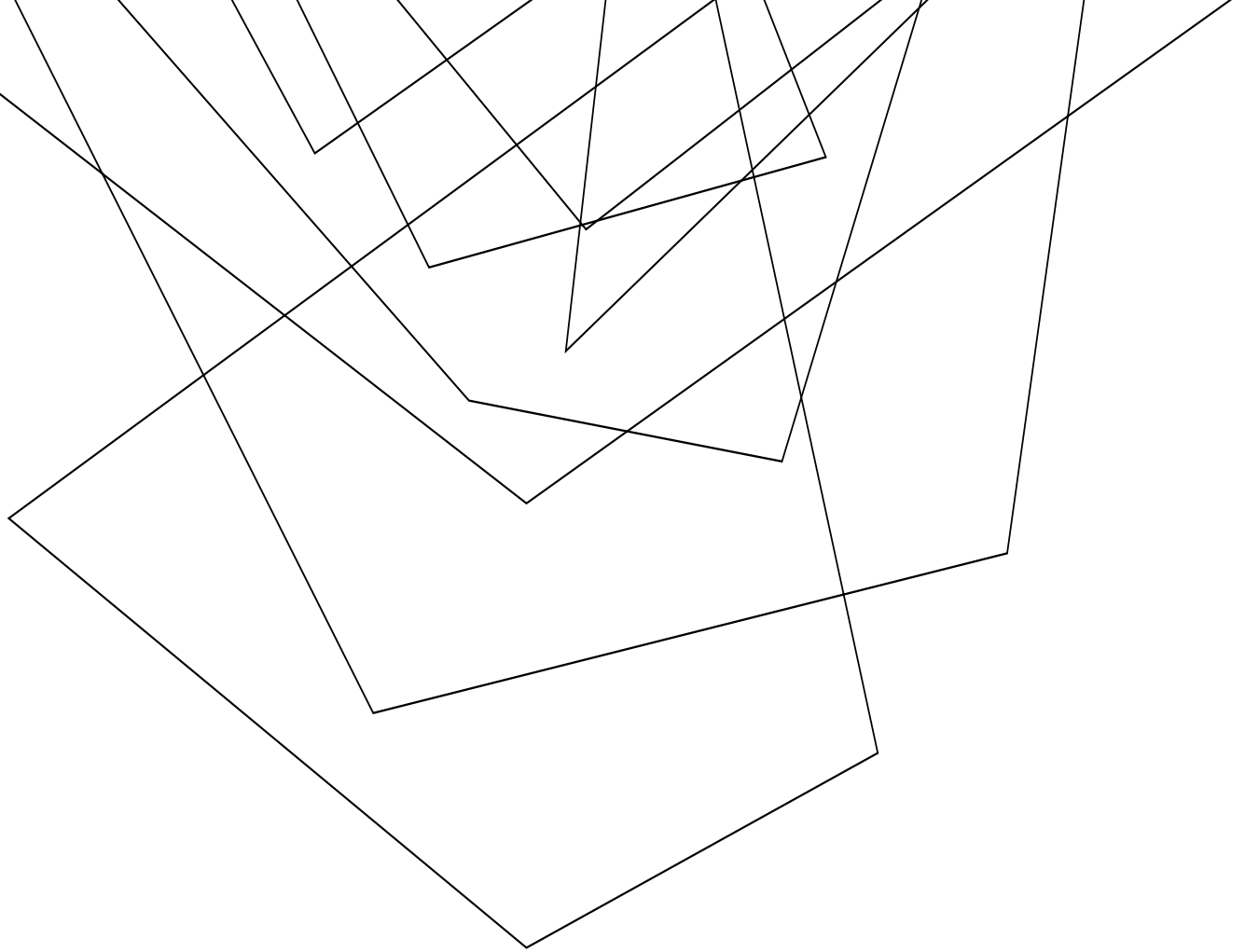
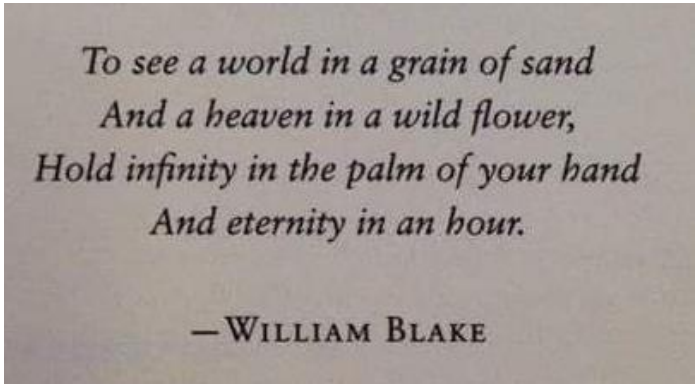


#ITW2023

GROUP 2 – PARTICLE DETECTORS

Antónia Juhásová, Feng Su, Francisco De Assis Leite Da Silva, Michael Madden, Regina Salmasan

CURRICULUM & CLASSROOM CONNECTIONS



"Men are not taught to be honest men, and they are taught everything else"

- Blaise Pascal

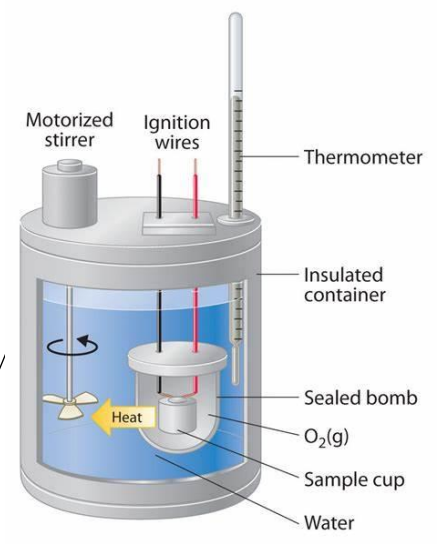
CURRICULUM & CLASSROOM CONNECTIONS

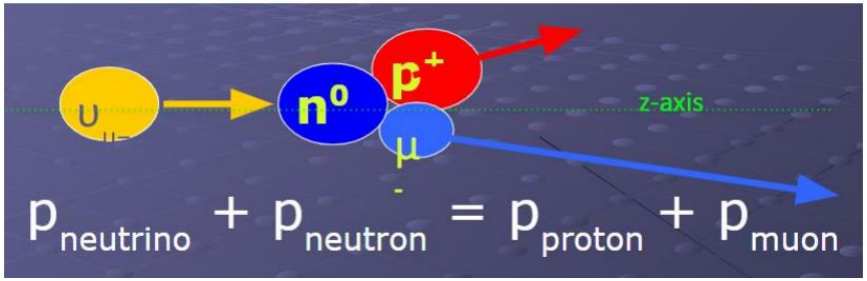
- **Not in any of our curricula**: National curricula have not **yet** incorporated new scientific discoveries.
- **Goal is to increases science literacy for our students**
- **Importance of CERN as an international organization**
- **Everyone, working together, working collaboratively for the good of humanity, is the greatest power of Science and Scientific Research.**

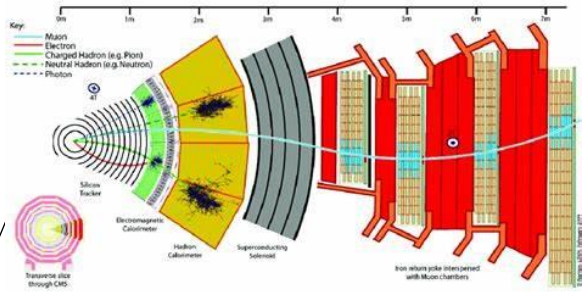
https://unesdoc.unesco.org/ark:/48223/pf0000243278

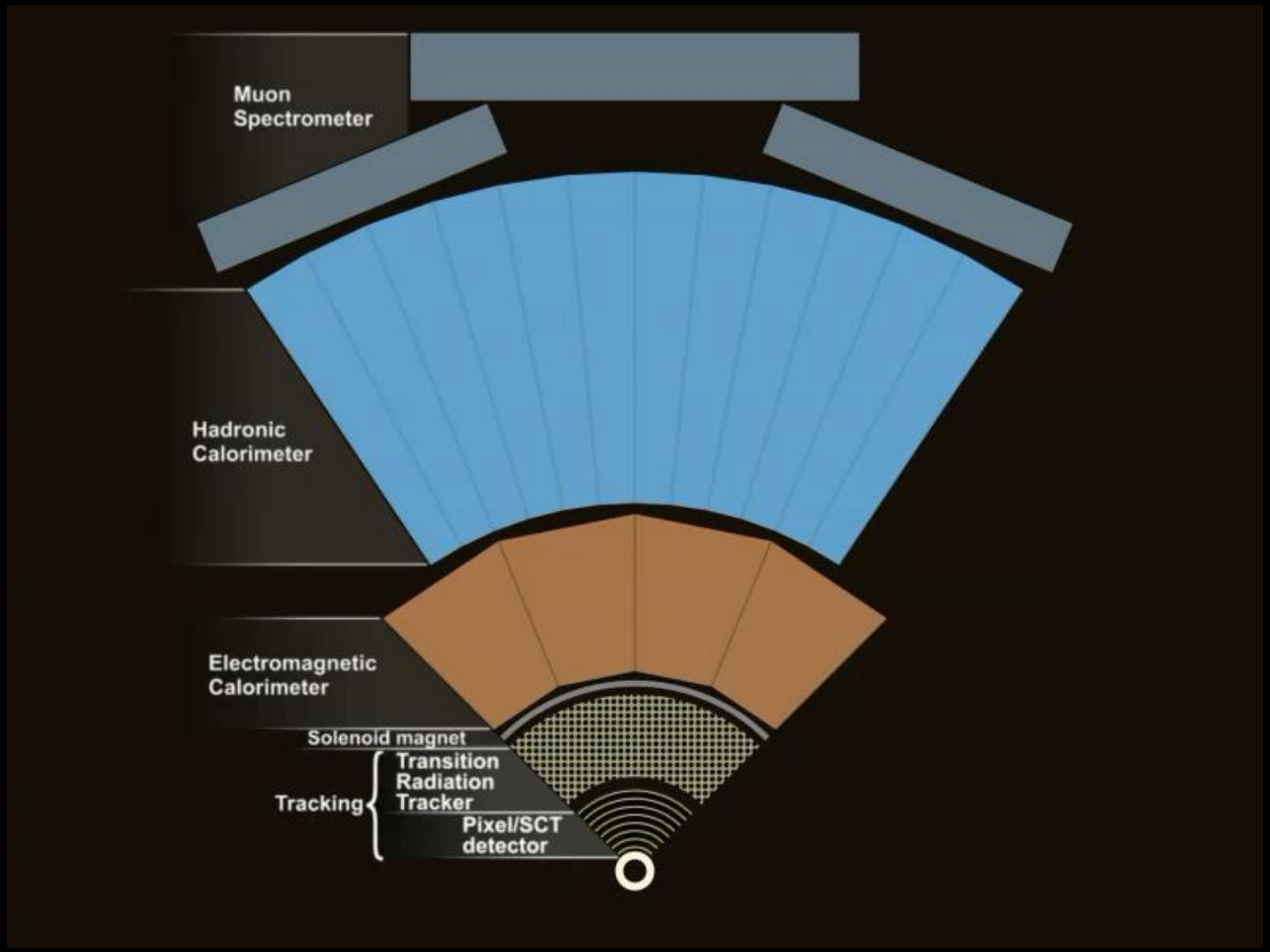
KEY IDEAS

- Pull from student's prior knowledge on concept of detectors
- 4 various detectors spread out around the LHC
- Conservation laws are utilized daily in the detectors



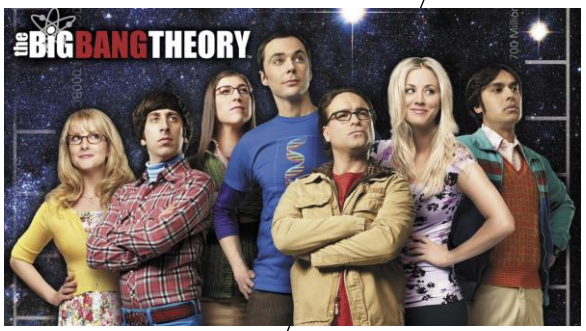





Muon
Spectrometer
Hadronic
Calorimeter
Electromagnetic
Calorimeter
Solenoid magnet
Tracking
Transition
Radiation
Tracker
Pixel/SCT
detector

POTENTIAL STUDENTS' CONCEPTS & CHALLENGES

- Depend on students' grade, knowledge, experience … etc.
- Students who have visited some labs may think that some physicists work in cubicles in front of the computers, some physicists and engineers work in a lab.
- Students may think scientists and research look like they saw on TV (e.g. The Big Bang Theory)

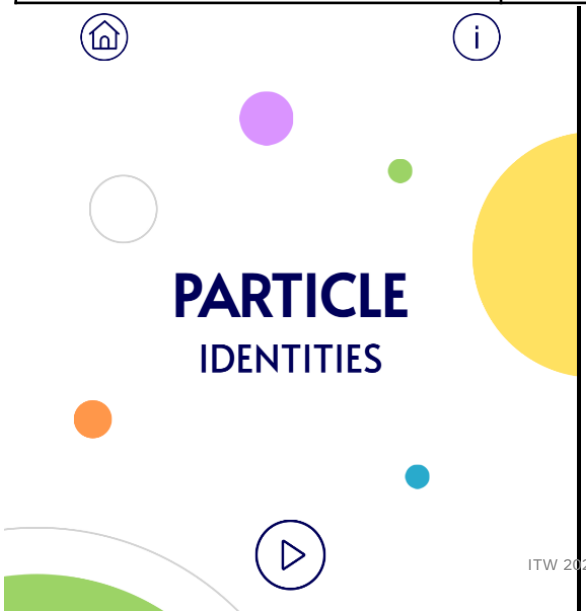


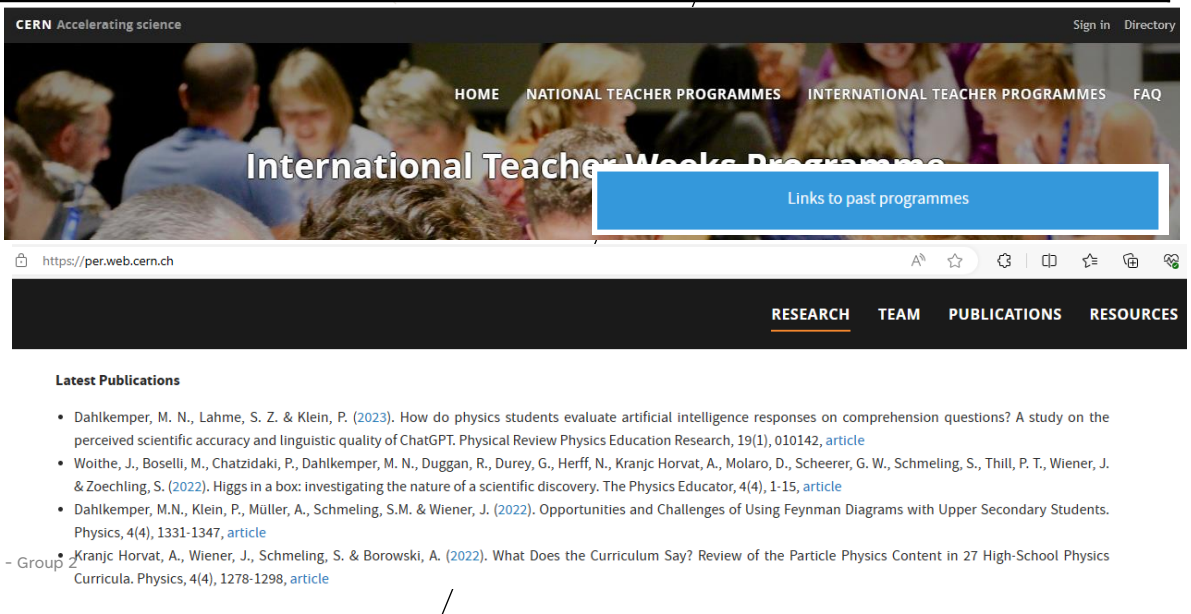
POTENTIAL STUDENTS' CONCEPTS & CHALLENGES

- Challenges may include:
  - Understanding what does Particle Physics means?
  - What do particle physicists work on?
  - Why do we detect particles?
  - How to detect particles?
  - …
- Really new field for middle school and high school students! !

HELPFUL MATERIAL & RESOURCES

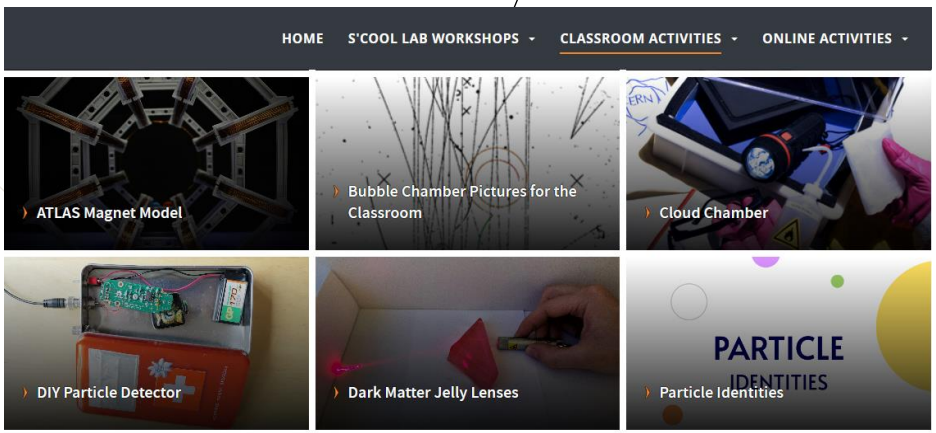
Pre-class Activities	• Interesting Videos or Comics (ALICE TPC Pre-Commissioning Song - YouTube) • Which particle are you?
Lesson Proper	• International Teachers Week Programme | CERN Teacher Programmes • Research | CERN Physics Education Research





HELPFUL MATERIAL & RESOURCES

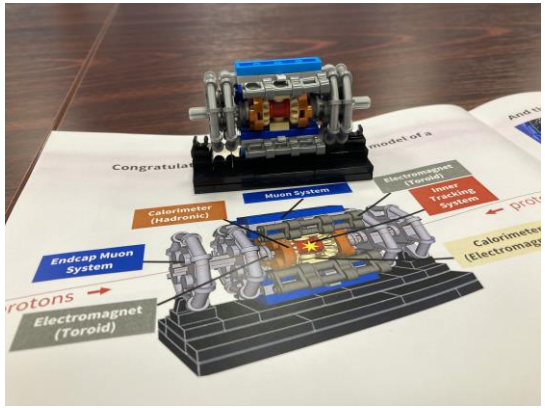
Supplementary Activities	• Quarknet | (e-labs, masterclasses) • Classroom Activities | S'Cool LAB (cern.ch) • Home | CERN Science Gateway (visits)



BEST PRACTICE EXAMPLE

- **WHAT THE DETECTOR IS?**
  - activity clarifying the concept of a detector
  - what all we can detect – fields, objects
  - using tracks to recognize the path of the "offender"

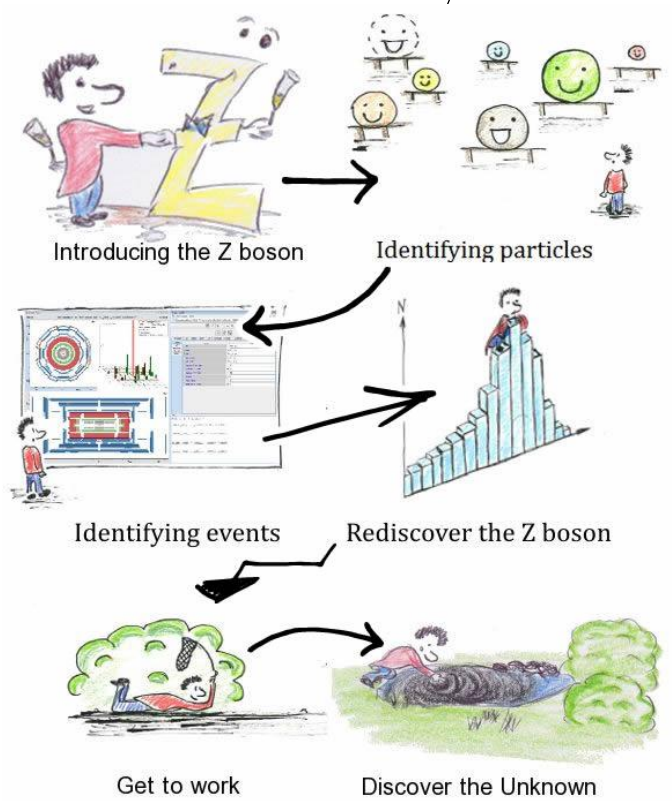
- **BUILD YOUR OWN DETECTOR – LEGO ACTIVITY**
  - activity developing not only cognitive but also motor skills
  - ATLAS Magnet Model

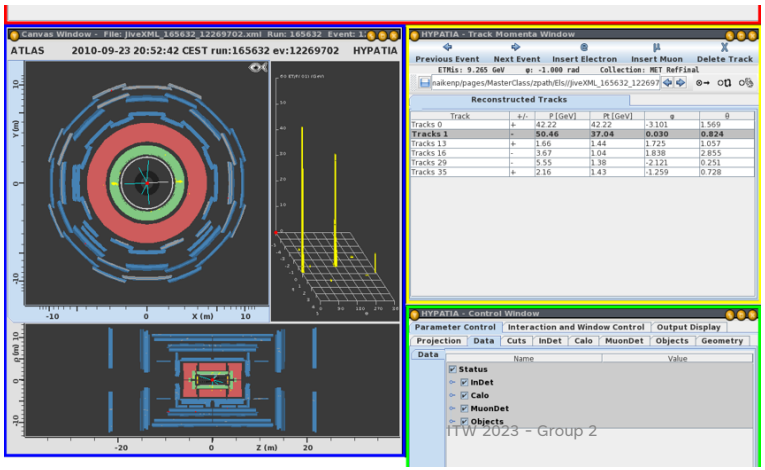


BEST PRACTICE EXAMPLE

VIZUALIZATION WITH HYPATHIA

- analysis of data samples that have been recorded with the ATLAS detector
- choice between two different measurements with original data from the ATLAS experiment - W-Path, Z-Path
- 60 – 90 minutes





https://atlas.physicsmasterclasses.org/en/zpath_teilchenid2.htm

https://atlas.physicsmasterclasses.org/sk/downloads.htm

THANKS/MERCI BEAUCOUP! QUESTIONS?