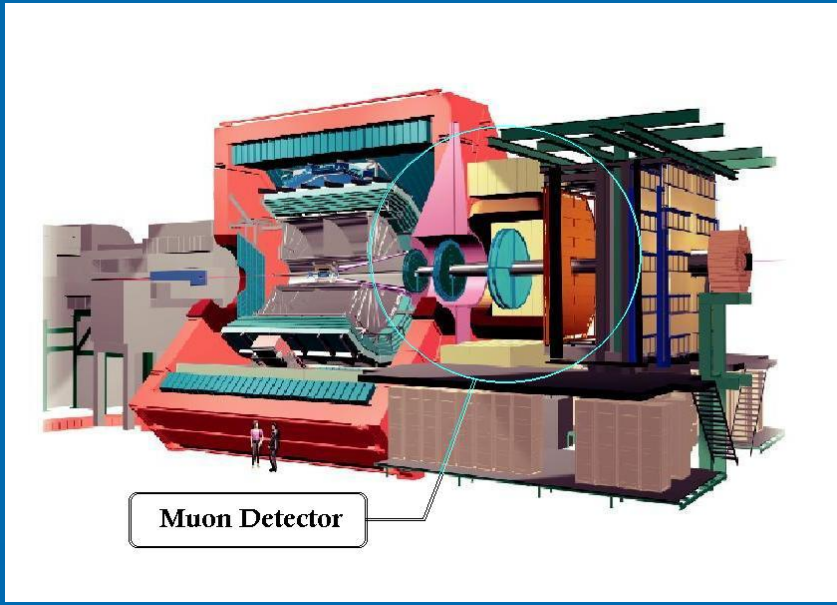
TS/CV/DC CFD Team



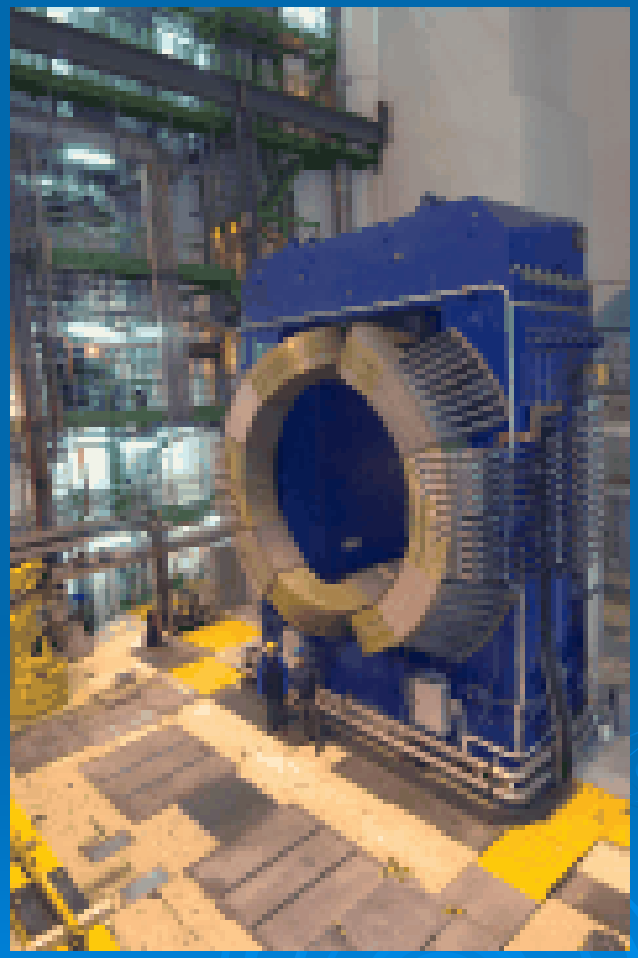
Temperature field on ALICE Muon Detector

Antonio Romanazzi

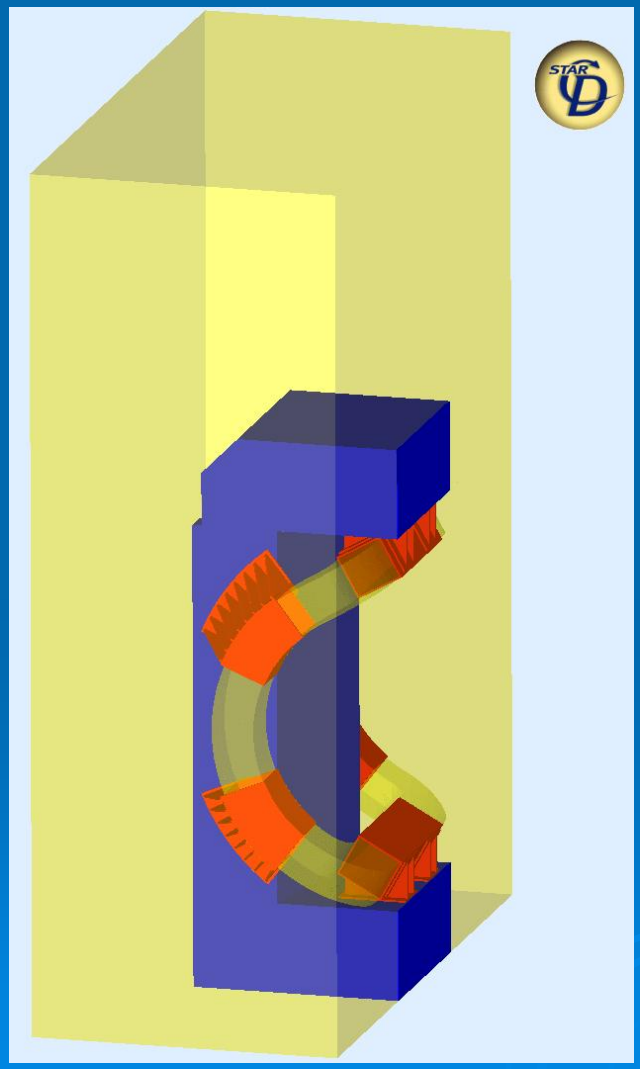
Physical Problem (Alice Moun Detector)

- Coil is powered by 3.64MW.
- A water cooling system is designed to evacuate the electrical power.
- Insulation of coil is not perfect therefore heat flux towards environment is inevitable.

The purpose of this study is to evaluate heat loss by convection, conduction and radiation from the coil through environmental air, yoke and supports of coil.



3D Model (Alice Moun Detector)

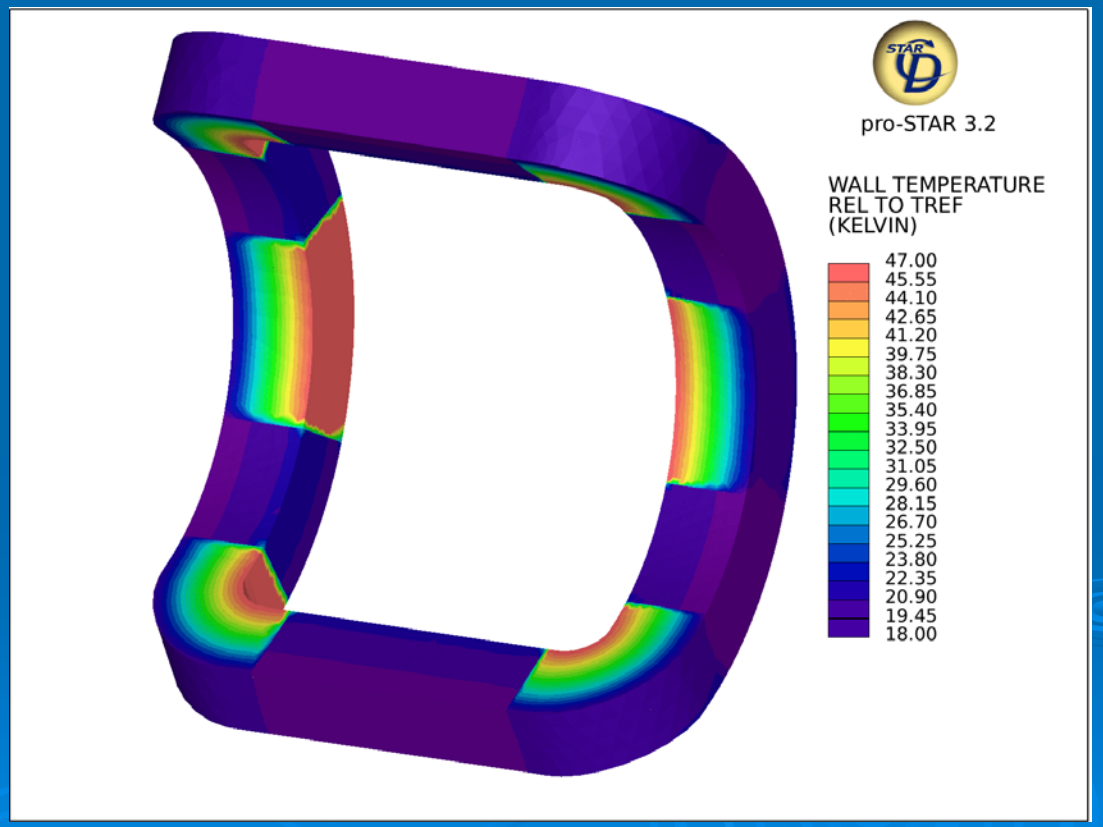


- Thanks to its symmetry property only half detector has been reproduced.
- Natural convection.
- Transient state calculation.
- Cells number ≈ 700˙000.
- Coil is modeled as empty volume.

Antonio Romanazzi

Boundaries (Alice Moun Detector)

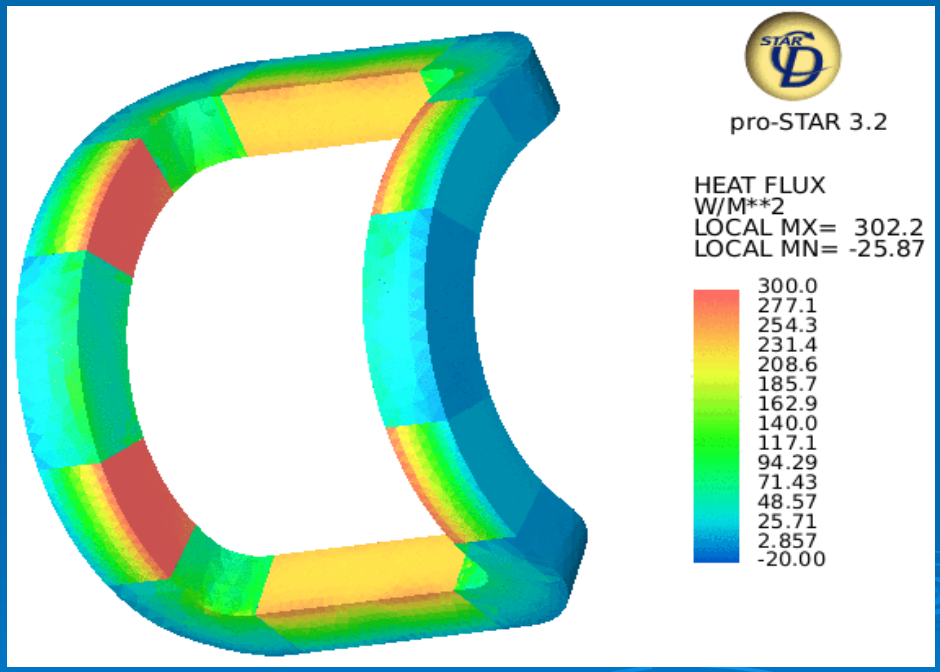
- Temperature and suitable heat resistance coefficients are imposed on coil surfaces to evaluate the heat transfer:
  - Temperature applied on coil's walls is the temperature of conductors.
  - Resistance takes in account the presence of epoxy layer and insulating rubber between coil and supports.



Results (Alice Moun Detector)

- Heat flux from the coil

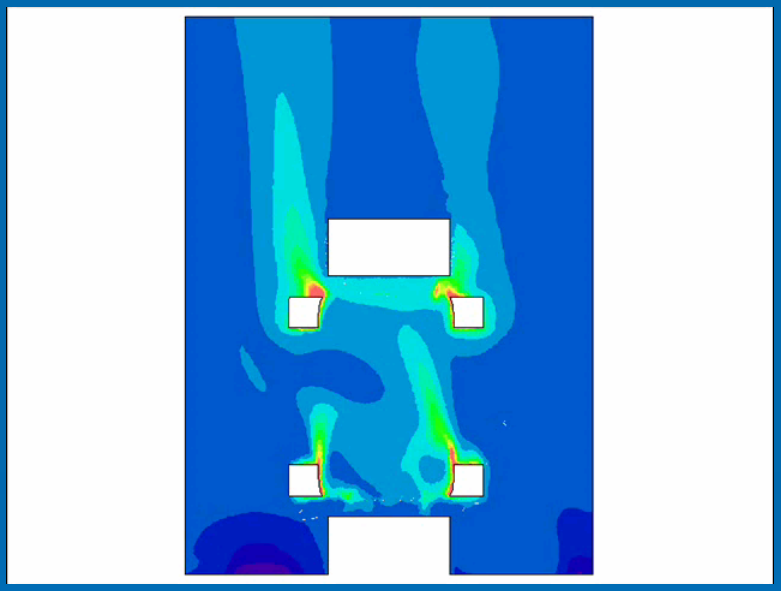
	from Coil
Convective heat flux (to air)	2.2 KW
Radiative heat flux (to air)	3 KW
Conductive heat flux (to solid)	7.6 KW



Results (Alice Moun Detector)

- Evaluation of thermal field in fluid.

Transient change of temperature on a cross section



- Temperature in “Station 3” is lower than expected, ventilation system and a further isolation on the coil could be reduced.

Antonio Romanazzi

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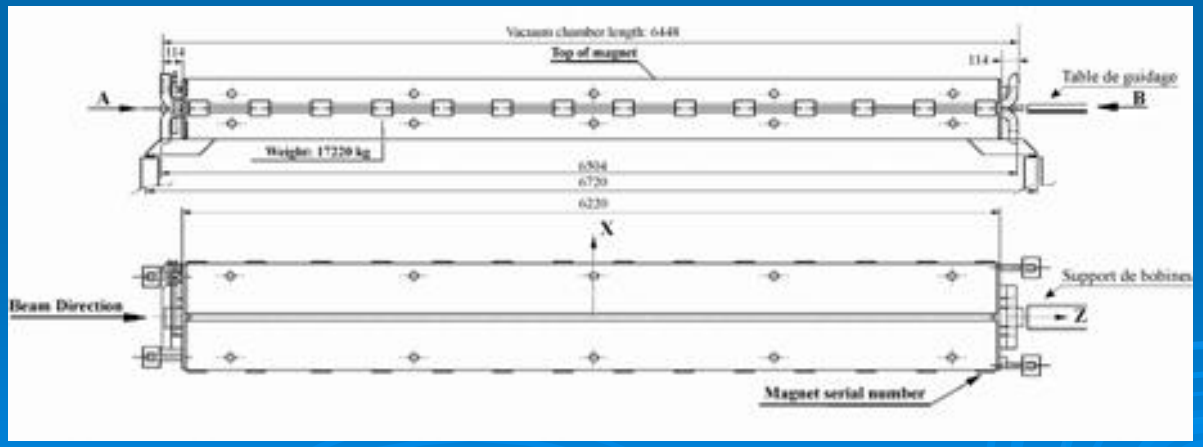
Losses in Air for MBB Magnet in SPS

Antonio Romanazzi

Physical Problem (MBB magnet: 2D and 3D study)

- A liquid cooling system is designed to evacuate the heat generate by Joule effect (42.3 KW) in the magnet
- Losses through the environment are inevitable.
- The aim of this study is to give an estimation of heat dissipated in the environment and in the cooling system .



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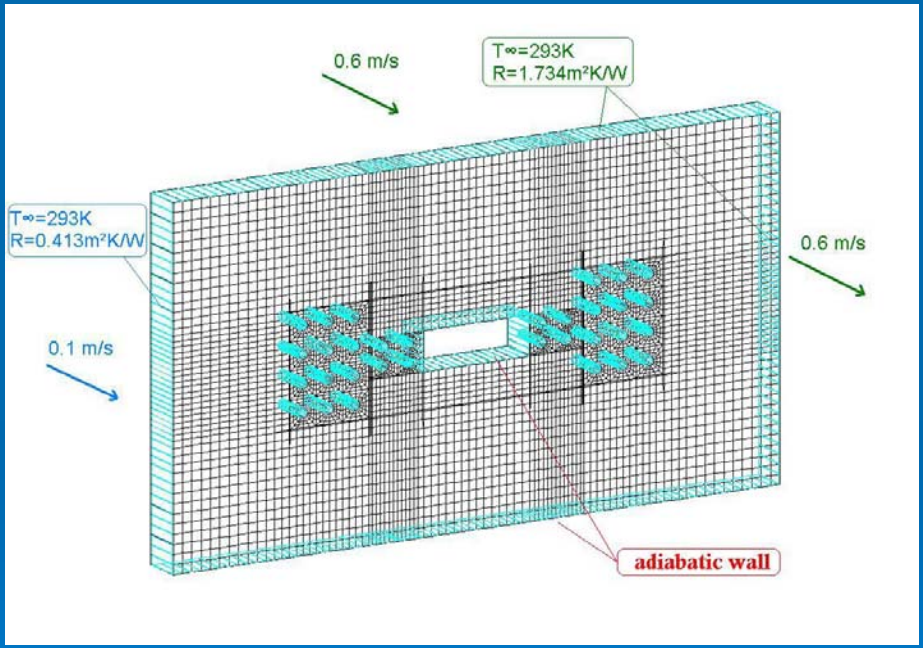
2D Model (MBB Magnet)



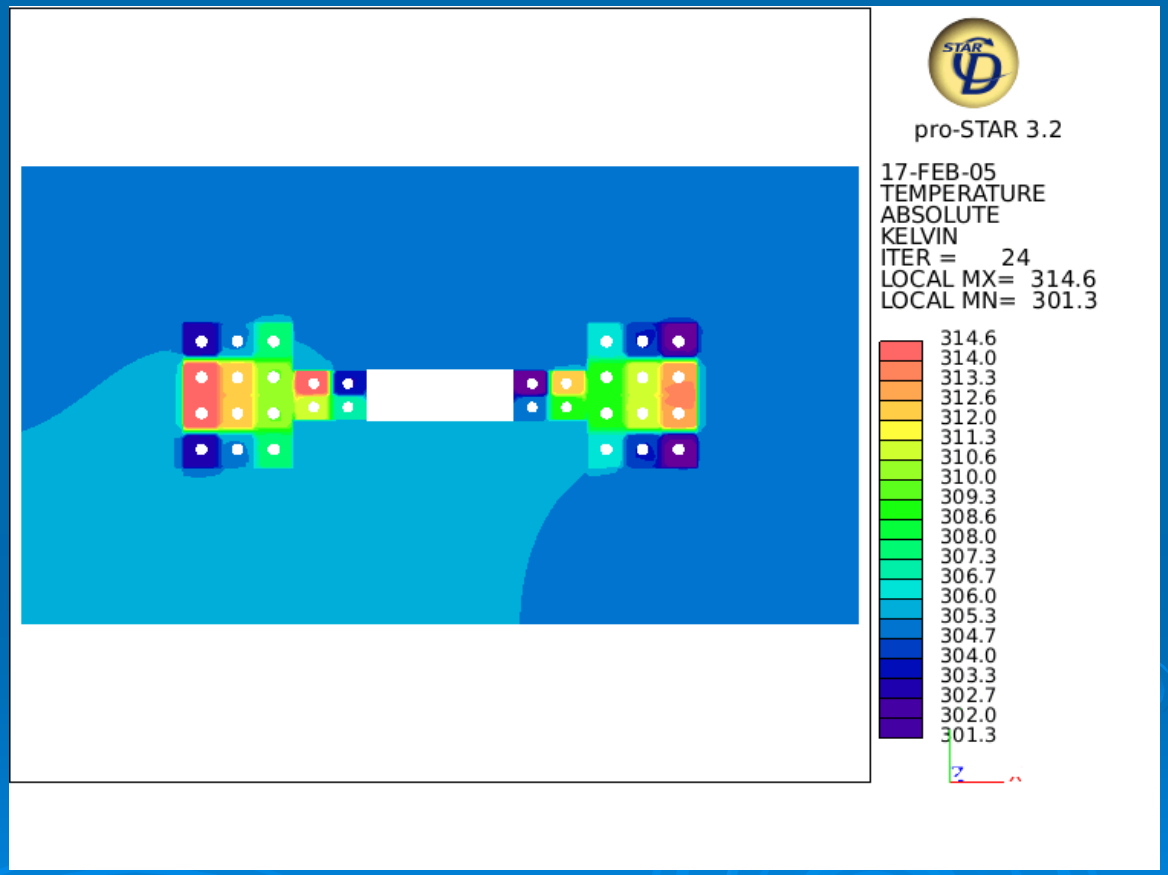
- The 2D model built represents a slice of the magnet in the middle cross section.
- Cooling water and environmental air are not modeled but represented by boundary condition.
- Temperatures for water are calculated assuming the behavior of fluid in the pipes linear (from 27° to 42°C).

Results (2D MBB magnet)

heat dissipated
in water **322 W**

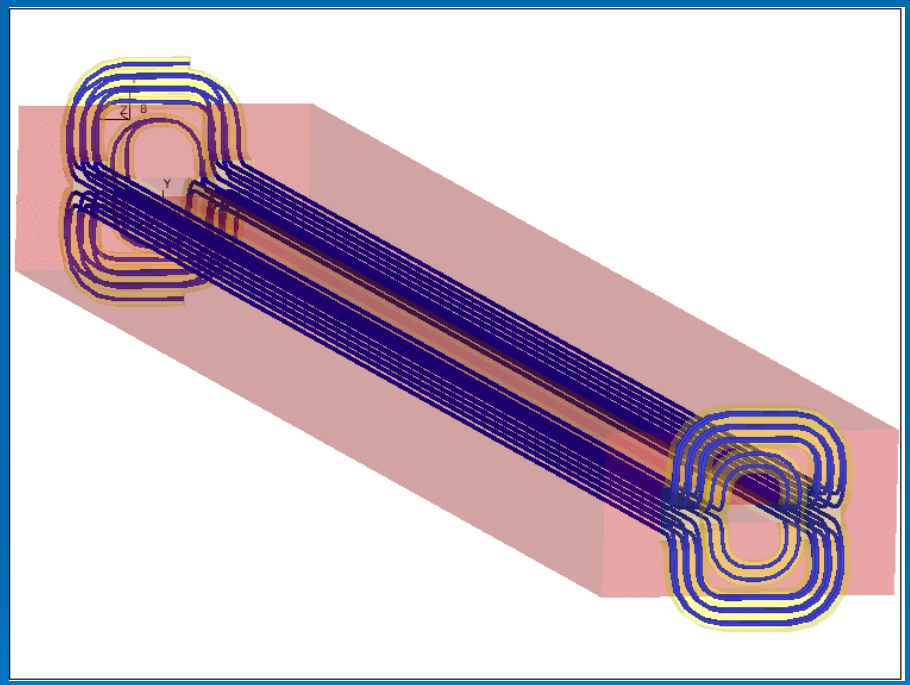
heat loss in air **2 W**

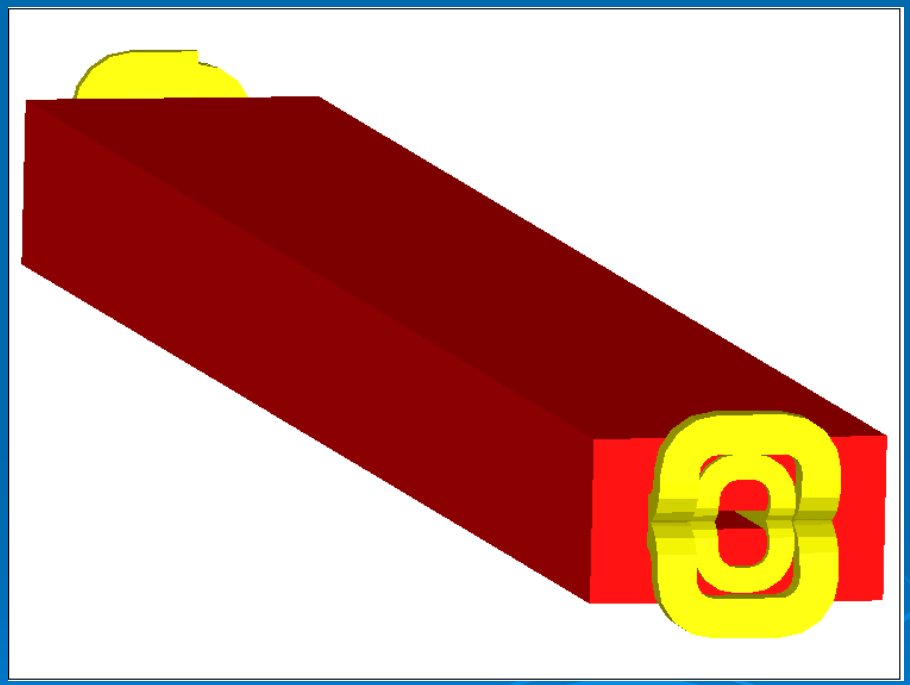
losses in air are the **6.5%**
of total heat generated



3D Model (MBB magnet)

The water in the cooling system is modeled to calculate the heat exchange between different loop of cooling system pipes.





The calculation is running and results are expected in the next days.

Antonio Romanazzi