4. CONCLUSIONS

In this dissertation, I presented new high-precision measurements of the magnetic form factor of the proton for large timelike momentum transfers at $q^2 = s$ between 8.8 GeV^2 and 14.4 GeV^2. An upper limit has also been extracted at $s = 18.4$ GeV^2, even though, due to the small amount of luminosity accumulated in this energy region, the limit is rather lax.

The results are in excellent agreement with those of E-760, which is the only other experiment which has obtained non-zero results in this energy interval. The values of $|G_M|$ I found also confirm the semi-quantitative predictions of QCD.

The experimental technique has proven very successful. It employs a non-magnetic spectrometer to identify e^+e^- final states generated by an antiproton beam intersecting an internal hydrogen gas jet target. Still, in order to investigate timelike form factors at higher energies and reach the asymptotic regime (where the theory is most easily calculable), it will be necessary to develop new techniques or better performing detectors. In fact, the rapidly decreasing cross section and the huge hadronic background demand higher and higher luminosities and more powerful electron/positron tagging.

This is a field of active research also from the theoretical point of view. One of the goals is being able to calculate the form factors of baryons where experimental information exists. In particular, the full understanding of the proton structure (one of the building blocks of matter as we know it) is among the extremely interesting challenges facing Quantum Chromodynamics.