

$$\left\{ \begin{array}{l}
\sigma_{pp} = B_{pp} \ln^2 \left(\frac{s}{s_0} \right) + Y_1^{pp} s^{-\eta_1} - Y_2^{pp} s^{-\eta_2}, \\
\sigma_{\bar{p}p} = B_{pp} \ln^2 \left(\frac{s}{s_0} \right) + Y_1^{pp} s^{-\eta_1} + Y_2^{pp} s^{-\eta_2}, \\
\sigma_{\pi^+p} = B_{\pi p} \ln^2 \left(\frac{s}{s_0} \right) + Y_1^{\pi p} s^{-\eta_1} - Y_2^{\pi p} s^{-\eta_2}, \\
\sigma_{\pi^-p} = B_{\pi p} \ln^2 \left(\frac{s}{s_0} \right) + Y_1^{\pi p} s^{-\eta_1} + Y_2^{\pi p} s^{-\eta_2}, \\
\sigma_{K^+p} = B_{Kp} \ln^2 \left(\frac{s}{s_0} \right) + Y_1^{Kp} s^{-\eta_1} - Y_2^{Kp} s^{-\eta_2}, \\
\sigma_{K^-p} = B_{Kp} \ln^2 \left(\frac{s}{s_0} \right) + Y_1^{Kp} s^{-\eta_1} + Y_2^{Kp} s^{-\eta_2}, \\
\sigma_{\gamma p} = \delta B_{pp} \ln^2 \left(\frac{s}{s_0} \right) + Y_1^{\gamma p} s^{-\eta_1}, \\
\sigma_{\gamma\gamma} = \delta^2 B_{pp} \ln^2 \left(\frac{s}{s_0} \right) + Y_1^{\gamma\gamma} s^{-\eta_1}, \\
\sigma_{\Sigma^-p} = B_{\Sigma p} \ln^2 \left(\frac{s}{s_0} \right) + Y_1^{\Sigma p} s^{-\eta_1} - Y_2^{\Sigma p} s^{-\eta_2}. \quad \blacksquare \\
\rho_{pp}\sigma_{pp} = \pi B_{pp} \ln \left(\frac{s}{s_0} \right) - \frac{Y_1^{pp} s^{-\eta_1}}{\tan \left[\frac{1-\eta_1}{2} \pi \right]} - \frac{Y_2^{pp} s^{-\eta_2}}{\cot \left[\frac{1-\eta_2}{2} \pi \right]}, \\
\rho_{\bar{p}p}\sigma_{\bar{p}p} = \pi B_{pp} \ln \left(\frac{s}{s_0} \right) - \frac{Y_1^{pp} s^{-\eta_1}}{\tan \left[\frac{1-\eta_1}{2} \pi \right]} + \frac{Y_2^{pp} s^{-\eta_2}}{\cot \left[\frac{1-\eta_2}{2} \pi \right]}, \\
\rho_{\pi^+p}\sigma_{\pi^+p} = \pi B_{\pi p} \ln \left(\frac{s}{s_0} \right) - \frac{Y_1^{\pi p} s^{-\eta_1}}{\tan \left[\frac{1-\eta_1}{2} \pi \right]} - \frac{Y_2^{\pi p} s^{-\eta_2}}{\cot \left[\frac{1-\eta_2}{2} \pi \right]}, \\
\rho_{\pi^-p}\sigma_{\pi^-p} = \pi B_{\pi p} \ln \left(\frac{s}{s_0} \right) - \frac{Y_1^{\pi p} s^{-\eta_1}}{\tan \left[\frac{1-\eta_1}{2} \pi \right]} + \frac{Y_2^{\pi p} s^{-\eta_2}}{\cot \left[\frac{1-\eta_2}{2} \pi \right]}, \\
\rho_{K^+p}\sigma_{K^+p} = \pi B_{Kp} \ln \left(\frac{s}{s_0} \right) - \frac{Y_1^{Kp} s^{-\eta_1}}{\tan \left[\frac{1-\eta_1}{2} \pi \right]} - \frac{Y_2^{Kp} s^{-\eta_2}}{\cot \left[\frac{1-\eta_2}{2} \pi \right]}, \\
\rho_{K^-p}\sigma_{K^-p} = \pi B_{Kp} \ln \left(\frac{s}{s_0} \right) - \frac{Y_1^{Kp} s^{-\eta_1}}{\tan \left[\frac{1-\eta_1}{2} \pi \right]} + \frac{Y_2^{Kp} s^{-\eta_2}}{\cot \left[\frac{1-\eta_2}{2} \pi \right]},
\end{array} \right.$$

Variable s is in the units $[GeV^2]$. The additional scale $s_1 = 1 [GeV^2]$ in terms with $(s/s_1)^{-\eta_{1,2}}$ is omitted for brevity.

Adjustable parameters naming. In total 18 parameters used:

$$\begin{aligned} \eta_1, \eta_2, \delta & - \text{dimensionless} \\ s_0 & - [\text{GeV}^2] \\ B_{pp}, B_{\pi p}, B_{Kp}, B_{\Sigma p}, Y_{1,2}^{pp}, Y_{1,2}^{\pi p}, Y_{1,2}^{Kp}, Y_{1,2}^{\Sigma p}, Y_1^{\gamma p}, Y_1^{\gamma\gamma} & - [\text{mb}] \end{aligned}$$

Scan-fits summary. 2000 database. Without cosmic data points.

$E_{\text{cm}}^{\text{min}}$ [GeV]	3	4	5	6	7	8	9	10
N_{dof} : ρ excluded	708	563	489	416	351	313	267	212
N_{dof} : ρ included	886	724	630	551	480	435	379	311
χ^2/dof : ρ excluded	1.33	1.05	0.88	0.85	0.91	0.89	0.90	0.89
χ^2/dof : ρ included	1.68	1.22	1.04	1.04	1.06	1.01	0.97	0.97

Details of the fit to the data in the whole domain of applicability

	\sqrt{s} of the starting point in [GeV]	Number of data points	χ^2/dof	=	0.975
			CL[%]	=	63.04
			Name of value	Numerical value	Error value
Breakdown of the CS data sample			s_0	0.00044828241	0.00024460879
pp :	9.02958	74	η_1	0.27258771	0.011454336
$\bar{p}p$:	9.02958	35	η_2	0.55536716	0.011704097
π^+p :	9.23822	24	δ	0.0032425586	0.000040824135
π^-p :	9.23822	49	B_{pp}	0.14468157	0.0076301918
K^+p :	9.2506	22	$B_{\pi p}$	0.095667243	0.0054272123
K^-p :	9.2506	28	B_{Kp}	0.086903116	0.005223447
Σ^-p :	11.922	8	$B_{\Sigma p}$	0.14239355	0.014294351
γp :	9.12473	25	Y_{pp1}	67.016128	1.1102999
$\gamma\gamma$:	9.	20	Y_{pp2}	35.55018	2.1720112
Breakdown of the ρ data sample			$Y_{\pi p1}$	32.04019	0.39097964
pp :	9.02958	59	$Y_{\pi p2}$	7.4035294	0.48788506
$\bar{p}p$:	11.5382	11	Y_{Kp1}	21.31041	0.42018063
π^+p :	9.94262	7	Y_{Kp2}	14.347013	0.86379412
π^-p :	9.28583	23	$Y_{\Sigma p1}$	43.427755	25.789132
K^+p :	9.9541	7	$Y_{\Sigma p2}$	16.783625	77.463775
K^-p :	11.5102	5	$Y_{\gamma p1}$	0.15234821	0.0039570217
			$Y_{\gamma\gamma1}$	0.00020568502	0.000053021967

Model quality indicators:

	A^M	C_1^M	C_2^M	U^M	R_1^M	R_2^M	S_1^M	S_2^M
RRL2(18)	1.726	63.04	63.04	11.19	20.89	0.902	1.395	2.657

Repository:

computer - NPT1

directory - d:\MathemD\Kolja\Evela\Gauron\((RR)L2(18)

Appendix RRL2(18) (N^o11) χ^2 /NoP by data samples

	CS data								
Reaction	pp	$\bar{p}p$	π^+p	π^-p	K^+p	K^-p	Σ^-p	γp	$\gamma\gamma$
χ^2 /NoP	1.03	1.21	0.47	1.03	0.45	0.75	0.41	0.68	0.65

	ρ data					
Reaction	pp	$\bar{p}p$	π^+p	π^-p	K^+p	K^-p
χ^2 /NoP	1.27	0.43	2.0	0.75	0.69	1.89

Appendix RRL2(18) (N=11) Correlation matrix

	s_0	η_1	η_2	δ	B_{pp}	$B_{\pi p}$	B_{Kp}	$B_{\Sigma p}$	Y_{pp1}	Y_{pp2}	$Y_{\pi p1}$	$Y_{\pi p2}$	Y_{Kp1}	Y_{Kp2}	$Y_{\Sigma p1}$	$Y_{\Sigma p2}$	$Y_{\gamma p1}$	$Y_{\gamma p2}$
s_0	100	-93.8	-11.1	32.4	99.6	99.6	99.7	56	-48	-9.64	14.3	-12.9	65.4	-10.9	2.54	-1.57	11.9	22.9
η_1	-93.8	100	23.2	-30.6	-90.8	-90.7	-91.7	-52	74.6	21.8	17.9	23.7	-41.5	22.5	-0.932	0.665	4.58	-21.9
η_2	-11.1	23.2	100	2.5	-9.91	-7.65	-9.03	-5.37	46.7	98.5	26.4	90.7	12.8	96.3	0.43	-0.768	16.3	-4.82
δ	32.4	-30.6	2.5	100	31.9	32.3	32.3	18.2	-13.9	2.94	3.83	1.32	20.9	2.34	0.742	-0.505	-77.2	-53.3
B_{pp}	99.6	-90.8	-9.91	31.9	100	99.9	99.8	55.9	-41.8	-8.45	21.3	-11.8	69.6	-9.77	2.87	-1.74	15.3	22.8
$B_{\pi p}$	99.6	-90.7	-7.65	32.3	99.9	100	99.7	55.9	-41	-6.2	19.8	-9.48	69.6	-7.59	2.85	-1.75	15.5	22.7
B_{Kp}	99.7	-91.7	-9.03	32.3	99.8	99.7	100	55.9	-43.3	-7.57	19	-11	65.6	-8.7	2.75	-1.69	14.3	22.8
$B_{\Sigma p}$	56	-52	-5.37	18.2	55.9	55.9	55.9	100	-25.6	-4.56	9.3	-6.45	37.4	-5.29	-79.6	78.3	7.34	12.8
Y_{pp1}	-48	74.6	46.7	-13.9	-41.8	-41	-43.3	100	46.6	46.6	70.1	43.8	17.6	44.9	2.28	-1.26	33.6	-12.6
Y_{pp2}	-9.64	21.8	98.5	2.94	-8.45	-6.2	-7.57	46.6	100	100	26.6	89.3	13.8	94.9	0.477	-0.788	16.5	-4.48
$Y_{\pi p1}$	14.3	17.9	26.4	3.83	19.8	19.8	19	70.1	26.6	26.6	100	19.1	61.4	25.2	4.21	-2.34	43	2.36
$Y_{\pi p2}$	-12.9	23.7	90.7	1.32	-11.8	-9.48	-11	43.8	89.3	89.3	19.1	100	9.88	87.3	0.328	-0.656	14.5	-5.01
Y_{Kp1}	65.4	-41.5	12.8	20.9	69.6	69.6	65.6	37.4	17.6	13.8	61.4	9.88	100	9.7	4.08	-2.37	34	14.3
Y_{Kp2}	-10.9	22.5	96.3	2.34	-9.77	-7.59	-8.7	-5.29	44.9	94.9	25.2	87.3	9.7	100	0.399	-0.731	15.6	-4.69
$Y_{\Sigma p1}$	2.54	-0.932	0.43	0.742	2.87	2.85	2.75	-79.6	2.28	0.477	4.21	0.328	4.08	0.399	100	-99.5	2.21	0.552
$Y_{\Sigma p2}$	-1.57	0.665	-0.768	-0.505	-1.74	-1.75	-1.69	78.3	-1.26	-0.788	-2.34	-0.656	-2.37	-0.731	-99.5	100	-1.26	-0.331
$Y_{\gamma p1}$	11.9	4.58	16.3	-77.2	15.3	15.5	14.3	7.34	33.6	16.5	43	14.5	34	15.6	2.21	-1.26	100	57.7
$Y_{\gamma p2}$	22.9	-21.9	-4.82	-53.3	22.8	22.7	22.8	12.8	-12.6	-4.48	2.36	-5.01	14.3	-4.69	0.552	-0.331	57.7	100

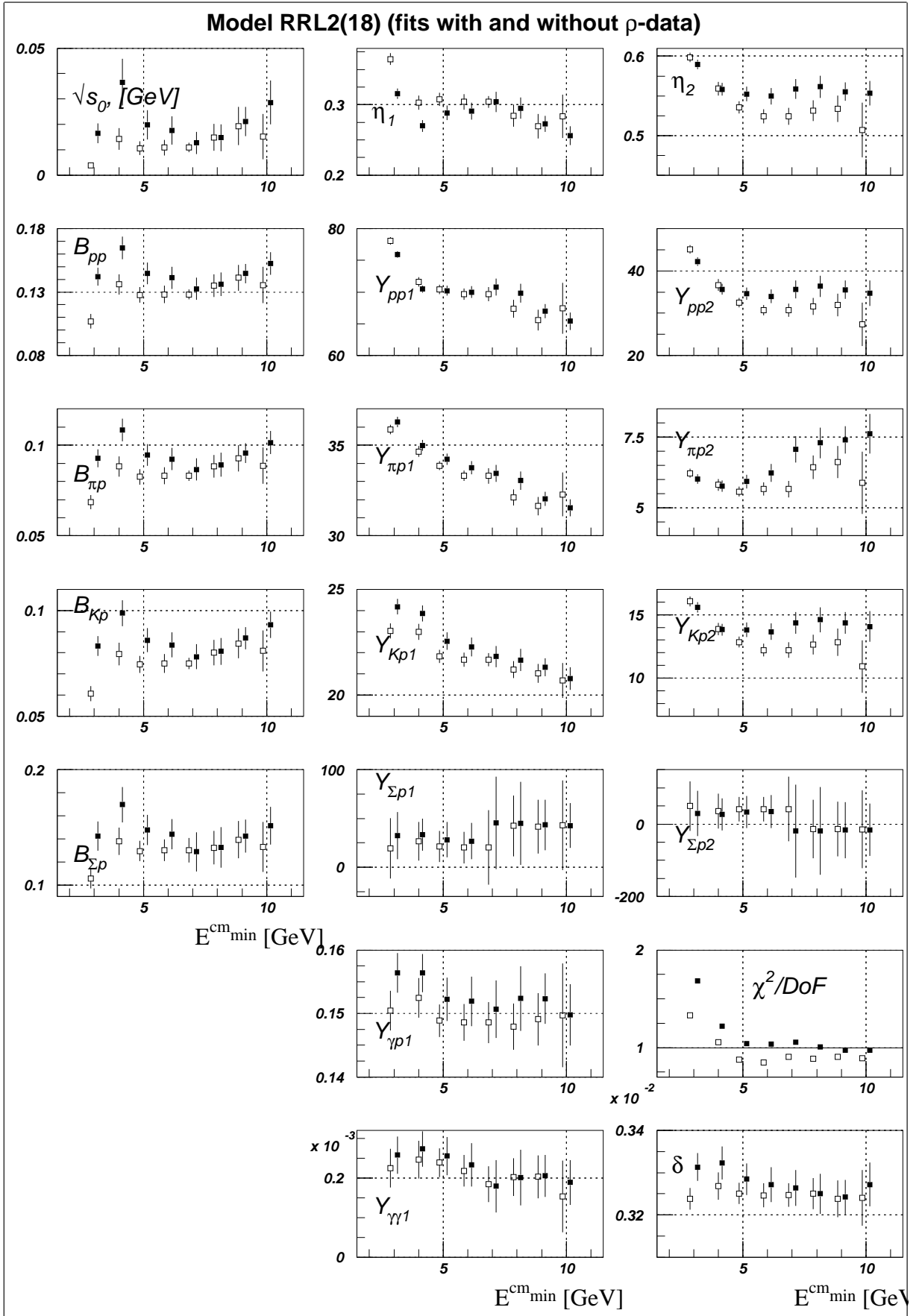


Figure 34: Bold (empty) symbol marks fits with (without) ρ data and are shifted to the right (left) in energy slightly for the cleanness

