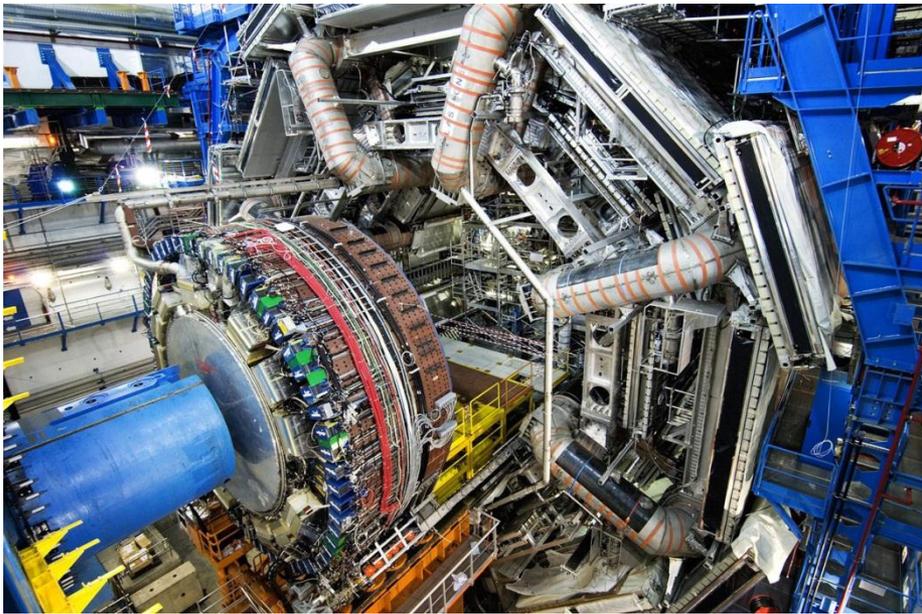
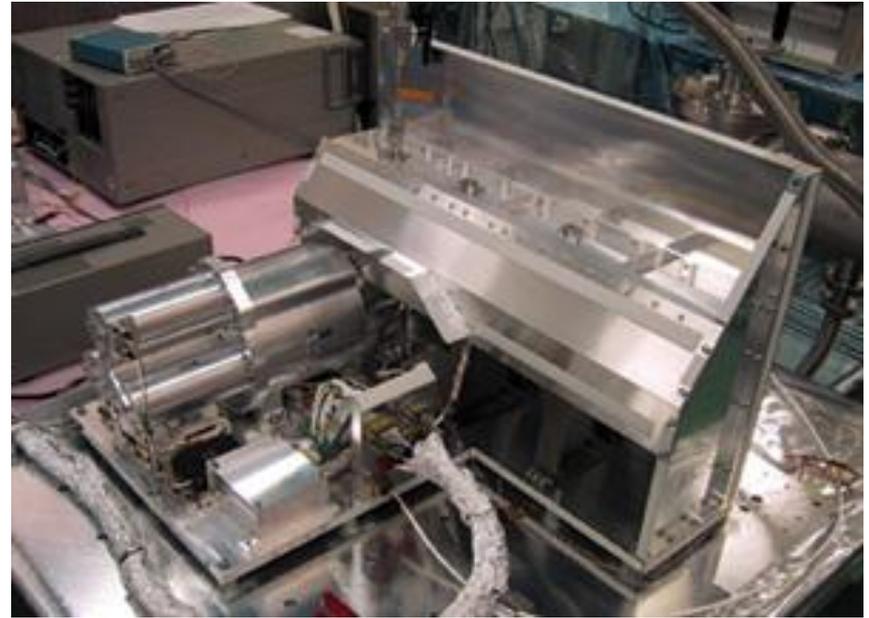


Mesurer l'infiniment petit et observer l'infiniment grand

stefano.panebianco@cea.fr



Détecteur ATLAS - CERN



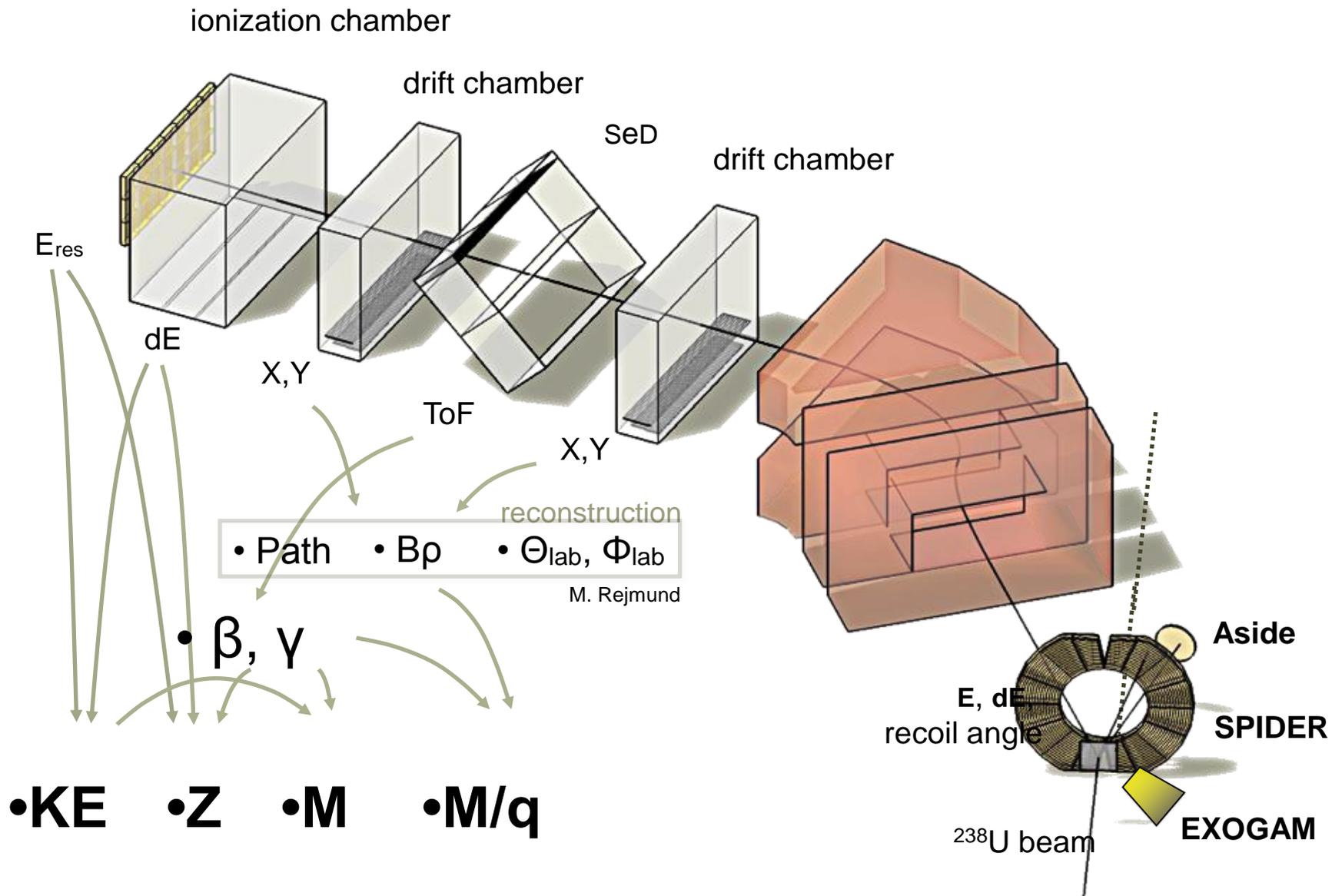
Détecteur GRD- KAGUYA

Plan des cours

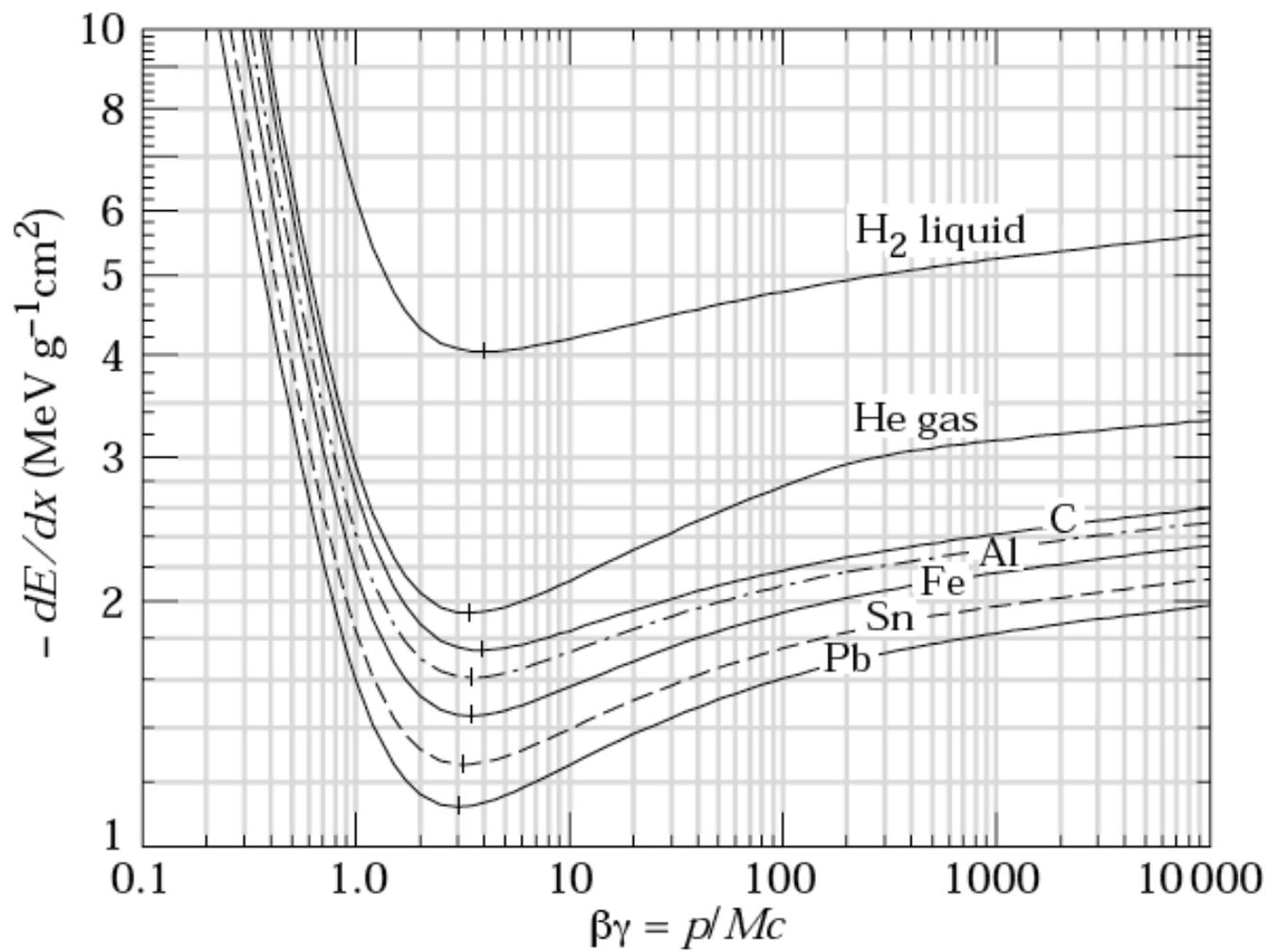
- 1^{er} cours
 - Comment mesurer des particules subatomiques?
 - Comment ces particules interagissent-elles avec la matière?
- 2^{ème} cours
 - Les détecteurs à ionisation
 - Les détecteurs à scintillation
- 3^{ème} cours
 - Les détecteurs semi-conducteurs
 - L'électronique de lecture

Plan des cours

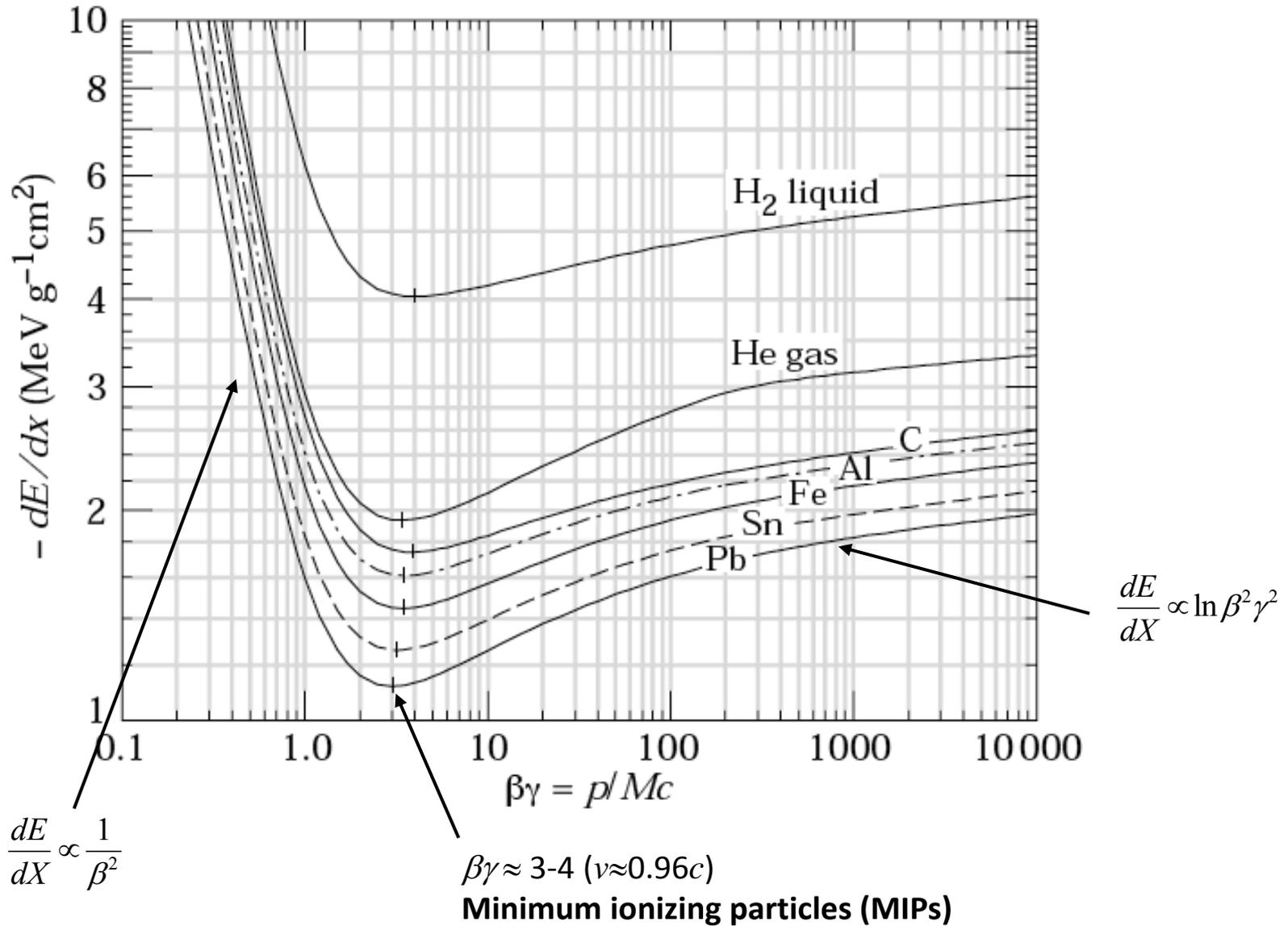
- 1^{er} cours
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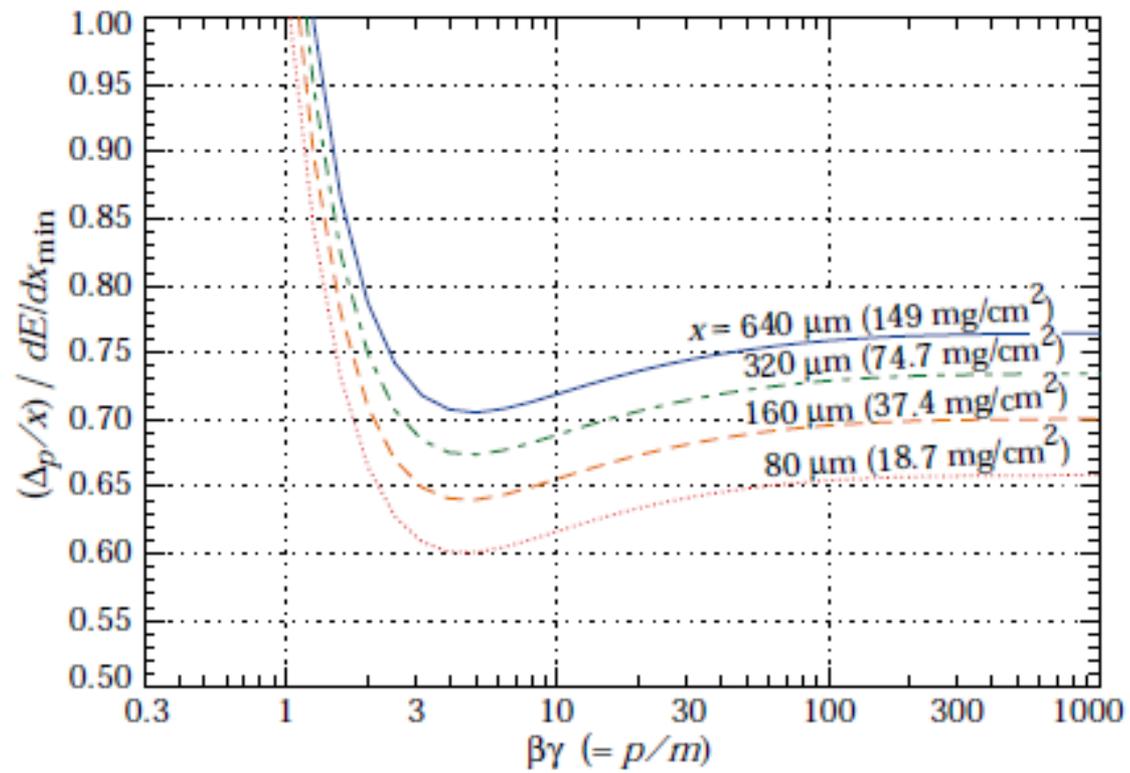


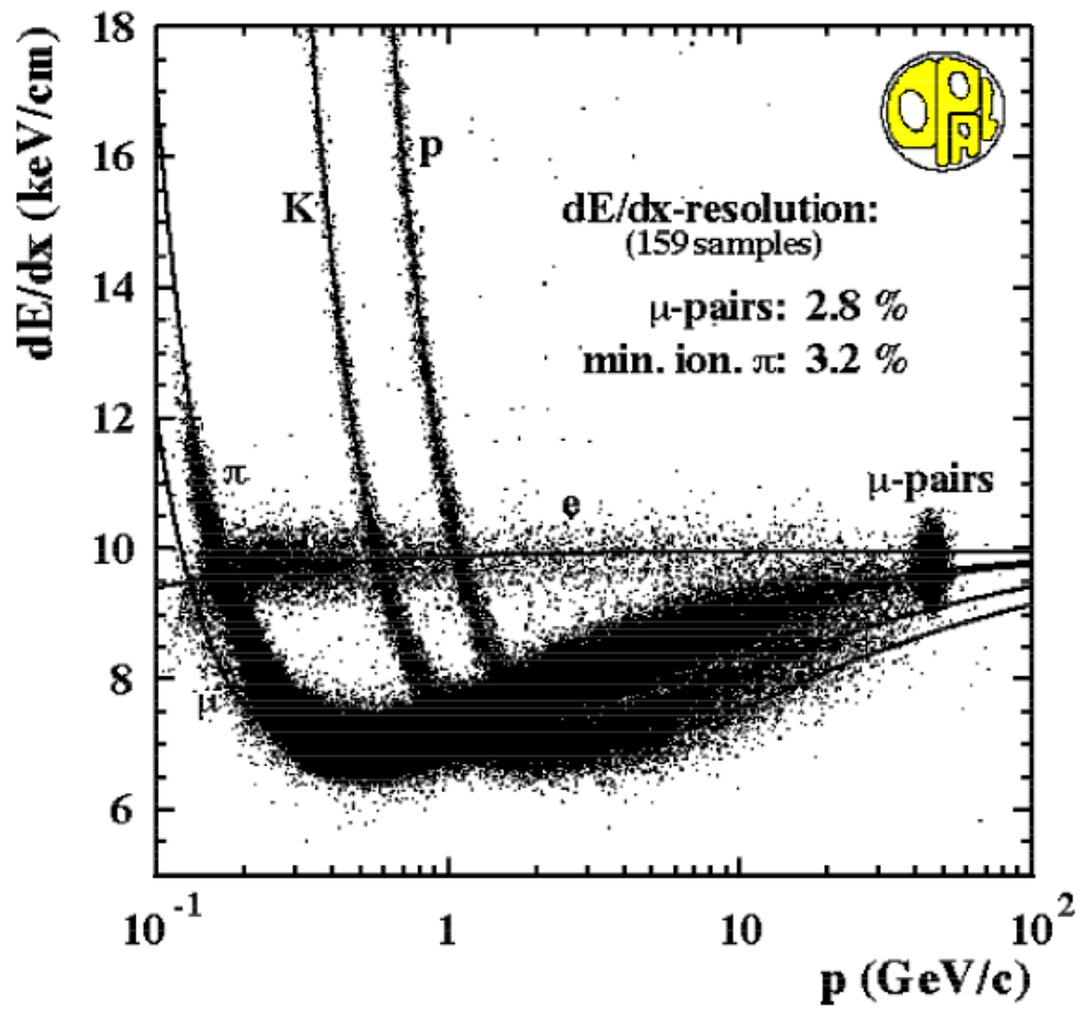
Interaction des particules chargées

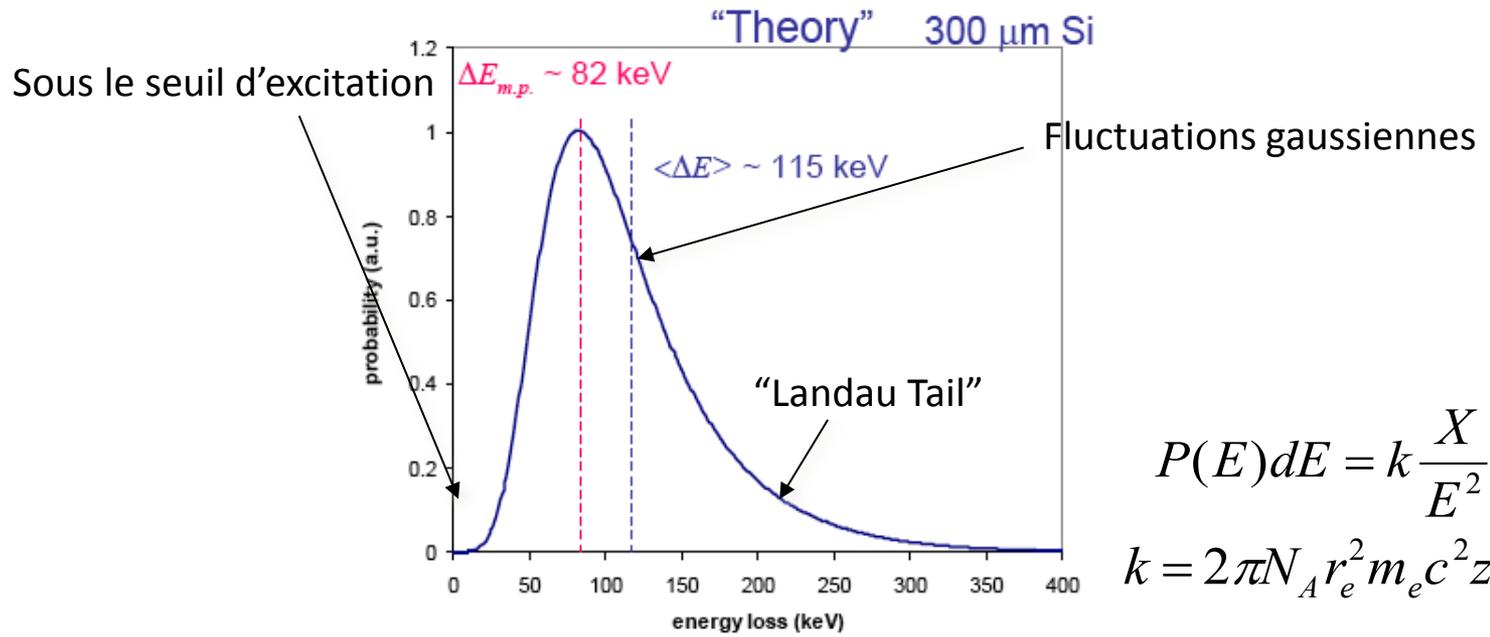


$$-\frac{dE}{dX} = 4\pi N_A r_e^2 m_e c^2 z^2 \frac{Z}{A} \rho \frac{1}{\beta^2} \left[\frac{1}{2} \ln \frac{2m_e c^2 \gamma^2 \beta^2 T_{\max}}{I^2} - \beta^2 - \frac{\delta}{2} - \frac{C}{Z} \right]$$



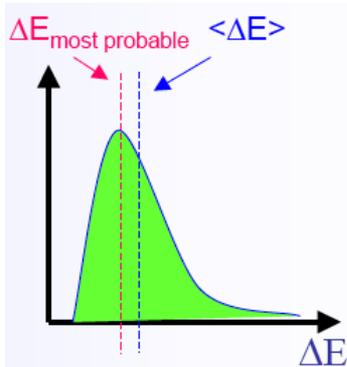




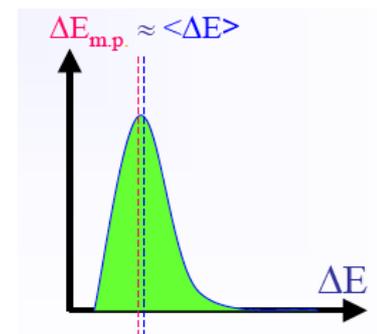


$$P(E)dE = k \frac{X}{E^2} dE$$

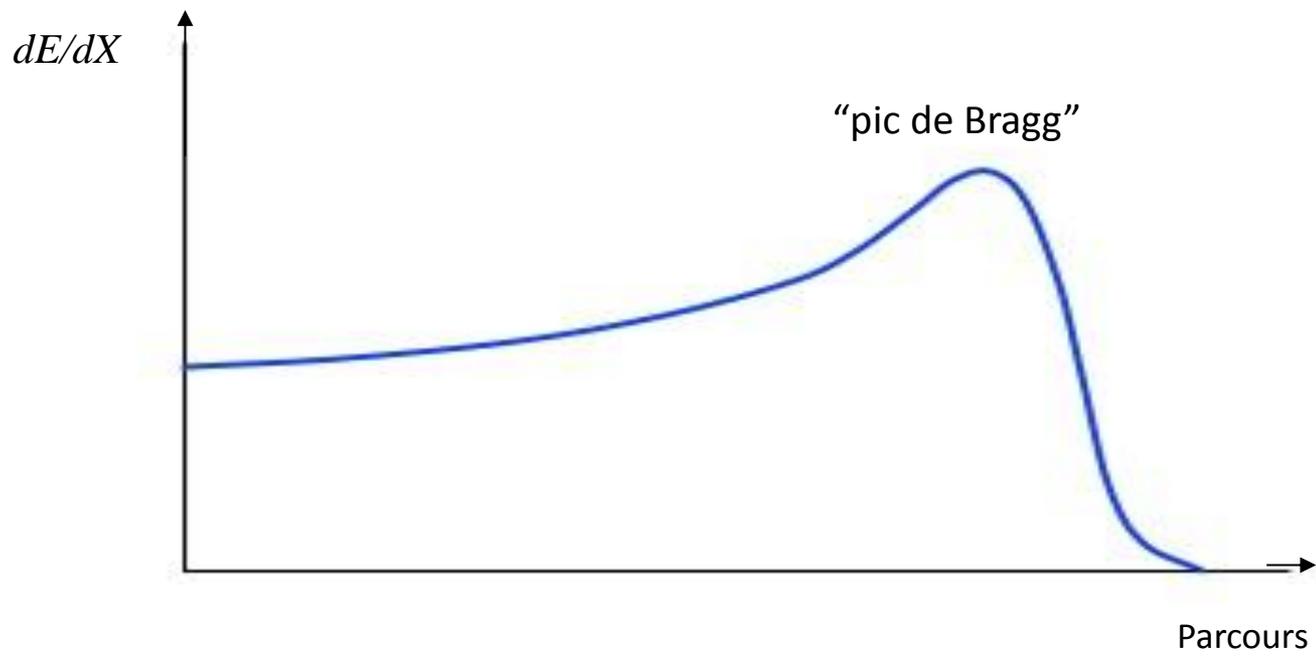
$$k = 2\pi N_A r_e^2 m_e c^2 z^2 \frac{Z}{A} \frac{1}{\beta^2}$$

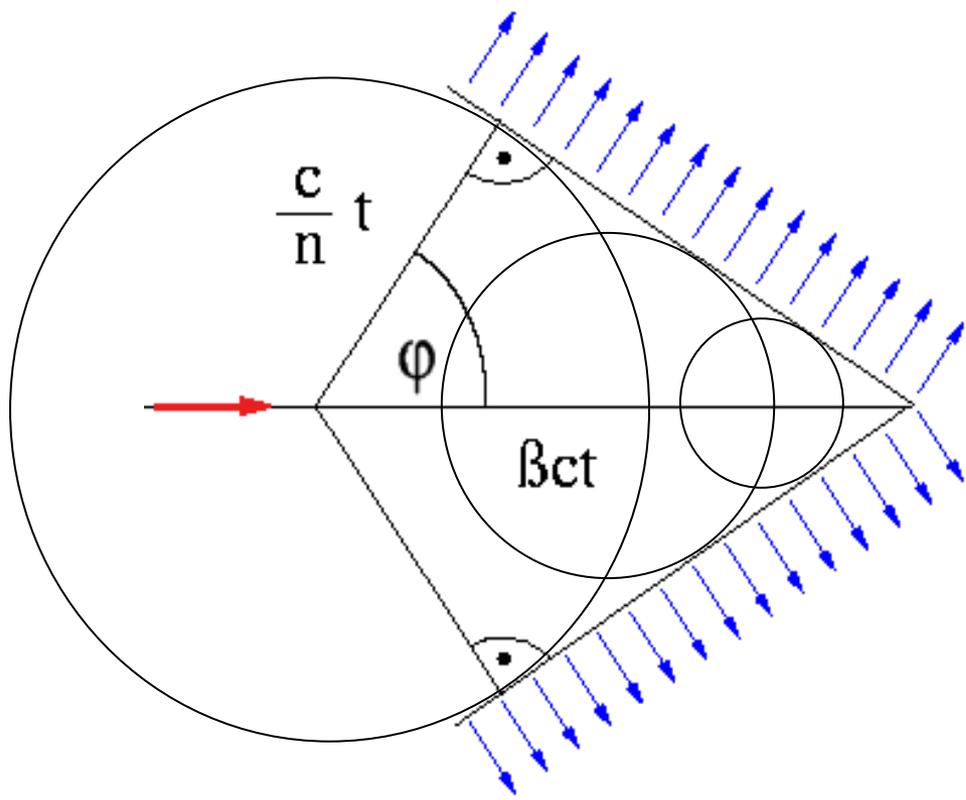


Matériau fin



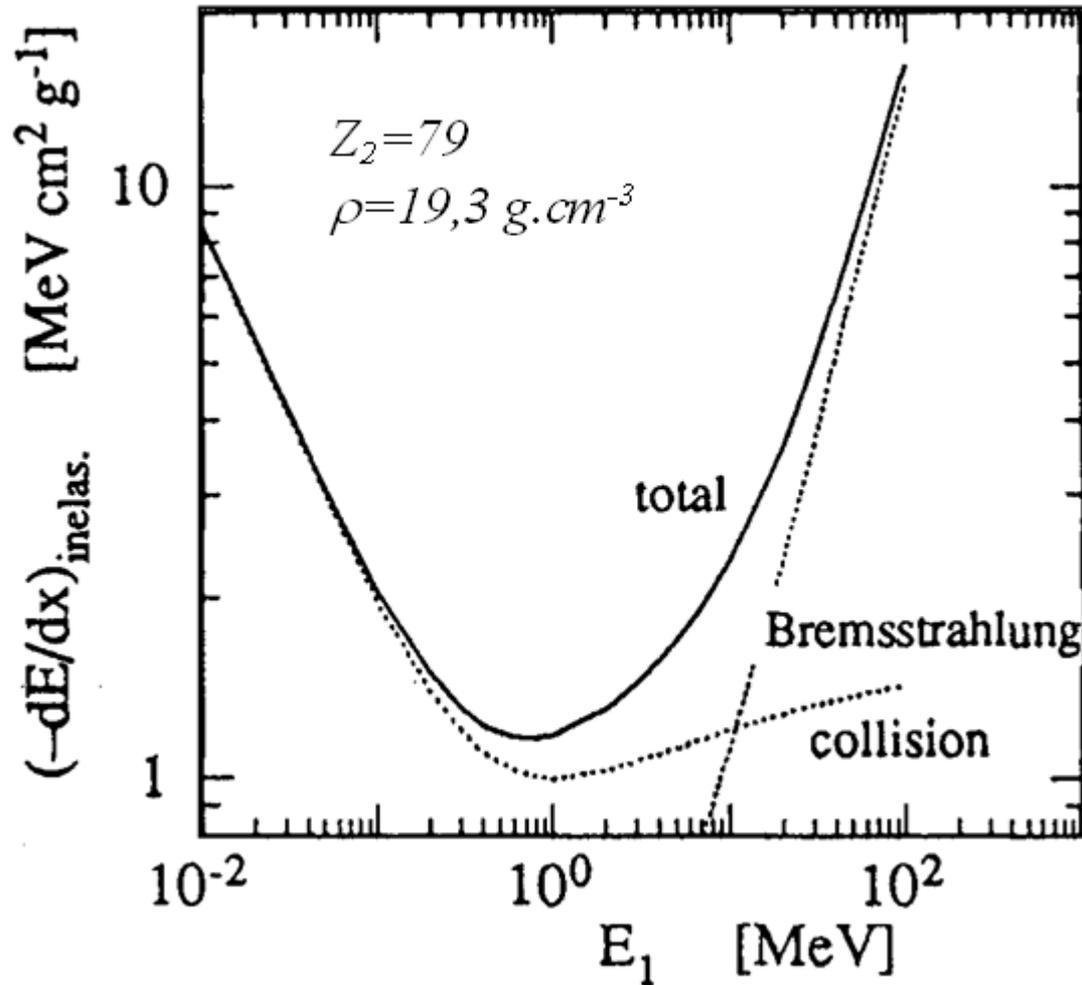
Matériau épais

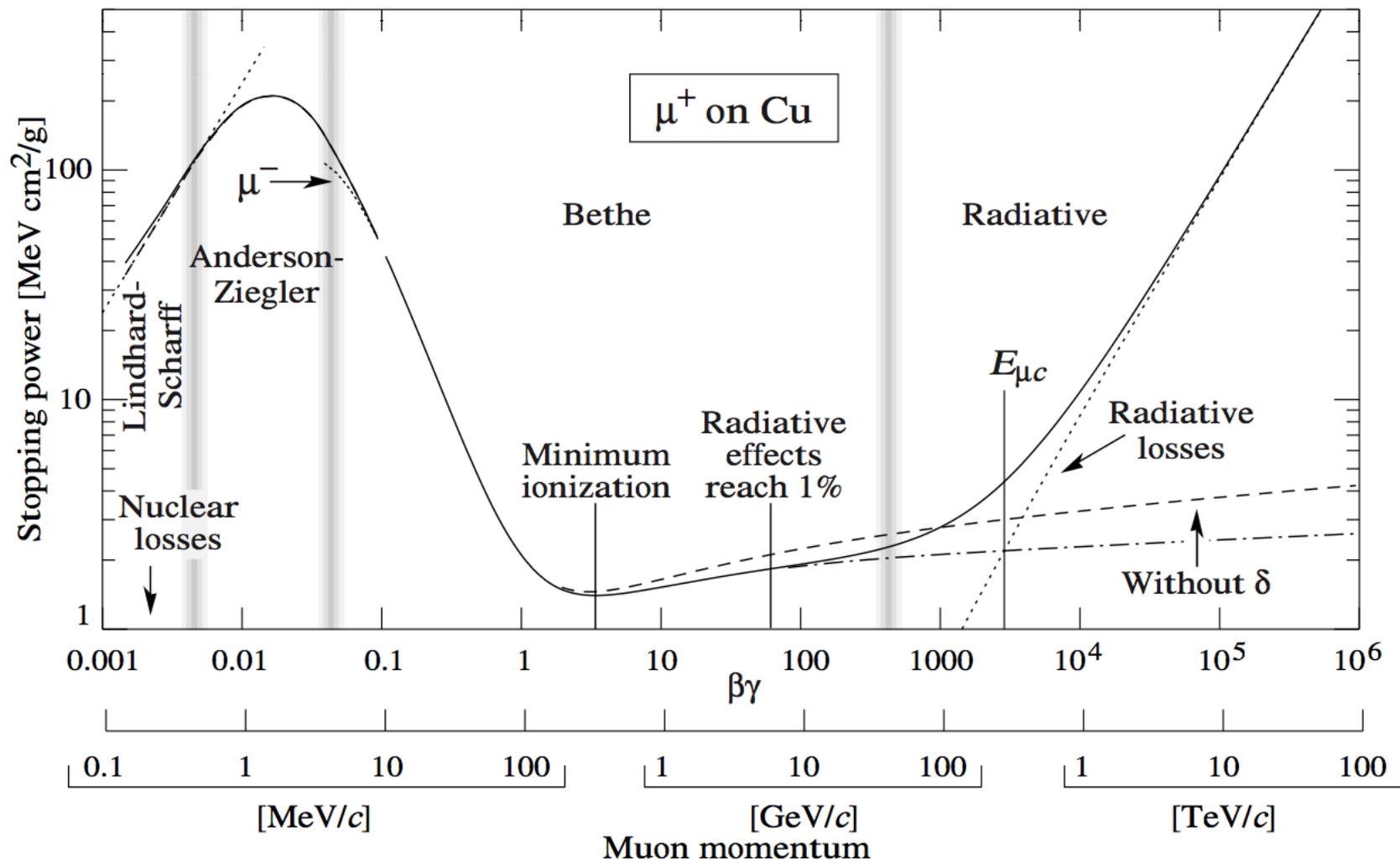




$$\left. \frac{dE}{dX} \right|_{tot} = \left. \frac{dE}{dX} \right|_{rad} + \left. \frac{dE}{dX} \right|_{ion}$$

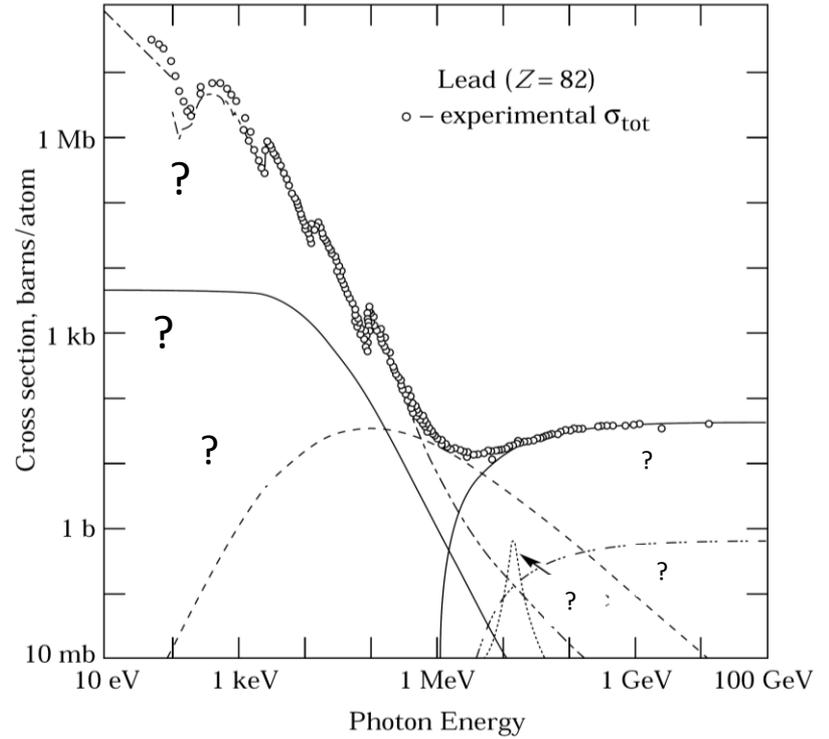
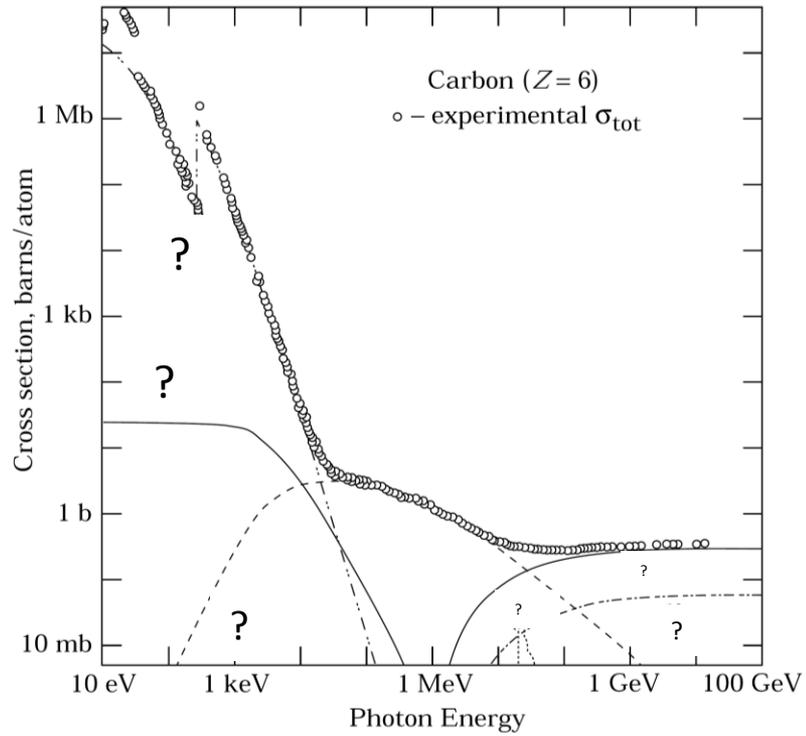
$$-\left. \frac{dE}{dX} \right|_{rad} = 4\alpha N_A r_e^2 \frac{Z^2}{A} E \ln \frac{183}{Z^{1/3}}$$



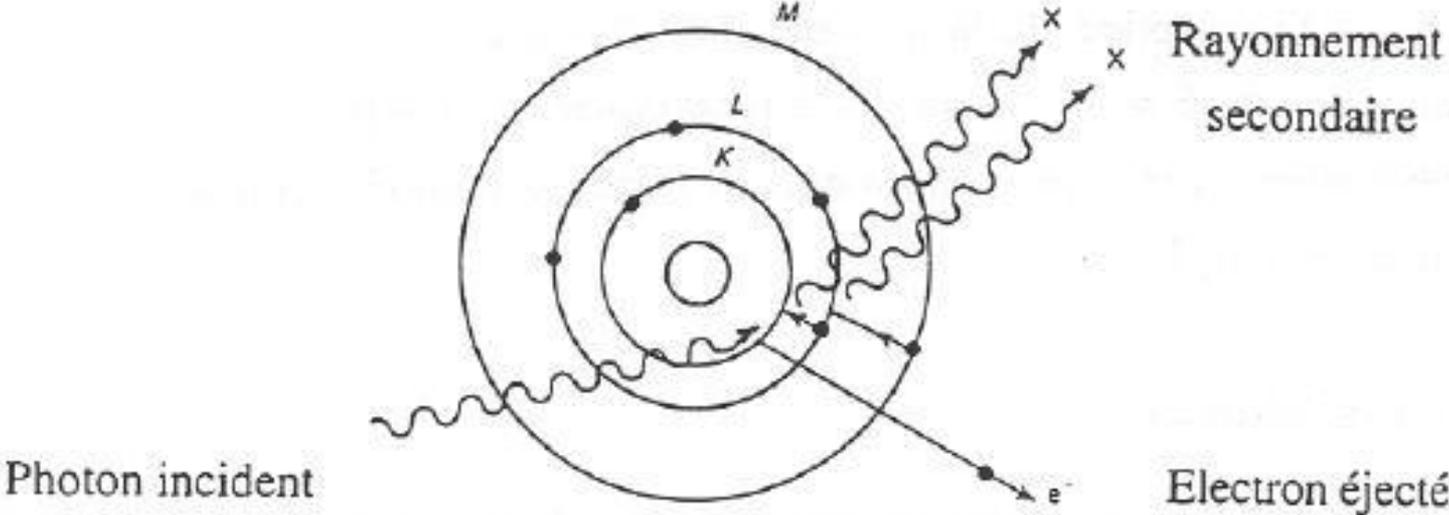


Interaction des photons

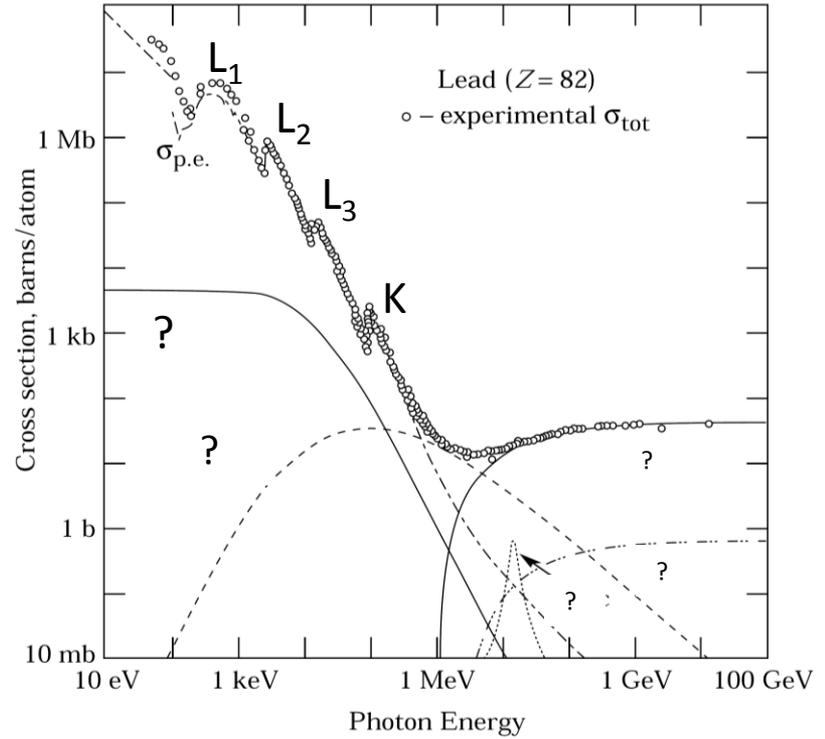
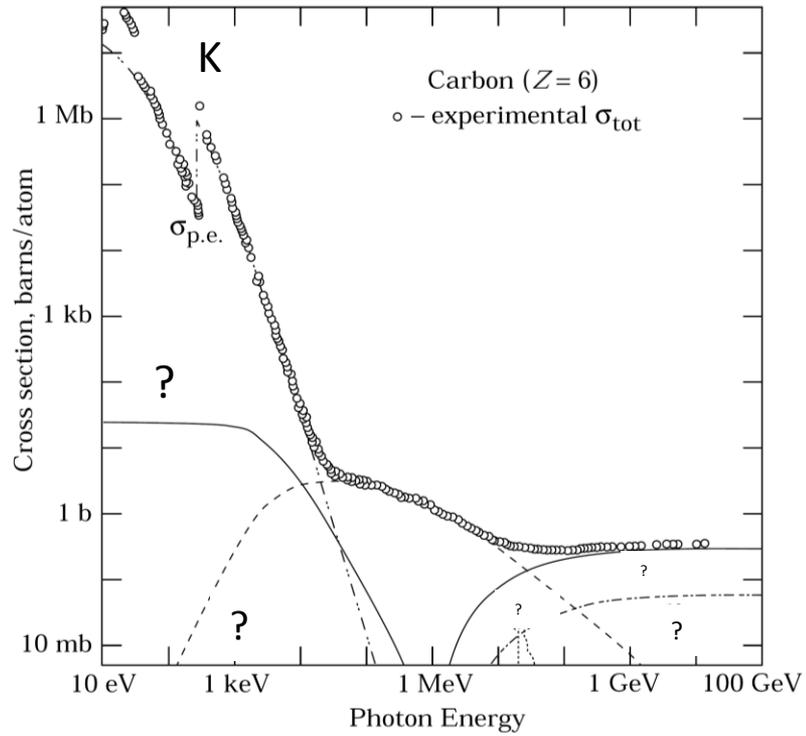
Section efficace d'interaction des photons



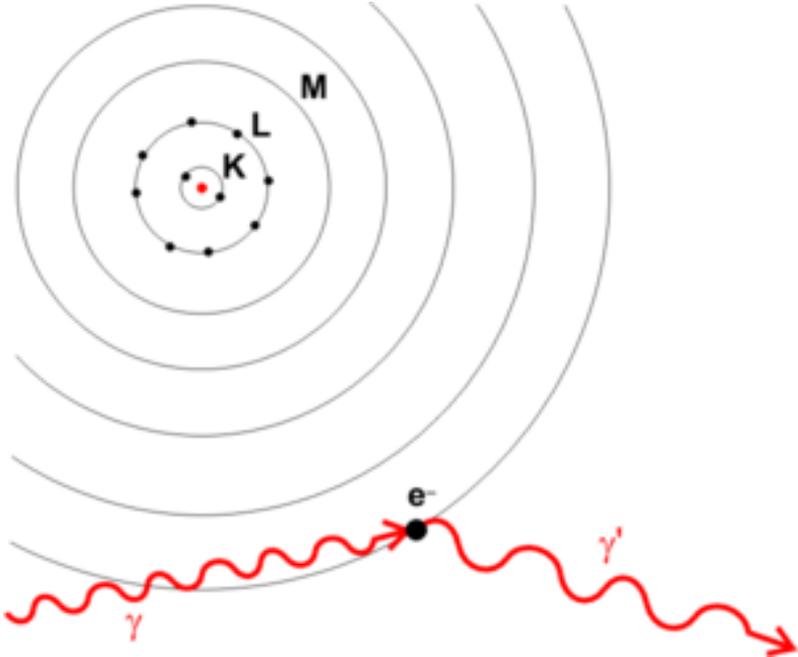
Effet photoélectrique



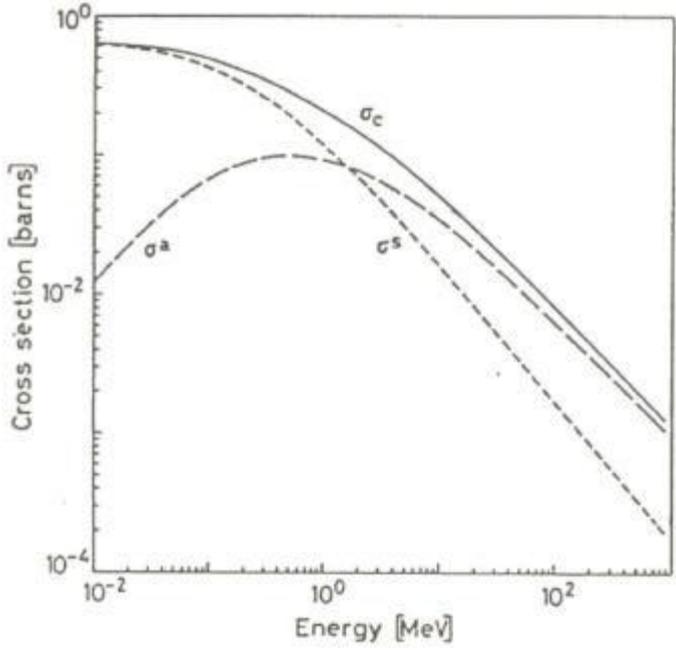
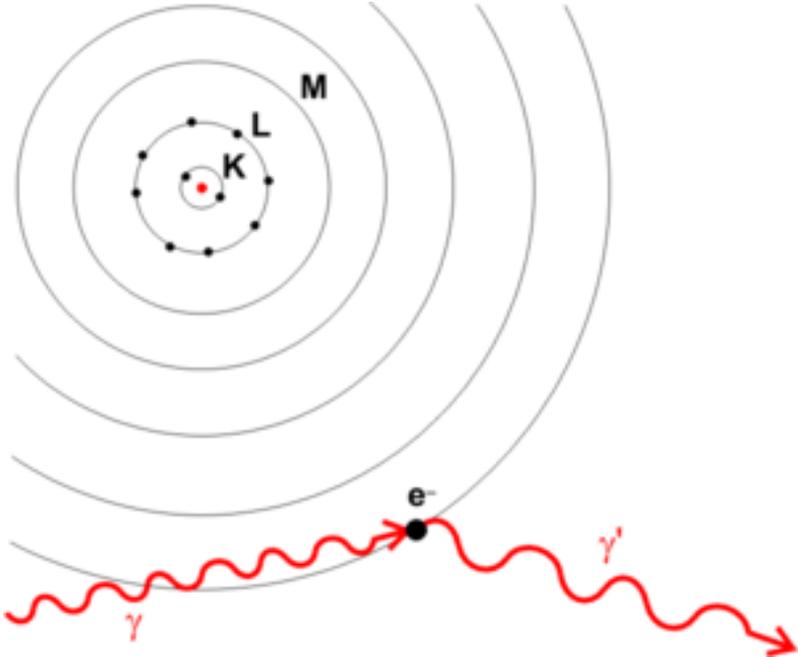
Section efficace d'interaction des photons



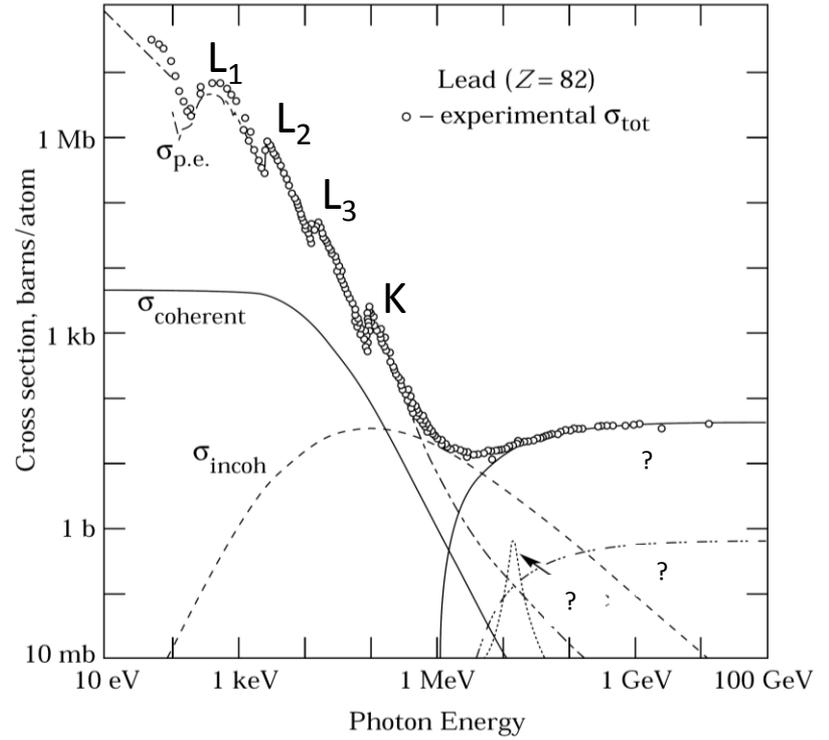
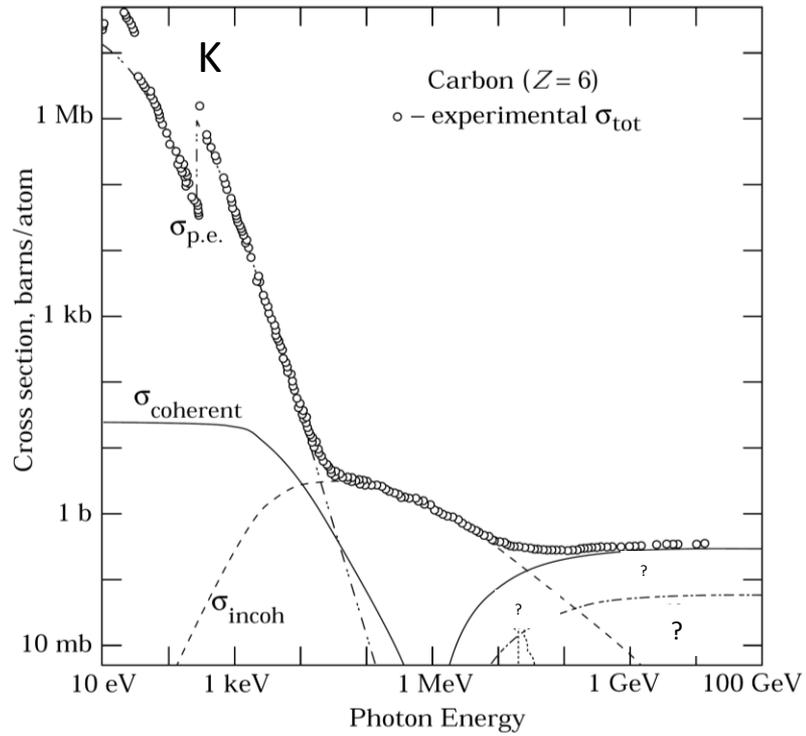
Effet Compton



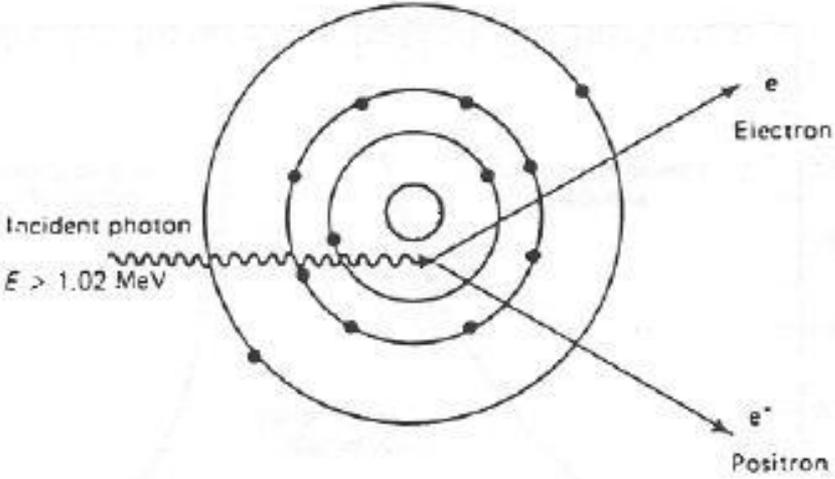
Effet Compton



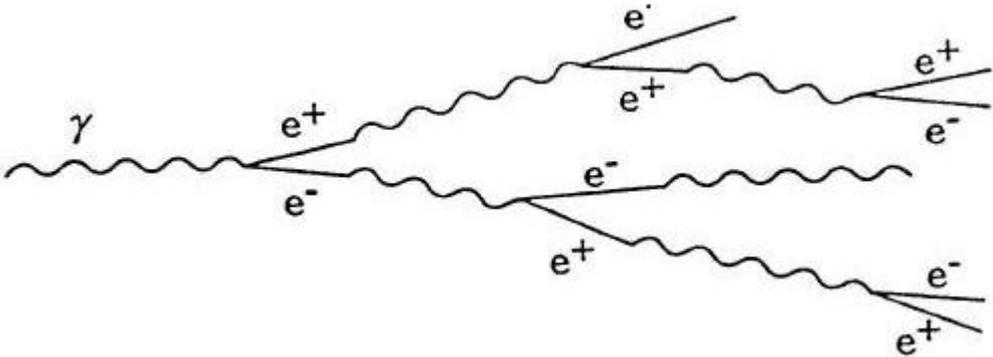
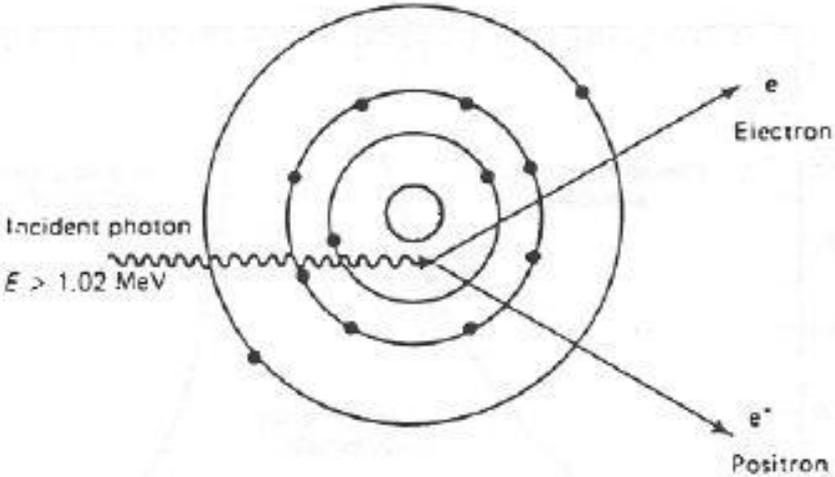
Section efficace d'interaction des photons



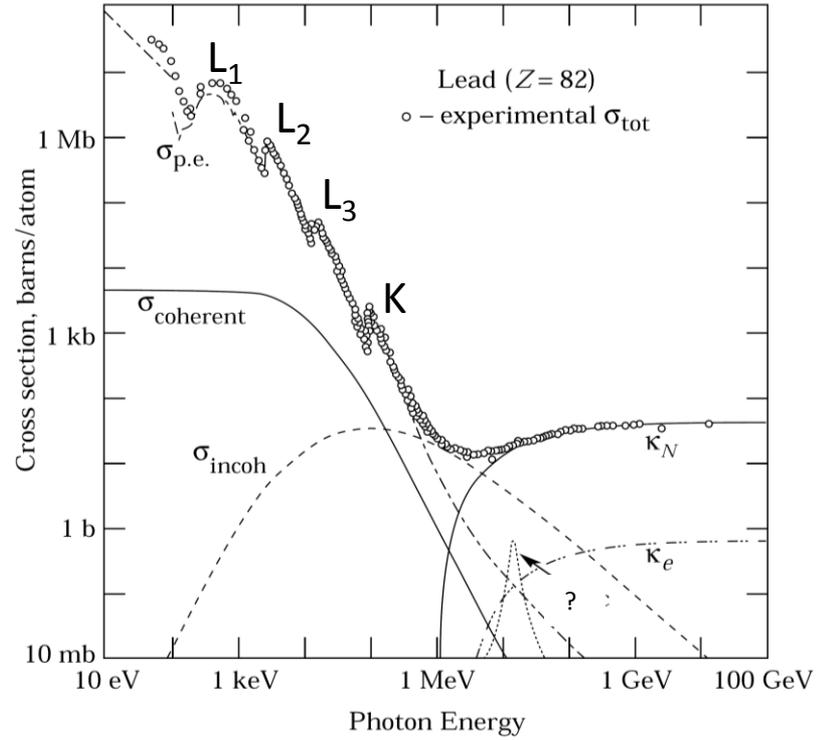
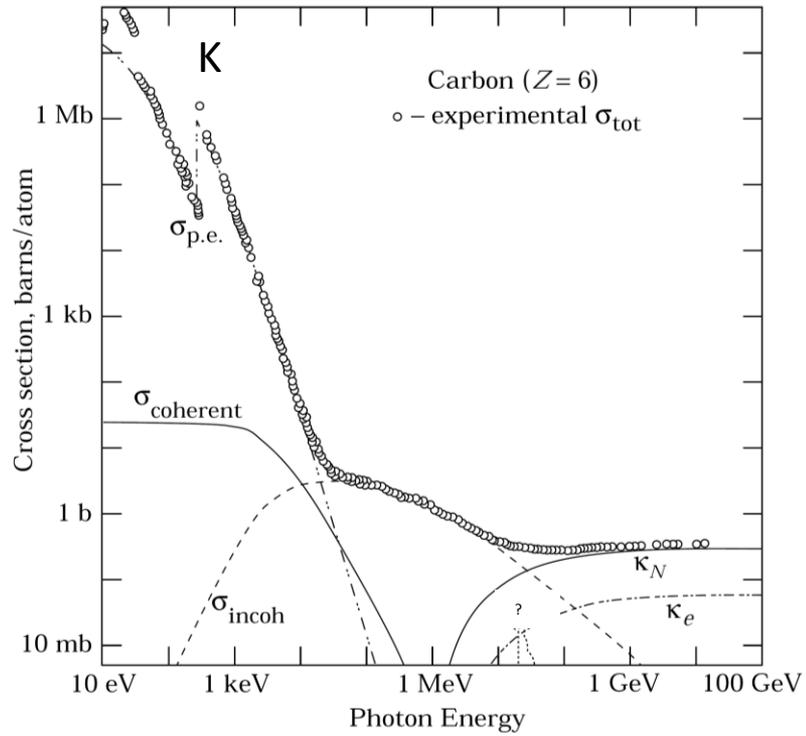
Production de paires



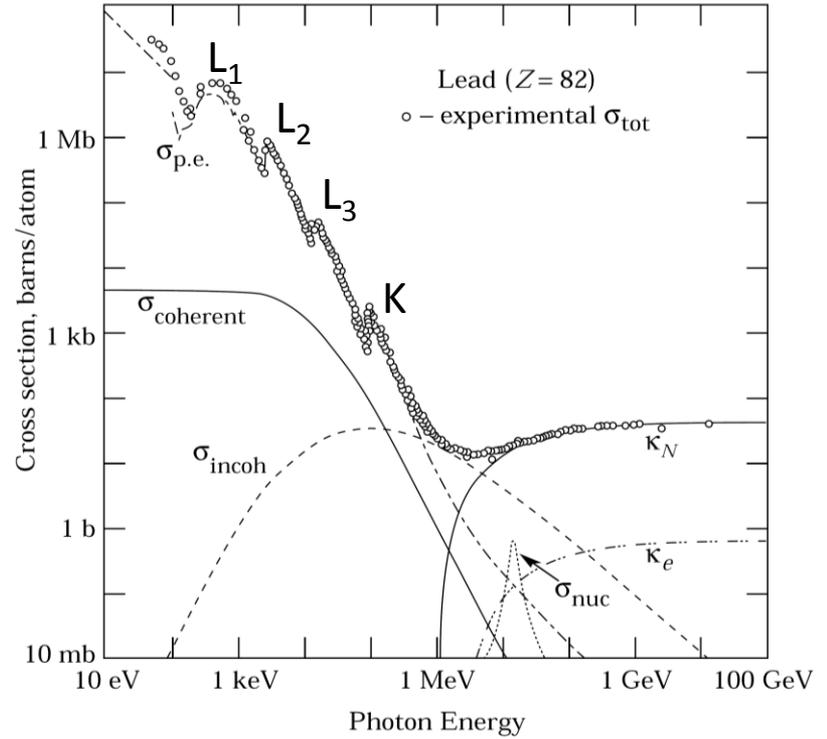
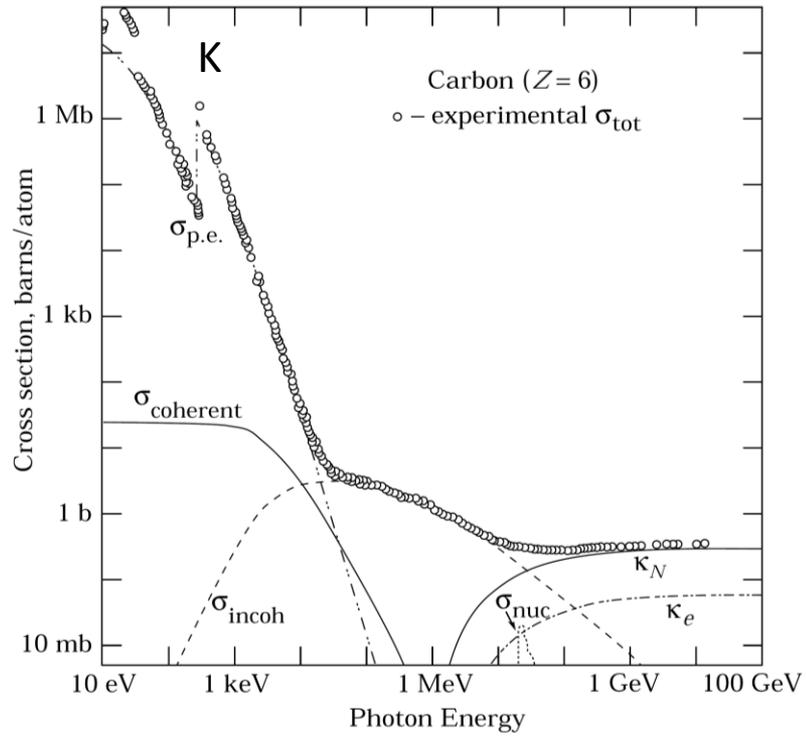
Production de paires



Section efficace d'interaction des photons

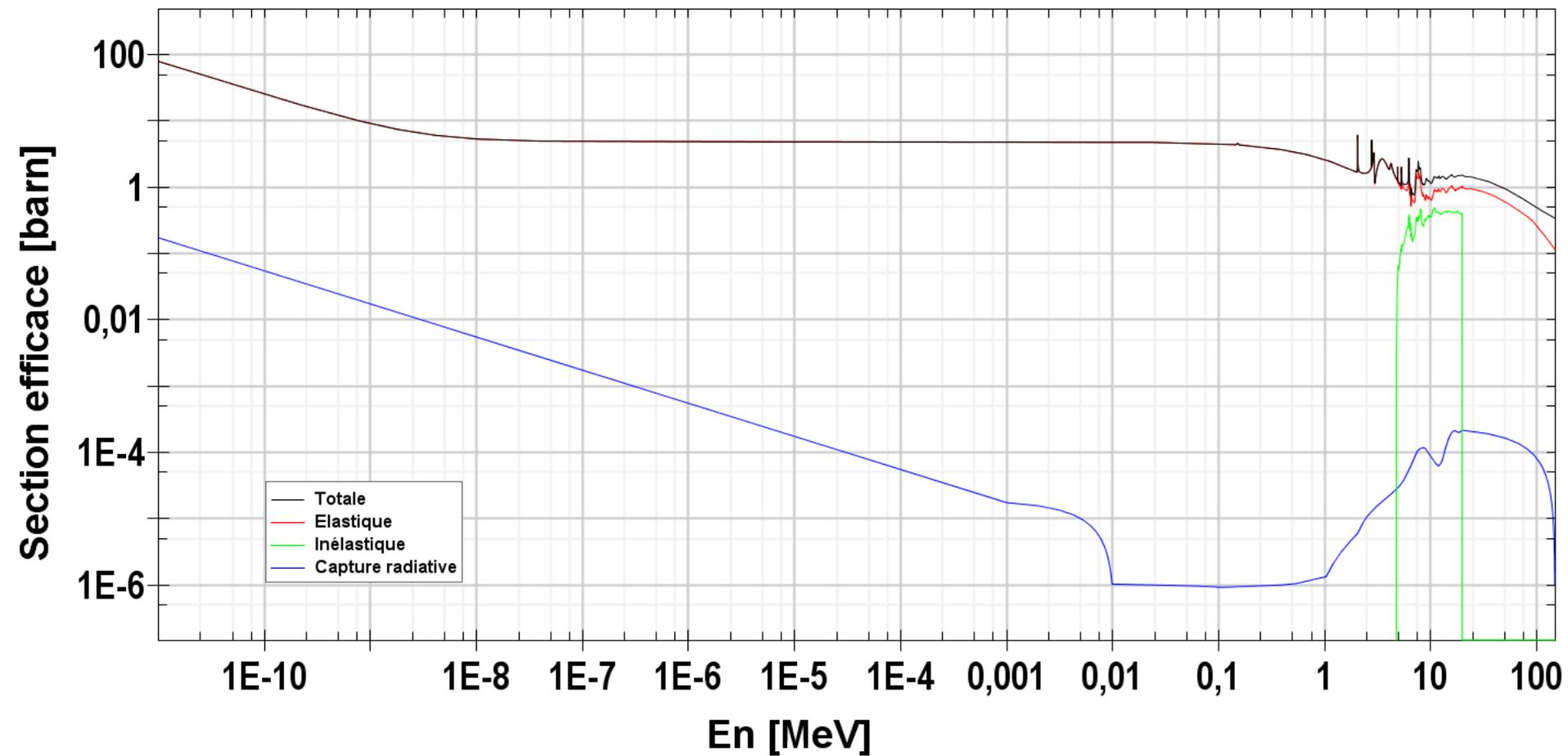


Section efficace d'interaction des photons

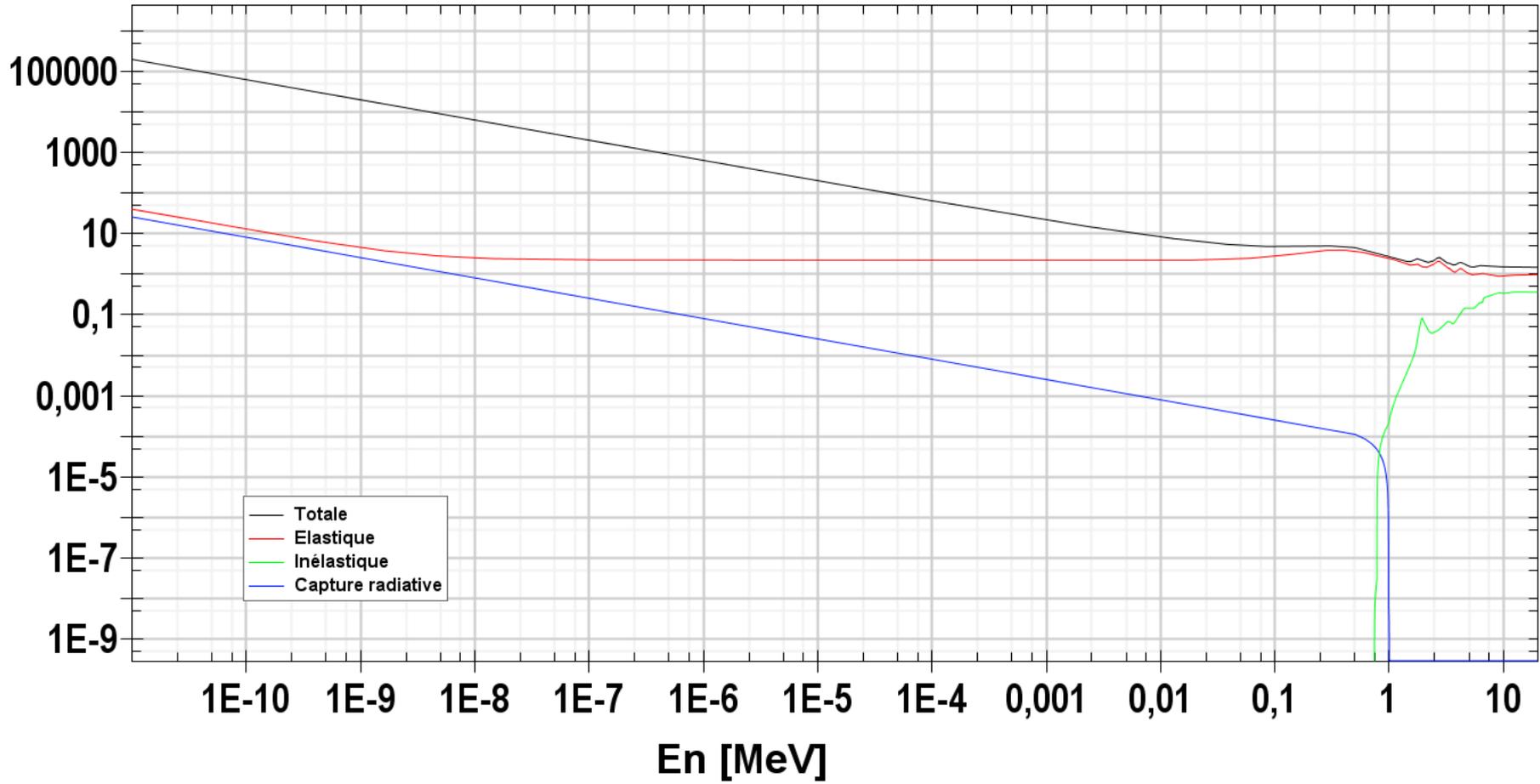


Interaction des neutrons

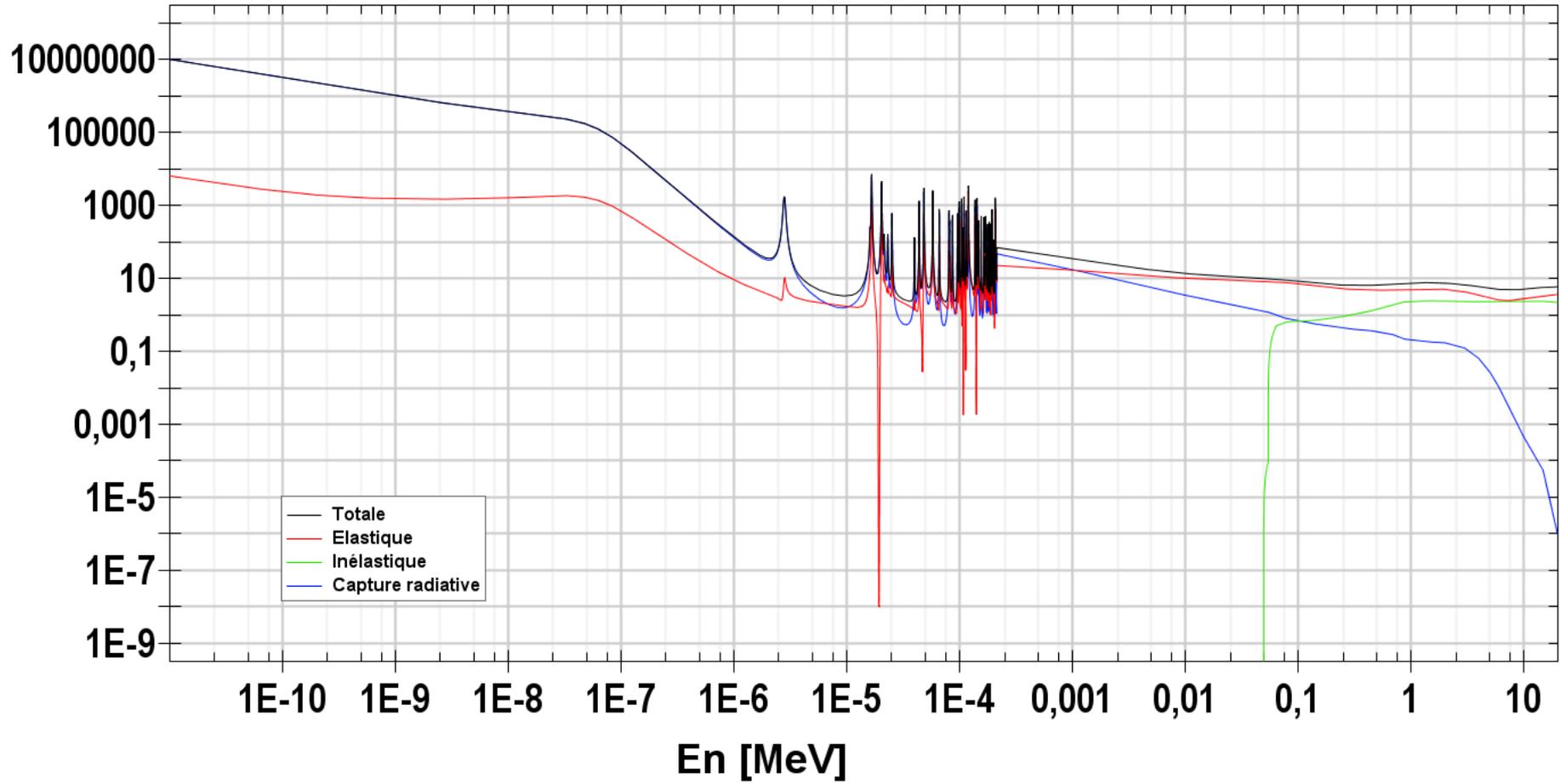
Carbon neutron cross sections



B-10 neutron cross sections



Gd-157 neutron cross sections



U-238 neutron cross sections

