

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 ($\bar{p}p \rightarrow \pi^+\pi^-$) to electrons ($\bar{p}p \rightarrow e^+e^-$) 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 $\bar{p}p \rightarrow \pi^+\pi^-$ and $\bar{p}p \rightarrow e^+e^-$, with the kinematical conditions. Note that, it is very important to keep in mind that the luminosity has decreased by a factor $3 \rightarrow 10$. The table is prepared for:

- a) luminosity : 2 fb^{-1} and 0.2 fb^{-1} .
- b) the cross section of the $\bar{p}p \rightarrow e^+e^-$ is calculated using the following parametrization for the proton form factors:

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

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 is integrated in the range $|\cos\theta| \leq 0.8$.

| s [GeV/c] ² | p [GeV/c] | R | $\sigma(e^+e^-)$ [pb] | $N(e^+e^-)$ | $\sigma(\pi^+\pi^-)$ [μ b] | $N(\pi^+\pi^-)$ | $\sigma(\pi^+\pi^-)/\sigma(e^+e^-)$ |
|--------------------------|-------------|---|------------------------|--|---------------------------------|--|-------------------------------------|
| 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 $\bar{p} + p \rightarrow e^+ + e^-$, $\bar{p} + p \rightarrow \pi^+ + \pi^-$, corresponding to an integrated luminosity $\mathcal{L} = 2 \text{ fb}^{-1}$ and $\mathcal{L} = 0.2 \text{ fb}^{-1}$.

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