Analysis and testing of a cooling layout for the new High Granularity Calorimeter (HGCAL) for the CMS detector

FCT Trainee: **GOMES, Ricardo**
Aerospace Engineer
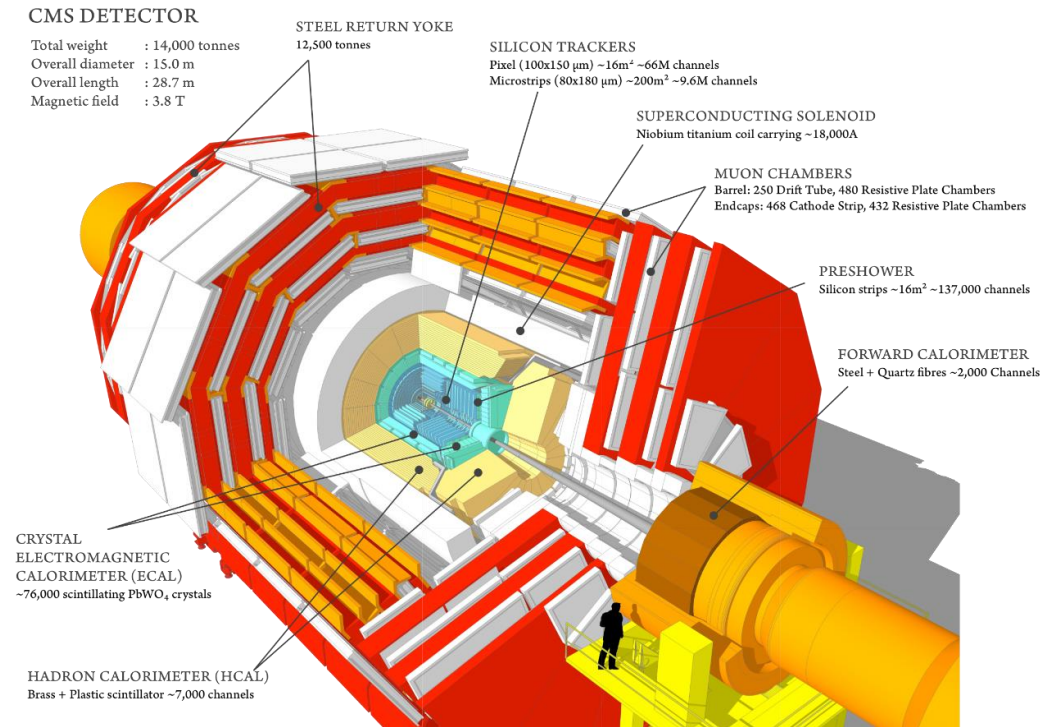**Starting date at CERN: 01/10/2018**
(now starting the second year)
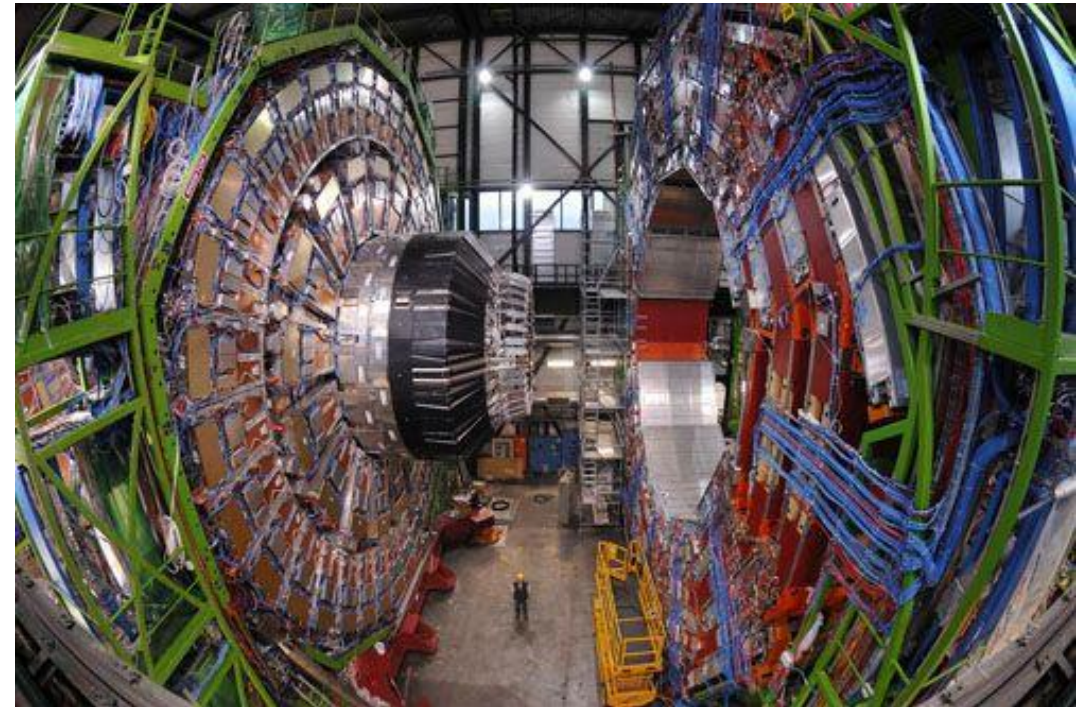
Supervisor: **MOCCIA, Stefano**

EP-CMX-EI

Context

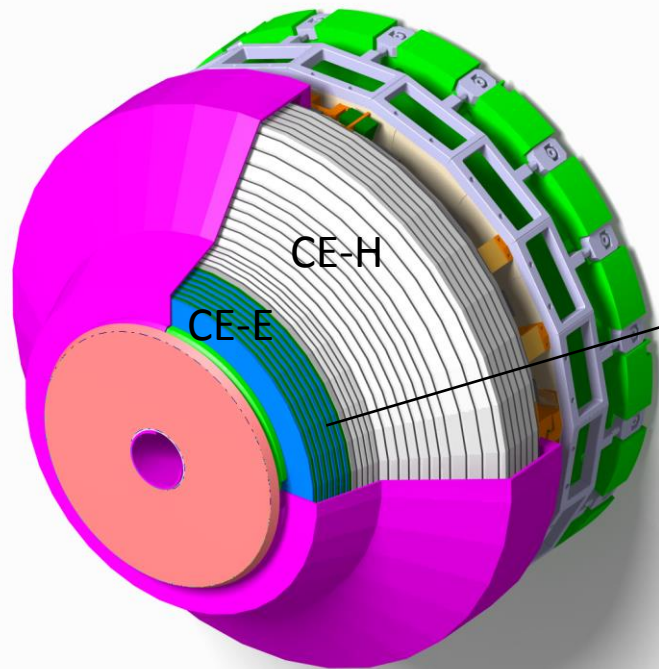## *What is the CMS?*

CMS detector – 3D model

CMS detector – cavern photo

CMS is one of the main experiments at CERN. For the High Luminosity operation of the LHC, CMS will replace the endcap calorimeters with a new High Granularity Calorimeter.
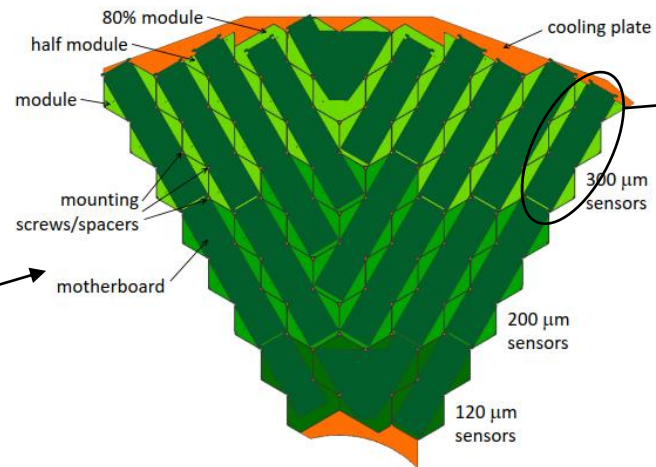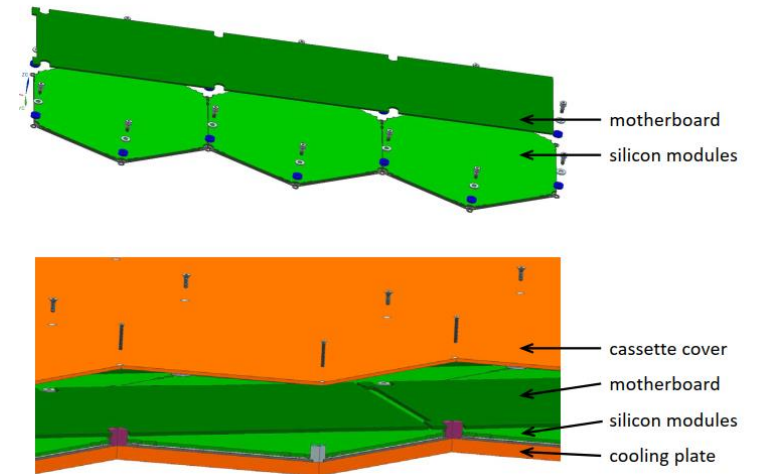
Context

High Granularity Calorimeter

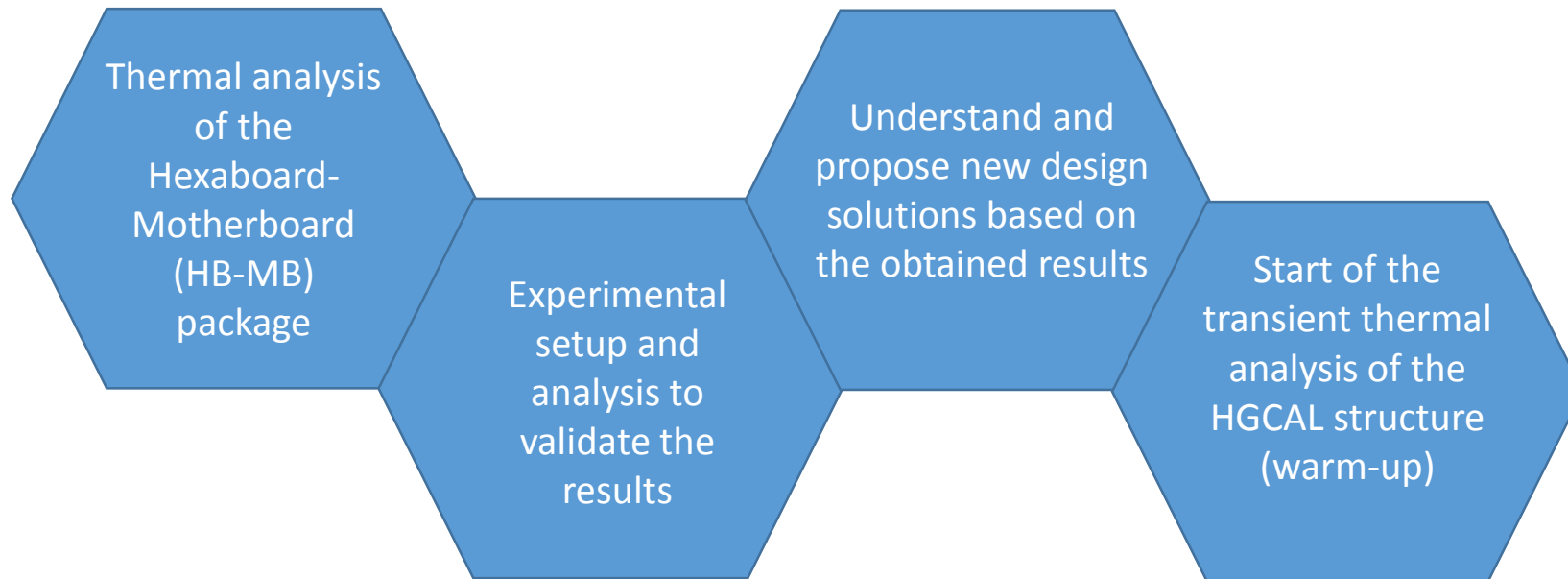HGCAL 3D Model

HGCAL 3D Model

HGCAL 3D Model

The HGCAL is divided into two main regions the CE-E (electromagnetic calorimeter) and CE-H (hadronic calorimeter).

Each one of these sections are composed by a significant number of disks – cassettes, composed by several electronic devises – e.g. Hexaboard-Motherboard package.
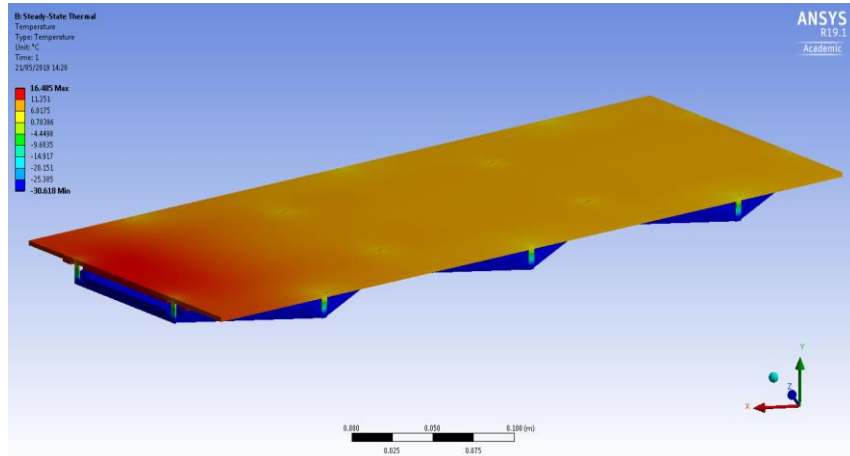
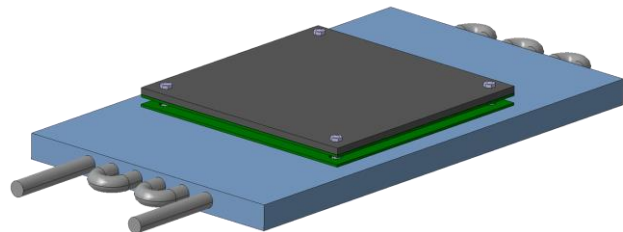# Internship objectives (1st year)
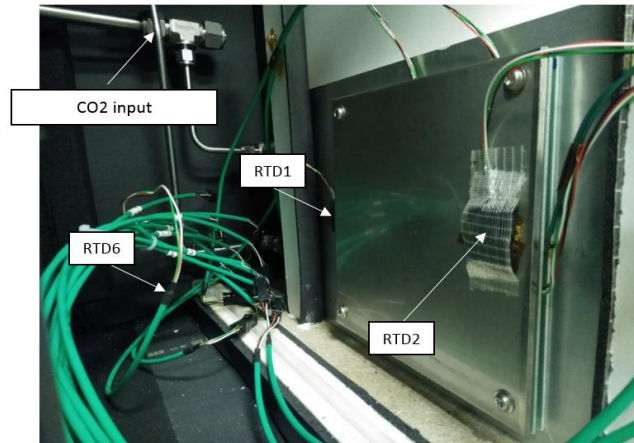
Internship objectives (2nd year)
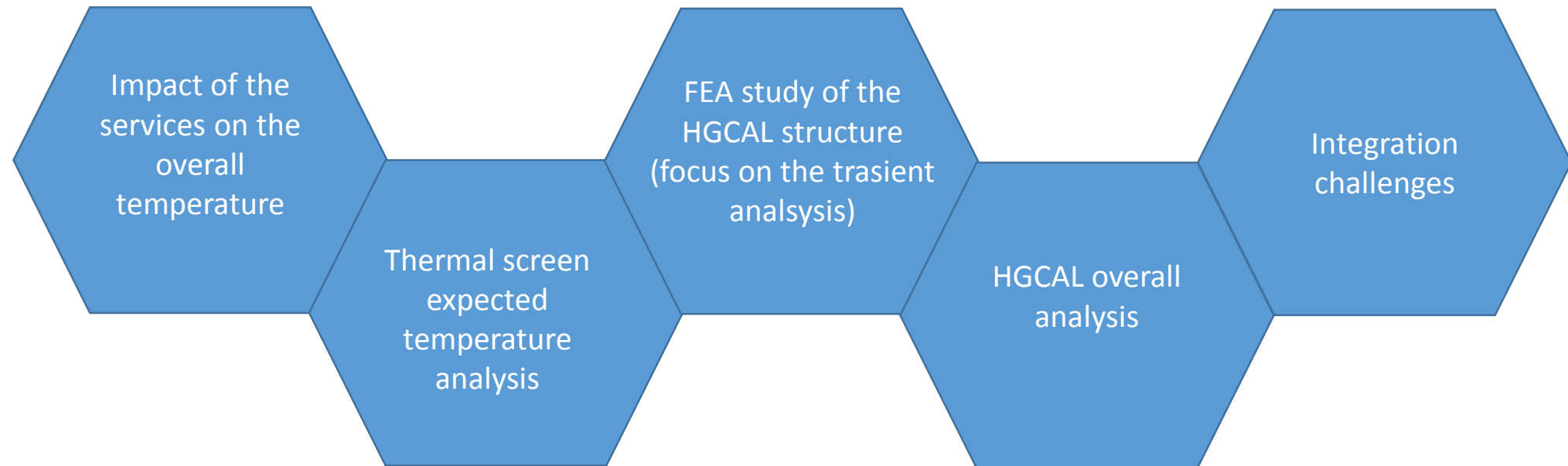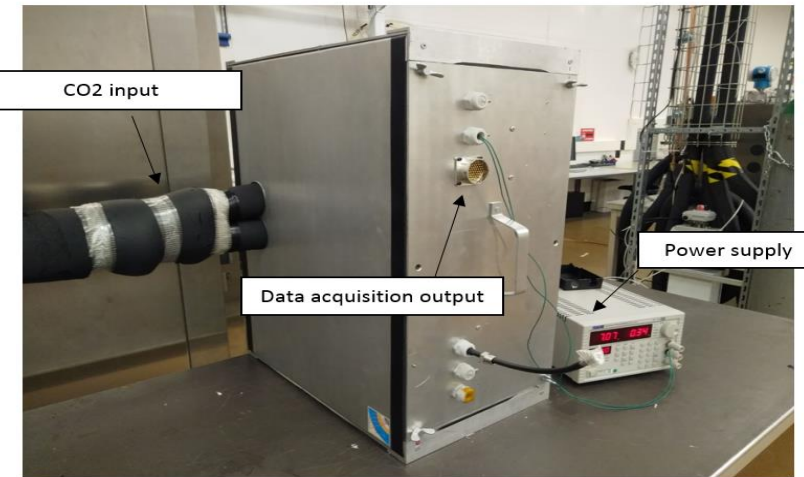
Experience/Personal development

FEA of the Hexaboard-Motherboard package.
Increased my FEM knowlegde on heat transfer mechanisms.

Mock-up simplified model of the HB-MB package.
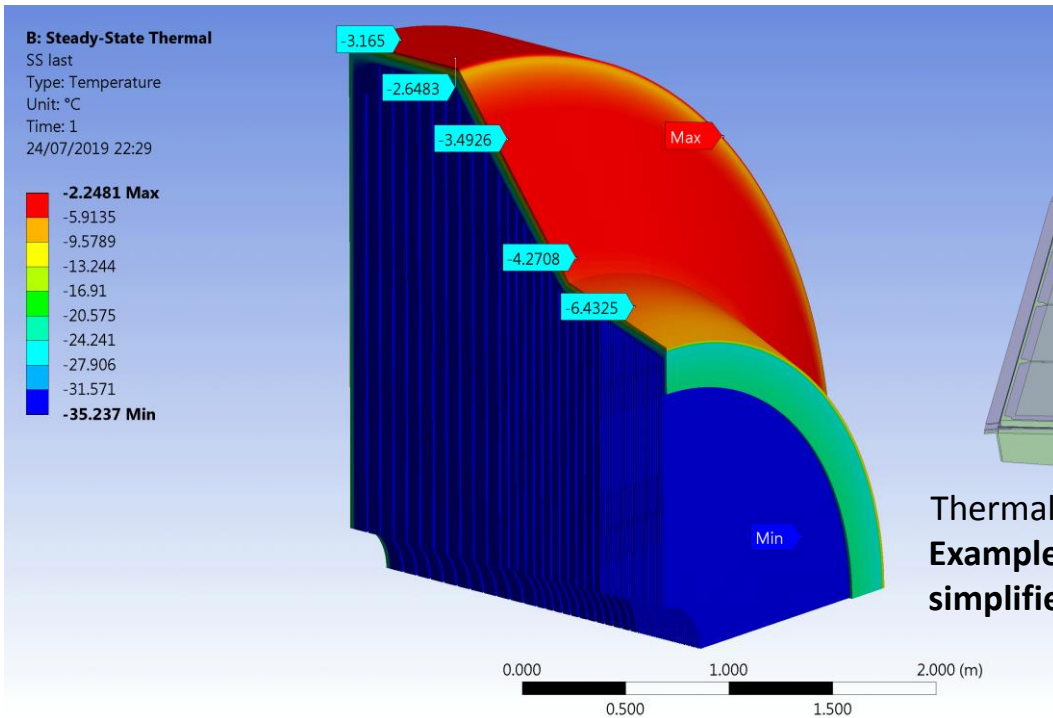**Enabled me to simplify the problem in order to validate the assumptions that were made.**

Mock-up inside the cooling chamber.
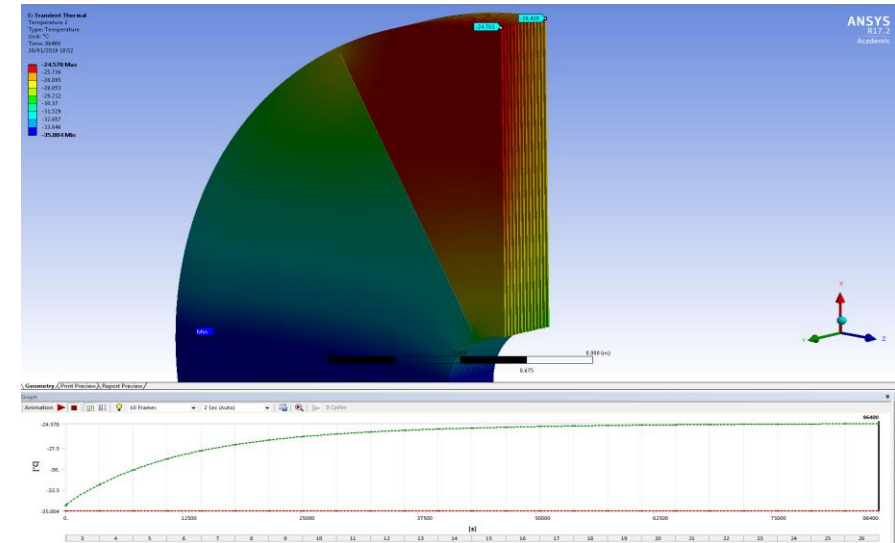**Increased my awareness in how to construct a simplified mock-up model.**

Experimental setup.
Increased my knowledge on LabView and experimental data aquisition systems and analysis.

Experience/Personal development

Thermal Screen + Gap for services Model.
**Example of a model designed and simplified in CATIA.**

CE-E transient analsysis neglecting the other components of the HGCAL (warm-up).
Increased my knowledge on how to perform a transient thermal FEA.

HGCAL simplified thermal model w/ heaters on thermal screen off.
Increased my ANSYS knowledge for bigger and more complex models.

Training courses (1st year)

- French course (January);
- CATIA course (January);
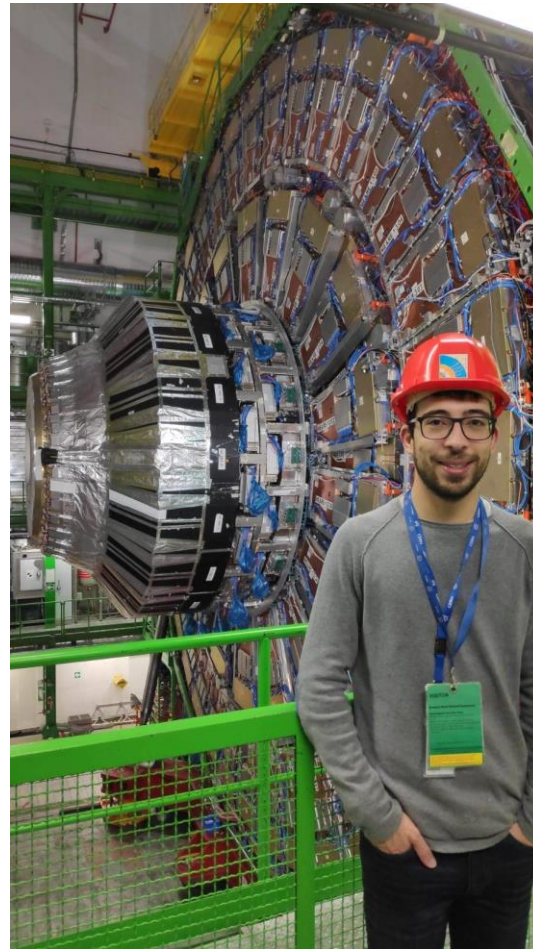
CMS visitor (May 2019)

As curiosity: CMS guide since June