Minutes of the meeting 06.05.2014: analysis of time-like form factor measurements at PANDA

[1] Presence:

Alaa Dbeyssi, Dmitry Khaneft, Frank Maas, Maria Carmen Mora Espi, Egle Tomasi-Gustafsson and Manuel Zambrana.

[2] Dmitry presented slides showing:

a) the acceptance of the sub-detectors of PANDA at the three values of the momentum transfer squared: $s = 5.4$, 8.21 and 13.8 $[\text{GeV/c}]^2$;

b) the ratio of the differential cross sections pions ($\bar{p}p \to \pi^+\pi^-$) to electrons ($\bar{p}p \to e^+e^-$) at the same values of the energy s.

[3] Discussion on future results: Alaa prepares the table of the total cross sections and the expected counts for the processes $\bar{p}p \to \pi^+\pi^-$ and $\bar{p}p \to e^+e^-$, with the kinematical conditions. Note that, it is very important to keep in mind that the luminosity has decreased by a factor $3 \to 10$. The table is prepared for:

a) luminosity : 2 fb^{-1} and 0.2 fb^{-1}.

b) the cross section of the $\bar{p}p \to e^+e^-$ is calculated using the following parametrization for the proton from factors:

$$|G_M| = \frac{22.5}{1 + s\,[GeV^2]/3.6} G_D^2, \ \ G_D = (1 + s\,[GeV^2]/0.71)^{-1}. \tag{1}$$

and $|G_E| = |G_M|$.

c) The s-values are chosen with the following criteria:

∗ the first three points are the "standard" values where the background is generated.

∗ the last four points correspond to the upper measurable limit of the total cross section of the signal (the range follows the possible different normalization of FFs).

∗ the total cross section in integrated in the range $|\cos\theta| \leq 0.8$.

s [GeV/c]^2	p [GeV/c]	R	$\sigma(e^+e^-)$ [pb]	$N(e^+e^-)$	$\sigma(\pi^+\pi^-)$ [μb]	$N(\pi^+\pi^-)$	$\sigma(\pi^+\pi^-)/\sigma(e^+e^-)$
5.4	1.7	1	417.39	83.48 10^4 83.48 10^3	101.06	202.12 10^9 202.12 10^8	0.24 10^6
8.2	3.306	1	24.61	49.21 10^3 49.21 10^2	2.95	5.9 10^9 5.9 10^8	0.12 10^6
13.8	6.347	1	0.77	1538.16 153.82	0.16	3.18 10^8 3.18 10^7	0.21 10^6
16.7	7.906	1	21.35 10^{-2}	426.93 42.69	0.05	10.05 10^7 10.05 10^6	0.24 10^6
22.3	10.905	1	30.22 10^{-3}	60.43 6.04	0.01	2.05 10^7 2.05 10^6	0.34 10^6
24.35	12.	1	16.63 10^{-3}	33.25 3.33	0.67 10^{-2}	1.33 10^7 1.33 10^6	0.4 10^6
27.9	13.898	1	65.81 10^{-4}	13.16 1.32			

TABLE I: Total cross section integrated in the range $|\cos\theta| \leq 0.8$ and number of counts, for $\overline{p} + p \rightarrow e^+ + e^-$, $\overline{p} + p \rightarrow \pi^+ + \pi^-$, corresponding to an integrated luminosity $\mathcal{L} = 2$ fb^{-1} and $\mathcal{L} = 0.2$ fb^{-1}.

[4] Alaa showed simulation results for the signal with different versions of PANDARoot.