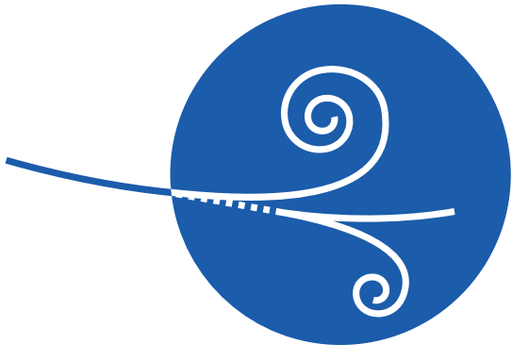

III. Physikalisches
Institut A

RWTH AACHEN UNIVERSITY

Experimental Techniques in Particle Physics (WS 2020/2021)

Exercises

Prof. Alexander Schmidt

24.11.2020

Exercise: Bremsstrahlung

- last week, you have implemented the average energy loss due to Bremsstrahlung
- nobody considered statistical fluctuations…. do that now, because you can learn something from it !

- start from the following equation, that can be found in text books and the particle physics review
  https://pdg.lbl.gov/2019/reviews/rpp2018-rev-passage-particles-matter.pdf

$$N_\gamma = \frac{d}{X_0}\left[\frac{4}{3}\ln\left(\frac{k_{\max}}{k_{\min}}\right) - \frac{4(k_{\max}-k_{\min})}{3E} + \frac{k_{\max}^2 - k_{\min}^2}{2E^2}\right]$$

- it is the average number of emitted Bremsstrahlung photons N_γ in the energy interval $[k_{min}, k_{max}]$ (see PDG for references to derive this from the cross section)

- compare the **average** energy loss with this equation to the one from previous week ($dE/dx = -E/X_0$)
- implement a statistical fluctuation based on **Poisson** statistics (do you understand why it must be a Poissonian distribution?)

- make a histogram of the resulting actual Bremsstrahlung energy loss of a particle going through the detector (run the experiment a couple thousand times…)

Exercise: Multiple Scattering

- implement the multiple scattering effect and make a histogram of the angular disturbance
- next week we will start a new chapter: Gas detectors and the corresponding signal formation