Data Acquisition Module
CMCA-550
Instruction Manual

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Fig.1a Front view of the CMCA-550 Data Acquisition Module
The front panel is equipped with five BNC connectors for the analog input ADC and the digital inputs COUNT, START, CHA and CE and with eight LED's showing the actual status of the Data Acquisition Module

Fig.1b The rear panel with USB and RS 232 C interface connectors and an power input for 7 - 9 V DC.

1. INTRODUCTION

Earlier used data acquisition modules for Mössbauer Spectroscopy had the drawback to work only in connection with a single-channel-analyser (SCA). They run in Multichannel Scaling mode (MCS), where data processing is fully digital and hence a SCA is needed to preselect the energy of the Mössbauer resonance line. Compared to these earlier used 'conventional' data acquisition modules, the CMCA-550 has the great advantage, that it can work in MCS (Window) mode, where a single-channel-analyser is no longer needed. For running in MCS (Window) mode, the CMCA-550 has in addition to its digital circuit an analog circuit for data acquisition. In MCS (Window) mode, analog pulses from the output of a spectroscopy amplifier are fed via the input 'ADC' to an analog-to-digital converter on the data acquisition module, where a window for selecting the digitalised pulses can be set. This means that the CMCA-550 does not only store pulses into the different addresses of its memory depending on the time of their occurrence, but is also able to store input counts depending on their pulse height. Thus it can filter the incoming analog pulses and consequently it can work like a single-channel-analyser. For special applications the CMCA-550 can work in Multichannel Scaling(MCS) mode as well. The CMCA-550 data acquisition module runs under Wissoft 2003. This program is compatible to Win98/Win2000/WinXP and allows to change between different data acquisition modes, to start and to stop data acquisition, to erase, display and to store data, to display data of a file and to analyse data.
In the following chapter, the different data acquisition modes are briefly discussed, beginning with the Multichannel Scaling (MCS) mode.

2. PRINCIPLE OF OPERATION

2.1 MULTICHANNEL SCALING (MCS) MODE

As mentioned above, the CMCA-550 can also be operated in MCS mode. This capability was mainly maintained for users of the MVC-450 Mössbauer velocity calibrator. In MCS mode the Laser data of the MVC-450 can be acquired for analyzation. In multichannel scaling mode, the input COUNT is usually connected to the output of an external single-channel-analyser unit or to the output of a (laser based) Mössbauer velocity calibrator. The inputs START and CHA are connected to the corresponding synchronisation outputs of the digital function generator (see Fig. 2). The CE (COUNT ENABLE) input must be set to high (can be set in submenu'General Settings' of menu 'CMCA', chapter 4.3.2.3), or must simply be open. Otherwise the data acquisition module does not accept input pulses. The counting procedure in MCS mode is as follows: The START signal from the function generator resets the address counter of the data acquisition module's memory. When data acquisition is switched on, the event counter of the CMCA-550 starts counting the pulses, fed to input COUNT, until the first CHA (Channel Advance) pulse of the sweep appears at input CHA. Now the content of the event counter is stored to address #0 of the data acquisition module's memory and the event counter is reset. After that the event counter is counting the events between the CHA pulses #1 and #2. When CHA pulse #2 appears, the content of the event counter is stored to address #1 of the memory. This operation will be repeated, until the last address has received the content of the event counter and the next START pulse resets the address counter to zero again. The maximum possible number of channels is 8192. The number of channels, used in an experiment, however, is determined by the digital function generator
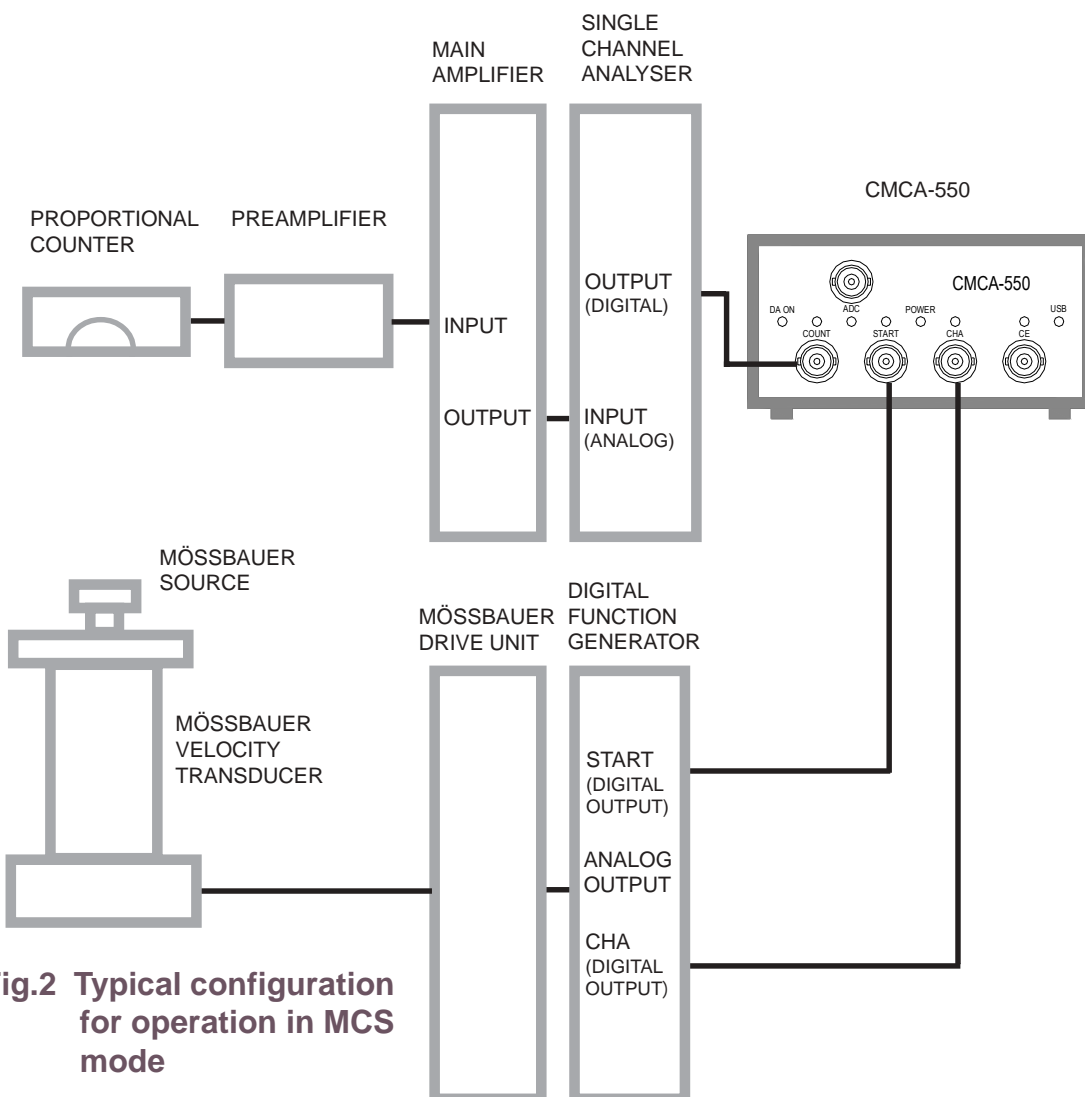
MAIN
AMPLIFIER

SINGLE
CHANNEL
ANALYSER

PROPORTIONAL
COUNTER

PREAMPLIFIER

CMCA-550

INPUT

OUTPUT
(DIGITAL)

CMCA-550

DA ON   ADC   POWER   CHA   USB

COUNT   START   CE

OUTPUT

INPUT
(ANALOG)

MÖSSBAUER
SOURCE

DIGITAL
FUNCTION
GENERATOR

MÖSSBAUER
DRIVE UNIT

MÖSSBAUER
VELOCITY
TRANSDUCER

START
(DIGITAL
OUTPUT)

ANALOG
OUTPUT

CHA
(DIGITAL
OUTPUT)

OUTPUT

**Fig.2 Typical configuration
for operation in MCS
mode**

Velocity
of Mössbauer
source in sine
mode

channel sweep between
two START pulses

dwell time
of a channel

length of a CHA

pulse: ～ 1 ms

first channel of sweep   second channel of sweep   last channel of sweep   first channel
of next sweep
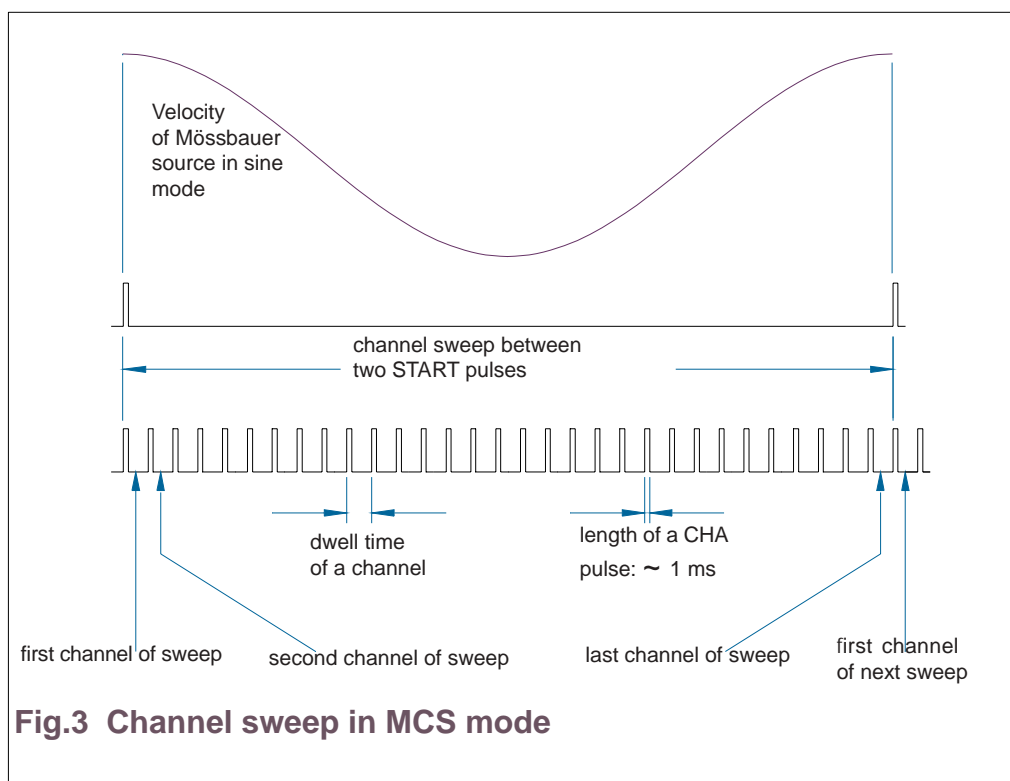
Fig.3 Channel sweep in MCS mode

Fig. 4   DATA ACQUISITION IN MCS AND IN MCS [WINDOW] MODE
Schematic representation
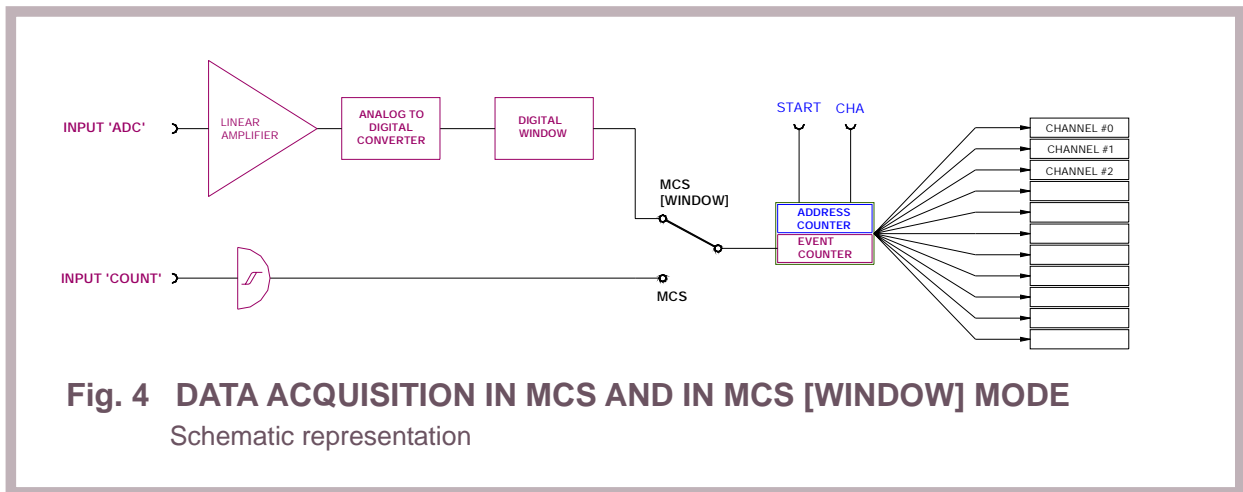
due to the fact that the address counter of the data acquisition module is reset when a START pulse is received. The Mössbauer source is moved synchronously with the channel sweep of the digital function generator Each channel corresponds to a certain value of the velocity. The START pulse is generated at the positive maximum of the reference signal.The process of data acquisition is schematically demonstrated in Fig. 3 and Fig.4. During a channel sweep and thus during a period of source motion each value of the velocity appears twice.This effect doubles the spectrum. In order to compensate for this, the spectrum must be 'folded' around its symmetry point at about half of the total number of channels (see chapter 4.3.2.2). The final result is a Mössbauer spectrum as shown in Fig. 5.
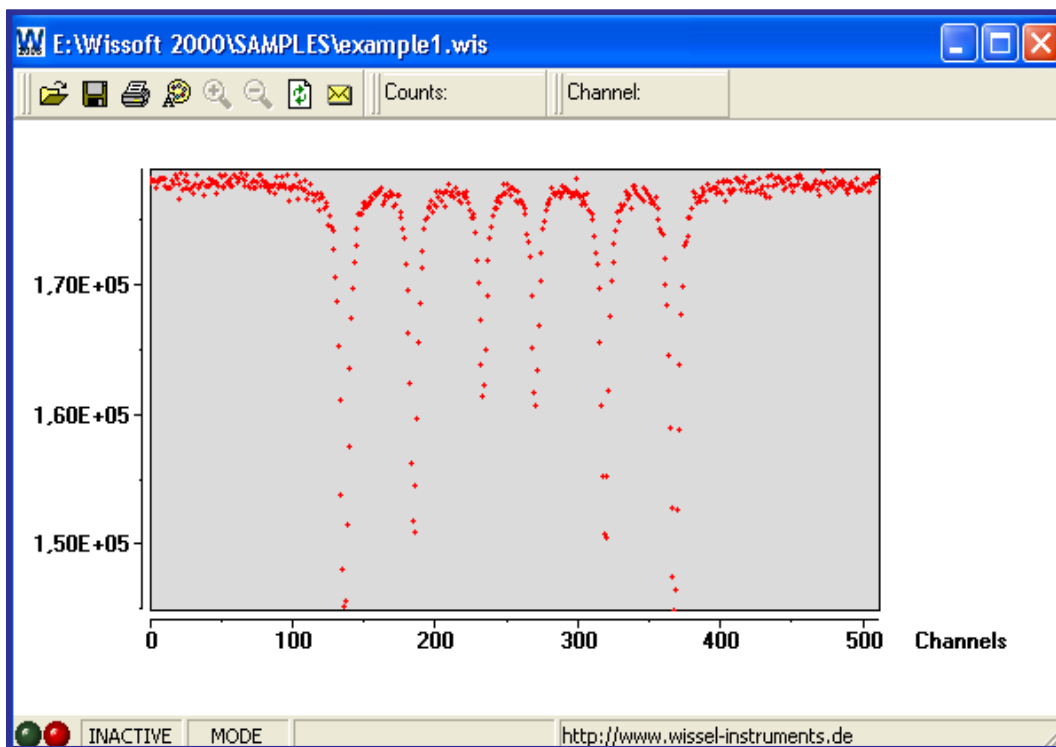

Fig. 5   CMCA-550 Data Acquisition Module in MCS mode:
Mössbauer spectrum of natural iron (folded)

2.2 THE PULSE-HEIGHT (PHA) MODE

When data acquisition is performed in pulse-height mode, analog pulses are analysed. A spectrum is collected, which represents the stochastic frequency of each pulse-height between 0 volts and 10 volts.

In PHA mode the input pulses are fed to the analog input 'ADC'. When an input pulse is detected, its height is digitally determined and corresponding to its height the pulse is allocated to a certain channel number. Now the numerical content of the corresponding channel is incremented by one. The maximum input voltage is 10 volts. The relation between voltage and channels is linear. This means - simplified expressed - that an input pulse with an amplitude of 10 V is stored to channel 8192 and an input pulse with an amplitude of 5 volts is stored to channel 4096. The configuration of instruments for
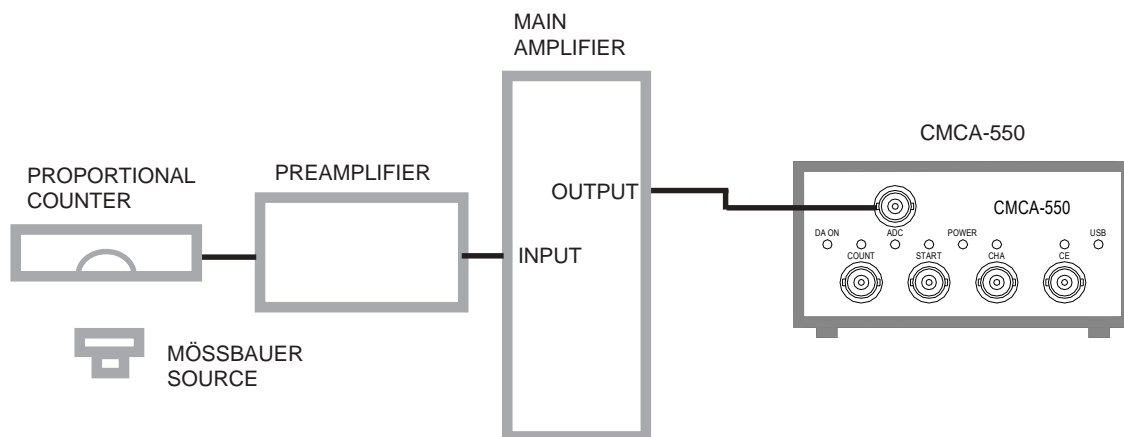

Fig. 6   Typical configuration for operation in PHA mode
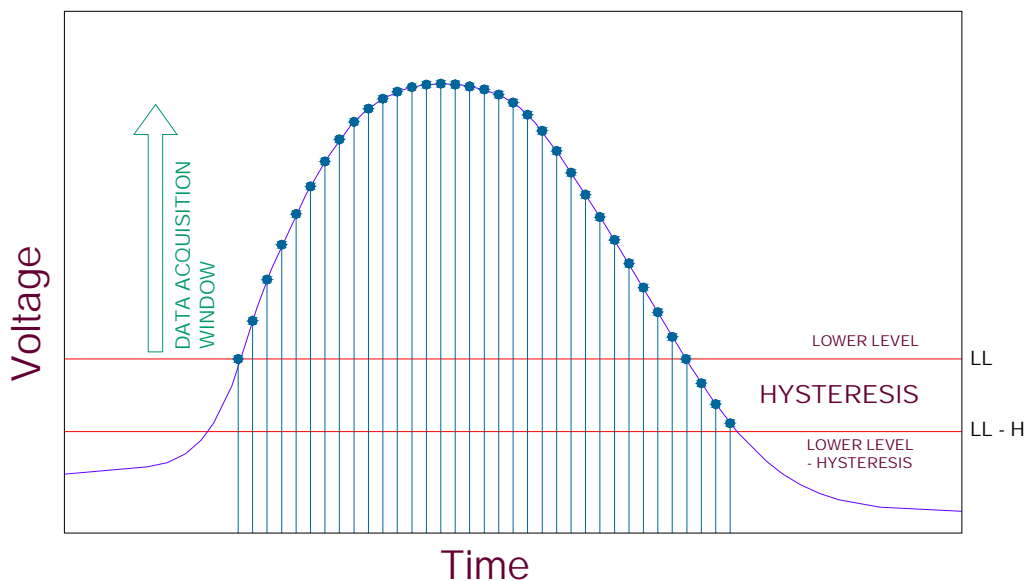

Fig. 7   PULSE SAMPLING

performing pulse-height-analysis is shown in Fig. 6.

Wissoft 2003 allows to set a data acquisition window (hardware window) which causes the CMCA-550 data acquisition module to ignore all input pulses outside of this window. Only input pulses with an amplitude higher than the lower level *LL* of this window and lower than the upper level *UL* are stored. With the hysteresis *H* another essential hardware parameter can be set in Wissoft 2003. H is the voltage difference between the lower level LL, at which the analysation of a pulse is started and the level LL-H, at which the analysation of a pulse is finished (see Fig. 7). When the voltage has dropped below LL-H, the data acquisition module is ready to analyse the next pulse. This occurs when the input voltage of a following pulse reaches again the lower level LL. For taking a full pulse-height spectrum, the upper level of the data analysis window may be set to its maximum value.

The lower level *LL* and the hysteresis *H*, however, should be set in such a way that the noise at the lower edge of the energy scale is cut off. A full pulse-height spectrum measured with a ^{57}Co Mössbauer source is shown in Fig.8.
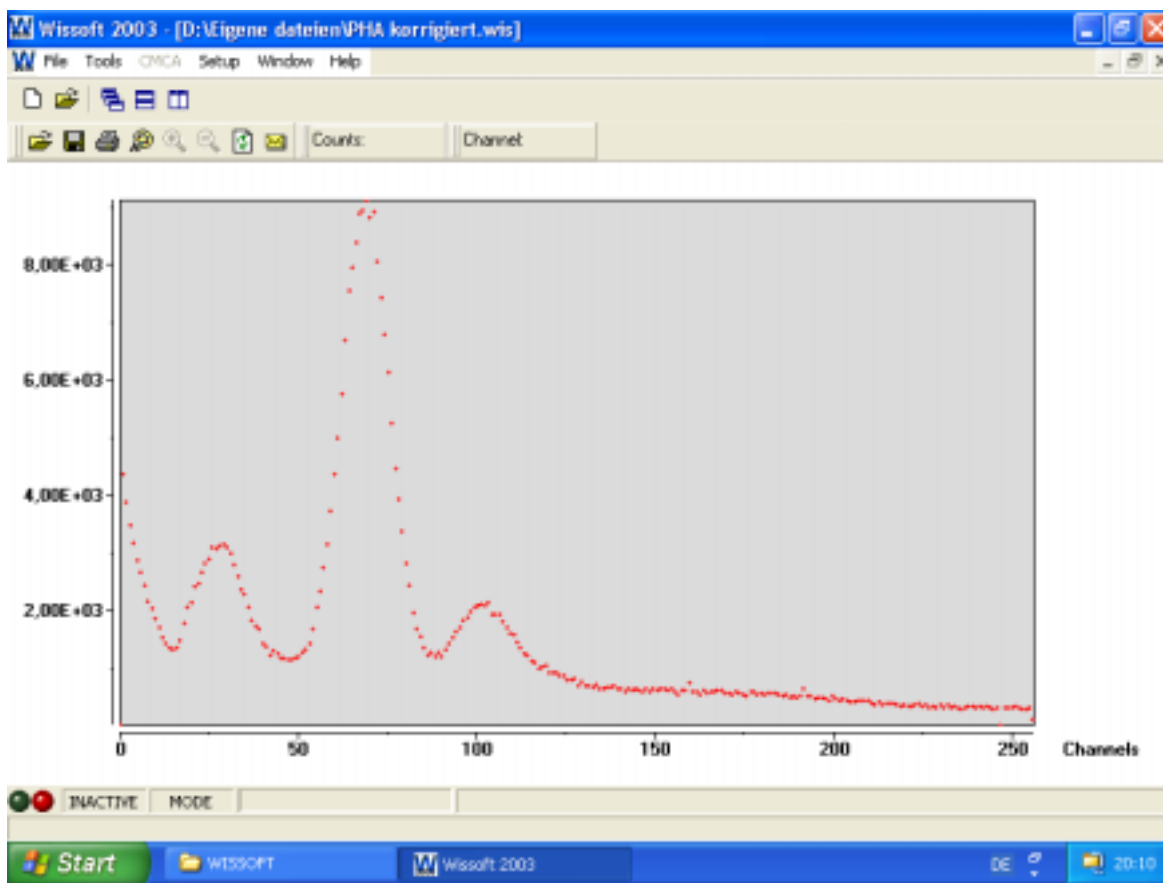
**Fig. 8   CMCA-550 Data Acquisition Module in PHA mode:
PHA Spectrum of Co-57 in full scale**

2.3 THE MCS [WINDOW] MODE

In the MCS[WINDOW] mode, analog pulses are fed from the output of a main amplifier directly to the input called 'ADC' of the CMCA-550, where they are converted to digital values. Now a digital window can be set by the user to filter the input pulses in such a way, that only pulses, whose heights lie in a defined voltage range, are counted. By this, the desired emission line of the incoming radiation can be selected. For taking a Mössbauer spectrum in MCS[WINDOW] mode, you first select PHA mode and take a pulse-height spectrum. Now you set a window, which includes that emission line, which should be used later in the MCS [WINDOW] mode. In case of a Mössbauer experiment on Fe-57, you select the 14,4 keV line of your γ-ray spectrum as shown in Fig. 9. Thereafter, you change from PHA to MCS[WINDOW] mode by using Wissoft 2003. Now only those pulses are counted, which lie in the selected voltage range. Please pay attention that you have fed the analog counts to the analog input 'ADC' (see Fig. 10). You get these analog pulses directly from the output of your main amplifier. An external single-channel-analyser is no longer required, as already mentioned.
Because of the possibility of electronic drift, we recommend you to check occasionally the position of the window in relation to the selected emission line.
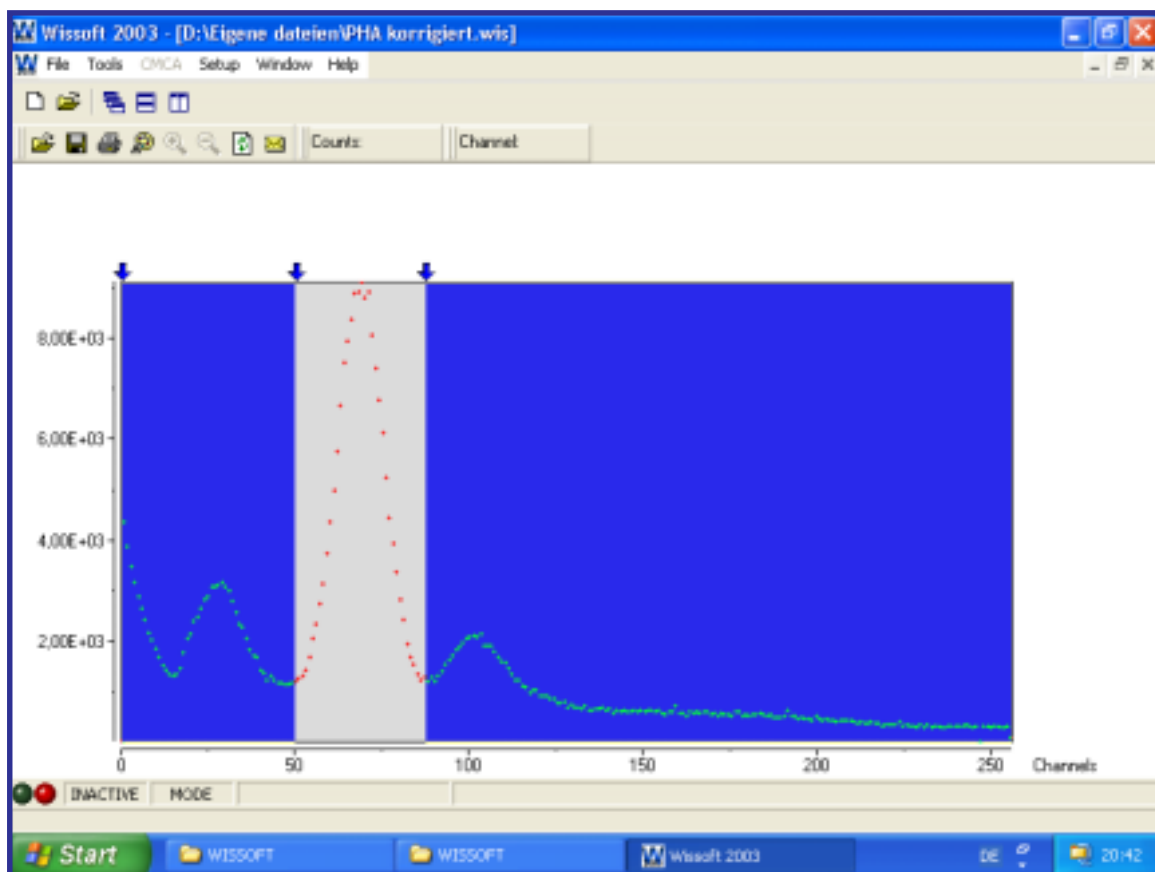

Fig. 9   THE DATA ACQUISITION WINDOW OF WISSOFT 2003
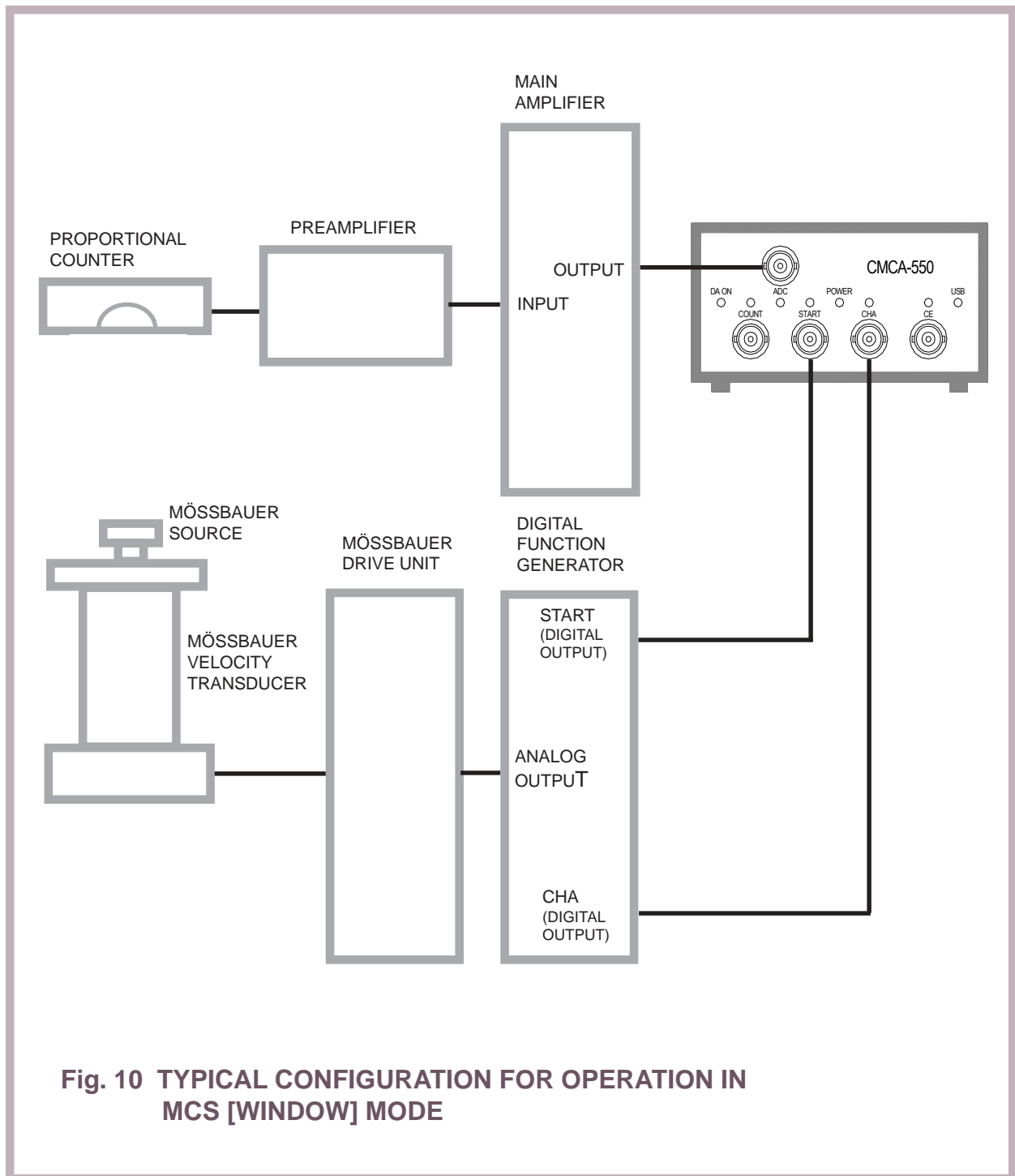Selection of the 14.4 keV γ-line of Co-57

Fig. 10 TYPICAL CONFIGURATION FOR OPERATION IN MCS [WINDOW] MODE

2.4 Using the CMCA-550 without PC

The CMCA-550 module has a separate power supply and continues its operation in case that the connected PC is switched off. The PC is required only for starting and stopping the data acquisition, for changing settings and for displaying and storing spectra.
In case of a power failure, it keeps data stored for more than four days.The operation can continued later without reset or other steps.
Please note: Having exhausted the capacity of the internal standby power supply, it takes several hours until it is recharged.

3. Operating the CMCA-550 Data Acquisition Module with Wissoft 2003

3.1 Hardware Requirements

☐ 128 MByte or more RAM
☐ Harddisk - about 10 MByte free hard disk space
☐ SVGA graphics board (we recommend a resolution of 800 x 600 16 bit or higher)
☐ Serial interface port or USB port
☐ CD-ROM Drive (compatible to CD-R discs)

3.2 Software Requirements

For running Wissoft 2003, Microsoft Windows 98 /Windows/ 2000/ Windows XP has to be installed on your Personal Computer.

3.3 Connecting the CMCA-550 Data Acquisition Module to a Personal Computer and Installing WISSOFT 2003 Software

☐ Connect the CMCA-550 data acquisition module to a serial port or to an USB port at the rear .
☐ Now install the software. For this insert the Wissoft 2003
CD-ROM into your CD-ROM drive, and run <Setup.exe> (and follow the self-explanatory instructions of the programme which are guided by the installation software).

4. Using WISSOFT 2003 Software

4.1 Starting Up WISSOFT 2003

When WISSOFT 2003 is successfully installed, the WISSOFT 2003 icon appears in the START MENU of Windows 98SE/Windows 2000/Windows XP. With a mouse click on this icon Wissoft 2003 will be started.
Now for a short time you will see a splash screen showing the Wissoft 2003 welcome page with the name of the company, the version No and the status of registration. A few seconds later the Main Screen appears. You can connect your CMCA-550 module to two kinds of ports, either to a USB port or to a serial port (RS232C).

4.1.1 Communication via USB Port
The best kind of communication between Personal Computer and CMCA-550 module is using USB. If you communicate via USB port, you can start immediately with operating the CMCA-550 unit.You see the main screen and a child window for each detected CMCA-550 module connected to the PC via the USB port (see Fig.11a) The child window shows an alphanumeric code, which is assigned to each CMCA-550 module. Beginning with Februar 2004 this code represents the last part of the serial number. You select a CMCA-550 unit by clicking on its window with the left mouse button.

4.1.2 Communication via Serial Port
If your Personal Computer has no USB port, you may communicate via the serial interface. However, in contrast to the USB communication, the serial communication daes not start automatically. Before you can communicate with your data acquisition unit(s), you have first to initialise Wissoft 2003.
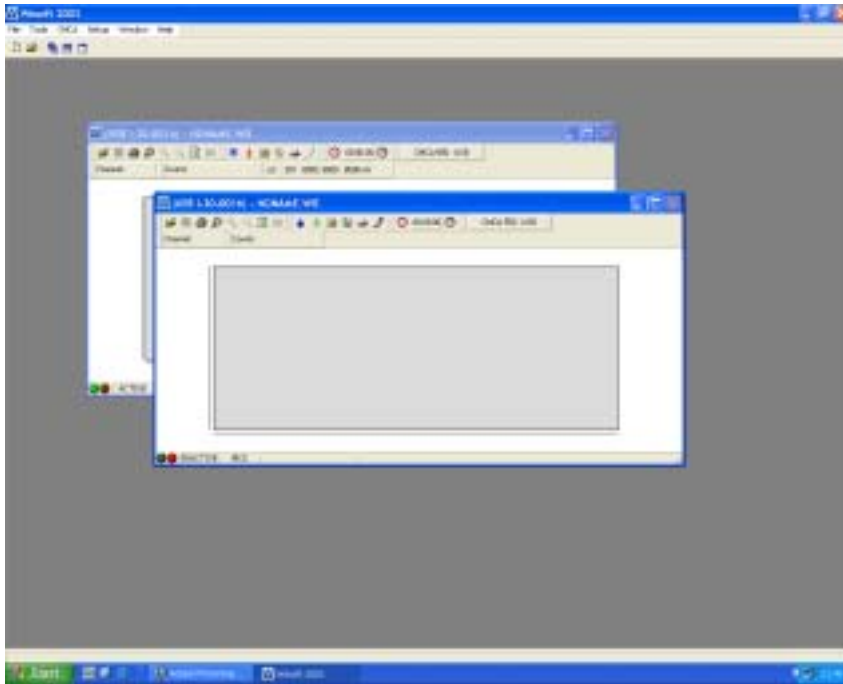
Fig. 11a
Starting the Communication via USB Port

When a CMCA-550 module is connected to a USB port, this is automatically detected by the computer. For each CMCA-550 unit a child window appears on the main screen, showing the identification code of the CMCA-550 unit in its upper left corner.

Fig. 11b
Wissoft 2003 the Hardware Configuration Panel
for Adding a Data Acquisition Unit

Before the initialising the fields of the Hardware Configuration Panel are empty. After clicking on the the arrow of the menu 'Add Device' all available ports or interrupt addresses (for previous CMCA-550 ISA cards) are shown. Having selected a port or interrupt address by a mouse click on the corresponding line, the port or address is displayed in the window. Now click on the button 'Check'. If a communication is possibly via the displayed port, the name of the button changes to 'Add'. Having confirmed the choice by clicking on 'Add', the selected port or interrupt address appears in the upper, large window (III).
By clicking on 'OK' the initialisation is finished and the panel disappears. Several ports can be selected by this way. After initialisation each CMCA-550 unit is represented by a child window similar to USB communication. The number of the corresponding serial port ist displayed on top of each child window.

Only a few steps are necessary for initialising Wissoft 2003. First you have to open the drop down menu 'SETUP' in the Main Screen. After clicking therein on 'Hardware Setup', the panel 'Hardware Configuration' appears (see Fig. 11b). At the beginning both windows of the Hardware Configuration Panel are empty. First you click on the arrow button of the lower window 'Add Device'. Now a list with available ports and iterrupt addresses appears. They interrupt addresses can be used for CMCA-550 ISA cards, the predecessors of the CMCA-550 modules. From this list you select a port number (Com1..Com4) or an interface address. Then you click on the button 'Check'. When the chosen port or interrup address communicates with the Personal Computer, the button 'Check' changes to 'Add'. By clicking on the button 'Add' your choice is realised and the number of the selected port appears in the upper window 'Configured Devices'. A small green hook indicates, that the configuration was successful. For communicating with further CMCA-550 modules, you simply repeat this procedure, choosing another port number. Each CMCA-550 unit is represented its own window on the main screen. The corresponding port number is displayed on top of its child window.

4.3 The Main Screen

The surface of Wissoft 2003 is similar to that of Word or Corel draw. When you open Wissoft 2003, the 'Main Screen' appears (Fig. 12), set up with the usual head bars - a headline, a menu bar, an icon bar and a working display showing the last spectrum of the previous session. Within the frame of the working display, you can open as many 'Child Windows' as you like (Fig.13). A 'Child Window' displays the content of a data file or the memory of a CMCA-550 data acquisition module (see also Fig. 12, Fig. 13).
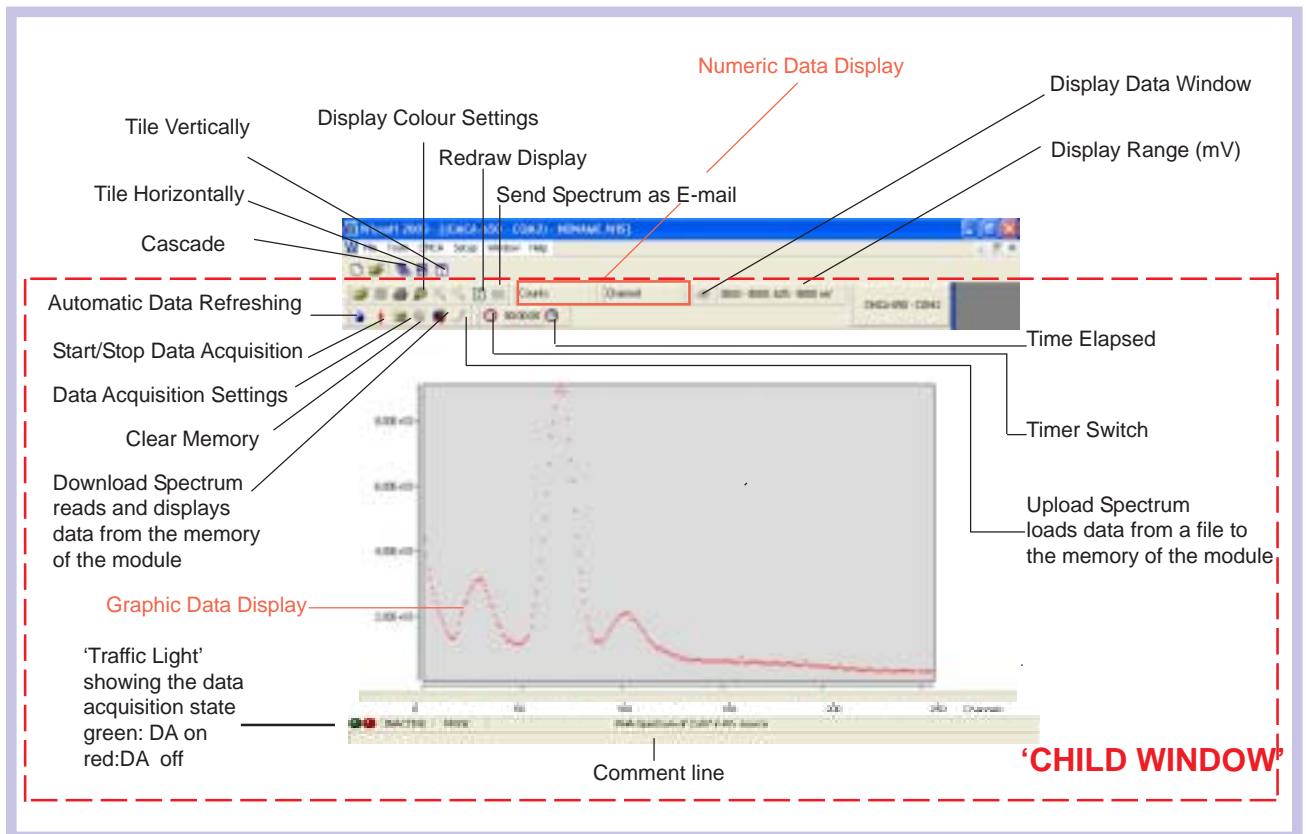

Fig.12 The 'Main Screen' of Wissoft 2003

The menu bar of the 'Main Screen' covers all commands and functions for working in the 'Child Windows'. It will be treated in a separate chapter. Here it should only be mentioned, that in the menu 'Window' (menu bar of the'Main Screen') all opened 'Child Windows' are listed and that from there they can be administrated and activated. Each 'Child Window' has its own headline, two icon bars and a graphic data display (see Fig. 13). The headline indicates the detected data acquisition unit and the name of the opened file. For each connected CMCA-550 a separate 'Child Window' can be opened. The 'Child Windows' can be arranged or can be moved within the frame of the 'Main Screen' by clicking with the left mouse button into their headlines and dragging them. When a 'Child Window' is opened, it loads and graphically displays the content of the previously used data acquisition unit. When data acquisition is in progress and thus the content of the Graphic Display is changing, you can switch on a continuous data transfer (command 'Automatic Data Refreshment'). Separate 'Child Windows' will also be opened, when you choose from the menu 'File' of the 'Main Screen' the commands 'Open' or 'Import'. With the command 'Open' you load a spectrum from a Wissoft - Windows file, with the command 'Import' you import a Wissoft - Dos file. The Graphic Data Display of the 'Child Window' provides an automatic scaling of the horizontal axis representing the channels and of the vertical axis, representing the channel contents. In horizontal direction all channels up to the last channel with content > 0 are displayed. If e.g. the maximum displayed channel has the number 1023, then all channels beginning from number 1024 up to 8192 have the content '0'. The Graphic Data Display provides also an automatic scaling on the vertical axis: The channel contents are displayed in such a way that the minimum value touches nearly the bottom of the display area, whereas the maximum channel content reaches the top of the vertical scale. The icons of the 'Child Window' are treated in the next chapter.
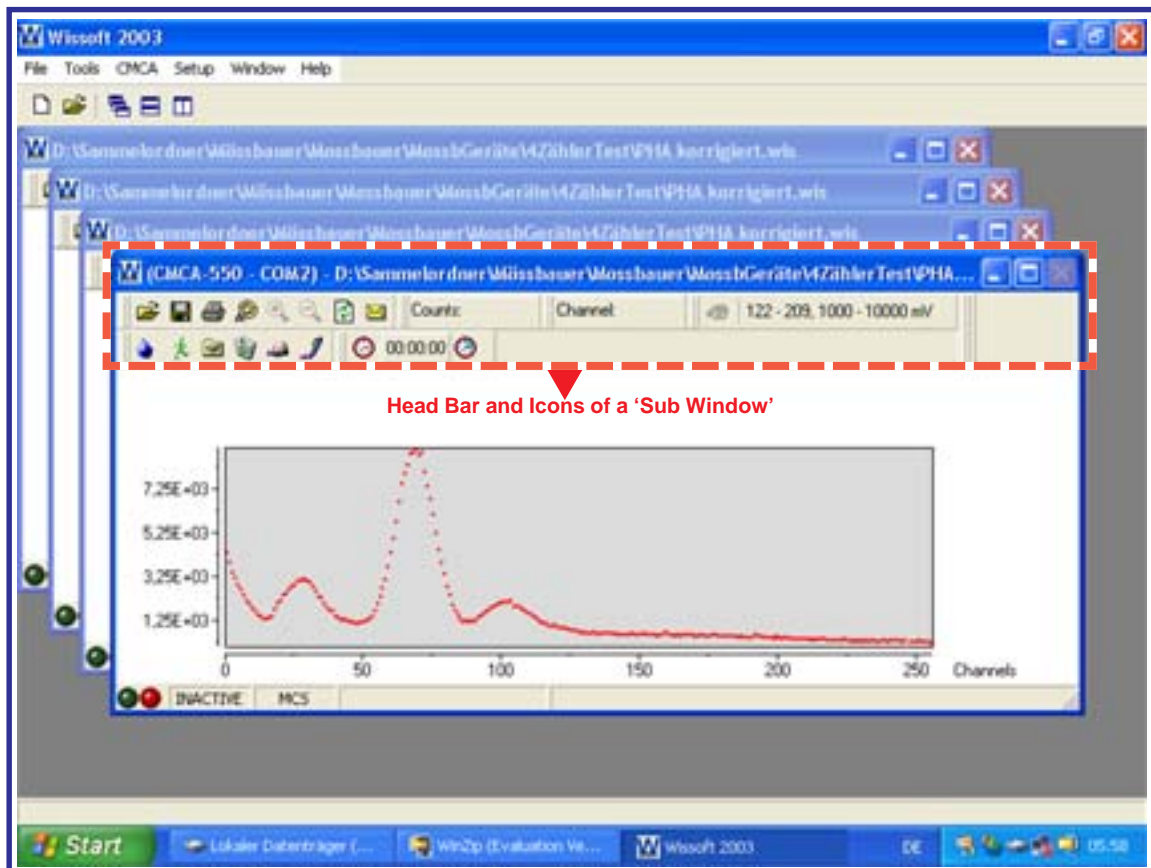

Fig. 13 Display of the 'Main Screen' with four 'Sub Windows' opened

4.3.1 The Icons of the 'Child Window'

The icons of the 'Child Window' provide an easy and direct access to the main functions of Wissoft 2003. Some of them are well known from other application programmes and should not be considered here. Only those icons, which are specific for Wissoft 2003, will be explained in detail, starting at the left side of the upper icon bar.

The button **'Display Color Settings'** opens the panel 'Color Dialog' (Fig. 14). If you click therein on the button 'Background' a list of parameters appears whose actual colors can be changed by simply clicking on 'Change'.
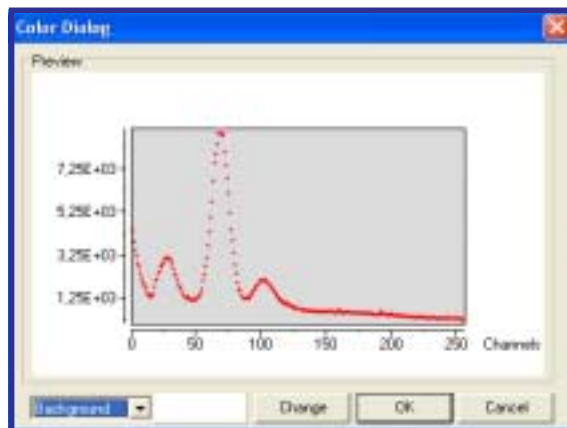
Fig. 14 Panel 'Color Dialog' for changing colors of the parameters of a displayed spectrum

A color panel will be opened, from which you can select the colors you need.
A useful tool of the graphic data display are the **zoom functions**.
First the zoom area has to be defined by a rectangle in the following way: a click with the right mouse button defines the first corner of a rectangle. Keeping the button pressed, you drag the mouse cursor diagonally to the position of the opposite corner and then you release it. The rectangle, created by this click and drag operation, is now highlighted. Now a click on the **'Zoom In'** symbol expands the highlighted rectangle stepwise as much as you like. For reducing the rectangle you simply click on the **'Zoom Out'** symbol.

The button **'Redraw Display'** enables you to redraw your original display after having used the Zoom In or Zoom Out functions.
When a spectrum is displayed on your 'Child Window', the numeric data display **'Counts'** and **'Channel'** shows the number and content of the channel at the cursor position. For this you drag the mouse cursor on the spectrum, whereby its symbol changes to a cross. If you now click on the left mouse button and
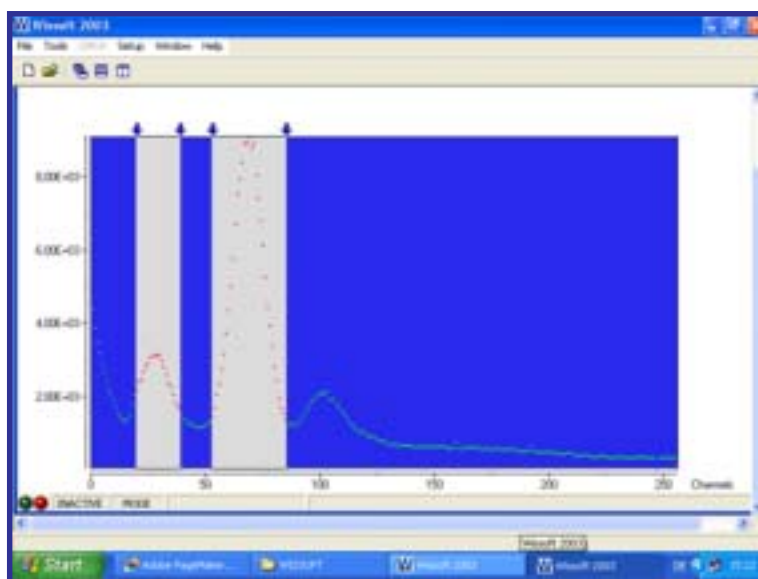

Fig. 15 Hardware - or Data Acquisition Window

keep it pressed, the cross enlarges to a crosswire and the values of the marked data point are displayed at the numeric data display.

The icon **'Display Data Window'** 💿 is activated in PHA mode. It provides an easy way to select the Mössbauer line. When you click on it, the limits for two hardware windows can be set by shifting the arrows which appear in the right upper corner of the spectrum graph (see Fig. 15). From the numeric data display 💿 12·20·100·1000mV connected to the icon you can read the values of lower and upper limits of the hardware windows given in mV. The shifting of the arrows results in a direct shift of the lower and upper limits of the hardware window on the CMCA-550 data acquisition module. In case you are setting two windows and two arrows overlap, a click with the right mouse button will open a menu asking which one of the superimposing arrows you want to shift.

The icon **'Automatic Data Refreshing'** starts or stops automatic data refreshing during data acquisition. When the automatic data refreshment has been stopped, the icon
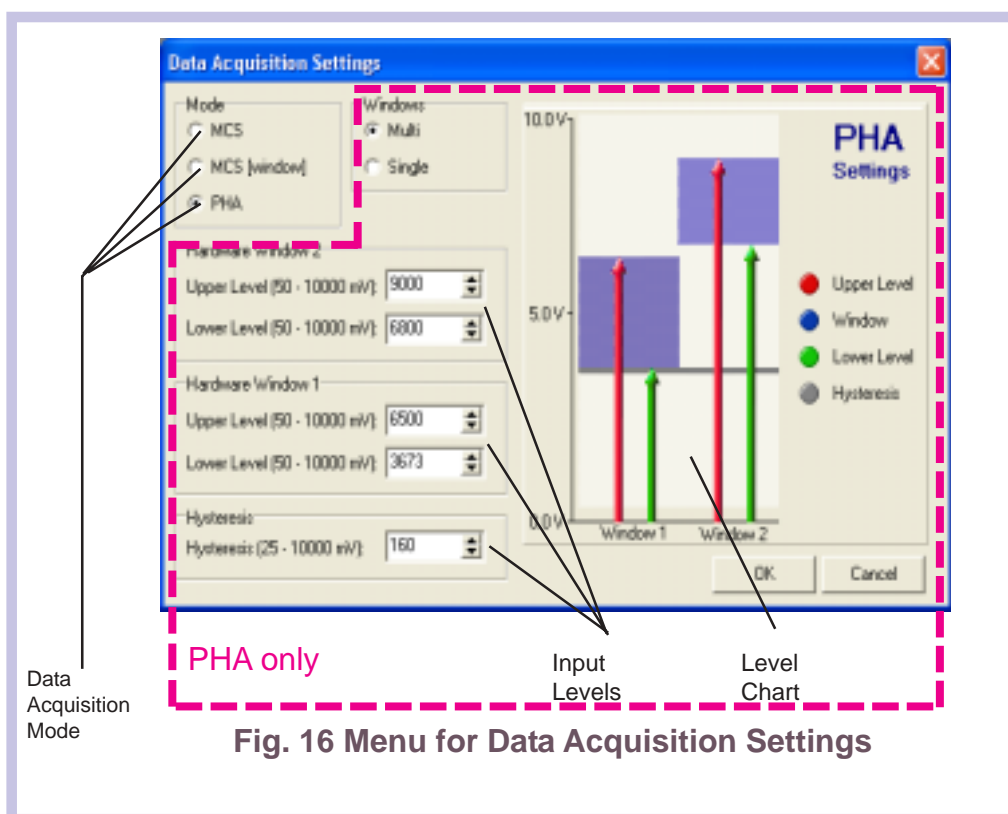

Fig. 16 Menu for Data Acquisition Settings

shows a water drop 💧 , when the automatic data refreshment is active, it shows an ice crystal ❄ .The data refreshing rate can be changed as explained in chapter 4.3.2.2. The button **'Data Acquisition Start / Stop'** allows a quick start or stop of data acquisition. Clicking on the icon 🚶 starts the data acquisition, whereby simultaneously the icon itself changes to 🚶 , showing that data acquisition is activated . A click on the red colored pedestrian stops data acquisition, whereby the icon changes back.

A click on the icon **'Data Acquisition Settings'** 🖼 opens the panel 'Data Acquisition Settings' (Fig.16). From the menu on the left side of the panel you can select one of the data acquisition modes described in chapter 2. At the right side of the panel the data acquisition parameters for the PHA - mode can be set for two different windows . The upper and the lower level mark the limits of the hardware or data acquisition window described in chapter 2.2. For the hysteresis a small value should be taken, which

however should be large enough to avoid that noise on the input signal is counted. From this results, that a noisy input signal requires a larger hysteresis than a smooth one.

The button '**Clear Memory**' is used, to erase the memory content of the CMCA-550 data acquisition module. Having clicked on the 'Clear Memory' button, a panel appears, asking you to confirm or to cancel your command.

The icon '**Download Spectrum**' reads and displays data from the memory of the data acquisition module. This command may be used only, when the automatic data refreshment is switched off. With'Download Spectrum' you can readout data from your data acquisition module to the Graphic Data Display.

The icon '**Upload Spectrum**' allows you, to write the content of the Graphic Data Display or of a Wissoft file back to the memory of the CMCA-550 data acquisition module. This can be useful, if you wish to continue an interrupted data acquisition and your spectrum is no longer stored on the CMCA-550.

The '**Timer**' is usually not needed, when you take a normal Mössbauer spectrum. For some purposes, however, a timer may be useful, for example when you evaluate data from a Mössbauer velocity calibrator. For such cases Wissoft 2003 provides a timer, which can be activated and deactivated by clicking on the 'Timer Switch' (clock at the left side) of the icon 'Timer'. A panel opens, where you can define your time for data acquisition. After confirming with ok, the time starts running. The numeric data display shows the time elapsed resp. the time remaining .The clock at the right side is the button for switching between time elapsed and time remaining. The 'Timer' has to be activated, before you start data acquisition. In case data acquisition has already been started, the 'Timer' can no longer be activated.

4.3.2 The Menu Bar of the 'Main Screen'

For most of the steps, when using Wissoft 2003, the icon bars of the 'Child Window' provides all what you need. The menu bar of the 'Main Screen' however, offers even some more tools. We know already the menu 'Window' for administrating and activating the 'Child Windows'.The menu bar can be seen on top of the graphics display (Fig. 13) and in detail in Fig.17.
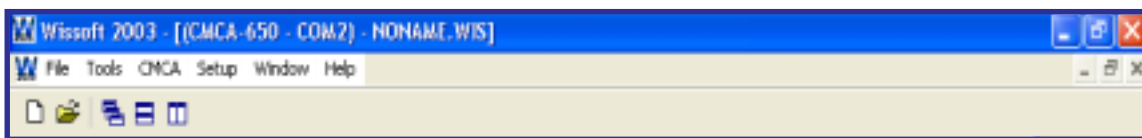

Fig. 17 The Menu Bar and the Icon Bar of the 'Main Screen'

The icon bar below contains some well-known icons for opening a new file or an already existing file and some self-explanatory icons for a quick rearranging of the 'Child Windows', which might be helpul, in case you have opened several of them on the 'Main Screen'.

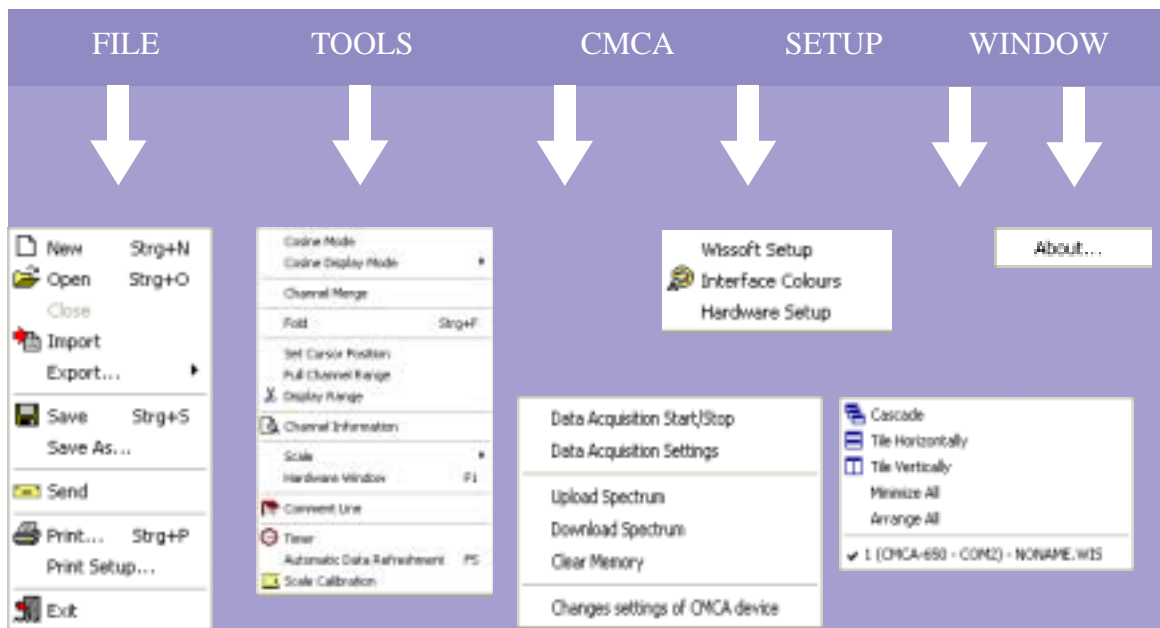Fig. 18 gives an overview over the commands available within the menu bar.

Fig.18 The drop down menus of the 'Main Screen'

4.3.2.1 File Menu

The first menu from the left contains all file operation commands. Again you can open a new file (New) or open an already existing file (Open) and you can close a corresponding 'Child Window' by the command 'Close'. The commands 'Import' and 'Export' allow you to open and save files of WISSOFT - DOS version. Save your data files with the commands 'Save' and 'Save As'. The latter command allows you to enter a new name and a new path for your file, also if name and path are already existing for this file. With the button ' Send' you can send your file by e-mail. A spectrum which is diplayed on the screen, can be printed by simply using the command 'Print'. For setting up the printer, use the command 'Print Setup'. Wissoft 2003 will be closed by clicking on 'Exit'.

Instead of executing a command by a mouse click on the corresponding menu icon , you can use short-cuts for nearly all commands. It is assumed, that the user is familiar with using the short-cuts. If not particularly asked for a different combination of keys (as e.g. in case of 'Open File' = Crtl + O), you execute a command by pressing simultaneously the underlined character and the Alt-key , e.g. in case of 'Import' you press the letter I together with the Alt-key. All short-cuts are indicated in the menus of Wissoft 2003.

4.3.2.2 Tools Menu

Cosine Mode / Cosine Display Mode

The drop down menu 'Cosine mode/Cosine Display mode' is optionally available for users of the Mössbauer Velocity Calibrator MVC-450. (A velocity spectrum is shown in Fig.19.) This option enables you to evaluate data from this unit, e.g. to fit the data to a cosine function in order to determine the deviation of the motion of your velocity transducer from the ideal waveform.

Channel Merge

This command allows to merge neighboured channels in order to improve the statistics of a spectrum. When you click on 'Channel Merge', a panel is opened, where you can enter the number of channels to be merged.

Folding

If you have taken a Mössbauer spectrum using a symmetric waveform for the source motion, each value of the velocity appears twice on the screen (see chapter 2.1). The total set of data has a symmetry point approximately in the middle. Therefore it is possible, to improve the statistics of the measurement by folding the whole data set. 'Folding' means that you first determine the symmetry point in the middle

Fig. 19 Velocity Spectrum taken with the MVC-450 Mössbauer Calibrator The collected spectrum has the form $\cos(i*2p / 512)$ i is the channel number

and then you add the channel contents of the right half to the channel contents of the left half in such a manner that always the contents of a pair of symmetric channels are added. The result is a spectrum with half the number of channels. Each channel has appoximately the double number of counts compared with the unfolded set of data. Having executed the command 'Fold', the Folding Panel appears, showing the
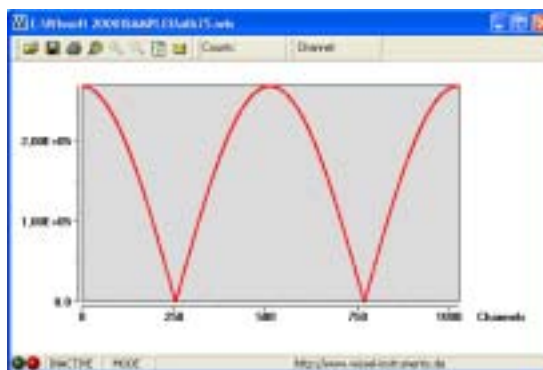

Fig. 20 'Folding' panel for determination of the folding point on the right side: unfolded (above) and folded (below) spectrum of α- Fe

appropriate folding point (at 100 %) and furthermore a channel analysis (see Fig. 20). You can accept this folding point or override it by another, manually entered value.

Setting a Cursor

When you click on the menu 'Set Cursor Position' a panel 'Cursor Position ' opens, which allows you to set a cursor. For this you enter numerically a value and after confirming the entry, the cursor appears at the entered position of your spectrum. You also can activate, deactivate, and move the cursor by using the arrow keys. Besides the

(permanent) cursor, a temporary cursor can be set by clicking with the left mouse button on the desired position of the screen. More details about cursors follow in Section 4.3.3.

Setting the Display Range
Wissoft 2003 normally displays all channels up to that one, from which on all channel contents are zero. However you can select any other display range using the menu choice 'Display Range'. This menu opens a panel of the same name where you can enter the lower and the upper limits of the desired range. When you activate the command 'Full Channel Range' the whole channel range up to 8192 is displayed. You return to the original display range of Wissoft 2003 by clicking on the button 'Original' of the 'Display Range' panel.

Channel Information
Clicking on the button 'Channel Information', shows a list containing channel numbers and channel contents. By scrolling you can display the whole range of channels and you have the possibility to change the channel contents manually.

Scale
On the vertical scale of the graphics display the number of counts is given. The horizontal axis, however, can have several scales: channels, voltage [V] and energy [keV]. By clicking on the button 'Scale' a menu opens, from which you can select an appropriate unit. The voltage scale refers to the analog input of the CMCA-550 Data Acquisition Module, where the maximum channel corresponds to a pulse height of 10 V. The energy scale given in keV units requires a calibration, because the relation between the energy of a counted γ-quantum and the number of that channel, whose content is incremented by this γ-quantum, depends not only on the parameters of the CMCA-550 Data Acquisition Module, but also on those of the detector, the amplifier and the applied voltage. The calibration is described in the next section. There is still another way of choosing the scale. When you move the cursor to the title of the horizontal axis at the right lower corner of the graphics display, it gets the shape of a hand. When you now press the left mouse button the next scale unit appears in a cyclic sequence.

Hardware Window
The Hardware Window can be activated only when the CMCA -550 data acquisition module is either in PHA or in MCS (Window) mode. It is an electronic filter of the CMCA-550, which rejects all incoming pulses with heights lower than its Lower Level or higher than its Upper Level. This refers to pulses fed in PHA or MCS[window] mode through the analog input 'ADC' (see section 2.2).The display of the hardware or data acquisition window is activated and deactivated by clicking on the menu button 'Hardware Window' or by pressing the F4-key. The numeric display of the 'Hardware Window is located on the right side of the icon 'Display Data Window' (see Fig.12).For setting the 'Hardware Window', you press the shift key and click with the right mouse button on that horizontal position, where you wish to set one of the limits of the 'Hardware Window'. Now keep the mouse button pressed (the shift key may be released) and drag the mouse to that direction, where you wish the second limit to be positioned. When dragging the mouse, a square appears which follows the displacement of the mouse. The area of this square is colored after releasing the mouse key and represents the 'Hardware Window' (see Fig.15). If this window should not have satisfying limits, you may repeat the setting procedure. You can use this way of setting a 'Hardware Window' alternatively to that one described in section 4.3.1 (icon 'Display Data Window').

Comment Line
Using this command a panel 'Comment Line' opens, where you can enter a comment to
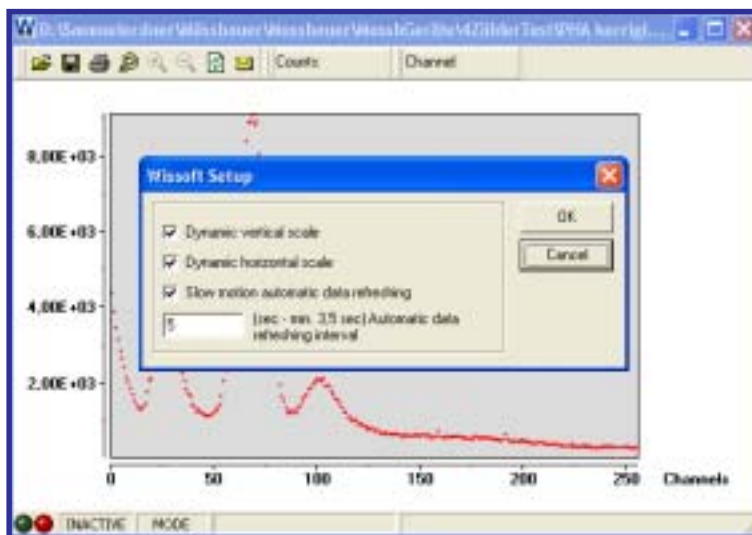
**Fig. 21 Panel 'Wissoft Setup' for changing the
parameters of the 'Data Refreshing' rate**

the displayed spectrum. This comment is stored with the spectrum and also printed at
the bottom of the printout.

Timer

The Timer can be useful when you want to evaluate data of a laser based velocity
spectrum. Its functions are alreday explained in 4.3.1.

Automatic Refreshment

This menu allows you to start or stop the automatic data refreshment, i.e. the automatic
transfer of data from the data acquisition unit to Wissoft 2003. The refreshment rate can
be set in the panel 'Wissoft Setup'. This panel appears after clicking in the pull down
menu 'Setup' on the button 'Wissoft Setup' (see Fig. 21). You can choose slow motion
data refreshment and in addition you can choose automatic scaling of the horizontal and
vertical scales. When the automatic refreshment is disabled, the Graphic Data Display
is frozen. That means that its content may differ from the actual memory content of the
data acquisition unit.

Scale Calibration

For calibrating the energy scale, you have to take first a pulse-height spectrum. Then
you select a peak of which the energy is known. Now click with the left mouse button on
top of this peak. During the mouse click a temporary cursor appears and you can read
from the Numeric Data Display (see Fig. 13) number and content of the corresponding
channel. The data display on remains visible until you set again a cursor or you activate
the permanent cursor. The cursors of Wissoft 2003 are described in Section 4.3.4. Now
you choose 'Scale Calibration' from the 'Tools' menu and the panel 'Scale Calibration'
appears with the number of the selected channel and you can enter the energy of the
peak.

Still easier is another way of calibrating the horizontal axis. When the cursor arrow is
positioned over the left side of the frame, which limits the Graphic Data Display, it gets
the shape of a hand. If you now press the left mouse button, a vertical cursor line
appears which can be dragged with the left mouse button pressed to the centre of a
peak of your pulse-height spectrum with known energy. When you release the mouse
button, the Scale Calibration Panel of Fig. 22 appears. Having entered and confirmed
an energy value, the horizontal axis is now calibrated in [keV]. The minimum value of
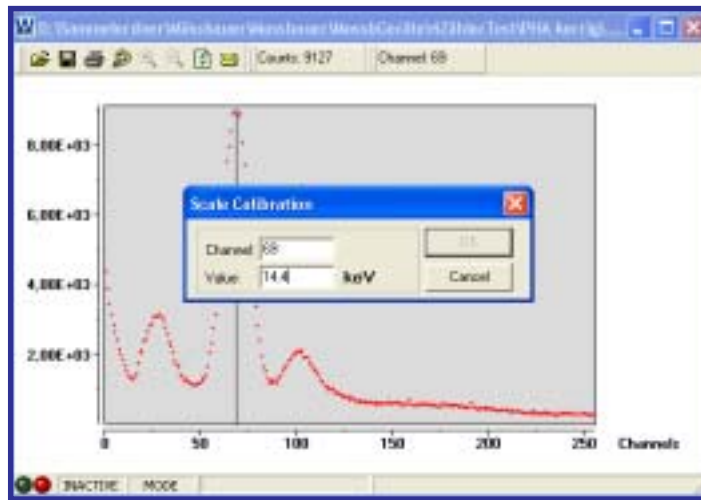the energy axis is always 0 keV.

**Fig. 22 Panel 'Scale Calibration' for calibrating
the horizontal scale in keV**

4.3.2.3 CMCA Menu

Besides one, all submenus of the menu CMCA have their corresponding equivalents in
the icon bar of the 'Child Window'. The submenu 'Data Aquisition Start/Stop' corresponds
to the icon [icon], the submenu 'Data Aquisition Settings' corresponds to the icon [icon]. The
submenus 'Upload Spectrum', Download Spectrum' and 'Clear Memory' can also be
executed by their adequate icons in the icon bar of the 'Child Window'. Clicking on the
menu point 'Changes settings of CMCA device' opens the panel 'General
Settings'shown in Fig. 23. The panel 'General Settings' allows to change several
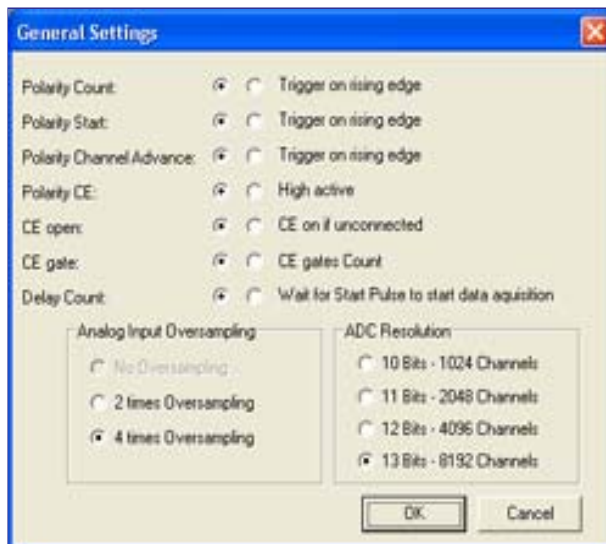

**Fig. 23 Panel 'General Settings' for the CMCA-55
Data Acquisition Module.**

hardware parameters to adapt the CMCA-550 to the connected devices. The
parameters set as in Fig. 23 are factory settings and need not to be changed for WissEL
equipment.

4.3.2.4 Setup Menu

The menu 'Setup' opens two submenus. The menu button ' ⚙ Interface Colours' we know already from its equivalent in the icon bar of the 'Child Window'. It has been discussed their in detail. The button 'Hardware Setup' was needed for configuring the CMCA Data Acquisition Module and was already explained in section 4.2.

4.3.2.5 Window Menu

The menu 'Window' contains some menu buttons for rearranging the opened 'Child Windows' (see Fig. 13) and in addition a list of the actually opened 'SubWindows'. If you click on one of the listed 'Child Windows', it comes to the fore and you can work in it.

4.3.2.6 The Menu About

If you wish to know the version number of your Wissoft 2003 software or if you have questions and wish to contact us, then click on the last choice, 'About', of the menu bar.

4.3.3 The Cursors

An unrenounceable tool for nearly all Windows programmes is the cursor. Wissoft 2003 provides two cursors, which can be alternatively activated. The permanent Cursor is indicated by a vertical line and activated by means of the arrow key ⬆ of the keyboard. You can change its position using the arrow keys ⬅ ➡. Number and content of the cursor channel are displayed in the Numeric Data Display on top of the Graphic Data Display. When pressing the arrow key ⬇, the cursor disappears. You can also activate this cursor using the submenu 'Tools' of the menu bar, as described in Section 4.3.2.3.

Wissoft provides also a second, temporary cursor. Its position is continuously indicated by a cursor arrow, also when no mouse key is pressed. However it is activated only during that time, when the left mouse button is pressed. Now the cursor gets the shape of cross-wires and the number and the content of the related channel are displayed in the Numeric Data Display on top of the Graphic Data Display, overriding the data of the permanent cursor.

The temporary cursor disappears automatically when the left mouse button is released. Its data, however, remains dispayed. In order to reactivate the data of the permanent cursor, press the button ⬆.

6. SPECIFICATIONS

INPUTS	5 BNC connectors	
	Analog Input	ADC
	Digital Inputs	COUNT, START, CHA, CE
INDICATORS	8 LEDs	DA ON, COUNT, ADC, START, POWER, CHA, CE, USB
OPERATING MODES	PHA, MCS, MCS[window]	
	PHA	Analog-to-Digital Conversion of analog input pulses Peak detection fully digital 1 - 10 V analog input 1024 - 8192 channels (8192 channels with interpolation (oversampling)) Sampling freuency: 48 MHz
	MCS	Digital input pulses max. 8192 channels per sweep count frequency > 100 MHz max. channel-advance-frequency: approx. 500 kHz
COMMUNICATION PORTS		
	RS-232C port	115.500 baud
	USB port	USB 1.1 specifications
POWER REQUIREMENTS	7 - 9 V DC, 400 mA	(from power cable with built-in AD-DC converter)
POWER PACK	AC-DC converter integrated in mains plug	
	Input	100 - 240 V AC* 50 - 60 Hz
	Output	7.5 V DC 800 mA
	Plug	European standard*
Physical	Size	135 mm x 100 mm x 53 mm
	Weight	500 g

* Power packs for non-European countries are also available