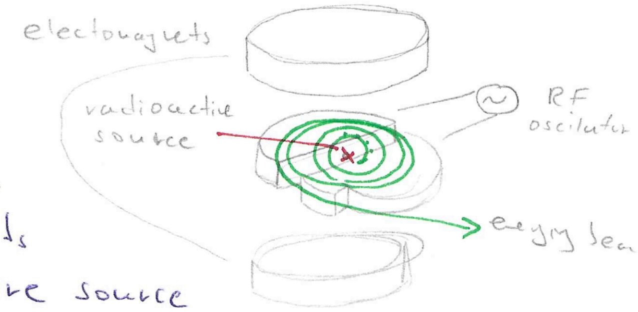
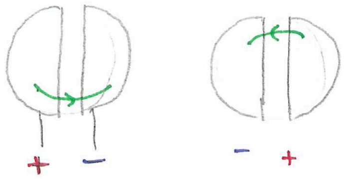
Accelerators



- Lawrence Cyclotron
  - ↳ 2 metal D shaped vacuum chambers between 2 electromagnets. the magnetic field bends the paths of the p+ from the radioactive source
  - ↳ as the p+ crosses the 2 D's it is accelerated by the pd then it curves and returns so the polarity must be switched. this repeats and as the V so KE increases the Fc also incresses untill the magnetic force can't curve it enough and it is ejected out



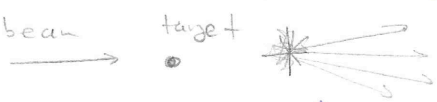
- initially the f was gradually increased since at different r of trajectory different f is required this can not generate a continuous stream - called synchrocyclotrons

- then a circular tube with vacuum was used. here the f and $\vec{B}$ are both increased so the beam is continuous and moving in a single tube - called synchrotron

$$f = \frac{Be}{2\pi m_p}$$

- Linear accelerators
  - ↳ in ring accelerators lot of E lost as EM radiation since the particles are constantly accelerating so giving out γ even at constant v
  - ↳ use straight path with sequence of accelerating plates

- collisions:



net momentum 0
less E wasted and
higher E archivable
difficult to collide beams

net momentum conserved
more E wasted
but easier to collide beam + target

- modern particle accelerators
  - ↳ RF accelerating cavities
    - ↳ particles accelerated from cavity to cavity
  - ↳ Bending magnets
    - ↳ keep particles orbiting in circular paths around ring
  - ↳ Focusing magnets
    - ↳ as charged particles are accelerated they repel so the beam spreads. these focus the beam ↑ the ρ so probability of collision