ATONARP


# ASTON™

## IMPACT

THE ADVANCED MOLECULAR SENSOR FOR SEMICONDUCTOR METROLOGY

# REAL TIME PROCESS CONTROL FOR SEMICONDUCTOR APPLICATIONS

## REAL-TIME METROLOGY

Up to 200 readings/second for high-speed atomic level etch and deposition processing and fast endpoint detection

Mass range up to 300 amu covers larger molecules found in more complex process gases

Detection Limit down to ppb levels and high sensitivity for Small Open Area % applications

Minimum detectable partial pressure of 1 x 10-12 for ultra-low-pressure processes and low-level contamination detection

## INTEGRATED COMMS

High speed deterministic EtherCAT support

RS432 serial coms for local peripheral control

## HIGH SENSITIVITY

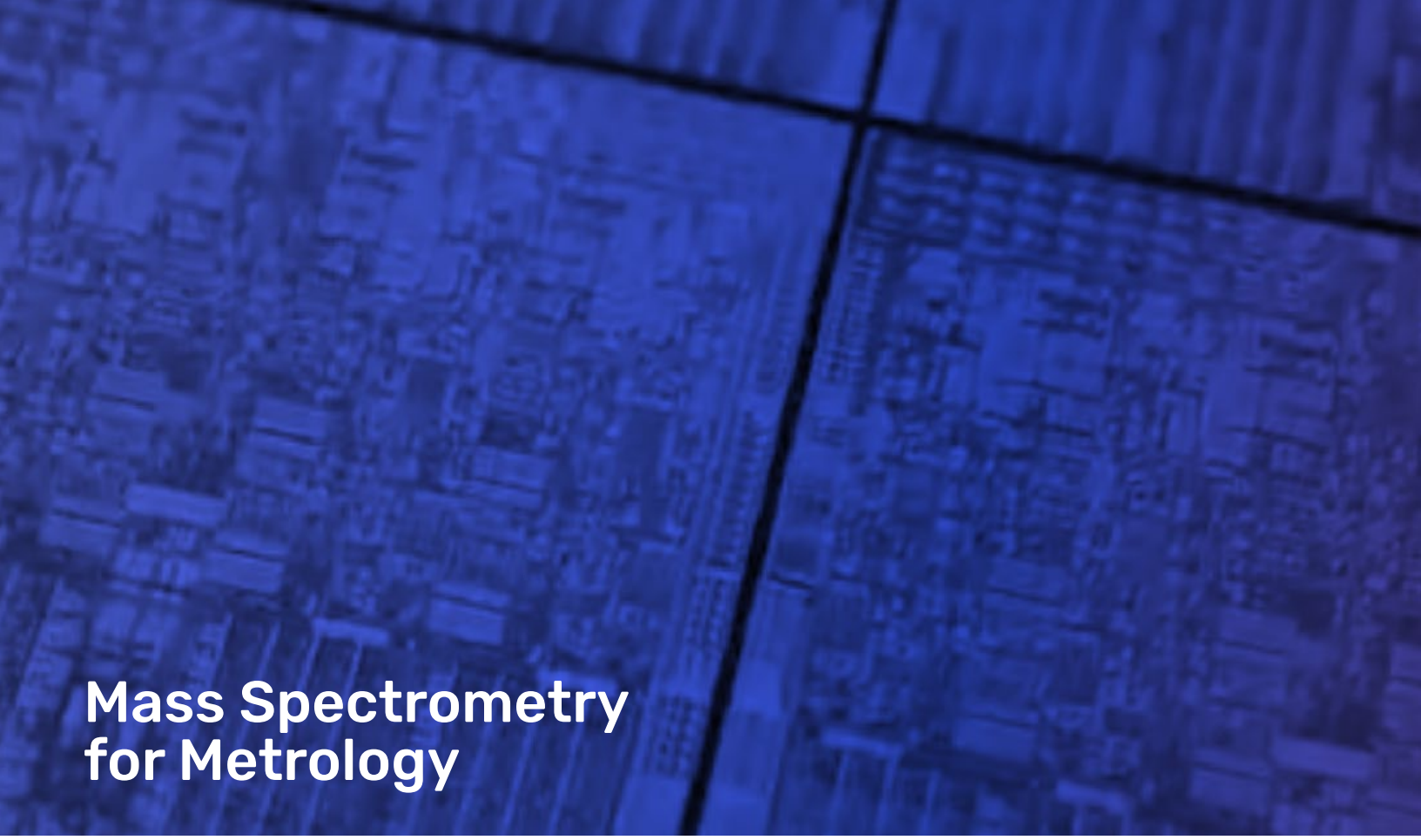
Secondary electron multiplier for low limit of detection

Process tool ready

Design for in-situ, high volume production semiconductor process control and metrology


## KEY APPLICATIONS OF ASTON IMPACT

- Chamber management: chamber finger printing and matching
- ALD and ALE processes
- Dry pump management
- Leak detection
- Gas delivery monitoring
- Pre-processing de-gas
- EUV mirror management



# Mass Spectrometry for Metrology

Atonarp Aston Impact is a compact mass spectrometer designed from the bottom up to be the workhorse metrology tool for gas monitoring and control in high volume semiconductor manufacturing.

High quantitative accuracy and real-time performance are combined with production ready dependability, increasing process chamber throughput, and maximizing yields in production environments. Additionally, the rich dataset from the complex process chamber chemistry provided during analysis enables and enhances advanced artificial intelligence and machine learning with a level of detail not possible with traditional metrology and on tool sensors.

The small footprint, integrated process logic controller (PLC) and industry standard communication interfaces allow for on-chamber installation and full integration into the process equipment control system.

Aston enables real time in-situ monitoring of precursors, reactants and byproducts during various process steps allowing for baseline fingerprinting and process monitoring end point. Aston™ represents a major evolution in metrology for semiconductor gas analysis by addressing the challenges of sensor durability, matching and ease of use.

Atonarp Aston™ enables a critical paradigm shift in the way processes are controlled, moving from crude time-based to precise measurement-based, real time, reliable, and accurate control. Additionally, having accurate metrology information is critical to chamber fingerprinting and matching and select atomic level deposition processes.

Embedded into the architecture of Aston™ are patented technologies enabling superior analytical and operational performance. Great emphasis is placed on low maintenance, long-term signal stability, and repeatability to enable the stringent requirements for ‘copy exact’ process control and matching of tools across production corridors within a fab and enterprise wide for similar processes across different fab locations.

KEY FEATURES

# Aston Impact: Designed for Superior Performance

## SELF-CLEANING

To withstand particulate build up found in deposition processes, Aston™ introduces a unique patented features to a semiconductor mass spectrometry solution, self-cleaning ReGen™ mode.

The ReGen mode enables the instrument to clean itself, using energetic plasma ions, to remove deposits on the sensor and Aston chamber walls that can build up during CVD. Aston sensitivity is therefore maintained up to a  thousand RF hours of operation. ReGen™ mode can be synchronized with regular tool preventive maintenance events.

## AVC™ SAMPLER (OPTIONAL)

Process gases are efficiently sampled by the Aston™ via a fast response pressure controller module: Automatic Vacuum Controller (AVC™). The intelligent sampler ensures a constant small inlet flow even if the process chamber experiences pressure excursions.

The pressure in HyperQuad sensor chambers is maintained at a constant level using a commercial dual inlet turbomolecular pump.

## HYPERQUAD SENSOR

Molecules ionized in the electron impact ionizer are efficiently transported to the sensor for analysis using a network of electrostatic lenses.

The analytical stage of the HyperQuad sensor is a quadrupole using µm-level accurate hyperbolic electrodes. Driven by a highly linear RF (Radio Frequency) circuitry and utilizing a dual Faraday/SEM detector, Aston's HyperQuad sensor produces high analytical performance over a mass range of up to 300 amu (see specifications table below).

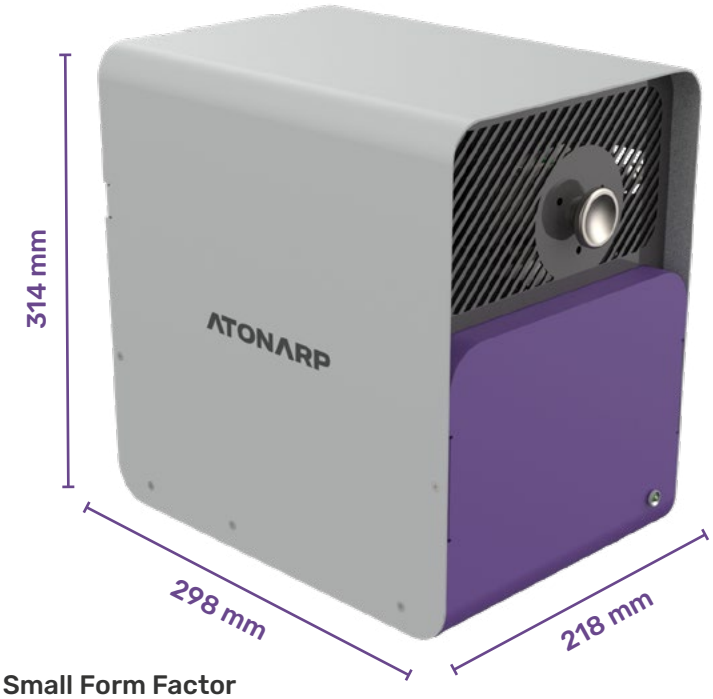
## SOFTWARE, TOOL INTEGRATION & COMMUNICATIONS

AtonLab™ is the primary graphical user interface (GUI) for control, data acquisition, analysis, and quantification. It is web browser-based and each Aston™ unit has a unique IP address. Atonarp also has a published web service application programming interface API to allow the user to directly control and acquire data from Aston™. High speed communications with the device are established using Ethernet and/or RS232 ports for the physical layer built into the controller module. Protocol interface options include Ethercat, Modbus, GEM/SECS and CLI (Command Line Interface).

Additionally Aston™ has a PLC (programmable logic controller) peripheral module featuring a network of digital and analog inputs and outputs (ADIOs) that can be used to control it local process environment directly (e.g. inlet valves) . Process parameter collection is accomplished over Ethercat to enable correlating chemistry data with the production run data (e.g. wafer ID), as well as providing advanced alarm capabilities that protect the process from "out of specification" process events.

## ASTON IMPACT INTERIOR COMPONENTS

- **High Performance Quadrupole**
  Electrical discharge machined hyperbolic electrodes
  Highly linear RF
- **Standard Comms**
  Ethernet & RS232 (hidden)
- **Electron Ionizer with ReGen™**
- **Process Tool Connection**
  AVC™ Sample Inlet (optional)
- **Compact Vacuum System**
  Dual inlet (SplitFlow) Turbo Molecular Pumps




**Small Form Factor**

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## IMPACT


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