ANNEX II. SOFTWARE TOOL

The software tool has been developed in order to facilitate processing of the luminescence and EPR-spectrometry results. The main goal of the software tool is to compute a conversion factor from absorbed dose measured by TLD- or EPR-methods to integral air kerma.

The software tool has been developed as a stand-alone Windows application "DCF Calculator", where DCF stands for "dose conversion factor". The name stresses the main goal of the software tool – to make a transition from absorbed doses in dosimeter's material to air kerma and, consequently, to human doses based on dose coefficients present in the ICRP publications, primarily in the Publication 74 of the ICRP. The software has been developed in Python programming language with additional libraries for interface creation and plotting (wxPython[1] and matplotlib[2]).

The software operates as a special-purpose calculator which performs linear and cubic spline interpolation of the user data and numerically integrates according eqns (2.15)–(2.16) found in Chapter 2 of the main report. As follows from these equations, to perform a conversion of absorbed doses in chip card or human tooth enamel to integral air kerma a user must be known of:

a) dose response function of the dosimeter applied (e.g. chip card or human tooth enamel) for the specific geometry of the photon source;

b) relative energy spectrum of the photon source;

c) mass-energy absorption coefficients $\frac{\mu_{en}}{\rho}(E)$.

Correspondingly, the user starts working with the software tool by identifying these quantities (see Fig. A.1). First, the dose response function (DRF) must be defined. The software tool is supplied with a set of various DRFs for the human enamel and a chip card. All these can be found in sub-directory "data" of the main directory of the tool. The data are provided as files having extension ".drf" in order to indicate their content. Shown in the plot window in Fig. A.1 is an example of DRF for milk teeth (2nd molar) for photon source of rotational geometry (ROT).

Correspondingly, characteristics of the photon source, namely its spectrum, can be loaded from the data files. These files have extension ".spc". Among them, there are files for standard X-Ray spectra (Ankerhold 2000) as well as some spectra typical for environmental or occupational exposure (see screenshot shown in Fig. A.2)

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[1] http://www.wxpython.org
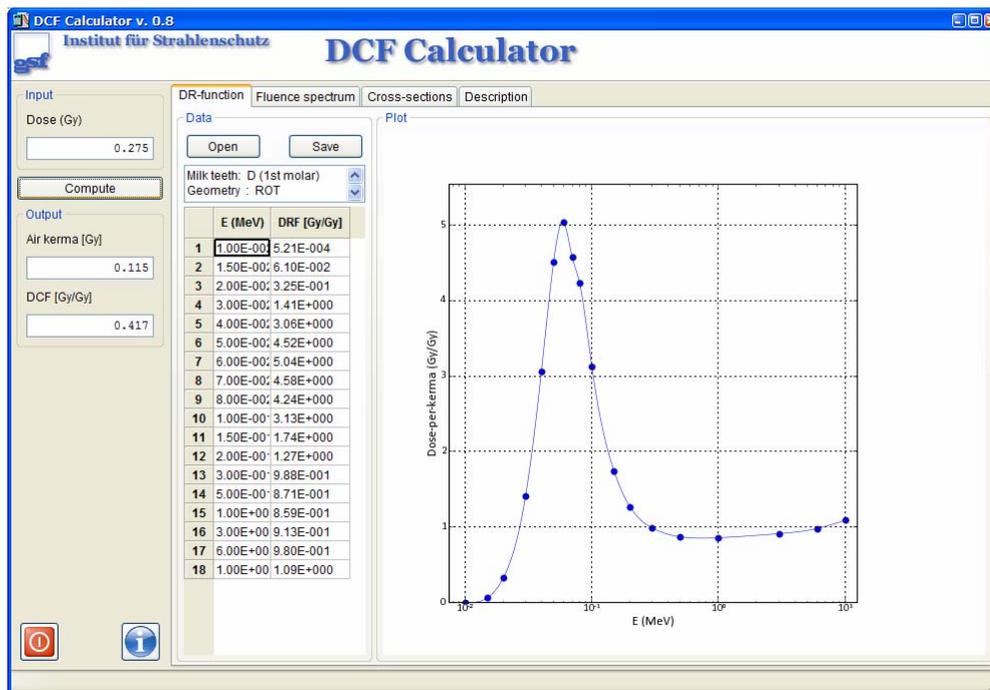
[2] http://matplotlib.sourceforge.net

Fig. A.1. Screenshot of the DCF-Calculator. Shown in the plot windows is dose response function for milk teeth and ROT photon source (see text).
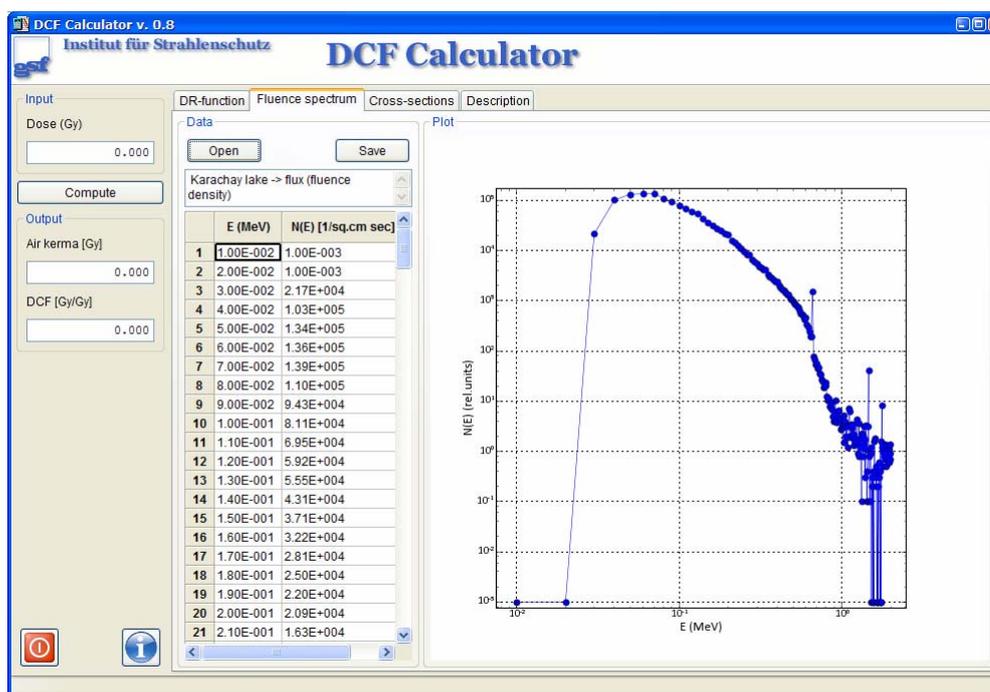

Fig. A.2. Screenshot of the DCF-Calculator. Shown in the plot windows is photon spectrum for environmental source.

The third tab of the notebook window of the software tool shows data used for photon cross-sections in air. Generally, the user uses attenuation data for air, only, because of the DRFs and the ICRP dose coefficients are defined as ratios to air

kerma. However, for the user's convenience data for water and ICRU soft tissue are given as well. The screenshot in Fig. A.3 shows the attenuation factors for air.

As soon as all data are specified the user can compute values of the integral air kerma and DCF by pressing "Compute" button separating input and output groups in the left panel of the software tool. Corresponding values appear then in the field of the output panel (see Fig. A.1)
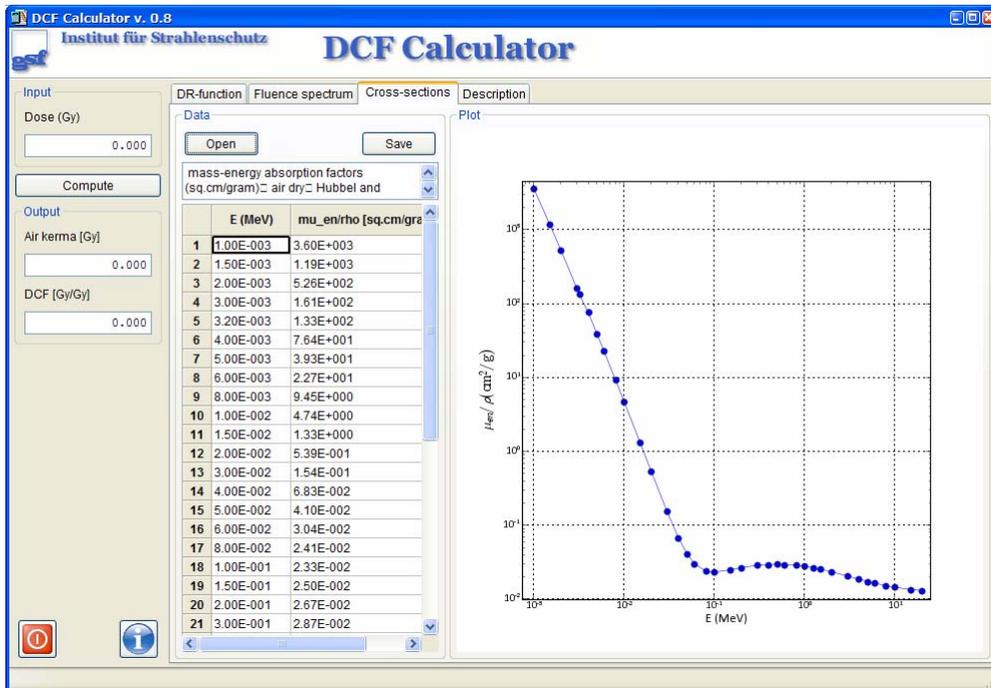

Fig. A.3. Screenshot of the DCF-Calculator. Shown in the plot window are mass-energy absorption coefficients for dry air at sea level.

Current version of the software tool can be further improved by:
a) providing a mechanism for data import from the user-prepared text files;
b) extending functionality of the data table by a data table editor and allowing saving of the user-entered data;
c) developing help system;
d) advancing plotting functionality by providing convenient controls for axis scaling, saving, and printing the plots in bitmap and vector formats.