BEAM IMAGING SOLUTIONS®

PRODUCTS

2022

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IMAGING PRODUCTS

ION BEAM PRODUCTS

HRBIS - HIGH RESOLUTION BEAM IMAGING SYSTEMS

High resolution beam imaging is made possible with the Beam Imaging Solutions HRBIS systems. The HRBIS can be used to measure two or three dimensional intensity distributions of ion, electron and neutral beams. The HRBIS can also be used to image UV or X-rays for applications such as pinhole imaging and spectroscopy. Images are created using a microchannel plate (MCP) and phosphor screen. The phosphor is uniformly deposited onto a coherent fiber-optic (FO) substrate so that the image can be optically transmitted to the outside of a vacuum system for analysis using a FO conduit. The HRBIS systems are available in many different configurations to best fit a customer's particular application and budget.

Features

- Available with single or dual MCPs
- Spatial resolution down to 25μm
- Interchangeable probe heads for changing imaging area, gain and/or resolution
- Digital readout CID or CCD cameras
- CID and CCD cameras available with fiber-optic faceplate for direct fiber-optic coupling to probe head
- Available with flexible fiberoptic cable for remote imaging applications
- Phosphor screen available aluminized (standard) or Indium-Tin Oxide (ITO)
- Front mounting grids available for electron suppression, beam attenuation, beam acceleration etc.
- UHV compatible
- Power supplies and image processing systems available

Applications

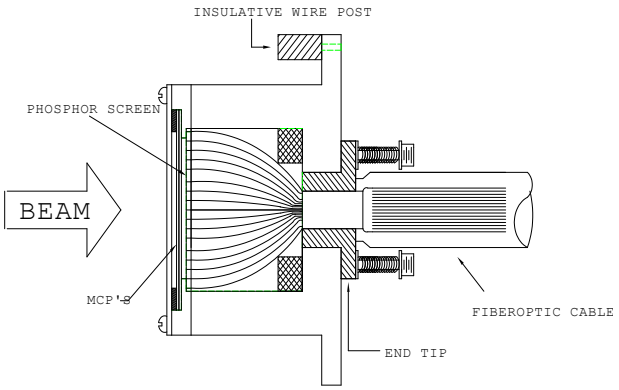
- High resolution single particle detection
- Remote beam line diagnostics
- Real time image analysis
- Beam profile analysis (beam tuning)
- Mass spectrometry (mass and dispersion determination)
- Low energy and low intensity beam imaging
- X-ray spectroscopy, X-ray pinhole imaging
- Field ion microscopy

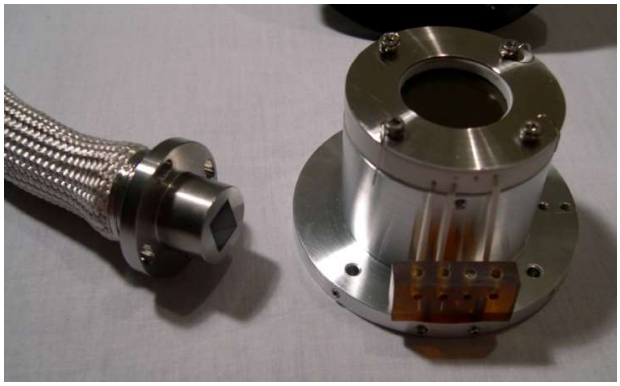
HIGH RESOLUTIONBEAM IMAGING SYSTEM - (HRBIS)

The HRBIS systems consist of three basic components: 1) the HRBIS *probe head* which houses the MCP and phosphor screen; 2) a *fiber-optic conduit* which optically transmits the image from the probe head to a fiber-optic vacuum feedthrough; and, 3) *a camera system* for digital readout of the image. These components are described in detail below.

PROBE HEAD

The HRBIS probe head creates an image of a beam by converting the incoming beam to electrons by secondary electron emission from the probe head microchannel plate (MCP). The electrons are then accelerated onto a phosphor screen with enough energy to excite the phosphor and create an image. The phosphor is deposited uniformly across a coherent fiber-optic (FO) disc or taper. The HRBIS-10000 series systems use a 1:1 magnification FO disc whereas, to image larger areas, the HRBIS-20000, HRBIS-30000 and HRBIS-40000 series systems use FO tapers with corresponding magnifications of 2x, 3x, and 4x. All HRBIS probe heads are interchangeable, allowing the user to change image resolution and image area by simply switching the probe head.





Model HRBIS-3-PH Probe Head and Fiber-optic Cable

Probe Head Specifications

Probe Head Model Number	Image Area	Approximate Spatial Resolution
HRBIS-1-PH	17mm diam.	25-35 μm
HRBIS-2-PH	25.4mm diam.	50-70 μm
HRBIS-3-PH	38.4mm diam.	75-100 μm
HRBIS-4-PH	~ 44.45mm diam.	150 μm

PROBE HEAD - OPTIONAL CONFIGURATIONS

- Probe heads are available with a single MCP (standard) or dual MCP (chevron) configuration for increased gain. MCP's are imaging grade and are available with optional coatings on the MCP input face. Coatings include CsI, CuI, MgF2, MgO, KBr, Cu, and Au.
- The phosphor screens are standard with P-43 phosphor and conductive aluminum coating. Other phosphors are available upon special request, as well as an Indium-Tin-Oxide (ITO) coating. ITO screens are generally used when lower electron accelerating voltages are required, however the quantum yield may be lower than that of aluminized screens.

- The probe heads also have the capability of mounting a variety of apertures, slits, lenses, pinholes, filters and grids using 1/8" (3mm) diameter ceramic mounting rods. HRBIS offers a selection of grids that can be mounted in front of the probe head for applications such as electron suppression, beam attenuation, and beam acceleration. A 4-terminal high voltage feedthrough on 2 3/4" (DN35) conflat flange is provided with the HRBIS system for the phosphor screen and MCP voltage application. HRBIS-1-PH with attenuation grids shown to right.

FIBER-OPTIC CONDUITS

Images are transmitted optically from the probe head through one of two types of FO conduits to a 2 3/4" (DN35) conflat® FO vacuum viewport. The image can then to be recorded on the outside of the vacuum chamber with a CCD/CID camera (see CCD and CID camera options below). Conduits consist of either a flexible 60cm long, 10mm x 8mm rectangular FO cable (*Remote System*) or 19mm diameter solid FO rod (*Standard System)* which is available in various lengths. Both conduit types attach at one end to the HRBIS probe head, and to the FO viewport at the other end. The remote systems with flexible FO cable are especially useful for imaging particle beams deep within the vacuum chamber where the beam cannot be brought to a vacuum port for imaging. The 60cm length is standard, however other lengths are available on request. The standard systems with solid FO rod are generally used when the beam can be brought close to a vacuum port for imaging. The FO rod is available in various lengths to allow for greater flexibility when adapting to a customer's particular application.

CCD AND CID CAMERA OPTIONS

Optional CCD and CID camera readout systems are available for all HRBIS systems. All cameras are available with lens, video monitor and mounting system for imaging the FO viewport. The CIDTEC 3710D is available with Fiber-Optic Face Plate (FOFP) directly attached to the camera sensor. The camera sensor is then mounted in a special housing which allows them to directly mate to the FO viewport. This direct FO coupling approach ensures highest possible resolution and gain. The camera can be connected to a video monitor in order to observe images in real time, and can also be connected to a video frame grabber making it possible to store and analyze the images later. BIS offers the optional Image Processing Systems (IPS) which includes a video monitor, frame grabber, cables and software.

CCD/CID Camera Specifications

Camera	CIDTEC 3710D	SONY XCD-U100	SONY XCD-SX97E
Optical Format	2/3" diagonal	1/3 Progressive Scan	2/3 Progressive Scan
Resolution	755H x 484V	1600 x 1200	1360 x 1024
Element Pitch (μm)	12.0 x 13.7	4.4 x 4.4	6.45 x 6.45
Area (mm)	9.05 x 6.83	7.04 x 5.3	8.77 x 6.60
FOFP (Optional)	4.5 μm pitch	4.5 μm pitch	4.5 μm pitch
Scanning Format	RS-170, 2:1 Interlace	IEEE-1394, 15FPS	GiGE, 16FPS
Electronic Shutter		16 - 1/100,000 sec.	2 - 1/100,000 sec.
Sync. System	Int./Ext.	Int./Ext.	Int./Ext.
Signal to Noise (db)	50		
Sensitivity (Face Plate Illumination	Full Output: 0.5fc	2lx(minimum illumination)	400 lx
Input Power (Watts)	8.5 max.	2.8	3.1
Input Voltage (Volts)	+ 15VDC nominal	+12VDC	+10.5VDC - +15VDC

HRBIS ORDERING INFORMATION

Use the table on the right to determine the HRBIS model you need. For example, a model HRBIS-31035 decodes as a HRBIS 30000 series system with HRBIS-3-PH probe head, dual MCP, 60cm long fiber-optic cable with 2 3/4" (DN35) conflat® viewport, and fiber-optically coupled CIDTEC 3710D camera.

NOTE: All HRBIS systems include a 4-terminal, 2-3/4" conflat (DN35) high voltage feedthrough (HRBIS part number PN-706).

Ordering Information

HRBIS - X X X X X

High Resolution Beam Imaging System

Probe Head
- 1 HRBIS-1-PH (FO 1:1)
- 2 HRBIS-2-PH (FO 2:1)
- 3 HRBIS-3-PH (FO 3:1)
- 4 HRBIS-4-PH (FO 4:1)

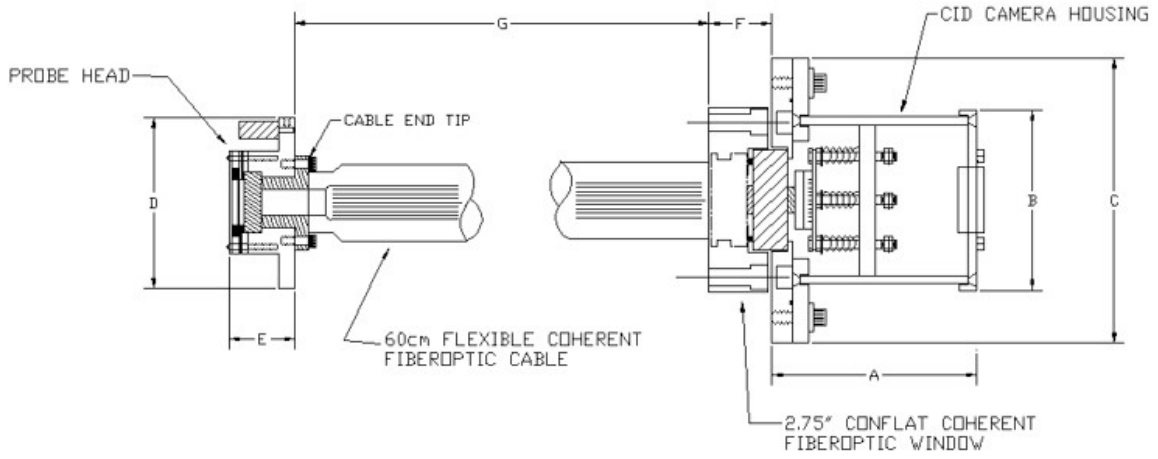
Microchannel Plate (MCP) Configuration
- 0 Single MCP
- 1 Dual MCP (Chevron)
- 2 None (Phosphor Screen Imaging)

Phosphor Screen Configuration
- 0 P-43 with Aluminum Overcoat
- 1 P-43 with ITO undercoat
- 2 Custom, Customer Specified

Fiberoptic (FO) Conduit
- 0 2" Long FO Rod/FO Viewport
- 1 3" Long FO Rod/FO Viewport
- 2 4" Long FO Rod/FO Viewport
- 3 60cm FO Cable/FO Viewport
- CR Custom Length FO Rod/Viewport
- CC Custom Length FO Cable/Viewport

Camera System
- 0 None
- 1 COHU 2600/Lens/Mount
- 2 COHU 2700/Lens/Mount
- 3 CIDTEC 3710D/Lens/Mount
- 4 CIDTEC 3710D/Fiberoptic Face-plate/Mount
- 5 Sony XCD-U100/Fiberoptic Face-plate/Mount
- 6 Sony XCG-SX97E/Fiberoptic Face-Plate/Mount
- 7 Custom, Customer Specified

REMOTE SYSTEM DIMENSIONS



The dimensions for the HRBIS system with optional FO cable and CIDTEC camera with FOFP are shown below.

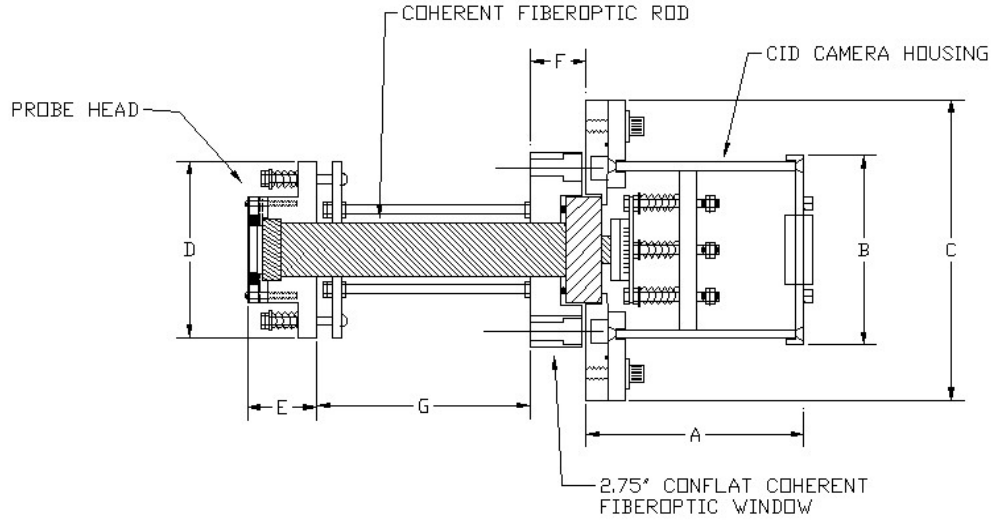
HRBIS with Fiber-optic cable (Remote) and CIDTEC3710D with FOFP Option

DIMENSIONS

	MODELS*	HRBIS-1XX34	HRBIS-2XX34	HRBIS-3XX34	HRBIS-4XX34
DIM (mm)					
A		77.5	77.5	77.5	77.5
B		68.3	68.3	68.3	68.3
C		108.0	108.0	108.0	108.0
D		63.5	76.2	88.9	101.5
E		24.8	43.3	56.3	70.09
F		23.9	23.9	23.9	23.9
G		566.7	566.7	566.7	566.7
CABLE END TIP O.D. (ϕ)		34.3	34.3	34.3	34.3

** The model number X descriptor determines the MCP option (see ordering information above).*

STANDARD SYSTEM DIMENSIONS



The dimensions for the HRBIS system with solid FO rod and CIDTEC camera with FOFP are shown below.

HRBIS with fiber-optic rod (Standard) and CIDTEC 3710D with FOFP option

DIMENSIONS

	MODELS*	HRBIS-1XX04	HRBIS-1XX14	HRBIS-1XX24	HRBIS-2XX04	HRBIS-2XX14	HRBIS-2XX24
DIM (mm)							
A		77.5	77.5	77.5	77.5	77.5	77.5
B		68.3	68.3	68.3	68.3	68.3	68.3
C		108.0	108.0	108.0	108.0	108.0	108.0
D		63.5	63.5	63.5	76.2	76.2	76.2
E		24.4	24.4	24.4	43.3	43.3	43.3
F		20.0	20.0	20.0	20.0	20.0	20.0
G		25.4	50.8	76.2	25.4	50.8	76.2
Fiber-optic Rod O.D.		19.1	19.1	19.1	19.1	19.1	19.1

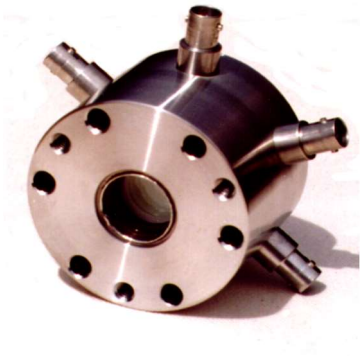
	MODELS*	HRBIS-3XX04	HRBIS-3XX14	HRBIS-3XX24	HRBIS-4XX04	HRBIS-4XX14	HRBIS-4XX24
DIM (mm)							
A		77.5	77.5	77.5	77.5	77.5	77.5
B		68.3	68.3	68.3	68.3	68.3	68.3
C		108.0	108.0	108.0	108.0	108.0	108.0
D		88.9	88.9	88.9	101.5	101.5	101.5
E		56.3	56.3	56.3	70.1	70.1	70.1
F		20.0	20.0	20.0	20.0	20.0	20.0
G		25.4	50.8	76.2	25.4	50.8	76.2
Fiber-optic Rod O.D.		19.1	19.1	19.1	19.1	19.1	19.1

** The model number X descriptor determines the MCP option (see ordering information on page 7).*

HIGH RESOLUTION BEAM IMAGING SYSTEM SPECIFICATIONS

Imaging Area	9.1mm x 6.6 mm Model HRBIS-10000 Series 18.2mm x 13.2 mm Model HRBIS-20000 series 27.3mm x 19.8mm Model HRBIS-30000 series 36.4mm x 26.4mm Approx. Model HRBIS-40000 series
Fiber-optic Cable:	10.0 mm x 8.0 mm image area, 10 micron square fiber size
(Remote Systems)	600 mm length, Flexible, UHV Compatible, 2 3/4" Conflat® port
Fiber-optic Rod:	Available in 2", 3" or 4" lengths, 3/4" Diameter
(Standard Systems)	6 micron diameter fiber size
MCP: (Standard)	0.975" Diam., (HRBIS-10000 series) 1.289" Diam., (HRBIS-2000 series) 1.970" Diam., (HRBIS-3000 series) 1.970" Diam., (HRBIS-4000 series 10 micron channel diameter Max. Gain: 2×10^4 (single plate,1000V), $>10^7$ (chevron,2000V) Spatial Resolution: 41 lp/mm
Phosphor Screen:	P-43 deposited onto aluminized fiber-optic faceplate Fiber-optic faceplate fiber size: 6 micron diameter P-43 Peak wavelength: $\lambda = 545$ nm
Power Supply	0 - + 1000V, 1 mA single Microchannel Plate
Specifications:	0 - + 2000V, 1 mA dual Microchannel Plate (chevron) 0 - + 5000V, 1 mA Phosphor Screen
Vacuum:	1×10^{-6} Torr or better required to operate probe (MCP) Good to at least 1×10^{-10} Torr; Maximum bakeout temp. 150° C

BEAM OBSERVATION SYSTEMS (BOS)

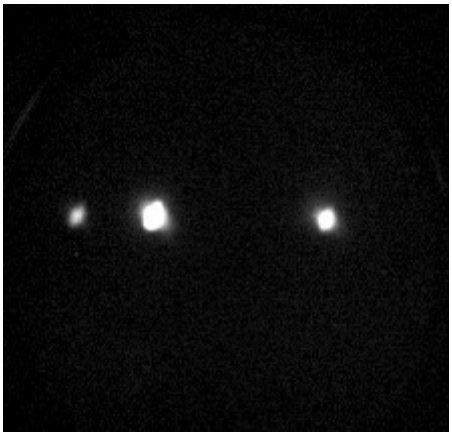


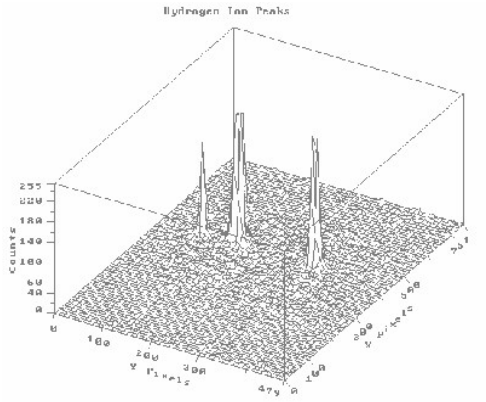
Model BOS-18 ***Model BOS-40-6 with optional fiberoptic window***

Beam Imaging Solutions presents the Beam Observation Systems (BOS). The BOS systems provide an easy, quick and low cost solution for beam profile analysis of electron, ion and neutral beams, as well as UV and X-rays. The image is formed using a microchannel plate (MCP) in combination with a phosphor screen assembly. The BOS units have a MCP/phosphor screen assembly mounted to a vacuum flange with electrical feedthroughs for applying voltages to the assembly and with vacuum window for observing the image. Currently, the BOS units are available with 18mm, 25mm, 40mm and 75mm active viewing diameters. In applications in which imaging is required at 90-degrees to the input beam, the new BOS-IW image wedge can be used. These units use the standard BOS MCP/phosphor screen imaging assembly attached to a stainless steel housing with mirror mounted at 45 degrees.
Typical uses for the BOS include:

- Real Time Image Analysis
- Single Particle Position Sensitive Detection
- Beam Line Diagnostics
- Beam Profile Analysis (beam tuning)
- Mass Spectrometry (mass and dispersion determination)
- Low Energy and Low Intensity Beam Imaging
- X-ray Spectroscopy
- Field Ion Microscopy

Image of mass separated ion beam showing H+, H2+ and H3+ on the BOS-18 Beam Observation System.





MODEL BOS-18 Beam Observation System

BOS-18 with Welded Window

BOS-18 with Removable Window

In standard form, the model BOS-18 Beam Observation system has a 18mm diameter active area MCP and P-43 phosphor screen assembly, housed within a 2.75" (70mm) conflat flange with glass viewport. Electrical connections to the phosphor screen and MCP are made with MHV feedthroughs.

OPTIONS

CCD Camera Systems

Model BOS-18 with optional CCD camera and mounting system. See page 24 for more details on available CCD camera systems.

Windows and SHV Feedthroughs

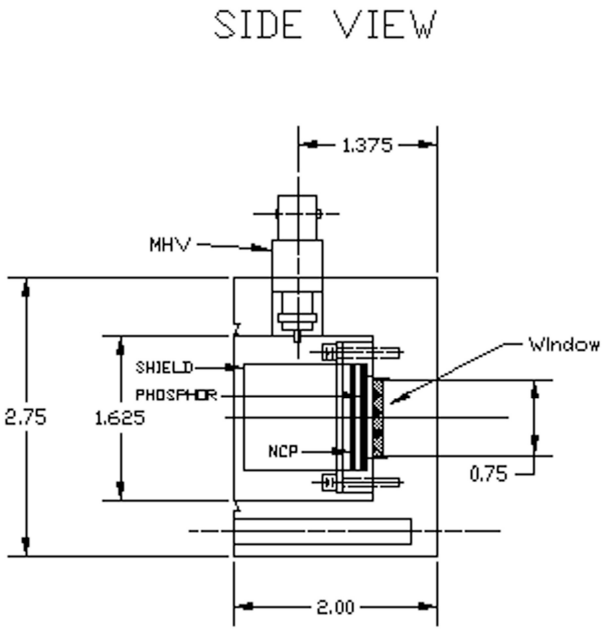
The MODEL BOS-18 is available with a welded glass window (standard), removable glass window, or fiberoptic window (shown to left). Also available are optional SHV (5kV) and SHV-B (7.5kV) feedthroughs, in place of the standard MHV (5kV)feedthroughs.

Stand alone MCP/Phosphor Screen Assemblies

The imaging assembly of the BOS-18 system is available separately. This assembly includes a MCP/phosphor screen stack mounted in a ceramic fixture with wires for attaching to your electrical feedthrough. The assembly is available with single or dual MCP plates and model BOS-18-CH-IDA (dual MCP) is shown at left.

BOS-18 SPECIFICATIONS

Flange Size: 2.75" Conflat
Imaging Area:
18mm Diam.(BOS-18)

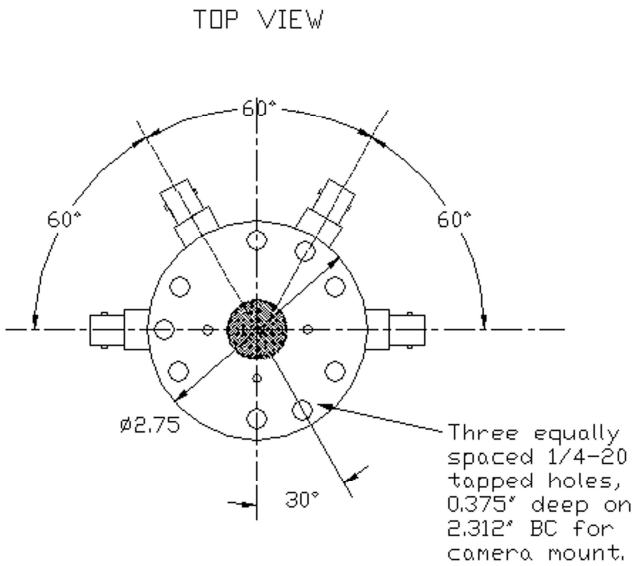


MCP: (Standard)
0.975" Diam.
10 μm channel diameter, Imaging Grade
12 micron pitch, 5° Bias Angle, 401 Aspect Ratio
Spatial Resolution: 42 lp/mm
Max. Gain: At 1000V per plate max. Voltage
2 x 10^4 (single plate, Std.)
> 10^7 (chevron, OPT01)

Phosphor Screen:
P-43 on aluminized glass plate
Conversion efficiency :

P-43 Peak Wavelength: λ= 545 nm

Power Supply Requirements:
0 - + 1000V, 1mA single MCP (Standard)
0 - + 2000V, 1mA dual MCP (OPT01)
0 - + 3000V, 1mA single MSP (OPT06)
0 - + 4000V, 1mA dual MSP (OPT07)
0 - + 5000V, 1 mA Phosphor Screen



Beam Energy Range: 1 eV to over 50 keV

Beam Current Range:

< 10 μA (with optional beam attenuation grids)

Attenuation Grids (Option OPT03, OPT04, OPT05) Recommended for:
Ion beams greater than 3.2 nA/mm², 90% beam attenuation (1 grid, OPT03)
Ion beams greater than 31.8 nA/mm², 99% beam attenuation (2 grids, OPT04)
Ion beams greater than 318.nA/mm², 99.9% beam attenuation (3 grids, OPT05)

Vacuum: 1 x 10^{-6} Torr or better required to operate MCP

Good to at least 1 x 10^{-10} Torr; Maximum bakeout temp. 350° C

MODEL BOS-25 Beam Observation System

In standard form, the model BOS-25 Beam Observation system has a 25mm diameter active area MCP and P-43 phosphor screen assembly, housed within a 4.50" (114mm) conflat flange with glass viewport. Electrical connections to the phosphor screen and MCP are made with MHV feedthroughs. The BOS-25-6 is also available and has a 6" (152mm) conflat flange mount (see below).

OPTIONS

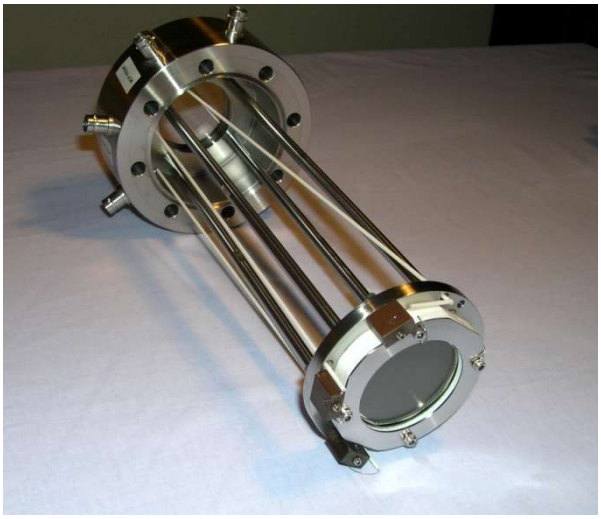
CCD Camera Systems

Model BOS-25 with optional CCD camera and mounting system. See page 23 for more details on available CCD camera systems.

Windows and SHV Feedthroughs

The MODEL BOS-25 is available with a welded glass window (standard), removable glass window, or fiberoptic window. Also available are optional SHV (5kV) and SHV-B (7.5kV) feedthroughs, in place of the standard MHV (5kV) feedthroughs.

Extended Platforms



The BOS-25 systems are available with extended platforms. This allows the MCP/phosphor screen assembly to be mounted at a customer defined distance from the flange

Stand alone MCP/Phosphor Screen Assemblies

The imaging assembly of the BOS-25 system is available separately. It includes a MCP/phosphor screen stack mounted in a ceramic fixture with wires. The assembly is available with single or dual MCP plates.

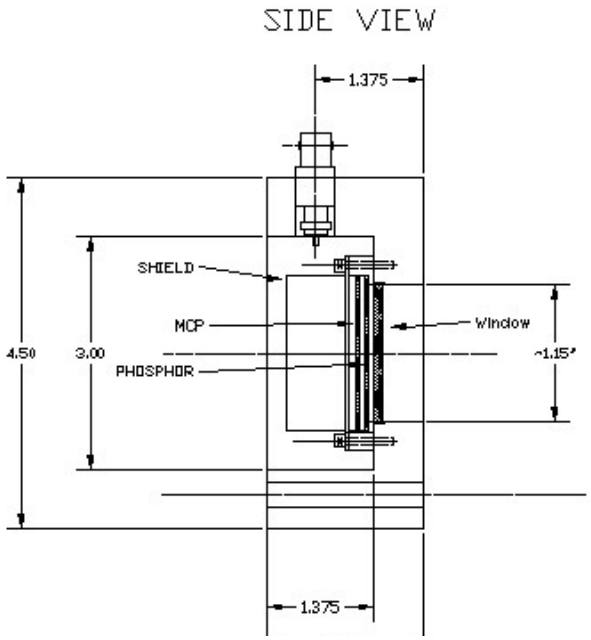
BOS-25 SPECIFICATIONS

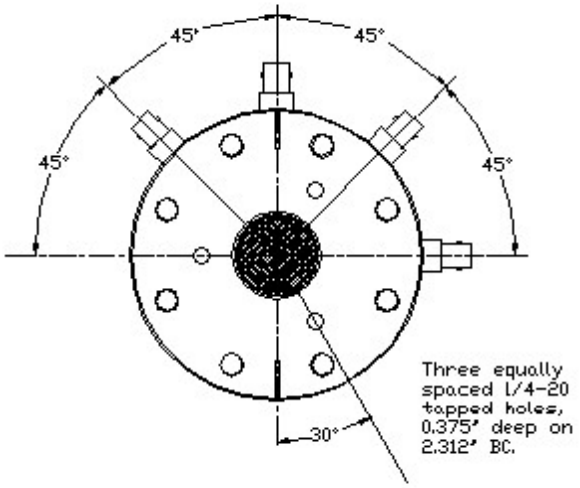
Flange Size: 4.5” Conflat
Imaging Area:
25mm Diam.(BOS-25)

MCP: (Standard)
1.289" Diam.
10 μm channel diameter, Imaging Grade
12 micron pitch, 12° Bias Angle, 40:1 Aspect Ratio
Max. Gain: At 1000V per plate max. Voltage
2 x 10^4 (single plate, Std.)
> 10^7 (chevron, OPT01)

Phosphor Screen:
P-43 on aluminized glass plate
Conversion efficiency :

P-43 Peak Wavelength: λ= 545 nm





Power Supply Requirements:
0 - + 1000V, 1mA single MCP (Standard)
0 - + 2000V, 1mA dual MCP (OPT01)
0 - + 3000V, 1mA single MSP (OPT06)
0 - + 4000V, 1mA dual MSP (OPT07)
0 - + 5000V, 1 mA Phosphor Screen

Beam Energy Range: 1 eV to over 50 keV

Beam Current Range:
< 10 μA (with optional beam attenuation grids)
Attenuation Grids (Option OPT03, OPT04, OPT05) Recommended for:
Ion beams greater than 3.2 nA/mm^2, 90% beam attenuation (1 grid, OPT03)
Ion beams greater than 31.8 nA/mm^2, 99% beam attenuation (2 grids, OPT04)
Ion beams greater than 318.nA/mm^2, 99.9% beam attenuation (3 grids, OPT05)
Vacuum: 1 x 10^{-6} Torr or better required to operate MCP

Good to at least 1 x 10^{-10} Torr; Maximum bakeout temp. 350° C

MODEL BOS-40 Beam Observation System

In standard form, the model BOS-40 Beam Observation system has a 40mm diameter active area MCP and P-43 phosphor screen assembly, housed within a 4.50" (114mm) conflat flange with glass viewport. Electrical connections to the phosphor screen and MCP are made with MHV feedthroughs. The BOS-40-6 is also available and has a 6" (152mm) conflat flange mount.

OPTIONS

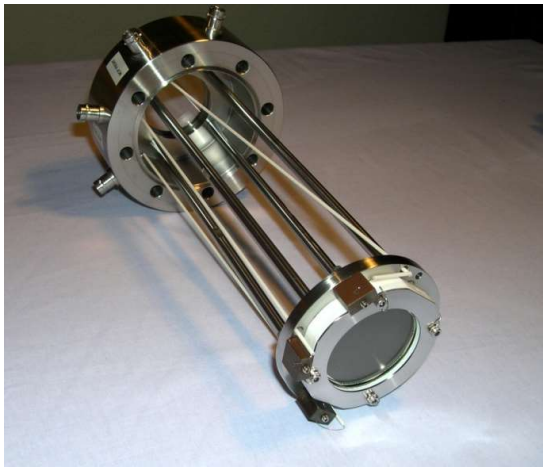
CCD Camera Systems

Model BOS-40 with optional CCD camera and mounting system. See page 23 for more details on available CCD camera systems.

Windows and SHV Feedthroughs

The MODEL BOS-40 is available with a welded glass window (standard), removable glass window, or fiberoptic window (shown to right). Also available are optional SHV (5kV) and SHV-B (7.5kV) feedthroughs, in place of the standard MHV (5kV)feedthroughs.

Extended Platforms



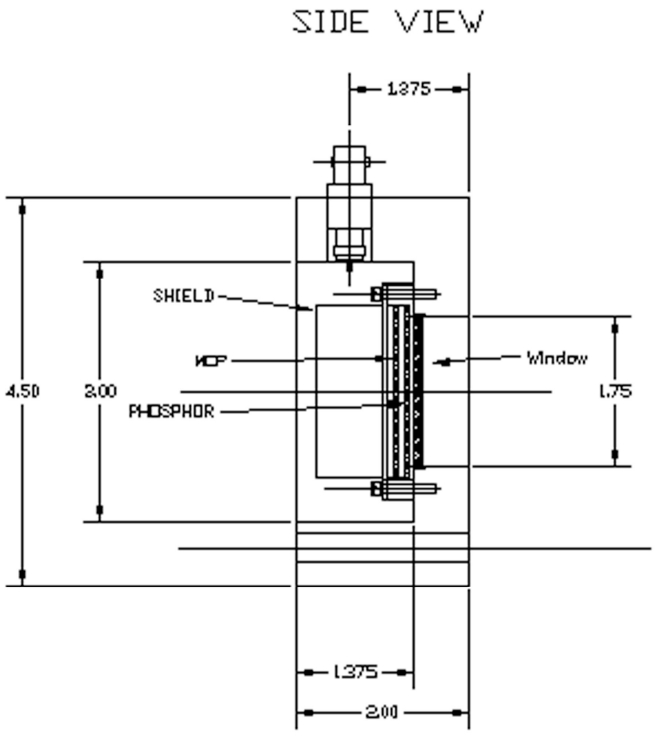
The BOS-40 systems are available with extended platforms. This allows the MCP/phosphor screen assembly to be mounted at a customer defined distance from the flange

Stand alone MCP/Phosphor Screen Assemblies

The imaging assembly of the BOS-40 system is available separately. It includes a MCP/phosphor screen stack mounted in a ceramic fixture with wires. The assembly is available with single or dual MCP plates. Model BOS-40-CH-IDA (dual MCP) is shown at right.

BOS-40 SPECIFICATIONS

Flange Size: 4.5” Conflat
Imaging Area:
40mm Diam.(BOS-40)

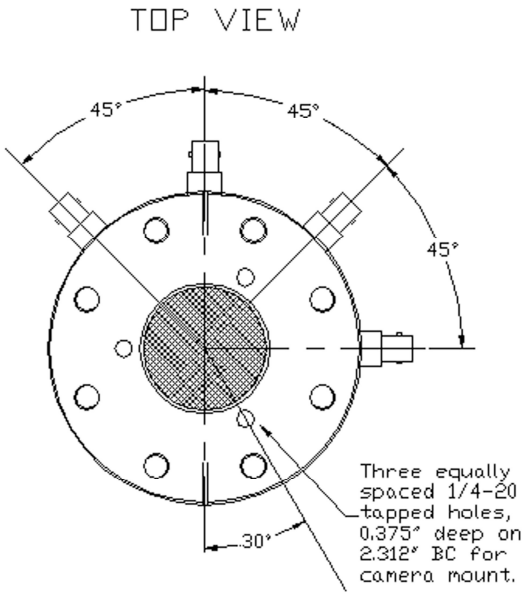


MCP: (Standard)
1.970" Diam.
10 μm channel diameter, Imaging Grade
12 micron pitch, 8° Bias Angle, 46:1 Aspect Ratio
Spatial Resolution: 42 lp/mm
Max. Gain: At 1000V per plate max. Voltage
2×10^4 (single plate, Std.)
$> 10^7$ (chevron, OPT01)

Phosphor Screen:
P-43 on aluminized glass plate
Conversion efficiency :

P-43 Peak Wavelength: $\lambda = 545$ nm

Power Supply Requirements:
0 - + 1000V, 1mA single MCP (Standard)
0 - + 2000V, 1mA dual MCP (OPT01)
0 - + 3000V, 1mA single MSP (OPT06)
0 - + 4000V, 1mA dual MSP (OPT07)
0 - + 5000V, 1 mA Phosphor Screen



Beam Energy Range: 1 eV to over 50 keV

Beam Current Range:

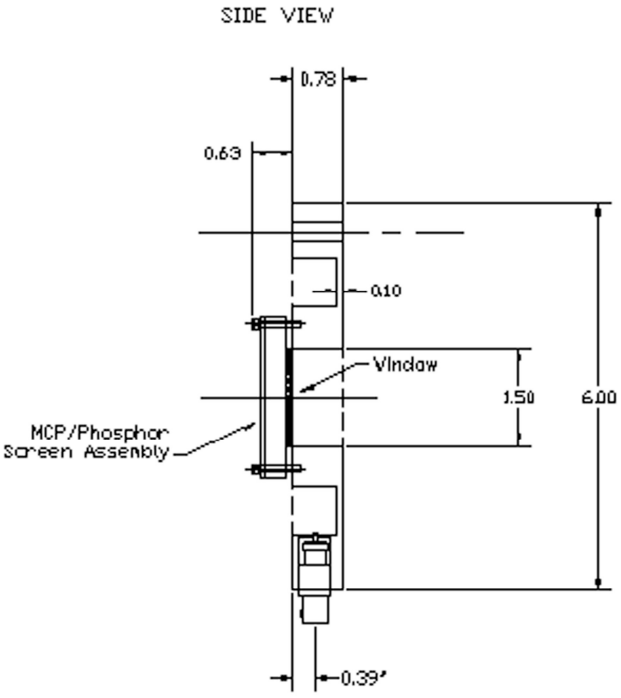
< 10 μA (with optional beam attenuation grids)

Attenuation Grids (Option OPT03, OPT04, OPT05) Recommended for:
Ion beams greater than 3.2 nA/mm², 90% beam attenuation (1 grid, OPT03)
Ion beams greater than 31.8 nA/mm², 99% beam attenuation (2 grids, OPT04)
Ion beams greater than 318.nA/mm², 99.9% beam attenuation (3 grids, OPT05)

Vacuum: 1×10^{-6} Torr or better required to operate MCP

Good to at least 1×10^{-10} Torr; Maximum bakeout temp. 350° C

BOS-40-6 SPECIFICATIONS

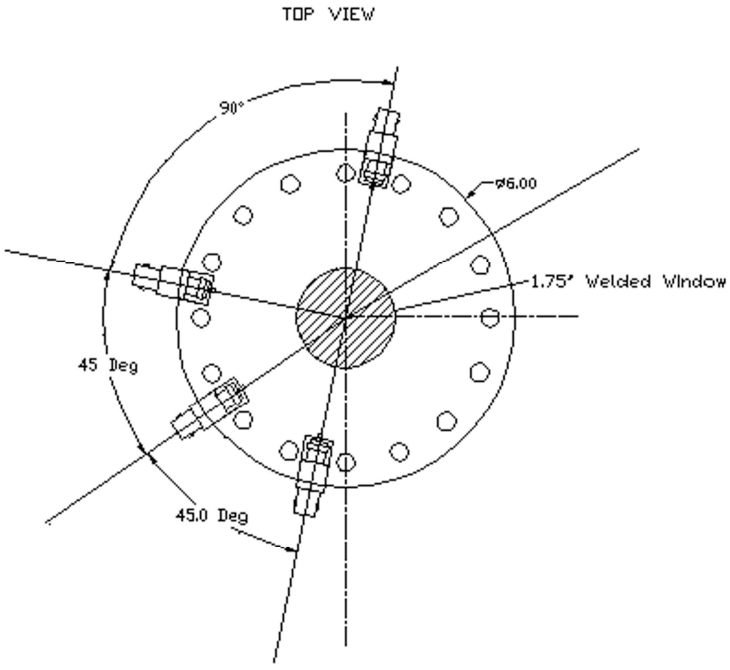


Flange Size: 6" Conflat
Imaging Area:
40mm Diam.(BOS-40)

MCP: (Standard)
1.970" Diam.
10 μm channel diameter, Imaging Grade
12 micron pitch, 8° Bias Angle, 46:1 Aspect Ratio
Spatial Resolution: 42 lp/mm
Max. Gain: At 1000V per plate max. Voltage
2×10^4 (single plate, Std.)
$> 10^7$ (chevron, OPT01)

Phosphor Screen:
P-43 on aluminized glass plate
Conversion efficiency :

P-43 Peak Wavelength: $\lambda = 545$ nm



Power Supply Requirements:
0 - + 1000V, 1mA single MCP (Standard)
0 - + 2000V, 1mA dual MCP (OPT01)
0 - + 3000V, 1mA single MSP (OPT06)
0 - + 4000V, 1mA dual MSP (OPT07)
0 - + 5000V, 1 mA Phosphor Screen

Beam Energy Range: 1 eV to over 50 keV

Beam Current Range:

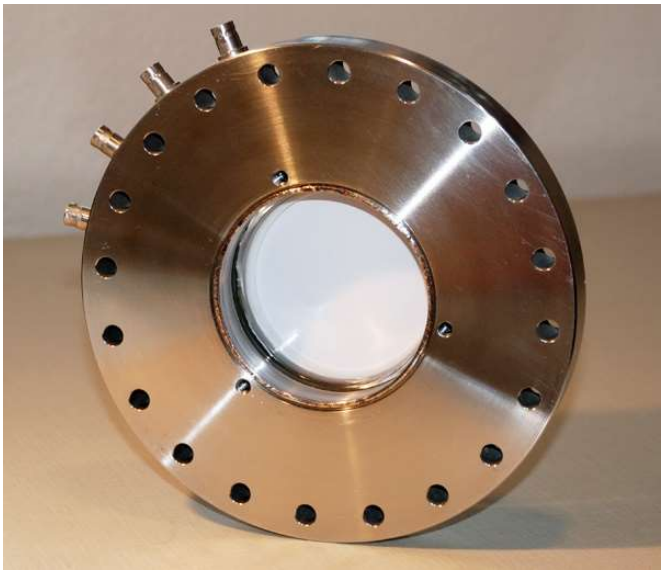
< 10 μA (with optional beam attenuation grids)

Attenuation Grids (Option OPT03, OPT04, OPT05) Recommended for:
Ion beams greater than 3.2 nA/mm², 90% beam attenuation (1 grid, OPT03)
Ion beams greater than 31.8 nA/mm², 99% beam attenuation (2 grids, OPT04)
Ion beams greater than 318.nA/mm², 99.9% beam attenuation (3 grids, OPT05)

Vacuum: 1×10^{-6} Torr or better required to operate MCP

Good to at least 1×10^{-10} Torr; Maximum bakeout temp. 350° C

MODEL BOS-75 Beam Observation System

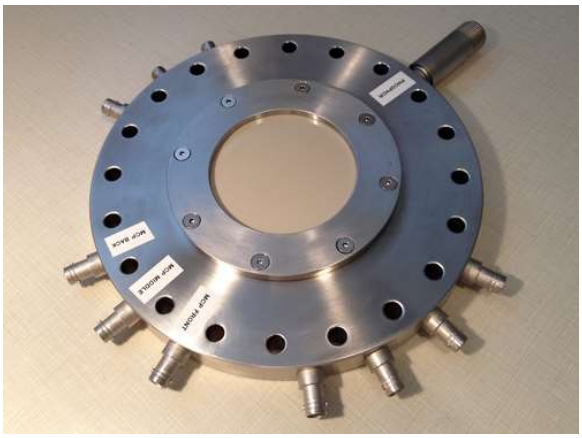


In standard form, the model BOS-75 Beam Observation system has a 75mm diameter active area MCP and P-43 phosphor screen assembly, housed within a 8" (203mm) conflat flange with glass viewport. Electrical connections to the phosphor screen and MCP are made with MHV feedthroughs.

OPTIONS

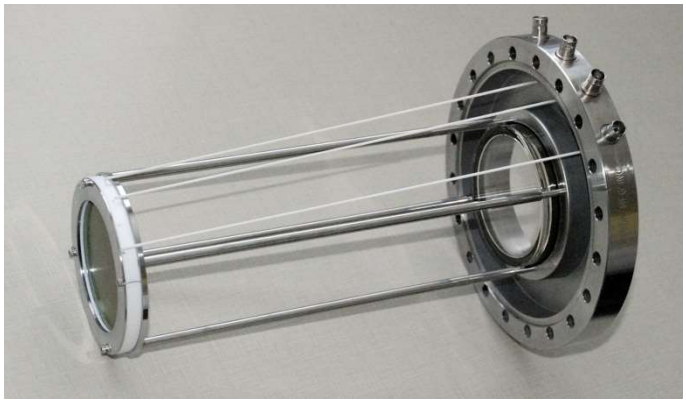
CCD Camera Systems

Model BOS-75 with optional CCD camera and mounting system. See page 23 for more details on available CCD camera systems.



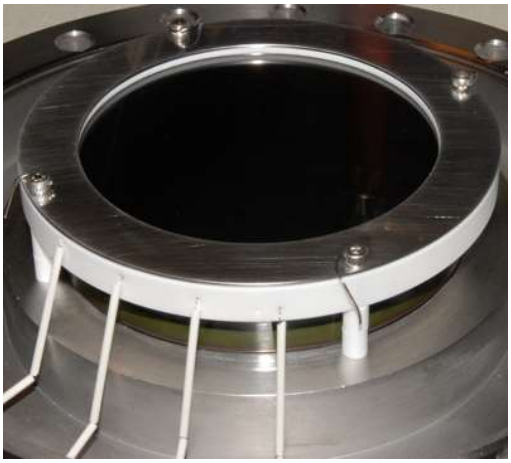
Windows and SHV Feedthroughs

The MODEL BOS-75 is available with a welded glass window (standard), removable glass window, or fiberoptic window (shown at right). Also available are optional SHV (5kV) and SHV-B (7.5kV) feedthroughs, in place of the standard MHV (5kV)feedthroughs.



Extended Platforms

The BOS-75 systems are available with extended platforms. This allows the MCP/phosphor screen assembly to be mounted at a customer defined distance from the flange (similar to BOS-40 with extended mount shown to the left.



Stand alone MCP/Phosphor Screen Assemblies

The imaging assembly of the BOS-40 system is available separately. It includes a MCP/phosphor screen stack mounted in a ceramic fixture with wires. The assembly is available with single or dual MCP plates. Model BOS-75-CH-IDA (dual MCP) is shown at right.

BOS-75 SPECIFICATIONS

Flange Size: 8” Conflat
Imaging Area:
75mm Diam.(BOS-75)

MCP: (Standard)
3.410" Diam.
25 μm channel diameter
32 micron pitch, 8° Bias Angle, 40:1 Aspect Ratio
Max. Gain: At 1000V per plate max. Voltage
2 x 10^4 (single plate, Std.)
> 10^7 (chevron, OPT01)

Phosphor Screen:
P-43 on aluminized glass plate
Conversion efficiency :

P-43 Peak Wavelength: λ= 545 nm

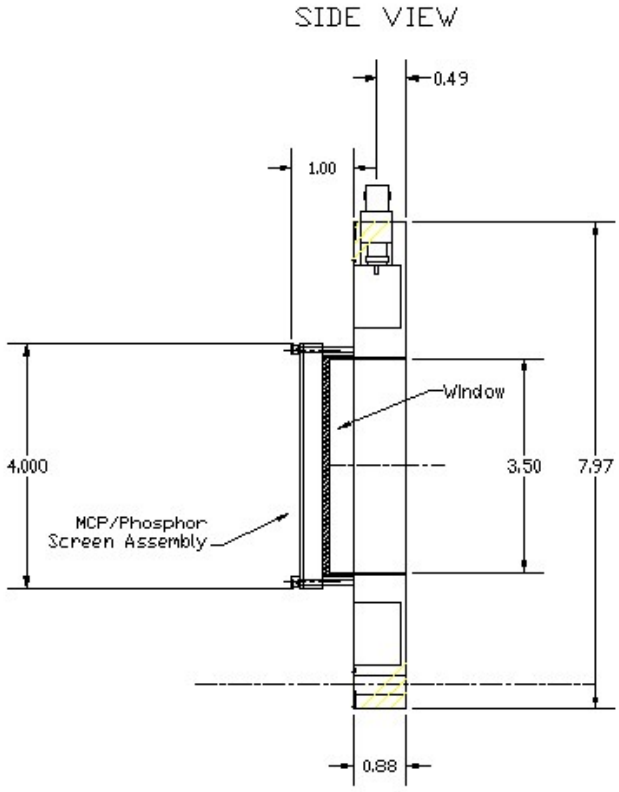
Power Supply Requirements:
0 - + 1000V, 1mA single MCP (Standard)
0 - + 2000V, 1mA dual MCP (OPT01)
0 - + 3000V, 1mA single MSP (OPT06)
0 - + 4000V, 1mA dual MSP (OPT07)
0 - + 5000V, 1 mA Phosphor Screen

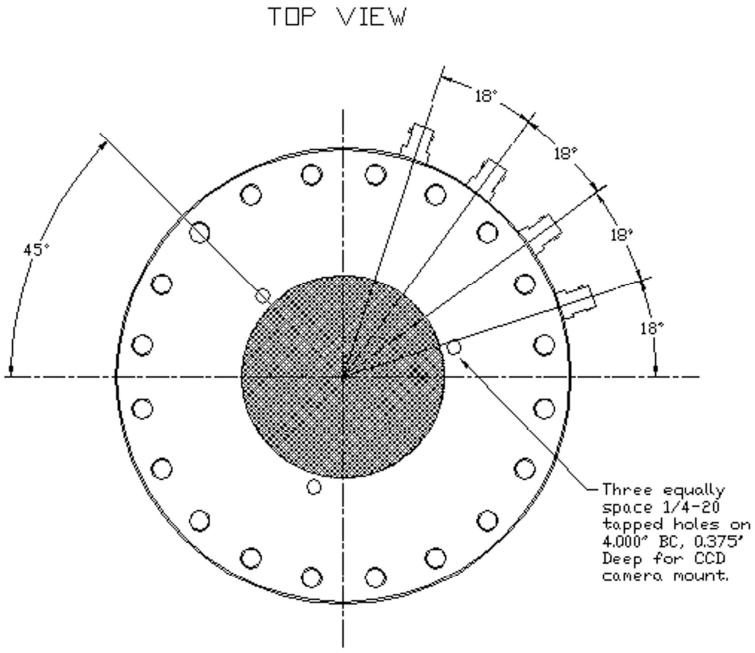
Beam Energy Range: 1 eV to over 50 keV

Beam Current Range:

< 10 μA (with optional beam attenuation grids)

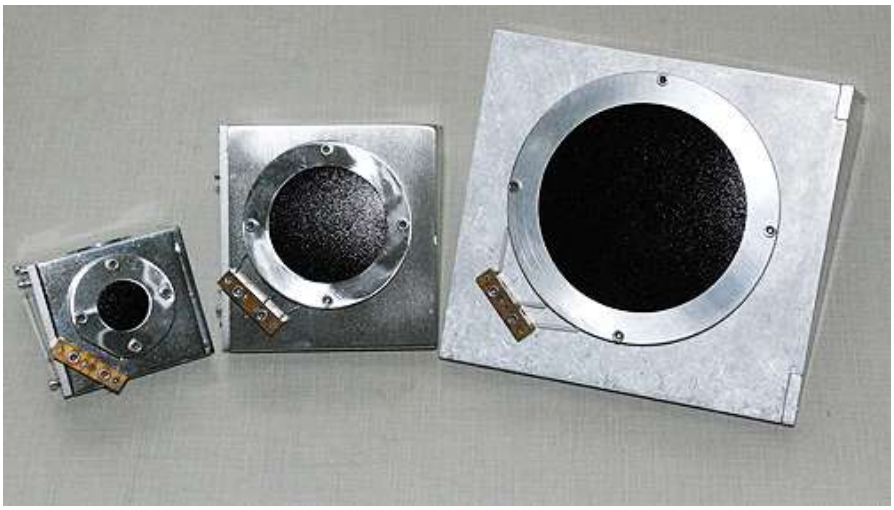
Attenuation Grids (Option OPT03, OPT04, OPT05) Recommended for:
Ion beams greater than 3.2 nA/mm², 90% beam attenuation (1 grid, OPT03)
Ion beams greater than 31.8 nA/mm², 99% beam attenuation (2 grids, OPT04)
Ion beams greater than 318.nA/mm², 99.9% beam attenuation (3 grids, OPT05)





Vacuum: 1 x 10^{-6} Torr or better required to operate MCP
Good to at least 1 x 10^{-10} Torr; Maximum bakeout temp. 350° C

MODEL BOS-IW Beam Observation System
Image Wedge



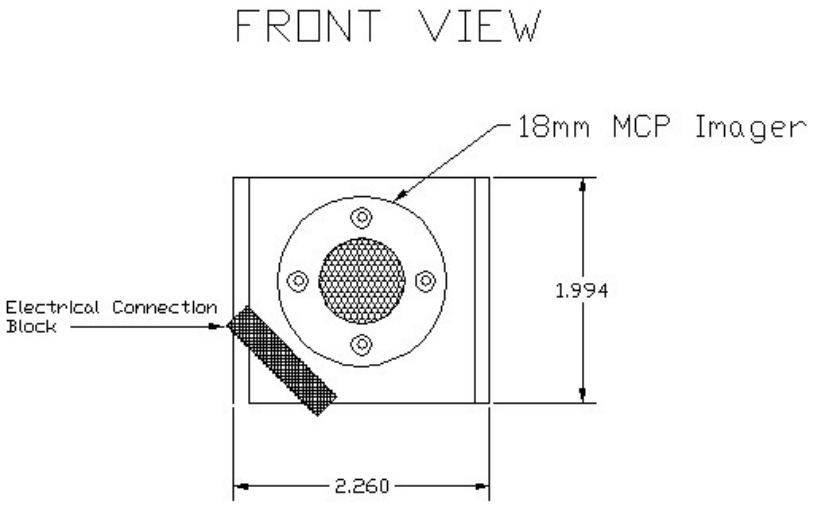
Pictured left to right, Model BOS-18-IW, BOS-40-IW and BOS-75-IW

Beam Imaging Solutions introduces the 90-degree BOS which allows remote imaging of a beam at 90 degrees to the imaging plane. The BOS-18-IW, BOS-25-IW, BOS-40-IW and BOS-75-IW can be attached to a linear motion feedthough and placed into and out of the beam allowing for remote imaging, deep within the vacuum chamber. The imaging is accomplished by mounting a standard BOS MCP/phosphor screen stack onto a metal housing which has a mirror mounted at 90-degrees with respect to the imaging plane. The housing is wedged shaped to minimize the physical size of the imager, and has convenient points for attaching to a linear motion feedthrough. Electrical connections are made by attaching flexible electrically insulated wires to a connection block on the wedge from an electrical feedthrough. In their standard form, the BOS-IW units are available with the MCP/phosphor assembly mounted to wedge shaped housing with electrical connection block. BOS-IW kits are also available, and include the BOS-IW unit with electrical feedthrough, viewport, linear motion feedthrough and camera systems. Contact us for more details.

BOS-18-IW SPECIFICATIONS

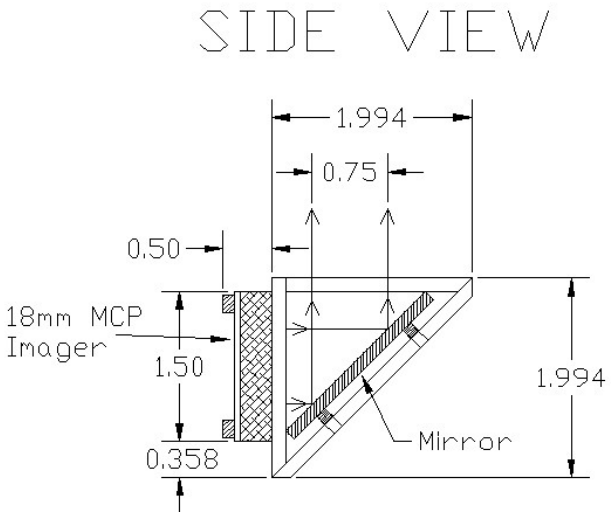
Imaging Area:
18mm Diam.(BOS-18)

MCP: (Standard)
0.975" Diam.
10 μm channel diameter
12 micron pitch, 5° Bias Angle, 401 Aspect Ratio
Spatial Resolution: 42 lp/mm
Max. Gain: At 1000V per plate max. Voltage
2 x 10^4 (single plate, Std.)
> 10^7 (chevron, OPT01)



Phosphor Screen:
P-43 on aluminized glass plate

P-43 Peak Wavelength: λ= 545 nm



Power Supply Requirements:
0 - + 1000V, 1mA single MCP (Standard)
0 - + 2000V, 1mA dual MCP (OPT01)
0 - + 5000V, 1 mA Phosphor Screen

Beam Energy Range: 1 eV to over 50 keV

Beam Current Range:

< 10 μA (with optional beam attenuation grids)

Attenuation Grids (Option OPT03, OPT04, OPT05) Recommended for:
Ion beams greater than 3.2 nA/mm², 90% beam attenuation (1 grid, OPT03)
Ion beams greater than 31.8 nA/mm², 99% beam attenuation (2 grids, OPT04)
Ion beams greater than 318.nA/mm², 99.9% beam attenuation (3 grids, OPT05)

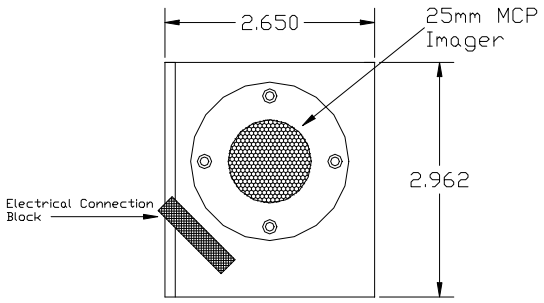
Vacuum: 1 x 10^{-6} Torr or better required to operate MCP

Good to at least 1 x 10^{-10} Torr; Maximum bakeout temp. 350° C

BOS-25-IW SPECIFICATIONS

Imaging Area:
25mm Diam.(BOS-25)

MCP: (Standard)
1.289" Diam.
10 μm channel diameter
12 micron pitch, 5° Bias Angle, 401 Aspect Ratio
Spatial Resolution: 42 lp/mm
Max. Gain: At 1000V per plate max. Voltage
2 x 10^4 (single plate, Std.)
> 10^7 (chevron, OPT01)



Phosphor Screen:
P-43 on aluminized glass plate

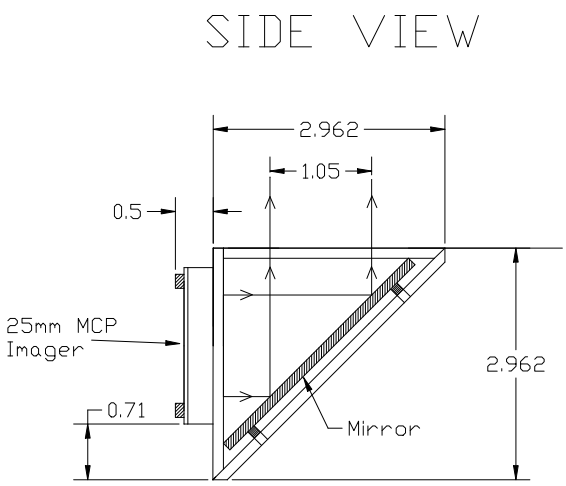
P-43 Peak Wavelength: λ= 545 nm

Power Supply Requirements:
0 - + 1000V, 1mA single MCP (Standard)
0 - + 2000V, 1mA dual MCP (OPT01)
0 - + 5000V, 1 mA Phosphor Screen

Beam Energy Range: 1 eV to over 50 keV

Beam Current Range:

< 10 μA (with optional beam attenuation grids)



Attenuation Grids (Option OPT03, OPT04, OPT05) Recommended for:
Ion beams greater than 3.2 nA/mm², 90% beam attenuation (1 grid, OPT03)
Ion beams greater than 31.8 nA/mm², 99% beam attenuation (2 grids, OPT04)
Ion beams greater than 318.nA/mm², 99.9% beam attenuation (3 grids, OPT05)

Vacuum: 1 x 10^{-6} Torr or better required to operate MCP

Good to at least 1 x 10^{-10} Torr; Maximum bakeout temp. 350° C

BOS-40-IW SPECIFICATIONS

Imaging Area:
40mm Diam.(BOS-40)

MCP: (Standard)
1.970" Diam.
10 μm channel diameter
12 micron pitch, 8° Bias Angle, 46:1 Aspect Ratio
Spatial Resolution: 42 lp/mm
Max. Gain: At 1000V per plate max. Voltage
2×10^4 (single plate, Std.)
$> 10^7$ (chevron, OPT01)

Phosphor Screen:
P-43 on aluminized glass plate

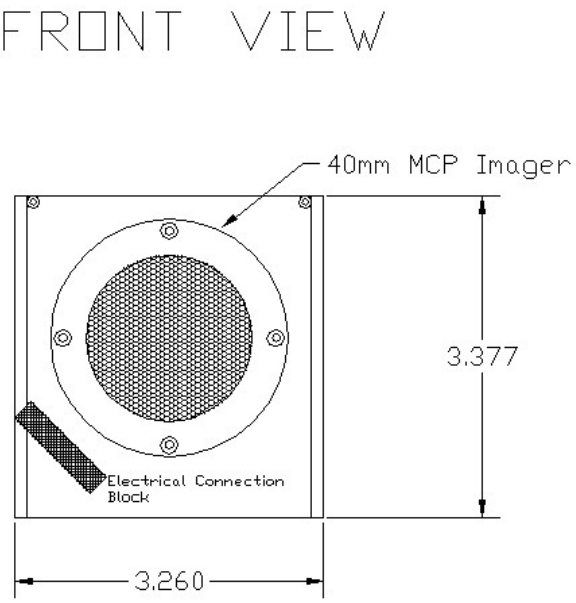
P-43 Peak Wavelength: $\lambda = 545$ nm

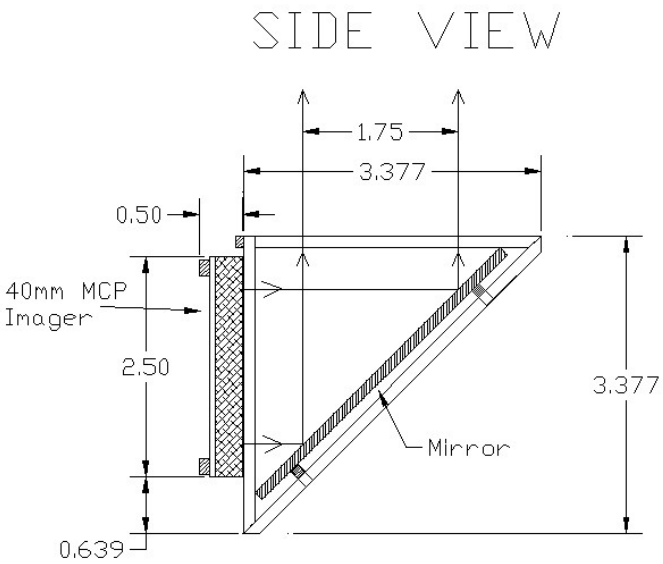
Power Supply Requirements:
0 - + 1000V, 1mA single MCP (Standard)
0 - + 2000V, 1mA dual MCP (OPT01)
0 - + 5000V, 1 mA Phosphor Screen

Beam Energy Range: 1 eV to over 50 keV

Beam Current Range:

< 10 μA (with optional beam attenuation grids)





Attenuation Grids (Option OPT03, OPT04, OPT05)
Recommended for:

Ion beams greater than 3.2 nA/mm², 90% beam attenuation (1 grid, OPT03)
Ion beams greater than 31.8 nA/mm², 99% beam attenuation (2 grids, OPT04)
Ion beams greater than 318.nA/mm², 99.9% beam attenuation (3 grids, OPT05)

Vacuum: 1×10^{-6} Torr or better required to operate MCP

Good to at least 1×10^{-10} Torr; Maximum bakeout temp. 350° C

BOS-75-IW SPECIFICATIONS

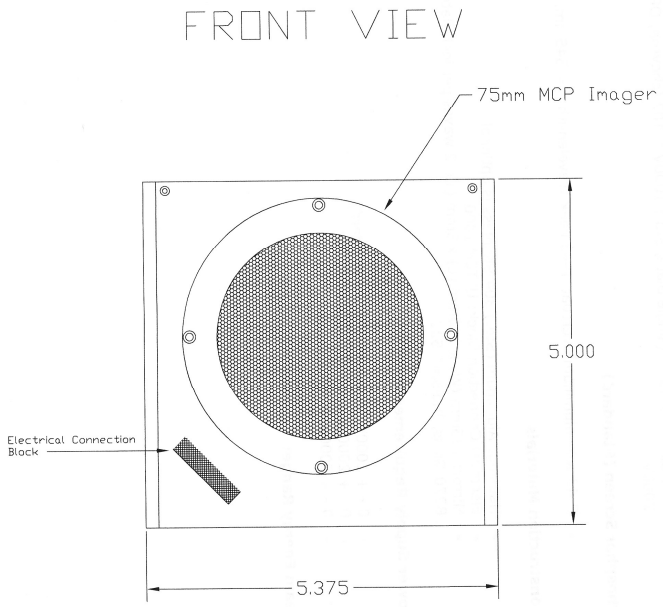
Imaging Area:
75mm Diam.(BOS-75)

MCP: (Standard)
3.410" Diam., Imaging and Detection Grade
25 μm channel diameter
32 micron pitch, 8° Bias Angle, 40:1 Aspect Ratio

Max. Gain: At 1000V per plate max. Voltage
1 x 10^4 (single plate, Std.)
> 10^7 (chevron, OPT01)

Phosphor Screen:
P-43 on aluminized glass plate

P-43 Peak Wavelength: λ= 545 nm

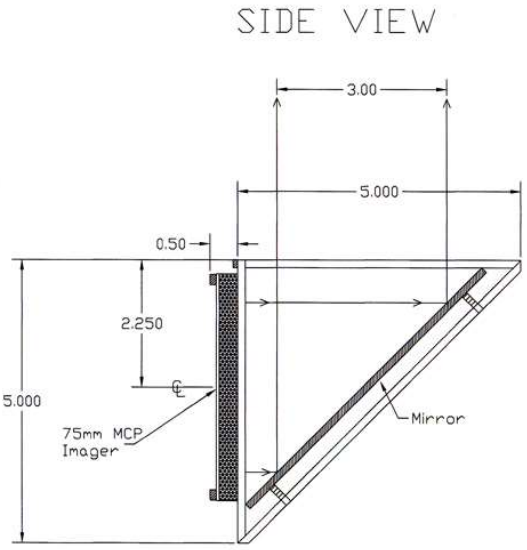


Power Supply Requirements:
0 - + 1000V, 1mA single MCP (Standard)
0 - + 2000V, 1mA dual MCP (OPT01)
0 - + 5000V, 1 mA Phosphor Screen

Beam Energy Range: 1 eV to over 50 keV

Beam Current Range:

< 10 μA (with optional beam attenuation grids)



Attenuation Grids (Option OPT03, OPT04, OPT05) Recommended for:
Ion beams greater than 3.2 nA/mm², 90% beam attenuation (1 grid, OPT03)
Ion beams greater than 31.8 nA/mm², 99% beam attenuation (2 grids, OPT04)
Ion beams greater than 318.nA/mm², 99.9% beam attenuation (3 grids, OPT05)

Vacuum: 1 x 10^{-6} Torr or better required to operate MCP

Good to at least 1 x 10^{-10} Torr; Maximum bakeout temp. 350° C

BOS Camera Options and Specifications

All camera systems include lens, BOS mounting hardware, video cable, and 17" high-resolution color LCD monitor

BOS Model Option	**BOS-OPT-02/2622**	**BOS-OPT-02/2722**	**BOS-OPT-02/3710**
Camera	COHU 2622	COHU 2722 (Dual Gain)	CIDTEC 3710D
Optical Format	1/2" diagonal	1/2" diagonal	2/3" diagonal
Resolution	768H x 494V RS-170 752 X 582 CCIR	755H x 488V RS-170 752 X 582 CCIR	755H x 484V RS-170 752 X 582 CCIR
Element Pitch (µm)	8.4 x 9.8	8.4 x 9.8	12.0 x 13.7
Area (mm)	6.4 x 4.8	6.4 x 4.8	9.05 x 6.83
Scanning Formats (Please Specify)	EIA RS-170 CCIR	EIA RS-170 CCIR	RS-170, 2:1 Interlace CCIR
Electronic Shutter	1/60 - 1/10,000 sec.	1/60 - 1/100,000 sec.	
Sync. System	Int./Ext.	Int./Ext.	Int./Ext.
Signal to Noise (db)	>55	58	50
Sensitivity (Face Plate Illumination)	Full Output: .65 lux	Full Output: 0.0012 lux	Full Output: 0.5fc
Input Power (Watts)	3.6	6 max.	8.5 max.
Input Voltage (Volts)	+12 VDC	+24VDC or 115 VAC	+ 15VDC nominal

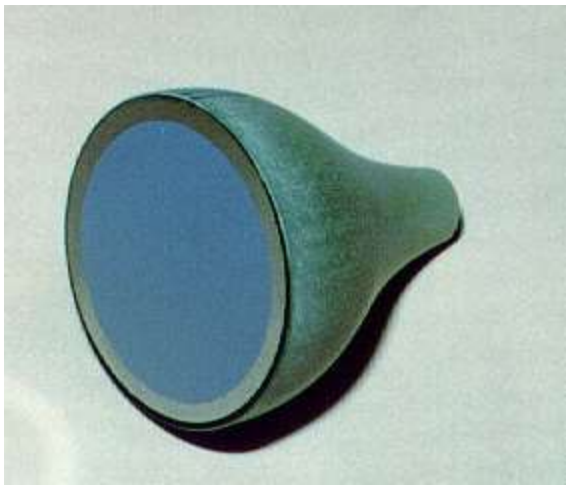
BOS Model Option	**BOS-OPT-02/SX90**
Camera	SONY XCD-SX90
Optical Format	1/3" diagonal Progressive scan IT CCD 30fps
Resolution	1280H x 960V (SXGA)
Element Pitch (µm)	3.75 x 3.75
Area (mm)	6.4 x 4.8
Digital Interface	IEEE1394b
Electronic Shutter	1/100,000 – 16s, Auto
Sync. System	Ext. IEEE1394b
Transfer Rate	Up to 800 Mb/s
Input Power (Watts)	2.8
Input Voltage (Volts)	DC 8 to 30 V (via IEEE1394b 9-pin cable or 12-pin camera cable)

Phosphor Screens

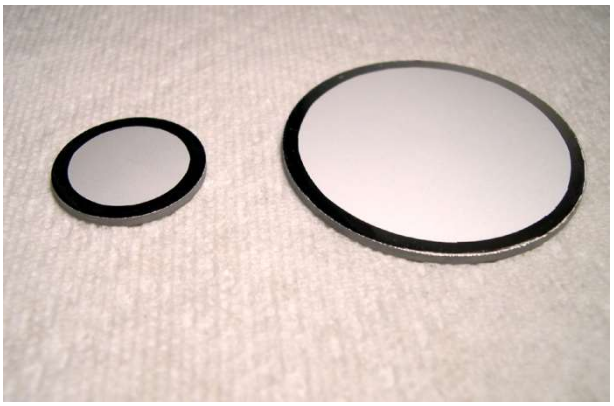
The phosphor screens used by the BOS and HRBIS systems are available separately (please see tables on following page). They consist of a glass disc or fiber-optic plates coated with P-43 phosphor and are aluminized. An extra layer of aluminum is deposited in a ring 0.1" (2.5 mm) wide on the outer diameter of the phosphor screens. This allows for electrical contact to the phosphor screen using optionally available metal contact rings. Screens are aluminized to increase light efficiency by up to 100% since light created at the phosphor is reflected back at the aluminum layer. Also, the conductive aluminum layer aids in the reduction of charge build up from electrons and ions. If the phosphor screen is used in conjunction with an electron multiplier such as a microchannel plate (MCP), an electron acceleration energy of 2-3kV will be required to pierce the aluminum layer. If this acceleration voltage is too high for a particular application, Indium-Tin-Oxide (ITO) coated screens can be used to provide the conductive base needed to minimize the electrostatic effects of charged particles. Phosphor screens can also be ordered with P-11, P46, and P-47 phosphors. If a custom size is required, or you need your own disc re-coated, please contact Beam Imaging Systems for a quotation.

Phosphor Screens (stock screens)

PN-2000-705-2 (FO Taper 2:1)



PN-4000-705-4 (FO 4:1)



PN-18-008 and PN-40-008

PN-40-FO (Fiberoptic Window-BOS-40-FO)

Standard Phosphor Screen Specifications

Part #	Material	Phosphor	Phosphor Thickness	Dimensions ϕ (mm diameter)		Effective Area ϕ (mm diameter)		Thickness (mm)	Tapered Ratio
				Input Surface	Output Surface	Input Surface	Output Surface		
18-008	Pyrex	P43 Aluminized	10-15 µm Al: 250-500 Å	25.0	25.0	19.9	19.9	1.50	N/A
18-008-ITO	Pyrex	P43 ITO Undercoat	10-15 µm	25.0	25.0	19.9	19.9	1.50	N/A
25-008	Pyrex	P43 Aluminized	10-15 µm Al: 250-500 Å	32.7	32.7	30.2	30.2	1.50	N/A
25-008-ITO	Pyrex	P43 ITO	10-15 µm	32.7	32.7	30.2	30.2	1.50	N/A
40-008	Pyrex	P43 Aluminized	10-15 µm Al: 250-500 Å	50.0	50.0	44.9	44.9	1.50	N/A
40-008-ITO	Pyrex	P43 ITO	10-15 µm,	50.0	50.0	44.9	44.9	1.50	N/A
40-FP (BOS-40/FO)	Fiber-Optic	P43 Aluminized	10-15 µm Al: 250-500 Å	41.00	50.8	35.96	35.96	20.88	1:1
75-008	Pyrex	P43 Aluminized	10-15 µm Al: 250-500 Å	86.6	86.6	81.5	81.5	1.50	N/A
75-008-ITO	Pyrex	P43 ITO	10-15 µm,	86.6	86.6	81.5	81.5	1.50	N/A
75-FP (BOS-75/FO)	Fiber-Optic	P43 Aluminized	10-15 µm Al: 250-500 Å	86.36	95.25	81.3	81.3	20.88	1:1
1000-705-1	Fiber-Optic	P43 Aluminized	10-15 µm Al: 250-500 Å	22.3	22.3	19.69	19.69	6.36	1:1
2000-705-2	Fiber-Optic	P43 Aluminized	10-15 µm Al: 250-500 Å	28.14	13.7	25.6	12.8	28.0	2:1
3000-705-3	Fiber-Optic	P43 Aluminized	10-15 µm Al: 250-500 Å	41.0	13.7	38.5	12.8	4.0	3:1
4000-705-4	Fiber-Optic	P43 Aluminized	10-15 µm Al: 250-500 Å	54.8	13.7	52.3	13.1	60	4:1
1000-705-1	Fiber-Optic	P43 Aluminized	10-15 µm Al: 250-500 Å	22.3	22.3	19.69	19.69	6.36	1:1

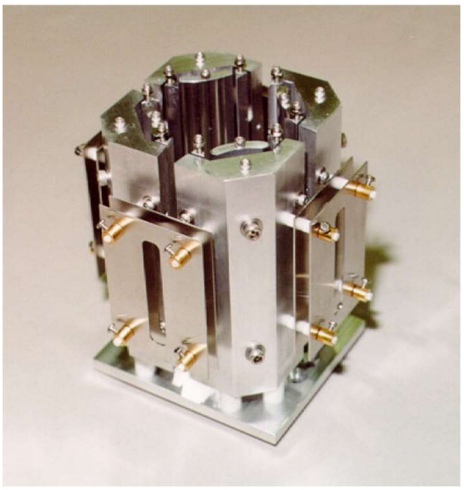
Phosphor Characteristics

Phosphor Type*	Chemical Composition	Typical Peak Wavelength	Fluorescent Color	Decay Time	Typical Quantum Yield (photons/electron-volt)	Typical Absolute Efficiency (radiated watts/watt excitation	Remarks
P1	Zn2SiO4:Mn2+	525 nm	Yellowish-green	1-100ms	-	-	Used in Oscilloscopes, radar
P11	ZnS:Ag	460 nm	Blue	34m s	0.038	0.10	Good energy conversion (efficiency) for blue light
P15	ZnO:Zn	504 nm	Green	1-10ms	-	-	Used in Flying-spot equipment, photography
P20	ZnCdS:Ag	560nm	Yellow-green	60m s	0.063	0.14	Good energy conversion (efficiency)for green light, Good for UV radiation, 250nm to 300nm
P22 R	Y2O2S:Eu3+	-	Reddish-orange	1-100ms			Used in color TV
P22 G	ZnS:Cu, Al	-	Yellowish-green	1-100ms			Used in color TV
P22 B	ZnS:Ag	-	Blue	1-100ms			Used in color TV
P24	ZnO:Zn	510 nm	Green	1-10ms			Flying-spot equipment
P43	Gd_2O_2S:Tb	545nm	Green	1ms	-	-	Excellent scintillator for x-rays < 250nm
P45	Y2O2S:Tb3+	-	White	1-100ms	-	-	Used in displays
P46	Y3Al5O12:Ce3+	530nm	Yellow-green	300ns	-	-	Flying-spot equipment
P47	Y_2SiO_5:Ce	400nm	Blue	55ns	-	-	Fast Decay
P48	Y3Al5O12:Ce3+(70%) Y2SiO5:Ce3+(30%)	-	Yellow-green	-	-	-	Flying-spot equipment
P53	Y3Al5O12:Tb3+	544 nm	Yellowish-green	1-100ms	-	-	Head-up displays

* EIA- Electronics Industries Association of the USA. These symbols have been in use since 1945.

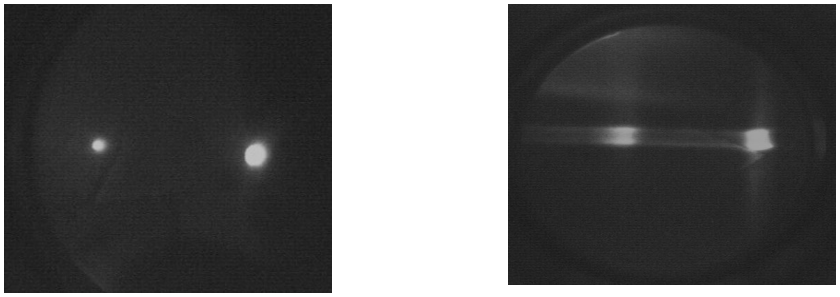
WTDS- Worldwide Phosphor Type Declaration System. Established in 1982.

Model QID-900 Quadrupole Ion Beam Deflector



The model QID-900 deflects the incoming positive or negatively charged ion beam at 90 degrees in a two-dimensional electrostatic quadrupole field*. The quadrupole field is set up using a combination circular electrode and shim electrodes to produce hyperbolic equipotentials. A set of entrance and exit einzel lens assemblies correct any 2-dimensional focusing of the ion beam through the quadrupole. Some possible applications for the model QID-900 include:

- Merged ion-laser beam experiments
- Merged ion-neutral beam experiments
- Multiple beam line switching
- Separation of ions from molecular/atomic/neutral beam
- Separation of ions from photons
- Cluster deposition and ion spectroscopy
- Deflection of ions at either 90, 180 or 270 degrees
- Energy filter or achromatic deflector

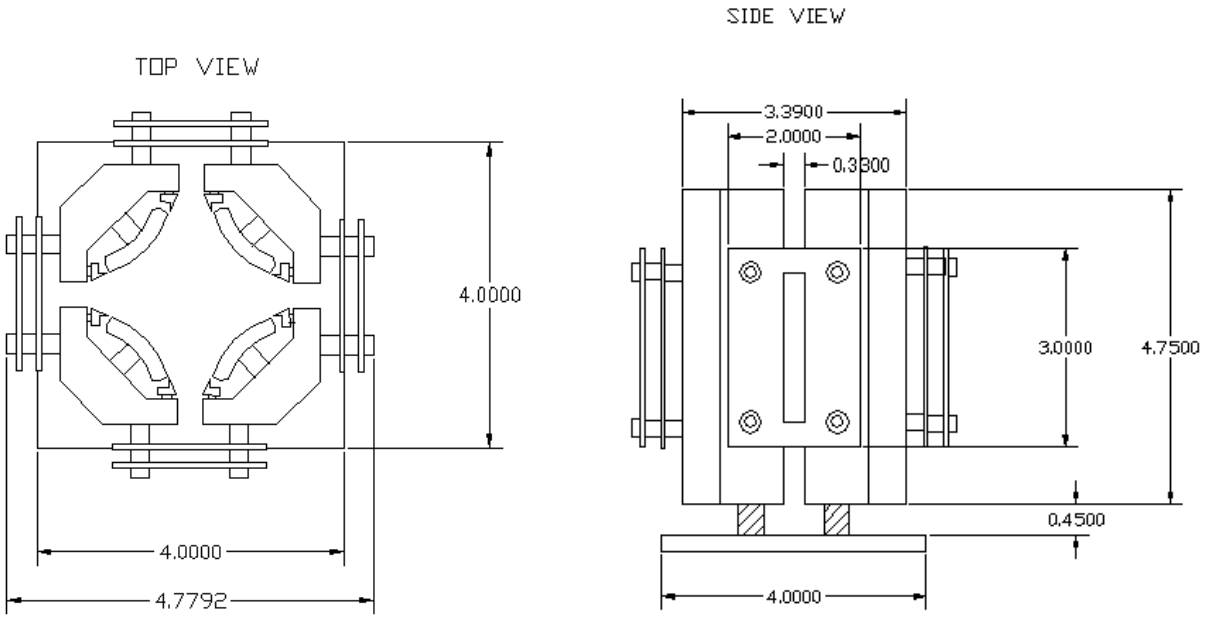


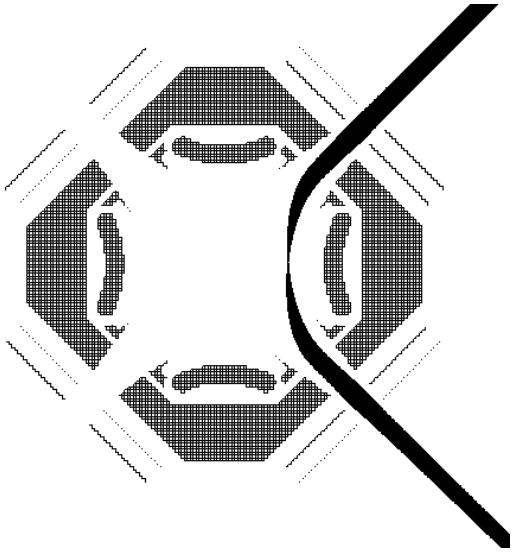
The picture above left shows a 1 keV H_2O^+ (left) and N_2^+ ion beam profiles before they are deflected, and after being deflected 90-degrees (right) using the model QID-900-H. The viewing area is 19mm diameter. The images were recorded using the model BOS-18 beam Observation System, with model BOS-18-OPT02-2622 CCD camera, and model IPS-1 image processing system.

* H. D. Zeeman, Rev. Sci. Instrum. **48**, (1079) 1977.

Model QID-900 Specifications:

Dimensions: 3.387"(L) x 3.387" (W) x 4.75" (H) [86mm (L) x 86mm (W) x 120mm (H)]
Materials used in construction:
Aluminum, stainless steel, macor (machinable glass) , and ceramic
Beam energy Range: Standard Operation, 1eV to 10 keV
Maximum Bakeout Temperature: 350° C
Power Supply Requirement
Center Circular Electrodes: Two power supplies, 0 to + 10kV and 0 to - 10kV
Corner Field Shaping Electrodes: Two power supplies, 0 to + 8kV, and 0 to - 8 kV
Entrance and Exit Cylindrical Einzel Lens: 0 to 5kV
Vacuum: UHV compatible, maximum bakeout temp. 350º C

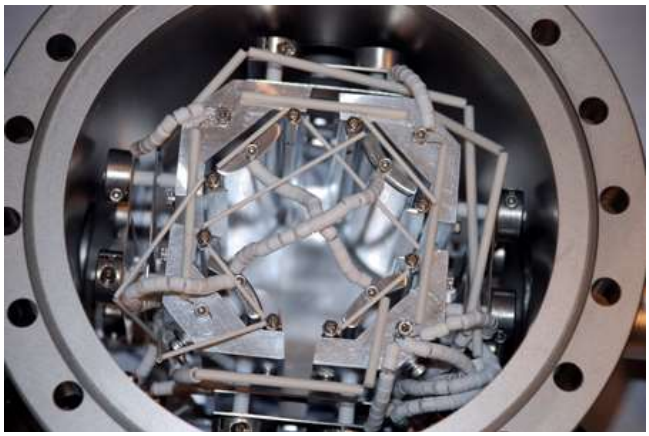




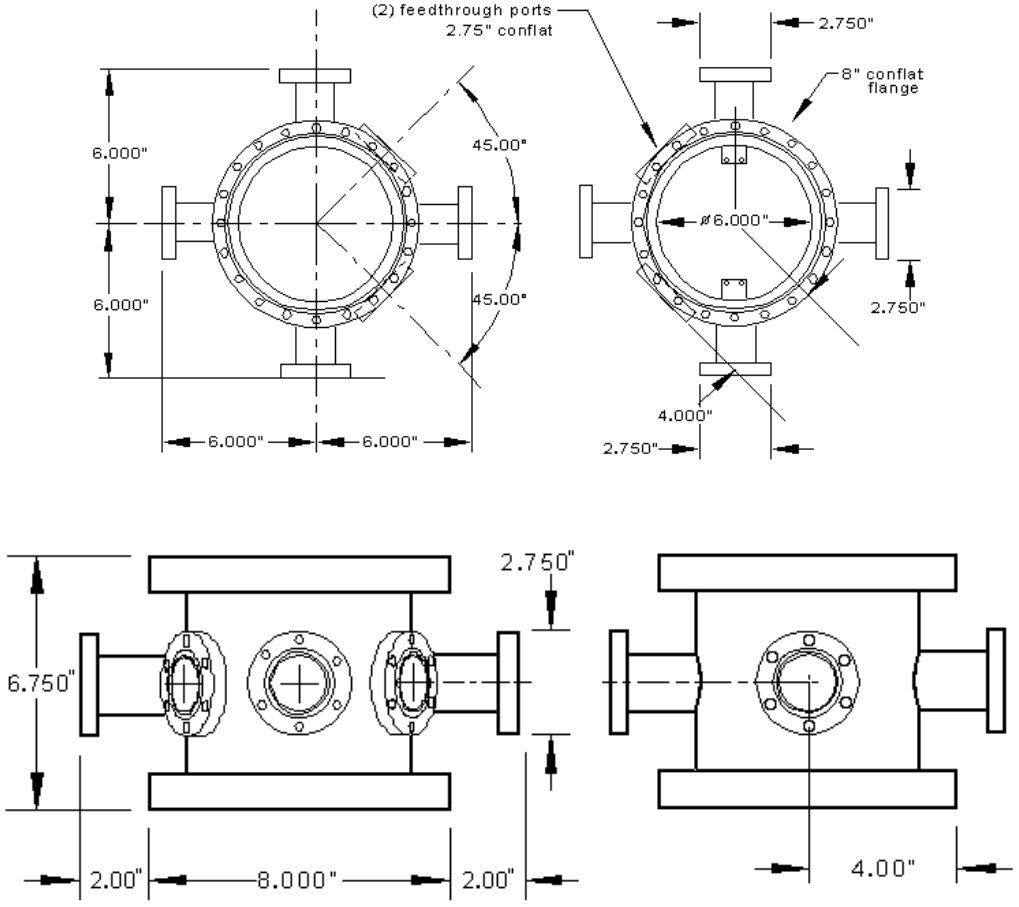
SIMION®-3D Simulation available.

The model QID-900 has been modeled using SIMION®-3D ion optics trajectory code. Beam Imaging Solutions will provide the geometry files for the deflector for the customer to simulate their particular application. Please contact us at technical@beamimaging.com

Model QID-900-H Quadrupole Ion Beam Deflector

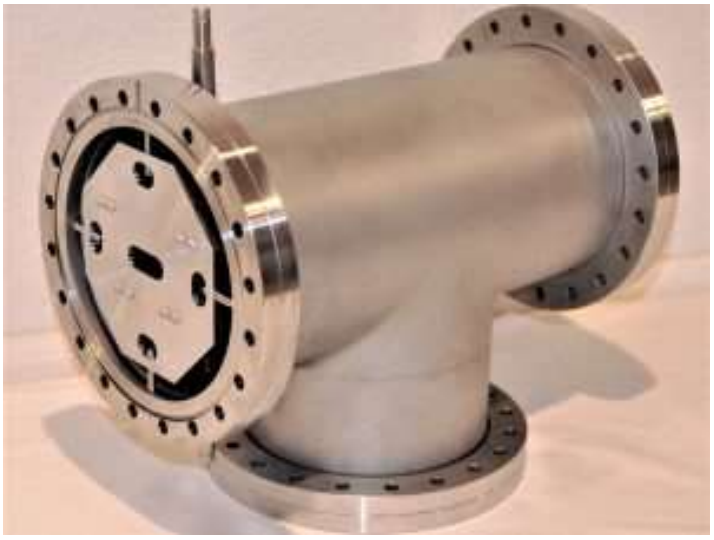


The QID-900 is available mounted in a vacuum chamber with electrodes connected to electrical feedthroughs (Model QID-900-H). The standard model QID-900-H has four 2.75" conflat input/output flanges. The housing also has two 8" conflat flanges for attaching a vacuum pump. An additional two 2.75" conflat ports are used for the electrical feedthroughs. The model QID-900-H is also available with different size input/output to adapt to the customer's existing equipment. Please contact Beam Imaging Solutions at sales@beamimaging.com for a custom quote.



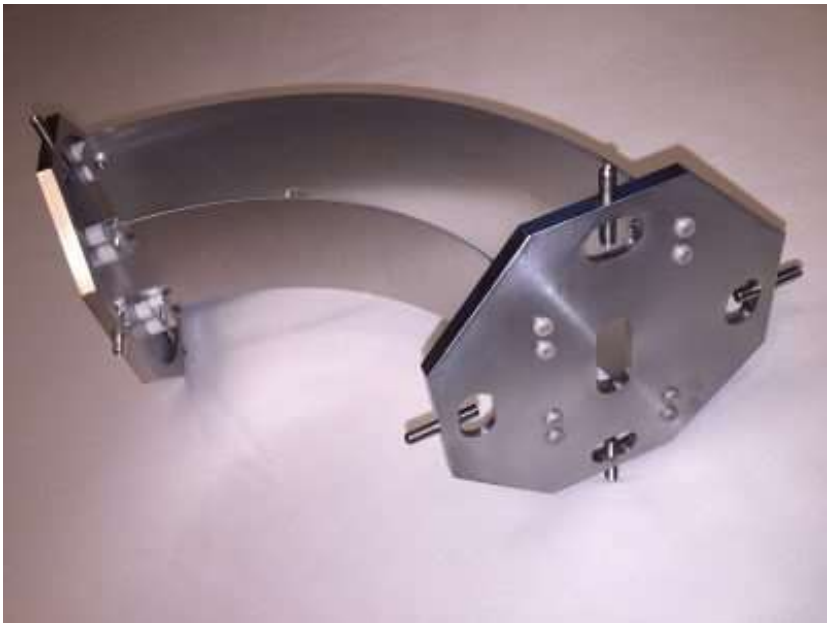
Model CIBD-100 Columbia Ion Beam Deflector

The model CIBD-100 is an electrostatic, double-focusing 90° ion beam deflector consisting of concentric cylindrical plates of differing heights*. In contrast to standard cylindrical deflectors, the CIBD-100 design allows for focusing of an incoming parallel beam not only in the plane of deflection but also in the orthogonal direction. The optical properties of our design resemble those of a spherical capacitor deflector while it is much easier and more cost effective to manufacture. Compared to our Model QID-900, the voltages required to deflect the ion beam are reduced by roughly 75% and are approximately (+/-) ¼ the beam energy in volts. The deflector can also be turned off and the ion beam can pass straight through the assembly via an aperture in one of the curved deflection plates.



Model CIBD-100-H

The standard model CIBD-100 is mounted in a standard 8″ conflat Tee vacuum chamber (Model CIBD-100-H).



In addition to deflecting the ion beam at 90 degrees, the deflector can be used to remove neutrals and photons from the beam line. Also, the deflector can be used to separate out and measure the multiply charged ion content in the ion beam.

* H. Kreckel et al., Rev. Sci. Instrum. 81, 063304 _20101.

PATENTED: US 8,309,936 B2, November 13, 2012.

Model CIBD-100-H Specifications:

Materials used in construction:

- Aluminum, stainless steel, Polyether ether ketone (PEEK), and ceramic

Beam energy Range:

- Standard Operation, 1eV to 40 keV

Maximum Bakeout Temperature:

- 250° C

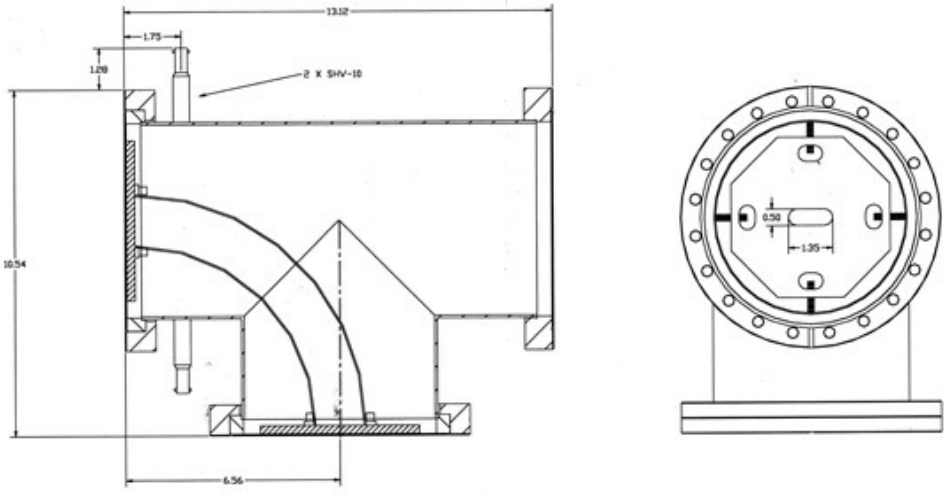
Power Supply Requirement:

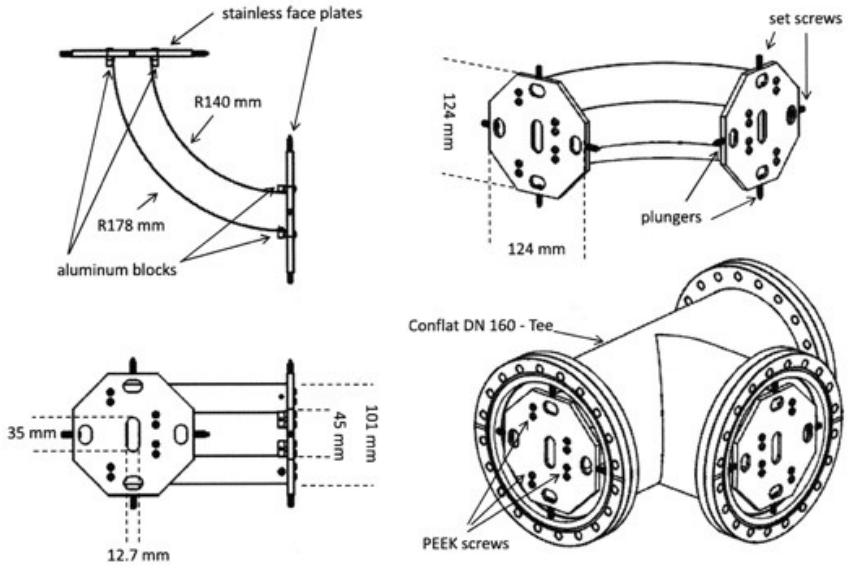
- Deflection Plates: Two power supplies, 0 to + 10kV and 0 to – 10kV

Feedthroughs:

- Two high voltage feedthroughs SHV-10 (10kV rating).

Deflector Dimensions:





DC AND RF ION SOURCES

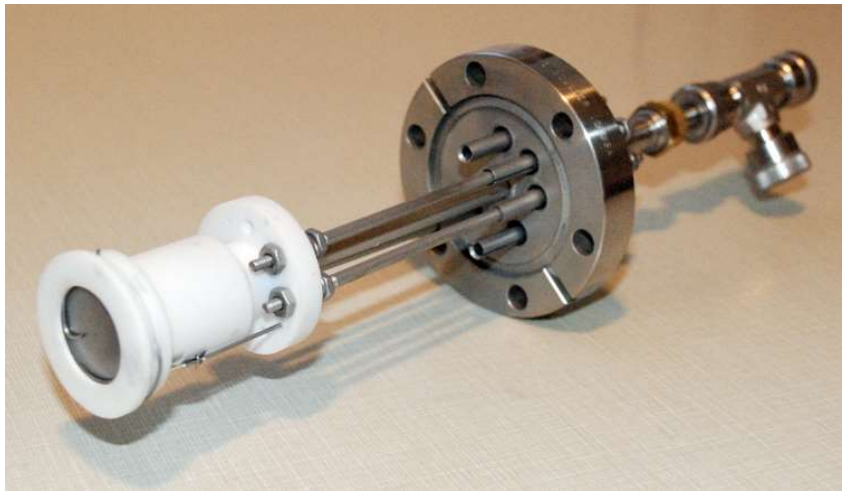
Beam Imaging Solutions now offers two new ion sources for the standard Colutron®model G-1 and G-2 ion gun accelerator systems. The RF ion source operates with a RF power supply at 13.56 MHz with manual adjust match network to produce an inductively coupled plasma (ICP). The DC ion source is of the Colutron type hot cathode DC discharge source. Customers that do not already own a Colutron ion gun can purchase the new sources to fit to their own ion accelerator systems. Please contact Beam Imaging Solutions technical support at technical@beamimaging.com for assistance.

Model RFIS-100 Ion Source

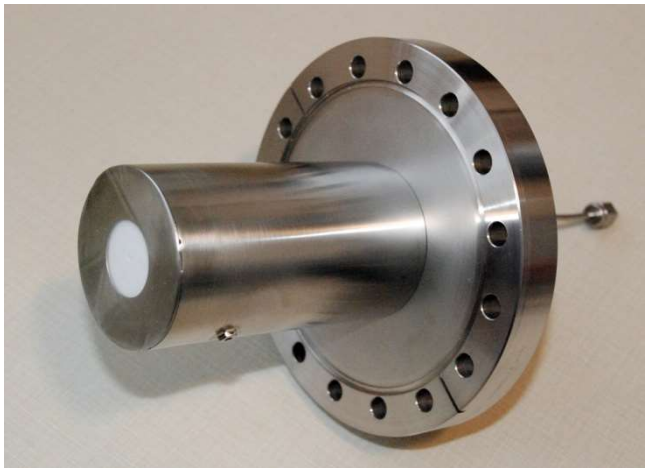
The model RF-100 is an alternative ion source to the standard Colutron type filament source. It can be adapted to the Colutron ion gun platform. The source includes match network and a RF Power supply is also available. Compared to the standard DC filament source, benefits of the RF source include longer operating times between maintenance, longer operation with reactive gasses like oxygen, and higher beam currents.

Model DC-100 Ion Source Assembly

The model DC-100 is of the standard Colutron type filament source. It is a direct plug in replacement with alumina (Al_2O_3) construction. Compared to the RF source, benefits of the DC source include low energy spread and the ability to run a wider range of solid materials from an insertable charge holder.



MODEL RFIS-100, RF ION SOURCE



RFIS-100 with Shield Cover

Beam Imaging Solutions presents the new model RFIS-100 ion source assembly. The RFIS-100 is designed to be retrofittable to the standard Colutron® model G-1 and G-2 ion gun accelerator systems. The ion source operates with a RF power supply at 13.56 MHz with manual adjust match network to produce an inductively coupled plasma (ICP). The RF ion source offers many benefits over the standard Colutron hot cathode DC discharge source including much longer operating time between maintenance, especially with oxygen and reactive gasses, and also higher beam currents. In addition to being able to produce ions from gasses, the new ion source has the added capability of producing metal ions by sputtering the source gas with a metal target in the discharge chamber. Customers that do not already own a Colutron ion gun can purchase the new source to fit to their own ion accelerator systems. Customers that have the Colutron ion gun would remove the standard Colutron DC ion source and heat sink assembly from the ion gun and attach the RF ion source directly to the Colutron model 500 insulator flange. The RF source does not require the Colutron heat sink to operate. Metal ions are also possible with the RF-100 source by using optional metal sputter targets that are placed within the ion source discharge chamber.
The RFIS-100 system is composed of the following primary components:

1. **RFIS-101 Ion Source Assembly** . To minimize down time, a fresh RFIS-101 assembly can be switched out very quickly with a used unit that might require cleaning and/or servicing.

2. **RFIS-007 Ion Source Flange**. The source flange has two VCR water feedthrough connections for the RF antenna, and 50 ohm BNC connection for an optional sputter target connection, as well as a 12kV high voltage feedthrough for an electric start circuit.

3. **RFMB-100 MRF Match Box**. The RF Match box houses the high current and high voltage vacuum variable capacitors needed for proper tuning of the RF antenna, as well as gas, water and electrical connections required for source operation. The match box also houses the new high voltage arc supply for simple electric push button starting of the ion source plasma.

4**. RFMB-200 High Voltage Safety Enclosure (Not Shown) .** The RFIS-100 package also includes a Plexiglas enclosure to ensure operator safety during high voltage operation of the ion source. A fan is incorporated into the enclosure to provide additional cooling of the ion source.

RFIS-100 SPECIFICATIONS

Ion Source Flange: 6" (152mm) Conflat

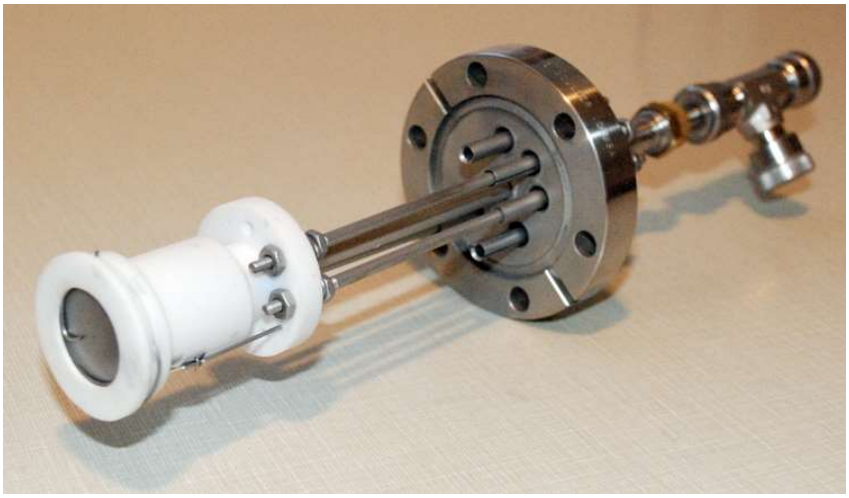
Ion Source Weight: 25.5 Pounds (11.6 kg) (Includes match box)

Power Supply Requirements (Available Separately from the RFIS-100 package):

RF Power Supply: 13.56MHz, 600W
Sputter Target, Metal Ions (Optional): 200V, 0.5A

RF Antenna: 6.5 Turn, 2mm diameter Cu tube, water cooled, 1/8" VCR
Gas Isolator: 10kV Isolation, 1/8" Swagelok input
RF Antenna Feedthrough: 5kV Isolation, Copper, 1/8" VCR
Plasma Start Circuit : 12kV Isolation feedthrough
Cooling Requirement: Water: 1 Liter/min (RF Antenna) (OPTIONAL)
Cooling Requirement: R-134A, Model CU-1 Cooling Unit (1/4HP Condensing Unit)
Force Air Cooling Requirement: Fan built into Plexiglas Enclosure for High Voltage Safety protection. (Fan Specification:47 CFM, 12VDC, 200mA)
RF Match Network: Two Vacuum variable capacitors (Tune, Load)
10-1200 pF, 4kV (Nominal), 6kV (Max), 75A (Manual Tune), Pmax=15kW (@40MHz)
RFMB-100 Match Box Input Connections (5):
2 X 1/4" Swagelok, Water cooling, RF Antenna or ¼" Flare R-134a Units
1/8" Swagelok, Source Gas Inlet
RF Type N, Male
BNC, Male, Sputter Target Supply

MODEL DCIS-100, DC ION SOURCE



Beam Imaging Solutions presents the new DCIS-100 ion source assembly. This ion source is of the ® hot cathode discharge type. This source is similar to the Colutron boron nitride ion source (Model 100) design but constructed from highly durable alumina ceramic (Al_2O_3). Unlike the boron nitride source, the initial outgas time of the DCIS-100 is measured in minutes, instead of hours due to the hygroscopic nature of boron nitride. The alumina is also more mechanically durable than its boron nitride counterpart. The DCIS-100 is mechanically stronger than the Colutron model 100-Q quartz ion source and capable of higher temperature and anode discharge current for higher current ion beams. The ion source is available as a complete assembly (model-100) with ion source (model DCIS-101), receptacle flange (DCIS-102), gas tee, and solid charge holder. The DCIS-101 ion source is also available separately and will plug into a standard Colutron receptacle flange. The ion source with oven is also available. The oven is used for vaporizing solid materials up to 2000C. Beam Imaging also offers replacement parts for the standard Colutron ion sources.

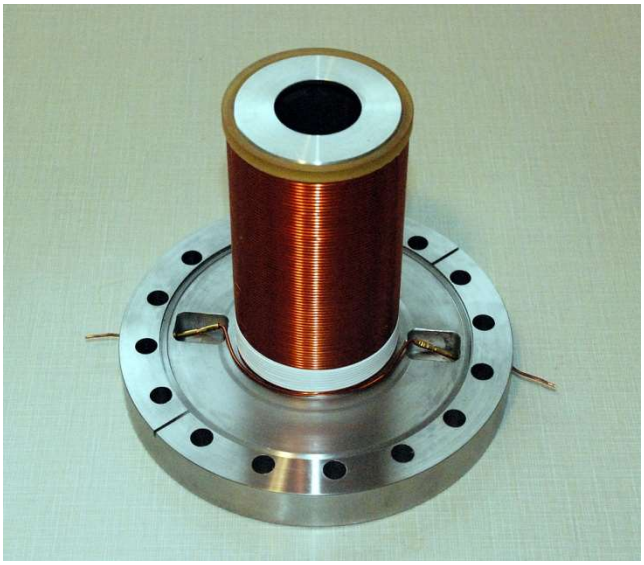
Power Requirements

FILAMENT: 16 V - 20 A DC for 20 mil **ANODE:** 0 - 150 V 0.4 A DC
16V - 12 A DC for 15 mil

OVEN (Model 100-O, 101-O only): 6V, 12A DC

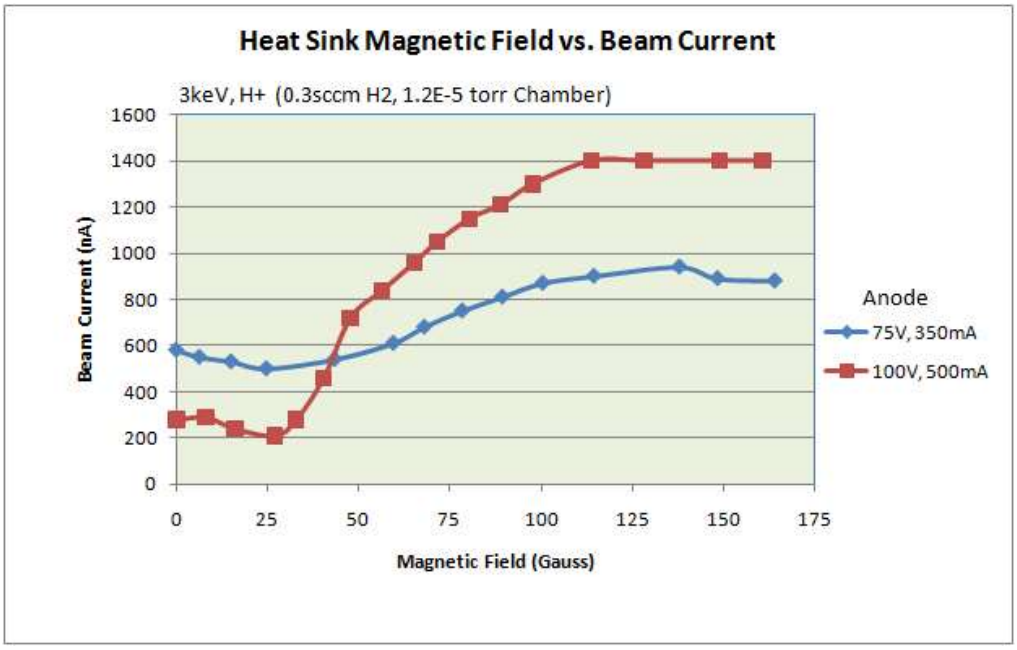
ISOLATION TRANSFORMER: (model IT-10-1) 1 KVA, with 10kV isolation for 10keV ion beams.

MODEL DCIS-103, HEAT SINK FOR DC ION SOURCE



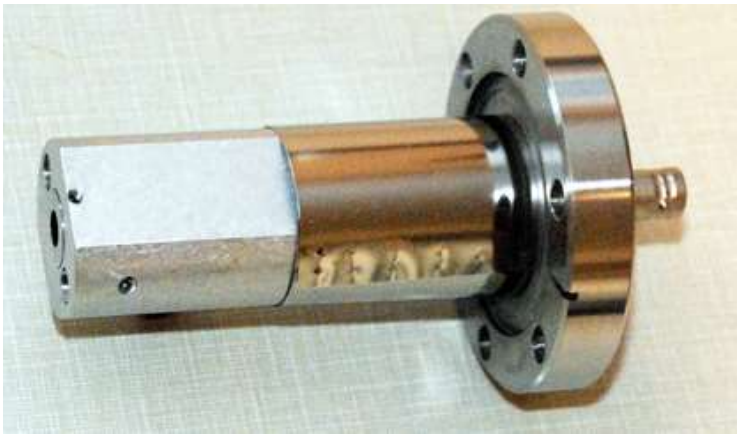
Beam Imaging Solutions presents the new DCIS-103 and DCIS-103-2 heat sink assemblies. The DCIS-102 heat sink is similar to the Colutron heat sink except that it also has a solenoid magnet coil. The magnetic field can be used to improve confinement of primary ionizing electrons in the plasma, which can enhance ionization and improve beam currents. The heat sink is available in two versions. The standard version, Model DCIS-103 has 2 layers of wire and can achieve about 150 Gauss at 10 amps. The optional DCIS-103-2* has 4 layers of wire and can achieve 300 Gauss at 10 amps.

** The DCIS-103-2 requires a specialized type Colutron insulator flange to accommodate the outer diameter of the solenoid which is approximately 2.75". This special insulator is available from Beam Imaging Solutions (Model DCIS-500).*

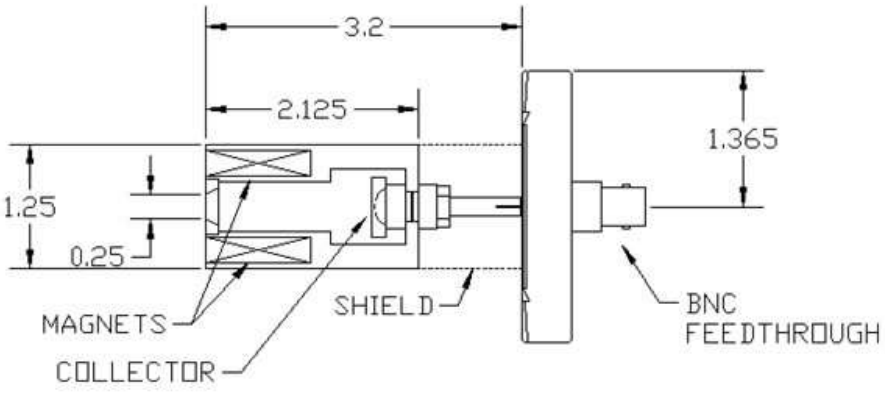


Enhancement of proton (H+) ion beam current with DCIS-103 heat sink and model DCIS-100 ion source at 3keV. A Colutron model G-1 ion gun was used to mass separate the beam. The model FC-1 faraday cup was used to measure the beam current at 12" from the exit of the ion gun.

MODEL FC-1, FARADAY CUP



Beam Imaging Solutions presents the new magnetically shielded FC-1 Faraday cup. This compact and easy to use system attaches to a standard 2.75" (69.8mm) conflat port. The FC-1 is designed to accurately measure the primary positive ion beam current from an ion source by using a magnetic field to filter out electrons which could otherwise enter the cup. Electron beams can be measured by removing the filter magnets. For ion beams, the Faraday cup collector is slightly positively biased to suppress secondary electron emission and also to reject low energy ions resultant from charge exchange collisions with the primary ion beam and background gas atoms. The beam current is measured with an electrometer connected to a 50 ohm BNC vacuum feedthrough. A shield skirt at the base of the Faraday cup prevents electron or ion current not entering through the cup aperture from being measured by the electrometer and to prevent sputtering of ceramics which isolate the collector from ground. The Faraday cup is also available separately, with UHV compatible coax cable for applications which require remote beam current measurements. (Dimensions below in inches)



Model FC-1 Specifications
(Standard)
Aperture: 0.25" (6.35mm)
INPUT: Max. 2W continuous
Max. Operating Temperature: 350C
Flange Mount: 2.75" (69.8mm) conflat flange mount.
Feedthrough: 50 Ohm, BNC
Faraday Cup Housing and shield is grounded to conflat flange in standard form.
Vacuum: UHV compatible to 1E-10 torr

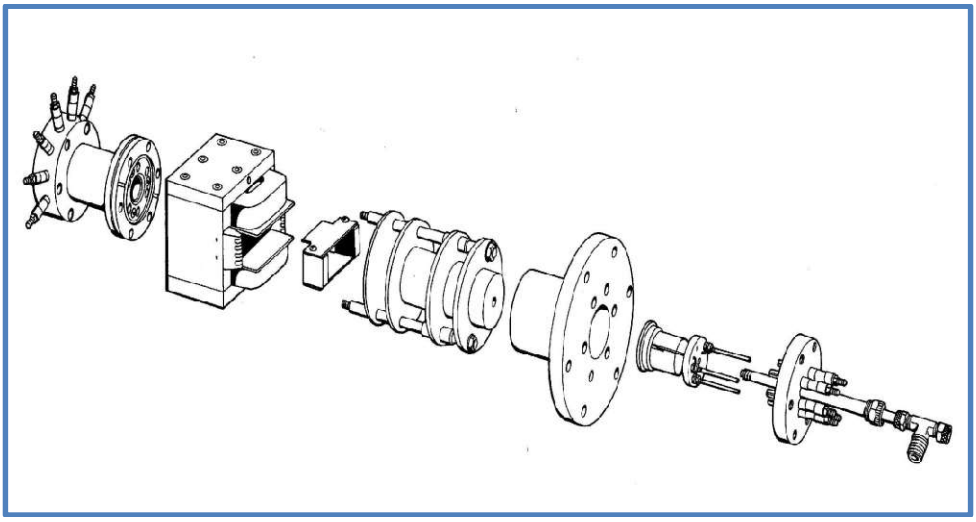
Model FC-1 Options
OPT01, Faraday Cup with UHV compatible coax cable and feedthrough assembly
OPT02, Aperture: Customer specified
OPT03, Collector: Graphite Inserts

Ion Gun Systems

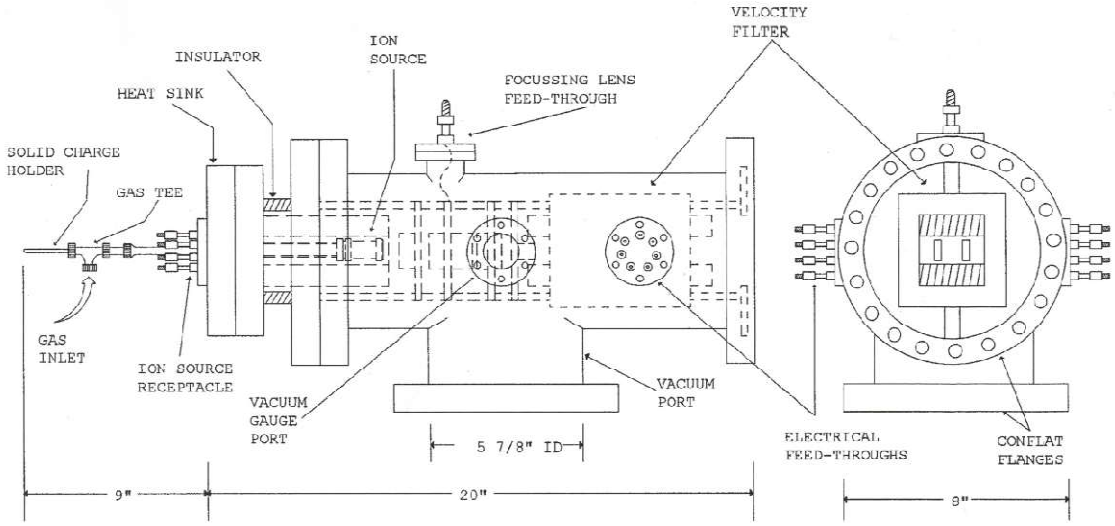
Mass separated Ion Beams 1eV – 20keV

Model G-2 Ion Gun

Beam Imaging Solutions has two Colutron type Ion Gun systems to offer. Each Gun includes an ion source assembly, heat sink, acceleration and focusing system, vertical deflection plates, a 6" long velocity filter and a velocity filter guard ring control unit. Components are assembled in a vacuum housing fitted with a flange for mounting onto the customer's equipment. Components are also available separately (Ion Beam Kit).



Ion Beam Kit



COLUTRON ION GUN MODELS G-1 AND G-2

The model G-1 is shown above. Model G-2 which has the same dimensions as the G-1 uses cooling connections for the velocity filter model 600-B, which are not shown in the drawing. The vacuum port and ion beam exit port are both standard rotatable 8" Conflats, with a 6" ID, with a 20 hole bolt pattern. The three electrical feed-through ports and vacuum gauge port are standard non-rotatable 2 3/4" Conflats, with 1 1/2" ID. If extra ports this size are needed, they may be ordered for $ 90 each. Send a drawing or sketch to show where the ports are to be located, and if they should be rotatable or non-rotatable.

PERFORMANCE SPECIFICATIONS FOR G-1 AND G-2 SERIES GUNS

Beam Energy G-1, G-2 ⇒ 500 eV to 10 keV (20keV Optional)
G-1-D, G-2-D ⇒ 1 eV to 10 keV (20keV Optional)

Resolution $M/\Delta M \approx 400$

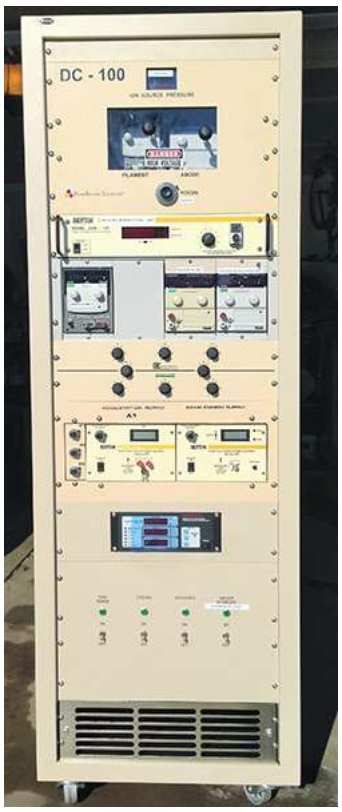
Ion Current Up to 20 μA focussed
100 μA unfocussed

POWER SUPPLY REQUIREMENTS FOR G-1 AND G-2 SERIES GUNS

Ion Source	Filament 16 V - 20 A; Anode 0 - 150 V, 0.4 A
IMPORTANT: Use voltage regulated power supplies for the ion source.	
Lens System	0 - 10 kV, 1 mA Acceleration Voltage
	0 - 10 kV, 0.5 mA Focussing Voltage
Vertical Deflection Plates	0 - 400 V, 1mA
Velocity Filter	Model G-1 ⇒ 9.5 V, 3 A Continuous operation
Magnet	Model G-2 ⇒ 28 V, 14 A
Velocity Filter Deflection Plates	0 - 300 V, 50 mA (Floating outputs)

Ion Gun System Controllers
E-Series

Beam Imaging Solutions (BIS) offers control units for both the models G-1 and G-2 Ion Gun Systems. These are the models E-1 and E-2 for the Ion Guns model G-1 and G-2 respectively. Since the ion guns can use either the legacy Coultron type filament source (Model DCIS-100) or the new Beam Imaging Solutions RFIS-100 ion Source, a separate interchangeable set of ion source power supplies are available.
If the DCIS-100 ion source is used, the E series controller is ordered with the Model DC-100 power supply system. For the RFIS-100 RF ion source, the E series controller is ordered with the RF-100 power supply. Power supplies are mounted within a plexiglass enclosure so they can be floated to 10kV (Optional 20kV).



Model E-1/DC-100

Model E-1/RF-100

Model DCIS-100 Power Supply,

DC Ion Source:

- Colutron filament source models DCIS-100 (Ceramic) and DCIS-100-Q (Quartz)

Ion Source:

- Filament 35 V – 20 A, Anode 0 – 160 V, 0.4 A

Model RF-100 Power Supply

RF Ion Source:

- Model RFIS-100

RF Generator:

- 600W, 13.56 MHz

All Controllers Have the following Power Supplies

Acceleration Supply:

- 10kV, 2.5mA (Optional 20kV, 1mA)

Isolation Transformer (Ion Source Power Supplies):

- 10kVA

Focus Supply:

- 10kV, 3mA

Velocity Filter Magnet:

- 25V, 5A (Model E-1, E-1-D)

Velocity Filter Magnet:

- 35V, 20A (Model E-2, E-2-D)

Velocity Filter Horizontal Deflection:

- 350V, 0.2A

Velocity Filter Vertical Deflection:

- 250V, 0.25A

Optional Decelerator (Model E-1-D, E-2-D)

Acceleration Supply:

- 1kV, 10mA, 10mV ripple, Floating Outputs

Beam Energy Supply:

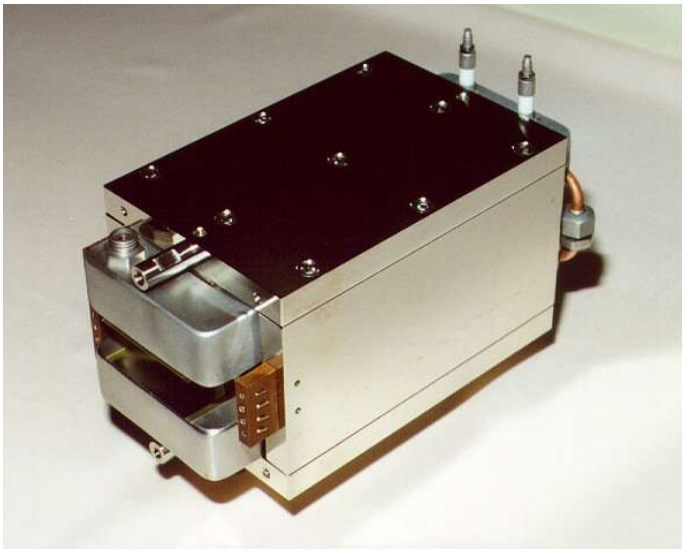
- 1kV, 10mA, 10mV Ripple, Reversible Outputs

Vacuum Gauge Controller:

- Terranova Model 924A

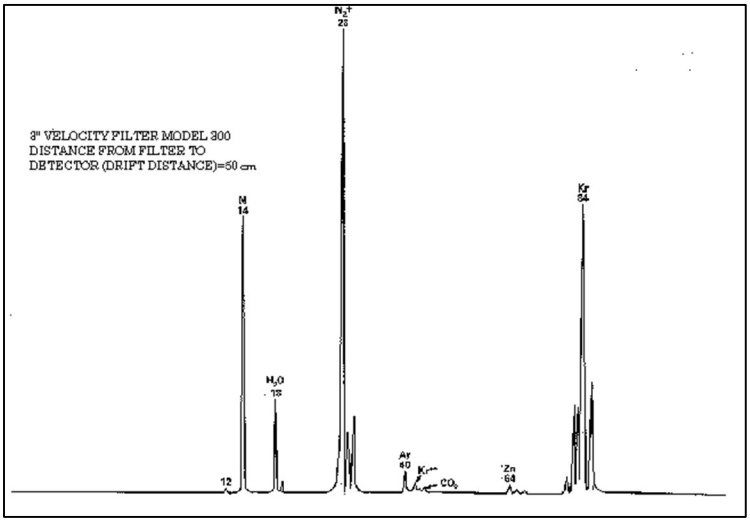
Velocity Filters

The Colutron type velocity filter is an E X B type "Wien filter", and consists of an electromagnet and a pair of electrostatic deflection plates. Using an electromagnet instead of the more traditional permanent magnet design enhances versatility and adjustability of the filter. The inherent focal property of the standard Wien filter has also been overcome by the velocity filter by properly biased guard ring electrodes. These electrodes guard the electric field from the magnet pole pieces, and also allow the electric field to be shaped for focussing and non-focussing configurations. The electric field plates are mounted between the magnet poles to produce an electric field E perpendicular to the magnetic field B (crossed E and B fields). The Model 300 is 4.4″ long and 3.5″ wide. The Model 600 and 600-B are similar except that the overall length is 9.10″and width is 4.40″. In most cases, the velocity v = (2qV/m)1/2 of charged beams are obtained by accelerating the particles of mass m, and charge q across a constant electric potential V. Different masses in the beam will be dispersed by the filter since they have different velocities. The filters are available in a vacuum housing (H-Series) as shown in on next page. The filter's ability to disperse masses makes it a superior tool in mass spectroscopy, and some of its main features are:



Model 600-B Velocity Filter

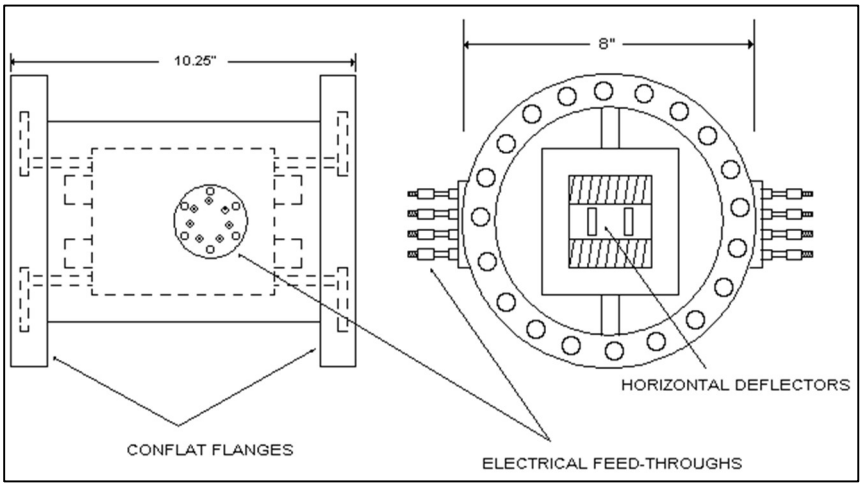
- Straight line system
- Electromagnet design
- Adjustable dispersion and focus ability
- Small size; up to 50 times smaller in weight and size compared to a sector magnet analyzer.
- The filter will also select the same velocity for both negative and positive particles simultaneously.



Velocity Filter Dispersion

D ~ [laE (ΔM)]/[4VM], where

D = the dispersion between the masses M and (M - ΔM), and undeflected and
M=2qV[B/E]2 where M = the mass (mass number) which is passing through the filter collected on the target.
a = the length of the filter
l = the drift distance from the center of the filter to target (drift distance).
E = the electric field strength in V/m.
V = acceleration voltage or ion energy.
B = magnetic field strength.
q = the ionic charge.
M/ ΔM = maximum mass resolution; ΔM= the full width at half maximum intensity.



Velocity Filter Specifications			
	Model 300	Model 600	Model 600-B
Length (a)	0.076m(3")	0.152m(6")	0.152m(6")
Max Electric Field (E)	12,500 V/m at 225V	16,800 V/m at 300V	16,800 V/m at 300V
Acceleration Voltage (V)	10eV to 10keV	10eV to 10keV	10eV to 10keV
Max. Magnetic Field (B)	1,100 Gauss	1,600 Gauss	3,000 Gauss
Resolution (M/D M)	~200	~400	~400
Beam Aperture	1.91cm x 1.91cm	1.78cm x 1.78cm	1.78cm x 1.68cm
Max. Magnet Power	30 Watts	30 Watts	400 Watts
Weight (lbs./kg)	12/5.5	21/9.5	20/9
Vacuum Range-Torr	10^{-7}	10^{-7}	10^{-9}
Max. Bakeout Temp. (C)	-	-	200°

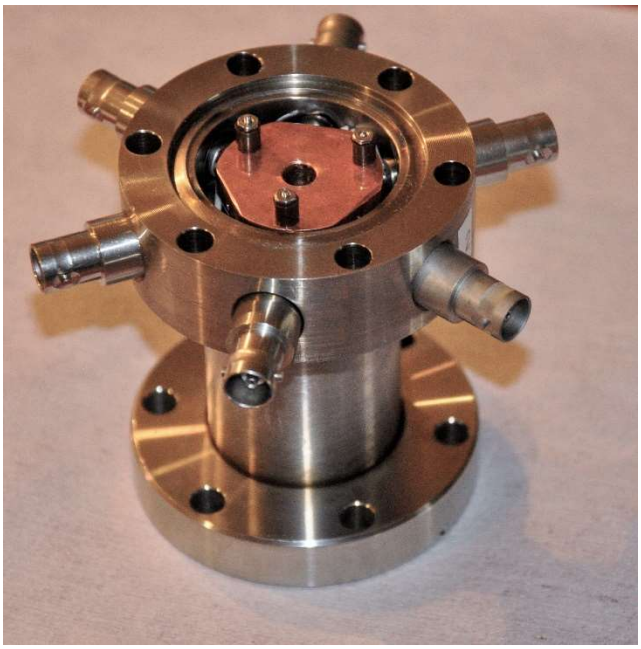
Power Requirements			
	Model 300	Model 600	Model 600-B
Electric Field (Horizontal deflection plates)	350V, 120mA	350V, 120mA	350V, 120mA
Magnet	9.5V, 3A	9.5V, 3A	

BIS also offers velocity filters mounted in vacuum housings (300-H, 600-H and 600-B-H). Model 600-H is shown above. Model 600-B-H which is the same size 600-H, has cooling connections for the magnet coils which are not shown in the diagram. The overall length of model 300-H is 6.750" instead of 10.25" as shown in the picture, and the side feed-through ports are centered between the two standard rotatable 8" Conflat® flanges, with a 6" ID. If a custom housing is needed, please send a drawing for quotation.

DECELERATORS

Model 400

The model 400 decelerator lens system consists of six OHFC copper concentric cylinders each electrically insolated. The ion beam is decelerated in two stages between the first three lens elements and then refocussed by an einzel lens incorporated into the last three elements. The overall length of the decelerator lens system (model 400-L) is ~3″ (7.6cm). It is also available mounted in a vacuum housing (Model 400) that is 3.25″ (8.25cm) long with 6 MHV feedthroughs. The input and output flanges are 2.75″ conflat. The Decelerator is designed for an optimum energy range from about 1eV to 1 keV. Beams can be decelerated to 1/200 of their original energy without appreciable beam current loss.



Model 400 Decelerator

Product Specifications

Lens Elements:

- OHFC Copper

Lens Element Spacers:

- Dupont Vespel

Lens Element Voltage rating:

- Max. recommended 2kV

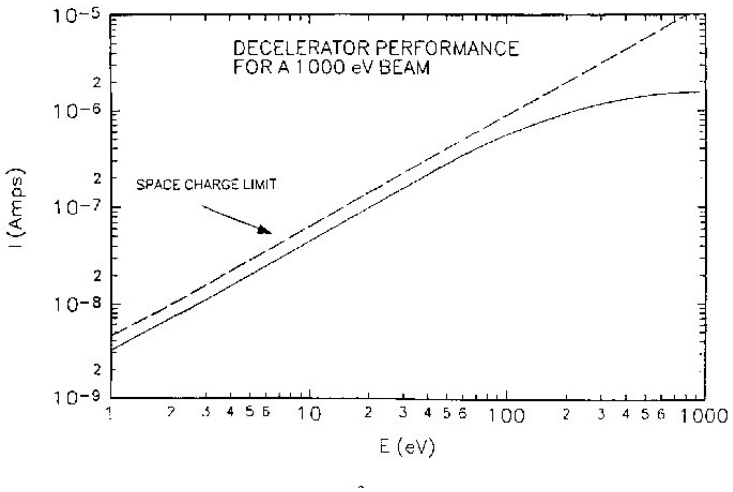
Feedthrough Type:

- MHV (SHV Optional upon request)

UHV Compatible

Weight with vacuum housing:

- 2.5 pounds ~1kg



Model 400-L Decelerator

DECELERATORS

Model 450

Beam Imaging Solutions presents the model 450 ion beam decelerator for generating high current low energy ion beams. This decelerator was designed to increase low energy ion beam current by minimizing ion beam scattering with larger lens elements and also allowing for much higher initial ion beam energies before deceleration.

Available in vacuum housing with two rotatable 8″ conflat flanges and two 2.75″ conflat ports for the electrical connections. The housing is 6.750″ (171.45mm) long.

Product Specifications

Lens Elements:

- 304 Stainless Steel

Lens Element Spacers:

- Al2O3 Ceramic

Lens Element Voltage rating:

- Max. recommended 5 kV

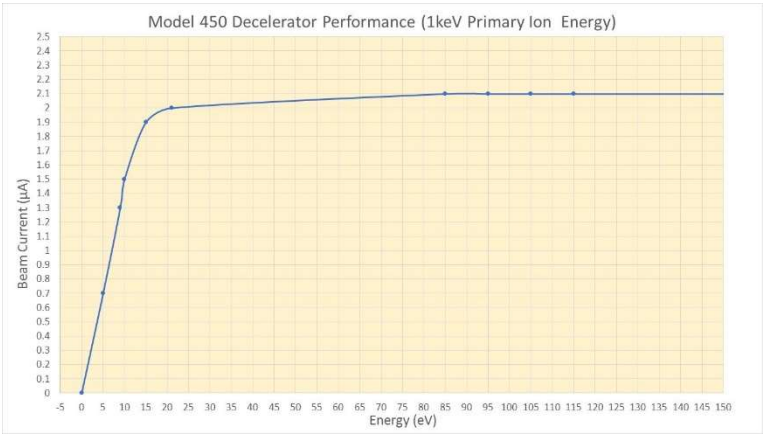
Feedthrough Type:

- MHV (SHV Optional upon request)

UHV Compatible

Weight with vacuum housing:

- 20.5 pounds ~9 kg



Model 450 Decelerator

Model 450-L Decelerator

Retarding Field Analyzer

Model RFEA-1 (Coming Soon, Summer 2022)

Beam Imaging Solutions is developing a new compact Retarding Field Energy Analyzer (RFEA) that will be available soon for purchase. The new Model RFEA-1 is of a collimated entrance aperture design with 3 grids. One grid will be for sweeping a retarding voltage and the other two grids for electron suppression before and after the sweeping grid. The RFEA-1 will mount to a standard 2.75" conflat flange and will have similar outer dimensions like our model BOS-18 Beam Observation System. This new instrument can be used to measure the mean energy and energy spread of the incoming ion beam with beam energies up to 5keV. A separate version, the model RFEA-2 will have the capability of measuring beam energies up to 10keV and will mount to a standard 4.5" conflat flange with outer dimensions similar to our BOS-25 Beam Observation System. Both units should be available sometime in 2022.

The data shown below was taken with the model G-2-D Ion gun with model 450 decelerator and RF-100 Ion Source. The RFEA-1 can be used to measure the ion beam anergy spread, as well as the mean ion beam energy and plasma potential of the ion source.