

## DIRAC 2010 annual report

1. Performing the 6 month run for the data taking with Ni target for:
  - a) Observation of the atoms consisting of  $\pi^+K^-$  and  $\pi^-K^+$  mesons;
  - b) Lifetime measurement of  $\pi^+\pi^-$  atoms with accuracy better than 6%.The data collected exceed the amount of 2009 data by 30%.

2. The Data Acquisition System was modified before beginning of the data taking that allows one to exclude a limit on the number of accepted events during one spill. It improves reliability and also allows to exclude event cuts at the trigger level and thus to record events at a wider dynamic range. As result the events from break-up of atoms formed by  $\pi$  and  $\mu$  mesons were recorded for later analysis.

3. The data collected in 2008 and 2009 were processed.

4. The data collected in 2001-2003 were processed and analysed basing on the information from all detectors, the total amount of observed  $\pi\pi$  atoms is more than 21000. (Only 13300 atoms were reconstructed in previous analysis.). We have measured the ground-state lifetime of  $\pi^+\pi^-$  atoms to be  $\tau = 3.15 \times 10^{-15}$ s, with a total statistical plus systematic error of about 9%. This has allowed to determine the  $\pi\pi$  scattering lengths difference  $|a_0 - a_2| = 0.253 M_\pi^{-1}$ , with a total error of about 4.3%. That is slightly better than accuracy of 5% declared for that stage of the experiment. The paper will be submitted for publication within one month.

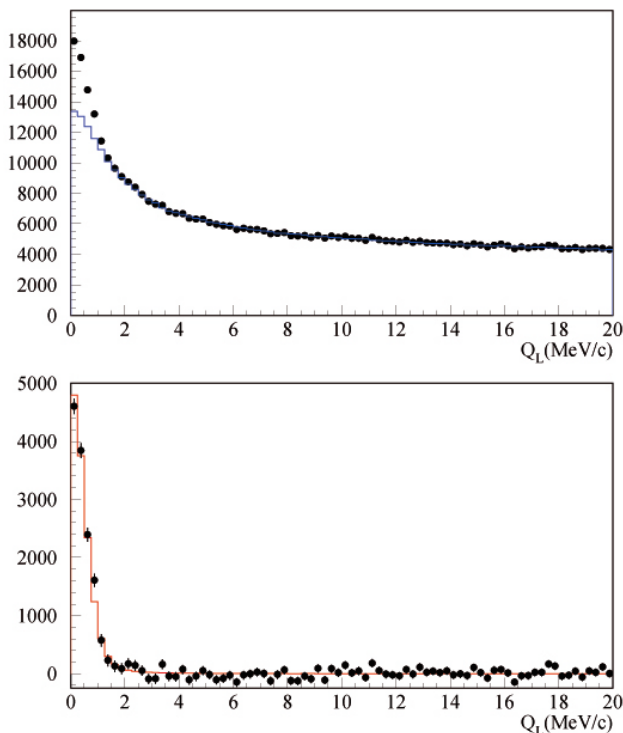


Fig. Distribution over the longitudinal component of CMS relative momentum of the  $\pi^+\pi^-$  pairs from data and simulation (full line). Top plot shows the simulated background compared to the experimental spectrum; bottom plot shows the pionium signal for both data (after background subtraction) and simulation.

5. Till the end of this year an addendum to the experiment for observation of the long-lived states of  $\pi^+\pi^-$  atoms in 2011 will be prepared and submitted to SPSC. In frame of this work the first measurements of the yield of  $\pi\pi$  atom from a Beryllium target have been performed.
6. Results of DIRAC was reported at the conference MESON 2010, 10 - 15 June 2010, Krakow, Poland.

## Plans for 2010.

1. 6 month data taking run for observation of the long-lived states of  $\pi^+\pi^-$  atoms
2. Analysis of the data collected in 2008-2010 for:
  - a) preparation of the paper about the first observation of atoms consisting of  $\pi^+K^-$  and  $\pi^-K^+$  mesons.
  - b) improvement of the accuracy in the  $\pi^+\pi^-$  atoms lifetime.