

EXP2003: Express analysis - Documenting #475

MWPC thickness determination

08/14/2020 05:22 PM - Ivan Muzalevsky

Status:	Открыта	Start date:	08/14/2020
Priority:	Нормальный	Due date:	
Assignee:	Ivan Muzalevsky	% Done:	0%
Category:		Estimated time:	0.00 hour
Target version:			
Description			
According to https://docs.google.com/spreadsheets/d/1iiHbtsYoJ0SU4npbNyPAj121nhRYDr5UVYS0nEZCo9U/edit?fbclid=IwAR1zr3RBus_SXOh_oFQyNtqVZd4UvUatU1VLCGkVvF0uZhimoHx6UazoBnJl#gid=0 , from <small>25.01.2020 17:48:09 to 25.01.2020 18:11:00</small> , extra MWPC plane was installed in the F4 plane (4758 mm from the F5 plane).			
In compare with the experimental data (e.g. run40-43), one should estimate the MWPC thickness in Si equivalent.			
Compare the obtained value with one, determined in Lise++.			
Provide all used macroses and Lise scripts.			

History

#1 - 08/14/2020 05:53 PM - Ivan Muzalevsky

- File *setupEXP2001.xml* added
- File *digibuilder.C* added
- File *beamCut.C* added
- File *convert.C* added
- File *selection.C* added

Used data:

data_nas/exp202001/data/run4* - experimental data

data_nas/exp202001/data/clb/crun09_0001.lmd - data with extra MWPC plane install in the F4 plane

The collected data was converted into .root with **setupEXP2001.xml** file.

The obtained raw data was digibuilder with **digibuilder.C** macro. In which the following cuts were used:

dE-ToF graphical cut, provided in **beamCut.C**

trigger==1

all MWPC planes were fired,

all TOF PMTs were fired

mwpc time (tMWPC) with respect to time in F5 (tF5) was in the following range 55ns

With the macro **convert.C** the digi data was read, and events with cluster multiplicity==1 in all MWPC planes were selected.

The macro **selection.C** reconstructed the beam in the the central target plane, and ToF plane (energy before F5)

All of spectra analyzing methods are in the in the **processData.C** macro

Beam PID plot

left figure - MWPC measurement data

right figure - experimental data

beamID.jpg

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- File processData.C added

- File processData.h added

#3 - 08/14/2020 06:18 PM - Ivan Muzalevsky

TOF and beam energy

Top row: TOF, ns

Bottom row: beam energy reconstructed in ToF plane (before F5), MeV

Left column: MWPC measurement data

Right column: experimental data

Screenshot%20from%202020-08-14%2018-16-36.png

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Left column: MWPC measurement data

Right column: experimental data

The ToF distribution for different data is presented in the TOP row. The raw histograms were smoothed (4 iterations). In the most right figure (red and blue graphs), one can see the shift of the ToF.

As long as the lower energy beam particles loose more energy in the installed MWPC and moreover, amount of low-energy ^9Li particles (with bigger ToF) prevails, **it was decided to compare the low-energy ^9Li 's. These low energy are located in the right slopes of the ToF distributions.**

The problem was how to properly compare the right low-energy slopes of the ToF distributions. The second row illustrates different methods of time-shift calculation.

Time of the **Red** and **green** points was obtain by analysing the distribution slopes by the Constant Fraction Discriminator method. Its realization is shown in the 2 bottom rows. The raw graph was summed with the negative one, amplified by 0.5 and shifted by 1.5 ns to the right / 0.5 ns to the left. The times with the zero value in the obtained graphs are Times of the **Red** and **green** points. The values of the shift (1.5 and 0.5 ns) are the halves of the slopes range (left and right).

Purple points - the inflection points of the right slopes. (maximum of the first derivative)

Red lines in the second row - lines at the 50% of the maximum amplitude value

Screenshot%20from%202020-08-14%2018-20-19.png

The time differenc of:

green points 0.535 ns

purple points 0.535 ns

red points 0.385 ns (this value is less informative as it was obtained from the high energy ^9Li , which has low statistics. for this region ToF graph has much more fluctuations)

Whole low-energy slopes compare

Another method allows to compare the whole low-energy slopes with each other.
For this purpose, both graphs was rescaled to the maximum value of the experimental graph

Screenshot%20from%202020-08-14%2019-30-32.png

As one can see, that on the distribution from experiment, the right slope is more steep.
In order to make right slopes of both graphs more similar, the experimental graph was amplified by 0.9
Then, the time shift was chosen so, that the low-energy slopes cross in their middle (half length or at points with half-maximum values)

Screenshot%20from%202020-08-14%2019-09-45.png

The time-shift was 0.55 ns in this method

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The 270 MeV 9Li beam was delayed by 0.55 ns, by placing some passive volume in 4758 to F5 plane.
That means that, the energy loss was -4.8 MeV, which means that the thickness of the MWPC in Si equivalent is 150 micron.

Files

setupEXP2001.xml	3.14 KB	08/14/2020	Ivan Muzalevsky
digibuilder.C	3.7 KB	08/14/2020	Ivan Muzalevsky
beamCut.C	2.71 KB	08/14/2020	Ivan Muzalevsky
convert.C	12.8 KB	08/14/2020	Ivan Muzalevsky
selection.C	4.08 KB	08/14/2020	Ivan Muzalevsky
processData.C	12.3 KB	08/14/2020	Ivan Muzalevsky
processData.h	813 Bytes	08/14/2020	Ivan Muzalevsky