0.1 Simulations

In order to compute how many of the three-photons events we detect out of all the three-photons decays we performed a Montecarlo simulation. If we denote as E the total energy of the three photons, we randomly divided the segment $[0, E]$ into three parts E_1, E_2, E_3. Since for a photon the modulus of its momentum is its energy and we assume the decay happens at rest, i.e. the momenta should sum to 0, E_1, E_2, E_3 must obey the trangular inequality:

$$\sum_i E_i \geq 2 \max_i E_i \tag{1}$$

So, by discarding invalid triplets, we obtain a uniform distribution on all the possible energy triplets. The resulting distribution of the angles between the photons is non trivial (fig 1a) Now we can simulate also the three detectors and trigger on the triple coincidences, obtaing for each detector an energy spectrum like in fig 1b.
Among 10^7 three-photons decays, 4927 events triggered all the detectors, so we can give an estimate of the correction coefficient to the observed rate:

$$c_{3\gamma} := \frac{\#\text{ detected events}}{\#\text{ events}} \approx 5 * 10^{-4}$$

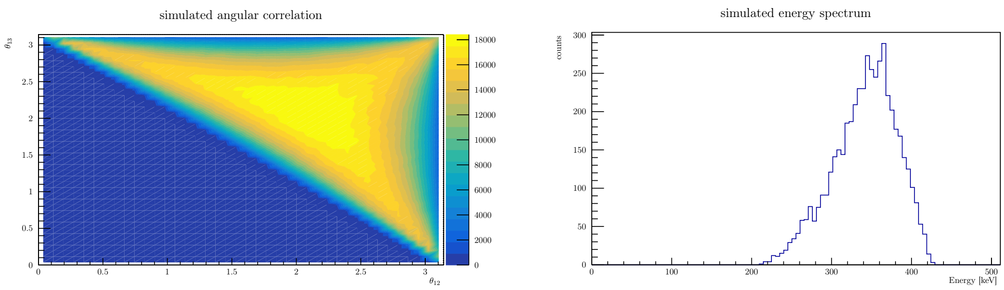
With a much simpler calculation one can obtain the correction coefficient for the two-photons decay:

$$c_{2\gamma} \approx 3.7 * 10^{-2}$$

We can now take the ratio between the two in order to find the right coefficient to match three-photons decay and two-photons ones:

$$c := \frac{c_{3\gamma}}{c_{2\gamma}} = \frac{\#\text{ detected }3\gamma\text{ events}}{\#\text{ detected }2\gamma\text{ events}} \frac{\#\ 2\gamma\text{ events}}{\#\ 3\gamma\text{ events}} \approx 1.4 * 10^{-2}$$

This coefficient depends on the distance detector-source that we measured to be roughly 18cm. From the simulation we see that c varies less than 10% for distances between 17 5cm and 18 5cm



(a)

(b)

Figure 1