



LINEAR ACCELERATOR (LINAC)

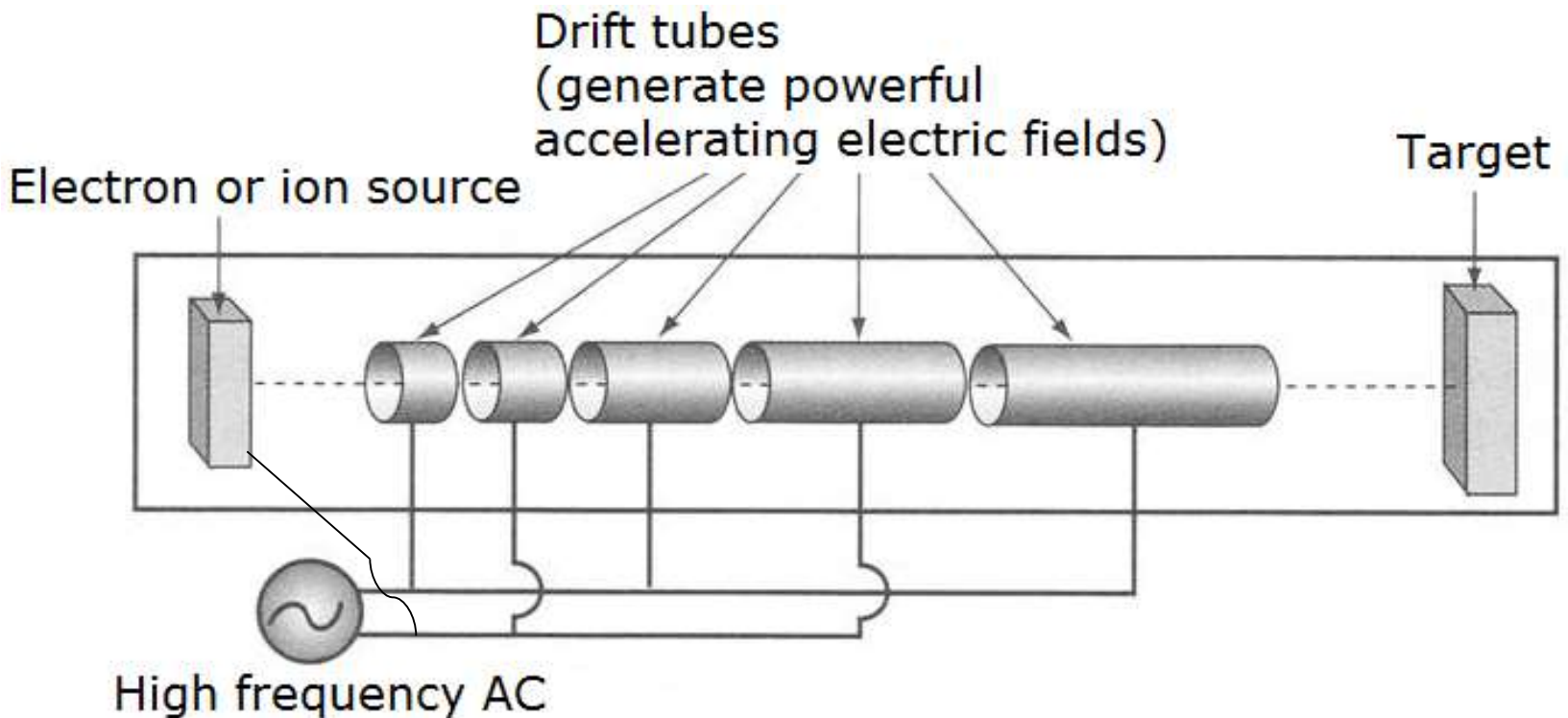
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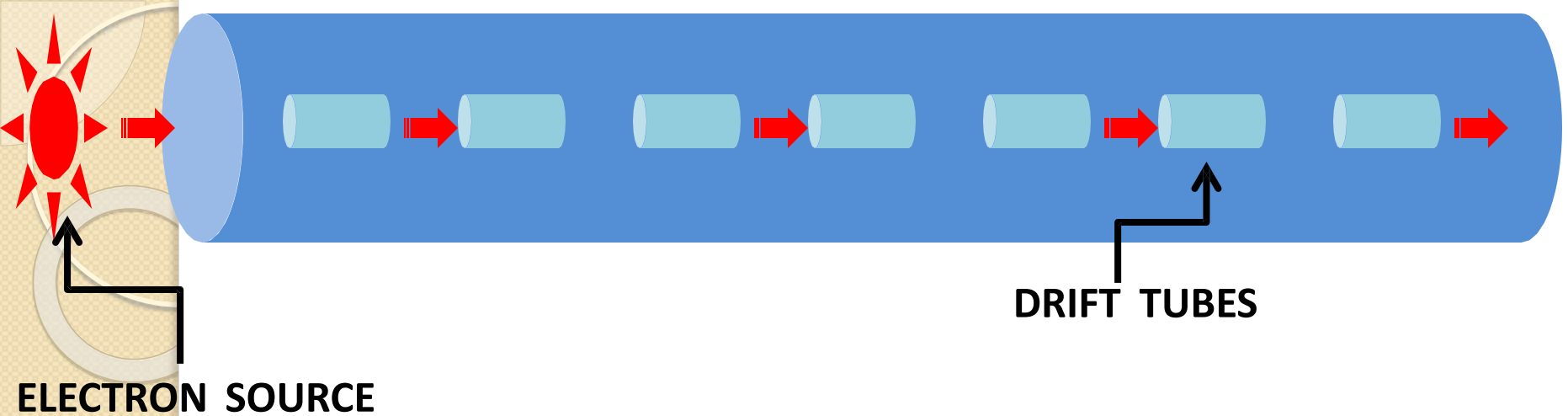
LINEAR ACCELERATOR (LINAC)

- A linear accelerator is a device that uses high Radio-Frequency (RF) electromagnetic waves to accelerate charged particles (i.e. electrons) to high energies in a linear path, inside a drift tubes.

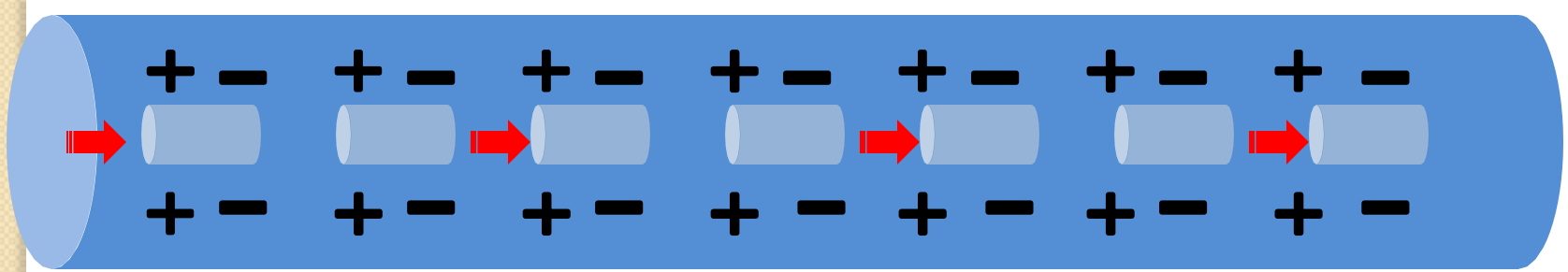
Working of LINAC

- There are a series of isolated electrodes (drift tubes) connected to an alternating voltage. The alternating voltage ensures that the voltage of each electrode switches back and forth between positive and negative.

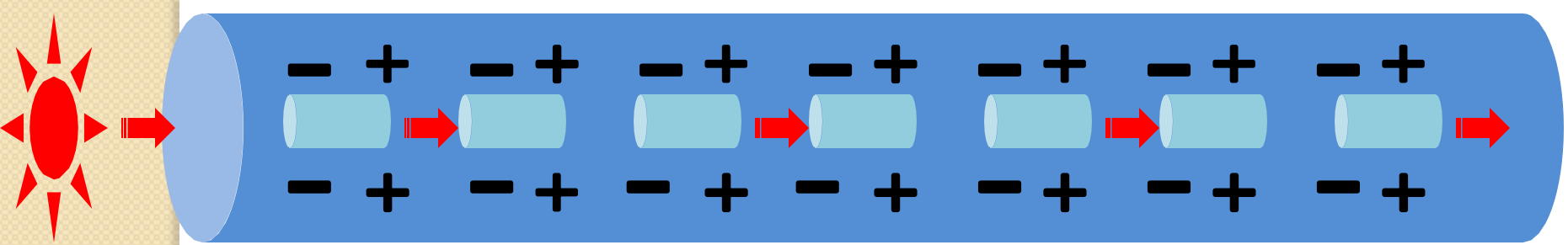




- Ion source gives bunch of electrons which are then accelerated towards first drift tube because of their negative potential and drift tube's positive potential.



- When electrons comes inside tube, in that moment RF source shifts its polarity.
- First drift tube then becomes negatively charged and second drift tube positively charged.
- Electrons comes outside of tube because of its inertia and in that moment they are pushed with first drift tube and attracted by the second one and so on.



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- There is no electric field inside the tubes as they are hollow conductors.
- The RF power must be synchronized with the motion of the electrons, so that acceleration occurs in every tube.
- Each time the same magnitude of voltage is applied and so the energy of the Particle $E=nQV$, is built up in steps without needing to increase the voltage.
- Since the frequency of the oscillating voltage is kept constant, the electrode drift tubes must get longer so that the particle takes the same time to travel through each electrode.

Advantages of Linear Accelerator

- It makes use of an alternating voltage, which means it can easily be stepped up and down using transformers.
- It does not require the use of high voltages which could cause sparks to jump between the electrodes.

Disadvantages of Linear Accelerator

- In order for high energies to be obtained the machines must be made longer and longer. A great number of driver devices and their associated power supplies are required, increasing the construction and maintenance expense

Applications

A linear particle accelerators have many applications:

- They generate X-rays and high energy electrons for medicinal purposes in radiation therapy, LINAC-based radiation therapy for cancer therapy began with treatment of the first patient in 1953 in London
- Investigation of the properties of subatomic particles
- Serve as particle injectors for higher-energy accelerators,
- Directly used to achieve the highest kinetic energy for light particles (electrons and positrons) for particle physics.