

Prospect of the International Linear Collider

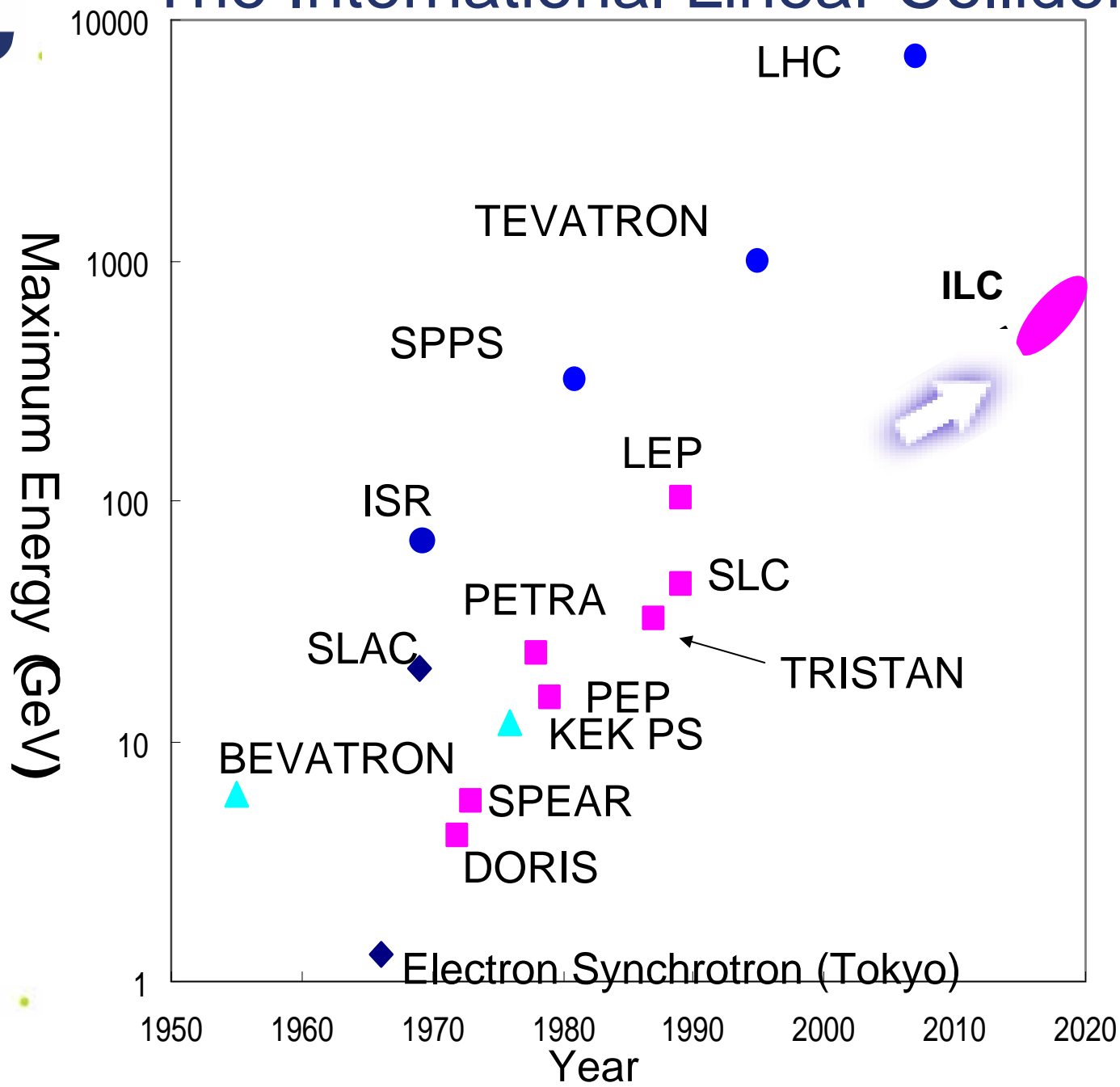
Tohru Takahashi
Hiroshima Univ.

2007/02/08
KEK Topical Conference





The International Linear Collider





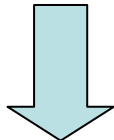
What I am going to talk

- Many review prospect was already given in this conference
 - **particle physics and Cosmology**
 - **neutrino physics : Status and Prospect**
 - **B physics; Status and Prospect**
 - **Physics with LHC + ILC**
 - **Prospects of LHC**
 - Start this year, expect physics results ~ 2010

The International Linear Collider

~ Experiments will start ~10 years from now~

- **International**
 - synonym of complex organization/procedure



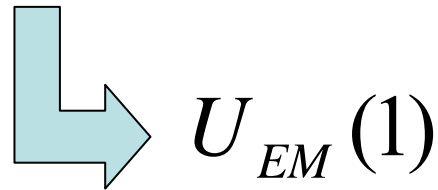
Messages to encourage young physicists

Remark: ACFALC/GDE meeting Feb4-7, ICFA press conf. Feb.8



The Standard Model

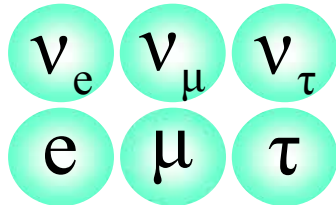
$$SU_C(3) \times SU_L(2) \times U_Y(1)$$



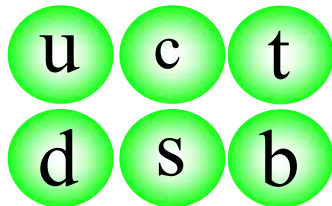
Matter Field

Gauge Fields

leptons



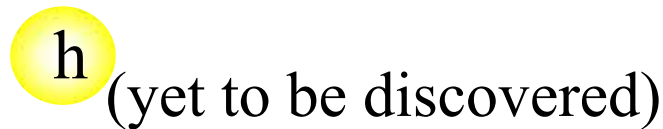
quarks



+ Right handed

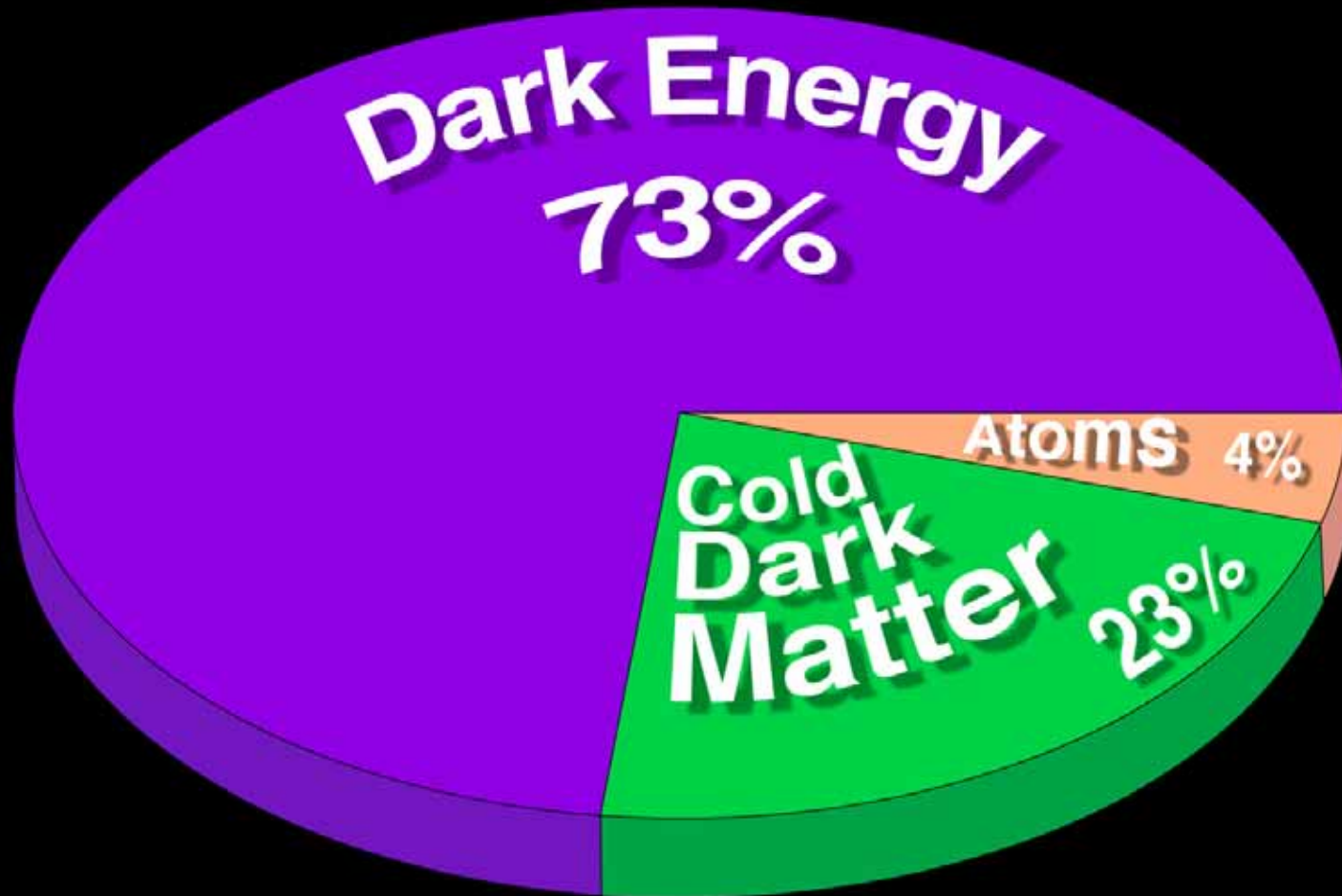


A Scalar Field



well describes
phenomena
up to
~100GeV scale:i.e.,
 $\hat{\lambda} \sim 10^{-18} m$
10⁻¹⁰s after Big Bang

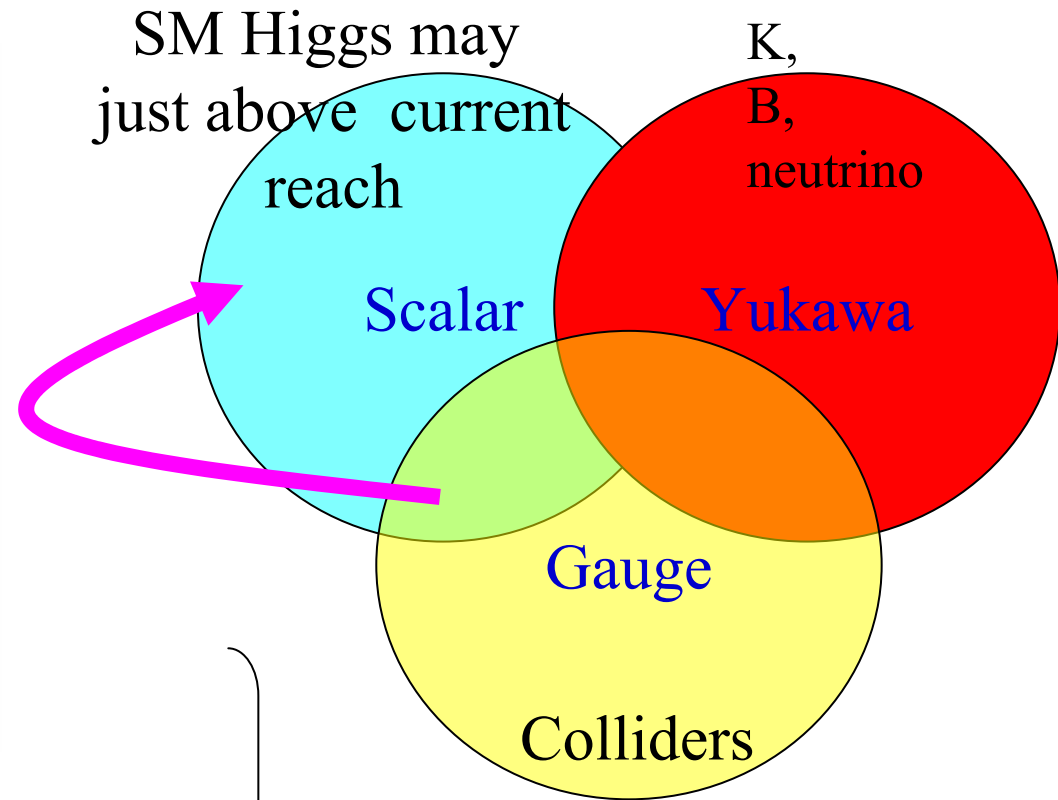
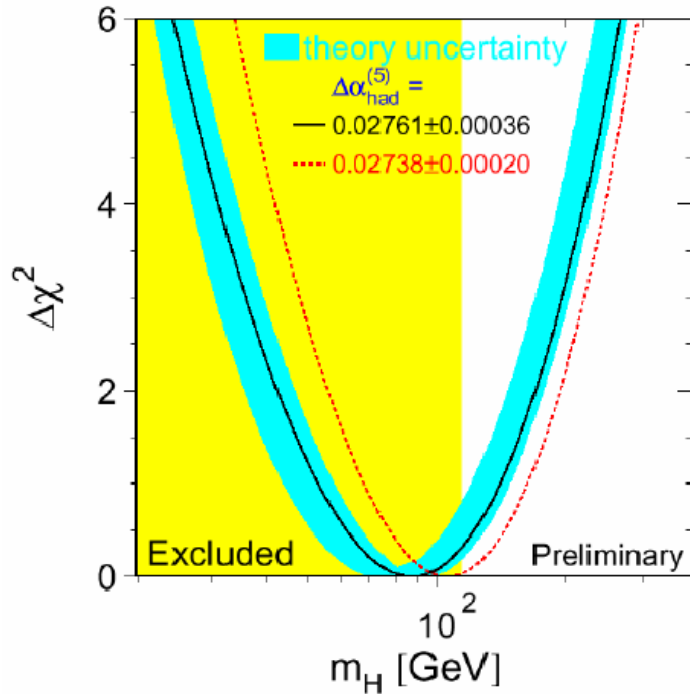
Cosmological observation



We know nothing about 96% of our universe

Hints for next step

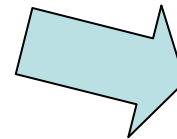
SLC/LEP/TEVATRON



Extensions of SM which predict(expect):
something new in TeV scale

Supersymmetry

Extradimensions



Explore TeV region

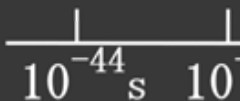
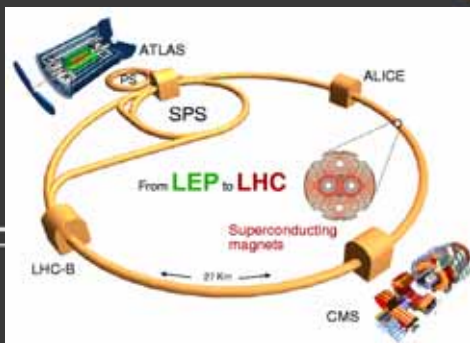
A way to go



TeV scale

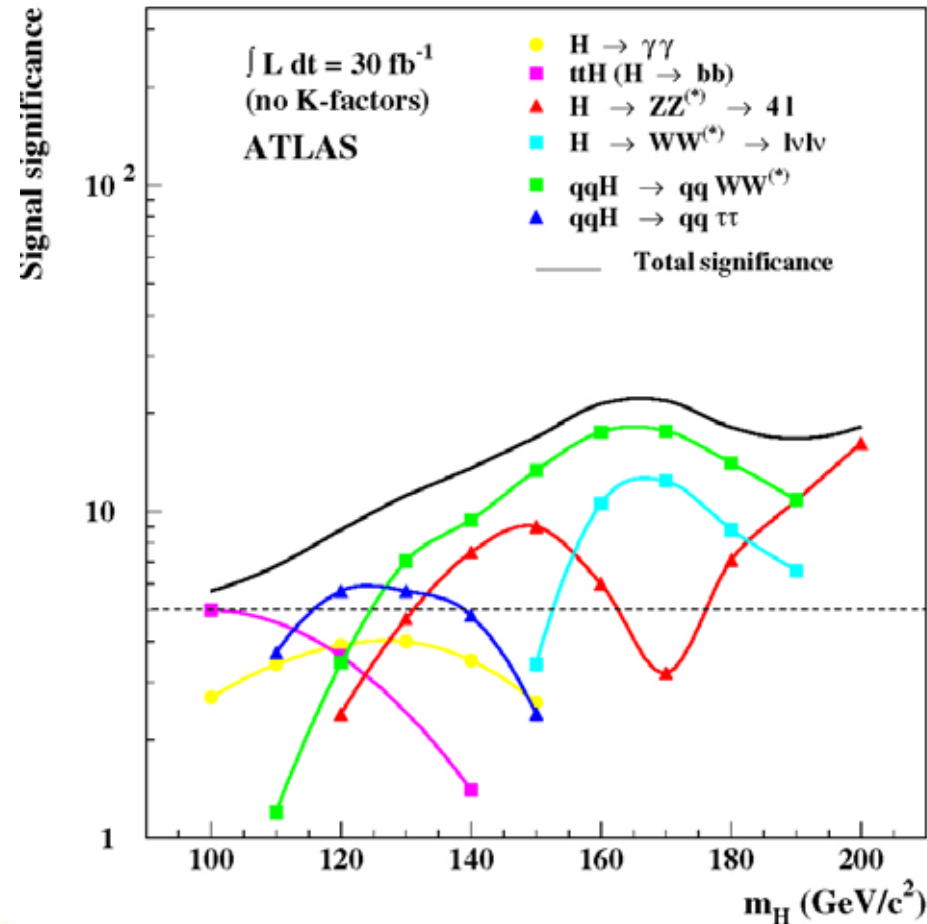
Direct access is possible
by current technologies
of accelerators and detectors

not by single machine

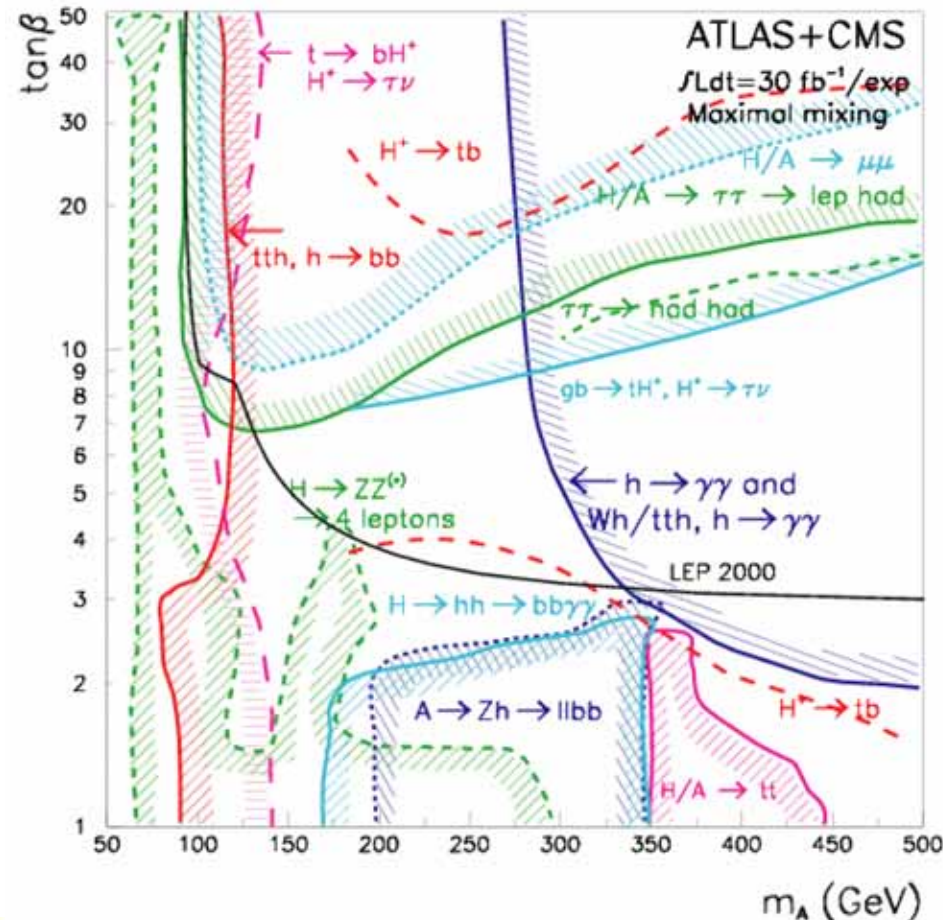


It is likely ,,,, ~ <2010 (Higgs)

SM Higgs



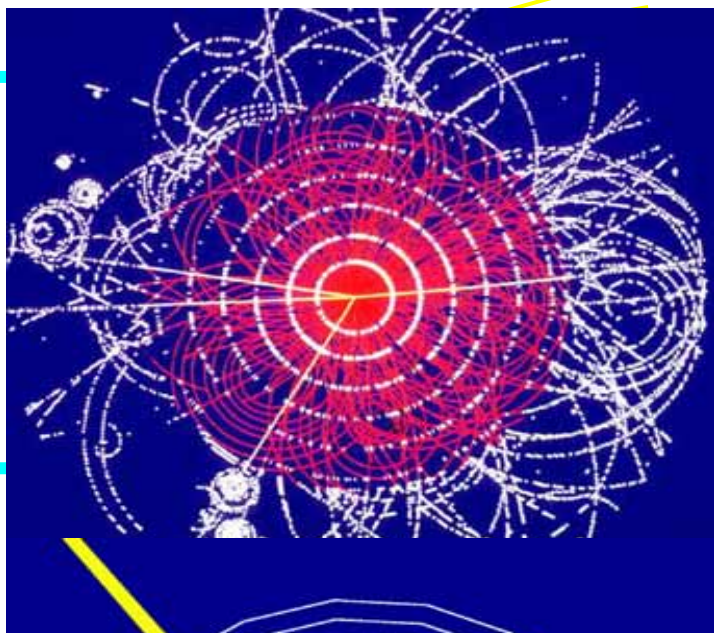
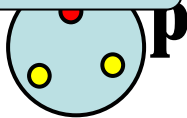
MSSM Higgs





ILC vs LHC

pp Collision

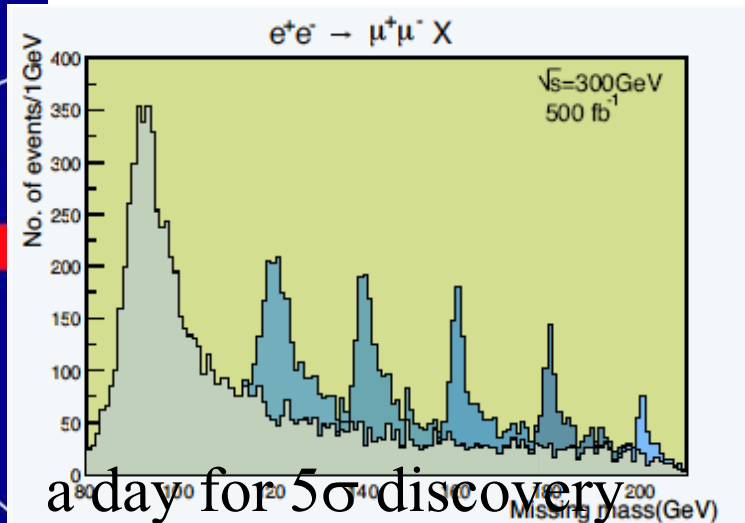
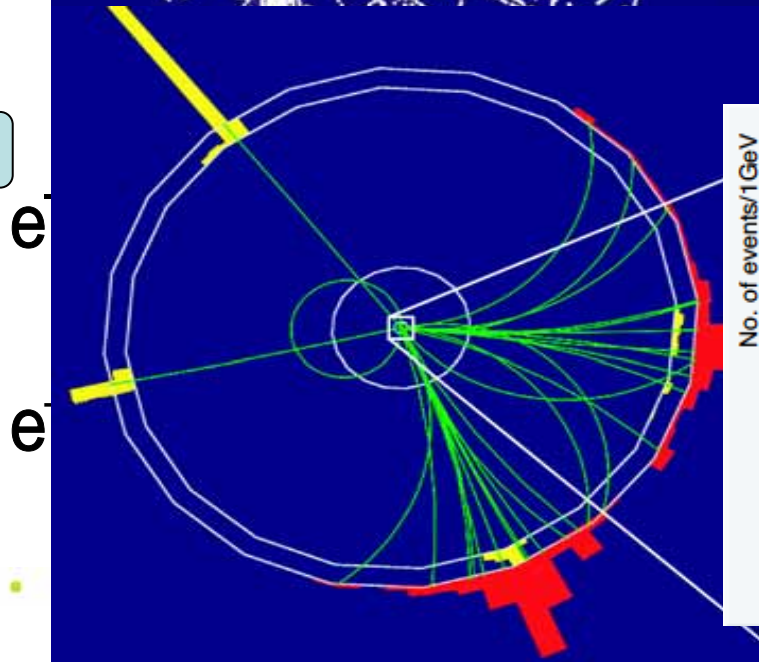
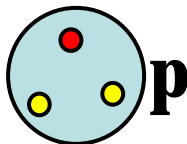


hadrons

$b\bar{b}$

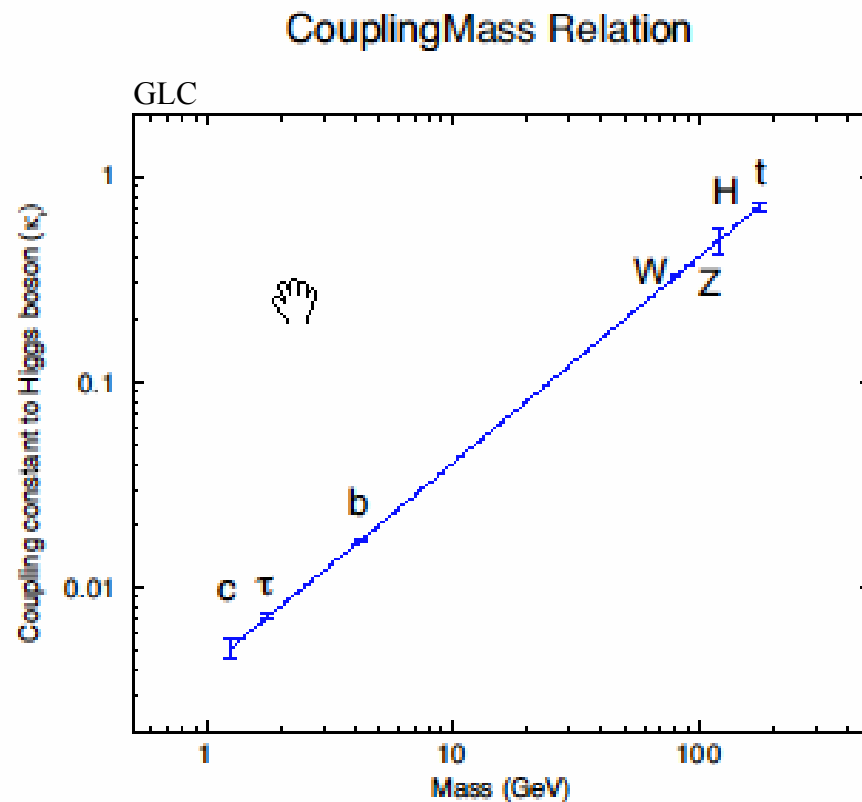
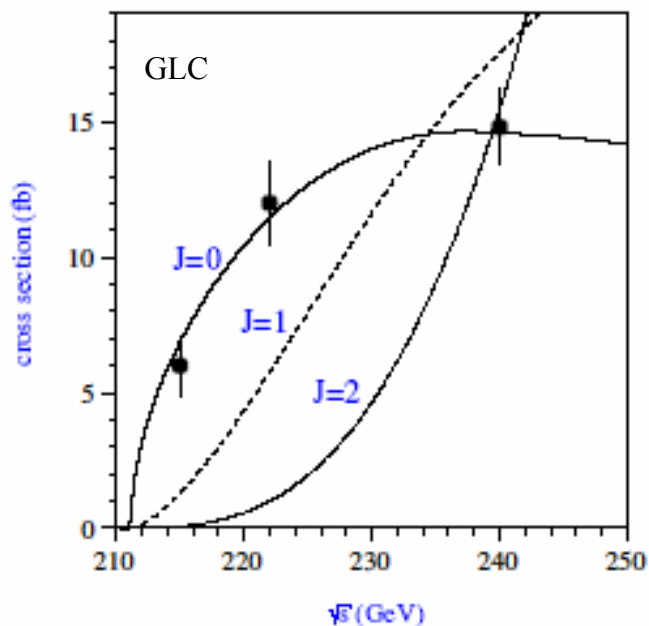
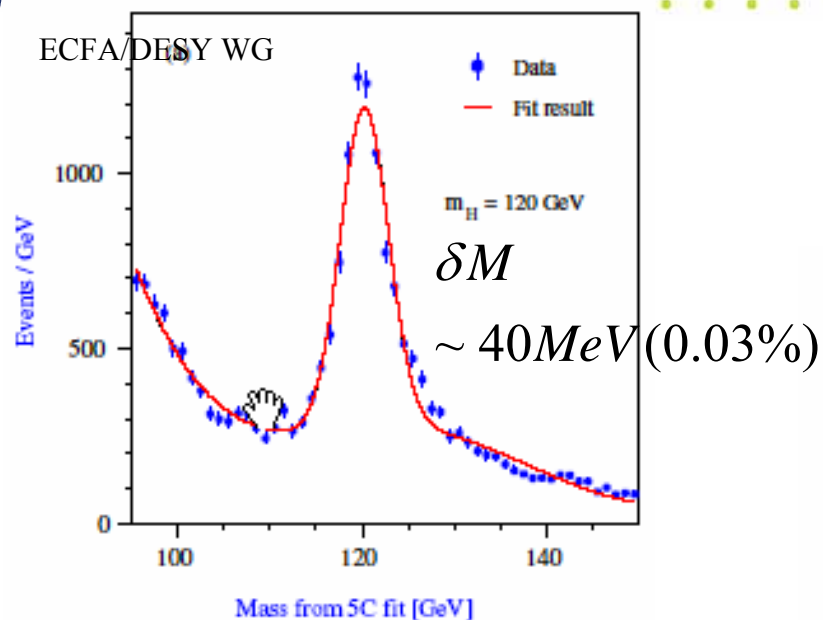
hadrons

e^+e^- Collision





ILC is the precision machine

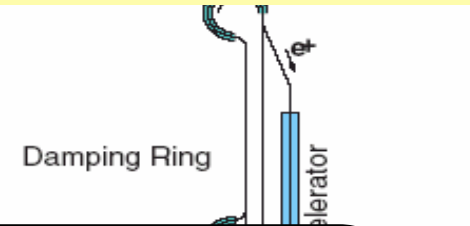
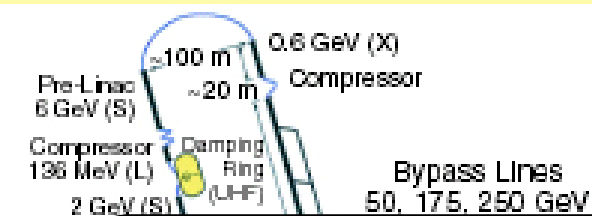




At the time KEK TC5 (2001)

GLC/NLC Concept

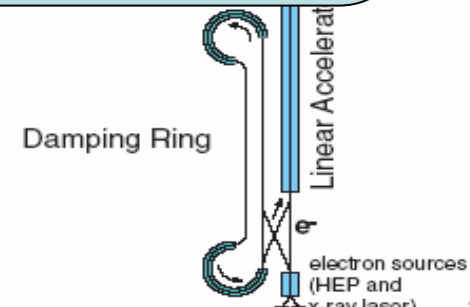
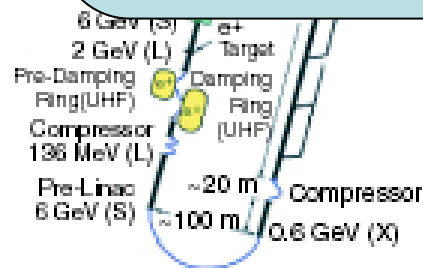
TESLA Concept



- no show stopper for both technologies

,,,,,, but,,,,

- too expensive to try both to move to the next step
(being ready to construct a machine)

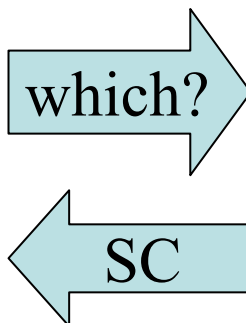


Normal Conducting
X(C) band 65MeV/m

Super Conducting
L band 25MeV/m



SCRF Technology for the ILC



The recommendation by International Technology Recommendation Panel (ITRP)

August 2004

Will Construct one International Linear Collider by Superconducting RF

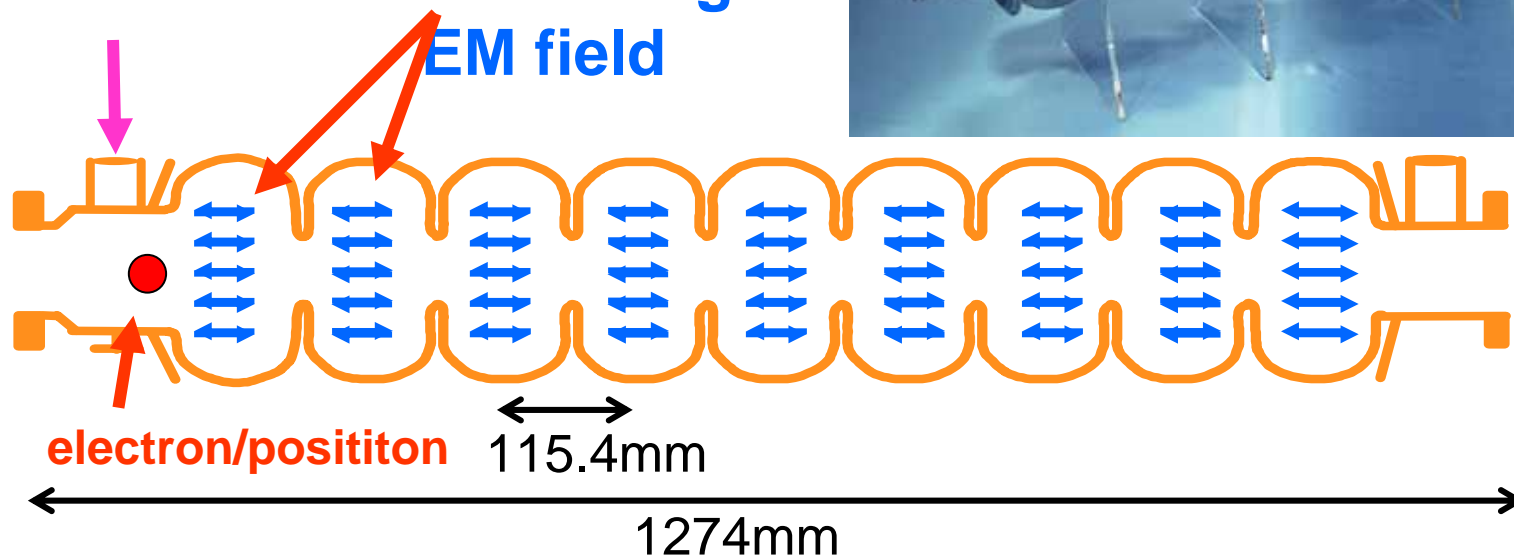


Superconducting RF



L band(1.3GHz RF)

Standing
EM field

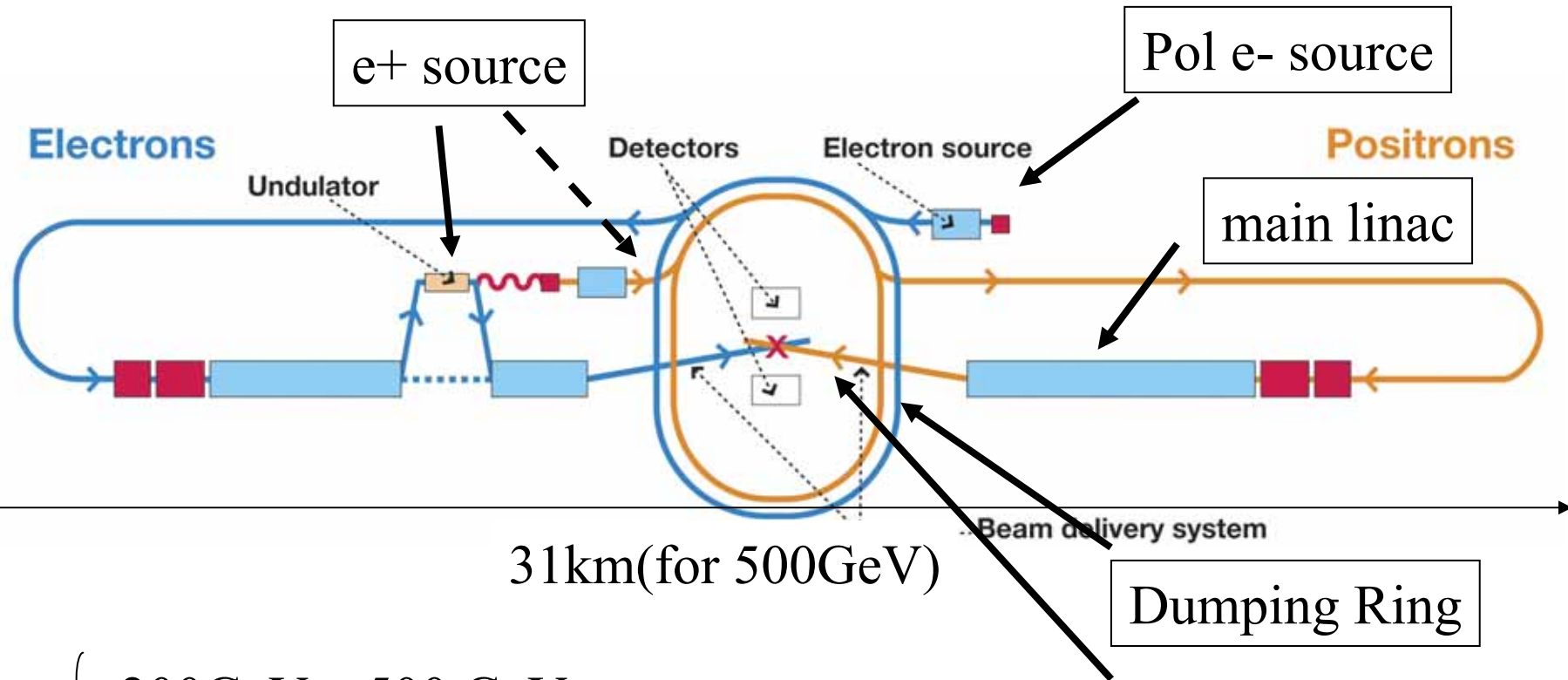


Superconducting RF



higher efficiency for RF->beam
lower acc. gradient

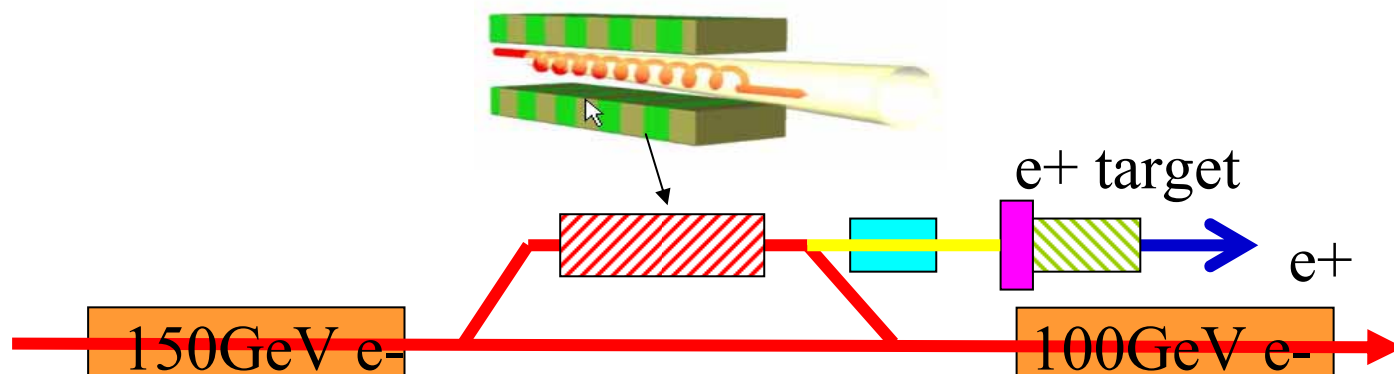
Schematic of the ILC



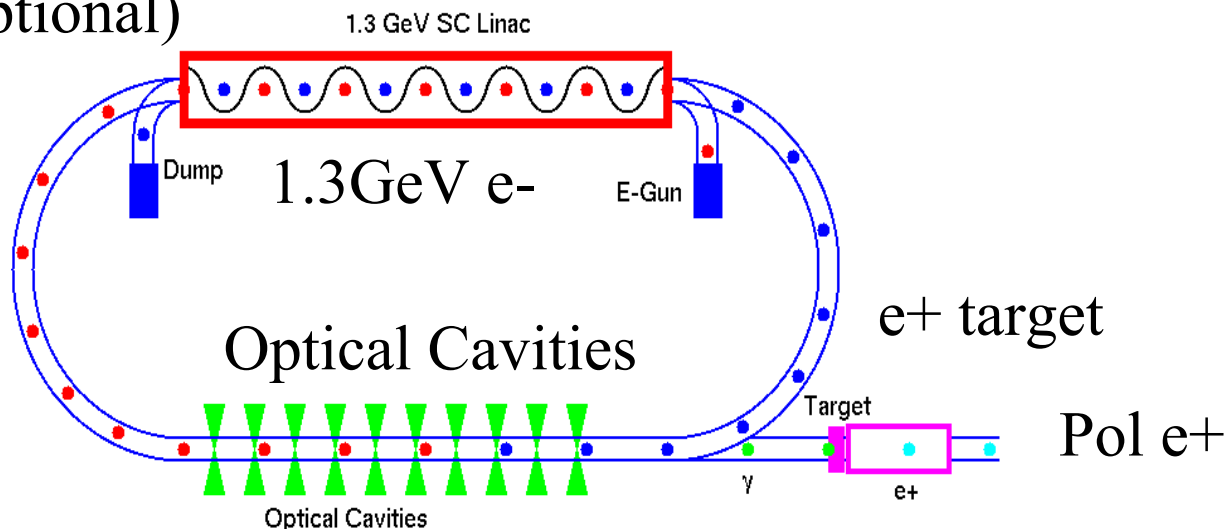
- 200 GeV – 500 GeV
- 500 fb⁻¹ in 4 years
- P_{e⁻} > 80%
- upgradeable to 1 TeV

Beam Delivery System
and Interaction Region

Undulator based (Basic design)



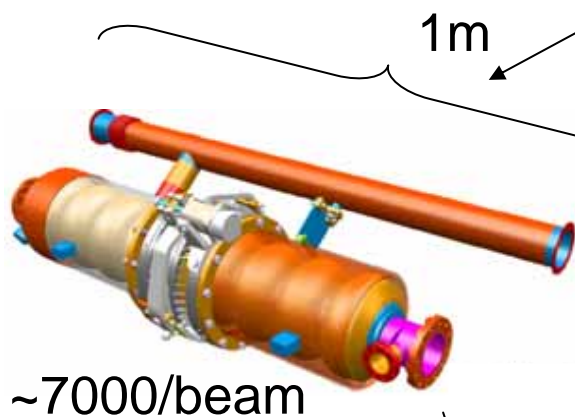
Compton based (Optional)



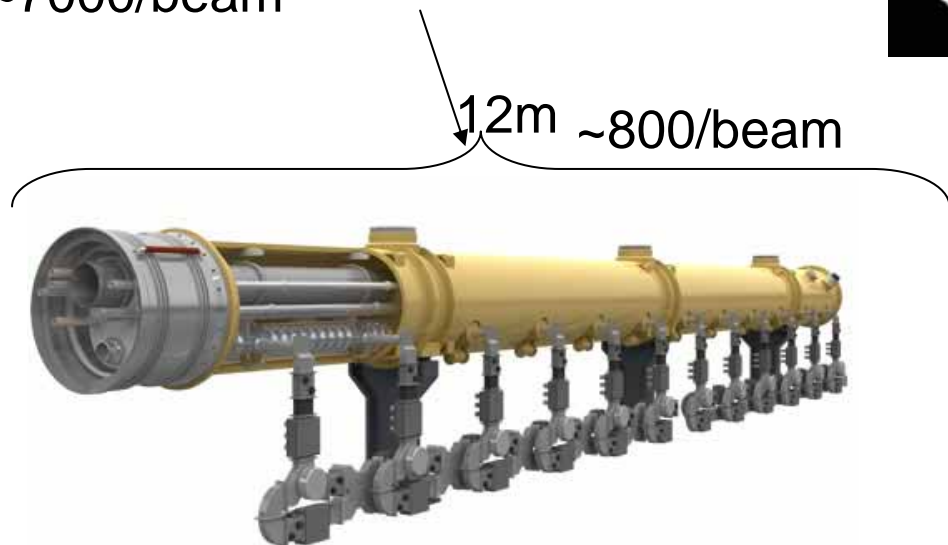
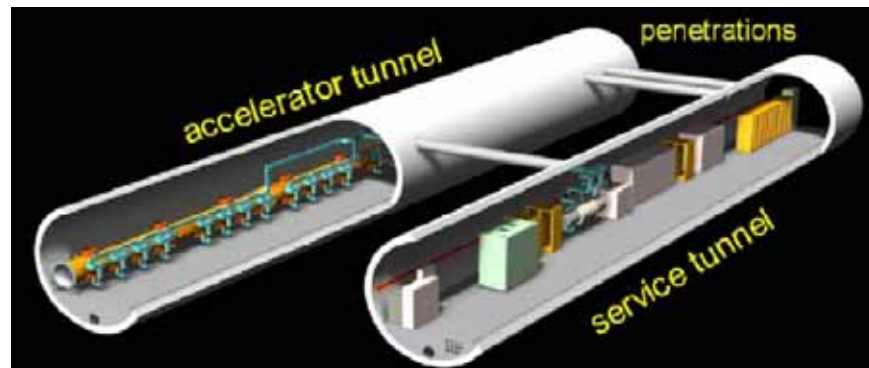
pol γ by laser-Compton



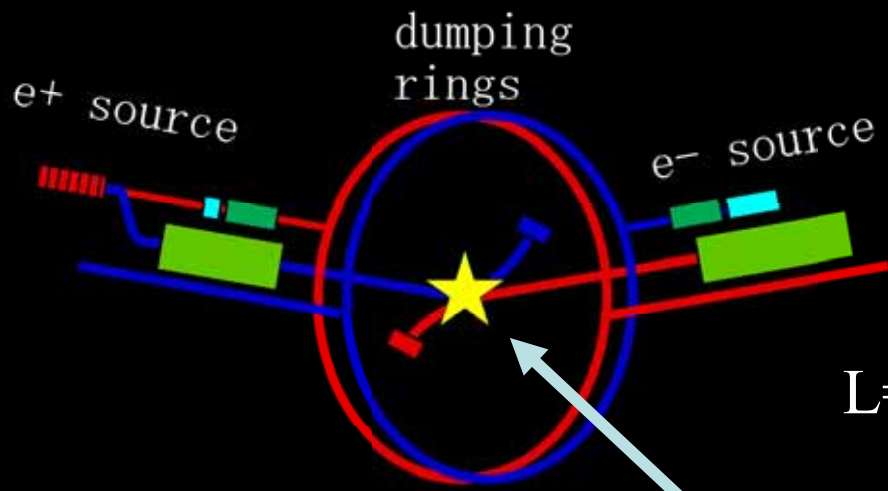
Main Linac



~11km/beam



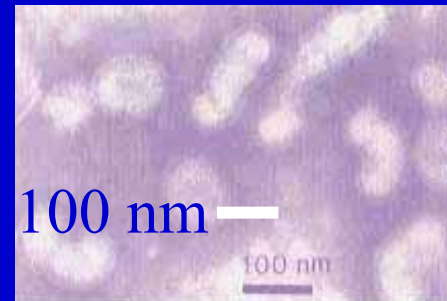
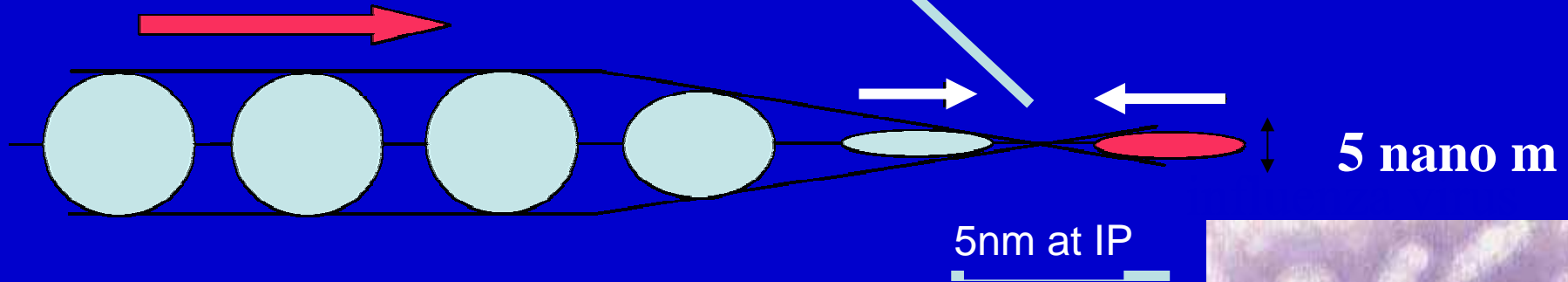
Getting High luminosity



$$L = \frac{f_{\text{rep}} n_e^2}{4\pi\sigma_x\sigma_y}$$

PB ¥ / \$ / ¢

We need ultra-low emittance beam





How we are doing

International Council of
Scientific Unions

ICSU

IUPAP

International Union of
Pure and Applied Physics

ICFA

International Committee for
Future Accelerators

ILCSC

International Linear
Collider Steering Committee

Informal information
exchange with
founding agencies

GDE

Barish

Global Design Effort (Aug 2005)

Asia

Nozaki

many
labs.
univs.

Europe

Foster

many
labs.
univs.

America

Dugan

many
labs.
univs.

Bangalore Mar 2006
Vancouver Jul 2006
Valencia Nov 2006
Beijing Feb 4-7 2007

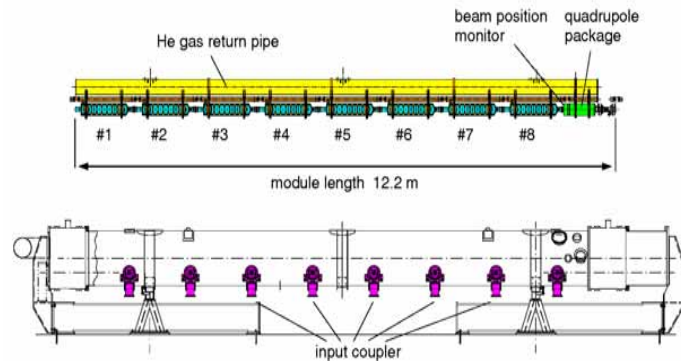
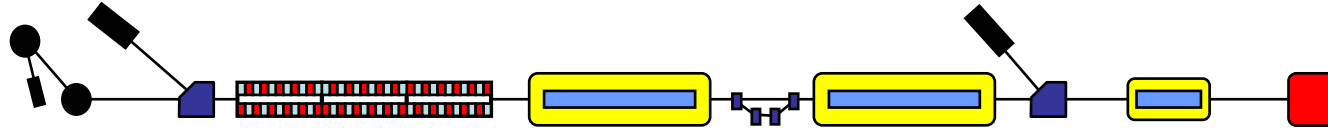
until yesterday



LCWS06 (Linear Collider Workshop 2006)

Wednesday 08 March 2006 - Monday 13 March 2006
Indian Institute of Science, Bangalore.

TESLA Test Facility - DESY

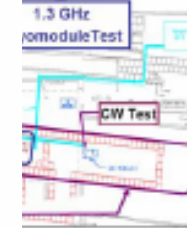


End Station A

ment

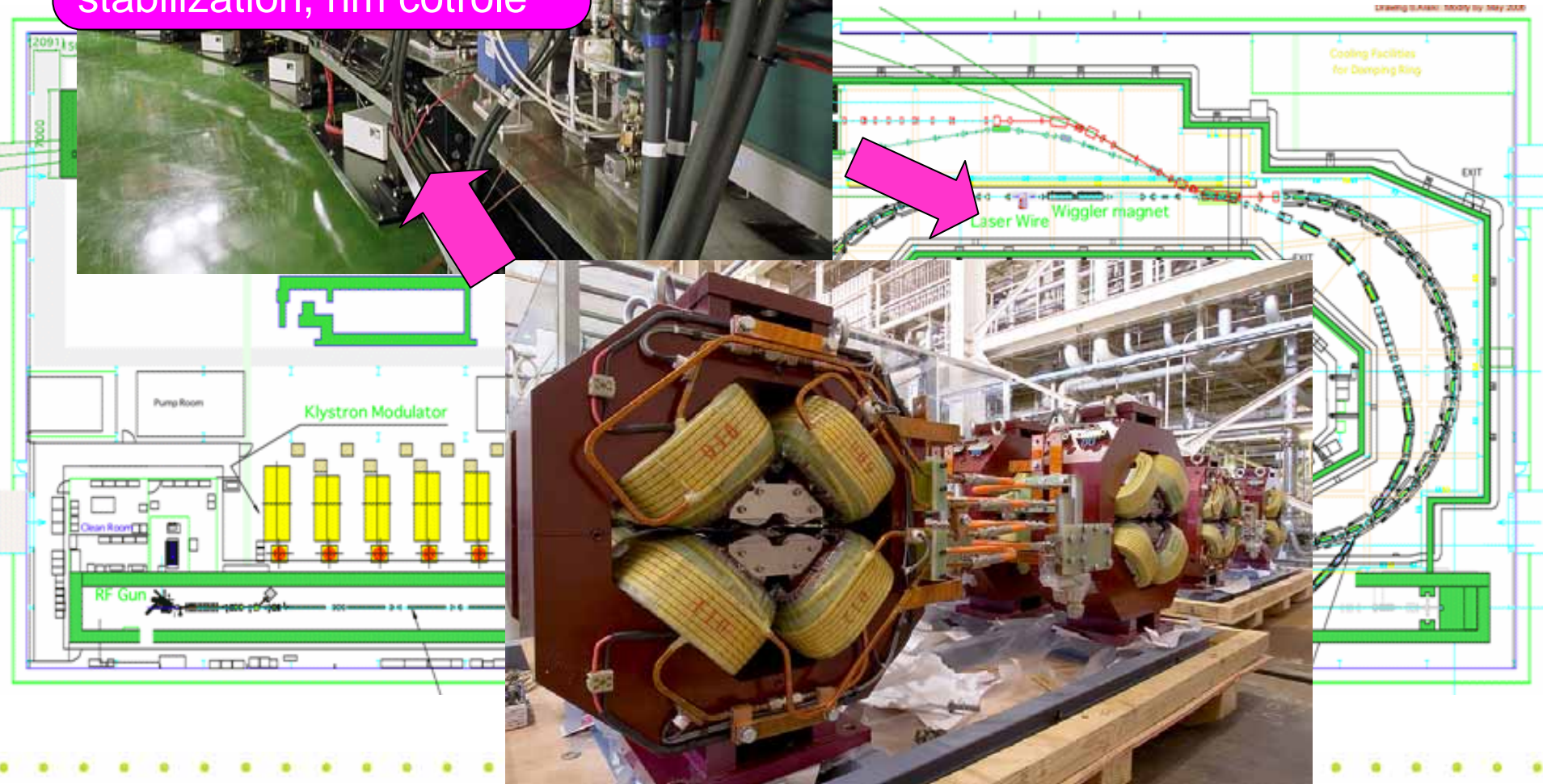
your Concept

Proton Driver
1A Linac Test



ATF2 (2007-)
Testing Final Focus
stabilization, nm cotrole

100 of quad, 68 of sect.
align within tens of μm :
low emittance beam for the ILC
has been achieved

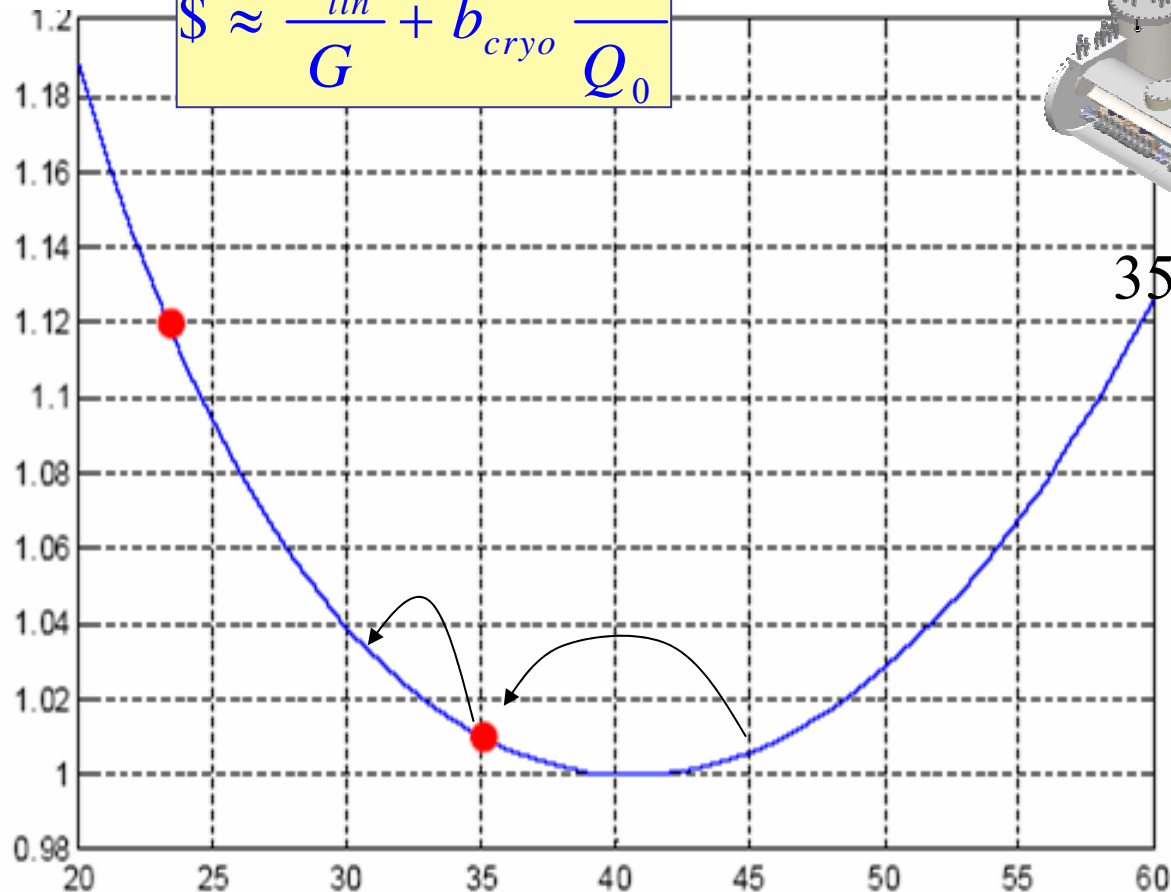




Acc. gradient w/ SCRF

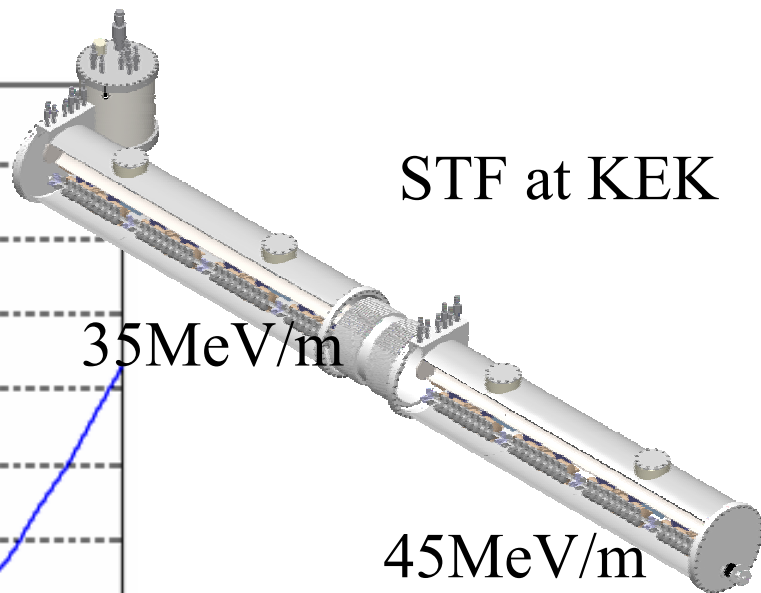
$$\$ \approx \frac{a_{lin}}{G} + b_{cryo} \frac{G^2}{Q_0}$$

Relative Cost



C. Adolphsen (SLAC)

Gradient MV/m



STF at KEK

35MeV/m

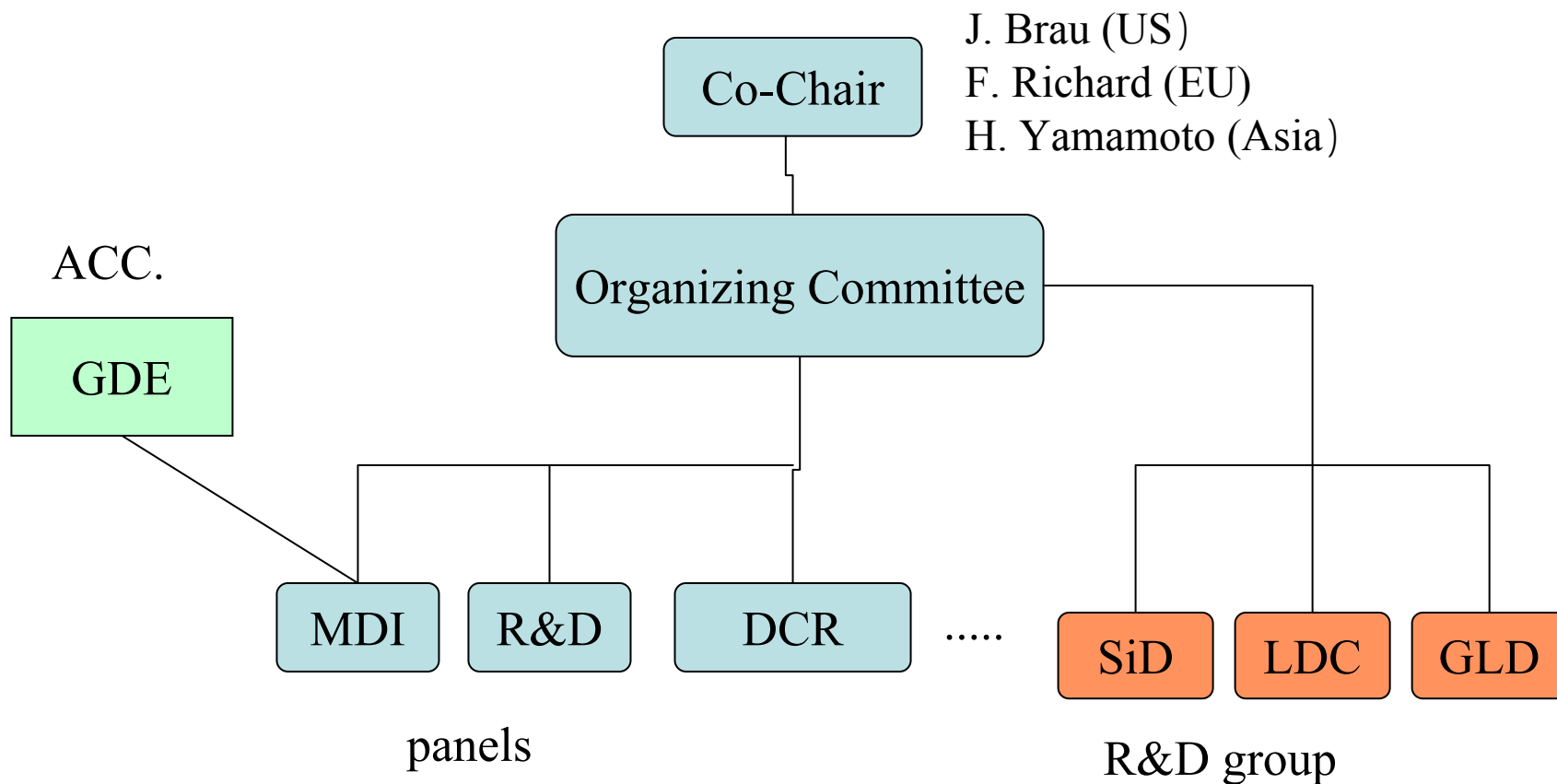
45MeV/m

pushing higher



ILC Detector R&D

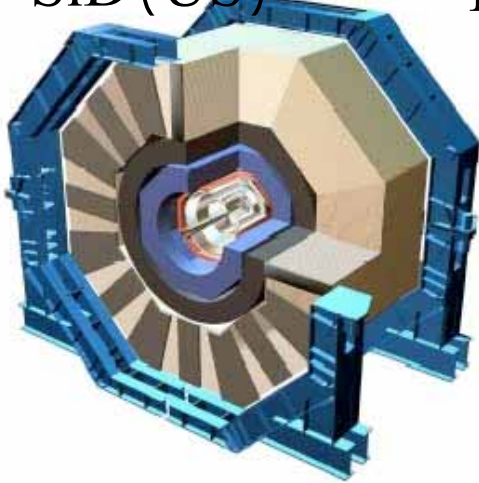
Worldwide Study on Physics and Detector for Linear Collider
(WWS)



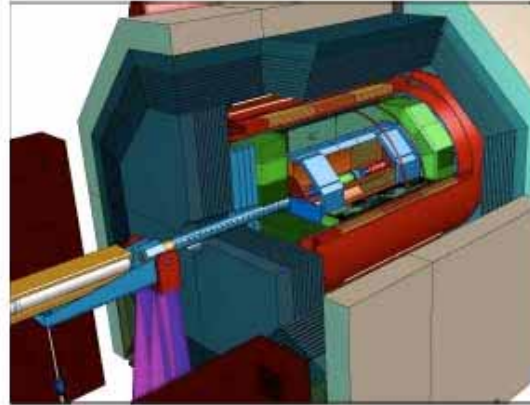
Detector R&D

Three (+ 4th recently)

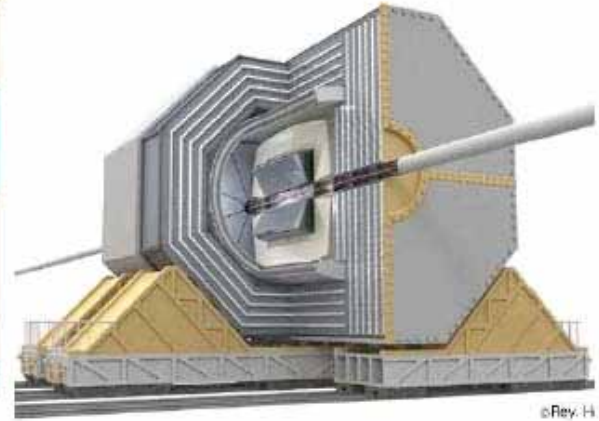
SiD (US)



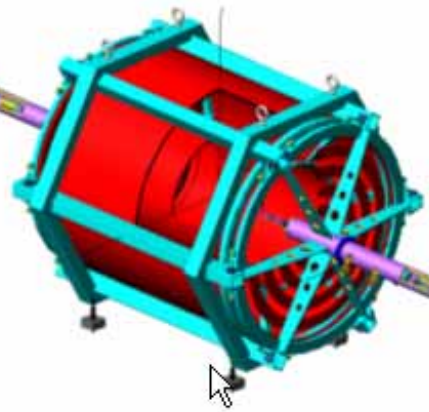
LDC (EU)



GLD (Asia)

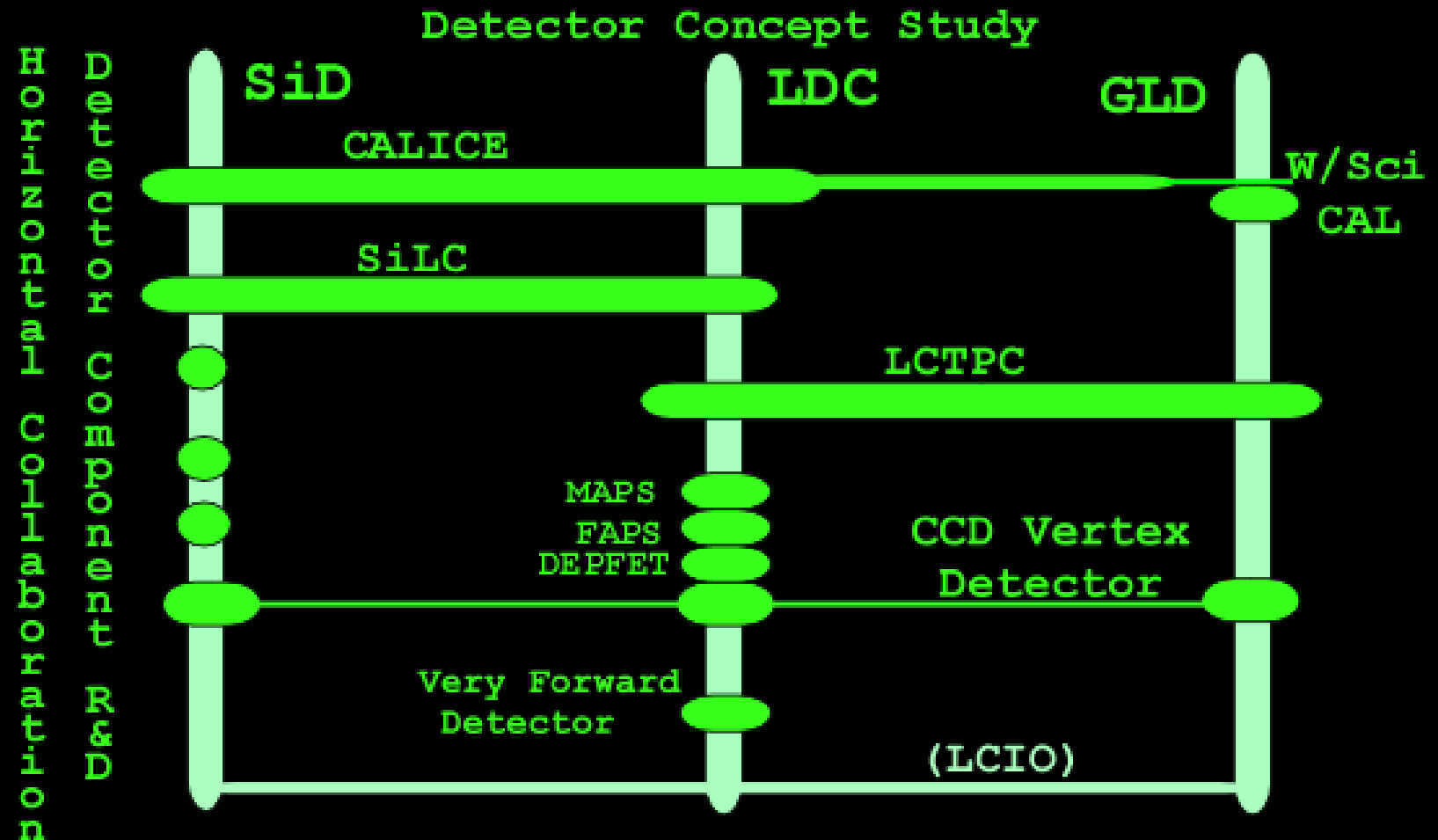


4th



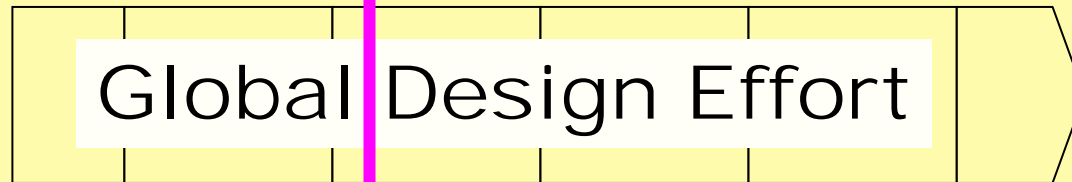
R&D matrix

THE MATRIX



International Linear Collider Timeline

2005 2006 2007 2008 2009 2010



➡ **Baseline configuration**

➡ **Reference Design**

➡ **Engineering Design**

[Draft of RD reported at Beijing](#): open to public soon
~First major milestone by International collaboration~



Engineering Design to bring the ILC ready for construction

Summary

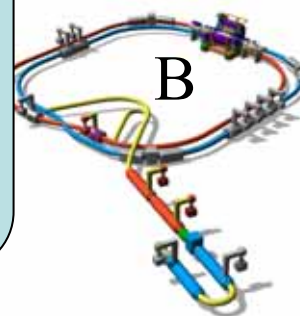
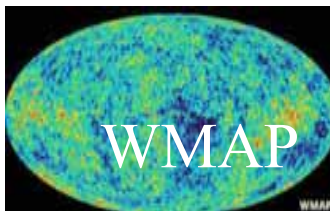
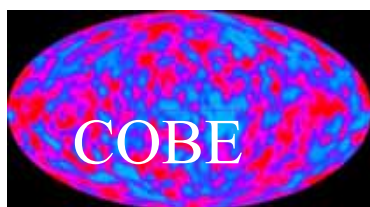
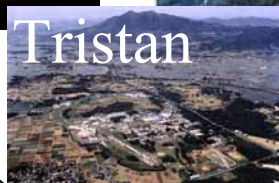
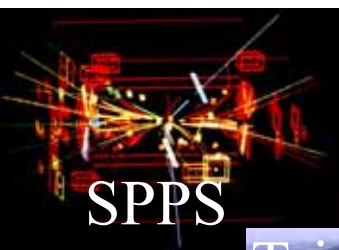
'80

'90

2000

2010

2020



we are on the right track
but,
major players ~late 2010s will be,,