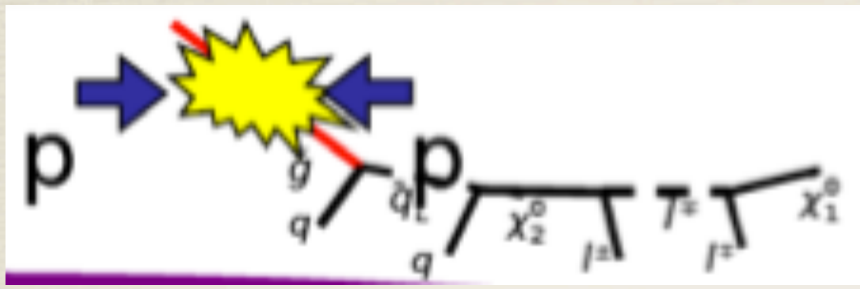
Physics at the future B Factories

Francesco Forti
INFN e Università di Pisa

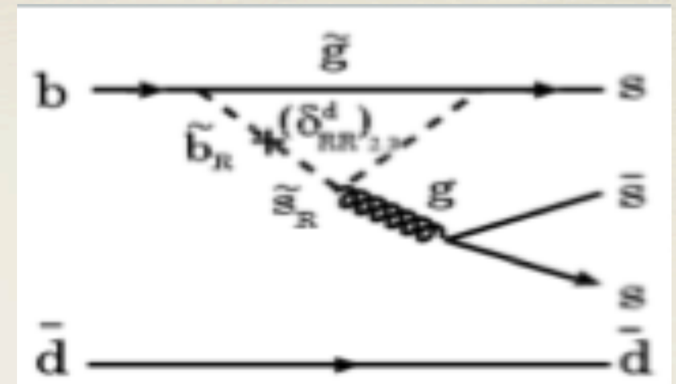
Incontri di Fisica delle Alte Energie
Perugia, 27-29 Aprile 2011

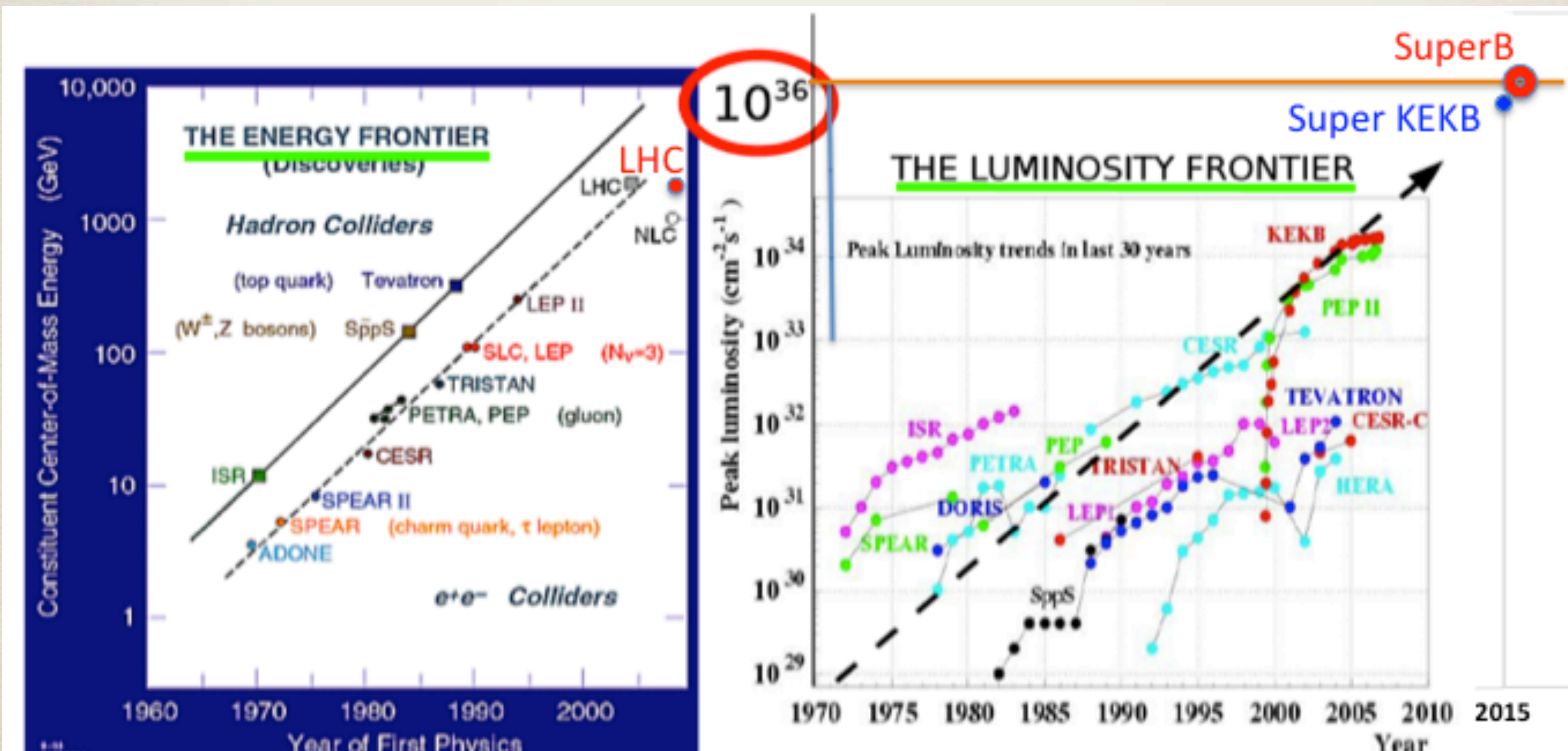
2-way street to New Physics

Relativistic path



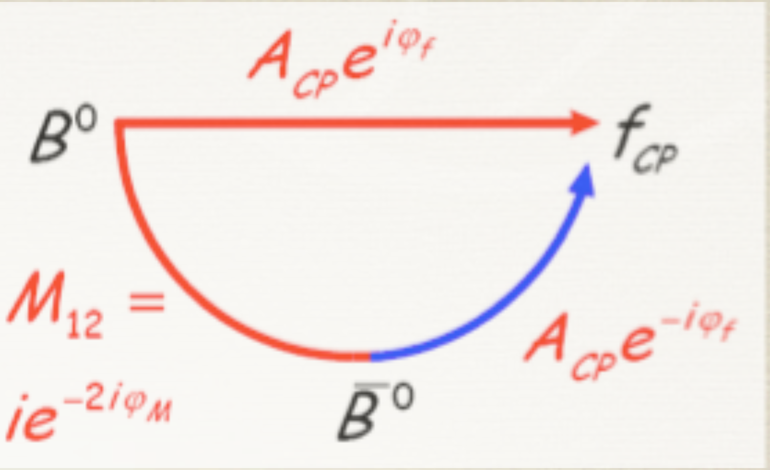
Quantum path

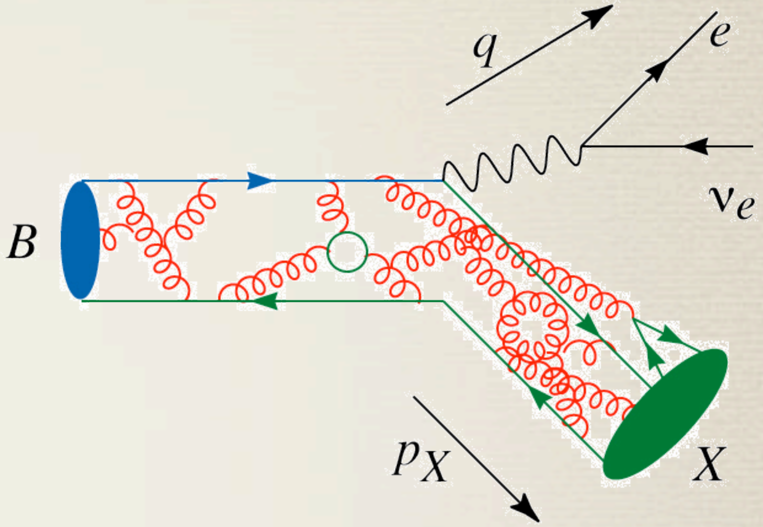


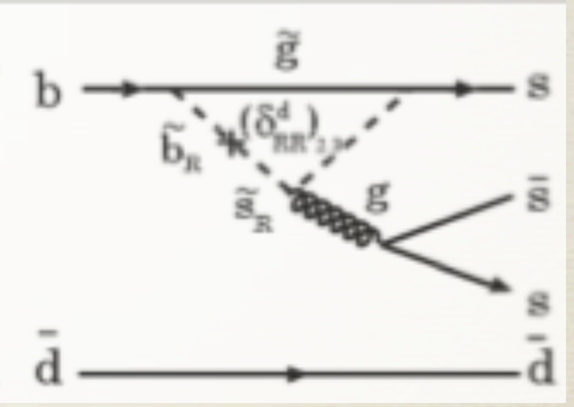


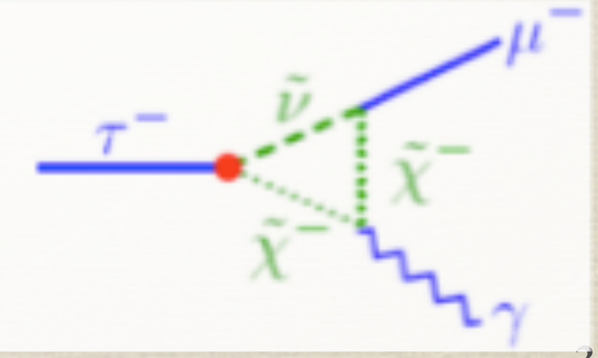
Why flavour physics

1. Explore the origin of CP violation
   - Key element for understanding the matter content of our present universe
   - Established in the B meson in 2001
   - Direct CPV established in B mesons in 2004
2. Precisely measure parameters of the standard model
   - For example the elements of the CKM quark mixing matrix
   - Disentangle the complicated interplay between weak processes and strong interaction effects
3. Search for the effects of physics beyond the standard model in loop diagrams
   - Potentially large effects on rates of rare decays, time dependent asymmetries, lepton flavour violation, ...
   - Sensitive even to large New Physics scale, as well as to phases and size of NP coupling constants









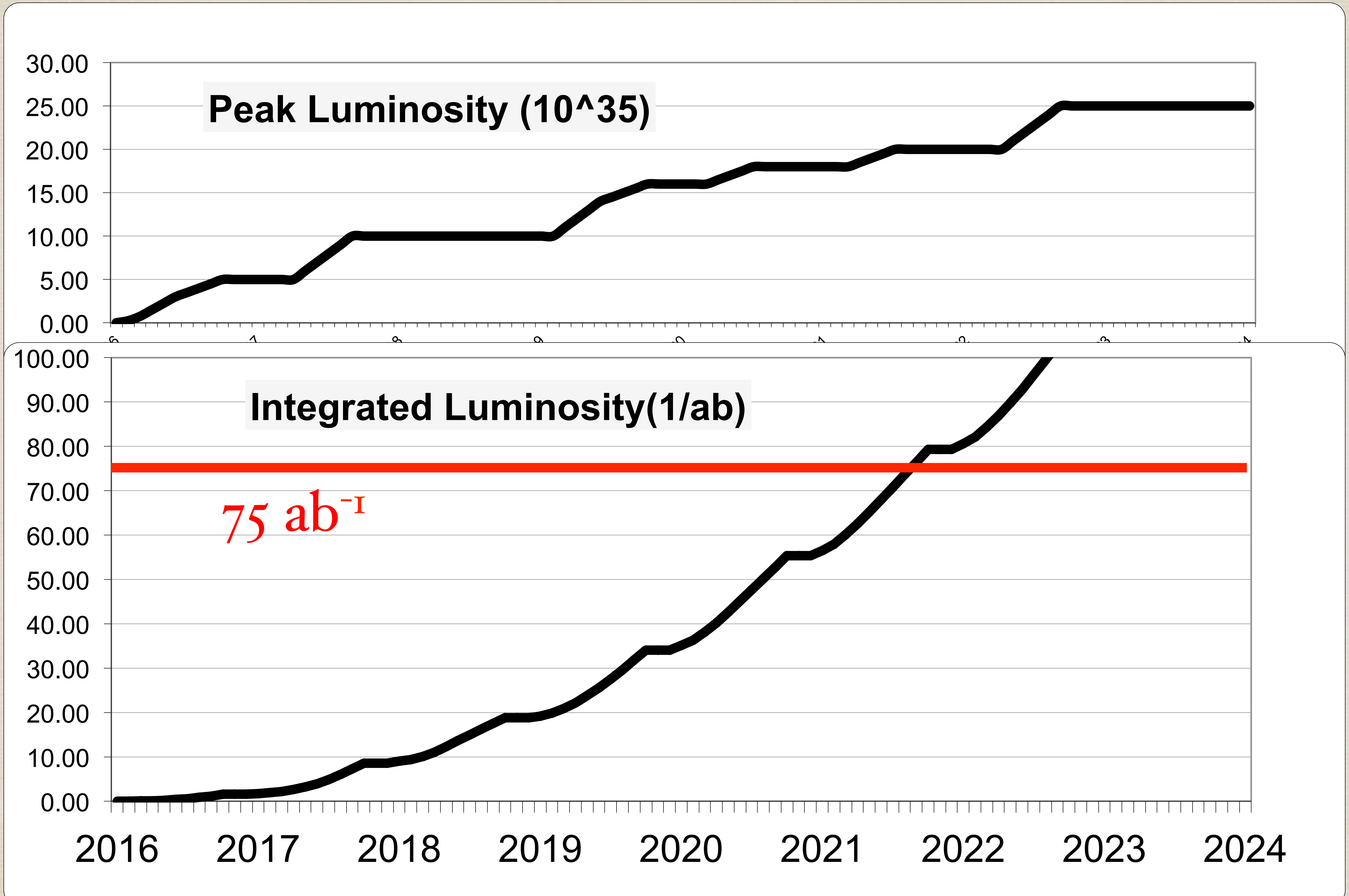
Questions

* Are KEK-B and SuperB discovery machines in the LHC era ?
* Why is a luminosity > 10^{36} required ?
* Why LHCb is not enough for flavor studies ?
* Is it important to run at the charm/tau threshold ?
* Is it important to have polarization ?

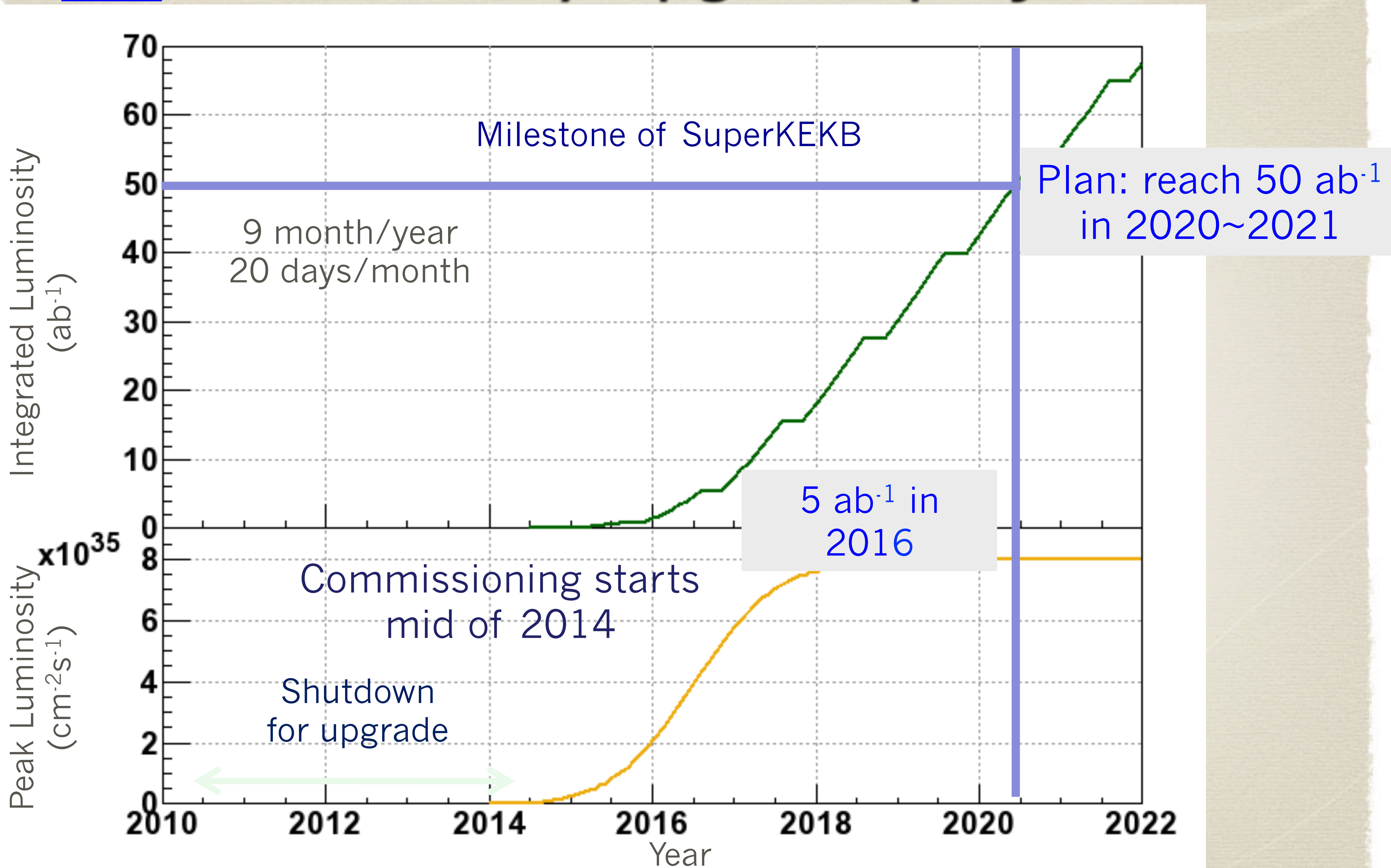
Future Super B Factories

	SuperB	Super KEKB
Peak Luminosity	$>10^{36}$	0.8×10^{36}
Integrated Luminosity	75 ab^{-1}	50 ab^{-1}
Site	Green Field	KEKB Laboratory
Collisions	mid 2016	2015
Polarization	80% electron beam	No
Low energy running	10^{35} @ charm threshold	No
Approval status	Approved	Approved

SuperB Luminosity model

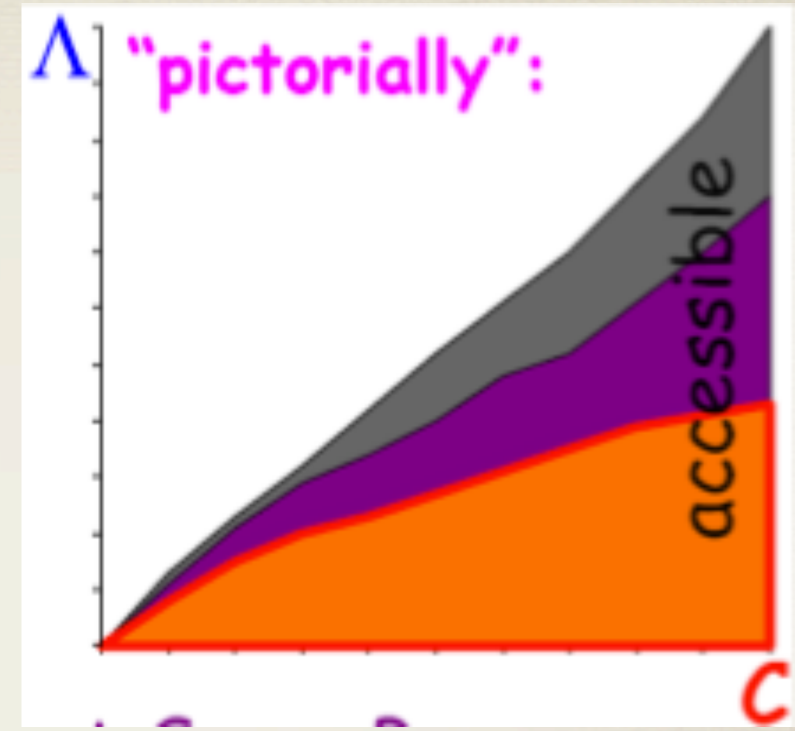


Luminosity upgrade projection



Power of Intensity

- Precision measurements in the flavour sector are sensitive to New Physics (NP)
  - Intereference effects in known processes
  - SM Rare or forbidden decays
- NP effects are controlled by
  - NP scale Λ and effective couplings: C
    - Different coupling intensity (different interactions)
    - Differente patterns (e.g. because of simmetries)



- With 5 to 10 x 10^{10} bb, cc, ττ pairs (50-100 ab^{-1}) one can:

LHC finds NP(Λ)

- Determine detailed structure of couplings of NP
- Look for heavier startes
- Study NP flavour structure

LHC does not find NP(Λ)

- Look for indirect NP signals
- Connect them to models
- Exclude regions in parameters space

Some channels, such as the LFV decays of τ are unambiguous signals of NP

$L \sim 10^{34}\ cm^{-2}\ s^{-1} \leftrightarrow$ EW scale ~100GeV

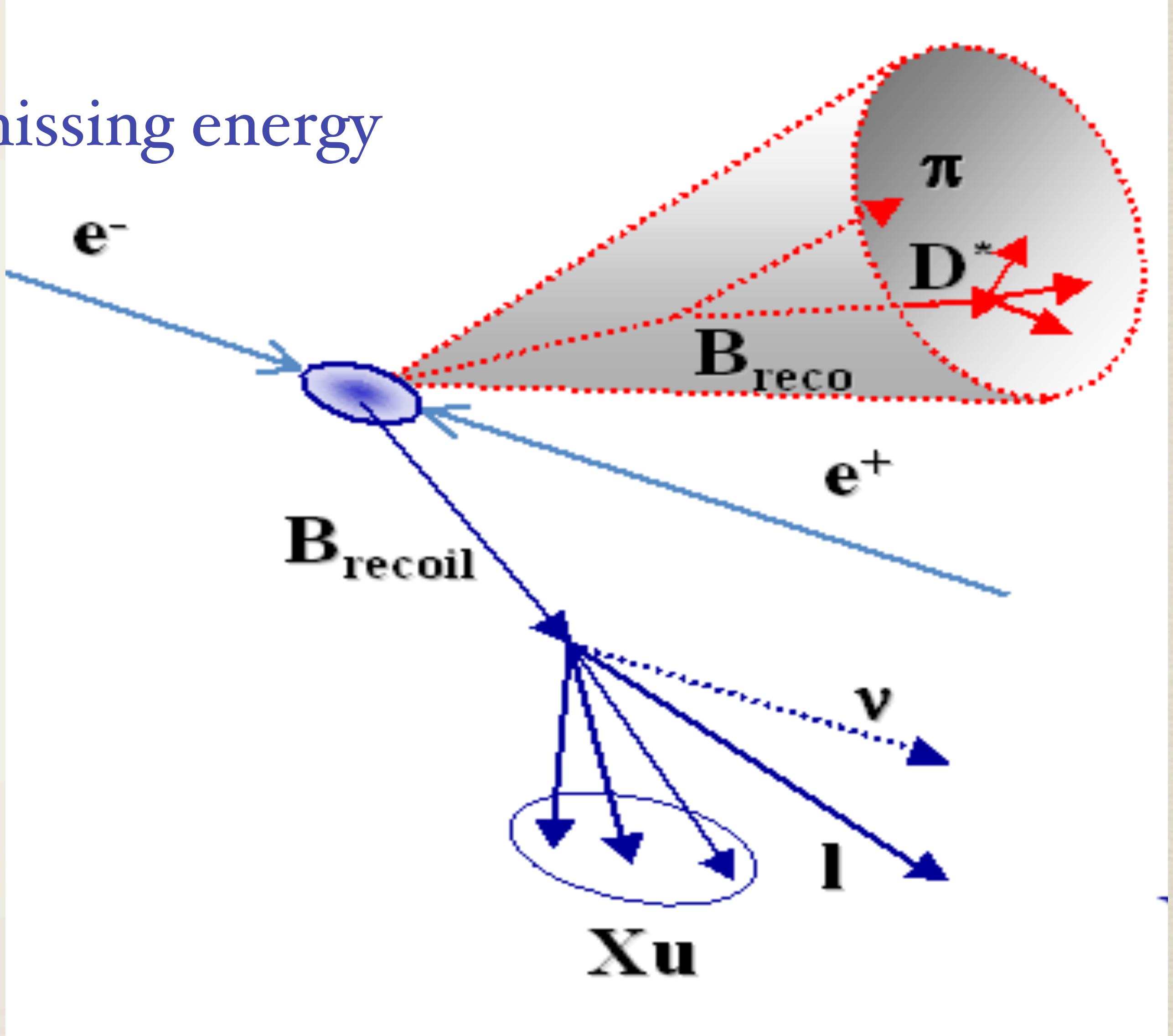
$L \sim 10^{36}\ cm^{-2}\ s^{-1} \leftrightarrow$ TeV scale

Cross section is not everything

- Hadron machines do have the advantage of an enormously larger B production cross section, ...BUT...
- SuperB has a super-easy ½ track trigger
- Initial state is coeherent, allowing interference measurements
- SuperB can do t physics.
- Has access to states with a loss of missing energy

B-Beam Method

- Fully reconstruct one the two Bs in hadronic modes
  - High efficiency: a few per mille
  - > 10^7 recoil Bs in $10ab^{-1}$
- Obtain a pure B Beam on the other side
  - High purity sample
  - Can look at channels with a lot of missing energy.
  - For example BR(B→nothing) measured.



Recoil cinematics well known
Recoil flavor and charge is determined

B physics @ Y(4S)

Variety of measurements for any observable

Observable	B Factories (2 ab^{-1})	Super$B$ (75 ab^{-1})
$\sin(2\beta)$ $(J/\psi\, K^0)$	0.018	0.005 (†)
$\cos(2\beta)$ $(J/\psi\, K^{*0})$	0.30	0.05
$\sin(2\beta)$ (Dh^0)	0.10	0.02
$\cos(2\beta)$ (Dh^0)	0.20	0.04
$S(J/\psi\, \pi^0)$	0.10	0.02
$S(D^+D^-)$	0.20	0.03
α $(B \to \pi\pi)$	$\sim 16^\circ$	3°
α $(B \to \rho\rho)$	$\sim 7^\circ$	1–2° (∗)
α $(B \to \rho\pi)$	$\sim 12^\circ$	2°
α (combined)	$\sim 6^\circ$	1–2° (∗)
γ $(B \to DK,\, D \to CP$ eigenstates)	$\sim 15^\circ$	2.5°
γ $(B \to DK,\, D \to$ suppressed states)	$\sim 12^\circ$	2.0°
γ $(B \to DK,\, D \to$ multibody states)	$\sim 9^\circ$	1.5°
γ $(B \to DK$, combined)	$\sim 6^\circ$	1–2°
$2\beta + \gamma$ $(D^{(*)\pm}\pi^\mp,\, D^\pm K^0_S\pi^\mp)$	20°	5°
$S(\phi K^0)$	0.13	0.02 (∗)
$S(\eta' K^0)$	0.05	0.01 (∗)
$S(K^0_S K^0_S K^0_S)$	0.15	0.02 (∗)
$S(K^0_S \pi^0)$	0.15	0.02 (∗)
$S(\omega K^0_S)$	0.17	0.03 (∗)
$S(f_0 K^0_S)$	0.12	0.02 (∗)
$\lvert V_{cb}\rvert$ (exclusive)	4% (∗)	1.0% (∗)
$\lvert V_{cb}\rvert$ (inclusive)	1% (∗)	0.5% (∗)
$\lvert V_{ub}\rvert$ (exclusive)	8% (∗)	3.0% (∗)
$\lvert V_{ub}\rvert$ (inclusive)	8% (∗)	2.0% (∗)

Observable	B Factories (2 ab^{-1})	Super$B$ (75 ab
$\mathcal{B}(B \to \tau\nu)$	20%	4% (†)
$\mathcal{B}(B \to \mu\nu)$	visible	5%
$\mathcal{B}(B \to D\tau\nu)$	10%	2%
$\mathcal{B}(B \to \rho\gamma)$	15%	3% (†)
$\mathcal{B}(B \to \omega\gamma)$	30%	5%
$A_{CP}(B \to K^*\gamma)$	0.007 (†)	0.004 († ∗)
$A_{CP}(B \to \rho\gamma)$	~ 0.20	0.05
$A_{CP}(b \to s\gamma)$	0.012 (†)	0.004 (†)
$A_{CP}(b \to (s+d)\gamma)$	0.03	0.006 (†)
$S(K^0_S\pi^0\gamma)$	0.15	0.02 (∗)
$S(\rho^0\gamma)$	possible	0.10
$A_{CP}(B \to K^*\ell\ell)$	7%	1%
$A^{FB}(B \to K^*\ell\ell)s_0$	25%	9%
$A^{FB}(B \to X_s\ell\ell)s_0$	35%	5%
$\mathcal{B}(B \to K\nu\bar{\nu})$	visible	20%
$\mathcal{B}(B \to \pi\nu\bar{\nu})$	–	possible

Possible also at LHCb

Similar precision at LHCb

Example of « SuperB specifics »

- inclusive in addition to exclusive analyses
- channels with π°, γ's, ν, many Ks...

τ physics (polarized beams)

Process	Sensitivity
$\mathcal{B}(\tau \to \mu\gamma)$	2×10^{-9}
$\mathcal{B}(\tau \to e\gamma)$	2×10^{-9}
$\mathcal{B}(\tau \to \mu\mu\mu)$	2×10^{-10}
$\mathcal{B}(\tau \to eee)$	2×10^{-10}
$\mathcal{B}(\tau \to \mu\eta)$	4×10^{-10}
$\mathcal{B}(\tau \to e\eta)$	6×10^{-10}
$\mathcal{B}(\tau \to \ell K_s^0)$	2×10^{-10}

Charm at Υ(4S) and threshold

Mode	Observable	B Factories (2 ab^{-1})	Super$B$ (75 ab^{-1})
$D^0 \to K^+K^-$	y_{CP}	2–3×10^{-3}	5×10^{-4}
$D^0 \to K^+\pi^-$	y'_D	2–3×10^{-3}	7×10^{-4}
$D^0 \to K_s^0\pi^+\pi^-$	x'^2_D	1–2×10^{-4}	3×10^{-5}
	y_D	2–3×10^{-3}	5×10^{-4}
	x_D	2–3×10^{-3}	5×10^{-4}
Average	y_D	1–2×10^{-3}	3×10^{-4}
	x_D	2–3×10^{-3}	5×10^{-4}
$D^0 \to K^+\pi^-$	x'^2	To be evaluated at LHCb	3×10^{-5}
	y'		7×10^{-4}
$D^0 \to K^+K^-$	y_{CP}		5×10^{-4}
$D^0 \to K_S^0\pi^+\pi^-$	x		4.9×10^{-4}
	y		3.5×10^{-4}
	$\lvert q/p\rvert$		3×10^{-2}
	ϕ		2°

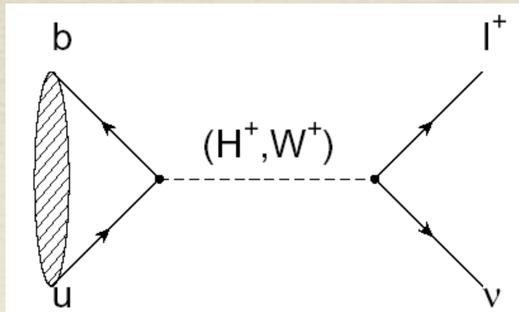
Channel	Sensitivity
$D^0 \to e^+e^-$, $D^0 \to \mu^+\mu^-$	1×10^{-8}
$D^0 \to \pi^0e^+e^-$, $D^0 \to \pi^0\mu^+\mu^-$	2×10^{-8}
$D^0 \to \eta e^+e^-$, $D^0 \to \eta\mu^+\mu^-$	3×10^{-8}
$D^0 \to K_S^0e^+e^-$, $D^0 \to K_S^0\mu^+\mu^-$	3×10^{-8}
$D^+ \to \pi^+e^+e^-$, $D^+ \to \pi^+\mu^+\mu^-$	1×10^{-8}
$D^0 \to e^\pm\mu^\mp$	1×10^{-8}
$D^+ \to \pi^+e^\pm\mu^\mp$	1×10^{-8}
$D^0 \to \pi^0e^\pm\mu^\mp$	2×10^{-8}
$D^0 \to \eta e^\pm\mu^\mp$	3×10^{-8}
$D^0 \to K_S^0e^\pm\mu^\mp$	3×10^{-8}
$D^+ \to \pi^-e^+e^+$, $D^+ \to K^-e^+e^+$	1×10^{-8}
$D^+ \to \pi^-\mu^+\mu^+$, $D^+ \to K^-\mu^+\mu^+$	1×10^{-8}
$D^+ \to \pi^-e^\pm\mu^\mp$, $D^+ \to K^-e^\pm\mu^\mp$	1×10^{-8}

B_s at Υ(5S)

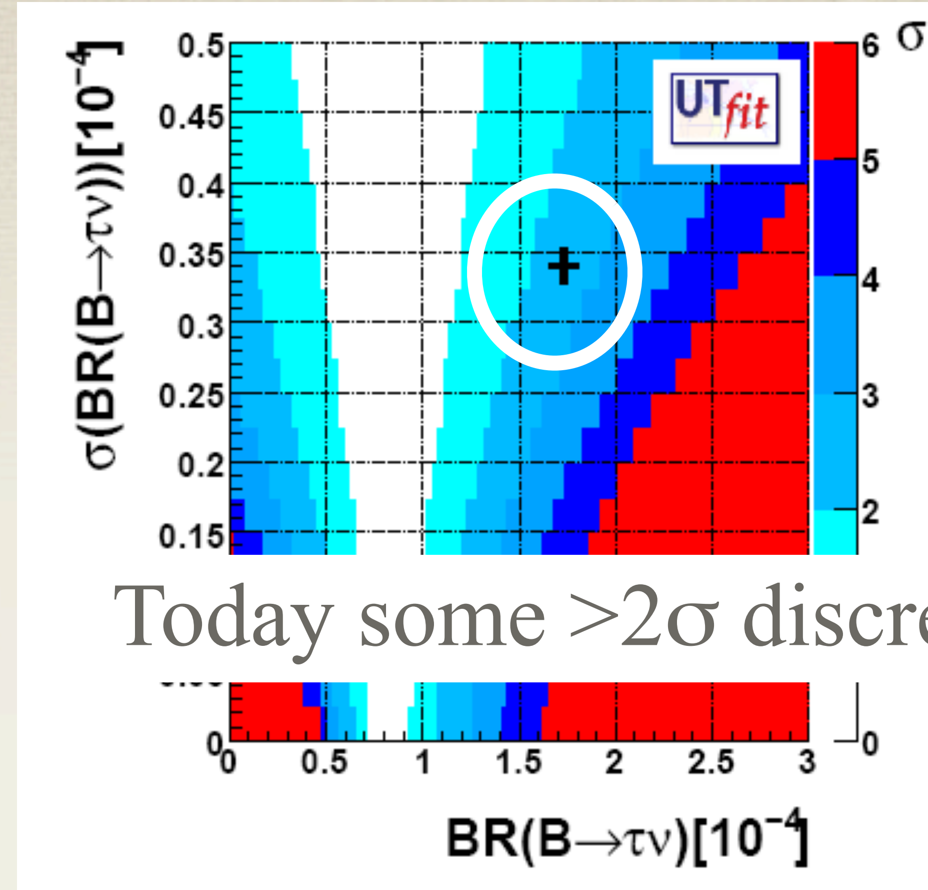
Observable	Error with 1 ab^{-1}	Error with 30 ab^{-1}
$\Delta\Gamma$	0.16 ps^{-1}	0.03 ps^{-1}
Γ	0.07 ps^{-1}	0.01 ps^{-1}
β_s from angular analysis	20°	8°
$A^s_{\rm SL}$	0.006	0.004
$A_{\rm CH}$	0.004	0.004
$\mathcal{B}(B_s \to \mu^+\mu^-)$	-	$< 8 \times 10^{-9}$
$\lvert V_{td}/V_{ts}\rvert$	0.08	0.017
$\mathcal{B}(B_s \to \gamma\gamma)$	38%	7%
β_s from $J/\psi\phi$	16°	6°
β_s from $B_s \to K^0\bar{K}^0$	24°	11°

Bs : Definitively better at LHCb

Leptonic decay $B \rightarrow l\nu$



$$BR(B\rightarrow\tau\nu) = BR_{SM}(B\rightarrow\tau\nu)\left(1-\frac{m_B^2}{M_H^2}\tan^2\beta\right)^2$$

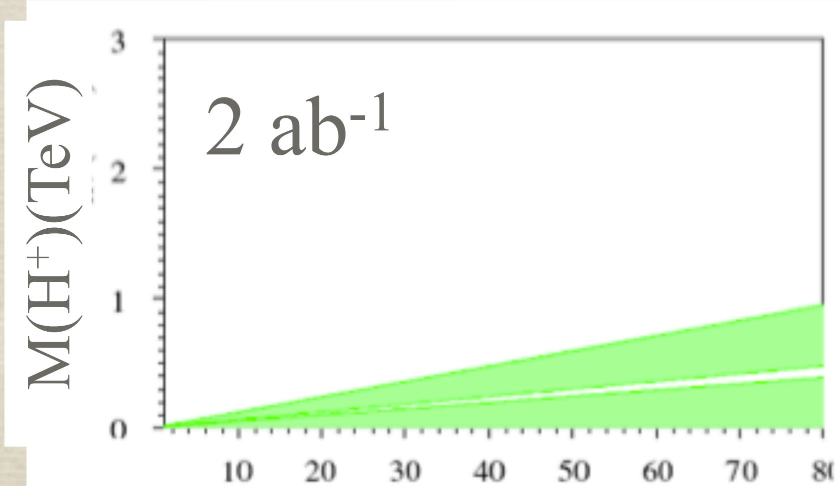


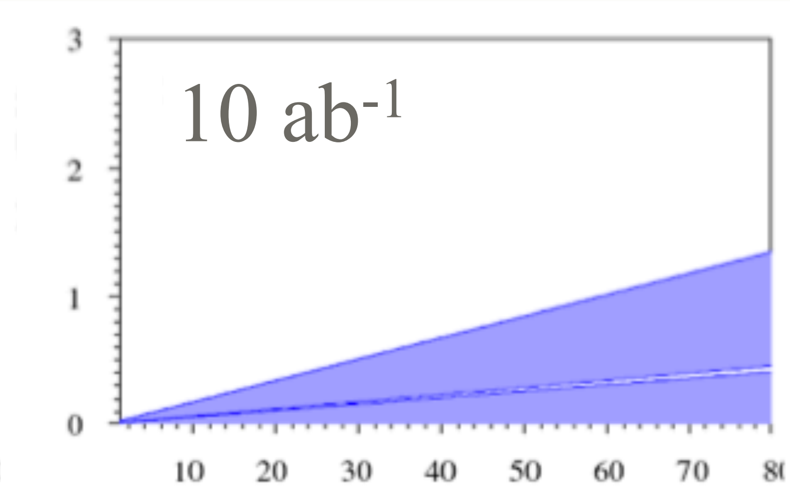
Today some >2σ discrepancy..

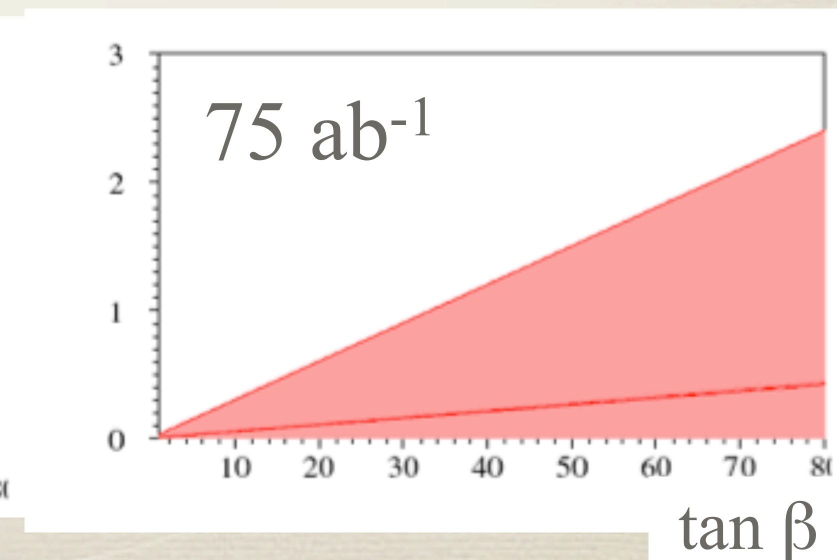
Observable	B Factories (2 ab^{-1})	Super$B$ (75 ab^{-1})
$\mathcal{B}(B\rightarrow\tau\nu)$	20%	4% (†)
$\mathcal{B}(B\rightarrow\mu\nu)$	visible	5%
$\mathcal{B}(B\rightarrow D\tau\nu)$	10%	2%

SuperB - 75ab^{-1}
M_H ~1.2-2.5 TeV
for tanβ~30-60

Exclusion regions @ 2σ in case of no-signal







$B \to K^*\gamma$ t-dependent CPV

$$P(B^0 \to f;\Delta t) = \frac{e^{-|\Delta t|/\tau}}{4\tau}[1 + S^f_{CP}\sin(\Delta m \Delta t) + A^f_{CP}\cos(\Delta m \Delta t)]$$

SM:

$$|S^{K_S\pi^0\gamma}_{CP}| \approx (2m_s/m_b)\sin 2\Phi_1 \approx 0.04$$

Left-Right Symmetric Models:

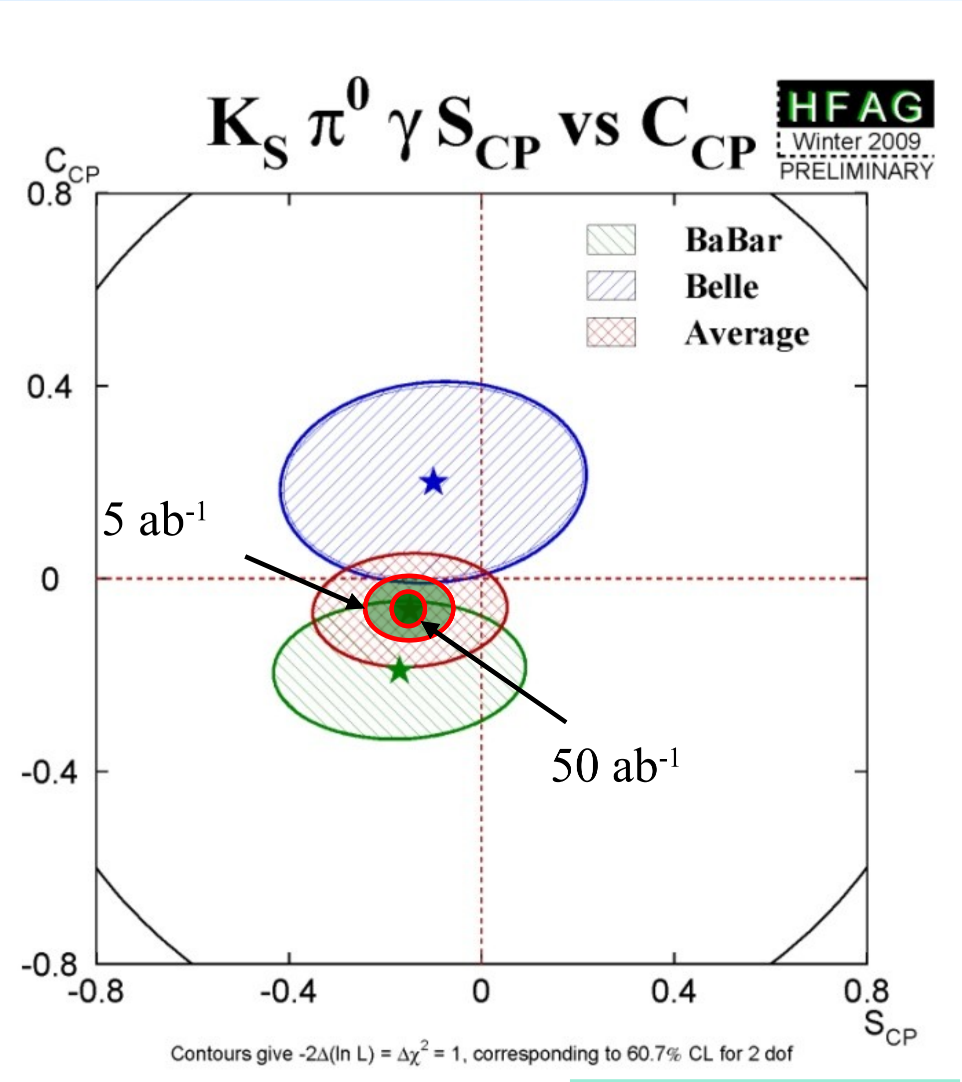
$$|S^{K_S\pi^0\gamma}_{CP}| \approx 0.67\cos 2\Phi_1 \approx 0.5$$

D. Atwood et al., PRL79, 185 (1997)

$$S^{K_S\pi^0\gamma}_{CP} = -0.15 \pm 0.20$$

$$A^{K_S\pi^0\gamma}_{CP} = -0.07 \pm 0.12$$

HFAG, Winter'09



adopted from HFAG

$$\sigma(S^{K_S\pi^0\gamma}_{CP}) = 0.09 \ @ \ 5ab^{-1}$$
$$0.03 \ @ \ 50ab^{-1}$$ (~SM prediction)

Charm Physics

Running at charm threshold (SuperB specific)

Charm physics using the charm produced at Y(4S)

Charm physics at threshold   0.3 ab^{-1}

Consider that running 2 month at threshold we will collect 500 times the stat. of CLEO-C

Strong dynamics and CKM measurements

@threshold(4GeV)

D decay form factor and decay constant @ 1%
Dalitz structure useful for γ measurement

ξ~1%,
exclusive V_{ub} ~ few %
syst. error on γ from Dalitz Model <1°

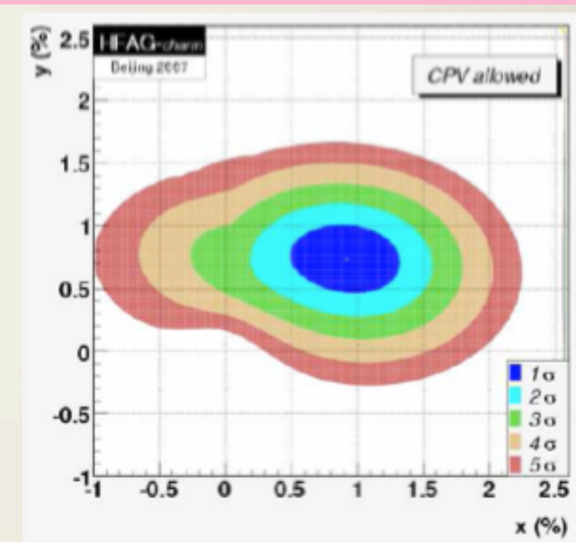
Rare decays FCNC down to 10^{-8}

@threshold(4GeV)

Channel	Sensitivity
$D^0 \to e^+e^-$, $D^0 \to \mu^+\mu^-$	1×10^{-8}
$D^0 \to \pi^0 e^+e^-$, $D^0 \to \pi^0\mu^+\mu^-$	2×10^{-8}
$D^0 \to \eta e^+e^-$, $D^0 \to \eta\mu^+\mu^-$	3×10^{-8}
$D^0 \to K^0_S e^+e^-$, $D^0 \to K^0_S\mu^+\mu^-$	3×10^{-8}
$D^+ \to \pi^+ e^+e^-$, $D^+ \to \pi^+\mu^+\mu^-$	1×10^{-8}
$D^0 \to e^\pm\mu^\mp$	1×10^{-8}
$D^+ \to \pi^+ e^\pm\mu^\mp$	1×10^{-8}
$D^0 \to \pi^0 e^\pm\mu^\mp$	2×10^{-8}
$D^0 \to \eta e^\pm\mu^\mp$	3×10^{-8}
$D^0 \to K^0_S e^\pm\mu^\mp$	3×10^{-8}
$D^+ \to \pi^- e^+e^+$, $D^+ \to K^- e^+e^+$	1×10^{-8}
$D^+ \to \pi^- \mu^+\mu^+$, $D^+ \to K^- \mu^+\mu^+$	1×10^{-8}
$D^+ \to \pi^- e^\pm\mu^\mp$, $D^+ \to K^- e^\pm\mu^\mp$	1×10^{-8}

D mixing

Better studied using the high statistics collected at Y(4S)



Mode	Observable	B Factories (2 ab^{-1})	Super$B$ (75 ab^{-1})
$D^0 \to K^+K^-$	y_{CP}	$2\text{–}3 \times 10^{-3}$	5×10^{-4}
$D^0 \to K^+\pi^-$	y'_D	$2\text{–}3 \times 10^{-3}$	7×10^{-4}
	x'^2_D	$1\text{–}2 \times 10^{-4}$	3×10^{-5}
$D^0 \to K^0_S\pi^+\pi^-$	y_D	$2\text{–}3 \times 10^{-3}$	5×10^{-4}
	x_D	$2\text{–}3 \times 10^{-3}$	5×10^{-4}
Average	y_D	$1\text{–}2 \times 10^{-3}$	3×10^{-4}
	x_D	$2\text{–}3 \times 10^{-3}$	5×10^{-4}

CP Violation in mixing could now addressed

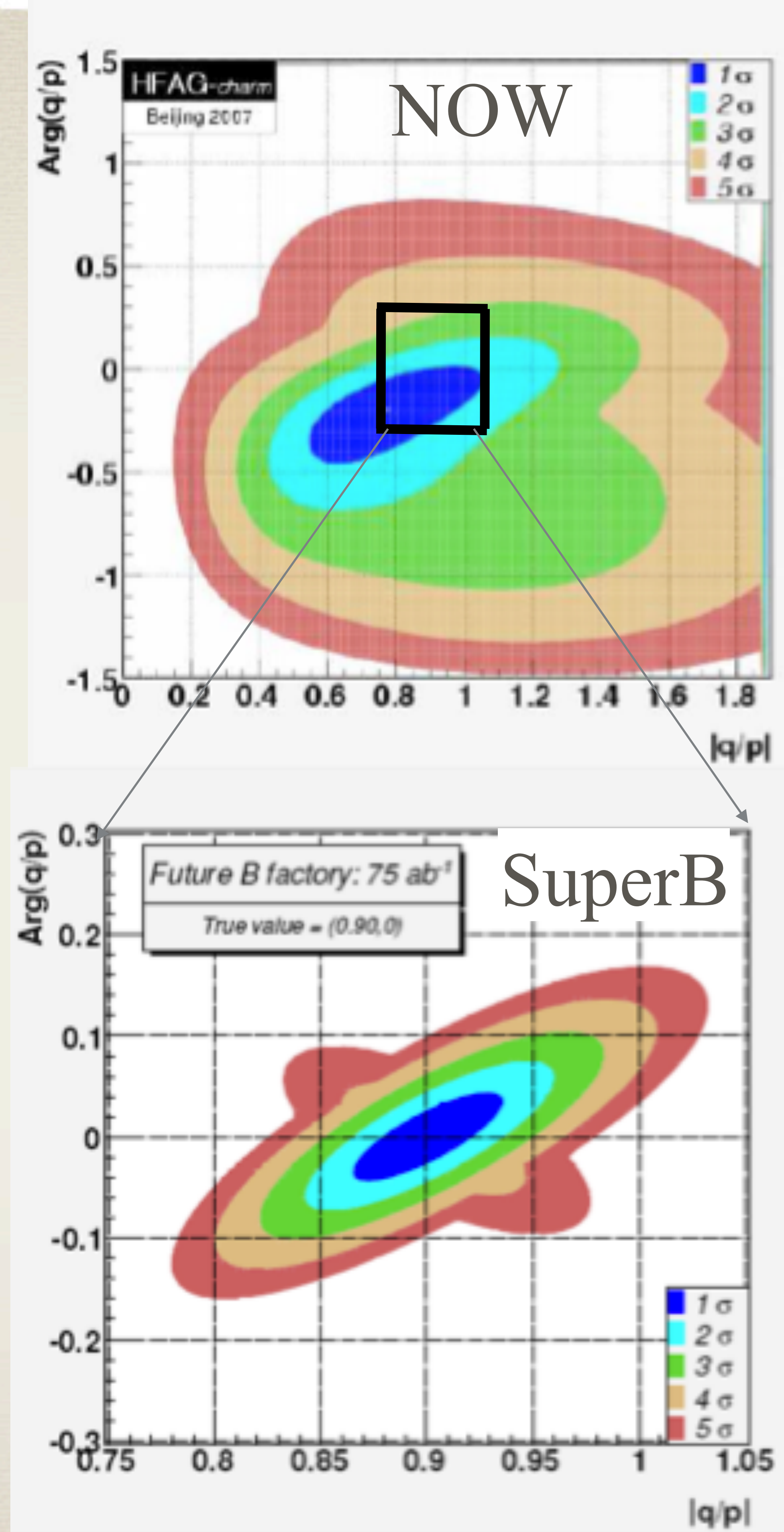
CP Violation in charm

$$\varphi \sim \frac{2\eta A^2\lambda^5}{\lambda} \sim O(10^{-3})$$

CPV in D system negligible in SM

Mode	Observable	$\Upsilon(4S)$ (75 ab^{-1})	$\psi(3770)$ (300 fb^{-1})
$D^0 \to K^+\pi^-$	x'^2	3×10^{-5}	
	y'	7×10^{-4}	
$D^0 \to K^+K^-$	y_{CP}	5×10^{-4}	
$D^0 \to K^0_S\pi^+\pi^-$	x	4.9×10^{-4}	
	y	3.5×10^{-4}	
	$\|q/p\|$	3×10^{-2}	
	ϕ	2°	
$\psi(3770) \to D^0\overline{D}^0$	x^2		$(1-2) \times 10^{-5}$
	y		$(1-2) \times 10^{-3}$
	$\cos\delta$		$(0.01-0.02)$

CPV in D sector is a clear indication of New Physics !



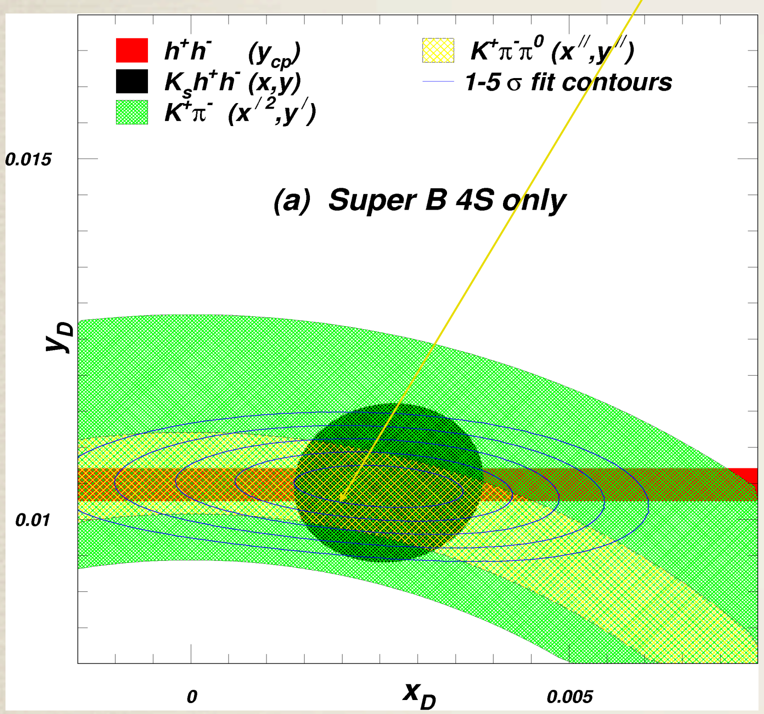
Running @ threshold

Decays of $\psi(3770) \rightarrow D^0 \bar{D}^0$ produce coherent $(C=-1)$ pairs of D^0's. Quantum correlations in their subsequent decays allow measurements of strong phases

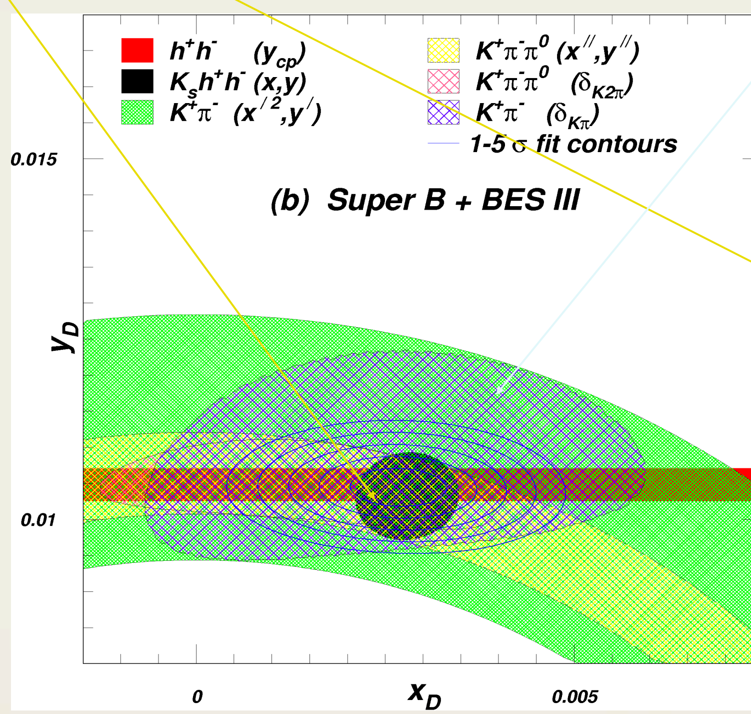
- Required for improved measurement of CKM γ
- Also required for D^0 mixing studies

500 fb-1 at $\psi(3770)$

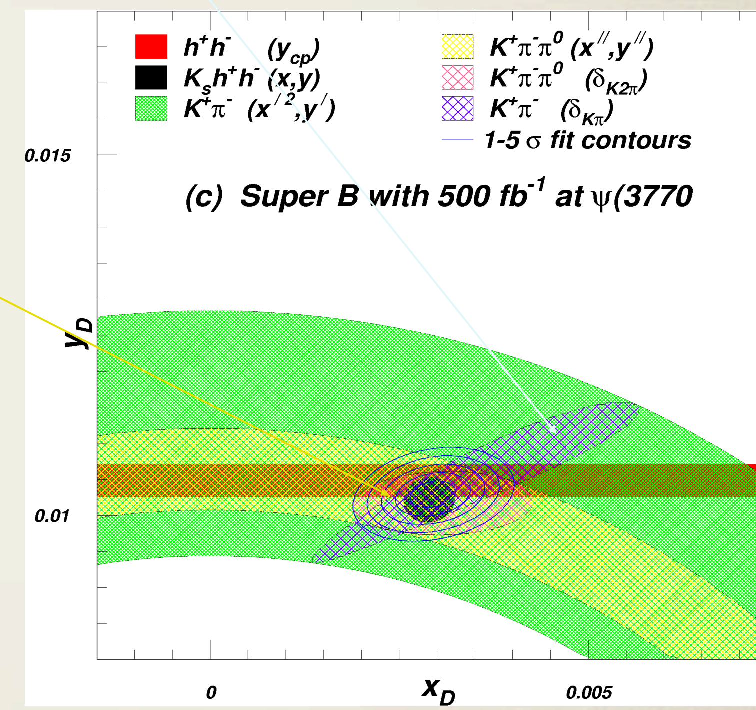
- Dalitz plot model uncertainty shrinks
- Information on overall strong phase is added



Fit	$x \times 10^3$	$y \times 10^3$	$\delta^\circ_{K+\pi-}$	$\delta^\circ_{K+\pi-\pi^0}$
(b)	$xxx^{+0.72}_{-0.75}$	$xxx \pm 0.19$	$xxx^{+3.7}_{-3.4}$	$xxx^{+4.6}_{-4.5}$
Stat.	(0.18)	(0.11)	(1.3)	(2.9)



Fit	$x \times 10^3$	$y \times 10^3$	$\delta^\circ_{K+\pi-}$	$\delta^\circ_{K+\pi-\pi^0}$
(c)	$xxx \pm 0.42$	$xxx \pm 0.17$	$xxx \pm 2.2$	$xxx^{+3.3}_{-3.4}$
Stat.	(0.18)	(0.11)	(1.3)	(2.7)

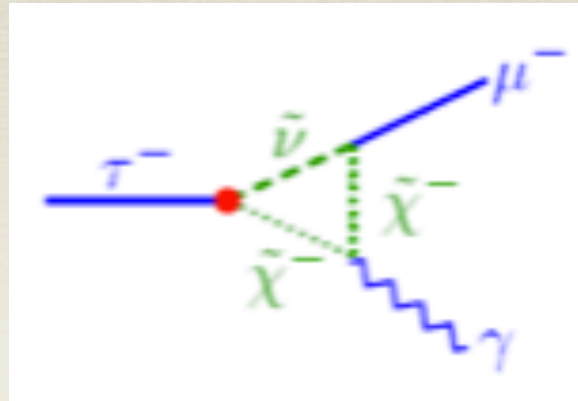


Fit	$x \times 10^3$	$y \times 10^3$	$\delta^\circ_{K+\pi-}$	$\delta^\circ_{K+\pi-\pi^0}$
(d)	$xxx \pm 0.20$	$xxx \pm 0.12$	$xxx \pm 1.0$	$xxx \pm 1.1$
Stat.	(0.17)	(0.10)	(0.9)	(1.1)

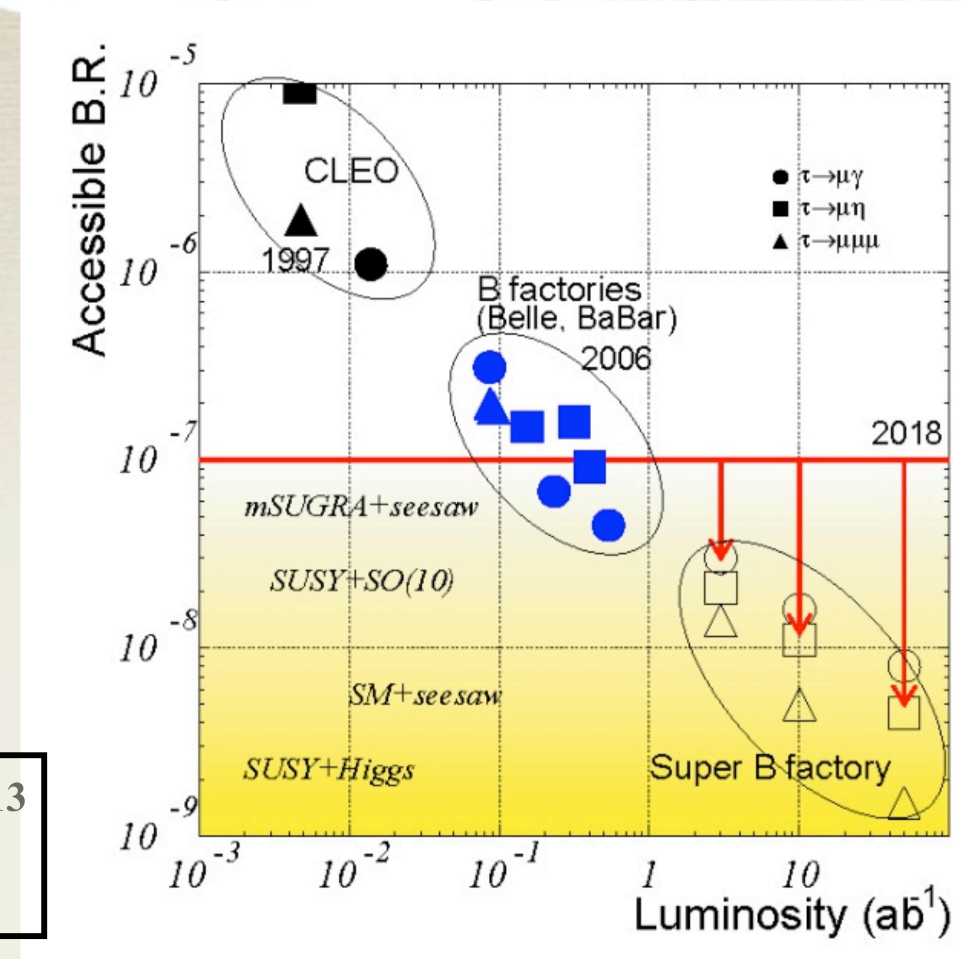
Uncertainty in x_D improves more than that of y_D

Lepton Flavour Violation in τ decays

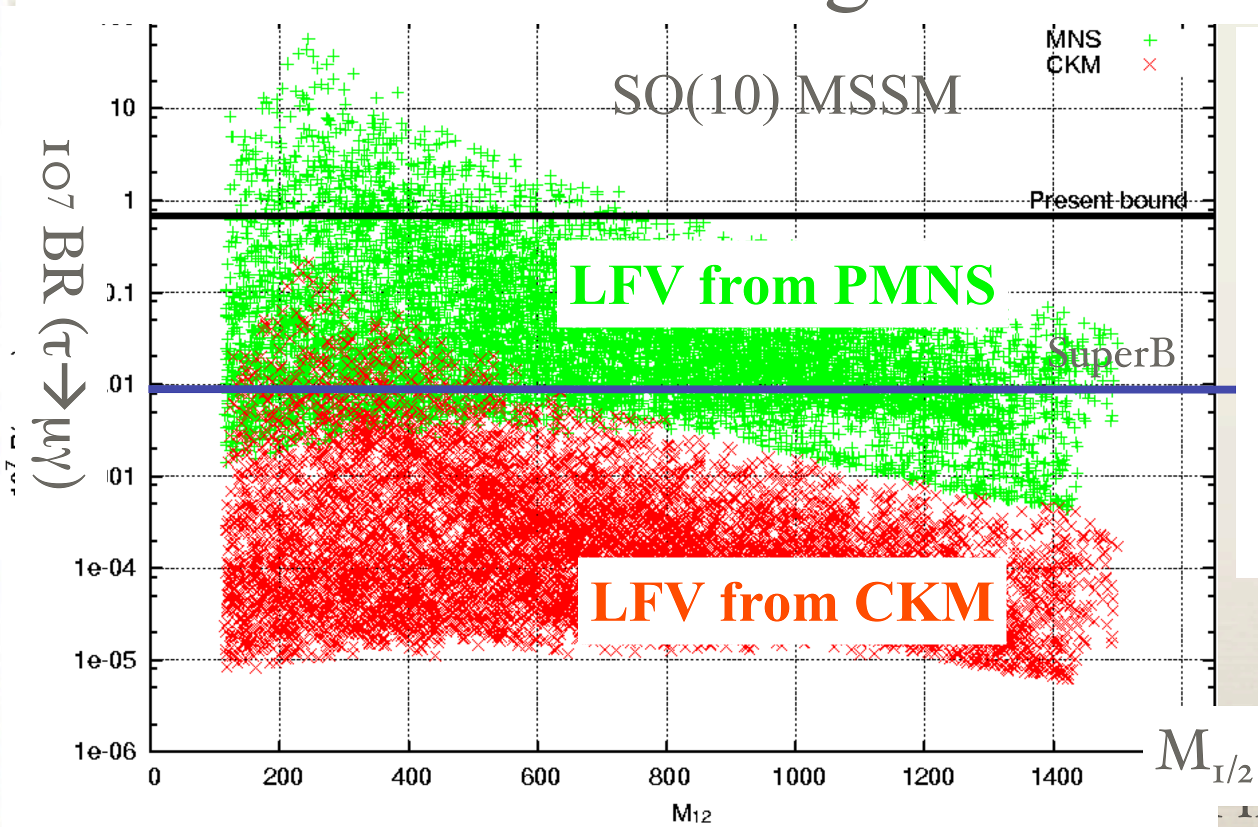
Process	Sensitivity
$\mathcal{B}(\tau \to \mu\gamma)$	2×10^{-9}
$\mathcal{B}(\tau \to e\gamma)$	2×10^{-9}
$\mathcal{B}(\tau \to \mu\mu\mu)$	2×10^{-10}
$\mathcal{B}(\tau \to eee)$	2×10^{-10}
$\mathcal{B}(\tau \to \mu\eta)$	4×10^{-10}
$\mathcal{B}(\tau \to e\eta)$	6×10^{-10}
$\mathcal{B}(\tau \to \ell K^0_S)$	2×10^{-10}



MEG sensitivity μ→eγ ~10^{-13}
Preliminary results < 3 10^{-11}



Masurements and origin of LFV

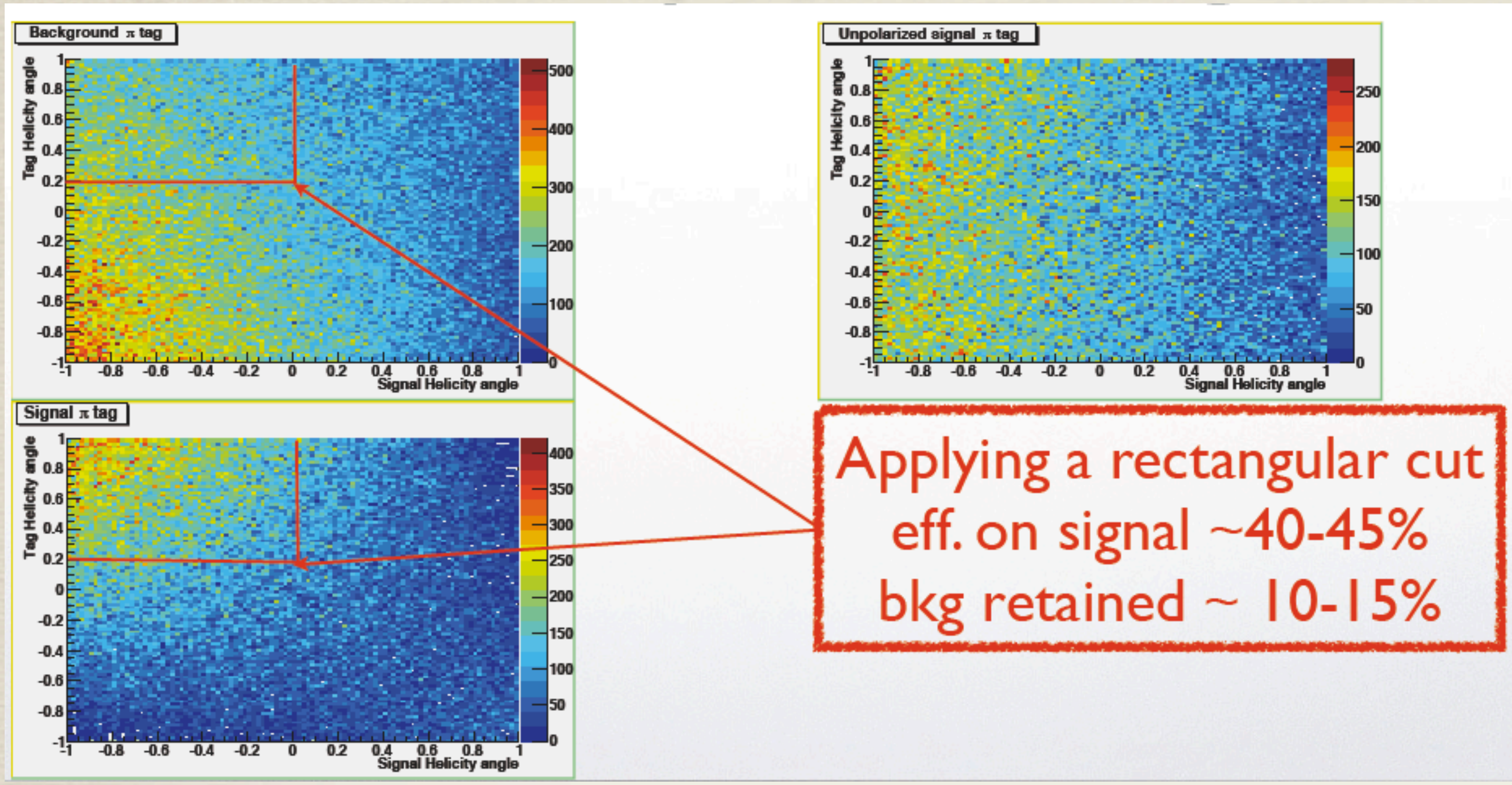


Discrimination between SUSY and LHT

ratio	LHT	MSSM (dipole)	MSSM (Higgs)
$\frac{\mathcal{B}(\tau^-\to e^-e^+e^-)}{\mathcal{B}(\tau\to e\gamma)}$	0.4...2.3	$\sim 1\cdot 10^{-2}$	$\sim 1\cdot 10^{-2}$
$\frac{\mathcal{B}(\tau^-\to \mu^-\mu^+\mu^-)}{\mathcal{B}(\tau\to \mu\gamma)}$	0.4...2.3	$\sim 2\cdot 10^{-3}$	0.06...0.1
$\frac{\mathcal{B}(\tau^-\to e^-\mu^+\mu^-)}{\mathcal{B}(\tau\to e\gamma)}$	0.3...1.6	$\sim 2\cdot 10^{-3}$	0.02...0.04
$\frac{\mathcal{B}(\tau^-\to \mu^-e^+e^-)}{\mathcal{B}(\tau\to \mu\gamma)}$	0.3...1.6	$\sim 1\cdot 10^{-2}$	$\sim 1\cdot 10^{-2}$
$\frac{\mathcal{B}(\tau^-\to e^-e^+e^-)}{\mathcal{B}(\tau^-\to e^-\mu^+\mu^-)}$	1.3...1.7	~ 5	0.3...0.5
$\frac{\mathcal{B}(\tau^-\to \mu^-\mu^+\mu^-)}{\mathcal{B}(\tau^-\to \mu^-e^+e^-)}$	1.2...1.6	~ 0.2	5...10

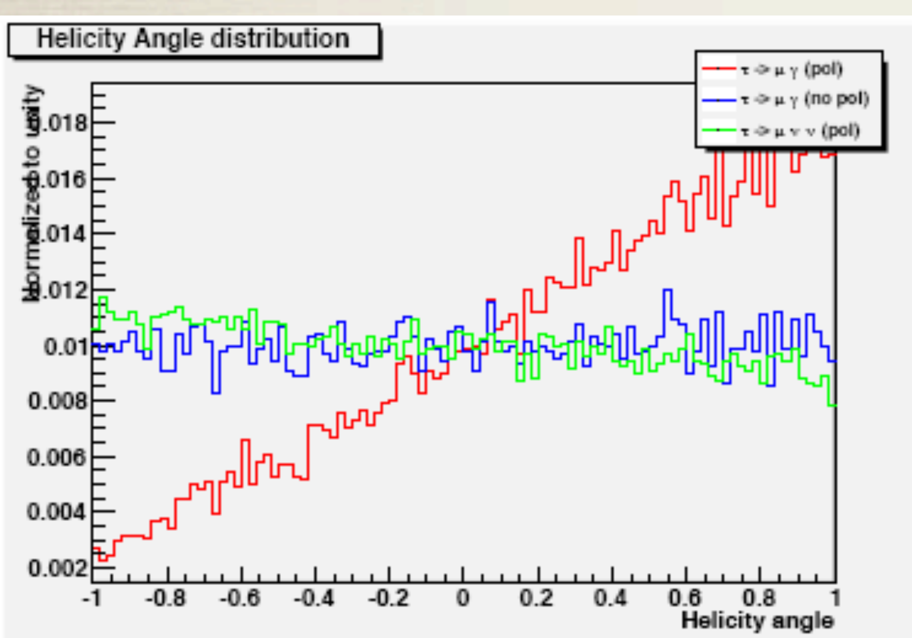
The ratio τ→ lll / τ→ μγ is not suppressed in LHT by α_e as in MSSM

Polarized beam and tag on leptons and on hadrons ($\tau \to \pi\nu$ / $\tau \to \rho\nu$) reduces irreducible background!



75 ab^{-1}

Sensitivity improves at least by a factor 2. Equivalent to a factor 4 increase in luminosity.



$B(\tau \to \mu\gamma)\ 2\times 10-9$

$B(\tau \to e\gamma)\ 2\times 10-9$

→

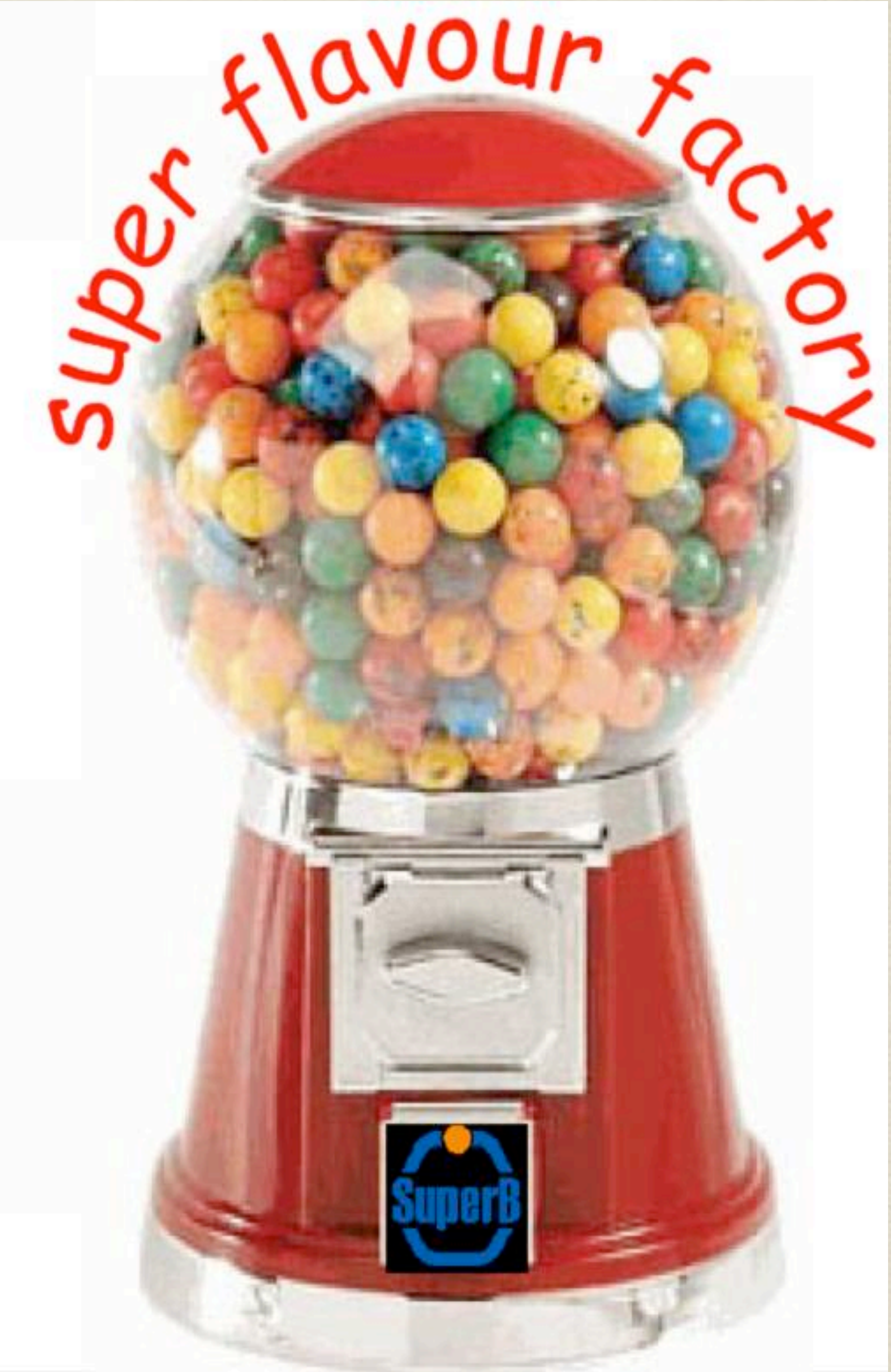
$B(\tau \to \mu\gamma)\ 1\times 10-9$

$B(\tau \to e\gamma)\ 1\times 10-9$

Polarisation is
- an important issue for LFV
- opens the possibility of measuring (g-2)
- opens measurement of EW parameters

Physics

- A luminosity of 50 – 100 ab^{-1} (100 times that of existing B-Factories) open windows on NP:
  - Precision measurements allowing to detect discrepancies from the standard model
  - Rare decay measurements, Lepton flavour violation
  - CP violation in Charm
- Polarized e^- beam:
  - τ CPV, EDM, g-2
- Possibility to run at tau/charm threshold
- Complementarity and synergy with LHC program



© by Ciuchini

BACKUP

SuperKEKB/Belle II funding Status

KEKB upgrade has been approved

- 5.8 oku yen (~MUSD) for Damping Ring (FY2010)
- 100 oku yen for machine -- Very Advanced Research Support Program (FY2010-2012)
- Full approval by the Japanese government by December 2010; the project is in the JFY2011 budget as approved by the Japanese Diet end of March 2011


一般向けページ >> 研究者向けページ >> English Pages >>

大学共同利用機関法人 KEK 高エネルギー加速器研究機構

Press Release

Top | Access | For Visitors | Map & Guide | Document | Site Map | Search

>Top >PressRelease >this page

last update: 10/06/23

Press Release

KEKB upgrade plan has been approved

June 23, 2010
High Energy Accelerator Research Organization (KEK)

The MEXT, the Japanese Ministry that supervises KEK, has announced that it will appropriate a budget of 100 oku-yen (approx $110M) over the next three years starting this Japanese fiscal year (JFY2010) for the high performance upgrade program of KEKB. This is part of the measures taken under the new "Very Advanced Research Support Program" of the Japanese government.

"We are delighted to hear this news," says Masanori Yamauchi, former spokesperson for the Belle experiment and currently a deputy director of the Institute of Particle and Nuclear Studies of KEK. "This three- year upgrade plan allows the Belle experiment to study the physics from decays of heavy flavor particles with an unprecedented precision. It means that KEK in Japan is launching a renewed research program in search for new physics by using a technique which is complementary to what is employed at LHC at CERN."

[Media Contact] Youhei Morita,
Head of Public Relations Office, KEK
tel. +81-29-879-6047

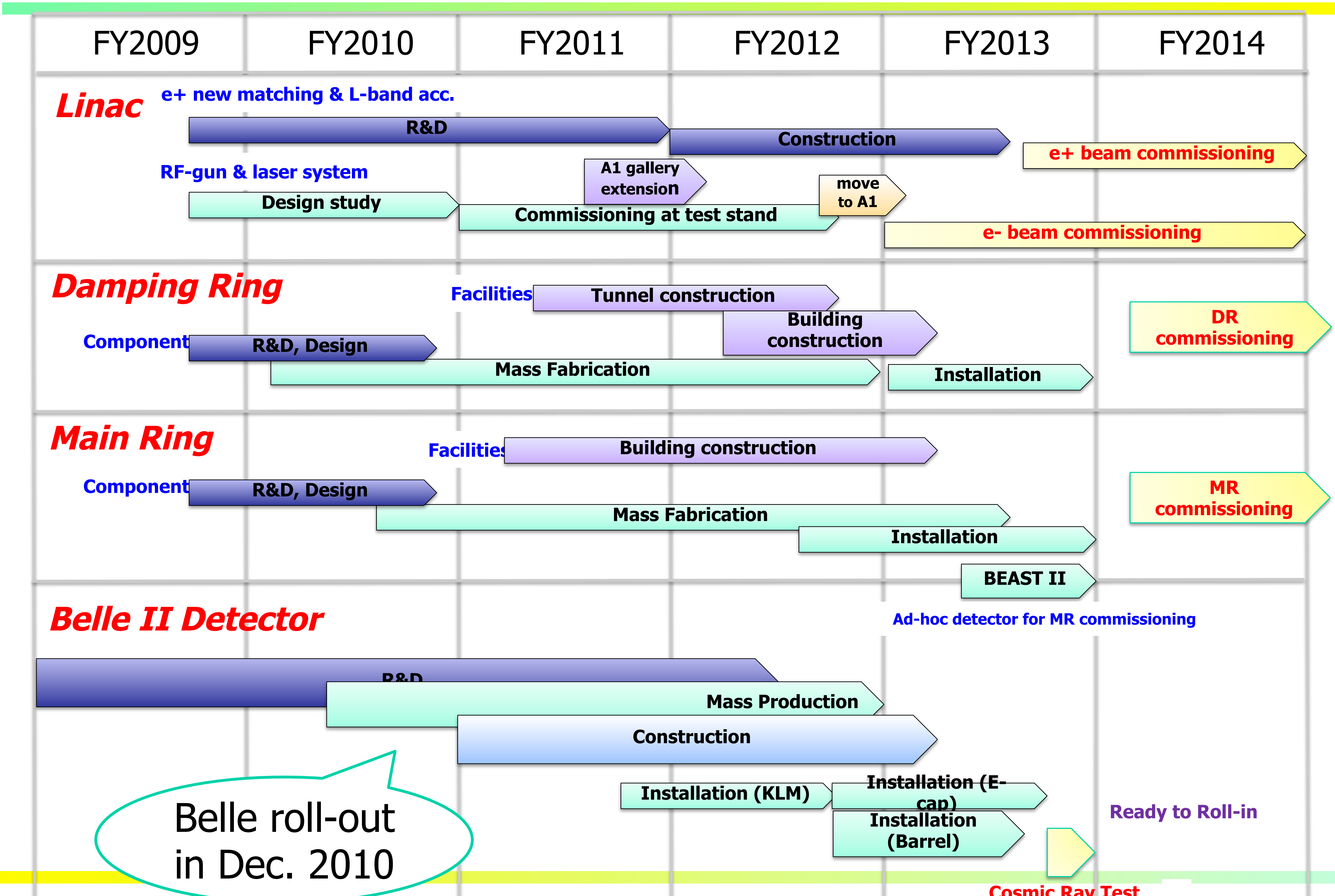
copyright(c) 2010, HIGH ENERGY ACCELERATOR RESEARCH ORGANIZATION, KEK
1-1 Oho, Tsukuba, Ibaraki 305-0801 Japan

| proffice@kek.jp | Copyright | Send Question

Several non-Japanese funding agencies have also already allocated sizable funds for the upgrade.

→construction started!

Construction Schedule of SuperKEKB/Belle II



KEKB/Belle status: official statement

As is now well known, Japan suffered a terrible earthquake and tsunami on March 11, which has caused tremendous damage, especially in the Tohoku area. Fortunately, all KEK personnel and users are safe and accounted for.

The injection linac did suffer significant but manageable damage, and repairs are underway. The damage to the KEKB main rings appears to be less serious, though non-negligible. No serious damage has been reported so far at Belle. Further investigation is necessary.

We would like to convey our deep appreciation to everyone for your generous expressions of concern and encouragement.

SuperB Accelerator Schedule

Task Name	Duration
Approvazione	0 wks
Infrastrutture	**156 wks**
Scelta del sito	26 wks
Progettazione edilizia civile	52 wks
Gara edilizia civile	19 wks
Costruzione Tunnel, Edifici, e Sala sperim.	78 wks
Progetto/gara Linac, DR, & BTL	104 wks
Progetto e gara Elettr., Raffredd., Cryo.	104 wks
Progetto & Costruzione Acceleratore	**260 wks**
Progettazione acceleratore	78 wks
Costruzione magneti	104 wks
Costruzione sistema vuoto	104 wks
Costruzione supporti	104 wks
Costruzione utilities	104 wks
Costruzione controlli	104 wks
Costruzione RF	104 wks
Costruzione alimentatori	104 wks
Installazione Acceleratore	**110 wks**
Installazione nel tunnel	110 wks
Installazione Zona Interazione	52 wks
Installazione Linac, DR, & BTL	65 wks
Commissioning Acceleratore	**71 wks**
Commissioning Linac	39 wks
Commissioning Fasci	26 wks
Prime collisioni	0 wks