

**Preliminary results of analysis of πK data collected
in 2008 and 2009 at DIRAC experiment**

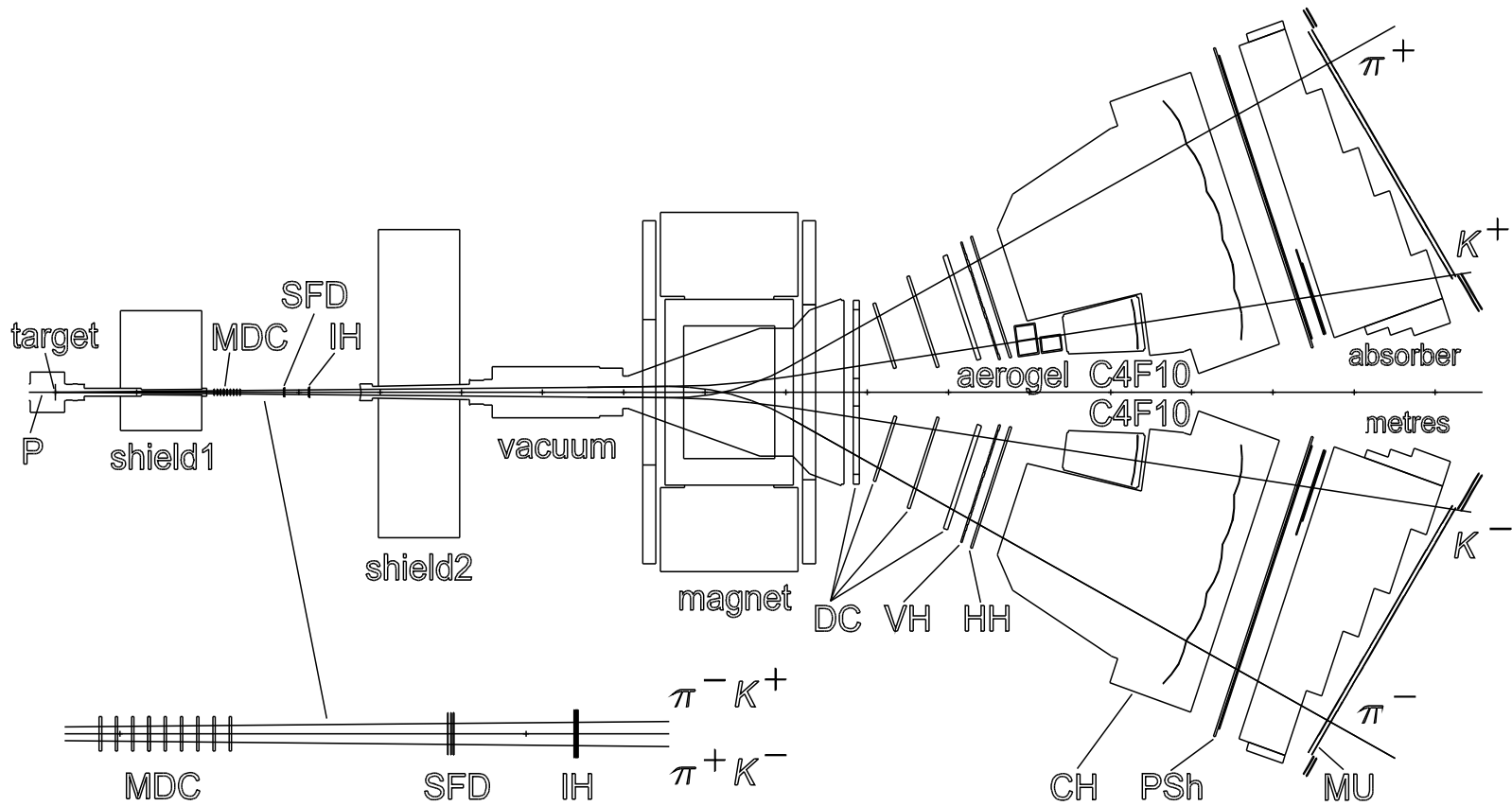
Valeriy Yazkov, SINP MSU, Moscow

11 November 2010

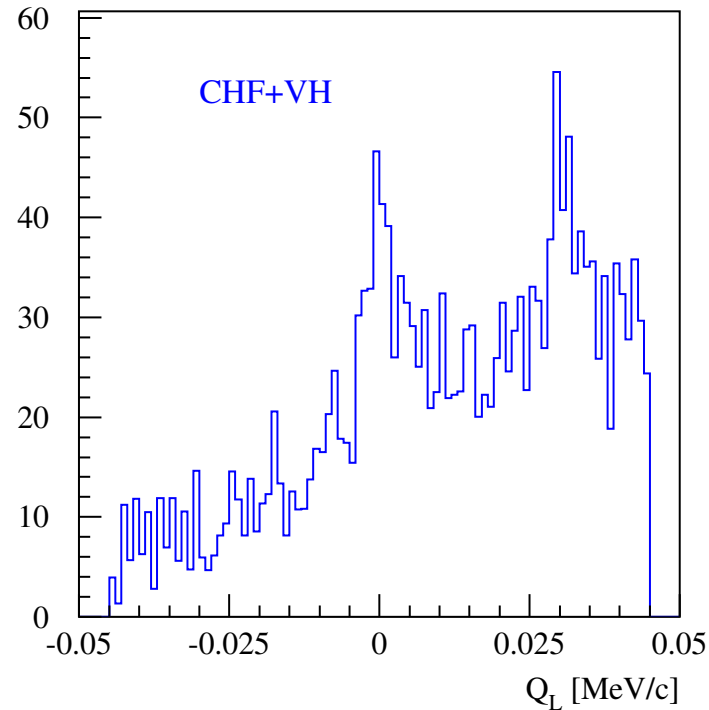
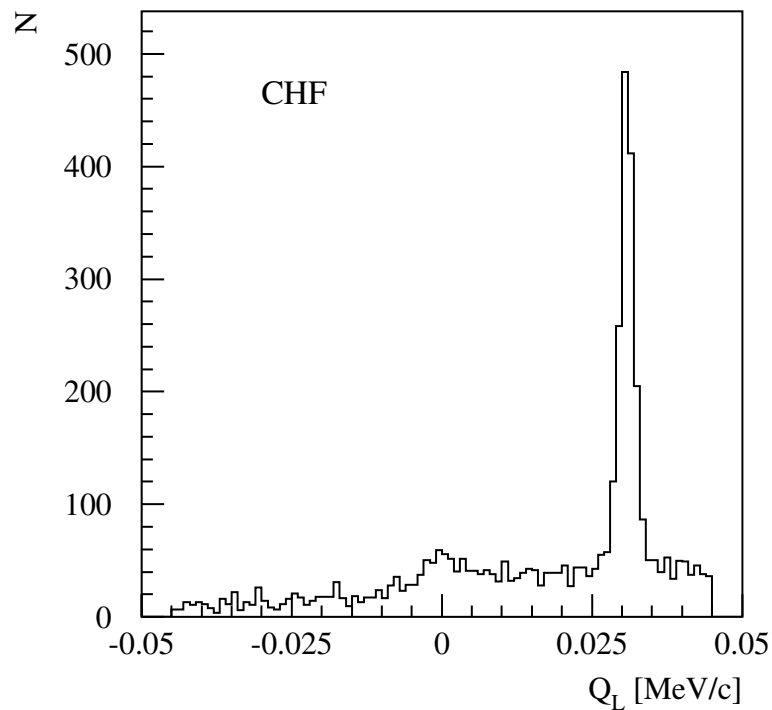
At present procedure of data analysis select events which have low level of background hits:

- Offline analysis program select events which have not more than two tracks in each spectrometer arm. If there are two track then earliest in time is taken.
- In upstream part of the setup only X- and Y- planes of scintillation fiber detector (ScFi) are used together with scintillation ionization hodoscope (IH)
- For each DC-track program defines region of ScFi where hits produced by the particle are expected. If common region for pair of particles (± 1 cm) contains more than 2 particles then event is rejected. It allows to decrease systematic effects due to presents of hits from background particle, detector inefficiency and noise hits. Negative effect is reduction of statistic by factor 1.5.
- At present we are investigating upstream detectors response (ScFi, IH, Micro Drift Chambers — MDC) in order to include rejected events to analysis without increasing systematic error.

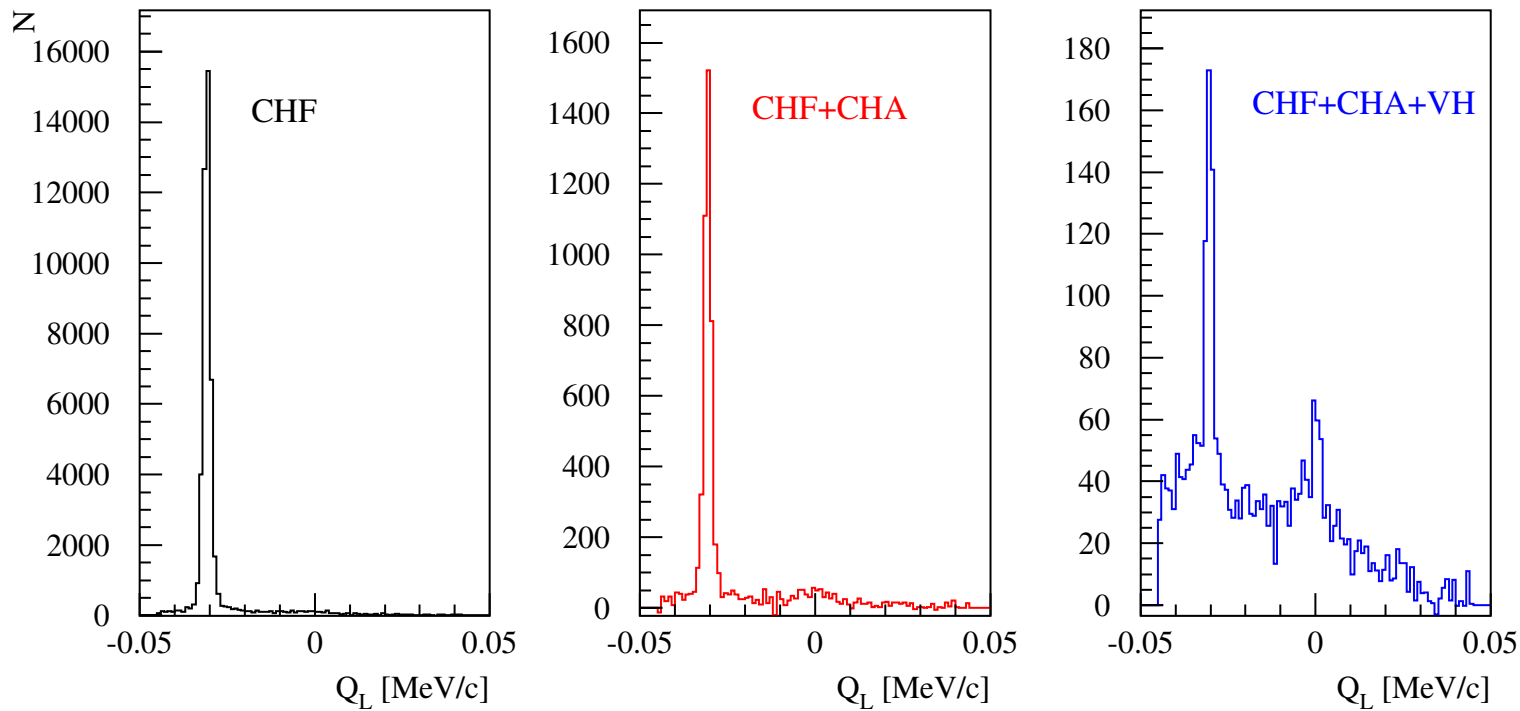
DIRAC experimental setup



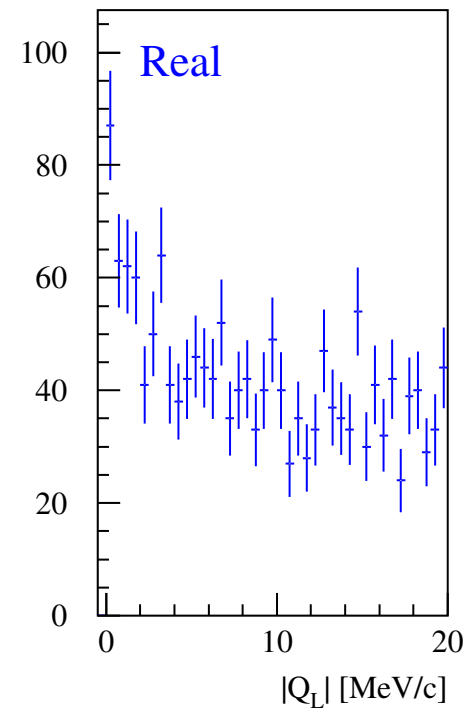
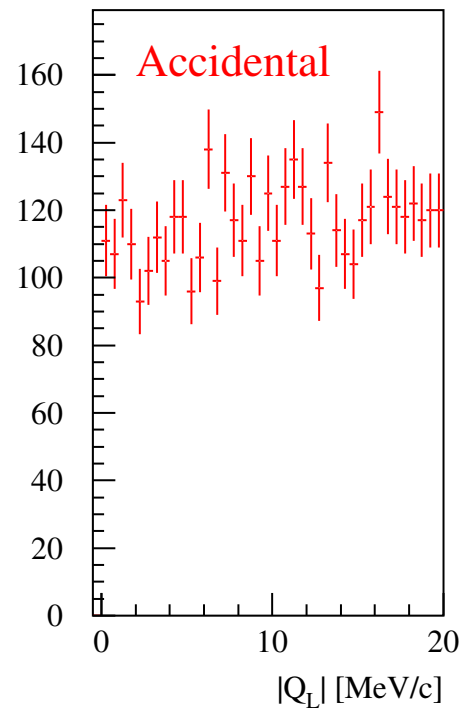
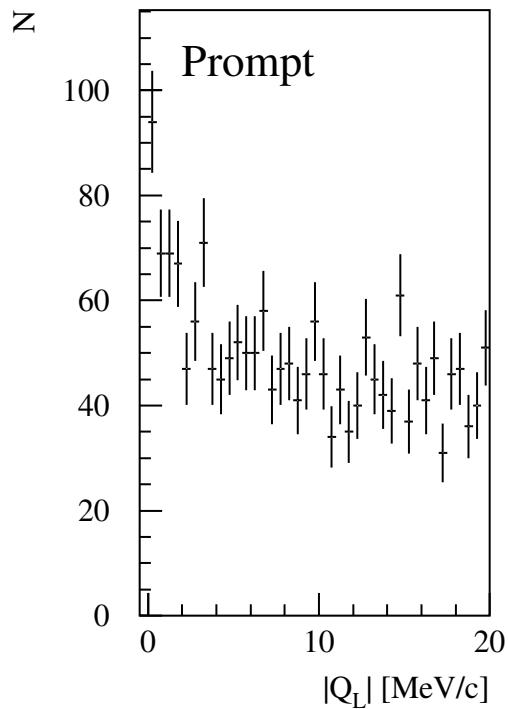
Experimental distribution of π^+K^- pairs after criterion on absence of signal in heavy gas Cherenkov detector (CHF) and on expected time difference measured with Vertical hodoscope (VH).



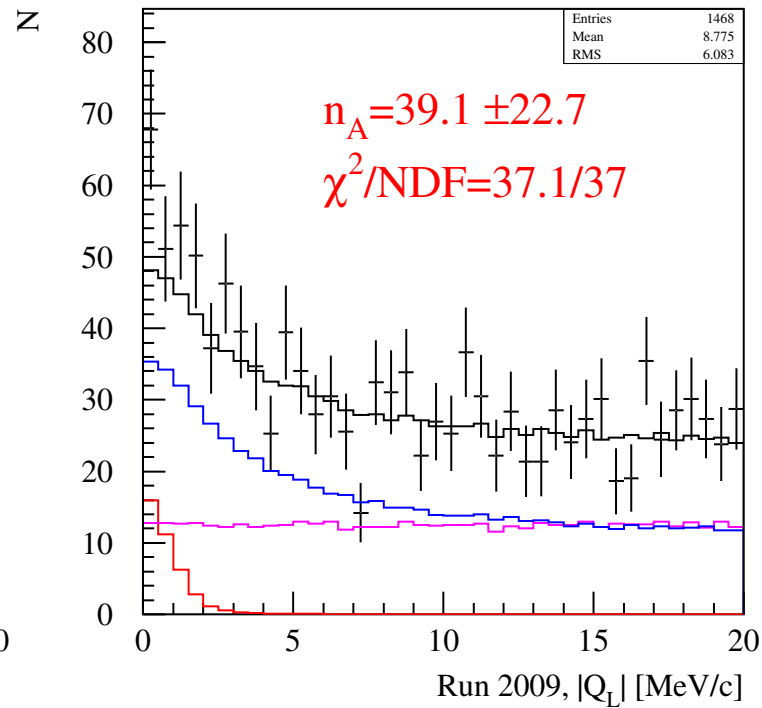
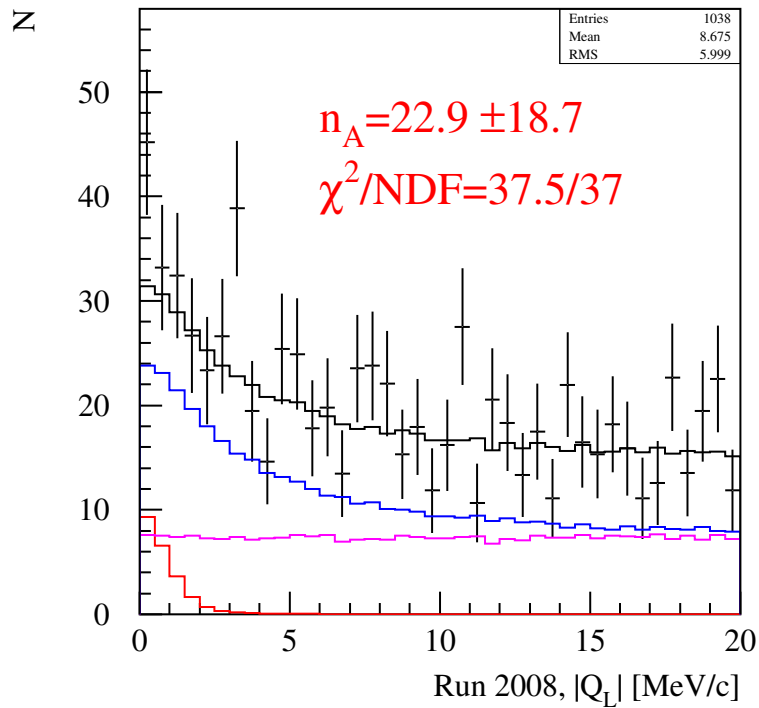
Experimental distribution of $K^+\pi^-$ pairs after criterion on absence of signal in heavy gas Cherenkov detector (CHF), aerogel Cherenkov detector (CHA) and on expected time difference measured with Vertical hodoscope (VH).



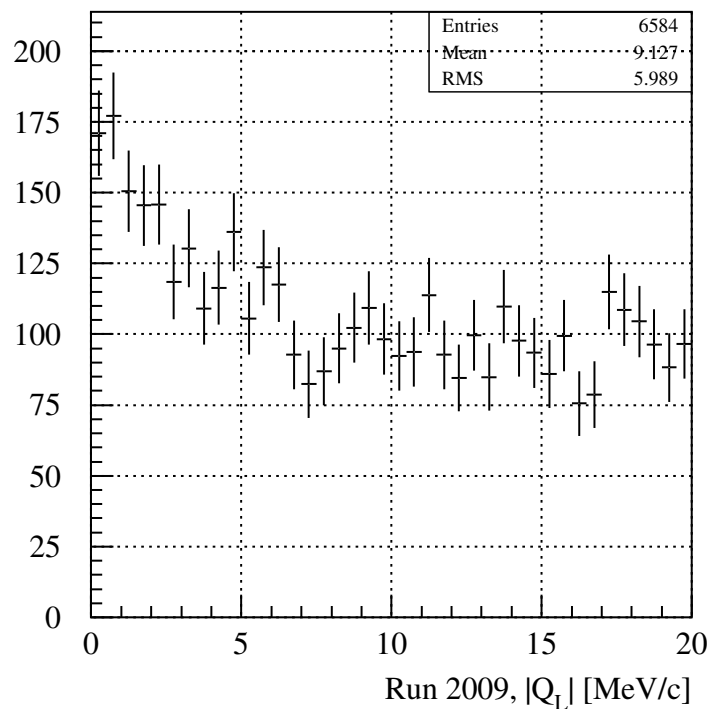
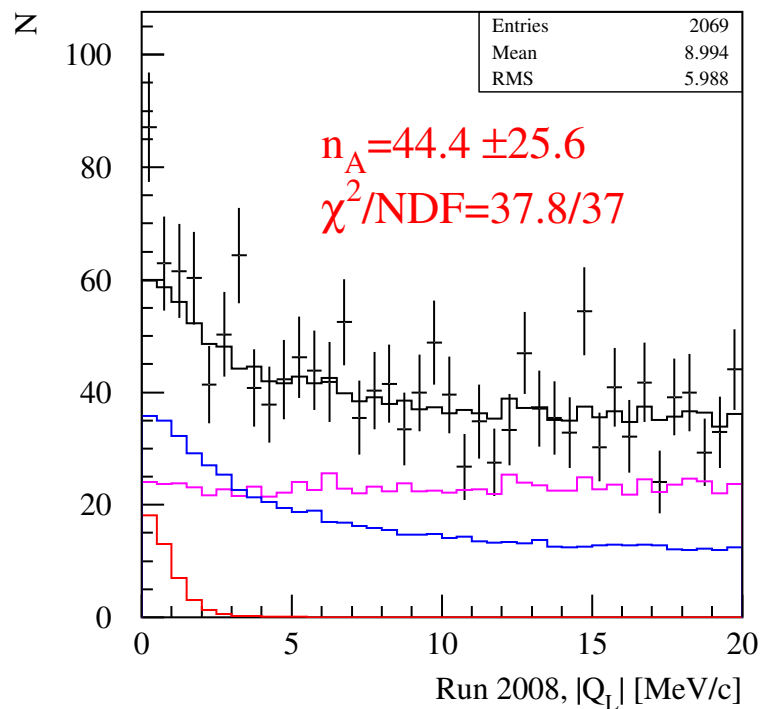
Experimental distributions of $K^+\pi^-$ pairs with different criteria on time difference: prompt (pair with small time difference), accidental (particles are generated in different proton-nuclear interactions) and real (particles are generated in one proton-nuclear interaction)



Experimental distribution of π^+K^- pairs (points with error bar) are fitted with a sum of “atomic pairs” (red line), “Coulomb pairs” (blue line), “non-Coulomb pairs” (magenta line). A sum of “Coulomb” and “non-Coulomb” pairs is presented with black line.



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Numbers of generated πK atoms (N_A) and numbers of “atomic pairs” (n_A) are found for data samples of 2008 and 2009. Expected results for 2010 data are presented too.

Year	N_A	n_A
$\pi^+ K^-$		
2008	44 ± 13	23 ± 19
2009	66 ± 16	39 ± 23
2010	190% from 2008	
$K^+ \pi^-$		
2008	66 ± 18	44 ± 26
2009	150% from 2008	
2010	190% from 2008	
Sum (could be increased by factor 1.5)		
Ready	176 ± 28	106 ± 39
Expected	170% from analyzed data	

Expected ratio of signal to error for data with low background:

$$\frac{n_A}{\sigma_{n_A}} = 4.5 .$$

Analysis of all statistic allows to achieve:

$$\frac{n_A}{\sigma_{n_A}} = 5.5 .$$

Additional statistic for measurement of $a_0 - a_2$ scattering length difference.

Year	n_A	δ_{stat} %	δ_{syst} %	$\delta_{\text{syst:MS}}^{\text{MS}}$ %
2001-2003	22000	3	3	2.5
2008 2009 2010	4500 7500 exp. 9000			
2008-2010	exp. 21000 (31000?)	exp. 2.2 (1.9?)	exp. 3 (2.2?)	exp. 2.5 (1.25?)

EdB status

EdB has finished investigation of procedure for 2001-2003 data analysis and achieve agreement on final value of $|a_0 - a_2|$ scattering length difference and values of statistical and systematic errors:

$$|a_0 - a_2| = 0.261 \pm 0.008(\text{stat.}) \pm 0.008(\text{syst.}) = 0.261 \pm 0.011$$

Present theoretical prediction from ChPT is:

$$|a_0 - a_2| = 0.265 \pm 0.004$$

Experimental result on NA48 (cusp-effect):

$$|a_0 - a_2| = 0.2571 \pm 0.0056(\text{exp.}) \pm 0.0088(\text{theor.})$$

Draft of article will be sent to DIRAC Collaboration in November 2010.

Thank you for your attention