



lascom

Processing line for electrically heated glass

Production of heated glass is more
effective with Lascom unique technologies

9 April 2018

www.lascom.pro

Table of contents

3 Electrically heated glass

4 Applications

8 Technologies

11 Laser processing

12 Quality

14 Machinery

16 Conductive bus bars

17 Technologies

19 Machinery

21 Thermal field modeling

23 Outcome

1

Electrically heated glass

Our unique technologies change the perception of heated glass and its processing



Aviation



Railway transport



Shipbuilding

Heated glass applications



Automotive

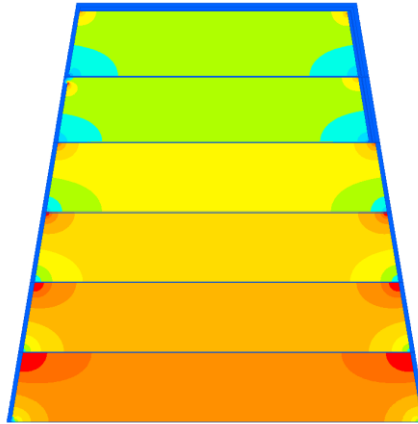


Power efficient
buildings



Military technology

Architecture



- Low-E glass edging;
- Electrically heated roofs:
 - ice and fog removing,
 - gradient heating: top colder and bottom hotter;
- Electrically heated windows:
 - “quasi-draught” elimination,
 - central heating replacement.

Automobile industry



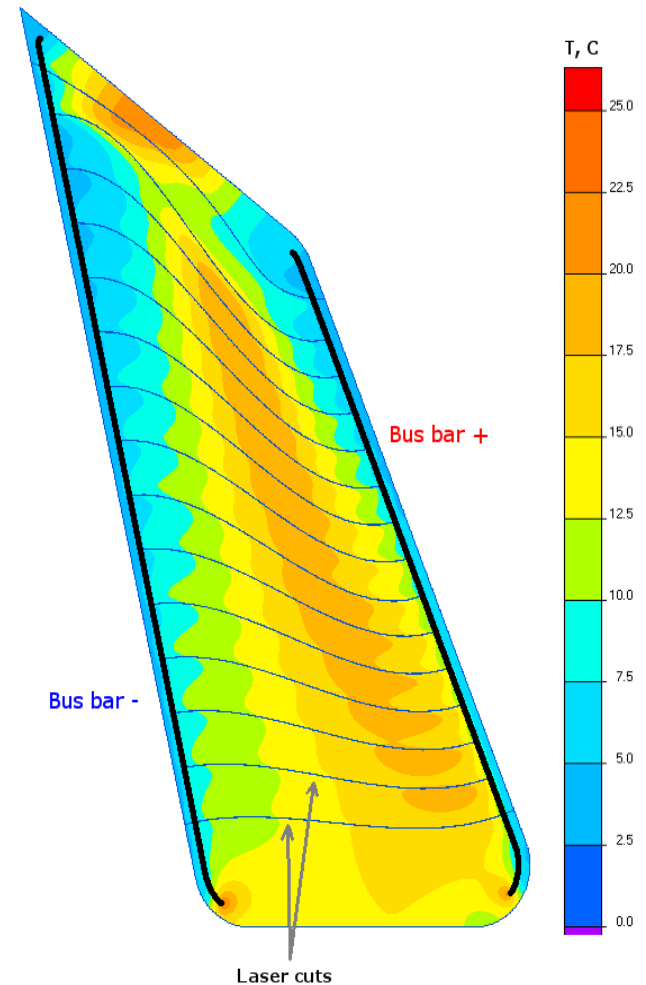
- Electromobiles already have necessary voltage in its electric systems.
- Roofs:
 - ice and fog removing,
 - interior heating;
- Electrically heated windscreens will be available in the near future.

Railroad industry



Necessary voltage is already available, heated glass is widely used in car building:

- windshields,
- headlights – LED lights are unable to defrost glass.



Technologies of glass electric heating

Wired technology

- nichrome wire,
- molybdenum wires net



Disadvantages:

- optical performance negatively influenced
- rainbow effect from counterlight

Technologies of glass electric heating

Low-E glass with surface modification

No optical distortions due to coating homogeneity.

Disadvantages:

- complication of surface modification with traditional methods,
- thermal smoothing problem.

We eliminate those drawbacks and take Low-E glass to the next step!

Technologies of surface modification

Acid etching

- poor effectiveness
- low quality
- high labor costs
- environmentally unfriendly

Laser evaporation

- high productivity
- fewer technological operations
- man-hour decrease
- ecological compatibility

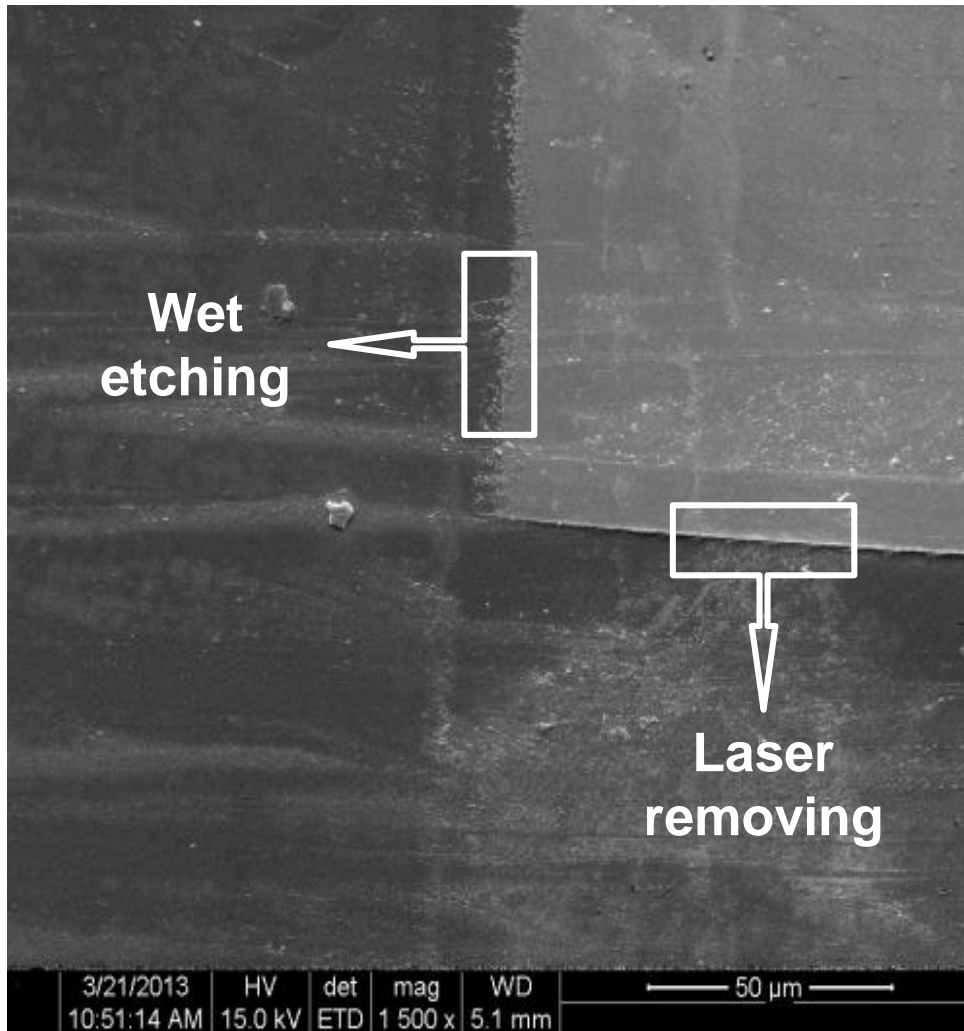
Nowadays there is no alternative methods for laser processing.

2

Laser processing

Great increase in productivity, quality and efficiency

Surface treatment



Laser removing Vs. Wet-etching test

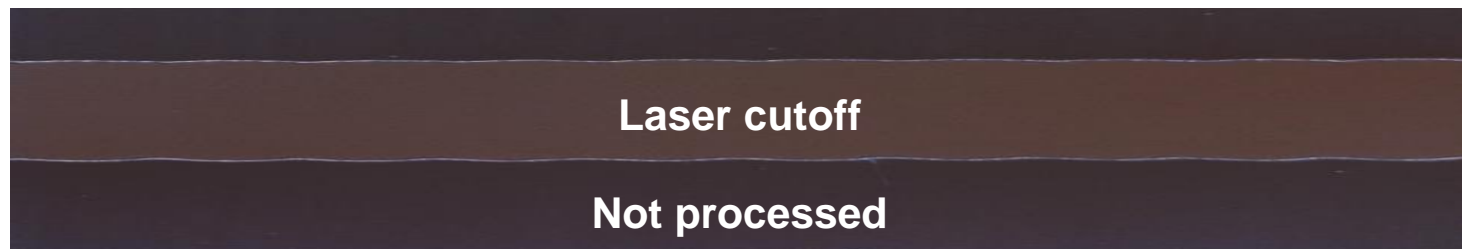
Traditional method of “acid etching surface modification” requires 2-3 hours of processing,

Laser evaporation method requires only 8 minutes of processing.

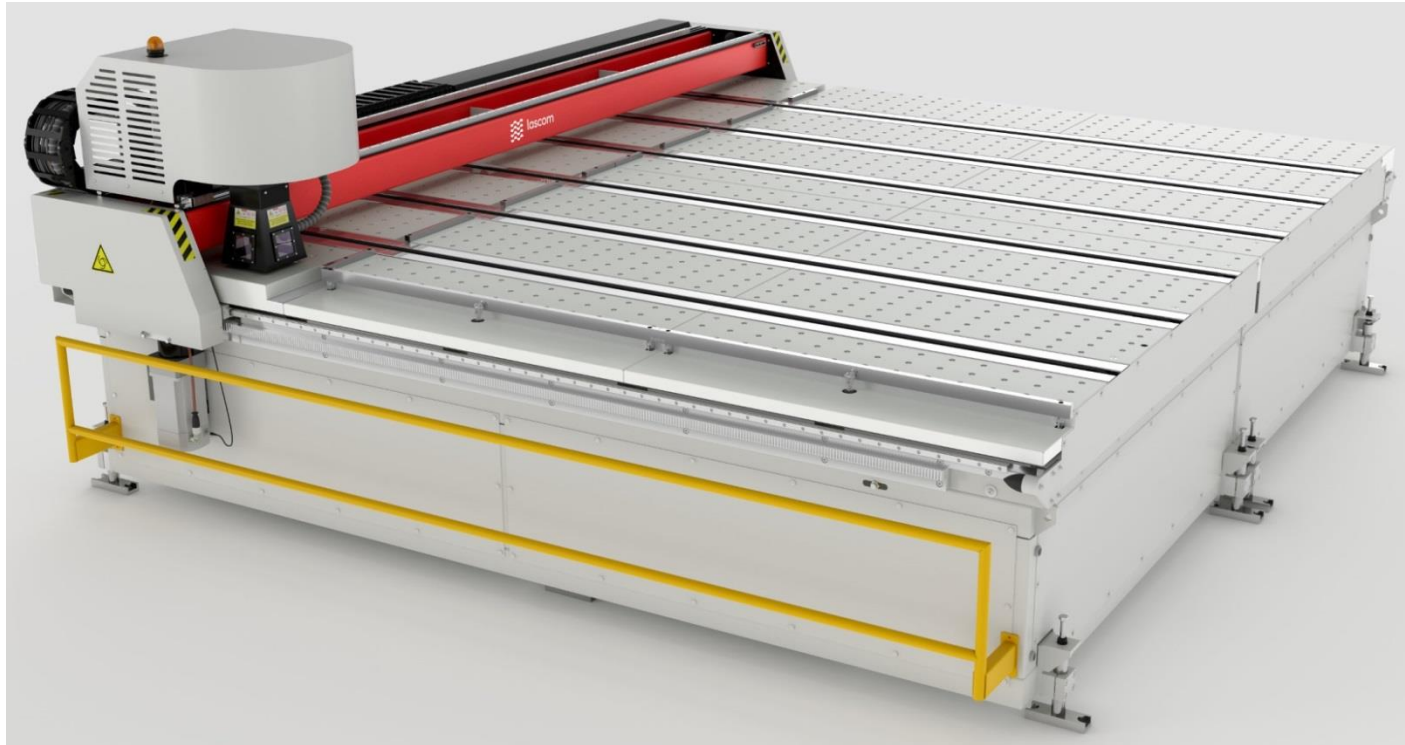
That brings the cost down significantly.

Cutoff breakdown voltage

- Width of a laser cutoff varies from 35 μ m (1.4 mil) up to several millimeters (~0.1 inch).
- A cutoff **0.5 mm** (0.02 inch) wide has a breakdown voltage of **1 kV** in the air.
- Assembled in glass sandwich a cutoff **0.05 mm** (2 mil) wide allows to apply up to **600 V**.
- This is the result of the complete coating evaporation by the laser beam.



Laser machinery



- Processing of hard and soft coatings
- Working area:
2500 x 3210 mm, 4000 x 3210 mm, 6000 x 3210 mm;
- Glass thickness: 3-12 mm (0.12-0.47 inches)

3

Conductive bus bars

Great increase in productivity, quality and efficiency

Traditional technologies of conductive bus bars application

- gluing of foil on the glass,
- indium ultrasonic soldering,
- silk-screen printing of silver-silicate paste.

Disadvantages:

- low adhesion of the bus bar to the glass,
- high resistance of the bus bar,
- complexity of the bus bar application,
- large number of process steps,
- high final cost of the bus bar.

Conductive bus bars deposition

Advantages:

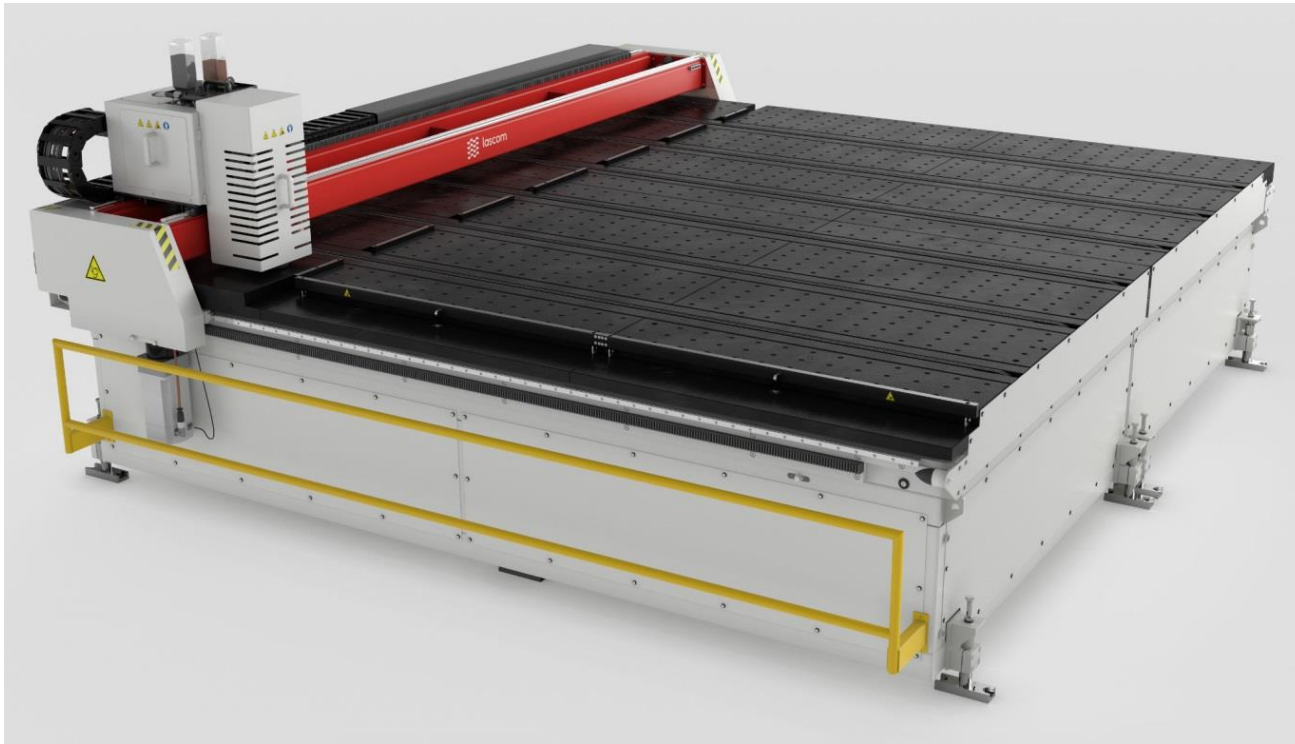
- bus bar deposition rate – 4 cm/s (1.6 inch/s) at 5 mm width (0.2 inch),
- bus bars of any shape can be deposited,
- high adhesion of the bus bar to the glass,
- glass with bus bars can be bent and laminated.

Disadvantages:

- a large number of metal dust remains in the air.

To overcome this shortcoming we have created compact aspiration system.

Gas-dynamic spray machine

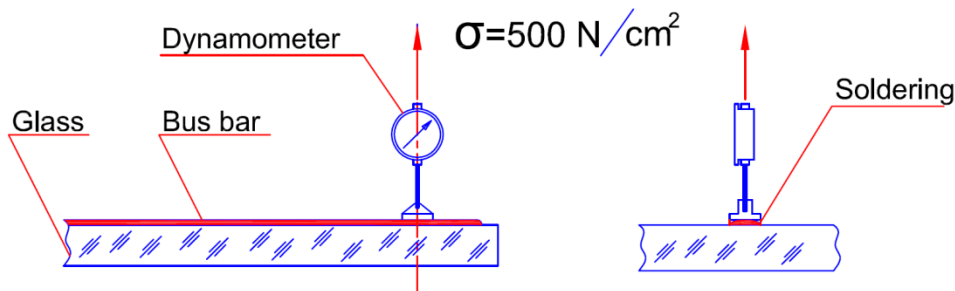


- The machine is designed for the conductive bus bars deposition on the flat glass.
- Workplace air around the machine with our special aspiration system installed has been tested by the testing laboratory, MPC limits are not exceeded.

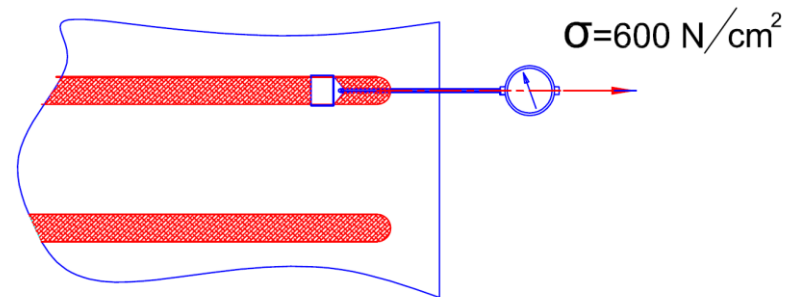
Bus bars characteristics at minimal width (5 mm / 0.2 inch):

- sputtering rate 30 - 40 mm/s (1.2 – 1.6 inch/s);
- cross-section of the bus bar 0,5 sq.mm (780 sq.mil);
- resistivity 0,09 - 0,35 Ω /m (2.3 – 9 m Ω /inch);
- maximum current 5 - 10 A;
- cost about 1 \$/m (25 cent/inch).

1. Tear test



2. Shear test

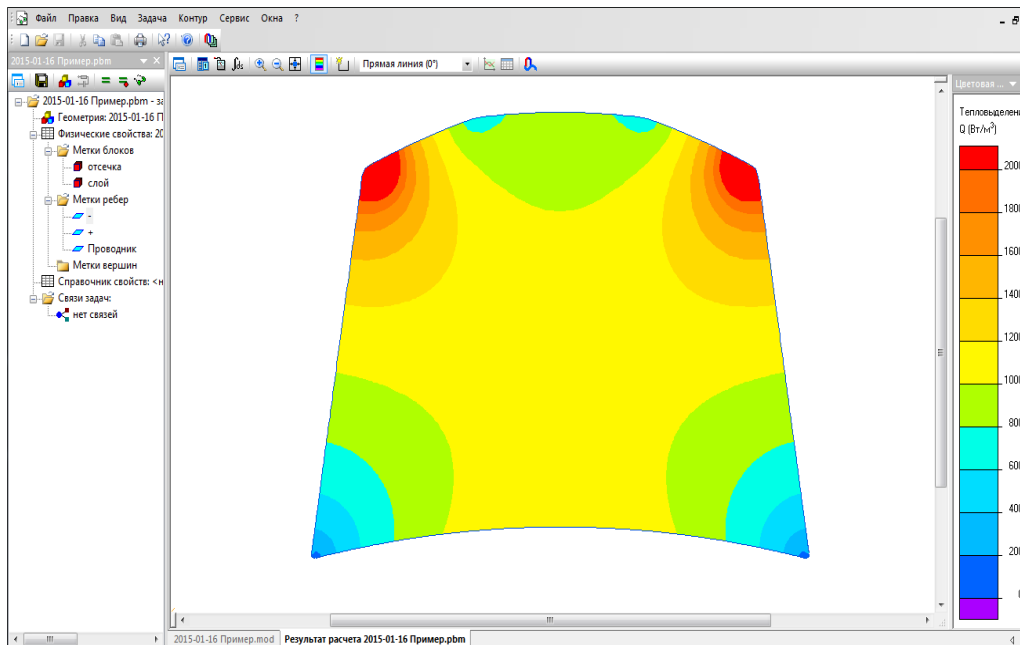


4

Thermal field modeling

Great increase in productivity, quality and efficiency

Thermal field smoothing problem

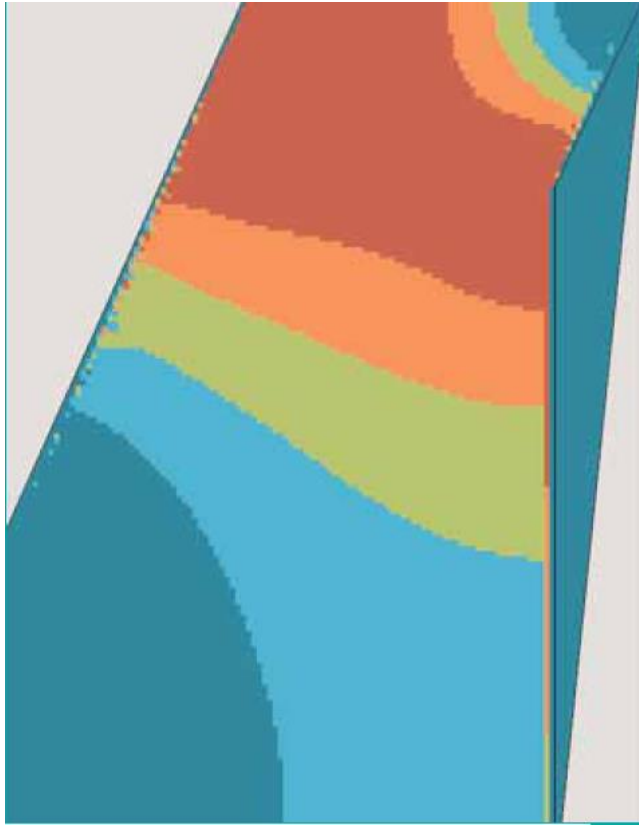


A special software for thermal field modeling allows to solve the thermal field equalizing problem.

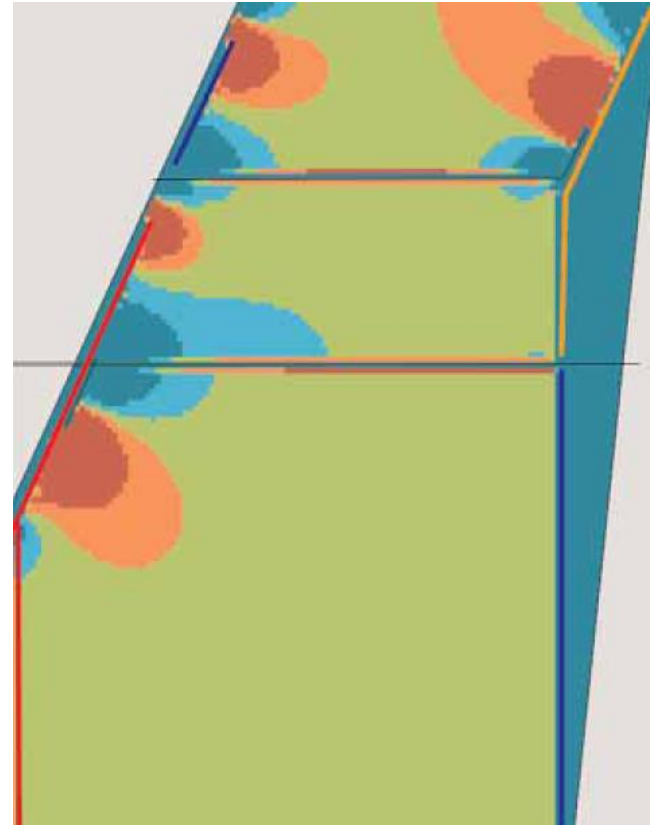
It can:

- calculate distribution of Joule heat on the glass surface,
- help to determine the optimal location of conductor bus bars and cutoffs, their length and configuration,
- calculate distribution of temperature on the glass surface under given external conditions.

Example of the thermal field smoothing



The thermal field without correction



Thermal field after correction

4

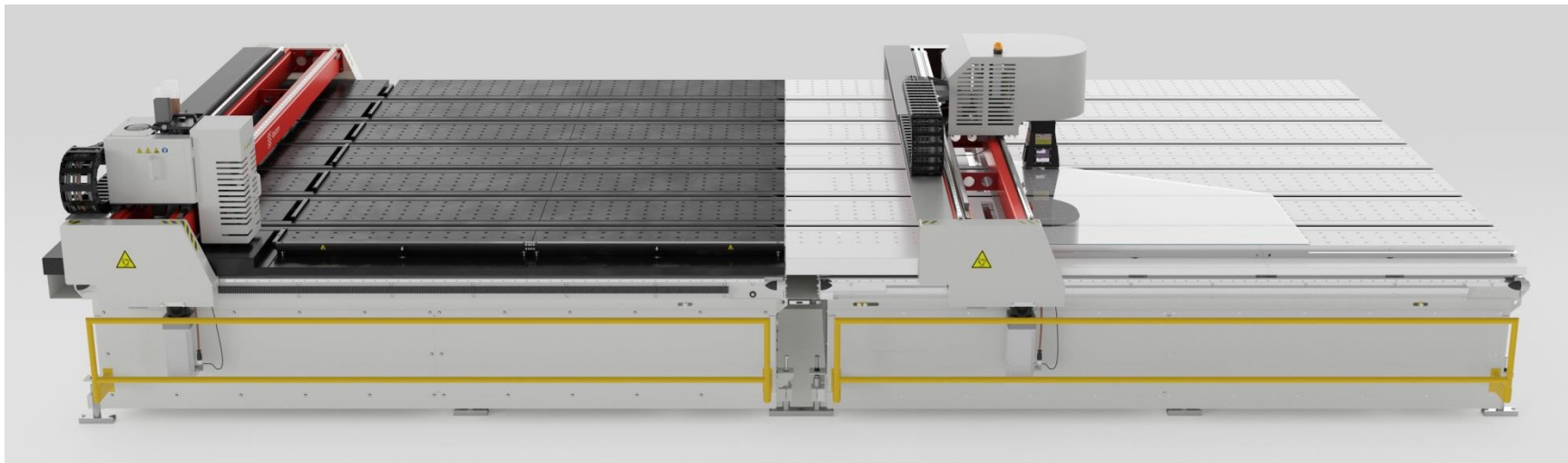
Outcome

Great increase in productivity, quality and efficiency

Elapsed time

Stage	Conventional methods	Our technology
Simulation of glass heating to provide uniform heating	1 hour for the production of the first sample + further samples production	10 minutes for the calculation of the first model + further modeling
Cutoffs application	2-3 hours (acid etching)	10 minutes (laser processing)
Bus bars application	1 hour (soldering)	10 minutes (deposition)

Our developments allow saving up to 90% of time required for 3 main production steps of electrically heated glass manufacturing.



Thank you for your attention!

Lascom, ООО

25 Druzhby str., Dubna,
Moscow region, Russia
141983

www.lascom.pro

+7 (496) 217-11-77