

HW 9

A few years ago CEBAF accelerator at JLab had maximal energy 6 GeV. The electrons with energy $E = 6\text{GeV}$ were scattered from the proton target (which was at rest). Was it possible to produce charmed particles at CEBAF accelerator? What about the present upgraded CEBAF with the electron energy 12 GeV? The lightest charmed particle (J/ψ) has a rest mass 3.1 GeV. The mass of the proton is about 0.94 GeV and that of the electron is about $0.5\text{ MeV} = 0.0005\text{ GeV}$ (in the units where $\hbar = c = 1$)

Hint: When we have barely enough energy, the electron, the proton and the produced (J/ψ) particle have negligible relative velocities in the final state.