Laser Compton Scattering X-ray Source at AIST

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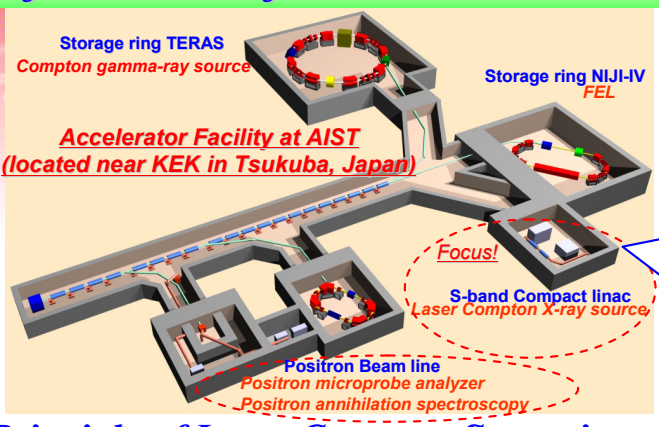
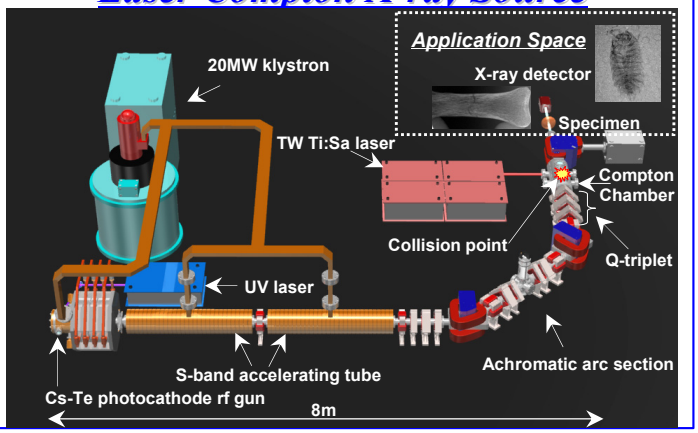
Infrastructure for Accelerator Science



Laser Compton X-ray Source



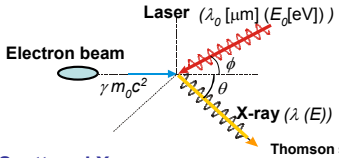
Principle of Laser Compton Scattering

Interaction between high energy electron beam and high power laser

- Max. Energy(θ=0)

$E=2\gamma^2 E_0$ (ϕ=90)

$E=4\gamma^2 E_0$ (ϕ=0)



Scattered X-ray energy

$$E = \frac{(1+\beta\cos\phi)E_0}{1-\beta\cos\theta+(1+\cos(\theta+\phi))\frac{E_0}{\gamma m_0 c^2}}$$

LCS X-ray source
- Short pulse
- Energy tunability
- Quasi- monochromatic
- Small source size
- Good directivity
- Good polarization
- Compact system …etc

Many benefits!

TW Ti:Sa Laser beam (CPA)

Wave length	800 nm
Energy/pulse	140 mJ
Pulse width (FWHM)	100 fs
Beam size (σ_x/σ_y)	30 μm

Electron beam

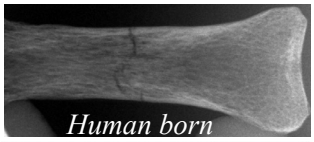
Electron Energy	20 ~ 42 MeV
Energy spread	0.2%
Bunch charge/bunch	1 nC
Bunch length (rms)	3 ps
Beam size (σ_x/σ_y)	40/30 μm

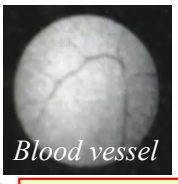
Quasi-monochromatic X-ray

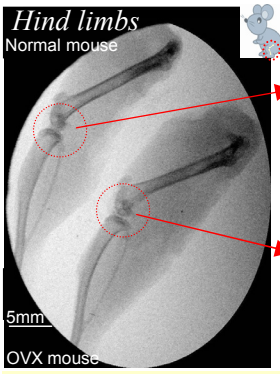
Collision angle (ϕ)	Photon energy	Pulse width	Number of Photons
90	~20 keV (max)	150 fs (rms)	~10^6 /s (max) @10Hz
0	~ 40 keV (max)	3 ps (rms)	~10^7 /s (max) @10Hz

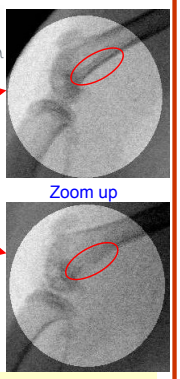
Beam Status

Biological & Medical Uses





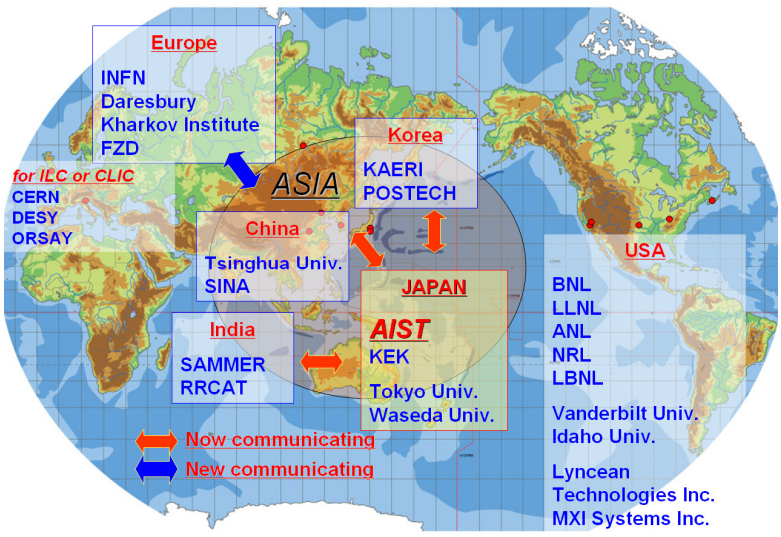




We can observe the bone erosion of OVX mouse which is the initial symptom of osteoporosis !

Application to biological and medical research
in-line phase contrast imaging, K-edge imaging
(because of quite small size of X-ray source about 30~40 μm)

Global Communication for Development of Accelerator Technologies



Advanced Key Technology

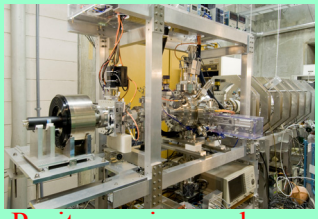
Superconducting Accelerator Technology

Suggestion **International relationship**

Europe		JAPAN
DESY	ILC	KEK
Daresbury	ERL	JAEA
INFN	LCS-X	AIST New
…	e-source	…

Laser Compton Scattering Technology

I suggest the ASIA group should make many relations in the development of LCS X-ray source and Superconducting Accelerator technology with Europe group.



Positron microprobe analyzer at AIST

Under development!

X

High duty electron source