GLCTA / C+X Option

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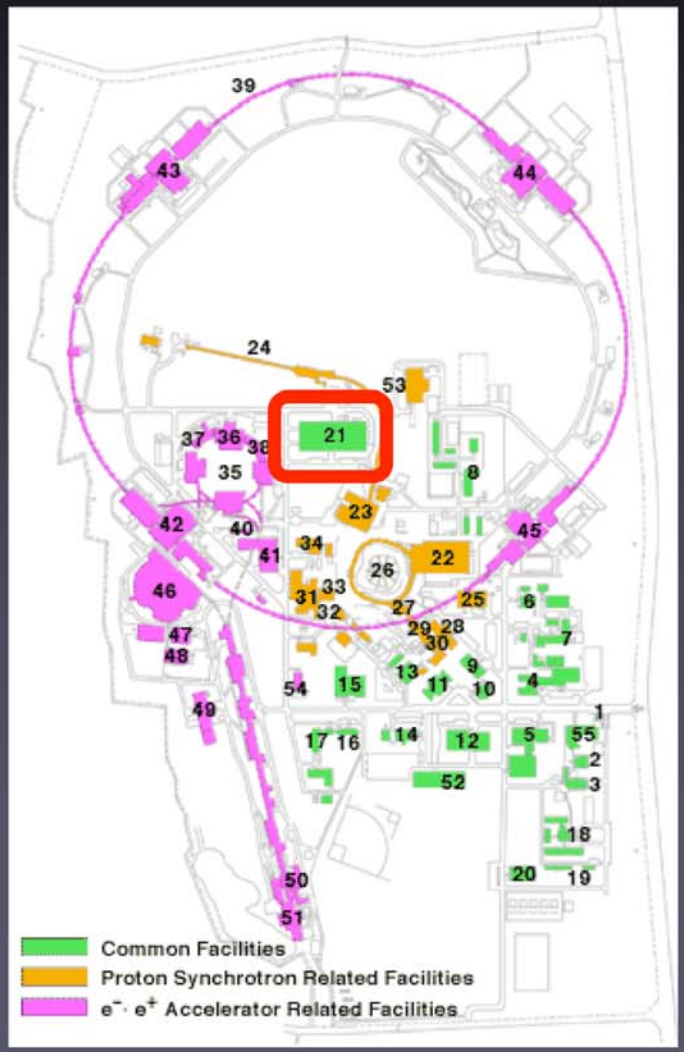
1. GLCTA : Introduction

What is GLCTA

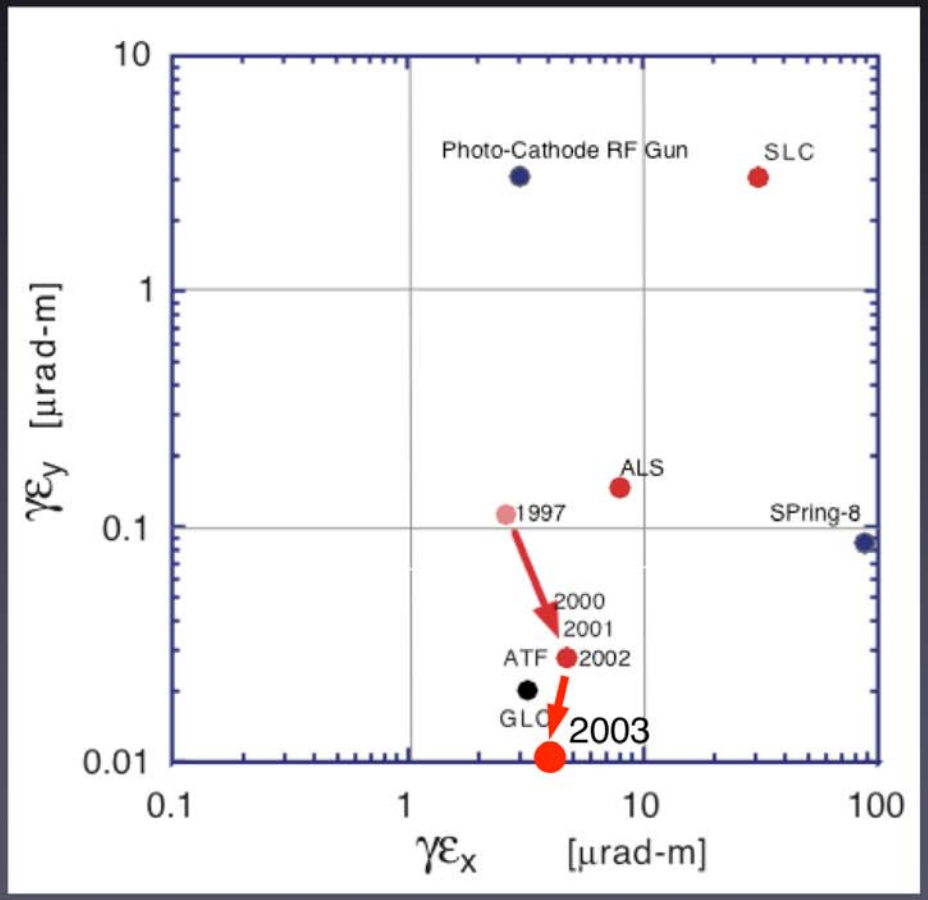
- GLC Test Accelerator
- Test station for high-power components & structures
- Demonstrating GLC accelerator

Where is GLCTA

- KEK Assembly Hall
- Same as ATF
  - Very low emittance beam at hand



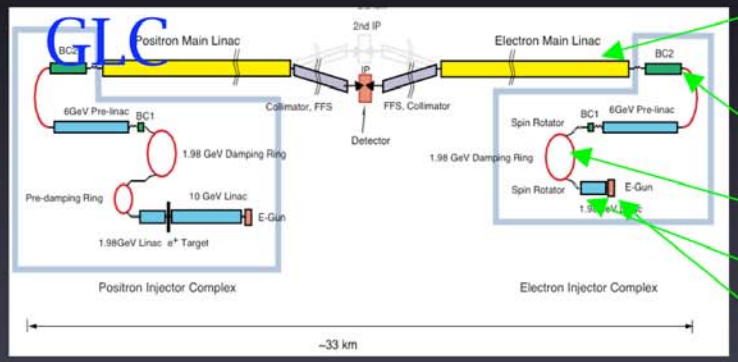
ATF -> GLCTA



Yokoya @6th ACFA WS

- ATF provides ultra low emittance "GLC-like beam"
- Real demonstration
  - ATF : injector
  - GLCTA : main linac

ATF -> GLCTA



"GLC Project"
KEK Report 2003-7

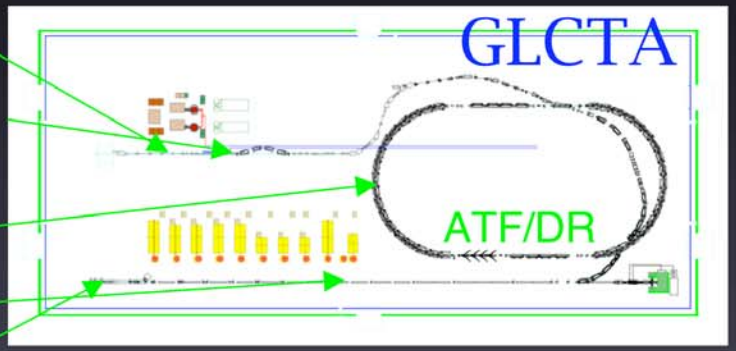
Acc. Structure

Bunch Compressor

Damping Ring

Linac

e-Gun



- GLC electron injector complex

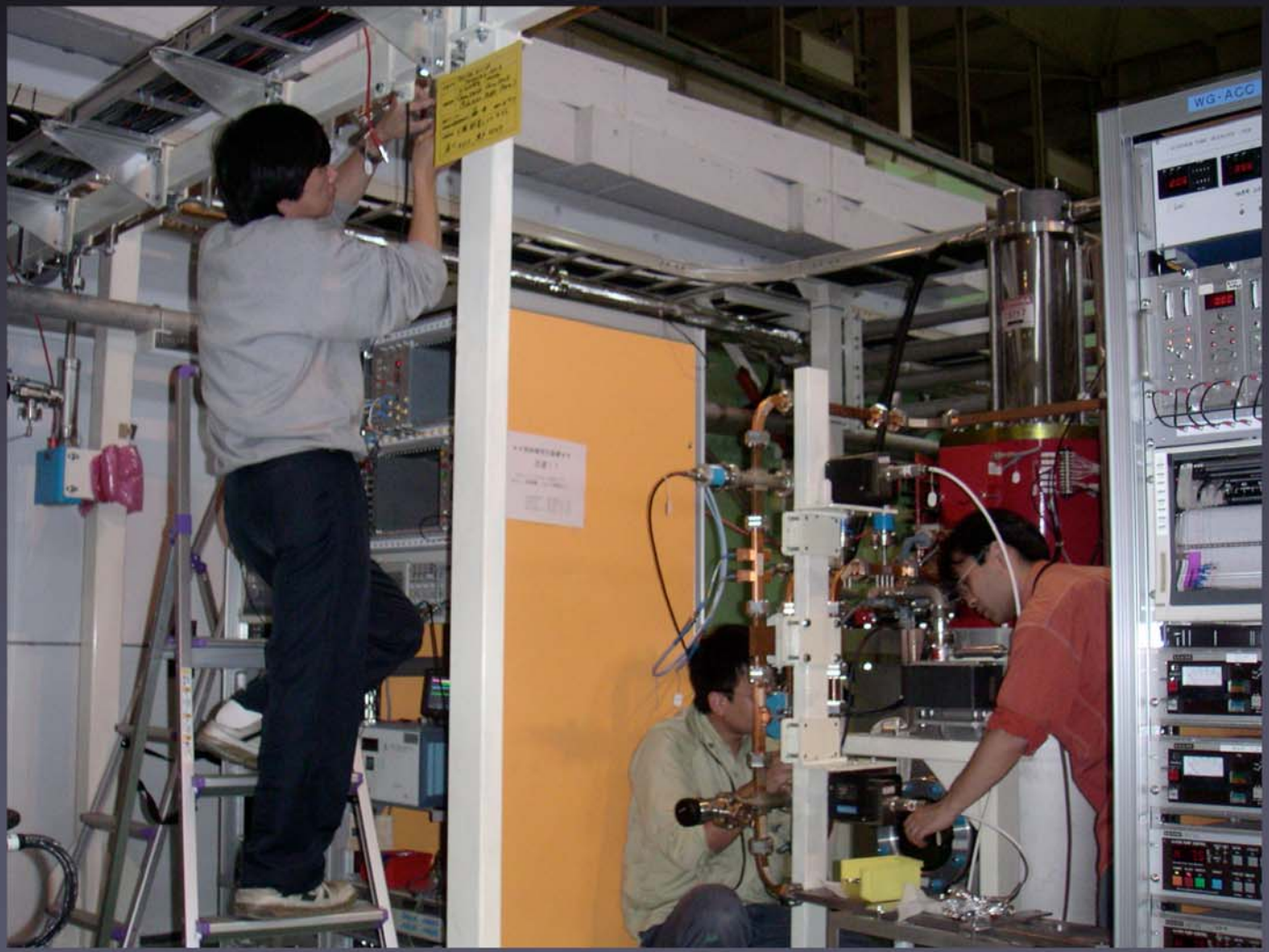
+

- GLC 1/5,000 of main linac

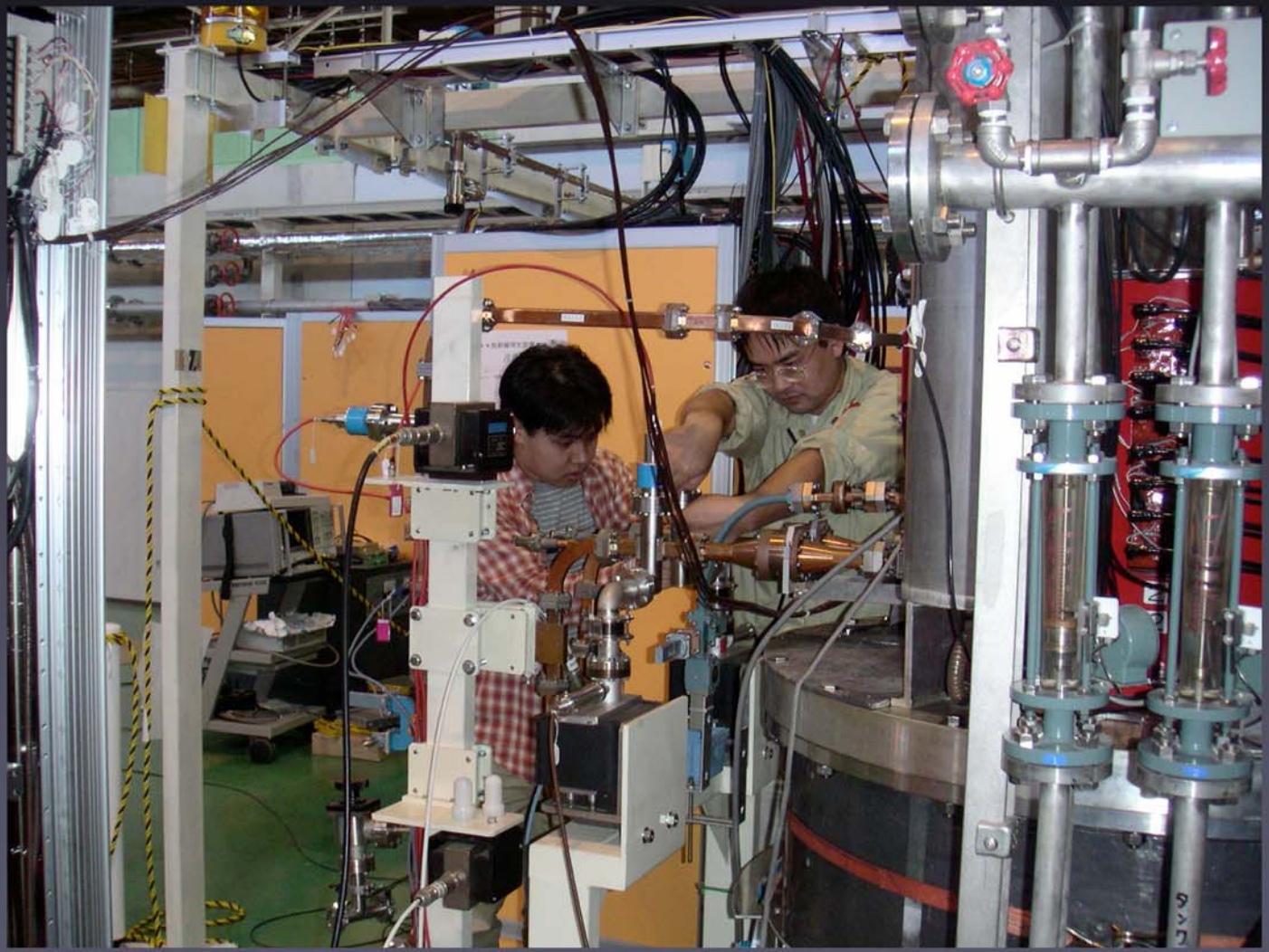
Realistic demonstration of GLC accelerator

2. GLCTA : Current status
- slideshow-

Construction/power source

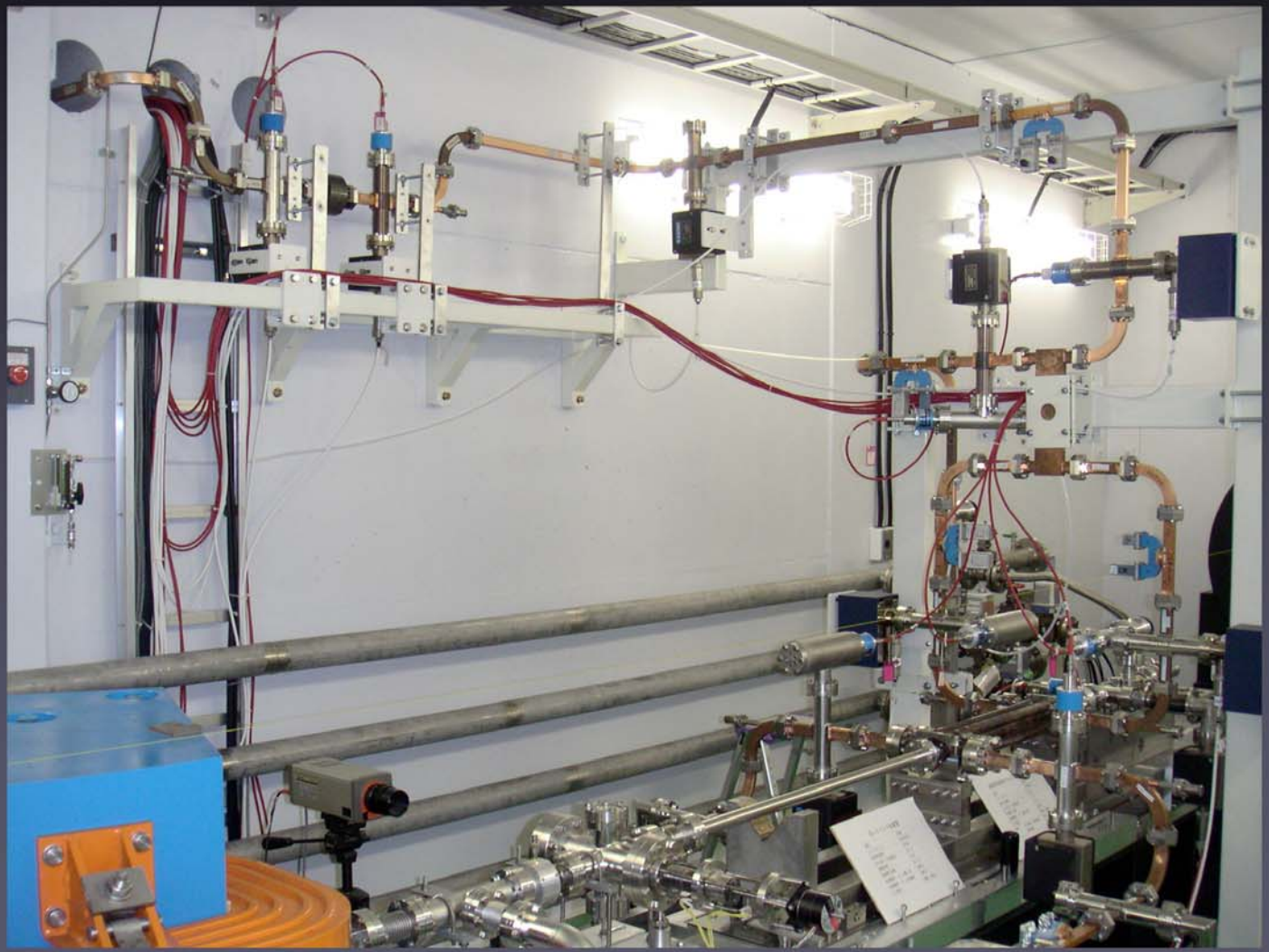


Construction/power source

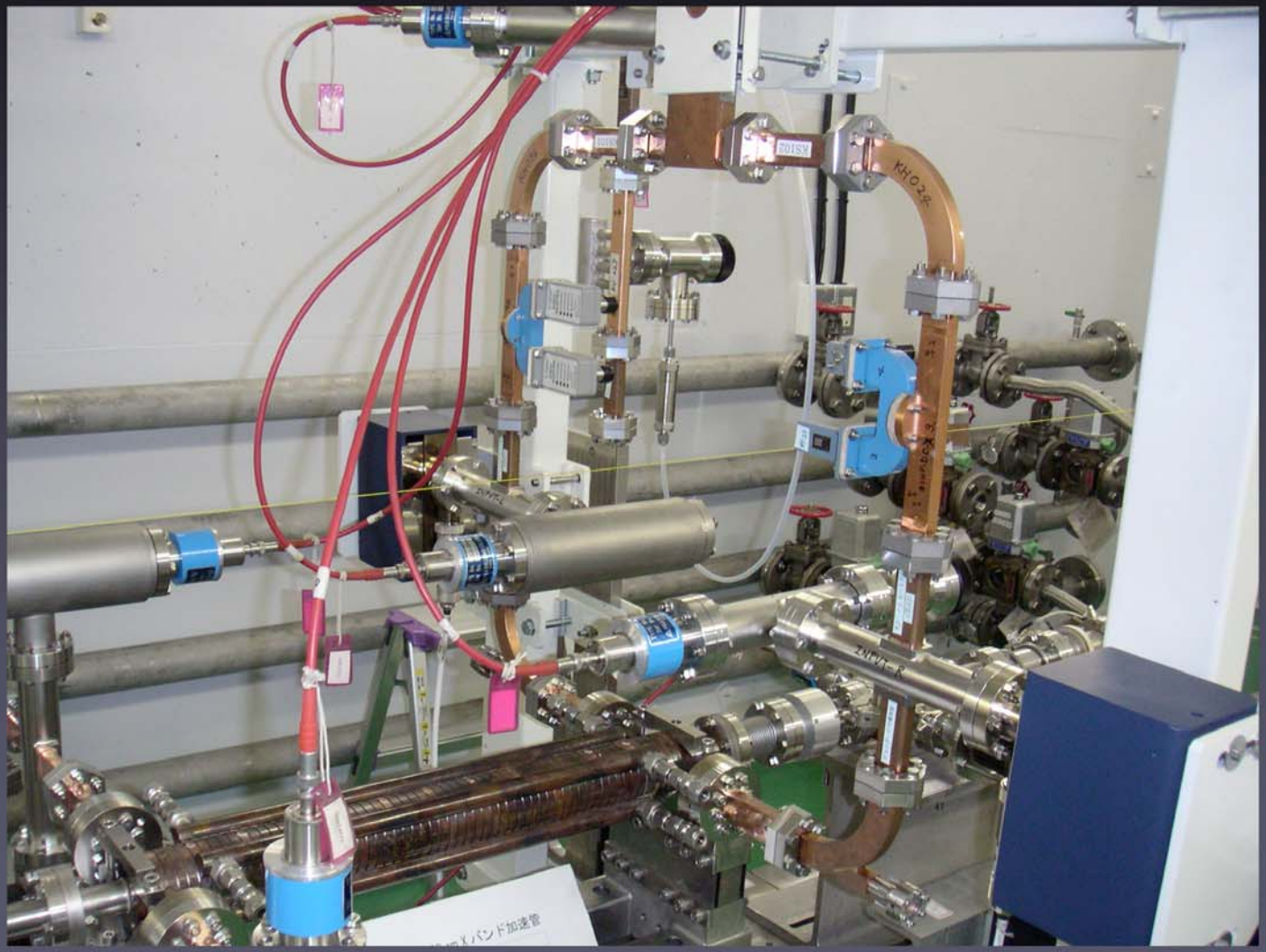


Construction/acc. structure

Inside shield

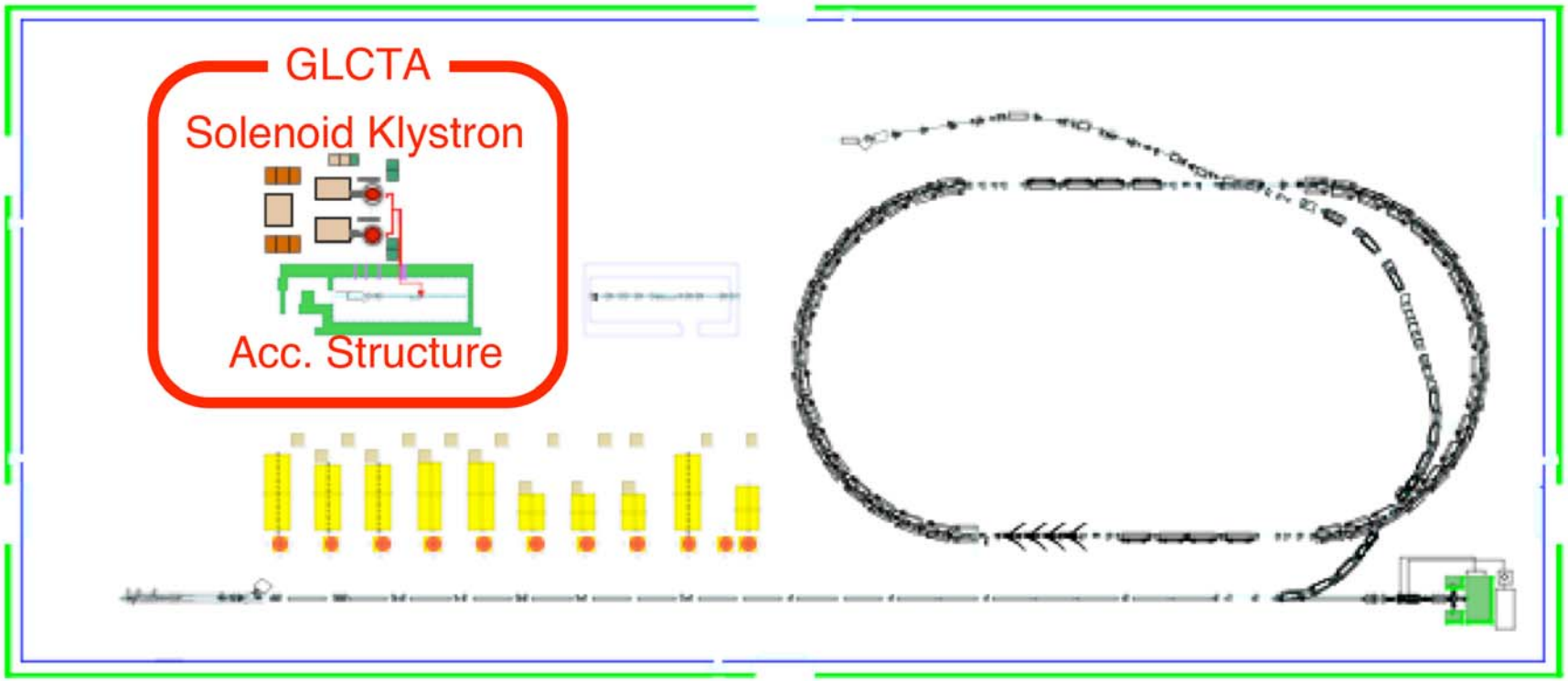


Accelerating structure



Control room

GLCTA 2003-



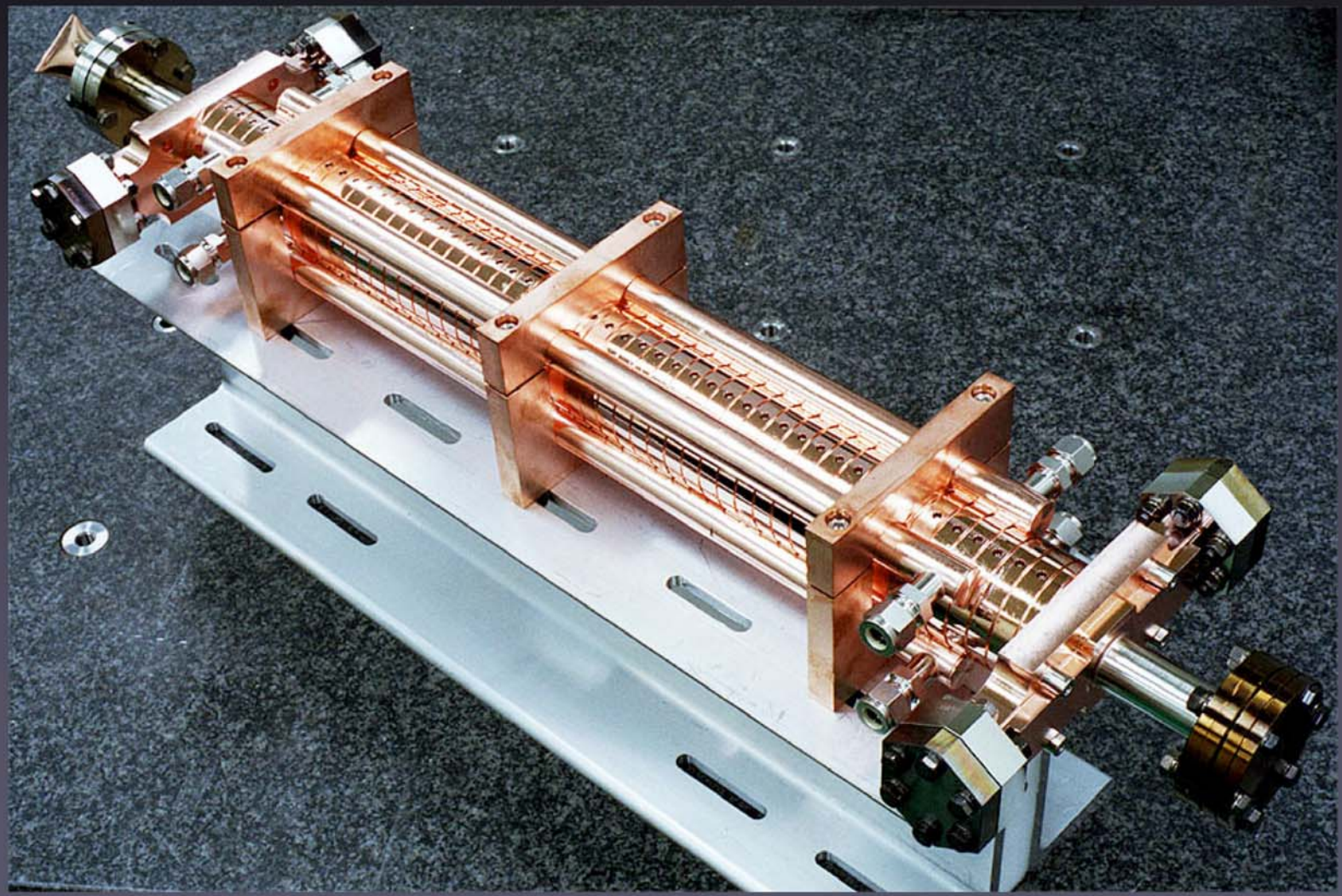
October 1, 2003

Ready for operation

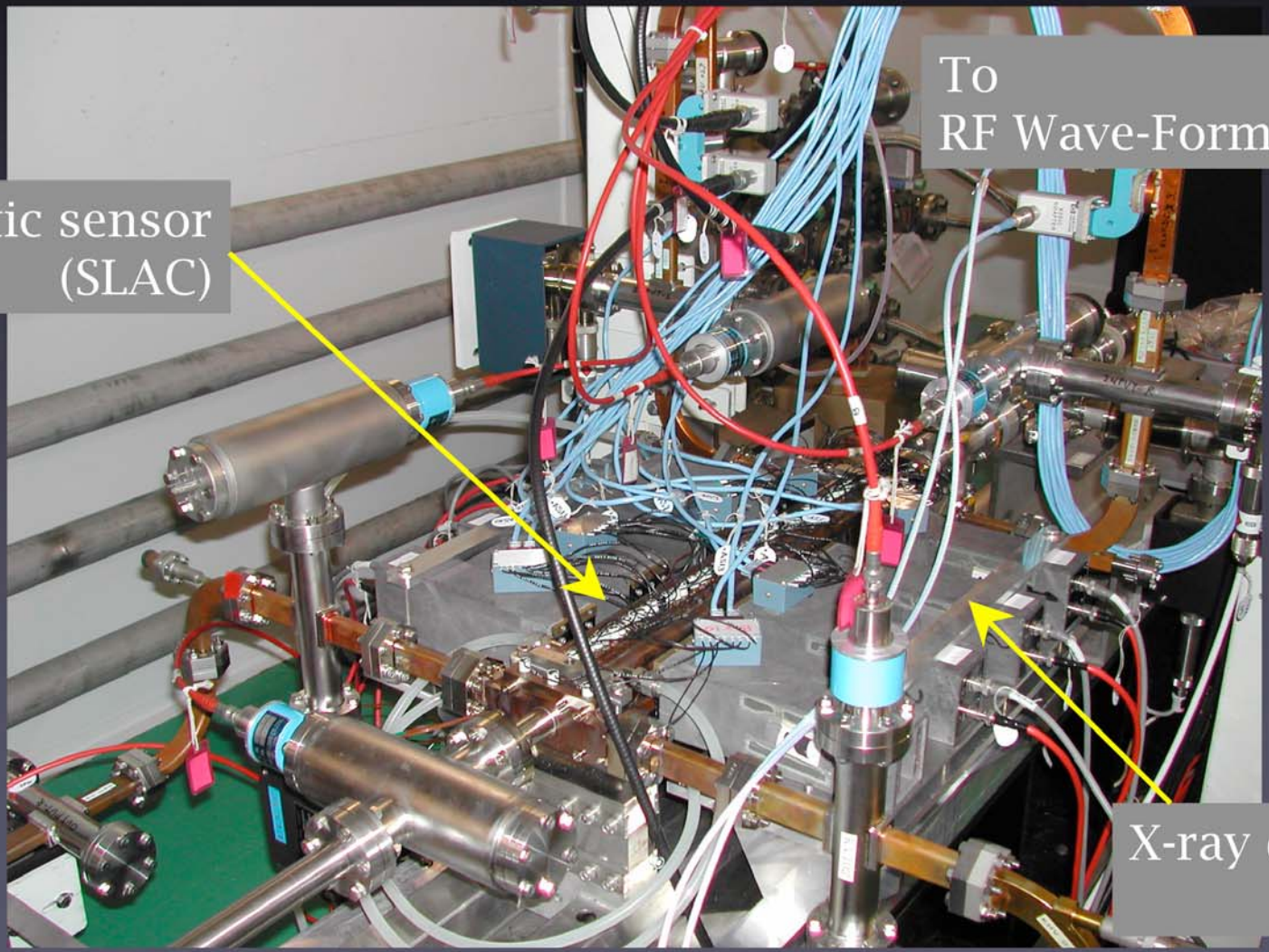
Last 1/2 year

- 10-years old modulators, klystrons, wave guides are waking up.
- Conditioning
- Moving to experiments

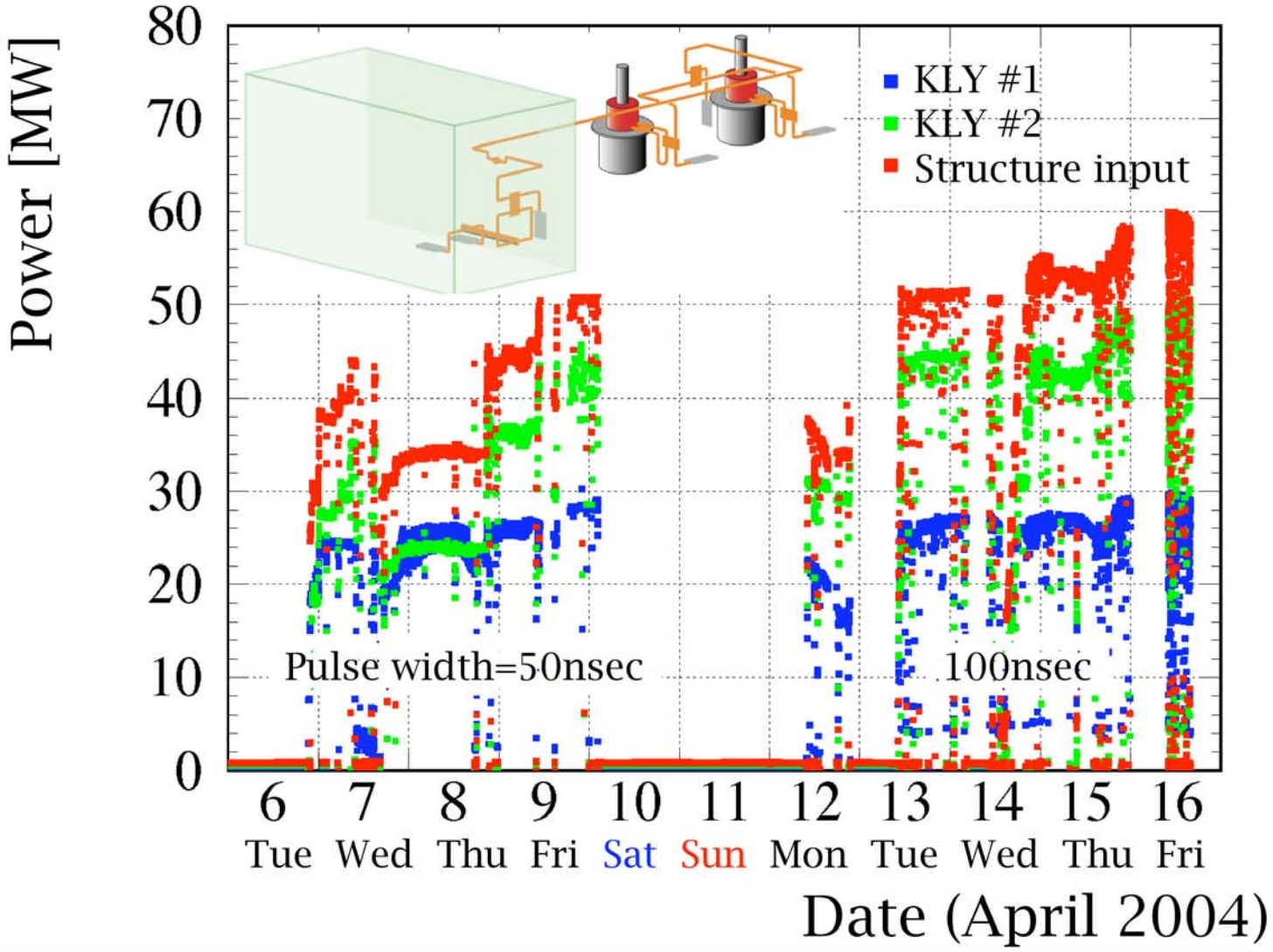
New Accelerating Structure



… was installed

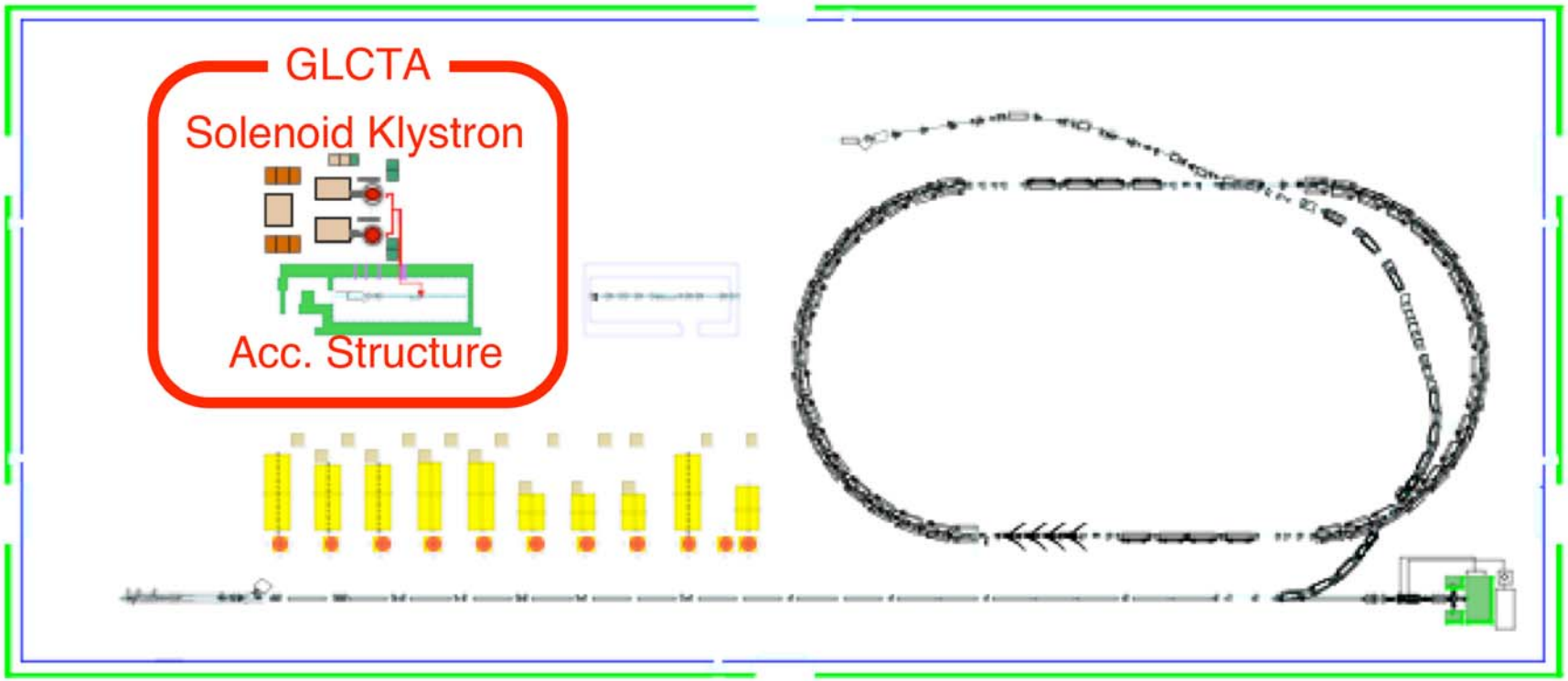


Conditioning

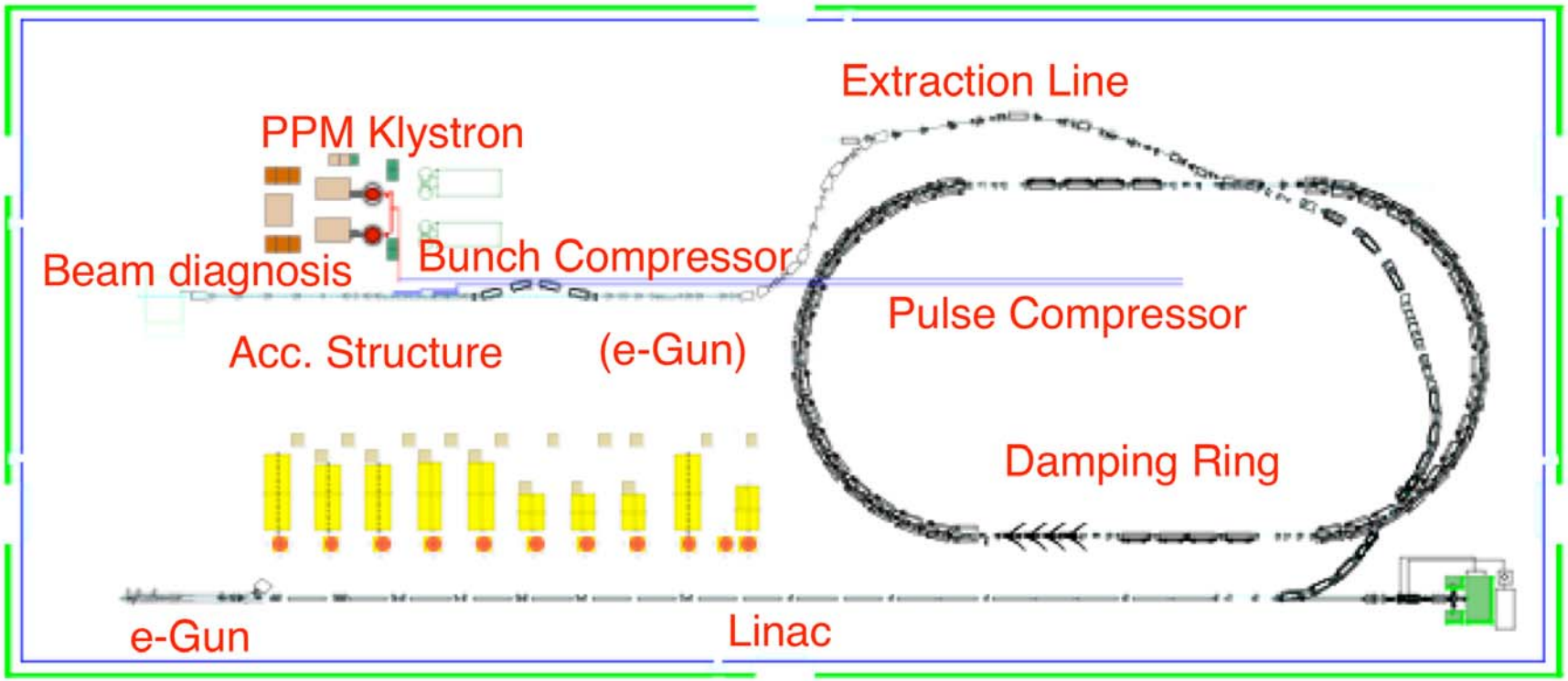


3. GLCTA : Future prospect (example)

2003



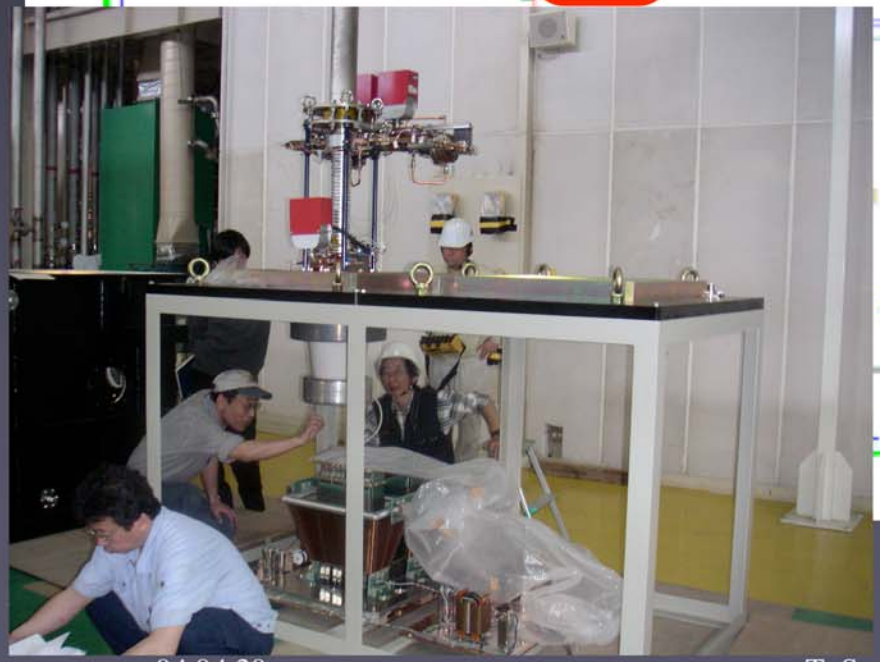
2006



Realistic demonstration of GLC accelerator

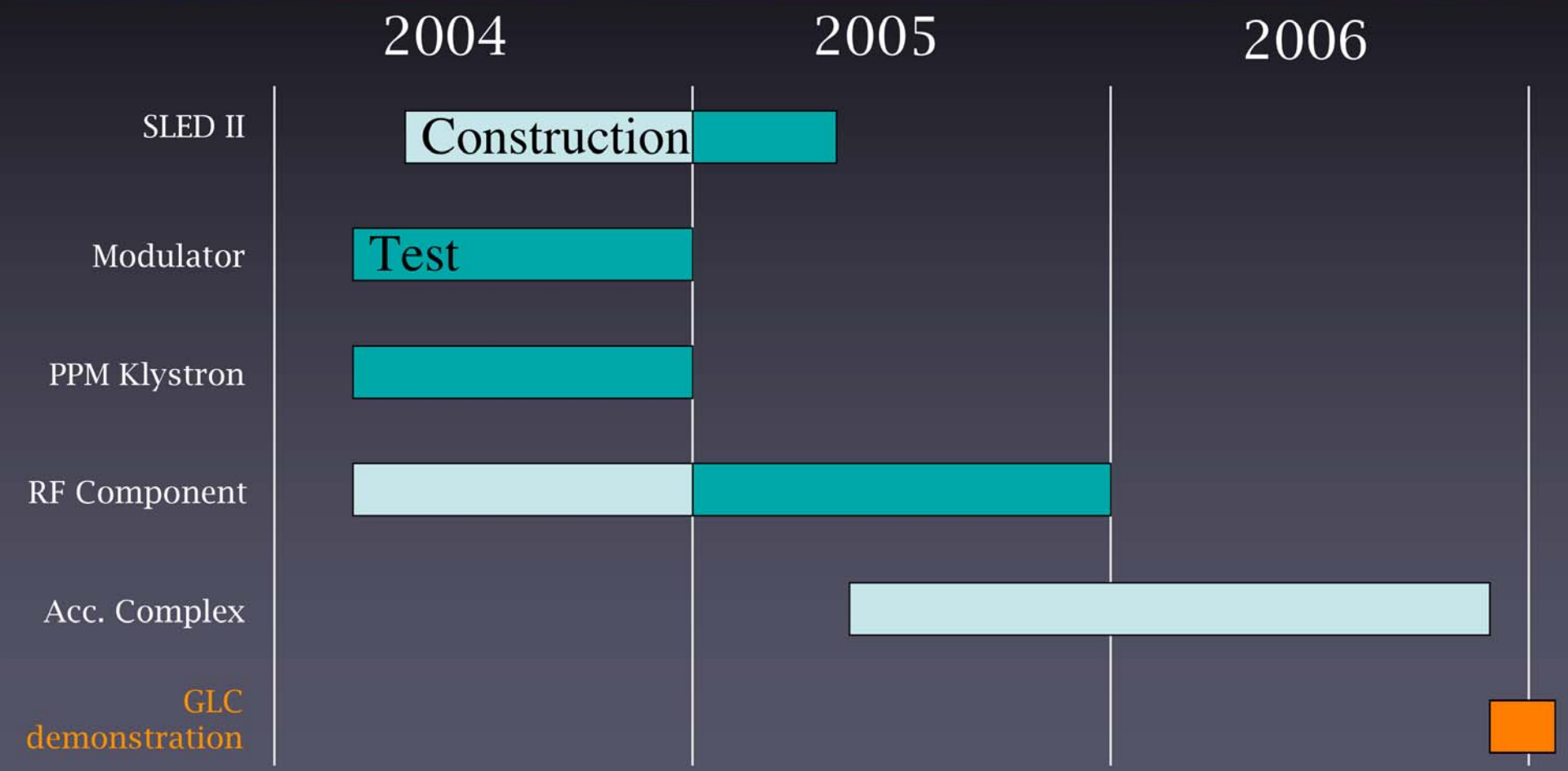
Right Now

Modulator PS



PPM Klystron

Schedule (example)



Warm cavity developed in Japan

	X-Band	C-band
RF Frequency	11.424 GHz	5.712 GHz
Wave Length	26.2 mm	52.5 mm
Developed as	“Main Stream”	“Back-up”

KEKB Injector

On October 10 (2003), Electron/Positoron Injector Linac group successfully accelerated electron beams using a C-band accelerator section with an acceleration field of 40MV/m …

Success of Electron Beam Acceleration Using a C-band Accelerator Module !

On October 10, Electron/Positron Injector Linac group successfully accelerated electron beams using a C-band accelerator section (5712MHz, 1m long) with an acceleration field of about 40 MV/m, which is twice as high as the current operational value. This result has demonstrated that the same acceleration energy as gained by presently-used accelerator structures (2856MHz, 2m long, 20MV/m) is obtainable by C-band structures at half length.

Since FY2002, the Linac group has been focusing on R&Ds of miniaturization and efficiency of electron linacs, regarding energy upgrade and stabilization of the Injector Linac. This is the first significant outcome and this technology is expected to be applied to upgrading of high-energy linacs and to miniaturization of linacs for medical or industrial purpose.

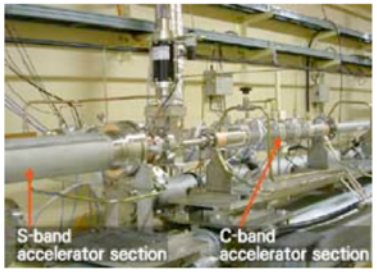


Fig. 1 : One-meter C-band accelerator section installed in the fourth unit of the fourth sector (44) at Electron/Positron Injector Linac (the right-side from the center). The left-side is an upstream direction, where part of 2-m S-band accelerator section (43) is also seen. The first measurement of the acceleration gain of the C-band accelerator section was successfully carried out, while the C-band accelerator section is now used to accelerate an electron beam for PF/AR(photon factory ring) as well. Several acoustic sensors are attached on the acceleration section in order to pinpoint the break-down location by detecting the vibration signal generated on the occasion of break-downs.

Fig. 2 : High power C-band (5712MHz) rf system. (A) Compact pulse modulator for klystron (350kV, 310A, 2*m*sec. (flat top), 50Hz). (B) 50 MW high-power klystron (Toshiba E3748) assembly. (C) Waveguide to the C-band accelerator section.

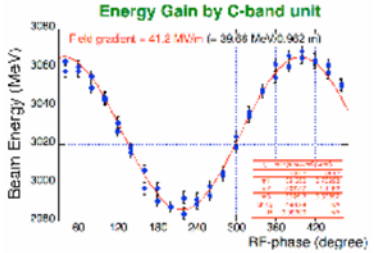
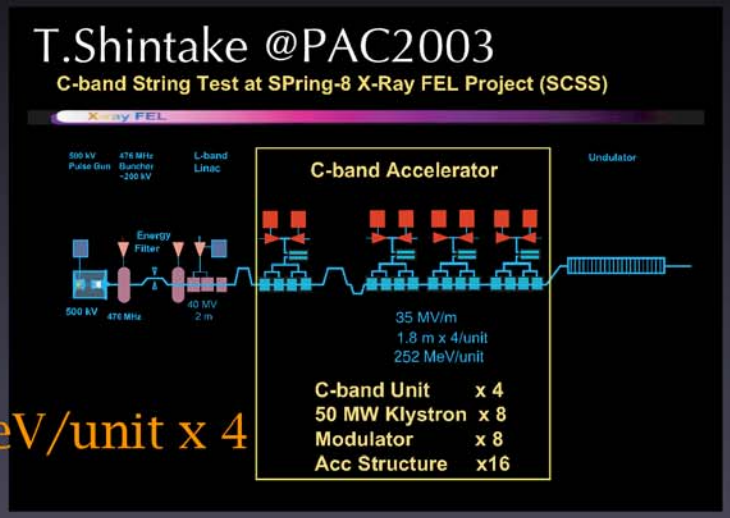


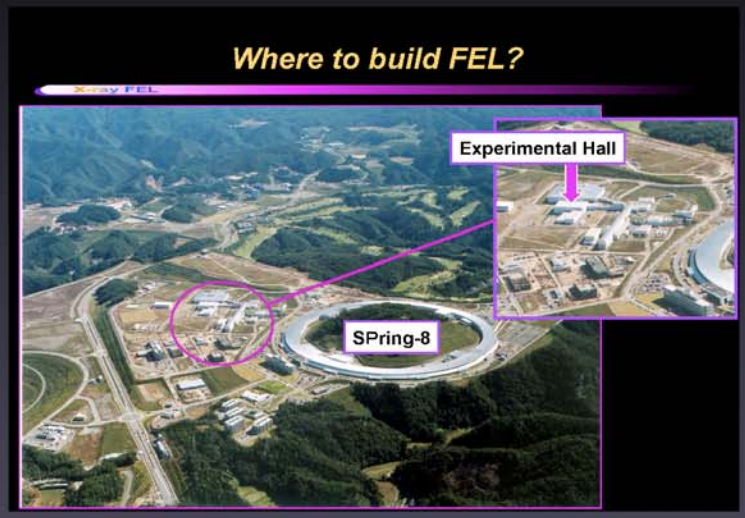
Fig. 3 : First measurement of the acceleration gain in the 1-m C-band accelerator section. Beam energy variation was observed at the end of the linac by changing rf phases, giving an acceleration gain of 41.2MV/m, which is almost the design value.

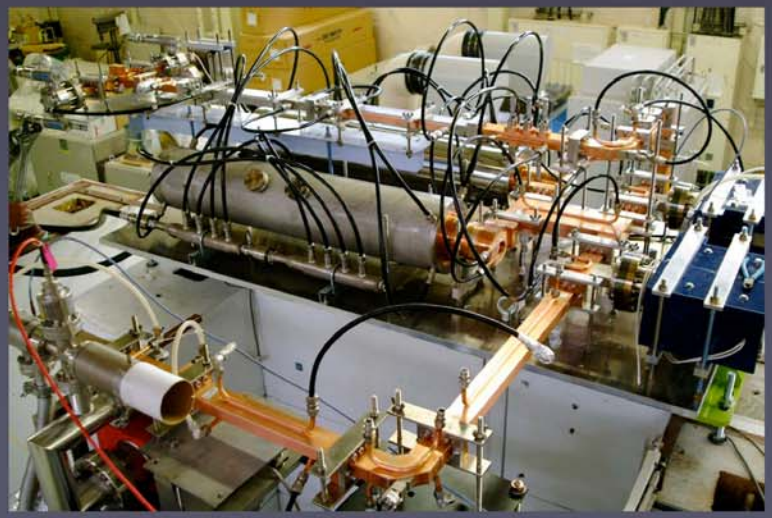
Oct. 16. 2003

SPring-8 Compact SASE Source



252MeV/unit x 4





http://www-xfel.spring8.or.jp

4. C+X option

Start with …

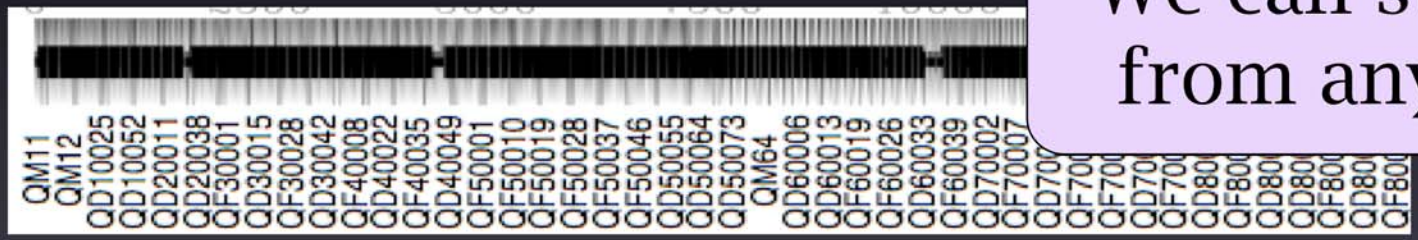
C-band has nice feature for LC beginners.

$\lambda_C > \lambda_X$

- Less severe fabrication
- Less severe alignment

Possible Scenario C, C+X, X

We can start from any phase



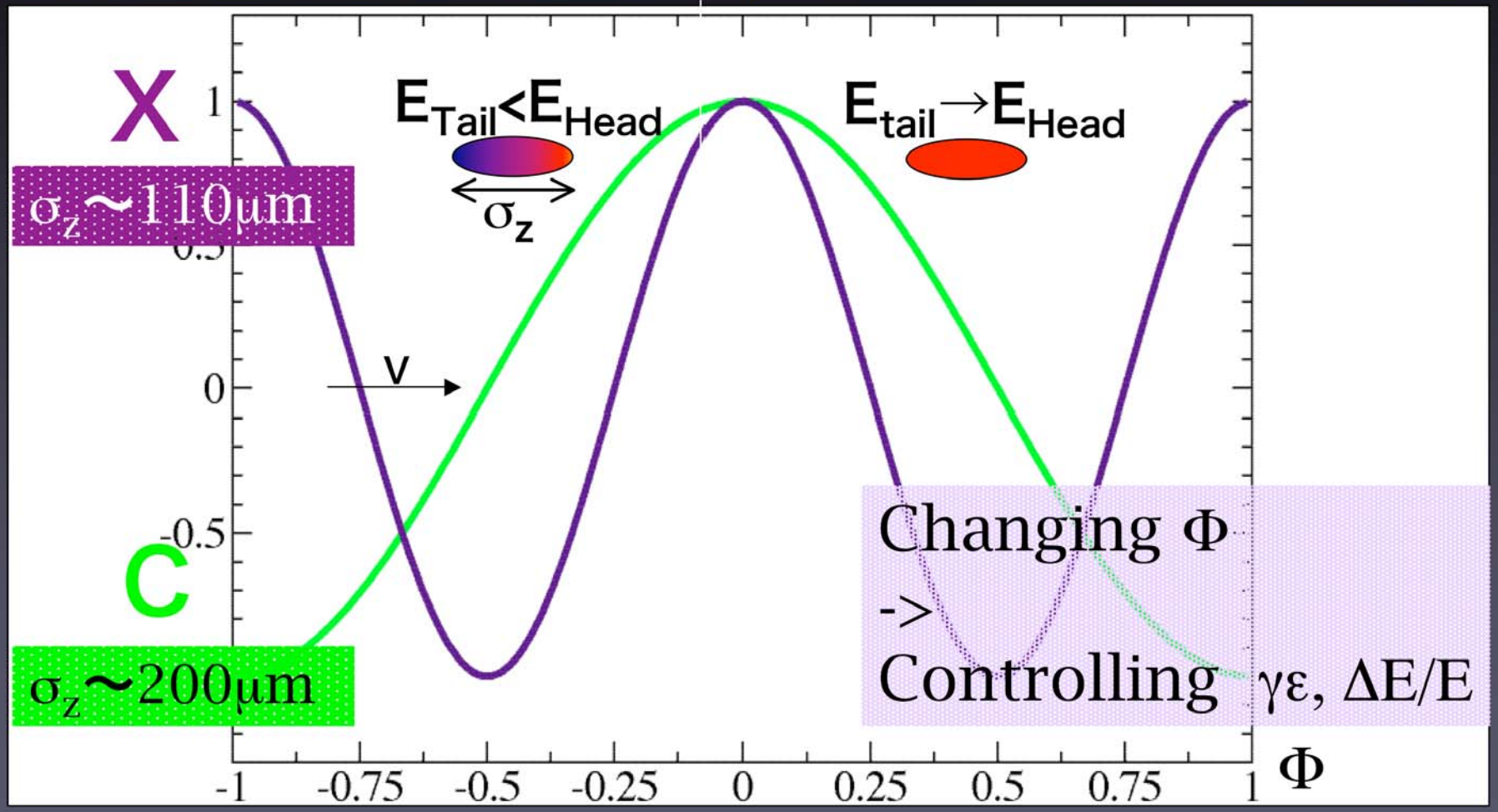
400GeV

800GeV

1TeV

1.25TeV

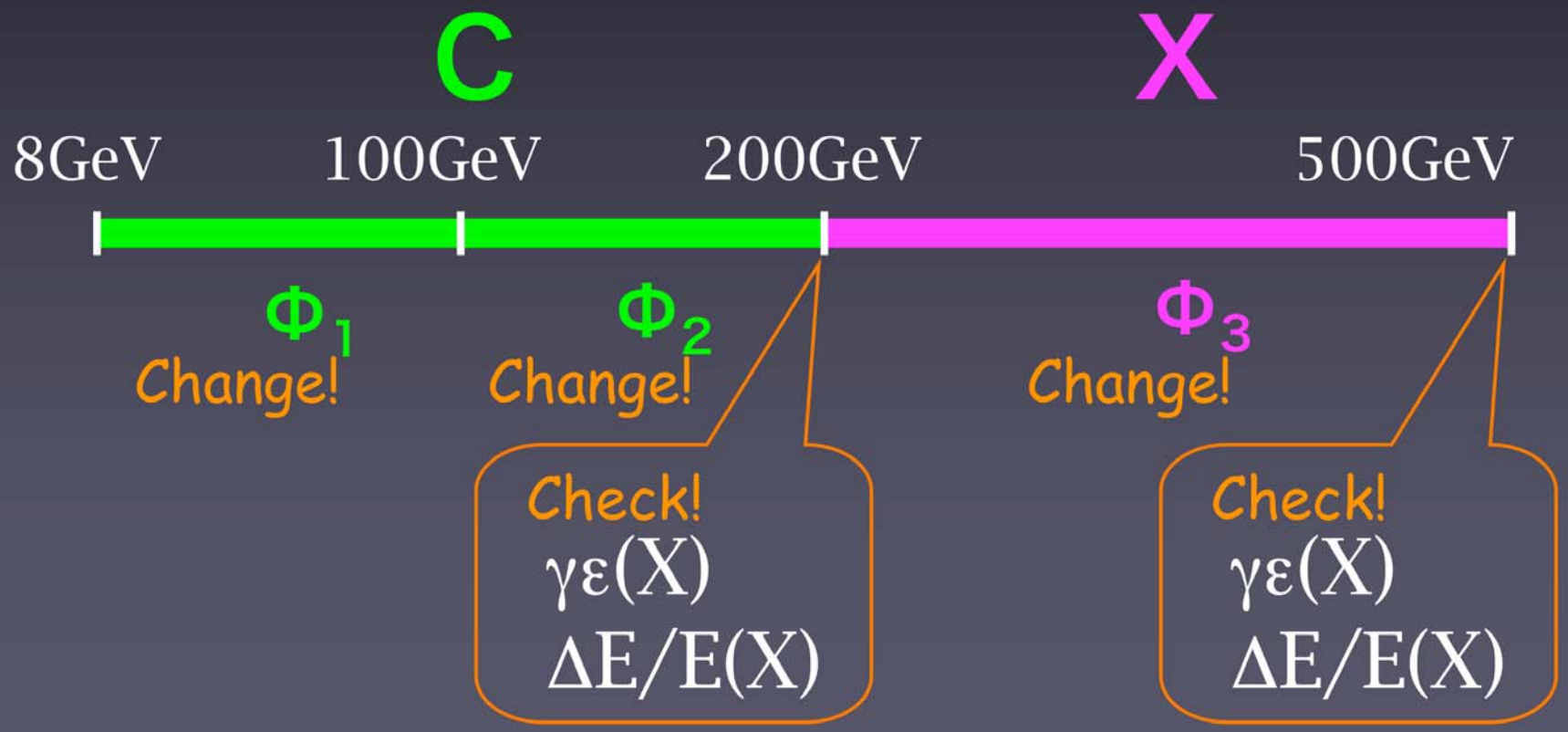
RF λ & Bunch Length σ_z



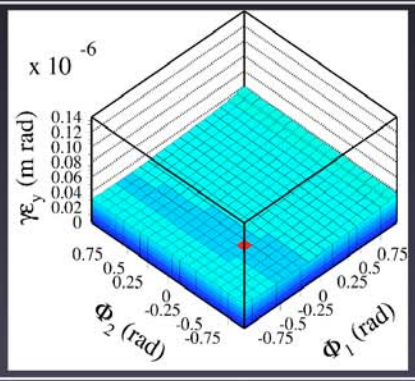
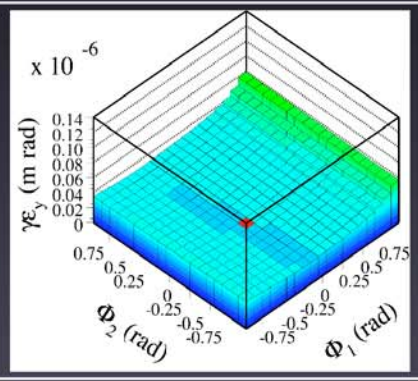
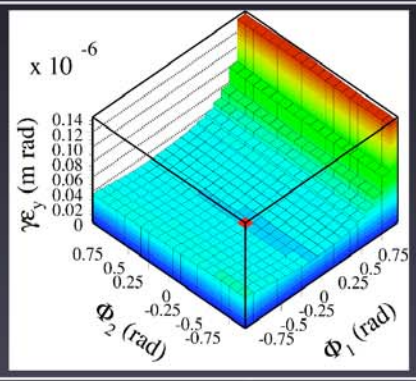
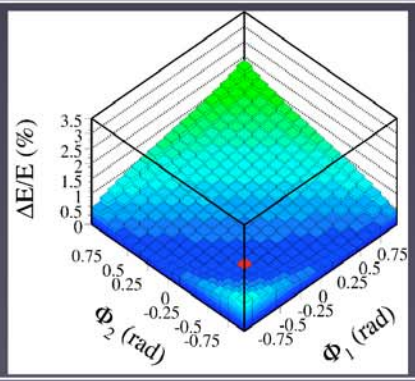
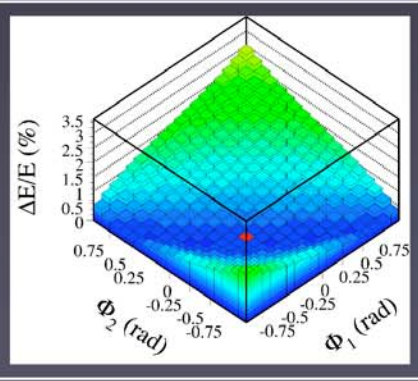
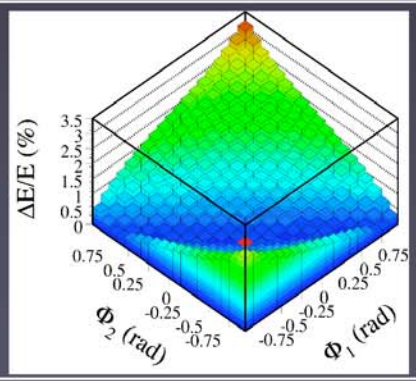
$\lambda_C = 2\lambda_X$ Optimum Bunch Length? In C+X

Optimization σ & Φ (SLEPT)

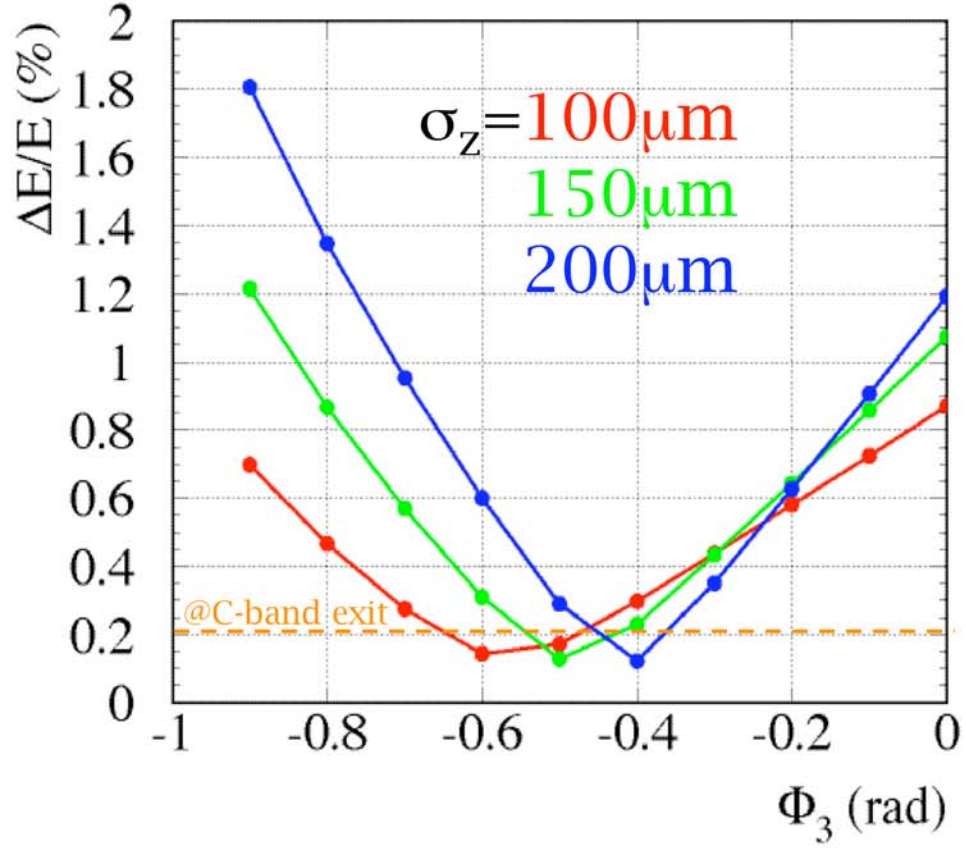
Bunch Length σ_z = 100μm, 150μm, 200μm

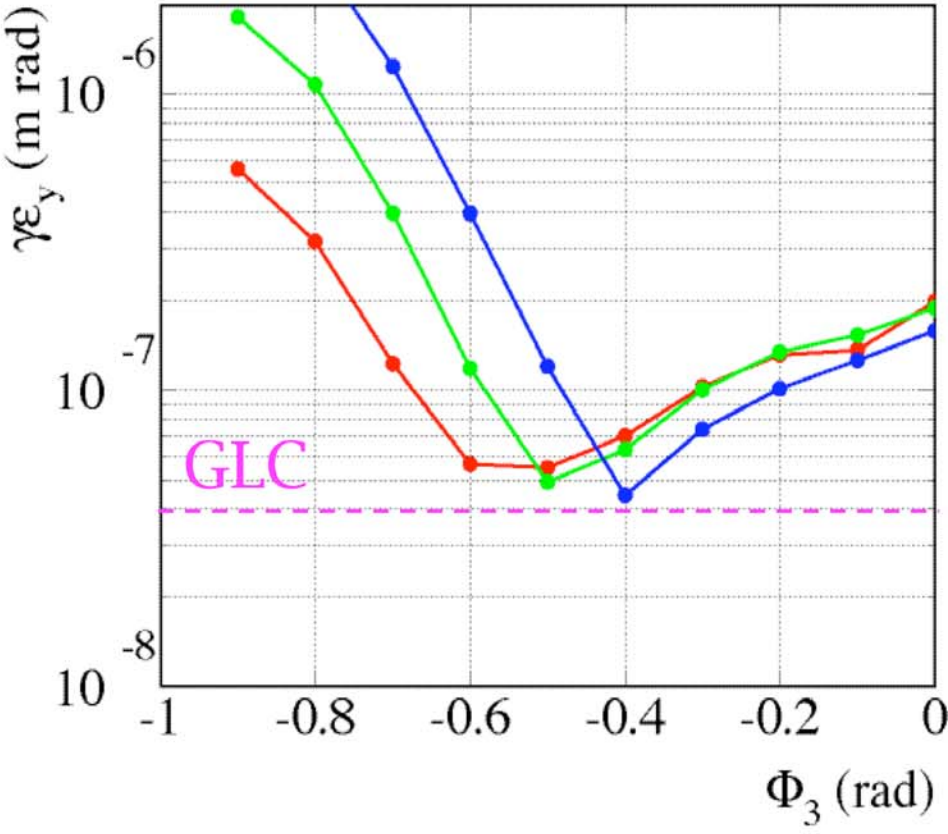


@Exit of C-band section

σ_z	100μm	150μm	200μm
γε(C) vs Φ_1,Φ_2			
ΔE/E(C) vs Φ_1,Φ_2			
ΔE/E(C) @ ■	0.2%	0.2%	0.2%
Φ_1 / Φ_2	-0.4 / -0.4	-0.2 / -0.2	-0.2 / -0.2

@Exit of main linac @E_b=500GeV





ΔE/E & γε are controlled in C+X hybrid optics

Possible scenario

- Phase I C-band
  - $\sqrt{s}$ = 400 GeV
- Phase II C-band + X-band
  - $\sqrt{s}$ = 1 TeV
- Phase III X-band
  - $\sqrt{s} \rightarrow$ 1.25 TeV

We can start from any phase

Summary

- GLC Test Accelerator was launched
- Very realistic demonstration of GLC
- Conditioning is proceeding
- Moving to experiment
- C+X hybrid optics looks OK

end

Thanks!