



INTERNATIONAL CENTRE FOR THEORETICAL PHYSICS  
34100 TRIESTE (ITALY) - P.O.B. 586 - MIRAMARE - STRADA COSTIERA 11 - TELEPHONES: 224281/23450  
CABLE: CENTRATOM - TELEX 460392-1

SMR/108-4

WORKSHOP ON NUCLEAR MODEL COMPUTER CODES

16 January - 3 February 1984

SENSITIVITY TO THE PARAMETERS

Exercises

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Missing or extra copies are available from Room 231.



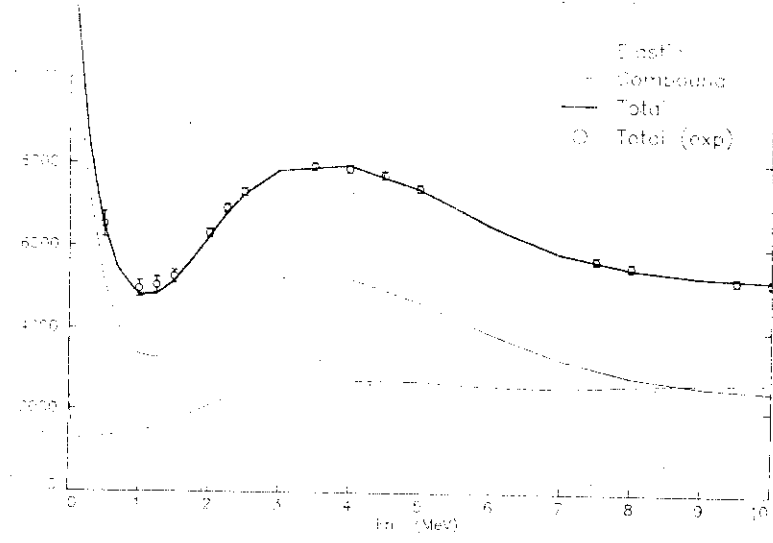
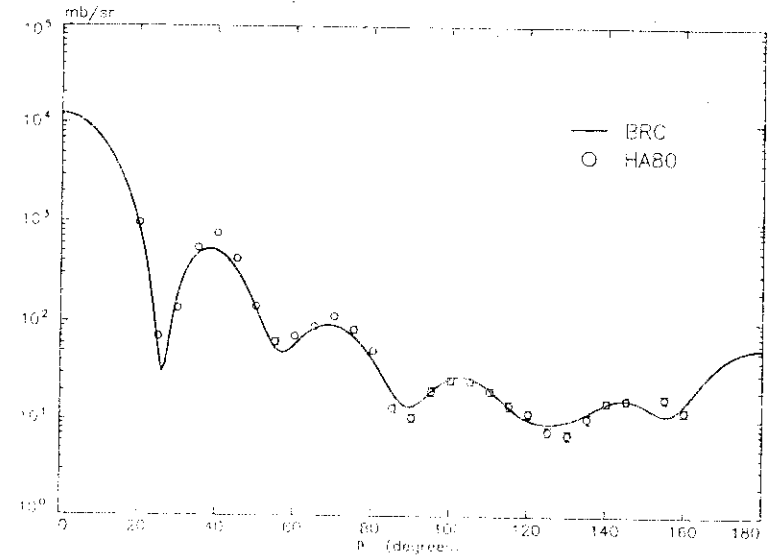
# 209-Bi

## Optical parameters set

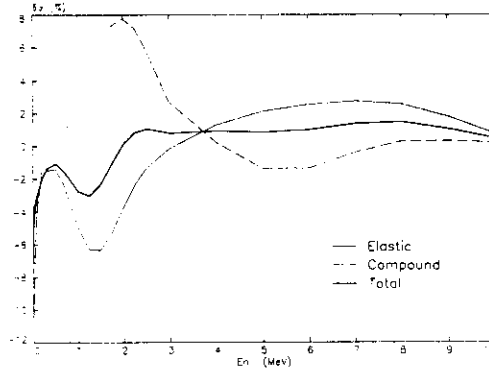
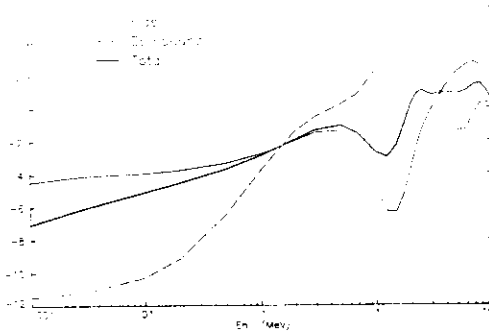
Potential	Depth (MeV)	Radius (fm)	Diffus. (fm)
Real	$45.45 - .22E$	1.265	.65
Imaginary surface	$2.2 + .47E$ if $E < 10$ $6.9 - .045E$ if $E > 10$	1.235	.5
Imaginary volume	.08E	1.235	.5
Spin-orbit	5.5	1.08	.6

Experimental	Calculated
$S_0$	.65 (.07)
$S_1$	.25 (.08)
$R'$	9.47 (1)
	10.3

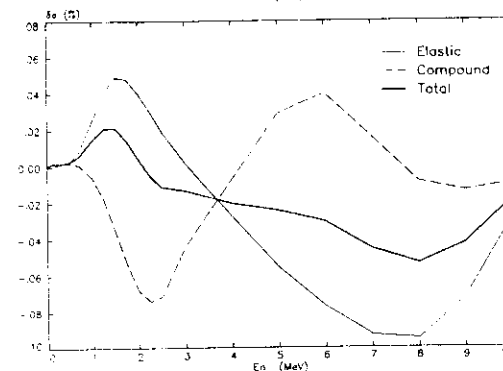
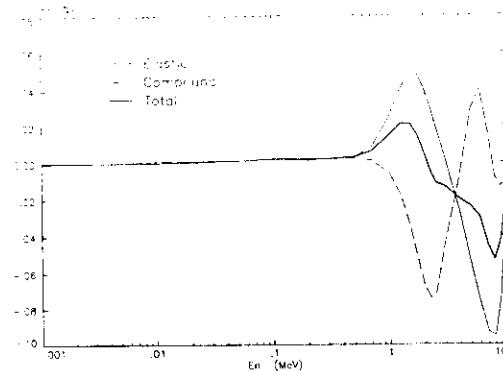
Energy-range: 1 keV - 150 MeV.



209-Bi  $E_n = 13.5$  MeV



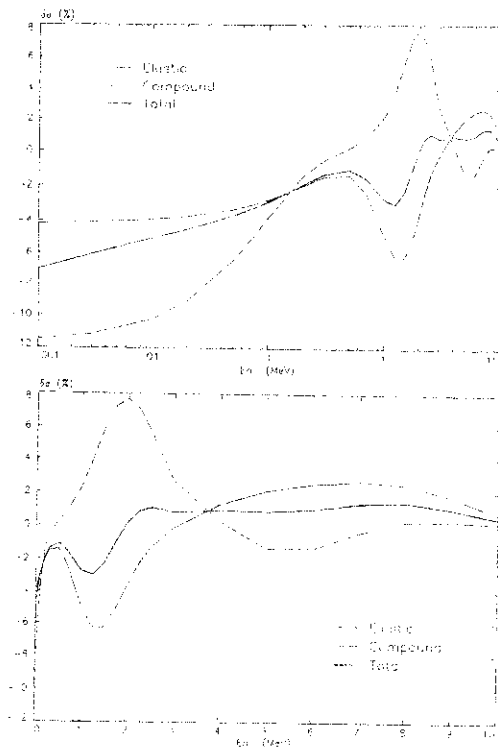
Energy MeV	Elastic	Compound	Total
0.001	0.000	0.000	0.000
0.002	0.000	0.000	0.000
0.010	0.000	0.000	0.000
0.020	0.000	0.000	0.000
0.050	0.000	0.000	0.000
0.100	0.000	0.000	0.000
0.200	0.000	0.000	0.000
0.500	0.000	0.000	0.000
1.000	0.000	0.000	0.000
1.250	0.000	0.000	0.000
1.500	0.000	0.000	0.000
1.750	0.000	0.000	0.000
2.000	0.000	0.000	0.000
2.250	0.000	0.000	0.000
2.500	0.000	0.000	0.000
3.000	0.000	0.000	0.000
4.000	0.000	0.000	0.000
5.000	0.000	0.000	0.000
6.000	0.000	0.000	0.000
7.000	0.000	0.000	0.000
8.000	0.000	0.000	0.000
9.000	0.000	0.000	0.000
10.000	0.000	0.000	0.000



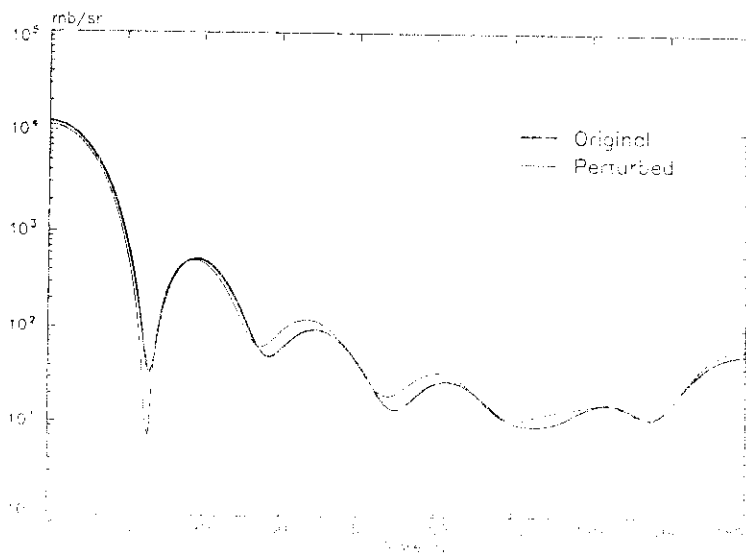
Energy MeV	Elastic	Compound	Total
0.001	0.000	0.000	0.000
0.002	0.000	0.000	0.000
0.010	0.000	0.000	0.000
0.020	0.000	0.000	0.000
0.050	0.000	0.000	0.000
0.100	0.000	0.000	0.000
0.200	0.000	0.000	0.000
0.500	0.000	0.000	0.000
1.000	0.000	0.000	0.000
1.250	0.000	0.000	0.000
1.500	0.000	0.000	0.000
1.750	0.000	0.000	0.000
2.000	0.000	0.000	0.000
2.250	0.000	0.000	0.000
2.500	0.000	0.000	0.000
3.000	0.000	0.000	0.000
4.000	0.000	0.000	0.000
5.000	0.000	0.000	0.000
6.000	0.000	0.000	0.000
7.000	0.000	0.000	0.000
8.000	0.000	0.000	0.000
9.000	0.000	0.000	0.000
10.000	0.000	0.000	0.000

Energy MeV	Elastic	Compound	Total
0.001	0.000	0.000	0.000
0.002	0.000	0.000	0.000
0.010	0.000	0.000	0.000
0.020	0.000	0.000	0.000
0.050	0.000	0.000	0.000
0.100	0.000	0.000	0.000
0.200	0.000	0.000	0.000
0.500	0.000	0.000	0.000
1.000	0.000	0.000	0.000
1.250	0.000	0.000	0.000
1.500	0.000	0.000	0.000
1.750	0.000	0.000	0.000
2.000	0.000	0.000	0.000
2.250	0.000	0.000	0.000
2.500	0.000	0.000	0.000
3.000	0.000	0.000	0.000
4.000	0.000	0.000	0.000
5.000	0.000	0.000	0.000
6.000	0.000	0.000	0.000
7.000	0.000	0.000	0.000
8.000	0.000	0.000	0.000
9.000	0.000	0.000	0.000
10.000	0.000	0.000	0.000

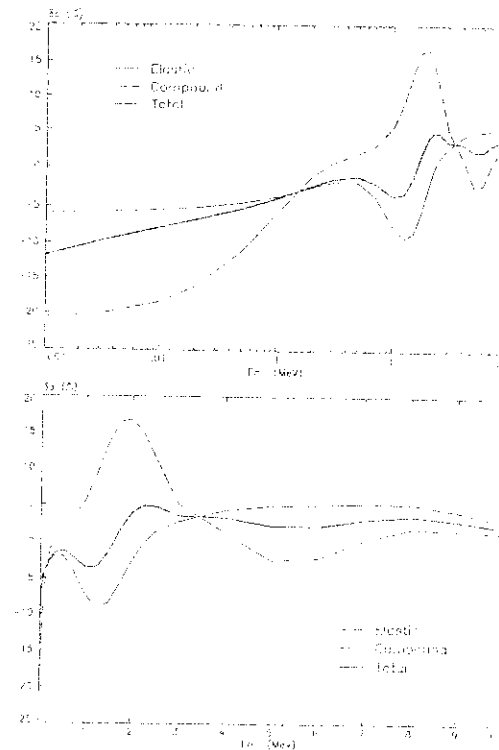
-1% variation of the real depth

209-Bi  $E_n = 13.5$  MeV

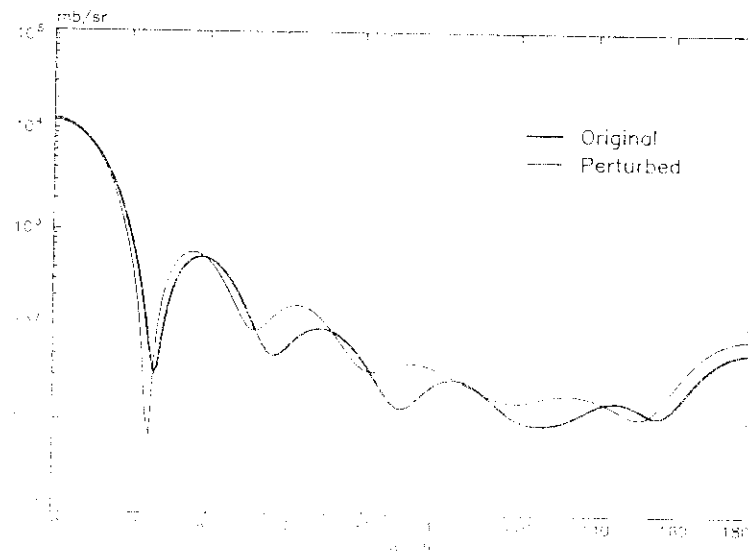
+5% variation of the real depth



+1% variation of the real radius

209-Bi  $E_n = 13.5$  MeV

+5% variation of the real radius

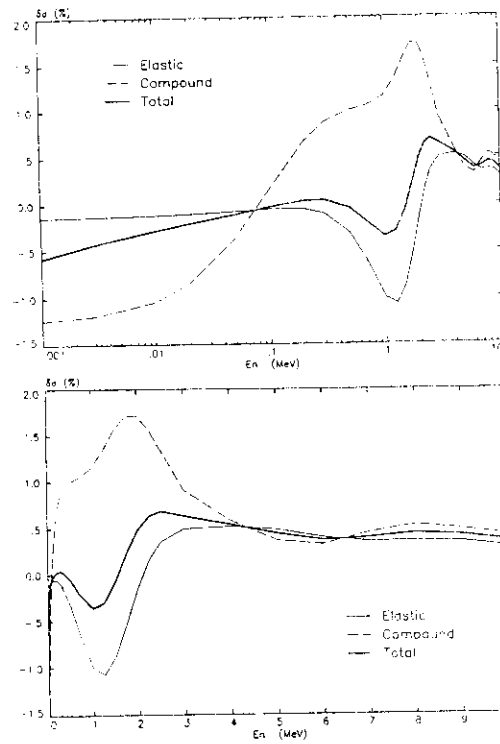


Energy MeV	Elastic %	Compound %	Total %
0.001	-4.112	-11.407	-15.519
0.005	-4.099	-11.182	-15.281
0.01	-3.931	-10.263	-14.194
0.05	-3.792	-9.131	-12.923
0.10	-3.537	-8.457	-11.994
0.140	-2.754	-8.795	-11.549
0.180	-1.945	-11.4.5	-13.343
0.200	-1.455	-12.50	-13.955
0.300	-1.343	-12.16	-13.503
0.340	-2.355	-10.74	-13.094
0.350	-4.810	-9.215	-14.025
0.420	-5.179	-8.259	-13.438
0.500	-6.113	-7.817	-13.930
0.750	-5.225	-7.259	-12.484
0.750	-3.717	-7.692	-11.409
0.750	-2.350	-7.093	-9.443
0.750	-1.350	-5.781	-7.131
0.750	-1.147	-2.629	-3.776
0.800	-1.245	-5.6	-6.845
0.800	-2.069	-11.342	-13.411
0.800	-2.475	-11.333	-13.808
0.800	-2.653	-7.797	-10.450
0.800	-2.446	-1.251	-3.697
0.800	-1.712	-1.291	-3.003
0.800	-1.705	-1.176	-2.881

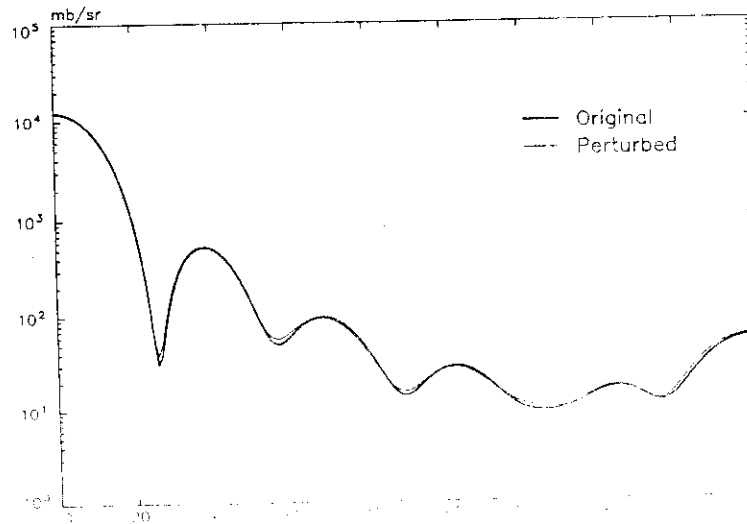
Energy MeV	Elastic %	Compound %	Total %
0.001	-5.880	-10.240	-16.120
0.005	-5.760	-10.030	-15.790
0.01	-5.490	-10.370	-15.860
0.05	-5.300	-10.120	-15.420
0.10	-4.550	-11.160	-15.710
0.140	-3.710	-8.860	-12.570
0.180	-2.520	-11.120	-13.640
0.200	-1.630	-6.30	-7.930
0.300	-1.670	-1.920	-3.590
0.340	-3.620	-2.920	-6.540
0.350	-7.510	-5.620	-13.130
0.420	-9.250	-9.540	-18.790
0.500	-8.510	-13.550	-22.060
0.750	-5.760	-16.480	-22.240
0.750	-2.750	-16.880	-19.630
0.750	-1.130	-14.750	-15.880
0.750	-1.370	-11.420	-12.790
0.800	-2.760	-5.030	-7.790
0.800	-4.700	-1.510	-6.210
0.800	-4.020	-2.373	-6.393
0.800	-5.440	-2.050	-7.490
0.800	-5.120	-4.50	-9.620
0.800	-5.160	-1.500	-6.660
0.800	-5.120	-1.740	-6.860
0.800	-2.730	-1.400	-4.130

## 209-Bi

+1% variation of the real diffuseness

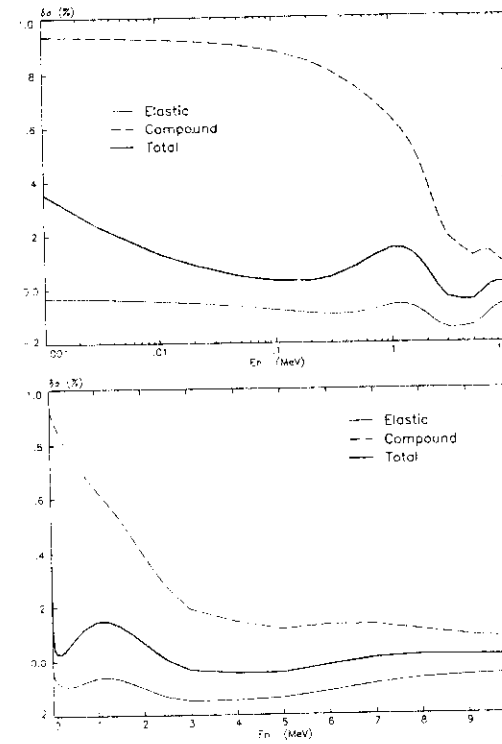
209-Bi  $E_n = 13.5$  MeV

+5% variation of the real diffuseness

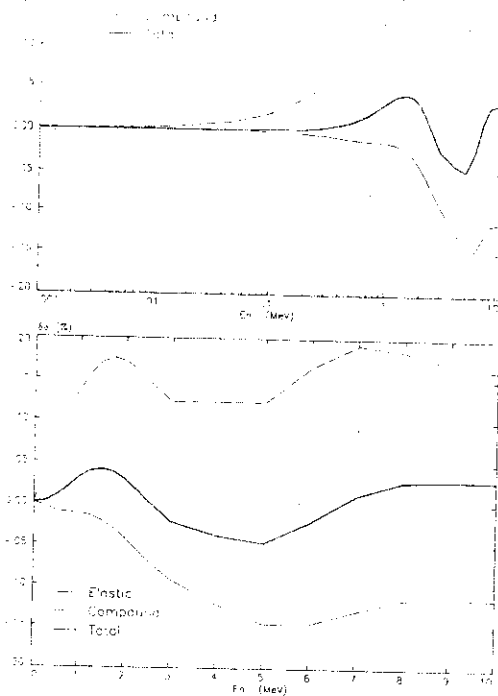


## 209-Bi

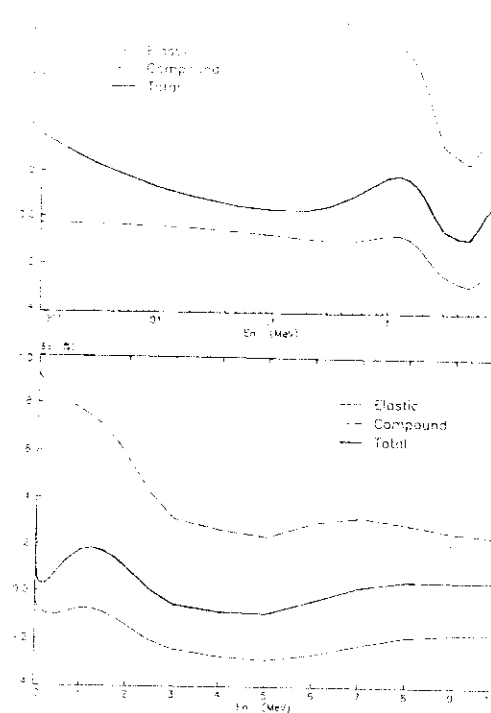
+1% variation of the imaginary surface depth (constant term)



Energy MeV	Elastic %	Compound %	Total %
.001	-.032	.935	.354
.003	-.036	.930	.234
.010	-.045	.922	.131
.020	-.052	.915	.088
.050	-.066	.899	.045
.100	-.078	.879	.028
.200	-.091	.843	.027
.300	-.095	.809	.041
.500	-.091	.758	.091
.700	-.078	.698	.117
1.000	-.062	.632	.146
1.250	-.061	.582	.145
1.500	-.069	.529	.128
1.750	-.084	.469	.101
2.000	-.101	.401	.068
2.250	-.119	.335	.034
2.500	-.133	.275	.005
3.000	-.147	.190	-.047
4.000	-.146	.143	-.045
5.000	-.138	.114	-.017
6.000	-.115	.130	.008
7.000	-.098	.129	.017
8.000	-.069	.108	.015
9.000	-.060	.088	.014
10.000	-.054	.076	



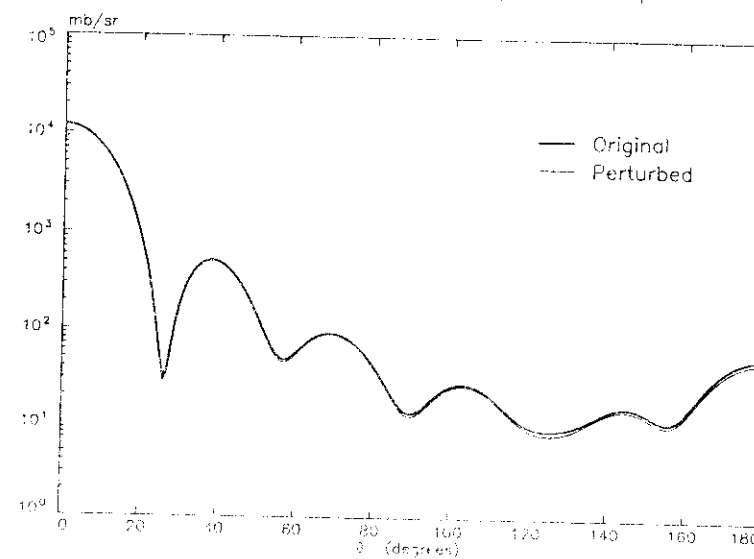
$E_n$ (MeV)	$R_1$	$R_2$	$R_3$
0.000	0.000	0.000	0.000
0.250	0.000	0.000	0.000
0.500	0.000	0.000	0.000
0.750	0.000	0.000	0.000
1.000	0.000	0.000	0.000
1.250	0.000	0.000	0.000
1.500	0.000	0.000	0.000
1.750	0.000	0.000	0.000
2.000	0.000	0.000	0.000
2.250	0.000	0.000	0.000
2.500	0.000	0.000	0.000
2.750	0.000	0.000	0.000
3.000	0.000	0.000	0.000
3.250	0.000	0.000	0.000
3.500	0.000	0.000	0.000
3.750	0.000	0.000	0.000
4.000	0.000	0.000	0.000
4.250	0.000	0.000	0.000
4.500	0.000	0.000	0.000
4.750	0.000	0.000	0.000
5.000	0.000	0.000	0.000
5.250	0.000	0.000	0.000
5.500	0.000	0.000	0.000
5.750	0.000	0.000	0.000
6.000	0.000	0.000	0.000
6.250	0.000	0.000	0.000
6.500	0.000	0.000	0.000
6.750	0.000	0.000	0.000
7.000	0.000	0.000	0.000
7.250	0.000	0.000	0.000
7.500	0.000	0.000	0.000
7.750	0.000	0.000	0.000
8.000	0.000	0.000	0.000
8.250	0.000	0.000	0.000
8.500	0.000	0.000	0.000
8.750	0.000	0.000	0.000
9.000	0.000	0.000	0.000
9.250	0.000	0.000	0.000
9.500	0.000	0.000	0.000
9.750	0.000	0.000	0.000
10.000	0.000	0.000	0.000



$E_n$ (MeV)	$R_1$	$R_2$	$R_3$
0.000	0.000	0.000	0.000
0.250	0.000	0.000	0.000
0.500	0.000	0.000	0.000
0.750	0.000	0.000	0.000
1.000	0.000	0.000	0.000
1.250	0.000	0.000	0.000
1.500	0.000	0.000	0.000
1.750	0.000	0.000	0.000
2.000	0.000	0.000	0.000
2.250	0.000	0.000	0.000
2.500	0.000	0.000	0.000
2.750	0.000	0.000	0.000
3.000	0.000	0.000	0.000
3.250	0.000	0.000	0.000
3.500	0.000	0.000	0.000
3.750	0.000	0.000	0.000
4.000	0.000	0.000	0.000
4.250	0.000	0.000	0.000
4.500	0.000	0.000	0.000
4.750	0.000	0.000	0.000
5.000	0.000	0.000	0.000
5.250	0.000	0.000	0.000
5.500	0.000	0.000	0.000
5.750	0.000	0.000	0.000
6.000	0.000	0.000	0.000
6.250	0.000	0.000	0.000
6.500	0.000	0.000	0.000
6.750	0.000	0.000	0.000
7.000	0.000	0.000	0.000
7.250	0.000	0.000	0.000
7.500	0.000	0.000	0.000
7.750	0.000	0.000	0.000
8.000	0.000	0.000	0.000
8.250	0.000	0.000	0.000
8.500	0.000	0.000	0.000
8.750	0.000	0.000	0.000
9.000	0.000	0.000	0.000
9.250	0.000	0.000	0.000
9.500	0.000	0.000	0.000
9.750	0.000	0.000	0.000
10.000	0.000	0.000	0.000

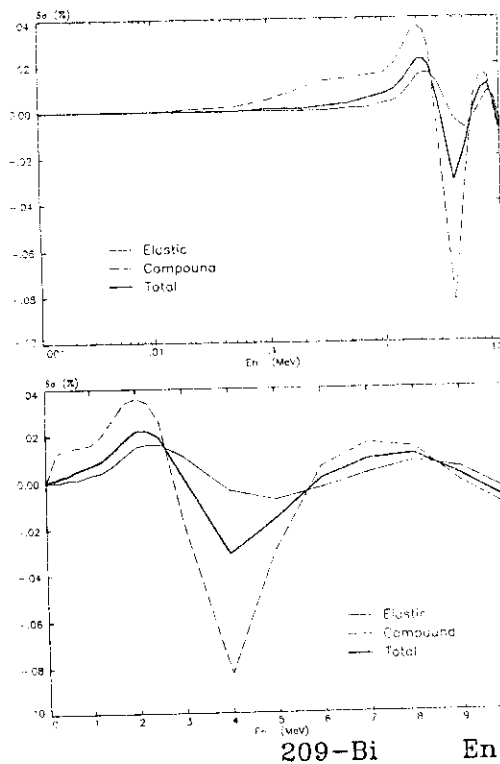
209-Bi  $E_n = 13.5$  MeV

+5% variation of the imaginary surface depth



209-Bi

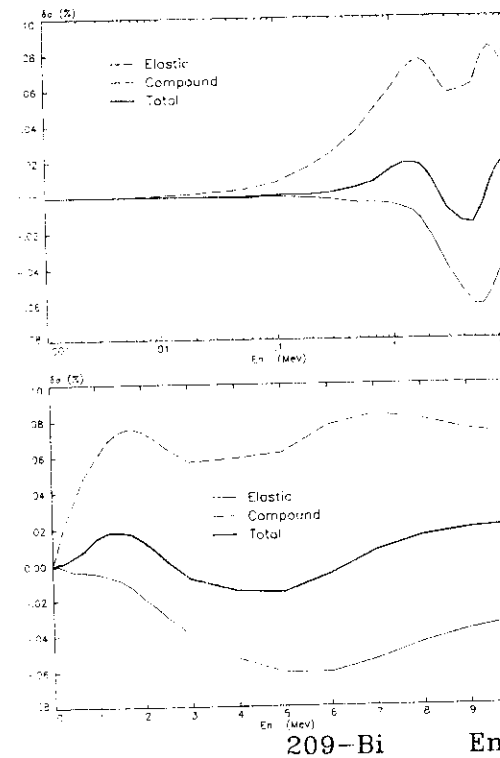
+1% variation of the spin-orbit diffuseness



Energy MeV	Elastic %	Compound %	Total %
.001	0.000	0.000	0.000
.003	0.000	0.000	0.000
.010	0.000	0.000	0.000
.020	0.000	.001	0.000
.050	0.000	.002	0.000
.100	0.000	.005	.001
.200	0.000	.010	.001
.300	0.000	.013	.002
.500	.001	.014	.003
.700	.001	.015	.005
1.000	.003	.016	.007
1.250	.004	.020	.009
1.500	.007	.027	.013
1.750	.011	.034	.018
2.000	.015	.036	.022
2.250	.016	.034	.022
2.500	.016	.027	.019
3.000	.011	.017	.002
4.000	-.004	-.003	-.016
5.000	-.009	-.029	-.001
6.000	-.003	.006	.003
7.000	.003	.015	.009
8.000	.000	.014	.011
9.000	.005	-.001	.002
10.000	-.005	-.012	-.009

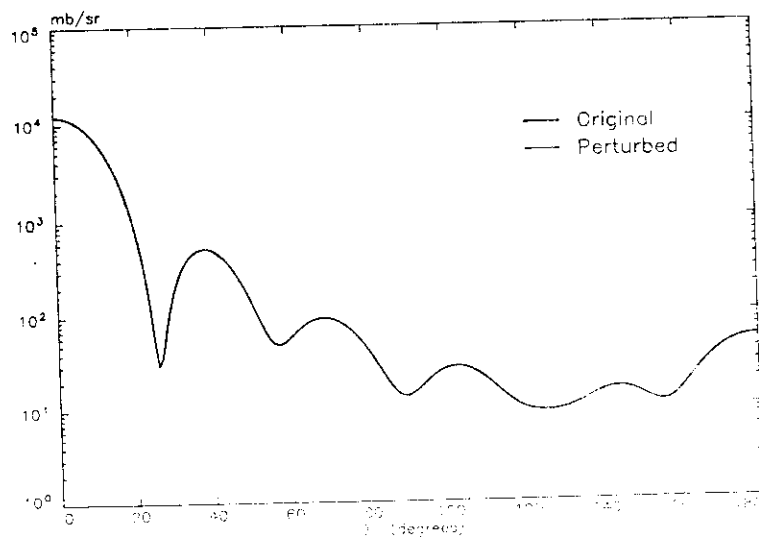
209-Bi

+1% variation of the imaginary volume depth (linear term)

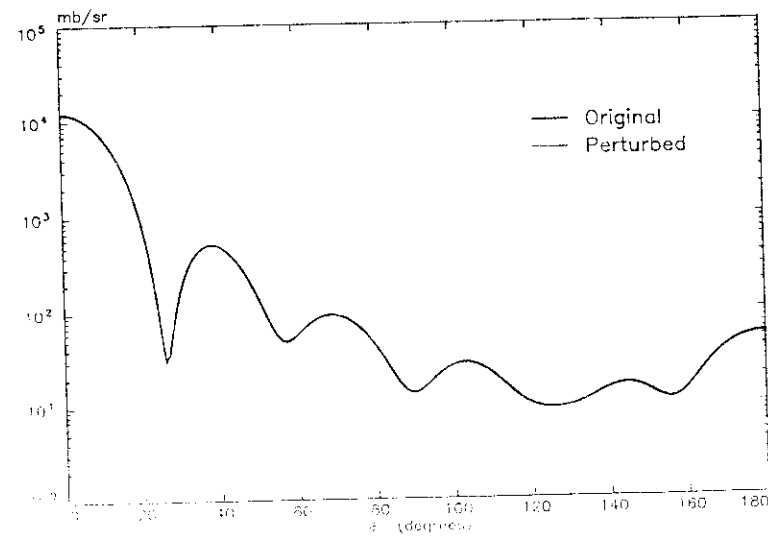


Energy MeV	Elastic %	Compound %	Total %
.001	0.000	0.000	0.000
.003	0.000	0.000	0.000
.010	0.000	.001	0.000
.020	0.000	.002	0.000
.050	-.001	.004	0.000
.100	0.000	.008	.001
.200	-.001	.017	.001
.300	-.002	.024	.002
.500	-.004	.036	.005
.700	-.004	.048	.008
1.000	-.005	.050	.015
1.250	-.007	.059	.018
1.500	-.009	.074	.018
1.750	-.013	.076	.017
2.000	-.019	.074	.013
2.250	-.024	.065	.002
2.500	-.020	.057	-.008
3.000	-.053	.053	-.015
4.000	-.061	.062	-.016
5.000	-.061	.077	-.008
6.000	-.054	.083	.007
7.000	-.045	.088	.015
8.000	-.038	.074	.019
10.000	-.033	.071	.021

+5% variation of the spin-orbit diffuseness

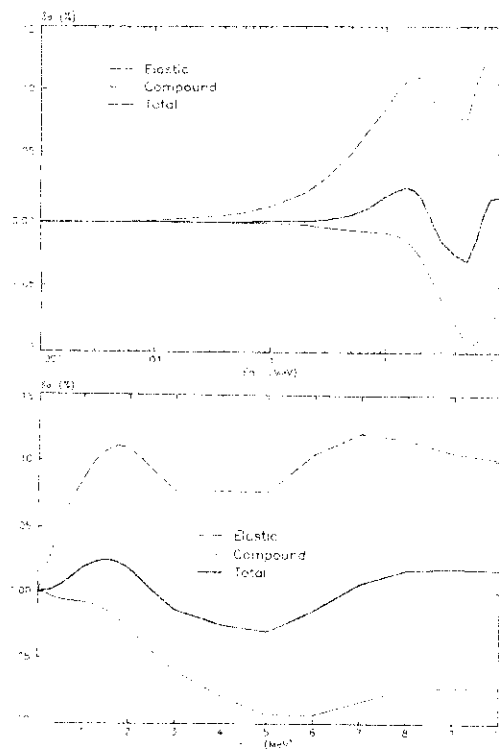


+5% variation of the imaginary volume depth

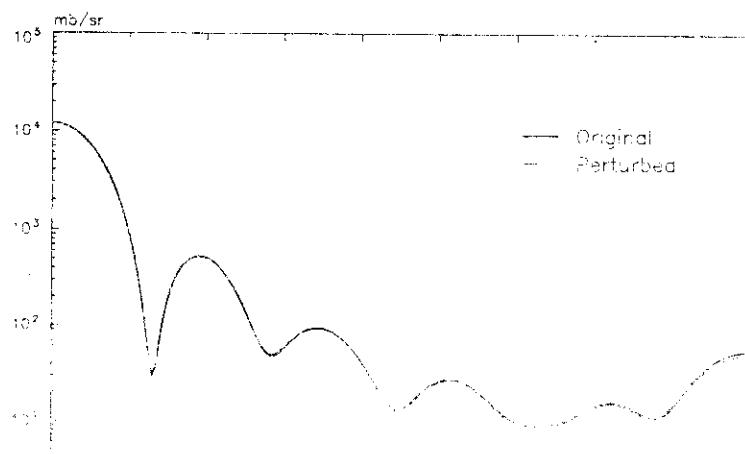




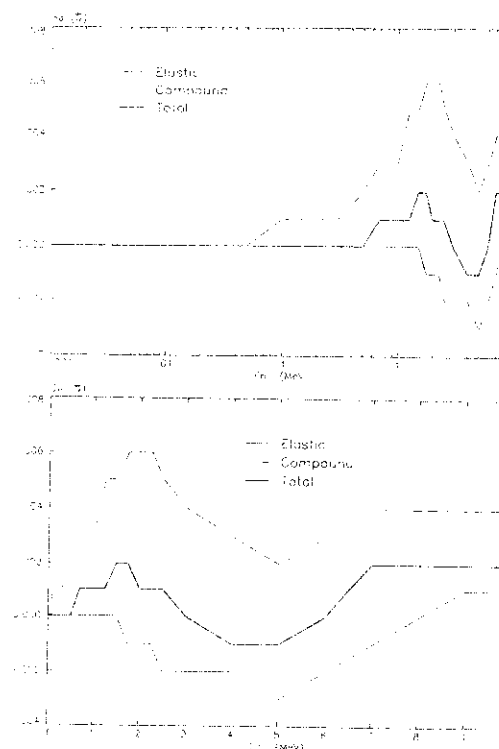
+1% variation of the imaginary volume radius

209-Bi  $E_n = 13.5$  MeV

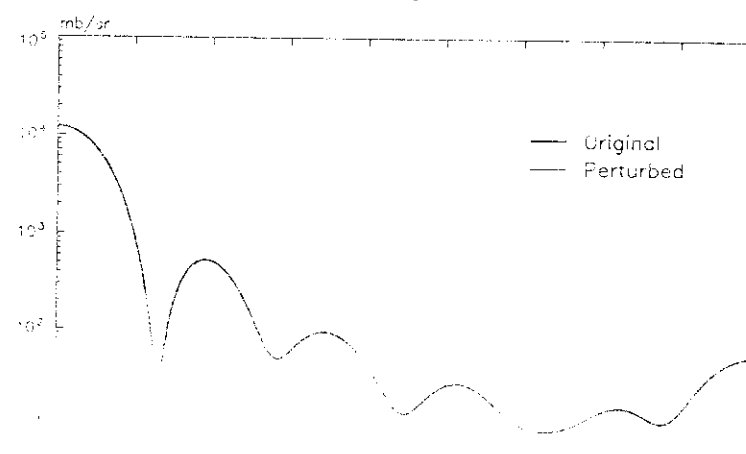
+5% variation of the imaginary volume radius



+1% variation of the imaginary volume diffuseness

209-Bi  $E_n = 13.5$  MeV

+5% variation of the imaginary volume diffuseness



Energy MeV	Elastic %	Compound %	Total %
0.01	0.000	0.000	0.000
.003	0.000	0.000	0.000
.010	0.000	0.001	0.000
.030	0.000	0.003	0.000
.050	-0.001	0.000	0.000
.100	-0.001	0.012	0.001
.200	-0.002	0.023	0.001
.300	-0.004	0.032	0.002
.500	-0.008	0.050	0.006
.700	-0.007	0.067	0.011
1.000	-0.006	0.085	0.020
1.250	-0.010	0.099	0.024
1.500	-0.014	0.107	0.024
1.750	-0.020	0.111	0.024
2.000	-0.027	0.099	0.014
2.250	-0.036	0.102	0.010
2.500	-0.043	0.093	0.001
3.000	-0.060	0.077	-0.014
4.000	-0.079	0.077	-0.029
5.000	-0.093	0.076	-0.050
6.000	-0.093	0.065	-0.111
7.000	-0.089	0.051	-0.077
8.000	-0.073	0.036	-0.010
9.000	-0.072	0.026	0.019
10.000	-0.072	0.011	0.010

Energy MeV	Elastic %	Compound %	Total %
0.001	0.000	0.000	0.000
.003	0.000	0.000	0.000
.010	0.000	0.000	0.000
.030	0.000	0.000	0.000
.050	0.000	0.000	0.000
.100	0.000	0.001	0.000
.200	0.000	0.001	0.000
.300	0.000	0.001	0.000
.500	0.000	0.001	0.000
.700	0.000	0.001	0.001
1.000	0.000	0.003	0.001
1.250	0.000	0.005	0.001
1.500	0.000	0.005	0.002
1.750	-0.001	0.005	0.002
2.000	-0.001	0.006	0.001
2.250	-0.001	0.006	0.001
2.500	-0.002	0.005	0.001
3.000	-0.002	0.004	0.000
4.000	-0.002	0.003	-0.001
5.000	-0.003	0.002	-0.001
6.000	-0.002	0.003	0.000
7.000	-0.001	0.004	0.002
8.000	0.000	0.004	0.002
9.000	0.001	0.004	0.002
10.000	0.001	0.004	0.002

