Experiment

The experiment was performed on August 2018 in Lawrence Berkeley National Laboratory where we wanted to study the ^natZn(n,p)64,67Cu reaction. The laboratory is located in the hills directly over the university of California at Berkeley, not so far away from San Francisco bay.

As a beam, we used deuterium with the energy of 16 MeV and 33 MeV (How many npA?) which hit a 6 mm thick Beryllium disk with the intention of produce neutron beam.(how) This neutron beam was then used to irradiate our targets of Zinc, Indium, Aluminum, Zirconium, Yttrium and NaCl. Med denne metoden så får du en fokusert nøytron beam The targets was placed 10 cm away from the Beryllium since we only wanted the neutrons to hit the targets without any angular distribution.

The co-targets Indium, Aluminum, Zirconium and Yttrium was there as monitor foils have known cross sections, which makes it easier to find the absolute cross sections for 64,67Cu.

By irradiating Zinc targets we were able to measure energy-integrated production rate for Cu64 and Cu67, witch is two medically interesting radionuclides. Cu64 has a halflife of 12.701 hours and decayes with beta+/EC which is good for imaging by PET. 67Cu has a halflife of 68.3 hours and decays with beta-. Since it has a halflife of approximately 2.5 days and it has a short range beta- witch makes it good for irradiate the cells we don't want in our bodies and spare the healthy tissue.

Target design

A specific design of the targets were used to make sure that the cross section for each target could be measured for the different energies we radiated the targets with. Five different targets, Al, In, Y, Zn, and Zr were the targets were made into small "packings" using kapton tape to tightly seal them. The kapton contains polymer carbon, hydrogen and oxygen but the sticky part of the tape are made from silicone. For each target we measured their wight, thickness and length Using what? to calculate the uncertainty of each target. The targets were attached to a plastic frame and were placed in the end of a metallic box made of? where we wanted the targets to be 10 cm from the Br disk, the targets were held in place by a spring between them and the disk in front. The metallic box were then placed in the beamline by inserting it into a tube were there was vacuum. The vacuum were there to prevent the beam to hit air molecules and to make the beamline as straight as possible such that more of the beam would hit the targets. The radiation of the targets were on for approximately 12 hours? for both 16 MeV and 33 MeV.

Measurements of gamma rays

The gamma rays was observed using a high purity germanium detector (HPGe). The detector is a semiconductor and therefore it is doped? with? and as a result the germanium detector will be negative charged on one side and positive charged on the other side. do I need this?
When a sample is in the detector, the germanium detector will detect the electrons from the sample. Three things that will occur (if enough energy) is photoelectric effect, compton effect and pair production explain what they are?. In additional to that, there will be peaks that represents different nuclei?

We radiated the targets overnight from 23? pm to 08? am with both the 16 MeV beam and the 33 MeV beam

Calibration

To do the calibration and everything I used gf3.