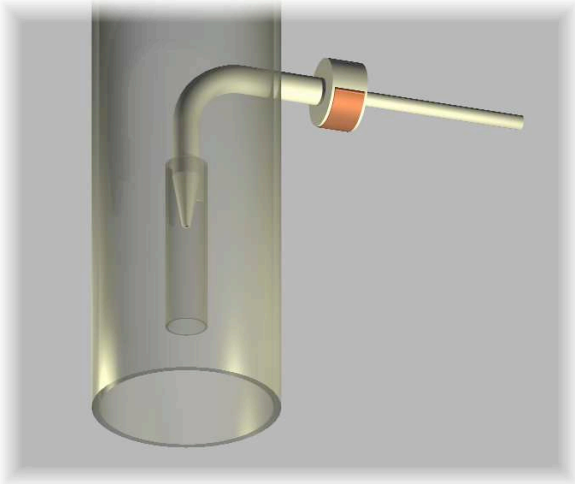

# DEPOSITION 2001
## *An Illustrated User's Guide*


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**SUMMARY**

DEPOSITION is software for evaluating penetration of aerosol through sampling systems. This version of DEPOSITION is upgraded to include the following additional features:

- Better graphics display.
- Better input and output capabilities.
- Accommodation for sampling with Commercial Probes.
- Accommodation for having flow splitters in the transport system.

## I. Document Overview

This document is to assist first time users of the DEPOSITION 2001 program. It assumes the user has had prior experience with Microsoft Windows® operating system, and is familiar with using a point and click framework, including pull down menus, and dialog boxes.

## II. System Requirements

Deposition for Windows requires an IBM compatible system capable of running Microsoft Windows version 3.1 or better (including Windows NT, or Windows 95 or higher), and a mouse. DEPOSITION 2001 may only be run in Windows.

## III. Starting Deposition for Windows

Deposition for Windows consists of one executable file, DEPO.EXE, and a help file, DEPO.HLP. There are no installation procedures. However, it is recommended that both DEPO.EXE and DEPO.HLP be copied to a separate directory on a fixed disk. DEPO.EXE may be run from the file manager or by configuring a program item (allowing Deposition to run from the program manager).

A new program item may be added by opening the File menu in the program manager, and selecting the New option.

## IV. Getting Started

Once the program has been started, DEPOSITION should open a main frame window, labeled DEPOSITION 2001, with an open child window labeled Document 1. The child window will have an introductory image when opened. The child window has an already opened default configuration file (these defaults are determined by the program, not a file, and therefore may not be changed). A test-case analysis could be run without making any changes to the setup.

A typical use-cycle of DEPOSITION will consist of configuring your aerosol transport system, ensuring the system you entered is correct, running an analysis of the system, and viewing the results.

DEPOSITION has context sensitive help available. Pressing the F1 key at any time will open a help window, which will provide information regarding the currently opened window or dialog box.

## A. Configuring parameters

Sample parameters, which will allow a test-case analysis to be run, are already set when the DEPOSITION for Windows program is opened. However, the user will need to change certain properties to accommodate the design and operational conditions of his/her particular transport system. These input parameters have been divided into three categories: 1) system properties and parameters, 2) the transport system, and 3) the particle distribution.

### A. 1 *System properties and parameters*

System properties and parameters have heretofore been defined, as all the information required to run an analysis of the penetration of an aerosol through a transport system. More specifically, in the DEPOSITION program, the system properties and parameters are defined as the following:

- The ambient temperature in degrees Celsius. Default value is 25.0ºC.
- The ambient air pressure in mm Hg. Default value is 760 mm Hg.
- The particle density in grams per milliliter. Default value is 1 g/mL.
- The flow rate in liters per minute. The default value is 56.6 L/min., i.e., 2-cfm.
- The tube diameter in the transport system in millimeters. Default value is 25.4 mm, i.e., 1-inch.
- The free stream velocity in meters per second. Default value is 10.0 m/s.

The listed properties and parameters may be changed by opening the Set Up menu and selecting “System Properties and Parameters.” This will open a dialog where the values may be edited. Once changes are complete, clicking “OK” will update the changed parameters, or pressing “Cancel” will neglect the new information.

### A. 2. *Transport system.*

The transport system will generally consist of a number of elements. These elements are defined as:

- Probe (Isokinetic, Anisokinetic, Shrouded or Commercial)
- Tube
- Bend
- Expansion fitting
- Contraction fitting
- Splitters

DEPOSITION 2001 allows from one to fifteen of these elements (with a maximum of one probe) to be defined in series. The default transport system consists of three elements:

- Shrouded probe with an 18.2 mm diameter for the inner probe, a 40.0 mm diameter shroud, a velocity reduction ratio of 1.25 and a 0º orientation relative to the free stream.
- A tube 1.0 meters long (horizontal)
- 90º bend (oriented clockwise about the positive z-axis, Curvature Ratio of 4).
- A tube 2.0 meters long (orthogonal to the horizontal plane, and pointed downwards, i.e., the inlet is above the outlet).

The layout of a transport system may be altered by opening up the "Set Up" menu and selecting the "Transport System" option. A dialog with the default transport elements will open. Once this has been opened, the user can set up the required transport elements by either a) double clicking on each component, and then changing the element type or b) removing the default transport system and then adding the required transport elements, one by one. Depending on the element type, further dialog boxes will ask for greater detail about the individual elements. Because some analyses are invalid with certain transport elements, warning dialogs will alert the user on what may be invalid. If a mistake is made, the user may go back and correct an element by clicking the "Cancel" button. Repeated selection of "Cancel" buttons in the dialogs will open up earlier element configuration boxes for the transport system.

The dialog for some of the transport elements asks for orientation information. The purpose of this information is to provide a basis for a geometrical representation of the system to be displayed graphically. It is important to note that the only orientation information that plays a part in the analysis is the orientation of tubes.

### A. 3. *Particle size distribution.*

Deposition for Windows allows the definition of three types of particle size distributions:

- Monodisperse
- Polydisperse, Lognormal
- Polydisperse, User-Defined
-

The default particle distribution is monodisperse, with a particle size of 10 μm aerodynamic diameter (AD). The distribution may be altered, by selecting the "Particle Size Distribution" option under the "Set Up" menu.

## B. Ensuring correctness

The data entered in the "Set Up" menu may be displayed using several options under the

"View" menu. The "View" menu options, besides toggling the status and tool bars, allow a view dialog to be toggled open for each of the three "Set Up" categories. A check mark will appear beside the open item in the "View" menu.

The view dialogs allow the data entered in the "Set Up" menu to be checked for accuracy. Furthermore, in the "System Properties and Parameters" and the "Transport System" view dialogs, a single item may be altered by double clicking the line where the parameter or element is listed.

The "Transport System" and "Particle Size Distribution" view dialogs opened under the "View" menu also permit the generation of graphical representation of the corresponding data. In the "Transport System" dialog, selecting the "View System" button results in an (approximately) isometric representation of the transport system being displayed in a child window. In cases where there is a monodisperse particle distribution, the "Graph" button on the "Particle Size Distribution" view dialog is grayed, and cannot be selected. Otherwise, in cases where a polydisperse distribution is chosen, the "Graph" button may be selected, which generates a bar graph of the particle frequency in a size interval versus the mean particle diameter for that interval.

## C. Running an analysis

There are four different analysis options available. Each option has a corresponding listing under the "Analysis" pull down menu. The choices are:

- Calculation of the "Total Penetration" of aerosol through a specified transport system.
- Determination of the "Optimum Tube Diameter," which will maximize penetration through a system that has at least one non-vertical straight tube.
- Prediction of "Maximum Penetration," which provides an upper limit on the penetration through a straight tube that connects two points in space.
- Analysis of "Penetration with Varied Parameters," such as the effect of variations in tube diameter, flow rate and particle size.

Certain analysis options are only valid for some types of transport systems (for example, varying the tube diameter is not allowed if an expansion or contraction is present in the transport system). In the case where an invalid analysis is attempted, the selected analysis will be aborted.

The first analysis that you run using DEPOSITION for Windows will require an output file name. The results will be stored as MS Access file. A file name query dialog will be opened. The file name for the analysis should be given and the "OK" button selected. Later analyses will not ask for a file name, but the file name may still be changed by selecting the "Save to New Database" option under the "File" menu.

## D. Viewing analysis data

Once an analysis has been run, a brief summary of results will be displayed in the child window. A graph of penetration achieved versus a varied parameter (such as tube diameter, particle size, or flow rate) is appended in cases where such an analysis was selected.

## E. An illustrated example

When DEPOSITION 2001 has been configured as a program item, it should appear as shown in Figure 1. To open the application, double click on the DEPOSITION 2001 icon.

After the application has been opened, the window should appear as shown in Figure 1.

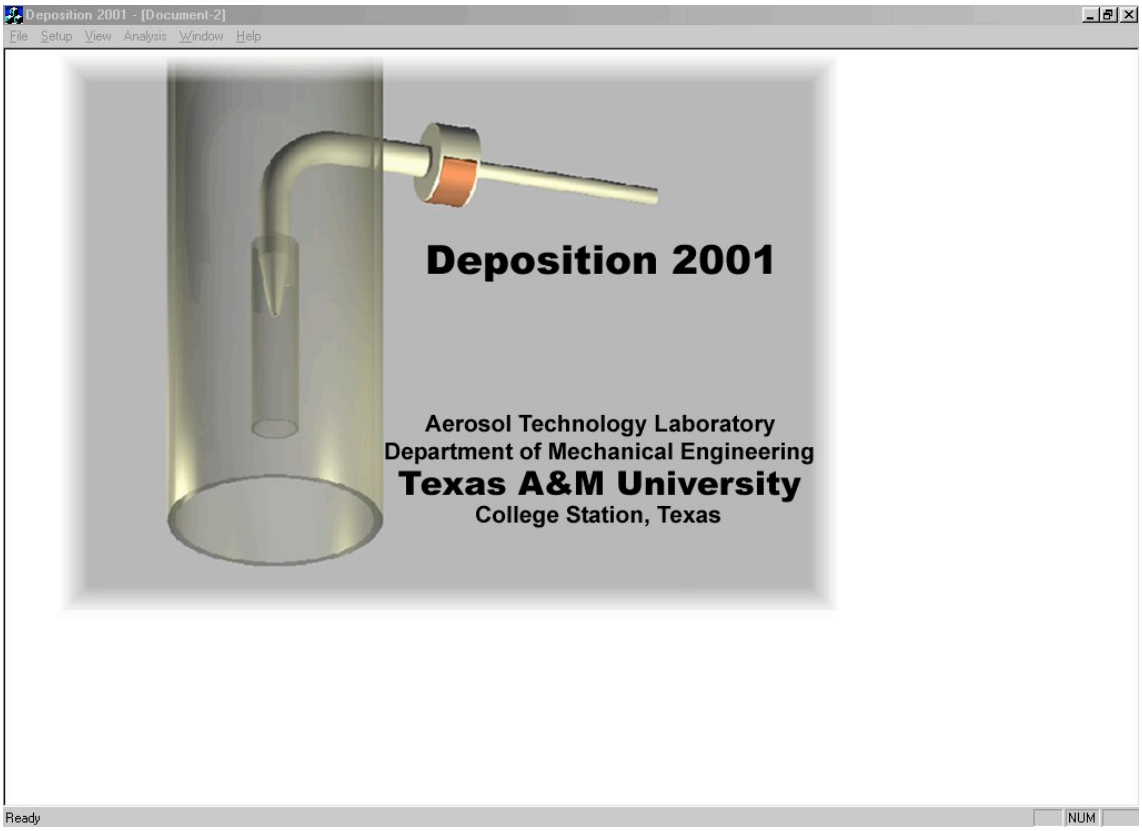


*Figure 1: The Opening Screen of DEPOSITION 2001*

As an example, suppose it is desired to calculate the total penetration for the following transport system and operational parameters:

- Sampled air temperature of 29.3°Celsius.
- Sampled air pressure of 760 mm Hg.
- Particle density of 1 g/mL.
- Flow rate of 60.0 L/min.
- Transport tube diameter of 30 mm.
- Free stream velocity in the stack or duct of 12.5 m/s.

The transport system is to consist of the following elements:

- A commercial probe (RF2-111)
- A horizontal tube of 0.5 m long.
- A 90° bend (with airflow in the clockwise direction from entrance to exit). The specification of direction is used in the pictorial representation, but plays no role in calculations.
- A vertical tube 1.5 m long with the inlet above the outlet (the inclination angle needs to be specified for computational purposes; however, the direction of flow is only used in constructing the pictorial representation of the system).

The aerosol particle distribution is monodisperse, with the following characteristics

- Particle Diameter = 10.0μm

First, the "Set Up" menu should be opened. Then by selecting the "System Properties and Parameters" option, the dialog box shown in Figure 2 will be opened.

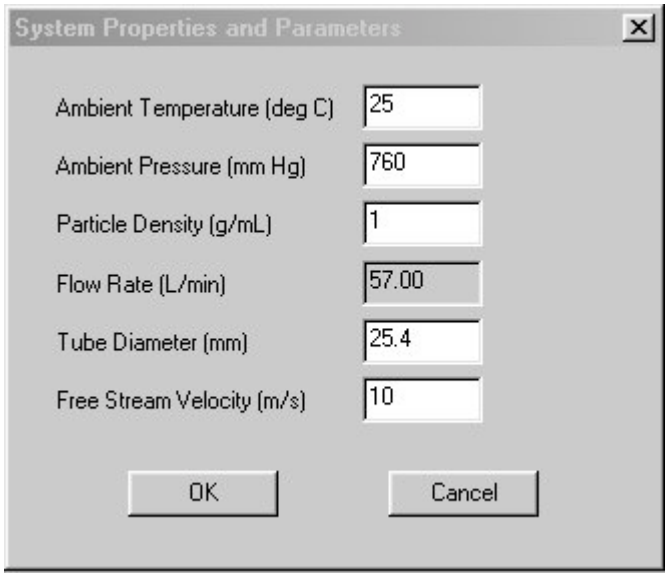


Figure 2: The System Properties and Parameters dialog

Data in the boxes correspond to the example properties listed above. These values were changed from the default values by using the mouse to select values that needed to be changed, and then entering the new value through the computer keyboard. When completed and the values are satisfactory, the "OK" button should be selected using the mouse cursor.

The transport system may be configured by selecting the "Transport System" option in the Set Up menu. The component number dialog is opened by selecting the required component.

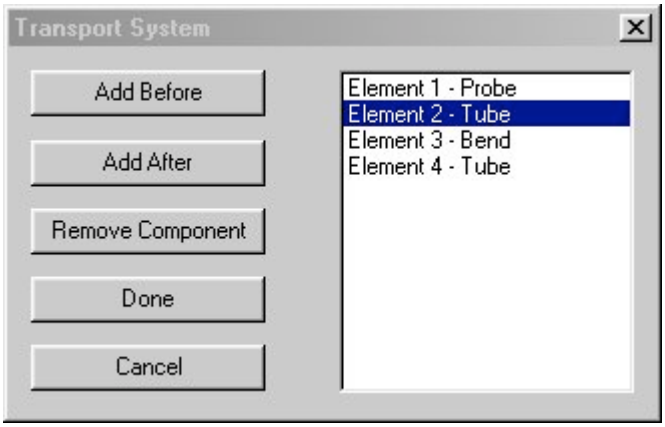


*Figure 3: The Transport System Setup dialog*

The transport elements can now be added in the dialog box that opens, and changed to suit user requirements. Figure 4 illustrates one element type in the process of being changed. The options that are open, are characteristic to the shrouded probe and opened up, once the probe type was selected.

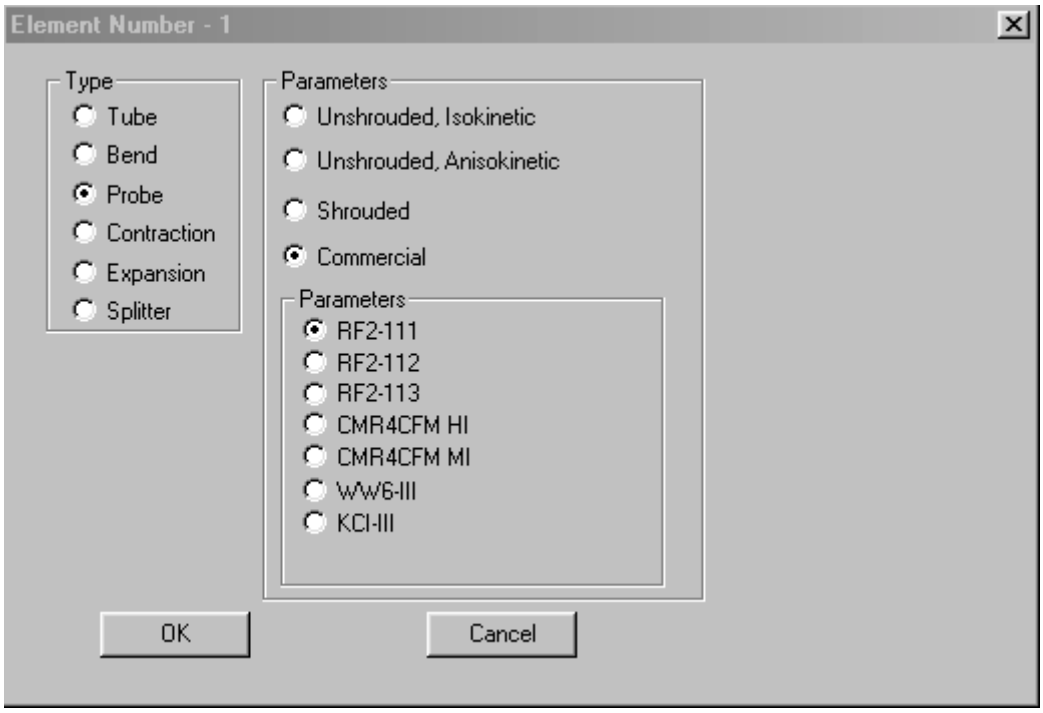


*Figure 4: Commercial Probe Dialog Box*

The transport system setup procedure already has the parameters for a default system. The first element that was considered is a probe. Selecting "OK" will cause the program to continue by returning to the transport element dialog box. We now proceed with the transport system set up by clicking on the "Add" option. This now opens the "Tube Element Type" dialog, which is shown in Figure 5.

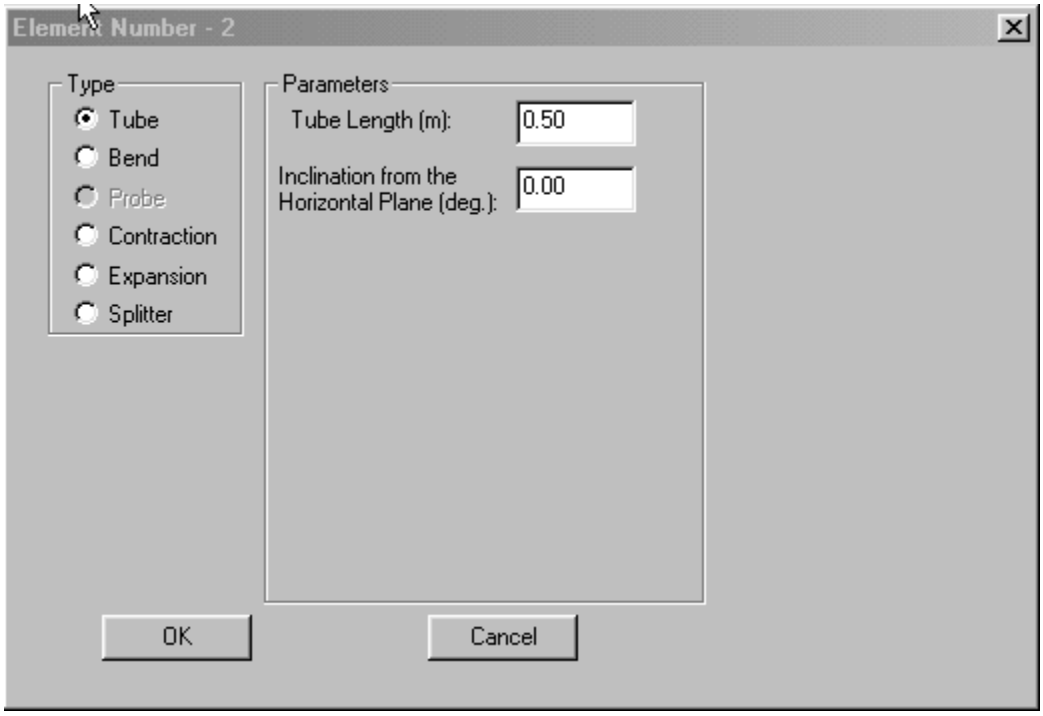


*Figure 5: The Tube Element Dialog Box*

Note that this box is different from the previous one. First, the element number must have changed to 2. Also, the probe element is no longer an option among the different element types, because it is illogical to define a probe for a location other than the inlet of the transport system. "Cancel" can be used to back up editing of elements. Were an element improperly entered, selecting "Cancel" at the "Element Type" dialog will back up to the previous "Transport system Set Up" dialog box.

The second element in the example transport system (a straight horizontal tube) differs from the default element, which was a bend. Selecting the "Tube" option and clicking "OK" opens the "Tube Element" dialog. We now proceed with the setting up of this element as per user specifications. The rest of the elements are added in the same manner, and the options available in each element type are self-explanatory. Please note that the "Rotation About Positive Z Axis" information, in the Bend Element dialog box, is simply for orientation purposes in the pictorial display of the transport system.

The fourth and final element is a tube. However, because the angle from the horizontal plane is non-zero, orientation information is entered. The "Down" direction is the default orientation when the "Tube Orientation" dialog is opened. This orientation is, again, for pictorial purposes only, and has no role in any calculations involving penetration. Selecting "OK" completes entry of the transport system.

The final item to set up is the particle size distribution. Selecting the "Particle Size Distribution" option in the "Set Up" menu opens the "Particle Size Distribution" dialog.

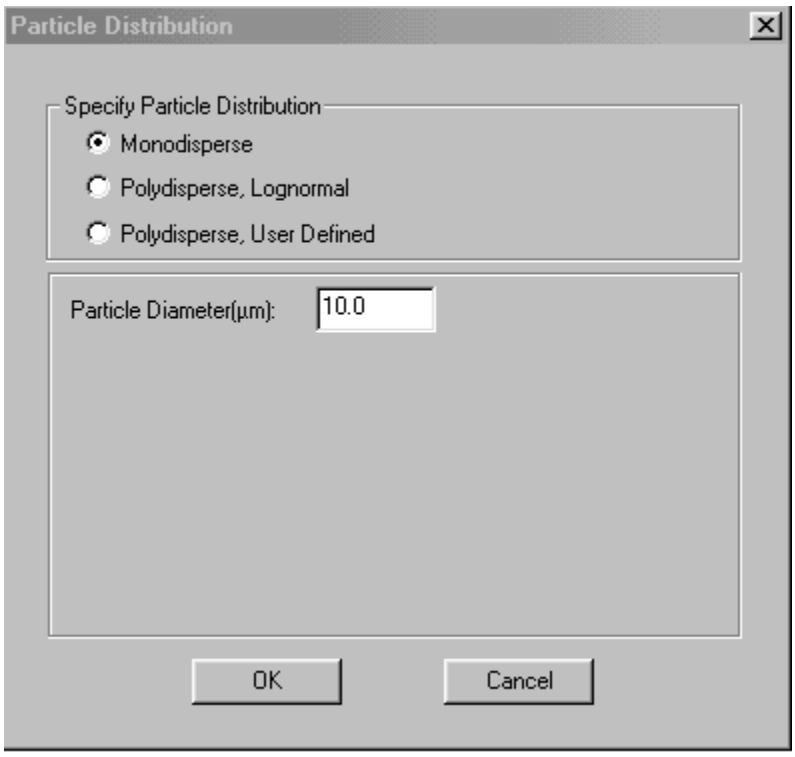


*Figure 6: The Particle Size Distribution dialog*

Figure 6 shows the "Particle Size Distribution" dialog, and the three possible choices for a particle size distribution. The example is for a monodisperse distribution, so this should be selected along with the particle size, and "OK" clicked. There exist other options for polydisperse aerosols with log normal/user-defined distributions. Once all system properties, transport system and particle distribution parameters have been set, the analysis may begin immediately.

To have the program perform the desired calculations, the "Analysis" menu should be opened. As specified earlier, an analysis of total penetration is needed, so that option is selected. DEPOSITION 2001, now calculates the total penetration, and reports this value along with the values of Stokes number and Reynolds number. DEPOSITION 2001 is configured in such a way, that it will report any discrepancies in the analysis. For example, if the user specifies a Reynolds number that is out of the range of applicability of the appropriate model, this discrepancy will be reported. Although, a value for penetration is reported, the user must check the parameters entered. If there are no mistakes, then the case being discussed may require greater research, and current models may not support such analyses. DEPOSITION 2001 has models, which have certain ranges of applicability. Cases outside such a range are subject to extrapolation, and hence the value of penetration reported is not reliable. In such a case, user discretion is advised in analysis of the values reported.

The submodels used in DEPOSITION 2001 are given in Appendix A together with sample calculations. The sample calculations are carried out both by DEPOSITION 2001 and with a hand calculator.

General characteristics appearing in all reports are pointed out in Figure 7. The screen in the report window can be printed using the "Print" option in the "File" menu.

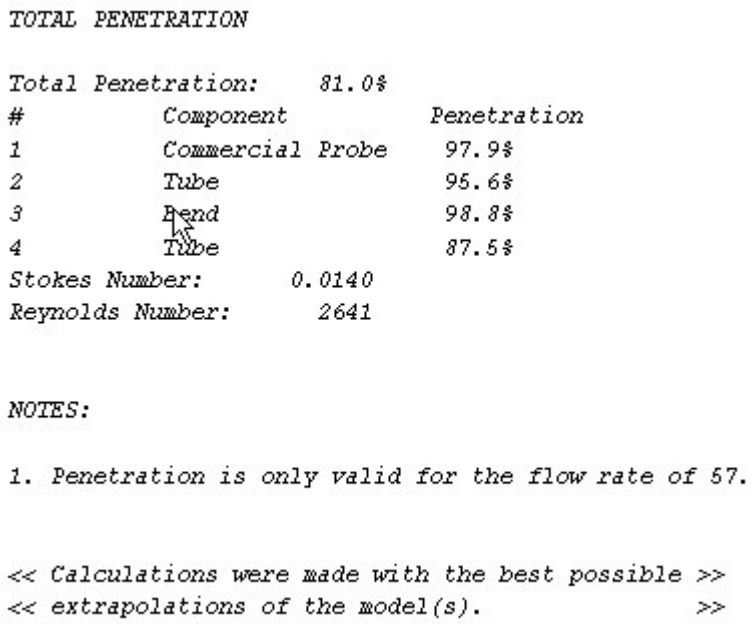


*Figure 7: General Report Characteristics*

Other information besides analysis of results may be viewed, and specific parameters easily modified using the view dialogs. The view dialogs may be toggled open or closed using the "View" menu option. Each option below the Status Bar option will either open or close a view dialog for the set of data listed (which correspond to parameters accessed in the "Set UP' menu).

For example, to open the view dialog for the transport system, select the corresponding option in the menu. A dialog similar to that shown in Figure 8 should open. However, unlike other dialogs, other program options may be selected or used concurrently with having an open "View" dialog.

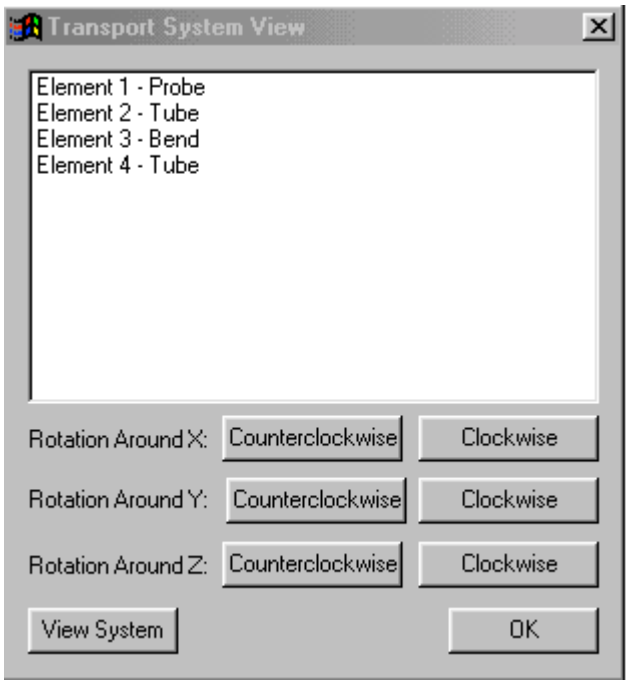


*Figure 8: The View Transport System view dialog*

Notice the contents of the transport system are listed. To change the transport system properties, the user has to do it through the Set Up, Transport Menu option.

A three dimensional picture of the transport may be displayed in the report window by selecting the "View System" button in the view dialog. The system can be viewed in various angles, by rotating clockwise or counterclockwise about any coordinate axis. Figure 9 shows the drawing corresponding to the transport system used in the example (with the 90° bend and vertical tube).

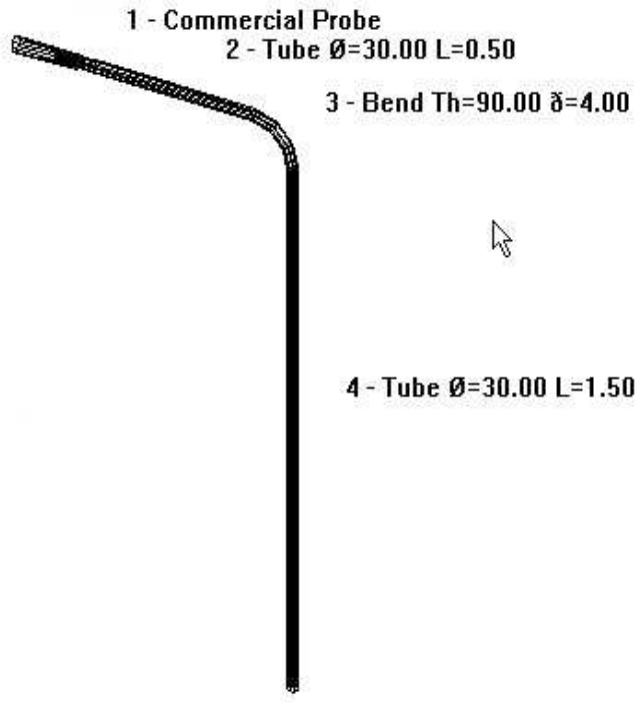


*Figure 9: Pictorial representation generated by View System*

By pressing the "Graph" Button, a frequency histogram of the amount of particulate matter versus the particle size may be shown for polydisperse particle distributions.

## V. Program Specifics

This section details the specifics of using DEPOSITION 2001 and contains sections for every menu available in the menu bar. It also discusses topics relating to the menu selections available for each pull down menu.

### V. A. The File Menu

The "File" menu allows the input parameters of the current setup to be saved and reloaded. This allows a sampling system configuration (a configuration being the combination of the geometrical layout of the transport system, and the operational conditions including the particle size distribution) that differs from the default to be stored and used later; saving time otherwise spent re-entering the setup.

For each configuration, one or more child windows will appear within the main application frame (the application frame window will be labeled DEPOSITION 2001 followed by a hyphen and the name of the file currently open and selected). These child windows will be labeled with the name of the file that corresponds to the configuration (the default name is Document 1). When the child window is selected, the title bar is

highlighted. All set up procedures will alter the selected file only, and all analyses run will be for that configuration and appear only in its corresponding child windows.

It is important to note that more than one file may be open at a time, allowing two (or more) analyses to be viewed and compared at the same time. However, because the view dialogs, which are the boxes toggled from the "View" menu, are not identified by file, some confusion is possible as to which view dialog corresponds to which file. Furthermore, "Set up" dialogs will also not explicitly identify the file the configuration is being changed for. Unlike "View" dialogs, only one "Set up" dialog may be open at any time, so the file may be inferred from noting the last highlighted child window.

### A. 1. *Creating a new file*

A new option under the "File" menu will cause a new file to be created. The new file will conform to the default configuration given above (Sections IV.A.1 to IV.A.3). A new child window will also be opened, and the introductory screen displayed within it.

### A. 2. *Opening an existing file*

Selecting the "Open" option under the "File" menu will open a standard Windows file selection dialog to be opened. Once a file is selected and OK is clicked, the file will be opened and a corresponding child window will appear. Note that the default extension for DEPOSITION configuration fields is .mdb (the extension being the three letters after the period in the file name) which can be opened using Microsoft Access. It will be up to the user to decide upon a convention for labeling her/his files.

### A. 3. *Closing an open file*

Selecting the close option under the "File" menu will close the currently selected file. The child windows will close and the configuration will no longer be available from the program (except if re-opened). No data are saved when this action takes place, and any changes made to the configuration since the last time the file was saved will be lost.

### A. 4. *Saving a current file*

Selecting the "Save" or Save as" option under the "File" menu will save the currently selected file. If the file being saved was a new configuration, or the "Save as" option was used, the standard file-naming dialog will open. The choice of a file name is at the discretion of the user, and once "OK" is pressed, the child window's title should update to the new name. Again, it should be noted that a file-naming convention, if any, is the user's responsibility (see Section V.A.2.).

### A. 5. *Printing*

Selecting the "Print" command will open the "Print" dialog. Choose the printer, the range (should be all, currently DEPOSITION does not support a selection of multi-page

printing) and the number of copies. Clicking "OK" prints the contents of the child window (e.g., analysis summary, transport pictorial, etc.) that is currently open.

### A. 6. *Exiting DEPOSITION 2001*

Selecting the "Exit" option under the "File" menu will close any open configuration files and will close the main window. Remember the files will not be saved if any changes were made since the last "Save". The same result may be accomplished by using the thumbnail menu icon (the small rectangle inside a square next to the main title bar).

## B. The Set Up menu

The Set Up menu allows configuration to be altered.

### B. 1. *Configuring system properties and parameters*

Selecting the system properties and parameters option under the "Set Up" menu allows system variables, such as the ambient air temperature, to be set. Once selected, a dialog box will open that contains entry fields for all properties and parameters as listed in Section IV.A.1. Clicking "OK" will update the current configuration, while clicking "Cancel" will ignore any changes.

### B. 2. *Constructing a transport system*

Selecting the "Transport System" option under the "Set Up" menu allows a new transport system to be created. The first dialog box that is opened will allow the entry of elements of the transport system. Selecting "Done" will continue, while selecting "Cancel" will abort the operation without changing the configured system.

Once the elements in the transport system have been specified, element specific dialog box can be opened by double clicking the corresponding element. The program starts with a display that shows the first element as a probe; however, the user can select other options as long as the first element that is chosen represents the first element in the transport system. Remaining elements are selected consecutively in the order in which they appear in the transport system. In addition to a probe, the other elements that can be included in a transport system are bends, straight tubes, contraction/ expansion fittings and splitters.

Clicking "Add Before" or "Add After" will open element specific dialogs, and clicking "Cancel" will back the element selection process to the Transport Element Dialog Box. The element specific dialogs can also be opened by double clicking on the element. If "Cancel" is pressed for the first element, the dialog for the number of transport elements is re-opened.

Double-clicking a probe element will open a box allowing one of four probe types to be chosen as a transport element. The available probe types are "Isokinetic sharp-edged", "Anisokinetic sharp-edged", "Commercial (RF2-111, RF2-112, RF2-113, CMR4CFM HI, CMR4CFM MI, WW6-III, KCl-III)" and "Shrouded". Selecting any one will open a probe specific dialog. For the isokinetic probe, a dialog will open that requires no inputs. The Anisokinetic probe requires a probe diameter to be given. The Commercial Probe requires no further information. Selection of a shrouded probe will open a dialog that requires input of the shroud diameter and the velocity reduction ratio (ratio of the undisturbed velocity in the stack or duct at the location of the shrouded probe to the mean velocity inside the shroud).

Other element-specific dialogs open immediately after the element has been selected. The tube-specific dialog prompts for a tube length, and the angle between the tube and the horizontal. If an angle greater than zero is entered, an orientation is asked for by a second dialog. The dialog particular to bends asks for the angle of the bend in degrees, and the rotation direction. The contraction and expansion element dialogs are similar in that they both ask for an outlet tube diameter, and an angle. The angle should be the half angle of contraction or expansion, in degrees. Information on whether the tube inlet is above or below the outlet and information on the direction of flow through a bend play no role in the calculation of aerosol penetration. These data only serve to provide the basis for generating graphical displays of the transport system.

### B. 3. *Configuring the particle size distribution*

Selecting the particle size distribution option under the "Set Up" menu opens a dialog prompting selection of one of the three distributions, namely, monodisperse, polydisperse lognormal, or a discrete, user-defined polydisperse distribution. Clicking "OK" continues the set up procedure for the particular distribution chosen.

Selecting the "Monodisperse" distribution option opens a single dialog that prompts for a particle diameter. The "Polydisperse, Lognormal" distribution option also opens a dialog, which prompts for both a geometric mean particle diameter, and a geometric standard deviation. In both cases, clicking "OK" will update the particle distribution for the current configuration.

The "Polydisperse, User Defined" distribution option opens an initial dialog to assign the number of discrete particle size intervals. Clicking "OK" causes a larger dialog to be opened. The larger dialog contains a notice of the sum of interval frequencies, a boxed listing of particle intervals, "OK" and "Cancel" buttons, and a scaling button. The listed sum of frequencies helps determine if the sum of frequencies is 100% or not. The sum of frequencies indicated must be 100%. If not, the dialog data should be scaled to 100%. The list box contains a line-by-line representation of discrete intervals in the distribution. Each line contains an interval number, the midpoint particle diameter for that interval, and the percentage of aerosol associated with that interval. If the listed number of intervals exceeds the number of lines available in the box, a scroll bar is drawn to the right of the listing, and allows the entire list to be scrolled through. Double clicking a

specific line opens a dialog for configuration of that interval. The midpoint particle diameter and frequency of an interval may be changed by clicking "OK", or rejected by clicking "Cancel". The "OK" button accepts the listed distribution only if the frequencies sum to 100% only. Otherwise a warning dialog is displayed, and once closed, focus will be returned to the interval listing box. The "Cancel" button invalidates the data, and makes no changes to the particle distribution of the configuration that is currently open. Clicking the "Scale to 100%" button proportionally adjusts all the frequencies so the sum is equal to 100%. The "Scale to 100%" button can be used to accommodate the input of non-normalized frequency data.

## C. The View menu

The "View" menu permits toggling of certain viewing features within the DEPOSITION application.

### C. 1. *Toggling the toolbar and status bar*

The toolbar, appearing as a set of square buttons just below the menu bar in the main window frame, allows for quick access of certain file commands. Its appearance may be toggled by selecting its corresponding option in the "View" menu. The status bar appears at the bottom of the main window frame, and occasionally offers hints as to the function of certain items. For example, when the "File" menu is open and the "Open" option is highlighted, the toolbar says "Open an existing file". The status bar may be toggled in a similar fashion as the toolbar. When either is present, a check appears by the toggling option of the present item.

### C. 2. *Toggling the view dialogs*

The dialogs in the "View" menu may be toggled open or closed in a similar manner as the toolbar and status bar. The view dialogs are unlike other dialog boxes present in the DEPOSITION program because they do not halt other interface options. Therefore a view dialog may be open and an analysis run at the same time.

Appearing within the view dialog is a "Close" button. The "Close" button, which is present in all the view dialogs, allows the box to be closed without using the "View" menu.

#### a. ***The properties and parameters dialog***

The properties and parameters dialog displays the information that is input (or the default values) for the design and operational variables of the transport system.

#### b. ***The transport dialog***

The "Transport System" dialog of the "View" menu displays a listing of the elements in the transport system. The element type and name cannot be changed from this dialog.

The transport system view dialog also contains a "View System" button. Clicking it causes an approximately isometric representation to be shown in the child window. Changes made either from the view dialog or the "Set up" menu are not updated in the drawing, and the "View System" button must be used for any needed updating.

**c. *The particle size distribution dialog***

The "Particle Size Distribution" dialog from the "View" menu displays the type of distribution currently selected. For monodisperse distributions, the particle diameter is also listed. For lognormal distributions, the particle diameter and standard deviation are listed. For both the polydisperse distributions, a "Graph" button, present in the lower left-hand corner of the view dialog may be clicked. Selection of the "Graph" button causes a bar graph to be generated that depicts the percent frequency as a function of particle diameter, in discrete intervals. Note that intervals for the user-defined distribution are sorted by increasing particle size, but that interval width is uniform, and therefore not necessarily to scale with respect to particle diameter.

## D. The Analysis Menu

The "Analysis" menu allows calculations to be made on a currently open configuration. Performing an analysis will produce a summary of the results to be displayed in the appropriate child window. The results can be saved to a file. The file may then be edited or inserted in another text file.

### D. 1. *Total penetration*

Selection of "Total Penetration" causes calculation of the fraction of aerosol that penetrates the transport system from the free stream in the stack or duct to the exit plane of the system. The displayed results include the percent penetration, the Stokes and Reynolds numbers, a table that shows aerosol penetration through each element, and any problems DEPOSTION encountered with the configuration (such as extrapolation of a parameter to values that are outside the range for which valid data exist). Along with the results a File Dialog is opened which allows the entry of a file name for storing the results.

### D. 2. *Optimum diameter*

Selection of "Optimum Diameter" will cause DEPOSITION to attempt to calculate a tube diameter that will maximize aerosol penetration through the transport system. In general, this option is useful for aerosol in the inertial size range (approximately 1 μm AD or greater), because for particles in the diffusional size range (less than about 0.1 μm) the predicted optimal diameters can be absurdly large. To calculate the optimal diameter, there must be at least one non-vertical straight tube element. The reason is that there will be increased turbulent deposition in tubes less than the optimal diameter and there will be increased gravitational settling in non-vertical tubes that are larger than the optimal diameter.

Optimum diameter analyses may not be run on transport systems containing contractions, expansions, and anisokinetic probes (including shrouded probes). The displayed results include the maximum penetration, the optimum tube diameter, the isokinetic probe diameter, the Stokes and Reynolds numbers, and any problems encountered with the configuration during the calculations. Along with the results a File Dialog will be opened which allows the entry of a file name for storing the results.

### D. 3. *Maximum penetration*

The "Maximum Penetration" option calculates the highest penetration that could be achieved by a straight transport system that connects two points in space. Upon selection of the "Maximum Penetration" option in the "Analysis" menu, a dialog box will open that requests the x, y and z coordinates of the second point relative to the first point, where the second point is assumed to be the sampling point. The analysis results show the probe penetration, the tube penetration, the maximum penetration, the Stokes and Reynolds numbers, and any problems incurred during analysis.

### D. 4. *Penetration with varied parameters*

Selection of the "Penetration with Varied Parameters" option under the "Analysis" menu opens a dialog box. The varied parameter dialog allows the variation of one of three parameters: tube diameter (not valid for transport systems with contractions and/or expansions), flow rate, or particle diameter. Entry fields allow inputs of the starting value of a parameter, the ending value of the parameter, the number of discrete intervals at which the calculations are to be performed. The report displayed in the child window shows the maximum penetration attained and the value of the parameter at that optimum penetration, any problems encountered during the analysis, and a graphic plot of penetration versus the varied parameter.

## E. The Window Menu

The "Window" menu contains options that allow child windows within the main frame window to be added, rearranged, or selected.

### E. 1. *New window*

The "New Window" option serves little purpose, since a second child window will be spawned from the currently selected window, and both windows will display the same results.

### E. 2. *Arranging open windows*

The opened child windows may be arranged in either of two ways: tiled or cascaded.

**a. *Tile option***

The tile option re-sizes all the open child windows so that no child window overlaps another, as well as optimizing space by titling the re-sized windows to fit the main frame window.

**b. *Cascade option***

The cascade option re-sizes all the open child windows to a uniform size, and then moves the windows to overlap one another, with the window behind any given window showing only its title and a small segment of its leftmost portion. The window on top is the only window allowed to be displayed in its entirety.

### E. 3. *Arrange icons*

Child windows may be minimized to conserve or create an uncluttered space. When a child window is minimized, an icon representing the window is displayed, still within the confines of the main frame. These icons may be rearranged using the arrange icons options in the Window menu.

### E. 4. *Window listing*

Also shown in the "Window" menu is a list of all the available child windows in the DEPOSITION for Windows application. A check mark appears next to the window that possesses the focus. Another child window may be selected as the current window by clicking its name in the "Window" menu.

## F. The Help menu

The "Help" menu offers three options. The first two open a separate Windows help application, showing help on various topics. The last option opens a brief dialog showing copyright and production information about DEPOSITION.

Note that the help files contain links to other help topics. The links are underlined in the help files, and may be followed by clicking the mouse cursor on them.

### F. 1. *Using the Help option*

Selecting the "Using Help" option opens the Windows help on help file. The new window is a separate help application, independent of DEPOSITION. The help manual is opened as a text document, and the user can scroll through the various options available.

### F. 2. *The index option*

Selecting the "Index" option of the "Help" menu opens the same Windows help

application as the previous option (V.F.1). “Index” addresses help topics specific to DEPOSITION 2001.

### F. 3. *The “About Depo” box*

The “About Depo” option in the “Help” menu opens a small dialog box showing the icon DEPOSITION 2001 uses when minimized and a copyright notice. The “OK” button closes the dialog.

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