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Velox 2.6
Software Introduction

Kirchhoff Institut für Physik Heidelberg

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Velox 2.6 Software Introduction

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  - Data types
- Velox Help
  - Workflow Guide

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Operation Basics

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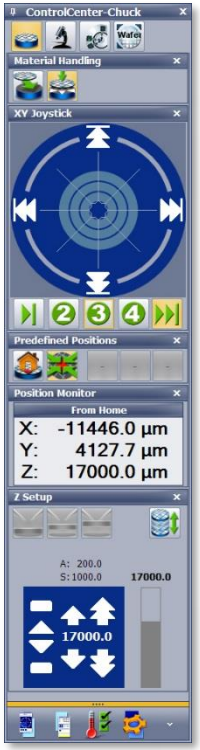
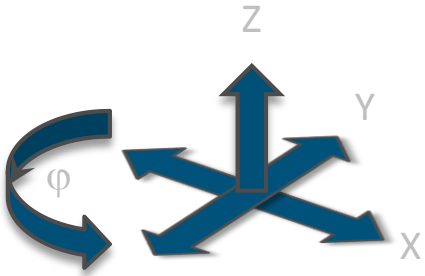
Velox 2.6 – Operation Basics

Prober Navigation



USB Joystick Controller



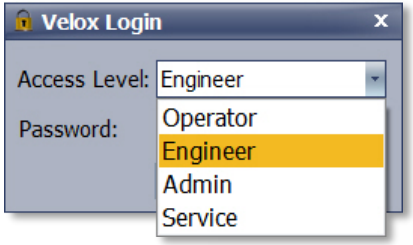
Probe Station	
▪ Chuck ▪ Microscope ▪ Positioners	
References	**Moves**
▪ Zero ▪ Home ▪ Center	▪ µ-Steps ▪ Speed 2-4 ▪ Index

Velox 2.6 – Operation Basics

User Levels

- 4 basic user levels:
  - Operator: very limited access, run projects, no password required
  - Engineer: basic functions to setup projects, password: Engineer
  - Admin: extended rights to change important settings and modify system, password: Admin
  - Service: complete access, requires service key, for instructed service personell only

- User levels provide access to different parameters, but do not act as an account (like in NUCLEUS).
- Individual user levels possible



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Core Applications

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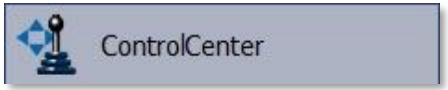
Velox 2.6 – Core Applications

Overview

- Toolbar

- Control Center



- Wafer Map

- Spectrum Vision System

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Toolbar

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Velox 2.6 – Core Applications

Toolbar

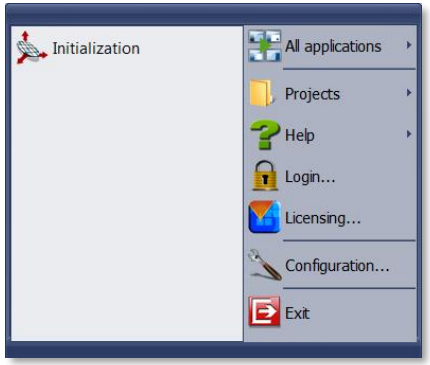
Project handling and login

Functions and Application links

Status information

- Quick access to all applications, tools and selected functions
- Open/ Save projects
- Change user level
- Status information
- Customizable

Click on for more options:



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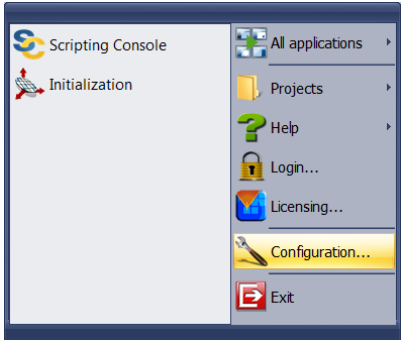
Toolbar - Customize

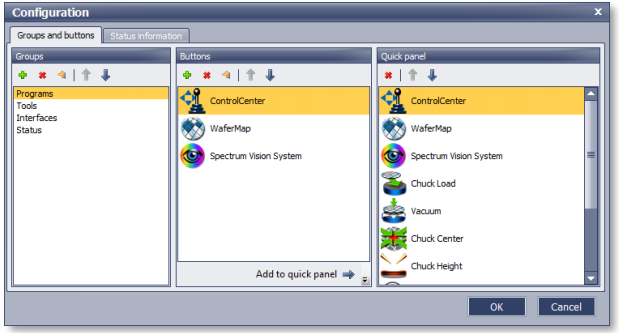
Add/remove buttons to:

- open applications
- change status
- execute a script

Add/remove status information

Click on for more options





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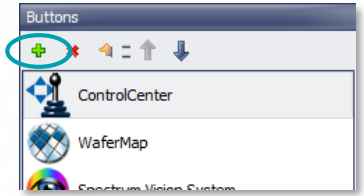
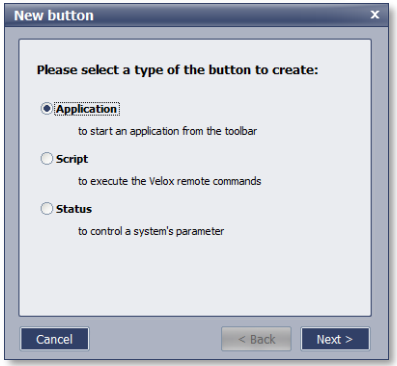
Toolbar - Customize

- Add button:

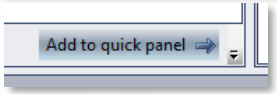
1.



2.

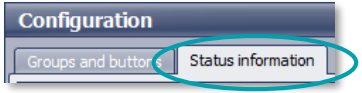


3.

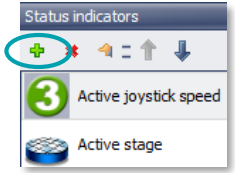


- Add status:

1.



2.



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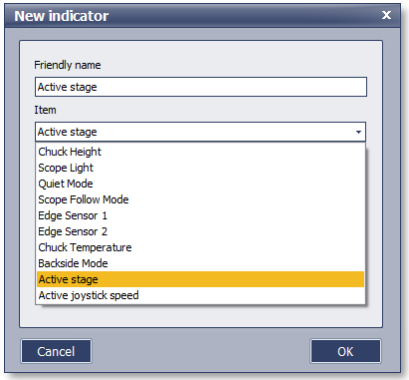

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Control Center

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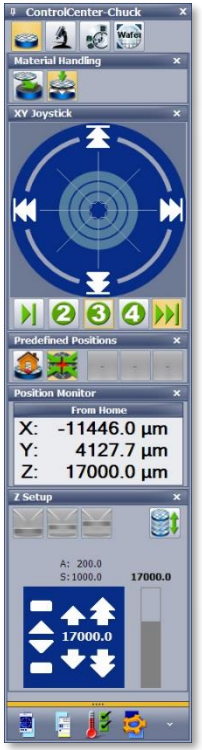
Velox 2.6 – Core Applications

ControlCenter



- Stage selection (all motorized stages)
- Load/unload wafer and wafer vacuum on/off
- XY-Joystick
- Speed selection (2,3,4, Jog, Index) XY-axis
- Pre-defined Positions (e.g. Home, Center)
- Position monitor (with selectable coordinate reference [zero, center, home] and unit [microns, index])
- Z Control
- ControlCenter page selection

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ControlCenter – Customize

- Customize ControlCenter by rearranging modules

Remove module by clicking on the "X"

Drag-and-drop to change position

„Right-click" → "Add Module" → All available modules are listed

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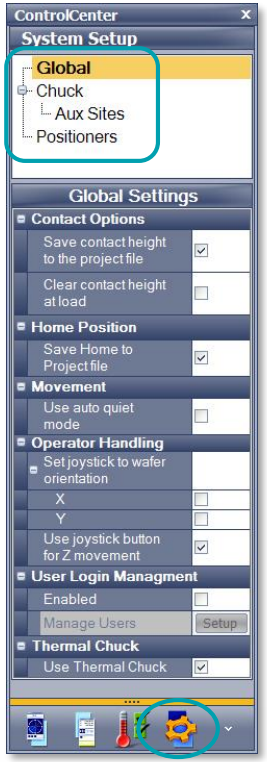
ControlCenter – System Settings

- Global settings
  - Joystick behavior (XY reverse)
  - Auto quiet usage
  - Contact height options
  - User Login management
- Chuck settings
  - Edge sensor
  - Multiline vacuum (station specific)
  - Contact count
  - AuxSites
- Positioner settings
  - Define position and type of motorized positioners



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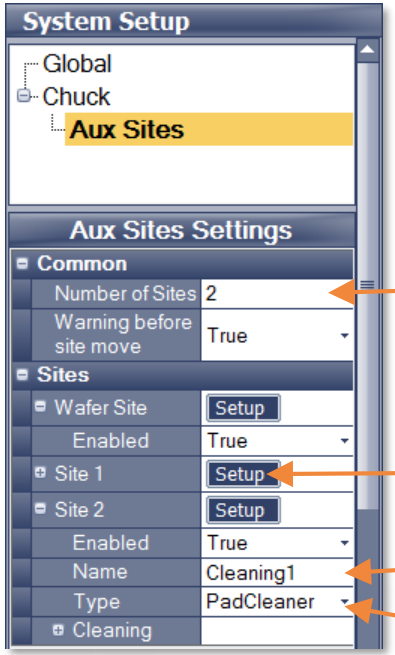
ControlCenter – AuxSite Settings



Number of auxiliary sites (additional to main chuck)

Start AuxSite setup wizard for selected site

Customizable name

Selectable type

Select AuxSite

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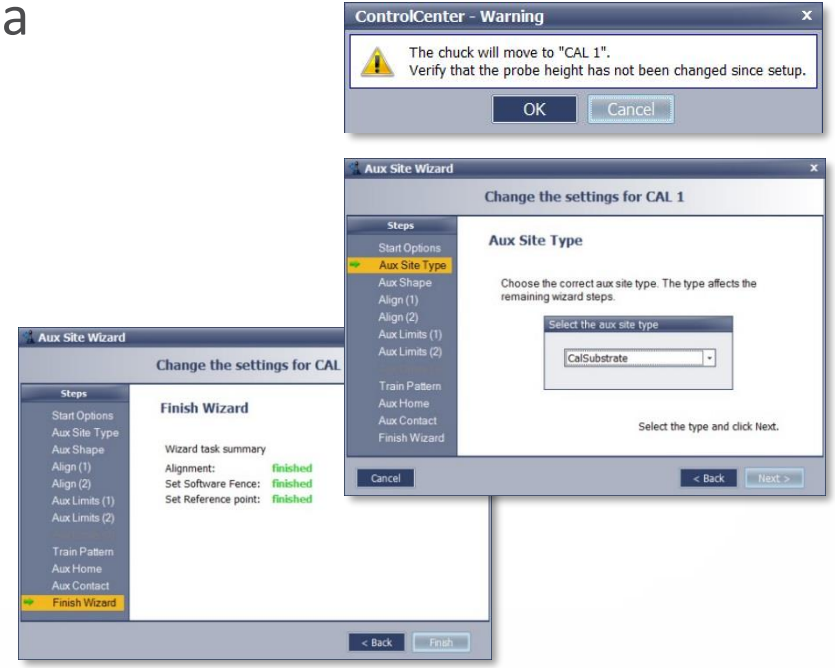
ControlCenter – AuxSite Wizard

- Push button Setup of desired AuxSite
- Moving to an AuxSite always raises a warning message:
- Follow the wizard instructions:
  - Select site type
  - Select shape
  - Align the substrate
  - Mark substrate area („Aux limits“)
  - Set Home and Contact position



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Wafer Map

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WaferMap

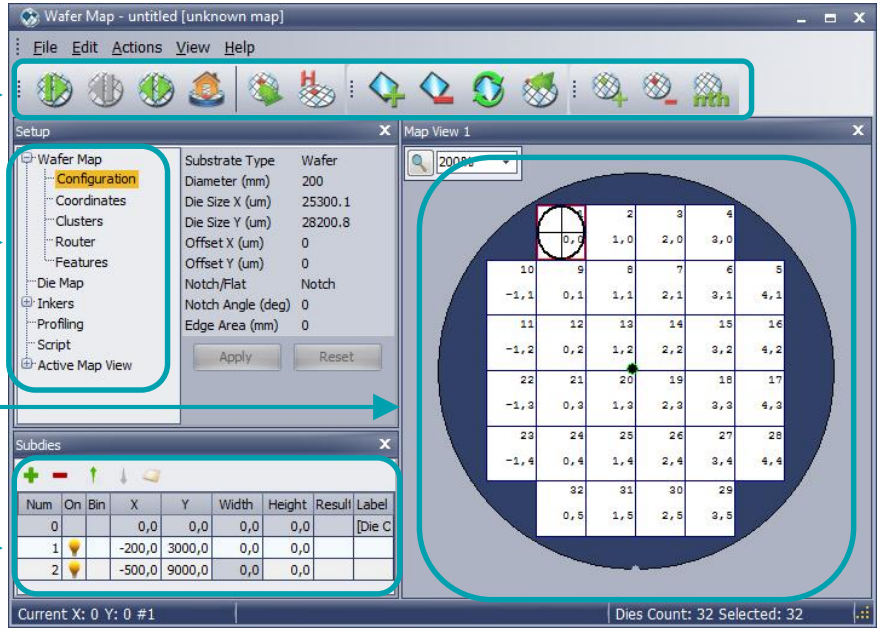
- Graphical application to probe regulary spaced die arrays

Toolbar for map control

Map configuration

Map View

SubDie table



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WaferMap – Features

- Virtual or remote die-to-die movement
- Die binning to visualize test results
- SubDie-testing
- Integrated wafer Z-Profiling
- Quick access to standard procedures via toolbars:

- Die stepping, set and go to home position

- Add/Remove dies to make map fitting the wafer layout

- Mark dies to test or to skip

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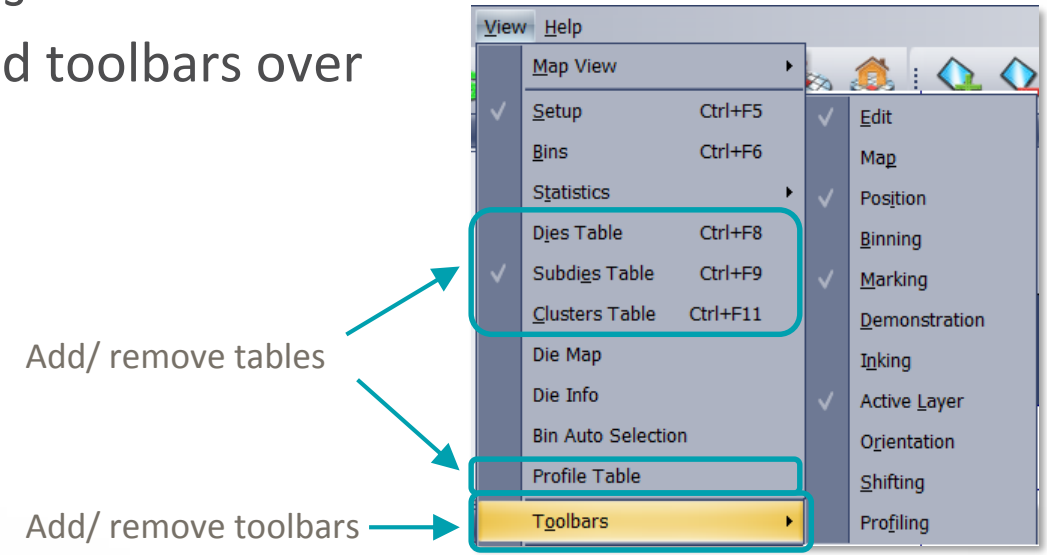
WaferMap – Display additional options

- Function access over toolbars
- Data access over tables
- Add/remove tables and toolbars over the „View“ menu



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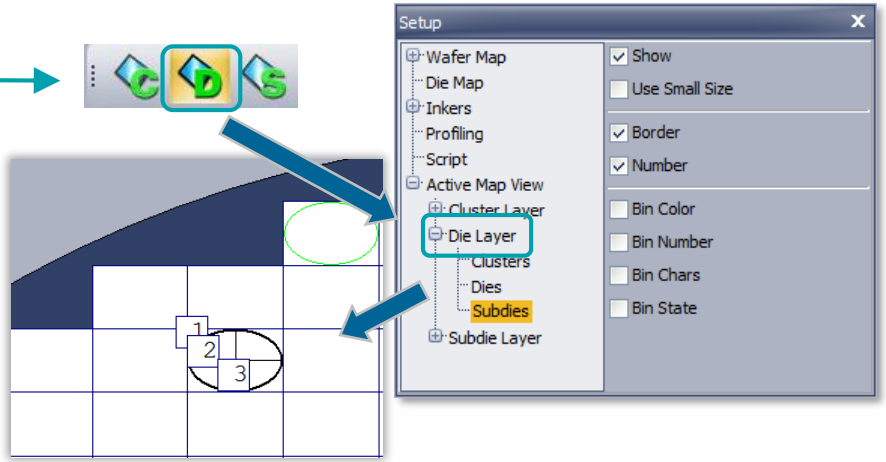
WaferMap – Subdies, Dies and Cluster

- Dies: rectangular test element with XY-origin and XY-dimension (= index) arranged in a wafer grid
- SubDies: point test element, related to a die
- Cluster: regular group of dies
- Organized in WaferMap Layers switchable over toolbar
- Customizable information for each layer



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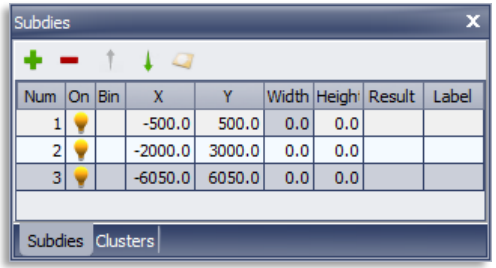
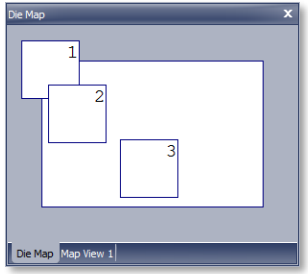
WaferMap – Subdies

- Use subdie table to add/remove subdies
- Click on ✚ to add subdie coordinate relative to die origin
- Subdie table applies to all dies
- Click on to create die-specific subdie table





- Use *StepFirstDie*/*StepNextDie* or *StepNextSubDie* commands

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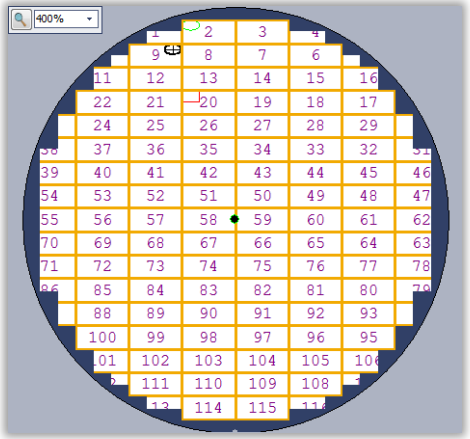
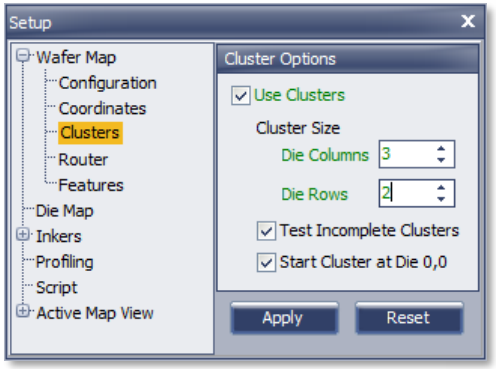
WaferMap – Cluster

- Activate cluster usage in WaferMap setup
- Use layer settings to display cluster areas





- Use *StepFirstCluster/ StepNextCluster* commands

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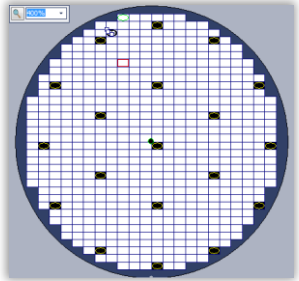
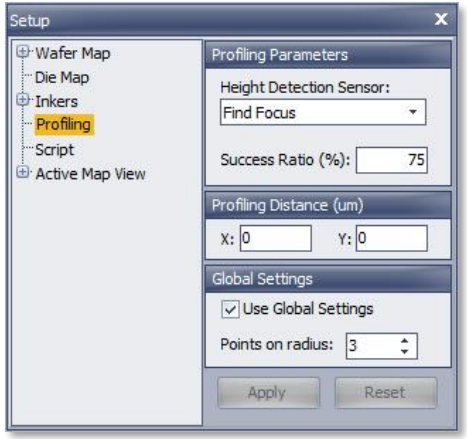
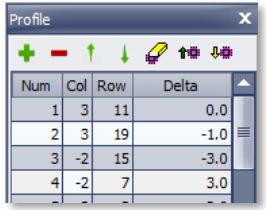
WaferMap – Z-Profiling

- Modifiy Z-Profiling settings
- Display profiling points using toolbar





- Click on map to add or remove profiling points
- View profiling results in profiling table
- Final profile is written to Kernel and applied at each positioned Z-move
- Profile is deleted, when moving to Load position (Kernel parameter)



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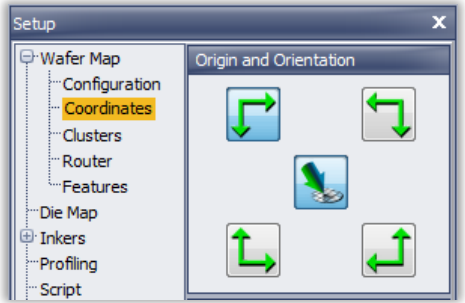
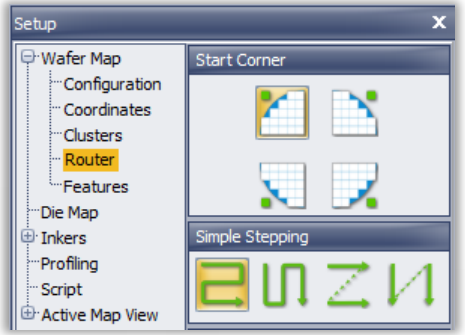
WaferMap – Coordinate System

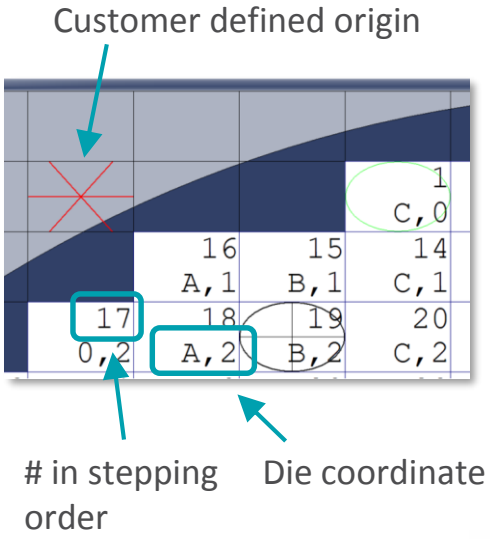
- Die coordinates ≠ stepping order

  - Select coordinate origin and axes orientation:



  - Select stepping start and route:





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Spectrum Vision System

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Velox 2.6 – Core Applications

Spectrum Vision System

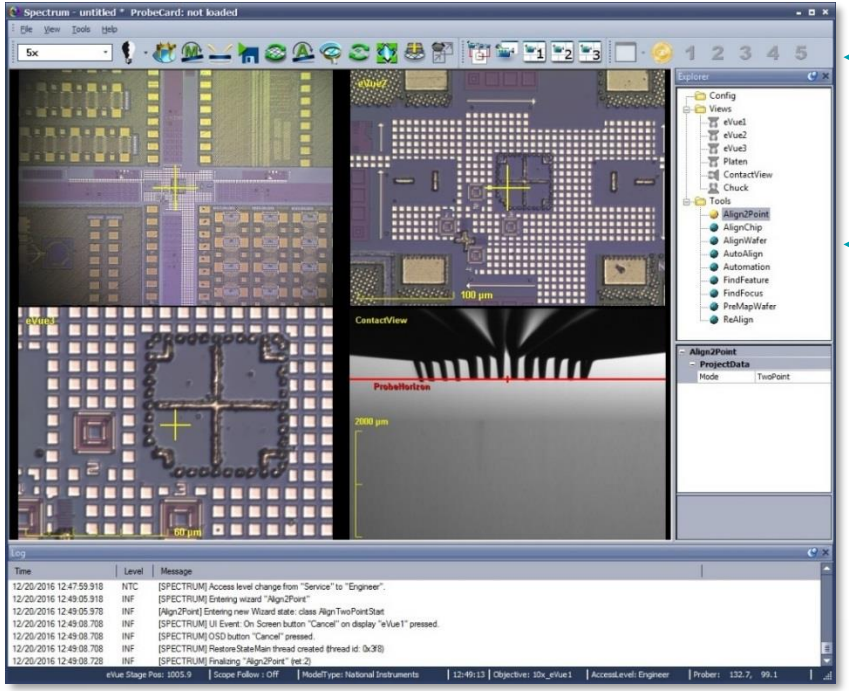
- Image processing application for digital cameras and Azoom2*remote*

Toolbars

Explorer

Camera Views

Log window



Velox 2.6 – Core Applications

Spectrum – Standard Tools

Current magnification

Light settings

ProbeHorizon:
Quick and save contact height and getting wafer in focus

SnapShot

ReAlign:
Set Home and Contact using platen camera

AlignChip:
Single chip alignment and reference

Automation:
AutoXY and Auto Z – tracks position

FindWafer Center:
Triangulates wafer center position

Manual 2-point measurement:
On-screen measurement of XY-dimension

Manual 2-point alignment:
Wafer alignment with only two clicks

AlignWafer:
Wafer alignment and Home reference

AutoAlign:
Theta alignment and index calculation

FindFocus:
Automatic focus function

CellView:
Die Overview

FindFeature:
Pattern recognition

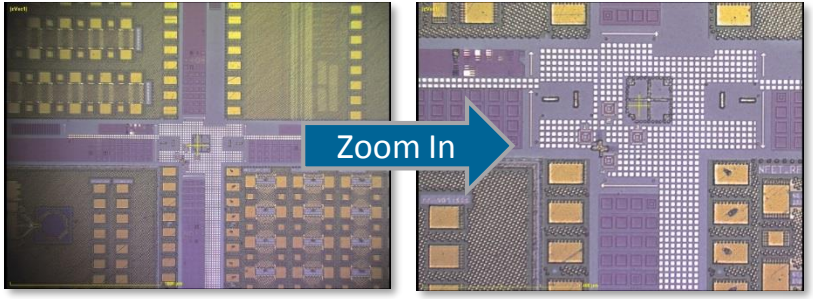
PreMap Wafer:
„AlignChip“ for all dies before testing

Locate Home Die:
Uses *FindWafer Center* to locate Home die

Velox 2.6 – Core Applications

Spectrum – Features

- Point-and-Shot navigation
- Digital Zoom (with mouse wheel)
- eVue seamless zoom
- On-screen wizards
- Detail views
- Basic configuration:
  - Pattern recognition using NI-Vision
  - Automated Alignment tools for X, Y and Theta
  - Automated focus function
- Extended configuration:
  - Pattern recognition with Patmax (high accuracy)
  - Optional tools for various tasks
  - Hardware dependend extensions (e.g. VueTrack, ReAlign)



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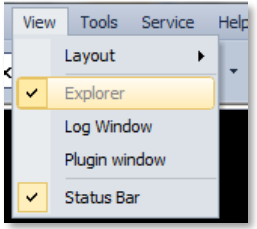
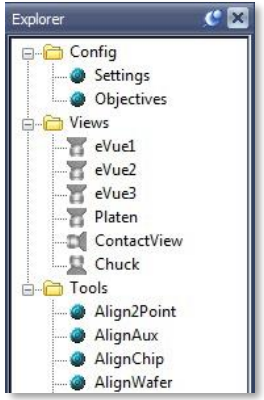
Spectrum – Properties Configurator

- Configure vision system, camera or tool properties with Spectrum Explorer



- General and objective properties
- Camera/View specific properties
- Tool specific properties



- Displayed features and options depend on user level
- Right-click menus

Velox 2.6 – Advanced Operation

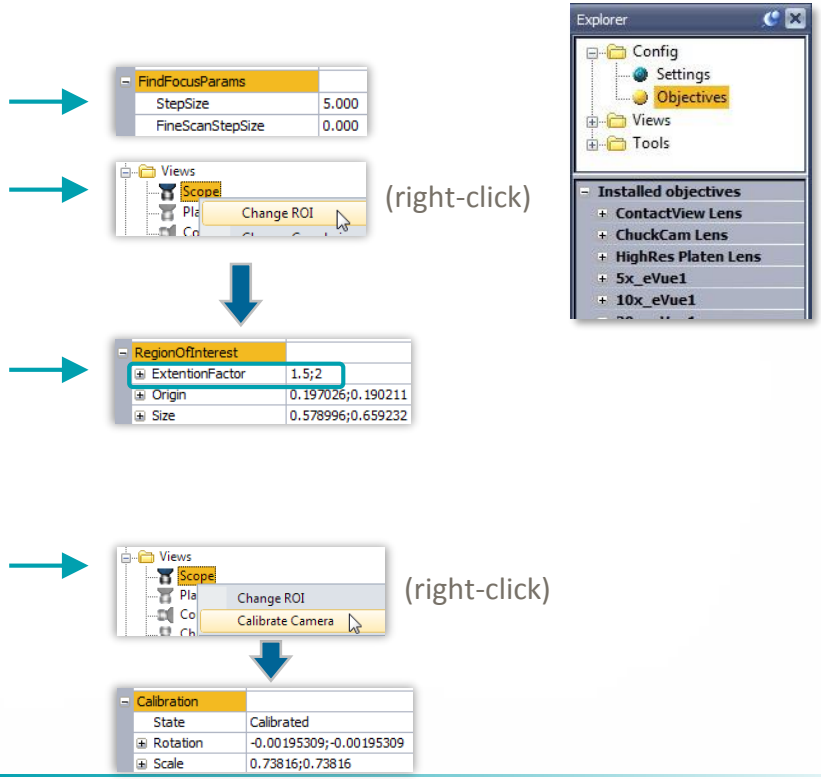
Spectrum – Image Processing Properties

- Objective related properties:
  - Focus parameters
  - Region of interest (ROI)

    → changes area for focus function and model search
  - Extension Factor

    → extends area for model search by chuck motion
  - Calibrate camera

    → eVue calibration: all optical paths are calibrated over eVue1



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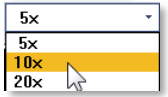
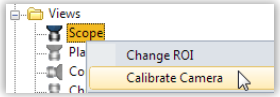
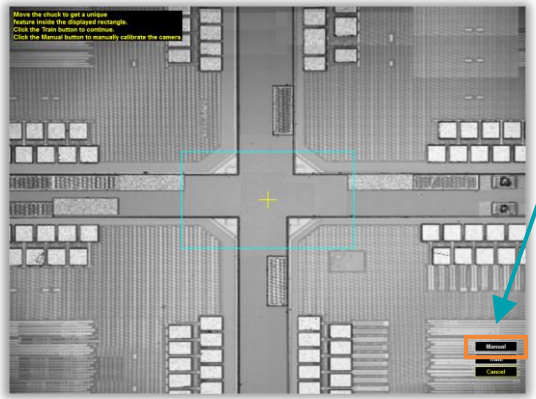
Spectrum – Calibrate Camera

1. Load structured wafer (alignment not required)
2. For microscope: select correct objective size
3. Right-click on camera to be calibrated (in case of eVue right-click on “eVue1”)





4. Automatic:
   - Place unique pattern inside blue rectangle
   - Follow the wizard instructions
   - Press button „Train“ and wait
   - Press button „Finish“

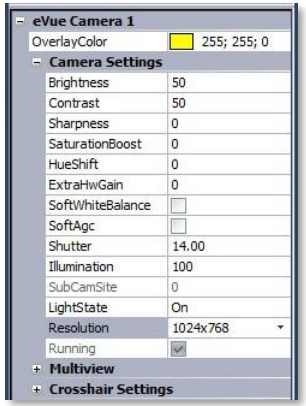


4. Manual:
   - Press button **Manual**
   - Follow the wizard instructions
   - Move a feature into yellow rectangle
   - Click pixel-exact on this feature
   - Move same feature into second yellow rectangle
   - Click exactly on the same feature pixel

Velox 2.6 – Advanced Operation

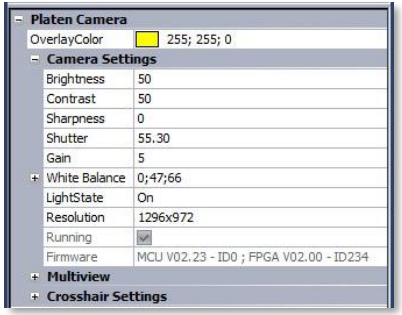
Spectrum – Image Processing Properties

- Camera/View related properties:
  - eVue camera:

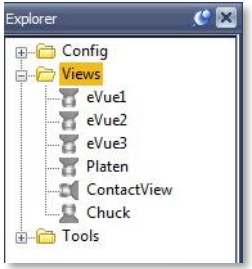


eVue Camera 1	
OverlayColor	255; 255; 0
Camera Settings	
Brightness	50
Contrast	50
Sharpness	0
SaturationBoost	0
HueShift	0
ExtraHwGain	0
SoftWhiteBalance	
SoftAgc	
Shutter	14.00
Illumination	100
SubCamSite	0
LightState	On
Resolution	1024x768
Running	✓
Multiview	
Crosshair Settings	

  - Platen camera (example for firewire cameras):



Platen Camera	
OverlayColor	255; 255; 0
Camera Settings	
Brightness	50
Contrast	50
Sharpness	0
Shutter	55.30
Gain	5
White Balance	0;47;66
LightState	On
Resolution	1296x972
Running	✓
Firmware	MCU V02.23 - ID0 ; FPGA V02.00 - ID234
Multiview	
Crosshair Settings	

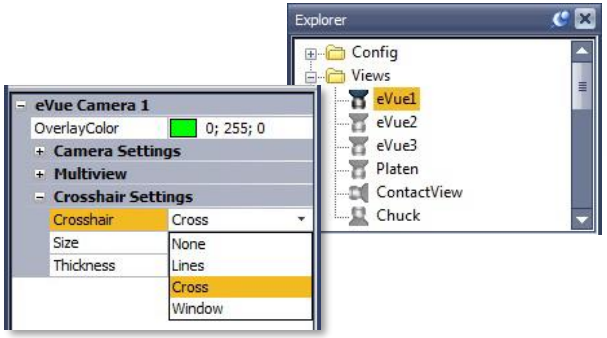


- *White Balance* (firewire color cameras only)
- Start/ Stop image processing („SetCameraQuiet“) (firewire cameras only)
- Toogle light on/ off (Velox toolbar) →
- Light settings (Spectrum toolbar) →

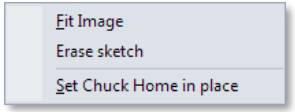
Velox 2.6 – Advanced Operation

Spectrum – Appearance

- Does not influence tool functions
- Change color of image overlays
- Show/ hide region of interest (ROI) (disabled for eVue)
- Change crosshair style



- Camera image right-click menu to erase sketches, change view size and set Home position



- Window layouts to arrange views:
  - General
  - eVue

Velox 2.6 – Advanced Operation

Spectrum – Tool Properties

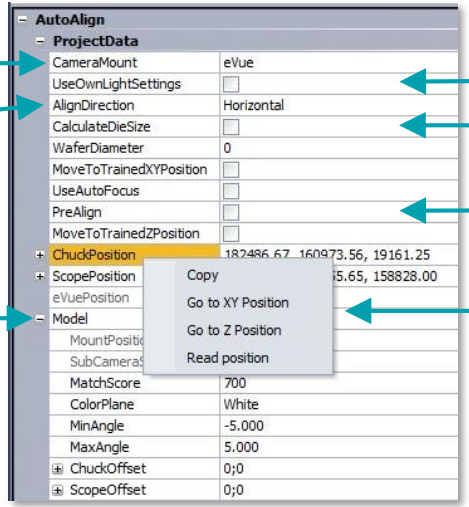
- Use tool wizard to train tool parameters (positions, models)
- Customize tool properties for specific needs (Example: „AutoAlign“ tool):

or

Assign camera used by this tool

Change alignment direction

Adjust model reliability and behavior



Use individual light settings

Calculate new index size

Basic pre-alignment, before AutoAign starts

Right-click option for selected parameters

Velox 2.6

Project Handling

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Velox 2.6 – Project Handling

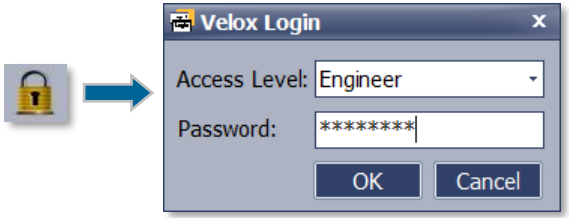
Create new project

- Log in as Admin or Engineer
- Open new project/ default project
- Open required applications
  (e.g. CONTROLCENTER, SPECTRUM, WAFERMAP)
- Load wafer
- Align wafer and calculate index size
- Set *Home* position and *Contact height*
- SPECTRUM: Adjust light, train tools, modify properties
- WAFERMAP: Configure map, set subdies, synchronize *Home*
- Save project data

Velox 2.6 – Create new project

Preparation

- Log in as „Engineer“



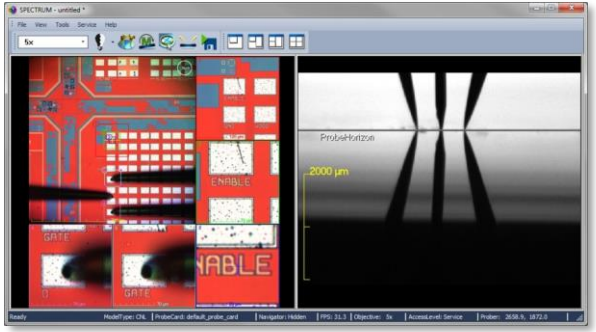
- Open new project
- Open CONTROLCENTER
  - Move chuck to load position
  - Place wafer on chuck and attach with vacuum

- Open SPECTRUM (live video)
  - Run *AutoAlign* tool to align wafer and set XY-die size

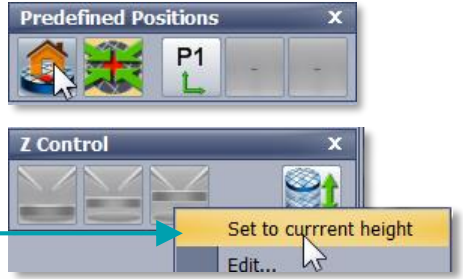
Velox 2.6 – Create new project

Home and Contact Position

- Place positioner(s) (manual or motorized), use Spectrum „ContactView“ if available to adjust needles in same height



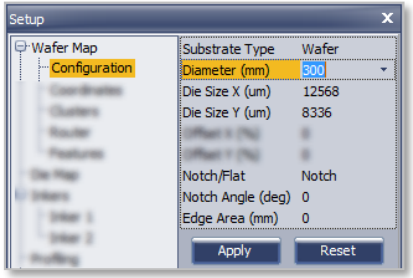
- Set *Home* (for chuck and motorized positioner stages) (→ CONTROLCENTER)
- Move chuck Z to get needles in contact
- Set *Contact height* (→ CONTROLCENTER)



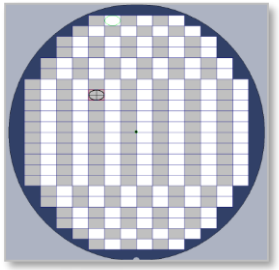
Velox 2.6 – Create new project

WaferMap

- Open WAFERMAP
- Configure WAFERMAP (select size, notch or flat → „Apply“ finally)



- Add/remove dies
- Select dies to test

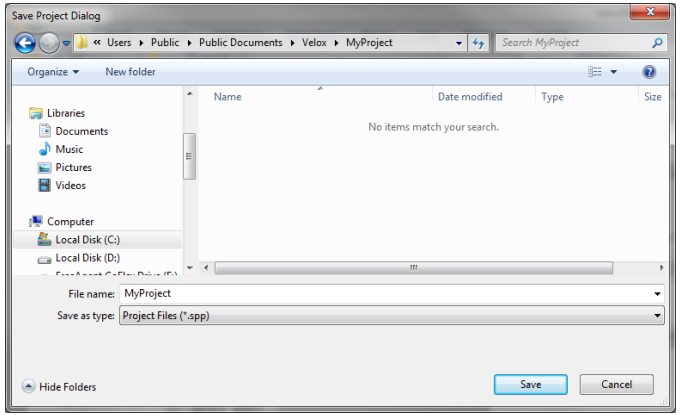


- Synchronize physical and graphical *Home* position

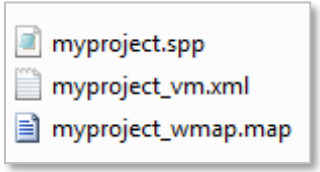
Velox 2.6 – Create new project

Save Project

- Save project data
  - Default project folder is: „C:\Users\Public\Documents\Velox“
  - Create subfolders as desired



Generated files (example):



- Project data is <u>not</u> related to the user level

Velox 2.6 – Data Types

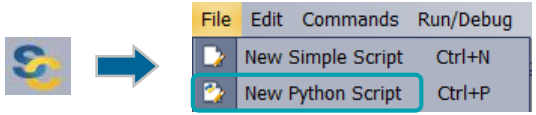
Project and configuration data

- There is no „main“ application, which saves/ loads all data
- Wafer/ Product specific data stored in project files:
  - Main file *.spp → Contains general information (e.g. involved applications, Home position, index size, Contact height)
  - Application specific files e.g.: *.map (WAFERMAP), *.stv (TableView), *_vm.xml (Spectrum), *.pat (SPECTRUM patmax model)
- Application configuration data stored in project-independent files under „C:\ProgramData\Cascade Microtech\Velox“
- Probe station configuration data (e.g. Center position) stored on Electronics flash card or Velox ProgramData folder

Velox 2.6 – Project Handling

Remote script

- Open SCRIPTING CONSOLE → open new Python script
- Create remote script for automated execution of e.g. vision tools and wafer stepping (example)



Stepping1.py

```python
from velox import *

# simple stepping without processing

print "Stepping..."
StepFirstDie()
while True:
    try:
        StepNextDie()
    except SciCommandError as e:
        if e.errorCode == 703: break # EndOfWafer
        raise
print "Done"
```

- Save script

Velox 2.6 – Project Handling

Save and use project

Save project

- Save the new project (does not include remote script)

Use project

- Log in as Engineer or higher (Operator access does not allow remote script usage)
- Open project (opens all applications stored with the project, restores views)
- Open remote script
- Start the remote script

Velox 2.6

Help

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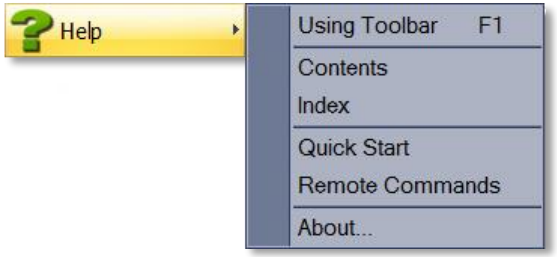
Velox 2.6 – Help

- Help menu

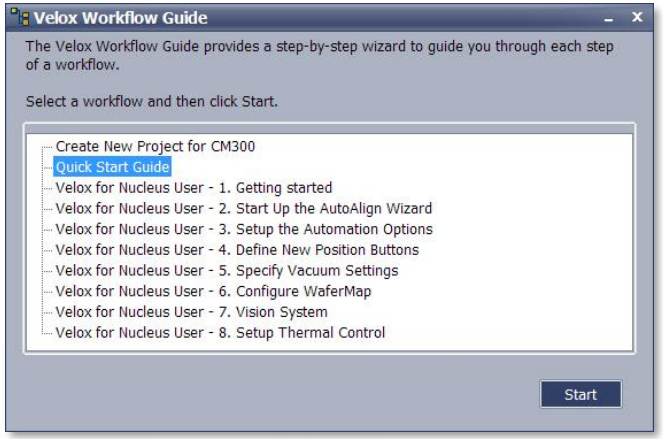


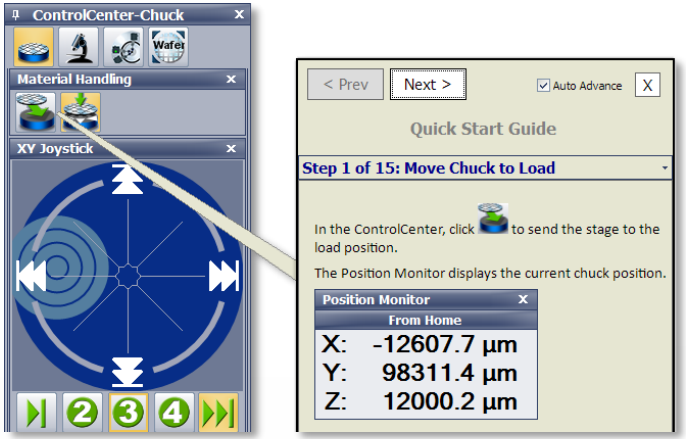
- „F1“ – function
- Velox „Documentation“ folder
  - „C:\Program Files (x86)\Cascade Microtech\Velox\ Documentation“
- Service Portal (www.cmicro.com)
  - Service related information

Velox 2.6 – Help

Workflow Guide

- Supports users operating Velox first time or seldom
- Predefined workflows for basic operation
- Requires appendant application to be opened
- Individual workflows possible with Workflow Guide Creator





Velox 2.6

Prober Communication Structure

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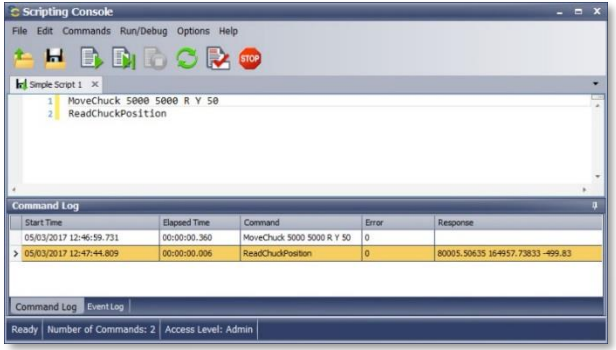
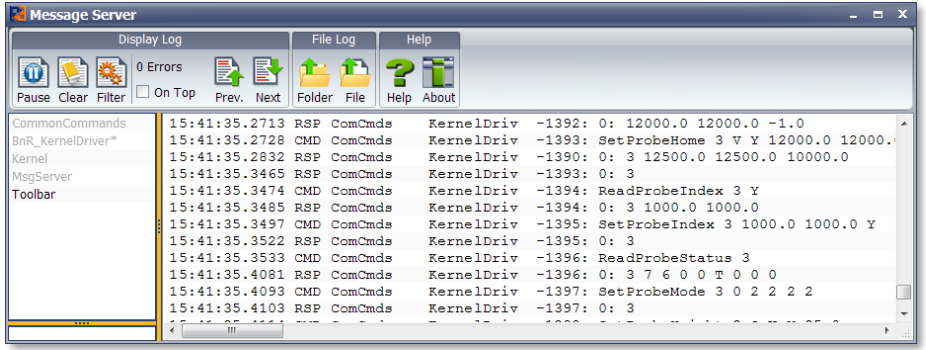
Velox 2.6 – Communication Structure

Remote Commands

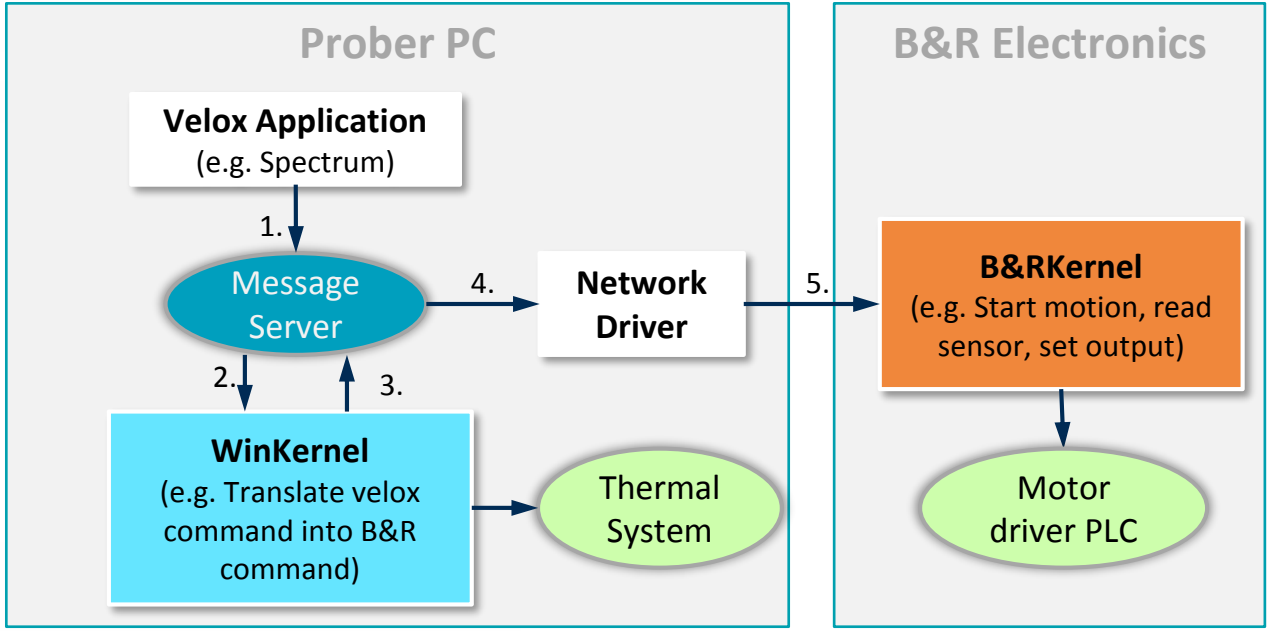
- All Velox applications and probe station electronics provide a set of remote commands
- All communication on the probe station is done via remote commands or notifications
- Scripting Console can be used to send any remote command or notification





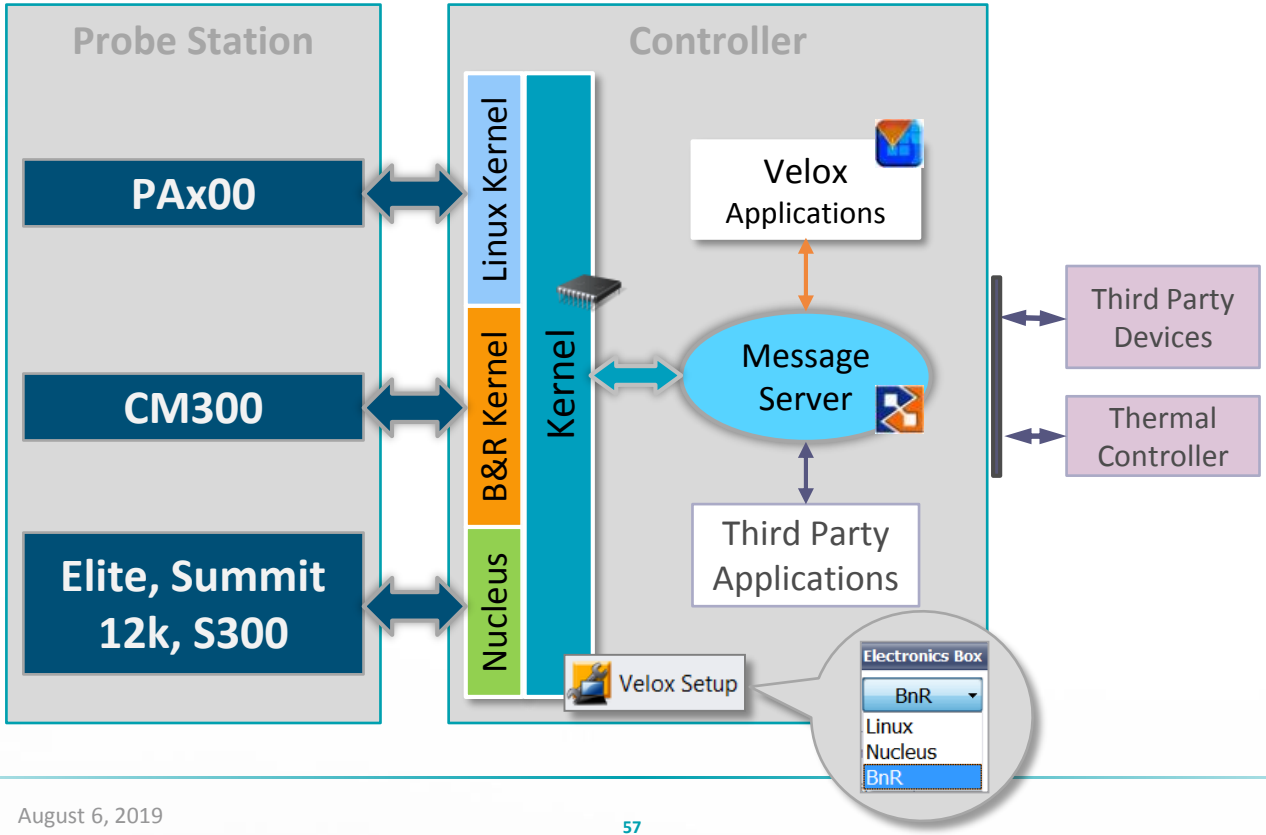
Velox 2.6 – Communication Structure

CM300 probe station (B&R Electronics)



Velox 2.6 – Communication Structure

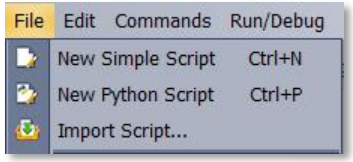
Overview

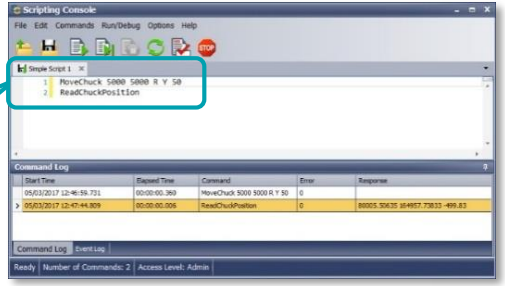


Velox 2.6 – Advanced Operation

Scripting Console

- Test single functions or sequences
- Supports simple script (*.scr), and Python (*.py)
  - Complex sequences with error handling only with Python
  - Import function for Pascal and Basic scripts
  - Example: send command „MoveChuck“ and “ReadChuckPosition”





Simple Script syntax:

Simple Script 1 | Python Script 2

```
1  MoveChuck 5000 5000 R Y 50
2  ReadChuckPosition Y H
```

Python Script syntax:

Simple Script 1 | Python Script 2

```
1  from velox import *
2  MoveChuck(5000, 5000, 'R','Y',50)                    # MoveChuck(XValue, YValue, PosRef, Unit,
3  ReadChuckPosition('Y', 'H')              # (X, Y, Z) = ReadChuckPosition(Unit, PosRef, Comp)
```

FormFactor™

Velox 2.6

Service Tools

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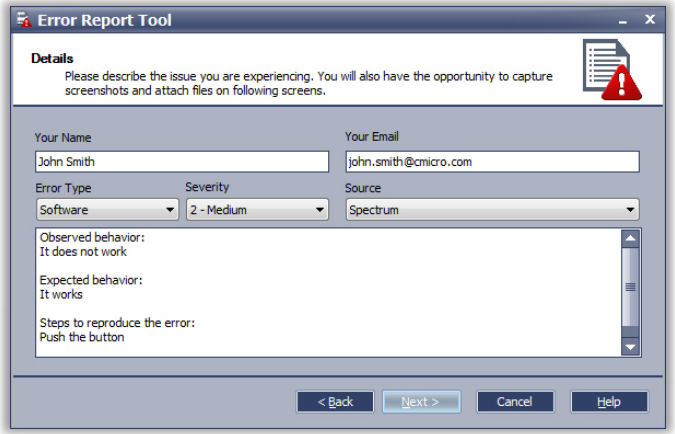
Velox 2.6 – Advanced Operation

Error Report Tool

- Wizard guided data collector
- Collects Velox and controller data → e.g. software versions, log files, configuration data, kernel parameters, last project
- Possibility to add further files and screenshots
- *.zip file format



Velox 2.6 – Advanced Operation

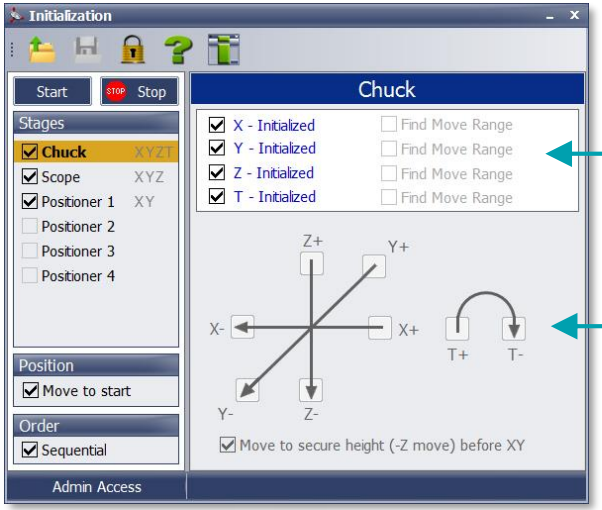
Initialization Tool

- Initializes every motorized axis (X,Y, Z, Theta) of each stage
- Updates axis zero-point
- Not required after probe station restart

Push Start

Available stages

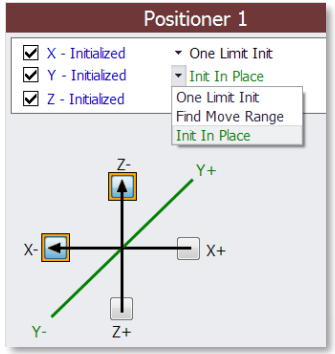
Init behaviour



Selected axes

Init directions

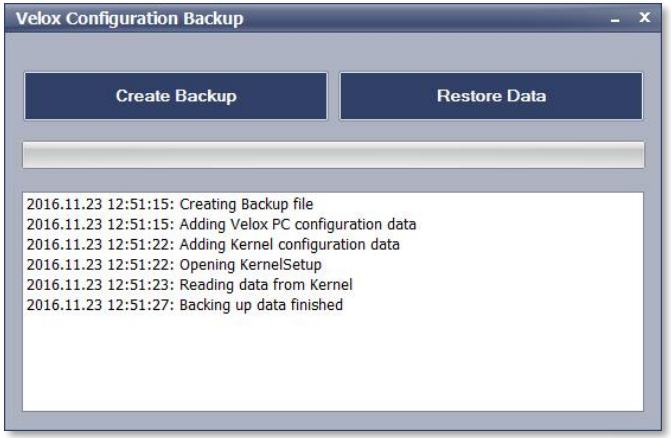
- Init-in-place for positioners:



Velox 2.6 – Advanced Operation

Backup/ Restore Tool

- Creates Velox configuration data backup
- Reads electronics data automatically
- *.zip-file format
- Restores Velox configuration and electronics data from zip-file
- Available for Admin access level or higher



Velox 2.6 – Advanced Operation

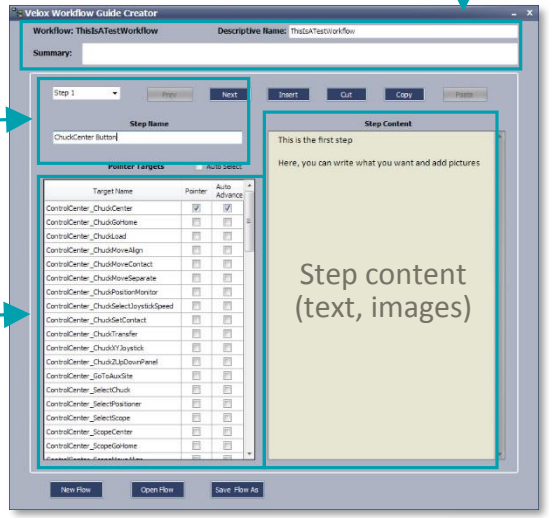
Workflow Guide Creator

- Locate in Velox Program Files folder
- Available for all user levels
- Create user specific workflow guides
  - Predefined workflow targets
  - Indivdual description and images can be added
  - Automatically saved to „C:\Users\Public\Documents\Velox\Workflow Guide“

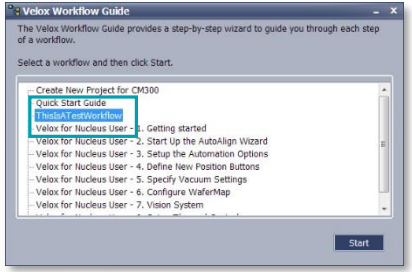
Workflow name and summary

Step # and name

Velox element referred to by the current step



Step content (text, images)



- Customized flows appear in Workflow Guide selection list

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