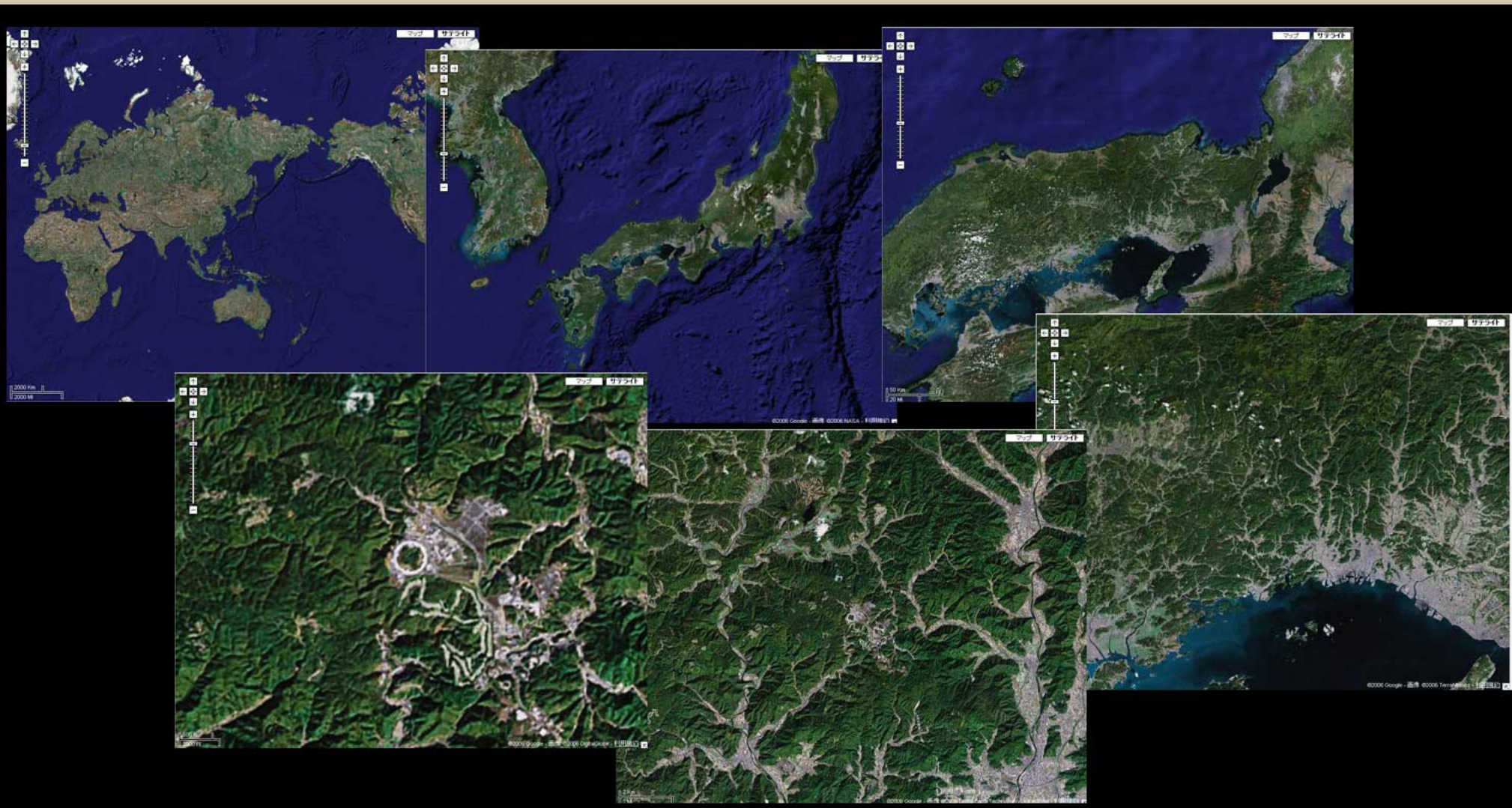
First Lasing at SCSS Test Accelerator

Tsumoru Shintake & SCSS-XFEL Team

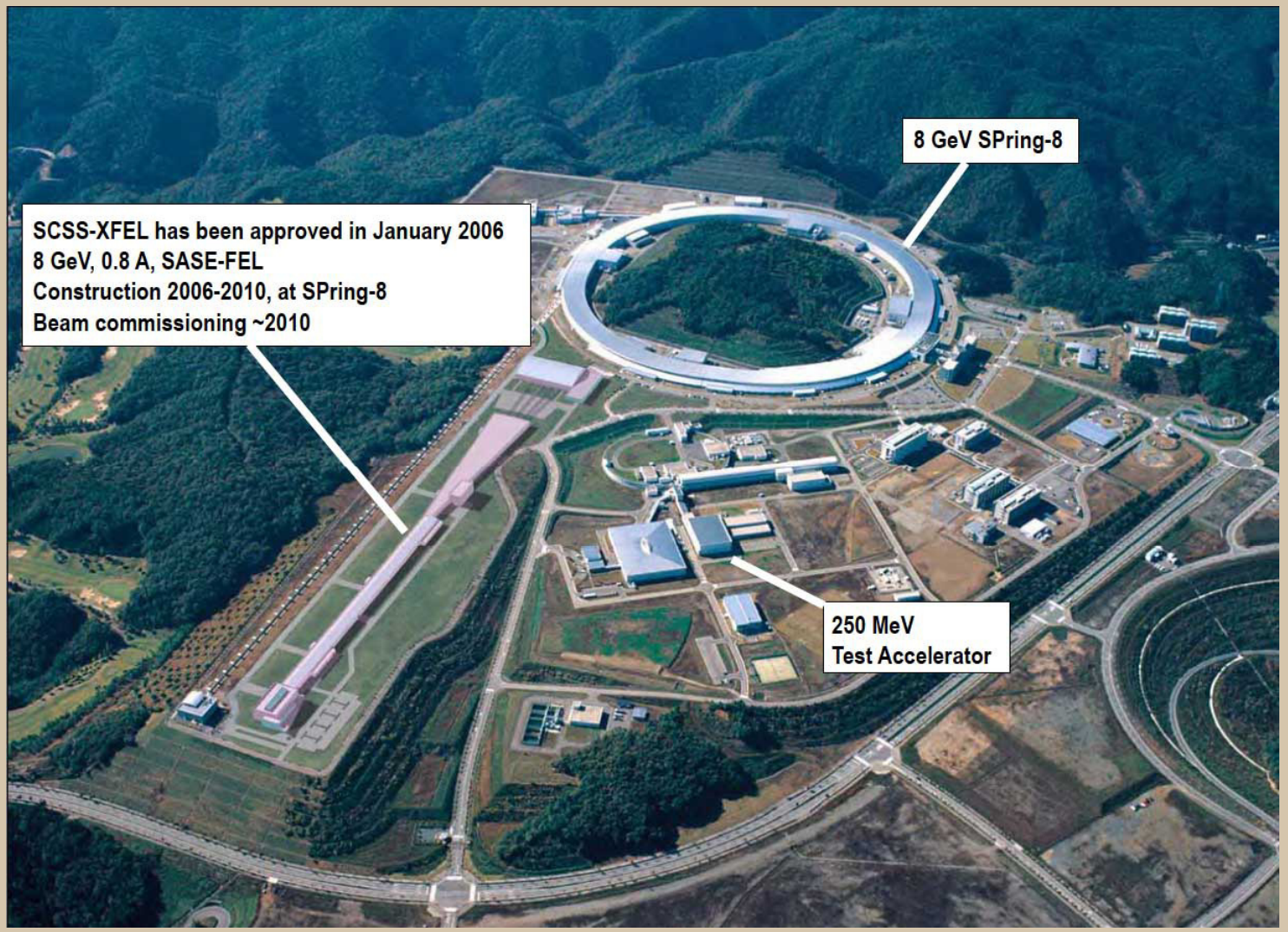
RIKEN/SPring-8, Japan

- ***First observation of SASE signal at 49 nm*, *in SCSS Prototype Accelerator, June 20~, 200***

Where is SPring-8?



XFEL Project at SPring-8/RIKEN

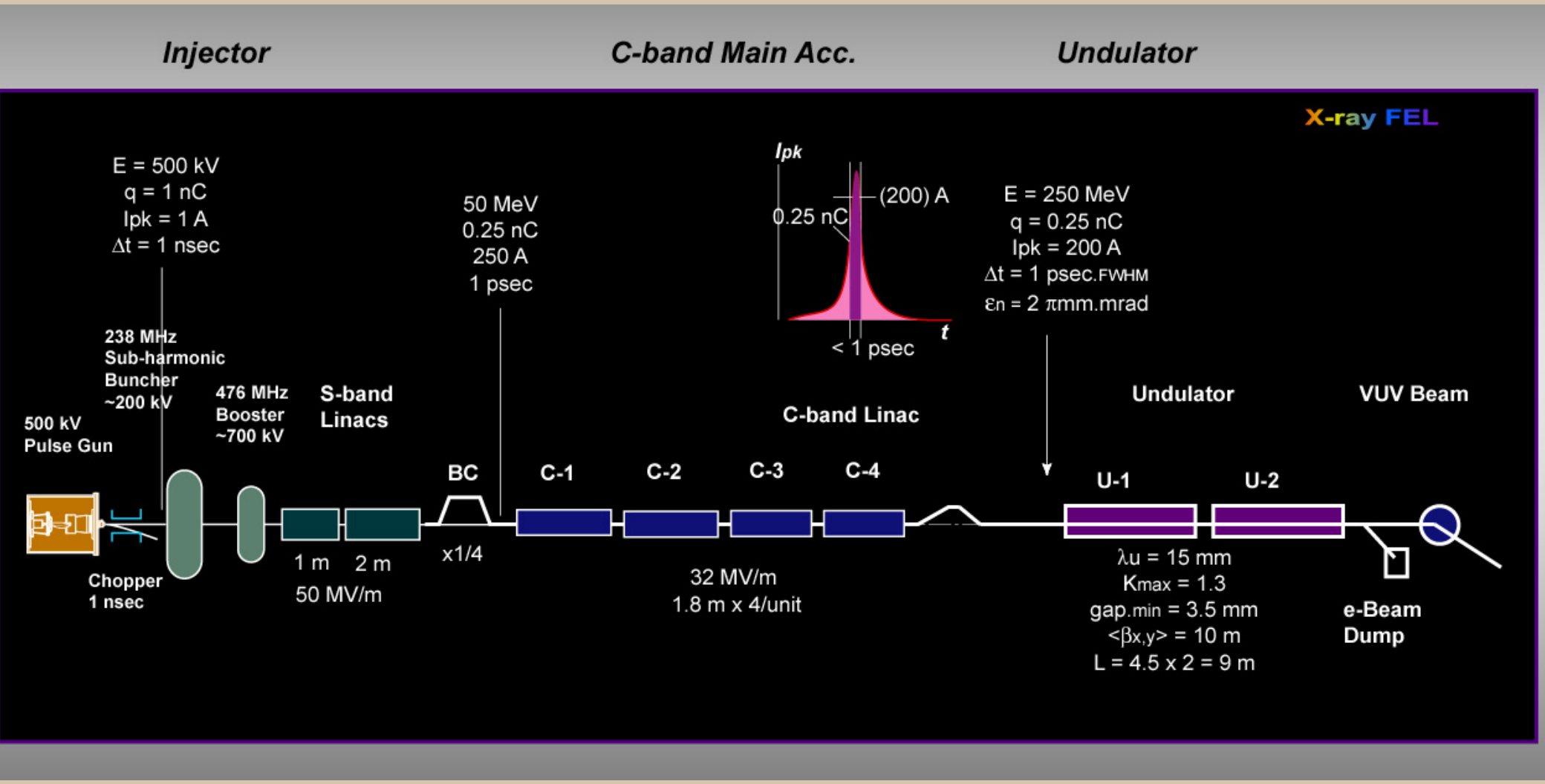


SCSS Test Accelerator

- C-band Accelerator
- 50 MW Klystron x 2
- Acc Structure 1.8 m x 4
- 250 MeV

- Undulator 4.5 m x 2 unit
- 15 mm period
- 4 mm gap

Test Accelerator Layout



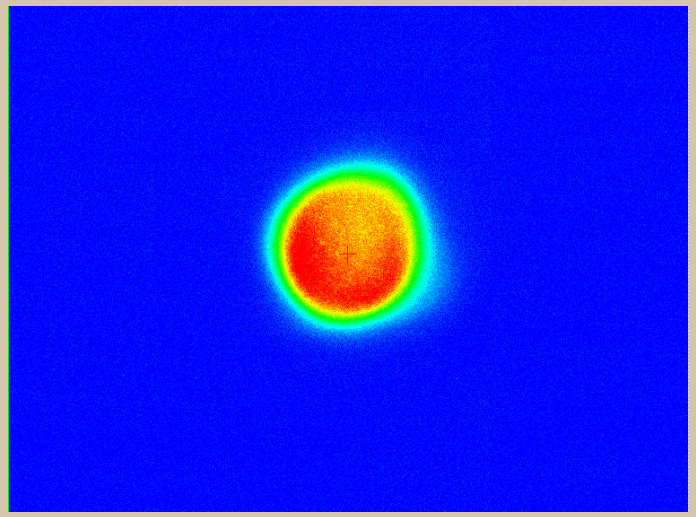
SCSS & X-ray FEL Beam Parameter

at undulator section

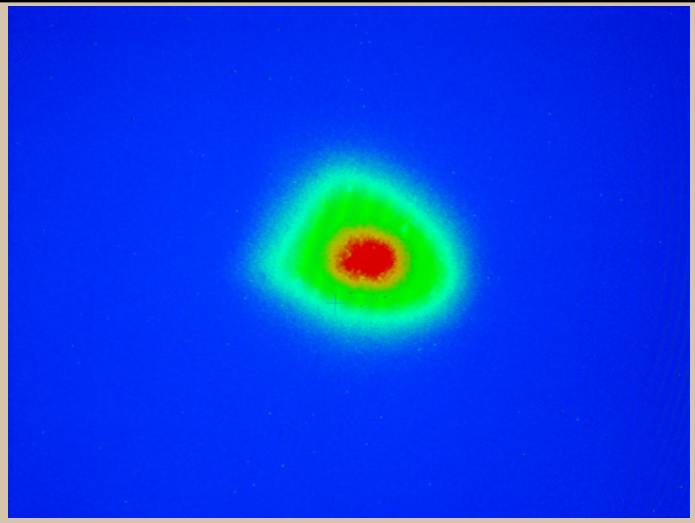
		Prototype	X-ray FEL	
Beam Energy	E	0.25	8.0	GeV
X-ray Wavelength	λ	60	0.1	nm
Beam Emittance	ε_n	2	1.0	πmm.mrad
Bunch Length	Δz	100	100	μm
	FWMH	0.3	0.3	psec
Transverse Beam Size	$\sigma_{x,y}$	100	25	μm
Peak Current	I_p	1	3	kA
Charge per bunch	q	0.3	1	nC
Undulator Parameter	λu	15	18	mm
	K	1.3	1.3	
Length	L	10	80	m
FEL Saturation Length	L_{sat}	20	60	m

CeB_6 Thermionic Gun provides stable beam.

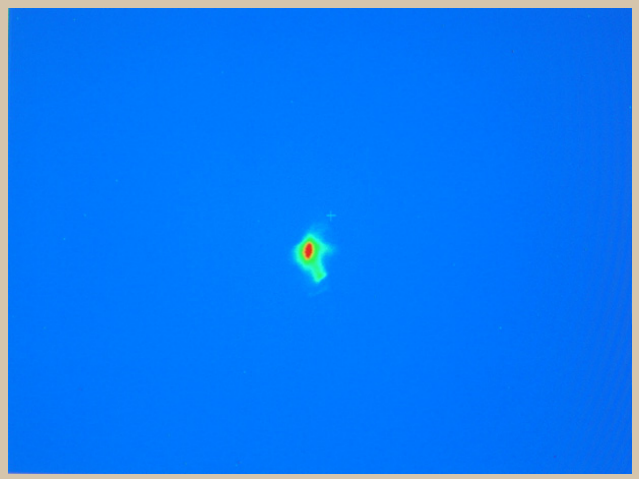
Beam Profile
CCD Image
Scale 10 mm



500 kV Gun



50 MeV Injector Out

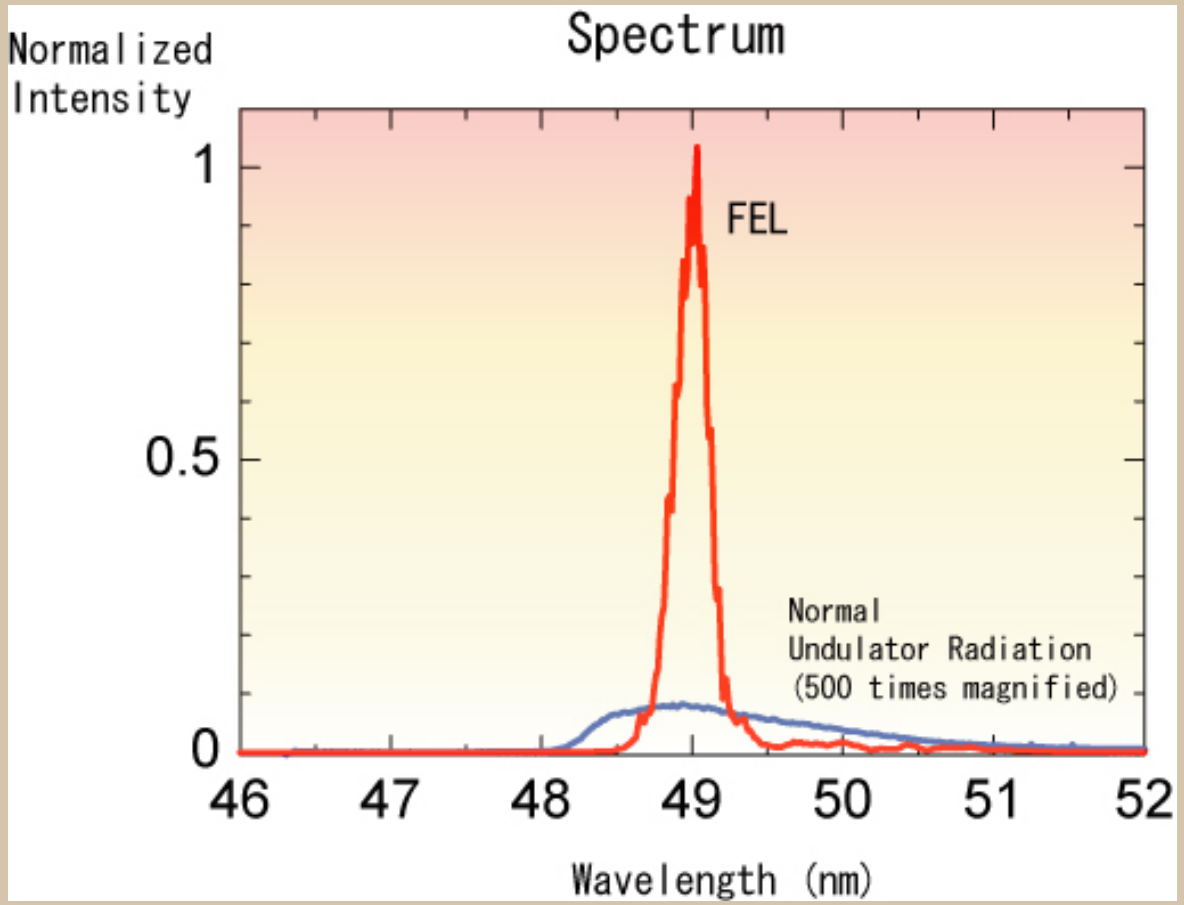


250 MeV Compressor

Undulator Input

Undulator Output

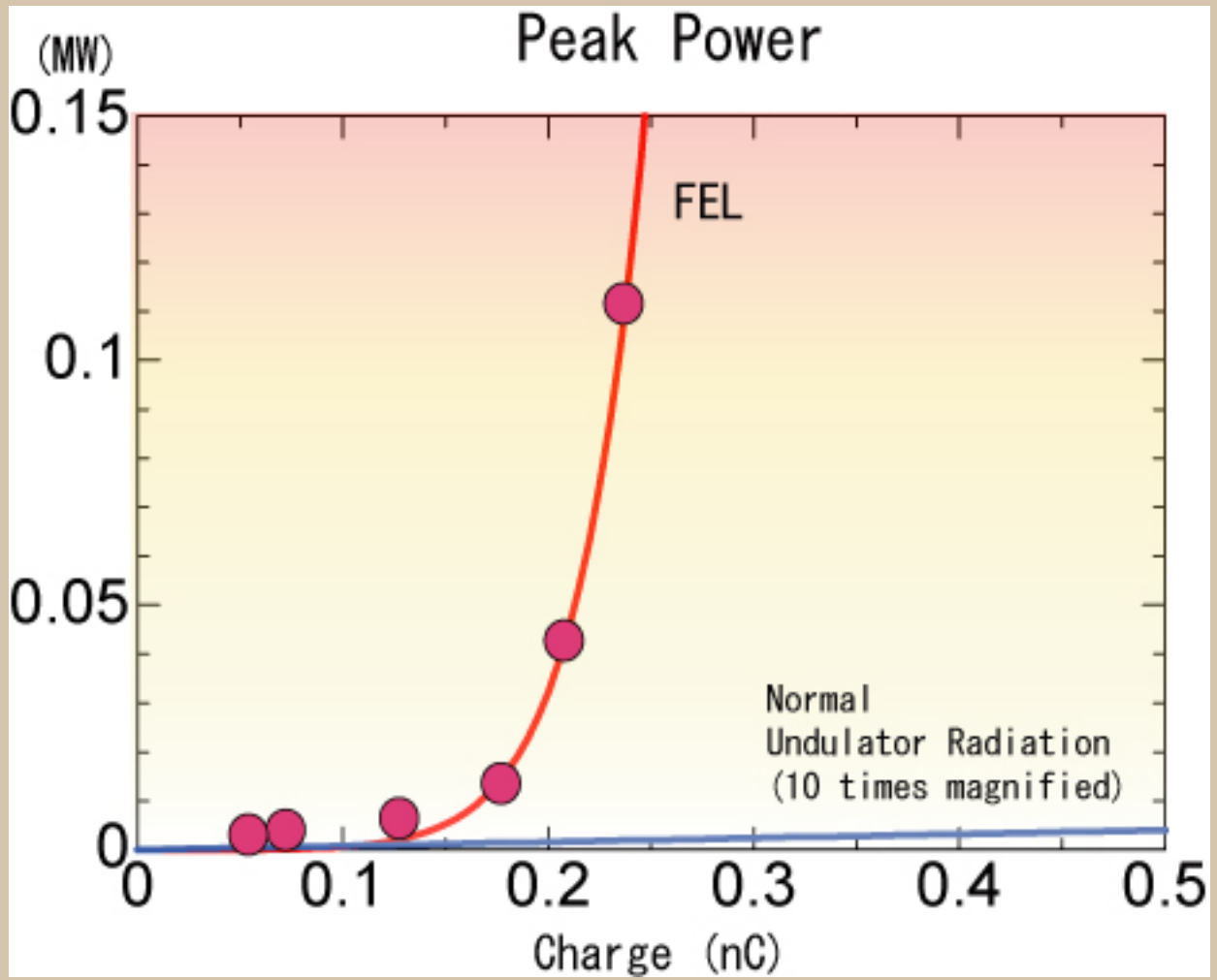
First Lasing at SCSS Prototype Accelerator.



- **The first lasing: 49 nm**
- **E-beam energy : 250 MeV**
- **Bunch charge: 0.25 nC**
- **Bunch length: (< 1 pse)**
- **Peak Current (> 300 A)**

- **At moment spectrum width 0.5 nm is dominated by e-beam energy fluctuation ~ 0.2%.**

First Lasing at SCSS Prototype Accelerator.

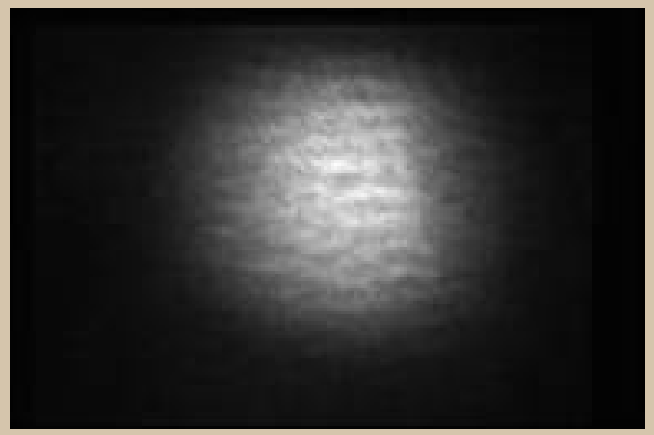


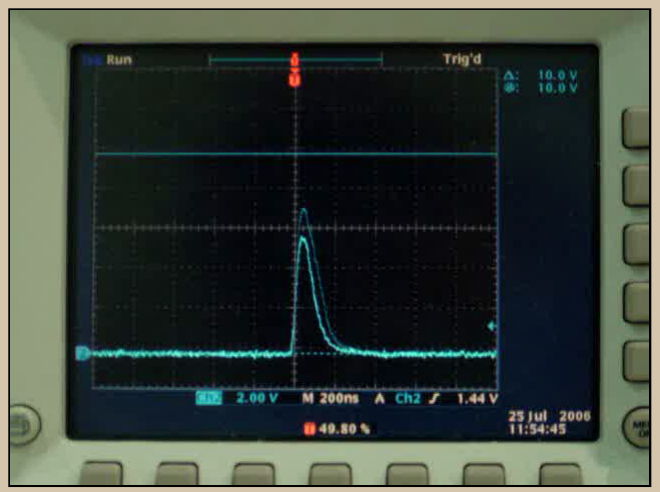
- **The first lasing: 49 nm**
- **E-beam energy : 250 MeV**
- **Bunch charge: 0.25 nC**
- **Bunch length: (< 1 pse)**
- **Peak Current (> 300 A)**

- **Laser pulse length has not yet measured, (will be ~ 100 fsec).**
- **Peak power estimation assumed 1 psec width.**

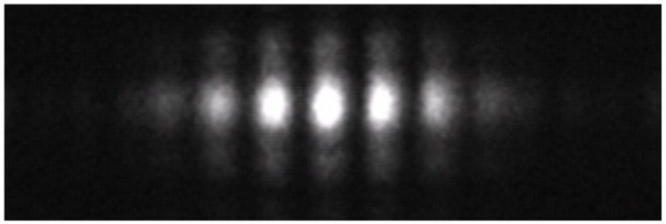
SASE Beam Profile and Interference Fringe

- **SASE Beam**
- **Diameter 1 mm**

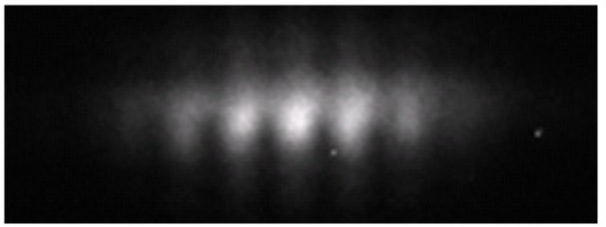




- **Double Slit**
- **Width 100 μm, Separation 400 μm**



SASE
(1 shot, bunching condition)



Spontaneous radiation
(debunching condition, 100 shots)

First Lasing at SCSS Prototype Accelerator.

June 15, 2006

Thank you very much!