

DIRAC experiment (PS212): Letter to the SPSC referees, June 23, 2014

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I. $K\pi$ atom

1. The paper about $K^-\pi^+$ and $K^+\pi^-$ atom lifetime measurement is approved by PLB (reference: PLB 30302). A report about πK atoms has been approved for presentation at the Rochester Conference.
2. The new procedure for tuning of the setup, using Lambda and anti-Lambda decays, has been fulfilled for the runs of 2008, 2009, and 2010. Using results of this tuning, new experimental ntuples are prepared for all these runs (fig.1,2,3,4).
3. The new software for preparation of Monte-Carlo simulation is finished. The main improvements are:
 - a) The multiple scattering description in the thin layers.
 - b) The SFD plane response has been significantly improved (fig.5,6) for the runs 2008, 2009 and 2010.
 - c) The SFD radiation thickness was obtained with better accuracy (fig.7,8).

The new simulation has been finished for the 2008 and 2010 runs, and the dedicated ntuples will be ready in 2 weeks. The simulation for the run 2009 will be finished before September.

4. We study the possibility to process and analyze $K^-\pi^+$ and $K^+\pi^-$ pairs with high SFD background (about 1/3 of the total statistics).

II. Long-lived $\pi^+\pi^-$ atom

1. The new software for the tuning of the setup for the run of 2012 is finished and the experimental event ntuples are ready.
2. The experimental distributions of e+e- pairs generated in the Be target and Pt foil were analyzed and compared with simulated distributions (fig.11,12). The correction of the calculated magnetic field map is done (fig.13).
3. The new GEANT-DIRAC program for the run 2012 simulation is ready.
4. The simulation of Coulomb, non-Coulomb and atomic pairs, generated in the Be target, is started with the new GEANT-DIRAC code.
5. A more sophisticated generator describes a) the distribution of the long-lived atom quantum numbers at the exit of the Be target, b) the long-lived atom interaction with the Pt foil and c) the q distribution of the generated atomic pairs at the breakup point in Pt. It will be ready in 3 weeks.

III. $\pi^+\pi^-$ pair analysis

1. The new procedure for the setup tuning, using Lambda and anti-Lambda decays, has been fulfilled for the runs 2008, 2009, 2010. Using the results of this tuning, new experimental ntuples have been prepared for all these runs. The new simulation was finished for the 2008 and 2010 run, and the corresponding ntuples will be ready in 2 weeks. For the run 2009, the simulation will be finished before September.

2. We study the possibility to process and analyze $\pi^+\pi^-$ and ??? pairs with high background in SFD (about 1/3 of total statistics).
3. Preliminary results for Pbr values, obtained with data with low, medium and high background, will be presented in October 2014.
4. The multiple scattering measurement, using dedicated experimental data, is in progress, and results will have a precision of 0.5%. A DIRAC note with preliminary results is ready.

IV. K^+K^- pair analysis

We analyze existing experimental data in order to search for a K^+K^- Coulomb pair signal. These pairs allow us to extract the number of K^+K^- atoms produced simultaneously with Coulomb pairs. At present time, the numbers of $\pi^+\pi^-$, K^+K^- , proton-antiproton pairs and their ratios were evaluated for the 2010 run, using 1/3 experimental data (fig.14,15,16,17). In July we will begin to search for Coulomb pairs. In future, this analysis will also be used for the 2008 and 2009 data.

V. $\pi^+\mu^-$ and $\pi^-\mu^+$ pair analysis

We are analyzing the existing experimental data (2010-2012) in order to search for $\pi^+\mu^-$ and $\pi^-\mu^+$ Coulomb pair signals. These pairs allow us to extract the number of $\pi\mu$ atoms produced simultaneously with Coulomb pairs. For the run 2010 the dedicated event preselection has been performed, and the ntuples are ready.

VI. Investigation of the $K^+\pi^-$, $K^-\pi^+$, $\pi^+\pi^-$ and K^+K^- atom production in p-nucleus interactions at 24GeV/c and 450GeV/c

This work is in progress using the FRITIOF generator tuned for low energy (proton momentum 32GeV/c) inclusive cross sections. This generator also describes high energy (proton momentum 450GeV/c) inclusive cross sections. The major part of the calculations are finished, and the results will be ready in October 2014.

VII. The paper about the DIRAC setup is ready for submission as a CERN preprint.