Evidência de estrutura fractal em hádrons 2

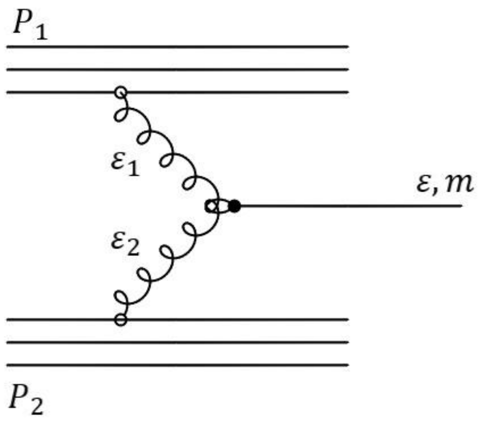
Modelo antigo

$$E\frac{d\sigma}{dp^3} = \sigma_0\left(1+(q-1)\frac{\varepsilon_1}{\Lambda}\right)^{\frac{-q}{q-1}}\left(1+(q-1)\frac{\varepsilon_2}{\Lambda}\right)^{\frac{-q}{q-1}}\left(1+(q-1)\frac{\varepsilon}{\lambda}\right)^{\frac{-1}{q-1}}$$

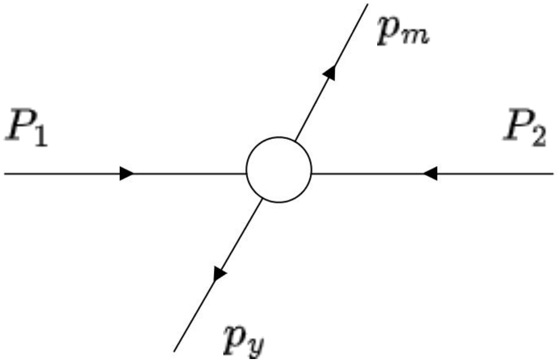
Parâmetros σ_0 Λ $\lambda = 0.14$ $q = 1.14$

$$\varepsilon = \sqrt{p_t^2 + m^2}$$

$$p_z = 0 \implies \varepsilon_1 = \varepsilon_2 = \frac{1}{2}\varepsilon$$



Modelo novo



$$E\frac{d^3\sigma}{dp_m^3} = \left(\int_0^1 dx_1 \int_0^1 dx_2 e_{\bar{q}}(\frac{x_1E_1}{\Lambda})e_{\bar{q}}(\frac{x_2E_2}{\Lambda})\right) \int d^4p_y e_q(\frac{\varepsilon_m}{\lambda})e_q(\frac{\varepsilon_y}{\lambda})\delta(p_y^2 - m_y^2)\delta^4(P_1 + P_2 - p_m - p_y)$$

$$\delta^4(P_1 + P_2 - p_m - p_y) \Rightarrow p_y = P_1 + P_2 - p_m \Rightarrow p_y = (\sqrt{s} - \varepsilon_m, -\vec{p_m})$$

Subprocesso

$$x_1E_1 + x_2E_2 = \varepsilon_m \Rightarrow (x_1 + x_2)\frac{\sqrt{s}}{2} = \varepsilon_m \Rightarrow x_1 = \frac{2}{\sqrt{s}}\varepsilon_m - x_2$$

$$E\frac{d^3\sigma}{dp_m^3} = \sigma_0 \int_0^{\frac{2}{\sqrt{s}}\varepsilon_m} dx_2 e_{\bar{q}}\left(\frac{\left(\frac{2}{\sqrt{s}}\varepsilon_m - x_2\right)\frac{\sqrt{s}}{2}}{\Lambda}\right) e_{\bar{q}}\left(\frac{x_2\frac{\sqrt{s}}{2}}{\Lambda}\right) e_q\left(\frac{\varepsilon_m}{\lambda}\right) e_q\left(\frac{\sqrt{s}-\varepsilon_m}{\lambda}\right)$$

Definindo

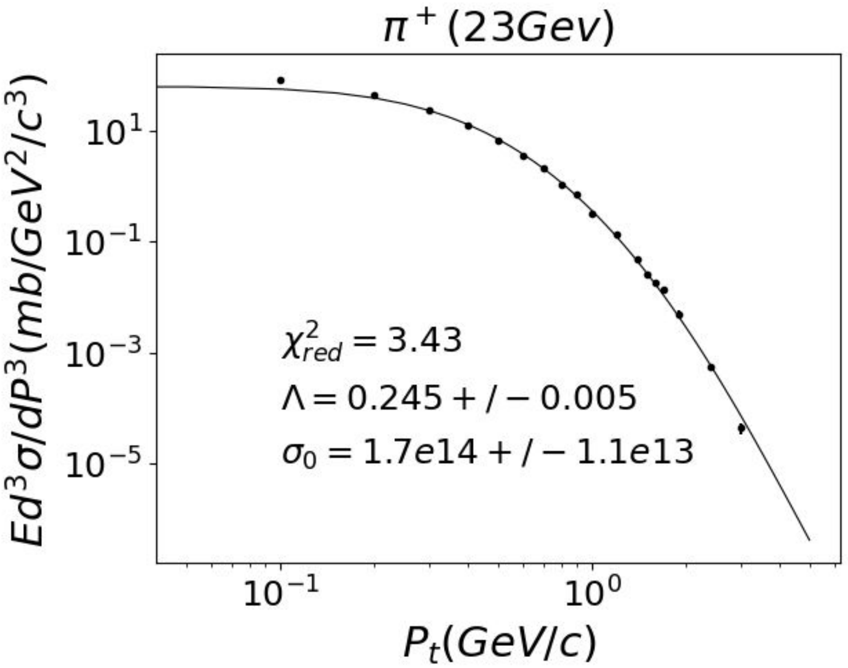
$$F = \int dx e_{\bar{q}}\left(\frac{\left(\frac{2}{\sqrt{s}}\varepsilon_m - x\right)\frac{\sqrt{s}}{2}}{\Lambda}\right) e_{\bar{q}}\left(\frac{x\frac{\sqrt{s}}{2}}{\Lambda}\right) =$$

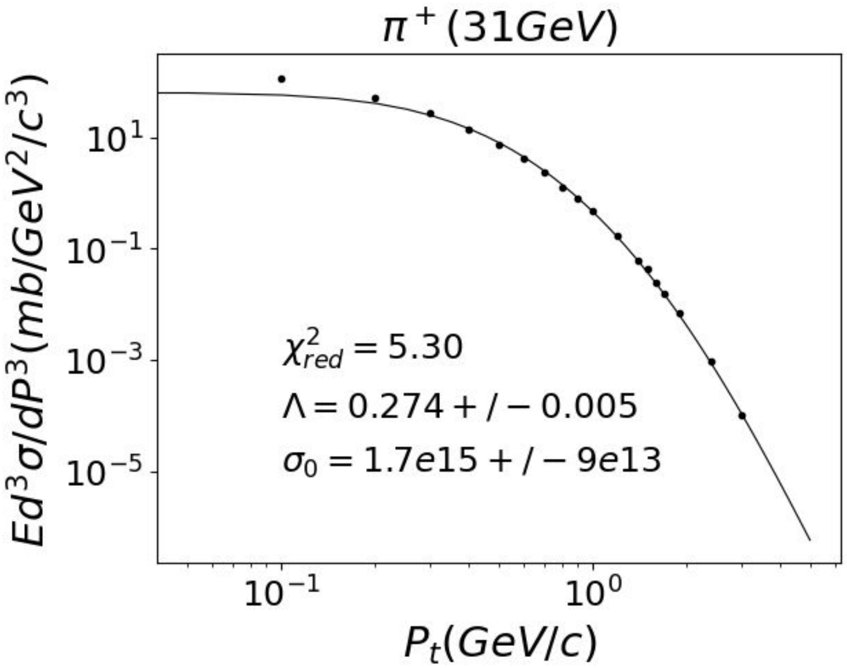
$$\frac{\left(\frac{2\Lambda+\sqrt{s}x(q-1)}{4\Lambda+2e_m(q-1)}\right)^{\frac{q}{q-1}}\left(1+\frac{(q-1)(-\sqrt{s}x+2e_m)}{2\Lambda}\right)^{-\frac{q}{q-1}}\left(1+\frac{\sqrt{s}x(q-1)}{2\Lambda}\right)^{-\frac{q}{q-1}}\cdot\left(2\Lambda+(q-1)\left(-\sqrt{s}x+2e_m\right)\right){}_2F_1\left(\left.\begin{matrix}\frac{1}{1-q},\frac{q}{q-1}\\ \frac{q-2}{q-1}\end{matrix}\right|\frac{2\Lambda+(q-1)\left(-\sqrt{s}x+2e_m\right)}{4\Lambda+2e_m(q-1)}\right)}{\sqrt{s}}$$

Fórmula final

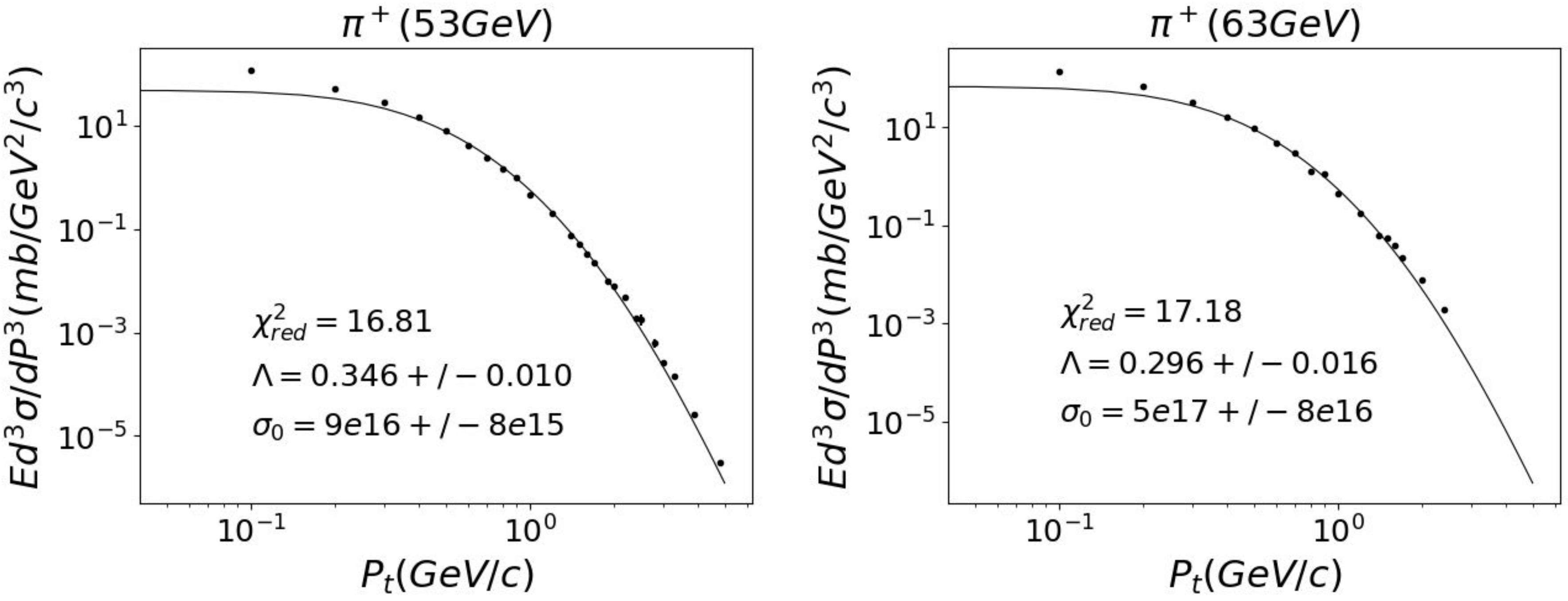
$$E\frac{d^3\sigma}{dp_m^3} = \sigma_0\left[F\left(\frac{2}{\sqrt{s}}\varepsilon_m\right) - F(0)\right]e_q\left(\frac{\varepsilon_m}{\lambda}\right)e_q\left(\frac{\sqrt{s}-\varepsilon_m}{\lambda}\right)$$

$$\varepsilon_m = \sqrt{\vec{p_m}^{\,2} + m^2}$$



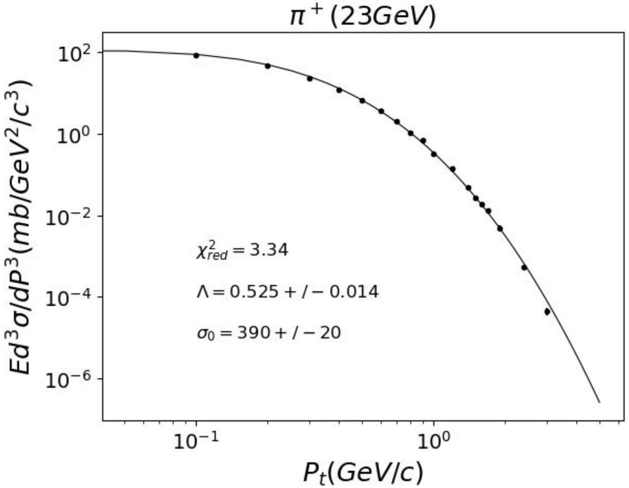


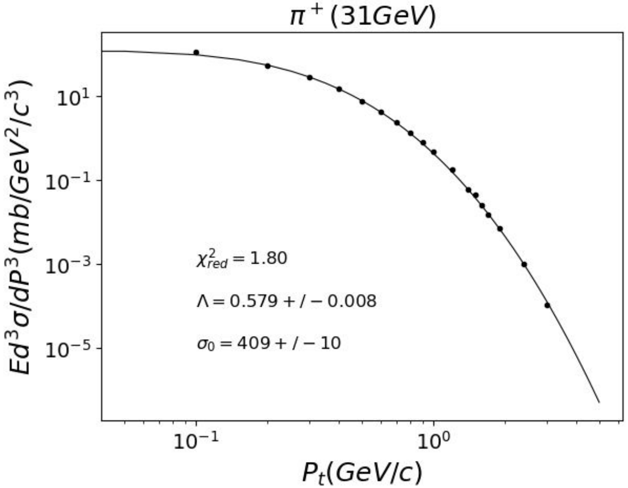
Parâmetros $\lambda = 0.14 \quad q = 1.14$

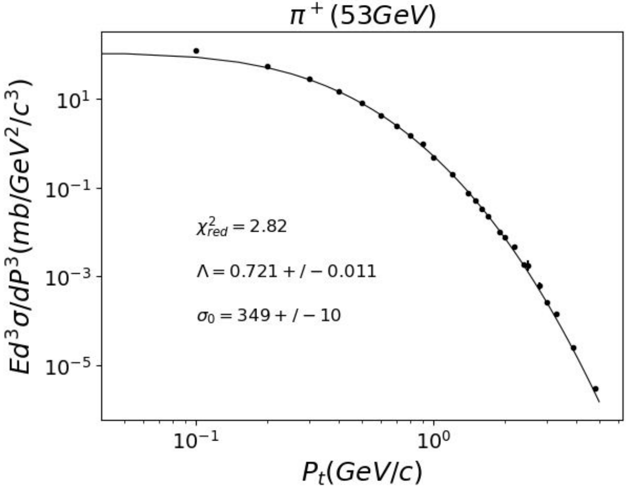


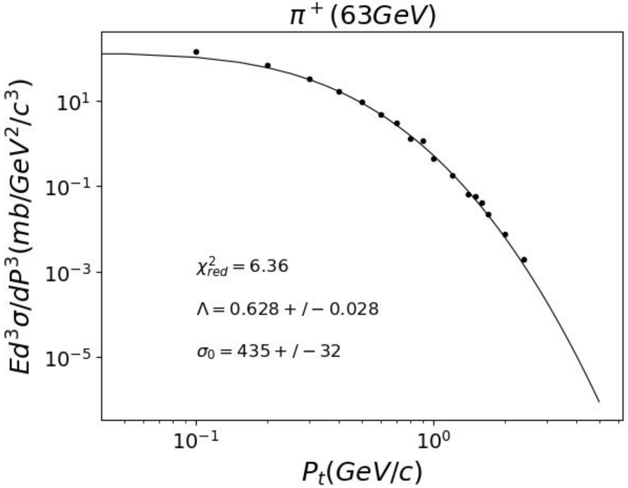
$\pi^+ (53GeV)$
$Ed^3\sigma/dP^3(mb/GeV^2/c^3)$
$\chi^2_{red} = 16.81$
$\Lambda = 0.346 +/- 0.010$
$\sigma_0 = 9e16 +/- 8e15$
$P_t(GeV/c)$
$\pi^+ (63GeV)$
$Ed^3\sigma/dP^3(mb/GeV^2/c^3)$
$\chi^2_{red} = 17.18$
$\Lambda = 0.296 +/- 0.016$
$\sigma_0 = 5e17 +/- 8e16$
$P_t(GeV/c)$

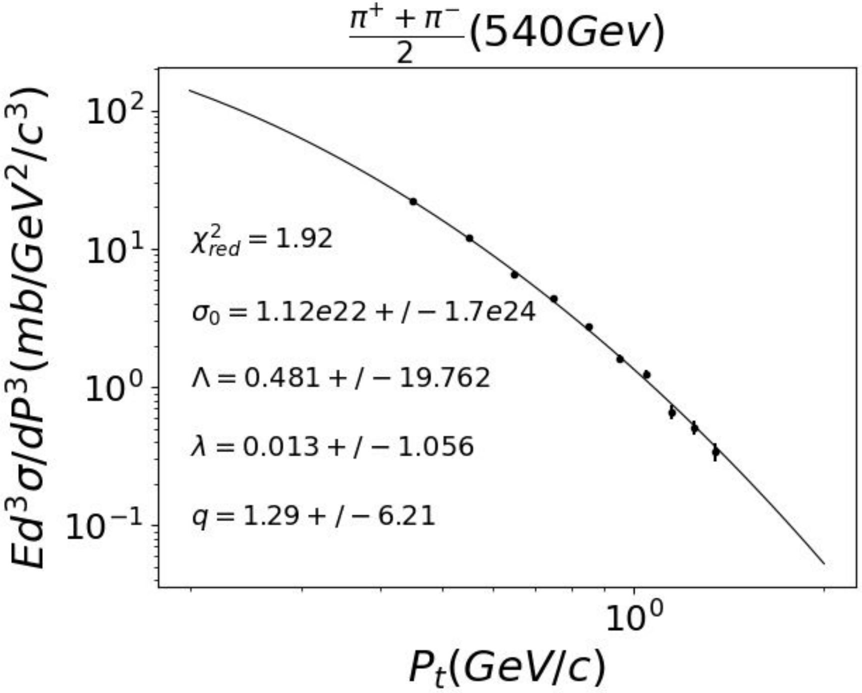
Modelo antigo



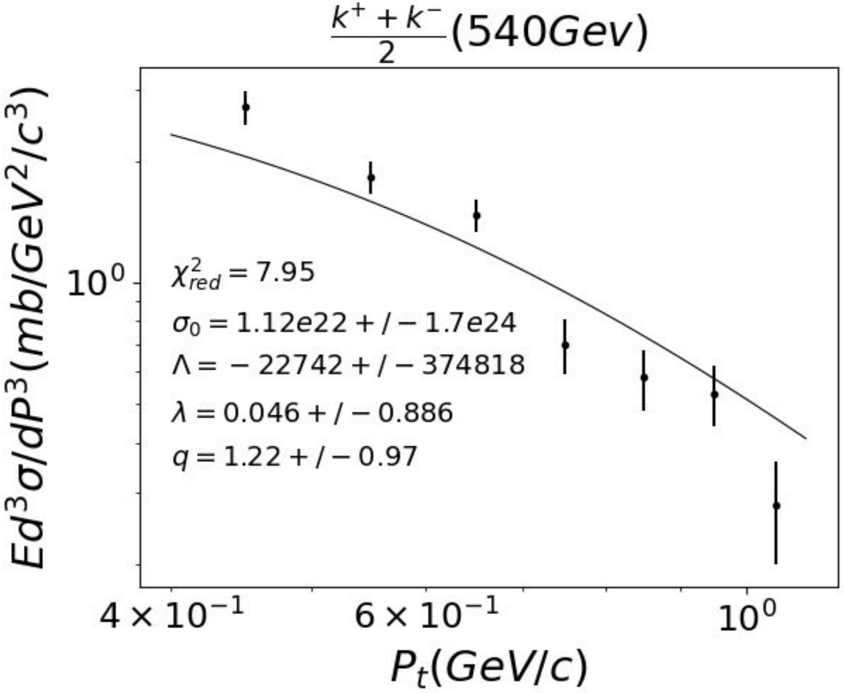






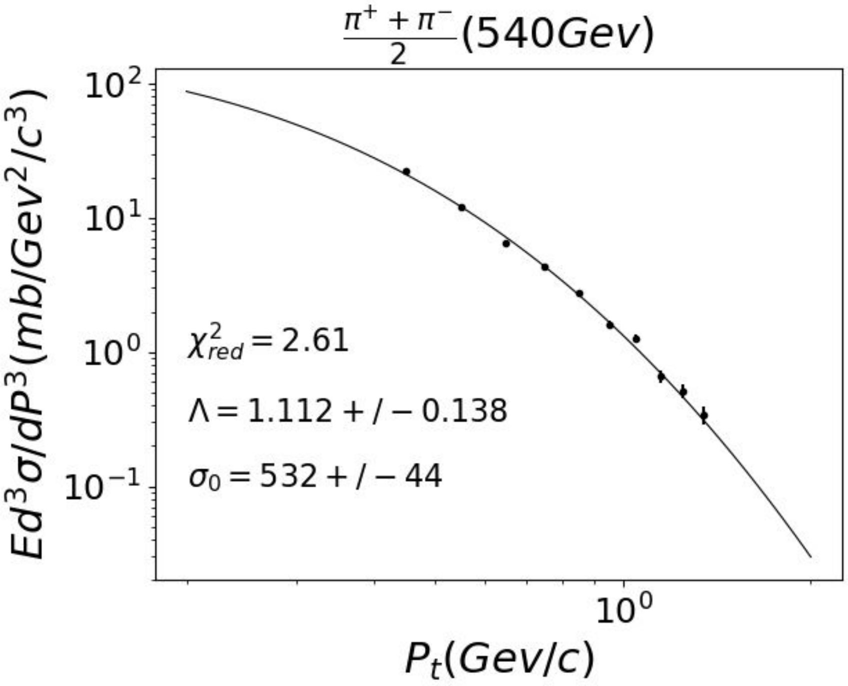


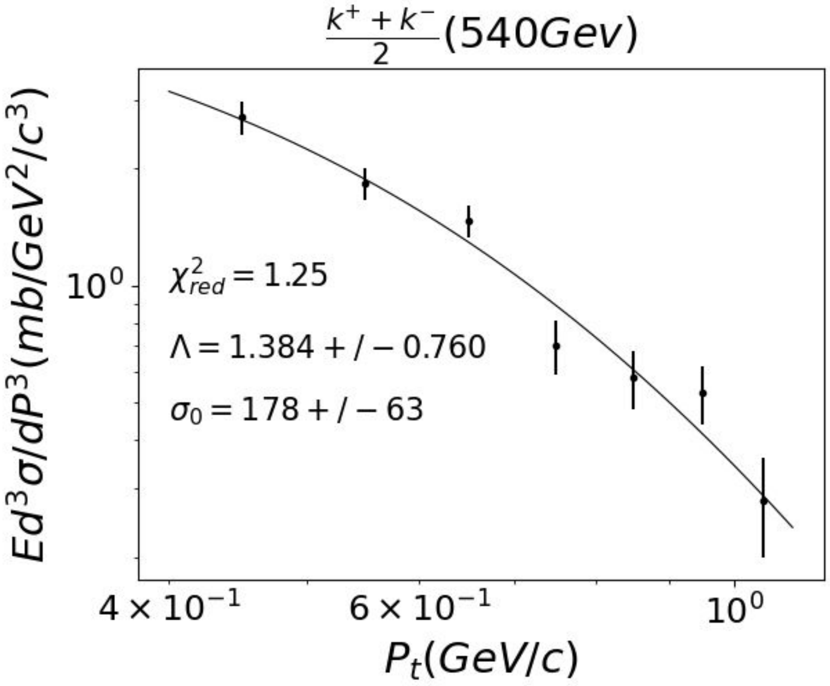
$\frac{\pi^+ + \pi^-}{2}(540Gev)$
$Ed^3\sigma/dP^3(mb/GeV^2/c^3)$
$\chi^2_{red} = 1.92$
$\sigma_0 = 1.12e22 + / - 1.7e24$
$\Lambda = 0.481 + / - 19.762$
$\lambda = 0.013 + / - 1.056$
$q = 1.29 + / - 6.21$
$P_t(GeV/c)$



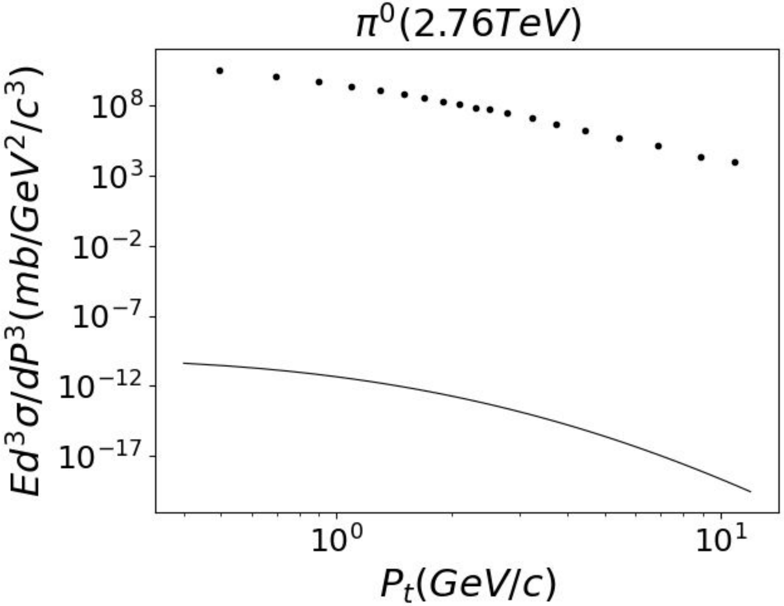
$\frac{k^+ + k^-}{2}(540Gev)$
$Ed^3\sigma/dP^3(mb/GeV^2/c^3)$
$\chi^2_{red} = 7.95$
$\sigma_0 = 1.12e22 + / - 1.7e24$
$\Lambda = -22742 + / - 374818$
$\lambda = 0.046 + / - 0.886$
$q = 1.22 + / - 0.97$
$P_t(GeV/c)$

Modelo antigo





Modelo novo



Modelo antigo