DTU Nutech
Center for Nuclear Technologies

The Sequence Editor

User Manual - December 2016 - Rev.1

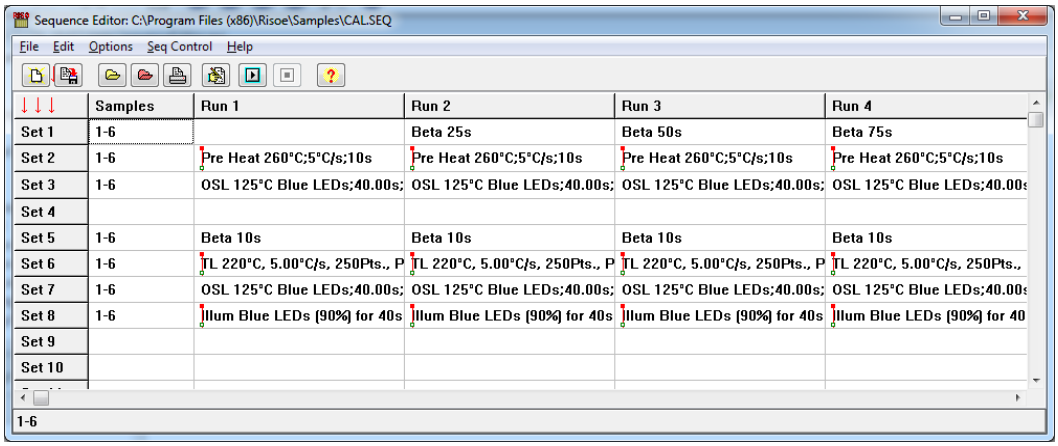


Table of Contents

Getting Started

For introductory information on basic Sequence concepts and features, choose one of the underlined topic titles in the table below. To return to this topic once you have selected another topic, choose the Back button at the top of the Help window until this topic reappears.

About Sequences
A Sequence is like a spreadsheet, it is a rectangular grid of columns and rows. The basic unit of a sequence is a cell, in which a single command is stored. Columns are labeled from left to right, beginning with ‘’Samples’’ then continuing with ‘’Run 1’’ through ‘’Run n’’. Rows are numbered down from ‘’Set 1’’ to ‘’Set n’’.

The cells in a sequence are filled in by choosing:

* Edit from the Edit menu,
* pressing F2,
* double clicking on the cell with the left mouse button or
* by choosing Edit from the context menu. The context menu appears whenever the right mouse button is pressed.

For an explanation of how cells (i.e. commands) are evaluated and the means by which the order of evaluation may be altered, see Sequence Options.

See Also

Sequences
Making sequences
Creating a new sequence.
Saving a Sequence.
Opening a Sequence.
Printing a Sequence.
Run a Sequence.
Break a Sequence.

Editing
Editing a set.
Editing a run.
Editing Cells.

Moving
Moving columns and rows.

Misc.
Changing the Column Width.
Shortcut keys

F1	Help
F2	Edit
^O	Open Sequence File
^S	Save Sequence File
^P	Print Sequence File
^R	Run Sequence
^Q	Break

SpeedBar

Create a new Sequence file
Save a Sequence file
Open a Sequence file
Open a Sequence Copy file
Print a Sequence file
Edit the selected cell
Run a Sequence file
Stop/Break a Sequence file
Open help

Advanced Topics

The following topics are for advanced users who are familiar with the operation of the Risø reader and the Mini-Sys low level programming language. These are the same commands which the sequence editor uses in routine operation. If you are not familiar with these commands then you may create sequences which do not behave as you expect...proceed with CAUTION!!

How to low level program the Mini-Sys.

File Format

Support

To report any problems encountered while using your Risø TL/OSL Reader or to make inquiries regarding software upgrades and additional hardware options, please feel free to contact us in any of the following ways:

+ By email: *pesq@dtu.dk*
+ By mail:

  Att. Per Günther Sørensen
  DTU Nutech
  Center for Nuclear Technologies
  DTU Risø Campus
  Frederiksborgvej 399, Building 201
  DK-4000 Roskilde
  Denmark
+ By phone: +45 4677 4932

Troubleshooting

In general

• Don’t run other applications that you have experienced to causing troubles for Windows crashing etc. during a sequence run, this may results in data loss since serial communication is often interrupted.
• Don’t print large print jobs.
• Don’t surf the Internet.
• Don’t run games, CD or other tasks using a large amount of resources.
• In doubt don’t do it... it’s your samples.

Windows Software

Decimal errors
You must set your Windows to use US/British decimal settings that means you set decimal point to a ‘.’

Nothing happens when you run the sequence
Check that the *TLMSLL.CMD* file exists and is placed in the TL root directory.

Cannot find Windows Help when using F1 etc.
Check that the *SequenceEditor.chm* file is placed in the TL root directory.

GPF and Windows
The software is tested, but there will be bugs in it, and unfortunately you will discover some of them. If you discover a bug please try to regenerate it and then report it.

Bugs
The software has been extensively tested, but if you are unfortunate enough to discover a bug then please do the following:

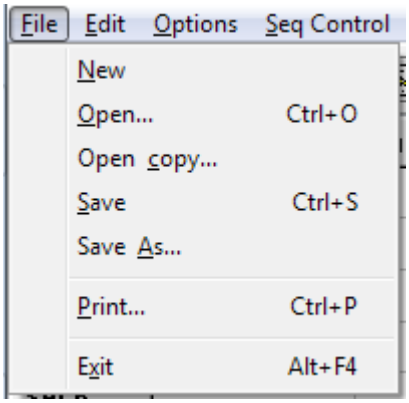
* Enable the log file (see Sequence Options).
* Generate the bug again (if you can).
* E-mail a short message to us including the sequence file and the log file (see Support for the correct address).

PC Hardware and Communications

For your serial connection to the Mini-Sys, use only the serial cable provided with your Risø system.

In order to ensure good serial communications performance we recommend that your computer use a UART 15500 serial communications chip. Check your ownders manual or run Microsoft diagnostics (MSD.EXE) to check your hardware.

File menu


File
Edit
Options
Seq Control
New
Open... Ctrl+O
Open copy...
Save Ctrl+S
Save As...
Print... Ctrl+P
Exit Alt+F4

Open

Opening Sequence Files
You can use the File Open dialog to find and open previously created sequence files.

By default the open dialog shows the files of type .SEQ in the last directory you opened a SEQ-file from or the default sequence path selected in User Options.

Open copy

Opening Sequence Files
You can use the File-Open copy dialog to find and open sequence file copy (SEC-file) that was stored by the sequence editor in a sequence run.

By default the open dialog shows the files of type .SEC in the last directory you opened a SEC-file from or the default data path selected in User Options.

New

Clearing a Sequence
Choose File|New to clear the current sequence and create a new sequence.
You can have only one sequence open at any time. If a sequence is open when you choose File|New, the program prompts you to save any changes made to the current sequence.

You can edit the sequence and options independent of other sequences.

Save/Save as...

You use the Save command to name and save changes to a file.

To save the current sequence choose:

* File|Save
* FileSave Speedbutton
* Ctrl-S

Print

Choose File|Print or click the button  to print the sequence in the Editor.

Note If you want to edit the printer settings or change the printer you must refer to your Windows manual

Exit

Choose File|Exit to close the open sequence and then close the Sequence Editor.
If you exit the Sequence Editor before saving your changes, it asks you if you want to save them.

You cannot exit the program while a run is ongoing, you must first Break the run.

Edit Sequence grid

Edit Cell

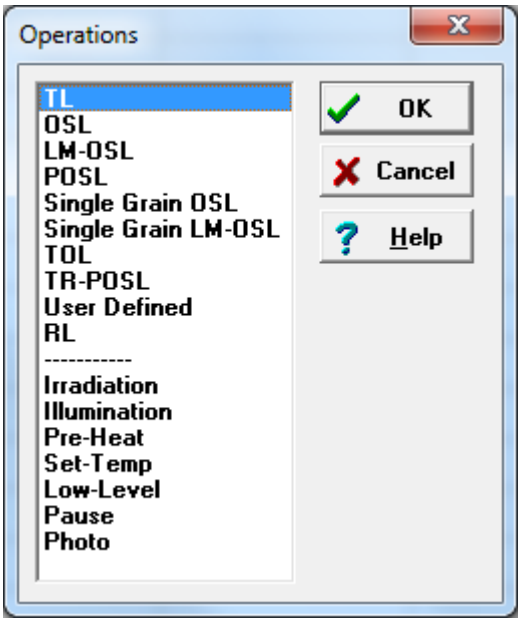
Double-click on the cell you want to edit, or choose Edit|Edit, click the  button or choose Edit from the Context menu, to edit the current cell.

The first column is used to define which samples that should be treaded.
The additional columns define each run for the sample, where a run is a complete revolution of the turntable.

Editing a run

To edit a run you must first select the Sample set and run no. you do this by either using the mouse or the arrow keys to move the insertion point in the grid.
If you use mouse simply move the cursor to the cell and then click once to select and then choose edit, or double-click to edit.

If the cell was empty the Operation Dialog pops up.



Simply click the command or operation you want to perform and then click the OK button or double-click the command or operation.
You may also go directly to the definition of a command by selecting the cell you want to define and pressing <shift>X , where X=

T for TL
for OSL
L for LM-OSL
S for Single Grain OSL
P for POSL
I for Irradiation
H for Pre-Heat

If you want specific information on commands or operations then refer to the following topics:

- TL (Thermo Luminescence)..
- OSL (Optical Stimulated Luminescence).
- LM-OSL (Linear Modulated OSL)
- POSL (Pulsed OSL)
- Single grain OSL
- Single grain LM-OSL
- TOL (Thermo Optical Luminescence).
- TR-POSL (Time resolved Pulsed Optical Stimulated Luminescence (slow)).
- User defined
- RL (Radio Luminescence)
- Irradiation.
- Illumination.
- Pre Heat.
- Set Temp.

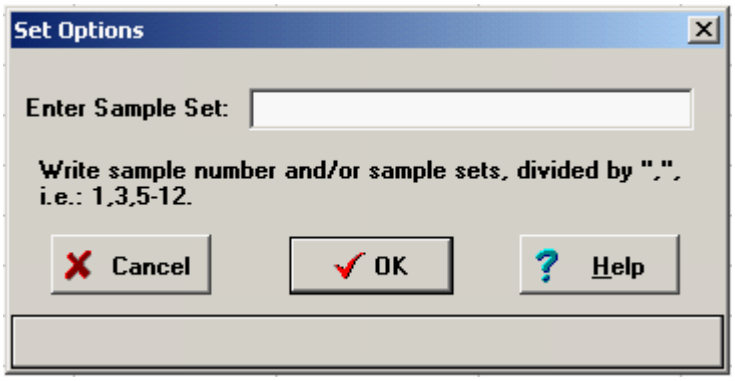
- Pause.
- Low Level.
- Photo

Editing a set (Options, Samples)

A single set consists of a list of sample numbers which are to have various operations performed on them (i.e. Irradiation, preheat, TL, OSL, etc.,...). The sets are modified by editing the cells in the column entitled “Samples”. You may enter the “Editing Set” dialog by start typing a number when a cell in column 1 is selected.

For additional options which effect the operation of the sequence, refer to Sequence Options.

Editing Set



Type in an interval to define the samples you want to use.
The samples must in ascending order, you may not define a sample twice.

Moving a Rows and Columns

While editing a sequence, columns and rows may be moved quite easily by using the “drag and drop” operation: simply place the mouse over the label cell (i.e. “Run i” or “Set i”) in the column or row which you want to move. Press and hold the left mouse button and “drag” the column or row to the location where you would like to move it and “drop” (i.e. release the mouse button) it in place.

When a column is moved it is re-inserted into the spreadsheet to the left of the column on which it was dropped. Rows are inserted above the row on which they are dropped.

Changing The Column Width

The width of columns in the spreadsheet display may be changed freely. You may wish to have quite wide columns in order to display more information in each cell, or you may want narrow columns in order to display more cells per page.

To change the cell width simply place the mouse cursor in the top row of the spreadsheet (the row with the column labels) and hold it over the right border line of the column to be altered. When the cursor changes shape (usually a double vertical bar) click and drag the line until the column has the desired width and release the mouse button.

Editing Cells

The command in a cell may be edited, deleted or copied and pasted elsewhere in the spreadsheet by using either the mouse or the keyboard.

To operate on a cell it must be the active cell: Either click on it or use the cursor keys to move to it.

Edit

To edit the contents of a cell you can double click on the cell, press F2 or click the right mouse button and select Edit from the menu.

Copy

The contents of a cell may be copied by either pressing Ctrl-Ins, or right clicking the mouse and choosing Copy from the menu.

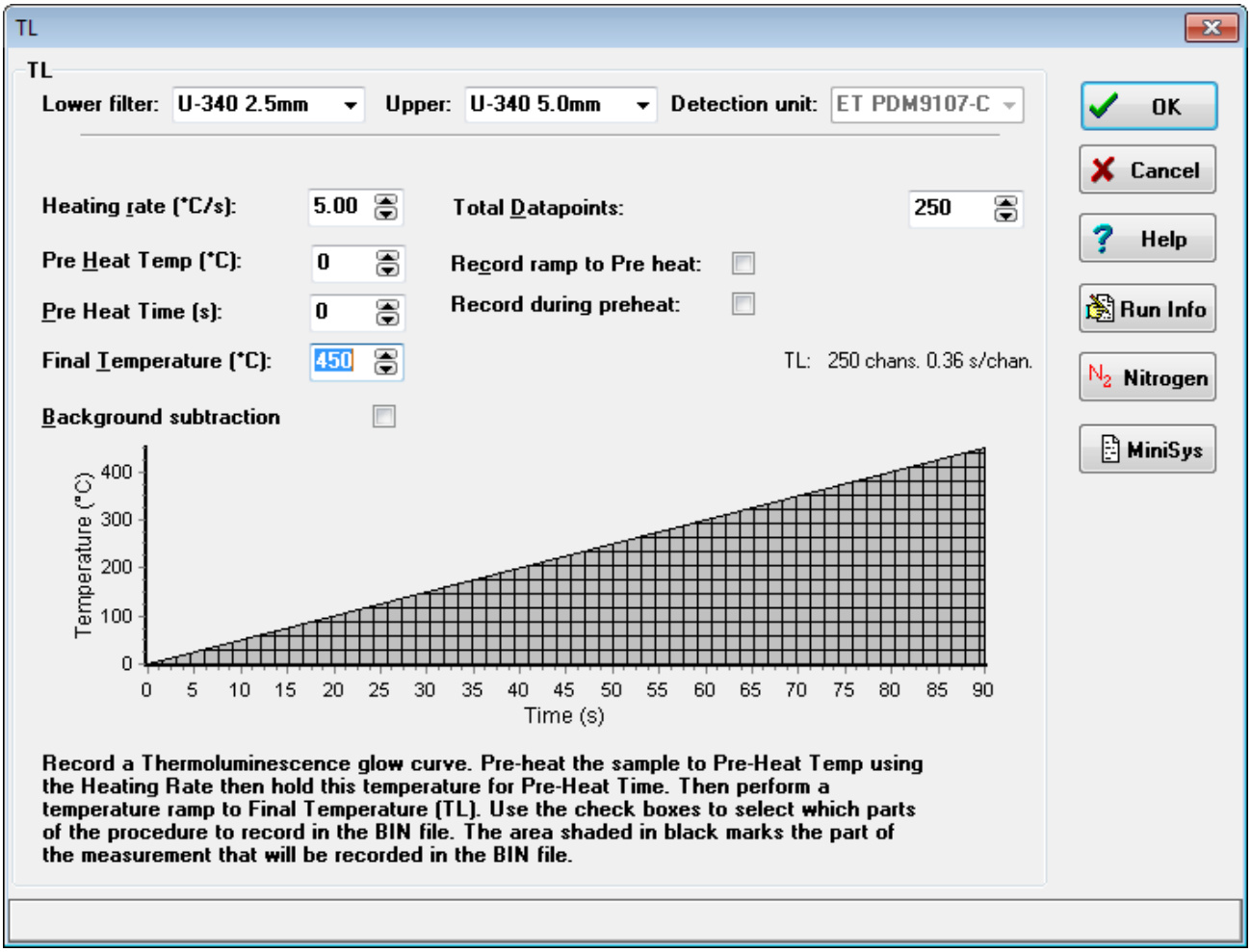
Paste

Once a cell is copied it may be pasted into another cell by selecting the destination cell and pressing Shift-Ins or right clicking the mouse and selecting Paste from the menu.

Delete

To delete the contents of a cell, select the cell and either press Ctrl-Del or click the right mouse button and select Del from the menu.

TL



Define parameters for recording a thermoluminescence (TL) glow curve.

TL will be recorded while the sample is heated from the current temperature to (***Max. Temperature***) at a heating rate of (***Heating rate***) ºC/s.

Pre Heat Temp:

If this number is non-zero then the sample is heated to this temperature at the indicated heating rate. Once ***Pre heat temp.*** is reached, the temperature is maintained for ***Pre heat time*** seconds before starting the normal TL run from ***Pre heat temp.*** to ***Max. Temperature***.

Record during preheat and Record during ramp to preheat:

If this box is checked then the TL data is recorded during the pre-heat and/or ramp to preheat temperature are appended to the beginning of the data which is recorded during the normal TL run. The number of ***Datapoints*** recorded is divided between the ramp, preheat and TL run according to the ratio of their duration. For example, if you select a Max. Temperature of 300C with a 100C preheat and you wish to record 150 data points then 50 data points will be recorded during the preheat and 100 data points will be recorded during the TL. These options are not available when EMCCD and spectrometer type detectors are selected.

Background subtraction:

If this box is checked then the TL will be performed twice, first recording the TL and second recording the background, subtracting the two leaves the final result.

Lower/Upper Filter:

Select the lower and upper filters for this operation. The default selction may be defined in *Sequence Options*

Detection unit:

Select the detection unit used for this operation. The default selction may be defined in *Sequence Options*

Use the buttons to:

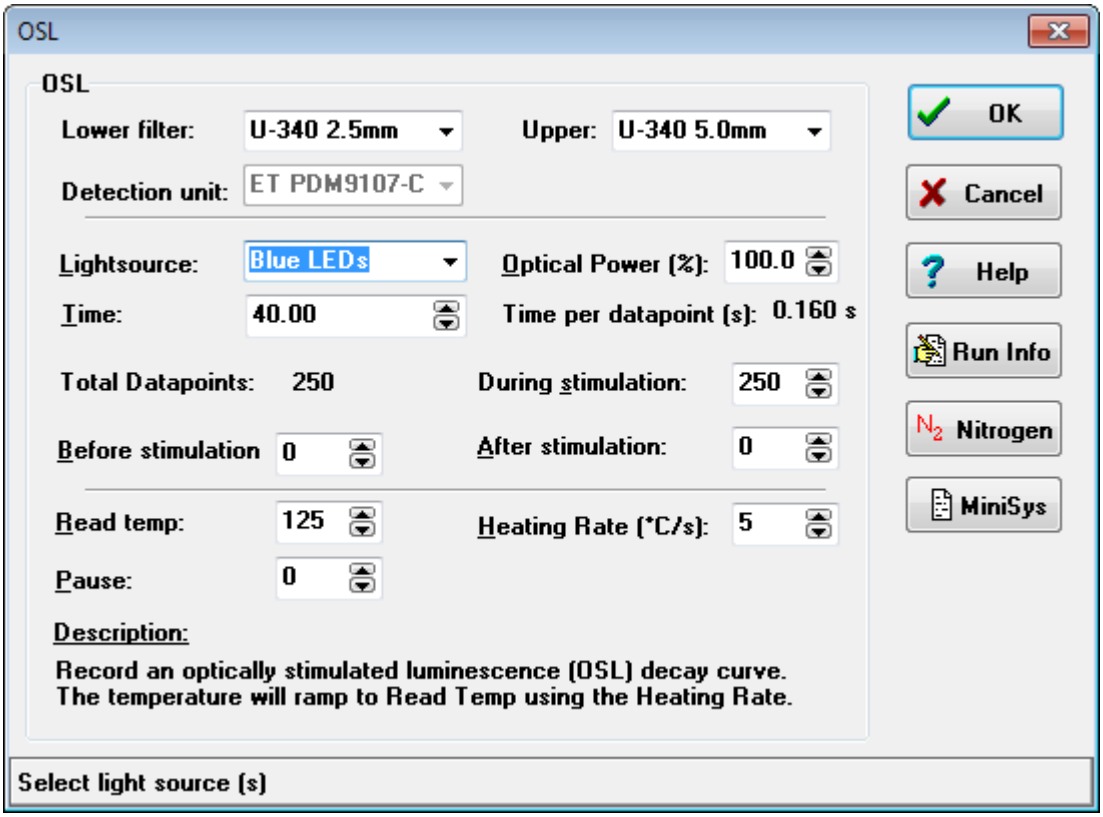
Run Info

Edit the Run Information such as sample description and a description of treatments received prior to loading into the reader.

Nitrogen

Click the N2 button to perform the TL in a nitrogen atmosphere.

OSL



Define parameters for recording an Optically Stimulated Luminescence (OSL) decay curve.
To measure Phosphorescence decay, select "none" as the light source.

Read Temp, ***Heating rate*** and ***Pause*** are used to control the measurement of OSL at elevated temperatures. If ***Read Temp*** is greater than zero then the sample is heated to ***Read Temp*** at ***Heating Rate*** ºC/s and OSL begins after ***Pause*** seconds.

Lower/Upper Filter:

Select the lower and upper filters for this operation. The default selction may be defined in *Sequence Options*

Detection unit:

Select the detection unit used for this operation. The default selction may be defined in *Sequence Options*

Use the buttons to:

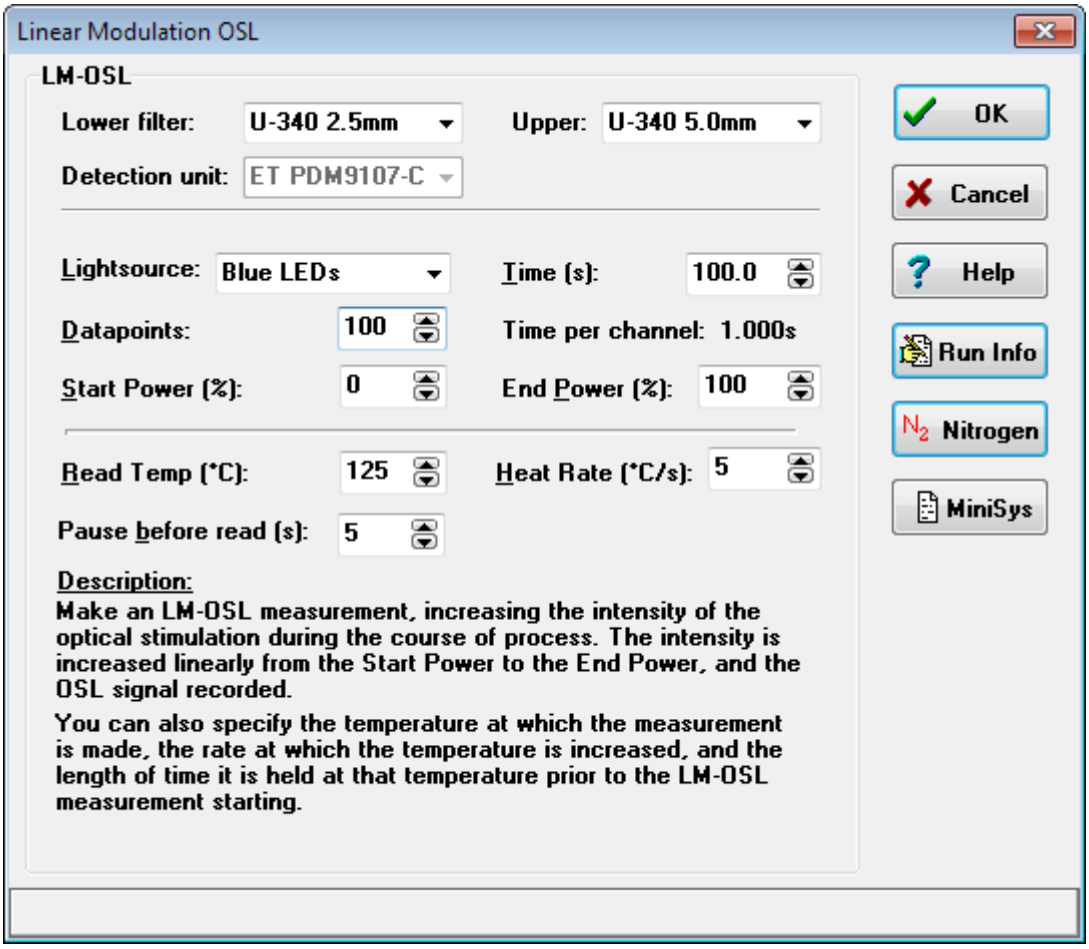
Run Info

Edit the Run Information such as sample description and a description of treatments recieved prior to loading into the reader.

Nitrogen

Click the N2 button to perform the OSL in a nitrogen atmosphere. This is usually only necessary if the OSL is being recorded at high temperatures.

LM-OSL



Define parameters for recording an Linear Modulated Optically Stimulated Luminescence (LM-OSL) decay curve.
To measure Phosphorescence decay, select "none" as the light source.

Read Temp, ***Heating rate*** and ***Pause*** are used to control the measurement of OSL at elevated temperatures. If ***Read Temp*** is greater than zero then the sample is heated to ***Read Temp*** at ***Heating Rate*** ºC/s and OSL begins after ***Pause*** seconds.

Lower/Upper Filter:

Select the lower and upper filters for this operation. The default selction may be defined in *Sequence Options*

Detection unit:

Select the detection unit used for this operation. The default selction may be defined in *Sequence Options*

Use the buttons to:

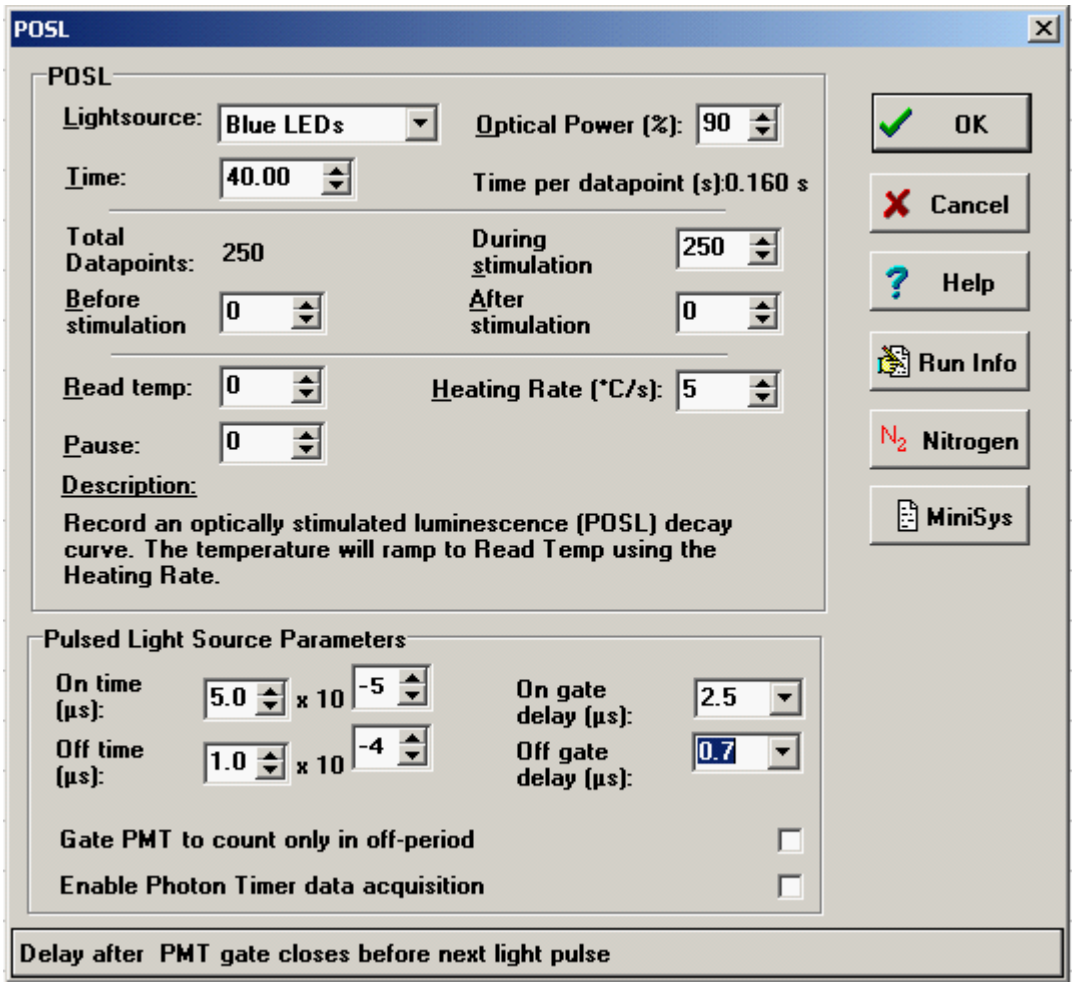
Run Info
Edit the Run Information such as sample description and a description of treatments recieved prior to loading into the reader.

Nitrogen
Click the N2 button to perform the OSL in a nitrogen atmosphere. This is usually only necessary if the OSL is being recorded at high temperatures.

POSL

There is a difference between this command depending on the type af stimulation head (Classic/automated)

Classic detection and stimulation head

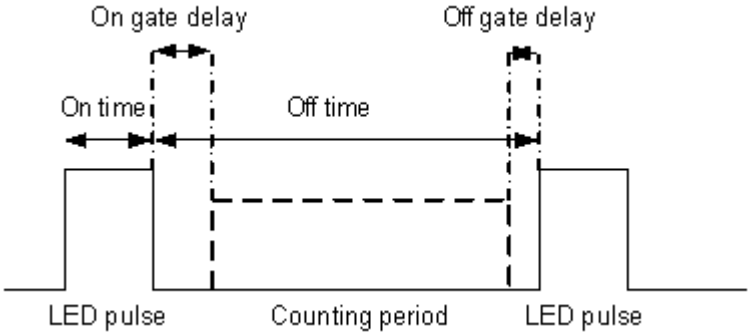


Define parameters for recording a Pulsed Optically Stimulated Luminescence (OSL) decay curve.
To measure Phosphorescence decay, select “none” as the light source.

Read Temp, ***Heating rate*** and ***Pause*** are used to control the measurement of OSL at elevated temperatures. If ***Read Temp*** is greater than zero then the sample is heated to ***Read Temp*** at ***Heating Rate*** ºC/s and OSL begins after ***Pause*** seconds.

Pulsed Light Source Parameters:

The meaning of the parameters are shown in the figure below



If ***Gate PMT to count only in off period*** is checked, counting is only done in the interval marked “counting period” in the above figure.

If the system is equipped with a Photon Timer (and the option is checked in the “User Options”) you may enable or disable Photon Timer data acquisition by use of the ***Enable Photon Timer data acquisition*** check box

Restrictions to On and Off time settings:

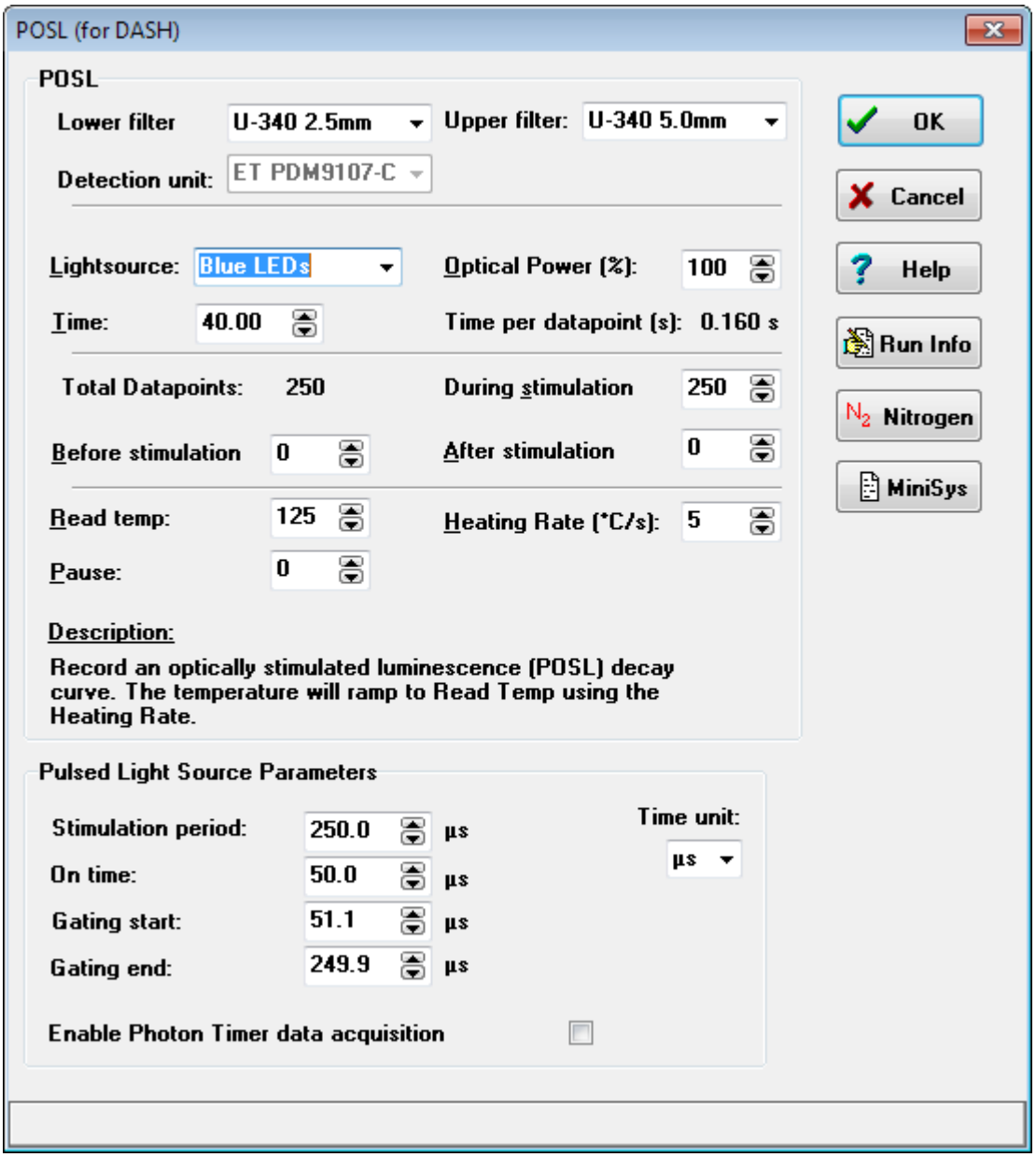
Exponents factors of 10-7 , 10-8 and 10-9 are invalid
Setting of on-time < 0.2 ìs is invalid
Setting of off-time < 0.6 ìs is invalid
Depending on the exponent factor of the lowest of on-time and off time, there are limitations to the other time setting:

Exponent factor of the lower of on-time and off time	The maximum setting of the larger of on-/off-time
10-6	1.3 x 10-2 s = 13 ms
10-5	6.5 x 10-2 s = 65 ms
10-4	6.5 x 10-1 s = 650 ms
10-3	6.5 x 10-0 s = 6.5 s
10-2, 10-1, 10-0 , 101	6.5 x 10-1 s = 65 s

Note: When the on-time is below approximately 5 ìs the LED pulse shape may not be as rectangular as for on-times higher than 5 ìs, especially at high power settings. If rectangular pulse shape is important you should restrict on-time to above 5 ìs.
Setting is only possible in steps of 0.2 ìs; For instance a setting of 1.7 ìs will effectively be 1.6 ìs.

If the currently set parameters are invalid, a red or yellow warning is shown in the form that tells that the current parameter setting is invalid. It will not be allowed to exit the form with an OK if the parameter setting is invalid.

Automated DASH



Define parameters for recording a Pulsed Optically Stimulated Luminescence (OSL) decay curve.
To measure Phosphorescence decay, select “none” as the light source.

Read Temp, ***Heating rate*** and ***Pause*** are used to control the measurement of OSL at elevated temperatures. If ***Read Temp*** is greater than zero then the sample is heated to ***Read Temp*** at ***Heating Rate*** ºC/s and OSL begins after ***Pause*** seconds.

Lower/Upper Filter:

Select the lower and upper filters for this operation. The default selction may be defined in *Sequence Options*

Detection unit:

Select the detection unit used for this operation. The default selction may be defined in *Sequence Options*

Use the buttons to:

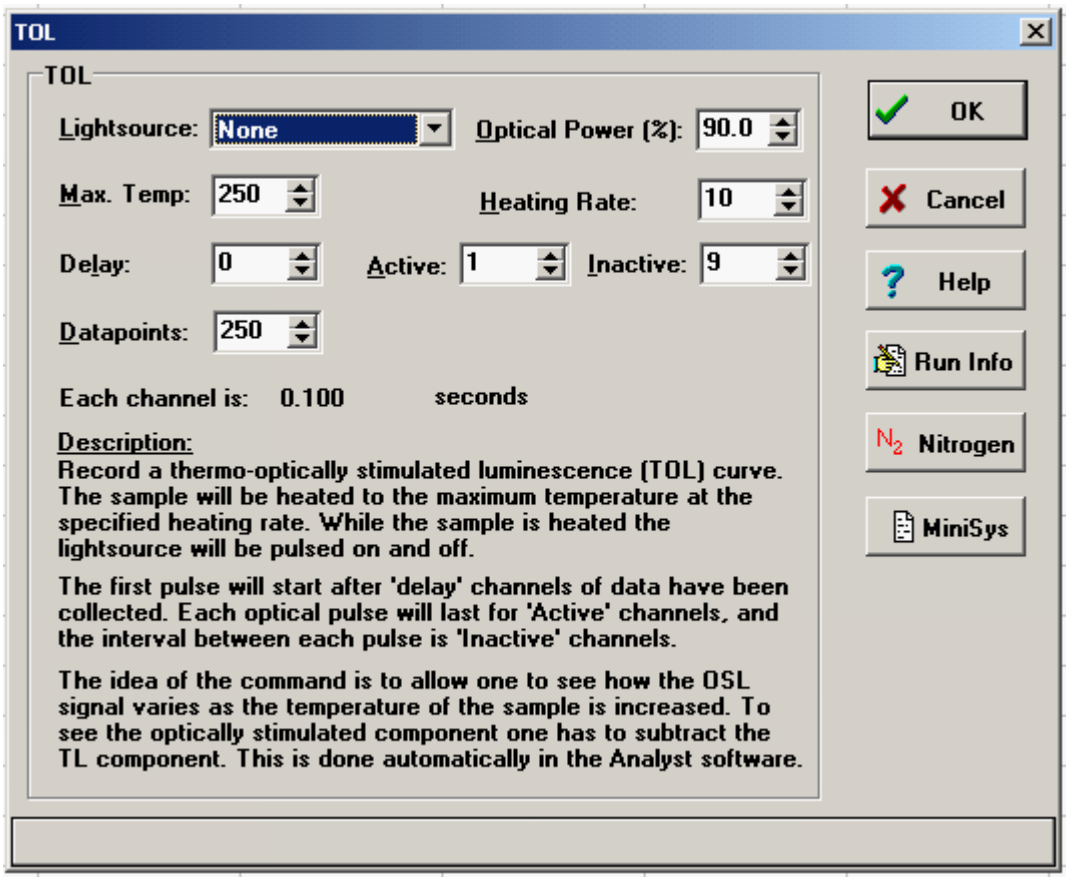
Run Info

Edit the Run Information such as sample description and a description of treatments received prior to loading into the reader.

Nitrogen

Click the N2 button to perform the OSL in a nitrogen atmosphere. This is usually only necessary if the OSL is being recorded at high temperatures.

TOL



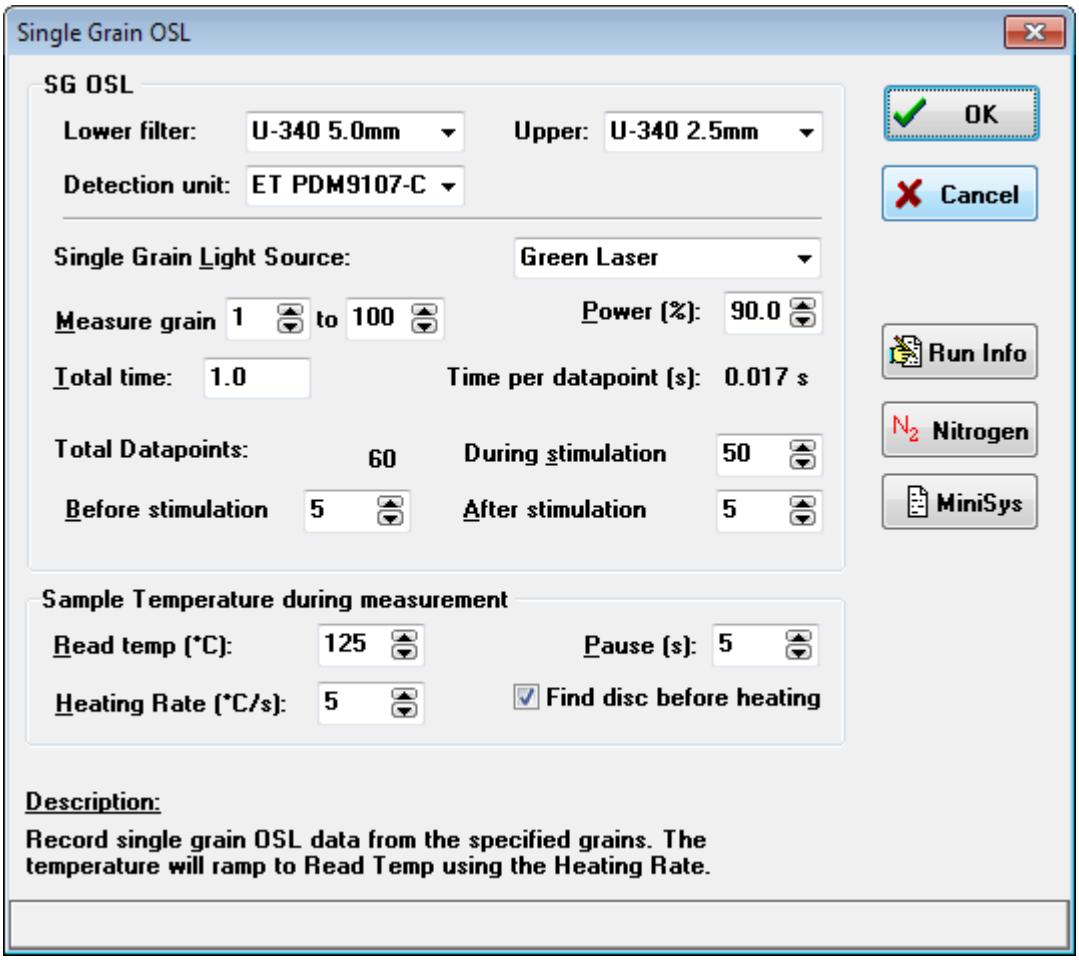
Define parameters for recording a Thermo-Optical Luminescence (TOL) spectrum.

During TOL the temperature is ramped from the current temperature to (***Max. Temp***) at a rate of (***Heating rate***) ºC/s.
During the temperature ramp the selected light source is pulsed according to the values of ***Delay***, ***Active*** and ***Inactive*** as follows: After recording ***Delay*** channels (or datapoints) the source is switched on for the next ***Active*** channels, switched off for the next ***Inactive*** channels, switched on again for ***Active*** channels, off for ***Inactive***...etc, until ***Datapoints*** channels have been recorded.
If the sum of ***Delay***, ***Active*** and ***Inactive*** is not evenly divisible into ***Datapoints***, or if the sum exceeds ***Datapoints*** no errors are generated. The Mini-Sys simply stops after ***Datapoints*** channels have been recorded, regardless of the values of the other parameters.
Use the buttons to:

Run Info
Edit the Run Information such as sample description and a description of treatments received prior to loading into the reader.

Nitrogen
Click the N2 button to perform the TOL in a nitrogen atmosphere.

Single grain OSL



Define parameters for recording an Single grain Optically Stimulated Luminescence (OSL) decay curve.

Read Temp, ***Heating rate*** and ***Pause*** are used to control the measurement of OSL at elevated temperatures. If ***Read Temp*** is greater than zero then the sample is heated to ***Read Temp*** at ***Heating Rate*** ºC/s and OSL begins after ***Pause*** seconds.

Lower/Upper Filter:

Select the lower and upper filters for this operation. The default selction may be defined in *Sequence Options*

Detection unit:

Select the detection unit used for this operation. The default selction may be defined in *Sequence Options*

Find disc before heating:

As the duration of the find disc procedure may vary. There may be an advantage in doing the find disc before heating
(for a discussion of this see: R.K.Smedley and G.A.T Duller, Optimising the redroducibility of measurement of the post-IR IRSL signal from single-grains of K-feldspar for dating, Ancient TL Vol. 31, No. 2, 2013)

Use the buttons to:

Run Info

Edit the Run Information such as sample description and a description of treatments recieved prior to loading into the reader.

Nitrogen

Click the N2 button to perform the OSL in a nitrogen atmosphere. This is usually only necessary if the OSL is being recorded at high temperatures.

Single grain LM-OSL

Define parameters for recording an Single grain Linear Modulated Optically Stimulated Luminescence (LM-OSL) decay curve.

Read Temp, ***Heating rate*** and ***Pause*** are used to control the measurement of OSL at elevated temperatures. If ***Read Temp*** is greater than zero then the sample is heated to ***Read Temp*** at ***Heating Rate*** ºC/s and OSL begins after ***Pause*** seconds.

Lower/Upper Filter:

Select the lower and upper filter for this operation. The default selction may be defined in *Sequence Options*

Detection unit:

Select the detection unit used for this operation. The default selction may be defined in *Sequence Options*

Use the buttons to:

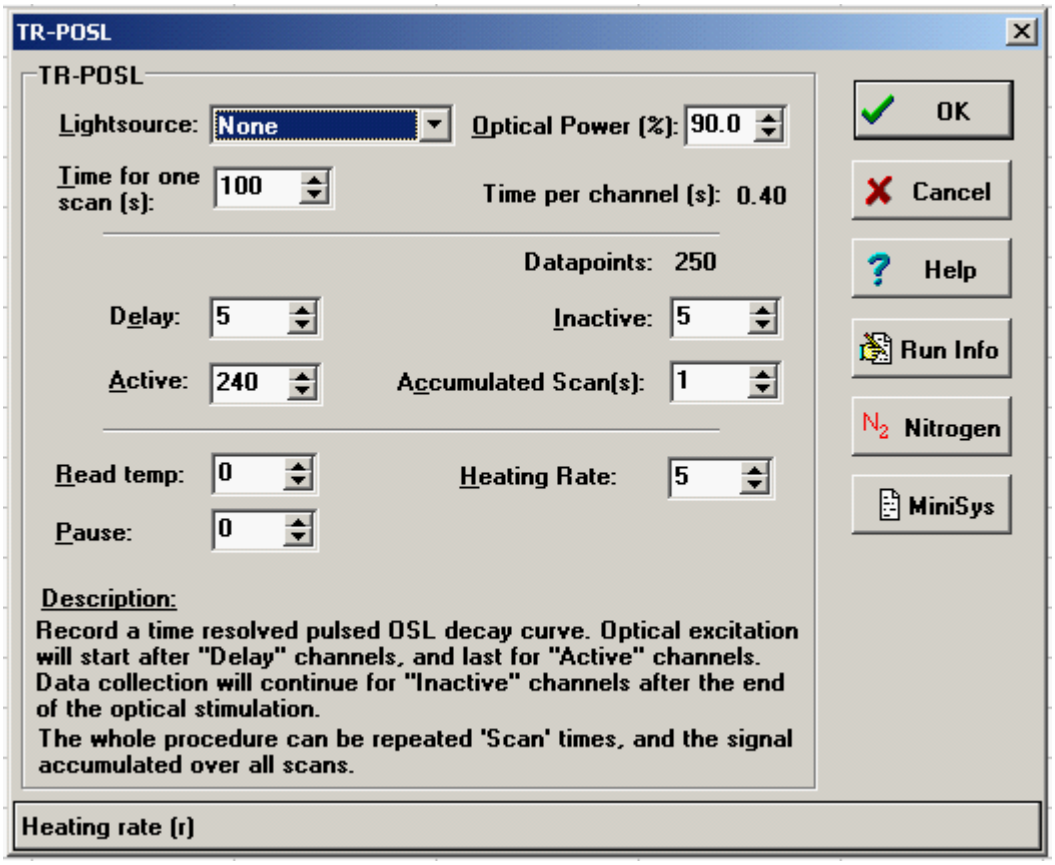
Run Info

Edit the Run Information such as sample description and a description of treatments recieved prior to loading into the reader.

Nitrogen

Click the N2 button to perform the OSL in a nitrogen atmosphere. This is usually only necessary if the OSL is being recorded at high temperatures.

TR-POSL



Define parameters for recording a Time Resolved Pulsed Optically Stimulated Luminescence (TR-POSL) spectrum.

During POSL data is recorded during a period of ***Time*** seconds. During acquisition the light source is pulsed according to the values of ***Delay***, ***Active*** and ***Inactive*** as follows: After recording ***Delay*** channels (or datapoints) the source is switched on for the next ***Active*** channels, switched off for the next ***Inactive*** channels, switched on again for ***Active*** channels, off for ***Inactive***...etc, until ***Datapoints*** channels have been recorded.
If the sum of ***Delay***, ***Active*** and ***Inactive*** is not evenly divisible into ***Datapoints***, or if the sum exceeds ***Datapoints*** no errors are generated. The Mini-Sys simply stops after ***Datapoints*** channels have been recorded, regardless of the values of the other parameters.
Accumulated Scans:
If this number is greater than one (some number *n*), then *n* scans will be repeated and accumulated. Only the total accumulation is downloaded from the Mini-Sys. The total acquisition time for an accumulated POSL is (***Time*** × *n*).
Note: Since we must wait for the Mini-Sys to accumulate the scans, the POSL spectrum will not be displayed until it is complete (i.e. no live display!).

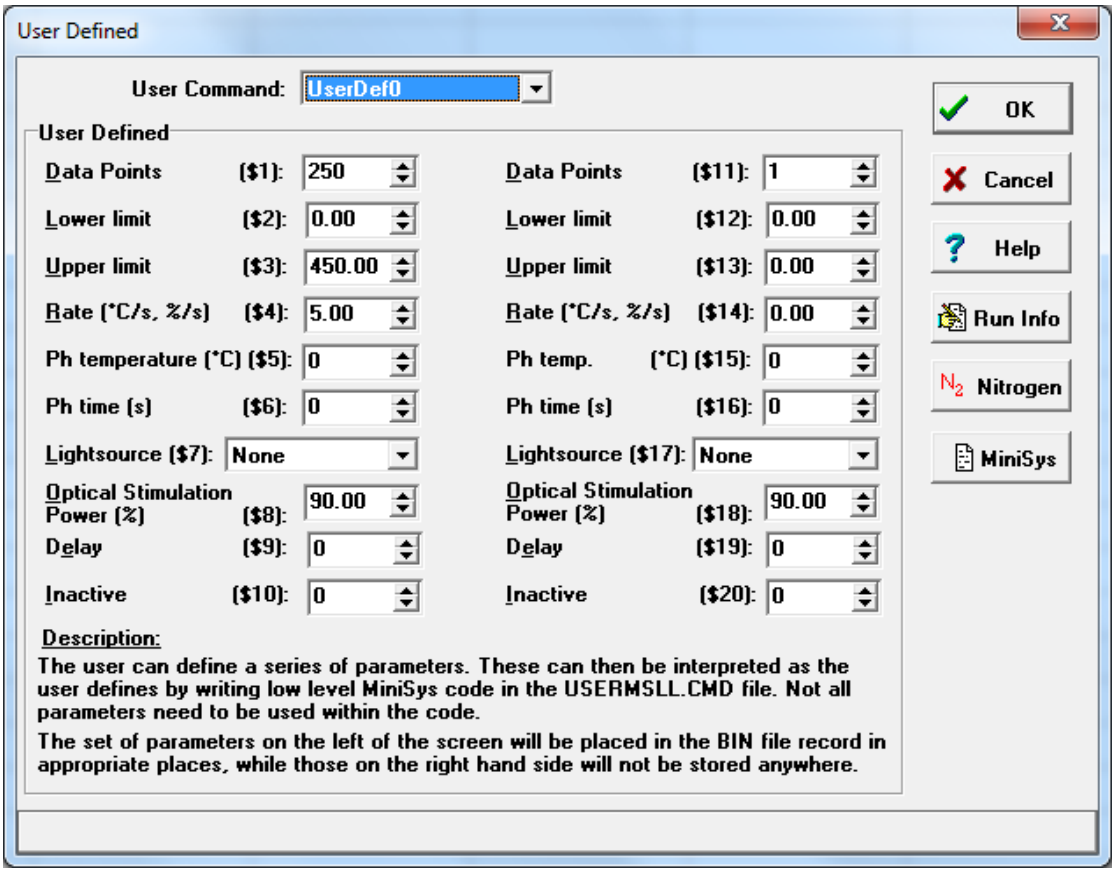
Use the buttons to:

Run Info
Edit the Run Information such as sample description and a description of treatments received prior to loading into the reader.

User Defined

A special ‘User Defined’ instruction has been created within the Sequence Editor, and this uses a separate command file specifically designed for your instructions called USERMSLL.CMD. This is designed to allow you to create unusual, or complex, measurement sequences that are tailored to your requirements.

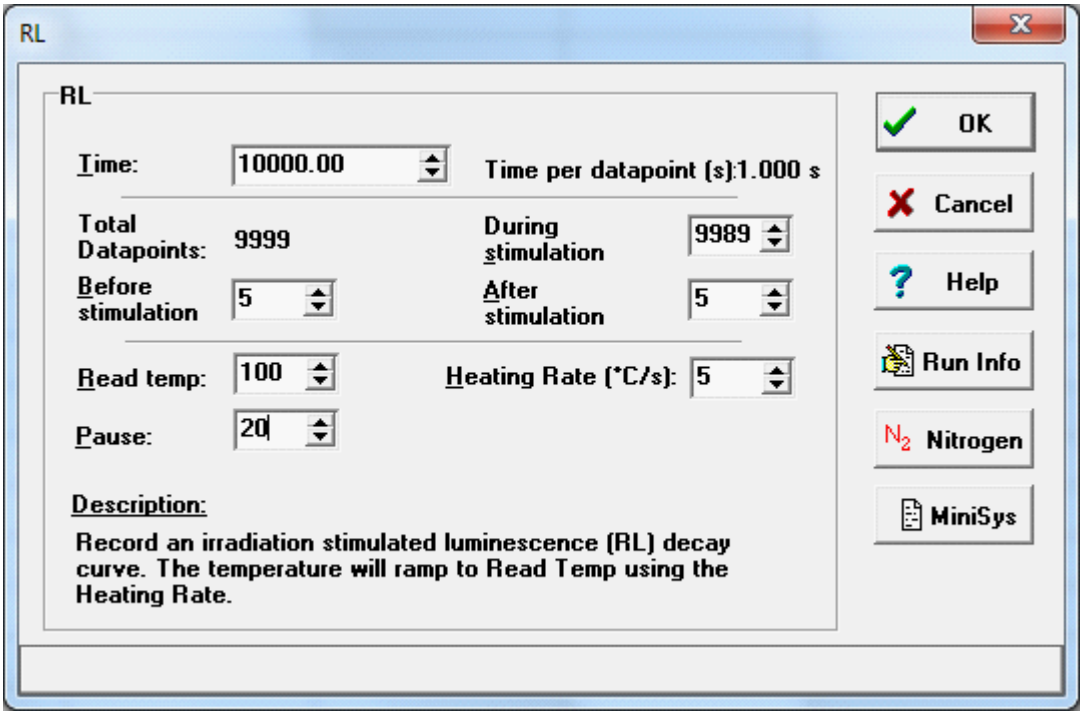
The ‘User Def.’ instruction is very similar to the standard set of instructions. In the same way as other instructions, you can specify a series of parameters. However, unlike the other instructions (such as TL, OSL, Pulsed OSL, TOL etc), there is no fixed format to these instructions – that is left entirely up to you. When you create a user defined instruction in the Sequence Editor you will see this dialogue box.



The most important things to note on this form are not the main titles associated with each box, but the numbers in brackets beside each box ($1, $4, $17 etc). These are the parameter numbers that each of these boxes represents. So you can see very clearly that with the User Defined command you can send up to 20 parameters to the dictionary file – that gives you an enormous amount of flexibility. Associated with each of the parameters are titles (e.g. parameter 1 - $1 – is called ‘Data Points’, parameter 6 is the preheat time). These are given for two reasons. The first is simply as a guideline. These are parameters that you will commonly need to define for an instruction, so where your needs coincide with these terms then you may as well use them. The second reason is that when the Sequence Editor creates a data record in a BIN file it attempts to fill in as much of the information associated with the BIN record as possible (e.g. the heating rate, type of optical stimulation source, optical stimulation power etc). For the standard TL, OSL, POSL, TOL measurements this can be done accurately since the meaning of the various parameters are well defined. For the User Defined instructions this is more difficult. However, what the Sequence Editor does is to place parameters 1 to 10 into the BIN record in the sections specified. So for instance, parameter 4 is placed into the part of the BIN file specified as the RATE. This is another reason why you should use these parameters for their specified purposes where they are appropriate for the command you are trying to implement.

For more information see the "**Writing User Defined Commands in the Risø TL/OSL Sequence Editor**" manual on your distribution disc or installation on your hard drive

RL



Define parameters for recording a Radio-luminescence (RL) decay curve.

Read Temp, ***Heating rate*** and ***Pause*** are used to control the measurement of OSL at elevated temperatures. If ***Read Temp*** is greater than zero then the sample is heated to ***Read Temp*** at ***Heating Rate*** ºC/s and OSL begins after ***Pause*** seconds.

Use the buttons to:

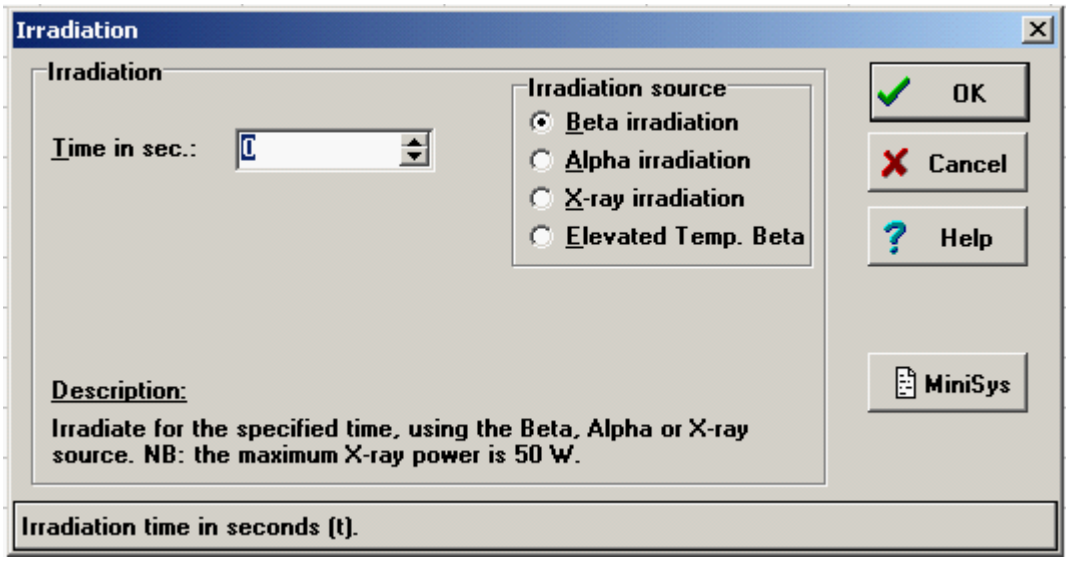
Run Info

Edit the Run Information such as sample description and a description of treatments recieved prior to loading into the reader.

Nitrogen

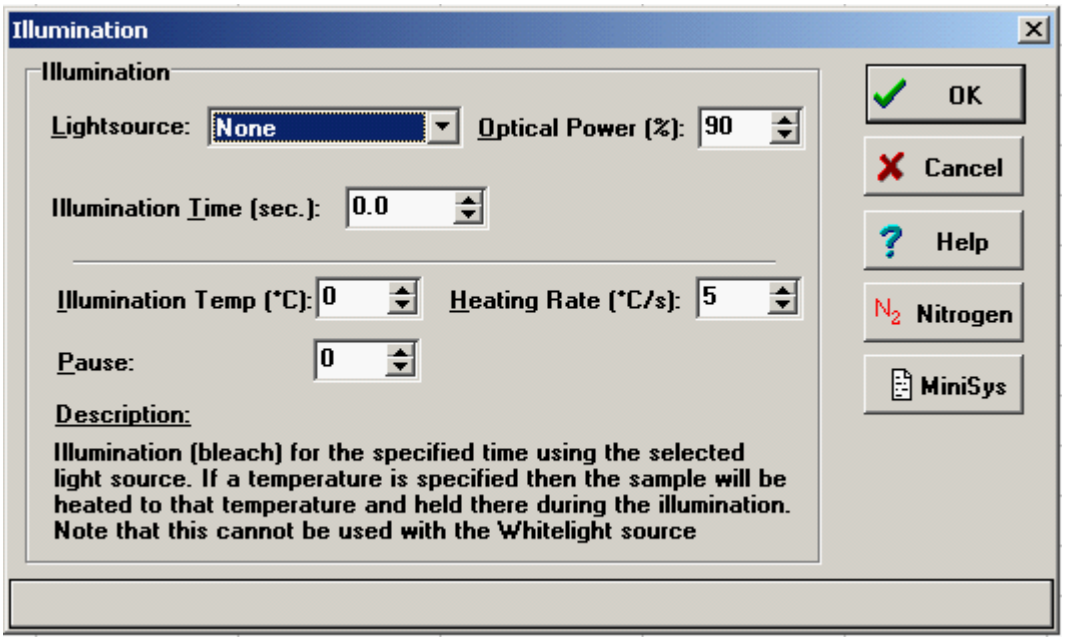
Click the N2 button to perform the OSL in a nitrogen atmosphere. This is usually only necessary if the OSL is being recorded at high temperatures.

Irradiation



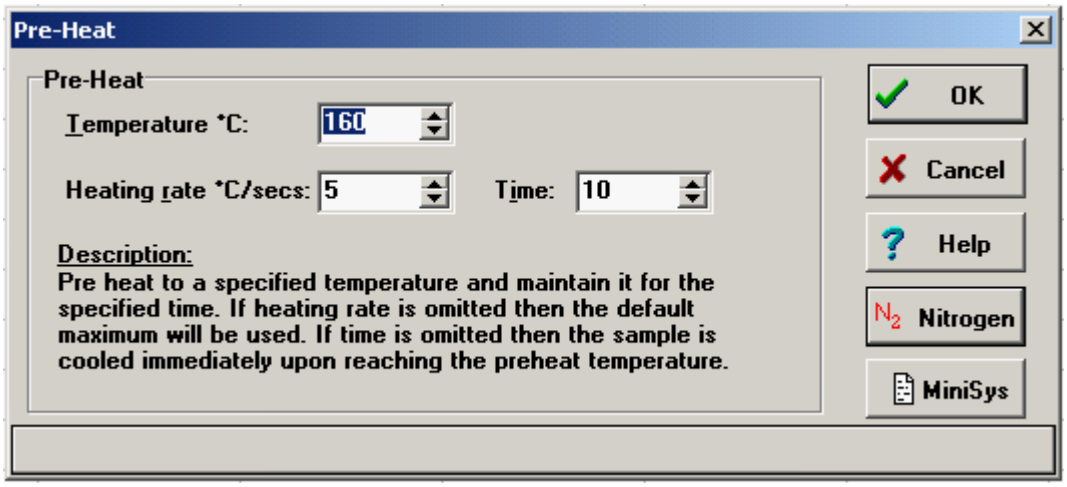
Irradiate the sample for ***Time in sec.*** seconds using any of the built-in irradiation sources. Consult the documentation which came with your reader for the approximate sample strength at the time of installation.

Illumination



Perform an illumination (bleach) for ***Illumination time*** seconds using the selected light source.

Pre Heat



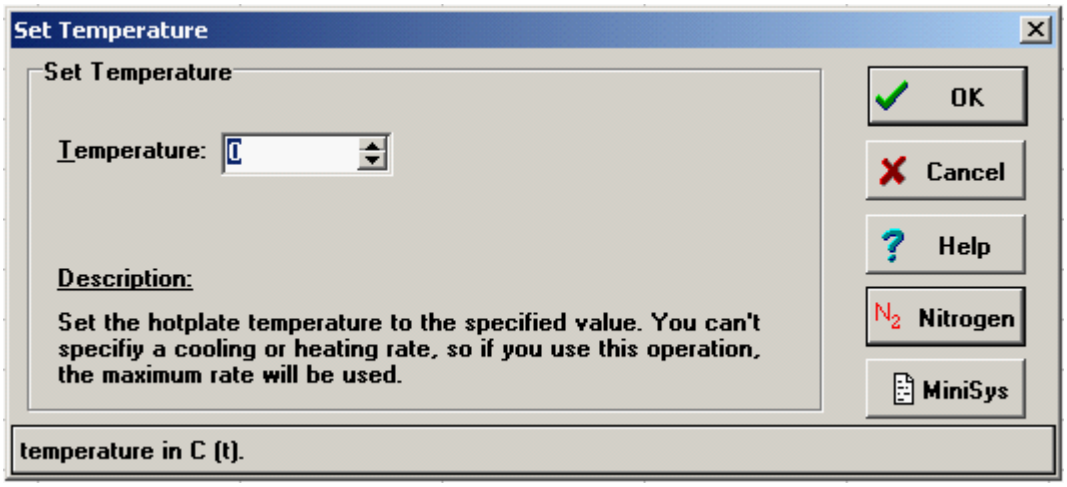
Heat to ***Temperature*** at ***Heating rate*** ºC/s and maintain for ***Time*** seconds. If ***Heating rate*** is zero then the maximum heating rate is used. If the ***Time*** is omitted (or zero) then the sample is cooled immediately after heating.

Use the buttons to:

Nitrogen

Click the N2 button to perform the TOL in a nitrogen atmosphere.

Set Temp



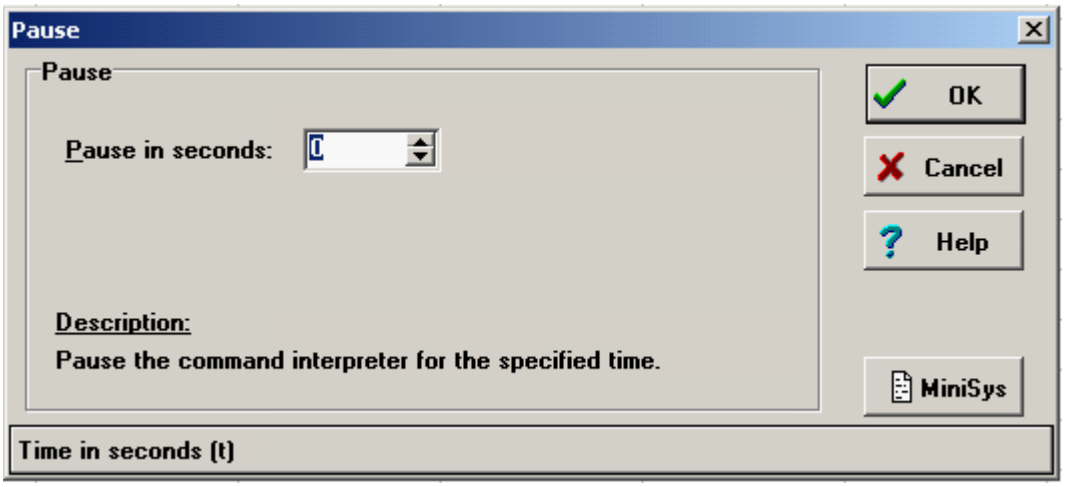
Set the hotplate to the desired temperature. If the desired temperature is higher than the current temperature then the hotplate is heated at the maximum temperature. If the desired temperature is below the current temperature then the set point is changed instantly in order to achieve a maximum cooling rate.

Use the buttons to:

Nitrogen

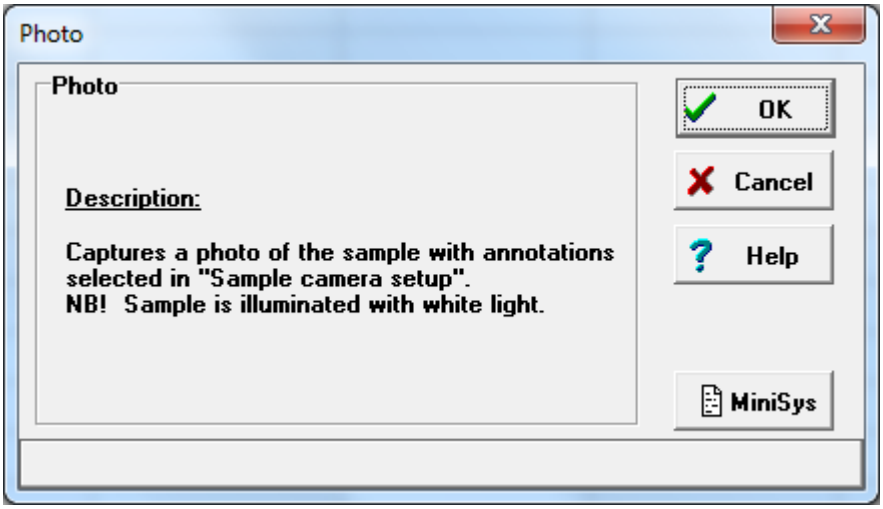
Click the N2 button to perform the TOL in a nitrogen atmosphere.

Pause

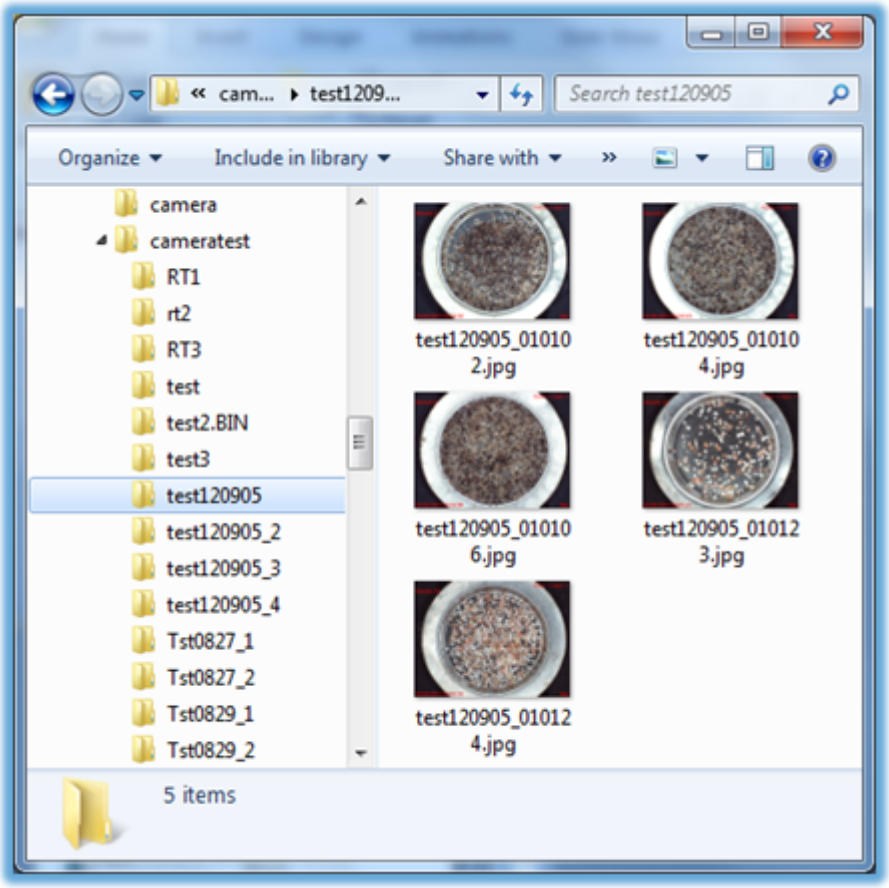


Pause the Mini-Sys command interpreter for the specified time. During a pause both the Command running status bit and the Command interpreter paused status bit are set to true (see Mini-Sys documentation for a description of all status bits).

Photo



Uses the sample camera to produce a photo of a sample. The photo is stored in a directory with the name of the bin-file, and the name of the picture file is *<bin-file name>_rrsspp.jpg*, where rr is run no., ss is set no., and pp is position no.



The photos are annotated according to what is specified in 'Sample Camera setup'

Low Level

Before attempting low level programming of the Mini-Sys you should read the Mini-Sys documentation and familiarize yourself with the command descriptions.

When sending commands to the Mini-Sys from the sequence editor you are not restricted in what you are allowed to send to the Mini-Sys. In other words, no command validation is performed by the sequence editor before pasing the command along to the Mini-Sys. This allows us to make changes and add new commands to the Mini-Sys without updating the sequence editor. However, it means if you mistype a command it will be passed to the Mini-Sys and the Mini-Sys will ignore it! The only commands which the sequence editor will recognize are data acquisition commands. When a data acquisition command is issued the sequence editor remembers the number of data points so that it can download the data if a #DATA command is issued.

When sending low level commands you should avoid using commands such as positioning of the turntable, vacuum and nitrogen unless you need specific settings. If you position the turntable the application may lose track of samples which can result in useless output.

In addition to the commands of the Mini-Sys low level language, we have implemented several additional controls to perform operations such as waiting for the Mini-Sys to be idle, waiting for the temperature to drop below a given level and downloading data.

* Graph Commands: Graph, InitGraph, EndGraph
* Data commands: DATA, DATB, DATC, SWAP, SWAP_AC, SWAP_BC, SUB_AB, SUB_BA, SAVE, CONCAT
* Control commands: RS, RT, RB, WLT
* Error commands: ER, TF, LF, CB

Graph Commands

In your scripts you can control how data should be graphed.

#INITGRAPH CHN

Initialize a graph fo maximum CHN channels, all data acquisitions until an EndGraph is reached are graphed in the same window.

```
#INITGRAPH 200          get ready for 200 datapoints
TL 200 8 100 200        perform TL using 100 pts
#DATA              download them in A
PA 10              wait 10 seconds
TL 300 8 100 0         perform TL using another 100 pts
#DATB              download them in B, graph them with A
#ENDGRAPH               Fit graph in window
```

#ENDGRAPH

Stop the use of the current graph, this also fit the graph to the window.

#GRAPH

View datapoints stored in A as a graph, you don’t need to use the ENDGRAPH command.

Datacommands

To control what to do with the data.

#DATA, #DATB, #DATC

Download the data from the last data acquisition command. This script command is used after a data acquisition where you want to obtain the data and put them into a data record. The #DATA command knows how many datapoints download based on the previous data acquisition command (e.g. TL, OSL, etc.,..). You can combine the #DATA command with live display (the default mode). In the example we obtain 250 points. The DATA command put data in the internal data storage A, DATB in the internal data storage B, and DATC in the internal data storage C.

```
LU              take lift up
#INITGRAPH 250     receive 200 pts
#RS             wait for lift
TL 500 8 250 0     perform tl
#DATA          obtain data and save them in A
#ENDGRAPH          fit graph
#RS             wait to complete
```

#CONCAT

Concatenate the internal storage A and B, into storage A.

```
#INITGRAPH 200     get rdy for 200 pts in graph
#TF             thermal failure?
#RS             wait to complete
LU              lift up
#RS             wait to complete
TL 300 8 100 300     TL for 100 pts
#DATA          put 100 pts in A
PA 30          wait 30 secs.
#RS
TL 500 8 100 0     TL for another 100 pts.
#DATB          put 100 pts in B
#CONCAT           add them together
#SAVE          save A, meaning the total 200 channels
#ENDGRAPH          fit graph
LD              lift down
#RS
```

#SAVE

Save datapoints in data storage area A in the current datafile as one record.
If you want to save B you must swap first.

#SUB_AB, #SUB_BA

Substract each channel from each other.
AB: A(i) = A(i) - B(i)
BA: A(i) = B(i) - A(i)

#SWAP, #SWAP_AC, #SWAP_BC,

Swap data area A and B, A and C, or B and C

Control commands

Command you can use to control different tasks.

#RT [Temp RTemp]

Wait for the specified temperature to be less than ***RTemp***, where ***Temp*** is (0 Set Point ; 1 Sample Temperature ; 2 Room Temperature). When the current temperature is reached, execution of the code continues.

```
#INITGRAPH 250
#TF             check for thermal failure
#RT 1 40           wait for sample temp to be less than 40 degrees
LU              then lift up
#RS             wait for lift to raise
TL 500 8 250 0     perform tl
#DATA          obtain data
#ENDGRAPH
LD              take lift down
```

#RS wait for lift

#RS

Wait for Mini-Sys to complete the previous command, status byte 3, bit 6 to be low.

#RB BYTE BIT VAL

Waits for the specified status ***byte*** and ***bit*** no. to become the specified ***val*** (0 or 1).

VO Turn on the vacuum pump
#RB 1 1 1 Wait for the vacuum to reach the preset level

Note: If there is a vacuum leak, or for some other reason the vacuum level cannot be reached, this command will wait indefinitely.

#WLT

Wait for the heater temperature to be lower that specified in the Sequence Options (default: 60 C)

Error commands

#CB BYTE BIT VAL

If the status ***byte***, ***bit*** and ***val*** is as specified the sequence is stopped. Upon stopping you will be presented with a dialog box in which you must select what to do next: Stop or Continue the sequence.

#ER CODE

Checks for a specified error ***code*** on the Mini-Sys. If the error has occured then you will be presented with a dialog box in which you must select what to do next: Stop or Continue the sequence.

#TF

Checks for thermal failure, if present the sequence is terminated.

#LF LAMP

Checks if the lamp is on

Use the buttons to:

Nitrogen

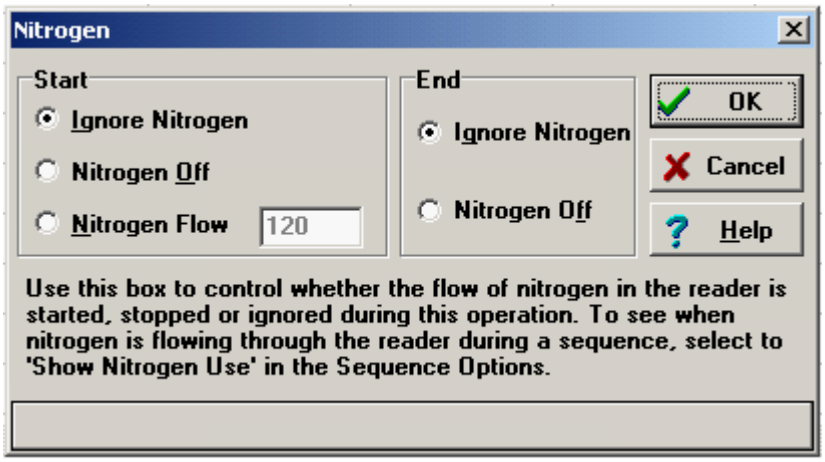
Click the N2 button to control the state of the Nitrogen flow while executing the commands.

Run Info

In this dialog box you have the freedom to enter information that would otherwise be unavailable to the application. It is not necessary to fill in this dialog, it is provided as a bookeeping tool if you wish to use it. Since this information is stored with the data and will always be available in the future, it is a good idea to take the time to fill it in!

This information is saved in the data file but is in no way modified by the execution of the sequence. In other words, if you enter an irradiation of 30sec, Gamma in the *Run Info* dialog and then Beta irradiate the sample in the reader, the *Run Info* information is not changed to reflect what you did!

Nitrogen



Control the flow of Nitrogen during the current operation.

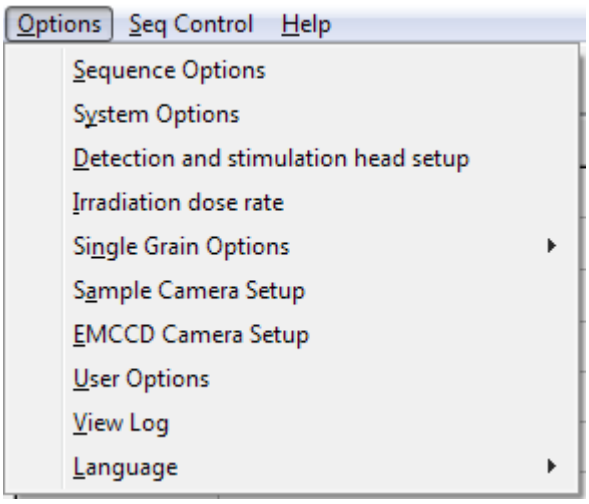
Start

Ignore Nitrogen:
Do not change the current state of the Nitrogen flow
Nitrogen off:
Do not use Nitrogen during the current operation.
Nitrogen flow:
Start the Nitrogen flow and pause for the specified time (sec) before starting the operation.

Finish

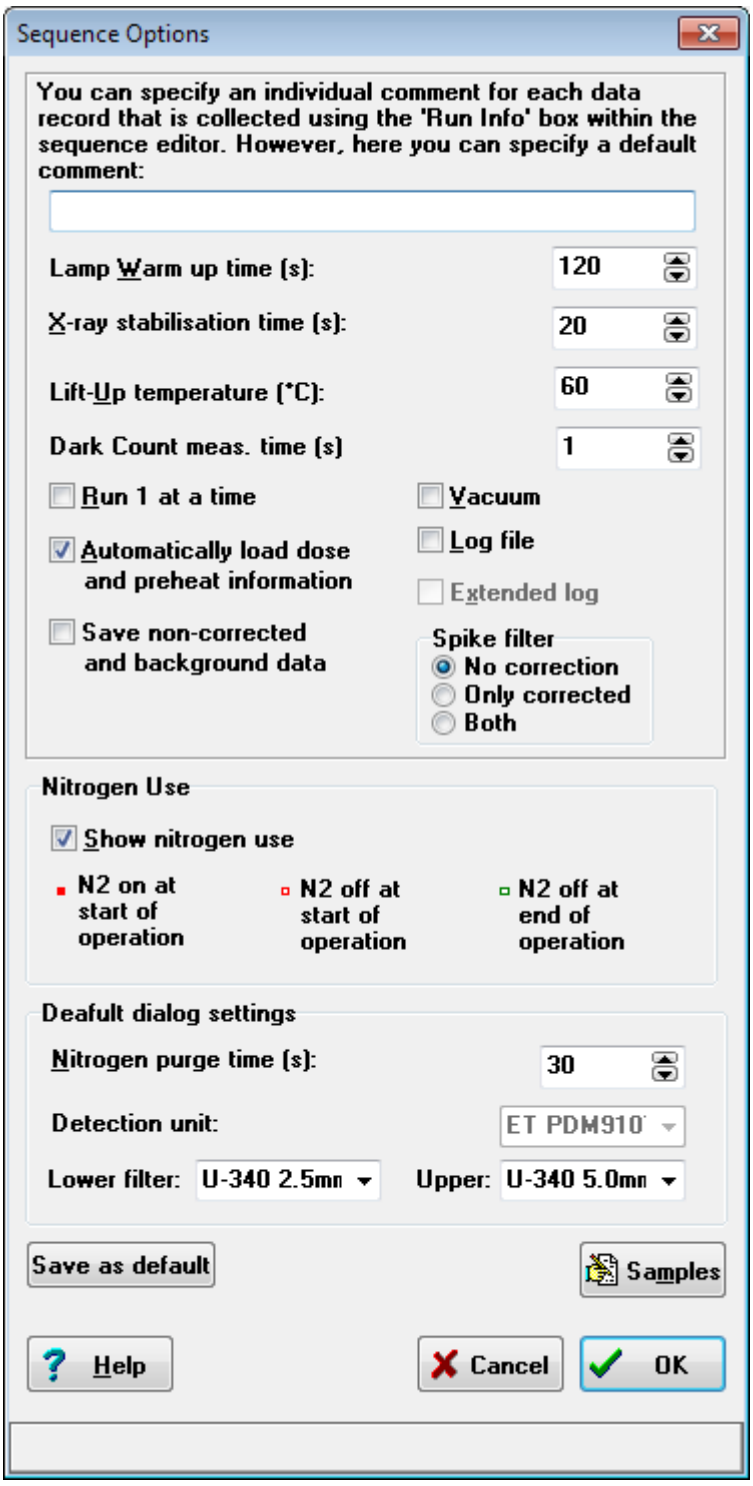
Ignore Nitrogen:
Do not change the state of the Nitrogen flow when the operation is finished.
Nitrogen off:
Turn off the Nitrogen flow when the operation is finished.

Options


Options
Seq Control
Help
Sequence Options
System Options
Detection and stimulation head setup
Irradiation dose rate
Single Grain Options
Sample Camera Setup
EMCCD Camera Setup
User Options
View Log
Language

Sequence Options

The sequence options, which are located in the Edit Menu (Edit | Sequence Options), define several options which affect the overall behavior of the sequence.



Lamp Warm up time:

This is the amount of time (in seconds) to allow the halogen lamp (i.e. Green light system) to warm up before starting a measurement using this source. The recommended warm up time is usually 120 sec.

Vacuum:

When checked, the TL/OSL chamber will be evacuated prior to starting the sequence. Note: the chamber will be evacuated until the vacuum level falls below the preset level on the vacuum indicator dial. Consult the hardware manual regarding this setting.

Log File:

When checked, a log file is maintained which keeps track of all operations, data transfer and errors generated while executing a sequence. If a particular sequence does not run properly then enable the log file, re-run the sequence and send the log file and the sequence file to Risø (see Support).

Extended Log File:

When 'Log File' is checked, the 'Extended log' may be checked as well to log all the communication between the PC and the Controller. This is especially useful for finding the reason for an error that occurs. As the log files become quite large it is only used when you have a specific error that need to be identified and solved. The extended log may be sent to Risø and may be helpful in order to solve the problem.

Save non-corrected and background data:

When checked the original non-corrected data as well as the background data are store as well as Curve no. 1 and 2 respectively.

Run 1 at a time:

Selecting this option causes the sequence to be run from left to right, one sample at a time, then from top to bottom one row at a time. If not selected then the sequence will be run from top to bottom one cell at a time and then from left to right one column at a time.

Example:

	Samples	Run 1	Run 2
Set 1	1,2,3	Irrad	TL
Set 2	4,5	Irrad	OSL

If **Run 1 at a time** is selected then the sequence will run in the following order:

Sample	*Operation*
1	Irrad
1	TL
2	Irrad
2	TL
3	Irrad
3	TL
4	Irrad
4	OSL
5	Irrad
5	OSL

If **Run 1 at a time** is **selected** the icon  is shown I the top left cell

If **Run 1 at a time** is *not* selected then the sequence will run in the following order:

Sample	*Operation*
1	Irrad
2	Irrad

3	Irrad
4	Irrad
5	Irrad
1	TL
2	TL
3	TL
4	OSL
5	OSL

If **Run 1 at a time** is **not selected** the icon  is shown I the top left cell

Samples

This button opens a dialog which allows you to give names to each of the samples in the sequence. Sample names may be up to 20 characters long and may contain any ASCII characters.
See Sample Names.

Spike filter

This filter may remove spikes on the decay/glow curve induced by e.g cosmic rays. The filterring is implemented as a non-linear median filter.
You may choose to keep the original data as well.

Default dialog settings:

Default nitrogen purge time:
The purge time that is used if not changed when specifying nitrogen use for a command.

Lower/Upper Filter:
Select the lower and upper filters that are used as a default for any operation that specifies these parameters.

Detection unit:
Select the detection unit that is used as a default for any operation that specifies these parameters.

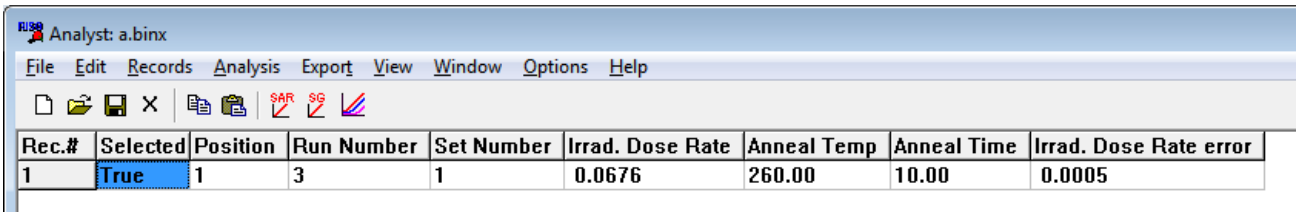
Save as default:

When this button is pressed, the Sequence Options for the current sequence are stored as default settings for any new sequence defined.

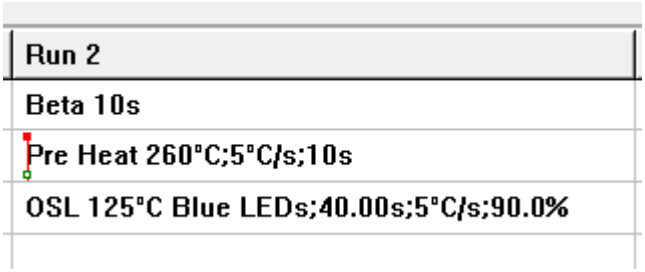
Automatically load dose and preheat information

A BIN-file record has four run-time information fields that can be filled automatically by enabling the **Automatically load dose and preheat information** checkbox:
• Irradiation dose rate,
• Irradiation dose rate error,
• Anneal temperature and
• Anneal time

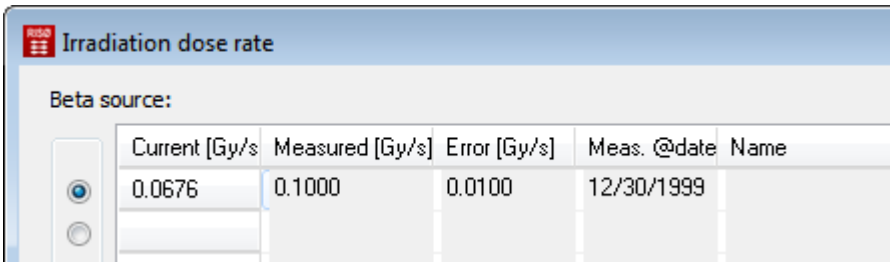
Here the fields are shown in Analyst:



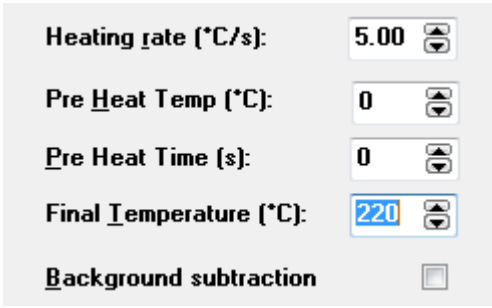
There are some conditions for this function to work. The sequence of operations must be something like this:



Also, an Irradiation dose rate entry must be filled out and selected:

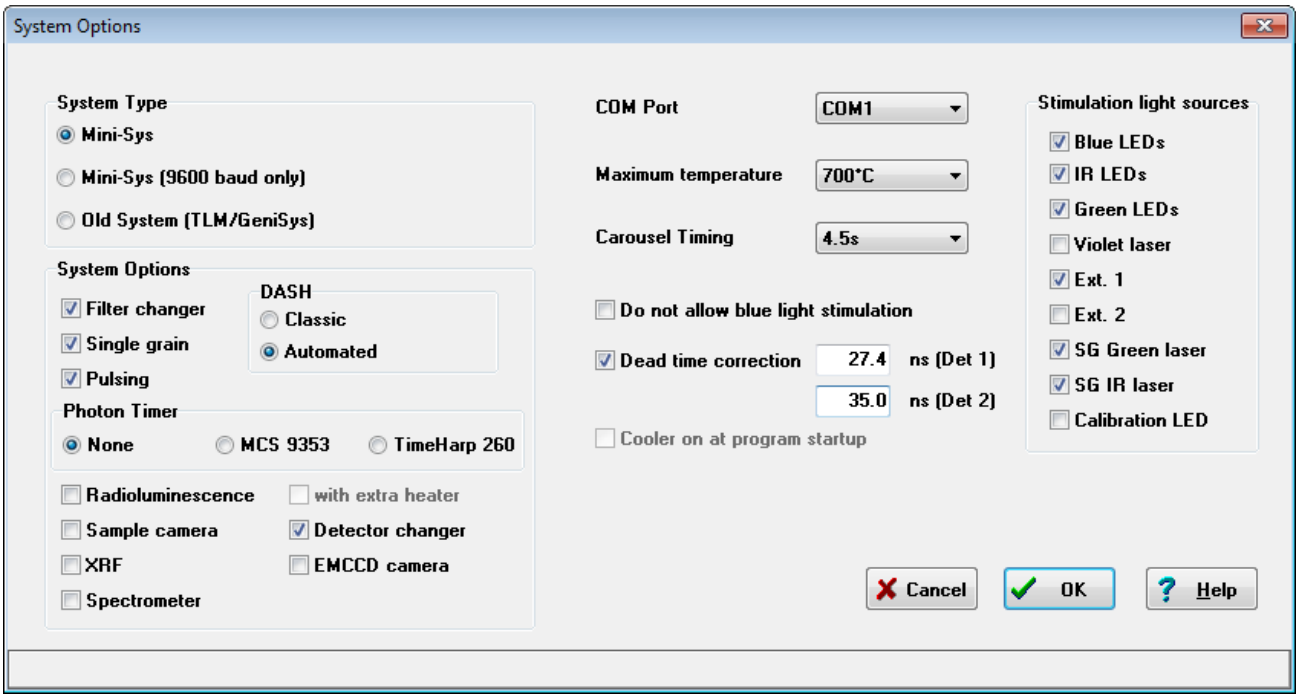


Note that the TL command has it's own preheat temperature and time parameters that will be used in place of values from a separate Preheat command:



System Options

The System Options, which are located in the Edit Menu (Edit | System Options), define several options specific to the attached reader system



If a system option is not checked then a command that depends on this option being available cannot be chosen when double-clicking a cell.

Do not allow blue light stimulation:

When this is checked a sequence containing blue light stimulation may be executed. This is a software alternative to turning off the blue light stimulation switch on the back of the controller in order to protect the PMT when a filter allowing blue light transmission is installed.

Dead time correction:

When this is checked the PMT count is corrected for dead time according to the correction formula:

$$n_c = \frac{t_c}{t_c - nT_d} n$$

where

n_C: is corrected count

n: is un-corrected count

t_C: is channel width

T_d: is dead time

COM port:

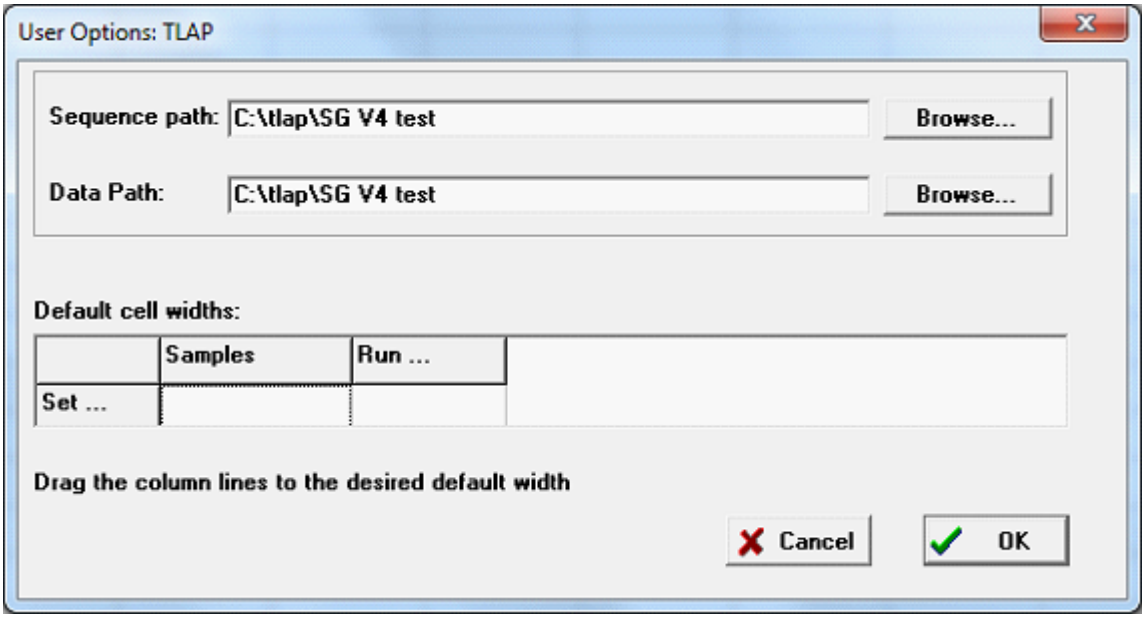
Only COM ports available on the PC is listed in the COM port selection box.

Stimulation light sources:

When automated DASH is selected you must also specify the available stimulation light sources

User Options

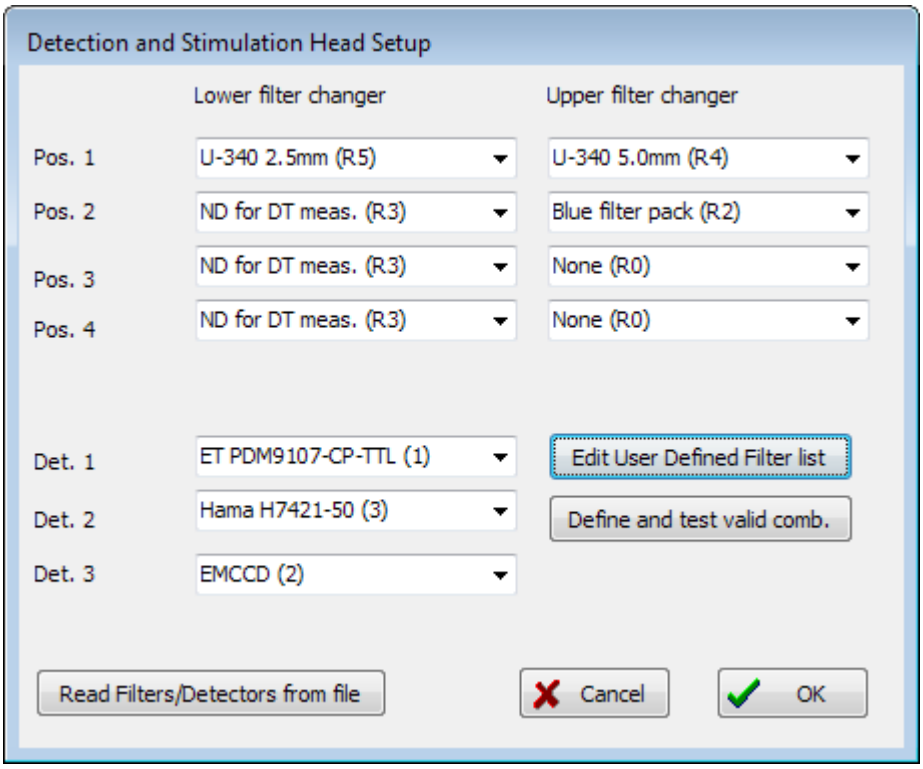
The User Options, which are located in the Edit Menu (Edit | User Options), define several options specific to user logged in



The data path also holds the sequence copy files (.SEC)

Detection and Stimulation Head setup

In this form the configuration of the automated DASH is specified



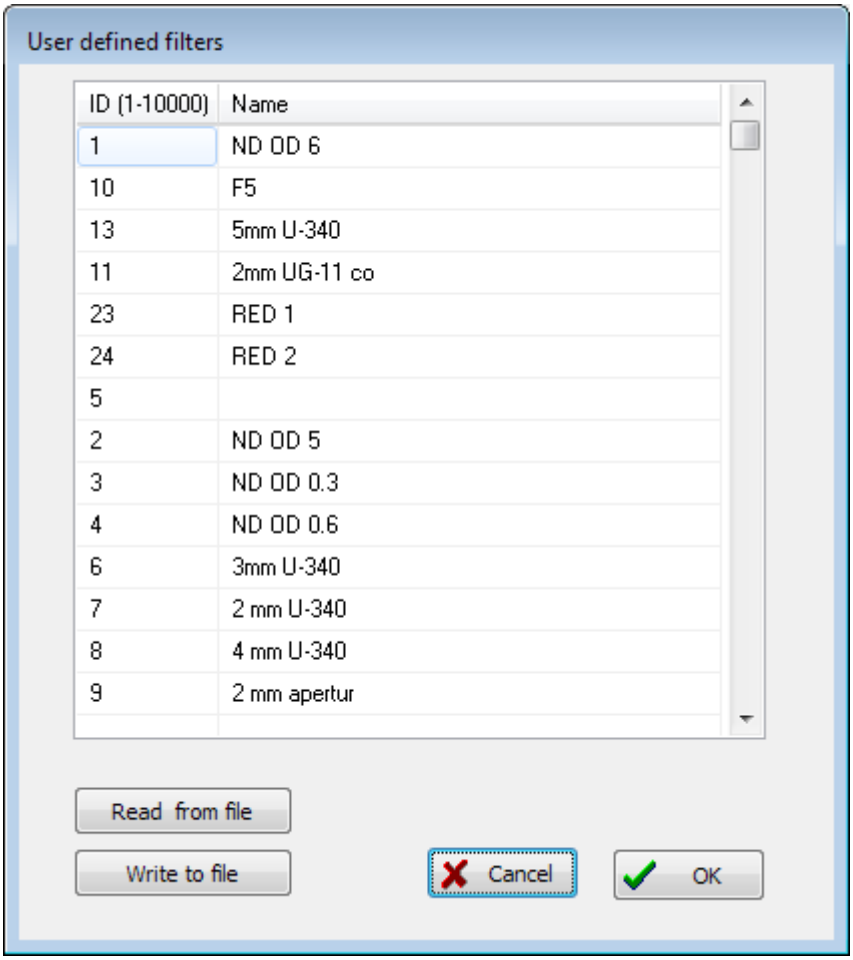
The positions of the installed filters and detection units are specified. Filters and detectors are selcted from a list that opens in the drop-down boxes.

The filters may be chosen from both standard Risø defined filter and User Defined filters (se *Edit User Defined Filter list*)

Read Filters/Detectors from file:

With this button you may overwrite the Risø filters and detectors specification file *R_FLTDET.INI* with a possible updated file

Edit User Defined Filter list



In this table you may define your own filters if these are not defined as standard Risø filters.
Every filter is defined by a unique ID and a name.

The information is stored in a file *U_FLT.INI* in the Risø program data folder (This may be e.g. *C:\ProgramData\Risoe* on a standard Windows 7 installation).

You may use the **Delete-key** to delete an entire row, and you may use the **Insert-key** to insert an entire row

You may share this information with other installations of the Sequence Editor by copying this file to the Risø program data folder on the other PC's with Sequence Editor installations.

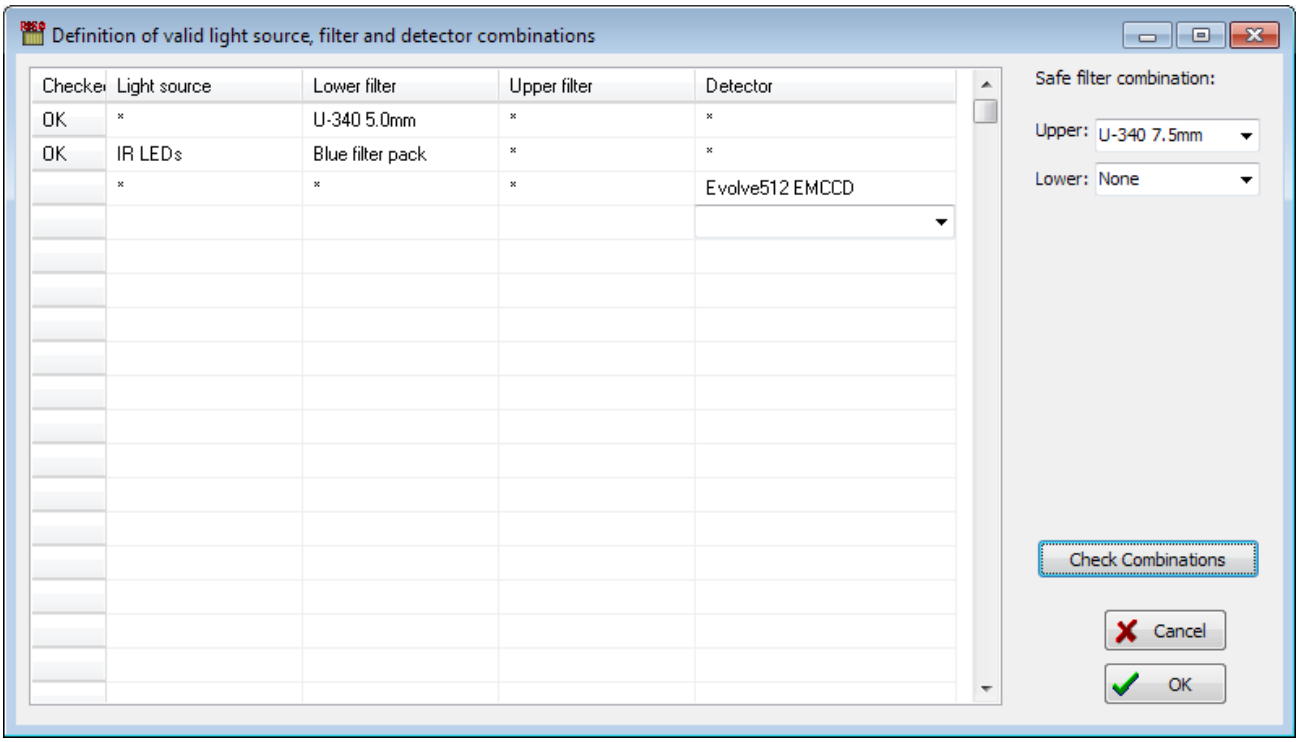
Read from file:

With this button you may overwrite the User defined filters and detectors specification file *U_DET.INI* with a file that has been defined on e.g. another installation of the Sequence Editor.

Write to file:

With this button you may store the User defined filters and detectors specification file *U_DET.INI as a backup or for use* on e.g. another installation of the Sequence Editor.

Define and check valid combinations



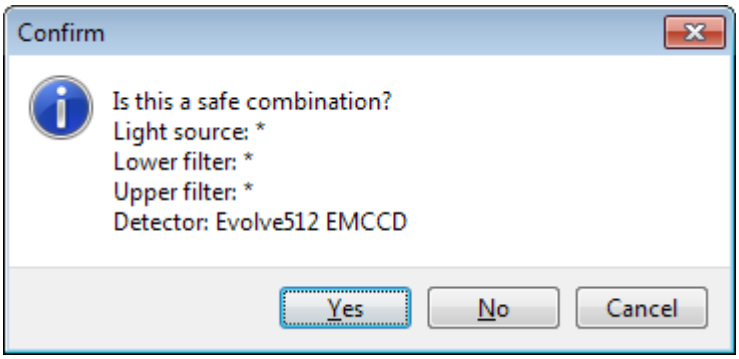
In this table you define which combinations of light sources, filters and detectors are valid. If a combination is defined in a sequence command that is not valid according to this table, you will get an error message when the sequence is started, and the sequence run is aborted.

You may use the **Delete-key** to delete an entire row, and you may use the **Insert-key** to insert an entire row

You may use wildcards (*) in the definition of valid combinations. Before a defined combination is considered valid it must have an OK for checked in the first column. To set the OK you must press the *Check Combinations*- button, and confirm each defined valid combination one by one.

Check Combinations:

When pressing *Check Combinations*- button on the form shown above you will be asked:



as this combination does not have an OK in first column.

Safe filter combination:

On this form you also specify a safe filter combination which is used for e.g. illumination and single grain disc search.

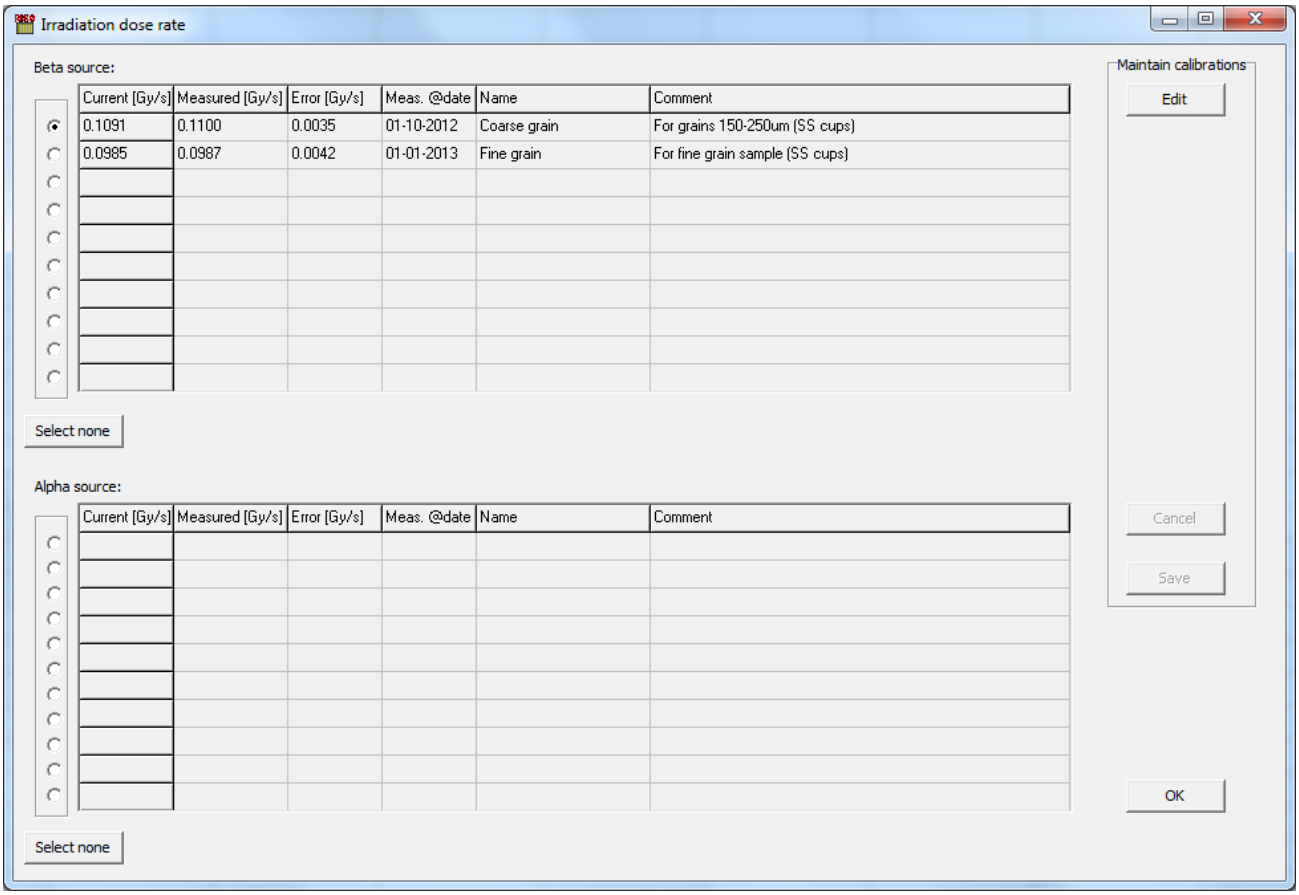
Irradiation dose rate

This dialog enables you to select the irradiation dose rate to be stored in the header with the acquired data. This enables Analyst to convert doses measured in equivalent seconds to Gy.

You may also type in new calibrations in the spreadsheet. When you press the 'Edit' button you may enter *measured dose rate, error on measured dose rate, measuring date*, *name* and *comment* for each of 4 available calibrations. The Current irradiation dose rate is automatically calculated based on the current date and the half-life of the source.

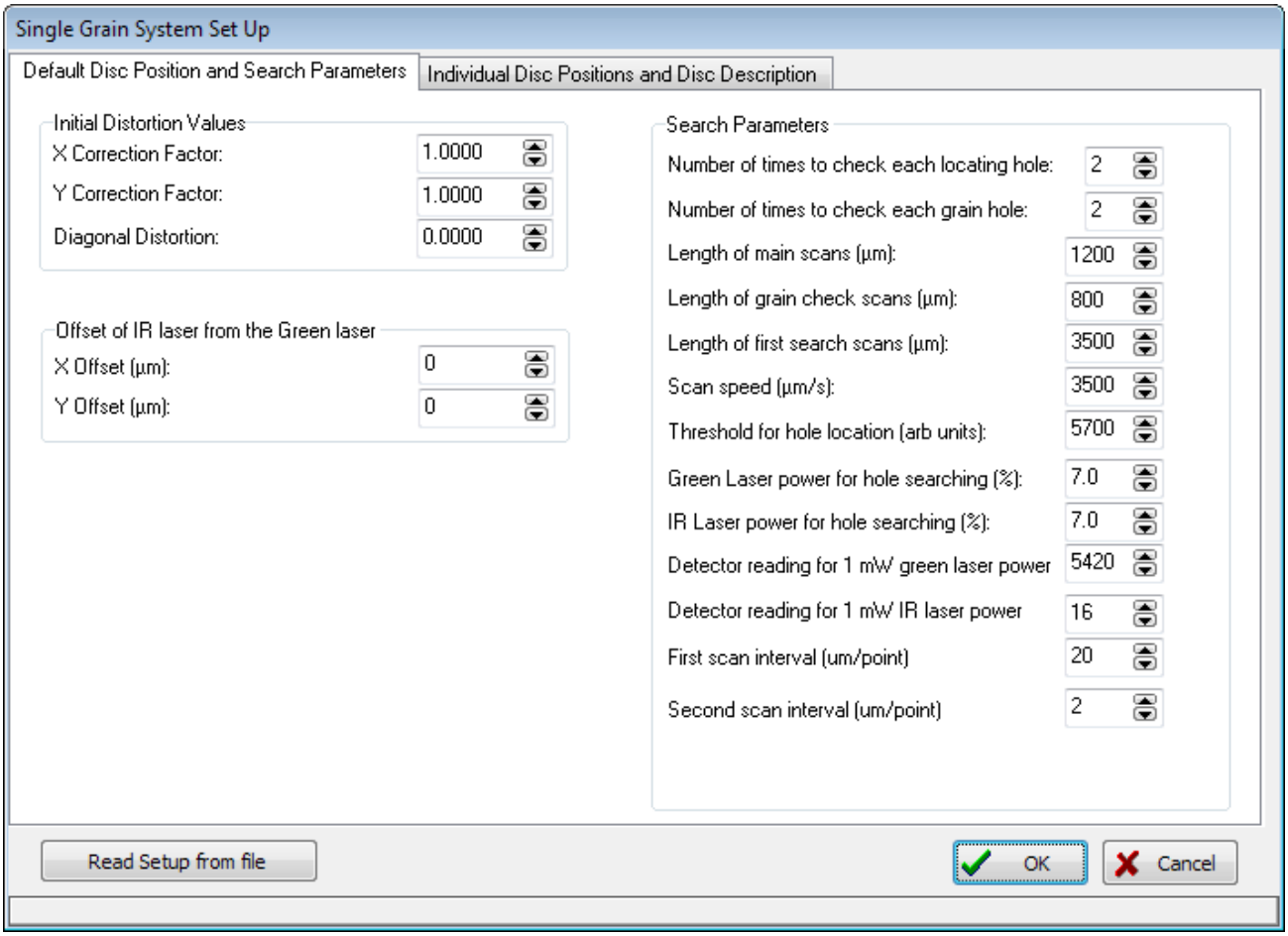
The dose rate and error will be compensated for decay according to the half-life of the radioactive source, and stored in the bin file header.

By pressing 'Select none' you may un-select all calibrations and a current dose rate and error of 0 is stored in the bin-file header.



Single grain options

Systems setup

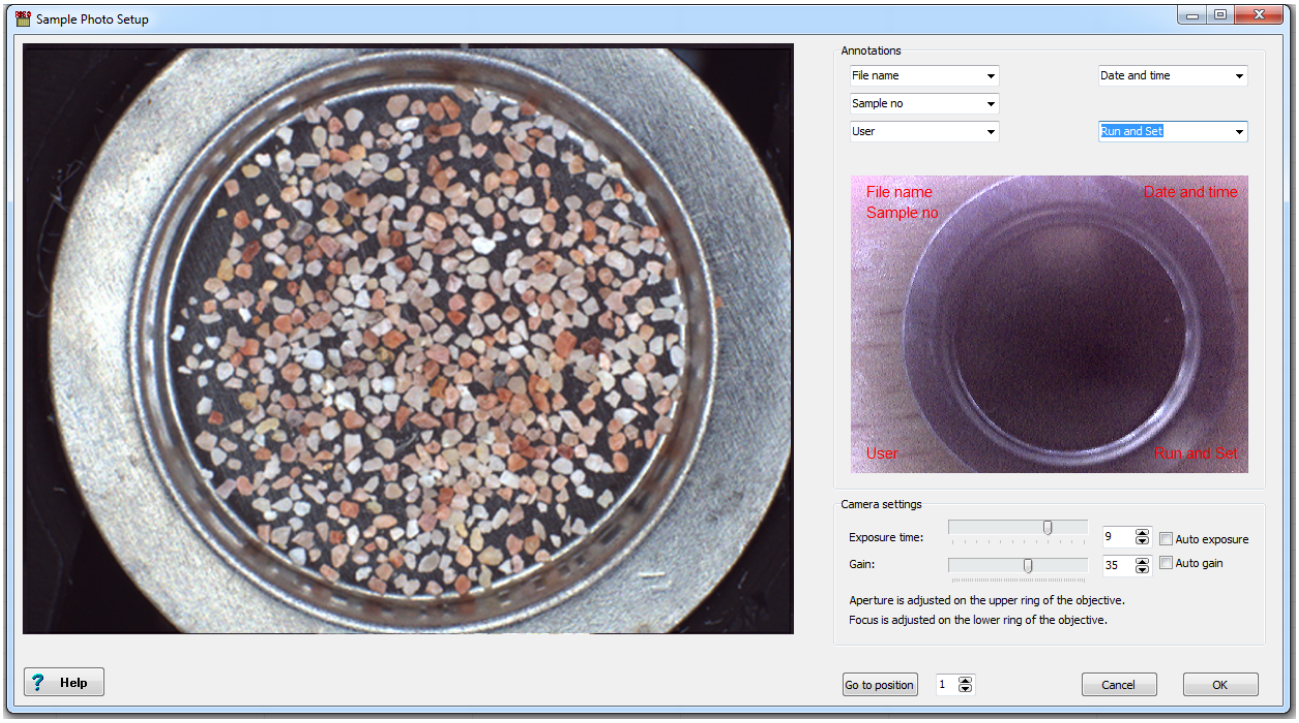


Here all the setup of the Single Grain System is defined.

Read Set up from file:

If you press this button you may read the complete setup from a a backup of the setup file *SGSETUP.INI.* The file will be stored in the Risø program data folder, e.g. *C:\ProgramData\Risoe* on a standard Windows 7 installation.

Sample Camera Setup



This is used for focusing the sample camera and setting up the camera.
You may move a specified sample to the camera position and display an image of the illuminated sample.

Focus is adjusted on the lower ring of the camera objective. The position may be locked with a locking screw. The aperture may be adjusted on the upper ring on the objective. The smaller the aperture, the wider the focal depth range. A small aperture may be compensated by a larger exposure time.The position may be locked with a locking screw.

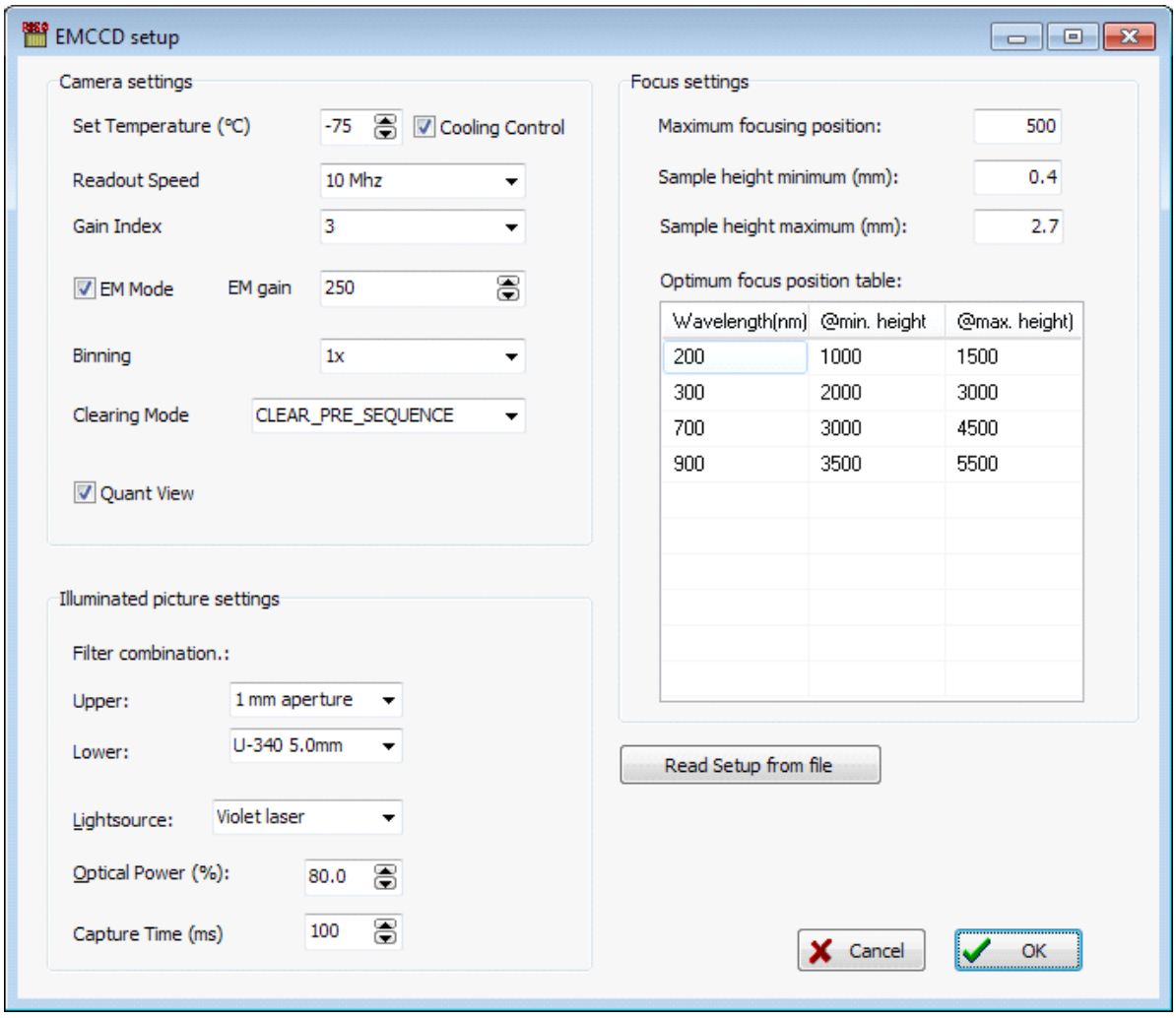
The exposure time and gain may be set either for automatic adjustment or adjusted manually on the track bars or spin buttons.

In this setup you also specify the annotation of the images. The annotation you may choose from are: File name, sample no. user, date and time, Run and Set.

The settings will be stored in a file called *PhotoSetup.cfg*

EMCCC camera setup

In this window you you setup paramters for the EMCCD camera



Camera settings

Set temperature:

Set the set point for the CCD temperature. Normally -80 ^{o}C is used and dark noise are negligible this temperature.

Readout speed:

Set the camera speed. There are two readout speeds (10 or 5 MHz). Fast readout has capability of higher frame rate but readout noise is bigger. Please refer the certificate from manufacturer.

EM Mode and EM Gain:

There are 2 readout ports. Conventional mode is operating like normal CCD. But EM mode has additional electron amplifying process before readout, so it can reduce readout noise dramatically. 250 or 300 EM gain setting is enough to have small readout noise. It the EM gain is too big, then it can cause more noise because of excess noise factor.

Gain Index:

Set the camera gain. There are 3 readout gains (E.x. 11, 6, 3 electrons /ADU). They have different noise. Please refer the certificate from manufacturer.

Binning:
Set the Binning mode for the image. (but present only 1× is compatible with Viewer+)

Clearing mode:
The clearing mode can be set to clear the CCD: Never, Pre-exposure, Pre-sequence, Post-sequence, Pre & Post-sequence, or Pre-Exposure & Post-sequence. Default setting is Pre-sequence.

Quant View:
This tick enables the counts to convert the ADU (an analog-to-digitla unit) value back into actual photoelectrons.

Illuminated picture settings

Filter combination :
Set the filter combination for illuminated images. Normally small aperture (ex. 1 mm) and empty position.

Light source:
Set the light source for illuminated images. Blue and Green illumination make better image quality. But IR illumination almost does not stimulates quartz samples, so default setting is IR.

Optical power:
Set the optical power for illuminated images. Default is 1%.

Capture time:
Set the capture time for illuminated images. Default is 10 ms.

Focus settings

Maximum focusing position:
Set the limit of maximum travel length of focusing unit. This value is set from manufacturer.

Sample height minimum and maximum:
Set the minimum and maximum height of focus testing target.

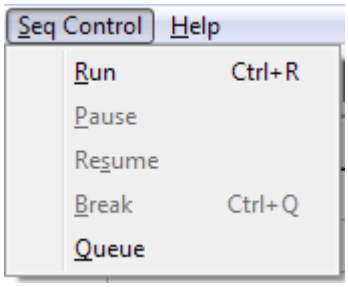
Optimum focus position table:
Fill in the table for focus positions. Default setting is carried out by Risø. But end user can modify the table.

You may use the **Delete-key** to delete an entire row, and you may use the **Insert-key** to insert an entire row.

Read Setup from file

When you press this button you may read the entire setup from an .ini file. This will be store in the *EMCCDSETUP.INI* file which in the <program data>\Risoe folder (e.g. c:\Program data\Risoe)

Seq Control



Run

Choose File|Run or the Run Speedbutton to run the sequence.
In order for the sequence to run properly, you must be sure that:

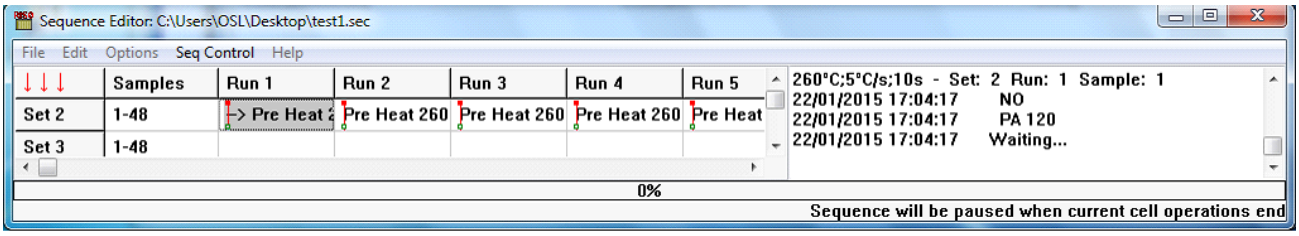
* A proper serial communication cable (RS232 or USB) is connected to both the Mini-Sys and this computer and that it is connected to the correct COM port.
- The correct samples are inserted into the reader.
- The Mini-Sys is turned on.
- That the Mini-Sys is working correctly.

If you have troubles using the communication please refer to Troubleshooting or Support.

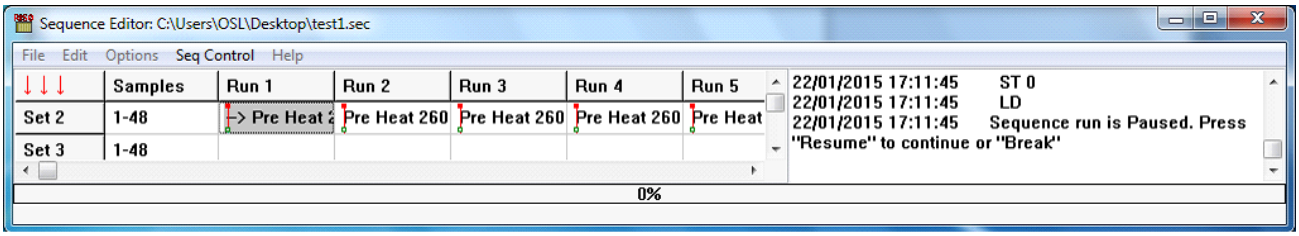
YOU CAN BREAK A RUN AT ANY TIME, BY CHOOSING Seq Control|Break OR THE SHORT CUT CTRL-Q. (see File|Break Stopping a Running Sequence)

Pause

When you press *Pause* a message will be shown in the in the status bar at the bottom of the program window



When all operations of the current cell has ended, a message in the log pane (also stored in the log file) will tell that the sequence has been paused and instruct you on how to resume operation



Resume

When you press *Resume*, the sequence that was paused start again from where it was paused. Initialisation of the sequence run is performed before the sequence is continued. E.g. the turntable is reset as it may have been removed and put back in again. The remaining data are appended to the BIN file and the SEC file is still valid as it is not possible to change the paused sequence.

The time the sequence was resumed is written in the log pane and the log file, and an updated estimate of sequence end is written in the bottom status bar.

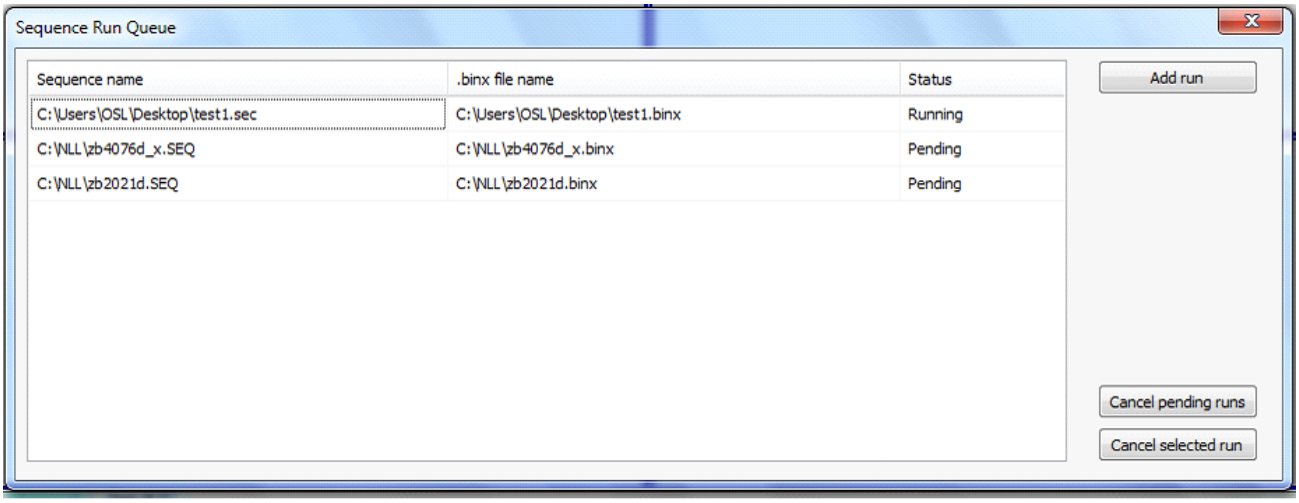
Break

Choose File|Break to break the sequence.

Note The sequence cannot restart at the stopped point, it must start all over!
All data are saved up to the time where you break the sequence.

Queue

When pressing *Queue* a list of running and pending sequence runs are shown.



You may add Sequences to be run by pressing “Add run”. You will be prompted for sequence (SEQ) file and BIN file names.

You may also delete pending runs by pressing “Cancel selected run” or “Cancel pending runs”.

Queue may be used to use the reader more efficiently (see Seq Control)

Sample Names

Enter up to a 20 character description of each sample. These descriptions will be saved in the data file headers.
The dialog has a row for each sample.

The Sequence File Format

The Sequence Cell is a text file that is constructed using an object oriented approach:
The first line is the version no.:
1
Then follows the sequence settings:
Name 8 chars
DataFile 8 chars
Vacuum True | False
HardCopy True | False
Display True | False
LiveDisplay True | False
SampleName1 20 chars
..
SampleName24 20 chars
Then we traverse each cell in the grid:
Starting with Set 1 going to run 1 to run <Max Run>
Then going to set 2 etc.
Until all 24 sets and runs are written.
If a cell is empty a zero (0) is written otherwise an ID is written where the ID is defined as:
spSeqNone = 0 Cell not used
spSeqHdr = 1 Not used
spSeqSet = 2 Set Options
spSeqRun = 3 Run Options / Run Info
spSeqCmdSV = 4 Scan Vis
spSeqCmdSI = 5 Scan IR
spSeqCmdTL = 6
spSeqCmdOSL = 7
spSeqCmdTOL = 8
spSeqCmdPOSL = 9
spSeqOpeIR = 10 Irradiate
spSeqOpeIL = 11 Illuminate
spSeqOpePH = 12 Pre Heat
spSeqOpeST = 13 Set Temp
spSeqOpePA = 14 Pause
spSeqOpeSV = 15 Set Vis Wavelength
spSeqOpeSI = 16 Set IR Wavelength
spSeqOpeLL = 17 Low Level command set

If the cell where used then follows the text in the cell.
Then each defined object in the file writes its specific settings:

Seq Set (2)

Name The name of the set default is Set <Set Number>
Run1 at a time True|False
UseSample1 True|False
..
UseSample24 True|False

Nitrogen (part of command or operation)

If a command or an operator is in the cell then we start with the N2 settings:
Flow 0:Ignore, -1:off, 1:on
Seconds Pause with flow on (int)

Run Info (part of command)

If it is a command in the cell then we write the Run Info for that command:
Run The run number (int)
Dtype The data type (Natural=0, Nat+Dose, Bleach, Bl. + Dose, Nat. + Bleach, N+B+D, Dose, Background

Irr_Time float
Irr_Unit (0=Secs, mins., hrs., gy, rads)
Irr_Type (0=Beta, alpha, gamma)
LightSource (0=none, Lamp, IR Diodes, Cal. LED)
Bl_Time float
Bl_Unit (0=Secs, mins., hrs., mJ, J)
An_Temp Anneal temp (Pre Heat) int
An_Time Anneal time (pre heat time) float
Comment up to 80 char of comment

TL (6)
DataPoints int
Rate float
HighTemp float
RecDuringPreHeat True|False

OSL
LightSource (0=none, Lamp, IR Diodes, Cal. LED)
IllumTime float
DataPoints int
Rate float
FlashHeat True|False

TOL
LightSource (0=none, Lamp, IR Diodes, Cal. LED)
MaxTemp Float
Rate Float
DataPoints int
Delay int
Active int
InActive int

TR-POSL
LightSource (0=none, Lamp, IR Diodes, Cal. LED)
Time float
Delay int
DataPoints int
Active int
InActive int
Accumulate int

ScanIr
DataPoints int
LightSource (0=none, Lamp, IR Diodes, Cal. LED)
LowLength float
HighLength float
ScanRate float
PreHeat float
HeatRate float
PreHeatTime float
FlashHeat True|False

ScanVis
DataPoints int
LightSource (0=none, Lamp, IR Diodes, Cal. LED)
LowLength float

HighLength float
ScanRate float
PreHeat float
HeatRate float
PreHeatTime float
FlashHeat True|False

Low Level
NoOfLines int
Line1 String
..
Line<nn>

Irradiation
Irradiation Time (alpha) float

Illumination
LightSource (0=none, Lamp, IR Diodes, Cal. LED)
BleachTime float

Pre Heat
PreHeatTime float
PreHeatTemp int
HeatRate float

Set Temp
PreHeatTemp int

Pause
Pause float

Set IR
WaveLength int

Set VIS
WaveLength int

Controlling Mini-Sys (TLMSLL.CMD file)

You decide which command to perform and when to do it by place the command/operation in a given cell. But is possible to control how a given command should be performed.

In the TLMSLL.CMD file we define how each of the high level commands is executed using the Mini-Sys low level commands.

The bin-file format

The results from a run of a Risø TL/OSL sequence are stored in a so-called BIN file.
For all versions of the BIN files, the version number is stored in the first 2 byte of the header.

V.8

The file format V.8 is used by Sequence editor V.4.40 and later

Description	Name	Type	Length (bytes)
Header size and structure			
Data format version number	Version	Small Integer	2
Length of this record (†)	Length	Long Integer	4
Length of previous record (†)	Previous	Long Integer	4
Number of data points	NPoints	Long Integer	4
Record type(§)	RecType	Byte	1
Sample characteristics			
Run number	Run	Small Integer	2
Set Number	Set	Small Integer	2
Carousel position	Position	Small Integer	2
Grain Number	GrainNumber	Small Integer	2
Curve number (for multiple curve operations)	CurveNo	Small Integer	2
X position of a single grain	XCoord	Small Integer	2
Y position of a single grain	YCoord	Small Integer	2
Sample name	Sample	String @	21
Comment	Comment	String @	81
Instrument and sequence characteristics			
System ID	SystemID	Small Integer	2
File name (.SEC, .BINX etc.)	FName	String @	101
User name	User	String @	31
Data collection time (hh-mm-ss)	Time	String @	7
Data collection date (dd-mm-yy)	Date	String @	7
Analysis			
Data type #	DType	Byte	1
Bleaching time	BL_Time	Single	4
Bleaching unit (mJ, J, secs, mins, hrs)	BL_Unit	Byte	1
Normalisation factor (1)	Norm1	Single	4
Normalisation factor (2)	Norm2	Single	4
Normalisation factor (3)	Norm3	Single	4

Background level	BG	Single	4
Number of channels to shift data	Shift	Small Integer	2
Tag	Tag	Byte	1
Reserved for internal use			20

Measurement characteristics

Luminescence type ‡	LType	Byte	1
Light Source *	LightSource	Byte	1
Optical Stimulation Power	LightPower	Single	4
Low (temperature, time, wavelength)	Low	Single	4
High (temperature, time, wavelength)	High	Single	4
Rate (heating rate, scan rate).	Rate	Single	4
Sample temperature	Temperature	Small Integer	2
Measured temperature	MeasTemp	Small Integer	2
Preheating temperature	An_Temp	Single	4
Preheating time	An_Time	Single	4
TOL 'delay' channels	Delay	Small Integer	2
TOL 'on' channels	On	Small Integer	2
TOL 'off' channels	Off	Small Integer	2
Irradiation time	IRR_Time	Single	4
Irradiation type (alpha, beta or gamma)	IRR_Type	Byte	1
Irradiation dose rate (Gy/s)	IRR_DoseRate	Single	4
Irradiation dose rate error (Gy/s)	DoseRateErr	Single	4
Time since last irradiation (s)	TimeSinceIrr	Long Integer	4
Time unit (time tick) for pulse parameters (s)	TimeTick	Single	4
On-time for pulsed stimulation (in time ticks)	OnTime	Long Integer	4
Stimulation period (on+off time in time ticks)	StimPeriod	Long Integer	4
PMT signal gating enabled	GateEnabled	Byte	1
Start of gating (in time ticks from start of on pulse)	GateStart	Long Integer	4
End of gating (in time ticks from start of on pulse)	GateEnd	Long Integer	4
Photon Timer enabled	PTenabled	Byte	1
PMT dead time correction enabled	DTenabled	Byte	1
PMT dead time (s)	DeadTime	Single	4
Stimulation power corresponding to 100% (mW/cm^2)	MaxLPower	Single	4
XRF acquisition time (s)	XrfAcqTime	Single	4
XRF X-ray high voltage (V)	XrfHV	Single	4
XRF X-ray current (uA)	XrfCurr	Long Integer	4
XRF dead time fraction	XrfDeadTimeF	Single	4
Detector ID	DtID	Byte	1
Lower filter ID	Fl1ID	Small Integer	2
Upper filter ID	Flt2ID	Small Integer	2

Excess Noise factor	ExNoiseF	Single	4
Marker position 1 to 3	Mrk.X, Mrk.Y	6xSingle	24
Extraction start	ExtrStart	Single	4
Extraction end	ExtrEnd	Single	4
Reserved for internal use		Byte	42
Length of header			*507*
Data			
Data array of NPOINTS Long Integers (Record type=0, 1)	DPoints	Long Integer	4x NPoints
or			
Region Of Interest definitions (Record type=128)			504 x NPoints
One ROI definition (504 bytes):			
Number of points in definition	NofPoints	Integer	4
Samples the ROI is used for	UsedFor	Byte	48 x 1
Samples the ROI is shown for	ShownFor	Byte	48 x 1
The colour the ROI is drawn with	Color	Integer	4
X Coordinates (in ref coordinate system)	X	Single	50 x 4
Y Coordinates (in ref coordinate system)	Y	Single	50 x 4

Notes:

§ Record type is introduced so the bin file may hold other data than signal data.
0: identifies ordinary count data acquired by the Sequence Editor
1: identifies count data for Region Of Interests (ROIs) extracted by e.g. the Viewer+ program
128: identifies ROI definitions. In This case “number of data points” means number of ROIs

† The records are of a variable length since the number of data points recorded (NPOINTS) may vary from one to 9,999 (this may be expanded in the future). A record with a single data point in it will be 507+(1x4) = 517 bytes long, while one with 2000 data points will be 507+(2000x4) = 8507 bytes long. Thus there is a considerable saving of disc space by having semi-variable length records. However, once created the length of the record is fixed (it does not make sense to be able to delete or add single data points) and is recorded in the variable LENGTH. This allows the program to be able to step through from one record to another without having to search for specific end of record markers. In order to be able to move UP through a file the length of each previous record is also stored in a record (this will be zero in the first record).

@ Strings are stored in Pascal format. That is with an additional byte used to define the length of the string. Thus the number of bytes used to store the string is one byte longer than the string itself. Thus the Date is stored as a 6 character string (ddmmyy), but this requires 7 bytes.

‡ The different types of luminescence that can be specified are as follows:-

Value	LTYPE	Description	Associated device
0	TL	Thermoluminescence	-
1	OSL	Optically stimulated luminescence	OSL lamp / Blue diodes

2	IRSL	Infrared stimulated luminescence	IR diode array or IR laser
3	M-IR	Infrared monochromator scan	IR monochromator
4	M-VIS	Visible monochromator scan	Visible monochromator
5	TOL	Thermo-optical luminescence	Any optical stimulation
6	TRPOSL	Time Resolved Pulsed OSL	Any optical stimulation
7	RIR	Ramped IRSL	IR diode array or IR laser
8	RBR	Ramped Blue LEDs	Blue diodes
9	USER	User defined	-
10	POSL	Pulsed OSL	Blue or IR diode arrays
11	SGOSL	Single Grain OSL	Green or IR laser
12	RL	Radio Luminescence	Beta irradiation source
13	XRF	X-ray Fluorescence	X-ray unit

The various data types specified by DTYPE are primarily designed for use when calculating equivalent doses. The different data types are as follows.

Value	Data Type	Irr.	Bl.
0	Natural		
1	N+dose	x	
2	Bleach		x
3	Bleach + dose	x	x
4	Natural (Bleach)		x
5	N+dose (Bleach)	x	
6	Dose	x	
7	Background		

* The values for the light source are as follows:

Value	Light Source
0	None
1	Lamp
2	IR diodes / IR Laser
3	Calibration LED
4	Blue Diodes
5	White light
6	Green laser (single grain)
7	IR laser (single grain)

V.7 and V.6 (file extension: binx)

The file format V.7 is used by Sequence editor V.4.30 and later.
The file format V.6 is used by Sequence editor V.4.20 to 4.29

Description	Name	Type	Length (bytes)
Header size and structure			
Data format version number	Version	Small Integer	2
Length of this record (†)	Length	Long Integer	4
Length of previous record (†)	Previous	Long Integer	4
Number of data points	NPoints	Long Integer	4
Sample characteristics			
Run number	Run	Small Integer	2
Set Number	Set	Small Integer	2
Carousel position	Position	Small Integer	2
Grain Number	GrainNumber	Small Integer	2
Curve number (for multiple curve operations)	CurveNo	Small Integer	2
X position of a single grain	XCoord	Small Integer	2
Y position of a single grain	YCoord	Small Integer	2
Sample name	Sample	String @	21
Comment	Comment	String @	81
Instrument and sequence characteristics			
System ID	SystemID	Small Integer	2
File name (.SEC, .BINX etc)	FName	String @	101
User name	User	String @	31
Data collection time (hh-mm-ss)	Time	String @	7
Data collection date (dd-mm-yy)	Date	String @	7
Analysis			
Data type (#)	DType	Byte	1
Bleaching time	BL_Time	Single	4
Bleaching unit (mJ, J, secs, mins, hrs)	BL_Unit	Byte	1
Normalisation factor (1)	Norm1	Single	4
Normalisation factor (2)	Norm2	Single	4
Normalisation factor (3)	Norm3	Single	4
Background level	BG	Single	4
Number of channels to shift data	Shift	Small Integer	2
Tag	Tag	Byte	1
Reserved for internal use			20
Measurement characteristics			
Luminescence type (‡)	LType	Byte	1

Light Source (*)	LightSource	Byte	1
Optical Stimulation Power	LightPower	Single	4
Low (temperature, time, wavelength)	Low	Single	4
High (temperature, time, wavelength)	High	Single	4
Rate (heating rate, scan rate).	Rate	Single	4
Sample temperature	Temperature	Small Integer	2
Measured temperature	MeasTemp	Small Integer	2
Preheating temperature	An_Temp	Single	4
Preheating time	An_Time	Single	4
TOL 'delay' channels	Delay	Small Integer	2
TOL 'on' channels	On	Small Integer	2
TOL 'off' channels	Off	Small Integer	2
Irradiation time	IRR_Time	Single	4
Irradiation type (alpha, beta or gamma)	IRR_Type	Byte	1
Irradiation dose rate (Gy/s)	IRR_DoseRate	Single	4
Irradiation dose rate error (Gy/s)	DoseRateErr	Single	4
Time since last irradiation (s)	TimeSinceIrr	Long Integer	4
Time unit (time tick) for pulse parameters (s)	TimeTick	Single	4
On-time for pulsed stimulation (in time ticks)	OnTime	Long Integer	4
Stimulation period (on+off time in time ticks)	StimPeriod	Long Integer	4
PMT signal gating enabled	GateEnabled	Byte	1
Start of gating (in time ticks from start of on pulse)	GateStart	Long Integer	4
End of gating (in time ticks from start of on pulse)	GateEnd	Long Integer	4
Photon Timer enabled	PTenabled	Byte	1
PMT dead time correction enabled	DTenabled	Byte	1
PMT dead time (s)	DeadTime	Single	4
Stimulation power corresponding to 100% (mW/cm^2)	MaxLPower	Single	4
XRF acquisition time (s)	XrfAcqTime	Single	4
XRF X-ray high voltage (V)	XrfHV	Single	4
XRF X-ray current (uA)	XrfCurr	Long Integer	4
XRF dead time fraction	XrfDeadTimeF	Single	4
Detector ID¤		Byte	1
Lower filter ID¤		Small Integer	2
Upper filter ID¤		Small Integer	2
Excess Noise factor¤		Single	4
Reserved for internal use		Byte	15/ (24 ¤)
Length of header			*447*

Data

Data array of NPOINTS Long Integers	DPoints	Long Integer	4x NPoints

Notes:

¤ These parameters are only stored in V.7 and not in V.6. The header size is unchanged from V.6 to V.7 and therefor the bytes reserved for internal use are different from V.7 to V.6.

V.4 (file extension: bin)

The file format us used by Sequence editor V.4.00 to V.4.12

Description	Name	Type	Length (bytes)
Data format version number	Version	Small Integer	2
Length of this record (†)	Length	Small Integer	2
Length of previous record (†)	Previous	Small Integer	2
Number of data points	NPoints	Small Integer	2
Luminescence type (‡)	LType	Byte	1
Low (temperature, time, wavelength)	Low	Single	4
High (temperature, time, wavelength)	High	Single	4
Rate (heating rate, scan rate).	Rate	Single	4
Sample temperature	Temperature	Small Integer	2
X position of a single grain	XCoord	Small Integer	2
Y position of a single grain	YCoord	Small Integer	2
TOL 'delay' channels	Delay	Small Integer	2
TOL 'on' channels	On	Small Integer	2
TOL 'off' channels	Off	Small Integer	2
Carousel position	Position	Byte	1
Run number	Run	Byte	1
Data collection time (hh-mm-ss)	Time	String	7
Data collection date (dd-mm-yy)	Date	String	7
Sequence name	Sequence	String	9
User name	User	String	9
Data type (#)	Dtype	Byte	1
Irradiation time	IRR_Time	Single	4
Irradiation type (alpha, beta or gamma)	IRR_Type	Byte	1
Irradiation unit (Gy, Rads, secs, mins, hrs)	IRR_UNIT	Byte	1
Bleaching time	Bl_Time	Single	4
Bleaching unit (mJ, J, secs, mins, hrs)	Bl_Unit	Byte	1
Annealing temperature	An_Temp	Single	4
Annealing time	An_Time	Single	4

Normalisation factor (1)	Norm1	Single	4
Normalisation factor (2)	Norm2	Single	4
Normalisation factor (3)	Norm3	Single	4
Background level	BG	Single	4
Number of channels to shift data	Shift	Small Integer	2
Sample name	Sample	String	21
Comment	Comment	String	81
Light Source (*)	LightSource	Byte	1
Set Number	Set	Byte	1
Tag	Tag	Byte	1
Grain Number	Grain	Small Integer	2
Optical Stimulation Power	LightPower	Single	4
System ID	SystemID	Small Integer	2
Reserved for internal use			20
Curve number (for multible curve operations)	CurveNo	Small Integer	2
Time unit for pulse parameters	TimeTick	Single	4
On-time for pulsed stimulation (in time ticks)	OnTime	Long Integer	4
Stimulation period (on+off time in time ticks)	StimPeriod	Long Integer	4
PMT signal gating enabled	GateEnabled	Byte	1
Start of gating (in time ticks from start of on pulse)	GateStart	Long Integer	4
End of gating (in time ticks from start of on pulse)	Gateend	Long Integer	4
Photon Timer enabled	PTenabled	Byte	1
Reserved			10
Length of header			*272*
Data array of NPOINTS Long Integers	DPoints	Long Integer	4 x NPOINTS

V.3 (file extension: bin)

The file format us used by Sequence editor V.3.xx

Description	Name	Type	Length (bytes)
Data format version number	Version	Small Integer	2
Length of this record (†)	Length	Small Integer	2
Length of previous record (†)	Previous	Small Integer	2
Number of data points	NPoints	Small Integer	2
Luminescence type (‡)	LType	Byte	1
Low (temperature, time, wavelength)	Low	Single	4

High (temperature, time, wavelength)	High	Single	4
Rate (heating rate, scan rate).	Rate	Single	4
Sample temperature	Temperature	Small Integer	2
X position of a single grain	XCoord	Small Integer	2
Y position of a single grain	YCoord	Small Integer	2
TOL 'delay' channels	Delay	Small Integer	2
TOL 'on' channels	On	Small Integer	2
TOL 'off' channels	Off	Small Integer	2
Carousel position	Position	Byte	1
Run number	Run	Byte	1
Data collection time (hh-mm-ss)	Time	String	7
Data collection date (dd-mm-yy)	Date	String	7
Sequence name	Sequence	String	9
User name	User	String	9
Data type (#)	Dtype	Byte	1
Irradiation time	IRR_Time	Single	4
Irradiation type (alpha, beta or gamma)	IRR_Type	Byte	1
Irradiation unit (Gy, Rads, secs, mins, hrs)	IRR_UNIT	Byte	1
Bleaching time	Bl_Time	Single	4
Bleaching unit (mJ, J, secs, mins, hrs)	Bl_Unit	Byte	1
Annealing temperature	An_Temp	Single	4
Annealing time	An_Time	Single	4
Normalisation factor (1)	Norm1	Single	4
Normalisation factor (2)	Norm2	Single	4
Normalisation factor (3)	Norm3	Single	4
Background level	BG	Single	4
Number of channels to shift data	Shift	Small Integer	2
Sample name	Sample	String	21
Comment	Comment	String	81
Light Source (*)	LightSource	Byte	1
Set Number	Set	Byte	1
Tag	Tag	Byte	1
Grain Number	Grain	Small Integer	2
Optical Stimulation Power	LightPower	Single	4
System ID	SystemID	Small Integer	2
Reserved for internal use			36
On-time for pulsed stimulation (s) (#)	OnTime	Single	4
Off-time for pulsed stimulation (s) (#)	OffTime	Single	4
Enable flags (PMT Gating and Photon Timer enable) (#)	EnableFlags	Byte	1
On-gate delay (s) (#)	OnGateDelay	Single	4

Off-gate delay (s) (#)	OffGateDelay	Single	4
Reserved			1
Length of header			*272*
Data array of NPOINTS Long Integers	DPoints	Long Integer	4 x NPOINTS

Notes:

The pulsing parameters are only stored from Sequence Editor V.3.30 and onwards