

# High Precision Systems



## Rotational Platform for NSRRC – Taiwan

The rotational platform was designed for use at Spring8 to allow for the rotation of the beamline components following a diamond monochromator to maintain system alignment over the range of beam energies.



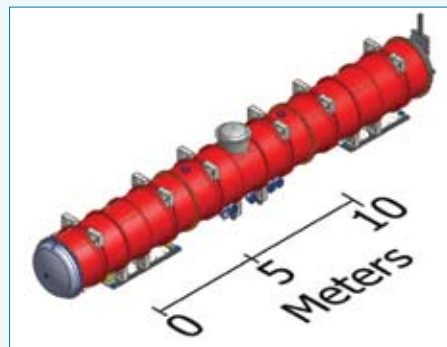
A 5-phase stepper motor drives the platform with an effective open loop resolution of .002 degrees through a chain drive. A rotary encoder can be used both as a digital readout of the position and to close the positioning loop for a system accuracy of up to .0005 degrees. The machine base is composed of polymer concrete with mounting surfaces ground to +/-20µm and combined with high precision crossed linear recirculating bearing rails to give the total system straightness of trajectory of +/- 50µm over the 36 degree arc.

## Bilby-SANS Instrument

Bilby Detector Vessel will be delivered for the new Time-of-Flight Small-Angle Neutron Scattering (SANS) instrument for The Australian Nuclear Sciences and Technology Organization (ANSTO) in Australia. SANS is a powerful technique for looking at structures of objects on the nanoscale (1-10nm), like polymer molecules, defect structures in metals and ceramics.

### Key Specifications:

Vacuum:	7.5 x 10 <sup>-5</sup> TORR, Leak Rate = 1 x 10 <sup>-7</sup> mbar-l/sec
Vessel Diameter:	2300 mm
Internal Dia. Tolerance:	0 to + 10 mm
Vessel Length:	65.7 feet (20020 mm) with the ends closed
Vessel Straightness:	Front to Back, +/- 10 mm
Internal Carriage Capacity:	1000 kg
Quick release latches:	Top and Rear Hatch
Internal Movement:	~ 60 Feet (15,240 mm)
Internal Drive:	Rack and Pinion
Internal Velocity:	4 m/min
External Movement:	59 inches (1500 mm)
External Drive:	Ball screw



## Colorado Gimbal System for MOBI Vacuum

A high precision motion system is required to operate in the MOBI Vacuum Chamber at a High Vacuum level. The motion system consists of: 1 Custom High Precision Linear Slide used for vertical travel; 1 Custom High Precision Linear Slide used for horizontal travel; 1 High Precision Rotation stage that will provide a yaw motion; and 1 High Precision Tilt stage that will provide a pitch motion.

### Key Specifications:

Vacuum 1 x 10<sup>-8</sup> TORR; Vertical Slide 362 mm; Horizontal Slide 315 mm; Tilt ±18; Rotation Full 360°.

## Double Crystal Deflector Assembly for DLS - UK

This is a custom double crystal deflector 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 centre of rotation to be adjusted to the beam.



## Arecibo Observatory Upgrade

Advanced Design Consulting designed a large turntable, capable of positioning the receiver heads to within .5 mm (taking into consideration the weight budget and achieving the required velocity). ADC also designed the positioning systems for the tertiary sub-reflector and the eight new receiver heads. This project was part of a \$25 million upgrade to the Arecibo facility. A Gregorian reflector system now hangs from the main detector area 137 meters (450 feet) above the main reflector dish. The Gregorian dome contains two reflector dishes, a radar transmitter, and microwave receivers. The secondary and tertiary reflectors channel the signal from the main reflector into the receivers. The CH and Gregorian drive systems met their tracking specifications with no problems, and in fact the carriage house exceeded its specifications by a large factor. More information about the observatory and its facilities is available at <http://www.astro.cornell.edu/facilities/arecibo.shtml>.



ADC USA, Inc. is a hands-on engineering company with over 15 years of experience. We custom design devices, integrated systems and a broad array of high-precision components and instruments for commercial, academic and government agencies worldwide. Our work covers mechanical design, control instrumentation, control software, manufacturing and assembly, and installation and training.

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## Vacuum Compatible Positioning Systems



## Five Axis Vacuum Compatible Positioning System for NASA – USA

ADC developed a 5 axis positioning system device to facilitate research in the area of electron beam free form fabrication in microgravity. This process will be used to create replacement components for isolated equipment from raw material in wire form. Possible applications range from military equipment, to the ISS, to manned exploration of space. This system will provide a high precision manipulation system with both position and velocity control of the electron gun and substrate. Other requirements for this system include operation in vacuum as well as capacity for dealing with large heat loads from the welding process.



Ultra-Small-Angle Neutron Scattering (USANS) Monochromator Instrument for ANSTO - Australia



Spectrometer for Inelastic X-ray Measurements at SPring-8 - Japan



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



Colorado Gimbal System for MOBI Vacuum

EQUIPMENT with REALIABILITY and DEPENDABILITY

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# Custom High Precision Spectrometer, Diffractometer...

**ADC** designs and builds a broad array of custom high precision systems and instruments (Stages, Spectrometer, Diffractometer, Goniometer, and Optical Tables) for astronomy, synchrotron and neutron research applications for facilities around the world. We typically design and build systems to customer engineered motion systems that are designed and built for system level performance for client application.

- Sub-Micron precision
- Encoder option
- Ultra High Vacuum (UHV), High Vacuum (HV) and Rough Vacuum (RV) option
- Customized to Customer Specifications; travel, load bearing, etc.

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## Spectrometer for Inelastic X-ray Measurements at SPring-8

This spectrometer is operating at the SPring-8 synchrotron in Japan as part of a dedicated inelastic beamline (BL12XU). The system is used for investigating electronic excitations with milli-electron volt resolution; therefore many of the specifications require high precision, and accuracy on the micron level. The 3-meter analyzer arm on the spectrometer needs to have an angular stability measured in arc seconds over a long range of travel, under vacuum conditions. The spectrometer is designed for several types of inelastic X-ray measurements, such as performing non-resonant inelastic X-ray scattering, which directly measures the dynamical structure factor,  $S(q, \omega)$ , of the sample. The scientific focus is to study the single-particle and collective electronic excitations in many-body systems. The incident table allows for diagnostics, attenuation of the highly monochromatic beam, and reduction of parasitic scattering. In addition to the standard capability of orienting the sample, the spectrometer will be used with large magnets, furnaces, or a specially designed cryostat with a fine-positioning carrier, for measurement of samples in extreme environments.



## SMARTS Translator for LANL Neutron Facility

This system was designed and built for a new spectrometer called SMARTS (spectrometer for materials research at temperature and stress) at the LANSCE facility at Los Alamos National Laboratory. SMARTS is used for measurements of residual macrostrain in engineering components and in-situ loading. This translator is the central component of SMARTS. It is used to position plates or tube specimens 10's of centimeters in dimension with a mass of a few kg as well as ancillary equipment (load frame, furnaces, eulerian cradle with a mass of as much as 1000 kg) relative to a fixed neutron beam and two detectors in permanent locations on either side of the translation table.



## Three-Axis High Precision System with Fast Sample Exchange for ANKA - Germany

This high precision table consists of a large, black granite top, with working surface measuring 2000 mm by 800 mm. System requirements for table movements included; motorized vertical movement of 200 mm and 2 degrees of pitch movement with a resolution of 0.005 degrees.

## Fourteen-Axis High Precision System for Diamond Light Source

This complex high precision positioning system was designed for X-ray diffraction and Tomography Experiments and was delivered to Diamond Light Source (UK). The stages are designed to position with micron accuracy a variety of samples and sample test chambers, stability and high repeatability. Stage motions includes orthogonal motions in X, Y, & Z, tilt motions and rotation motions. In operation, the stages will be used to position and translate samples and test chambers for X-ray diffraction, X-ray scattering, X-ray imaging and tomography experiments.

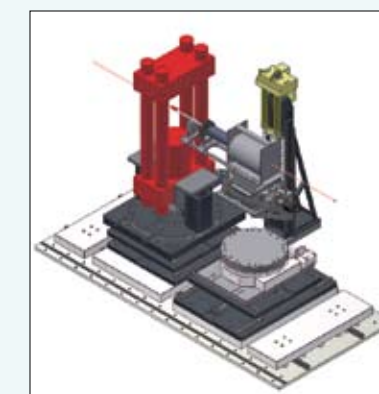


## Ultra-Small-Angle Neutron Scattering (USANS) Monochromator Instrument for ANSTO

Ultra-small-angle neutron scattering (USANS) is a method for studying structures in the 100nm to 10µm range by diffraction. USANS uses a neutron beam with an extremely sharp angular profile which can be obtained by diffraction from a perfect crystal ("Bonse-Hart" technique).

## Eight Axis Custom Design Motion for a Press and a Detector System

A system was designed for University of Chicago (Advanced Photon Source – US) that allows for the positioning of a large press that is aligned with the beam and a detector that is located downstream. Since the press and detector need to move independently, two sub-systems were designed. One sub-system controls the motion of the 600lb press. The second sub-system supports a detector assembly and provides motion in several directions. Both sub-systems share a set of guide rails which are mounted to a large base plate. This plate is designed to be grouted to the hutch floor, providing a permanent and stable base for the entire system. The sub-systems can be manually moved back and forth on the guide rails and secured using manual rail clamps.



There are four degrees of freedom for the press sub-system. Vertical motion is provided by two DJ400-100 Crossed Roller Jacks. Custom linear slides provide motion transverse to the beam and in the beam direction. A high-load-capacity manual rotation stage allows for rough positioning of the press and sample alignment. An attachment for motorized rotation provides fine adjustment of the manual stage.

## Brookhaven (NSLS II) meV Prototype System

The NSLS II Inelastic X-ray Scattering (IXS) project beamline research and development effort is to investigate and develop the optical scheme for an Ultra-high energy resolution monochromator/analyzer of the CDDW-CDDW type. Each monochromator and analyzer consists of one collimation and wavelength ("C/W") selection silicon crystal and two dispersion ("D") silicon crystals. The configuration also includes a collimating mirror to collect photons from the sample to be directed into the analyzer.



## Custom High Precision Motion System for BNL - USA

ADC designed and built a custom four degrees of freedom high precision system to manipulate a 7 ton press. The press was fabricated by Rockland Research Corporation.

## Nine Axis High Precision System for BNL - US

This optical table was designed to position both the sample and a MAR345 detector for use in an experiment at Brookhaven National Labs. 5 degrees of freedom of the detector were used to align the detector with the incoming beam. A 6th, high precision translation was used to position the detector along the beam path while maintaining a vertical position of +/- 20µm. The sample was positioned with a 4 DOF (degrees of freedom) stack up of stages including an X,Y,Z and a rotation. The entire structure is contained on a large welded steel tubing base with locking casters to create a unique, portable experiment station.



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