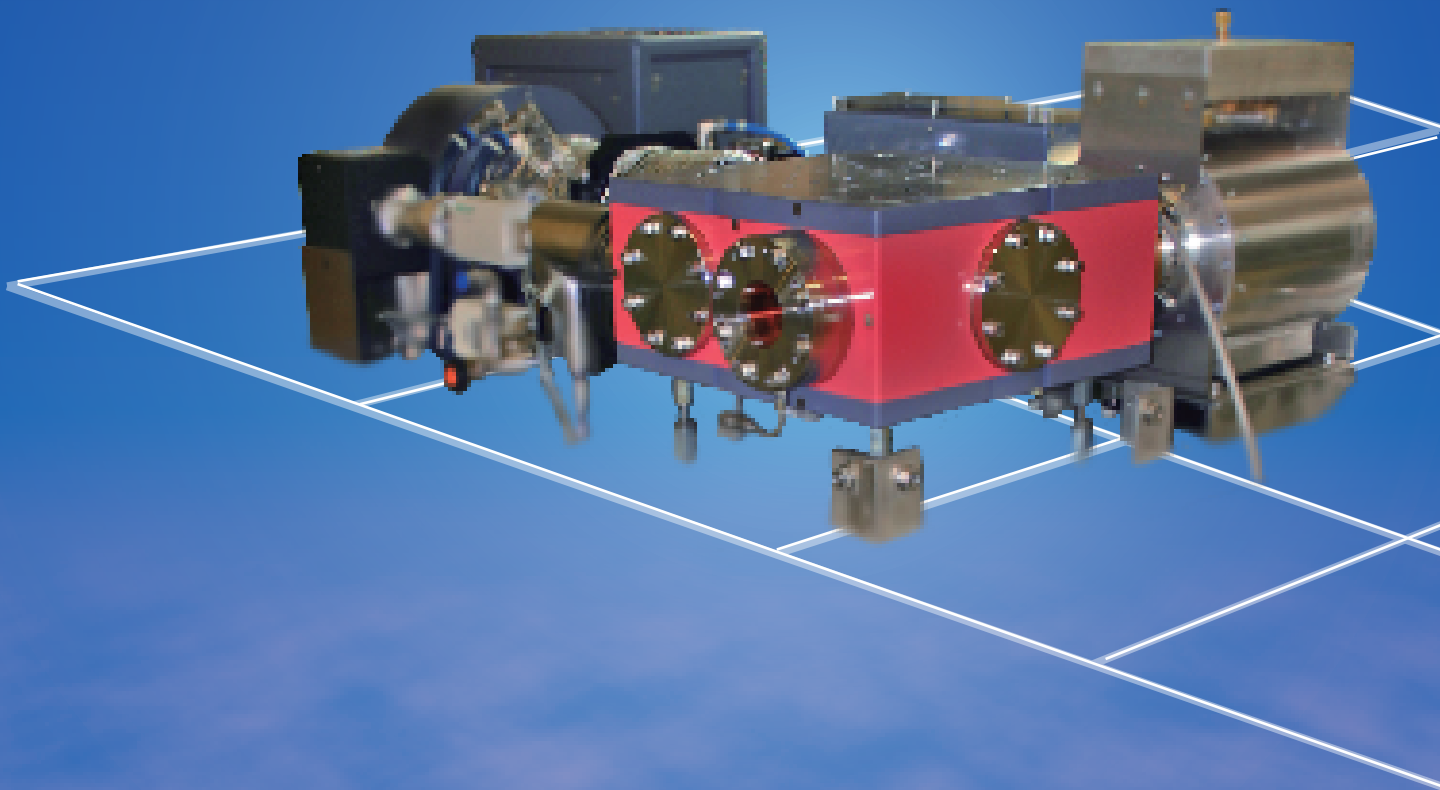


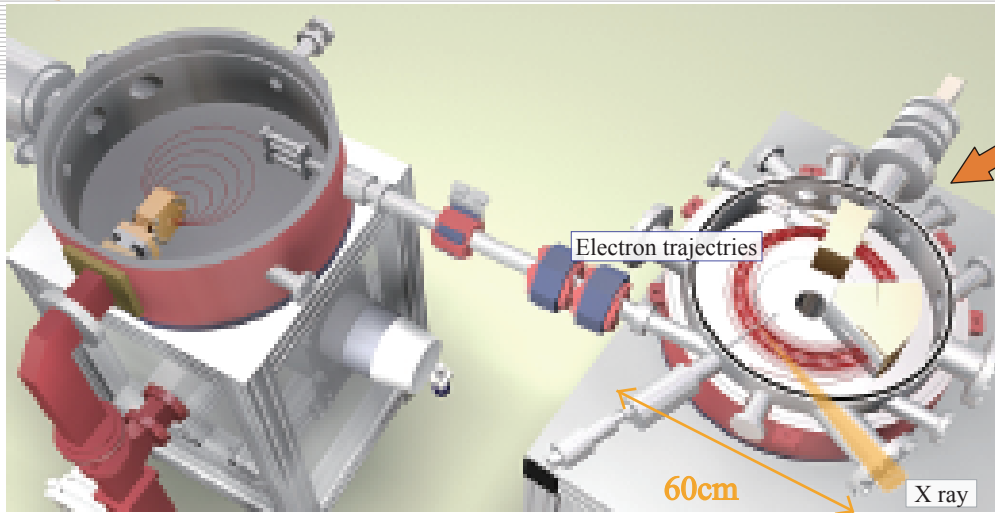
Innovations in X-ray analysis technology

Table top synchrotron “MIRRORCLE^{RAY}”



Introducing “MIRRORCLE RAY”. A new light source strikingly different from X-ray tubes or large synchrotron light sources. It has equalled the finest spacial resolution ever observed by Linac. Advanced X-ray analysis can be performed without visiting a conventional large synchrotron.

Table top Synchrotron **MIRRORCLE^{RAY}**



Photograph by Google

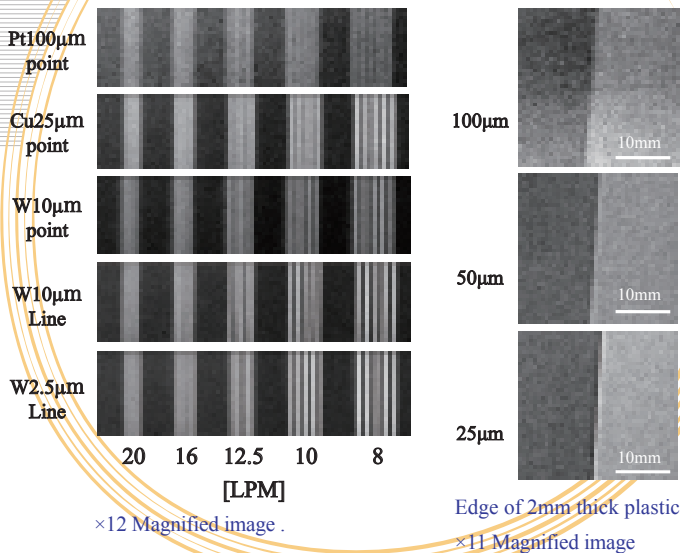
MIRRORCLE is the world's smallest tabletop synchrotron. Utilizing a low energy storage ring that emits far infrared synchrotron radiation, X-rays are also generated when a target is placed in the electron orbit as seen in Fig. Circulating electrons have the opportunity to repeatedly collide with the target resulting in a high energy transfer rate in MIRRORCLE. A small X-ray emission point generates X-rays with high resolution capability.

“MIRRORCLE RAY” Highlights

1. Brilliant and broadband radiation source to provide output in the FIR to hard X-ray range.
2. Excellent spatial resolution for X-ray imaging. Fine energy resolution for spectroscopy.
3. High energy X-rays - Powerful NDT tools for heavy construction.
4. Laboratory size!
5. Stress free operation - An automatic control system provides simple, appliance like operation

Fine spacial resolution is obtained without loosing intensity

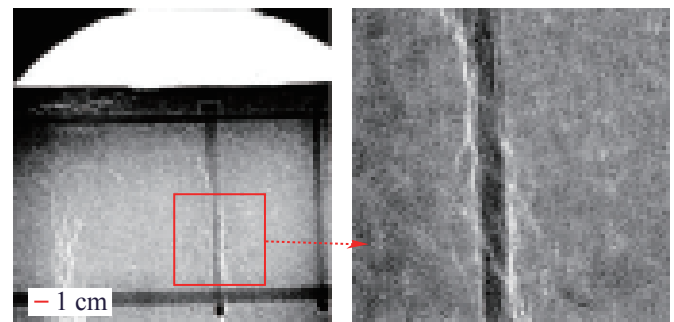
Left Fig. shows X-ray test chart imaging, indicate the spatial resolution depends on the X-ray target size. Right fig. shows edge imaging of plastic. We see here that not only the space resolution but also the contrast is very much improved. Edge contrast is improved as magnification increases.



X-ray Non Destructive Testing

Rebar and crack as observed within a concrete

X-ray image of 15cm thick concrete structure. We achieved to observe more than 10µm resolution.

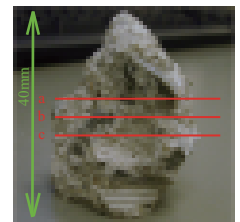


X-ray image of concrete.

×2 Magnified image.

Density difference inside concrete

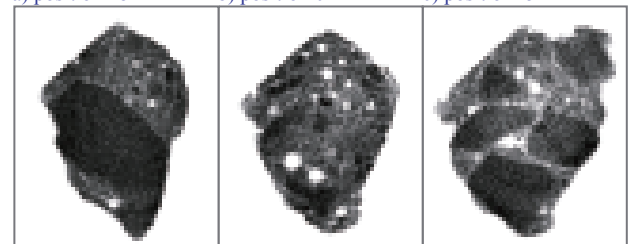
A CT image of concrete showing mosaic density. Polychromatic X-rays from MIRRORCLE increase image information.



Concrete

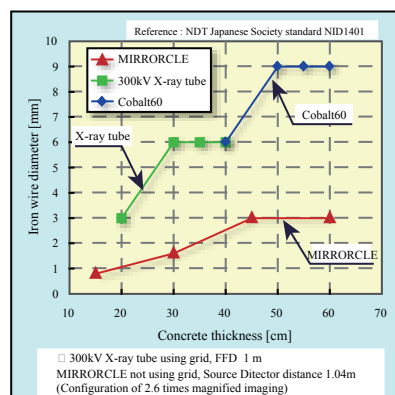
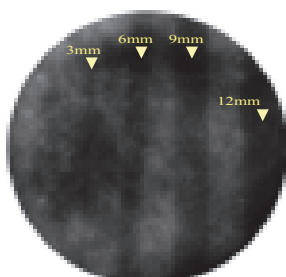
Cross sectional view of Concrete block

a) position +5mm b) position 0mm c) position -5mm



Heavy construction imaging

Image of iron wires as seen through 45cm thick concrete block. The NDT capabilities of MIRRORCLE are 3 times that of a Cobalt X-ray source.



A comparison of NDT capability between MIRRORCLE-CV4 and conventional X-ray source.

Advanced X-ray analysis

EXAFS

MIRRORCLE RAY is inherently suitable for DXAFS owing to its micrometre-size X-ray source point and wide radiatio emission angle. DXAFS experiments can be performed with high energy resolution and over a wide range.

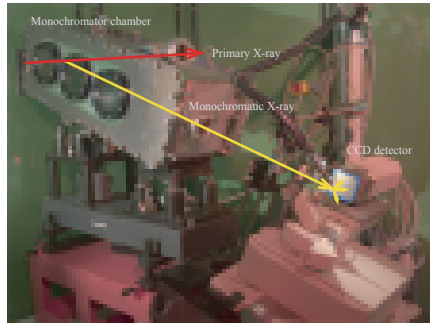
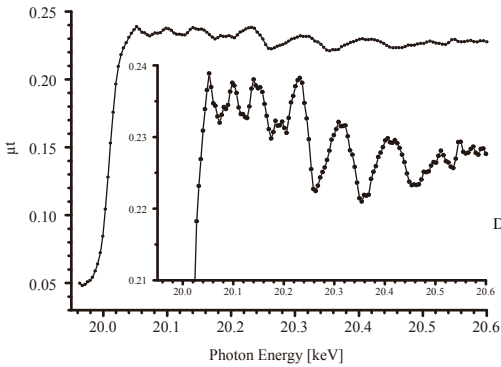
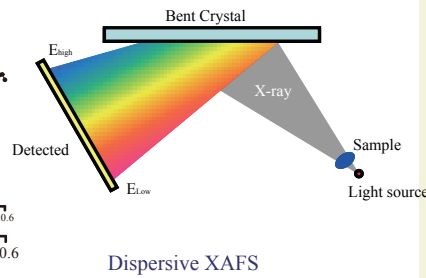


Photo of the second monochromator chamber



Mo10µm XAFS

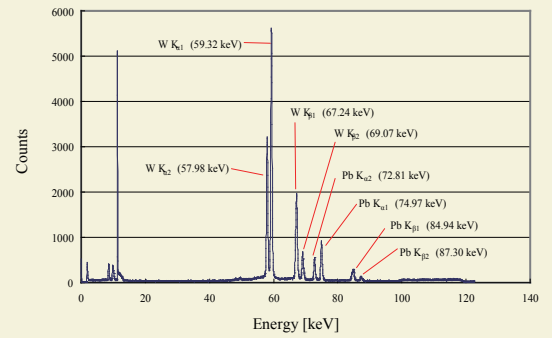


Dispersive XAFS

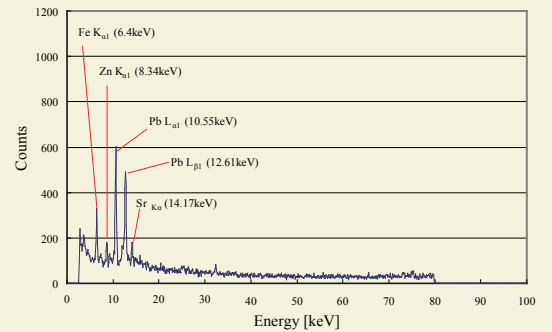
X-ray fluorescence analysis

X-ray fluorescence analysis excited the K-shells of heavy elements is possible on the tabletop.

Tungsten(W) spectrum. Pb shield were also detected.



Small amount of metal in the woods powder are recognized.



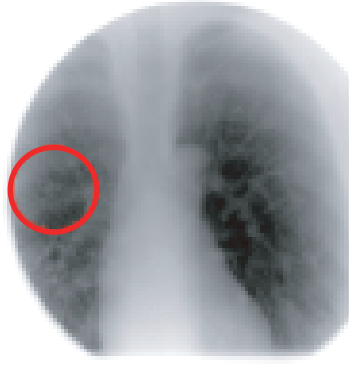
Phase contrast images of a chest phantom

Chest phantom

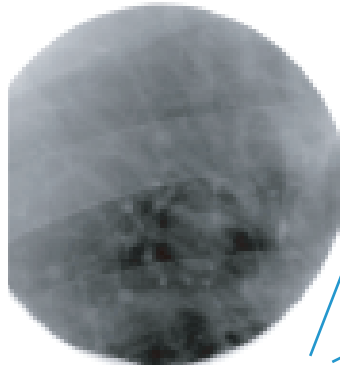


Magnified imaging make it possible to observe ribs, blood vessel and node clearly.

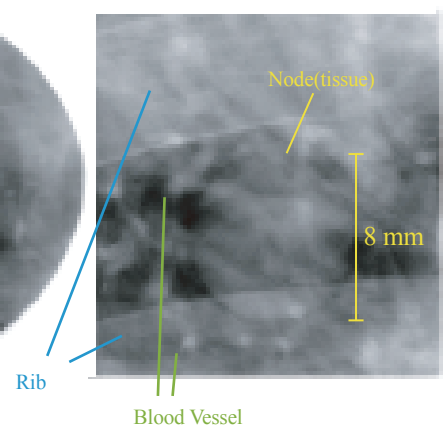
X-ray contact image



×5 magnified image



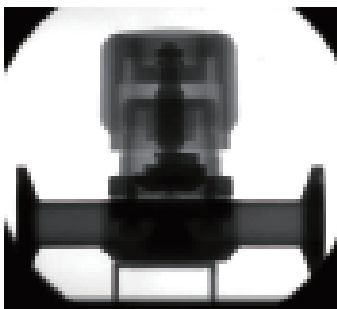
×11 magnified image



Chest phantom is provided by Shiga medical univ.

Complex materials are recognized.

Various materials such as SUS and PTFE can be identified clearly. Air gap of screw can be observed.



X-ray contact image

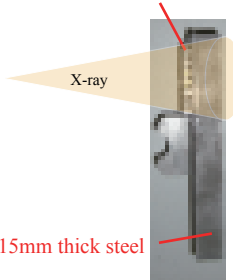


×4 magnified image

NDT capability 0.4%

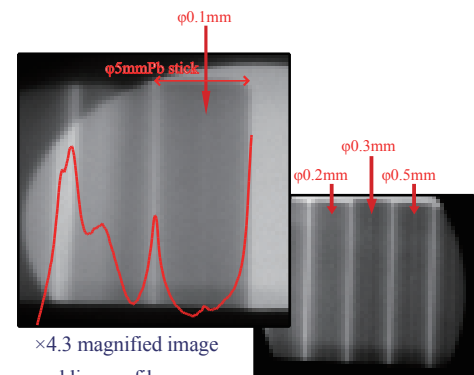
X-ray imaging of drill hole φ5mm Pb stick.

φ5mmPb stick(drill hole)



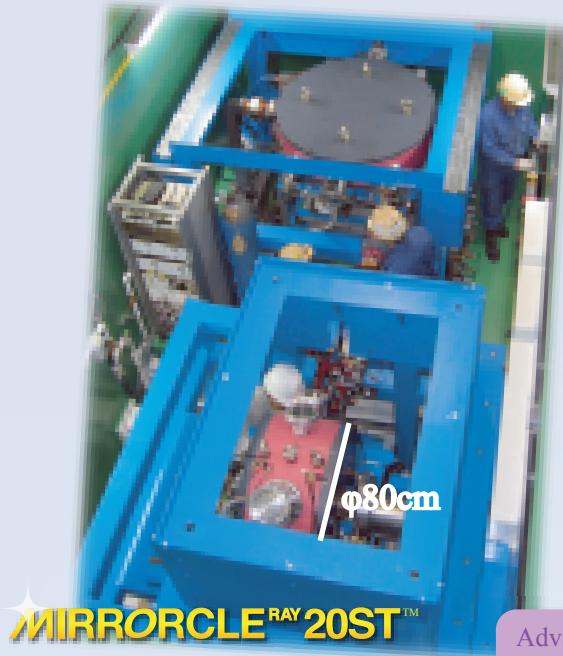
15mm thick steel

Steel sample



×4.3 magnified image and line profile.

MIRRORCLE^{RAY} Lineup



Monochromatic X-ray (8~30keV), Soft X-ray
EUV, Far infrared ray, Hard X-ray(10~20000keV)

Advanced X-ray analysis
XAFS, Spectroscopy
Protein crystallography
Fluorescent X-ray analysis

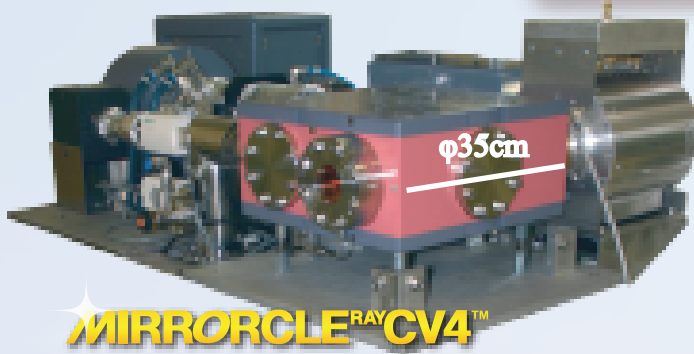
THz infrared spectroscopy
Solvent, Protein, Drug analysis

X-ray Non-Destructive Testing
MIRRORCLE has achieved the highest
spacial resolution ever observed.
Designed for NDT of bridges, industrial
plants and aerospace applications etc.

MIRRORCLE^{RAY}
Application

Medical
Cancer diagnosis in the back of bone

Micro focus X-ray imaging
NDT of complex materials and devices
such as electronic components and fuel
cell assemblies



Far infrared ray
Hard X-ray (10~4000 keV)

MIRRORCLE^{RAY} CV1™

Hard X-ray (10~1000 keV)



Picture shows just a 1MeV microtron.

Corporate profile



Name: Photon Production Laboratory, Ltd.
URL: <http://www.photon-production.co.jp>(in Japanese)
<http://www.ppl-xray.com>(in English)
Office: Nojihigashi 1-1-1, Kusatsu, SHIGA, 525-8577, JAPAN
Ritsumeikan University Business Incubator, #209
TEL 077-566-6362 FAX 077-566-6368
E-mail: i@photon-production.co.jp

Photon Production Laboratory was established to research, develop, design, produce, and promote "MIRRORCLE" - a super high brilliance light source. We offer not only MIRRORCLE as a product but provide contract analysis services, and welcome your inquiries and proposals.