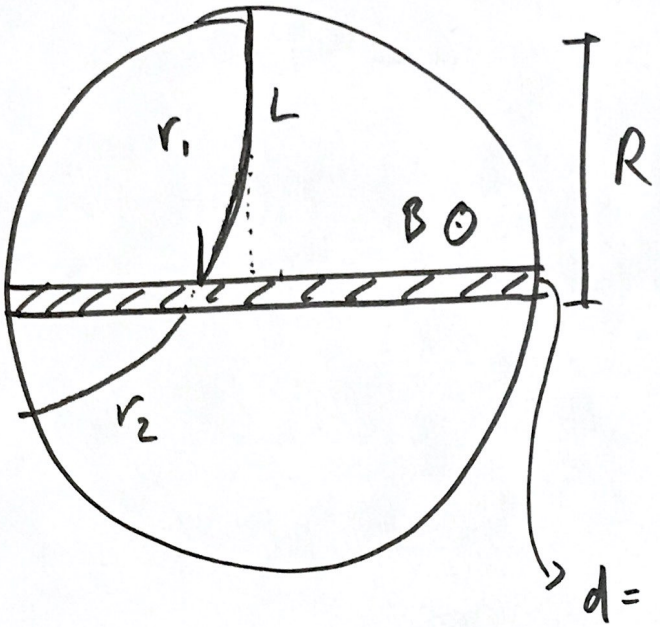
EX Wilson $R = 25$ cm

$B = 1.5$ T



Piombo:

$\rho = 11.35$ g/cm^3

$X_0 = 0.56$ cm

$I = 823$ eV

$Z = 82$

$A = 207$

$r_1 = 67$ cm

$r_2 = 65$ cm

(a) $\vartheta = ?$

$$p_1^{(r_1)}[\text{GeV}] = 0.3 \cdot R[\text{m}] \cdot B[\text{T}]$$

$$= 0.3 \cdot 0.67 \cdot 1.5 =$$

$$= 301.5 \text{ MeV}$$

$$\sin\vartheta \sim \vartheta = \frac{L}{r_1} = \frac{R}{r_1} = \frac{0.25}{0.67} = 0.37 \text{ rad}$$

(b) e o μ ?

106 MeV

(μ) $p_1 = 301.5$ MeV $\Rightarrow E_1 = \sqrt{p_1^2 + m_\mu^2} =$

$= 319.3$ MeV

$\rightarrow p_2 = 0.3 \cdot r_2[m] \cdot B[T] =$

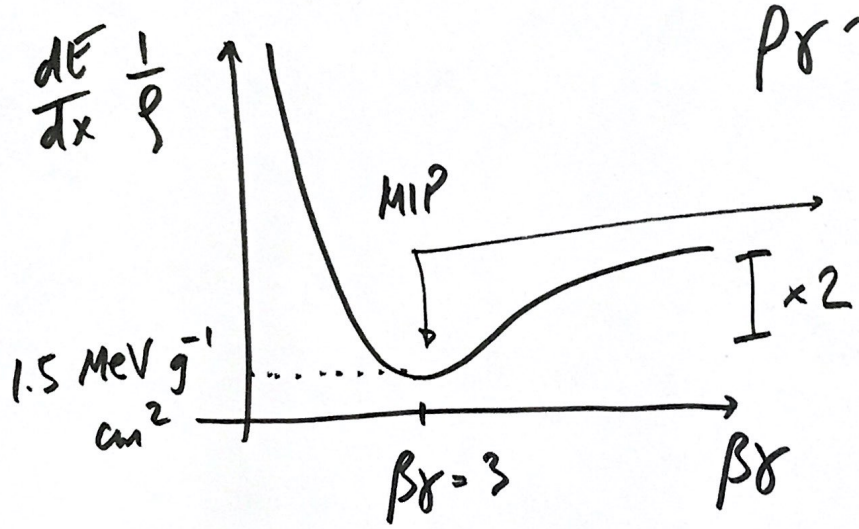
$= 0.3 \cdot 0.65 \cdot 1.5 = 0.2925$ GeV

$= 292.5$ MeV

$\Rightarrow E_2 = \sqrt{p_2^2 + m_\mu^2} = 310.8$ MeV

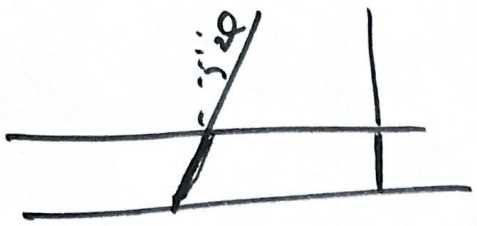
$\beta_1 = \frac{p_1}{E_1} = 0.94$ $\quad \gamma_1 = \frac{E_1}{m_\mu} = 3.03$

$p\gamma \sim 3$



$\frac{dE}{dx} = (1.5 \text{ MeV g}^{-1}\text{cm}^2) \cdot \rho = 17$ MeV/cm

$\rho = 11.35$



$d = 0.56$

$$\Delta E = \frac{d}{\cos\vartheta}\,\frac{dE}{dx} = 0.6 \cdot 17 \sim \underline{10\ \text{MeV}}$$

$E_1 = 319.3\ \text{MeV}$

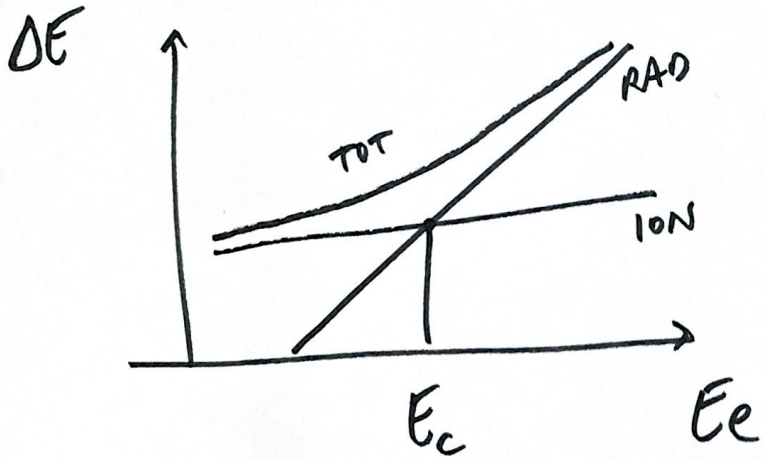
$E_2 = 310.8\ \text{MeV}$

$\Delta E \sim 10\ \text{MeV}$

(e) $p_1 = 301.5\ \text{MeV}$

$$\Rightarrow E_1 = \sqrt{p_1^2 + m_e^2} \sim p_1 = 301.5\ \text{MeV}$$

m_e: $0.511\ \text{MeV}$



$$E_c \sim \frac{600\ \text{MeV}}{Z} = \frac{600\ \text{MeV}}{82} = 7.3\ \text{MeV}$$

$$E(x) = E_0\, e^{-x/X_0} \qquad d = X_0$$

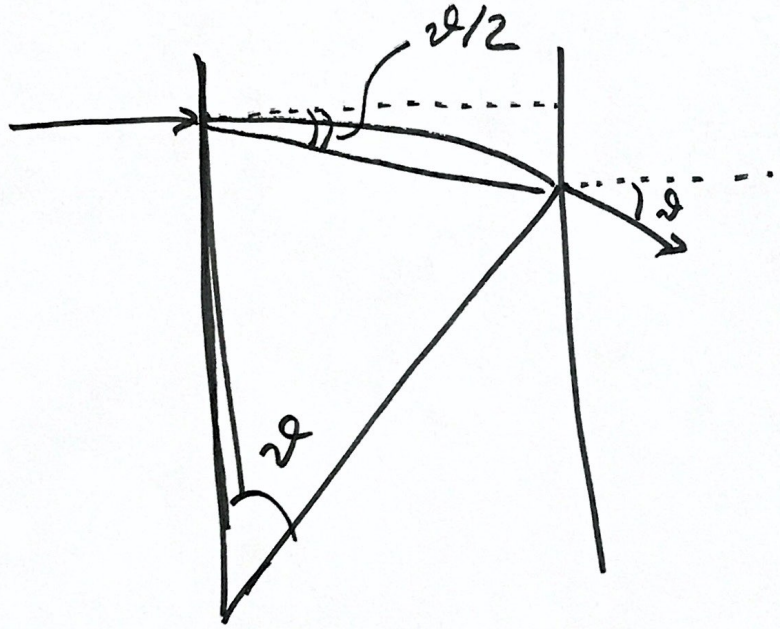
$$E(d) = E_0\, e^{-d/X_0} = \frac{E_0}{e} = 111\ \text{MeV}$$

→ $E_2 \sim \underline{110}$ MeV per BREM

→ $P_2 = 292.5$ MeV

↳ $E_2 = \sqrt{P_2^2 + m_e^2} \sim P_2$

m_e ↑ 0.511



SCOPERTA DELL'ANTIPROTONE

1955 p.lla $\longleftrightarrow$ anti. p.lla

$$m(p) = m(\bar{p})$$

$$q(p) = +1$$

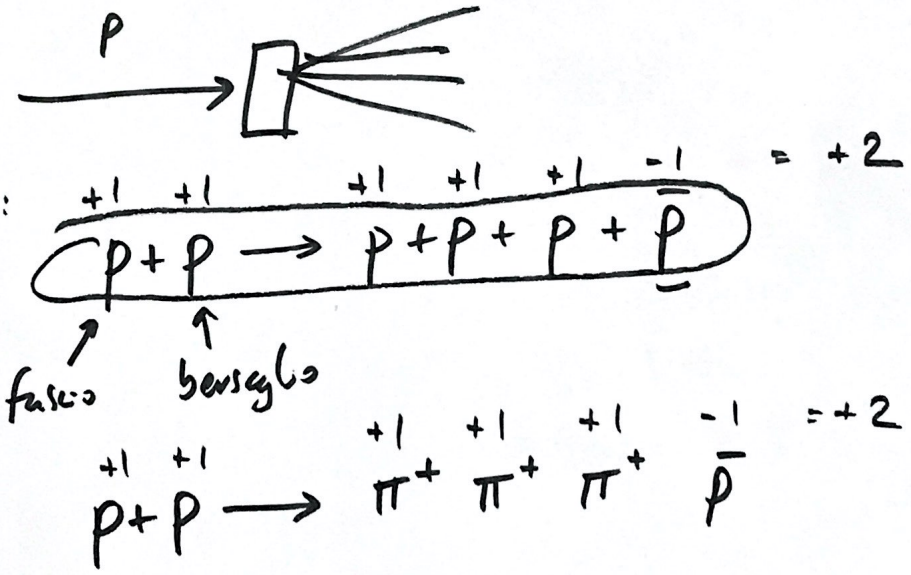
$$q(\bar{p}) = -1$$

SEGRÈ
CHAMBERLAIN

BEVATRON

$E_p = 6.2$ GeV

BeV $\leftrightarrow$ GeV



NUMERO BARIONICO

$$p + p \rightarrow p + p + p + \bar{p}$$

$$K_{soglia} = \frac{\left(\sum_f m_f\right)^2 - (m_p + m_p)^2}{2 m_p} \overset{m_p = m_{\bar{p}}}{=}$$

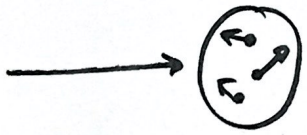
$$= \frac{(4m_p)^2 - (2m_p)^2}{2m_p} = \frac{16-4}{2} m_p =$$

$$= 6\, m_p$$

$$E_{soglia} = K_{soglia} + m_p = 7 m_p = 6.57 \text{ GeV}$$

0.938 GeV

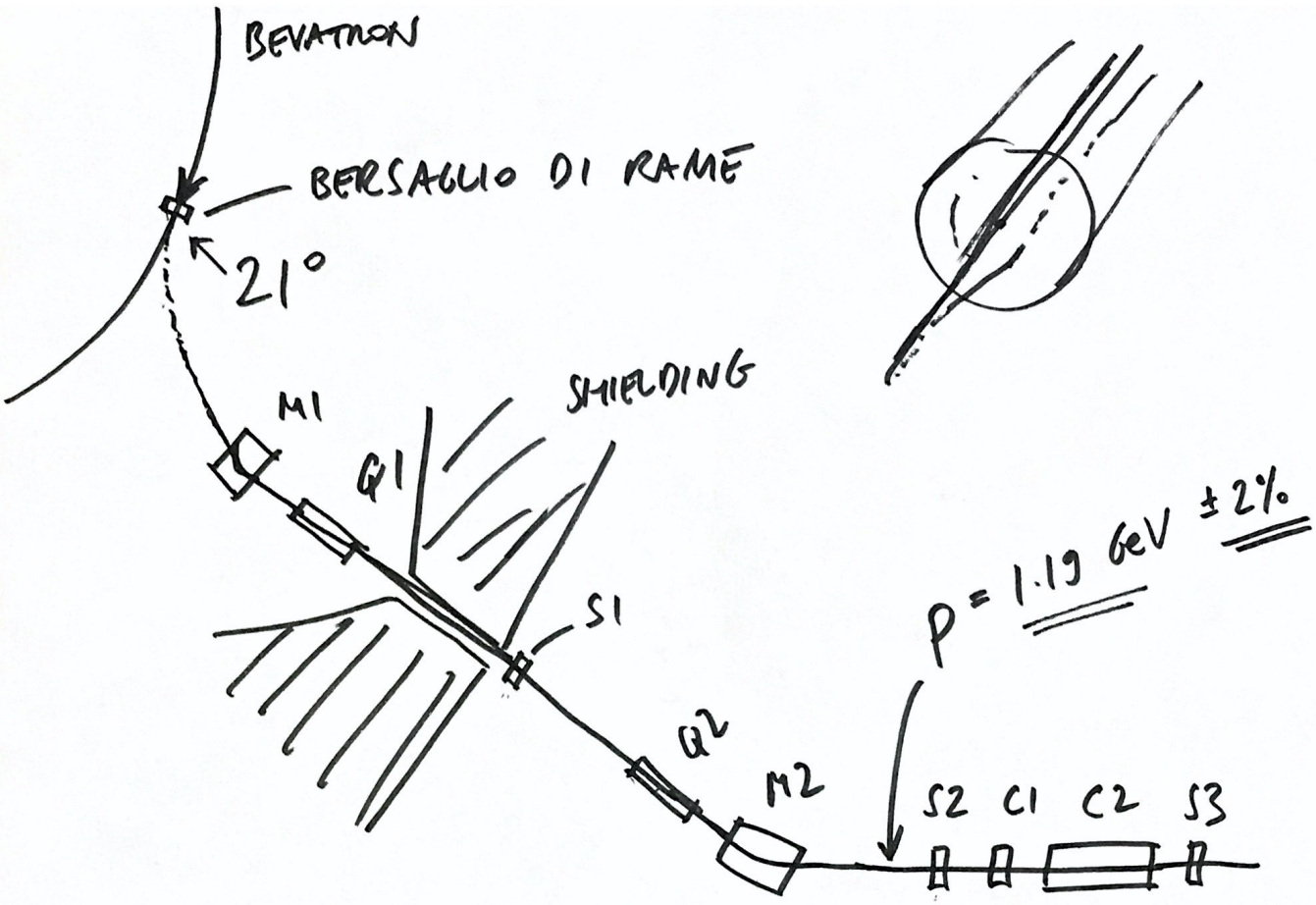
$E_p = 6.2$ GeV



$P_{Fermi} = 25$ MeV $\quad E_{soglia}: 6.57 \rightarrow \underline{5.1 \text{ GeV}}$

~ 30 MeV $\quad < 6.2$ GeV

AS LOW AS $\underline{4.3 \text{ GeV}}$



M1 e M2 due magneti $B = 1.37\ T$

$\sim 32°$

S1
S2
S3
diametro di 5.7 cm

$p = qRB$

$q = -1$

$B = 1.37\ T$

$p = 1.19$ GeV

$\Rightarrow \beta = 0.78$ (se $m = m_p$)

Segnale: $\bar{p} \longrightarrow \beta = 0.78$ $\quad m = m_p = 0.938$ GeV

Fondo: $\pi^- \longrightarrow \beta = 0.99$ $\quad m_\pi = 140$ MeV

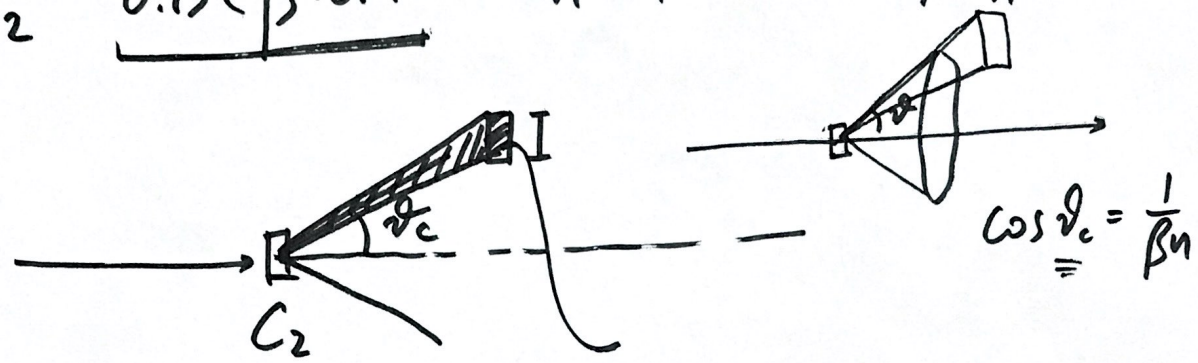
$\bar{p}$: $\beta = 0.78$ perdono energia per ion $\beta \to 0.765$

π^-: $\beta \sim 0.99$ $\qquad \beta \in [0.765, 0.78]$

C_1 contatore Čerenkov

$n = 1.276 \longrightarrow \beta > \frac{1}{n} = 0.784$

C_2 $\quad 0.75 < \beta < 0.78 \quad n = 1.458 \to \beta > \frac{1}{n} = 0.69$



	S1	S2	C1	C2	S3
$\bar{p}$	✓	✓	×	✓	✓
π^-	✓	✓	✓	×	(✓)

TEMPO DI VOLO S1-S2 $\quad 40ft \sim 12.2m$

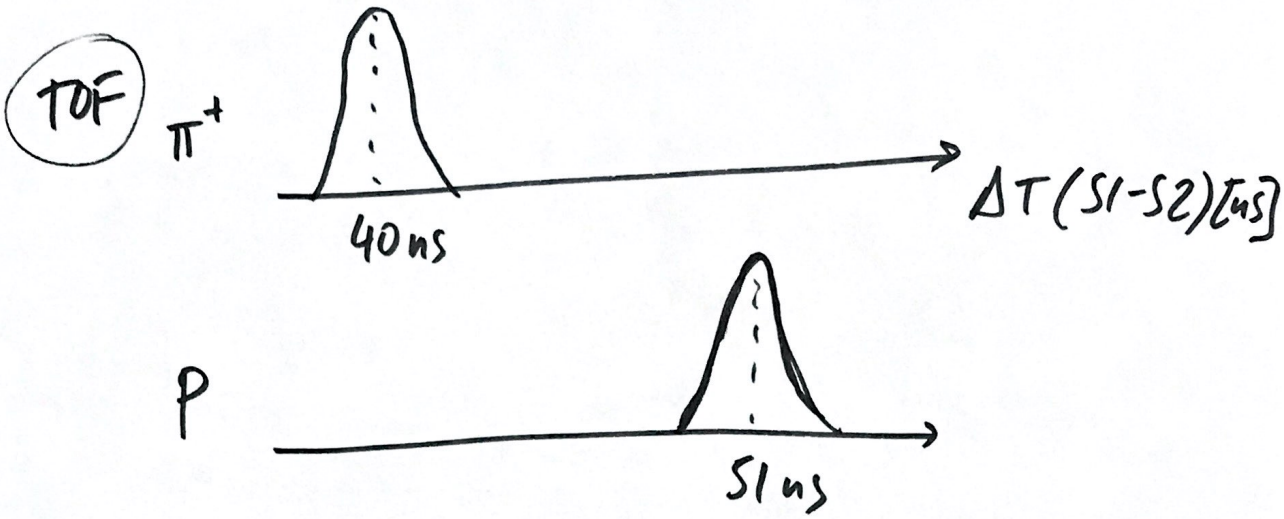
$\bar{p}$: $\beta = 0.76 \rightsquigarrow \Delta T = 51\,ns$

π^-: $\beta \sim 0.99 \rightsquigarrow \Delta T = 40\,ns$

INVERTENDO I MAGNETI

$\bar{p} \longrightarrow p$ $\quad m_{\bar{p}} = m_p$

$\pi^- \longrightarrow \pi^+$ $\quad m_{\pi^-} = m_{\pi^+}$ $\quad p = 1.19\,GeV$



MISURA DELLA MASSA

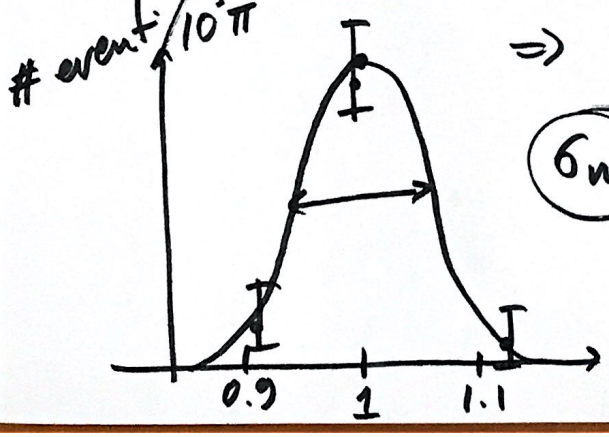
S1 S2 C1 C2 S3 $\longrightarrow$ fissi

misure di β

$\longrightarrow$ M1 M2 Q1 Q2 $\quad p = qR\beta$

β = fisso $\quad p$ = variabile $\quad \beta = \frac{p}{E} = \frac{p}{\sqrt{p^2+m^2}}$

$\Rightarrow m$ variabile



σ_m

60 event

$\bar{p}$ $\quad m(\bar{p}) \sim m_p$ entro 5%

$E_{soglia} = 5.1$ GeV $\leftarrow$ $p_{Fermi} = 25$ MeV

$\gtrsim 4.3$ GeV

$E_{Fascio} = 6.2$ GeV

5.1 GeV

4.2 GeV