

# Atmospheric Pressure UV and IR MALDI Imaging Mass Spectrometry for Peptides, Carbohydrates and Small Molecules

Berk Oktem<sup>1</sup>, Thomas D. Saul<sup>1</sup>, Appavu Sundaram<sup>1</sup>, Vladimir M. Doroshenko<sup>1</sup>, Shelley Jackson<sup>2</sup>, Benoit Colsch<sup>2</sup>, Amina S. Woods<sup>2</sup>,

<sup>1</sup>MasTech, Inc., Columbia, MD <sup>2</sup>National Institute on Drug Abuse, NIH, Baltimore, MD



## OVERVIEW

**Purpose:** Use AP IR and UV-MALDI Imaging for direct analysis of biological tissue sections.

**Methods:** A comparison of commercially available tunable AP IR-MALDI and conventional AP UV-MALDI employing high repetition rate laser for MS imaging is reported.

**Results:** AP IR-MALDI Imaging can be potentially applied for tissue analysis however droplet deposition needs to be further refined.

## INTRODUCTION

MALDI imaging mass spectrometry is a technique for direct analysis of biological tissue sections where spatial distribution of drugs, peptides and proteins are profiled. In this work, we report development of a MS imaging method by employing atmospheric pressure (AP) infra-red (IR) MALDI and its utility is compared with AP ultra-violet (UV) MALDI. Here we focus on IR-AP-MALDI and show its utility to analyze peptides, carbohydrates and small molecules and mammalian tissues. AP-MALDI source coupled with ion trap MS provides MS/MS possibility for imaging, which is elaborated as well.

## EXPERIMENTAL METHOD

Laser spot size ~500  $\mu$ m

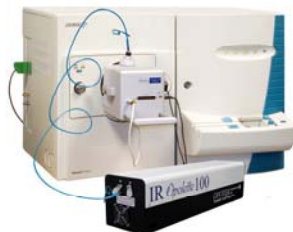
➢ Coating the matrix by airbrush  
➢ A commercially available AP-MALDI source is coupled with an ion trap mass spectrometer.

➢ Dual output UV and IR laser 20-100 Hz.

➢ Tunable IR laser. 2.75-3.1  $\mu$ m wavelength

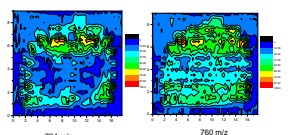
➢ Target 7.0 software synchronized with the MS Data Acquisition

➢ Separate software was used to convert the recorded set of mass spectra into a 2D MS image.



## RESULTS

### AP-UV-MALDI Imaging of Rat Brain Tissue



Matrix: dihydroxyacetophenone (DHA)

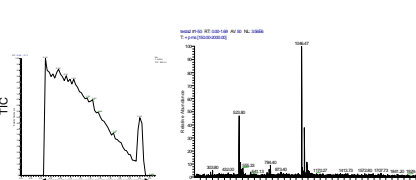
Image recording time: 50 minutes; Number of spectra: 2780

Laser spot size: 500  $\mu$ m; Laser repetition rate: 200 Hz

Tissue samples from rat brain have been investigated. Different phospholipids can be mapped on the brain tissue in line with previously published results. Here we show image from the rat brain slice (18x10 mm with thickness of 14  $\mu$ m)

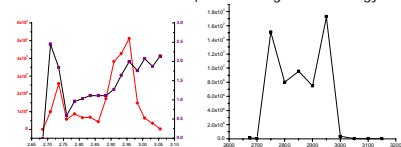
## RESULTS

### AP-IR-MALDI of Peptides



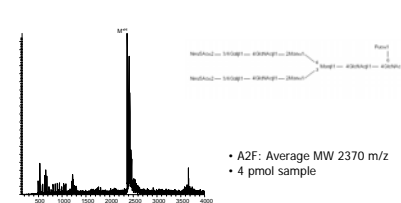
Droplet lifetime: ~2.1 min (1.9 min)

Angiotensin II, 1 pmol 3  $\mu$ l droplet with water  
100 Hz IR Laser at 2.94  $\mu$ m wavelength 1 mJ energy



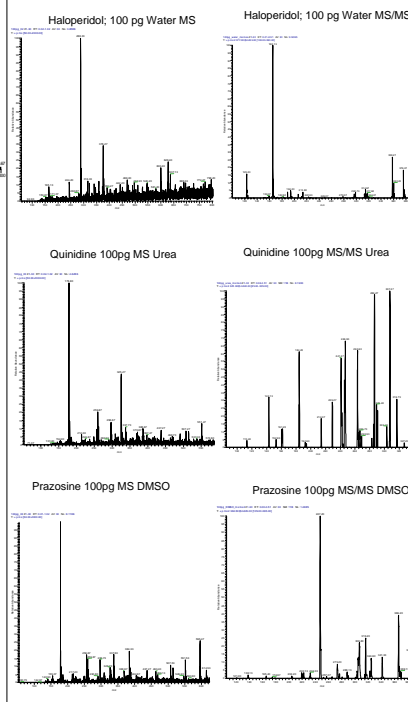
Wavelength dependence for Angiotensin signal 100 Hz laser on the left, 20 Hz laser on the right. All signal were Acquired with 1 mJ of laser energy. The Plot on the left also includes droplet evaporation time

### AP-IR-MALDI of Carbohydrates



• A2F: Average MW 2370 m/z  
• 4 pmol sample

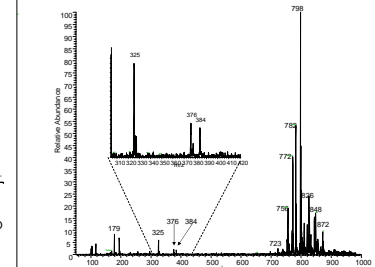
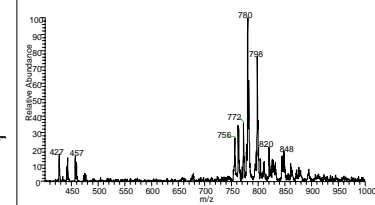
### AP-IR-MALDI of Small Molecules different Matrices



## AP-MALDI MS

### of tissue sections: Feasibility for Imaging

The sections were from adult wild-type C57 mouse and the sections were 18  $\mu$ m thick. The sections were cut using a cryostat (Leica Microsystems CM3050S).



MS above are acquired with DMSO droplets on the tissue sections. Top neat tissue; above, DMSO spiked with Haloperidol, Prazosin and Quinidine (25pg each)

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