KEK
高エネルギー加速器研究機構

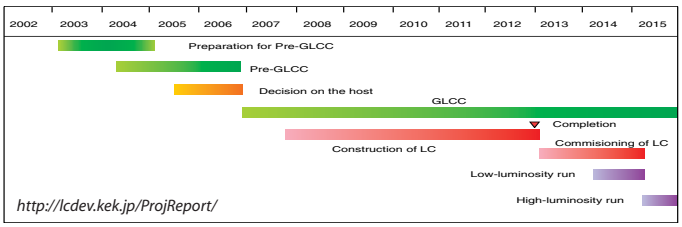
GLC Linear Collider for TeV Physics

The initial goal of GLC(Global Linear Collider), formerly known as JLC, is to perform experiments at the center of mass energy(E_{CM}) of up to 500GeV, with a luminosity of more than $10^{34}cm^{-2}s^{-1}$ based on X-Band(11.424GHz) RF technology, which has been developed in close collaboration with the US. The E_{CM} is extendable to above 1TeV. KEK, JAHEPC (Japan High Energy Physics Committee) and ACFA(Asian Committee for Future Accelerators) are proposing to construct it internationally with Japan as the host.

ACFA symposium

GLC project was announced at the ACFA symposium held in March 2003.

Roadmap



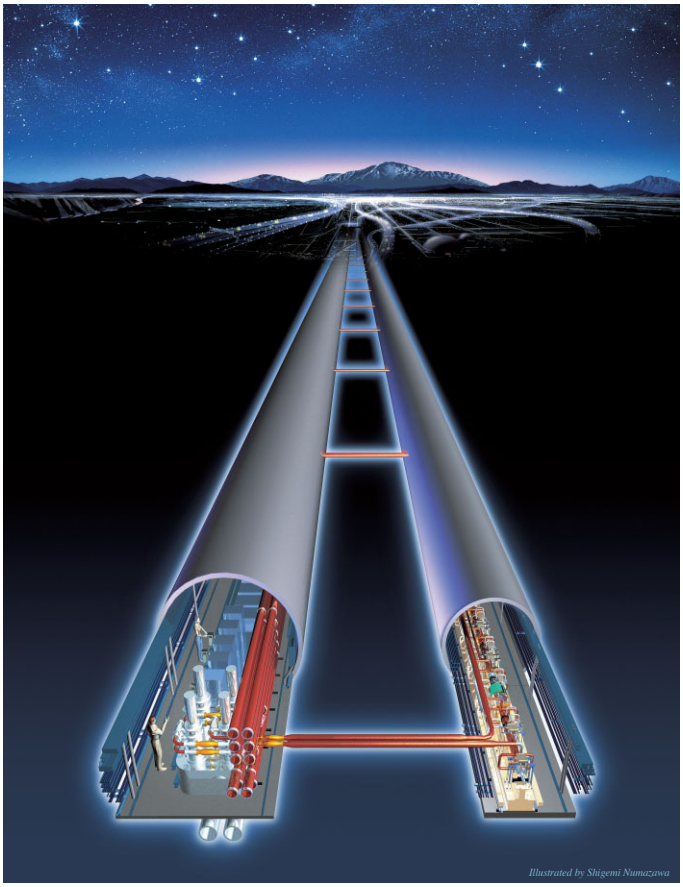
http://lcdev.kek.jp/ProjReport/

LC-Forum

In 2002 industry established "The Linear Collider Forum of Japan" in cooperation with the academic community for promoting the GLC project.

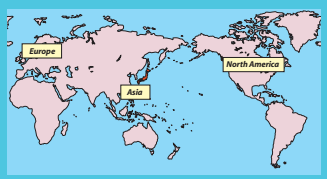
Design Parameters of GLC

Item	Stage I	Stage II	Unit
Center-of-mass energy (E_{CM})	500	1000	GeV
Luminosity	25	25	$10^{33}cm^{-2}s^{-1}$
Repetition rate	150	100	Hz
Bunch population	0.75×10^{10}		
Number of bunches / RF pulse	192		
Bunch separation	1.4		ns
Bunch train length	268.9		ns
Injected $\gamma\varepsilon_x/\gamma\varepsilon_y$	300 / 2		10^{-8} rad-m
Injected beam energy	8		GeV
$\gamma\varepsilon_x/\gamma\varepsilon_y$ at IP	360 / 4	360 / 4	10^{-8} rad-m
β_x/β_y at IP	8 / 0.11	13 / 0.11	mm
σ_x/σ_y at IP	243 / 3	219 / 2.1	nm
σ_z at IP	110		μm
$< \Upsilon >$	0.13	0.28	
Pinch enhancement	1.49	1.42	
Beamstrahlung	4.6	7.5	%
Photons per e^+, e^-	1.26	1.30	
Loaded gradient	49.8	49.8	MV/m
Linac length / beam	7.25	14.11	km
Beam delivery length / beam	1.9	1.9	km



GLCC(Global Linear Collider Center)

A new international laboratory will be created to facilitate the long-term commitment of participating partners, as well as open and transparent management.

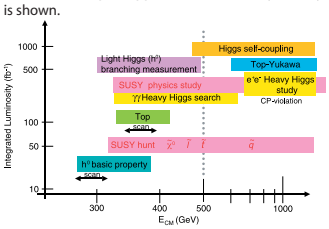


Pre-GLCC

As an intermediate step for realizing the GLCC, a Pre-GLCC (Pre-Global Linear Collider Center) is proposed with a staff to conduct R&D tasks, design the machine and pursue governmental approval for the project.

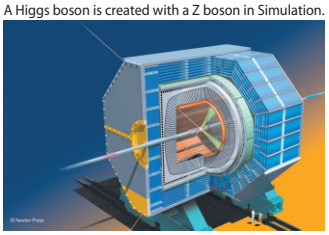
Physics covered by the GLC experiments

The case for a light Higgs boson and supersymmetry is shown.



Detector for GLC

A Higgs boson is created with a Z boson in Simulation.

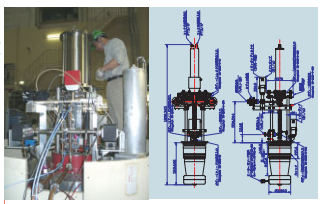


Candidate sites in Japan

Accelerator Test Facility & GLCTA

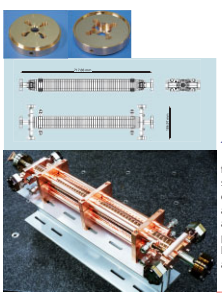
X-band PPM klystron

KEK PPM(periodic permanent magnet) focusing klystron has successfully generated a microwave power of 75MW 1.4μs, which is very close to the GLC requirement. Two new PPM klystrons will be installed to GLCTA in 2003.

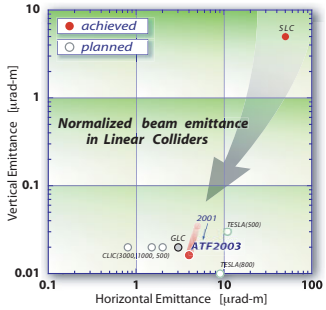


X-band Accelerator Structure

Rounded-edge DDS(damped detuned structure) features careful design optimization which ensures stable high-field operation and suitable wake field control. The "cells" for X-band accelerator structures are precision machined in the KEK machine shop and then bonded to form a structure. In the picture, the KEK 0.6m DS (detuned structure) has been built, and will be processed to prove 65MV/m at GLCTA in autumn, 2003.



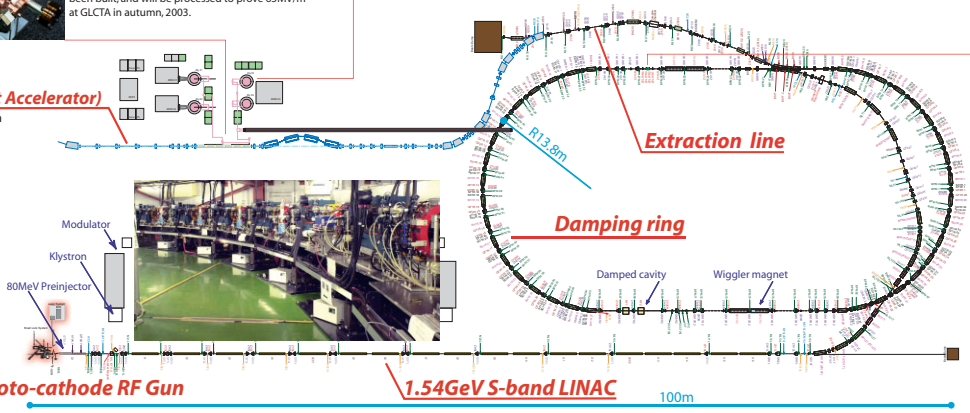
World Emittance Record at ATF

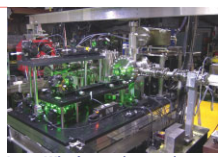


KEK-ATF is a test accelerator for demonstrating production of ultra-low emittance multi-bunch beam and for developing a variety of beam diagnostic tools required at the LC. A world record emittance has been achieved as $\gamma\varepsilon_x=4.0\times10^{-6}$ rad-m, $\gamma\varepsilon_y=16.3\times10^{-9}$ rad-m at 8×10^9 electrons/bunch intensity. This is close to the GLC specifications. The measurement has been done with the Laser Wire beam size monitor in the Damping Ring.

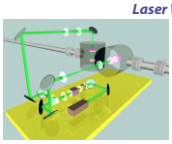
GLCTA (GLC Test Accelerator)

The basic unit of GLC main linac is being built for demonstrating in its RF performance and beam acceleration towards the year 2005. The ultra-low emittance beam from ATF will be supplied, following a single-stage bunch compressor, for testing the beam acceleration in X-band accelerator structures.





Laser Wire beam size monitor



For the beam size measurement, scattered gamma-ray flux from laser wire-beam interaction was measured by scanning the beam-laser relative position. The green laser wire (5.6μm rms size) is created in the two-mirror optical cavity that maintains its resonant condition by a precise feedback system.

ATF Collaboration