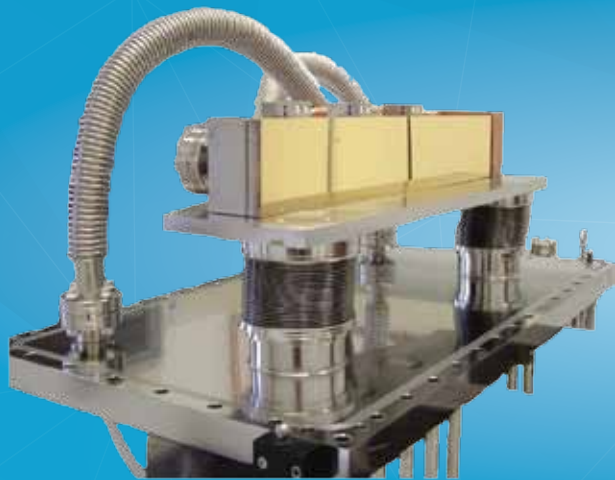


# Synchrotron Instrumentation 2016



Ion Chambers, High Precision Slits, Filters,  
Optics, Precision Engineering System &  
Precision Optical Tables



ISO 9001:2008 Certified  
[www.adc9001.com](http://www.adc9001.com)

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# INTRODUCTION

## ■ ABOUT ADC ■

### ADC an ISO9001 certified company

ADC an ISO9001 certified company, located near Cornell University in Ithaca, New York, is a leading developer and supplier of complex scientific components and instruments for large government laboratories and corporations around the world. Founded as a privately held company in 1995, ADC has grown into one of world's leading technology companies and has enjoyed 18 straight years of business growth and profitability with more than 500 customers located in over 26 countries. ADC's vision is to be a global leader in the development and manufacturing of innovative products for scientific and research markets.



For more information on “ADC” please go to:  
<http://www.adc9001.com>



# OVERVIEW

## Overview of Custom Neutron and High Energy Physics Instrumentation Manufacturing

ADC (ISO9001:2008 certified) has been a leading supplier of high quality instrumentation to the synchrotron, FEL, and high radiation scientific community for over 18 years. Many of our instruments have been in operation nearly that long in facilities around the world. From slits to undulators, ADC has provided instruments both inside and outside the shield wall. Our product portfolio is too broad to list, [please see http://www.adc9001.com/products/show\\_list/id/114 for more details.](http://www.adc9001.com/products/show_list/id/114)

Our engineering design, and build staff are well acquainted with the special requirements of the synchrotron and FEL scientific community such as shielding, stability, precise motion, and UHV. ADC's engineering staff approaches each new application by thoroughly understanding the risks, challenges, and requirements. Our intimate knowledge of synchrotron operations gives us a solid basis for "filling in the blanks" in our customer's specifications. We have developed the art of project management to a high degree; thereby ensuring complex instruments are delivered on time.

Our engineers begin each project with a specification check-list and thorough research of prior designs both by ADC and others as well as input from our customers via the specification and direct communication. We then develop a project plan that is executed by the project manager. A solid 3D model is developed and reviewed with the customer. Calculations and FEAs are then performed for load capacity, deflections, thermal distortion, and application specific requirements. A stack up of tolerances analysis is performed. Motion profiles and motor sizing is also performed to meet specific needs. The design is reviewed at a Preliminary Design Review (PDR) typically at the ADC site and a Final Design Review (FDR) at the customer site where more customer personnel can be in attendance.

The project is then detailed and passed to the ADC Operations Manager who develops the travelers for project. The travelers are then executed in ADC's extensive, State-of-the-Art, machine shop along with critical inspections. Our shop machining philosophy is to machine the parts to the best of our ability even if the tolerance requires less precision. The components are assembled and tested in ADC's various assembly areas according to requirements for clean room (UHV), vibrational stability, and special instrumentation. Each new device is tested according to a factory acceptance plan (FAT) that is developed in conjunction with the customer. The customer is welcomed and encouraged to visit ADC at any time but especially for FAT.

The instrument is not shipped until the customer sign-off. ADC is also extensive experience crating sensitive instruments for shipment around the world with no damage. Site acceptance (SAT), installation, and commissioning options are available. ADC's service after the sale is impeccable.

The attached catalog provides more information on our custom designed synchrotron instruments along with specific applications and references. Additional details are provided for calculations, FEAs, frequency response, repeatability measurements, loading, testing, quality control, electronics instrumentation, and controls are available for each application on request. We hope you find our product line exceeds your needs and our friendly staff willing to satisfy your specific requirements. Please do not hesitate to contact ADC for further details.



**BUREAU VERITAS**  
Certification



## **ADVANCED DESIGN CONSULTING USA, INC.**

126 Ridge Rd  
Lansing, NY, 14882 USA

*Bureau Veritas Certification Holding SAS – UK Branch certifies that the Management System of the above organization has been audited and found to be in accordance with the requirements of the management system standards detailed below*

*Standards*

### **ISO 9001:2008**

*Scope of certification*

**Design, manufacture, and delivery of devices, integrated systems, components and instruments for commercial, academic and government agencies**

Certification cycle start date: **31 December 2014**

Subject to the continued satisfactory operation of the organization's Management System, this certificate expires on: **30 December 2017**

Original certification date: **31 December 2014**

Certificate No. **US007466-1**

*Signed on behalf of BVCH SAS – UK Branch*

Certification body address: 66 Prescott Street, London, E1 8HG, United Kingdom

Issuing office: Bureau Veritas Certification North America, Inc.  
390 Benmar Drive, Houston, Texas, USA  
[www.us.bureauveritas.com/bvc](http://www.us.bureauveritas.com/bvc)



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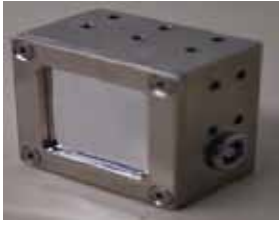







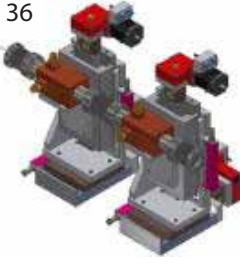





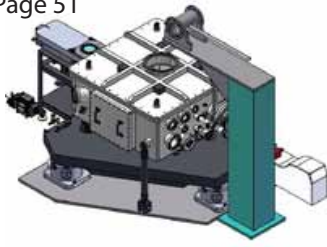



Further clarifications regarding the scope of this certificate and the applicability of the management system requirements may be obtained by consulting the organization.  
To check this certificate validity please call **+(800) 937-9311**.

# SYNCHROTRON

## Instrumentation Projects

[http://www.adc9001.com/products/show\\_list/id/114](http://www.adc9001.com/products/show_list/id/114)

The following section is based on ADC's custom and standard designed synchrotron projects completed over our 18 years of business. For more information on these projects please visit the website link listed above, or feel free to contact ADC at any time.

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Fluorescent Screen Assembly (FC-204)	Filter Array	APS 20-BM Mirror	Motion System for KB Mirror
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High Res extreme-ultraviolet-light (EUV) microscope	APS Double Crystal Monochromator	DLS Double Crystal Deflector	Cryo-Cooled Double Crystal Monochromator



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Focusing Mirror System for Argonne

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University of Georgia Motion System for KB Mirror

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BNL X13A Optical System

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BNL Mirror

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Synchrotron Beamlines

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Soft X-ray Scattering Octupole End Station

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Standard Pentacene Film Growth Instrument

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High Pressure Cryo-Cooler for Crystallography

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Beryllium Windows

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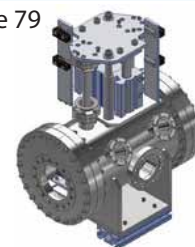
Beam Pipes

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Photon Shutter

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Bremsstrahlung Safety Shutter

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Emergency Line Stop with Tungsten Backing

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Beam Safety Shutter APS (SS3)

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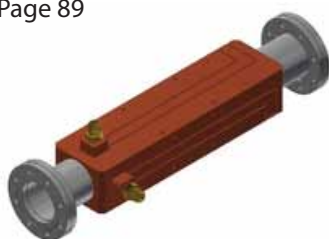
Beam Shutters APS (IS9)

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High Heat Load Primary Aperture

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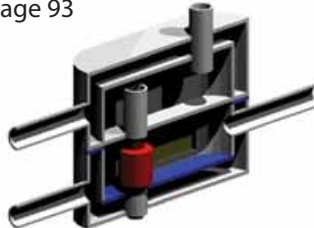
Secondary and Tertiary Apertures

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High Heat Load Beam Stop

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Cryostatic Micro-CT Imaging of Transient Process System

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Exchange System for Protein Crystallography

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X-Ray Ovens



# ION CHAMBERS

<http://www.adc9001.com/products/view/91>

ADC's ion chambers are designed for precise, low noise x-ray measurement. The electrodes are constructed of nickel plated copper on fiberglass supports, all housed within a nickel plated aluminum frame.



IC-400 Series



IC-500 Series



Micro Ion Chamber



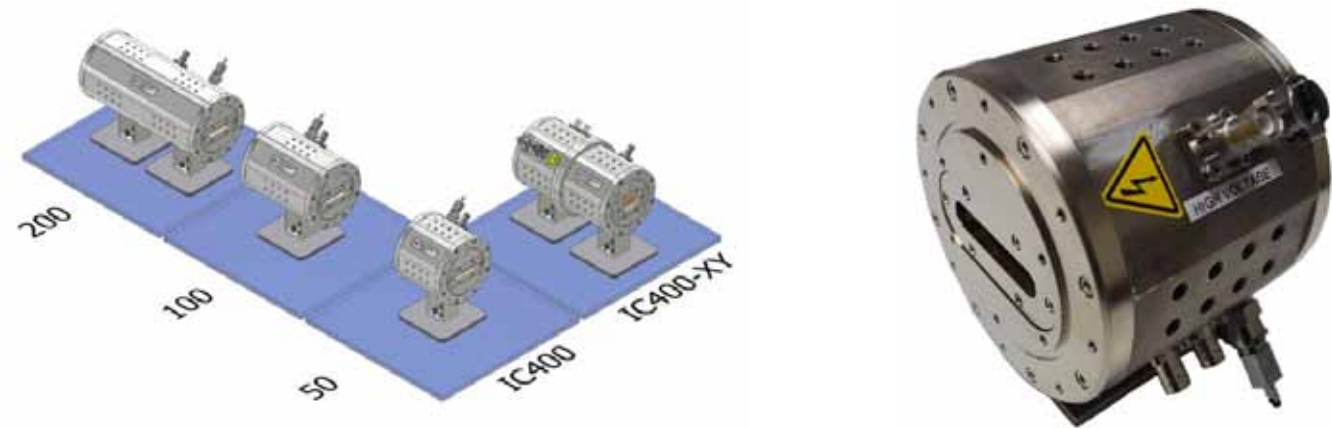
Custom Ion Chambers





# ION CHAMBER

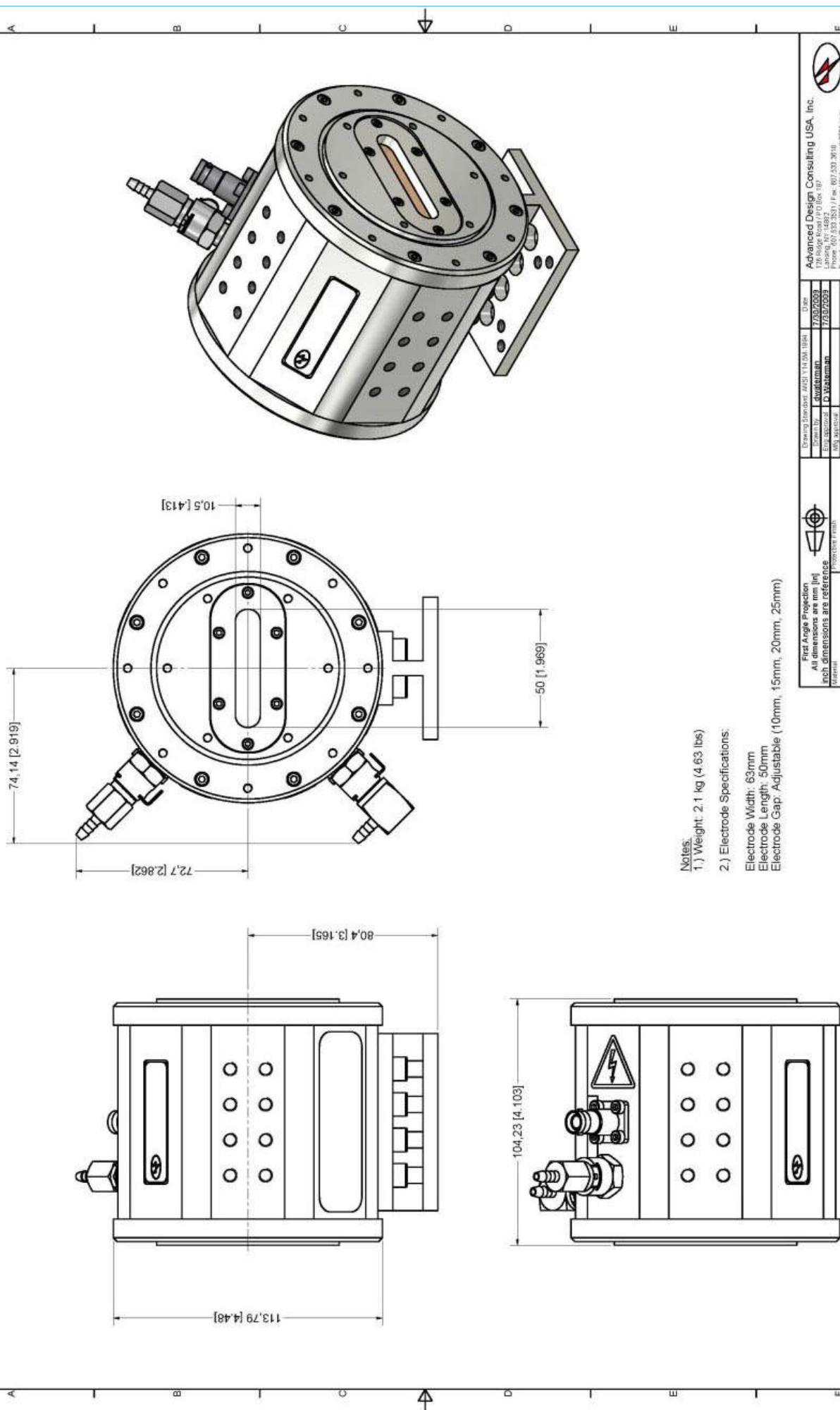
## 400 series

<http://www.adc9001.com/IC-400-Series>

ADC's ion chambers are designed for precise, low noise x-ray measurement. The device allows user to determine the change in beam position in a single axis by comparing two signals that are created as the beam passes through the Ion Chamber. By connecting two Ion Chambers together at 90° you can determine the horizontal and vertical beam position. The system can be configured for air, vacuum, or ultra high vacuum operation through one of three interfaces. One unique feature of ADC's precision ion chambers is the incorporation of a split collector plate. The electrode is split in a sawtooth configuration with a height of approximately 10mm that, when the differe



				
	IC-400 – 50	IC-400 – 100	IC-400 – 200	IC-400 – 50-XY
WINDOW APERATURE	25 MM X 40 MM	25 MM X 40 MM	WINDOW APERATURE	WINDOW APERATURE
KAPTON WINDOW	25, 50, AND 125	25, 50, AND 125	KAPTON WINDOW	KAPTON WINDOW
BODY MATERIAL	ALUMINUM 6061	ALUMINUM 6061	BODY MATERIAL	BODY MATERIAL
ELECTRODE GAPS	10, 15, 20, AND 25 MM	10, 15, 20, AND 25 MM	ELECTRODE GAPS	ELECTRODE GAPS
ELECTRODES	GOLD PLATED WITH GUARD RINGS	GOLD PLATED WITH GUARD RINGS	ELECTRODES	ELECTRODES
ELECTRODE LENGTHS	50 MM	100 MM	ELECTRODE LENGTHS	ELECTRODE LENGTHS
WORKING PRESSURE	0.7-1.3 BAR ABSOLUTE PRESSURE	0.7-1.3 BAR ABSOLUTE PRESSURE	WORKING PRESSURE	WORKING PRESSURE
OPERATING POTENTIAL	UPTO 1.7 KV	UPTO 1.7 KV	OPERATING POTENTIAL	OPERATING POTENTIAL
DIMENSIONS (W/O BASE)	113.8(W) X 104.3(L) X 113.8(H) MM	113.8(W) X 154.3(L) X 113.8(H) MM	DIMENSIONS (W/O BASE)	DIMENSIONS (W/O BASE)
LOW VOLTAGE ELECTRODE	FEMALE BNC PANEL MOUNT CONNECTOR	FEMALE BNC PANEL MOUNT CONNECTOR	LOW VOLTAGE ELECTRODE	LOW VOLTAGE ELECTRODE
HIGH VOLTAGE ELECTRODE	SHV RF PANEL MOUNT CONNECTOR	SHV RF PANEL MOUNT CONNECTOR	HIGH VOLTAGE ELECTRODE	HIGH VOLTAGE ELECTRODE



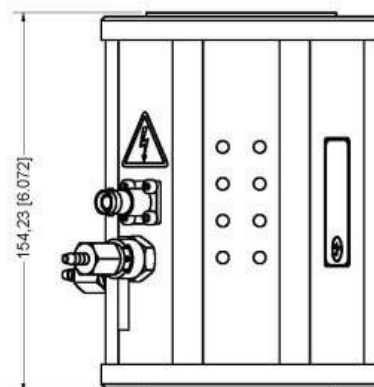
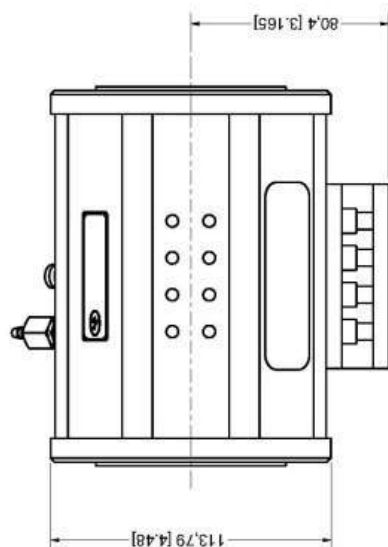
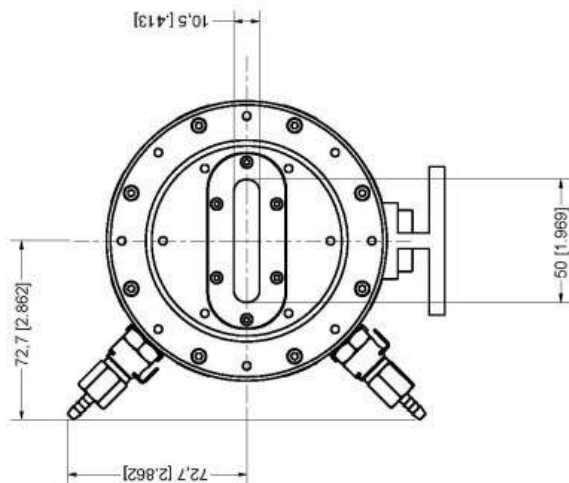
Notes:  
 1.) Weight: 2.1 kg (4.63 lbs)  
 2.) Electrode Specifications:  
 Electrode Width: 63mm  
 Electrode Length: 50mm  
 Electrode Gap: Adjustable (10mm, 15mm, 20mm, 25mm)

<p>First Angle Projection          All dimensions are mm [in]          inch dimensions are reference</p>		<p>Drawing Standard: ANSI Y14.5M 1994</p> <p>Scale: 1:1</p> <p>Sheet No: 1700/0009</p> <p>Rev: 01</p> <p>Author: D. Waldman</p> <p>Appr: [Signature]</p>		<p>Advanced Design Consulting USA, Inc.          10000 E. 1st Ave. Suite 100          Denver, CO 80231          Phone: 303.333.3333 / Fax: 303.333.3610          Email: info@adcs501.com Web: www.adcs501.com</p>	
<p>Part Number: IC-400-50</p>		<p>Revision: 3</p>		<p>Size: A2</p>	
<p>UNLESS OTHERWISE SPECIFIED</p>		<p>Material: 304 Stainless Steel</p>		<p>Finish: Polished</p>	
<p>Surface Finish: Ra 0.3</p>		<p>Hardness: HRC 20-22</p>		<p>Weight: 2.1 kg (4.63 lbs)</p>	

IC-400-50

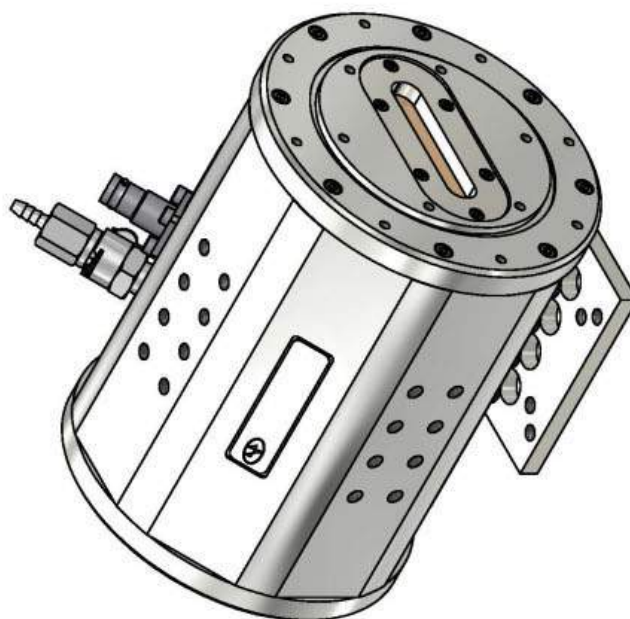




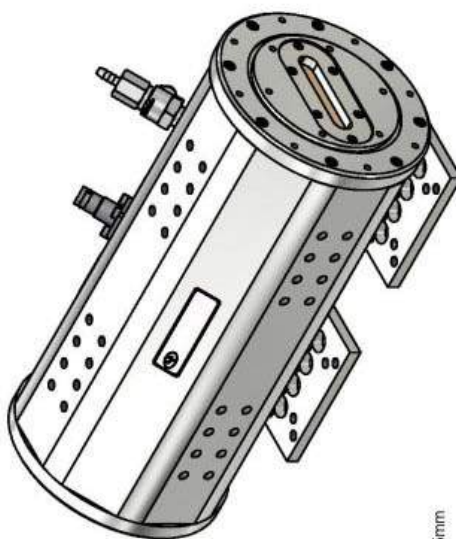
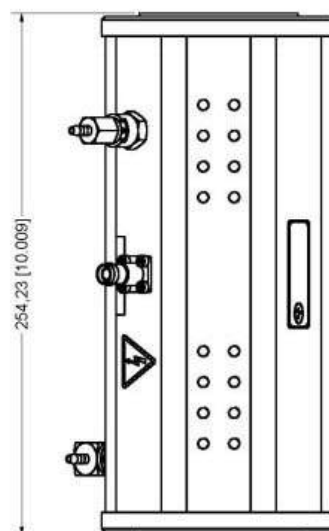
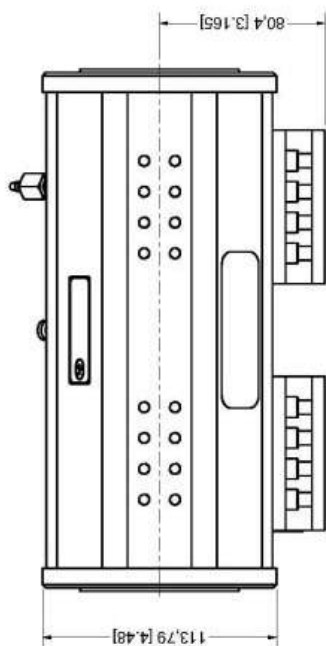
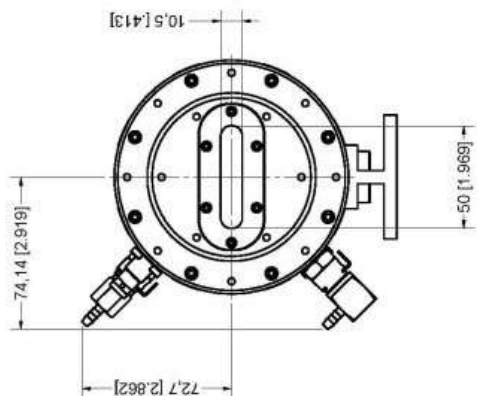


Specifications:

- 1.) 50 mm X 10mm Window
- 2.) Adjustability of Plates in 5mm Increments from 10mm to 25mm
- 3.) Weight: 2.890 kg [6.37 lb]

[illegible]

Purchased Part Modification	No
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# Specifications:

- 1.) 50mm X 10mm Window
- 2.) Adjustability of Plates in 5mm Increments from 10mm to 25mm
- 3.) Weight: 4.615 kg [10.175 lbs]

<p>First Angle Projection All dimensions are mm [in] inch dimensions are reference</p>		<p>Drawing Standard: ASME Y14.5M-1994</p> <p>Drawn by: <u>disalman</u></p> <p>Eng. approval: <u>D. Maksum</u></p> <p>AW approval: _____</p> <p>AW approval: _____</p>		<p>Date: 7/3/2009</p> <p>Part Number: 30172011</p>		<p>Advanced Design Consulting USA, Inc.</p> <p>13400 Old Highway 100, Suite 100 Lansing, MI 48226 Phone: 313.333.3333 / Fax: 313.333.3333 Email: info@adcsusa.com / Web: www.adcsusa.com</p>	
<p>UNLESS OTHERWISE SPECIFIED</p> <p>Material: <u>N/A</u></p> <p>Finish: <u>638</u></p> <p>Surface: <u>0.25 A B C</u></p> <p>Dimensions: <u>0.25 A B C</u></p>		<p>IC-400-200</p>		<p>IC-400-200</p>		<p>IC-400-200</p>	
<p>Purchased Part Modification</p>		<p>Revision</p>		<p>Part Number</p>		<p>Sheet</p>	
<p>4</p>		<p>3</p>		<p>7</p>		<p>8</p>	

IC-400-200




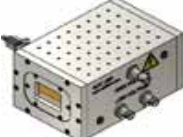

# ION CHAMBER

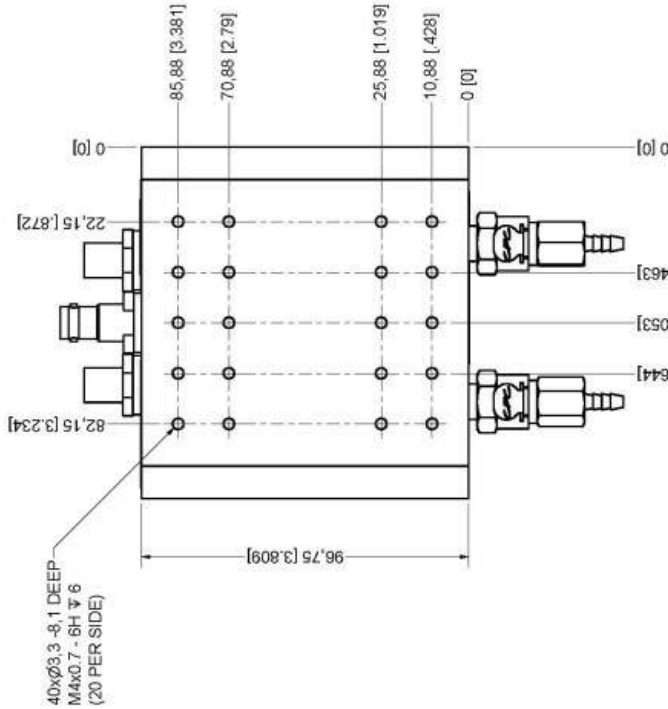
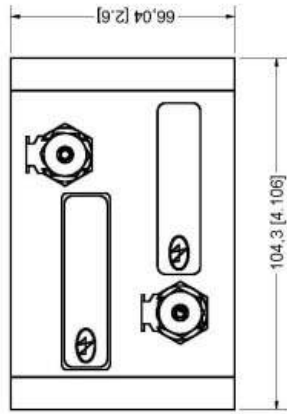
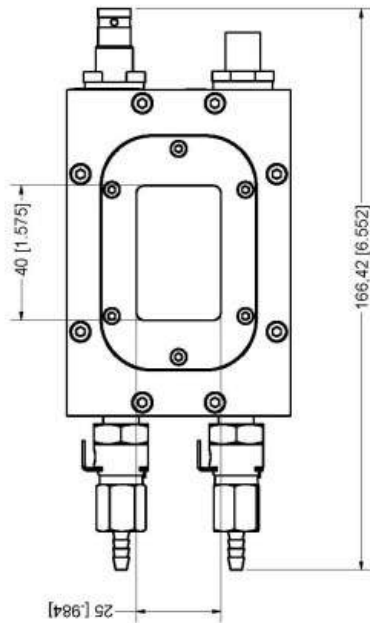
## 500 series

<http://www.adc9001.com/IC-500-Series>

ADC's ion chambers are designed for precise, low noise x-ray measurement. The electrodes are constructed of nickel plated copper on fiberglass supports, all housed within a nickel plated aluminum frame.

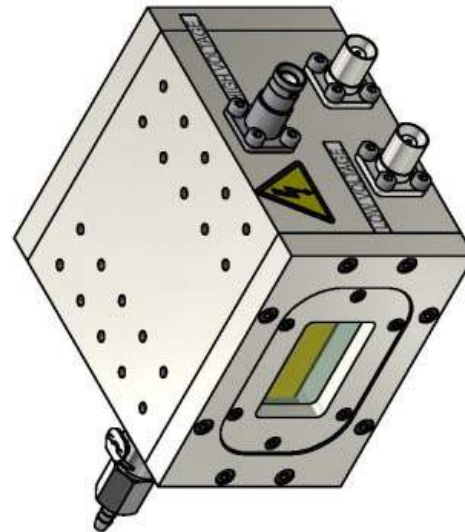


			
	IC-500-50	IC-500-100	IC-500-200
WINDOW APERTURE	25 MM X 40 MM	25 MM X 40 MM	25 MM X 40 MM
KAPTON WINDOW	25, 50, AND 125	25, 50, AND 125	25, 50, AND 125
BODY MATERIAL	ALUMINUM 6061	ALUMINUM 6061	ALUMINUM 6061
ELECTRODE GAPS	10, 15, 20, AND 25 MM	10, 15, 20, AND 25 MM	10, 15, 20, AND 25 MM
ELECTRODES	GOLD PLATED WITH GUARD RINGS	GOLD PLATED WITH GUARD RINGS	GOLD PLATED WITH GUARD RINGS
ELECTRODE LENGTHS	50 MM	100 MM	200 MM
WORKING PRESSURE	0.7-1.3 BAR ABSOLUTE PRESSURE	0.7-1.3 BAR ABSOLUTE PRESSURE	0.7-1.3 BAR ABSOLUTE PRESSURE
OPERATING POTENTIAL	UPTO 1.7 KV	UPTO 1.7 KV	UPTO 1.7 KV
DIMENSIONS (W/O BASE)	96.75(W) X 104.3(L) X 66(H) MM	96.75(W) X 154.3(L) X 66(H) MM	96.75(W) X 254.3(L) X 66(H) MM
LOW VOLTAGE ELECTRODE	FEMALE BNC PANEL MOUNT CONNECTOR	FEMALE BNC PANEL MOUNT CONNECTOR	FEMALE BNC PANEL MOUNT CONNECTOR
HIGH VOLTAGE ELECTRODE	SHV RF PANEL MOUNT CONNECTOR	SHV RF PANEL MOUNT CONNECTOR	SHV RF PANEL MOUNT CONNECTOR

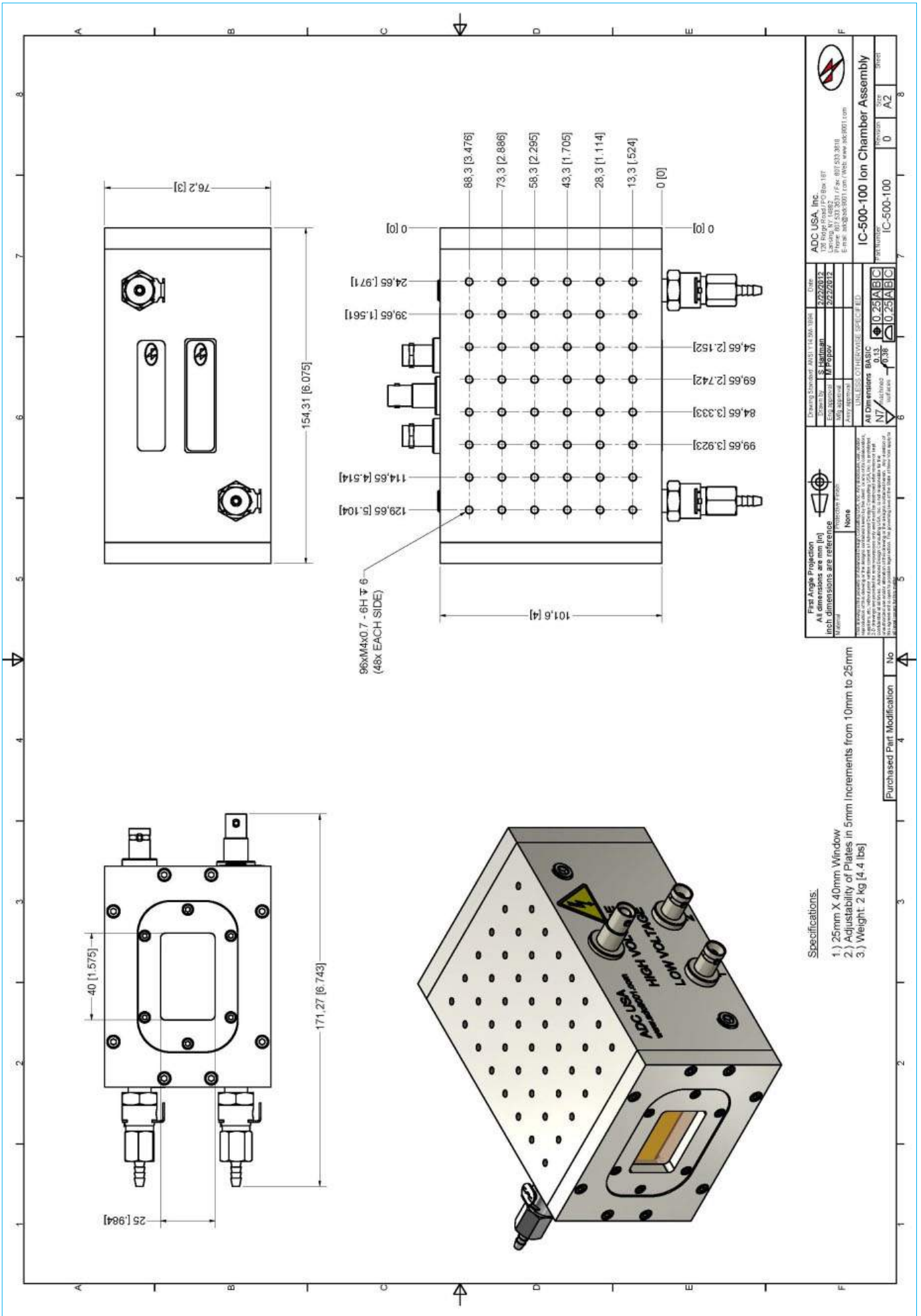


#### Specifications:

- 1.) 25mm X 40mm Window
- 2.) Adjustability of Plates in 5mm Increments from 10mm to 25mm
- 3.) Weight: 1.195 Kg [2.635 lb]

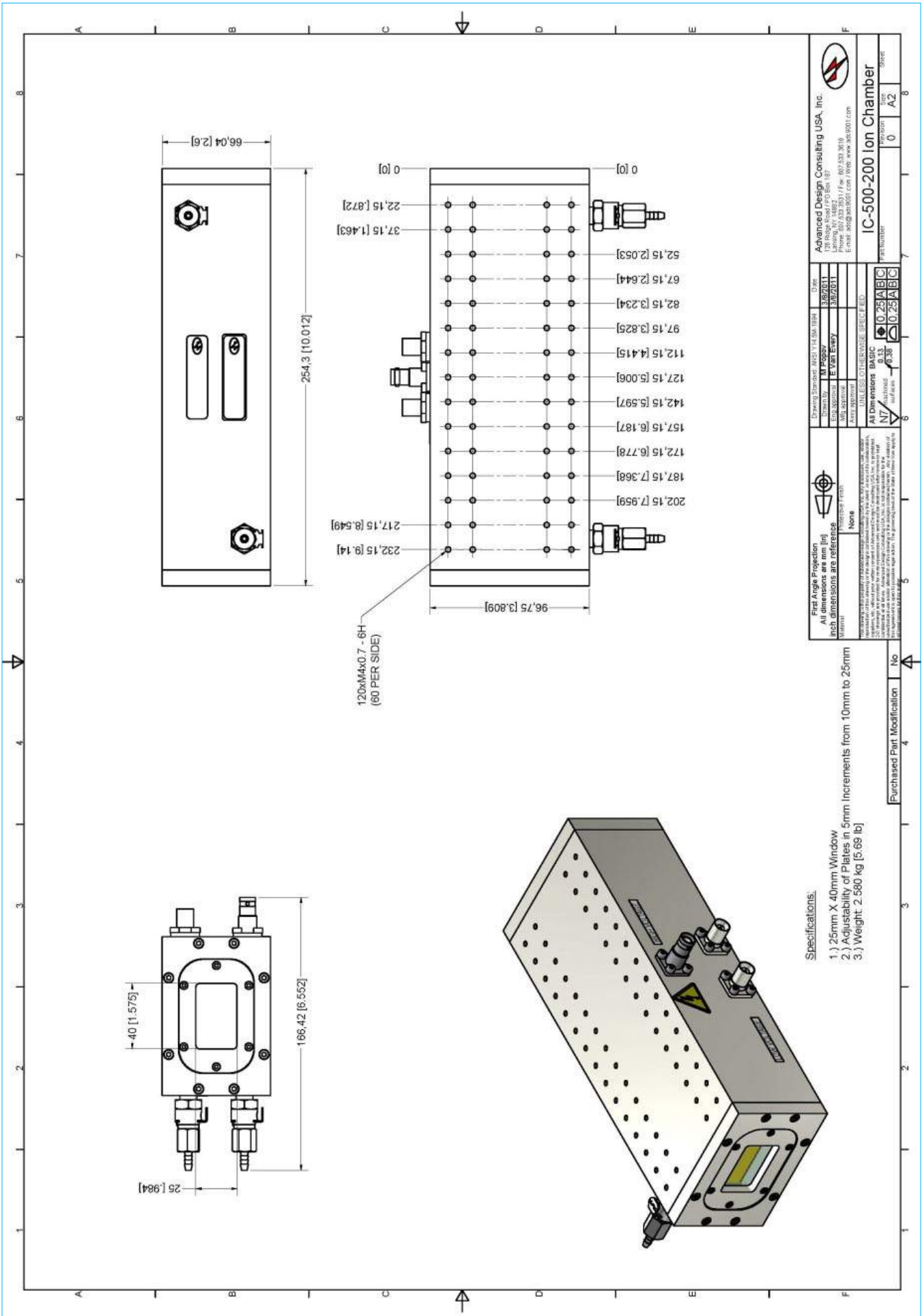


<b>First Angle Projection</b> All dimensions are mm [in] Inch dimensions are reference			Drawing Standard: ANSI Y14.5M-1982 Date: 3/6/2011 Drawn by: M. Pappas Eng. approval: 3/6/2011 Mfg. approval: Assy. approval:	Advanced Design Consulting USA, Inc. 730 Highway 101, Suite 101 Lakeland, NY 14882 Phone: 801.503.3031 Fax: 801.503.3014 E-Mail: info@adc-usa.com Web: www.adc-usa.com	
<b>Particulars</b> Part Name: IC-500-50 Ion Chamber Part Number: 025ABC Revision: 0 Size: A2 Sheet: 1 of 1		Part Name: IC-500-50 Ion Chamber Part Number: 025ABC Revision: 0 Size: A2 Sheet: 1 of 1	Purchased Part Modification No. 4		



IC-500-100





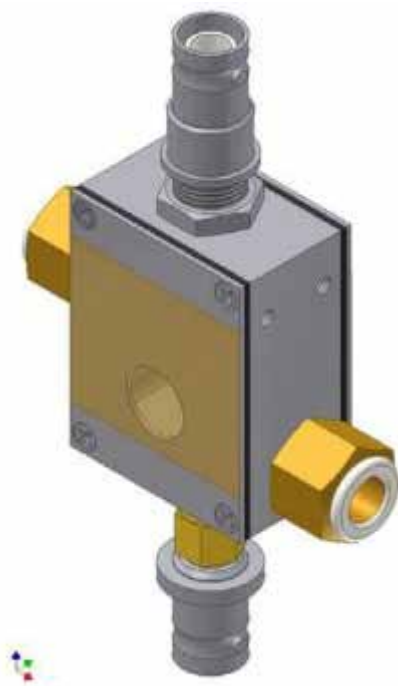
IC-500-200

# MICRO ION CHAMBER

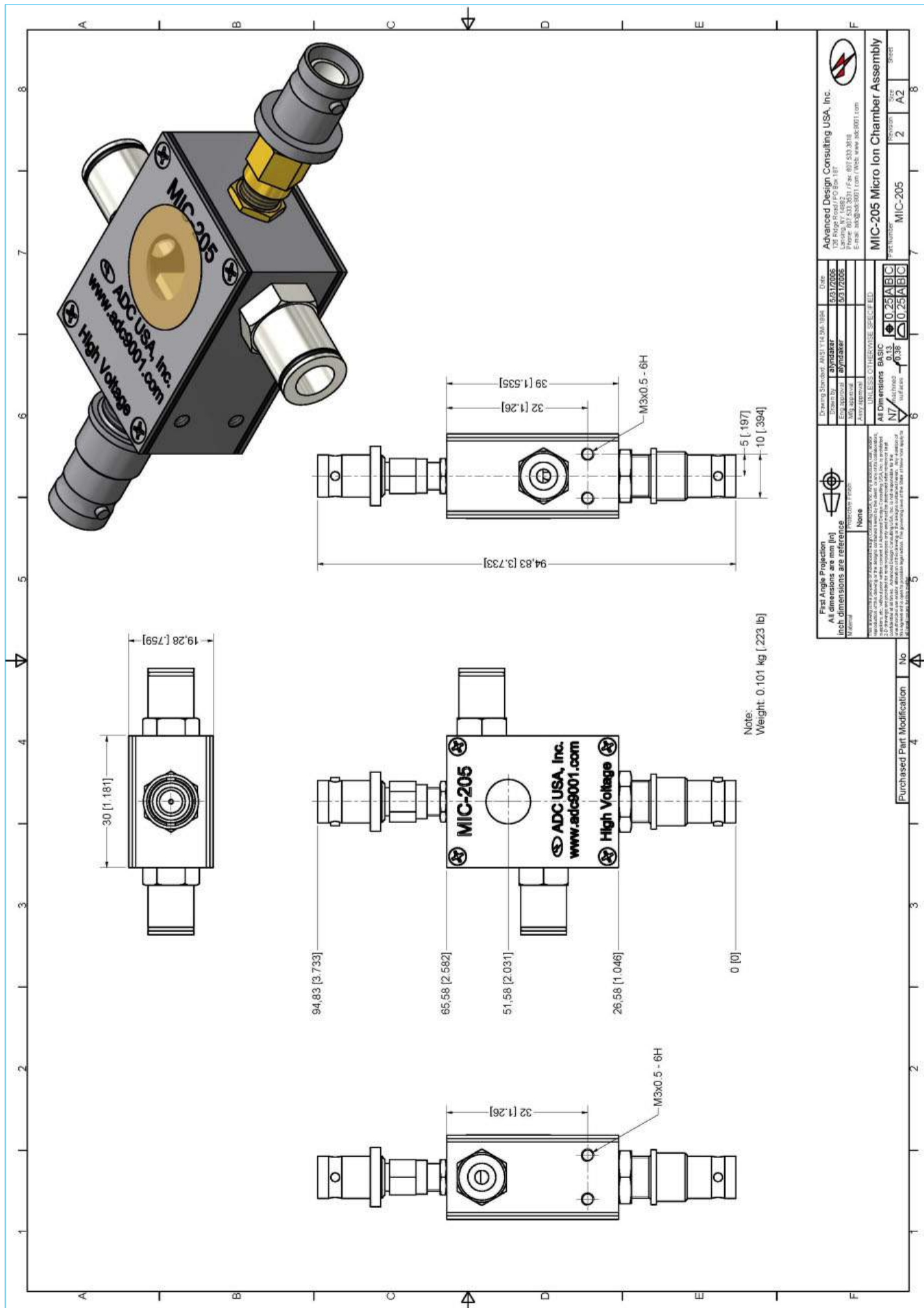
## MIC-205




<http://www.adc9001.com/Micro-Ion-Chamber>

A small ionization chamber detector has been developed for monitoring the intensity of hard X-ray beam for Synchrotron facilities around the world. The small dimensions of the ionization chamber (20 mm along the beam direction and 30 mm perpendicular to it) make it possible to place it very close to the sample. The housing of the detector is made of stainless steel, nickel-plated copper electrodes, SHV and BNC electrical connectors, and gas connectors. Sparking voltage is approximately 5500V under the atmospheric environment and leakage rate of gas is less than 2 torr/5 minutes under 10 torr vacuum environment.



MIC-205	
WINDOW APERTURE	10 MM DIAMETER
DIMENSIONS	19.28(W) X 56.07(L) X 94.83(H) MM
ORDER PART NUMBER	MIC-205



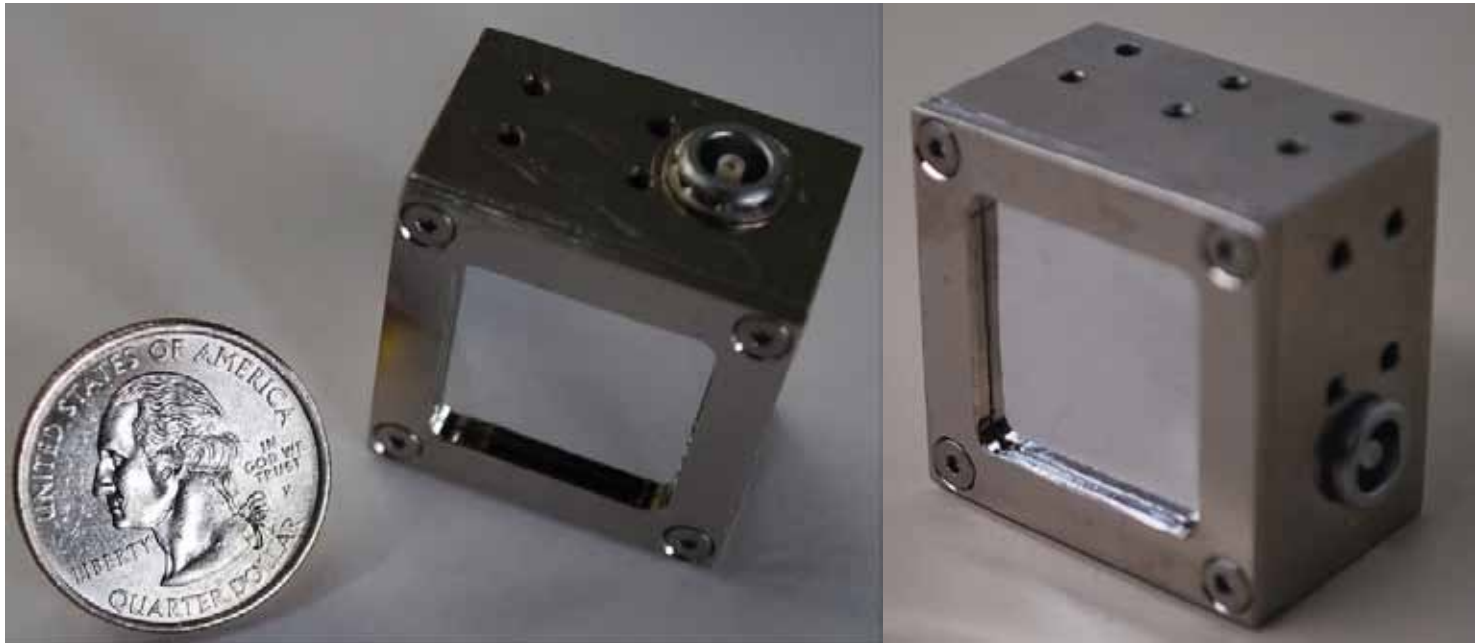
 First Angle Projection All dimensions are in (in) Inch dimensions are reference	 Micro Ion Chamber Assembly	Drawing Standard: ANSI Y14.5M-1994 Drawn by: aydaxer Eng. Approval: aydaxer Date: 5/31/2005	Date: 5/31/2005 Part Number: 30312005	Advanced Design Consulting USA, Inc. 126 Ridge Road, P.O. Box 187 Lansing, MI 48906 Phone: 517.537.5331 Fax: 517.537.3818 E-mail: info@adcs9001.com Web: www.adcs9001.com		
				MIC-205 Micro Ion Chamber Assembly		
UNLESS OTHERWISE SPECIFIED		Part Number: 30312005		Revision: 2		8
All Dimensions BASIC Tolerances: 0.13 Surface Finish: 0.38 Material: 303 Stainless Steel		MIC-205		Size: 2		



# X-RAY COUNTER AND BEAMSTOP

<http://www.adc9001.com/products/view/667>

This compact detector is designed for alignment and direct measurement of X-ray beams. The detector system consists of a photodiode and miniature coaxial connector to interface with an electronics package. Three different photodiode sizes are available: 20mm x 20mm, 10mm x 10mm, and 5mm x 5mm. Each size is mounted in aluminum housing. An array of mounting holes on the housing allows for several mounting configurations. A layer of aluminized Mylar film covers the photodiode to absorb visible light. The detector can be provided as UHV-ready with vacuum compatible finishes and components. Connecting the detector to a pre-amplifier electronics package can provide voltage readout, variable signal gain, and frequency output. ADC recommends the use of a low-noise current amplifier such as Stanford Research Systems SR570 unit, which can be purchased and provided with the detector.



## Features

<b>Linearity (for 4 decades)</b>	1%
<b>Dark Current Signal</b>	<0.3 pA
<b>Measurable flux</b>	$10^{14}$ photons/sec
<b>Usable Energy Range</b>	4 - 50 keV
<b>Amplifier Gain</b>	100 pA/V – 1 mA/V

## Mechanical Dimensions

<b>Photodiode Active Area</b>	20mm x 20mm; 10mm x 10mm; 5mm x 5mm
<b>Photodiode Thickness</b>	0.41mm
<b>Housing Size</b>	28mm x 27mm x 20mm



# CUSTOM ION CHAMBERS

[http://www.adc9001.com/products/show\\_list/id/175](http://www.adc9001.com/products/show_list/id/175)

The following section is based on ADC's custom designed Ion Chambers. For more information on these projects please visit the website link listed above, or feel free to contact ADC at any time.



ALBA Ion Chamber



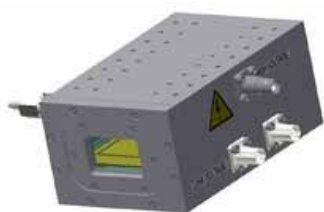
ANKA Custom Ion Chambers



APS-HP-CAT Custom Ion Chambers



CLS Custom Ion Chambers



DLS Custom Ion Chambers



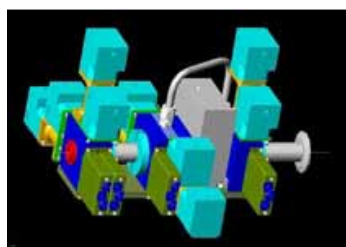
APS Custom Ion Chambers-3



APS Custom Ion Chambers-2



ADC Old Style Ion Chambers



ALS-Slits-Ion Chamber Assembly



Australia Ion Chamber






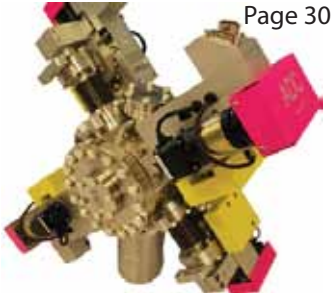

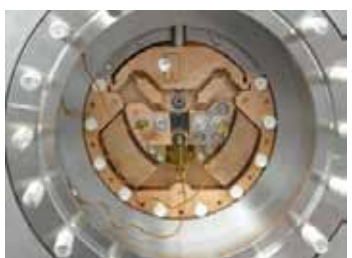
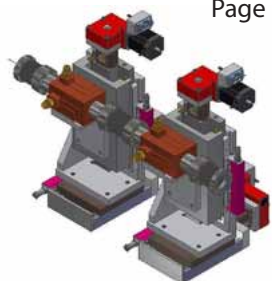

X-Ray Beam Monitor (XBM)



# HIGH PRECISION SLITS

[http://www.adc9001.com/products/show\\_list/id/112](http://www.adc9001.com/products/show_list/id/112)

ADC (ISO9001:2008 certified) has been a leading supplier of slits to the synchrotron and neutron source scientific community for over 18 years. Many of our slits have been in operation nearly that long in facilities around the world. Our standard slits run the range from in-air monochrome beam to UHV high heat load white beam. In co-operation with CHESS at Cornell, we have developed the very best blade polishing available in the industry today. We have built an extended family of standard slits in application categories though continuous improvement in our designs - please see <http://www.adc9001.com/SLITS>. These improvements have come from our custom designs for customers that require improved space constraints, heat load capacity, low reflectance and scatter, blade stability, and precision positioning – for more information please see [http://www.adc9001.com/products/show\\_list/id/142](http://www.adc9001.com/products/show_list/id/142)

 Page 24	 Page 26	 Page 28	 Page 30
X-Ray Slits SLT-100-P	X-Ray Slits SLT-50-P	SLT-310 X-Ray UHV Slit System	SLT-400-250 UHV High Precision Slit System Uncooled
 Page 32	 Page 34	 Page 36	 Page 38
SLT-600 UHV High Precision X-Ray Slit System (Cooled & Uncooled)	SLT-800 Exit Slit	SLT-1200-Cooled UHV High Heat Load OFHC-Glidcop Slit	Custom Slits

For detailed information regarding ADC's Standard and Custom Slits please refer to our 2016 Slit Catalog or visit the following website:

<http://www.adc9001.com/ABOUT-US/Catalogs>

# X-RAY SLIT

## ■ SLT-100-P

For more information please visit the following website:  
<http://www.adc9001.com/SLT-100-10>



### SLT-100-P Specifications and Options

Aperture size	24 mm x 24 mm Blades can go "past closed" without clashing "Fully overlap"
Resolution	<0.16 $\mu$ m precision*
Accuracy	Accuracy $\pm$ 2 $\mu$ m
Blade material	Tungsten or Tantalum, Tungsten Carbide, Cadmium, Boron Nitride
Blade Thickness	Standard 1.5 mm Thicker blade available; 5, 7 and 10 mm thick blade upon request.
Blade Options	Knife-edge profile (2 degrees slope) Or round blade edge Roughness of the jaw edge surface: <0.2 $\mu$ m (rms)
Environmental Options	Air or Vacuum (Tested to 10 <sup>-6</sup> mbar)
Overall Dimensions	Vacuum: 235 mm x 209 mm x 104 mm Air: 235 mm x 209 mm x 77 mm
Gearhead Options	Motors come with optional gearhead to increase resolution, 5:1, 10:1
Blade Beam Monitoring	Each blade is isolated to have the ability to monitor the current off the blade
Locking Manual Knobs	Each motor comes standard with a manual locking knob with scale
Encoder Options	Standard: Optional differential rotary encoder By request: Internal linear encoder
Motor Options	Bi-polar 2-phase steppers, 5-phase stepper, and IMS motors



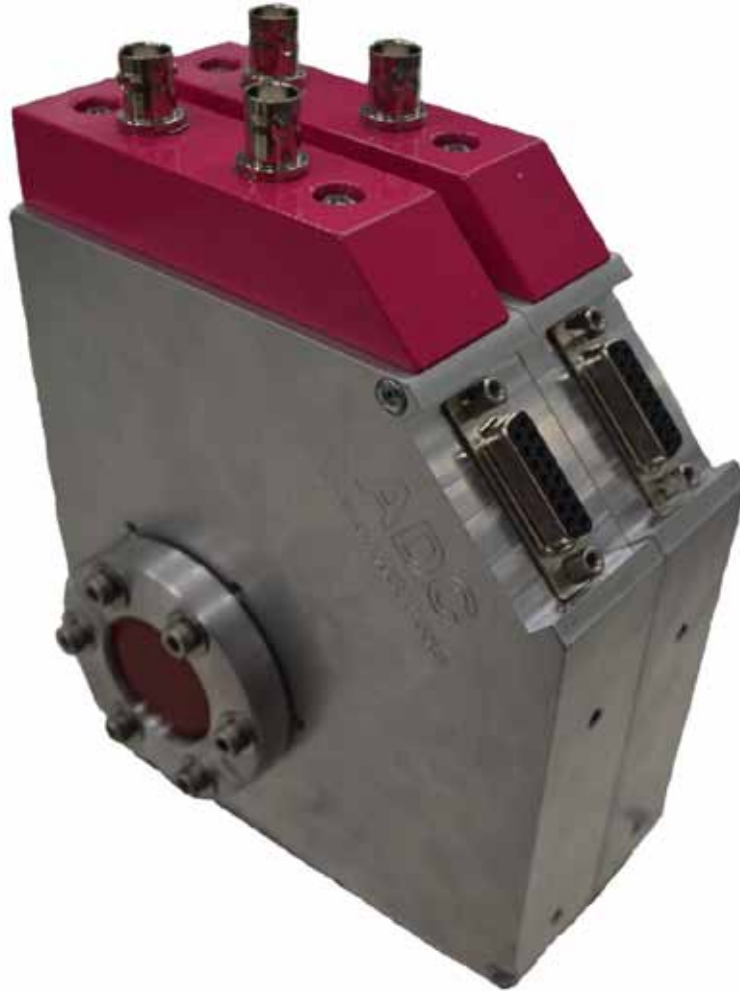


# X-RAY SLITS

## SLT-50-P

For more information please visit the following website:

<http://www.adc9001.com/SLT-200-10>



### SLT-50-P Specification

Aperture size	6 mm x 6 mm Blades can go "past closed" without clashing "Fully overlap"
Resolution	~ 50 nm scanning precision & ~160 nm aperture precision
Accuracy	Accuracy $\pm 2 \mu\text{m}$
Blade material	Tungsten or Tantalum, Tungsten Carbide, Cadmium, Boron Nitride
Blade Thickness	Standard 2 mm Thicker blade available; 5, 7 and 10 mm thick blade upon request.
Blade Options	Knife-edge profile (2 degrees slope) Or round blade edge Roughness of the jaw edge surface: $<0.2 \mu\text{m}$ (rms)
Environmental Options	Air or Vacuum (Tested to $10^{-6}$ mbar)
Overall Dimensions	Vacuum: 133 mm x 171 mm x 98 mm Air: 133 mm x 171 mm x 70 mm
Blade Beam Monitoring	Each blade is isolated to have the ability to monitor the current off the blade

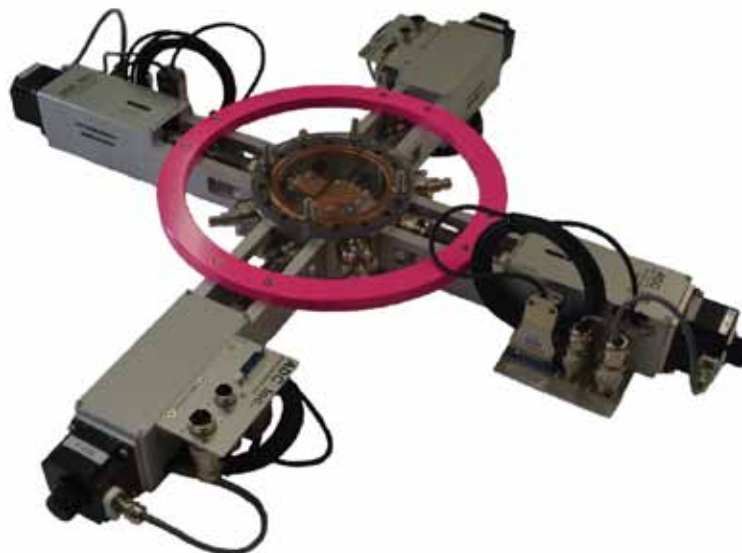


# X-RAY UHV SLIT SYSTEM

## SLT-310

For more information please visit the following website:

<http://www.adc9001.com/SLT-300-10>



### SLT-310 X-Ray UHV Slit System Specification:

Aperture size	20 mm, 25 mm, 50 mm, & 60 mm
Resolution	<0.16 $\mu$ m precision*
Accuracy	$\pm 2 \mu$ m
Blade material	Tungsten or Tantalum, Tungsten Carbide, Cadmium, Boron, copper, Nitride, or custom Blades can go "past closed" without clashing (Overlapping/Zero beam ~6mm)
Blade Thickness	Standard 1.5 mm Thicker blade available; 5, 7 and 10 mm thick blade upon request.
Blade Options	Knife-edge profile (2 degrees slope) Or round blade edge Roughness of the jaw edge surface: <0.2 $\mu$ m (rms)
Vacuum	Vacuum rated to better than $5 \times 10^{-10}$ mbar and have a leak rate of less than $1 \times 10^{-9}$ mbar-l/s.
Gearhead Options	Motors come with optional gearhead to increase resolution, 5:1, 10:1
Blade Beam Monitoring	Each blade is isolated to have the ability to monitor the current off the blade
Encoder Options	Standard: Renishaw (Incremental or Absolute) By request: Heidenhain, Other
Motor Options	Standard: Bi-polar 2-phase steppers By request: 5-phase stepper and IMS motors
Image Screen Options	Using fluorescent screen fixed to vertical upper and lower blade, single crystal YAG (Yttrium Aluminum Garnet)



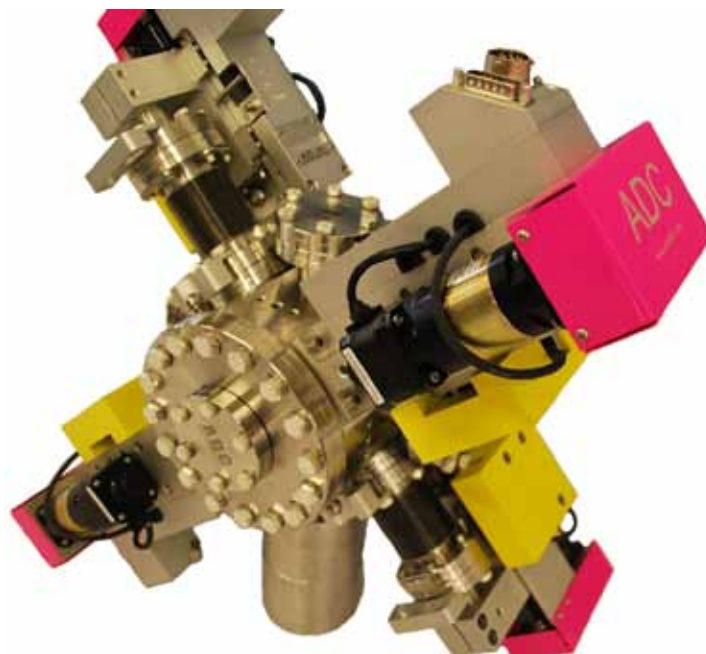


# UHV PRECISION SLIT SYSTEM UNCOOLED

## SLT-400-250

For more information please visit the following website:

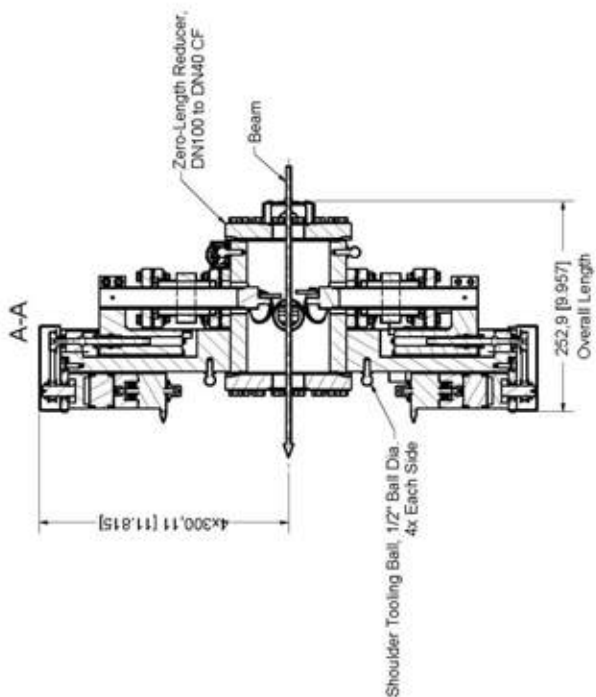
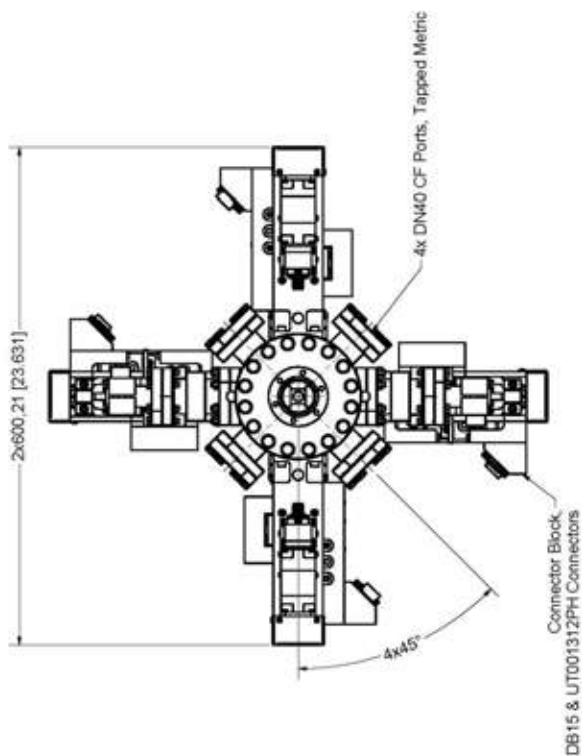
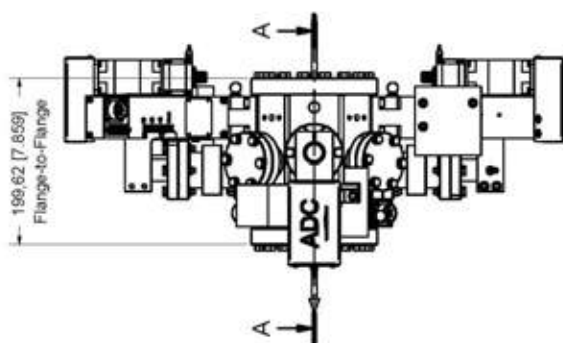
<http://www.adc9001.com/SLT-600-Monochromatic-Slit>



### SLT-310 X-Ray UHV Slit System Specification:

Aperture size	25 mm
Resolution	<0.16 $\mu$ m precision*
Accuracy	$\pm 2 \mu$ m
Blade material	Tungsten or Tantalum, Tungsten Carbide, Cadmium, Boron, copper, Nitride, or custom Blades can go "past closed" without clashing (Overlapping/Zero beam ~6mm)
Blade Thickness	Standard 2 mm Thicker blade available; 5, 7 and 10 mm thick blade upon request.
Blade Options	Knife-edge profile (2 degrees slope) Or round blade edge Roughness of the jaw edge surface: <0.2 $\mu$ m (rms)
Vacuum	Vacuum rated to better than $5 \times 10^{-10}$ mbar and have a leak rate of less than $1 \times 10^{-9}$ mbar-l/s.
Gearhead Options	Motors come with optional gearhead to increase resolution, 5:1, 10:1
Blade Beam Monitoring	Each blade is isolated to have the ability to monitor the current off the blade
Encoder Options	Standard: Renishaw (Incremental or Absolute) By request: Heidenhain, Other
Motor Options	Standard: Bi-polar 2-phase steppers By request: 5-phase stepper and IMS motors
Image Screen Options	Using fluorescent screen fixed to vertical upper and lower blade, single crystal YAG (Yttrium Aluminum Garnet)

# SLT-400-250



## Specifications:

- Aperture: 25mm Maximum
- Blade Overlap: 8mm Maximum
- Blade Material: Tungsten 95%-3.5% Ni-1.5% Cu
- Blade Thickness: 4mm [157]
- Approximate System Weight: 47.4 kg [107.4 lb]

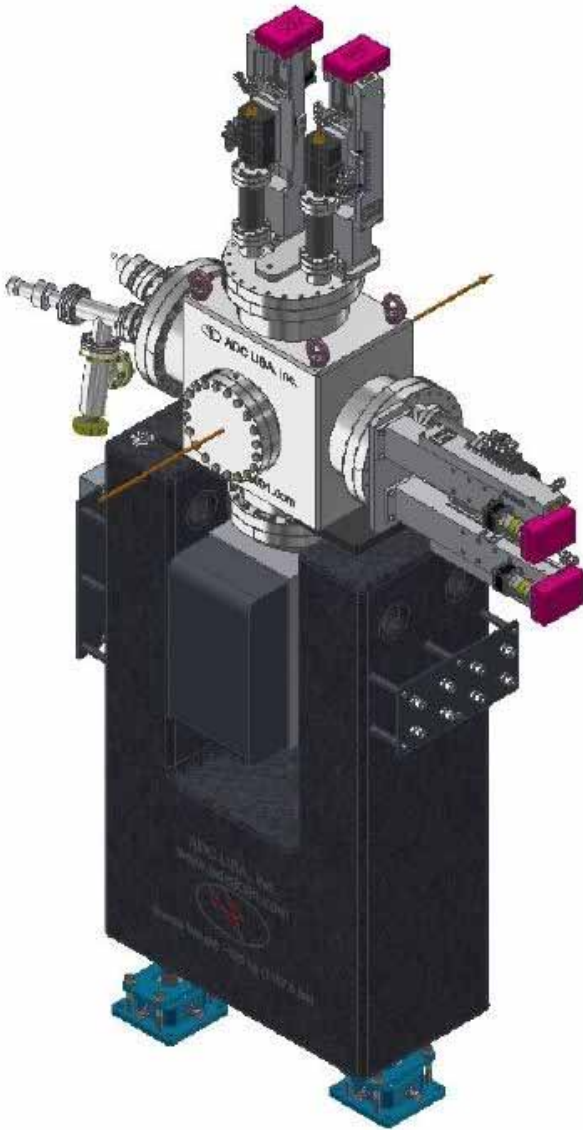
		<b>SLT-400-250 UHV Slit Assembly</b>	
Advanced Design Consulting USA, Inc. 128 Ridge Road, Suite 107 Lansing, MI 48906 P: 517.333.3018 F: 517.333.3019 E: info@adc-usa.com   Web: www.adc-usa.com		Part Number: <b>0</b> Revision: <b>A2</b> Date: <b>1/17/2013</b> Drawn by: <b>Ungor</b> Checked by: <b>Ungor</b> Date: <b>1/17/2013</b> Title: <b>SLT-400-250 UHV Slit Assembly</b>	
First Angle Projection All dimensions are in [in] Each dimension is reference		All Dimensions: <b>0.13</b> Tolerances: <b>N7</b> Surface Finish: <b>0.8</b> Material: <b>316L SS</b> Heat Treatment: <b>ASME-SE-812</b>	
Purchased Part Modification: <b>No</b>		Page: <b>0</b> of <b>1</b>	



# UHV HIGH PRECISION X-RAY SLIT SYSTEM -COOLED & UNCOOLED

## SLT-600

For more information please visit the following website:  
<http://www.adc9001.com/products/view/650>

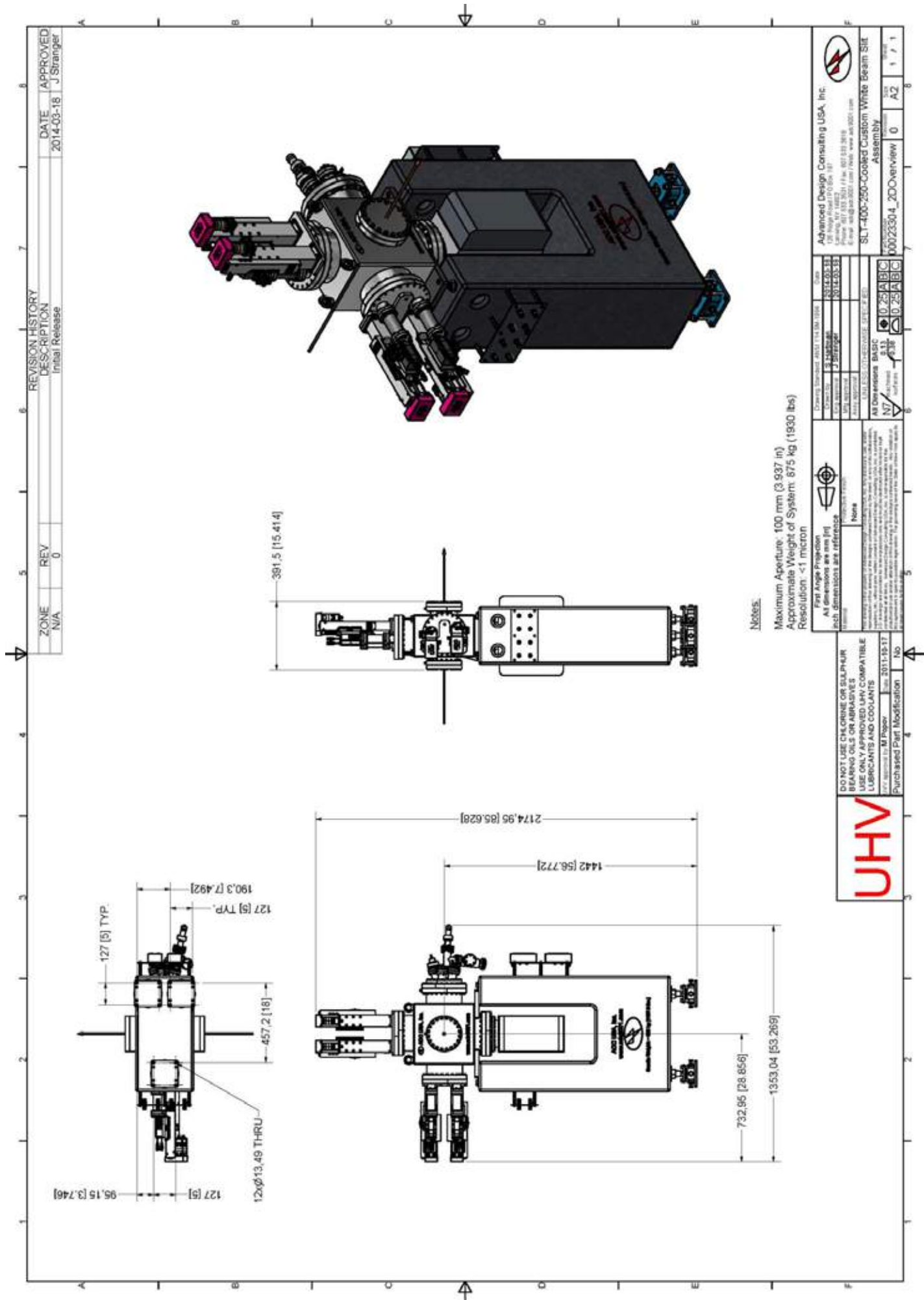


### Standard Key Specifications:

Parameter	Value
Maximum Aperture	25mm, 50mm, 100mm
Blade Overlap	20mm, 30mm, 50mm
Blade Material	Tungsten 95%~3.5% Ni~1.5% Cu*
Blade Thickness	4mm [0.16"]*
Cooling Connection	¼" Swagelok
Total Heat Load	680 W
Maximum Heat Flux	44.85 W/mm <sup>2</sup>
Recommended Cooling Flow	1.9 l/m [0.5 g/m]
Flange-to-Flange Length	400mm [15.41"]
Vacuum Level	< 5x10 <sup>-10</sup> mbar (UHV)
Beamline Connection	DN150, DN100 (6") CF to DN40 (2 ¾") CF*

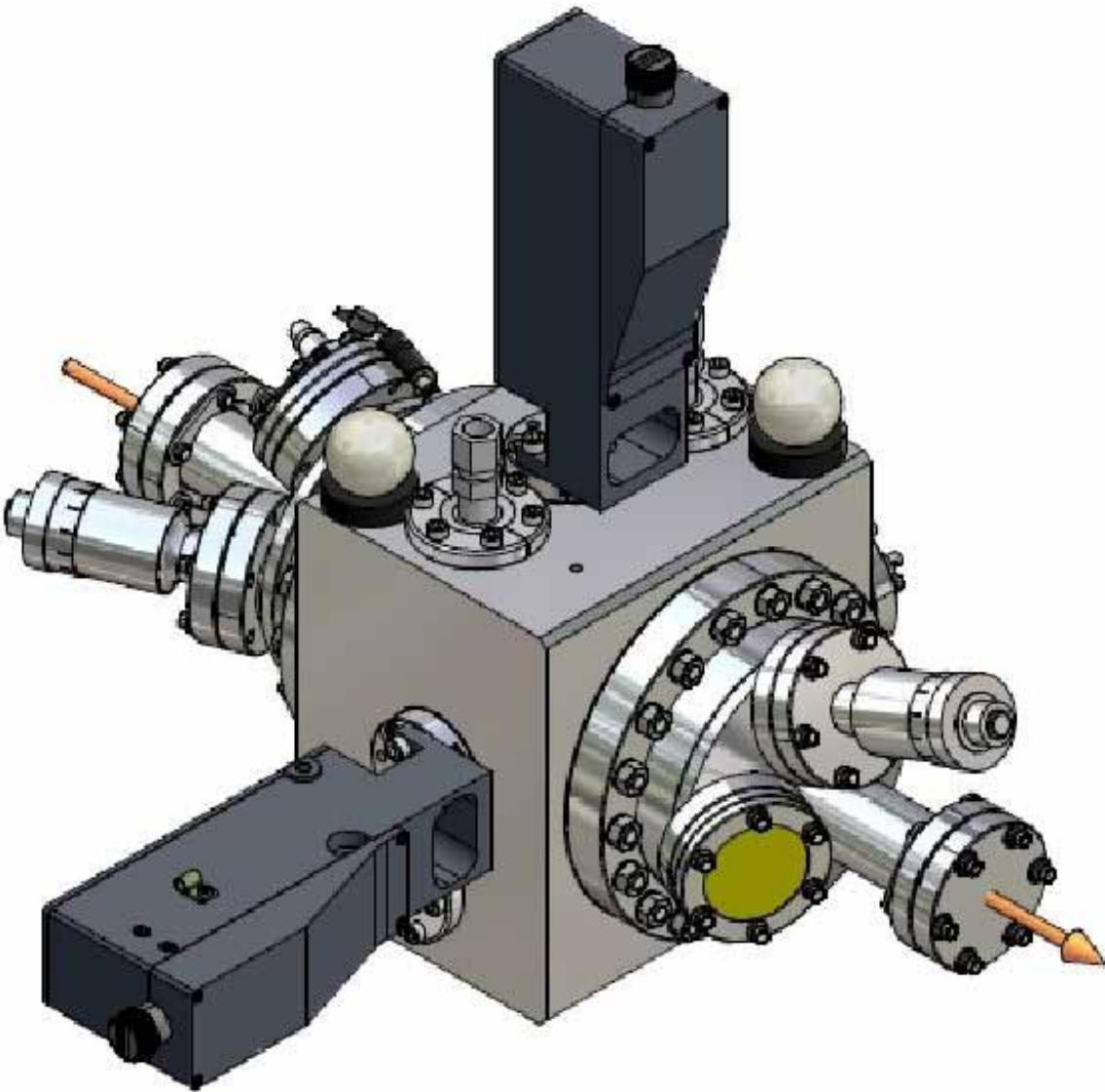


# SLT-600



## ■ SLT-800

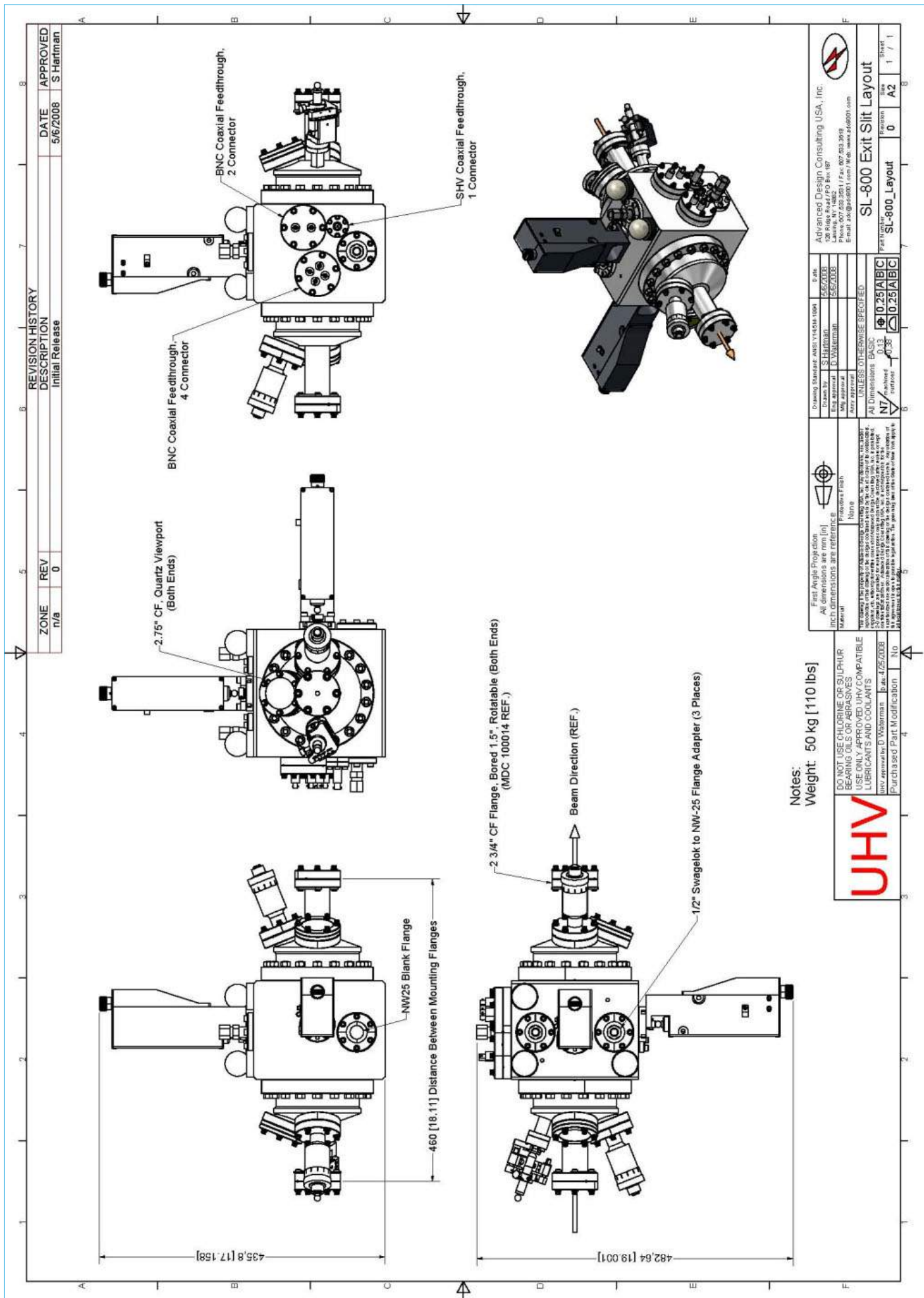
For more information please visit the following website:  
<http://www.adc9001.com/SLT-800>



**Stand Motion Specification**

	Horizontal Motions	Vertical Motions
Range	-10mm to +10mm	-6mm to +6mm
Resolution	<0.1μm	<0.1μm
Repeatability	<0.4μm	<0.4μm
Accuracy	<1μm	<1μm

# SLT-800

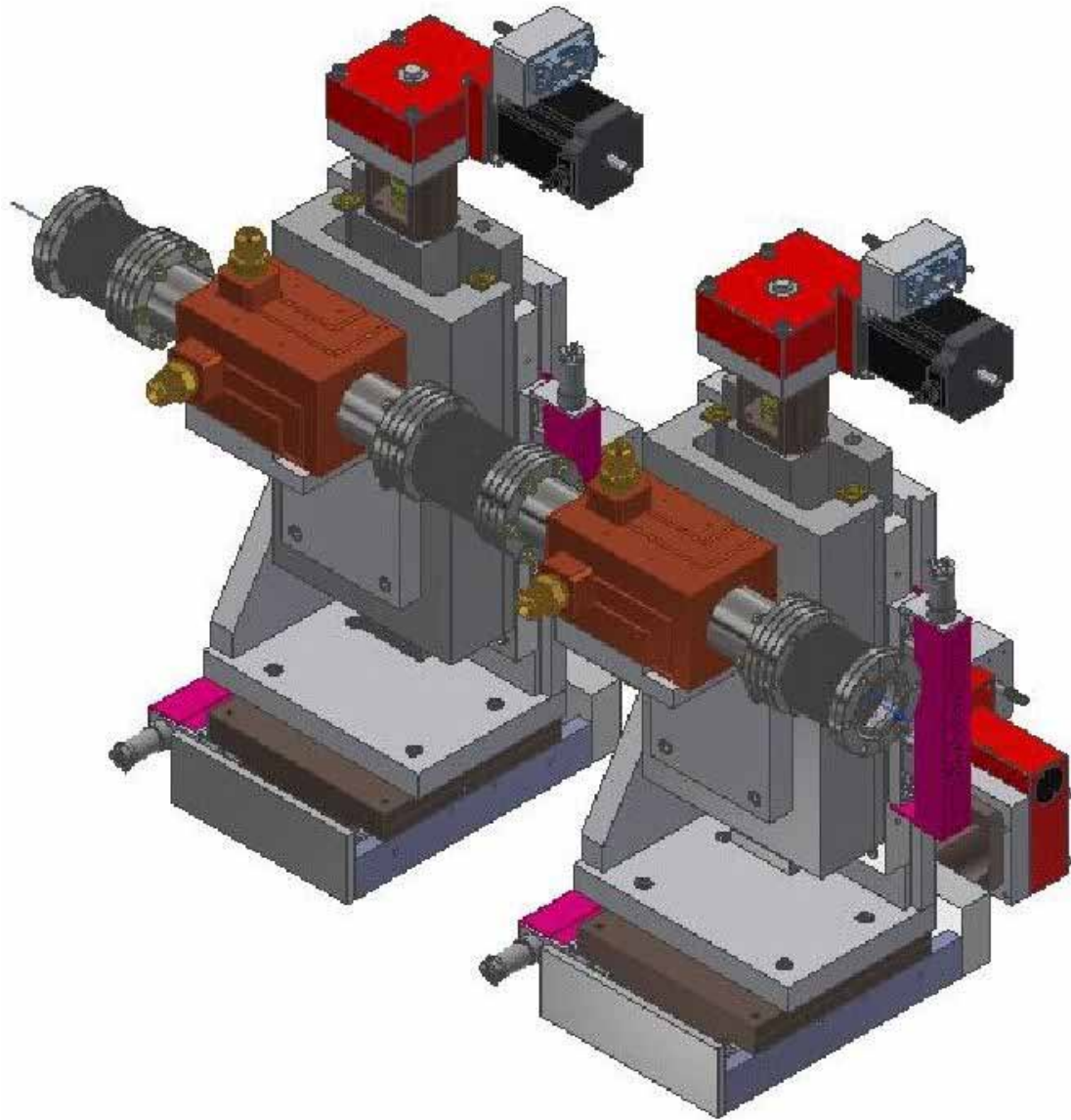




# UHV HIGH HEAT LOAD OFHC-GLIDCOP SLIT

## ■ SLT-1200

For more information please visit the following website:  
<http://www.adc9001.com/products/view/649>



Aperture Block Dimensions			
Dimension	Nominal	Tolerance per Edge	Units
Acceptance Width	15	+0.127 / -0	[mm]
Acceptance Height	10	+0.127 / -0	[mm]
Aperture Width with Tungsten	5	+0.025 / -0.025	[mm]
Aperture Height with Tungsten	3	+0.025 / -0.025	[mm]
Horizontal Half-Taper Angle	2.6	n/a	[°]
Vertical Half-Taper Angle	1.8	n/a	[°]
Diameter of Cooling Channel	12.7	n/a	[mm]
Length of Block	121.5	n/a	[mm]



# SLT-1200



50,8 [2] Horizontal Travel

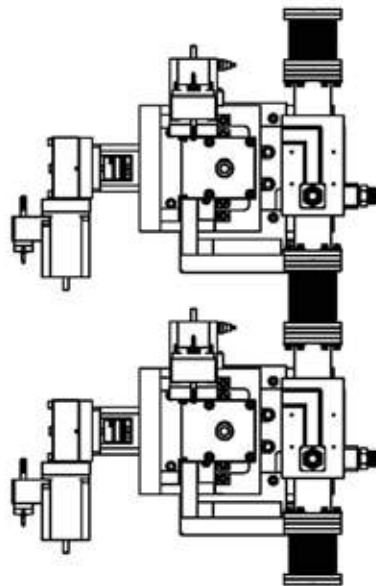
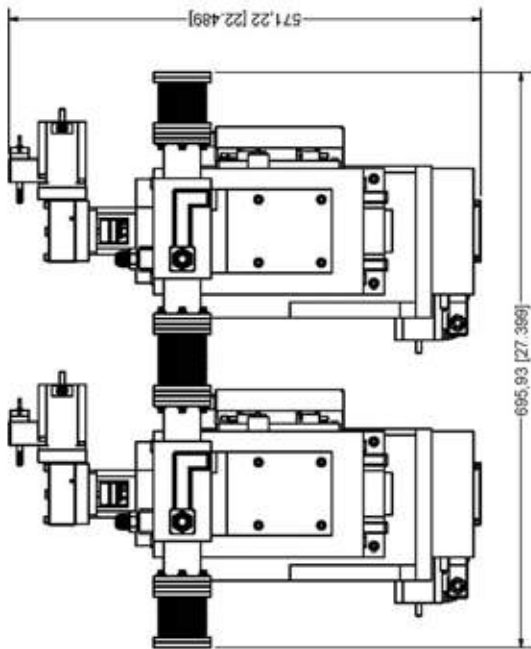
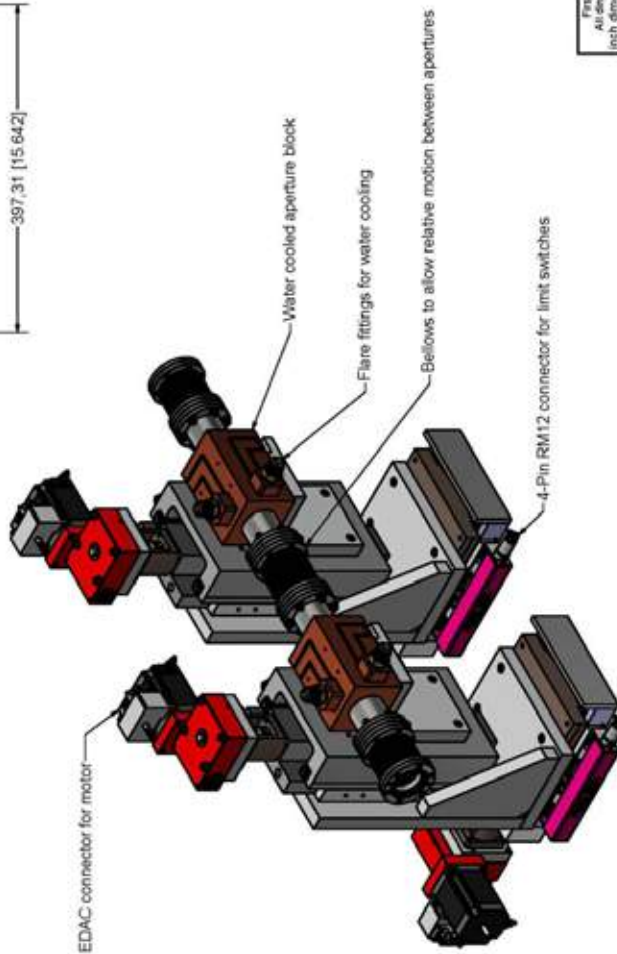
50.8 [2] Vertical Travel

±3 mm horizontal and ±2 mm vertical required

### 5. Loading:

Total heat load: 3.6 kW

Beam heat flux:  $>240 \text{ W/mm}^2$

[illegible]

Purchased Part Modification	No
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# CUSTOM SLITS

For more information please visit the following website:  
[http://www.adc9001.com/products/show\\_list/id/142](http://www.adc9001.com/products/show_list/id/142)



SwissFEL High Precision Slits  
(Curtain Design)



SwissFEL High Precision Slits- 45  
Degree



UHV Slit System . . .with YAG  
Crystal



Custom Monochromatic UHV Slits  
BL02B at SSRF



High Heat Load UHV Slit System  
for ESRF ID11 Pinhole Mono



UHV Slit System for ESRF



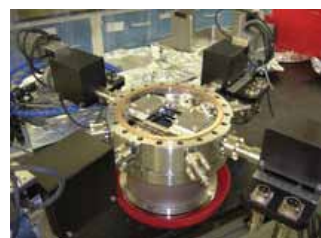
ALS Copper Braided Cooled High  
Precision Slit



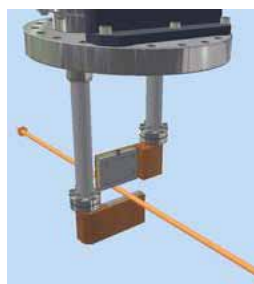
DLS I13 Front End Slit



DLS Custom Water Cooled High  
Precision Slit



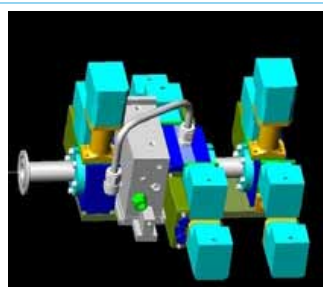
DLS Custom UHV Slit



MAX-Lab Custom Water Cooled Slit



SNS Custom SLT-100-30



ALS-Slits-Ion Chamber Assembly



ANKA- Copper Braided SLT-Slits



APS Two Slanted 30 Degree Slits



SSRF UHV Slits



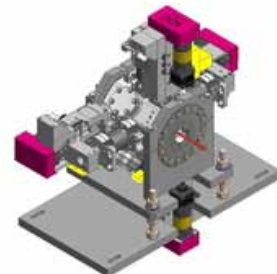
SLT-800-1 UHV Flexure Design  
White/Pink Beam Exit Slit System



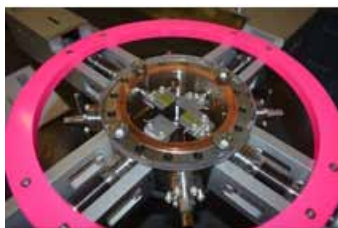
SLT-700 High Heat Load Water  
Cooled Slit



LSU/CAMD Water Cooled UHV Slits



UHV, high precision, slit for MAX IV



PAL UHV Slit System



APS UHV, high precision slit

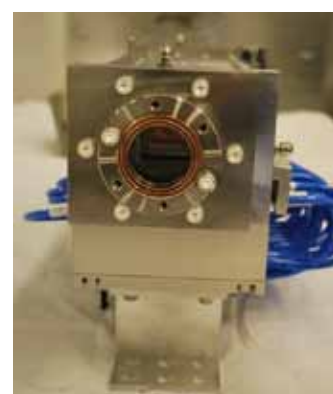


# PRECISION ATTENUATOR FOR HARD X-RAYS

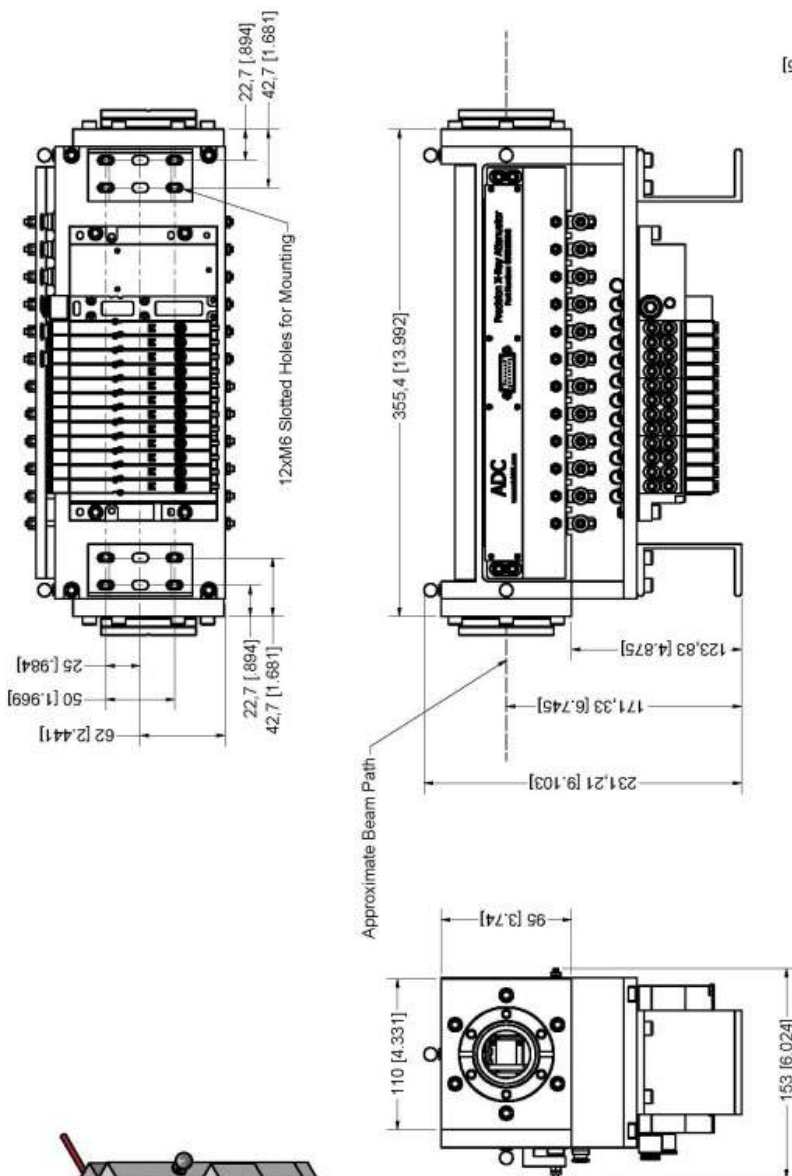
## ■ ABS-300

<http://www.adc9001.com/products/view/637>

ADC has licensed and is offering a Precision Attenuator for Hard X-Rays (ABS-300) that was developed over many years at the synchrotron radiation source PETRA III at DESY. This system will provide the ability for scientists to reduce the incident x-ray flux to any desired value. For many applications at hard x-ray beamlines at lab sources and synchrotron radiation sources the detected intensity spans more than six orders of magnitude. An integrated flux of more than one million counts per second is far too much for most of the detectors in use, which can even be severely damaged on saturation. For this reason, x-ray beamlines are equipped with so-called attenuators (or absorbers) which reduce the beam load on the detector by blocking the beam with a (for x-rays) semi-transparent material (called filter or foil).

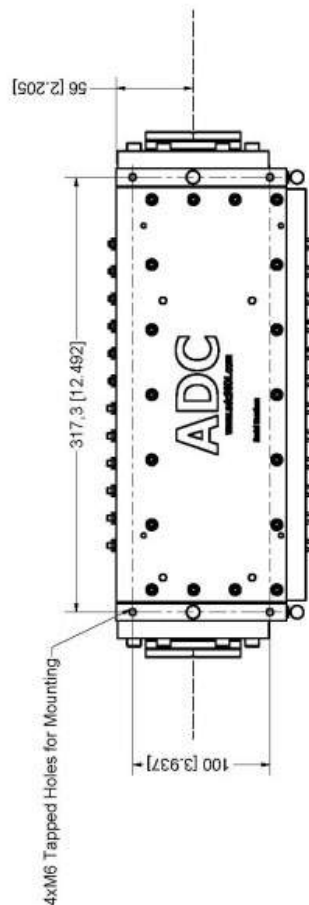






1. Product can be equipped with DN40 or NW40 flanges (DN40 flanges shown), or with adapters for Blake Industries' beampath tube.

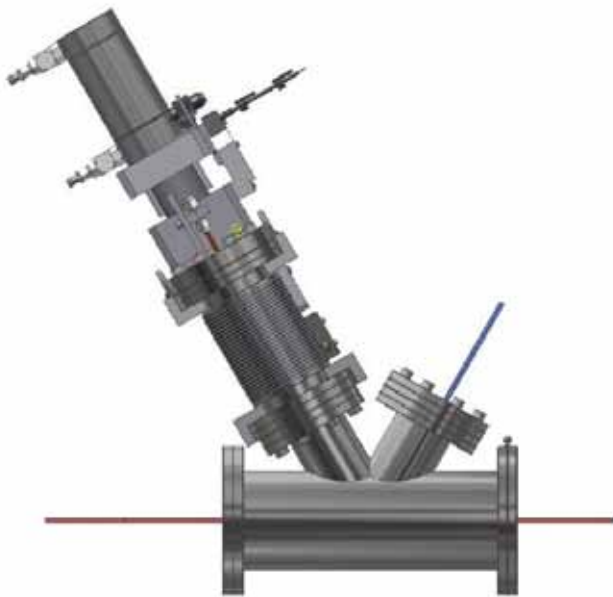
2. Specifications:  
Mass/Weight: 12.7 kg (28 lb)  
Vacuum Level: 1e-7 mbar  
Filler Frames: 12 frames with 20 mm x 15 mm effective aperture  
O-Ring Sizes: #143 and #334 (#135 for Male Beamtube Adapter)
3. Tubing for pneumatic actuators omitted for ease of viewing  
(Use 6 mm O.D. flexible pneumatic tubing)

[illegible]

# FLUORESCENT SCREEN ASSEMBLY

<http://www.adc9001.com/products/view/638>

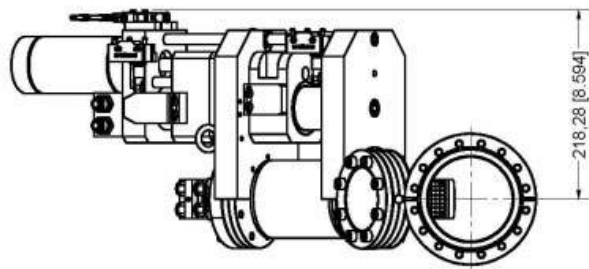
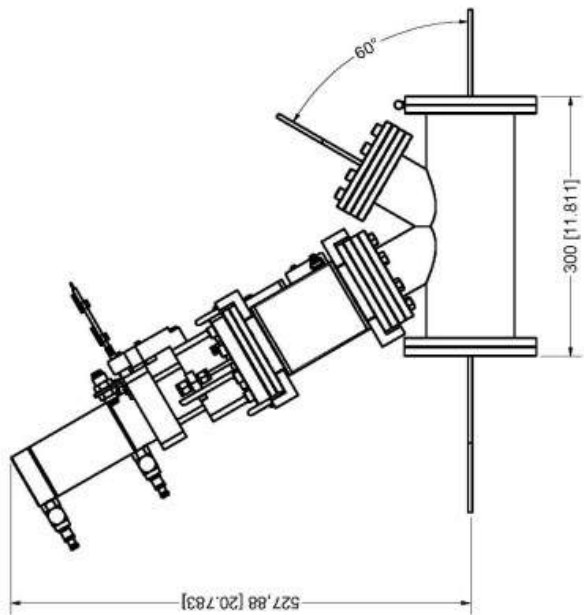
ADC has manufactured the FC-204 unit which allows the user to view the position and profile of an incident X-ray beam. The full assembly of the fluorescent screen consists of three main components: a welded vacuum chamber; a linear actuator mounted to one branch of the chamber; and a water-cooled fluorescent screen. The chamber has 6" CF flanges on the upstream side (non-rotatable) and downstream side (rotatable) for connecting to the CAMD beamline. The upper branches of the chamber have 4½" CF flanges. One branch is capped by a quartz-glass viewport, while the other supports the pneumatic actuator used to position the fluorescent screen. Copper tubes provide water-cooling for the fluorescent screen and have ¼" Swagelok fittings for connecting to the water supply. The tubes are vacuum brazed into the fluorescent screen. A stainless steel bracket provides structural for the screen and cooling tubes. The screen itself is at a 60° angle from the horizontal plane. The face of the screen is coated with P22R phosphor and features equally spaced grooves cut into the surface for imaging from the viewport above. The lower hard stop for the pneumatic actuator allows the screen location to be fine-tuned as needed to place the beam on a flat or a groove in the grid. Inventor Simulation was used to perform steady-state thermal analysis on the fluorescent screen assembly. An average mesh size of 0.6 mm was used for each analysis. A surface heat flux of 2.18 W/mm<sup>2</sup> was applied over the 40 mm x 5 mm beam footprint centered on the fluorescent face.



# LSU







Pneumatic Cylinder with 50 mm nominal travel (adjustable) between hard stops

Pneumatic Manifold  
1/4" Push-to-Connect Supply Port  
Minimum 40 psi air supply

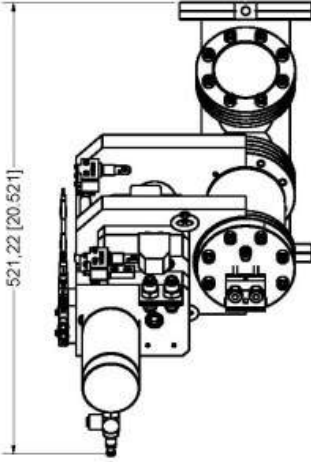
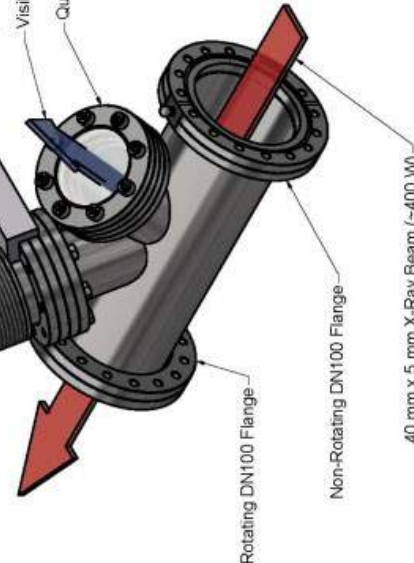
Cooling Water Supply and Return  
20 °C at minimum flow rate of 0.29 gal/min

BNC Connector for Drain Current Measurement

Adjustable Hard Stop

Visible Light from Phosphor Screen

Quartz-glass View Port for CCD Camera



#### Notes:

1. System Mass/Weight: 30 kg (66.2 lb)
2. Screen Position Stroke: 50 mm Between Hard Stops (Lower hard stop adjustable for precise screen location)
3. Fluorescent Screen Specifications:
  - P22R Phosphor
  - Electrically Isolated with Connector for Drain Current
  - 20 mm x 45 mm Open Face with 5.8 mm Tall x 5 mm Wide Grid
4. Required Fluid Supplies:
  - Pressurized Air at 40 psi Minimum (1/4" Push-In Connector)
  - Water at 20 °C and Minimum Flow Rate of 0.29 gal/min
5. End Flanges: DN100 (8" CF) with Clearance Holes
6. Water and Pneumatic Lines Omitted from Drawing

<b>UHV</b>		<b>DO NOT USE CHLORINE OR SULPHUR BEARING OILS OR ABRASIVES USE ONLY APPROVED UHV COMPATIBLE LUBRICANTS AND COOLANTS</b>		<b>ADC USA, Inc.</b> 10000 10th Avenue Larchmont, NY 10538 Phone: 907-533-3531 / Fax: 907-533-3531 E-mail: adc@adc-usa.com / Web: www.adc-usa.com		<b>Fluorescent Screen, Electrically Isolated, Top Assembly</b>	
Purchased Part Modification		Date: 9/18/2013		Drawing Standard: ASME Y14.2M-1994		Date: 10/9/2013	
No		Part Number: 00022220		Size: A2		Revision: 0	
4		5		6		7	
8		9		10		11	

# RSXS FILTER ARRAY

<http://www.adc9001.com/products/view/639>

RSXS Filter Array This Filter Array moves 14 x-ray filters into and out of the beam using a stepper motor and ball screw drive unit. The filters are mounted to an arm which moves perpendicular to the beam, allowing an individual filter to be selected for placement in the beam. The array is enclosed in a vacuum chamber which will connect to the customer’s beam line. The filters are mounted in easily interchangeable frames so that any desired filter can be installed A stand is provided for the system with horizontal, vertical, and leveling adjustments. This stand is constructed with chambers for ballast to stabilize the system, and the main chamber is made easy to fill with any locally available ballast material by the 2-inch square opening in the top plate.

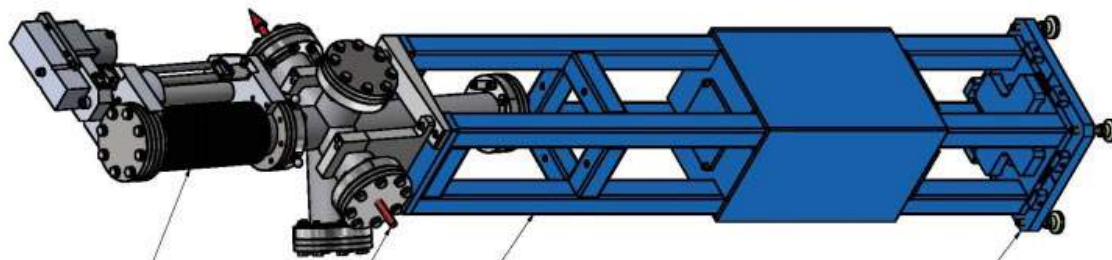
Motion	Product Description	Range of Motion
Vertical	UHV Design Linear Shift	150 mm
Vertical	Swivel Leveling Mounts	+/- 15 mm
Horizontal	2-Axes Set Screw Adjustment	+/- 10 mm

Filter List:

Materials	Thickness (um)
Schott Filter Glass UG 5	1000
Quartz (pure crystals)	500
MgF2 (pure crystals)	500
In	0.16
Sn	0.15
Ge	0.15
Mg	0.3
Si	0.3
B	0.3
C	1
Ti	0.8
Sn	0.5





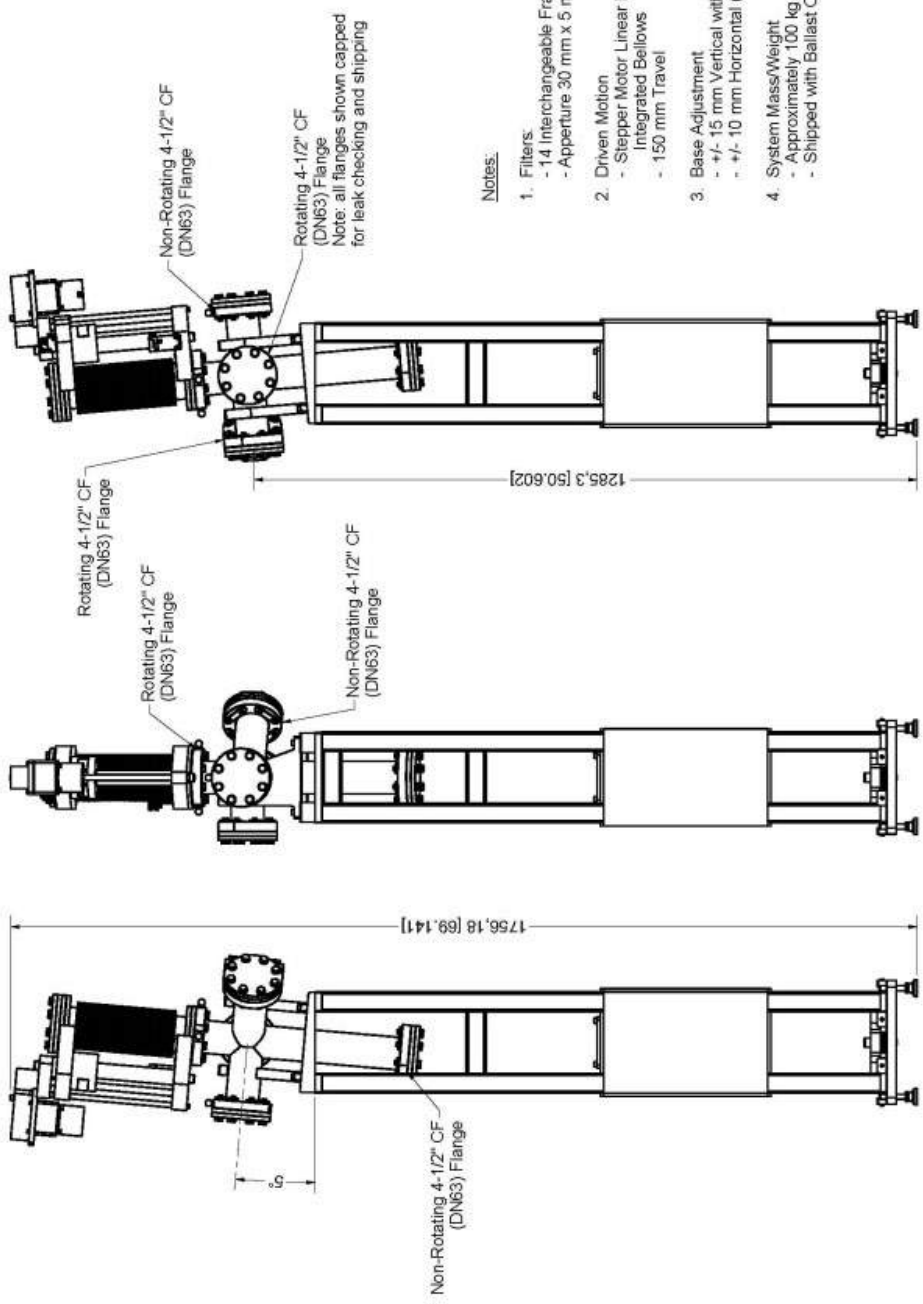


Stepper Motor and Ball Screw  
Linear Drive Mechanism with  
Integrated Bellows  
(150 mm Stroke)

X-Ray Beam

Welded Steel Stand  
Shipped with Ballast  
Compartments Empty

Base with 3-Axis Travel  
and Leveling Feet



Non-Rotating 4-1/2" CF  
(DN63) Flange

Rotating 4-1/2" CF  
(DN63) Flange  
Note: all flanges shown capped  
for leak checking and shipping

Rotating 4-1/2" CF  
(DN63) Flange

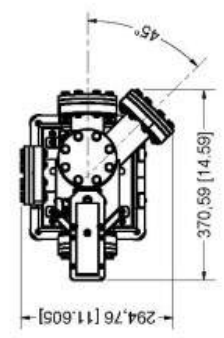
Rotating 4-1/2" CF  
(DN63) Flange

Non-Rotating 4-1/2" CF  
(DN63) Flange

Non-Rotating 4-1/2" CF  
(DN63) Flange

#### Notes:

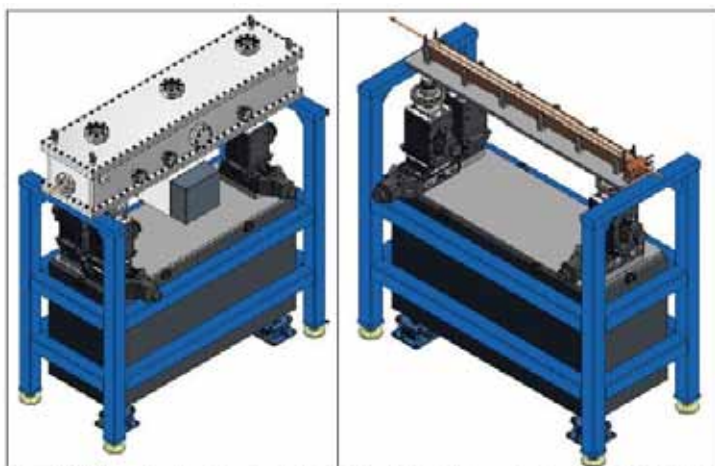
1. Filters:
  - 14 Interchangeable Frames
  - Aperture 30 mm x 5 mm
2. Driven Motion
  - Stepper Motor Linear Drive with Integrated Bellows
  - 150 mm Travel
3. Base Adjustment
  - +/- 15 mm Vertical with Leveling Feet
  - +/- 10 mm Horizontal (2 Orthogonal Axes)
4. System Mass/Weight
  - Approximately 100 kg (220 lb)
  - Shipped with Ballast Chambers Empty



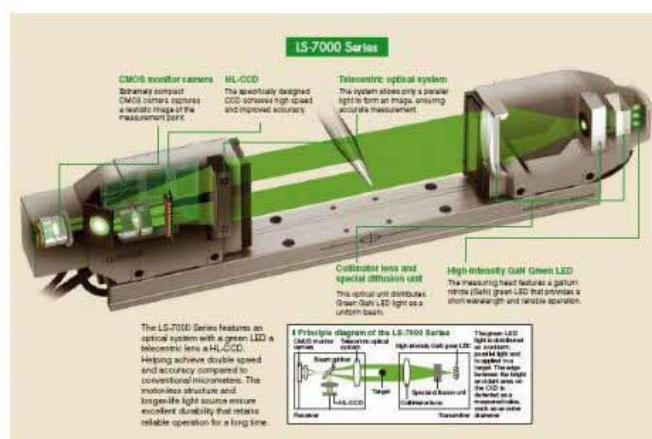
		<b>ADC USA, Inc.</b> 120 Ridge Road Larchmont, NY 10538 E-mail: info@adc-usa.com Web: www.adc-usa.com		<b>RSXS Filter Assembly</b> Part Number: 00022309 Revision: 0 Date: 11/15/2013	
Drawing Standard: ANSI Y14.3M-1994 Sheet: 1 of 1 Title: RSXS Filter Assembly Author: J. J. J. J. J. Date: 11/15/2013 Scale: 1:1 Unit: mm	Drawing Standard: ANSI Y14.3M-1994 Sheet: 1 of 1 Title: RSXS Filter Assembly Author: J. J. J. J. J. Date: 11/15/2013 Scale: 1:1 Unit: mm	Drawing Standard: ANSI Y14.3M-1994 Sheet: 1 of 1 Title: RSXS Filter Assembly Author: J. J. J. J. J. Date: 11/15/2013 Scale: 1:1 Unit: mm	Drawing Standard: ANSI Y14.3M-1994 Sheet: 1 of 1 Title: RSXS Filter Assembly Author: J. J. J. J. J. Date: 11/15/2013 Scale: 1:1 Unit: mm	Drawing Standard: ANSI Y14.3M-1994 Sheet: 1 of 1 Title: RSXS Filter Assembly Author: J. J. J. J. J. Date: 11/15/2013 Scale: 1:1 Unit: mm	Drawing Standard: ANSI Y14.3M-1994 Sheet: 1 of 1 Title: RSXS Filter Assembly Author: J. J. J. J. J. Date: 11/15/2013 Scale: 1:1 Unit: mm

[http://www.adc9001.com/products/show\\_list/id/114](http://www.adc9001.com/products/show_list/id/114)

Mirror System Optics Beamline mirror systems are typically highly customized to meet individual beamline requirements. However, all mirror systems have fundamental common elements. These are the “optics” which includes the mirror, bender or holder; and associated cooling; and the “mechanics” which includes all the rest of a complete mirror system including the base, out-of-vacuum motions, in-vacuum motions, in-vacuum optics plate, in-vacuum disaster masks, a vacuum chamber with associated ports, a separate vacuum chamber support, and a control system. Mirrors are typically polished for extreme flatness and then bent in cylindrical, elliptical, or toroidal shapes to meet beamline requirements. These mirrors require benders to produce the desired shape. Other mirrors are polished to a specific shape and are simply supported in a holder. In both cases the bender or holder must impart minimal stress to the mirror. Another consideration for the mirror is the heat load. Typically, the mirror has either no heat load ( $< 1$  Watt), medium heat load (1 to 1500 Watts), or high heat load (1000 to several thousand Watts). Mirrors with no heat load require none or passive cooling. Passive cooling may consist of a simple copper braid thermally connecting the holder/bender to a heat sink such as the optics plate or vacuum chamber. Mirrors with medium or high heat load require active water or LN<sub>2</sub> cooling. There is considerable overlap between medium and high heat loads. ADC performs a thermal FEA model of each new mirror system to determine the best method of cooling. Disaster masks on the entry or exit sides of the vessel are provided as well.



**Figure 1.** ADC Mirror System comprised of motorized stacked linear motions, granite plinth to support the motions, and UHV chamber mounted to steel framework. The steel frame is filled with sand to dampen floor vibrations. Kinematic feet below the granite plinth allow for adjustment of the mirror to its nominal position.



At ADC, the mirror motions are fully tested for positioning accuracy, repeatability, and resolution, as well as UHV base vacuum pressure, leak rate, and RGA. For minute dimensional and motion tests ADC uses a Keyence LS-7030 non-contact optical micrometer (shown below) to precisely measure blade motions. The high speed LED/CCD optical micrometer is capable of 2400 samples/second high-speed sampling with repeatability of  $\pm 0.06 \mu\text{m}$  and an accuracy of  $\pm 2 \mu\text{m}$ . Inspection data is provided in a final report.

# 20-BM MIRROR

<http://www.adc9001.com/APS-20-BM-Mirror>

ADC designed and built a 1100 mm long silicon mirror system to install at the Advanced Photon Source (APS). The APS 20-BM mirror system consists of five primary subcomponents: The mirror optic itself, its positioning system, the bending mechanism, a vacuum chamber, and the support structure all provided as an integrated package. All subsystems were designed to provide the highest positional stability and structural rigidity with precision motions on all axes.

## 20-BM Focusing Mirror and Bender Specifications

Clear Aperture of 40 x 1000mm, beam approx. 31mm wide. Bounce up. •Sagittal radius of 63mm  $\pm 1$ mm (Slope error of 20 $\mu$ rad)

Meridional radius of 8 to 15km (Slope error of 2 $\mu$ rad)

Unbent condition, mirror radius >30km

Material: ULE / Silica / Silicon

Roughness: 4A

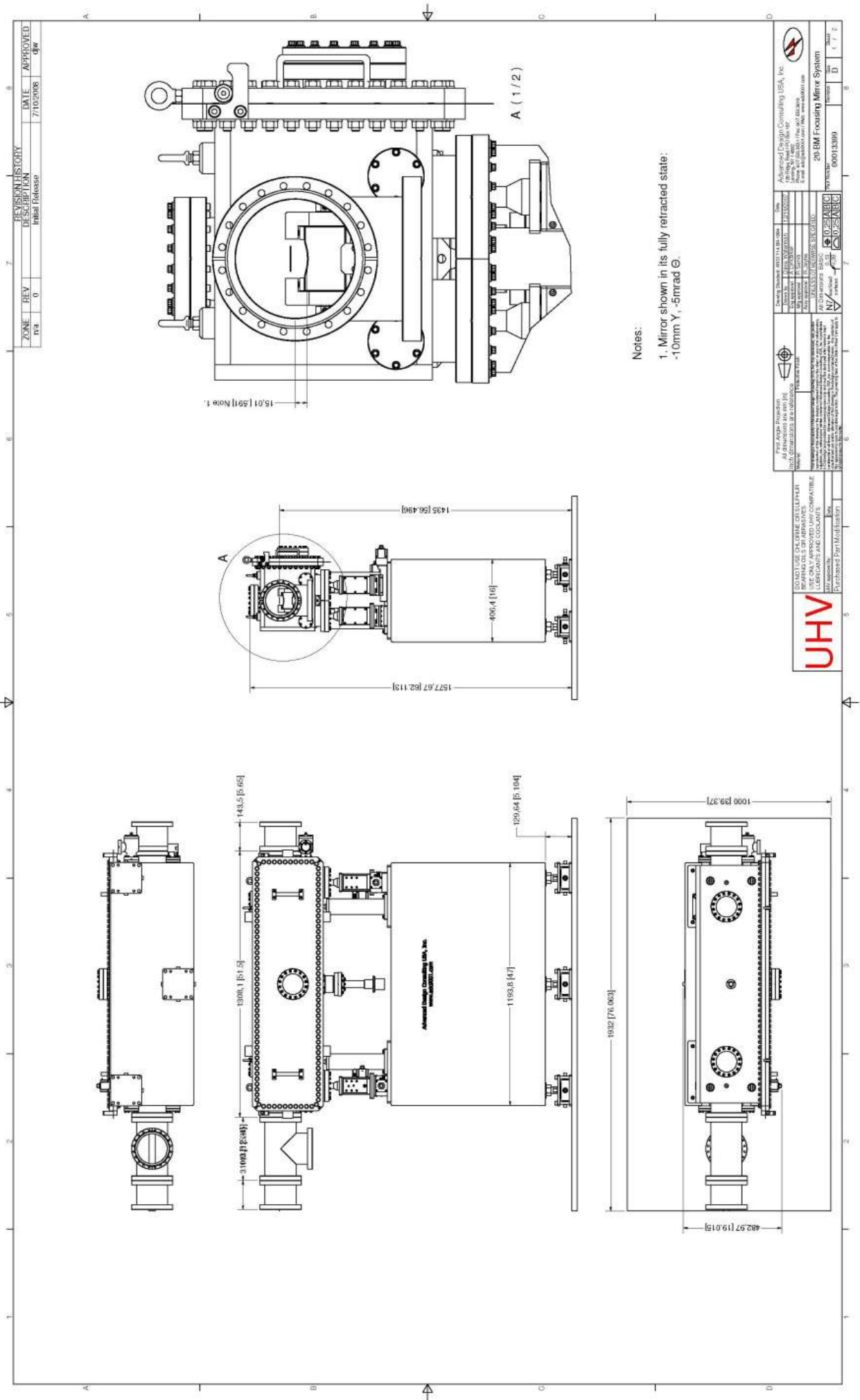
Coating: 50nm Pt on 5nm Cr



Argonne  
NATIONAL  
LABORATORY









# MOTION SYSTEM

## for KB Mirror

<http://www.adc9001.com/products/view/641>

A system was designed for Argonne National Laboratory that provides 5 degrees of motion for their KB Mirror. The mirror chamber has 50 mm of vertical (z-axis) travel and 75 mm horizontal (x-axis) travel with a resolution of 1  $\mu$ m. Through the use of stacked precision slides, precision jacks, and free slides the chamber can also be rotated around the x-axis, y-axis, and z-axis to allow for leveling and alignment of the chamber. The slides and jacks use NEMA 34 stepper motors. The jacks are fitted with planetary inline gearboxes, and the slides use right angle gear boxes. This removes the need for a brake while allowing greater precision of motion. The motion system sits on a granite base providing stability and vibration dampening. The granite is leveled precisely with lockable leveling feet and bolted to an aluminum plate grouted to the floor.

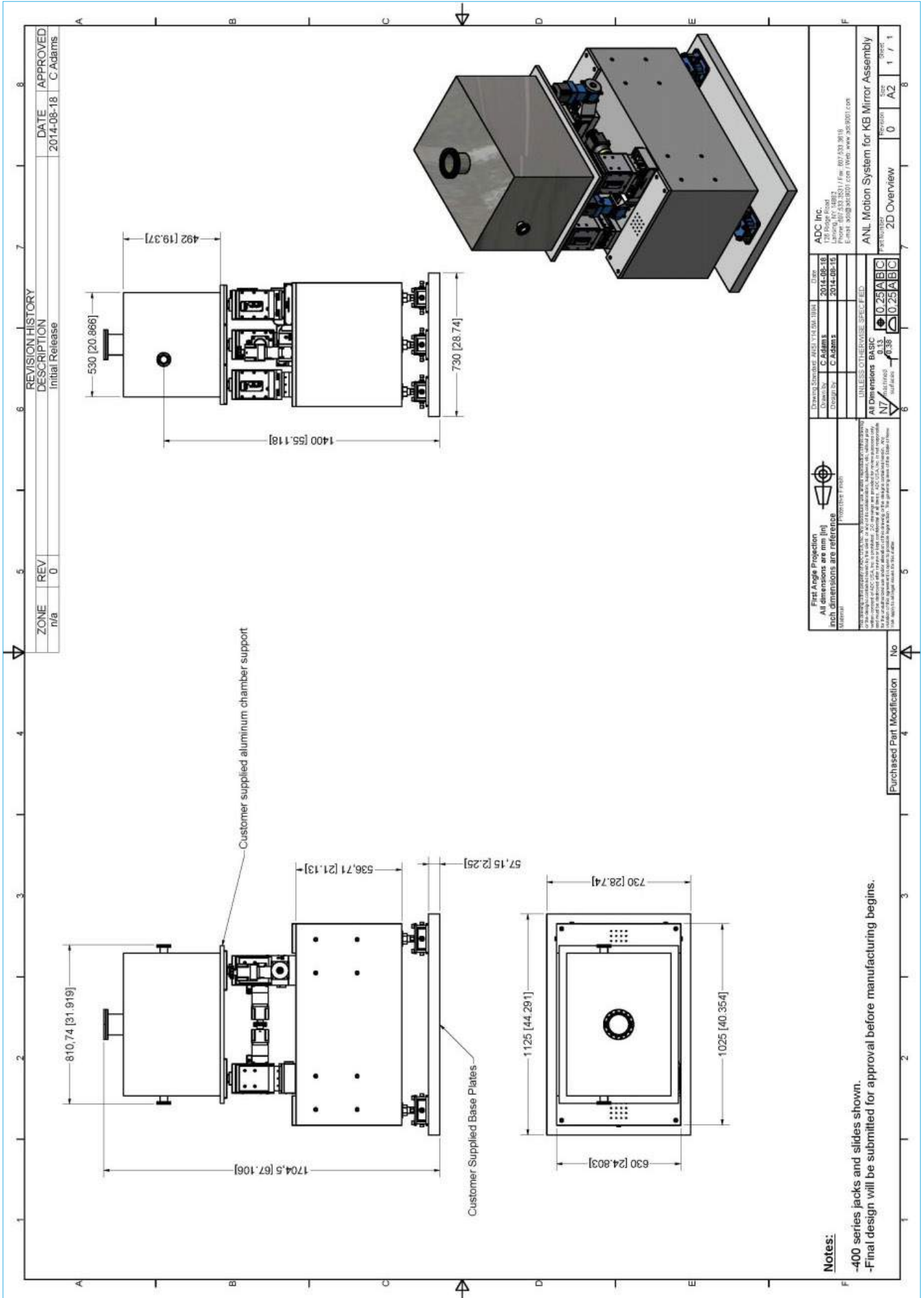


### Key Specifications:

#### Linear Travel Specifications:

Description	Value	Units
Range of Motion (Z Axis)	50 [~2]	mm [in]
Resolution (unit/step)	~0.001	mm/step
Encoder Manuf.	Renishaw	-
Encoder Resolution	0.1	$\mu$ m

Description	Value	Units
Range of Motion (X Axis)	75 [~3]	mm [in]
Resolution (unit/step)	~0.001	mm/step
Encoder Manuf.	Renishaw	-
Encoder Resolution	0.1	$\mu$ m



# EUV MASK MICROSCOPE

## for Lithography Generations Reaching 8 nm

<http://www.adc9001.com/products/view/666>

ADC designed, built and installed SHARP (the SEMATECH High-NA Actinic Reticle review Project) an actinic, synchrotron-based microscope dedicated to extreme ultraviolet (EUV) photomask research for Lawrence Berkeley National Laboratory. The system demonstrated the addition of complementary imaging modes to the SHARP EUV mask microscope, in an effort to extract additional information from actinic photomask imaging, improve navigation and enhance defect detection.

ADC USA, Inc. is introducing a state-of-the-art high-resolution extreme-ultraviolet-light (EUV) microscope. This system contains a state-of-the-art high-resolution extreme-ultraviolet-light (EUV) microscope for imaging of EUV photomasks. These photomasks are critical components in photolithography—the process used to mass-produce semiconductor electronic devices. Major components of the system include: a large vacuum chamber to house the experimental area; active vibration control system; 3 axis in-vacuum motion stages; and an automated loadlock for inserting the EUV photomasks. The system is designed for nm-scale stability, light exclusion (internal darkness), and ease of maintenance. It operates near ultra-high vacuum (UHV) conditions, requiring a base pressure of  $1\text{e-}7$  Torr, and therefore has a high degree of cleanliness and the exclusive use of compatible materials and components that do not outgas. Owing to the high resolution of the microscope (down to 30-nm), the system is designed for nm-scale relative stability of the critical mask and (zone plate) lens over exposure time periods up to one minute. It is designed so internal components do not radiate light into the chamber, or “glow” from internal heat generation. A mask-transfer system enables masks to be loaded and unloaded from the system chamber. The mask transfer system gently, cleanly, and safely handles the mask loading, installation, unloading and removal. The Mask XYZ stage is the heart of the system and the primary navigation tool in the system. Specifications for the XYZ stages are as follows:

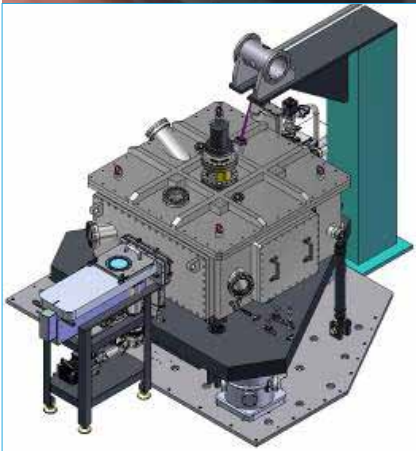
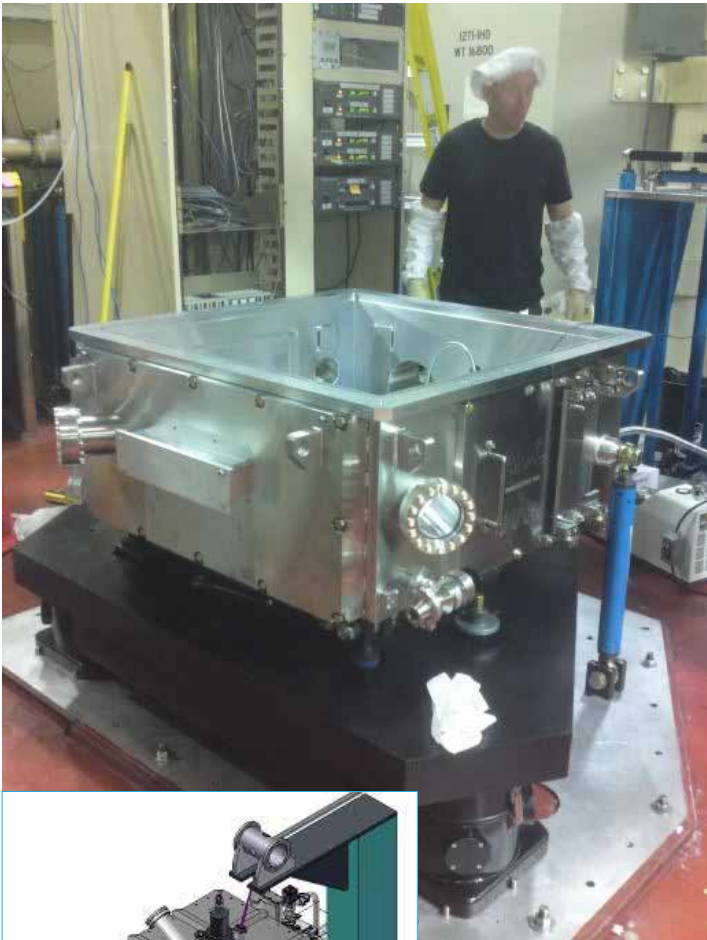
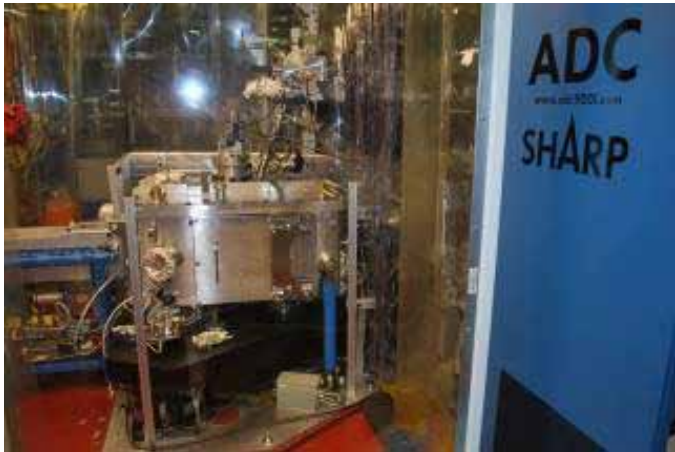
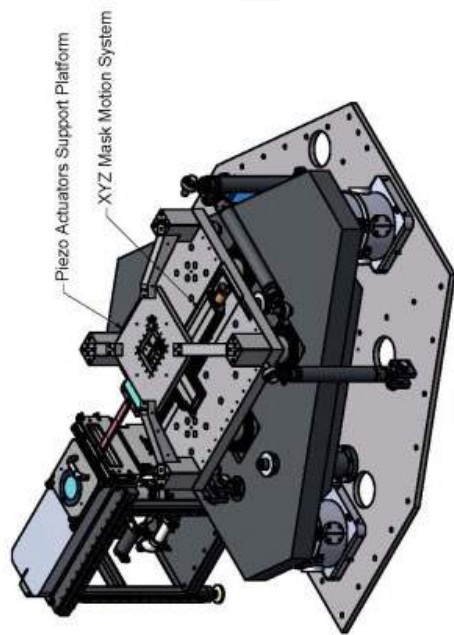


Table 1. Mask stage specifications. Axis	Travel (mm)	Resolution (nm)	Repeatability (μm)
X	250.00	< 100	±0.50
Y	250.00	< 100	±0.50
Z	5.00	< 50	±0.50

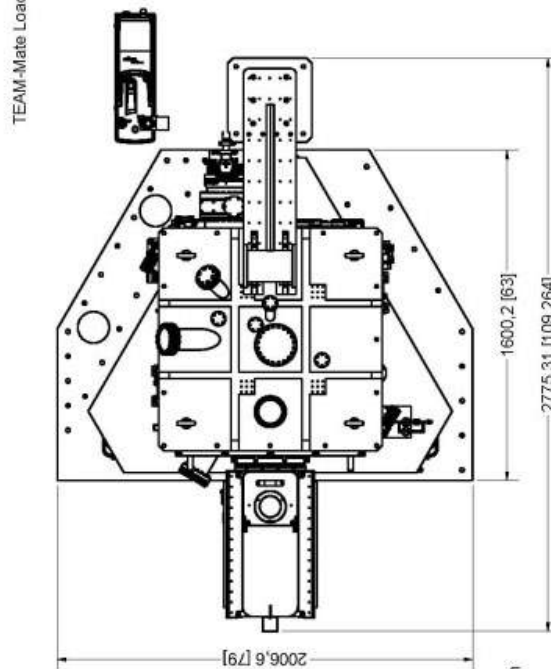
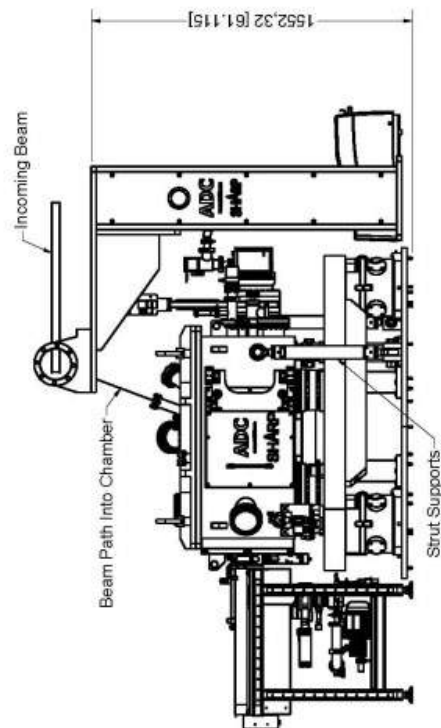








Internal View



#### Notes:

The SHARP Instrument is designed for the inspection of EUV photolithography masks. Key features of the system include low particle generation, nm-scale stability, and ease of maintenance. Due to long exposure times of up to 1 minute, relative stability and resolution of the mask and lens components are critical.

#### System Support Features:

- Grouted Floor Plate
- TMC Stacis 2100 Active Vibration Isolator Pads to Support Internal Motions
- Rigid 6 Strut Support System for Vacuum Chamber

#### Vacuum Chamber:

- Base Pressure:  $10E-7$  Torr
- 5x Viewports for Tracking the Mask and Optics Location
- Pumping System: Pfeiffer 800M Turbo-Pump, ACP 28 Roughing Pump
- Venting System: Swagelok Bellows Valves, High Purity PALL Filler

#### Internal Vacuum Assembly:

- Large, Rigid Support Structure for XYZ Motion System
- Upper Platform for Piezo Stages that Manipulate Optical Equipment

#### XYZ Mask Motions:

- X-Axis (Beam Direction): Micors LS-110 500mm Travel, 0.1 micron Resolution
- Y-Axis (Transverse to Beam): Micors LS-110 300mm Travel, 0.1 micron Resolution
- Z-Axis (Vertical): Micors UPL-120 13mm Travel, 0.1 micron Resolution

#### Mask Transfer:

- TEAM-Mate Automatic Load Lock for Positioning Mask in the Chamber

Approximate Weight: 3220kg [7081lb]

First Angle Projection		Drawn To Scale	Scale
All dimensions are in inches		1:1	1:1
All dimensions are reference		1:1	1:1
Material		Aluminum	Aluminum
Finish		Anodized	Anodized
Tolerance		±0.005	±0.005
Surface Finish		0.3	0.3
Surface Finish		0.3	0.3

Advanced Design Consulting USA, Inc.		120 Ridge Road, P.O. Box 187	Phone: 801.332.3531 / Fax: 801.332.3818	E-mail: sales@adc-usa.com / Web: www.adc-usa.com
SHARP Instrument Assembly		Part Number	Version	Size
			0	A2
				8

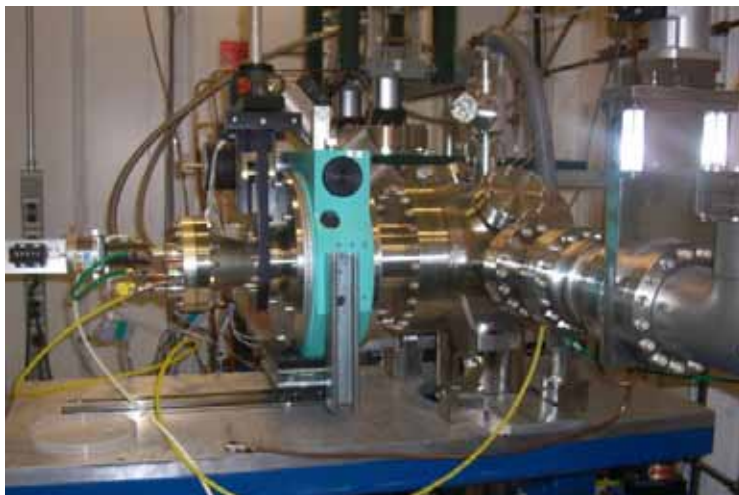
# MONOCHROMATOR

## ■ for Advanced Photon Source (APS) ■

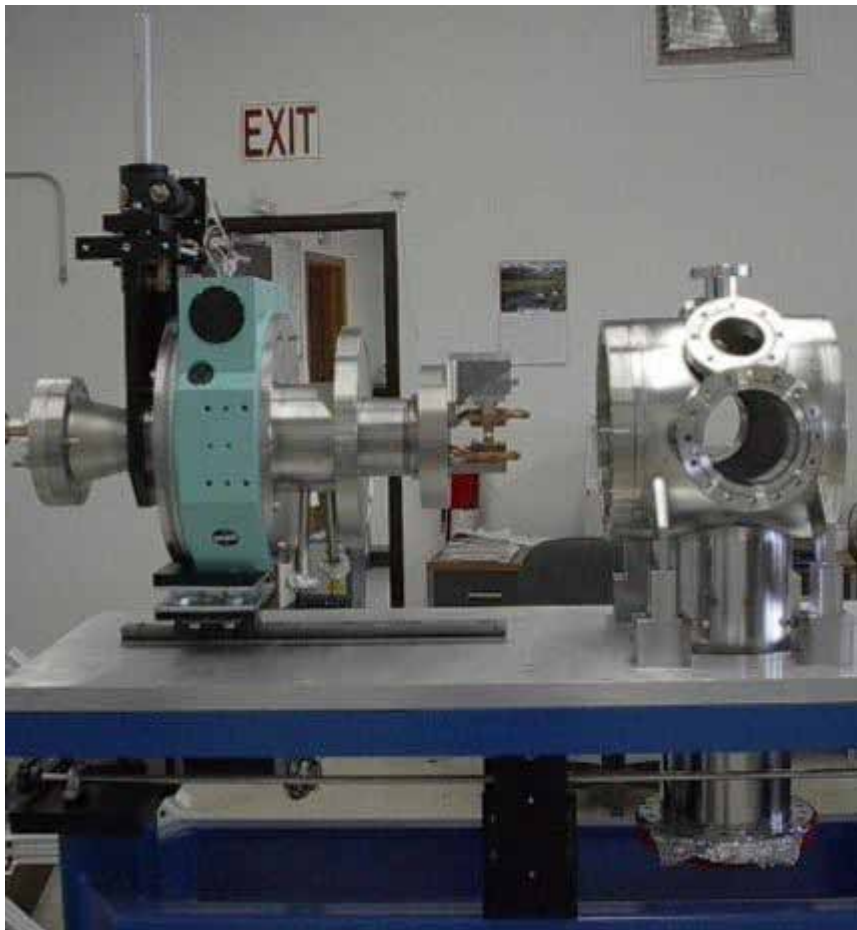
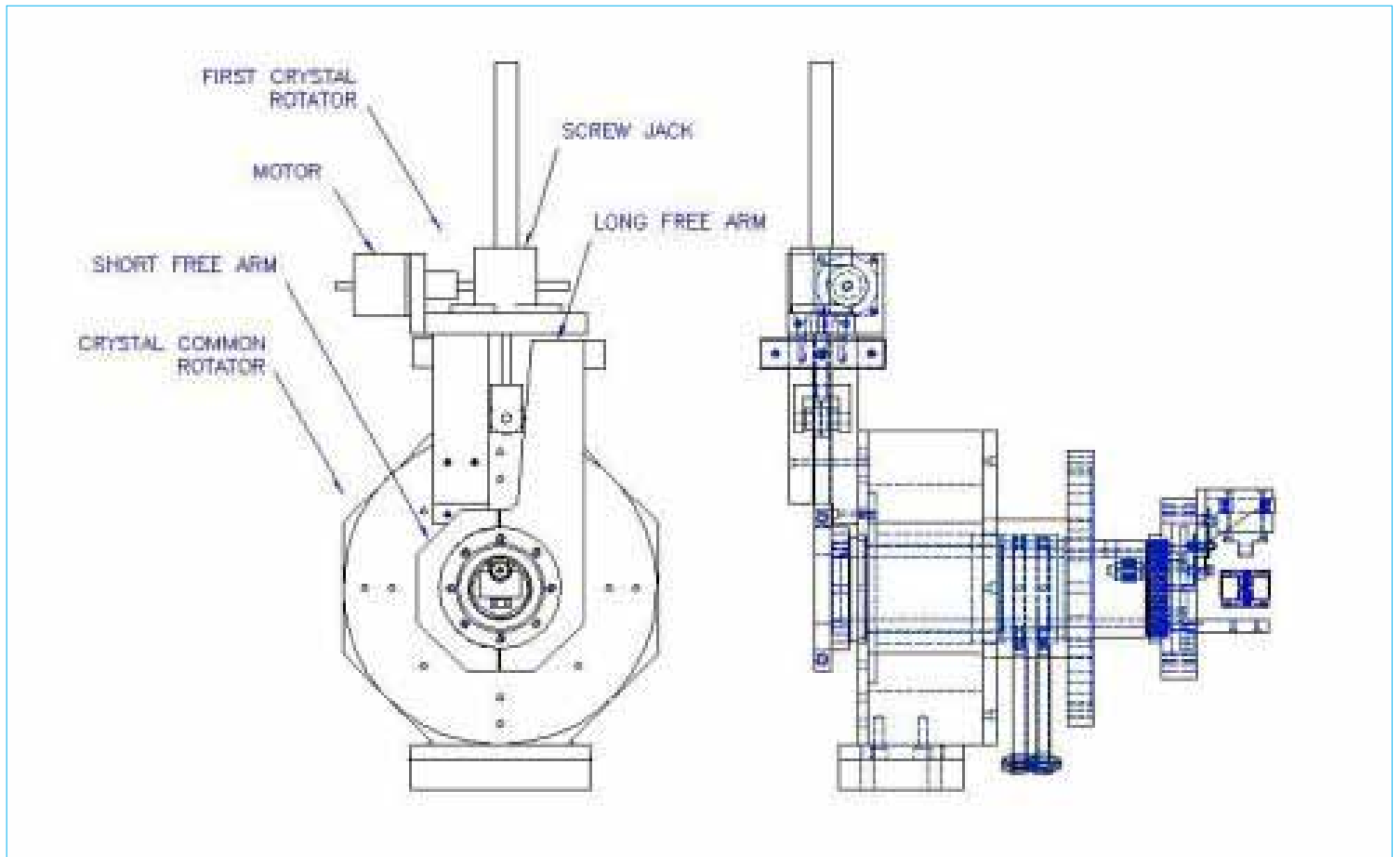
<http://www.adc9001.com/APS-Double-Crystal-Monochromator>

A high-precision water-cooled, small-offset, double crystal monochromator has been developed for the APS UNICAT (Sector 34) beamline. The design incorporates support and gravity-feed water cooling of two diamond or silicon crystals correctly positioned about a common rotation axis so that the incident and diffracted beam do not walk off the edges of the crystals within the energy range 6-15KeV ( $30^\circ < q < 11.6^\circ$ )

**Monochromator Design:** The design was created using parametric solid models. Finite Element Analysis was conducted on several critical parts to determine the possible deflection under different load and heat constraints. Key design features include: First crystal holder. This is a copper block excavated under the crystal and cooled by a continuous water tube starting and ending outside the vacuum. This tube features sections with wave-like bends to accommodate rotation of the crystal holder relative to the tubing entrance/exit flange. This was especially difficult to produce since it was made from OFHC copper which is available only in a relatively hard temper. Second Crystal Holder: This tilts  $\pm 6^\circ$  by being attached to a small vacuum-compatible tilt stage driven by an arrangement of miniature gears, shafts and couplings connected to a motorized feedthrough. A short manual horizontal adjustment is also incorporated. Both holders incorporate a matrix of very small tapped holes for attachment of the crystals via small wedges. Compton shield. This is attached to the second crystal holder to absorb parasitic radiation emitted from the first crystal holder. It is cooled by a tube virtually identical to that on the first crystal holder. Because of the very small area through which these tubes must pass, and their proximity to each other, the four wavelike areas mentioned above are staggered so they can nest together without interference





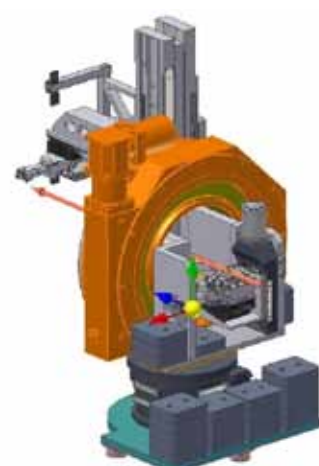
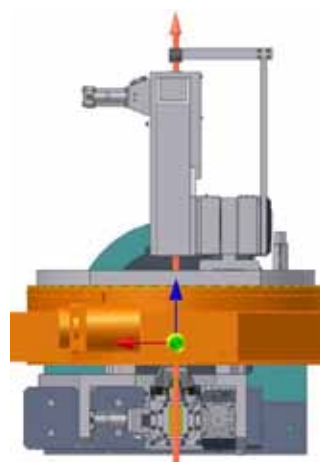
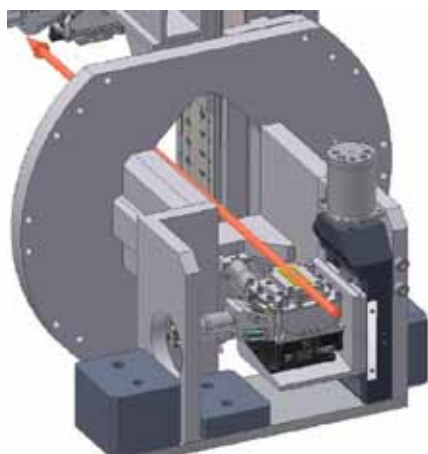
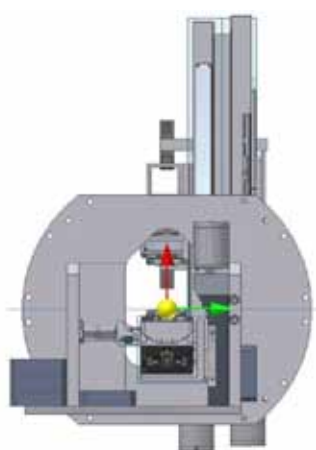


# HIGH VACUUM DOUBLE CRYSTAL DEFLECTOR ASSEMBLY

## for Diamond Light Source

<http://www.adc9001.com/DLS-Double-Crystal-Deflector>

This is a custom double crystal reflector system. The two crystals reflections being used to deflect the beam are Si(111) and Si(220). These crystals are mounted on a stage that allows for adjustable alignment within the beamline, and for their rotation around the beam axis. The radial separation of the second crystal is variable. The optics stage is adjustable in the horizontal and vertical planes and for alignment in pitch and yaw to allow the center of rotation to be adjusted







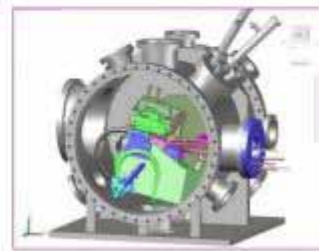


# CRYO-COOLED DOUBLE CRYSTAL MONOCHROMATOR

<http://www.adc9001.com/products/view/643>

EPICS compatible/ Licensed from Advanced Photon Source (APS) This DCM is suitable for use on bending magnet, SC wiggler, Wiggler, and other insertion device beamlines at second and third generation sources and is capable of being used in fixed exit or pseudo channel-cut. The first crystal can be LN or water cooled. Single or multiple second crystals are available. The DCM provides a tunable energy range of 2.0 to 50 keV through crystal exchange or custom designed to meet customer requirements.

The cooling of the 1st crystal accommodate approximately 400W of incident power. The results of the current crystal design at high power loads are shown below. These are crystal rocking curves at low power and maximum power conditions. [Note: for reference, ideal crystal rocking curve widths are 5.843 arc-sec for Si(111) and 1.339 arc-sec for Si(333).]



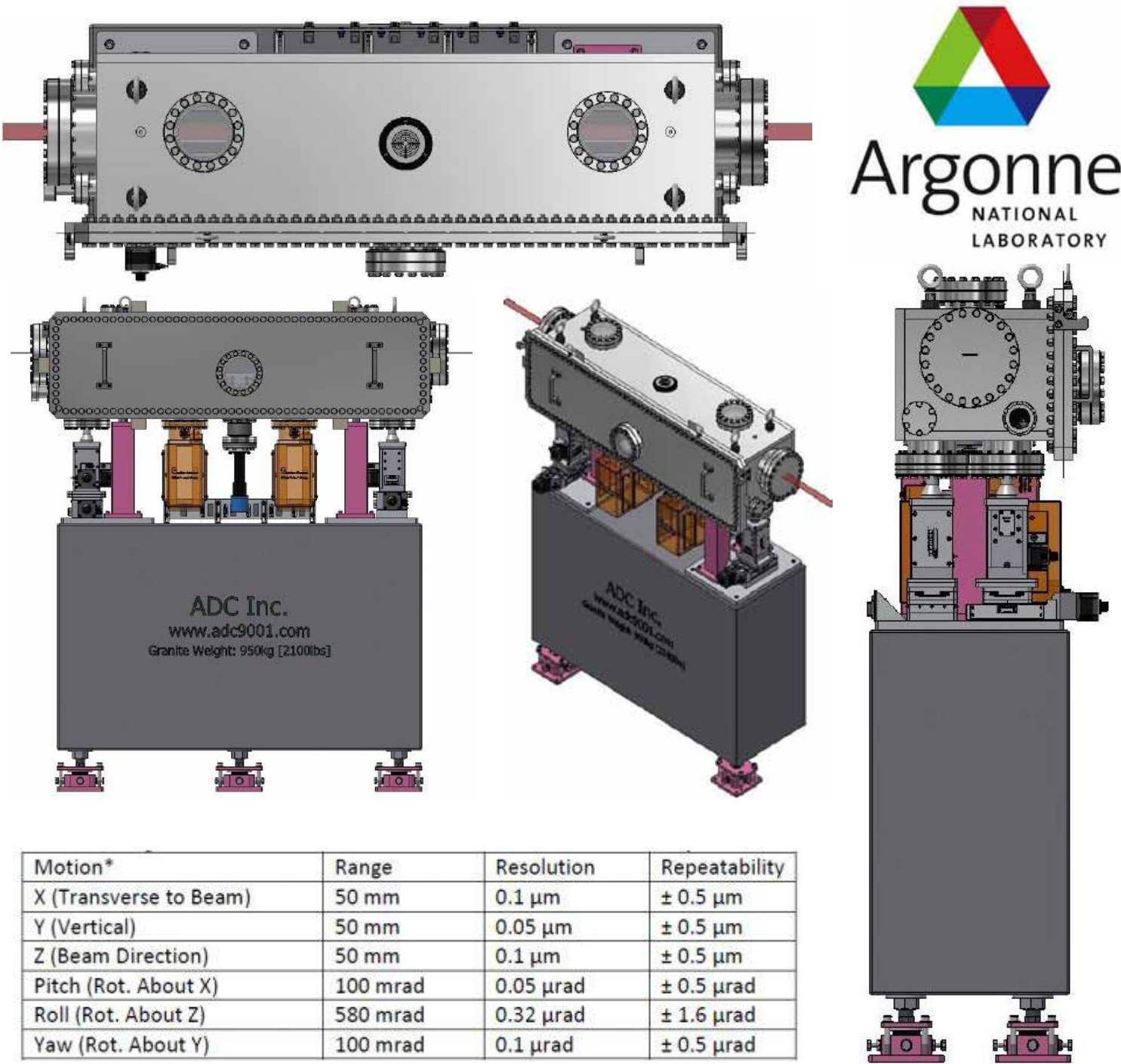
Motion	Parameter	Value(s)
Bragg Angle ( $\Theta$ ) (manual adjustment)	Range	Customer Specify
	Resolution	<1 $\mu$ rad
	Encoder Resolution	<1 $\mu$ rad
	Repeatability	<5 $\mu$ rad
	Scanning Speed	up to 1° / second
White Beam height (input)		Customer Specify
Mono Beam Height (output)		Customer Specify
Primary Stage Lateral Adjustment (X) (Motorized for Crystal Exchange)	Range	$\pm 20$ mm (or Customer Specify)
	Resolution	1 $\mu$ m
	Repeatability	2 $\mu$ m
Primary Stage Height Adjustment (Y) (Motorized for Input Beam Adjustment)	Range	20 mm
	Minimum Incremental Motion	10 $\mu$ m
Primary Stage Lateral Adjustment (X) (manual during installation only)	Range	20 mm
	Minimum Incremental Motion	10 $\mu$ m
Primary Stage Lateral Adjustment (Rz) (manual during installation only)	Range	$\pm 1.5^\circ$
	Minimum Incremental Motion	10 $\mu$ rad
Primary Stage Lateral Adjustment (Ry) (manual during installation only)	Range	$\pm 1.5^\circ$
	Minimum Incremental Motion	10 $\mu$ rad
Primary Stage Lateral Adjustment (Rx)	Range	$\pm 1.5^\circ$
	Minimum Incremental Motion	10 $\mu$ rad

# FOCUSING MIRROR SYSTEM

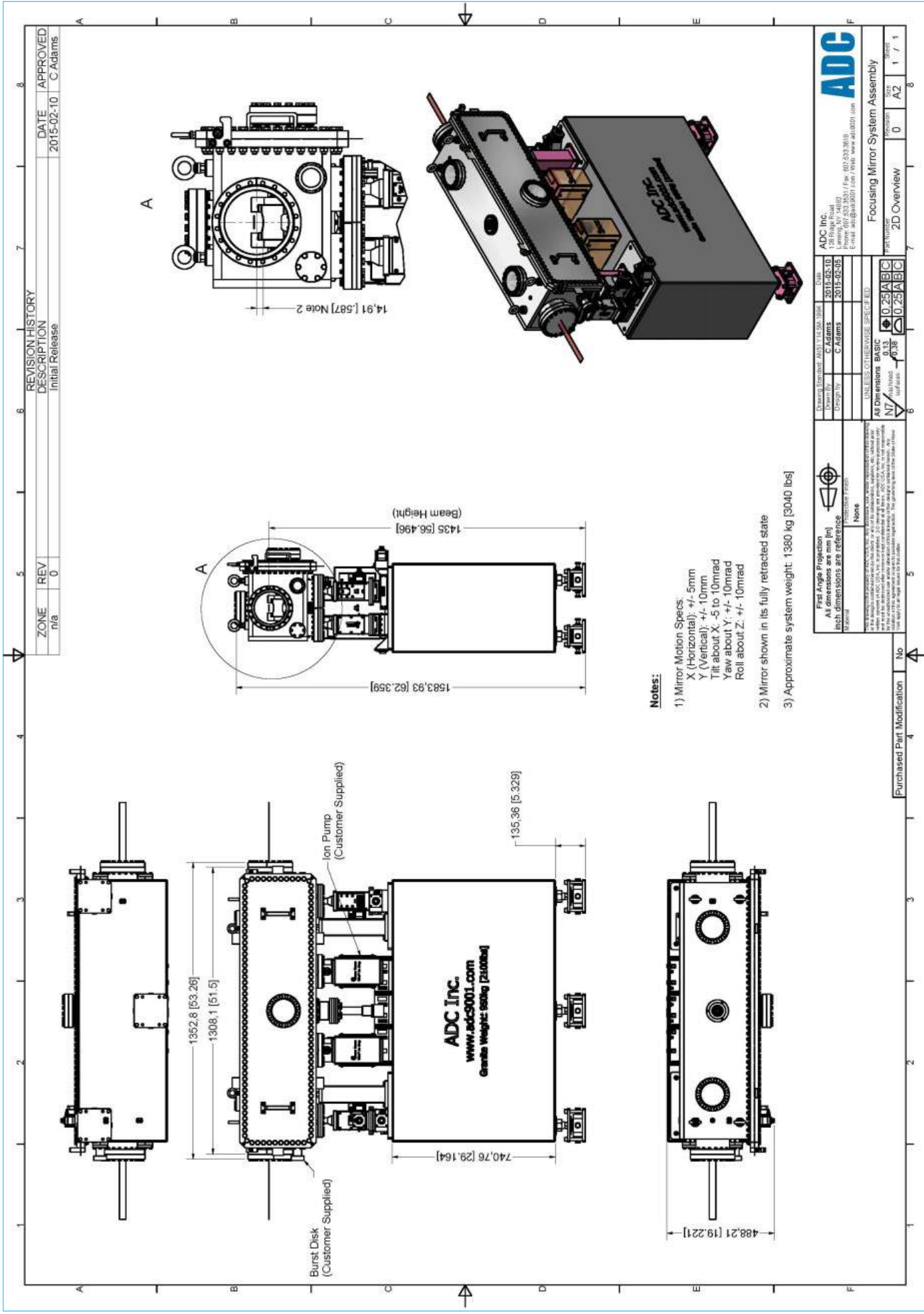
## for Argonne

<http://www.adc9001.com/products/view/664>

ADC has recently finished the design for a new upward reflecting focusing mirror system for use in Advanced Photon Source (APS). The mirror system consists of a large vacuum chamber supported by welded steel posts. This arrangement sits on a granite plinth providing great stability. The vacuum chamber has a number of flanges for viewports, ion pumps, and other accessories. Within the vacuum chamber is a Single Crystal Silicon mirror. This mirror can be bent to a radius as small as 8km by using a linear actuator to bend leaf springs within the vacuum chamber resulting in a moment at the ends of the mirror. Additionally, the mirror can be positioned within the vacuum chamber through the use of ADC's 300 series precision jacks and slides. This series utilizes NEMA 23 stepper motors with Renishaw encoders to achieve great accuracy and repeatability. These are arranged in a way to provide 5 axis of movement to position the mirror







**Notes:**

- 1) Mirror Motion Specs.  
X (Horizontal): +/- 5mm  
Y (Vertical): +/- 10mm  
Tilt about X: -5 to 10mrad  
Yaw about Y: +/- 10mrad  
Roll about Z: +/- 10mrad
- 2) Mirror shown in its fully retracted state
- 3) Approximate system weight: 1380 kg [3040 lbs]

Drawing Standard: ASME Y14.5M, Y14.5-2012		Date	2015-02-10
Drawn by:	C Adams	Design by:	C Adams
ADC Inc. 138 Ridge Road Lewing, NY 14882 Phone: 814.333.8800 Email: adc@adc3001.com / WWW: www.adc3001.com		ADC Inc. 138 Ridge Road Lewing, NY 14882 Phone: 814.333.8800 Email: adc@adc3001.com / WWW: www.adc3001.com	
UNLESS OTHERWISE SPECIFIED		Focusing Mirror System Assembly	
All dimensions are in inches (mm)		Part Number	
1/16		2D Overview	
1/16		0	
1/16		A2	
1/16		1 / 1	



# UNIVERSITY OF GEORGIA MOTION SYSTEM

## for KB Mirror

<http://www.adc9001.com/products/view/665>

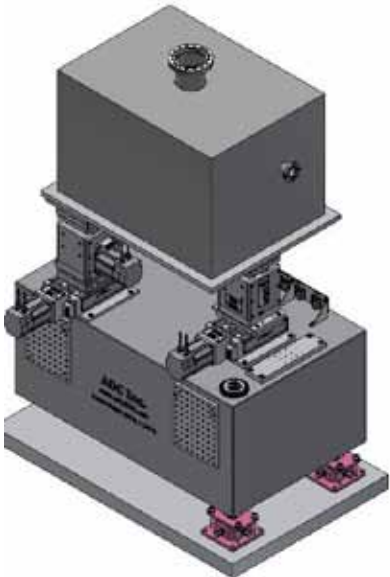
A system was designed for University of Georgia that provides 5 degrees of motion for their KB Mirror. The mirror chamber has 50 mm of vertical (z-axis) travel and 75 mm horizontal (x-axis) travel with a resolution of 1  $\mu\text{m}$ . Through the use of stacked precision slides, precision jacks, free slides, and spherical bearings the chamber can also be rotated around the x-axis, y-axis, and z-axis to allow for leveling and alignment of the chamber. The slides and jacks use MDM-5000 Series Brushless Servo Motors. The motion system sits on a granite base providing stability and vibration dampening. The granite is fitted with removable aluminum breadboards and aluminum plates where additional holes can be added to allow for wiring and other devices to easily be secured in place. The granite is leveled precisely with ADC's lockable leveling feet and bolted to an aluminum plate grouted to the floor.



**Key Specifications:**  
**Linear Travel Specifications:**

Description	Value	Units
Range of Motion (Z Axis)	50 [~2]	mm [in]
Resolution (unit/step)	~0.005	mm/step
Encoder Manuf.	Renishaw	-
Encoder Resolution	0.1	$\mu\text{m}$

Description	Value	Units
Range of Motion (X Axis)	50 [~3]	mm [in]
Resolution (unit/step)	~0.010	mm/step
Encoder Manuf.	Renishaw	-
Encoder Resolution	0.1	$\mu\text{m}$





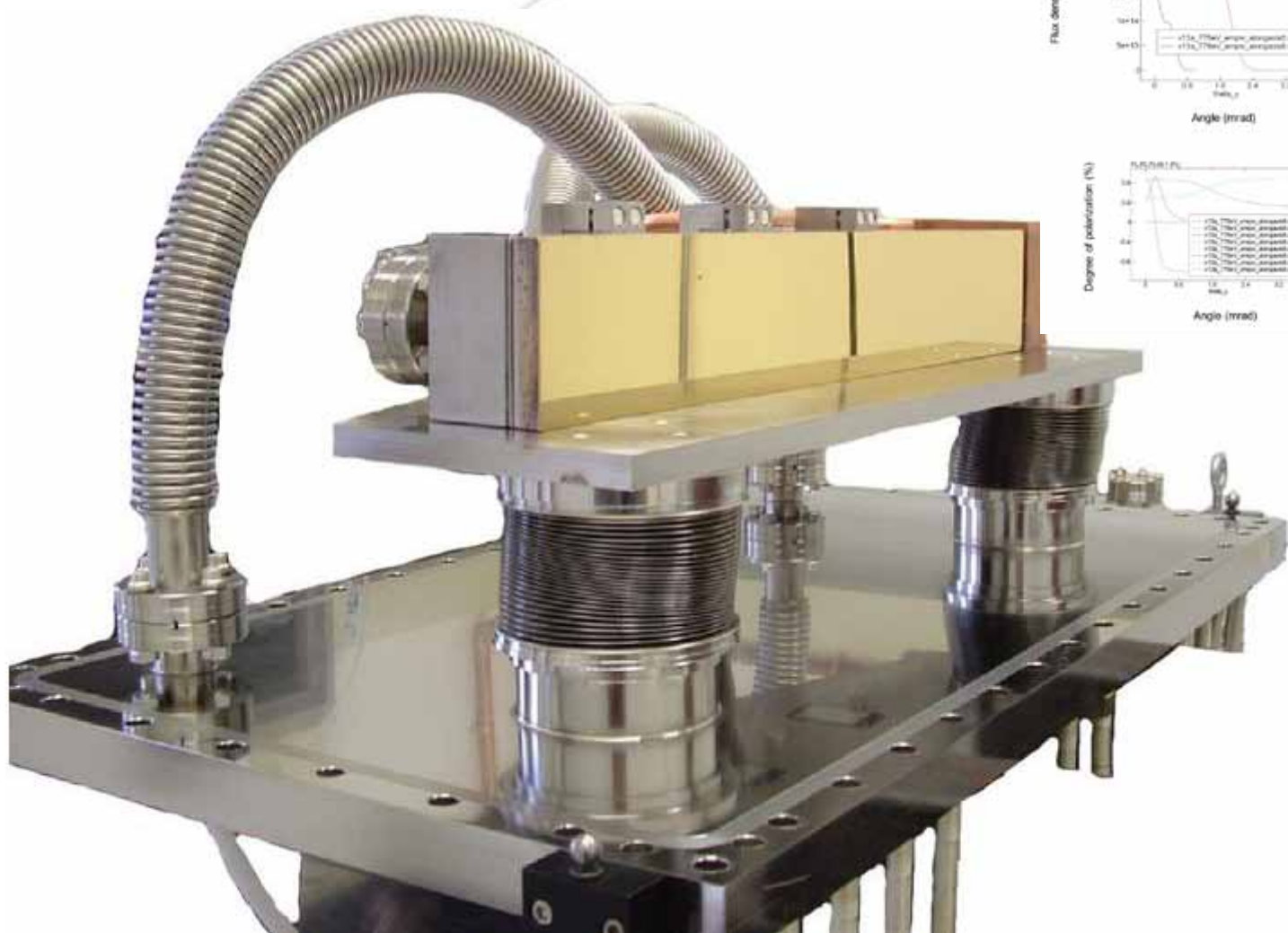
# INTEGRALLY WATER COOLED DEFLECTION/FOCUSING MIRROR

<http://www.adc9001.com/products/view/451>

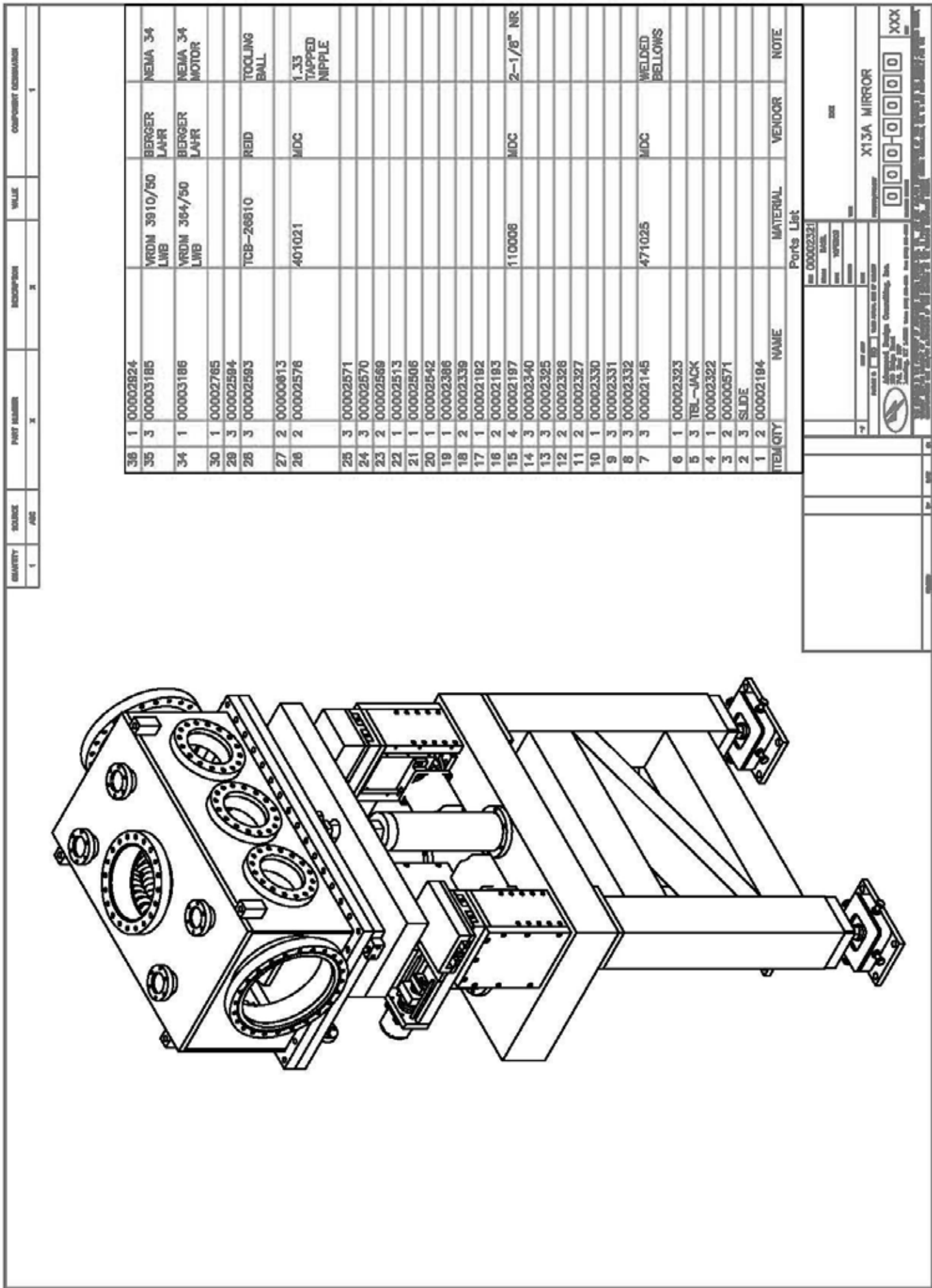
The X13A optics consist of an integrally-water-cooled deflection/focusing mirror (M0) followed by a horizontally dispersing soft x-ray spherical grating monochromator (SGM) and a 22-Hz polarization selection chopper. The M0 mirror, installed and commissioned in mid-2004, provides more stability and higher flux (gain of one order of magnitude) than did the old mirror. The SGM features two diffraction gratings (800 and 1600 grooves/mm), a water-cooled entrance slit, and a movable exit slit. The 22-Hz chopper is synchronized to the switching frequency of the EPW and provides both 22 Hz and 44 Hz signals to the phase-sensitive detector electronics.

The undulator has an 8 cm period, and its first harmonic is in the energy range of 200–700 eV at the nominal ring energy of 2.5 GeV. The beamline uses horizontally deflecting optics. It consists of a SiC plane mirror, a water cooled entrance slit, a spherical grating, and two fixed exit slits. A flux of more than  $10^{12}$  photons/s at 450 eV was measured at X13A with an aluminum-oxide photodiode with a 200  $\mu\text{m}$  entrance slit, a 500  $\mu\text{m}$  exit slit, and a ring current of 242 mA. A VF3 absorption spectrum recorded at X13A shows the monochromator resolving power is at least 1000 at 500 eV with 30  $\mu\text{m}$  entrance and exit slits, in agreement with calculations. The X13A beamline is used for x-ray coherence studies, spectroscopy, and multilayer reflectivity measurements as well as for x-ray instrumentation diagnostics

**BROOKHAVEN**  
NATIONAL LABORATORY







# WHITE LIGHT FOCUSING MIRROR

<http://www.adc9001.com/BNL-Mirror>

ADC USA, Inc. in collaboration with Case Western Reserve University, Center for Synchrotron Biosciences has completed the design of a bendable mirror for the X28C beamline. It is a 50 mm x 100 mm x 1100 mm single crystal silicon with a cylindrical cut with a radius of 43.1 mm bendable to a toroid from infinite to 1200 m radius. The unique feature of this mirror system is the dual use of Indalloy 51 as both a mechanism for heat transfer and a buoyant support to negate the effects of gravity.



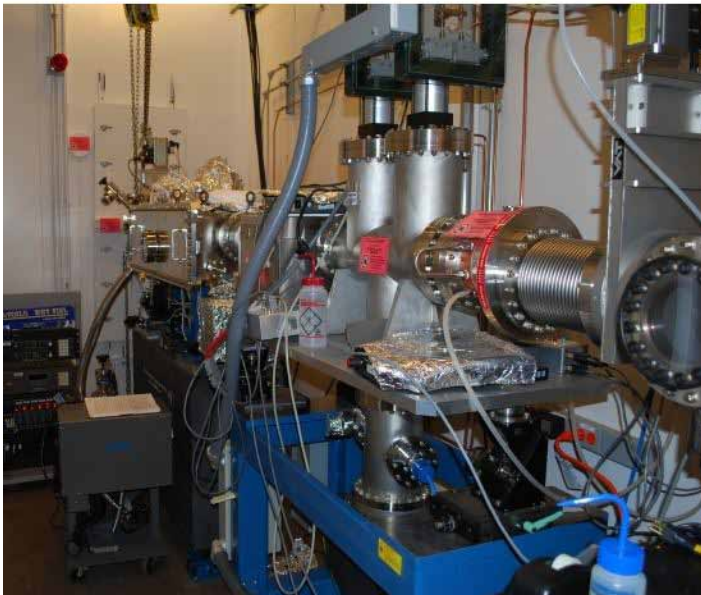
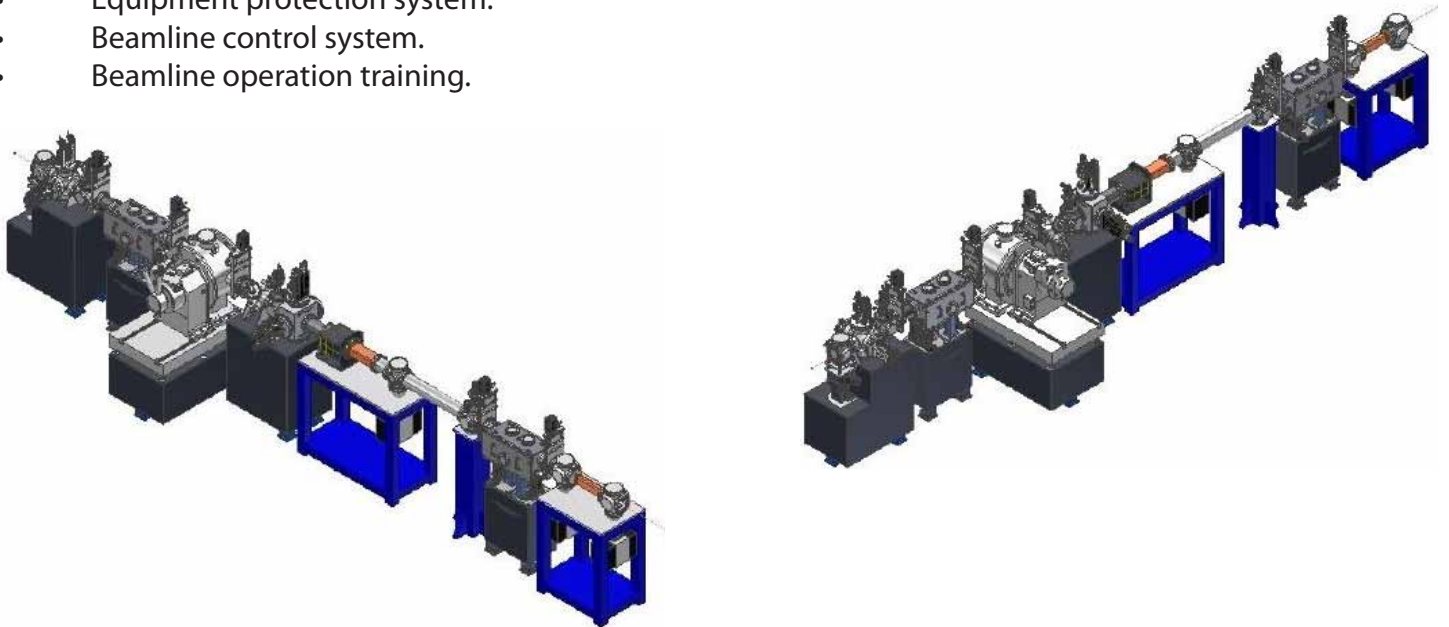


# TURN-KEY BEAMLINE

<http://www.adc9001.com/products/view/457>

ADC manages designs and manufactures complete front ends and beamlines. Our assistance includes overall project management, mechanical and instrumentation design, manufacturing, assembly and testing, commissioning and training, including:

- Ray-tracing, including measured optical elements profile.
- Thermal and stress analysis, using ANSYS FEA calculations, to validate high heat load components design.
- Cryo-cooling design optimization.
- Selection of cooling scheme for mirrors and crystals.
- Heat load calculations for filters, masks and mirrors.
- Mirrors substrate selections.
- Design of complex brazing and special welding.
- Mirror coating selection.
- Equipment protection system.
- Beamline control system.
- Beamline operation training.





# SOFT X-RAY SCATTERING OCTUPOLE END STATION

The Octupole End Station is used for Soft X-ray Scattering. This device imparts a magnetic field in any direction on a sample for magnetic dichroism (XMD) experiments. Eight magnets, equidistantly spaced about the surface of a sphere, create an omnidirectional magnetic field vector with a magnitude of 1 [T]. The magnets protrude into an ultra-high vacuum chamber with a base pressure of 5E-10 [mbar] that houses both the sample and detector apparatus. The entire system is then capable of rotation about the beam axis.

## Technical Specification:

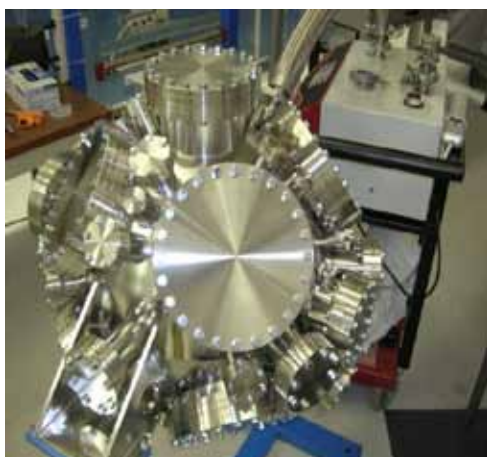
- Peak field magnitude of 1T
- Field uniformity of 5% over 10mm cube • Field vector rotatable in free space
- Integrated goniometer
- UHV operation @ 5E-10mbar
- System rotatable from +/-45O about beam axis
- Support frame constructed of 304SS
- Optional x,y,z,theta sample manipulator
- Optional load lock chamber
- Optional LHe cryostat for sample cooling to 4K
- Optional Programmable power supplies with 0-60V, 0-100A
- Optional EPICS motion controller

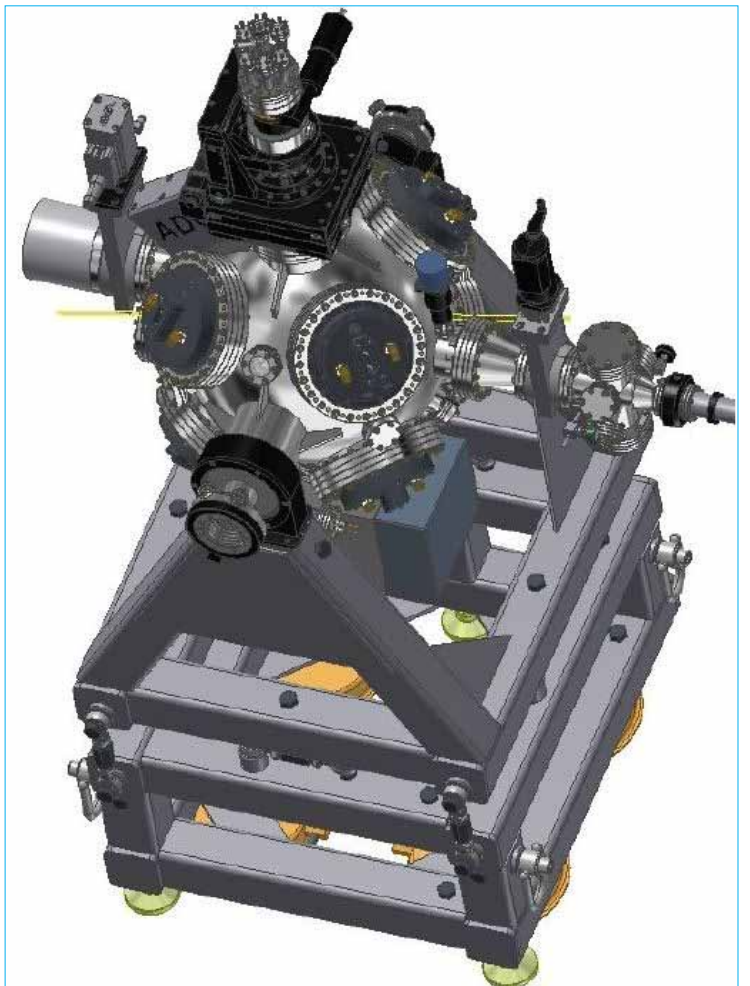
**Note: The original idea for this Octupole End Station was originated from ALS:**

Design and performance of an eight-pole resistive magnet for soft x-ray magnetic dichroism measurements Rev. Sci. Instrum. 76, 083908 (2005)

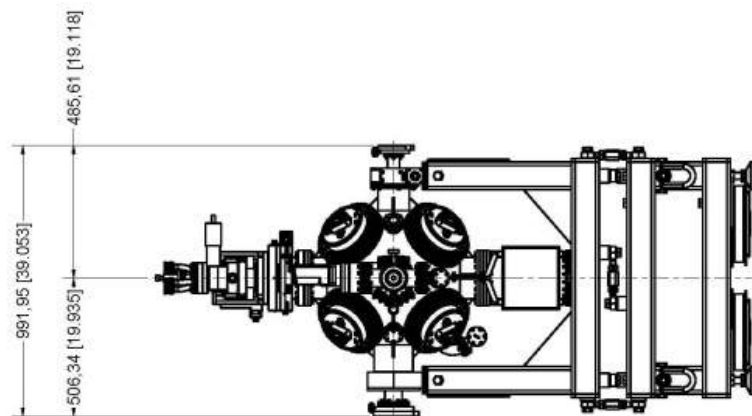
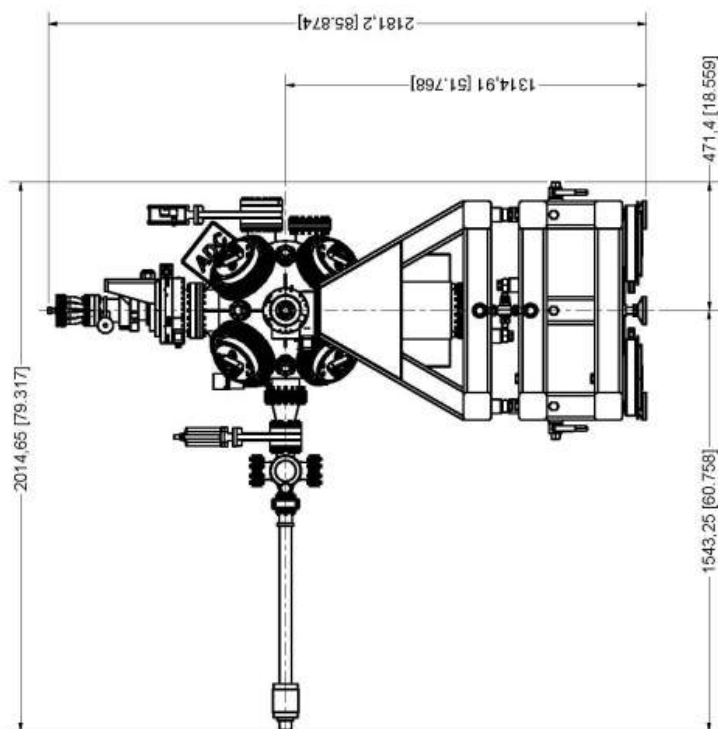
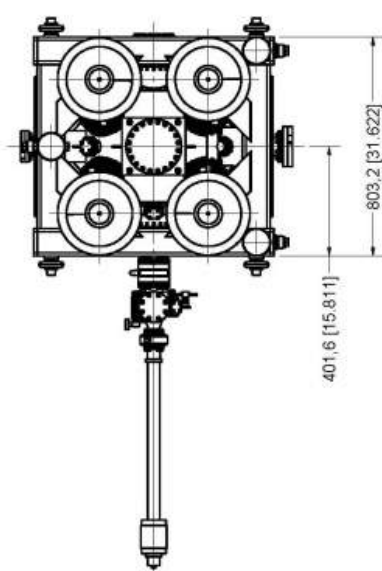
<http://dx.doi.org/10.1063/1.2008027>

<http://ssg.als.lbl.gov/ssgdirectory/arenholz/Vectormagnet.html>









First Angle Projection All dimensions are max [in]			Drawing Standard: ANSI Y14.5m Drawing Date: 7/7/2006 Drawing By: SWH Drawing Check: AIL Date: 7/7/2006		Advanced Design Consulting USA, Inc. 14890, NY 14892 Phone: (815) 333-3531 Fax: (815) 333-3519 E-Mail: info@adc-usa.com		
Material:		Finish:	All Dimensions: BASIC Tolerances: 0.13 Surface: 0.38		Layout Dimensions, Octupole Part Number: 00009386_layout Revision: 1 Size: A2		



# OTFD-100 IN-SITU X-RAY SCATTERING

## of organic thin film deposition

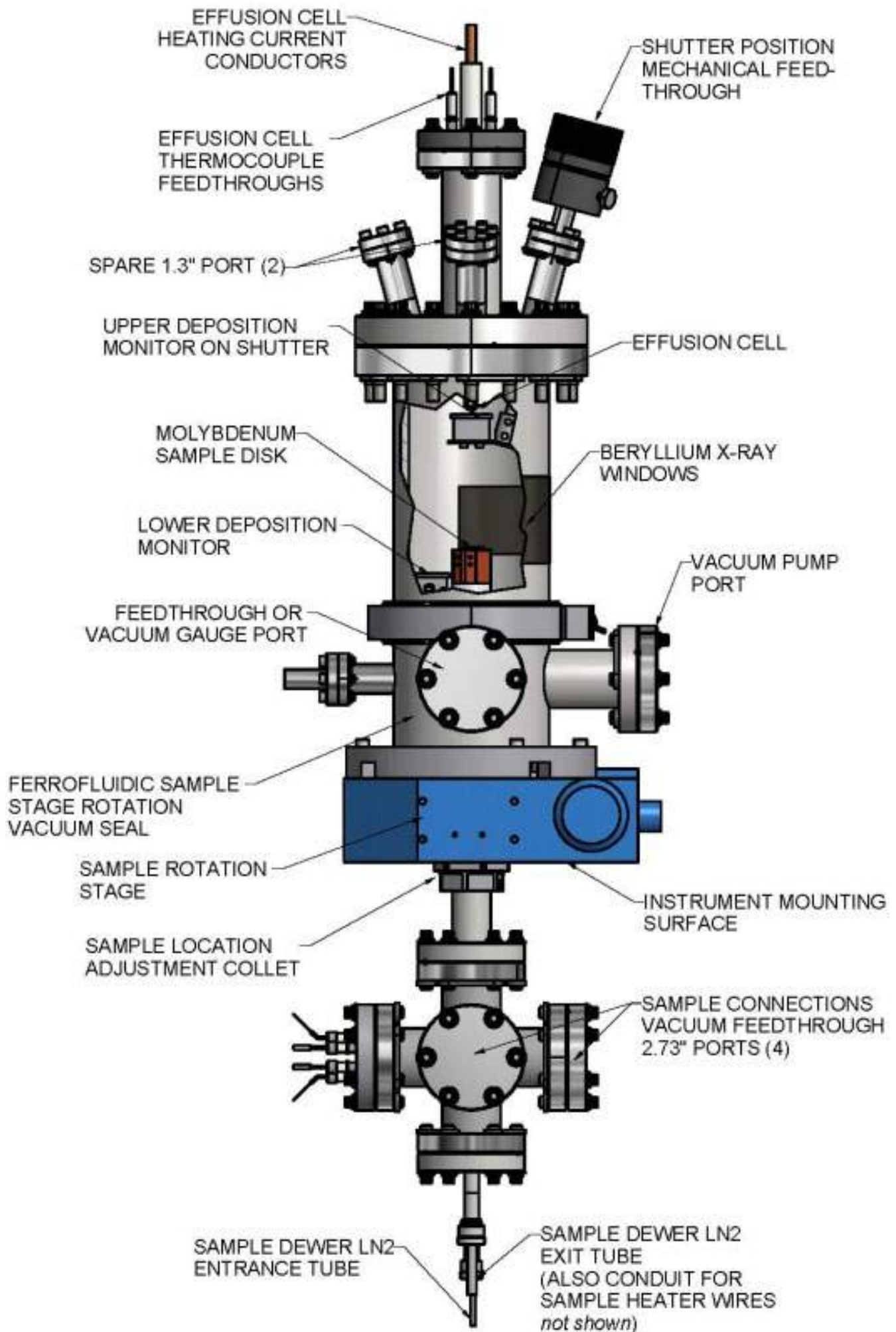
<http://www.adc9001.com/Standard-Pentacene-Film-Growth-Instrument>

Modern materials science calls for sophisticated tools that allow X-ray investigations in defined environments and under controlled temperature conditions. Organic electronic materials have potential applications in a number of low-cost, large area electronic devices, such as flat panel displays and inexpensive solar panels. Small molecules of the series Anthracene, Tetracene, Pentacene, are model molecules for organic, semiconductor, thin films, to be used as the active layers in such devices. The OTFD-100 is a compact vacuum deposition chamber for in-situ x-ray scattering studies of organic thin film growth. The system is based on a small cylindrical chamber that can be mounted on a standard four-circle diffractometer. Incident and scattered x-rays enter and exit the chamber through a curved Be foil window that covers 270 degrees, and is sealed to the body of the chamber. The sample is mounted on a post with heating and cooling from liquid nitrogen temperature to >100 centigrade. Integral to the sample stage is a multi-wire feed through to facilitate in-situ electrical transport characterization of organic semiconductor thin films. This is one of the unique capabilities of the system. In addition, the sample stage is mounted on a rotary vacuum feed through, which is mechanically coupled to the "phi" stage of the diffractometer. An effusion cell, shutter, and quartz oscillator thickness monitor are also incorporated into the system, which is pumped by a small turbomolecular pump. The system thus configured is capable of access to full reciprocal space, within the limits of the Be window.

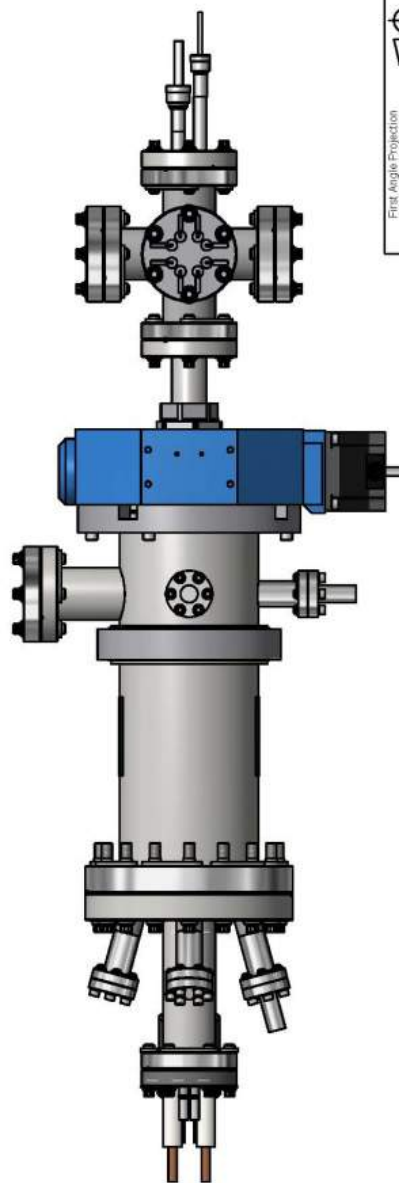
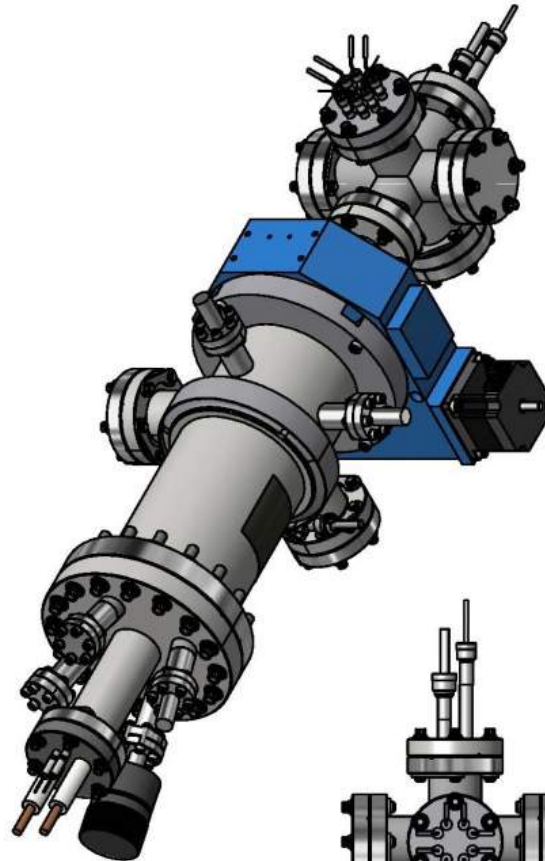
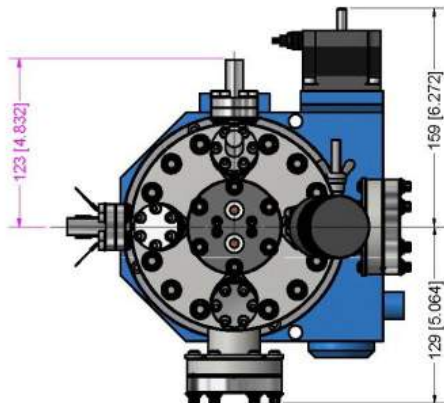
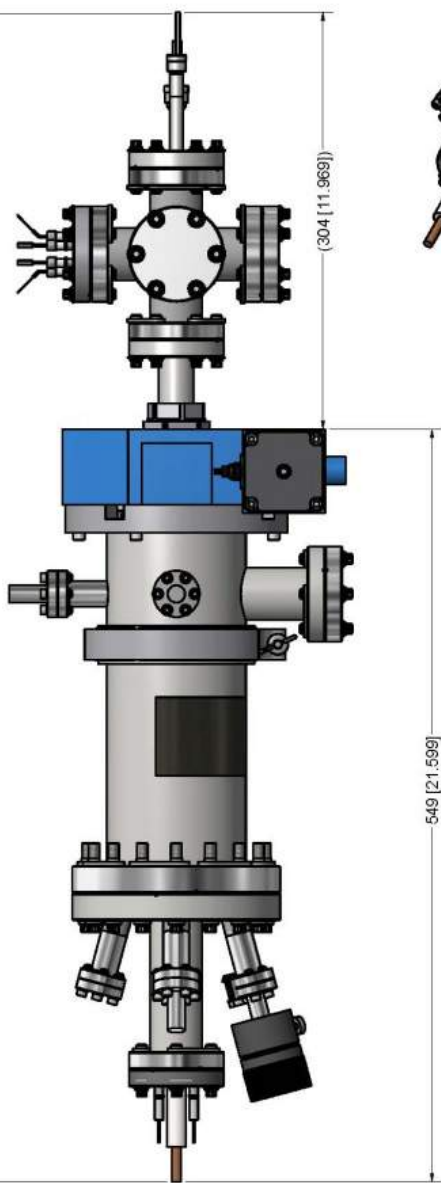
### Features and Benefits

- Excellent sample temperature uniformity due to environmental heating and cooling
- Reliable measurement and control of the sample temperature
- Sample mounting for optimal data quality
- Custom specialized inner and outer heater shielding
- Easy exchange of samples
- Chemically passive sample carrier
- Easy installation in most standard diffractometers
- Robustness and long durability
- Automatic heating, cooling and pumping of samples with one button
- Graphical data display of real time for each run
- Integrated work station
- Integrated high-end PLC with large screen interface
- Universal and application specific sample base
- Safety and ergonomically designed system process chamber
- Multilingual operating
- Compact and mobile
- Uses standard 100-250 V / 50-60 hz power supply





852 [33.528]  
VARIES SLIGHTLY DEPENDING ON POSITION OF  
SAMPLE DISK IN CHAMBER



OVERALL INSTRUMENT DIMENSIONS

<p>First Angle Projection All dimensions are in inches unless otherwise specified. inch dimensions are reference</p>		<p>Drawing Standard: ANSI Y14.5M-1994 Drawing Number: 00015595 Revision: 3 Date: 03/21/00 E-mail: aedg@adco.com / Web: www.adco.com</p>		<p>Advanced Design Consulting USA, Inc. 126 Ridge Road, P.O. Box 187 Ridge, NY 11774 Phone: 607.533.3531 / Fax: 607.533.3618 E-mail: aedg@adco.com / Web: www.adco.com</p>	
<p>Material: Inconel 600 Finish: None Tolerance: ±0.005 Surface: N7</p>		<p>UNLESS OTHERWISE SPECIFIED: All Dimensions: BASIC Tolerances: 0.005 Surface: N7</p>		<p>Top Assembly-Pentacene Film Instrument Part Number: 00015595 Revision: 3 Sheet: 4</p>	

Purchased Part Modification No



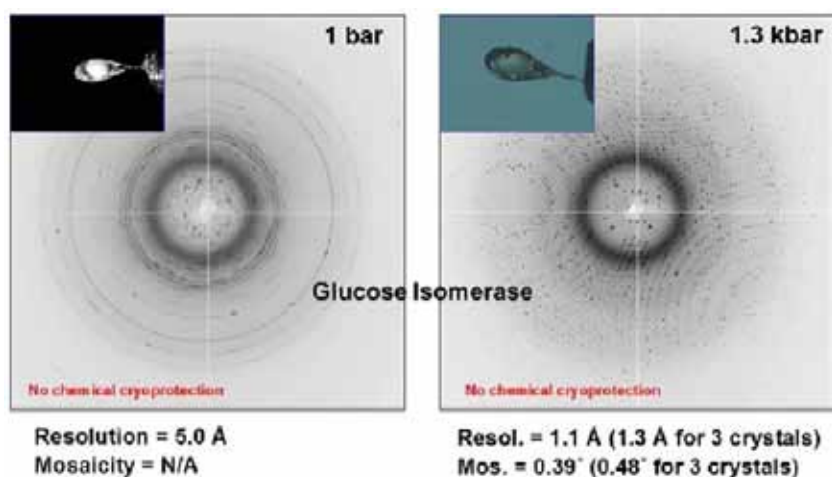
# HIGH PRESSURE CRYO-COOLER

## for X-Ray Crystallography (HPC-201)

<http://www.adc9001.com/products/view/659>

ADC is offering a High Pressure Cryo-Cooler for preparing protein crystals. This device is based on a process developed by Cornell University scientists Prof. Sol M. Gruner and Dr. Chae Un Kim. This exciting new technology enables the simultaneous capture of both amplitude and phase information from single anomalous diffraction (SAD) of a cryocooled protein crystal, thereby providing sufficient data to solve the crystal structure of a protein with an unknown structure. Flash-freezing at atmospheric pressure requires the use of cryoprotectants. Finding the right cryoprotectant for a sample type can be a long trial-and-error process. The High Pressure Cryo-Cooler eliminates the need to use cryoprotectants and produces superior results. The scatter images below of a glucose isomerase crystal prepared at atmospheric pressure (left) and under high pressure (right) demonstrate the benefits of high-pressure cryocooling.

The high-pressure cryo-cooler is designed to hold 3 samples at a time. Crystal samples are picked up using a standard cryoloop. Cryoloops are mounted to heavy duty stainless steel tubing in the unit and are then ready to be pressurized and cooled. A high pressure oil pump provides helium gas to the samples. External controls allow the sample to be first pressurized and then cooled by a LN2 bath. Once pressure is released the samples can be removed and handled like any other samples prepared by the conventional flash freezing.



### Features

Pressurizing Gas	Helium
Working Pressure	200 MPa
Cooling Fluid	LN <sub>2</sub>
Cryo Cooling Temp	77 K (-196 °C)
Sample Capacity (per pressure & cooling cycle)	3
Process Time	< 10 min (2 min for pump operation; ~ 5 min under pressure; 1min freezing)
ZEISS Microscope	SteREO Discovery.V8
LN <sub>2</sub> dewar	Taylor-Wharton HC34

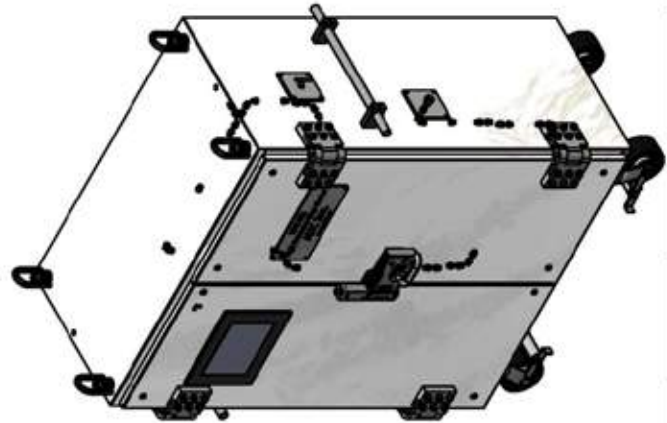
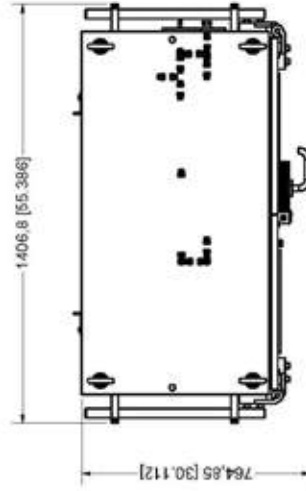
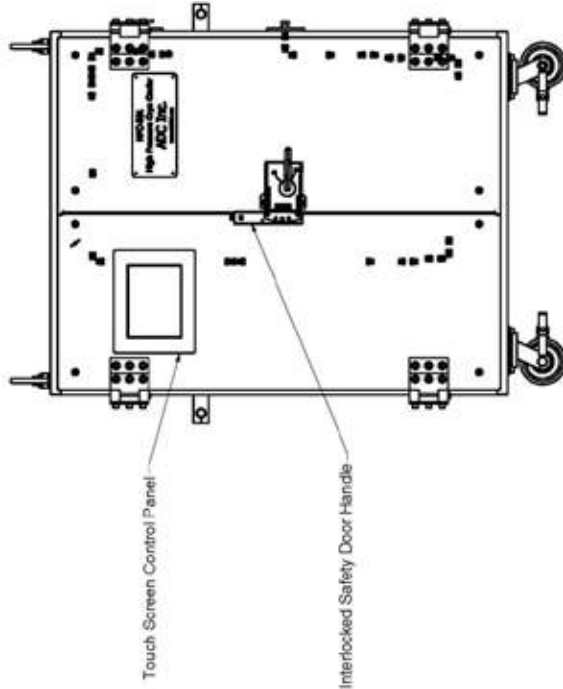
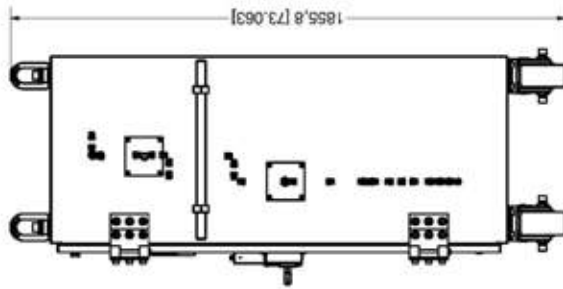
### Connection Data


Voltages, frequencies	50/60 Hz
Power input, approx.	115/230 VAC
Oil pump pressure	200 MPa
LN <sub>2</sub> Dewar Holding	200 Days



**Specifications:**

- $\frac{1}{4}$ " or  $\frac{3}{16}$ " High Pressure Tubing can be used during this process
- Maximum 3 samples can be cooled per cycle
- Touch screen display for operating the system
- LED indicators provide visual feedback of what state the system is in during operation
- Compressor requires He gas supplied at 6.9 MPa
- Internal pressure reaches 200 MPa
- Approximate system weight = 1350 kg [2976 lb]

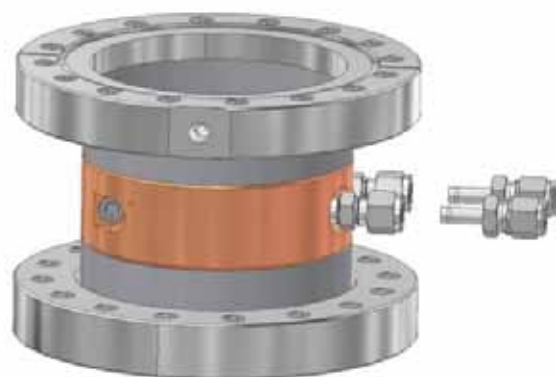
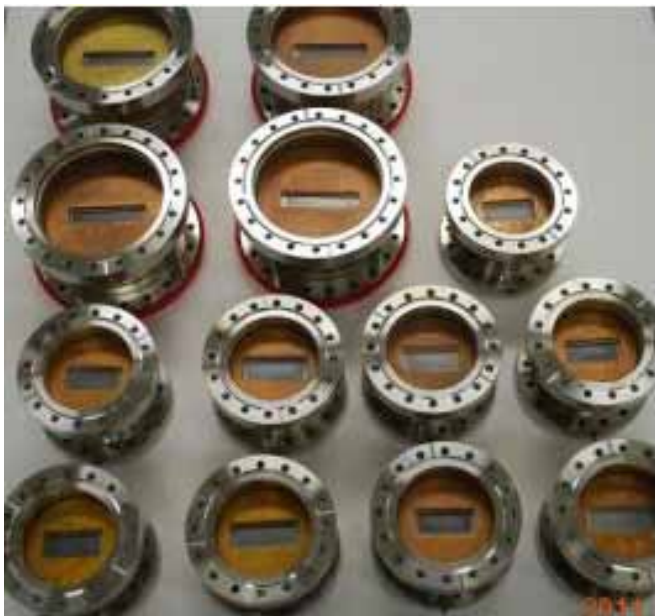


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DECIMALS		None	
ANGLES		None	
HATCH		None	
DIMENSIONS		None	
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FRACTIONS		None	
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TOLERANCES		None	
FRACTIONS		None	
DECIMALS		None	
ANGLES		None	

# BERYLLIUM WINDOWS

<http://www.adc9001.com/Beryllium-Windows>

ADC produces beryllium window assemblies that incorporate state-of-the-art bonding of beryllium to OFHC copper. These assemblies typically include TIG-welded lengths of stainless steel pipe and vacuum flanges. Better beryllium foil surface finish and/or customization is available upon request. Standard Surface Finish: is  $\sim 1.0$  micrometer Ra Vacuum Tested: Better than  $2 \times 10^{-10}$  Torr





# BEAM PIPES

[http://www.adc9001.com/products/show\\_list/id/172](http://www.adc9001.com/products/show_list/id/172)

ADC delivers high quality beam pipes, used for front and back end synchrotron equipment. The pipes are manufactured to exact customer specifications and requirements, and come with or without lead shielding. Lead shielded transport pipes are used for locations such as hard X-ray insertion device beamlines at synchrotron facilities to transport white beam from one experimental hutch to another. These pipes are UHV-clean stainless steel pipes with conflat flanges on either end to complete the vacuum seal, but have a certain thickness of lead around the outside. Each assembly undergoes complete leak testing. In addition, a lead clam shell-type transition piece is installed over the conflat connections to prevent radiation from escaping in this location.



The lead shielded design ensures that every linear path from inside the pipe to outside pass through the design specification of lead thickness. ADC produces the lead either in sheet form and wrapped around the pipe or extruded as 1 piece and slid over the outside pipe diameter. When the lead is in sheet form, all the joints are staggered to prevent a line of sight to the inside of the tube and the overall minimum thickness of the lead in all areas are met. A minimum 0.020 inch thick stainless steel sheet is tack welded over the entire outside diameter of the lead in order to prevent lead handling contamination. ADC uses lead that meets ASTM specification B29-92, Standard Specification for Refined Lead. All lead are free from voids or fissures. All transport pipes are 304 stainless steel

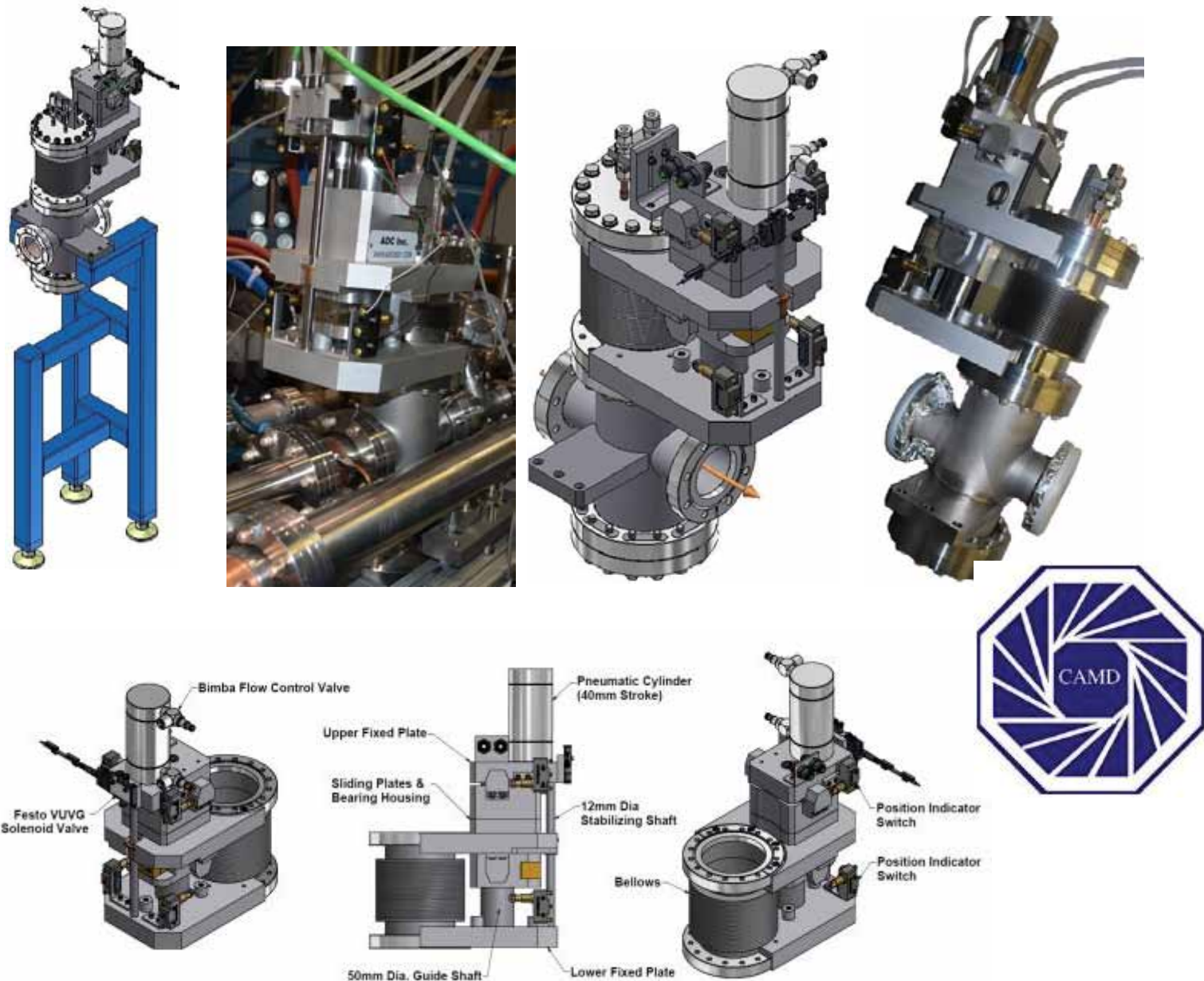
ADC delivers customized evacuated flight tubes, used to minimize absorption and stray scattering. The pipes are manufactured to exact customer specifications and requirements and come in fixed or adjustable lengths.



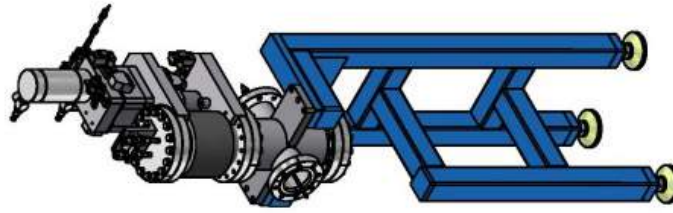
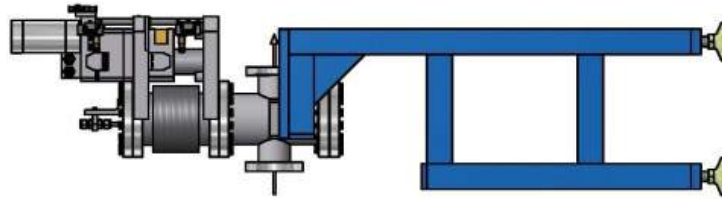
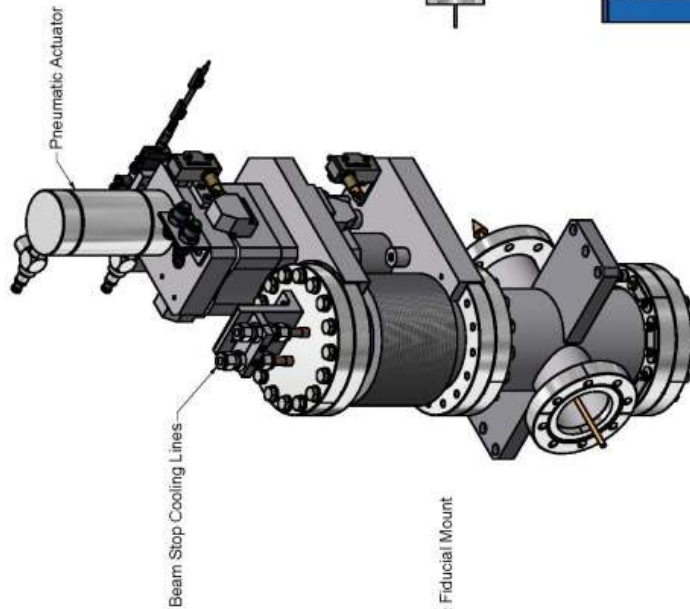
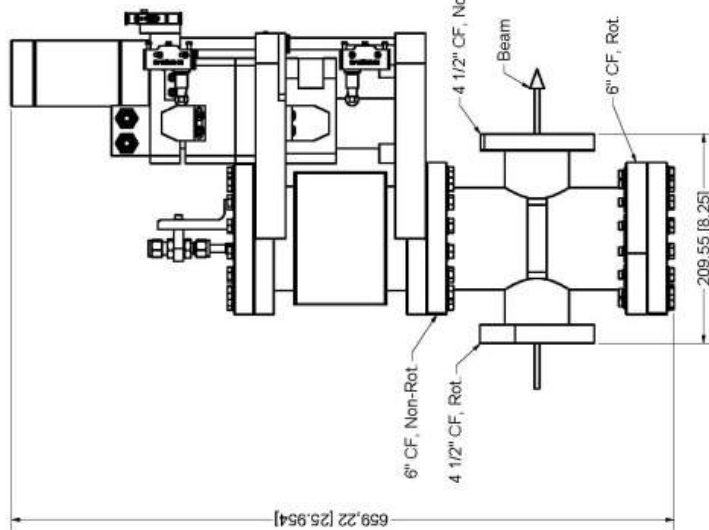
# PHOTON SHUTTER

<http://www.adc9001.com/products/view/459>

This document presents a detailed overview of ADC's beam stop and safety shutter design. Beam stops are designed as high heat load absorbers to provide equipment protection. For applications requiring personnel protection, safety shutters are designed to provide high heat load and radiation absorption. ADC has designed these components to be easily removed from the beamline. This reduces the downtime required for the beamline while these critical front-end components are replaced or repaired. The following paragraphs, figures, and attached drawings will present the detailed design of ADC's beam stop and safety shutter offerings. ADC's stops and shutters consist of three major components – a linear pneumatic actuator, water cooled absorber, and a vacuum chamber. These shutters are designed for ease of assembly and servicing. Figure 1 below shows the complete assembly of a photon shutter along with an exploded view highlighting the major components. By using a 4-way cross, the beam stop assembly and actuator assembly can be removed without disconnecting components directly from the beamline. A similar pneumatic actuator is used for ADC's safety shutter design, shown in Figure 2. The longer length absorber is attached to the actuator at two points. A rectangular UHV chamber houses the absorber allowing the actuator and absorber to be removed as a single unit.







Photon Shutter Assembly Mounted to Adjustable Stand

#### Specifications:

- Vacuum Level: UHV
- Bellows: Rated for 10,000 Cycles
- Actuator Stroke Designed to Meet Individual Requirements
- Water Cooled Copper Beam Stop Designed for High Heat Load Applications
- Approximate System Weight: 40.19 kg [88.6 lb] Without Stand, 63.32 kg [139.6 lb] With Stand
- Different Flange Sizes and Bellows Sizes Available to Meet Specific Requirements

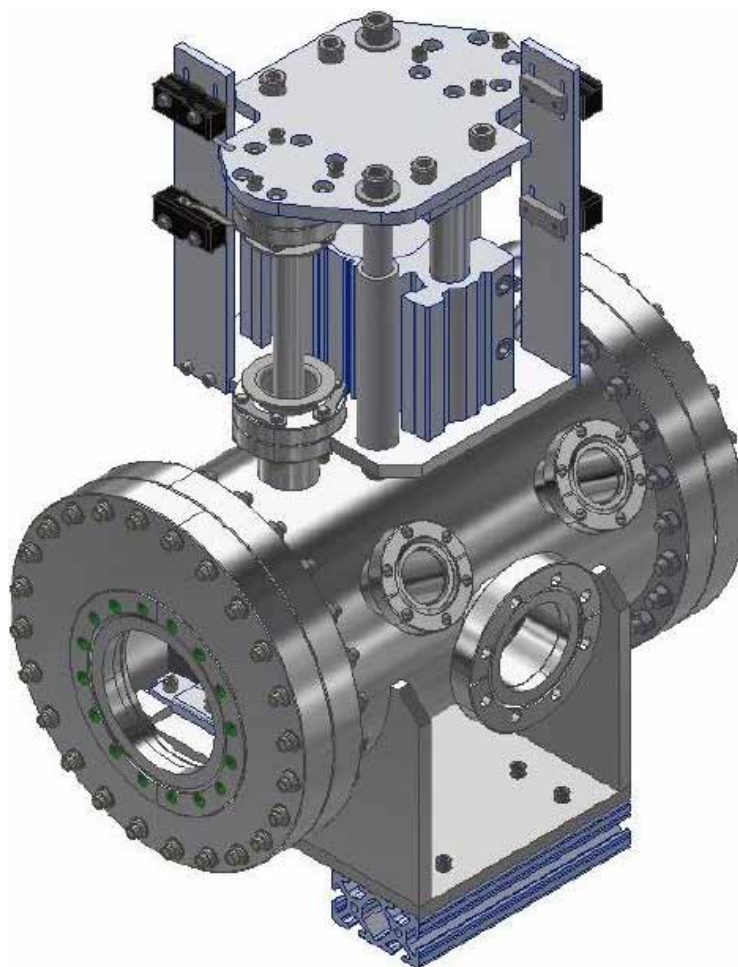
<b>UHV</b> DO NOT USE CHLORINE OR SULPHUR BEARING OILS OR ABRASIVES USE ONLY APPROVED UHV COMPATIBLE LUBRICANTS AND COOLANTS DATE APPROVED BY: M. Popov Date: 9/14/2012 Purchased Part Modification No. 4		First Angle Projection All dimensions are in [in] Inch dimensions are reference 1/8" = 1"		Drawing Standard: ASME Y14.5-1994 Drawn by: E. Acome Eng. approval: M. Popov Date: 9/14/2012 Date: 9/14/2012		ADC USA, Inc. 125 Ridge Road Lansing, MI 48902 Tel: 517.487.3900 Fax: 517.487.3901 E-mail: sales@adc-usa.com / Web: www.adc-usa.com	
		TOLERANCE SPECIFICATIONS All Dimensions: BASIC Finish: N7 Surface: 0.13 Flatness: 0.38 Roundness: 0.13		Part Number: 0 Revision: 0 Date: 9/14/2012 Drawn by: 1 / 1			



# BREMSSTRAHLUNG SAFETY SHUTTER

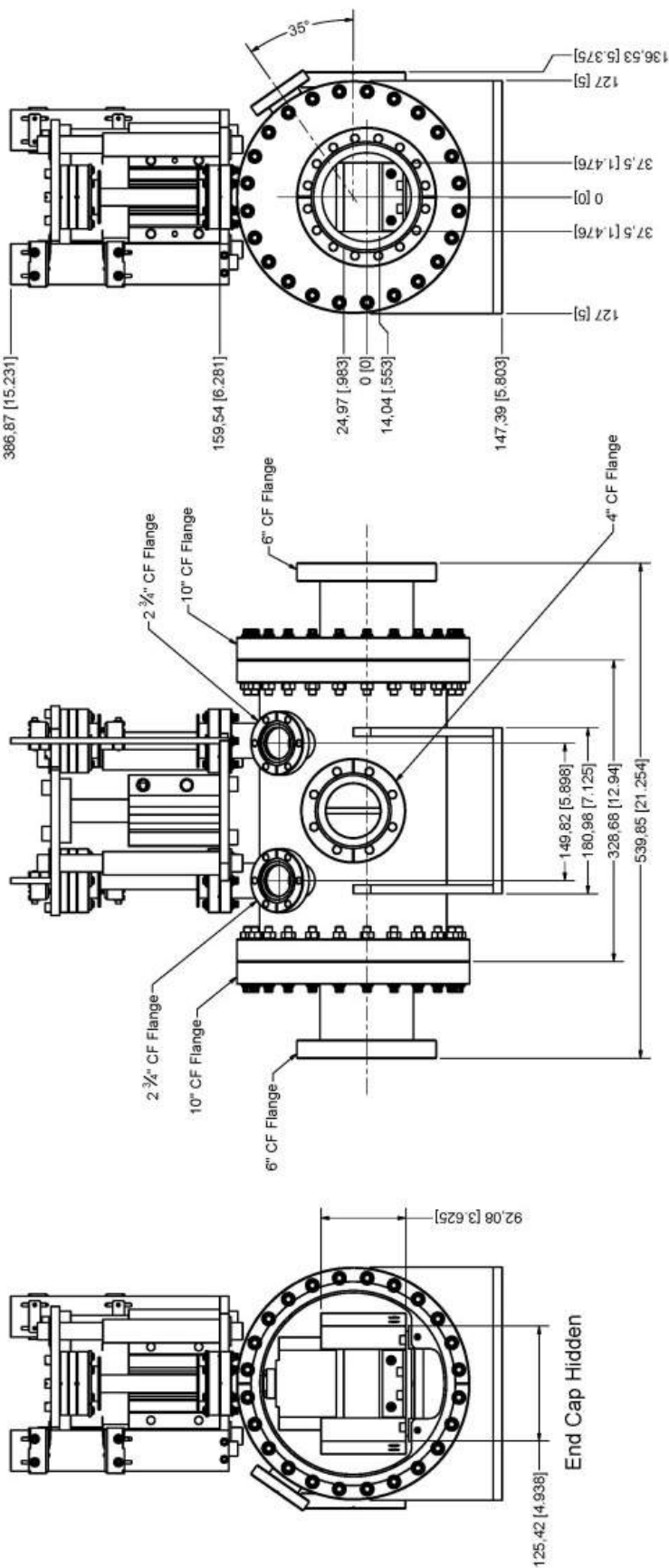
<http://www.adc9001.com/products/view/668>

An adaptation of the bremsstrahlung safety shutter on A-Line at the Cornell High Energy Synchrotron Source (CHESS) was designed for use on F-Line. The significant changes were a larger profile of tungsten transverse to the beam, and the correspondingly larger actuator stroke and chamber size. Other changes included re-orienting the pump and auxiliary ports on the chamber, providing a chamber base that easily interfaces with 80/20® 15-Series aluminum extrusions, and adding adjustability for the position switch locations. The shutter consists of a stationary, U-shaped block of tungsten into and out of which the moving block is raised and lowered to open and close the shutter. These blocks are made with sloped walls and overlaps to ensure there are no gaps allowing direct line of sight through the tungsten. If the actuator fails or the moving block becomes disconnected, the moving block falls into the closed position and is held by the stationary block.



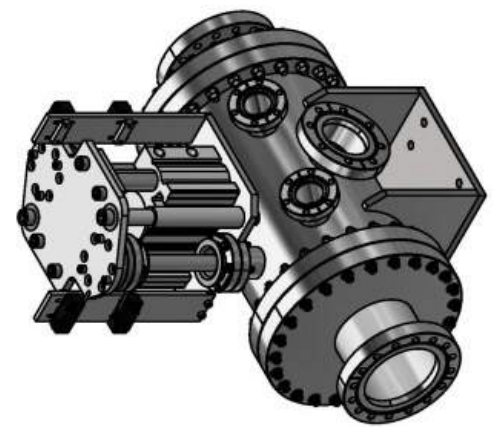
## Key Specifications:



Description	Value	Units
Range of Motion	46 [1.811]	mm [inch]
Weight	108 [240]	kg [lbs.]
Horizontal Aperture	75 [2.953]	mm [inch]
Vertical Aperture	-14 / +25 [-0.551 / +0.984] (not centered on beam)	mm [inch]
Tungsten Profile (Closed)	76.2 [3] tall x 127 [5] wide	mm [inch]
Tungsten Thickness	228.6 [9] nominal 190.5 [7.5] minimum	mm [inch]



**Notes:**

1. Aperture when open: 39 mm tall x 75 mm wide
2. Tungsten block size when closed: 3.5" tall x 5" wide (nominal)
3. System Weight: 111 kg [245 lb]
4. Tungsten nominal thickness: 228 mm [9 in.]

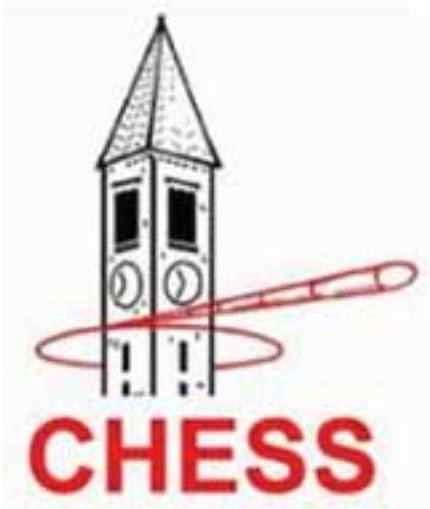
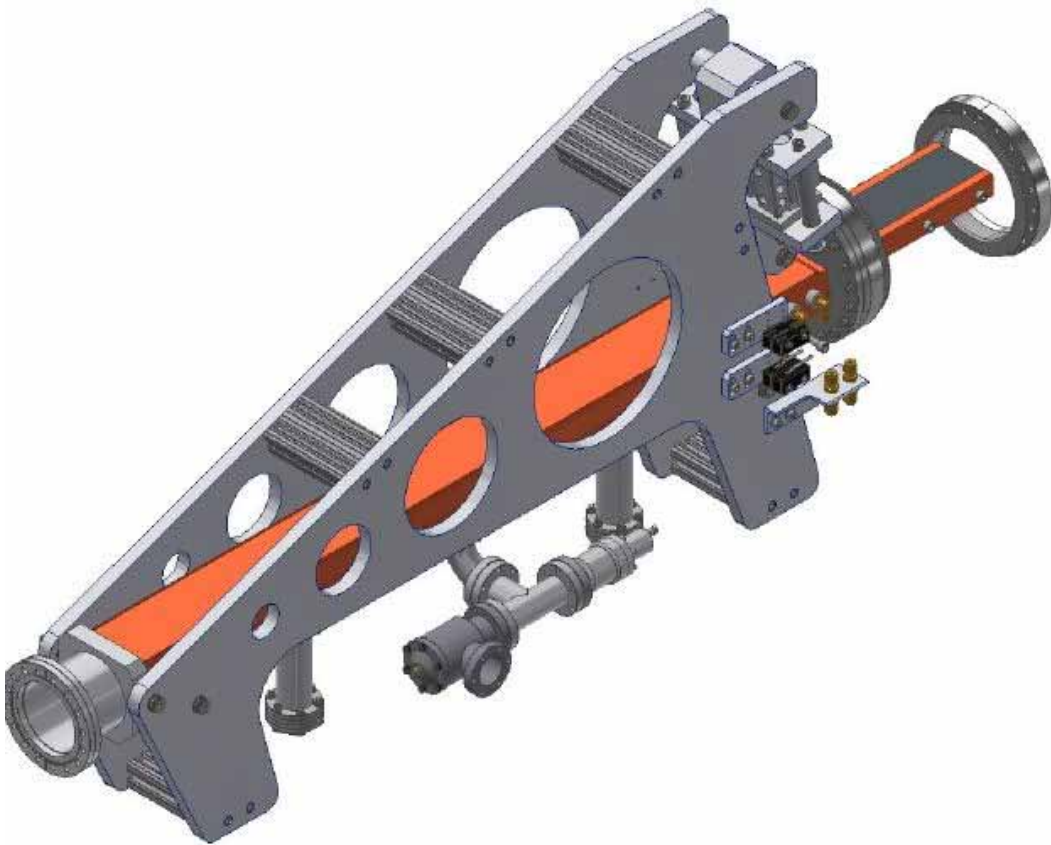


		<b>UHV</b>		DO NOT USE CHLORINE OR SULPHUR BEARING OILS OR ABRASIVES. USE ONLY APPROVED UHV COMPATIBLE LUBRICANTS AND COOLANTS		First Angle Projection (All dimensions are mm [in]) Inch dimensions are referenced Used				Drawing Standard: ADC 114-094-1984 Drawn by: T Shea Design by: T Shea Date: 2015-10-28 2015-09-28		<b>ADC Inc</b> 120 Ridge Road Pineville, NC 28134 Phone: 607.533.3631 / Fax: 607.533.3618 E-mail: adc@adc5001.com / Web: www.adc5001.com									
<b>Bremsstrahlung Shutter Top Assembly</b>		UHV approved by: T Shea		Date: 2015-09-28		UHV approved by: T Shea		Date: 2015-09-28		All Dimensions BASIC		UNLESS OTHERWISE SPECIFIED		Part Number: 00026774		Risk: 0		Size: A2		Sheet: 1	
		Purchased Part Modification: No		No		Yes		No		Yes		N7/finished surfaces		0.13 0.38		0.25/ABC		0.25/ABC		0.25/ABC	

# EMERGENCY LINE STOP WITH TUNGSTEN BACKING

<http://www.adc9001.com/products/view/669>

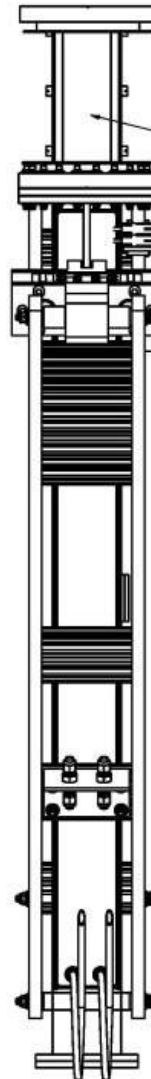
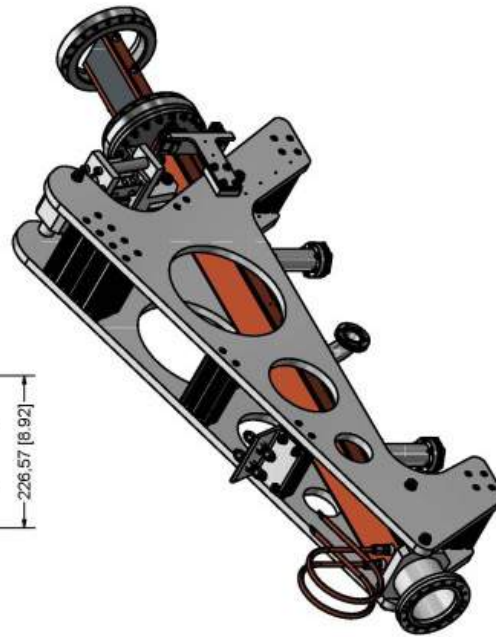
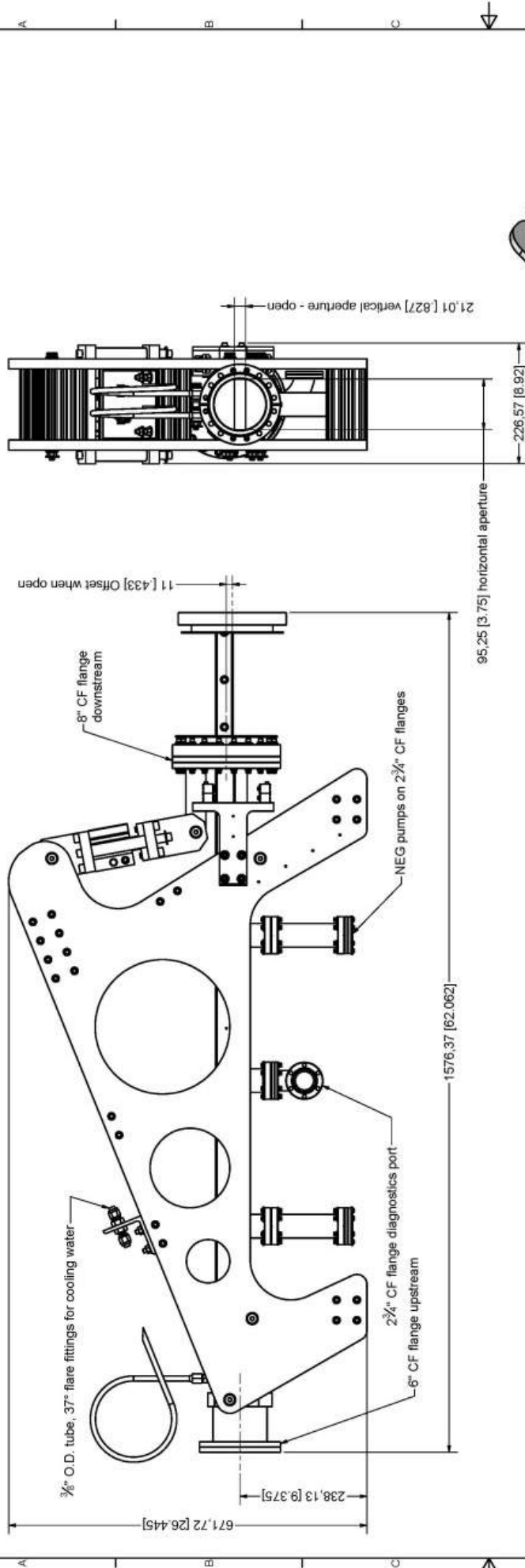
Improvements were designed for an existing emergency line stop design (operating on A-Line) for the Cornell High Energy Synchrotron Source (CHESS). These included a new support structure to allow table mounting and simplify manufacturing, an added tungsten backing block to attenuate higher-energy photons, widening the cooled copper absorber to accommodate the canting angle on F-Line, and improving limit switch position tuning. The photon absorber is a length of beam pipe made from copper, with a thick, water-cooled upper wall. When closed, one end of the pipe is lowered so that the upper interior surface blocks the beam path with a ramp to spread the deposited power over a wide area. The robust frame is made from two mirror-imaged aluminum plates and cross bars cut from 80/20© 15-Series extrusion. For security, features on the tungsten block engage with features on the copper absorber to hold the two together, while the added bolts are safety-wired to prevent tampering. NEG pumps and vacuum diagnostics connect to ports on the absorber section. The absorber is opened and closed by a pneumatic cylinder, and fails closed under loss of air pressure.



**Key Specifications:**

Description	Value	Units
Range of Motion	21 [0.827]	mm [inch]
Range of Motion	17.4 [1]	mrاد [degree]
Upstream Flange	6" CF	-
Downstream Flange	8" CF	-
Weight	112.3 [247]	kg [lb.]





Tungsten block attenuates higher-energy photons not absorbed by cooled copper block

#### Notes:

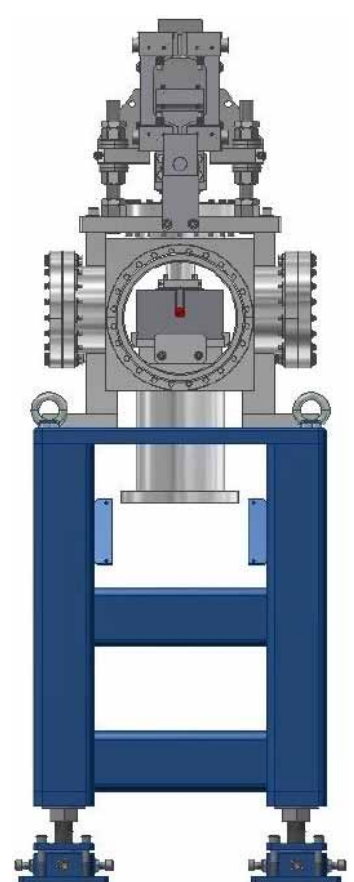
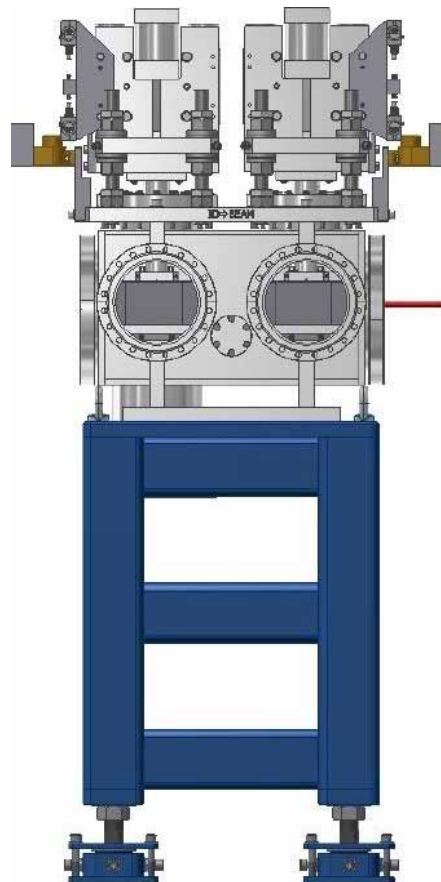
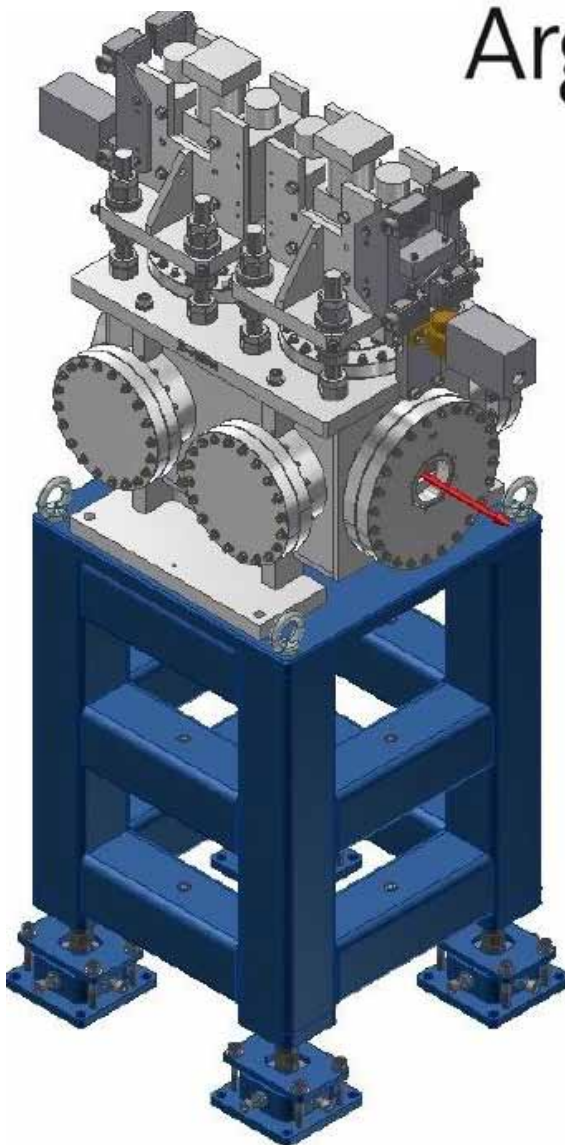
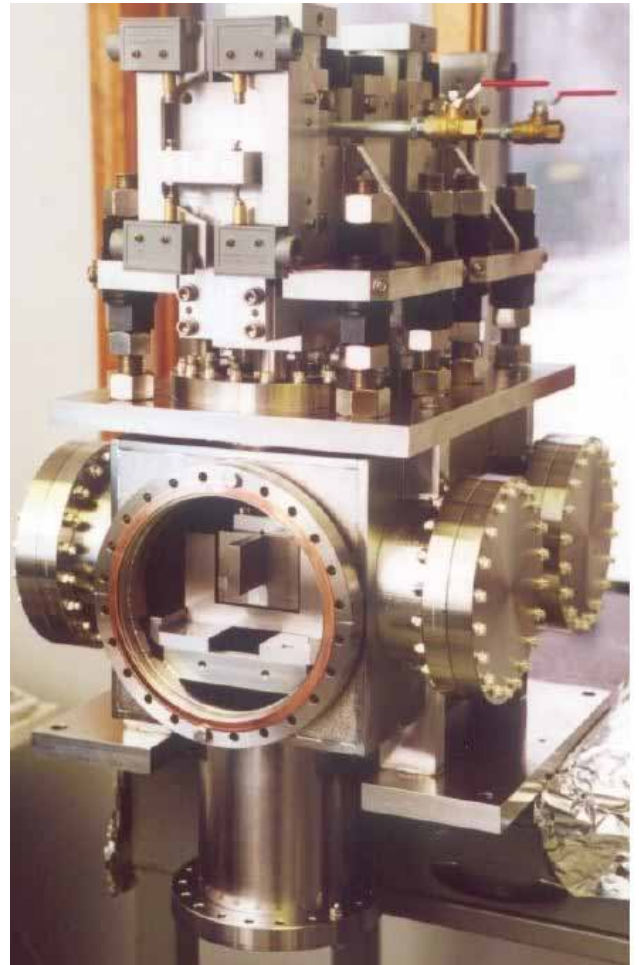
1. Device pivots closed to present a cooled copper ramp, spreading the incident beam over a large area.
2. Open Aperture: 95 mm wide x 21 mm tall
3. System Weight: 114 kg [250 lb]

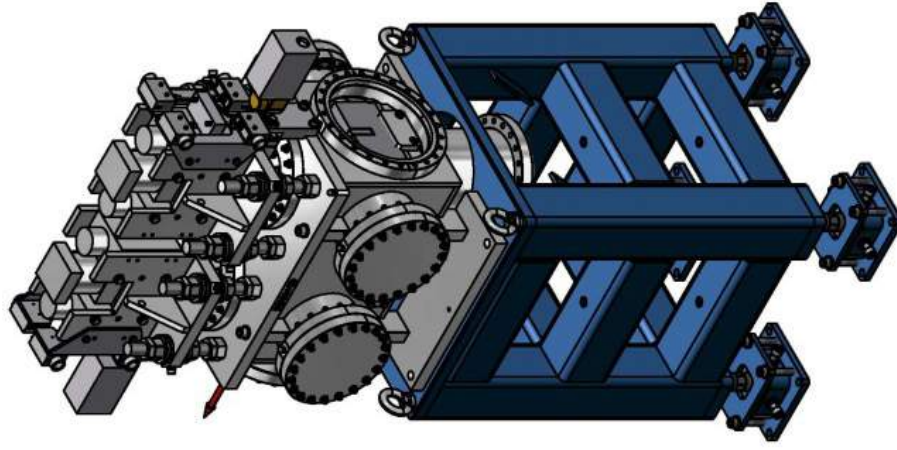
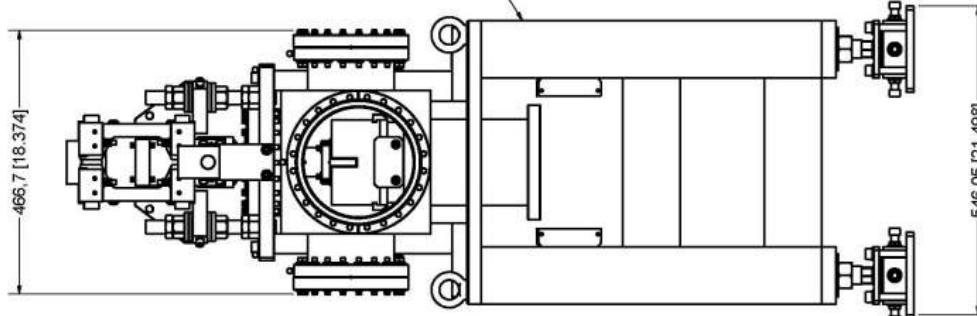
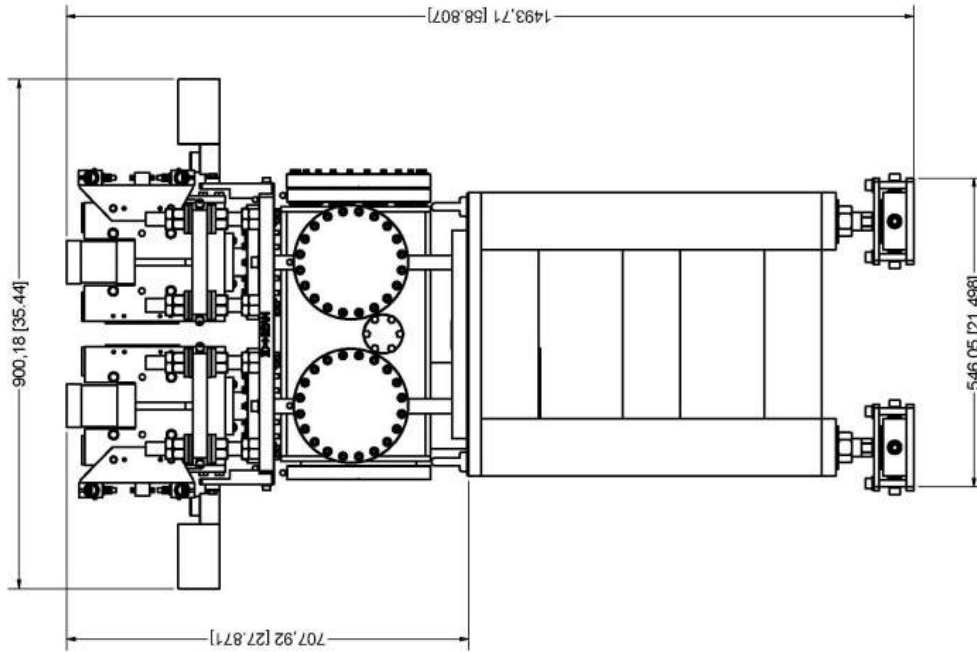
<b>UHV</b>		<b>ADC</b>	
		ADC, Inc. 128 Ridge Road Ridge, NJ 07078 Phone: 807.533.3631 / Fax: 807.533.3618 Email: adc@adc9001.com / Web: www.adc9001.com	
DO NOT USE CHLORINE OR SULPHUR BEARING OILS OR ABRASIVES USE ONLY APPROVED UHV COMPATIBLE LUBRICANTS AND COOLANTS Rev'd approval by: T. Sines Date: 2015-09-30		Drawn: Standard Date: 11/15/1994 Design: T. Sines Date: 2015-09-24 Check: T. Sines Date: 2015-09-24	
Purchased Part Modification No.		Line Stop Top Assembly Part Number: 00026809 Revision: 0 Size: A2 Sheet: 1	
First Angle Projection All dimensions are in [in] Rich dimensions are reference None		UNLESS OTHERWISE SPECIFIED All Dimensions: BASIC N7 / surface 0.13 surface 0.38	

# UHV SAFETY SHUTTER/COLLIMATOR (SS3)

<http://www.adc9001.com/Beam-Stops->

The Bremsstrahlung safety shutter is an important device for synchrotron radiation facility personnel safety. These assemblies are needed to guard against accidental positron beam loss during injection and normal operation, which then can result in high-energy Bremsstrahlung radiation being directed down the front end into an experimental station. In, for example, the Advanced Photon Source (APS) top-up mode of operation, positron injection will be continued during normal operation. Therefore, it is necessary to have special Bremsstrahlung shielding to protect the downstream experimental area. The most economical way to do this is to employ a special long Bremsstrahlung collimator in the front-end area.





-S Option  
(Stand)

**Notes:**

Approximate Weight: 365 kg [803 lbs] (no stand)  
544 kg [1197 lbs] (with stand)

**UHV**

DO NOT USE CHLORINE OR SULPHUR  
BEARING OILS OR ABRASIVES  
USE ONLY APPROVED UHV COMPATIBLE  
LUBRICANTS AND COOLANTS  
UHV approved by:  
Purchased Part Modification

First Angle Projection  
All dimensions are mm [in]  
Inch dimensions are reference



Protective Finish  
No

Unless otherwise specified

All Dimensions: BASIC  
N7 0.13 0.38 0.25 A B C 0.25 A B C

ADC USA, Inc.  
10000 100th Ave  
Lansing, MI 48203  
Phone: 607.533.3531 / Fax: 607.533.3518  
E-mail: adcusa@adcusa.com / Web: www.adcusa.com



SS3 Safety Shutter/Collimator

00018887 0 A2 1 / 1

00018887

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A2

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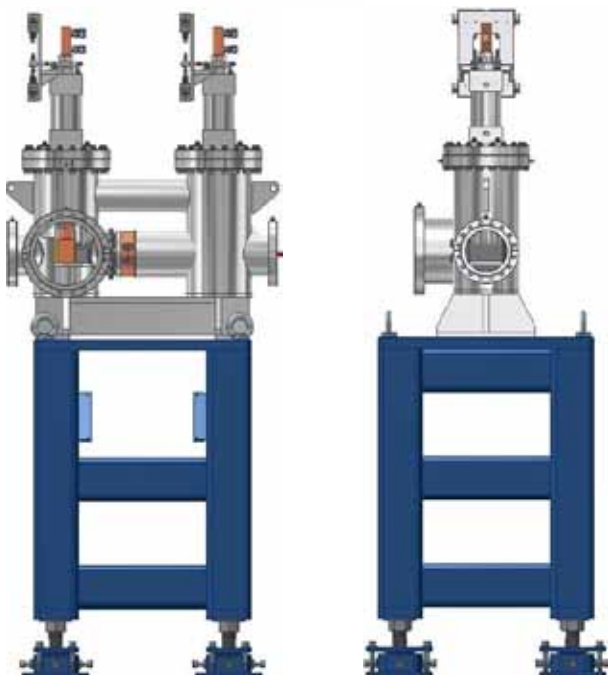
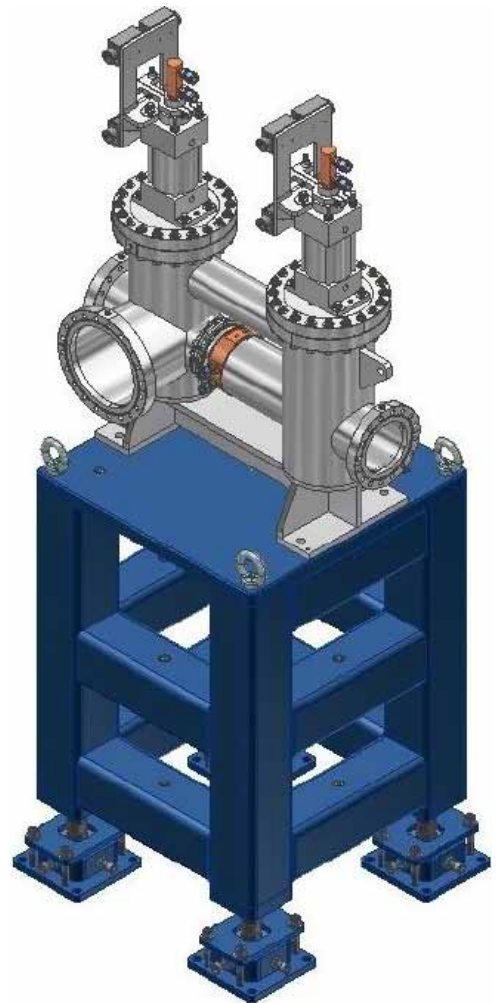
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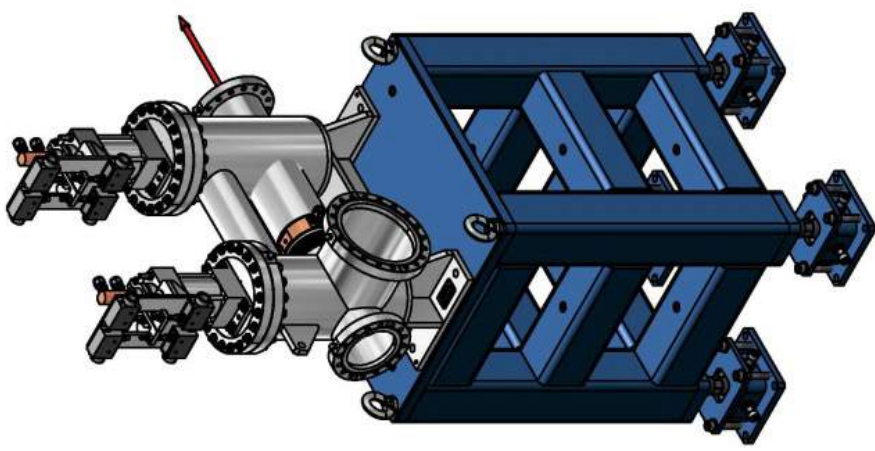


# UHV INTEGRAL SHUTTER (IS9)

<http://www.adc9001.com/Beam-Shutters->

Overview: The integral shutter combines the features of a pink beam photon shutter, a pink beam safety shutter, a pink beam fixed mask and a pink beam collimator. The safety shutter is an important device for synchrotron radiation facility personal safety. These assemblies are needed to guard against accidental positron beam loss during injection and normal operation, which then can result in high-energy radiation being directed down the front end into an experimental station. The moving assembly is a double-redundant remotely-actuated device containing tungsten and explosivebonded Glidcop/OFHC copper which prevents the photon beam from traveling down a beamline into an experimental enclosure. When the shutter is closed, two shielding blocks are positioned to stop the synchrotron beam, although either block by itself provides adequate shielding. Redundant switches detect any shutter failure so that a personnel safety interlock system can take appropriate measures to shut the beam off during a fault condition. All shutters are designed in the 'fail safe' mode such that, in the event of a power, communication, or mechanical system failure, the shutter will come to a closed state and will remain in the closed state. The fixed mask and collimator are positioned between the shutter assemblies.

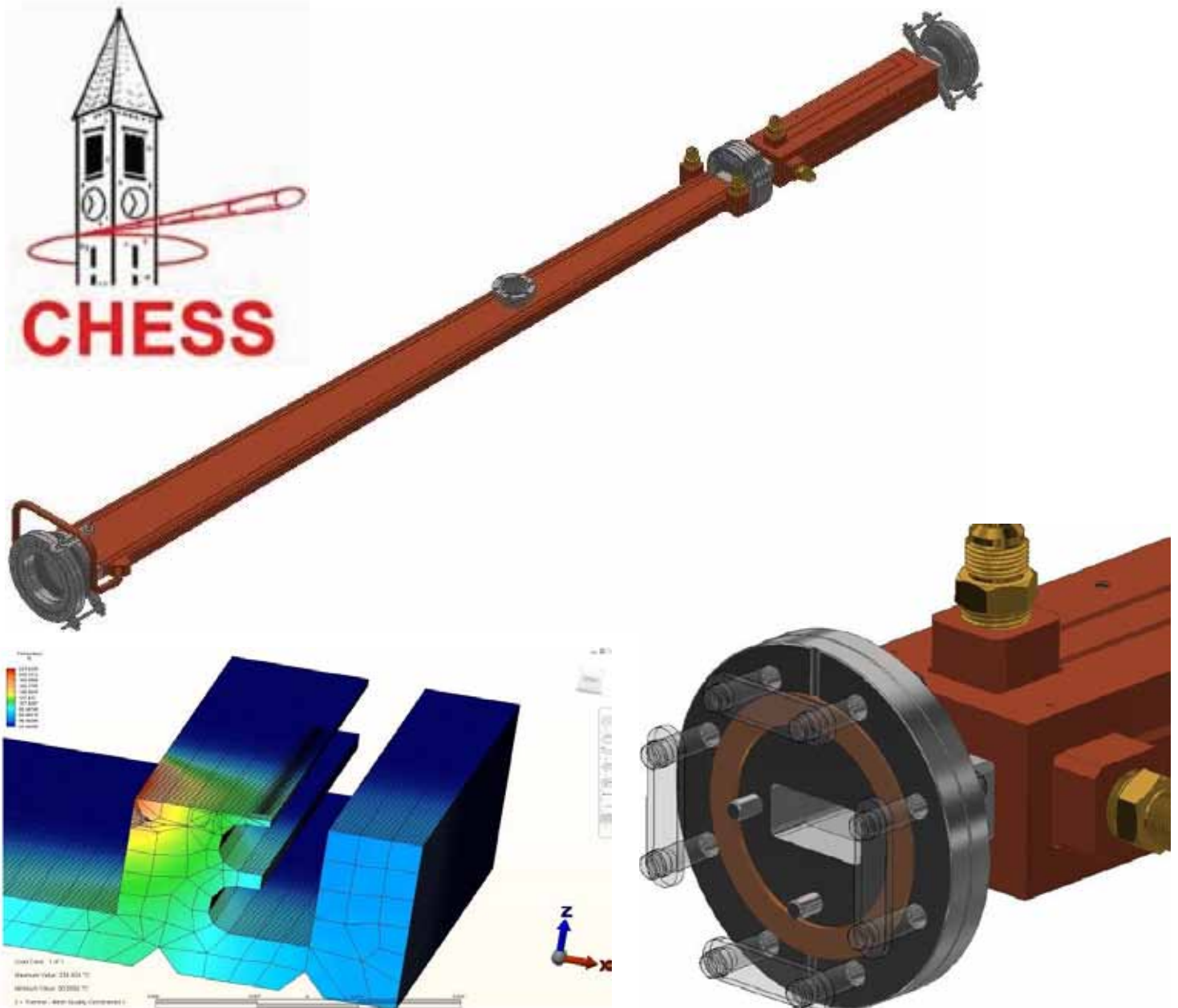


[illegible]

# HIGH HEAT LOAD PRIMARY APERTURE

<http://www.adc9001.com/products/view/644>

Overview: The integral shutter combines the features of a pink beam photon shutter, a pink beam safety shutter, a pink beam fixed mask and a pink beam collimator. The safety shutter is an important device for synchrotron radiation facility personal safety. These assemblies are needed to guard against accidental positron beam loss during injection and normal operation, which then can result in high-energy radiation being directed down the front end into an experimental station. The moving assembly is a double-redundant remotely-actuated device containing tungsten and explosivebonded Glidcop/OFHC copper which prevents the photon beam from traveling down a beamline into an experimental enclosure. When the shutter is closed, two shielding blocks are positioned to stop the synchrotron beam, although either block by itself provides adequate shielding. Redundant switches detect any shutter failure so that a personnel safety interlock system can take appropriate measures to shut the beam off during a fault condition. All shutters are designed in the 'fail safe' mode such that, in the event of a power, communication, or mechanical system failure, the shutter will come to a closed state and will remain in the closed state. The fixed mask and collimator are positioned between the shutter assemblies.



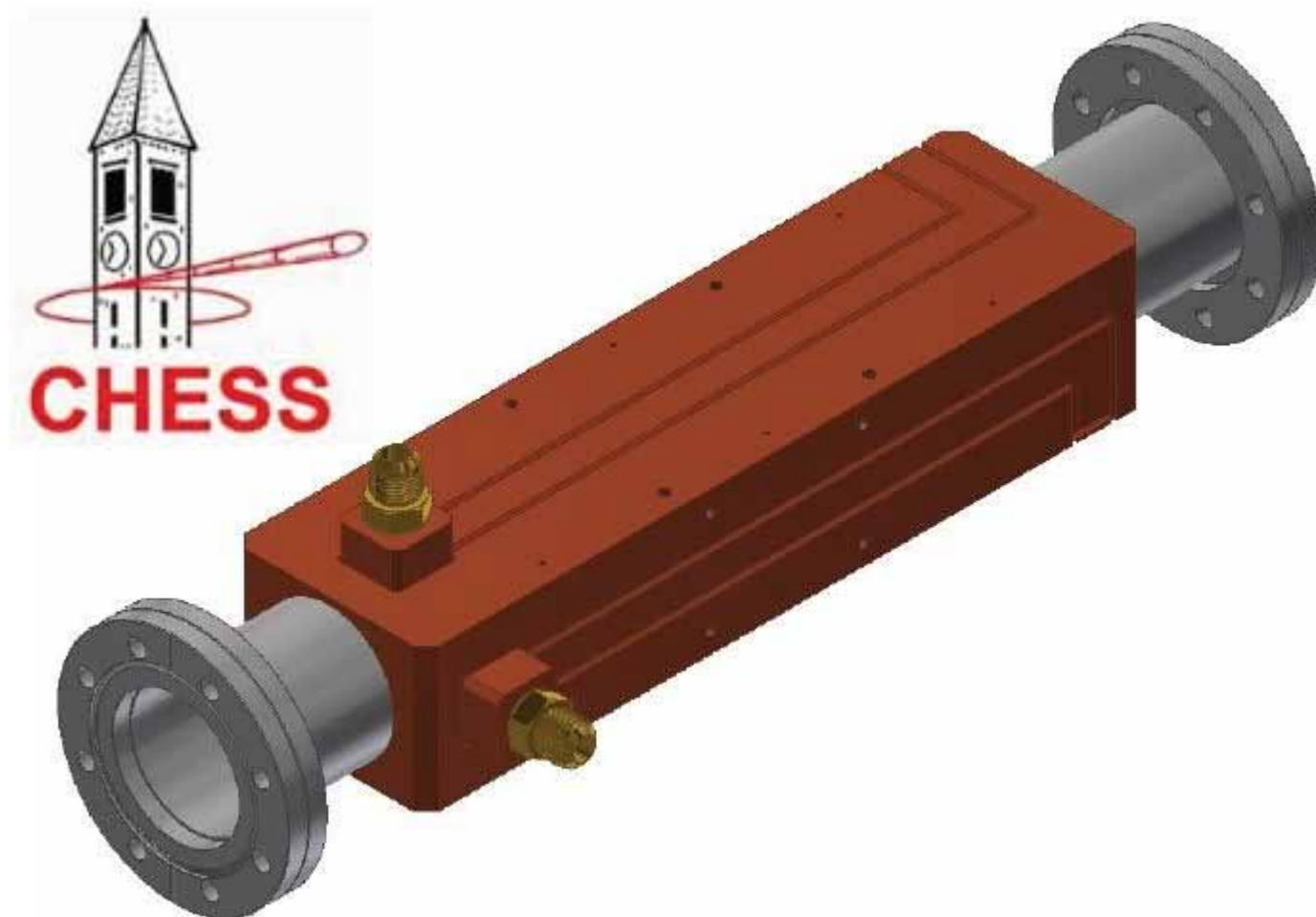




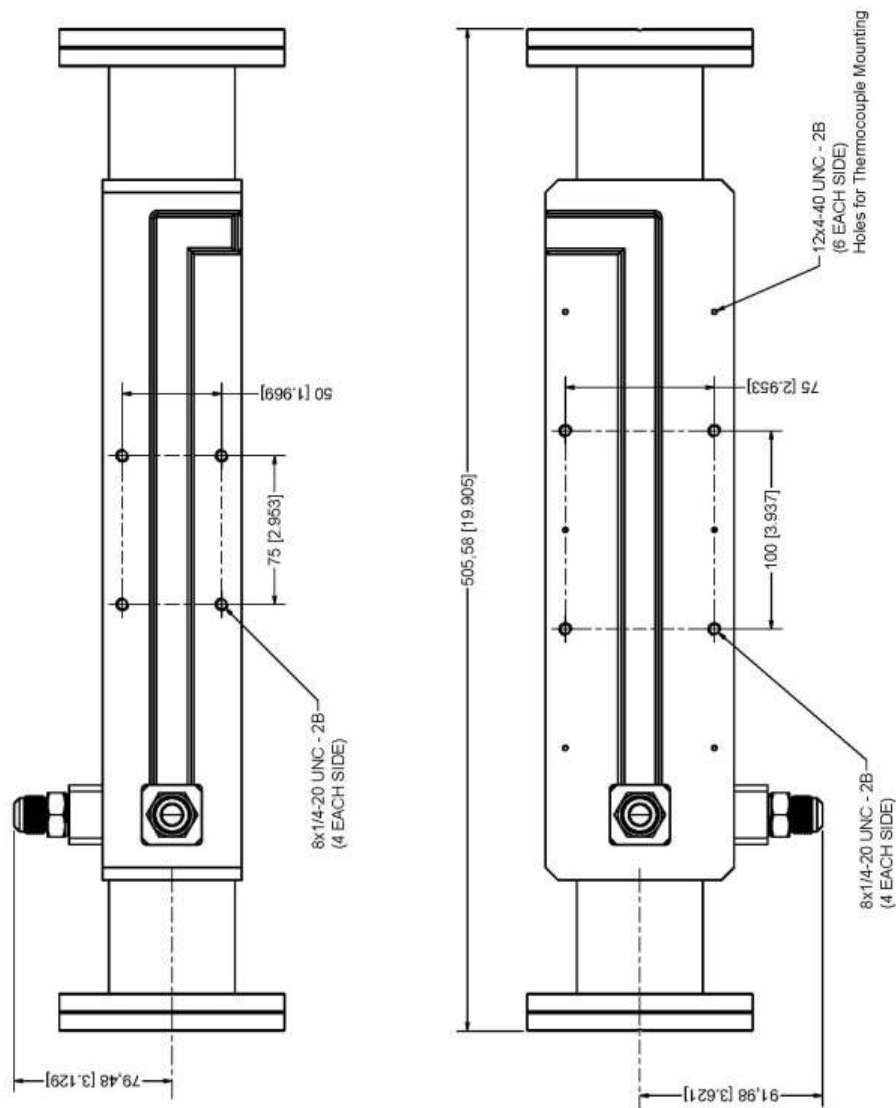
# SECONDARY AND TERTIARY APERTURES

<http://www.adc9001.com/products/view/645>


These apertures are designed for use with an undulator beam produced at machine energy of 5.3 GeV and current of 250 mA. Both are constructed from a solid block of copper with the aperture cavity cut out using wire EDM. A single cooling channel is milled into the block and covered with copper plates. The apertures connect to the facility cooling system using 45° flare fittings, and connect into the beamline with rotatable 4.5" CF flanges at each end. The table below summarizes the dimensions of the two apertures, while the cutaway views further illustrate the internal arrangement and cooling channels.



Aperture Dimensions			
Quantity	Secondary Aperture	Tertiary Aperture	Units
Upstream Width	45	35	[mm]
Upstream Height	20	10	[mm]
Downstream Width	30	5	[mm]
Downstream Height	5	3	[mm]
Length (Flange-to-Flange)	505.6	485.6	[mm]
Side Wall Taper Angle	1.23	2.6	[°]
Top/Bottom Taper Angle	1.23	0.6	[°]



1. System Mass/Weight: 20.5 kg (45 lb.)  
Aperture Dimensions: 45 mm x 20 mm tapering to 30 mm x 5 mm (1 23" taper)
2. Cooling: One loop, water cooling, 45° flare fittings
3. Vacuum Connection: 4.5" CF flanges, both ends rotatable

		Drawing Standard: <b>ASIS 114-581 1984</b>		Date: <b>2014-03-08</b>	
All dimensions are in <b>mm</b>		Scale: <b>1:1</b>		Unit: <b>mm</b>	
All dimensions are <b>inference</b>		Material: <b>MS 304</b>		Mfg. standard: <b>None</b>	
Surface Finish: <b>None</b>		A-why approval: <b>None</b>		All Dimensions: <b>BASIC</b>	
Title: <b>Secondary Aperture, Top Assembly</b>		Drawing Number: <b>000729931</b>		Sheet: <b>0</b> of <b>2</b>	
Revision: <b>0</b>		Date: <b>2014-03-08</b>		Drawn by: <b>ADC</b>	
Checked by: <b>ADC</b>		Approved by: <b>ADC</b>		Date: <b>2014-03-08</b>	
Notes: <b>UNLESS OTHERWISE SPECIFIED</b>		All Dimensions: <b>BASIC</b>		Tolerance: <b>0.13</b>	
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Material: <b>None</b>		Material: <b>None</b>		Material: <b>None</b>	
Assembly: <b>None</b>		Assembly: <b>None</b>		Assembly: <b>None</b>	
Drawing: <b>None</b>		Drawing: <b>None</b>		Drawing: <b>None</b>	
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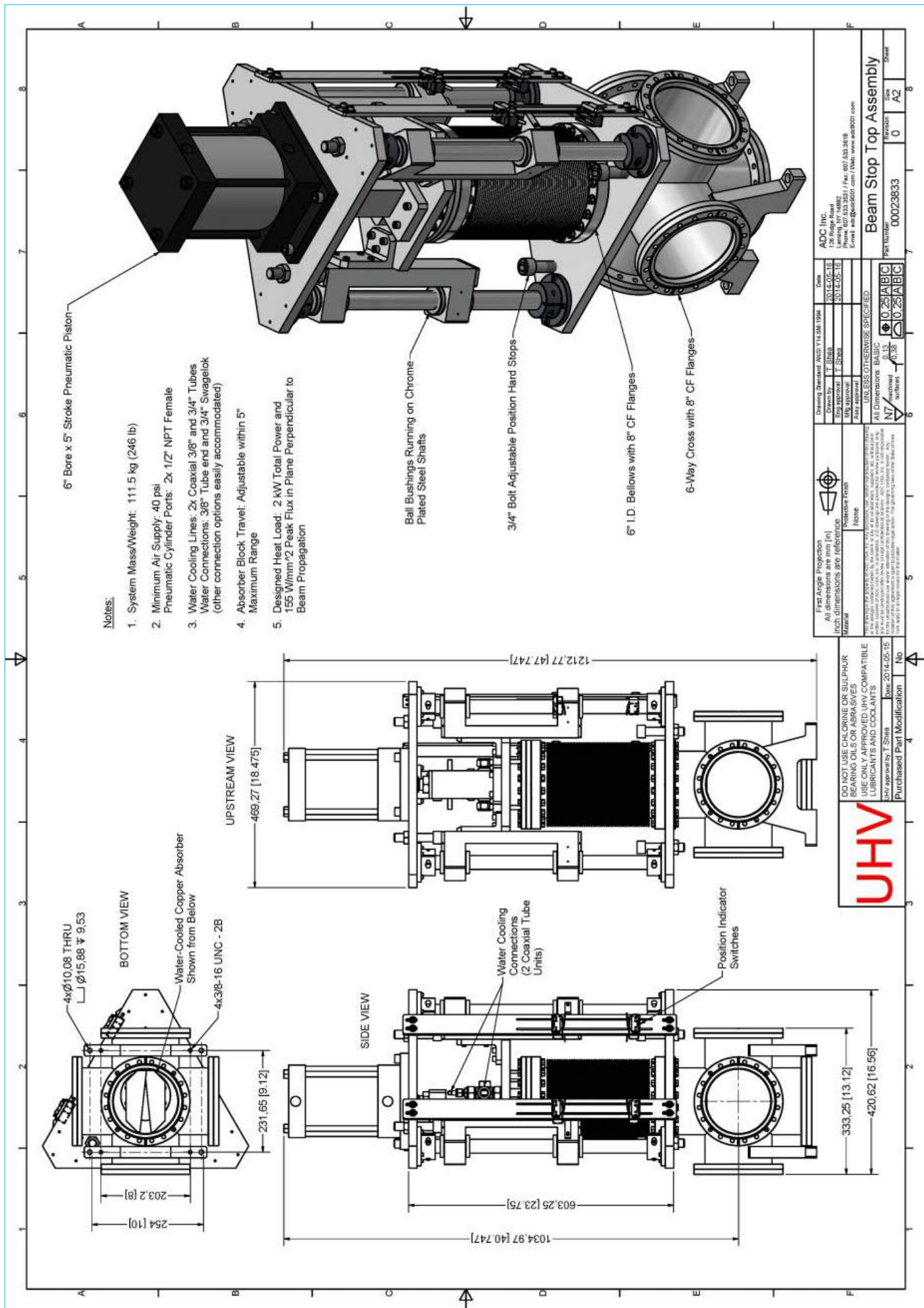


# HIGH HEAT LOAD BEAM STOP

<http://www.adc9001.com/products/view/646>

This pneumatically operated beam stop was designed by ADC. The water cooled copper block will absorb an undulator white beam with a peak heat flux (in a plane perpendicular to the beam propagation) of 155 W/mm<sup>2</sup> and total power delivery into the copper of 2 kW. Surfaces of the copper block struck by the beam are sloped at 6° relative to the beam axis in order to reduce the flux intensity at the surfaces. Four inches of vertical acceptance are provided to allow the block to stop either the white beam, pink beam, or one of two monochromatic beams to be used, each of which runs at a different height in the flight path tube. The horizontal acceptance of the block is 1 inch, and the travel is adjustable within the 5 inch maximum stroke of the pneumatic piston using the hard stop bolts. Water cooling is provided by two coaxial tube circuits, one into each half of the copper block. These circuits could be tied together, or connected individually to the facility cooling system, and numerous connection fitting options could easily be substituted. The pneumatic cylinder requires a minimum of 40 psi supplied pressure, and connects with ½" NPT female ports. It has built-in flow adjustment valves. Two sets of position sensing switches are provided for redundancy. The chamber consists of a 6-way cross with 8 inch CF flanges, and the additional openings can be fitted with view ports, pumps, or other instrumentation, or simply capped. Advantages of the design include: robust construction, an extra-long bellows to extend its lifetime, pneumatic actuation which fails closed, and modularity which allows maintenance without removing the chamber from the beamline.





<b>ADC Inc.</b> 128 Ridge Road East Windsor, NJ 07030 Phone: 607.533.3531 / Fax: 607.533.3518 Email: sales@adc001.com / Web: www.adc001.com		Drawing Standard: ANSI Y14.5M-1994 Date: 2014.05-15 Drawn by: T. Shoop 2014.05-15 Design approval: T. Shoop Mfg approval: _____ Assy approval: _____
<b>Beam Stop Top Assembly</b> Part Number: 00023833 Revision: 0 Size: A2 Sheet: 8		UNLESS OTHERWISE SPECIFIED ALL DIMENSIONS BASIC Tolerances: Holes: $\pm 0.25$ A B C Surfaces: $\pm 0.38$ A B C Finish: N/A Material: _____ Inductive Finish: _____ Note: _____ THIS PART IS THE PROPERTY OF ADC INC. AND IS LOANED TO YOU FOR YOUR USE ONLY. IT IS NOT TO BE REPRODUCED OR COPIED IN ANY MANNER WITHOUT THE WRITTEN PERMISSION OF ADC INC. A 25% DEPOSIT OF THE TOTAL INVOICE PRICE MUST BE PAID UPON ORDER. THE REMAINING BALANCE IS DUE 30 DAYS AFTER THE DATE OF INVOICE. THIS DRAWING IS THE PROPERTY OF ADC INC. AND IS LOANED TO YOU FOR YOUR USE ONLY. IT IS NOT TO BE REPRODUCED OR COPIED IN ANY MANNER WITHOUT THE WRITTEN PERMISSION OF ADC INC. A 25% DEPOSIT OF THE TOTAL INVOICE PRICE MUST BE PAID UPON ORDER. THE REMAINING BALANCE IS DUE 30 DAYS AFTER THE DATE OF INVOICE. THIS DRAWING IS THE PROPERTY OF ADC INC. AND IS LOANED TO YOU FOR YOUR USE ONLY. IT IS NOT TO BE REPRODUCED OR COPIED IN ANY MANNER WITHOUT THE WRITTEN PERMISSION OF ADC INC. A 25% DEPOSIT OF THE TOTAL INVOICE PRICE MUST BE PAID UPON ORDER. THE REMAINING BALANCE IS DUE 30 DAYS AFTER THE DATE OF INVOICE.

<b>UHV</b> DO NOT USE CHLORINE OR SULPHUR BEARING OILS OR ABRASIVES USE ONLY APPROVED UHV COMPATIBLE LUBRICANTS AND COOLANTS UHV approved by: T. Shoop Date: 2014.05-15 Purchased Part Modification: No		First Article Production All dimensions are mm [in] inch dimensions are reference Material: _____ Inductive Finish: _____ Note: _____ THIS PART IS THE PROPERTY OF ADC INC. AND IS LOANED TO YOU FOR YOUR USE ONLY. IT IS NOT TO BE REPRODUCED OR COPIED IN ANY MANNER WITHOUT THE WRITTEN PERMISSION OF ADC INC. A 25% DEPOSIT OF THE TOTAL INVOICE PRICE MUST BE PAID UPON ORDER. THE REMAINING BALANCE IS DUE 30 DAYS AFTER THE DATE OF INVOICE. THIS DRAWING IS THE PROPERTY OF ADC INC. AND IS LOANED TO YOU FOR YOUR USE ONLY. IT IS NOT TO BE REPRODUCED OR COPIED IN ANY MANNER WITHOUT THE WRITTEN PERMISSION OF ADC INC. A 25% DEPOSIT OF THE TOTAL INVOICE PRICE MUST BE PAID UPON ORDER. THE REMAINING BALANCE IS DUE 30 DAYS AFTER THE DATE OF INVOICE. THIS DRAWING IS THE PROPERTY OF ADC INC. AND IS LOANED TO YOU FOR YOUR USE ONLY. IT IS NOT TO BE REPRODUCED OR COPIED IN ANY MANNER WITHOUT THE WRITTEN PERMISSION OF ADC INC. A 25% DEPOSIT OF THE TOTAL INVOICE PRICE MUST BE PAID UPON ORDER. THE REMAINING BALANCE IS DUE 30 DAYS AFTER THE DATE OF INVOICE.
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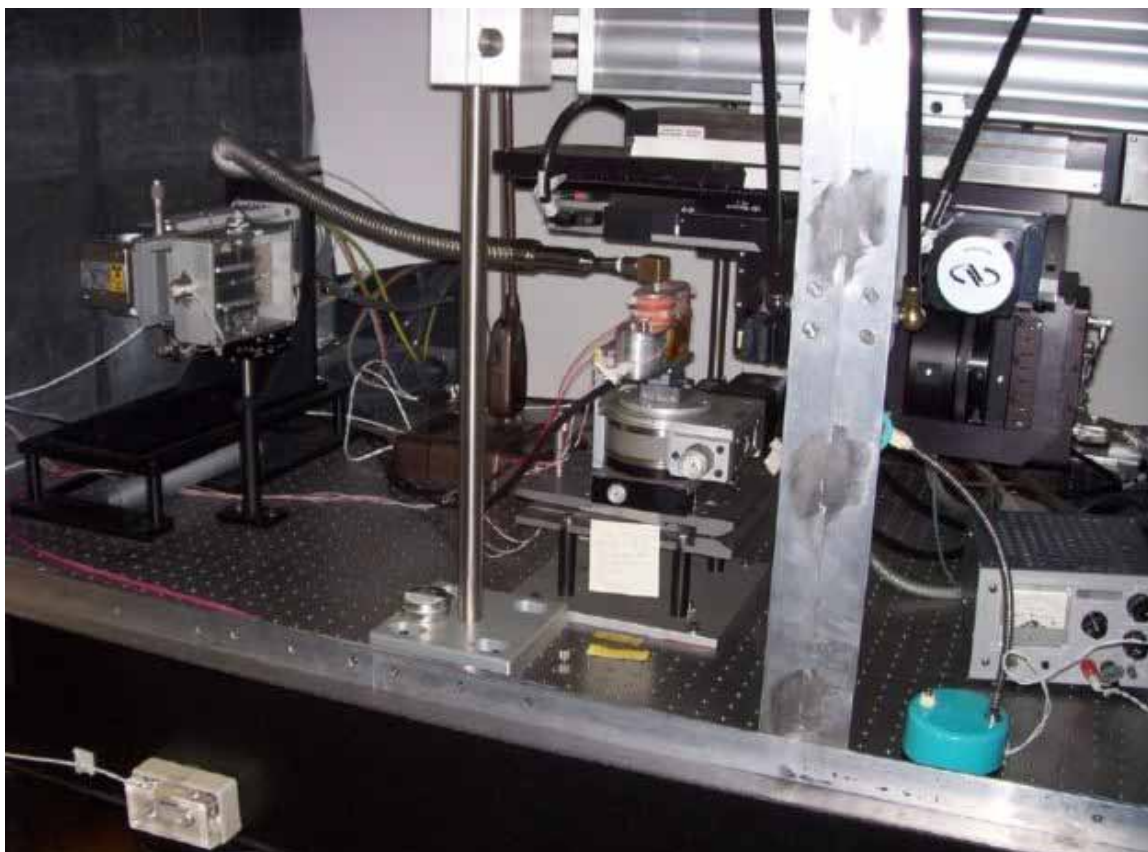
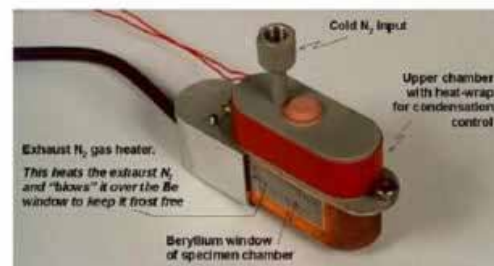
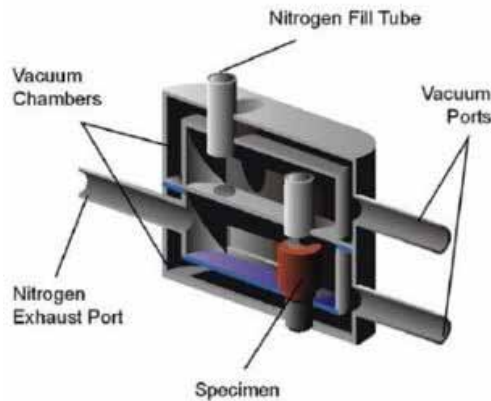
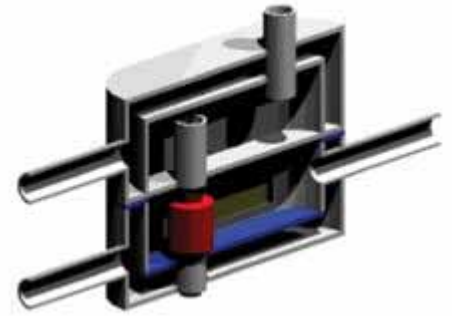
# CRYOSTATIC MICRO-CT IMAGING

## ■ Transient Process System

<http://www.adc9001.com/Cryostatic-Micro-CT-Imaging>

A double walled copper vessel was fabricated for the micro-CT scanning of tissue specimens maintained at cryogenic temperature. The space between the two nested vessels was evacuated and in two opposing sides of the vessel the copper was replaced by beryllium foil. The vessel consists of two chambers, each of which is surrounded by vacuum for better thermal stability. The vacuum in this area is on the order of  $1 \times 10^{-3}$  torr. Nitrogen gas, boiling off liquid nitrogen, is injected continuously

into the top of the chamber during the scanning process. Just prior to venting from the vessel the gas is heated and directed through a narrow gap over the outside of the beryllium windows to keep them frost-free. A temperature detector within the chamber is used to control the rate of inflow of the nitrogen gas. The frozen specimen is attached to a small horizontal platform on top of a vertical stainless steel pin which exits the base of the vessel through a closely fitting hole and is attached to the computer-controlled rotating stage under the vessel. The vessel and rotation-stage assembly is mounted on a chamber-controlled horizontal translation stage which can move the specimen out of the x-ray beam, from time to time, for x-ray beam calibration purposes.





# EXCHANGE SYSTEM

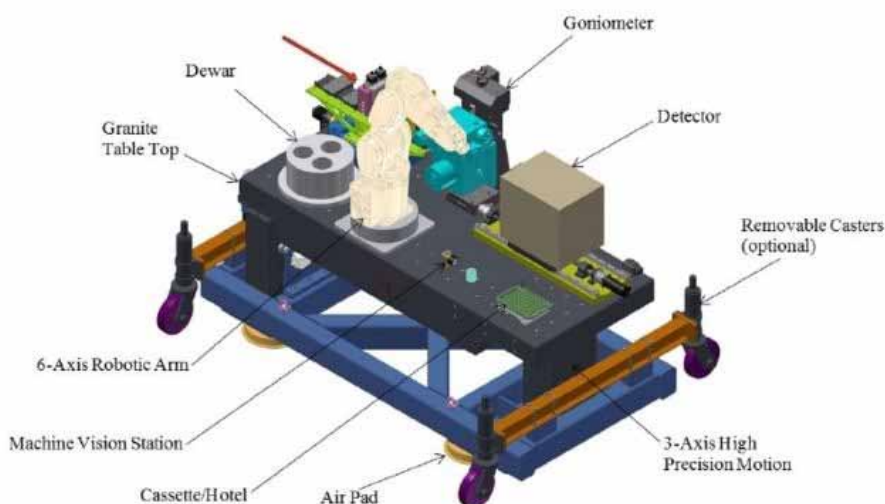
## for Protein Crystallography

<http://www.adc9001.com/products/view/640>

The ADC robotic Sample Exchange System (SES-800) is designed for the automated handling of protein crystallography samples in a synchrotron beamline hutch. The SES-800 six-axis ABB IRB1200 robot offers the world's highest speed and precision for their class. The SES-800 provides compact size, broad work envelopes, high speed, precise location, clean environments, ABB SafeMove, and, above all, the flexibility to adapt to the greatest number of tasks. ANSI and CE safety compliance allows global deployment. The SES-800 system is capable of accurately and automatically, transferring frozen samples from a storage Dewar or ambient temperature cassette to a diffractometer.

The SES-800 robotic sample exchange system is based on the popular ABB IRB1200 series robot, shown above. This Swedish made 6 DOF robot has been modified and calibrated at the factory using ABB absolute calibration (AbsAcc) to achieve exceptional repeatability on low mass payloads. The SES-800 system has a 900 mm reach relative to the center of the base. The maximum speed is 8.9 meters per second. The sleek enclosed structure allows a more compact sample exchange system in the hutch where space is a premium. The control system is intuitive and easy to use and connects easily to safety limits and PLCs. The user can control the robot directly using built-in routines, ABB software, or through an ADC, PC based controller executing LabView routines. The ADC control system is compatible with EPICS IOC commands and also interfaces directly, via Ethernet, to motion controllers such as Delta-Tau, Parker, and Galil as well as to host controllers for easy integration to beamline controls.

The SES-800 robotic sample exchange system, shown below, is comprised of an advanced articulating arm robot that is linked with an adaptive vision system and equipped with a library of application-specific tools. The SES-800 handles samples at ambient temperature or cryo-cooled crystals in a liquid nitrogen Dewar. Sensors on the Dewar monitor liquid level and cover access and auto make-up is optional.



# X-RAY OVENS

## (XRD-1500)

<http://www.adc9001.com/XOV-35-X-Ray-Oven>

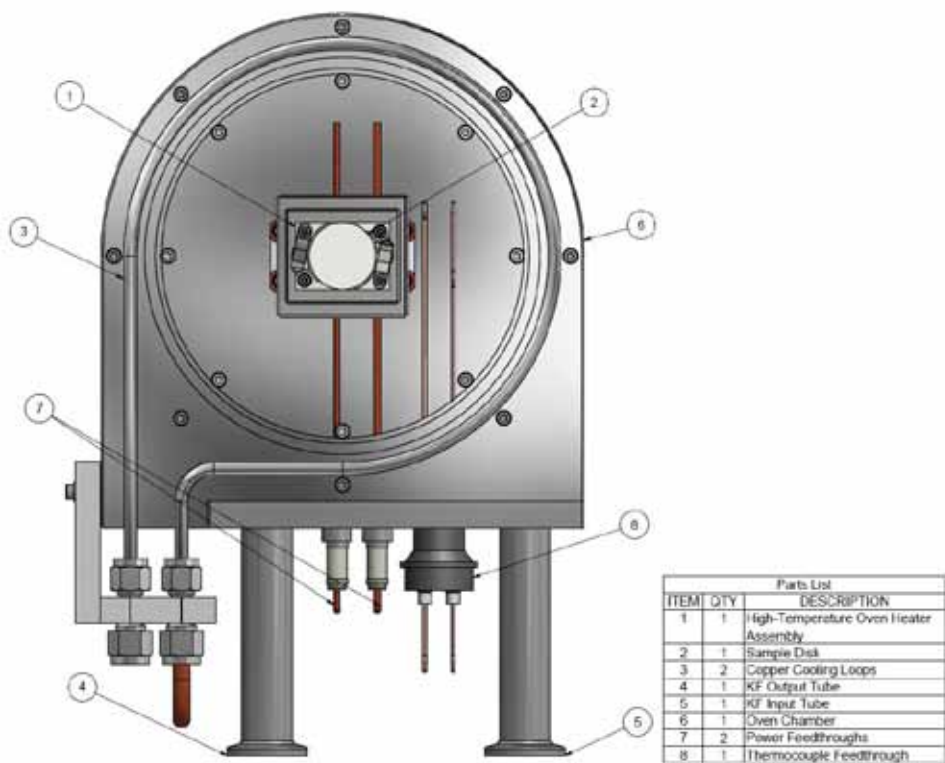
New materials science calls for refined tools that enable X-ray research in well-defined environments and under controlled temperature conditions. The XRD-1500 High-Temperature Oven Chamber is a resourceful and dynamic sample stage for in-situ X-ray studies in different atmospheres up to 1500 °C. It guarantees superb temperature consistency in the sample as well as precise temperature measurement and control.

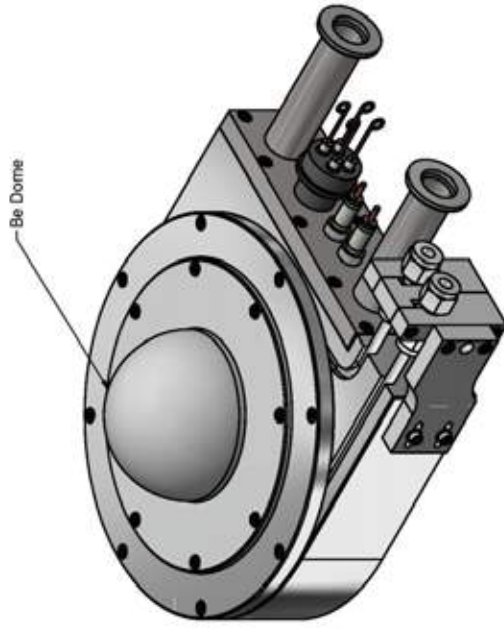
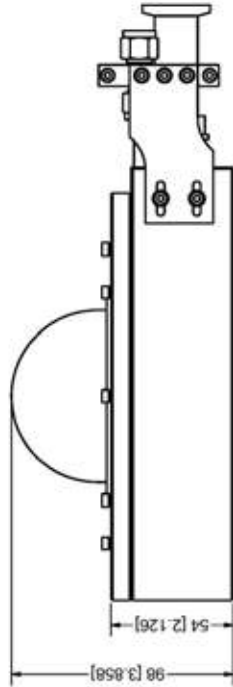
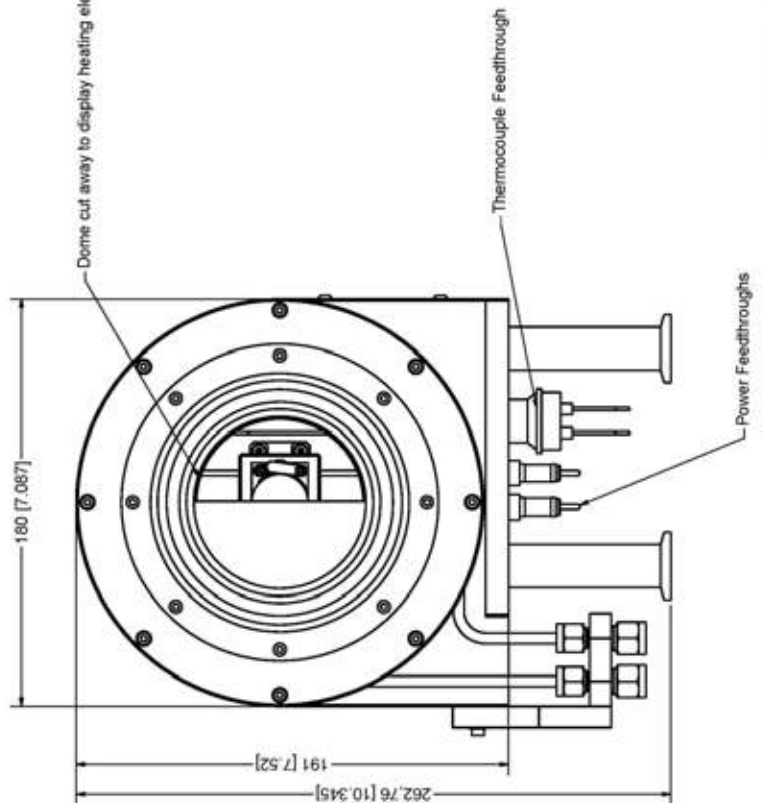
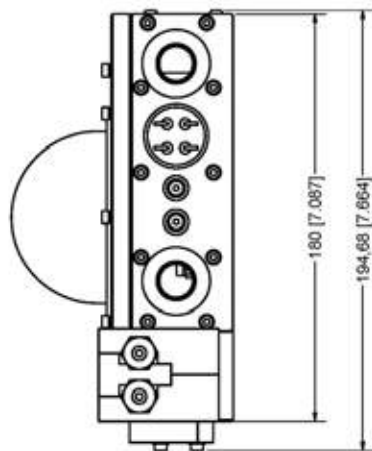


The XRD-1500 is an innovative heating High-Temperature Oven Chamber for in-situ diffraction studies on two, four, six or eight-circle goniometers up to 1500 °C. It fits all common goniometers. The XRD-1500 is exceptionally compact and lightweight. The heating plate design secures a high temperature regularity and respectable position stability at higher temperatures.



The distinctive dome-shaped X-ray window made of beryllium allows the investigation of samples under vacuum and inert gas conditions to avoid oxidation or other chemical reactions of the sample at high temperatures. Extensive cooling of the dome and the XRD-1500 housing is reached. The unique design of the XRD-1500 provides all the features our customers have in mind - compactness, safety and high performance.

The temperature sensor in XRD-1500 is located directly under the sample in a protective ceramic sample holder. This type of structure allows for a highly repeatable and dependable temperature measurement and firm temperature control compared to those arrangements with free-standing temperature sensors. The well-proven design of the environmental heater assures that there are essentially no temperature gradients in the sample, allowing for varying sample thicknesses.





Approximate Weight = 9.1 kg [20 lbs]

			
First Angle Projection		Third Angle Projection	
All dimensions are mm [in]		All dimensions are mm [in]	
such dimensions are reference		such dimensions are reference	
Material		None	
Part Name		None	
Drawing Standard: ANSI Y14.1M 1994		Date: 2014-05-15	
Drawn by: LC Adams		2014-04-17	
Design by: J. J. Adams		2014-04-17	
ADC Inc.		ADC Inc.	
1000 Main Street		1000 Main Street	
Lanesville, VT 05648		Lanesville, VT 05648	
Phone: 802.533.3531 / Fax: 802.533.3618		Phone: 802.533.3531 / Fax: 802.533.3618	
E-mail: info@adcinc.com / Web: www.adcinc.com		E-mail: info@adcinc.com / Web: www.adcinc.com	
UNLESS OTHERWISE SPECIFIED		UNLESS OTHERWISE SPECIFIED	
All Dimensions BASIC		All Dimensions BASIC	
N7/finished		N7/finished	
0.13		0.13	
0.38		0.38	
Surfaces		Surfaces	
10.25 ABC		10.25 ABC	
0.25 ABC		0.25 ABC	
Part Number		Part Number	
XRD-1500 High-Temperature Oven Assembly		XRD-1500 High-Temperature Oven Assembly	
00023648 overview		00023648 overview	
Revision		Revision	
5		5	
Size		Size	
A2		A2	
Sheet		Sheet	
1 / 1		1 / 1	



# INSERTION DEVICES

[http://www.adc9001.com/products/show\\_list/id/113](http://www.adc9001.com/products/show_list/id/113)

ADC USA (ISO 9001 certified), has provided insertion devices and magnetic measurement systems to synchrotron facilities around the world for the last 15 years. We have built EPU's, Planers, IVU's, CPMU's, Wigglers, and Tapered Undulators – 18 in all. We have also recently engineered and designed a Segmented Adjustable Gap Undulator or SAGU for BNL. We have built 5 magnetic measurements systems which are in operation at Maxlab, PAL, SSRF, Danfysik, and BNL. From magnet modeling, FEA, and engineering and design to fabrication, assembly, shimming, and magnetic characterization; ADC capability, procedures, quality organization and trained staff to provide "Turn-Key" Insertion Devices and Magnetic Measurement Systems complete with in-house and customer site training.



BNL Cryo In-Vacuum Undulator



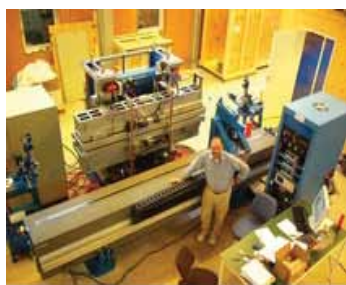
Australian Synchrotron Wiggler



ALBA Synchrotron Wiggler



NSLS II Three-Pole Wiggler - TPW



MAX Lab Magnetic Field Measurement System



SSRF Magnetic Field Measurement System



PAL Magnetic Field Measurement System



ADC OLD In-House Undulator Magnetic Measurement System



NSLS II Flip Coil System



ADC's New 8 Meter Magnetic



CLS Planar Undulator



MAX Lab Planar Undulator



Synchrotron Radiation Center (SRC) Planar Undulator



CHESS Tapered Undulator



CLS EPU Undulator



MAX Lab EPU Undulator



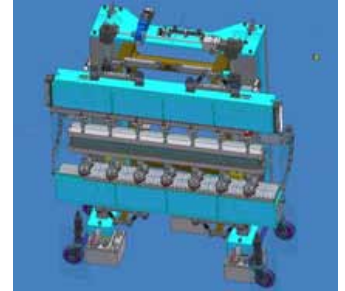
MAX Lab Hybrid EPU Undulator



NSLS II EPU Undulator



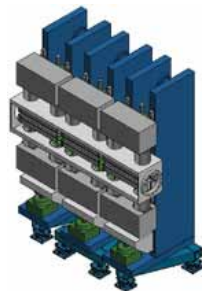
NSRRC 4 Meter EPU



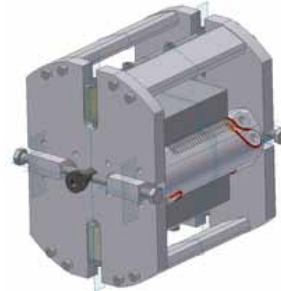
SSRF In-Vacuum Undulator



PAL In-Vacuum Undulator



NSLS II Segmented Adaptive-Gap In-Vacuum Undulator



SSLS Superconducting Mini-Unulator



Canada Planar Undulator



# ENGINEERING SYSTEMS

[http://www.adc9001.com/products/show\\_list/id/106](http://www.adc9001.com/products/show_list/id/106)

ADC (ISO9001:2008 certified) has been a leading supplier of high quality Complex Precision Systems to the synchrotron and neutron source scientific community as well as FELs and laser based experiments for over 18 years. Many of our High Precision Systems have been in operation nearly that long in facilities around the world. Our Precision Systems are noted for stability as well as range of motion and load capacity. Options run from steel to granite base as well as size of the system and range of motion.

Please see [http://www.adc9001.com/products/show\\_list/id/106](http://www.adc9001.com/products/show_list/id/106)

ADC has continuously improved our designs by supporting our customer's unique needs for improved space constraint, load capacity, vibrational stability, positional precision and stability, encoder position feedback, and base and frame requirements. ADC has developed a portfolio of complex high precision components such as base and frames, lifts and lateral stages, floor location and attachments, wheel and air bearing movement, breadboards, and controls. These components are customizable to meet your specific application. The attached catalog provides more information on our optical tables and custom designs along with specific applications and references.

			
Motion System for KB Mirror	VSANS Instrument for NIST (Very Small Angle Neutron Scattering)	Cryostat Dilution Refrigerator	Radar Cross Section (RCS) Test Range
			
Interchangeable (Switchable) Beamline Design	Taiwan Spectrometer for Inelastic X-ray Measurements at SPring-8	Five-Axis Vacuum Compatible Positioning System for NASA	Four-Axis High Precision System for ANKA
			
SMARTS Translator for LANL Neutron Facility	Twelve-Axis High Precision System for Diamond Light Source	Fourteen-Axis High Precision System for DLS	Custom High Precision Motion System
			
Four-Axis High Precision System for DLS	ANSTO 4-Axis Translation & Rotation Stages	Ultra-small-angle neutron scattering (USANS) instrument	Ultra-high energy resolution monochromator/analyzer





Small-Angle Neutron Scattering (SANS) Instrument



Compact Precision Translator for LANL Neutron Facility



Selector Wheel Shutter Unit



Four-Axis Goniometer for the Canadian Neutron Beam Centre



Four-Axis Goniometer for the Korea Neutron Facility



High Precision Upright Cryostat Holder for SPring-8



Rotational Platform for NSRRC SPring-8



Nine-Axis High Precision System



DLS Double Crystal Deflector



ANKA Fast Sample Exchange System



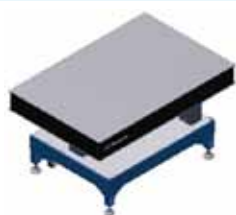
Kappa Six-Circle Goniometer for CHESS



MAX-Lab Precision Positioning System



Two-Axis High Precision System for DLS



Six-Axis High Precision System



Six-Axis High Precision System for Brookhaven National Laboratory



Arecibo Observatory Upgrade



Colorado Gimbal System for MOBI Vacuum



HFIR Image Neutron Focusing System



High-resolution extreme-ultraviolet-light (EUV) microscope



Eleven Axis Custom Design Motion for a Press and a Detector System



Four Axis Custom Design Motion for a Press Manipulation System



XYZ & Multistage UHV Manipulators



Diffractometer Table, 2 Axis Motion System



Seven Axis High Load Precision Motion System

# OPTICAL TABLES

<http://www.adc9001.com/Custom-Optical-Tables>

ADC (ISO9001:2008 certified) has been a leading supplier of high quality optical tables to the synchrotron and neutron source scientific community as well as FELs and laser based experiments for over 18 years. Many of our optical tables have been in operation nearly that long in facilities around the world. Our tables are noted for stability as well as range of motion and load capacity. Options run from steel to granite base as well as size of the table and range of motion.

please see <http://www.adc9001.com/Custom-Optical-Tables>

ADC has continuously improved our designs by supporting our customer's unique needs for improved space constraint, load capacity, vibrational stability, positional precision and stability, encoder position feedback, and base and frame requirements. ADC has developed a portfolio of optical table components such as base and frames, lifts and lateral stages, floor location and attachments, wheel and air bearing movement, breadboards, and controls. These components are customizable to meet your specific application.



SOLARIS 3-Axis Motorized  
Positioner High Precision Device



One Degree of Freedom Optical  
Table (Brookhaven National Lab)



Cornell Custom Optics Table



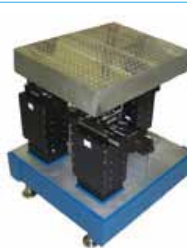
The Air Force 3-Axis Optical Table



ANKA - the Synchrotron Radiation  
Facility at KIT 3 Axis Table



Cornell Custom Optics Table



NASA Custom Optics Table



3 Degree of Freedom Optical Table  
(CHESS, Cornell University)



Diamond Light Source (DLS)  
Custom Optics Table



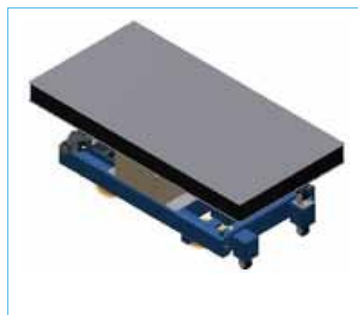
Advanced Photon Source (APS)  
Custom Optics Table



Advanced Photon Source (APS)  
Custom Optics Table



2 Degree of Freedom Optical Table  
(Argonne National Lab)



ANKA - the Synchrotron Radiation Facility at KIT 6 Axis Table



MAX IV Laboratory Custom Optics Table



Diamond Light Source (DLS) 2 Degree of Freedom Custom Optics Table



DeutschesElektronen-Synchrotron (DESY) Custom Optics Table



ElettraSincrotrone Trieste Custom Optics Table



Center for Advanced Microstructures and Devices (CAMD) Custom Optics Table



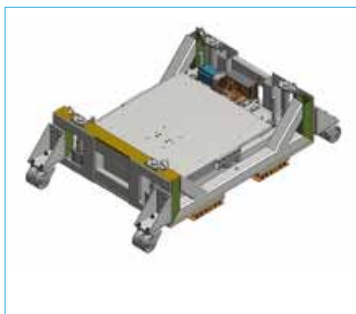
Michigan State University (MSU) Custom Optics Table



Six Degree of Freedom Optical Table (Brookhaven National Lab)



SLAC National Accelerator Laboratory Six Degree of Freedom Optical Table



Low Profile Diffractometer Table (LPDT-100)



DeutschesElektronen-Synchrotron (DESY-2) Custom Optics Table



Two Degree of Freedom Optical Table (Brookhaven National Lab)



Advanced Photon Source (APS) Custom Optics Table



Canadian Light Source (CLS) Custom Optics Table



OPT-1000-3-X-X



Six Degree of Freedom Optical Table (Brookhaven National Lab)

**For detailed information regarding ADC's Optical Tables please refer to our 2016 Optical Table Catalog or visit the following website:**

**<http://www.adc9001.com/ABOUT-US/Catalogs>**



# PRECISION STAGES

[http://www.adc9001.com/products/show\\_list/id/104](http://www.adc9001.com/products/show_list/id/104)

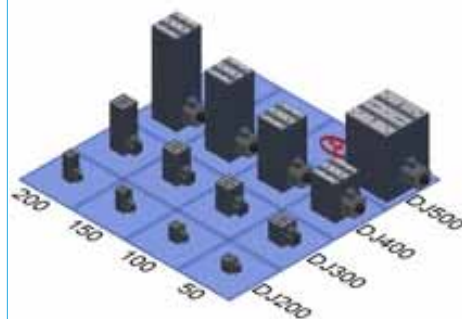
ADC manufactures high quality motion control products and systems that are qualified for Semi-conductor, Automation, and Aerospace industries. Our extensive product line includes; linear stages, lift stages (Jacks), rotation stages, goniometers, gantry systems, optical tables, vacuum compatible motion systems, and Nanotechnology positioners.



Mounting Plates and Brackets



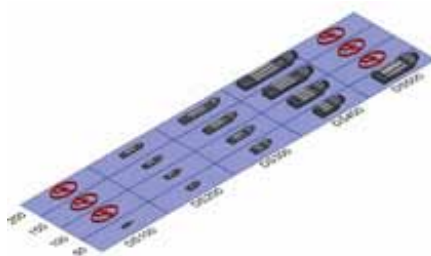
Rotation Stages



Lift Stages



Goniometers



Linear Stages

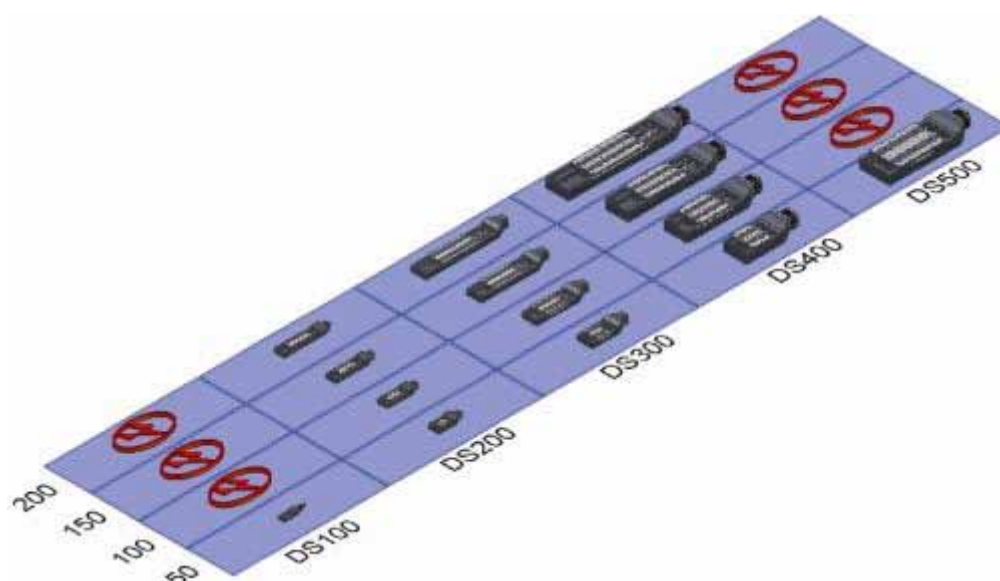


Custom Stages

# LINEAR STAGES

<http://www.adc9001.com/Linear-Stages>

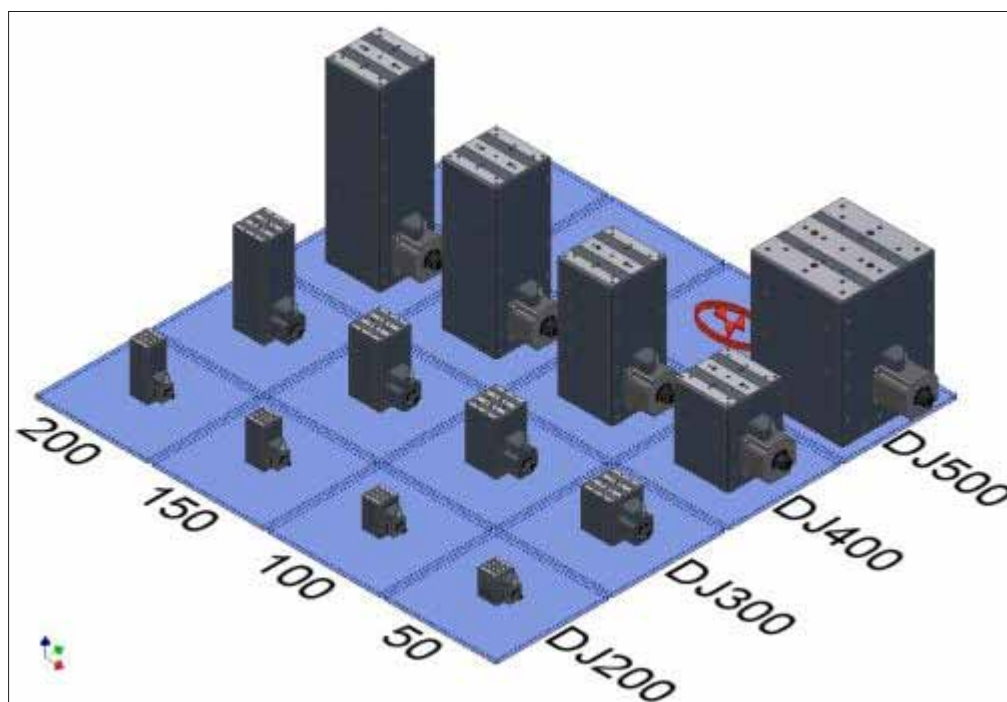
ADC's high precision linear slides provide an accurate and rigid platform for use in any positioning system. The rugged black anodized aluminum housing features a precision ground base and top plate, each with multiple utility holes for easy integration into the users' system. The stage is driven by a high class preloaded ballscrew coupled to a high torque 200 step per revolution stepper motor which can be run in full, half, or microstepping mode to meet your resolution requirements. Maximum rigidity is assured through the use of preloaded crossed roller linear bearings. Each slide also features two fully adjustable, normally closed limit switches to define the extents of travel.



# LIFT STAGES

<http://www.adc9001.com/Lift-Stages>

ADC's high precision jacks provide an accurate and rigid platform for use in any positioning system. The rugged black anodized aluminum housing features a precision ground base and top plate, each with multiple utility holes for easy integration into the users' system. The vertical stage is driven by a high class preloaded ballscrew coupled to a high torque 200 step per revolution stepper motor which can be run in full, half, or microstepping mode to meet your resolution requirements. Maximum rigidity is assured through the use of preloaded crossed roller linear bearings. Each jack also features two adjustable, normally closed limit switches at the end of travel.





# ROTATION STAGES

<http://www.adc9001.com/Rotation-Stages>

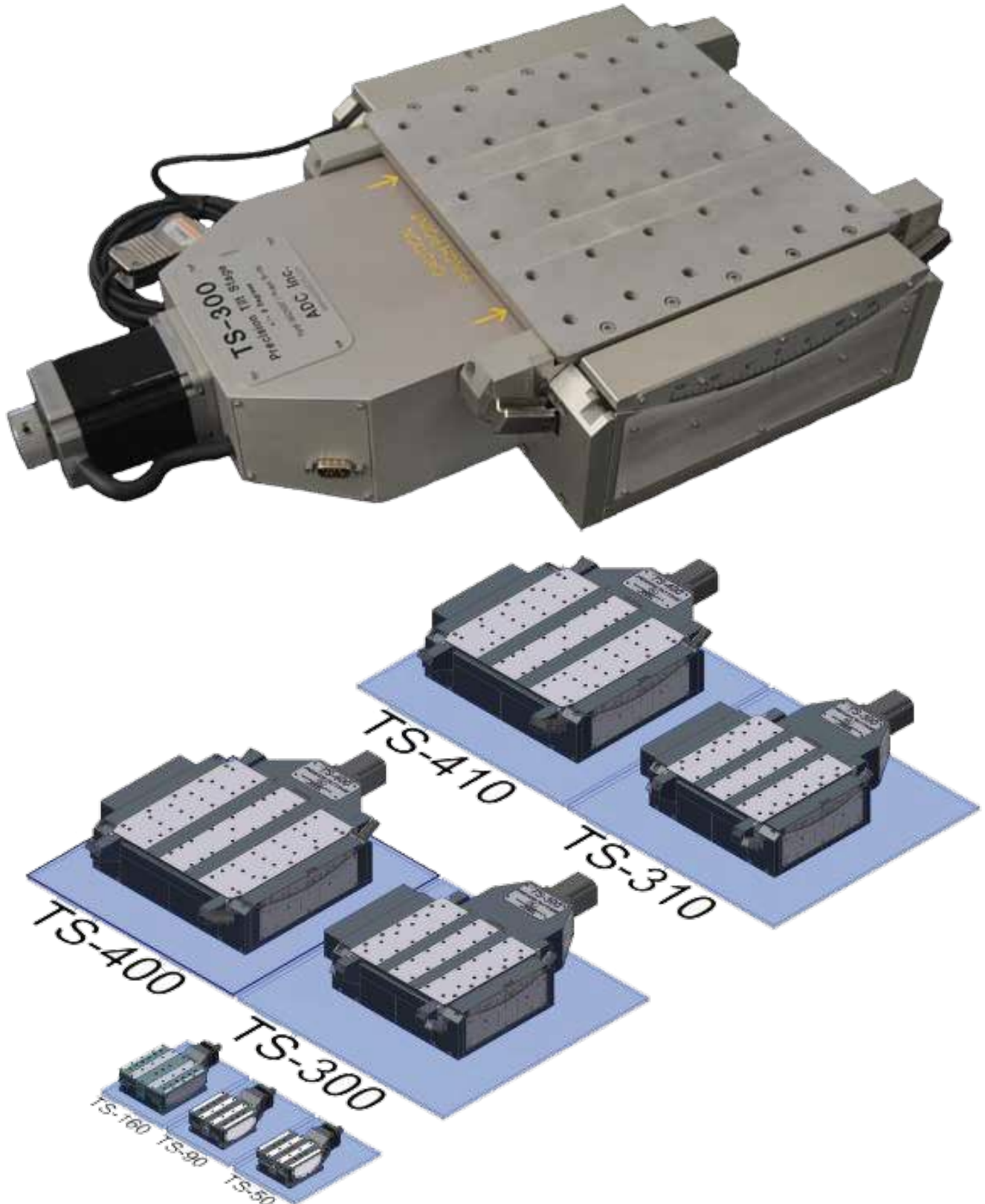
ADC's series 100 to 700 rotation stages are designed for use in industrial applications such as measurement systems, vision control, automation, and robotics, and in scientific applications such as synchrotron experiments. The body is fabricated from a high rigidity aluminum alloy. Two industrial high-precision angular contact ball bearings capable of withstanding substantial radial and thrust loads guarantee the highest precision with excellent rigidity. A high-precision worm gear drive provides optimal, quiet, smooth motion.



# PRECISION GONIOMETERS

<http://www.adc9001.com/Goniometers>

These tilt stages are based on precision curved guide rails combined with a tangent bar (TS Series) or worm gear drive system (TSW Series) providing fine angular resolution and accuracy. The stages can be paired to provide an orthogonal (X-Y) tilt stage system. All tilt stages come standard with a stepper motor.



# OVERALL CAPABILITIES



Design



Fabrication



Assembly



Installation



# MANUFACTURING CAPABILITIES

ADC USA, located near Cornell University in Ithaca, New York, is a leading developer and supplier of complex engineering components and instruments for large government laboratories and corporations around the world. Founded as a privately held company in 1995, ADC has grown into one of world's leading technology companies with more than 500 customers located in over 26 countries. ADC provides machining systems and products to our diverse customers from structural metal fabrication to turn key design products with complex control systems. ADC is fully equipped with a CNC precision machine shop; and over the past 4 years our unique ability to fabricate/provide parts for precision vacuum machining equipment has grown immensely. Our process begins with providing quotes, which we prepare, based on specific drawing requirements given to us by the customer.

## Our customers say ADC is unique because we:

- Proactively solve manufacturing challenges
- Initiate cost savings for our customers
- Innovate – in the way we build and the equipment we use
- Integrate complex systems, efficiently
- Understand schedule
- Listen

Customers are the most valuable people for an organization. They are the resource upon which the success of our business depends. The relationships we build with our customers are based upon loyalty and satisfaction. Our purpose is to fulfill the needs of the customer and they in turn make achieving our business aims possible.



ADC offers a large assortment of synchrotron equipment including; High Precision Slits, Optical Tables, Custom Complex Motion Systems, Micro and Split Two Axis Ion Chambers, Mirror Systems, Spectrometers, and Insertion Devices.

## Equipment

We use precision equipment to verify each order and are committed to delivering precision machined parts. We are very proud of our shop and the capabilities we can offer because of our state-of-the-art precision CNC milling and CNC turning machines. Equipment used for inspections a Brown & Sharpe CMM, a Jones & Lamson Optical Comparator, and an extensive selection of gages. We ensure calibrations are performed and are traceable to meet your standards. Our inspection room is temperature controlled to enable the utmost accuracy and consistency in measurements. We can provide a Certificate of Conformance for all processes as required. These are stored electronically and attached to each job for future reference.

## Process Flow

We pay strict attention to every detail of our operation. Our process includes having the machinists check parts throughout the process flow and inspect parts as they are run. First articles are performed on all new parts and at each operation. In addition, all parts also go through a final inspection on state-of-the-art measuring equipment. We are pleased our clients recognize and count on our quality capabilities so much so that we've even had customers come to us to help them inspect parts where there may be a discrepancy even though the parts were made by a different machine shop!



**ADC's Manufacturing Material Stack**  
for Machining Projects



# WELDING

At ADC, we offer full service custom metal fabrication which includes welding services for short and long production run jobs. Our extensive welding capabilities utilize both robotic welding and manual welding in MIG and TIG and mesh welding for wire products. We are experienced in welding aluminum, carbon steel, and stainless steel materials. We also have complete resistance welding, also known as spot welding capabilities. Our unique welding shop supports our custom metal fabrication process.



The welding services at ADC support our full service fabrication process with capabilities including:

- Resistance Welding / Spot Welding
- Gas Metal Arc Welding (GMAW) / Metal Inert Gas (MIG Welding) - This semi-automatic or automatic process uses a continuous wire feed.
- Gas Tungsten Arc Welding (GTAW) / Tungsten Inert Gas (TIG Welding) - A manual welding process that is extremely precise, especially useful for welding thin materials.
- Mesh Welding - electric flash butt welding where the two wires are pressed together and the electric current is activated



### Benefits of TIG Welding

- Superior quality welds
- Welds can be made with or without filler metal
- Precise control of welding variables (heat)
- Free of spatter
- Low distortion

### Benefits of MIG Welding

- All position capability
- Higher deposition rates than SMAW
- Less operator skill required
- Long welds can be made without starts and stops
- Minimal post weld cleaning is required

### Benefits of Mesh Welding

- wires resist movement
- it is much faster than traditional welding
- it is a high quality low cost spot welding solution



Welding shop strength is our ability to engineer and fabricate complex, multiple part welded assemblies. We also design and build our own weld fixtures when needed.

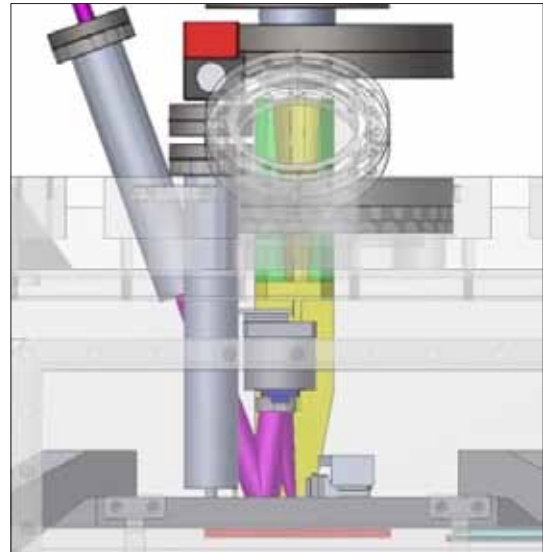
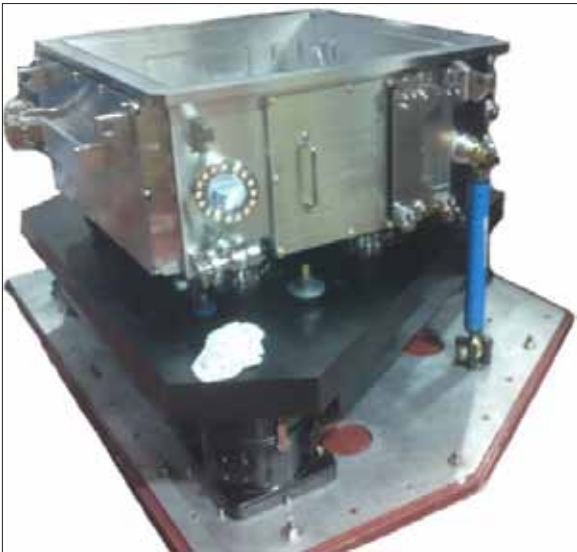
ADC has 23 years of combined experience as a welding shop and high attention to detail required ensuring that our welding shop provides the best welds and custom metal fabrication products every time.

ADC welders are constantly trained and kept up-to-date on the latest welding techniques and have some of the most technologically advanced equipment available. That means customers enjoy a welding shop with knowledgeable craftsmen who give more attention to detail than other welding companies. Our goal is to complete every custom metal fabrication job in the most timely, professional, and mistake-free manner possible.

# ENGINEERING DESIGN & ANALYSIS

The Engineering Design and Analysis group is a multi-disciplinary team of engineers with unique training and creativity, and dedication to meeting the needs of our customers. ADC uses the latest computational and graphics software and hardware to approach the most challenging problems in the Aerospace, Automotive, Nuclear, Turbomachinery, Automated Machinery, Electro-Optical Products, synchrotron, high energy physics, and neutron diffraction communities. Parametric solid models are created for all mechanical designs, using Autodesk Inventor 2014 Professional. Drawing on our extensive experience, we present practical, economical and safe designs. We stand apart by providing a multidisciplinary approach - in materials, modelling and manufacturing to the design process. We review design and fabrication requirements, scoping and detailed stress analysis, determining specification and regulatory constraints, and working to practical cost limitations.

These models are the basis for procurement, manufacturing and assembly, ensuring accurate and timely execution of the designs. Autodesk Inventor 2014 comes with a finite element package capable of many different types of simulations including stress analysis, modal analysis and thermal analysis. These simulations as well as ANSYS are used for providing numerical results that cannot be efficiently calculated by hand. With a dedication to customer satisfaction backed by over 18 years of experience in developing innovative designs, we are confident we can tackle and solve the most challenging problems; examples below.

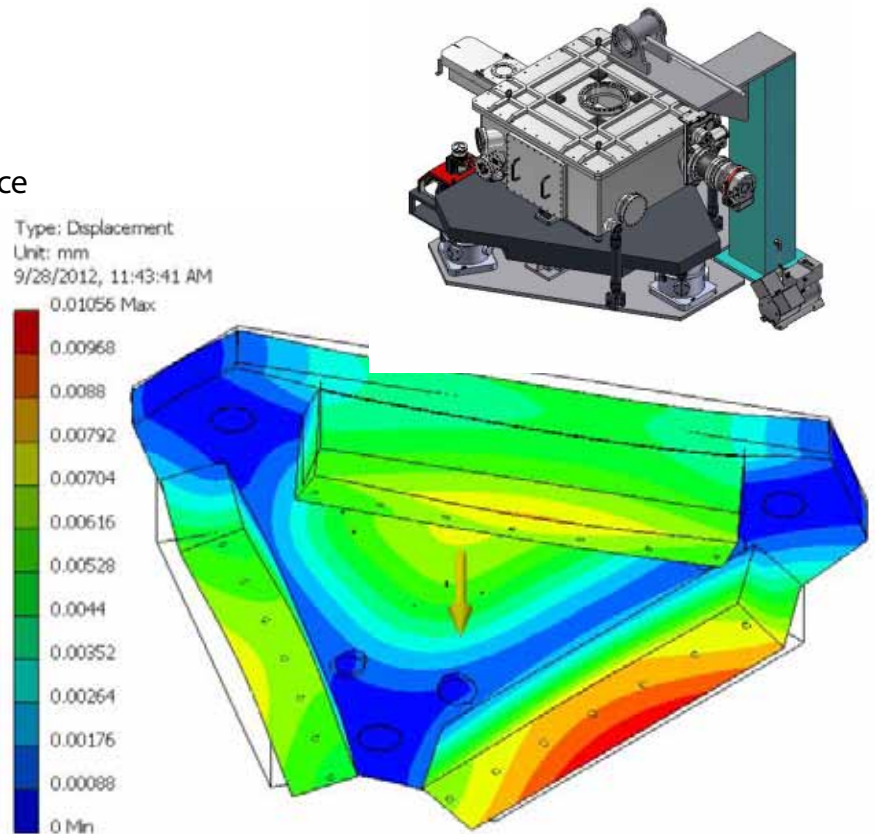


# FINITE ELEMENT ANALYSIS

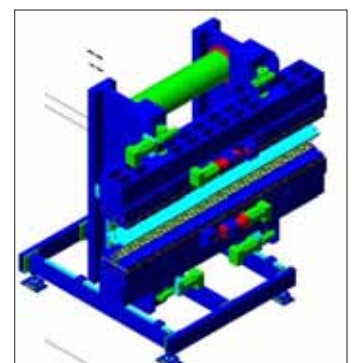
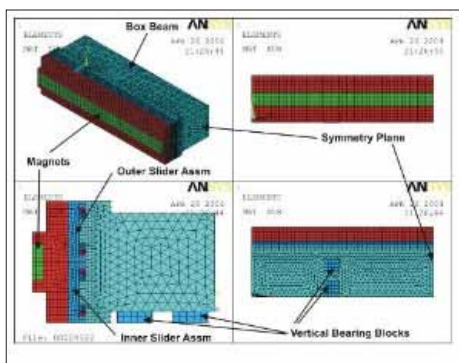
ADC Engineers perform structural design and analysis for the manufacturing, aerospace, Electro-Optical Products, synchrotron, high energy physics, and neutron diffraction communities. We perform finite element analysis (FEA) to accurately model products and processes to determine structural integrity, performance and reliability, as well as predict structural failures. ADC uses FEA for decreasing design cycles, keeping production costs low through design optimization, and uncovering potential sources of field failures. Analysis includes:

## Structural Integrity

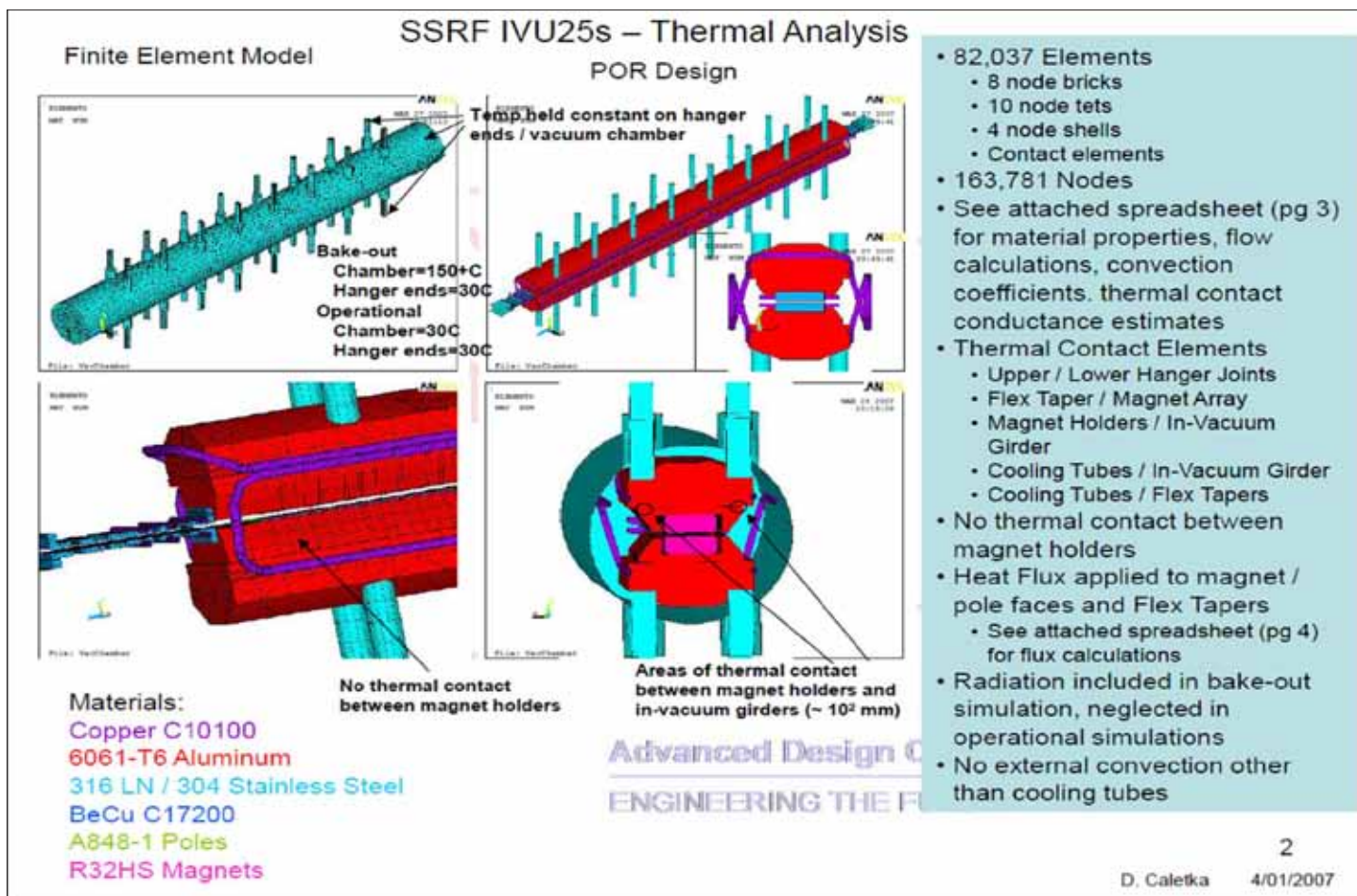
- Component Life Prediction
- Fatigue, Buckling, and Code Compliance
- Design Optimization
- Fabrication Process Evaluation
- Heat Transfer
- Thermal Cycling
- Creep Response & Ratcheting
- Shock, Vibration & Impact
- Flow-Induced Vibrations
- Fluid Flow Analyses
- Computational Fluid Mechanics
- 2D & 3D Finite Element Analysis
- Linear & Nonlinear
- Seismic & Vibration
- Thermal Analysis
- Elevated Temperature Applications



ADC uses Finite Element Analysis (FEA) to predict the deflections of complex and critical structures and to solve the most challenging product engineering problems. For example, when ADC's engineers design insertion devices, the magnet support structure behavior can be simulated in ANSYS by applying the anticipated magnetic forces, which are determined from a RADIA calculation. Solid models generated using Autodesk Inventor can be imported into ANSYS, greatly simplifying the interactive design process. Many aspects of the design, such as material selection, girder geometry, bearing size and preload, and magnet clamping are optimized using FEA. Below is a typical example of what you would expect to see from ADC, including a solid model, finished product and installed product.







## Design process and project completion

### Magnetic Design

The Engineering Design and Analysis group at ADC also perform magnetic designs. These are typically performed for an insertion device. ADC's scientists use B2E, SRW and RADIA (developed at the ESRF), along with Mathematica and ANSYS FEA in the design of insertion devices. An initial, parametric magnetic design is completed as part of each proposal to ensure that the customer's specifications can be met. From these specifications the magnetic materials are chosen to produce either a pure permanent magnet (PPM) or hybrid design (both SmCo and NdFeB magnets have been used in our designs).

Using a model of the device, and a preliminary magnet design, the specifications are checked to ensure that the period, length, gap and flux density are sufficient to meet the desired range of photon energy.

### Optics Design

ADC uses SHADOW a widely used program for the simulation of optical systems, more geared to the synchrotron radiation research. It is based on a geometrical ray-tracing approach, but also traces field amplitude with phase difference. This design tool is used by ADC in combination with ADC's High Accuracy Optical Mirror Metrology Profilometer.



# ELECTRONICS AND INSTRUMENTATION

ADC has several electrical/software engineers and techs capable of providing custom circuit design and complete turn-key control systems. Some of our skills include integrated PLC design and programming, analog and digital circuit design, logic design (including PLA and FPGA programming), stepper and servo motor applications, microprocessor, RFID, serial and RF communications, and system controllers.



We have a suite of instrumentation tools for test and measurement of temperature, position, angular displacement, tolerance, acceleration, vacuum, magnetic fields, and motor controls with extensive stock components for prototyping and breadboard. Our electrical lab includes various precision DVMs, oscilloscopes, power supplies, and other tools.

Our design tool set includes National Instruments (NI) MultiSim for schematic capture and NI UltiBoard for circuit board design, Xilinx ISE for FPGA design, ModelSim for simulation, and StateCad. Non-circuit board Schematics are drawn on various platforms with output to DXF. Microprocessor experience is broad but recent projects focus on the PIC Micro Family from MicroChip. ICE units and code simulation for the PIC microprocessors are in-house. Software skills and development platforms include Microsoft Visual C++, PERL, LabView, Visual Basic, CNC, and generic PLC (AB, NAIS, GE-Fanuc, Schneider, etc.) and Parker 6K and 9K (Accroloop).

Our standard motor controls and driver that we offer is Galil as described in this document. However, many of our customers have requirements for custom integration of these components into a functioning system, fully debugged, documented, and ready for operation.



### ADC's Standard Motor Controls and Driver

The DMC-40x0 motion controller is Galil's highest performance, stand-alone motion controller, at right. It belongs to Galil's latest generation motion controller family:



the Accelera Series, which accepts encoder inputs up to 22 MHz, provides servo update rates as high as 32 kHz, and processes commands as fast as 40 microseconds-10 times the speed of prior generation controllers.

ADC has supplied many customers turn-key slits system using the Ensemble® motion controller. This is a 4 multi-axis, stand-alone controller for high-performance applications with high-speed communication through 10/100 Base T Ethernet or USB interfaces. The Ensemble™ can control brushless, brush or stepper motors or stages in any combination, and both PWM and linear drives are available. It offers easy to use, affordable multi-axis (1-10 axes) motion programming for laboratory experimentation, production testing or advanced OEM automated manufacturing systems.

### ADC Standard Motor Controls and Driver





## Ensemble Series of Controllers by Aerotech

The Ensemble® motion controller is a next-generation, multi-axis, stand-alone controller for moderate-to high-performance applications with high-speed communication through 10/100 Base T Ethernet or USB interfaces. The Ensemble™ can control brushless, brush or stepper motors or stages in any combination, and both PWM and linear drives are available. It offers easy to use, affordable multi-axis (1-10 axes) motion programming for laboratory experimentation, production testing or advanced OEM automated manufacturing systems.

Like all Galil controllers, programming the DMC-40x0 is simplified with two-letter, intuitive commands and a full set of software tools such as GalilTools for servo tuning and analysis.

### Computer Hardware

#### Dell- Personal Computer

- Intel® Core™ i3-2100 processor (3MB Cache, 3.10GHz)
- 2GB Dual Channel DDR3 SDRAM at 1333MHz - 2 DIMMs
- 250GB Serial ATA Hard Drive (7200RPM) w/DataBurst Cache™
- Genuine Windows® 7 Professional SP1, 64bit
- Dell E Series E2011H 20"W Monitor, 20.0 Inch VIS, Widescreen, VGA/DVI



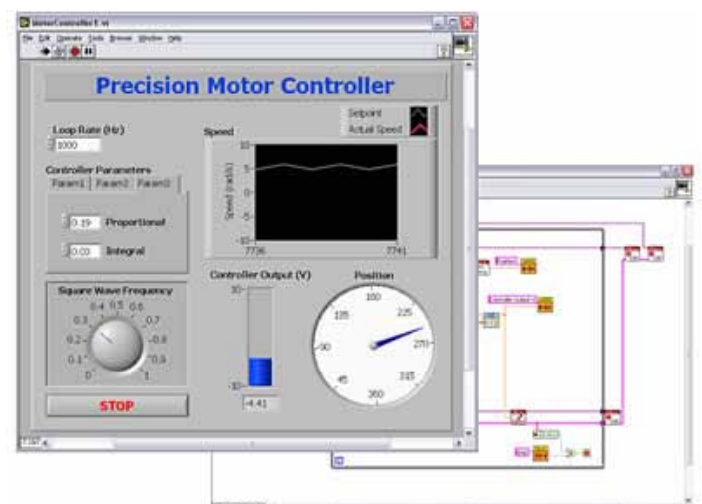
### User / Software Interface

#### National Instruments- LabView

LabVIEW is a graphical programming environment used by millions of engineers and scientists to develop sophisticated measurement, test, and control systems using intuitive graphical icons and wires that resemble a flowchart. It offers unrivaled integration with thousands of hardware devices and provides hundreds of built-in libraries for advanced analysis and data visualization – all for creating virtual instrumentation. The LabVIEW platform is scalable across multiple targets and OSs, and, since its introduction in 1986, it has become an industry leader.

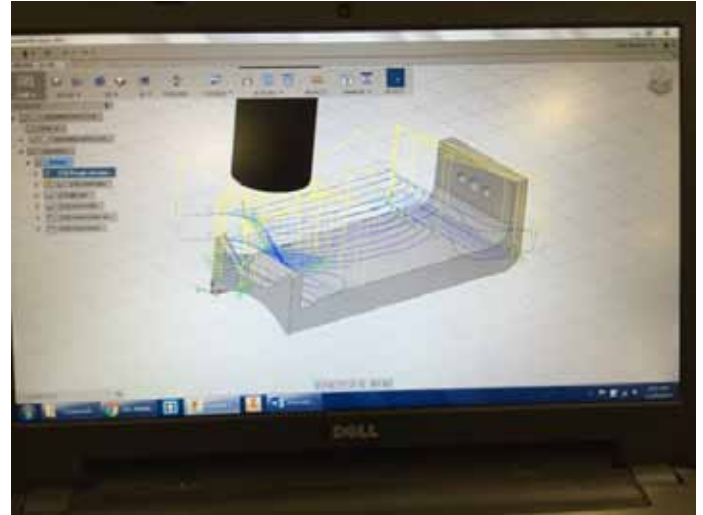
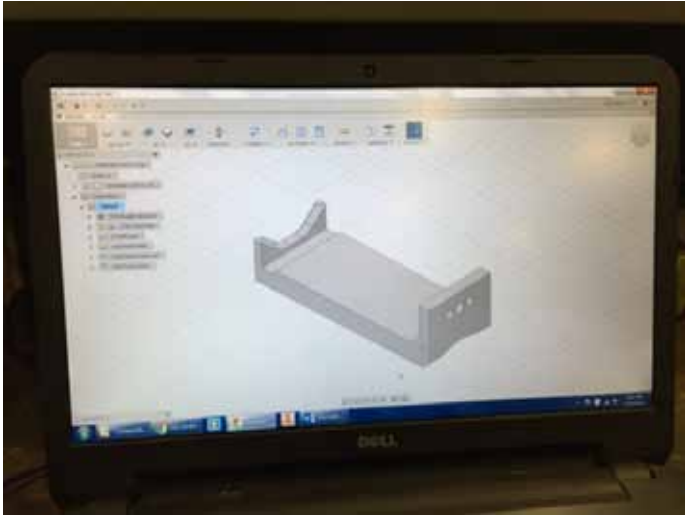
Graphical User interface for the motion control include:

- Data Display;
- Ability to move individual axis;
- Absolute move of axis;
- Relative move of axis;
- Home individual axis;
- Encoder feedback;
- Limit switch detection, and;
- Easy install on a Windows OS platform.



## CAM SOFTWARE

We have also set up a computer station with the appropriate program packages so that we can feed our CAD drawings directly into our machining centers. We have recently switched to new powerful CAM software called Fusion 360 from Autodesk. Fusion 360 is built off of the same kernel as HSMWorks and Inventor HSM giving it years of proven experience. Fusion 360 is the next generation of CAM software allowing the machinist to create a CNC program faster and more accurately than ever before. Using adaptive clearing strategies that maintain load on the tool cutting time is decreased by as much as 50% while also increasing tool life. Fusion 360 also includes extensive finishing strategies to allow machining of fine details. The part shown below was programmed and run in the CNC machine in less than 90 minutes while maintaining a small tolerance of one thousandth of an inch!!



# ASSEMBLY & TESTING

## Team Structure

Our team-based structure provides a distinctive advantage in the overall success of the organization. Common processes and integrated team based concepts allow for effective and efficient program management. We measure the performance of our teams through feedback channels that allow for continual improvement. This element is essential to the team's ability to meet and exceed their objectives. Through the team process, with a focus on our vision of being our customer's premier supplier, we provide the highest level of customer satisfaction possible.

Each month our Manufacturing, CFT, and Support teams hold a Workplace Meeting. This is a devoted time for each team to communicate important team-based and corporate information. Every team is empowered to hold other meetings as needed to ensure all customer specific requirements are met. ADC's assembly and testing consists of different departments to make up the framework of our operations. This includes: Ultra-High Vacuum (UHV) Facility, Metrology Laboratory, Magnetic Measurement Facility (Undulator Testing Facility), and Electronics and Instrumentation. Each department plays an important role in the capabilities we offer to our customers. It is rare to find this myriad of capabilities in one company.

## Temperature Control/Clean Room Assembly/Testing Facility

ADC has a temperature controlled class 10,000 clean room that is used for testing purposes (below). The room has a vibration-dampening vault (in the lower two photos) to isolate the testing area from building vibrations. This room is also isolated from the rest of the assembly area and can be closed off for temperature control.



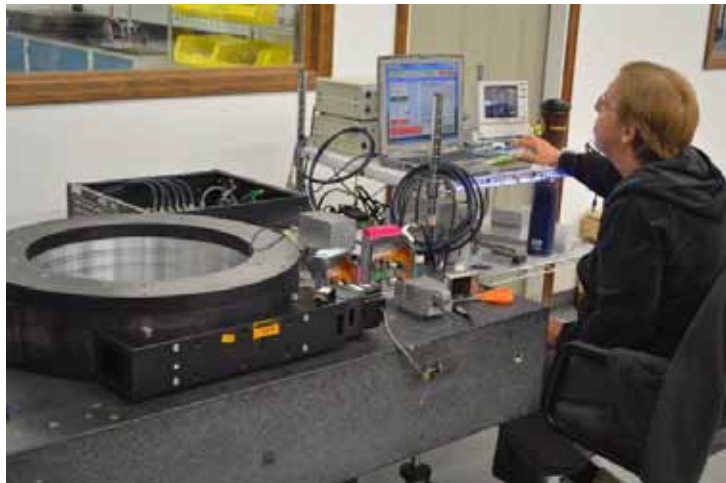
**Vibration dampening vault**



## Dedicated Assembly Area

ADC's assembly department (below) is dedicated to providing quality assembly and technical support to our manufacturing department and customers. Assembly methods are guided by procedures developed in accordance with requirements of military standards, federal specifications, international standards, and customers' "in-house" specifications (photos below).

ADC has a large solid granite table, 8-foot (3.8 m) by 14-foot (6.6 m) polished to a flatness of one-micron accuracy over its entire length providing an excellent surface to assemble massive high precision systems as well as undulator back bones. It is isolated from external vibrations by a 0.75 meter thick concrete block that is supported on Unisorb™ anti-vibration padding.



# QUALITY CONTROL

ADC has developed and implemented a quality management system in order to document the company's best business practices, better satisfy their requirements and expectations of its customers and to improve the overall management of the company.

The quality management system of ADC meets their requirements of the international standard ISO9001:2008. This system addresses the manufacture and production of ADC's and its customers' products.

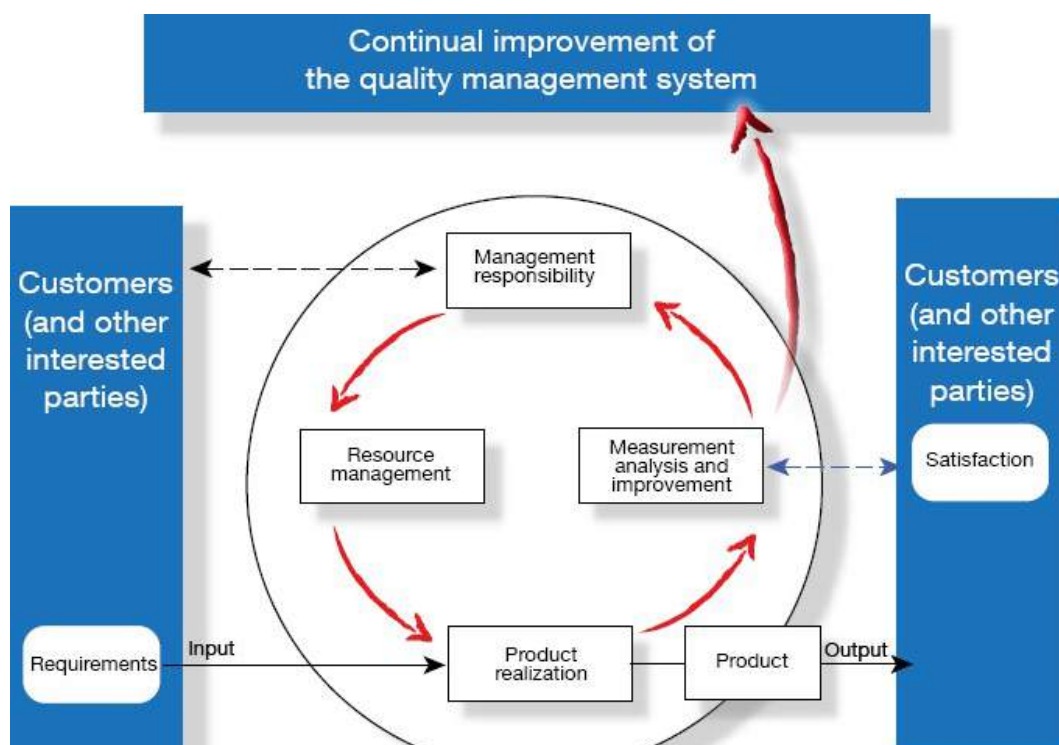
This manual describes the quality management system, delineates authorities, inter relationships and responsibilities of personnel responsible for performing within the system. The manual also provides procedures or references for all activities comprising the quality management system to ensure compliance to the necessary requirements of the standard.

This manual is also used externally to introduce our quality management system to our customers and other external organizations or individuals. The manual is used to familiarize them with the controls that have been implemented and to assure that the integrity of our quality management system is maintained and focused on customer satisfaction and continuous improvement.

ADC has its own quality management team which consists of three individuals. ADC President, who is responsible for finance, sales/marketing, public relations. Director of Operations, who is responsible for the day to day operations of ADC including the overseeing of the quality management system. Quality administrator, who is responsible for dealing with supplier issues before and after orders are placed, helps oversee the quality management systems, deals with the maintenance and ADC upkeep.

## Quality Management System Process Approach

The model above illustrates that effectiveness and improvement can be represented as a cyclical process that uses components of the quality management system to analyze data and then direct changes and initiatives that ensure the system's continual improvement. This ensures a proactive approach to meeting the quality management system objectives and customer requirements.



## General Requirements

ADC has implemented a quality management system that exists as part of a larger, overall management system which has established, documented and implemented our quality policy and related processes for providing products and services which meet or exceed customer requirements, while satisfying the requirements of ISO9001:2008.

ADC has adopted the process approach advocated by ISO9000:2005, by defining and managing process inputs, controls and outputs to ensure the desired results are achieved and by managing the interfaces between interrelated processes to ensure system effectiveness is maintained.

ADC monitors, measures and analyzes needed processes and takes action to achieve planned results and ensures the continue a improvement of our quality management system. Any outsourced process or activity is controlled as per applicable ISO9001 requirements.

Specific responsibilities for, and the sequence and interaction of key quality management system processes are detailed in the quality procedures, some of which contain or reference deployment flowcharts depicting the processor which is also described in the narrative of the procedure.

Management has the responsibility and authority for supporting the development and implementation of the quality management system, for ensuring that it remains relevant to the company's objectives, and the needs and expectations of customers while promoting an ethos of continual improvement. Management and their direct reports are responsible for communicating the quality policy as well as the importance of meeting customer, statutory and regulatory requirements to employees within their respective departments. They ensure the policy is understood and that it is applied to the daily work of the organization through the establishment of measureable goals and objectives.

Management is responsible for ensuring that the quality policy is appropriate for the goals of the business, that it promotes the continuing improvement of the effectiveness of the quality management system and that it is reviewed for continuing suitability.

All managers are responsible for reporting back to the organization on the performance and effectiveness of the quality management system.





### Customer Satisfaction

Customer complaints, whether received in writing, verbally or electronically are immediately forwarded to the Manufacturing Manager for action.

Customer survey data along with other customer feedback, including written or verbal complaints and information collected via the customer feedback form are reviewed by management who initiates appropriate corrective actions needed as required by Section 8.5.

#### Customer satisfaction is monitored in various ways:

- Product returns and warranty claims
- Repeat customers
- Analysis of customer complaints
- Levels of repeat business
- Recognition and awards
- On-time delivery

### Corrective Action

Evidence of non-conformance, customer dissatisfaction or process weakness is used to drive our corrective action system. Since problems may exist, they will require immediate correction and possible additional action aimed at eliminating or reducing the likelihood of recurrence. Management with responsibility and authority for corrective action are notified promptly of product or process non-conformities. Investigating and eliminating the root cause of the failures is a critical part of our continual improvement process.

ADC take action to eliminate the cause of non-conformities in order to prevent recurrence. Corrective actions are appropriate to the effects of the non-conformities encountered.

The documented Complaints, Corrective, and preventive Action Procedure (OP-85-02) defines the requirements for:

- Reviewing non-conformities (including customer complaints)
- Determining the causes of non-conformities
- Evaluating the need for action to ensure that non-conformities do not recur
- Determining and implementing action needed
- Records of the results of action taken (see Section 4.2.4)
- Reviewing corrective action taken

Follow-up audits are conducted in accordance with the internal audit process; Section 8.2.2, to ensure that effective corrective action is taken and that the action is appropriate to the impact and nature of the problem encountered. In addition, management summarizes and analyzes corrective action data to identify trends in order to assess the overall effectiveness of the corrective action system and to develop related recommendations for improvement.

The corrective actions are considered effective if the specific problem was corrected and data indicates that the same or similar problems have not recurred. Results of data analysis and subsequent recommendations are presented to management for review.

### Preventative Action

ADC determines any necessary action to eliminate the causes of potential non-conformities in order to prevent their occurrence. Preventive actions are appropriate to the nature of a potential problem. Data from internal audits, customer feedback, employee suggestions, and other appropriate data is collected and analyzed to identify the actions needed to eliminate the causes of potential. Investigating and eliminating the root cause of potential failures is a critical part of our continual improvement process.

# REFERENCES

The following is a list of the world class facilities that work with ADC creating cutting edge instrumentation. To see more information, follow the link to our reference page on our website.

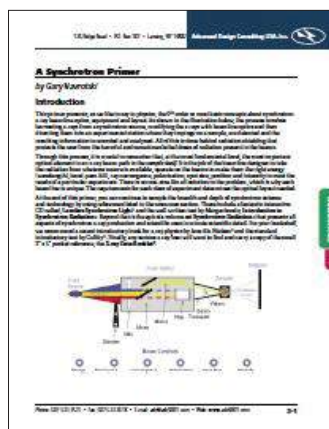
<http://www.adc9001.com/REFERENCES>

			
National Aeronautics and Space Administration (NASA)	The Air Force Research Laboratory (AFRL)	ITER(International Thermonuclear Experimental Reactor)	The Advanced Light Source (ALS)
			
ANKA (abbreviation for „Angströmquelle Karlsruhe“)	The Australian Nuclear Science and Technology Organisation (ANSTO)	The Australian Synchrotron (AS)	Diamond Light Source (DLS)
			
MAX IV Laboratory	CCLRC (Council for the Central Laboratory of the Research Councils)	Cornell High Energy Synchrotron Source (CHESS)	The Canadian Light Source (CLS)
			
Deutsches Elektronen-Synchrotron (DESY)	Department of Justice (DOJ)	Department of Transportation (DOT)	Brookhaven National Laboratory (BNL)
			
The European Synchrotron Radiation Facility (ESRF)	Free Electron Laser for Infrared eXperiments (FELIX)	High Flux Isotope Reactor (HFIR)	Hiroshima Synchrotron Radiation Center (HiSOR)
			
Raja Ramanna Centre for Advanced Technology, Indore (INDUS, RRCAT)	Science & Technology Facilities Council (ISIS)	ALBA (meaning "Sunrise" in Catalan and in Spanish)	IUC
			
Korea Atomic Energy Research Institute (KAERI)	Photon Factory (PF) at KEK	Los Alamos National Laboratory (LANL)	Laboratory for Atmospheric and Space Physics (LASP)

 <p>Michigan State University (MSU)</p>	 <p>United States Navy (USN)</p>	 <p>National Institute of Standards and Technology (NIST)</p>	 <p>National Nuclear Security Administration (NNSA)</p>
 <p>National Synchrotron Radiation Research Center (NSRRC)</p>	 <p>Oak Ridge National Laboratory (ORNL)</p>	 <p>Pohang Accelerator Laboratory (PAL)</p>	 <p>Paul Scherrer Institute (PSI)</p>
 <p>SLAC National Accelerator Laboratory</p>	 <p>Spallation Neutron Source (SNS)</p>	 <p>Special Operations Command (USSOCOM)</p>	 <p>SOLARIS National Synchrotron Radiation Centre</p>
 <p>Shanghai Synchrotron Radiation Facility (SSRF)</p>	 <p>Mayo Clinic</p>	 <p>Cornell University Department of Astronomy</p>	 <p>Bar-Ilan University</p>
 <p>The Advanced Photon Source (APS)</p>	 <p>CAMD (LSU Louisiana State University)</p>	 <p>Canadian Institute for Neutron Scattering (CINS)</p>	 <p>Elettra Sincrotrone Trieste</p>
 <p>Institute of High Energy Physics, Chinese Academy of Sciences (IHEP)</p>	 <p>Thomas Jefferson National Accelerator Facility (Jefferson Lab)</p>	 <p>Brazilian Synchrotron Light Laboratory (LNLS)</p>	 <p>National Oceanic and Atmospheric Administration (NOAA)</p>
 <p>Shanghai Institute of Applied Physics (SINAP)</p>	 <p>SPRing-8 (Super Photon ring-8 GeV)</p>	 <p>National Science Foundation</p>	



The following are primers offered by ADC, Inc. To view or download a copy of our primers, visit our website at: <http://www.adc9001.com/ABOUT-US/Primers>.



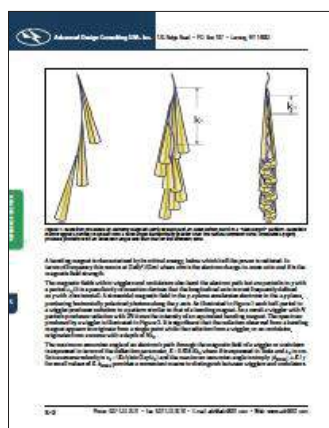
## A Synchrotron Primer

"This primer presents, as we like to say in physics, the 0-th order or most basic concepts about synchrotron x-ray beamline optics, equipment and layout...."



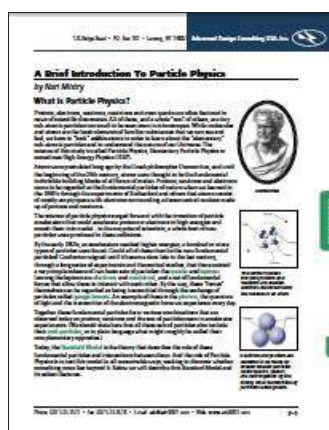
## A Vacuum Primer

"The first thing you need to know about vacuum was documented in 16th century Italy..."



## Insertion Devices Primer

"Applications such as protein crystallography have recently driven much greater interest in the use of synchrotron radiation as a research tool...."



## A Brief Introduction to Particle Physics

Design



Fabrication



Assembly



Installation



ISO 9001:2008 Certified  
[www.adc9001.com](http://www.adc9001.com)