$$
\left\{
\begin{array}{rcl}
\sigma_{pp} &=& 9B\ln^2\left(\dfrac{s}{s_0}\right) + Y_1^{pp}s^{-\eta_1} - Y_2^{pp}s^{-\eta_2},\\
\sigma_{\bar{p}p} &=& 9B\ln^2\left(\dfrac{s}{s_0}\right) + Y_1^{pp}s^{-\eta_1} + Y_2^{pp}s^{-\eta_2},\\
\sigma_{\pi^+p} &=& 6\lambda_m B\ln^2\left(\dfrac{s}{s_0}\right) + Y_1^{\pi p}s^{-\eta_1} - Y_2^{\pi p}s^{-\eta_2},\\
\sigma_{\pi^-p} &=& 6\lambda_m B\ln^2\left(\dfrac{s}{s_0}\right) + Y_1^{\pi p}s^{-\eta_1} + Y_2^{\pi p}s^{-\eta_2},\\
\sigma_{K^+p} &=& 3\lambda_m(1+\lambda_s) B\ln^2\left(\dfrac{s}{s_0}\right) + Y_1^{Kp}s^{-\eta_1} - Y_2^{Kp}s^{-\eta_2},\\
\sigma_{K^-p} &=& 3\lambda_m(1+\lambda_s) B\ln^2\left(\dfrac{s}{s_0}\right) + Y_1^{Kp}s^{-\eta_1} + Y_2^{Kp}s^{-\eta_2},\\
\sigma_{\gamma p} &=& 6\lambda_m\delta B\ln^2\left(\dfrac{s}{s_0}\right) + Y_1^{\gamma p}s^{-\eta_1},\\
\sigma_{\gamma\gamma} &=& 4\lambda_m^2\delta^2 B\ln^2\left(\dfrac{s}{s_0}\right) + Y_1^{\gamma\gamma}s^{-\eta_1},\\
\sigma_{\Sigma^-p} &=& (6+3\lambda_s) B\ln^2\left(\dfrac{s}{s_0}\right) + Y_1^{\Sigma p}s^{-\eta_1} - Y_2^{\Sigma p}s^{-\eta_2}. \quad \blacksquare
\end{array}
\right.
$$

$$
\left\{
\begin{array}{rcl}
\rho_{pp}\sigma_{pp} &=& 9\pi B\ln\left(\dfrac{s}{s_0}\right) - \dfrac{Y_1^{pp}s^{-\eta_1}}{\tan\left[\dfrac{1-\eta_1}{2}\pi\right]} - \dfrac{Y_2^{pp}s^{-\eta_2}}{\cot\left[\dfrac{1-\eta_2}{2}\pi\right]},\\
\rho_{\bar{p}p}\sigma_{\bar{p}p} &=& 9\pi B\ln\left(\dfrac{s}{s_0}\right) - \dfrac{Y_1^{pp}s^{-\eta_1}}{\tan\left[\dfrac{1-\eta_1}{2}\pi\right]} + \dfrac{Y_2^{pp}s^{-\eta_2}}{\cot\left[\dfrac{1-\eta_2}{2}\pi\right]},\\
\rho_{\pi^+p}\sigma_{\pi^+p} &=& 6\pi\lambda_m B\ln\left(\dfrac{s}{s_0}\right) - \dfrac{Y_1^{\pi p}s^{-\eta_1}}{\tan\left[\dfrac{1-\eta_1}{2}\pi\right]} - \dfrac{Y_2^{\pi p}s^{-\eta_2}}{\cot\left[\dfrac{1-\eta_2}{2}\pi\right]},\\
\rho_{\pi^-p}\sigma_{\pi^-p} &=& 6\pi\lambda_m B\ln\left(\dfrac{s}{s_0}\right) - \dfrac{Y_1^{\pi p}s^{-\eta_1}}{\tan\left[\dfrac{1-\eta_1}{2}\pi\right]} + \dfrac{Y_2^{\pi p}s^{-\eta_2}}{\cot\left[\dfrac{1-\eta_2}{2}\pi\right]},\\
\rho_{K^+p}\sigma_{K^+p} &=& 3\pi\lambda_m(1+\lambda_s) B\ln\left(\dfrac{s}{s_0}\right) - \dfrac{Y_1^{Kp}s^{-\eta_1}}{\tan\left[\dfrac{1-\eta_1}{2}\pi\right]} - \dfrac{Y_2^{Kp}s^{-\eta_2}}{\cot\left[\dfrac{1-\eta_2}{2}\pi\right]},\\
\rho_{K^-p}\sigma_{K^-p} &=& 3\pi\lambda_m(1+\lambda_s) B\ln\left(\dfrac{s}{s_0}\right) - \dfrac{Y_1^{Kp}s^{-\eta_1}}{\tan\left[\dfrac{1-\eta_1}{2}\pi\right]} + \dfrac{Y_2^{Kp}s^{-\eta_2}}{\cot\left[\dfrac{1-\eta_2}{2}\pi\right]},
\end{array}
\right.
$$

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 17 parameters used:

$\eta_1, \eta_2, \delta, \lambda_m, \lambda_s$ – dimensionless
s_0 – [GeV^2]
$B, Y_{1,2}^{pp}, Y_{1,2}^{\pi p}, Y_{1,2}^{Kp}, Y_{1,2}^{\Sigma p}, Y_1^{\gamma p}, Y_1^{\gamma\gamma}$ – [mb]

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

$E_{\rm cm}^{\rm min}$ [GeV]	3	4	5	6	7	8	9	10
N_{dof}: ρ excluded	709	564	490	417	352	314	268	213
N_{dof}: ρ included	887	725	631	552	481	436	380	312
χ^2/dof: ρ excluded	1.33	1.06	0.88	0.85	0.88	0.88	0.90	0.89
χ^2/dof: ρ included	1.68	1.22	1.04	1.04	1.05	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
Breakdown of the CS data sample		
pp:	9.02958	74
$\bar{p}p$:	9.02958	35
π^+p:	9.23822	24
π^-p:	9.23822	49
K^+p:	9.2506	22
K^-p:	9.2506	28
Σ^-p:	11.922	8
γp:	9.12473	25
$\gamma\gamma$:	9.	20
Breakdown of the ρ data sample		
pp:	9.02958	59
$\bar{p}p$:	11.5382	11
π^+p:	9.94262	7
π^-p:	9.28583	23
K^+p:	9.9541	7
K^-p:	11.5102	5

χ^2/dof	=	**0.97**
CL[%]	=	64.2
Name of value	Numerical value	Error value
η_1	0.27261187	0.01145315
η_2	0.5552468	0.011697771
λ_s	0.8168957	0.009981307
λ_m	0.99178998	0.0049437527
δ	0.0049039875	0.000059129061
B	0.016076625	0.00084766039
s_0	0.00044830086	0.00024455797
Y_{pp1}	67.01912	1.110379
Y_{pp2}	35.528122	2.1696148
$Y_{\pi p1}$	32.044131	0.39094229
$Y_{\pi p2}$	7.3987287	0.48735937
Y_{Kp1}	21.309284	0.42014885
Y_{Kp2}	14.338892	0.86291144
$Y_{\gamma p1}$	0.15235874	0.0039571782
$Y_{\gamma\gamma 1}$	0.00020571091	0.000053026337
$Y_{\Sigma p1}$	57.37743	5.3027903
$Y_{\Sigma p2}$	57.69251	22.760787

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^{qc}(17)	1.726	64.2	64.2	11.23	22.06	0.941	1.318	2.503

Repository:

computer - **NPT1**

`directory - d:\MathemD\Kolja\Evela\Gauron\(RR)L2qc(17)`

Appendix RRL2$_{qc}$(17) (№12) 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	0.43	0.68	0.65

	ρ data					
Reaction	pp	$\bar{p}p$	π^+p	π^-p	K^+p	K^-p
χ^2/NoP	1.27	0.42	2.0	0.75	0.69	1.88

	η_1	η_2	λ_s	λ_m	δ	B	s_0	Y_{pp1}	Y_{pp2}	$Y_{\pi p1}$	$Y_{\pi p2}$	Y_{Kp1}	Y_{Kp2}	$Y_{\gamma p1}$	$Y_{\gamma\gamma 1}$	$Y_{\Sigma p1}$	$Y_{\Sigma p2}$
η_1	100	23.2	-66.5	-71.6	-2.33	**-90.8**	**-93.8**	74.6	21.8	18	23.8	-41.5	22.5	4.6	-21.9	14.7	5.04
η_2	23.2	100	-19.8	17.8	-4.76	-9.92	-11.1	46.7	**98.5**	26.4	**90.7**	12.8	**96.3**	16.3	-4.82	5.26	11.7
λ_s	-66.5	-19.8	100	26.5	9.91	60.4	62.3	-50.3	-18.8	3.88	-22.3	-1.57	-16.8	-3.22	14.6	-20.4	-11.2
λ_m	-71.6	17.8	26.5	100	-9.78	78.3	79.2	-24.5	18.8	-0.33	16.6	56.1	17	13.7	16.7	-0.297	4.99
δ	-2.33	-4.76	9.91	-9.78	100	0.887	1.08	-4.32	-4.7	4.12	-5.51	-1.42	-4.58	-86.3	-62.5	-2.38	-1.79
B	**-90.8**	-9.92	60.4	78.3	0.887	100	**99.6**	-41.8	-8.46	21.3	-11.8	69.6	-9.78	15.3	22.8	-7.75	-2.48
s_0	**-93.8**	-11.1	62.3	79.2	1.08	**99.6**	100	-48	-9.65	14.2	-12.9	65.4	-10.9	11.9	22.9	-9.01	-2.73
Y_{pp1}	74.6	46.7	-50.3	-24.5	-4.32	-41.8	-48	100	46.6	70.1	43.8	17.6	44.9	33.6	-12.6	20.6	9.18
Y_{pp2}	21.8	**98.5**	-18.8	18.8	-4.7	-8.46	-9.65	46.6	100	26.7	89.3	13.7	**94.9**	16.5	-4.48	5.21	11.6
$Y_{\pi p1}$	18	26.4	3.88	-0.33	4.12	21.3	14.2	70.1	26.7	100	19.2	61.4	25.2	43	2.35	12.2	3.46
$Y_{\pi p2}$	23.8	**90.7**	-22.3	16.6	-5.51	-11.8	-12.9	43.8	89.3	19.2	100	9.85	87.3	14.5	-5.01	5.56	11
Y_{Kp1}	-41.5	12.8	-1.57	56.1	-1.42	69.6	65.4	17.6	13.7	61.4	9.85	100	9.68	34	14.3	10.1	6.06
Y_{Kp2}	22.5	**96.3**	-16.8	17	-4.58	-9.78	-10.9	44.9	**94.9**	25.2	87.3	9.68	100	15.6	-4.69	4.59	11
$Y_{\gamma p1}$	4.6	16.3	-3.22	13.7	-86.3	15.3	11.9	33.6	16.5	43	14.5	34	15.6	100	57.7	7.23	3.1
$Y_{\gamma\gamma 1}$	-21.9	-4.82	14.6	16.7	-62.5	22.8	22.9	-12.6	-4.48	2.35	-5.01	14.3	-4.69	57.7	100	-2.44	-1.05
$Y_{\Sigma p1}$	14.7	5.26	-20.4	-0.297	-2.38	-7.75	-9.01	20.6	5.21	12.2	5.56	10.1	4.59	7.23	-2.44	100	**98**
$Y_{\Sigma p1}$	5.04	11.7	-11.2	4.99	-1.79	-2.48	-2.73	9.18	11.6	3.46	11	6.06	11	3.1	-1.05	**98**	100

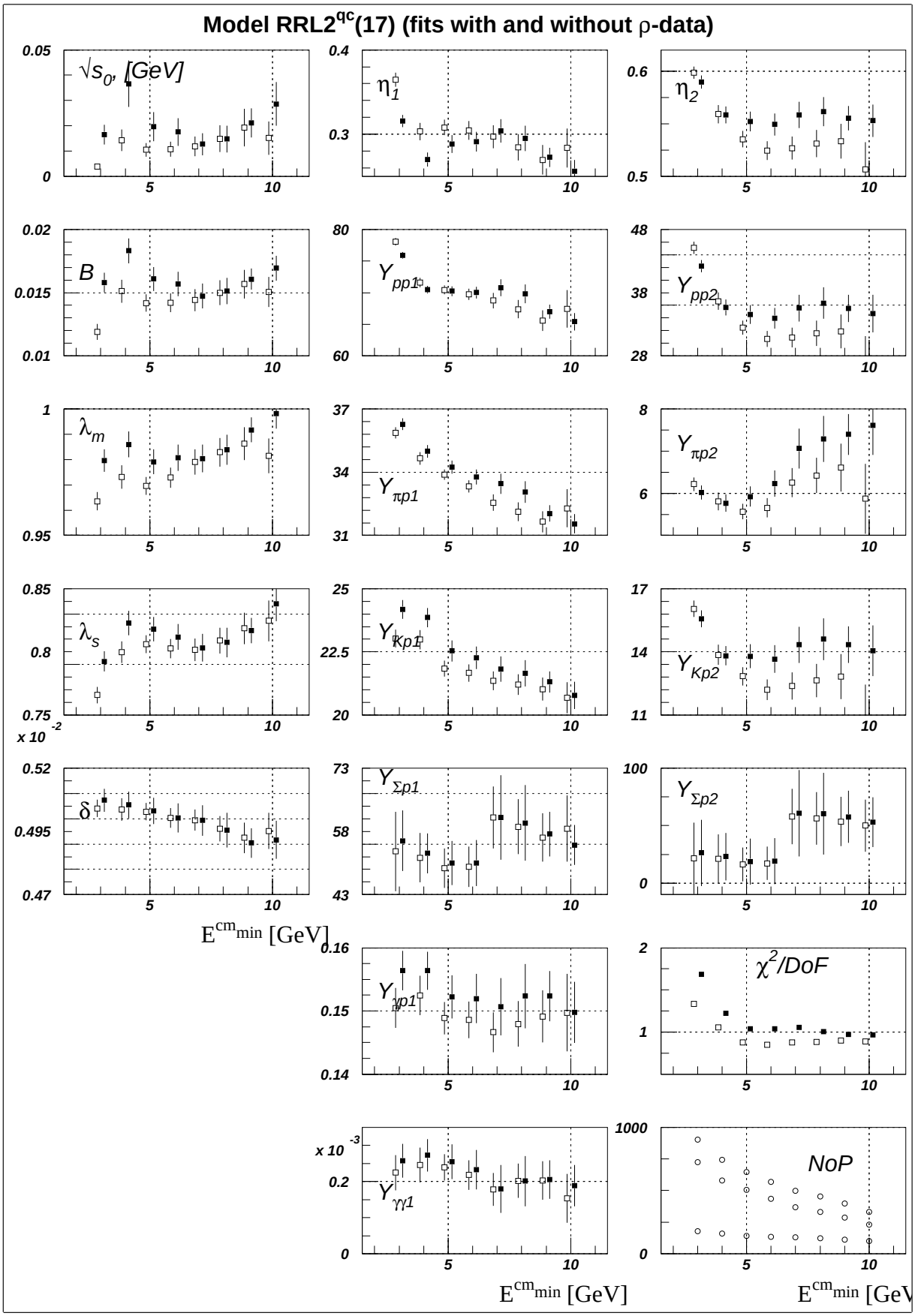
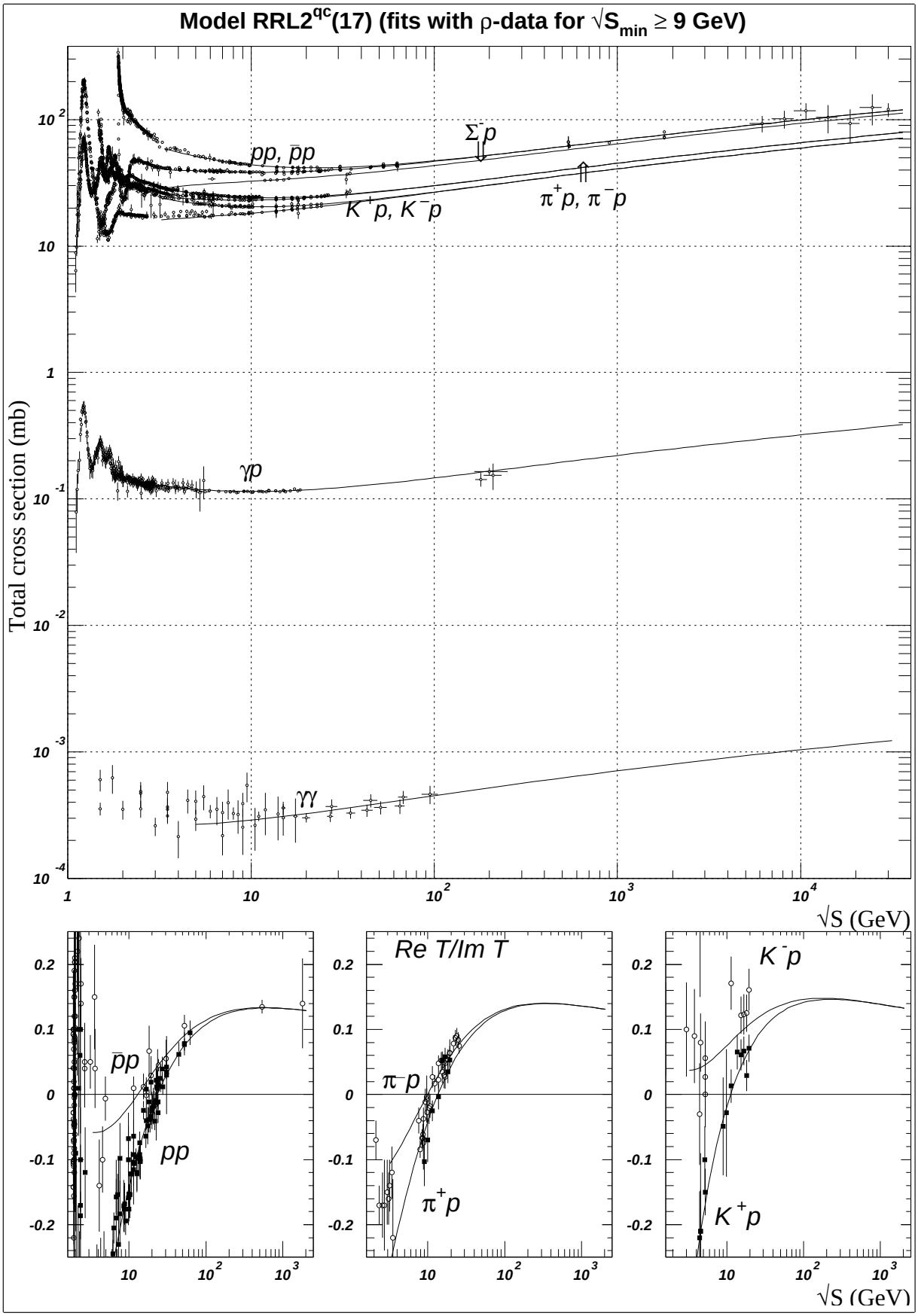


Figure 22: Bold (empty) symbol marks fits with (without) $\boldsymbol{\rho}$ data and are shifted to the right (left) in energy slightly for the clearness


Model RRL2qc(17) (fits with ρ-data for √Smin ≥ 9 GeV)
Total cross section (mb)
√S (GeV)
pp, p̄p
Σ⁻p
K⁺p, K⁻p
π⁺p, π⁻p
γp
γγ
Re T/Im T
p̄p
pp
π⁻p
π⁺p
K⁻p
K⁺p