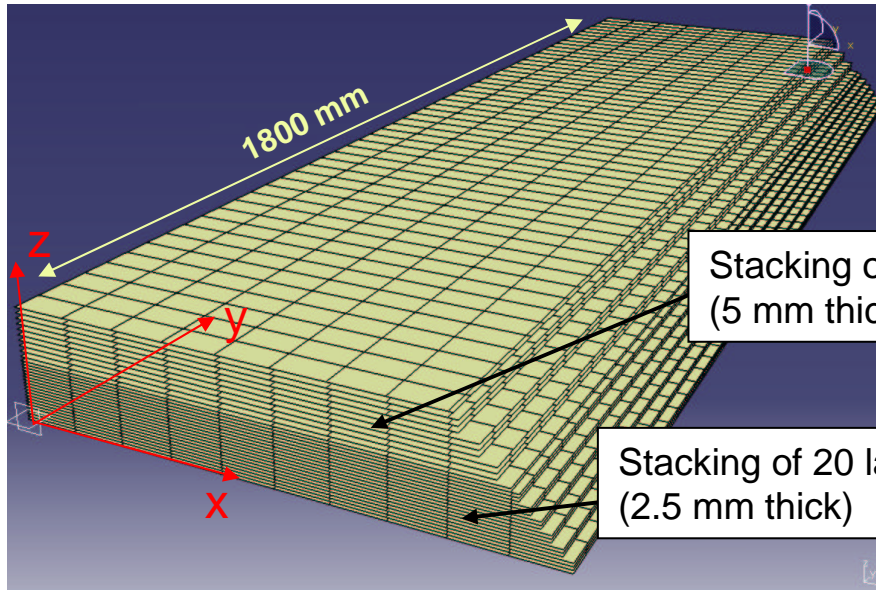


# Preliminary results on SiD studies

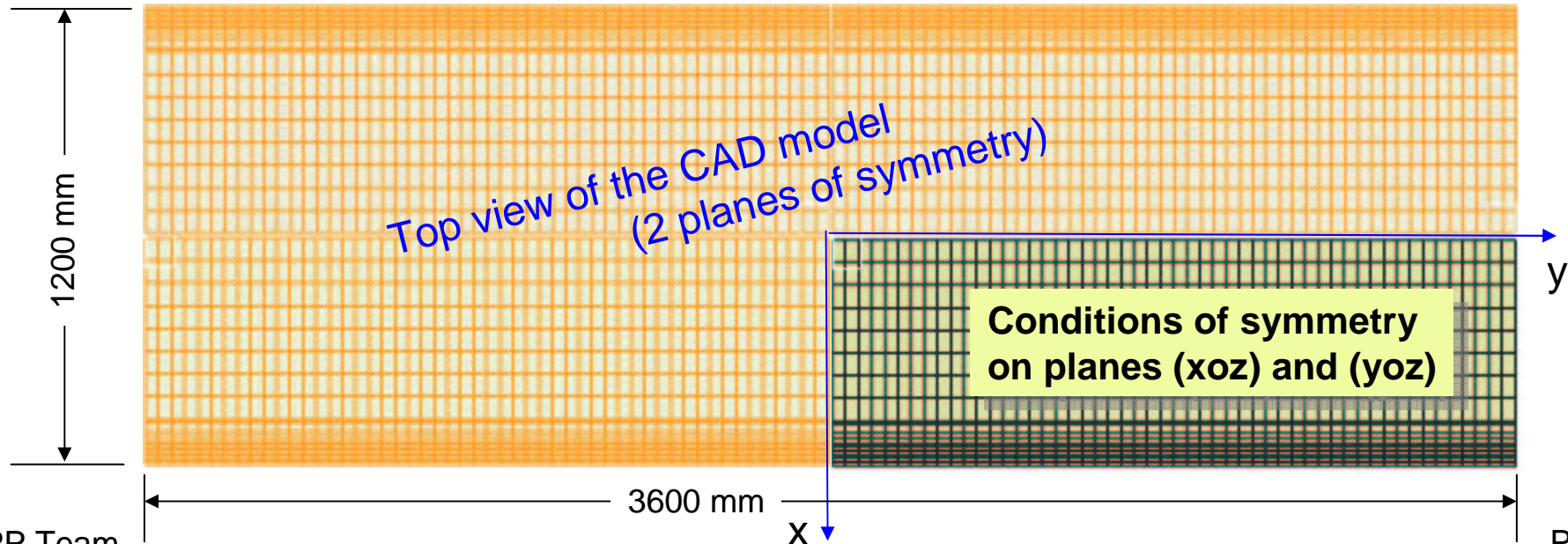
## - CAD Model of $\frac{1}{4}$ module -



**“Beam + shell” FEM model**  
⇒ CAD model made of surfaces and wires

Stacking of 10 layers of tungsten (5 mm thick)

Stacking of 20 layers of tungsten (2.5 mm thick)



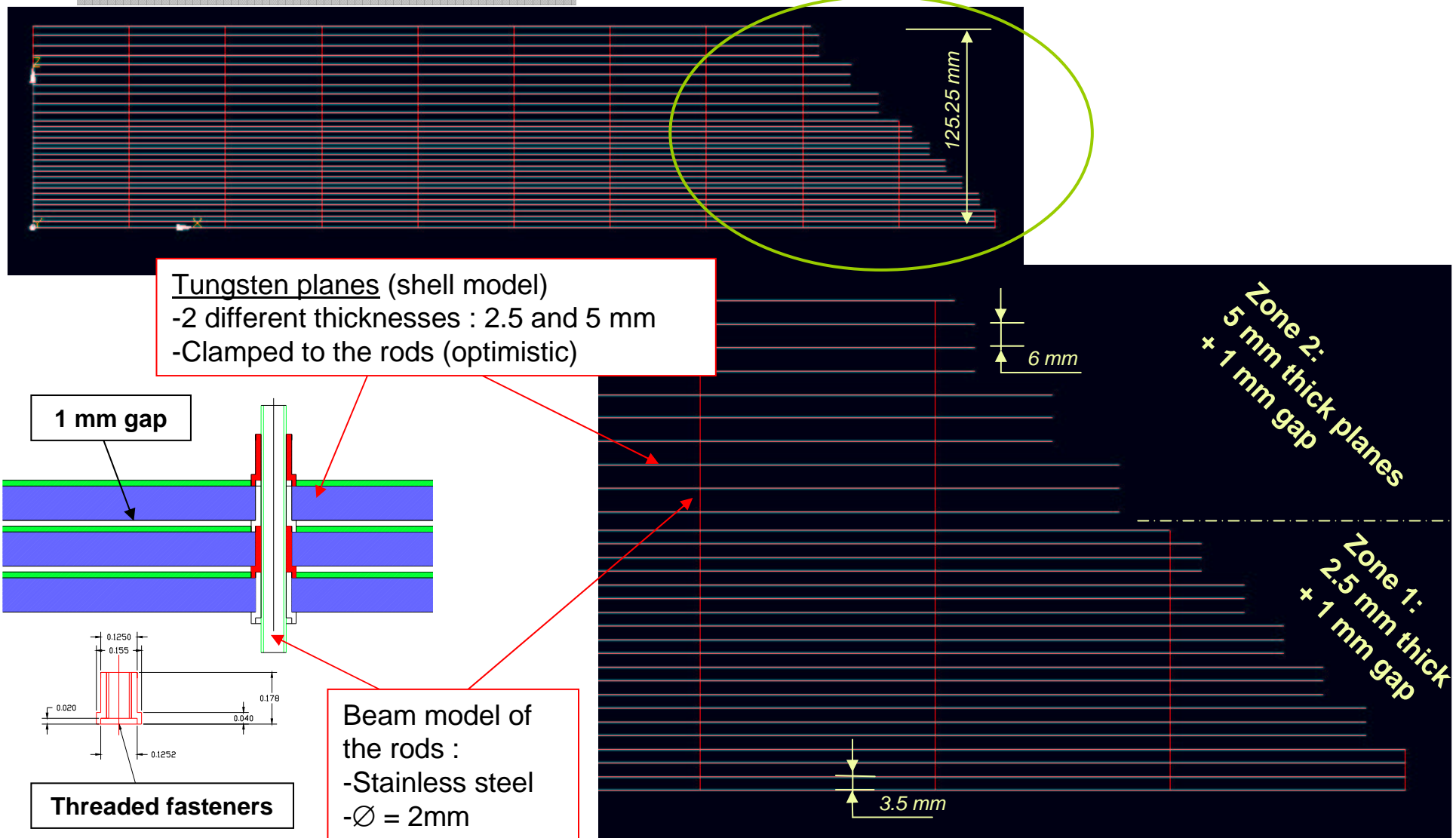
Top view of the CAD model  
(2 planes of symmetry)

Conditions of symmetry  
on planes (xoz) and (yoz)

# Preliminary results on SiD studies

## - Meshing -

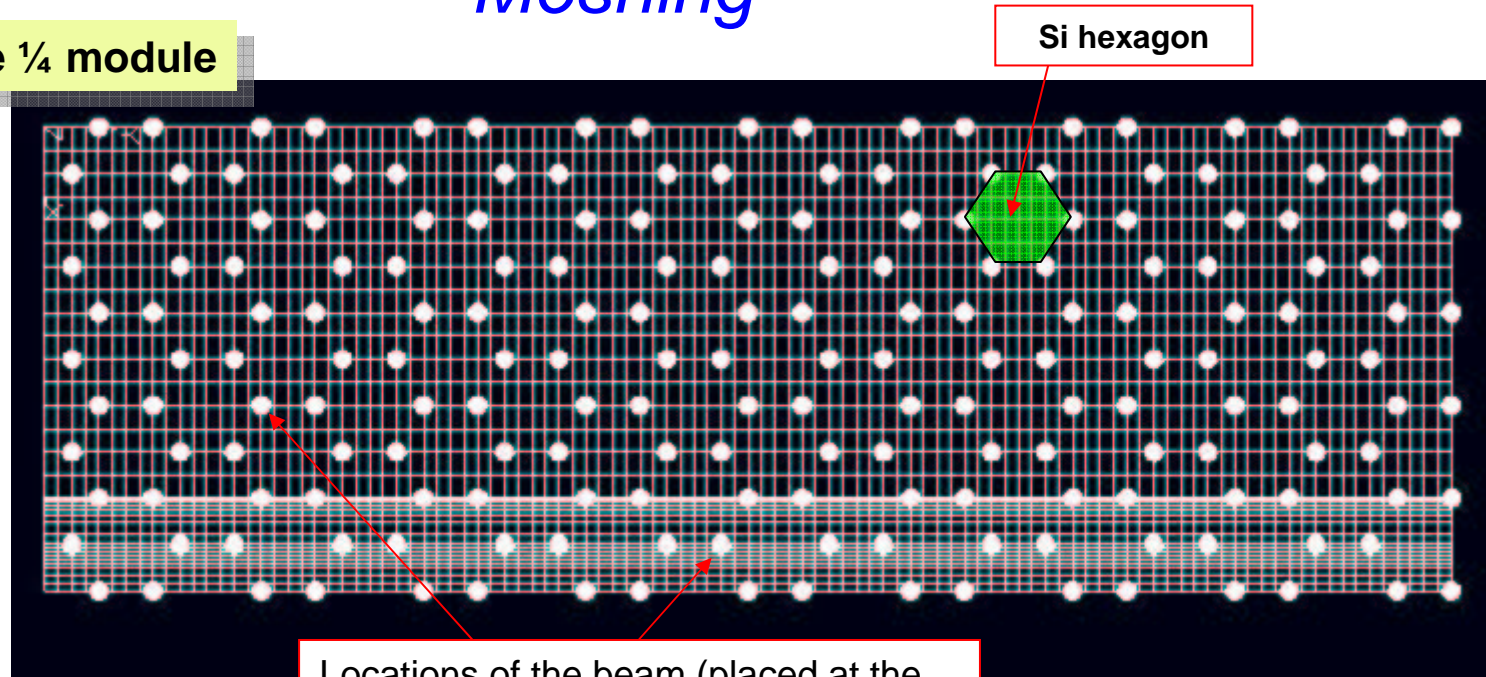
### Cross section of the 1/4 module



# Preliminary results on SiD studies

## - Meshing -

Top view on the  $\frac{1}{4}$  module

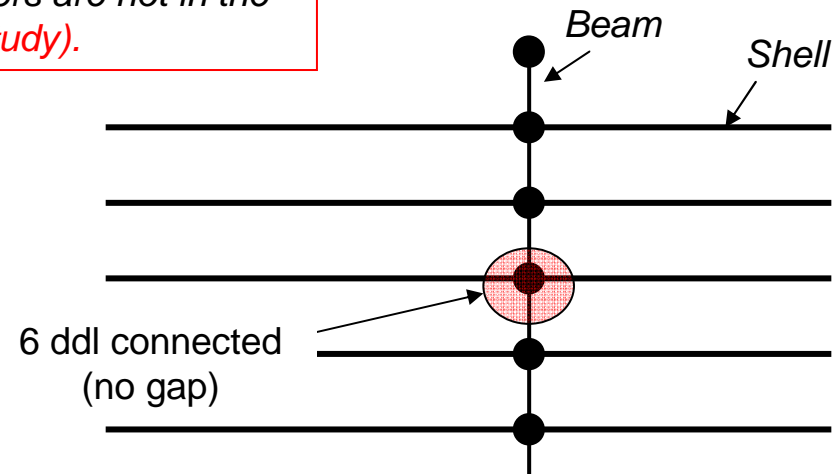
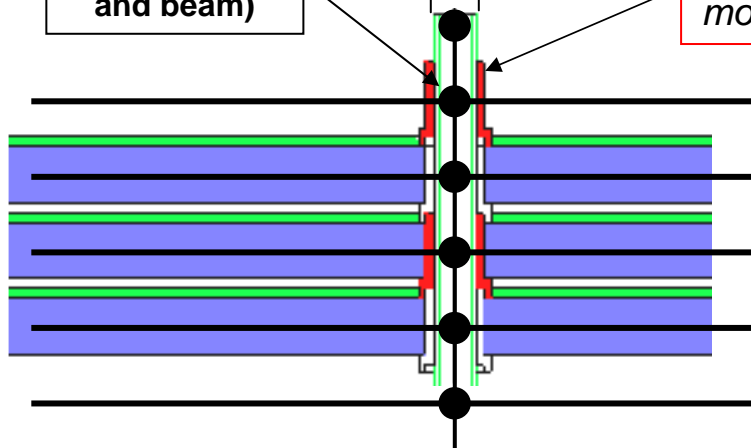


Si hexagon

Node  
(connection  
between shell  
and beam)

2 mm

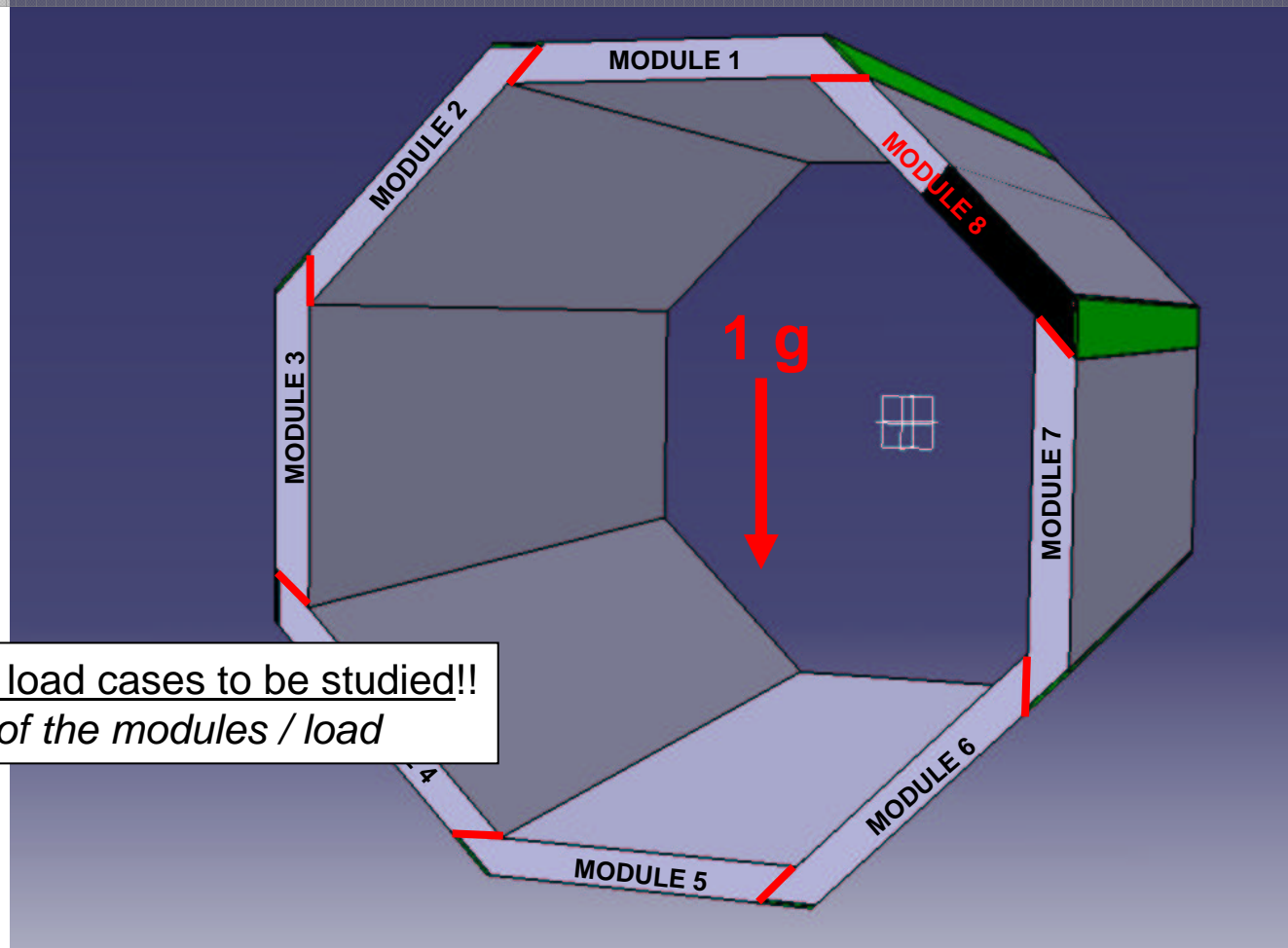
Locations of the beam (placed at the corners of the Si hexagons)  
*The threaded fasteners are not in the model (worst case study).*



# Preliminary results on SiD studies

## - *Boundary Conditions (BC's) and load cases* -

Barrel overview: *Location of the BC's (red lines/interfaces between modules)*

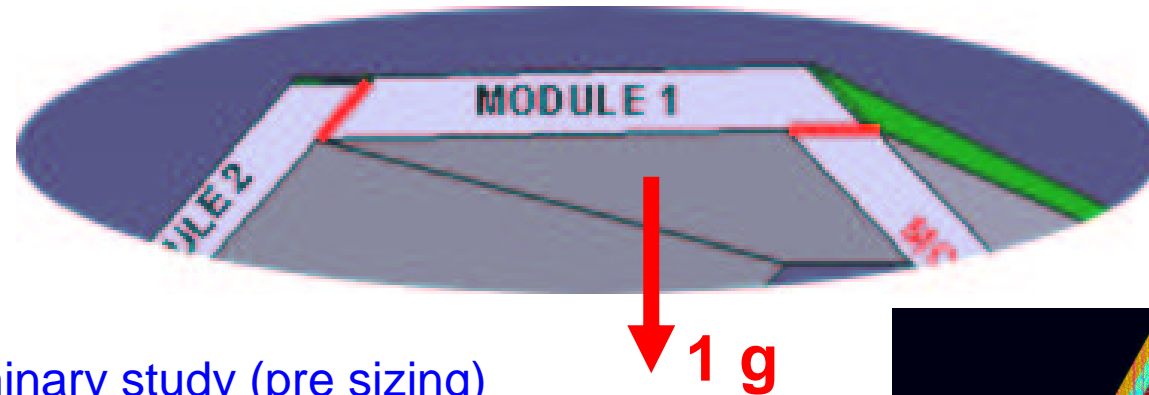


Finally... 8 load cases to be studied!!  
*"Rotation" of the modules / load*

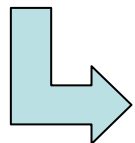
# Preliminary results on SiD studies

## - *Boundary Conditions (BC's) and load cases* -

### Description of the model ("zoom" on 1 module)

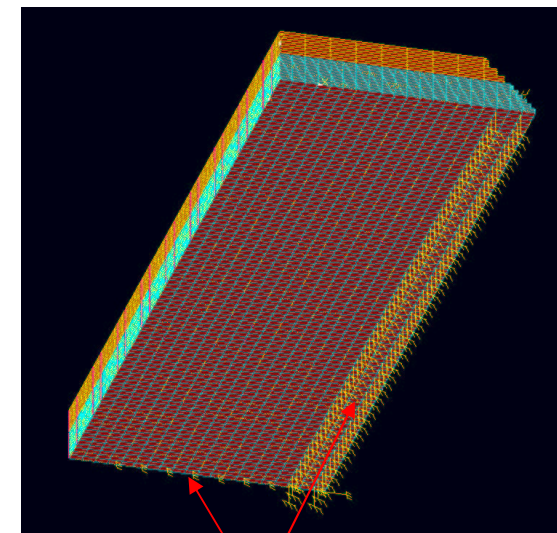


To start with a preliminary study (pre sizing)

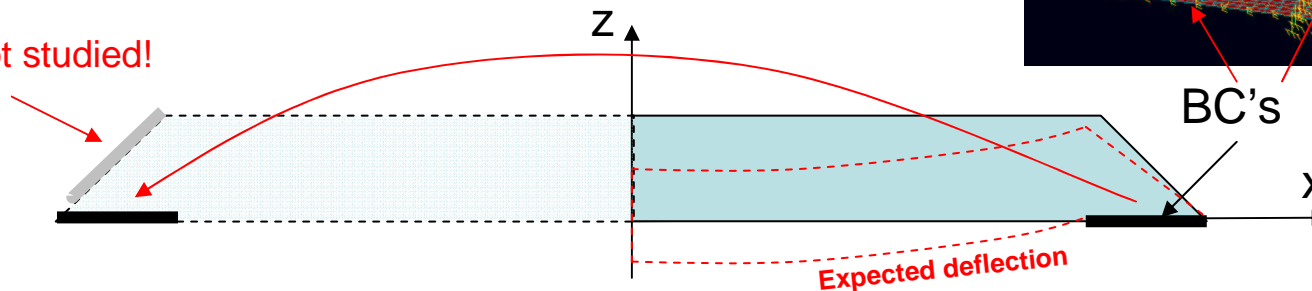


Assuming:

- Perfect interfaces between modules  $\Rightarrow$  no overall rotation (6 ddl blocked per BC node)
- Due to the symmetries:
  - BC's will be symmetrical (see below)
  - Only 2 load cases studied over the 8 (+z, and -z)



Configuration not studied!



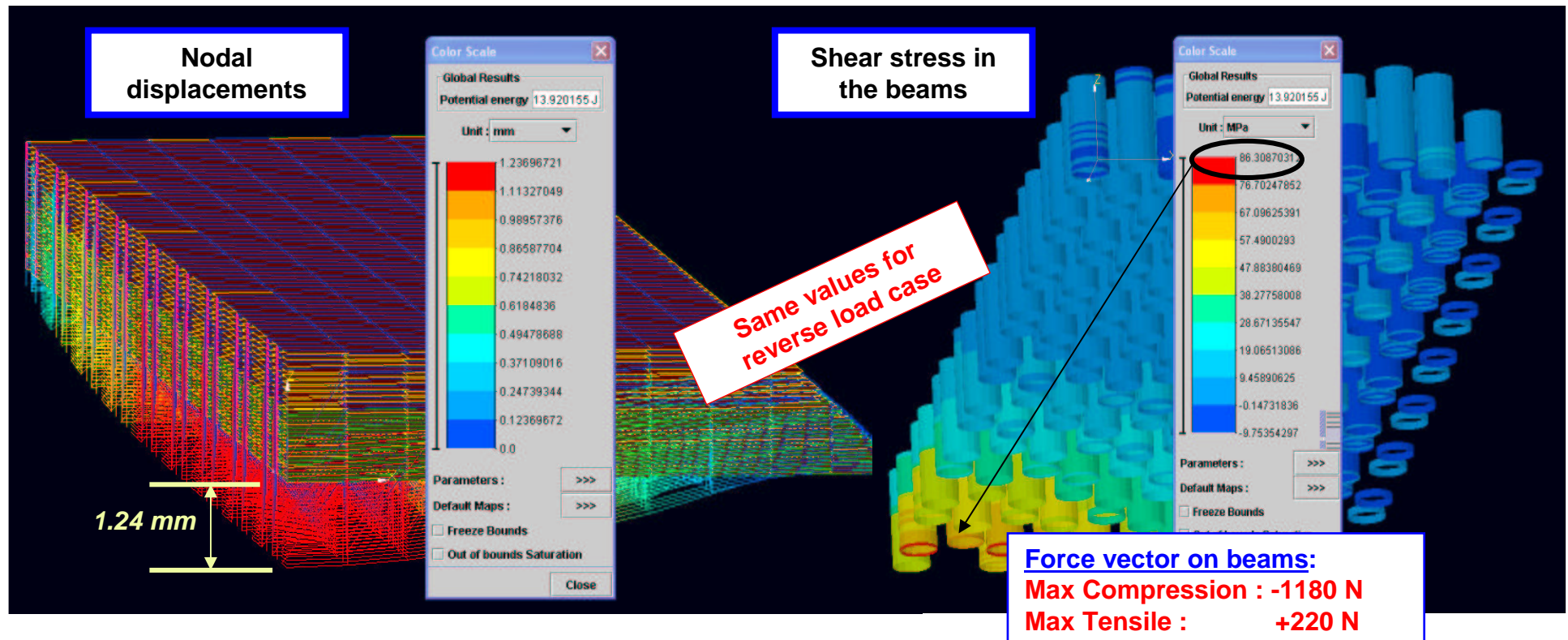
# Preliminary results on SiD studies

## - RESULTS -

### Deflection and stresses ...

Let's check :

- The central deflection
- Shearing and tensile Stresses in the beams
- "Von-Mises" stresses in the Tungsten plates



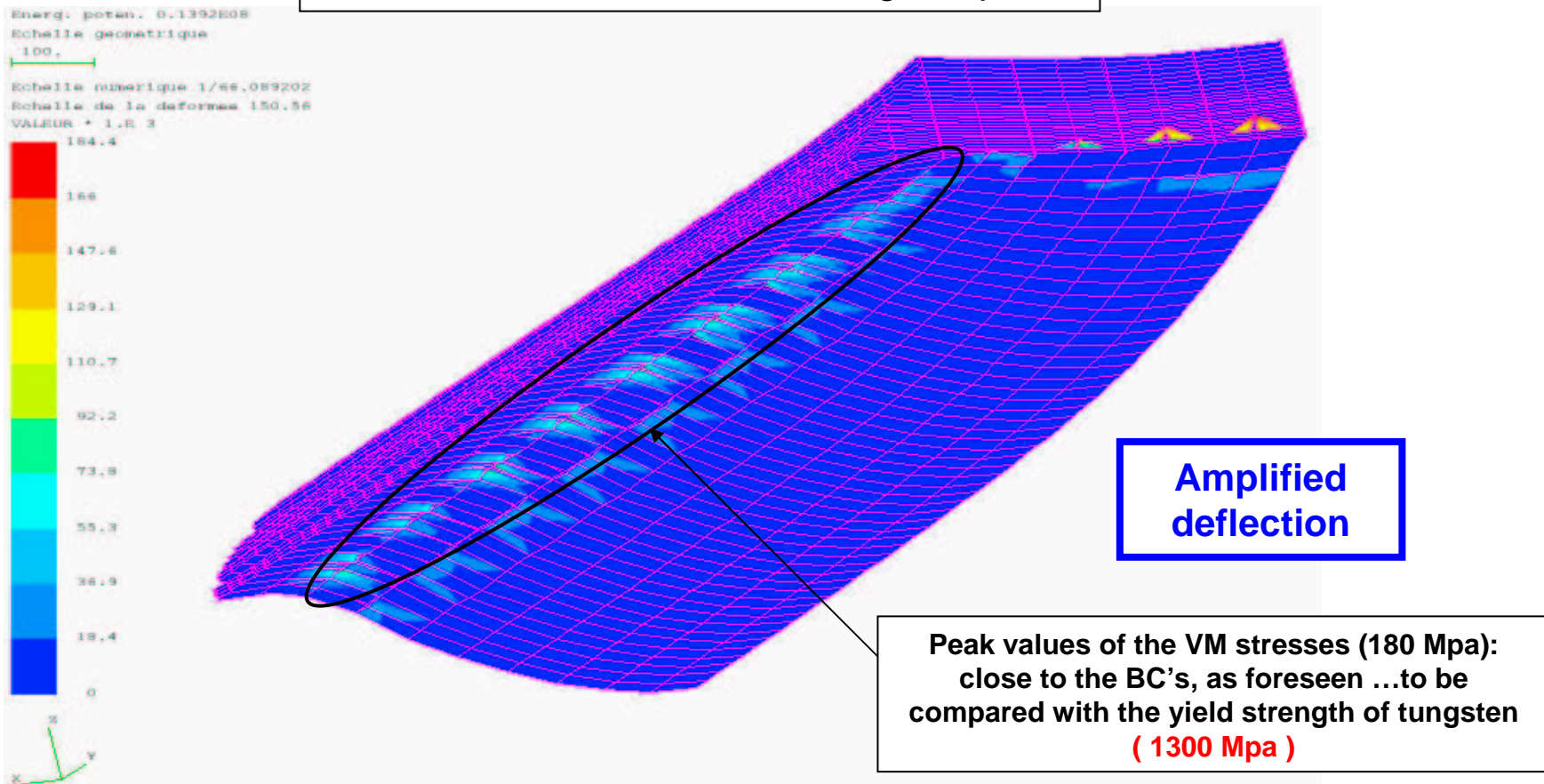
# Preliminary results on SiD studies

## - RESULTS -

### Deflection and stresses ...

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- *The central deflection*
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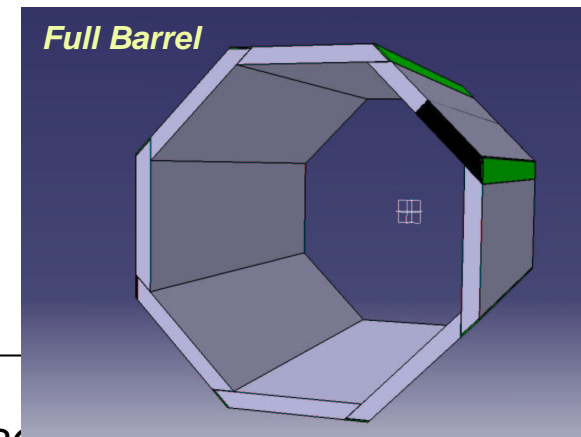
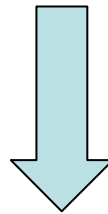
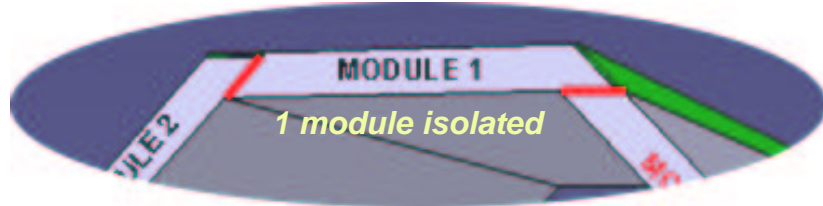


# Preliminary results on SiD studies

## - *First conclusions and perspectives* -

### Preliminary simulation :

- *Central deflection* (maximum) seems OK with respect to the length
- *Shearing and tensile Stresses* in the beams need to be carefully studied ...
- *The Von Mises stresses* (about 180 Mpa close to the BC's) of the Tungsten plates are well within the yield strength of this material ( $\sigma_e = 1300$  Mpa)



### Short-term perspectives :

- New calculation performed on a *½ module* (dissymmetry of the BC's)
- Finite Element Model of a *Full Barrel (8 modules)* to estimate the overall deflection, using “simplified” modules (material homogenization  $\Rightarrow$  equivalent rigidity).
- Work to be done on the joints between the Tungsten plates and the rods (to be more realistic)
- First idea of the “*Thermo Elastic*” behavior of the module (on ½ model)
- *Should we study an integrated ECAL-HCAL object ? (new Boundary Conditions ...)*