

UniBEaM25-D

**Dual-Axis Ion Beam Profiler System
Using Scintillating Fiber Sensor**



*UniBEaM25-D
Dual Axis Probe
(shown with quick clamp option)*



Front



Back

UniBEaM25-D – Dual Axis Controller

- **Measures beams from keV to GeV and pA to mA depending on the power density deposited**
- **Maximum beam diameter² 25 mm**
- **Beam energy density³ 1 W/mm²**
- **No vacuum box required**
- **Insertion length⁴ of just 70mm**
- **Scintillating sensor fibers**
- **Dual X & Y axis profiles**
- **In-plane scanning**
- **Radiation resistant – no electronics in the probe**
- **Low electromagnetic susceptibility**
- **Complete turnkey system**

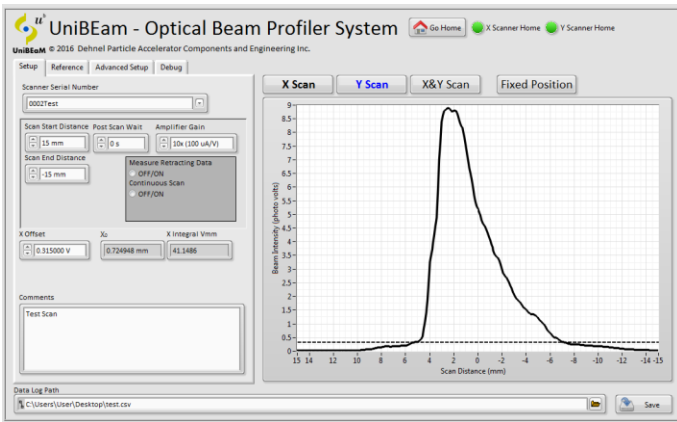
UniBEaM was conceived by the AEC-LHEP of the University of Bern¹ and commercialized by D-Pace. UniBEaM is a charged-particle beam profiling system - similar to a wire scanner except an optical sensor fiber is used instead of a metal wire. Ø50µm to 400µm sensing fibers scintillate in the visible spectrum as they pass through the beam. The scintillation light is transmitted through the short sensor fiber into a standard multimode optical fiber, which transmits the light long distances with minimal attenuation and no electromagnetic susceptibility. The light is converted by a high-sensitivity photo sensor located in the UniBEaM controller, amplified, digitized, and displayed on a monitor.

The system is a standalone device, requiring only the addition of a monitor and keyboard. A TCP/IP text-based command set is in development. This will allow UniBEaM to be used as a slave device to a higher-level controller or to interface with EPICS over Ethernet.

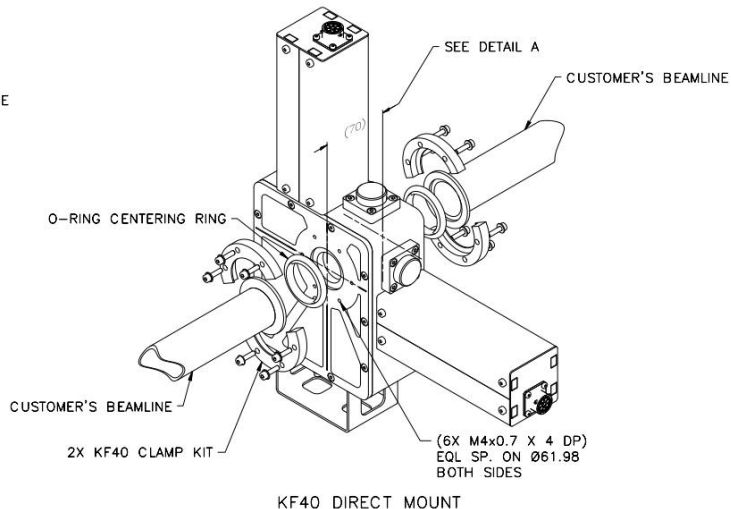
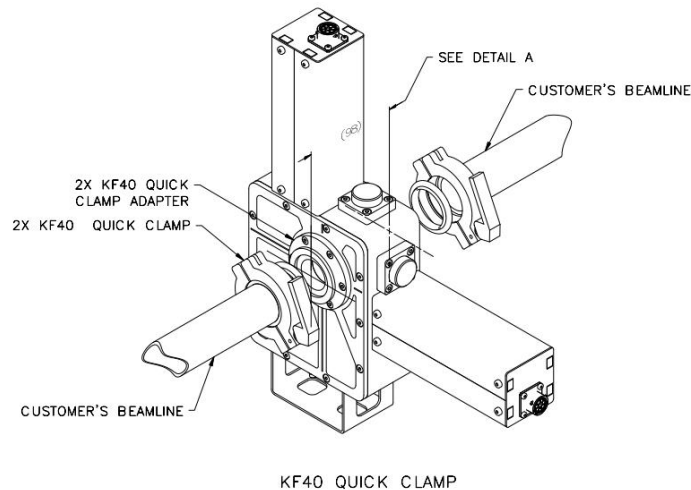
The probes are very compact, and require only 70mm along the beam axis⁴. X and Y scans can be conducted individually or concurrently.



Replaceable Sensor Fiber



Control & Analysis Software



SPECIFICATIONS: UniBEaM25-D

Max Beam Diameter ²	25mm
Particle Kinetic Energy	> keV
Sensitivity (Standard) ⁵	12pA @ 18MeV
Max Power Density ³	1 W/mm ²
Sensor Fibers	Doped Silica Ø200µm (Ø50µm to Ø600µm)
Position Resolution	0.025mm
Scan Speed	18mm/second
Probe Insertion Length ⁴	70mm
Flange Options	KF40 quick clamp or bulkhead CF40 flange
Probe Mass	7 kg
Data File Format	CSV with header
View port	KF16 quartz w/ cap
Controller	19" Rack Mount, 2U
Input Power	100-240VAC 50/60Hz
Cable & Fiber Length	15 meters (custom available)

1. UniBEaM is licensed from AEC-LHEP University of Bern to D-Pace Inc. for exclusive worldwide manufacturing, sales, and distribution.
2. UniBEaM50 (50mm) and UniBEaM100 (100mm) are in development.
3. Higher beam power densities possible for > 5MeV. At 18MeV, maximum beam power density is 18W/mm².
4. With QF40 bulkhead clamp (98mm with QF40 quick clamp option, 92mm for CF40 option - see D-Pace drawing 1590329).
5. For signal-to-noise of 2 for standard system at 18MeV H⁺. Contact D-Pace for higher sensitivity systems.
6. D-Pace reserves the right to update specifications as part of its ongoing product improvement program.



OSCILLATING WIRE SCANNER PROBE MODEL OWS-30

TRIUMF-Licensed, Beam Profiler



The **D-Pace OWS-30 Oscillating Wire Scanner Probe** performs two orthogonal intensity scans of a beam in one scanning operation. A replaceable 0.5mm diameter tungsten wire with two legs is pivoted about an axis within the case of the instrument. A high-sensitivity ammeter is used to measure the intercepted beam current.

The wire crosses the beam in an arc of approximately $\pm 13^\circ$. Each wire leg passes through the center of the beam at 45° relative to the flange. The oscillation speed is controlled by adjusting the motor voltage. Position feedback is output as an analog signal.

D-Pace can provide a custom vacuum box.¹

The Wire Scanner Probe can be purchased separately, or D-Pace can provide a turnkey system, complete with the probe, controller, current meter, PC, software, cables, and optional instrument rack. The software displays 2D intensity distributions in real time as scans are performed, allowing the operator to tune and center beams. A single oscillation results in two passes of both legs of the scanning wire through the beam.

- Measure low-energy charged-particle beam profiles (< 1 MeV)
- Simultaneous orthogonal scanning as a diagnostic tool for centering a beam
- Scan $\varnothing 30$ mm beam²
- Controllable scan speed
- Interchangeable $\varnothing 0.5$ mm tungsten wires
- Optional turnkey system and custom vacuum box
- TRIUMF-licensed technology³

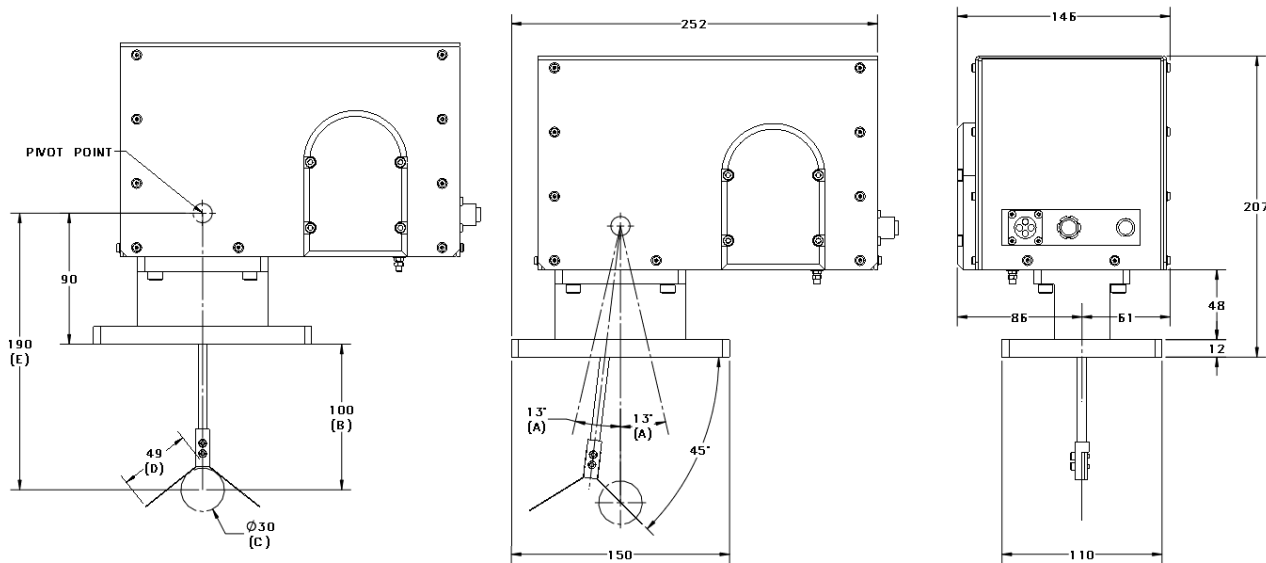
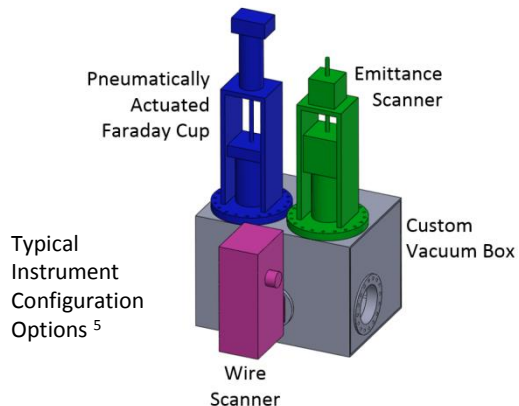
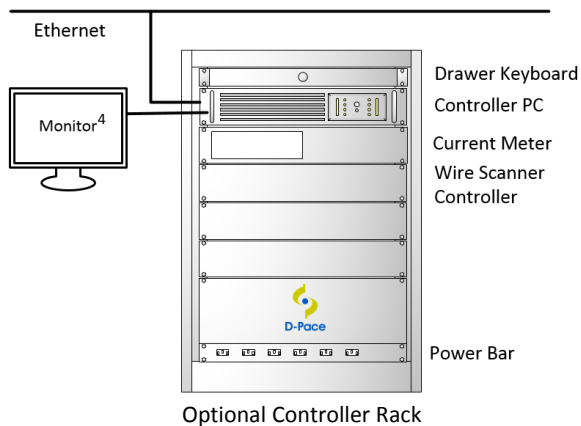
SPECIFICATIONS - EMITTANCE PROBE

Max Beam Diameter ²	30 mm
Min Oscillation Period	10 seconds/cycle
Max Oscillation Period	> 60 seconds/cycle
Maximum Beam Intensity	$1\text{W}/\text{mm}^2$
Wire	$\varnothing 0.5$ mm Tungsten
Bias voltage	None
Flange	Custom, O-ring
Mass	4 kg
Arm Scan Angle (A)	$\pm 13^\circ$
Flange to Beam Center (B)	100mm
Leg Wire Length (D)	49mm
Pivot Length (E)	190mm
Output	BNC Coax

The wire scanner can be factory configured for smaller beams by adjusting the scan angle. This allows the device to operate in smaller vacuum boxes.

SPECIFICATION - TURNKEY SYSTEM OPTION 4

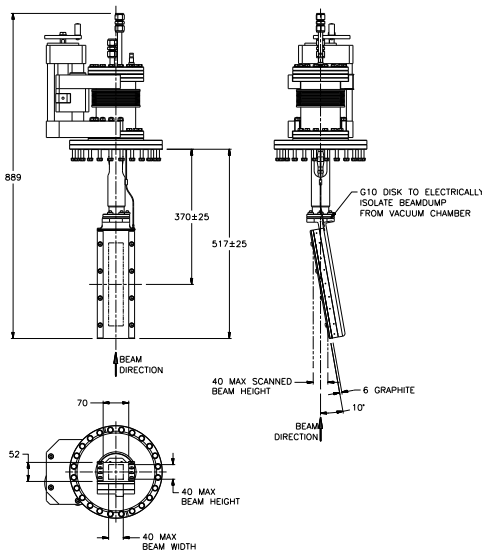
Turnkey System	Includes probe, computer, software, power supplies, instrumentation and cables
Instrument Rack Option	Optional 19" rack, keyboard and power distribution
Platform	Industrial PC / Windows™ OS
Control Options	Stand alone or Remote Ethernet control
Current Meter	2nA to 20mA (full scale) 10-100pA (typical noise floor)
Power	115 or 220 VAC (configured) 550 W, single phase
Data Plots & Visualization	2D orthogonal intensity distribution displayed in real time
File Export	CSV
Dimensions (W x D x H)	16U instrument rack 545 x 660 x 765 mm
Mass (approx.)	60 kg excluding probe



1. D-Pace can provide a custom vacuum box. Contact D-Pace with custom requirements for a quotation.
2. Wires tangent to beam diameter at maximum angle.
3. Technology licensed from TRIUMF for world-wide distribution.
4. Turnkey system with instrument rack option. Monitor not supplied.
5. Wire Scanner can be combined with D-Pace's Phase Space Emittance Scanner and Faraday Cup Probes.
6. D-Pace reserves the right to update specifications as part of its ongoing product improvement program.

BEAMSTOP – MODEL BS-10kW-1

Position Adjustable High Power Beamstop For Ultra High Vacuum Applications



- Designed to stop 350μA, 30MeV proton beam
- Beam current read back
- CF flanges with aluminum gaskets and Kalrez o-ring for low maintenance in radiation environment

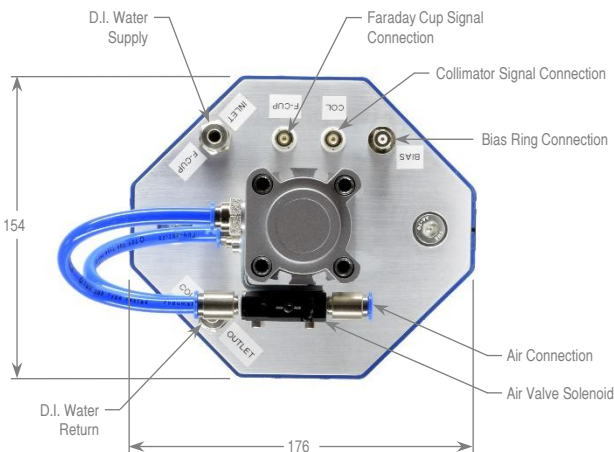
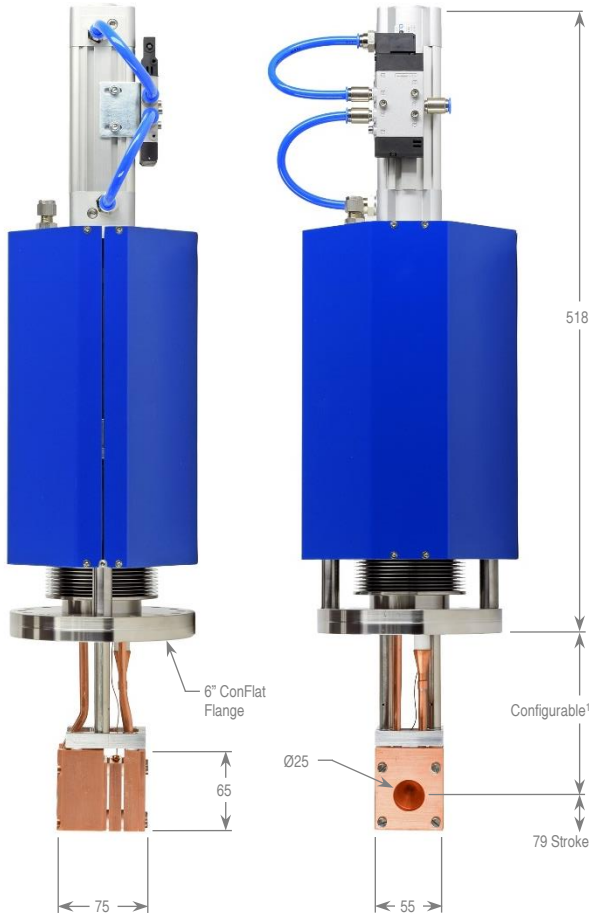
SPECIFICATIONS: Beamstop, BS-10kW-1

Maximum beam power	10.5kW
Maximum beam intensity	2.0 W/mm ²
Maximum proton kinetic energy	30 MeV
Max beam size	40 mm X 40 mm
Cooling water:	
Flow rate	30 l/min
Inlet temperature	15°C (60°F)
Inlet connection	Ø12 mm Swagelok Tube fitting
Max inlet pressure	724 kPa (105 psi)
Pressure drop	372 kPa (54 psi)
Current read back	BNC Connector
Flange	DN 200CF (10"CF) (Ø203mm) Rotatable, with tapped M8 holes
Adjustment	±25 mm in beam direction, Manual hand wheel

Notes:

1. More detailed information available and dimensions on sketch 1590273.
2. D-Pace can provide a custom vacuum box.
3. D-Pace reserves the right to update specifications as part of its ongoing product improvement program.

Pneumatically-actuated, water-cooled, Faraday Cup for Ø25 mm beams capable of 1000 W beam power,



- Measure charged particle beams up to 1 kW beam power, with up to 1 MeV particle energy
- Secondary-electron suppression electrode
- Water-cooled (de-ionized water required)
- Beam current readback from both entrance collimator and Faraday Cup
- Ø25 mm aperture, Ø55 max. beam size
- Pneumatic actuation
- Reed limit switch feedback for device position
- Cylinder actuation speed adjustments

SPECIFICATIONS: FC-25.1K

Max. Beam Power 1000 W (< 500W·cm⁻²)

Max. Particle Energy 1 MeV

Collimator I.D. Ø25 mm

Collimator O.D. 55 mm × 65 mm

Flange 6" ConFlat (152 mm O.D.)

Max. Travel 79 mm

Pneumatic Operation Connections 24 V DC Solenoid
Ø8 mm push tube fitting

Cooling Water 1 L/min
De-ionized water only

Inlet Temperature Connections < 20 °C
Ø6 mm tube fittings

Current Readbacks:
Faraday Cup Signal Isolated BNC, female
Collimator Signal Isolated BNC, female

Bias Ring Connection Grounded MHV, female
Max. Bias Voltage 500 V

Limit Switches (Qty 2)* (Inserted & Retracted) N/O reed switch, 2-wire, 5-30 V, 80 mA max.

Cylinder Speed Adjustments* One-way flow control valves for exhaust air

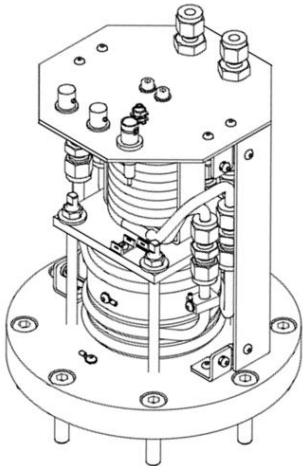
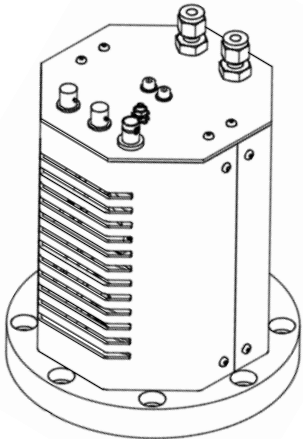
1. Inserted length at retracted position configurable for customer's application. Stroke fixed.
 2. D-Pace reserves the right to update specifications as part of its ongoing product improvement program. Refer to D-Pace website for latest specifications.
- * Limit switches and cylinder speed adjustments not shown in images.

FARADAY CUP, MODEL FC-600-F

600W STATIONARY



- Measures low-energy charged-particle beam currents (< 1 MeV) up to 600W
- Secondary-electron suppression electrode
- Water-cooled
- Beam current read back from both collimator and Faraday cup
- Polymer water tubing for electrical isolation within chassis for safety



SPECIFICATIONS: FC-600-F

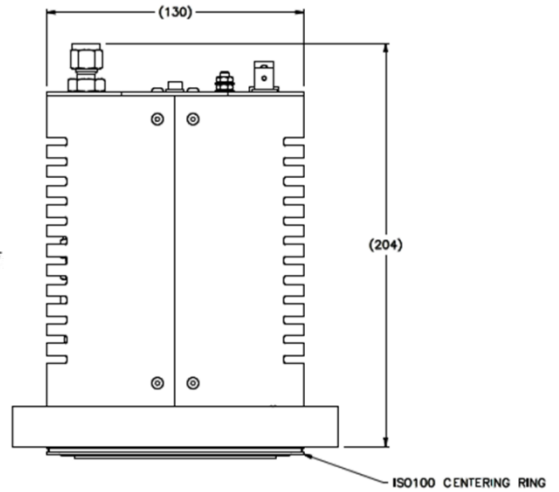
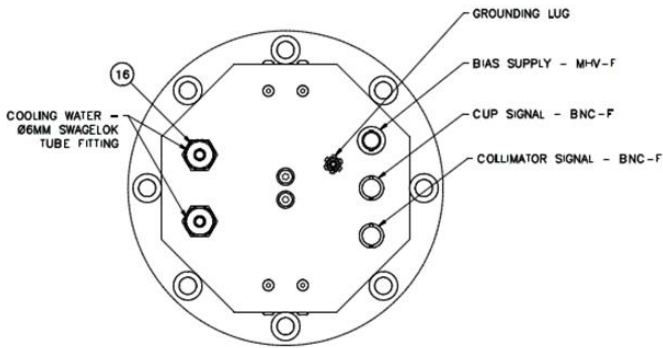
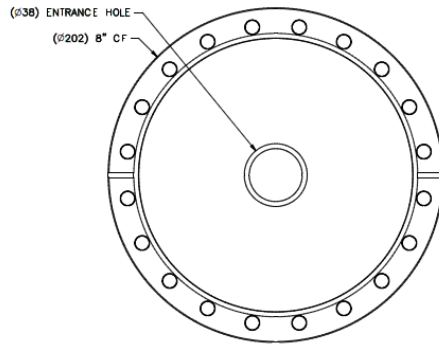
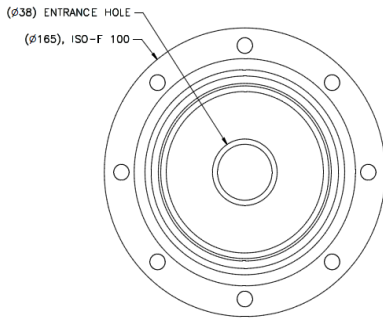
Beam Power, Max	600W
Collimator Diameter	32 mm
Bias Ring Diameter	32 mm
Faraday Cup Diameter	32 mm
Standard Flange	ISO 100F (O.D. 165mm)
Optional Flange	8" CF (O.D. 202mm)
Cooling	Water
Particle Kinetic Energy Range	< 1 MeV
Vacuum	HV (10 ⁻⁸ Torr) ¹

Notes:

1. FC-600-F design utilizes internal O-rings
2. Signal connector shells isolated from chassis, but grounded internally with a jumper wire to the ground post.
3. D-Pace reserves the right to update specifications as part of its ongoing product improvement program.

ISO 100 FLANGE (STANDARD)

8" CF FLANGE OPTION



CONNECTORS AND COOLING: FC-600-F

Connector, Faraday Cup Signal	Isolated BNC ³
Connector, Collimator Signal	Isolated BNC ³
Connector, Electron Suppression Bias	MHV, 500V Maximum
Cooling Water Connections Minimum flow Pressure, minimum Pressure, maximum	6mm Swagelok Tube Fitting 1 liter/min 200 kPa (30psi) 620 kPa (90psi)
Water Tubing, Internal	Cup, bias ring and collimator cooling tubes connected in series with >100 cm of 4 mm I.D. polymer tubing between collimator and bias, and between signal and bias. This eliminates the need for external isolation water tubing.
Current Leakage, DI Water, 1MΩ/cm Water, 1kΩ/cm	Bias to Cup, Bias to Collimator < 200 nA < 200 μA
Grounding Lug	M4 Stud



FARADAY CUP – MODEL FC-50

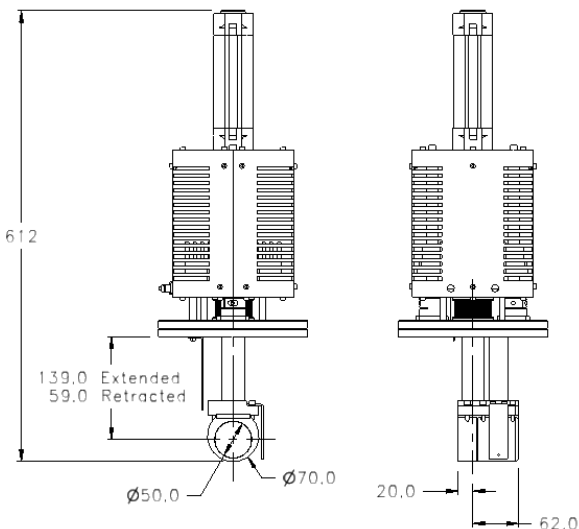
Pneumatically-Actuated Faraday Cup For Ultra High Vacuum Applications



- Measures low-energy charged-particle beam currents (< 1 MeV) up to 50W
- Secondary-electron suppression electrode
- Air-cooled for simplicity
- Beam current read back
- End stop limit switches

SPECIFICATIONS: Faraday Cup, FC-50

Maximum Beam Power	50W
Maximum Travel	80 mm
Cup Inner Diameter	50 mm
Flange	DN 150CF (O.D. 203mm)
Electron Suppression	Bias Ring, 500V Max MHV Connector
Cooling	Air
Current Read back	BNC Connector
Particle Kinetic Energy Range	< 1 MeV
Pneumatic Control	3.5 – 7.0 Bar



Notes:

1. Expansion/retraction distance is configurable for customer's application.
2. D-Pace can provide a custom vacuum box.
3. D-Pace can provide a controller for current-to voltage conversion, limit-switch feedback, and pneumatic control.
4. D-Pace reserves the right to update specifications as part of its ongoing product improvement program.

PS-50 - PRECISION SLITS, 50W

**Manually-Actuated Slits for Ultra High Vacuum
Where High Precision is Required**

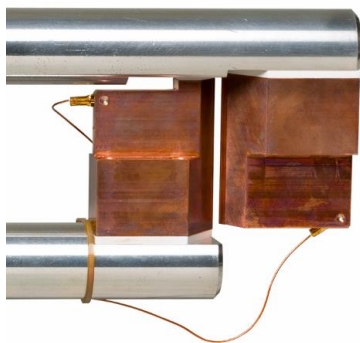


- High accuracy. Ideal for mass spectroscopy
- Measures low-energy charged-particle beam currents (< 1 MeV) up to 50W
- Ambient air cooled for simplicity
- Slit beam current read back³
- Designed for UHV vacuum

The **D-Pace 50W Precision Slits** were designed for mass spectroscopy. This device is manually actuated using a single knob, and has a convenient digital readout which indicates the slit separation distance. The slits are electrically isolated, allowing the current to be read from each slit independently through the BNC connectors on the flange. BNC shorting caps are provided if electrical isolation is not required.

The 50W Precision Slits are air-cooled, eliminating the need for water. This was accomplished with large cross section aluminum rods to conduct heat from the copper slits to heat sinks in ambient air within the device. Low-thermal-expansion Invar rods are used to compensate for high expansion rate materials used to conduct heat. The welded bellows design is UHV compatible and requires no O-rings.

D-Pace can also provide crosses, beamlines, spectrometer magnets, and control systems for a complete spectrometer system.



Electrically-Isolated Copper Slits



Manual adjustment with single knob



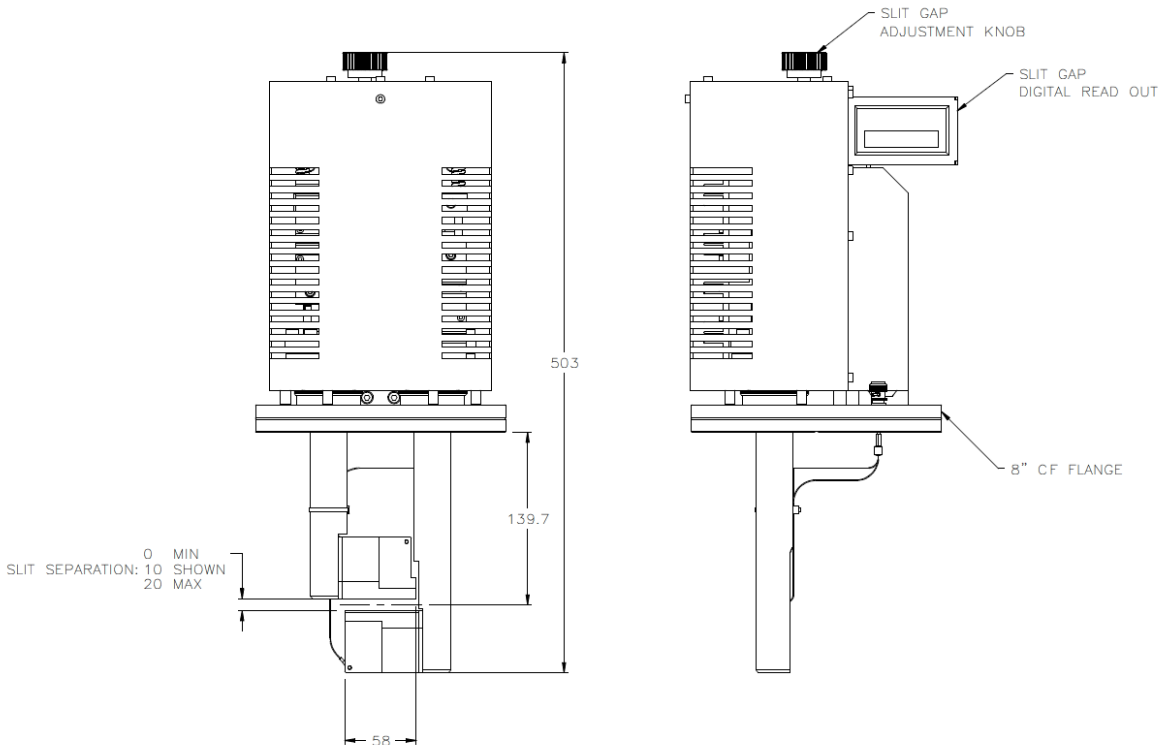
Digital readout of slit gap

SPECIFICATIONS: PS-50

Maximum Beam Power	50W
Slit Adjustment	0.00 – 20.00mm
Slit Width	50 mm ¹
Flange	DN 150CF ² (O.D. 203mm)
Cooling	Ambient Air
Current Read back	2 BNC Connectors ³
Particle Kinetic Energy Range	< 1 MeV
Vacuum	UHV
Absolute Slit Position Relative to Flange	± 0.1mm
Position Resolution	0.05mm

Notes:

1. Plane transverse to slit motion.
2. Designed for use with standard cross with rotatable flange. Bolted from below.
3. Optional. BNC shorting caps are provided.
4. D-Pace reserves the right to update specifications as part of its ongoing product improvement program.





EMITTANCE SCANNER – MODEL ES-4

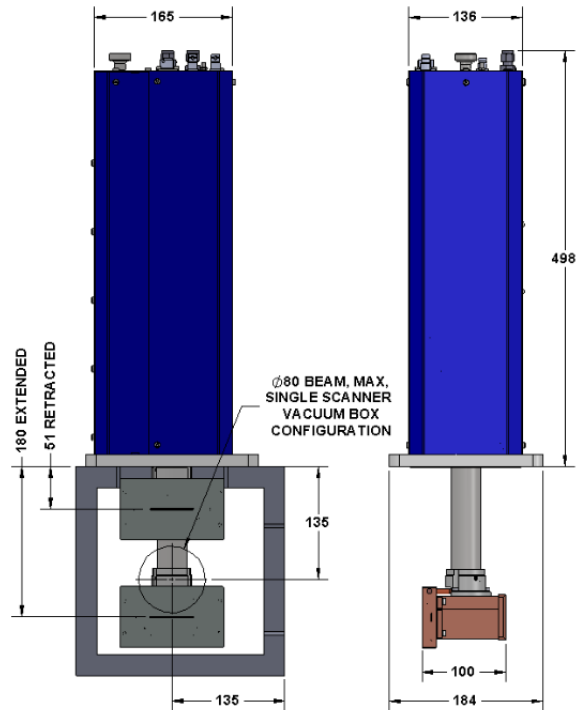
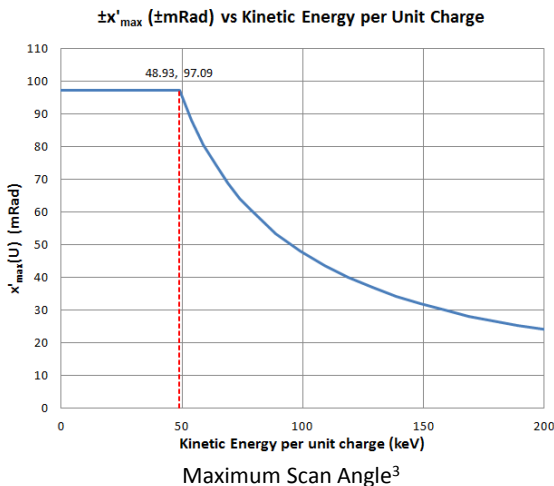
TRIUMF-Licensed Emittance & Phase Space Scanner Probe
With Turnkey Controller and Analysis Software



- Measure magnitude of emittance for low-energy charged particles (<1MeV)
- Water-cooled head for beam power up to 1500W and 500W/cm²
- Determine phase space ellipses by percentage of total beam or by RMS emittance
- Use data for modelling beam transport in ion-optical analysis software
- TRIUMF-licensed technology¹

The D-Pace Emittance and Phase Space Scanner System is an Allison-type emittance scanner, combining an electric trajectory sweep technique with a mechanical position beam sweep, enabling the simultaneous measurement of position (y) and angle (y'). Two probes can be used to scan horizontal and vertical plane phase spaces, or a single head can be used by re-mounting the head on a port 90° to the first. The system includes probe, computer, software, power supplies, and instrumentation.

D-Pace acquisition and analysis software enables the operator to optimize scans for resolution and scan time, and plot beam profiles, 2D and 3D contours with and without emittance ellipses. Data can be exported.



D-Pace can customize the Emittance Probe to customers' requirements. D-Pace provides custom vacuum boxes for single or dual scanners.²