

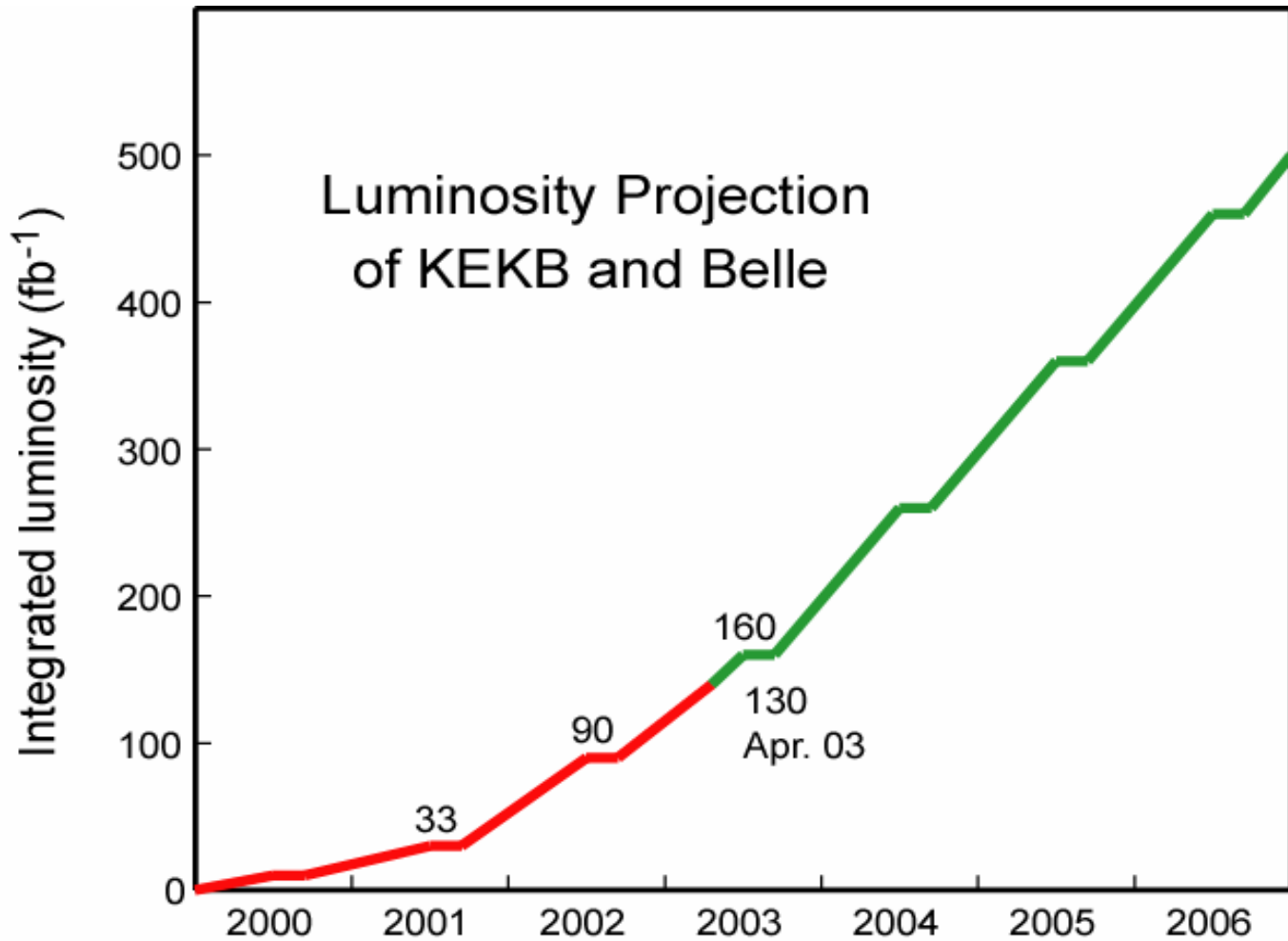
SuperKEKB

to search for new sources of flavor mixing and CP violation

M.Yamauchi
FPCP03, Paris
June 2003

- Introduction
- Motivation for $L=10^{35-36}$
 - Precise test of KM scheme of CP violation
 - Search for new physics in B and τ decays
 - Identification of SUSY breaking mechanism in B decays
- Upgrade of KEKB and Belle
- Summary and conclusions

KEKB in near future



Mission of Super *B* Factory(ies)

Mission 1

Precision test of KM unitarity.

Bread'nd butter
for *B* factories.

Mission 2

Search for new physics in *B* and τ decays.

See quantum effect in
penguin and box loop.

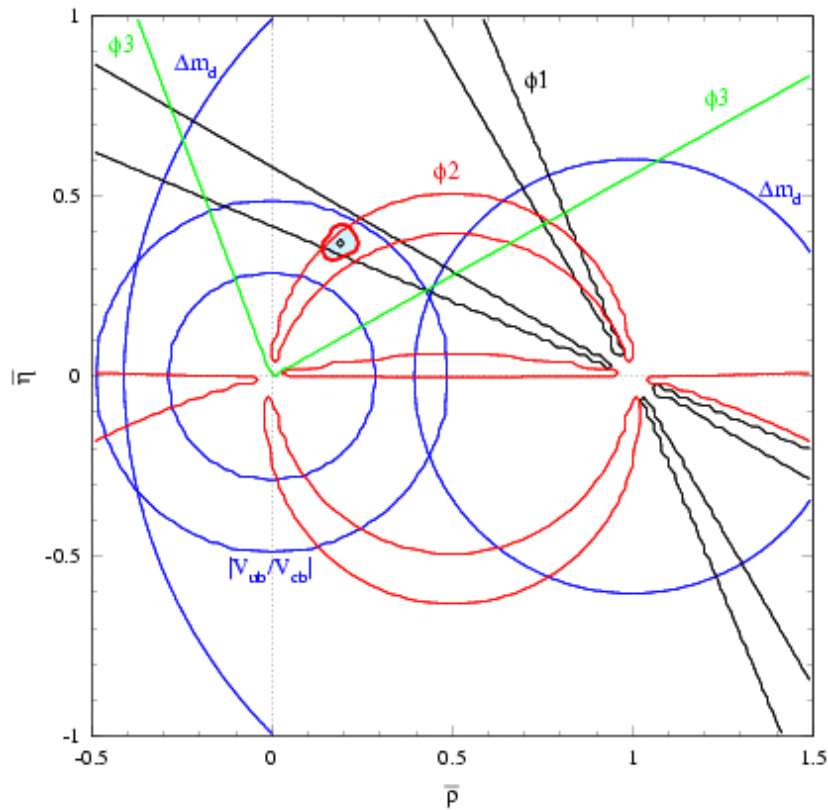
Mission 3

Identify SUSY breaking mechanism.

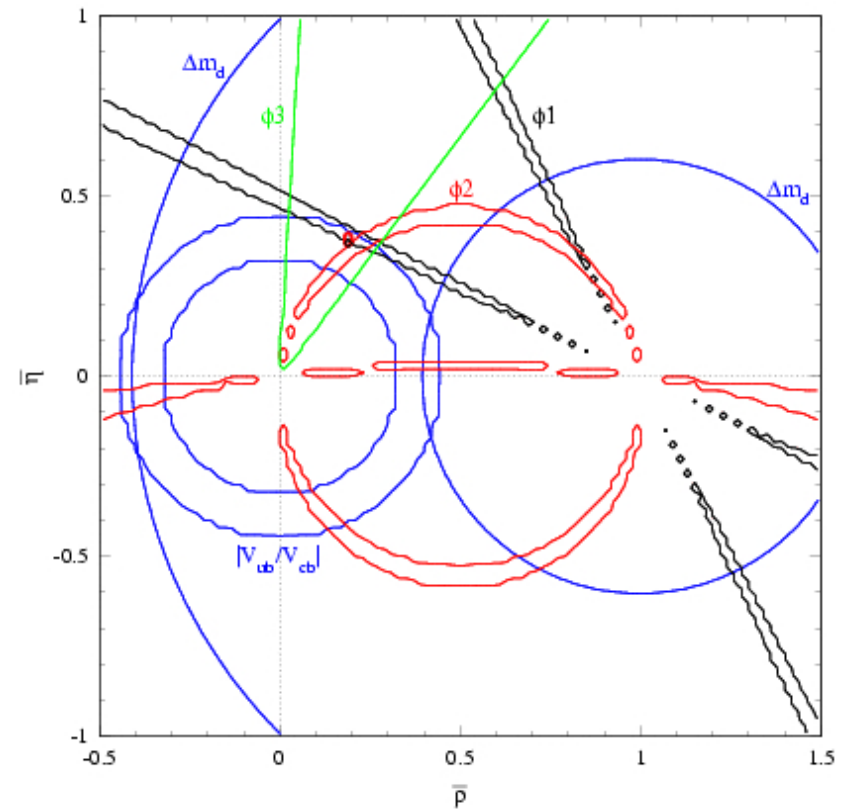
Very important
if New physics = SUSY.

Triangle in the future

300fb⁻¹

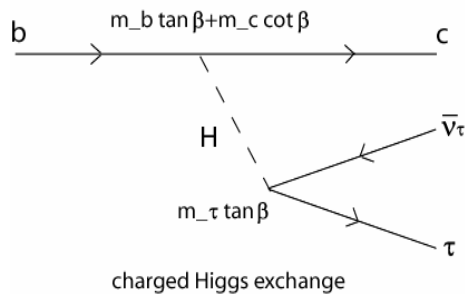
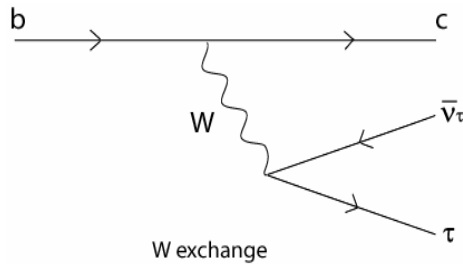


3000fb⁻¹

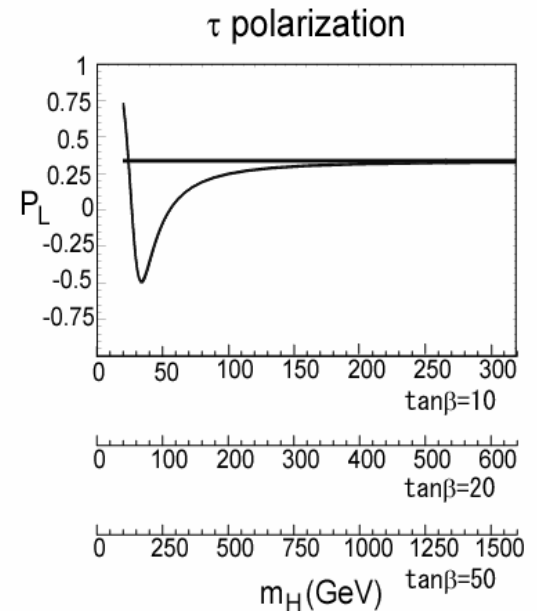
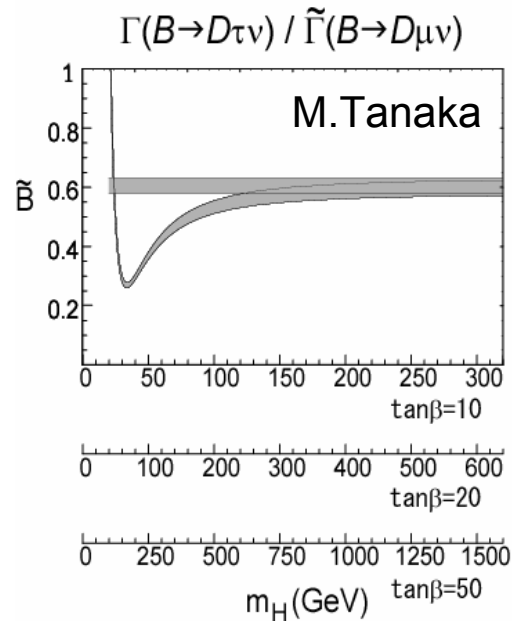


Charged Higgs in tree decay

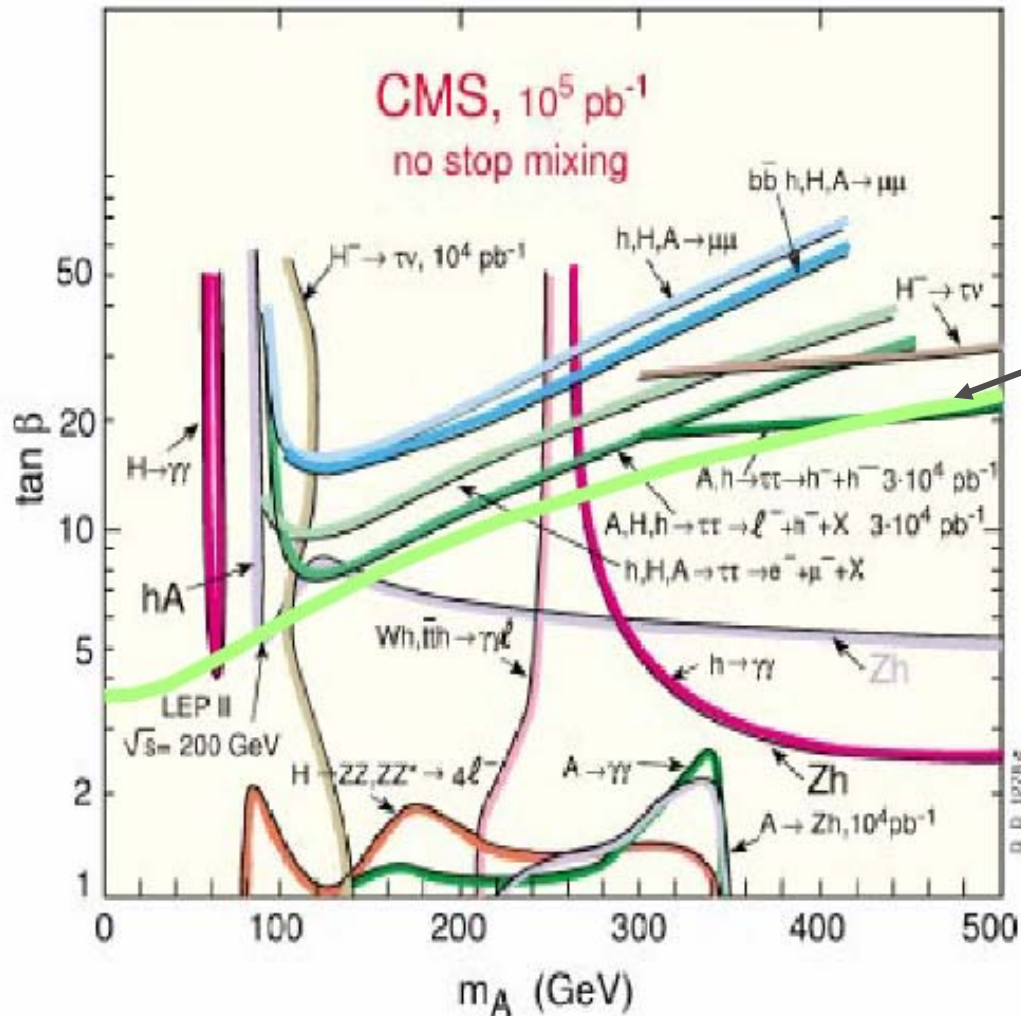
$B \rightarrow D^{(*)} \tau \nu$ vs. $D^{(*)} \mu \nu$



- Large BF of O(1)%
- Uncertainty in form factor cancels in the ratio $\Gamma(B \rightarrow D \tau \nu) / \Gamma(B \rightarrow D \mu \nu)$.
- τ polarization is more sensitive to H^\pm .

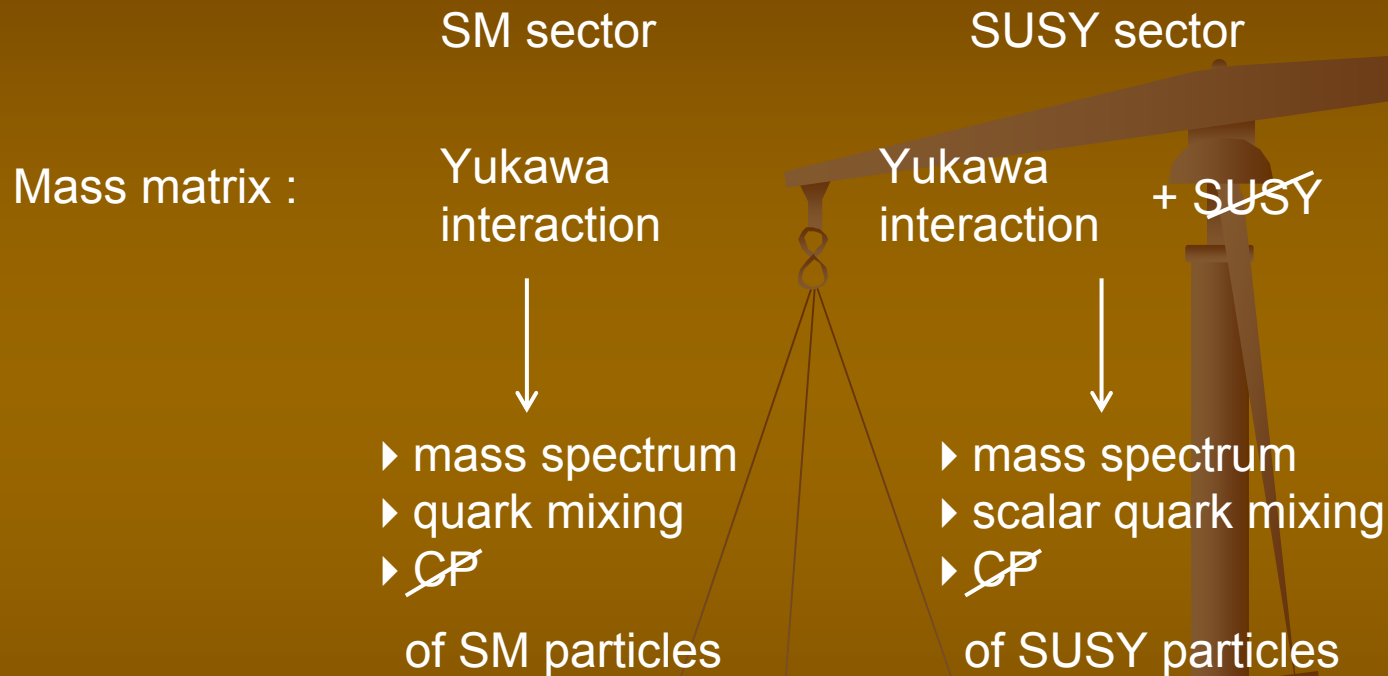


Comparison with a LHC experiment



$\Gamma(B \rightarrow D\tau\nu)/\Gamma(B \rightarrow D\mu\nu)$
at B factory with
 $5,000 \text{ fb}^{-1}$

SUSY is an asymmetric symmetry!?

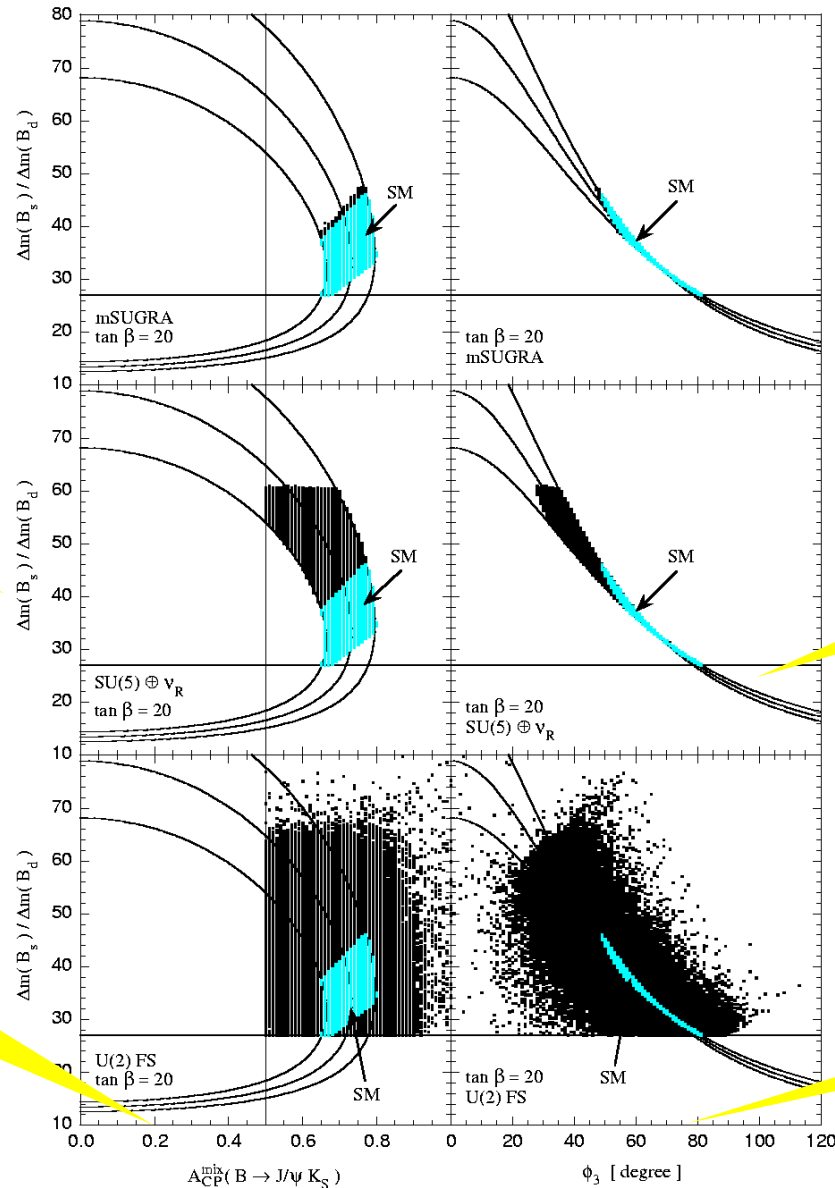


~~SUSY~~ : mSUGRA or SU(5) SUSY GUT or U(2) flavor symmetry or ... ???

Flavor structure of SUSY must be studied.

~~SUSY~~ scenario vs. B decays (1)

T.Goto *et al.*,
PRD:035009,02



Δm_s will be measured
at Tevatron soon.

$\delta \sin 2\phi_1$
= 0.082 (now)
→ 0.02 ($1ab^{-1}$)

$\delta(|V_{ub}|/|V_{cb}|)$
= 0.02 (now)
→ 0.005 ($1ab^{-1}$)

$\delta\phi_3$
→ 10° ($1ab^{-1}$)

~~SUSY~~ scenario vs. B decays (2)

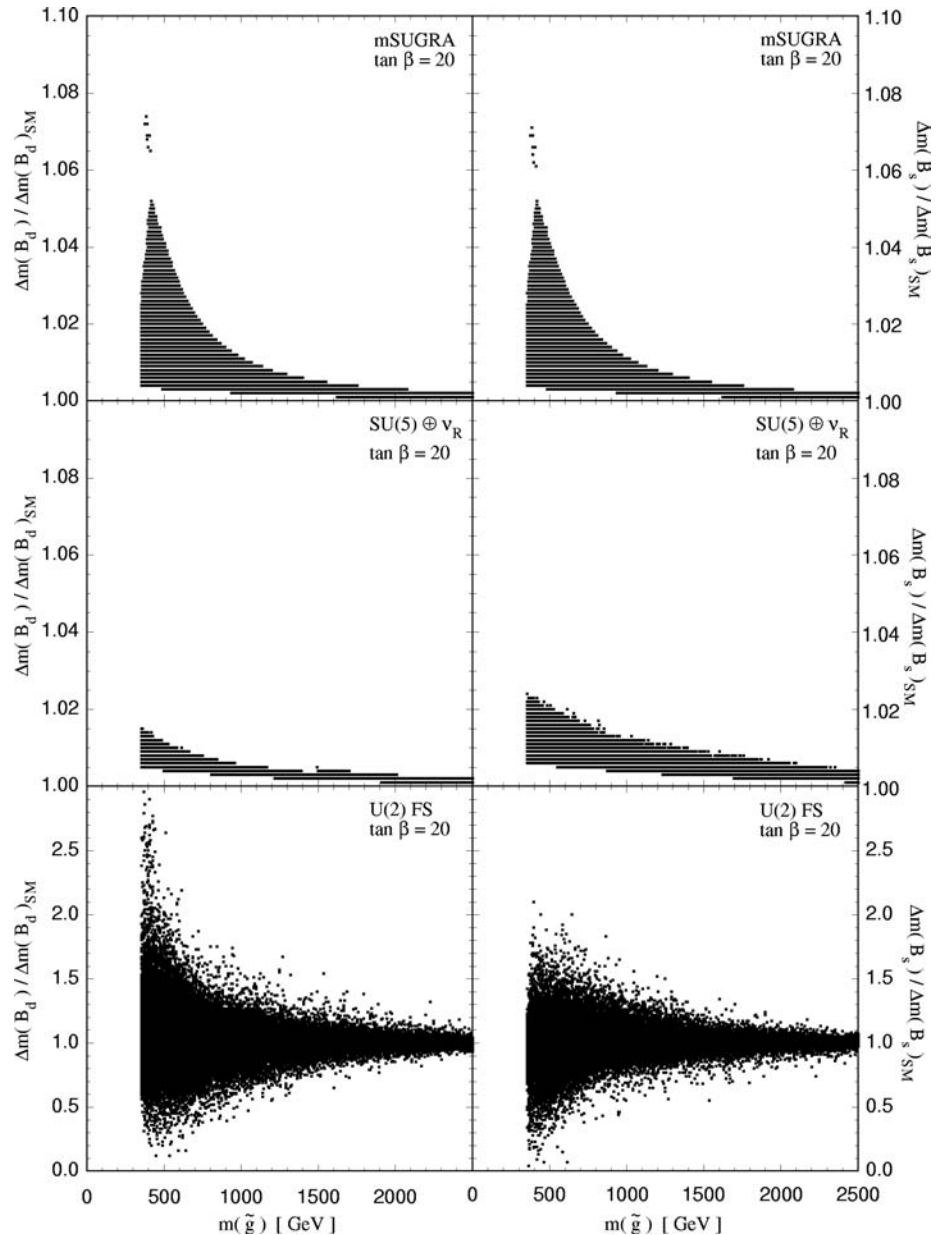
T.Goto *et al.*,
PRD:035009,02

$$\Delta m_d = 0.489 \pm 0.008 \text{ ps}^{-1}$$

$$\Delta m_d / \Delta m_d^{\text{SM}}$$

Estimated from $\sin 2\phi_1$, V_{cb} , V_{ub} and ϕ_3 using the unitarity relation.

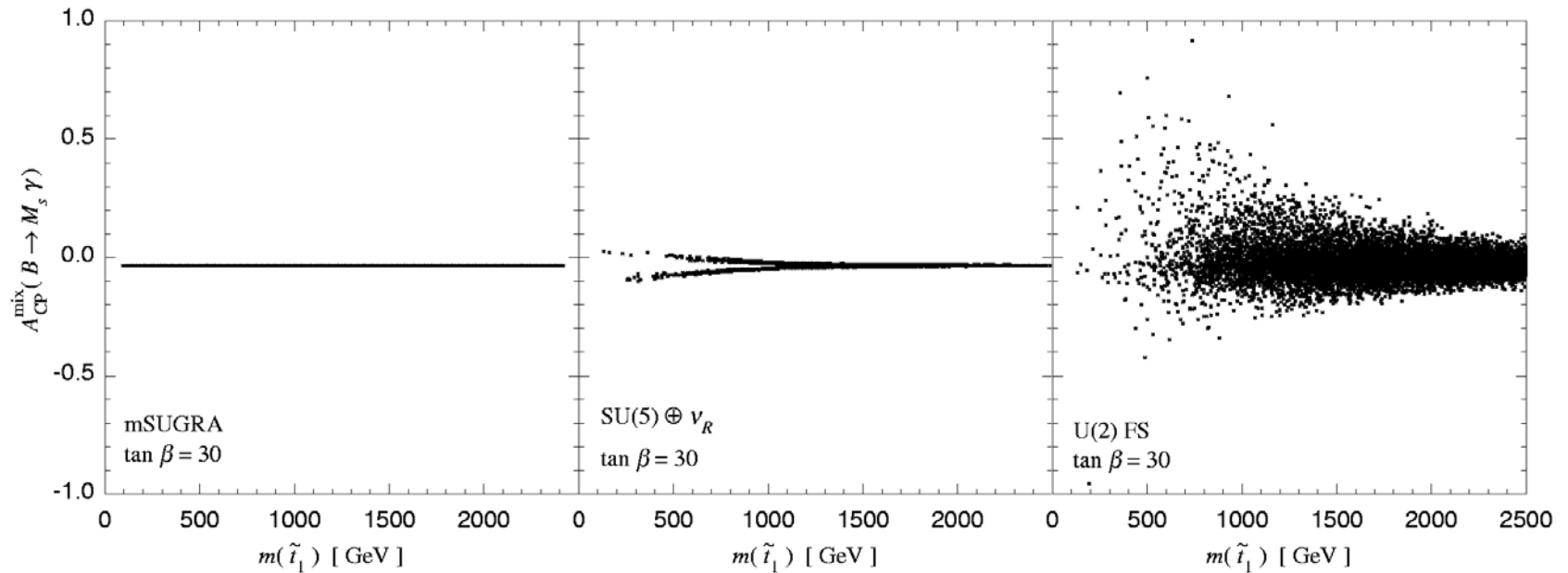
$$\delta \Delta m_d^{\text{SM}} \sim 5\% \quad (3ab^{-1})$$



~~SUSY~~ scenario vs. B decays (3)

$A_{CP}(B \rightarrow M_S \gamma)$ vs. stop mass

T.Goto *et al.*,
hep-ph/0211143

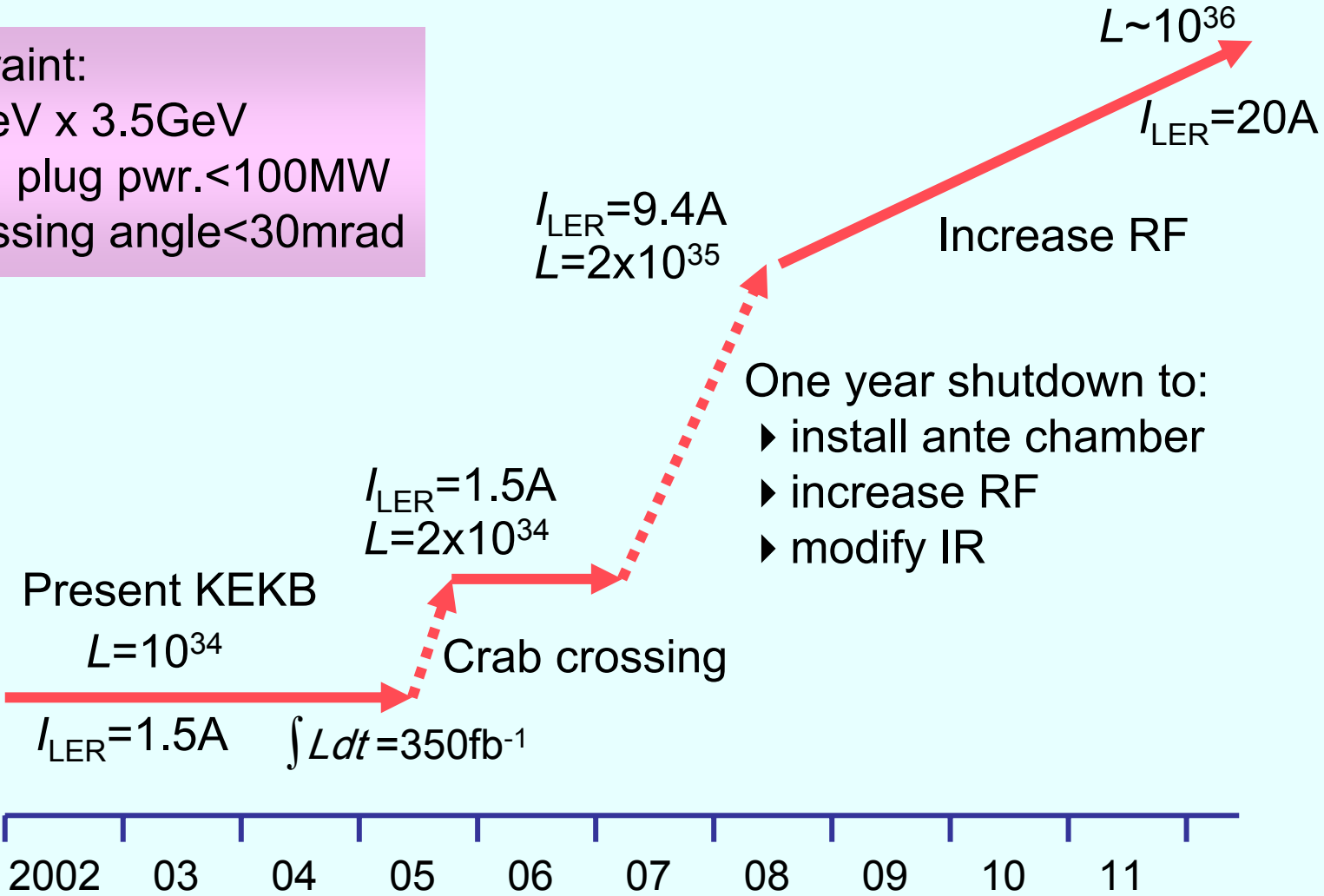


$$\delta A_{CP}(B \rightarrow M_S \gamma) \sim 0.05 (3ab^{-1})$$

KEKB upgrade strategy

Constraint:

- ▶ 8GeV x 3.5GeV
- ▶ wall plug pwr. < 100MW
- ▶ crossing angle < 30mrad

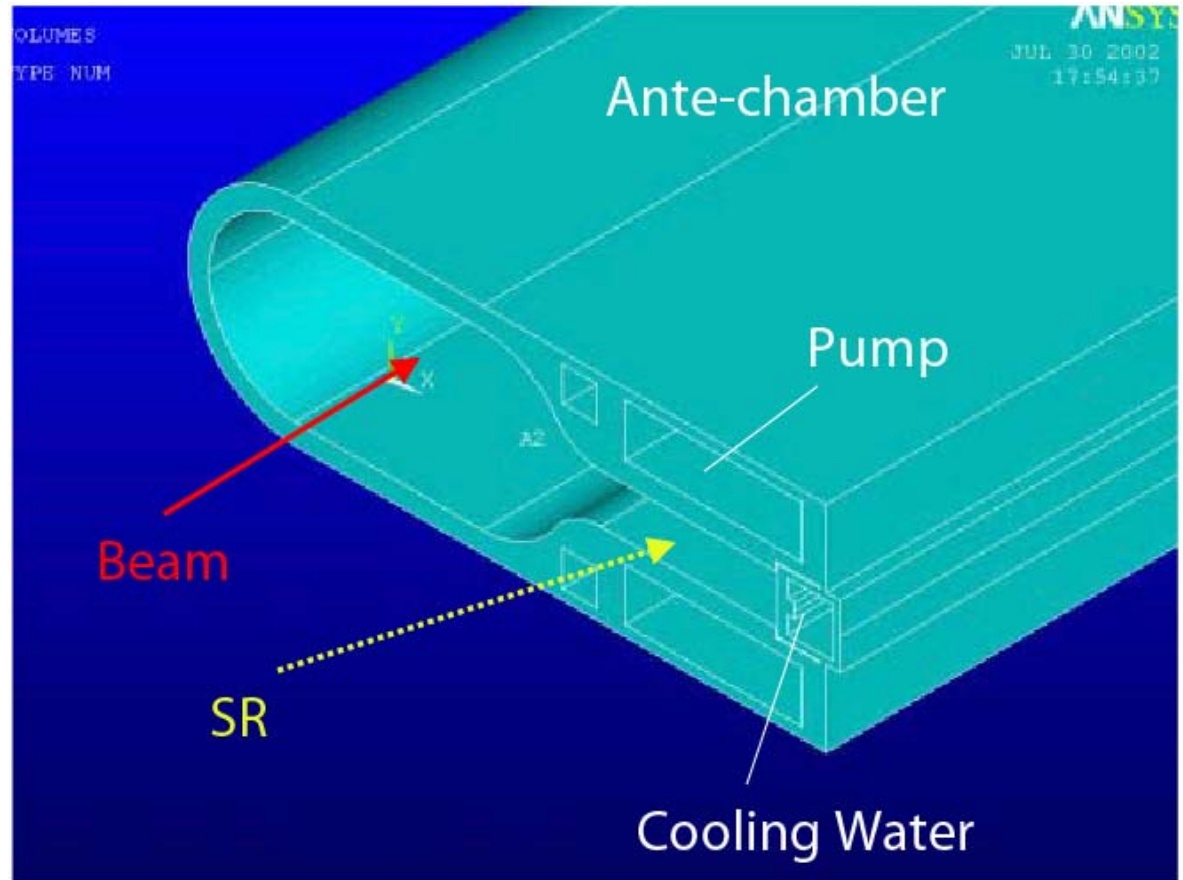


New vacuum chamber

KEKB luminosity is limited by photo-electron instability.



Antechamber in solenoidal magnetic field



Machine parameters

Luminosity	10^{34} (now)	10^{35}	$5-10 \times 10^{35}$
Number of bunches	1223	5018	5018
Vertical beta at IP (mm)	7	3	1~3*
Beam-beam parameter	0.05	0.05	0.07*
Bunch length (mm)	5.6	3	3~5*
Horizontal beta at IP (cm)	60	30	15*
Horizontal emittance (nm)	18	33	6~33*
Half crossing angle (mrad)	11	15	20*
Vertical beam size at IP (μm)	2.6	2.5	~2*
HER current (A)	0.9	4.1	8
LER current (A)	1.5	9.4	20

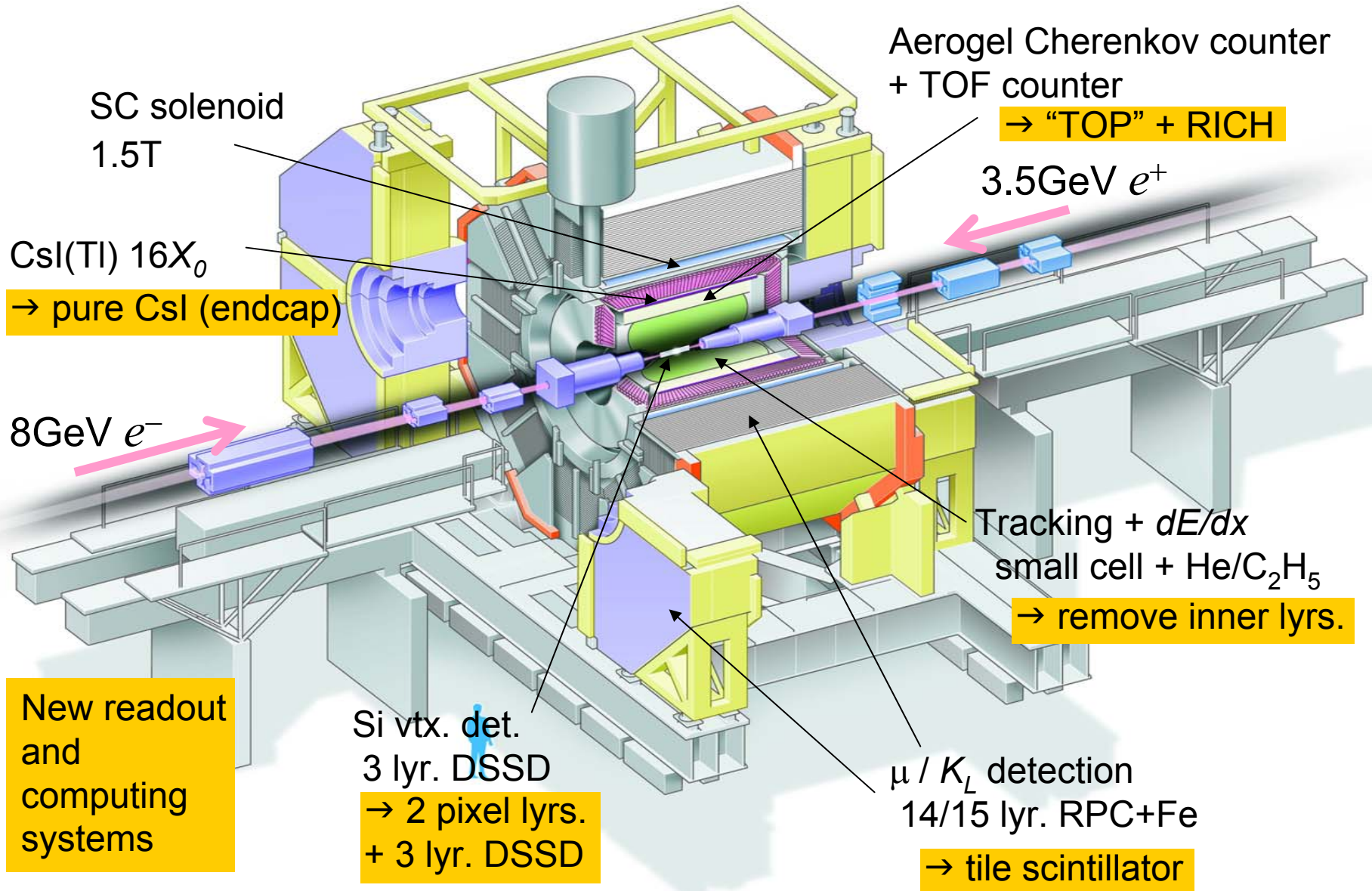
* These parameters are under study.

Detector upgrade

Higher luminosity collider will lead to:

- ▶ Higher background
 - radiation damage and occupancy in the vtx. detector
 - fake hits in the EM calorimeter
 - radiation problem in the tracker and $K_L\mu$ detector
- ▶ Higher event rate
 - higher rate trigger, DAQ and computing
- ▶ Require special features to the detector.
 - low p_μ identification $\leftarrow s_{\mu\mu}$ reconstruction eff.
 - hermeticity $\leftarrow \nu$ “reconstruction”

Detector upgrade: an example



What will happen next

- We have a series of workshops. The 5th one will be on September 24-26, 2003 in Izu, Japan.
- Lol will be submitted to KEK/LCPAC/HEP community after the workshop.
- We will continue R&D for machine and detector.
- PEP-II/BaBar – KEKB/Belle joint workshop is scheduled on January 19-22, 2004 in Honolulu.

Summary and Conclusions

- Next generation B factories with $L=10^{35-36}$ is useful for:
 - Precise test of KM scheme of CP violation
 - Search for new physics in B and τ decays
 - Identify mechanism of SUSY breaking.
- Design of the accelerator and detector is going on at KEK and other places.
- Lol will be submitted by the end of this year.