Spectrum Evaluator - a program for evaluating fluorescence spectra.

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-a program for evaluating fluorescence spectra

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1. Abstract

This report describes the program Spectrum Evaluator. It is a Windows based program for evaluating fluorescence spectra obtained with the EG&G **OMAIII** system and the Spectroscopy Instruments (**SI**) multichannel analyser, using the programs called CSMA and WinSpec. The program is developed in Visual Basic 3.0. A complete program listing is included as an appendix to the report.

2. Introduction

The medical laser physics group at the Atomic Physics Division (Lund Institute of Technology, Sweden) has used laser-induced fluorescence in diagnostic research for many years. Thousands of fluorescence spectra have been obtained from all kind of samples, ranging from rat muscle, oak leaves, oil slicks to malignant tumours *in vivo*. During the last years two kinds of equipment have been used for obtaining the data: an EG&G OMAIII system and a multichannel analyser system manufactured by Spectroscopy Instruments. The OMAIII system and the SI system are briefly described in Refs. 1 and 2, respectively. The purpose of this report is to describe a program called Spectrum Evaluator. The program has been developed to evaluate the fluorescence spectra in a rational way. The program is used under the Microsoft Windows operating environment and it is developed in Microsoft Visual Basic 3.0. The predecessor to this program was developed by Dr. Sune Montán. It was a program called Eval that worked under MS-DOS and used a Hercules graphics card. As we more and more use the Windows environment and Super-VGA graphics, there was a need to develop a new program. Also, Eval could not handle spectra obtained with the Spectroscopy Instruments system. The foundation to Spectrum Evaluator was a program called CSMA2PS which is an MS-DOS program developed in C, and it was initially intended only for converting Spectroscopy Instruments spectra to postscript files to be able to print them out rapidly. As the program evolved it soon became an evaluation program and a new version emerged which soon was converted to a version for handling also the OMAIII spectra.

2.1 Installation

The program has been compressed using the Microsoft Application Setup Wizard. To install the program, insert the installation disk and run the program SETUP.EXE (under Windows). The set-up program will ask for a directory to place the program in and then expand all necessary files into this directory. The program needs the following files:
SPECEVAL.EXE - the program. SPECEVAL.HLP - the help file. CMDIALOG.VBX - Visual Basic control for the common dialogues, in this case the file open, file save and printer set-up dialogues. COMMDLG.DLL - dynamic link library used for the common dialogues. This file is often already present. SSBC.VBX - Visual Basic control for the spreadsheet (FarPoint Technologies, Inc., Richmond, VA, USA). This VBX comes with the Borland Visual Solution Pack. VBRUN300.DLL - the Visual Basic 3.0 run-time library. If the SPECAEVAL.INI file is not present, it will be created by the program.

2.2 Evaluation

The aim of the program is to in a rational way evaluate a large number of fluorescence spectra. The procedure when evaluating is to read the spectrum from the disk, display it, performing various corrections, fit parts of the spectrum to analytical expressions, calculating the intensity at different wavelengths and to print out the spectrum. The corrections that can be performed

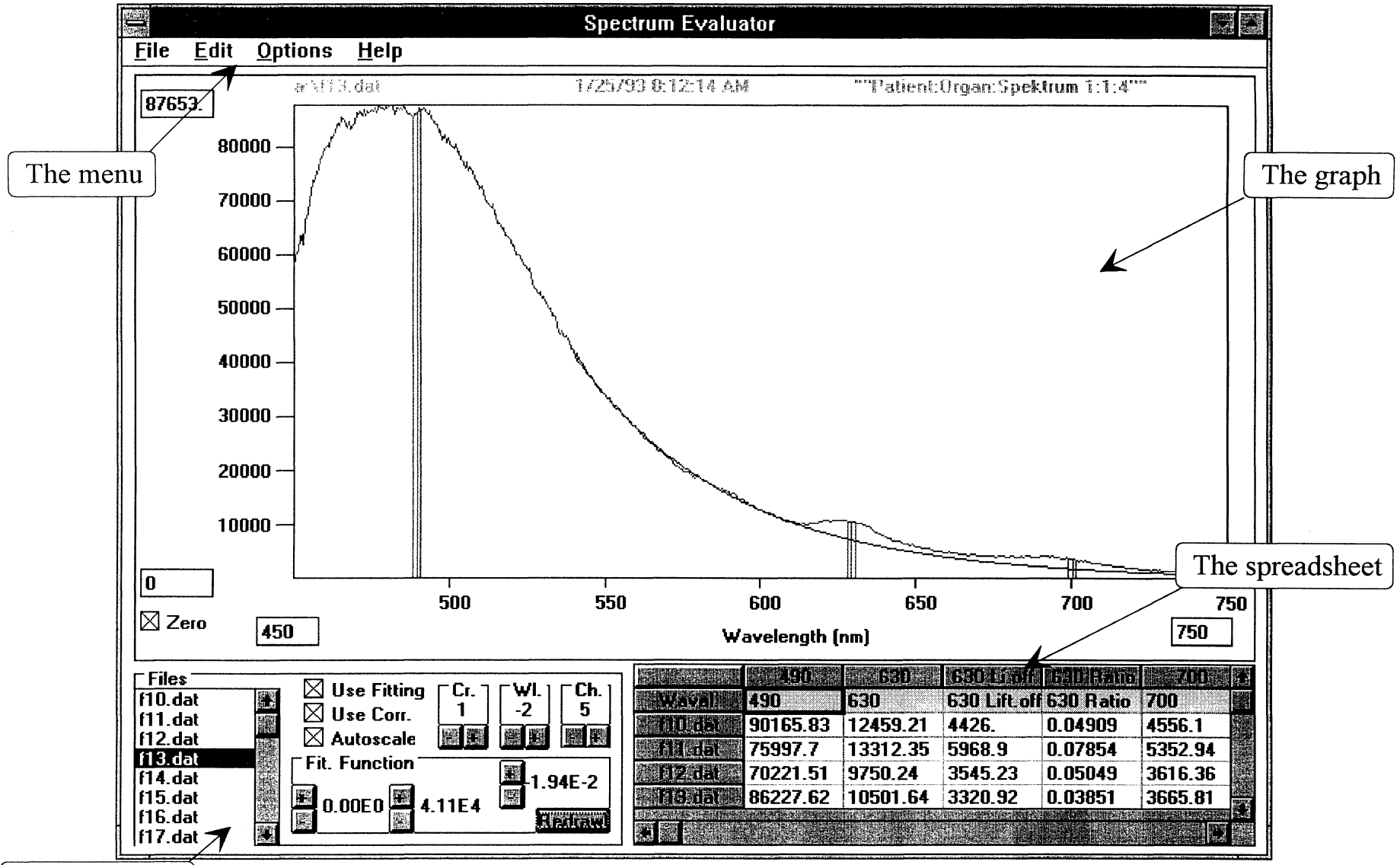

Fig. 1. The main window.

are correction for spectral sensitivity of the detection system and adjust any wavelength misalignments in the spectrum or the correction curve. To correct for the spectral sensitivity of the detection system, a correction curve obtained from a recording of a calibrated black-body radiator is used. See The Correction File section for further details. In the analysis of fluorescence spectra a fitting of an exponential can be performed. The reason for this is that very often the samples from which the fluorescence spectra are taken, consist of tissue with some kind of tumour marker in it, e.g. haematoporphyrin derivative (HPD) or protoporphyrin.[1-4] The tissue has an intrinsic fluorescence (autofluorescence) which is broad and has its maximum at 450-500 nm. The tumour markers fluoresce at a longer wavelength (above 600 nm) and very often this fluorescence sits on a background created by the autofluorescence. To lift off the marker fluorescence from the autofluorescence, the program models the long wavelength wing of the autofluorescence wavelengths with an exponential. The fluorescence contribution from the marker can thus be calculated by taking the difference between the spectrum and this exponential fit.

3. Using The Program

Below follows a brief description of how to use the program. The numbers in parenthesis refer to the section where to find details in this document. The first thing to do when the program has started is to select what type of data to read: OMAIII or SI files (4.1.3). Select the directory where the data is located (4.1.1). If a correction file is to be used, select one (4.1.1) and turn on the correction (4.2.2). Adjust the wavelength scale to the desired region (4.2.1). The vertical scale can also be adjusted (4.2.1) but usually the autoscale function should be turned on (4.2.2). Turn on the fitting function if necessary (4.2.2). Put in the wavelengths to evaluate in the spreadsheet (4.2.3) and adjust the numbers of channel to average over (4.2.2). Try a spectrum and if necessary adjust the wavelength scale and the position of the correction curve (4.2.2). When these initial adjustments have been performed the evaluation can start. Select the file in the file list box (4.2.2). Adjust the fitting manually if necessary (4.2.2). Now repeat these two steps for all files and then save the result from the spreadsheet (4.1.1) or copy it to the clipboard (4.1.2). Many of the initial adjustments are saved when the program is ended and restored when the program is started the next time.

4. The User Interface

Figure 1 shows the user interface. The main window and its components are automatically adjusted to fit any type of screen resolution.

4.1 The Menu

4.1.1 The File Menu

Open Corr File - Brings up the open correction file dialogue box. If OMAIII files are selected (see The Options Menu) this dialogue wants a *.DAT file. The file should be a correction curve created with the OMAIII system. If SI is selected the dialogue wants a *.SPE or a *.PRN file. The *.SPE file should be a raw spectrum from a well defined calibration lamp. The *.PRN file should be a text file exported from the CSMA program. The file contains two columns with wavelength in the first column and intensity in the second. The intensity should be a raw spectrum from the calibration lamp. After the correction curve has been read you will be asked if the program should take the wavelength calibration from the correction curve. If you answer yes the program will not take any

wavelength data from the data files. To turn off this function, uncheck the Options-Wl. from Corr menu command.

Save Result - Brings up the save result dialogue box. The result from the spreadsheet is saved as a text file with tab-delimiter.

Directory - Brings up the directory dialogue box. In this dialogue the working directory is selected by clicking on the appropriate drive and directory. The corresponding data-files in that directory are shown in the file list box in the main window.

Printer Setup - Brings up the printer set-up dialogue box. This dialogue is a regular Windows printer set-up dialogue where the desired printer and its options can be set.

Print Graph - Prints the graph on the chosen printer. The contents of the spreadsheet are printed below the graph.

Exit - Ends the program.

4.1.2 The Edit Menu

Copy Graph - Copies the graph to the clipboard. The graph is copied as two numeric columns corresponding to the wavelength and the intensity as displayed in the program. This format is convenient to paste into a spreadsheet program, such as Excel.

Copy Result - Copies the result from the spreadsheet to the clipboard.

Clear Sheet - Deletes the result in the spreadsheet but keeps the selected evaluation wavelengths.

Clear Wavel. - Deletes the result in the spreadsheet and also the selected evaluation wavelengths. This command starts the spreadsheet from scratch.

4.1.3 The Options Menu

Data Type - Gives the option to select whether the program should read OMAIII files (*.DAT) or SI files (*.SPE).

Add Constant - Brings up the add constant dialogue box. In this dialogue it is possible to add a constant to the spectrum, if e.g. the background has drifted due to temperature fluctuations. See below how the resulting spectrum is calculated.

Label - Brings up the label dialogue box. In this dialogue the label belonging to the file can be changed. This is only for the printout of the graph.

Backgr. File - Brings up the background file dialogue box. In this dialogue a separate background file can be chosen. See below how the resulting spectrum is calculated.

Wl. from Corr. - By unchecking this menu item the program will read the wavelength information from the data files and not from the correction curve.

4.1.4 The Help Menu

Contents - Invokes the help file.

About - Brings up the about box.

4.2 The Main Window

4.2.1 The Graph

The major component of the main window is the graph where the fluorescence spectrum is shown. The graph shows the intensity as a function of wavelength. The graph is red and if an analytical fit is used, the fitting is blue. The evaluated wavelengths are displayed in green. The vertical as well as the horizontal scale can be chosen arbitrarily. Below the graph there are two edit boxes, one to the left and one to the right. With the use of these edit boxes the wavelength

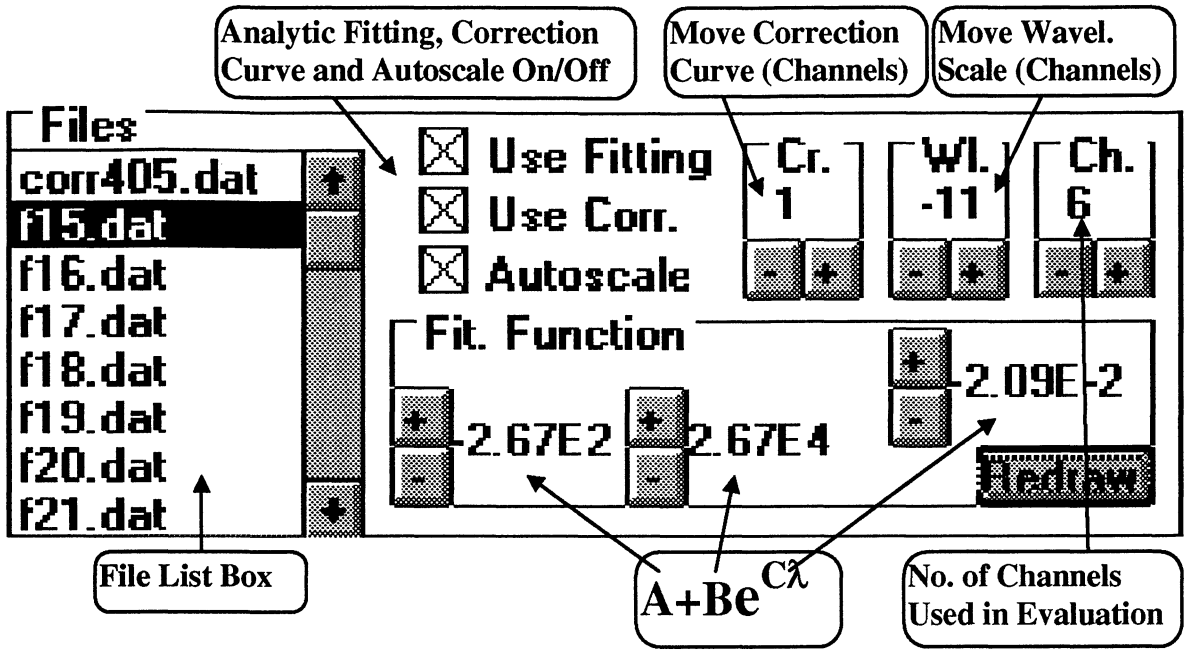

Fig. 2. The utility box.

scale (low and high) can be chosen. To the left of the graph similar edit boxes are located to choose the min.- and max.- intensity to display. The check box, called **Zero**, below left of the graph is used to force the min. value to zero even though the autoscale function is chosen (see The Utility Box). On top of the graph the file name, date and label are displayed.

4.2.2 The Utility Box

The utility box located below the graph contains functions for evaluating the spectrum. See Fig. 2. The file list box (labelled **Files**) shows the data files in the selected directory. By clicking a filename with the left mouse button, the file will be read, displayed and ready for evaluation. There are three check boxes in the utility box. The **Autoscale** check box turns the autoscaling of the graph on or off. If the max.- or min.- intensity is changed manually (see above) the autoscale function will be turned off automatically. The **Use Corr.** check box determines whether to multiply the spectrum with the correction curve or not. The **Use Fitting** check box turns the exponential fit to the curve on or off. When this box is checked you are asked to fill in three wavelengths, which are used to do an initial fit of the exponential to the curve. The wavelengths have to be entered in ascending order and the fit will start at the first entered wavelength. The fitting is displayed in blue colour. The exponential is of the form:

$$A+B\,e^{C\lambda}$$

Where λ is the wavelength. A, B and C are coefficients that are initially determined when the fit is performed. The coefficients can be fine tuned using the + and - buttons in the **Fit. Function** box. If the + or - buttons are clicked with the left mouse button, respective coefficient is altered approximately 1 %. If the buttons are clicked with the right mouse button they are altered approximately 5 %. When the coefficients are fine tuned the graph will zoom in to display only the region which involves the fitting. The wavelength scale will not change, thus it is obsolete during this process. To zoom out and redisplay the graph, click on the button labelled **Redraw**.

In the utility box there are three more small boxes with + and - buttons. The **Cr.** box is used to move the correction curve relative to the fluorescence spectrum. A click on the + or - button will move the correction curve one channel in respective direction. The **Wl.** box is used to

move the wavelength scale +/- one channel for each click. The **Ch.** box is used to set the number of channels to average over when the intensity is evaluated (see The Spreadsheet below).

4.2.3 The Spreadsheet

The spreadsheet located below the graph is used for the actual evaluation of the intensities at different wavelengths. The top row is yellow and it is there the wavelengths of interest are filled in. When the first wavelength is filled in there will appear a new column where it is possible to fill in the next wavelength. This first wavelength is a sort of reference wavelength. When this is filled in there will appear three new columns. The first is called "*** Lift. Off" where *** is the selected wavelength. This column contains the difference between the fluorescence spectrum and the fitted exponential. If the fitting is not turned on a 0 will be displayed. The next column is called "*** Ratio". This shows the ratio between the lifted off intensity and the first selected wavelength (the column furthest to the left). If the fitting is off, the ratio will be taken between the not lifted off intensity and the reference wavelength. The third column is empty and into this a new evaluation wavelength can be filled in. The selected wavelengths are visualised in the graph as green vertical bars where the width is determined by the number of channels to average over (the **Ch.** box). When a new file is selected in the file list box, a new row will be created containing the evaluation results for that curve. The file name will be visible in the grey column to the left. The result from the spreadsheet can be saved as a text file or copied to the clipboard. A warning message will be displayed if the data has not been saved or copied, and you try to exit the program or reset the spreadsheet.

5. Technical Details

5.1 Calculation of the Resulting Spectrum

The resulting spectrum is calculated as:

R[i]=(O[i]-B[i]+K) * C[i+m]

where i is the index, R is the resulting spectrum, O is the original raw curve, B is a separate background file (if selected), K is a constant (if selected), C is the correction curve (if selected) and m is the optional index for moving the correction curve (in the Cr. box). As can be seen the separate background file should be spectrally uncorrected.

5.2 The File Formats

The **OMAIII** system stores its data in a unique file system which can not be read by a MS-DOS PC. The OMA system can convert the data files to the FAT (file allocation table) file system and thus the files can be used on a PC. The PC files are text files and all the data is stored in one column. The first four rows are not used. Then follow the data on the next 1024 rows. In the program the data is read as float. After the data follow two rows with information not used by the program and then the file label. The next 36 rows are not used and then follow the wavelength information, first the wavelength for the first data channel and then the wavelength difference per channel. After this there are more rows, but none of them are used in the program.

The **Spectroscopy Instruments CSMA** and **WinSpec** programs are PC based. The data are stored as binary files. The files from the CSMA program do not contain any wavelength information but this is solved by getting the wavelength data from the correction file. Initially

the header is read, and from this the data type can be extracted (long int. or float). The program checks if the file is from the WinSpec program and in that case the wavelength data are read. It consists of the coefficients to a polynomial up to an order of five. Then follow the data. The data is 578 channels long. The data can be either float or long integers. What type to use depends on how the data are obtained in the CSMA program. The reader is referred to the CSMA manual for further details. In the WinSpec program you select explicitly what type of data you want to use.

5.3 The Correction File

The correction file from the **OMAIII** system is created by the OMA system itself. A spectrum of a well defined calibration lamp is acquired. Then the known intensities from the calibration sheet for the calibration lamp are plugged in and a correction curve is created. The correction file has to be converted to MS-DOS format and then it can be used by multiplying it to any recorded spectrum to correct for the spectral sensitivity of the detection system.
The correction curve in the **SI** system is created in the program. The program wants a spectrum from a calibration lamp which is spectrally well defined. The program uses an equation to model the spectral intensity of a specific lamp, in this case an Oriel 200 W lamp (model no. 63355, serial no. 5_048, 6.5 A).
The correction curve (Corr(λ)) is calculated as:

$$\mathrm{Corr}(\lambda) = \frac{3.023 \cdot 10^{-28} \dfrac{\nu^5}{e^{4.2433 \cdot 10^{-6} \cdot \nu} - 1}}{\mathrm{Org}(\lambda)}$$

where

$$\nu = \frac{1}{(-24.167 + \lambda) \cdot 10^{-9}}$$

Here is λ the wavelength and Org(λ) is the raw lamp spectrum.
If another lamp is used the parameters have to be changed. The correction curve is then normalised to 1 at 570 nm. This normalisation is similar to what the OMAIII system does.

5.4 The SPECEVAL.INI File

When the program is finished some information will be stored in the .INI file. This file will be read the next time the program is launched. Here is an example of a typical file, with comments to the right. Generally, in Visual Basic the value -1 is treated as TRUE and 0 as FALSE:

```
[Spectrum Evaluator]
OMA III=-1                          : -1= OMA III, 0= SI file type
Working Directory=E:\OMA            : Name of directory
Use Correction File=-1              : 0= Use corr. file, -1= Do not use
Correction File=E:\OMA\CORR405.DAT  : Name of corr. file
Move Wavelength Scale=4             : No. of channels to move wavel. scale
Move Correction Curve=-2            : No. of channels to move corr. curve
Display Min Wavelength=450          : Min. wavel. to display
Display Max Wavelength=750          : Max. wavel. to display
No Of Evaluation Channels=5         : No. of channels to evaluate over
Added Constant To Curve=0           : Constant added to curve
Use Spectrum Wavel.=-1              : -1= Use wavel. from data files, 0= Use
                                      from correction curve
```

6. References

1. S. Andersson-Engels, Å. Elner, J. Johansson, S.-E. Karlsson, L. G. Salford, L.-G. Strömblad, K. Svanberg, and S. Svanberg, "Clinical recordings of laser-induced fluorescence spectra for evaluation of tumour demarcation feasibility in selected clinical specialities," Lasers Med. Sci. **6,** 415-424 (1991).

2. H. Nilsson, J. Johansson, K. Svanberg, S. Svanberg, G. Jori, E. Reddi, A. Segalla, D. Gust, A. L. Moore, and T. A. Moore, "Laser-induced fluorescence in malignant and normal tissue in mice injected with two different carotenoporphyrins," Brit. J. Cancer **70**, 873-879 (1994).

3. L. Baert, R. Berg, M. A. D'Hallewin, J. Johansson, K. Svanberg, and S. Svanberg, "Localization of superficial bladder tumours using low-dose HpD and laser-induced fluorescence," J. Urology **41,** 322-330 (1993).

4. K. Svanberg, T. Andersson, D. Killander, I. Wang, U. Stenram, S. Andersson-Engels, R. Berg, J. Johansson, and S. Svanberg, "Photodynamic therapy of non-melanoma malignant tumours of the skin utilizing topical δ-amino levulinic acid sensitization and laser irradiation," Br. J. Dermatol. **130,** 743-751 (1994).

7. File Listings

7.1 SPECMOD.BAS

```
Option Explicit
Declare Function WinHelp Lib "User" (ByVal hwnd As Integer, ByVal
                        HelpFile$, ByVal wCommand As Integer,
                        ByVal dwData As Long) As Integer
Global OMAIII As Integer
Global MAXARR As Integer
Global InpMask As String
Global Label As String
Global Datum As String
Global Tid As String
Global CurrentFile As String
Global CorrFile As String
Global OrgArr(1023) As Single
Global GraphArr(1023) As Single
Global CorrArr(1023) As Single
Global WavelArr(1023) As Single
Global WOrgArr(1023) As Single
Global BackArr(1023) As Single
Global WavelStart As Single
Global DeltaWavel As Single
Global WStartGraph As Single
Global MaxVal As Single
Global MinVal As Single
Global DispMinVal As Integer
Global DispMaxVal As Integer
Global AutoScale As Integer
Global UseCorr As Integer
Global MoveCorr As Integer
Global MoveWavel As Integer
Global DrawFit As Integer
Global FitStart As Single
Global FitMid As Single
Global FitStop As Single
Global FitA As Single
Global FitB As Single
Global FitC As Single
Global EvalWavel(1 To 16) As Single
Global NoOfEvWavel As Integer
Global NoOfEvChans As Integer
Global CurrRow As Integer
Global AddCon As Single
Global Start As Integer
Global Stopp As Integer
Global DrawM As Integer
Global Modified As Integer
Global MStart As Integer
Global ForceZero As Integer
Global HelpFilePath As String
Global UseFloat As Integer
Global UseSpWl As Integer
***********************************
 Static Sub CalcArray ()
   Dim i As Integer

   For i = 0 To MAXARR
      If UseCorr Then
         If i + MoveCorr < 0 Or i + MoveCorr > MAXARR Then
            GraphArr(i) = 0
         Else
            GraphArr(i) = (OrgArr(i) - BackArr(i) + AddCon) *
                              CorrArr(i + MoveCorr)
         End If
      Else
         GraphArr(i) = OrgArr(i) - BackArr(i) + AddCon
      End If

      If i + MoveWavel < 0 Or i + MoveWavel > MAXARR Then
         WavelArr(i) = WavelStart + DeltaWavel * (i + MoveWavel)
      Else
         WavelArr(i) = WOrgArr(i + MoveWavel)
      End If
   Next
   WStartGraph = WavelStart

End Sub
***********************************
 Static Sub CalcFit ()
    On Error GoTo Logerr
    Dim i, j, k, l, s, t As Integer
    Dim sdump1, sdump2 As Single

    s = True
    t = True
    For i = 0 To MAXARR
       If WavelArr(i) > FitStart And s Then
          s = False
          j = i
       End If
       If WavelArr(i) > FitMid And t Then
          t = False
          l = i
       End If
       If WavelArr(i) > FitStop Then
          k = i
          Exit For
       End If
    Next
    FitA = 0
    Form1!OffLabel = Format(FitA, "0.00E-0")
    FitB = GraphArr(j)
    Form1!AmpLabel = Format(FitB, "0.00E-0")
    sdump1 = (Log(GraphArr(k)) - Log(GraphArr(j))) / (WavelArr(k)
                        - WavelArr(j))
    sdump2 = (Log(GraphArr(l)) - Log(GraphArr(j))) / (WavelArr(l) -
                        WavelArr(j))
    FitC = (sdump1 + sdump2) / 2
    Form1!ExpLabel = Format(FitC, "0.00E-0")
    Exit Sub
Logerr:

   MsgBox "Fitting incorrect!", 48, "Log Error"
   Exit Sub

End Sub
***********************************
 Static Sub DrawGraph ()
   Dim i, s, j As Integer
   Dim x As Single
   Dim y As Single
   Dim Steg2 As Single
   Dim CurrVal As Single
   Dim Steg As Long
   Dim CurrWl As Long
   Dim sdump, sdump2 As Single
   Dim RefWl As Single

   If DrawM = 1 Then
      If Not DrawFit Then Exit Sub
      Form1!Graph.Line (.02, .02)-(9.97, 9.97), RGB(255, 255, 255),
                        BF
      Start = MStart
      GoTo Dr1
   End If

   Start = 0
   Stopp = MAXARR
   For i = 0 To MAXARR
      If WavelArr(i) >= DispMinVal And Start = 0 Then Start = i
      If WavelArr(i) >= DispMaxVal And Stopp = MAXARR Then
                        Stopp = i
   Next
```

```
142
143     If Start >= Stopp Then
144        Stopp = Start + 10
145     End If
146
147     If AutoScale Then
148        MaxVal = -100000
149        MinVal = 100000
150        For i = Start To Stopp
151           If GraphArr(i) > MaxVal Then MaxVal = GraphArr(i)
152           If GraphArr(i) < MinVal Then MinVal = GraphArr(i)
153        Next
154        If ForceZero Then MinVal = 0
155        Form1!Text3.Text = CStr(MinVal)
156        Form1!Text4.Text = CStr(MaxVal)
157     End If
158     If MaxVal <= MinVal Then
159        MaxVal = MinVal + 1
160     End If
161
162     Form1!Graph.Cls
163     Form1!Graph.Line (0, 0)-(10, 0), RGB(0, 0, 0)
164     Form1!Graph.Line -(10, 10), RGB(0, 0, 0)
165     Form1!Graph.Line -(0, 10), RGB(0, 0, 0)
166     Form1!Graph.Line -(0, 0), RGB(0, 0, 0)
167
168     Steg2 = 10 ^ Int(Log(MaxVal - MinVal) / Log(10))
169     If (MaxVal - MinVal) / Steg2 < 2 Then
170        Steg2 = Steg2 / 5
171     ElseIf (MaxVal - MinVal) / Steg2 < 5 Then
172        Steg2 = Steg2 / 2
173     End If
174
175     CurrVal = Steg2 * (Int(MinVal / Steg2) + 1)
176     Do
177        y = 10 * (CurrVal - MinVal) / (MaxVal - MinVal)
178        Form1!Graph.CurrentX = 0
179        Form1!Graph.CurrentY = y
180        Form1!Graph.Line -Step(-.2, 0), RGB(0, 0, 0)
181        If CurrVal = 0 Then Form1!Graph.Line -Step(10.2, 0), RGB(0, 0,
182                                0)
183        Form1!Graph.CurrentX = -
184                                Form1!Graph.TextWidth(CStr(CurrVal)) -
185                                .3
186        Form1!Graph.CurrentY = y +
187                                Form1!Graph.TextHeight(CStr(CurrVal)) /
188                                2
189        Form1!Graph.Print CurrVal
190        CurrVal = CurrVal + Steg2
191     Loop Until CurrVal > MaxVal
192
193     Steg = 10 ^ Int(Log(WavelArr(Stopp) - WavelArr(Start)) / Log(10))
194     If (WavelArr(Stopp) - WavelArr(Start)) / Steg < 2 Then
195        Steg = Steg / 5
196     ElseIf (WavelArr(Stopp) - WavelArr(Start)) / Steg < 5 Then
197        Steg = Steg / 2
198     End If
199
200     CurrWl = Steg * (Int(WavelArr(Start) / Steg) + 1)
201     For i = Start To Stopp
202        If WavelArr(i) >= CurrWl Then
203           x = 10 * (CurrWl - WavelArr(Start)) / (WavelArr(Stopp) -
204                                WavelArr(Start))
205           Form1!Graph.CurrentX = x
206           Form1!Graph.CurrentY = 0
207           Form1!Graph.Line -Step(0, -.2), RGB(0, 0, 0)
208           Form1!Graph.CurrentX = x -
209                                Form1!Graph.TextWidth(CStr(CurrWl)) / 2
210           Form1!Graph.CurrentY = -.3
211           Form1!Graph.Print CurrWl
212           CurrWl = CurrWl + Steg
213        End If
214     Next
215     Form1!Graph.CurrentX = 4.6
216     Form1!Graph.CurrentY = -1
217     Form1!Graph.Print "Wavelength (nm)"
218
219  Dr1:
220     For i = Start To Stopp
221        x = 10 * (WavelArr(i) - WavelArr(Start)) / (WavelArr(Stopp) -
222                                WavelArr(Start))
223        y = 10 * (GraphArr(i) - MinVal) / (MaxVal - MinVal)
224        If y >= 10 Then y = 9.98
225        If y <= 0 Then y = .02
226        If i = Start Then
227           Form1!Graph.CurrentX = x
228           Form1!Graph.CurrentY = y
229        Else
230           Form1!Graph.Line -(x, y), RGB(255, 0, 0)
231        End If
232     Next
233
234     If DrawFit Then
235        s = True
236        For i = Start To Stopp
237           If WavelArr(i) >= FitStart Then
238              x = 10 * (WavelArr(i) - WavelArr(Start)) / (WavelArr(Stopp)
239                                - WavelArr(Start))
240              y = 10 * (FitA + FitB * Exp(FitC * (WavelArr(i) - FitStart)) -
241                                MinVal) / (MaxVal - MinVal)
242              If y >= 10 Then y = 9.98
243              If y <= 0 Then y = .02
244              If s Then
245                 Form1!Graph.CurrentX = x
246                 Form1!Graph.CurrentY = y
247                 s = False
248              Else
249                 Form1!Graph.Line -(x, y), RGB(0, 0, 255)
250              End If
251           Else
252              MStart = i
253           End If
254        Next
255     End If
256
257     If DrawM = 0 Then
258        If NoOfEvWavel > 0 Then
259           Form1!Spread1.Row = CurrRow
260           For s = 1 To NoOfEvWavel
261              For j = 0 To MAXARR
262               If EvalWavel(s) <= WavelArr(j) Then Exit For
263              Next j
264              sdump = 0
265              sdump2 = 0
266              For i = j - NoOfEvChans / 2 To j - NoOfEvChans / 2 +
267                                NoOfEvChans - 1
268                 x = 10 * (WavelArr(i) - WavelArr(Start)) /
269                                (WavelArr(Stopp) - WavelArr(Start))
270                 y = 10 * (GraphArr(i) - MinVal) / (MaxVal - MinVal)
271                 If y >= 10 Then y = 9.98
272                 If y <= 0 Then y = .02
273                 If x >= 10 Then x = 9.98
274                 If x <= 0 Then x = .02
275                 Form1!Graph.CurrentX = x
276                 Form1!Graph.CurrentY = y
277                 Form1!Graph.Line -(x, 0), RGB(0, 255, 0)
278                 sdump = sdump + GraphArr(i)
279                 If DrawFit Then sdump2 = sdump2 + (GraphArr(i) - (FitA
280                                + FitB * Exp(FitC * (WavelArr(i) -
281                                FitStart))))
282              Next i
283              sdump = sdump / NoOfEvChans
284              sdump2 = sdump2 / NoOfEvChans
285              If s = 1 Then
286                 Form1!Spread1.Col = 1
287                 Form1!Spread1.Text = Format(sdump, "#####0.##")
288                 RefWl = sdump
289              Else
290                 Form1!Spread1.Col = (s - 2) * 3 + 2
291                 Form1!Spread1.Text = Format(sdump, "#####0.##")
292                 Form1!Spread1.Col = (s - 2) * 3 + 3
293                 Form1!Spread1.Text = Format(sdump2, "#####0.##")
```

```
            Form1!Spread1.Col = (s - 2) * 3 + 4
            If DrawFit Then
              Form1!Spread1.Text = Format(sdump2 / RefWl,
                    "0.#####")
            Else
              Form1!Spread1.Text = Format(sdump / RefWl,
                    "0.#####")
            End If
          End If

        Next s
      End If
    End If
    DrawM = 0
End Sub
'***********************************
Sub GetArray ()
    On Error GoTo Errh96
    Dim Ts
    Dim Dump As String
    Dim i, j, Order As Integer
    Dim fdump As Single
    Static Chrs As String * 1
    Dim ldump As Long
    Static Coeffs(0 To 5) As Double

    If OMAIII Then
      Open CurrentFile For Input As 1
      For i = 1 To 4
        Input #1, fdump
      Next
      For i = 0 To MAXARR
        Input #1, OrgArr(i)
      Next
      For i = 1 To 2
        Input #1, fdump
      Next
      Label = ""
      Do
        Chrs$ = Input(1, #1)
        If Asc(Chrs$) = 13 Then Exit Do
        Label = Label + Chrs$
      Loop
      For i = 1 To 36
        Input #1, fdump
      Next
      Input #1, WavelStart
      Input #1, DeltaWavel

      Close #1
      If UseSpWl Then
        For i = 0 To MAXARR
          WOrgArr(i) = WavelStart + DeltaWavel * i
        Next
      End If

      Form1!LabelLabel = Label
    Else
      Open CurrentFile For Binary As #1
      For i = 1 To 27
        Get #1, , ldump
      Next
      Get #1, , j
      UseFloat = False
      If j = 0 Then UseFloat = True
      Get #1, , j
      For i = 1 To 721
        Get #1, , ldump
      Next
      Get #1, , ldump
      If ldump = &H1234567 And UseSpWl Then
        For i = 1 To 102
          Get #1, , Chrs
        Next
        Order = Asc(Chrs)
        For i = 1 To 161
          Get #1, , Chrs
        Next
        For i = 0 To 5
          Get #1, , Coeffs(i)
        Next
        For i = 0 To MAXARR
          WOrgArr(i) = 0
          For j = 0 To Order
            WOrgArr(i) = WOrgArr(i) + Coeffs(j) * (i ^ j)
          Next
        Next
        For i = 1 To 797
          Get #1, , Chrs
        Next
      Else
        For i = 1 To 275
          Get #1, , ldump
        Next
      End If

      For i = 0 To MAXARR
        If UseFloat Then
          Get #1, , fdump
          OrgArr(i) = fdump
        Else
          Get #1, , ldump
          OrgArr(i) = ldump
        End If
      Next
      Close #1
      WavelStart = WOrgArr(1)
      DeltaWavel = WOrgArr(2) - WOrgArr(2)
      Form1!LabelLabel = ""
    End If
    Ts = FileDateTime(CurrentFile)
    Datum = Format(Ts, "General Date")
    Form1!DateLabel = Datum
    Form1!FileLabel = CurrentFile
    Exit Sub
Errh96:
    Exit Sub
End Sub
'***********************************
Function Help_File_In_Path ()
    Dim Path As String, CurrentDir As String
    Dim Found, SemiColon As Integer

    On Error Resume Next
    CurrentDir = App.Path
    If Right$(CurrentDir, 1) <> "\" Then CurrentDir = CurrentDir + "\"
    Found = Dir$(CurrentDir + "SPECEVAL.HLP") <> ""
    If Not Found Then
      Path = Environ$("PATH")
      If Path <> "" Then
        If Right$(Path, 1) <> ";" Then Path = Path + ";"
        SemiColon = InStr(Path, ";")
        Do
          CurrentDir = Left$(Path, SemiColon - 1)
          If Right$(CurrentDir, 1) <> "\" Then CurrentDir =
                    CurrentDir + "\"
          Found = Dir$(CurrentDir + "SPECEVAL.HLP") <> ""
          Path = Right$(Path, Len(Path) - SemiColon)
          SemiColon = InStr(Path, ";")
        Loop While ((SemiColon <> 0) And Not Found)
      End If
    End If
    If Found Then
      HelpFilePath = CurrentDir + "SPECEVAL.HLP"
      App.HelpFile = CurrentDir + "SPECEVAL.HLP"
    End If
    Help_File_In_Path = Found

    On Error GoTo 0

End Function
```

7.2 SPECEVAL.FRM

```
VERSION 2.00
Begin Form Form1
  Caption      = "Spectrum Evaluator"
  ClientHeight = 7530
  ClientLeft   = 4260
  ClientTop    = 2010
  ClientWidth  = 9840
  ClipControls = 0 'False
  Height       = 8220
  Icon         = SPECEVAL.FRX:0000
  Left         = 4200
  LinkTopic    = "Form1"
  ScaleHeight  = 9.525
  ScaleMode    = 6 'Millimeter
  ScaleWidth   = 9.525
  Top          = 1380
  Width        = 9960
  Begin SpreadSheet Spread1
    FontBold      = -1 'True
    FontItalic    = 0 'False
    FontName      = "MS Sans Serif"
    FontSize      = 8.25
    FontStrikethru = 0 'False
    FontUnderline = 0 'False
    Height        = 1815
    Left          = 5400
    TabIndex      = 35
    Top           = 5520
    Width         = 4095
  End
  Begin Frame Frame1
    Caption     = "Files"
    Height      = 1812
    Left        = 120
    TabIndex    = 12
    Top         = 5520
    Width       = 4812
    Begin FileListBox File1
      Height      = 1590
      Left        = 0
      TabIndex    = 0
      Top         = 240
      Width       = 1455
    End
    Begin CheckBox Check1
      Caption     = "Autoscale"
      Height      = 252
      Left        = 1680
      TabIndex    = 6
      Top         = 600
      Width       = 1092
    End
    Begin CheckBox Check2
      Caption     = "Use Corr."
      Height      = 252
      Left        = 1680
      TabIndex    = 7
      Top         = 360
      Width       = 1212
    End
    Begin Frame Frame5
      Caption     = "Cr."
      Height      = 732
      Left        = 3000
      TabIndex    = 8
      Top         = 120
      Width       = 492
      Begin CommandButton CBCrMin
        Caption     = "-"
        Height      = 252
        Left        = 0
        TabIndex    = 9
        Top         = 480
        Width       = 252
      End
      Begin CommandButton CBCrPlu
        Caption     = "+"
        Height      = 252
        Left        = 240
        TabIndex    = 10
        Top         = 480
        Width       = 252
      End
      Begin Label CorrLabel
        Alignment   = 2 'Center
        Height      = 252
        Left        = 120
        TabIndex    = 11
        Top         = 240
        Width       = 252
      End
    End
    Begin Frame Frame2
      Caption     = "Wl."
      Height      = 732
      Left        = 3600
      TabIndex    = 28
      Top         = 120
      Width       = 492
      Begin CommandButton CBWlMin
        Caption     = "-"
        Height      = 252
        Left        = 0
        TabIndex    = 30
        Top         = 480
        Width       = 252
      End
      Begin CommandButton CBWlPlu
        Caption     = "+"
        Height      = 252
        Left        = 240
        TabIndex    = 29
        Top         = 480
        Width       = 252
      End
      Begin Label WavelLabel
        Alignment   = 2 'Center
        Height      = 252
        Left        = 120
        TabIndex    = 31
        Top         = 240
        Width       = 252
      End
    End
    Begin CheckBox Check3
      Caption     = "Use Fitting"
      Height      = 252
      Left        = 1680
      TabIndex    = 27
      Top         = 120
      Width       = 1212
    End
    Begin Frame Frame3
      Caption     = "Fit. Function"
      Height      = 852
      Left        = 1560
      TabIndex    = 17
      Top         = 840
      Width       = 3132
      Begin CommandButton CBRedraw
        Caption     = "Redraw"
        Height      = 252
        Left        = 2400
        TabIndex    = 34
        Top         = 600
        Width       = 732
      End
      Begin CommandButton CBAPlu
        Caption     = "+"
```

```
      Height      = 252
      Left        = 0
      TabIndex    = 23
      Top         = 360
      Width       = 252
    End
    Begin CommandButton CBAMin
      Caption     = "-"
      Height      = 252
      Left        = 0
      TabIndex    = 22
      Top         = 600
      Width       = 252
    End
    Begin CommandButton CBBPlu
      Caption     = "+"
      Height      = 252
      Left        = 960
      TabIndex    = 21
      Top         = 360
      Width       = 252
    End
    Begin CommandButton CBBMin
      Caption     = "-"
      Height      = 252
      Left        = 960
      TabIndex    = 20
      Top         = 600
      Width       = 252
    End
    Begin CommandButton CBCPlu
      Caption     = "+"
      Height      = 252
      Left        = 2040
      TabIndex    = 19
      Top         = 120
      Width       = 252
    End
    Begin CommandButton CBCMin
      Caption     = "-"
      Height      = 252
      Left        = 2040
      TabIndex    = 18
      Top         = 360
      Width       = 252
    End
    Begin Label OffLabel
      Alignment   = 2 'Center
      Height      = 252
      Left        = 240
      TabIndex    = 26
      Top         = 480
      Width       = 732
    End
    Begin Label AmpLabel
      Alignment   = 2 'Center
      Height      = 252
      Left        = 1200
      TabIndex    = 25
      Top         = 480
      Width       = 732
    End
    Begin Label ExpLabel
      Alignment   = 2 'Center
      Height      = 252
      Left        = 2280
      TabIndex    = 24
      Top         = 240
      Width       = 732
    End
  End
  Begin Frame Frame4
    Caption     = "Ch."
    Height      = 732
    Left        = 4200
    TabIndex    = 13
    Top         = 120
    Width       = 492
    Begin CommandButton CBChMin
      Caption     = "-"
      Height      = 252
      Left        = 0
      TabIndex    = 15
      Top         = 480
      Width       = 252
    End
    Begin CommandButton CBChPlu
      Caption     = "+"
      Height      = 252
      Left        = 240
      TabIndex    = 14
      Top         = 480
      Width       = 252
    End
    Begin Label ChanLabel
      Alignment   = 2 'Center
      Height      = 252
      Left        = 120
      TabIndex    = 16
      Top         = 240
      Width       = 252
    End
  End
End
Begin CommonDialog CMDialog1
  DialogTitle   = "Open Corr File"
  Filter        = "OMAIII file (*.DAT)|*.DAT|CSMA file
                  (*.SPE)|*.SPE|CSMA text file
                  (*.PRN)|*.PRN"
  Left          = 5040
  Top           = 6840
End
Begin PictureBox Graph
  ClipControls  = 0 'False
  Height        = 5052
  Left          = 120
  ScaleHeight   = -12.877
  ScaleLeft     = -2
  ScaleMode     = 0 'User
  ScaleTop      = 11
  ScaleWidth    = 13
  TabIndex      = 1
  Top           = 120
  Width         = 9636
  Begin TextBox DateLabel
    BorderStyle = 0 'None
    Enabled     = 0 'False
    Height      = 195
    Left        = 1320
    TabIndex    = 38
    Top         = 1560
    Width       = 2532
  End
  Begin TextBox FileLabel
    BorderStyle = 0 'None
    Enabled     = 0 'False
    Height      = 195
    Left        = 1320
    TabIndex    = 4
    Top         = 960
    Width       = 2052
  End
  Begin TextBox LabelLabel
    BackColor   = &H00FFFFFF&
    BorderStyle = 0 'None
    Enabled     = 0 'False
    ForeColor   = &H00000000&
    Height      = 195
    Left        = 2040
    TabIndex    = 5
    Top         = 360
    Width       = 2772
```

```
    End
    Begin CheckBox ChkZero
      Caption      = "Zero"
      Height       = 30
      Left         = 120
      TabIndex     = 36
      Top          = 4560
      Width        = 855
    End
    Begin TextBox Text2
      Height       = 285
      Left         = 8520
      TabIndex     = 33
      Top          = 4680
      Width        = 612
    End
    Begin TextBox Text1
      Height       = 285
      Left         = 1200
      MaxLength    = 4
      TabIndex     = 32
      Top          = 4680
      Width        = 612
    End
    Begin TextBox Text4
      Height       = 285
      Left         = 120
      TabIndex     = 3
      Top          = 120
      Width        = 612
    End
    Begin TextBox Text3
      Height       = 285
      Left         = 120
      TabIndex     = 2
      Top          = 4200
      Width        = 612
    End
    Begin Label Label1
      Caption      = "Label1"
      Height       = 15
      Left         = 1440
      TabIndex     = 37
      Top          = 1320
      Width        = 2415
    End
  End
  Begin Menu mnuFile
    Caption      = "&File"
    Begin Menu mnuOpenCFile
      Caption      = "&Open Corr File"
    End
    Begin Menu mnuSave
      Caption      = "&Save Result"
    End
    Begin Menu mnuDirectory
      Caption      = "&Directory"
    End
    Begin Menu mnuSep2
      Caption      = "-"
    End
    Begin Menu mnuPrSetUp
      Caption      = "Printer Set&up"
    End
    Begin Menu mnuPrint
      Caption      = "&Print Graph"
    End
    Begin Menu mnuSep
      Caption      = "-"
    End
    Begin Menu mnuExit
      Caption      = "E&xit"
    End
  End
  Begin Menu mnuEdit
    Caption      = "&Edit"
    Begin Menu mnuCpyGrp
      Caption      = "Copy &Graph"
    End
    Begin Menu mnuCpyRes
      Caption      = "&Copy Result"
      Shortcut     = ^{INSERT}
    End
    Begin Menu mnuSep4
      Caption      = "-"
    End
    Begin Menu mnuClear
      Caption      = "Clear &Sheet"
    End
    Begin Menu mnuSep5
      Caption      = "-"
    End
    Begin Menu mnuClWav
      Caption      = "Clear &Wavel."
    End
  End
  Begin Menu mnuOptions
    Caption      = "&Options"
    Begin Menu mnuDataType
      Caption      = "&Data Type"
      Begin Menu mnuOMAIII
        Caption      = "&OMA III"
      End
      Begin Menu mnuCSMA
        Caption      = "&CSMA"
      End
    End
    Begin Menu mnuAddCon
      Caption      = "&Add Const."
    End
    Begin Menu mnuLabel
      Caption      = "&Label"
    End
    Begin Menu mnuBackFile
      Caption      = "&Backgr. File"
    End
    Begin Menu mnuSep6
      Caption      = "-"
    End
    Begin Menu mnuWl
      Caption      = "&Wl. from Corr"
    End
  End
  Begin Menu mnuHelp
    Caption      = "&Help"
    Begin Menu mnuCont
      Caption      = "&Contents"
      Shortcut     = {F1}
    End
    Begin Menu mnuSep3
      Caption      = "-"
    End
    Begin Menu mnuAbout
      Caption      = "&About"
    End
  End
End
Option Explicit
'************************************
Sub CBAMin_MouseDown (Button As Integer, Shift As Integer, X As
                      Single, Y As Single)
  If Button = 1 Then
    FitA = FitA - FitB * .01
  Else
    FitA = FitA - FitB * .05
  End If
  OffLabel = Format(FitA, "0.00E-0")
  DrawM = 1
  If NoOfEvWavel > 0 Then Modified = True
  DrawGraph
End Sub
'************************************
```

```
Sub CBAPlu_MouseDown (Button As Integer, Shift As Integer, X As
                      Single, Y As Single)
  If Button = 1 Then
    FitA = FitA + FitB * .01
  Else
    FitA = FitA + FitB * .05
  End If
  OffLabel = Format(FitA, "0.00E-0")
  If NoOfEvWavel > 0 Then Modified = True
  DrawM = 1
  DrawGraph
End Sub
**********************************
Sub CBBMin_MouseDown (Button As Integer, Shift As Integer, X As
                      Single, Y As Single)
  If Button = 1 Then
    FitB = FitB * .99
  Else
    FitB = FitB * .95
  End If
  AmpLabel = Format(FitB, "0.00E-0")
  If NoOfEvWavel > 0 Then Modified = True
  DrawM = 1
  DrawGraph
End Sub
**********************************
Sub CBBPlu_MouseDown (Button As Integer, Shift As Integer, X As
                      Single, Y As Single)
  If Button = 1 Then
    FitB = FitB * 1.01
  Else
    FitB = FitB * 1.05
  End If
  AmpLabel = Format(FitB, "0.00E-0")
  If NoOfEvWavel > 0 Then Modified = True
  DrawM = 1
  DrawGraph
End Sub
**********************************
Sub CBChMin_Click ()
  If NoOfEvChans > 1 Then
  NoOfEvChans = NoOfEvChans - 1
  ChanLabel = CStr(NoOfEvChans)
  If NoOfEvWavel > 0 Then Modified = True
  DrawGraph
  End If
End Sub
**********************************
Sub CBChPlu_Click ()
  NoOfEvChans = NoOfEvChans + 1
  ChanLabel = CStr(NoOfEvChans)
  If NoOfEvWavel > 0 Then Modified = True
  DrawGraph
End Sub
**********************************
Sub CBCMin_MouseDown (Button As Integer, Shift As Integer, X As
                      Single, Y As Single)
  If Button = 1 Then
    FitC = FitC * .99
  Else
    FitC = FitC * .95
  End If
  ExpLabel = Format(FitC, "0.00E-0")
  If NoOfEvWavel > 0 Then Modified = True
  DrawM = 1
  DrawGraph
End Sub
**********************************
Sub CBCPlu_MouseDown (Button As Integer, Shift As Integer, X As
                      Single, Y As Single)
  If Button = 1 Then
    FitC = FitC * 1.01
  Else
    FitC = FitC * 1.05
  End If
  ExpLabel = Format(FitC, "0.00E-0")
  If NoOfEvWavel > 0 Then Modified = True
  DrawM = 1
  DrawGraph
End Sub
**********************************
Sub CBCrMin_Click ()
  MoveCorr = MoveCorr - 1
  CorrLabel.Caption = CStr(MoveCorr)
  If NoOfEvWavel > 0 And UseCorr Then Modified = True
  CalcArray
  DrawGraph
End Sub
**********************************
Sub CBCrPlu_Click ()
  MoveCorr = MoveCorr + 1
  CorrLabel.Caption = CStr(MoveCorr)
  If NoOfEvWavel > 0 And UseCorr Then Modified = True
  CalcArray
  DrawGraph
End Sub
**********************************
Sub CBRedraw_Click ()
  DrawM = 0
  DrawGraph
End Sub
**********************************
Sub CBWlMin_Click ()
  MoveWavel = MoveWavel - 1
  WavelLabel.Caption = CStr(MoveWavel)
  If NoOfEvWavel > 0 Then Modified = True
  CalcArray
  DrawGraph
End Sub
**********************************
Sub CBWlPlu_Click ()
  MoveWavel = MoveWavel + 1
  WavelLabel.Caption = CStr(MoveWavel)
  If NoOfEvWavel > 0 Then Modified = True
  CalcArray
  DrawGraph
End Sub
**********************************
 Static Sub Check1_Click ()
  If Check1.Value = 1 Then
    AutoScale = True
    DrawGraph
  Else
    AutoScale = False
  End If
End Sub
**********************************
Sub Check2_Click ()
  If Check2.Value = 1 Then
    UseCorr = True
  Else
    UseCorr = False
  End If
  If NoOfEvWavel > 0 Then Modified = True
  CalcArray
  If DrawFit Then CalcFit
  DrawGraph
End Sub
**********************************
Sub Check3_Click ()
  On Error GoTo Errh13
  Dim dump As Single
  dump = FitStart
  If Check3.Value = 1 Then
    FitStart = InputBox("Enter start wavelength for fitting.", "Fitting
                        Start", CStr(FitStart))
    FitMid = InputBox("Enter middle wavelength for fitting.", "Fitting
                        Start", CStr(FitMid))
    FitStop = InputBox("Enter stop wavelength for fitting.", "Fitting
                        Stop", CStr(FitStop))
    DrawFit = True
    CalcFit
```

```
    Else
      DrawFit = False
    End If
    If NoOfEvWavel > 0 Then Modified = True
    CalcArray
    DrawGraph
    Exit Sub

Errh13:
    FitStart = dump
    Check3.Value = 0
    Exit Sub
End Sub
***********************************
Sub ChkZero_Click ()
    If ChkZero.Value = 1 Then
      ForceZero = True
      DrawGraph
    Else
      ForceZero = False
      DrawGraph
    End If
End Sub
***********************************
Sub File1_Click ()
    Dim idump As Integer
    If Right(File1.Path, 1) = "\" Then
      CurrentFile = File1.Path + File1.FileName
    Else
      CurrentFile = File1.Path + "\" + File1.FileName
    End If
    GetArray
    CalcArray
    If DrawFit Then CalcFit
    If NoOfEvWavel > 0 Then
      Spread1.MaxRows = Spread1.MaxRows + 1
      Spread1.Row = Spread1.MaxRows
      Spread1.Col = 0
      Spread1.Text = File1.FileName
      Spread1.Col = -1
      Spread1.Lock = True
      CurrRow = Spread1.MaxRows
      idump = Spread1.Height
      Spread1.TopRow = CurrRow - 4
      Modified = True
    Else
      Spread1.Col = 0
      Spread1.Row = CurrRow
      Spread1.Text = File1.FileName
    End If
    DrawGraph
End Sub
***********************************
Sub Form_Load ()
    On Error GoTo Errh14
    Dim i, j, Order, Exists As Integer
    Dim sdump As String
    Dim Ext As String
    Dim fdump As Single
    Static Chrs As String * 1
    Dim ldump As Long
    Static Coeffs(0 To 5) As Double

    LoadForm.Left = (Screen.Width - LoadForm.Width) / 2
    LoadForm.Top = (Screen.Height - LoadForm.Height) / 2
    LoadForm.Show
    Width = Screen.Width * .95
    Height = Screen.Height * .95
    Left = (Screen.Width - Width) / 2
    Top = (Screen.Height - Height) / 2

    Frame1.Left = ScaleWidth * .01
    Frame1.Top = ScaleHeight * .99 - Frame1.Height

    Graph.Left = ScaleWidth * .01
    Graph.Width = ScaleWidth * .98
    Graph.Top = ScaleHeight * .01
    Graph.Height = .97 * (ScaleHeight - Frame1.Height)
    Graph.ScaleMode = 0
    Graph.ScaleHeight = -12.3
    Graph.ScaleLeft = -1.7
    Graph.ScaleTop = 10.6
    Graph.ScaleWidth = 12
    Text1.Top = -.8
    Text1.Left = -.4
    Text2.Top = -.8
    Text2.Left = 9.4
    Text3.Top = .2
    Text3.Left = -1.65
    Text3.Width = .8
    Text4.Top = 10.3
    Text4.Left = -1.65
    Text4.Width = .8
    Spread1.Left = Frame1.Left + Frame1.Width + ScaleWidth * .01
    Spread1.Top = Frame1.Top
    Spread1.Height = Frame1.Height
    Spread1.Width = ScaleWidth * .97 - Frame1.Width
    FileLabel.Top = 10.6
    FileLabel.Left = 0
    FileLabel.Height = .65
    FileLabel.Width = 2.9
    DateLabel.Top = 10.6
    DateLabel.Left = 3
    DateLabel.Height = .65
    DateLabel.Width = 2.9
    LabelLabel.Top = 10.6
    LabelLabel.Left = 6
    LabelLabel.Height = 5.65
    LabelLabel.Width = 4

    ChkZero.Top = -.7
    ChkZero.Left = -1.65

    Exists = True
    Open App.Path + "\" + "speceval.ini" For Input As #1
    If Exists Then
      Line Input #1, sdump
      Line Input #1, sdump
      OMAIII = CInt(Mid(sdump, InStr(sdump, "=") + 1))
      Line Input #1, sdump
      File1.Path = Mid(sdump, InStr(sdump, "=") + 1)
      Line Input #1, sdump
      UseCorr = CInt(Mid(sdump, InStr(sdump, "=") + 1))
      If UseCorr Then
        Line Input #1, sdump
        CorrFile = Mid(sdump, InStr(sdump, "=") + 1)
      End If
      Line Input #1, sdump
      MoveWavel = CInt(Mid(sdump, InStr(sdump, "=") + 1))
      Line Input #1, sdump
      MoveCorr = CInt(Mid(sdump, InStr(sdump, "=") + 1))
      Line Input #1, sdump
      DispMinVal = CInt(Mid(sdump, InStr(sdump, "=") + 1))
      Line Input #1, sdump
      DispMaxVal = CInt(Mid(sdump, InStr(sdump, "=") + 1))
      Line Input #1, sdump
      NoOfEvChans = CInt(Mid(sdump, InStr(sdump, "=") + 1))
      Line Input #1, sdump
      AddCon = CSng(Mid(sdump, InStr(sdump, "=") + 1))
      Line Input #1, sdump
      UseSpWl = CInt(Mid(sdump, InStr(sdump, "=") + 1))
      Close #1

      If OMAIII Then
        MAXARR = 1023
      Else
        MAXARR = 577
      End If
      If UseCorr Then
        Open CorrFile For Input As #2
        Exists = True
        If Exists Then
```

```
758         Close #2
759         If OMAIII Then
760           Open CorrFile For Input As #2
761           For i = 1 To 4
762             Input #2, fdump
763           Next
764           For i = 0 To 1023
765             Input #2, CorrArr(i)
766           Next
767           For i = 1 To 2
768             Input #2, fdump
769           Next
770           Input #2, Label
771           For i = 1 To 36
772             Input #2, fdump
773           Next
774           Input #2, WavelStart
775           Input #2, DeltaWavel
776           Close #2
777
778           For i = 0 To MAXARR
779             WOrgArr(i) = WavelStart + DeltaWavel * i
780             OrgArr(i) = CorrArr(i)
781           Next
782         Else
783           Ext = Mid(CorrFile, InStr(CorrFile, ".") + 1)
784           If UCase$(Ext) = "PRN" Then
785             Open CorrFile For Input As #2
786
787             For i = 0 To MAXARR
788               Input #2, WOrgArr(i), CorrArr(i)
789             Next
790             Close #2
791           Else
792             Open CorrFile For Binary As #2
793             For i = 1 To 27
794               Get #2, , ldump
795             Next
796             Get #2, , j
797             UseFloat = False
798             If j = 0 Then UseFloat = True
799             Get #2, , j
800             For i = 1 To 721
801               Get #2, , ldump
802             Next
803             Get #2, , ldump
804             If ldump = &H1234567 Then
805               For i = 1 To 102
806                 Get #2, , Chrs
807               Next
808               Order = Asc(Chrs)
809               For i = 1 To 161
810                 Get #2, , Chrs
811               Next
812               For i = 0 To 5
813                 Get #2, , Coeffs(i)
814               Next
815               For i = 0 To MAXARR
816                 WOrgArr(i) = 0
817                 For j = 0 To Order
818                   WOrgArr(i) = WOrgArr(i) + Coeffs(j) * (i ^ j)
819                 Next
820               Next
821               For i = 1 To 797
822                 Get #2, , Chrs
823               Next
824             Else
825               For i = 1 To 275
826                 Get #2, , ldump
827               Next
828               For i = 0 To MAXARR
829                 WOrgArr(i) = i
830               Next
831             End If
832
833             For i = 0 To MAXARR
834               If UseFloat Then
835                 Get #2, , fdump
836                 CorrArr(i) = fdump
837               Else
838                 Get #2, , ldump
839                 CorrArr(i) = ldump
840               End If
841             Next
842             Close #2
843           End If
844
845           WavelStart = WOrgArr(1)
846           DeltaWavel = WOrgArr(2) - WOrgArr(2)
847
848           For i = 0 To MAXARR
849             If CorrArr(i) <> 0 Then
850               CorrArr(i) = (3.02299117E-28 * ((1 / ((-
851                     24.16706244 + WOrgArr(i)) *
852                     .000000001)) ^ 5) / (Exp(.000004243352 /
853                     ((-24.16706244 + WOrgArr(i)) *
854                     .000000001)) - 1)) / CorrArr(i)
855             Else
856               CorrArr(i) = 0
857             End If
858           Next
859
860           For i = 0 To MAXARR
861             If WOrgArr(i) >= 570 Then Exit For
862           Next
863
864           If i > MAXARR Then i = MAXARR / 2
865           fdump = CorrArr(i)
866           If fdump = 0 Then fdump = 1
867
868           For i = 0 To MAXARR
869             CorrArr(i) = CorrArr(i) / fdump
870             OrgArr(i) = CorrArr(i)
871           Next
872         End If
873       Else
874         UseCorr = False
875       End If
876     End If
877   Else
878     OMAIII = True
879     UseCorr = False
880     MoveWavel = 0
881     MoveCorr = 0
882     DispMinVal = 100
883     DispMaxVal = 10000
884     NoOfEvChans = 5
885     AddCon = 0
886     WavelStart = 0
887     DeltaWavel = 10
888     UseSpWl = True
889   End If
890
891   If OMAIII Then
892     mnuOMAIII.Checked = True
893     mnuCSMA.Checked = False
894     InpMask = "*.DAT"
895     MAXARR = 1023
896   Else
897     mnuOMAIII.Checked = False
898     mnuCSMA.Checked = True
899     InpMask = "*.SPE"
900     MAXARR = 577
901   End If
902   File1.Pattern = InpMask
903
904   If Not UseCorr Then
905     For i = 0 To MAXARR
906       OrgArr(i) = i
907       GraphArr(i) = i
908       CorrArr(i) = 1
909       WOrgArr(i) = i * 10
```

```
910         BackArr(i) = 0
911       Next
912     End If
913
914     AutoScale = True
915     DrawFit = False
916     CalcArray
917
918     Check1 = 1
919     If UseCorr Then
920       Check2 = 1
921     Else
922       Check2 = 0
923     End If
924     Check3 = DrawFit
925     mnuBackFile.Checked = False
926
927     CorrLabel = CStr(MoveCorr)
928     WavelLabel = CStr(MoveWavel)
929     ChanLabel = CStr(NoOfEvChans)
930     Text1 = CStr(DispMinVal)
931     Text2 = CStr(DispMaxVal)
932     OffLabel = "0"
933     AmpLabel = "0"
934     ExpLabel = "0"
935     ForceZero = False
936     ChkZero = 0
937
938     Spread1.Protect = True
939     Spread1.MaxCols = 1
940     Spread1.MaxRows = 2
941     Spread1.Col = 0
942     Spread1.Row = 1
943     Spread1.Text = "Wavel."
944     Spread1.Col = 0
945     Spread1.Row = 2
946     Spread1.Text = " "
947     Spread1.Col = 1
948     Spread1.Row = 0
949     Spread1.Text = " "
950     Spread1.ColWidth(0) = 9
951     Spread1.Col = 1
952     Spread1.Row = 2
953     Spread1.Lock = True
954     Spread1.Col = 1
955     Spread1.Row = 1
956     Spread1.BackColor = RGB(255, 255, 0)
957     Spread1.SelectBlockOptions = 0
958
959     NoOfEvWavel = 0
960     CurrRow = 2
961     Modified = False
962
963     Unload LoadForm
964
965     If Not Help_File_In_Path() Then
966       sdump = "SPECEVAL.HLP not found in your path."
967       MsgBox sdump, 48, "Help not available"
968     End If
969     Exit Sub
970   Errh14:
971     Exists = False
972     Resume Next
973   End Sub
974   ***********************************
975   Sub Form_Unload (Cancel As Integer)
976     Dim Ok As Integer
977     Ok = 1
978     If Modified Then
979     Ok = MsgBox("Exit whitout saving changes?", 1 + 32, "Result
980                                 Modified")
981     End If
982     If Ok = 1 Then
983       Open App.Path + "\" + "speceval.ini" For Output As #1
984       Print #1, "[Spectrum Evaluator]"
985       Print #1, "OMA III=" + CStr(OMAIII)
986       Print #1, "Working Directory=" + File1.Path
987       Print #1, "Use Correction File=" + CStr(UseCorr)
988       If UseCorr Then
989         Print #1, "Correction File=" + CorrFile
990       End If
991       Print #1, "Move Wavelength Scale=" + CStr(MoveWavel)
992       Print #1, "Move Correction Curve=" + CStr(MoveCorr)
993       Print #1, "Display Min Wavelength=" + CStr(DispMinVal)
994       Print #1, "Display Max Wavelength=" + CStr(DispMaxVal)
995       Print #1, "No Of Evaluation Channels=" + CStr(NoOfEvChans)
996       Print #1, "Added Constant To Curve=" + CStr(AddCon)
997       Print #1, "Use Spectrum Wavel.=" + CStr(UseSpWl)
998       Close #1
999     Else
1000      Cancel = 1
1001    End If
1002  End Sub
1003  ***********************************
1004  Sub Graph_Paint ()
1005    DrawGraph
1006  End Sub
1007  ***********************************
1008  Sub mnuAbout_Click ()
1009    frmAbout.Show 1
1010  End Sub
1011  ***********************************
1012  Sub mnuAddCon_Click ()
1013    On Error GoTo Errh15
1014    Dim dump As Single
1015    If mnuAddCon.Checked Then
1016      mnuAddCon.Checked = False
1017      AddCon = 0
1018    Else
1019      dump = AddCon
1020      AddCon = InputBox("Enter constant to add to curve.", "Added
1021                                  Constant", CStr(AddCon))
1022      If AddCon <> 0 Then mnuAddCon.Checked = True
1023    End If
1024    If NoOfEvWavel > 0 Then Modified = True
1025    CalcArray
1026    DrawGraph
1027    Exit Sub
1028  Errh15:
1029    AddCon = dump
1030    Resume Next
1031  End Sub
1032  ***********************************
1033  Sub mnuBackFile_Click ()
1034    On Error GoTo Errh93
1035    Dim fdump As Single
1036    Dim stdump As String
1037    Dim i As Integer
1038    Dim ldump As Long
1039
1040    If mnuBackFile.Checked Then
1041      mnuBackFile.Checked = False
1042      For i = 0 To MAXARR
1043        BackArr(i) = 0
1044      Next
1045    Else
1046      CMDialog1.DialogTitle = " Open Background File"
1047      CMDialog1.Flags = &H800& Or &H4& Or &H1000&
1048      CMDialog1.CancelError = True
1049      CMDialog1.InitDir = File1.Path
1050      CMDialog1.Filename = ""
1051      If OMAIII Then
1052        CMDialog1.Filter = "OMA III File (*.DAT)|*.DAT"
1053        CMDialog1.Action = 1
1054        If CMDialog1.Filename <> "" Then
1055          Open CMDialog1.Filename For Input As #1
1056          For i = 1 To 4
1057            Input #1, fdump
1058          Next
1059          For i = 0 To MAXARR
1060            Input #1, BackArr(i)
1061          Next
```

```
            Close #1
          End If
        Else
          CMDialog1.Filter = "CSMA File (*.SPE)|*.SPE"
          CMDialog1.Action = 1
          If CMDialog1.Filename <> "" Then
            Open CMDialog1.Filename For Binary As #1
            For i = 1 To 1025
              Get #1, , ldump
            Next
            For i = 0 To MAXARR
              Get #1, , ldump
              BackArr(i) = ldump
            Next
            Close #1
          End If
        End If
        mnuBackFile.Checked = True
      End If
      CalcArray
      DrawGraph
      Exit Sub
Errh93:
Exit Sub

End Sub
***********************************
Sub mnuClear_Click ()
    Dim i, Ok As Integer
    Ok = 1
    If Modified Then
      Ok = MsgBox("Clear whitout saving changes?", 1 + 32, "Result
                                Modified")
    End If
    If Ok = 1 Then
      Spread1.TopRow = 1
      If NoOfEvWavel = 0 Then
        Spread1.MaxRows = 2
        Spread1.Row = 2
        For i = 0 To Spread1.MaxCols
          Spread1.Col = i
          Spread1.Text = " "
        Next
      Else
        Spread1.MaxRows = 1
        Spread1.Row = 1
      End If

      CurrRow = 2
      Modified = False
    End If
End Sub
***********************************
Sub mnuClWav_Click ()
    Dim i, Ok As Integer
    Ok = 1
    If Modified Then
      Ok = MsgBox("Clear whitout saving changes?", 1 + 32, "Result
                                Modified")
    End If
    If Ok = 1 Then
      Spread1.TopRow = 1
      Spread1.MaxCols = 1
      Spread1.MaxRows = 2
      Spread1.Col = 1
      Spread1.Row = 0
      Spread1.Text = " "
      Spread1.Row = 1
      Spread1.Text = " "
      Spread1.Row = 2
      Spread1.Text = " "
      Spread1.Col = 0
      Spread1.Text = File1.FileName
      NoOfEvWavel = 0
      CurrRow = 2
      Modified = False
    End If
End Sub
***********************************
Sub mnuCont_Click ()
    Dim R As Integer
    R = WinHelp(hWnd, HelpFilePath, &H3, 0)
End Sub
***********************************
Sub mnuCpyGrp_Click ()
    Dim i As Integer
    Dim strdump As String
    strdump = ""
    For i = Start To Stopp
      strdump = strdump + CStr(WavelArr(i)) + Chr$(9) +
                          CStr(GraphArr(i)) + Chr$(10)
    Next
    Clipboard.Clear
    Clipboard.SetText strdump
End Sub
***********************************
Sub mnuCpyRes_Click ()
    Spread1.Row = -1
    Spread1.Col = -1
    Clipboard.SetText Spread1.Clip
    Modified = False
End Sub
***********************************
Sub mnuCSMA_Click ()
    If OMAIII Then
      UseCorr = False
      Check2.Value = 0
      OMAIII = 0
      mnuOMAIII.Checked = False
      mnuCSMA.Checked = True
      File1.Pattern = "*.SPE"
      MAXARR = 577
    End If
End Sub
***********************************
Sub mnuDirectory_Click ()
    frmDir.Show 1
End Sub
***********************************
Sub mnuExit_Click ()
    Unload Form1
End Sub
***********************************
Sub mnuInpMask_Click ()
    InpMask = InputBox("Enter input file mask:", "Input Mask")
    File1.Pattern = InpMask
End Sub
***********************************
Sub mnuLabel_Click ()
    LabelLabel = InputBox$("Enter a new label to the spectrum",
                          "Label", LabelLabel.Text)
End Sub
***********************************
Sub mnuOMAIII_Click ()
    If Not OMAIII Then
      UseCorr = False
      Check2.Value = 0
      OMAIII = 1
      mnuOMAIII.Checked = True
      mnuCSMA.Checked = False
      File1.Pattern = "*.DAT"
      MAXARR = 1023
    End If
End Sub
***********************************
Sub mnuOpenCFile_Click ()
    On Error GoTo Errh92
    Dim fdump As Single
    Dim i, j, Order As Integer
    Dim Ext As String
    Dim ldump As Long
    Static Coeffs(0 To 5) As Double
```

```
1214    Static Chrs As String * 1
1215    Dim sdump As String
1216
1217    CMDialog1.Flags = &H800& Or &H4& Or &H1000&
1218    CMDialog1.CancelError = True
1219    CMDialog1.InitDir = File1.Path
1220    CMDialog1.DialogTitle = "Open Correction File"
1221    CMDialog1.Filename = CorrFile
1222    If OMAIII Then
1223      CMDialog1.Filter = "OMA III File (*.DAT)|*.DAT"
1224      CMDialog1.Action = 1
1225      If CMDialog1.Filename <> "" Then
1226        i = MsgBox("Use wavelength cal. from correction file?", 32 + 4,
1227                   "Wavel. Cal.")
1228        UseSpWl = True
1229        If i = 6 Then
1230          UseSpWl = False
1231          mnuWl.Checked = True
1232        End If
1233        CorrFile = CMDialog1.Filename
1234        Open CorrFile For Input As #1
1235        For i = 1 To 4
1236          Input #1, fdump
1237        Next
1238        For i = 0 To MAXARR
1239          Input #1, CorrArr(i)
1240        Next
1241
1242        For i = 1 To 2
1243          Input #1, fdump
1244        Next
1245        Input #1, sdump
1246        For i = 1 To 36
1247          Input #1, fdump
1248        Next
1249        If Not UseSpWl Then
1250          Input #1, WavelStart
1251          Input #1, DeltaWavel
1252
1253          For i = 0 To MAXARR
1254            WOrgArr(i) = WavelStart + DeltaWavel * i
1255          Next
1256        End If
1257        Close #1
1258      End If
1259    Else
1260      CMDialog1.Filter = "CSMA File (*.SPE)|*.SPE|CSMA Text File
1261                         (*.PRN)|*.PRN"
1262      CMDialog1.Action = 1
1263      If CMDialog1.Filename <> "" Then
1264        i = MsgBox("Use wavelength cal. from correction file?", 32 + 4,
1265                   "Wavel. Cal.")
1266        UseSpWl = True
1267        If i = 6 Then
1268          UseSpWl = False
1269          mnuWl.Checked = True
1270        End If
1271        CorrFile = CMDialog1.Filename
1272        Ext = Mid(CorrFile, InStr(CorrFile, ".") + 1)
1273        If UCase$(Ext) = "PRN" Then
1274          Open CorrFile For Input As #1
1275
1276          For i = 0 To MAXARR
1277            Input #1, fdump, CorrArr(i)
1278            If Not UseSpWl Then WOrgArr(i) = fdump
1279          Next
1280          Close #1
1281        Else
1282          Open CorrFile For Binary As #1
1283          For i = 1 To 27
1284            Get #1, , ldump
1285          Next
1286          Get #1, , j
1287          UseFloat = False
1288          If j = 0 Then UseFloat = True
1289          Get #1, , j
1290          For i = 1 To 721
1291            Get #1, , ldump
1292          Next
1293          Get #1, , ldump
1294          If ldump = &H1234567 And (Not UseSpWl) Then
1295            For i = 1 To 102
1296              Get #1, , Chrs
1297            Next
1298            Order = Asc(Chrs)
1299            For i = 1 To 161
1300              Get #1, , Chrs
1301            Next
1302            For i = 0 To 5
1303              Get #1, , Coeffs(i)
1304            Next
1305            For i = 0 To MAXARR
1306              WOrgArr(i) = 0
1307              For j = 0 To Order
1308                WOrgArr(i) = WOrgArr(i) + Coeffs(j) * (i ^ j)
1309              Next
1310            Next
1311            For i = 1 To 797
1312              Get #1, , Chrs
1313            Next
1314          Else
1315            For i = 1 To 275
1316              Get #1, , ldump
1317            Next
1318          End If
1319
1320          For i = 0 To MAXARR
1321            If UseFloat Then
1322              Get #1, , fdump
1323              CorrArr(i) = fdump
1324            Else
1325              Get #1, , ldump
1326              CorrArr(i) = ldump
1327            End If
1328          Next
1329          Close #1
1330        End If
1331
1332        WavelStart = WOrgArr(1)
1333        DeltaWavel = WOrgArr(2) - WOrgArr(2)
1334
1335        For i = 0 To MAXARR
1336          If CorrArr(i) <> 0 Then
1337            CorrArr(i) = (3.02299117E-28 * ((1 / ((-24.16706244 +
1338                       WOrgArr(i)) * .000000001)) ^ 5) /
1339                       (Exp(.000004243352 / ((-24.16706244 +
1340                       WOrgArr(i)) * .000000001)) - 1)) /
1341                       CorrArr(i)
1342          Else
1343            CorrArr(i) = 0
1344          End If
1345        Next
1346
1347        For i = 0 To MAXARR
1348          If WOrgArr(i) >= 570 Then Exit For
1349        Next
1350
1351        If i > MAXARR Then i = MAXARR / 2
1352        fdump = CorrArr(i)
1353        If fdump = 0 Then fdump = 1
1354
1355        For i = 0 To MAXARR
1356          CorrArr(i) = CorrArr(i) / fdump
1357        Next
1358
1359        CalcArray
1360        DrawGraph
1361      End If
1362    End If
1363
1364    If UseCorr Then
1365      If NoOfEvWavel > 0 Then Modified = True
```

```
      CalcArray
      DrawGraph
    End If
    Exit Sub

Errh92:
    Exit Sub
End Sub
**********************************
Sub mnuPrint_Click ()
    On Error GoTo errh96
    Dim i, s, j As Integer
    Dim Start As Integer
    Dim Stopp As Integer
    Dim X As Single
    Dim Y As Single
    Dim Steg2 As Single
    Dim CurrVal As Single
    Dim Steg As Long
    Dim CurrWl As Long
    Dim sdump, Sdump2 As Single
    Dim RefWl As Single
    Dim strdump As String

    PrForm.Left = (Screen.Width - PrForm.Width) / 2
    PrForm.Top = (Screen.Height - PrForm.Height) / 2
    PrForm.Show

    Printer.ScaleMode = 0
    Printer.ScaleLeft = -2
    Printer.ScaleTop = 11
    Printer.ScaleWidth = 13
    Printer.ScaleHeight = -13
    Printer.DrawWidth = 2
    Printer.FontName = "Times"
    Printer.FontSize = 10

    Start = 0
    Stopp = MAXARR
    For i = 0 To MAXARR
      If WavelArr(i) >= DispMinVal And Start = 0 Then Start = i
      If WavelArr(i) >= DispMaxVal And Stopp = MAXARR Then
                              Stopp = i
    Next

    If AutoScale Then
      MaxVal = -100000
      MinVal = 100000
      For i = Start To Stopp
        If GraphArr(i) > MaxVal Then MaxVal = GraphArr(i)
        If GraphArr(i) < MinVal Then MinVal = GraphArr(i)
      Next
      If ForceZero Then MinVal = 0
      'Form1!Text3.Text = CStr(MinVal)
      'Form1!Text4.Text = CStr(MaxVal)
    End If
    If MaxVal <= MinVal Then
      MaxVal = MinVal + 1
    End If

    Printer.Line (0, 0)-(10, 0), RGB(0, 0, 0)
    Printer.Line -(10, 10), RGB(0, 0, 0)
    Printer.Line -(0, 10), RGB(0, 0, 0)
    Printer.Line -(0, 0), RGB(0, 0, 0)

    For i = Start To Stopp
      X = 10 * (WavelArr(i) - WavelArr(Start)) / (WavelArr(Stopp) -
                              WavelArr(Start))
      Y = 10 * (GraphArr(i) - MinVal) / (MaxVal - MinVal)
      If Y >= 10 Then Y = 9.98
      If Y <= 0 Then Y = .02
      If i = Start Then
        Printer.CurrentX = X
        Printer.CurrentY = Y
      Else
        Printer.Line -(X, Y), RGB(255, 0, 0)
      End If
    Next

    If DrawFit Then
      s = True
      For i = Start To Stopp
        If WavelArr(i) >= FitStart Then
          X = 10 * (WavelArr(i) - WavelArr(Start)) /
                              (WavelArr(Stopp) - WavelArr(Start))
          Y = 10 * (FitA + FitB * Exp(FitC * (WavelArr(i) - FitStart))
                              - MinVal) / (MaxVal - MinVal)
          If Y >= 10 Then Y = 9.98
          If Y <= 0 Then Y = .02
          If s Then
            Printer.CurrentX = X
            Printer.CurrentY = Y
            s = False
          Else
            Printer.Line -(X, Y), RGB(0, 0, 255)
          End If
        End If
      Next
    End If

    Steg2 = 10 ^ Int(Log(MaxVal - MinVal) / Log(10))
    If (MaxVal - MinVal) / Steg2 < 2 Then
      Steg2 = Steg2 / 5
    ElseIf (MaxVal - MinVal) / Steg2 < 5 Then
      Steg2 = Steg2 / 2
    End If

    CurrVal = Steg2 * (Int(MinVal / Steg2) + 1)
    Do
      Y = 10 * (CurrVal - MinVal) / (MaxVal - MinVal)
      Printer.CurrentX = 0
      Printer.CurrentY = Y
      Printer.Line -Step(-.2, 0), RGB(0, 0, 0)
      If CurrVal = 0 Then Printer.Line -Step(10.2, 0), RGB(0, 0, 0)
      Printer.CurrentX = -Printer.TextWidth(CStr(CurrVal)) - .3
      Printer.CurrentY = Y + Printer.TextHeight(CStr(CurrVal)) / 2
      Printer.Print CurrVal
      CurrVal = CurrVal + Steg2
    Loop Until CurrVal > MaxVal

    Steg = 10 ^ Int(Log(WavelArr(Stopp) - WavelArr(Start)) / Log(10))
    If (WavelArr(Stopp) - WavelArr(Start)) / Steg < 2 Then
      Steg = Steg / 5
    ElseIf (WavelArr(Stopp) - WavelArr(Start)) / Steg < 5 Then
      Steg = Steg / 2
    End If

    CurrWl = Steg * (Int(WavelArr(Start) / Steg) + 1)
    For i = Start To Stopp
      If WavelArr(i) >= CurrWl Then
        X = 10 * (CurrWl - WavelArr(Start)) / (WavelArr(Stopp) -
                              WavelArr(Start))
        Printer.CurrentX = X
        Printer.CurrentY = 0
        Printer.Line -Step(0, -.2), RGB(0, 0, 0)
        Printer.CurrentX = X - Printer.TextWidth(CStr(CurrWl)) / 2
        Printer.CurrentY = -.3
        Printer.Print CurrWl
        CurrWl = CurrWl + Steg
      End If
    Next
    Printer.CurrentX = 4.6
    Printer.CurrentY = -.6
    Printer.Print "Wavelength (nm)"

    If NoOfEvWavel > 0 Then
      For s = 1 To NoOfEvWavel
        For j = 0 To MAXARR
          If EvalWavel(s) <= WavelArr(j) Then Exit For
        Next j
        sdump = 0
        Sdump2 = 0
```

```
        For i = j - NoOfEvChans / 2 To j - NoOfEvChans / 2 +
                        NoOfEvChans - 1
          X = 10 * (WavelArr(i) - WavelArr(Start)) /
                        (WavelArr(Stopp) - WavelArr(Start))
          Y = 10 * (GraphArr(i) - MinVal) / (MaxVal - MinVal)
          If Y >= 10 Then Y = 9.98
          If Y <= 0 Then Y = .02
          If X >= 10 Then X = 9.98
          If X <= 0 Then X = .02
          Printer.CurrentX = X
          Printer.CurrentY = Y
          Printer.Line -(X, 0), RGB(0, 255, 0)
          sdump = sdump + GraphArr(i)
          If DrawFit Then Sdump2 = Sdump2 + (GraphArr(i) - (FitA +
                        FitB * Exp(FitC * (WavelArr(i) -
                        FitStart))))
        Next i

      Next s
    End If
    Printer.CurrentX = 0
    Printer.CurrentY = 10.5
    Printer.Print FileLabel.Text
    Printer.CurrentX = 3
    Printer.CurrentY = 10.5
    Printer.Print DateLabel.Text
    Printer.CurrentX = 6
    Printer.CurrentY = 10.5
    Printer.Print LabelLabel.Text
    If NoOfEvWavel > 0 Then
      Printer.CurrentX = 0
      Printer.CurrentY = -.9
      Spread1.Row = 0
      strdump = ""
      For i = 1 To Spread1.MaxCols
        Spread1.Col = i
        strdump = strdump + Spread1.Text + Chr$(9)
        If Len(Spread1.Text) < 7 Then strdump = strdump + Chr$(9)
      Next
      Printer.Print strdump
      Printer.CurrentX = 0
      Printer.CurrentY = -1.2
      Spread1.Row = CurrRow
      strdump = ""
      For i = 1 To Spread1.MaxCols
        Spread1.Col = i
        strdump = strdump + Spread1.Text + Chr$(9)
        If Len(Spread1.Text) < 7 Then strdump = strdump + Chr$(9)
      Next
      Printer.Print strdump
    End If

    Printer.EndDoc

  errh96:
    Unload PrForm
    Exit Sub
  End Sub
  ***********************************
  Sub mnuPrSetUp_Click ()
    On Error GoTo errh95
    CMDialog1.Filename = "XXX.PS"
    CMDialog1.Flags = &H40& Or &H4&
    CMDialog1.Action = 5
    Exit Sub
  errh95:
    Exit Sub
  End Sub
  ***********************************
  Sub mnuSave_Click ()
    On Error GoTo Errh90
    Dim i As Integer
    CMDialog1.Flags = &H4&
    CMDialog1.InitDir = File1.Path
    CMDialog1.DialogTitle = "Save Result"
    CMDialog1.CancelError = True
    CMDialog1.Filter = "Text File (*.TXT)|*.TXT"
    CMDialog1.Filename = ""
    CMDialog1.Action = 2
    Open CMDialog1.Filename For Output As #1
    Spread1.Row = -1
    Spread1.Col = -1
    Print #1, Spread1.Clip
    Modified = False
    Close #1
    Exit Sub
  Errh90:
    Exit Sub
  End Sub
  ***********************************
  Sub mnuWl_Click ()
    If mnuWl.Checked Then
      mnuWl.Checked = False
      UseSpWl = True
    End If
  End Sub
  ***********************************
  Sub Spread1_Change (Col As Long, Row As Long)
    On Error GoTo Errh12
    Dim i As Integer
    Dim Txt As String
    If Col = 1 Then
      i = 1
    Else
      i = (Col - 2) / 3 + 2
    End If
    Spread1.Row = Row
    Spread1.Col = Col
    Txt = Spread1.Text
    EvalWavel(i) = CDbl(Txt)
    Spread1.Row = 0
    Spread1.Text = Txt
    If Col = Spread1.MaxCols Then
      If i = 1 Then
        Spread1.MaxCols = Col + 1
      Else
        Spread1.MaxCols = Col + 3
      End If
      Spread1.Row = 1
      Spread1.Col = -1
      Spread1.BackColor = RGB(255, 255, 0)
      Spread1.Row = 0
      Spread1.Col = Spread1.MaxCols
      Spread1.Text = " "
      NoOfEvWavel = NoOfEvWavel + 1
    End If
    If i <> 1 Then
      Spread1.Col = Col + 1
      Spread1.Row = Row
      Spread1.Text = Txt + " Lift.off"
      Spread1.Lock = True
      Spread1.Row = 0
      Spread1.Text = Txt + " Li.off"
      Spread1.Col = Col + 2
      Spread1.Row = Row
      Spread1.Text = Txt + " Ratio"
      Spread1.Lock = True
      Spread1.Row = 0
      Spread1.Text = Txt + " Ratio"
    End If
    DrawM = 0
    Modified = True
    DrawGraph
    Exit Sub

  Errh12:
    If Col = Spread1.MaxCols Then
      Spread1.Text = ""
    Else
      Spread1.Text = CStr(EvalWavel(i))
    End If
    Exit Sub
```

```
End Sub
***********************************
Sub Text1_KeyPress (KeyAscii As Integer)
   If (KeyAscii < 48 Or KeyAscii > 57) And KeyAscii <> 8 Then
                              KeyAscii = 0
End Sub
***********************************
Sub Text1_LostFocus ()
   Dim i As Long
   On Error GoTo Errh
   i = CLng(Text1.Text)
   If i < WavelArr(0) Or i > (DispMaxVal - 10) Then
      Text1.Text = CStr(DispMinVal)
   Else
      DispMinVal = i
      DrawGraph
   End If
   Exit Sub

Errh:
   i = 0
   Resume Next
End Sub
***********************************
Sub Text2_KeyPress (KeyAscii As Integer)
   If (KeyAscii < 48 Or KeyAscii > 57) And KeyAscii <> 8 Then
                              KeyAscii = 0
End Sub
***********************************
Sub Text2_LostFocus ()
   Dim i As Long
   On Error GoTo Errh2
   i = CLng(Text2.Text)
   If i > WavelArr(MAXARR) Or i < (DispMinVal + 10) Then
      Text2.Text = CStr(DispMaxVal)
   Else
      DispMaxVal = i
      DrawGraph
   End If
   Exit Sub
Errh2:
   i = 0
   Resume Next
End Sub
***********************************
Sub Text3_KeyPress (KeyAscii As Integer)
   If (KeyAscii < 45 Or KeyAscii > 57 Or KeyAscii = 47) And
                        KeyAscii <> 69 And KeyAscii <> 101 And
                        KeyAscii <> 8 Then KeyAscii = 0
End Sub
***********************************
Sub Text3_LostFocus ()
   Dim i As Single
   On Error GoTo Errh3
   i = CSng(Text3.Text)
   If i >= MaxVal Then
      Text3.Text = CSng(MinVal)
   Else
      MinVal = i
      Check1.Value = 0
      DrawGraph
   End If
   Exit Sub

Errh3:
   i = 0
   Resume Next
End Sub
***********************************
Sub Text4_KeyPress (KeyAscii As Integer)
   If (KeyAscii < 45 Or KeyAscii > 57 Or KeyAscii = 47) And
                        KeyAscii <> 69 And KeyAscii <> 101 And
                        KeyAscii <> 8 Then KeyAscii = 0
End Sub
***********************************
Sub Text4_LostFocus ()
   Dim i As Single
   On Error GoTo Errh4
   i = CSng(Text4.Text)
   If i <= MinVal Then
      Text3.Text = CSng(MaxVal)
   Else
      MaxVal = i
      Check1.Value = 0
      DrawGraph
   End If
   Exit Sub

Errh4:
   i = 0
   Resume Next
End Sub
```

7.3 SPECDIR.FRM

```
VERSION 2.00
Begin Form frmDir
   Caption      = "Directory"
   ClientHeight = 2430
   ClientLeft   = 1155
   ClientTop    = 2970
   ClientWidth  = 3540
   Height       = 2835
   Left         = 1095
   LinkTopic    = "Form2"
   ScaleHeight  = 2430
   ScaleWidth   = 3540
   Top          = 2625
   Width        = 3660
   Begin CommandButton Cancel
      Caption      = "Cancel"
      Height       = 492
      Left         = 240
      TabIndex     = 3
      Top          = 1680
      Width        = 1092
   End
   Begin CommandButton OK
      Caption      = "OK"
      Height       = 492
      Left         = 240
      TabIndex     = 2
      Top          = 960
      Width        = 1092
   End
   Begin DirListBox Dir1
      Height       = 1968
      Left         = 1800
      TabIndex     = 1
      Top          = 240
      Width        = 1572
   End
   Begin DriveListBox Drive1
      Height       = 288
      Left         = 240
      TabIndex     = 0
      Top          = 240
      Width        = 1332
   End
End
Option Explicit
***********************************
Sub Cancel_Click ()
   Unload frmDir
End Sub
***********************************
Sub Drive1_Change ()
   Dir1.Path = Drive1.Drive
End Sub
***********************************
```

```
Sub Form_Load ()
    Drive1.Drive = Form1.File1.Path
    Dir1.Path = Form1.File1.Path
End Sub
**********************************
```

7.4 SPECLOAD.FRM

```
VERSION 2.00
Begin Form LoadForm
  Caption      = "Loading"
  ClientHeight = 1500
  ClientLeft   = 4830
  ClientTop    = 4140
  ClientWidth  = 4005
  ControlBox   = 0 'False
  Height       = 1905
  Left         = 4770
  LinkTopic    = "Form2"
  MaxButton    = 0 'False
  MinButton    = 0 'False
  ScaleHeight  = 1500
  ScaleWidth   = 4005
```

7.5 SPECPRINT.FRM

```
VERSION 2.00
Begin Form PrtForm
  Caption      = "Printing"
  ClientHeight = 1245
  ClientLeft   = 4170
  ClientTop    = 3855
  ClientWidth  = 3300
  Height       = 1650
  Left         = 4110
  MaxButton    = 0 'False
  MinButton    = 0 'False
  ScaleHeight  = 1245
  ScaleWidth   = 3300
  Top          = 3510
```

7.6 SPECABOU.FRM

```
VERSION 2.00
Begin Form frmAbout
  Caption      = "About Spectrum Evaluator"
  ClientHeight = 1650
  ClientLeft   = 4920
  ClientTop    = 3720
  ClientWidth  = 4500
  Height       = 2055
  Left         = 4860
  LinkTopic    = "Form2"
  MaxButton    = 0 'False
  MinButton    = 0 'False
  ScaleHeight  = 1650
  ScaleWidth   = 4500
  Top          = 3375
  Width        = 4620
  Begin CommandButton btnOK
    Caption      = "OK"
    Height       = 372
    Left         = 3240
    TabIndex     = 2
    Top          = 1080
    Width        = 972
  End
  Begin PictureBox Picture1
    AutoSize     = -1 'True
    Height       = 510
    Left         = 240
    Picture      = SPECABOU.FRX:0000
    ScaleHeight  = 480
```

```
Sub OK_Click ()
  Form1.File1.Path = Dir1.Path
  Unload frmDir
End Sub
```

```
    Top          = 3795
    Width        = 4125
    Begin Label Label1
      Alignment    = 2 'Center
      Caption      = "Loading Spectrum Evaluator"
      FontBold     = -1 'True
      FontItalic   = 0 'False
      FontName     = "MS Sans Serif"
      FontSize     = 13.5
      FontStrikethru = 0 'False
      FontUnderline = 0 'False
      Height       = 855
      Left         = 120
      TabIndex     = 0
      Top          = 360
      Width        = 3615
    End
End
```

```
    Width        = 3420
    Begin Label Label1
      Alignment    = 2 'Center
      Caption      = "Printing"
      FontBold     = -1 'True
      FontItalic   = 0 'False
      FontName     = "MS Sans Serif"
      FontSize     = 12
      FontStrikethru = 0 'False
      FontUnderline = 0 'False
      Height       = 375
      Left         = 720
      TabIndex     = 0
      Top          = 360
      Width        = 1575
    End
End
```

```
      ScaleWidth   = 480
      TabIndex     = 1
      Top          = 1080
      Width        = 510
    End
    Begin Label Label4
      Alignment    = 2 'Center
      Height       = 255
      Left         = 1560
      TabIndex     = 5
      Top          = 1080
      Width        = 1215
    End
    Begin Label Label3
      Alignment    = 2 'Center
      Caption      = "Lund Medical Lasercenter, Lund, Sweden"
      Height       = 255
      Left         = 240
      TabIndex     = 4
      Top          = 720
      Width        = 3855
    End
    Begin Label Label2
      Alignment    = 2 'Center
      Caption      = "by Roger Berg"
      Height       = 255
      Left         = 1080
      TabIndex     = 3
      Top          = 480
      Width        = 2175
    End
    Begin Label Label1
      Alignment    = 2 'Center
```

```
    Caption      = "Spectrum Evaluator ver. 1.1"
    FontBold     = -1 'True
    FontItalic   = 0 'False
    FontName     = "MS Sans Serif"
    FontSize     = 9.75
    FontStrikethru = 0 'False
    FontUnderline = 0 'False
    Height       = 255
    Left         = 600
    TabIndex     = 0
    Top          = 120
    Width        = 3135
End
End
**********
Sub btnOK_Click ()
    Unload frmAbout
End Sub
**********
Sub Form_Load ()
    Dim sdump As String
    sdump = App.Path + "\SPECEVAL.EXE"
    Label4 = Format(FileDateTime(sdump), "General Date")
    frmAbout.Left = (Screen.Width - frmAbout.Width) / 2
    frmAbout.Top = (Screen.Height - frmAbout.Height) / 2
End Sub
```