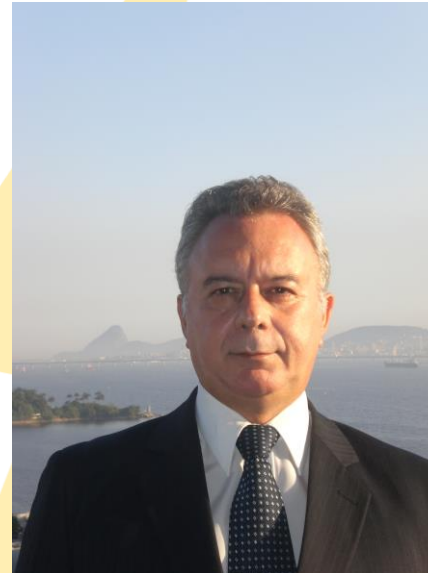


DESIGN CONCEPTS + software SwitchgearDesign for SWITCHGEAR, SWITCHBOARDS, BUSDUCTS & SUBSTATIONS"



Item 3:

Introduction to the
use of the Software
Switchgear_Design



- Applications and capabilities of the software SwitchgearDesign.
- Software for the development of switchgear, switchboards, bus ducts , ... with less laboratory tests by use the simulations
- The main screens, the input variables and how to obtain them.
- The screens with the main results
- Complete training : units employed, conditions of use, validation of results, concepts and how to use and interpret results.



- Types of tests to simulate

- Types of equipment possible to simulate

- Position of bars (vertical, horizontal)

- Rated current and short circuit current

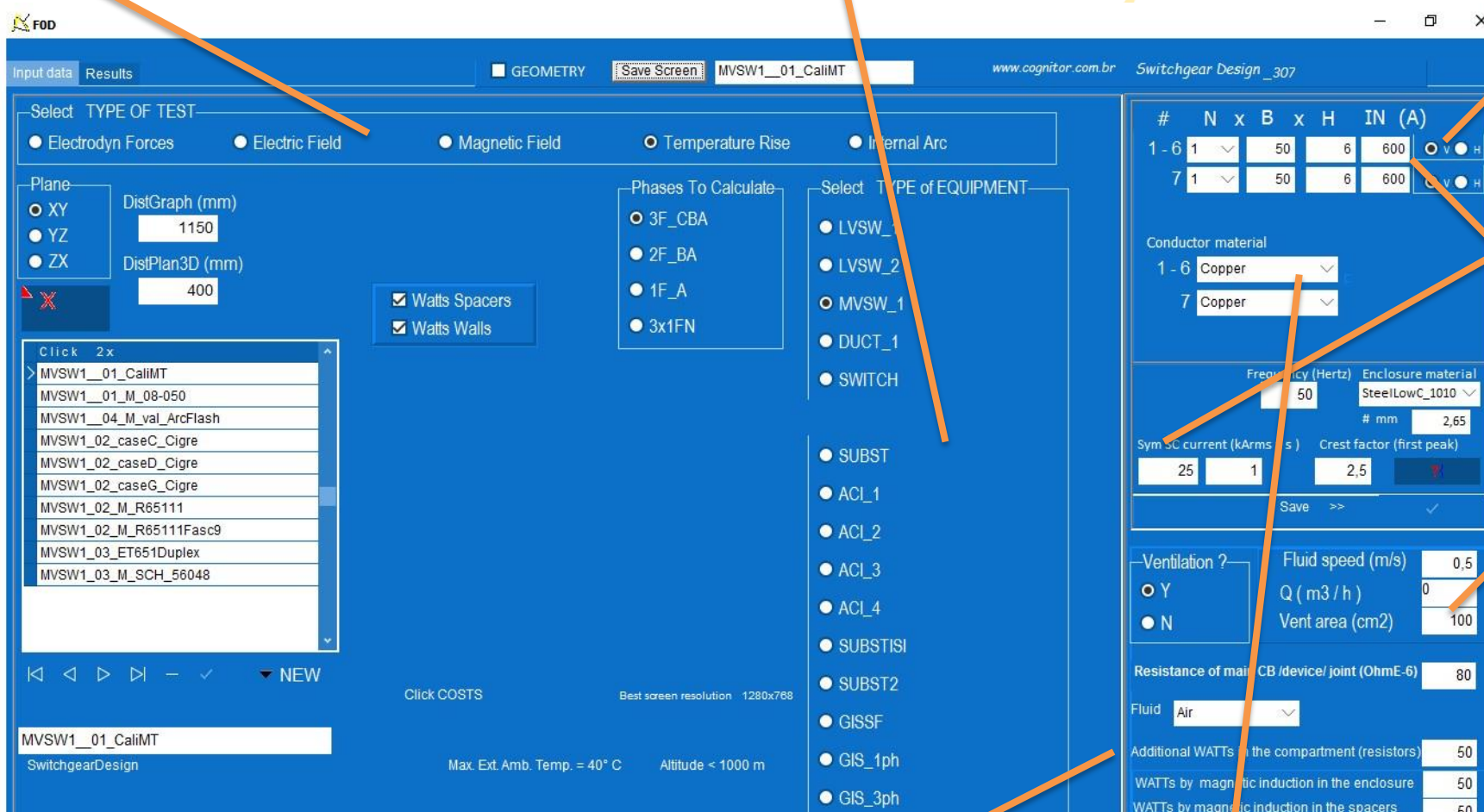
- Ventilation area

- Velocity / flow of fans

- Areas ventilation & depressurization

- Additional Watts (for bus bars and connections are automatically calculated)

- Materials of conductors, plates and fluid (air, SF6)



The screenshot shows the 'Input data' tab of the COGNITOR software. The interface is divided into several sections:

- Select TYPE OF TEST:** Radio buttons for Electrodyn Forces, Electric Field, Magnetic Field, Temperature Rise, and Internal Arc. The 'Electric Field' option is selected.
- Plane:** Radio buttons for XY, YZ, and ZX. 'XY' is selected. Below are input fields for 'DistGraph (mm)' (1150) and 'DistPlan3D (mm)' (400).
- Phases To Calculate:** Radio buttons for 3F_CBA, 2F_BA, 1F_A, and 3x1FN. '3F_CBA' is selected.
- Select TYPE of EQUIPMENT:** Radio buttons for LVSW_1, LVSW_2, MVSW_1, DUCT_1, SWITCH, SUBST, ACI_1, ACI_2, ACI_3, ACI_4, SUBSTISI, SUBST2, GISSF, GIS_1ph, and GIS_3ph. 'MVSW_1' is selected.
- Conductor material:** Dropdown menus for '1 - 6' (Copper) and '7' (Copper).
- Frequency (Hertz):** Input field with value 50.
- Enclosure material:** Dropdown menu with 'SteelLowC_1010' selected. Below is a field for '# mm' (2,65).
- Sym SC current (kArms):** Input field with value 25.
- Crest factor (first peak):** Input field with value 2,5.
- Ventilation ?** Radio buttons for Y and N. 'Y' is selected. Below are input fields for 'Fluid speed (m/s)' (0,5), 'Q (m3 / h)' (0), and 'Vent area (cm2)' (100).
- Resistance of main CB / device/ joint (OhmE-6):** Input field with value 80.
- Fluid:** Dropdown menu with 'Air' selected.
- Additional Watts:** Input fields for 'the compartment (resistors)' (50), 'WATTS by magnetic induction in the enclosure' (50), and 'WATTS by magnetic induction in the spacers' (50).

At the bottom, there are buttons for 'Click COSTS' and 'NEW', and a status bar showing 'Max. Ext. Amb. Temp. = 40° C' and 'Altitude < 1000 m'.

Initial Screen with input data for simulations

- Geometry, dimensions, positions and number of supports
- Number of the conductor

The screenshot displays the COGNITOR software interface for switchgear design. The main window shows a 3D model of a switchgear with various components labeled, including conductors (V1, V2, V3), busbars, and supports. Dimensions and positions are indicated by lines and numbers. The interface includes a top menu bar with 'Input data' and 'Results' tabs, and a 'GEOMETRY' checkbox. A 'Save Screen' button and a file name 'MVSW_01_CaliMT' are also visible. The right panel contains input parameters for the simulation.

Input Parameters:

#	N	x	B	x	H	IN (A)
1 - 6	1		50	6	600	<input type="radio"/> V <input type="radio"/> H
7	1		50	6	600	<input type="radio"/> V <input type="radio"/> H

Conductor material:
1 - 6 Copper
7 Copper

Frequency (Hertz): 50
Enclosure material: SteelLowC_1010
mm: 2,65

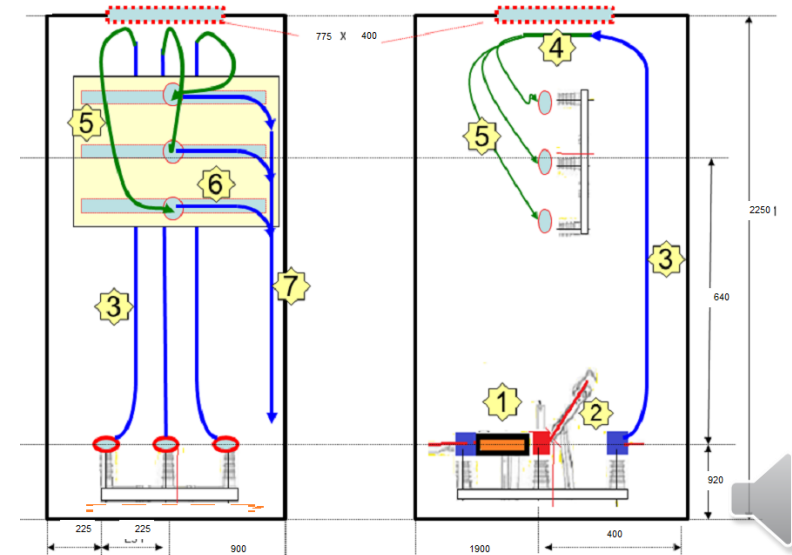
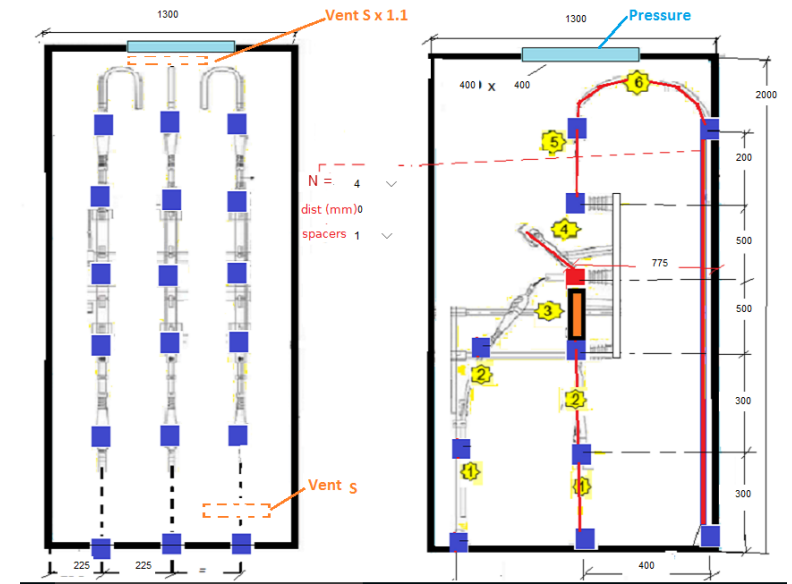
Sym SC current (kArms x s): 25, 1
Crest factor (first peak): 2,5

Ventilation ?
☐ Y ☐ N
Fluid speed (m/s): 0,5
Q (m3 / h): 0
Vent area (cm2): 100

Resistance of main CB /device/ joint (OhmE-6): 80
Fluid: Air

Additional WATTS in the compartment (resistors): 50
WATTS by magnetic induction in the enclosure: 50
WATTS by magnetic induction in the spacers: 50

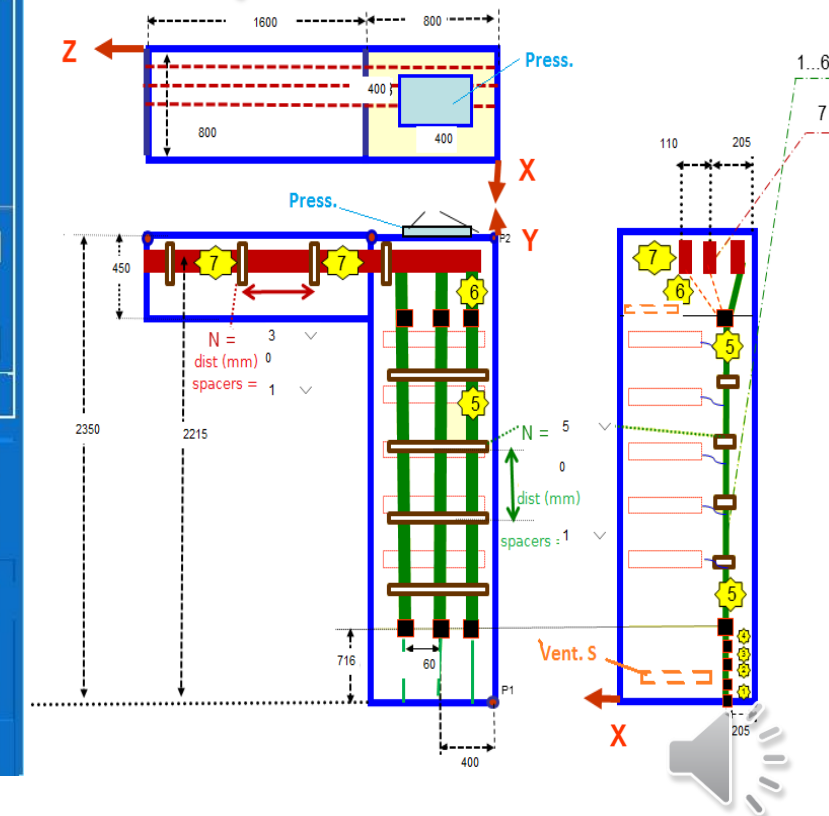
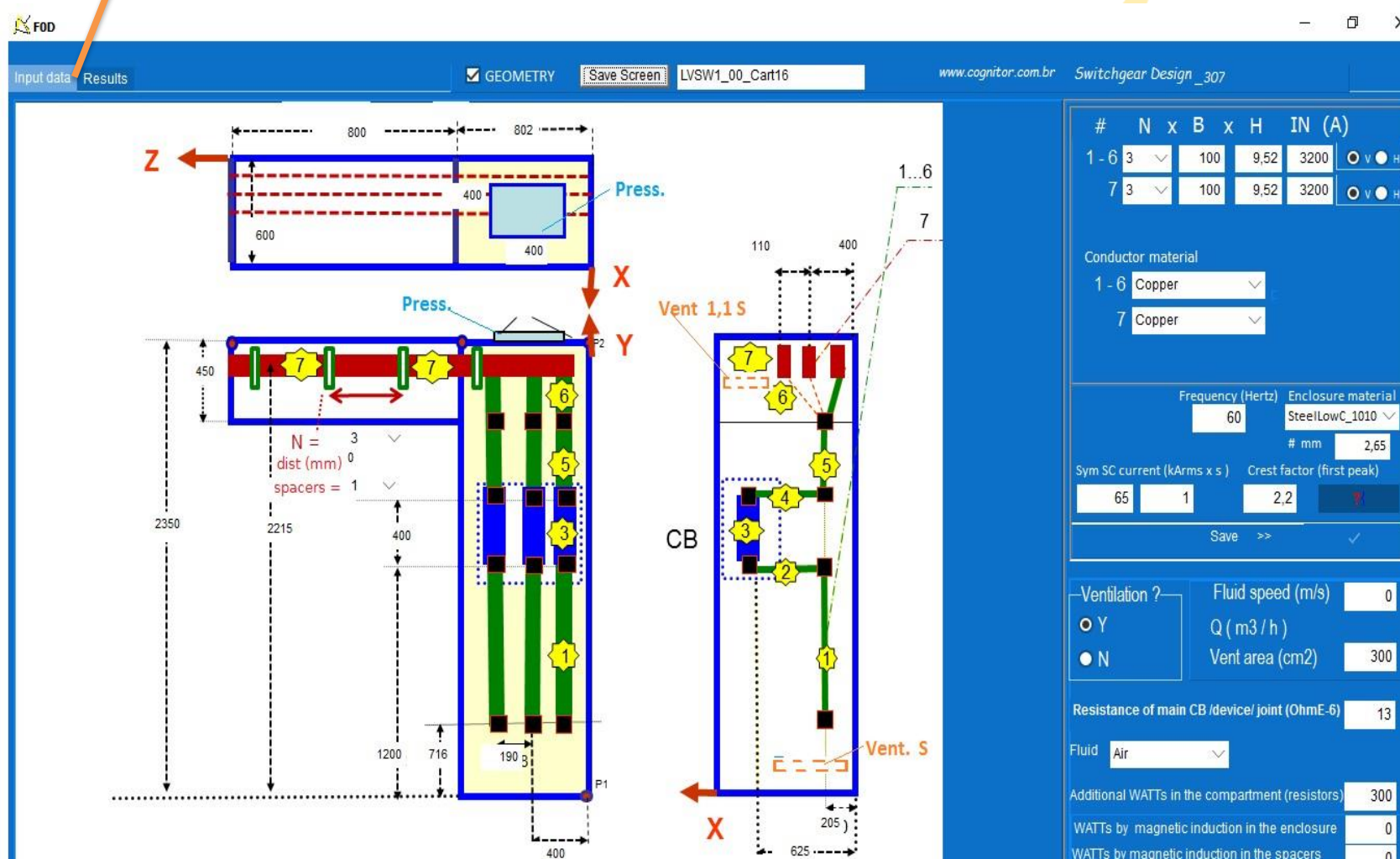
ACI_1 e ACI_2



Types of equipment which can be simulated

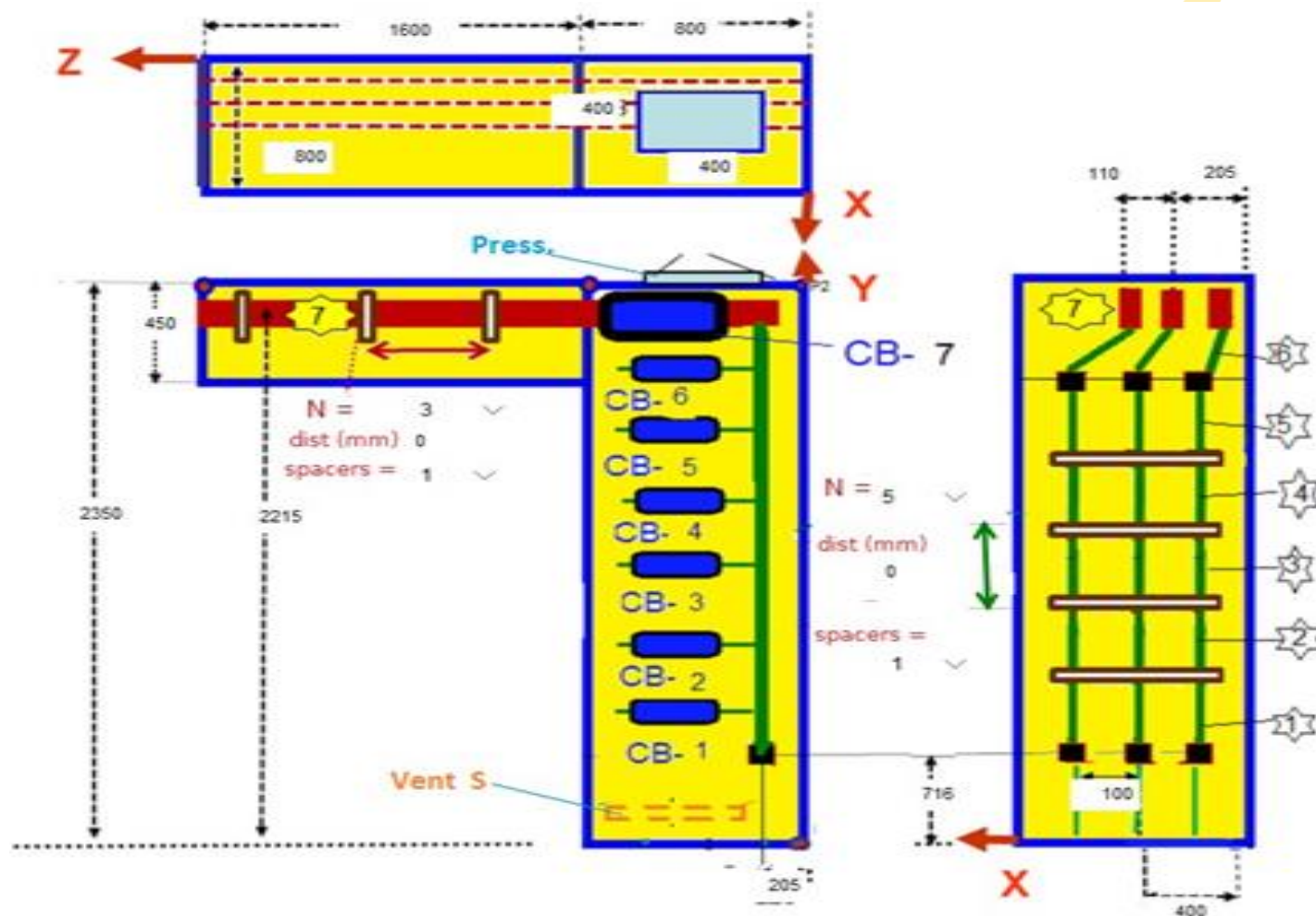
LVSW_1 : Low voltage AIS – circuit breaker compartment

LVSW_2: MCC drawers

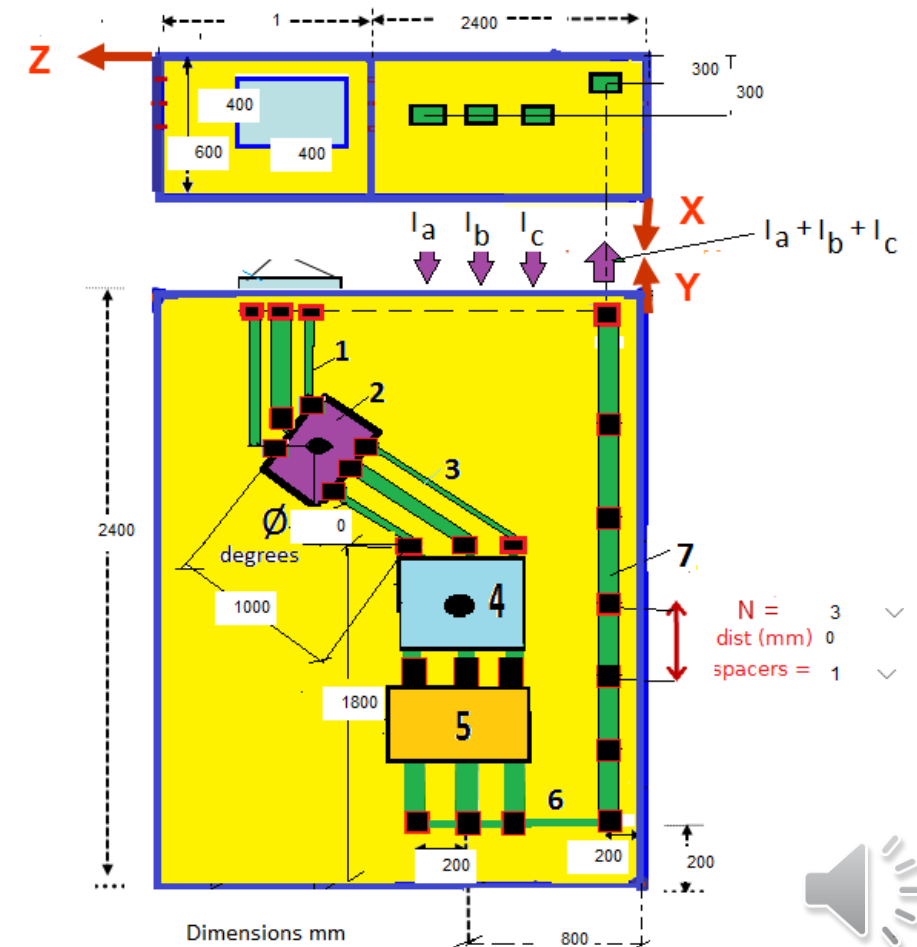


Types of equipment which can be simulated

ACI_3 - Low voltage AIS



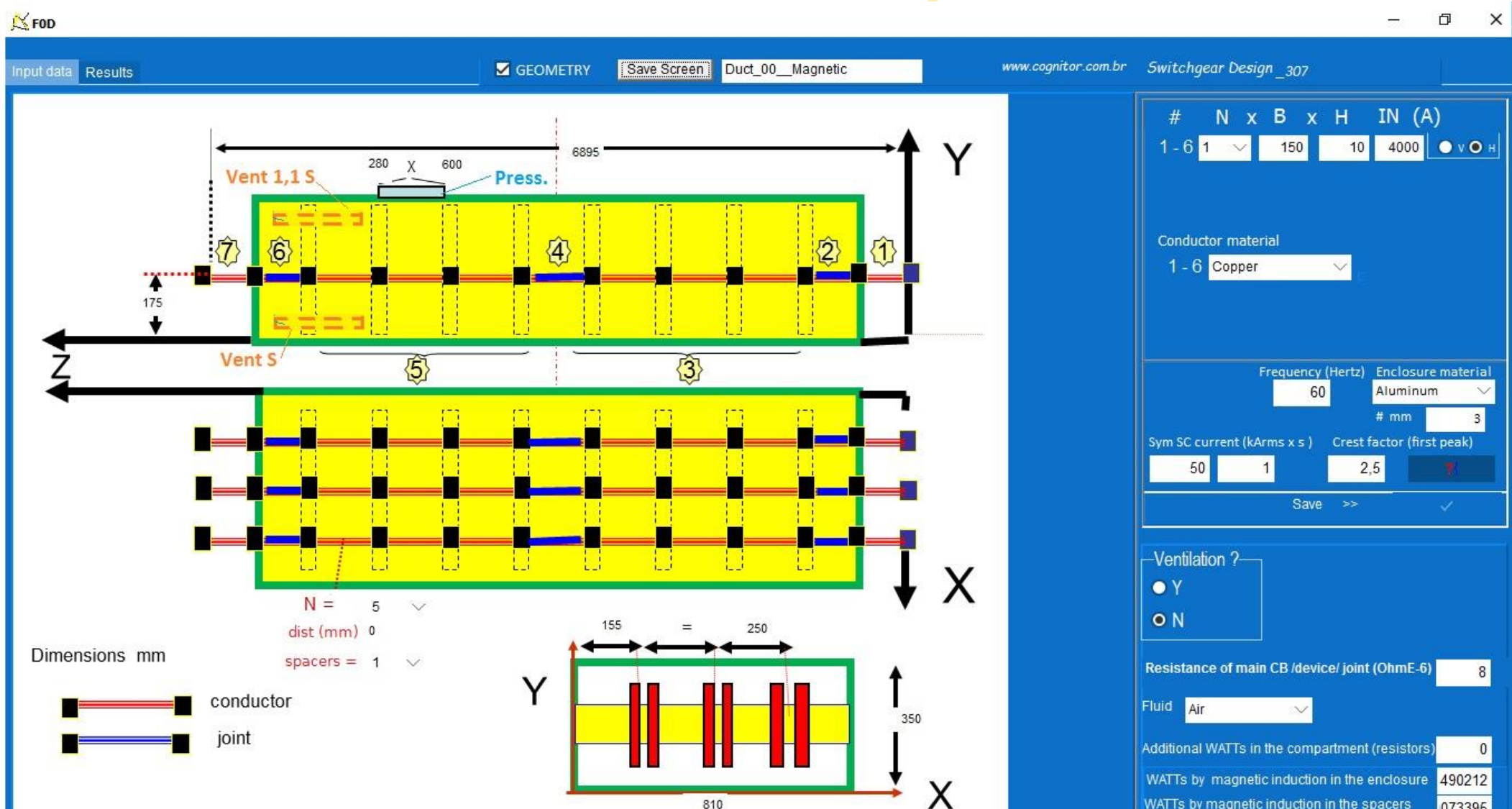
ACI_4 - Special Low voltage AIS



Types of equipment which can be simulated

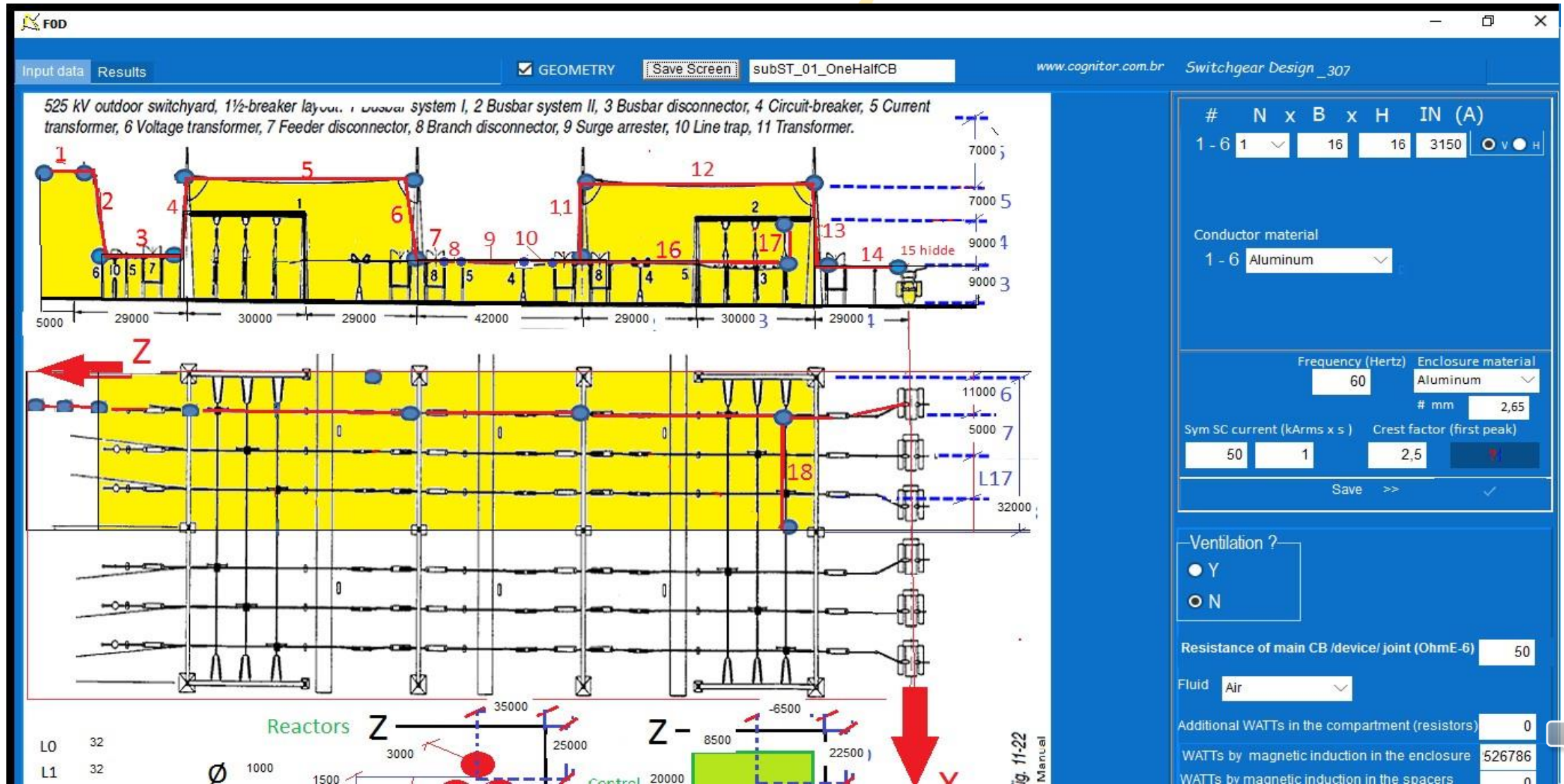
DUCT_1:

Busway



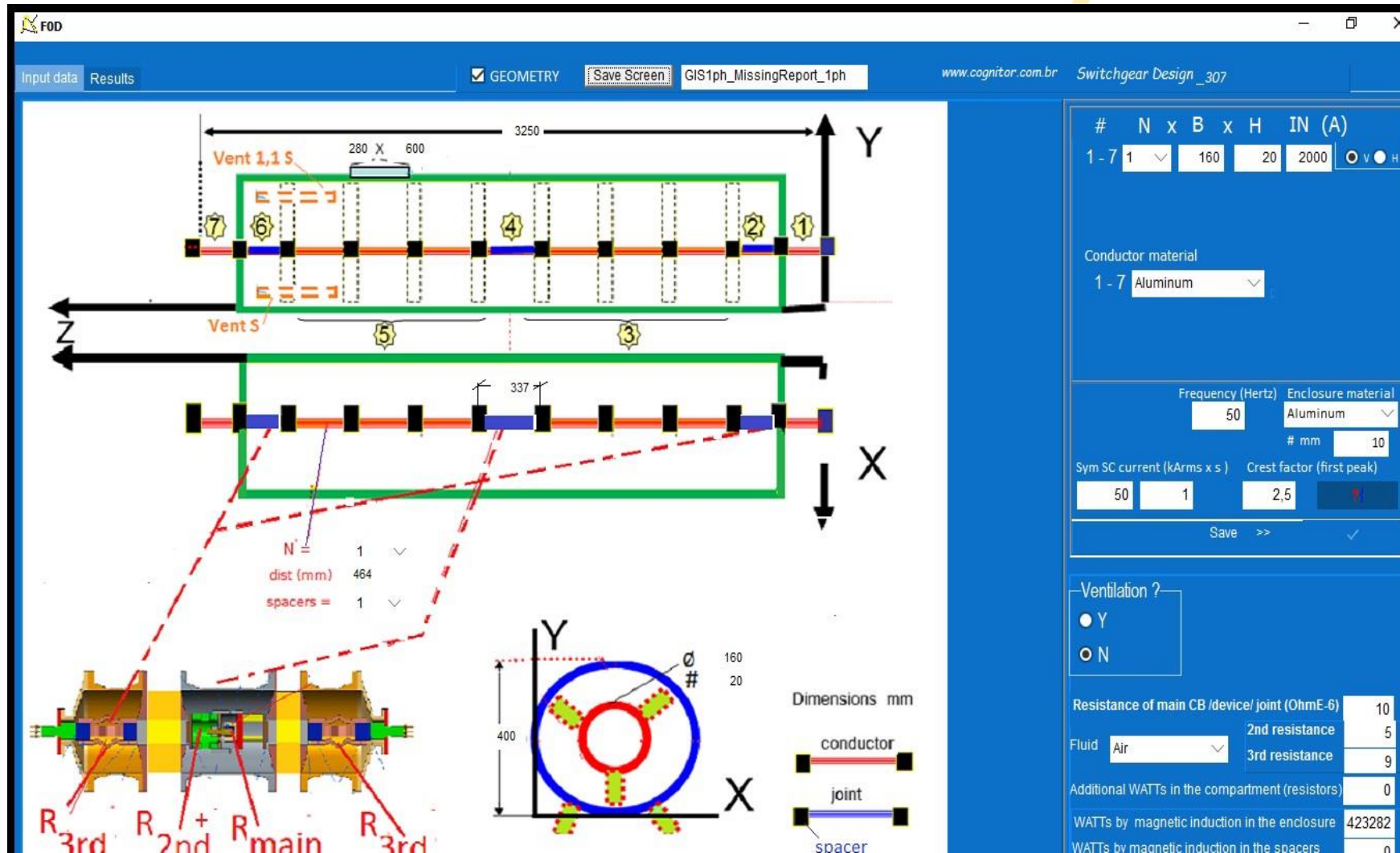
Types of equipment which can be simulated

Subst – Substation arrangements

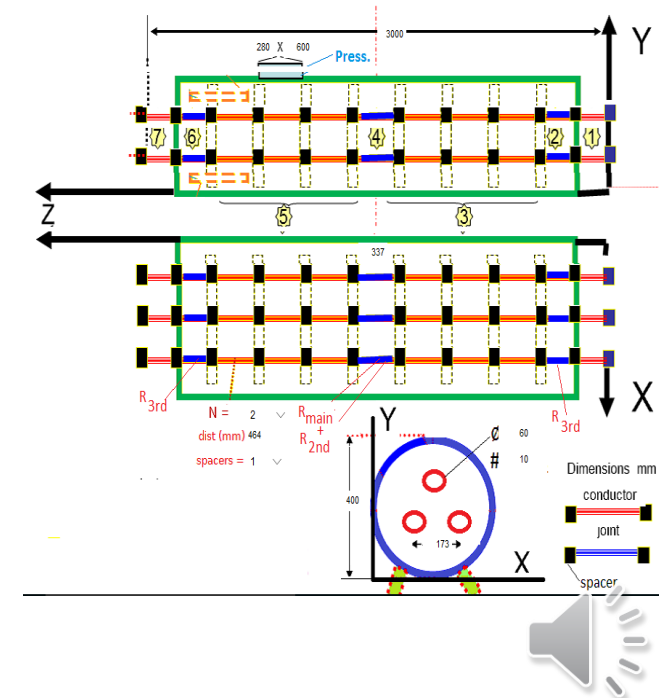


Types of equipment which can be simulated

- GIS_1ph - GIS single phase



- GIS_3ph - GIS Three phase

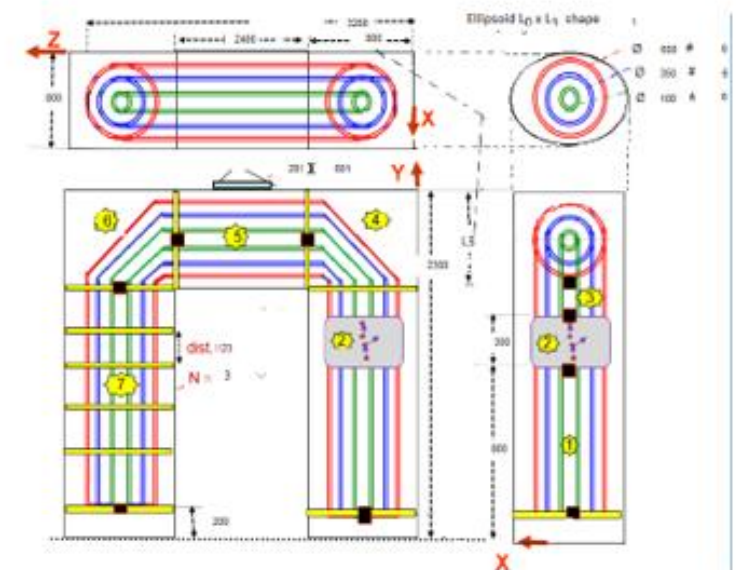
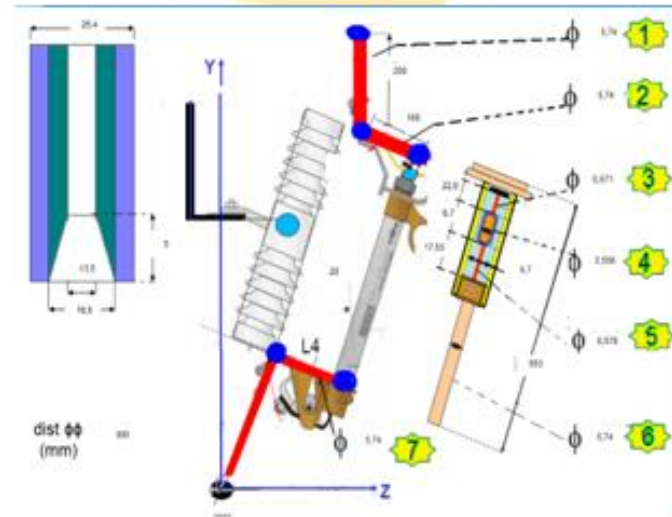
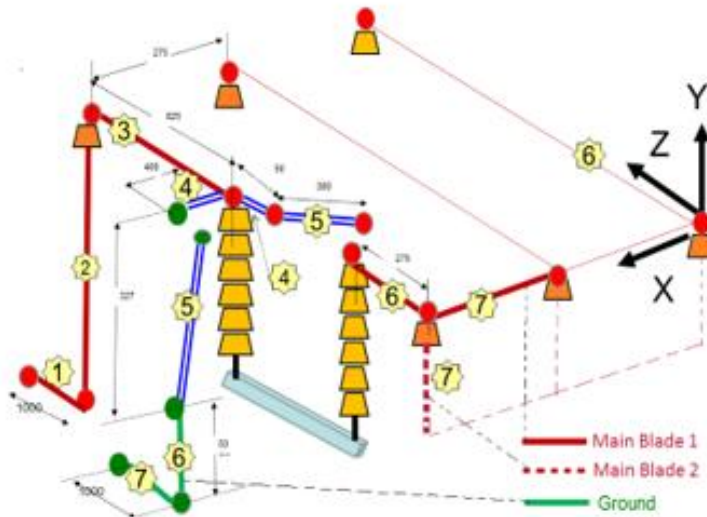


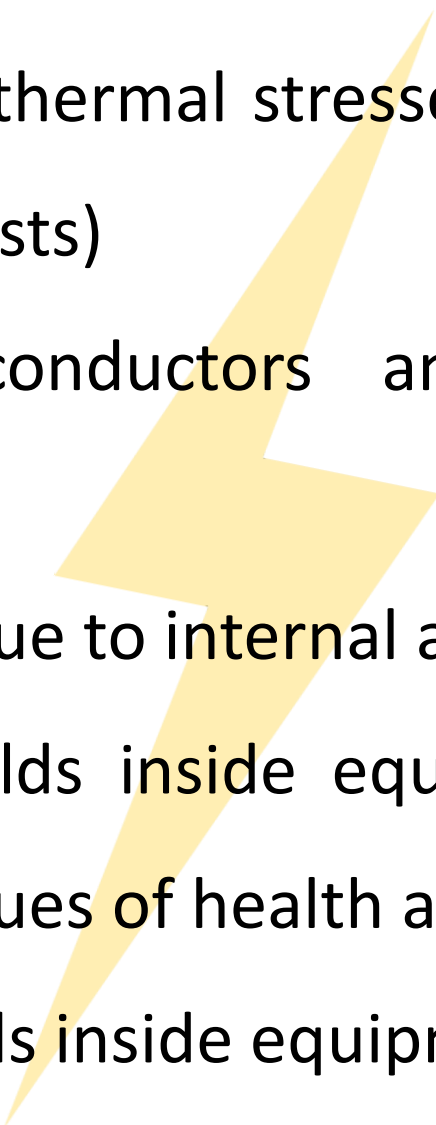
Types of equipment which can be simulated

~~FUSE_1:~~ — ~~Fuse~~

~~SWITCH:~~ — ~~Isolator~~

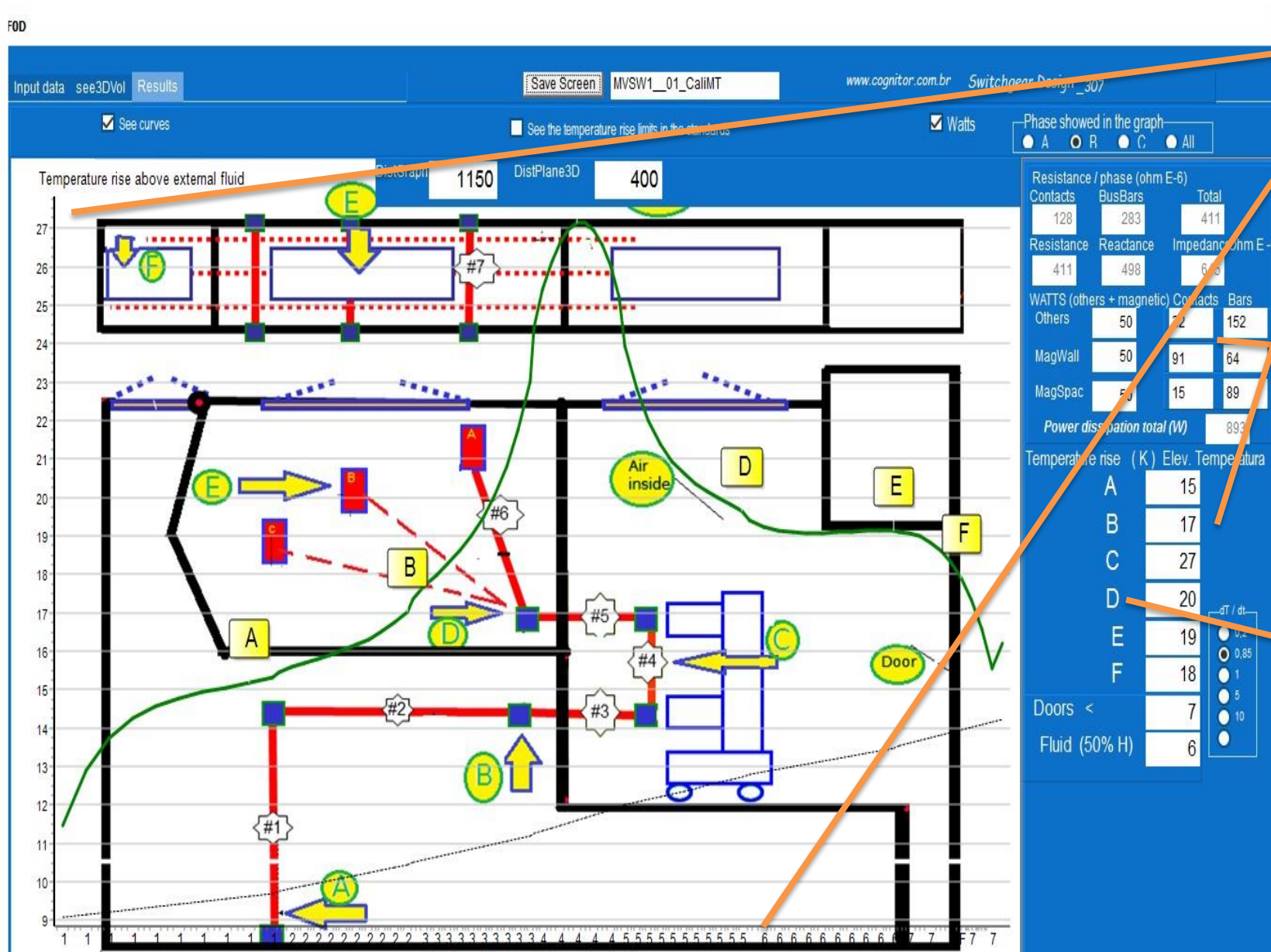
~~GISSF~~ — (busway tri axial)



- 
- A large, stylized yellow lightning bolt graphic that originates from the top right and points downwards towards the bottom left, passing behind the list of test types.
- Electrodynamic forces & thermal stresses during short circuits (short time and crest current tests)
 - Temperature rise of conductors and insulating parts during temperature rise tests.
 - Effects of overpressures due to internal arcs (switchgear, busways, ...)
 - Mapping of electrical fields inside equipment and inside complete substations (attending values of health and work legislation)
 - Mapping of magnetic fields inside equipment



Screen with the results of temperature rise tests



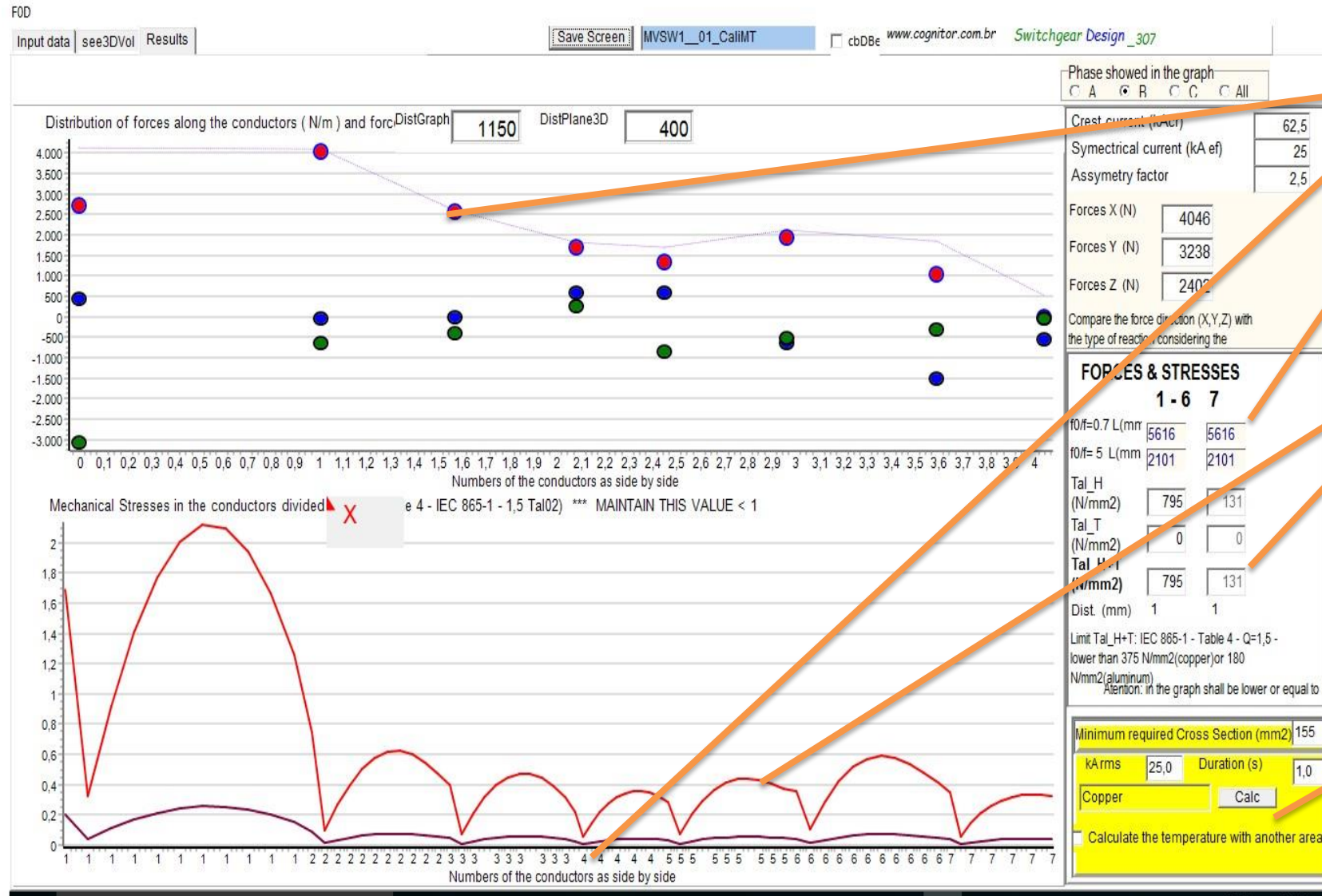
Temperature rise along conductors (1 to 7)

• Watts in the groups of components

• Points A, B, ... E, F are the ones prescribed in technical standards



Screen with the results of electrodynamic forces and stresses



- Forces in insulators and supports

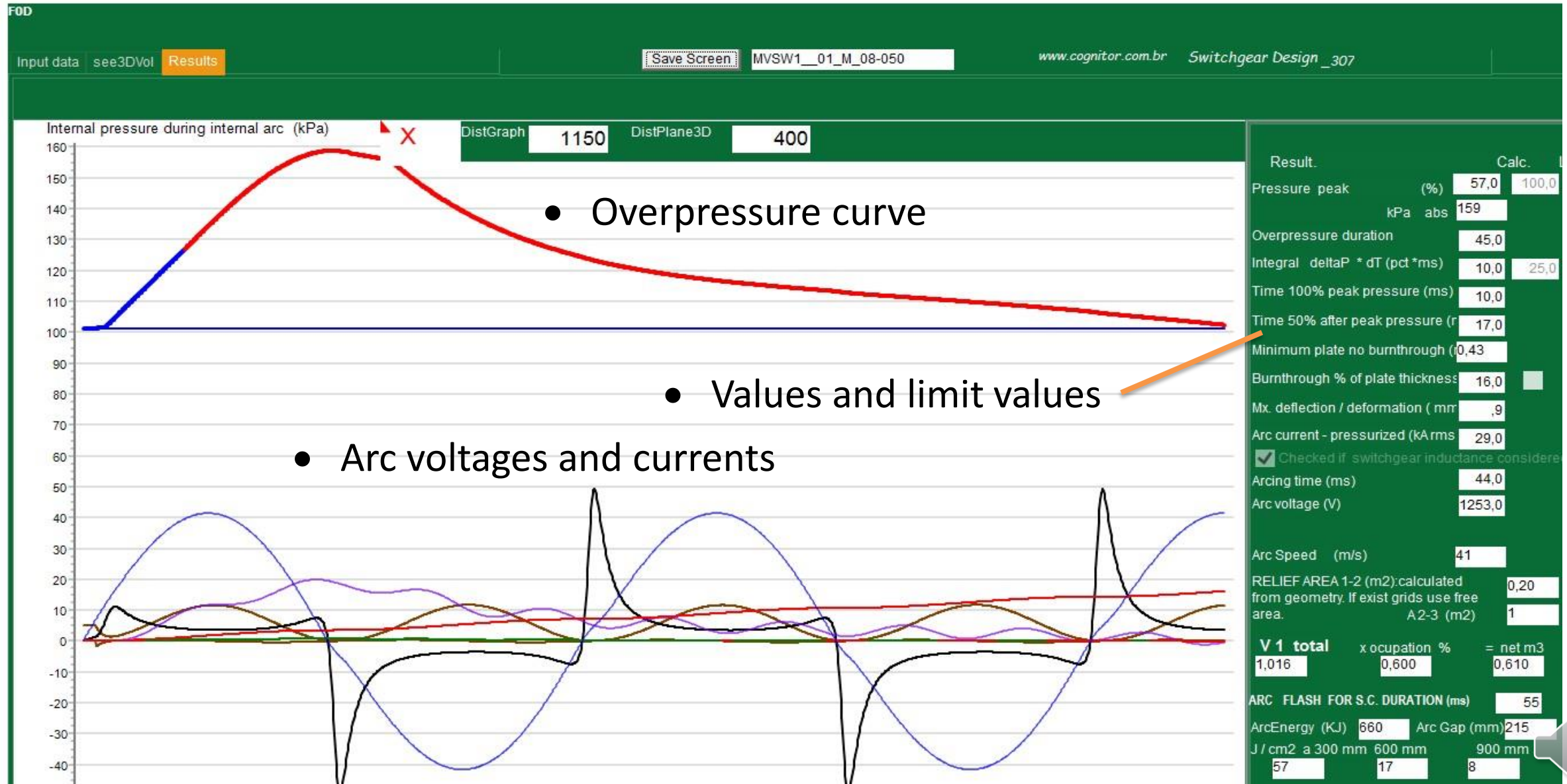
- Values and limit values

- Mechanical stresses which can bend conductors

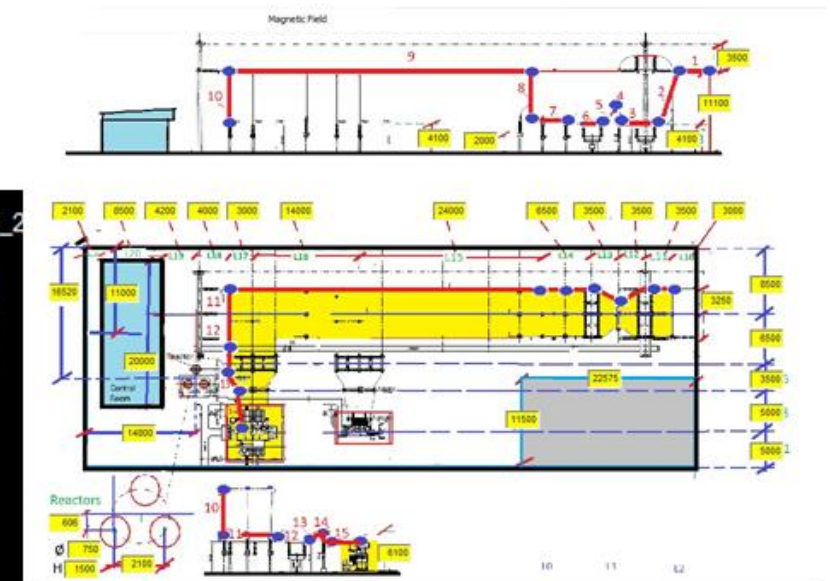
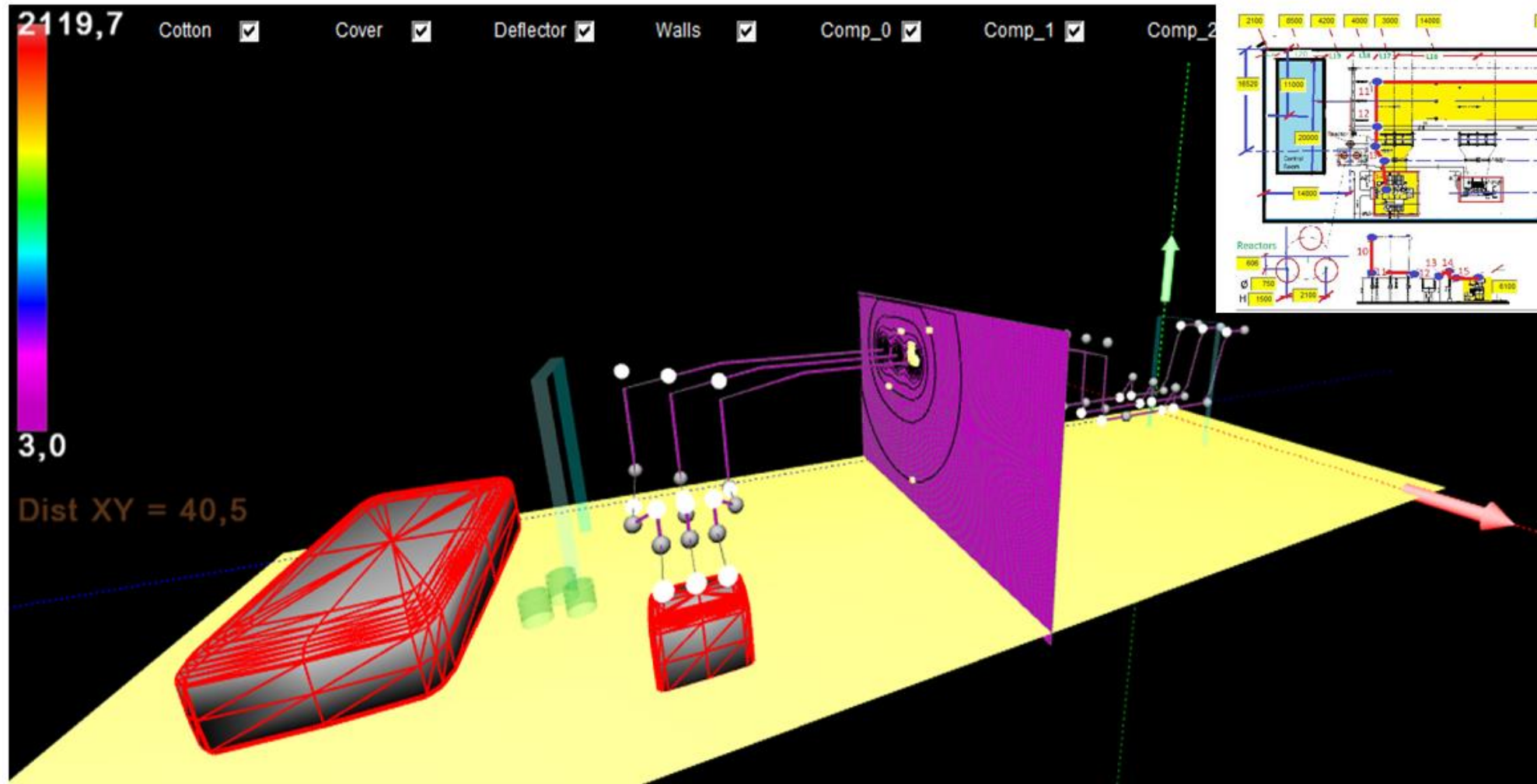
- Minimum cross-section to avoid thermal annealing

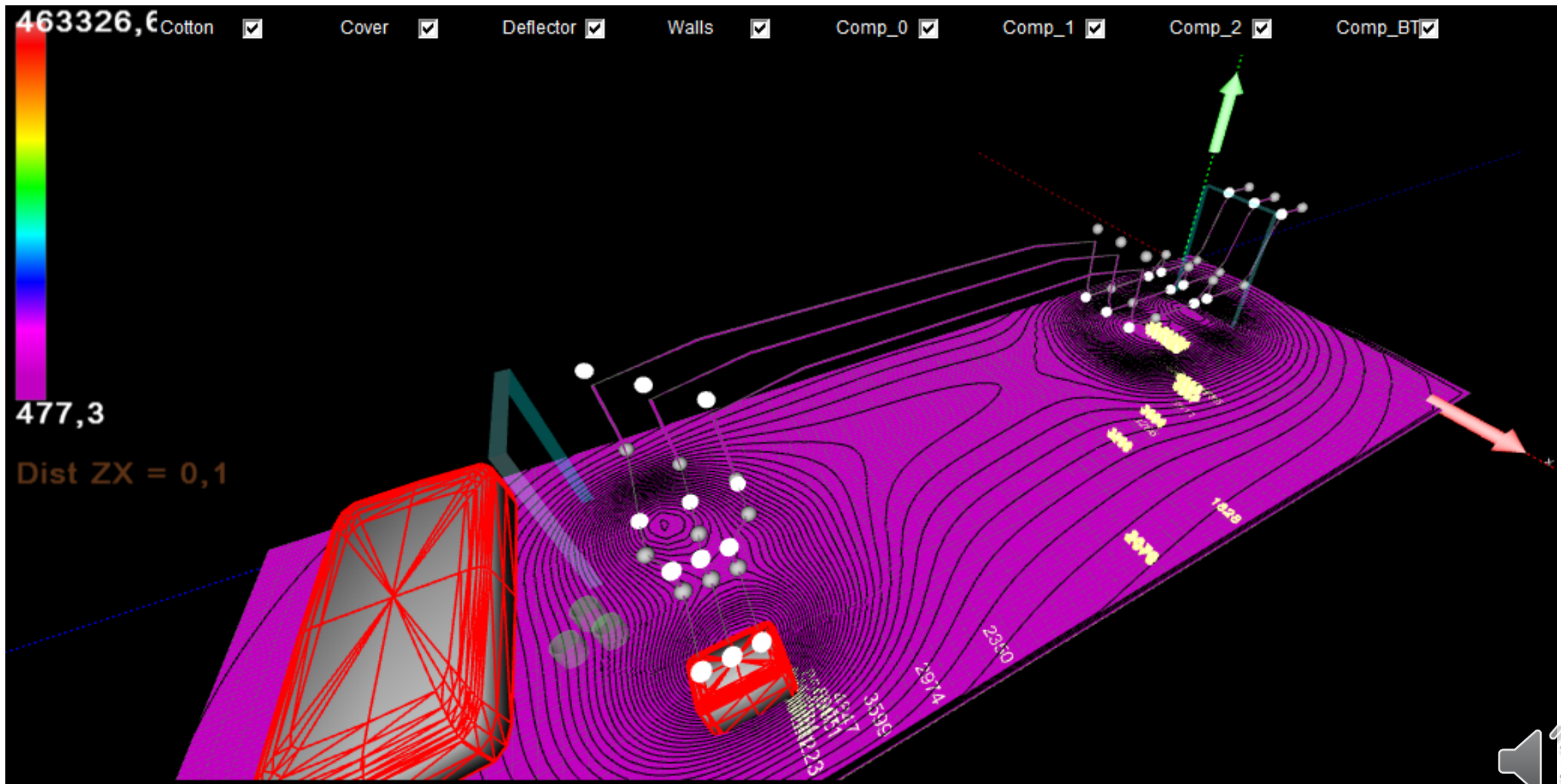


Screen with the results of overpressures during internal arc tests



Screen with the results of magnetic fields





[illegible]

End

