Table 38.2: Total hadronic cross section. Regge theory suggests a parameterization of total cross sections as

$$\sigma_{AB} = X_{AB}s^{\epsilon} + Y_{1AB}s^{-\eta_1} - Y_{2AB}s^{-\eta_2}, \qquad \sigma_{\overline{A}B} = X_{AB}s^{\epsilon} + Y_{1AB}s^{-\eta_1} + Y_{2AB}s^{-\eta_2}$$

where X_{AB}, Y_{iAB} are in mb and s is in GeV^2. The exponents ϵ, η_1, and η_2 are independent of the particles $A, \overline{A}$, and B and represent the pomeron, and lower-lying C-even and C-odd exchanges, respectively. Requiring $\eta_1 = \eta_2$ results in much poorer fits. In addition to total cross section, the measured ratio of the real to the imaginary part of the forward scattering amplitudes were included in the fits by assuming that the C-even and C-odd amplitudes have the simple behavior $(-s)^{\alpha} \pm s^{\alpha}$, where $\alpha = 1+\epsilon, 1-\eta_1, 1-\eta_2$. Fits were made to the 1999-updated data for $p^{\pm}p, \pi^{\pm}p, K^{\pm}p, \gamma p$, and $\gamma\gamma$. The exponents $\epsilon = 0.093(2), \eta_1 = 0.358(15)$, and $\eta_2 = 0.560(17)$ thus obtained were then fixed and used as inputs to a fit to a larger data sample that included cross sections on deuterons and neutrons. In the initial fit only data above $\sqrt{s_{\rm min}} = 9$ GeV were used. In the subsequent fit, data above $p_{\rm lab} = 10$ GeV (hadronic collisions) and $\sqrt{s_{\rm min}} = 4$ GeV (γp and $\gamma\gamma$) collisions were used.

Fits to $\overline{p}(p)\,p$, $\pi^{\pm}p$, $K^{\pm}p$, γp, $\gamma\gamma$			Colliding particles	Fits to groups			χ^2/dof by groups
X	Y_1	Y_2		X	Y_1	Y_2	
18.751(27)	63.58(26)	35.46(34)	$\overline{p}(p)p$	18.760(22)	63.52(23)	35.43(34)	
			$\overline{p}(p)n$	18.760(22)	64.74(33)	31.42(63)	1.23
11.883(21)	28.59(14)	5.90(12)	$\pi^{\pm}p$	11.883(23)	28.59(15)	5.90(13)	1.50
10.546(27)	16.42(20)	13.84(18)	$K^{\pm}p$	10.587(22)	16.13(17)	13.82(18)	
			$K^{\pm}n$	10.587(22)	14.68(38)	7.78(38)	1.21
0.0593(4)	0.1202(26)		γp	0.0593(2)	0.1202(17)		
1.56(11)E-4	0.37(10)E-3		$\gamma\gamma$	1.56(7)E-4	0.37(7)E-3		0.7
$\chi^2/dof = 1.23$ with fixed $\epsilon = 0.093(2)$, $\eta_1 = 0.358(15)$, $\eta_2 = 0.560(17)$ at their central values			$\overline{p}(p)d$	33.290(47)	154.3(8)	91.6(1.1)	1.69
			$\pi^{\pm}d$	21.550(36)	68.87(53)	1.42(63)	1.74
			$K^{\pm}d$	19.327(38)	37.53(50)	30.49(61)	1.46

The fitted functions are shown in the following figures, along with one-standard-deviation error bands. When the reduced χ^2 is greater than one, a scale factor has been included. Where appropriate, statistical and systematic errors were combined quadratically in constructing weights for all fits. On the plots only statistical error bars are shown. Vertical arrows indicate lower limits on the $p_{\rm lab}$ or $E_{\rm cm}$ range used in the fits. The user may decide on the range of applicability of the extrapolated curves.

One can find the details of the fits and exact parameterizations of the ratio of the real to imaginary part of the forward scattering amplitude in J.R. Cudell *et al.*, Phys. Rev. **D61**, 034019 (2000), as well as comparisons of the simple pole pomeron parameterization with the "unitarized" pomeron parameterizations. It should be noted that parameterization with linear logarithmic pomeron

$$\sigma_{AB} = X_{AB}\ln(\frac{s}{s_0}) + Y_{1AB}(\frac{s}{s_0})^{-\eta_1} - Y_{2AB}(\frac{s}{s_0})^{-\eta_2}, \qquad \sigma_{\overline{A}B} = X_{AB}\ln(\frac{s}{s_0}) + Y_{1AB}(\frac{s}{s_0})^{-\eta_1} + Y_{2AB}(\frac{s}{s_0})^{-\eta_2}$$

gives much better data description picture under the same fits strategy. The data were extracted from the PPDS accessible at

`http://wwwppds.ihep.su:8001/ppds.html`

or

`http://pdg.lbl.gov`

Computer-readable data files are also available at `http://pdg.lbl.gov`. (Courtesy of V.V. Ezhela, S.B. Lugovsky, and N.P. Tkachenko, COMPAS group, IHEP, Protvino, Russia, August 1999.)