正电子湮没实验数据处理

[redacted]

2022 年 12 月 1 日

1 Experimental results

1.1 data

See figure1 to figure7

1.2 data processing

According to the experimental results, the time corresponding to each track site is 0.021132 ns.So that we can get the lifetime of positron annihilation is equals to 0.27 ns. And the covariance matrix is shown below:

$$\begin{bmatrix} -11.32 & -2.18 & 0.031 & 1.418 \\ 0.021 & -0.08 & -0.120 & -3.250 \\ 0.019 & -0.210 & 2.07 & 2.182 \end{bmatrix}$$

2 Thinking

1. What are the adverse effects of too weak or too strong a Na-22 radioactive source? If it is too weak, the data generation efficiency is insufficient, resulting in too long exper-

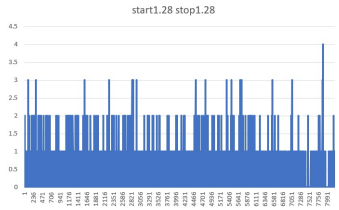

图 1: no obvious peaks

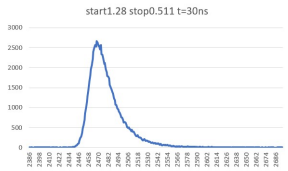

图 2: peak:2473.02;FWHM:33.8059

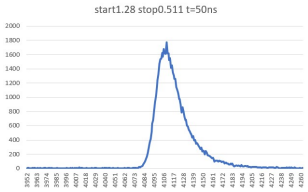

图 3: peak:4111.29;FWHM:33.7286

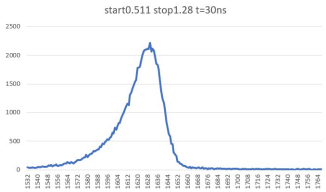

图 4: peak:2446.75;FWHM:38.523

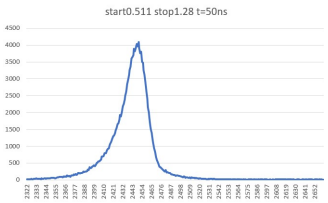

图 5: peak:4091.11;FWHM:46.1496

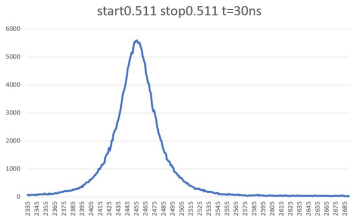

图 6: peak:2455.76;FWHM:48.7602

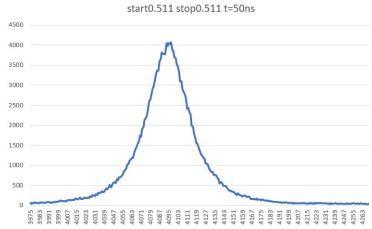

图 7: peak:4093.78;FWHM:49.5366

iment time, and it is easy to amplify the influence of spectrometer performance drift. If it is too strong, the radiation is too high, which will cause safety hazards; and the background noise is too large, which will affect the degree of compliance of the background.

2. If the discriminator threshold of the constant ratio discriminator is improperly selected, for example, it is set above the lower threshold of the corresponding energy window, why will the annihilation event be lost?

The 1.28MeV γ photon emitted by ^{22}Na enters the initial probe. If large-angle Compton scattering occurs, it will not only generate an initial signal in the initial track, but the scattered photons may also enter the end probe. If the energy is just in Within the range of the energy window of the end channel, it will be regarded as the end channel signal, forming an additional coincidence count. Thus affecting the accuracy of the experimental results. The lower threshold of the termination channel should be set as large as possible to eliminate the influence of backscatter and reduce noise.