Radiation Effects Software (RES) GUI User Manual

July 9, 2018
(for internal Peraton use only)

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1. Introduction

The Radiation Effects Software (RES) currently provides a fast-running radiation transport scaling capability that calculates endo-atmospheric and exo-atmospheric environments based on a database of pre-calculated prompt radiation dose, dose rate, and fission heating data for sources in the NWM80 and NWM21 redbooks. It currently supports the GENFIT and FLYTHRU analysis codes.

RES consists of:

- a graphical user interface (GUI) (see Figure 3-1)
- a properties file
- a database of simulation input options and radiation data
- xml input and output files
- a C++ analysis code (which calculates all results based on simulation and environment inputs)

The GUI allows the user to set up simulations with environments, execute one or more simulations, and review results. The database stores options for various drop-down list boxes on the GUI. All simulation inputs are stored in the input .xml file, and all calculated results are stored in an output .xml file results file. The RES analysis code is a C++ application called by a Java GUI.

This User Manual provides instructional information on using the RES GUI and descriptions of the database, the .xml files, and a summary of the C++ analysis code. Specifically,

- Section 2 provides instructions on installing the RES GUI and all associated files.
- Section 3 provides a Getting Started guide.
- Section 4 provides information on the RES properties file.
- Section 5 provides information on simulations and how to use them.
- Section 6 provides information on environments and how to use them.
- Section 7 provides information on executing one or more simulations and reviewing calculated results.
- Section 8 describes the contents and structure of the .xml input and output files.
- Section 9 describes the structure and content of the RES database.
- Section 10 provides information on warning and error messages associated using the RES GUI and analysis code executable.

2. Installation

Note that an installation program has not yet been developed for the RES GUI or the GENFIT C++ executable application.

In ADTEC, the files for the RES GUI and GENFIT executable are located in:
"//navyfx01/repo/software/RES/win64/current"

If you are running in an unclassified environment, the files can be located in any folder anywhere on your computer; all files are to be located in the same folder.

Some files are required for the operation of the GUI and some are required for running the a. Table 2-1 lists each file and indicates when each file is required. Note that the GENFIT executable can be ran outside of the RES GUI or the GUI can be used to set up and execute GENFIT. Also note, that at this time, full support of executing the FLYTHRU code is not complete.

Table 2-1. RES GUI and GENFIT Executable Files

File	Description	RES GUI	C++ executable application
genfit.db3	Database	X	X
GENFIT.dll	Dynamically linked library	X	X
GENFIT.exe	Executable application		X
GENFIT.lib	Statically linked library		
Genfit.xml	Example XML input file	X	
Genfit_dose.dll	Dynamically linked library for dose calculations	X	X
Genfit_dose.lib	Executable applicationfor dose calculations		
RES GUI.jar	Java file	X	
RES.properties	Properties file	X	
RES User Manual.pdf	User manual		
simulations.xsd	XML schema file	X	
xerces-c_3_1_D.dll	XML validating parser library	X	X
Examples	Example input and output files		

To easily access the RES GUI, create a desktop shortcut to the "RES GUI.jar" file. In ADTEC, the following will allow you to easily access and use the RES GUI:

- In ADTEC, create a shortcut on your computer to: "//navyfs01/repo/software/RES/win64/current/RES GUI.jar"
- You may also want to copy the following example input file to your computer: "//navyfs01/repo/software/RES/win64/current/genfit.xml"

3. Getting Started

GENFIT can be used with or without the RES GUI. If you don't want to use the GUI, a valid .xml input file and a GENFIT database is required.

3.1. Standalone RES Executable

To run the C++ executable application without using the RES GUI, open a Command Window and enter "genfit" followed by the xml input filename and the database filename (i.e., "genfit genfit_input.xml genfit.db3"). GENFIT will execute and write results to the output file. The output file is ASCII text and can be opened using any text editor. It is named according to the name of the input file. For example, if "genfit_input.xml" is the input file, the output file will be named "genfit_input-out.xml". Note that this output file can be opened using the RES GUI to view results (see Section 9.2).

3.2. RES GUI

To start RES GUI, click on the shortcut to your "RES GUI.jar" file (see previous section). RES GUI starts by reading a Properties file which specifies locations of required .xsd, database, and C++ application files. The **Open** dialog is displayed to allow you to navigate to and select a Properties file. A Properties file must be named with the ".properties" file extension. The **Open** dialog displays only files with the ".properties" file extension and should open to:

"//navyfs01/repo/software/RES/win64/ current/RES.properties".

This is the file you want to select unless you have other specialized Properties file. See Section 4. Properties File and Other Configuration Concerns for description and explanation of the Properties file.

Note: If you double click the "RES GUI.jar" file (or its shortcut) and nothing happens (i.e., the Open dialog does not display), try starting RES GUI from a Command Prompt:

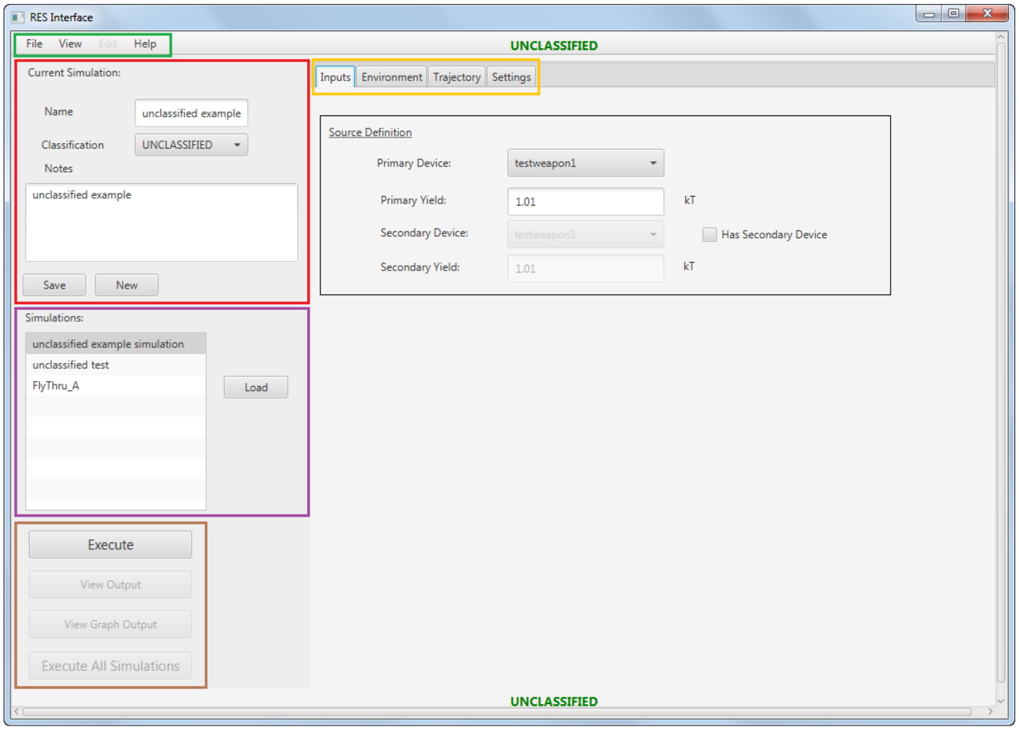
1. *Use the Start menu to navigate to and start the Command Prompt program (located under the Accessories folder).*
2. *In the command window, navigate to the location where the "RES_GUI.jar" file is located.*
3. *Enter "java -jar RES_GUI.jar".*
4. *Make note of all error messages displayed in the command window and contact an RES developer.*

Once you have selected the Properties file, click the **Open** button. The **RES Interface GUI** will be displayed (see Figure 3-1). The **RES Interface GUI** includes a **Main Menu**, a **Current Simulation** area, a **Simulations List**, an **Inputs** tab, an **Environment** tab, and a set of action buttons (**Execute**, **View Output**, **View Graph Output**, **Execute All Simulations**).

- The **Main Menu** includes three menu items: **File**, **View**, and **Help**. The **File** menu item allows you to import a .xml file or an output/results file, save the simulation/environment data to an "export.xml" file, or exit the RES GUI. The **View** menu item allows you to switch between GENFIT and FLYTHRU modes (Note: FLYTHRU is not yet functional) and view output. The **Help** menu item provides access to the version number.

- The **Current Simulation** area allows you to create a new simulation (in terms of a name, a classification, and notes), save the current simulation, and create a new simulation.
- The **Simulation Selection** area allows you to select and load a simulation.
- The **Action Buttons** allow you to execute a single simulation, execute all defined simulations, and view graphical or numerical output (results).
- The **Inputs** tab allows you to define the source and geometry properties for a specific simulation.
- The **Environment** tab allows you to define multiple environments which can be associated with a specific simulation. Environments define the dose kind and the response type, particle type, in-body transport type, a constraint value and balanced environment options.

For more information, see Section 5. Simulations, Section 6. Environments, and Section 7. Executing Simulations and Viewing Results.



Legend:

Main Menu (green box): allows you to import a .xml file, save the simulation, choose a simulation mode, view help, and exit the application.

Current Simulation area (red box): shows the currently selected simulation whose data is displayed on the Inputs and Environment tabs; allows you to create a new simulation, save a simulation, copy a simulation and delete a simulation.

Simulations List area (purple box): shows all defined simulations; allows you to select and load a simulation.

Action buttons (brown box): allows you to execute one or all simulations and view output/results in tabular or graphical format.

Tab selection (yellow box): allows you to select to view, set, and edit Inputs data or Environment data (for GENFIT) and Settings and Trajectory (for FLYTHRU).

Figure 3-1. RES GUI Components

When RES GUI is started, it does not load a pre-selected input file, but rather allows you to import an .xml input file.

To import an xml input file:

1. Click the **File | Import XML** menu item. A **File Open** dialog will be displayed.
2. Navigate to and select a .xml input file and click the **Open** button. See Section 9 for information on the input file format and contents. The RES GUI will display all information in the input file (as shown in Figure 3-1).

If there is an error in the format or content of the selected .xml input file, nothing will be loaded (displayed) on the GUI. Since specific error messages are not displayed indicating what the error might be, do one of two things to correct the input file:

- Compare your selected input file to one that is known to be correct.
- Manually check the tags and data values in your selected input file to the XML scheme defined in the "simulations.xsd" file (location of this file is defined in the Properties file).

Analysis Code Selection

The **View | Run Type** menu option allows you to select either GENFIT or FLYTHRU. GENFIT is selected by default when the **RES GUI** is started.

If GENFIT is selected, the **Inputs** tab and the **Environments** tab are active. The **Trajectory** tab and the **Settings** tab are not displayed. Selecting FLYTHRU activates and displays the **Trajectory** tab and the **Settings** tab. (Note: FLYTHRU is not yet functional). The Inputs tab for GENFIT includes both weapon and geometry properties, while the Inputs tab for FLYTHRU includes only weapon properties.

4. Properties File and Other Configuration Concerns

When the RES GUI application is started, you are first prompted to open a Properties (.properties) file. The Properties file defines the location for .xsd file, which describes the .xml file format, the RES database, and the executable RES application. A default "RES.properties" file is included when RES GUI is installed. Figure 4-1 shows the contents of a sample Properties file.

```
xmlbindingdatasets=1
xml.1 = .\\getfit.xml
xsd.1 = .\\simulations.xsd
db.1 = .\\genfit.db3
genexe.1 = .\\GENFIT.exe
```

Figure 4-1. Sample Properties File

Table 4-1 explains each line in the Properties file.

Table 4-1. Properties File Contents

Line		Description
1	xmlbindingdatasets	By default, set to "1". Do not change this value or RES GUI will not function properly. XML data binding makes it possible for a Java application (like RES GUI) to read and write .xml files.
2	xml.1	The location of an .xml input file. Note that this input file is currently not opened when the RES GUI starts; instead you must use the File | Import menu item to load an input file.
3	xsd.1	The location of the .xsd input file. When RES GUI is installed, a default "simulations.xsd" file is installed. The .xsd file is an .xml schema file which specifies what can and cannot be included in an .xml file. It is the .xml file validator.
4	db.1	The location of the RES database. When RES GUI is installed, the RES SQLite database (genfit.db3) is installed.
5	genexe.1	The location of the executable RES application (which is launched through the RES GUI. When RES GUI is installed, the executable RES application is installed. The application file is named "GENFIT.exe".

Note: Because of the way Java parses file paths and filenames, you must include "\\" for the normal "\" in a filename within the Properties file.

If you install the GENFIT GUI in a different location other than the default location (C:\Genfit_IN), you will most likely need to update lines 2 - 5 in the "Genfit.properties" file to accurately indicate where the files are located. Note that a double "\\" is required when specifying the path for each subfolder.

You may also have custom .xml input files located in a different location than C:\Genfit_IN. If so, you will need to only update line 2 in the "Genfit.properties" file. On the rare occasion that you have also created a custom .xsd file for your custom .xml input file and that is also located in a different location than C:\Genfit_IN, you will need to update line 3, as well.

Note: It is not recommended that a custom .xsd file be used. GENFIT GUI may not function correctly depending on the type of differences made between the default .xsd file and your custom file. If you need to alter the structure and/or content type of the .xml input file (which is validated by using the .xsd file), contact the GENFIT GUI developer.

5. Simulations

Simulations define the problem to be analyzed and include identification properties, source properties, geometry properties, and one or more environments.

- Identification properties are used to uniquely identify a simulation and include a name, a classification, and notes. Table 5-1 describes each simulation identification property.
- Source properties define the devices(s) included in the simulation and include the device name and yield. Table 5-2 describes each source property.
- Geometry properties define the general simulation inputs (which will apply to all environments associated with the simulation). Geometry properties include the run type, the height of burst, an angle, and an independent variable with minimum and maximum values and the number of steps in the value range. Table 5-3 describes each geometry property.

Simulations can be viewed, edited, added, and deleted through the **RES Interface GUI**. All simulations are stored in the .xml input file (see Section 8. Input and Output Files).

Table 5-1. Simulation Identification Properties

Field	Description	
Name	Description:	The name of the simulation. A short description or title of the simulation.
	Valid values:	Text value of unlimited length.
	Notes:	Names must be unique among all simulations.
Classification	Description:	The classification of the simulation.
	Valid values:	Selection of: UNCLASSIFIED, CONFIDENTIAL, SECRET, RESTRICTED. The default value is UNCLASSIFIED.
	Notes:	Each Classification is accompanied by an associated color: UNCLASSIFIED is green, CONFIDENTIAL is blue, SECRET is red, and RESTRICTED is yellow. Classifications are displayed at the top and bottom of the RES GUI..
Notes	Description:	Provides additional information describing the simulation.
	Valid values:	Text value of unlimited length.
	Notes:	Descriptions can be entered here to further explain the simulation than what is provided by the simulation Name (see above).

Table 5-2. Source Properties	
Field	**Description**
Primary Device Secondary Device	The name of the device(s) to be included in the simulation. At least one device must be selected. See note below about available devices. A Primary Device selection is required. To access the Secondary Device drop-down list box, the Has Secondary Device checkbox (see below) must be checked.
Primary Yield Secondary Yield	The Primary and Secondary Yields correspond to the Primary and Secondary Devices. These yield values are expected to be in kT units. There is no validation done on the yield values; reasonable values are expected. A Primary Yield value is required. To access the Secondary Yield text box, the Has Secondary Device checkbox (see below) must be checked.
Has Secondary Device	This checkbox turns on (enables) or turns off (disables) the Secondary Device and Secondary Yield selection and input fields (see above). Check the box to access the fields and specify a secondary weapon for the scenario. By default, this box is not checked.

Note about sources (devices) in RES:

The sources (or devices) available in the RES Interface GUI are read from the database. There is currently no way to define (add, edit, or delete) devices through the RES GUI. Note that RES GUI does not validate any device data. Reasonable names and yields are expected.

Table 5-3. Geometry Properties

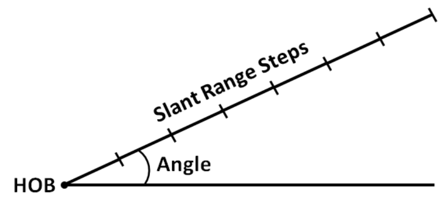
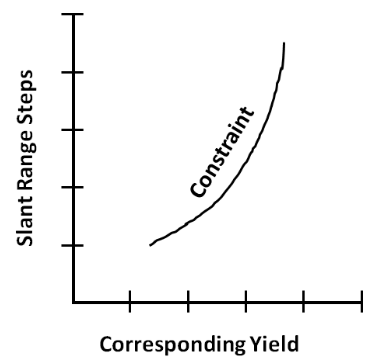
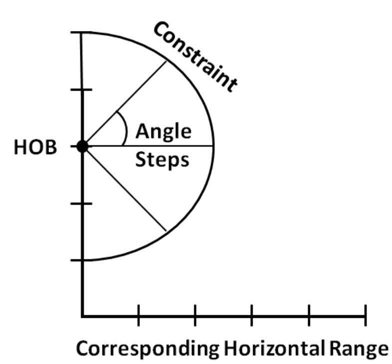
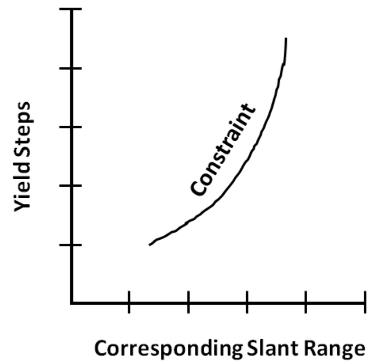
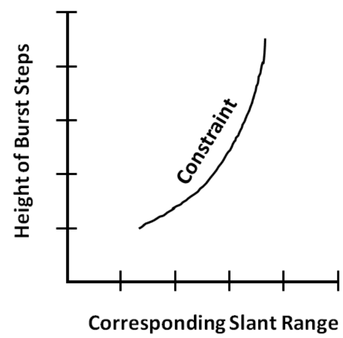
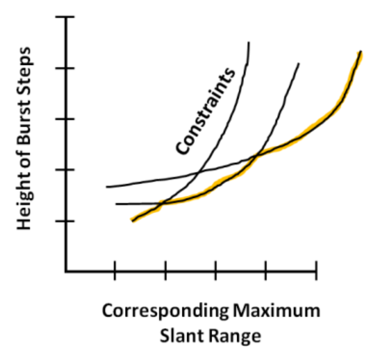
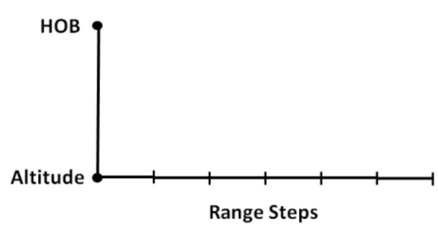
Field	**Description**
Run Type	Description: Selects the simulation type (what is to be calculated). Current options are (in displayed order) : ▪ <u>ENVRNG Calculate Environment Range</u> Calculates, for a given height of burst along an elevation angle, an environment as a function of range from the burst for each user-defined slant range.  ▪ <u>PI4RHOR Calculate Environment at RHOR</u> Calculates the environment as a function of RHOR (air depth).  ▪ <u>FITRNG Solve for Yield Range</u> Calculates, for a given height of burst and angle, the yield necessary to get a user-defined environment contour level as a function of range from the burst for each user-defined slant range. The user-defined contour level is the Constraint Value (environment field).  ▪ <u>FITCON Solve for Range at Angle</u> Calculates the range from a user-defined burst-centered contour for a given height of burst over a range of angles. The user-defined burst-centered contour is the Constraint Value (environment field). 

Table 5-3. Geometry Properties	
Field	**Description**
	▪ FITYLD Solve for Range at Yield Calculates, for a given height of burst and angle, the slant range to a user-defined contour level by varying the yield. The user-defined contour level is the Constraint Value (environment field).  ▪ FITHOB Solve for Range at HOB Calculates, for a given angle, the slant range to a user-defined contour level over a range of burst altitudes. The user-defined contour level is the Constraint Value (environment field).  ▪ ENVHOB Solve for Maximum Range at HOB Calculates, for a given angle, the maximum slant range over all environments to a user-defined contour level over a range of burst altitudes. The user-defined contour level is specified in the Constraint Value (environment field).  ▪ XENVRNG Calculate Environment Along Line Calculates, for a given height of burst, an environment at the specified altitude along a line of detectors located over a range of horizontal distances. 

<table>
<tr><th colspan="2">Table 5-3. Geometry Properties</th></tr>
<tr><th>Field</th><th>Description</th></tr>
<tr><td>Height of Burst</td><td>Description: The height of burst of the weapon, in feet.
Valid values: All numerical values (positive, negative, and 0) are accepted; however, reasonable values should be used to ensure accurate results.
Notes: This field is not available when the selected Run Type (KIND) is "FITHOB Solve for Range at HOB".</td></tr>
<tr><td>Angle</td><td>Description: The angle from the burst to the detector, in degrees.
Valid values: All numerical values (positive, negative, and 0) are accepted; however, reasonable values should be used to ensure accurate results.
Notes: This field is not available if the selected Run Type (KIND) is "FITCON Solve for Range at Angle".</td></tr>
<tr><td>Independent Variable</td><td>Description: The independent variable whose value will be varied according to the specified Minimum Value, Maximum Value, and Number of Steps values.
Valid values: NA (see Notes below)
Notes: This field is automatically filled based on the selected Run Type (KIND), as follows:
<table>
<tr><th>Run Type (KIND)</th><th>Independent Variable</th></tr>
<tr><td>ENVHOB …</td><td>Height of Burst</td></tr>
<tr><td>ENVRNG …</td><td>Slant Range</td></tr>
<tr><td>FITRNG …</td><td>Slant Range FIT</td></tr>
<tr><td>FITCON …</td><td>Angle</td></tr>
<tr><td>FITYLD …</td><td>Yield</td></tr>
<tr><td>FITHOB …</td><td>Height of Burst FIT</td></tr>
<tr><td>PI4RHOR …</td><td>RHOR</td></tr>
<tr><td>XENVRNG …</td><td>Range</td></tr>
</table></td></tr>
<tr><td>Minimum Value</td><td>Description: The first value the Independent Variable will start at.
Valid values: All numerical values (positive, negative, and 0) are accepted; however, reasonable values should be used to ensure accurate results Must be less than the Maximum Value.
Notes: NA</td></tr>
</table>

Table 5-3. Geometry Properties			
Field	**Description**		
Maximum Value	Description:	The last value the Independent Variable will end at.	
	Valid values:	All numerical values (positive, negative, and 0) are accepted; however, reasonable values should be used to ensure accurate results. Must be more than the Minimum Value.	
	Notes:	NA	
Number of Steps	Description:	Determines the number of individual values the Independent Variable takes on between the Minimum Value and the Maximum Value.	
	Valid values:	The value must be a whole (integer) value greater than 0. There is no set maximum, however, reasonable values should be used.	
	Notes:	The Number of Steps determines the actual values the Independent Variable takes on. The values for the Independent Variable are: First value = value of Minimum Value Intermediate value(s) = Minimum Value + X * Stepsize; where Stepsize = (Maximum Value - Minimum Value)/Number of Steps, and X is from 1 to Number of Steps. Last value = value of Maximum Value	
		For Run Type "PI4RHOR Calculate Environment at RHOR," the steps are calculated in a nonlinear manner at each power of ten. For example suppose that the Minimum Value is 0.001 and the maximum value is 10,000 and the Number of Steps is 9 then values will be:	
		0.001, 0.002, 0.003, 0.004, 0.005, 0.006, 0.007, 0.008, 0.009, 0.1, 0.2, 0.3, 0.4, 0.5, 0.6, 0.7, 0.8, 0.9, 0.01, 0.02, 0.03, 0.04, 0.05, 0.06, 0.07, 0.08, 0.09, 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 20, 30, 40, 50, 60, 70, 80, 90, 100, 200, 300, 400, 500, 600, 700, 800, 900, 1000, 2000, 3000, 4000, 5000, 6000, 7000, 8000, 9000, 10000	

5.1. Working with Simulations

Instructions are provided in this section to:

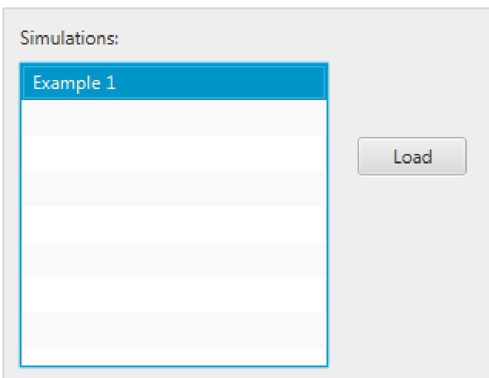
- Load a simulation
- Add a new simulation
- Edit an existing simulation

See Section 6. Environments for instructions on defining environments for simulations and Section 7. Executing Simulations and Viewing Results for instructions on executing simulations and reviewing results.

To load a simulation:

Loading a simulation displays its values on the **RES Interface GUI** and makes it selected for execution. Only one simulation can be viewed (loaded) at a time, although multiple simulations can be selected for execution (see Section 7. Executing Simulations and Viewing Results).

1. Select a simulation from the **Simulations List** on the GUI.
2. Click the **Load** button.



The weapon and geometry data values defined within the simulation are displayed on **Inputs** tab in the **Source Definition** section and the **Geometry Properties** section. The environments associated with the simulation are displayed on the **Environment** tab.

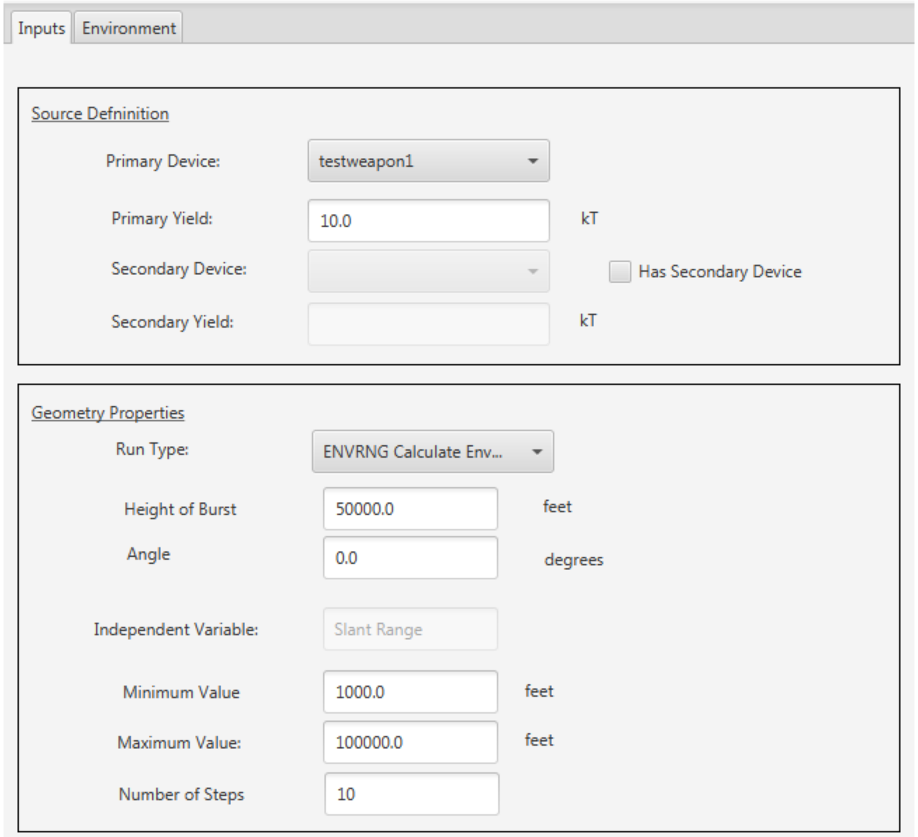
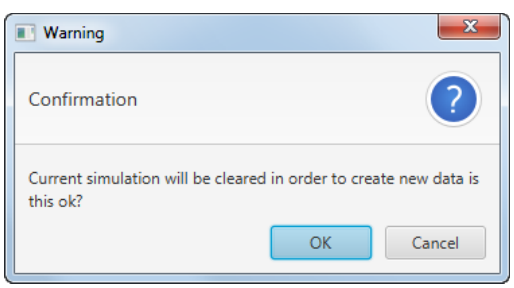


Figure 5-1. Inputs Tab

*Note that the **Geometry Properties** section of the **Inputs** tab is not displayed when FLYTHRU is the selected analysis code. Geometry properties only apply to the GENFIT code.*

To add a new simulation:

1. Click the **New** button in the **Current Simulation** area of the GUI. A warning message will be displayed notifying you that the data values currently displayed will be erased. The GUI fields will either be blank or with default values.



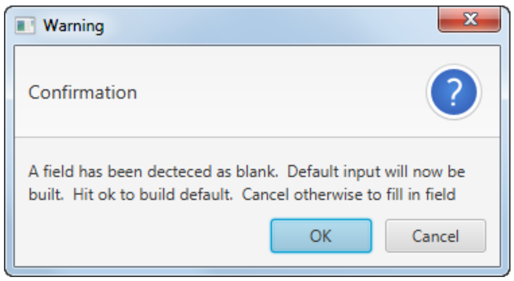
2. Click the **OK** button to continue adding a new simulation. Click the **Cancel** button to return to the currently selected/displayed simulation.

3. If the **OK** button is clicked, all GUI fields are initialized to either be empty or to contain default values.

4. Enter values into the **Current Simulation** fields (see Table 5-1), the **Source Definition** fields (see Table 5-2), and the **Geometry Properties** fields (see Table 5-3).

   The following fields are required: **Primary Yield**, **Minimum Value**, **Maximum Value**, and **Number of Steps**. Depending on the selected **Run Type**, **Height of Burst** and **Angle** may also be required. Note that if the field is not enabled, it is not required.

5. Click the **Save** button to save the simulation data to the .xml input file. If any required field is blank, a warning will be displayed:



6. Click the **OK** button to accept default values for the simulation. Click the **Cancel** button to abort the save and fill in any blank fields for the simulation. When all fields are filled in, click the Save button. The new simulation will be added to the end of the .xml input file.

Note: A simulation can be defined without defining environments for those simulations. Environments can be later defined and associated with a simulation. When a simulation is created, a default environment is also created. See Section 6. Environments for more information.

To edit an existing simulation:

1. Select the simulation from the **Simulations List** on the GUI.
2. Click the **Load** button. The data values for the simulation will be displayed on the GUI.
3. Make changes to the fields and click the **Save** button. The edited simulation will be saved in the .xml input file. Note that if you change the **Name** field, you are essentially creating a simulation.

Also refer to instructions for editing or adding environments.

To define environments for a single simulation:

Simulations include from one to many environments. See Section 5. Simulations for more information on defining, editing, and selecting environments.

To review results from a simulation execution:

See Section 7. Executing Simulations and Reviewing Results on executing simulations and reviewing results.

6. Environments

Environments specify the dose kind, the response type, the particle types, and an in-body transport type, along with a constraint value and a balance ratio. All simulations must include at least one environment. When a new simulation is created, a default environment is also created for that simulation. Figure 6-1 shows the **Environment** tab where all environments are defined, edited, and deleted.

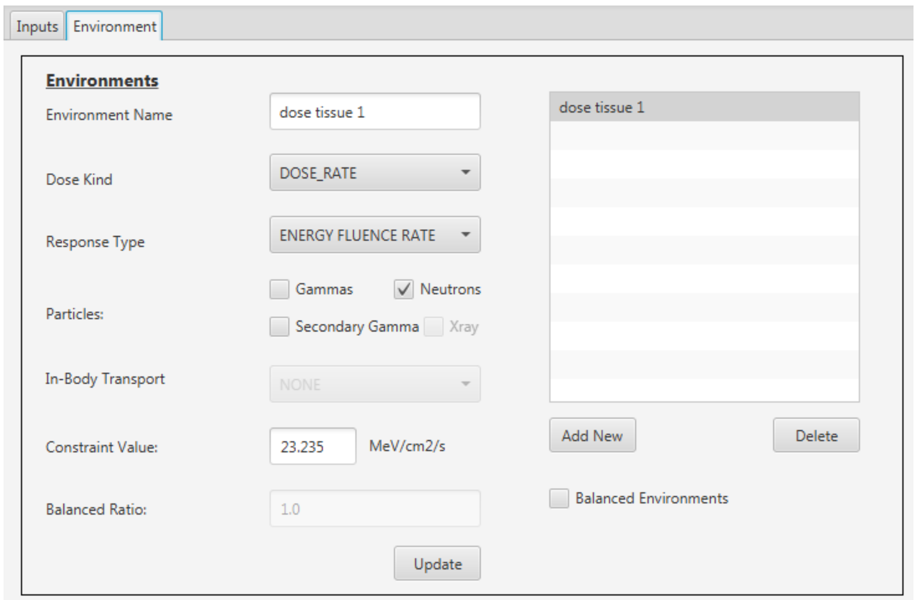


Figure 6-1. Environment Tab

Note that environments are associated with a single simulation. If a specific environment is to be used with multiple simulations, it must be defined (added) for each simulation. There is no way to define an environment outside of a simulation. Table 6-1 describes each environment property.

Table 6-1. Environment Properties

Field	Description
Environments (List of Environments)	Description: List of the currently defined environments. Valid values: NA - this is a display and selection only field. Notes: Selecting an environment from the list displays the properties for the environment.

Table 6-1. Environment Properties

Field	Description
Environment Name	Description: The unique environment name. Valid values: Any string value is allowed. It is recommended to name each environment something indicating the content of the environment, without making the name too complicated. Notes: Environments are associated with a specific (single) simulation. Environments in different simulations can have the same name, although to avoid confusion, it is suggested that all environments have unique names.
Dose Kind	Description: The type of radiation dose result. Determines the available values for Response Type. Valid values: Single selection of: Dose, Dose Rate, Dose Rate Slope or Fission Heating. Notes: These values are read from the RES database (genfit.db3). If additional values are required, the DoseKind database table must be manually updated.
Response Type	Description: The response type corresponding to the selected Dose Kind. Valid values: Values available depend on the selected Dose Kind. ▪ Dose Kind = Dose Available values are: Total Number Fluence, Total Energy Fluence, 1-MeV-Equivalent Fluence, Ionizing Dose, Biological Tissue Dose Rems-Tis, Biological Tissue Dose Rads-Tis, Epithermal Neutron Fluence, ASTM 1 Mev-Equivalent Dose ▪ Dose Kind = Dose Rate Available values are: Ionizing Dose Rate ▪ Dose Kind = Dose Rate Sloe Available values are: Ionizing Dose Rate Slope ▪ Dose Kind = Fission Heating Available values are: Fissions in Uranium, etc. Notes: These values are read from the RES database. If additional values are required, the KindEnvironment database table must be manually updated.
Particles	Description: The particle types. Valid values: Single or multiple selection of: Gammas, Neutrons, Secondary Gamma and/or Xray. The selection of Response Type determines which particle type is available (see Table 6-2). Notes: NA

Table 6-1. Environment Properties

Field	Description
In-Body Transport	Description: The type of In-Body Transport Valid values: Single selection of: values read from the RES database - Shield table. Notes: This field is only available if the selected Particles is Xray. These values are read from the RES database. If additional values are required, the Shield database table must be manually updated.
Constraint Value	Description: An environment value (dose, dose rate, dose rate slope or fission heating) used for specific Simulation Run Types of: "ENVHOB Solve for Maximum Range at HOB", "FITRNG Solve for Yield Range", "FITCON Solve for Range at Angle", "FITYLD Solve for Range at Yield", and "FITHOB Solve for Range at HOB". Valid values: All numerical values (positive, negative, and 0) are allowed; however, reasonable values should be used to ensure accurate results. Notes: This field is enabled regardless of what Simulation Run Type is selected. It is only for those listed above, in which the entered value is used.
Balanced Ratio	Description: A multiplicative factor that can be applied to an environment. Valid values: All numerical values (positive, negative, and 0) are allowed; however, reasonable values should be used to ensure accurate results. Notes: Use of the balanced ratio may be helpful if you want to plot environments that span a range of many orders of magnitude more conveniently on a single plot. The Balanced Ratio value is only applicable when the Balanced Environments checkbox is checked, and also only used when the Simulation Run Type is set to: "ENVRNG Calculate Environment Range", "PI4RHOR Calculate Environment at RHOR", or "XENVRNG Calculate Environment Along Line".

Table 6-1. Environment Properties

Field	Description
Balanced Environments	Description: Determines whether or not to apply a balanced ratio factor to the environment, as set in the Balanced Ratio text field for the following Simulation Run Types: "ENVRNG Calculate Environment Range", and "XENVRNG Calculate Environment Along Line". **Special Cases:** "FITCON Solve for Range at Angle": Checking this box results in a FITCON calculation for the first environment defined. It then calculates the dose for subsequent environments at the slant range calculated for the first environment. "FITHOB Solve for Range at HOB": Checking this box results in a FITHOB calculation for the first environment defined. It then calculates the dose for subsequent environments at the slant range calculated for the first environment. "PI4RHOR Calculate Environment at RHOR": Checking this box results in a PI4RHOR calculation for the first environment defined. For subsequent environments it applies the balanced ratio and divides by the first environment. Valid values: Checkbox that is either checked (use balanced environments) or not checked (do not use balanced environments). Notes: This checkbox must be checked in order to apply the Balanced Ratio value to the environment when Simulation Run Type is set to: "ENVRNG Calculate Environment Range", or "XENVRNG Calculate Environment Along Line".

Table 6-2. Environment Particle Type Selections

Dose Kind / Response Type	Gammas	Neutrons	Secondary Gamma	Xray
Dose				
Total Number Fluence	√	√	√	√
Total Energy Fluence	√	√	√	
1-MeV-Equivalent Neutron Fluence		√		
Ionizing Dose	√	√	√	√
Biological Tissue Dose Rems-Tis	√	√		

Table 6-2. Environment Particle Type Selections				
Dose Kind / Response Type	**Gammas**	**Neutrons**	**Secondary Gamma**	**Xray**
Biological Tissue Dose Rads-Tis	√	√		
Epithermal Neutron Fluence		√		
ASTM 1 Mev-Equivalent Dose		√		
Dose Rate				
Ionizing Dose Rate	√			√
Dose Rate Slope				
Ionizing Dose Rate Slope	√			√
Fission Heating				
All cases		√		

The default environment created when a new simulation is created has the following properties:

- **Environment Name** = "dose tissue 1"
- **Dose Kind** = Dose
- **Response Type** = Total Number Fluence
- **Particles** = Neutrons
- **In-Body Transport** = NONE
- **Constraint Value** = "23.235 particles/cm2"
- **Balanced Ratio** = "1.0"
- **Balanced Environments** = not checked

6.1. Working with Environments

Instructions are provided in this section to:

- Add a new environment
- Edit an existing environment
- Delete an existing environment

To add a new environment:

1. Select the simulation, for which the environment is to be included in, from the **Simulations List** on the GUI.
2. Access the environment data for the selected simulation by clicking the **Environments** tab.
3. Click the **New** button.
4. Fill in all fields for the environment. See Table 6-1 and Table 6-2 for a description of each field.
5. Click the **Add** button. The new environment will be listed in the **List of Environments**.

To edit an existing environment:

1. Access the environment data by clicking the **Environments** tab.
2. Select the environment in the **List of Environments**.
3. Make changes to the fields for the environment (all are on the **Environments** tab). See Table 6-1 and Table 6-2 for a description of each field. Note that you can change the name of the environment.
4. Click the **Update** button.

To delete an existing environment:

1. Access the environment data by clicking the **Environments** tab.
2. Select the environment to be deleted in the **List of Environments**.
3. Click the **Delete** button. The environment will be deleted from the **List of Environments**. (Note that currently there is no confirmation required prior to the deletion.)

7. Trajectories (FLYTHRU)

Trajectory data includes **Follower**, **Aimpoint**, and **Integration** fields as shown in Figure 7-1. Note that currently this tab is not fully functional.

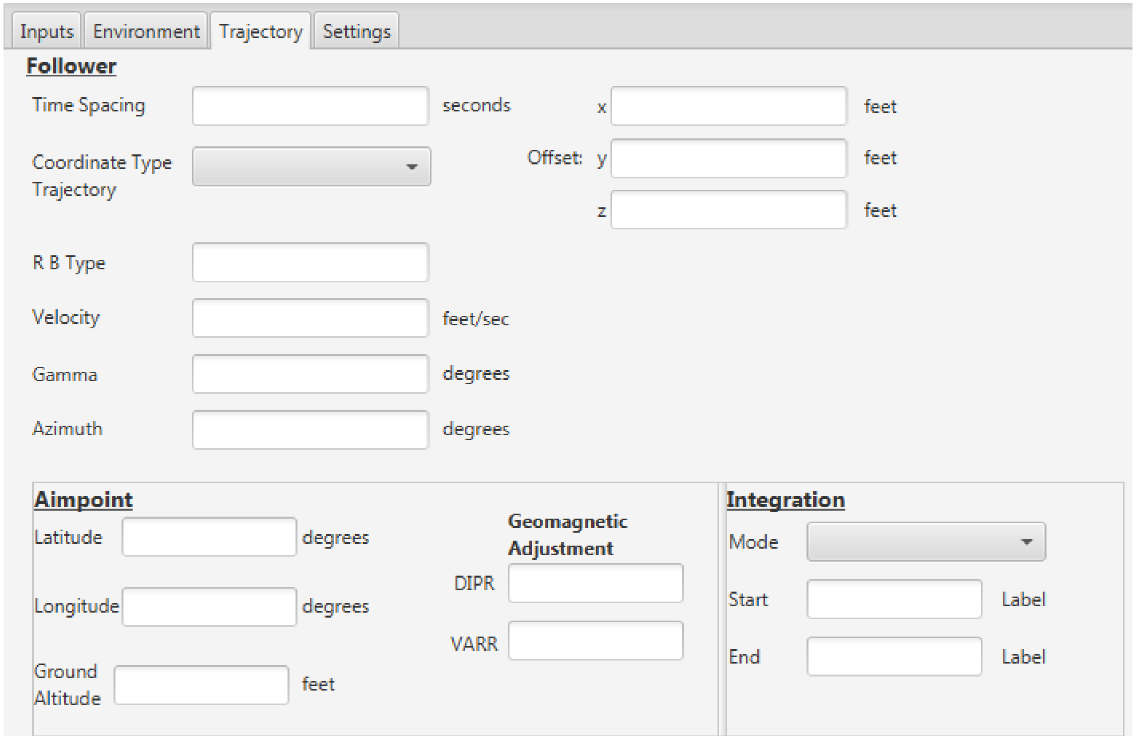


Figure 7-1. Trajectory Tab (FLYTHRU)

Table 8-1 describes each trajectory property.

Table 7-1. Trajectory Properties (FLYTHRU)	
Field	**Description**
Time Spacing	Description: Valid values: Notes:
Coordinate Type Trajectory	Description: Valid values: Notes:
R B Type	Description: Valid values: Notes:

Table 7-1. Trajectory Properties (FLYTHRU)

Field	Description
Velocity	Description: Valid values: Notes:
Gamma	Description: Valid values: Notes:
Azimuth	Description: Valid values: Notes:
Offset: x, y, z	Description: Valid values: Notes:
Latitude	Description: Valid values: Notes:
Longitude	Description: Valid values: Notes:
Ground Altitude	Description: Valid values: Notes:
DIPR	Description: Valid values: Notes:
VARR	Description: Valid values: Notes:
Mode	Description: Valid values: Notes:

Table 7-1. Trajectory Properties (FLYTHRU)

Field	Description
Start	Description: Valid values: Notes:
End	Description: Valid values: Notes:

8. Settings (FLYTHRU)

Settings allow you to set properties specific to FLYTHRU execution. Figure 8-1 shows the **Settings** tab. Note that currently this tab is not fully functional.

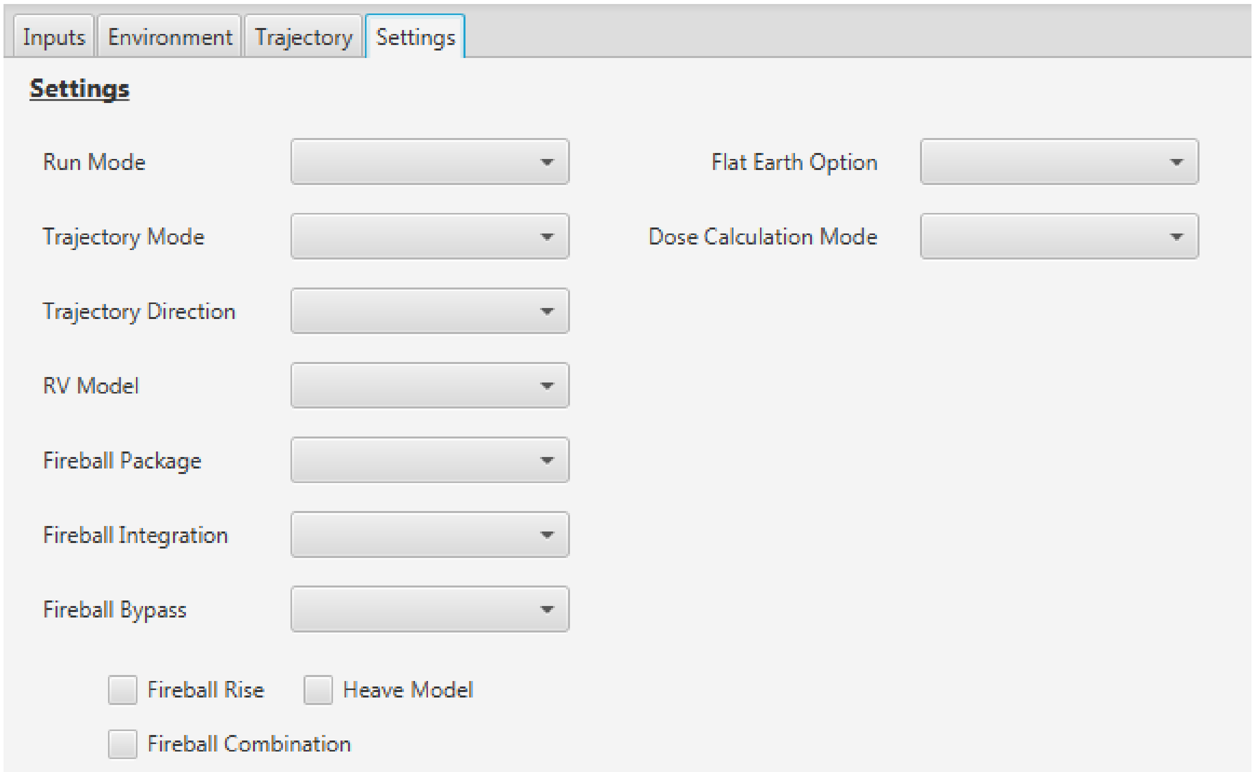


Figure 8-1. Settings Tab (FLYTHRU)

Table 8-1 describes each setting.

Table 8-1. FLYTHRU Settings

Field	Description
Run Mode	Description: Valid values: Notes:
Trajectory Mode	Description: Valid values: Notes:
Trajectory Direction	Description: Valid values: Notes:

Table 8-1. FLYTHRU Settings	
Field	**Description**
RV Model	Description: Valid values: Notes:
Fireball Package	Description: Valid values: Notes:
Fireball Integration	Description: Valid values: Notes:
Fireball Bypass	Description: Valid values: Notes:
Fireball Rise	Description: Valid values: Notes:
Heave Model	Description: Valid values: Notes:
Fireball Combination	Description: Valid values: Notes:
Flat Earth Option	Description: Valid values: Notes:
Dose Calculation Mode	Description: Valid values: Notes:

9. Executing Simulations and Viewing Results

Once a simulation is defined with at least one associated environment (a default environment is included with every simulation), it can be executed and results can be reviewed. Executing a simulation calls the C++ RES application with data values set by the user in the **RES Interface GUI**. When execution is complete, simulation results can be viewed from the **RES Interface GUI**. Any error that occurs during simulation execution will be displayed on the **RES Interface GUI**.

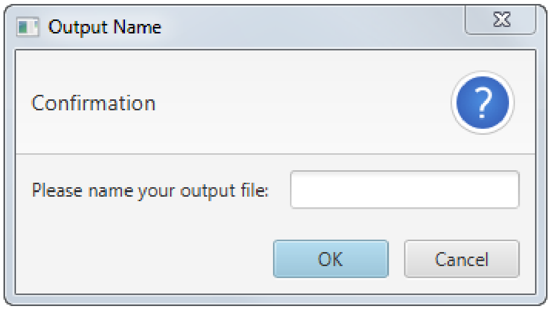
9.1. How to Execute Simulations

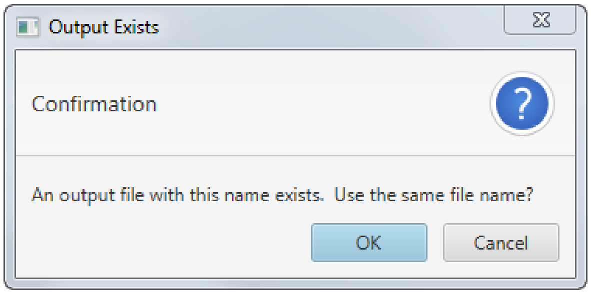
Instructions are provided in this section to:

- Execute a single simulation
- Execute a set of simulations
- Execute all defined simulations
- View numerical results
- View graphical results

To execute a single simulation:

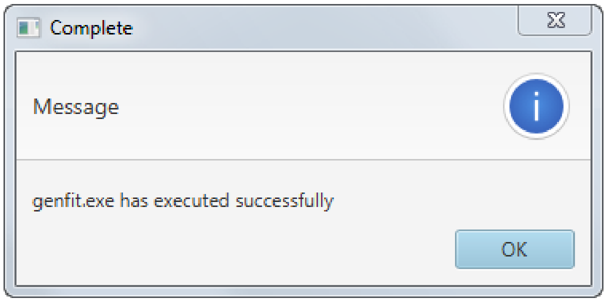
1. Select the desired simulation from the **Simulations List** on the GUI.
2. Click the **Execute** button. If this is the first simulation execution, you will be asked to name the output file. Otherwise, you will be asked if you want to use the existing output file.





If you do not want to use the existing filename, click the **Cancel** button and you will be asked the name a new output file.

3. Enter the name for the output file and click the **OK** button. A message will be displayed when the execution is complete:



Once execution is complete, results are available in numerical and graphical output. See Section 7.2. How to View Results for instructions on viewing results.

To execute a set of simulations:

Note that this is a feature to be available in the future. It is not currently implemented.

1. First, select the desired environments for each desired simulation to be executed:
    a. On the **Environments** tab, click the checkbox next to each listed environment which you want to be included in the simulation execution. Repeat this for each simulation you want to execute.
2. Select all simulations to be executed from the **Simulations List**. Use CTRL-click to select multiple simulations or drag the mouse over consecutive simulations in the list.
3. Click the **Execute** button.

   Once execution is complete, results are available in numerical and graphical output for each simulation. See Section 7.2. How to View Results for instructions on viewing results.

To execute all defined simulations:

Note that this is a feature to be available in the future. It is not currently implemented.

1. Click the **Execute All Simulations** button (on the left side of the **RES Interface GUI**). All defined environments for all simulations will be executed. Results are available once execution is complete for all simulations.

   Once execution is complete, results are available in numerical and graphical output for each simulation. See Section 7.2. How to View Results for instructions on viewing results.

9.2. How to View Results

Once simulation execution is complete, results can be viewed using the **View Output** and the **View Graph Output** buttons. Results are displayed in easily readable graphs and numerical tabular outputs. Result plots can also be saved as .png image files.

Note that if you can open an GENFIT output file using the Import menu item. Importing an output file will enable the View Output and View Graph Output buttons allowing you to view the results in the imported output file.

To view numerical results:

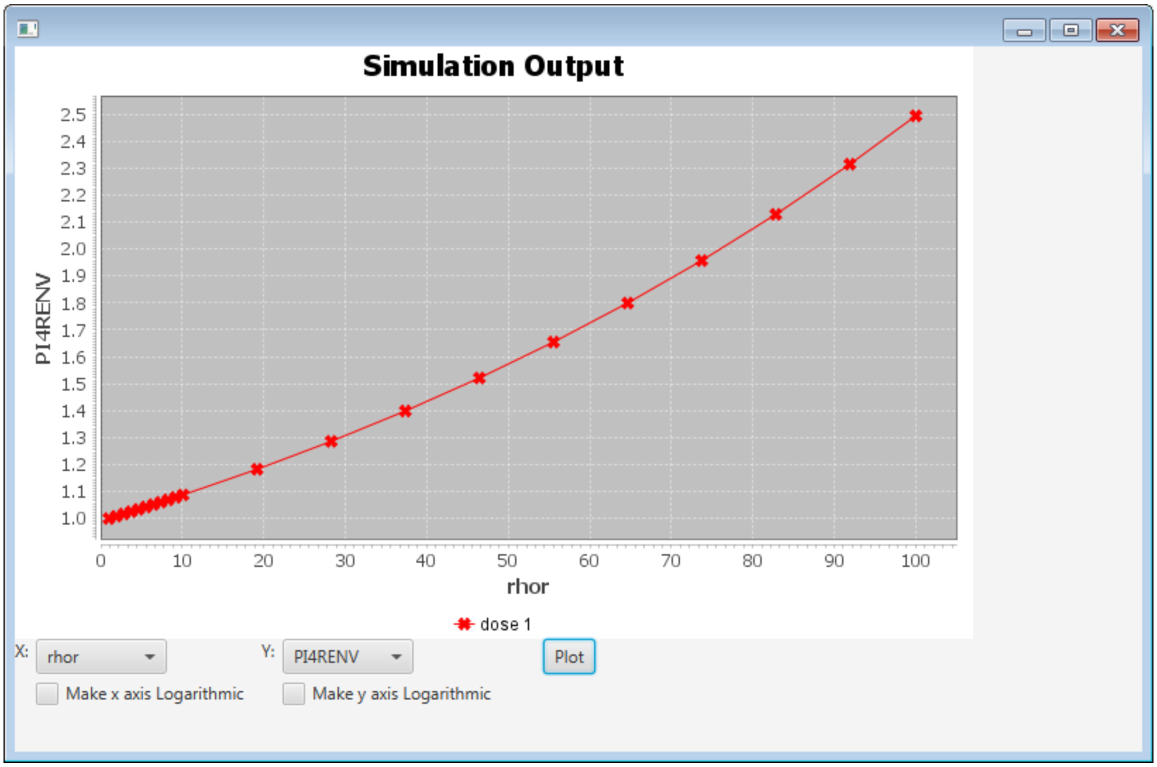
1. Once simulation execution is complete, whether it is a single simulation, a set of simulations, or all simulations, results can be viewed in numerical format by clicking the **View Output** button.
2. The results are displayed in tabular form:

yield	secondary yield	primary yield	altitude	rhor	horizontal range	slant range	4pirenv
12.5	12.5	0.0	50000.0	0.0	1000.0	1000.0	2.7125794433359042E11
12.5	12.5	0.0	50000.0	0.0	5714.285714	5714.285714	8.857402263953975E12
12.5	12.5	0.0	50000.0	0.0	10428.571429	10428.571429	2.950068541538171E13
12.5	12.5	0.0	50000.0	0.0	15142.857143	15142.857143	6.22011073986168E13
12.5	12.5	0.0	50000.0	0.0	19857.142857	19857.142857	1.0695866821365922E14
12.5	12.5	0.0	50000.0	0.0	24571.428571	24571.428571	1.6377336786050903E14
12.5	12.5	0.0	50000.0	0.0	29285.714286	29285.714286	2.3264520633916612E14
12.5	12.5	0.0	50000.0	0.0	34000.0	34000.0	3.1357418364963056E14
12.5	12.5	0.0	50000.0	0.0	38714.285714	38714.285714	4.0656029979190244E14
12.5	12.5	0.0	50000.0	0.0	43428.571429	43428.571429	5.116035547659816E14
12.5	12.5	0.0	50000.0	0.0	48142.857143	48142.857143	6.287039485718682E14
12.5	12.5	0.0	50000.0	0.0	52857.142857	52857.142857	7.578614812095624E14
12.5	12.5	0.0	50000.0	0.0	57571.428571	57571.428571	8.990761526790638E14
12.5	12.5	0.0	50000.0	0.0	62285.714286	62285.714286	1.0523479629803722E15
12.5	12.5	0.0	50000.0	0.0	67000.0	67000.0	1.2176769121134882E15
12.5	12.5	0.0	50000.0	0.0	71714.285714	71714.285714	1.3950630000784115E15
12.5	12.5	0.0	50000.0	0.0	76428.571429	76428.571429	1.5845062268751415E15
12.5	12.5	0.0	50000.0	0.0	81142.857143	81142.857143	1.7860065925036795E15
12.5	12.5	0.0	50000.0	0.0	85857.142857	85857.142857	1.9995640969640242E15
12.5	12.5	0.0	50000.0	0.0	90571.428571	90571.428571	2.225178740256177E15

3. The results can be sorted by column by clicking the column header. An up arrow (▲) is displayed next to the column heading to indicate the results are sorted in descending order. A down arrow (▼) is displayed to indicate the results are sorted in ascending order.

To view graphical results:

1. Once simulation execution is complete, whether it is a single simulation, a set of simulations, or all simulations, results can be viewed in graphical format by clicking the **View Graph Output**.
2. The results are displayed in graphical form: (sample shown; not necessarily related to any actual results)



3. You can select various X and Y axes by using the **X** and **Y** drop-down list boxes to make a selection. Click the **Plot** button to generate the plot.
4. The graph can be zoomed in or out by right-clicking anywhere on the graph to display the context menu and selecting **Zoom In** or **Zoom Out**:

You can select to zoom in/out on the **Domain Axis**, the **Range Axis**, or **Both Axes**.

You can also click and drag a box in which to zoom in.

5. Selecting **Auto Range** will return the graphical display to the original magnification (i.e., not zoomed in or out).
6. Selecting **Save Image** will save a .png file of the graph in the location where the .xml input and output files are stored.

10. Input and Output Files

XML files are used to store simulations and environments as defined in the RES GUI. There is a single .xml file for input and another .xml file that stores a copy of the input along with the results. Figure 8-1 shows the general structure of the input .xml file.

```
simulations
    simulation
        title
        classification
        notes
        weapon
            primarydevice
            primaryyield
            secondarydevice
            secondaryyield
        geometry
            runkind
            yield (includes value, minvalue, maxvalue, numsteps)
            xenvrng (includes value, minvalue, maxvalue, numsteps)
            height of burst (includes value, minvalue, maxvalue, numsteps)
            angle (includes value, minvalue, maxvalue, numsteps)
            slantrange (includes value, minvalue, maxvalue, numsteps)
            rhor (includes value, minvalue, maxvalue, numsteps)
        environments
            balanced (true/false)
            environment
                name
                dosekind
                kindenv
                ishld
                particles (includes neutron, gamma, secondarygamma, xray)
                constraint
                balancedratio
        atmosphere
```

Figure 8-1. .xml (.xsd) Input File Structure

Table 8-1 describes each element field in the input .xml file. Note that all elements are required unless otherwise noted.

Table 8-1. Input .xml File Element Fields

Element	Description
simulations	The base name of the entire .xml file content.
simulation	Indicates the beginning of a simulation definition. At least one must be defined. There may be multiple simulation definitions.
title	A text (string) description of the simulation. No error or bound checking is performed. There can also only be one title element. This element corresponds to the Name field on the RES GUI.
classification	A text (string) describing the classification level of the simulation. There must be one and only one classification element defined. This element corresponds to the Classification field on the RES GUI.
notes (optional)	Additional text (string) to describe the simulation in further detail that what is described in the title. This is an optional element field and is empty by default. This element corresponds to the Notes field on the RES GUI. This is an optional element.
weapon	Indicates the beginning of weapon definitions. There must be one and only one weapon element defined.
primary device	A text (string) description of the primary weapon. There must be one and only one primary device element defined. This element corresponds to the Primary Device field on the Inputs tab on the RES GUI.
primary yield	A numeric yield value for the primary device, in kT. The value is represented as a double, therefore, the only limit on the value is that it fits the size of a double. There must be one and only one primary yield element defined. This element corresponds to the Primary Yield field on the Inputs tab on the RES GUI.
secondary device	A text (string) description of the primary weapon. There must be one and only one secondary device element defined. This element corresponds to the Secondary Device field on the RES GUI.
secondary yield	A numeric yield value for the secondary device, in kT. The value is represented as a double, therefore, the only limit on the value is that it fits the size of a double. There must be one and only one secondary yield element defined. This element corresponds to the Secondary Yield field on the RES GUI.
geometry	Indicates the beginning of the geometry inputs for the simulation. There can be one and only one geometry defined.
runkind	A text (string) description of the type of simulation to be run (executed). This element corresponds to the Run Type (KIND) field on the Inputs tab on the RES GUI.

Table 8-1. Input .xml File Element Fields

Element	Description
yield (optional)	Defines the varying weapon yield for the scenario. The yield value is varied for multiple runs within the simulation based on a minimum value, a maximum value, and the number of steps (which ultimately determines how many runs are made). The yield value starts at the minimum value and increased to the maximum value by a value determined by the difference between the minimum and maximum value divided by the number of steps. This element corresponds to the Yield (conditionally displayed) field on the Inputs tab on the RES GUI. This is an optional element as it only applies to certain Run Types.
heightofburst	Defines the varying height of burst (i.e., weapon detonation) for the scenario. The height of burst value is varied for multiple runs within the simulation based on a minimum value, a maximum value, and the number of steps (which ultimately determines how many runs are made). The height of burst value starts at the minimum value and increased to the maximum value by a value determined by the difference between the minimum and maximum value divided by the number of steps. This element corresponds to the Height of Burst (conditionally displayed) field on the Inputs tab on the RES GUI, along with the Minimum Value, Maximum Value, and Number of Steps fields.
angle	Defines the varying angle for the scenario. The angle value is varied for multiple runs within the simulation based on a minimum value, a maximum value, and the number of steps (which ultimately determines how many runs are made). The angle value starts at the minimum value and increased to the maximum value by a value determined by the difference between the minimum and maximum value divided by the number of steps. This element corresponds to the Angle (conditionally displayed) field on the Inputs tab on the RES GUI, along with the Minimum Value, Maximum Value, and Number of Steps fields.
slantrange	Defines the varying slant range for the scenario. The slant range value is varied for multiple runs within the simulation based on a minimum value, a maximum value, and the number of steps (which ultimately determines how many runs are made). The slant range value starts at the minimum value and increased to the maximum value by a value determined by the difference between the minimum and maximum value divided by the number of steps.

Table 8-1. Input .xml File Element Fields

Element	Description
rhor	Defines the varying Rhor for the scenario. The rhor value is varied for multiple runs within the simulation based on a minimum value, a maximum value, and the number of steps (which ultimately determines how many runs are made). The rhor value starts at the minimum value and increased to the maximum value by a value determined by the difference between the minimum and maximum value divided by the number of steps.
environments	Indicates the beginning of environment definitions.
balanced	A true or false indication of whether the environments are balanced. This element corresponds to the Balanced Environments checkbox on the Environment tab on the RES GUI.
environment	Indicates the beginning of an individual environment definition. There can be multiple individual environments defined.
name	A text (string) name of the environment. This element corresponds to the Environment Name field on the Environment tab on the RES GUI.
dosekind	A text (string) name of the dose kind. This element corresponds to the Dose Kind field on the Environment tab on the RES GUI.
kindenv	A text (string) name of the kind environment. This element corresponds to the Response Type field on the Environment tab on the RES GUI.
ishld	A text (string) name of the type of shield. No maximum length defined. This element corresponds to the In-Body Transport field on the Environment tab on the RES GUI.
particles	Indicates the beginning of the particle type selections (neutron, gamma, secondary gamma, and xray). Particle types indicate the type of output (results) desired.
neutron	A true/false indicator of whether or not neutron output (results) is desired. This element corresponds to the Neutrons checkbox on the Environment tab on the RES GUI.
gamma	A true/false indicator of whether or not gamma output (results) is desired. This element corresponds to the Gammas checkbox on the Environment tab on the RES GUI.
secondarygamma	A true/false indicator of whether or not secondary gamma output (results) is desired. This element corresponds to the Secondary Gamma checkbox on the Environment tab on the RES GUI.

Table 8-1. Input .xml File Element Fields

Element	Description
xray	A true/false indicator of whether or not xray output (results) is desired. This element corresponds to the Xray checkbox on the Environment tab on the RES GUI.
constraint	A numerical value applied to a specific environment (dose, dose rate, dose rate slope, or fission heating). This element corresponds to the Constraint Value field on the Environment tab on the RES GUI.
balancedratio	A numerical value representing a multiplicative factor for an environment. This element corresponds to the Balanced Ratio field on the Environment tab on the RES GUI.
atmosphere	A text (string) element that describes the atmosphere for the simulation. This element does not correspond to any RES GUI item. It is currently set to "standard" in all cases.

Outputs are stored in a separate .xml file along with plot and other output files. The top portion of the output .xml file reiterates the inputs from the input .xml file (as set in the RES GUI). The results are stored following the reiteration of the inputs. Figure 8-2 shows the structure of the results portion of the .xml output file. Table 8-2 describes the element fields in the results portion.

```
results
    result
        name
        columns
            column
                name
                units
        data
            row
```

Figure 8-2. RES .xml Output File Structure - Results Portion

Table 8-2. RES GUI Output .xml File Element Fields in Results Portion

Field	Description
results	Indicates the beginning of the results section.
result	Indicates the beginning of one set of results. There can be multiple result sections.
name	A name which describes the type of results to follow.
columns	Indicates the beginning of the columns section for the individual result.

Table 8-2. RES GUI Output .xml File Element Fields in Results Portion	
Field	Description
column	Defines a unique column of data.
name	A name which describes the type of data stored/displayed in this column.
units	The unit for the type of data values stored/displayed in this column.
data	The result data values for the row-column cell.
row	Each row contains numerical results data ordered according to the columns

The output file (named "genfit-out.xml" by default) contains results along with the input elements for the simulation (identical copy of the simulation element data in the "genfit.xml" input file). The results are written inside the <simulation> </simulation> element tags are contained in <results> </results> element tags. When a simulation is executed multiple times, multiple sets of <results></results> elements are written. If multiple simulations are executed multiple times, the output file contains all results for all simulations as:

```
<simulations>
    <simulation>
           ….
         <results>
             <result>
               …
             </result>
             <result>
               …
            </result>
        </results>
    </simulation>
</simulations>
```

Figure 8-3 shows a sample output for the results in the output ("genfit-out.xml") file. The data contents (as opposed to the element tags) are highlighted in blue text. Comments, in *italic green* text, are provided for description and not included in the actual output file. Note also that line wrapping shown in Figure 8-3 does not occur in the actual output file.

```
<results>
     <result>
       <name>fitrng environment 1</name>
       <columns>
         <column>
           <name>yield</name>
           <units>kt</units>
         </column>
```

```
    <column> <!-- secondary yield values, in kT, in column #2 -->
     <name>secondary yield</name>
     <units>kt</units>
    </column>
    <column> <!-- primary yield values, in kT, in column #3 -->
     <name>primary yield</name>
     <units>kt</units>
    </column>
    <column> <!-- altitude values, in ft, in column #4 -->
     <name>altitude</name>
     <units>ft</units>
    </column>
    <column> <!-- RHOR values, in g/cm2, in column #5 -->
     <name>rhor</name>
     <units>g/cm2</units>
    </column>
    <column> <!-- horizontal range values, in ft, in column #6 -->
     <name>horizontal range</name>
     <units>ft</units>
    </column>
    <column> <!-- slant range values, in ft, in column #7 -->
     <name>slant range</name>
     <units>ft</units>
    </column>
    <column> <!-- 4pirenv values, in cal/cm2, in column #8 -->
     <name>4pirenv</name>
     <units>cal/cm2</units>
    </column>
    <column> <!-- env values, in cal/cm2, in column #9 -->
     <name>env</name>
     <units>cal/cm2</units>
    </column>
   </columns>
   <data> <!-- results in multiple rows of nine columns each; columns defined above-->
    <row>12.500000 12.500000 0.000000 50000.000000 0.000000 1000.000000 1000.000000
       271257944333.590424 23.235000</row>
    <row>12.500000 12.500000 0.000000 50000.000000 0.000000 5714.285714 5714.285714
       8857402263953.974609 23.235000</row>
    <row>12.500000 12.500000 0.000000 50000.000000 0.000000 10428.571429 10428.571429
       29500685415381.710938 23.235000</row>
    <row>12.500000 12.500000 0.000000 50000.000000 0.000000 15142.857143 15142.857143
       62201107398616.796875 23.235000</row>
    <row>12.500000 12.500000 0.000000 50000.000000 0.000000 19857.142857 19857.142857
       106958668213659.218750 23.235000</row>
    <row>12.500000 12.500000 0.000000 50000.000000 0.000000 24571.428571 24571.428571
       163773367860509.031250 23.235000</row>
```

```
    <row>12.500000 12.500000 0.000000 50000.000000 0.000000 29285.714286 29285.714286
      232645206339166.125000 23.235000</row>
    <row>12.500000 12.500000 0.000000 50000.000000 0.000000 34000.000000 34000.000000
      313574183649630.562500 23.235000</row>
    <row>12.500000 12.500000 0.000000 50000.000000 0.000000 38714.285714 38714.285714
      406560299791902.437500 23.235000</row>
    <row>12.500000 12.500000 0.000000 50000.000000 0.000000 43428.571429 43428.571429
      511603554765981.625000 23.235000</row>
    <row>12.500000 12.500000 0.000000 50000.000000 0.000000 48142.857143 48142.857143
      628703948571868.250000 23.235000</row>
    <row>12.500000 12.500000 0.000000 50000.000000 0.000000 52857.14285752857.142857
      757861481209562.375000 23.235000</row>
    <row>12.500000 12.500000 0.000000 50000.000000 0.000000 57571.428571 57571.428571
      899076152679063.750000 23.235000</row>
    <row>12.500000 12.500000 0.000000 50000.000000 0.000000 62285.714286 62285.714286
      1052347962980372.250000 23.235000</row>
    <row>12.500000 12.500000 0.000000 50000.000000 0.000000 67000.000000 67000.000000
      1217676912113488.250000 23.235000</row>
    <row>12.500000 12.500000 0.000000 50000.000000 0.000000 71714.285714 71714.285714
      1395063000078411.500000 23.235000</row>
    <row>12.500000 12.500000 0.000000 50000.000000 0.000000 76428.571429 76428.571429
      1584506226875141.500000 23.235000</row>
    <row>12.500000 12.500000 0.000000 50000.000000 0.000000 81142.857143 81142.857143
      1786006592503679.500000 23.235000</row>
    <row>12.500000 12.500000 0.000000 50000.000000 0.000000 85857.142857 85857.142857
      1999564096964024.250000 23.235000</row>
    <row>12.500000 12.500000 0.000000 50000.000000 0.000000 90571.428571 90571.428571
      2225178740256177.000000 23.235000</row>
    <row>12.500000 12.500000 0.000000 50000.000000 0.000000 95285.714286 95285.714286
      2462850522380137.000000 23.235000</row>
    <row>12.500000 12.500000 0.000000 50000.000000 0.000000 100000.000000 100000.000000
      2712579443335903.500000 23.235000</row>
   </data>
  </result>
</results>
```


Figure 8-3. Sample RES .xml Output File Structure - Results Portion

11. RES Database Summary

The RES database ("genfit.db3") is a compilation of pre-calculated one-dimensional ANISN results and includes radiation dose data as a function of air density for neutrons, air produced secondary gammas, prompt gammas and gamma rate, free-field and internal Xray dose and dose rate, and fission heating in the primaries of several U.S. Navy re-entry bodies.

The RES database is an SQLite database which can be viewed using the DB Browser for SQLite (http://sqlitebrowser.org/), SQLiteManager (http://www.sqlabs.com/sqlitemanager.php) or similar tool. Table 9-1 describes each table in the database.

Table 9-1. RES Database Summary ("genfit.db3")		
Table: **APK**		
Purpose:	Contains an array of scaling data for gamma dose rate slope calculations.	
Fields:	Id	Unique APK record identifier. (not defined as a primary key)
	APK	APK data value. Real value; all real values allowed.
Table: **ASD**		
Purpose:	Contains an array of ASD data for Xray models used in RES calculations.	
Fields:	Id	Unique ASD record identifier (primary key).
	ASD	ASD data value. Real value; all real values allowed.
Table: **AtmosphereProfile**		
Purpose:	Contains density and integrated density by altitude for each air condition (which corresponds to the <atmosphere> element in the .xml input file (see Section 8. Input and Output Files).	
Fields:	Id	Unique atmosphere profile record identifier (primary key).
	AirConditionID	Identifier for the air condition. Currently, only "1" is supported.
	Altitude	Altitude. Real value; all real values allowed.
	IntegratedDensity	Integrated density by altitude. Real value; all real values allowed.
	Density	Density by altitude. Real value; all real values allowed.
Table: **DDT**		
Purpose:	Contains dose rate slope parameters.	
Fields:	Id	Unique DDT record identifier. (not defined as a primary key)
	DDT	DDT data value. Real value; all real values allowed.

Table 9-1. RES Database Summary ("genfit.db3")		
Table: **Devices**		
Purpose:	Contains device names and additional data for each device which is used in certain calculations within RES. Additional data includes: data on output scaling, component fractions, Xray rate pulse width data, yield dependence parameter for Xray pulses, number of component fractions, Xray specs, and blackbody energies. The device names correspond to the <primarydevice> and <secondarydevice> elements in the .xml input file.	
Fields:	Id	Unique weapon record identifier (primary key).
	Name	Name of the weapon. Text value of unlimited length. Examples: testweapon, SAP5000.
	XData1 … XData7	Output scaling data. Integer value; all integer values allowed.
	FRACA1 … FRACA4	Component fractions. Integer value; all integer values allowed.
	TPULSEA1 … TPULSEA4	Xray rate pulse width data. Integer value; all integer values allowed.
	TSDA	Yield dependence parameter for Xray pulses. Integer value; all integer values allowed.
	NFRACA	Number of component fractions (FRACA*). Integer value; all integer values allowed.
	EXA	Xray specs. Real value; all real values allowed.
	BBTA1 …BBTA4	Blackbody energy data. Real value; all real values allowed.
Table: **DoseKind**		
Purpose:	Contains the names of the dose options and the corresponding legacy identifier.	
Fields:	Id	Unique dose kind record identifier (primary key).
	Name	Name of the dose kind. Text value of unlimited length. Examples: Dose, Dose Rate, Dose Rate Slope, Fission Heating.
	LegacyID	Indicator of the corresponding legacy value. Integer value; all integer values allowed.
	Description	Description of the dose kind. Text value of unlimited length.

Table 9-1. RES Database Summary ("genfit.db3")		
Table: **Environment**		
Purpose:	Contains radiation dose data as a function of air density (Rhor) by device and environment options.	
Fields:	Id	Unique environment record identifier. (not defined as a primary key)
	DeviceId	Identifier of the device for the environment. Integer value which should correspond to a record in the Devices database table, although this isn't enforced (i.e., not defined as a foreign key).
	DoseKindId	Identifier of the dose kind for the environment. Integer value which should correspond to a record in the DoseKind database table, although this isn't enforced (i.e., not defined as a foreign key).
	KindEnvId	Identifier of the kind environment for the environment. Integer value which should correspond to a record in the KindEnvironment database table, although this isn't enforced (i.e., not defined as a foreign key)..
	ShldId	Identifier of the shield type for the environment. Integer value which should correspond to a record in the Shield database table, although this isn't enforced (i.e., not defined as a foreign key)..
	ParticleId	Identifier of the particle type for the kind environment. Integer value which should correspond to a record in the Particles database table, although this isn't enforced (i.e., not defined as a foreign key)..
	Rhor	Rhor value. Real value; all real values allowed.
	Data	Radiation dose value. Real value; all real values allowed.
Table: **KindEnvironment**		
Purpose:	Contains the names of the requested environment type. Environment types are dependent upon the dose kind (see DoseKind database table) and the particle type (see Particles database table). This corresponds to the <kindenv> element in the .xml input file.	
Fields:	Id	Unique kind environment record identifier (primary key).
	DoseKindId	Identifier of the kind environment for the particle. Integer value which should correspond to a record in the KindEnvironment database table, although this isn't enforced (i.e., not defined as a foreign key).

Table 9-1. RES Database Summary ("genfit.db3")		
	Name	Name of the kind environment. Text value of unlimited length. Examples: Total Number Fluence, Total Energy Fluence, 1-MeV-Equivalent Neutron Fluence, Ionizing Dose, Ionizing Dose Rate, Biological Tissue Dose Rems-Tis, Biological Tissue Dose Rads-Tis, Epithermal Neutron Fluence, ASTM 1 Mev-Equivalent Dose, Ionizing Dose Rate Slope, Fissions.
	ParticleId	Identifier of the particle type for the kind environment. Text value of unlimited length. Ideally will correspond to a record in the Particles database table, although this isn't enforced (i.e., not defined as a foreign key).
	Units	Units associated with the kind environment. Text value of unlimited length. Examples: particles/cm2, particles/cm2/s, particles/cm2/s2, MeV/cm2, MeV/cm2/s, neutrons/cm2, neutrons/cm2/s, cal/cm2, cal/cm2/s, Rad-Si.
Table: **Particles**		
Purpose:	Contains the names of the available particles.	
Fields:	Id	Unique particle type record identifier (primary key).
	Name	Name of the particle type. Text value of unlimited length. Examples: neutron, gamma, secondary gamma, and Xray.
Table: **Shield**		
Purpose:	Contains the names of the shields. This corresponds to the <ishld> element in the .xml input file, which specifies the name of the shield.	
Fields:	Id	Unique shield type record identifier (primary key).
	DoseKindID	Identifier of the dose kind for the shield. Integer value which should correspond to a record in the DoseKind database table, although this isn't enforced.
	KindEnvID	Identifier of the kind environment for the shield. Integer value which should correspond to a record in the KindEnvironment database table), although this isn't enforced.
	ParticleID	Identifier of the particle type for the shield. Integer value which should correspond to a record in the Particles database table, although this isn't enforced.
	Name	Name of the shield. Text value of unlimited length.
	Units	Units associated with the shield. Text value of unlimited length. Examples: n/cm2, rads/g.

Table 9-1. RES Database Summary ("genfit.db3")		
Table: **TDATA**		
Purpose:	Contains array of TDATA data.	
Fields:	Id	Unique TDATA record identifier (primary key).
	TDATA	Numeric TDATA value. Real value; all real values allowed.
Table: **XARRAY**		
Purpose:	Contains array of XARRAY indexing data for Xray models used in RES calculations.	
Fields:	Id	Unique Xarray record identifier (primary key).
	XARRAY	Numeric Xarray data value. Real value; all real values allowed.
Table: **sqlite_sequence**		
Purpose:	TBD	
Fields:	name	TBD
	seq	TBD

11.1. Data Sources

The database includes transported results for all threat sources included in the NWM80 and NWM21 Redbooks. The RES database was generated with the ANISN transport code. ANISN is a one-dimensional (1D) Discrete Ordinates (DO) code written by Oak Ridge National Laboratory (ORNL). To generate the database, individual ANISN air-transport calculations were performed for all neutron spectra, gamma spectra, and Xray spectra in the NWM80 and NWM21 Redbooks. In addition, pulse width data found in the Redbooks is used to calculate dose rates at each RHOR point. The ANISN output results provide particle fluence and energy spectrum at each point in a large grid of air densities (or RHORs) ranging from vacuum density (0.0 g/cm2) to 180 g/cm2 of air.

Another specialized code, ANIFIT, extends the air density database out to 300 g/cm2 of air. Using this fluence and energy spectrum at each RHOR point, a collection of intermediate codes folds the transported energy spectrum at each RHOR with an energy dependent response function. Note that the folding operations performed by the intermediate codes remove the energy dependence and provide un-normalized doses as a function of air density. It is these doses and dose rates as a function of RHOR that are found in the RES database. RES uses the principle of RHOR scaling to calculate dose at various altitudes, based on an internal calculation of RHOR for the geometry specified.

12. Messages

The following warnings and errors are returned to the user, though the use of the RES GUI. These errors include those covering user inputs into the GUI and processing errors occurring in the RES C++ application which are returned to the GUI. Additional warnings/errors may be displayed on pop-up message box which are self-explanatory and are not included here.

Section 10.1 lists warning and other messages. Section 10.2 lists error messages. Section 10.3 lists messages generated due to internal GUI mishaps. There are no user actions associated with these messages, however, if any of these messages are displayed, contact the RES developer. In the future, error codes will be available through the **Help | Error Codes** menu item. Currently, this menu item is not implemented.

12.1. Warning Messages

Warning messages typically do not stop the execution of GENFIT or the RES GUI. You can respond to the message by clicking the **OK** or **Yes** button included with the message and execution will continue.

Table 10-1. Warning Messages	
A field has been detected as blank. Default inputs will now be built. Hit ok to build default. Cancel otherwise to fill in field.	
Cause:	One of the following input fields on the RES GUI was not filled in or selected by the user: Primary Yield, Secondary Yield, Height of Burst, Angle, Minimum Value, Maximum Value, or Number of Steps. Note that if the field is not enabled, it is not required and does not need to be filled in.
Correction:	The simulation can still be created/saved using default simulation values (see Section 5. Simulations). Hit the OK button on the message box to use the default values. Otherwise, click the Cancel button and fill in any empty text field or selection boxes and try saving the simulation again.
An output file with this name exists. Use the same file name?	
Cause:	Execution for the selected simulation has already been completed and an output file exists.
Correction:	Click the Yes button to continue execution or click the No button to select a new filename for the results.
Are you sure you want to delete this simulation?	
Cause:	This message should never be displayed. The RES GUI no longer supports deletion of simulations.
Correction:	NA

Table 10-1. Warning Messages	
Current simulation will be cleared in order to create new data. Is this okay?	
Cause:	The New button was clicked and fields on the GUI have data in them. This is just an indication that the values displayed will be cleared.
Correction:	Click the OK button to continue with creating a new simulation. Otherwise, click the Cancel button to return to the current simulation.
No simulation is selected. Defaulting to first simulation output.	
Cause:	The View Output or View Graph Output button was clicked but there is no simulation selected in the Simulations area. Output is displayed for the first simulation listed in the Simulations area.
Correction:	Make sure you select the desired simulation in the Simulations area before clicking the View Output or View Graph Output button.
RunType ENVHOB requires that you have more than one environment to run.	
Cause:	Only one environment is defined for the selected simulation and the Run Type for the selected simulation is set to ENVHOB.
Correction:	Define additional environments for the selected simulation or change the RunType for the selected simulation.

12.2. Error Messages

Error messages typically cause the GENFIT execution to stop. Error messages can be simulation-related, inputs-related, environment-related, database-related, or they can be general errors.

12.2.1. Simulations

Table 10-2. Simulations Errors	
No run can be found with this simulation name. Please execute and try again.	
Cause:	
Correction:	
Please select a simulation to save.	
Cause:	The Save button before a simulation was selected (in the Simulations List). No simulations are saved.
Correction:	Make sure a simulation is selected before clicking the Save button.
Please select a simulation to execute.	

Table 10-2. Simulations Errors	
Cause:	The Execute button was clicked without at least one simulation selected in the Simulations List.
Correction:	Make sure there is a least one simulation selected before clicking the Execute button.
Simulation must have at least one environment.	
Cause:	There are no environments defined for the simulation executing.
Correction:	Make sure at least one environment is defined.
Simulation must have at least one field.	
Cause:	
Correction:	

12.2.2. Inputs

Table 10-3. Inputs Errors	
A field on the input tab has an incorrect value. Please correct and try again.	
Cause:	The value entered for a field on the Inputs tab of the RES Interface GUI is not valid. This is detected when attempting to save a simulation.
Correction:	Review all data entered in all fields on the Inputs tab of the RES Interface GUI. Correct if necessary and attempt to save the simulation again.
"Dose Kind" is not an available Dose Kind	
Cause:	The input "Dose Kind" is not available in the database.
Correction:	Make sure to pick a Dose Kind listed in the DoseKind table in the database.
"Kind Environment" is not an available Response Type	
Cause:	The input "Kind Environment" is not available in the database
Correction:	Make sure to pick a Response Type listed in the KindEnvironment table in the database.
"RunKind" is not an available Run Type	
Cause:	The input Run Type is not available.
Correction:	Select one of the following Run Types: ENVRNG, PI4RHOR, FITRNG, FITCON, FITYLD, FITHOB, ENVHOB, ENVHOB2, XENVRNG

12.2.3. Environments

Table 10-4. Environments Errors	
A field on the environment tab has an incorrect value. Please correct and try again.	
Cause:	The value entered for a field on the Environment tab of the RES Interface GUI is not valid. This is detected when attempting to save a simulation.
Correction:	Review all data entered in all fields on the Environment tab of the RES Interface GUI. Correct if necessary and attempt to save the simulation again.
Balanced ratio must have a value.	
Cause:	The Balanced Environments checkbox is checked but there is no value in the Balanced Ratio text box.
Correction:	If the Balanced Environments checkbox is checked a value is required to be in the Balanced Ratio text box. Either enter a Balanced Ratio value or uncheck the Balanced Environments checkbox.
Constraint Value cannot be empty.	
Cause:	The Constraint Value text box was empty when the Update button was clicked. Constraint values are required.
Correction:	Enter a value in the Constraint Value text box before clicking the Update button.
Environment must have a constraint value	
Cause:	The Constraint Value text box was empty when the Update button was clicked. Constraint values are required.
Correction:	Enter a value in the Constraint Value text box before clicking the Update button.
Environment must have a name	
Cause:	A new environment is being added (or an existing environment is being edited) and the Name field on the Environment tab was left blank.
Correction:	Enter a value in the Name field.
No particle type selected for environment:	
Cause:	None of the particle types are selected (all false) for the specified environment.
Correction:	Select at least one particle type.

12.2.4. Database

Table 10-5. Database Errors	
CAtmosphere::readDatabase: …	
Cause:	An error occurred while reading the AtmosphereProfile table in the database.
Correction:	Refer to the description of the AtmosphereProfile table in Section 9. Make sure the table in your database conforms to requirements for each field in the table.
CDevice::getDeviceNames: …	
Cause:	An error occurred while reading the Devices table in the database.
Correction:	Refer to the description of the Devices table in Section 9. Make sure the table in your database conforms to requirements for each field in the table.
CDevice::readBbta: …	
Cause:	An error occurred while reading BBTA from the Devices table in the database for the specified device.
Correction:	Refer to the description of the Devices table in Section 9. Make sure the table in your database includes the BBTA field and that the value is valid.
CDevice::readExa: …	
Cause:	An error occurred while reading EXA from the Devices table in the database for the specified device.
Correction:	Refer to the description of the Devices table in Section 9. Make sure the table in your database includes the EXA field and that the value is valid.
CDevice::readFraca: …	
Cause:	An error occurred while reading FRACA from the Devices table in the database for the specified device.
Correction:	Refer to the description of the Devices table in Section 9. Make sure the table in your database includes the FRACA field and that the value is valid.
CDevice::readNfraca: …	
Cause:	An error occurred while reading NFRACA from the Devices table in the database for the specified device.
Correction:	Refer to the description of the Devices table in Section 9. Make sure the table in your database includes the NFRACA field and that the value is valid.
CDevice::readTdata: …	
Cause:	An error occurred while reading the TDATA table in the database.
Correction:	Refer to the description of the TDATA table in Section 9. Make sure the table in your database conforms to requirements for each field in the table.

Table 10-5. Database Errors	
CDevice::readTpulsea: …	
Cause:	An error occurred while reading TPULSEA from the Devices table in the database for the specified device.
Correction:	Refer to the description of the Devices table in Section 9. Make sure the table in your database includes the TPULSEA field and that the value is valid.
CDevice::readTsda: …	
Cause:	An error occurred while reading TSDA from the Devices table in the database for the specified device.
Correction:	Refer to the description of the Devices table in Section 9. Make sure the table in your database includes the TSDA field and that the value is valid.
CDevice::readXdata: …	
Cause:	An error occurred while reading XData from the Devices table in the database for the specified device.
Correction:	Refer to the description of the Devices table in Section 9. Make sure the table in your database includes the XData field and that the value is valid.
CEnvironment::readApk: …	
Cause:	An error occurred while reading the APK table in the database.
Correction:	Refer to the description of the APK table in Section 9. Make sure the table in your database conforms to requirements for each field in the table.
CEnvironment::readDatabase: …	
Cause:	An error occurred while reading the Environment table in the database.
Correction:	Refer to the description of the Environment table in Section 9. Make sure the table in your database conforms to requirements for each field in the table.
CEnvironment::readDdt: …	
Cause:	An error occurred while reading the DDT table in the database.
Correction:	Refer to the description of the DDT table in Section 9. Make sure the table in your database conforms to requirements for each field in the table.
CEnvironment::getKindEnvNames: …	
Cause:	An error occurred while reading the KindEnvironment table in the database.
Correction:	Refer to the description of the KindEnvironment table in Section 9. Make sure the table in your database conforms to requirements for each field in the table.

Table 10-5. Database Errors	
CEnvironment::getIshldNames: …	
Cause:	An error occurred while reading the Shield table in the database.
Correction:	Refer to the description of the Shield table in Section 9. Make sure the table in your database conforms to requirements for each field in the table.
CEnvironment::readXarray: …	
Cause:	An error occurred while reading the XARRAY table in the database.
Correction:	Refer to the description of the XARRAY table in Section 9. Make sure the table in your database conforms to requirements for each field in the table.
CGenfit::getUnits: …	
Cause:	An error occurred while reading Units from the KindEnvironment table in the database.
Correction:	Refer to the description of the KindEnvironment table in Section 9. Make sure the table in your database includes the Units field and that the value is valid.
CGenfit::readAsd: …	
Cause:	An error occurred while reading the ASD table in the database.
Correction:	Refer to the description of the ASD table in Section 9. Make sure the table in your database conforms to requirements for each field in the table.
"Device" has no Environment data for Dose Kind: "DoseKind" Response Type: "KindEnv" and In-Body Transport "Ishld" for Xrays	
Cause:	The database does not contain environment data for the input Dose Kind, Response Type, and In-Body Transport for Xrays for the input device.
Correction:	Choose a Dose Kind, Response Type, In-Body Transport, and Particle Type that exists in the Environment table in the database for the chosen device.
"Device" has no Environment data for Dose Kind: "DoseKind" Response Type: "KindEnv" for "Particle Type"	
Cause:	The database does not contain environment data for the input Dose Kind, Response Type, for the particle type and input device.
Correction:	Choose a Dose Kind, Response Type, and Particle Type that exists in the Environment table in the database for the chosen device.

Table 10-5. Database Errors	
No Environment data for Dose Kind: “DoseKind” Response Type: “KindEnv” and In-Body Transport “Ishld”	
Cause:	The database does not contain environment data for the input Dose Kind, Response Type, and In-Body Transport for the input device.
Correction:	Choose a Dose Kind, Response Type, In-Body Transport, and Particle Type that exists in the Environment table in the database for the chosen Device.
Primary device: “Device” is not an available Device	
Cause:	The input primary device name “Device” is not available in the database.
Correction:	Make sure to pick a device name listed in the Devices table in the database.
Secondary device: “Device” is not an available Device	
Cause:	The input secondary device name “Device” is not available in the database.
Correction:	Make sure to pick a device name listed in the Devices table in the database.

12.2.5. Miscellaneous

Table 10-6. Miscellaneous Errors	
Conversion is not implemented for desired 'from' TemperatureType	
Cause:	The specified temperature units are not available.
Correction:	Choose one of the following temperature units: F, R, K, C.
One of the X data values is 0. Cannot take log of 0.	
Cause:	TBD
Correction:	TBD
One of the Y data values is 0. Cannot take log of 0.	
Cause:	TBD
Correction:	TBD
Please select a file to view.	
Cause:	An attempt to view results was made with a results file (output file) being selected.
Correction:	This is an internal error. There should be no way a user could generate this error. Contact an RES developer.

Table 10-6. Miscellaneous Errors	
Problem with xml file	
Cause:	A problem occurred while reading or writing to the xml file.
Correction:	TBD
Start Error	
Cause:	An internal error has occurred. The RES GUI application was unable to successfully start.
Correction:	Try to start the application again. If this error persists, contact RES developers.
Xml File Does Not Exist	
Cause:	The xml input file name passed to RES does not exist.
Correction:	Specify an existing xml input file. where?
Unknown Acceleration to convert to/from string	
Cause:	The specified acceleration units are not available.
Correction:	Choose one of the following acceleration units: mil/s^2, inch/s^2, ft/s^2, yard/s^2, mile/s^2, micrometer/s^2, mm/s^2, cm/s^2, m/s^2, km/s^2.
Unknown AirThickness to convert to/from string	
Cause:	The specified air thickness units are not available.
Correction:	Choose one of the following air thickness units: g/cm^2, kg/cm^2, kg/m^2, slug/ft^2.
Unknown Angle to convert to/from string	
Cause:	The specified angle units are not available.
Correction:	Choose one of the following angle units: turn, rad, deg.
Unknown Area to convert to/from string	
Cause:	The specified area units are not available.
Correction:	Choose one of the following area units: mil2, inch2, ft2, yard2, mile2, micrometer2, mm2, cm2, m2, km2.
Unknown Density to convert to/from string	
Cause:	The specified density units are not available.
Correction:	Choose one of the following density units: g/cm^3, kg/cm^3, kg/m^3, slug/ft^3.
Unknown Length to convert to/from string	
Cause:	The specified length units are not available.
Correction:	Choose one of the following length units: mil, inch, ft, yard, mile, micrometer, mm, cm, m, km.

Table 10-6. Miscellaneous Errors	
Unknown Mass to convert to/from string	
Cause:	The specified mass units are not available.
Correction:	Choose one of the following mass units: oz, lb, mg, g, kg.
Unknown Pressure to convert to/from string	
Cause:	The specified pressure units are not available.
Correction:	Choose one of the following pressure units: Pa, g/cm^2, dynes/cm^2, bar, atm, psi, psf.
Unknown TemperatureType to convert to string	
Cause:	The specified temperature units are not available.
Correction:	Choose one of the following temperature units: F, R, K, C.
Unknown Time to convert to/from string	
Cause:	The specified time units are not available.
Correction:	Choose one of the following time units: sec, milsec, micsec, nanosec, picosec.
Unknown Velocity to convert to/from string	
Cause:	The specified velocity units are not available.
Correction:	Choose one of the following velocity units: mil/s, inch/s, ft/s, yard/s, mile/s, micrometer/s, mm/s, cm/s, m/s, km/s.
Unknown Volume to convert to/from string	
Cause:	The specified volume units are not available.
Correction:	Choose one of the following volume units: mil3, inch3, ft3, yard3, mile3, micrometer3, mm3, cm3, m3, km3.
Unknown Yield to convert to/from string	
Cause:	The specified yield units are not available.
Correction:	Choose one of the following yield units: t, kt, Mt, Gt.

12.1. Internal Messages

If any of the messages in Table 10-7 are displayed while operating the RES GUI, contact an RES developer. There are no user actions available to correct these errors.

Table 10-7. Internal RES GUI Messages

Error Type	Message
Updating (or displaying) environments	No selected environment to update. Please select an environment.
Scatter plot generation	One of the X data values is 0. Cannot take log of 0.
Scatter plot generation	One of the Y data values is 0. Cannot take log of 0.
Starting the GUI	Could not load library GENFIT. Could not load library with explicit path GENFIT.dll
Database Errors (should only be seen in the log)	Failed to start connecting to SQLite database. Failed to close SQLite database connection. Unable to retrieve <data type> data from SQLite due to: <reason>.