Test Beam Request

To Directly Measure dE/dx of High Energy Muons
from 150 to 650 GeV/c in Muon Laboratory

G. R. Kalbfleisch, D. H. Kaplan and D. Lawrence
University of Oklahoma
D. Edwards,H. Fenker, R. Stefanski, SSCL, Texas

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Kalbfleisch has talked to Tajii Y., Carlos Hojvat and H. Lubatti regarding the possibilities of making such a measurement in the Fermilab muon beam. A direct dE/dx measurement of highly radiating muons has apparently not been made, although indirect verification of the theoretical predictions have come through muon leakage studies by *e.g.* J. D. Cossairt, *et.al.*(NIM **A276**, 78(1989)). H. Kasha and C. Hojvat also believe this is true; and they have suggested (Kasha) that one should try to separate the ionization versus radiative parts and (Hojvat) one should possibly consider using various metallic foils of the appropriate thickness also.

The plan is to use a thin **and** a thick active detector of each of two different materials; we will leave gaps in which foils could also be inserted, using a trigger to force a *dE/dx type interaction* there. Plastic scintillator and sodium iodide will be the two active materials (four counters). In addition, two vetoes and four other trigger counters are envisioned (see sketch enclosed). A simple trigger (X1bar.P2.P3) will gate ADC's to record all pulse heights; *fancy triggers* will all be done offline in software. The trigger should accept something like 1% of all muons (1 cm^2 of the muon beam). The apparatus needs less than 4 feet of longitudinal space in the beam; C. Hojvat has indicated some possibilities, one of which needs to be realized.

A 0.65 TeV muon deposits on average about 5 GeV of energy per meter of Fe, largely in the range about 2.5 to 7.5 Gev with a long tail (mostly due to bremstrahlung) out to 25 GeV. This translates into (0.1,0.3,1 GeV) for 10 cm of NaI and (5,15,60 MeV) for 10 cm of plastic (CH or CH2). Comparisons of the pulse heights from the different materials (augmented by calculations of escape energy for NaI, and photon conversions (*e.g.* energy inclusion) for plastic) **and** different energies will allow a determination of the energy loss parameters to compare with theory (Particle Data Book graph, p. 117, April 1990, or Eastman and Loken, LBL Workshop Proceedings, July 1987, and other works). Calibration will be done with a special radioactive source; amplification of the source signals with gains of one, ten and one hundred will effect the transformation of the 0.1 to 1.3 MeV range of the source gammas to the 5 MeV to 1 GeV range needed. The dE/dx parameters of high energy muons need to be checked in order to have more confidence in muon range calculations (being done for shielding purposes, etc.) for different materials and extrapolation to higher energies.

An ENUMERATION of the test beam request list items follows:

a) Spokesperson: G. R. Kalbfleisch, Oklahoma (405-325-3961 OU, FAX 405-325-7557; 214-708-3038 SSCL, FAX 708-298-5451; E-mail UOKHEP::grk, FNAL::grk, SSCVX1::grk)
and others as listed above.

b) Description of apparatus and purpose given above.

c) Schematic layout attached. Plus one NIMbin, one high voltage distribution. (LRS 4032), one CAMAC crate and Mac2 computer.

d) Muon beam run at 150,...650 GeV/c for several days. Lubatti, *et.al.*, have 5 days to make measurements for SDC R & D studies; we expect to run concurrently with them. We would be ready by mid-October or sooner.

e) Data acquisition: Mac2 + CAMAC. Between SSC and OU, we have most of the necessary electronics + crates EXCEPT for possibly a few negative high voltage PODS and an LRS 2249W (long gated ADC for NaI).

f) Financial arrangements: SSCL will support travel expenses, construct mechanical structure and counters; supplies at FNAL will be covered by OU account(s) CNN (&/orIDS); possible loan of 2249W + HV pods from PREP.

g) Need approval to bring one SEALED calibration source from OU; OU's Radiation Safety Officer, Dr. Paul Skierkowski, will make and seal the mixed source, ^{22}Na, ^{54}Mn and ^{57}Co (microCurie levels).

h) Occupancy in experimental area: for the duration of the *Lubatti* test; +setup/teardown time(very short).

i) Other special conditions: none expected at this time.

GAR // ESCA, OU // 8/2/71

"SCHEMATIC"