Photopeak Efficiency of NaI(Tl) Detectors

In many applications, it is desirable to discriminate against background radiation or other spurious events. In these instances, it is necessary to count only the full energy or photopeak events generated by a detector.

There is no easy way to calculate the number of events that are expected in the photopeak. The absorption efficiency of NaI(Tl), which is detailed in another application note, can be used to calculate the total counts that can be expected in the channel or energy integrated spectrum if the number of photons incident on the crystal are known. However, this includes the full energy peak, Compton edge, single and double escape peaks, backscattered and other Compton events. To get the number of events in the photopeak only, the absorption efficiency should be multiplied by the photofraction.

The photofraction or photopeak efficiency for various geometries has been measured for a series of energies and can be obtained from the attached charts.

Thus, to calculate the approximate number of 662 keV events expected in the photopeak in a 1" thick NaI(Tl) detector, the absorption efficiency of 52% is multiplied by photofraction for this energy, approximately 0.2 to 0.25 (depending on geometry), to yield a photopeak counting efficiency of 10% to 13% of the total events.