PART II: CONFIRMATION OF THE DISCOVERY AND MEASUREMENT OF MAJOR PROPERTIES, 1976–1982

I. IS IT A LEPTON ?, 1976–1978

Our first publication was followed by several years of confusion and uncertainty about the validity of our data and its interpretation. It is hard to explain this confusion a decade later when we know that τ pair production is 20% of the e^+e^- annihilation cross section below the Z^0, and when the τ pair events stand out so clearly at the Z^0.

There were several reasons for the uncertainties of that period. It was hard to believe that both a new quark, charm, and a new lepton, tau, would be found in the same narrow range of energies. And, while the existence of a fourth quark was required by theory, there was no such requirement for a third charged lepton. So there were claims that the other predicted decay modes of tau pairs such as e–hadron and μ–hadron events could not be found. Indeed finding such events was just at the limit of the particle identification capability of the detectors of the mid-1970's.

Perhaps the greatest impediment to the acceptance of the τ as the third charged lepton was that there was *no* other evidence for a third particle generation. Two sets of particles u, d, e^-, ν_e and c, s, μ^-, ν_μ seemed acceptable, a kind of doubling of particles. But why three sets? A question which to this day has no answer.

It was a difficult time. Rumors kept arriving of definitive evidence against the τ: $e\mu$ events *not* seen, the $\tau \rightarrow \pi\nu$ decay *not* seen, theoretical problems with momentum spectra or angular distribution. With colleagues such as Gary Feldman I kept going over our data again and again. Had we gone wrong somewhere in our data analysis?

Clearly other tau pair decay modes had to be found. Assuming the τ to be a charged lepton with conventional weak interactions, simple and very general theory predicted the branching fractions: