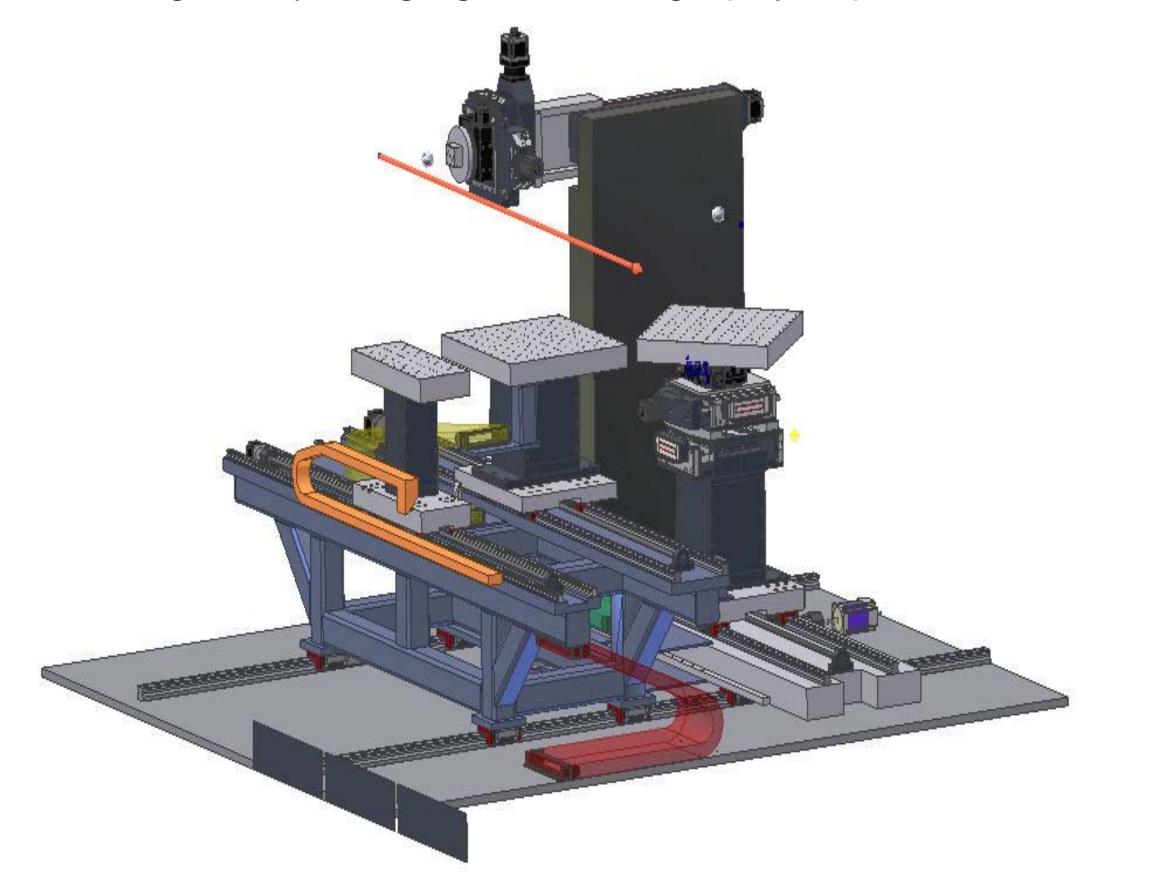
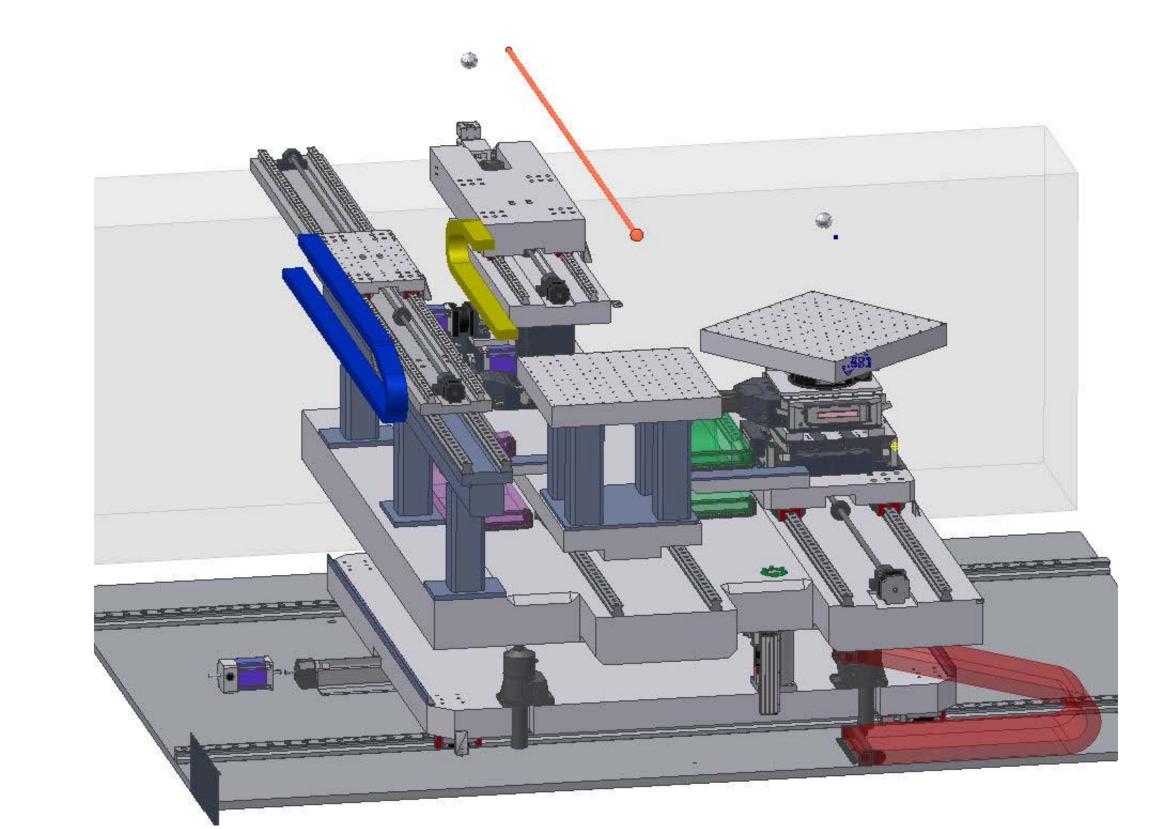
Development of Six Sample Positioning Stages for X-ray diffraction, X-ray Scattering, X-ray Imaging and Tomography Experiments

Joe Kulesza^a, Dave Waterman^a, Alex Deyhim^a, Eric Van Every^a ^a Advanced Design Consulting USA, 126 Ridge Road, P.O. Box 187, Lansing, NY 14882; adc@adc9001.com

The design of six high precision systems for detector and optical element positioning stage to be used in a Xray diffraction, X-ray Scattering, X-ray Imaging and Tomography Experiments for Diamond Light Source will be presented. The stages are designed to position with micron accuracy a variety of detector and optical elements. 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 detector and optical elements for X-ray diffraction, X-ray scattering, X-ray imaging and tomography experiments





The Large Detector Table 2, as shown in Figure 2, was designed to support three different detectors on individual units. The purpose is to change and align these detectors during one experiment without manual interaction. By this, different information can be obtained from one sample in a remotely controlled way.

Module 1 support an x-ray camera for imaging and tomography. Module 2 hold a large 2-dimentional detector or an energy-dispersive detector. Module 3 is a multipurpose unit for different kinds of detectors and will also allow performing off-axis measurements, where the detector is not directly behind the incoming x-ray beam. These three modules are linked with a common transverse translation for the switching of the detectors. The range of this transverse translation X is large enough to switch between the three Modules plus a margin on both sides of the travel. At the positive limit, the centre of Module 1 is 100 mm on one side the x-ray beam. At the negative limit of X, the centre of Module 3 is 200 mm on the other side the x-ray beam. The specifications of motions and interface plates are given in the following Tables 4-5.

These six high precision systems will be installed 3 in Experimental Hutch 1 (EH1) and 3 in EH2 of the I12 Joint Engineering, Environmental and Processing (JEEP) beamline at DLS. The beamline is designed for experiments on engineering materials and components, including the use of sample environments to simulate in-service conditions or materials processing. Mounted elements could include x-ray cameras, detectors, beam stops, slits, and detectors, as well as other specialist rigs designed by beamline users. The high precision systems will be mounted on a floor carriage so it can be translated perpendicular to the X-ray beam. Over the last fourteen years ADC has developed many high precision motion systems in collaboration with major synchrotron and neutron facilities around the world

	BLE 3: Large Detecto	or lable 1 - N				Overall X-translation	1
V	Range		150 mm,				
X,	Resolution		1 μm				Enough to switch betwee
Transverse	Maximum Spee	Repeatability5 µmMaximum Speed> 1 mm/s				Range	centres of Module 1, 2 and
		ne switch, en				ixange	3 plus a margin of 50 mm
		40 m	m. At 0-position, the int		Х,		Approximate 1300 mm
v		Rangeplate height above floor is 1675 mmResolution1 µm			transverse translatio		
Y, vertical						Resolution	<u>1 μm</u>
translation	······································	Repeatability 5 µm				Repeatability	2 μm
		Maximum Speed > 1 mm/s Home switch, encoder				Maximum Speed	> 2 mm/s
	Range		150mm			Home sv	vitch, encoder
F	Resolution		20 μm		V wanting 1 translatio	Range	50 mm
Z,	Repeatability				Y, vertical translatio	Resolution	1 μm
longitudinal	Maximum Spee				(alternatively individual for each	Repeatability	2 μm
translation	· · · · · · · · · · · · · · · · · · ·	orizontal and vertical			module)	Maximum Speed	> 2 mm/s
	straightness	100 um			Home switch, encoder		
	Hor	ne switch, en	coder				
	Range		180		T	ABLE 5. Large Detector Table	
Ry	Resolution		0.005			Range	1030 mm
		e switch, no e				Resolution	20 µm
Ļ	Range		5		Z,	Repeatability	200 µm
Rx	Rotation centre	2	50 mm below interface	plate	longitudinal	Maximum Speed	20 mm/s
	Resolution		0.005		translation	Horizontal and vertical	100 µm
D' 1 11 1	Home	e switch, no e	ncoder			straightness	
Pitch, roll and	< 20	0 µrad for all	l axes				ch, no encoder
yaw		•			Z, manual	Range	0 mm - 800 mm
Load Top interface		5 kg			extension		100 μm resolution
Top interface plate		60 mm			Pitch, roll and yaw	< 200 µra	d for all axes
dimension x		00 11111			Load	2	0 kg
Top interface					Top interface plate		
plate dimension z		60 mm			dimension x	22	0 mm
Upstream z- limit		≤ 300 mm			Top interface plate dimension z	52	0 mm
Downstream z- limit		0 mm			Upstream z-limit	0	mm
mint					Downstream z-		mm
	TABLE 2: Large				limit	0	
	Modu		Modu	ule 2			
		50 mm.		50			
		At 0-		50 mm			
		position, the overall		At 0- position,			
		table		the overal			
		height is		table heigh			
Y,	Range	1105 mm	Range	is 1105 m			
vertical translatio		1 µm	Resolution	10 µm	-		
			Repeatabilit		\neg		
	Repeatability	2 µm	у	50 µm			
	Maximum		Maximum				
	Speed	> 2 mm/s	Speed	> 2 mm/s	<u>.</u>		
	Home switch	n, encoder	Home switc	h, encoder			
Ζ,	Range	1000 mm	Range	1000 mr	n		
longitudinal translation	Resolution	20 um	Desolution	20 µm			
u ansiation	NESOIUUOII	20 µm	Resolution Repeatabilit	20 µm			
	Repeatability	200 µm	v	200 µm			
	Maximum	200 µm	Maximum	200 µm	_		
	Speed	> 20 mm/s	Speed	> 20 mm/	s		
	Horizontal		Horizontal				
	and vertical		and vertical				
	straightness	>100 µm	straightness	>100 µm			
	Home switch,		Home switch	, ,	r		
Pitch, roll and yay			< 200 µrad :		_		
Load	50 k	g	100	kg	_		
Top interface plat dimension x		nm	520	mm			
	2201	220 mm					

TABLE 3: Large Detector Table 1 - Module 4				TABLE 4. Large Detector Table 2 – Overall X-translation			
	Range		150 mm,				-
Х,	Resolution		1 µm				Enough to switch betweer
Transverse	Repeatability		5 µm				centres of Module 1, 2 and
translation	Maximum Spee	ed	> 1 mm/s			Range	
Γ	Hor	me switch, en	coder				3 plus a margin of 50 mm
	Range	40 mm. At 0-position, the interface			Х,		Approximate 1300 mm
Y,				5 mm	transverse translation		
ŕ	Resolution		1 μm			Resolution	<u>1 μm</u>
vertical	Repeatability		5 µm			Repeatability	2 μm
translation		Maximum Speed > 1 mm/s				Maximum Speed	> 2 mm/s
	Hoi	Home switch, encoder				1	vitch, encoder
	Range	Range 150mm					
Z,	Resolution		20 μm 200 μm		Y, vertical translation (alternatively	Range	50 mm
	Repeatability					Resolution	<u>1 μm</u>
	Maximum Spee	ed	> 20 mm/s		individual for each	Repeatability	2 μm
translation	Horizontal and ver					Maximum Speed	> 2 mm/s
translation	straightness	litear	100 µm		module)	-	vitch, encoder
		ma avvitabilitari	aadar	L		Home sw	
		me switch, en		—————		DIES Laws - Det (T11	2 Madula 1
-	Range		180			BLE 5. Large Detector Table	
Ry	Resolution		0.005			Range	1030 mm
		e switch, no e				Resolution	20 µm
L	Range		5		Z,	Repeatability	200 µm
	Rotation centre	e 2	50 mm below interface	plate	longitudinal	Maximum Speed	20 mm/s
Rx	Resolution		0.005		translation	Horizontal and vertical	100
F		e switch, no e	ncoder			straightness	100 µm
Pitch, roll and					F		ch, no encoder
	< 20	00 µrad for all	l axes		Z, manual	Range	0 mm - 800 mm
yaw						0	
Load Tag interface		5 kg			extension		00 µm resolution
Top interface					Pitch, roll and yaw	$< 200 \mu rad$ for all axes	
plate		60 mm			Load	2	0 kg
dimension x					Loud		
Top interface plate dimension		60 mm			Top interface plate dimension x	220 mm	
z Upstream z- limit		≤ 300 mm			Top interface plate dimension z	520 mm	
Downstream z-							
limit		0 mm			Upstream z-limit	0	mm
mmt						0	
					Downstream z-	0	mm
	TADIE 3. Long	a Datastar Tal	h 1a 1		limit		
	TABLE 2: Larg			1.0	-		
	Modu		Modu	ule 2	-		
		50 mm.					
		At 0-		50 mm.			
		position,		At 0-			
		the overall		position,			
		table		the overall			
		height is		table height			
Y,	Range	1105 mm	Range	is 1105 mm			
vertical translatio	ŭ	1105 mm	Resolution	10 μm	1		
vertiear translatio		<u>ιμπ</u>		τομπ	1		
	D (1.11)		Repeatabilit	50			
	Repeatability	2 µm	y y	50 µm	4		
	Maximum		Maximum				
	Speed	> 2 mm/s	Speed	> 2 mm/s			
	Home switc	h, encoder	Home switc	ch, encoder			
Z,	Range	1000 mm	Range	1000 mm			
longitudinal					1		
translation	Resolution	20 µm	Resolution Repeatabilit	20 µm			
	Repeatability	200 µm	V	200 µm			
	Maximum Speed	$> 200 \mu\text{m}$	Maximum Speed	$> 200 \mu\text{m}$			
	Horizontal	- 20 mm/ 5	Horizontal	- 20 mm/ 5	1		
	and vertical	. 100	and vertical	. 100			
	straightness	>100 µm	straightness	>100 µm	4		
	Home switch,		Home switch		4		
Pitch, roll and ya				for all axes			
Load	501		100	kg			
Top interface pla							
dimension x		220 mm 5'		mm			
		220 mm			4		

TABLE 1 : Large Detector Table 1 - Overall X-Translation					
X, transverse	Range	Enough to switch between centres of Module 1,2 and 3 plus a margin of 50 mm. Approximate 1300 mm.			
translation	Resolution	1 μm			
	Repeatability	2 μm			
	Maximum Speed	> 2 mm/s			
	Home switch, encoder				

Top interface plate			
dimension z	520 mm	520 mm	
Upstream z-limit	\leq 300 mm	≤ 300 mm	
Downstream z-limit	0 mm	0 mm	



Advanced Design Consulting USA, Inc. www.adc9001.com adc@adc9001.com **PO Box 187** 187 Ridge Road Lansing, NY 14882 USA

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