I.

The fit of the resonance parameters for two resonances was performed in the "bootstrap" procedure.

At the first step all parameters: M^1, $A^1_{1/2}$, $A^1_{3/2}$, Γ^1_{tot}, M^2, $A^2_{1/2}$ and Γ^2_{tot} were **randomly** varied within the search range:

- $2.00 < M < 2.50$ GeV
- $0.1 < \Gamma_{tot} < 0.4$ GeV
- $-0.05 < A_{1/2} < +0.05$ GeV$^{-1/2}$
- $-0.05 < A_{3/2} < 0.05$ GeV$^{-1/2}$

Here is the printout of the variations. Each line with the values of the parameters was printed, when the new minimum of χ^2 was found. χ^2 is **proportional** to the $\chi^2/N_{d.p.}$

Jr_1	Mr_1	A12_1	A32_1	Gtot_1	Jr_2	Mr_2	A12_2	Gtot_2	chi2	Niteration
1.5	2.209	-7.90	-48.09	0.173	0.5	2.207	-9.75	0.2987	16064.	0
1.5	2.205	27.32	-10.33	0.349	0.5	2.097	-8.42	0.1224	13277.	4
1.5	2.199	34.77	-22.43	0.253	0.5	2.089	-2.93	0.3191	10203.	7
1.5	2.171	-3.34	-26.38	0.326	0.5	2.119	13.28	0.2756	7231.9	8
1.5	2.055	22.74	-6.791	0.348	0.5	2.125	40.85	0.2059	6565.6	38
1.5	2.088	42.27	-3.835	0.184	0.5	2.134	25.35	0.2943	5806.8	72
1.5	2.225	11.59	-19.59	0.159	0.5	2.231	-3.62	0.3099	5480.8	170
1.5	2.215	14.12	-28.75	0.364	0.5	2.128	1.649	0.1245	3261.9	174
1.5	2.207	26.25	-27.16	0.348	0.5	2.335	23.10	0.2793	2983.8	388
1.5	2.221	33.75	-26.26	0.293	0.5	2.226	29.03	0.3723	2418.9	911

At the second step the ranges of the variation of the parameters were narrowed on the basis of the results of the first step.

- $2.12 < M^1 < 2.32$ GeV
- $0.1 < \Gamma^1_{tot} < 0.4$ GeV
- $0 < A^1_{1/2} < +0.05$ GeV$^{-1/2}$
- $-0.05 < A^1_{3/2} < 0.0$ GeV$^{-1/2}$
- $2.10 < M^2 < 2.40$ GeV
- $0.1 < \Gamma^2_{tot} < 0.4$ GeV$^{-1/2}$
- $0 < A^2_{1/2} < +0.05$ GeV$^{-1/2}$

Jr_1	Mr_1	A12_1	A32_1	Gtot_1	Jr_2	Mr_2	A12_2	Gtot_2	chi2	Niteration
1.5	2.278	37.65	-25.97	0.2848	0.5	2.110	49.70	0.2668	14746.	0
1.5	2.144	42.79	-22.56	0.1674	0.5	2.177	36.03	0.1624	4166.7	1
1.5	2.155	27.40	-29.30	0.3916	0.5	2.137	9.614	0.2764	2704.4	4
1.5	2.168	25.99	-14.32	0.1586	0.5	2.193	29.49	0.2196	1989.2	14
1.5	2.176	20.02	-32.85	0.2321	0.5	2.203	11.57	0.1925	1384.8	59
1.5	2.170	28.00	-28.08	0.2580	0.5	2.169	23.24	0.3011	710.55	193
1.5	2.173	27.49	-21.60	0.2059	0.5	2.151	26.20	0.3426	645.59	773
1.5	2.150	29.10	-24.38	0.2424	0.5	2.247	22.15	0.1524	579.22	1928
1.5	2.162	28.70	-24.33	0.2561	0.5	2.244	18.09	0.1172	562.46	4123
1.5	2.173	27.32	-18.96	0.2723	0.5	2.201	23.81	0.2973	551.32	5715

These steps were repeated two more times. Here is the printout of the last step.

Jr_1	Mr_1	A12_1	A32_1	Gtot_1	Jr_2	Mr_2	A12_2	Gtot_2	chi2	Niteration
1.5	2.1357	26.07	-24.28	0.1552	0.5	2.248	15.96	0.281395	1814.	0
1.5	2.1500	29.41	-25.79	0.2192	0.5	2.259	17.32	0.287901	453.0	1
1.5	2.1704	29.60	-24.34	0.2205	0.5	2.250	18.43	0.24157	122.6	7
1.5	2.1611	30.82	-23.93	0.2443	0.5	2.228	19.98	0.269691	101.0	1899

The true values of the parameters are:

Jr_1	Mr_1	A12_1	A32_1	Gtot_1	Jr_2	Mr_2	A12_2	Gtot_2
1.5	2.18	30	-25	0.25	0.5	2.23	20	0.27

It was found that the simplified fit procedure, when some parameters are fixed and some are varied, do not give reliable results. All parameters must be varied simultaneously. The simplified fit procedure worked when fitting the parameters of the only one resonance and it failed when fitting the parameters of two resonances.

The fit procedure when I had to calculate χ^2 in the 7-dim grid is extremely time consuming.