MUO - Muon Lifetime

Signature Sheet

Student's Name Youcan Liang Partner's Name Mert Guldu

Pre-Lab Discussion Questions

It is your responsibility to discuss this lab with an instructor before your first day of your scheduled lab period. This signed sheet must be included as the first page of your report. Without it you will lose grade points. You should be prepared to discuss at least the following before you come to lab:

1. What is a muon?
2. How and where are the muons in this experiment produced?
3. In deriving the muon lifetime from the measured data, does any correction need be made for the time that the muon travels before it reaches the tank?
4. The cosmic ray flux at sea level, integrated over all angles is approximately one particle per square centimeter per minute on any horizontal surface. The flux passing in both directions through a vertical surface is one-half as much. Use the zenith angle dependence of muon intensity to prove this result. Muons come only from the upper hemisphere (above the horizon). Based on this result, do you think the geometry of the detector matters.
5. Given the geometry of the detector, 60 cm x 30 cm x 240 cm high, calculate the number of cosmic rays per minute which enter the detector.
6. The fact that Figure 6 of Rossi Ref. 4 is relatively flat from zero to several hundred g/cm2, means that the number of muons which stop in a fairly shallow detector depends only on the mass of the detector. It does not depend on the shape of the detector, nor on the direction of incidence of the muons. For solid angle use $2\pi/3$ steradians (=cos2 integrated over the upper hemisphere), calculate the number of muons that will stop in the detector. Assume the density of the mineral oil is 0.8 g/cm3.
7. Think how you will analyze the data. What program will you use? What steps need to be done? Discuss your choices with an instructor.

Staff Signature _____ Date _____

Completed before the first day of lab? (Circle one) Yes / No

Mid-Lab Discussion Questions

1. On day 3 of this lab, you should have successfully acquired an over-night muon spectrum with a calibrated time scale. Make a crude measurement of the lifetime. Show your spectrum to a GSI and ask for a signature.

Staff Signature _____ Date _____

Completed by day 3 of lab? (Circle one) Yes / No

Checkpoint Signatures

1. Oscilloscope (TDS 360)

   Staff Signature _____

2. Apparatus in the other room

   Staff Signature _____

3. Trigger Rate

   Staff Signature _____

4. Time Difference Data

   Staff Signature _____