

{ APPLICATION NOTE }

Tube Re-arraying with Titian's Mosaic Automated Tube Sorter Module



Mosaic Sample Management is Titian Software's comprehensive, customisable, modular software product to control and monitor all aspects of sample storage, preparation and delivery. From small biotech to global pharma, Mosaic helps to provide a seamless, error-free sample supply chain and audit trail.

Mosaic Sample Management is a tailored solution for all sample management requirements, configured through expert consulting services.

Mosaic SampleBank and Mosaic FreezerManagement are Mosaic packages, optimised and pre-configured for rapid deployment:

- FreezerManagement keeps track of samples in freezers and provides a comprehensive audit trail as samples are accessed and aliquoted.
- SampleBank provides full inventory tracking capabilities coupled with sample ordering and workflow management in a simple package. It offers seamless start-up and ongoing performance for busy sample managers.

Mosaic's modular approach means that it is simple to upgrade or extend the software's functionality whenever it is needed.

Introduction

Manual methods of sorting and picking samples in tubes are slow and inefficient in comparison to automated ones, so Titian Software has created an easy to use integration package for the efficient management of racked sample tubes.

This intuitive package enables the following operations:

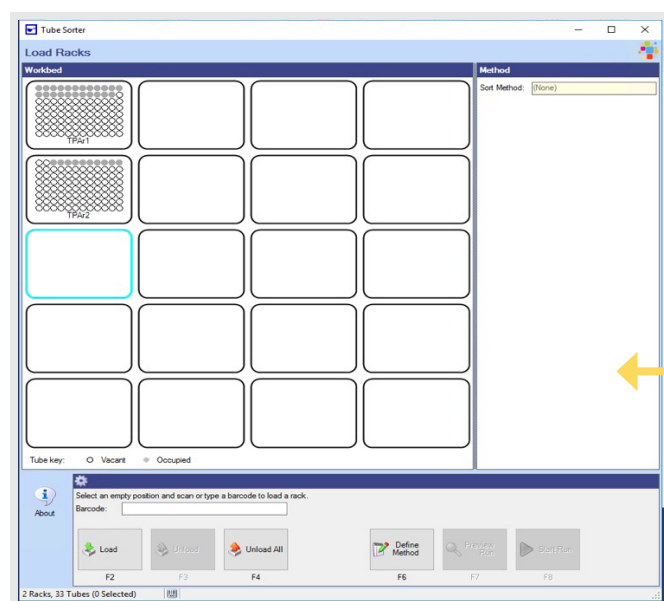
1. Order picking: tubes required for fulfilment orders can be easily identified and picked
2. Collection segregation: groups of tubes can be sorted into the same racks for easy access
3. Rack compression: maximizes storage space in each rack

Automated Tube Sorter (ATS)

Titian Software's Mosaic sample management application offers an Automated Tube Sorter (ATS) control module as part of Mosaic's overall product suite. This ATS module integrates Mosaic with BioMicroLab automated tube handlers (XL9, XL20, XL100 and XL200) to provide efficient and accurate rearrangement of barcoded tubes within racks.

This document describes a few practical use cases that make ATS an essential part of any Mosaic configuration. This is especially useful when stock tubes are not held within an automated tube store that can perform the rearrangement for you.

Mosaic interfaces with the tube handler via the ATS control module (see below).



ATS Module



BioMicroLab XL20 Automated Tube Handler

Supported Operations



Mosaic's ATS module supports four different sorting methods:

1. Order Processing: tubes required for selected Mosaic orders are sorted onto separate racks
2. Rack Compression: sort the tubes into as few racks as possible
3. Empty Tube Removal: usually for disposal
4. Tube Collection Segregation: assign each tube to a logical group

Basic Usage Sequence

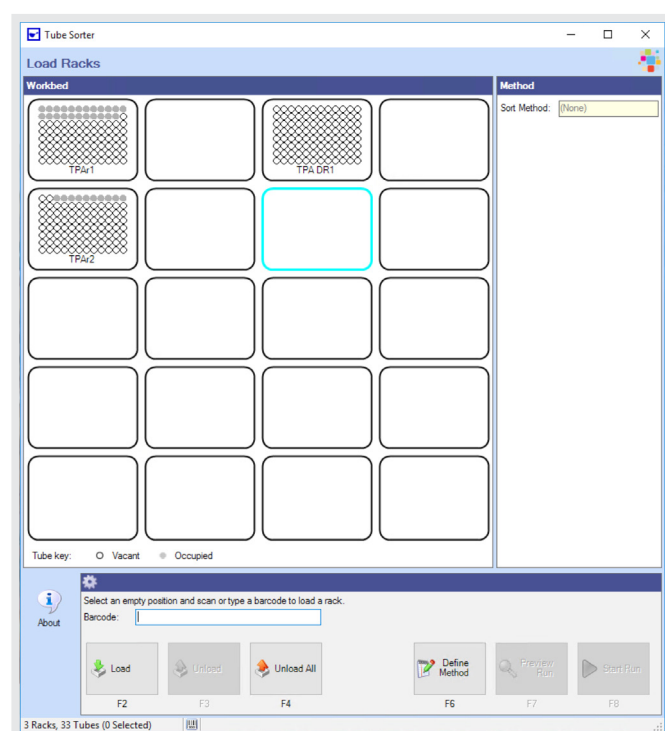
For each of the supported ATS operation types, an operator will follow the same basic usage event sequence:

1. Load racks
2. Define sorting method
3. Specify run settings
4. Perform run
5. Unload racks

Use Case 1: Order Processing

Source tubes required to fulfil a specific Mosaic order may be held in different storage racks at various locations together with other tubes that are not required in that order. Therefore, to fulfill the order the required tubes need to be consolidated into separate racks, often in a specific layout defined by the order.

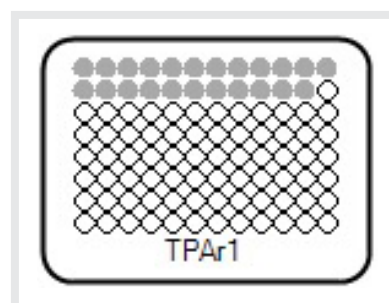
In this example, the tubes will be picked from storage racks into a new, empty rack for subsequent delivery.



1. Load Racks

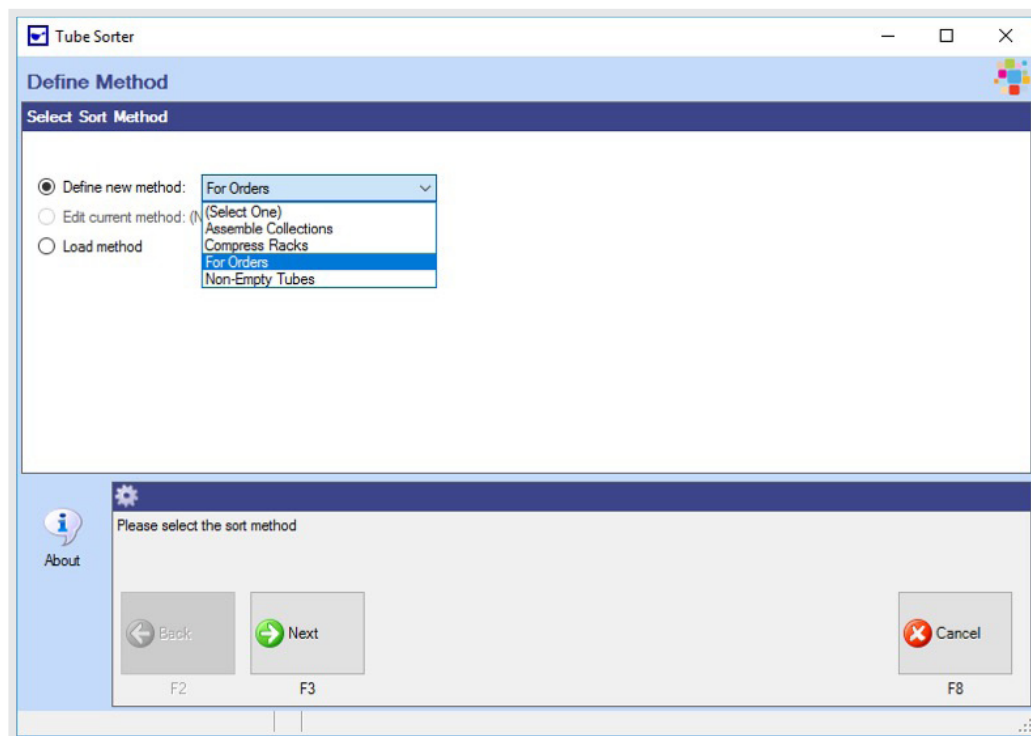
Racks of tubes required for one or more orders are first retrieved from various storage locations and loaded onto the picking bed by selecting a bed position and entering (by scanning) the rack's barcode.

The software displays the loaded rack contents. Within loaded racks, occupied positions are shown in grey and vacant positions are shown in white.



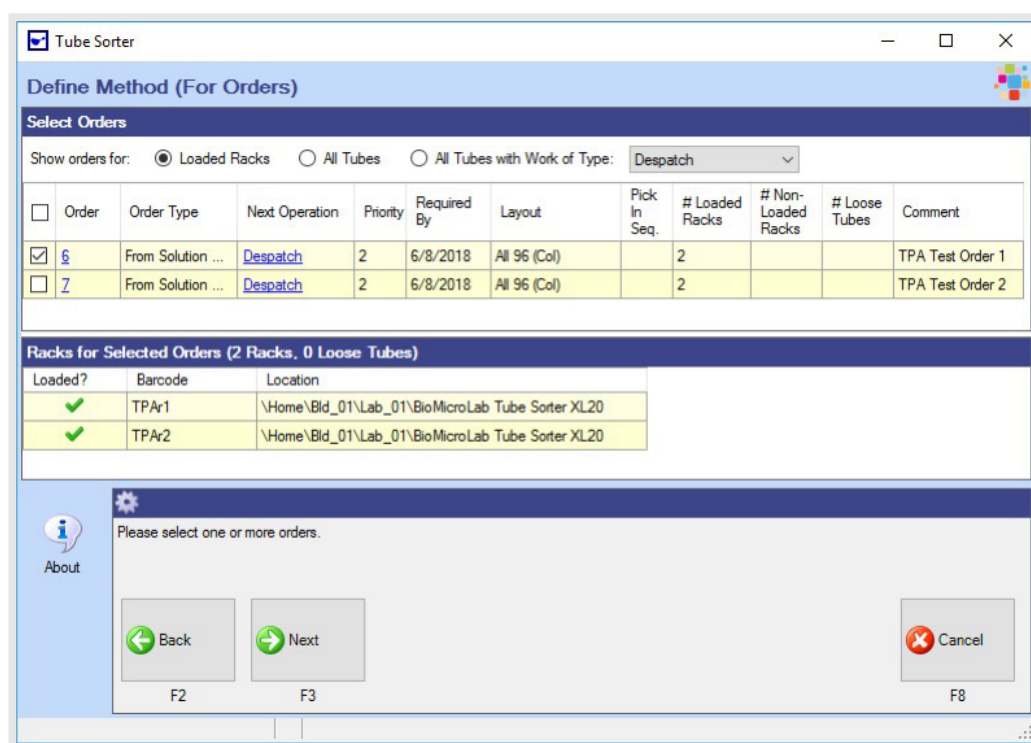
2. Define Sorting Method

The next step is to define the sorting method. For this example, click on the “Define Method” button on the ‘Load Racks’ page and select the ‘For Orders’ option from the dropdown list (see below).



The ‘Define Method (For Orders)’ form below now opens. This allows the operator to view all Mosaic orders where a tube picking activity could be applied – not just the orders relating to tubes in the already loaded racks.

Selecting one or more orders enables the ‘Racks for Selected Orders’ sub-form to display all tube racks that contain tubes for the selected order(s) along with their location(s).



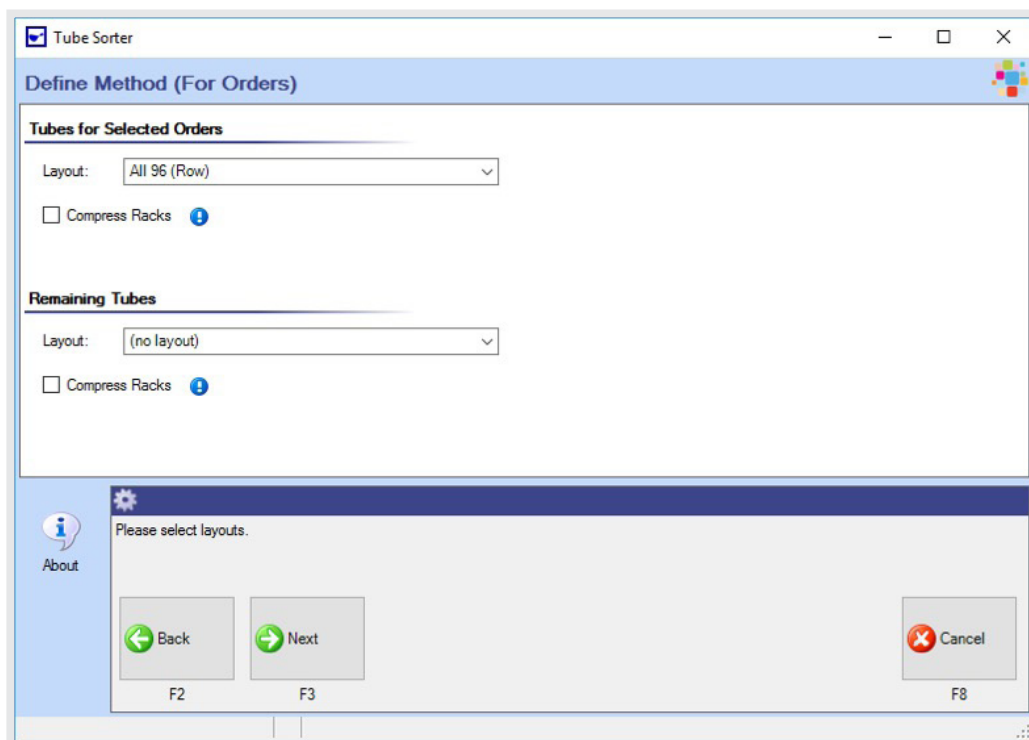
| Order | Order Type | Next Operation | Priority | Required By | Layout | Pick In Seq. | # Loaded Racks | # Non-Loaded Racks | # Loose Tubes | Comment |
|-------|-------------------|----------------|----------|-------------|--------------|--------------|----------------|--------------------|---------------|------------------|
| 6 | From Solution ... | Despatch | 2 | 6/8/2018 | All 96 (Col) | | 2 | | | TPA Test Order 1 |
| 7 | From Solution ... | Despatch | 2 | 6/8/2018 | All 96 (Col) | | 2 | | | TPA Test Order 2 |

| Loaded? | Barcode | Location |
|---------|---------|--|
| ✓ | TPAr1 | \Home\Bld_01\Lab_01\BioMicroLab Tube Sorter XL20 |
| ✓ | TPAr2 | \Home\Bld_01\Lab_01\BioMicroLab Tube Sorter XL20 |

Once the operator is ready to progress with the pick they can select the “Next” button to open the form.

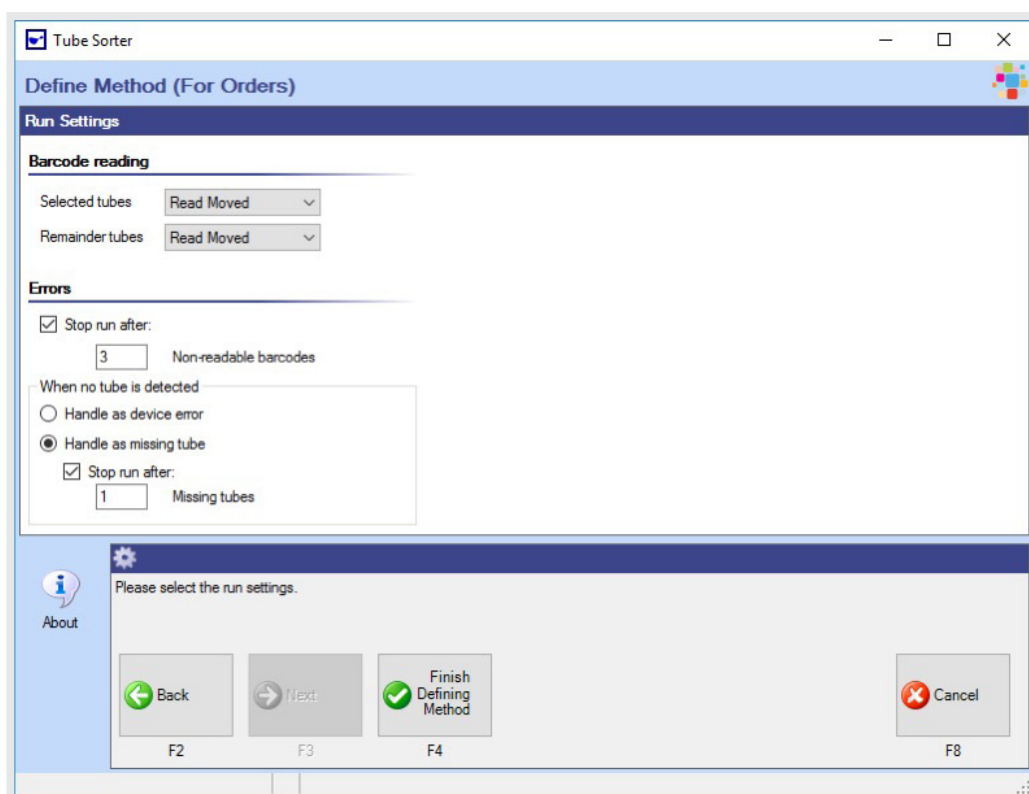
The operator can now select the layout of the destination racks that tubes will be picked into.

The default is the layout specified in the Mosaic order, but this can be overridden if the operator selects a different layout. The operator can also choose to compress tubes that remain in the source racks.

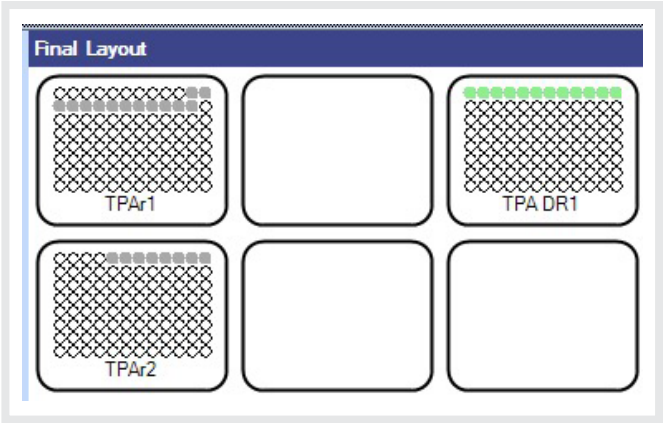


3. Specify Run Settings

Selecting the “Next” button will bring up the ‘Run Settings’ form where the operator defines 2-D tube reading and error handling preferences. Once completed the run method definition is now finished and the operator can select the “Finish Defining Method” button



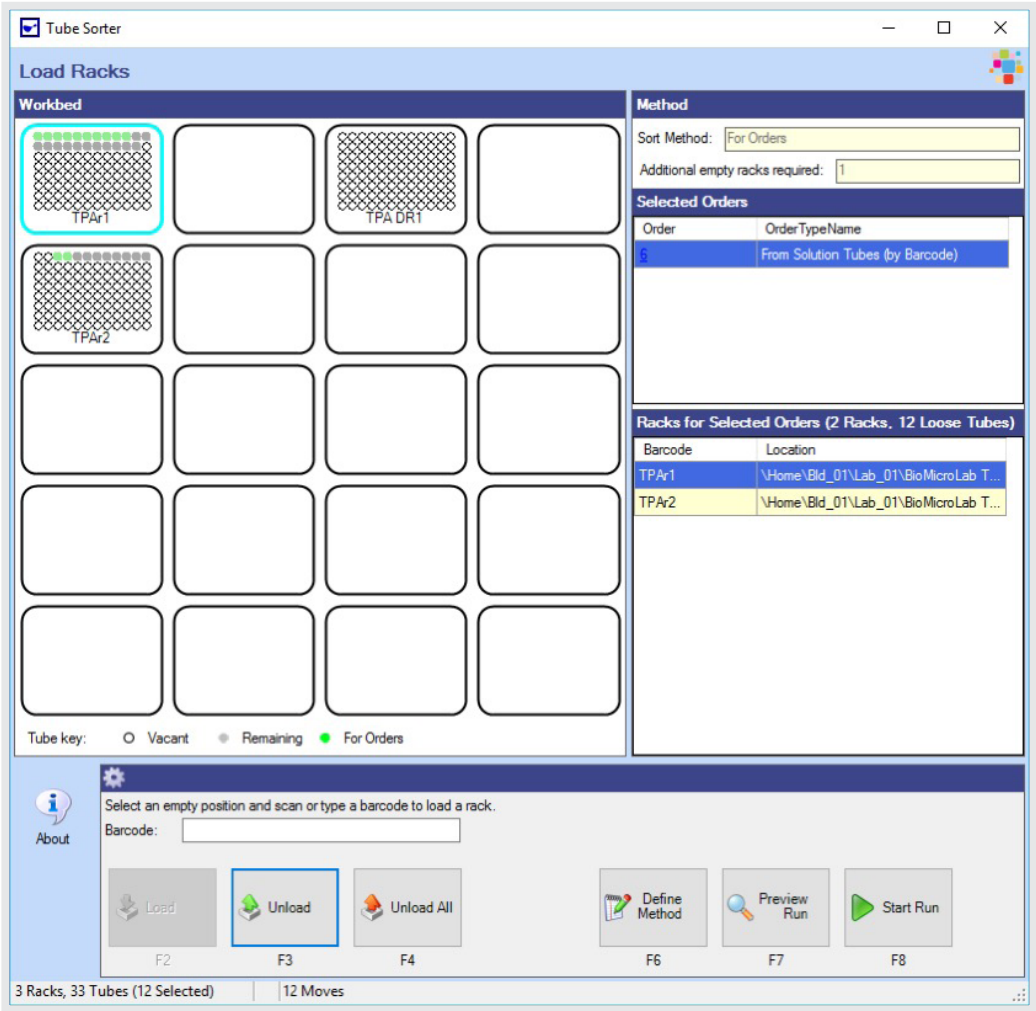
4. Perform Run



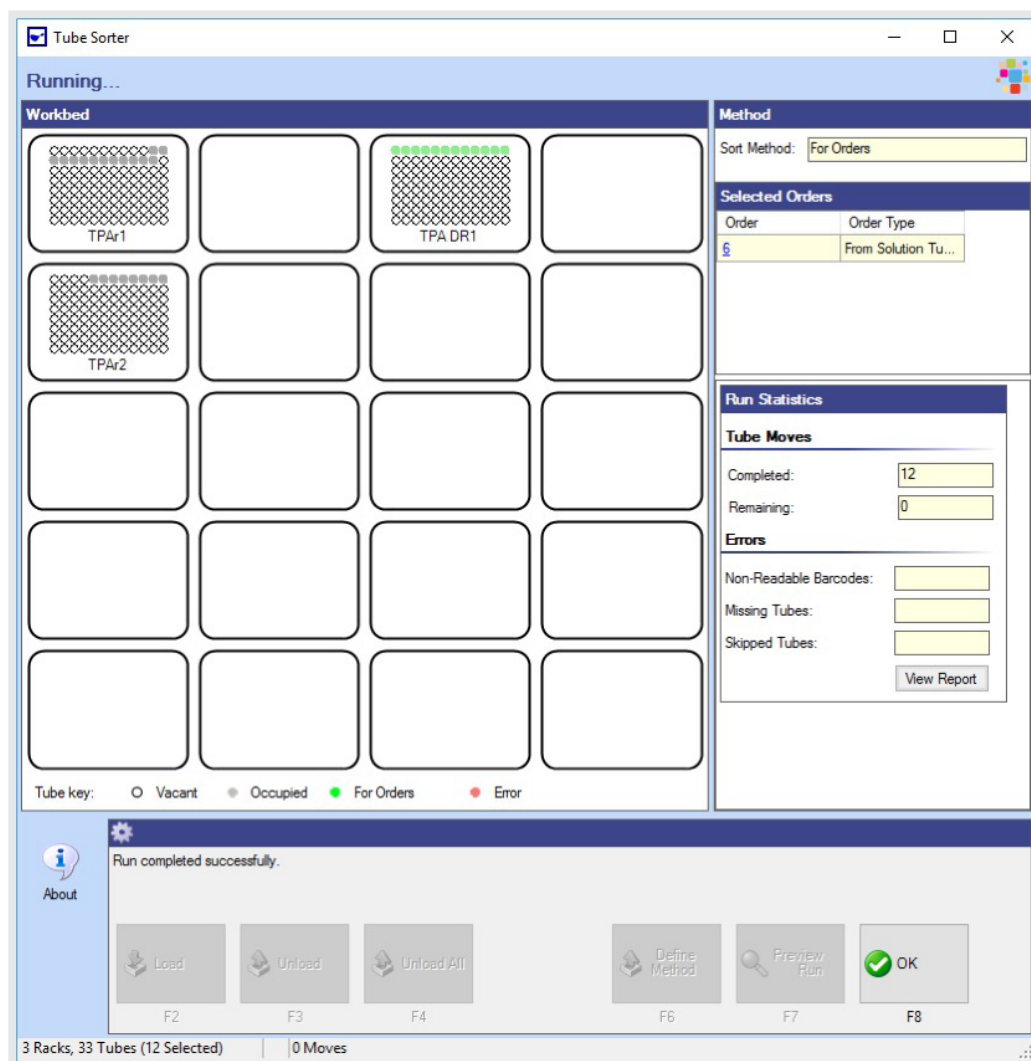
Now that all the required run parameters are defined, the sorting can be performed. At this point, the operator may select the "Preview Run" button to view what the final sorting result will look like (see left).

Preview Run

If, after having a look at the preview, the operator wishes to redefine the run method, this can be redone until the operator is happy with the projected result. Once the desired method is settled upon, the run can be initiated by selecting the "Start Run" button.

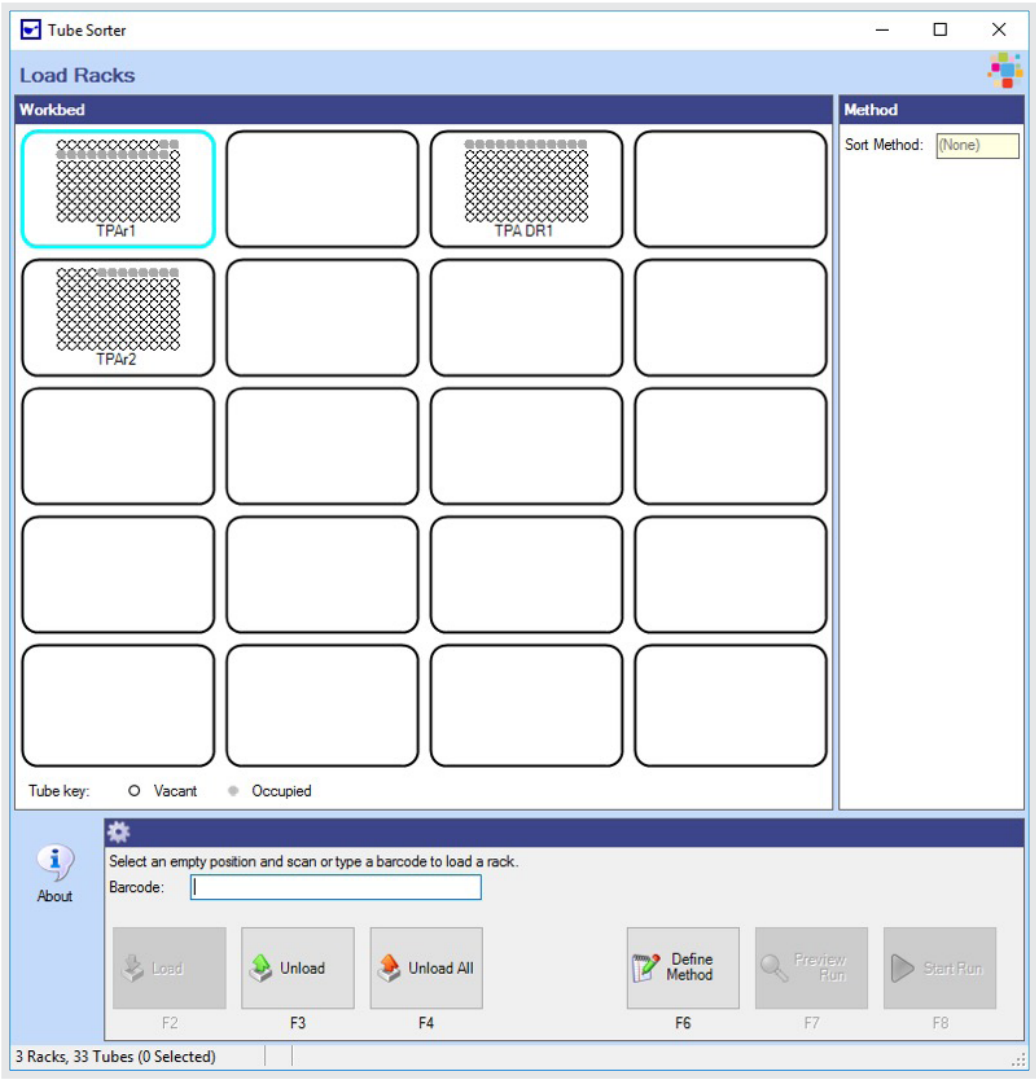


During the run, the application will update tube locations as each tube is moved from the source rack to the destination rack. After the run is completed the successful tube transfers are indicated. If there were any errors encountered (e.g. incorrect tube, tube not found), these are also displayed.



5. Unload Racks

After the run is completed the racks can be removed from the tube handler by selecting the “Unload All” button.



Use Case 2: Rack Compression

This example will show how tube racks can be easily compressed and consolidated using the ATS application.

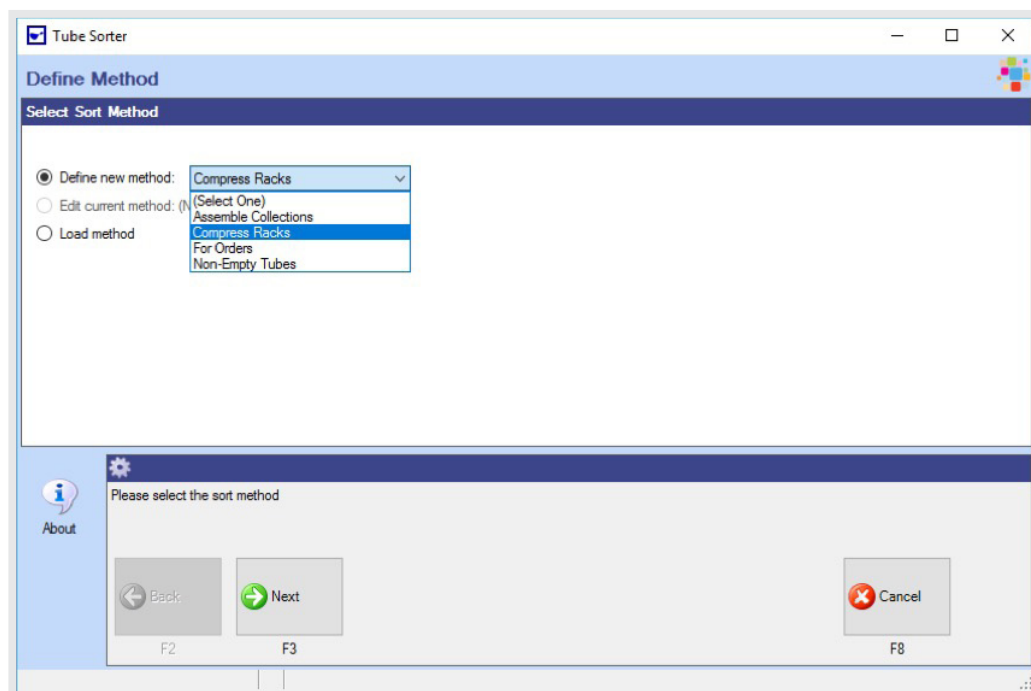


1. Load Racks

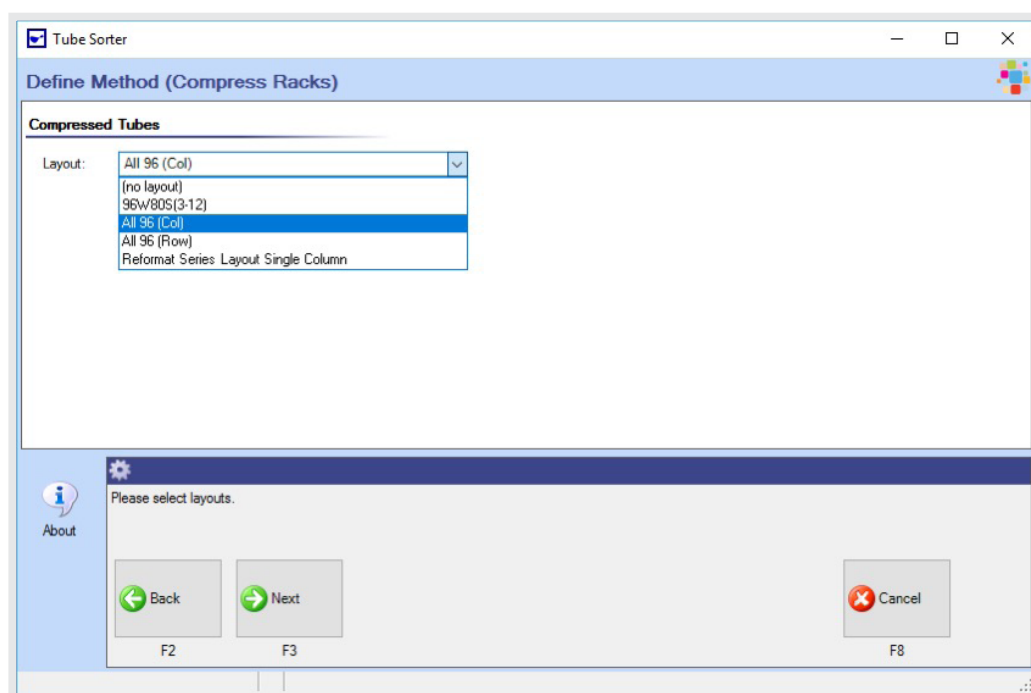
Racks of tubes that require compression are loaded onto the picking bed by selecting a bed position and entering (by scanning) the rack's barcode.

2. Define Sorting Method

The next step is to define the sorting method. For this use case, click on the “Define Method” button on the ‘Load Racks’ page and select the ‘Compress Racks’ option from the dropdown list (see below).

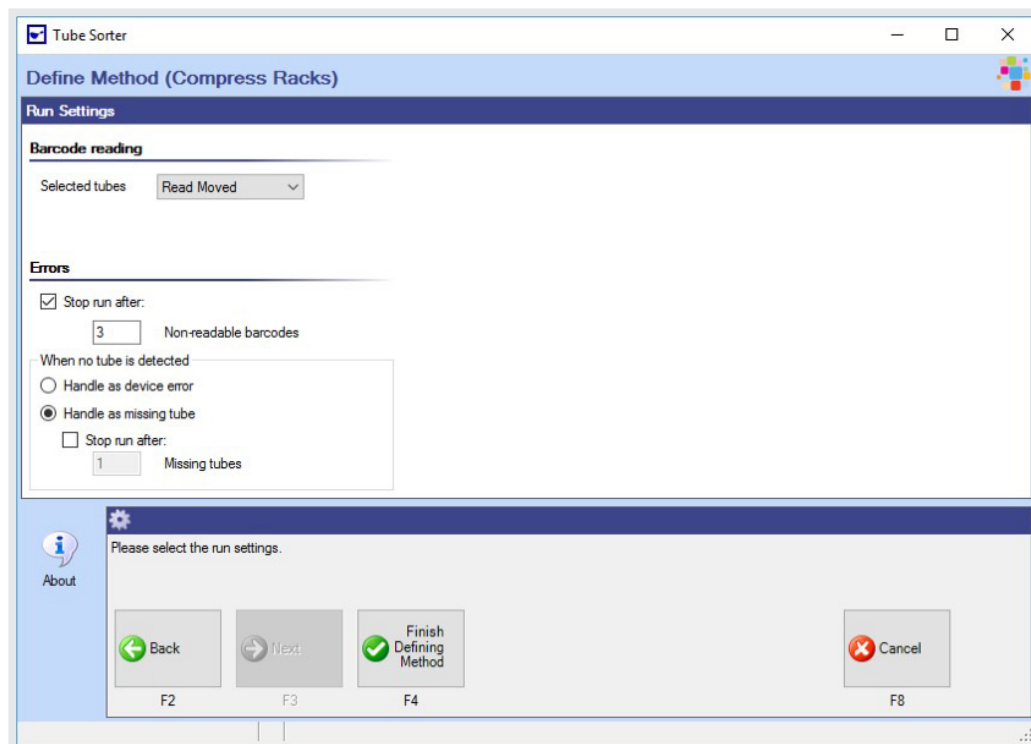


The ‘Define Method (Compress Racks)’ form below now opens. This allows the operator to select their preferred final rack layout.



3. Specify Run Settings

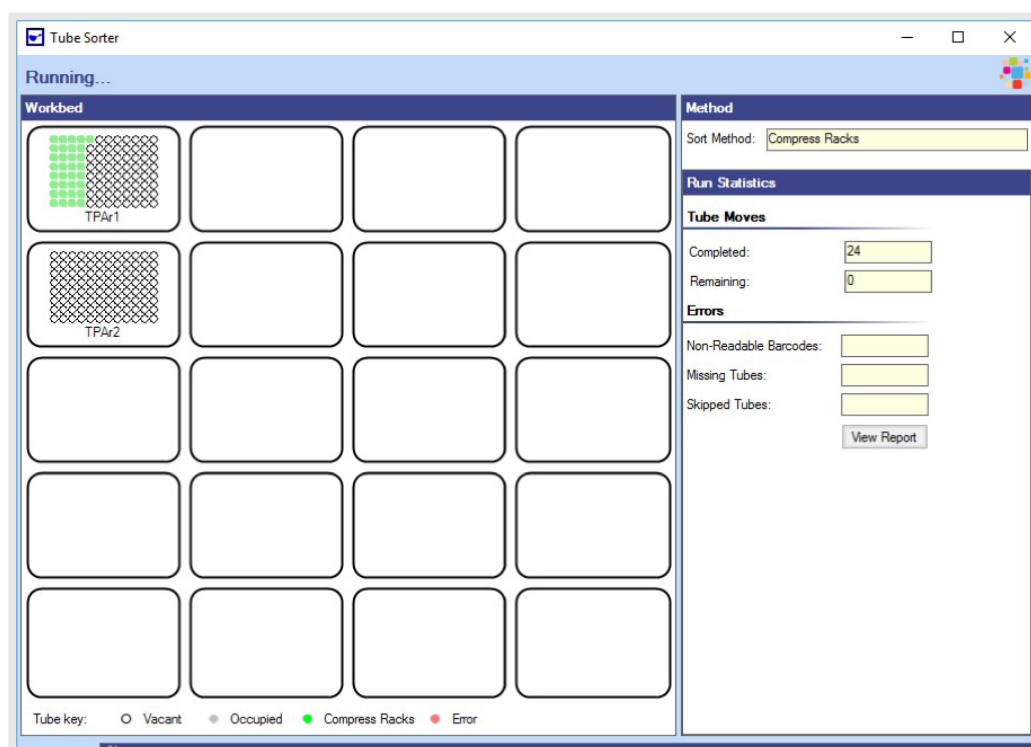
Selecting the “Next” button will bring up the ‘Run Settings’ form where the operator defines 2-D tube reading and error handling preferences. Once completed, the run method definition is now finished and the operator can select the “Finish Defining Method” button.



4. Perform Run

Once the desired method is settled upon, the run can be initiated by selecting the “Start Run” button. The completed run details are shown below.

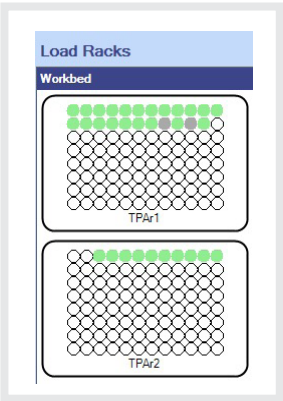
During the run, the application will update tube locations as each tube is moved. After the run is completed the successful tube transfers are indicated. If there were any errors encountered, these are also displayed.



After the run is completed the racks can be removed from the tube handler by selecting the “Unload All” button.

Use Case 3: Empty Tube Removal

In this example the ATS application can be used to remove empty tubes to maintain maximum capacity in the storage rack.

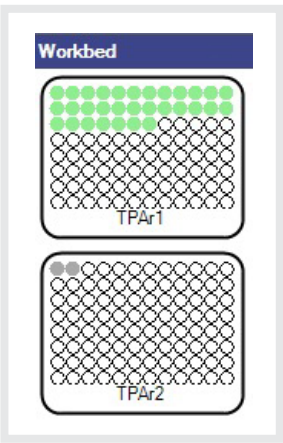
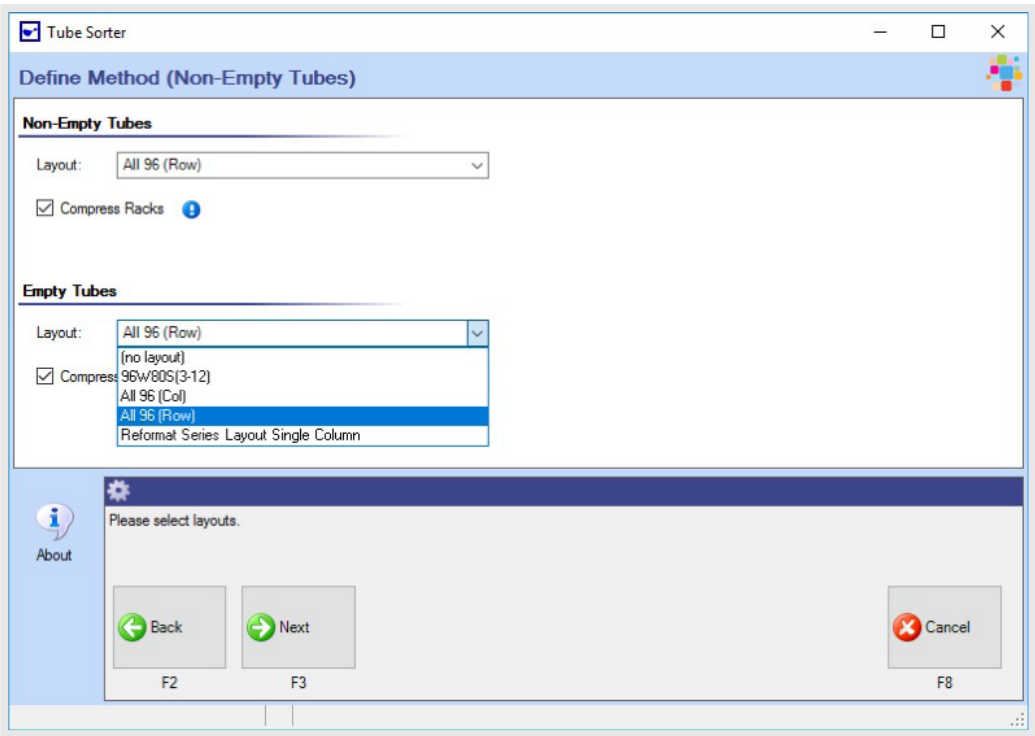


1. Load Racks

Racks of tubes are loaded onto the picking bed by selecting a bed position and entering (by scanning) the rack's barcode. Note that empty tubes are displayed as grey circles.

2. Define Sorting Method

After selecting the 'Non-Empty Tubes' sorting method, the layouts of the final racks can be defined:



3. Specify Run Settings

In the same way as shown in the previous examples, the run settings are now defined.

4. Perform Run

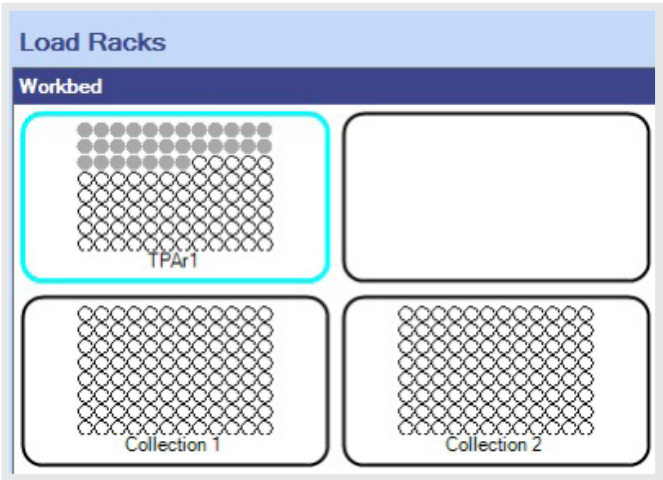
Once the desired method is settled upon, the run can be initiated by selecting the "Start Run" button.

The completed Picked layouts are shown on the left.

After the run is completed the racks can be removed from the tube handler by selecting the "Unload All" button.

Use Case 4: Tube Collection Segregation

This example shows how defined collections of tubes can be efficiently segregated using the ATS application.

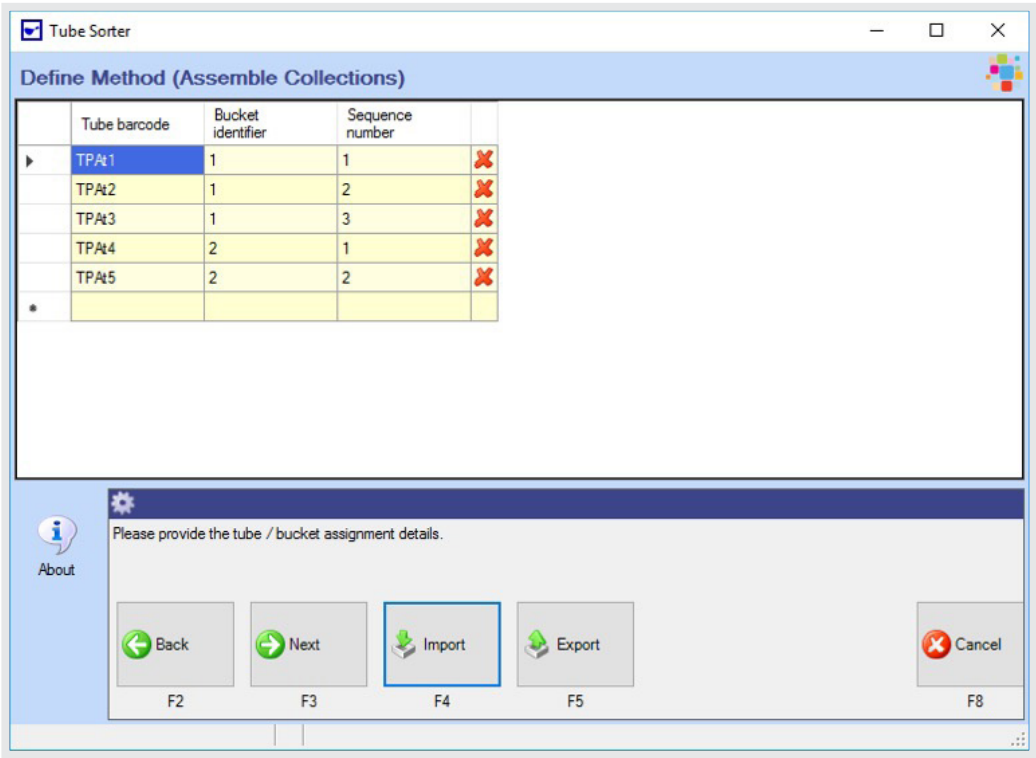


1. Load Racks

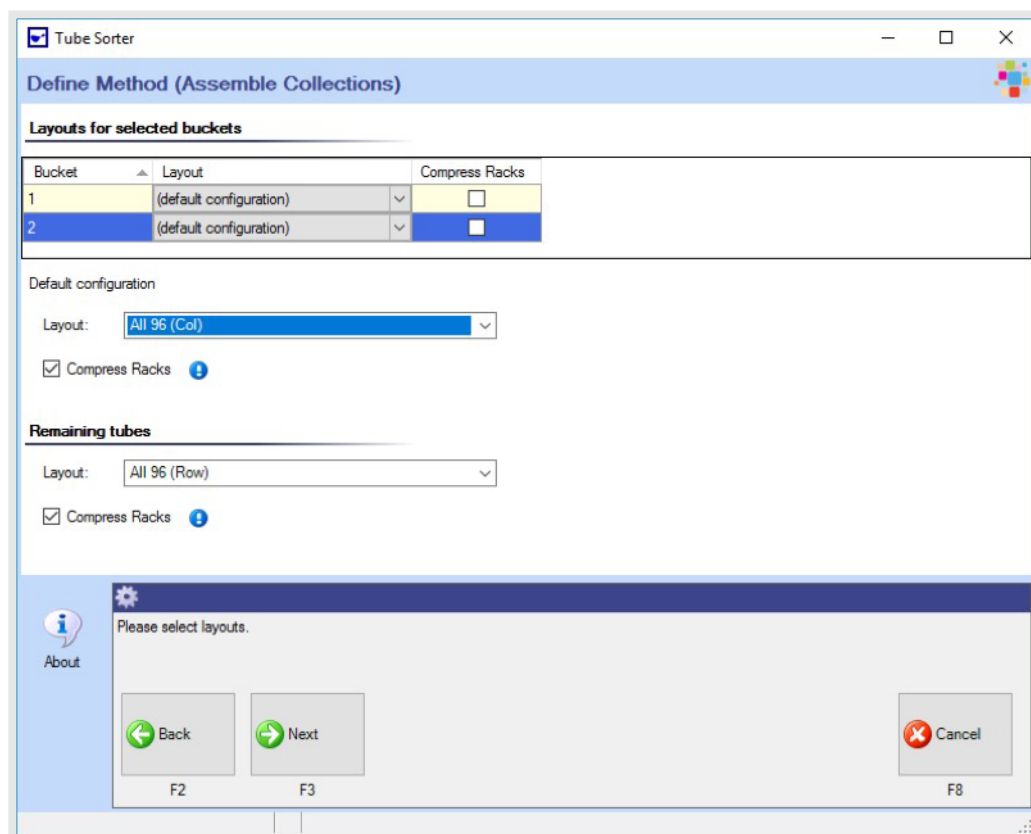
Racks of tubes are loaded onto the picking bed by selecting a bed position and entering (by scanning) the rack's barcode. Note that two empty racks have been added to contain the segregated tube collections.

2. Define Sorting Method

After selecting the 'Assemble Collections' sorting method, the 'Define Method (Assemble Collections)' screen allows an operator to enter details of the required segregation grouping details. These details can be imported from a text file.

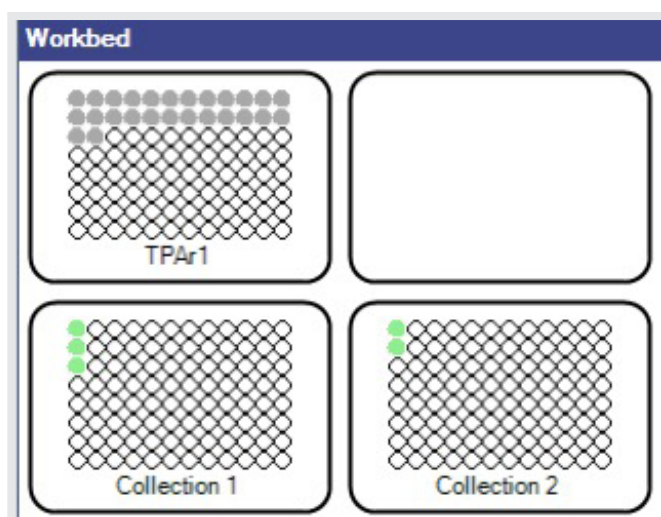


The various options can now be set to define the layout and picking logic for the source and destination racks.



3. Specify Run Settings

In the same way as the previous examples the run settings are now defined.



4. Perform Run

Once the desired method is settled upon, the run can be initiated by selecting the "Start Run" button.

The completed Picked layouts are shown on the left.

After the run is completed the racks can be removed from the tube handler by selecting the "Unload All" button.

Summary



Titian Software's Mosaic ATS module, in combination with a BioMicroLab tube handler, provides an effortless and efficient method for managing and maintaining samples stored in 2D barcoded tubes and racks. This is especially useful where no automated store is available for handling your valuable sample collections. The seamless integration with the Mosaic sample management application allows operators to easily:

- Retrieve and segregate tubes for order fulfilment
- Compress storage racks to minimize storage space requirements
- Separate and consolidate groups of selected tube sets
- Remove tubes flagged for disposal

About Titian Software

Titian Software is the industry leader in providing sample management software for life sciences. Using our Mosaic software, our customers see significant benefits in terms of throughput, response times, error rate reduction, sample conservation and cost savings due to markedly reducing the labour associated with managing sample collections. We also use our experience of integrating laboratory instrumentation and robotics into our systems to ensure that our clients make best use of their investment in research and development technologies.

At Titian Software, our development efforts never stop as we continue to advance Mosaic sample management software toward higher levels of efficiency and practicality for the user. The ongoing collaborative relationship between Titian and hardware vendors continues to ensure that new applications are made available on a timely basis to fulfill our customer's research goals. We pride ourselves on taking into account customer feedback for all of our Mosaic modules to drive our product to be the best it can be. It's all part of Titian's commitment to providing innovative solutions that make life easier for sample management professionals.

About the author

Paul Kay - After 16 years as a medicinal chemist at Roche, Paul Kay moved to Organon (later Merck) where he specialized in compound management and automation systems for 10 years. He joined Titian in 2011 as a business application consultant.

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