

coppie di ioni  
mm

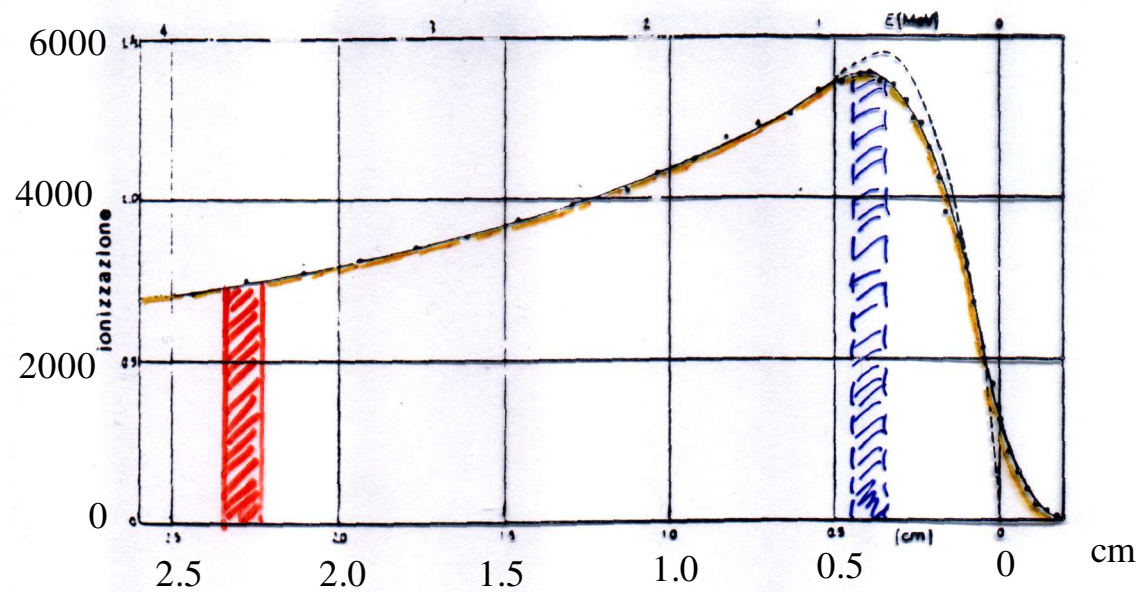
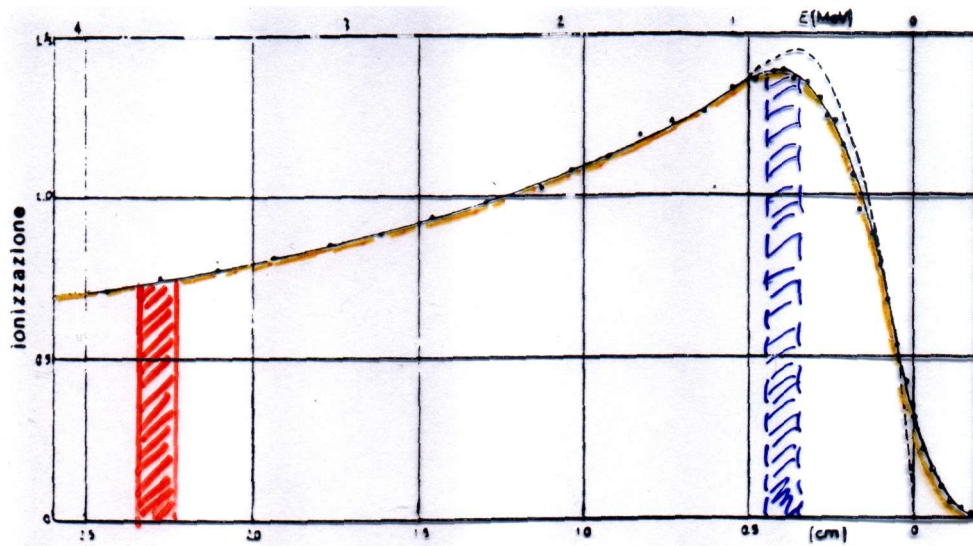


Fig 1.2-Curva di Bragg per particelle  $\alpha$  da 5.3 MeV di energia in aria

# Interazione di particelle cariche con la materia



$E_{\alpha} = 5.8 \text{ MeV}$   
in aria

- Area                      Energia cinetica (  $A, \beta$  )
- Lunghezza              Range (  $A, Z, \beta$  )
- $dE/dx$                       (  $z, \beta$  )
- Picco di Bragg              (  $z$  )

## Formula di Bethe-Bloch

$$-\frac{dE}{dx} = 4\pi N_A r_e^2 m_e c^2 z^2 \frac{Z}{A} \frac{1}{\beta^2} \left[ \log\left(\frac{2m_e c^2 \gamma^2 \beta^2}{I}\right) - \beta^2 - \frac{\delta}{2} \right]$$

$Z$  e  $A$  del mezzo frenante

$$4\pi N_A r_e^2 m_e c^2 = 0.3071 \text{ MeV cm}^2 \text{ gr}^{-1}$$

## Range

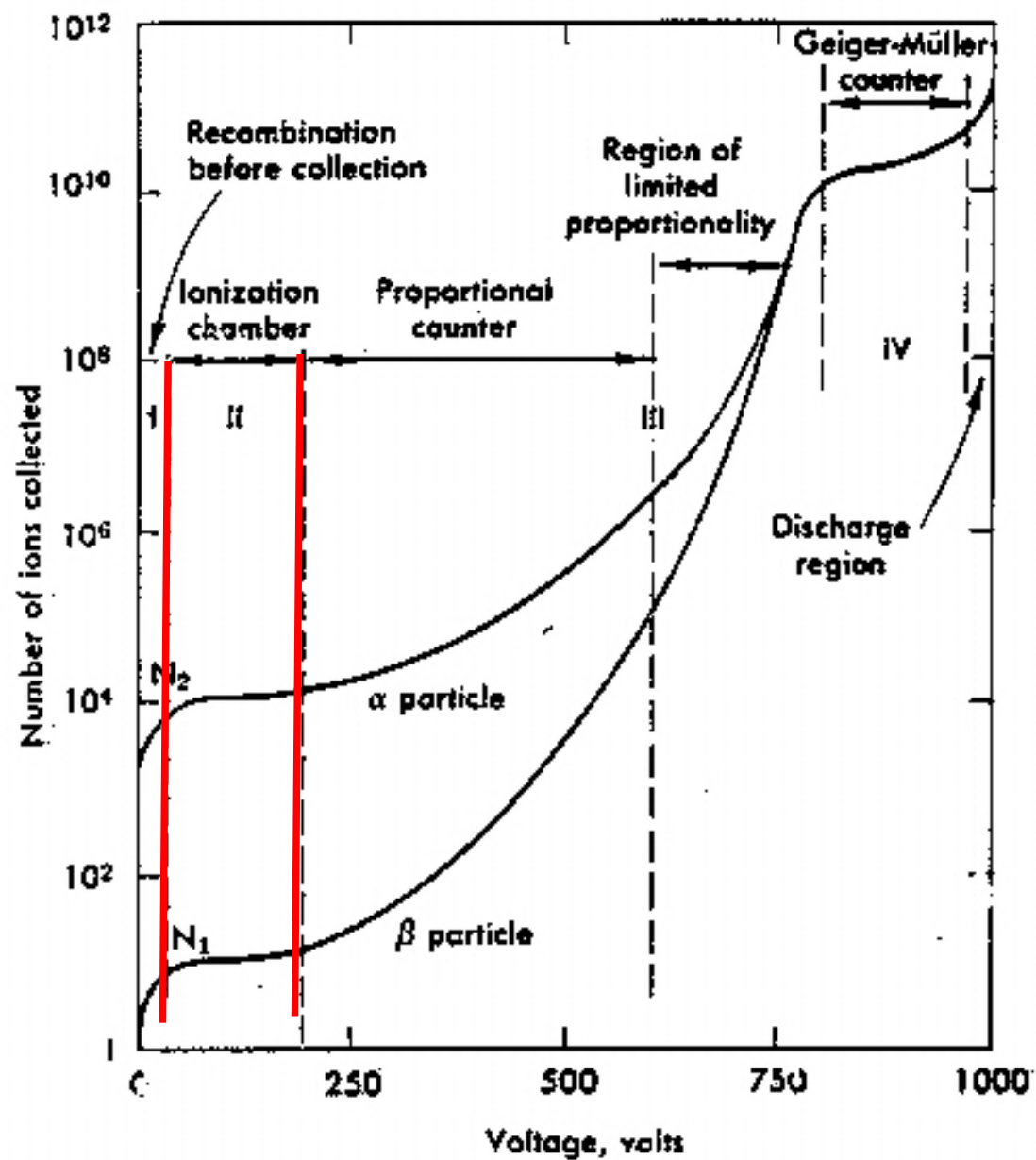
$$R = \int_E^0 \frac{dE}{-dE/dx}$$

sostituendo  $-\frac{dE}{dx}$  preso dalla formula di Bethe-Bloch

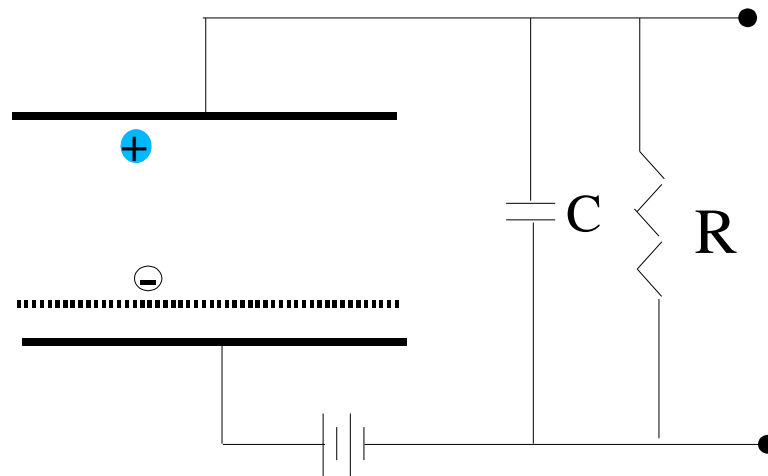
$$\boxed{R(v) \propto \frac{m}{z^2} F(v)}$$

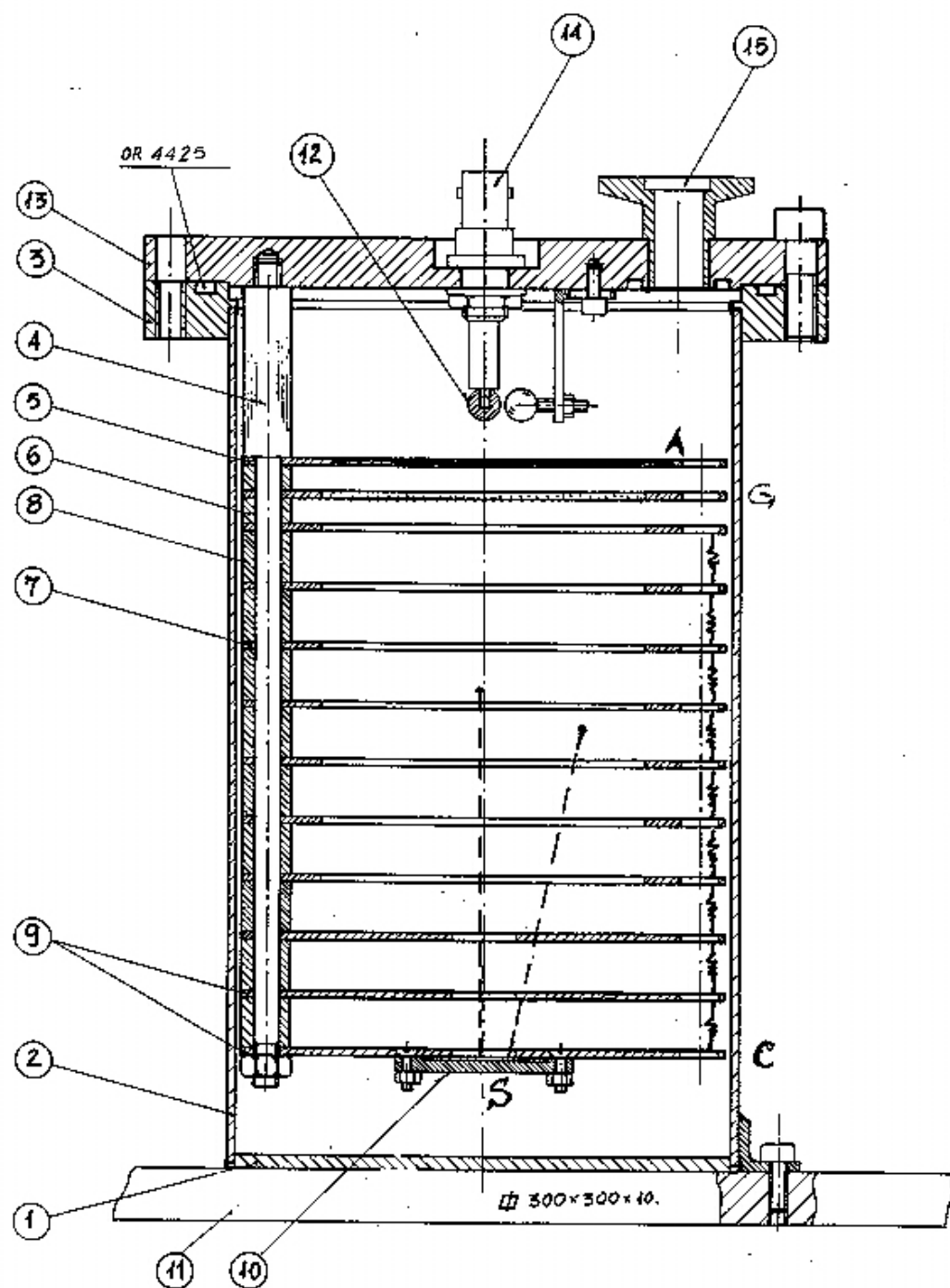
Formula empirica di Bragg-Kleman

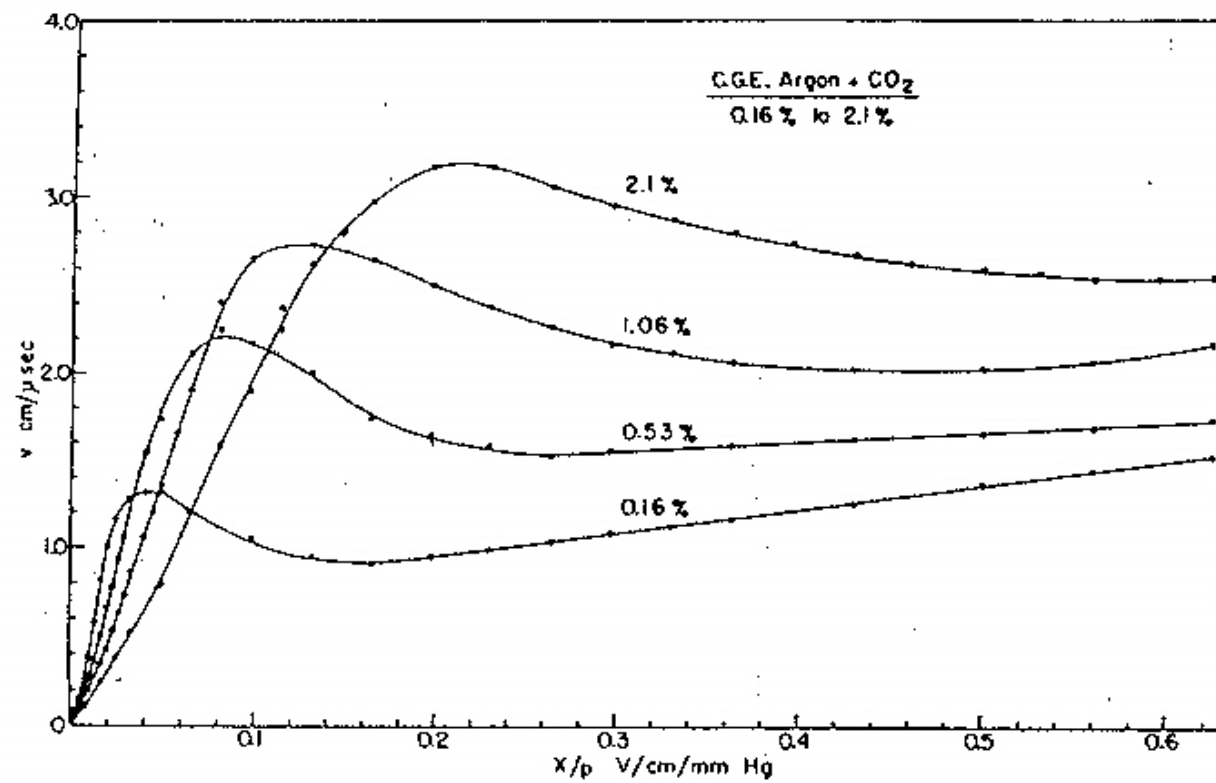
$$\frac{R_1}{R_2} = \frac{\rho_2 \sqrt{A_1}}{\rho_1 \sqrt{A_2}}$$



Griglia









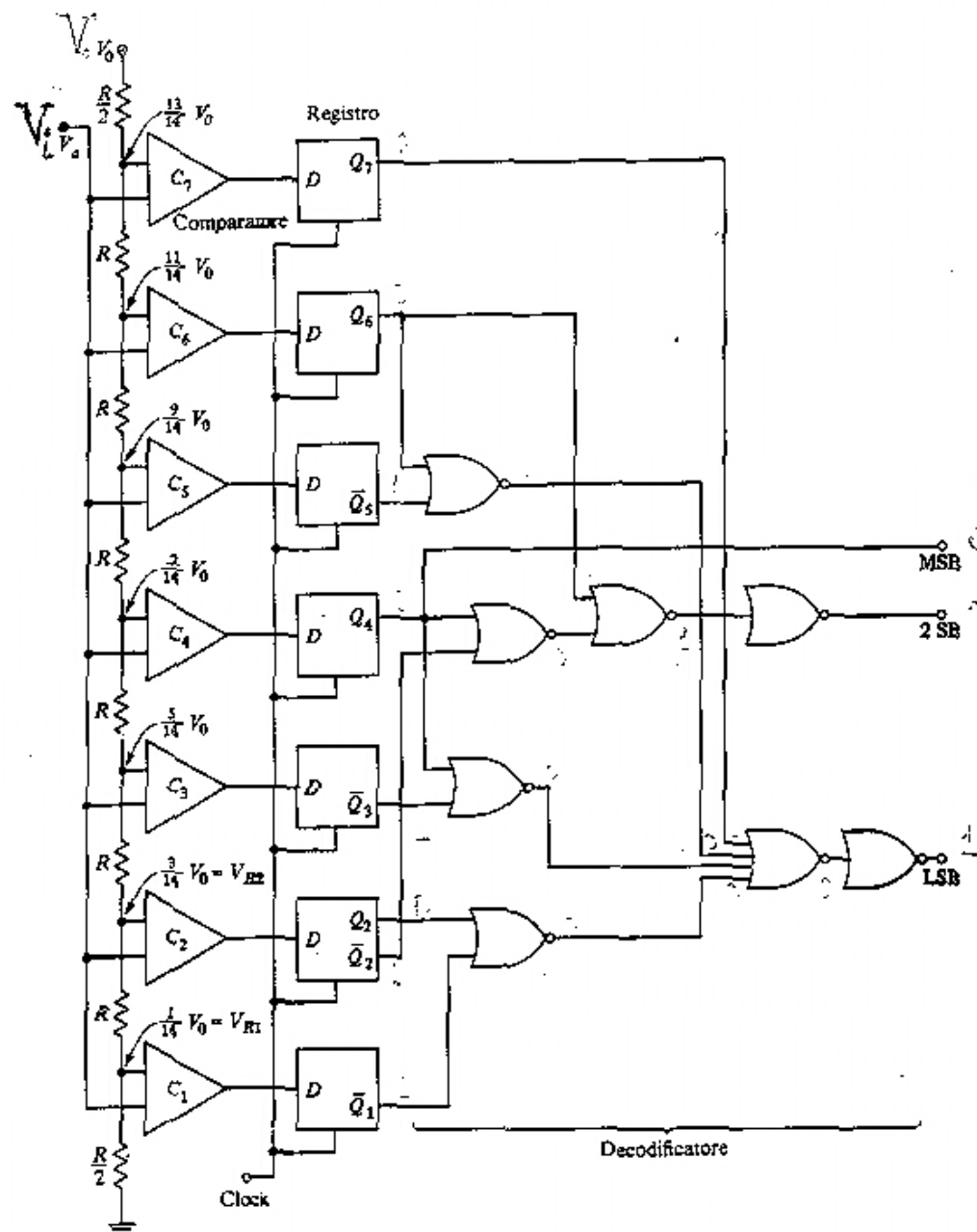
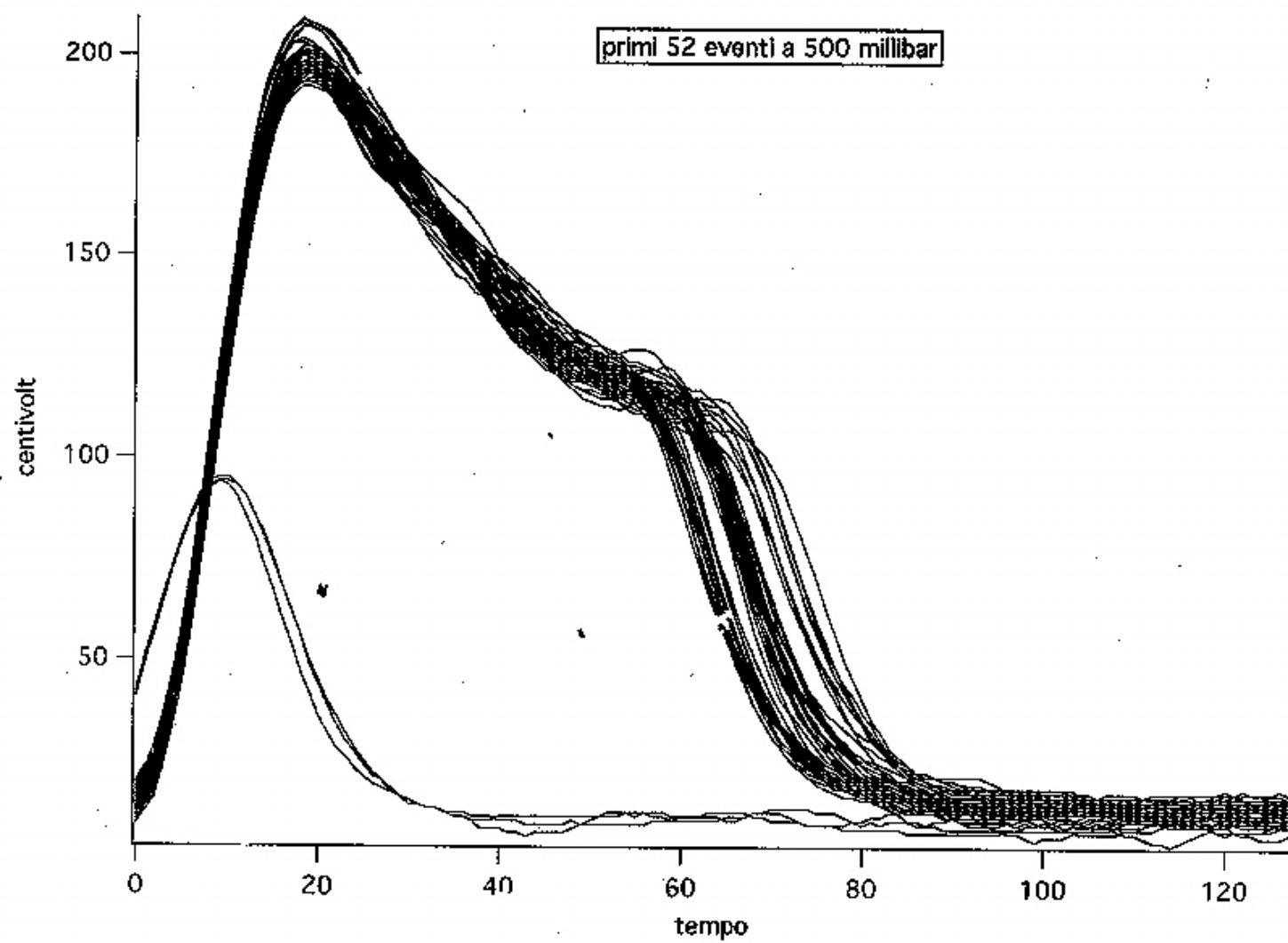


Figura 14.12-1 Convertitore A/D a comparatori.

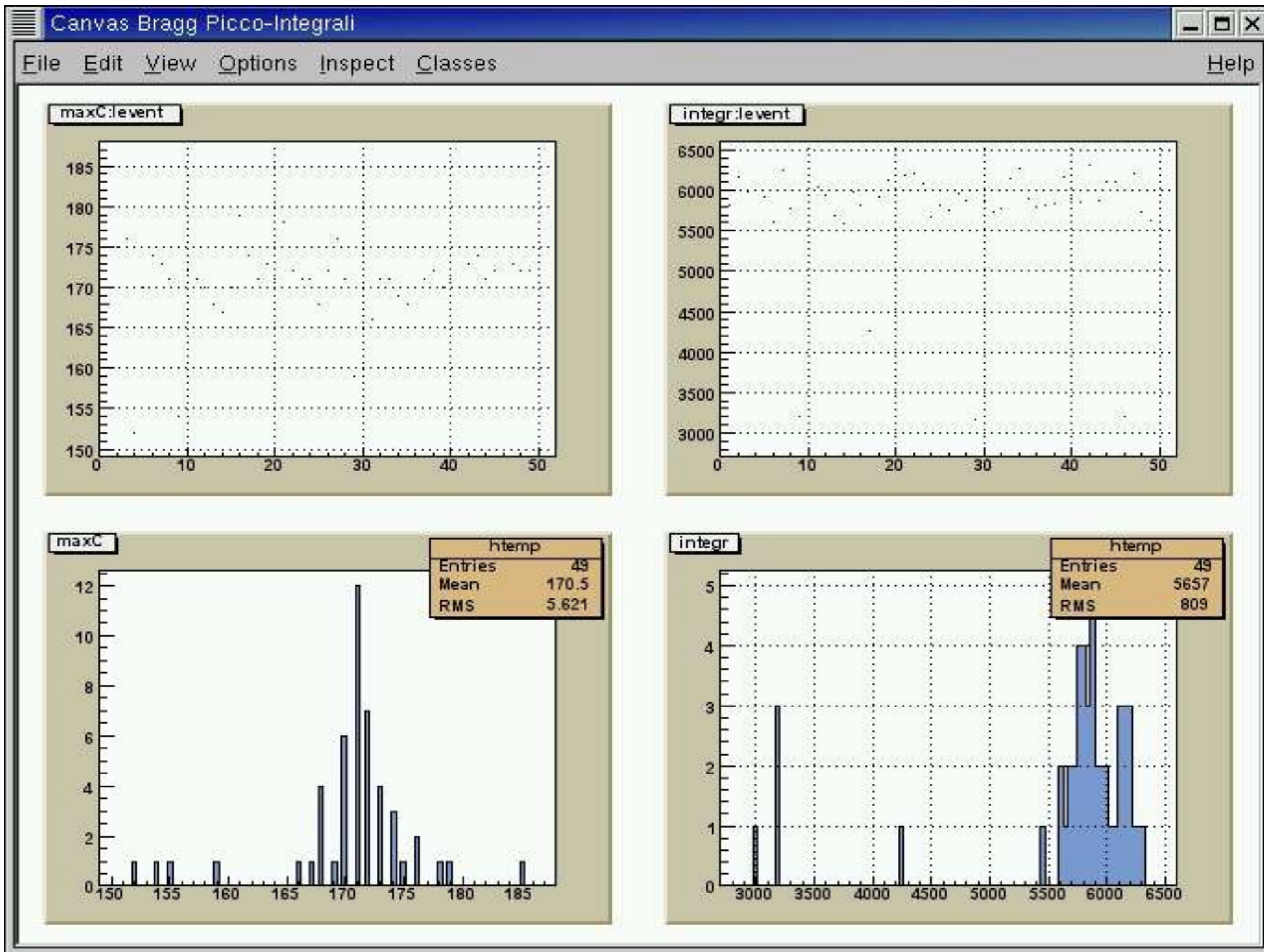
## Sorgente composita

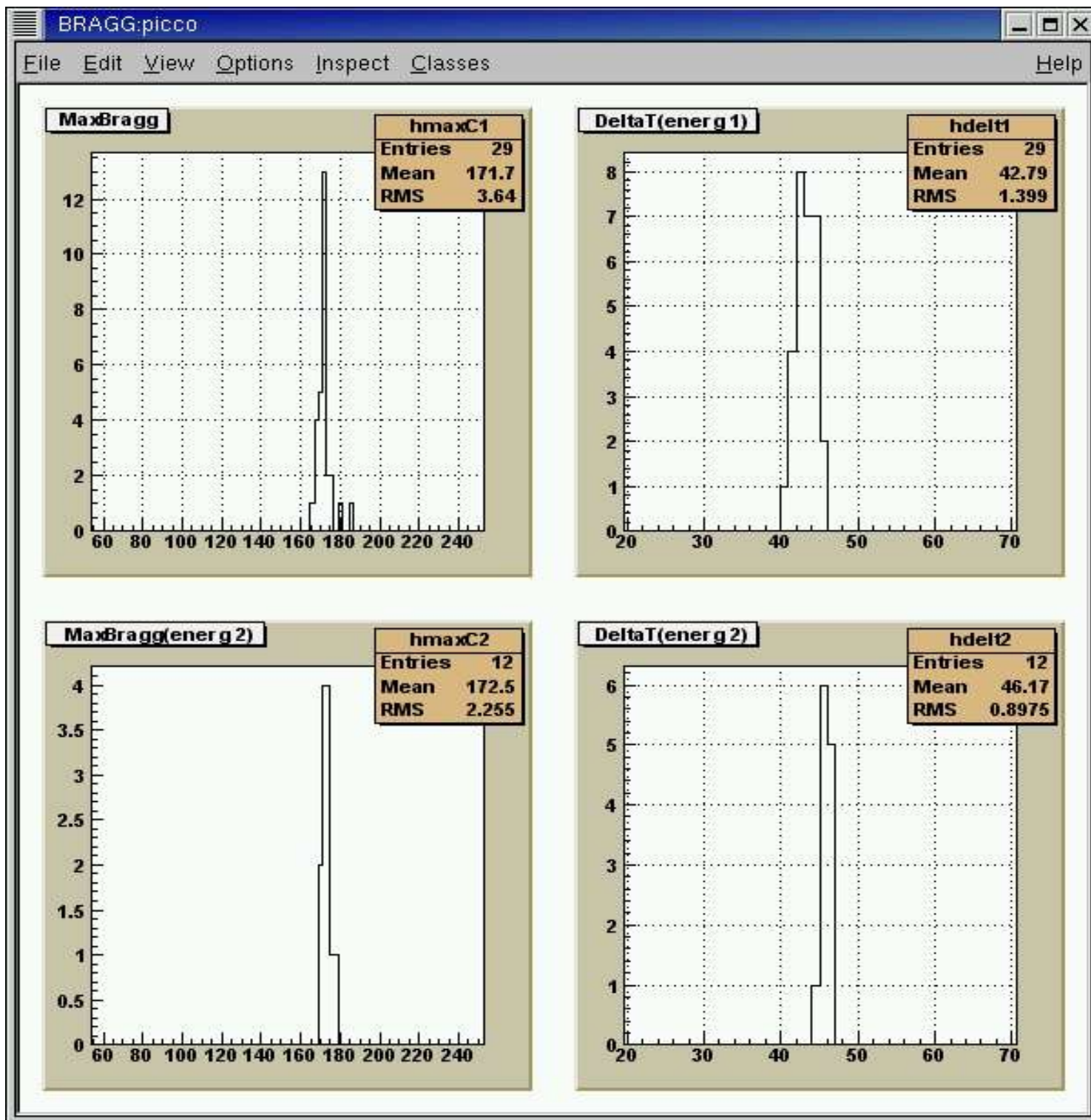
$^{241}\text{Am}$ (432.7 y )	5484 keV	85%
	5442 keV	12%
	5387 keV	1.6%
$^{244}\text{Cm}$ (18.11 y )	5806 keV	76%
	5763 KeV	24%

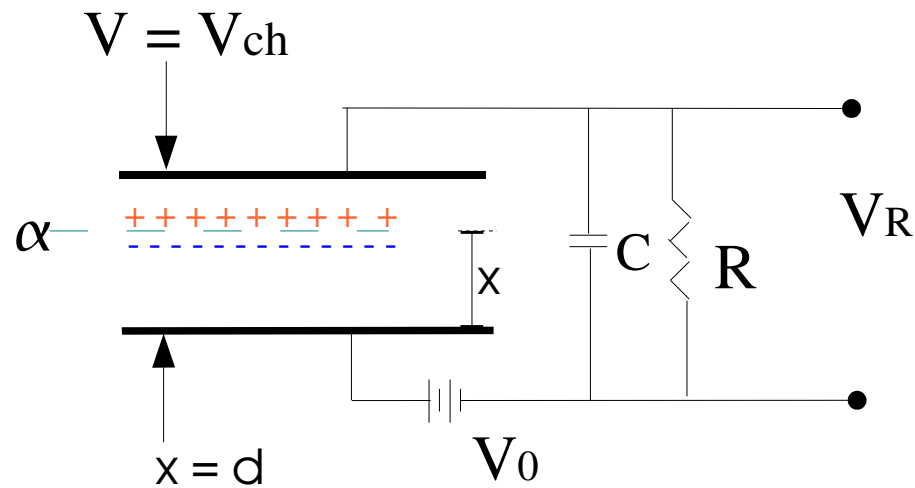


# Esperienza di Bragg

- Estrarre da ogni evento:
  - Picco di Bragg
  - Energia dello ione incidente
  - Range dello ione incidente
  - Velocità di drift degli elettroni







$$\frac{1}{2}CV_0^2 = n_0ev^+tE + n_0ev^-tE + \frac{1}{2}CV_{ch}^2$$

dove  $E = \frac{V}{d}$

se consideriamo che  $V_0 + V_{ch} \simeq 2V_0$  e  $\frac{V_{ch}}{d} \simeq \frac{V_0}{d}$

$$\frac{1}{2}C(2V_0)(V_0 - V_{ch}) = n_0e\frac{V_{ch}}{d}(v^+ + v^-)t$$

da cui otteniamo

$$V_R = \frac{n_0e}{dC}(v^+ + v^-)t$$

dopo un tempo  $t^- = \frac{x}{v^-}$   $V_R = \frac{n_0e(x+v^+t)}{dC}$

e dopo  $t^+ = \frac{(d-x)}{v^+}$   $V_R = \frac{n_0e}{C}$