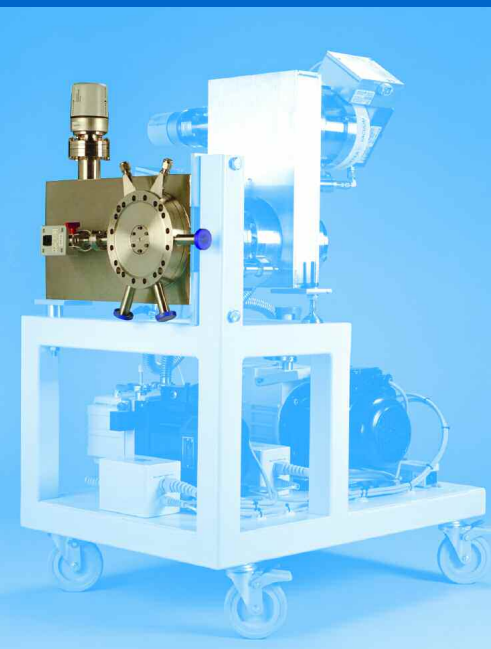


# Hiden *HPR60* Molecular Beam Mass Spectrometer System



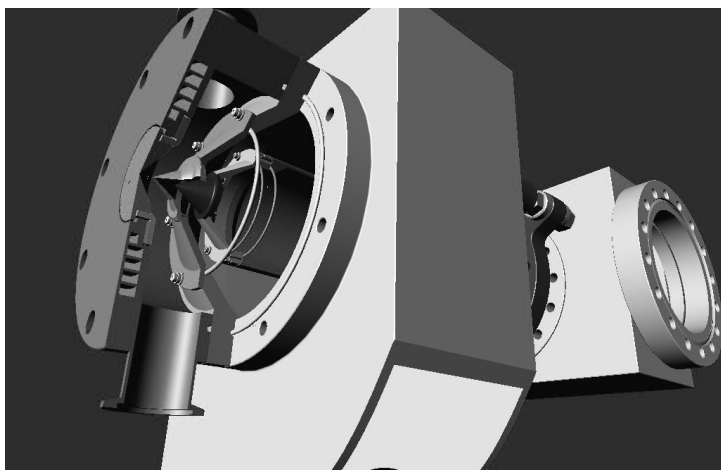
vacuum analysis

surface science

plasma diagnostics

gas analysis

## HPR60 MBMS Overview



The Hiden HPR60 Molecular Beam Mass Spectrometer (MBMS) is a compact, mobile gas analysis system for the quantitative analysis of reactive gas species.

Radicals, ions, polymers and clusters are sampled via a multi-stage differentially pumped inlet, forming a molecular beam that is transferred to the ion source of a precision triple filter quadrupole spectrometer.

Reactive species sampled by this method are entirely representative of the process species since they undergo no further gas phase reactions and do not collide with the walls of the sampling system on their way to the mass spectrometer detector.

Unlike some optical based diagnostic techniques which are limited by the availability of accessible excited states and often provide spatially averaged information, the MBMS technique provides a quantitative measure of all radical species at the substance surface.

Both two and three stage differentially pumped versions are available to address a broad range of applications covering the pressure range  $10^{-4}$  mbar to atmospheric, including reaction kinetics in;

- Environmental and atmospheric chemistry
- Low and high pressure plasma chemistry
- Catalytic reactors
- CVD / MOCVD
- Combustion chemistry
- Flame chemistry
- Semiconductor gas abatement

# HPR60 MBMS technology... at a glance

## Threshold Ionisation Mode

Radicals are ionised in the ion source of the HPR60 MBMS by electron impact. The positive ion signal as a function of the ionising electron energy being directly proportional to the absolute radical number density.

The threshold ionisation signals correspond to both sampled radicals and to background radicals which are generated in the ion source of the spectrometer. These beam and background signals are automatically measured by scanning the electron energy across a given threshold and automatically separated by use of a software controlled beam chopper (see overleaf), for unrivalled S/N and accuracy.

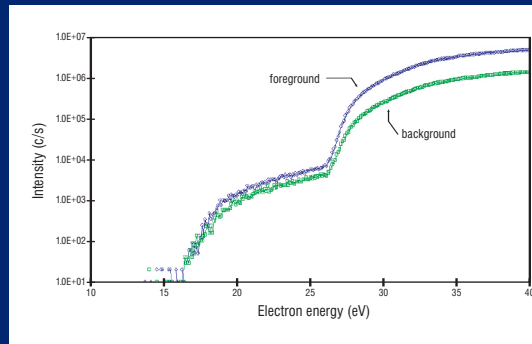
## Electron Attachment Mode

Radicals can also be studied by dissociative electron attachment in the ion source and the subsequent detection of the negative ion that is formed in the process. The electron attachment curve for the beam radicals is again automatically separated from the background with the software controlled beam chopper, as in the case of threshold ionisation above.

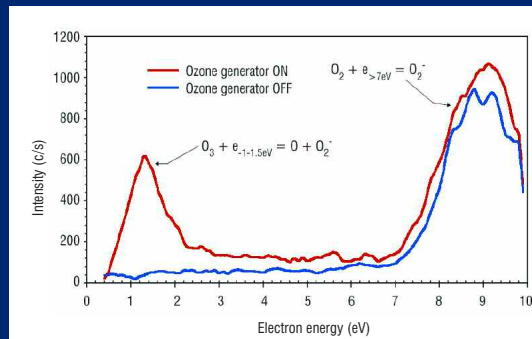
Electron attachment ionisation is a unique feature of Hiden's mass spectrometers and provides a powerful tool to the researcher interested in basic molecular phenomena

## Positive/Negative Ion Mode

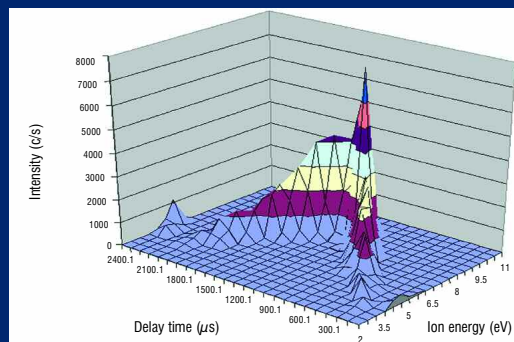
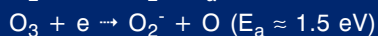
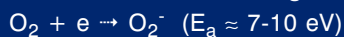
Pre-set software modes provide for instant switching between positive and negative ion detection as well as threshold and attachment ionisation. Ion energy distributions of plasma ions are acquired in seconds in both continuous and pulsed plasmas. Ion energy range options are 100 and 1000 eV and time resolution for pulsed plasmas is 100 nanosecond with all the necessary gating circuitry provided within the HPR60 MBMS control electronics and under full software control.



Threshold Ionisation curves of  $N^+$  obtained from an atmospheric pressure helium discharge operating in ambient air.

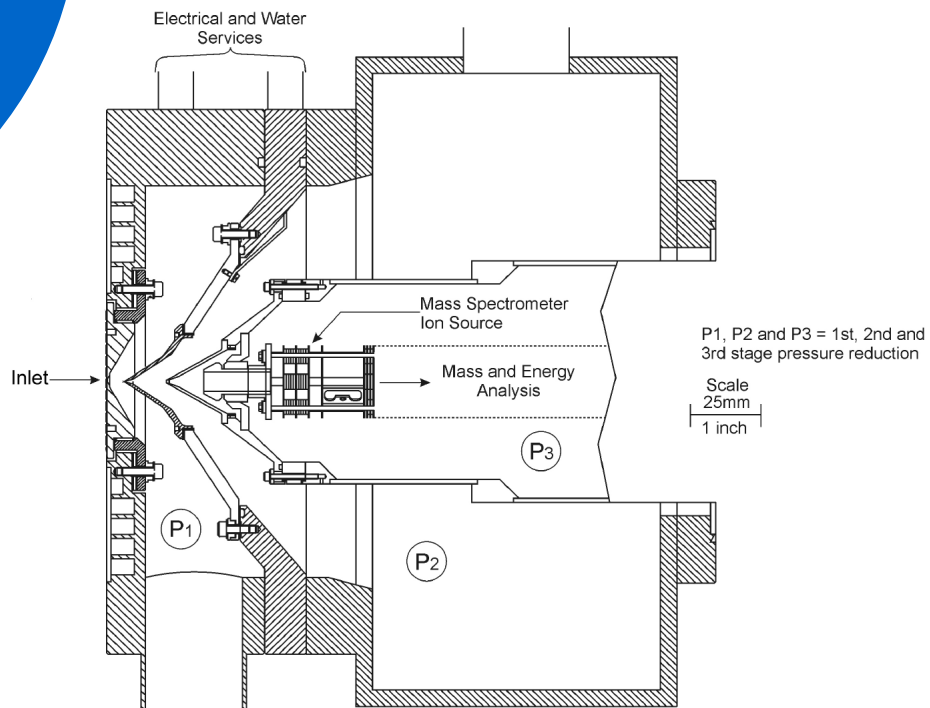


Dissociative Electron Attachment of Ozone from a commercial ozone generator.



Time resolved Ion Energy Distribution generated automatically by software controlled scanning of the timing parameters (delay and gate) from within MASsoft.

# HPR60 MBMS



## Specifications

**Mass Range:** 50, 300, 500, 1000 or 2500 amu

**Sampling Pressure Range:**  $10^{-4}$  mbar up to atmosphere depending on chosen configuration

**Operating modes:** Threshold Ionisation      Electron Attachment Ionisation  
Positive Ion Detection      Negative Ion Detection  
Multiple Ion Detection      Bar Scan, Profile Scan  
Ion Energy Distributions

**Mass Spectrometer:** Precision Triple Filter Quadrupole

**Detector:** Off axis Positive and Negative Ion Pulse Counting Single Channel  
Electron multiplier, 7 decade continuous dynamic range

**Ion Source:** Low profile electron impact with dual filaments

**Energy Filter:** Pole Bias, Bessel Box or 45 degree sector field options

**Inlet:** Modular 2 or 3 stage close coupled skimmer cone orifice inlets with fine alignment of mass spectrometer across the molecular beam axis  
Complete turbomolecular pump sets and vacuum gauging to suit each inlet

**Data Acquisition and Control:** 32 bit MASsoft operating system with HAL 5 Microprocessor

Rotating disc chopper assembly for automated beam foreground-background measurement with beam chopping rates to 360 Hz.

Programmable Signal Gating Module providing full software control of beam chopper and timing circuitry in pulsed applications

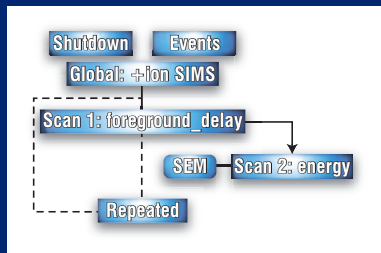
2 Analog Inputs, 3 Relay Outputs, 5 Digital I/O lines

## software control

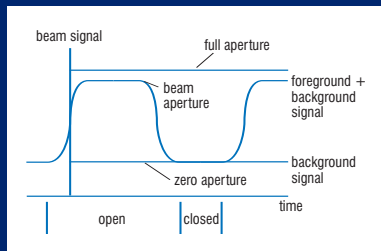
Integrated multi-bladed rotating disc chopper with UHV stepper motor drive and LED opto-detector linked directly to MASsoft control software via on-board programmable signal gating module.



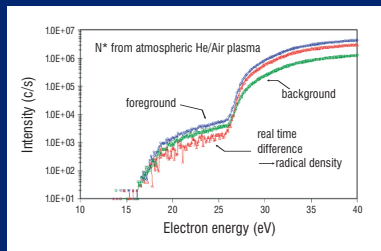
MASsoft scan tree allows full and automatic control of data acquisition synchronized with chopper cycles via the in-built scan tree function.



Foreground and background signals are automatically processed with the programmable signal gating module.



The resultant 'beam only' signal, which is directly proportional to radical number density, is identified automatically, providing rapid and accurate quantification of key species.



# MBMS

# HIDEN

ANALYTICAL



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It is Hiden Analytical's policy to continually improve product performance and therefore specifications are subject to change.

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