



THE CODE **MUPLOT**

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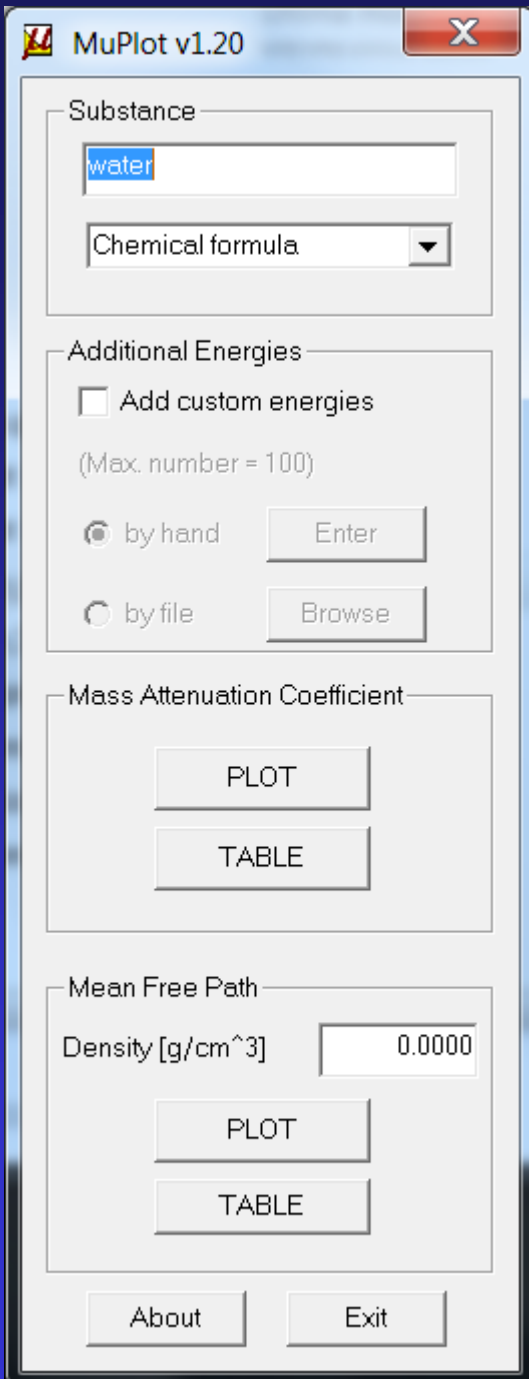
*Laboratory of Montecuccolino-DIENCA
Alma Mater Studiorum University of Bologna*

MUPLOT

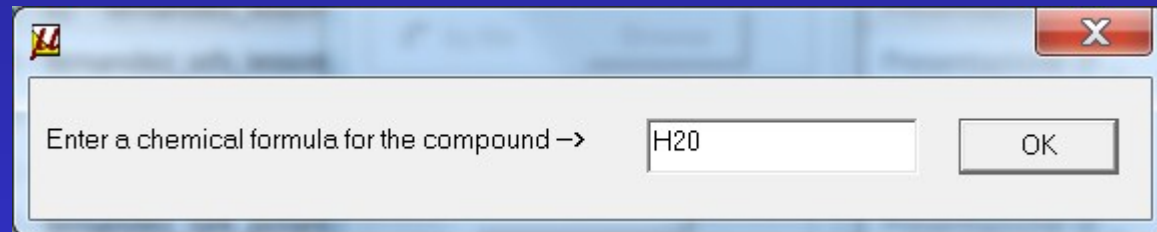
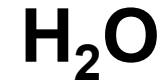
It allows the computation of **attenuation coefficients** (total, photoelectric, Rayleigh and Compton) for materials defined as:

- single element, entering atomic number Z or chemical symbol (allowed elements are $Z=1..92$),
- compound (entering chemical formula),
- mixture of elements (entering elements and weight concentrations),
- mixture of compounds (entering chemical formulas and weight fractions).

Example 1 (water)



Compound:





MuPlot v1.20



Substance

water

Chemical formula

Additional Energies

Add custom energies

(Max. number = 100)

by hand

Enter

by file

Browse

Mass Attenuation Coefficient

PLOT

TABLE

Mean Free Path

Density [g/cm³]

0.0000

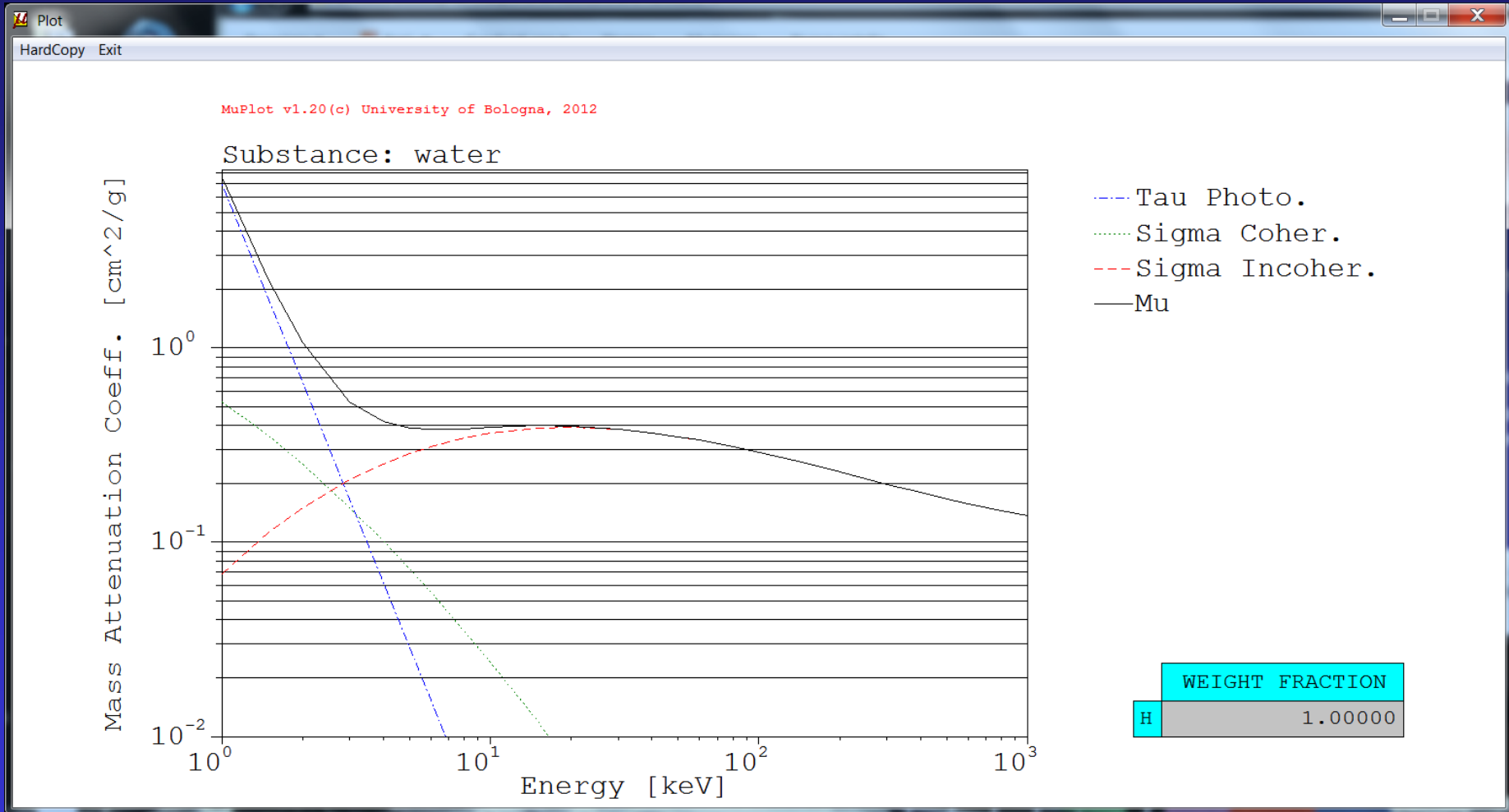
PLOT

TABLE

About

Exit

PLOT



TABLE

Results

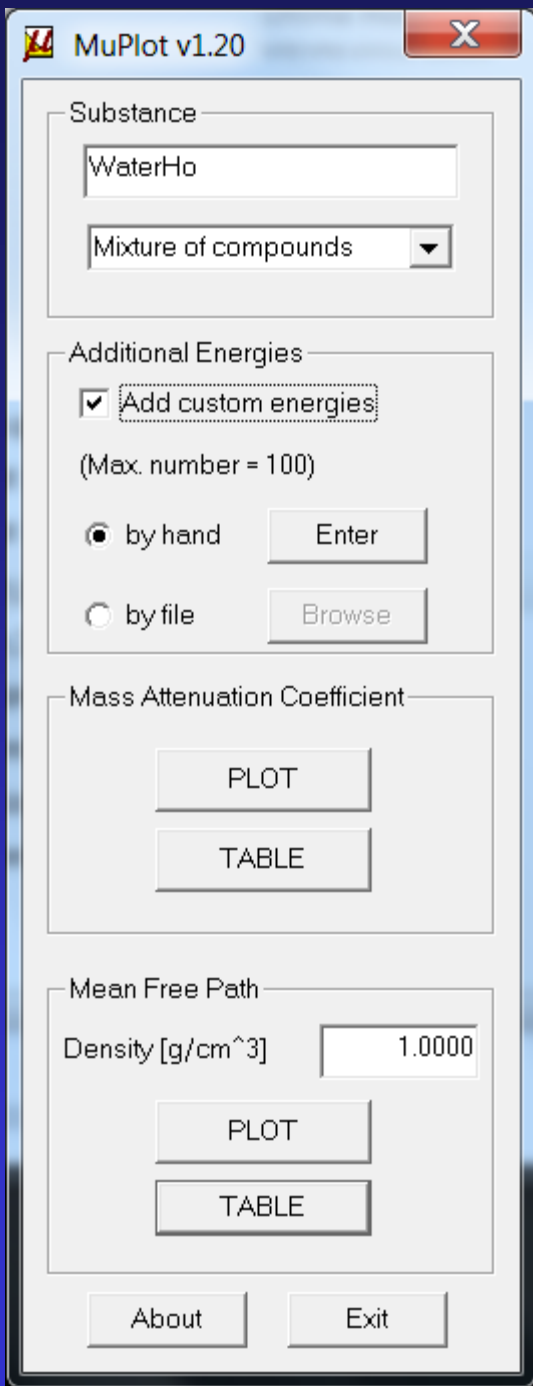
ENERGY (keV)	TAU [cm ² /g]	SIG COH [cm ² /g]	SIG INC [cm ² /g]	MU [cm ² /g]
1.0000	6.9201	0.53031	0.69049E-01	7.5194
1.5000	1.7666	0.35116	0.11260	2.2303
2.0000	0.66526	0.25243	0.15048	1.0682
3.0000	0.16648	0.15082	0.21023	0.52752
4.0000	0.61996E-01	0.10123	0.25371	0.41693
5.0000	0.28755E-01	0.72986E-01	0.28594	0.38768
6.0000	0.15335E-01	0.55254E-01	0.31028	0.38087
8.0000	0.56805E-02	0.34937E-01	0.34336	0.38397
10.000	0.26284E-02	0.24110E-01	0.36341	0.39014
15.000	0.64843E-03	0.11903E-01	0.38536	0.39791
20.000	0.24068E-03	0.70502E-02	0.38931	0.39660
30.000	0.59834E-04	0.32732E-02	0.38002	0.38336
40.000	0.22396E-04	0.18642E-02	0.36481	0.36669
50.000	0.10487E-04	0.11932E-02	0.34934	0.35054
60.000	0.56571E-05	0.82410E-03	0.33497	0.33580
80.000	0.21478E-05	0.45532E-03	0.31027	0.31072
100.00	0.10187E-05	0.28538E-03	0.29026	0.29054
150.00	0.26616E-06	0.12053E-03	0.25410	0.25423
200.00	0.10391E-06	0.64847E-04	0.22986	0.22992
300.00	0.28123E-07	0.26843E-04	0.19903	0.19906
400.00	0.11291E-07	0.14301E-04	0.18002	0.18003
500.00	0.56137E-08	0.87654E-05	0.16702	0.16703
600.00	0.31917E-08	0.58749E-05	0.15755	0.15756
800.00	0.13254E-08	0.31268E-05	0.14469	0.14469
1000.0	0.67765E-09	0.19199E-05	0.13643	0.13644

Substance: water

ELEMENT	WEIGHT FRACTION
H	1.0000

HARD COPY OK

Adding a new Energy to the grid



MuPlot v1.20

Substance

WaterHo

Mixture of compounds

Additional Energies

Add custom energies

(Max. number = 100)

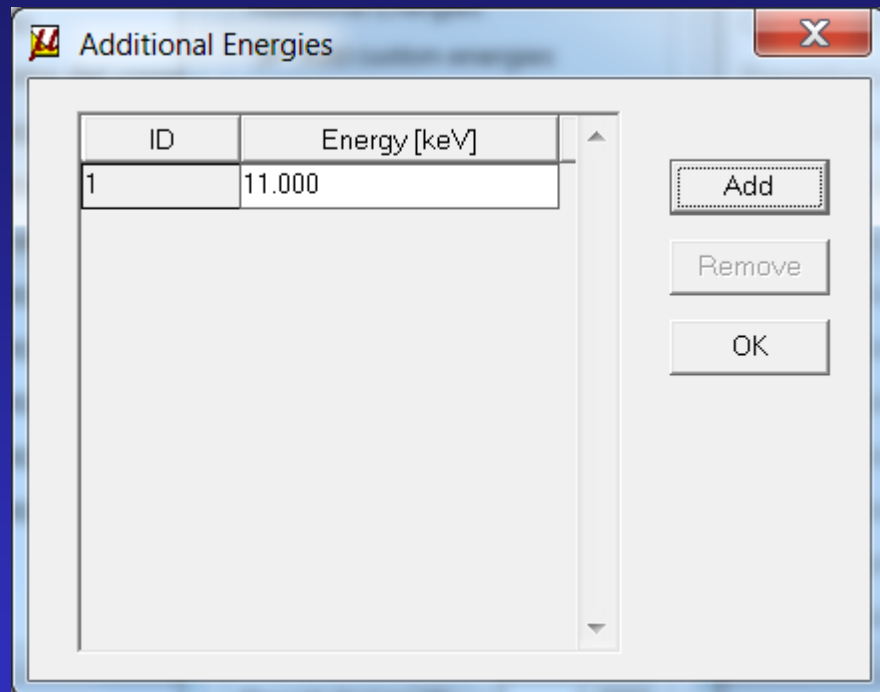
by hand

by file

Mass Attenuation Coefficient

Mean Free Path

Density [g/cm³]



Additional Energies

ID	Energy [keV]
1	11.000

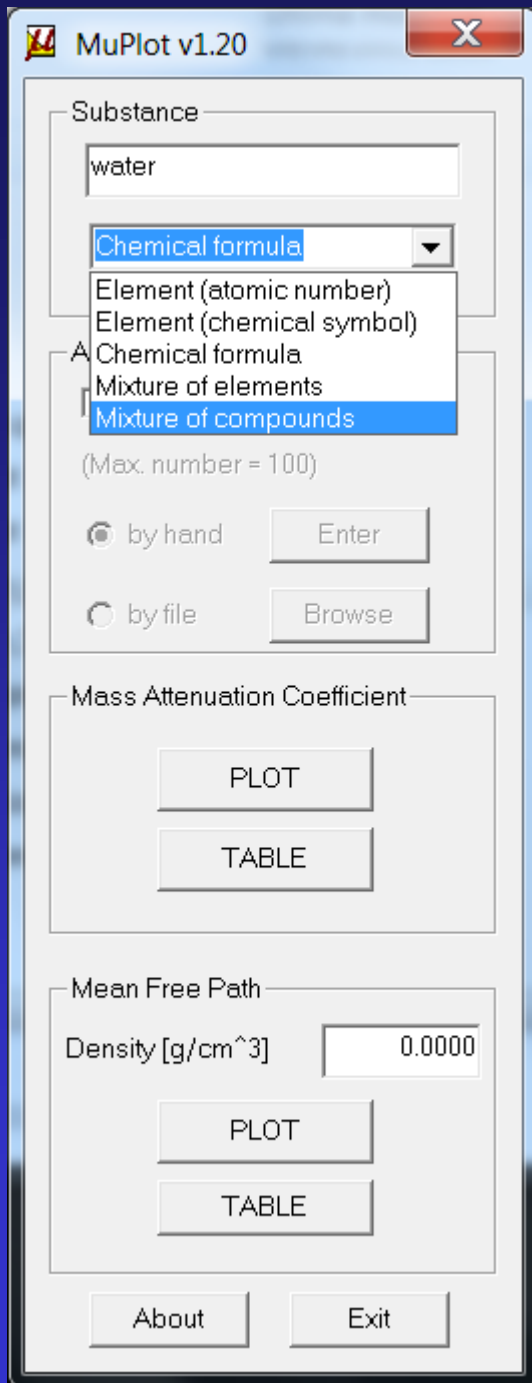
Then push the **Add** button, until all the new energies have been added

HOW MANY SCATTERS OCCUR IN A GIVEN SAMPLE?

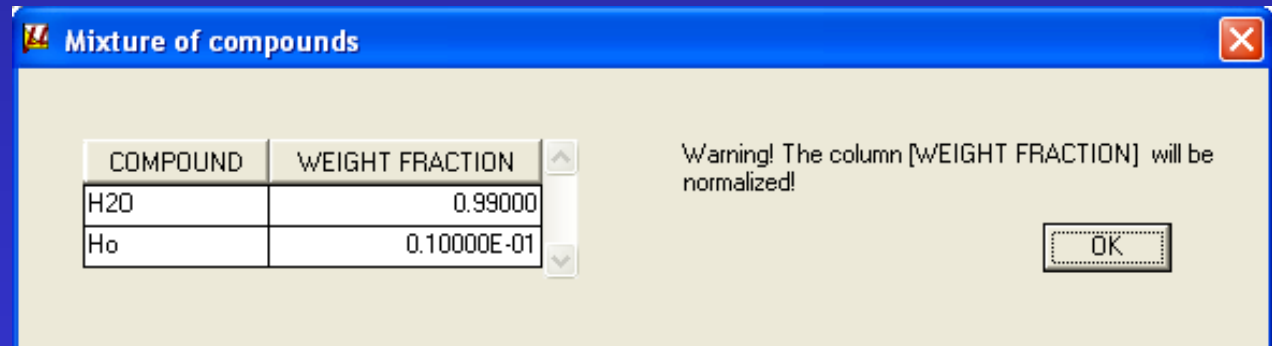
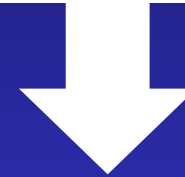
- This information is given by the mean free path which may be compared with the actual size of the specimen under study
- Mean free path ℓ : is the mean distance that a photon undergoes in a material having attenuation coefficient μ

$$\ell = \frac{1}{\mu}$$

Example 2 (water + Ho)



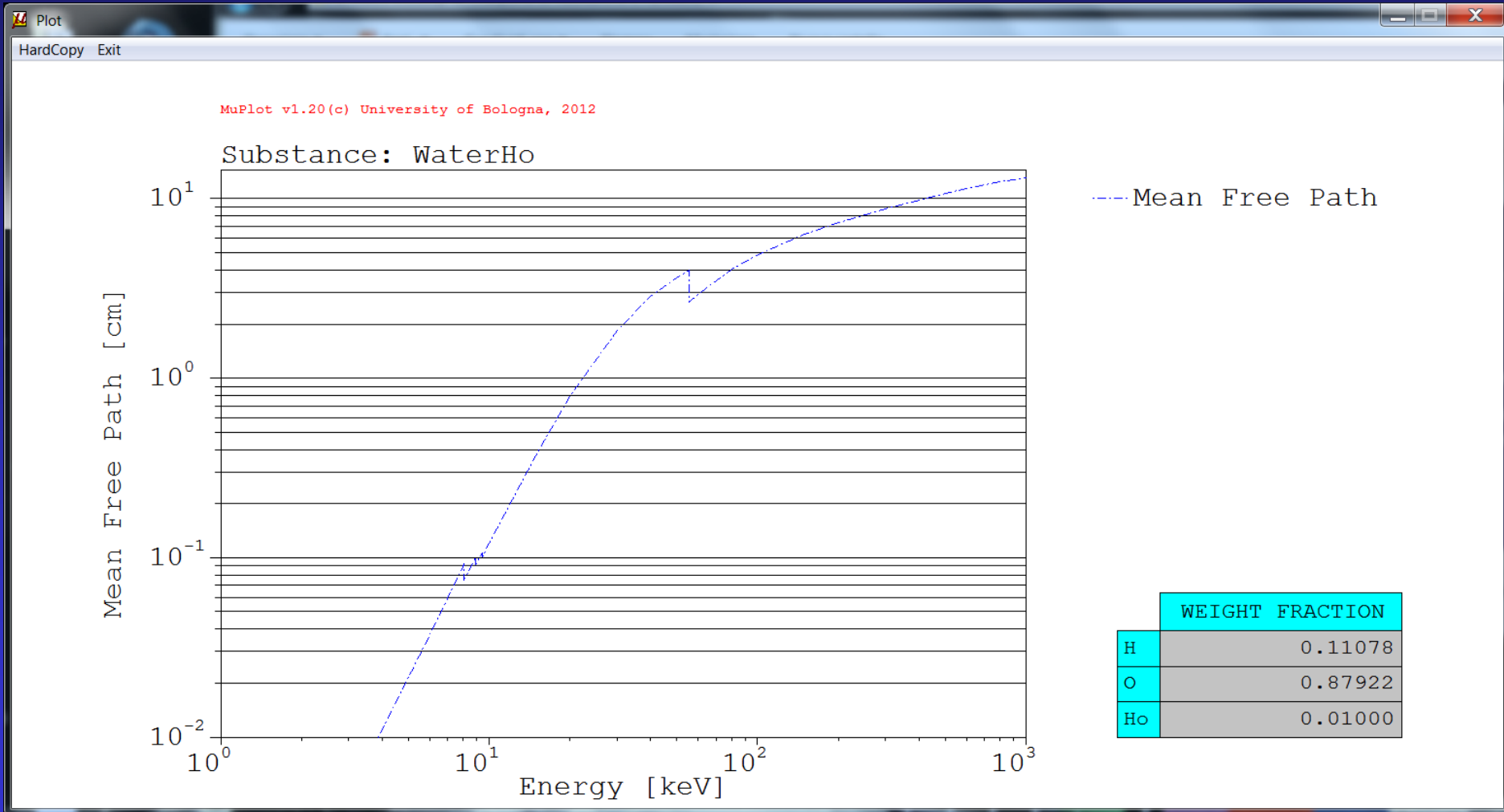
**Mixture of
compounds H₂O
(99%) Ho (1%)**





Mean free
path
section

PLOT



TABLE

Mean Free Path

ENERGY (keV)	MFP [cm]
1.0000	0.24520E-03
1.3553	0.54577E-03
1.3554	0.52246E-03
1.3951	0.56484E-03
1.3952	0.56017E-03
1.5000	0.68168E-03
1.7284	0.10063E-02
1.7285	0.99710E-03
1.9103	0.13174E-02
1.9104	0.13119E-02
2.0000	0.14919E-02
2.1024	0.17177E-02
2.1026	0.17124E-02
3.0000	0.47577E-02
4.0000	0.11111E-01
5.0000	0.21659E-01
6.0000	0.37510E-01
8.0000	0.89269E-01
8.0675	0.91549E-01
8.0676	0.75132E-01
8.9163	0.10091
8.9164	0.91428E-01
9.3996	0.10663
9.3997	0.10113
10.000	0.12097
15.000	0.37714
20.000	0.78792

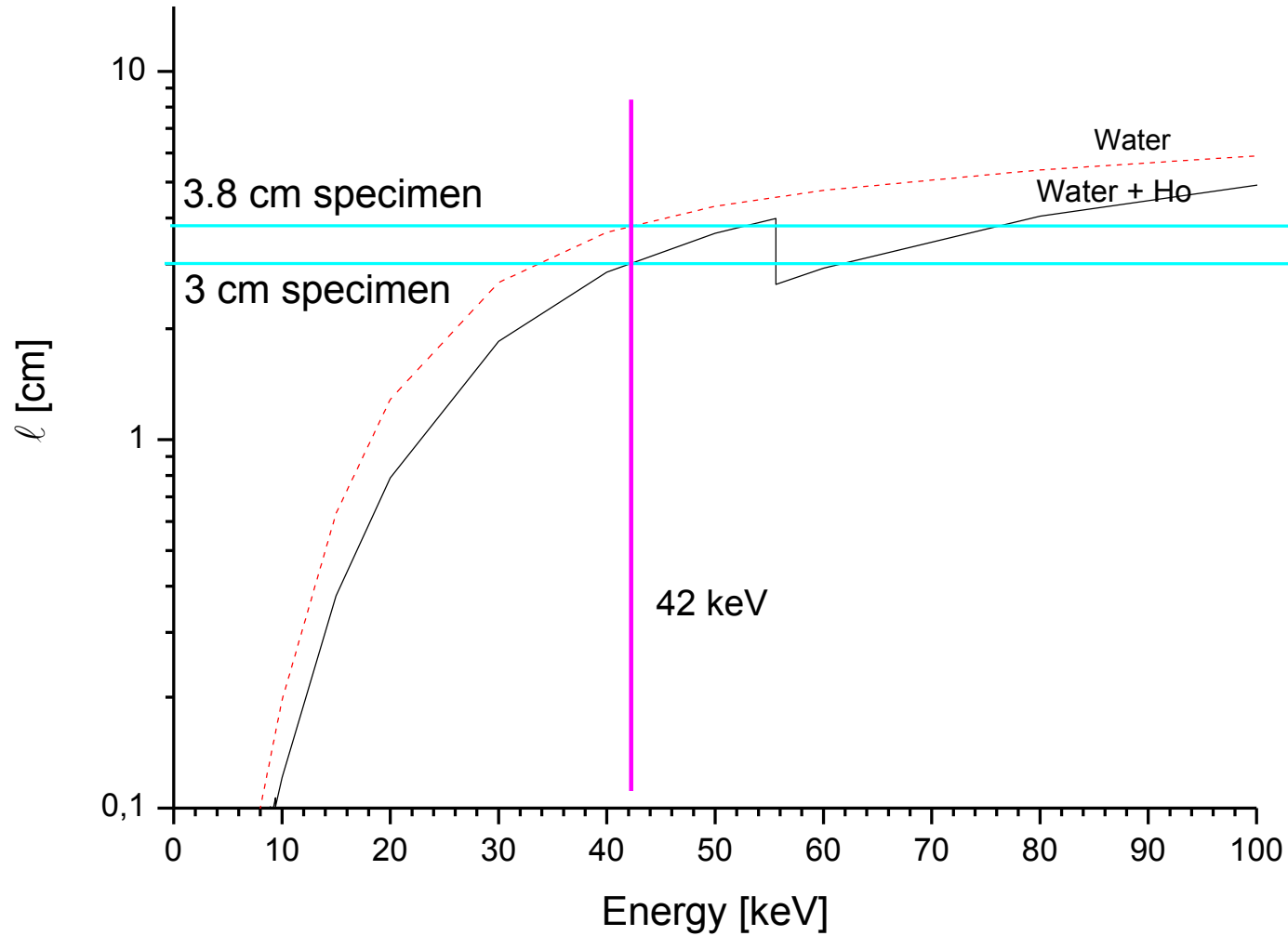
Substance: **WaterHo**

ELEMENT	WEIGHT FRACTION
H	0.11078
O	0.87922
Ho	0.10000E-01

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OK

MFP comparison for two close materials



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Deterministic and Monte Carlo photon transport codes

The multiple scattering description of polarised photon diffusion represents a unified approach to describe attenuation of photon beams maintaining the optical properties which are related to the polarisation state.

Several codes for photon transport with high level of refinement on the description of the interactions photon-atom and the evolution of the polarisation state have been developed along the years by our group.

[more...](#)



LATEST VERSIONS

MCSHAPe v2.50
MCINPUT v2.10
SHAPe v2.20
MUPLOT v1.03

NEWS

September 9th, 2005 - **MCSHAPe v2.50** for both, Windows and Linux, ready to download

March 9th 2005 - **MCINPUT v2.10** for both, Windows and Linux, ready to download

October 28th 2004 - **MUPLOT v1.03** for both, Windows and Linux, ready to download.

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