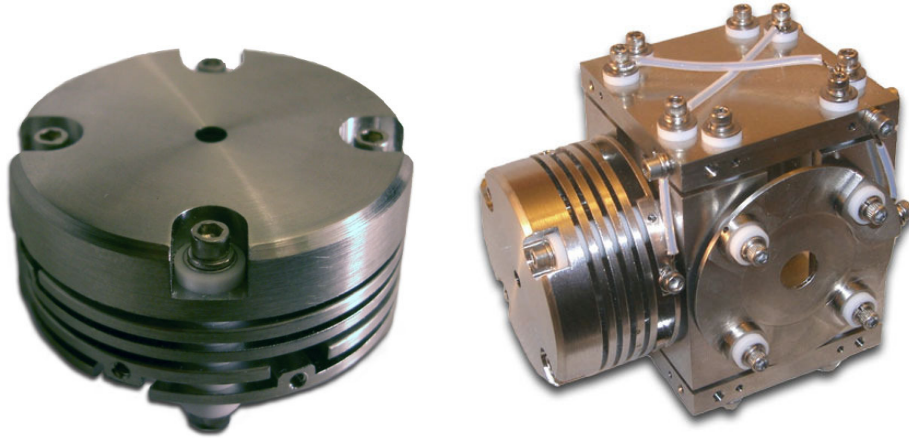


Molecular Beam Ionizers



- Flexible ‘Mix and Match’ design readily allows for customization through the mixing of a wide variety of components.
- Four standard ionizer configurations are available, a Slim-Line Ionizer, an In-Line Ionizer, an Axial Molecular Beam Ionizer, and a Cross Molecular Beam Ionizer with integrated Quadrupole Deflector Energy Filter.
- 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 all components
- Standard 1.56 inch outer lens diameter for all components.
- Radial M2 electrical connections for all components.
- Thru holes are vented for vacuum where appropriate.
- Ion region is constructed of gold-coated molybdenum for minimum secondary electron emission and minimum electron stimulated desorption outgassing.
- Easy replacement for filament assembly, with easy maintenance and repair due to rugged components.
- Tungsten and Ytria-coated Iridium filaments available.
- Recessed bolt circle on top of filament shield allows ion region to mount closer to molecular beam source.

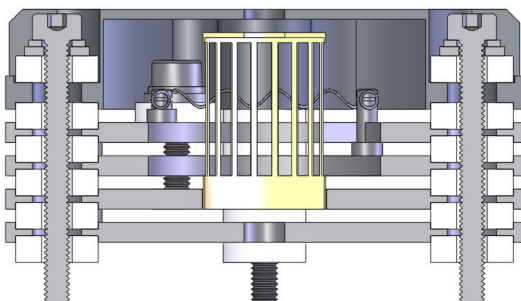
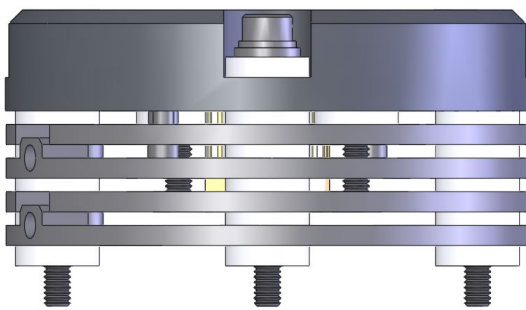
I. SLIM-LINE IONIZER

The Ardara Technologies Slim-Line 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 M2 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.

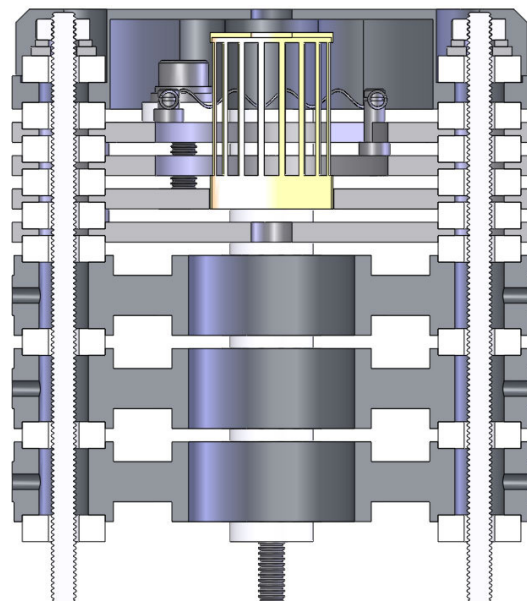
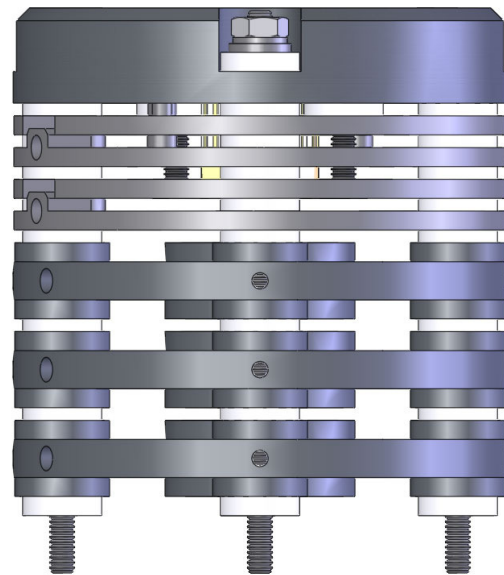
The Slim-Line ionizer is the basic building block for the other molecular beam ionizers in the Ardara Technologies ionizer family.



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.

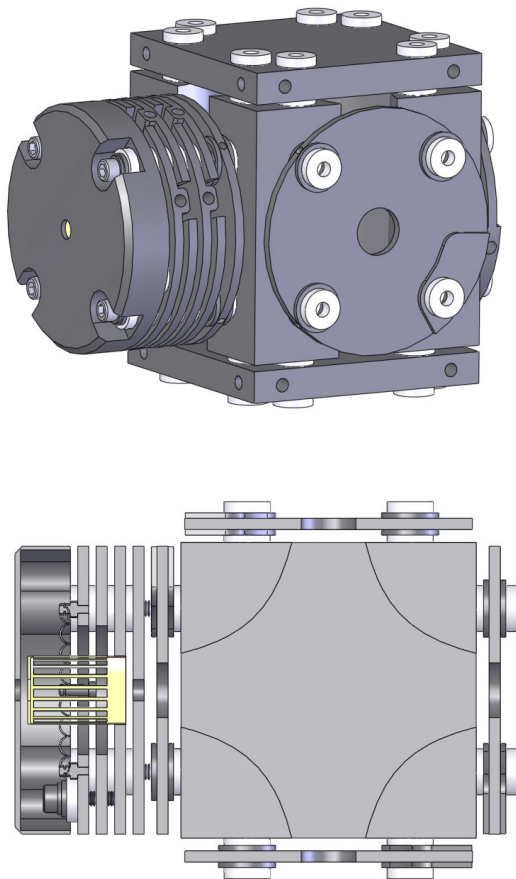
The Axial Molecular Beam Ionizer is the standard choice for a general purpose molecular beam ionizer, which is also optimized for residual gas analysis work.



III. CROSS BEAM 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.



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.

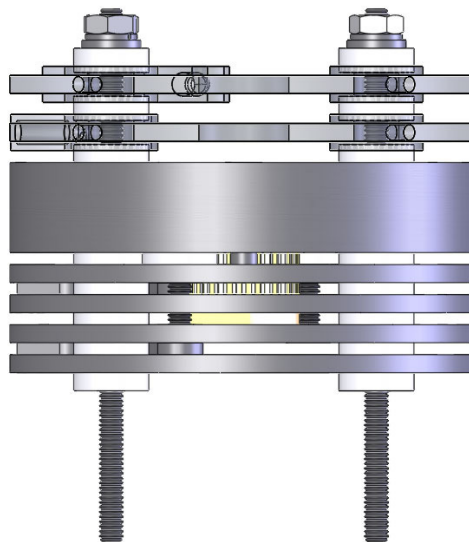
This allows the In-Line ionizer to mount directly in-line with virtually any assembly with the standard 1.25 inch bolt circle, acting like an einzel lens when the filament is disabled.

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 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 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).



IV. IN-LINE IONIZER

In large complicated systems with lots of opportunities for signal loss, it is recommended that one

V. EXPLODED VIEW OF IONIZER

The figure to the right illustrates an exploded view of the Axial Molecular Beam Ionizer, demonstrating some assembly details of the ion source design.

Starting from the top, M2 threaded rods are used to bolt the ionizer together. Note that the threaded rod can be added at the last minute, since it is not structurally significant in the assembly buildup of the ionizer.

The filament shield has recessed mounting holes for the M2 nuts and washers, with the bottom counterbored 0.020 inches to precisely seat a precision aluminum oxide ceramic washer.

This filament shield is electrically connected to the more negative of the filament connections (upper filament plate by definition) through the substitution of a precision stainless steel washer for one of the ceramic washers, thus requiring no extra wires.

The filament assembly is constructed from a pair of thin plates which have press-fit stainless steel filament posts. This integrated design simplifies wiring, since electrical connections are made radially to the plates, which are pre-wired to the filaments by design.

This filament assembly is constructed as a subassembly, with lots of room to spot-weld replacement filament wires into the slotted posts. Note the interlocking nature of the filament plates, allowing for radial electrical connection with M2 screws, while maintaining a thin elevation profile (0.160 inches from the bottom of the lower filament plate to the top of the upper filament plate).

Ceramic washers (0.080 inches thick) are used to insulate all of the components, providing precise alignment and elevation spacing into 0.020 inch counterbores in the stainless components, leaving a 0.040 inch gap.

A gold coated molybdenum ionization region is spot-welded to a thin stainless steel mounting plate, which is specially interlocked with the extraction lens, maintaining full functionality while maintaining the thinnest of profiles.

If we stop here, we have a basic Slim-Line ionizer, however if we instead mount a thick lens einzel lens (0.5 inch apertures, each 0.25 inch thick), resulting in an Axial Molecular Beam ionizer with a well collimated exit beam.

Of course this einzel lens set is available as a separate component assembly.

Alternatively, a quadrupole deflector energy filter can be substituted for the einzel lens, resulting in an elegant cross beam ionizer with high sensitivity, without mass discrimination for supersonic molecular beams, as seen in conventional cross beam ion sources.

