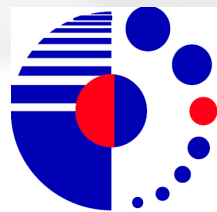


Analysis of diffractive dissociation
of exclusive $K^- \pi^+ \pi^-$ events
in the high energetic hadron beam of the
COMPASS experiment

Prometeusz Kryspin Jasinski
Mainz 19.March.2012



bmb+f - Förderschwerpunkt

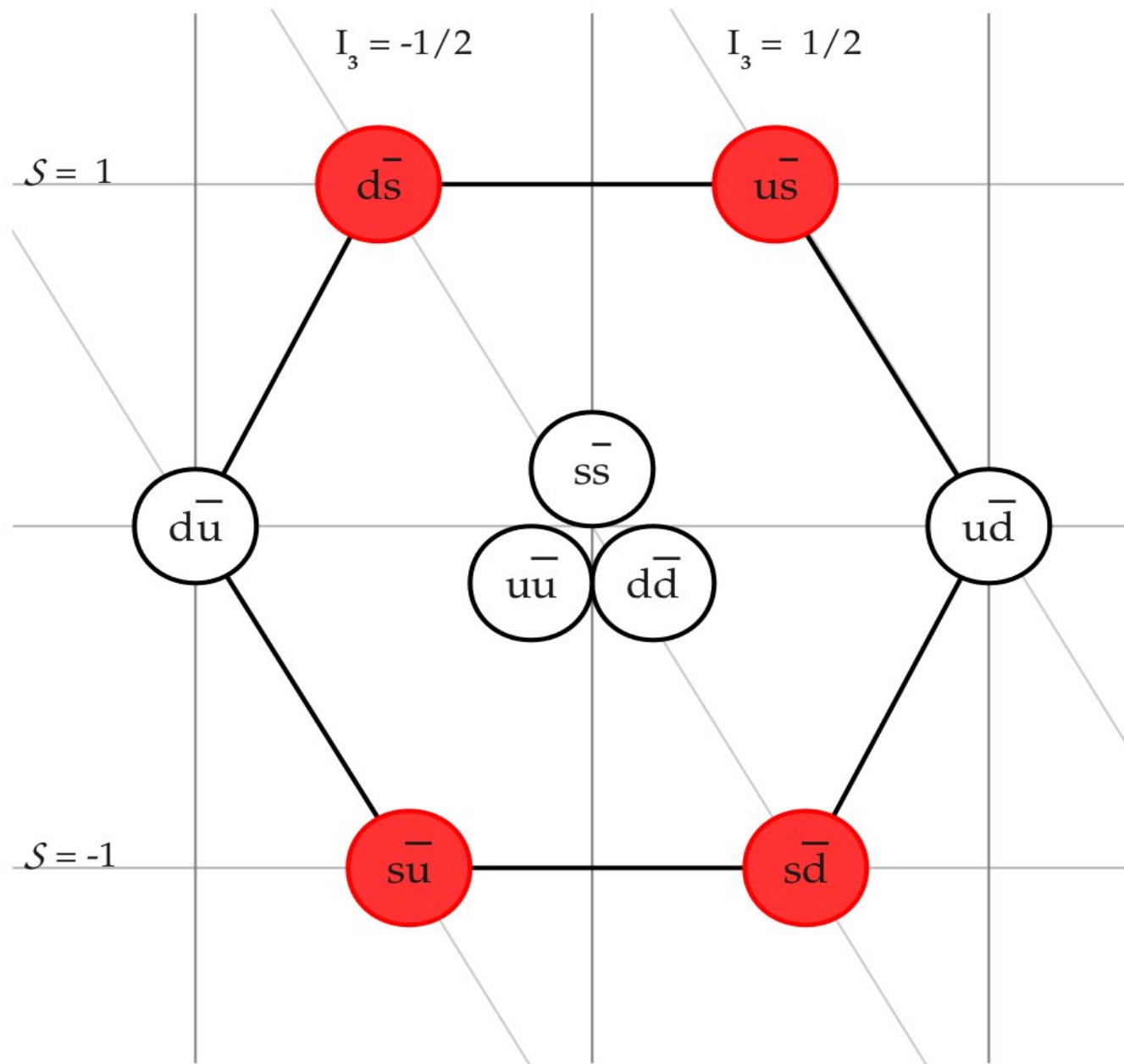
COMPASS

Großgeräte der physikalischen
Grundlagenforschung

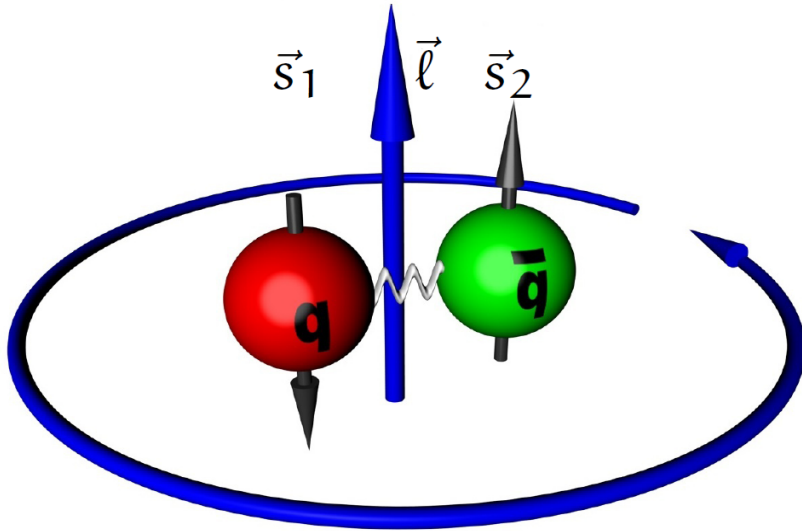


JOHANNES GUTENBERG
UNIVERSITÄT MAINZ

The SU(3) meson octet



Categorization of strange mesons



$$\vec{S} = \vec{s}_1 + \vec{s}_2 \rightarrow S = 0, 1$$

$$\vec{J} = \vec{S} + \vec{l}$$

$$|\ell - S| \leq J \leq |\ell + S|$$

$$P = (-1)^{(\ell+1)}$$

	S=0					S=1				
$\ell =$	0	1	2	3	4	0	1	2	3	4
J =	0	1	2	3	4	1	0,1,2	1,2,3	2,3,4	4,5,6
P =	-	+	-	+	-	-	+	-	+	-

Categorization of mesons

	S=0					S=1				
$\ell=$	0	1	2	3	4	0	1	2	3	4
J=	0	1	2	3	4	1	0,1,2	1,2,3	2,3,4	4,5,6
P=	-	+	-	+	-	-	+	-	+	-

$\text{mass [GeV}/c^2]$ 0.5		

Categorization of mesons

	S=0					S=1				
$\ell =$	0	1	2	3	4	0	1	2	3	4
J =	0	1	2	3	4	1	0,1,2	1,2,3	2,3,4	4,5,6
P =	-	+	-	+	-	-	+	-	+	-

$\text{mass [GeV}/c^2]$ 0.5		
	<u>K</u>	

Categorization of mesons

	S=0					S=1				
$\ell=$	0	1	2	3	4	0	1	2	3	4
J=	0	1	2	3	4	1	0,1,2	1,2,3	2,3,4	4,5,6
P=	-	+	-	+	-	-	+	-	+	-

mass [GeV/c ²] 0.5		
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Categorization of mesons

	S=0					S=1				
$\ell=$	0	1	2	3	4	0	1	2	3	4
J=	0	1	2	3	4	1	0,1,2	1,2,3	2,3,4	4,5,6
P=	-	+	-	+	-	-	+	-	+	-

mass [GeV/c ²] 0.5		Mixing \longleftrightarrow	
	<u>K</u>		<u>K</u>[*](892)

Strange mesons in the PDG

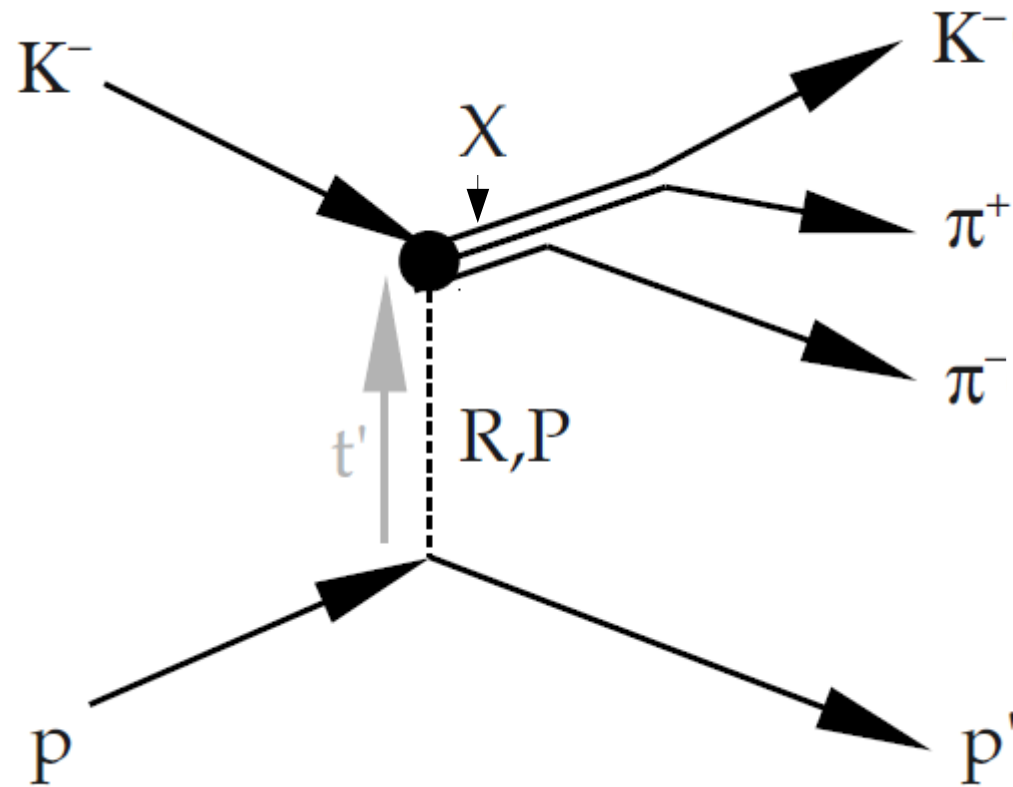
J^P	name
0^-	K
0^-	K(1460)
0^-	K(1830)
0^+	$K_0^*(1430)$
0^+	$K_0^*(1950)$
1^-	$K^*(892)$
1^-	$K^*(1410)$
1^-	$K^*(1680)$
1^+	$K_1(1270)$
1^+	$K_1(1400)$
1^+	$K_1(1650)$

2^-	$K_2(1580)$
2^-	$K_2(1770)$
2^-	$K_2(1820)$
2^-	$K_2(2250)$
2^+	$K_2^*(1430)$
2^+	$K_2^*(1980)$
3^-	$K_3(1780)$
3^+	$K_3(2320)$
4^-	$K_4^*(2500)$
4^+	$K_4^*(2045)$
5^-	$K_5^*(2380)$

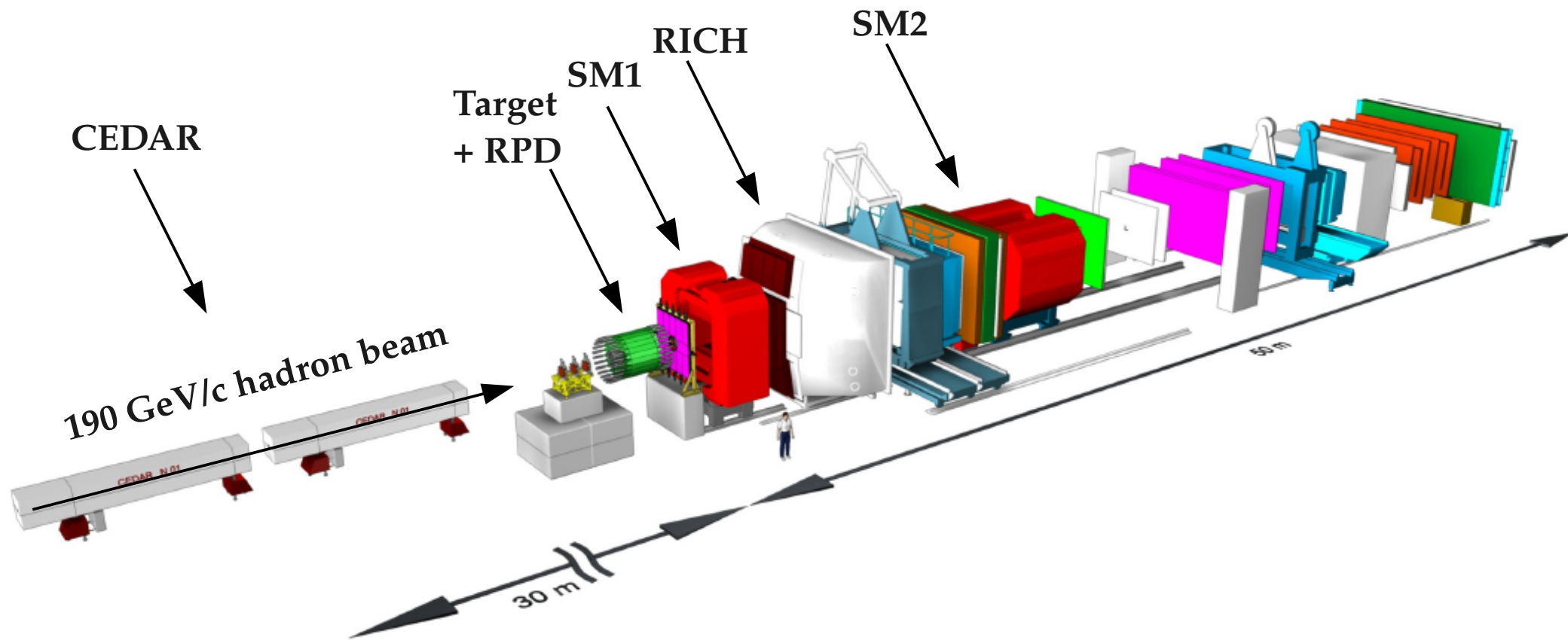
Strange mesons in the PDG

J^P	name	
0^-	K	
0^-	K(1460)	Not confirmed
0^-	K(1830)	Not confirmed
0^+	$K_0^*(1430)$	
0^+	$K_0^*(1950)$	Not confirmed
1^-	$K^*(892)$	
1^-	$K^*(1410)$	
1^-	$K^*(1680)$	
1^+	$K_1(1270)$	
1^+	$K_1(1400)$	
1^+	$K_1(1650)$	Not confirmed
2^-	$K_2(1580)$	Not confirmed
2^-	$K_2(1770)$	
2^-	$K_2(1820)$	
2^-	$K_2(2250)$	Not confirmed
2^+	$K_2^*(1430)$	
2^+	$K_2^*(1980)$	Not confirmed
3^-	$K_3(1780)$	
3^+	$K_3(2320)$	Not confirmed
4^-	$K_4^*(2500)$	Not confirmed
4^+	$K_4^*(2045)$	
5^-	$K_5^*(2380)$	Not confirmed

The diffractive production mechanism

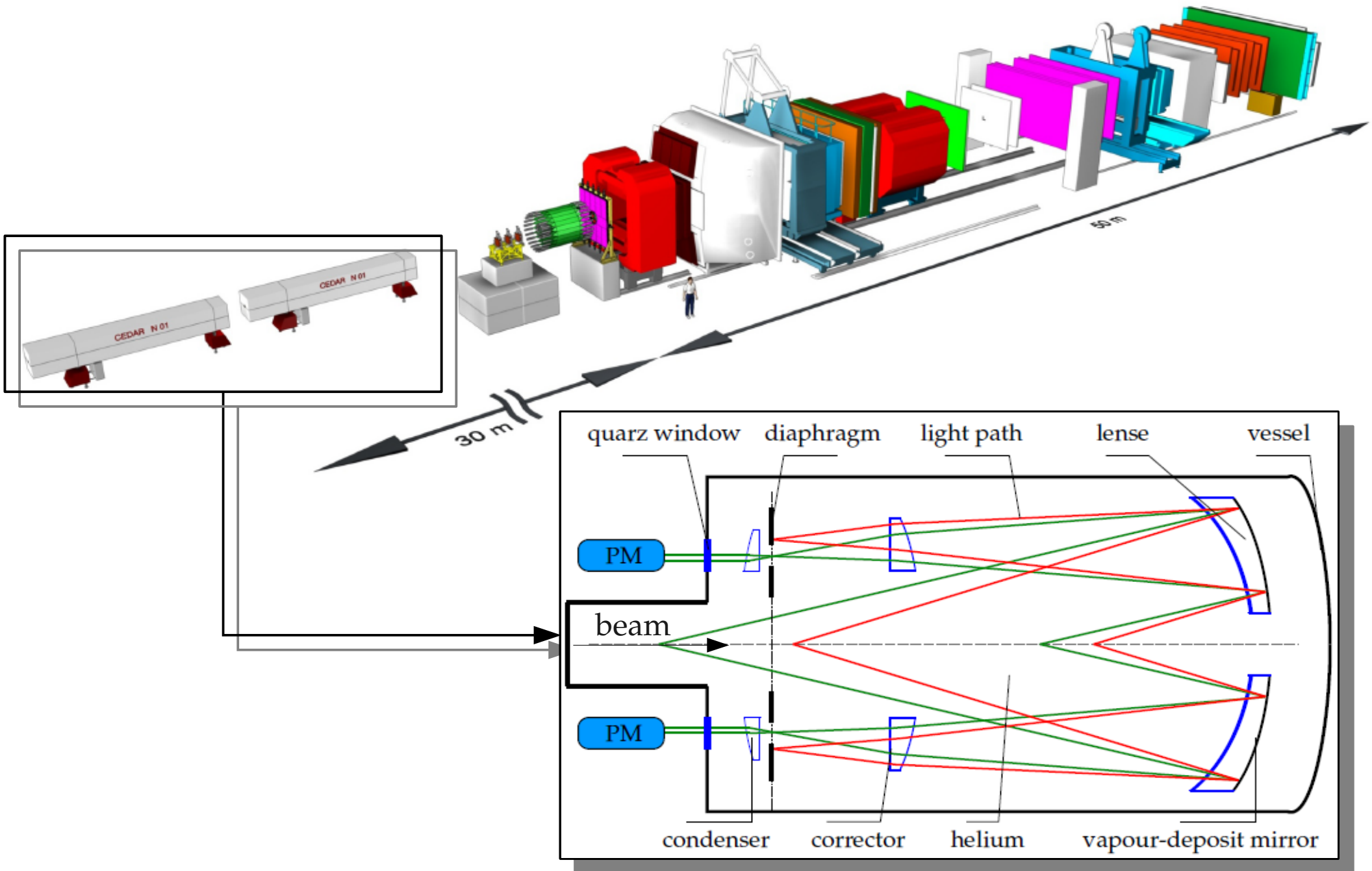


The COMPASS spectrometer 2008/2009

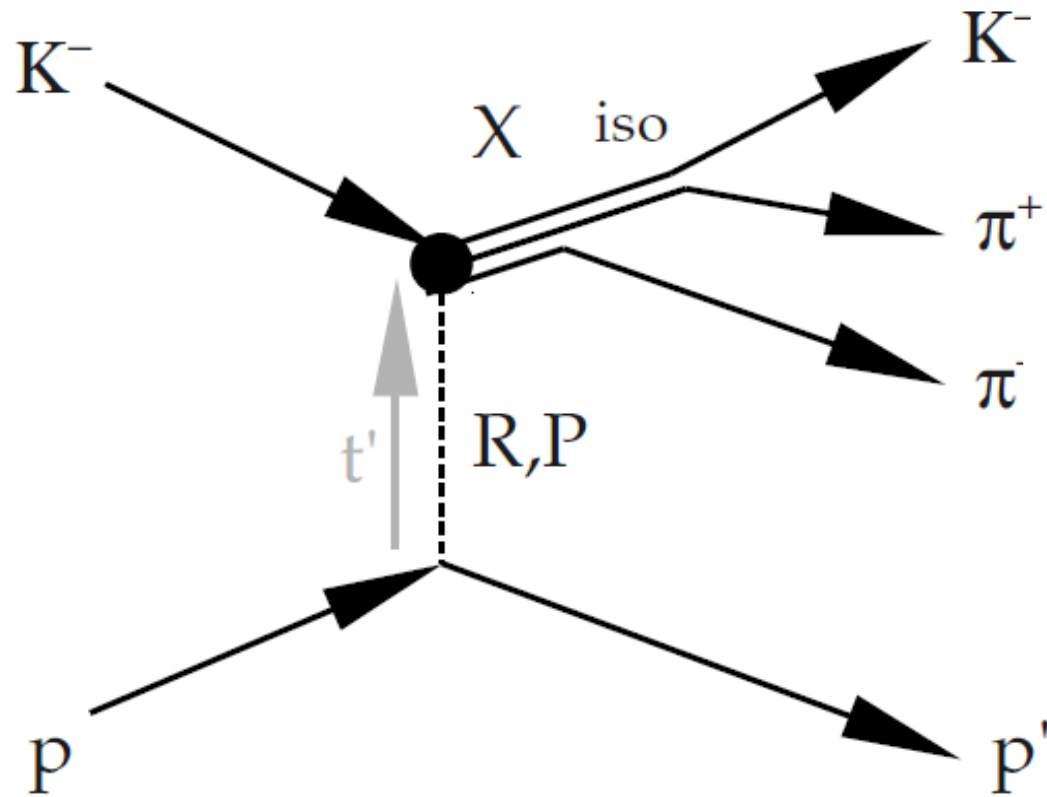


particle	π^-	K^-	\bar{p}
fraction	0.968	0.024	0.008

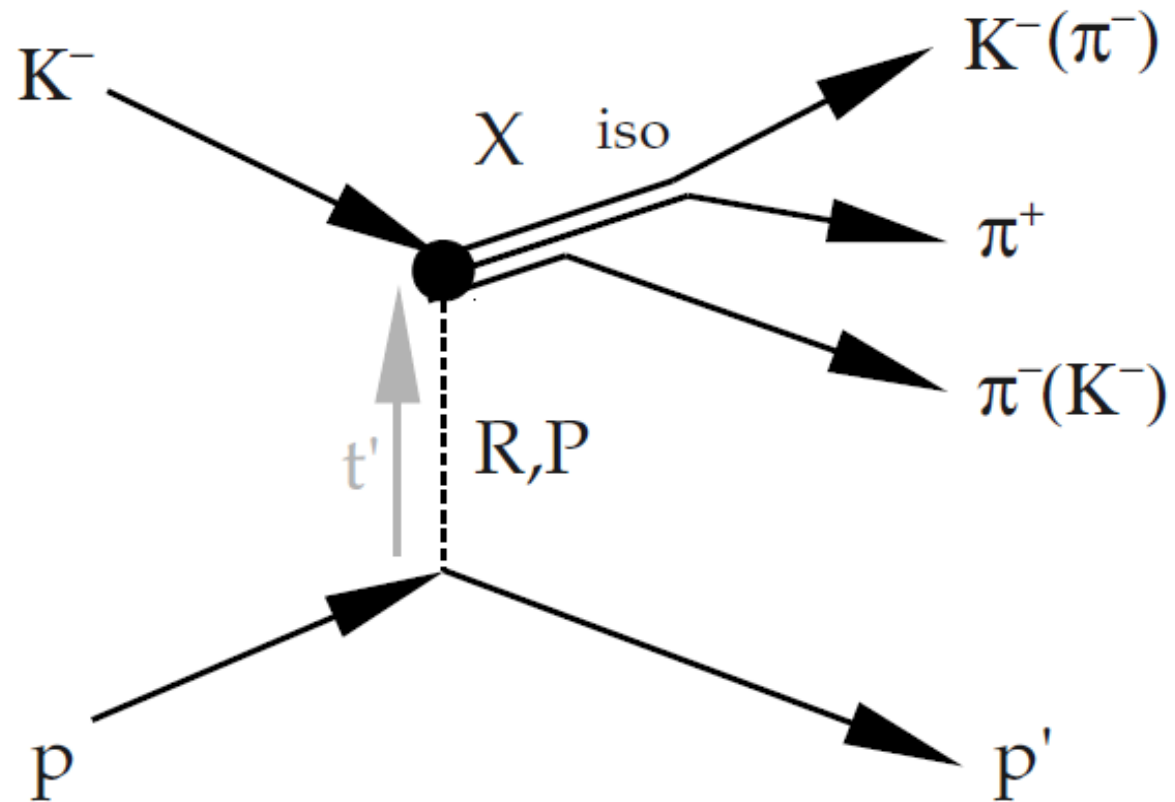
Beam particle separation



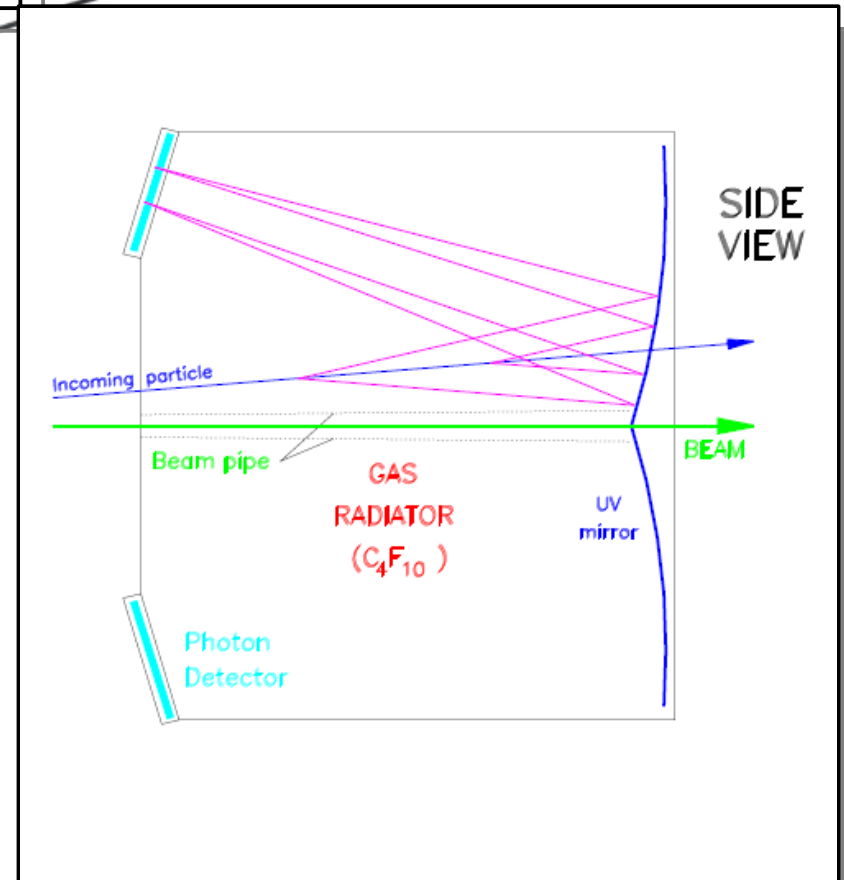
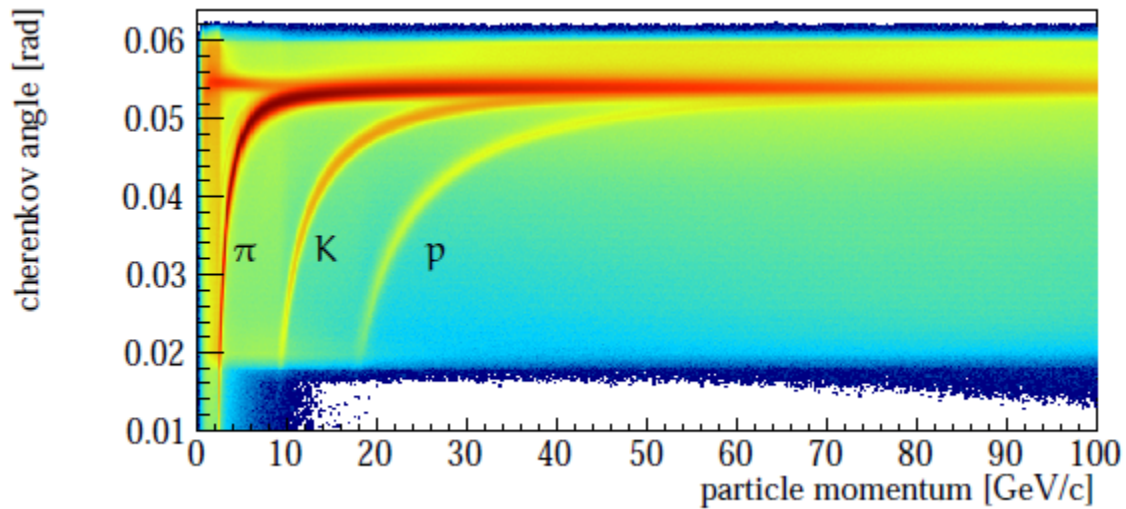
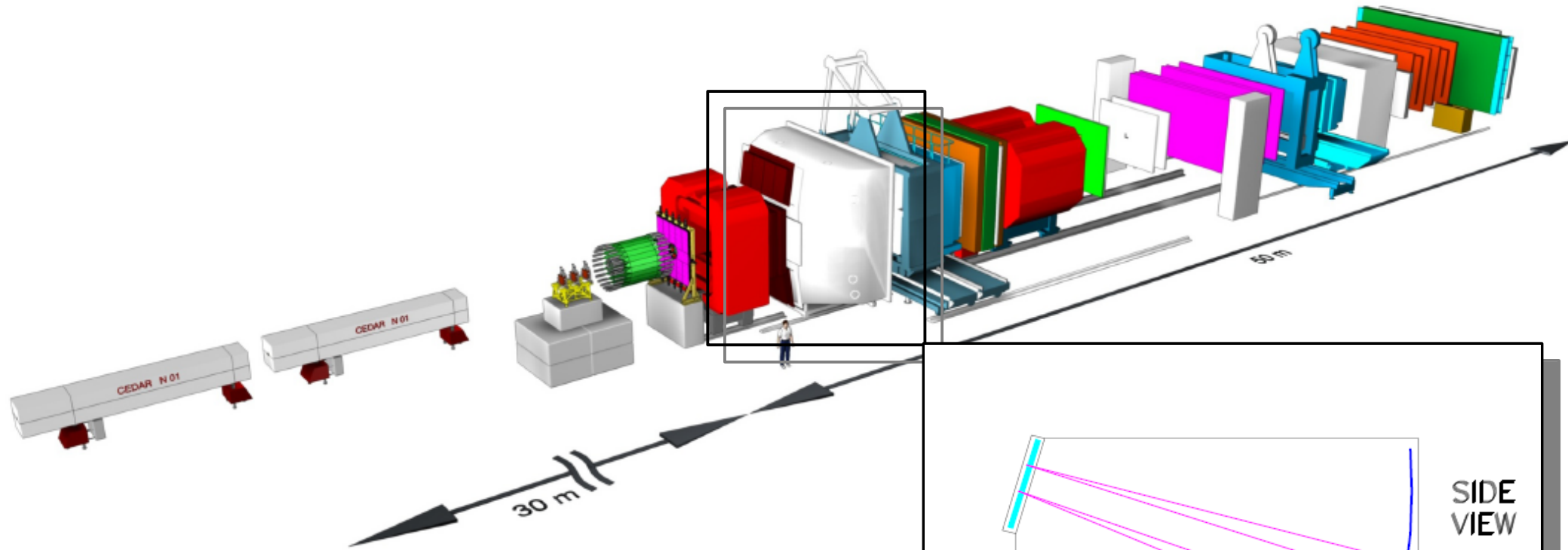
Ambiguities in the selection



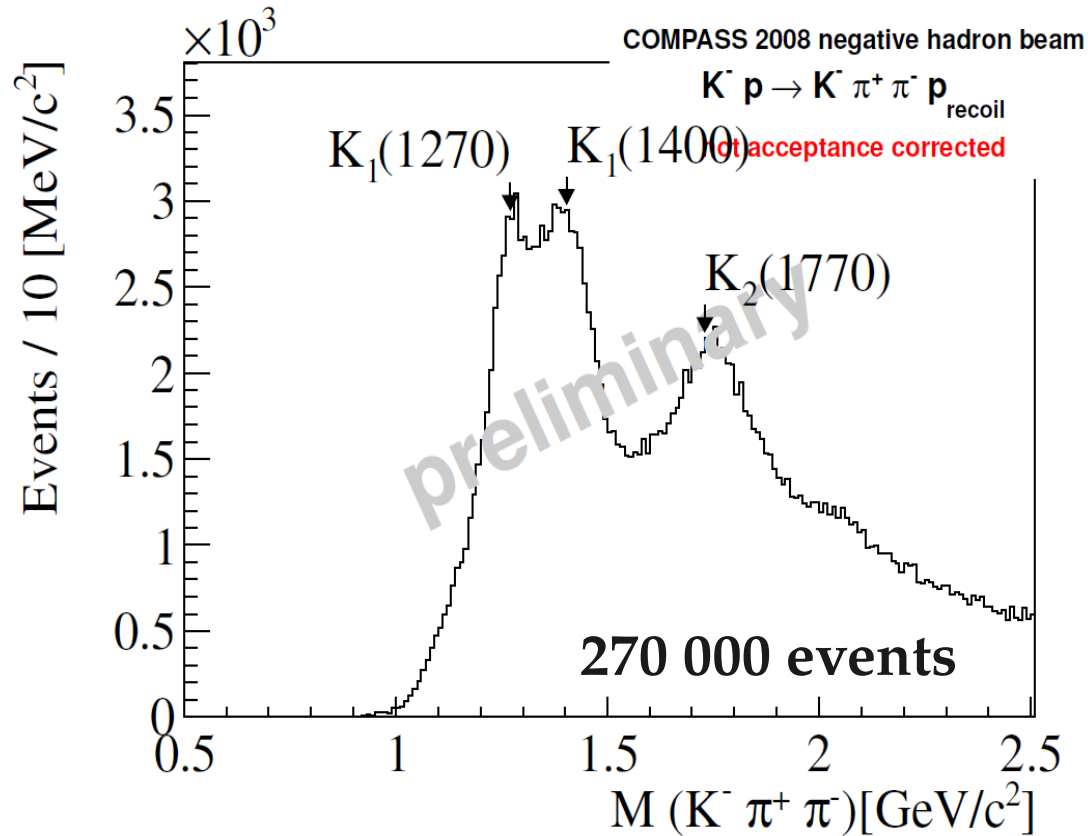
Ambiguities in the selection



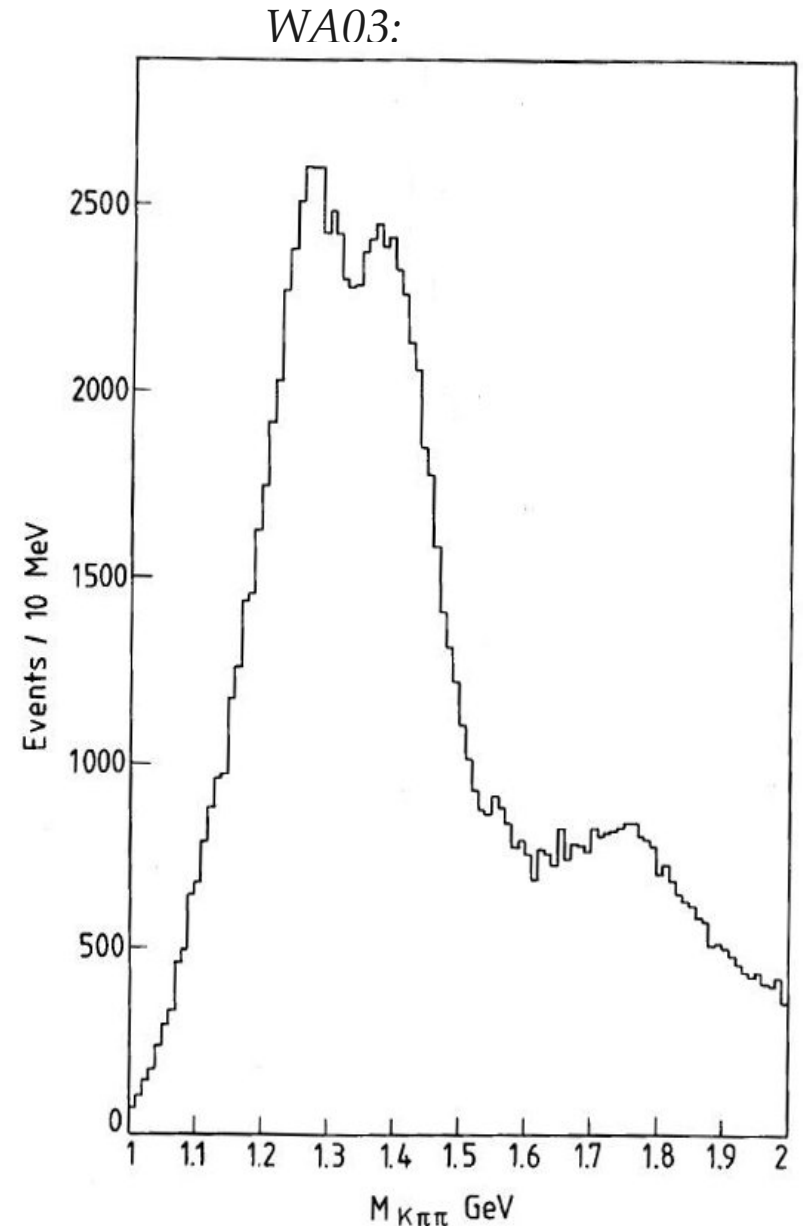
Ring Imaging Cherenkov Detektor (RICH)



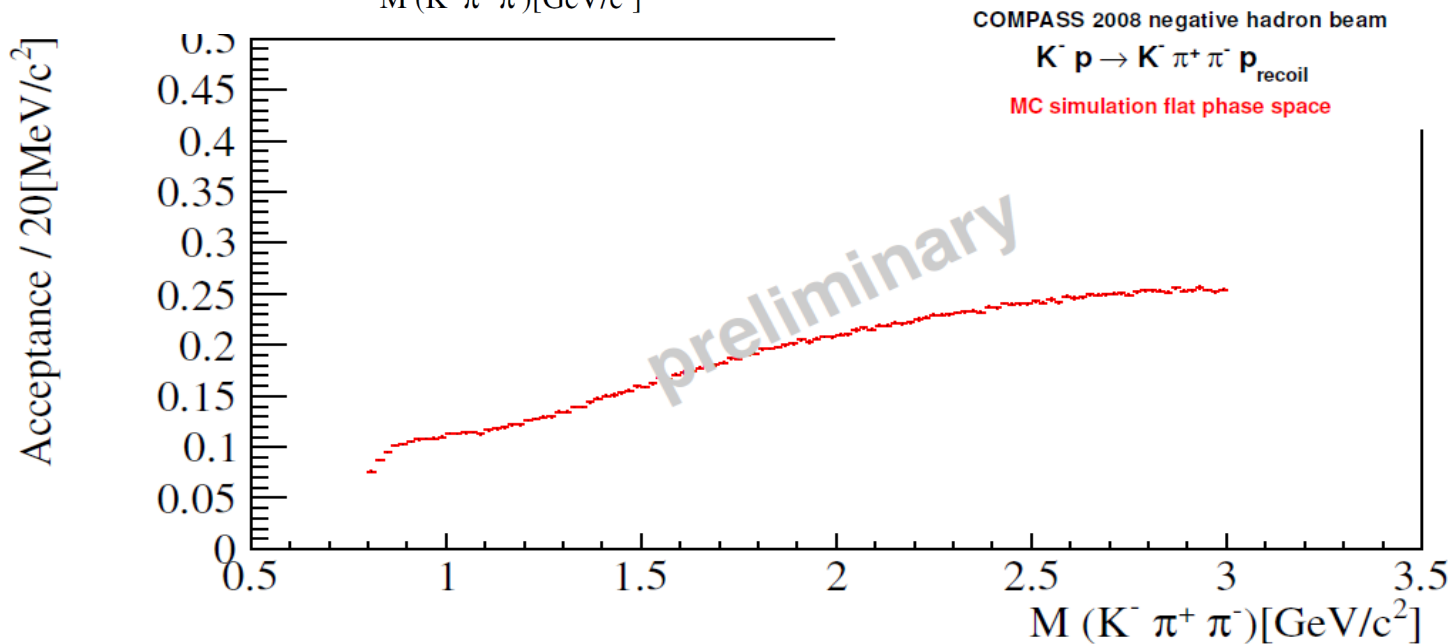
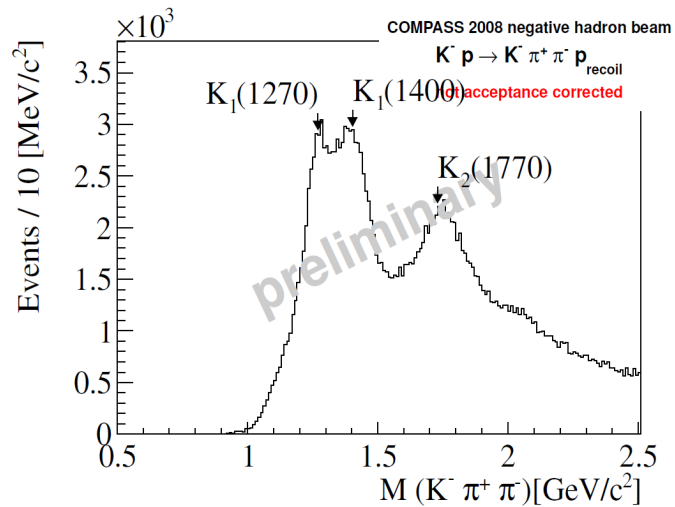
Invariant mass distributions of 2008



- already 35% more events than WA03 from data of 2008
- nearly 2 times larger sample for masses above 1.6 GeV/c²

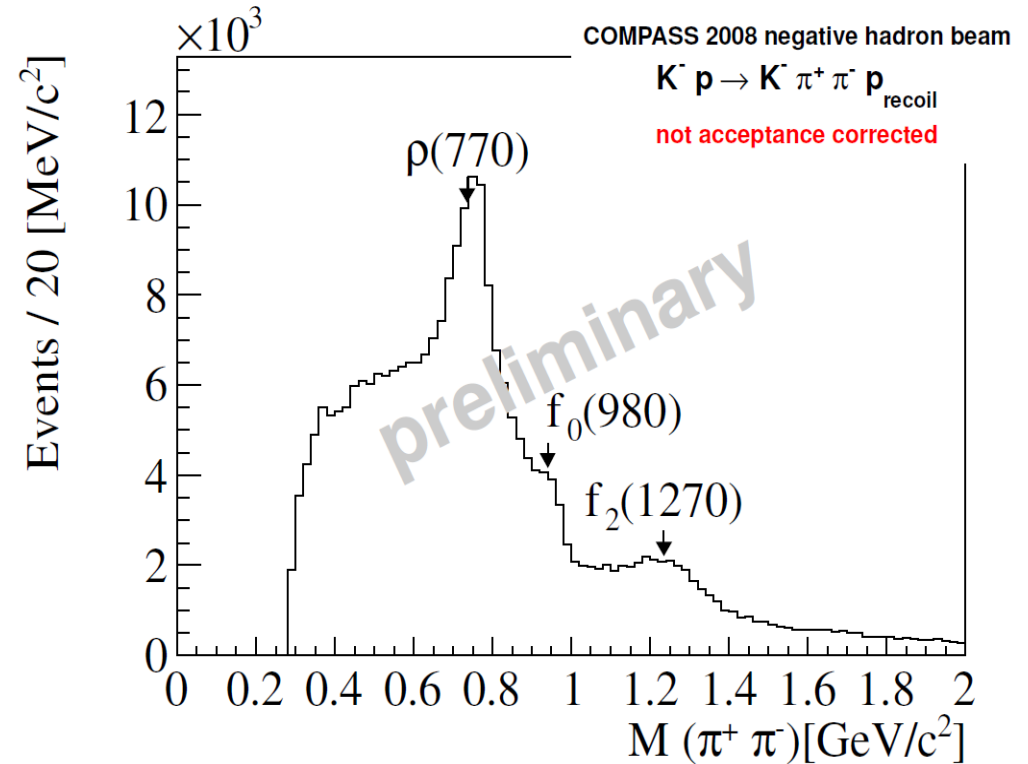
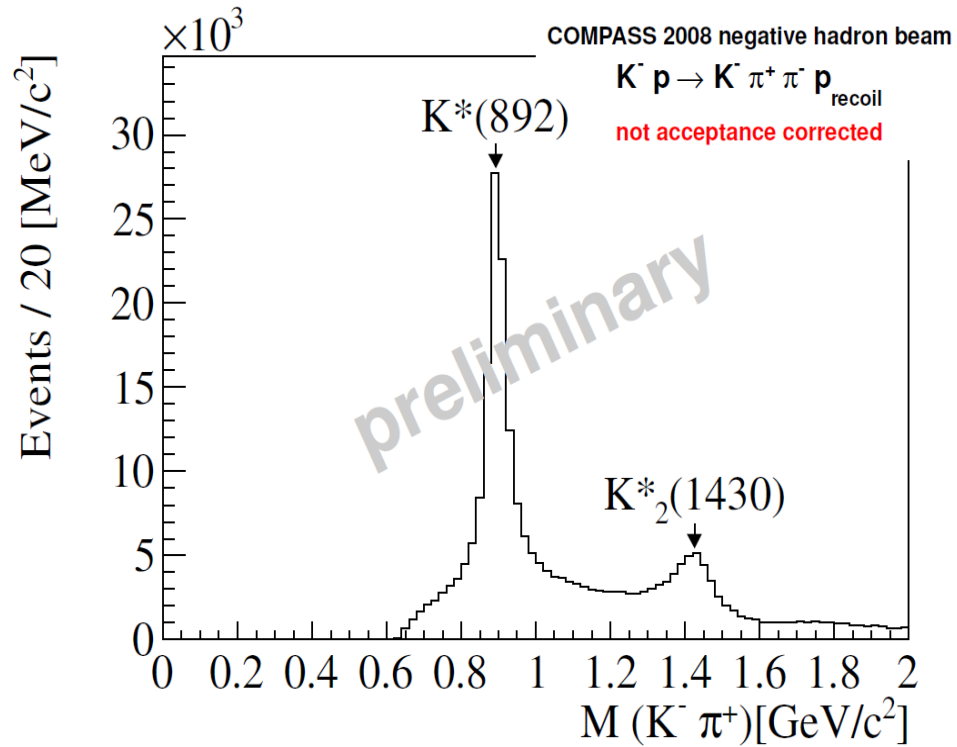


Invariant mass distributions of 2008



Affected by strong momentum acceptance effects of the RICH detector

Resonances in the sub systems



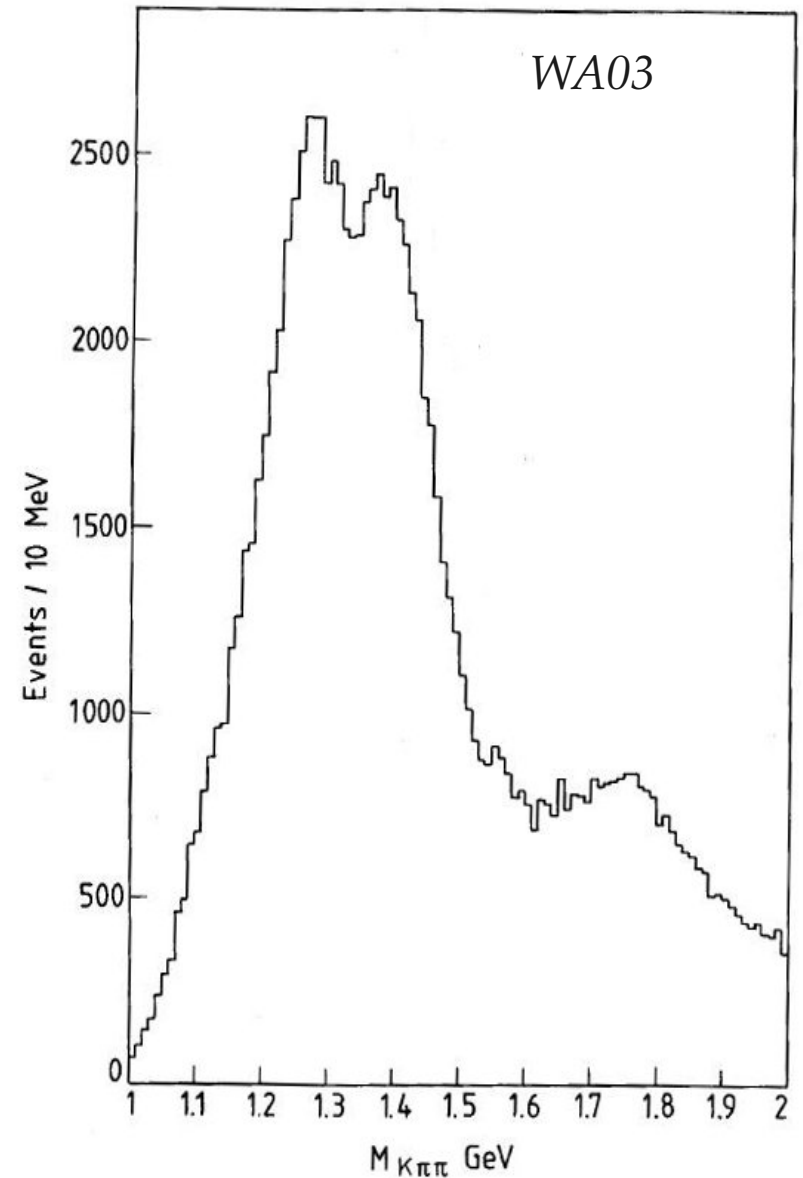
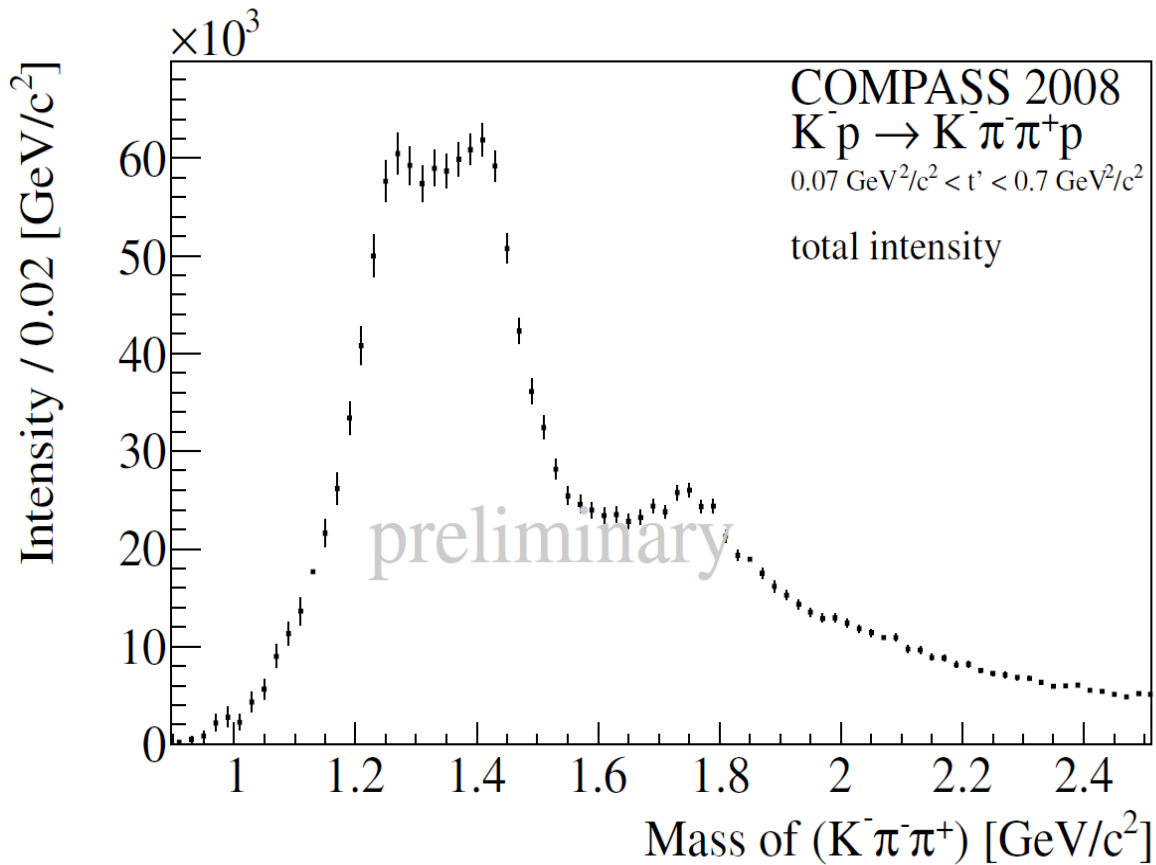
→ Model of a decay chain

The partial wave set

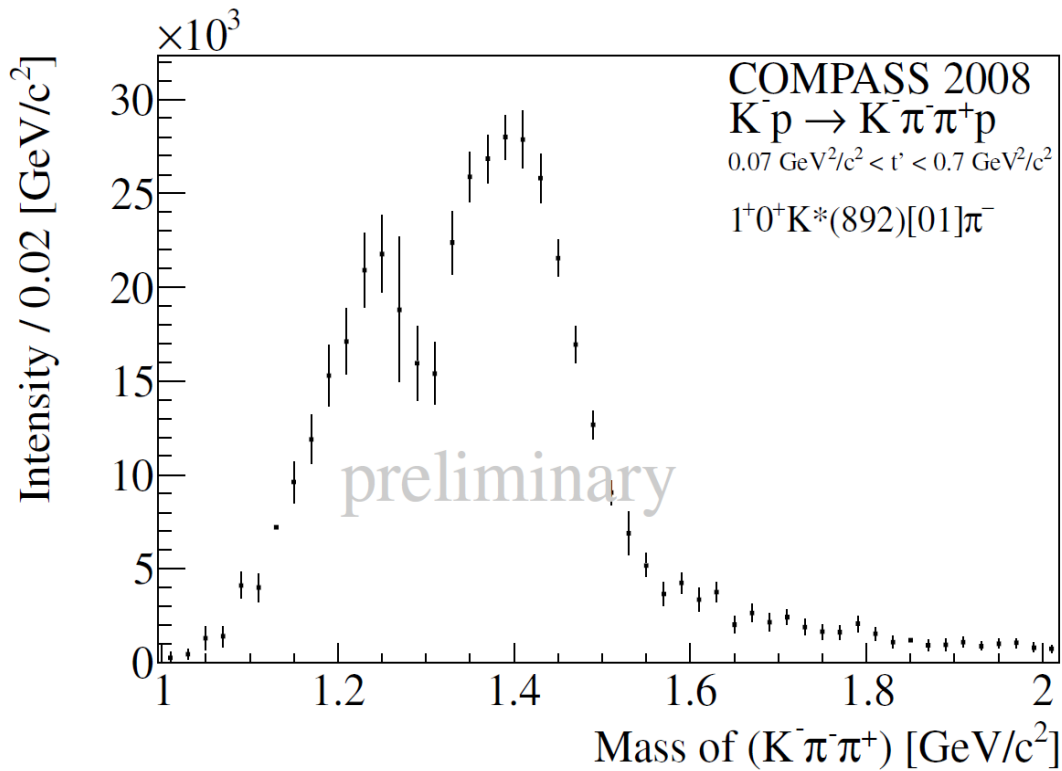
J^P	M^e	meson 1	$[\ell_S]$	meson 2
0^-	0^+	$K^*(892)$	$[\begin{smallmatrix} 1 \\ 1 \end{smallmatrix}]$	π^-
0^-	0^+	$\rho(770)$	$[\begin{smallmatrix} 1 \\ 1 \end{smallmatrix}]$	K^-
0^-	0^+	$f_0(600)$	$[\begin{smallmatrix} 0 \\ 0 \end{smallmatrix}]$	K^-
1^+	0^+	$K^*(892)$	$[\begin{smallmatrix} 0 \\ 1 \end{smallmatrix}]$	π^-
1^+	0^+	$\rho(770)$	$[\begin{smallmatrix} 0 \\ 1 \end{smallmatrix}]$	K^-
1^+	0^+	$K^*(800)$	$[\begin{smallmatrix} 1 \\ 0 \end{smallmatrix}]$	π^-
1^+	1^+	$K^*(892)$	$[\begin{smallmatrix} 0 \\ 1 \end{smallmatrix}]$	π^-
1^+	1^+	$\rho(770)$	$[\begin{smallmatrix} 0 \\ 1 \end{smallmatrix}]$	K^-
1^+	1^+	$K^*(800)$	$[\begin{smallmatrix} 1 \\ 0 \end{smallmatrix}]$	π^-
1^+	1^+	$f_0(600)$	$[\begin{smallmatrix} 1 \\ 0 \end{smallmatrix}]$	K^-
1^+	0^+	$\rho(770)$	$[\begin{smallmatrix} 2 \\ 1 \end{smallmatrix}]$	K^-
1^+	0^+	$K^*(892)$	$[\begin{smallmatrix} 2 \\ 1 \end{smallmatrix}]$	π^-
1^-	1^+	$K^*(892)$	$[\begin{smallmatrix} 1 \\ 1 \end{smallmatrix}]$	π^-
1^-	1^+	$\rho(770)$	$[\begin{smallmatrix} 1 \\ 1 \end{smallmatrix}]$	K^-
2^+	1^+	$K^*(892)$	$[\begin{smallmatrix} 2 \\ 1 \end{smallmatrix}]$	π^-
2^+	1^+	$\rho(770)$	$[\begin{smallmatrix} 2 \\ 1 \end{smallmatrix}]$	K^-
2^-	0^+	$K^*(892)$	$[\begin{smallmatrix} 1 \\ 1 \end{smallmatrix}]$	π^-
2^-	0^+	$\rho(770)$	$[\begin{smallmatrix} 1 \\ 1 \end{smallmatrix}]$	K^-
2^-	0^+	$K_2^*(1430)$	$[\begin{smallmatrix} 0 \\ 2 \end{smallmatrix}]$	π^-
2^-	0^+	$f_2(1270)$	$[\begin{smallmatrix} 0 \\ 2 \end{smallmatrix}]$	K^-

Results of mass independent pwa fits

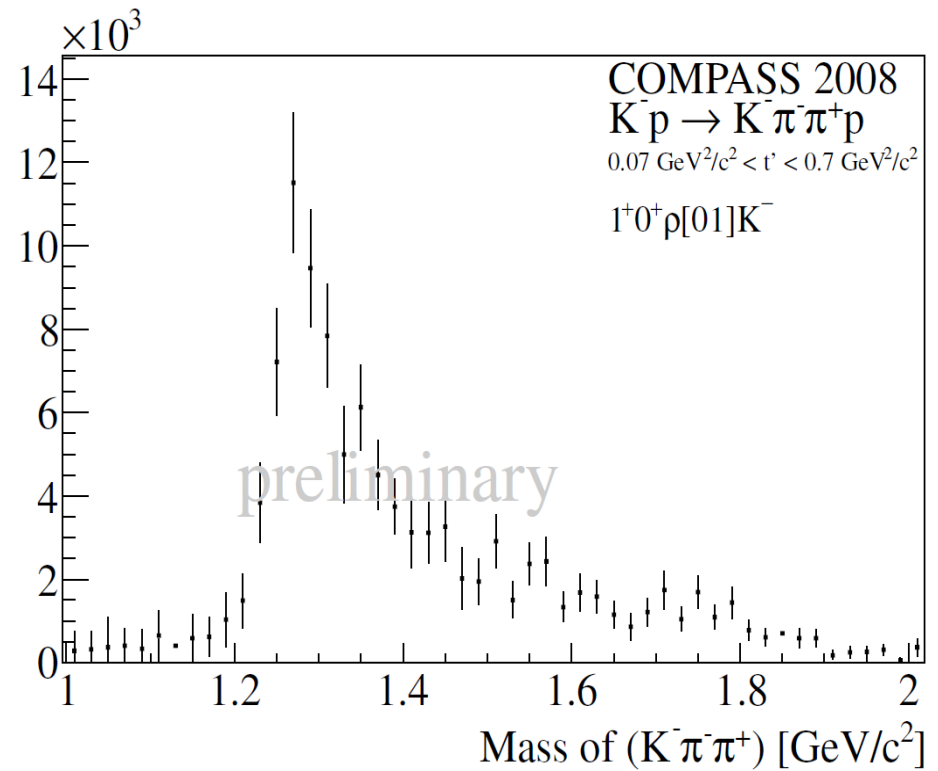
Coherent sum of all partial waves



Results of mass independent pwa fits

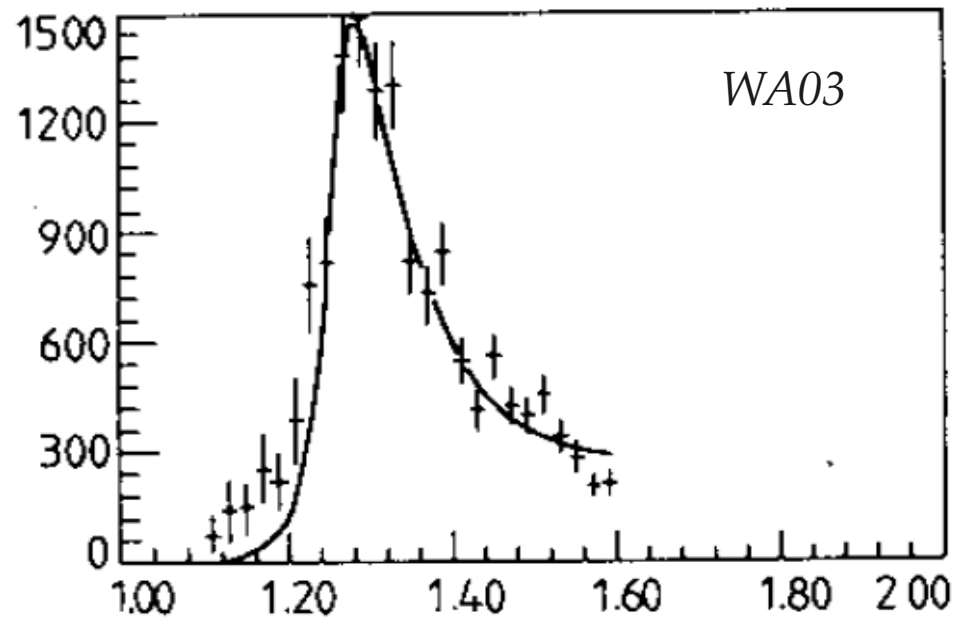
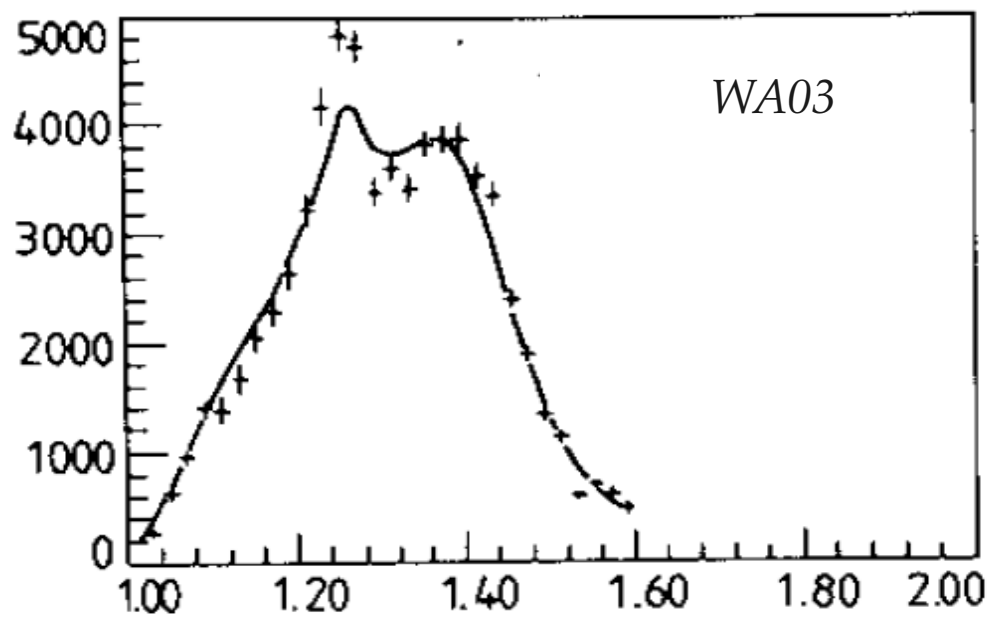
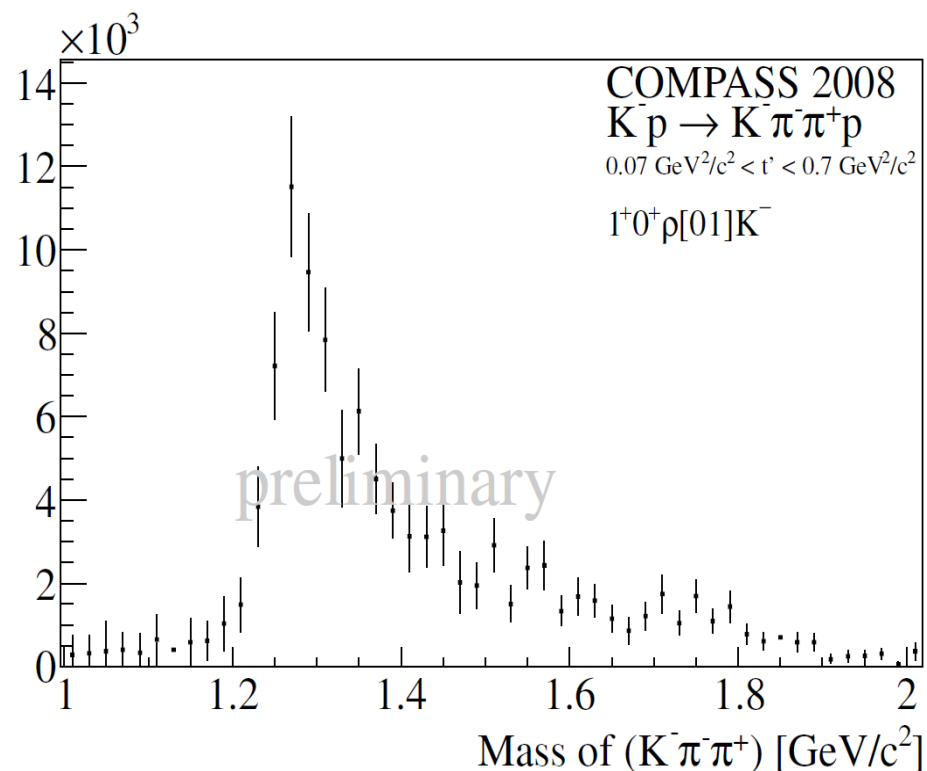
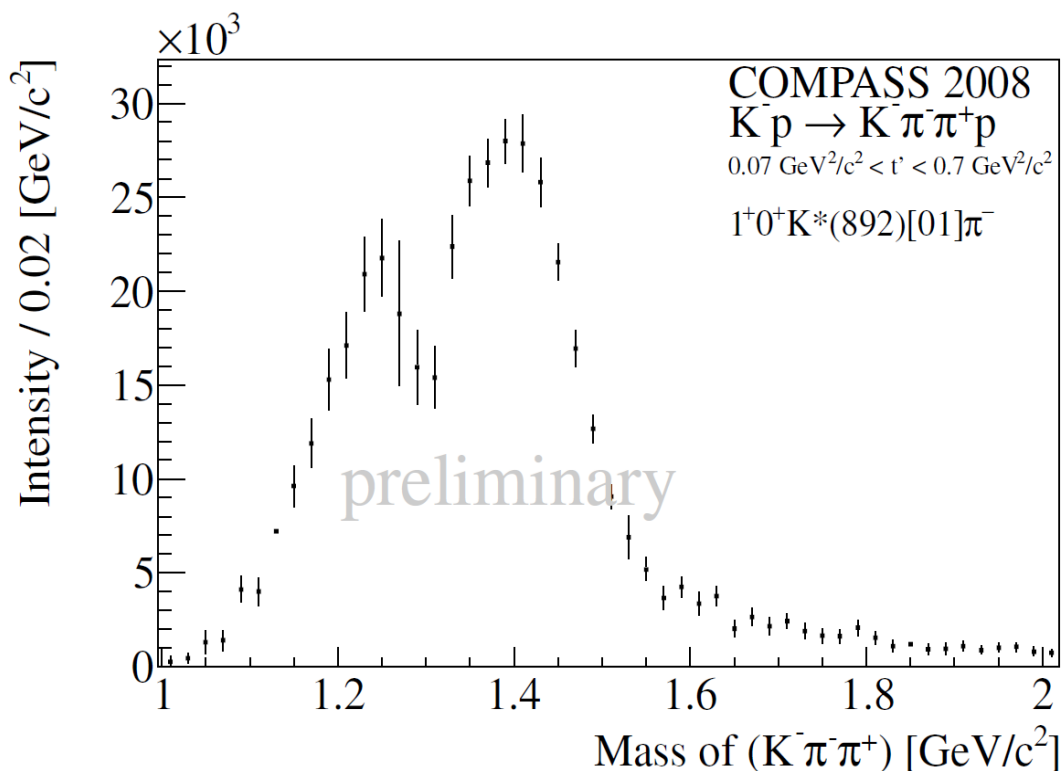


WA03

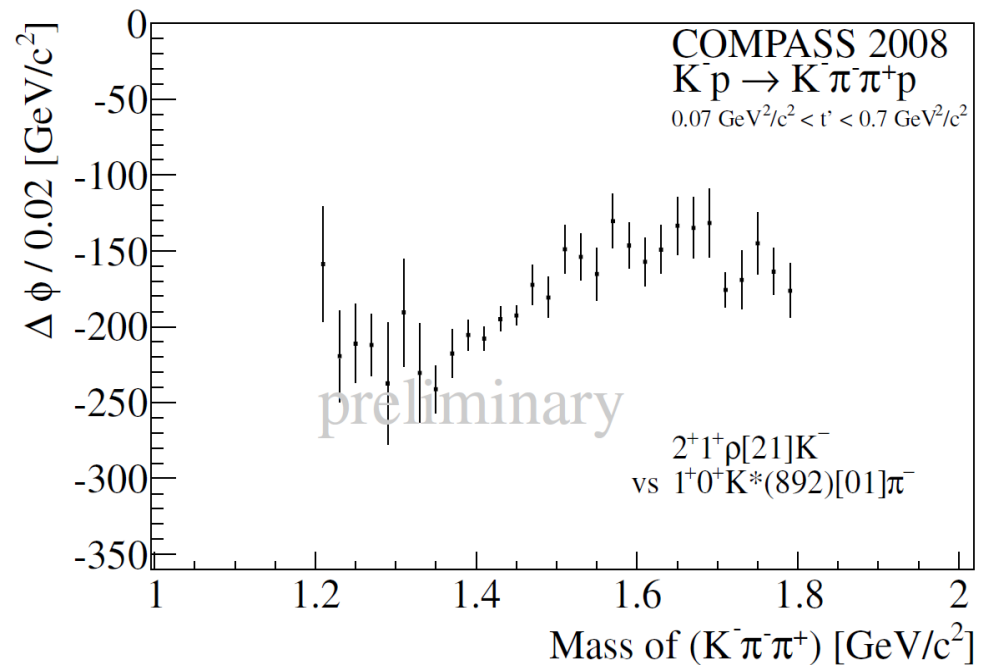
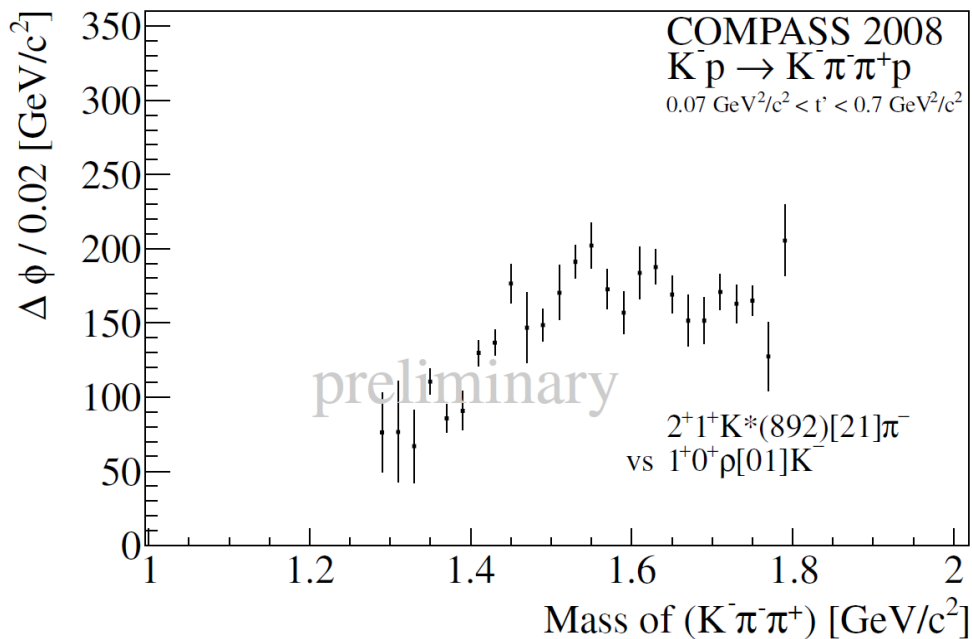
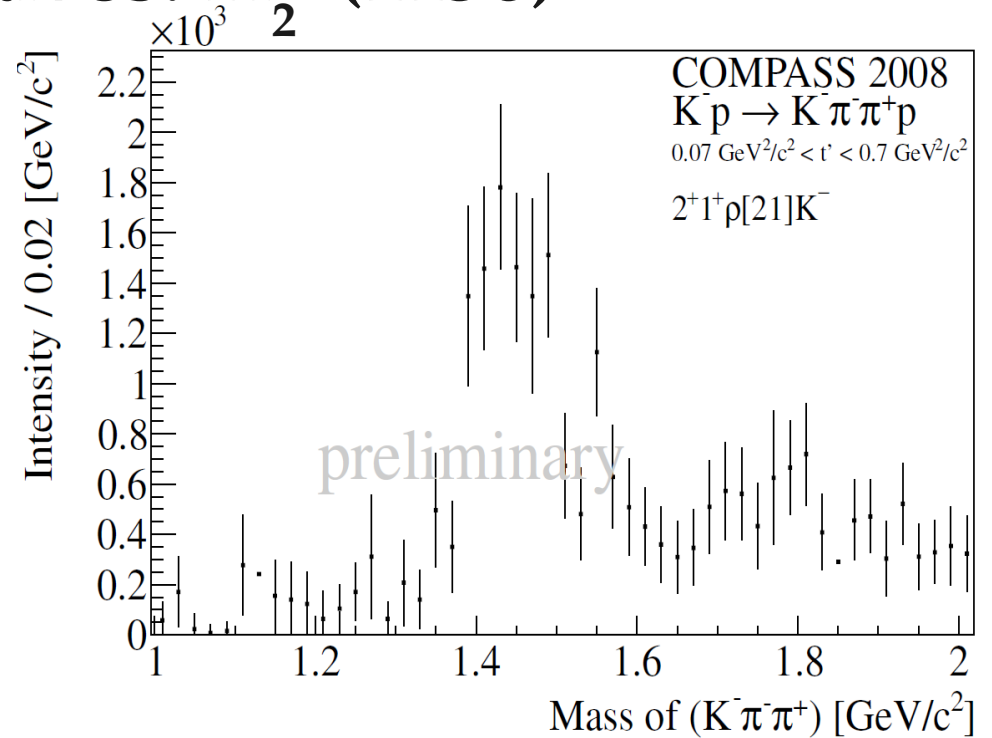
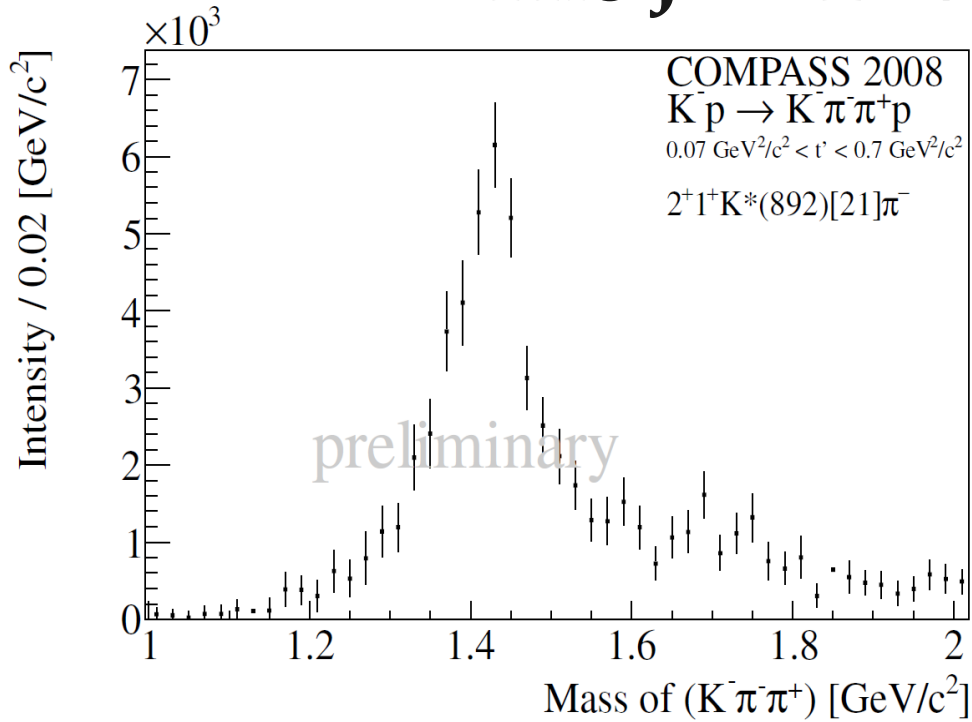


WA03

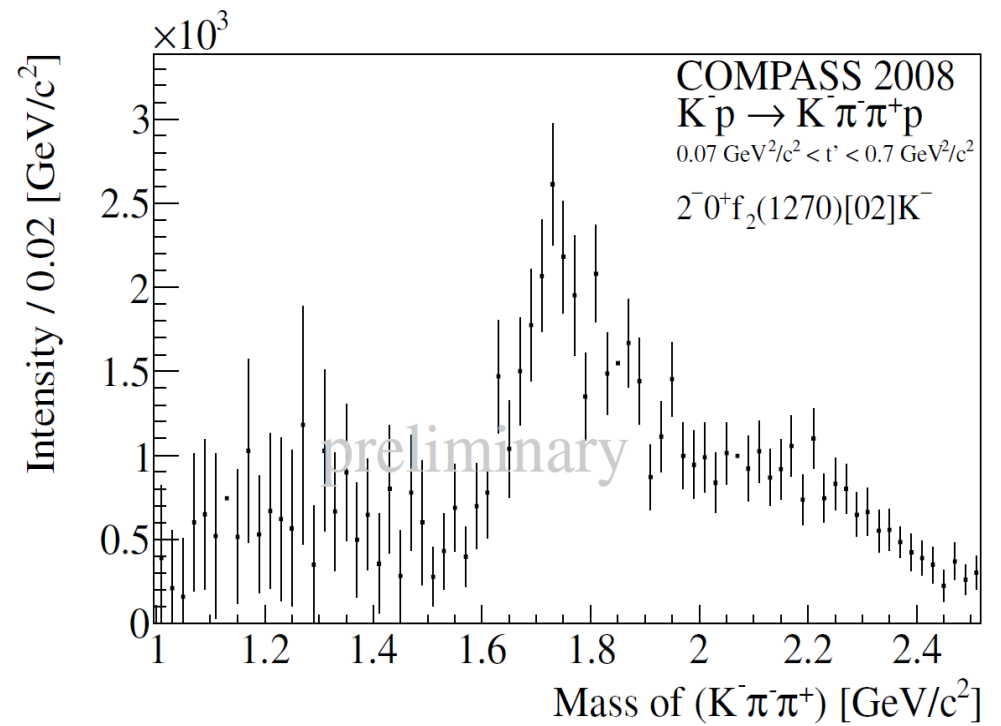
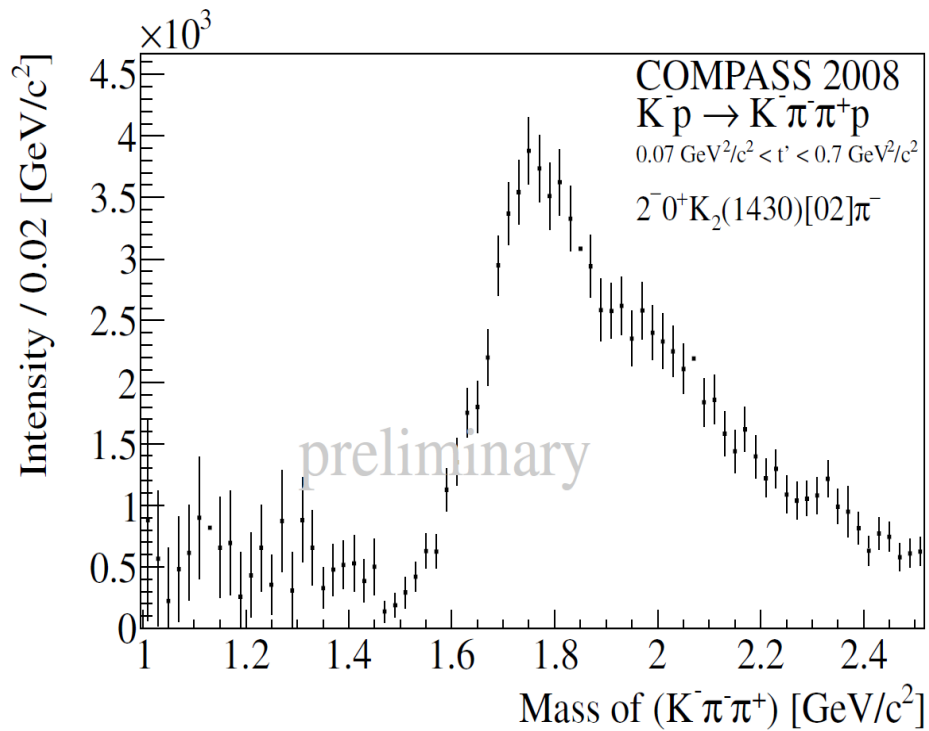
Results of mass independent pwa fits



The $J^P = 2^+$ waves: $K_2^*(1430)$



The $J^P = 2^-$ waves



Observations of strange mesons

J^P	name		
0^-	K		
0^-	K(1460)	Not confirmed/seen	
0^-	K(1830)	Not confirmed	
0^+	$K_0^*(1430)$		
0^+	$K_0^*(1950)$	Not confirmed	
1^-	$K^*(892)$		
1^-	$K^*(1410)$		
1^-	$K^*(1680)$	seen	
1^+	$K_1(1270)$	seen	
1^+	$K_1(1400)$	seen	
1^+	$K_1(1650)$	Not confirmed/seen	
2^-	$K_2(1580)$	Not confirmed/not seen	
2^-	$K_2(1770)$		seen
2^-	$K_2(1820)$		seen
2^-	$K_2(2250)$	Not confirmed/seen	
2^+	$K_2^*(1430)$		seen
2^+	$K_2^*(1980)$	Not confirmed/not seen	
3^-	$K_3(1780)$		
3^+	$K_3(2320)$	Not confirmed	
4^-	$K_4^*(2500)$	Not confirmed	
4^+	$K_4^*(2045)$		
5^-	$K_5^*(2380)$	Not confirmed	

Summary

- Data of 2008 successfully filtered
- A mass independent, acceptance corrected PWA was performed
- Very promising results

Outlook

- Analysis of 2009 data is pending
- Mass dependant fits are under preparation
- A completed analysis is expected soon

Thank you!

Study of the $K^+ \pi^+ \pi^-$ final state in $B^+ \rightarrow J/\psi K^+ \pi^+ \pi^-$ and $B^+ \rightarrow \psi' K^+ \pi^+ \pi^-$

(The Belle Collaboration)

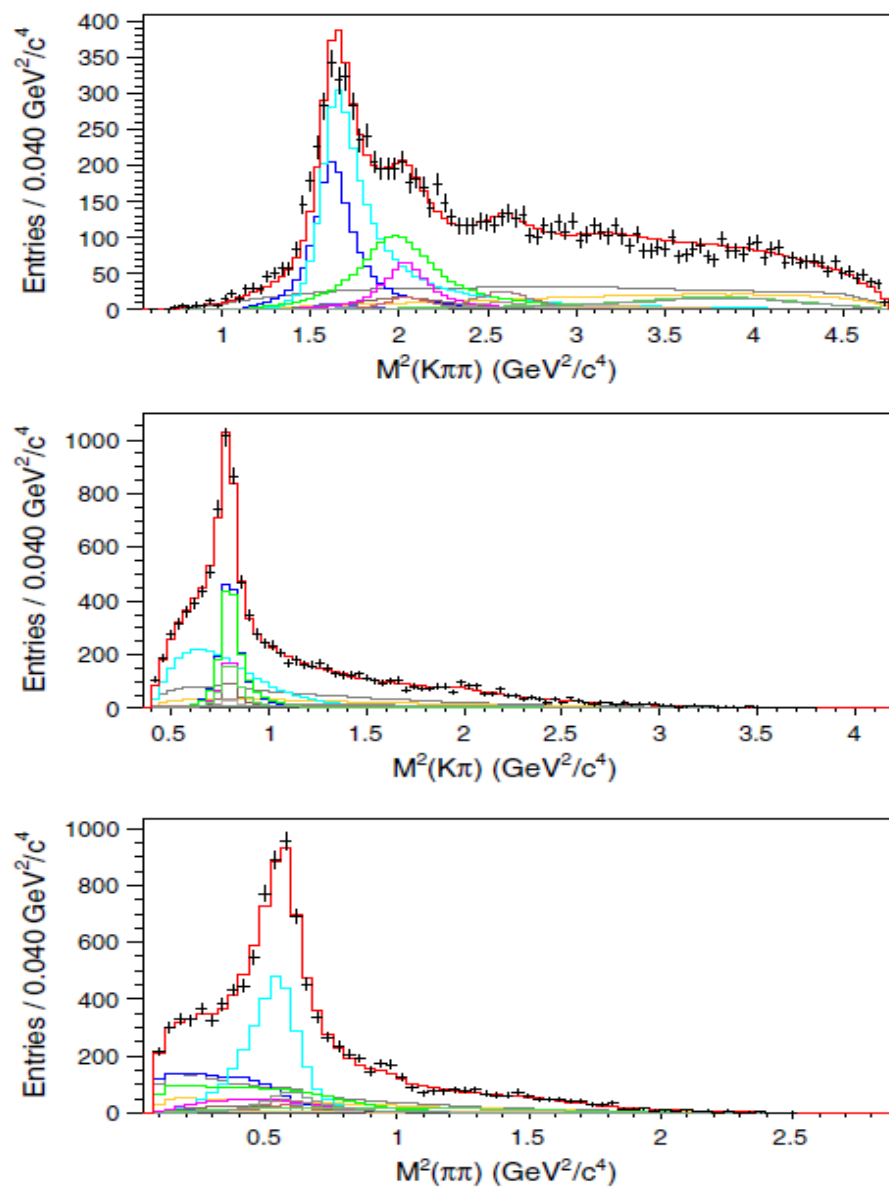


FIG. 18 (color online). Results of signal-region fits for $B^+ \rightarrow J/\psi K^+ \pi^+ \pi^-$. Data (points) and fits (histograms) are shown projected onto the three axes. The fit components are color coded as shown in Fig. 19. 28