

SG3

Engineering at CERN



Carolina, Harrison, Tibi, Vivian, Dilmurod



ONE
WEEK
LATER...



Mechanical/Materials engineer

Design, Simulations and Measurements

(advanced calculations, analyses and numerical simulations to evaluate and improve the components' behaviour in the extreme conditions of the CERN machines: cryogenic or extremely high temperatures, high radiation, intense magnetic fields or vacuum).

Material science

(develop, select, quality control and analyse of materials such as metals and their alloys, ceramics or thin films, including destructive, non-destructive and dimensional examinations of materials and components. .

<https://en.web.cern.ch/group/mme>



An electric engineer...power management team



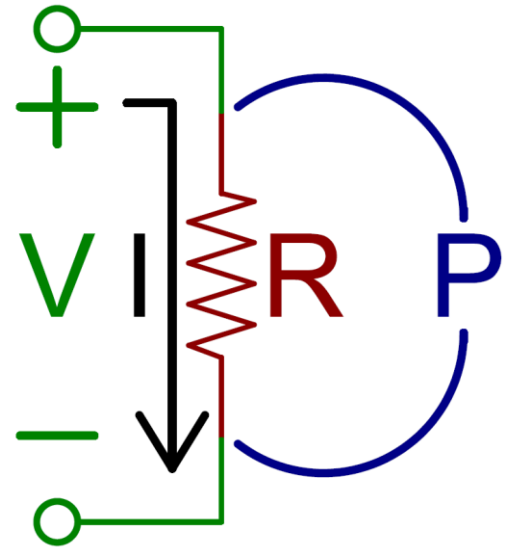
-design, wire, ensure transmission, distribution of power from the power grid, from 400kV to 230/400V.
CERN use about 200 kW at its peak.

-high electric current is needed for generating high magnetic fields



An electric engineer...power management team

- also, the fibre optic network, projections for upgrades, relations with electricity suppliers, standard racks for accelerators and all experiments
- furthermore, maintenance and tools of electric equipment, cables, computer-aided design tools



WORKING CONDITIONS

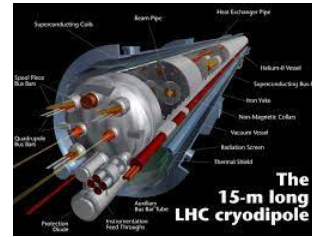


1. Make it work → electrical engineering

- Transmission from the net, distribution and independency
- In LHC it is used $\frac{1}{3}$ of whole city needs

2. Guide the particles → material engineering

- Super Magnets
- Superconductors



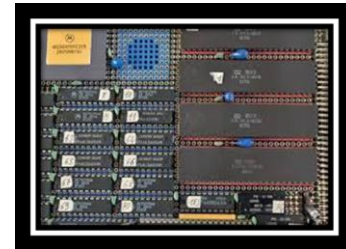
3. Beam Pipe → fluid dynamics engineering

- More vacuum than in outer space!
- Low temperatures → cryogenics



4. Overall Control → electronics engineering

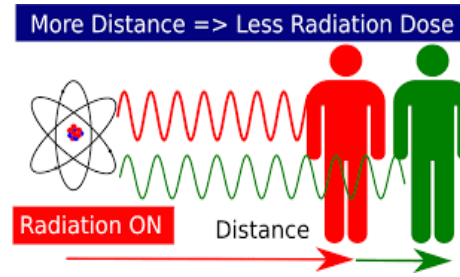
- All devices electronically controlled
- Data management



WHERE SHOULD WE BUILD(GEOGRAPHICALLY) THE LHC?

Safe, non-destructive for humans and nature

The place, with low seismic activity, solid rocks, rivers, lake



THE LARGE HADRON COLLIDER OF CERN





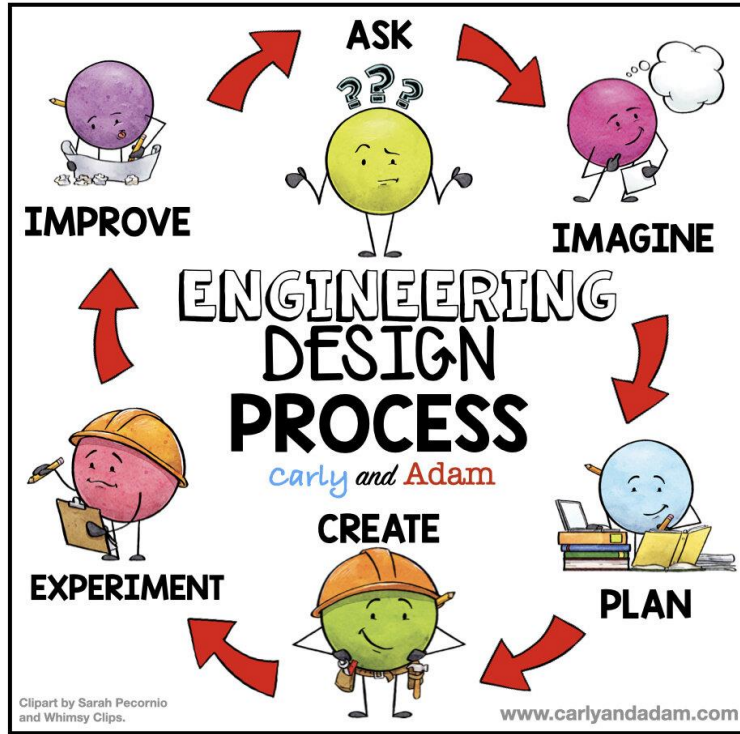
A) To what extent is the topic featured in your curriculum?

- Optional modules at A-Level
- Overall, engineering is not widely covered, and is instead called a 'science project'





B) Which students' conceptions about the topic do you know?



- Engineering design process (define problem, ask, imagine, plan, prototype, test, improve)
- Students know about engineering as we are surrounded by some prestigious engineering universities, but they aim more for aeronautics and computers, not very much about particle physics engineering.
- Some students think engineering is 'low skilled', such as a plumber

C) What is your experience with teaching the topic in your classroom?



- Engineering is an optional topic in the IB Diploma programme curriculum. Students learn core concepts about rigid bodies, rotational dynamics, torque, moment of inertia, angular acceleration, thermodynamics.
- Also, some simple laboratory experiments.
- In addition, in the HL, fluids and fluids dynamics, Stokes law, viscosity, vibrations and damped oscillations.

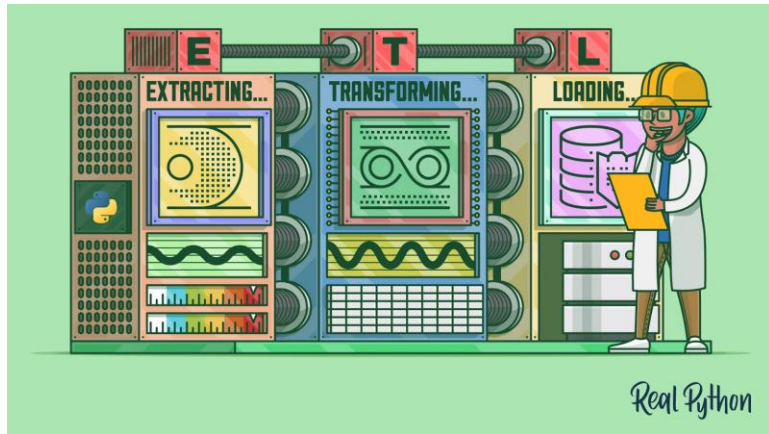
D) Which words and phrases can cause difficulties and misunderstandings?

- The broad names of different types of engineering such as civil, mechanical and electrical can cause difficulties, as students are unfamiliar of what these mean



E) Which aspects of the topic do you consider challenging to teach to students?

- Civil engineering. Because, this type of engineering consists of building accelerators, detectors and etc.

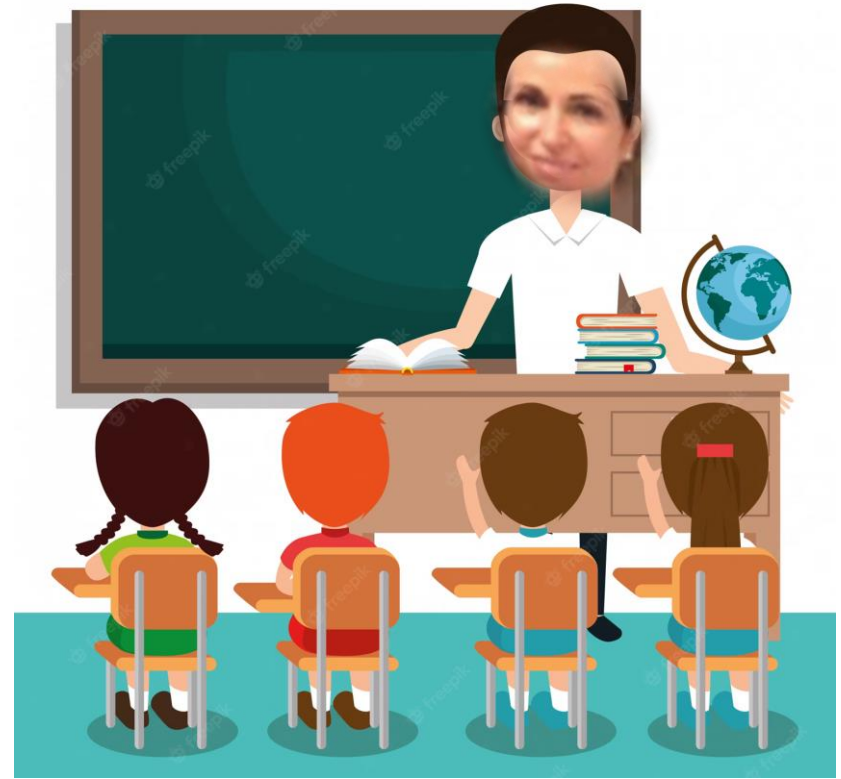


- Data analysis engineering



F) Which aspects of the topic do you think can be appropriately introduced in the classroom?

- What engineers do
- All types of engineering at CERN
- Robotics



Thank you for attention



First observation of a new particle in the Standard Model
at the LHC

