# Automated hyphenation of HPTLC to DART-MS and ESI-MS

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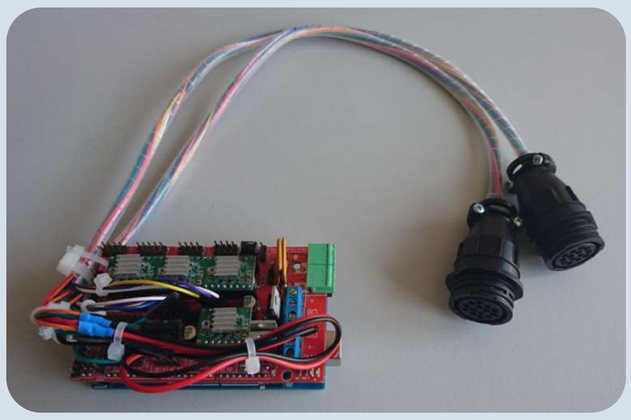


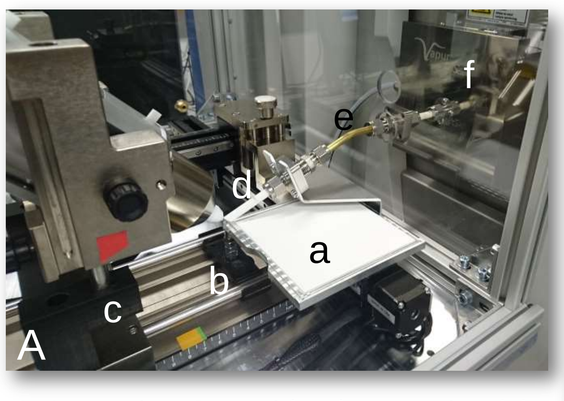
Arduino mega 2560 with RAMPS 1.4 for motor control used on both prototypes

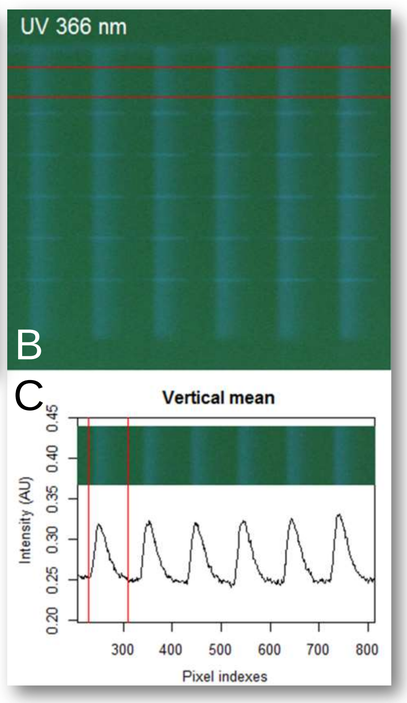
## Highlights

- ✓ ***Automated HPTLC plate alignment and batch processing of***
  - ***multiple tracks for desorption-based DART-MS (10 x 10 cm)***
  - ***multiple zones for elution-based ESI-MS (20 x 10 cm)***
- ✓ ***High accuracy of positioning at a given high sample throughput***
- ✓ ***3D printer mechanics and electronics used for interface modifications***
- ✓ ***Rapid prototyping by fused deposition modeling (FDM)***

## *Inspection Box for automated HPTLC-DART-MS*

- *Automated scanning of multiple scan tracks*
- *Homogenious desorption/ionization*
- *Standardized gas phase in the enclosure*
- *Advanced ion transfer by tethered DART*
- *High-throughput scanning of tracks or substance windows*



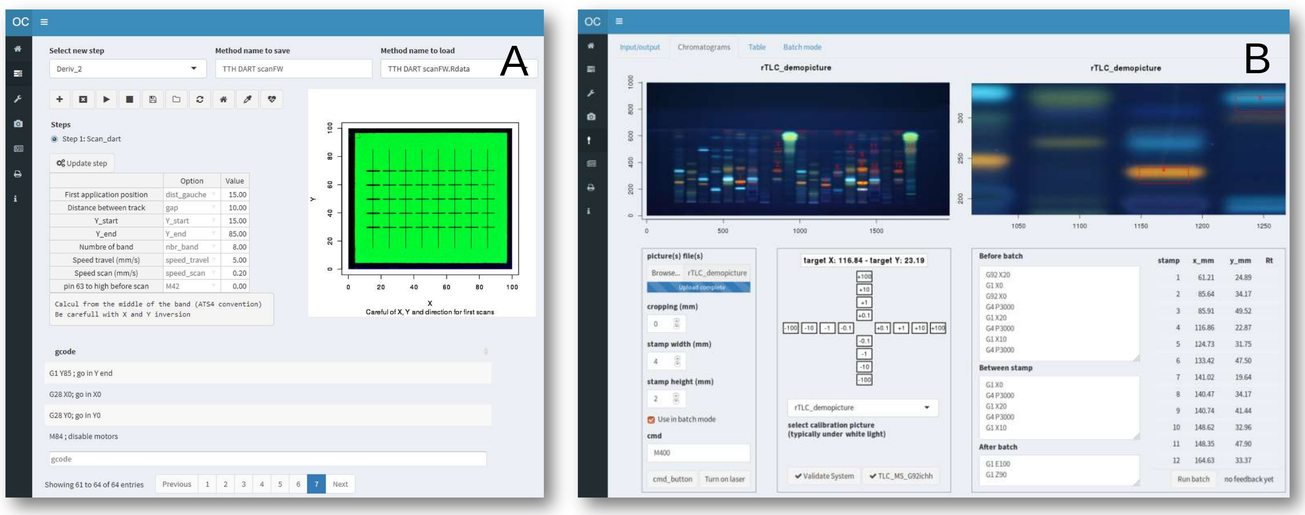

A: *Inspection Box* with plate carrier (a), vertical stabilizer (b), notched source base (c), advanced ion transfer tube (d) and brass tether (e) towards the MS system (f)

B: Plate afterglow at UV 366 nm after scanning of applied butyl paraben bands (6 tracks x 5 bands of 120 ng each)

C: Homogenity and width of the plate afterglow (8 mm) evaluated via video densitometry

## *OC Manager user interface*

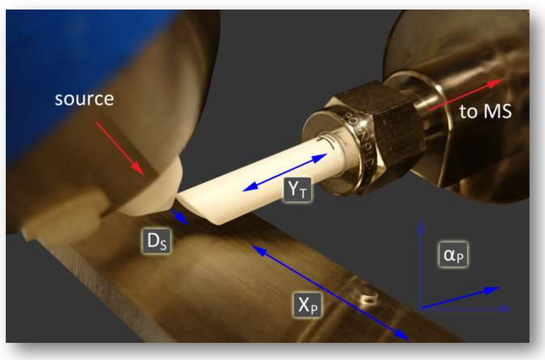
- *Edit parameters of positioning for desorption scanning or targeted elution*
- *Visual feedback for scan track alignment*
- *Image-based target zone selection*
- *Multiple scan tracks and target zones in batch mode*
- *Outlook: Combining HPTLC and MS results in one software platform*




Custom made OC Manager platform as user interface to control DART-MS (A) and ESI-MS (B) procedures

## *Base model for HPTLC-DART-MS*

*DART SVPA-3DS (IonSense) previously modified for quantitative HPTLC scanning (2 x 10 cm) at improved detectability [1]*




Modified DART SVPA-3DS with:

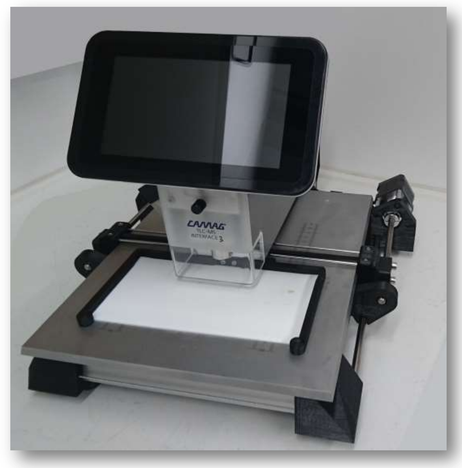
- shortened source cap
- reduced distances ($D_S$)
- movable ($X_P$) and angled ($\alpha_P$) plate carrier
- modified transfer tube ($Y_T$)

### *Modifications*

- *Enclosed stand-alone device with gas phase inlet*
- *Aluminum plate carrier (10 x 10 cm)*
- *Vertical stabilizer (FDM based)*
- *Notched source base (FDM based) for table movement*
- *Advanced ion transfer tube for „tethered DART“*
- *Temperature measurement to avoid heat stress*
- *Motor control by Arduino mega 2560 with RAMPS 1.4*
- *GCODE based input for Marlin Firmware*

## *Automated HPTLC-ESI-MS interface*

- *Zone targeting based on UV/Vis images*
- *Automated stamping of multiple target zones*
- *Automated cleaning cycles*
- *Accurate elution times for quantification*
- *Easy documentation and assignment of zones*
- *Syncronization of stamping and MS data acquisition*
- *Touchscreen (Raspberry Pi) for digital control*
- *High-throughput stamping*




## *Base model for HPTLC-ESI-MS*

*TLC-MS Interface 2 (CAMAG), unmodified*

### *Modifications*

- *Plate frame (10 x 10 cm and 20 x 10 cm)*
- *Motorized X-Y rails to move the plate frame*
- *Motorized mechanic for pneumatic and purge system*
- *Motorized 6-port valve mechanic*
- *Touchscreen for digital control*
- *Motor control by Arduino mega 2560 with RAMPS 1.4*
- *GCODE based input for Marlin Firmware*


**References** [1]T. Häbe, G. Morlock, Rapid Commun Mass Spectrom 30, 321 (2016)

IFZ Interdisziplinäres Forschungszentrum Giessen Research Centre for BioSystems, Land Use and Nutrition

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