Focus G-4 “Particle Accelerators”

- Accelerating
- To
- Enable
- of
- Study
- Nature
General Overview of CERN

Chain of Accelerators
Production of plasma

Linear Accelerator
LINAC-3, LINAC-4

Proton Synchrotron Booster
(PSB)

Proton Synchrotron (PS)

Super Proton Synchrotron (SPS)

Large Hadron Collider (LHC)
Why Do We Need Accelerators

Accelerators help to:

✓ Increase the particle energy

✓ Only $F_e$ can increase the particle energy

✓ increase the velocity and the momentum of particles

✓ Deflect particles - $F_B$ is by far the most effective changing the particle direction

✓ These particles are then made to collide which creates new particles
Basic elements of an Accelerator

• Structures in which the particles will move

• Structures to accelerate the particles

• Structures to steer the particles

• Structures to measure the particles
# Types of accelerators

## Linear
- Particles are accelerated in a straight line.
- Each accelerating element is used only one time.
- Charged particles are accelerated in RF cavities by electric impulse.

## Circular
- Accelerating elements are used many times.
- The particle beam trajectory is bended by magnets.
- In colliders bunches of particles can be used many times.
- The magnetic field is constant,
- The radius is increasing.
- The time for single revolution is constant (isochronic).
- Electric field accelerates particles only in the gap between the dees.

- The radius is constant.
- The magnetic field is changed synchronously.
- The beam trajectory is bended in horizontal plane by dipole magnets.
Two types of student reactions:

MISS, MY MIND IS BLOWWWNNNN!

WHAAAAT? (MINION VOICE)

BUT, both the type of students have the same question.
But Miss, HOW DO I VISUALIZE THIS?
CURVES????????

1. Does the ball slow down?

Right, KEY POINTS TO KNOW IF YOU WANT TO GET A NOBEL PRIZE

1. Straight line: Radio frequency cavity
2. Bend: Dipole magnets
3. Slows down? Synchrotron radiation
• **Classroom activities**
  The salad bowl accelerator (S’Cool Lab) is a simple model for explaining the workings of real particle accelerators, such as the LHC.
• [https://www.scienceinschool.org/content/particle-accelerator-your-salad-bowl](https://www.scienceinschool.org/content/particle-accelerator-your-salad-bowl)
• **Linear accelerator**
• Classroom activities

www.golabz.eu
Go-Lab online platform for IBL lesson plans.