Rerum Naturalium Fragmenta

No. 406

PEREC for PC-DOS
Version 2.5
User's Guide

by

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Chapter 5
ADDITION OF PROSPECTS

Chapter 6
FILE OPERATIONS

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Chapter 5
ADDITION OF PROSPECTS

Select the Add option from the main PEREC menu. The Addition menu will be displayed. The main items on this menu are Edit Add, Monte-Carlo Add, STOIIP, Reserves, Display and Print results.

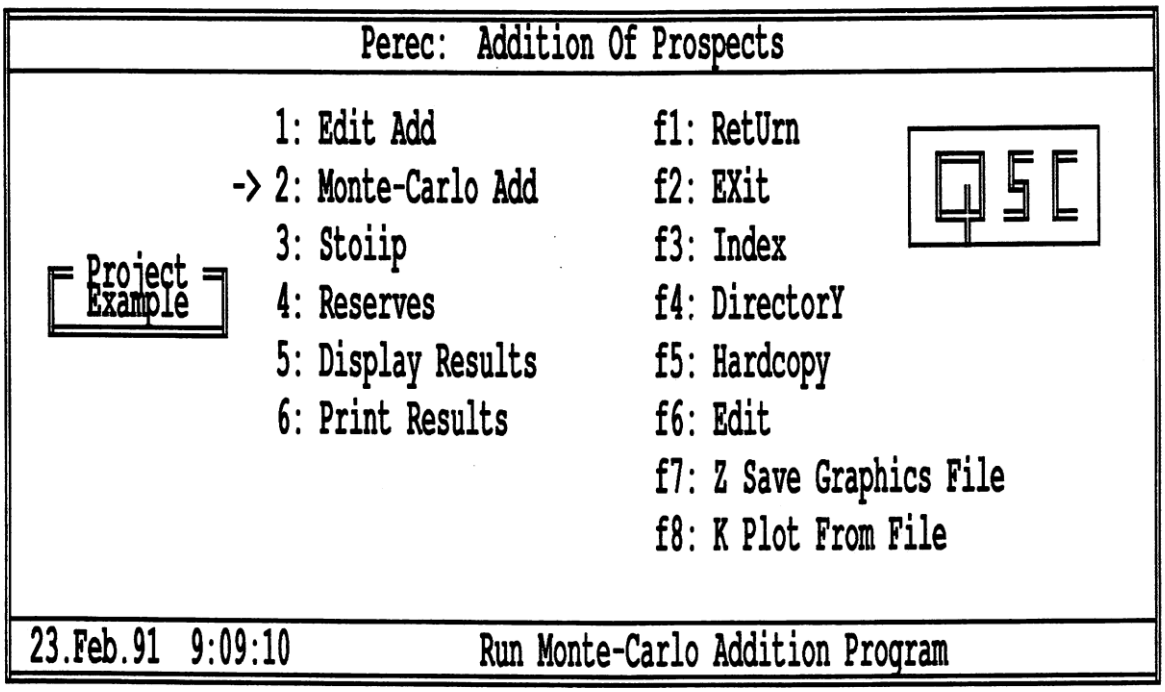


Fig. 5.1

The total expectation for a prospect consisting of several reservoirs can be computed by Monte-Carlo addition of the individual expectations of each reservoir.

As the input to the program consists of the chance factor and the expectation curve for each reservoir, these have to be computed before adding them together. To access the results stored

in the reservoir data files, the user has to enter the list of the reservoir files. This is done by the Edit Addition model option.

The addition program can do partially dependent addition as well as independent and totally positive addition. The level of dependency can be specified by the user when running the program.

Prospect Name	Xi 2/23					Oil, Gas or Metric	Gas
Quantiles P%	90	50	10			Minimum Economic Level (Cutoff)	
Monte-Carlo Samples	2000	Generator	System	Seed			

File to add	Depends on	Force
Gamma	-	-
Omicron		
Pi		
Rho		

File to add	Depends on	Force

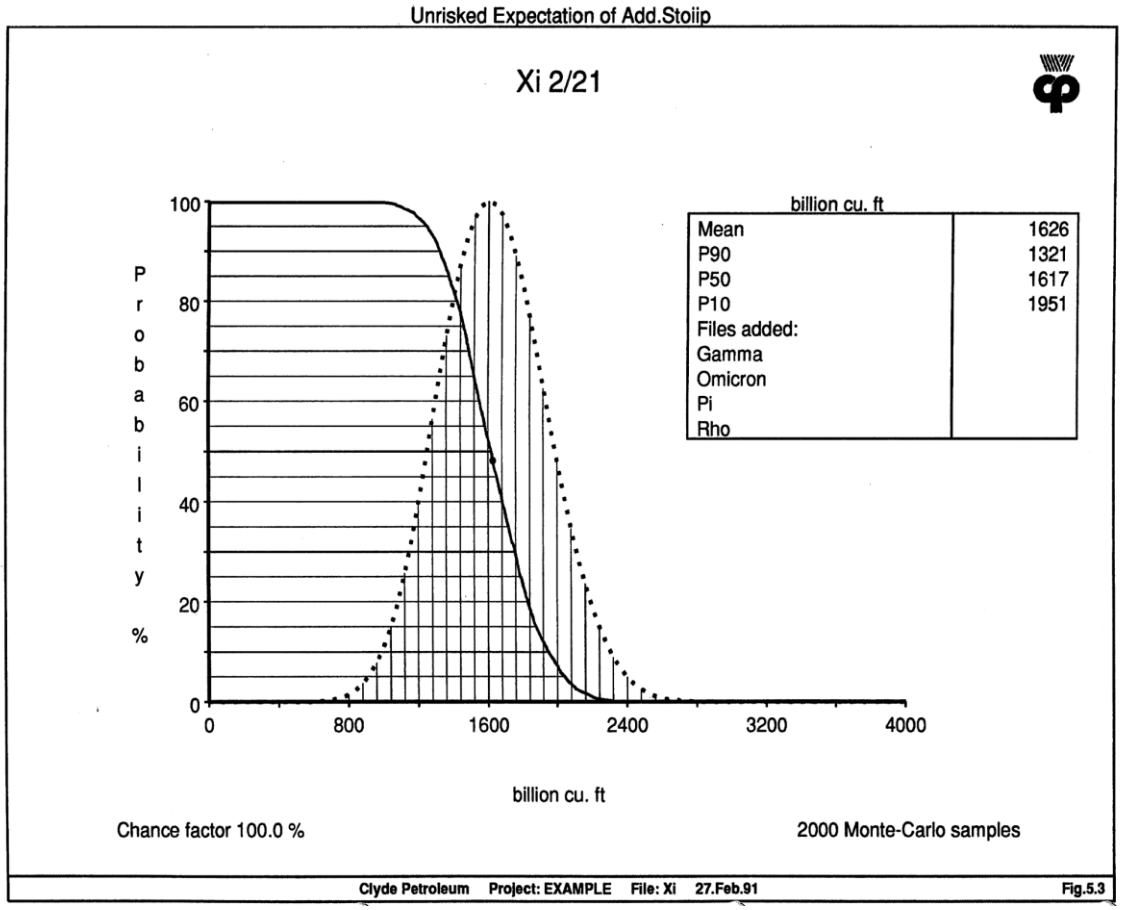
Press End to exit

Fig. 5.2

Other parameters to be entered include the prospect name to be displayed on plots and the units to be used for reporting the results. Enter Oil for million barrels, Gas for billion cubic feet of gas, Metric for million cubic metres. You can also specify the number of simulation samples, the random number generator and seed.

When editing is completed, press the End key. The program will save your data and calculate STOIIP and reserves results without pausing. If you want to see the details of the Monte-

Carlo calculation you can rerun the calculations with the Monte-Carlo Add option which will pause after each stage.



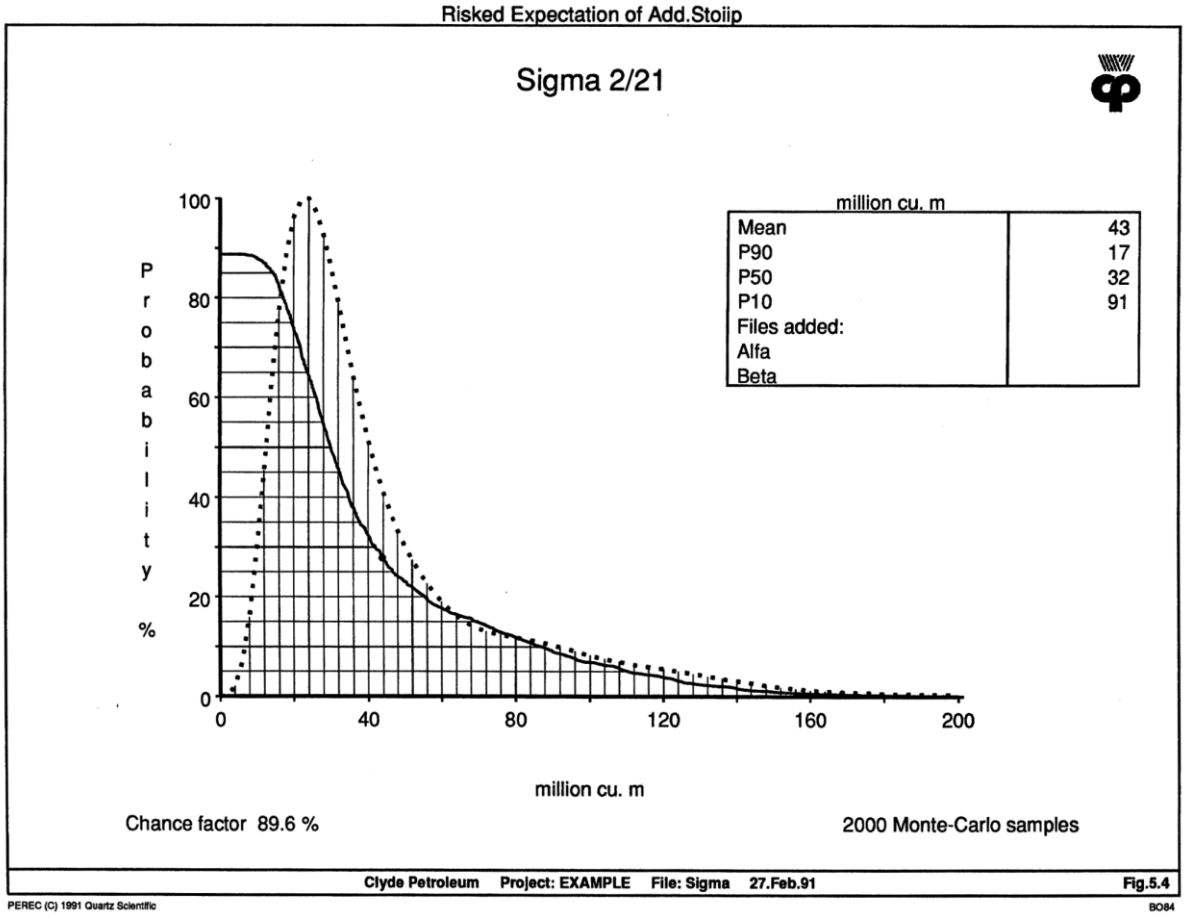
Monte-Carlo addition

The Monte-Carlo addition program always works on a 'risked' basis. It selects an oil (gas) in place value for the first reservoir by generating a random number between zero and one.

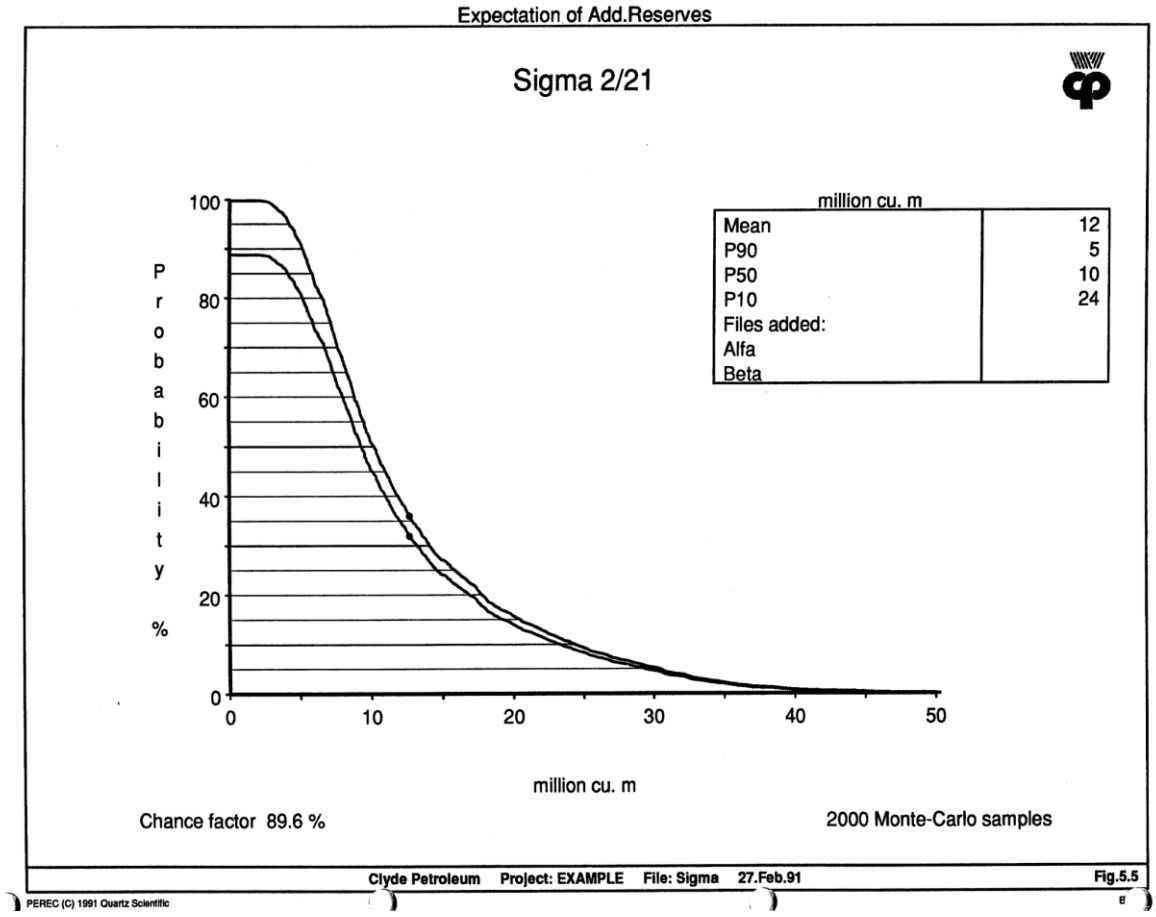
If the random number exceeds the chance factor then it points to unsuccessful (dry) outcome and a value of 0 is recorded for the reservoir. Otherwise it is projected from the probability scale to the risked expectation curve to obtain a positive value for the reservoir.

This is repeated for each of the reservoirs and the reservoir values are added together.

The sum may be zero if all reservoirs gave zero (dry) oil in place values. In this case the counter of totally dry samples is incremented by one. Otherwise, the sum is stored as a positive sample.



This sequence of getting random values for each of the reservoirs and storing their sum (if greater than zero) is repeated until the requested number of non-zero samples are collected. The total number of samples will equal the dry count plus the requested number of positive samples.



Chance factor

An overall chance factor can be computed for the prospect as the ratio of possible outcomes

c.f. = positive / (dry + positive)

Monte-Carlo simulation gives an estimate of the chance factor, in certain cases it is also possible to compute the chance factor by an exact formula.
The estimated chance factor is, like the rest of the results, dependent on the choice of random numbers.

Exact chance factor can only be computed if all the reservoirs are independent or if all are totally positively dependent.

The chance of independent addition is given by

c.f. = 1-(1-cf[l])*...*(1-cf[n])

where the chance factors of the reservoirs are cf[l]... cf[n].

For total positive dependency the chance is the maximum of the reservoir chance factors.

Dependencies

Dependencies between the added reservoirs can be specified the same way as for the factors of reservoir data files.

The *progress of computation* of Monte-Carlo samples is indicated by symbols printed on the screen: a + for 250 positive samples, a - for 250 dry samples. If the overall chance factor is 100% then plus signs will only appear. If it is less than 100 % then there will be some hyphens among the plus signs.

Running the addition program

Provided that each reservoir has a computed and stored expectation curve, both the Edit and Monte-Carlo addition options will compute the sum of expectations for Stoiip and Reserves, respectively.

The STOIIP and Reserves options can then be used to display the computed expectation curve in unrisked or risked form. The comments of Chapters 3 and 4 on random numbers and precision are equally applicable to Monte-Carlo addition. Note,

that adding the same reservoirs in a different order has the effect of changing the seed for the random number sequence.

Summary listings of the model data and results can be obtained by the Display and Print options.

Special cases of dependency

The handling of independent and positively dependent reservoirs in the addition program is similar to the treatment of independent and positively dependent factors in the Monte-Carlo simulation of individual reservoirs.

Independent and total positive dependent additions are special cases included in the addition program. For the default case of independent addition, leave the box empty, for the total positive dependent case, enter dependency with a strength of +10.

Mutually exclusive models

Two mutually exclusive prospect models can be analysed and combined to give a single curve. To achieve this, define the two models as separate data files.

The chance factors should be scaled so that the sum of both chance factors is equal to the total chance factor for the prospect. E.g. if the overall chance factor for the prospect is 40 % and model A is 3 times more likely than model B then the chance factors should be specified as 30 % and 10 %.

Compute the expectation curves for both models. Add them specifying a dependency of -10 (totally negative dependency).

It is not possible to add more than two mutually exclusive models this way.

```
..ddition Model File: Sigma
_____________________________________________________________
Prospect:Sigma 2/23
--------:

 ------ Hydrocarbons in place ------ million cu. m ------
Chance factor  89.6 %
 2000 Monte-Carlo samples
Mean =      45.9
P90 =       18.2
P50 =       34.5
P10 =       93.8

 ------ Recoverable reserves ------ million cu. m ------
Mean =      13.2
P90 =        5.4
P50 =       10.7
P10 =       25.1

..les added:
Alfa
Beta

Clyde Petroleum     Project: EXAMPLE     Sigma.Xad     23.Feb.91
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Fig. 5.6

Chapter 6
FILE OPERATIONS

Select the File option in the main PEREC menu. The program displays the File menu.

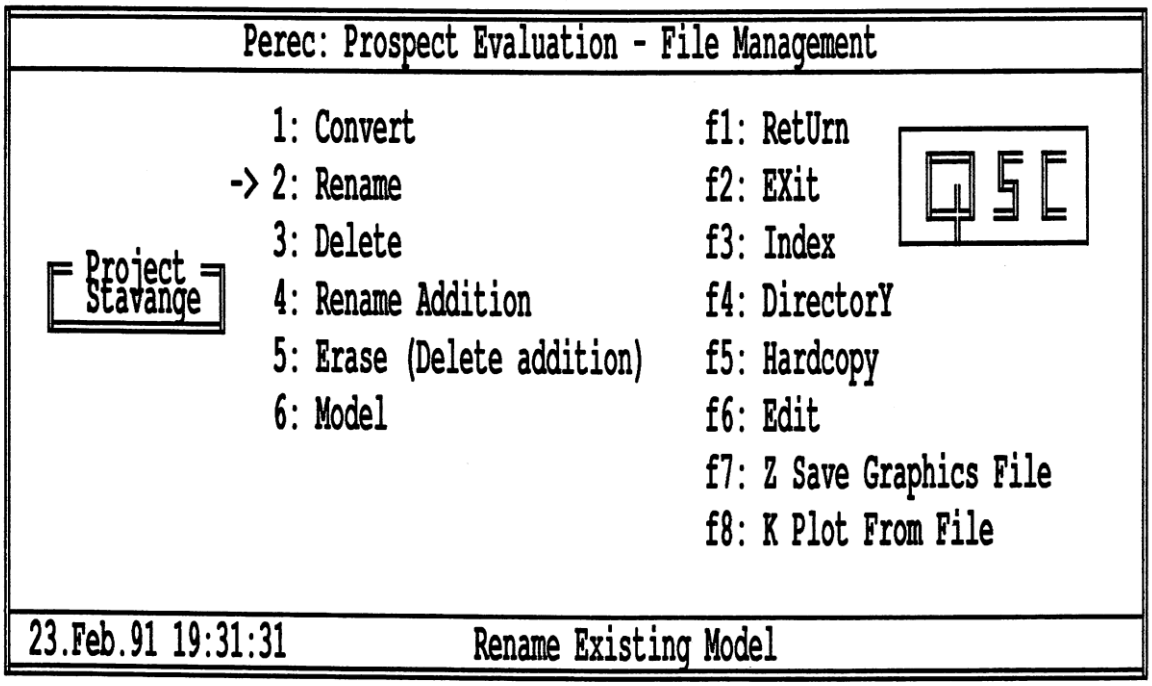


Fig.6.1

Main options on this menu are Convert, Rename, Delete, Rename Addition and Erase.

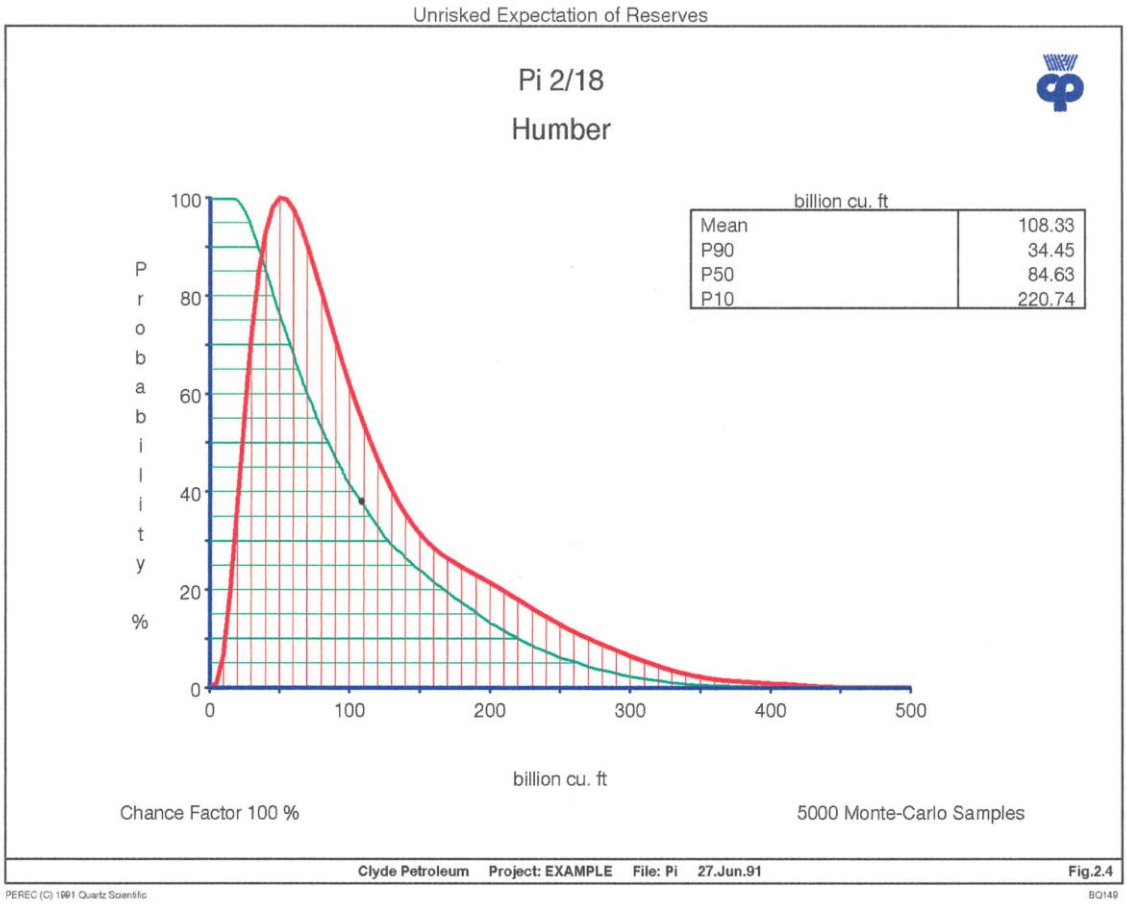
Rename & Delete

Use the Rename option to change the name of a reservoir model file. Select Delete to delete a reservoir model. Rename Addition and Erase will do the same for addition models.

Convert

Prior to Version 2.3 PEREC used a different format for recording model data. Such files can be converted to the new format using the Convert option. This option converts the input data file. After converting you should edit the file - this will produce up to date results for display and plotting.

The second column of the menu contains the secondary options e.g. Return, Exit, Directory & Index list.



(Perec Version 2.5. User Guide, Quartz Scientific, Watford, 1991, p.17-19)