

Hand-in exercises in the course QCD@Colliders, HT 2006

5. Parton branching and jet simulation

- A*. **Calculate** $F_{qq}(z; \lambda_a, \lambda_b, \varepsilon_c)$ along the lines indicated on page 163 in the book (note the errors in Eq 5.19 and table 5.3 - see the errata on the book homepage). It is also instructive to look at chapter 17.5 in Peskin & Schroeder although the conventions used are different.
- B. Starting from the LO AP-equation for the gluon density using the plus-prescription to regularize the splitting functions, rewrite it on the form (5.34) and **derive** the Sudakov form factor for the gluon, $\Delta_g(t)$ by comparing to Eq. (5.47).
- C. **Show that** Eqs. (5.62) and (5.67) are equivalent. Hint, use Eq. (5.34) and

$$\exp \left[- \int_{t_1}^{t_2} \frac{dt}{t} \frac{1}{f(x, t)} t \frac{\partial f}{\partial t} \right] = \frac{f(x, t_1)}{f(x, t_2)}$$

- D. **Show that** the emission of a soft gluon from a $q\bar{q}$ pair in e^+e^- annihilation can be written as the incoherent sum of gluon emissions from either the quark or the anti-quark with emission angle $\theta < \theta_{q\bar{q}}$ after azimuthal averaging, in other words Eq. (5.76).