B Physics Observables for New Physics Discoveries

Update from Valencia

Tim Gershon
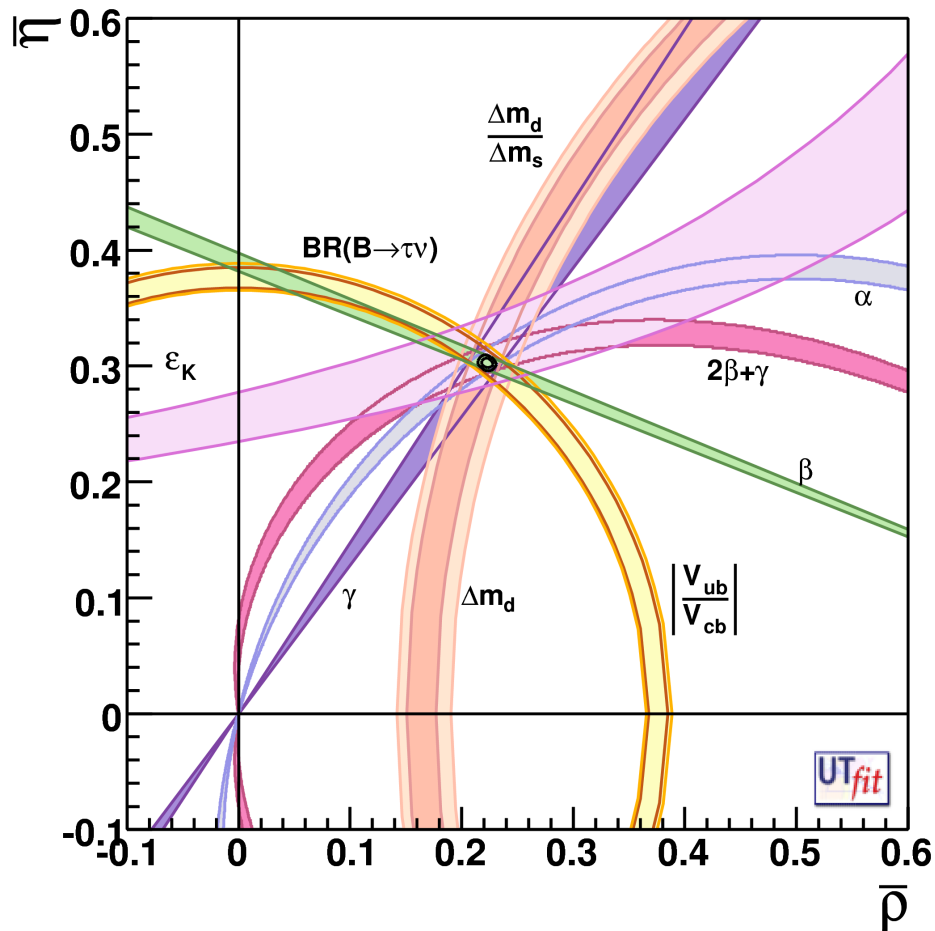University of Warwick

SuperB meeting in Elba,
31st May 2008
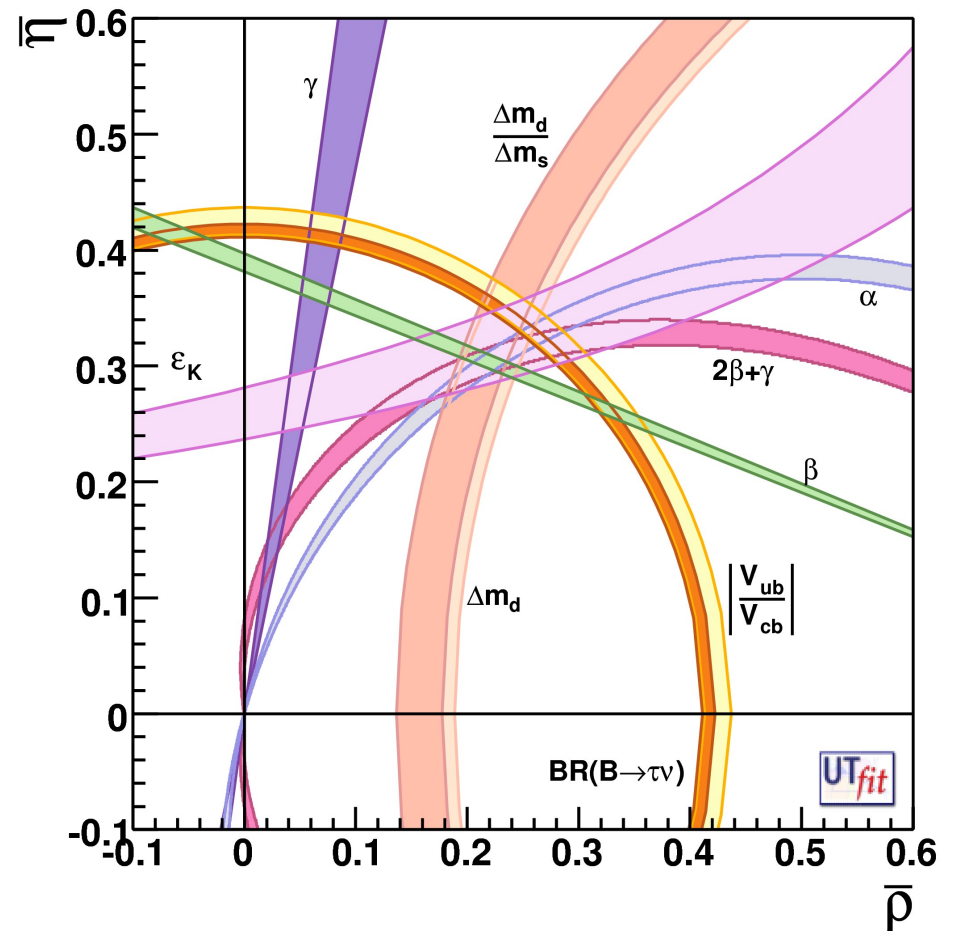
Outline

- B physics measurements

  - Precise CKM determination: Vub

  - Theoretically clean rare decays (inclusive b→sγ, b→sll, exclusive B→K(*)νν, B→lν)

- "Golden modes"

- High energy interplay and Snowmass points

- New physics models

SuperB UT fit scenarios

- Possible NP discovery from precise CKM metrology
- Precise knowledge of SM parameters essential in any scenario

How to make the dream reality?

- Need very precise measurements

- Is 2% error on V_{ub} feasible?

  – Experimentally: yes (B.Viaud)

  – Theoretically: maybe (P.Gambino)

  – Note

    - "maybe" is a very positive answer at this stage

    - need to discuss with other experts

    - (endorsed already by I.Bigi)

Towards precise Vub

- Control weak annihilation and shape function

  – Possible from data

- Control error from mb

  – Precise measurements of radiative decays

  – Improvements in lattice and other theory

  – Inclusive mX analysis $\Rightarrow$ reduced sensitivity

- Control pertubative corrections

  – Homework for theorists

A new theoretical analysis

- **kinetic scheme**. Wilsonian infrared cutoff $\mu \sim 1$ GeV: contribution of soft gluons absorbed into definition of OPE parameters AND distribution function(s)

- **Fermi motion**: finite m_b SF, includes all available subleading corrections

  - local OPE breaks down at **high q²**: need to model the tail, consistent with positivity, **WA** naturally emerge.

  - Triple differential distribution including all known pert and nonpert effects, c++ code

published in PG, P.Giordano, G.Ossola, N.Uraltsev, JHEP10(2007)058

Theoretical errors

- Parametric errors generally dominant, in particular m_b, 3-4%

- Perturbative corrections 2-3%

- Functional form   1-2%

- Modelling of the q^2 tail and WA depending on cut from 0 to 7%. WA tends to decrease V_{ub}

$$\frac{1}{\Gamma}\frac{d\Gamma}{dMx^2}$$
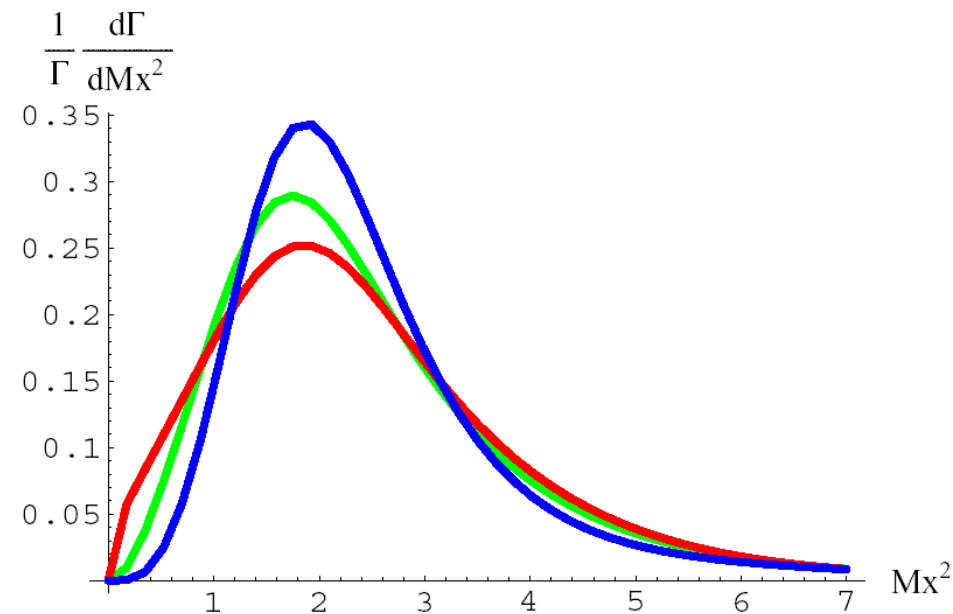
cuts	$|V_{ub}| \times 10^3$	f	exp	par	pert	tail model	q_*^2	X	ff	tot th
A [28]	3.87	0.71	6.7	3.5	1.7	1.6	2.0	$+0.0$ -2.7	$+2.4$ -1.1	$\pm 4.7^{+2.4}_{-3.8}$
B [28, 29]	4.44	0.38	7.3	3.5	2.6	3.0	4.0	$+0.0$ -5.0	$+1.4$ -0.5	$\pm 6.6^{+1.4}_{-5.5}$
C [30]	4.05	0.30	5.7	4.2	3.3	1.8	0.9	$+0.0$ -6.2	$+1.2$ -0.7	$\pm 5.7^{+1.2}_{-6.9}$

A= M_X cut Belle,   B= (M_x,q^2) cut Belle+Babar, C= E_l cut Babar

Overall theory errors are 5-9%, depending on the cuts.

Main theoretical desiderata

- ## know the b mass and the OPE pars precisely
  lattice, b→c and bsγ moments, pert calculations, goal 15-20 MeV for m_b

- ## study all the spectra of b→u l v
  to constrain WA and the SFs, complementary to OPE constraints

- ## be as inclusive as possible
  to minimize dependence on functional forms

Present parametric is 3.5% with δm_b~40 MeV, dominates cleanest cuts.
From b→c experience, duality violation should be small
Therefore, a 2% goal on |V_{ub}| seems to be realistic.

Rare Decays

- $b \to s\gamma$ serves as prototype FCNC
  - Extremely important NP constraints (see later)
  - Precision of BF ~ theory errors (~7%)
    - Prospects to improve the theoretical precision?
  - Also, isospin & CP asymmetries, photon polarization, etc.
    - Discussed in the CDR, not updated

- Nonperturbative corrections $\Lambda^2/m_{b,c}^2$ to $\Gamma(\bar{B} \to X_s\gamma)$ are well under control

- However: Estimation of power corrections of $O(\alpha_s\Lambda/mb)$ should be improved: Largest uncertainty (5%) in our new NNLL prediction (see Lee et al)

- Further uncertainties: parametric (3%), higher-order (3%), mc-interpolation (3%)

$$BR(\bar{B} \to X_s\gamma)_{E_\gamma > 1.6\,\text{GeV}} = BR(\bar{B} \to X_c e\bar{\nu})^{\text{exp}} \left[\frac{\Gamma(b \to s\gamma)}{\Gamma(b \to ce\bar{\nu})}\right]_{\text{LO EW}} f\left(\frac{\alpha_s(M_W)}{\alpha_s(m_b)}\right) \times$$

$$\times \left\{1 + \mathcal{O}(\alpha_s) + \mathcal{O}(\alpha_s^2) + \mathcal{O}(\alpha_{\text{em}}) + \mathcal{O}\left(\frac{\Lambda^2}{m_b^2}\right) + \mathcal{O}\left(\frac{\Lambda^2}{m_c^2}\right) + \mathcal{O}\left(\frac{\alpha_s\Lambda}{m_b}\right)\right\}$$

NLO   NNLO

~25%   ~7%   ~4%   ~1%   ~3%   ~5%

- Additional sensitivities to nonperturbative physics due to necessary cuts in the photon energy spectrum to suppress the $B\bar{B}$ background:

Shape function methods and multi-scale SCET analysis
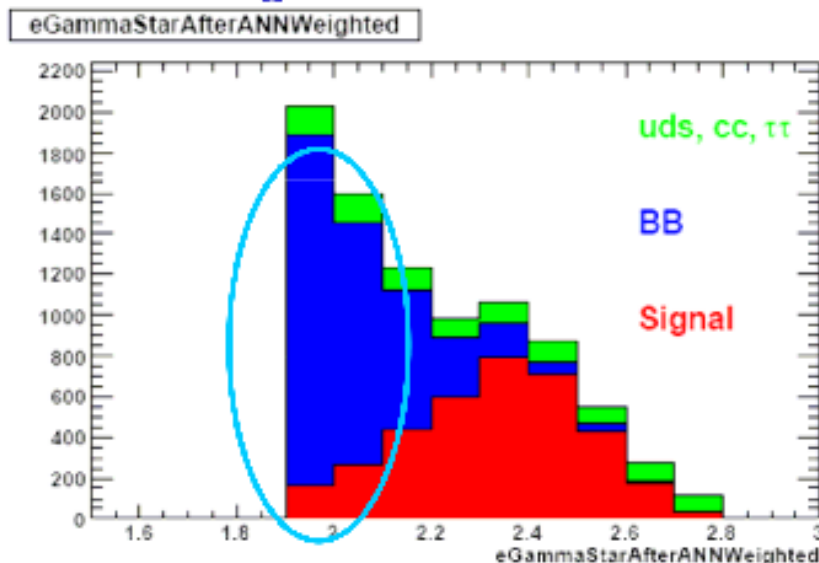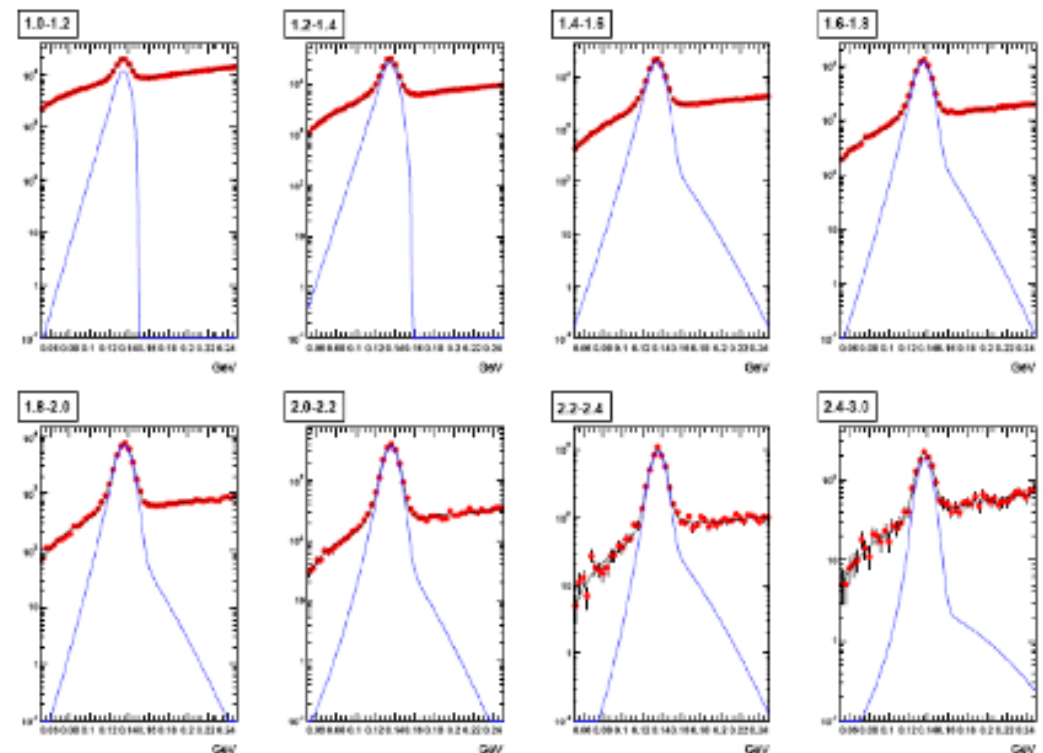$\Rightarrow$ Additional theoretical uncertainties
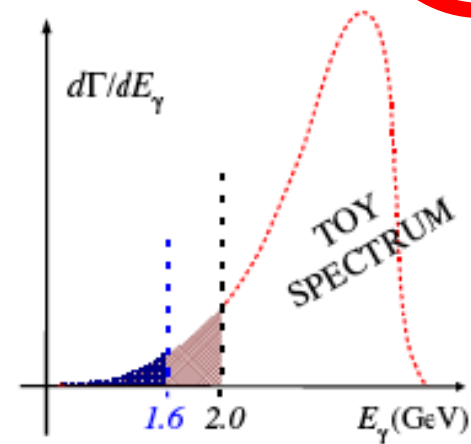
Main source of theoretical uncertainty in B(b→sγ) at present.
If this can be removed, theory error could be 3%.

Inclusive, lepton tag: after selection

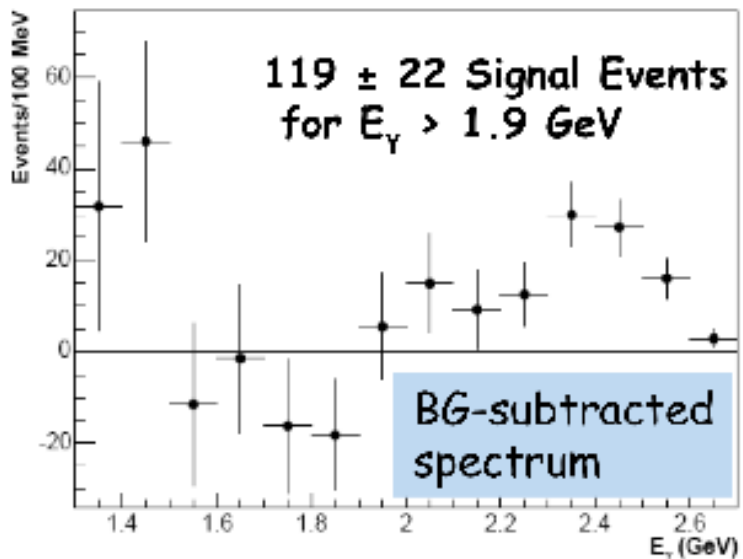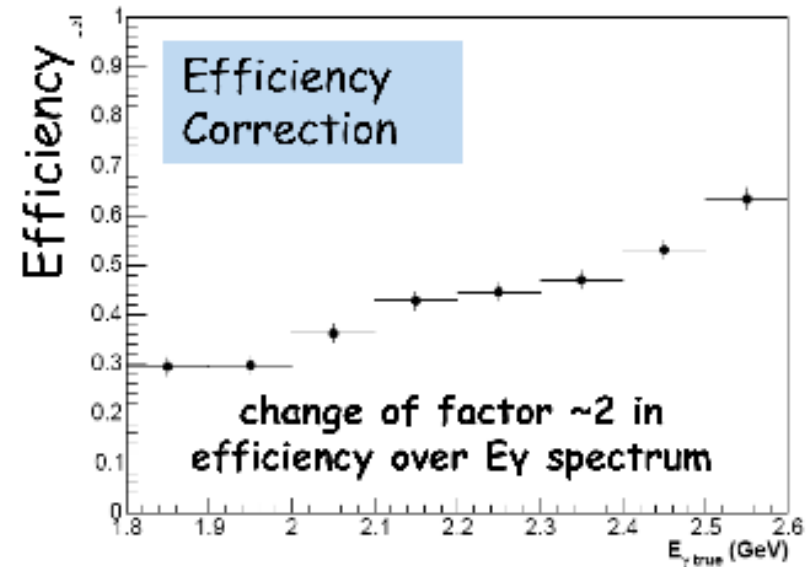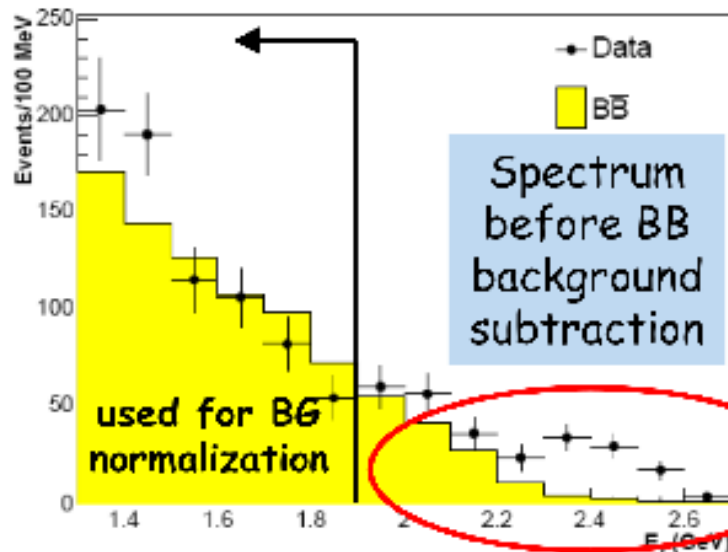- BB background reduced with π^0 and η veto

- Still significant background remains at low E_γ

- Study inclusive π^0 and η production to tune MC of BB background

Fits to data and MC

Inclusive, hadronic tags: E_γ Spectrum

Spectrum before BB background subtraction

used for BG normalization

b→sγ signal

Efficiency Correction

change of factor ~2 in efficiency over Eγ spectrum

119 ± 22 Signal Events for E_γ > 1.9 GeV

BG-subtracted spectrum

efficiency correction

also takes care of E$_\gamma$ resolution

Efficiency & Resolution corrected spectrum

Recoil Technique (II)

- The Super-B detector design would introduce significant improvement in the recoil performances;

- HERMITICITY:

    helps to reduce the background when applying a cut on the track multiplicity in the recoil (see M. Mazur talk in Paris) → *30% bkg reduction is realistic*

  - modify the distribution of Eextra (the most important cut) → *effect to be established, see next slide*

- VERTEXING:

  - vertexing informations poorly used at present;

  - bkg reduction is probably possible applying vertexing requirements and secondary vertex informations;

- OTHER (PID, K_L^0 velo, etc.).

Recoil Technique (II)

EXPECTED IMPROVEMENTS at SUPER-B

- The Super-B detector design would introduce significant improvement in the recoil performances;

- HERMITICITY:

    helps t[...]g a cut on
    the tra[...]M. Mazur
    talk i[...]listic

    - modify [...] important
      cut) → [...]slide

    Detailed Simulations Needed to have precise estimates of improvements

- VERTEXING:

    - vertexing informations poorly used at present;

    - bkg reduction is probably possible applying vertexing requirements and secondary vertex informations;

- OTHER (PID, K_L^0 velo, etc.).

Caveats

Searches for modes with missing energy rely heavily on the low multiplicity of the signal to keep backgrounds managable

- higher multiplicity requires harder cuts or additional kinematic handles

- Detector non-hermiticity and/or non-physics "junk" is a killer

- Tag reconstruction is usually CLEANER in these events, so can potentially use tag modes that appear to be too messy in "generic" B decays
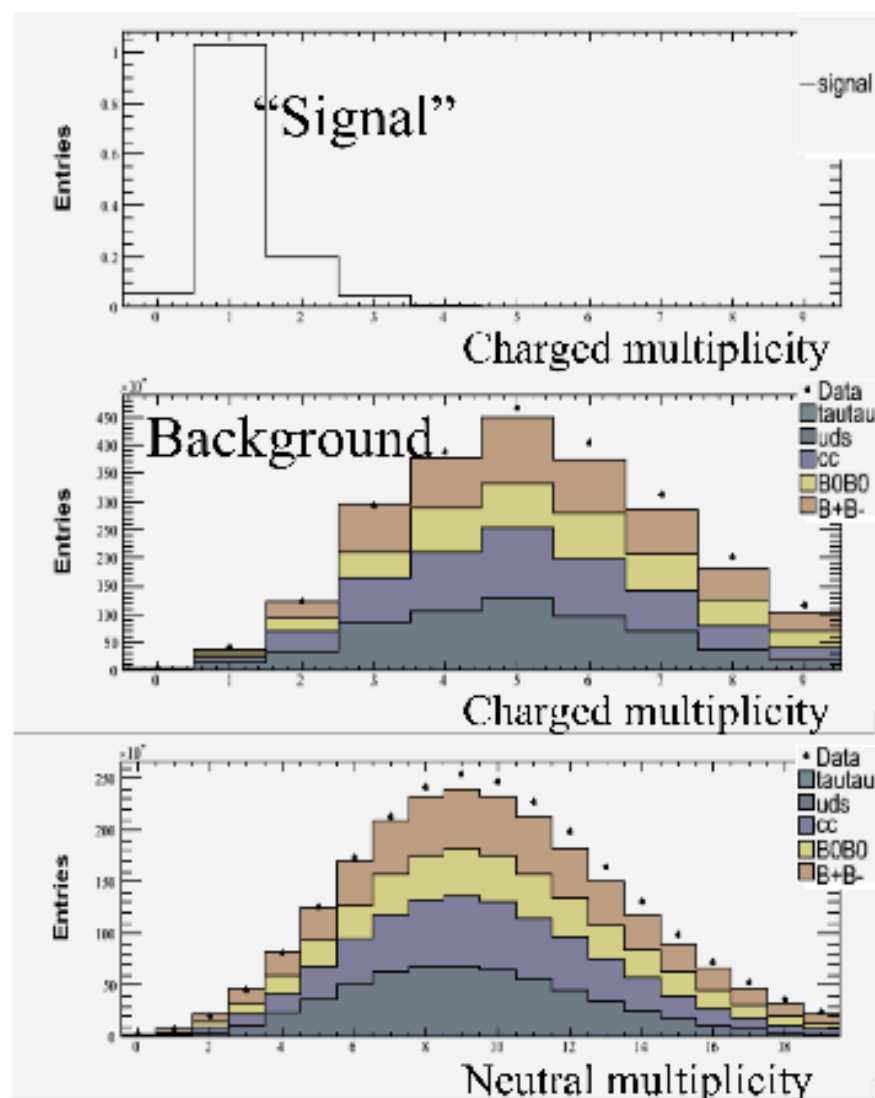
Caveats

Tag B reconstruction efficiency scales non-linearly with tracking and calorimeter acceptance

- Not clear what the impact of reduced beam energy asymmetry will be

Need to balance reconstruction efficiency against cleanliness of the reconstruction by careful choice of what modes to reconstruct

- Potential for significant efficiency gain by including e.g. $D^0 \rightarrow K^+\pi^-2\pi^0$, or purity gain by including e.g. J/Ψ - seeded decays

Devil is in the details!

- performance of vertexing, kinematic fitting, track-cluster matching, presence of tracking and/or calorimeter artifacts etc etc.

$\Rightarrow$ **Important to study impact of proposed detector design**

Simulation studies

- Sensitivity estimates for many interesting channels require simulation studies
- Huge effort by fastsimu group since Valencia

- Physics studies can and will benefit from this important work
    - Improved, detailed, dedicated studies necessary for TDR phase

Rare decays (cont.)

- b→sll
  - Situation very different to b→sγ
  - Exclusive modes will be precisely measured by LHCb
  - Inclusive analyses theoretically much cleaner
    - Not yet possible at B factories
      - (semi-inclusive analyses have been done)
    - Requires SuperB statistics
  - b→sττ provides another interesting possibility

Recent proposal: normalization to semileptonic $B \to X_u \ell \nu$ decay rate with the same cut reduces the impact of $1/m_b$ corrections in the high-q^2 region significantly. Ligeti,Tackmann,hep-ph/0707.1694

Numerical results Huber, Hurth, Lunghi

$$\mathcal{R}(s_0)^{\text{high}}_{\mu\mu} = 2.29 \times 10^{-3}\left(1 \pm 0.04_{\text{scale}} \pm 0.02_{m_t} \pm 0.01_{C,m_c} \pm 0.006_{m_b} \pm 0.005_{\alpha_s} \pm 0.09_{\text{CKM}}\right.$$

$$\left. \pm 0.003_{\lambda_2} \pm 0.05_{\rho_1} \pm 0.03_{f^0_u+f_s} \pm 0.05_{f^0_u-f_s}\right)$$

$$= 2.29 \times 10^{-3}(1 \pm 0.13)$$

Theoretical uncertainty in B(b→sll) quite large at present.
But, in this approach, dominated by CKM factors.

Numerical results Huber, Hurth, Lunghi arXiv/0712.3009[hep-ph]

- Zero of the forward-backward asymmetry q_0^2:

$$(q_0^2)_{\mu\mu} = \Big[3.50 \pm 0.10_{\text{scale}} \pm 0.002_{m_t} \pm 0.04_{m_c,C}$$
$$\pm 0.05_{m_b} \pm 0.03_{\alpha_s(M_Z)} \pm 0.001_{\lambda_1} \pm 0.01_{\lambda_2} \Big] \text{GeV}^2 = (3.50 = 0.12) \, \text{GeV}^2$$

$$(q_0^2)_{ee} = \Big[3.38 \pm 0.09_{\text{scale}} \pm 0.002_{m_t} \pm 0.04_{m_c,C}$$
$$\pm 0.04_{m_b} \pm 0.03_{\alpha_s(M_Z)} \pm 0.002_{\lambda_1} \pm 0.01_{\lambda_2} \Big] \text{GeV}^2 = (3.38 \pm 0.11) \, \text{GeV}^2$$

NNLO + QED

$$\frac{\mathrm{d}\mathcal{A}/\mathrm{d}q^2}{\mathrm{d}\mathcal{B}/\mathrm{d}q^2}$$

$q^2 \, (\text{GeV}^2)$
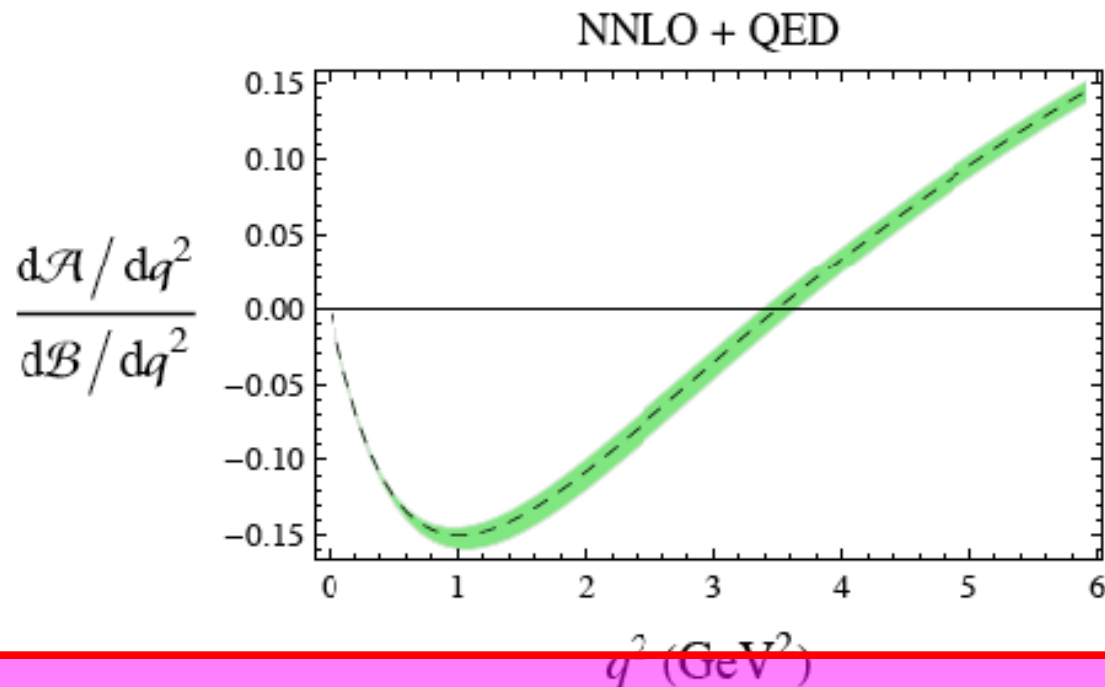
Forward-backward asymmetry in inclusive b→sll
Theoretically very clean! (Much better than exclusive)

More rare decays

- b→svv and B→lv provide further examples of rare decay modes where the full statistics of SuperB is required to reach the interesting sensitivity region
  - Expect observation of B→K(*)vv above 10/ab
  - Precision of B→μv overtakes that of B→τv (systematics limited) around the same time

$B^+ \rightarrow K^+ \nu \nu$ (II)
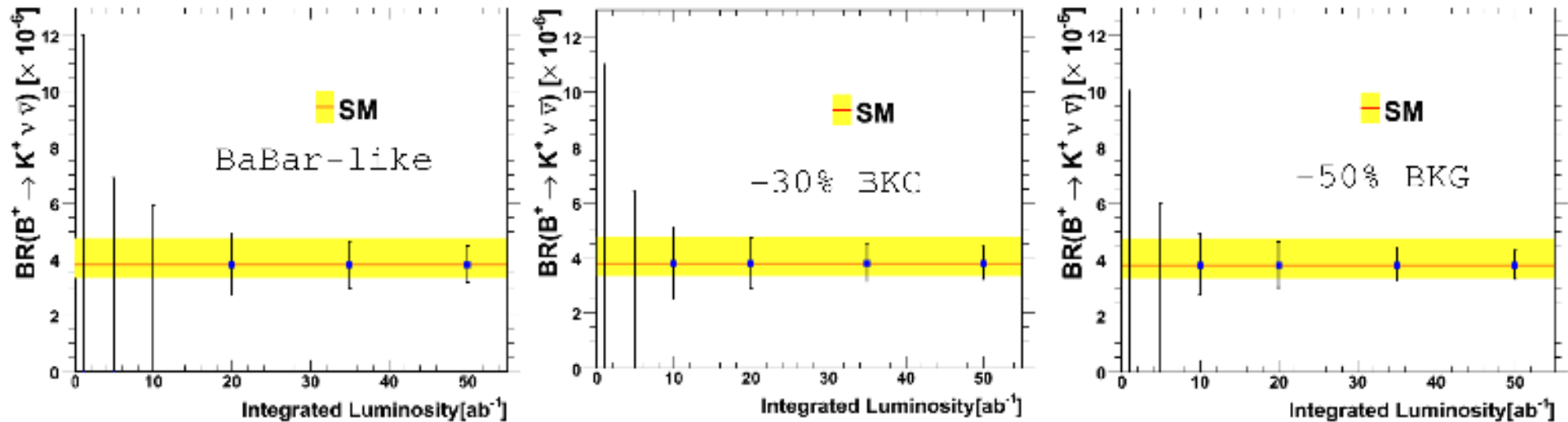
Observation between 10 and 20 ab^{-1};

Exp. error ~ theoretical error around 30 ab^{-1};

18% error at 50ab^{-1} in the most conservative scenario.

Tagged $B^+ \rightarrow l^+\nu$ ($l = e, \mu$)

- Signal lies at kinematic endpoint in lepton p* for B decays, hence essentially no B background

- Continuum background can produce high p* leptons, but this background can be directly determined from data using the tag B m_{ES} sideband

- Narrow signal peak would lead to a very compelling signal with a very small number of events
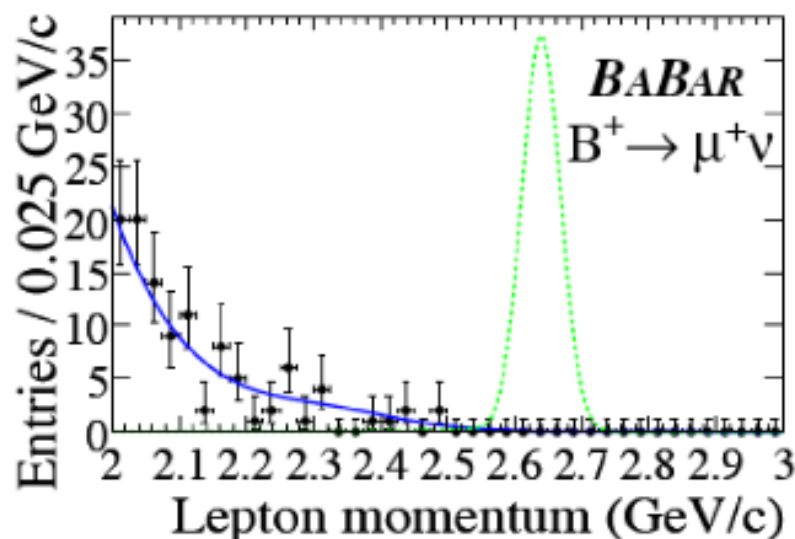
	$e^+\nu$	$\mu^+\nu$
$\epsilon_{tot} \times 10^5$	135 ± 4	120 ± 4
n_b^* MC	2.66 ± 0.13	5.74 ± 0.25
n_b^*	2.67 ± 0.19	5.67 ± 0.34
n_s^*	-0.07 ± 0.03	-0.11 ± 0.05
$\mathcal{B} \times 10^{-6}$	$-0.1^{+2.6}_{-1.7}$	$-0.2^{+2.7}_{-1.8}$
$\mathcal{B}^{90\% \ C.L.}$	5.2×10^{-6}	5.6×10^{-6}

Leptonic Decays

- B→τν will be limited by systematics at some stage

  – CDR estimate of precision may be optimistic

- B→μν does **not** suffer the same problem

  – Will become "golden channel" for leptonic B decays at some luminosity (likely above 10/ab)

- Also allows universality test

Golden modes

	H^+ high $\tan\beta$	Minimal FV	Non-Minimal FV (1-3)	Non-Minimal FV (2-3)	NP Z-penguins	Right-Handed currents
$\mathcal{B}(B \to X_s\gamma)$		X		O		O
$A_{CP}(B \to X_s\gamma)$				X		O
$\mathcal{B}(B \to \tau\nu)$	X-CKM					
$\mathcal{B}(B \to X_s l^+ l^-)$				O	O	O
$\mathcal{B}(B \to K\nu\bar{\nu})$				O	X	
$S(K_S\pi^0\gamma)$						X
β			X-CKM			O

- Which channel is "golden" for new physics discovery depends on the particular brand of NP
  - Many others can be added to the list
  - [add your favourite here]
  - ... however, the request was to make a selection

Improvements in B→lν with Luminosity
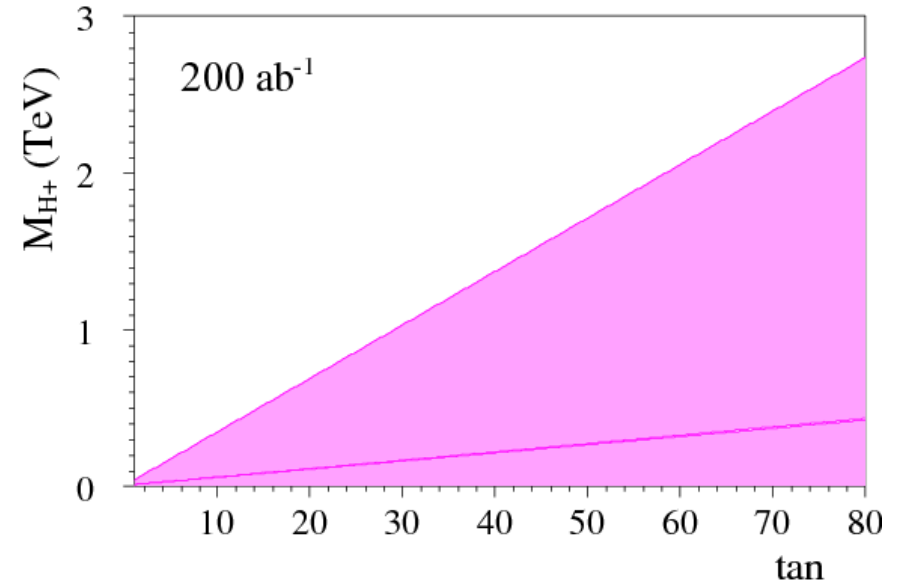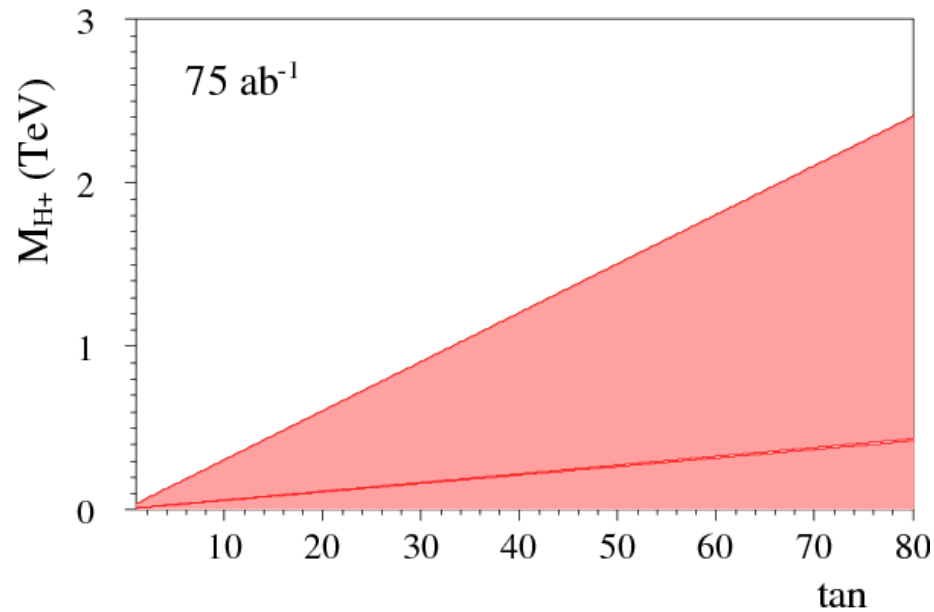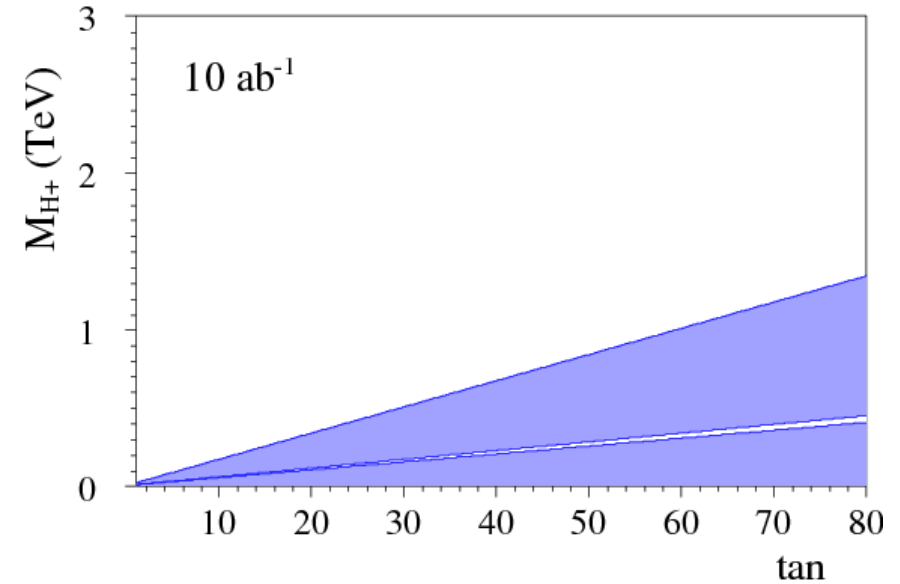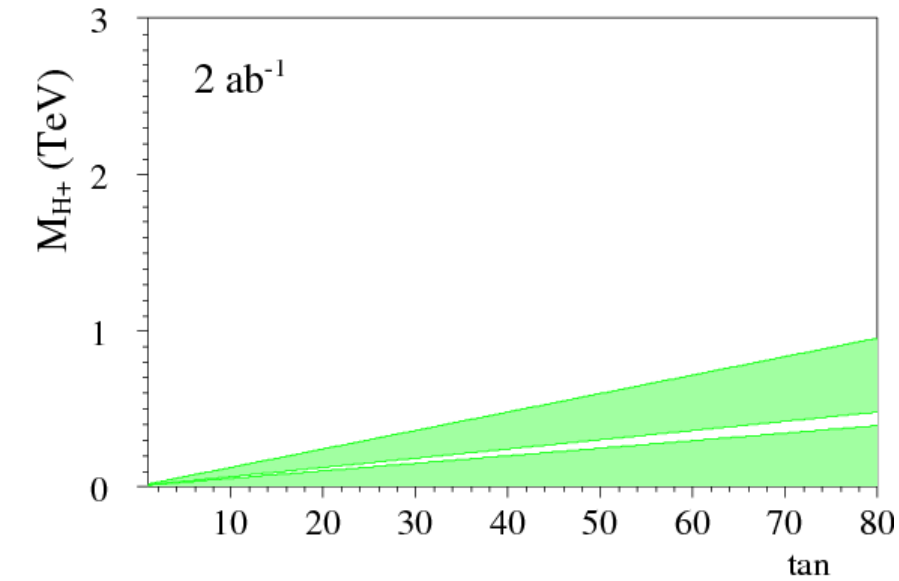
Comparison with KEKB upgrade

Mode	Sensitivity		
	Current	10 ab^{-1}	75 ab^{-1}
$\mathcal{B}(B \to X_s\gamma)$	7%	5%	3%
$A_{CP}(B \to X_s\gamma)$	0.037	0.01	0.004–0.005
$\mathcal{B}(B^+ \to \tau^+\nu)$	30%	10%	3–4%
$\mathcal{B}(B^+ \to \mu^+\nu)$	X	20%	5–6%
$\mathcal{B}(B \to X_s l^+ l^-)$	23%	15%	4–6%
$A_{FB}(B \to X_s l^+ l^-)_{s_0}$	X	30%	4–6%
$\mathcal{B}(B \to K\nu\bar{\nu})$	X	X	16–20%
$S(K_S^0\pi^0\gamma)$	0.24	0.08	0.02–0.03

Benchmarks and LHC Interplay

- Work done mainly by F.Ronga & S.Heinemayer

- Many thanks for their efforts and responses to our requests ...

- Work on interplay between flavour and LHC is ongoing

Thursday 29 May 2008   top↑

10:00->12:00 Week IV: B@LHC Focus Week: Charm, Tau, New States, ... (Location: 13-2-005)

10:00 Charm Physics at LHCb (30') (Slides 📄 💻)   Raluca Muresan

10:30 Charm Physics (Theory) (30') (Slides 📄)   Alexei Petrov

11:00 Discussion (1h00')

14:00->18:00 Week IV: B@LHC Focus Week: Spectroscopy, Lambda_b, |V(xb)|, ...

14:00 Non-CP Physics at LHCb (30') (Slides 📄)   Michael Schmelling

14:30 Determination of Vcb and Vub (Theory) (30') (Slides 📄)   Nikolai Uraltsev

15:00 Discussion (30')

15:30   Coffe Break

16:00 Special Seminar: Where to expect New Physics in flavour-violating processes? (1h00')   Andrzej Buras

Friday 30 May 2008   top↑

09:00->12:00 Week IV: B@LHC Focus Week: Long-Term Future

09:00 LHCb upgrade (20') (Slides 📄)   Jim Libby

09:20 Status and Prospects of sKEKB (20') (Slides 📄 💻)   Yutaka Ushiroda

09:40 The SuperB Project: an overview (20') (Slides 📄)   Marcello Giorgi

10:00   Coffee Break

10:30 Non-Perturbative QCD Calculations for B Physics (and related topics) (30') (Slides 📄 💻)   Guido Martinelli

11:00 Theory Outlook (30') (Slides 📄)   Zoltan Ligeti

11:30 Final Discussion (30')

The SPS1a benchmark point

A (too) good point for LHC!

$$M_0 = +100 \text{ GeV}/c^2$$
$$M_{1/2} = +250 \text{ GeV}/c^2$$
$$A_0 = -100 \text{ GeV}/c^2$$
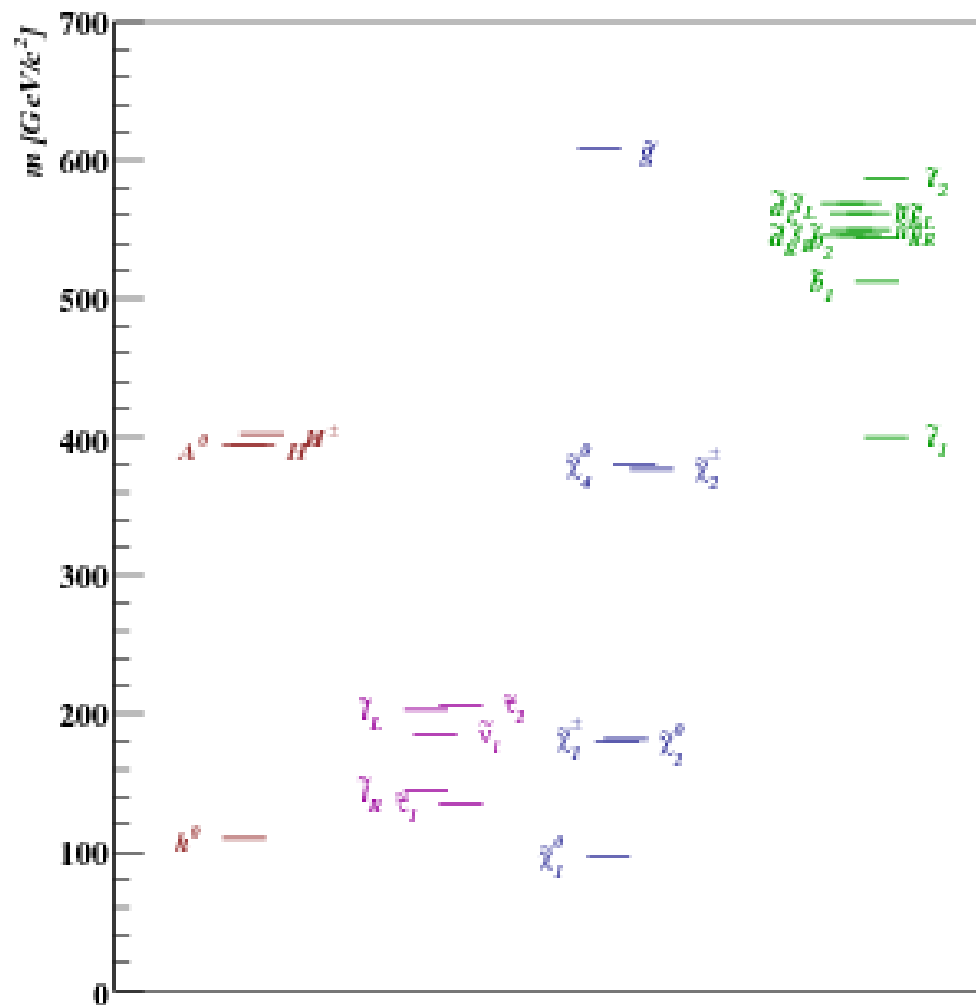$$\tan\beta = +10$$
$$\text{sign}(\mu) = +1$$

Allows cascade decay

$$\tilde{q}_L \to \tilde{\chi}_2^0 q \to \tilde{\ell}_R \ell q \to \tilde{\chi}_1^0 \ell\ell q$$

for "edge" measurements:

$$(m_{ll}^2)^{edge} = \frac{(m_{\tilde{\chi}_2^0}^2 - m_{\tilde{\ell}_R}^2)(m_{\tilde{\ell}_R}^2 - m_{\tilde{\chi}_1^0}^2)}{m_{\tilde{\ell}_R}^2}$$

$$(m_{qll}^2)^{edge} = \frac{(m_{\tilde{q}_L}^2 - m_{\tilde{\chi}_2^0}^2)(m_{\tilde{\chi}_2^0}^2 - m_{\tilde{\chi}_1^0}^2)}{m_{\tilde{\chi}_2^0}^2}$$

$$(m_{ql}^2)_{min}^{edge} = \frac{(m_{\tilde{q}_L}^2 - m_{\tilde{\chi}_2^0}^2)(m_{\tilde{\chi}_2^0}^2 - m_{\tilde{\ell}_R}^2)}{m_{\tilde{\chi}_2^0}^2}$$

SUSY spectrum at SPS1a

Note: *SPS1a is close to the overall preferred minimum with today's data.*

LHC performance at SPS1a [hep-ph/0410364]

Performance based on 300/fb (2014)

SUSY spectrum [GeV]

	Mass	Error
$\tilde{\chi}_1^0$	96.9	4.8
$\tilde{\chi}_2^0$	179.8	4.7
$\tilde{\chi}_4^0$	375.6	5.1
$\tilde{e}_R$	144.1	4.8
$\tilde{e}_L$	202.6	5.0
$\tilde{\mu}_R$	144.1	4.8
$\tilde{\mu}_L$	202.6	5.0
$\tilde{\tau}_1$	134.7	8.0
$\tilde{q}_R$	547.5	12.0
$\tilde{q}_L$	565.0	8.7
$\tilde{b}_1$	514.9	7.5
$\tilde{b}_2$	544.1	7.9
$\tilde{g}$	608.0	8.0
h^0	112.9	0.25

Edge measurements [GeV]

$(m_{\ell\ell})^{edge}$	58.878	0.085
$(m_{q\ell\ell})^{edge}$	451.1	4.5
$(m_{ql})^{edge}_{min}$	317.5	3.1

$\Rightarrow$ Impact on CMSSM parameters

- include this spectrum as constraints;
- combine with today's constraints;
- get best fit values and errors:

$$M_0 = 100.0 \pm 1.5$$
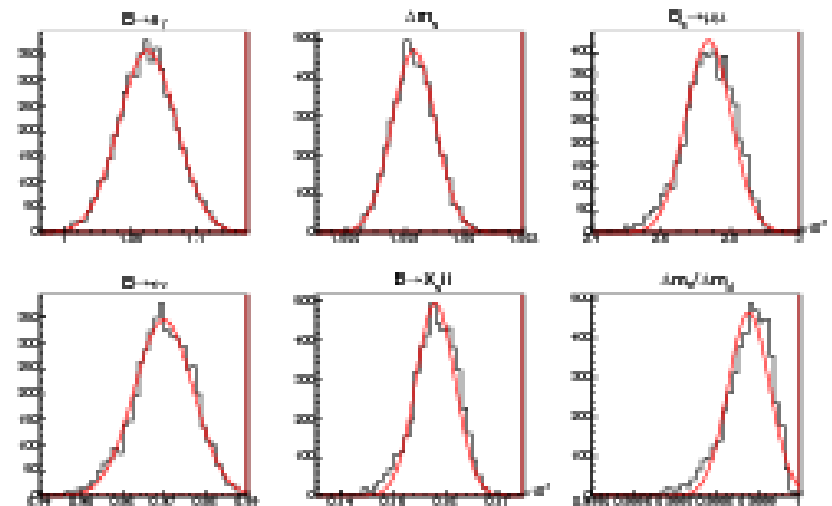$$M_{1/2} = 250.0 \pm 1.1$$
$$A_0 = 100 \pm 30$$
$$\tan\beta = 9.8 \pm 1.2$$

All ideal masses generated by SoftSusy
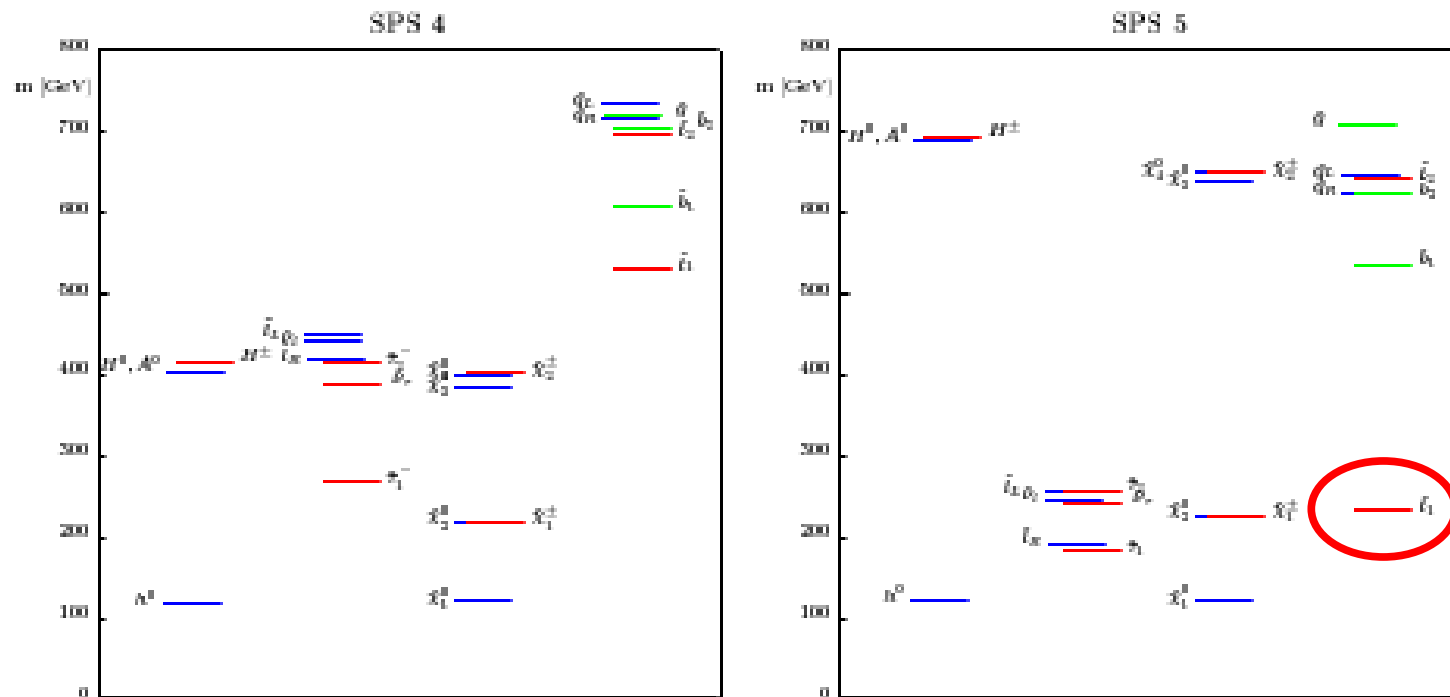
Flavour Physics predictions

Strong impact of LHC constraints on Flavour Sector!

$$R(B \to s\gamma) = 1.063 \pm 0.022$$
$$R(\Delta m_s) = 1.0582 \pm 0.0007$$
$$R(B \to \tau\nu) = 0.970 \pm 0.007$$
$$R(B \to X_s\ell\ell) = 0.910 \pm 0.003$$
$$R(\Delta m_s/\Delta m_d) = 0.99988 \pm 0.00005$$
$$B_s \to \mu\mu = 2.736e\text{-}09 \pm 0.066e\text{-}9$$
$$B_d \to \mu\mu = 1.580e\text{-}10 \pm 0.038e\text{-}10$$

But...

- this point is especially good for L(H)C;
- we assumed MFV;
- correlations are not taken into account.

SPS 4: mSUGRA scenario with large tan β

The large value of tan β in this scenario has an important impact on the phenomenology in the Higgs sector. The couplings of A, H to b̄b and τ⁺τ⁻ as well as the H±tb̄ couplings are significantly enhanced in this scenario, resulting in particular in large associated production cross sections for the heavy Higgs bosons.

Point:

$$m_0 = 400\,\text{GeV}, \quad m_{1/2} = 300\,\text{GeV}, \quad A_0 = 0, \quad \tan\beta = 50, \quad \mu > 0.$$

This point equals mSUGRA point 3 of the "Points d'Aix" and is similar to BDEGMOPW point I.

SPS 5: mSUGRA scenario with relatively light scalar top quark

This scenario is characterized by a large negative value of A_0, which allows consistency of the relatively low value of tan β with the constraints from the Higgs search at LEP, see Ref. [34].

Point:

$$m_0 = 150\,\text{GeV}, \quad m_{1/2} = 300\,\text{GeV}, \quad A_0 = -1000, \quad \tan\beta = 5, \quad \mu > 0.$$

This point equals mSUGRA point 4 of the "Points d'Aix".

More Snowmass Points

	SPS1a	SPS4	SPS5
$\mathcal{R}(B \to X_s \gamma)$	0.919 ± 0.038	0.248	0.848 ± 0.081
$\mathcal{R}(B \to \tau\nu)$	0.968 ± 0.007	0.436	0.997 ± 0.003
$\mathcal{R}(B \to X_s l^+ l^-)$	0.916 ± 0.004	0.917	0.995 ± 0.002
$\mathcal{R}(B \to K \nu\bar{\nu})$	0.967 ± 0.001	0.972	0.994 ± 0.001
$\mathcal{B}(B_d \to \mu^+\mu^-)/10^{-10}$	1.631 ± 0.038	16.9	1.979 ± 0.012
$\mathcal{R}(\Delta m_s)$	1.050 ± 0.001	1.029	1.029 ± 0.001
$\mathcal{B}(B_s \to \mu^+\mu^-)/10^{-9}$	2.824 ± 0.063	29.3	3.427 ± 0.018
$\mathcal{R}(K \to \pi^0 \nu\bar{\nu})$	0.973 ± 0.001	0.977	0.994 ± 0.001

Already excluded!

No LHC sensitivity estimates ⇔ no uncertainties

How to Add Flavour Structure?

- Explicit models (T.Shindou & collaborators)
  - mSUGRA (MFV)
  - MSSM + r-h-neutrinos
  - SU(5) SUSY with r-h-neutrinos
  - MSSM with U(2) flavour symmetry
- Alternative, general, approach:
  - MSSM with mass-insertions
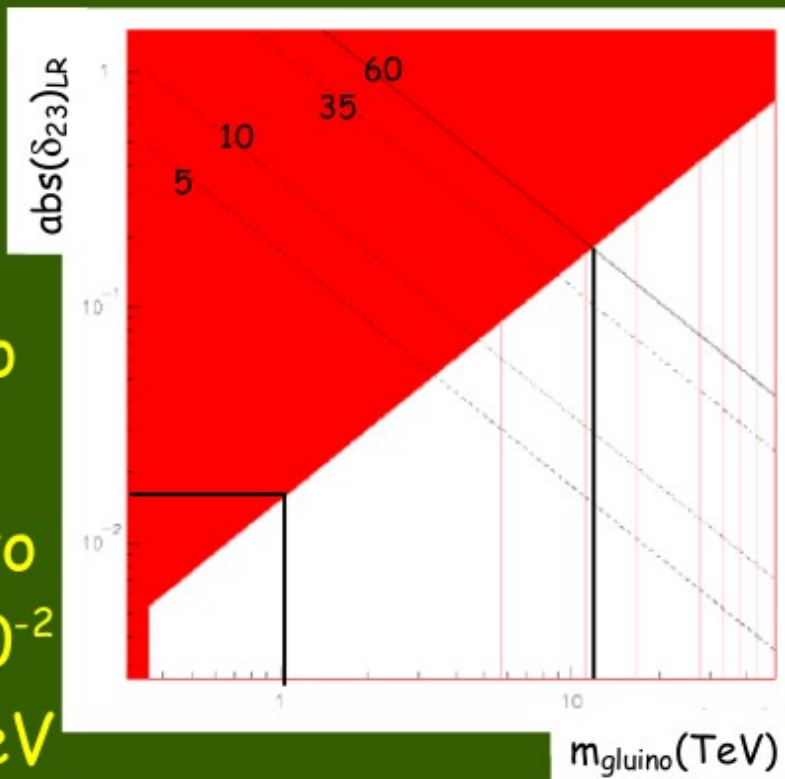   - M.Ciuchini & L.Silvestrini, work in CDR, update ongoing

MSSM

$$M^2_{\tilde{d}} =$$

$$\begin{pmatrix} m^2_{\tilde{d}_L} & m_d(A_d - \mu\tan\beta) & (\Delta^d_{12})_{LL} & (\Delta^d_{12})_{LR} & (\Delta^d_{13})_{LL} & (\Delta^d_{13})_{LR} \\ & m^2_{\tilde{d}_R} & (\Delta^d_{12})_{RL} & (\Delta^d_{12})_{RR} & (\Delta^d_{13})_{RL} & (\Delta^d_{13})_{RR} \\ & & m^2_{\tilde{s}_L} & m_s(A_s - \mu\tan\beta) & (\Delta^d_{23})_{LL} & (\Delta^d_{23})_{LR} \\ & & & m^2_{\tilde{s}_R} & (\Delta^d_{23})_{RL} & (\Delta^d_{23})_{RR} \\ & & & & m^2_{\tilde{b}_L} & m_b(A_b - \mu\tan\beta) \\ & & & & & m^2_{\tilde{b}_R} \end{pmatrix}$$

LHC, ILC - HE frontier

SuperB

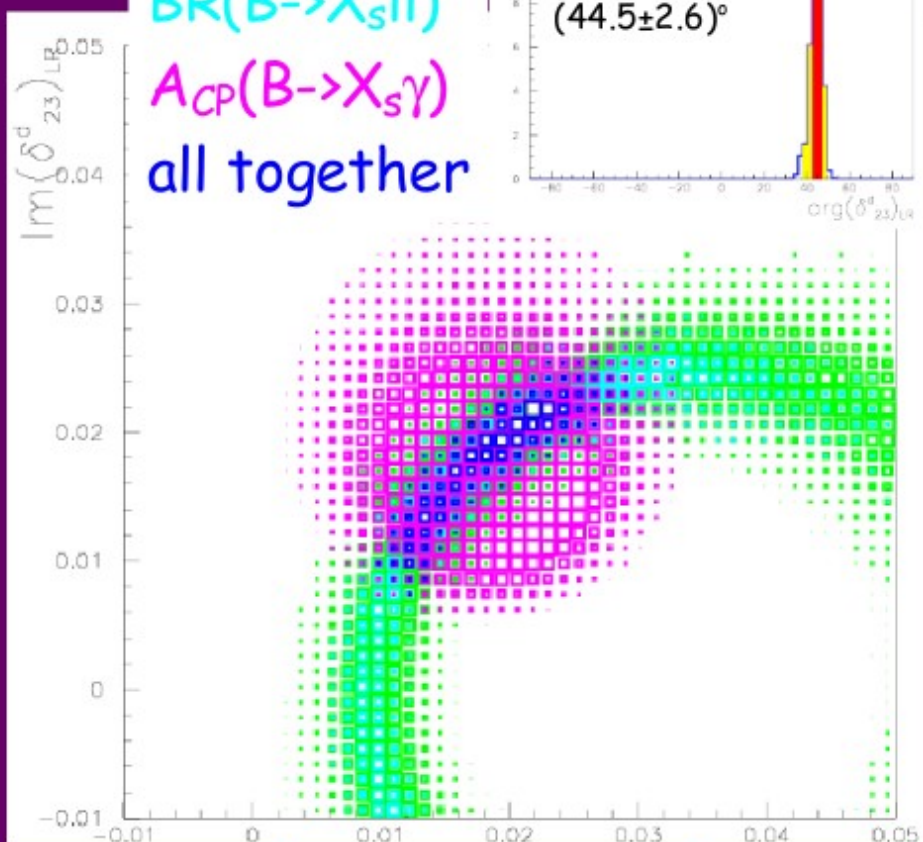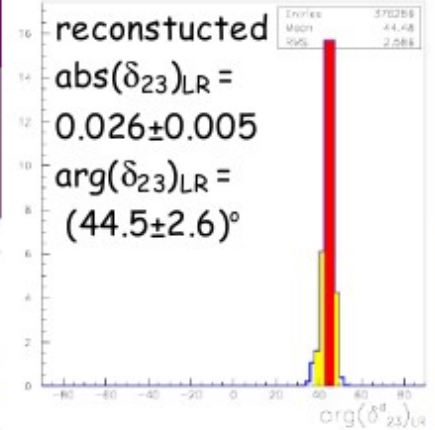**Mass Insertions**
$(\delta^d_{ij})_{AB} = (\Delta^d_{ij})_{AB}/m^2_{\tilde{q}}$

3σ from 0 sensitivity plot

i) sensit. to Λ<20 TeV

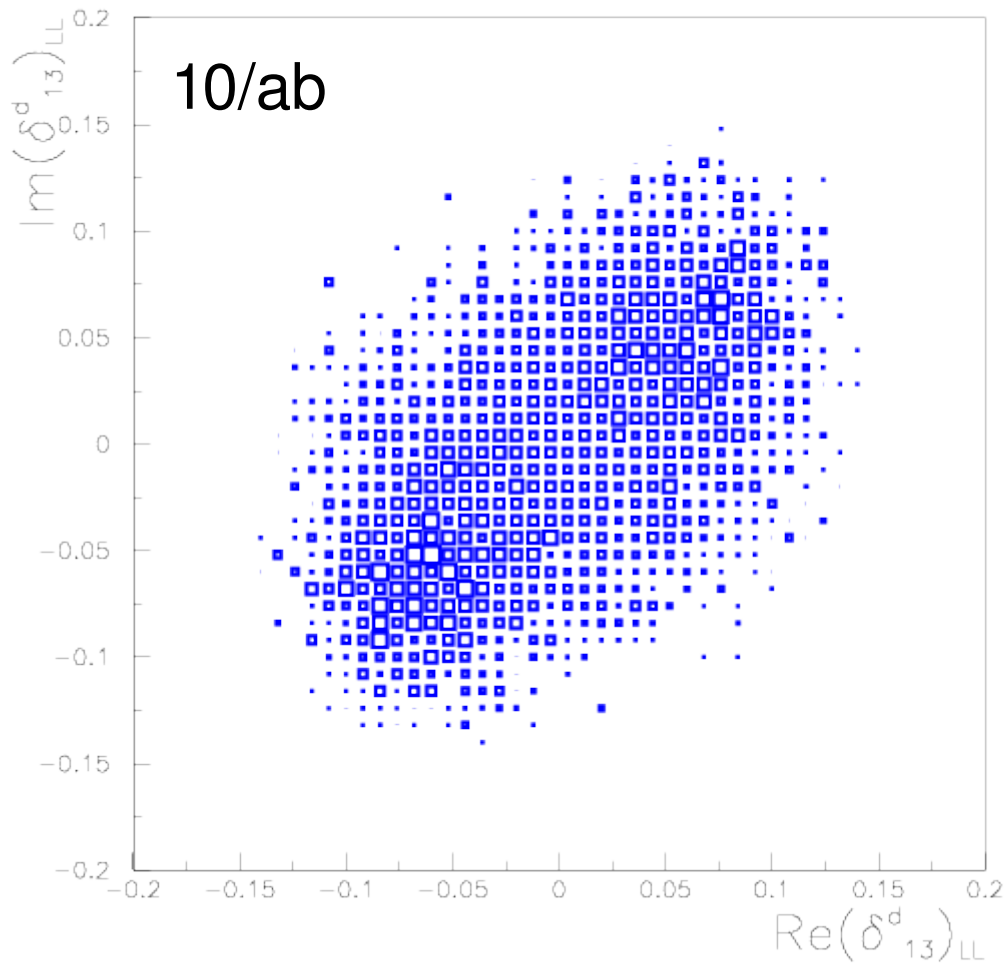ii) sensit. to $|(\delta^d_{23})_{LR}|>10^{-2}$ for Λ<1 TeV

abs(δ_{23})$_{LR}$

60
35
10
5

m_{gluino}(TeV)

BR(B->$X_s\gamma$)
BR(B->$X_s$ll)
A_{CP}(B->$X_s\gamma$)
all together

reconstucted
abs(δ_{23})$_{LR}$ = 0.026±0.005
arg(δ_{23})$_{LR}$ = (44.5±2.6)°

arg(δ^d_{23})$_{LR}$

Im(δ^d_{23})$_{LR}$

Im(δ^d_{23})$_{LR}$ vs Re(δ^d_{23})$_{LR}$

Reconstruction of
$(\delta^d_{23})_{LR}$=0.028 $e^{i\pi/4}$ for
Λ = $m_{\tilde{g}}$ = $m_{\tilde{q}}$ = 1 TeV

M.Ciuchini at SuperB Review, LNF, 12 November

More comparison with KEKB upgrade
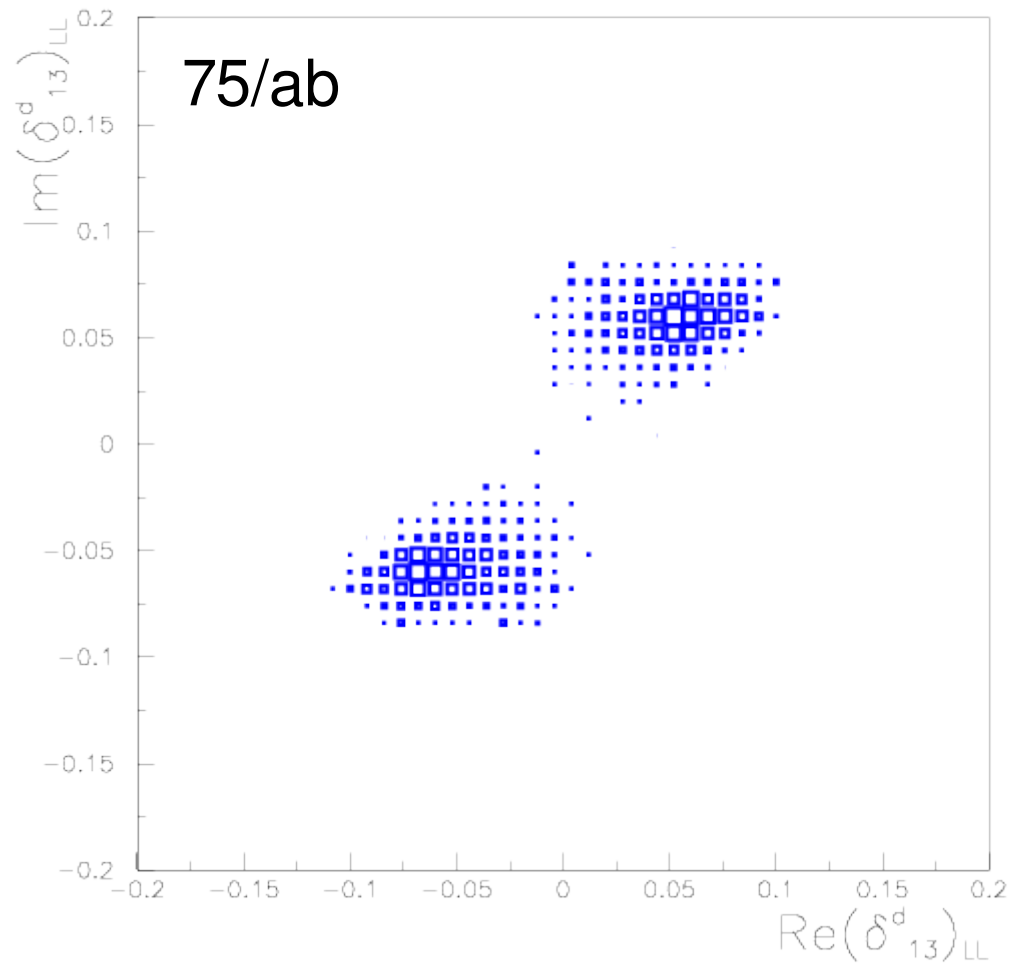
Re vs Im parts of MSSM mass insertion parameter $(\delta_{13})_{LL}$

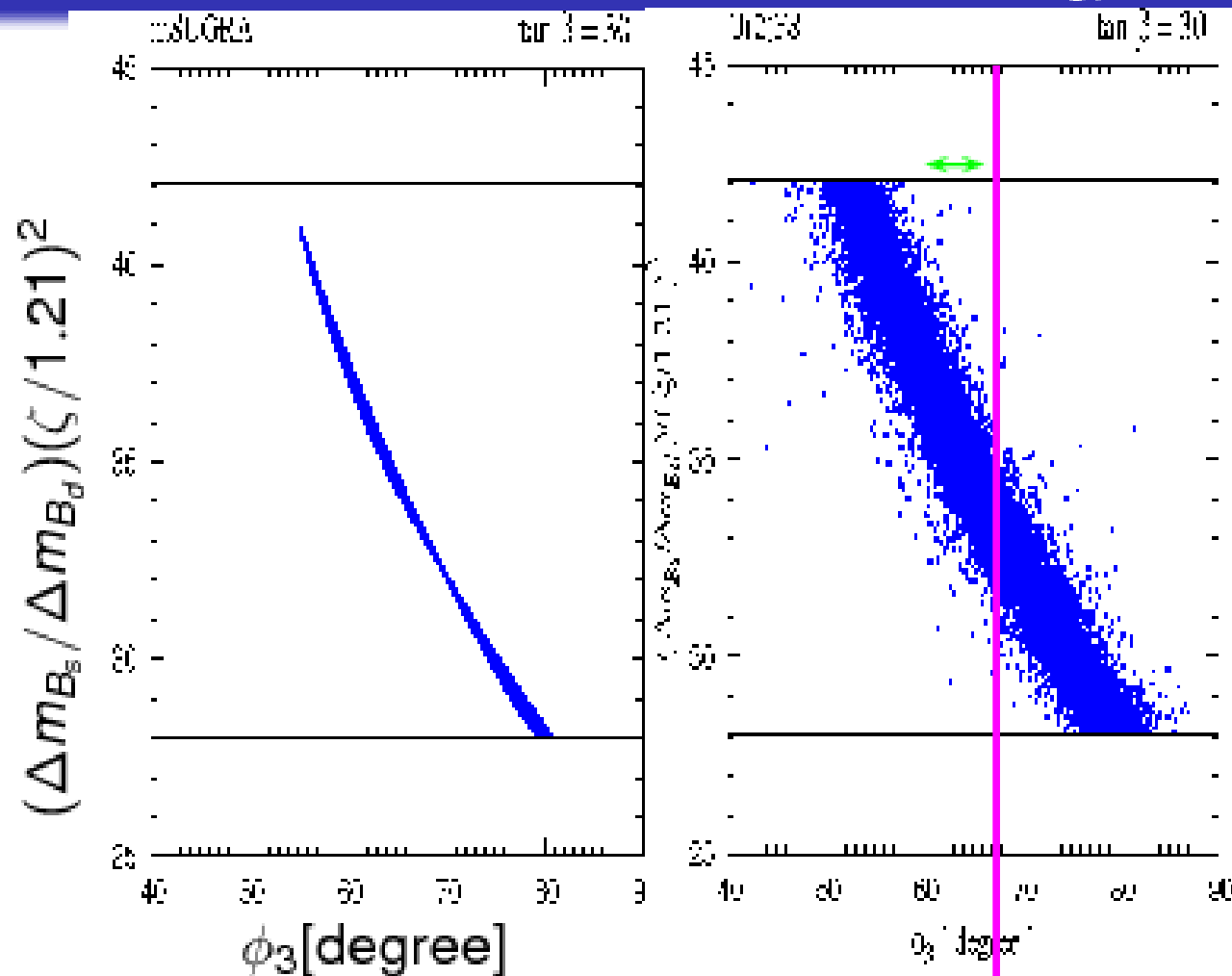# $S_{CP}(B_d \to K^* \gamma)$
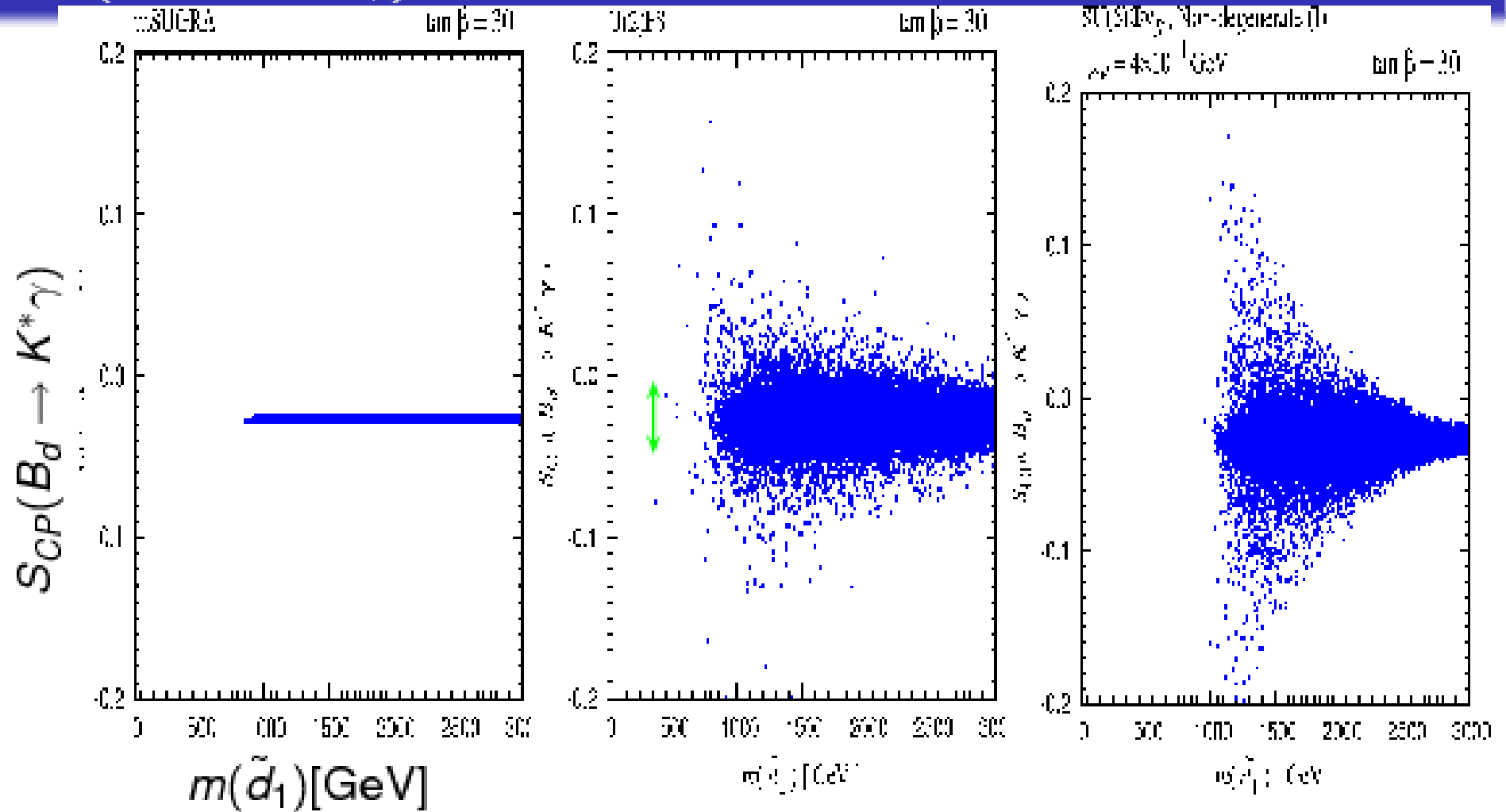
mSUGRA   U(2)   SU(5) Non-Degen. (I)

Correlation between ϕ_3 and $\Delta m_{B_s}/\Delta m_{B_d}$

mSUGRA   U(2)

Need <1˚ precision on γ in UT fit

Summary

- Thanks, once again, to the local organizers of the Valencia workshop

- The physics case has been made:

  – Conceptual Design Report

  – Flavour in the LHC Era write-up (arXiv:0801.18{33,26})

  – Report from Valencia

  – Several other documents

- Further refinements always possible, but what we really need now is a machine, detector, and lots and lots of lovely luminosity!