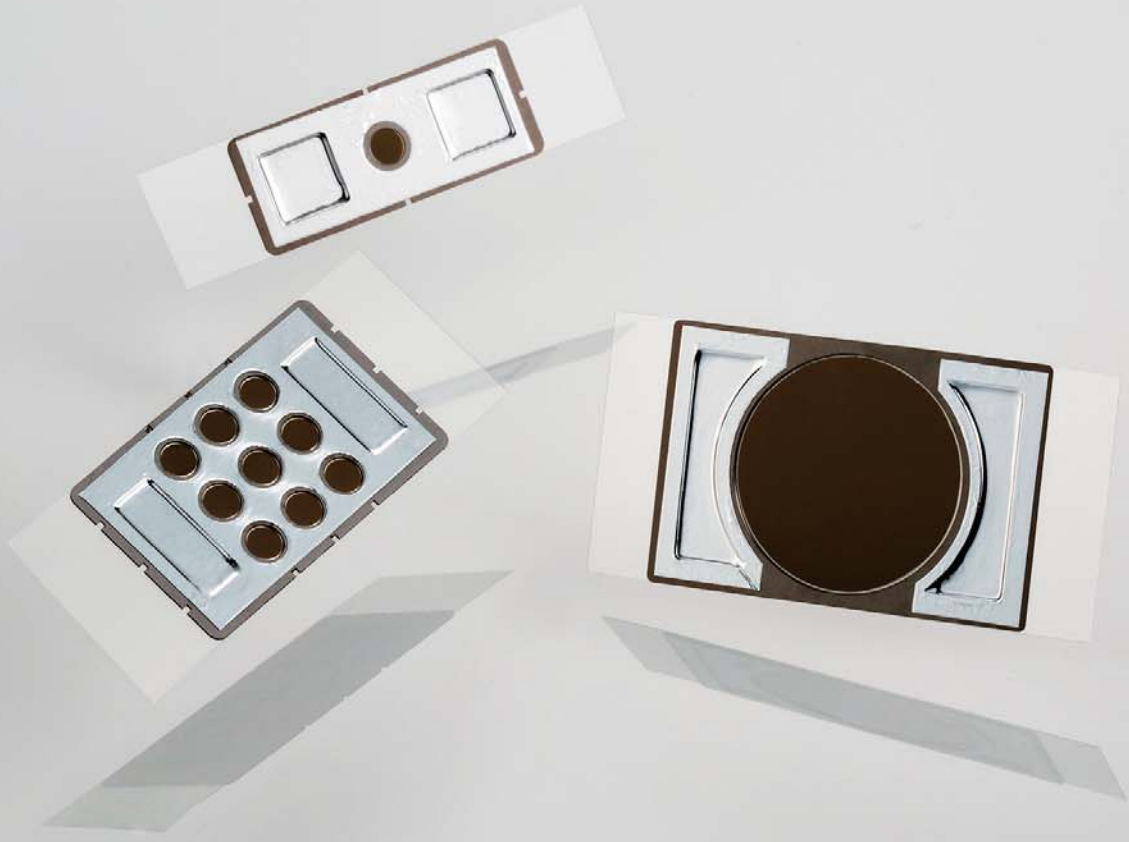
Ionization-assisting substrates

Desorption Ionization Using Through Hole Alumina MEmbrane

DIU THAME™



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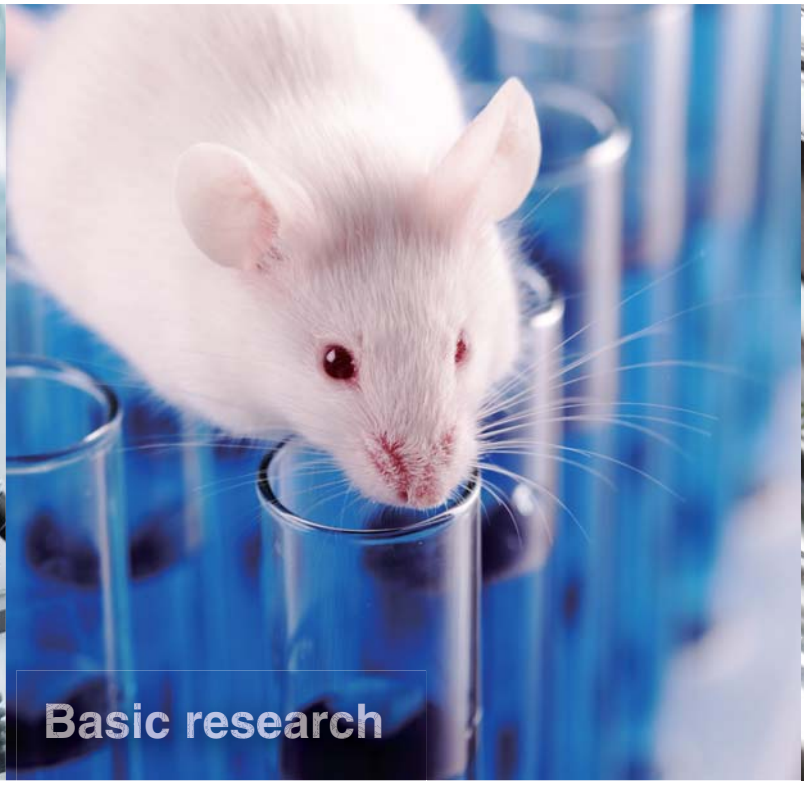
PHOTON IS OUR BUSINESS

DIUTHAME ensures high repro in your mass spectrometry tasks!



Hamamatsu offers ionization-assisting substrates called DIUTHAME that support ionization in mass spectrometry in place of matrix that is currently used for MALDI (Matrix-Assisted Laser Desorption/Ionization) and also eliminate the cumbersome sample pretreatment process. DIUTHAME brings high reproducibility and ease-of-handling to mass spectrometry by serving as a completely new tool that can readily be used by all MALDI mass spectrometer users.

●Example: Difference in

Steps when using DIUTHAME

Steps when using a matrix and airbrush

DIUTHAME is an acronym for “Desorption Ionization Using Through Hole Alumina Membrane”

ducibility and accuracy

preparations for frozen section measurements of mouse brain

* See page 7 for details on these measurement examples.

Features

NO matrix required

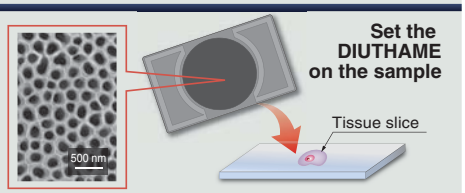
- NO matrix background noise
- High reproducibility with minimal variation no matter who does the measurement
- NO sample pretreatment required
- High spatial resolution in imaging mass spectrometry ensured by nanometer-order structure

How DIUTHAME differs from conventional MALDI

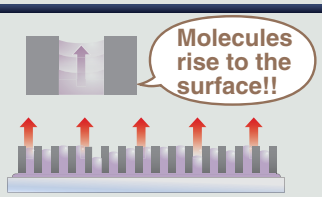
Item	DIUTHAME	MALDI
Background noise	None	Matrix noise appears
Ease of handling	Easy	Expertise is required
Reproducibility	High	Not so high
Spatial resolution	High	Not so high
Measurement of high molecules	Possible depending on samples	Possible

Ionization process using DIUTHAME

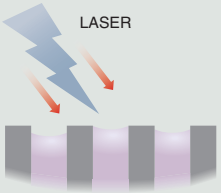
1 Place the DIUTHAME on the sample



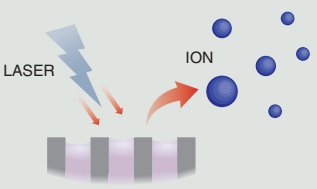
2 Wait until the molecules in the sample rise to the surface by capillary action



3 Irradiate a laser beam onto molecules that have risen to the surface



4 The target molecules are desorbed and ionized due to the effect from the fine convexo-concave structure



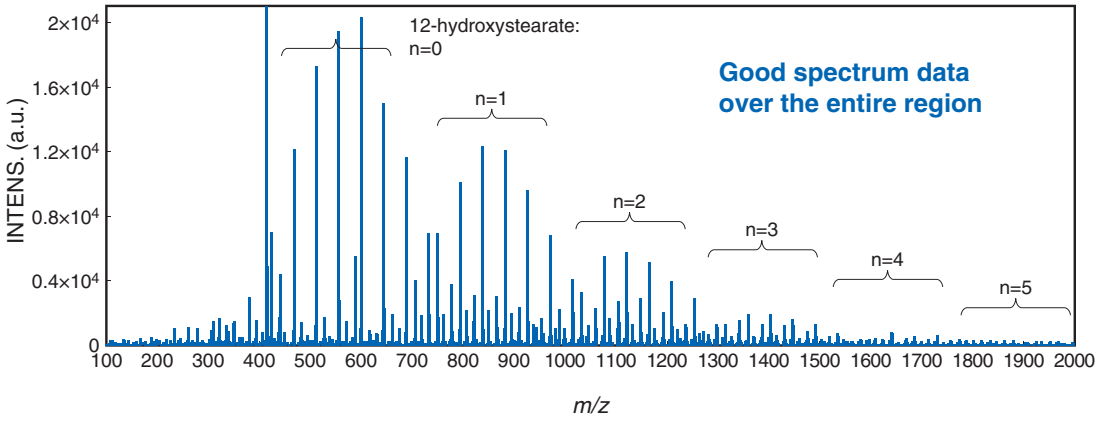
Mass spectrum measurement example

Measurements were carried out in cooperation with Dr. Hiroaki Sato, Polymer Chemistry Group of the Research Institute for Sustainable Chemistry, National Institute of Advanced Industrial Science and Technology (AIST).

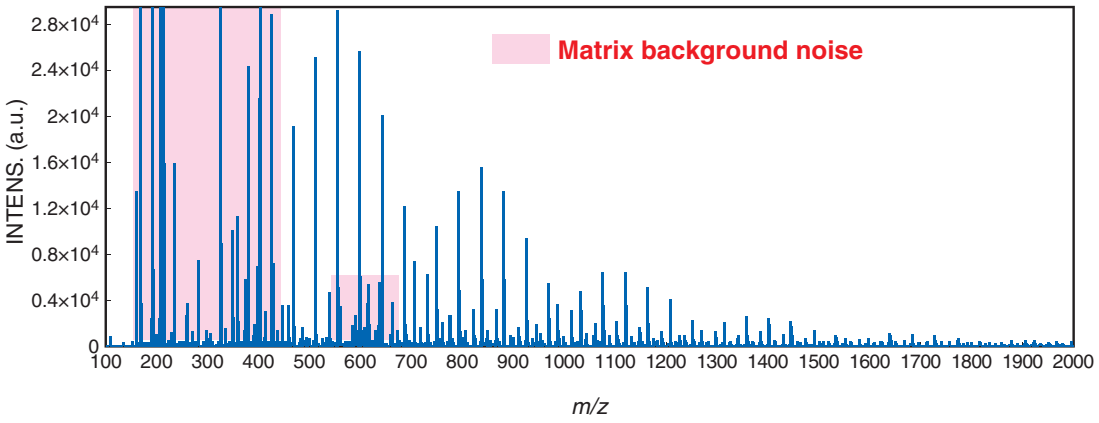
● PEO-hydrogenated castor oil

Measurement sample: Cosmetic raw material (Hydrogenated castor oil)

●Measurement example of PEO-hydrogenated castor oil using DIUTHAME



●Measurement example of PEO-hydrogenated castor oil using MALDI



Measurement method

The mixed sample was dropped from above the DIUTHAME.

Measurement sample details

The sample was dissolved in THF at a concentration of 1 mg/mL.
NaTFA was used as the cationizing agent and dissolved in THF at a concentration of 1 mg/mL.
The sample was mixed with the cationizing agent at a ratio of 1:10 (v/v).

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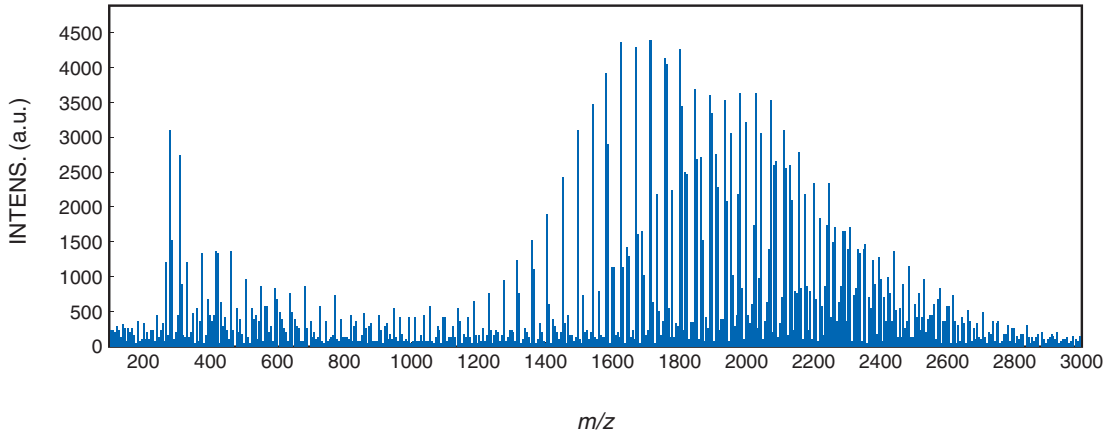
● PEO-monostearate

Measurement sample: Industrial surfactant (PEO monostearate)



Measurement method

The mixed sample was dropped from above the DIUTHAME.

Measurement sample details

The sample was dissolved in THF at a concentration of 1 mg/mL.
NaTFA was used as the cationizing agent and dissolved in THF at a concentration of 1 mg/mL.
The sample was mixed with the cationizing agent at a ratio of 1:10 (v/v).

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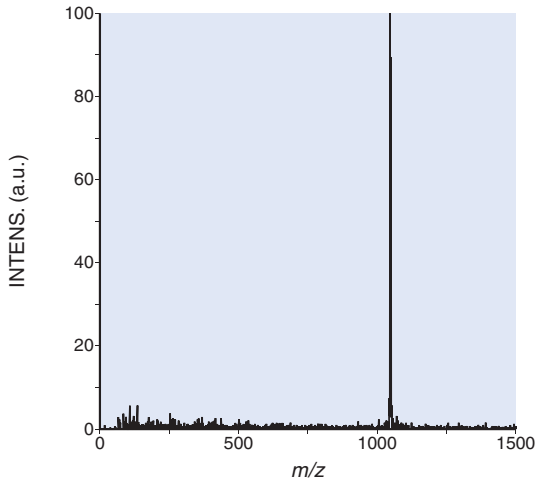
Mass spectrum measurement example

● Angiotensin II

Measurement sample: Angiotensin II ($[M+H]^+$, *m/z* 1046.5): 1 µM
Measurement conditions: Linear, positive ion mode



Measurement method

The mixed sample was soaked up from below the DIUTHAME.

Measurement sample details

Angiotensin II: DHC : CitAc : ACN=1 : 1 : 1 : 1
Angiotensin II: 1 µM
DHC (Diammonium hydrogen citrate): 0.2 M
CitAc (Citric acid): 0.2 M
ACN: Acetonitrile

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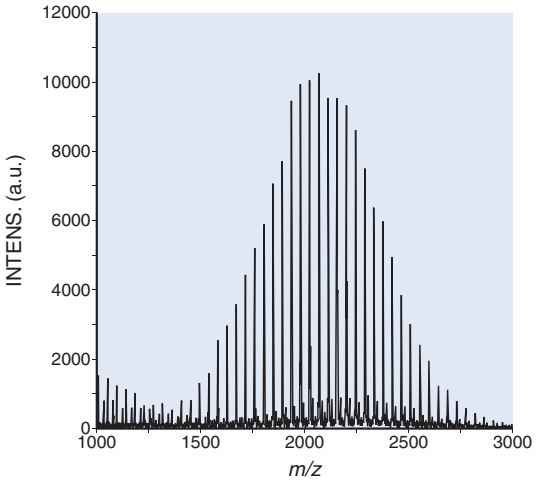
● Polyethylene glycol 2000

Measurement sample: Polyethylene glycol 2000: 1mM in acetone
Measurement conditions: Linear, positive ion mode



Measurement method

The mixed sample was dropped from above the DIUTHAME.

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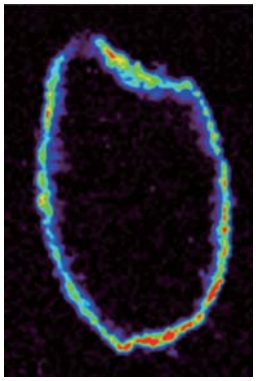
Measurement examples using imaging mass spectrometry

● Black rice

<Microscopic image>

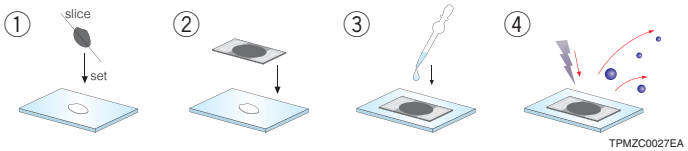


m/z 920 (Phosphatidylcholine)
Measurement conditions:
Linear, positive ion mode
Laser pitch: 50 µm

*After making measurements using imaging mass spectrometry, a microscopic image was captured from above the DIUTHAME by using a microscope.

Measurement method

①Set a slice of black rice on an ITO glass slide.
②Place the DIUTHAME substrate on the sliced black rice.
③Drop 2 µL of "70 % AcCN / 30 % H20" solution from above the DIUTHAME to extract the components of interest.
④After the sample dries,
make measurements using imaging mass spectrometry.



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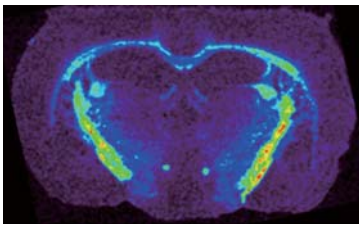
● Mouse brain

<Microscopic image>

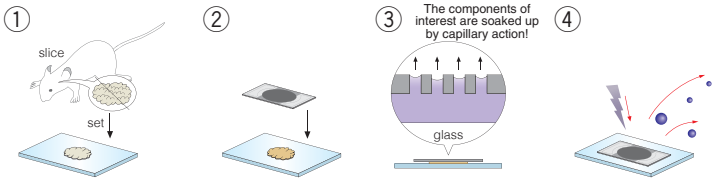


m/z 840
Measurement conditions:
Linear, positive ion mode
Laser pitch: 60 µm

*Before making measurements using imaging mass spectrometry, a microscopic image was captured from above the DIUTHAME by using a microscope.

Measurement method

①Set a slice of frozen mouse brain on an ITO glass slide.
②Place the DIUTHAME on the mouse brain slice before it thaws.
③After the brain slice thaws, the components derived from the sample are soaked up by capillary action.
④After the sample dries, make measurements using imaging mass spectrometry.



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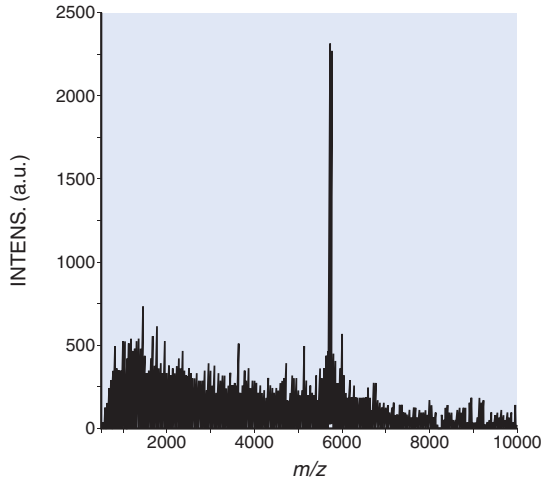
●Mass spectrum measurement example
Measurements were carried out in cooperation with Associate Professor Yasuhide Naito,
The Graduate School for the Creation of New Photonics Industries

● Insulin

Measurement sample: Insulin ([M+H]$^+$, *m/z* 5733.6): 0.5 mM
Measurement conditions: Linear, positive ion mode



Measurement method

The mixed sample was soaked up from below the DIUTHAME.

Measurement sample details

Insulin: DHC : CitAc : ACN=1 : 1 : 1 : 1
Insulin: 0.5 mM
DHC (Diammonium hydrogen citrate): 0.2 M
CitAc (Citric acid): 0.2 M
ACN: Acetonitrile

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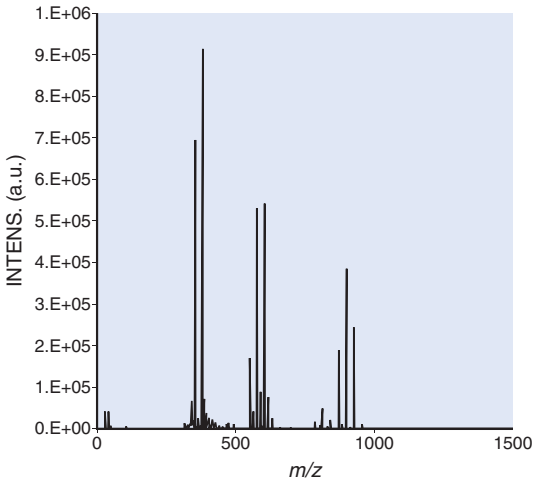
● Cocoa raw bean (Triglycerides)

Measurement sample: Triglycerides in cocoa raw beans
Measurement conditions: Linear, positive ion mode



Measurement method

①Set a slice of cacao raw bean on an ITO glass slide.
②Place the DIUTHAME on the sliced bean.
③Drop 2 µL of acetone from above the DIUTHAME to extract the components of interest.
④Irradiate a laser beam onto the DIUTHAME to cause ionization.

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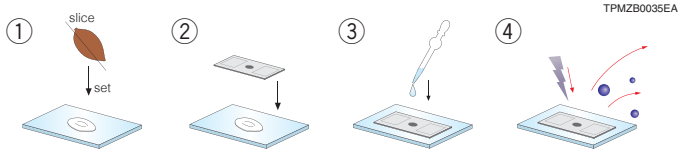

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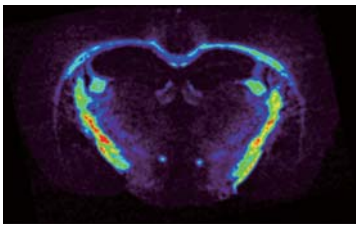
●Imaging mass spectrometry measurement example
Measurements were carried out in cooperation with Designated Assistant Professor Keiko Kuwata,
The Institute of Transformative Bio-Melecules Nagoya University

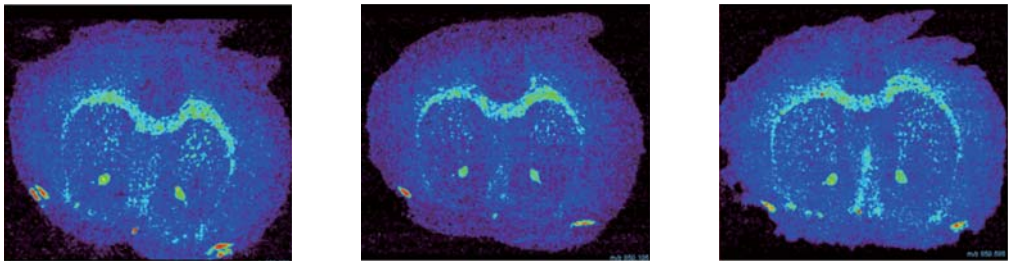


m/z 910
Measurement conditions:
Linear, negative ion mode
Laser pitch: 60 µm

● Reproducibility of serial slices of mouse brain (near *m/z* 850)

Good reproducibility **DIUTHAME**

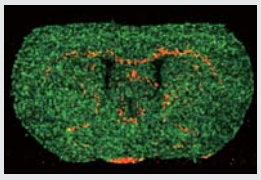
Mouse brain slice thickness: 50 µm
Laser pitch: 50 µm



First time　Second time　Third time

● Comparison between MALDI and DIUTHAME using mouse brain (*m/z* 848)

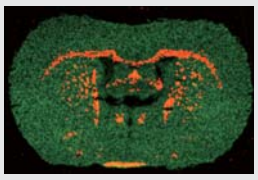
MALDI



Tissue section has contracted somewhat

<Conditions>
■Mouse brain slice thickness
10 µm
■Matrix conditions
DHB 50 mg/ml,
50 % ACN
Spray coating
■Measurement conditions
Reflectron,
positive ion mode
■Laser pitch
50 µm

DIUTHAME

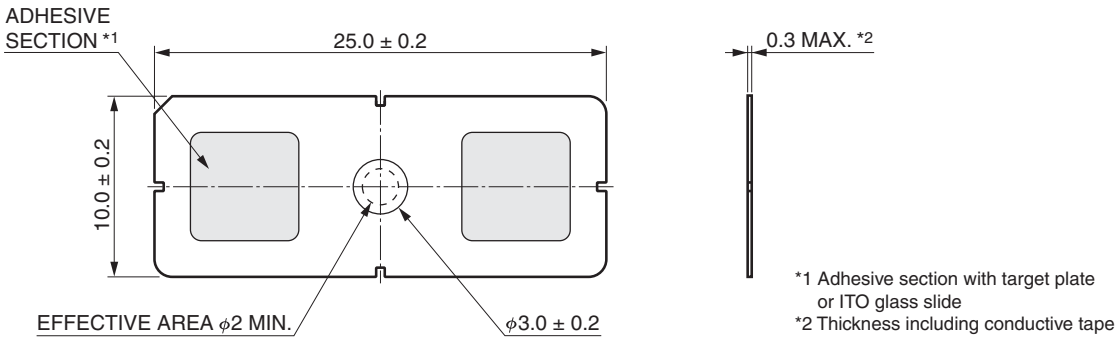


· Good spatial resolution
· Maintains shape of tissue section

<Conditions>
■Mouse brain slice thickness
50 µm
■DIUTHAME size
Effective diameter: 18 mm
■Measurement conditions
Reflectron,
positive ion mode
■Laser pitch
50 µm

Dimensional outlines (unit: mm)

A13331-3-1 (3 mm diameter)
For mass spectrum



*1 Adhesive section with target plate or ITO glass slide
*2 Thickness including conductive tape

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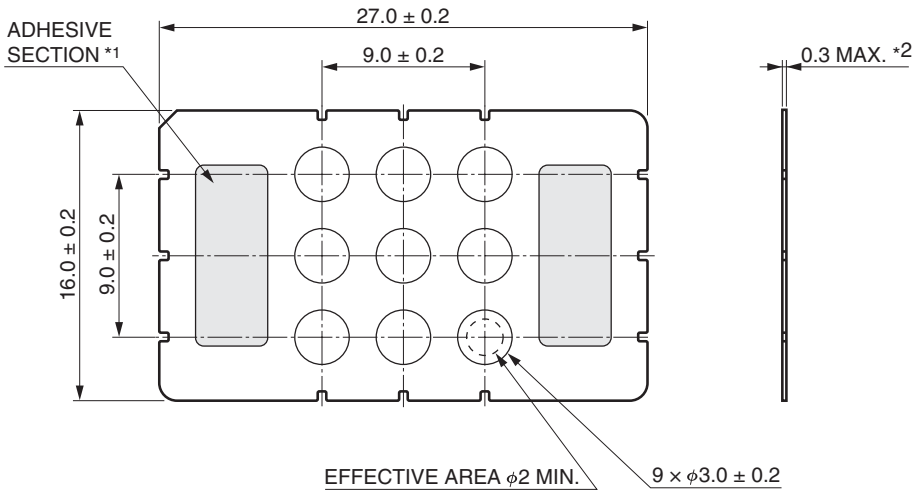
A14111-3-1 (3 mm diameter × 9 ch)
For mass spectrum



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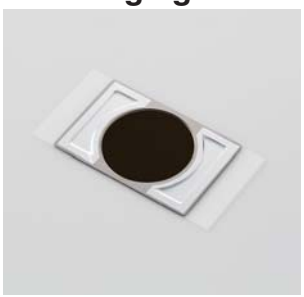
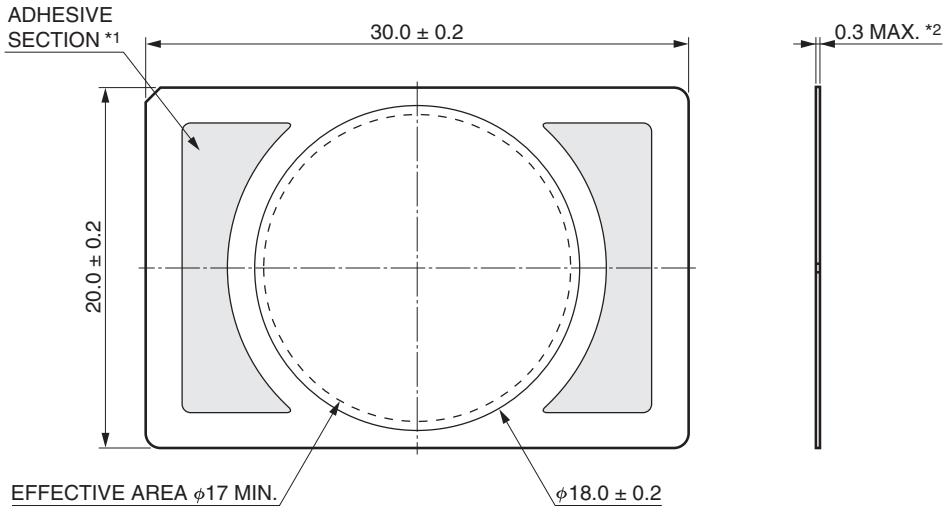
A13331-18-1 (18 mm diameter)
For imaging mass spectrometry





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