Neutrinos at Fermi Lab

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Questions regarding neutrino detection at FermiLab and elsewhere, where neutrino beams are under the control of a proton beam that is turned on and off, were answered privately several times. Because the questions continue to surface, we include the answer as a FAQ (Frequently Asked Question).

As the question is directly related to "background" events which yield the same neutrino-like reaction, and also to the "shield" or "filter" used to reduce the background, a detailed analysis of the problem follows.

NOTE

This answer does NOT belong to Autodynamics (AD), but rather is provided by arguments accepted by the mainstream scientific community, taking into account the Special Relativity (SR) solution. Of course, this explanation is accepted within Autodynamics also, as we will show below.

In the present case, the neutrino detector is a bubble chamber.

It is universally accepted by the scientific community that any neutral particle such as the pion, kaon, neutron, gamma ray and cosmic ray, yields the same neutrino-like reaction inside a bubble chamber.

It is universally accepted that it is necessary to install "shields" or "filters" to reduce the "background," that is, those particles, or penetrating radiation, that would yield the same neutrino-like reaction.

It is understood that the solar neutrino detectors need shields to reduce the background, because the latter is not directional.

It is understood that a filter is needed between the particle production locus and the bubble chamber, because all the neutral particles mentioned above yield, in the bubble chamber, the same neutrino-like reaction.

There is, in consequence, an historical answer: The more energetic the proton beam on target, the more energetic the pion and kaon beam, and consequently, the more energetic will be the neutral particles or the penetrating radiation. Hence, the need to increase the filter length or its density.

This tacitly recognizes that the "background" is what yields the neutrino-like reaction in the bubble chamber.

The observation that the phenomenon is **directional** is a very trivial observation.

The observation that the events in the bubble chamber **depend** on the beam being ON and OFF, is redundant. It is the confirmation that the neutral particles or penetrating radiation reach the bubble chamber and yield the neutrino-like reaction.

How does the overall mechanism operate?

As promised, the answer is given by the SR proponents themselves, that is, using the tool that SR provides: **time**

dilation. (In AD, simply the time **interval,** or the time that the phenomenon requires in order to occur).

It is worth mentioning here a "little detail" of great import. The following application employs the Lorentz time dilation equation. As we have said before, this equation is formed as a puzzle, i.e.:**in pieces**. When needed to explain the twin paradox, the Lorentz equation has the term (**piece**) "position," $\left(v\ x'/c^2\right)$. When needed only as an application of time dilation to a particle's lifetime, the piece that has the term "position" is separated, and the Lorentz coefficient, $1/\sqrt{1-\beta^2}$, is used. That is the only piece in the Carezani (i.e., Autodynamics) equation of time interval.

The aritmethic follows:

$$\gamma = \frac{1}{\sqrt{1-\beta^2}}$$ (1) (The Lorentz or Carezani coefficient)

We perform two calculations, for two situations.

1).- We suppose a neutral kaonL (K0|L) with β= 0.999 c, that is, a KE = 10633.99 MeV = 10.63399 GeV. This, today, is a small energy in many Labs. In the last question that we received, the proton beam has 800 GeV, many times larger that the energy above mentioned.

With β= 0.999, γ = 22.366 (2)

The neutral kaon half-life "at rest" is τ= 5.2 10E-8 sec.

The kaon half-life due to "time dilation" regarding its motion in the "frame Lab" at β= 0.999 is

τ' = γ x τ

τ'= 22.366 x 5.2 10E-8 = 1.162 10E-6 sec. (3)

Normally, the "decay tube" for pion and kaon decay to produce neutrinos is 400 meters long and the filter is 1000 meters long. We take a 1500 meters length, supposing the bubble chamber at 100 meters beyond the filter's end.

As the kaon has a velocity equal to β>= 0.999 c, to travel a distance of 1500 meters, requires a time equal to:

t = 1500 / (0.999 x 3 10E+8) = 5.005 10E-6 sec. (4)

The kaon number in the bubble chamber, starting with No = 100 10E+6 kaons[1] in the target is:

N = 100 10E+6 x e $^{\left(-5.005\ 10E-6\ /\ 1.162 10\ E-6\right)}$ (5)

N = 1,347,082 kaons. (6)

Of course, the number of neutral kaons stopped inside the filter is **enormous**, but the possibility or probability that a few of them will reach the bubble chamber is significant.

The other side of the penny shows the following:

2.- The pion+ decays as follow: $p_i^{+} \rightarrow p_i^{0}\ e^{+}\ nu(e)$ even though the proportion is very small[2] (1.025 +- 0.034) 10E-8, into mu+ nu(mu) gamma with (1.24 +- 0.25) 10E-4 and into e+ nu(e) gamma with (1.6 +- 0.23) 10E-7. The percentage is small, but considering the enormous production of pion+, the secondary decay has thousands and thousands of neutral particles or penetrating radiation. Its mechanism is very special, as is shown in what follows.

We suppose the pion+ velocity $\beta1 = 0.99999$ and the pion+ half-life is $\tau1 = 2.6\ 10E\text{-}8$ sec. Its KE =31.165 GeV.

$\gamma1 = 223.607$ (7)

$\tau'1 = \gamma1 \times \tau1 = 223.607 \times 2.6\ 10E\text{-}8 = 5.814\ 10E\text{-}6$ sec (8)

$t1 = 400 / (0.99999 \times 3\ 10E{+}8) = 1.333\ 10E\text{-}6$ (9)

The number of positive pions at the end of the "decay tube" is

$N1 = No \times e(-1.333 / 5.814) = 79.51\ 10{+}6$ of positive pion+ (10)

This shows that inside the 400 meters long "decay tube" or "pipe" only 20 % of positive pions decay to produce neutrinos, secondary particles and radiation. 80 % of them decay later, inside the filter, producing the same decay mode. A few of them decay close to the bubble chamber,and as the half-life of the neutral pion is very short, $\tau2 = 0.83\ 10E\text{-}16$ the positive pion or the gamma ray could produce the same neutrino-like reaction.

The larger fallacy regarding neutrino production inside the "decay tube" is related to the pion+ and kaon+ decay plus neutrinos.

As the pion+ and kaon+ decay **in flight**, the emission of neutrinos and secondary particles and radiation is very small, in the bubble chamber direction. The neutrino, and the secondary emission, is emitted, in its**center of mass,** in all directions, that is, the neutrino is emitted between 0 and 360 degree with respect to its line of flight. The number of neutrinos that reach the bubble chamber is very small, because a very small quantity of the original particles that decay (pions and kaons) produces neutrinos in the bubble chamber direction.

Another fountain of neutral particles, is the enormous neutron quantity yielded in the target. In reference [1], 8 10E+9 neutrons are given.

Various phenomena yield the same reaction, as was explained. Many particles, of the total produced, will collide with the nuclei inside the filter. It is very well known, in nucleus-nucleus collision,the showers produced by decay of compound nucleus after the nuclear collision as fusion-like. Such reactions also produce neutrons and gamma rays.

Conclusion

Any expensive experiment performed at FermiLab "demonstrates conclusively" the existence of "neutrinos." (**Neutral particles**). Contrarily, a cheaper experiment, such as Buechner and Van de Graaff[3] demonstrates overwhelmingly the nonexistence of the electron-neutrino.

The filter length was constantly increased, but, we must be careful: we cannot increase it too much, because the risk of eliminating all the **neutral particles** that yield a neutrino-like reaction also increases.**Sooner or later,** if the filter is too long, the reaction in the bubble chamber will cease to be neutrino-like, and the neutrino business will cease to be a successful enterprise.

References

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2. Pion Beta Decay Experiment. (PSI R89-01). A Precise Measurement of the pi+ --> pi0 e+ nu Decay Rate. http://helena.phys.virginia.edu/~pibeta/ Last update: 22 Apr. 1996.
3. Calorimetric Experiment on the Radiation Losses of 2-Mev Electrons 1" W. W. Buechner and R. J. Van de Graaff, Massachusetts Institute of Technology, Cambridge, Massachusetts.*Phys. Rev. 70, 174(1946).*