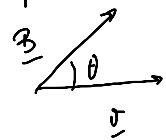
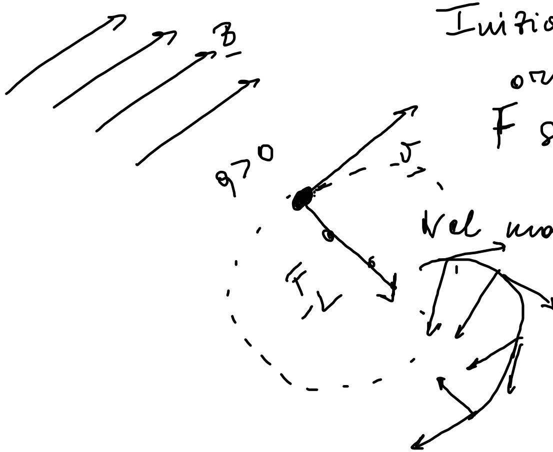
q $\underline{B}$

$$\underline{F} = q(\underline{v} \times \underline{B}) \qquad |\underline{F}| = qvB\,\text{sen}\,\theta$$

$K = \frac{1}{2}mv^2$ (e quindi $|\underline{v}|$) rimangono invariate sotto l'azione di $\underline{F}$



$\underline{B}$ uniforme



Inizialmente la velocità $\underline{v}$ è ortogonale a $\underline{B}$

F sempre $\perp$ a v

$\cdot \; \cdot \; \cdot$
$\cdot \; \cdot \; \cdot$ } $\underline{B}$ è uscente nel piano

Nel moto circolare

Per analogia, ci aspettiamo moto circolare della carica uniforme attorno alle linee di c. magnetico

$\times \; \times \; \times$
$\times \; \times \; \times$ } $\underline{B}$ è entrante nel piano

Raggio (di Larmor)? r_L

Frequenza?

$$m \cdot a_{centripeta} = F_{centr}$$

$\nearrow$ Forza di Lorentz

$$a_{centripeta} = \frac{v^2}{r_L}$$

$$m\frac{v^2}{r_L} = q\,|\underbrace{(\underline{v}\times\underline{B})}_{\underline{v}\perp\underline{B}}| = qvB\,\mathrm{sen}(90°) = qvB$$

$$m\frac{v^{\cancel{2}}}{r_L} = q\cancel{v}B \; ; \quad r_L = \frac{mv}{qB}$$

$$r_L \propto m, v \qquad \propto \frac{1}{q}, \frac{1}{B}$$

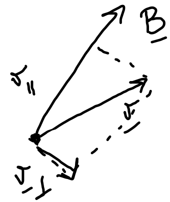
$$\omega = \frac{v}{r_L} = \frac{\cancel{v}}{m\cancel{v}}\,qB = \frac{qB}{m}$$

$\uparrow$ vel. angolare

Non dip. da en. (o v) della particella

"Grande" r_L ⇒ particella poco curvata

"Piccolo" r_L ⇒ part. molto curvata



Ipotesi: $\underline{v} = v_\parallel \hat{\underline{b}} + \underline{v}_\perp$

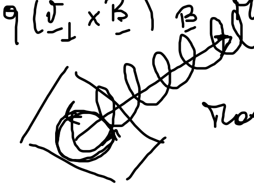
con versore campo magnetico

$$\underline{F}_L = q(\underline{v} \times \underline{B}) = q(v_\parallel \hat{\underline{b}} + \underline{v}_\perp) \times \underline{B} = q(0 + \underline{v}_\perp \times \underline{B})$$

$$m\underline{a} = \underline{F}_L$$

Direzione // a $\underline{B}$: $m a_\parallel = 0$; $m \, dv_\parallel / dt = 0$; moto rettilineo uniforme con $v_\parallel$

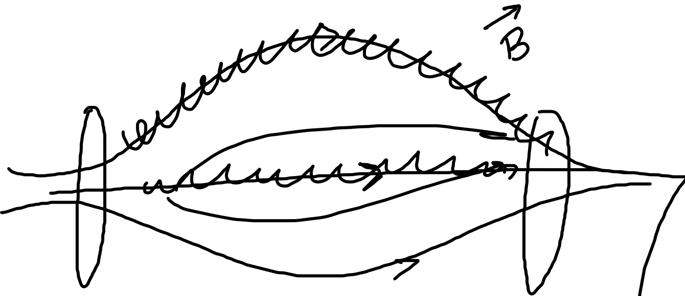
" $\perp$ a $\underline{B}$: $m \frac{d\underline{v}_\perp}{dt} = q(\underline{v}_\perp \times \underline{B})$ moto circolare uniforme $r_L = \frac{m v_\perp}{qB}$

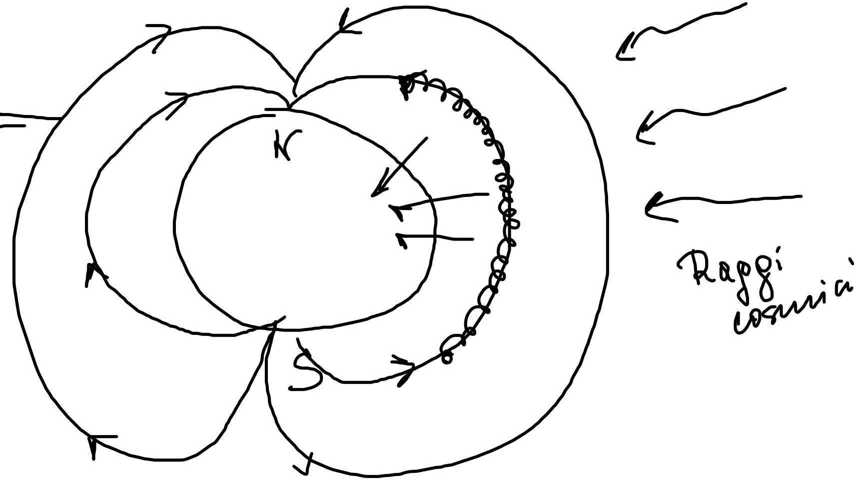


Moto elicoidale $\omega_L = qB/m$

→ circolare con $v_\perp \perp \underline{B}$

→ rettilineo con $v_\parallel$ lungo $\underline{B}$

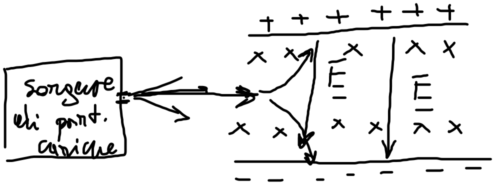

$\vec{B}$

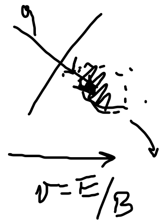

N
S
Raggi

Se ci sono sia $\underline{E} \neq 0$ sia $\underline{B} \neq 0$

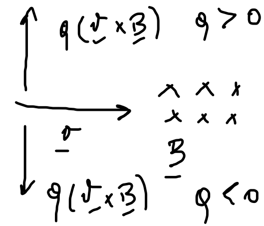
$$\underline{F} = \underline{F}_{el} + \underline{F}_{B} = q\underline{E} + q(\underline{v} \times \underline{B}) = q\left[\underline{E} + \underline{v} \times \underline{B}\right]$$

<u>Selettore di velocità</u>





$\underline{F} = q\underline{E}$

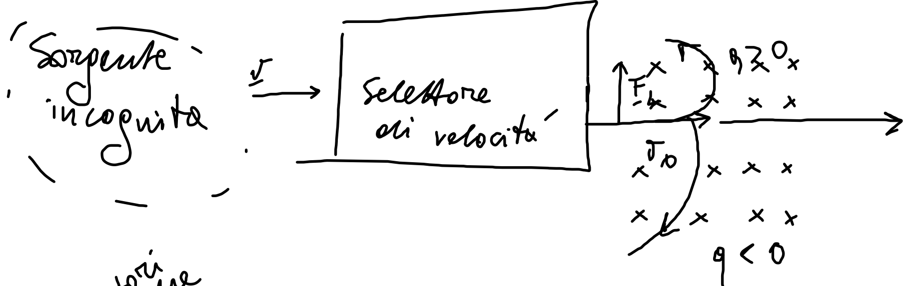


È possibile bilanciare $q\underline{E}$ e $q(\underline{v} \times \underline{B})$

$\cancel{q}E = \cancel{q}vB$; $v = E/B$ Se $v = E/B$ particelle indeflesse

se $v \neq E/B$ domina $q\underline{E}$ oppure $q(\underline{v} \times \underline{B})$

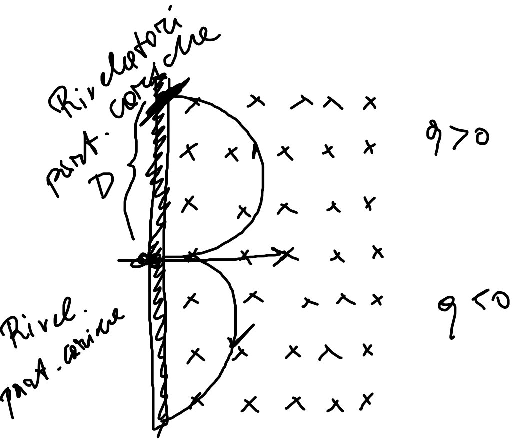
$\Rightarrow$ Fascio è deflesso vs alto o basso



$$\vec{F} = q(\vec{v} \times \vec{B})$$

Se $q = 0$, $F_L = 0$

Se $q \neq 0$, $F_L \neq 0$

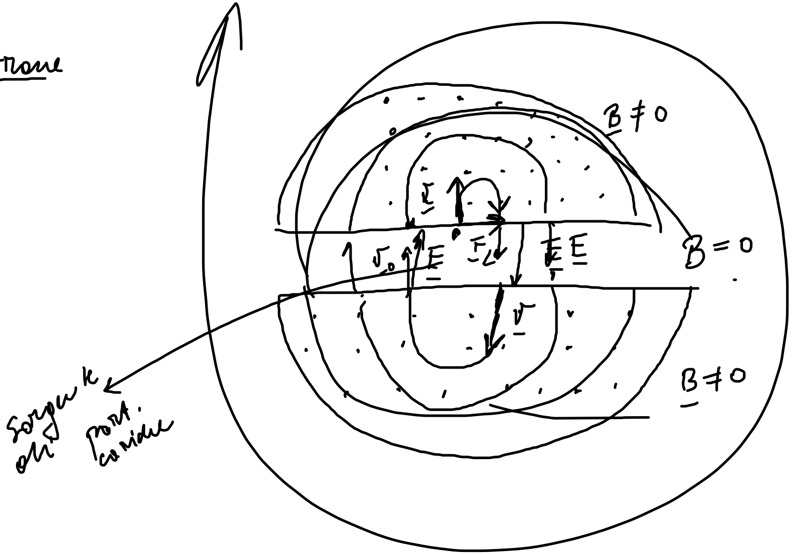


D = diametro della circonf. di Larmor

$$\underset{\text{misuro}}{D} = 2r_L = 2\,\frac{m\,\overset{\text{noto}}{v}}{\underset{\substack{\text{non noto}\\\text{si può determinare}}}{q}\ \underset{\text{noto}}{B}}$$

$$\frac{m}{q} = \frac{D \cdot B}{2v}$$

Ciclotrone



$$\omega = \frac{qB}{m}$$

$$T = \frac{2\pi}{\omega} = \frac{2\pi m}{qB}$$

al max $\quad r_L = \frac{m v_{max}}{qB} = R$

$K_{max} \sim$ qualche decina di MeV