Benchmark for flavour physics

- Work done for valencia document: (c.f IRC requirement):
  Working on SPS (LHC benchmark) point

Parameters for the SPS points

$$
\begin{aligned}
&\text{SPS1}a: && m_0 = 100\text{GeV}, \quad m_{1/2} = 250\text{GeV}, \quad (7)\\
& && A_0 = -100\text{GeV}, \quad \tan\beta = 10, \quad \mu > 0\\
&\text{SPS4}: && m_0 = 400\text{GeV}, \quad m_{1/2} = 300\text{GeV},\\
& && A_0 = 0, \quad \tan\beta = 50, \quad \mu > 0,\\
&\text{SPS5}: && m_0 = 150\text{GeV}, \quad m_{1/2} = 300\text{GeV},\\
& && A_0 = -1000, \quad \tan\beta = 5, \quad \mu > 0.
\end{aligned}
$$

	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
$\mathcal{R}(B \to K\nu\overline{\nu})$	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
$\mathcal{R}(K \to \pi^0\nu\overline{\nu})$	0.973 ± 0.001	0.977	0.994 ± 0.001

- SPS points are mSUGRA type (flavour blind)
  - ☑ The main effect comes from:
    Large tan β effect, Higgs mass splitting effect, Non-degenerated squark mass (namely light R-stop)
  - ☑ The main effect goes to limited observables:
    $B \to \tau\nu, B \to X_s\gamma$ (and some LHCb channels)

➔Some more detailed works in this meeting...

Superimposed constraints

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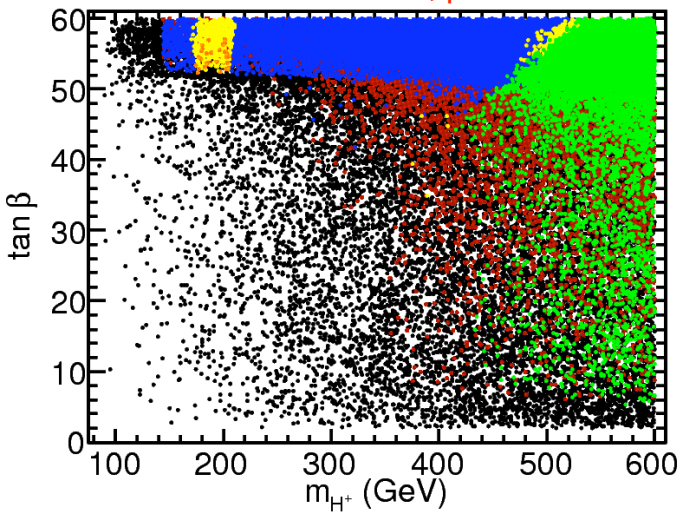
Neutral LSP, μ>0



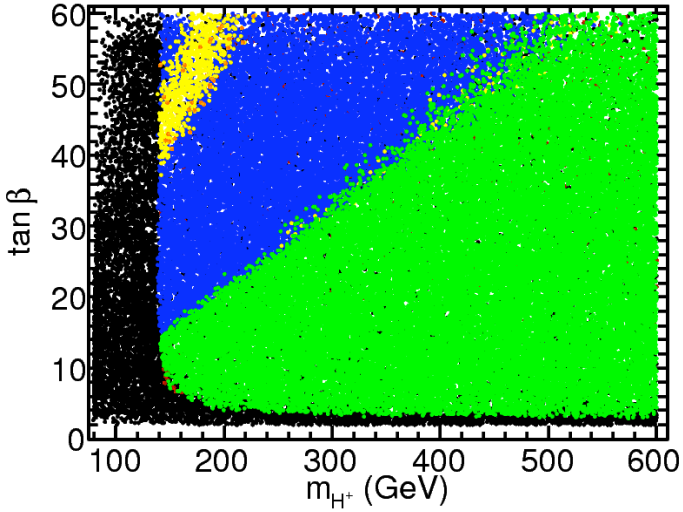
CMSSM

$m_0, m_{1/2}, A_0, \mathrm{sign}(\mu), \tan\beta$

- Allowed
- Direct
- b→ s γ
- $B_u \to \tau\,\nu$
- $B_s \to \mu^+\,\mu^-$
- $B \to D\,\tau\,\nu$
- $K \to \mu\,\nu$

- High tan β "tail" excluded by comb. flavor constraints

$m_{H^+} \gtrsim 400$ GeV



NUHM

$m_0, m_{1/2}, A_0, \mu, m_A, \tan\beta$

- Allowed
- Direct
- b→ s γ
- $B_u \to \tau\,\nu$
- $B_s \to \mu^+\,\mu^-$
- $B \to D\,\tau\,\nu$
- $K \to \mu\,\nu$

- Large exclusion from flavor.
- Low mass H+ only for intermediate tan β.

$m_{H^+} \gtrsim 135$ GeV

Comparing flavour physics to LHC rea

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- Tevatron results with 1 fb^{-1} starting to probe interesting NUHM region

D0 note 5715-CONF

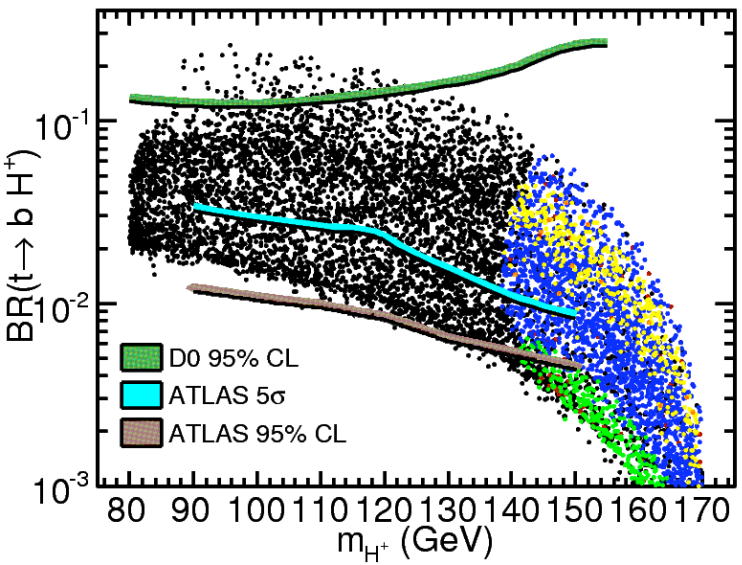
- Reach for CMS and ATLAS with 30 fb^{-1} (3 years of "low" luminosity @ 14 TeV)

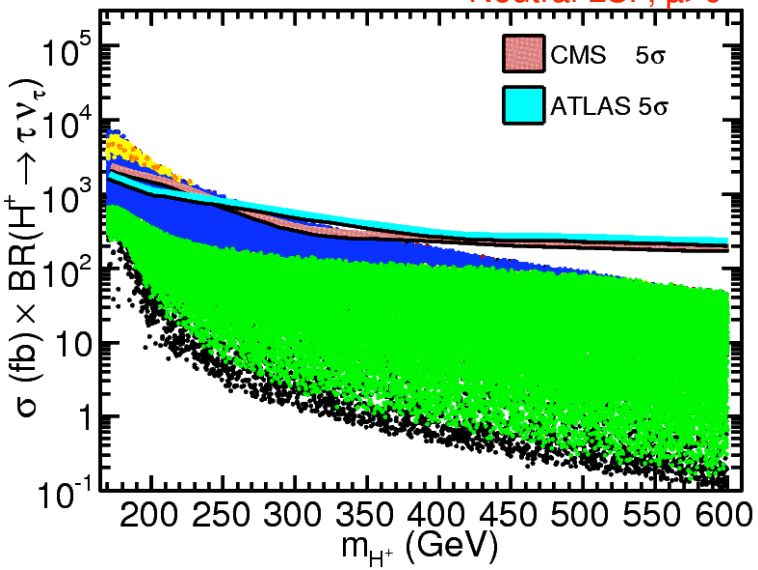
CMS-NOTE-2006-100, 2006-056
ATLAS, arXiv:0901.0512
pp. 1451-1479

- LHC experiments will probe most of the NUHM parameter space for low m_{H+}.
- High m_{H+} region will require more luminosity.

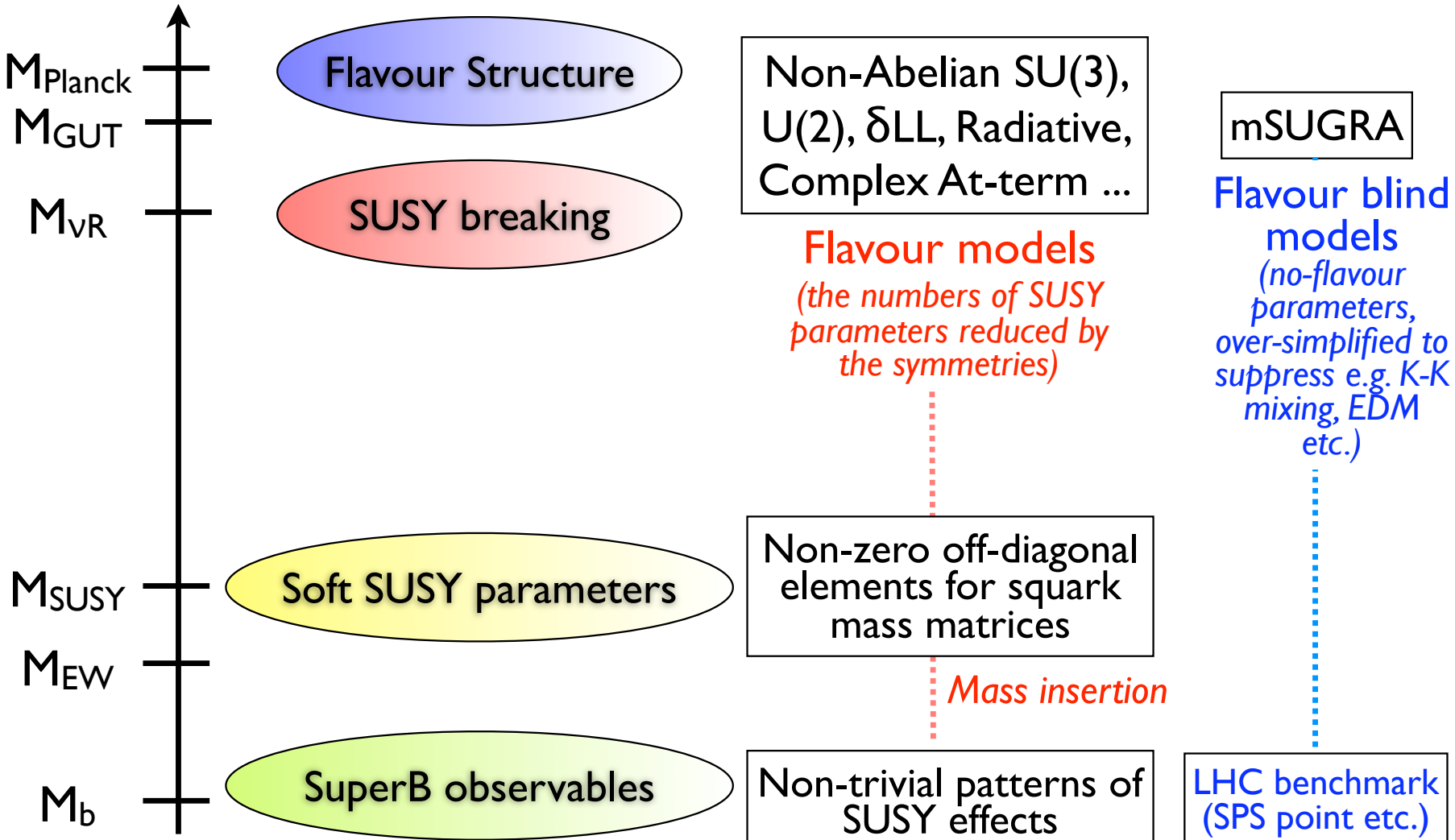
Allowed
Direct
$b \to s\,\gamma$
$B_u \to \tau\,\nu$
$B_s \to \mu^+\mu^-$
$B \to D\,\tau\,\nu$
$K \to \mu\,\nu$

Neutral LSP, $\mu>0$





SUSY SuperB Benchmark (flavour non-blind)



In this meeting...

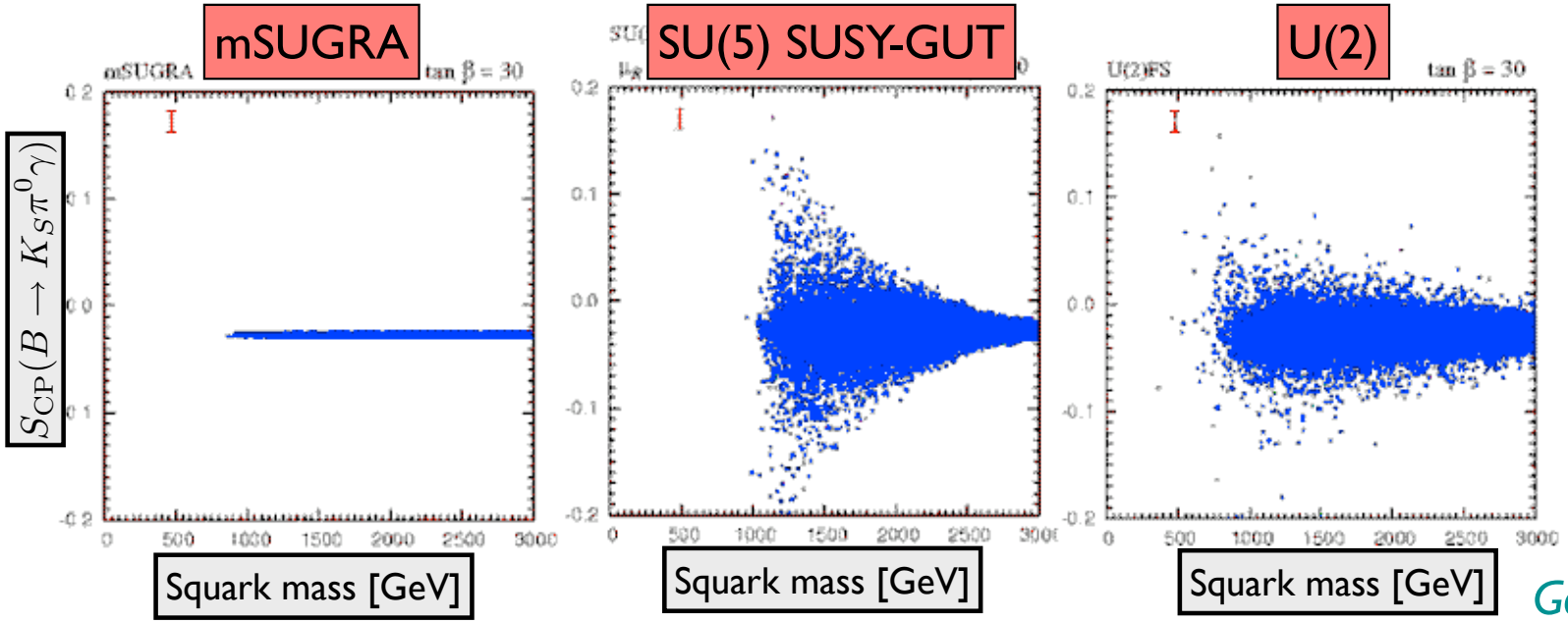
- 5 flavour models are selected to start with.

  U(2) model *(Goto)*, Non-abelian SU(3) model *(Straub,Vives)*, Radiative model *(Crivellin)*, Complex A-term model *(Hofer)*, MIA approach *(Silvestrini, Ciuchini)*

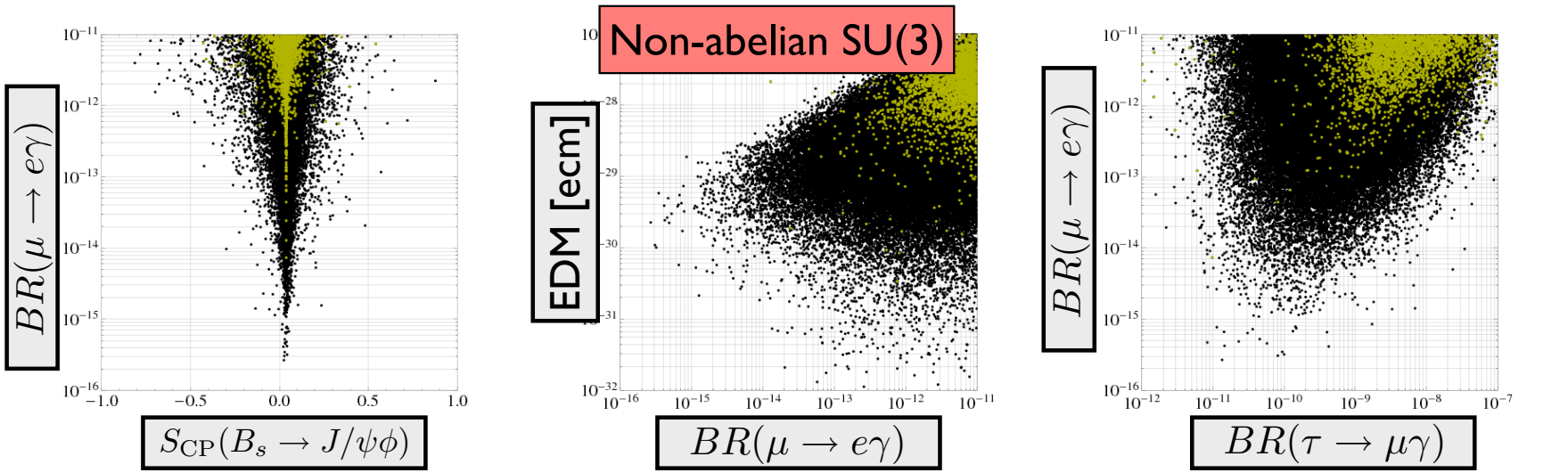
- Each model still contains a few free parameters. Person in charge will choose a representative parameter set (benchmark point) and produce the prediction for the SuperB observables.

Co-relation among different observables must be carefully studied. The SUSY particle mass spectrum should be produced (useful for the interplay with the high-p_T SUSY search).

Scattered plot to Benchmark point



Goto et al



Straub et al

Discussions continue on Wiki...

- Listing the SuperB observables (and it's sensitivity at SuperB) *Ciuchini*
- Defining common low-energy parameterization (mass insertion, Super-CKM basis etc) *Crivellin, Kou, Goto*
- Strategy to select the benchmark points *Goto, Straub, Vives*
- Tools to produce the SUSY mass spectrum *Vives, Kou (to contact to experts)*
- etc.....

For the next meeting...

Number should be produced!!!

Benchmark point for given models (proposal)

	(delta, delta, delta, delta, delta)	**B-> tau nu**	**(B-> K* gamma)CP**	**(B-> phi Ks)CP**	**B -> K* nu nu**	! ...
mSUGRA1	(0.1,0,0,0,0)	?%	?%	?%	?%	...
mSUGRA2	(0.3,0,0,0,0)	?%	?%	?%	?%	...
SUSY-GUT1	(0.1,0,1,0,0)	?%	?%	?%	?%	...
SUSY-GUT2	(0.3,0,0,1,0)	?%	?%	?%	?%	...
U(2)1	(1,0,1,1,0)	?%	?%	?%	?%	...