

Specifications of X-ray refractive lens arrays at SPring-8 II BL12XU Taiwan Beamline

National Synchrotron Radiation Research Center

101 Hsin-Ann Rd., Hsinchu 30076, Taiwan

2026年7月8日

The National Synchrotron Radiation Research Center (hereinafter referred to as "NSRRC") shall be pleased to receive full details of your quotation in accordance with the following terms and conditions:

Overviews

The document is for the bid of four X-ray refractive lens arrays at SPring-8-II BL12XU Taiwan Beamline, Hyogo 679-5198 Japan.

Scope of the contract

The vendor should provide:

- 4 X-ray refractive lens arrays.
- Factory test report.

Specifications

The four X-ray refractive lens arrays are used to focus high-energy photons ($E = 40\text{--}50\text{ keV}$) for inelastic X-ray scattering at beamline BL12XU. One X-ray refractive lens array consists of 13 lens lines, each composed of Si (or Al) columns with parabolic front and back surfaces, fabricated on a substrate with an area of approximately $20 \times 20\text{ mm}^2$ and a thickness of 1 mm. (see Figure 1). Each lens line contains several lenses ($N=21\text{--}33$) of column(see Figure 2). Each column has a length of $300\text{--}400\text{ }\mu\text{m}$, a width of $500\text{--}1000\text{ }\mu\text{m}$, and a height of $300\text{--}400\text{ }\mu\text{m}$. Two X-ray refractive lens arrays are required to focus the beam in the vertical and horizontal directions and the other two lens arrays are spares. Total is 4 lens arrays. The specifications of one X-ray refractive lens array are listed below:

- Chip dimensions: $20\text{mm} \times 20\text{mm}$ (WxL), tolerance: $\pm 0.1\text{ mm}$,
- Chip thickness: 1 mm ,
- Material: Si
- Lens function: $y = x^2 / (2R)$, $R = 0.20\text{ mm}$:
 - Lens pitch: $0.32\text{ mm} \pm 0.03\text{ mm}$,
 - Lens width: $0.49\text{ mm} \pm 0.04\text{ mm}$,
 - Lens gap: $0.02\text{ mm} \pm 0.01\text{ mm}$,
 - Lens depth $> 0.3\text{ mm}$,

- Number of lens line: 13 types, N=21-33(See Figure 2).

Inspection and Acceptance Criteria

General term

- In order to meet these specifications, NSRRC reserves the right to inspect and require alterations of the completed design.
- Agreement between NSRRC and the vendor on the entire design drawings must occur before any actual fabrication process begins.
- Unless otherwise specified in the contract or order, the vendor is responsible for the performance of all inspection requirements as specified herein.
- Except as otherwise specified, the vendor may utilize his own facilities or any commercial laboratory acceptable to NSRRC.
- A written report of the tests shall be provided to NSRRC to verify compliance with the specifications. Test methods, criteria and measuring equipment should be shown in the test report.

Factory acceptance tests

Factory acceptance tests report shall show the following items:

- Tester of the vendor: print name and his/her signature
- Date
- Place
- Test methods
- Exterior appearance check
 - Configuration should accord with the approval drawing.
 - No flaw, dent, scratch and fouling that affect the equipment in use and/or in function.
 - No sharp edges and corners.
- Chip dimensions: 20mmx20mm(WxL), tolerance: +/-0.1mm,
- Chip thickness:1mm,
- Material
- Lens function: $y=x^2/(2R)$, $R=0.20\text{mm}$:
 - Lens pitch:0.32mm+/-0.03mm,
 - Lens width:0.49mm+/-0.04mm,
 - Lens gap:0.02mm+/-0.01mm,
 - Lens depth>0.3mm,
- Number of lens line: 13 types, N=21-33(See Figure 2).

Packing and Shipping

The finished components must be thoroughly clean and free from any organic materials or cutting fluid. The equipment must be packed in such a way that foreign materials cannot penetrate inside. The packaging methods must be subject to approval by NSRRC.

Package for shipment must ensure that the equipment is insulated from any severe shock. Markings indicating the fragile nature should be on the outside wall of the container.

The supplier must be responsible for the delivery of all the components, including the payment of the import/consumption tax. The address for the delivery is BL12XU at SPring-8, 1-1-1 Kouto, Sayo-cho, Sayo-gun, Hyogo 679-5198, Japan (DDP, Hyogo, JP, INCOTERM2020) Attention: Dr. Nozomu Hiraoka, Consignee: Japan Synchrotron Radiation Research Institute.

Besides the shipping address, the following is to be displayed clearly on the outside of the packaging:

- NSRRC contract number
- Weight of the loaded package

Warranty

- The vendor warrants that all Contract Product(s) delivered by the vendor to NSRRC shall be of new manufacture, free from defects in material, workmanship.
- The warranty will remain in force for 12 months at least from installation and NSRRC's acceptance.

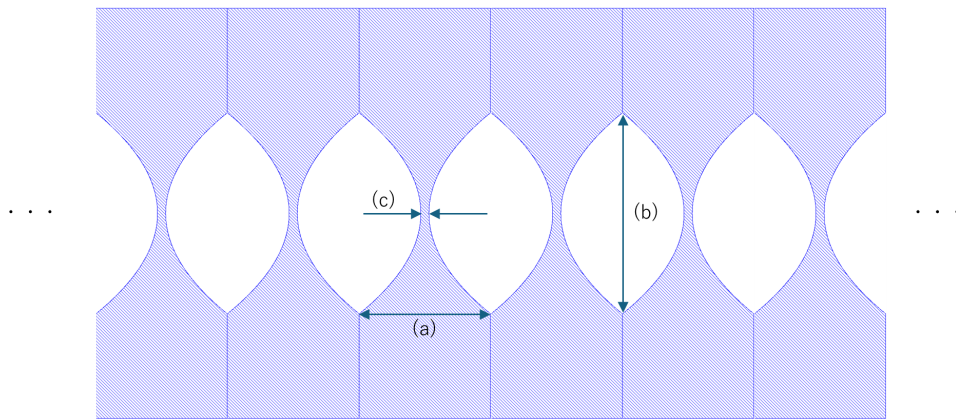


Fig. 1 Lens array layout. White area is etched area.

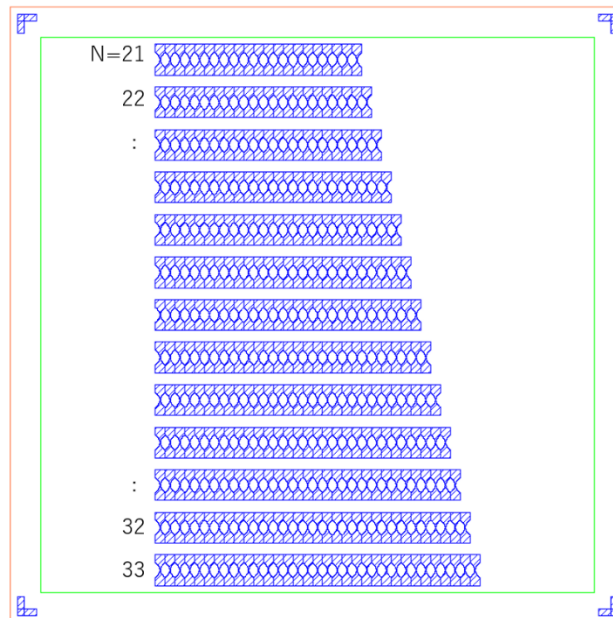


Fig. 2 Pattern layout. The number of lenses (N) are 21 – 33, respectively. Note that the white area is an etched area. The figures include the chip size (20 mm sq., red lines) and the pattern area (18 mm sq., green lines).