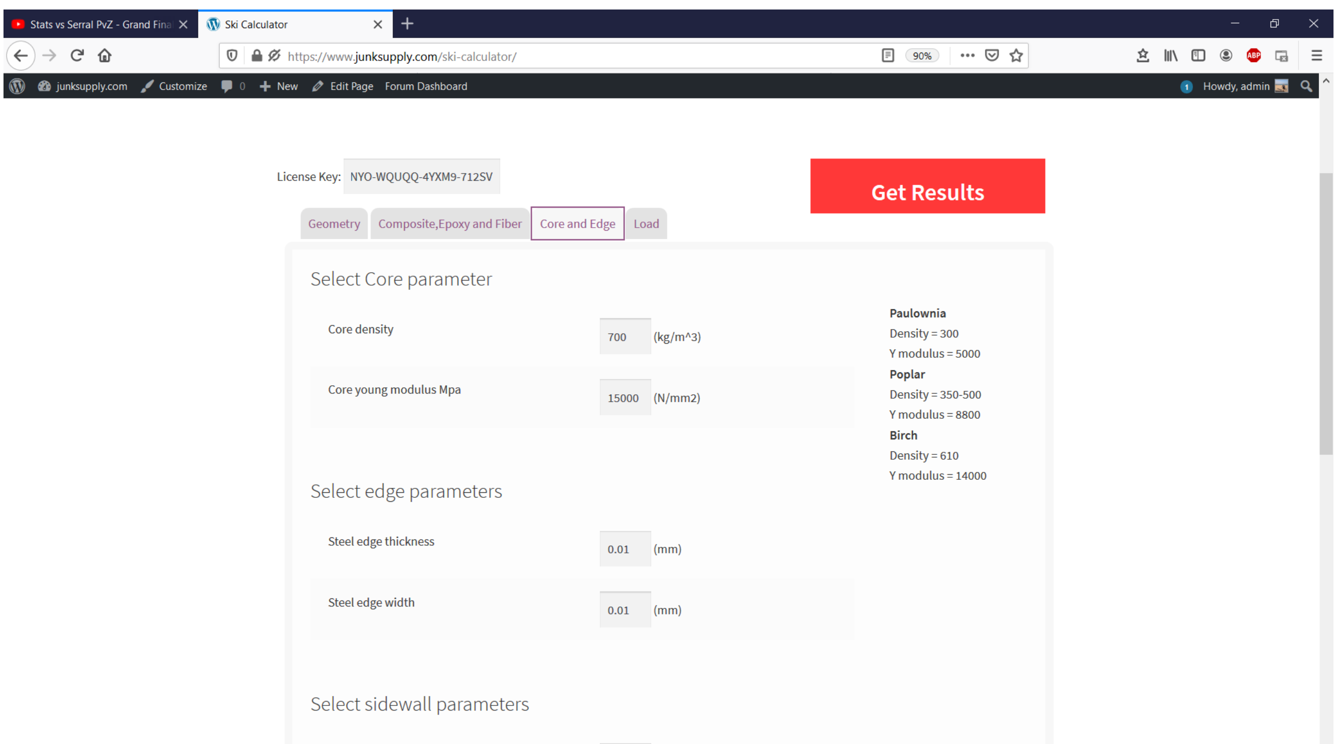
Get Results
Geometry
Composite,Epoxy and Fiber
Core and Edge
Load
Select composite parameters
Define the fabric density 0 degree
1700
(kg/m^3)
Define the fabric density +/-45 degree
1700
(kg/m^3)
Fabric weight 0 degree
0.001
(kg/m2)
Fabric weight +/-45 degree
0.001
(kg/m2)
Fabric Y modulus 0 degree
23500(
(N/mm^2 - MPa)
Fabric Y modulus +/-45 degree
23500(
(N/mm^2 - MPa)
Glass
Density = 2600
Y modulus = 75000
Carbon
Density = 1700
Y modulus = 235000
Basalt
Density = 2700
Y modulus = 88000


Stats vs Serral PvZ - Grand Fina
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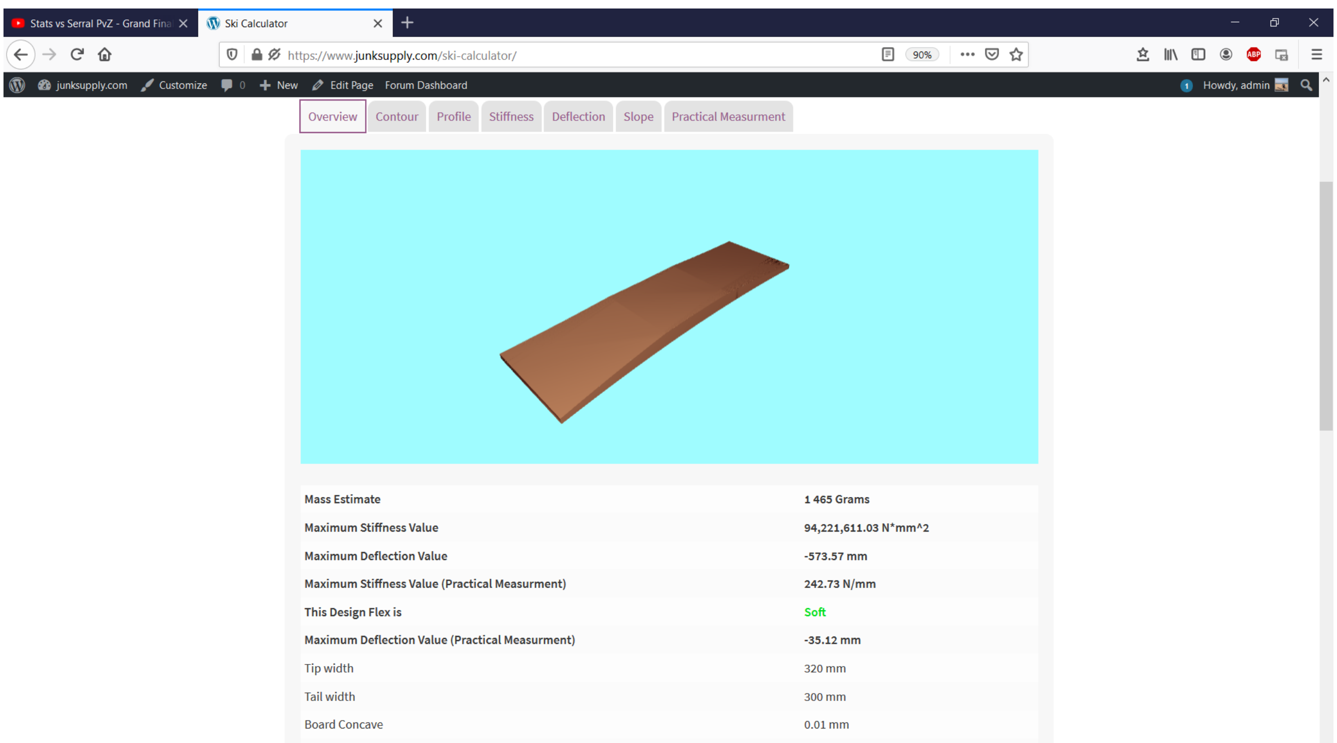
Get Results
Geometry
Composite,Epoxy and Fiber
Core and Edge
Load
Select Core parameter
Core density
700
(kg/m^3)
Core young modulus Mpa
15000
(N/mm2)
Paulownia
Density = 300
Y modulus = 5000
Poplar
Density = 350-500
Y modulus = 8800
Birch
Density = 610
Y modulus = 14000
Select edge parameters
Steel edge thickness
0.01
(mm)
Steel edge width
0.01
(mm)
Select sidewall parameters
Sidewall width



Max stiffness for practical measuremnt is 243N/mm

1. simualting wood core and UD carbon in length direction only

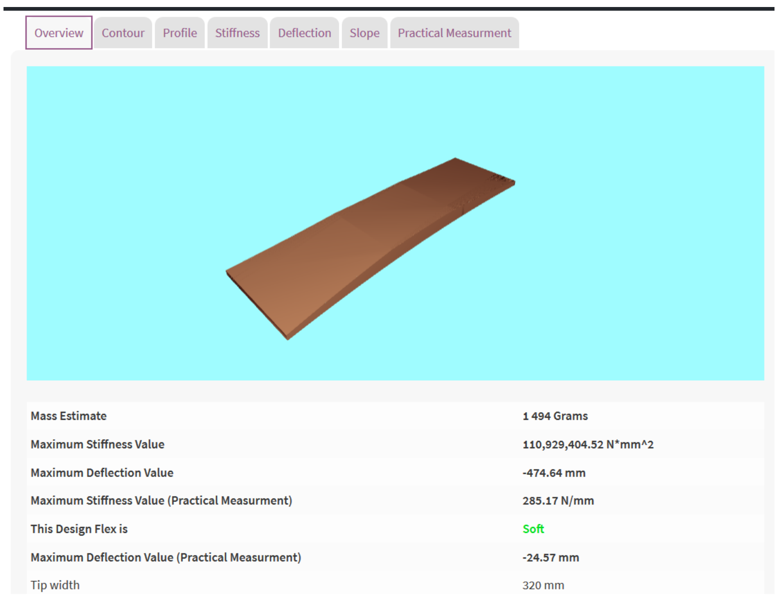
Now we add 2x2.5mm UD carbon stringers of 130gms. This is equal to 1x50mm carbon stringer. Since simulator assumes that the fabric we use is spread evenly over the entire board, we cant just input 130gms into the 0 direction field. This would be wrong since the simulator would calculate as if there was a end to end fabric of this weight covering out board. So we will calculate equivalent fabric weight:

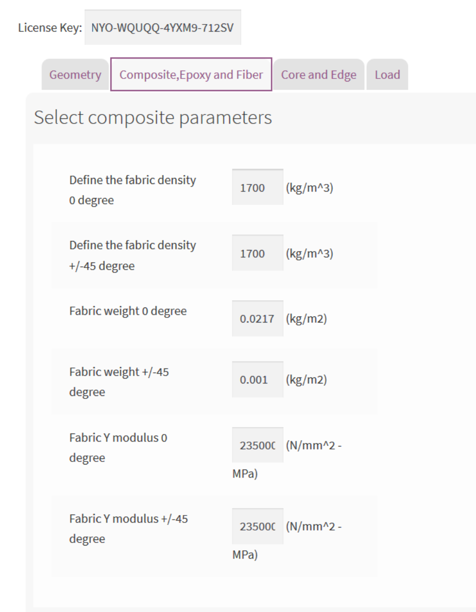
Equivalent fabric weight = Stringer weight * stringer width / board average width

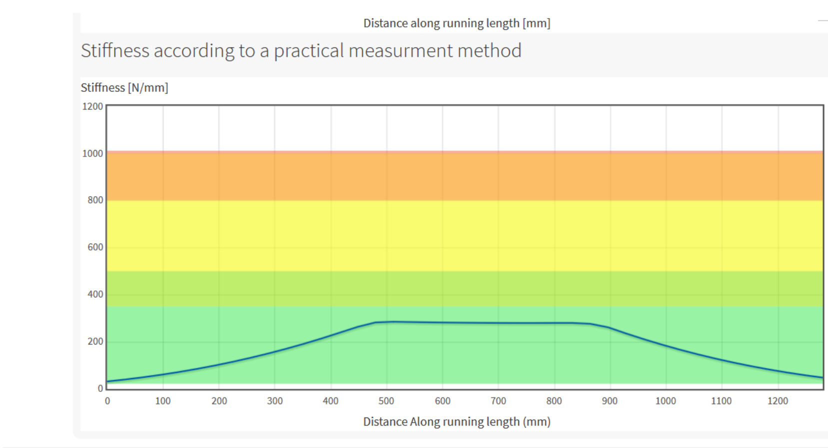
Equivalent fabric weight = 130gms * 50mm / 300mm = 21,7gms.

So we will use 21,7gms for our simulation.

Here are the results: maximum stiffness is now 285 N/mm, **increase of 50 N/mm!**





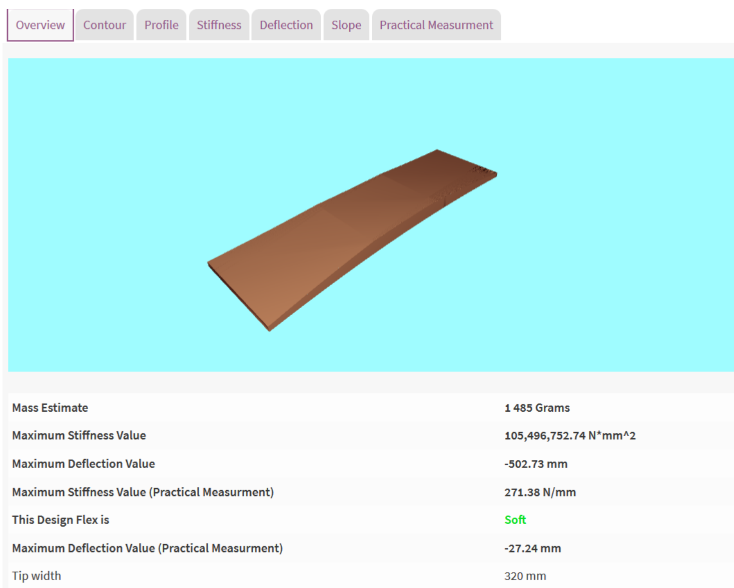


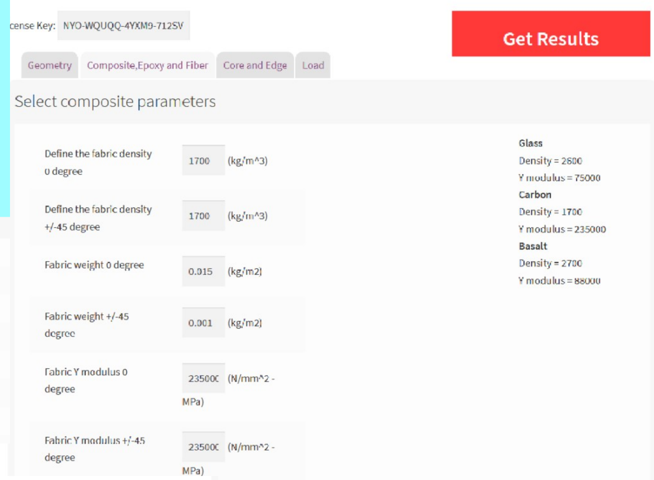
2. **Simulation the UD carbon in X/diagonal direction only**
Now we will simulate only 2 x 50mm diagonal carbon UD stringers, 130gms.
We can do this by splitting the diagonal +/-45 degree weight contribution into a 0 degree contribution and a 90 degree contribution.

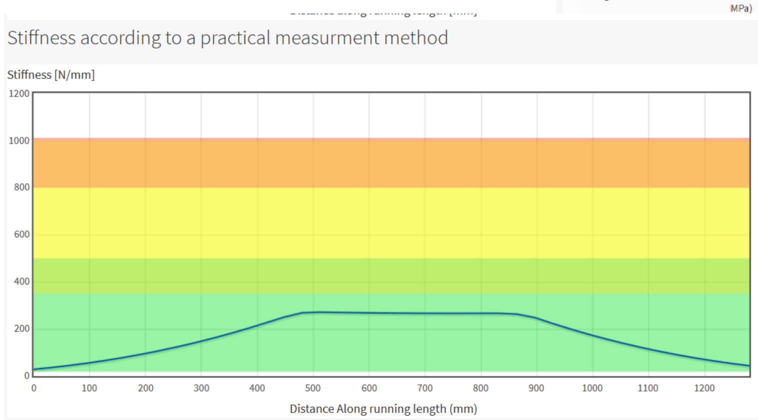
90 degree contribution we can ignore as it will make the board more stiff and responsive in width, but it wont impact our longitudinal stiffness. So to see the impact of longitudinal stiffness by these X stringers we calculate:

0 degree weight contribution = +/-45 degree equivalent weight * cosine(45 degrees)
0 degree weight contribution = (130gms*50/300) * 0,7 = 15gms

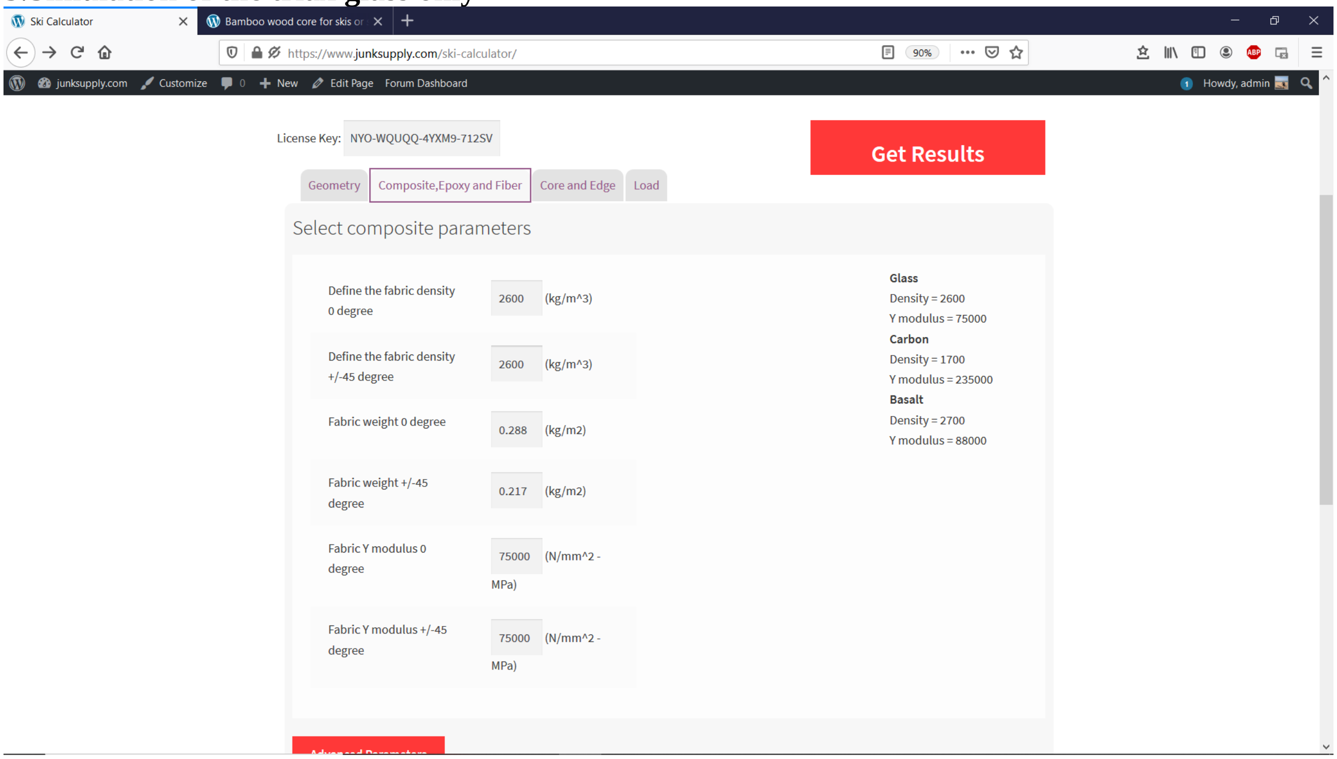
So we can now simulate this contribution and here are results: max stiffness is 271N/mm, **increase of about 30N/mm**



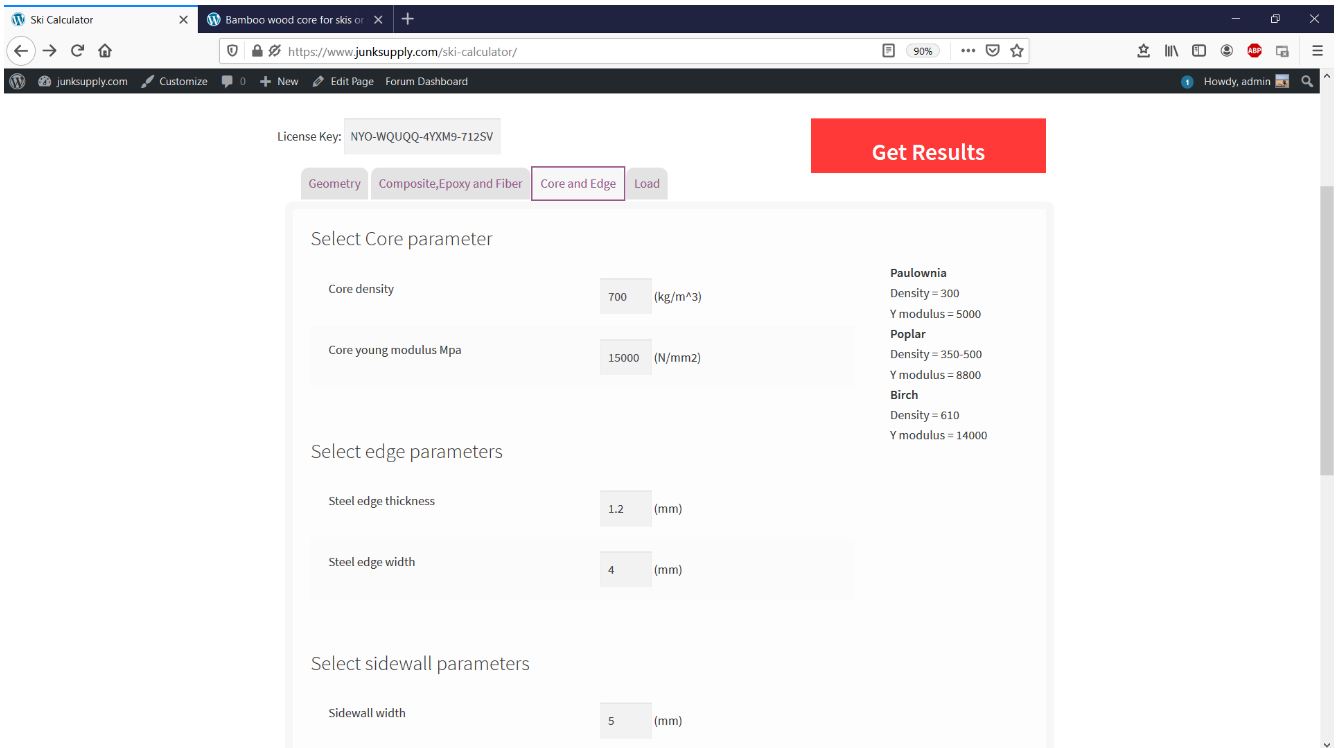




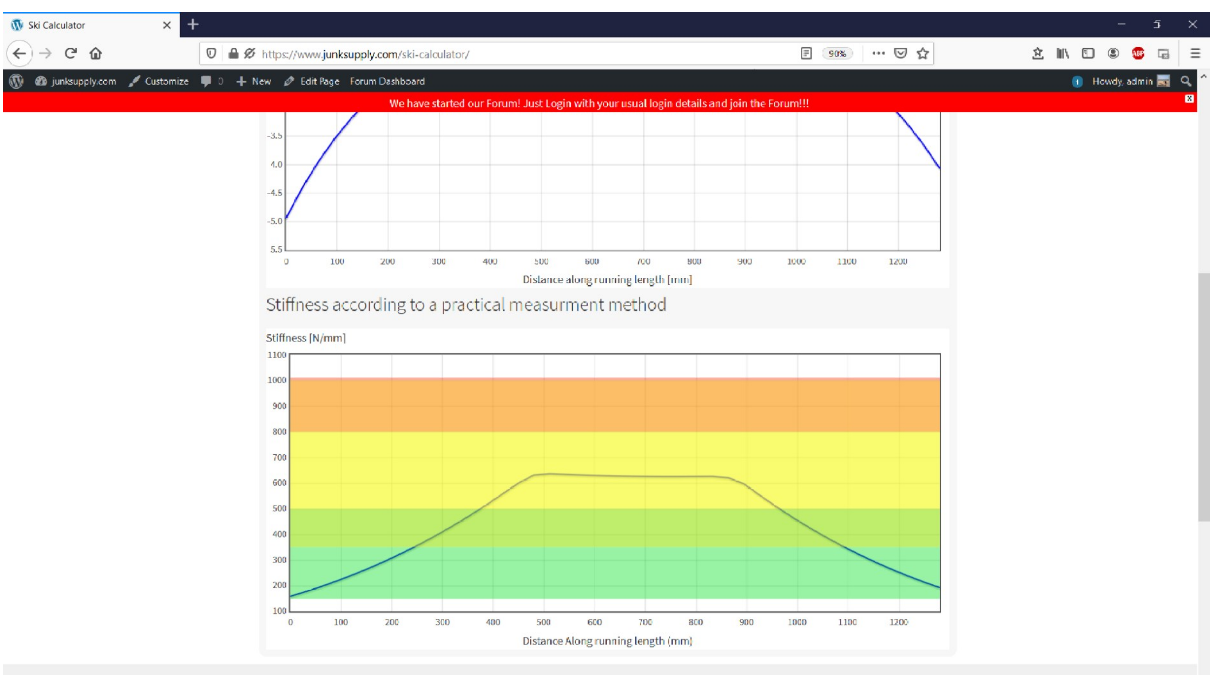
3.Simulation of the triax glass only

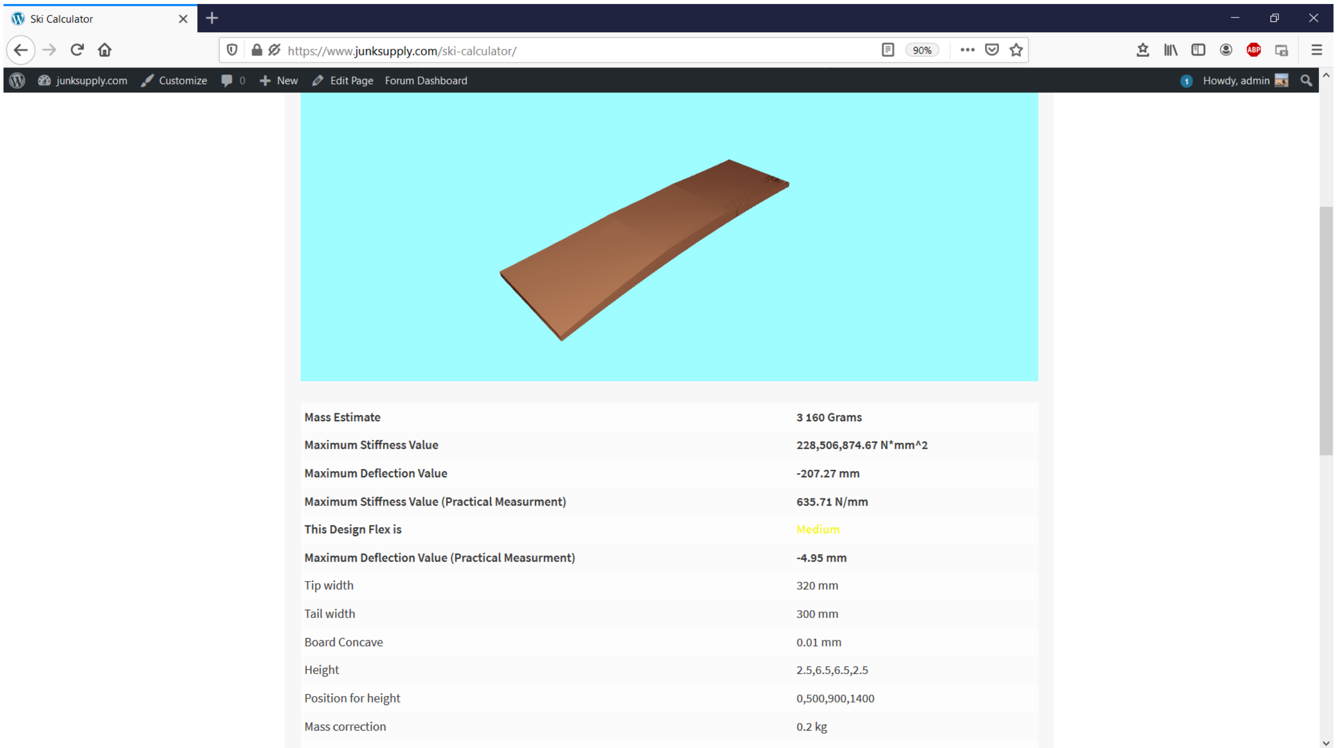


Since the splitboard has 1 x 2mm wide steel edge on each side, and also 2 in the middle (that is 2mm+2mm+2mm+2mm = 8mm in total), we will change the total steel edge width to 4mm (as simulator simulates with 1 steel edge on each side this will be 2x4mm = 8mm in total and matches the reality).



Here are results:





Mass Estimate	**3 160 Grams**
Maximum Stiffness Value	**228,506,874.67 N*mm^2**
Maximum Deflection Value	**-207.27 mm**
Maximum Stiffness Value (Practical Measurment)	**635.71 N/mm**
This Design Flex is	Medium
Maximum Deflection Value (Practical Measurment)	**-4.95 mm**
Tip width	320 mm
Tail width	300 mm
Board Concave	0.01 mm
Height	2.5,6.5,6.5,2.5
Position for height	0,500,900,1400
Mass correction	0.2 kg

Max stiffness is 635N/mm for the glass fabric simulation. This is considered medium.

4. **Combining the impact of all simulations**
So the core with triaxial glass layup has a max stiffness of 635N/mm. By adding the UD stringers in length we increase this by about 50N/mm, and by placing the diagonal 45 degree X stringers we further increase the stiffness by about 30N/mm. This gives total of 715N/mm, which is an increase of about 13%, however more importantly the board will feel more responsive due to added carbon stringers.

Now simulator will always assume that the top and bottom layup is identical. If we however only wish to add a stringer on top or only on bottom, we can assume that the contribution at best will be half the simulated value, but probably less, since the composite have best benefit when used as sandwich construction, top and bottom.

NOTE: please consider that simulation does not take into account the splitboard buing split in half, this means that your final stiffness will be less then this since splitboard clips dont do perfect job of putting the 2 halfs of splitboard together at every single point. So I suggest you increase thickness of your core by up to 1mm, or you add extra material to make the final stiffness even greater.