POSITRONIUM

All devices/electronics should be switched on (the farthest to the left and right switchers + time delay switches) for the experiment. Here the 22Na is used as a source - it can be found in the blue box, the source itself is a white flask. All measurements in this experiment will be done with the Geanie program.

Task 1

(Energy spectrum absorption)

1) In the Geanie program do the following: File → open → Detector. Set scale of the fit to linear.

2) Check that all cables are connected in the correct way. Note that for the first task the cable from the TAC (labeled "to PC, A/D input") should be connected to the Spectroscopy. The amplifier should be connected to the middle connector (the left output).

3) Since here we want to have a spectrum for particles over a certain energy, in particularly we are interested in the second peak in the second peak around the channel 300, we want to suppress lower energies. To cut the spectrum turn the lower wheel on the right DC Diff Disc all the way down so that the Compton edge is cut off. Remember to press clear when starting new measurements. Save the obtained spectrum:

a) File -> save as (as CAM file) - this will save file in a format that later on can be reopened in Geanie.
b) Analyze → E Reporting → Print (exel file template) - this will save file in a readable txt format. Files are always saved under C:\GENE2K\REPFILES\ with the same filename, so remember to rename the file before copying it into your folder.

Task 2

(Time calibration)

1) Plug the cable labeled "to PC, A/D input" back into the TAC (left input, i.e. the one with the sloping edges).

2) Record a spectrum. *Take the two markers and set them so that the leading edge and the peak (but not really much of the right side). At the bottom of the "Marker Info" box, the mu of the gaussfit is indicated under "Centroid"; note that units are wrong, so ignore them. Note that this step is not necessary should be done in a way mentioned here. Probably, it is more convenient to record the spectra and fit afterwards with any chosen program/software.*

3) Then add more and more delay in 4 ns steps (if all delay switches are switched off, the delay is 2.5 ns due to cables etc.). You can either to record and save each spectrum in separate files or to have spectra with peaks for all delays. The number of delays is not fixed. In case if it decided to have peaks for all delays on single plot then do as much delays as will fit on the screen.

4) Save spectra:

a) File -> save as (as CAM file) - this will save file in a format that later on can be reopened in Geanie.
b) Analyze → E Reporting → Print (exel file template) - this will save file in a readable txt format. Files are always saved under C:\GENE2K\REPFILES\ with the same filename, so remember to rename the file before copying it into your folder.

Task 3

(Mean lifetime of the positronium)

Here it is recommended to record the spectrum in the log scale, but it can be done in the linear scale as well. If spectrum is recorded in log-scale the fit is done with two linear functions. If spectrum is recorded is linear scale then the fit function is y = A1*exp(-x/t1) + A2*exp(-x/t2) + y0, where t1 is the mean lifetime of the parapositronium and t2 is the mean lifetime of the orthopositronium.

1) Set the scale to the log-format. (*question since I am not sure: should I have the delay to be set to 4ns or no*)

2) Record the spectrum. It takes rather a long time- around 30-40 min.

3) Save files:

a) File -> save as (as CAM file) - this will save file in a format that later on can be reopened in Geanie.
b) Analyze → E Reporting → Print (exel file template) - this will save file in a readable txt format. Files are always saved under C:\GENE2K\REPFILES\ with the same filename, so remember to rename the file before copying it into your folder.

4) Fit tail of the peak.

Task 4

(Measuring the speed of light)

For this task you need to record the spectrum in the same way as it was done in the Task 3, but for different distances between the 'start' and 'stop' , i.e. the position of the right detector should be shifted with a step of 10 cm from 0 up to 60 cm distance.

1) Save files:

c) File -> save as (as CAM file) - this will save file in a format that later on can be reopened in Geanie.

d) Analyze → E Reporting → Print (exel file template) - this will save file in a readable txt format. Files are always saved under C:\GENE2K\REPFILES\ with the same filename, so remember to rename the file before copying it into your folder.

2) Always fit the peak in front. I.e. rising edge.