Interplay among measurements

report on the "interplay" section of the White Paper*

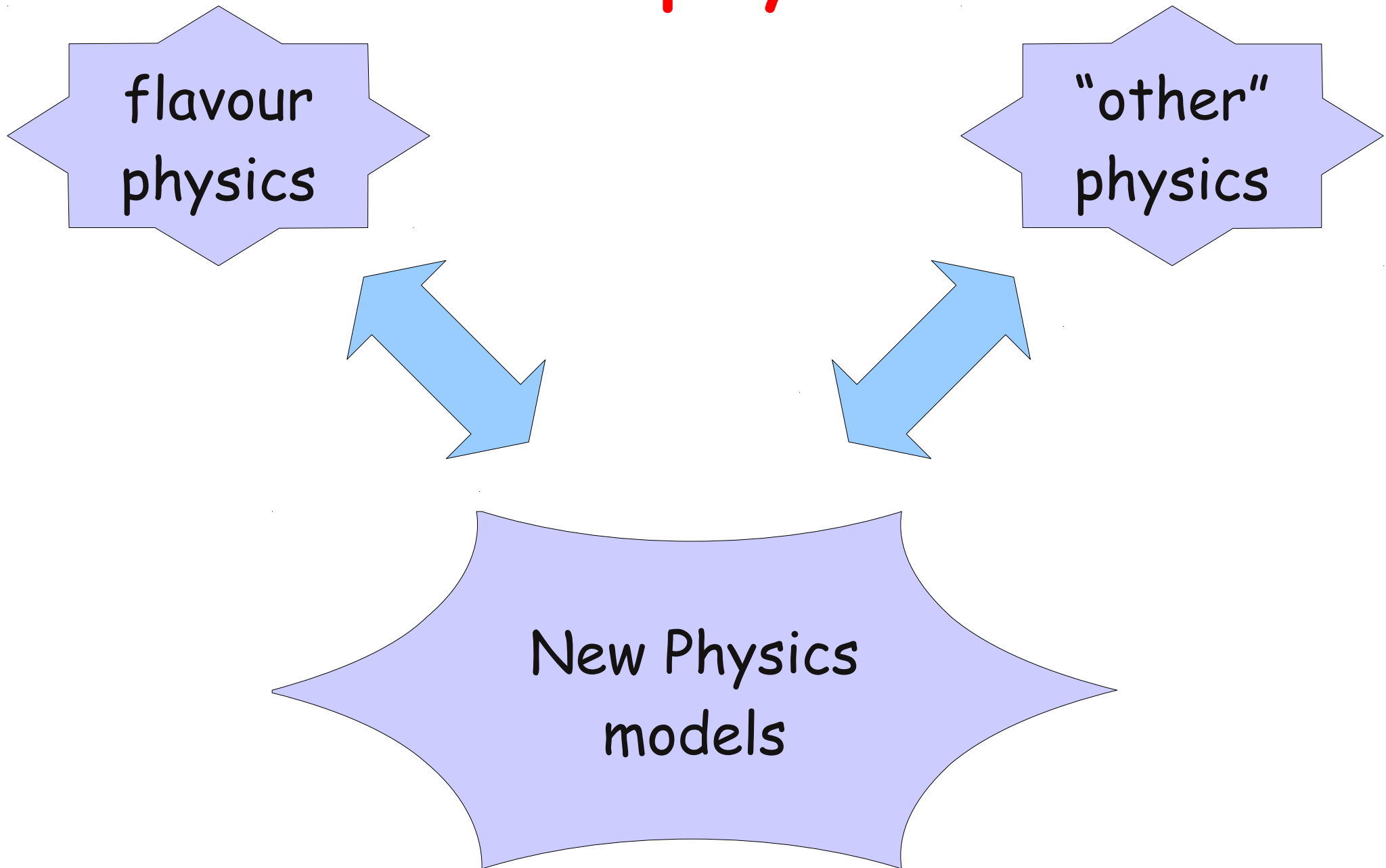### Marco Ciuchini

INFN Roma Tre

*full credits to Cecilia, Emi & Monika, blame on me

XIII SuperB General Meeting - Isola d'Elba

Interplay…?

flavour physics

"other" physics

New Physics models

In the white paper, we mainly focus on the "interplay" among SuperB measurements, i.e. correlations

	model #1	model #2	model #...
observable #1	↔	↔	↑
observable #2	↑	↔	↑
...	↓	↓	↔
observable #n	↑	↑	↔

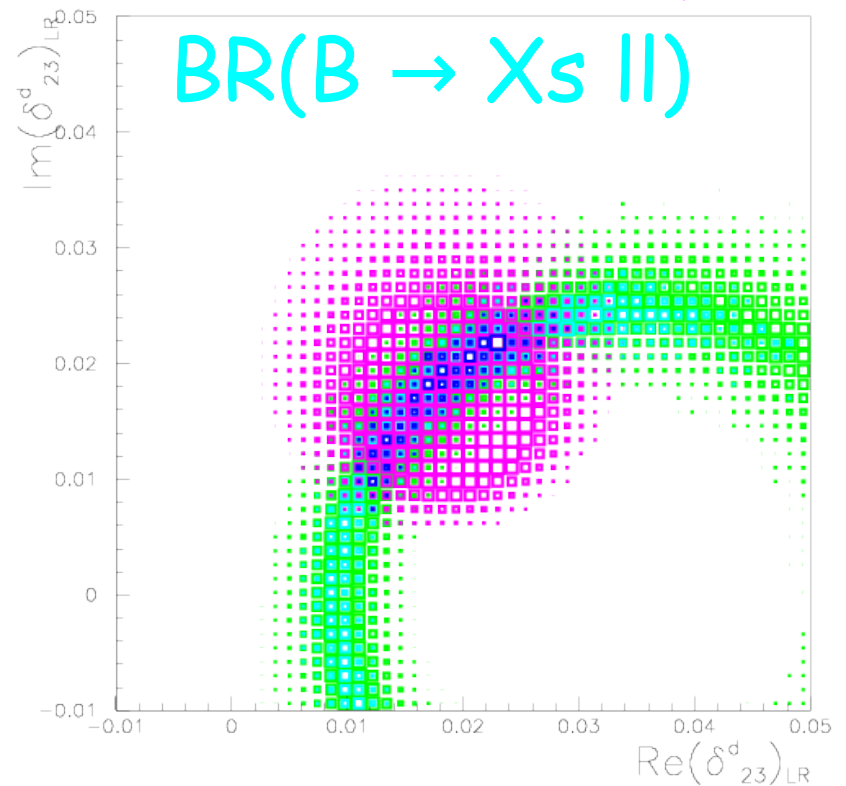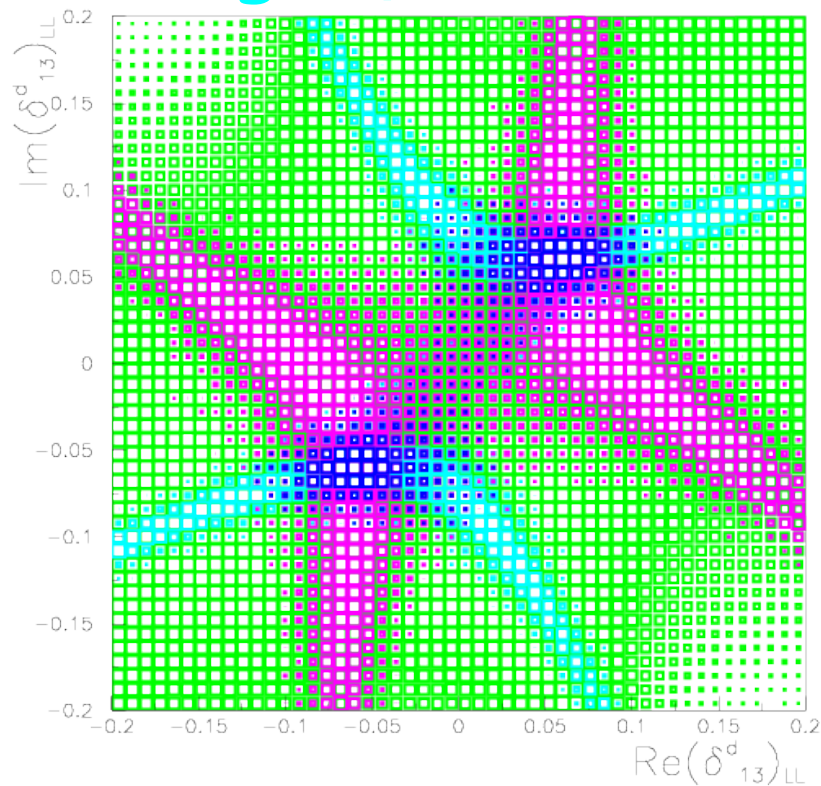## Strategy of choice for NP studies at SuperB where many different NP-sensitive observables can be measured

MSSM (i) : "model-independent" studies

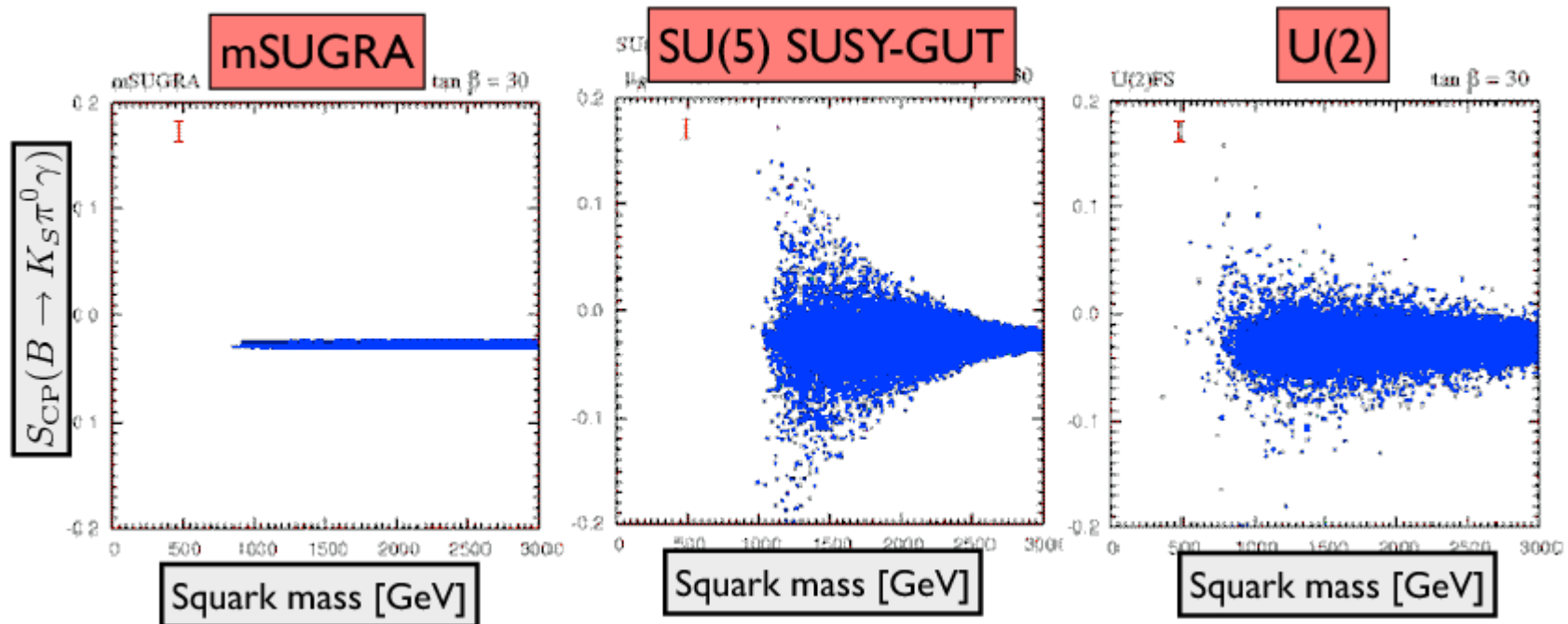* off-diagonal scalar mass matrix elements are free parameters (e.g. mass insertion approx.)

ASLd, ΔMd

angle β

SuperB projections

BR(B → Xs γ)

ACP(B → Xs γ)

BR(B → Xs ll)

MSSM (ii) : model-dependent studies

- first attempt already in the CDR, based on T. Goto et al., 0711.2935

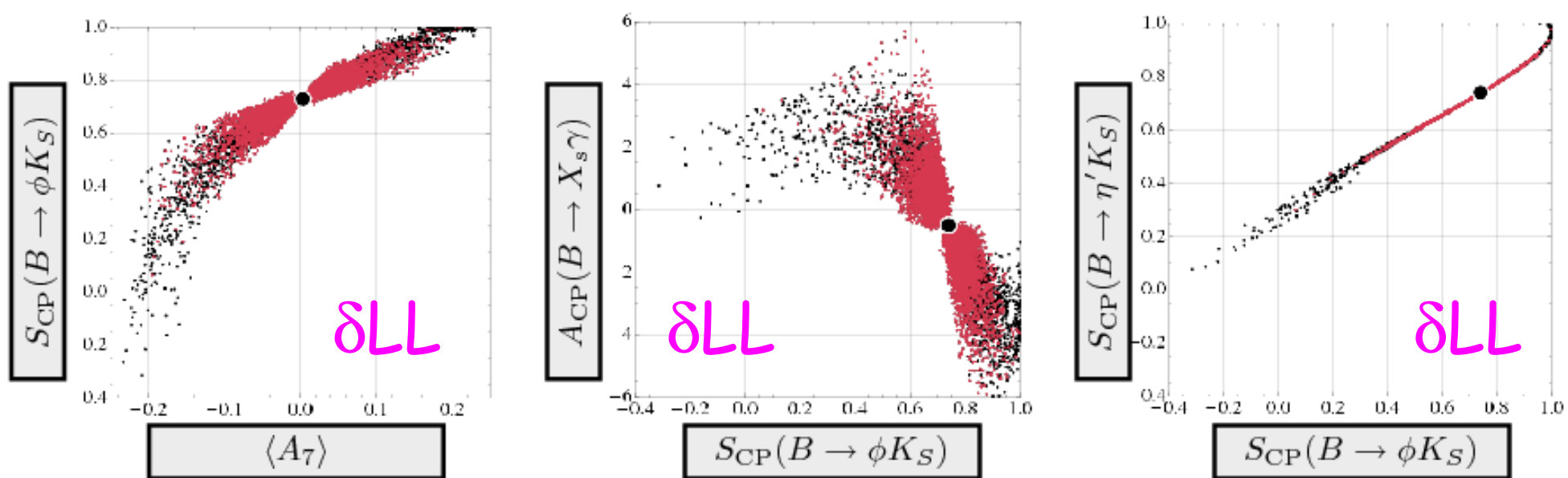Estimate of NP effects in different models, but only few correlations considered

	AC	RVV2	AKM	δLL	FBMSSM
$D^0 - \bar{D}^0$	★★★	★	★	★	★
$S_{\psi\phi}$	★★★	★★★	★★★	★	★
$S_{\phi K_S}$	★★★	★★	★	★★★	★★★
$A_{CP}(B \to X_s \gamma)$	★	★	★	★★★	★★★
$A_{7,8}(B \to K^* \mu^+ \mu^-)$	★	★	★	★★★	★★★
$A_9(B \to K^* \mu^+ \mu^-)$	★	★	★	★	★
$B \to K^{(*)} \nu\bar{\nu}$	★	★	★	★	★
$B_s \to \mu^+ \mu^-$	★★★	★★★	★★★	★★★	★★★
$\tau \to \mu\gamma$	★★★	★★★	★	★★★	★★★

AC / RVV2,AKM: abelian / non-abelian flavour models

δLL: CKM-like new LH currents + 2↔3 NP CPV phase

FBMSSM: universal SSB terms + CPV phases

δLL δLL δLL

10^{-29} $10^{-28.5}$ 10^{-28} $10^{-27.5}$ 10^{-27} $10^{-26.5}$ 10^{-26}

$|d_e|$ [ecm]

Correlations between 2+ observables can be used to characterize and possibly identify NP models
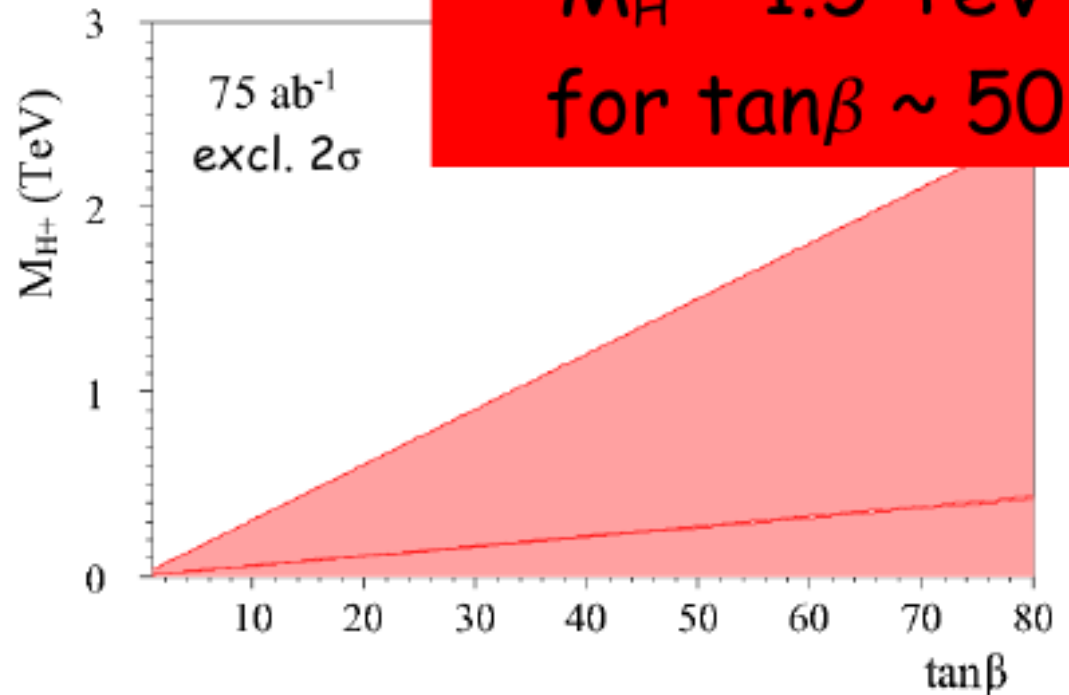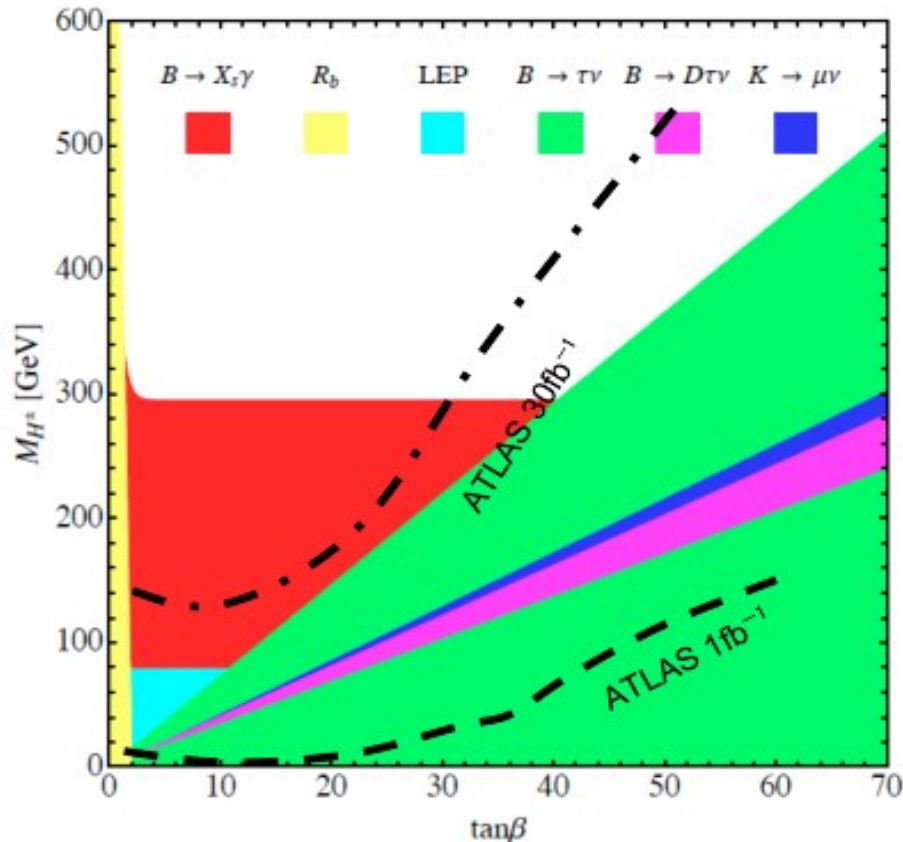
W. Altmannshofer et al., 0808.0707

FBMSSM

A possible problem of "look-alikes" is much eased thanks to the rich flavour phenomenology
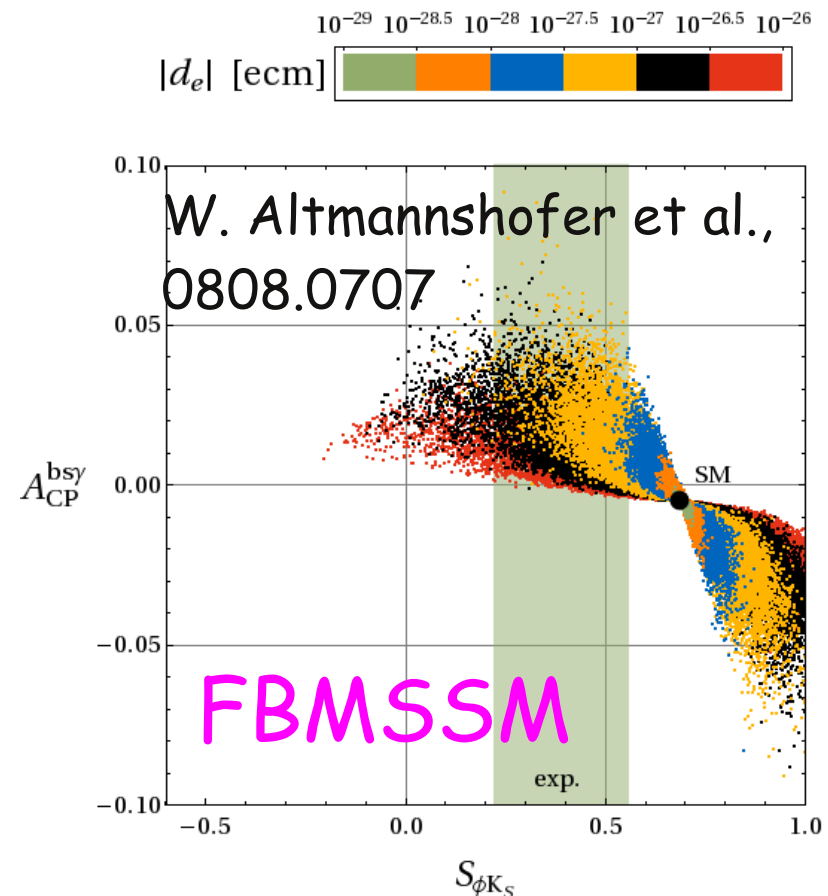
2-Higgs-Doublet Model

* B → τ ν & B → D τ ν on the tanβ–M_{H^+} plane
* direct searches are not competitive
* strong bounds also from B_s → μμ

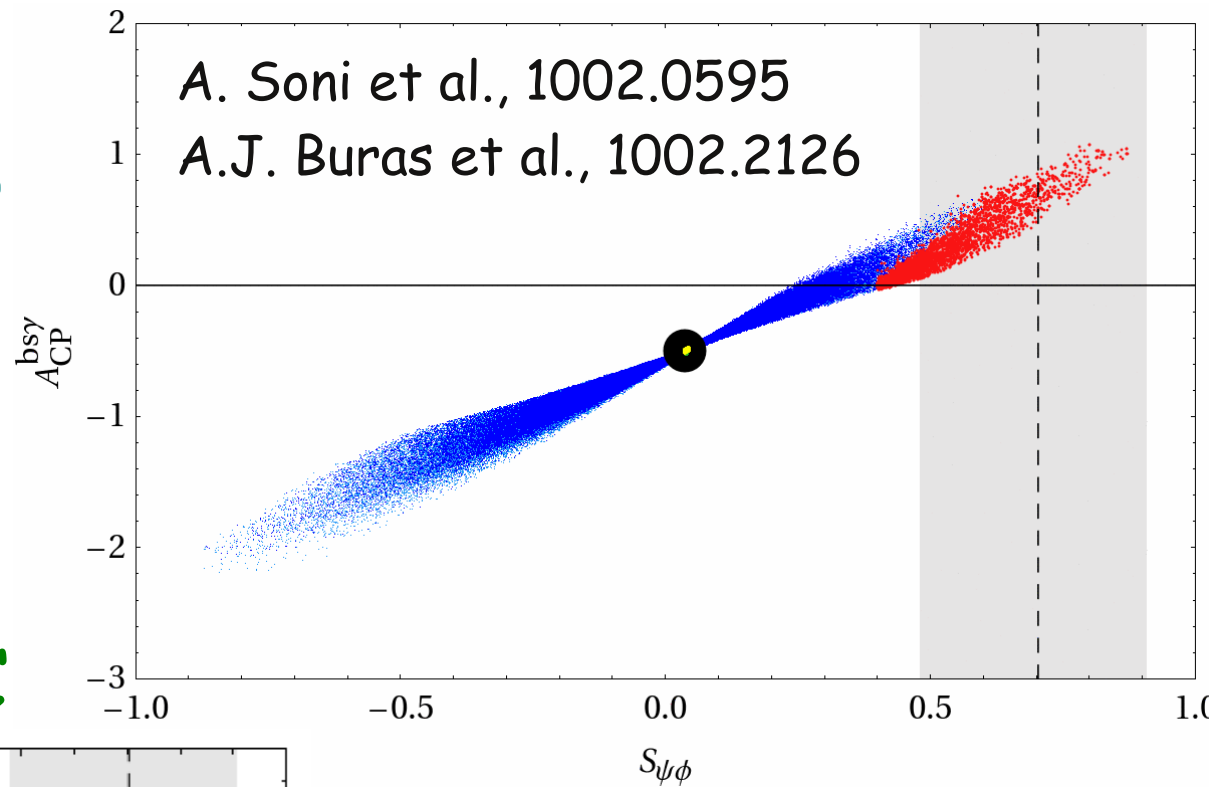U. Haisch, 0805.2141

SuperB (75/ab)
M_H ~ 1.5 TeV
for tanβ ~ 50

4th generation

- allows for a heavier Higgs

- allows for large CPV in Bs mixing

- testable at the LHC

A. Soni et al., 1002.0595

A.J. Buras et al., 1002.2126
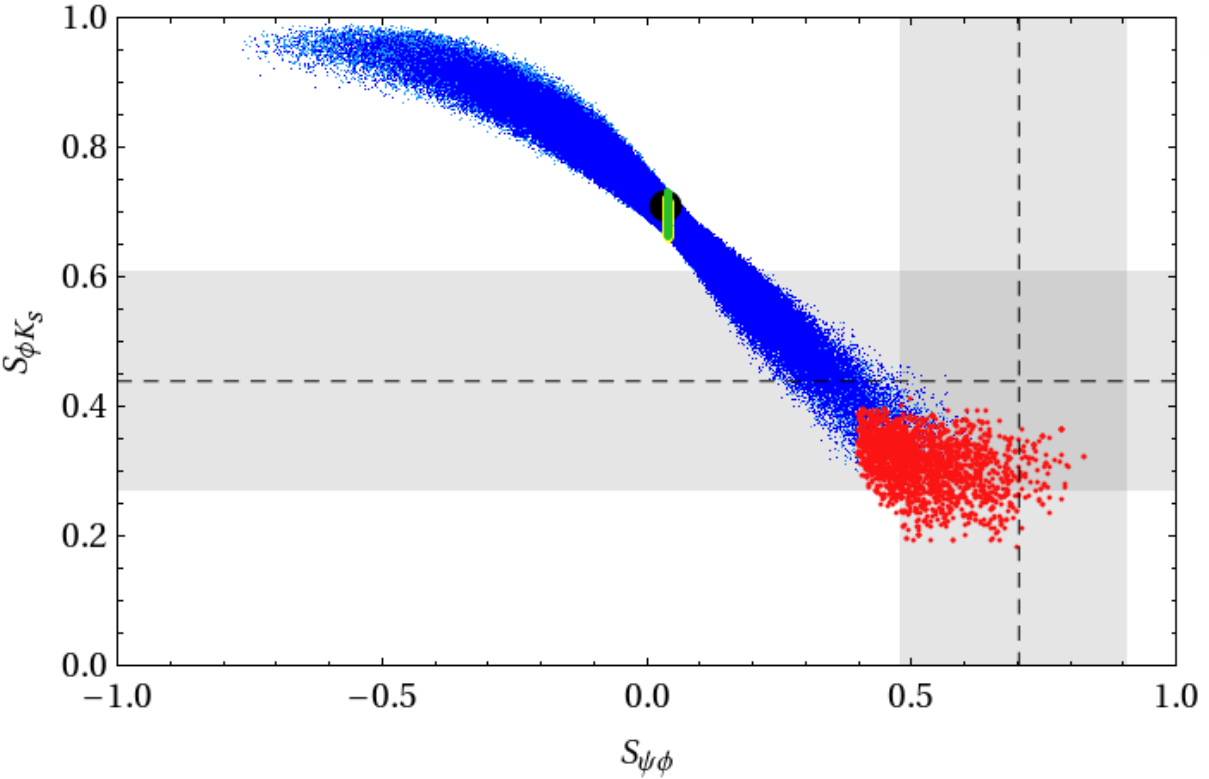
Extremely interesting implications also for SuperB phenomenology

R-S models

- flavour in extra-dim. is severely constrained by ε_K

- large B/Bs effect are still possible

M. Bauer et al., 0912.1625
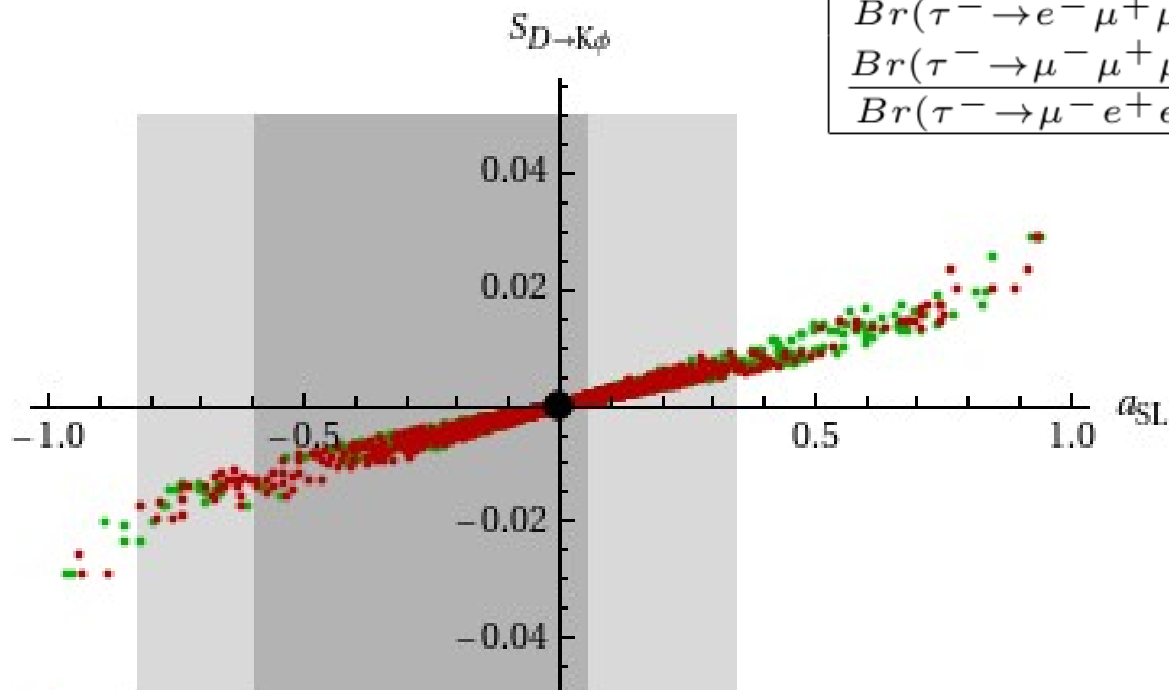
95% CL DØ

5σ LHCb

M. Blanke et al., 0809.1073
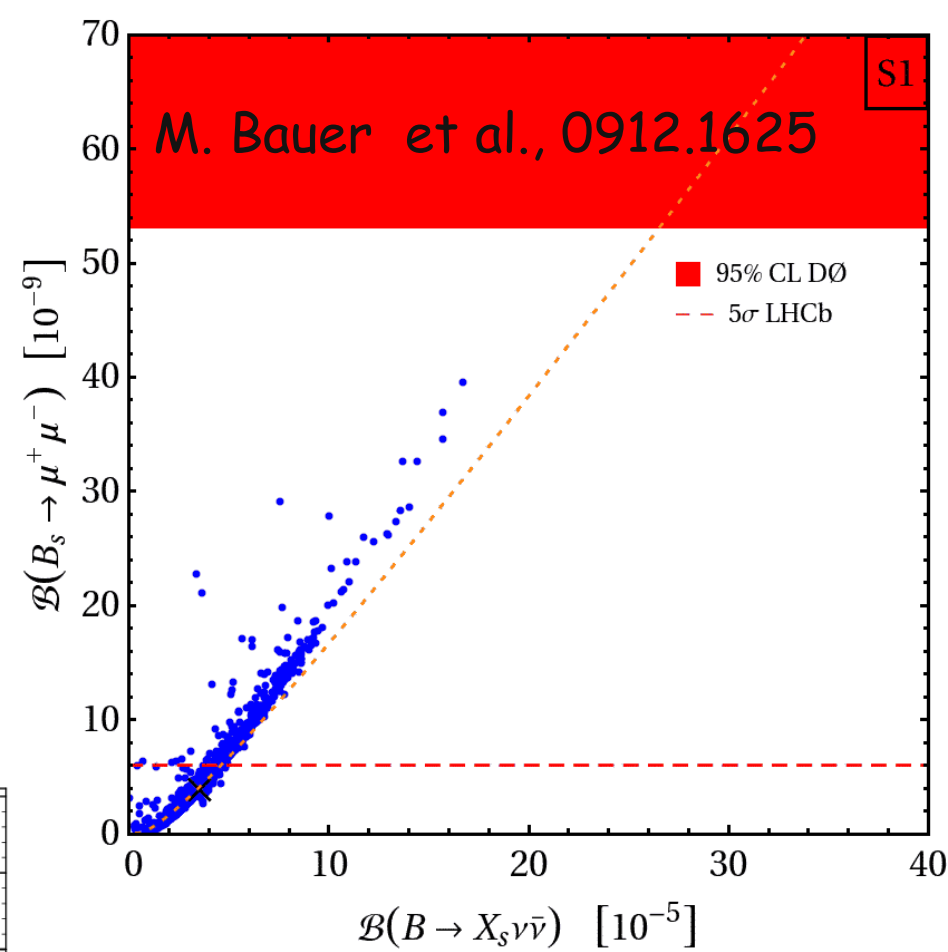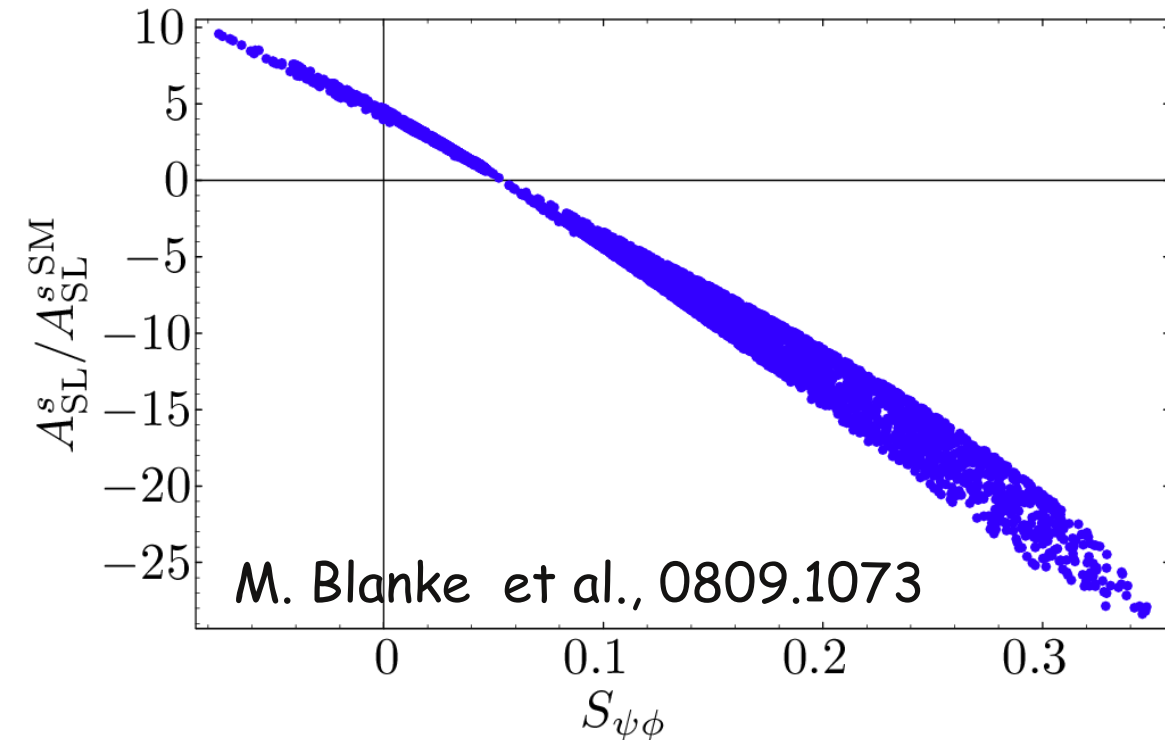
there are R-S models where effects in B(s) are confined to the mixing amplitudes

LHT model

- LFV: $\tau \to \mu\gamma$ vs $\tau \to \ell\ell\ell$
- semileptonic asymmetries

ratio	LHT	MSSM (dipole)	MSSM (Higgs)
$\dfrac{Br(\tau^- \to e^- e^+ e^-)}{Br(\tau \to e\gamma)}$	$0.04\ldots0.4$	$\sim 1\cdot10^{-2}$	$\sim 1\cdot10^{-2}$
$\dfrac{Br(\tau^- \to \mu^- \mu^+ \mu^-)}{Br(\tau \to \mu\gamma)}$	$0.04\ldots0.4$	$\sim 2\cdot10^{-3}$	$0.06\ldots0.1$
$\dfrac{Br(\tau^- \to e^- \mu^+ \mu^-)}{Br(\tau \to e\gamma)}$	$0.04\ldots0.3$	$\sim 2\cdot10^{-3}$	$0.02\ldots0.04$
$\dfrac{Br(\tau^- \to \mu^- e^+ e^-)}{Br(\tau \to \mu\gamma)}$	$0.04\ldots0.3$	$\sim 1\cdot10^{-2}$	$\sim 1\cdot10^{-2}$
$\dfrac{Br(\tau^- \to e^- e^+ e^-)}{Br(\tau^- \to e^- \mu^+ \mu^-)}$	$0.8\ldots2.0$	~ 5	$0.3\ldots0.5$
$\dfrac{Br(\tau^- \to \mu^- \mu^+ \mu^-)}{Br(\tau^- \to \mu^- e^+ e^-)}$	$0.7\ldots1.6$	~ 0.2	$5\ldots10$

Recently: large and correlated CPV effects in D mixing

I.I. Bigi et al., 0904.1545

Conclusions

Admittedly, I have shown a bunch of colorful plots produced using an arbitrary set of NP models, with the only purpose to advertise SuperB physics

Yet, this is a honest advertisement which wants to convey the following simple message:

Correlations ("interplay") among flavour observables are fingerprints of NP models and SuperB is an ideal place to read these fingerprints and contribute to identify the model

In real life it is a hard task, but hopefully rewarding

That's why

WE (theorists) want YOU to provide us with plenty of precision flavour measurements