

$$\begin{aligned} \langle x^i x^j \rangle - \langle x^i \rangle \langle x^j \rangle &= (X^0)^2 \left(\left\langle \frac{p^i p^j}{E_{\mathbf{p}}} \right\rangle - \left\langle \frac{p^i}{E_{\mathbf{p}}} \right\rangle \left\langle \frac{p^j}{E_{\mathbf{p}}} \right\rangle \right) \\ &\quad - \sigma^2 P_i P_j + \sigma^2 (P^0)^2 \left\langle \frac{p_i p_j}{E_{\mathbf{p}}^2} \right\rangle + \sigma P^0 \left\langle \frac{p_i p_j}{E_{\mathbf{p}}^3} \right\rangle + \frac{1}{4} \left\langle \frac{p_i p_j}{E_{\mathbf{p}}^4} \right\rangle \end{aligned}$$