

Molecular Beam Ionizers



- Ardara Technologies Molecular Beam Ionizers were designed to be used to either generate ions from a directed molecular beam, or as a general purpose electron impact (EI) ionizer to analyze residual gases in a vacuum chamber.
- Standard molecular beam ionizers can be coupled with either an einzel lens or a quadrupole deflector to couple to a mass analyzer.
 - Two sizes (0.555 i.d., and 0.92 inch i.d.) of durable, removable, Ionization Volumes and other ion optical components are made from stainless steel to allow for easy maintenance and cleaning, with all holes vented for UHV compatibility.
 - Either size Molecular Beam Ionizer can be used as a simple ‘Slim-Line’ Ionizer, without additional lenses after the extraction lens, or coupled with an einzel lens for better focusing into an quadrupole mass filter, or coupled with a quadrupole deflector to form a cross beam deflector ionizer.
 - For each ionizer size, there is the choice of easy to replace tungsten wire, or yttria coated iridium wire, which operates at a lower temperature, and is more suitable for molecular oxygen rich beams and backgrounds.
- Precision ceramics and precision-machined lenses allow for stable accurate alignment, without ‘wobble’, and without ruby balls rolling around the lab.
- Standard 1.25 inch bolt circle for mounting the standard size (1.56 inch outer diameter) molecular beam ionizer, with the Jumbo ionizer (2.25 inch outer diameter) having a 1.9 inch mounting bolt circle.
- Recessed bolt circle on top of filament shield allows ion region to mount closer to molecular beam source than our competitor’s top-mounted filament design.

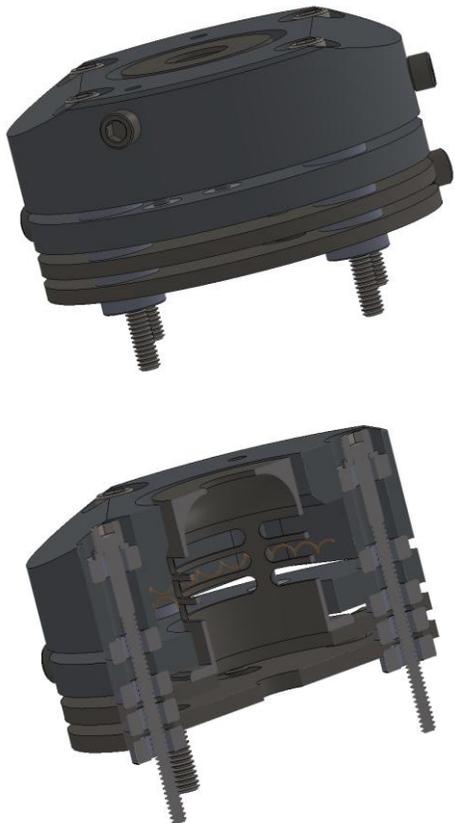
I. SLIMLINE AXIAL MOLECULAR BEAM IONIZER

The Ardara Technologies standard Axial Molecular Beam Ionizer was designed to provide maximum sensitivity with the shortest possible profile. The ion source mounting hardware has been recessed into the filament shield, minimizing potential mechanical interferences with other vacuum components, allowing a shorter path from a molecular beam source to the electron emitting filaments.

The use of interlocking lens assemblies allows for tight coupling of the ion region to the extraction lens, and the upper and lower filament plates while allowing for simple radial electrical connections using 2-56 hardware.

The use of high tolerance aluminum oxide washers and high tolerance counterbores yields the assembly precision of ruby balls and reamed holes, without chasing tiny ruby balls across the floor.

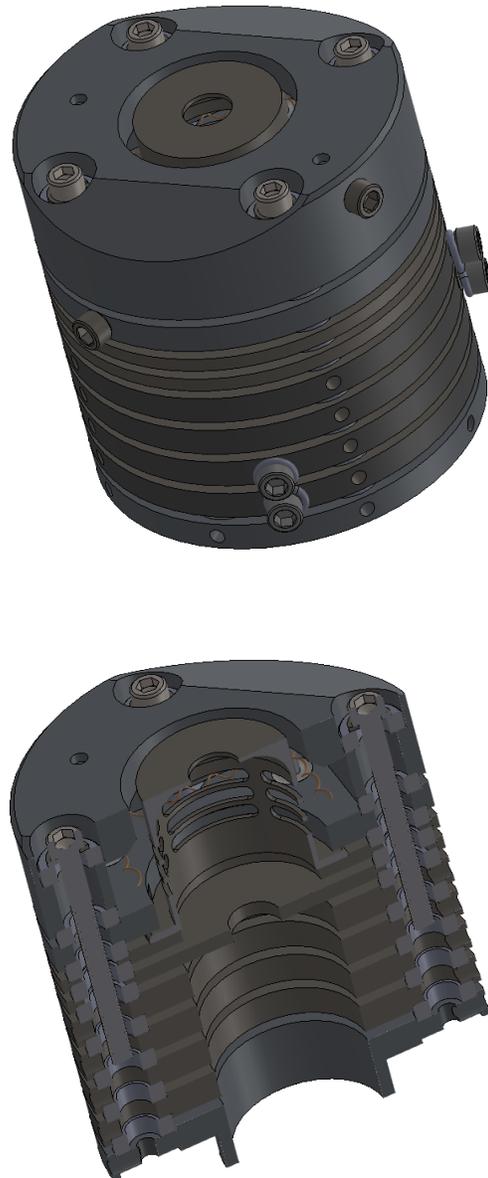
The Slim-Line configuration of ionizer is the basic building block for the other molecular beam ionizers in the Ardara Technologies ionizer family.



II. AXIAL MOLECULAR BEAM IONIZER

This high performance ionizer provides excellent sensitivity and long focal lengths for optimal abundance sensitivity. The Axial Molecular Beam Ionizer is constructed from our standard Slim-Line ionizer components mounted to a thick-lens einzel lens set.

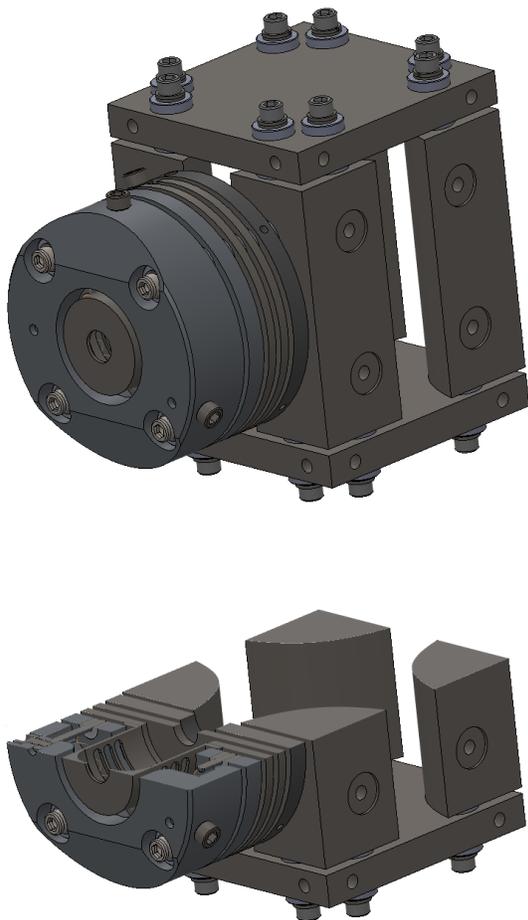
The Axial Molecular Beam Ionizer is the standard choice for a general purpose molecular beam ionizer, which is also optimized for residual gas analysis work.



III. CROSS BEAM DEFLECTOR IONIZER

When performing analysis of a molecular beam consisting of a corrosive, reactive or condensable material, it is generally best not to flow the molecular beam through the mass analyzer and the detector, rather one should sample the molecular beam orthogonally to the analyzer axis, and extract the ions from the molecular beam, deflecting them ninety degrees to the analyzer.

By mounting a Slim-Line ionizer to a Quadrupole Deflector Energy Filter, one can unite a high-sensitivity molecular beam ionizer with a high transmission energy filter. The bandpass of the energy filter can be tuned to a wide energy range, especially useful for use with supersonic molecular beams, where conventional cross beam ionizers have been known to show mass discrimination effects.



IV. IN-LINE IONIZER

In large complicated systems with lots of opportunities for signal loss, it is recommended that one include an electron impact ionizer in the system for diagnostic purposes, ideally as far upstream as possible.

Such a diagnostic source of ions is especially useful during the initial commissioning of a system, and can prove invaluable when troubleshooting.

To answer that need, Ardara Technologies modified our standard Slim-Line ionizer by substitution of a planar-top-surface filament shield plate.

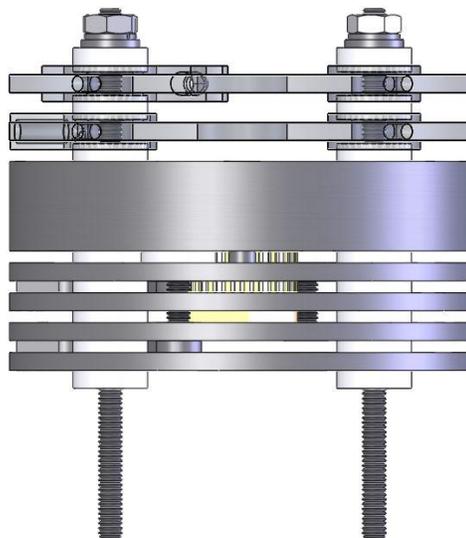
This allows the In-Line ionizer to mount directly in-line with virtually any assembly with the standard 1.25 inch bolt circle, acting like an einzel lens when the filament is disabled.

When the filament is enabled, the In-Line ionizer provides a reliable diagnostic source of ions, either providing signals representative of the residual vacuum background, or when used downstream from a gas load, the In-Line ionizer can even be used to measure the neutral components of the molecular beam.

Another useful application, when the filament is enabled, is its use as a source of electrons for charge reduction of multiply-charged electrospray ions.

Of course, a conventional Slim-Line ionizer could be used as the first ion optics after the high pressure external ion source, but the In-Line ionizer allows the ionizer to be embedded within the analyzer train, without requiring it to be the entrance terminus, while the Slim-Line ionizer, by definition, must be mounted at the top of the ion optics stack.

In the figure below, an In-Line ionizer is shown with a pair of lenses (shown slightly transparent).



V. JUMBO AXIAL MOLECULAR BEAM IONIZERS

Research by Ardara Technologies scientists has demonstrated that for the largest of our quadrupoles (12mm and 20 mm quadrupole rod diameters), a conventionally scaled axial molecular beam ionizer does not allow us to fully realize the full increase in absolute sensitivity afforded by the larger acceptance of the larger quadrupoles.

To answer this opportunity, we have developed a 'Jumbo Ionizer' that can be configured similar to our standard axial molecular beam ionizer, but with a scaled up ion volume internal diameter, (0.920 inches inner diameter for the Jumbo molecular beam ionizer, compared with the standard molecular beam ionizer.

The figure to the right illustrates an elevation drawing showing the difference in dimensions between our standard Axial Molecular Beam Ionizer, and our larger Jumbo Axial Molecular Beam Ionizer.

The Jumbo ionizer can be configured with the same Einzel lens or quadrupole Deflector options as the standard Molecular Beam Ionizer, but with a much larger ionization volume (0.92 inch inner diameter, versus the standard 0.555 inch inner diameter), resulting in dramatically increased output ion current than the standard axial molecular beam ionizer, which, being significantly larger than the design of a major competitor, demonstrates much higher ion currents than our competitors' fragile gold coated 0.375 inch inner diameter ionization region.

