Correlator Application User Guide

Peter Blum, 21 November 2016

1. Introduction

The Correlator application is a user application that facilitates stratigraphic correlation of cores from multiple holes at a drill site, by depth shifting cores to construct a core composite depth below sea floor (CCSF) depth scale, and splicing selected core intervals to construct the most complete stratigraphy possible at a site, based on high-resolution core logging data.

On the *JOIDES Resolution (JR)*, where stratigraphic correlation has become a standard operating procedure over the past two decades, additional stratigraphic correlation support (SCORS) applications interact with the JRSO Laboratory Information Management System (LIMS) and further facilitate the process for the user (Fig. 1-1):

- SCORS Downloader: Allows user to download core logging data from the LIMS database, offering filters and features to make iterative downloading and appending of data during the coring process more efficient.

- SCORS Uploader: Allows user to upload affine table (depth offsets for cores) and splice interval tables to the expedition LIMS database. LIMS internal computations create a CCSF depth scale that can be applied to any data in LIMS.

- SpliceFileFixer: Allows user to check if the splice intervals generated by an external application, such as Correlator, are consistent with the core and section information in the LIMS registry.

- LORE (LIMS online reports): Reports allow user to retrieve (A) Lists of existing affine tables and splice interval tables, with links to uploaded user files; (B) detailed, LIMS-computed affine and splice interval tables; (C) CCSF (alternate) depths for any data set in the LIMS; and (C) data sets by selected splice.

These LIMS applications are described in a separate user guide because the Correlator application does not directly interact with the LIMS and can be used with data generated elsewhere, as long as some basic input file specifications are honored. Correlator output is independent of the LIMS as well, however, affine tables and splice interval tables must follow specifications to ensure they can be loaded to the LIMS.

The reasons for Correlator being decoupled from the LIMS infrastructure are both historical and practical: the Correlator application began as the third-party "Splicer" program in the early 1990ies; and other programs have been, and can be used as well for shifting and splicing cores. Following the "Splicer" era of the Ocean Drilling Program (ODP; 1983-2003), Correlator was further developed as a third party tool at the LDEO, as part of the Corewall suite of software application. When that effort essentially ended ten years later, and *JR* user change requests for Correlator persisted, a service agreement between the current main supporter of Corewall (CSDCO, University of Minnesota) and the JRSO was eventually established (August 2015). Under that agreement, a small team directs and implements

user change requests, and ensures compatibility with the LIMS, with a modest annual budget allocated at the JRSO for ongoing programming support. A first task set focusing on the robust and accurate definition of splice intervals was completed in 2016. A second task set focusing on enhanced depth shifting options will be completed in 2017.

Figure 1-1: Overview of SCORS tools and data flow and how they relate to the Correlator application. Red shapes are LIMS applications extracting and/or loading data from/to the LIMS database. Yellow shapes are data files.
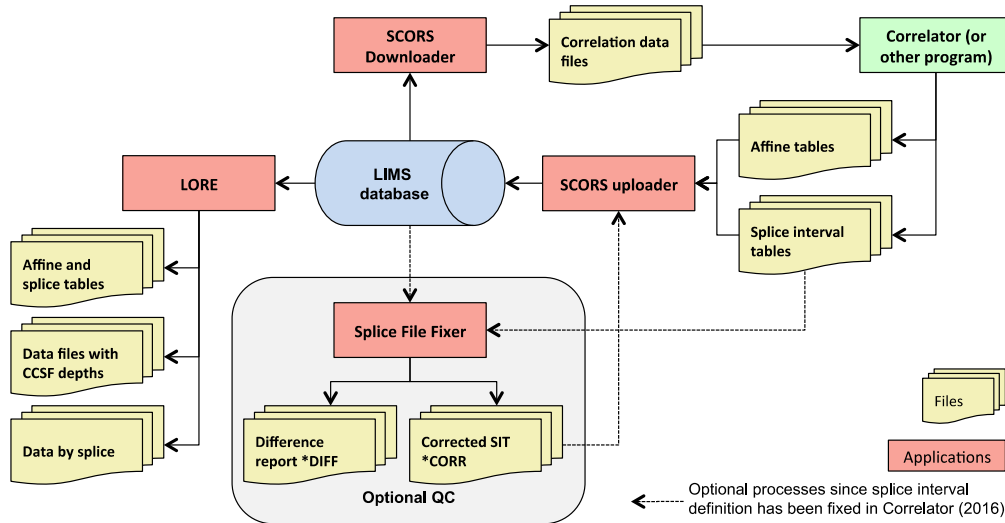
Users *cannot* upload affine and splice tables to the LIMS on shore because implementing the required "sandbox" is currently too costly. However, that part of the process is quick and simply compared to learning the Correlator applications.

2. Process overview

Creating affine table and splice interval table files (the *correlation files* in short) is the essence of the *affine-based stratigraphic correlation process*, and the primary task of the stratigraphic correlation specialist (SCS) aboard the *JR*. Two sub-tasks must be completed in sequence:

a) Depth shifting of cores from multiple holes in a way that optimizes correlation of stratigraphic features across the holes.
b) Definition of splice intervals that result in the most complete stratigraphic representation possible.

Construction of the composite depth scale and the selection of splice intervals have a significantly subjective aspect. Scientific parties usually place a large degree of confidence into the shipboard SCS to accomplish these tasks to the satisfaction of the scientists, who use the splice for integrated subsampling and postcruise analysis of the cores. The basic rules, terminology and specifications provided here aim at providing a robust depth scale and splice support structure while at the same time strengthening correlation specialists' confidence in serving the science party and the science parties' confidence in the methods and the reliability of the results.

The affine-based correlation and splicing process by definition creates a stratigraphic section from a selection of core intervals and therefore leaves *non-splice intervals* in most cores from the holes participating in the CCSF depth scale. Stratigraphic features in the non-splice intervals of adjacent holes do not have the exact same depth than corresponding features in the splice at a cm-dm scale, even though they are at the same CCSF scale, because cores are stretched and squeezed during recovery, or because the stratigraphic architecture is not a perfect layer cake. Non-splice intervals can be mapped separately to the splice using a general depth mapping process. This process is currently being examined and defined to determine if IODP should implement SCORS infrastructure in the future to support it.

Depth shifting of cores and the affine table

Stratigraphic correlation specialists define a core composite depth below seafloor (CCSF) depth scale in the form of an *affine table* (example in Table 2-1; specifications in Appendix 1). Using different types of high-resolution data sets obtained from the cores recovered in multiple adjacent holes, each core is shifted to optimize alignment of stratigraphic features across the holes, assuming that the stratigraphy is a perfect "layer cake" across the holes. Even in cases where that assumption is true, in general not all stratigraphic features in two cores can be perfectly aligned because the cores are stretched and squeezed during the coring process. The SCS has to decide in which part of the core to establish the best alignment of features. As a rule of thumb, the alignment of features should be best where the SCS plans to establish a splice tie point, i.e., in the upper and lower parts of core intervals that will be used in the splice.

The affine table resulting from the shifting process is a list of all cores from the participating holes, each with a cumulative offset (m) relative to the default core depth below seafloor (CSF-A) depth scale, whereby:

$$CCSF\_depth = CSF\text{-}A\_depth + cumulative\_offset$$

The cumulative offsets are usually positive (downhole direction), range from centimeters to tens of meters, and generally increase with depth.

Table 2-1. Affine table example, shown in spreadsheet view to facilitate view of content. The file must be in CSV text format for upload to the LIMS. Specifications for each column are given in Appendix 1.

Site	Hole	Core	Core type	Depth CSF-A (m)	Depth CCSF-A (m)	Cumulative offset (m)	Differential offset (m)	Growth rate	Shift type	Data type used	Quality comment
U1391	A	1	H	0	0	0			ANCHOR		
U1391	A	2	H	4.1	5.05	0.95	0.95	1.232	TIE		
U1391	A	3	H	13.6	15.64	2.04	1.09	1.15	TIE		
U1391	A	4	H	23.1	25.68	2.58	0.54	1.112	TIE		
U1391	A	5	H	32.6	35.63	3.03	0.45	1.093	TIE		
U1391	A	6	H	42.1	45.01	2.91	-0.12	1.069	TIE		

3

| U1391 | A | 7 | H | 51.6 | 55.36 | 3.76 | 0.85 | 1.073 | TIE | | |
| U1391 | A | 8 | H | 61.1 | 65.78 | 4.68 | 0.92 | 1.077 | TIE | | |

Four methods are used to define core offsets and the applicable method can optionally be noted in the affine table (also see Table 2-2):

- *ANCHOR* - the top of one core from one of the participating holes is correlated to, or interpreted as, the seafloor reference. This is in general the only core not shifted relative to the CSF-A depth scale (zero offset).

- *TIE* - a core is shifted to align one or more stratigraphic features with those in a core from an adjacent hole that has (in general) already been shifted and is now considered the reference. If specific tie points are selected that link a specific stratigraphic feature between the two cores, the tie points have by definition the same CCSF-A depth. Any other stratigraphic feature may not have the exact same CCSF depth in the two cores because of physical squeezing and stretching of cores during drilling and recovery, or a stratigraphic architecture that is not a perfect layer cake.

- *APPEND* - features cannot be correlated between cores, and a core is shifted by appending the top of the cored interval to the bottom of the cored interval of the previous core in the same hole, as if no gap or overlap existed at the CSF-A scale. The appended core has the same cumulative offset as the previous core (zero differential offset).

- *SET* - features in a core cannot be tied to those in a core from an adjacent hole. A depth shift is applied based on some assumptions, most commonly the CCSF/CSF-A growth rate of the previous core in the same hole. This method is recommended over the APPEND option because it is more realistic, particularly in depth intervals where cores are expanding significantly.

Table 2-2. Shift types

Shift type	Shift method	Comment
ANCHOR	Tie to seafloor (typically top of core, but not necessarily)	Only one core per CCSF scale.
TIE	Correlative tie	Most common and desirable.
APPEND	Same cumulative offset as previous core in same hole (zero differential offset)	Used to be common, will rarely be applied compared the SET method.
SET	Set any offset based on information such as growth rate	Necessary if TIE is not possible; generally better option than APPEND.

In addition to the shift type, users can optionally indicate the data types used and the general quality of the depth shift for each core in the last two comment columns of the affine table (Table 2-1). Note that comments cannot contain commas because of the use of the CSV format, where commas are column delimiters. The SCORS Uploader will check and reject a correlation file if more commas exist than expected.

Short cores may not have had correlation data acquired, and data from cores disturbed or damaged by the drilling process may have been filtered during download with the SCORS Downloader. Those cores will not "appear" in the correlation data set and therefore not be used in the depth shifting process. Depending on the correlation tool used, they may not be present in the affine table unless manually added before uploading to the LIMS using the

4

SCORS Uploader (see below). Correlation specialists need to be aware that if cores are not present in the affine upload file, they will not be included in the CCSF depth scale and therefore be missing in data reports. The uploader will check for the presence of all cores, and if one or more are missing, will prompt the user to add them to the affine table, or ignore them and be responsible for the consequences.

Core shifting and the affine table should be complete before splicing begins. If cumulative offsets of cores are adjusted after splice intervals for those cores have been defined, the splice intervals need to be revisited to ensure that no unintended gaps or overlaps persist in the splice.

Splicing

After the cores of adjacent holes have been shifted into a CCSF depth scale, the SCS define intervals in the depth shifted cores that will constitute the splice for a site, representing the most continuous section and most complete stratigraphic representation possible with the recovered cores.

The splice tie-point concept (deprecated)

The traditional process of defining the splice consists of using splice tie points, essentially tie lines that splice the bottoms of upper intervals with the tops of lower intervals at exactly the same CCSF depth. That process results in a *splice tie point table (STPT)* (Table 2-3), as published in many ODP and IODP Proceedings volumes. Although the *STPT* used to be the standard expression of a splice, it turned out to be inadequate when splices were discontinuous, i.e., all intervals could not be tied to one another because of coring gaps, drilling disturbance or inadequate data records. When scientists attempted to integrate the segments of a discontinuous splice (often referred to as "floating splices") to create a "complete but discontinuous splice" as the overall most useful stratigraphic framework for a site, they had to "fake" interval boundaries as ties in the STPT. Even in a continuous splice, the first and last interval could not be adequately defined in the STPT. This led to the computational routines in the IODP database to return unexpected and unpredictable results. Therefore, in the current implementation of SCORS, users can optionally upload their *STPT* files, but they are not used by the database internal computations.

Table 2-3. Example format of a splice tie-point table.

Site	Hole	Core No	Section Type	Section No	Offset	CSF-A	CCSF	TIE/APPEND	Site	Hole	Core No	Section Type	Section No	Offset	CSF-A	CCSF
U1446	C	1	H	6	49	7.5	7.5	TIE	U1446	A	2	H	3	55.5	7.855	7.5
U1446	A	2	H	7	19.8	13.298	12.944	TIE	U1446	C	2	H	4	21.4	12.444	12.944
U1446	C	2	H	7	35.9	16.919	17.419	TIE	U1446	A	3	H	2	136.1	16.661	17.419
U1446	A	3	H	6	111.9	22.419	23.177	TIE	U1446	C	3	H	4	54.5	22.385	23.177
U1446	C	3	H	6	84.4	25.594	26.387	TIE	U1446	A	4	H	2	66.5	25.465	26.387
U1446	A	4	H	6	9.3	30.893	31.815	TIE	U1446	C	4	H	3	25.8	30.118	31.815
U1446	C	4	H	7	44.8	36.158	37.855	TIE	U1446	A	5	H	3	68.6	36.416	37.855
U1446	A	5	H	7	21.7	41.787	43.226	TIE	U1446	C	5	H	4	28	41.15	43.226
U1446	C	5	H	7	14.5	45.545	47.621	TIE	U1446	A	6	H	2	93.2	44.682	47.621
U1446	A	6	H	5	33.3	47.513	50.452	TIE	U1446	C	6	H	1	141.3	47.313	50.452

The splice interval concept

A more generic definition of a splice as a collection of splice intervals rather than tie points eliminates the restrictions of a *STPT*. Splice intervals are defined by the core (from a site and hole) that contains the interval, and the CCSF depths of the top and bottom boundary. This process results in the *splice interval table (SIT)* (example in Table 2-4; specifications in Appendix 2). Each splice interval is from one core only, however, more than one splice interval can theoretically be defined from the same core. The *SIT* has replaced the *STPT* as the correlation specialist's main deliverable, along with the affine table.

The SIT format also includes the section and offset for top and bottom boundaries, because those ultimately matter when investigators take sub-samples from the cores along the splice. We learned the hard way that a third application may not always compute section and offset correctly and therefore created the SCORS-QA applications to rectify that potential problem (see section 4).

Table 2-4. Splice interval table file example, given in spreadsheet view to facilitate view of content. The file must be in CSV format for upload to LIMS. Specifications for each column are given in Appendix 3.

Site	Hole	Core	Type	Top section	Top offset (cm)	Top depth CSF-A (m)	Top depth CCSF (m)	Bottom section	Bottom offset (cm)	Bottom depth CSF-A (m)	Bottom depth CCSF (m)	Splice type	Data used	Quality comment
U1391	A	1	H	1	0	0	0	2	56.88	2.07	2.07	CORE-TIE		
U1391	B	1	H	1	127.5	1.28	2.07	4	54.8	5.06	5.85	TIE-TIE		
U1391	A	2	H	1	79.73	4.9	5.85	6	83.21	12.43	13.38	TIE-TIE		
U1391	B	2	H	2	6.73	11.07	13.38	5	11.37	15.61	17.92	TIE-TIE		
U1391	A	3	H	2	77.82	15.88	17.92	7	46.44	22.87	24.91	TIE-TIE		
U1391	B	3	H	3	61.44	22.61	24.91	6	122.5	27.73	30.03	TIE-TIE		
U1391	A	4	H	3	135.46	27.45	30.03	5	147.81	30.58	33.16	TIE-TIE		
U1391	B	4	H	2	16.77	30.17	33.16	7	22.14	37.58	40.57	TIE-TIE		
U1391	A	5	H	4	43.77	37.54	40.57	6	81.45	40.91	43.94	TIE-TIE		
U1391	B	5	H	2	91.7	40.42	43.94	3	145.86	42.46	45.98	TIE-TIE		
U1391	A	6	H	1	97.37	43.07	45.98	6	123.27	50.88	53.79	TIE-TIE		
U1391	B	6	H	3	70.4	51.2	53.79	6	55.03	55.45	58.04	TIE-TIE		

Top and bottom of a splice interval can be determined in three ways:
- *TIE* - A correlative stratigraphic features in two cores from two different holes occurs at the same CCSF depths in both cores and is selected as a tie point (most common and preferred method);
- *CORE* - Tops and/or bottoms of cores are used to define the splice interval because ties do not exist. This is a typical scenario when the core was shifted using the ANCHOR, APPEND or SET method.
- *TRUNC* - In the absence of ties, parts of cores may be truncated (omitted from the splice interval) based on additional information such as drilling disturbance. This is a possible scenario when the core was shifted using the SET, APPEND, or rarely the ANCHOR method.

6

> ➢ Note: truncation is implicit if data from a disturbed core interval were culled during correlation data download (see "Download correlation data"), i.e., the SCS will not "see" that disturbed interval in the data.

This results in nine top-bottom combinations, or *Splice interval types* (Table 2-5), which can optionally be denoted in the *SIT*.

Table 2-5. Splice interval types.

Splice interval type	Top	Bottom	Comment	Likely core shift type*
TIE-TIE	Correlative tie	Correlative tie	Most common case	TIE
TIE-CORE	Correlative tie	Core bottom	Typical last interval	
TIE-TRUNC	Correlative tie	Truncation	Rare	
CORE-TIE	Core top	Correlative tie	Typical floating interval	ANCHOR, APPEND, SET
CORE-CORE	Core top	Core bottom	Less typical floating int.	
CORE-TRUNC	Core top	Truncation	Rare	
TRUNC-TIE	Truncation	Correlative tie	Rare	SET, APPEND, ANCHOR
TRUNC-CORE	Truncation	Core bottom	Rare	
TRUNC-TRUNC	Truncation	Truncation	Rare	

3. Software installation

Correlator is available from the Corewall web site, however, the JRSO cannot guarantee that the latest version a user may find at that site is the latest one we are using on the JR (and that is described here). The most recent changes implemented through a contract between the JRSO and UMN (currently CorrelatorMac_2.1_rc2) will always be available here:

- Find the Correlator application on the following JRSO web sites:
  - ➢ Ship: (Don't try this on shore….!) http://web.ship.iodp.tamu.edu/apps/
  - ➢ Shore production: http://web.iodp.tamu.edu/apps/
  - ➢ Shore test: (only available to IODP staff) http://short.iodp.tamu.edu/apps/
- Follow your browser and operating system's instructions to install and launch the application.

Correlator installs a directory for its internal database at a default location that looks something like this:

        Documents [or other system folder]
           Correlator
                2.1 [or similar version number]
                    db
                    default.cfg
                    log
                    temp

When user imports correlation data from a directory of choice, Correlator indexes the data and places them in this directory for internal use. User doesn't have to be aware of this directory but can find the path at:

- File>Data Repository Path

4. Basic functions of Correlator

Correlator operates within a single window that can be toggled between the *Data Manager* view and the *Display* view (Fig. 4-1). To navigate between these views, use the top button on the floating toolbar, or use the View menu. The tool bar is always available unless turned off in the Preferences tab to the right of the window. The entire application window can be expanded as much as available monitor space permits.

Figure 4-1. The two main views in the Correlator main window.

A. Data Manager
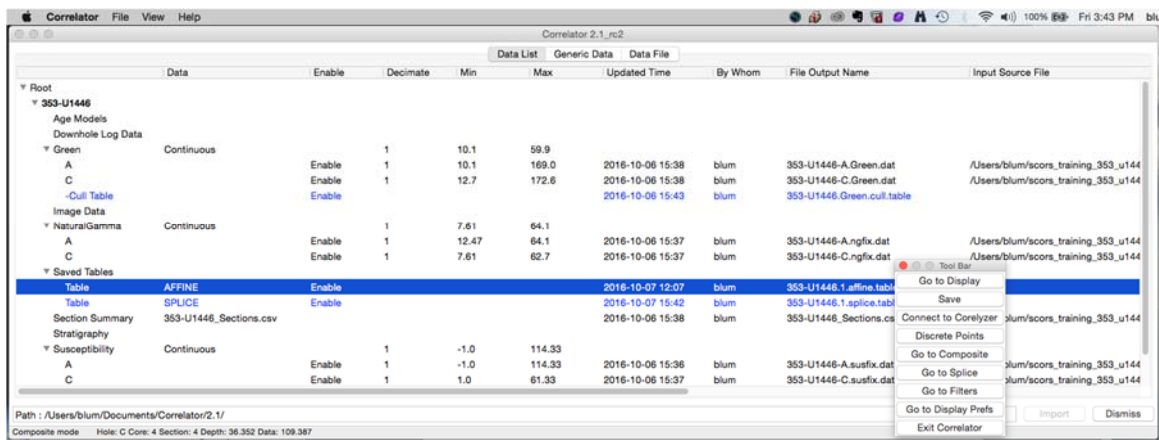
B. Display
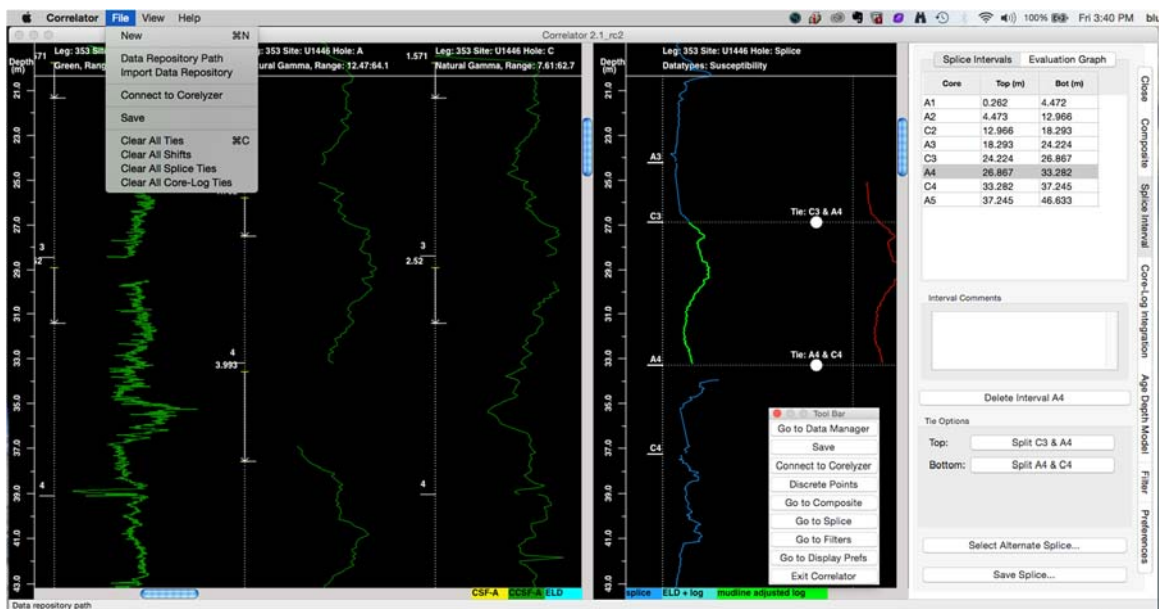
The *Data Manager* view has three functional tabs across the top:

- The *Data List* tab lists the files imported into Correlator and provides the main functions for managing the data in Correlator. The data list items are organized in a tree structure by site, data type, and hole.
- The *Generic Data* tab displays data from files being imported when such an import is triggered in the *Data List* tab.
- The *Data File* tab function is to display any data set listed in the *Data List* tab.

The *Display* view has task tabs located vertically on the right side of the window, mostly corresponding to buttons on the floating toolbar (Fig. 4-1B):

- *Close*: Closes Tab Information window
- *Composite*: Parameters and correlation plot for depth shifting.
- *Splice Interval*: Parameters and correlation plot to construct splices.
- *Age Depth Model*: not used/discussed here.
- *Filter*: Parameters for decimating, smoothing and/or culling data (creates Cull Table)
- *Preferences*: Display preferences

The graphics part of the *Display* view is separated into the depth shift (composite) and the splice sub-windows separated by a sliding middle bar. The bar can be dragged left or right for more room on either side (Fig. 4-1B).

- The splice sub-window can be removed by unchecking the Splice/Log Window box in the Preference tab.

Note that the selection of a particular tab does not constrain the actions user can take in the graphics part of the window. This means that user may have the splice tab selected but be depth shifting using the context menu.

> Good or bad? For now just an observation.

5. Import and load correlation data

## Import correlation data files

- In the *Data Manager* view, click the *Data List* tab. The list is empty when you start out except for the *Root* item.
- You have to import each file separately for them to show up in the Data List.
  - ➢ Right-click on the word *Root* on the top line item and select *Add new data* (the only option except deleting Root).
  - ➢ A browser window opens that allows user to browse to the data files in a directory of choice.
    - o Content of each data file must be for one hole and one data type. This is automatically true if using LIMS data via SCORS Downloader and is a reminder for those using other data sources.
    - o Best practice is to have the data files stored in separate folders for each site.
  - ➢ Data opens in *Generic Data* tab (Fig. 5-1)

9

Figure 5-1. Data import opens in Generic Data window, where user may have to fill in the Data Type column by clicking on the header "Data Type" and selecting the appropriate item.
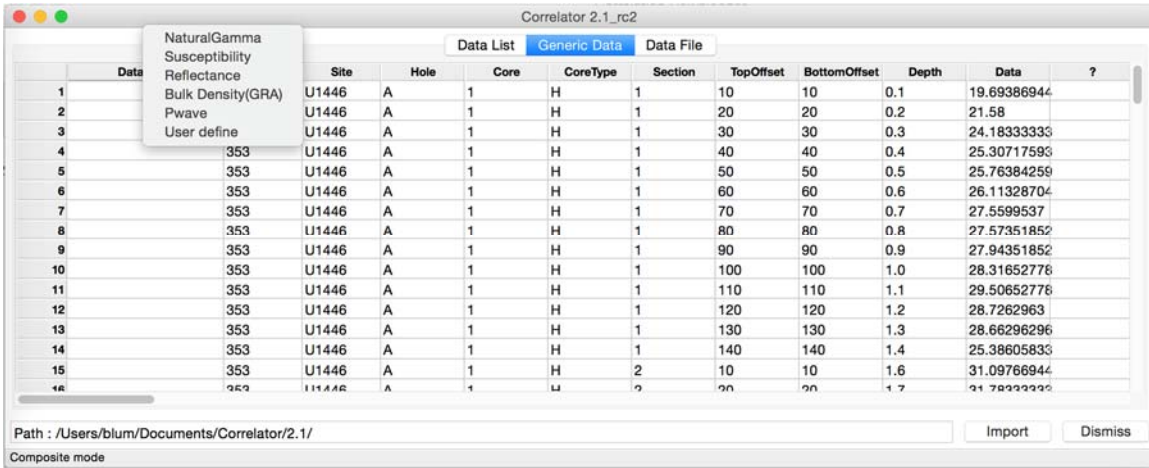
- Select appropriate items for the data columns.
  - Mainly, you need to confirm or set the header of the first column if it is empty. Click on the header and select one of the listed data types.
  - If a suitable data type is not available, create a data label using *User define*. (Fig. 2-3).
    - In the case of *User define*, also click the *Register* box, which will add the name to the choice list. (Fig. 5-2).
  - For the occasional column that has data and a question mark in the header, user typically needs to select Bottom Offset, or Depth.

*Figure 5-2. Registering a data type not available in the Correlator choice list*
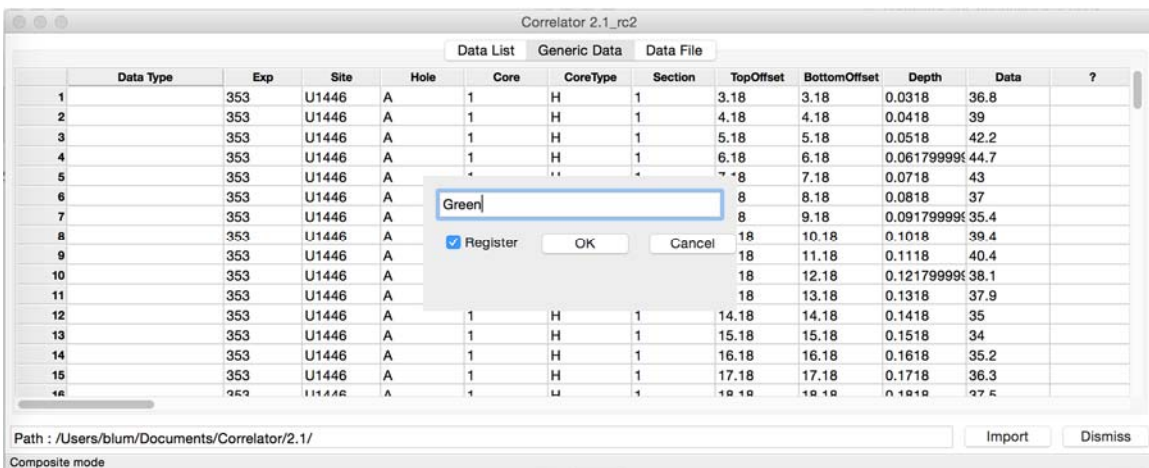
- Click Import and the focus returns to the *Data List* tab where a data summary line is added.
  - You may have to click on a parent item to expand the list (e.g., triangle in front of "Root" after importing the fist data file).
  - The data are organized in a tree structure by site, data type, hole.

➢ Other lines without data are added such as Downhole Log Data, Image Data, etc., which is related to the original concept of Correlator as part of the Corewall suite (not relevant for JR operations).

- Keep right clicking in the *Data List* to add more data. See later for the other options that have now appeared in the context menu.

- Correlator also needs detailed section information so it can compute splice intervals correctly. Section files are automatically generated from LIMS with each Correlation Downloader download (a new, 2016 feature). To load a section file, right-click on *Section Summary*, then select *Import Section Summary* (Fig. 5-3).

> ISSUE: Correlator currently only allows one section file to be uploaded. That means user has to concatenate the section files downloaded from LIMS for each hole (and simply name the resulting file "sections" or something). Then user has to delete the existing Section Summary before uploading the updated file.
>
> A change request for Correlator to accept multiple section files is in the works.

Figure 5-3. In addition to the stratigraphic data, Correlator needs a section summary file.
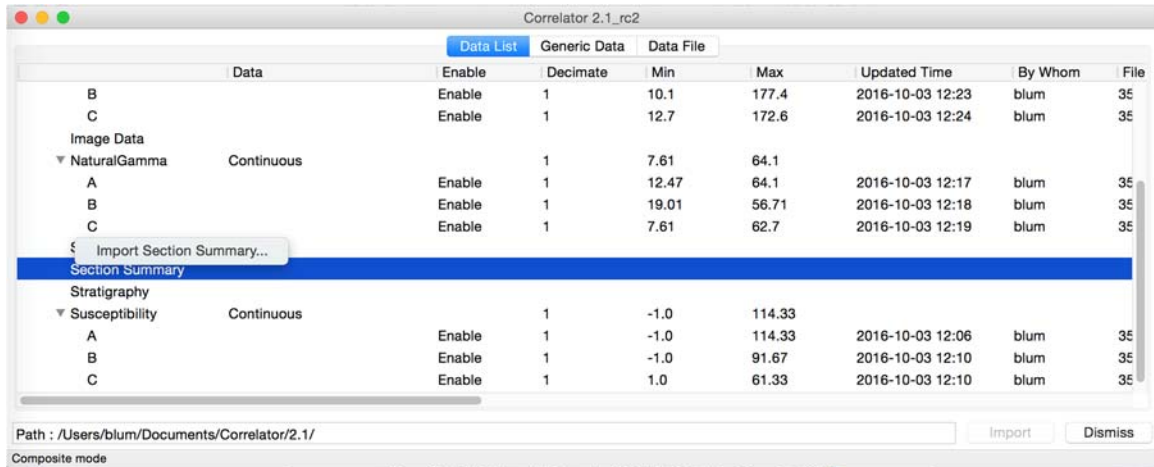
Note that right clicking on highlighted *Data List* items brings up different context menus with several options (Table 5-1).

- Make sure you select/highlight the item first, then right-click it to get the appropriate context menu.

> This doesn't seem very intuitive for many users.

- The special data type items added to list, even if users don't import the data (Age Models, Downhole Log Data, Image Data, Stratigraphy), have their own import context menus and are not used/described here within the context of JR operations.

Table 5-1. Data List context menu items.

Menu item	Function	Root level	Site level	Data group items	Hole-data items

Add new data	Import data from directory	YES	YES	YES	
Load	Load data for plotting in Display view.		YES	YES	YES
View					YES
Edit	?			YES	YES
Discrete	?			YES	
Enable	Enable "Load", i.e., enable plotting in Display view.			YES	
Disable	Disable "Load", i.e., disable plotting in Display view.			YES	YES
Delete	Remove from Correlator.	YES	YES	YES	YES
Import cull table				YES	
Update	The specified file is re-imported and the information in Correlator is updated.		YES	YES	YES
Export	Mainly used to generate affine and splice tables a CSV files that can be uploaded to LIMS.			YES	YES

Load data for correlation

Whenever sufficient data have been imported to Correlator and are available in the *Data List*, user needs to load them for display and correlation. Correlator is loading the data from its own database, which resides in the directory shown from the file menu:

- File>Data Repository Path

To load data:

- In the *Data List*, select, then right-click on a line item and select *Load*.
  - ➢ You can load an individual file, a set of files for a data type, or all files for a site.
  - ➢ Make sure that the files you want to load are enabled. When saved, affine and splice tables are enabled and will be applied to the loaded data.
  - ➢ After loading the data, the *Data Manager* view turns into the *Display* view where the data is plotted and correlation and splicing functions are available.

Update Correlator data

During the typical JR work flow, correlators download the correlation data from LIMS each time the data from a new core are available. This process is facilitated in at least two ways:

- The Correlation Downloader application has features that allow the download to be executed efficiently with pre-configured parameters and by appending core data to the hole data file (see chapter 1).
- The Correlator application remembers the source directory for each data file name.

To update the Correlator internal database with these files:

- Select the highest practical item in the *Data List*, right click and select *Update*.
  - ➢ No, you don't have to delete the data and re-import!
- Select the item again and select *Upload*.
  - ➢ Yes, you do need to load them again.
  - ➢ Make sure you also load the affine and splice tables again, if applicable.

6. Preferences

Before starting to work in the *Display* view it is worthwhile looking at the options in the *Preferences* tab (equivalent to using Go to Display Prefs button; Fig. 6-1). The options are largely self-explanatory and not described further at this time.

Figure 6-1. Display preference options.
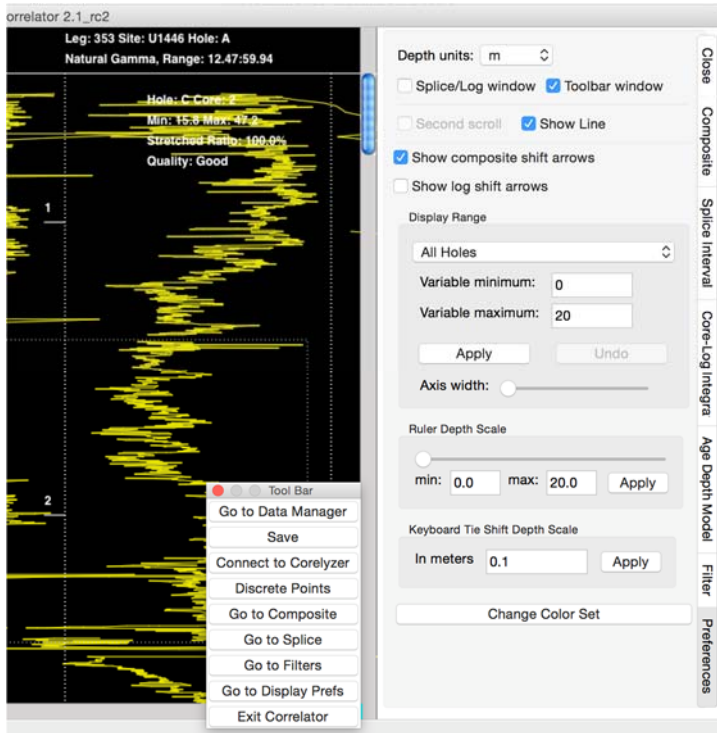
7. Filter data

If you haven't filtered the data a the time of download, or you would like to apply more filtering (masking) now to facilitate correlation:

- Select the *Filter tab* on the right or the Go to Filters button on the floating menu (Fig. 7-1).
- Set Filter Range option: if you loaded multiple data types, you can define here which ones the filter parameters shall apply to.
  - ➢ It appears "All holes" is a misnomer and should read "All data types".
  - ➢ If multiple data types were loaded, select the one the parameters shall be applied to.
- *Decimate:* to reduce excessively large data sets:
  - ➢ Set the number to skip data points.
  - ➢ Click the Apply button.
- *Smooth:* to reduce noise.
  - ➢ In the Smooth window, leave Gaussian as the Type default
  - ➢ Leave 9 for the Width default

- ➢ Set Display to SmoothedOnly
- ➢ Click the Apply button.
- • *Cull*: get rid of outliers.
 - ➢ If you want to cull, click the *Use parameters* Boolean, otherwise the Apply button will do nothing.

> It is not clear why this Boolean is needed since user has to press the Apply button to activate the filters anyway.

  - ➢ Enter # cm from each core top if warranted.

> Why only top of core? I thought it used to be possible to cull intervals from section ends too. This should be easier now that a section summary is loaded.

  - ➢ Data value: Set low pass and high pass values as needed for the data type. Apply to all cores or selected cores.
  - ➢ Click the Apply button.

Figure 7-1. Filter options.
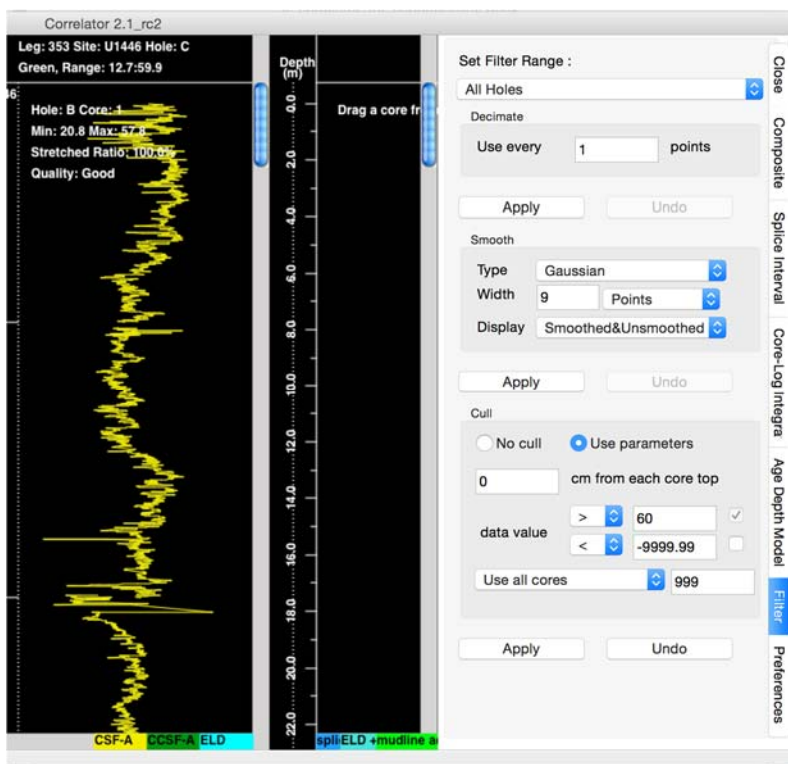
8. Shift Cores

To shift cores, you may want to select the *Composite* tab of the *Display* view to see the parameter sub-window. You can also get there using the Go to Composite button on the

floating menu. If no data are displayed, switch to the ***Data Manager*** view and load a data type (see earlier section).

Note that you can shift cores even if you have not selected the ***Composite tab***.

Several shift parameters are given in the parameter panel to the right (Fig. 8-1).

- TIE Shift Options
  - ➤ Choice list 1: cores that shall be shifted.
    - o *This core only*
    - o *This core and all below*: This only shifts the cores "below" that are in the same hole, but not correlated cores from the other holes, thus invalidating all previously set ties below!

      > A change request is in the works to provide a third TIE option that shifts all correlated cores in all holes, sustaining all existing correlations.

  - ➤ Choice list 2: Shift method
    - o To tie: shift is to user-defined tie (most common).
    - o To best correlation: user can let cross correlation function determine shift amount.
    - o By given amount (m): user can set shift depth interval.
  - ➤ Clear tie button: allows user to clear a tie that has been defined but not yet applied.
  - ➤ Apply shift button: applies the shift as defined.
- SET dialog: Set by growth rate or % button.
  - ➤ Opens dialog….
- Undo Options
  - ➤ *Previous offset*: The latest shift applied can be undone.

    > It would be helpful if multiple past shifts could be un-done.

  - ➤ *Offset of core above*:
- Save Affine Table button.

15

Figure 8-1. Composite tab parameters.
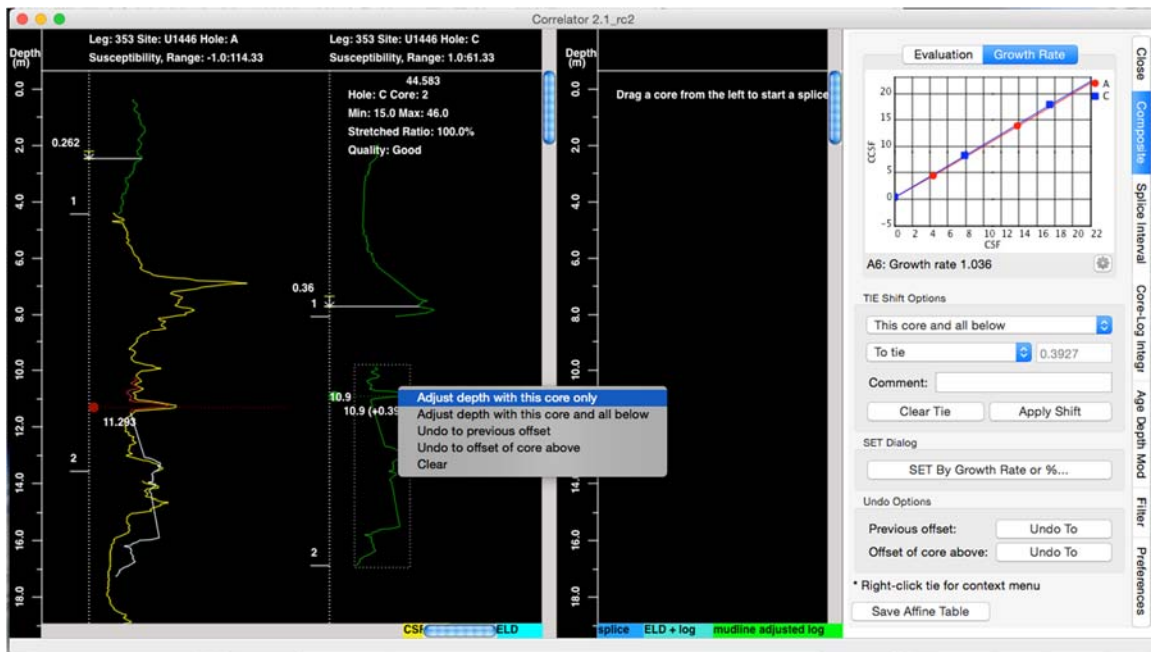
For the shift options user can also access context menus by right clicking on the red and green dot symbols (Fig. 8-1).

- Red dot options:
  - ➤ Clear
- Green dot options:
  - ➤ Adjust depth with this core only
  - ➤ Adjust depth with this core and all below
  - ➤ Undo to previous offset
  - ➤ Undo to offset of core above
  - ➤ Clear

To make a tie:

- Shift-left-click a characteristic reference point, creating a red dot (reference point). This core will not shift.
- Shift-left-click a matching point on the data from a different hole, creating a green dot. This core will shift. A copy of the data trace from the core with the green dot is overlain on the plot with the red dot.
- To move the floating trace over the reference trace for optimum correlation, drag the green line/dot up or down; alternatively toggle the line with the arrow keys.
- Click the Apply shift button.
  - ➤ The core that had the green dot is moved relative to the red point (anchor) and changed to green (CCSF) to indicate the data has been depth adjusted. (Color cues for tracking depth scale changes can be changed in Preferences.)
  - ➤ The amount of shift (m) is shown on the plot.
- To delete the last tie before it is applied, click the Clear Tie button.
- To delete all ties and start over:
  - ➤ Select *Clear all ties* from the *File* menu; or

16

- Go to Data Manager, open the *Saved Tables* tree, and delete the affine and splice tables using right-click context menu.
  - ➢ NOTE: Deleting the affine table will also remove your loaded data (rather than just undo the shifts) and you will have to load them again. After re-loading, you need to reset the Cull filters (the Smooth filter sticks).
- To save the depth shifts, do one of the following, which will save the affine and splice tables internally to Correlator:
  - ➢ Click the Save Affine Table button on the *Composite* tab
  - ➢ Click Save on the Tool Bar
  - ➢ Switch to the Data Manager, which prompts you to save.

9. Construct the splice

For users of older versions of Correlator, note that the entire splicing functionality has been redone in 2015-2016 to (1) comply with the splice interval (as opposed to splice tie) concept, and (2) to use detailed section information imported along with the data types so top and bottom of splice intervals can be properly calculated. Splicing is now easier and more accurate and precise.

To create a splice:

- Choose the *Splice Interval* tab in *Display* view, or use the Go to Splice button on the floating menu.
  - ➢ This will show the parameter sub-window for splicing on the right (Fig. 9-1).
- Drag core data traces from the depth shift sub-window on the left to the splice window on the right side of the divider.
- Click on a core trace to make the splice interval top and bottom lines appear with handle dots and drag or toggle them to the desired splice interval boundary depths.
  - ➢ The resulting splice interval table in the parameter window to the right shows the exact depth.

> [Oct 2016 discussion] Dragging the core data traces over to the splice window seems redundant. Why not allow splice interval definition in the depth shift window and then display the resulting splice in the splice window?

> [Oct 2016 request] Users would like the option of displaying section boundaries as this (a) helps identify core disturbance effects associated with section boundaries, and (b) helps users avoid setting splice interval boundaries very near section boundaries.
>
> As a result of completing issue C001 from September 2015, Correlator now has the precise information needed to draw section boundaries.

Figure 9-1. Display view with Splice Interval tab selected.
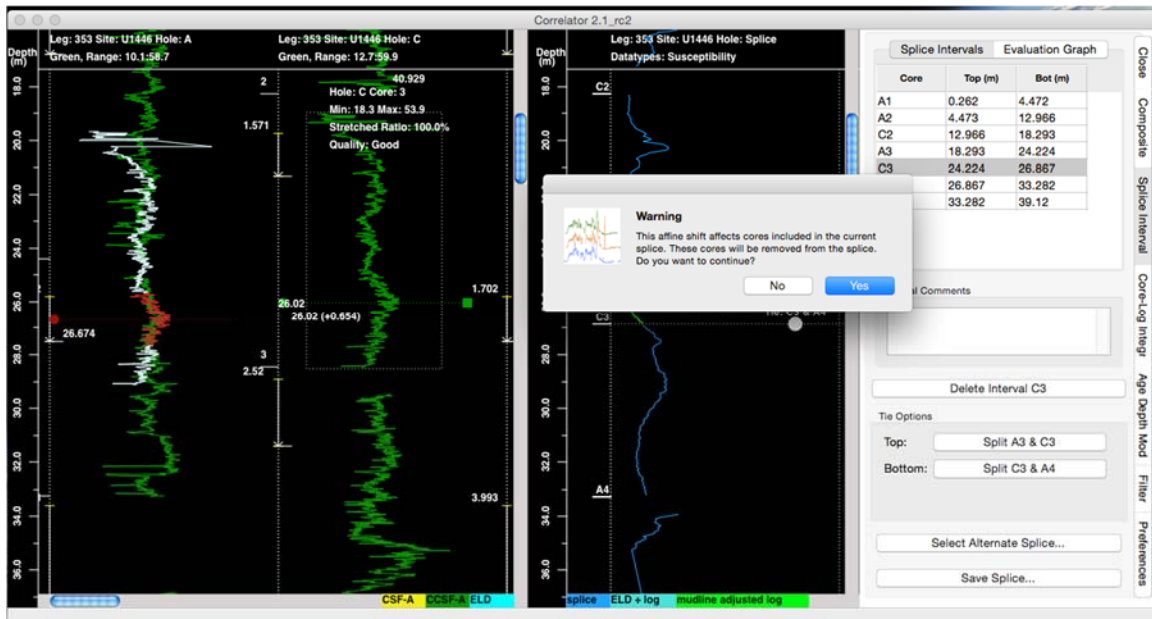
Features in the parameter panel to the right (Fig. 9-1):

- A short form of the splice interval table, updated in real time as user defines intervals:
  - ➢ *Core*: a combination of hole ID and core number.
  - ➢ *Top (m)*: interval top CCSF depth of the interval based on current affine.
  - ➢ *Bot (m)*: interval bottom CCSF depth of the interval based on current affine.

    > [Oct 2016 discussion] Having the short form of the splice interval table displayed in the parameter window is great; however, why not display the full SIT (as specified for export), as well as the affine table, preferentially as a floating window? Those tables are currently viewable as CSV text files (not as nice as in columnar form) by going to the Data Manager and using ~5 click actions.

- *Interval Comments* box: user can add a comment about the interval selection for the interval selected in the table – the comment will be exported with the splice interval table.

- Delete Interval @# button: removes the interval selected in the table.

- *Tie Options*: If two cores dragged into the splice area overlap (say A2 and B2), one or two of the following buttons become enabled:
  - ➢ Top: Split A2 & B2 toggles with Tie A2 & B2 , with the notation on the splice interval top changing accordingly between *Tie: A2 & B2* and *B2 Top*, respectively.
  - ➢ Bottom: No Action if bottom of B2 interval dos not overlap with another core data trace, otherwise it works the same as Top.

    > [Oct 2016 discussion] It is not immediately clear what the buttons are trying to accomplish for the user; apparently, the buttons simply change the nomenclature for the same thing, namely a splice interval boundary. Perhaps this feature is a "left-over" related to the change

<div style="color: #9e3030; border: 1px solid #9e3030; padding: 10px;">
from splice tie point table (STPT) concept to the splice interval table (SIT) concept, and the way Correlator is now accounting for ties and intervals.
</div>

- Select Alternate Splice button opens a dialog where user can select one of multiple splices if multiple splices were previously created:
  - ➢ CAUTION: "alternate" splice does not mean that this is a "secondary splice" that only uses intervals NOT used in the "primary" splice! It's just another splice.
  - ➢ Data Type: User can select the data type for which to display the splice.
  - ➢ Splice: user can select one among multiple splices.
- Save Splice… button brings up a dialog with the following options:
  - ➢ Create New If you do this, you will see in the *Data Manager* window that the previous splice is automatically disabled.
  - ➢ Update Existing is the typical choice.
  - ➢ Cancel

Changing the affine during the splicing process

While on the *Splice Interval* tab, the depth shift display area on the left is still active and lets user define a shift using.

- If user clicks the Apply Shift button, a warning dialog appears:
  - ➢ "Warning: This affine shift affects cores included in the current splice. These cores will be removed from the splice. Do you want to continue?" (No, Yes). (Fig. 9-1).
  - ➢ If user chooses "Yes", the affected cores are removed from the splice sub-window.
    - o User then simply has to drag the affected core trace(s) back into the splice area and again define the top and bottom of the adjusted splice interval.
  - ➢ If user chooses "No" and then cancels the shift TIE (e.g., via context menu), nothing changes.
- If user has at some point created an alternate splice, the cores with compromised splice interval boundaries are not removed from that splice. Only if and when user switches to that alternate splice using the Alternate Splice button will they find a surprise:
  - ➢ "Error: Core B2: Applied affine shift (9.243) does not match shift in Splice Table (7.918), can't load splice."
- In any case, user should make sure the depth shifting is complete before spending the time selecting splice interval boundaries.

<div style="color: #9e3030; border: 1px solid #9e3030; padding: 10px;">
[Oct 2016 discussion] These problems could arguably be avoided if depth shifting and splicing were fully integrated in terms of accounting and graphics. Any core could be shifted at any time and any splice interval boundary could be defined at any time, and the resulting splice would be shown in the splice window in real time. Given the propose accounting of core correlations and the proposed "Shift all cores below in all holes" feature, splice interval boundaries could be shifted with the cores. Any core shift and any splice interval boundary shift would trigger an update in both affine and splice interval tables as well as the plots. At any time, what user sees is what user gets.
</div>

To delete a splice:

- Go to the *Data Manager*
- Right-click on the line item
- Select *Delete*.
- After user acknowledges the warning, the splice is deleted and all loaded data are cleared from the *Display* view. User has to re-load the data.

10. Export Data

You can export any data item listed in the *Data List* window of the *Data Manager*. When working with the LIMS database, user will typically only be exporting affine tables and splice interval tables, which will be uploaded to LIMS so any LIMS user can download any LIMS data type by splice, including those not used in the correlation process. However, if users work outside of the LIMS infrastructure, exporting splice data becomes important.

To export depth shifted and spliced data from Correlator (i.e., LIMS not available):

- Select a data item to be exported, right-click on it and select *Export* (Fig. 10-1).
- Under some circumstances you will get a prompt notifying you that data will be cleared (Fig. 10-2).

> This should be an option so user can continue work in Correlator even if they export the data.

- If you proceed with Export, you get a check box list of what should be applied to the exported data (Fig. 10-3). Make your selection and export.

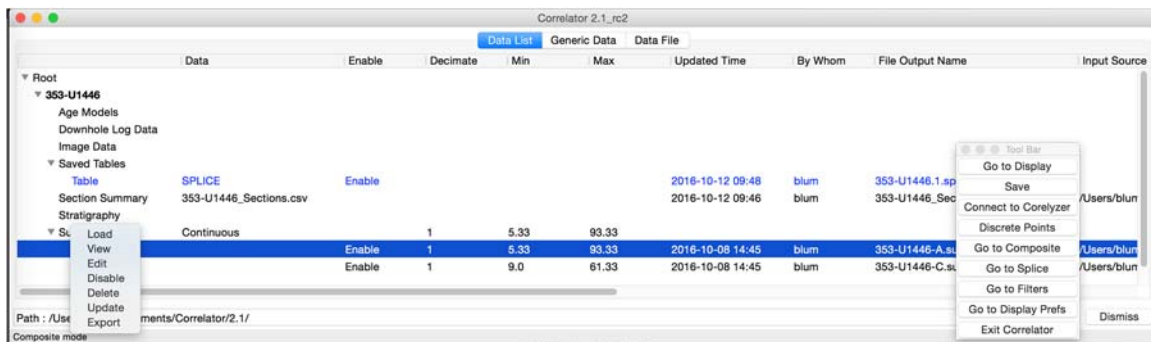*Figure 10-1. Export in data item context menu.*
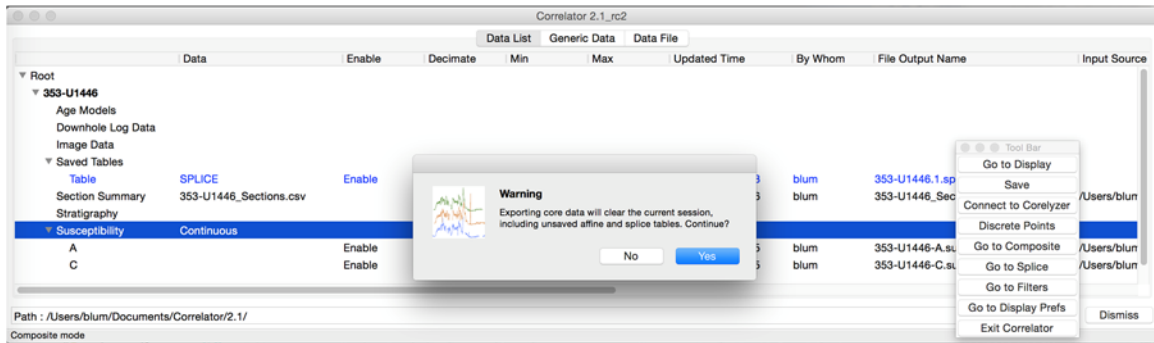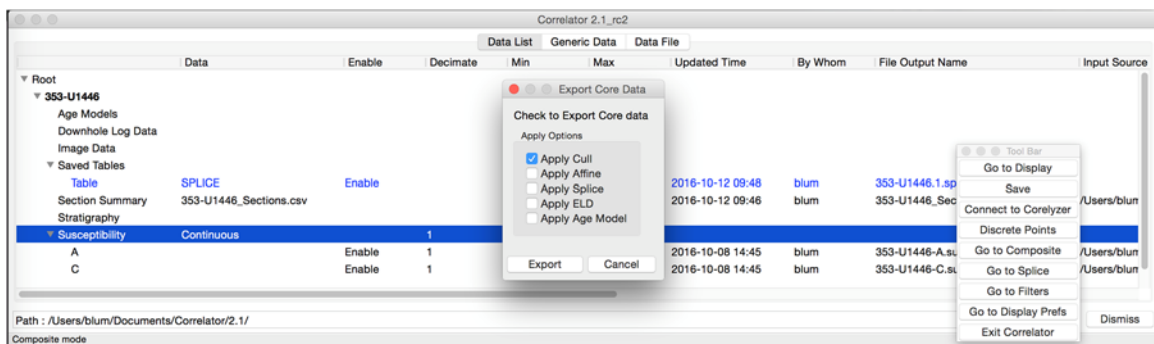
Figure 10-2. Export prompt/warning.

Figure 10-3. Export options.

When a LIMS user on the JR is done with shifting and splicing for a site, they want to export the affine and splice tables and upload them to the LIMS where CCSF depth scales and splice intervals are generated. Any authorized LIMS user can then download depth-shifted and spliced data from the LIMS, including data not used in the correlation process.

- Select each affine/splice file item to be exported, right-click and select *Export*.
  - ➢ If multiple affine or splice tables exist, the latest one will show as *Enable* (enabled) and earlier versions as *Disable* (disabled).
  - ➢ You can export either status.
  - ➢ The status matters for loading and working with an existing affine.
  - ➢ You can change the status of tables via the context menu.
- Columns of tables exported from Correlator 2.1_rc2 are compliant with LIMS specification for all practical purposes (see Appendix 1 and Appendix 2). The exact column header spelling in the specifications is given to the right of the Correlator spelling.
  - o Affine table:

Correlator 2.1_rc2Site	LIMS
Site	Site
Hole	Hole
Core	Core
Core Type	Core type
Depth CSF (m)	Core top depth CSF-A (m)
Depth CCSF (m)	Core top depth CCSF (m)
Cumulative Offset (m)	Cumulative offset (m)
Differential Offset (m)	Differential offset (m)

        Growth Rate   Growth rate
        Shift Type   Shift type
        Data Used   Data type used
        Quality Comment   Quality comment

o Splice interval table:

        Correlator 2.1_rc2Site   LIMS
        Site   Site
        Hole   Hole
        Core   Core
        Core Type   Core type
        Top Section   Top section
        Top Offset   Top offset (cm)
        Top Depth CSF-A   Top depth CSF-A (m)
        Top Depth CCSF-A   Top depth CCSF (m)
        Bottom Section   Bottom section
        Bottom Offset   Bottom offset (cm)
        Bottom Depth CSF-A   Bottom depth CSF-A (m)
        Bottom Depth CCSF-A   Bottom depth CCSF (m)
        Splice Type   Splice type
        Data Used   Data used
        Comment   Quality comment

Other:

> Under certain circumstances export attempts fail and no error message is given. [Describe in more detail.]

Appendix 1: Specifications for affine tables

Column header	Upload file requirements	LIMS report sourcing	Format	Examples	Comments
Site	required	from upload file	text up to 5 chars	69, 987, 1103, U1423	
Hole	required	from upload file	single letter	A, B, C, ...	
Core	required	from upload file	integer, 1-3 digits	3, 45, 138	
Core type	optional	from LIMS	single letter	H, X, R, ...	
Core top depth CSF-A (m)	optional	from LIMS	number	2.3, 124.175, 1504.4	
Core top depth CCSF (m)	optional	from LIMS	number	2.3, 124.175, 1504.4	
Cumulative offset (m)	required	from upload file	number	-0.56, 48.392	
Differential offset (m)	optional	computed in LIMS	number	0.012, 4.562	
Growth rate	optional	computed in LIMS	number	0.91, 1.05, 1.21	
Shift type	optional information	from upload file	text up to 50 chars	TIE, truncated	Commas not allowed
Data used	optional information	from upload file	text up to 50 chars	magnetic susc.	Commas not allowed
Quality comment	optional information	from upload file	text up to 50 chars	Tentative	Commas not allowed

Appendix 2: Specifications for splice interval tables

Column header	Upload file requirements	LIMS report sourcing	Format	Examples	Comments
Site	required	from upload file	text up to 5 chars	69, 987, 1103, U1423	
Hole	required	from upload file	single letter	A, B, C, ...	
Core	required	from upload file	integer, 1-3 digits	3, 45, 138	
Core type	required	from upload file	single letter	H, X, R, ...	
Top section	required	from upload file	integer 1-2 digits, or "CC"	1, 12, CC	
Top offset (cm)	required	from upload file	number	1.2, 45, 151.7	
Top depth CSF-A (m)	required	computed in LIMS	number	2.3, 124.175, 1504.4	
Top depth CCSF (m)	required	computed in LIMS	number	2.3, 124.175, 1504.4	
Bottom section	required	from upload file	integer 1-2 digits, or "CC"	1, 12, CC	
Bottom offset (cm)	required	from upload file	number	1.2, 45, 151.7	
Bottom depth CSF-A (m)	required	computed in LIMS	number	2.3, 124.175, 1504.4	
Bottom depth CCSF (m)	required	computed in LIMS	number	2.3, 124.175, 1504.4	
Splice type	optional information	from upload file	text up to 50 chars	TIE, truncated	Commas not allowed
Data used	optional information	from upload file	text up to 50 chars	magnetic susc.	Commas not allowed
Quality comment	optional information	from upload file	text up to 50 chars	Tentative	Commas not allowed