

# Annihilation DESY data

See [www.hepdata.net/record/ins191231](http://www.hepdata.net/record/ins191231), Table 2, 14.0 GeV.

$x$	$y$
0.0502	0.09983
0.1505	0.10791
0.2509	0.12026
0.3512	0.13002
0.4516	0.17681
0.5521	0.19570
0.6526	0.27900
0.7312	0.33204

For columns  $x$  and  $y$  we have

$$x = \cos \theta, \quad y = \frac{d\sigma}{d\Omega}$$

The cross section formula is

$$\frac{d\sigma}{d\Omega} = \frac{\alpha^2}{2s} \left( \frac{1 + \cos \theta}{1 - \cos \theta} + \frac{1 - \cos \theta}{1 + \cos \theta} \right) \times (\hbar c)^2$$

Let  $\hat{y}$  be predicted values. The factor  $10^{37}$  converts square meters to nanobarns.

$$\hat{y}_i = \left. \frac{d\sigma}{d\Omega} \right|_{\cos \theta = x_i} = \frac{\alpha^2}{2s} \left( \frac{1 + x_i}{1 - x_i} + \frac{1 - x_i}{1 + x_i} \right) \times (\hbar c)^2 \times 10^{37}$$

The following table shows predicted values for  $s = (14.0 \text{ GeV})^2$ .

$x$	$y$	$\hat{y}$
0.0502	0.09983	0.106325
0.1505	0.10791	0.110694
0.2509	0.12026	0.120005
0.3512	0.13002	0.135559
0.4516	0.17681	0.159996
0.5521	0.19570	0.198562
0.6526	0.27900	0.262745
0.7312	0.33204	0.348884

The coefficient of determination  $R^2$  measures how well predicted values fit the data.

$$R^2 = 1 - \frac{\sum (y - \hat{y})^2}{\sum (y - \bar{y})^2} = 0.98$$

The result indicates that  $d\sigma$  explains 98% of the variance in the data.