Plans for use of the Tandem-Offset Undulator at Sector 24

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Dept. Chemistry &
Biological Chemistry

NEC Functional Specification

1) Phased Construction of 3 operationally “independent” ID beamlines for macromolecular crystallography at a single APS sector using the APS tandem-canted undulator.

   a) 2 Tunable beamlines b) 1 Fixed energy side station.

   Tunable beamlines optimized for Se MAD data collection.

   Fixed energy side station optimized for monochromatic data collection near 12 KeV.

2) Tunable bending magnet beamline.

3) Broad experimental mandate: everything from extreme unit cells (e.g. ribosomes, complexes) to sub-angstrom resolution or MR.

4) Sector 8BM – prototype for Sector 24 endstations, control systems, etc.

Institutional Composition of NE-CAT:

Cornell	Cerione Crane Ealick Fu Lima Wu
Yale	Moore Reinisch Steitz
Harvard	Clardy Eck Ellenberger Frederick Gaudet Harrison Hogle Stehle Wang
Columbia	Gouaux Hendrickson Hunt ShapiroTong
Rockefellar	Darst MacKinnon Stebbens
Sloan-Kettering	Goldberg Nikolov Patel Pavletich
MIT/WhiteHead	Bartel Drennan Grant Imperiali Keating Malashevitch Matsudiara Rich Sauer Stubbe Yeffe

NIH-NCRR
HHMI

Total: >40 crystallography research groups

Operational: Sector 8 Bending Magnet

Pre-mono collimator mirror
Vertical offset, sagittally-focusing mono (5-15 KeV, 2 eV band pass)
Vertical focusing mirror

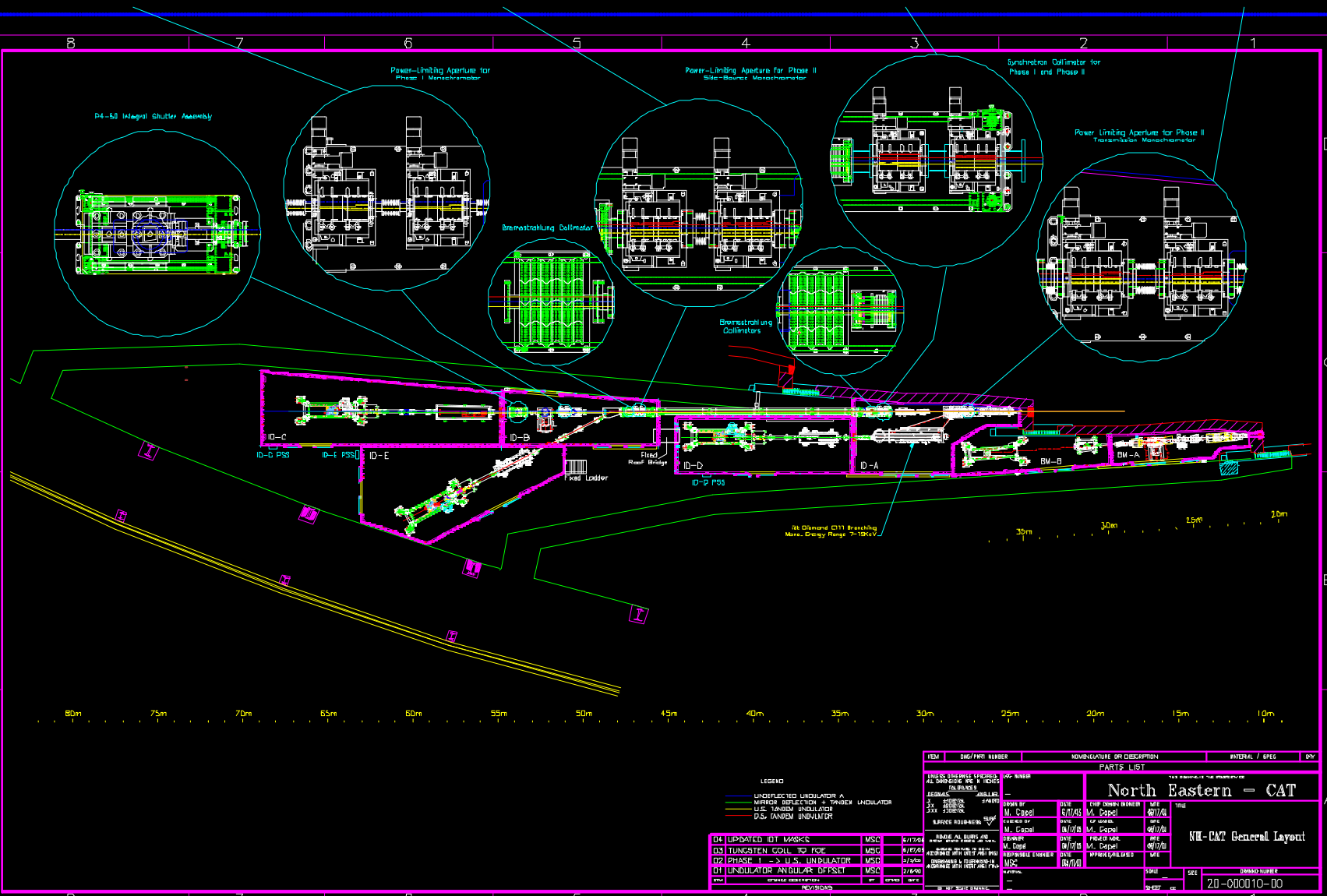
Planned: Sector 24 Canted, Dual Undulator, Bending Magnet

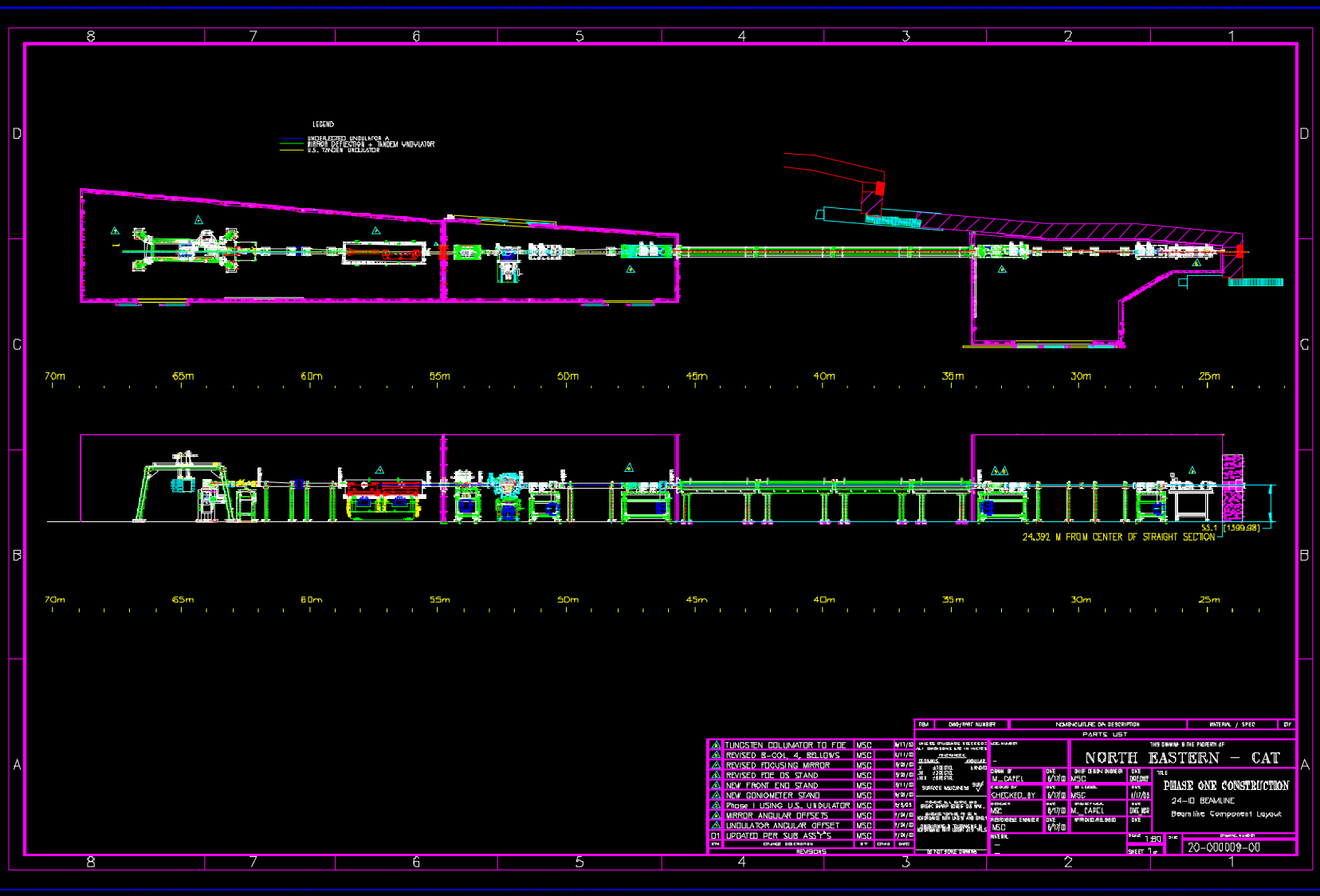
Phase I: Upstream Undulator
Vertical offset Si-III mono (5-25 KeV, 2eV bandpass)
Kirkpatrick – Baez focusing
Target flux: (phot/sec @ 12 KeV, 100x100 micron): 10^{12}

Phase II: Downstream Undulator
Single-bounce C-111 mono (fixed 13 KeV, 2eV band pass)
Kirkpatrick – Baez focusing
Target flux: (phot/sec @ 12 KeV, 100x100 micron): 10^{12}

Phase III: Bending Magnet
Sagittally-focusing mono (5-15 KeV, 2 eV bandpass)
Target flux: (@ 12 KeV, 100x100 micron): 10^{11}

Phase IV: Downstream Undulator
Horizontal offset C-III transmission mono (9-17KeV, 2eV band pass)
Kirkpatrick – Baez focusing
Target flux: (phot/sec @ 12 KeV, 100x100 micron): 10^{12}


Power-Limiting Aperture for Phase I Monochromator
Power-Limiting Aperture for Phase II Side-Bounce Monochromator
Synchrotron Collimator for Phase I and Phase II
Power Limiting Aperture for Phase II Transmission Monochromator
P4-50 Integral Shutter Assembly
Bremsstrahlung Collimator
Bremsstrahlung Collimators
ID-C
ID-B
ID-E
ID-D
ID-A
ID-B PSS
ID-E PSS
ID-D PSS
Fixed Roof Bridge
Fixed Ladder
BM-B
BM-A
60m
75m
70m
65m
60m
55m
50m
45m
40m
35m
30m
25m
20m
15m
10m
LEGEND
UNDEFLECTED UNDULATOR A
MIRROR DEFLECTION + TANDEM UNDULATOR
U.S. TANDEM UNDULATOR
D.S. TANDEM UNDULATOR
04 UPDATED IDT MASKS MSC 6/17/04
03 TUNGSTEN COIL TO FOE MSC 6/07/04
02 PHASE I -> U.S. UNDULATOR MSC 2/5/04
01 UNDULATOR ANGULAR OFFSET MSC 2/6/03
REVISIONS
ITEM DWG/PART NUMBER NOMENCLATURE OR DESCRIPTION MATERIAL / SPEC QTY
PARTS LIST
North Eastern – CAT
NE-CAT General Layout
DRAWN BY M. Capel 6/17/03
CHK'D BY M. Capel 6/17/03
ENGINEER M. Capel 6/17/03
PROJECT MGR. M. Capel 6/17/03
RESPONSIBLE ENGINEER MSC 6/17/03
SIZE B
SHEET 1 OF 1
DRAWING NUMBER 20-000010-00



ITEM	DWG/PART NUMBER	NOMENCLATURE OR DESCRIPTION	MATERIAL / SPEC	QTY
		PARTS LIST		

REVISIONS			
TUNGSTEN COLLIMATOR TO FOE	MSC	9/11/01
REVISED E-COIL & BELLOWS	MSC	9/11/01
REVISED FOCUSING MIRROR	MSC	9/28/01
REVISED FOE DS STAND	MSC	9/28/01
NEW FRONT END STAND	MSC	9/11/01
NEW GONIOMETER STAND	MSC	9/28/01
Phase I USING U.S. UNDULATOR	MSC	9/5/01
MIRROR ANGULAR OFFSETS	MSC	7/24/01
UNDULATOR ANGULAR OFFSET	MSC	7/24/01
01 UPDATED PER SUB ASSYS	MSC	7/24/01
STN CHANGE DESCRIPTION	BY	CHKD	DATE

UNLESS OTHERWISE SPECIFIED ALL DIMENSIONS ARE IN INCHES
DECIMALS: ANGULAR
X ±0.01 ±0.01
XX ±0.005 ±0.5
XXX ±0.002 ±0.25
SURFACE ROUGHNESS

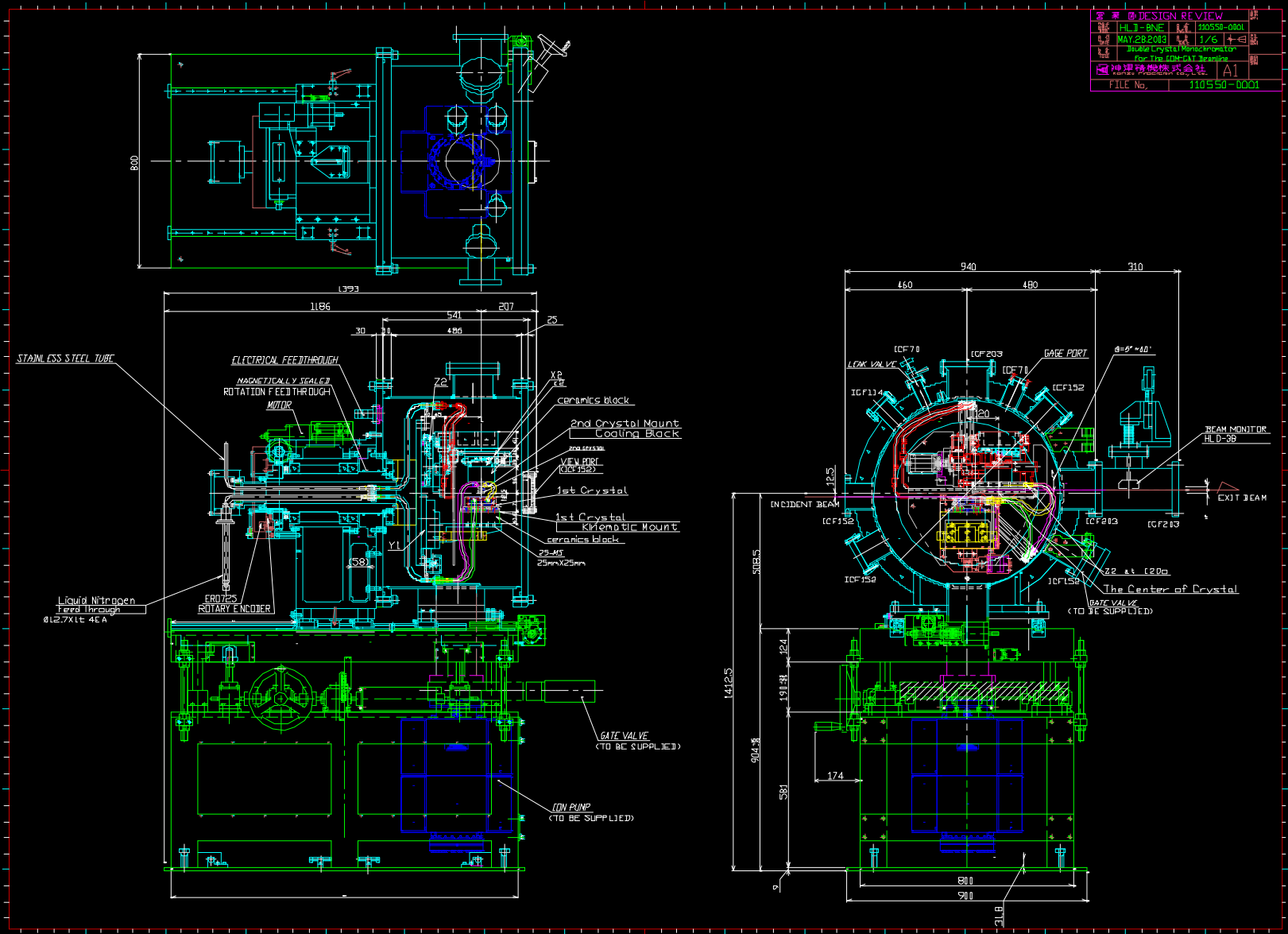
DO NOT SCALE DRAWING

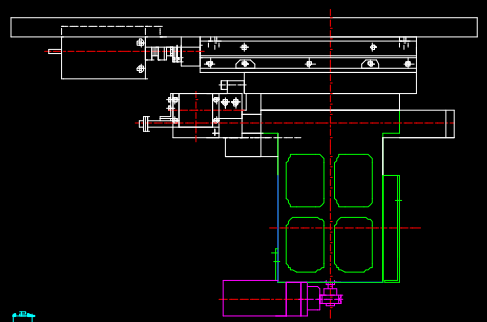
THIS DRAWING & THE PATENTS OF
NORTH EASTERN – CAT

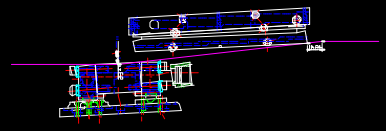
DRAWN BY M. CAREL	DATE 6/17/01	SHIP TEAM LEADER MSC	DATE ORIGINAL
DESIGNED BY CHECKED BY	DATE 6/17/01	QA LEADER MSC	DATE 6/17/01
DRAFTER M.C.	DATE 6/17/01	APPROVED BY M. CAREL	DATE DWG REV
PROJECT ENGINEER MSC	DATE 6/17/01	APPROVED/RELEASED	DATE

TITLE
PHASE ONE CONSTRUCTION
24-ID BEAMLINE
Beamline Component Layout

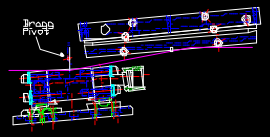
MATERIAL –
SCALE 1:20
SHEET 1 of 1
SIZE D
DRAWING NUMBER
20-C00009-00


DESIGN REVIEW
HLB-BNE
110550-0A01
MAY.28.2013
1/6
Double Crystal Monochromator For The FDM-CAT Beamline
神津精機株式会社
A1
FILE No. 110550-0001
800
1393
1186
541
207
30
480
25
STAINLESS STEEL TUBE
ELECTRICAL FEEDTHROUGH
MAGNETICALLY SEALED ROTATION FEEDTHROUGH
MOTOR
Z2
X2
Y2
ceramics block
2nd Crystal Maunt Cooling Block
VIEW PORT (CF152)
1st Crystal
1st Crystal Kinematic Mount
ceramics block
25-M3 25mmX25mm
Y1
58
Liquid Nitrogen Feed Through Ø12.7X1t 4EA
ERO725 ROTARY ENCODER
GATE VALVE (TO BE SUPPLIED)
ION PUMP (TO BE SUPPLIED)
940
310
460
480
CF70
CF203
LEAK VALVE
GAGE PORT
CF70
CF152
IGF114
120
θ=0°~40°
BEAM MONITOR HLD-3B
EXIT BEAM
125
INCIDENT BEAM
CF152
CF203
CF203
CF152
CF152
Z2 at 1200
The Center of Crystal
GATE VALVE (TO BE SUPPLIED)
1412.5
508.5
124
191.38
904.38
581
174
800
900
218

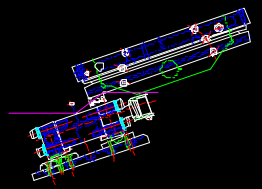




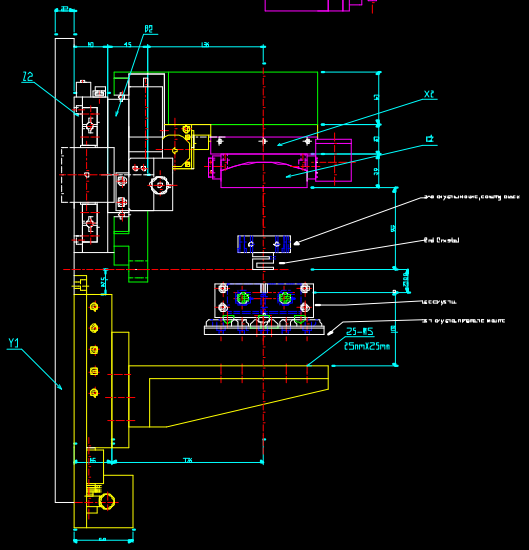
2-Theta=3 deg
X2 120 mm
-29 KeV

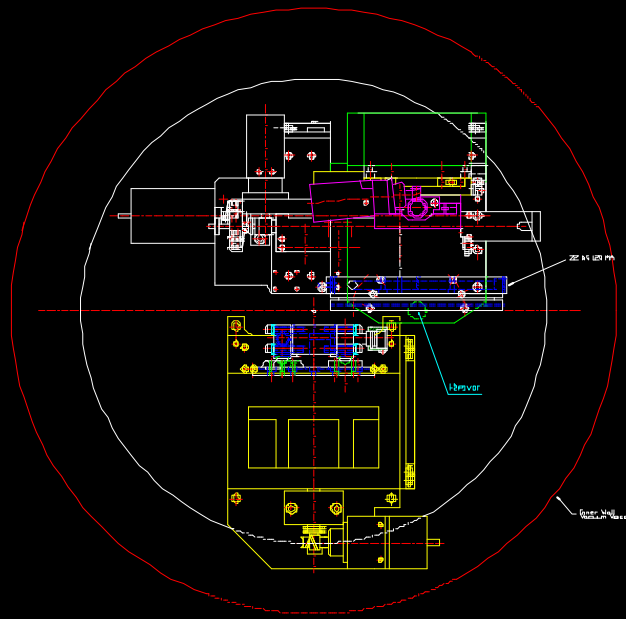


2-Theta=5 deg
X2 120 mm
22.3 KeV
y1 = 12.55 mm

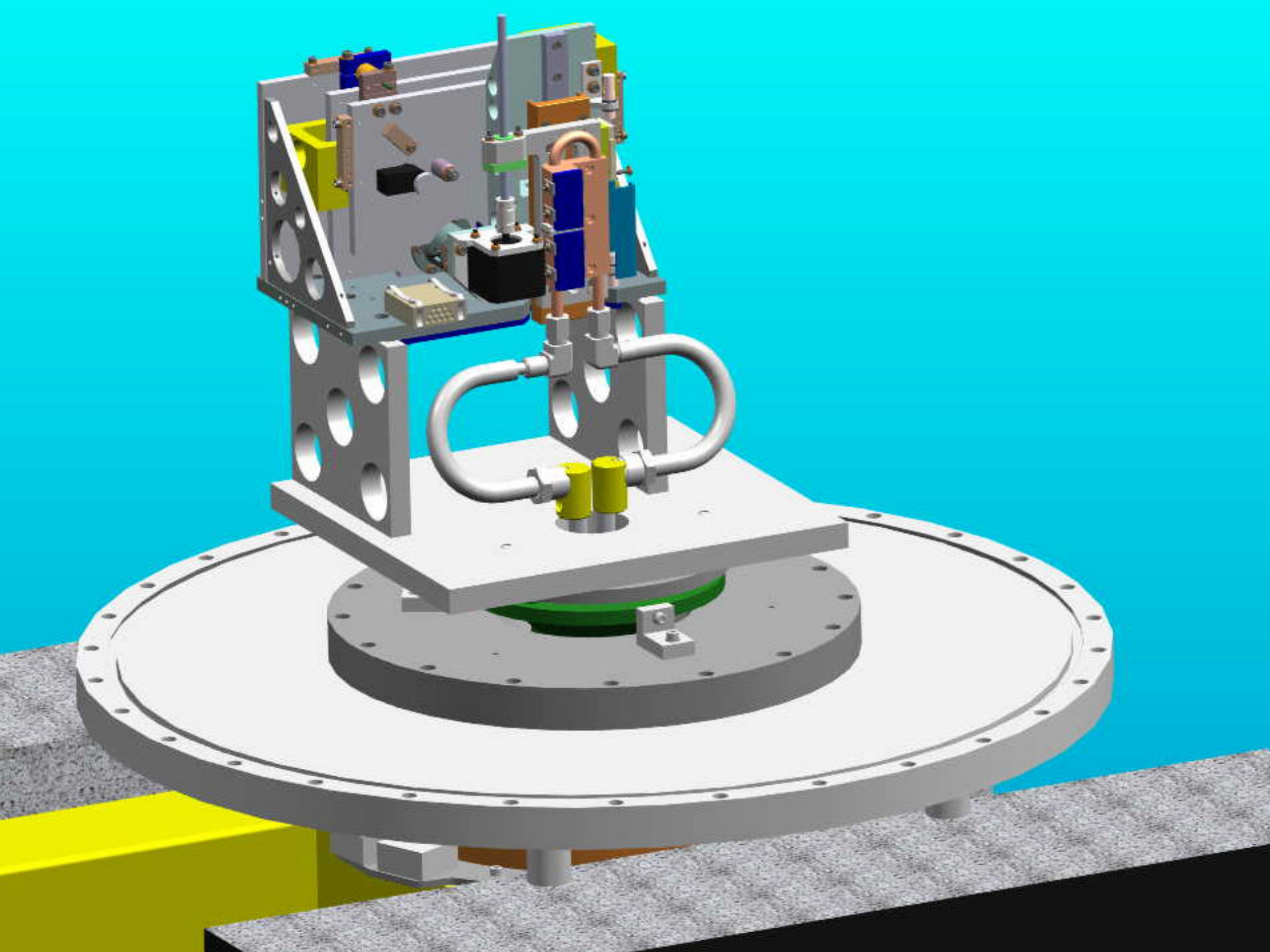


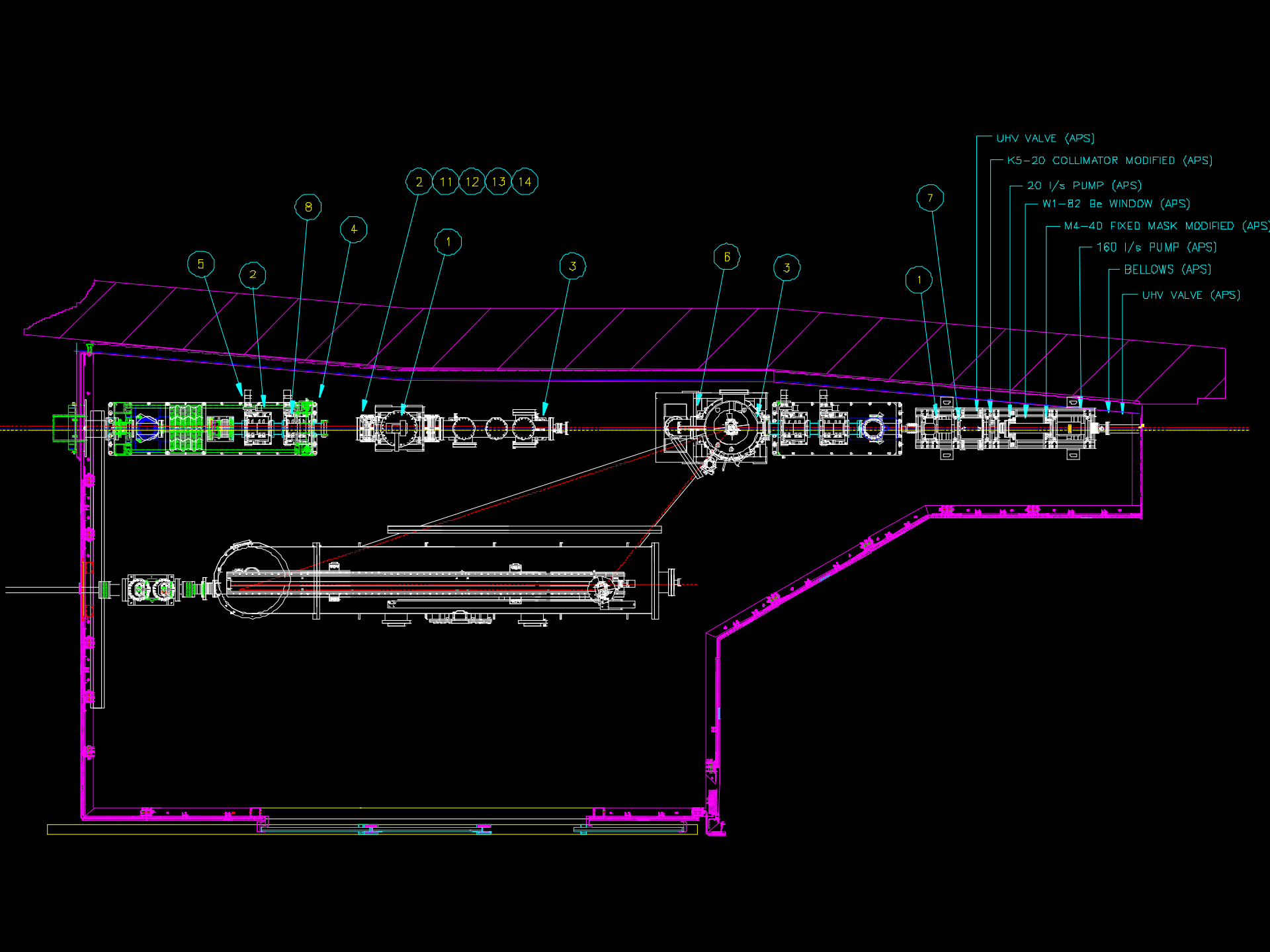
2-Theta=19 deg
X2 120 mm
6 KeV
y1 = 12.22 mm

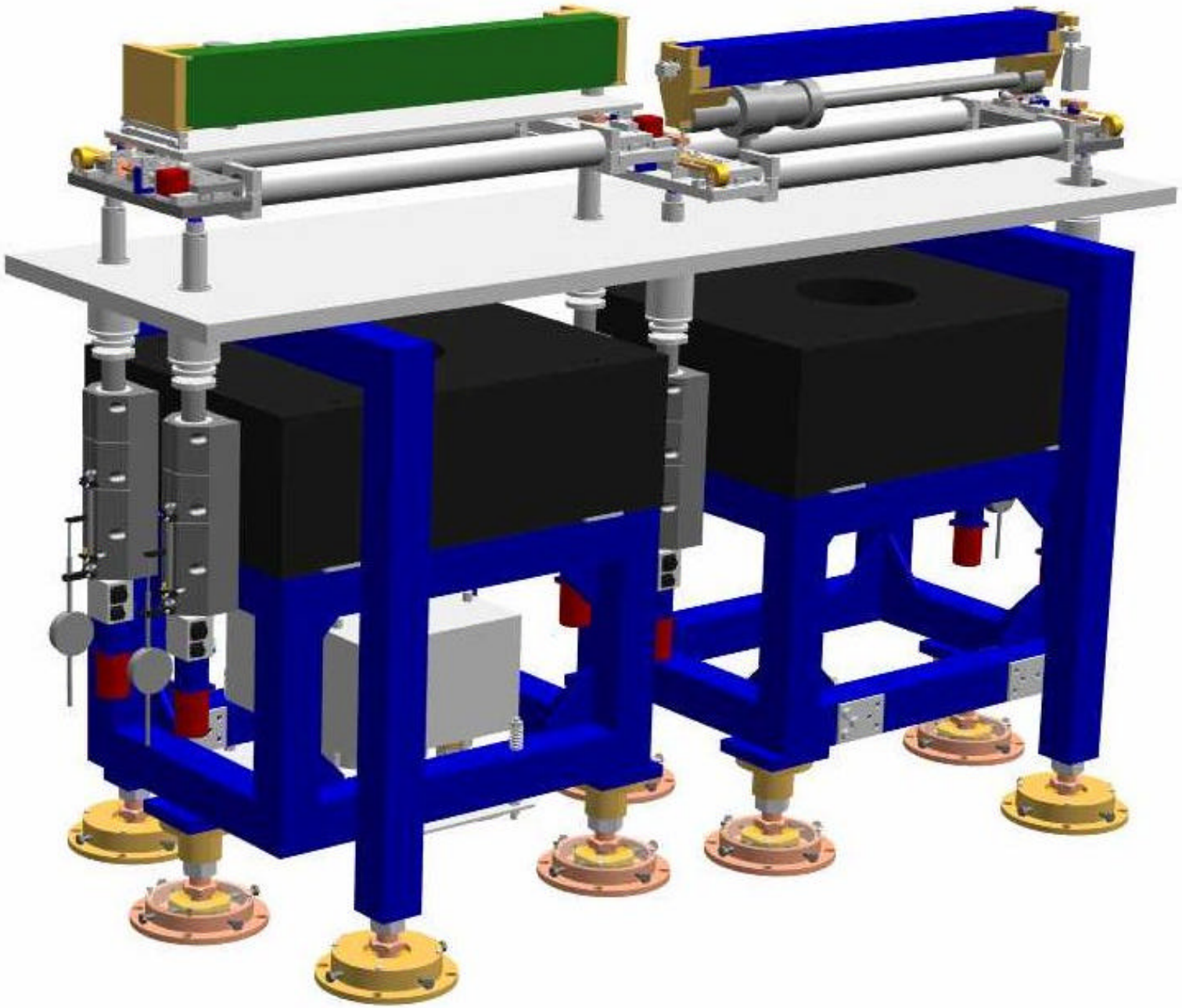




DESIGN REVIEW				CHKD
MODEL	HLO-4	DWG NO	80-03	JTOU
DATE	2000.04.24	SCALE	1/2	ENGR
TITLE	Crystal adjustment mechanism			TOU
				APPRVD
KOHZU Precision,Ltd				MIZUNO

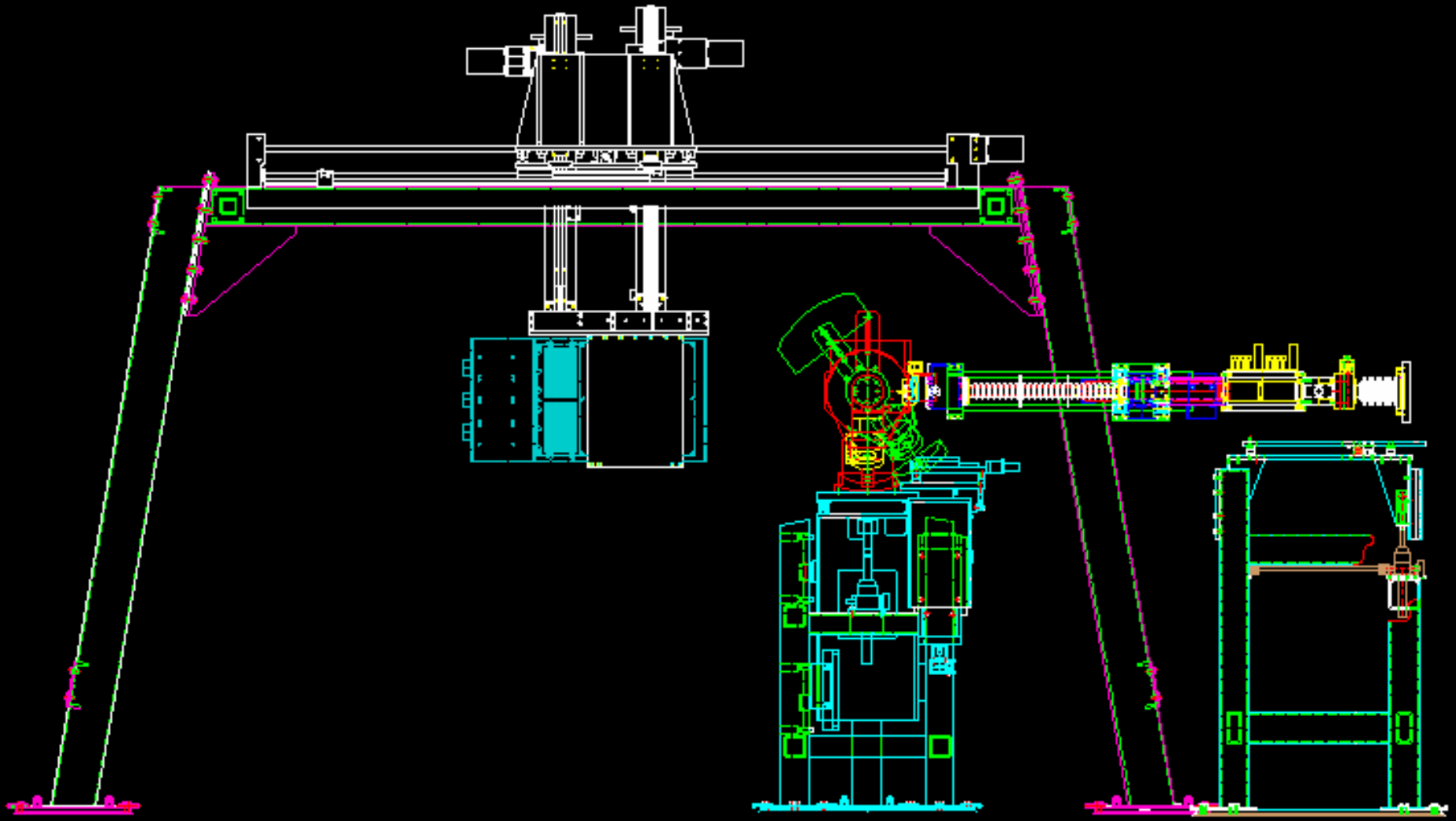


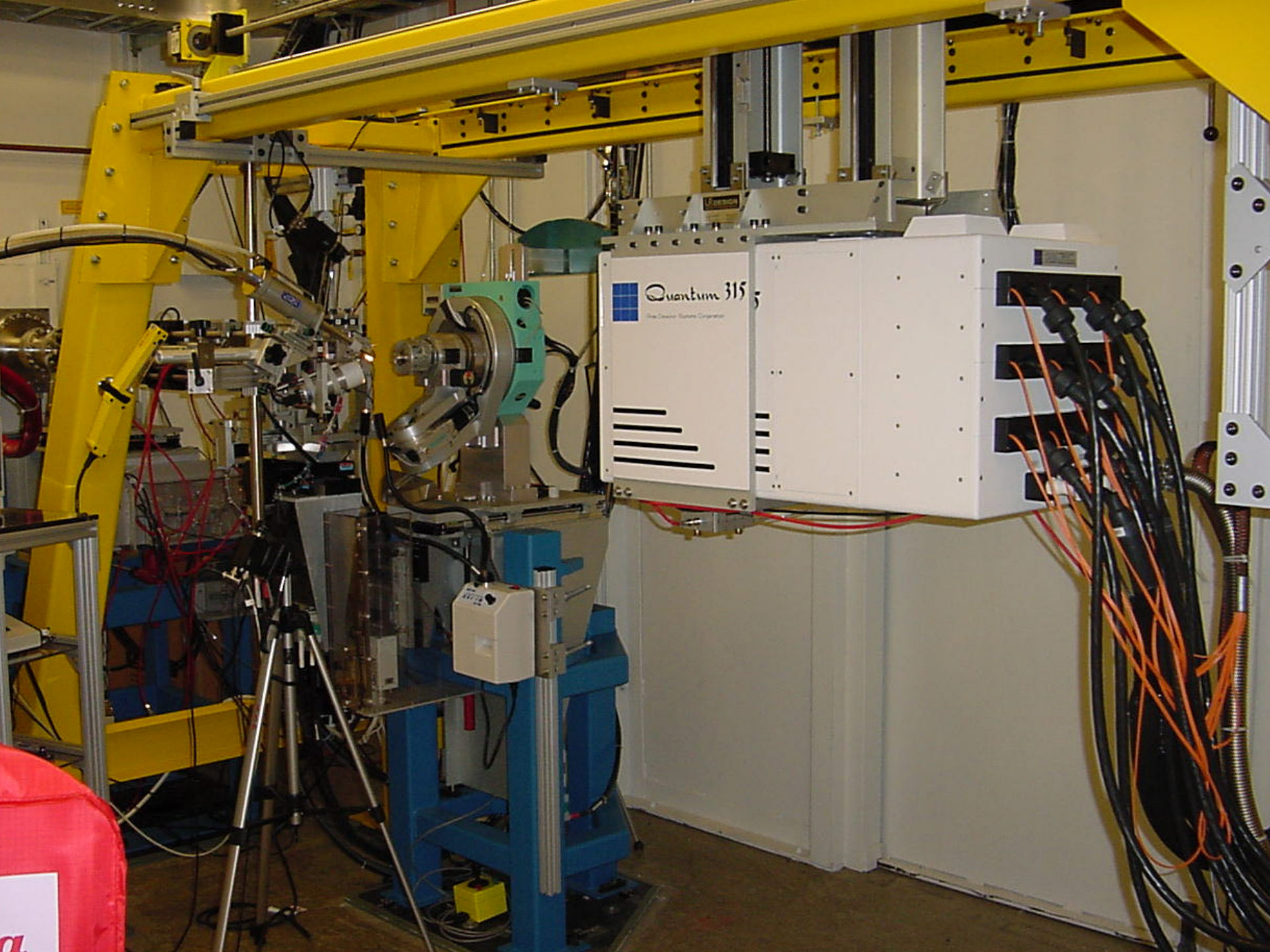

UHV VALVE (APS)
K5-20 COLLIMATOR MODIFIED (APS)
20 l/s PUMP (APS)
W1-82 Be WINDOW (APS)
M4-40 FIXED MASK MODIFIED (APS)
160 l/s PUMP (APS)
BELLOWS (APS)
UHV VALVE (APS)
2
11
12
13
14
8
4
1
3
6
3
7
1
5
2



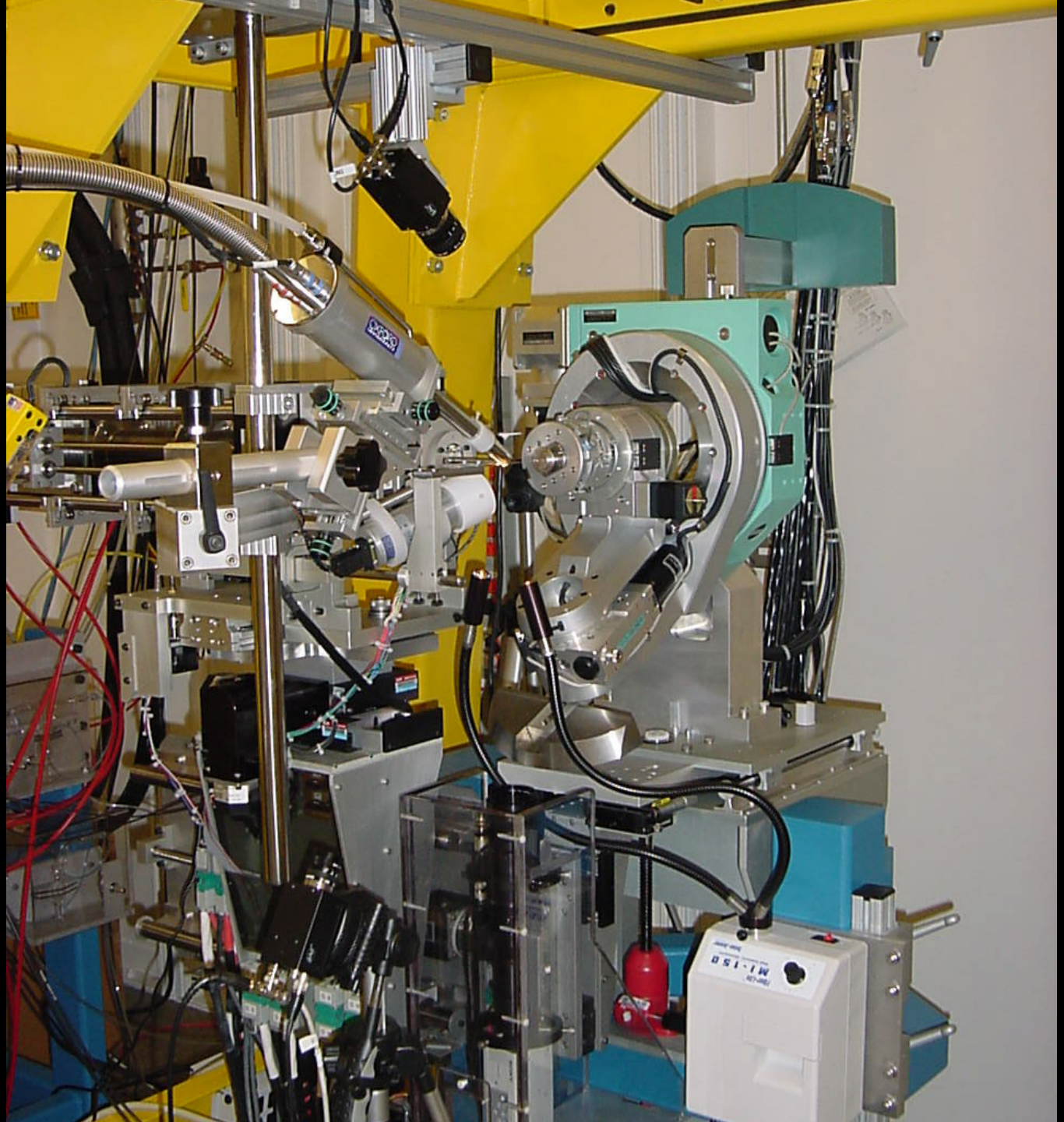
Focus Spot Size

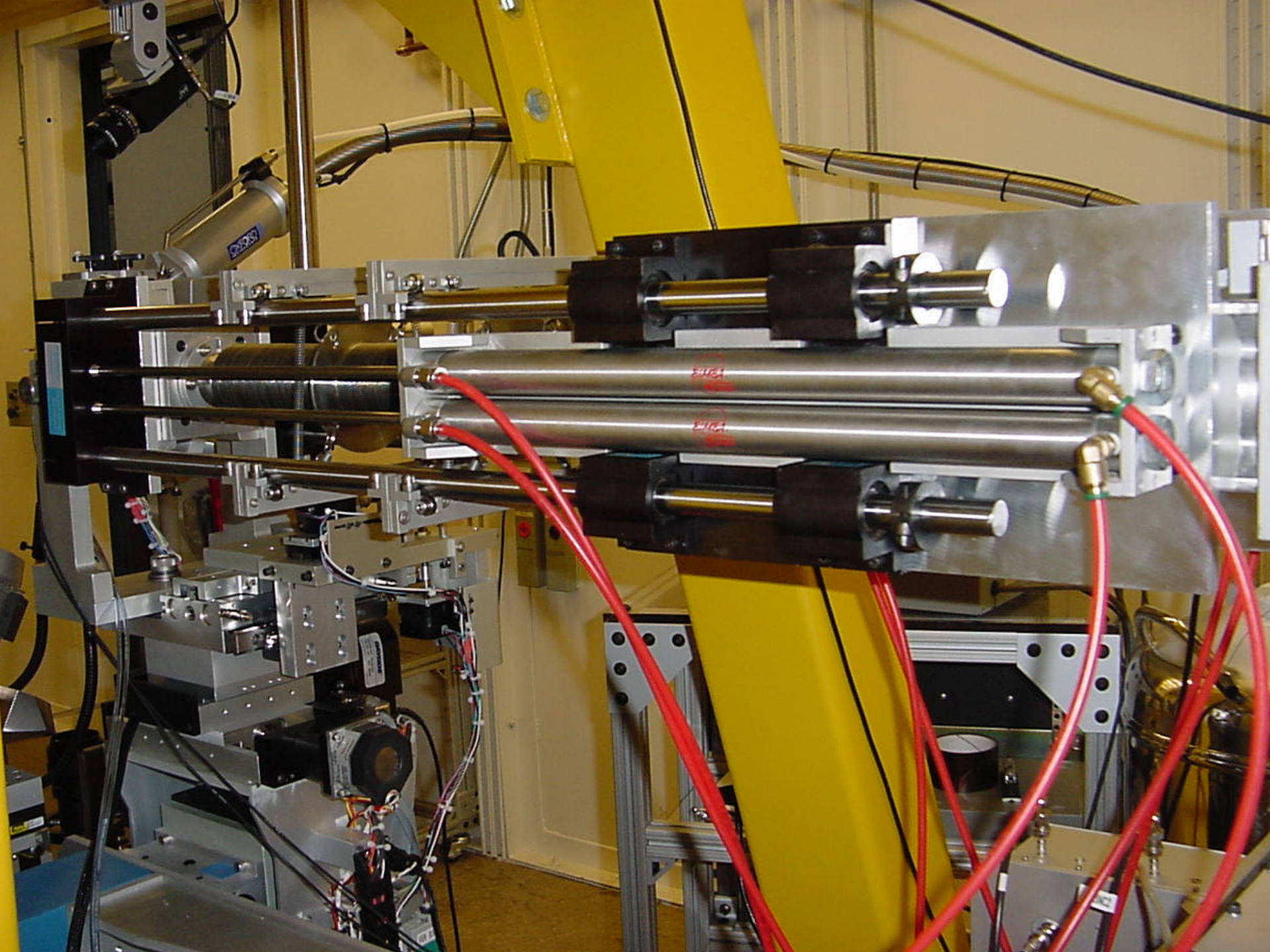
Mirror	Demagnification	Spherical Horizontal FWHH (cm)	Spherical Vertical FWHH (cm)	Elliptical Horizontal FWHH (cm)	Elliptical Vertical FWHH (cm)
Phase I	8.45	0.0685	0.0074	0.0011	0.0057
Phase IV	7.23	0.0441	0.0068	0.0008	0.0059
Phase II	11.86	0.0360	0.0004	0.0050	0.0009

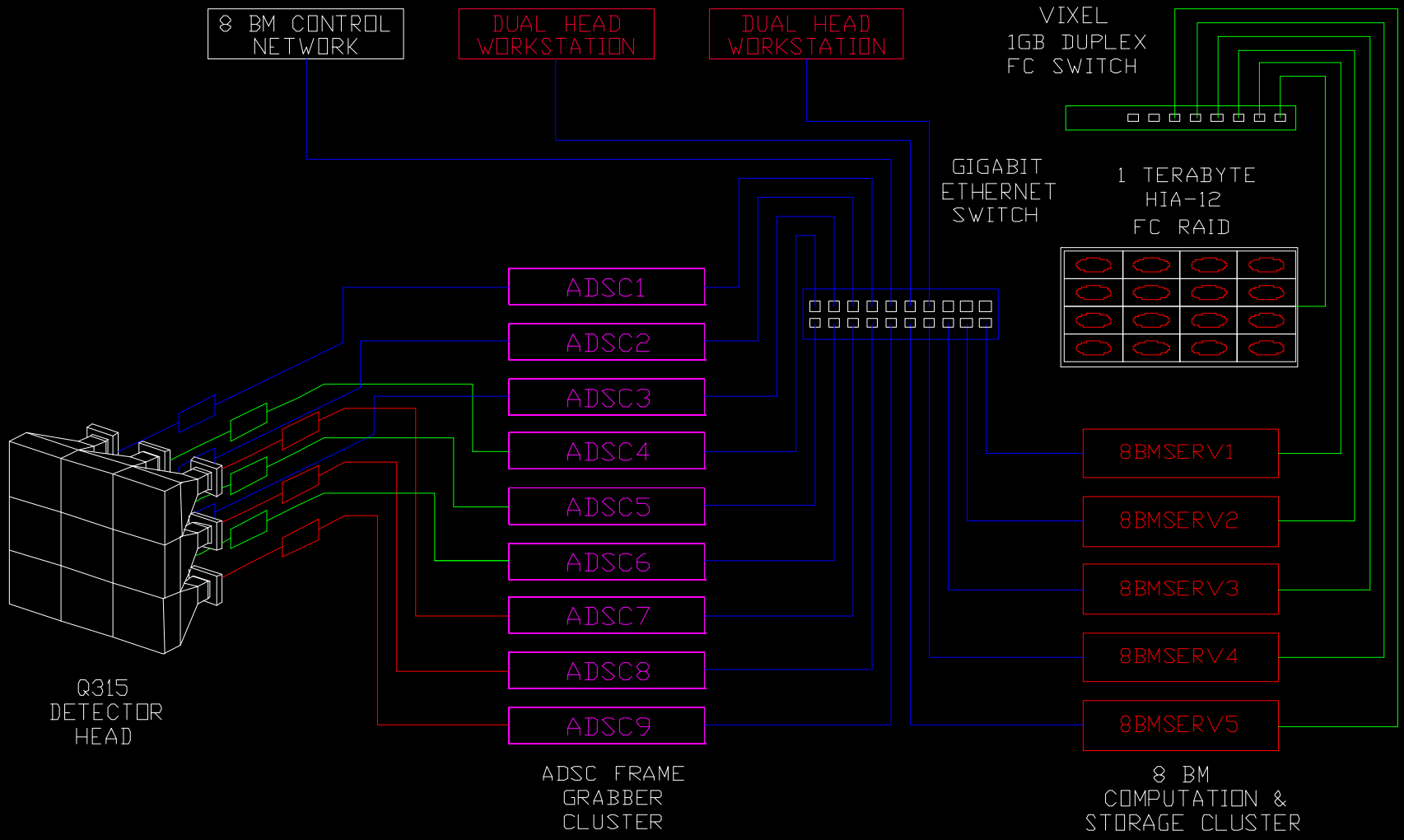


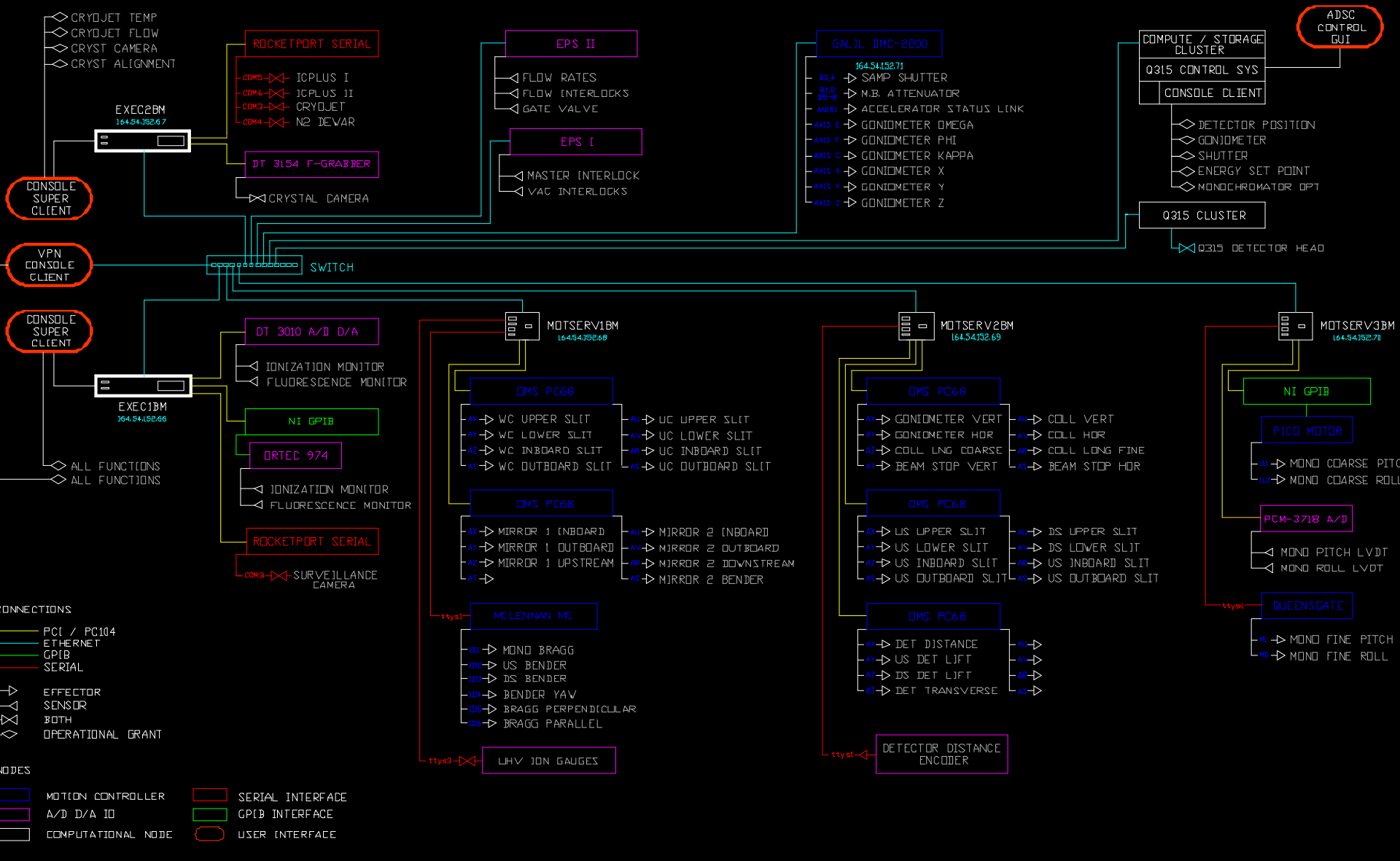

Quantum 315


Quantum 315






8 BM CONTROL NETWORK
DUAL HEAD WORKSTATION
DUAL HEAD WORKSTATION
VIXEL 1GB DUPLEX FC SWITCH
GIGABIT ETHERNET SWITCH
1 TERABYTE HIA-12 FC RAID
ADSC1
ADSC2
ADSC3
ADSC4
ADSC5
ADSC6
ADSC7
ADSC8
ADSC9
8BMSERV1
8BMSERV2
8BMSERV3
8BMSERV4
8BMSERV5
Q315 DETECTOR HEAD
ADSC FRAME GRABBER CLUSTER
8 BM COMPUTATION & STORAGE CLUSTER


CRYOJET TEMP
CRYOJET FLOW
CRYST CAMERA
CRYST ALIGNMENT
EXEC2BM
164.54.152.67
CONSOLE SUPER CLIENT
ROCKETPORT SERIAL
COM5 ICPLUS I
COM6 ICPLUS II
COM3 CRYOJET
COM4 N2 DEWAR
DT 3154 F-GRABBER
CRYSTAL CAMERA
EPS II
FLOW RATES
FLOW INTERLOCKS
GATE VALVE
EPS I
MASTER INTERLOCK
VAC INTERLOCKS
GALIL DMC-2200
164.54.152.71
SAMP SHUTTER
M.B. ATTENUATOR
ACCELERATOR STATUS LINK
GONIOMETER OMEGA
GONIOMETER PHI
GONIOMETER KAPPA
GONIOMETER X
GONIOMETER Y
GONIOMETER Z
COMPUTE / STORAGE CLUSTER
Q315 CONTROL SYS
CONSOLE CLIENT
ADSC CONTROL GUI
DETECTOR POSITION
GONIOMETER
SHUTTER
ENERGY SET POINT
MONOCHROMATOR OPT
Q315 CLUSTER
Q315 DETECTOR HEAD
VPN CONSOLE CLIENT
SWITCH
CONSOLE SUPER CLIENT
DT 3010 A/D D/A
IONIZATION MONITOR
FLUORESCENCE MONITOR
EXEC1BM
164.54.152.66
NI GPIB
ORTEC 974
IONIZATION MONITOR
FLUORESCENCE MONITOR
ROCKETPORT SERIAL
COM3 SURVEILLANCE CAMERA
ALL FUNCTIONS
ALL FUNCTIONS
MOTSERV1BM
164.54.152.68
OMS PC68
WC UPPER SLIT
WC LOWER SLIT
WC INBOARD SLIT
WC OUTBOARD SLIT
UC UPPER SLIT
UC LOWER SLIT
UC INBOARD SLIT
UC OUTBOARD SLIT
OMS PC68
MIRROR 1 INBOARD
MIRROR 1 OUTBOARD
MIRROR 1 UPSTREAM
MIRROR 2 INBOARD
MIRROR 2 OUTBOARD
MIRROR 2 DOWNSTREAM
MIRROR 2 BENDER
ttyS1
MCLENNAN MC
MONO BRAGG
US BENDER
DS BENDER
BENDER YAW
BRAGG PERPENDICULAR
BRAGG PARALLEL
ttyS3
UHV ION GAUGES
MOTSERV2BM
164.54.152.69
OMS PC68
GONIOMETER VERT
GONIOMETER HOR
COLL LNG COARSE
BEAM STOP VERT
COLL VERT
COLL HOR
COLL LONG FINE
BEAM STOP HOR
OMS PC68
US UPPER SLIT
US LOWER SLIT
US INBOARD SLIT
US OUTBOARD SLIT
DS UPPER SLIT
DS LOWER SLIT
DS INBOARD SLIT
DS OUTBOARD SLIT
OMS PC68
DET DISTANCE
US DET LIFT
DS DET LIFT
DET TRANSVERSE
ttyS1
DETECTOR DISTANCE ENCODER
MOTSERV3BM
164.54.152.70
NI GPIB
PICO MOTOR
MONO COARSE PITC
MONO COARSE ROLL
PCM-3718 A/D
MONO PITCH LVDT
MONO ROLL LVDT
ttyS1
QUEENSGATE
MONO FINE PITCH
MONO FINE ROLL
ONNECTIONS
PCI / PC104
ETHERNET
GPIB
SERIAL
EFFECTOR
SENSOR
BOTH
OPERATIONAL GRANT
ODES
MOTION CONTROLLER
A/D D/A IO
COMPUTATIONAL NODE
SERIAL INTERFACE
GPIB INTERFACE
USER INTERFACE

TEXT EDITOR

CSL SOURCE

GUI EDITOR

CSL COMPILER

CSL EXECUTABLE

GUI

CONSOLE EXECUTION UNIT (WIN32)

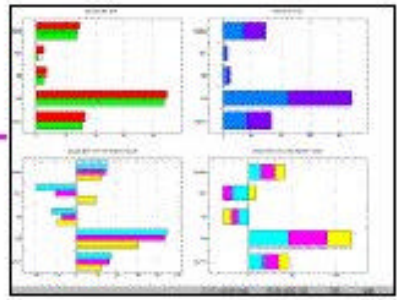
USB | SERIAL COM | GPIB | MAPPED I/O

LOCAL DEVICES

RPC CLIENT SERVICES

CONSOLE | MCL | DNS | GALIL | ADSC | COMEDI | SERIAL | GPIB | HEI PCL | DTRAN

TCP / UDP TRANSPORT



PLOTTING (PGPLOT)

CONSOLE RPC SERVER	MCLENNAN RPC SERVER	DNS RPC SERVER	GALIL RPC SERVER	ADSC RPC SERVER
WIN32	LINUX	LINUX WIN32	LINUX	LINUX

SERVER-DRIVERS

REMOTE DEVICES

COMEDI RPC SERVER	SERIAL RPC SERVER	GPIB RPC SERVER	HEI PLC RPC SERVER	DATA TRANS RPC SERVER
LINUX	LINUX WIN32	LINUX WIN32	LINUX	WIN32

SERVER-DRIVERS

REMOTE DEVICES

Administrative Status

1) NECAT-APS MOU and Management Plan accepted by APS.

2) Sector 24 formally assigned to NECAT
   Offices furnished and occupied
   Front end and undulators to be installed during Fall ’03 shutdown.

3) Hutch/Utilities designs finalized and contracts let.

4) RFP’s for long lead Phase I beam line items (optics) are le

5) 8BM user program operational.

STAFFING

CAT Director: Steve Ealick (Dept Chemistry & Chemical Biology, Cornell U)

Assoc. Director for Technical Program: Malcolm Capel

Project Manager	John Unik
Systems Admin:	Kazimirez Gofron
Technicians:	Ed Lynch
	TBA

Assoc. Director for Scientific Program: Craig Ogata

Staff Scientists:	Igor Kurinov
	N. Sukumar
	Jun Wang