A TEST OF MUON-ELECTRON UNIVERSALITY

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The proposed shutdown of the Meson Area in FY '78 provides an unique opportunity for mounting a test of muon-electron universality by a study of the reactions

$$\nu_e + Z \rightarrow e^- + \Sigma(\text{hadrons})$$

$$\nu_\mu + Z \rightarrow \mu^- + \Sigma(\text{hadrons})$$

As discussed extensively in recent years,[1,2] this test of universality is best accomplished by using an electron neutrino beam formed from decaying K_L^o's. Mori, et al[3] have shown that such a beam requires ≃70 feet for beam forming elements, and a total of ≃150 feet for the total beam length. The beam forming elements would fit very nicely into the 80-foot Meson Target Box, and the beam dump would fit readily into the Front End Hall. The decay region could extend to the 700-foot crossover with sweeping in the Front End Hall and 450-foot crossover. By placing the detector in the M3 region of the Meson Detector Building we gain an order of magnitude in flux, by reason of solid angle, over the calculated flux in the Neutrino Area at the Bubble Chamber position. We lose a factor of two by reason

of decay length. There is an additional advantage relative to background in the Meson Area in that the entire beam system can be placed under vacuum.

The ν_e beam is very simple and can be put together in a straightforward way at relatively little cost. Since the beam would be delivered by Switchyard and dumped in the Target Box, this experiment would not require Meson Area crews to be on duty and could be run while Meson Area is technically "off". By the same token it would preserve the ability to divert beam from the Neutrino Area during train changes, etc.

To carry out the experiment we need a detector of several hundred tons capable of distinguishing and identifying electrons and muons. Approximately 70 tons of aluminum rod and billets are available in the shielding inventory which can be fabricated cheaply into an electron calorimeter. Several hundred tons of prime steel from the Rochester cyclotron are also available in the inventory. These can be converted into a dipole array for muon identification. A rough scaling indicates that for a 200-ton detector we should expect the order of 40K events for 10^{18} protons on a 1 γ target.

Track reconstruction can be accomplished by using the large area magnetostrictive chambers from the Multiparticle Spectrometer, which will not be in use or, preferably, by proceeding with con-

struction of the drift chambers for the Multiparticle Spectrometer Facility and using them first in the Neutrino detector. Alternatively, or additionally, we could fabricate some subset of the detectors that Walker proposes for his much more ambitious system and move them to Lab C at the conclusion of the experiment.

REFERENCES

[1]1976 Summer Study, vol. 2, p. 47, C. Baltay, D. Reeder, P. Limon, R. Stefanski

[2]1973 Summer Study, vol. 1, D. Baltay, B. Roe

[3]TM-725, Electron Neutrino Beam, S. Mori, S. Pruss, R. Stefanski, April 9, 1977