

DICE: USER'S MANUAL

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1.0 WHAT IS DICE

1.1 Introduction

DICE is a database with a user friendly interface that is used to search for specific data and/or parameters within evaluations and each case within the evaluations provided in the *International Criticality Safety Benchmark Evaluation Project (ICSBEP) Handbook*. The DICE database interface or tool has the ability to display evaluations based on specific search criteria, plot various data, or indicate whether there is a correlation of experiments that have been evaluated and provided in the *ICSBEP Handbook*.

1.2 What's new?

The DICE 2009 edition database tool has been enhanced by the following features:

- New search themes: keywords, geometry description, average fission neutrons per neutron absorbed in the core;
- Text criterion: now offers the possibility to search at the beginning or end of text and to perform case sensitive searches;
- Fuel form and fissile materials fields: have been merged into a more user friendly tree structure. The 'Miscellaneous' fuel form is described as a combination of 'Compound', 'Metal/Alloy' or 'Solution' physical forms;
- Search history: DICE stores the 10 most recent queries;
- Correlation matrix: content has been revised. Only reviewed data is available in the DICE 2009 version. When case data is available, cells are shown in a different color. Additionally, the first column is "frozen" and stays visible while scrolling the matrix on the far right;
- Results view: it is now possible to display revision numbers, keywords, core and assembly descriptions directly in the view field.

The geometry structure or theme has been reorganized into three tiers (Core, Assembly and Fuel). It is possible to search on core and assembly descriptions. However, these fields have been filled for approximately only 10% of available evaluations.

The database content has also been revised. In particular:

- Spectra calculation results have been added;
- Spectra data has been checked and verified;
- Effort to verify data has been continued.

2.0 QUICK START

In order to use the DICE tool and access the DICE database, you must:

- Have the DVD containing DICE in order to run DICE directly from the DVD or add DICE to your computer as instructed below;
- Have Java installed on your computer or add it as instructed below;
- Have a large screen; a minimum resolution of 1024x768 is recommended.

2.1 DICE 2009 DVD Contents

The DVD contains the following directories and files for DICE installation and operation:

- Root directory contains this user's manual;
- Directory "CD2009": contains the *ICSBEP Handbook*;
- Directory "Dice": contains **dice.bat** and **dice.sh** batch command files;
- Directory "Dice\data\balance": contains neutron balance files;
- Directory "Dice\data\newE": contains energy group structure files;
- Directory "Dice\data\ornl": contains TSUNAMI-3D-K5 and TSUNAMI-3D-K6 sensitivity profiles and corresponding input files for KENO V.a and KENO VI;
- Directory "Dice\data\sensitivity": contains sensitivity files;
- Directory "Dice\data\spectra": contains spectra files;
- Directory "Dice\databases": contains the H2 local database;
- Directory "Dice\java": contains Java installation files for Windows and Linux;
- Directory "Dice\software": contains the DICE software.

2.2 DICE Installation (Optional)

You can run DICE directly from the DVD or copy the entire "Dice" folder contents onto your hard drive. This requires approximately 1.16 GB.

2.3 Java **Installation**

If Java is already installed on your system, skip Section 2.3 and proceed to Section 2.4. The DVD provides two executable files (directory “Dice\java”), one for Windows and one for Linux:

- Double click on the file **jre-6u15-windows-i586-s.exe** to install the Java runtime on Windows;
- Execute the file **jre-6u7-linux-i586-rpm.bin** to install the Java runtime on Linux.

If you are not using Windows or Linux, Java runtimes for other operating systems can be obtained from Sun Microsystems' websites <http://www.java.com> or <http://java.sun.com>.

2.4 **Launch DICE**

DICE can be launched by using the **dice.bat** (for Windows) or **dice.sh** (for Linux/UNIX) executable scripts available in the “Dice” folder.

Once you launch DICE, a Disclaimer window will appear before the main DICE window appears.

3.0 GENERAL OVERVIEW

The DICE main window is composed of four main panes:

1. Critical / Subcritical: searches through all of the critical and/or subcritical experiment cases (Volumes I-VII) of the *Handbook*;
2. Alarm / Shielding: searches through all of the alarm and/or shielding measurement cases (Volume VIII) of the *Handbook*;
3. Fundamental Physics: searches through all of the fundamental physics measurement cases (Volume IX) of the *Handbook*;
4. Correlation Matrix: displays correlation coefficients for criticality evaluations.

The “File” menu allows you to:

- Export DICE results tables/plots into files;
- Open a PDF evaluation from the *ICSBEP Handbook*;
- Open the Settings dialog;
- Check if an update is available (requires an Internet connection);
- Exit the software.

The “Database” menu allows you to switch databases:

- “Local”: the local database provided on the DVD;
- “LocalShared”: the local database, ready to be shared with DICE plugins once they are available (at a later date);
- “NEA”: the NEA master database that can be updated.

The database menu is dynamically updated to display the selected database name.

Note: To successfully update the DICE code, DICE needs to be copied on a local folder in order to create new files containing updates.

3.1 Critical / Subcritical Pane

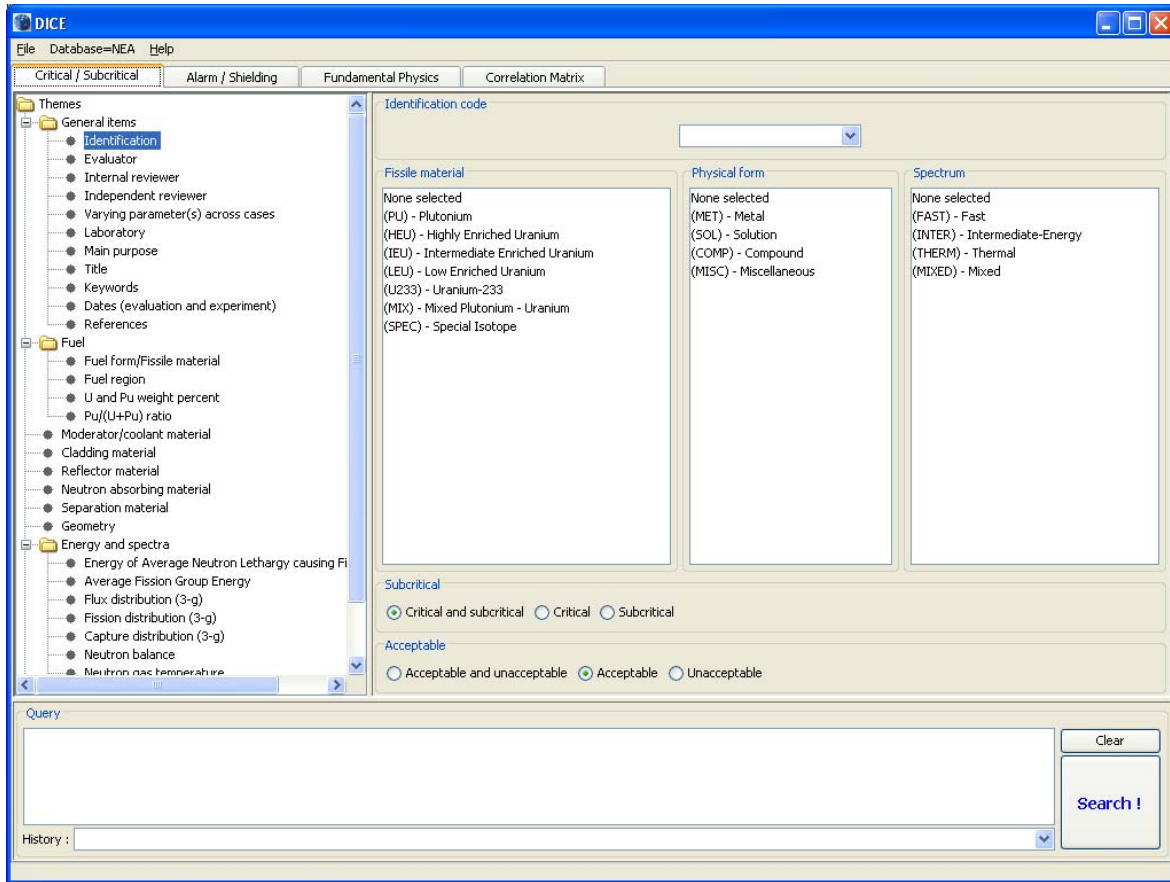


Figure 1. Critical / Subcritical Pane.

This pane provides you with various data and/or parameter search criteria (e.g. fissile material, evaluator, geometry, etc.) allowing you to search for specific critical and/or subcritical cases in regards to your search criteria (Volumes I,II,III,IV,V,VI and VII of the *ICSBEP Handbook*).

3.2 Alarm / Shielding Pane

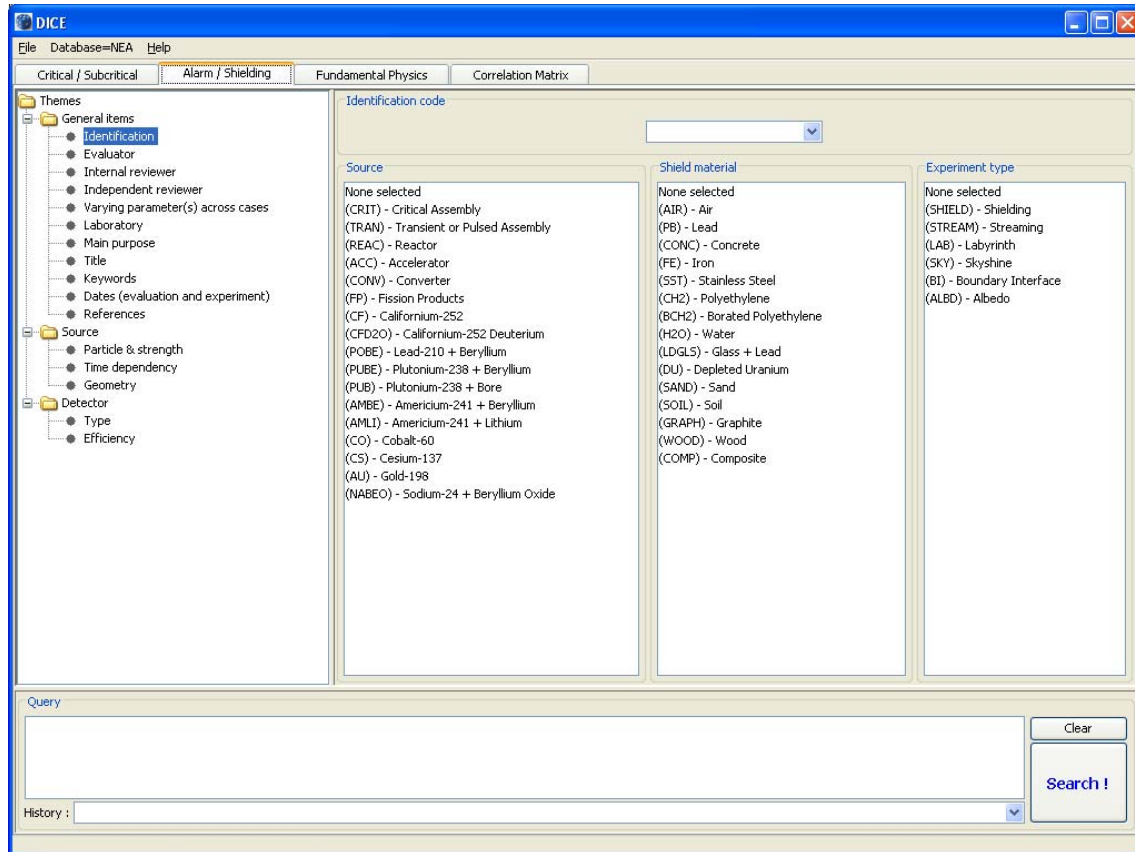


Figure 2. Alarm / Shielding Pane.

This pane provides you with various data and/or parameter search criteria (e.g. source, evaluator, detector type, etc.) allowing you to search for specific alarm and/or shielding cases in regards to your search criteria (Volume VIII of the *ICSBEP Handbook*).

3.3 Fundamental Physics Pane

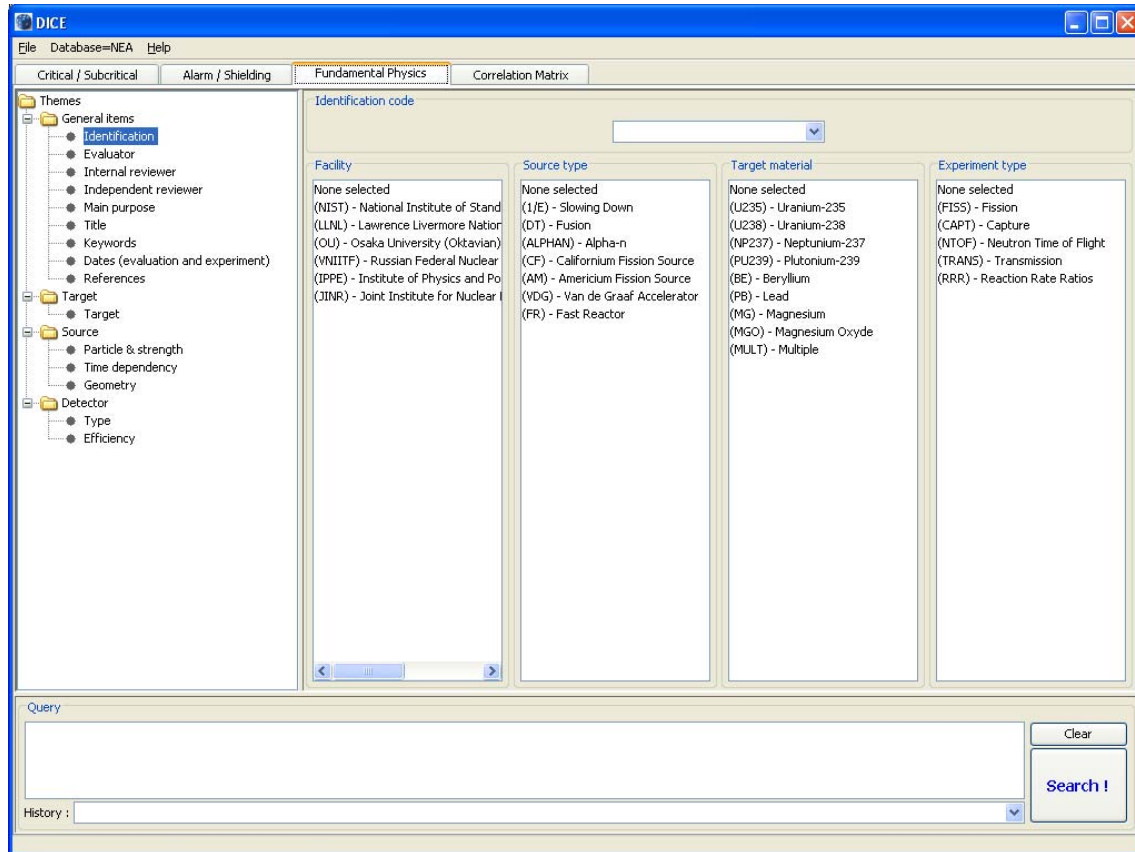


Figure 3. Fundamental Physics Pane.

This pane provides you with various data and/or parameter search criteria (e.g. source, evaluator, detector type, etc.) allowing you to search for fundamental physics cases in regards to your search criteria (Volume IX of the *ICSBEP Handbook*).

3.4 Correlation Matrix Pane

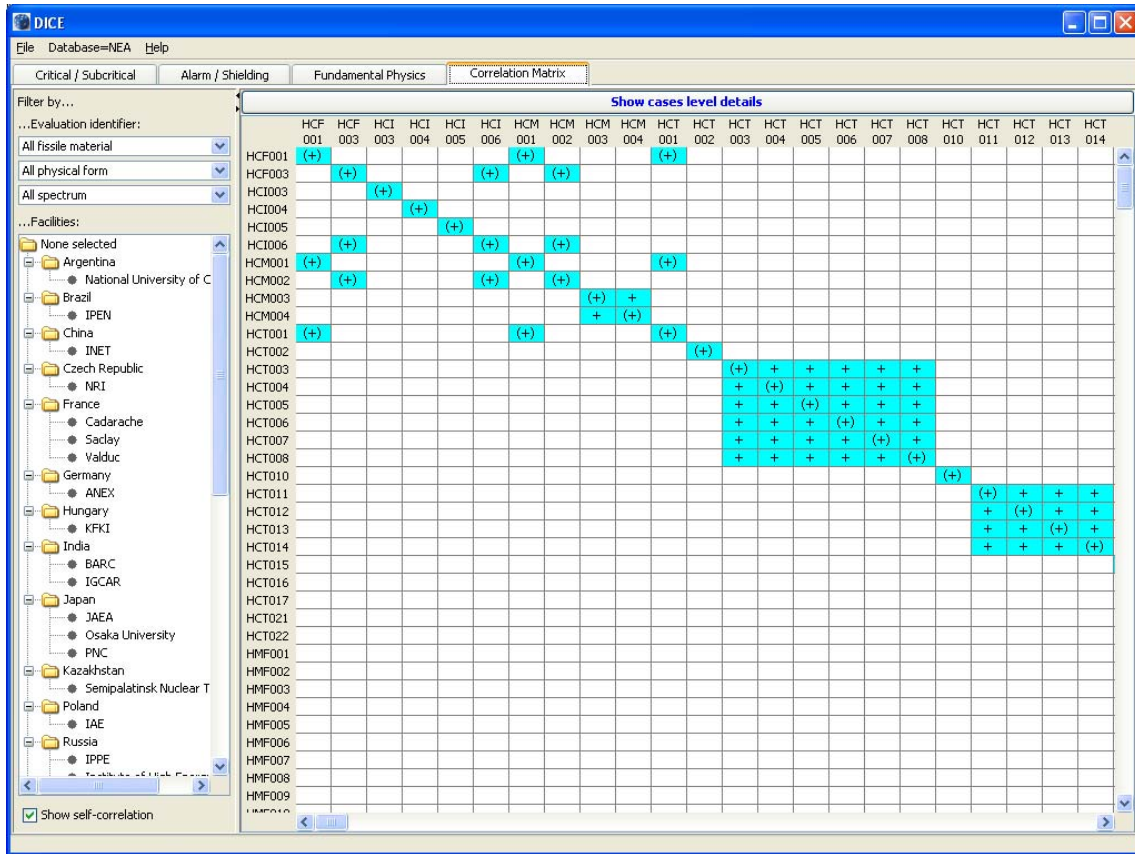


Figure 4. Correlation Matrix Pane.

This pane provides you with data indicating whether two criticality cases are correlated and to which degree (coefficient between 0.0 and 1.0) once that information is available.

Note: Only limited correlation coefficient data are currently available. These data were derived from IPPE.

3.5 Customizing DICE

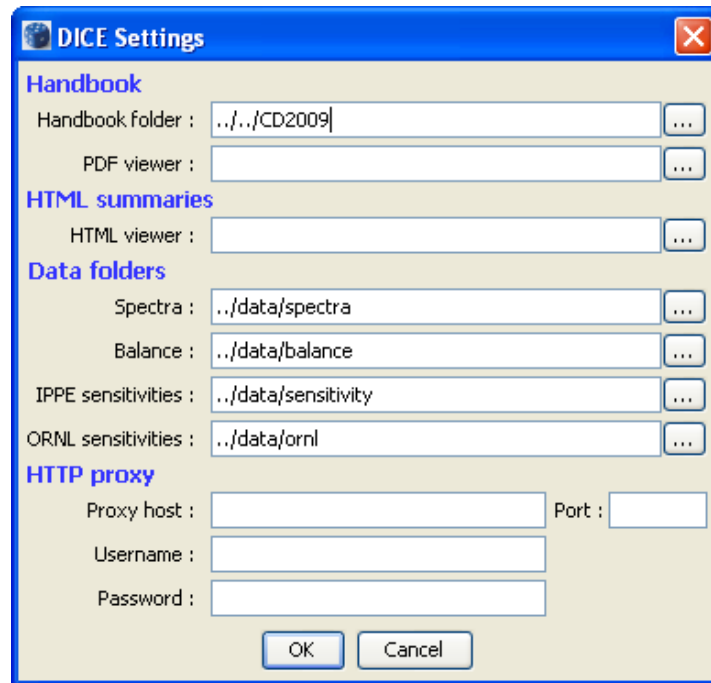


Figure 5. Settings Dialog.

Once the DICE DVD is inserted or DICE is available on your computer, Java is installed and available, and DICE is launched, you may be required to customize DICE to operate properly on your computer. This can be done by opening the Settings dialog by selecting the menu “File->Settings...”. This dialog allows you to set:

- The *ICSBEP Handbook* folder location;
- The PDF viewer executable file to use;
- The HTML viewer executable file to use;
- The location of the folders for balance, spectra, and sensitivity data files;
- HTTP Proxy information (host, port, and credentials). You must restart DICE for this setting to take effect.

Note: If you run DICE on Microsoft Windows, the PDF and HTML viewer settings should not need to be set. When these settings are left empty, DICE will launch the default PDF and HTML viewers which were automatically installed.

Note: DICE settings are stored in a plain text file located under your personal documents folder (%USERPROFILE% under Windows) named **dice_2_1_settings.txt**. To reset the settings to the default values, you can delete this file while DICE is not running.

3.6 **About DICE Dialog**

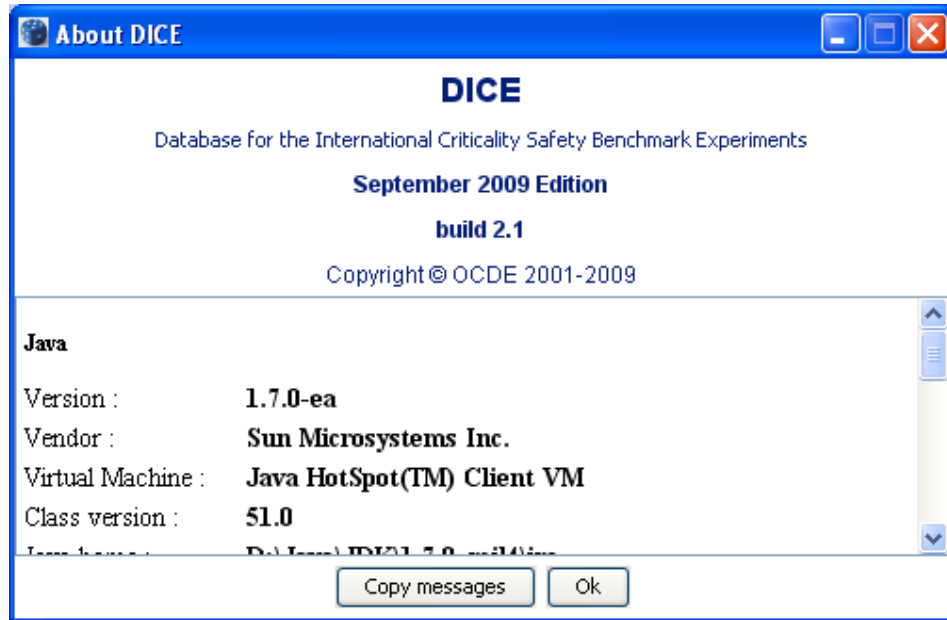


Figure 6. About DICE dialog.

If you would like to view this information, open the About DICE dialog by selecting the menu “Help->About DICE”.

This dialog shows summary information about the DICE version, Java version, operating system, and network settings that you are currently using. This information should be transmitted to the DICE developers if you report a problem or submit an enhancement request (use the “Copy messages” button to copy this information to the clipboard). To contact DICE developers directly, send an e-mail to dice@nea.fr.

4.0 SEARCHING

DICE allows you to search the *Handbook* for particular evaluations. The three panes “Critical / Subcritical”, “Alarm / Shielding” and “Fundamental Physics” work the same way.

4.1 Setting Search Criterion

The list or tree in the far left side of the main window presents the available search criteria grouped into “Themes.” The right panel(s) of the window displays the selected theme control panel(s). The four main types of search criterion are described below.

4.1.1 Selection List

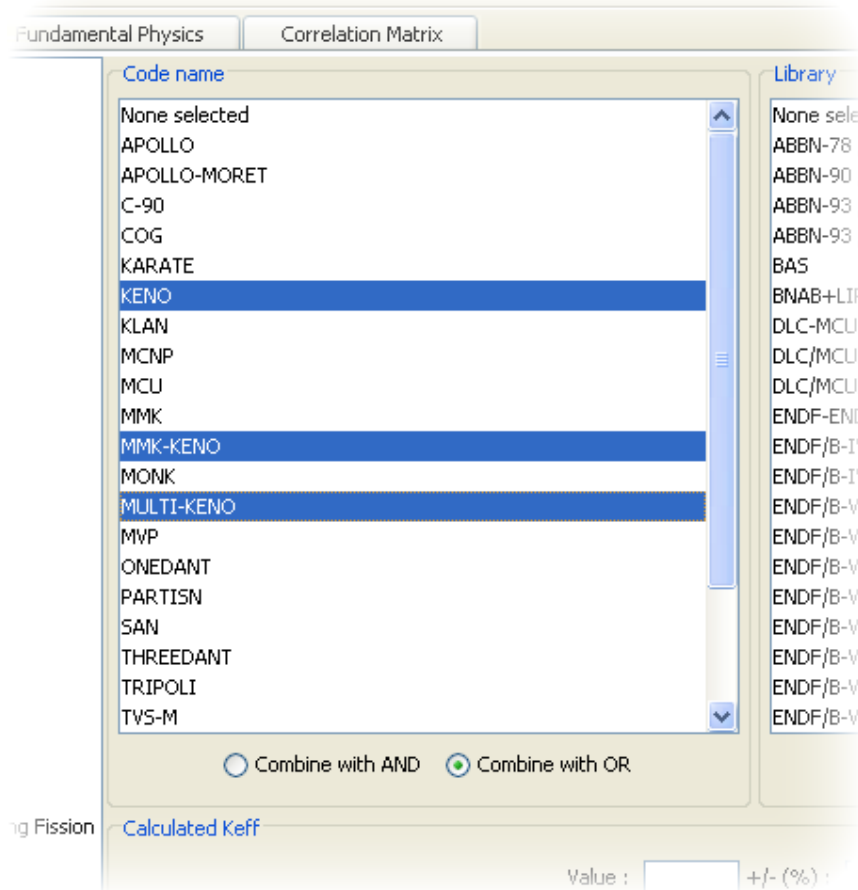


Figure 7. Selection List criterion.

Select one or more items from the list.

Note: You can use the CTRL and SHIFT keys to select multiple items.

The first item “None selected” can be used to unselect all highlighted items.

Some theme criteria can have multiple values for a given ICSBEP evaluation or cases within an evaluation (e.g. moderator material). In these instances, you can search evaluations by selecting:

- Any of your choices with the “OR” button;
- Or all of your choices together with the “AND” button.

These two buttons remain grayed-out until you select more than one item from the list (“OR” is the default).

For example, by selecting “Lucite” and “Water (Light Water)” in the moderator/coolant materials list and leaving the default “OR” button, you will find the ICSBEP evaluation cases having “Lucite” or “Water (Light Water)” or both as moderator/coolant material. If you select the “AND” button, you will only find those evaluation cases that have “Lucite” and “Water (Light Water)”.

4.1.2 Numerical Values

Combine with AND Combine with OR

Percent captures for the selected isotope(s)

Value : +/- (%) :

OR >= <=

only about 90% of the Available Configurations in the ICSBEP Handbook

Figure 8. Numerical Values criterion.

You can search for numerical values in two ways:

- For a specific value with an optional accuracy, the accuracy has to be input as a percentage of the specified value (e.g. “75” with an accuracy of “10” would search for values between 68.5 and 82.5).
- For a range of values, specify a minimum and/or a maximum value. If you specify an upper value that is less than the current value, the criterion is not set.

You can enter a numeric value in scientific notation (e.g. 1E3 means 1000).

Note: If a numeric value is invalid, it is displayed in white on a red background (e.g. you cannot add a percent sign [%] in the accuracy field).

4.1.3 Text Fields



Figure 9. Text criterion.

Text searches may be performed by selecting “Title”, “Keyword”, or “Reference” under the General Items tree structure. Keyword searches are limited to the list of Keywords provided in each ICSBEP evaluation report. To search on text, first choose the operator in the drop-down:

- Contains;
- Does not contain;
- Begins;
- Does not begin;
- Ends;
- Does not end;
- Equals;
- Does not equal.

Then, enter a word or part of a sentence in the text field.

If you wish to perform a case sensitive search, check the “case sensitive” box.

Note: You can search for Unicode characters as they appear in titles and references (e.g. some Russian references are spelled in Cyrillic in the database).

4.1.4 Hierarchical Field

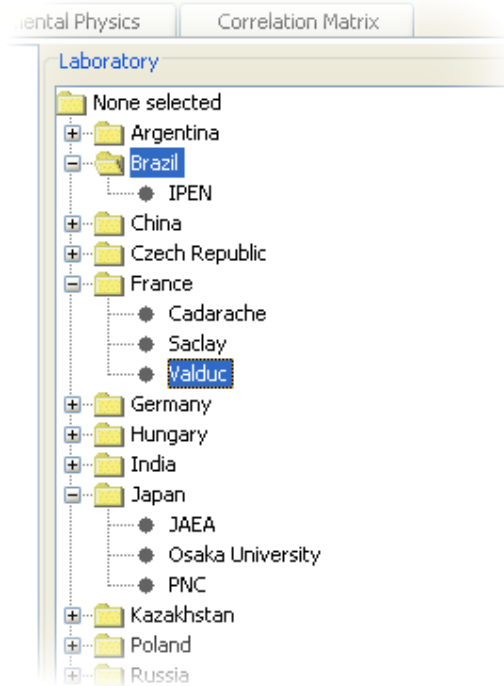


Figure 10. Hierarchical criterion.

You can select one or more items from the selection lists within a tree.

Selecting a parent node of a tree is equivalent to selecting all of its children nodes within a tree (e.g. by selecting “France” in the Laboratory tree, the database searches for all experiments performed in “Cadarache”, “Saclay” or “Valduc”).

4.2 Query Panel

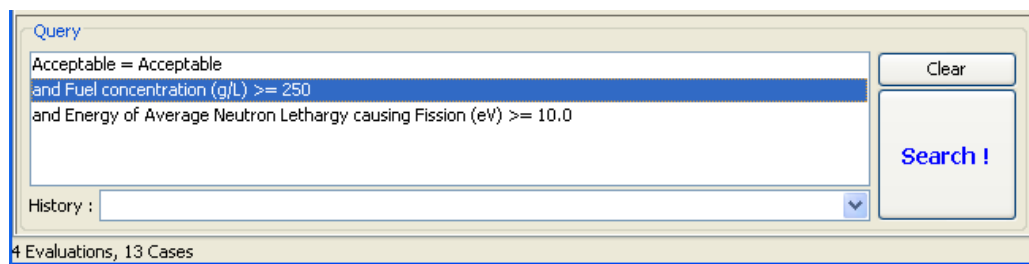


Figure 11. Query Panel.

The query pane located at the bottom of the screen displays the criteria currently set.

You can remove a criterion by selecting it and pressing the “Del” key. The “Clear” button removes all selected criteria.

Each time you add, change, or remove a criterion, the status bar is updated to display the number of evaluations and cases found in the database matching the current selected criteria.

Once the search criteria have been selected, run the query by clicking the “Search !” button. This will display the “Results” view.

Note: The “History” drop down list displays the 10 most recent executed DICE queries. To recall a previous query, select it from the list and all search criteria will be automatically set to match the previous search.

5.0 DISPLAYING RESULTS

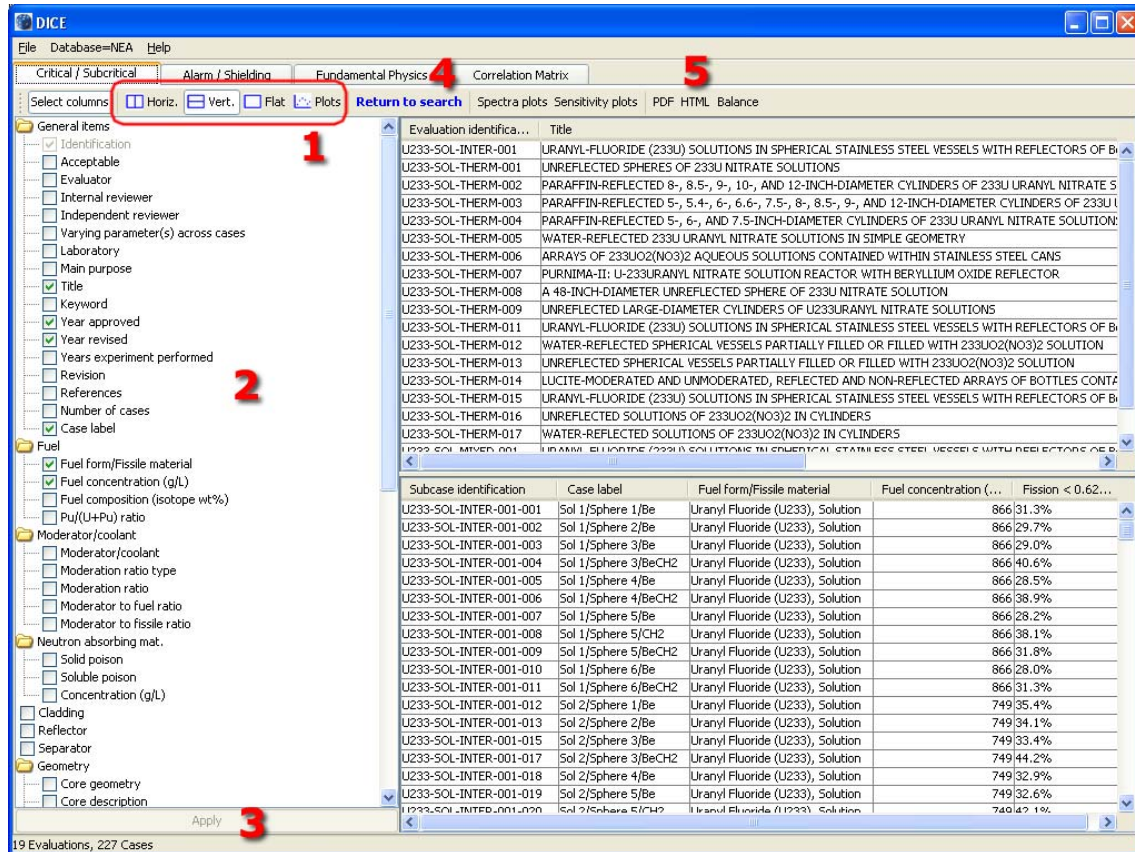


Figure 12. Results Window.

Several views are available for displaying search results [You can switch between the four views by using the toolbar buttons (1 in Figure 12)]:

- Flat table;
- Hierarchical tables (horizontal or vertical split);
- Plot.

Use the left tree to select the result tables/plots columns (2 in Figure 12). After making changes, press the “Apply” button (3 in Figure 12) to refresh the result views.

To return to the main search window, click on the “Return to search” button (4 in Figure 12).

In order to enlarge the space available for the result views you can hide this tree by clicking on the “Select columns” button.

Note: You cannot uncheck the Identification column. A computed column (# cases) that displays the number of cases matching the query is automatically added.

5.1 Results Tables

To sort data, click on the desired column's header. To reverse the sort order, press the SHIFT key while clicking on the desired column header.

You can remove row(s) from the tables by selecting them and pressing the DEL key or by right-clicking the mouse to display the contextual menu and then selecting "Remove selected row(s)". To restore the initial search results, press the "Apply" button.

You can copy selected row(s) from the results tables and paste them into your text editor or Microsoft Excel.

You can reorder the results tables' columns. To do so, click on a column header and drag the mouse to the desired location.

5.1.1 Hierarchical Results Tables, Horizontal Split

This view is made of two tables separated by a vertical bar. In the left pane, the evaluation level columns are shown. In the right pane, the case level columns are shown.

The right table (case level) displays the cases for the selected evaluations in the left table or all of the cases if none are selected.

5.1.2 Hierarchical Results Tables, Vertical Split

This view is the same as hierarchical results tables, horizontal split, except the tables are split by a horizontal bar.

5.1.3 Single Result Table, Flat View

In this mode, all columns are displayed in a single table.

5.2 Results Plot View

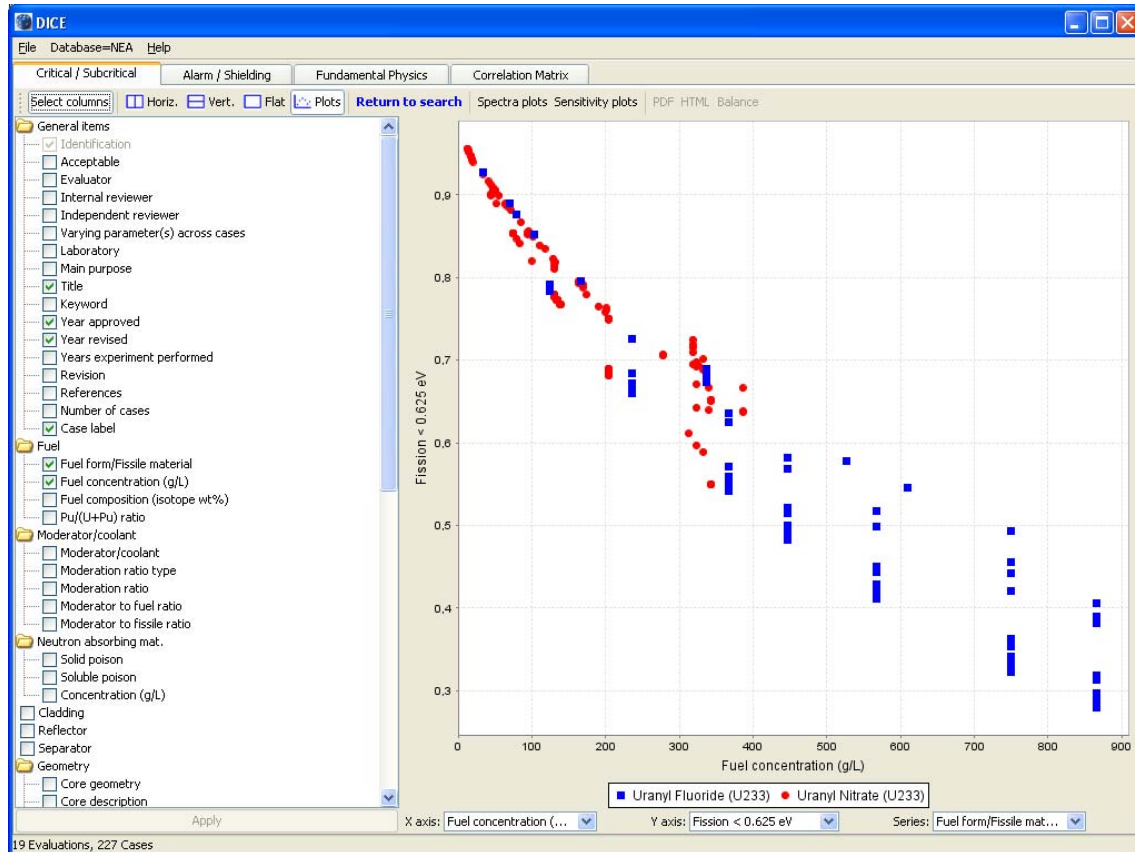


Figure 13. Results Plot View.

In order to plot certain data, you can select “X axis”, “Y axis” and “Series” among the selected results columns (see Section 5.0). At least one numerical column needs to be available in order to obtain plots. The text columns (e.g. “References”) cannot be used in plots but all others can, except for the “Y axis”, which requires a numerical column (e.g. “Number of cases”). For example, you can plot “Calculated Keff” (Y axis) against “Fuel concentration” (a numerical column) but also against “Library” or “Codename” (short text columns).

By right-clicking on the plot, a contextual menu allows you to:

- Set some plot properties (title, legend, ticks);
- Save the plot in a file;
- Print the plot;
- Zoom in or out.

You can also use the mouse to zoom in by pressing the left button and then dragging the mouse from the top-left to the bottom-right corner. To reset the zoom level, drag the mouse from the bottom-right to the top-left.

To display the data values corresponding to each point, hover the cursor over it to display a tooltip showing its coordinates.

Note: The legend is not displayed when there are more than 20 items to show. Press the “Select columns” button to enlarge the plot window.

5.3 Evaluation PDF from the Handbook

After having selected a single evaluation level row, press the “PDF” button in any results table view to open the PDF file containing the evaluation from the *Handbook* (5 in Figure 12).

Note: If the selected evaluation does not open, DICE was probably not able to find your default PDF reader, and you need to specify its location in the Settings dialog (see Section 3.5).

5.4 Case Summary in HTML

After having selected a single case in any of the results tables, press the “HTML” button (5 in Figure 12) to open an HTML file displaying a summary of the selected case.

Note: If a browser does not open, DICE was probably not able to find your default browser, and you need to specify its location in the Settings dialog (see Section 3.5).

5.5 Neutron Balance File

After having selected a single case in any of the results tables, press the “Balance” button (5 in Figure 12) to open the corresponding neutron balance file.

Note: If the balance file cannot be found, check the location of the “Balance folder” specified in the Settings dialog (see Section 3.5).

Note: Neutron balance data are currently available for only about 82% of the available configurations in the *ICSBEP Handbook*.

5.6 Spectra and Sensitivity Plots

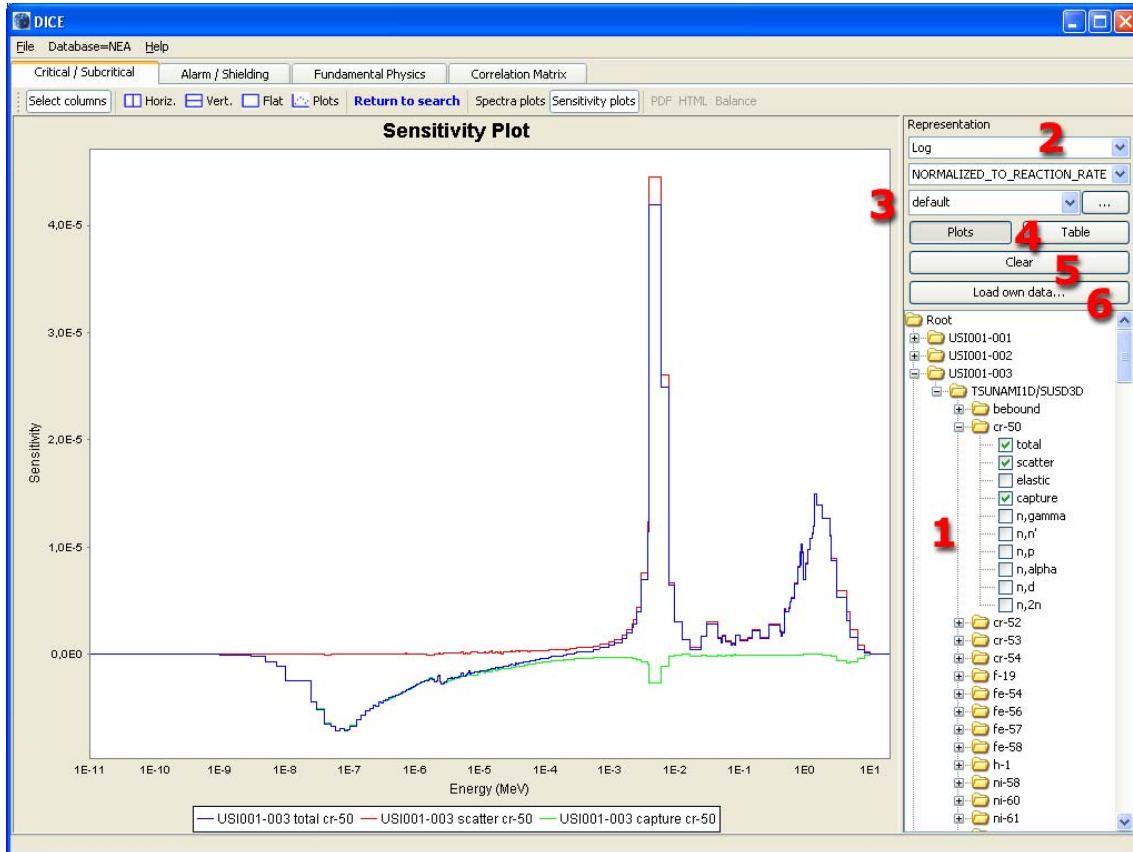


Figure 14. Sensitivity Plot.

DICE can plot spectra and sensitivity data for criticality cases. Click on the “Spectra plots” or “Sensitivity plots” buttons.

Select the dataset(s) in the tree on the lower right pane (1 in Figure 14).

Then, select the representation (2 in Figure 14):

- Group averaged/Group integrated;
- Normalization: to one or the entire reaction rate;
- Energy Group structure: select one structure from the drop-down list, press the “...” button to add an energy file to this list (3 in Figure 14).

All data share the same representation. When you change the energy group structure, all plots and the table are automatically updated.

To zoom in, drag the mouse from the top-left corner to the bottom-right corner. To reset the plot to its initial zoom level, drag the mouse from the bottom-right corner to the top-left corner.

You can switch between the plots and a tabular display by using the buttons “Plots” and “Table” (4 in Figure 14).

Click on the “Clear” button to remove all plots and empty the table (5 in Figure 14).

Click on the “Load own data...” button to add a curve from a file (6 in Figure 14).

A sensitivity file must be in any of the following formats in order to plot:

- ABBN sensitivity format;
- TSUNAMI1D;
- TSUNAMI3D.

Check the corresponding button in the Open file dialog before pressing the OK button.

Note: ORNL provides two TSUNAMI3D sensitivity files when there are both a detailed and a simplified model in a given evaluation.

DICE automatically opens the sensitivity file corresponding to the detailed model.

To open the file corresponding to the simplified model, use the “Load own data...” button and select the sensitivity file ending with ‘**S.sdf**’.

Note: Spectra data are currently available for only about 82% of the available configurations in the *ICSBEP Handbook*.

Note: IPPE sensitivity data are currently available for only 7% of the available configurations in the *ICSBEP Handbook* (in Volumes I and II).

Note: ORNL sensitivity data are currently available for only 8% of the available configurations in the *ICSBEP Handbook* (mainly in Volumes V and VI).

5.7 Exporting Results

5.7.1 Clipboard

The DICE results tables can be copied to the clipboard by using the CTRL-C or CTRL-INS keys. Results can be pasted into Microsoft Word (as a formatted table) or Excel (as table cells) or any other text editor or spreadsheet program.

5.7.2 Files

The menu “File->Save As...” can be used to save tables or plots.

Tables can be saved as “tab delimited” (convenient for Microsoft Excel or any other spreadsheet program) or “Comma Separated Values” (CSV) files.

Use the export dialog to set the delimiter:

- Tab;
- Semicolon;
- Comma;
- Other (type a delimiter in the box below).

Then set the encoding:

- ASCII (non-ASCII characters will be converted, e.g. 'δ' will be converted into 'delta');
- Unicode (no conversion of characters).

Plots can be exported as Portable Network Graphics (PNG) files.

6.0 CORRELATION MATRIX WINDOW

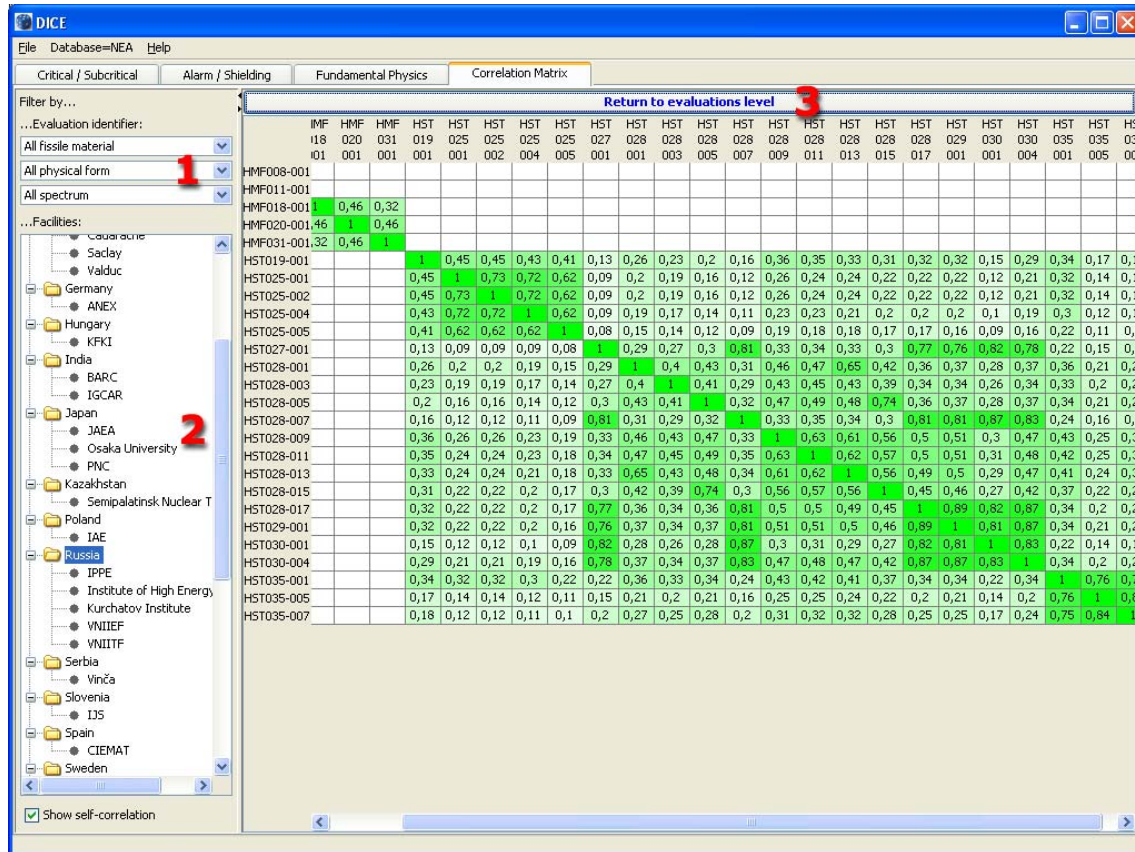


Figure 15. Correlation Matrix Window.

The correlation matrix window is split into two panes. The left pane allows you to narrow the display by evaluation IDs or by nuclear facilities. The right pane displays the correlation matrix.

You can display certain parts of the correlation matrix by filtering on the following criteria:

- Evaluation identification: the three drop-down menus on the upper left (1 in Figure 15);
- Country/facility by using the tree (2 in Figure 15);
- Self-correlations: check or uncheck the “Show self-correlation” check box.

At the evaluation level, the matrix cells will have the following attributes:

- Empty when there is no correlation;
- A “+” sign to indicate correlation;
- A “(+)” symbol to indicate a 100% correlation;
- Teal when there are case level data available, or bright blue otherwise.

Note: The “(+)” symbol appears when an evaluation has many identifiers in the *ICSBEP Handbook* (i.e. is a cross reference).

At the case level, the matrix cells may be:

- Empty when there is no correlation or the correlation coefficient is not known;
- Colored with shades of green, brighter green being closer to 1.

To switch between evaluation and case levels click the “Show cases level details” at the top of the matrix window and “Return to evaluations level” buttons (3 in Figure 15).

When no correlation coefficients (cases level) are available in the database, the message “Sorry, no case/case correlation coefficients available...” is displayed.

Note: You can select multiple cells by holding the CTRL key while selecting cells or dragging the mouse to select a sub block from the matrix.

7.0 TROUBLESHOOTING

7.1 Known Problem(s)

This table lists all known problems and their solutions:

Problem description	Solution
Figures are displayed with a comma instead of a dot as the decimal separator or vice versa	You can override your language settings to American-English by adding the following command line options to the dice.bat or dice.sh file: -Duser.language=en -Duser.country=us Refer to java.sun.com/developer/technicalArticles/J2SE/locale/ for technical details.
DICE results tables contains strange characters (e.g. square boxes or question marks)	This problem can stem from missing fonts. Try the following: On Microsoft Windows, select Add/Remove programs in the Control Panel. Be sure that the optional feature "Additional Fonts and Media Support" is installed on the local hard drive. To check that all fonts are installed, browse your Java home directory and the lib/fonts subdirectory.

7.2 Startup Problem(s)

DICE cannot start if it cannot connect to any database. If this occurs, you will obtain the following dialog:



Figure 17. No Connection Dialog.

If you are trying to connect to the NEA master database (see Section 3.0), first check if the NEA website is currently accessible (www.nea.fr). If you need to connect through an HTTP proxy, click on

the “Setup HTTP proxy...” button to open the Settings dialog. Restart DICE for the settings to take effect.

If you are trying to connect to a local database (see Section 3.0), check that the data files exist on the media (DVD or computer) and that you have read access.

If you still cannot connect to either master database, please send an email message containing the error messages to dice@nea.fr. You can copy these messages to the clipboard by using the “Copy messages” button.

7.2.1 Windows

To track down start up problems on Windows, follow these instructions:

1. Determine if you have a suitable Java environment.
2. Open a command window (Start menu > Run...) then type cmd.
3. In the Command Prompt window, issue the `java -version` command.
4. If you see the following message, your computer does not have Java properly installed:

```
C: \>j ava -versi on
'java' is not recognized as an internal or external command,
operable program or batch file.
```

If this is the case, check that the PATH environment variable is correctly set. Alternatively, Sun Microsystems offers a web page to verify your Java installation at www.java.com/en/download/installed.jsp.

You can download Java from java.sun.com or alternatively install it from the DVD in the Dice\java folder. (You should use a JRE 1.5 version at a minimum). Once this is done, go to the DICE\software folder and type the following command:

```
j ava -j ar Di ce. j ar
```

DICE should now open. If not, to request further help, if there are error messages in the console, right-click in the title bar, choose menu “Select all”, then “Copy”, and send the text in the clipboard to the DICE developers (dice@nea.fr) for assistance.

7.2.2 Linux/UNIX

To troubleshoot problems on Linux, follow the below instructions:

First, make sure your Java installation is correct with the following command:

```
j ava -versi on
```

You may need to put the full path to your Java executable in the **dice.sh** script and make sure that it has execution rights.

7.3 Speed Problem(s)

The following tips will improve execution speed:

- Copy the DVD onto your hard drive instead of running from the DVD drive
- Connect to the NEA remote database
- Narrow the search to a few evaluations before pressing the “Search !” button
- Display only relevant columns in result views.

7.4 **Memory Problem(s)**

Java programs need to specify the maximum memory they can use. With a Sun Microsystems Java Machine this setting must be set by command line (or in the BAT or SH file). The memory limit used by DICE is set in the **dice.bat** file (or **dice.sh** for Linux):

```
-Xmx256M
```

The above option `-Xmx256M` specifies that DICE will take at most 256Mbytes of memory. If you have more physical memory (e.g. 512MB, 1GB, or more), you can edit this command line and replace the option `-Xmx256M` with `-Xmx512M`. For example to allow DICE to use at most 512MB of memory the **dice.bat** file should be:

```
-j avaw -Xmx512M -j ar Di ce. j ar
```

7.5 **Bug Report Dialog**

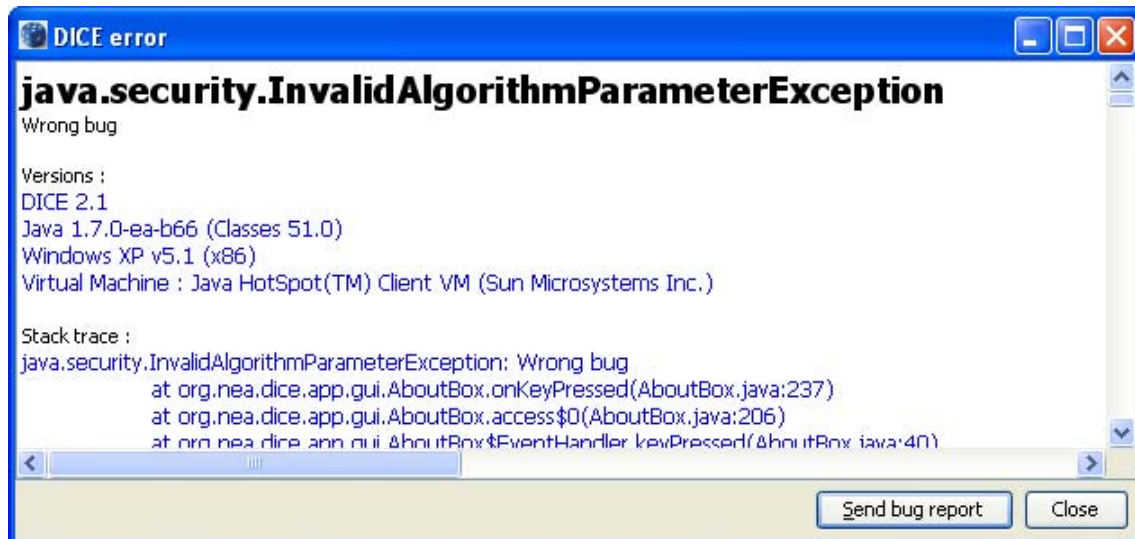


Figure 18. Bug Report Dialog.

The “Bug report” dialog is shown when a problem occurs in the DICE software. This dialog contains useful information for developers and allows you to send an automatic report to them.

Clicking the button “Send bug report” will bring up a dialog allowing you to enter your name, email address, and explanatory text.

Filling in these fields are optional but consider inputting your email address so that you can receive an answer.

Note: Your email address will not be used for any other purpose.

The Bug report functionality can only detect a programming bug (i.e. misuse of software API).

To submit a manual bug report or a software enhancement request, please send an e-mail to dice@nea.fr. Please include the following information:

- Screen captures;
- Your environment (Operating System and Java version);
- DICE version.

This information can be found in the “About” dialog (see Section 3.6).

8.0 REFERENCES

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