

$$\left\{ \begin{array}{l}
\sigma_{pp} = 9Z + B \ln^2 \left(\frac{s}{s_0} \right) + Y_1^{pp} s^{-\eta} - Y_2^{pp} s^{-\eta}, \\
\sigma_{\bar{p}p} = 9Z + B \ln^2 \left(\frac{s}{s_0} \right) + Y_1^{pp} s^{-\eta} + Y_2^{pp} s^{-\eta}, \\
\sigma_{\pi+p} = 6\lambda_m Z + B \ln^2 \left(\frac{s}{s_0} \right) + Y_1^{\pi p} s^{-\eta} - Y_2^{\pi p} s^{-\eta}, \\
\sigma_{\pi-p} = 6\lambda_m Z + B \ln^2 \left(\frac{s}{s_0} \right) + Y_1^{\pi p} s^{-\eta} + Y_2^{\pi p} s^{-\eta}, \\
\sigma_{K+p} = 3\lambda_m(1 + \lambda_s)Z + B \ln^2 \left(\frac{s}{s_0} \right) + Y_1^{Kp} s^{-\eta} - Y_2^{Kp} s^{-\eta}, \\
\sigma_{K-p} = 3\lambda_m(1 + \lambda_s)Z + B \ln^2 \left(\frac{s}{s_0} \right) + Y_1^{Kp} s^{-\eta} + Y_2^{Kp} s^{-\eta}, \\
\sigma_{\gamma p} = 6\delta\lambda_m Z + \delta B \ln^2 \left(\frac{s}{s_0} \right) + Y_1^{\gamma p} s^{-\eta}, \\
\sigma_{\gamma\gamma} = 4\delta^2\lambda_m^2 Z + \delta^2 B \ln^2 \left(\frac{s}{s_0} \right) + Y_1^{\gamma\gamma} s^{-\eta}, \\
\sigma_{\Sigma-p} = (6 + 3\lambda_s)Z + B \ln^2 \left(\frac{s}{s_0} \right) + Y_1^{\Sigma p} s^{-\eta}. \quad \blacksquare \\
\rho_{pp}\sigma_{pp} = \pi B \ln \left(\frac{s}{s_0} \right) - \frac{Y_1^{pp} s^{-\eta}}{\tan \left[\frac{1-\eta}{2} \pi \right]} - \frac{Y_2^{pp} s^{-\eta}}{\cot \left[\frac{1-\eta}{2} \pi \right]}, \\
\rho_{\bar{p}p}\sigma_{\bar{p}p} = \pi B \ln \left(\frac{s}{s_0} \right) - \frac{Y_1^{pp} s^{-\eta}}{\tan \left[\frac{1-\eta}{2} \pi \right]} + \frac{Y_2^{pp} s^{-\eta}}{\cot \left[\frac{1-\eta}{2} \pi \right]}, \\
\rho_{\pi+p}\sigma_{\pi+p} = \pi B \ln \left(\frac{s}{s_0} \right) - \frac{Y_1^{\pi p} s^{-\eta}}{\tan \left[\frac{1-\eta}{2} \pi \right]} - \frac{Y_2^{\pi p} s^{-\eta}}{\cot \left[\frac{1-\eta}{2} \pi \right]}, \\
\rho_{\pi-p}\sigma_{\pi-p} = \pi B \ln \left(\frac{s}{s_0} \right) - \frac{Y_1^{\pi p} s^{-\eta}}{\tan \left[\frac{1-\eta}{2} \pi \right]} + \frac{Y_2^{\pi p} s^{-\eta}}{\cot \left[\frac{1-\eta}{2} \pi \right]}, \\
\rho_{K+p}\sigma_{K+p} = \pi B \ln \left(\frac{s}{s_0} \right) - \frac{Y_1^{Kp} s^{-\eta}}{\tan \left[\frac{1-\eta}{2} \pi \right]} - \frac{Y_2^{Kp} s^{-\eta}}{\cot \left[\frac{1-\eta}{2} \pi \right]}, \\
\rho_{K-p}\sigma_{K-p} = \pi B \ln \left(\frac{s}{s_0} \right) - \frac{Y_1^{Kp} s^{-\eta}}{\tan \left[\frac{1-\eta}{2} \pi \right]} + \frac{Y_2^{Kp} s^{-\eta}}{\cot \left[\frac{1-\eta}{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 16 parameters used:

$$\begin{aligned} \eta, \delta, \lambda_s, \lambda_m & - \text{dimensionless} \\ s_0 & - [\text{GeV}^2] \\ B, Z, Y_{1,2}^{pp}, Y_{1,2}^{\pi p}, Y_{1,2}^{Kp}, Y_1^{\Sigma p}, Y_1^{\gamma p}, Y_1^{\gamma\gamma} & - [\text{mb}] \end{aligned}$$

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	710	565	491	418	353	315	269	214
N_{dof} : ρ included	888	726	632	553	482	437	381	313
χ^2/dof : ρ excluded	1.30	1.04	0.88	0.87	0.91	0.91	0.90	0.86
χ^2/dof : ρ included	1.98	1.29	1.04	1.04	1.03	0.98	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	=	0.985
			CL[%]	=	58.4
Breakdown of the CS data sample			Name of value	Numerical value	Error value
pp :	8.21361	78	η	0.55062892	0.0093614814
$\bar{p}p$:	8.0405	43	λ_m	0.89247005	0.0033018097
π^+p :	8.15962	28	λ_s	0.71350349	0.0048514818
π^-p :	8.15962	61	δ	0.0048897087	0.000028095296
K^+p :	8.17372	26	B	0.31640911	0.0091598989
K^-p :	8.17372	37	Z	4.1266114	0.024292142
Σ^-p :	11.922	8	s_0	46.272116	5.9252153
γp :	8.06586	28	Y_{pp1}	46.412235	1.9386101
$\gamma\gamma$:	8.	22	Y_{pp2}	34.157737	1.5785239
Breakdown of the ρ data sample			$Y_{\pi p1}$	17.261616	1.5281771
pp :	8.55262	62	$Y_{\pi p2}$	6.9434145	0.3532398
$\bar{p}p$:	11.5382	11	Y_{Kp1}	1.9181056	1.8151037
π^+p :	8.98072	8	Y_{Kp2}	13.87197	0.63858286
π^-p :	8.36404	28	$Y_{\Sigma p1}$	-14.794026	3.3470633
K^+p :	8.99347	8	$Y_{\gamma p1}$	0.067711582	0.011983732
K^-p :	11.5102	5	$Y_{\gamma\gamma1}$	-0.00025211112	0.00015869028

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
(RR) ^d P ^{qc} L2 _u (16)	1.793	58.40	66.41	19.98	26.65	0.917	0.470	1.241

Repository:

computer - NPT1

directory - d:\MathemD\Kolja\Evela\Gauron\ (RR)dPqcL2u(16)

Appendix (RR)^d P^{qc}L2_u(16) (N^o28) 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	1.07	1.19	0.32	0.93	0.37	0.66	0.48	0.95	1.17

	ρ data					
Reaction	pp	$\bar{p}p$	π^+p	π^-p	K^+p	K^-p
χ^2 /NoP	1.3	0.59	1.73	0.94	0.64	1.48

Appendix (RR)^d P^{qc}L2_u(16) (N^o=28) Correlation matrix

	η	λ_m	λ_s	δ	B	Z	s_0	Y_{pp1}	Y_{pp2}	$Y_{\pi p1}$	$Y_{\pi p2}$	Y_{Kp1}	Y_{Kp2}	$Y_{\Sigma p1}$	$Y_{\gamma p1}$	$Y_{\gamma\gamma1}$
η	100	47.9	-7.19	-2.44	24	51.9	39.2	47.2	98.1	-21	89	-39.8	95.8	-52.5	-17.4	-13.9
λ_m	47.9	100	29.2	-3.01	82.2	83.8	90	-32.3	47.6	-89.2	36.5	-85.2	45.9	-61.3	-57.9	-19.6
λ_s	-7.19	29.2	100	12.3	50	47.7	53.2	-53.9	-6.07	-47	-11.3	-68.2	4.81	-53.2	-38.2	-8.57
δ	-2.44	-3.01	12.3	100	4.04	4.36	4.68	-6.87	-2.27	-1.37	-2.68	-4.63	-2.34	-5.54	-73	-39.7
B	24	82.2	50	4.04	100	78.9	92.2	-50.5	24.8	-83	14.7	-81.4	23	-58	-57.3	-17.2
Z	51.9	83.8	47.7	4.36	78.9	100	95.5	-49.1	52.6	-90.3	39.5	-93.8	49.8	-81.4	-64	-20
s_0	39.2	90	53.2	4.68	92.2	100	100	-54.5	39.8	-94	27.6	-94.7	37.5	-74.3	-65.8	-20
Y_{pp1}	47.2	-32.3	-53.9	-6.87	-50.5	-49.1	-54.5	100	45.8	68.3	48.6	53.2	45.1	30.6	46.1	5.63
Y_{pp2}	98.1	47.6	-6.07	-2.27	24.8	52.6	39.8	45.8	100	-22.1	87.2	-40.5	94	-52.8	-18.2	-13.9
$Y_{\pi p1}$	-21	-89.2	-47	-1.37	-83	-90.3	-94	68.3	-22.1	100	-13.2	90.9	-20.1	65.6	65.8	17.9
$Y_{\pi p2}$	89	36.5	-11.3	-2.68	14.7	39.5	27.6	48.6	87.2	-13.2	100	-28.5	85.3	-41.8	-10.3	-11.1
Y_{Kp1}	-39.8	-85.2	-68.2	-4.63	-81.4	-93.8	-94.7	53.2	-40.5	90.9	-28.5	100	-39.7	79.6	63.9	19.3
Y_{Kp2}	95.8	45.9	-4.81	-2.34	23	49.8	37.5	45.1	94	-20.1	85.3	-39.7	100	-51	-16.7	-13.4
$Y_{\Sigma p1}$	-52.5	-61.3	-53.2	-5.54	-58	-81.4	-74.3	30.6	-52.8	65.6	-41.8	79.6	-51	100	49	16.3
$Y_{\gamma p1}$	-17.4	-57.9	-38.2	-73	-57.3	-64	-65.8	46.1	-18.2	65.8	-10.3	63.9	-16.7	49	100	41
$Y_{\gamma\gamma1}$	-13.9	-19.6	-8.57	-39.7	-17.2	-20	-20	5.63	-13.9	17.9	-11.1	19.3	-13.4	16.3	41	100

Appendix (RR)^d P^{qc}L2_u(16) (N^o=28) Parameters evolution

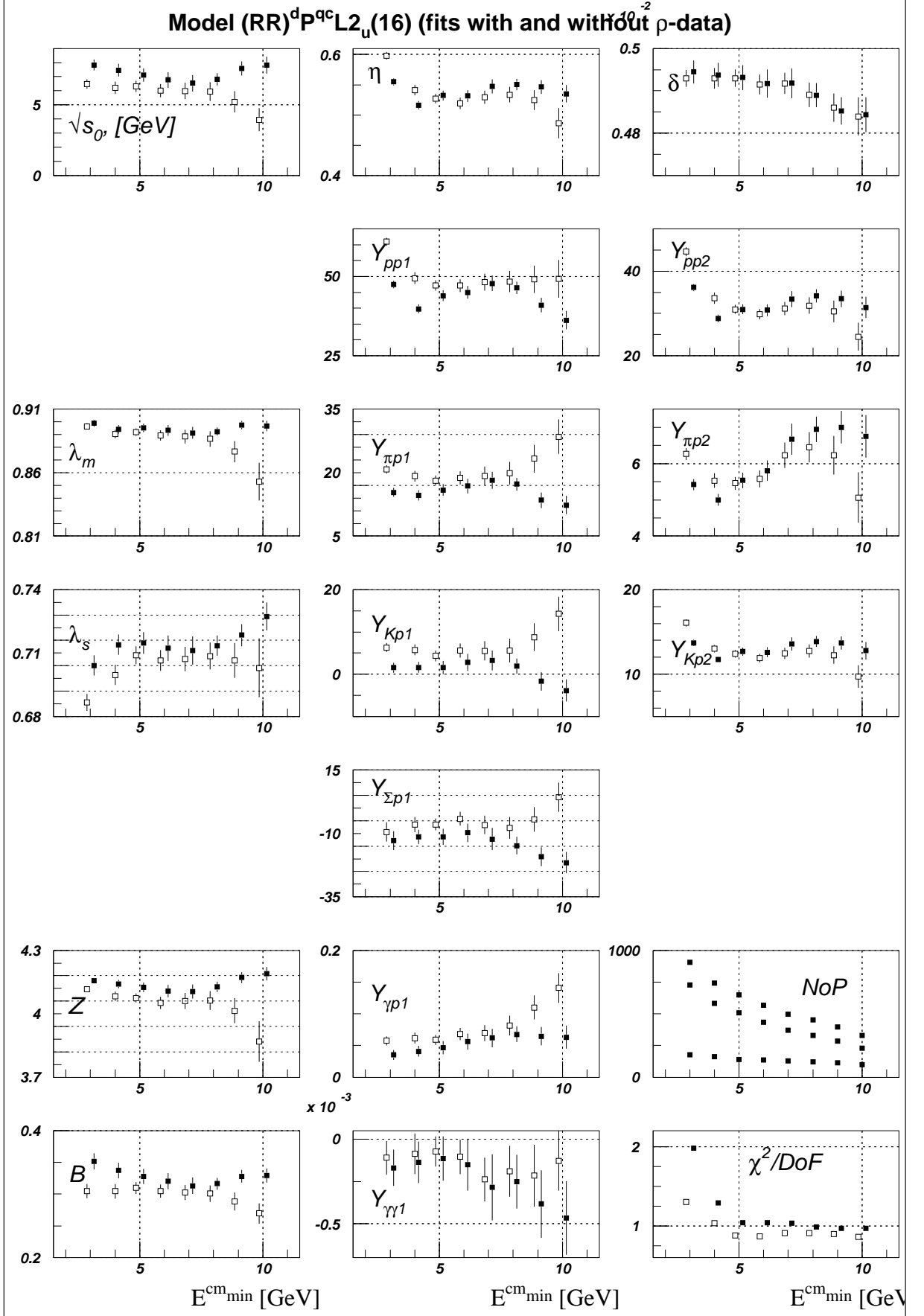


Figure 14: Bold (empty) symbol marks fits with (without) ρ data and are shifted to the right (left) in energy slightly for the cleareness

