



PAL3 Generation 2014

PAL SYSTEM
Ingenious sample handling

PAL3 Product portfolio



PAL HTX-xt



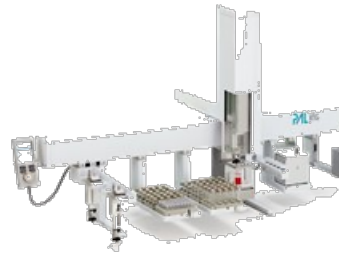
PAL HTS-xt



PAL HTC-xt



PAL COMBI-xt



PAL RTC



PAL RSI



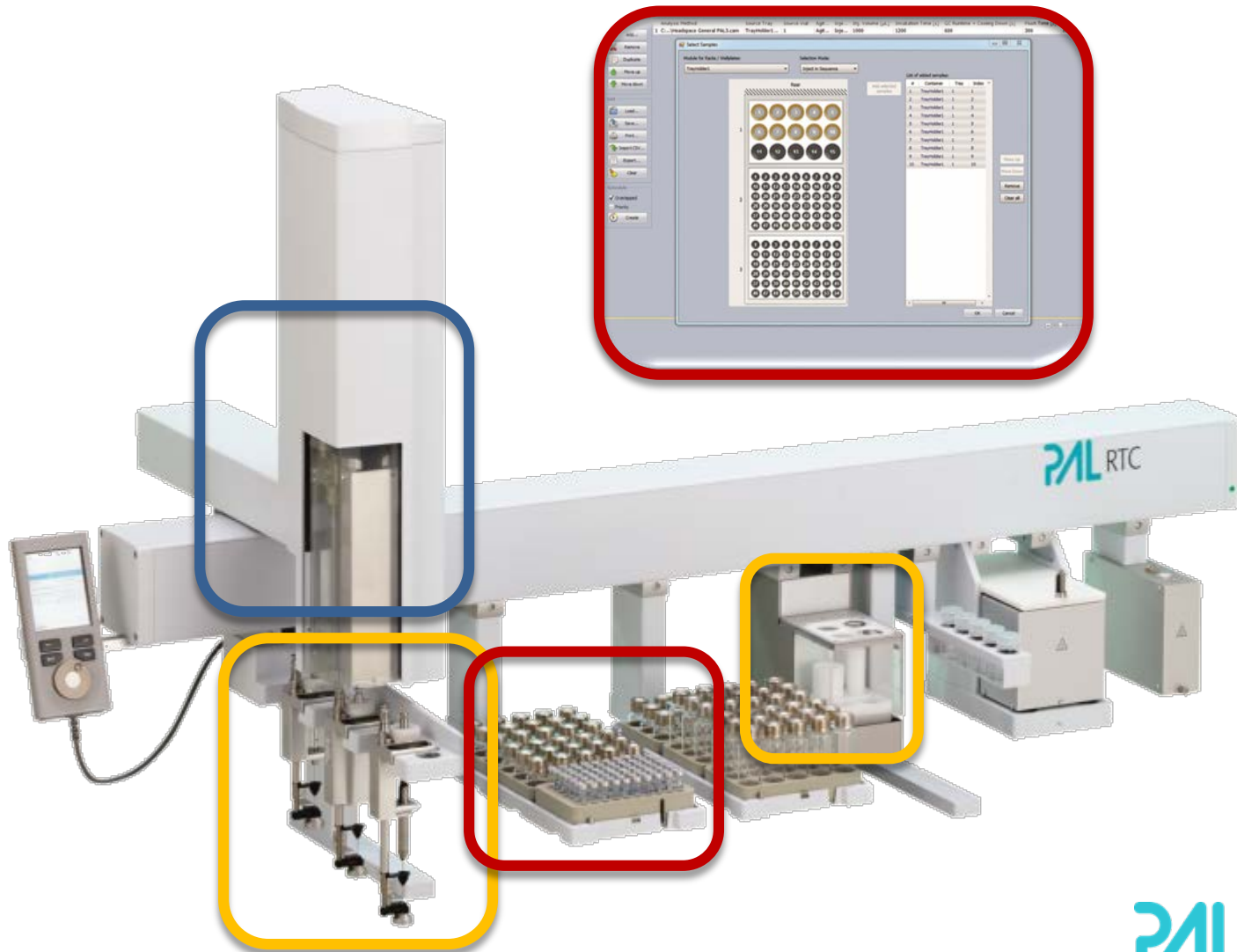
PAL LSI

Robotic Tool Change
for sample preparation included
in LCMS or GCMS frontend

Robotic Sample Injection
(manual tool change)
>> **successor of PAL-xt**

Liquid Sample Injection
for liquid sample injection and
pick and place application

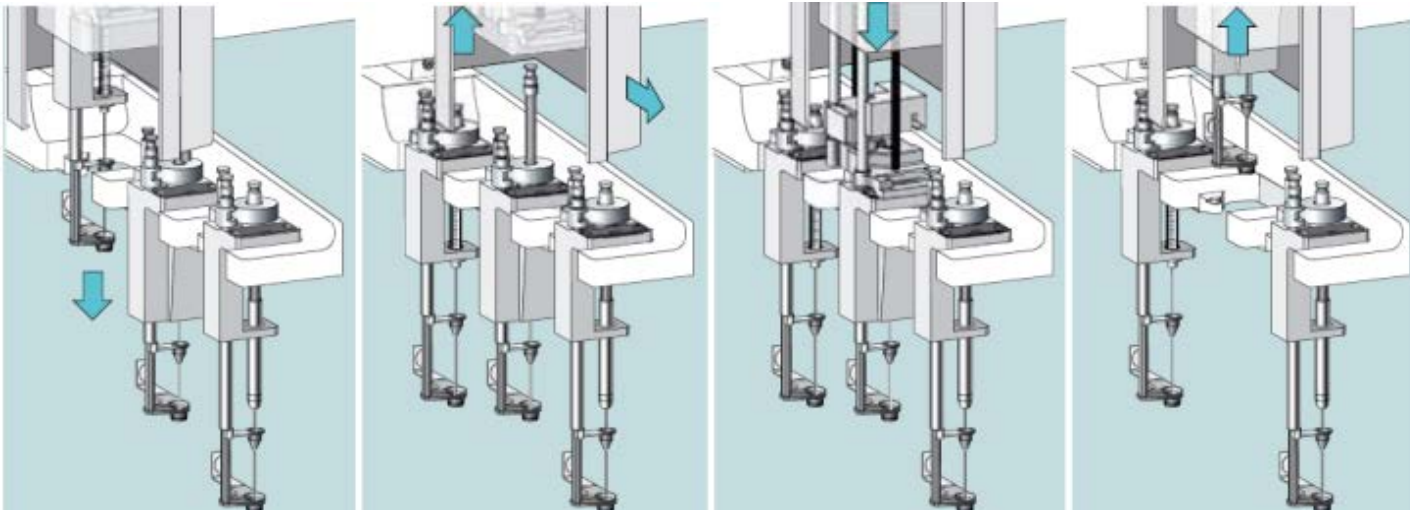
PAL3 Family (3rd Generation PAL Platform)



Robotic Tool Change (PAL RTC)

Increase of laboratory productivity and widens the application range

- **Sample Preparation Automation** thanks to higher degree of with Robotic Tool Change (up to 6 tools) >> standard addition, derivatisations
- **Over night run** thanks to automatic change of injection modes — Liquid Injection, Headspace and SPME
- **Workstation:** Sequential dilution, calibration dilution, sample preparation





Tools & Syringes for GC and LC

5x Liquid Syringe Tools

- 1 μ L – 100 μ L NL: 57mm or 85mm
- 250 μ L – 1000 μ L NL: 57mm or 85mm
- 10000 μ L NL: 57mm

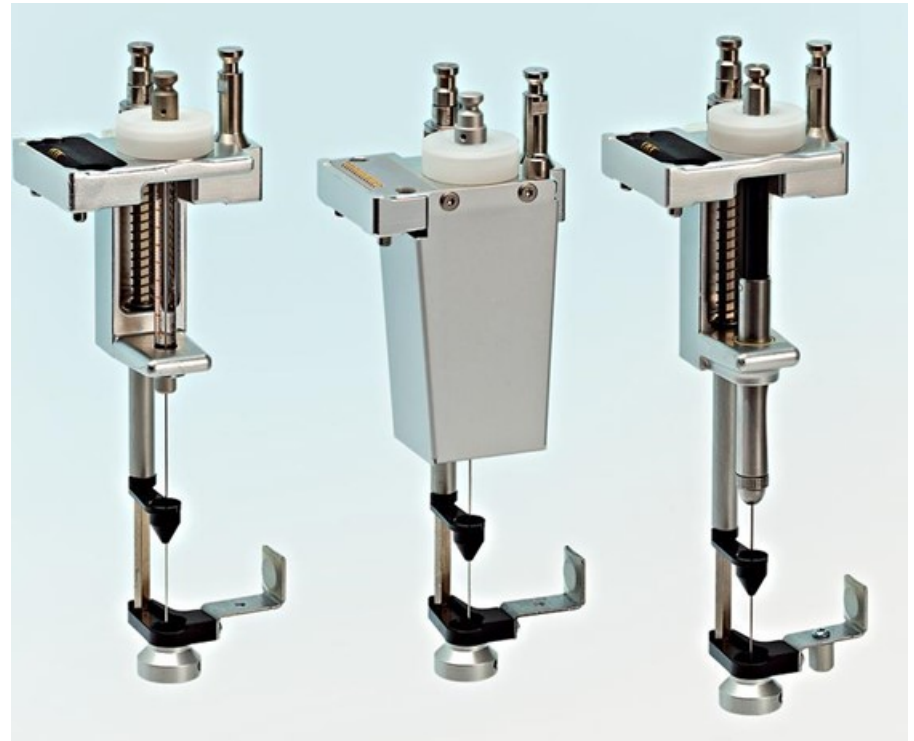
3x specific Headspace Tools

Temp: RT- 150°C, Purge Gas on tool

- 1000 μ L NL: 65mm
- 2500 μ L NL: 65mm
- 5000 μ L NL: 65mm

1x SPME Tools

Patented design for a large variety of SPME fiber types



Liquid Syringe
Tool

Headspace
Tool

SPME
Tool

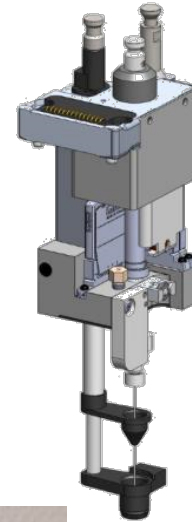
Tools & Syringes for GC and LC

1 LCMS Tool

- Time between UHPLC Runs approx. 10 sec. (if look ahead)
- Total Cycle Time: < 60 seconds
- LCMS Tool for fast and clean injections with lowest carry over for LC-MS applications

1 Dilutor Tool with 2 Dilutor option (1c and 5c)

The Module for Sample Prep: LLE, Dilutions, prepare Standard Dilution curves, fast micro SPE or LC Injections.....

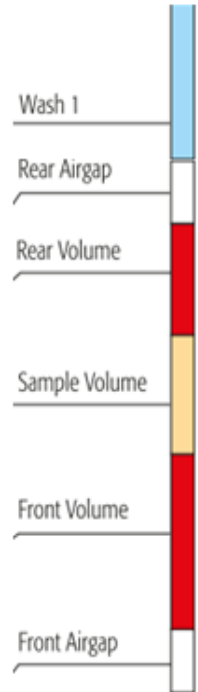
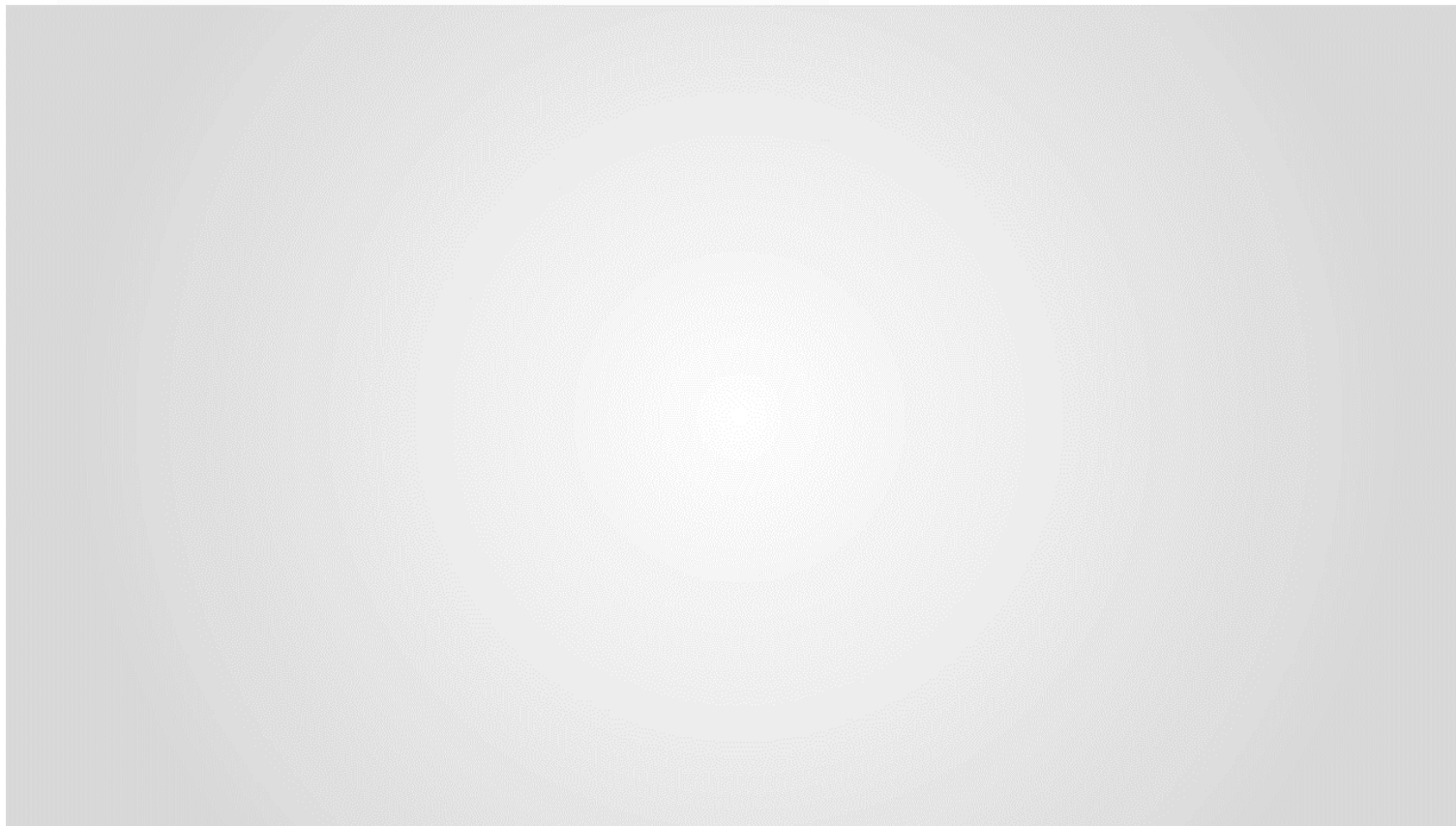


LCMS Tool (fast injection)

- PAL Sample Control Method: LC Injection LCMS Fast General Rev 2.1

LC Injection LCMS Fast_General_Rev 2.1

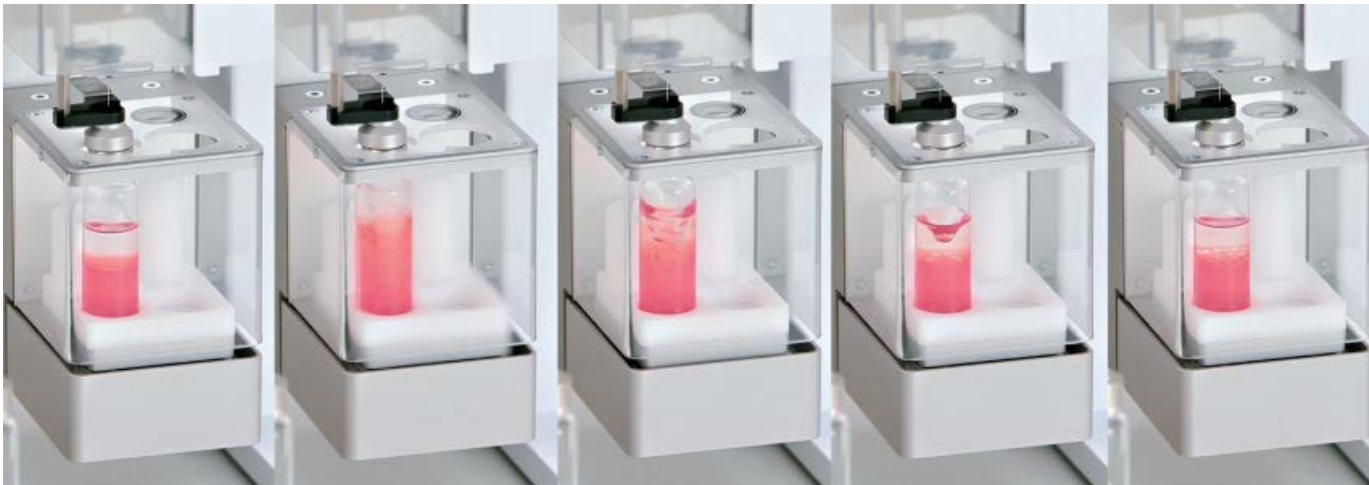
LC Injection LCMS Standard_General_Rev 2.1



Vortex Mixer (PAL RTC, PAL RSI, PAL LSI)

Efficient mixing for liquid homogenization and extraction steps

- Magnetic transportation of 2mL, 10mL and 20mL vials. (1 additional slot for custom specific vials)
- Provides efficient 2-phase mixing for : I/I extraction, dilution, derivatisation,...





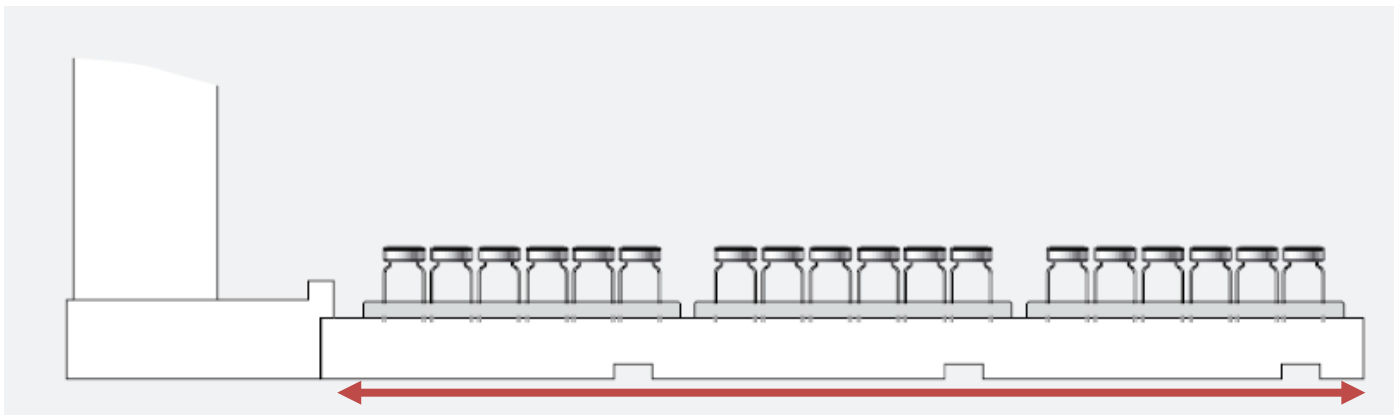
Increased vial capacity (PAL RTC, PAL RSI, PAL LSI)

Up to 50% more samples in a single Tray Holder

Due to extended working range for y-axis (255mm) we have additional capacity per tray holder:

- 162 x 2mL vials
- 60 x 10/20mL vials
- 3 x Microtiter plates

With two Peltier Stacks up to 13'824 samples (384 MTP)



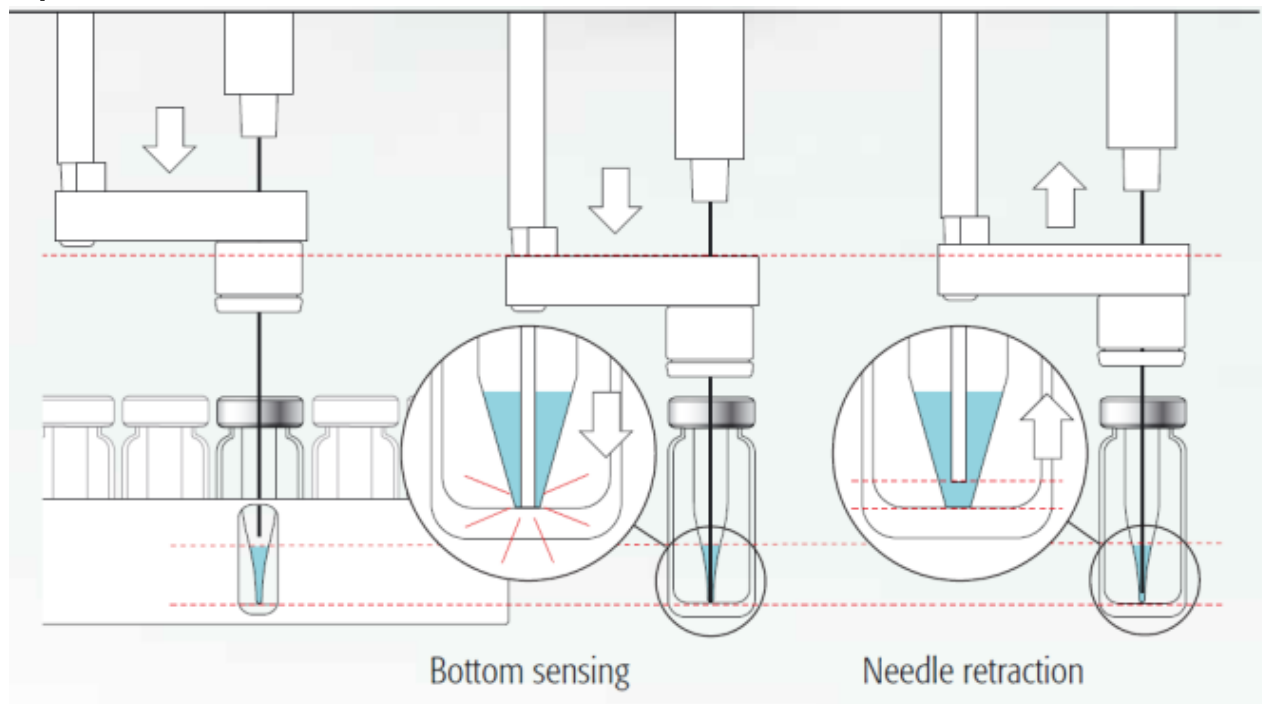
X, Y, Z axes, needle guide and plunger are moved by servo drives (PAL RTC, "PAL RSI", "PAL LSI")

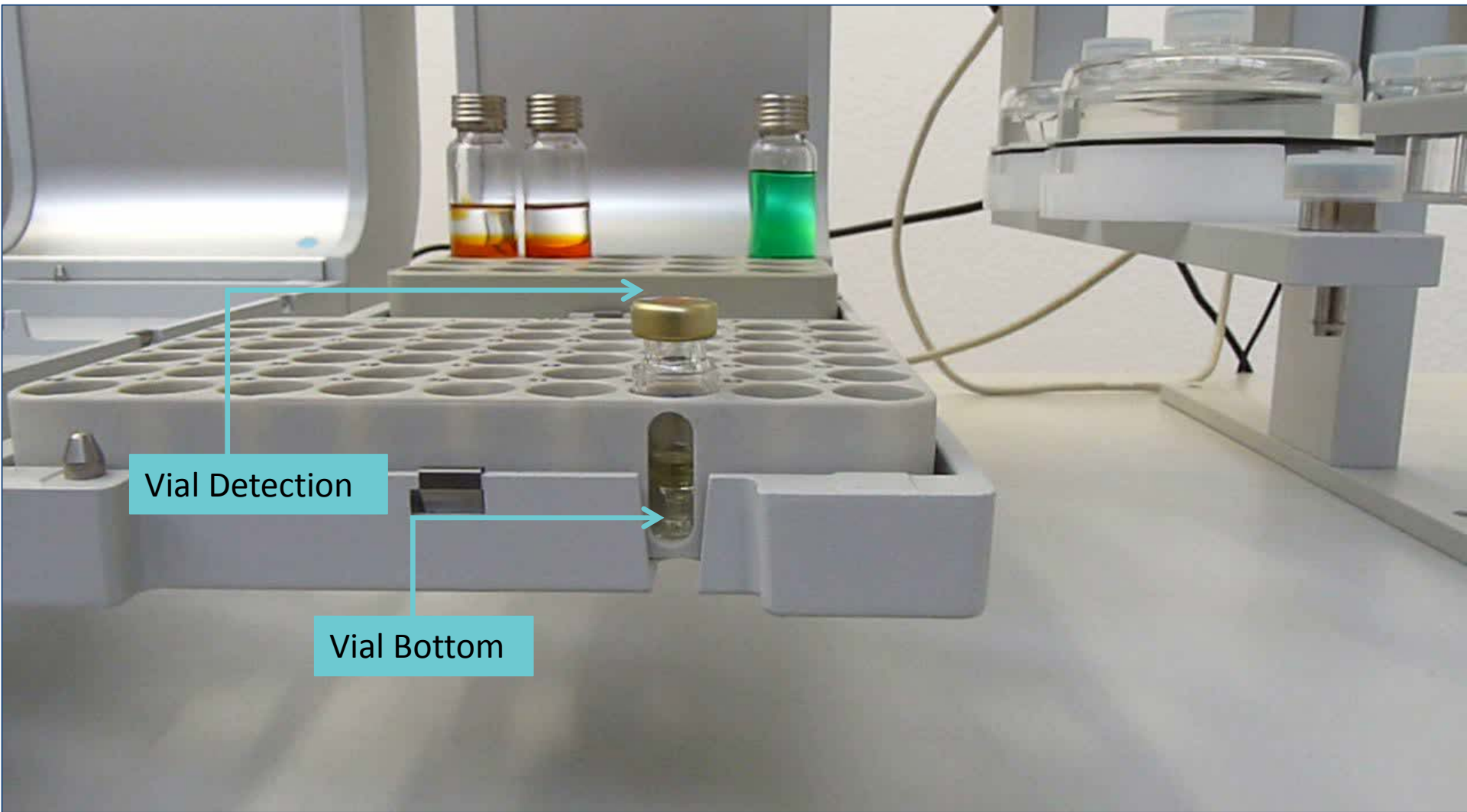
- **Higher reliability:** no risk of losing steps, homing is only necessary once at startup
- **Small sample volume:** features such as touch down or bottom sense become possible as drives can act as a force sensor
- **Higher efficiency:** improved dynamics and higher speeds due to parallel movement of all drives
- **Reduced noise:** silent and smooth operation
- **Discrimination free GC Injection:** cold needle injection (100ms)

Bottom Sense (PAL RTC, "PAL RSI", "PAL LSI")

Microsample injection

The vial bottom sense allows reliable aspirations of small sample volumes even out of a few microliter samples. Definable Needle Retraction Distance Example: Inject up to **3 x 1 μ L** out of **only 5 μ L** total sample volume.



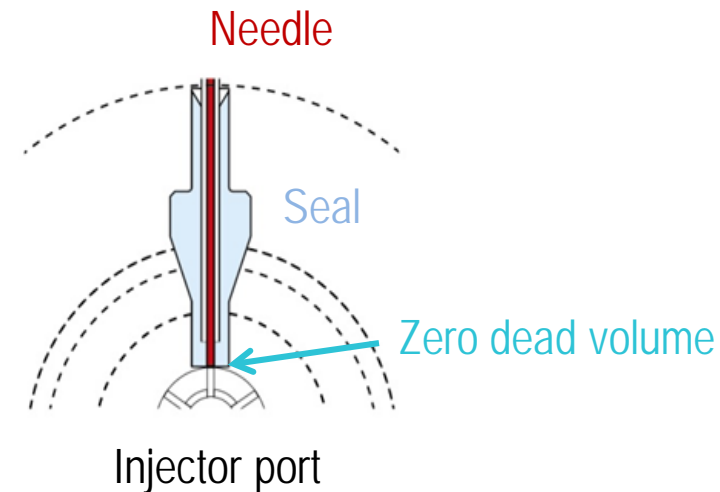


Vial Detection

Vial Bottom

Minimized Carryover with PAL RTC & RSI

- Constant Force/ Bottom Sense Technology
 - Automatic detection of the correct needle position in the injector port/needle seal avoids dead volumes/carryover
 - No more manual adjustment of needle position required
- New design of the needle seal
 - No dead volumes → reduced Carry-
 - Lifetime > 30'000 injections
 - Compatible with Vici and Rheodyne



PAL3 for LC Applications



PAL Sample Control

Intelligent Automation for Sample Prep

Time schedules

Method Editor

Sample selection

CDS compatibility

The screenshot displays the PAL Sample Control software interface, which is divided into several functional areas:

- Time schedules:** A Gantt chart showing the sequence of tasks for 10 samples. The tasks include Transport, WaitOverlapped, Injection, Transport, MoveToHome, FlushSyringe, and WaitOverlapped. The chart shows the duration of each task and the overlap between them.
- Method Editor:** A table listing tasks and their descriptions. The tasks are:

| Task | Description |
|------------------|----------------------------|
| 1 Transport | Put sample in Agitator |
| 2 WaitOverlapped | HS generation |
| 3 Injection | Get sample and inject |
| 4 Transport | Put sample back to initial |
| 5 MoveToHome | |
| 6 FlushSyringe | |
| 7 WaitOverlapped | Wait for GC to be ready |
- Sample selection:** A dialog box for selecting samples. It includes a list of tasks, a 'Sample' list, and a 'Schedule' section with checkboxes for 'Overlapped', 'Priority', and 'Create'.
- CDS compatibility:** A list of supported CDS and MS-Data Systems, including AB Sciex Analyst, ChemStation, EZChrom, MassHunter for GCMS, Empower 2, Clarity, ChromPerfect, Chromcard, ChromQuest, QuanLab, and Xcalibur.

PAL SPME



PAL SPME

| Phase | Color Code | Set of 1 Fiber Description PNo. | Set of 3 Fibers Description PNo. | Set of 5 Fibers Description PNo. |
|--|------------|------------------------------------|-------------------------------------|-------------------------------------|
| PDMS Fiber (Polydimethylsiloxane) | | | | |
| 7 µm | Green | FIB-P-7/10-P1 | FIB-P-7/10-P3 | FIB-P-7/10-P5 |
| 30 µm | Golden | FIB-P-30/10-P1 | FIB-P-30/10-P3 | FIB-P-30/10-P5 |
| 100 µm | Red | FIB-P-100/10-P1 | FIB-P-100/10-P3 | FIB-P-100/10-P5 |
| Acrylate Fiber (Polyacrylate) | | | | |
| 85 µm | Grey | FIB-A-85/10-P1 | FIB-A-85/10-P3 | FIB-A-85/10-P5 |
| Carbon WR Fiber / PDMS (Carbon Wide Range / PDMS) | | | | |
| 95 µm | Dark Blue | FIB-C-WR-95/10-P1 | FIB-C-WR-95/10-P3 | FIB-C-WR-95/10-P5 |
| Fiber Collection – Development Kit (1 Fiber of each Fiber Type Set of 5) | | | | |
| various | | | | Fiber Collection FIB-SEL5-S1 |

SPME – Comparison Supelco - CTC

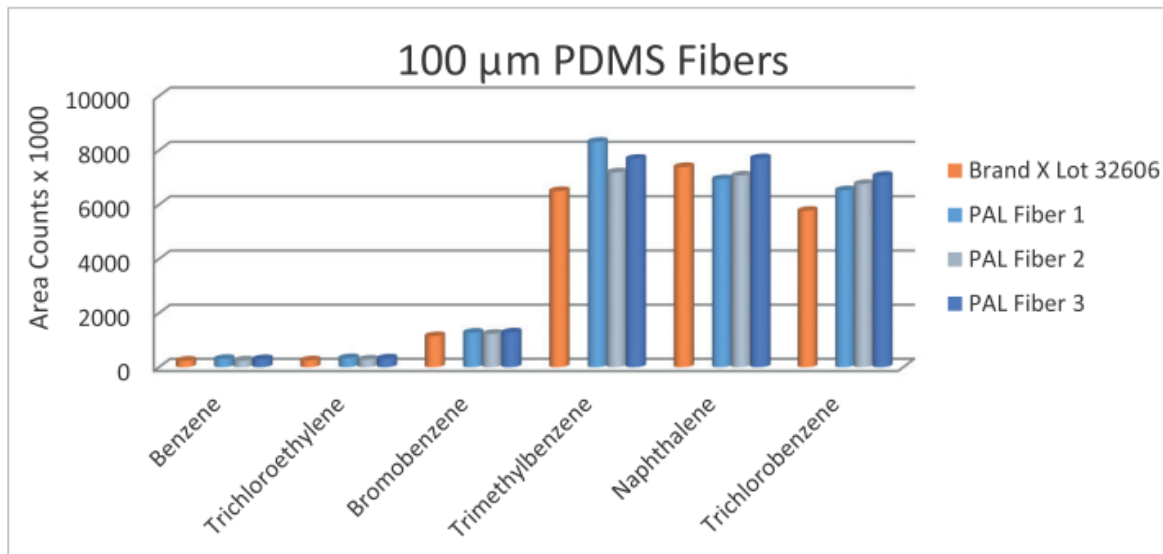


Figure 5: Quantitative Comparison of PAL 100 µm PDMS Fiber and Brand X Fiber for Six selected Target Molecules.

- Identical results for all PDMS fibers and the Acrylate fiber

Comparison of PAL SPME Fibers with established Fibers

Abstract

The performance of SPME fibers is an essential aspect of an analytical method. This study shows the comparison of three different SPME fibers of a conventional brand (referred to in the following as 'Brand X') and the new PAL SPME Fibers. The tests involve the EPA Method 8130 for PAHs standards using three dedicated Brand X fibers, and the PAL SPME Fibers: PDMS 7 µm, PDMS 50 µm, and Acrylate 85 µm. Furthermore the EPA Method 802.2 was tested for a mixture of 64 VOCs (Mega Mix 502.2) using two dedicated Brand X fibers, and the PAL SPME Fibers PDMS 100 µm and Carbon WR 95 µm. The new PAL fibers (PDMS fibers 7 µm, 50 µm, and 100 µm and the Acrylate fibers) yield identical results when compared with the corresponding Brand X fibers. For medium and high boiling compounds the PAL Carbon WR fibers show a significantly better performance than the respective Brand X fibers.

For more information visit:
www.pal-system.com

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