



KOHZU

**SYNCHROTRON
RADIATION
INSTRUMENTS**

PRODUCTS GUIDE



GREETING

Since founded in 1945, KOHZU SEIKI CO., LTD. has been making endless efforts to design and manufacture high-precision scientific instruments to meet demanding requirements from the customers in various fields of science and technology.

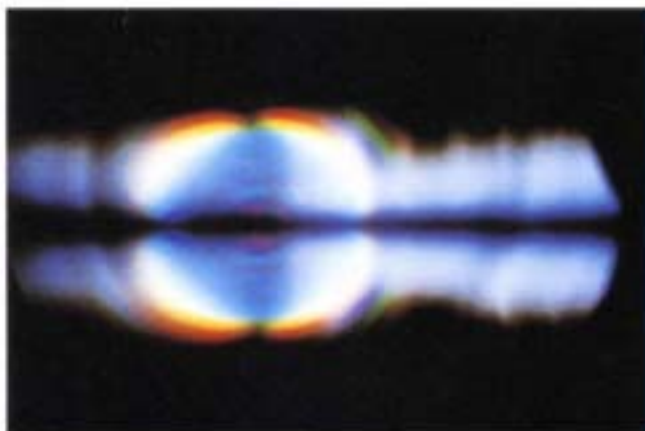
In recent years KOHZU SEIKI CO., LTD. has produced a number of monochromators, diffractometers and spectrometers for VUV and X-rays to be used at modern synchrotron radiation sources around the world. Our products also include various types of insertion devices like multipole wigglers and undulators.

KOHZU SEIKI CO., LTD. presents here in this brochure information on some of its products in current use at synchrotron radiation facilities in Japan, The United States, Europe and Asia.

We, KOHZU, hope that our accumulated experiences and technologies support you in your scientific challenges.

神津 和雄

KAZUO KOHZU, Chief executive
KOHZU SEIKI CO., LTD.



A rainbow pattern produced by PMU-1, a proto-type 3D-pole undulator manufactured by KOHZU SEIKI and TDR.
Photograph taken by a joint team TF/ISSP, in IML.

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Overview

KOHZU SEIKI CO. LTD has long experiences in designing and manufacturing various types of synchrotron radiation instruments. Our activity in this field was initiated some 20 years ago when second-generation sources were commissioned. Since then monochromators have been one of our principal products.

As seen in the attached list, KOHZU SEIKI CO. LTD has so far delivered some 35 monochromators to synchrotron institutions located in Japan and overseas countries. They include monochromators for VUV and X-rays. All these have produced excellent results showing the expected performances and a high stability, requiring little post-installation modification. Model ARM-1 monochromator, one of our oldest design, is still operational on the INS-SOR BL-2 beamline 20 years after the installation.

This brochure introduces to you KOHZU's latest double-crystal X-ray monochromators. Descriptions are limited to those products delivered to APS (Advanced Photon Source, Argonne National Laboratory), ESRF (European Synchrotron Radiation Facility), Photon Factory (KEK, Japan) and SPring 8 (Super Photon Ring 8 GeV, Japan), and monochromators to be shortly delivered to SRRC (Synchrotron Radiation Research Center, Taiwan). Information on other designs is available on request.

Linked or separate crystal control

Fundamental design requirements for double-crystal X-ray monochromators are the energy tunability and the fixed direction and position of the exit beam independent of the selected X-ray energy. KOHZU SEIKI CO. LTD provides two types of crystal-motion control mechanisms to meet these requirements.

1. Cam-control system

The rotation and linear motions of either the first or second crystal are constrained by a cam mechanism. When the first crystal needs to be cooled because of heat-load problems, the second crystal is mounted on a cam stage. A standard beam offset distance is 25 mm, but other designs are possible. The exit beam, which is emitted parallel to the primary beam irrespective of the photon energy, can be offset both downward and upward depending on customer's request.

2. Independent control system

Two crystals are mounted on separate motion stages which can be independently controlled by computer software. Semi-independent models are also available, where the two crystals are mounted on a common rotary table. Models RKN-1 and KIZ-1 use completely independent control mechanisms, while model HLD-1 uses a semi-independent mechanism.

Salient features of KOHZU monochromators

1. High-precision drive and encoding

The principal crystal rotation axes are driven via high-precision worm gears and the actual rotation angles are read with a HEIDENHAIN high-resolution rotary encoder directly coupled to the rotating shaft.

2. Ultrahigh vacuum and high-radiation compatibility

The in-vacuum crystal-control mechanisms is lubrication free. All components including crystal holders and tubings use materials which hardly denature in strong radiation environment. The system are bakable at temperatures up to 200°C for operation in ultrahigh vacuum.

3. Easy operation and maintenance

All mechanisms inside the vacuum housing are mounted on the inner surface of a vacuum flange supported on a rail. A simple pull out allows you to exchange crystals and perform maintenance operations in open space.

4. Easy installation and alignment

The whole monochromator system is mounted on a four-way translation stage which allows easy installation and alignment of the optical axis.

5. Compatibility with crystal coolers

The hollow design of the main rotary shafts allows the mounting of various types of crystal cooling units using water, heat pipes, liquid nitrogen and liquid gallium.

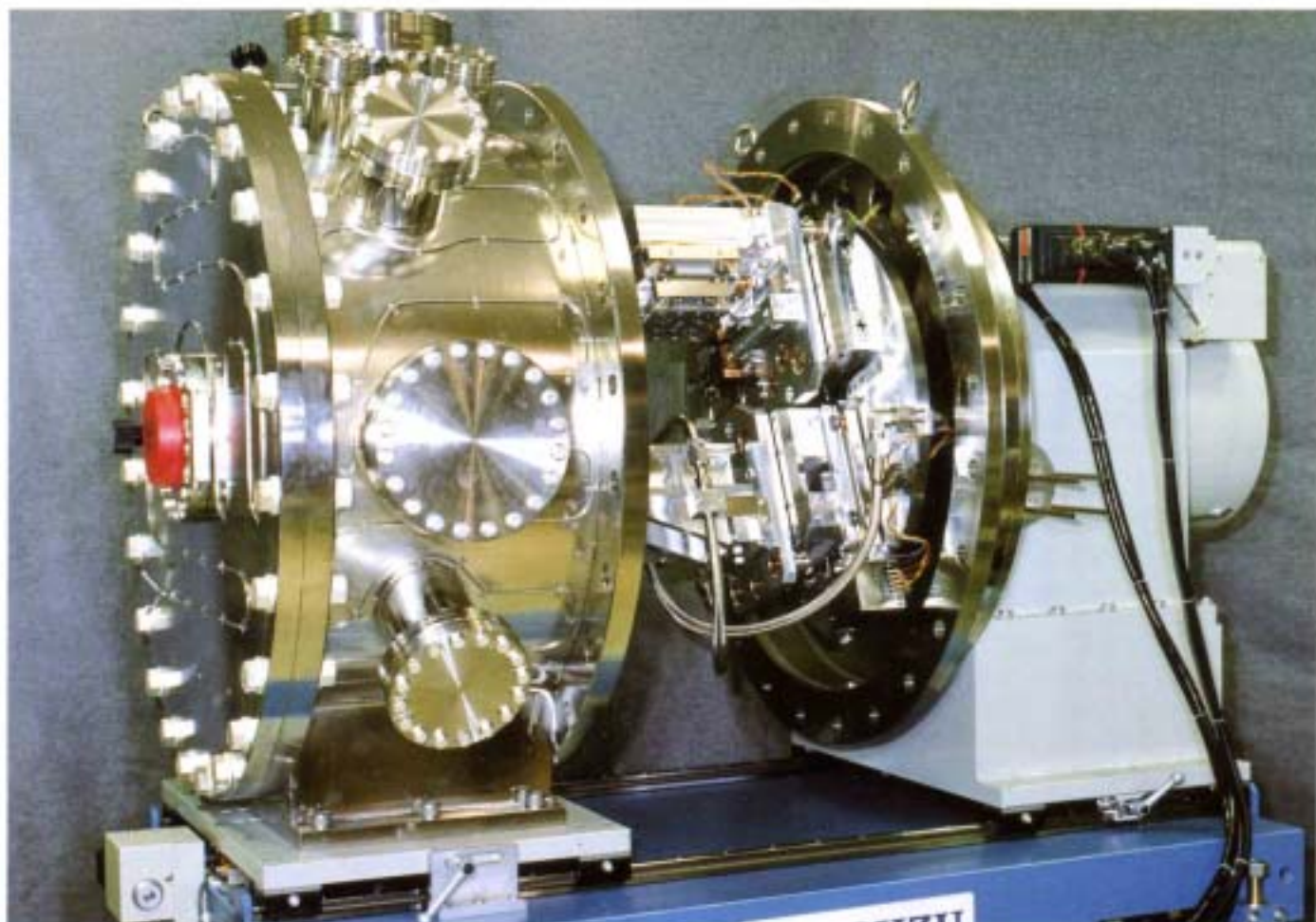
HIGH HEAT LOAD DOUBLE CRYSTAL MONOCHROMATOR

Delivered to A.P.S.

HLD-1

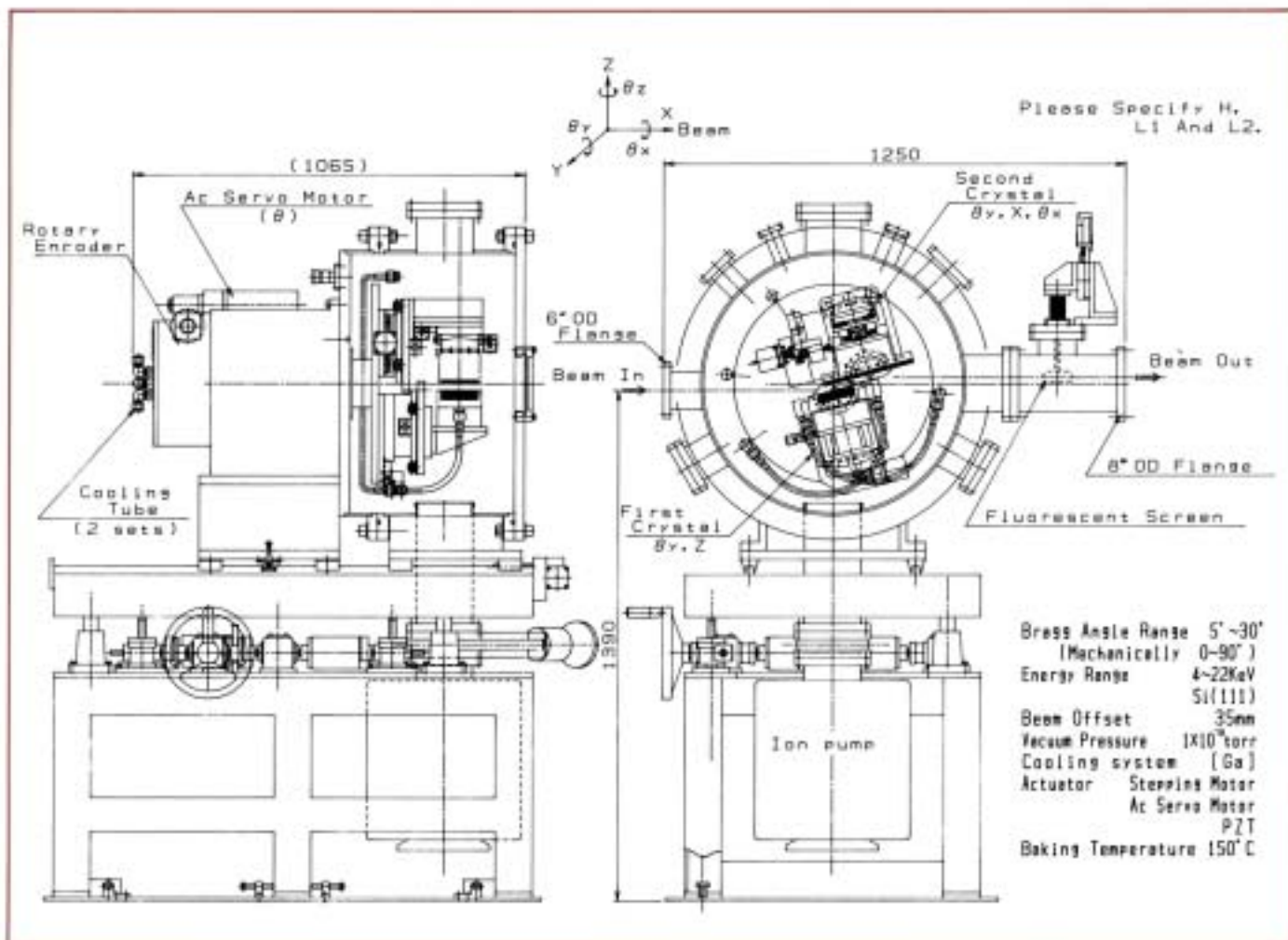
General Description

Highly intense X-rays from an insertion-device source in a third-generation high-energy synchrotron impose challenges on the design of monochromators. Heat load on the first crystal is estimated to be over a few 100 Watts/mm² and the radiation level in the monochromator housing is extremely high. This requires a system that efficiently removes heat from the crystal and high vacuum in the housing box, in addition to radiation-proof materials to be used for the various components. At APS (Advanced Photon Source/Argonne National Laboratory) a novel design has been worked out for a high-heat-load double-crystal monochromator, which uses a skew-reflection geometry and liquid gallium for cooling crystals in high vacuum. KOHZU SEIKI CO. LTD was in charge of the practical design and construction of the mechanical part of the monochromator. Model HLD-1 high-heat-load double-crystal monochromator, described here, was delivered to APS in January 1994. An initial test by the APS staffs showed quite favorable results.



Primary Axis	θ	Resolution	0.1 arc sec/step
		Axis Accuracy	1 arc sec
First Crystal	Z	Resolution	0.1 $\mu\text{m}/\text{step}$
		Straightness	1 arc sec/10mm
	θ adj 1	Resolution	2×10^{-6} arc sec with feedback UHV applicable PZT

Second Crystal	X2	Resolution	1 $\mu\text{m}/\text{step}$
	θ adj 2	Resolution	2.1×10^{-6} arc sec with feedback UHV applicable PZT
	Y2	Resolution	0.1 $\mu\text{m}/\text{step}$
	X2	Resolution	1 arc sec
Support Structure	Y	Resolution	0.5 $\mu\text{m}/\text{step}$
	Z	Resolution	0.11 $\mu\text{m}/\text{step}$

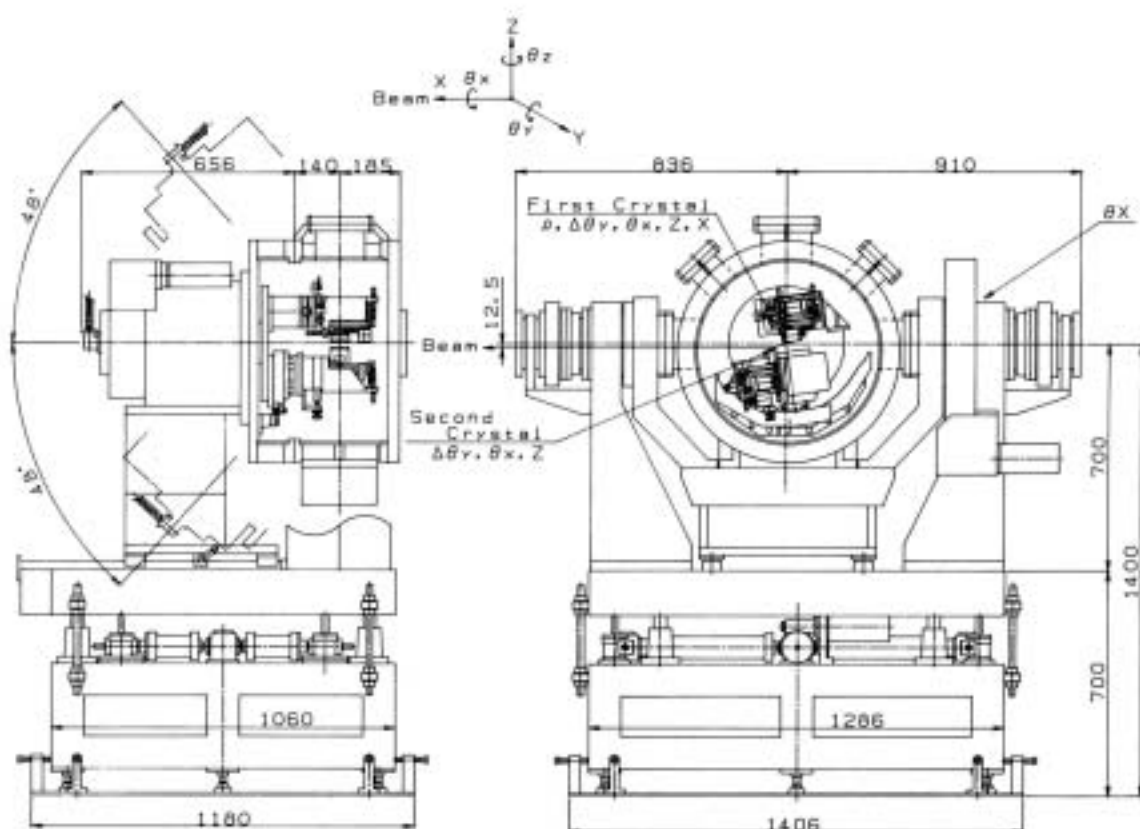
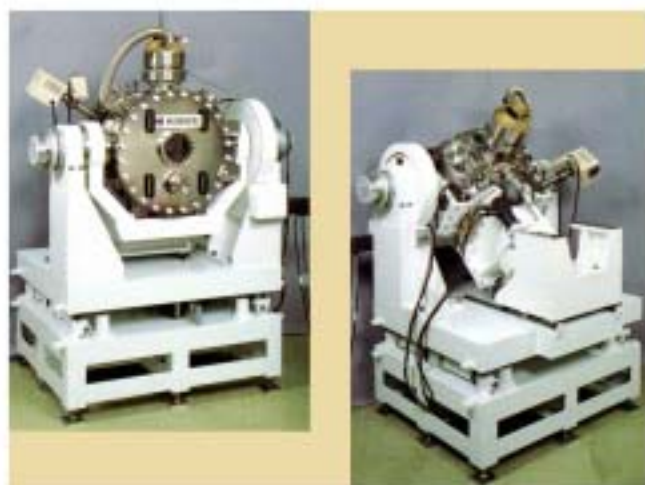


DOUBLE CRYSTAL CAM MONOCHROMATOR

Delivered to E.S.R.F.

EMG-T1

Bragg Angle Range	8° ~ 78° (0 ~ 80°, Mechanically)
Energy Range	4 ~ 14KeV Si (111)
Beam Offset	12.5mm
Vacuum Pressure	1×10^{-4} torr
Cooling system	Water
Actuator	Stepping motor AC servo motor PZT
Baking Temperature	200°C

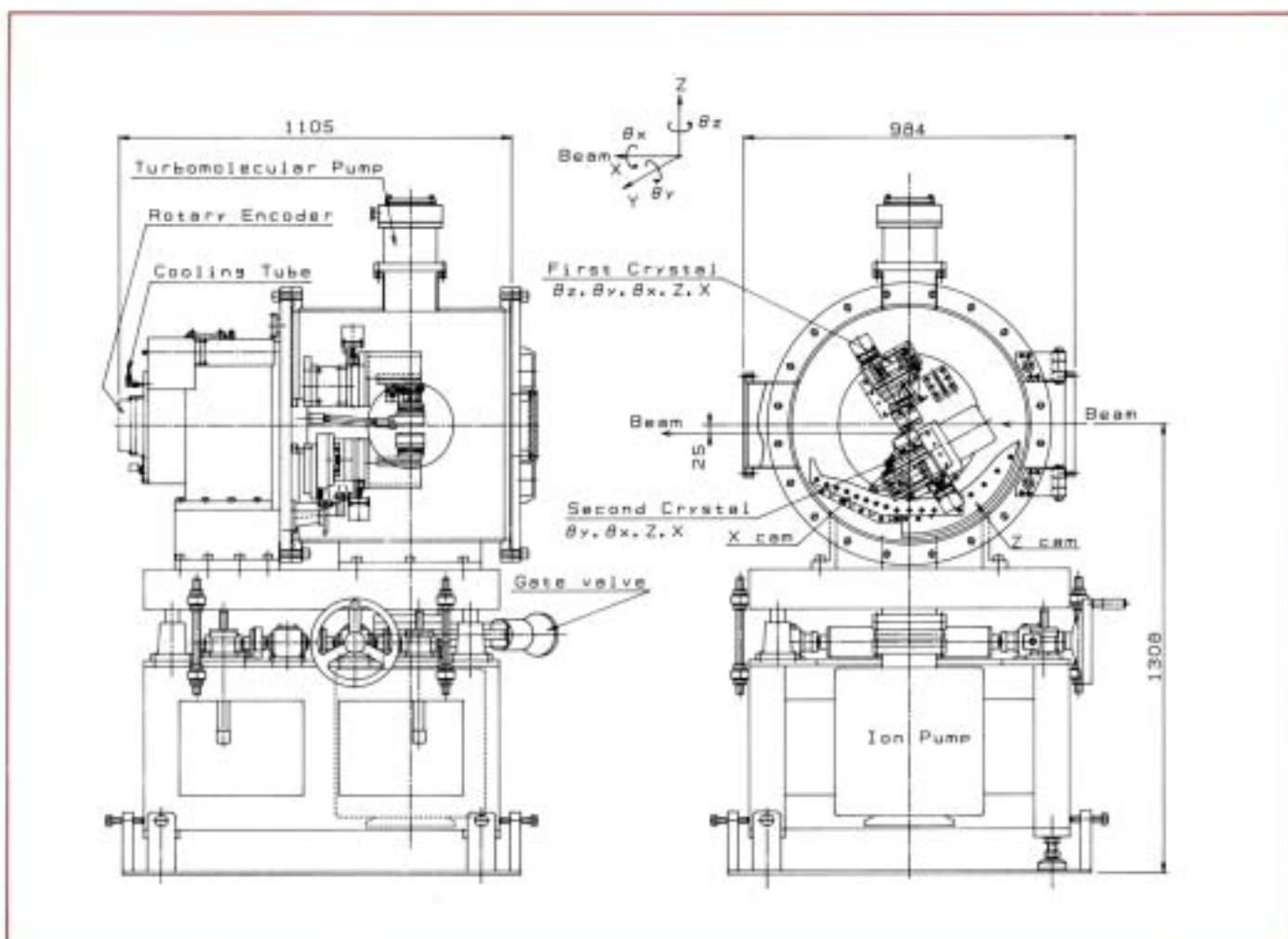
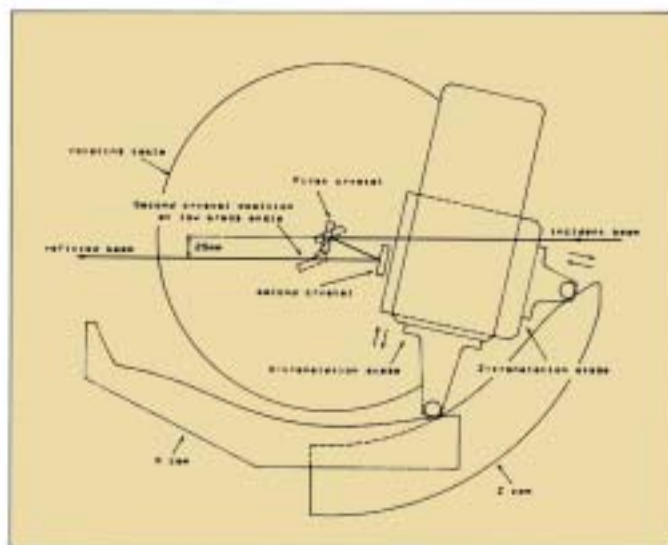


DOUBLE CRYSTAL CAM MONOCHROMATOR

Delivered to S.R.R.C.

TWC-1

Bragg Angle Range	8° – 78° (0 – 80°, Mechanically)
Energy Range	4 – 14KeV Si (111) 1.7 – 4KeV InSb (111)
Beam Offset	25mm
Vacuum Pressure	1×10^{-8} torr
Cooling system	No Water to vacuum joints system
Actuator	Stepping motor PZT
Baking Temperature	150°C

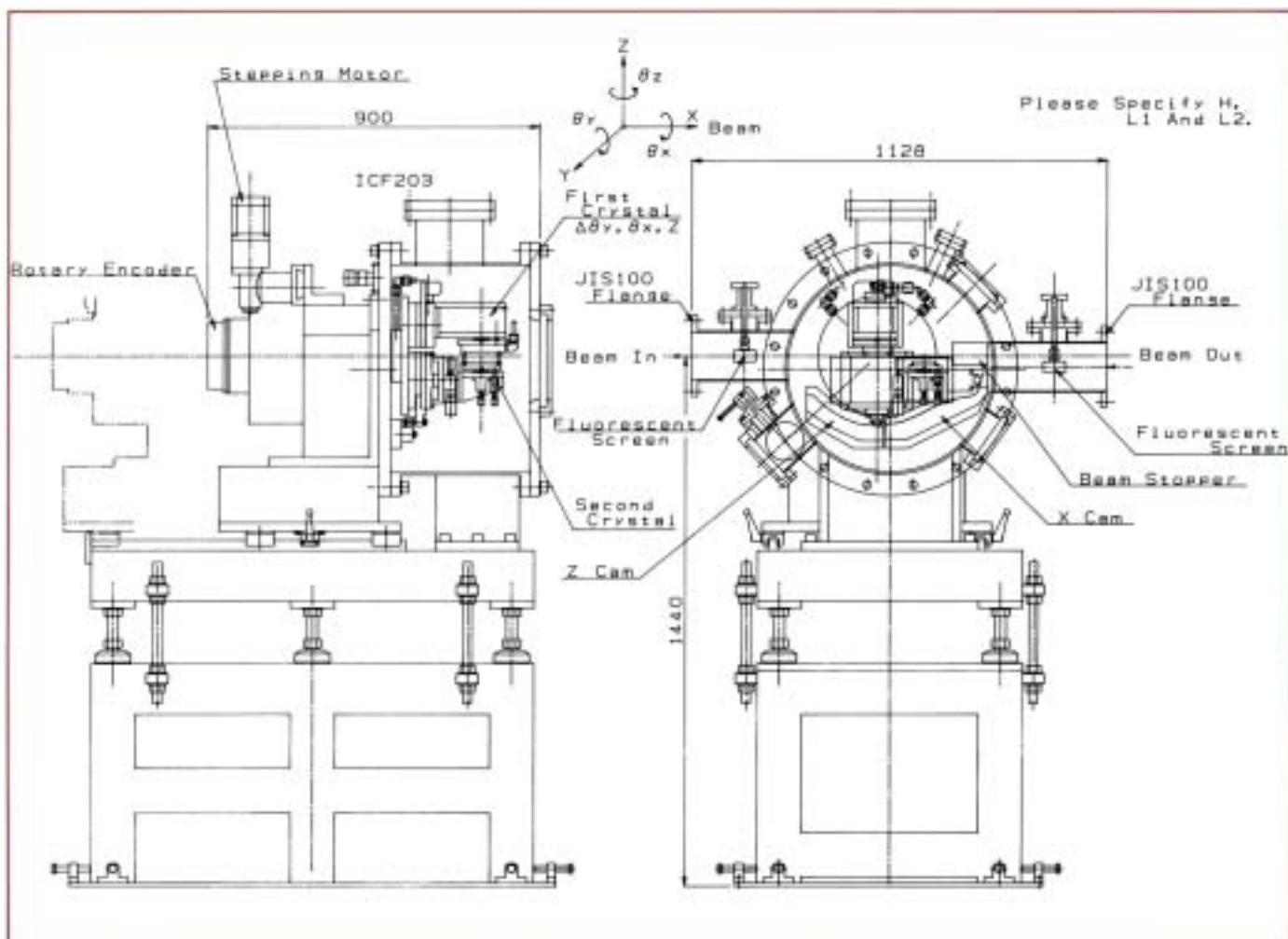


DOUBLE CRYSTAL CAM MONOCHROMATOR

Delivered to P.F.

KMA-33

Bragg Angle Range	7° – 50° (Mechanically 0 – 52°)
Energy Range	2.6 – 16KeV Si (111) 5 – 31KeV Si (311)
Beam Offset	25mm
Vacuum Pressure	1×10^{-7} torr
Cooling system	Water
Actuator	Stepping motor PZT

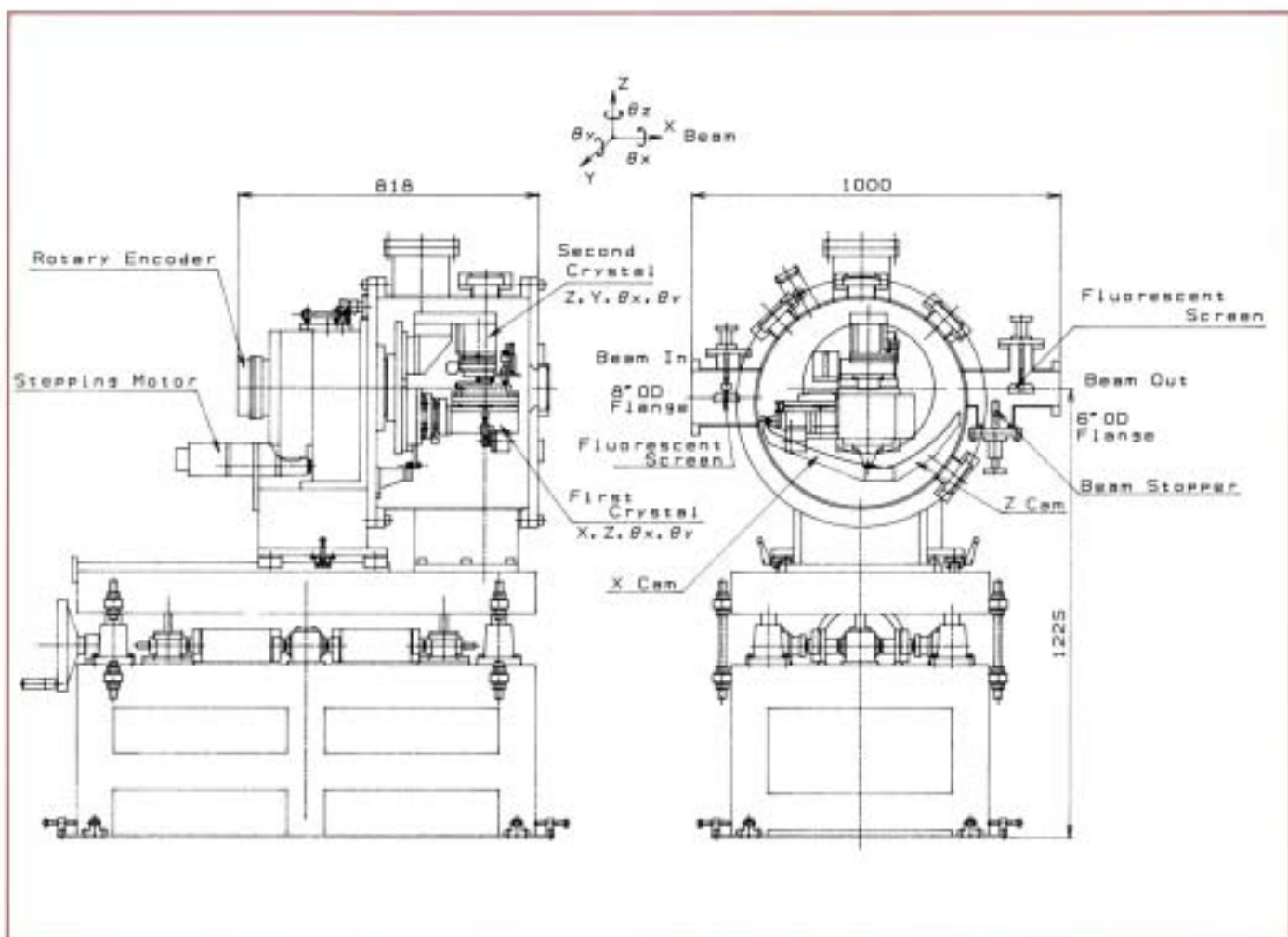


SAGITTALLY FOCUSING DOUBLE CRYSTAL CAM MONOCHROMATOR

Delivered to P.F.

KMA-23

Bragg Angle Range	6° ~ 60° (0 ~ 72°, Mechanically)
Energy Range	2.3 ~ 19KeV Si (111)
Beam Offset	25mm
Vacuum Pressure	1×10^{-6} torr
Cooling system	Water
Actuator	Stepping motor DC Motor PZT

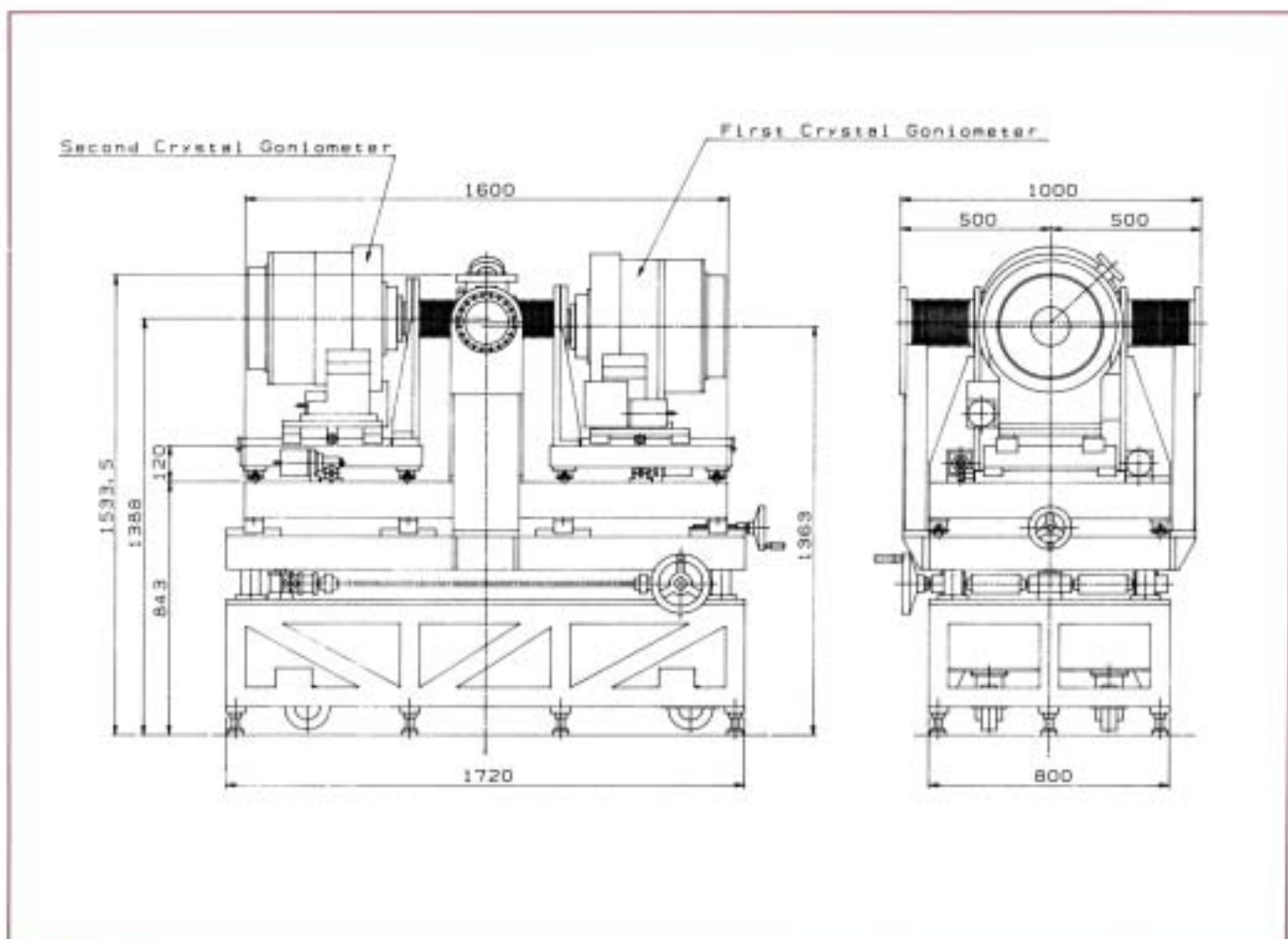


SOFT X-RAYS DOUBLE CRYSTAL MONOCHROMATOR

Delivered to P.F.

KIZ-1

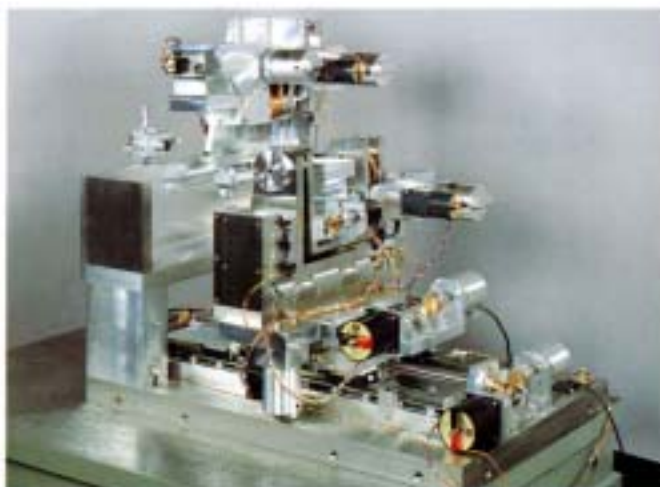
Bragg Angle Range	10° – 70° (0 – 70°, Mechanically)
Energy Range	2 ~ 10KeV Si (111) (220) InSb (111) (220)
Beam Offset	25mm
Vacuum Pressure	1×10^{-10} torr
Cooling system	Water Liquid Gallium
Actuator	Stepping motor PZT
Baking Temperature	200°C



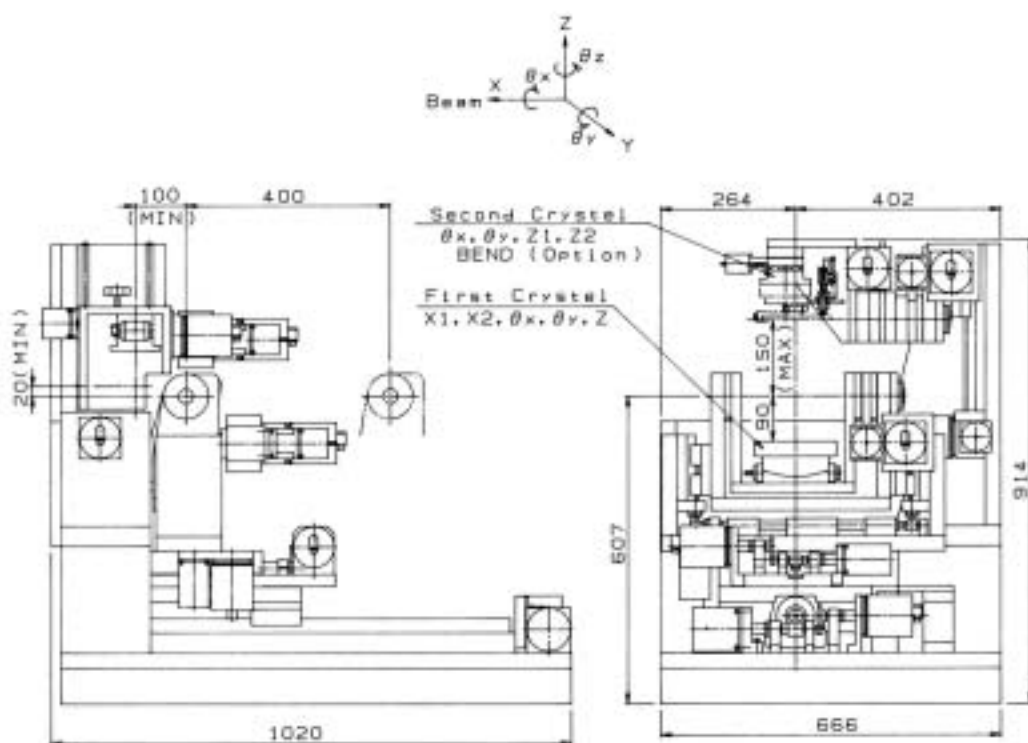
INDEPENDENTLY-CONTROLLED DOUBLE CRYSTAL MONOCHROMATOR

Delivered to SPring 8

RKN-1



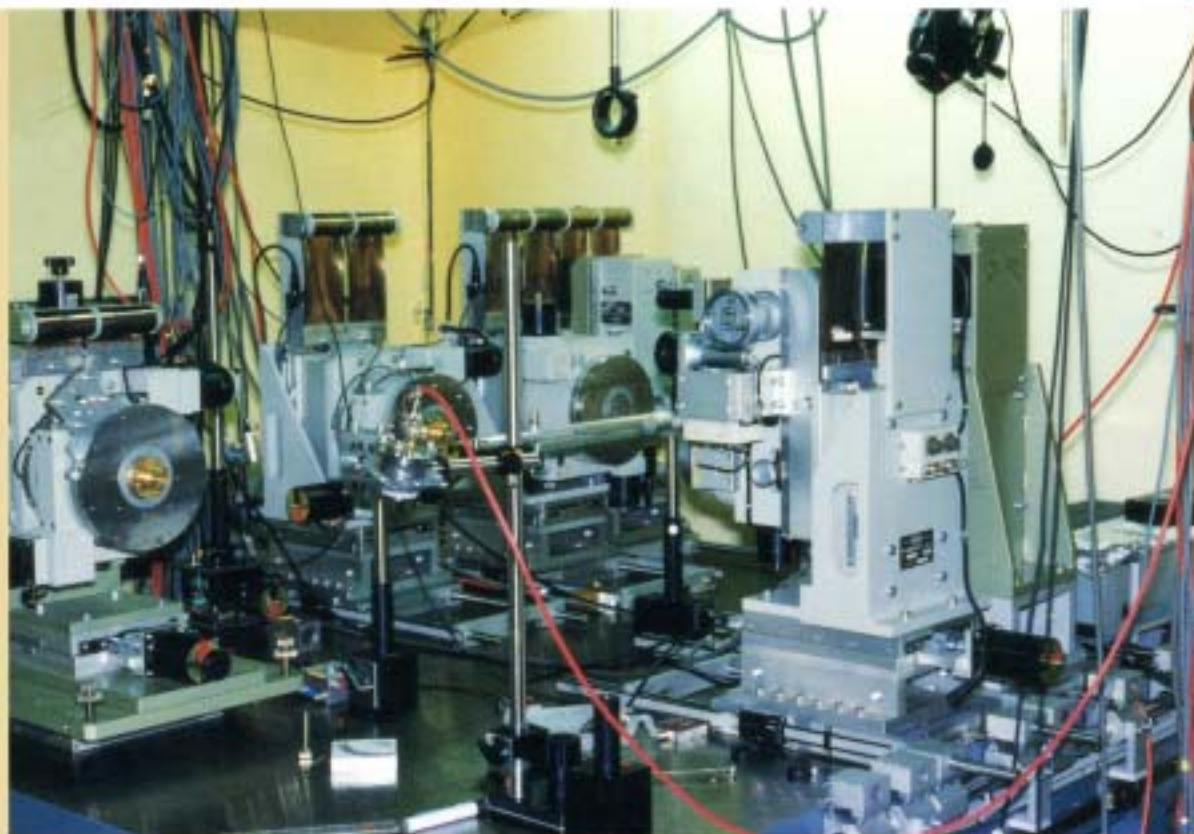
Bragg Angle Range	3° ~ 30° (-3 ~ 30°, Mechanically)
Energy Range	4 ~ 37KeV Si (111)
Beam Offset	20mm ~ 150mm
Vacuum Pressure	1 × 10 ⁻⁵ torr
Cooling system	Water (Option)
Actuator	Stepping motor



X-ray Diffractometers

In addition to monochromators, KOHZU SEIKI CO. LTD produces various types of high-precision mechanics to build goniometers and diffractometers for use at synchrotron X-ray sources. Our products are of modular design, and cover rotary tables, translation stages, sample holders and other components, of various designs, sizes and levels of accuracy. Users can combine and assemble appropriate components to build a complete system to meet the requirements for particular research experiments. Just to give you an idea, rotary tables with a high-precision worm gear or a tangent-bar drive system are available from KOHZU. The latter component provides a 0.01 arc sec angular resolution and a 0.1 arc sec reproducibility in angular setting with a shaft precession angle less than 1 arc sec.

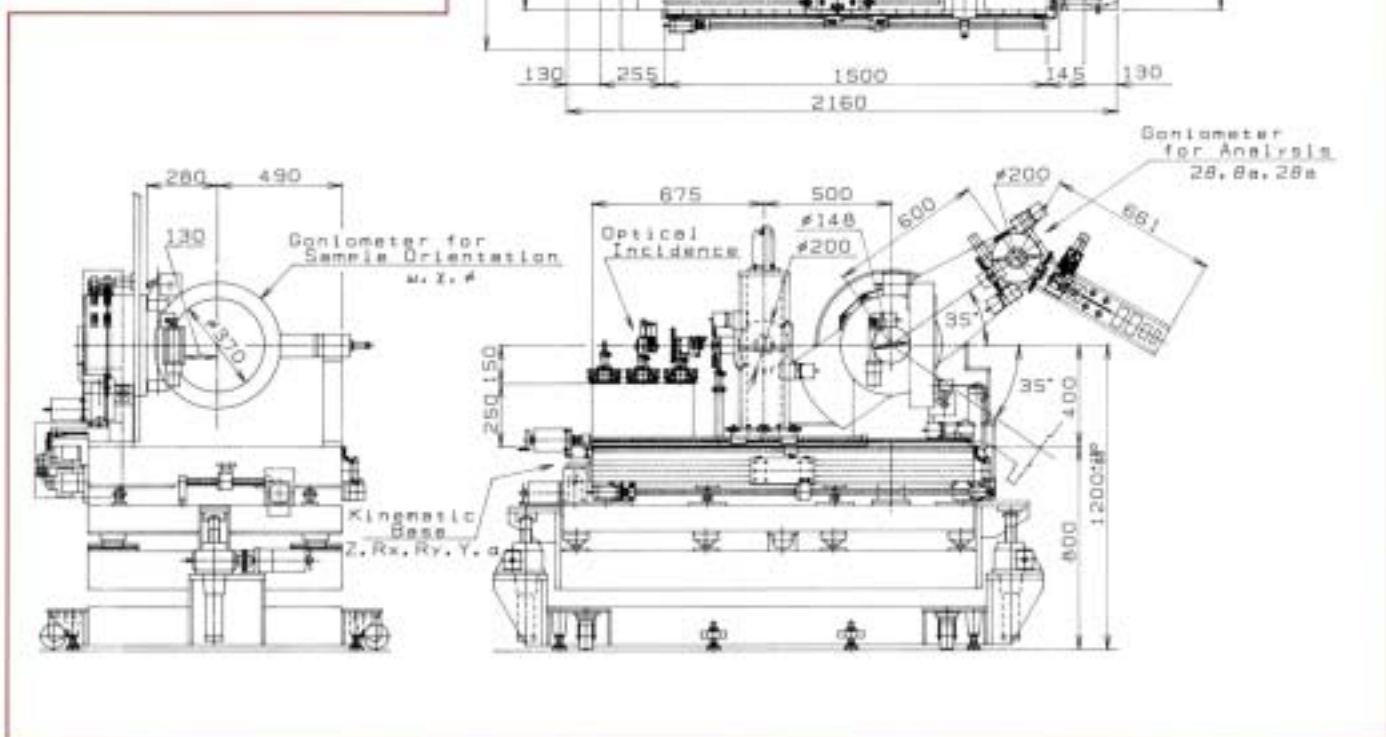
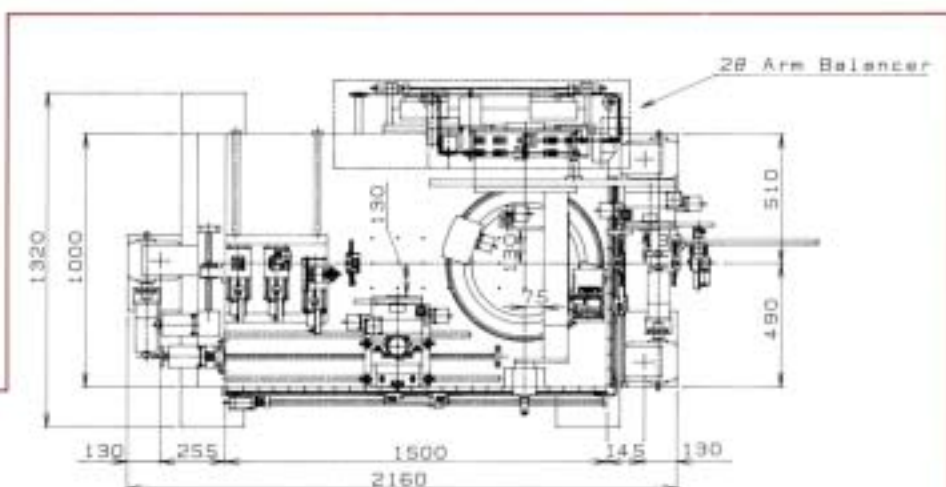
The diffractometers described below are originally designed for synchrotron X-rays. A four-circle goniometer is mounted on a positioning table with three rotation and two translation axes supported on large magnetic bases. These models are used in conjunction with dedicated beam conditioners, also designed by KOHZU, for various types of X-ray diffraction experiments.



4 CIRCLE X-RAY DIFFRACTOMETER

Installed at P.F. BL-3A

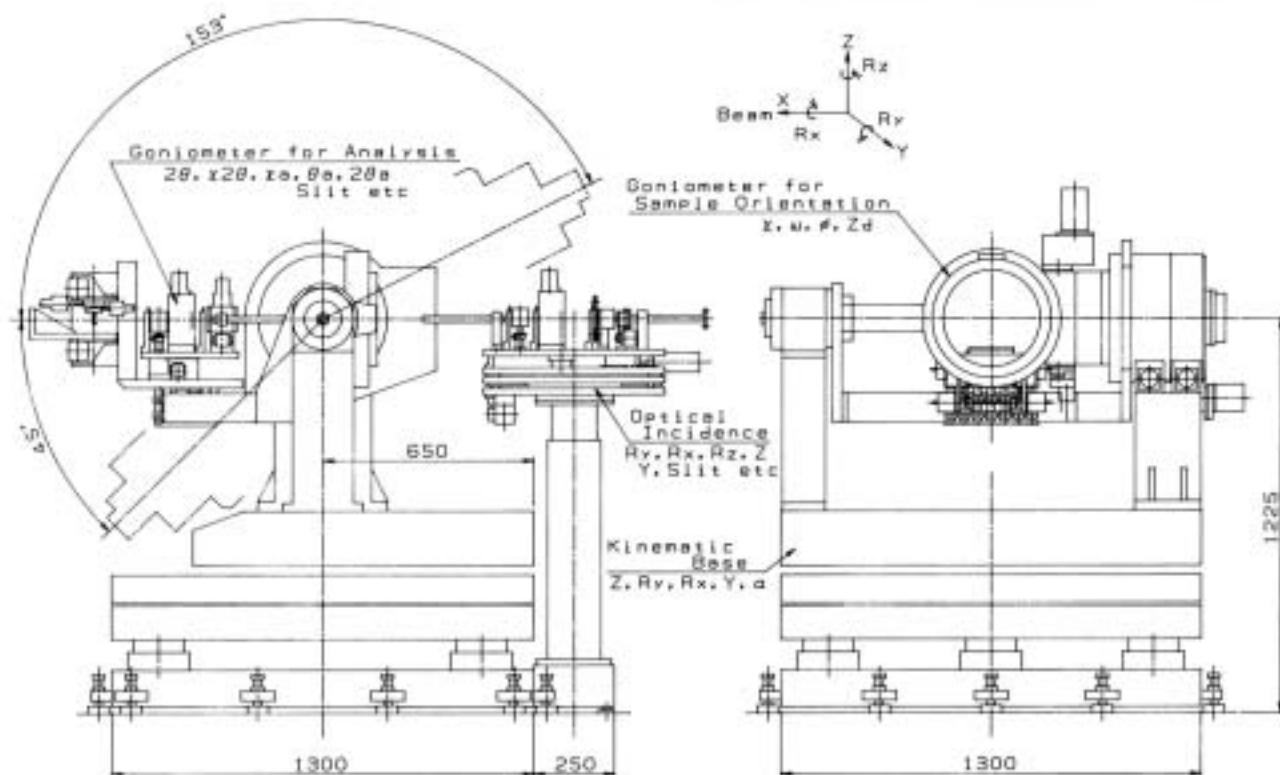
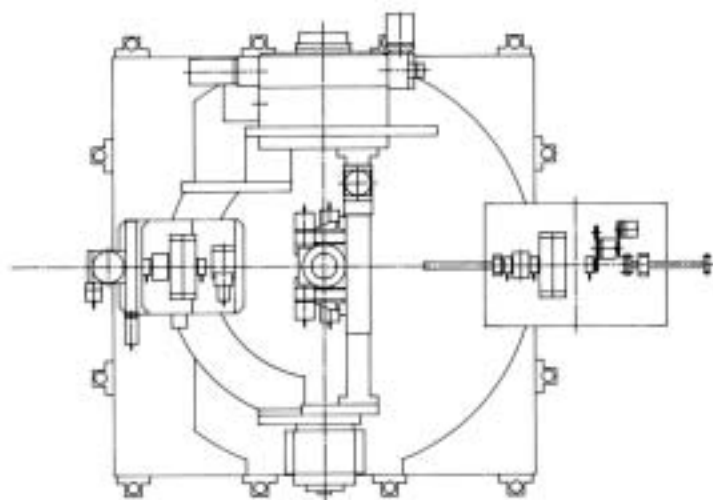
SIN-1



9 AXIS X-RAY DIFFRACTOMETER

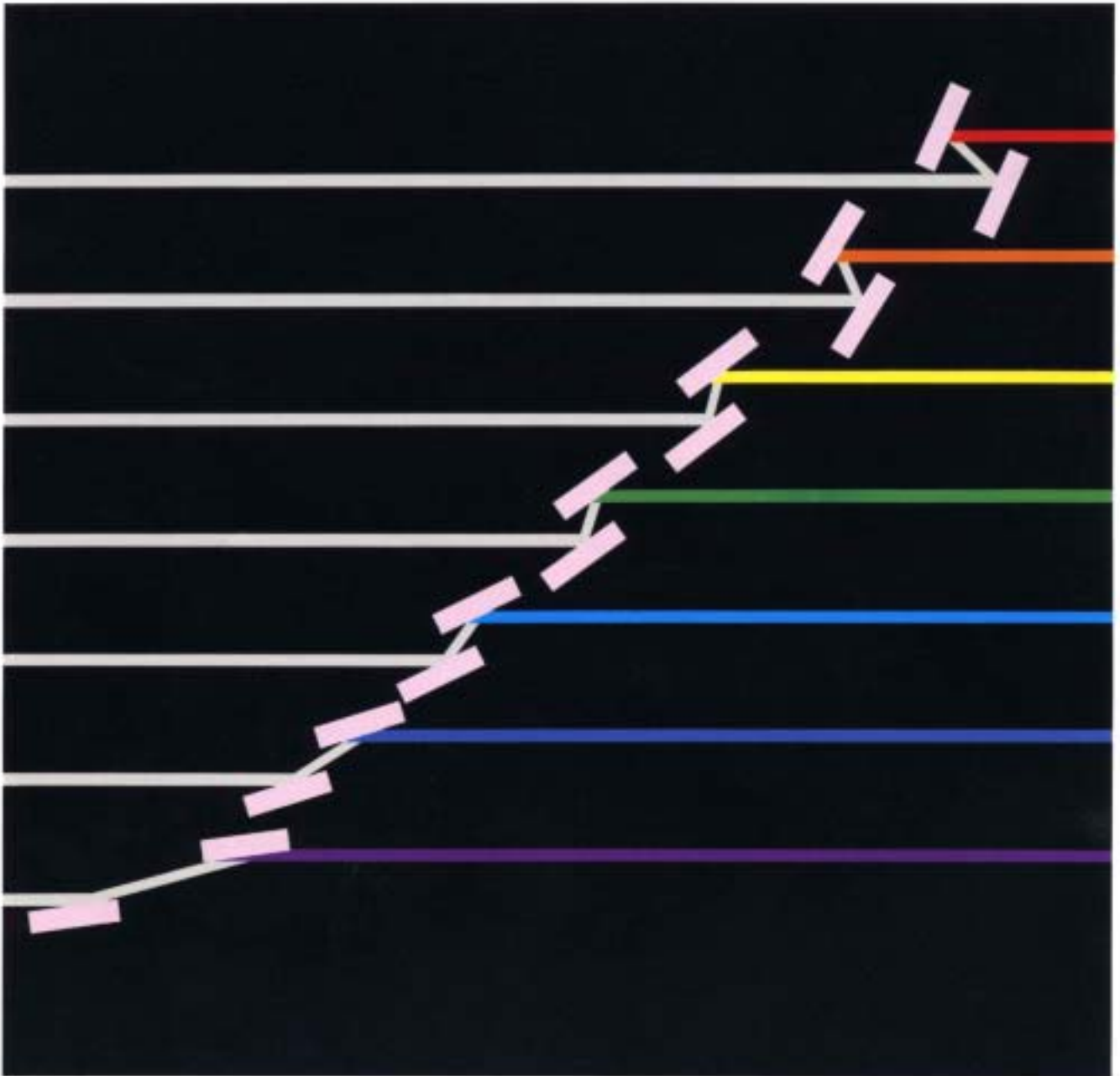
Installed at P.F.BL-27

GHM-3



KOHZU SUPPLY LIST FOR MONOCHROMATORS

DELIVERED YEAR	MODEL	DESCRIPTION	CUSTOMER
1974/12	SEY-1	Seya-Namioka Monochromator	INS-SOR II
1974/12	ARM-1	Grazing Incidence Monochromator	INS-SOR II
1981/03/31	SEY-2	1m Seya-Namioka Monochromator	KEK PF BL-12
1982/03/31	KMA-7	Independently-Controlled Double Crystal Monochromator	KEK PF BL-7
1983/03/25	KVM-10	10m Grazing Incidence Monochromator	KEK PF BL-2
1983/03/31	KSY-9	Double Crystal Wide-Range X-ray Monochromator	KEK PF BL-14A
1984/03/19	KMI-9E	Sagittally Focusing Double Crystal Cam Monochromator	KEK PF BL-4
1985/10/30	KMA-9N	Sagittally Focusing Double Crystal Cam Monochromator	NEC LTD. PF BL-9
1986/03/30	KMA-15	Sagittally Focusing Double Crystal Cam Monochromator	KEK PF BL-16
1986/06/30	HNA-8	Wide Range Independently-Controlled Double Crystal UHV Monochromator	HITACHI LTD. PF BL-8
1987/03/30	DSO-1	Independently-Controlled Double Crystal UHV Monochromator	ETL
1987/03/30	KKB-1	Soft X-Rays Grazing Incidence Monochromator	KEK
1987/03/30	KNK-16	Independently-Controlled Double Crystal Monochromator	NRLM
1988/01/30	FKY-7	Independently-Controlled Double Crystal Monochromator	FUJITSU LTD. PF BL-17
1988/03/11	KWD-3	Quasi-Double-Bent Crystal Monochromator	KEK AR NE-1
1988/03/25	KMA-24	Double Crystal Monochromator for High Energy (28Kev) Range	KEK AR NE-1
1988/03/30	NEN-1	Flipper Type VUV Monochromator	NEC LTD. PF BL-9
1988/04/25	KMA-15B	Sagittally Focusing Double Crystal Cam Monochromator	HHMI NSLS X-14
1988/12/23	KMA-23	Sagittally Focusing Double Crystal Cam Monochromator	KEK PF BL-14
1989/02/28	KMA-26	Sagittally Focusing Double Crystal Cam Monochromator	KEK PF BL-3A
1989/07/30	KNT-3	Soft X-Rays Double Crystal Cam Monochromator	NTT
1990/03/30	KMC-28	Double Crystal Cam Monochromator	KEK AR NE-3
1991/04/25	KMA-23G	Hard X-Rays Double Crystal Cam Monochromator	JAERI PF BL-27
1991/09/30	KMG-30	Soft X-Rays Double Crystal Cam Monochromator	JAERI PF BL-27
1992/01/30	KMF-32	Sagittally Focusing Double Crystal Cam Monochromator	FUJITSU KEK PF BL-17
1992/03/19	KIZ-1	Soft X-Rays Double Crystal Monochromator	KEK PF BL-28
1992/03/19	KMA-31	Double Crystal Cam Monochromator	KEK PF BL-18
1992/03/30	RKN-1	Independently-Controlled Double Crystal Monochromator for Spring-8	RIKEN
1994/01/20	EMG-T1 EMG-T2	Double Crystal Cam Monochromator	ESRF
1994/01/10	HLD-1	High Heat Load Double Crystal Monochromator	APS
1994/06/20	KMA-33	Double Crystal Cam Monochromator	KEK PF BL-12C
Under Construction	TWC-1 TWB-2	Double Crystal Cam Monochromator	SRRC



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