Physics 252 – Reading Exercise #7

(due Tuesday, May 24)

Read the paper:

R. Akers, *et al.*, Z. Phys. **C 65**, 17 (1995)

Write a brief summary of this paper. Include answers to the questions below.

This paper measures the branching fraction for Z^0 boson decays to $b\bar{b}$ relative to the total branching fraction to hadrons as a test of the $SU(2) \times U(1)$ electroweak theory. The data is taken in e^+e^- collisions with center of mass energy tuned to the Z^0 resonance at 91 GeV.

1. What is the observation claimed in this paper?

2. Describe the lepton tagging method of identifying b quark hadrons in the final state. Why does this method separate b from u, d, s, c?

3. Describe the vertex tagging method of identifying b quark hadrons in the final state. Why does this method separate b from u, d, s, c? What is the typical path length of a b hadron? (You might want to look up the lifetimes of the D and B mesons in the Particle Data Tables.)

4. Explain the L/σ_L distribution in Figure 2. What is the meaning of "forward tag" vs. "backward tag"? How does measurement of the "backward tag" vertex distribution aid the analysis?

5. What is the role of double tagging in this analysis? How does the 2-jet structure of $e^+e^- \to hadrons$ events assist the interpretation of double tagging?