

LASER PROCESSING WITH RAYLASE

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THE POWER OF WE.

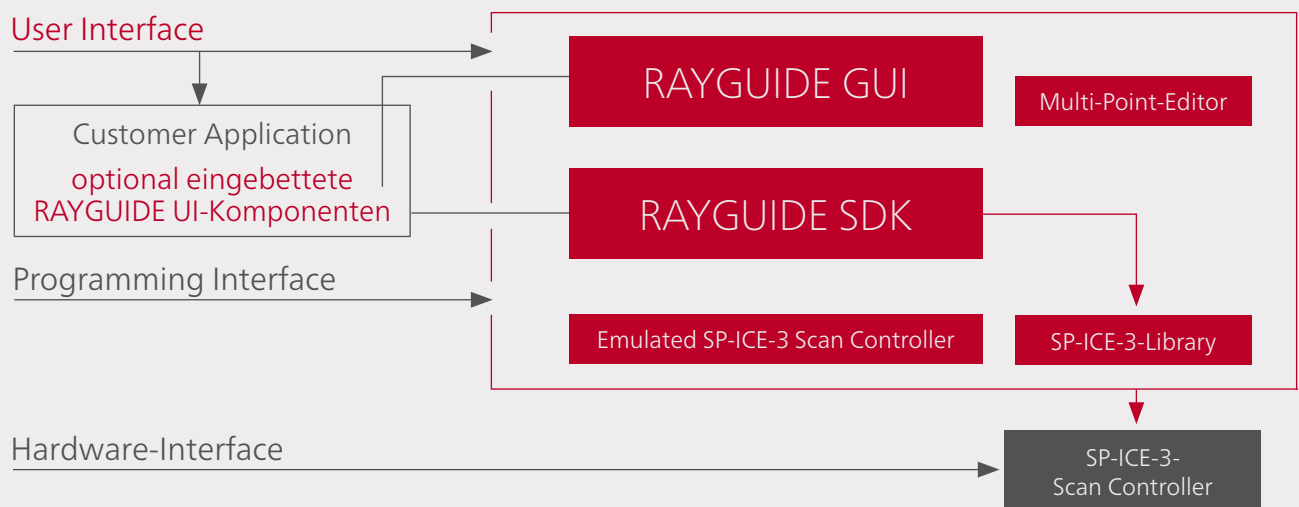
RAYGUIDE is the modern laser processing software, developed by RAYLASE for end-users and programmers with the goal to increase usability and decrease programming complexity. RAYGUIDE comes with all fundamental tools to setup and calibrate the galvo-scanner-system, create laser processing jobs and execute them with all required automation including a continuously expanding range of features and functions. RAYGUIDE utilizes the full feature capacity of the SP-ICE-3 control card to complete a powerful laser processing package.

Basic Interface Structure

Vision: The API should contain all functions of the GUI and support them with easily adaptable sample code.



- RAYGUIDE RAYGUIDE user Interface for quick and easy interaction
- RAYGUIDE programming library for highest level of automation and integration



RAYGUIDE API:

Available as RAYLASE SDK License for programming your own application

- RAYGUIDE SDK License grants access to RAYGUIDE GUI for system configuration and calibration
- RAYGUIDE API offers complete range of functions as the RAYGUIDE GUI
- API programming in .NET environment
- Supported by sample codes and tutorials, it was never easier to benefit from the powerful predefined functions and integrate them into your system HMI
- Create your laser process job programmatically or just modify jobs created by RAYGUIDE GUI as required to automate your process

```
// 1. Create the API:
using ( MarkerAPI markerAPI = new MarkerAPI() )
{

    // 2. Create and assign the devices:

    // 2.a) Create the SP-ICE-3 device:
    IDeviceManager deviceManager = markerAPI.DeviceManager;
    deviceManager.AddDevice( "my SP-ICE-3 card", typeof( SPICE3Device ) );
    BaseScanController scanController = (BaseScanController)deviceManager.GetDevice( "my SP-ICE-3 card" );
    scanController.IPAddress = "169.254.0.98"; // <= put your SP-ICE-3 card's IP address here
    scanController.EnableLogging = true;
}
```

Features For Basic Process Tasks

Vision: The graphical user interface of RAYGUIDE should impress by an self-explanatory and easy usage, and a fresh look & feel.

2.1 | Laser-Process-Parameters

To maintain the best process results, RAYGUIDE in combination with the SP-ICE 3 scan controller card supports the basic process parameters and advanced features such as:

Velocity based power correction:

Enables scan controller to automatically adjust laser power depending on the actual process speed to achieve constant laser power density on the material. This option can be activated individually for each pen used.



Skywriting:

Creates sharp corners and avoids energy burn-in at the beginning/end of the vector due to the advanced synchronization of laser and deflection unit.

Ramping

Ramping mode: **Time**

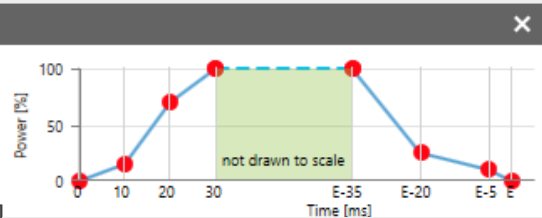
Start segments: **0 0;10 15;20 70;30 ***

End segments: **0 0;5 10;20 25;35 ***

Edit ramping start segment

Time	Power	Use laser power
0	0	<input type="radio"/> Use laser power
10	15	<input type="radio"/> Use laser power
20	70	<input type="radio"/> Use laser power
30	0	<input checked="" type="radio"/> Use laser power

OK Cancel



Power ramping:

Advanced laser control for welding applications. Ramping the laser power at start and end of path allows to adapt the laser Impact to individual process request. RAYGUIDE also allows you to compile ramps from several gradients. In addition, you can validate the ramp length to the vector length.

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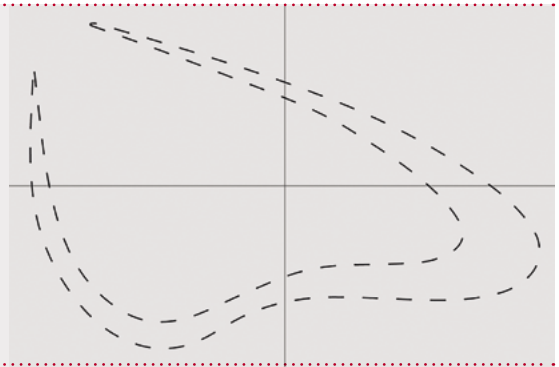
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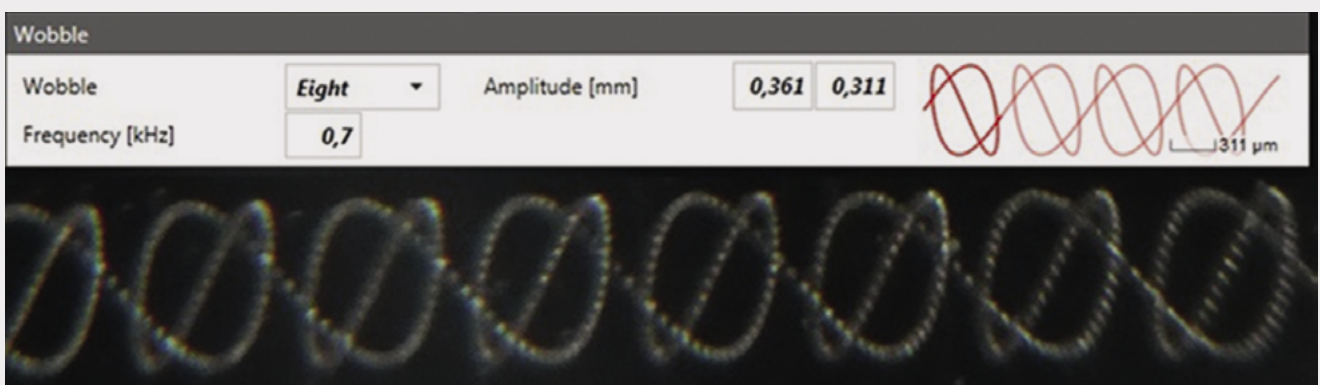
Dashed Line:

Enables to structure vector path with regular or non-regular gaps, independent to the style of the contour, e.g., scribing of easy-opening packaging



Wobble:

Predefined geometries such as circles, 8 and Lissajous figures are available. Shape preview function eliminates trial and error approach to parametrize chosen wobble shape



Support of New Laser Models:

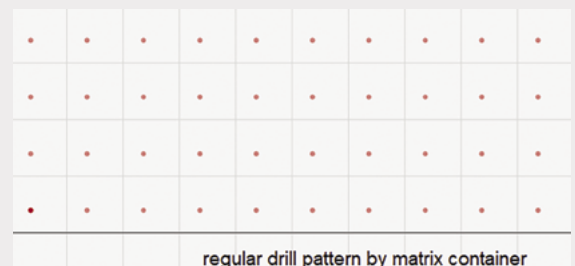
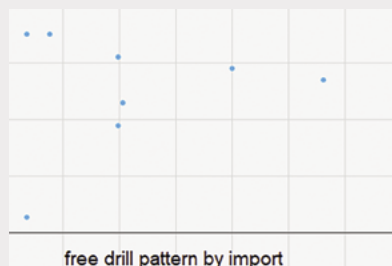
Some current lasers require new control options to optimally design the respective processes

- **IPG YLS AMB Laser** – Definition of two independent power channels
- **IPG YLPN** – Control of optical pulse width (APD Mode)
- **nLight AFX** – Control of beam shape mode

2.2 | Drill Pattern

Drill points can be defined by number of pulses or laser on duration

Variable drill pattern can be imported by coordinate table while homogeneous drill pattern can be generated by matrix copy container



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2.3 | Text Objects

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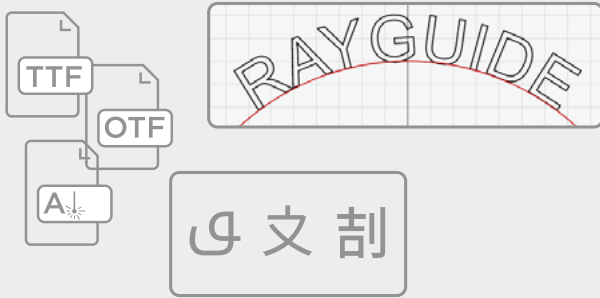


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- TrueType fonts, OpenType fonts and special laser stroke fonts can be used.
- Various variable sources of text content are available to create, for example, date and time stamps, serial numbers, or the combination of both.
- Optionally, the text automatically fits into a predefined placeholder, regardless of the content or font



Preview
001 RAYGUIDE 16:37:45

Data

Source	Custom		
Text	%O RAYGUIDE %t		
Add placeholder	v		
Start	1	Increment	1
Batch	1	Digits	3
Current iteration	0		
Auto reset	Never		

- Configure its processing direction in regular writing direction or opposite
- Arrange text radially
- The UTF16 encoding also allows the transfer of special characters as they can occur in some languages (Japanese, Chinese, Arabic).

2.4 | Filling Structures

- Choose the optimal filling structure to realise short process times. For example, "contour filling" can be faster than "hatch filling". Or with a "drill point filling" other optical effects can be achieved than with a "hatch filling".

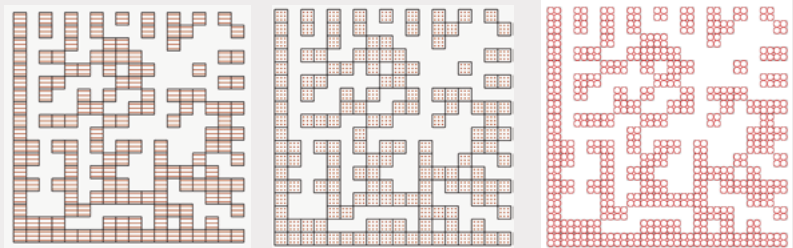
job "hand-line-fill" settings

Markable objects	SPRICE-3		Total
	Contour	Filling	
Total mark length [mm]	271,289	800,575	1071,864
Total jump length [mm]	29,625	176,797	206,423
Execution time [ms]	00:02:727	00:08:121	00:10:849
Number of commands	27	277	304
Number of points	804	277	1081
Number of scan lines	0	0	0

job "hand-insert-fill" settings

Markable objects	SPRICE-3		Total
	Contour	Filling	
Total mark length [mm]	271,289	544,87	816,159
Total jump length [mm]	29,625	78,51	108,135
Execution time [ms]	00:02:727	00:05:489	00:08:216
Number of commands	27	11	38
Number of points	804	1851	2455
Number of scan lines	0	0	0

- Simply fill codes with a defined number of fill lines or dots or circles, which are evenly distributed in the code cell by RAYGUIDE



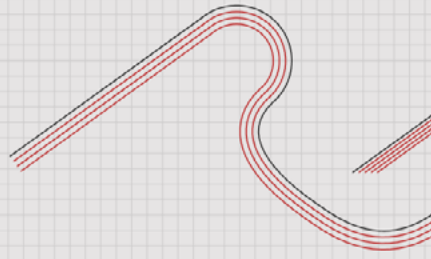
- Assign filling to individual paths of a graphic

Text

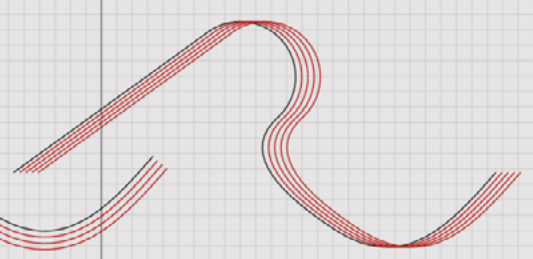
- > Layer: 11 paths
- > [1] Closed path
- > [2] Closed path
- > [3] Closed path
- > [4] Closed path
- > [5] Closed path
- > [6] Closed path
- > [7] Closed path
- > [8] Closed path
- > [9] Closed path
- > [10] Closed path
- > [11] Closed path

- Realise special parallel contour lines using fill options

contour copy feature



orthogonal offset copy



Additional useful options for fillings:

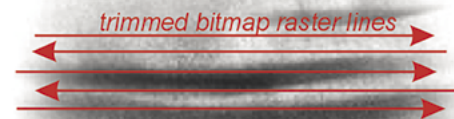
- Processing of the filling itself can be automatically sorted to optimise the process time.
- Fill structures can be stacked
- Save fill patterns as template for re-usage



2.5 | Bitmap Marking

- Select from 2 available process modes: Point-and-Shoot or Sprint-Mode
- Execute bitmap lines alternative horizontally or vertically, which, depending on the bitmap, reduces the number of line breaks, which in turn saves process time.
- Easy Power Scaling to achieve fast result depending on the target material
- Faster processing by trimming the raster to the minimal necessary

white pixel
border omitted



Quick results with any material thanks to simple optimization and power adaption.

2.6 | Multiplying Container

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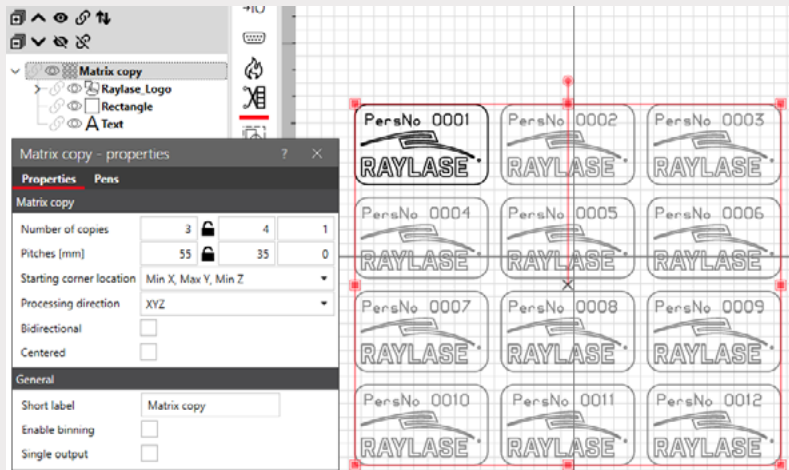
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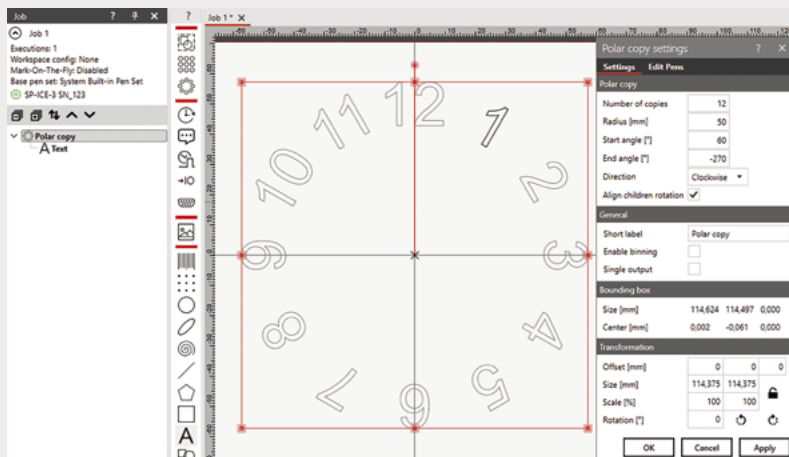
Matrix.Copy -Container

- .Copy container arranges its content in columns/rows. The process sequence can be set flexible.
- This makes it easy, for example, to apply serial numbers to several objects with defined increments.



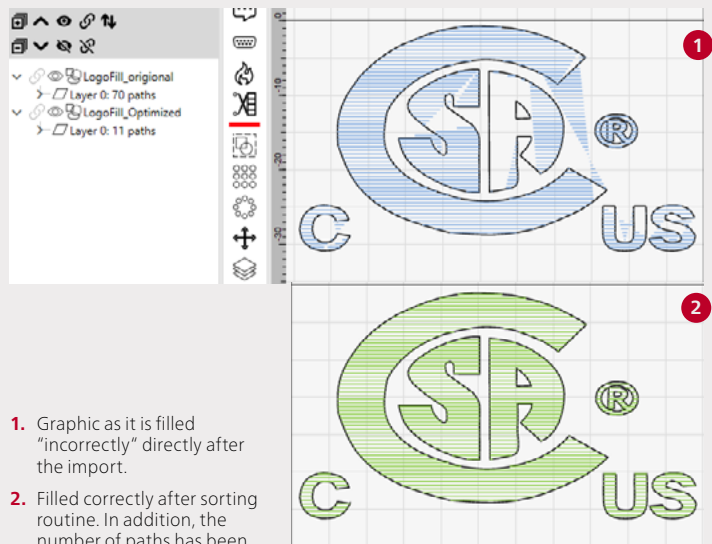
Polar.Copy -Container

- Polar.Copy container arranges its contents along a circular line.
- Option to aligning its elements ("children") in the case that they should point to the centre.



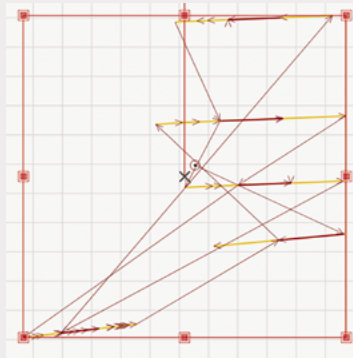
2.7 | Comprehensive Vector Editing

- Edit imported graphic files to align with laser-marking requirements
- Convert layout object defined by content (e.g., text) into real vector-based objects
- Optimize marking order easily in job tree by drag & drop
- Combine or split vector objects
- Save process time by automatically sorting the vector order with a click to optimise the processing sequence. In addition, you could unite contiguous paths and close gaps in order to fill layouts (correctly).

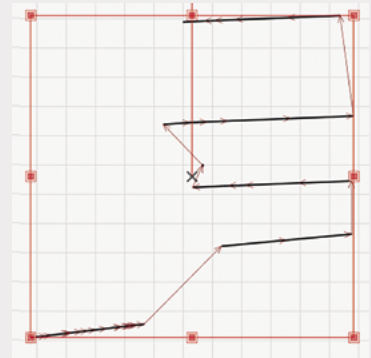


1. Graphic as it is filled "incorrectly" directly after the import.
2. Filled correctly after sorting routine. In addition, the number of paths has been reduced from 70 to 11.

- Easily assign common properties to a selection of several objects (e.g., number of passes)

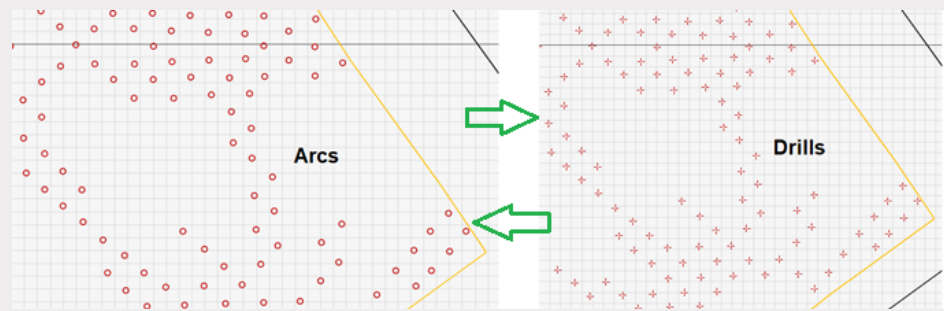
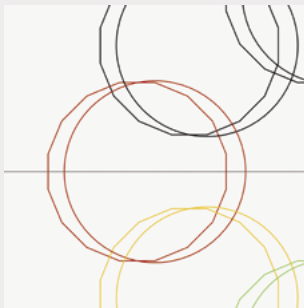


Before sorting routine



After sorting routine

- Convert geometric elements as needed (e.g., arcs to polylines, circles to points etc.)



2.8 | Pen Management and Pen Assignment

- Address all marking quality related features by pen
- Pen and layout objects are managed independently
- Unlimited number of pens available
- Change purposeful individual parameters in a selection of multiple pens
- Save important pen parameters in the pen library
- Conveniently assign pens at up to very granular levels: per object, per layer, per path, within a path

#	Outline	Filling	Name	Power	Frequency	Pulse width	Mark speed	Jump speed	Color
1*	-	-	55	10	100	1	2	2	
2*	-	-	66	10	100	1	2	2	
3*	-	-	77	10	100	1	2	2	
4*	-	-	100	10	100	1	2	2	
5*	-	-	100	10	100	1	2	2	
6*	-	-	100	10	100	1	2	2	
7*	-	-	100	10	100	1	2	2	
8*	-	-	100	10	100	1	2	2	

Context menu options:

- General
- Laser
- Mark timings
 - ✓ Mark speed [m/s]
 - Mark delay [µs]
- Jump timings
 - Poly delay [µs]
 - Variable poly delay
- Skywriting
- Ramping
- Dashed line
- Spot Magnification
- Wobble
- Reset to default

- Select which parameters to be shown in the pen-panel table
- Export all current pen parameters to a CSV table for your application reporting.

2.9 | Job Analytics

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- 1. Job statistics** provide valuable information before execution, such as calculated process times. Detect immediately how changes in parameters or sequence affect the process duration
- 2. View options** (show jumps, show vector tips) allow a fast insight of the process sequence of the layout and its possible potential for improvements

Barcode

MNG-0737DDVN

hubble

Job "Job 1" settings

Settings Statistics

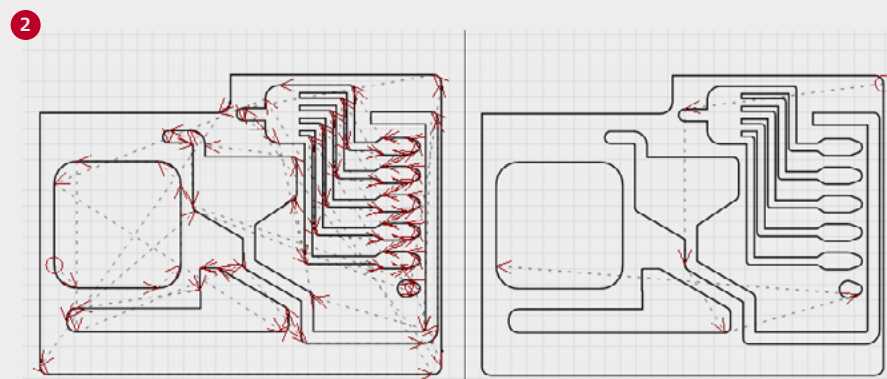
SP-ICE-3 SN123

	Contour	Filling	Total
Total mark length [mm]	25515,255	0	25515,255
Total jump length [mm]	23789,101	4906,227	28695,328
Execution time [ms:ms]	01:00.905	00:02.595	01:03.500
Number of commands	363	1422	1785
Number of points	1520	1422	2942
Number of scan lines	463	0	463

OK

Cancel

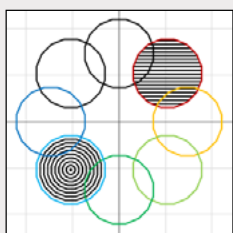
Apply



In this sample one might detect fast if there is a potential to optimize process sequence (left before and right after optimization)

2.10 | Using Visible Pointer

Many lasers are equipped with a visible pointer that allows you to verify and adjust the processing position of layouts in advance.



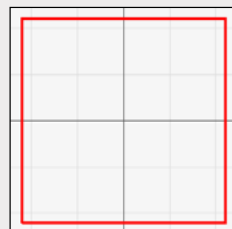
Select from various options to choose what part or how a layout object should be displayed:

Rectangle: very quick and simple overview

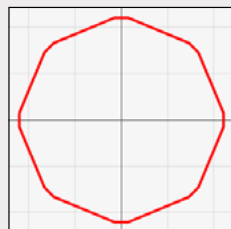
Envelope: quick but somewhat more detailed overview

Contour: detailed display of layout position and space requirements

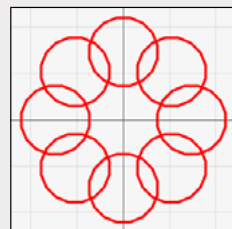
All: Compared to the contour, also includes the display of fill structures



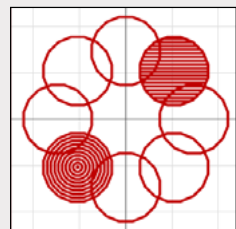
Rectangle preview



Envelope preview



Contour preview



All preview

Point: Useful to fit contours to component geometry by displaying discrete geometry points

Unique feature: edit the layout while the preview is running, e.g., by adjusting its position and move it to the desired position. Detailed editing is also possible. Even a change from one to another object is possible without interrupting the preview.

2.11 | User Permissions

Convenient task management and always up to date thanks to easy user assignment



- Allow system owner to establish different user permissions
- No additional user management needed since RAYGUIDE uses Windows user/user groups
- Flexible assignment of user roles and their allowed actions
- If editing is restricted, the related dialogs become read only for reviewing

Covenient and flexible set up of different user profiles possible

Preferences ? X

System (all users) User (current user)

General Workspace UI Process adjustment Visibility Permissions

Users/Groups Operations

Operations	Roles	Administrator	Designer	Operator
Configure devices		<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Configure system		<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Define roles		<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Assign roles to users		<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Assign operations to roles		<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Edit job layouts		<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>
Edit pens		<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>
Delete templates		<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>
Adjust process parameters		<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>

OK Cancel Apply Add role

Preferences ? X

System (all users) User (current user)

General Workspace UI Process adjustment Visibility Permissions

Users/Groups Operations

Users/Groups	Roles	Administrator	Designer	Operator
User: User_1		<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>
User: Administrator		<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

OK Cancel Apply Add User Add role

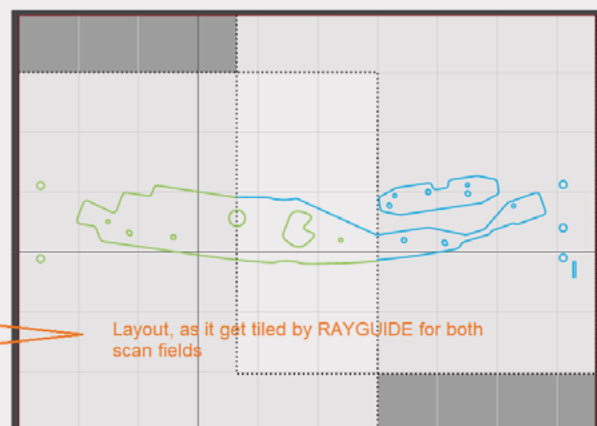
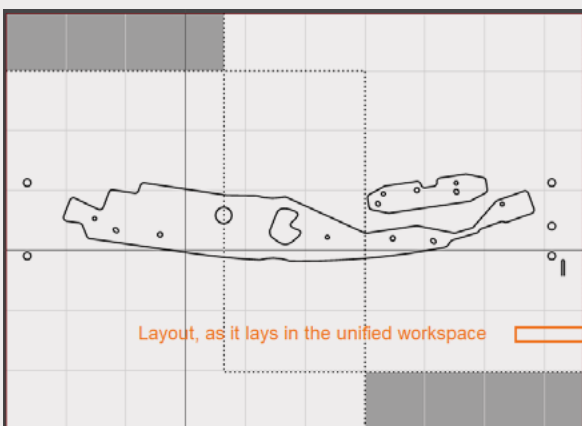
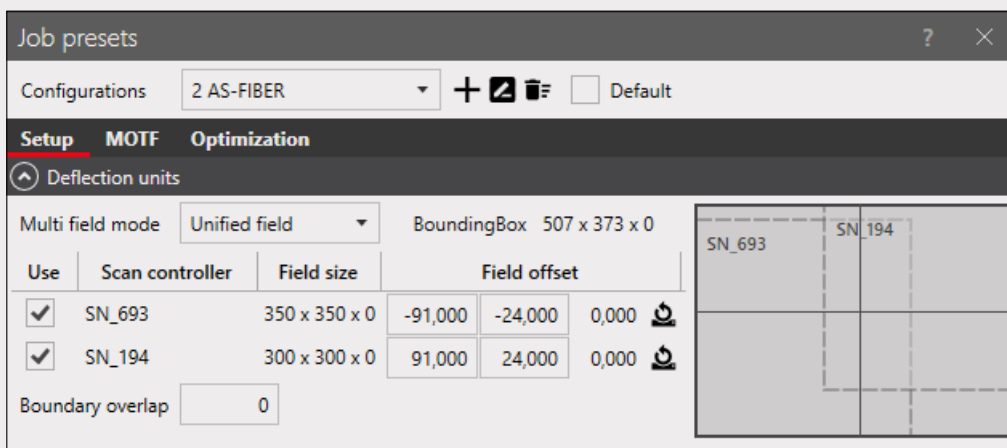
Features For Demanding Process Requirements

3.1 | Multiple Scan Field Management

Define the arrangement of the scan fields as specified by the machine setup, so that the display in the viewport reflects reality.

3 variants are available for the use of multiple scan fields:

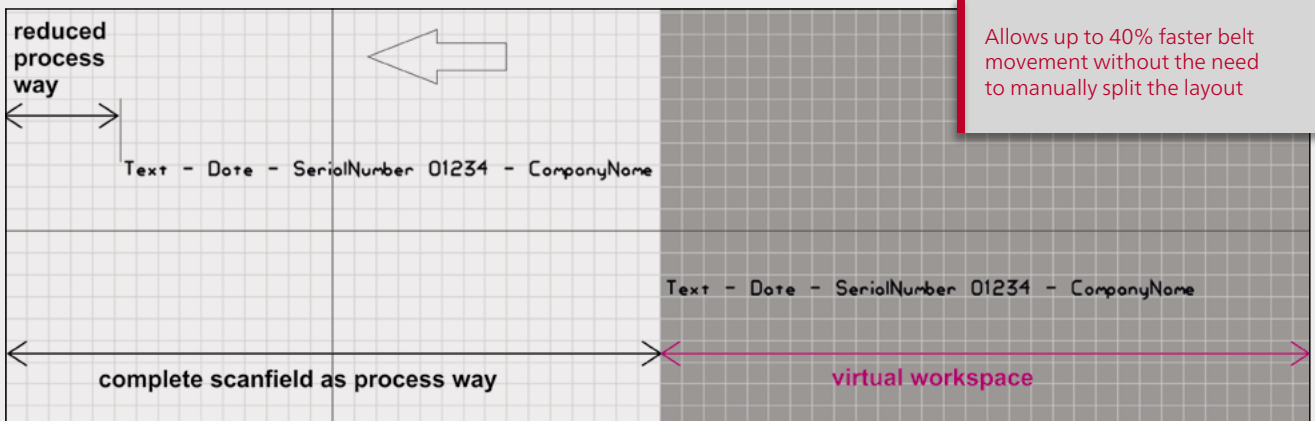
- **Unified:** Use the scan fields provided by multiple deflection units as a contiguous workspace. With combined scan fields, RAYGUIDE automatically splits spanning graphics, but tries to avoid separating laser paths where possible.
- **Intersected:** Divide the processing task among several deflection units covering a superimposed working area to save process time
- **Individual:** Execute the same job in parallel on several deflection units synchronised.



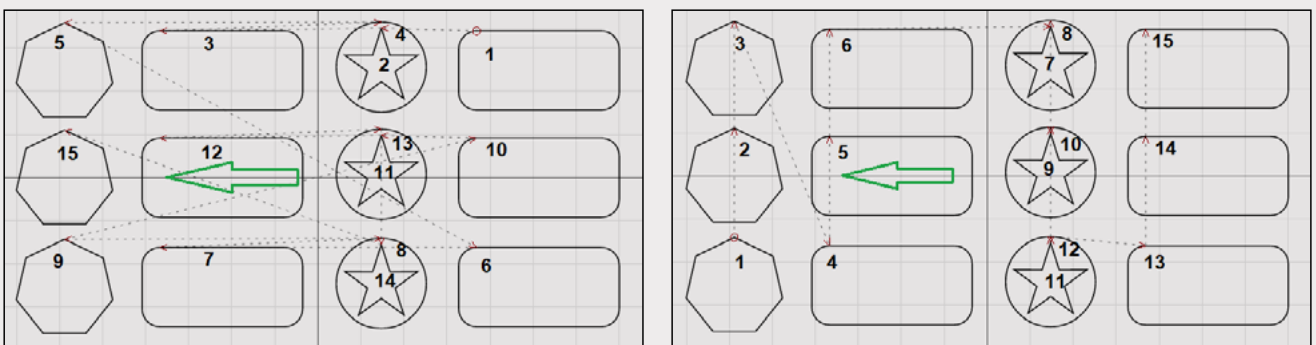
The example shows a contour that extends over both scan fields. However, only the laser paths that do not lie completely in one of the two scan fields are cut.

3.2 | Marking-On-The-Fly (MOTF)

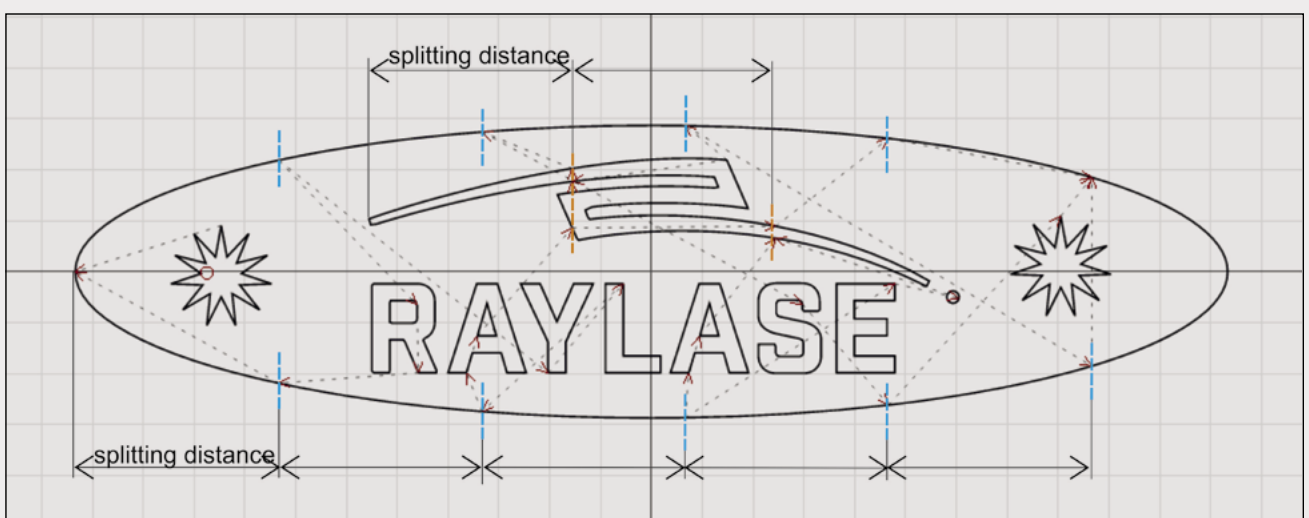
Define the **“virtual workspace”** to also place objects outside the scan field to achieve the maximum possible process way in the field.



By means of **automatic sorting**, the paths are processed in the sequence required by the direction of belt movement for a fast belt speed:



Only necessary paths that exceed the limit that have been set shall be “split” accordingly:



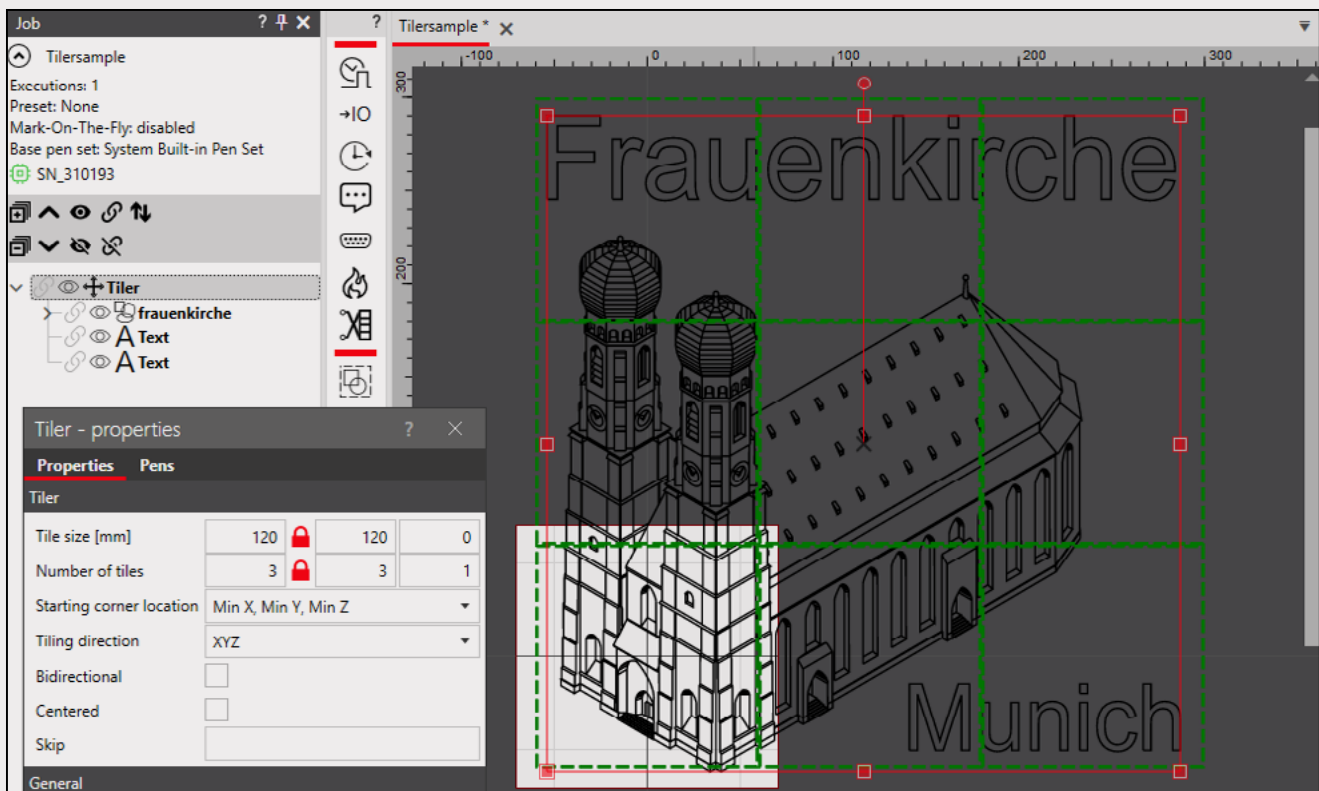
- Use the simulation encoder to evaluate the maximum belt speed.

3.3 | Sequences and Z-Shifter-Container

- By means of a sequence, you define a process succession where the process parameters for a layout object can be changed in several repetitions to achieve the desired effects on the material.
- hatch filling can be offset and/or rotated per sequence to avoid scoring during deep engraving.
- Layout objects that are placed in the Z-shift-container pass through several focus positions in which they are executed, for example, to get engraved into the material depth.

3.4 | Processing Oversized Graphics

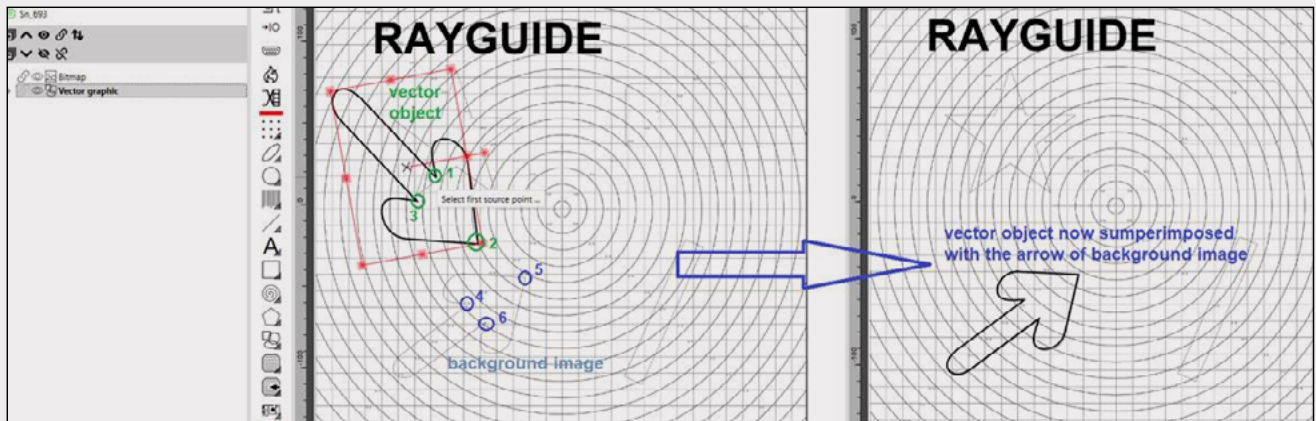
- The tiler-container allows you to process layouts that are larger than the scan field.
- By using the container property, even several layout objects that have been put together are split up as one overall image.
- Empty segments can be omitted.
- The process sequence of the tiled segments can be set flexible.
- Place IO automation objects in the container to synchronize the laser process with PLC-controlled axis movement.



3.5 | Click To Fit

Only a few mouse clicks are needed to adjust position and orientation of your welding contour to the desired component contour, which is shown in camera images of your part, for example.

In combination with the RAYGUIDE Click & Teach option, this function supports a simple but at the same time exact positioning of geometries to the individual component position.



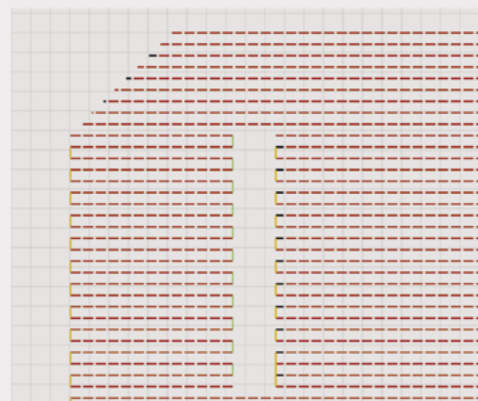
3.6 | Solar-Wafer Plug in

Import module: Using a special import function, individual line elements are combined to form a dashed-line. Due to the associated elimination of many delay times and the optimised use of the SKYWRITING function, the process times can be reduced by up to 60% with improved marking results at the same time.

Designer module: Create the wafer design directly in RAYGUIDE and react flexibly to layout adjustments. The special jerk-limited control that can be activated in this module enables perfect precision (in the μm range) even at the highest process speeds.



Common DXF Import: 25.654 single paths

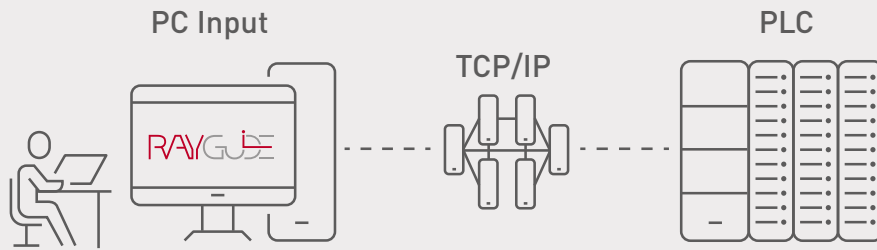


Dashed Wafer Import: 965 dashed paths
 Up to 60% faster processing!

Features For Automation

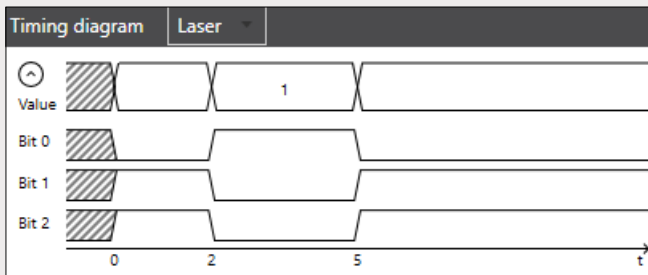
4.1 | PLC-Command-Interface

- Remote control of the RAYGUIDE GUI from your PLC via TCP/IP connection using appropriate commands.
- Submit transformations to adapt the position of the geometry to the component position.
- Submit new content for text/code objects.
- Switch the laser job remotely according to actual part



4.2 | Automated Communication Of System Malfunctions

- Enables the monitoring of the deflection unit status, and in case of malfunction, forwards the information via IO to external PLC
- Other system errors such as laser alarms, abort events or control card error messages can also be automatically communicated to an external monitoring centre.

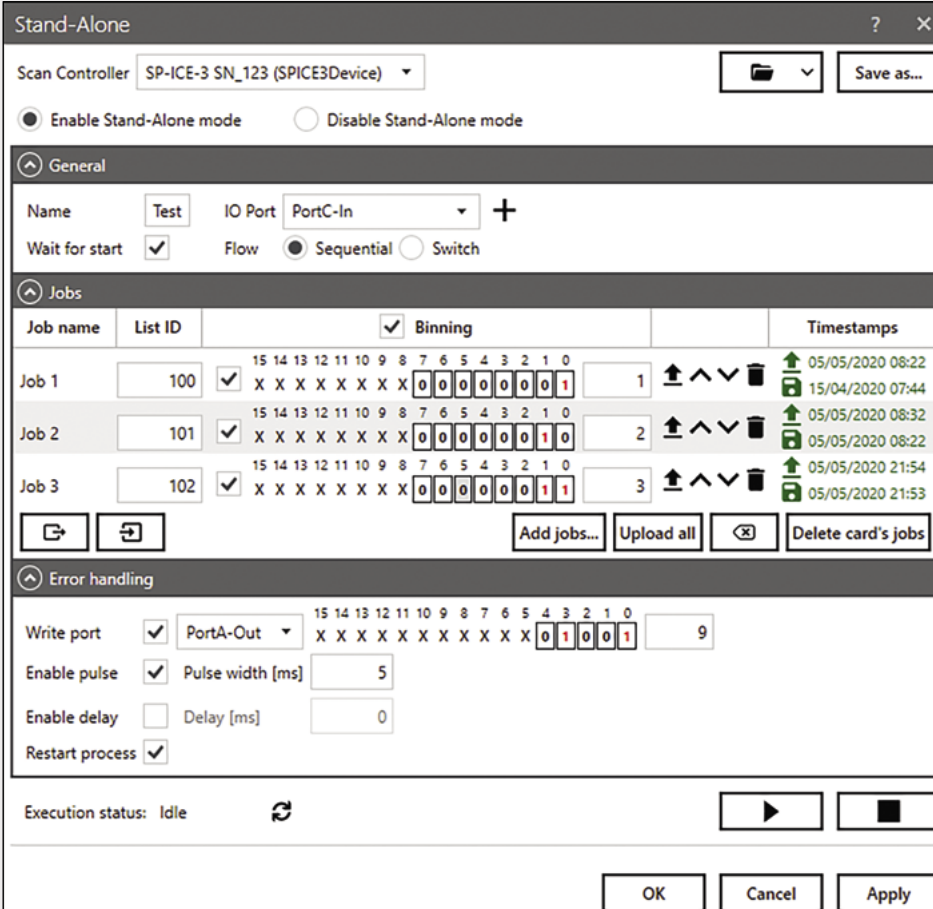


Error handling	
Device type	IO controller
Device	
Controller	SN_693 - IO
Port	PortA-Out
Setup time [ms]	2
Pulse width [ms]	3
Error action	
Laser	15 14 13 12 11 10 9 8 7 6 5 4 3 2 1 0 <input type="checkbox"/> <input type="checkbox"/> <input checked="" type="checkbox"/> <input type="checkbox"/> 1
Deflection unit	15 14 13 12 11 10 9 8 7 6 5 4 3 2 1 0 <input type="checkbox"/> <input type="checkbox"/> <input checked="" type="checkbox"/> <input checked="" type="checkbox"/> 2
Scan controller	15 14 13 12 11 10 9 8 7 6 5 4 3 2 1 0 <input type="checkbox"/> <input checked="" type="checkbox"/> <input checked="" type="checkbox"/> <input checked="" type="checkbox"/> 3
Out of field	15 14 13 12 11 10 9 8 7 6 5 4 3 2 1 0 <input checked="" type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> 4
Execution aborted	15 14 13 12 11 10 9 8 7 6 5 4 3 2 1 0 <input checked="" type="checkbox"/> <input checked="" type="checkbox"/> <input checked="" type="checkbox"/> <input type="checkbox"/> 7

4.1 | Setting Up Stand-Alone Control Card Operation

By preparing the stand-alone mode of the control card, the job execution can be directly synchronized between PLC and scan controller.

- Select and upload multiple jobs in just two steps to the scan controller.
- Easily assign the binning conditions and maintain the job overview by using the csv-export/import option
- The time stamp display makes any job content that has been updated since the last download noticeable
- Define the desired action in case of an error event. This includes the option to return to the start trigger without the need to reinitialize the card after an abort.
- Using a previous stored configuration, it is easy to clone the stand-alone setup onto another SP-ICE-3 scan controller



The screenshot shows the 'Stand-Alone' configuration window. At the top, the 'Scan Controller' is set to 'SP-ICE-3 SN_123 (SPICE3Device)'. Below this, there are radio buttons for 'Enable Stand-Alone mode' (selected) and 'Disable Stand-Alone mode'. The 'General' section includes fields for 'Name' (Test), 'IO Port' (PortC-In), 'Wait for start' (checked), and 'Flow' (Sequential selected). The 'Jobs' section contains a table with columns for Job name, List ID, Binning, and Timestamps. Three jobs are listed: Job 1 (List ID 100), Job 2 (List ID 101), and Job 3 (List ID 102). Each job has a binning configuration row with 16 columns (15-0) and a 'Timestamps' column with two entries. Below the table are buttons for 'Add jobs...', 'Upload all', and 'Delete card's jobs'. The 'Error handling' section includes 'Write port' (checked, PortA-Out), 'Enable pulse' (checked, Pulse width [ms] 5), 'Enable delay' (unchecked, Delay [ms] 0), and 'Restart process' (checked). At the bottom, the 'Execution status' is 'Idle', and there are 'OK', 'Cancel', and 'Apply' buttons.

Job name	List ID	Binning	Timestamps
Job 1	100	X X X X X X X X X X 0 0 0 0 0 0 0 1	05/05/2020 08:22 15/04/2020 07:44
Job 2	101	X X X X X X X X X X 0 0 0 0 0 0 0 0	05/05/2020 08:32 05/05/2020 08:22
Job 3	102	X X X X X X X X X X 0 0 0 0 0 0 0 1	05/05/2020 21:54 05/05/2020 21:53

Further Advantages Of RAYGUIDE

5.1 | GUI Multitasking

- Full access to all job dialogues and thus the currently used process parameters, while job is running.
- Create and edit other jobs is possible, even while one job is executed

5.2 | Virtual Scan Cotroller

- Design and evaluate laser process jobs using the emulated SP-ICE 3 scan controller without a physical scan controller connected

5.3 | Intergrated Multi-Point-Editor

- Ease & Improve field calibration with the powerful Multi Point Editor Tool integrated within RAYGUIDE

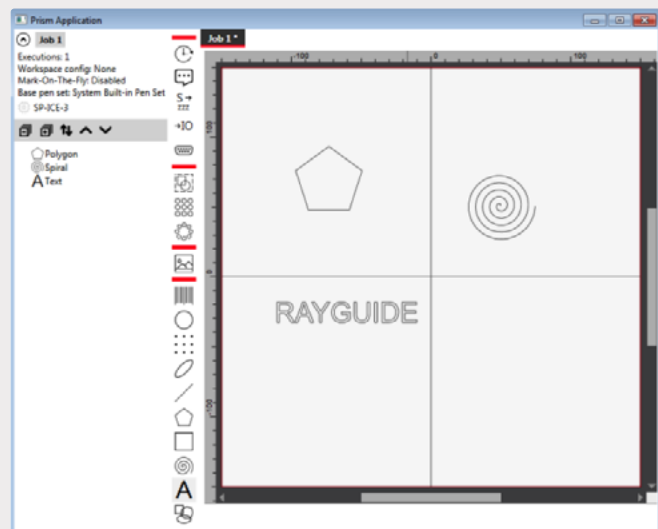
5.4 | Customer Plug Ins

- Use RAYGUIDE as master UI and embed your individual machine feature controls
- Allows additional hardware controls
- Allows user to embed specific graphic items

5.5 | Embedded GUI

- Embed RAYGUIDE as part of your machine HMI which will be the master UI
- Use only the parts of RAYGUIDE GUI needed
- Save development time when using ready programmed controls
- Work with the widely used Microsoft WPF tool to embed RAYGUIDE

Dialogue with embedded RAYGUIDE instance



6.1 | RAYGUIDE Click&Teach

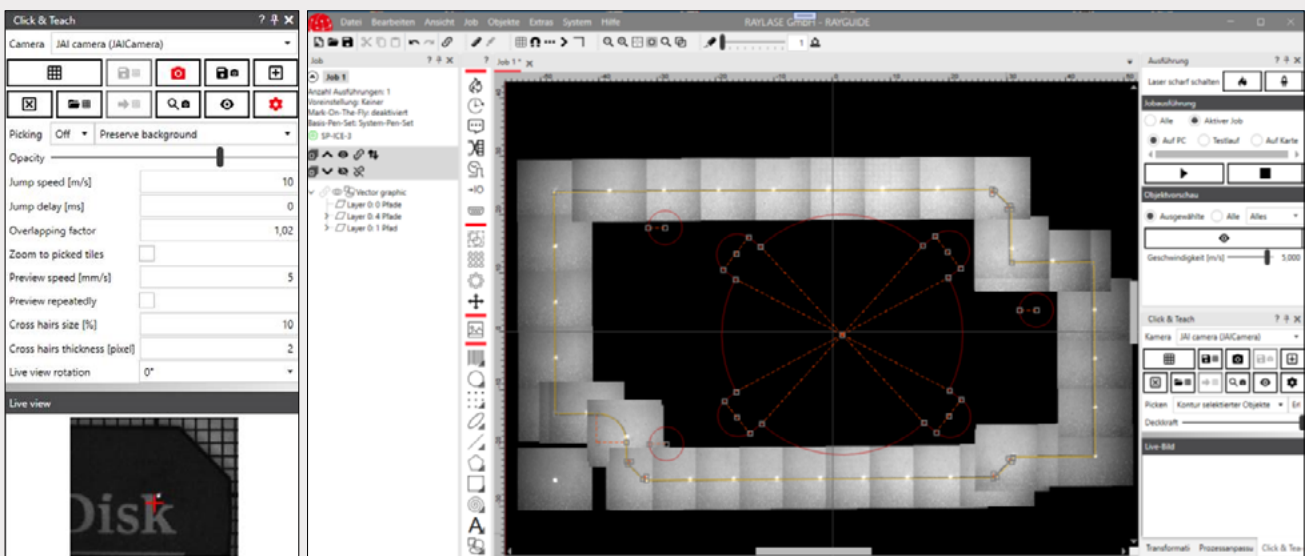
By means of a coaxially coupled camera ("on-axis"), images can be taken of the workpiece(s)/ component(s) or the entire scan field. Subsequently, the geometry to be processed can be aligned as accurately as possible to the actual position.

The associated calibration routine ensures that optical and/or geometric distortions in the camera images are compensated so that the position in the image and laser beam position will match.

- Select between 2 already fully integrated camera models
- The function can be used for 2-axis deflection units with F-Theta and matching camera adapter as well as our pre-focusing AS-FIBER series with RAYSPECTOR.

Benefit from the following advantages:

- Within a single GUI application, in beside Click&Teach function, you can still access RAYGUIDE's powerful graphics editing function.
- Acquisitions are possible in different focus positions
- Choose from various acquisition modes to suit your task
- The following acquisition modes are available: single or 3x3 or 5x5 picked image tiles, the whole selected layout object, only along a special layout contour, a part of the working field drawn with the mouse pointer or the whole working field.
- Zoom directly into the desired image tile with one click
- Simulate the final contour progression for verification in the live image





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