Cyclotron

Purpose: accelerate charged particles to high energy.

- Low-energy protons are injected at $S$.
- Path is bent by magnetic field $\vec{B}$.
- Proton is energized by alternating voltage $\Delta V$ between $Dee_1$ and $Dee_2$.
- Proton picks up energy $\Delta K = e\Delta V$ during each half cycle.
- Path spirals out as velocity of particle increases:
  Radial distance is proportional to velocity: $r = \frac{mv}{eB}$.
- Duration of cycle stays independent of $r$ or $v$:
  cyclotron period: $T = \frac{2\pi m}{eB}$.
- Cyclotron period is synchronized with alternation of accelerating voltage.
- High-energy protons exit at perimeter of $\vec{B}$-field region.