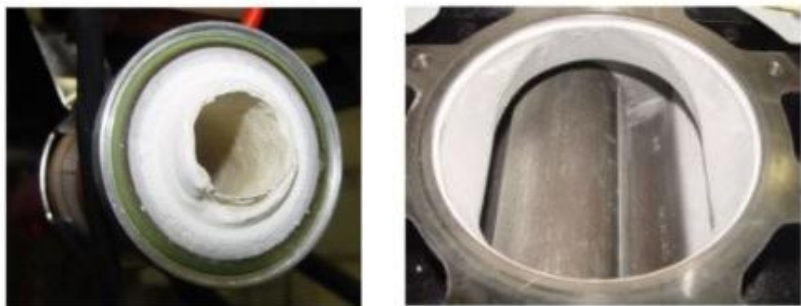


## Introduction

Vacuum pumps are one of the most widely used equipment in semiconductor process plants. They are critical to various Chemical Vapor Deposition processes which operate under vacuum to ensure uniform and conformal deposition coatings at lower processing temperatures. Vacuum dry pumps are generally inert and reliable, but when pumping in harsh semiconductor manufacturing processes, they can suffer from unexpected failures.

## The Problem

Dielectric deposition condensates and harsh process gases (e.g.,  $NF_3$ ) can result in degraded performance or sudden failure modes, including sudden suction of deposits, exhaust blockages, deposition causing pump seizure and the corrosive degradation of pump components. Pump failure typically causes irreparable damage to 10's or even 100's of in-process wafers. Additionally, tool downtime and cleanup can result in significant expenses and lost revenue.



## The Solution

Data-Driven Pump Failure Prediction. Measurement of molecule type and qualification (partial pressure) of the gases entering (fore-line) and leaving (exhaust) of the dry pump allows for modeling of destructive corrosion or deposit build-up. Gas pressure and volume alone are only partially indicative of the corrosive or clogging nature of the gas flow. Critically important is composition of the gases flowing through the pump. By modelling the pumps exposure to the gases concentration and correlating the model to real life pump failures it's possible to predict, with a high confidence level, the expected pump operating life.

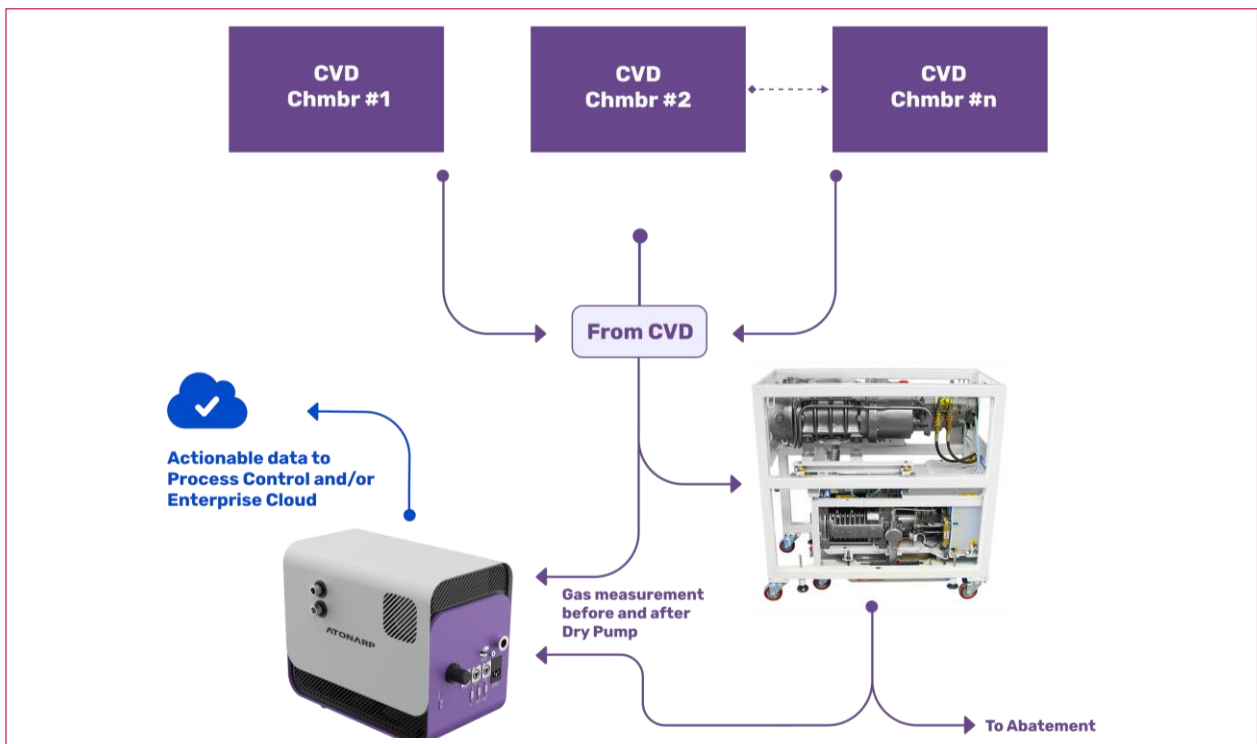
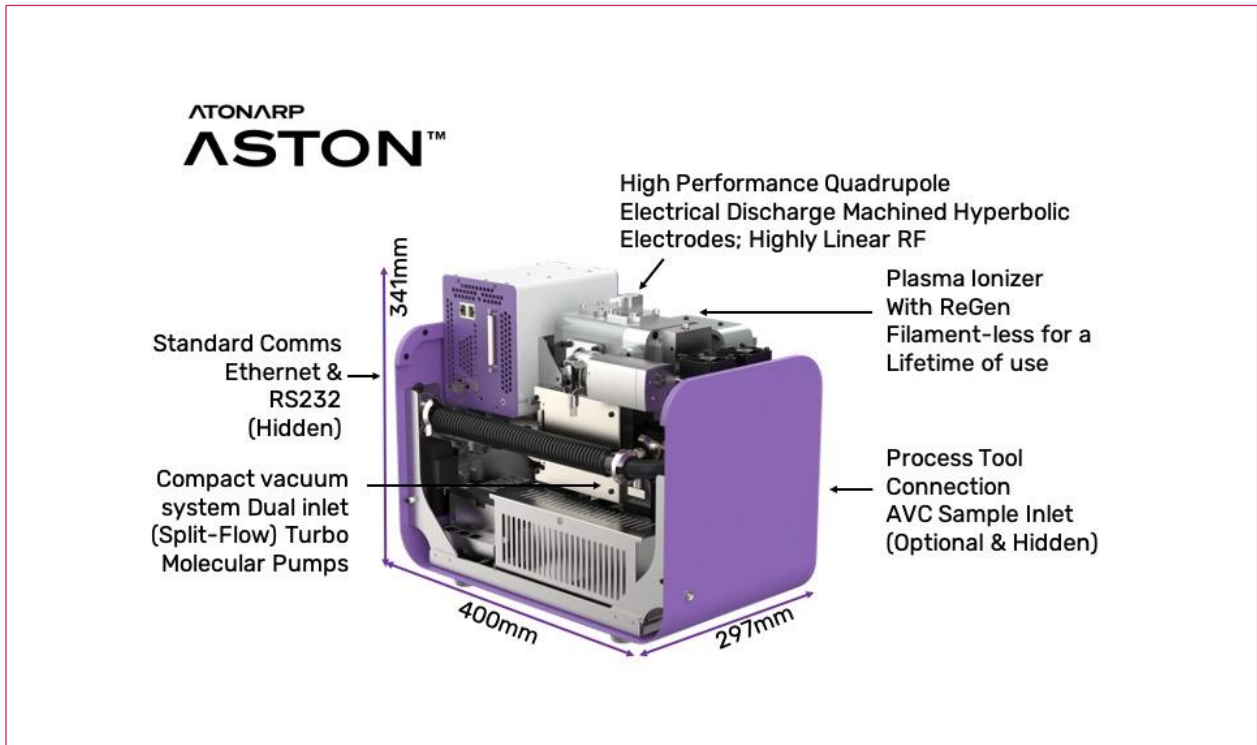
## Summary

By pre-emptively replacing or taking the dry pump offline prior to failure, catastrophic vacuum loss can be mitigated, resulting in improvements in line yield.



## Applications Supported

- Dielectric Etch
- Metal Etch EPD
- CVD Monitoring
- Chamber Clean EPD
- Chamber Fingerprinting
- Chamber Matching
- High Aspect Ratio Etch
- Small Open Area <0.3% Etch
- ALD
- ALE



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