

# Dirac status report 2012

The main aim of 2012 and 2011 runs was the data taking for the long-lived  $\pi\pi$  atoms observation. It opens the possibility to measure the Lamb shift of  $\pi\pi$  atom and to check the low energy QCD precise predictions

# Run 2012

- ◆ During 4.7 months data taking, the total number of spills during 2012 run was 740000 (3.07 spills per supercycle). The proton beam intensity was  $3 \times 10^{11}$  protons/spill and the total number of proton interactions with a Be target of thickness 100  $\mu\text{m}$  was  $5.4 \times 10^{13}$ .
- ◆ The Sm-Co magnet was installed near the target to improve the long-lived atoms identification.

- ◆ The magnet was irradiated by neutrons and other particles produced on the target.
- ◆ The magnetic field strength decreased during the 2012 run by 0.26%.
- ◆ The magnetic field strength of the magnet made of Nd-Fe-B installed in the 2011 run decreased by 50% under the same conditions.
- ◆ As today, the data from July up to the end of September have been processed ( $5.05 \times 10^5$  spills).

- ◆ The total number of  $A_{2\pi}$  was obtained from the Coulomb  $\pi^+\pi^-$  pairs analysis:  $N_A=5700\pm500$ .
- ◆ In agreement with Monte Carlo simulation, the corresponding number of atomic pairs from long-lived  $A_{2\pi}$  breaking in the Pt foil will be  $n_a=130\pm12$ .
- ◆ For the total number of spills in the 2012 run (=740000), the expected signal from atomic pairs after background subtraction divided by its uncertainty will be at the level of more than 6.

# Run 2011

All experimental data were preselected and ntuples prepared.

Multiple Scattering measurements :

- ▶ In the present analysis, only events with one track in each projection were selected.
- ▶ The data analysis of Ni target with 100  $\mu\text{m}$  and 150  $\mu\text{m}$  thickness was done.

- ▶ The preliminary measurement of the multiple scattering angle has a precision of 0.7 % in each target.
- ▶ The final precision for the 2011 run using ALL events will be better than 0.5 %.
- ▶ These measurements were continued during the 2012 run.

# $\pi^+\pi^-$ atoms (RUNS 2008, 2009, 2010)

- ❖ After  $e^+e^-$  background subtraction, the systematic error analysis using 2008 data was performed.
- ❖ The numbers of atomic pairs were obtained for the events with a low level of background in the scintillation fiber detector (SFD), using distributions of pairs in  $Q$ ,  $Q_1$  and  $Q_1-Q_t$ .
- ❖ After systematic error reduction, the numbers of atomic pairs  $n_a$  are:

$$n_a = 3455 \pm 163 (Q)$$

$$n_a = 4059 \pm 270 (Q_1)$$

$$n_a = 3601 \pm 162 (Q_1 - Q_t)$$

The atom break up probability is  $P_{br} = (45.6 \pm 3.4)\% (Q_1)$ , the same as  $P_{br} = (44.6 \pm 0.9)\%$  obtained in 2001– 2003 runs.

- ❖ The difference between the numbers of atomic pairs in these three analyses was caused by systematic error connected to the new SFD planes.
- ❖ The method to decrease the systematic error is known. The total number of atomic pairs detected in 2008-2010 runs will be more than 21000 for the statistic with low and medium background in SFD, which is about 70% of the total experimental data.



# $\pi^-K^+$ and $\pi^+K^-$ atoms (RUNS 2008, 2009, 2010)

- ✿ The multiplicity in all detectors for  $\pi\pi^-$  and  $\pi K^-$  triggers are the same. Therefore the systematic error suppression used in the  $\pi\pi$  atoms analysis can be used also for the  $K\pi$  atoms analysis.
- ✿ The preliminary results on  $\pi K$  atoms and  $\pi K$  atomic pairs production will be ready in April 2013. This analysis will take into account the non point-like  $\pi$  and  $K$  mesons productions.
- ✿ The total number of  $\pi K$  atoms detected in 2008-2010 runs will be about 600 using experimental statistic with low and medium background in the SFD, which is about 70% of the total experimental data.

# The new ionization hodoscopes

- \* The existing ionization hodoscopes (IH) consists of 4 planes with an area of  $S=108 \times 108 \text{ mm}^2$  assembled from 16 slabs with thickness 1 mm. Each slab connection to its PM uses Lucite light-guide.
- \* The 4 planes of the new IH consists of 32 slabs.
- \* The granularity increase allows to decrease the signal overlapping and the dead time of electronics.
- \* This detector was installed in the beam and was investigated during October–November 2012.

# DIRAC dismantling

In accordance with the plan prepared by CERN and the DIRAC collaboration, the setup dismantling will be finished before **June 2013**.

The calculation of the  $\pi K$   
and  $\pi\pi$  atoms yield on SPS  
CERN ???