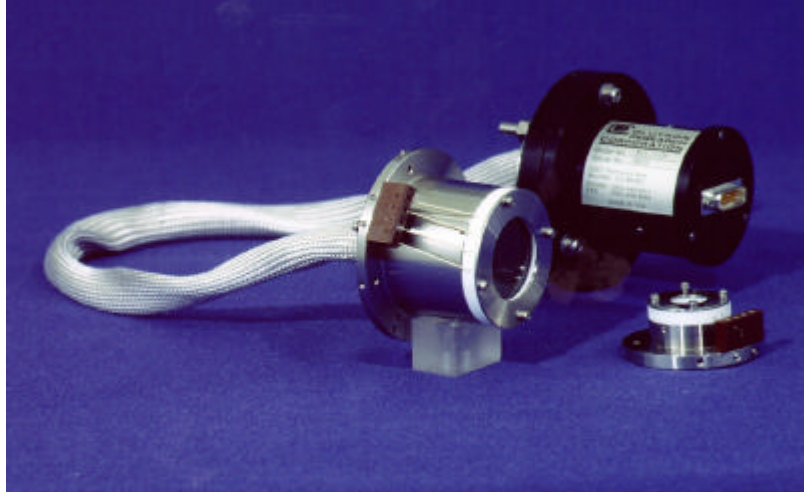


HIGH RESOLUTION BEAM IMAGING SYSTEMS



Model BIS-3135 with model BIS-1-PH Probe Head

High resolution beam imaging is made possible with the Colutron Beam Imaging Systems (BIS). The BIS can be used to measure two or three dimensional intensity distributions of ion, electron and neutral beams. The BIS can also be used to image 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 BIS systems are available in many different configurations to best fit a customer's particular application and budget.

Features

- Available with single or dual MCPs
- Microsphere plates (MSP) also available
- Spatial resolution down to 25 μ m
- 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

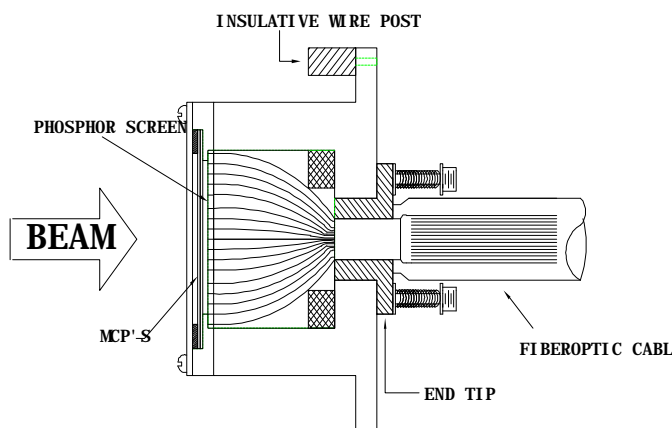
- High resolution single particle detection
- Remote beam line diagnostics
- Real time image analysis
- Beam profile analysis (beam tuning)
- Mass spectrometry (mass and dispersion determination)
- Low energy and low intensity beam imaging
- X-ray spectroscopy, X-ray pinhole imaging
- Field ion microscopy

BEAM IMAGING SYSTEM - (BIS)

The BIS systems consist of three basic components: 1) the BIS *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 BIS 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 BIS-1 systems use a 1:1 magnification FO disc whereas, to image larger areas, the BIS-2, BIS-3 and BIS-4 systems use FO tapers with corresponding magnifications of 2x, 3x, and 4x. All BIS probe heads are interchangeable, allowing the user to change image resolution and image area by simply switching the probe head.



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

Probe Head Specifications

Probe Head Model Number	Image Area	Approximate Spatial Resolution
BIS-1-PH	17mm diam.	25-35 μm
BIS-2-PH	25.4mm diam.	50-70 μm
BIS-3-PH	38.4mm diam.	75-100 μm
BIS-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. Also available are microsphere plates (MSP) in single or dual stack. These plates have higher gain per stage and less severe vacuum requirements, but have poorer spatial resolution (*see Beam Imaging Specifications on page 27*).
- The phosphor screens come standard with P-20 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. Colutron offers a small 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 BIS system for the phosphor screen and MCP voltage application.

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 BIS 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 BIS systems. All cameras are available with lens, video monitor and mounting system for imaging the FO viewport. The CIDTEC 3710D and COHU 4812 cameras are also available with Fiber-Optic Face Plates (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. Colutron offers the optional Image Processing Systems (IPS) which include video monitor, frame grabber, cables and software (see page 26 for details).

CCD/CID Camera Specifications

Camera	CIDTEC 3710D	COHU 4812	COHU 2122
Optical Format	2/3" diagonal	2/3" diagonal	1/2" diagonal
Resolution	755H x 484V	755H x 488V	768H x 494V
Element Pitch (µm)	12.0 x 13.7	11.5 x 27	8.4 x 9.8
Area (mm)	9.05 x 6.83	8.8 x 6.6	6.4 x 4.8
FOFP (Optional)	4.5 µm pitch	4.5 µm pitch	N/A
Scanning Format	RS-170, 2:1 Interlace	EIA RS-170	EIA RS-170
Electronic Shutter			1/60 - 1/10,000 sec.
Sync. System	Int./Ext.	Int./Ext.	Int./Ext.
Signal to Noise (db)	50	50	>55
Sensitivity (Face Plate Illumination)	Full Output: 0.5fc	Full Output: 0.2 lux	Full Output: 0.65 lux
Input Power (Watts)	8.5 max.	4.2	3.6
Input Voltage (Volts)	+ 15VDC nominal	+12VDC	+12VDC

BIS Ordering Information

Use the table below to determine the BIS model you need. For example, a model BIS-3135 decodes as a BIS 3000 series system with BIS-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. Prices are given on page 35.

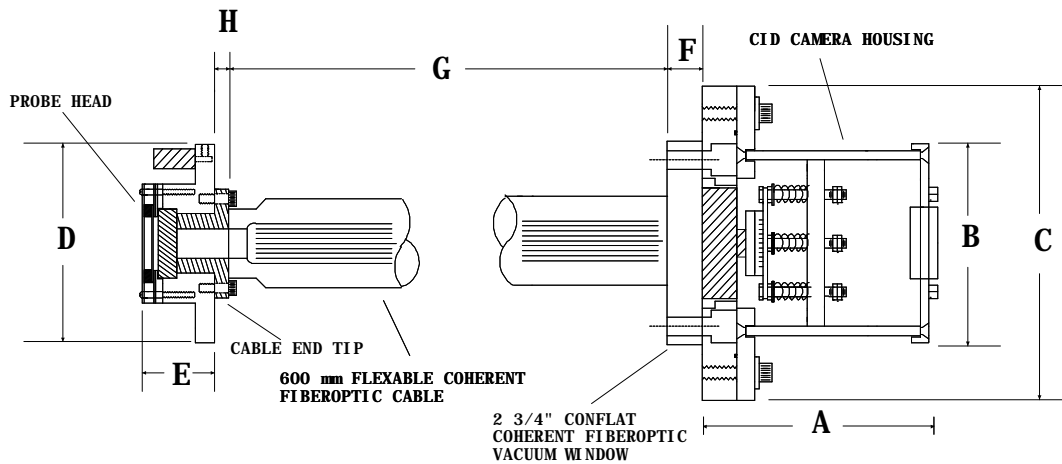
NOTE: All BIS systems include a 4-terminal, 2-3/4" conflat (DN35) high voltage feedthrough (Colutron part number PN-706).

ORDERING INFORMATION				
BIS - X	X	X	X	
Probe Head	MCP Options	FO Conduit	Camera System	
1 BIS-1-PH	0 Single MCP	0 2" FO Rod/FO Viewport	0 None	
2 BIS-2-PH	1 Dual MCP	1 3" FO Rod/FO Viewport	1 COHU 2122/Lens/Mount	
3 BIS-3-PH	2 Single MSP	2 4" FO Rod/FO Viewport	2 COHU 4812/Lens/Mount	
4 BIS-4-PH	3 Dual MSP	3 60 cm FO Cable/FO Viewport	3 CIDTEC 3710D/Lens/Mount	
			4 COHU 4812/FOFP/Mount	
			5 CIDTEC 3710D/FOFP/Mount	

REMOTE SYSTEM DIMENSIONS

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

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



DIMENSIONS

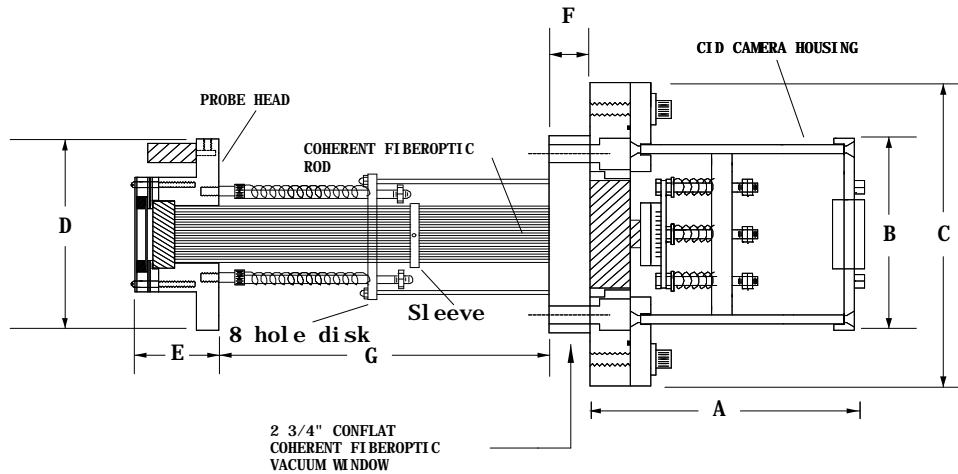
DIM (mm)	MODELS*	BIS-1X35	BIS-2X35	BIS-3X35	BIS-4X35
A		83.5	83.5	83.5	83.5
B		68.3	68.3	68.3	68.3
C		108.0	108.0	108.0	108.0
D		63.5	76.2	88.9	101.5
E		24.8	43.3	56.3	70.09
F		12.7	12.7	12.7	12.7
G		566.7	566.7	566.7	566.7
H		4.7	4.7	4.7	4.7
CABLE END TIP O.D. (φ)		34.3	34.3	34.3	34.3

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

STANDARD SYSTEM DIMENSIONS

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

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



DIMENSIONS

	MODELS*	BIS-1X05	BIS-1X15	BIS-1X25	BIS-2X05	BIS-2X15	BIS-2X25
DIM (mm)							
A		83.5	83.5	83.5	83.5	83.5	83.5
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		24.8	24.8	24.8	43.3	43.3	43.3
F		12.7	12.7	12.7	12.7	12.7	12.7
G		23.6	49.0	74.4	23.6	49.0	74.4
Fiber-optic Rod O.D.		19.1	19.1	19.1	19.1	19.1	19.1

	MODELS*	BIS-3X05	BIS-3X15	BIS-3X25	BIS-4X05	BIS-4X15	BIS-4X25
DIM (mm)							
A		83.5	83.5	83.5	83.5	83.5	83.5
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	70.09	70.09	70.09
F		12.7	12.7	12.7	12.7	12.7	12.7
G		23.6	49.0	74.4	23.6	49.0	74.4
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 24).

POWER SUPPLY CONTROL UNITS (PCU)



Model PCU-2 Power Supply Control Unit

The BIS system is available with an optional Power Supply Control Unit (PCU). The control unit consists of the following items:

- ❶ 19" wide rack-mount unit , 8 3/4" high mounted in 10 1/2" high instrument cabinet.
- ❷ 5kV phosphor screen power supply.
- ❸ 1kV or 2kV (chevron models) MCP power supply.
- ❹ Front panel with power supply control, digital voltmeters, and analog current meters.
- ❺ Power control with vacuum interlock capability.
- ❻ MHV Cables.

POWER INPUT: 115V AC Standard, please specify 220V if required.

COLUTRON IMAGE PROCESSING SYSTEMS

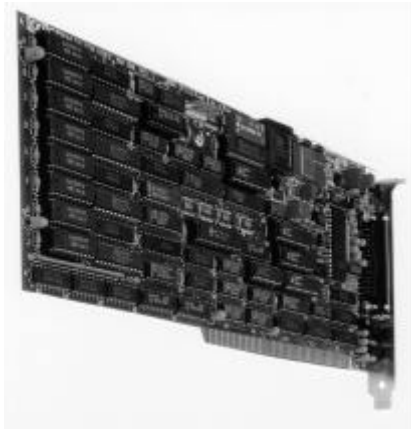


Image Processing System Frame Grabber Board

The Colutron Image Processing System (IPS) is an optional addition to the Colutron Beam Imaging Systems (BIS), and the Colutron Beam Viewing Systems (BVS). The system allows the user to capture, display, store and process images from the BIS and BVS video cameras. The system includes a 1 or 4 MB on board memory frame grabber board (IPS-1 and IPS-2), software, cables and a high resolution 13" Sony Trinitron RGB color video monitor. Some of the features of the system are shown below. The new economical IPS-3 system includes a PCI slot frame grabber board, cables, software. For more information on this system, contact Colutron Research.

FRAME GRABBER BOARD FEATURES

1 or 4 megabyte image memory (IPS-1 or IPS-2)	8 bits per pixel
8000 to 4 pixels per line	1020 to 2 lines per field
RS-170, RS-330 and CCIR input/output	Genlock to external timing sources
Variable timing for non-standard formats	External input/output for event sync
Pseudo-color display on RGB monitor	PC/AT bus compatible
Generates RS-170 or CCIR video timing	Programmable timing/resolution
Six input video multiplexer	

SOFTWARE FEATURES

Video rate image sequence capture. Triggered event acquisition. Continuous sequence acquisition until terminated by trigger event. Trigger on TTL signal, time of day, keyboard, mouse, video time code.

Software zoom, pan or scroll

Enhance and pseudo color

Set lookup tables numerically: linear ramps, log curve, gamma curve, mathematical expression Set lookup tables interactively: sliding controls for black level, gain, high contrast window

2-D plot of pixel values across line, column, or image buffers: overplot reference data, subtract baseline data, filter, color, size, label

3-D plot of pixel values, color, rotate, size, label. Numerical display of pixel values, in same or successive image buffers. Pixel scope: continuous update of numerical display or plot while capturing images.

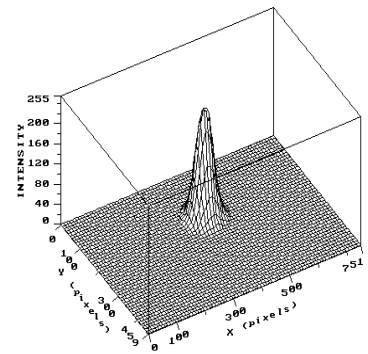
A few of the many processing functions include Pixel AND, XOR, compliment, dither, scale, offset, contrast enhance, user defined value mappings. Image pair add, subtract, AND, XOR, average, weighted product and ratio, user defined expression. Filters, edge detectors, convolutions, discrete fourier transform (and FFT)

Image import/export with standard TIFF format

Operate on full image buffer, or rectangular area of interest selected by quadrants, coordinates, or interactive placement via cursor keys or mouse.

For full details on the frame grabber board or software, contact Colutron Research for specifications pamphlet.

4 keV OH⁺ ion beam (0.86mm FWHM)
made with Colutron Model
G-1 Ion Gun System, Model E-1 Control
Unit, BIS-1 Beam Imaging System and
recorded with Colutron
IPS-1 Image Processing System.



BEAM IMAGING SYSTEM SPECIFICATIONS

Imaging Area	9.1mm x 6.6 mm Model BIS-1000 Series 18.2mm x 13.2 mm Model BIS-2000 series 27.3mm x 19.8mm Model BIS-3000 series 36.4mm x 26.4mm Approx. Model BIS-4000 series
CCD/CID Cameras	See page 23 for details
Fiber-optic Cable: (Remote Systems)	10.0 mm x 8.0 mm image area, 10 micron square fiber size 600 mm length, Flexible, UHV Compatible, 2 3/4" Conflat [®] port
Fiber-optic Rod: (Standard Systems)	Available in 2", 3" or 4" lengths, 3/4" Diameter 6 micron diameter fiber size
MCP: (Standard)	0.975" Diam., single plate (BIS-1000 series), chevron (BIS-1100 series) 1.289" Diam., single plate (BIS-2000 series), chevron (BIS-2100 series) 1.970" Diam., single plate (BIS-3000 series), chevron (BIS-3100 series) 1.970" Diam., single plate (BIS-4000 series), chevron (BIS-4100 series) 10 micron channel diameter Max. Gain: 2×10^4 (single plate, 1000V), $>10^7$ (chevron, 2000V) Spatial Resolution: 41 lp/mm
MSP:(Optional)	0.980" Diameter Single plate (BIS-1200 series), chevron (BIS-1300 series) 1.291" Diameter single plate (BIS-2200 series), chevron (BIS-2300 series) 1.970" Diameter single plate (BIS-3200 series), chevron (BIS-3300 series) single plate (BIS-4200 series), chevron (BIS-4300 series) 50 μ m sphere diameter Max. Gain: 1.5×10^6 (one plate, 3000V), $\sim 10^9$ (dual plate, 4000V) Spatial Resolution: 2 lp/mm
Phosphor Screen:	P-20 deposited onto aluminized fiber-optic faceplate Fiber-optic faceplate fiber size: 6 micron diameter Conversion efficiency: $\eta = 0.063$ photons/eV/electron P-20 Peak wavelength: $\lambda = 560$ nm
Power Supply Specifications:	0 - + 1000V, 1 mA single Microchannel Plate 0 - + 2000V, 1 mA dual Microchannel Plate (chevron) 0 - + 3000V, 1mA single Microsphere Plate 0 - + 4000V, 1mA dual Microsphere Plate 0 - + 5000V, 1 mA Phosphor Screen
Vacuum:	1×10^{-6} Torr or better required to operate probe (MCP) 1×10^{-5} Torr or better required to operate probe (MSP) Good to at least 1×10^{-10} Torr; Maximum bakeout temp. 150° C